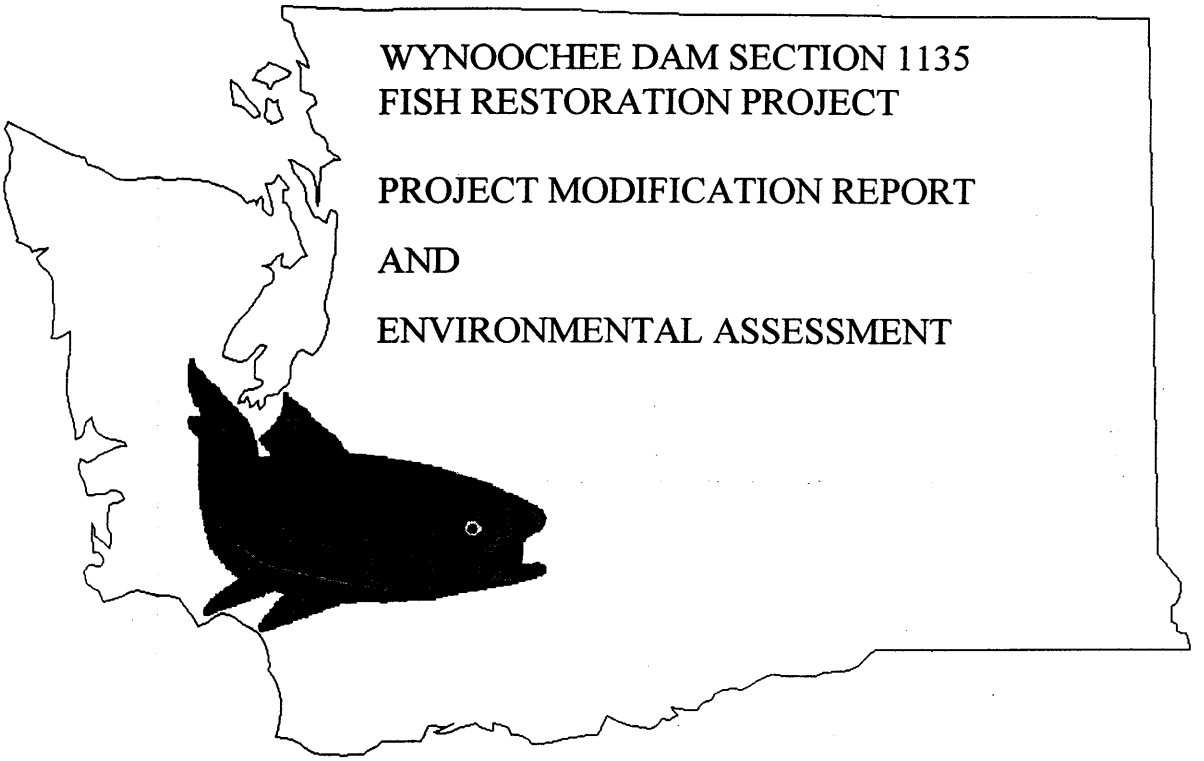
US Army Corps of Engineers®

Seattle District



WYNOOCHEE DAM SECTION 1135 FISH RESTORATION PROJECT

PROJECT MODIFICATION REPORT

AND

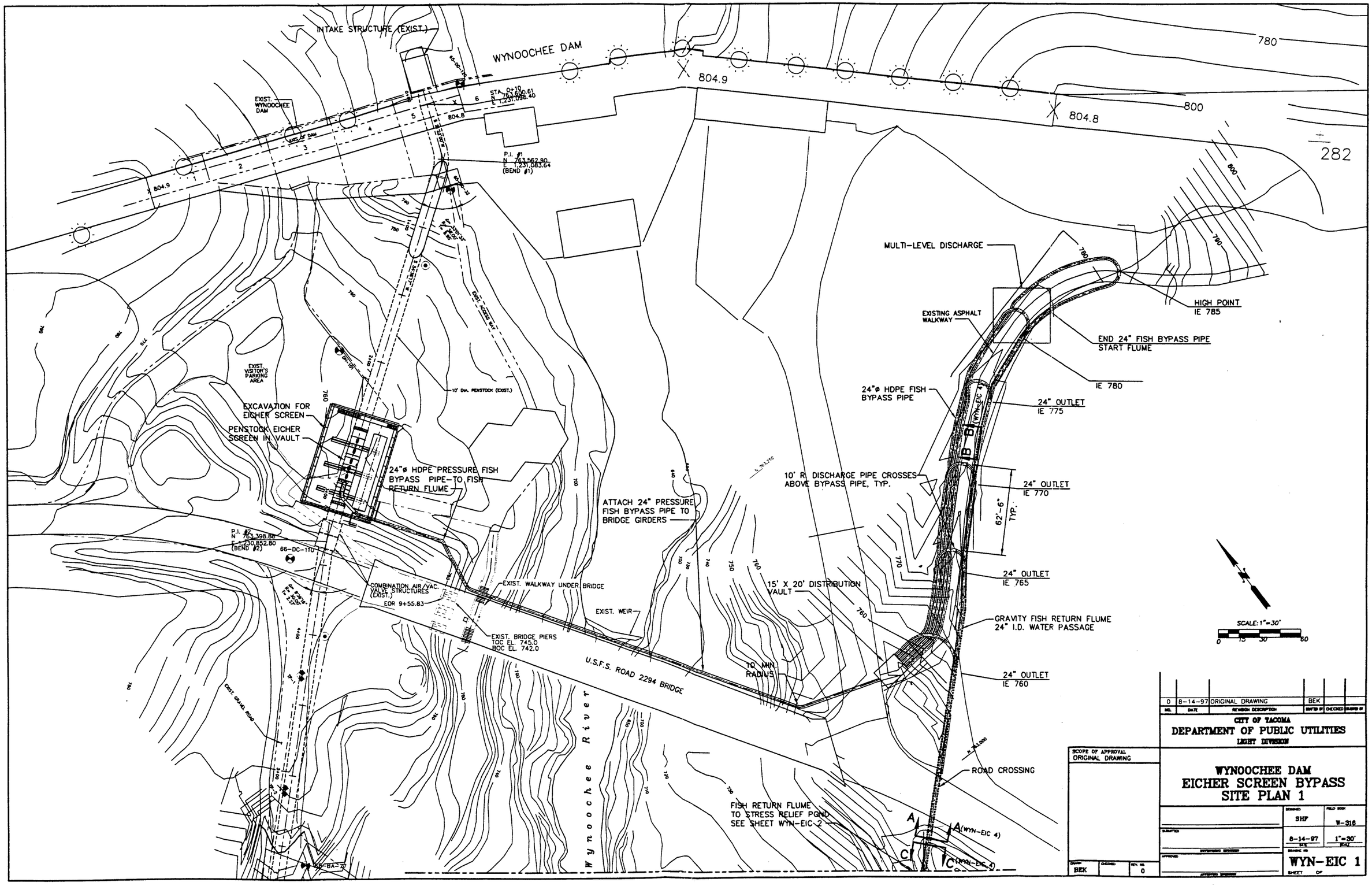
ENVIRONMENTAL ASSESSMENT

WYNOOCHEE RIVER
GRAYS HARBOR COUNTY
WASHINGTON

MAY 1998

APPENDIX A

WYNOOCHEE DAM
FIGURES



NO.	DATE	REVISION DESCRIPTION	DRFTD BY	CHECKED	ISSUED BY
0	8-14-97	ORIGINAL DRAWING	BEK		

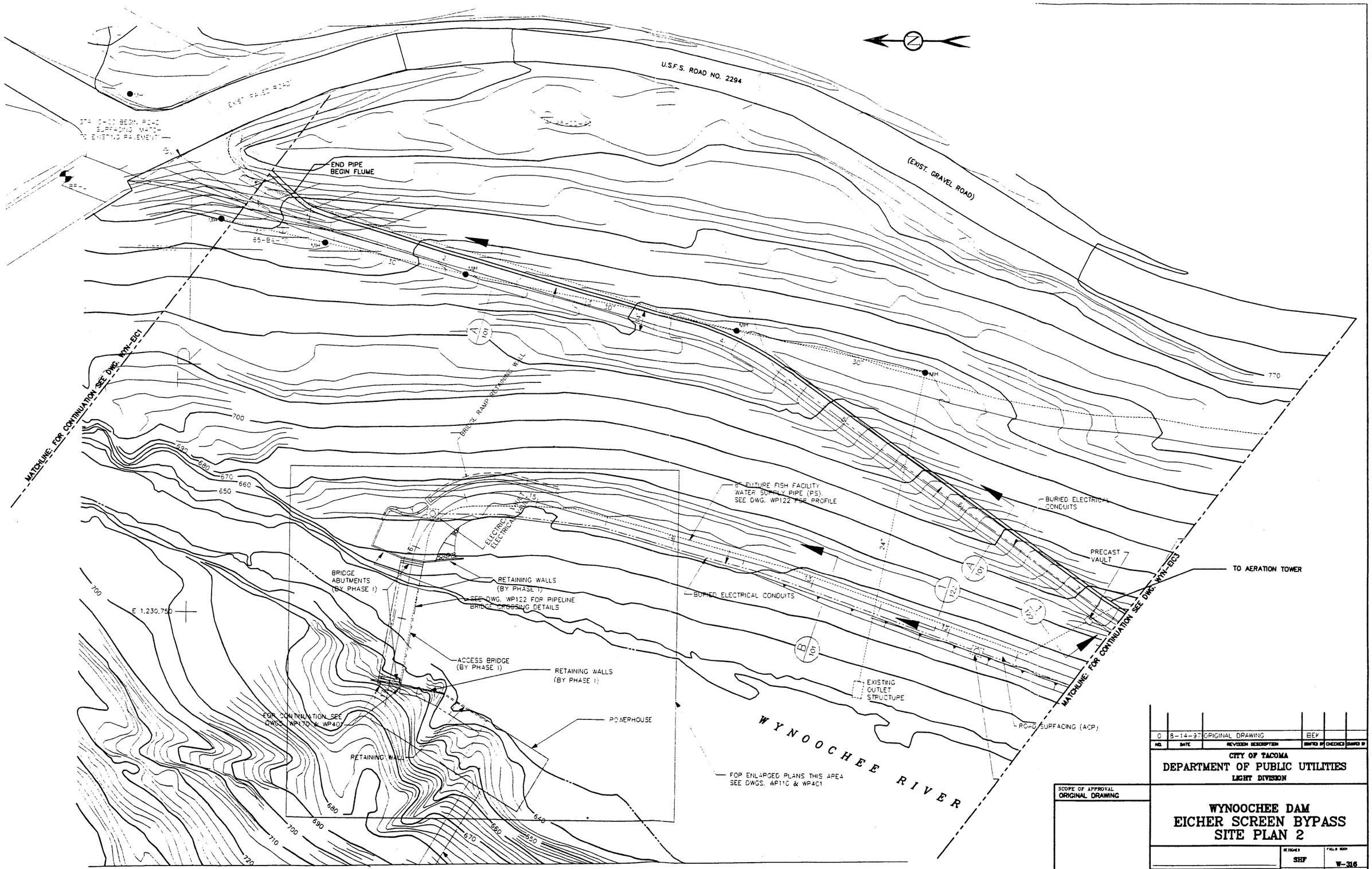
CITY OF TACOMA
DEPARTMENT OF PUBLIC UTILITIES
LIGHT DIVISION

SCOPE OF APPROVAL
ORIGINAL DRAWING

WYNOOCHEE DAM
EICHER SCREEN BYPASS
SITE PLAN 1

DESIGNED: SHF
FIELD BOOK: W-316
DATE: 8-14-97
SCALE: 1"=30'
DRAWN: BEK
CHECKED:
REV. NO. 0
DRAWING NO. WYN-EIC 1
SHEET OF

DWG FILED IN.



NO.	DATE	REVISION DESCRIPTION	DRAWN BY	CHECKED	SUPERV BY
0	8-14-97	ORIGINAL DRAWING	BEK		

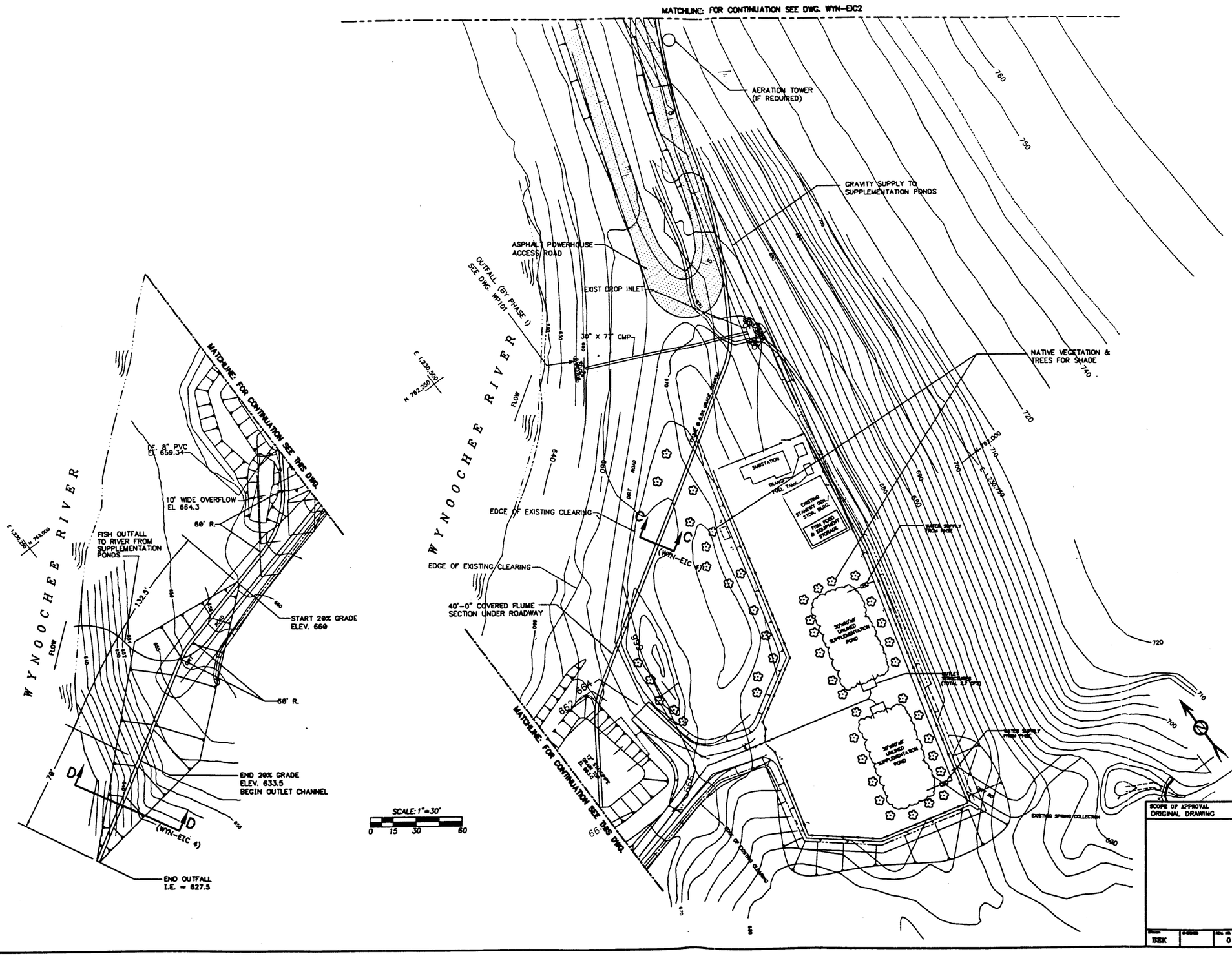
CITY OF TACOMA
DEPARTMENT OF PUBLIC UTILITIES
LIGHT DIVISION

SCOPE OF APPROVAL
ORIGINAL DRAWING

WYNOOCHEE DAM
EICHER SCREEN BYPASS
SITE PLAN 2

DESIGNED: SHF
FACILITY NO.: W-316
SUBMITTED: DEPARTMENT ENGINEER
DATE: 8-14-97
SCALE: 1"=30'
APPROVED: APPROVING ENGINEER
DRAWING NO.: WYN-EIC2
SHEET OF

DRAWN: BEK
CHECKED:
REV. NO.: 0



NO.	DATE	REVISION DESCRIPTION	DRAWN BY	CHECKED	REVIEWED BY
0	8-4-97	ORIGINAL DRAWING	BEK		

CITY OF TACOMA
DEPARTMENT OF PUBLIC UTILITIES
LIGHT DIVISION

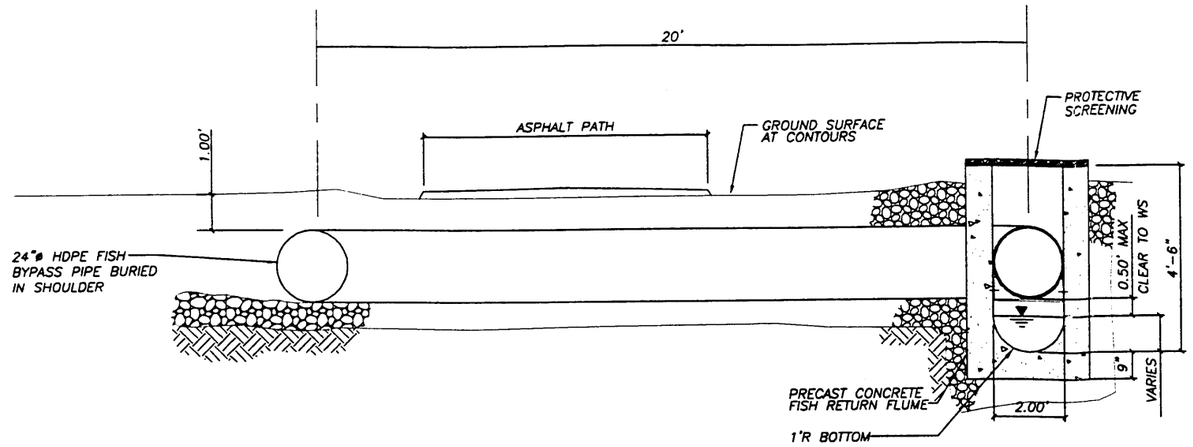
SCOPE OF APPROVAL
ORIGINAL DRAWING

WYNOOCHEE DAM FISH RETURN FLUME SITE PLAN 3

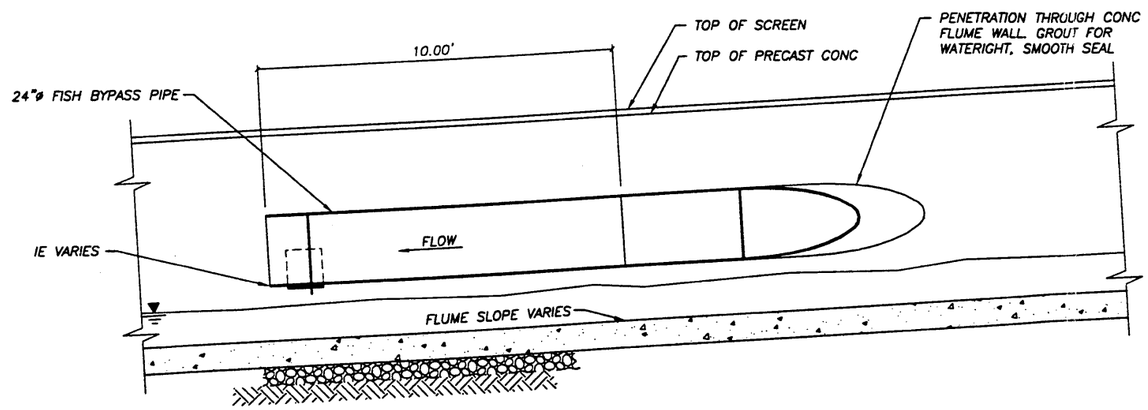
DESIGNED: SHF
FIELD BOOK:
SUBMITTED:
DATE: 8-4-97
SCALE: 1"=30'
APPROVED:
DRAWING NO. WYN-EIC3
SHEET OF

DRAWN: BEK
CHECKED:
REV. NO. 0

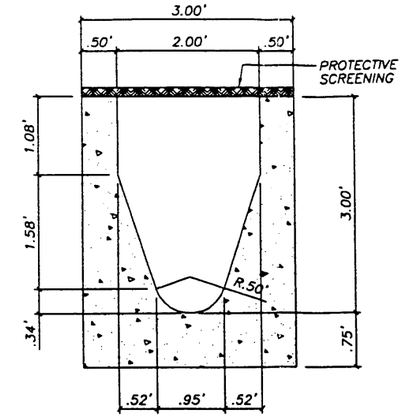
DWG FILED



SECTION A – A
SCALE 1/2" = 1'-0"

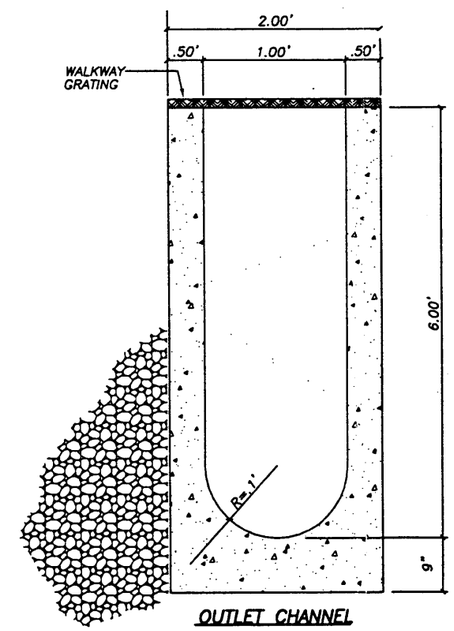


SECTION B – B
SCALE 1/2" = 1'-0"



PRECAST FLUME

SECTION C–C
SCALE 1" = 1'-0"



OUTLET CHANNEL

SECTION D–D
SCALE 1" = 1'-0"

NO.	DATE	REVISION DESCRIPTION	DRAWN BY	CHECKED	ISSUED BY
0	8-14-97	ORIGINAL DRAWING	BEK		

CITY OF TACOMA
DEPARTMENT OF PUBLIC UTILITIES
LIGHT DIVISION

SCOPE OF APPROVAL
ORIGINAL DRAWING

WYNOOCHEE DAM
EICHER SCREEN BYPASS
TYPICAL DETAILS

DRAWN: DWH | CHECKED: | REV. NO. 0

DESIGNED: DEP | FIELD WORK:
DATE: 8-14-97 | SCALE: AS SHOWN
DRAWING NO. WYN-EIC4
SHEET OF

DWG FILED ...

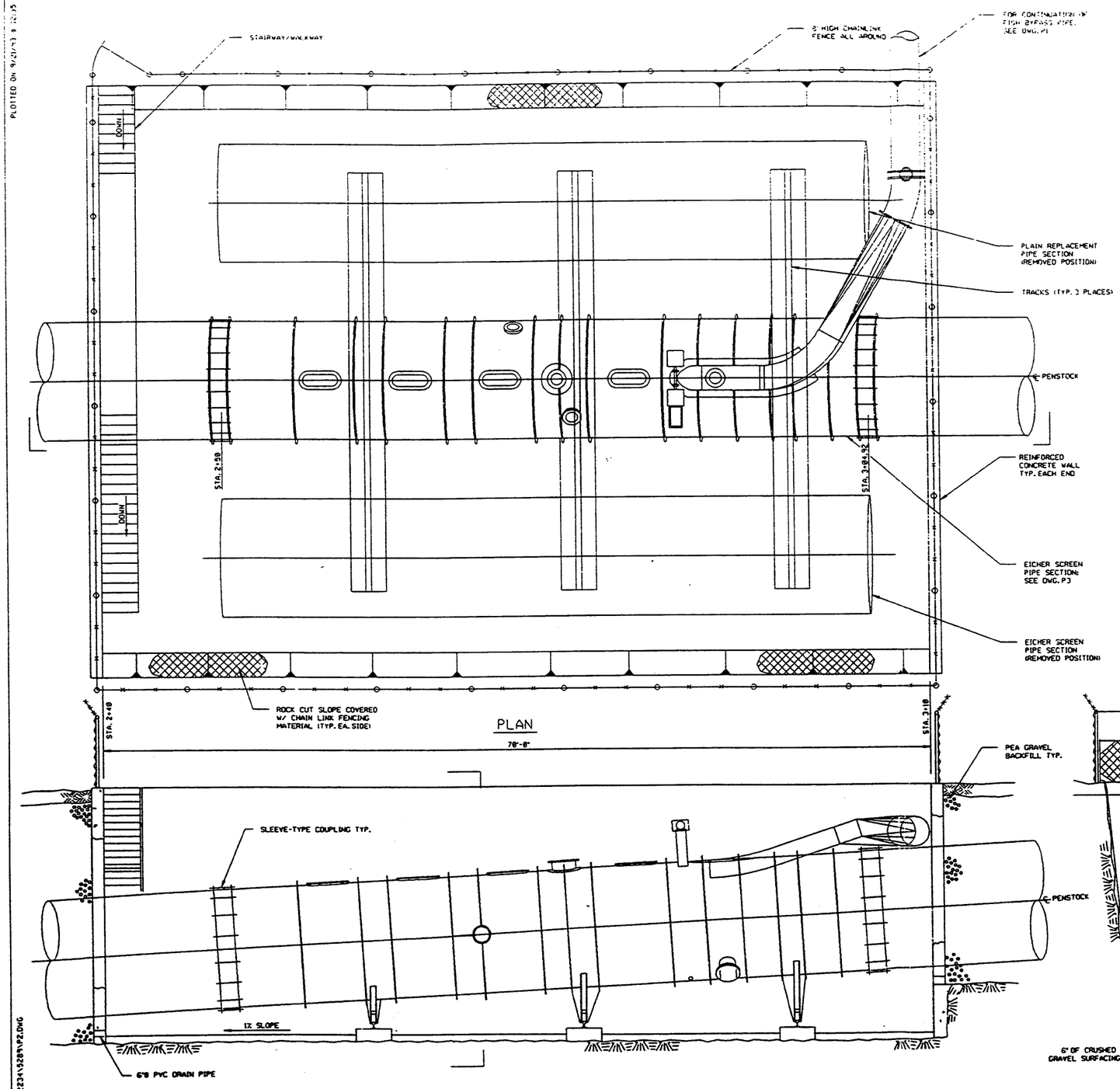


FIGURE 5

Rev.#	By	Checked	Date	Revision Description
-	W.M.D.		9-21-93	ISSUED FOR AGENCY REVIEW

HARZA NORTHWEST, INC. Engineers and Scientists

Designed OPT/WRD Drawn W.M.D. Checked ____ Proj. Mgr. A.L.
Scale 1/4"=1'-0" Unless noted otherwise Date 7-12-93
Original Drawing 28" x 40" O.A.

Wynoochee Lake Project

SECTION 1135 FACILITIES

SCREEN/PENSTOCK CHANGEOUT ARRANGEMENT

Contract No. 5289H

Drawing No. P2 Rev. -

PLOTTED ON 9/21/93 @ 12:15 PM

F:\...\CADD\2223\5289\P2.DWG

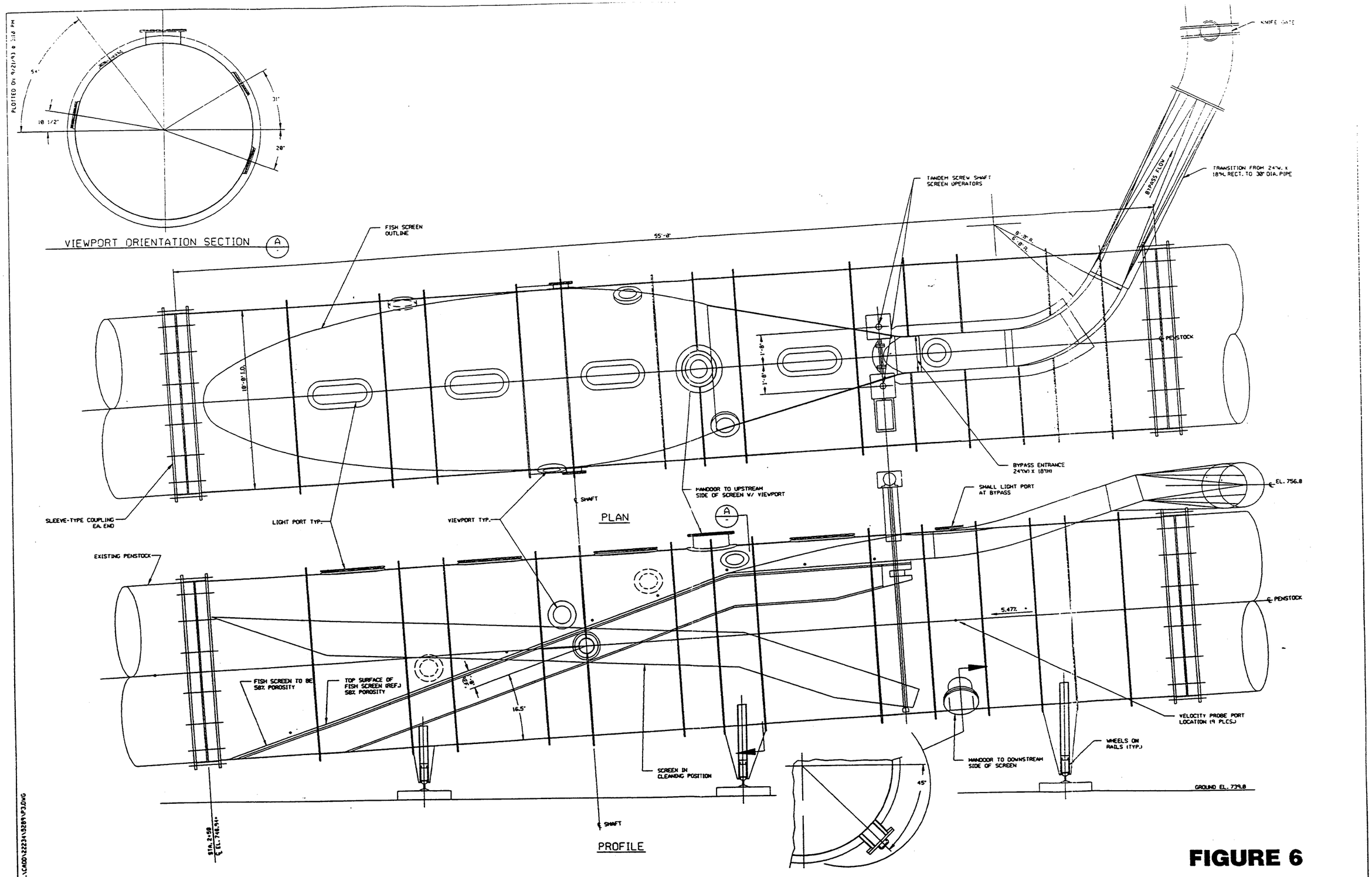


FIGURE 6

Rev.*	By	Checked	Date	Revision Description
-	W.M.D.		4-21-93	ISSUED FOR AGENCY REVIEW

HARZA NORTHWEST, INC.
Engineers and Scientists

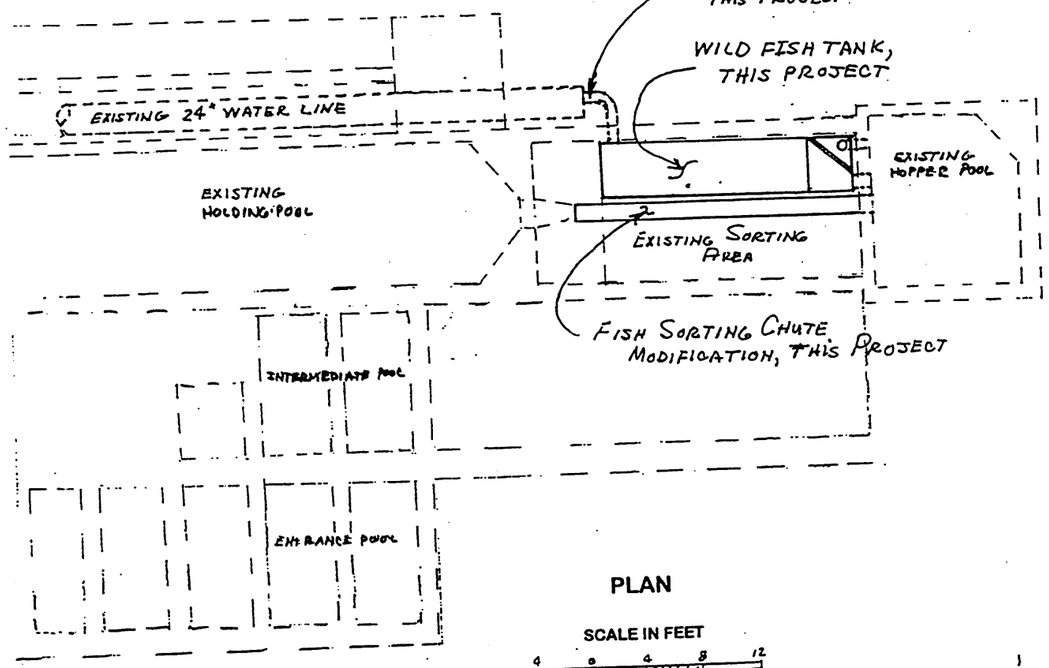
Designed DPT/WMD Drawn W.M.D. Checked ____ Proj. Mgr. A.L.
Scale 1/2"=1'-0" *Unless noted otherwise! Original Drawing 28" x 48" O.A. Date 7-9-93

Wynoochee Lake Project

SECTION 1135 FACILITIES

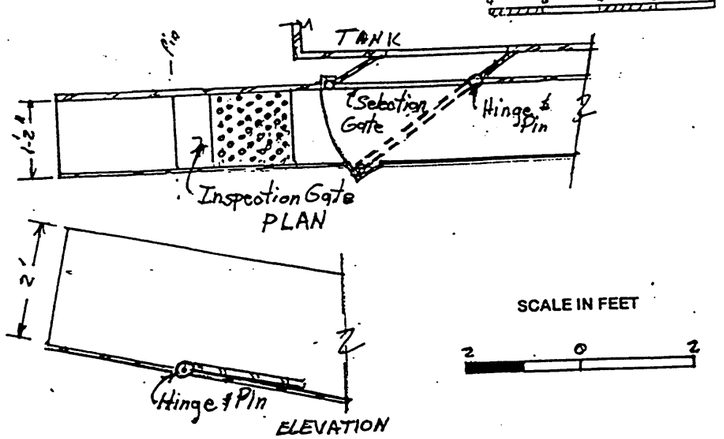
EICHER SCREEN
GENERAL ARRANGEMENT

Contract No. 5289H
Drawing No. P3
Rev. -



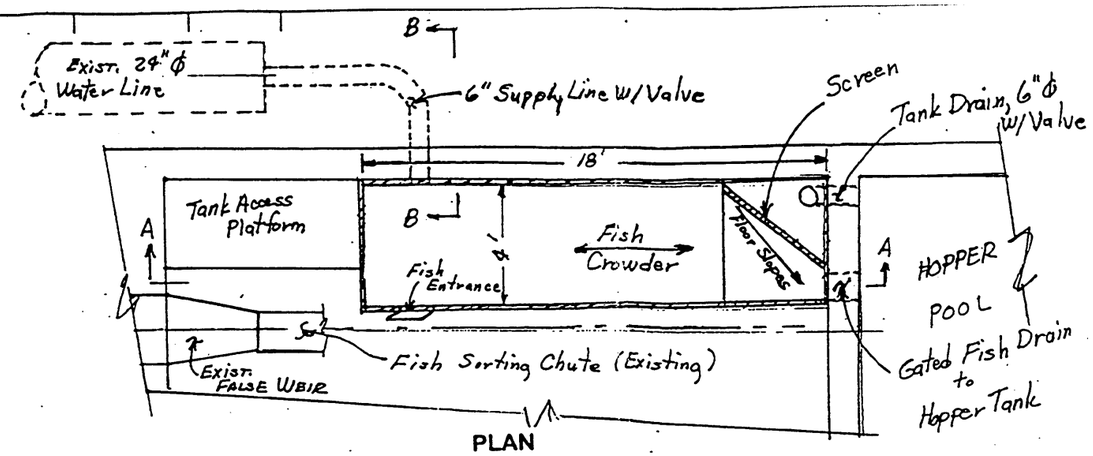
PLAN

SCALE IN FEET

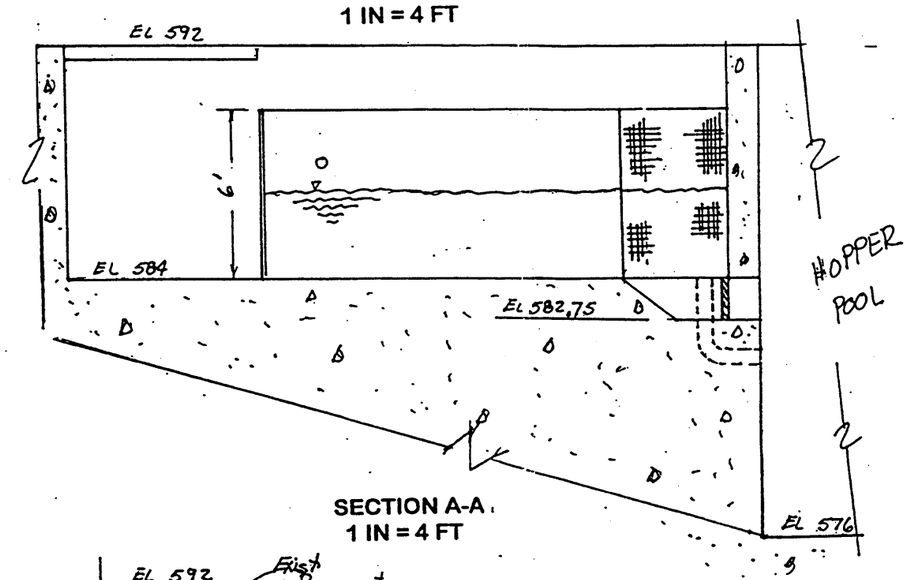


SCALE IN FEET

FISH SORTING CHUTE MODIFICATION



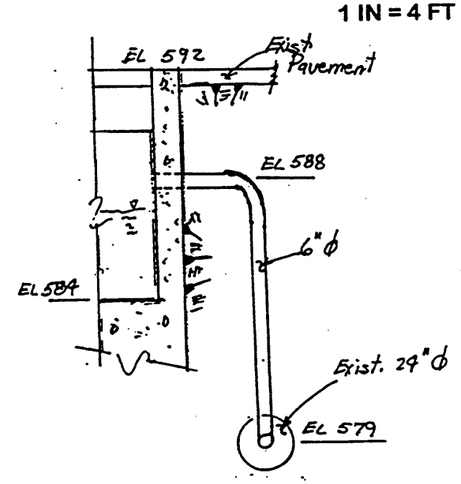
PLAN
1 IN = 4 FT



SECTION A-A
1 IN = 4 FT

1 IN = 4 FT

4 0 4 8



SECTION B-B
1 IN = 4 FT

WILD FISH TANK

FIGURE 7

DIVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS, SEATTLE, WASHINGTON

PREPARED BY U.S. ARMY ENGINEER DISTRICT WALLA WALLA

DESIGN BY G.D.E. | DR. BY L.E.L. | CK. BY G.D.E.

WYNOOCHEE RESERVOIR PROJECT
WYNOOCHEE RIVER, WASHINGTON
FACILITIES FOR UPSTREAM FISH PASSAGE
PAVING AND DRAINAGE

DATE 1983 JUL 18

SCALE AS SHOWN

DRAWING NUMBER E-57-11-1

SHEET L 39

APPENDIX B

WYNOOCHEE DAM CORRESPONDENCE

Tacoma Public Utilities

Mark Crisson
Director

3628 South 35th Street
P.O. Box 11007
Tacoma, WA 98411-0007

Divisions
Light
Water
Belt Line

October 11, 1996

Colonel Donald Wynn
District Engineer
Seattle District Army Corps of Engineers
4735 East Marginal Way S
Seattle, Washington 98134

Dear Colonel Wynn:

This letter provides the City of Tacoma, Department of Public Utilities, Light Division, (City) acknowledgment of the Project Modification Report and Environmental Assessment for the Wynoochee Dam Section 1135 Fish Restoration Project at Wynoochee Dam, Washington. It also provides intent that the City will assume the responsibility of local sponsor for this project.

The draft Project Modification Report has been reviewed by the City. We agree to cooperate with the Corps proposed modifications to Wynoochee Dam. The Eicher screen fish bypass, supplementation ponds, modifications to the fish trap, modified spring refill curve and target flows at Save Creek are components of the program.

The details contained in the enclosed Project Cooperation Agreement have been discussed by the City. Approval by our Public Utility Board will, ultimately, be required before execution. The 25 percent cost share required for this project will be available as indicated in our Statement of Financial Capability.

We look forward to working with you on this endeavor.

Sincerely,

Steven J. Klein
Light Superintendent

WYNOOCHEE DAM
Section 1135 Fish Restoration Project
Statement of Financial Capability

City of Tacoma, Department of Public Utilities, Light Division

BACKGROUND

The City of Tacoma, Department of Public Utilities, Light Division (City), local sponsor for the Wynoochee Dam Fish Restoration Project is capable of meeting cost sharing and other obligations as required under the terms of the Project Cooperation Agreement. Funding for this program comes from a Fish Trust Fund, Account 4706, held by the City for the Washington Department of Fish and Wildlife and City revenues. The City's obligation for the total project is estimated to be $1,089,000 which is the sum of both in-kind services and cash payments to the U.S. Army Corps of Engineers.

SPONSOR CONTRIBUTIONS

The City's contributions are a combination of services provided by the City and listed in Exhibit 2 of the Project Cooperation Agreement (In-Kind Services) and money from the Fish Trust Fund held by the City for the Washington Department of Fish and Wildlife. The balance of the Fish Trust Fund (#4706) as of September 4, 1996, is $1,318,041.99 of which approximately $655,000 will be used for the capital construction requirements. The remaining $434,000 local sponsor obligation is previously spent in-kind services provided by the City. The purpose of the Fish Trust Fund was to finance both construction of the fish restoration program and its operations and maintenance. Thus, moneys remaining in the fund will be used to partially fund operations and maintenance of the supplementation pond portion of the project. Other operation and maintenance costs will be funded from City revenues.

ADDITIONAL AGREEMENTS

An agreement will be signed between the City and the Department of Fish and Wildlife releasing the Fish Trust Fund to the City for use in funding the local sponsor contributions and for providing funding to the Washington Department of Fish and Wildlife for maintenance and operations of the supplementation ponds through the year 2037. The State makes no financial commitment to this project other than release of the Fish Trust Fund. Signing of this exhibit is evidence of intent by the City and State to complete this project.

Steven J. Klein
Light Superintendent
City of Tacoma, Dept of Public Utilities

Lembit E. Ratassepp
Comptroller
Washington Department of Fish and Wildlife

Tacoma Public Utilities

Mark Crisson
Director

3628 South 35th Street
P.O. Box 11007
Tacoma, WA 98411-0007

Divisions
Light
Water
Belt Line

September 13, 1996

Mr. Mike McNeely
U.S. Army Corps of Engineers
Environmental Resources Section
PO Box 3755
Seattle, Washington 98124-3755

Dear Mr. McNeely:

Subject: Comments on the Section 1135 Fish Restoration Project Draft Project Modification Report/Environmental Assessment for the Wynoochee Lake Hydroelectric Project (FERC No. 6842)

We commend the U.S. Army Corps of Engineers (ACOE) in your efforts to restore fisheries resources in the Wynoochee Basin impacted by the construction of the Wynoochee Lake Project. Tacoma Public Utilities (TPU) supports your fisheries mitigation efforts as you proceed with the Section 1135 Project. Following are comments on the Section 1135 Fish Restoration Project Draft Project Modification Report/Environmental Assessment (EA) for the Wynoochee Lake Hydroelectric Project.

Cover:

The TPU logo should be removed from the EA document. Its presence suggests coauthorship of the document by TPU. We had no role in the preparation or review of the EA document.

Page 1:

Power was not an originally-authorized purpose for construction of the Wynoochee Dam. Power production was considered, but deleted, and recreation was added in its place. Therefore, original "project costs" would not have been allocated to power.

Page 4:

What reference reports that "Smolts were found to mill inside and outside of the trashrack and wetwell...?" The wetwell was built after Dunn (1978) was published. Could you be referring to the multi-level outlets in the fourth paragraph of page 4? It is unclear whether you are referring to studies by Dunn and milling in front of the multi-level outlets, or to studies of the wetwell conducted in the spring of 1996. In paragraph 6 (page 4), it is apparent that you are referring to the new hydroelectric unit intake when you use the term wetwell.

Page 6:

Modifications to the "minimum project discharge during the summer and early fall" are not being proposed. Rather, increased river flows are being proposed for downstream at the Save Creek USGS gauging station.

It should be mentioned in the EA that the two existing Eicher screen installations are used in surface applications. The Wynoochee Eicher screen is proposed for a deep-water application.

The statement "Current mortalities will be dramatically reduced" is highly speculative at this time. The ACOE must consider the serious questions of fish attraction and diving down to the penstock in writing the final project report and EA.

The EA should provide references given to support use of supplementation as a fisheries management tool. Also, the WDFW is the entity responsible for setting fish stock genetics and disease policies in the state. The EA should state that the WDFW will set fisheries management policies.

The WDFW is responsible for fish management policies in the state. The trap-and-haul facility is proposed to be modified to allow the WDFW to sort fish for greater flexibility in fish management policies. The modified trap-and-haul facility will be a tool to help the WDFW implement proper fish management programs. The Section 1135 Program should not dictate specific fisheries management scenarios for the Wynoochee River. The EA should be written to reflect this understanding.

Page 7:

Rewrite the first sentence in Section 3a.

At this time, the potential modifications to the intake are subject to engineering considerations as to the best method to create higher vertical-flow velocity and biological findings concerning fish attraction. Studies will need to be performed in the spring of 1997 to confirm fish attraction. Tacoma believes there may be better alternatives to the second tier of temperature panels as shown in the EA. As long as all parties are open to finding the best solution and can be proven to work, the project can proceed.

Page 8:

The EA should describe the decision process for choosing unlined dirt ponds over concrete raceways.

The ACOE should consider a cover/shade system for the ponds, similar to the WDFW Methow Hatchery, rather than in-pond structures.

The description on page 8 states the ponds will be 30' x 60' x 8'. Figure 1, Appendix A, illustrates that the rearing ponds are approximately 250 feet in length and located at the site of the existing substation and storage building. The scale for Figure 1, Appendix A, may be incorrect.

Page 10:

The EA should provide plans and specifications for the trap-and-haul facility modifications.

Rewrite the third sentence in the second paragraph.

Page 11:

Under the section titled Consistency with Purpose, the 1135 program does not necessarily benefit hydroelectric power. The overall value of the power generated is worth less after all components of the 1135 Project are implemented. Although the number of megawatt hours generated is increased when the 77-day shutdown is eliminated, the change in the spring refill curve and the losses associated with the bypass, result in less power being generated in times when power is more valuable. Therefore, the overall value of the electricity generated at the project decreases. Also, recreation is negatively impacted (as stated in the appendix on hydrology).

Page 13:

What is the basis for the assumption whereby fish that pass through the turbines are injured or killed at an unacceptable rate?

The last sentence in paragraph 2 states that TPU will be able to increase releases from the Wynoochee Reservoir in the spring and summer once the Eicher screen is in place. We disagree with this assumption. TPU will be able to generate during the annual shutdown, however, the actual amounts of water released from the dam will not be increased except to meet the new-flow proposals. The operation of the Eicher screen is independent of any flow proposals.

Cutthroat trout are not proposed to be reared at the supplementation facility. This species should be removed from discussions in the EA.

Remove sentences 5 and 6 in the first paragraph in the discussion of supplementation ponds. These statements are not supported in the EA.

Page 14:

In the third paragraph in Section 3 C III, the EA should not state that smolt outmigration is limited to 77 days, from April 15 to June 30. Our studies indicate (and other references agree) that smolt outmigration is much more variable. TPU, the ACOE, and resource agencies must still discuss when the Eicher screen will be deployed. The best

current assumption would be that it will be for 77 days, but probably varied, based on actual outmigration observed through hydroelectric-acoustic monitoring.

Page 16:

Maintaining a minimum-flow regime at Save Creek will result in fluctuating flows between the dam and Save Creek. At the last TAC meeting of June 29, 1996, attendees expressed a concern that these flow fluctuations may adversely affect local fishery resources. The ACOE should present the findings of the resource on this topic as discussed in the TAC meeting.

Page 18:

The EA should reference assumptions regarding fish stimuli in your discussion of supplementation ponds.

Page 19:

The EA should address the effects of flow fluctuations between the dam and Save Creek.

In the discussions of Total Project Benefit, it is recommended that the ACOE must use references or other satisfactory information to support assumptions on the benefits of the 1135 Restoration Project.

Page 23:

Nealson and Scott (1995) does not support this conclusion. This study was not conducted to assess smolt passage survival through the project. The study was conducted by TPU and HTI to ascertain if smolts would enter the wetwell and dive to the proposed location of the Eicher screen in the penstock. We found the smolts would not dive to the penstock. The EA should consider these findings in future proposals.

The ACOE should note that the Eicher screens were used as a surface collector at Elwha and Punteledge. A deep-water application for an Eicher screen has not been successfully demonstrated.

Page 41:

The non-federal funding required to satisfy the local sponsorship portion of the 1135 Program is estimated to be $1,120,000 not $9,150.

Appendix F, page 1:

The second sentence under Background should be modified to read, "The project sponsors desire additional operational flexibility to enhance refill."

Additional comments:

There appears to be some confusion throughout the EA on refill dates (especifically the full-pool date). Delaying reservoir refill until May 5 may adversely affect the ability to reach summer-full pool. At the operator's discretion, the reservoir should be allowed to fill from 795 beginning April 13 to 800 on May 1, unless weather forecasts indicate large inflows are likely, then refill from 795 to 800 could be delayed. The sections in the EA pertaining to refill operations should be adjusted to reflect these changes.

We appreciate the opportunity to provide the ACOE comments on the Section 1135 Fish Restoration Project Draft Project Modification Report/Environmental Assessment.

Sincerely,

Patrick D. McCarty
Generation Manager
Light Division

BSS/skm 1135ea1.doc

TACOMA PUBLIC UTILITIES
Patrick McCarty- Generation Manager

RESPONSE TO COMMENTS
WYNOOCHEE SECTION 1135 REPORT/ EA

COMMENT	SECTION	RESPONSE
1. Remove TPU logo from cover.		Noted. Concur.
2. Power not an original project purpose. Project costs not allocated to power.	1.A	Noted. Concur.
3. Reference which report stated "Smolts were found to mill inside and outside the trashrack and wetwell".	1.B	Citation has been added.
4. Minimum project discharge is not being proposed. Eicher Screen is deep water installation rather than surface water like the examples.	2	Concur. Velocity and nature of water over the screen should determine success, not where the water is coming from. Consensus is that if velocities can be held within biological parameters, the screen will perform adequately.
5. Current mortalities will be dramatically reduced is highly speculative given questions surrounding fish attraction and sounding to depth.	2	In light of recent outmigration studies, we believe mortalities will be reduced. The word "dramatically" will be removed.
6. EA should provide references given to support use of supplementation as a management tool. Also WDFW is responsible for setting fish policy, EA should state that.	8.B	Noted. References for supplementation as an appropriate tool come mostly from unpublished memorandums and meeting notes developed during the planning process. Additional information on ponds and trap modification can be found in the document. EA will state the WDFW role in fish policy.
7. EA shouldn't dictate specific fisheries management scenarios for the Wynoochee River.	8.B	The role of this EA is to simply outline the opportunities available to the state. Text modifications will outline or qualify Corps' statements to indicate the state will have ultimate decision making power on how the fisheries improvements are operated.
8. Rewrite first sentence in Section 3a "Intake Trashrack and Wetwell".	3.A	Concur.

