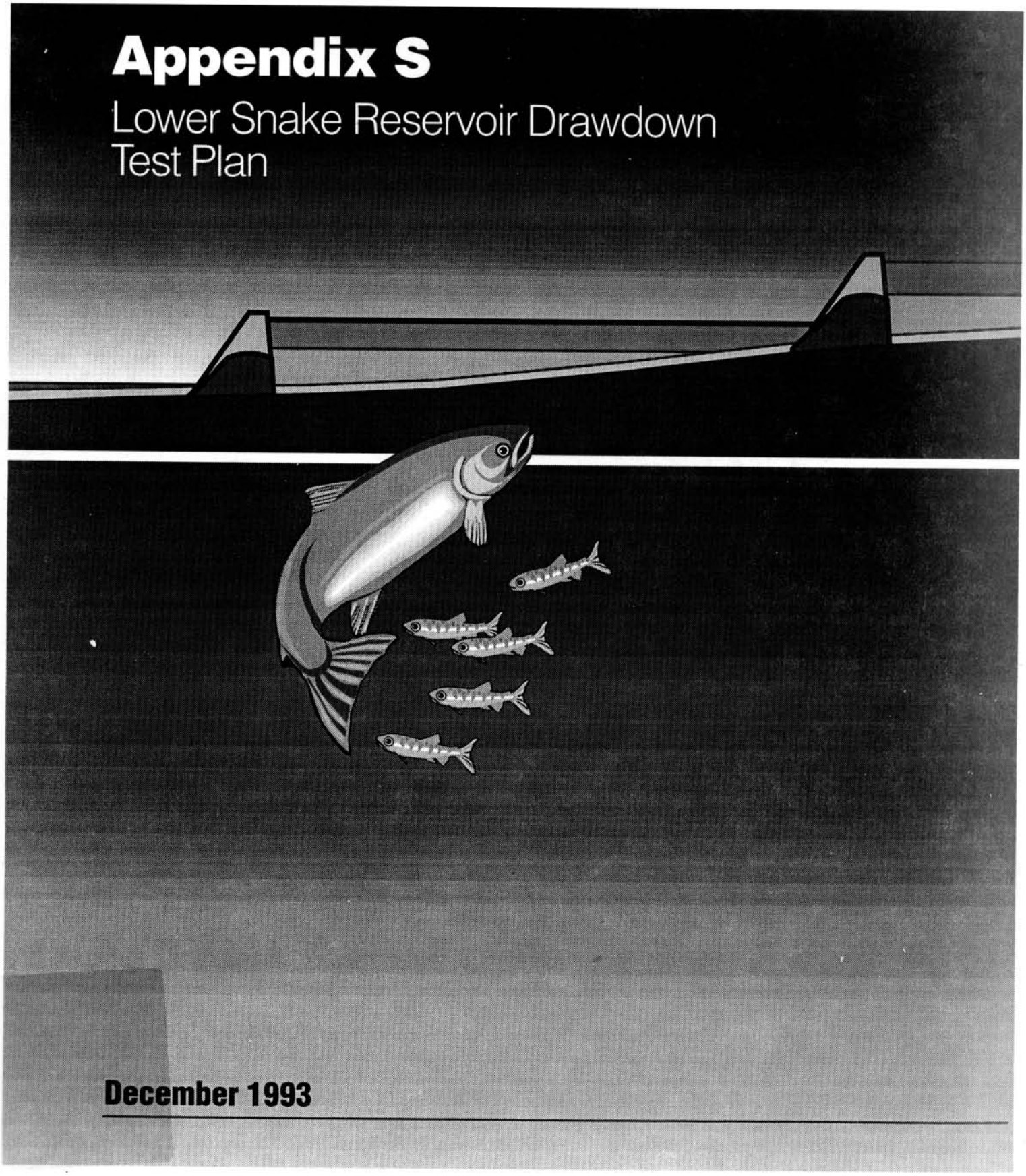
US Army Corps
of Engineers
Walla Walla District