9. EA should describe decision process for choosing unlined dirt ponds over concrete. Should consider shade/cover rather than in-pond structure. Which pond size is correct?	3.A.2.a	Current plan is to use a concrete raceway design in keeping with Washington Department of Fish and Wildlife policies. As such, the same policies will govern appropriate pond size. Pond size will be finalized during the design phase.
10. EA should provide plans and specifications for trap mod. Rewrite third sentence in second paragraph.	3.A.2.b	Plans for the Trap are to be developed by the WDFW. If one is available prior to finalizing this report it will be included. Otherwise, it will be developed during plans and specifications and text descriptions will suffice.
11. Hydropower would not be a beneficiary to Section 1135 project.	3.B	Noted. Concur.
12. What is the basis for the assumption that fish pass through the turbines and are killed? Tacoma cannot increase releases from the reservoir once the screen is in place.	3.C.1	The assumption that fish are injured or killed in the penstock is based on agency concern with penstock design and formalized through the FERC license which prohibits project operation due to concern for outmigrant mortality.
13. Cutthroat are not being reared in the ponds and should be removed from the list. Sentences 5 and 6 are not supported in the EA.	3.C.2.a	Noted. Cutthroat have been removed from discussions pertaining to the supplementation ponds.
14. EA should not state that smolt outmigration is limited to 77 days.	3.C.1	Concur.
15. TAC found fluctuating flows between dam and Save Ck. would have adverse impact to fish. COE should present.	5.A.5	The impact from flow fluctuations stems from the need to compensate reduced local inflow at Save Ck. by ramping up at the dam. Quick ramping rates could impact juvenile fish located in areas with wide wetted perimeters (Approx. 4 miles). Ramping rates are currently regulated by established operational criteria.
16. EA should reference assumptions regarding fish stimuli.	3.C.1	Concur.

	3.E	
17. Total project benefit. recommend COE use references or other satisfactory information to support assumptions of benefits.		Noted. References are available for estimating adult returns based on benefits or impacts derived from habitat modification. Previous work done for similar benefits analysis provide the baseline information.
18. Nealson and Scott does not support the survival conclusion. Study was not conducted to assess smolt passage survival.	3.F.1	Statement including the Nealson reference has been modified to show that the study was not conducted to assess smolt passage survival.
19. Mention should be made of surface collection at other Eicher screen locations and that Wynoochee is deep water draft.	3.G	Noted. In general, surface collection is considered optimal for passage of coho and steelhead smolts. However, the success of the Wynoochee Eicher screen could equal that of a surface collector given proper flow and attraction velocities. The change in the rule curve and modifications to the wetwell are intended to provide attraction and capture velocities
20. Non federal funding required to satisfy sponsorship is 1,120,000 not 9,150.	3.D	Noted. Statement is corrected.
21. Appendix F. Second sentence under background should be modified.		Noted. This comment refers to the refill operation report which will be modified to read "The project sponsors desire additional operational flexibility to enhance refill".
22. Delaying refill until May 5 may adversely affect the ability to reach summer full pool. The reservoir should be allowed to fill from 795 beginning on April 13 to 800 on May 1 unless weather forecasts indicate large inflows are likely, then refill from 795-800 could be delayed. The sections of the EA pertaining to refill operations should be adjusted accordingly.	3.A.3	Noted. Sections pertaining to refill operations have been adjusted.

United States Department of Agriculture
Forest Service
Olympic National Forest
Hood Canal Ranger District
P.O. Box 68
Hoodsport, WA 98548
(360)877-5254

File Code: 2770

Date: September 13, 1996

Mike McNeely
U.S. Army Corps of Engineers
Environmental Resources Section
P.O. Box 3755
Seattle, WA 98124-3755

Re: Wynoochee Dam (FERC No.6842)
Section 1135 Fish Restoration Project

Dear Mr. McNeely:

We have reviewed the Draft Project Modification Report and Environmental Assessment for the Wynoochee Lake, Section 1135 Fish Restoration Project and provide the following comments for consideration.

We consider this Draft Project Modification Report and Environmental Assessment inadequate, and recommend that a second draft effort be made. The report is incomplete regarding several issues and concerns, and generally does not adequately address, evaluate, or document environmental impacts. The report seems to focus on impacts, effects, and mitigation relating principally to fish resources. While that is understandable and reasonable given the circumstances, it should not serve to give an impression that other resource values or issues are not important.

The following comments are more specifically tied to the report.

PROJECT BOUNDARY AND LAND USE

In order to better assess the impacts of land use of the 1135 Fish Restoration Project, the location of the FERC License Project Boundary should be included to provide a better context and perspective for this environmental assessment. The FERC Order amending the License issued March 5, 1996, required the licensee to file a revised Exhibit G to show all lands used for License operation or mitigation, within the Project boundary. This revised project boundary map should be included in your report, and may serve as a basis for further License Amendment requirements. A related topic is the "Real Estate Appendix" which includes some statements and references that are not entirely clear to us.

As the report bears out, considerable National Forest System Land (NFSL) may be involved in this proposal and yet no reference is made to the Olympic National Forest Land and Resource Management Plan or the Record of Decision for

Amendments to the Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. We feel this is a serious oversight that needs to be corrected as many land management standards and guidelines will be applicable to any proposed activities. Important components are concerns relating to Riparian Reserves, Late Successional Reserves, and Aquatic Conservation Strategies.

AESTHETICS / VISUAL AND RECREATION IMPACTS

The document states on page 11, paragraph 2, and again on page 35, paragraph 2, that "The proposed project modification will not effect the aesthetic quality of the Wynoochee River and surrounding areas." This statement is not supported by any discussion, analysis, or identification of mitigation for visual impacts. We have repeatedly voiced Forest Service concerns over the visual impacts of the proposed Eicher Screen beginning in a November 24, 1993 letter where we spell out the concern for maintaining the quality of the visual resource along the recreation travel routes in the area. The Olympic National Forest Land and Resource Management Plan assigns a Visual Quality Objective to the area surrounding the project site which calls for managing specific landscapes in such a manner that their scenic values are protected, maintained, or enhanced as viewed from major travel routes, use areas, or water bodies. We can provide a copy of this plan if needed, and would be happy to work with you to develop mitigation actions to protect visual quality.

We have appreciated to date the attention to designing attractive facilities that are consistent with the character of this forest recreation setting. We are however concerned with the visual impact of the proposed Eicher Screen that would articulate approximately 40 feet above a FS bridge, obstructing an otherwise visually pleasing corridor. I was surprised by the dismissal of any visual quality concerns without explanation, particularly in light of a recent field trip with Corps personnel, during which this specific concern was discussed.

In the same context, it states on page 11, that the proposed modification would have no impact on recreation. It is still unclear how you plan to mitigate the impacts to the existing visitors area with the proposed Eicher Screen within just a few feet of this site.

It seems to us that the proposed rule curve changes may have a bearing on the recreational use and experience for boaters and general recreation users of the reservoir. While this may not be significant there should be some reference and discussion of this issue.

The proposed modification does involve ground disturbing activities that will have an effect of project aesthetics and recreation. These issues should be addressed.

We have previously discussed interpretive opportunities about the proposed project and that it may provide public awareness about fisheries enhancement programs and efforts. Reference to this should be included.

THREATENED AND ENDANGERED SPECIES

The draft assessment resource section omits reference to and should include the marbled murrelet which is present in the project area and was listed as Threatened in 1992. It was also inferred in the document that the bull trout was a listed species; the bull trout is in fact a candidate species but not as yet listed. Also, the spotted owl was listed in 1990; the statement that it was "recently" listed seems odd. In any event, reference should be made to the need for biological evaluations, and consultation protocols to meet requirements under ESA. Construction restrictions may be necessary to mitigate adverse impacts and the report should indicate such possible eventualities.

ROAD USE

The draft EA document does not address the additional transportation needs in the project area and the effect on FS roads. A road use plan should be submitted as part of the project proposal addressing the project induced road maintenance needs of the area. This plan should include projected future use of specific roads, public safety, year-round access needs, and winter maintenance needs relating to the project modifications increased needs.

FISHERIES

The Forest Service has previously stated that, as the land manager for a significant amount of fish habitat in the watershed, we obviously have an interest in fish stocks in relation to this habitat. The seriousness of the loss of smolts is evident from the Table on page 12 of the draft EA. It is imperative that these losses be mitigated to protect this public resource on National Forest Land. We do, however, recognize the involvement of other agencies who have primary responsibility for the protection and management of fish stocks. We defer to these agencies to make specific comments relative to the technical aspects of dam passage and reservoir survival.

It has come to our attention recently that there is growing concern over the operation of the adult trap and haul operation. Specifically, the shutdown of the facility during the "shoulder seasons" of fish runs, which is thought to continually narrow the genetic composition of wild stocks; and holding adults for long periods during which time they repeatedly collide with trap gates or barriers as they try to force their way upstream. While we do not have first hand knowledge of this, we want to make sure you are aware of the concern.

SUPPLEMENTATION PONDS

It seems that this part of the proposal has not been subjected to the same level of detail. Additional information is needed to fully assess impacts created by the proposed supplementation ponds. Please provide data relating to the following:

1) Would "unlined dirt ponds" hold water in the locations proposed?

2) Would rearing significant numbers of fish and the addition of fish foods create pollution problems in these ponds? Would ponds require cleaning, and if so, how would this be accomplished and would there be any pollution problems or impacts?

3) Would the ponds be secured for public safety, and to discourage vandalism? Will the ponds be part of a fence plan, as previously proposed?

4) Would the outlet streams be subject to erosion? Would they be lined or armored?

5) The draft EA lists a "Vegetation Resources" section on page 28 but does not address the environmental effects of clearing the site for the ponds on such vegetation. Any land disturbing activity including that of vegetation removal will need a description of the equipment to be used along with the construction times involved.

6) On page 14 it is concluded that "Environmental changes as a result of.....will be positive". Some further discussion may be helpful.

The Forest Service and cooperators are currently preparing a Watershed Analysis for the upper Wynoochee watershed. A draft analysis will be available this fall for review upon request.

We have several other minor, incidental comments such as the Cost Tables and relating text on page 17 do not seem to square with information at the top of page 41. It is also not clear to us at times how the responsibilities of Tacoma and Aberdeen are related or pertinent to specific issues at times. The ratings of alternatives against criteria and the selection of the preferred alternative, besides being rather subjective, troubles us somewhat.

Frankly as we review our conclusions at this point, we wonder if there might not be some benefit to meet and jointly discuss some of these concerns. If you think that a meeting might serve a good purpose we would certainly make ourselves available.

We appreciate this opportunity to review this Draft Environmental Assessment. Please contact me if you have any questions regarding these comments or further concerns.

Sincerely,

David W. Craig

DAVID W. CRAIG
District Ranger

cc: Tacoma Public Utilities
The City of Aberdeen
Forest Supervisor, ONF
Regional Forester, R-6

US FOREST SERVICE
David Craig- District Ranger

RESPONSE TO COMMENTS
WYNOOCHEE SECTION 1135 REPORT/ EA

COMMENT	SECTION	RESPONSE
1. The report focuses mostly on aquatic resources. It is reasonable that it should, but the report should not serve to give an impression that other resource values or issues are not important.	4.	The report focuses primarily on aquatic resources because they are the major direct beneficiary of the proposed project. Some analysis will be added where potential benefits or impacts could arise to other resources. However, notable additions to describe resources other than those targeted for this restoration project are not anticipated.
2. FERC license project boundary should be included to provide better context and perspective.		Noted. Tacoma has been asked to provide. This map will be included in the final design package.
3. No reference is made to the Olympic National Forest Land and Resource Management Plan or ROD. Important components are concerns relating to Riparian Reserves, Late Successional Reserves, and Aquatic Conservation Strategies.	4.C 4.F	The NFLRM and ROD provide valuable information on recreation and existing condition of the Wynoochee area. It will be incorporated for that purpose. Concerns relating to Riparian reserves, Late Successional Reserves, and Aquatic Conservation Strategies are not provided for in enough detail within the 2 documents to comment upon except to say that the project will strive to adhere to the guiding provisions by reducing land disturbance and function as much as practicable. All reference to no impact on recreation will be revised to say "no significant impact to recreation or other project purposes."
4. Interpretive opportunities about the proposed project may provide public awareness.		Noted. No funds are budgeted for interpretive displays.
5. Environmental Assessment omits reference to Marbled Murrelet. Statement that spotted owl was recently listed seems odd. Construction restrictions may be	4.C	Marbled Murrelet wording will be taken from the USFWS CAR and inserted into the ESA section of the EA. The EA contains all the information needed for a BA.

necessary to mitigate adverse impacts.		
6. Document does not address additional transportation needs in the project area and the effect on FS roads.	4.E	Detailed road plans are not being developed. Coordination with FS is appropriate during later project phases when detailed road plans and transportation/equipment needs are known. Corps' will document current condition of road prior to project and assume coordination and oversight to ensure contractor returns FS roads to pre-project condition. Road closure as required by this project will be minimized.
7. Shutdown of trap during the "shoulder seasons" of fish runs, is thought to continually narrow the genetic composition of wild stocks.	3.A.2.a	Noted. The U.S. Army Corps of Engineers has identified this as a problem. To reduce this concern, trap modifications will functionally eliminate the shutdown period and allow year-round collection and transportation of adult salmon.
8. Would unlined dirt ponds hold water in the proposed locations?	3.A.2.a	WDFW recommends implementation of concrete lined ponds due to operation and maintenance concerns. Concrete lined ponds will hold water in the proposed locations.
9. Would rearing significant numbers of fish and the addition of fish foods create pollution problems in these ponds. Would ponds require cleaning. if so, how?	3.A.2.a	The size and carrying capacity of the supplementation ponds are tailored to Washington Department of Fish and Wildlife stocking protocol. These are short term rearing ponds (2-4 weeks) so not impact from feeding is likely. Study memorandums show that the two 30'x60'x8' ponds with 1,200 GPM flow should be adequate to support 25,000 steelhead at 5-7/pound and 55,700 coho at 16-18/pound. These numbers are well within appropriate loading densities as calculated by the Fisheries Handbook of Engineering Requirements and Biological Criteria (Bell, 1991).
10. Would the ponds be secured for public safety and will the ponds be part of a fence plan.	3.A.2.a	The ponds would be secured against public intrusion or vandalism with a fence or other means. Coordination with the USFS during plans and specifications will answer fencing questions.

11. Would the outlet streams be subject to erosion. Would they be lined or armored.	3.A.2.a	The WDFW will be responsible for the desig of all supplementation pond features. The WDFW plans to use a buried conduit to transport smolts quickly from the ponds to the river. When linked with a volitional release system at the ponds, this system will safely deliver the smolts to the river.
12. What are the effects of clearing vegetation for the ponds? Need a description of equipment to be used as well as construction timing.	5.A.2	No effect on vegetation. The pond construction site is currently an open area. Construction and equipment and timing will be determined during the design phase.
13. It is concluded that trap modifications will be positive. More discussion may be helpful.	3.A.2.b	Noted.

STATE OF WASHINGTON
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September 12, 1996

Mr. Mike Neely
US Army Corps of Engineers
PO Box 3755
Seattle WA 98124-3755

Dear Mr. Neely

Thank you for the opportunity to comment on the draft Federal Project Modification Report and environmental assessment (EA) for the Wynoochee Lake, Wynoochee River Section 1135 Project, Grays Harbor County, Washington.

Consistent with the Department of Ecology's responsibilities as Washington State's coordinator for the National Environmental Policy Act, we are forwarding the comments received from the State of Washington, Department of Fish and Wildlife. If you have any questions on the comments made by Washington Department of Fish and Wildlife, please call Mr. Dave Gufler at (360) 586-6129 ex. 224.

Sincerely,

Barbara J. Ritchie

Barbara J. Ritchie
Environmental Review Section

BJR:ri
96-5735

Attachment

State of Washington
DEPARTMENT OF FISH AND WILDLIFE

Mailing Address: 600 Capitol Way N • Olympia, WA 98501-1091 • (360) 902-2200, TDD (360) 902-2207
Main Office Location: Natural Resources Building • 1111 Washington Street SE • Olympia, WA

September 10, 1996

Rebecca Inman
Environmental Review Section
Washington Department of Ecology
Post Office Box 47600
Olympia, Washington 98504-7600

RE: Section 1135 Fish Restoration Project Draft Project Modification Report/Environmental Assessment for Wynoochee Dam Project

Dear Ms. Inman:

The Washington Department of Fish and Wildlife has been closely involved in the planning and development of this restoration for several years. We support this effort and concur, in general, with the contents of this report.

The U.S. Army Corps of Engineers and Tacoma Public Utilities are to be commended for their efforts in coordinating agency input and assimilating the information necessary for completion of this complex report. There are, however, several areas in the report in need of minor revisions. The following comments will reflect our recommendations for those changes.

- Page 6, fourth and fifth full paragraphs - The key issues that should be stressed for "fish quality" are: 1) the increased survival rates; 2) the use of locally returning stocks; 3) the use of only unmarked fish for passing above the dam and in the supplementation program; and 4) the use of acclimation ponds with the potential for more natural rearing conditions.

  Suggested language:

  "Improving fish quality is another important element of the project. Fish quality is a function of genetic diversity, local adaption and overall survival and productivity. Genetic diversity is important because it helps fish populations cope with the highly variable environment they live in. Local adaptation improves productivity by providing fish that

have characteristics in tune with local conditions. Both of these important factors have been affected by the loss of stock abundance due to survival and passage problems associated with the dam, and use of outside stocks for past supplementation efforts.

Improved survival and passage due to the project will help maintain larger population sizes and prevent the extinction of local stocks. Larger populations maintain greater diversity within the population and preventing extinction helps maintain the overall stock diversity in the Chehalis Basin. Local adaptation will be maintained and improved through the use of local, naturally produced fish for passage above the dam and in the supplementation program. All the fish produced in the supplementation program will be marked to identify them as hatchery fish. Only unmarked fish will be taken from the Wynoochee fish trap for use in the hatchery or for insertion above the dam. By using only non-fin-clipped stock, a larger, more diverse gene pool can be tapped. For development of the pond stock, a minimum of 20 adult fish (per stock) are needed, but 40 adult fish would be optimal; again to insure a more diverse gene pool. The rest of the non-fin-clipped stock would be inserted above the dam. Modifications to the fish trap will give the ability to sort natural from fin-clipped fish.

The survival and quality of the hatchery production will be improved by the use of the acclimation ponds that allow fish to recover from the transfer process, provide more natural rearing conditions, reduce stress from trucking during smoltification, and provide volitional releases that better match the fishes need to migrate."

- Page 10, first paragraph - The statement, " At 150 fish /lb, the fish will be trucked to the supplemental ponds . . . ." needs correction. The fish will be much larger that 150 fish/lb when transferred to the acclimation ponds.

- Page 10, paragraph b. Trap Modifications. - Suggest rewriting the first sentence as follows: "Without trap modifications and subsequent sorting capability, selection of wild stocks to be transported upstream of the dam, and selection of Wynoochee stock for hatchery supplementation, would not be possible."

- Page 13, paragraph a. Supplementation Ponds. - The smolt numbers for coho and steelhead should be reversed, 25,000 <u>steelhead</u> and 55,700 <u>coho</u>. This also needs to be corrected on Page 18.

- Page 14, paragraph b. - The third sentence is awkward and doesn't emphasize the key point. Perhaps this could be rewritten as: Hatchery fish will not be used above the dam or in the supplementation program so that higher levels of local adaptation and productivity can be maintained in the naturally spawning stocks. It should also be pointed out that

future operations will be subject to rules (guidelines) established by this department's Wild Salmonid Policy (and/or the Federal Endangered Species Act).

- Page 16, last paragraph - The references to spring chinook occurrences may be misleading. The document refers to spring chinook frequently, and not until the very end, does it suggest that they do not appear in significant numbers in the Wynoochee River system nor does it appear they ever have. The occasional fish observed recently can by traced to releases of hatchery fish in the early 1970s. Also, natural coastal spring/summer chinook do not migrate as yearlings but as zero age fish.

- Page 17, D. Costs, first line "Table x summarizes," the x needs to be filled in as 3-6.

- Page 18, paragraph a, - The term "sterile" in reference to the concrete raceways is not totally accurate and should be eliminated.

- Page 18, paragraph a., last sentence - In keeping with the goal of maintaining local adaptation etc., it is unlikely that we would use the returning hatchery fish in nearby hatcheries or egg box programs except in a rare emergency. This sentence could be restated as follows: Excess fish returning to the trap as a result of supplementation could be recycled, used as carcasses to fertilize the upper watershed, or disposed of.

- Page 19, paragraph on Flow Modification - The last two sentences may be overstated and should be revised. The adult passage situation has not been a serious problem with the minimum flow established with dam operation. Low dissolved oxygen and warm water temperatures may be more important concerns that will be addressed with flow augmentation during the late summer/fall period. The last sentence should be revised to indicate that adult returns will be increased <u>appreciably</u> (delete percentage rates) from flow modifications.

- Page 22, Table 3-9 - The supplementation ponds should have a neutral effect on bull trout. No evidence was presented otherwise.

- Page 25, I. No Federal Action Alternative, last sentence - ". . . elimination of natural fish runs in this system." This should be changed to reflect the area above the dam, not the entire system.

- Page 30, first full paragraph - Coho production above the dam is between 25 and 30 percent. The importance (relative abundance) of spring chinook in the Wynoochee is debatable.

- Page 33, paragraph E. - The discussion on potentially listed fish species should be revised as follows:

  Bull Trout - The U.S. Fish and Wildlife Service (USFWS) has not listed bull trout. They have indicated that listing is warranted, but postponed due to other more pressing issues.

  The term "candidate species" has a specific usage under the Endangered Species Act (ESA) and should not be used here. We recommend striking the sentence that begins: Several candidate anadromous . . . ." The next sentence explains that stocks are under review.

  National Marine Fisheries Service (NMFS) has not declared the status of spring chinook and searun cutthroat. The Nehlsen et al. 1991 paper was published by the American Fisheries Society.

- Page 34, Section A., No. 4 Effects on Wetlands - The construction of the acclimation ponds will take place in an area already disturbed and will not impact wetlands.

We appreciate the opportunity to participate in this effort and hope our comments will be valuable in developing the final Environmental Assessment.

Sincerely,

Dave Gufler
Regional Habitat Program Manager

DG:kam

cc: Distribution List

Distribution List

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WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
Dave Gufler- Habitat Program Manager

RESPONSE TO COMMENTS
WYNOOCHEE SECTION 1135 REPORT/ EA

COMMENT	SECTION	RESPONSE
1. Key issues for supplementation ponds and fish trap are understated.	2	COE is open to changes in wording or using suggested language. Paragraphs four and five will be rewritten to stress important items.
2. Fish will be larger than 150/lb. when transferred to acclimation ponds.	3.A.2.a	Noted. Fish will be raised in the supplementation ponds for 2-4 weeks prior to release. Text has been changed to reflect 10 fish/lb for steelhead and 20 fish/lb for coho at time of transfer.
3. Suggested rewrite of first sentence of trap modification.	3.A.2.b	Noted. Concur.
4. Smolt numbers are reversed..	3.A.2.b	Numbers have been corrected.
5. References to spring chinook may be misleading. Document refers to spring chinook often but only at the end states they are small in number.	3.C.1	Refer to the WDFW SASSI report for information which states spring chinook have not been abundant in the Wynoochee Basin since the 1950's. The report identifies the spring chinook as a distinct run within the basin and only when appropriate does it identify the relative contribution to the system that the spring chinook make.
6. Table x needs filling in as Table 3-6.		Noted. Table was corrected.
7. Term "sterile" not totally correct.	3.E.2.a	Term has been replaced with "unnatural"
8. Restate sentence referring to disposition of excess eggs.	3.E.2.a	More detail is given.
9. Last two sentences may be overstated. Low flow not particularly a problem with current dam operation. Benefits from flow modification primarily from temperature	3.E.3	Sentence changed to emphasize DO and temperature benefits. COE believes the adult return analysis is appropriate and necessary for proper evaluation.

reduction and DO increases. Change last sentence to state adult returns will be appreciably increased rather than applying percentages.		
10. Supplementation ponds should have neutral effect on bull trout.	4.B.5	It is stated in the report that the supplementation ponds will provide resident fish with increased prey opportunities. While it may not be major, bull trout may also be provided with this increased prey base and therefore the supplementation ponds are not neutral to bull trout or any other piscivorous resident fish large enough to capitalize on salmonid smolts.
11. No action alternative-last sentence. Should be changed to reflect the area above the dam not the entire system will be eliminated of natural runs.	3.G	Sentence modified.
12. Coho production above the dam is between 25 and 30 percent. The importance of spring chinook is debatable.	4.B.5	Concur.
13. Discussion of ESA fish should be revised..	5.B	Section will be revised.
14. Area of acclimation ponds already disturbed and will not affect wetlands.	5.A.5	Concur. The ponds are not located in wetlands and no pond construction will occur in waters of the U.S.

9/23/96

September 18, 1996

Karen S. Northup
Chief, Environmental Resources Section
Planning Branch
Seattle District, Corps of Engineers
P.O. Box 3755
Seattle, WA 98124-2255

Dear ~~Ms.~~ Karen Northup:

My review comments on the draft Federal Project Modification Report and Environmental Assessment (EA) for the Wynoochee Lake, Wynoochee River Section 1135 Project, Grays Harbor County, Washington, are provided by this letter. Please be advised that while I am a member of Trout Unlimited the comments are those of an individual and may or may not be consistent with comments you received from the Northwest Steelhead and Salmon Council of Trout Unlimited. Each should be considered on their own merits.

I appreciate the additional information provided by Jeff Dillon of your staff in his letter of September 16 and the extension of time to submit my comments. I have also benefited from recent information provided by Washington Department of Fish and Wildlife (WDFW) staff, including confirmation that the Aberdeen Hatchery, due to water quality problems, is not meeting mitigation requirements for steelhead production. However, I was told that operational changes are being considered to correct this situation and that the annual 170,000 smolt plant obligation is being met in part with smolts from sources outside the Wynoochee Basin.

There remains some discrepancy regarding the intended steelhead brood stock for the Aberdeen Hatchery between Mr. Dillon's response to my question and information provided by Chuck Johnson, WDFW. Mr. Johnson indicated some of the wild steelhead taken at the Wynoochee project trap are the intended brood stock for hatchery production. If this is the situation then care must be taken to avoid under escapement to the basin above the Wynoochee project due to brood stock demands for the Aberdeen Hatchery and the Section 1135 project. Given the most recent escapement figures for above dam it appears that the genetic criteria could easily be violated for the remaining escapement.

Comments.

1. Cost limitations and other parameters of the Section 1135 program which have a bearing on the recommended anadromous fish restoration project should be presented at the beginning of the report to provide context.

1

2. While the Section 1135 scope is restoration and not mitigation, clearly the intent expressed previously by Corps staff was to ensure that outstanding mitigation requirements were resolved by the Section 1135 project. Therefore, your final Project Modification Report/EA should document: (a) the original Wynoochee project anadromous fish mitigation requirements, (b) requirements satisfied by measures completed to date (showing both intended and actual accomplishments), (c) balance of requirements to be met by the Section 1135 project and (d) Section 1135 accomplishments above and beyond mitigation. The lack of this information adds to the confusion and lack of public confidence in the process and the project proponents.

3. The proposed Section 1135 project, as adopted by the interagency Section 1135 Technical Committee, appears to have the potential for accomplishing restoration objectives. However, the projected success of the proposed project is dependent on a number of premises which may or may not be valid. Accordingly, it is imperative that some further testing of outmigrating smolt behavior be performed next spring in the wet well with temporary baffles in place. Also, concurrent monitoring should be performed of smolt attraction to the wet well as was done last year. On the premise that the baffles will result in the desired response and the smolts will sound to the penstock, there should also be some means of sampling smolts that have passed through the powerplant for injury and mortality. The test should demonstrate the viability of the fish passage element of the Section 1135 project without significant loss of 1997 out migrants. I would like to be kept informed of the details of the 1997 test and may choose to visit the site during testing.

4. Table 3-1 comparison of existing fish passage survival vs. expected with project survival and overall improvement. An appendix should include the analysis that was the basis for this presentation. Some indication of the validity of dam passage survival estimates may be gained from the requested 1997 testing. Is it possible to concurrently test smolt reservoir migration response as well in order to gain a sense of impacts on residualization?

5. Table 3-8 Estimated addition anadromous production above and below Wynoochee Dam and Reservoir from implementation of restoration project alternatives. An appendix should include the analysis that was the basis for this presentation. How can there be a gain in spring chinook above Wynoochee Dam when no spring chinook are now trucked above the project (see Table 4-1)?

6. Table 4-1. Summary of Wynoochee Basin salmon and steelhead escapements for 1985-1992 should be updated to include 1993, 1994 and 1995 data to provide the most recent trends.

7. Given the uncertainty of the success of the Section 1135 project it is imperative that a commitment is made now to scientifically monitor and evaluate the performance of the

project for at lease two cycles of each of the target species of fish (chinook, coho, steelhead and sea-run cutthroat) to verify pre-Section 1135 project predications and provide a basis for project modifications. This would suggest perhaps a ten year program, twice that allowed under the Section 1135 authority. However, monitoring should make biological sense and verify that the substantial public investment in the project is in fact realized.

8. Adaptive management should be employed with the Section 1135 Technical Committee tasked with an annual review of the project's performance and to make recommendations for project modifications, as appropriate. The review and recommendations should be documented in a report that is made available for public review and comment. It is noted in Section 9. Modification Evaluation, that some monitoring is proposed of juvenile movement through the reservoir and of fish passage facilities. However, as mitigation and restoration success will be determined by adult returns, it is imperative that at least two cycles of adult salmon and steelhead be monitored and evaluated as to project performance.

7

9. As requested previously, the Section 1135 project should be presented in the context of the current overall Wynoochee basin fish management strategy, even if that strategy has not been formally adopted. Surely, senior managers at WDFW can articulate their current basis for production and harvest management.

8

10. The final report should discuss what actions the Corps will take if indeed the Section 1135 project does not meet expectations and production improvements fall short of outstanding mitigation requirements.

9

Please continue to include me on your interested public mailing lists for this project and provide me with a copy of the final documents.

Sincerely,

Frank Urabeck, P.E.
2409 S.W. 317th
Federal Way, WA
98023-2202

cf:

Joe Durham
TPU
WDFW

Frank Urabeck
Federal Way, Washington

RESPONSE TO COMMENTS
WYNOOCHEE SECTION 1135 REPORT/ EA

COMMENT	SECTION	RESPONSE
1. Cost limitations should be presented at beginning of document.	1.C	Cost limitations of the Section 1135 program does dictate the items available for inclusion. To provide context to the reader, mention of the Section 1135 funding limitations has been provided.
2. Final EA should document the original Wynoochee mitigation requirement, portion that has been satisfied, balance of requirements to be met by Section 1135 and accomplishment of the Section 1135 above and beyond mitigation.	1.B	Noted. The Wynoochee Section 1135 project is a restoration project. Section 1B outlines the mitigation history of Wynoochee Dam. Further documentation of project mitigation is not required by the Section 1135 program and will not be included in the PMR/EA.
3. Some further testing of smolt behavior should be performed. Sampling smolts that have passed through the powerplant should be done.	3.E	Noted. In the spring of 1997 Tacoma biologists tested fish attraction through a wetwell of reduced cross sectional area. Smolt condition after exiting the penstock was recorded.
4. Appendix should be included that shows the analysis done for table 3-1 and table 3-8.	3.E	Noted. Table 3-1 is described throughout the Eicher Screen and Fish Bypass Facility section. First paragraph lays out 3 parts of project survival, and the 4 paragraphs that follow the intro. paragraph describe the 3 parts of project survival in detail which in turn describes survival rates provided in Table 3-1. Table 3-8 was developed by Harza in conjunction with Corps, and TAC. Final Numbers of fish and survival rates were reviewed by WDFW.
5. How can there be an increase in spring chinook above the dam when no spring chinook are released there?	4.B.5	Noted. The assumption made during the presentation for spring chinook was that there were still spring chinook above the reservoir. Stream type chinook smolts do exit the reservoir; however it's uncertain whether the are ocean type chinook that residualized for a

		year or if they are actually stream type. To avoid confusion, and making many caveats, the column for spring chinook has been eliminated. The words "if still present" remain in the discussion of spring chinook benefits.
6. Add 1993,1994, and 1995 escapements to table 4-1.	4.B.5	Noted. The WDFW was contacted regarding the updated escapement numbers. They are included in the report.
7. Monitoring should be considered now and cover at least two cycles of salmonid life history.	9.A	Noted. A five year monitoring plan will be implemented as part of this project. Five years is the upper limit for monitoring under the Section 1135 authority. The monitoring will focus primarily on passage success at the dam, however adult monitoring will be considered.
8. The project should be presented in the context of the current overall Wynoochee basin fish management strategy even if that strategy has not been formally adopted.	1.C	Noted. We believes that this project complies with all current literature such as the SASSI and draft wild salmonid policy. The overall basin fish management strategy is beyond the scope of this project.
9. The final report should discuss contingency measures or actions should the project fall short of outstanding mitigation needs.	9.A	Noted. The Section 1135 project has been tailored to fit unrealized production potentials brought on by poor outmigration of smolts through the dam/powerhouse. The project monitoring plan will assist in determining optimal project operation. No further contingencies have been included in this project.

TROUT UNLIMITED

Mike Mcneely
U.S. Army Corps of Engineers
Environmental Resources Section

9-14-96

Dear Sir:

In response to the Wynoochee Dam, Section 1135 Fish Restoration Project Draft Project Modification Report / Environmental Assessment, The Northwest Steelhead and Salmon Council of Trout Unlimited is delighted to have the opportunity to respond and comment on this report and restoration project. Trout Unlimited see's this as an opportunity to start rebuilding wild population of steelhead and salmon within the Wynoochee Watershed through a carefully designed supplementation program that addresses all stocks.

We believe the following areas must be addressed to mitigate for lost habitats and to sustain native and wild populations of trout and salmon.

1. In stream flows recommendations must address all species of trout and salmon and their life cycles. The fisheries would include but not be limited to Spring-Summer and Fall Chinook, Coho, Chum, Steelhead and Cutthroat Trout. We would like to see the U.S. Fish and Wildlife Service, and Washington State Department of Fish and Wildlife come to a consensus on the minimum and optimal flows for all species.

2. T.U. is concerned about the reliance that has been place on the 1978 Dunn study in developing the projects recommendations. We believe that the work is outdated and that the proposal relies too much on estimates that are not verifiable under current operating conditions. The Dunn study does not take into consideration changing river conditions and hydropower operations when evaluating fish movement and juvenile survival.

3. A ten-year monitoring study should be conducted to include all species. Ten years of study would cover the life cycle of two generations of chinook, thus giving connotative data.

4. Mitigation should address all anadromous and resident stocks of fish. Dam mitigation has been delayed for more than twenty years during which natural fish production has declined in the river. The restoration project must strive to restore natural stocks through a supplementation program, using stocks of origin. The use of none native hatchery plants are no longer acceptable for mitigation. Chambers Creek steelhead will continue to weaken the natural stock, only stocks of origin should be used in the restoration effort.

5.Currently, the returning hatchery run coincides with the wild coho stock. Tribal fishing for steelhead results in a by-catch of wild coho, this impact should be addressed in this proposal.

6. The rearing of fish eggs for the supplementation must be on sight rather than the Bingham Creek facility in the Satsop River drainage. The most current technology will be used to insure the project success, including use of underwater feeders, aquatic insect feed, plant cover and in-stream structures for the supplementation ponds. These techniques have been successful designed by the National Marine Fisheries Service, at their Hood Canal research facility.

7.Additional rearing ponds are needed above the reservoir to supplement the past mitigation needs on steelhead and to aid in the restoration and recovery of all other targeted fish stocks.

8. Additional design work needs to be done for downstream migrations. We know that currently coho and steelhead residualize in the reservoir and juveniles have unsuccessfully migrated downstream. The best means to ensure downstream passage must be implemented. This might include drawdowns during different times of the year.

9. We are concerned that trap and haul method is not working and that other means must be addressed in the proposal, including a laddered system.

10. Contingency measures, dam decommissioning and removal must be addressed in the Environmental Assessment

11. The proposed infrastructure should be tested for a minimum of two years and up to ten years before any power certification is issued to ensure this project will be sustainable.

12. We are unclear what is the City of Aberdeen roles are in this project, if any.

13.A rule curve must be developed to operate the project that seeks to balance fish needs with flood control and power needs. There needs to be an eighteen-hour warning to the fisherman before an emergency release of water. This Environmental Assessment needs to address the effects of rapid water fluctuations on gravel recruitment, fish stranding, bank erosion and loss of woody debris.

14. It is mentioned several times in the Modification Report that the City of Tacoma would be able to operate their power house during the seventy seven-day downstream migration periods." This is seventy-seven more than they are currently able to produce power. What is the additional revenue, is generated from the power generation during this seventy, seven-day period?

15. On page forty-one there is a significant error in the math. Tacoma Public Utilities share in the cost of this project is $1,120,000.00 not $9,150.00.

16. On page thirty two, the report states "since there was no appreciable spawning of salmon within the inundated area of the reservoir, there was no mitigation for salmon." On the previous page, the report points out that "Spring Chinook may lose over fifty % of the traditional spawning habitat due to the construction of the Wynoochee Dam; however the populations involved were reported to be of such magnitude that predicted effects would be negligible". It seems that if one wipes out fifty % of a population's spawning habitat that it would be both appreciable and that the effects would be catastrophic; not negligible.

The Northwest Steelhead and Salmon Council supports the need for this project, with the above concerns being implemented and addressed. We see this as an excellent opportunity to restore and enhance wild and native stocks of the Wynoochee River through a carefully designed recovery plan and supplementation program.

Sincerely,

Don Schluter
Hydropower Coordinator
N.W.S.S.C. of Trout Unlimited

cc:

Bern Shanks, Director Washington State Fish and Wildlife
Dave Mudd, Washington State Deptment of Fish and Wildlife
Karen Terwilleger, Washington State Department of Fish and Wildlife
Dave Frederick, Supervisor U.S. Fish and Wildlife Service
Will Stelle, NW Regional Director National Marine Fisheries Service
Bill Frank, N.W. Indian Fisheries Commission
Mona Janopaul, Conservation Council Trout Unlimited
Rick Applegate, West Coast Director of Trout Unlimited
Bill Robinson, N.W. Regional Director Trout Unlimited
Jim Wilcox, President N.W.S.S.C. of Trout Unlimited
Bob Johnson, VP N.W.S.S.C. of Trout Unlimited
Joe Duham, President Grays Harbor Chapter of Trout Unlimited
Ric Abbett, Columbia River Chairman N.W.S.S.C. of Trout Unlimited
Jim Derry, Trout Chairman N.W.S.S.C. of Trout Unlimited
Norm Keppler, Salmon and Steelhead Chairman N.W.S.S.C. of Trout Unlimited

TROUT UNLIMITED
Don Schluter- Hydropower Coordinator

RESPONSE TO COMMENTS
WYNOOCHEE SECTION 1135 REPORT /EA

COMMENT	RESPONSE
1. EA should address all species of trout and salmon life cycles as they relate to streamflow. The state agencies should come to consensus on minimal and optimal flows for all species.	Noted. Flow modifications will not adversely effect any species of trout or salmon. This Section 1135 project will provide adequate instream flow for fish throughout the year. State and federal fisheries agencies are in full agreement with the flow modification proposal.
2. Reliance placed on Dunn studies of 1970's may be outdated and the proposal relies too much on estimates that are not verifiable under current operating conditions. The Dunn study does not take into consideration changing river conditions and hydropower operations when evaluating fish movement.	Noted. The U.S. Army Corps of Engineers and other agency team members have gathered and reviewed the available and pertinent literature and found that the Dunn reports provide the best available specific data on juvenile behavior and survival. The U.S. Army Corps of Engineers, with other state and federal agencies have coordinated the components this project for years. The latest research and technical insight have not given us reason to believe the conclusions of Dunn and others are invalid.
3. A ten year monitoring study should be conducted to cover two years of chinook life cycles.	Noted. The project team is currently investigating the use of PIT tags (passive integrated transponders) inside the penstock for juvenile monitoring. For adult return monitoring the WDFW could investigate the use of coded wire tags. We will continue to plan and schedule monitoring efforts using available options.
4. Mitigation should address all anadromous and resident stocks. Restore natural stocks through supplementation using stocks of origin.	Noted. The Corps and Tacoma have entered into this project to restore unrealized production at the project. Therefore, our efforts are focused on those species for which production has been most limited. We believe the project will have qualitative benefits to other species including spring chinook.

	It has always been this project's plan to use natural stocks for the supplementation program.
5. Returning hatchery run coincides with the wild coho stock. Tribal fishing for steelhead results in by-catch of wild coho. This impact should be addresses.	Noted. We do not have the ability under this authority to manipulate fishing regulations and harvest management. They remain the responsibilities of the state and tribe.
6. Rearing of eggs must be on sight. Use most current technology including underwater feeders, insect feed, plant cover, and instream structures. Consult NMFS Hood Canal research facility.	Noted. We will inform the WDFW of the research being conducted at Hood Canal since they will be engineering and constructing the supplementation ponds. Some of the comment items will be considered such as inwater structure and plant cover. The WDFW are the recognized experts in pond construction and operation; the eggs will be incubated where it is practical and acceptable by that agency. Rearing from the fry to smolt stage and imprinting will be done at the supplementation ponds. The WDFW will be the lead agency for the design, construction, and operation of the supplementation ponds.
7. Additional rearing ponds are needed above the reservoir to supplement the past mitigation needs on steelhead.	Noted. It is not necessary to place additional ponds above the reservoir. The two ponds proposed are large enough to produce adequate numbers of adult returns and supplant lost production above the reservoir.
8. Additional design work needs to be done for downstream migrants.	Noted. Considerable time and effort has been spent developing proper outmigration facilities which are within biological criteria set during years of coordination. We will be testing the engineering results against these criteria this coming spring.
9. We are concerned that the trap and haul facility is not working. TU suggests investigating the use of other methods such as laddering.	Noted. No specifics were given supporting the contention that the trap and haul facility does not work. The report proposes the trap will be modified to allow fish transportation with less stress. A ladder at the dam would allow uncontrolled passage above the reservoir that is not consistent with agency management pla

10. Dam decommissioning and removal must be addressed in the EA.	Noted. Dam removal is not consistent with the project purpose and therefore not applicable under the Section 1135 authority.
11. Proposed infrastructure should be tested for a minimum of two years before power certification is issued.	Noted. The project is already certified for power generation. The structural components of the hydropower project are continuously monitored.
12. What role does Aberdeen play in this project	None at this time. The City of Aberdeen owns Wynoochee Dam. The cities of Aberdeen and Tacoma entered into an agreement to operate and maintain the dam. Tacoma has agreed to be the local sponsor for the Section 1135 project.
13. A rule curve must be developed. The EA should address rapid water fluctuations, gravel recruitment, fish stranding, bank erosion and loss of woody debris.	Noted. A new rule curve has been developed and is accepted by the key agencies. The scope of this Section 1135 is limited to fish passage at the dam and dam operation. No rapid water fluctuations will occur. The project will be constrained by existing ramping rate considerations. Observations from agency representatives find that no significant impact is expected from flow fluctuations between the dam and Save Ck.
14. What is the additional revenue from the opening of the 77 day shutdown to power generation.	Noted. Little additional revenue is expected due to losses in marketable power from flow modifications elsewhere in the year. Actual dollar figures from spring generation have not been disclosed to the COE.
15. Error in math. TPU share in the cost is 1.12 million not 9,150 dollars.	Noted. The typo has been corrected.

HARZA

File: —
Date: 09/23/96

FAX TRANSMITTAL

To Fax #: 764-4470
Attention: Mike McNeely
Company: USACOE, Environmental Resources - Seattle District

Project: Wynoochee
Charge #: OH

From: Dave Thompson
2353 130th Ave NE, Suite 200
Bellevue, Washington 98005

FAX: (206) 883-7555
(206) 882-2455

Page: 1 of 2

Message:

Re: Federal Project Modification Report and Environmental Assessment for Wynoochee Lake

Figures 3-1 and 1 indicate locations of acclimation ponds. Please be aware that there are existing facilities at the north end of the ponds (i.e., step-up transformer and emergency generator/storage building). We believe these interfere with the pond location. You may contact Mike Downs of our office to get locations of the structures.

Dave Thompson
Harza

RESPONSE TO COMMENTS
WYNOOCHEE SECTION 1135 REPORT/ EA

COMMENT	RESPONSE
1. Supplementation Ponds may interfere with existing facilities.	Noted. We believe the WDFW is aware of these structures and will design the pond footprints accordingly.

Dave Thompson
Harza

RESPONSE TO COMMENTS
WYNOOCHEE SECTION 1135 REPORT/ EA

COMMENT		RESPONSE
1. Supplementation Ponds may interfere with existing facilities.		Noted. We believe the WDFW is aware of these structures and will design the pond footprints accordingly.

APPENDIX C

WYNOOCHEE DAM PROJECT COOPERATION AGREEMENT

Wynoochee Dam Section 1135 Project Cooperation Agreement Modification

The Project Cooperation Agreement for the Wynoochee Dam Section 1135 Fish Restoration Project follows the approved template for Project Cooperation Agreements with the following three exceptions.

1. Article 1 - Paragraph M (italics note added language)

> The term "work-in-kind" shall mean the study and work related to the alteration of the existing project for the project modification; study *as defined in the attached STUDY AGREEMENT FOR THE WYNOOCHEE DAM SECTION 1135 PROJECT dated 16 April 1993, exhibit 1; and work as defined in LIST OF WORK IN KIND, exhibit 2; as approved by WRDA 86 in the STUDY AGREEMENT FOR THE WYNOOCHEE DAM SECTION 1135 PROJECT, and the Memorandum for Siri Nelson, Subject: Environmental Restoration Measures at Wynoochee Lake, Washington dated 12 March 1993, exhibit 3.* The work-in-kind includes implementation of the authorized improvements as well as planning, engineering, design, supervision and administration, and other activities associated with implementation, but does not include the implementation of betterments or the provision of lands, easements, rights-of-way, reallocations, or suitable borrow and dredged or excavated material disposal areas associated with the work-in-kind.

The attached exhibits define the work-in-kind and the approval documents for authorizing such work-in-kind.

2. Article 1 - Paragraph N

> N. The obligations created under this agreement shall continue with the Non-Federal Sponsor or its successors in interest in the ownership of the Wynoochee Dam Hydroelectric Project, upon approval of the Government, Non-Federal Sponsor, and subsequent Non-Federal Sponsor.

This general provision has been included to link the 1135 project OMRR&R responsibilities to the ownership of the hydroelectric facility at the Wynoochee Dam. The City of Tacoma is authorized to generated power under FERC License No. 6842. This license expires in the year 2037. At that time, if Tacoma transfers the hydropower project to a new owner, they would want to transfer all of the 1135 project responsibilities as well. At that time, the PCA would be amended upon approval by the Corps, the City, and the new owner operator.

3. Article 1 - Paragraph O

> O. All provisions of this agreement are subject to requirements of the Non-Federal Sponsors license for the Wynoochee Dam Hydroelectric Project, FERC License No. 6842 or modified versions.

The City of Tacoma has obligations under their FERC license. Neither the 1135 project modification or PCA are in conflict with the FERC license. The purpose of this general provision is to ensure this 1135 project will meet existing FERC license conditions.

PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
CITY OF TACOMA, DEPARTMENT OF PUBLIC UTILITIES, LIGHT DIVISION
FOR MODIFICATION OF THE
Wynoochee Dam

THIS AGREEMENT is entered into this _____ day of _____, 19__, by and between the DEPARTMENT OF THE ARMY (hereinafter the "Government"), represented by the U.S. Army Engineer for the Seattle District (hereinafter the "District Engineer") and the City of Tacoma, Department Public Utilities, Light Division (hereinafter the "Non-Federal Sponsor"), represented by the Light Superintendent.

WITNESSETH, THAT:

WHEREAS, the Secretary of the Army completed construction of the Wynoochee Dam (hereinafter the "Existing Project", as defined in Article I.A. of this Agreement) in 1972.

WHEREAS, modification of the Existing Project is authorized by Section 1135(b) of the Water Resources Development Act of 1986, Public Law 99-662, as amended;

WHEREAS, the Government and the Non-Federal Sponsor desire to enter into a Project Cooperation Agreement for implementation of the Wynoochee Dam Section 1135 Fish Restoration Project (hereinafter the "Project Modification", as defined in Article I.B. of this Agreement);

WHEREAS, Section 1135 (b) of the Water Resources Development Act of 1986, Public Law 99-662, as amended, specifies the cost-sharing requirements applicable to this Project Modification;

WHEREAS, the Non-Federal Sponsor desires to perform certain work (hereinafter the "work-in-kind", as defined in Article I.M. of this Agreement) which is a part of the Project Modification;

WHEREAS, the Government and Non-Federal Sponsor have the full authority and capability to perform as hereinafter set forth and intend to cooperate in cost-sharing and financing of the implementation of the Project Modification in accordance with the terms of this Agreement.

NOW, THEREFORE, the Government and the Non-Federal Sponsor agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

A. The term "Existing Project" shall mean the Wynoochee Reservoir Project, authorized by Public Law 87-874, Flood Control Act of 1962, enacted by the 87th Congress, Second Session, authorized for flood control, water supply, irrigation, fishery enhancement, and recreation. Hydropower was added under FERC license for the Project as FERC No. 6842.

B. The term "Project Modification" shall mean the addition of a fish bypass facility that includes a Eicher Screen, a depressurization system, and flume; the addition of smolt supplementmentation (rearing and acclimatization) ponds; the modification of the existing fish trap and haul facility; modification to the Wynoochee Dam spring refill curve; modification to the minimum downstream flow regime as generally described in Wynoochee Dam Section 1135 Fish Restoration Project - Project Modification Report/Environmental Assessment dated September, 1996 and approved by the District Engineer on September __, 1996. The Project Modification includes the work-in-kind described in Article I.M. of this Agreement.

C. The term "total project modification costs" shall mean all costs incurred by the Non-Federal Sponsor and the Government in accordance with the terms of this Agreement directly related to implementation of the Project Modification. Subject to the provisions of this Agreement, the term shall include, but is not necessarily limited to, feasibility phase planning costs; all engineering and design costs, including those incurred in the feasibility phase; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; the costs incurred by the Government for clean-up and response in accordance with Article XV.C. of this Agreement; costs of historic preservation activities in accordance with Article XVIII.A. of this Agreement; actual implementation costs; the credit amount for the work-in-kind performed by the Non-Federal Sponsor in accordance with Article II.D.4. of this Agreement; supervision and administration costs; costs of participation in the Project Coordination Team in accordance with Article V of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, reallocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article IV of this Agreement; and costs of audit in accordance with Article X of this Agreement. The term does not include any costs for operation, maintenance, repair, replacement, or rehabilitation; any costs due to betterments; or any costs of dispute resolution under Article VII of this Agreement.

D. The term "financial obligation for implementation" shall mean a financial obligation of the Government or a financial obligation of the Non-Federal Sponsor for work-in-kind, other than an obligation pertaining to the provision of lands, easements, rights-of-way, reallocations, and borrow and dredged or excavated material disposal areas, that results or would result in a cost that is or would be included in total project modification costs.

E. The term "implementation" shall mean all actions required to carry out the Project Modification including all actions required for modification in operations of the Existing Project.

F. The term "non-Federal proportionate share" shall mean the ratio of the Non-Federal Sponsor's total cash contribution required in accordance with Article II.D.2. of this Agreement to total financial obligations for implementation as projected by the Government.

G. The term "period of implementation" shall mean the time from the effective date of this Agreement to the date that the District Engineer notifies the Non-Federal Sponsor in writing of the Government's determination that implementation of the Project Modification is complete.

H. The term "highway" shall mean any public highway, roadway, street, or way, including any bridge thereof.

I. The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility, or railroad when such action is authorized in accordance with applicable legal principles of just compensation. Providing a functionally equivalent facility may take the form of alteration, lowering, raising, or replacement and attendant removal of the affected facility or part thereof.

J. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

K. The term "functional portion of the Project Modification" shall mean a portion of the Project Modification that is suitable for tender to the Non-Federal Sponsor to operate and maintain in advance of completion of the entire Project Modification. For a portion of the Project Modification to be suitable for tender, the District Engineer must notify the Non-Federal Sponsor in writing of the Government's determination that the portion of the Project Modification is complete and can function independently and for a useful purpose, although the balance of the Project Modification is not complete.

L. The term "betterment" shall mean a change in the design and construction of an element of the Project Modification resulting from the application of standards that the Government determines exceed those that the Government would otherwise apply for accomplishing the design and construction of that element.

M. The term "work-in-kind" shall mean the study and work related to the alteration of the existing project for the project modification; study as defined in the attached STUDY AGREEMENT FOR THE WYNOOCHEE DAM SECTION 1135 PROJECT dated 16 April 1993, exhibit 1; and work as defined in WYNOOCHEE DAM Section 1135 Fish Restoration Project Statement of In-Kind Services, exhibit 2; as approved by WRDA 86 in the STUDY AGREEMENT FOR THE WYNOOCHEE DAM SECTION 1135 PROJECT, and the Memorandum for Siri Nelson, Subject: Environmental Restoration Measures at Wynoochee Lake, Washington dated 12 March 1993, exhibit 3. The work-in-kind includes implementation of the authorized improvements as well as planning, engineering, design, supervision and administration, and other activities associated with implementation, but does not include the implementation of betterments or the provision of lands, easements, rights-of-way, reallocations, or suitable borrow and dredged or excavated material disposal areas associated with the work-in-kind.

N. The obligations created under this agreement shall continue with the Non-Federal Sponsor or its successors in interest in the ownership of the Wynoochee Dam Hydroelectric Project, upon approval of the Government, Non-Federal Sponsor, and subsequent Non-Federal Sponsor.

O. All provisions of this agreement are subject to requirements of the Non-Federal Sponsors license for the Wynoochee Dam Hydroelectric Project, FERC License No. 6842 or modified versions.

ARTICLE II - OBLIGATIONS OF THE GOVERNMENT AND THE NON-FEDERAL SPONSOR

A. The Government, subject to the availability of funds and using those funds and funds provided by the Non-Federal Sponsor, shall expeditiously implement the Project Modification, applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

1. The Government shall afford the Non-Federal Sponsor the opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Government's issuance of such solicitations. The Government shall not issue the solicitation for the first contract for implementation until the Non-Federal Sponsor has confirmed in writing its willingness to proceed with the Project Modification. To the extent possible, the Government shall afford the Non-Federal Sponsor the opportunity to review and comment on all contract modifications, including change orders, prior to the issuance to the contractor of a Notice to Proceed. In any instance where providing the Non-Federal Sponsor with notification of a contract modification or change order is not possible prior to issuance of the Notice to Proceed, the Government shall provide such notification in writing at the earliest date possible. To the extent possible, the Government also shall afford the Non-Federal Sponsor the opportunity to review and comment on all contract claims prior to resolution thereof. The Government shall consider in good faith the comments of the Non-Federal Sponsor, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all work on the Project Modification (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

2. Throughout the period of implementation, the District Engineer shall furnish the Non-Federal Sponsor with a copy of the Government's Written Notice of Acceptance of Completed Work for each contract for the Project Modification.

3. Notwithstanding paragraph A.1. of this Article, if, upon the award of any contract for implementation of the Project Modification, cumulative financial obligations for implementation would exceed $5,000,000, the Government and the Non-Federal Sponsor agree to defer award of that contract and all subsequent contracts for implementation of the Project Modification until such time as the Government and the Non-Federal Sponsor agree to proceed with further contract awards for the Project Modification, but in no event shall the award of contracts be deferred for more than three years. Notwithstanding this general provision for deferral of contract awards, the Government, after consultation with the Non-Federal Sponsor, may award a contract or contracts after the Assistant Secretary of the Army (Civil Works) makes a written determination that the award of such contract or contracts must proceed in order to comply with law or to protect life or property from imminent and substantial harm.

B. The Non-Federal Sponsor may request the Government to accomplish betterments. Such requests shall be in writing and shall describe the betterments requested to be accomplished. If the Government in its sole discretion elects to accomplish the requested betterments or any portion thereof, it shall so notify the Non-Federal Sponsor in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsor shall be solely responsible for all costs due to the requested betterments and shall pay all such costs in accordance with Article VI.C. of this Agreement.

C. When the District Engineer determines that the entire Project Modification is complete or that a portion of the Project Modification has become a functional portion of the Project Modification, the District Engineer shall so notify the Non-Federal Sponsor in writing and furnish the Non-Federal

Sponsor with an Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual (hereinafter the "OMRR&R Manual") and with copies of all of the Government's Written Notices of Acceptance of Completed Work for all contracts for the Project Modification or the functional portion of the Project Modification that have not been provided previously. Upon such notification, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the entire Project Modification or the functional portion of the Project Modification in accordance with Article VIII of this Agreement.

D. The Non-Federal Sponsor shall contribute 25 percent of total project modification costs in accordance with the provisions of this paragraph.

1. In accordance with Article III of this Agreement, the Non-Federal Sponsor shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the Non-Federal Sponsor must provide for the implementation, operation, and maintenance of the Project Modification, and shall perform or ensure performance of all reallocations that the Government determines to be necessary for the implementation, operation, and maintenance of the Project Modification.

2. If the Government projects that the value of the Non-Federal Sponsor's contributions under paragraph D.1. of this Article and Articles V, X, and XV.A. of this Agreement will be less than 25 percent of total project modification costs, the Non-Federal Sponsor shall provide an additional cash contribution, in accordance with Article VI.B. of this Agreement, in the amount necessary to make the Non-Federal Sponsor's total contribution equal to 25 percent of total project modification costs.

3. If the Government determines that the value of the Non-Federal Sponsor's contributions provided under paragraphs D.1. and D.2. of this Article and Articles V, X, and XV.A. of this Agreement has exceeded 25 percent of total project modification costs, the Government, subject to the availability of funds, shall reimburse the Non-Federal Sponsor for any such value in excess of 25 percent of total project modification costs. After such a determination, the Government, in its sole discretion, may provide any remaining Project Modification lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas and perform any remaining Project Modification reallocations on behalf of the Non-Federal Sponsor. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of reallocations by the Government under this paragraph, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of cleanup and response in accordance with Article XV.C. of this Agreement.

4. The Government has determined that the work-in-kind is compatible with the Project Modification and has approved a credit in the estimated amount of $794,261.63 for implementation of such work by the Non-Federal Sponsor. The affording of such credit shall be subject to an on-site inspection by the Government to verify that the work was accomplished in a satisfactory manner and is suitable for inclusion in the Project Modification. The actual amount of credit shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. To afford such credit, the Government shall apply the

credit amount toward any additional cash contribution required under paragraph D.3. of this Article. The Non-Federal Sponsor shall not receive credit for any amount in excess of such additional cash contribution, nor shall the Non-Federal Sponsor be entitled to any reimbursement for any excess credit amount. In no event shall the Non-Federal Sponsor perform work-in-kind that would result in the credit afforded under this paragraph, plus the value of lands, easements, rights-of-way, reallocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article IV of this Agreement, exceeding 25 percent of total project modification costs.

E. The Non-Federal Sponsor may request the Government to provide lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or perform reallocations on behalf of the Non-Federal Sponsor. Such requests shall be in writing and shall describe the services requested to be performed. If in its sole discretion the Government elects to perform the requested services or any portion thereof, it shall so notify the Non-Federal Sponsor in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsor shall be solely responsible for all costs of the requested services and shall pay all such costs in accordance with Article VI.C. of this Agreement. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of reallocations by the Government under this paragraph, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of cleanup and response in accordance with Article XV.C. of this Agreement.

F. The Government shall perform a final accounting in accordance with Article VI.D. of this Agreement to determine the contributions provided by the Non-Federal Sponsor in accordance with paragraphs B., D., and E. of this Article and Articles V, X, and XV.A. of this Agreement and to determine whether the Non-Federal Sponsor has met its obligations under paragraphs B., D., and E. of this Article.

G. The Non-Federal Sponsor shall not use Federal funds to meet its share of total project modification costs under this Agreement unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

ARTICLE III - LANDS, REALLOCATIONS, DISPOSAL AREAS, AND PUBLIC LAW 91-646 COMPLIANCE

A. The Government, after consultation with the Non-Federal Sponsor, shall determine the lands, easements, and rights-of-way required for the implementation, operation, and maintenance of the Project Modification, including those required for reallocations, borrow materials, and dredged or excavated material disposal. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions, including maps as appropriate, of the lands, easements, and rights-of-way that the Government determines the Non-Federal Sponsor must provide, in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with acquisition of such lands, easements, and rights-of-way. Prior to the end of the period of implementation, the Non-Federal Sponsor shall acquire all lands, easements, and rights-of-way set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each

construction contract, the Non-Federal Sponsor shall provide the Government with authorization for entry to all lands, easements, and rights-of-way the Government determines the Non-Federal Sponsor must provide for that contract. The Non-Federal Sponsor shall ensure that lands, easements, and rights-of-way that the Government determines to be required for the operation and maintenance of the Project Modification and that were provided by the Non-Federal Sponsor are retained in public ownership for uses compatible with the authorized purposes of the Project Modification.

B. The Government, after consultation with the Non-Federal Sponsor, shall determine the improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the implementation, operation, and maintenance of the Project Modification. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and de-watering pumps and pipes. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions of such improvements in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with construction of such improvements. Prior to the end of the period of implementation, the Non-Federal Sponsor shall provide all improvements set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsor shall prepare plans and specifications for all improvements the Government determines to be required for the proper disposal of dredged or excavated material under that contract, submit such plans and specifications to the Government for approval, and provide such improvements in accordance with the approved plans and specifications.

C. The Government, after consultation with the Non-Federal Sponsor, shall determine the reallocations necessary for the implementation, operation, and maintenance of the Project Modification, including those necessary to enable the removal of borrow materials and the proper disposal of dredged or excavated material. The Government in a timely manner shall provide the Non-Federal Sponsor with general written descriptions, including maps as appropriate, of such reallocations in detail sufficient to enable the Non-Federal Sponsor to fulfill its obligations under this paragraph, and shall provide the Non-Federal Sponsor with a written notice to proceed with such reallocations. Prior to the end of the period of implementation, the Non-Federal Sponsor shall perform or ensure the performance of all reallocations as set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsor shall prepare or ensure the preparation of plans and specifications for, and perform or ensure the performance of, all reallocations the Government determines to be necessary for that contract.

D. The Non-Federal Sponsor in a timely manner shall provide the Government with such documents as are sufficient to enable the Government to determine the value of any contribution provided pursuant to paragraphs A., B., or C. of this Article. Upon receipt of such documents the Government, in accordance with Article IV of this Agreement and in a timely manner, shall determine the value of such contribution, include such value in total project modification costs, and afford credit for such value toward the Non-Federal Sponsor's share of total project modification costs.

E. The Non-Federal Sponsor shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition

Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring lands, easements, and rights-of-way required for the implementation, operation, and maintenance of the Project Modification, including those necessary for reallocations, borrow materials, and dredged or excavated material disposal, and shall inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - CREDIT FOR LANDS, REALLOCATIONS, AND DISPOSAL AREAS

A. The Non-Federal Sponsor shall receive credit toward its share of total project modification costs for the value of the lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Non-Federal Sponsor must provide pursuant to Article III of this Agreement, and for the value of the reallocations that the Non-Federal Sponsor must perform or for which it must ensure performance pursuant to Article III of this Agreement. However, the Non-Federal Sponsor shall not receive credit for the value of any lands, easements, rights-of-way, reallocations, or borrow and dredged or excavated material disposal areas that have been provided previously as an item of cooperation for another Federal project, including the Existing Project. The Non-Federal Sponsor also shall not receive credit for the value of lands, easements, rights-of-way, reallocations, or borrow and dredged or excavated material disposal areas to the extent that such items are provided using Federal funds unless the Federal granting agency verifies in writing that such credit is expressly authorized by statute.

B. For the sole purpose of affording credit in accordance with this Agreement, the value of lands, easements, and rights-of-way, including those necessary for reallocations, borrow materials, and dredged or excavated material disposal, shall be the fair market value of the real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph.

1. Date of Valuation. The fair market value of lands, easements, or rights-of-way owned by the Non-Federal Sponsor on the effective date of this Agreement shall be the fair market value of such real property interests as of the date the Non-Federal Sponsor provides the Government with authorization for entry thereto. However, for lands, easements, or rights-of-way owned by the Non-Federal Sponsor on the effective date of this Agreement that are required for the construction of the work-in-kind, fair market value shall be the value of such real property interests as of the date the Non-Federal Sponsor awards the first construction contract for the work-in-kind, or, if the Non-Federal Sponsor performs the implementation with its own labor, the date that the Non-Federal Sponsor begins implementation of the work-in-kind. The fair market value of lands, easements, or rights-of-way acquired by the Non-Federal Sponsor after the effective date of this Agreement shall be the fair market value of such real property interests at the time the interests are acquired.

2. General Valuation Procedure. Except as provided in paragraph B.3. of this Article, the fair market value of lands, easements, or rights-of-way shall be determined in accordance with paragraph B.2.a. of this Article, unless thereafter a different amount is determined to represent fair market value in accordance with paragraph B.2.b. of this Article.

a. The Non-Federal Sponsor shall obtain, for each real property interest, an appraisal that is prepared by a qualified appraiser who is acceptable to the Non-Federal Sponsor and the Government. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government. The fair market value shall be the amount set forth in the Non-Federal Sponsor's appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's appraisal, the Non-Federal Sponsor may obtain a second appraisal, and the fair market value shall be the amount set forth in the Non-Federal Sponsor's second appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's second appraisal, or the Non-Federal Sponsor chooses not to obtain a second appraisal, the Government shall obtain an appraisal, and the fair market value shall be the amount set forth in the Government's appraisal, if such appraisal is approved by the Non-Federal Sponsor. In the event the Non-Federal Sponsor does not approve the Government's appraisal, the Government, after consultation with the Non-Federal Sponsor, shall consider the Government's and the Non-Federal Sponsor's appraisals and determine an amount based thereon, which shall be deemed to be the fair market value.

b. Where the amount paid or proposed to be paid by the Non-Federal Sponsor for the real property interest exceeds the amount determined pursuant to paragraph B.2.a. of this Article, the Government, at the request of the Non-Federal Sponsor, shall consider all factors relevant to determining fair market value and, in its sole discretion, after consultation with the Non-Federal Sponsor, may approve in writing an amount greater than the amount determined pursuant to paragraph B.2.a. of this Article, but not to exceed the amount actually paid or proposed to be paid. If the Government approves such an amount, the fair market value shall be the lesser of the approved amount or the amount paid by the Non-Federal Sponsor, but no less than the amount determined pursuant to paragraph B.2.a. of this Article.

3. Eminent Domain Valuation Procedure. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted after the effective date of this Agreement, the Non-Federal Sponsor shall, prior to instituting such proceedings, submit to the Government notification in writing of its intent to institute such proceedings and an appraisal of the specific real property interests to be acquired in such proceedings. The Government shall have 60 days after receipt of such a notice and appraisal within which to review the appraisal, if not previously approved by the Government in writing.

a. If the Government previously has approved the appraisal in writing, or if the Government provides written approval of, or takes no action on, the appraisal within such 60-day period, the Non-Federal Sponsor shall use the amount set forth in such appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

b. If the Government provides written disapproval of the appraisal, including the reasons for disapproval, within such 60-day period, the Government and the Non-Federal Sponsor shall consult in good faith to promptly resolve the issues or areas of disagreement that are identified in the Government's written disapproval. If, after such good faith consultation, the Government and the Non-Federal Sponsor agree as to an appropriate amount, then the Non-Federal Sponsor shall use that amount as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

If, after such good faith consultation, the Government and the Non-Federal Sponsor cannot agree as to an appropriate amount, then the Non-Federal Sponsor may use the amount set forth in its appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

c. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted in accordance with sub-paragraph B.3. of this Article, fair market value shall be either the amount of the court award for the real property interests taken, to the extent the Government determined such interests are required for the implementation, operation, and maintenance of the Project Modification, or the amount of any stipulated settlement or portion thereof that the Government approves in writing.

4. Incidental Costs. For lands, easements, or rights-of-way acquired by the Non-Federal Sponsor within a five-year period preceding the effective date of this Agreement, or at any time after the effective date of this Agreement, the value of the interest shall include the documented incidental costs of acquiring the interest, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such incidental costs shall include, but not necessarily be limited to, closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with Article III.E. of this Agreement.

C. After consultation with the Non-Federal Sponsor, the Government shall determine the value of reallocations in accordance with the provisions of this paragraph.

1. For a relocation other than a highway, the value shall be only that portion of relocation costs that the Government determines is necessary to provide a functionally equivalent facility, reduced by depreciation, as applicable, and by the salvage value of any removed items.

2. For a relocation of a highway, the value shall be only that portion of relocation costs that would be necessary to accomplish the relocation in accordance with the design standard that the State of Washington would apply under similar conditions of geography and traffic load, reduced by the salvage value of any removed items.

3. Relocation costs shall include, but not necessarily be limited to, actual costs of performing the relocation; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with performance of the relocation, but shall not include any costs due to betterments, as determined by the Government, nor any additional cost of using new material when suitable used material is available. Relocation costs shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

D. The value of the improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such costs shall include, but not necessarily be limited to, actual costs of providing the improvements; planning, engineering and design costs; supervision and

administration costs; and documented incidental costs associated with providing the improvements, but shall not include any costs due to betterments, as determined by the Government.

ARTICLE V - PROJECT MODIFICATION COORDINATION TEAM

A. To provide for consistent and effective communication, the Non-Federal Sponsor and the Government, not later than 30 days after the effective date of this Agreement, shall appoint named senior representatives to a Project Modification Coordination Team. Thereafter, the Project Modification Coordination Team shall meet regularly until the end of the period of implementation. The Government's Project Manager and a counterpart named by the Non-Federal Sponsor shall co-chair the Project Modification Coordination Team.

B. The Government's Project Manager and the Non-Federal Sponsor's counterpart shall keep the Project Modification Coordination Team informed of the progress of implementation and of significant pending issues and actions, and shall seek the views of the Project Modification Coordination Team on matters that the Project Modification Coordination Team generally oversees.

C. Until the end of the period of implementation, the Project Modification Coordination Team shall generally oversee the Project Modification, including issues related to design; plans and specifications; scheduling; real property and relocation requirements; real property acquisition; contract awards and modifications; contract costs; the Government's cost projections; final inspection of the entire Project Modification or functional portions of the Project Modification; preparation of the proposed OMRR&R Manual; anticipated requirements and needed capabilities for performance of operation, maintenance, repair, replacement, and rehabilitation of the Project Modification; and other related matters.

D. The Project Modification Coordination Team may make recommendations that it deems warranted to the District Engineer on matters that the Project Modification Coordination Team generally oversees, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider the recommendations of the Project Modification Coordination Team. The Government, having the legal authority and responsibility for implementation of the Project Modification, has the discretion to accept, reject, or modify the Project Modification Coordination Team's recommendations.

E. The costs of participation in the Project Modification Coordination Team shall be included in total project modification costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE VI - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties and current projections of total project modification costs and costs due to betterments. At least quarterly, the Government shall provide the Non-Federal Sponsor with a report setting forth all contributions provided to date and the current projections of total project modification costs, of total costs due to betterments, of the components of total project modification costs, of each party's share of total project modification costs, of the Non-Federal Sponsor's total cash contributions required in accordance with Articles II.B., II.D., and II.E. of this Agreement, and of the non-Federal proportionate share. On the effective date of this Agreement, total

project modification costs are projected to be $4,625,000 and the Non-Federal Sponsor's cash contribution required under Article II.D. of this Agreement is projected to be $313,000. Such amounts are estimates subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsor.

B. The Non-Federal Sponsor shall provide the cash contribution required under Article II.D.2. of this Agreement in accordance with the following provisions: Not less than 30 calendar days prior to the scheduled date for issuance of the solicitation for the first construction contract, the Government shall notify the Non-Federal Sponsor in writing of such scheduled date and the funds the Government, after consideration of any credit afforded pursuant to Article II.D.4. of this Agreement, determines to be required from the Non-Federal Sponsor to meet its projected cash contribution under Article II.D.2. of this Agreement. Not later than such scheduled date, the Non-Federal Sponsor shall provide the Government with the full amount of the required funds by delivering a check payable to "FAO, USAED, CENPS" to the District Engineer. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums as the Government, after consideration of any credit afforded pursuant to Article II.D.4. of this Agreement, deems necessary to cover: (a) the non-Federal proportionate share of financial obligations for implementation incurred prior to commencement of the period of implementation; and (b) the non-Federal proportionate share of financial obligations for implementation as they are incurred during the period of implementation. In the event the Government determines that the Non-Federal Sponsor must provide additional funds to meet the Non-Federal Sponsor's cash contribution, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required. Within 60 calendar days thereafter, the Non-Federal Sponsor shall provide the Government with a check for the full amount of the additional required funds.

1. Not less than 30 calendar days prior to the scheduled date for issuance of the solicitation for the first construction contract, the Government shall notify the Non-Federal Sponsor in writing of such scheduled date and the funds the, after consideration of any credit afforded pursuant to Article II.D.4. of this Agreement, determines to be required from the Non-Federal Sponsor to meet the non-Federal proportionate share of projected financial obligations for implementation through the first fiscal year of implementation, including the non-Federal proportionate share of financial obligations for implementation incurred prior to the period of implementation. Not later than such scheduled date, the Non-Federal Sponsor provide the Government with the full amount of the required funds by delivering a check payable to "FAO, USAED, CENPS to the District Engineer.

2. For the second and subsequent fiscal years of implementation, the Government shall notify the Non-Federal Sponsor in writing, no later than 60 calendar days prior to the beginning of that fiscal year, of the funds the Government, after consideration of any credit afforded pursuant to Article II.D.4. of this Agreement, determines to be required from the Non-Federal Sponsor to meet the non-Federal proportionate share of projected financial obligations for implementation for that fiscal year. No later than 30 calendar days prior to the beginning of the fiscal year, the Non-Federal Sponsor shall make the full amount of the required funds for that fiscal year available to the Government through the funding mechanism specified in Article VI.B.1. of this Agreement.

3. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums as the Government, after consideration of any credit afforded pursuant to Article II.D.4. of this Agreement, deems necessary to cover: (a) the non-Federal proportionate share of financial obligations for implementation incurred prior to the period of implementation; and (b) the non-Federal proportionate share of financial obligations for implementation as they are incurred during the period of implementation.

4. If at any time during the period of implementation the Government determines that additional funds will be needed from the Non-Federal Sponsor to cover the non-Federal proportionate share of projected financial obligations for implementation for the current fiscal year, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required, and the Non-Federal Sponsor, no later than 60 calendar days from receipt of such notice, shall make the additional required funds available through the payment mechanism specified in Article VI.B.1. of this Agreement.

C. In advance of the Government incurring any financial obligation associated with additional work under Article II.B. or II.E. of this Agreement, the Non-Federal Sponsor shall provide the Government with the full amount of the funds required to pay for such additional work by delivering a check payable to "FAO, USAED, CENPS to the District Engineer. The Government shall draw from the funds provided by the Non-Federal Sponsor such sums as the Government deems necessary to cover the Government's financial obligations for such additional work as they are incurred. In the event the Government determines that the Non-Federal Sponsor must provide additional funds to meet its cash contribution, the Government shall notify the Non-Federal Sponsor in writing of the additional funds required. Within 30 calendar days thereafter, the Non-Federal Sponsor shall provide the Government with a check for the full amount of the additional required funds.

D. Upon completion of the Project Modification or termination of this Agreement, and upon resolution of all relevant claims and appeals, the Government shall conduct a final accounting and furnish the Non-Federal Sponsor with the results of the final accounting. The final accounting shall determine total project modification costs, each party's contribution provided thereto, and each party's required share thereof. The final accounting also shall determine costs due to betterments and the Non-Federal Sponsor's cash contribution provided pursuant to Article II.B. of this Agreement.

1. In the event the final accounting shows that the total contribution provided by the Non-Federal Sponsor is less than its required share of total project modification costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement, the Non-Federal Sponsor shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet the Non-Federal Sponsor's required share of total project modification costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement.

2. In the event the final accounting shows that the total contribution provided by the Non-Federal Sponsor exceeds its required share of total project modification costs plus costs due to any betterments provided in accordance with Article II.B. of this Agreement, the Government shall, subject to the availability of funds, refund the excess to the Non-Federal Sponsor no later than 90 calendar days after the final accounting is complete. In the

event existing funds are not available to refund the excess to the Non-Federal Sponsor, the Government shall seek such appropriations as are necessary to make the refund.

ARTICLE VII - DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE VIII - OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R)

A. Upon notification in accordance with Article II.C. of this Agreement and for so long as the Project Modification remains authorized, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the entire Project Modification or the functional portion of the Project Modification, at no cost to the Government, in a manner compatible with the Project Modification's authorized purposes and in accordance with applicable Federal and State laws as provided in Article XI of this Agreement and specific directions prescribed by the Government in the OMRR&R Manual and any subsequent amendments thereto.

B. The Non-Federal Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor owns or controls for access to the Project Modification for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project Modification. If an inspection shows that the Non-Federal Sponsor for any reason is failing to perform its obligations under this Agreement, the Government shall send a written notice describing the non-performance to the Non-Federal Sponsor. If, after 30 calendar days from receipt of the notice, the Non-Federal Sponsor continues to fail to perform, then the Government shall have the right to enter, at reasonable times and in a reasonable manner, upon property the Non-Federal Sponsor owns or controls for access to the Project Modification for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project Modification. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the Non-Federal Sponsor's obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance pursuant to this Agreement.

ARTICLE IX - INDEMNIFICATION

The Non-Federal Sponsor shall hold and save the Government free from all damages arising from the implementation, operation, maintenance, repair, replacement and rehabilitation of the Project Modification, and any Project

Modification-related betterments, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X - MAINTENANCE OF RECORDS AND AUDIT

A. Not later than 60 calendar days after the effective date of this Agreement, the Government and the Non-Federal Sponsor shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Non-Federal Sponsor shall maintain such books, records, documents, and other evidence in accordance with these procedures and for a minimum of three years after the period of implementation and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Non-Federal Sponsor shall each allow the other to inspect such books, documents, records, and other evidence.

B. Pursuant to 32 C.F.R. Section 33.26, the Non-Federal Sponsor is responsible for complying with the Single Audit Act of 1984, 31 U.S.C. Sections 7501-7507, as implemented by Office of Management and Budget (OMB) Circular No. A-128 and Department of Defense Directive 7600.10. Upon request of the Non-Federal Sponsor and to the extent permitted under applicable Federal laws and regulations, the Government shall provide to the Non-Federal Sponsor and independent auditors any information necessary to enable an audit of the Non-Federal Sponsor's activities under this Agreement. The costs of any non-Federal audits performed in accordance with this paragraph shall be allocated in accordance with the provisions of OMB Circulars A-87 and A-128, and such costs as are allocated to the Project Modification shall be included in total project modification costs and cost shared in accordance with the provisions of this Agreement.

C. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Non-Federal Sponsor is required to conduct under the Single Audit Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits performed in accordance with this paragraph shall be included in total project modification costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE XI - FEDERAL AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the Non-Federal Sponsor and the Government agree to comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

ARTICLE XII - RELATIONSHIP OF PARTIES

A. In the exercise of their respective rights and obligations under this Agreement the Government and the Non-Federal Sponsor each act in an independent capacity, and neither is to be considered the officer, agent, or employee of the other.

B. In the exercise of its rights and obligations under this Agreement, neither party shall provide, without the consent of the other party, any contractor with a release that waives or purports to waive any rights such other party may have to seek relief or redress against such contractor either pursuant to any cause of action that such other party may have or for violation of any law.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - TERMINATION OR SUSPENSION

A. If at any time the Non-Federal Sponsor fails to fulfill its obligations under Article II.B., II.D., II.E., VI, or XVIII.C. of this Agreement, the Assistant Secretary of the Army (Civil Works) shall terminate this Agreement or suspend future performance under this Agreement unless he determines that continuation of work on the Project Modification is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project Modification.

B. If appropriations are not available in amounts sufficient to meet the Government's share of Project Modification expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Non-Federal Sponsor in writing, and 60 calendar days thereafter either party may elect without penalty to terminate this Agreement or to suspend future performance under this Agreement. In the event that either party elects to suspend future performance under this Agreement pursuant to this paragraph, such suspension shall remain in effect until such time as the Government receives sufficient appropriations or until either the Government or the Non-Federal Sponsor elects to terminate this Agreement.

C. In the event that either party elects to terminate this Agreement pursuant to this Article or Article XV of this Agreement, both parties shall conclude their activities relating to the Project Modification and proceed to a final accounting in accordance with Article VI.D. of this Agreement.

D. Any termination of this Agreement or suspension of future performance under this Agreement in accordance with this Article or Article XV of this Agreement shall not relieve the parties of any obligation previously incurred. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

ARTICLE XV - HAZARDOUS SUBSTANCES

A. After execution of this Agreement and upon direction by the District Engineer, the Non-Federal Sponsor shall perform, or cause to be performed, any investigations for hazardous substances that the Government or the Non-Federal Sponsor determines to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the implementation, operation, and maintenance of the Project Modification, except for any such lands, easements, or rights-of-way that are owned by the United States and administered by the Government, and except for any such lands that the Government determines to be subject to the navigation servitude. The Government shall perform, or cause to be performed, all investigations on lands, easements, or rights-of-way that are owned by the United States and administered by the Government. For lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the District Engineer provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction. All actual costs incurred by the Non-Federal Sponsor or the Government for such investigations for hazardous substances shall be included in total project modification costs and cost shared in accordance with the provisions of this Agreement, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

B. In the event it is discovered through any investigation for hazardous substances or other means that hazardous substances regulated under CERCLA exist in, on, or under any lands, easements, or rights-of-way, that the Government determines, pursuant to Article III of this Agreement, the Non-Federal Sponsor must provide for the implementation, operation, and maintenance of the Project Modification, the Non-Federal Sponsor and the Government shall provide prompt written notice to each other, and the Non-Federal Sponsor shall not proceed with the acquisition of the real property interests until both parties agree that the Non-Federal Sponsor should proceed.

C. The Government and the Non-Federal Sponsor shall determine whether to initiate implementation of the Project Modification, or, if already in implementation, whether to continue with work on the Project Modification, suspend future performance under this Agreement, or terminate this Agreement for the convenience of the Government, in any case where hazardous substances regulated under CERCLA are found to exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the implementation, operation, and maintenance of the Project Modification. Should the Government and the Non-Federal Sponsor determine to initiate or continue with implementation after considering any liability that may arise under CERCLA, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination on lands, easements or rights of way that the Government determines, pursuant to Article III of this Agreement, to be required for the implementation, operation, and maintenance of the Project Modification, except for any such lands, easements, or rights-of-way owned by the United States and administered by the Government. Such costs shall not be considered a part of total project modification costs. In the event the Non-

Federal Sponsor fails to provide any funds necessary to pay for clean up and response costs or to otherwise discharge the Non-Federal Sponsor's responsibilities under this paragraph upon direction by the Government, the Government may, in its sole discretion, either terminate this Agreement for the convenience of the Government, suspend future performance under this Agreement, or continue work on the Project Modification. The Government shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination on lands, easements, or rights of way owned by the United States and administered by the Government. All costs incurred by the Government shall be included in total project modification costs and cost shared in accordance with the terms of this Agreement.

D. The Non-Federal Sponsor and the Government shall consult with each other in accordance with Article V of this Agreement in an effort to ensure that responsible parties bear any necessary cleanup and response costs as defined in CERCLA. Any decision made pursuant to paragraph C. of this Article shall not relieve any third party from any liability that may arise under CERCLA.

E. As between the Government and the Non-Federal Sponsor, the Non-Federal Sponsor shall be considered the operator of the Project Modification for purposes of CERCLA liability. To the maximum extent practicable, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project Modification in a manner that will not cause liability to arise under CERCLA.

ARTICLE XVI - NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally, or by telegram, or mailed by first-class, registered, or certified mail, as follows:

If to the Non-Federal Sponsor:

Tacoma Public Utilities
3628 South 35th Street
P.O. Box 11007
Tacoma, WA 98411-0007

If to the Government:

Seattle District USACE
P.O. Box 3755
4735 E. Marginal Way S.
Seattle, WA 98124-3755

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

ARTICLE XVII - CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XVIII - HISTORIC PRESERVATION

A. The costs of identification, survey and evaluation of historic properties shall be included in total project modification costs and cost shared in accordance with the provisions of this Agreement.

B. Pursuant to Section 7(a) of Public Law 93-291 (16 U.S.C. Section 469c(a)), the costs of mitigation and data recovery activities associated with historic preservation shall be borne entirely by the Government and shall not be included in total project modification costs, up to the statutory limit of one percent of the total amount the Government is authorized to expend for the Project Modification.

C. The Government shall not incur costs for mitigation and data recovery that exceed the statutory one percent limit specified in paragraph B. of this Article unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit in accordance with Section 208(3) of Public Law 96-515 (16 U.S.C. Section 469c-2(3)). Any costs of mitigation and data recovery that exceed the one percent limit shall be included in total project modification costs and shall be cost shared in accordance with the provisions of this Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Department of the Army.

THE DEPARTMENT OF THE ARMY

BY:_____
District Engineer

DATE:_____

THE City of Tacoma, Department of Public Utilities, Light Division

BY:_____
Steven J. Klein
Light Superintendent

DATE:_____

CERTIFICATE OF AUTHORITY

I, _____, do hereby certify that I am the principal legal officer of the City of Tacoma, Department of Public Utilities, Light Division, that the City of Tacoma, Department of Public Utilities, Light Division is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the City of Tacoma, Department of Public Utilities, Light Division in connection with the Wynoochee Dam Section 1135 Fish Restoration Project and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, and that the persons who have executed this Agreement on behalf of the City of Tacoma, Department of Public Utilities, Light Division have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this _____ day of _____ 19___.

_____
Steven J. Klein
Light Superintendent

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____
Steven J. Klein
Light Superintendent

DATE: _____

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO
ATTENTION OF

STUDY AGREEMENT
FOR THE
WYNOOCHEE DAM SECTION 1135 PROJECT

The Seattle District has received authorization to proceed with a Section 1135 project for Wynoochee Dam. The City of Aberdeen has been identified as the local sponsor for the Project Cooperation Agreement in the event the project is constructed.

In light of the unique circumstance of the Environmental Restoration Measures at Wynoochee Lake, Washington, it has been determined to be consistent with WRDA 86 to allow the cities of Aberdeen and Tacoma to undertake the necessary coordination, design and environmental studies needed to amend the Federal Energy Regulatory Commission (FERC) license and alter their facility.

Therefore, it is understood that the City of Aberdeen will receive an appropriate credit toward its share of the project cost for the value of work identified in the attached scope of work and contributed on or after January 1, 1993. The value of these costs will be determined by audit. The appropriateness of the crediting shall be in accordance with the applicable statutes, regulations and other applicable guidance and the signed Project Cooperation Agreement.

In the event the project is not implemented, the cities will not receive any reimbursement for work undertaken by them.

Chuck Gurrad
Chuck Gurrad
Mayor, City of Aberdeen

Date 4/16/93

Walter J. Cunningham
Walter J. Cunningham
Colonel, Corps of Engineers
District Engineer

Date 13 APR 93

EXHIBIT 1

WYNOOCHEE LAKE PROJECT

SECTION 1135 STUDY AGREEMENT

SCOPE OF WORK
TO OBTAIN FEDERAL ENERGY REGULATORY COMMISSION
(FERC) LICENSE AMENDMENT
AND ALTER ABERDEEN/TACOMA FACILITIES

1.0 Coordination

1.1 Coordinate negotiations with state and Federal agencies and Tribes on criteria for fish screen and bypass facilities, and document as necessary.

1.2 Work with state agencies to identify operating criteria for natural fish supplementation program, and document plan of operations.

1.3 Act as coordinator between Corps of Engineers and estimators, and state and Federal agencies, Tribes and Licensees on design, cost estimates, and schedule.

1.4 Coordinate with Federal and state agencies as necessary on the work to satisfy the requirement in Paragraph 6 of the Recommendations in the FERC License for a study of the efficiency of the new intake.

1.5 Coordinate with Federal and state agencies on elimination of the 77-day window in order to operate fish bypass facilities and fish screen.

1.6 Coordinate approval of modification of flow regime with state and Federal agencies.

1.7 Coordinate filing and processing of FERC License amendment.

1.7.1 Meet and communicate as necessary with Federal and state agencies, Tribes, Corps of Engineers, public interest groups, and the FERC to assure the development of a coordinated License amendment application and a smooth amendment process.

1.7.2 Print and circulate application to all interested parties on the circulation list provided by the FERC.

1.7.3 Contact interested parties to coordinate and solicit their review of and response to the application.

1.7.4 Receive and process comments.

1.7.5 Expedite process and publication to keep restoration project on schedule.

1.8 Coordinate all activities with the Corps

1.8.1 Provide monthly written reports on progress, budget and schedule.

1.8.2 Provide or comment on written meeting minutes.

2.0 Environmental

2.1 Participate in scoping processes, public meetings, and work with state and federal agencies on identification of required compliance documents, scope of analyses, other reasonable mitigation alternatives and to address questions, concerns, and comments.

2.2 Obtain information and studies as necessary to analyze alternatives and potential impacts.

2.3 Consider and analyze potential impacts and mitigation proposals.

2.4 Prepare (and comment on Corps drafts of) NEPA compliance documents for fish restoration project, including, but not limited to, Corps Section 1135 decision, Forest Service permit, and FERC License amendment.

2.5 Obtain amendment to FERC License.

2.5.1 Perform any analysis of efficiency of new intake required to eliminate 77-day shutdown period.

2.5.2 Prepare application for license amendment and circulate proposed draft amendment.

2.5.3 Respond to information and documentation requests from the FERC.

2.5.4 Prepare for use by the FERC suggested revised Articles and work with the FERC to develop final Articles.

2.5.5 Finalize and submit to the FERC the application for amendment to License No. 6842.

2.5.6 Perform testing of fish screen and bypass facilities to demonstrate performance to state and Federal agencies.

3.0 Design

3.1 Prepare preliminary designs, quantity take-offs, and cost estimates for fish screen, and acclimation ponds.

3.2 Work with Corps of Engineers on preliminary designs, quantity take-offs and cost estimates for fish bypass facilities.

3.3 Provide value engineering services.

3.4 Prepare final plans and specifications for acclimation ponds, fish screen, and portions of fish bypass facilities.

3.5 Review final plans and specifications for fish bypass facilities.

3.6 Review and approval of construction budget and schedule.

3.7 Review and participation in evaluation of bids and selection of contractors, subject to Federal statutory constraints.

3.8 Construction contract review, subject to Federal statutory constraints.

3.9 Inspection of fabrication of fish screen.

3.10 Inspection, management, and/or construction of acclimation ponds.

3.11 Inspections during construction for fish screen and bypass facilities.

3.12 Calculations necessary to evaluate modified flow regime.

WYNOOCHEE DAM
Section 1135 Fish Restoration Project
Statement of In-Kind Services

City of Tacoma, Department of Public Utilities, Light Division

The following is a breakdown of in-kind services already performed and to be performed by the City for implementation of the fish restoration project. No charges are listed for any work done by City personnel prior to October 1, 1996. The charges shown prior to this date are all based on billings to the City. All City labor performed after October 1, 1996 will be charged to accounts established for the fish restoration project.

6/92-3/93 Preliminary Engineering	$14,292.76
3-93-12/93 Preliminary Engineering	$226,161.16
1994 Preliminary Engineering	$72,356.26
Const of Powerhouse Piping and Intake for Ponds	$19,404.00
Const of Piping to Hatchery Vicinity	$25,936.68
Const of Emergency Power (1/2 of total cost)	$18,865.00
Const of Storage Building (3/8 of total cost)	$44,697.92
1995 Hydroacoustic Testing of Fish Passage	$11,331.00
1995 Mtg with COE and Al Solonsky	$669.05
1996 Mtg with COE and Al Solonsky	$547.80
Engineering, Plan Review, License Amendment	*$100,000.00
Control System Design and Installation	*$60,000.00
Design of Supplementation Pond System	*$45,000.00
Construction of Rearing Ponds and Bingham Hatch	*$155,000.00
TOTAL IN-KIND SERVICES	*$794,261.63

* Based on current best estimates for future work.

EXHIBIT 2

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

12 MAR 1993

CECC-J

MEMORANDUM FOR SIRI NELSON (CENPS-OC)

SUBJECT: Environmental Restoration Measures at Wynoochee Lake, Washington

1. This follows up my note to you of 4 March 1993 concerning efforts to reduce fish kill attributed to the operation of Wynoochee Lake. I have agreed to the following guidance in further reply to your memorandum to me of 26 February 1993 requesting assistance on the matters you discussed. Your district may proceed pursuant to this guidance that was developed in cooperation with the Office of the Assistant Secretary of the Army (Civil Works) and the Office of the Army General Counsel.

2. Section 1135 of the Water Resources Development Act of 1986, as amended, (WRDA 86) states that the non-Federal share of the cost of project modifications is to be 25 percent. While WRDA 86 does not specify additional conditions for the Section 1135 cost share, the Army policy is that work-in-kind is credited only where Congress has specifically stated that it is to be counted toward the non-Federal share of project costs. This policy is based on consistent interpretation of WRDA 86 as a whole. Initial interpretations of this authority were based on the concept that modifications would be made on Federal facilities and that no LERRD's would be required. However, as the program matured improvements were allowed which would require acquisition of some added lands. Consistent with other provisions of WRDA 86 Army policy provides that the sponsor is to acquire those lands and that the value of the lands acquired would be credited to the local share of the cost of the modification.

3. The proposal at Lake Wynoochee is similar. A portion of this project is envisioned to include the modification of the Cities' penstock which is being constructed under FERC license. The provisions of WRDA 86 generally provide that alterations to local facilities be provided by the sponsor. Thus, to allow the work related to the alteration of local facilities to be contributed by the sponsor and count toward their share of the project cost would be analogous to an alteration and generally consistent with other provisions of WRDA 86. Such a position is further supported by the uniqueness of this project in that we are currently authorized to transfer title of the project to Aberdeen, a part owner of the penstock.

EXHIBIT 3

4. In light of the unique circumstances of this project we believe it is consistent with WRDA 86 to allow the cities of Aberdeen and Tacoma to undertake the necessary coordination, design, and environmental studies needed to amend the FERC license and alter their facility.

5. This work should be identified in a study agreement between the City of Aberdeen and the District Engineer which would provide for the city to undertake such work and to receive an appropriate credit for the value of the work contributed, after signing of the agreement, toward their share of the project cost. The value of these costs would be determined by audit. In the event the project is not implemented the cities would not receive any reimbursement for work undertaken by them.

6. Please continue to consult with me if there are any significant questions occasioned by this guidance or any requests for deviation from this guidance. I wish to thank you, Earl Stockdale, Robert Kaighn, and Kathy Kurke for your wisdom on these matters and your patience in educating me.

Ronald C. Allen
Senior Assistant Chief Counsel
for Legislation and General Law

Copies to: Mr. Robert Kaighn - Office of the Assistant Secretary of the Army (Civil Works)
Mr. Earl Stockdale - Office of the Army General Counsel
Mr. Cecil Reinke - North Pacific Division Counsel
Ms. Kathy Kurke - Office of the Chief Counsel
Mr. Jimmy Bates - Policy and Planning Division, Civil Works Directorate

APPENDIX D

WYNOOCHEE DAM
REAL ESTATE ANALYSIS

REAL ESTATE ANALYSIS

In 1993 the Department of the Army, acting by and through the Corps of Engineers (COE) entered into an agreement with the City of Aberdeen, Washington, for the transfer of title to the Wynoochee Dam and Reservoir (approximately 570.50 acres of land) to Aberdeen. The transfer of land was accomplished by Quitclaim Deed of September 16, 1993. City of Aberdeen assumed responsibility for all operation, maintenance, repair, replacement and rehabilitation for the dam and reservoir. The City of Aberdeen and City of Tacoma (Non-Federal Sponsor for the Section 1135 project) obtained a joint license for the operation of the hydroelectric facilities constructed at the dam. By mutual agreement of both Aberdeen and Tacoma only one city should be responsible for the OMRR&R of the dam. The Cities signed a transfer agreement to remain in effect until final transfer of the Project from City of Aberdeen to the City of Tacoma, with Corps approval. There is currently an operating agreement in effective between the City of Aberdeen and City of Tacoma that provides Tacoma with the right to use the lands associated with Wynoochee Dam. The City of Tacoma acts as the sole operating partner of the dam and is the Non-Federal Sponsor for the Section 1135 project. The City's are awaiting COE approval of a Memorandum of Agreement (MOA) that allows the City of Aberdeen to transfer title to the dam to the City of Tacoma. Except for the supplementation ponds, all other projects features are on lands within the immediate Wynoochee Dam area.

The Non Federal Sponsor currently holds a Special Use Permit (SUP) from the United States Forest Service (USFS) for lands within the Wynoochee Dam project area that are not owned by the City of Tacoma or included in the current operating agreement. The proposed location of the supplementation ponds appear to fall outside the area covered by the existing SUP. The Non Federal Sponsor will need to obtain an amendment to their existing SUP for the additional use and area. The Non-Federal Sponsor will need to amend the SUP before advertising for construction.

The USFS is agreeable to amending the SUP for any additional areas needed for the supplementation ponds. The USFS usually requires the holder of the SUP to pay annually, a sum determined by the USFS. The sum is typically 5 percent (or some other percentage approved by Congress) of the fair market value of the use rights granted by the SUP. However, if the SUP holder makes payments, in accordance with Section 10(e) of the Federal Power Act, to the Federal Energy Regulatory Commission (FERC) for the use of the same lands, the USFS waives the SUP fees. When FERC issues the Non-Federal Sponsor the license it will most likely contain this fee provision.

The Non-Federal Sponsor will not receive credit for lands acquired from the USFS if the acquisition is accomplished at no cost. For any project features on land not under the control of the USFS, the Non-Federal Sponsor will need to demonstrate it owns an adequate interest for those lands. The Non-Federal Sponsor will not receive credit for any lands already available for the existing Wynoochee Dam Project. The Non-Federal Sponsor's estimate administrative costs for obtaining/amending the SUP from the USFS, demonstrating land ownership, and certifying the land available before advertising for construction is $5,000. Federal review and assistance costs are currently estimated at $2,500.

WYNOOCHEE SECTION 1135 PROJECT ASSESSMENT OF NON-FEDERAL SPONSOR'S REAL ESTATE ACQUISITION CAPABILITY

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? **YES.**

b. Does the sponsor have the power of eminent domain for this project? **YES**

c. Does the sponsor have "quick-take" authority for this project? **No. In the case of this project, the United States Forest Service (USFS) owns the land. The city cannot condemn federal lands. The City of Tacoma has a SUP from the USFS for lands within the Wynoochee Dam project boundary. The USFS is agreeable to amending the SUP if additional lands are required.**

d. Are any of the lands or interests in land required for the project located outside the sponsor's political boundary? **YES.**

e. Are any of the lands or interests in land required for the project owned by an entity whose property the sponsor cannot condemn? **YES. Lands needed for the project are U.S. Forest Service lands.**

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? **NO.**

b. If the answer to II.a. is "yes," has a reasonable plan been developed to provide such training? **Not Applicable.**

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **YES.**

d. Is the sponsor's projected in-house staff level sufficient considering its other work load, if any, and the project schedule? **YES.**

e. Can the sponsor obtain contractor support, if required, in a timely fashion? **YES.**

f. Will the sponsor likely request USACE assistance in acquiring real estate? **YES. The sponsor expects the COE to work with the USFS on any**

APPENDIX E

WYNOOCHEE DAM
COST ESTIMATE

TOTAL - ALL CONTRACTS

**** TOTAL PROJECT COST SUMMARY ****

THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE FEASIBILITY REPORT DATED SEPTEMBER 1997

PROJECT: WYNOOCHEE DAM, SECTION 1135
LOCATION: WYNOOCHEE RIVER, WASHINGTON

DISTRICT: SEATTLE
POC: OLTON SWANSON, CHIEF, COST ENGINEERING

ACCOUNT NUMBER	FEATURE DESCRIPTION	CURRENT MCACES ESTIMATE PREPARE SEP 97 EFFECTIVE PRICING LEVEL: OCT 97 COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	AUTHORIZED/BUDGET YEAR: EFFECTIVE PRICING LEVEL: COST ($K)	CNTG ($K)	TOTAL ($K)	FULLY FUNDED ESTIMATE COST ($K)	CNTG ($K)	FULL ($K)
04	DAMS										
04.03	OUTLET WORKS	1,559	391	25%	1,950						
06	FISH AND WILDLIFE FACILITIES	878	220	25%	1,098						
	TOTAL CONSTRUCTION COST	2,437	611		3,048						
01	LANDS AND DAMAGES	5	1	25%	6						
31	CONSTRUCTION MANAGEMENT	200	50	25%	250						
	TOTAL PROJECT COSTS	2,642	662		3,304						

THIS TPCS REFLECTS A PROJECT COST CHANGE OF: 0

TOTAL FEDERAL COSTS: _____

TOTAL NON-FEDERAL COSTS _____

THE MAXIMUM PROJECT COST IS : _____

DISTRICT APPROVED:

Olton Swanson CHIEF, COST ENGINEERING

_____ CHIEF, REAL ESTATE

_____ CHIEF, PLANNING

_____ CHIEF, ENGINEERING

_____ CHIEF, CONSTRUCTION

_____ CHIEF, OPERATIONS

_____ CHIEF, PROGRAMS MANAGEMENT

_____ PROJECT MANAGER

_____ DDE (PM)

DIVISION APPROVED.

_____ CHIEF, COST ENGINEERING

_____ DIRECTOR, REAL ESTATE

_____ CHIEF PROGRAMS MANAGEMENT

_____ DIRECTOR OF PPMD

APPROVED DATE _____

CONSTRUCTION COSTS

**** TOTAL CONTRACT COST SUMMARY ****

THIS ESTIMATE IS BASED ON THE SCOPE CONTAINED IN THE FEASIBILITY REPORT DATED SEPTEMBER 1997

PROJECT: WYNOOCHEE DAM, SECTION 1135
LOCATION: WYNOOCHEE RIVER, WASHINGTON

DISTRICT: SEATTLE
POC: OLTON SWANSON, CHIEF, COST ENGINEERING

ACCOUNT NUMBER	FEATURE DESCRIPTION	CURRENT MCACES ESTIMATE PREPARE SEP 97 EFFECTIVE PRICING LEVEL: OCT 97 COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	EFFECTIVE PRICING LEVEL: OCT 97 FEATURE MIDPT	CWCCIS (%)	COST ($K)	CNTG ($K)	FULL ($K)	FULLY FUNDED ESTIMATE FEATURE MIDPT	OMB (%)	COST ($K)	CNTG ($K)	FULL ($K)
04	DAMS														
04.03	OUTLET WORKS														
04.03.01	MOB, DEMOB & PREP WORK	130	33	25%	163						OCT 99	6.3%			
04.03.E.	CONDUIT OR TUNNEL	641	160	25%	801						OCT 99	6.3%			
	FISH BYPASS	642	161	25%	803						OCT 99	6.3%			
04.03.G.	INTAKE GATES AND EQUIPMENT	146	37	25%	183						OCT 99	6.3%			
	SUBTOTAL OF FEATURE 4, DAMS	$1,559	$391		$1,950										
06	FISH AND WILDLIFE FACILITIES														
06.02	FISH HATCHERY														
06.02.E.	ASSOCIATED GENERAL ITEMS														
	PIT TAG FACILITY, CAPITAL COSTS	247	62	25%	309						OCT 99	6.3%			
	PIT TAG FACILITY, O&M DURING CONSTRUCTION	151	38	25%	189						OCT 99	6.3%			
	SUPPLEMENTATION PONDS AND TRAP MODIFICATIONS	480	120	25%	600	THIS WORK WILL BE DESIGNED AND BUILT BY WASHINGTON STATE DEPARTMENT OF FISH AND WILDLIFE. DETAILS ARE BELOW.					OCT 99	6.3%			
	2 PONDS, 30'X80'X8'	878	220		1,098										
	WATER SUPPLY														
	OUTLET STRUCTURE (TIES INTO BYPASS)														
	FEEDER SYSTEM														
	MISC UTILITIES														
	FENCING														
	TOTAL CONSTRUCTION COST	2,437	611		3,048										

Wynoochee 1135 Feasibility Study
Grays Harbor County
Washington

Designed By: Seattle District Corps of Engrs.
Estimated By: Cost Engineering Branch

Prepared By: Stephen Pierce

Preparation Date: 09/18/97
Effective Date of Pricing: 09/18/97
Est Construction Time: 150 Days

Sales Tax: 8.00%

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contained herein is For Official Use Only.

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by Building Systems Design, Inc.
Release 5.30

BASIS OF ESTIMATE
WYNOOCHEE DAM FISH BYPASS
FEASIBILITY REPORT, LESS THAN 35 % DESIGN

The existing penstock intake will be modified to better attract fish at multiple pool elevations. A fish screen will be built into the penstock to crowd the fish into a fish friendly HDPE pipe, to bypass the turbine. The series of pipes and troughs will carry the fish downstream, free from high pressure changes and preditor/feeders. Several associated facilities such as; ponds and hatchery enhancements will be built, also.

The construction schedule is for four months, starting early in 1999. The total contract should be completed in 120 days. Intake construction will be scheduled for low pool seasons, to eliminate the need for a cofferdam. The penstock sections will be constructed independently and will not interrupt power generation until they are installed. After that, the fish screen section of penstock will only be used during fish passage and pulled out at other times. This operation will be accomplished in about two days as the penstock flanges are unbolted, the penstock section wheeled over out of the way and the other penstock section is bolted in.

No overtime is included in the estimate. The item requiring lead time is the fish screen.