1992 Reservoir Drawdown Test

Lower Granite and Little Goose Dams

Appendix S

Lower Snake Reservoir Drawdown Test Plan



December 1993

APPENDIX S

LOWER SNAKE RESERVOIR

DRAWDOWN TEST PLAN

1992 Reservoir Drawdown Test

Lower Granite and Little Goose Dams

Sarah J. Wik
Walla Walla District
U.S. Army Corps of Engineers

APPENDIX S

1992 RESERVOIR DRAWDOWN TEST
LOWER GRANITE AND LITTLE DAMS

LOWER SNAKE RESERVOIR DRAWDOWN
TEST PLAN

The document contained in this appendix is the plan for the March 1992 reservoir drawdown test, drawn up prior to the test initiation. The plan was a cooperative effort on the part of every major division in the Walla Walla District, U.S. Army Corps of Engineers. This plan was used to implement the drawdown test, but some changes took place from the initial test designs and plans. Changes from this original plan are noted, where appropriate, in the 1992 Reservoir Drawdown Test, Lower Granite and Little Goose Dams Main Report.

LOWER SNAKE RESERVOIR DRAWDOWN TEST PLAN

MARCH 1992

WALLA WALLA DISTRICT
CORPS OF ENGINEERS
17 February 1992

TABLE OF CONTENTS

I. BACKGROUND

Dams in the Columbia River Basin have provided many benefits to the region, including power, navigation, irrigation, recreation, and more. However, these structures have also had negative effects, particularly on salmon populations that migrate through the system on their way to and from the ocean. Although adult fish passage facilities were constructed in each of the eight mainstem lower Snake and Columbia River Dams, and juvenile fish bypass facilities will be complete in all by 1998 (six of the eight will be operational in 1992), the reservoirs created by the dam pose additional problems. Water velocities through these reservoirs are greatly reduced as compared to pre-dam times as a result of increased cross-sectional area and changes in the natural hydrograph resulting from storage projects such as Dworshak and Brownlee.

The number of salmon returning to the Columbia River basin is estimated to be approximately 20% of the original runs, the majority of which are hatchery fish. These declines are a result of many aspects of development: dams, irrigation, harvest, water pollution, etc. In April and June of 1990, the Snake River stocks of Sockeye (Oncorhynchus nerka), and Spring, Summer and Fall Chinook (Oncorhynchus tshawytscha) were petitioned for protection under the Endangered Species Act. A regional team, comprised of State and Federal fish agencies, river system operating agencies, environmental groups, and river users, was formed to develop a recovery plan for these stocks. The team, known as the "Salmon Summit", met for several months but were unable to reach a consensus on a plan. However, many ideas for additional measures to improve conditions through the hydrosystem were suggested and evaluation of these concepts has been an ongoing process.

The concept of drafting lower Snake River reservoirs to elevations at which water flows freely over the spillway (approximately 30-40' below normal minimum operating pool) was proposed at the Salmon Summit to assist juvenile salmonids in their downstream migration. Lowering the water surface elevation of the reservoir reduces the cross-sectional area and increases the average water particle velocity. An inter-agency group met in April 1991, facilitated by the Corps of Engineers, to develop potential alternatives for a test of the reservoir drawdown concept. The group reconvened in September and October 1991 to develop specific elements of the test design.

The following document contains the implementation, monitoring, evaluation, and coordination plans for a test drawdown of two lower Snake River reservoirs, Lower Granite and Little Goose during March 1992. The test is designed to allow the Corps of Engineers and other parties to gather information to assist in evaluating the concept of substantial reservoir drawdown for long-term usage to speed the spring outmigration of the juvenile salmon. The proposed time frame for this test is March 1 - 31, 1992. The March test period provides for a physical rather than a biological test because of concerns expressed regarding potential fish impacts during the

more active migration period.