Much of the work can be done by a general contractor such as earth and rock excavation, concrete, and assembly of shop fabricated items, such as gates, gate guides and other misc. steel. Metal fabricators will assemble much of the items off site. Misc electrical controls and mechanical systems will be installed by subcontractors, also.

Access is along the project road, approximately 30 miles north of Montesano. During construction, access should be limited to project and construction employees only. The public access to the boat ramp and park should be curtailed.

Concrete required is less than 500 cubic yards, so it will be trucked from a redi-mix source on Highway 12. Much of the work will be shop fabricated, but the site work should be able to continue in all but the worst winter weather. No problems are anticipated with the soil or rock excavation. Disposal will be on the project site, per direction of the site staff. The work is of a conventional nature, therefore no unique techniques or unusual construction is expected. All labor, materials and equipment are locally available.

There are no major environment concerns with construction at this site because all of the construction is within the project boundaries and have been disturbed before.

Contingencies are between 20 and 25 percent for all of the work. The only item of concern is that the design functions correctly with the fish migration as expected. If there are operational problems, some rework will be done on-site, as required.

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	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	INSURANC	BOND	TOTAL COST	UNIT COST
04 Dams									
04.03 Outlet Works									
04.03. 1 Mob, Demob & Preparatory Work		100,000	12,000	6,720	8,310	1,270	1,321	129,622	
TOTAL Mob, Demob & Preparatory Work		100,000	12,000	6,720	8,310	1,270	1,321	129,622	
04.03. E Conduit or Tunnel									
04.03. E.01 Site Work		124,036	14,884	8,335	10,308	1,576	1,639	160,779	
TOTAL Site Work		124,036	14,884	8,335	10,308	1,576	1,639	160,779	
04.03. E.02 Metals									
04.03. E.02_ 1 EICHER SCREEN MATERIAL		46,800	5,616	3,145	3,889	595	618	60,663	
04.03. E.02_ 2 SCREEN FRAME		87,000	10,440	5,846	7,230	1,105	1,150	112,771	
04.03. E.02_ 3 SCREEN SHAFT		7,800	936	524	648	99	103	10,111	
04.03. E.02_ 4 EICHER PENSTOCK		85,000	10,200	5,712	7,064	1,080	1,123	110,179	
04.03. E.02_ 5 BYPASS TRANSITION SECTION		9,000	1,080	605	748	114	119	11,666	
04.03. E.02_ 6 REPLACEMENT PENSTOCK		46,000	5,520	3,091	3,823	584	608	59,626	
04.03. E.02_ 7 Misc Items		15,552	1,866	1,045	1,292	198	206	20,159	
TOTAL Metals		297,152	35,658	19,969	24,695	3,775	3,927	385,175	
04.03. E.03 Electrical and Mechanical									
04.03. E.03_ 1 SCREEN OPERATOR		23,000	2,760	1,546	1,911	292	304	29,813	
04.03. E.03_ 2 ELECTRICAL CONTROLS		38,000	4,560	2,554	3,158	483	502	49,256	
04.03. E.03_ 3 LIGHTING		12,000	1,440	806	997	152	159	15,555	
TOTAL Electrical and Mechanical		73,000	8,760	4,906	6,067	927	965	94,624	
04.03. E.04 Conduit for Fish Passage									
04.03. E.04_ 1 HDPE between Penstock & Bridge	150.00 LF	9,807	1,177	659	815	125	130	12,712	84.75
04.03. E.04_ 2 HDPE across River under Bridge	250.00 LF	123,497	14,820	8,299	10,263	1,569	1,632	160,080	640.32
04.03. E.04_ 3 HDPE between Bridge & Transition	150.00 LF	10,373	1,245	697	862	132	137	13,445	89.64
04.03. E.04_ 4 Transition Selector Vault		24,855	2,983	1,670	2,066	316	328	32,217	
04.03. E.04_ 5 HDPE thru Transition area	1010.00 LF	68,722	8,247	4,618	5,711	873	908	89,079	88.20
04.03. E.04_ 6 HDPE, Elbow Sections	6.00 EA	37,917	4,550	2,548	3,151	482	501	49,149	8191.54
04.03. E.04_ 7 Concrete Flume	1860.00 LF	217,467	25,529	14,296	17,679	2,702	2,811	280,485	150.80
04.03. E.04_ 8 HDPE under Project Road	50.00 LF	3,668	440	246	305	47	48	4,754	95.08

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	INSURANC	BOND	TOTAL COST	UNIT COST
TOTAL Conduit for Fish Passage		496,305	58,989	33,034	40,852	6,245	6,496	641,921	
TOTAL Conduit or Tunne.		990,493	118,292	66,243	81,921	12,522	13,027	1,282,499	
04.03. G Intake Gates and Equipment									
04.03. G.02 Structure Modification									
04.03. G.02_02 Permanent attraction Lighting		8,000	960	538	665	102	106	10,370	
04.03. G.02_03 Hydraulic Hoist and Controls		50,000	6,000	3,360	4,155	635	661	64,811	
04.03. G.02_04 Upper Passage Gate Improvements		4,000	480	269	332	51	53	5,185	
04.03. G.02_05 Upper Fish Passage Baffle	90.00 SF	16,921	2,031	1,137	1,406	215	224	21,937	243.75
04.03. G.02_06 Lower Fish Passage Baffle	40.00 SF	14,886	1,786	1,000	1,237	189	197	19,296	482.39
04.03. G.02_07 Penstock Transition Concrete	10.00 CY	11,265	1,331	745	922	141	147	14,551	1455.11
04.03. G.02_08 Control System Modifications		8,000	960	538	665	102	106	10,370	
TOTAL Structure Modification		113,075	13,548	7,587	9,383	1,434	1,492	146,520	
TOTAL Intake Gates and Equipment		113,075	13,548	7,587	9,383	1,434	1,492	146,520	
TOTAL Outlet Works		1,203,569	143,840	80,551	99,614	15,227	15,840	1,558,641	
TOTAL Dams		1,203,569	143,840	80,551	99,614	15,227	[illegible]	1,558,641	
06 Fish and Wildlife Facilities									
06.01 Pit Tag Facility, Capital Costs		247,000	0	0	0	0	0	247,000	
06.02 Pit Tag Facility, O&M during		151,000	0	0	0	0	0	151,000	
06.03 Supplementation Ponds and Trap		480,000	0	0	0	0	0	480,000	
TOTAL Fish and Wildlife Facilities		878,000	0	0	0	0	0	878,000	
TOTAL Wynoochee 1135 Feasibility Study		2,081,569	143,840	80,551	99,614	15,227	15,840	2,436,641	

	QUANTITY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
04 Dams									
04.03 Outlet Works									
04.03. 1 Mob, Demob & Preparatory Work			0	0	0	0	100,000	100,000	
TOTAL Mob, Demob & Preparatory Work			0	0	0	0	100,000	100,000	
04.03. E Conduit or Tunnel									
04.03. E.01 Site Work			1,813	64,381	6,695	52,960	0	124,036	
TOTAL Site Work			1,813	64,381	6,695	52,960	0	124,036	
04.03. E.02 Metals									
04.03. E.02_ 1 EICHER SCREEN MATERIAL			0	0	0	0	46,800	46,800	
04.03. E.02_ 2 SCREEN FRAME			0	0	0	0	87,000	87,000	
04.03. E.02_ 3 SCREEN SHAFT			0	0	0	0	7,800	7,800	
04.03. E.02_ 4 EICHER PENSTOCK			0	0	0	0	85,000	85,000	
04.03. E.02_ 5 BYPASS TRANSITION SECTION			[illegible]	0	0	0	9,000	9,000	
04.03. E.02_ 6 REPLACEMENT PENSTOCK			0	0	0	0	46,000	46,000	
04.03. E.02_ 7 Misc Items			0	0	0	15,552	0	15,552	
TOTAL Metals			0	0	0	15,552	281,600	297,152	
04.03. E.03 Electrical and Mechanical									
04.03. E.03_ 1 SCREEN OPERATOR			0	0	0	0	23,000	23,000	
04.03. E.03_ 2 ELECTRICAL CONTROLS			0	0	0	0	38,000	38,000	
04.03. E.03_ 3 LIGHTING			0	0	0	0	12,000	12,000	
TOTAL Electrical and Mechanical			0	0	0	0	73,000	73,000	
04.03. E.04 Conduit for Fish Passage									
04.03. E.04_ 1 HDPE between Penstock & Bridge	150.00	LF	58	1,872	625	7,290	20	9,807	65.38
04.03. E.04_ 2 HDPE across River under Bridge	250.00	LF	1,539	66,311	1,390	55,796	0	123,497	493.99
04.03. E.04_ 3 HDPE between Bridge & Transition	150.00	LF	60	1,967	660	7,726	20	10,373	69.15
04.03. E.04_ 4 Transition Selector Vault			223	7,690	563	16,596	6	24,855	
04.03. E.04_ 5 HDPE thru Transition area	1010.00	LF	432	14,107	5,179	49,086	350	68,722	68.04
04.03. E.04_ 6 HDPE, Elbow Sections	6.00	EA	144	4,692	1,498	31,687	40	37,917	6319.55
04.03. E.04_ 7 Concrete Flume	1860.00	LF	1,161	37,871	6,335	163,261	10,000	217,467	116.92
04.03. E.04_ 8 HDPE under Project Road	50.00	LF	18	585	206	2,866	10	3,668	73.35

	QUANTITY	UOM	MANHRS	LABOR	EQUIPMNT	MATERIAL	OTHER	TOTAL COST	UNIT COST
TOTAL Conduit for Fish Passage			3,635	135,096	16,454	334,309	10,446	496,305	
TOTAL Conduit or Tunnel			5,448	195,477	23,149	402,821	365,046	990,493	
04.03. G Intake Gates and Equipment									
04.03. G.02 Structure Modification									
04.03. G.02_02 Permanent attraction Lighting			0	0	0	0	8,000	8,000	
04.03. G.02_03 Hydraulic Hoist and Controls			0	0	0	0	50,000	50,000	
04.03. G.02_04 Upper [illegible] ssage Gate Improvements			0	0	0	0	4,000	4,000	
04.03. G.02_05 Upp[illegible] Passage Baffle	90.00	SF	[illegible]75	11,628	128	5,168	[illegible]	16,924	188.05
04.03. G.02_06 Lower Fish Passage Baffle	40.00	SF	275	11,628	128	3,130	0	14,886	372.15
04.03. G.02_07 Penstock Transition Concrete	10.00	CY	326	10,451	713	102	0	11,265	1126.51
04.03. G.02_08 Control System Modifications			0	0	0	0	8,000	8,000	
TOTAL Structure Modification			[illegible]	33,708	968	8,400	70,000	113,075	
TOTAL Intake Gates and Equipment			876	33,708	968	8,400	70,000	113,075	
TOTAL Outlet Works			6,325	233,184	24,117	411,221	535,046	1,203,569	
TOTAL Dams			6,325	233,184	24,117	411,221	535,046	1,203,569	
06 Fish and Wildlife Facilities									
06.01 Pit Tag Facility, Capital Costs			0	0	0	0	247,000	247,000	
06.02 Pit Tag Facility, O&M during			0	0	0	0	151,000	151,000	
06.03 Supplementation Ponds and Trap			0	0	0	0	480,000	480,000	
TOTAL Fish and Wildlife Facilities			0	0	0	0	878,000	878,000	
TOTAL Wynoochee 1135 Feasibility Study			6,325	233,184	24,117	411,221	1,413,046	2,081,569	
Field Office Overhead								143,840	
SUBTOTAL								2,225,409	
Home Office Overhead								80,551	
SUBTOTAL								2,305,960	
Profit								99,614	
SUBTOTAL								2,405,574	
Liability Insurance								15,227	
SUBTOTAL								2,420,801	
Bond								15,840	
TOTAL INCL INDIRECTS								2,436,641	

APPENDIX F

WYNOOCHEE DAM
HYDROLOGICAL REPORTS

Wynoochee River Alternative Flow Target Study

Introduction

Objective. This study was undertaken as part of the section 1135 , Wynoochee Anadromous Fish Restoration Study, Washington. The objective of the study is to investigate the viability of providing specific alternative target flows at the Wynoochee River Above Save Creek stream gaging station while meeting existing minimum streamflow requirements and diversions elsewhere on the river. The alternative target flows are intended to provide greater instream flows for fish. A particular alternative target flow would not be considered feasible if it were to cause a failure in meeting flow requirements elsewhere on the river. More specifically, a failure would occur in any year of record if the reservoir were to reach the bottom of the conservation pool and consequently cause an insufficient amount of water in the system such that required minimum instream flows and/or Aberdeen's diversion could not be met.

After our analysis the city of Tacoma investigated the monetary impact of the alternative flow proposals on the generation of power at Wynoochee reservoir. They first computed the potential power production under existing conditions and then compared the results with the potential power production under the alternative flow condition.

Basin Overview. A map of the Wynoochee River basin is shown on Plate 1. Key points in the basin for this study are the Wynoochee Dam and Reservoir (Wynoochee Project) located in the upper basin, the Wynoochee River near Grisdale gaging station (Grisdale) just below the Dam at river mile 51.3, the Wynoochee River Above Save Creek gaging station (Save Creek) at river mile 40.6, the Wynoochee River Above Black Creek gaging station (Black Creek) at river mile 5.9, and the Aberdeen diversion 2.2 miles upstream of the Black Creek gage.

During the winter rainflood season Wynoochee Project provides the top 24,000 acre feet as vacant storage for flood control. As the potential for floods decreases through the spring Wynoochee Project gradually stores water to reach full pool by early May. Between the top of the buffer pool of 720 feet and full pool of 800 feet, 59,415 acre-feet of conservation storage is available to supplement natural flows during late spring, summer, and fall to meet fish flows,

Aberdeen's water supply needs, and irrigation. Currently a minimum flow of 190[1] cfs must be maintained at Grisdale and 120 cfs at Black Creek with 117[2] cfs diverted by Aberdeen at their diversion works upstream of Black Creek. All of the proposed target flows are at Save Creek.

Hydrologic Analysis

Overview. The primary objective in this analysis was to determine if sufficient water is available in the system to provide for the proposed flows without running out of water. The concept of the analysis was simple. Obtain as many years of daily flow data as possible for each point of interest in the basin. Set up an HEC-5 model of the reservoir and river system for the existing condition and for each flow proposal. Route the observed, period of record, daily flows through the model and evaluate the performance of the system under each flow demand scenario. If the Wynoochee pool were to drop below elevation 720 feet, the bottom of the conservation pool, for any year, the proposed flow would be considered a failure. If the results were acceptable, i.e., no failures, the results were shipped to Tacoma Public Utilities for the hydropower analysis. They then determined the cost of the alternative flow proposal relative to the base case (existing condition).

In addition to the primary objective stated above the relative effects of the various flow scenarios at Save Creek and at the Reservoir are discussed.

The Database. Save Creek and Grisdale natural (unregulated) daily flow records from 1928 to 1972 were available from the USGS or had been derived in earlier studies using regression relationships with nearby stations on the Wynoochee River. Natural (unregulated) daily flow records for Black Creek were available for the periods 1942-1949 and 1956-1972 from the USGS or had been derived in earlier studies using regression relationships with nearby stations on the Wynoochee River. The daily flow records from 1972 to 1993 were regulated by the project. They had been deregulated to reflect natural conditions in an earlier study. So a complete continuous natural long term record from 1928 to 1993 was available at Grisdale and Save Creek. The Black Creek record was shorter and not continuous. It went from 1942 to 1949 and then from 1957 to 1993.

[1] These minimum flows are documented in section 8.08 of the Wynoochee Water Control Manual.

The model was run for the entire period 1928-1993. During the period when no Black Creek flows were available the analysis was limited to meeting the target flows at Save Creek and Grisdale.

Base Case verses Alternatives. The existing condition represents the base case against which all other alternatives can be compared. Several conditions in the reservoir-river system can be varied. The obvious variables of importance in this analysis are the minimum flow targets. In the base case the flow targets were 200 cfs at Grisdale, 130 cfs at Black Creek (120 cfs plus 10 cfs factor of safety), and 140 cfs diversion above Black Creek. The diversion and Black Creek targets were only considered for the period of record, 1942-49 and 1957-93, when the Black Creek natural was available. The actual required target flow at Grisdale is 190 cfs, July through April, and 140 cfs for May and June. The operator of the project rarely ever reduces the flow below 190 and commonly releases 200 cfs in order to provide a 10 cfs factor of safety to insure that the minimum target of 190 cfs is met. This was reflected in the model by maintaining a 200 cfs target at Grisdale.

In addition to all the targets that are observed in the base case an additional target flow at Save Creek is observed in the alternatives. When the Wynoochee pool is above a selected trigger elevation, either 770 feet or 763 feet depending on the alternative, the Save Creek target is met. When the pool drops below the trigger elevation (770 or 763 feet) the Save Creek target is ignored but all the other targets are maintained. When the target flows proposed at Save Creek are met all the other flow requirements elsewhere on the river are generally met by default.

The only difference between reservoir levels in the base case and the proposed alternatives is the spring refill portion of the maximum allowable pool elevation rule curve (top of conservation pool). In the base case the maximum allowable pool during the spring refill period followed the Water Control Manual requirements; the reservoir begins a gradual refill from 776.1 feet on March 25 and follows a relatively straight line to elevation 795 feet by April 22. The pool is held at elevation 795 feet until May 1 when it begins to fill to elevation 800 feet by May 5. It will probably be noted that the rule curves shown in the Water Control Manual and in the Wynoochee Spring Flood Control Study Report show the refill curve going straight past elevation 795 to elevation 800 feet (full pool). The pool is not shown to level off at 795 feet

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[2] This value was obtained from Bob Salmon of the city of Aberdeen. The USGS Water Resources Data publication states that 114 cfs is diverted while Todd Lloyd (City of Tacoma) recently (April 15, 1996) told me they assumed a diversion of 134 cfs.

during the end of April. This requirement however is stated in the Water Control Manual, section 8.04, and in the conclusion of the Wynoochee Spring Flood Control Study Report.

In each alternative the pool was allowed to begin filling from 776.1 feet on March 1 (instead of March 25) and to fill gradually to elevation 795 feet by 13 April (compared to April 22). The pool was then held at elevation 795 feet until May 1 when it was allowed to fill to elevation 800 feet by May 5. The main difference between the new refill curve in the alternatives and the old refill curve in the Base Case is the opportunity to fill to elevation 795 feet 9 days earlier with the new curve. Plate 2 shows the existing and proposed reservoir rule curves.

This specific application of the two refill rule curves was coordinated and agreed upon in a meeting between the sponsor, the fisheries agencies, and the Corps. The purpose is to compare possible future (proposed) conditions with existing conditions, i.e. not just a comparison of flow targets. Table 1 is a checklist of alternatives examined.

Table 1. Checklist of Alternatives Examined.

Name of Scenario	Location of Desired Target	Desired Target Flow, cfs	Location of Required Target	Required Target Flow, cfs	Reservoir Rule Curve and switching level
Base Case	Grisdale	200	Grisdale	200	Existing, none
Proposed 330	Save Creek	330	Grisdale	200	Proposed, 770
Proposed 330	Save Creek	330	Grisdale	200	Proposed, 763
Proposed 345	Save Creek	345	Grisdale	200	Proposed, 770
Proposed 345	Save Creek	345	Grisdale	200	Proposed, 763

Results of Alternative Target Flow Analyses. Minimum flow targets at Grisdale and Black Creek were met without running out of conservation storage (storage above 720 ft) under each of the scenarios analyzed. The alternative Save Creek flow targets were not always met. They were met only so long as the pool was above the designated switching level (763 ft. or 770 ft.). In a comparison of the 330 cfs target with the 345 cfs target, with either switching level, the Save Creek target was met for a longer period of time each year under the 330 cfs target. This result is intuitive since the lower flow consumes less storage.

Another intuitive result was observed in comparing the two different switching levels, 763 feet verses 770 feet, while keeping the Save Creek target flow fixed at 345 or 330 cfs. The first obvious note is that the target flow was met for a longer period with the switching level at

763 feet. The other obvious point is that the pool stayed above the 763 foot level, the lowest possible hydropower productive pool elevation, longer when the switching level was at 770 feet.

Table 2. Ratio of years when the pool falls below the trigger level.

	200 EXS	330 770	330 763	345 770	345 763
Pool<770	0.28	0.61	0.64	0.72	0.73
Pool<763	0.09	0.27	0.36	0.30	0.48

The lowest pool for the two alternatives that switched at elevation 770 feet occurred on 12 December, 1929. The lowest pool for the two alternatives that switched at elevation 763 feet occurred on 8 November, 1987. The low pool elevations for 1929, 1936, 1987 and 1992, the four driest years, are summarized in Table 3. Plates 3 and 4 provide a table for the minimum and maximum pools respectively for each year and the respective date they occurred.

Summary hydrographs of pool elevations and flows at each station, Grisdale, Save Creek, and Black Creek, for each scenario are displayed on Plates 5 through 12. These summary hydrographs were limited to six curves each, the minimum, average, and the 5-, 10-, 25-, and 50-percentiles. An additional set of summary hydrographs on plates 13-20 provides a comparison between the existing condition (200 EXS) and the selected alternative (330 770) as well as a second alternative (330 763). Note that this second set of hydrographs splits the year in two, January to June and July to December.

Table 3. Minimum Pools

Scenario / Date	12 December, 1929	5 December, 1936	8 November, 1987	17 October, 1992
Base Case, Existing Condition	754.08	750.87	760.69	756.45
Save=330, Switch at 770	742.42	748.42	742.87	746.73
Save=330, Switch at 763	740.19	745.81	739.91	742.27
Save=345, Switch at 770	739.78	748.11	740.67	742.5
Save=345, Switch at 763	736.22	745.18	736.01	739.1

Hydropower Analysis. Tacoma Public Utilities (TPU) performed the hydropower analysis to determine the impact each alternative flow regime would have on power production. Relative to the base case each alternative showed a net loss. The approximate losses are

summarized in Table 4. TPU has chosen the 330 770 alternative as the selected alternative. More details on the hydropower analysis will be provided in the section on hydropower by TPU.

Table 4. Costs to Power Production. Values are given in Average Annual dollars.

Scenario	Loss in Power Production
Base Case, Existing Condition	0
Save=330, Switch at 770	$10,000
Save=330, Switch at 763	$20,000
Save=345, Switch at 770	$20,000
Save=345, Switch at 763	$30,000

Conclusion. The primary purpose of this analysis was to evaluate if water was available in the system to provide for an increase in the target flow at Save Creek. From a water supply perspective each of the scenarios analyzed is acceptable and will not conflict with existing flow demands or diversions. The following section discusses the relative effects on the flows at Grisdale, Save Creek, and Black Creek. TPU will provide the analysis and conclusion of the alternative flows to hydropower.

Effects on streamflow at non-target locations. This section includes an evaluation on flow fluctuations, supporting hydrographs, and information requests by fisheries.

The Grisdale summary hydrographs shown on Plates 6, and 10 verify that the flow at Grisdale did not fall below the existing target of 190 cfs. It was in fact maintained at or above 200 cfs.

Generally the Grisdale, Save Creek, and Black Creek flows were greater under the selected alternative than under the base case (Comparing plates 6, 7, 8 to 10, 11, 12). Two periods provide and exception. The spring refill and the fall draw down periods. The spring refill periods are different as discussed above in the section Base Case Verses Alternatives, paragraph 3. From 1 March to 24 March the flows are generally higher under the Base Case. For the base case, in most instances, inflows are passed during 1-24 March. In the selected alternative water is actively being stored during this period so flows are less than inflow, generally.

The higher September flows in the base case as compared to the selected alternative (and the other alternatives) are a consequence of more excess water in storage that must be drafted by

1 October. The reservoir should not exceed elevation 776.1 feet on 1 October. In September the flows are dependent on the reservoir level. If the reservoir level is higher than 776.1 feet some water must be drafted and inflow passed during September. If the pool is at or below 776.1 feet no water is drafted during September. Generally the existing condition requires less water from storage during the summer months because it has a lower target flow than the selected alternative. Consequently more water remains in storage and the reservoir levels are higher at the end of August and into September. This results in storage being drafted more often in the base case than in the selected alternative. This more frequent drafting from storage results in greater flows downstream in the base case.

The revised spring refill curve increased the number of years in which the reservoir filled to 800 feet (see Plate 4). In the base case the reservoir came short of filling in 13 of 64 years, or 20 % of the years, whereas in the selected alternative (and all the other alternatives as well) the reservoir failed to fill in only 5 of 64 years, or 8 % of the years. The improved occurrence of fill was due entirely to the revised spring refill curve. In the years that the reservoir did not fill in either the base case or the selected alternative the selected alternative experienced a higher pool. In at least 11 of the 13 years the higher pool was significant in providing the higher target flow for a longer period of time. In the remaining 2 years the additional water in storage made little difference because the pool never feel below 770 feet and therefore the flow at Save Creek never fell below 330 cfs.

Table 5 provides a comparison between the 5 scenarios by showing the percent of days per year, for various percentiles, that the flow falls below 330 cfs. Table 6 shows the corresponding average flow during the time when the flow is below 330 cfs. The selected alternative provides flows at or above 330 significantly more often than the base case.

Table 5.

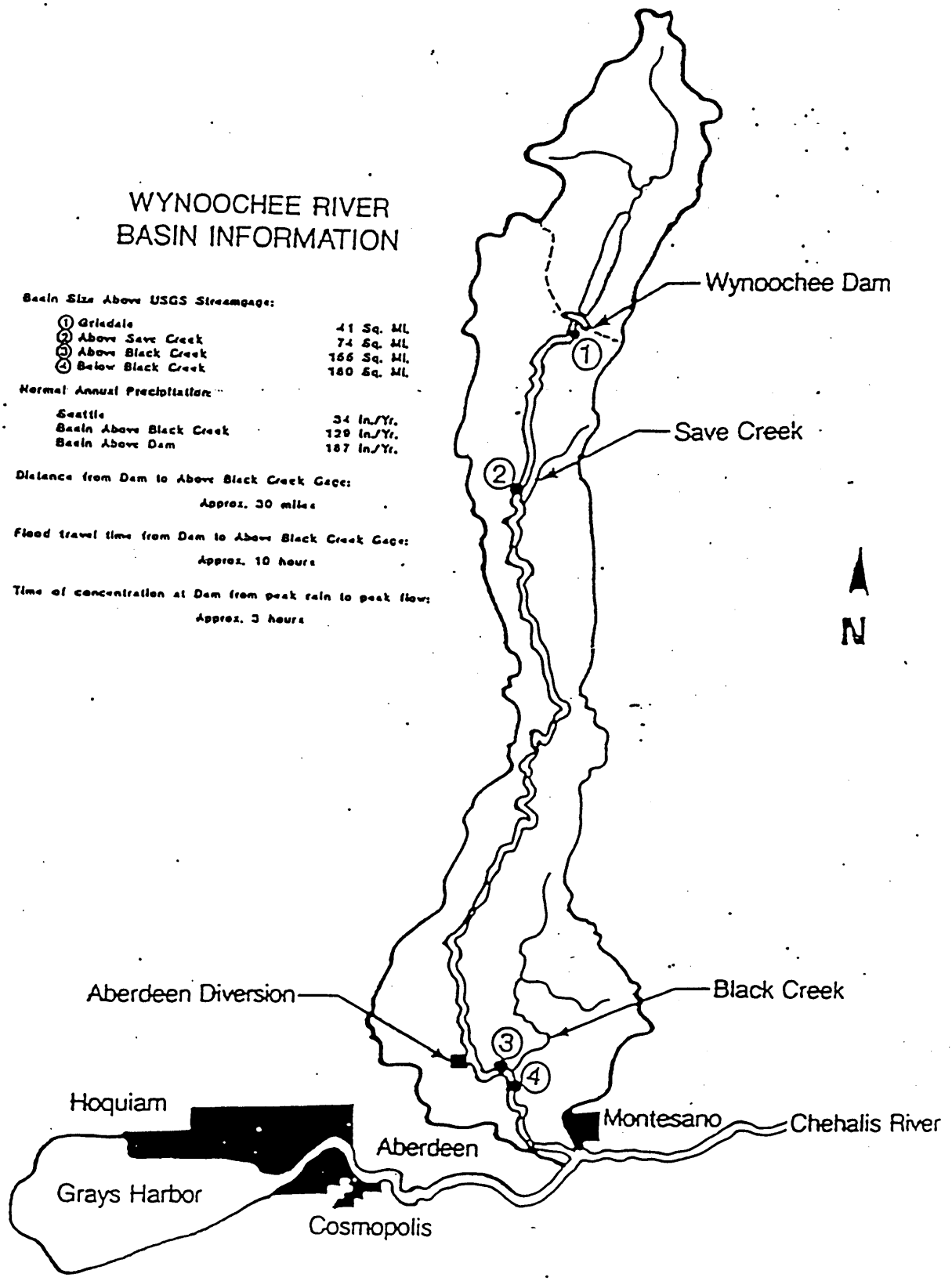
	PERCENT OF DAYS IN THE YEAR THAT				
	FLOWS FALL BELOW 330 CFS				
	Base Case		Selected		
	200 EXS	330 763	330 770	345 763	345 770
MIN	95%	31%	41%	34%	45%
P-05	74%	19%	27%	22%	28%
P-10	51%	11%	18%	15%	21%
P-25	39%	0%	7%	4%	10%
P-50	27%	0%	0%	0%	0%
P-75	16%	0%	0%	0%	0%
P-90	10%	0%	0%	0%	0%
P-95	5%	0%	0%	0%	0%
MAX	1%	0%	0%	0%	0%
AVG	15%	0%	3%	0%	0%

Table 6.

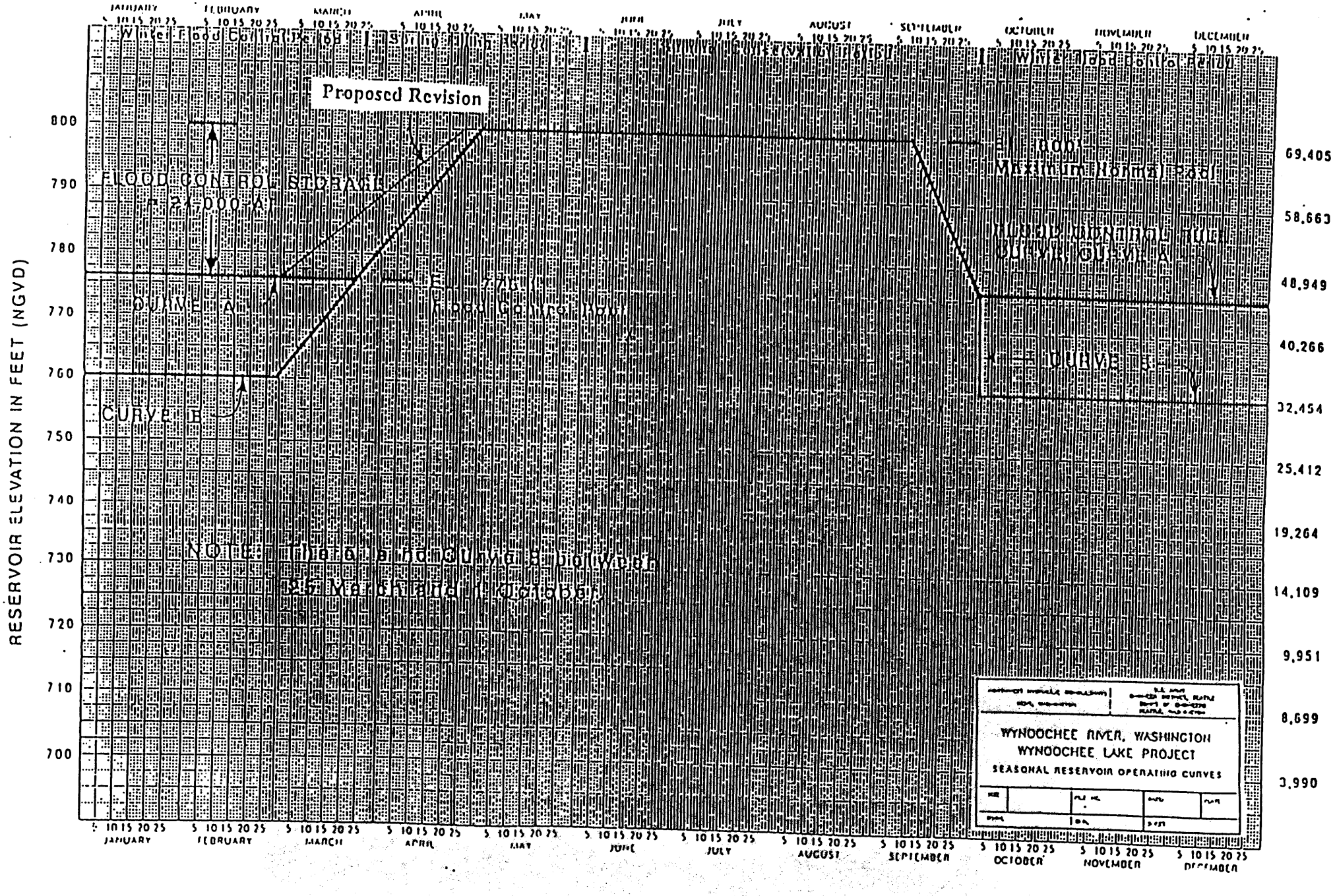
	Average flow for the periods when				
	Flows fall below 330 cfs				
	Base Case		Selected		
	200 EXS	330 763	330 770	345 763	345 770
MIN	264	252	251	251	254
P-05	274	267	263	263	260
P-10	272	278	270	274	267
P-25	277	0	284	292	273
P-50	278	0	0	0	0
P-75	278	0	0	0	0
P-90	291	0	0	0	0
P-95	304	0	0	0	0
MAX	315	0	0	0	0
AVG	287	329	329	0	0

Plates 21 through 26 show hydrographs of sample high (1953), medium (1967), and low (1987) years. Note that this set of hydrographs splits the year in two, January to June and July to December. These are provided at the request of the fisheries agencies.

Wynoochee River Basin



46 2890


Proposed Revision
Winter Flood Control Period
Spring Refill Period
Winter Flood Control Period
FLOOD CONTROL STORAGE
21,000 AF
CURVE A
CURVE B
Maximum Normal Pool
CURVE C
RESERVOIR ELEVATION IN FEET (NGVD)
800
790
780
770
760
750
740
730
720
710
700
69,405
58,663
48,949
40,266
32,454
25,412
19,264
14,109
9,951
6,699
3,990
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
WYNOOCHEE RIVER, WASHINGTON
WYNOOCHEE LAKE PROJECT
SEASONAL RESERVOIR OPERATING CURVES

Wynoochee Target Flow Study				Minimum pool elevations for each Scenario along with the date of occurance													
Scenario																	
200 EXS	*Elev/date*	773.38	12-Oct-35	766.9	30-Oct-42	769.62	15-Feb-49	775.58	13-Oct-56	773.47	12-Oct-63	771.13	17-Oct-70	773.04	22-Oct-77	775	6-Oct-84
330 770	*Elev/date*	770.18	11-Nov-35	764.95	30-Oct-42	766.56	15-Feb-49	774.92	13-Oct-56	766.04	12-Oct-63	762.76	17-Oct-70	770.98	22-Oct-77	769.33	6-Oct-84
330 763	*Elev/date*	768.44	11-Nov-35	762.65	30-Oct-42	763.41	15-Feb-49	774.92	13-Oct-56	763	12-Oct-63	756.18	17-Oct-70	770.98	22-Oct-77	768.38	6-Oct-84
345 770	*Elev/date*	767.44	10-Nov-35	763.68	30-Oct-42	766.18	15-Feb-49	774.6	13-Oct-56	763.74	12-Oct-63	756.93	17-Oct-70	769.64	22-Oct-77	767.2	6-Oct-84
345 763	*Elev/date*	763.54	11-Nov-35	760.71	30-Oct-42	762.66	15-Feb-49	774.6	13-Oct-56	760.07	12-Oct-63	753.48	17-Oct-70	769.13	22-Oct-77	764.79	6-Oct-84
775.75	2-Nov-28	750.87	5-Dec-36	772.83	16-Oct-43	775.58	3-Oct-50	772.01	22-Oct-57	775.93	29-Oct-64	768.59	27-Oct-71	774.04	1-Nov-78	775	6-Oct-84
765.76	30-Sep-28	748.42	5-Dec-36	761.59	16-Oct-43	775.12	4-Oct-50	769.27	22-Oct-57	775.55	31-Oct-64	767.04	27-Oct-71	772.01	1-Nov-78	769.33	6-Oct-84
763.66	30-Sep-28	745.81	5-Dec-36	759.11	16-Oct-43	775.12	4-Oct-50	768.57	22-Oct-57	775.55	31-Oct-64	766.8	27-Oct-71	772.01	1-Nov-78	768.38	6-Oct-84
763.39	30-Sep-28	748.11	5-Dec-36	758.63	16-Oct-43	775.01	4-Oct-50	767.86	22-Oct-57	775.26	31-Oct-64	766.65	27-Oct-71	771.06	2-Nov-78	767.2	6-Oct-84
760.39	30-Sep-28	745.18	5-Dec-36	755.98	16-Oct-43	775.01	4-Oct-50	765.38	22-Oct-57	775.26	31-Oct-64	766.16	27-Oct-71	771.06	2-Nov-78	764.79	6-Oct-84
754.08	12-Dec-29	774.16	11-Feb-37	763.37	29-Oct-44	760.4	27-Sep-51	772.66	7-Oct-58	775.11	4-Oct-65	769.45	31-Oct-72	772.21	17-Oct-79	775.35	30-Oct-86
742.42	12-Dec-29	771.1	14-Feb-37	758.26	29-Oct-44	759.63	27-Sep-51	759.33	7-Oct-58	762.41	4-Oct-65	766.69	31-Oct-72	769.59	17-Oct-79	765.23	30-Oct-86
740.19	12-Dec-29	771.1	14-Feb-37	754.54	29-Oct-44	755.95	27-Sep-51	755.84	7-Oct-58	758.92	4-Oct-65	763.84	31-Oct-72	763.35	21-Oct-79	762.17	30-Oct-86
739.78	12-Dec-29	770	14-Feb-37	753.79	29-Oct-44	757.35	27-Sep-51	756.98	7-Oct-58	760.29	4-Oct-65	764.14	31-Oct-72	764.38	17-Oct-79	762.78	30-Oct-86
736.22	12-Dec-29	769.98	14-Feb-37	751.16	29-Oct-44	753.66	27-Sep-51	753.17	7-Oct-58	756.52	4-Oct-65	760.64	31-Oct-72	760.39	17-Oct-79	759.79	30-Oct-86
762.34	16-Oct-30	764.25	10-Oct-38	768.51	23-Oct-45	764.34	10-Nov-52	776	18-Nov-59	771.39	18-Oct-66	774.06	12-Oct-73	771.68	30-Oct-80	760.69	8-Nov-87
752.24	16-Oct-30	751.41	10-Oct-38	758.69	23-Oct-45	762.51	10-Nov-52	775.72	16-Nov-59	768.12	18-Oct-66	772.37	12-Oct-73	761.4	30-Oct-80	742.87	8-Nov-87
748.28	16-Oct-30	749.37	10-Oct-38	754.23	23-Oct-45	760.02	10-Nov-52	775.72	16-Nov-59	763.29	18-Oct-66	770.2	12-Oct-73	756.15	30-Oct-80	739.91	8-Nov-87
746.86	16-Oct-30	748.78	10-Oct-38	754.54	23-Oct-45	762.08	10-Nov-52	775.49	16-Nov-59	764.32	18-Oct-66	768.32	12-Oct-73	756.65	30-Oct-80	740.67	8-Nov-87
744.44	16-Oct-30	746.51	10-Oct-38	751.31	23-Oct-45	759.45	10-Nov-52	775.49	16-Nov-59	760.83	18-Oct-66	766.52	12-Oct-73	752.98	30-Oct-80	736.01	8-Nov-87
775.34	21-Oct-31	773.87	18-Oct-39	769.78	19-Oct-46	776.07	29-Oct-53	774.79	6-Oct-60	776.1	1-Jan-67	766.35	6-Nov-74	776	10-Feb-81	773.27	12-Oct-88
774.24	21-Oct-31	765.24	18-Oct-39	767.79	19-Oct-46	775.95	29-Oct-53	771.22	6-Oct-60	767.41	29-Sep-67	763.84	6-Nov-74	773.15	26-Sep-81	771.7	12-Oct-88
774.24	21-Oct-31	762.19	18-Oct-39	767.09	19-Oct-46	775.95	29-Oct-53	771.2	6-Oct-60	765.83	30-Sep-67	760.86	6-Nov-74	773.15	26-Sep-81	768.27	12-Oct-88
773.06	28-Sep-31	762.42	18-Oct-39	767.38	19-Oct-46	775.82	29-Oct-53	768.69	6-Oct-60	765.42	29-Sep-67	763.51	6-Nov-74	770.18	26-Sep-81	766.25	12-Oct-88
773.06	28-Sep-31	759.46	18-Oct-39	766.07	19-Oct-46	775.82	29-Oct-53	767.48	6-Oct-60	762.63	29-Sep-67	760.1	6-Nov-74	770.18	26-Sep-81	764.39	12-Oct-88
771.05	13-Oct-32	760.91	9-Oct-40	776.1	1-Jan-47	775.19	6-Oct-54	774.24	8-Oct-61	775.97	3-Oct-68	775.72	3-Oct-75	773.95	20-Oct-82	771.18	20-Oct-89
770.15	13-Oct-32	747.66	9-Oct-40	775.98	9-Jan-47	774.48	6-Oct-54	766.39	8-Oct-61	775.85	3-Oct-68	775.52	3-Oct-75	768.32	20-Oct-82	766.18	20-Oct-89
770.15	13-Oct-32	745.32	9-Oct-40	775.01	1-Oct-47	774.48	6-Oct-54	762.73	8-Oct-61	775.85	3-Oct-68	775.52	3-Oct-75	767.19	20-Oct-82	763.83	20-Oct-89
769.76	13-Oct-32	744.91	9-Oct-40	770.53	1-Oct-47	774.3	6-Oct-54	763.77	8-Oct-61	775.72	5-Oct-68	775.45	3-Oct-75	766.34	20-Oct-82	763.97	20-Oct-89
769.7	13-Oct-32	742.36	9-Oct-40	770.53	1-Oct-47	774.3	6-Oct-54	760.17	8-Oct-61	775.72	5-Oct-68	775.45	3-Oct-75	763.28	20-Oct-82	761.26	20-Oct-89
775.79	17-Oct-33	775.67	8-Oct-41	776.08	13-Feb-48	775.67	3-Oct-55	775.82	3-Nov-62	775.81	2-Feb-69	770.41	24-Oct-76	771.31	20-Oct-83	768.12	3-Nov-91
774.99	17-Oct-33	773.57	30-Aug-41	775.87	13-Feb-48	775.39	3-Oct-55	775.39	3-Nov-62	775.81	2-Feb-69	767.67	24-Oct-76	769.3	29-Oct-83	764.46	3-Nov-91
774.99	17-Oct-33	771.26	8-Oct-41	775.87	13-Feb-48	775.39	3-Oct-55	775.39	3-Nov-62	775.81	2-Feb-69	766.14	24-Oct-76	768.18	29-Oct-83	762.59	3-Nov-91
774.61	17-Oct-33	769.16	8-Oct-41	775.57	13-Feb-48	775.32	3-Oct-55	775.14	3-Nov-62	775.71	26-Oct-69	767.34	24-Oct-76	769.05	20-Oct-83	764.1	3-Nov-91
774.61	17-Oct-33	767.36	8-Oct-41	775.57	13-Feb-48	775.32	3-Oct-55	775.14	3-Nov-62	775.71	26-Oct-69	765.28	24-Oct-76	767.2	29-Oct-83	761.62	3-Nov-91
772.84	7-Oct-34															758.39	17-Oct-92
762.21	7-Oct-34															746.7	17-Oct-92
759.72	7-Oct-34															742.38	17-Oct-92
759.4	7-Oct-34															742.45	17-Oct-92
756.11	7-Oct-34			*The 4 lowest years, 1929, 36, 87, 92 are highlighted by a darker box.*												739.19	17-Oct-92

Plate 3

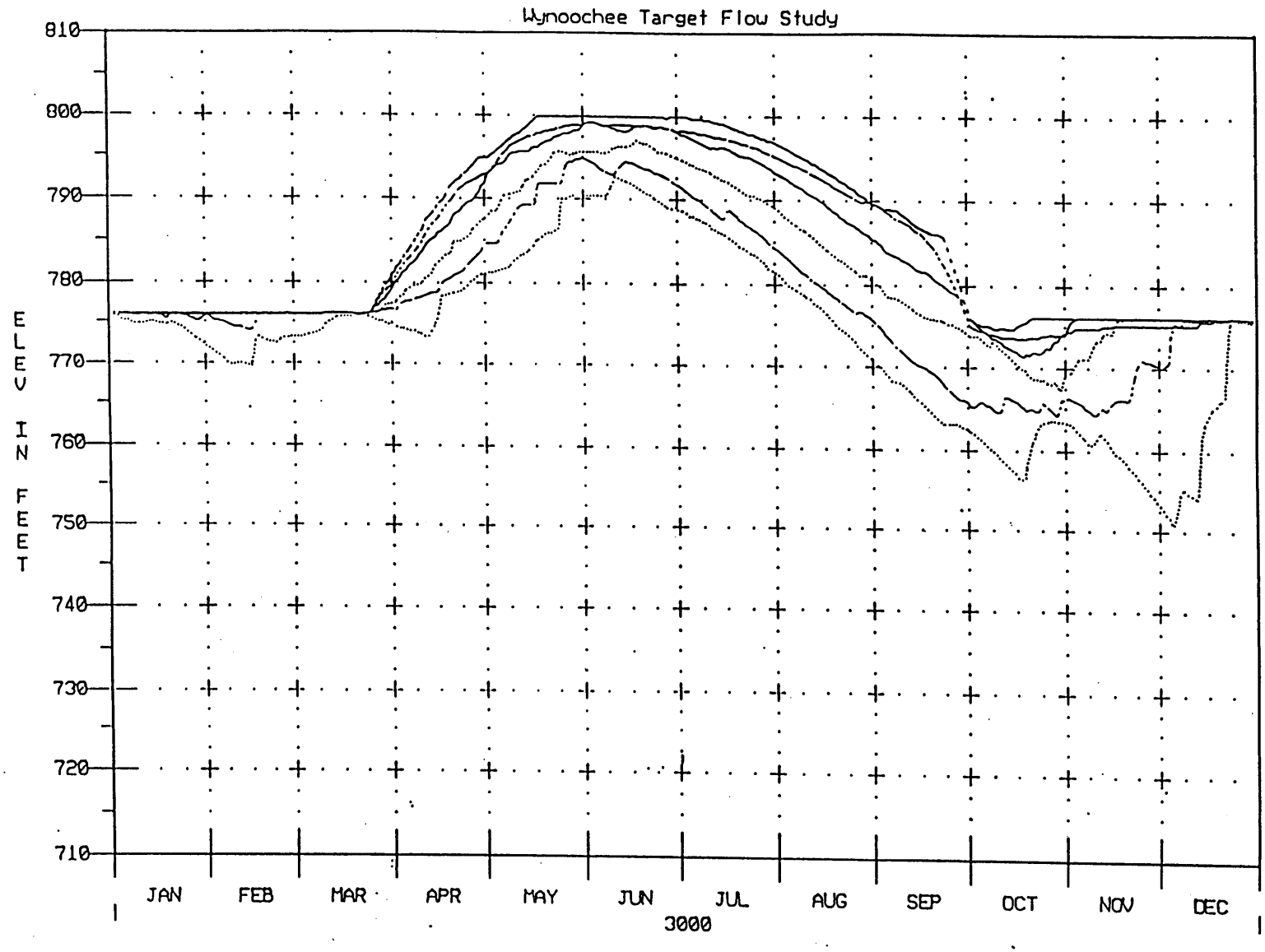
Wynoochee Target Flow Study

Maximum pool elevations for each Scenario along with the earliest date of occurance

Scenario																			
200 EXS	Elev/date	800	1-Jun-35	800	27-Jun-42	800	7-May-49	800	11-May-56	800	9-May-63	798.59	4-Jun-70	800	12-May-77	800	11-May-84
330 770	Elev/date	800	20-May-35	800	12-Jun-42	800	7-May-49	800	11-May-56	800	9-May-63	798.72	30-May-70	800	8-May-77	800	11-May-84
330 763	Elev/date	800	20-May-35	800	12-Jun-42	800	7-May-49	800	11-May-56	800	9-May-63	798.72	30-May-70	800	8-May-77	800	11-May-84
345 770	Elev/date	800	20-May-35	800	15-Jun-42	800	7-May-49	800	11-May-56	800	9-May-63	798.47	30-May-70	800	8-May-77	800	11-May-84
345 763	Elev/date	800	20-May-35	800	15-Jun-42	800	7-May-49	800	11-May-56	800	9-May-63	798.47	30-May-70	800	8-May-77	800	11-May-84
800	10-May-28	800	17-May-36	800	5-Jun-43	800	14-May-50	799.71	28-May-57	800	29-May-64	800	6-May-71	800	16-May-78	800	11-May-84
800	10-May-28	800	6-May-36	800	1-Jun-43	800	13-May-50	800	22-May-57	800	22-May-64	800	6-May-71	800	14-May-78	800	11-May-84
800	10-May-28	800	6-May-36	800	1-Jun-43	800	13-May-50	800	22-May-57	800	22-May-64	800	6-May-71	800	14-May-78	800	11-May-84
800	10-May-28	800	6-May-36	800	2-Jun-43	800	13-May-50	800	22-May-57	800	22-May-64	800	6-May-71	800	14-May-78	800	11-May-84
800	10-May-28	800	6-May-36	800	2-Jun-43	800	13-May-50	800	22-May-57	800	22-May-64	800	6-May-71	800	14-May-78	800	11-May-84
800	14-May-29	800	8-May-37	795.17	4-Jun-44	800	23-May-51	798.23	2-Jun-58	800	15-May-65	800	13-May-72	798.44	29-May-79	800	25-May-86
800	13-May-29	800	8-May-37	799.2	3-Jun-44	800	19-May-51	799.06	2-Jun-58	800	14-May-65	800	12-May-72	800	7-May-79	800	13-May-86
800	13-May-29	800	8-May-37	799.2	3-Jun-44	800	19-May-51	799.06	2-Jun-58	800	14-May-65	800	12-May-72	800	7-May-79	800	13-May-86
800	13-May-29	800	8-May-37	798.76	2-Jun-44	800	19-May-51	798.87	1-Jun-58	800	14-May-65	800	12-May-72	800	7-May-79	800	13-May-86
800	13-May-29	800	8-May-37	798.76	2-Jun-44	800	19-May-51	798.87	1-Jun-58	800	14-May-65	800	12-May-72	800	7-May-79	800	13-May-86
798.12	4-Jun-30	800	22-May-38	800	11-May-45	800	12-May-52	800	6-May-59	800	9-May-66	800	17-Jun-73	798.3	22-May-80	800	1-Jun-87
798.32	3-Jun-30	800	20-May-38	800	10-May-45	800	12-May-52	800	6-May-59	800	9-May-66	800	25-May-73	796.45	14-May-80	800	14-May-87
798.32	3-Jun-30	800	20-May-38	800	10-May-45	800	12-May-52	800	6-May-59	800	9-May-66	800	25-May-73	796.45	14-May-80	800	14-May-87
797.69	3-Jun-30	800	20-May-38	800	10-May-45	800	12-May-52	800	6-May-59	800	9-May-66	800	25-May-73	796.25	12-May-80	800	14-May-87
797.69	3-Jun-30	800	20-May-38	800	10-May-45	800	12-May-52	800	6-May-59	800	9-May-66	800	25-May-73	796.25	12-May-80	800	14-May-87
800	25-Jun-31	797.78	16-Jun-39	800	12-May-46	800	15-May-53	800	12-May-60	800	2-Jun-67	800	12-May-74	800	18-May-81	800	13-May-88
800	25-Jun-31	800	29-May-39	800	11-May-46	800	9-May-53	800	12-May-60	800	20-May-67	800	12-May-74	800	14-May-81	800	12-May-88
800	25-Jun-31	800	29-May-39	800	11-May-46	800	9-May-53	800	12-May-60	800	20-May-67	800	12-May-74	800	14-May-81	800	12-May-88
800	26-Jun-31	800	30-May-39	800	11-May-46	800	9-May-53	800	12-May-60	800	20-May-67	800	12-May-74	800	14-May-81	800	12-May-88
800	26-Jun-31	800	30-May-39	800	11-May-46	800	9-May-53	800	12-May-60	800	20-May-67	800	12-May-74	800	14-May-81	800	12-May-88
800	15-May-32	800	8-May-40	797.71	20-Jul-47	800	4-Jun-54	800	8-May-61	800	2-Jun-68	800	2-Jun-75	800	18-May-82	800	18-May-89
800	13-May-32	800	7-May-40	798.28	16-May-47	800	29-May-54	800	8-May-61	800	22-May-68	800	13-May-75	800	17-May-82	800	18-May-89
800	13-May-32	800	7-May-40	798.28	16-May-47	800	29-May-54	800	8-May-61	800	22-May-68	800	13-May-75	800	17-May-82	800	18-May-89
800	13-May-32	800	7-May-40	798.14	14-May-47	800	31-May-54	800	8-May-61	800	22-May-68	800	13-May-75	800	17-May-82	800	20-May-89
800	13-May-32	800	7-May-40	798.14	14-May-47	800	31-May-54	800	8-May-61	800	22-May-68	800	13-May-75	800	17-May-82	800	20-May-89
800	7-May-33	798.82	2-Jun-41	800	6-May-48	800	18-May-55	800	8-May-62	800	10-May-69	800	8-May-76	800	6-Jul-83	795.02	17-May-91
800	6-May-33	800	17-May-41	800	6-May-48	800	17-May-55	800	8-May-62	800	9-May-69	800	8-May-76	800	28-May-83	798.51	19-May-91
800	6-May-33	800	17-May-41	800	6-May-48	800	17-May-55	800	8-May-62	800	9-May-69	800	8-May-76	800	28-May-83	798.51	19-May-91
800	6-May-33	800	18-May-41	800	6-May-48	800	17-May-55	800	8-May-62	800	10-May-69	800	8-May-76	800	30-May-83	798.5	18-May-91
800	6-May-33	800	18-May-41	800	6-May-48	800	17-May-55	800	8-May-62	800	10-May-69	800	8-May-76	800	30-May-83	798.5	18-May-91
797.27	28-May-34															797.18	12-May-92
800	9-May-34															797.47	13-May-92
800	9-May-34															797.47	13-May-92
800	10-May-34															797.47	13-May-92
800	10-May-34															797.47	13-May-92

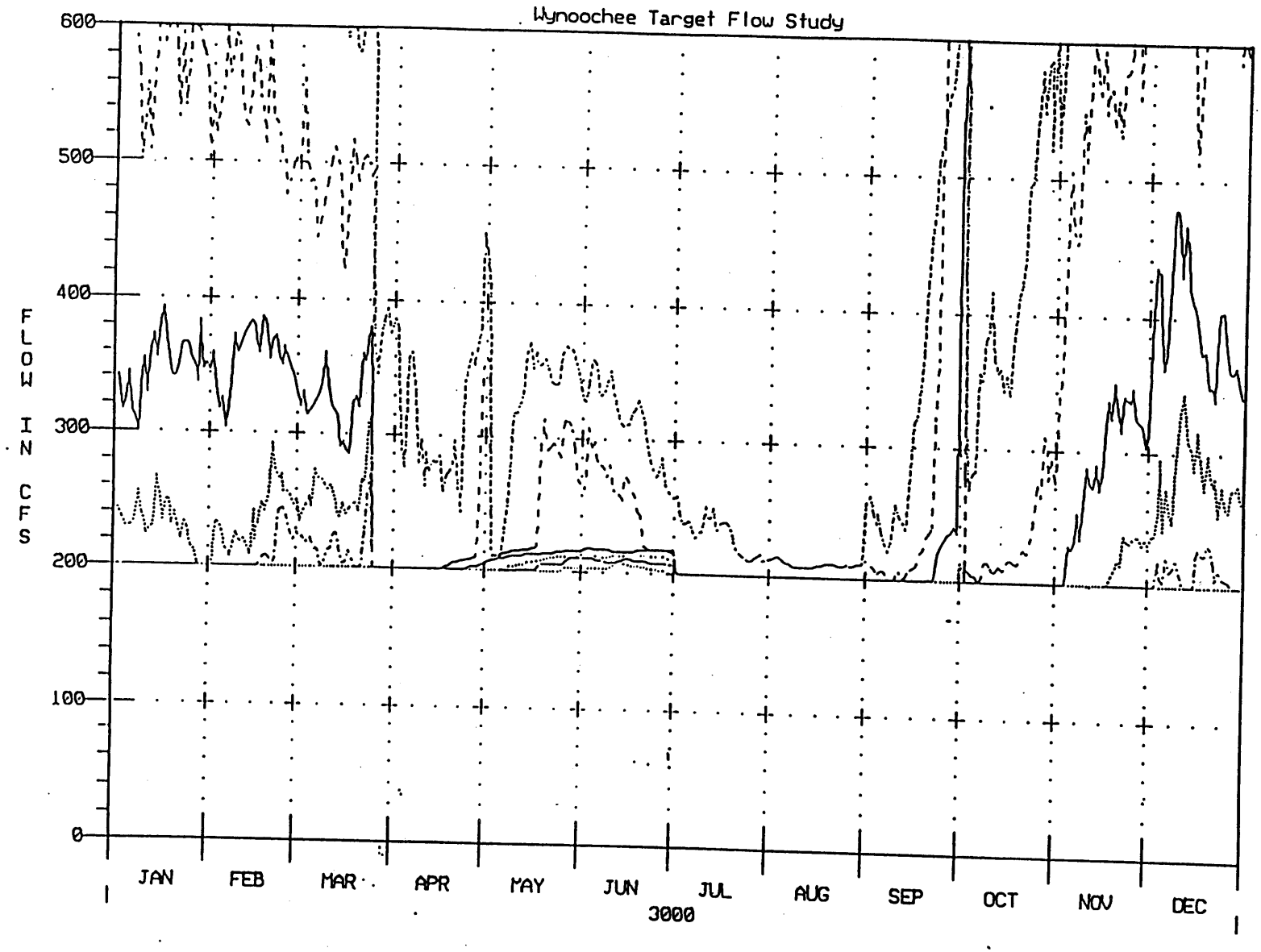
In 7 of 65 years the Reservoir did not fill under any scenario, 1930, 44, 47, 58, 70, 80, 91, & 92.

In 5 of 65 years the Reservoir did not fill under the 200 EXS scenario only, 1934, 39, 41, 57, & 79.



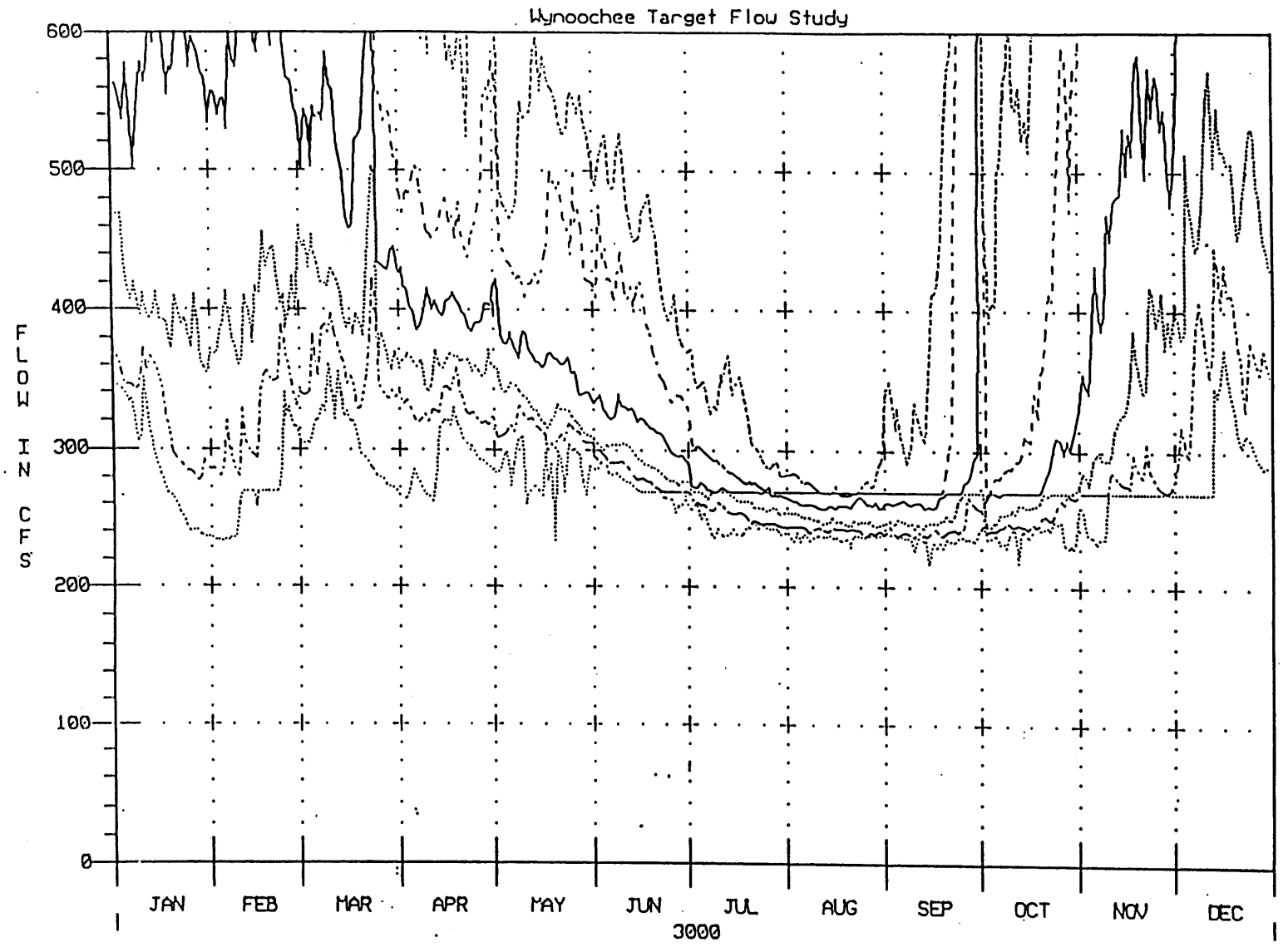
RESERVOIR ELEV-MIN 200 EXS
RESERVOIR ELEV-P05 200 EXS
RESERVOIR ELEV-P10 200 EXS
RESERVOIR ELEV-P25 200 EXS
RESERVOIR ELEV-P50 200 EXS
RESERVOIR ELEV-AVER 200 EXS

Plate 5



GRIS FLOW-REG-MIN 200 EXS
GRIS FLOW-REG-P05 200 EXS
GRIS FLOW-REG-P10 200 EXS
GRIS FLOW-REG-P25 200 EXS
GRIS FLOW-REG-P50 200 EXS
GRIS FLOW-REG-AVER 200 EXS

Plate 6



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SAVE FLOW-REG-P05 200 EXS
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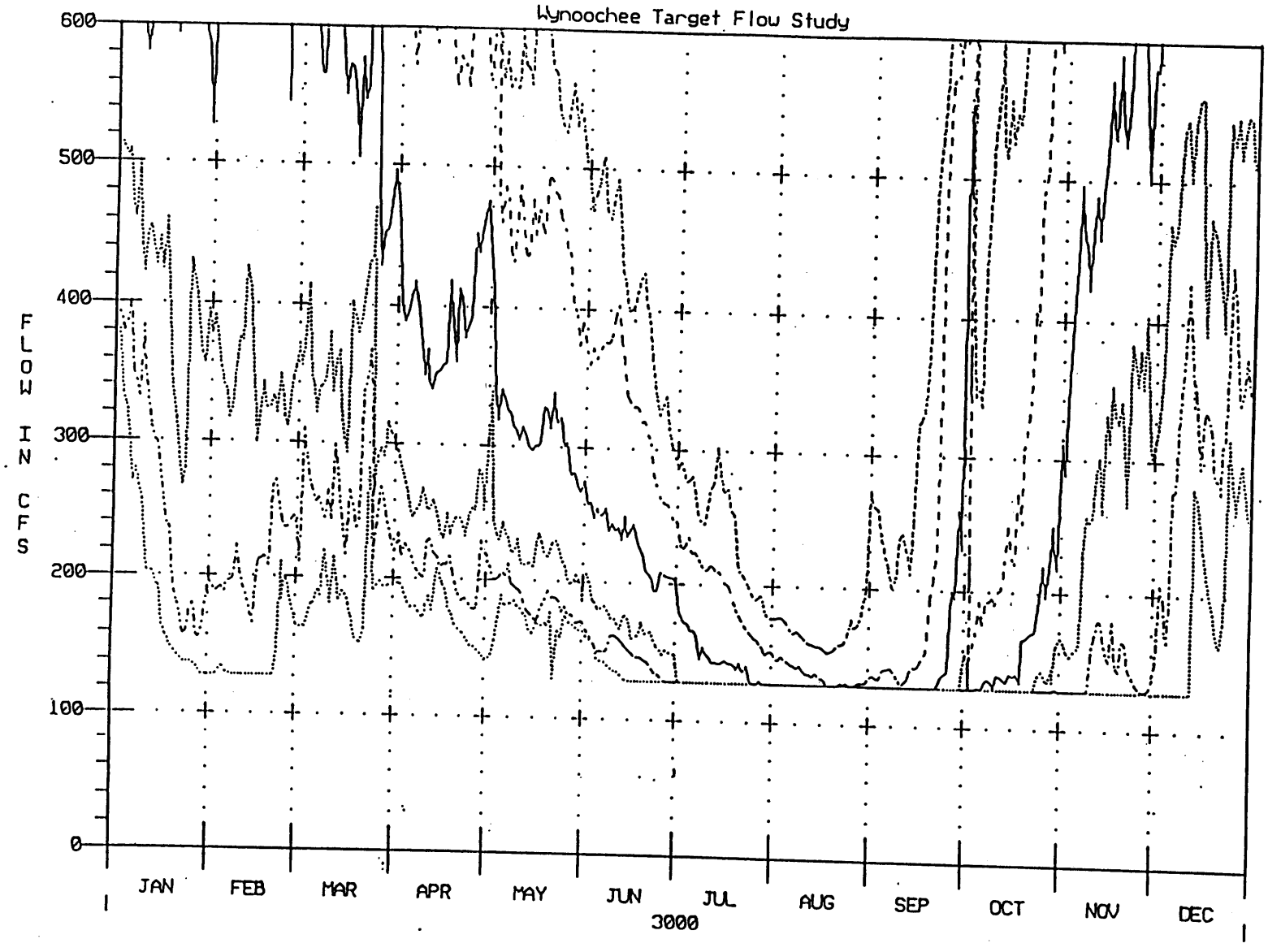
Plate 7



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BLACK FLOW-REG-AVER 200 EXS

Plate 8

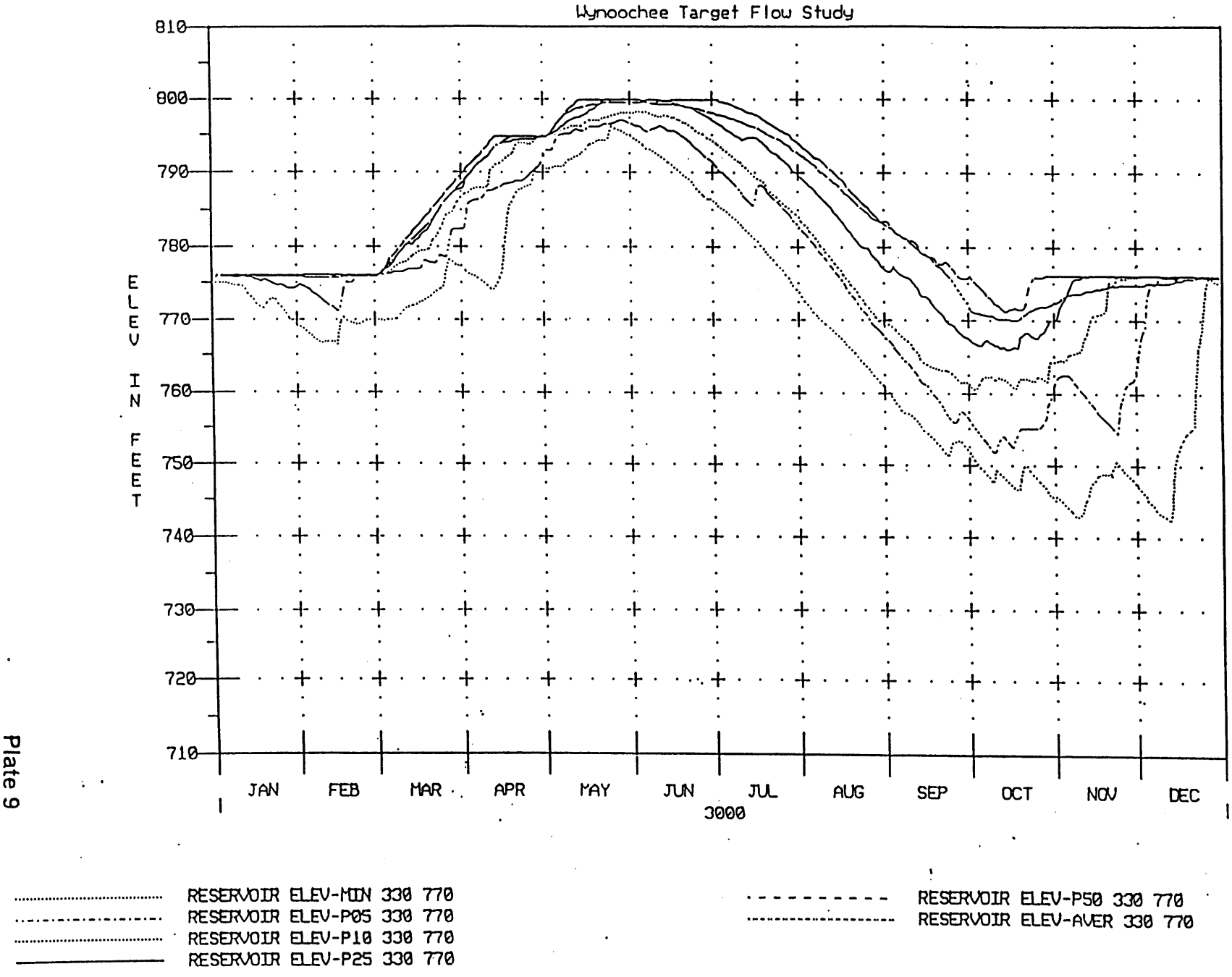
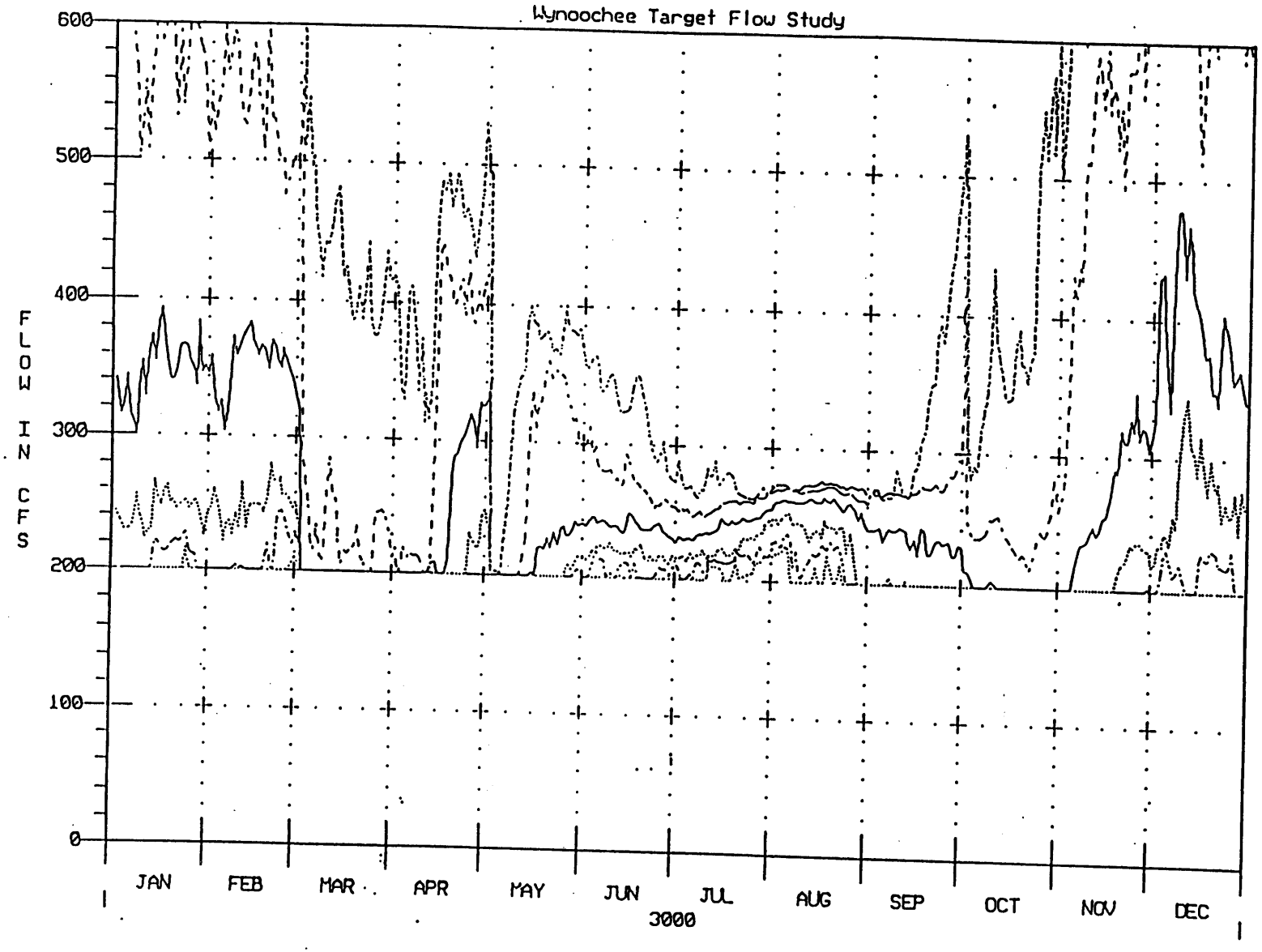

Wynoochee Target Flow Study
ELEV IN FEET
810
800
790
780
770
760
750
740
730
720
710
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
3000
RESERVOIR ELEV-MIN 330 770
RESERVOIR ELEV-P05 330 770
RESERVOIR ELEV-P10 330 770
RESERVOIR ELEV-P25 330 770
RESERVOIR ELEV-P50 330 770
RESERVOIR ELEV-AVER 330 770

Plate 9



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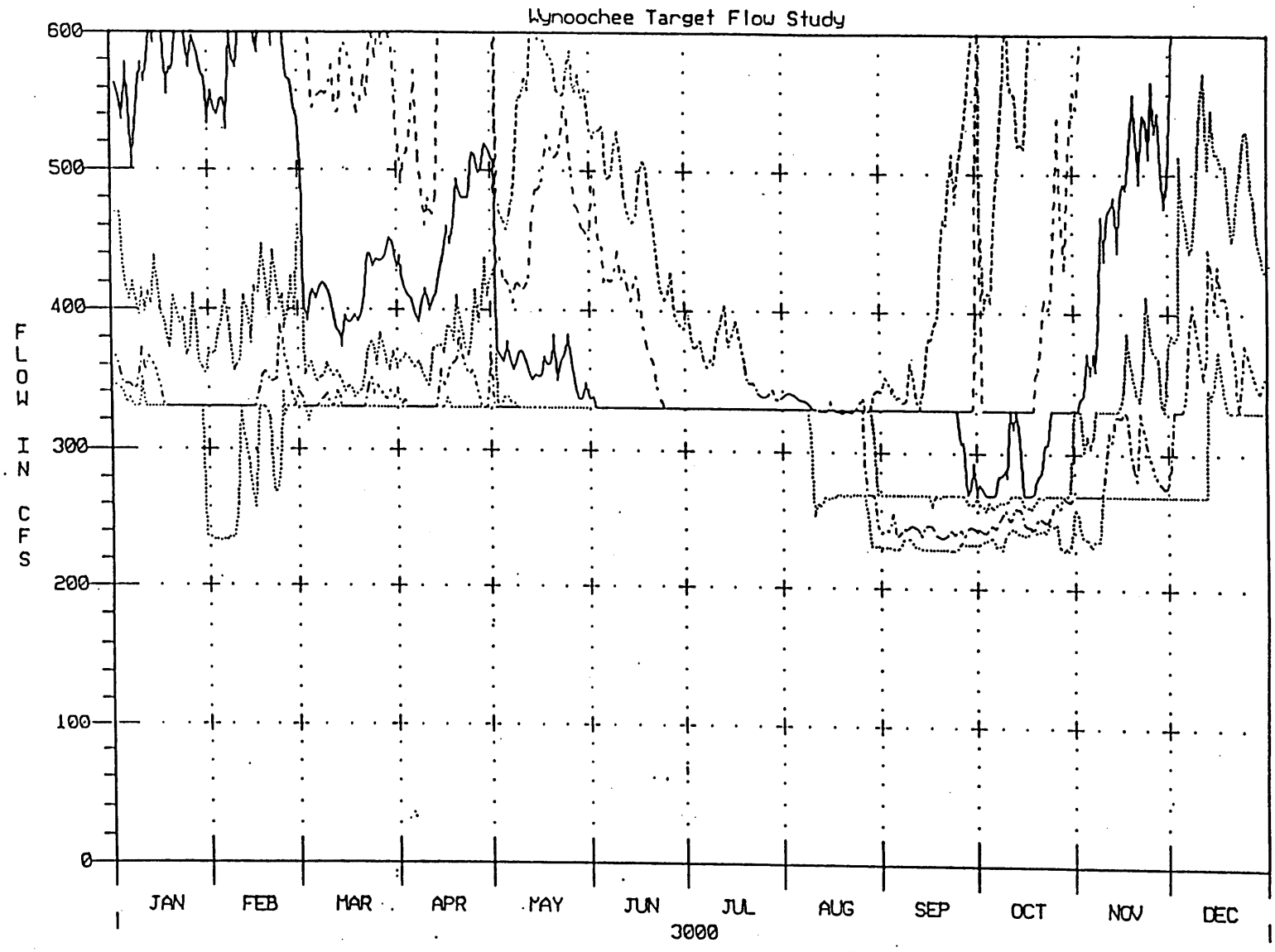
GRIS FLOW-REG-AVER 330 770

Plate 10



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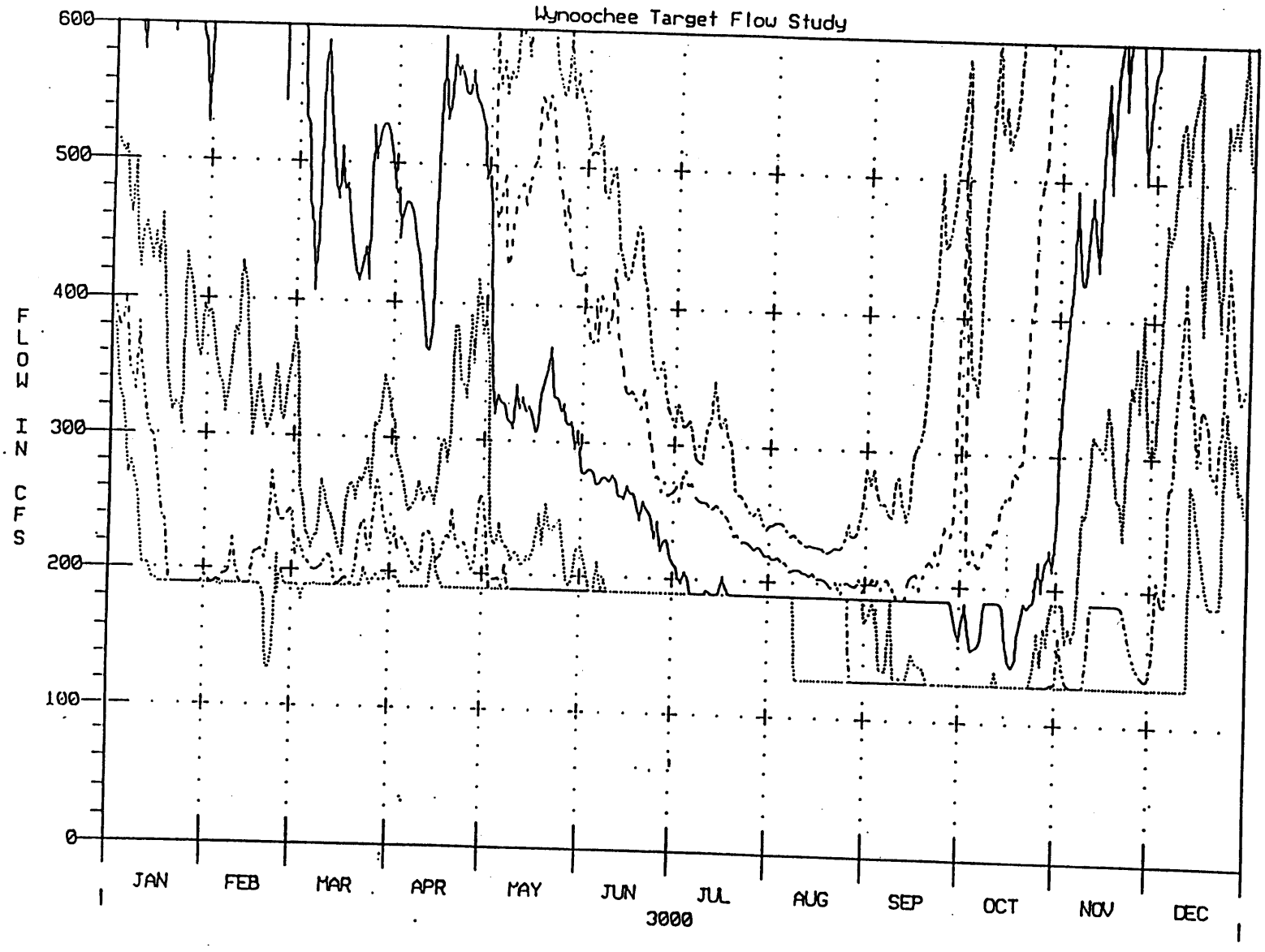
SAVE FLOW-REG-P50 330 770
SAVE FLOW-REG-AVER 330 770

Plate 11



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BLACK FLOW-REG-P50 330 770
BLACK FLOW-REG-AVER 330 770

Plate 12

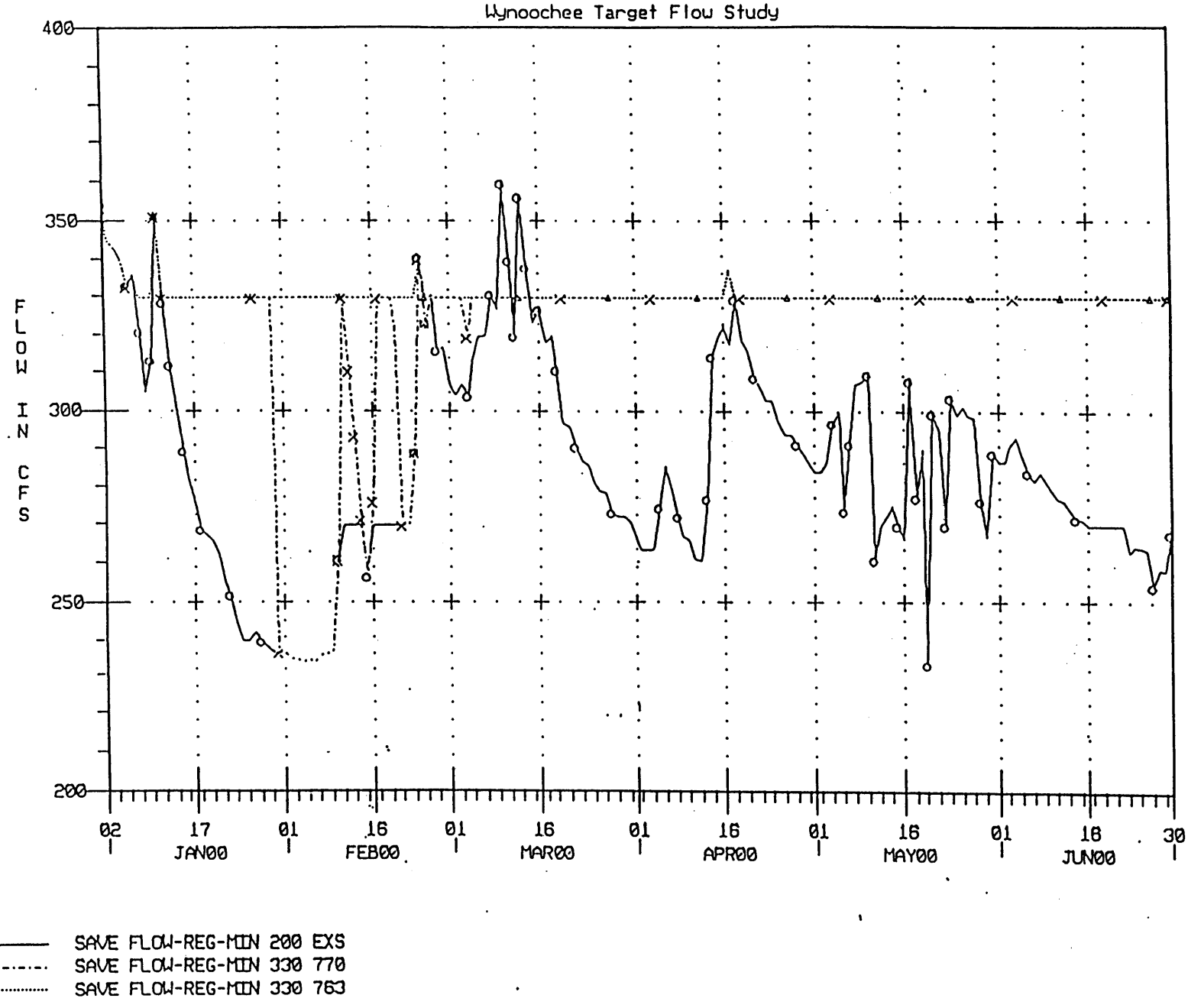

Wynoochee Target Flow Study
FLOW IN CFS
400
350
300
250
200
02
17
01
16
01
16
01
16
01
16
01
16
30
JAN00
FEB00
MAR00
APR00
MAY00
JUN00
SAVE FLOW-REG-MIN 200 EXS
SAVE FLOW-REG-MIN 330 770
SAVE FLOW-REG-MIN 330 763

Plate 13

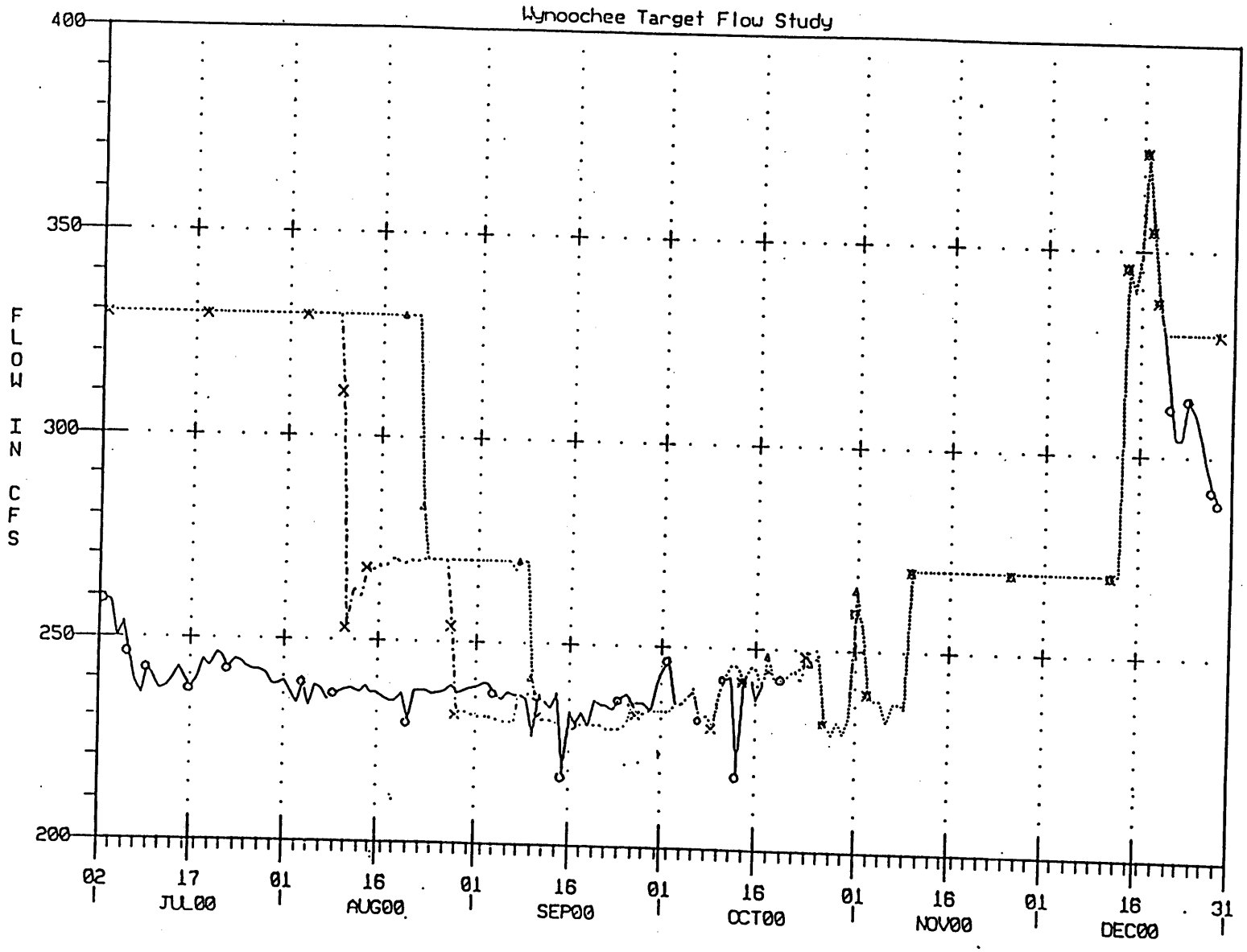
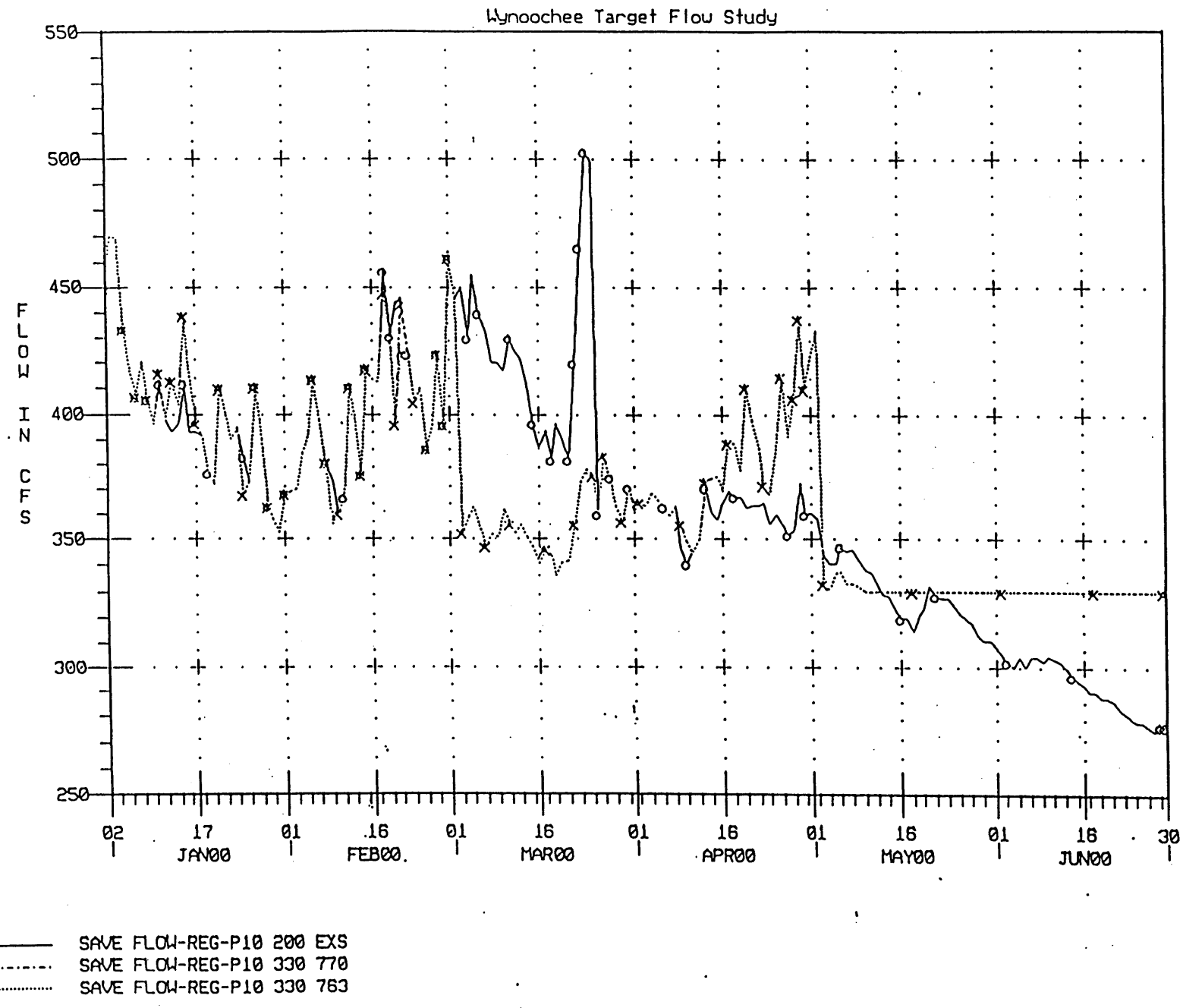

Wynoochee Target Flow Study
FLOW IN CFS
400
350
300
250
200
02
17
JUL00
01
16
AUG00
01
16
SEP00
01
16
OCT00
01
16
NOV00
01
16
DEC00
31
SAVE FLOW-REG-MIN 200 EXS
SAVE FLOW-REG-MIN 330 770
SAVE FLOW-REG-MIN 330 763

Plate 14


Wynoochee Target Flow Study
FLOW IN CFS
550
500
450
400
350
300
250
02
17
01
16
01
16
01
16
01
16
01
16
30
JAN00
FEB00
MAR00
APR00
MAY00
JUN00
SAVE FLOW-REG-P10 200 EXS
SAVE FLOW-REG-P10 330 770
SAVE FLOW-REG-P10 330 763

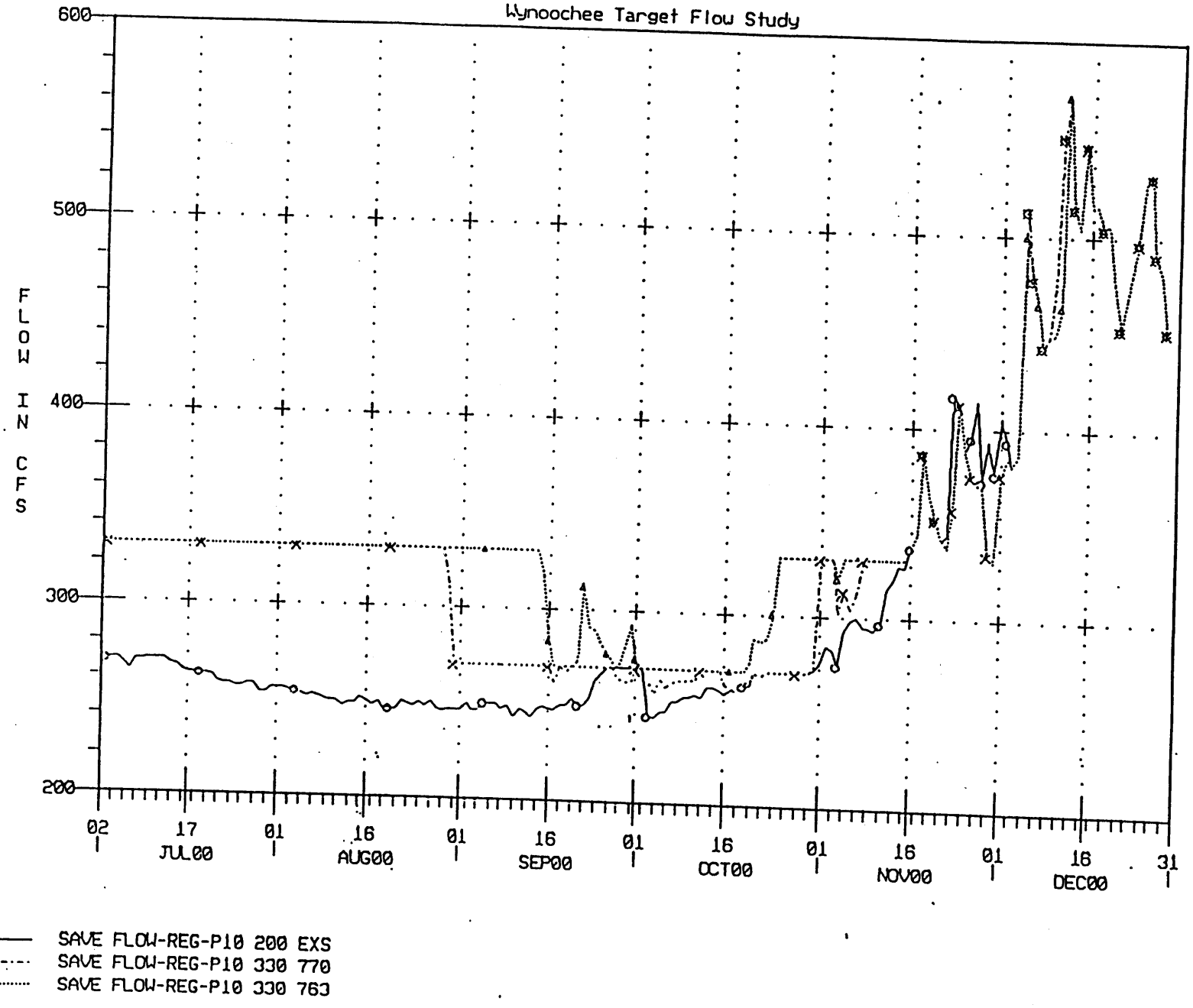
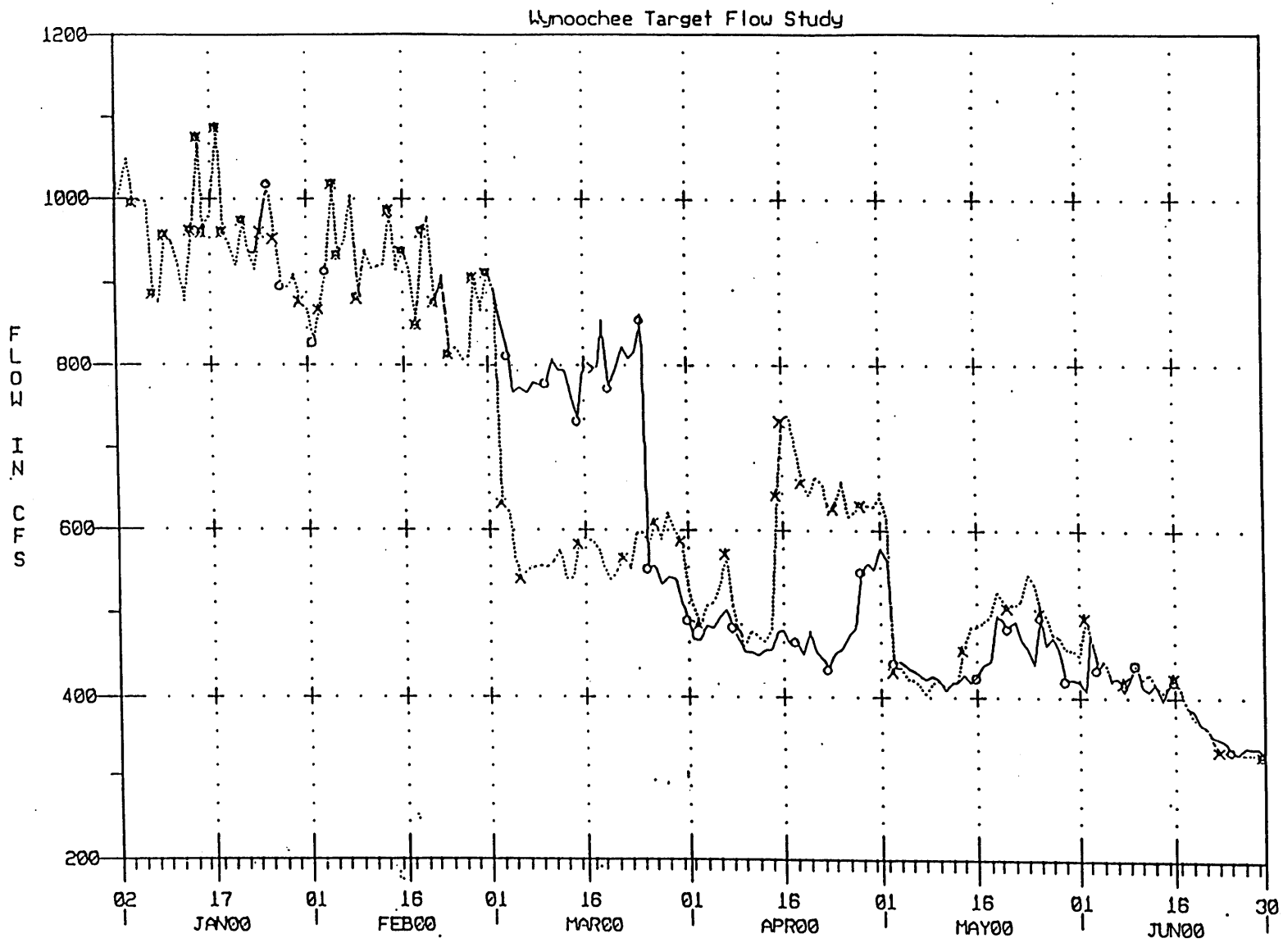

Wynoochee Target Flow Study
FLOW IN CFS
600
500
400
300
200
02
17
JUL00
01
16
AUG00
01
16
SEP00
01
16
OCT00
01
16
NOV00
01
16
DEC00
31
SAVE FLOW-REG-P10 200 EXS
SAVE FLOW-REG-P10 330 770
SAVE FLOW-REG-P10 330 763