The plans within this document will continue to be developed up to the time of actual implementation. Because some of the plans were intended to be stand alone documents for a particular division within the Walla Walla District Corps of Engineers, there is repetition among this overview plan (to be used for general distribution) and the individual detailed plans (for distribution to technical personnel).

II. TEST PLAN

A. OBJECTIVES

Evaluate environmental and structural/physical effects of reservoir drawdown to near spillway crest elevation. Potential effects on structural integrity of project facilities; bank erosion; sediment resuspension; anadromous and resident fish, and other aquatic organisms; water quality; water velocities and flow patterns; wildlife; cultural resources; and recreation will be monitored and evaluated. Specific objectives for each of these areas are identified as follows:

1. Ability of existing Kaplan turbines to operate under significantly reduced head and tailwater elevations.

2. Effect of reduced head and tailwater elevations on dissolved gas supersaturation levels created during spill events.

3. Hydraulic conditions in stilling basin and tailrace at reduced head and tailwater elevations; confirmation of physical model.

4. Erosion of downstream area below stilling basin.

5. Heretofore unidentified problem areas to be evaluated using the physical models.

6. Movement of predator populations from upper to lower reservoir; predator concentrations.

7. Relative change in water velocities from normal pool to near spillway crest elevation.

8. Extent of potential shallow-water habitat and aquatic vegetation loss under significant reservoir drawdown conditions.

9. Effect of significant reservoir drawdown on benthic organism populations.

10. Sediment transport as a result of drawdown.

11. Potential for impact to cultural resource sites under significant reservoir drawdown conditions.

12. Effect of pool lowering and refill on embankment (railroad, highway, levee, dam) stability.

13. Effect if reservoir drawdown on groundwater flow and contaminant transport through the Lewiston levee encapsulated fill.

14. Effect of pool lowering on movement of pre-migratory salmonids rearing in Lower Granite reservoir.

15. Effect of pool lowering on furbearers, water fowl, etc.

Data obtained during the test time frame will represent acute/immediate effects of this test, and may not be representative of conditions likely to occur should the system be operated in such a fashion over longer periods of time, but can be used in designing possible long-term reservoir drawdown operations.

B. APPROACH

1. Basic test design - Beginning on March 1, Lower Granite reservoir will be drafted from minimum operating pool to an elevation of 705 mean feet above sea level (MSL) at a maximum rate of two feet per day. All water will be passed through the turbines, if possible. While Lower Granite reservoir is maintained between elevation 705 and 703 MSL, Little Goose reservoir will be drafted two feet per day until free-flow conditions exist in Lower Granite tailwater or until flows dictate the need to begin refill in order to have all fish facilities operable by April 1. (Little Goose drafting will occur during daylight hours only. Intensive monitoring of shoreline areas should allow detection of fall chinook redds. If found, drafting will be terminated and refill initiated.) If flows are high enough, Lower Granite reservoir will then be drafted the remaining distance to near spillway crest (at a rate of two feet per day), and any time remaining prior to refill will be used to test various combinations of spill and powerhouse flow. Refill of both pools to minimum operating level will be complete by April 1 and will be accomplished using zero-nighttime flow and a minimum of 11,500 cubic feet per second (cfs). Figures 1 - 4 are example drafting and refill plans for various potential flow levels.

The above scenario assumes that no structural problems occur, turbines are functional throughout the range of head, and conditions remain safe. Any one of several factors may necessitate a change in test design. It is understood that involved parties will be in close coordination before and during the test period. The proposed basic test plan is therefore an "ideal" plan, but may have to be modified to some extent. It was generally agreed that all possible information would be gathered during the drafting and refill process, even if it is not possible to achieve near spillway crest elevations.

Detailed pool lowering and reservoir regulation plans are included in Addendum A.

2. Structural/Physical Monitoring

a. Turbine Operation - The turbines at Lower Granite and Little Goose will theoretically operate within the head range proposed for this test without significant risk of unit damage, although this has never been field-tested. (If operated within 1% of best efficiency, they will still be within their design cavitation safety margins according to the original turbine model test.) The following objectives have been identified for turbine monitoring:

1) Determine/verify the operating power range of the turbines (Units 1-3, and 4-6) as the head and tailwater levels are drawn down.

2) Determine (if possible) the change in relative efficiency in the turbines.

Turbines will be operated and cooling water systems for turbine, generators, and transformers will be monitored as the pools are lowered. Instrumentation will be installed in Units 3, 4, and 5 at Lower Granite. Standard length submerged traveling screens will be installed in Units 1, 2, 3, 4, and 6 simulated extended length submerged screening devices will be installed in Unit 5. Turbine operation will be measured as each pool is lowered approximately 10 feet. Appendix B, the Operations Plan for the drawdown, further describes turbine testing procedures.

b. Safety

1) **Dam - Embankments and Stilling Basin** - A sectional model of the spillway has been constructed at the Corps' Waterways Experiment Station (Vicksburg, Mississippi) and will be used to determine maximum spill levels allowable under proposed head and tailwater elevations. (Details of the sectional model testing and other preparatory hydraulic efforts are included in Addendum A.) Effects of spill on the stilling basin will be field-tested to verify model results by drafting Lower Granite reservoir to elevation 705 feet above mean sea level (MSL), spilling in accordance with model test results for several hours while drafting to 703, and then shutting off the spill to allow inspection of the basin. Lower Granite reservoir will be refilled to 705 prior to the next test. This test will be performed approximately every other day as Little Goose reservoir is drafted up to 15 feet below minimum operating pool (to whatever elevation is equivalent to natural river conditions below Lower Granite and is possible under flow conditions). The stilling basin will be surveyed for possible physical damage on an approximately alternate day basis, unless model results indicate the need for examination following each spill test.

A Lower Granite forebay elevation of 703-705 for this portion of the test is required to maintain spillway gate control of the

flow. This operation is important in preventing damage to the stilling basin which could be caused by uncontrolled spill at lowered tailwater elevations. The two foot range of head will allow simulation of higher flows without having a significant impact on test conditions since this water surface elevation is within the near spillway crest range under higher flows.

Embankments will be monitored on a continuous basis throughout the test period.

2) **Reservoir structures** - Railroad and highway embankments, the Lewiston levee system, and all other areas potentially at risk of failure will be monitored on an as-needed basis. Inspections will be made both on the ground and from the air. Types of fill material used in the levees and embankments will be recorded for future reference, where possible. Areas of slumping will be documented. The encapsulated toxic waste fill area will be monitored through groundwater wells that will be installed. Contaminant concentrations in the groundwater at the encapsulated fill will be compared before, during and after the test period.

Addendum A is the engineering surveillance plan for the pool lowering test. Additional details regarding physical/structural monitoring are included in this document.

3. Environmental Monitoring

This section presents an overview of planned environmental monitoring during the reservoir drawdown test. Details on each of the efforts identified below are included in Addendum C of this plan.

a. Water Quality/Velocity Monitoring

1) Dissolved Gas Levels - The primary objective of this monitoring is to determine the levels of dissolved gas supersaturation that will occur with consecutive reservoirs at near spillway crest elevations, and over as wide a flow range as possible. Dissolved gas levels will be monitored above and below Lower Granite Dam before, during, and after periods of spill during the test.

In the event that turbines cannot be operated as the reservoirs are drafted and refilled during this test process, and model tests indicate that spill is acceptable as long as Lower Granite tailwater is maintained within normal operating pool elevations, water flow may be passed over the spillway. The decision on this element will be made sometime in late January based on modelling results. If spill is acceptable, dissolved gas levels will be monitored. Should dissolved gas supersaturation levels exceed 125% for 12 hours, the test will be stopped and refill initiated. This measure is to protect likely fall chinook fry below Lower Granite. The value of 125% was chosen based on general consensus of the reservoir drawdown inter-agency design team. The drawdown design

team did not consider it likely that the shorter spill tests (two to four hours) would affect these fish, or other aquatic organisms, even if dissolved gas levels exceed 140%. (Note: These values do not guarantee protection of fall chinook within redds below Lower Granite Dam.)