Plate 16



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SAVE FLOW-REG-P50 330 763

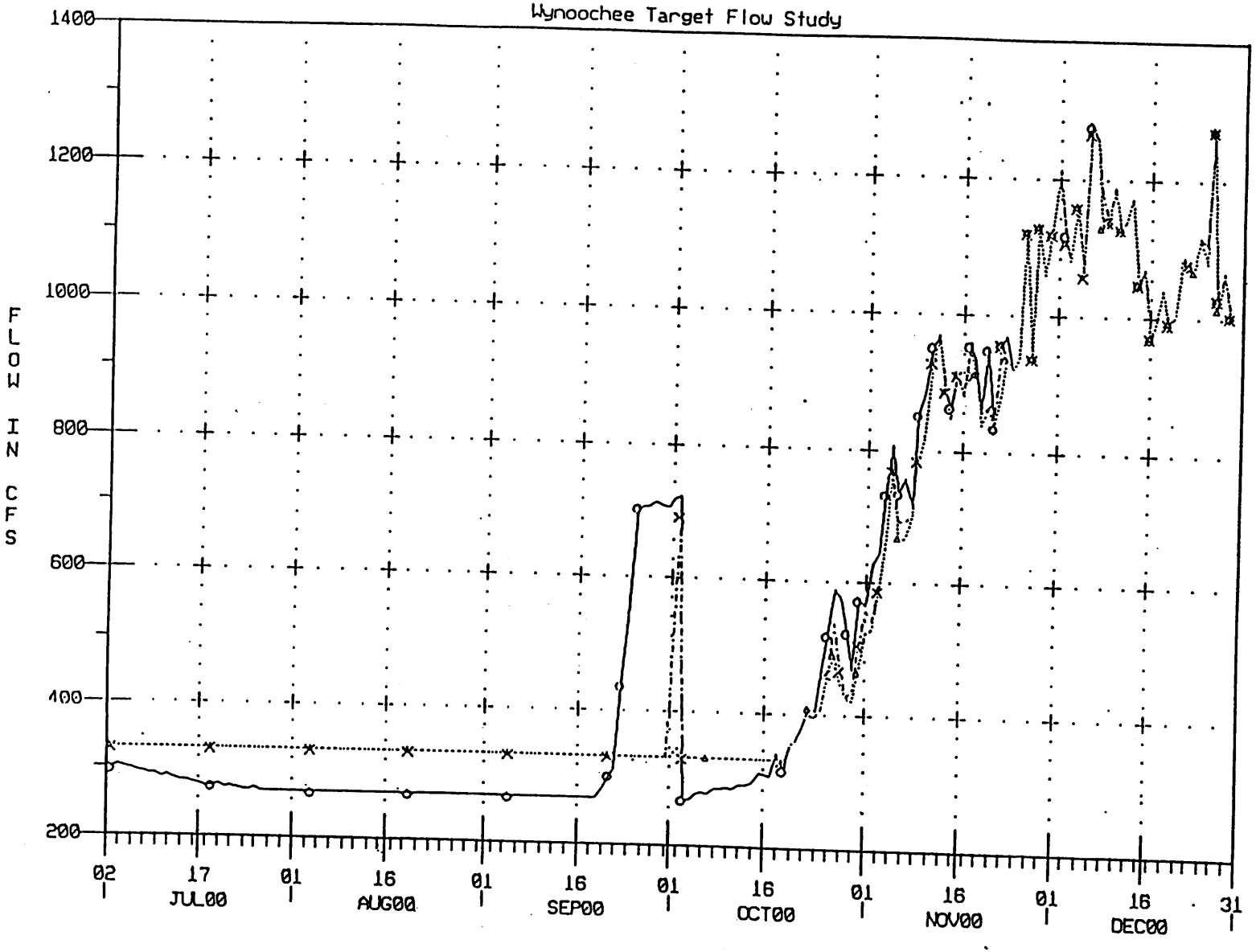
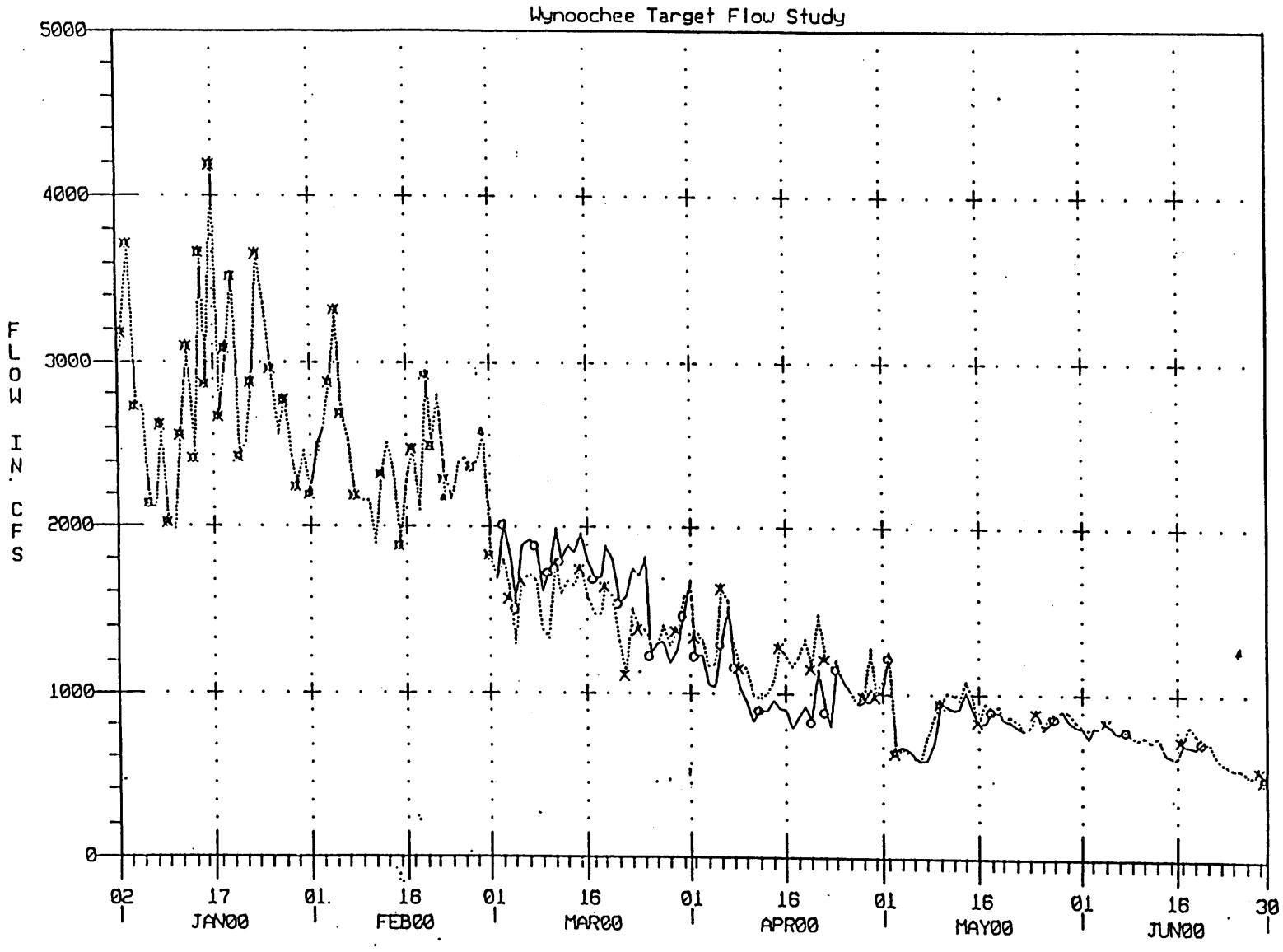

Wynoochee Target Flow Study
FLOW IN CFS
1400
1200
1000
800
600
400
200
02
17
JUL00
01
16
AUG00
01
16
SEP00
01
16
OCT00
01
16
NOV00
01
16
DEC00
31
SAVE FLOW-REG-P50 200 EXS
SAVE FLOW-REG-P50 330 770
SAVE FLOW-REG-P50 330 763

Plate 18



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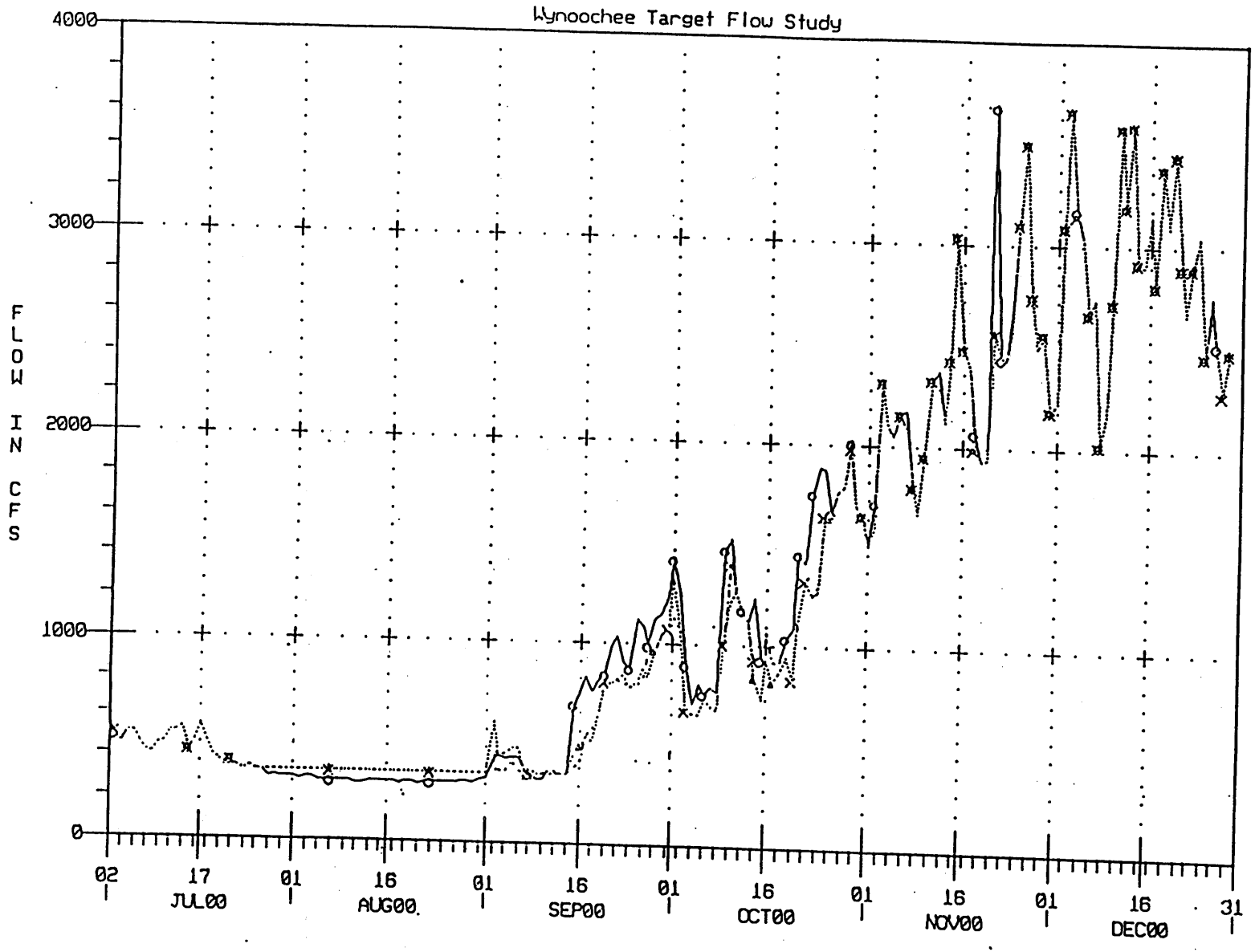

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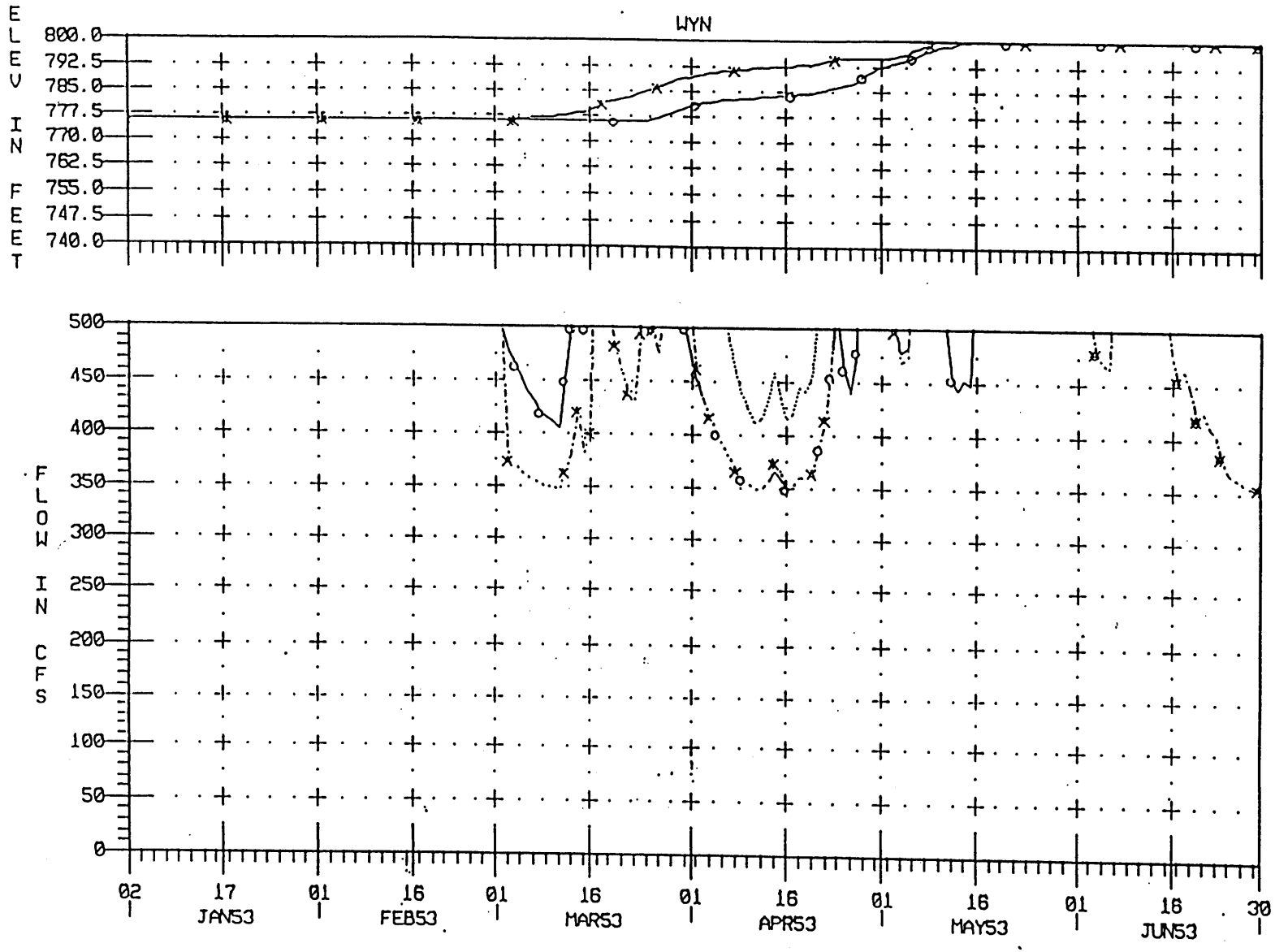
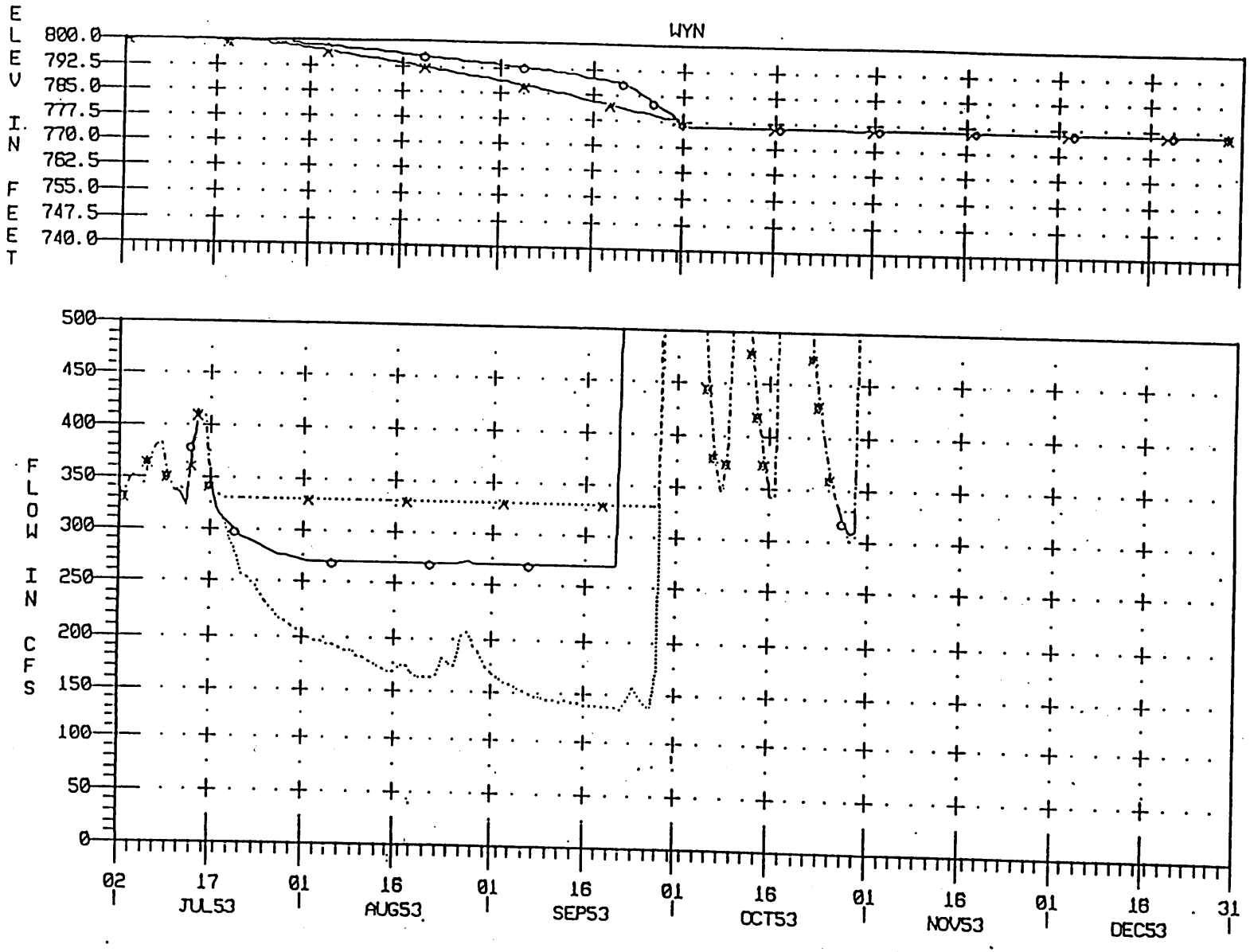


SAVE NATURAL FLOW
SAVE 200 EXS FLOW-REG
SAVE 330 770 FLOW-REG
SAVE 330 763 FLOW-REG

RESERVOIR 200 EXS ELEV
RESERVOIR 330 770 ELEV
RESERVOIR 330 763 ELEV


WYN
ELEV IN FEET
800.0
792.5
785.0
777.5
770.0
762.5
755.0
747.5
740.0
FLOW IN CFS
500
450
400
350
300
250
200
150
100
50
0
02
17
JUL53
01
16
AUG53
01
16
SEP53
01
16
OCT53
01
16
NOV53
01
16
DEC53
31
SAVE NATURAL FLOW
SAVE 200 EXS FLOW-REG
SAVE 330 770 FLOW-REG
SAVE 330 763 FLOW-REG
RESERVOIR 200 EXS ELEV
RESERVOIR 330 770 ELEV
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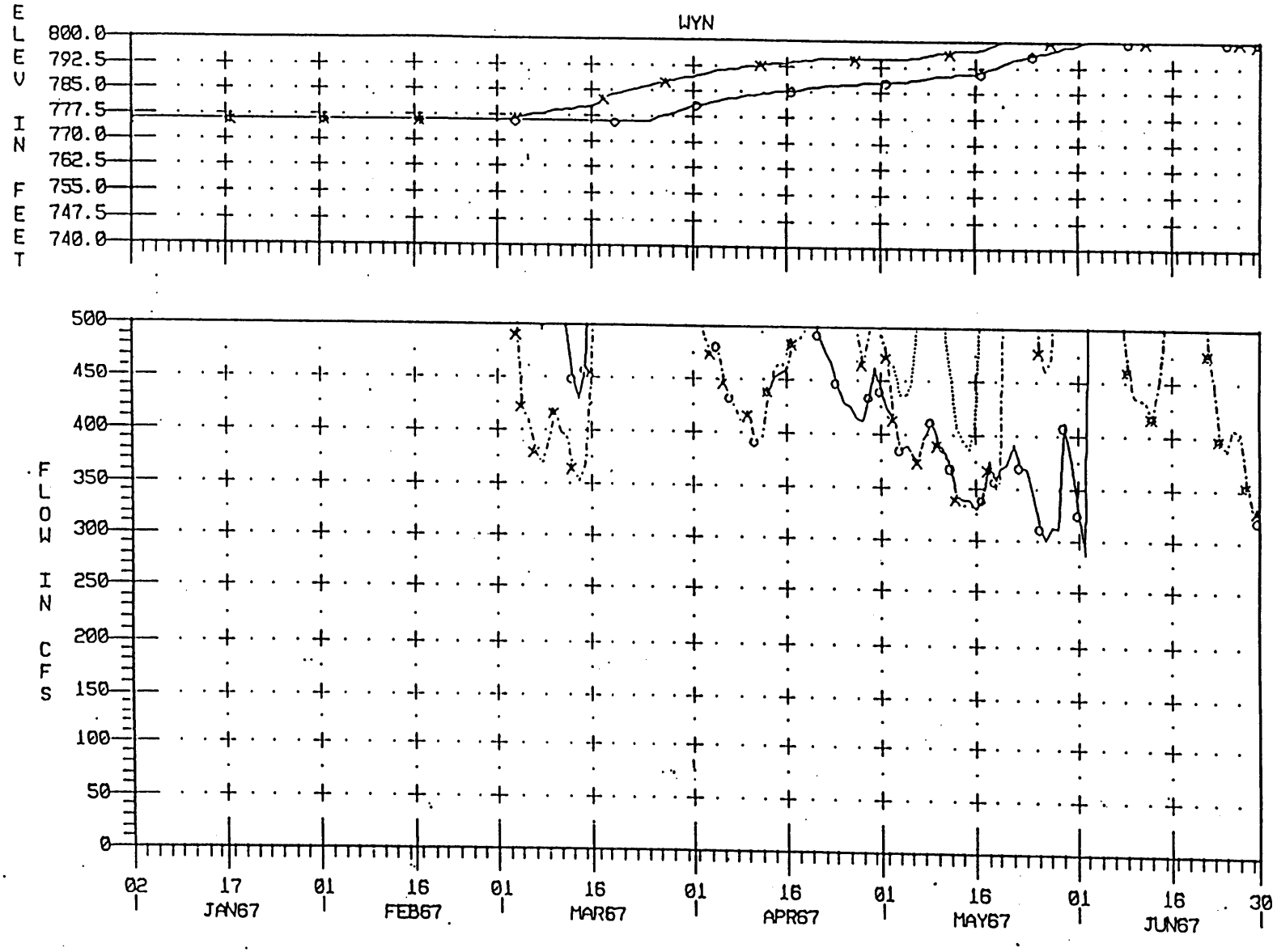

SAVE NATURAL FLOW
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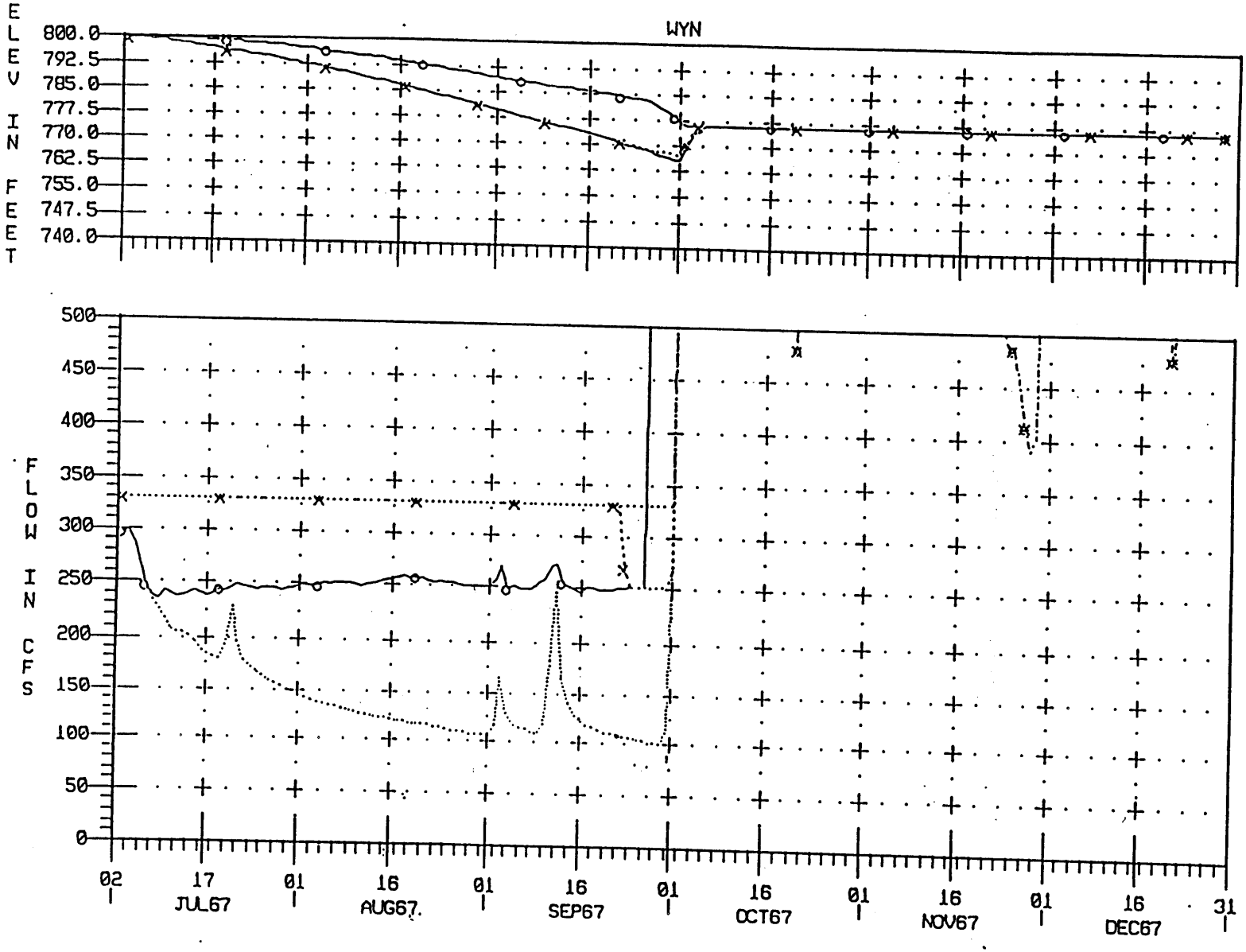
SAVE 330 763 FLOW-REG

RESERVOIR 200 EXS ELEV
RESERVOIR 330 770 ELEV
RESERVOIR 330 763 ELEV



SAVE NATURAL FLOW
SAVE 200 EXS FLOW-REG
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RESERVOIR 200 EXS ELEV
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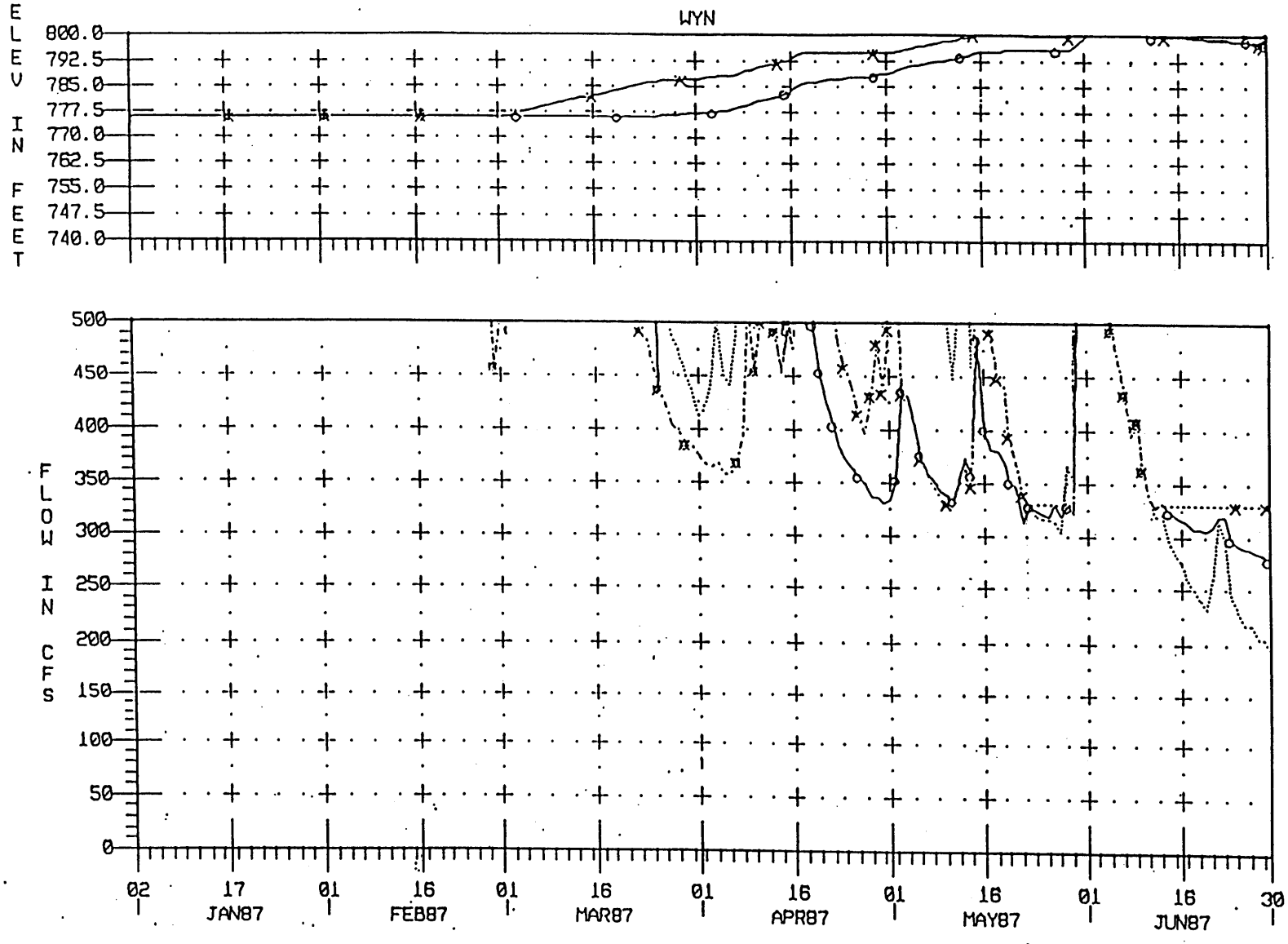

SAVE NATURAL FLOW
SAVE 200 EXS FLOW-REG
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RESERVOIR 200 EXS ELEV
RESERVOIR 330 770 ELEV
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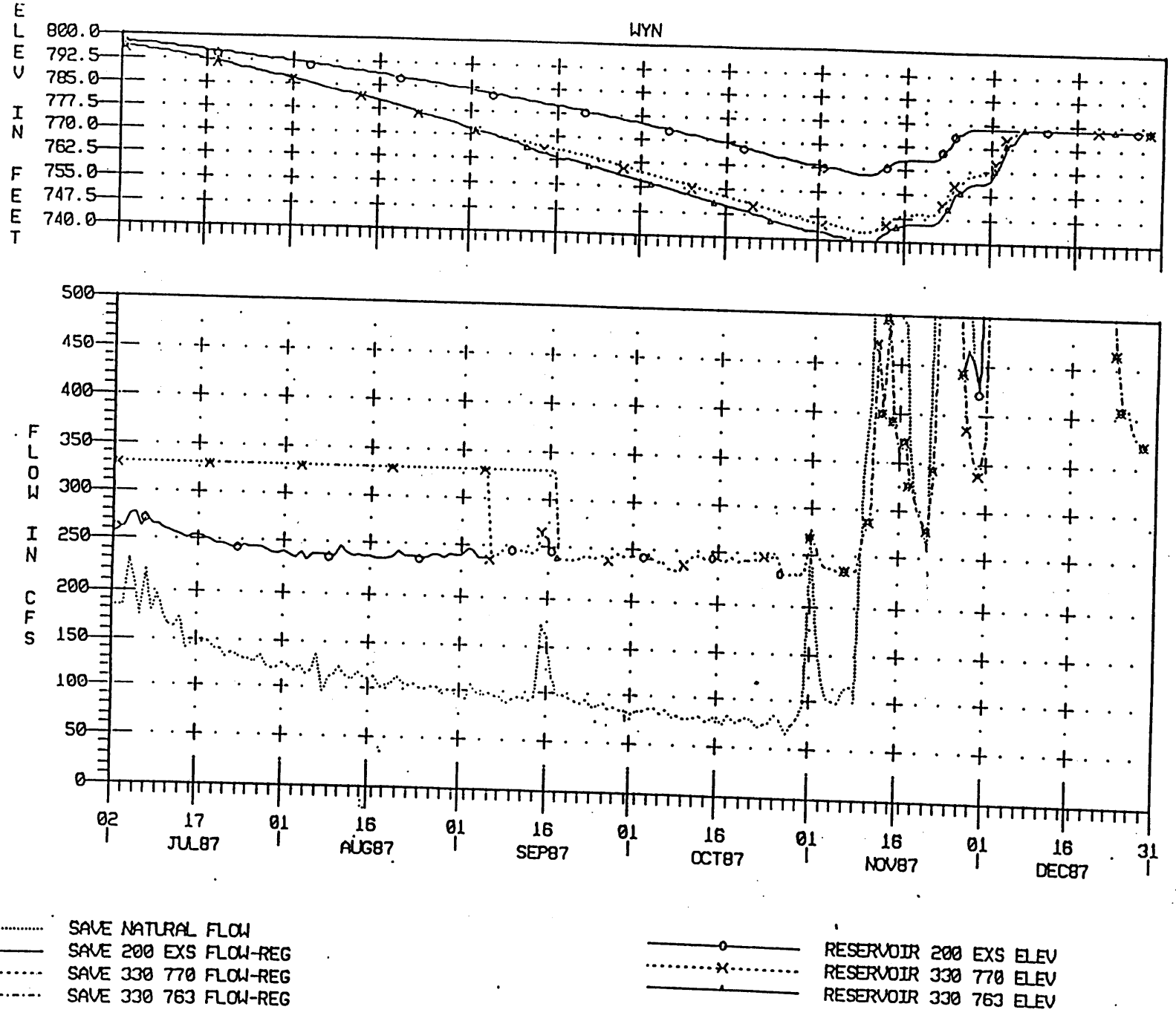

WYN
ELEV IN FEET
800.0
792.5
785.0
777.5
770.0
762.5
755.0
747.5
740.0
FLOW IN CFS
500
450
400
350
300
250
200
150
100
50
0
02
17
JUL87
01
16
AUG87
01
16
SEP87
01
16
OCT87
01
16
NOV87
01
16
DEC87
31
SAVE NATURAL FLOW
SAVE 200 EXS FLOW-REG
SAVE 330 770 FLOW-REG
SAVE 330 763 FLOW-REG
RESERVOIR 200 EXS ELEV
RESERVOIR 330 770 ELEV
RESERVOIR 330 763 ELEV

Wynoochee Spring Flood Control Study Report

Introduction

Background. This study was undertaken as part of the section 1135 , Wynoochee Anadromous Fish Restoration Study, Washington. The project sponsors desire additional operational flexibility for spring and summer flow releases. Reduced flood control storage in the spring could improve refill reliability and could provide some additional operational flexibility. Refill could proceed earlier if the flood control requirement is reduced. The winter flood control storage was modified based on an earlier study (See "Wynoochee Storage Modification Study Summary Report," it will be referred to simply as the "Winter study" in this report), from 35,000 acre-feet to 24,000 acre-feet. There was therefore reason to believe that with new data and refined methods the spring flood control requirements could also be reduced.

It should be mentioned that no in depth spring time flood analysis was done in the original study and planning of the project. This was consistent with the original winter flood control study. The original project purposes of flood control and water supply did not conflict with one another. The size of the project was based on supplying water through the summer months. Plenty of storage was available in the winter to be used for flood control without conflicting with any other purpose. Therefore no attempt was made to determine the *minimum* safe flood control storage requirement. The original design assumed winter flood control through 15 March. No flood control was needed by the beginning of May. A straight line was drawn from elevation 762.5 feet on 15 March to 800 feet on the beginning of May to define the spring flood control curve. When the winter flood control pool was modified from 762.5 feet to 776.1 feet the old spring curve between 1 March and 24 March was raised to 776.1 feet as well. From 25 March to 1 May it was not modified. The existing Seasonal Reservoir Operating Curve is shown on Plate 1.

Purpose. The objective of this study is to clearly define the spring flood control requirements. The spring flood control requirements will be reduced if it can be done without decreasing the flood control benefits more than an acceptably small amount. The detail of this study is commensurate with the winter study. The criterion followed here is the same as that followed in the winter flood control study. Any change to the existing operation and/or flood control storage could not result in a regulated discharge above zero damage greater than the regulated discharge above zero damage resulting from existing

operations and flood control storage. This would apply to all floods up to and including the 200-year event (the same criteria used in the winter study) that were greater than the zero damage flow of 18,000 cfs at the Wynoochee River gage Above Black Creek (Above Black).

Scope. The level of detail applied in this study is comparable to the level of detail used in the Winter Flood Control study. In order to maintain consistency and to minimize duplication of work this study utilizes as much data, information, and methodologies as possible from the "Wynoochee Storage Modification Study." Many of the topics in this study have already been discussed in the Winter Study report. If more information is desired on those topics please refer to the Winter Study summary report.

Hydrologic Analysis

General methodology and approach. The main difference between this study and the Winter Study is the changing nature of the flood control requirements in the Spring. The flood control storage requirement is constant throughout the winter whereas in the spring the flood control storage requirement decreases as the magnitude of floods decreases through the spring months, March, April, and May. This study will not effect the winter flood control pool from October to February but will investigate possible revisions beginning on March 1. Five periods were used to analyze the spring flood control storage: March, March 16 - April 15, April, April 16 - May 15, and May.

Only the three earliest periods, March, March 16 - April 15, April, had 200-year natural peak flows above the zero damage level of 18,000 cfs at the Above Black. These 200-year floods were routed through the basin to test reduced storage volumes. *The desired storage reduction was th*at which *would not increase the Above Black 200-year regulated peak discharge above* 18,000 cfs. (Under existing storage requirements each of the 200-year spring floods had *regulated* peak flows under 18,000 cfs.)

The 200-year floods were based on the maximum monthly 1-day flow volume for each period at the Above Black gage. The peak and 24-hour flood flows associated with the 1-day flows at Above Black were derived from appropriate regression relationships. Peak and 24-hour flows into the reservoir and at the Wynoochee River Above Save Creek gage (Save Creek) were also derived from regression relationships. This collection of flows was used to find actual historical flood events with comparable flow magnitudes. These historical flows were available in hourly record format and provided excellent flow data to route through the basin model to test alternative storage volumes.

Control Station. The downstream control point used in this analysis, the Wynoochee River Above Black Creek, is the same one used in regular flood control operations and the same one used in the winter flood control study. Travel time from the dam to the control point is approximately 10 hours during a flood event. The flow at the control point is targeted to stay below 18,000 cfs. Floods with peak flows greater than about 24,500 cfs at Above Black (the 10-year annual maximum flood) have the potential to have regulated flows in excess of 18,000 cfs. This is caused primarily by excessive uncontrollable local inflow below the Dam. It can also be caused by excessive flow into the dam such that some of the flood waters must be spilled.

During real time operation the maximum regulated target flow is 15,000 cfs at the control point as a factor of safety to allow for forecasting errors. This 3000 cfs factor of safety is to prevent the actual flows at Above Black from exceeding 18,000 cfs.

Time Periods Analyzed. Five periods were used to analyze the spring flood control storage: March, March 16 - April 15, April, April 16 - May 15, and May. The periods are overlapping to allow for a more precise definition of the flood control storage curve. The spring flood control storage curve will be drawn through the midpoints of each period at the storage level determined from the routings in this study. Passing the curve through the midpoints, instead of through the beginning or ending points of the period, was selected because the flood peaks are generally higher at the early part of the periods and diminish as the period progresses. The recommended curve for the first half of the period will provide as much or more flood control storage as prescribed by the routing. The amount of storage will be less than that prescribed by the routing after the mid-point of the period. This is not a concern because the flood control requirements for the second half of any period are amply provided for by the first half of the next period since the second half of each period corresponds to the first half of the subsequent period. Passing the curve through the end of the period would be recommended to insure ample flood control for the entire period if the periods analyzed did not overlap.

Database. Three streamflow gaging stations on the Wynoochee River were used in this study: Near Grisdale, Above Save Creek, and Above Black Creek. Their locations on the Wynoochee River are shown on the basin map, Plate 2. The Grisdale gage is located just downstream of the dam so inflow to the reservoir is assumed to be equivalent to the unregulated or deregulated Grisdale flow.

Flood data was needed to form frequency curves, to perform regression relationships, and to form hypothetical flood flows. Frequency curves would define the 200-year design flood magnitudes. Regression relationships would provide the right combination of peak to volume flow relationships and station to station flow relationships when determining the shapes of the design floods. The hypothetical flood flows would be used to test alternative flood control storage reserves. Ideally, peak, 24-hour, and 72-hour maximum flows would be used to establish hypothetical 200-year flood events. Therefore hourly data would be preferred. Unfortunately complete peak and hourly flow data sets were available for the winter months but were not available in sufficient numbers for the spring periods analyzed. Data from the Winter Study was adopted for use in this study and is discussed under the Regression Relationships section found below. For more information concerning the hourly data please refer to the Winter Study report.

Good daily flow data sets during the spring were readily available in our office. Above Black Creek 1-day frequency curves were developed for each Spring period under consideration. Natural unregulated Above Black Creek records were available from 1957 through 1972. The regulated period of record from 1972-1993 was deregulated by NPS in a previous study using a water balance method. The period between 1942-1949 was adjusted from records available at the Wynoochee River Below Black Creek gage. Table 1 summarizes the 1-day flow period of record used in this study.

Station		Natural	Regulated	Extended	Total Years
Above Black Creek		1957-1972	1972-1993	1942-1949	44

Table 1, Streamflow Records

Natural Frequency Curves. Maximum 1-day analytical frequency curves were derived for each spring period. A constant skew coefficient of -0.04 was adopted based on the 1-day generalized skew coefficient for this region. The sample mean was not adjusted. The standard deviation was adjusted so the curves from the different periods did not cross each other or the annual 1-day curve within the 0.01 percent chance exceedence. Table 2 shows the computed and the adopted means and standard deviations of the log of the flows for Above Black Creek. The actual flood event points were plotted along with the adjusted frequency curves to check reasonableness of fit. All curves were adopted as adjusted and are displayed on Plate 3.

Period	Mean, log	Computed Standard Deviation, log	Adopted Standard Deviation, log	Adopted Skew
Annual	4.0789	.1412	.1412	-0.04
March	3.6665	.2265	.2300	-0.04
Mar 16 - Apr 15	3.6127	.2506	.2300	-0.04
April	3.4966	.2665	.2400	-0.04
Apr 16 - May 15	3.3549	.2270	.2300	-0.04
May	3.2151	.2252	.2250	-0.04

Table 2. Wynoochee River Above Black Creek 1-day Flow Frequency Statistics.

Regression Relationships. The winter hourly regression relationships (peak to 24-hr, 24-hour to 72-hour, etc.) could be used in this study if they could be shown to apply equally as well to the spring period. Use of these hourly regression relationships would save time and effort, and would improve the reliability of the hypothetical spring floods. The regression relationships are a measure of the shape and distribution of the flood hydrographs in the basin. The premise is that the general shape and travel time of the spring hydrographs do not differ from the general shape and travel time of the winter hydrographs. They do differ in the order of magnitude of the floods experienced (this is measured by the frequency curves) because the *intensity* of rainfall has the potential to be greater in the winter than in the spring. The reason the shape and travel time of the Wynoochee basin floods are assumed to be the same in the winter and the spring is that both are caused by frontal orographic rainfall coming generally out of the southwest and falling in the same general pattern over the basin. Snowmelt runoff plays a minor role or no role at all in any given event. If our premise can be shown to be true then the winter regression relationships can be used in this study.

A few spring flood events were available in hourly data format. These were visually compared to various winter events and appeared consistent in shape and travel time. The travel time is easily compared by examining the flood hydrographs and measuring the time between upstream to downstream peak flows. In either season the travel time between Grisdale and Save Creek is about two hours and between Save Creek and Above Black Creek is about eight hours. The travel times are the same in winter and spring.

To verify that the hydrograph shapes are the same the winter and spring data sets were compared. Data common to both periods included 1-day and 3-day flows. The 1-day verses 3-day flows for Above Black Creek were regressed and compared. The data sets included all available events above 2000 cfs at Above Black Creek. The regression curves, Plate 4, fell extremely close to one another and nearly overlaid one another for 1-day flows between 15,000 cfs and 23,000 cfs (corresponding three day flows were between 11,000 cfs and 16,000 cfs). The same analysis was done for Grisdale 1-day and 3-day flows with the results shown on Plate 5. These relationship indicate that the data are consistent between winter and spring and that the winter regression relationships can be used in the spring study.

The magnitudes of the spring design floods are determined from the spring 1-day frequency curves. The appropriate Above Black Creek *peak* flows are derived from the peak verses 1-day regression relationship developed in this study using the data from the Winter Study. The peak verses 1-day regression relationship forms the bridge between the 1-day frequency curve flow and the peak, 24-hour, and 72-hour regression relationships. As a check on the peak to 1-day relationship the relationship between the annual peak frequency curve to the annual 1-day frequency curve was also derived and plotted along with the regression relationship. This frequency curve relationship was generated by taking a set of peak and 1-day flows. Each pair of peak and 1-day flows have the same expected probability from the frequency curve. Plate 6 shows the regression curve relationship along with the frequency curve relationship, and the observed points. The two curves fall extremely close for the range of flows under consideration in the spring, 1-day flows between 13,000 cfs and 20,000 cfs. The peak flows used in determining the hypothetical spring floods were taken directly from the regression relationship curve.

Hypothetical Flood Events. A collection of observed hourly flood events for the months of October through April were available from the winter study. Many of these are of the same order of magnitude as the desired hypothetical 200-year spring floods. With minor adjustments several of these observed floods provided excellent 200-year spring floods for our routing model. Table 3 lists the peak and volume flows computed from the frequency and regression curves along with the flows of the adopted hypothetical 200-year floods. The flood hydrographs are shown on Plates 7, 8, and 9. Note that the peak flows at Above Black Creek for April 16 - May 15 and for May are

well below the control flow of 18,000 cfs. Consequently hypothetical floods for these two periods were not needed.

Table 3. 200-year flows

Station	Period	Computed Flow, cfs			Adopted Flow, cfs	
		1-day	Peak	24-hr	Peak	24-hr
Black	March	19,200	25,500	20,000	25,500	20,600
	Mar 16 - Apr15	17,000	22,800	18,000	22,600	18,800
	April	13,800	18,800	15,000	18,800	15,070
	Apr 16 - May15	9,550	13,300	10,800		
	May	7,000	9,400	7,800		
Save	March		18,500	13,000	18,200	14,100
	Mar 16 - Apr15		16,500	11,500	16,900	13,500
	April		13,300	10,000	15,100	11,300
	Apr 16 - May15		9,400	7,000		
	May		6,500	5,000		
Grisdale	March		10,700	7,000	11,000	8,100
	Mar 16 - Apr15		9,600	6,200	10,600	8,000
	April		8,000	5,400	8,900	6,300
	Apr 16 - May15		5,800	4,100		
	May		4,200	3,100		

Routing Model. The HEC-5 basin reservoir and streamflow routing model used in this study was adopted from the winter study. It is calibrated the same and performs the same functions as in the winter study. No alterations were necessary. It should be pointed out that the target control flow in the model is a variable amount computed by the model. It is equal to 18,000 cfs (or the highest regulated flow above 18,000 cfs for the current event) minus the factor of safety. The factor of safety increases and decreases with inflow and is close to the 3000 cfs used in practice.

Flood Control Space Determination. Initially each of the three floods was routed with the flood control pool at the winter level of 776.1 feet. This provided ample storage space for these spring events. The amount of storage that filled up above 776.1 ft to

control these floods was used to compute revised flood control storage volumes and pool elevations. These revised flood control pool values were tested by routing the floods again. Some adjustments to the initial storage estimates were made and tested if excess or insufficient storage caused the peak control flow to be out of bounds, i.e. less than 15,000 cfs or greater than 18,000 cfs. After each flood was satisfactorily controlled with revised flood control volumes these volumes were increased by 17% to provide a factor of safety consistent with that used in defining the winter flood control storage requirement. The flood routings are displayed on Plates 7, 8, and 9. The recommended pool elevations are given in Table 4 along with the peak flows with and without regulation by the reservoir. Plate _ shows the existing and the recommended revised seasonal reservoir operating curves.

Table 4. Flood Control Storage Test Results.

	Old Flood Pool	Recommended Flood Pool*	Peak Control Flow, cfs	
Time Period	Elevation, ft	Elevation, ft	Unregulated	Regulated
March	776.1	782.5	25,500	16,300
Mar 16 - Apr 15	782.0	789.5	22,600	16,600
April	791.0	796.5	18,800	16,100

*Includes 17% Safety Factor

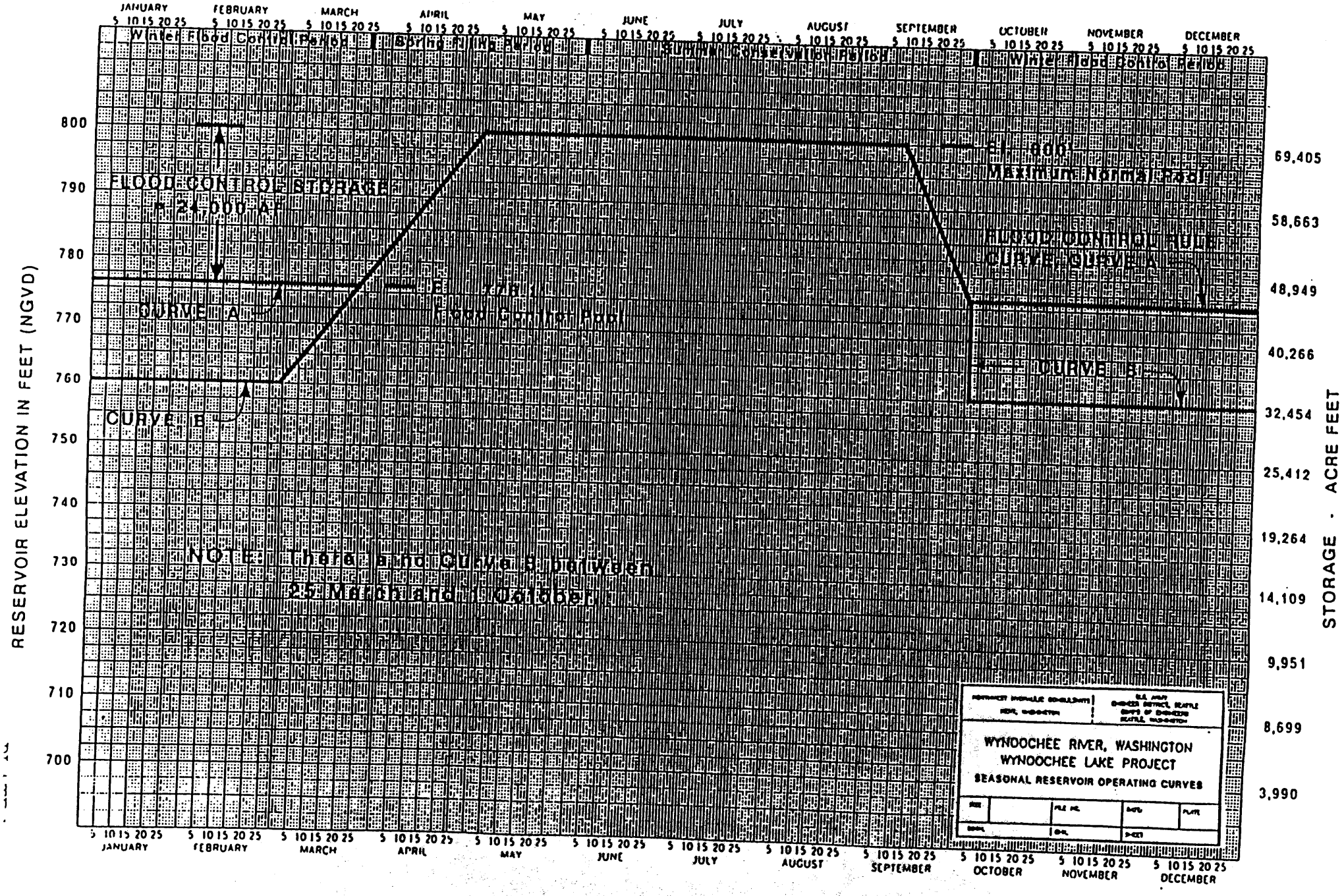
Three more floods were routed, one for each period, which were more severe than the design floods shown above. This was done to evaluate the effect of greater flow volumes on the proposed flood control storage pools. Each of these floods had a regulated peak flow several hundred cfs higher than the design floods shown above but below the control flow of 18,000 cfs at Above Black Creek.