2) Sediments - The effects of the reservoir drawdown test on turbidity levels throughout the lower Snake River projects will be documented. It is acknowledged that levels observed, if elevated because of the drawdown process, are not necessarily indicative of levels that would be found under a long-term drawdown operation since sediments have built up over time and would likely be flushed from the system during initial drawdowns. Transport of sediments through Lower Granite and Little Goose reservoir, including measures of suspended and bed load sediments, will also be monitored.

Since sediment load coming into the system varies with flow, weather conditions such as rainstorms, etc., these measurements will be used to identify general trends.

Nutrients associated with suspended sediments are available for algal bloom formation. Although low water temperatures and short days during this test period preclude increased algal productivity, nutrient levels will be monitored, if possible, to assess the potential for eutrophication. The monitoring plan will include sampling at selected reservoir sites, and of the Snake and Clearwater Rivers above the confluence.

3) Velocity - The objectives for this effort are 1) to validate existing water particle travel time mathematical models, and 2) to obtain velocity profiles in the reservoirs at normal and low pool to help evaluate relative changes in velocities at given points. Velocities will be taken at selected locations in the Clearwater and Snake Rivers above the confluence, and within Lower Granite and Little Goose reservoirs. Dye will be used to gather additional information on water travel times and currents.

4) Water Temperature - Water temperature is not of significant concern during the test time period, but will be measured at each location where other data are gathered (velocity, turbidity, suspended sediment, dissolved gas). In addition, temperatures may be measured using infrared sensing equipment during reservoir monitoring flights.

b. **Fish and Other Aquatic Organisms**

1) Anadromous Fish - Since there will be very few juveniles in the system during the proposed test period, and adult passage will be blocked at Lower Granite once the reservoir elevation is below 710 and at Little Goose once it drops below minimum operating pool, these issues are not a specific part of the test design. However, fish condition, such as injury and gas bubble disease, will be monitored at all points fish are collected: adults

through the ladders at operational facilities (at Lower Granite until elevation 710, and at Lower Monumental and other downstream facilities), and juveniles collected in the gatewells at Lower Granite. It is unknown at this point how many juveniles will be obtained in Lower Granite gatewells if the turbines remain functional throughout the reservoir drawdown, but it is believed to be a relatively small number. Up to 100 of each major species, chinook and steelhead, (all fish if less than 100) will be anesthetized and examined approximately two times per week (unless excessive numbers occur, in which case consultation with the National Marine Fisheries Service will occur). Addendum B contains the fish handling plan for the drawdown test.

Lower Granite reservoir may be a rearing area for wild summer chinook, as well as fall chinook. These fish may be present in late winter and thus be affected by loss of low velocity shallow-water habitat areas as the reservoir is drafted. Efforts will be made to sample areas throughout Lower Granite reservoir before, during, and after the test drawdown to determine effect of the type of operation on rearing juvenile salmonids. Addendum C contains the study design for this element of the test.

Sampling below Lower Granite Dam in 1991 suggests that fall chinook may be spawning within this area. An attempt was made to locate spawning areas, but no redds were discovered. As noted above, the shoreline areas below Lower Granite will be intensively monitored as Little Goose pool is drafted. (See Addendum C for monitoring plan.)

2) Resident Fish and Other Aquatic Organisms

Resident fish populations, including sturgeon, benthic organisms, and aquatic habitat areas will be monitored and the effects of reservoir drawdown evaluated.