Conclusions. In this analysis alternative flood control storage volumes were tested for the spring months of March and April. The analysis showed that the flood control storage requirements could be reduced from the existing requirements without adversely impacting flood control benefits. All floods tested were 200-year events or more extreme. The alternative flood control storage volumes were sufficient to control these flood flows to below the control flow of 18,000 cfs at Above Black Creek and caused no additional damages in the basin. Therefore the seasonal reservoir operating

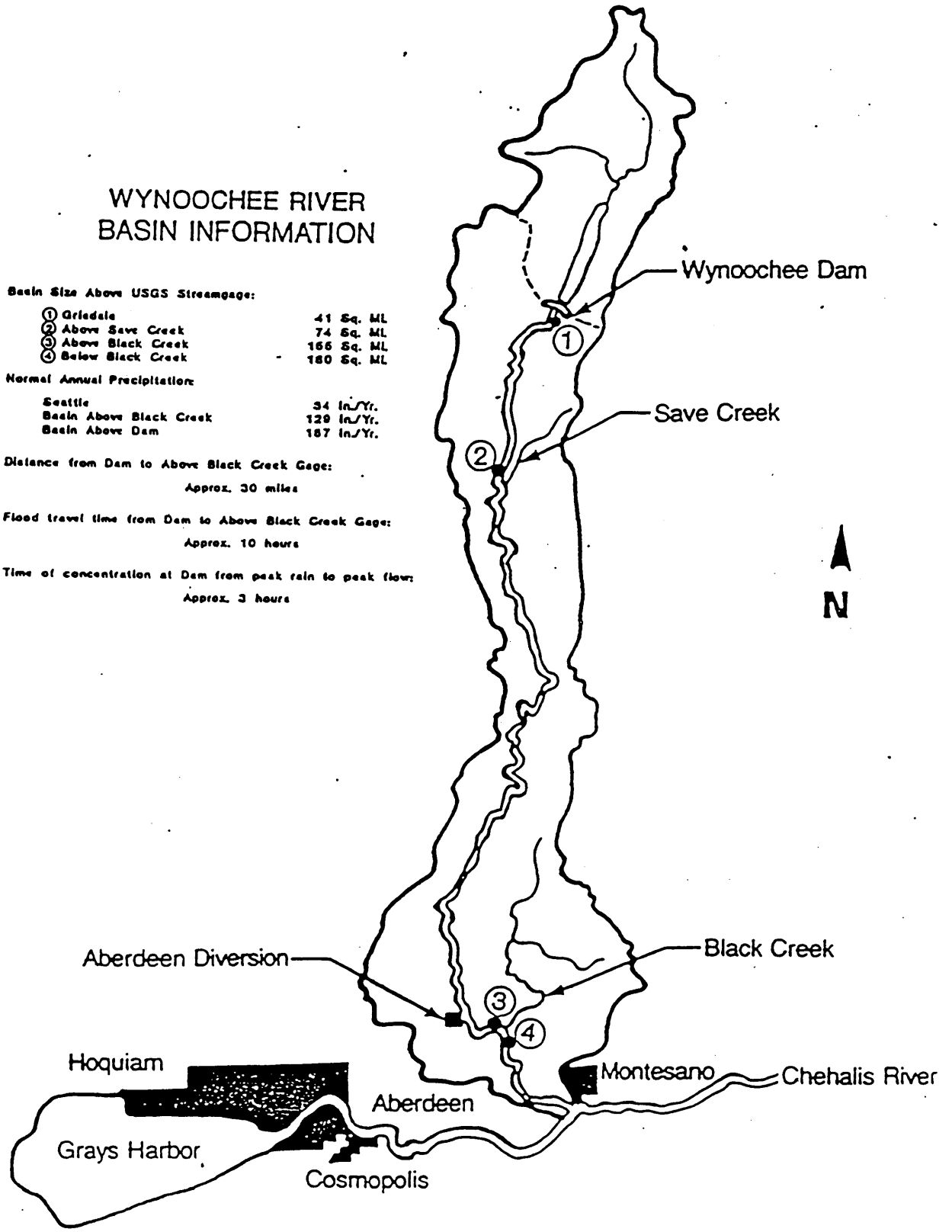
curve can be modified upward during the spring months of March and April as shown on Plate 10. Any increase above that shown on Plate 10 could adversely impact flood control in the basin by causing the regulated flows to go above 18,000 cfs.

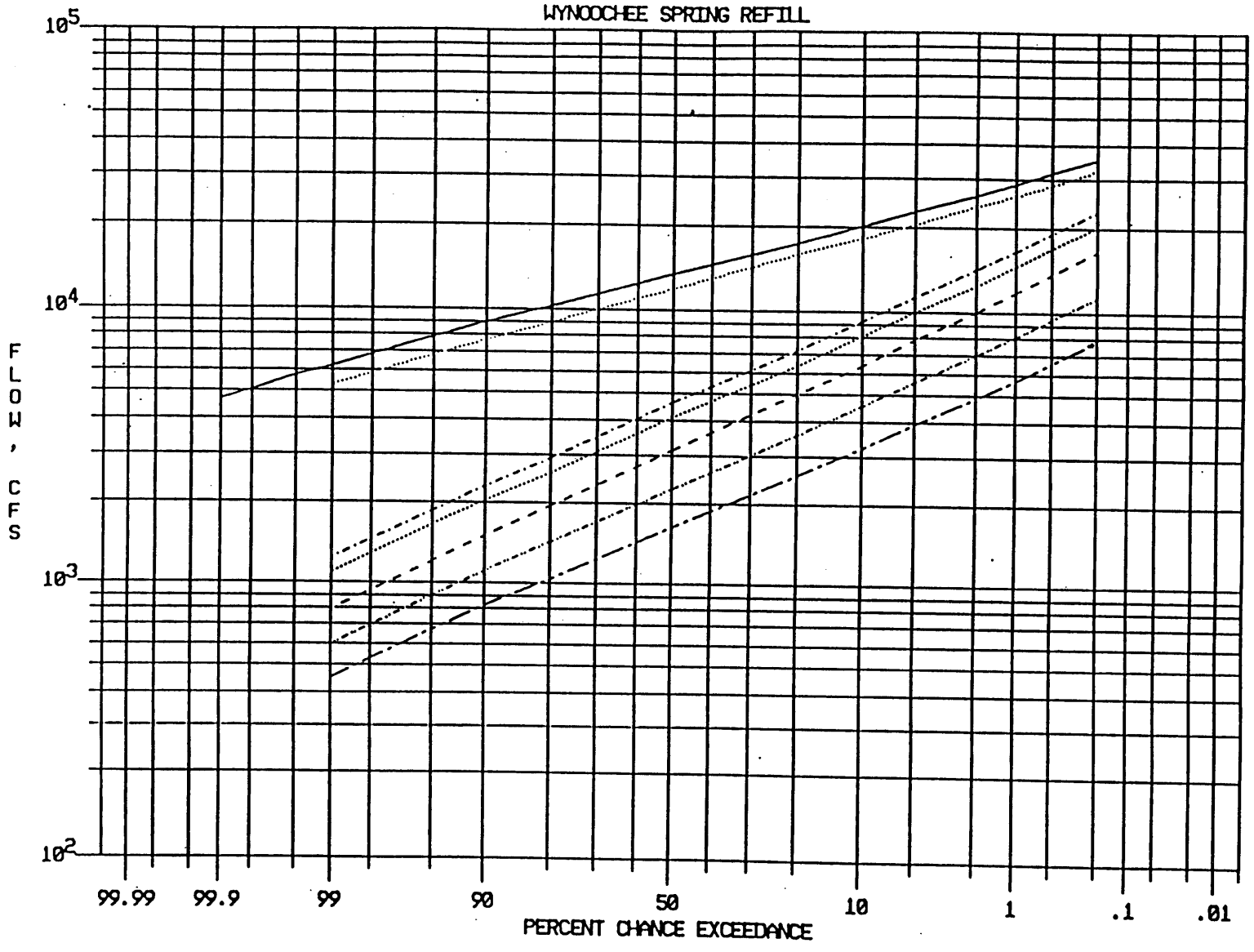
The revised curve shows the pool being full at 800 ft by April 25. However the procedure set forth in the water control manual for the later half of April should be maintained. In section 8.04. Overall Plan for Water Control - b. Spring Reservoir Filling (25 March to 1 May) it states that "filling from 795 to 800 feet will be delayed to as late a date as possible to preclude runoff from an unexpected heavy rain forcing the elevation above 800 feet or requiring a rapid increase in discharges."

Modifications to the Water Control Manual. If the recommended modification to the Spring Flood Control curve is adopted certain modifications will need to be made to the Water Control Manual. Section 8.04.b of the Water Control Manual must be revised. In the title of section b and in the second sentence of this section the date "25 March" should be changed to "1 March." Chart 8-1 in the manual would be changed according to the modified portion of the curve between 1 March and 1 May as shown on Plate 10.


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
5 10 15 20 25
Winter Flood Control Period
Spring Flood Control Period
Summer Conservation Period
Winter Flood Control Period
RESERVOIR ELEVATION IN FEET (NGVD)
800
790
780
770
760
750
740
730
720
710
700
FLOOD CONTROL STORAGE
24,000 AF
CURVE A
CURVE B
El. 800'
Maximum Normal Pool
FLOOD CONTROL RULE
CURVE CURVE A
CURVE B
NOTE: Therefore Curve B between
25 March and 1 October.
STORAGE - ACRE FEET
69,405
58,663
48,949
40,266
32,454
25,412
19,264
14,109
9,951
8,699
3,990
WYNOOCHEE RIVER, WASHINGTON
WYNOOCHEE LAKE PROJECT
SEASONAL RESERVOIR OPERATING CURVES

Wynoochee River Basin





BLACK 1DAY 24HR ANNUAL OBS
BLACK 1DAY ANNUAL
BLACK 1DAY MONTH 3
BLACK 1DAY MONTH 3.5
BLACK 1DAY MONTH 4
BLACK 1DAY MONTH 4.5
BLACK 1DAY MONTH 5

DI ATTE 3

AB1D3D6.XLC

WYNOOCHEE SPRING REFILL STUDY
ABOVE BLACK CR REGRESSION ANALYSIS

Comparing Data from Annual and Spring(Mar-May, Q>2000) Analyses

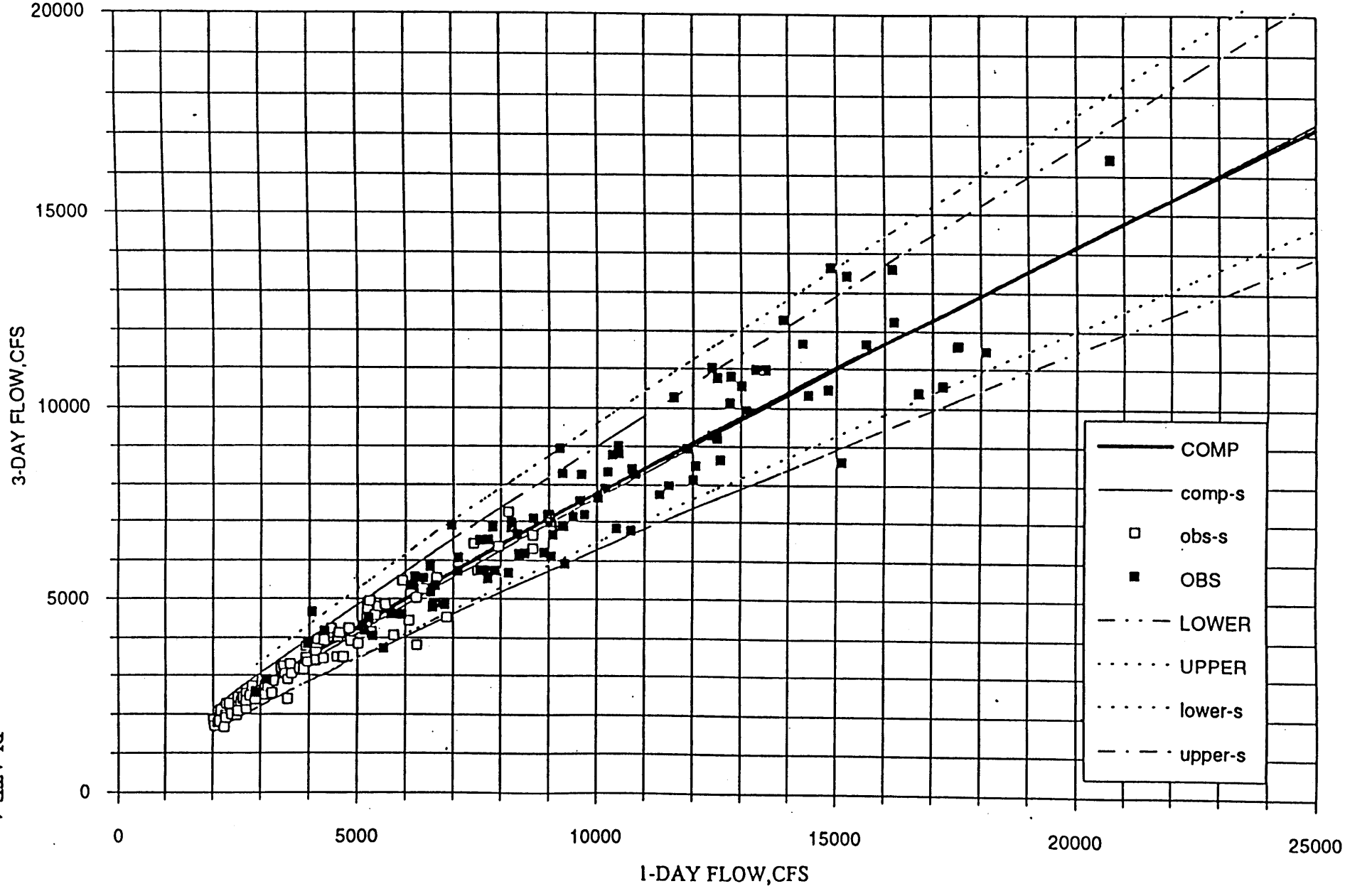
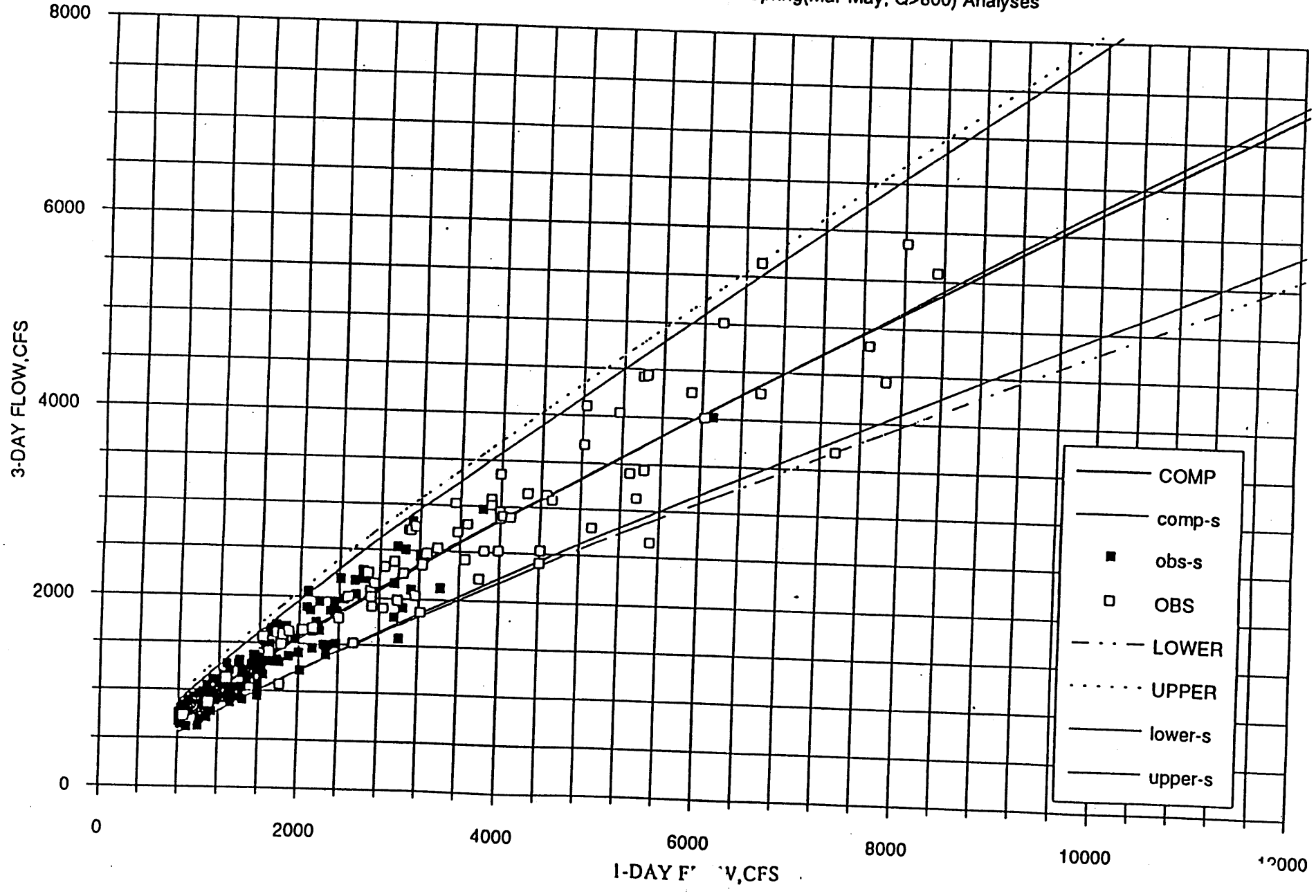


PLATE 4

GR1D3D2.XLC

WYNOOCHEE SPRING REFILL STUDY
GRISDALE REGRESSION ANALYSIS

Comparing Data from Annual and Spring(Mar-May, Q>800) Analyses



ABPK1 .C

WYNOOCHEE SPRING REFILL STUDY
ABOVE BLACK CR REGRESSION ANALYSIS

Using Dates from Annual Analysis

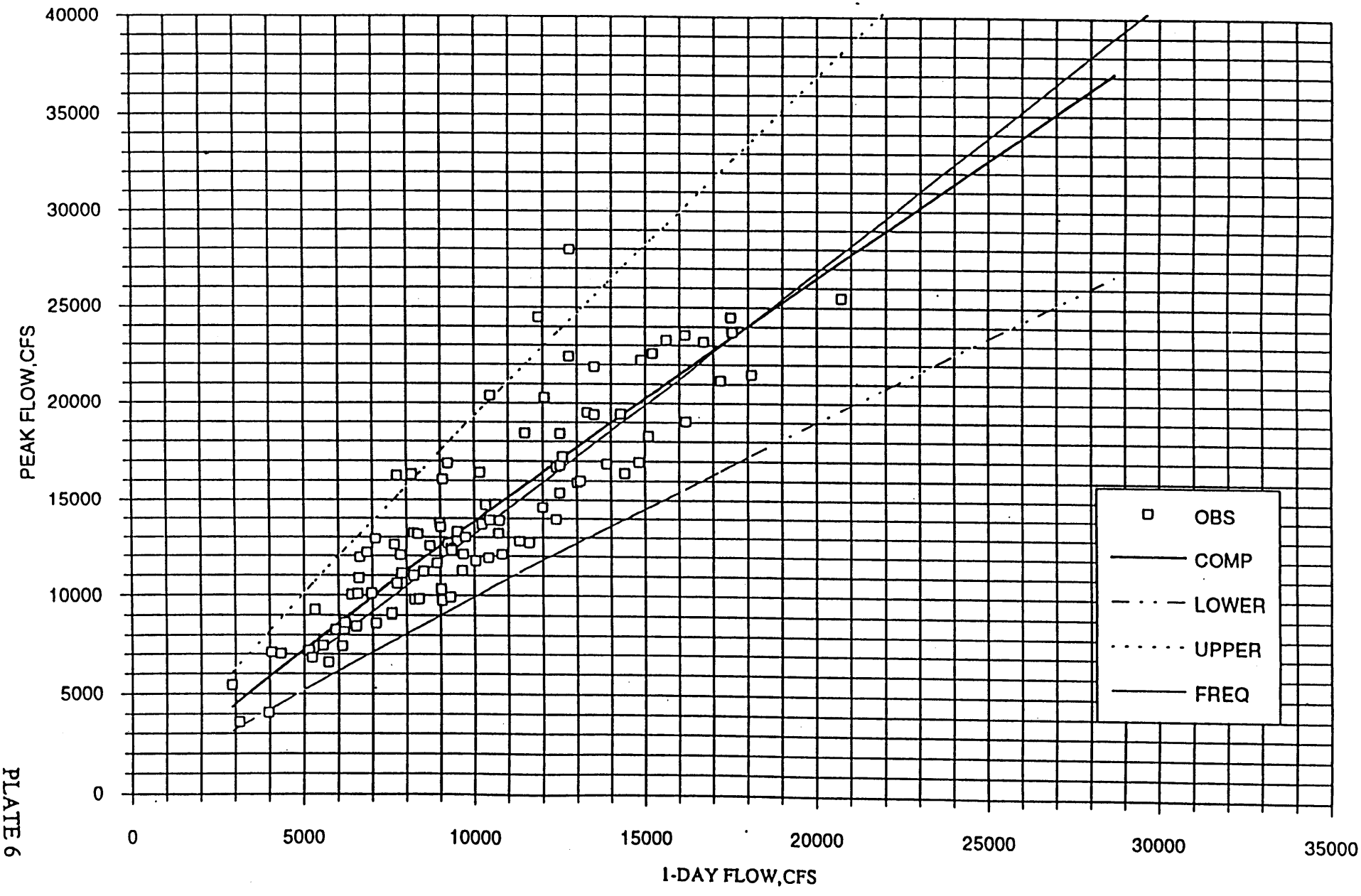
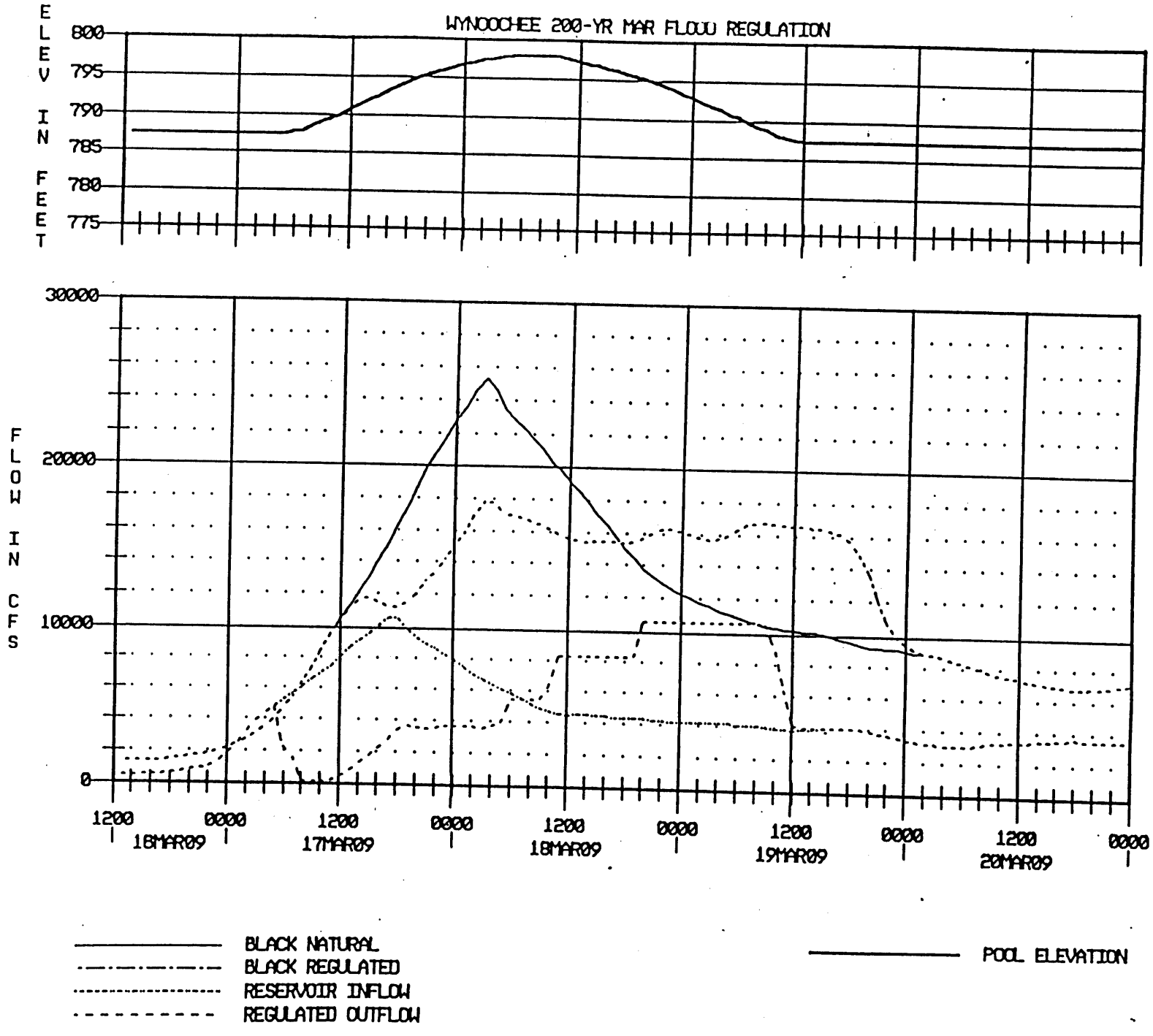


PLATE 6


WYNOOCHEE 200-YR MAR FLOOD REGULATION
ELEV IN FEET
800
795
790
785
780
775
FLOW IN CFS
30000
20000
10000
0
1200
0000
1200
0000
1200
0000
1200
0000
1200
0000
18MAR09
17MAR09
18MAR09
19MAR09
20MAR09
BLACK NATURAL
BLACK REGULATED
RESERVOIR INFLOW
REGULATED OUTFLOW
POOL ELEVATION

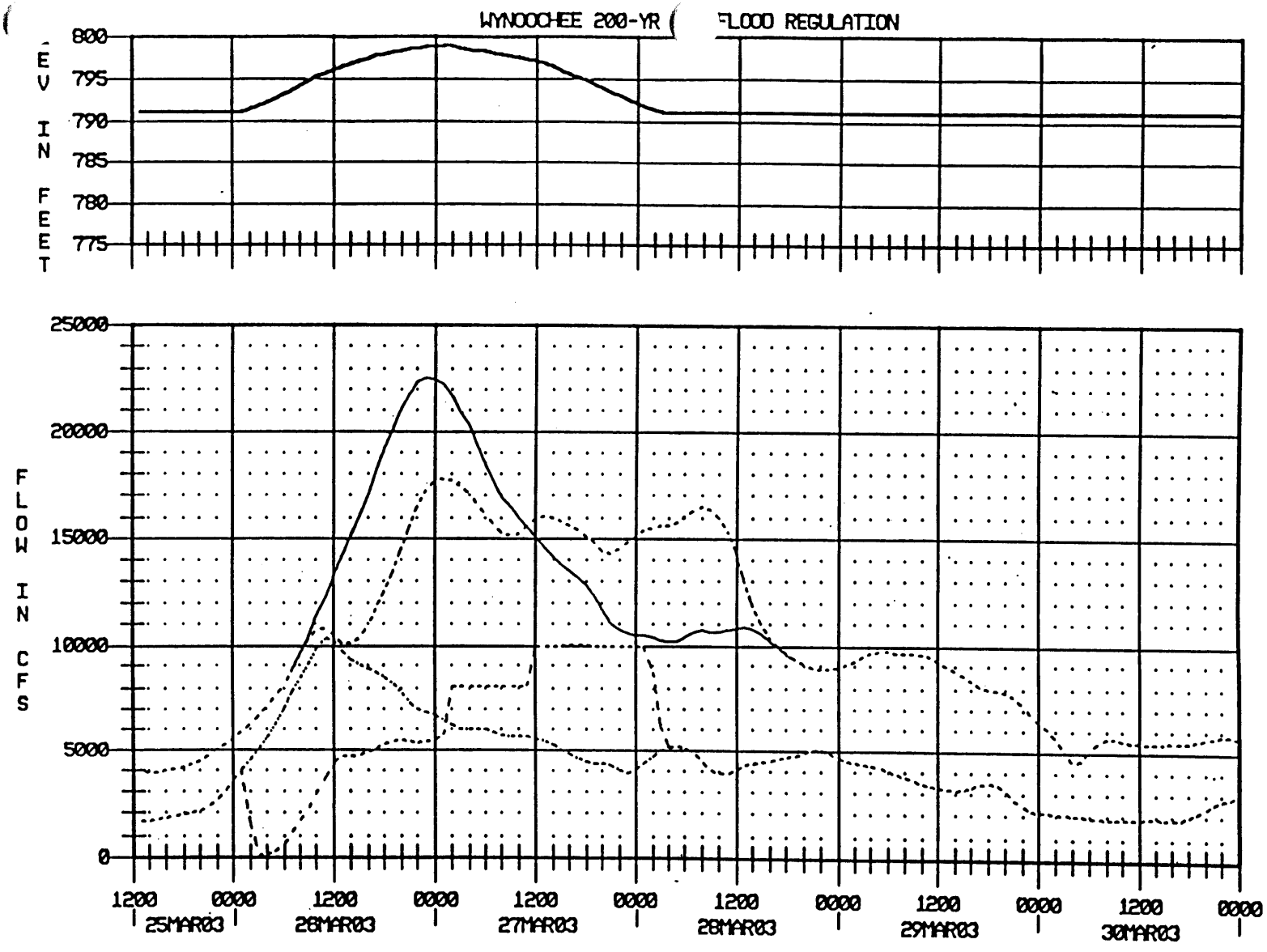
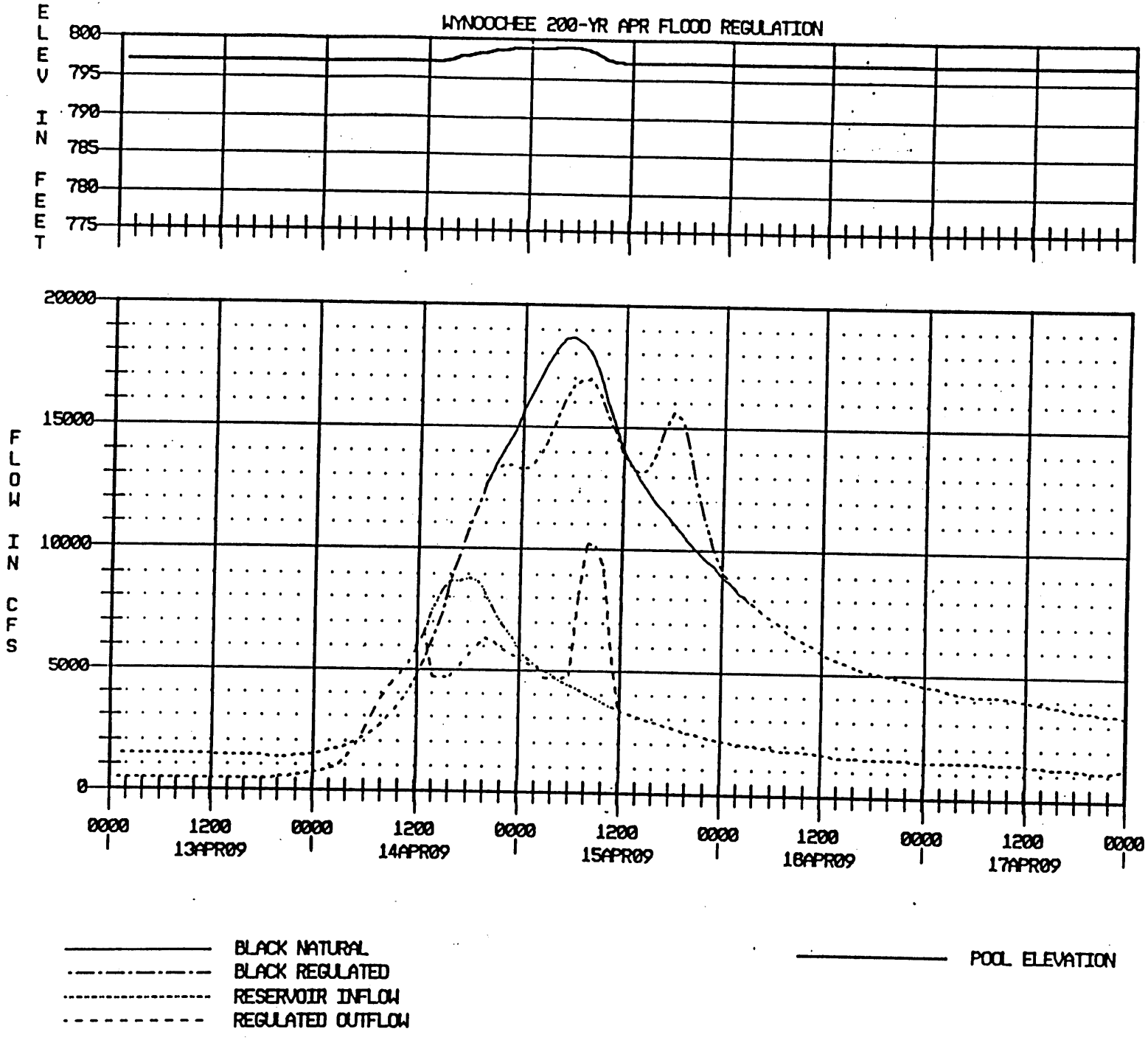
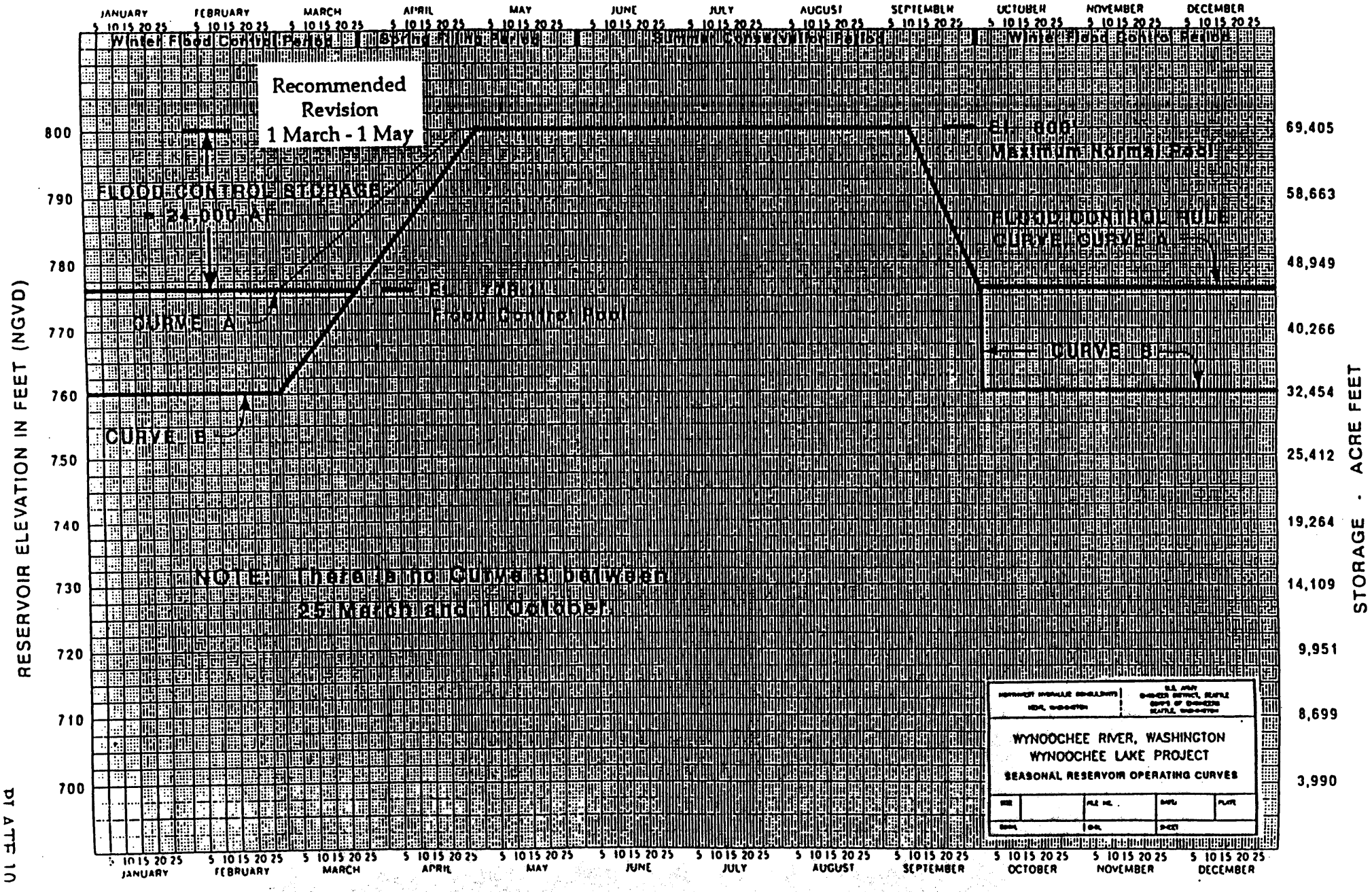

WYNOOCHEE 200-YR FLOOD REGULATION
ELEV IN FEET
800
795
790
785
780
775
FLOW IN CFS
25000
20000
15000
10000
5000
0
1200
0000
25MAR03
26MAR03
27MAR03
28MAR03
29MAR03
30MAR03
BLACK NATURAL
BLACK REGULATED
RESERVOIR INFLOW
REGULATED OUTFLOW
POOL ELEVATION

PLATE 8


WYNOOCHEE 200-YR APR FLOOD REGULATION
ELEV IN FEET
800
795
790
785
780
775
FLOW IN CFS
20000
15000
10000
5000
0
0000
1200
13APR09
0000
1200
14APR09
0000
1200
15APR09
0000
1200
16APR09
0000
1200
17APR09
0000
BLACK NATURAL
BLACK REGULATED
RESERVOIR INFLOW
REGULATED OUTFLOW
POOL ELEVATION


JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
Winter Flood Control Period
Spring Flow Period
Summer Conservation Period
Winter Flood Control Period
Recommended Revision 1 March - 1 May
FLOOD CONTROL STORAGE - 24,000 AF
CURVE A
CURVE B
Flood Control Pool
Maximum Normal Pool
FLOOD CONTROL RULE CURVE CURVE A
CURVE B
NOTE: There is no Curve B between 25 March and 1 October.
RESERVOIR ELEVATION IN FEET (NGVD)
800
790
780
770
760
750
740
730
720
710
700
STORAGE - ACRE FEET
69,405
58,663
48,949
40,266
32,454
25,412
19,264
14,109
9,951
8,699
3,990
WYNOOCHEE RIVER, WASHINGTON
WYNOOCHEE LAKE PROJECT
SEASONAL RESERVOIR OPERATING CURVES

APPENDIX G

WYNOOCHEE DAM
HYDRAULIC REPORTS

APPENDIX G

HYDRAULIC DESIGN

1. 1 General

1.2 Biological Hydraulic Design Criteria

1.3 General Hydraulic Analysis

1.4 Hydraulic Analysis of Project Alternatives

1.5 Hydraulic Analysis of Recommended Project Design

1.6 References Cited

HYDRAULIC DESIGN

1.1 General. The development of the fish bypass design was achieved during a series of planning meetings of the technical review and advisory group. This group was composed of staff from the Washington Department of Fish and Wildlife, the National Marine Fisheries Service, Tacoma City Light, and the Corps of Engineers. Major components of the Wynoochee Section 1135 project include the construction and operation of several large acclimation ponds to improve juvenile survival prior to release, construction of a juvenile bypass system through the existing dam, and modification of the operating rule curve to enhance instream flows and operational flexibility downstream of the dam. Design of the acclimation ponds was to be completed by the Washington Department of Fish and Wildlife. The juvenile bypass system design was completed by the Corps of Engineers and by the City of Tacoma's engineering consultant, HARZA Northwest. The design concept for the acclimation ponds was developed during the early stages of the study, while the operating rule curve modification and juvenile bypass design underwent a fairly extensive alternatives analysis and selection procedure.

Initial alternatives for downstream juvenile bypass systems included a collector located in the reservoir connected to a bypass conduit/s through the dam and leading to the river below, an Eicher screen located in the hydropower intake penstock connected to a bypass flume leading to the river, and lastly, modifications to the existing low flow/fish passage outlets to improve survival. The Eicher screen was selected for more detailed analysis because of its very low expected mortality rate for juvenile fish passage, its relatively low cost, and the high reliability of operation within limits of the biological criteria for fish passage. HARZA Northwest and the Corps of Engineers continued to refine this concept throughout the progression of the study as comments and discussion of the design continued during the general technical review group meetings. The completed feasibility design, fully coordinated with the agency technical review group, consists of the addition of a second set of temperature control bulkheads in the existing intake wet well, a penstock Eicher screen located about two hundred feet downstream of the dam on top of the high rock cliff on the right bank of the river, a pressure bypass fish withdrawal leading to a vertically telescoping pipe, an inclined rigid open flume into which the telescoping pipe discharges, a steeply sloping high velocity open channel flume, a flat slope transition and energy loss flume, and a low velocity semicircular jet outlet spilling into the river near the powerhouse tailrace.

The initial alternatives for the juvenile fish bypass system are described below:

Alt. 1 Upstream 'gulper' collector similar to the one constructed at Green Peter Reservoir project in Oregon. A free surface screen with adjustable submergence depth intake horn which would pass screened flow into the existing penstock intake, while fish would pass through the dam via one of several small ports then

into a small flume leading to the river below. Flume design alternatives included a larger, much longer low velocity flume (<10 fps) and a short steep very smooth high velocity flume (<30 fps).

Alt. 2 Upstream floating MIS high velocity screen passing flow into the existing hydropower wet well intake structure. Fish pass into small diameter bypass conduit and through a submerged, adjustable slope enclosed flume, then through the dam structure and downstream to the river in a short, steep, smooth, high velocity flume.

Alt. 3 Penstock Eicher screen with wet well modifications. An Eicher screen located inside the existing hydropower penstock would screen fish into a pressurized bypass pipe. A vertical telescoping pipe brings fish to atmospheric pressure, then spills them into an adjustable slope flume connected to a short, steep, high velocity flume leading to a discharge point near the powerhouse.

Alt. 4 Modification of the existing low flow (fish bypass) outlets through dam. Existing outlets pass fish under pressure at high velocity through a series of 90 degree or near 90 degree bends to a submerged jet release outlet into the tailwater pool. Proposed modifications include passing the conduits horizontally entirely through the dam and connecting them each, with a short section of pipe, directly to a large stilling well chamber constructed on the downstream face of the dam. The chamber would be dewatered through a floor screen and gated outlet, while the fish would pass over a weir and into an adjustable slope flume connected to a fixed steep slope flume leading to the river.

1.2 Biological Hydraulic Design Criteria. Staff from the Washington Department of Fisheries and the National Marine Fisheries Service provided criteria for hydraulic conditions to be met throughout the bypass system. These criteria were based on the environmental requirements of the fish which are to be passed through the system. The criteria are listed below:

1. Eicher screen penstock discharge safe structural operating range = 0 to 800 cfs.
2. Penstock minimum diameter = 10.0 ft.
3. Eicher screen removable penstock section diameter = 10.0 ft.
4. Maximum average penstock flow velocity within removable Eicher screen penstock section during screen operation = 8.0 fps.
5. Minimum average penstock flow velocity within removable Eicher screen penstock section during screen operation = 2.2 fps.
6. Fish bypass flow acceleration must be continuous from Eicher screen to a point beyond the downstream end of the transition to 30 inch diameter pressure bypass pipe.
7. No light must enter the bypass transition upstream of the 30 inch diameter pressure pipe.
8. Pressure bypass pipe minimum diameter = 30 inches.

9. Pressure bypass pipe material smooth wall HDPE pipe only.
10. Minimum bend radius within pressure bypass pipe = 5 diameters.
11. Articulated flume constructed of continuous welded HDPE or aluminum sheet material.
12. Flow velocity normal to Eicher screen at any one point must not exceed 0.40 times the average upstream penstock velocity.
13. Fish bypass discharge during Eicher screen operation must be between 10 and 30 cfs.
14. Fish bypass pressure pipe average velocity must not exceed 10 fps nor be less than 4 fps.
15. Fish and bypass water must reach artesian free surface conditions at top of telescoping pipe prior to discharge into flume.
16. Free surface open channel flume or pipe flow velocity must not exceed 35 fps.
17. Hydraulic jumps are not permitted within the bypass system.
18. Water depth within the open channel flume or free surface pipe flow must exceed 9 inches at all times.
19. Horizontal or vertical bends with radius less than 60 feet are not permitted within the high velocity free surface pipe or flume flow.
20. Any cross sectional area transitions are to be smooth, such that no protruding surfaces are present, and no abrupt changes in flow characteristics shall occur.
21. At no point will full pipe flow conditions be permitted within the free surface flow pipe, either as a result of excessive depth of water or as a result of air entrainment into the flow.
22. Viewing ports must be provided at strategic locations along any enclosed pipe within which free surface flow conditions are to be maintained.
23. Discharge of the bypassed flow into the river is to be effected through a spreading of flow such that no plunging singular jet is formed.
24. Maximum entrance jet total velocity of bypassed flow into the river must be less than 30 fps.
25. Bypass flow discharge must exit into a pool of water greater than five (5) feet in depth.

1.3 General Hydraulic Analysis. Hydraulic analysis was conducted for only the fish bypass features of the Section 1135 project. No hydraulic design or analysis was performed for features related to the fish acclimation pond system. Feasibility-level design of the downstream migrant fish passage system included the development of several preliminary alternative concepts utilizing upstream or downstream collection, dewatering or full bypass, high velocity or low velocity transport, and release to the river. The preliminary concepts varied primarily in the method by which the primary collection flow would be dewatered, if at all, and the method by which the fish would be transported to the river below. The dewatering concepts used similar designs for the transport conduit. Each component of the overall system is discussed below.

1.3.A. Collection Systems. Fish collection systems were developed with two basic differences. In three of the conceptual designs, collection occurs at a single point at the dam face, while in a fourth, collection occurs at one or more of several closely spaced existing low flow outlet ports along the dam face. The single collection site concepts dewater the flow either at or near the reservoir surface with large enclosed high velocity screens, or with an Eicher screen inside the powerhouse penstock downstream of the dam. The multiple collection site concepts dewater through either small, multiple enclosed high velocity inclined screens located at the fixed low flow outlet ports, or at a large common dewatering chamber on the downstream face of the dam.

Concept 1: This collector is similar in function to that of the Green Peter Dam fish "gulper", except that dewatering is accomplished with a low pressure, high velocity Modular Inclined Screen (MIS) (Ref #1), instead of a free-surface screen, mounted inside a large floating collector horn chamber. In this design, the collector withdraws water and fish from the reservoir and screens out fish and a small percentage of the intake flow. The attraction flow is provided by the powerhouse intake withdrawal supplemented by large pumps which would draw water into the intake and discharge the excess back into the reservoir through a diffuser.

Concept 2: This is also a dewatering type collector identical to that of concept 1 above, except that no supplemental attraction flow is required.

Concept 3: This concept provides attraction flow equal to the hydropower plant operating discharge up to 600 cfs through the existing intake wet well. Dewatering is accomplished with a penstock Eicher screen located within the powerhouse penstock downstream of the dam. Minor modifications to the existing hydropower intake wet well insure sufficient downwell velocities to entrain fish into the penstock and on to the Eicher screen.

Concept 4: Concept 4 incorporates one small MIS screen positioned directly in front of one of the existing low flow fish collection ports. A variation could include several MIS screens positioned in front of more than one port. Attraction flow is provided by the full discharge capacity of the port (210 cfs). Dewatering is accomplished within the MIS screen chamber and fish are bypassed into a small conduit bored through the dam monolith. Fish are bypassed into a small open flume from the outlet of each bored conduit.

Concept 5: This concept utilizes the existing separate low flow and fish collection outlets ports for attraction, except that the existing conduits will be short-circuited through the dam in bored conduits connecting to a large, common dewatering chamber constructed on the downstream face of the dam. Dewatering within the chamber is accomplished by means of a submerged floor screen and separate outlet conduit with control gate. Fish are bypassed into a small open flume at the top of the water surface in the chamber.

1.3.B. Pressure Bypass. Pressure bypass conceptual designs were developed for both the upstream and downstream dewatering locations. Both of the upstream floating collector concepts utilize a short length of pressure bypass conduit rising to near the reservoir elevation from the screen chamber. At this point the bypass flow reaches free surface conditions inside a smooth connection manifold which passes flow into an adjustable

slope rigid enclosed flume with a hinged connection at a point below the lowest operating range of the collection intake horn. The enclosed flume is submerged in the reservoir along the upstream face of the dam, but is designed to maintain free surface flow conditions throughout. The downstream penstock Eicher screen concept incorporates a pressure bypass conduit from the screen to a telescoping pipe tower just downstream of the Forest Service bridge. As in the upstream screen concepts, a smooth connection manifold joins the top of the telescoping pipe to an adjustable slope rigid flume hinged at the downstream end.

Concept #4 above incorporates small pressure bypass conduits bored through the dam monolith just above each of the existing low flow fish outlets. These conduits exit the downstream face of the dam and pass flow into a free surface open flume through a smooth transition. Each of the four open flumes (one for each low flow outlet) extend downstream to connect to a single open flume which carries either the single screen bypass flow or the combination of several screen bypass flows on downstream to the powerhouse (if several screens simultaneously deployed).

Concept #5 above discharges the entire low flow outlet/s flow/s into a large dewatering chamber on the downstream face of the dam. Discharge through the outlets is controlled by the dewatering chamber drain conduit valve indirectly by varying the head differential between the reservoir forebay and the dewatering chamber. Fish enter the chamber and are released into free surface conditions within the chamber. A small overflow weir passes fish and flow into an adjustable slope rigid open flume hinged at the downstream end and connected to a fixed, steep open flume leading to the powerhouse.

1.3.C. Atmospheric Pressure Relief Manifold. Several unique concepts for the atmospheric pressure relief manifold were evaluated during the initial analysis. Generally, the problem of bringing the migrating fish from ambient pressure at depth in the pressure bypass to atmospheric pressure gradually is difficult to solve with a constant-flow system, such as this must be. Some primary concepts were considered to have some merit for this project; an inclined telescoping pipe system discharging into a continuous flume, a vertical telescoping pipe system discharging into an adjustable slope rigid flume, pressure discharge into a large open chamber exposed to atmospheric pressure, and a multiple pressure relief tank system with gradual, fixed-volume pressure relief. The unproven nature of the design for this type of pressure tank system caused the agency staff to eliminate it from any further consideration. Subsequent analysis also indicated that the construction and maintenance costs of the inclined telescoping pipe would be prohibitively high, thus effectively limiting further analysis to the vertical telescoping pipe system and the large dewatering chamber used in concept #5 above.

1.3.D. Downstream Bypass. The general concepts for the downstream bypass were limited to those which would operate unpressurized and with a free water surface. Two alternatives for the conveyance conduit were evaluated; a hydraulically rough conduit which would operate at fairly low velocities with moderate

turbulence, and a hydraulically smooth conduit which would operate at higher velocities with low turbulence. The bypass conduit would generally follow an alignment which allowed for fairly uniform slope with as little excavation as possible and a limited length of elevated sections. The low velocity alternative would require considerably more length to reach the elevation of the river than would the high velocity alternative, due to its shallower slope. Open and closed conduits were evaluated for both alternatives, with selection based on installed original cost and long term maintenance costs. The much longer, more expensive shallow slope flume eventually was eliminated from consideration, largely because the unit cost of both the steep and shallow slope flumes was approximately equal.

1.3.E. Discharge Outlet. Several points along both banks of the river downstream of the dam were considered for the terminus of the downstream bypass conduit. However, the outfall site along the powerhouse wall was selected during further evaluation, since the fish could be discharged into the turbine tailwater and thus disguised from predators until they recovered orientation and evasion ability. Generally, all alternatives terminated five to fifteen feet in elevation above the river water surface under low water conditions, which is high enough to provide some clearance above the river during flood conditions, yet low enough to limit impact velocity resulting from the free fall of the discharge jet into the river. To reduce the horizontal velocity component at the jet, the slope of the downstream end of the bypass conduit is reduced to near zero for a sufficient distance to reduce the flow velocity as low as possible without transitioning through a hydraulic jump. The shape of the discharge outlet is similar for all alternatives, and is designed to effectively spread the jet emanating from the outlet into a semicircular arc. This shape is expected to thin the jet considerably, causing a significant percentage of flow to enter the river as spray or a thin jet of lower energy, protecting the entrained fish from impact on the tailwater channel bottom. An alternative to this shape would be an outlet with the same shape as the flume combined with excavation of the channel bottom to provide sufficient water volume for jet energy dissipation.

1.4 Hydraulic Analysis of Project Alternatives. Hydraulic conditions for each bypass concept alternative were evaluated through hand computations and standard computer-based water surface profile modeling methods. Velocities, pressures, flow depths, and water surface profiles were computed throughout the system, where applicable. Water surface profile modeling utilized the standard step method with Manning's equation. Conduit shapes and sizes were optimized to satisfy the biological criteria, while at the same time minimizing discharge and total loaded component weight, maximizing available flow depth at the lowest discharge and minimizing flow depth at highest discharge, and maximizing energy losses from wetted perimeter skin friction. Inexpensive construction materials were utilized where applicable throughout the development of the alternative concepts.

Generally, the low velocity, high hydraulic roughness type of bypass alternatives utilize smoothly corrugated walls or smooth baffles within the conduit to provide energy loss by form drag rather than by skin friction drag. The high velocity, low hydraulic roughness type of bypass alternatives utilize conduits with a large wetted perimeter and smooth walls to provide energy loss by skin friction drag, while at the same time protecting fish from abrasion and descaling injuries. Both the high and low velocity bypass alternatives require a steep, smooth wall open channel flume into which the atmospheric pressure relief manifold discharges. For all low velocity bypass alternatives, the low velocity section must be preceded by a flat slope, smooth wall open channel section to provide for energy loss following the steep flume section prior to entrance into the low velocity bypass section.

1.5 Hydraulic Analysis of Recommended Project Design. The recommended project design and its components are described in detail in the following sections 1.5.A through 1,5,H below. Smooth, gradual transitions have been designed throughout the entire system to reduce turbulence and obstructions to a minimum. Horizontal curve radii in the open channel flume portion of the project have been limited to no less than 30 feet to reduce the possibility of superelevation of the flow.

1.5.A. Intake Wet Well. A second set of temperature control panels will be operated within the rear portion of the wet well in a similar manner as the current panels. In addition, a false wall bulkhead panel will be deployed in the existing penstock closure bulkhead slot to provide a flush surface on the rear wall of the wet well from the surface down to the protruding penstock entrance bellmouth top lip (Figures 3 and 4, Appendix A). Partial closure of the lower portion of the wet well entrance trashrack may also be required to increase the apparent attraction velocity into the wet well. Operating penstock discharge range for these secondary panels would be 200 cfs to 650 cfs. Penstock discharges in excess of 650 cfs would require stowing of these panels and reversion to existing panels for withdrawal control. Position of the bulkhead panels was determined by fish passage velocity limitations within the wet well. The fish passage design guidance criteria specifies desirable velocities within an enclosed, or non-free surface flow to be no less than 5 fps (to insure capture of smolts), and no more than 10 fps (to prevent injury to fish from collision with conduit walls or against corners. Since the ratio of minimum to maximum discharge (200/650 = 0.308) is less than the ratio of minimum to maximum velocity (5/10 = 0.5), it is not possible to entirely satisfy the criteria with the secondary fixed panel guides throughout the full range of discharges. Therefore, capacity would have to be supplemented either by partial opening of the lowest panel for direct flow into the penstock or removal of the secondary panels and reversion to the existing panels.

The minimum clearance between the false wall bulkhead and the top panel can be adjusted by moving the panels from guide to guide to increase or decrease the space between the two as required. When the top panel is

in the nearest guide, the minimum clearance (3.333 ft) is sufficient to provide at least 5 fps capture velocity at a the minimum project discharge of 200 cfs. Maximum velocity of 10 fps through the same cross section provides 400 cfs capacity. Although the minimum cross section between the second panel and the false wall bulkhead is larger (4.167 ft x 12 ft wet well width) and provides less than optimum capture velocity (4.0 fps), agency reviewers felt that the initial capture at the top of the wet well would be sufficient to force juvenile fish to keep moving down into the penstock. The additional 250 cfs capacity would be provided by opening the lower bulkhead panel such that some flow could pass directly into the penstock. To prevent or minimize injury due to collision of juvenile fish with the structural members of the panels, smooth skins and flush joints are used. With this arrangement, the maximum capacity of the intake wet well (limited by the anticipated survival rate for the Eicher Screen downstream) as proposed would be 650 cfs, and the minimum would be 200 cfs (limited by the fish passage criteria). Discharges less than this occur very rarely during the migration season, and agency reviewers felt that to design for lower discharges would put unnecessary constraints upon the design of these panels. Operation at flows higher than this during the migration season would necessitate partial operation of the deeply submerged flood control sluices to minimize problems with false attraction away from the intake wet well.

1.5.B. Penstock Eicher screen. About 100 feet downstream of the dam face, a section of the 10 ft diameter penstock about 40 feet long would be modified to incorporate an Eicher screen. Within a large pit excavation about 20 feet deep (Figures 2 and 5, Appendix A), a rail guided sliding mechanism would carry two interchangeable sections of penstock; one with the Eicher screen and all associated operating machinery and the other just a standard penstock section (Figure 3, Appendix A). Sufficient floor space would be provided within this excavation in which to perform all necessary maintenance and replacement work associated with the interchangeable penstock sections. The Eicher screen configuration would generally follow after the existing Elwha Dam or Puntledge facilities. Both the Elwha and Puntledge Eicher screens have been evaluated and have exhibited good fish survival rates over a range of operating discharges (Ref #2, #3, #4). A small diameter outlet at the top of the penstock near the downstream end of the Eicher screen (Figure 5, Appendix A) passes fish which have been screened from the main flow into a 24 inch diameter pressure bypass pipe.

Hydraulic conditions within the penstock during operation of the Eicher screen are to be controlled by the powerhouse demand. However, the average penstock velocity during operation of the screen would not be allowed to fall outside of the range dictated by the biological criteria (Section 1.2 above). Generally, the screen is designed to operate at penstock discharges between 200 cfs and 650 cfs. The screen would be cleaned at regular intervals by tilting in the opposite direction to reverse the flow and flush debris. Cleaning would be required when the head loss across the screen exceeded about 1.2 psi, as determined by automatic gauges mounted in the penstock wall upstream and downstream of the screen. The Eicher screen is designed to allow fish to be guided along or above its surface, without contacting the screen, to the top of the penstock, where the a small percentage

of the penstock flow and all the guided fish are accelerated into a pressurized pipe bypass system. Ideal bypass conditions would provide gradual but continuous acceleration of about 0.1 fps per linear foot of bypass entrance to draw fish into the pressure pipe. However, the design for this project results in somewhat faster, but continuous, rates of acceleration into the bypass entrance. Agency staff have concurred with this design assumption. The fish bypass is designed to withdraw an average of 15 to 30 cfs, roughly 5 to 8 percent of the penstock flow.

1.5.C. Pressure Bypass. A pressure bypass pipe carries the bypass discharge from the penstock to the top of the telescoping atmospheric pressure relief manifold pipe (Figure 2, Appendix A). A 90 degree turn and a shut-off valve within a few feet of the bypass entrance opening at the ceiling of the penstock section provide disconnection capability for the interchangeable penstock sections (Figures 5 and 6, Appendix A). This short section would be constructed of stainless steel, whereas the remainder of the pressure bypass would be constructed almost entirely of High Density Polyethylene (HDPE) material. A gradual expansion from the 24 inch diameter pipe to a 30 inch diameter pipe commences just downstream of this valve. The 30 inch diameter pressure pipe would follow a cut-and-cover excavation from the Eicher screen pit to the base of the telescoping vertical pipe tower on the downstream side of the right abutment of the Forest Service access road bridge. It would likely be buried throughout its length and encased in concrete under the pedestrian access walkway, which passes under the right bridge abutment (Figure 9, Appendix A). A 12.5 ft radius 140 degree bend brings the pipe to vertical, where it would be joined to the telescoping pipe section with a flanged HDPE pressure fitting.

Flow in the pressure bypass system accelerates throughout the entrance and into the pressure bypass through the 24 inch diameter shutoff valve. The valve is located well beyond the entrance, such that fish drawn into the pressure bypass cannot escape back to the penstock. A gradual expansion from 24 inch to 30 inch diameter downstream of the valve allows for gradual reduction of velocity to an average of 2.5 to 5.0 feet per second through the remainder of the bypass system. Bend radii within the pressure bypass system is limited to a minimum of 5 pipe diameters, or 12.5 feet for the 30 inch diameter. Average velocity throughout the bypass would remain low to moderate and fairly uniform. Smooth HDPE walls and low velocities would prevent abrasion injury to the fish, and the minimum diameter of 24 inches at the entrance assures that impact injury from hard surface obstructions would be avoided. The uniform velocity throughout the bypass (downstream of the valve and contraction section) would also encourage fish to follow, rather than fight, the water particle velocity.

1.5.D. Atmospheric Pressure Relief Manifold. In the recommended design, the manifold consists of an arrangement of interlocking vertically telescoping pipe sections through which the bypass flow would upwell to atmospheric pressure at the top of the pipe. The top elevation of the telescoping pipe would be nearly the same as the reservoir elevation throughout the full range of operation from elevation 760 to elevation 800, minus head losses accrued throughout the intake, penstock, and bypass system. A discharge box at the top of

the telescoping pipe shaped to smoothly transition the flow into a control weir would provide more uniform flow into the rigid adjustable flume. Figures 7 and 8 (Appendix A) show the configuration of the telescoping pipe, the discharge box, and control weir.

Flow conditions in the vertical telescoping pipe would insure fairly uniform velocity, carrying the fish along at about 2.5 to 5.0 fps toward the free surface at the top. Upwelling flow turbulence would not be significant in this pipe, which ranges in diameter from 30 at the bottom to 34 inches at the top. This velocity is expected to be sufficient to force neutrally or negatively buoyant fish to the surface, yet not so high as to cause excessive turbulence at the water surface within the weir box. The weir box is of sufficient length to develop fairly uniform approach flow to the control weir. Water surface profiles within the weir box were analyzed with a standard step water surface profile model. Although this may be an imperfect method for analyzing such complex flow, it provides a fair estimate of the depth and relative velocity approaching the control weir. Geometry of the weir box was designed to provide a smooth transition into the rigid adjustable flume in which flow velocity and depth at the exit section downstream of the weir matches the computed normal depth within the flume for the particular design flow rate.

1.5.E. Downstream Bypass. The section of the bypass downstream of the telescoping vertical pipe and manifold weir box consists of a rigid, narrow open flume hinged about the downstream end which discharges into a long, steep, fixed flume. The adjustable portion of the flume is about 161 feet long and is hinged at the downstream end about an axis coincident with a point slightly below the invert of the flume. A section of flexible flume (HDPE) at the hinge point will retain a smooth transition from the adjustable flume to the fixed flume throughout the range of motion, limiting separation of flow and its resulting induced turbulence. The upstream end of the adjustable flume is attached to a sliding pin connection fixed to the manifold weir Figures 7 and 8, Appendix A). The configuration allows the telescoping pipe and manifold hoist to simultaneously raise or lower the end of the adjustable flume to meet the required elevation. The fixed flume downstream of the adjustable section is of the same cross section as the adjustable section, and its slope is fixed at the same slope of the adjustable section when it is raised to its highest position. This steep slope of 26.7% is that which provides a normal depth of at least 9 inches at the lowest flume discharge, and it is continued along nearly the entire alignment of the bypass. Just upstream of the powerhouse access bridge, the flume turns to cross the river beneath the bridge, with the superstructure of the flume support truss suspended from the bridge. The slope is shallower under the bridge to provide clearance above flood elevations of the river. A broad curve and short section of steeper flume just downstream of the bridge carry the alignment adjacent to the powerhouse parking area retaining wall and the powerhouse wall. This free-standing portion of the flume is supported on concrete columns, and is provided with an access walkway. The downstream end of the flume is of nearly flat slope, and is anchored to the

powerhouse structure throughout. A smoothly shaped spreading jet exit section extends beyond the powerhouse wall a short distance to provide a thin, wide jet trajectory into the tailrace area.

The entire bypass flume is designed to insure supercritical flow conditions throughout the entire length. In this way, turbulent zones within the flow profile will be minimized. The flume will be constructed of either smooth welded aluminum sheet or welded HDPE sheet. The cross section is designed to maximize skin friction energy losses without inducing turbulence or abrasion injury. It is narrow and deep to insure sufficient depth at low discharge and high velocity. Horizontal and vertical bend radii are limited to a minimum of 60 feet throughout the alignment, with longer radii in zones of highest velocity. The alignment provides for uniform slope without excessive excavation or long elevated sections. Clearance under the powerhouse access bridge is provided above the approximate 100 year flood water surface elevation, while at the same time insuring adequate headroom for pedestrian inspection of the flume via the attached walkway. The transition zone of shallow slope extending a distance upstream of the exit section is designed to provide energy dissipation to reduce flow velocity and increase the depth preceding the free fall of the jet into the tailrace. Maximum height of the exit section above the tailrace can thus be achieved without forcing the jet impact entrance velocity higher than that specified in the biological criteria.

1.5.F. Discharge Outlet. The discharge outlet of the bypass system is located near the powerhouse tailrace on the right bank of the river. The outlet structure is designed to be supported from the powerhouse wall and is cantilevered a short distance over the tailrace area. The shape of the outlet is designed to spread and thin the discharge jet to enlarge and diffuse the impact entrance footprint at the river water surface. A center riser gradually rises from the invert throughout the length of the exit section to effectively spread the two outer threads of flow without itself protruding from the water surface in the jet. This design would require modification and possible model or prototype study during the future design phase to insure successful performance. The intent of the outlet shape is to spread the jet into a semicircular impact arc and to thin it to provide more surface area for spray dissipation. Impact injury to fish is significantly reduced if the entrance jet in which they are contained is dissipated into spray prior to actual impact, as the boundary shear layer between the jet and the receiving water body develops much less turbulent energy transfer.

1.5.G. Juvenile Monitoring, Capture and Holding System. Immediately upstream of the spreading flume section at the outfall, a shunt gate in the flume and a dewatering and holding tank will be provided to accomplish miscellaneous fish monitoring tasks. The shunt gate is designed similarly to that used for most WDFW evaluation facilities across the State. It utilizes a long flexible flume section that shifts flow into the live box/dewatering section and holding tank when tripped manually by project staff. Sloping floor and sidewall

screens controlled by adjustable exterior weirs provide dewatering of most of the flume discharge. An overflow weir is provided at the downstream end of the dewatering chamber to separate the holding tank from the dewatering chamber. A floor screen, again controlled by exterior adjustable weirs, provide secondary dewatering of the holding tank and insure relatively quiescent conditions within the tank. Fish can be dip netted or crowded for capture as necessary within the holding tank.

1.6 References Cited

Reference #1 - Taft, E.P, S.V. Amaral, F.C. Winchell. "Biological evaluation of a New Modular Fish Diversion Screen." Fish Passage Policy and Technology: Proceedings of a Symposium. Bioengineering Section, American Fisheries Society, 1993, Portland, Oregon.

Reference #2 - Winchell, F., N. Taft, and T. Cook. "EPRI's Evaluation of the Elwha Dam Eicher Screen and Subsequent Design Changes and Hydraulic Tests." Fish Passage and Technology: Proceedings of a Symposium. Bioengineering Section, American Fisheries Society, 1993, Portland, Oregon.

Reference #3 - Smith, Hugh. "Development of a Fish Passage Solution at the Puntledge Hydro Intake Facility." Fish Passage and Technology: Proceedings of a Symposium. Bioengineering Section, American Fisheries Society, 1993, Portland, Oregon.

Referance #4 - "Puntledge River Diversion Dam Permanent Fish Screen Project - Hydraulic Model Studies." ENSR Consulting and Engineering, for British Columbia Hydro and Power Authority, Vancouver, British Columbia. 1993.

APPENDIX H

WYNOOCHEE DAM
EICHER FISH REPORTS

Studies of High Velocity Screens in Relation to Eicher Screen Use at Wynoochee Dam

The Corps of Engineers is proposing to design, build and install a high velocity screen (Eicher Screen) and juvenile fish bypass system, consisting of the Eicher, depressurization tower, and bypass flume, to improve downstream fish passage at Wynoochee Dam. The Wynoochee interagency work group (which developed the current design of the new fish passage system) believe current outlet moralities will be dramatically reduced through the installation of the Eicher. Eicher screens have been installed at Elwha Dam in Washington and the Puntledge project on Vancouver Island in British Columbia, with reported survival rates of 91% to greater than 98%. Attaining this level of survival is considered essential to maintain and successfully restore existing native upper Wynoochee fish stocks.

Review of Existing Survival Rates During the spring outmigration period (approximately April 15 to June 30) downstream migrant chinook (underyearling and yearling), coho salmon and steelhead smolts experience morality rates of approximately 14 to 42% (58-86% survival) when passing through Wynoochee Dam using the existing outlet facilities (Dunn 1978). The new bypass facility and Eicher Screen are expected to improve dam passage survival rate by an estimated 15-66%. The target for the restoration project is to attain a 95% dam passage survival rate (Table 1, Dam Passage Survival). To reach this estimated project survival rate, the Eicher Screen and fish bypass system were designed to meet 25 distinct biological hydraulic criteria, from maximum screen velocity to minimum water depth in the bypass (Table 2). Staff from the Washington Department of Fisheries and the National Marine Fisheries Service provided criteria for hydraulic conditions to be met throughout the bypass system. These criteria were based on the environmental requirements of the juvenile salmon, steelhead and cutthroat trout which are to be passed through the system.

Table 1. Comparison of existing (without project, from Dunn 1978) fish passage survival vs. expected with project survival and overall improvement. Note, existing survival rates are for only 2 years of data and cannot be considered an accurate long-term estimate of smolt survival and are used only for comparison purposes.

	Without Project	With Project	Improvement (%)
Dam Passage Survival			
Chinook underyearling	58%	96%	66%
Chinook yearling	80%	98%	48%
Coho smolts	86%	98%	14%
Steelhead smolts	72%	98%	36%
Reservoir Survival[1]			
Chinook underyearling	25%	44%	75%
Chinook yearling	54%	81%	50%
Coho smolts	55%	83%	50%

Steelhead smolts	52%	78%	50%
Overall Survival			
Chinook underyearling	15%	42%	180%
Chinook yearling	43%	79%	84%
Coho smolts	47%	81%	72%
Steelhead smolts	37%	76%	105%

1. Reservoir survival = 1 - reported residualism rate: data used is from 1973 and 1975, trapping equipment could not be used in 1974 because of high flows.
2. Overall survival rate = Dam survival x reservoir survival.

Table 2. Biological Hydraulic Design Criteria for the Wynoochee Dam fish bypass system.

1. Eicher screen penstock discharge safe structural operating range = 0 to 800 cfs.
2. Penstock minimum diameter = 10.0 ft.
3. Eicher screen removable penstock section diameter = 10.0 ft.
4. Maximum average penstock flow velocity within removable Eicher screen penstock section during screen operation = 8.0 fps.
5. Minimum average penstock flow velocity within removable Eicher screen penstock section during screen operation = 2.2 fps.
6. Fish bypass flow acceleration must be continuous from Eicher screen to a point beyond the downstream end of the transition to 30 inch diameter pressure bypass pipe.
7. No light must enter the bypass transition upstream of the 30 inch diameter pressure pipe.
8. Pressure bypass pipe diameter = 30 inches.
9. Pressure bypass pipe material smooth wall HDPE pipe only.
10. Minimum bend radius within pressure bypass pipe = 5 diameters.
11. Articulated flume constructed of continuous welded HDPE or aluminum sheet material.
12. Flow velocity normal to Eicher screen at any one point must not exceed 0.40 times the average upstream penstock velocity.
13. Fish bypass discharge during Eicher screen operation must be between 20 and 30 cfs.
14. Fish bypass pressure pipe average velocity must not exceed 10 fps nor be less than 4 fps.
15. Fish and bypass water must reach artesian free surface conditions at top of telescoping pipe prior to discharge into flume.
16. Free surface open channel flume or pipe flow velocity must not exceed 35 fps.
17. Hydraulic jumps are not permitted within the bypass system.
18. Water depth within the open channel flume or free surface pipe flow must exceed 9 inches at all times.

19. Horizontal or vertical bends with radius less than 60 feet are not permitted within the high velocity free surface pipe or flume flow.
20. Any cross sectional area transitions are to be smooth, such that no protruding surfaces are present, and no abrupt changes in flow characteristics shall occur.
21. At no point will full pipe flow conditions be permitted within the free surface flow pipe, either as a result of excessive depth of water or as a result of air entrainment into the flow.
22. Viewing ports must be provided at strategic locations along any enclosed pipe within which free surface flow conditions are to be maintained.
23. Discharge of the bypassed flow into the river is to be effected through a spreading of flow such that no plunging singular jet is formed.
24. Maximum entrance velocity of bypassed flow into the river must be less than 30 fps.
25. Bypass flow discharge must exit into a pool of water greater than five (5) feet in depth.

Existing Studies of High Velocity Screens To date, several studies have been performed on the survival of juvenile salmonids passed through high velocity incline screens such as the Eicher and a similar design, modular incline screen (MIS) (Taft et al. 1993; Winchell et al. 1993; and Smith 1993). These studies have consistently shown that for the normal range of flows (250-600 cfs) and velocities (<8 fps) the Wynoochee Eicher will screen, survival rates for outmigrant salmonids should exceed 95% (Table 3 and Table 4).

Table 3. Net passage survival for juvenile anadromous salmonids during two years of tests for the Elwha Eicher screen (adapted from Winchell et al. 1993).

Species and Size Class	Average. Length in & (mm)	Average Diversion Efficiency	Net Passage Survival
steelhead smolts	6.9 (174)	99.6%	99.4%
steelhead fry	2.0 (52)	92.0%	97.1%
coho smolt 1990	5.3 (135)	99.5%	99.4%
1991	5.7 (145)	98.7%	98.7%
coho juvenile	4.0 (102)	99.4%	99.2%
coho fry all data	1.7 (44)	96.1%	91.6%
tests<7 fps		98.0%	95.9%
chinook smolts	3.9 (99)	99.7%	98.8%
chinook juveniles	2.9 (73)	99.9%	99.9%

Table 4. Net passage survival for juvenile salmonid species tested during the MIS biological evaluation, 1992-93 (Taft et al. 1993).

	Avg. Length	Net Passage Survival	Combined

Species and size class	mm & (in)	2 fps[1]	4 fps	6 fps	8 fps	10 fps	Survival
rainbow trout fry	1.9 (48)	92.6	100	100	95.2	91.9	96.8
rainbow juveniles	2.6 (66)	100	99.2	100	98.9	89.9	97.4
coho fry	1.9 (49)	100	100	100	99	99.3	99.6
chinook fry	2.1 (53)	100	100	99.3	98	93.8	97.2

1. fps=velocity in feet per second.

Response to Specific Scoping Comments on the Eicher Screen Even with the expected survival rates of 95%, some concern was raised early in the project about the screen diameter (10 ft selected vs. a larger 11 ft, NMFS letter, February 23, 1994). To determine whether the selected 10 ft diameter penstock would protect 95% of any fry (minimum sized outmigrant, coho fry ~ 44 mm, 1.8 in) present at the project from April 1 to July 31, a comparison of calculated survival rates for a 10 ft vs. 11 ft diameter screen was developed.

The assumptions for the analysis were: 1) flow duration curves are applicable (attachment 1); 2) extrapolated survival rates for coho fry at Elwha Dam's Eicher Screen are representative; 3) migrations of fry through Wynoochee Dam are unrelated to flow; and 4) survival rates are directly related to the maximum approach velocity component of the screen. Velocities for this analysis are based upon a maximum approach velocity component in the penstock of 40% of the average penstock velocity (anticipated conditions, NMFS memorandum of April 9, 1993). The analysis also assumes that current fry migration timing at Wynoochee Dam is similar to lake and scoop trap data from 1974 and 1975 (Table 5).

Based on the results of the calculations, a 10-foot diameter penstock should provide 95% protection for fry. There appears to be virtually no difference in the total calculated survival for 10-foot vs. 11-foot diameter penstocks (Table 6). Survival does vary slightly by month. April survival rates were as low as 90-92% for either penstock due to the higher exceedance flows expected for this first month of outmigration. However, less than 1% of coho fry are expected to be outmigrants at this time so the lower survival rate is negligible. Tables 7 and 8 provide monthly exceedance flows and monthly survival rates for each penstock diameter.

Table 5. Outmigrant timing of wild coho fry (minimum sized outmigrants) at Wynoochee Lake 1973-1975 (from Dunn 1978).

Month	1974 No. Captured	Lake Trap % of Total	1975 No. Captured	Lake Trap % of Total	1975 No. Captured	Scoop Trap % of Total	Mean Monthly Percent
April	0	0	0	0	43	<1	0%
May	0	0	0	0	5908	41%	14%
June	25	12%	505	23%	6913	48%	28%
July	183	88%	1661	77%	1439	10%	58%

Table 6. Calculated monthly and total survival of upper Wynoochee River coho fry[2] for 10 and 11 ft diameter Eicher screen penstocks.

Month	Coho Outmigrants	10 ft Penstock Survival	Total Survival	11 ft Penstock Survival	Total Survival
April	0%	90.1%	0.0%	92.2%	0.0%
May	14%	94.6%	13.2%	95.9%	13.4%
June	28%	96.3%	27.0%	96.7%	27.1%
July	58%	97.0%	56.3%	97.0%	56.3%
Total			96.5%		96.8%

1. Survival calculations for coho fry are presented by month and by penstock diameter in the Hydraulic Appendix: outmigration percentage is from Dunn (1978) and penstock survival estimates are from Elwha studies in comparison to Wynoochee monthly exceedance flows.
2. Coho fry were selected for comparison as the smallest sized outmigrant expected to use the penstock during the normal spring outmigration period.

APPENDIX I

FISH AND WILDLIFE COORDINATION ACT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
North Pacific Coast Ecoregion
Western Washington Office
3704 Griffin Lane SE, Suite 102
Olympia, Washington 98501
(360)753-9440 Fax: (360)753-9008

September 30, 1996

Colonel Donald T. Wynn, District Engineer
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124
Attention: Bruce Sexauer, Study Manager; Mike McNeely, Environmental Resources Section

Dear Colonel Wynn:

Enclosed is our draft Fish and Wildlife Coordination Act Report for the Wynoochee Section 1135 feasibility study. This study is a feasibility level effort to offset the remaining adverse impacts of the Wynoochee project on fisheries resources and was assumed under the authority of Section 1135 of the Water Resources Development Act of 1990. It has been prepared under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended, 16 U.S.C. 661 et seq.).

Copies of the draft report are also being provided to the state, federal, and tribal resource agencies that are parties to this project for their review and comment.

Sincerely,

David C. Frederick
Supervisor

sf/jmc
Enclosure
c: NMFS, Seattle (Bob Vreeland)
WDFW, Montesano (Dave Gufler)
Chehalis Indian Tribe, Oakville (Gene Deschamps)
Quinault Indian Nation, Taholah (Scott Chitwood)

U.S. Fish and Wildlife

Draft Coordination Act Report

WYNOOCHEE LAKE PROJECT

SECTION 1135
Feasibility Study

Prepared for
U.S. Army Corps of Engineers
Seattle District

Prepared by
Steve Fransen, Biologist
U.S. Fish and Wildlife Service
North Pacific Coast Ecoregion
Western Washington Office
Olympia, Washington

September 1996

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INTRODUCTION

This draft Fish and Wildlife Coordination Act report (DCAR) for the Wynoochee Lake Project Section 1135 feasibility study represents the U.S. Fish and Wildlife Service's (Service) preliminary views regarding the impacts to the fish and wildlife resources of the Wynoochee River basin of developing and implementing the contemplated components of the proposed Section 1135 project. This study is a feasibility level effort to develop a plan that, when implemented, will offset the remaining adverse impacts of the Wynoochee project on fisheries resources. This study was assumed under the authority of Section 1135 of the Water Resources Development Act of 1990. Aberdeen and Tacoma are the local sponsors of the Section 1135 project. Our report has been prepared under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended, 16 U.S.C. 661 et seq.).

The Wynoochee Reservoir Project was originally authorized by Public Law 87-874, Flood Control Act of 1962 for the multiple purposes of water supply, irrigation, flood control, fishery enhancement, and recreation. The Corps subsequently changed the name to the Wynoochee Lake Project. The City of Aberdeen, Washington was the local sponsor of the original project. Aberdeen and the City of Tacoma, Washington, as joint licensees, were granted a license by the Federal Energy Regulatory Commission to develop and operate a hydroelectric plant in 1987 as an additional authorized use. Subsequently, in 1993 the Army transferred the Wynoochee Lake Project to Aberdeen under the condition that the city operate, maintain, repair, replace, and rehabilitate the project in accordance with regulations prescribed by the Secretary that are consistent with the project's authorized purposes.

PROJECT LOCATION AND DESCRIPTION

The Wynoochee River is one of several river systems draining the southern slopes of the Olympic mountains on western Washington's Olympic peninsula in Grays Harbor County. The Wynoochee River is 63 miles long and is a major tributary to the Chehalis River, which subsequently drains into Grays Harbor. The Wynoochee River's source is the 4,500 foot elevation peaks near Sundown Pass in the Olympic National Park. Much of the upper drainage is in the Olympic National Forest. Just downstream from the Wynoochee Dam, the river enters the 18 mile long Weatherwax Basin, a steep sided canyon area. The river flows almost due south past the town of Montesano to its confluence with the Chehalis River. The lowermost mile of the Wynoochee is influenced by Pacific tides from Grays Harbor. The Wynoochee River drainage area is approximately 197 square miles. The basin is bounded on the east by the Satsop River drainage and on the west by the Humptulips and Wishkah River basins. The climate is generally mild, and runoff is primarily influenced by precipitation, which varies from about 80 inches annually near the river's mouth to about 140 inches per year near the reservoir.

Water impounded in the reservoir is released under controlled conditions to prevent downstream flooding during periods of high runoff and to augment low natural river flows for the benefit of

downstream water users and fisheries during periods of low runoff. The principal fisheries benefit is that of increased minimum instream flows downstream of the City of Aberdeen's water diversion at river mile 8.1. Prior to development of the Wynoochee project, flows of less than 40 cfs commonly blocked the upstream migrations of adult chinook and coho salmon. The 175 foot-high dam is sited at river mile 51.8, and a small barrier dam and fish trap are located at river mile 49.6 to facilitate the trapping and hauling of upstream migrating fish.

Wynoochee Lake impounds water to an elevation of 800 feet, msl. The reservoir extends 4.4 miles upstream, covering 1,122 acres, with a live storage capacity of 59,415 acre-feet. Total storage is about 70,000 acre-feet.

The proposed project is described with four components. They are:

1. An Eicher screen in the penstock of the hydroelectric plant.

2. Supplementation, or short-term fish rearing, ponds.

3. A modified spring refill curve and improved spring and summer streamflows to improve juvenile fish outmigration and instream rearing.

4. Modifications to the trap at the barrier dam to facilitate the sorting of adult fish.

The proposed project modifications and improvements would be operated and maintained by the local sponsor.

The Eicher screen is the major component of the proposed project. Its purpose is to significantly increase the effective rate of survival of juvenile fish that are passed downstream. An Eicher screen is an elliptically shaped fine mesh screen placed diagonally in a pipeline. In this case the pipeline is the turbine penstock of the hydroelectric generator. The screen diverts fish from the turbine water supply and into a smaller diameter bypass pipeline that safely transports the fish around the passage hazard or obstacle and back to the river or stream. The Eicher screen was selected as the alternative most likely to significantly improve the downstream passage survival of juvenile salmon and steelhead at a reasonable cost.

Supplementation ponds are proposed to augment production of coho and steelhead. These species predominate in passage upstream of the dam and therefore, are most affected by downstream passage losses. The supplementation ponds would offset continuing losses of these fish due to the screening structure and from residualization in the reservoir. The proposed screen is expected to achieve 95 percent survival. Some smolts never migrate out of the reservoir, regardless of passage technique, resulting in chronic, continuing losses to the fish populations. Two supplementation ponds are proposed; one would provide final rearing for 25,000 steelhead smolts and the other for 55,700 coho smolts. An additional 1,000 steelhead recruits and 1,210 coho spawners are the anticipated result of developing and operating these ponds. The supplementation ponds would be located across the river

from the powerhouse, a short distance downstream of the dam. The site for the ponds is a former lay down area for the construction of the powerhouse and is already cleared. The exact size and design of the ponds has not yet been developed, but each pond is estimated to be about 30 feet by 60 feet by 8 feet deep. The water supply is from the reservoir and routed through the powerhouse. The basic plumbing was included during construction of the hydroelectric project.

The third component and benefit of the proposed project is improved streamflow coupled with a modification to the spring refill curve that would benefit the spring outmigration of smolts and increase the juvenile rearing capacity of the mainstem Wynoochee River downstream of the project by providing increased streamflow. The modification would allow pool refill to begin 25 days earlier and fill 7 to 10 days earlier. Refill would begin from the flood storage elevation of 776.1 feet on March 1, instead of March 25, filling to elevation 795 feet by April 13, where it would be held through the end of the month to provide some very late season flood storage. On May 1 the pool would be allowed to finish filling to full pool at 800 feet. This modification improves the water storage scenarios for spring and summer flow release enhancements for fish. Increased target flows at Save Creek (about 10 miles downstream of the dam) would be met more often and held for a longer period of time.

Modification to the existing trap and haul facility is a necessary project component as well. The present trap was not designed with the sorting of adult fish as an operational procedure. Sorting is necessary to obtain the desired wild broodstock, that is, fish that are the result of natural production. An additional holding pond would be added to the trap to facilitate sorting hatchery fish from natural production fish.

The proposed modifications are consistent with the multiple purposes of the project. The modifications provide further mitigation of original project impacts to the fishery while not affecting water supply, irrigation, recreation, or flood control. Hydropower would be beneficially affected by the Eicher screen because the power plant could then operate during the spring outmigration. It is presently required to be shut down for 77 days during the spring. Hydropower could also be affected somewhat by increasing summer streamflow by a reduction in head caused by drafting the reservoir.

FISH AND WILDLIFE RESOURCES IN THE WYNOOCHEE RIVER BASIN

Wildlife Resources

Wildlife species present in the Wynoochee River basin correspond to the habitat types present. Habitat diversity is represented by the Montane Forest community that ranges in this area from nearly sea level to elevations above 4,000 feet. The lower Wynoochee valley is developed as agricultural pasture and crop land, while all the upper valley and watershed are in timber production. A substantial riparian corridor adds to the overall habitat diversity. Wildlife species in this area are

those common throughout western Washington. A unique occurrence is that of Roosevelt elk *(Cervus canadensis roosevelti)*, whose distribution in Washington state is limited to the Olympic Peninsula and southwest Washington.

Fisheries Resources

Anadromous and resident fish species naturally occur in the Wynoochee River basin. The best known species are the migratory Pacific salmon and trout. Resident trout are common as well, particularly in the upper river and its tributaries and upstream of migratory barriers. The salmon species include chinook *(Oncorhynchus tshawytscha)*, coho *(O. Kisutch)*, and chum *(O. Keta)*. The trout species, in anadromous and resident forms, are represented by *O. mykiss* and *O. clarki*, rainbow and cutthroat, respectively. Bull trout, a species presently proposed for listing as threatened or endangered under the Endangered Species Act, may occur in the Wynoochee River system, however, there is no confirmation of their presence at this time. Other species of fish that occur in the Wynoochee include whitefish, suckers, squawfish, sculpins, dace, and sticklebacks.

The chinook salmon population historically included both spring and fall stocks. However, spring chinook were apparently few in number and have reached the Wynoochee trap at River Mile 49.6 infrequently, and then only in very small numbers, since the project went online over 20 years ago. Small numbers of fall chinook, averaging about 50 or one percent of the spawning escapement, continue to be trapped and hauled upstream of Wynoochee Dam each year. These comprise a viable population only if aggregated with those chinook spawning downstream of the dam.

Coho salmon are the largest salmonid population in the Wynoochee River basin. Nearly 4,000 of these fish have escaped to spawn annually in recent years. A significant run of steelhead returns to the Wynoochee, supporting commercial and recreational fisheries. A spawning escapement of over 2,000 steelhead has been realized in recent years. Sea-run cutthroat trout are common to the basin, but their numbers are not enumerated.

SITE SPECIFIC FISH AND WILDLIFE RESOURCES

Most of the fish and wildlife species common to the Wynoochee River basin occur at or near the vicinity of the project. As previously mentioned, chinook salmon continue to be trucked upstream of Wynoochee Dam, but their numbers are few, about one percent of the total escapement. Coho salmon and steelhead trout are the predominant migratory species that continue to reproduce upstream of the dam. About 25 percent of the coho escapement and 20 percent of the steelhead escapement are trucked upstream of the dam annually. Sea-run cutthroat are also occasionally passed upstream, but an adfluvial population of cutthroat is sustained by Wynoochee Lake and the Wynoochee River upstream of the reservoir (LaRiviere, pers. comm.).

THREATENED AND ENDANGERED SPECIES

The project area is within the normal range of northern spotted owls (*Strix occidentalis caurina*), marbled murrelets (*Brachyramphus marmoratus marmoratus*), and wintering bald eagles (*Haliaectus leucocephalus*). These species are listed by the federal government as threatened in the state of Washington. Bull trout (*Salvelinus confluentus*), presently a candidate species for listing, may occur in the Wynoochee River basin, but their presence is not confirmed.

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, the Corps is required to assure that their actions have taken into consideration impacts to federally listed or proposed threatened or endangered species for all federally funded, constructed, permitted, or licensed projects.

Therefore, the Service has enclosed a species list (Attachment A) as a response to Section 7(c) of the act. The Corps should assess the potential of the project to affect listed species and determine the need to prepare a biological assessment. Those responsibilities are described in Attachment B.

POTENTIAL IMPACTS TO FISH AND WILDLIFE RESOURCES

Wynoochee Dam is an obstruction to the free upstream and downstream migration of resident and anadromous fish. It impounds over four miles of formerly free-flowing river with an 1,100 acre reservoir whose area, volume, and surface elevation vary seasonally. The reservoir provides incidental fish habitat, while flooding the former riparian habitat and displacing the wildlife that was associated with it.

Wildlife mitigation for the development of the Wynoochee Lake Project took place in the form of a 1,030 acre wildlife management area, located downstream from the project along the Wynoochee River. Fisheries mitigation occurred in three forms. First, a barrier dam with trap and haul facilities was constructed and is operated to provide access to the upper watershed to migratory fish. Second, multi-level outlet structures were designed into the dam to provide two specific benefits: to provide egress for downstream migrating salmon and steelhead smolts and to provide temperature control so that the summer thermal regime of the water supply can be regulated to replicate pre-project temperatures. The third form of mitigation was a cash payment to the Washington Department of Game (now Washington Department of Fish and Wildlife, WDFW) to offset the loss of steelhead rearing habitat with hatchery fish. The WDFW raises juvenile steelhead trout at the Aberdeen hatchery to stock the Wynoochee River to mitigate for the loss of steelhead habitat caused by the dam.

The wildlife acreage has generally been satisfactory mitigation for the habitat lost to the reservoir upstream of Wynoochee Dam. The management of the mitigation property caused the state and the

Service some concerns at times. However, those were resolved in a 1993 agreement between the state and the licensees. Most of the fisheries mitigation features have been similarly satisfactory, except for smolt residualization in the reservoir and the downstream passage and passage effectiveness of the multi-level outlets. Studies and evaluations by Dunn (1978), Hiss (1983), and Mathews (1980) indicate downstream passage losses of 14 percent of coho smolts and a 24 percent loss of steelhead smolts. Dunn (1978) also found that a significant proportion of smolts residualize in the reservoir.

DISCUSSION

Fish Screens

The screen, supplementation ponds, and streamflow improvements of the proposed 1135 project are expected to ameliorate the residual adverse impacts of the Wynoochee Dam Project to the basin's fisheries resources. The screen and streamflow modification would benefit the existing fishery resource by directly increasing survival. Any screening alternative, including the Eicher, is expected to produce some loss, but 95 percent survival is the target objective for this installation. This objective is consistent with the results obtained at a similar Eicher screen installation on the Elwha River.

The supplementation ponds were selected as the best alternative to mitigate any continuing fishery losses due to passage facilities and to residualization of smolts in the reservoir. Several alternatives were analyzed for each mitigation component.

An Eicher screen was the initial choice for the juvenile fish passage improvements. In 1995, Tacoma Public Utilities conducted tests in the multi-level outlet gates and the turbine wetwell in six 36 hour sampling periods during the spring smolt outmigration period. The results indicated that fish passage rates were significantly higher through the multi-level outlet gates than through the penstock, suggesting that smolts are reluctant to sound through the wetwell to the elevation where entrainment velocities occur. Consequently, the agencies and Tacoma elected to consider other passage improvement alternatives. The other alternatives considered included the following:

A. A collector similar to that at Green Peter Reservoir In Oregon.

B. A Modular Inclined Screen (MIS).

C. A "miniature," or reduced scale Modular Inclined Screen.

D. Modifications of the existing multi-level outlets.

A Green Peter style smolt collector may be suitable to the Wynoochee application, but high cost and seasonally unsuitable surface water temperatures caused this alternative to be dropped. The MIS also presents an engineering problem concerning the collection of attraction water near the surface where the fish are and simultaneously meeting the water temperature requirements for downstream release. (Wynoochee has multi-level outlets so that surface and deep water can be combined to control release temperatures.) The miniature MIS was included to check a lower cost alternative to the standard MIS. The miniature MIS could not pass the full range of project flows and would have to be hard coupled to one outlet at a time and therefore has limited operational feasibility. Modifying the existing multi-level outlets would improve passage, but it would not allow power generation during the outmigration season.

These alternatives were examined as being less expensive, potentially more viable options, to the initial choice. The Corps' analysis, however, indicates that they are not less expensive, and they may include engineering or operational problems. The agencies then reconsidered the initial alternative, the Eicher screen, and proposed to modify the turbine wetwell to create attraction and capture velocities. The proposed modification of this application of an Eicher screen should not be adversely affected by the smolts' reluctance to sound in the wetwell, and the Corps estimates that it can be completed within the available budget.

Supplementation Ponds

The fish supplementation ponds were proposed to mitigate the continuing or residual losses of fish due to the project. Some parties raised concerns about hatchery fish interactions with the indigenous Wynoochee River stocks of salmon and steelhead. The alternatives considered range from very intensive fish culture, with standard hatchery stocks and practices, to less intensive culture techniques, to no fish culture - just habitat improvement projects that may increase natural fish production. The agencies' analysis, including the Service's, of the natural production alternative concludes that habitat improvement projects alone would not increase existing production enough to offset project-induced losses. Therefore, the Service supports this mitigation component of the proposed project.

To address hatchery stock - wild stock concerns, a draft (9/12 & 25/94) fish supplementation protocol was developed by the Washington Department of Fish and Wildlife. Unmarked broodstock from natural production will be collected at the Wynoochee River fish trap whenever available. Marked fish, or broodstock that has cycled through fish culture would only be used if there are insufficient natural production fish. The Aberdeen and Simpson hatcheries (existing off-site and out-of-basin facilities) are planned for egg incubation and early juvenile rearing. The juvenile coho and steelhead will be transferred to the supplementation ponds in mid-winter for final rearing, imprinting, and release. This alternative does not preclude any genetic introgression from occurring among the hatchery and wild stocks, but according to WDFW geneticists it would be minimized if subsequent hatchery adults are selectively removed at the adult trap from the naturally spawning population.

Flow Modification

Direct rainfall is the most dominant influence on Wynoochee River discharge. The dominant winter discharges shape the river channel and characterize the fish habitat. The basin headwaters receive a limited winter snowpack that runs off early in the season. Consequently, high spring outmigration flows only occur with coincidental spring rainfall, and summer rearing flows for the stream rearing obligate species were invariably low prior to construction of Wynoochee Dam. Smolt survival rates are generally directly correlated with spring discharge, and smolt populations are similarly influenced by summer and fall minimum streamflow. Under existing conditions, summer flows exceed pre-project levels, thereby increasing juvenile rearing habitat. This Section 1135 project includes a hydrologic and hydraulic analysis component by the Corps to identify improvements that may be made to these still limiting minimum stream discharges.

Modifying the spring refill curve would increase the likelihood of pool refill from 80 percent to 92 percent according to the Corps' hydrologic analysis, prepared as Appendices F and G to the environmental assessment for the project. Improving refill enhances the ability to meet a designated target flow at the Save Creek gage (about 10 miles downstream of the dam) for a longer period of time. The analysis and flow management has certain constraints. The hard minimum flow requirements can be illustrated as follows:

Black Creek, river mile 5.9	120 cfs, 130 with safety factor.
Aberdeen diversion, river mile 8.1	140 cfs, in addition to Black Creek requirement.
Grisdale gage, river mile 51.3	190 cfs, 200 with safety factor (July through April and 140 cfs, May and June).

The Corps' analysis used 130 cfs at Black Creek and maintained 200 cfs year roung at Grisdale. Our review concurs with the Corps that several flow improvement scenarios are possible with these hard constraints and the naturally varying range of the available water supply. Since Tacoma Public Utilities has developed a hydroelectric generating station at Wynoochee Dam an additional constraint is imposed. As a practical matter, Tacoma cannot generate with the pool elevation below 763 feet although live storage is available in the reservoir down to elevation 720 feet.

The Corps' analysis includes four alternatives. The alternatives include two target flows and two switching elevations. The switching elevations represent the threshold elevation at which the flow release would be switched from maintaining the target flow at Save Creek to the minimum flow release of 190 cfs from the dam. The target flows at Save Creek are 330 and 345 cfs and switching elevations are 763 and 770 feet. Each of these alternatives are operationally feasible from a water supply perspective, and the 345 cfs with the 763 switching elevation is preferred from a fish habitat perspective. However, a target flow improvement to 330 cfs at the Save Creek gage and a 770 feet switching elevation (Tacoma's selected alternative) is the least costly of the four alternatives to hydropower production. Spring outmigration flows would average 15 percent more water than

existing conditions, and summer rearing would average 12 percent more water than at present. Higher target flows and lower switching elevations would have incrementally severe impacts on hydropower production coupled with incremental enhancements to fish habitat. The alternatives analyzed represent power production losses ranging from $10,000 to $30,000 annual averages. Of the several operating and water supply constraints, hydropower is the first constraint affecting the provision of additional flow for fish habitat.

Trap Modification

The project proposal has been amended at the request of WDFW to include modifications to the trap and haul facility. Presently the trap is not configured for convenient or efficient sorting of adult fish. Manual sorting in the holding area is the only existing option. The modification would add an additional holding tank to allow operators to efficiently separate hatchery and natural production fish, based on marks. Improved separation would minimize handling stress that the fish would otherwise experience by sorting in the existing trap. The state's hauling truck would also be modified to accommodate water to water transfers frem the hopper.

RECOMMENDATIONS

The Service supports the proposed Section 1135 project to modify Wynoochee Dam to improve fish passage, develop and operate supplementation ponds, improve flow releases from the dam, and modify the adult fish trap. Our specific recommendations include:

1. The Service recommends the installation and operation of the preferred alternative, an Eicher screen in the turbine penstock of the hydropower project. The penstock wetwell, as presently configured, does not produce velocities sufficient to capture migrating smolts. Tacoma's 1995 hydro acoustic study of fish behavior in the wetwell indicates that they are reluctant to sound to the depth necessary to be captured by penstock velocities. Therefore, the Service recommends that the Corps' final plans and specifications include specific modifications to produce the necessary capture velocities of 6 feet per second, or better.

2. The Service recommends the development and operation of the fish supplementation ponds according to the draft protocols developed by WDFW.

3. The Service recommends modifying the spring refill curve as proposed to improve the probability of refill.

4. The Service recommends adoption of the flow release alternative of a target flow of 345 cfs at the Save Creek gage when the elevation of Wynoochee reservoir is 763 MSL, or

higher. This recommendation is made consistent with the original project purposes of water supply, irrigation, flood control, recreation, and fishery resource enhancement. The recommendation does not divert any water away from hydropower production but would affect the net head and timing of a small part of the total power production.

5. The Service recommends releasing the minimum flow of 190 cfs when the elevation of Wynoochee reservoir is below 763 MSL.

6. The Service recommends modifying the adult fish trap to facilitate sorting hatchery fish from those resulting from natural production.

REFERENCES

Dunn, C.A. 1978. Evaluation of downstream fish passage through multilevel outlet pipes at Wynoochee Dam. Washington State Department of Fisheries Progress Report 45.

Hiss, J.M., J.H. Meyer, and R.S. Boomer. 1983. Evaluation of existing fisheries resources at the Wynoochee Lake Project. USFWS Western Washington Fisheries Assistance Office.

LaRiviere, M. 1995. Fisheries Biologist for Tacoma City Light. Personal communication.

Mathews, S.B. 1980. Effects of Wynoochee Dam on anadromous fish. College of Fisheries, University of Washington. Report for Seattle District Corps of Engineers.

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES WHICH MAY OCCUR WITHIN THE VICINITY OF THE PROPOSED SECTION 1135 PROJECT IN GRAYS HARBOR COUNTY, WASHINGTON

1-3-96-SP-594

LISTED

Bald eagle *(Haliaeetus leucocephalus)* - wintering bald eagles may occur in the vicinity of the project from about October 31 through March 31. There is a bald eagle nest in the vicinity of the project.

Major concerns that should be addressed in your biological assessment of project impacts to bald eagles are:

1. Level of use of the project area by bald eagles.

2. Effect of the project on eagles' primary food stocks and foraging areas in all areas, in addition to roosting, nesting, and dispersal habitat for applicable species in all areas influenced by the project.

3. Impacts from project construction and operation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) which may result in disturbance to eagles and/or their avoidance of the project area.

Marbled murrelet *(Brachyramphus marmoratus marmoratus)* - murrelets do occur and occupy a site in the vicinity of the project.

Northern spotted owl *(Strix occidentalis caurina)* - a designated spotted owl circle is in the vicinity of the project.

PROPOSED

None

CANDIDATE

Bull trout *(Salvelinus confluentus)* Bull trout may occur in the vicinity of the project.

ATTACHMENT B
FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c)
OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - Consultation/Conference

Requires:

1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with FWS when a federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with FWS when a federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which is/are likely to be affected by a construction project. The process is initiated by a federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with our Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Division, 3704 Griffin Lane SE, Suite 102, Olympia, W 98501-2192.

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* "Construction project" means any major federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes federal action such as permits, grants, licenses, or other forms of federal authorization or approval which may result in construction.

APPENDIX J

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO ATTENTION OF
CENPS-EN-PL-ER

10 January 1997

FINDING OF NO SIGNIFICANT IMPACT
WYNOOCHEE DAM SECTION 1135
FISH AND WILDLIFE RESTORATION PROJECT

As described in the accompanying Project Modification Report (PMR) and Environmental Assessment (EA), Seattle District has considered alternatives for modifications for improvement of fish passage, production and instream flows at the Wynoochee Dam Project, Wynoochee River, Grays Harbor County, Washington, under Section 1135 of the 1986 Flood Control Act. The city of Tacoma Public Utilities Division is local sponsor for this study.

The Wynoochee Dam Section 1135 Study has investigated methods of restoring the coho and steelhead fish runs in the Wynoochee River to pre-project historical levels. Studies in the 1970s showed that a notable number of coho and steelhead smolts that pass through the project during their downstream migration are killed. This Section 1135 project will reduce this loss in three steps. First, improved fish passage will be gained through the hydropower intake structure where an Eicher fish screen will move the juvenile fish around the penstock into a bypass system for transportation into the Wynoochee River downstream of the project. The second step will be the construction of rearing facilities just downstream of the project. These rearing ponds will be used to acclimate coho and steelhead smolts before their release into the Wynoochee River. The third step will include increasing the river flows by increased releases from the project in the spring and summer months to assist in the downstream migration of fish and help enhance the habitat in the lower 52 miles of the Wynoochee River. The combination of these three steps will restore the fish runs to a more historic condition.

The study examined alternatives based on several categories of potential project components to restore coho and steelhead fish runs in the Wynoochee River. In addition to a No Action alternative, the study analyzes various:

- downstream fish passage plans
- increased flow regimes
- supplementation ponds
- fish trap improvements

The preferred alternative selected from the above four (4) categories is based on the overall criteria of maximizing improvement opportunities while minimizing potential impacts.

The proposed project modification is consistent with the project purpose and provides a positive benefit to fish resources. Impacts to other environmental amenities are minimal.

This study has been coordinated with resource agencies, environmental interest groups, tribes, and interested individuals from the outset. In August and September 1996, the draft PMR/EA was widely distributed for a thirty (30) day review and comment period. Commentors generally concurred with the selected preferred plan; some offered various technical points of view related to operation of the plan; downstream fishery issues; and refill/release strategy. The Corps responded point-by point to each comment and revised the PMR/EA as appropriate. These letters and documented revisions are attached as an appendix to the PMR/EA.

The planning for this PMR complies with all applicable laws, regulations, and agency consultations, including the Endangered Species Act, Fish and Wildlife Coordination Act, and National Environmental Policy Act. Based on the analysis described above and provided in more detail in the PMR/EA, this project is not a major Federal action significantly affecting the quality of the human environment and, therefore, does not require preparation of an environmental impact statement.

22 Jan 97
Date

Donald T. Wynn
Colonel, Corps of Engineers
District Engineer