Resident and anadromous fish may be stranded in embayments and ponds behind railroad and highway embankments. The Idaho Department of Fish and Game, and Washington Departments of Fisheries and Wildlife are responsible for rescue operations for these fish and have plans in place for removal and/or salvage as necessary.

c. **Wildlife**

Impacts to waterfowl and shorebirds, wetland and riparian habitats, and furbearers will be monitored and evaluated. Areas where land bridges and new islands become exposed will be identified through aerial photography, field observation, and mapping. Predator access/occurrence and impact on bridged islands will be monitored through direct field observation or population index methodology. Impacts to existing goose nesting structure use will be monitored through field observation and comparison of previous years' nesting data. Furbearer dens and areas of concentrated activity will be located and impacts monitored through field observation and

possible expansion of an existing radio-telemetry study.

All wildlife riparian and drawdown zone field observations will be documented, indicating species, behavior, location, number, time of day, habitat being utilized, and historic frequency of occurrence in preparation for possible long-term monitoring and mitigation recommendations.

d. **Cultural Resources** - Selected known archeological sites will be monitored during the drawdown and refill periods to determine effects of potential erosion, vandalism, etc.

e. **Recreation**

Visitation data will continue to be collected at each of the Corps recreation areas that are open during the March-April time frame. Data will be compared to previous years' visitation rates during periods with similar ambient temperatures and weather conditions. This time frame is not considered a high use period however, except for possibly fishermen.

C. ORGANIZATION

An on-site field coordinator, Mr. Wayne John, has been appointed to manage the drawdown test. A team of individuals from Engineering, Operations, Construction, and Planning Divisions (and others, as appropriate), and the Public Affairs Office will report directly to the Chief of the Drawdown Field Office, Mr. John. The drawdown field office will work closely with the Lower Granite-Little Goose Project Manager.

The Chief of the drawdown field office will provide test data and information to the Chief of Operations Division, and the Columbia River System Salmon Program Manager (CRSSP). Decision trees have been developed (see Addenda A, B, and C) that will guide the field office in test protocol. Emergency decisions to suspend the test can be made by the Chief and his team. Non-emergency decisions will be staffed up the appropriate stove-pipe and coordinated with necessary outside agencies.

See Figures 6-7 for detail on the Drawdown Execution Organization, Decision Process, and Information Transfer.

D. SCHEDULE

All activities are scheduled as noted on the print-outs in Addendum E. These schedules are tentative, and will be revised as necessary. A daily list of activities will be produced for both field use and information purposes. Examples of this are included in the Addendum.

III. RESPONSIBILITIES

A. Operations

Operations Division is responsible for completing all necessary steps at the project level to allow the reservoir drawdown test to take place. This includes modification of equipment to allow function at lower pool elevations, where possible and necessary for the test. It also includes operation of fish facilities and handling of any anadromous fish at the project. Any public safety hazards are to be identified, and appropriate precautionary steps will be taken, such as closing off boat ramps that are not accessible at lower pool levels.

B. Engineering Division

Engineering Division is responsible for monitoring of all project and reservoir structures to gather data and prevent, if possible, major structural failures by observing for predictive signs. Coordination will be maintained between the Drawdown Field Office, Operations and Planning Division, etc.

C. Planning Division

Planning Division is responsible for coordination and oversight of all hydrological and environmental monitoring and information. This includes coordination with their counterparts in outside resources agencies, such as National Marine Fisheries Service, where necessary and appropriate.

D. Public Affairs Office

The Public Affairs Office is responsible for distribution of information regarding the drawdown test to all interested media and general public parties. This includes coordination of on-site tours and release of regular public notices. See Appendix D for further detail.

IV. ADMINISTRATIVE SUPPORT

Office space for the drawdown field team will be at the Lower Granite Juvenile Fish Facility and in the north shore visitors' center. Telephones, computers, and fax machine will be available to these personnel.

Office space for the drawdown field team will be utilized as follows:

A. Main Field Office, North Shore Visitor Center, LGR

1. Occupants - field coordinator - NPWOP-PO
   - fish biologist - NPWOP-PO
   - staff engineer - NPWOP-EM
   - clerk - NPWOP-EM

B. Juvenile Fish Facility Visitor Room, LGR

1. Occupant - public affairs person (1)

C. Juvenile Fish Facility Conference Room, LGR

1. Occupants - fish biologist - NPWPL-ER
- fish biologist - NMFS
- civil engineer - NPWEN-DB-HY
- 3 personnel - WES

D. Central Non-Overflow Building - Top of Dam - LGR

1. Occupants - survey crew - NPWEN-GB-SM

E. Clarkston Resources Warehouse Office #1

1. Occupants - public affairs personnel (2)
- public affairs liaison - NPWPL-ER

F. Clarkston Resources Warehouse Office #2

1. Occupants - civil engineers (2) - NPWEN-GB

G. Existing Granite-Goose Project offices will house project staff who will participate in drawdown activities.

Offices will be functional with telephones, computers, and fax machines by 24 Feb 92.

V. COORDINATION AND COMMUNICATION

Field coordination meetings will be conducted as early as possible each morning immediately following a helicopter surveillance flight of the reservoirs. The key field representatives from each test team will provide summary information which will be consolidated for upward reporting to the Walla Walla District office by CC:Mail. The District Project Review Board will meet to discuss the information, and then forward a report to the North Pacific Division Test Management team. It is anticipated that North Pacific Division notification will be accomplished by mid-morning each day. Figure 5 outlines the Drawdown Execution Organization.

Field monitoring and surveillance activities will continue throughout the day and a late afternoon supplemental report will be prepared and distributed (by CC:Mail) through the command chain.

Figure 6 describes the information transfer process. The formal summary reports and a list of daily events will be sent from the Drawdown Field Office simultaneously to Columbia River System Salmon Program coordinator and to the Walla Walla District Corps of Engineers Division Chiefs. Once the Walla Walla District Project Review Board has met and reviewed data, the Columbia River System Salmon Program Coordinator will forward a report to the North Pacific Division Test Management Team.

Environmental monitoring information will be forwarded directly to the National Marine Fisheries Service and the Fish Passage Center (representing the fisheries agencies and tribes, and the reservoir drawdown design team) as appropriate. Direct coordination with state agency field offices will occur in the event stranded fish are observed.

It is understood that each Corps of Engineers "stovepipe" has flexibility to discuss detailed test information at anytime throughout the test period.

Should events occur such as those mentioned in paragraph VI - TEST CONTINGENCIES, test operations will be stabilized until proper staffing of the incident is accomplished. The corporate decision will then be implemented.

(A communications chart with names and phone numbers will be attached as Figure 8 prior to the start of the test. This will include emergency/after hours call-out procedure.)

An after action report will be prepared following completion of the drawdown. This will include an evaluation of all aspects of the test procedure: structural/physical, environmental, operational, media, etc. A draft of this report is scheduled to be available in late June. This draft report will be available for public comment. The final report will be distributed to all interested parties.

VI. TEST CONTINGENCIES

A. Risks Involved in Testing Program

Certain risks will be involved in implementing a drawdown of this type. The above outline includes steps to minimize these risks where possible, but will not eliminate them. The following potential risks have been identified, but the list is not all-inclusive:

1. Erosion downstream of the project and an undermining of the stilling basin.

2. Damage to reservoir embankments and structures, including embankment failures, marina and port facilities, etc.

3. Potential dewatering fall chinook fry (fish will still be in the gravel during the proposed time frame).

4. Potential exposure of resident and anadromous fish (including in-gravel fall chinook), and other aquatic organisms to high dissolved gas levels.

B. Contingencies

Detailed decision trees and discussions are presented in Addenda A, B, and C for engineering, operational, and environmental

elements of the test. Some events may require termination of the test, others will require coordination with the appropriate parties to determine necessary modifications to the test design.

In the event of the following occurrences, the test will be cancelled and the reservoir either refilled or maintained at the level necessary to accomplish repairs:

1. damage to project structures, including dam and/or reservoir embankments, levees; stilling basin; etc.

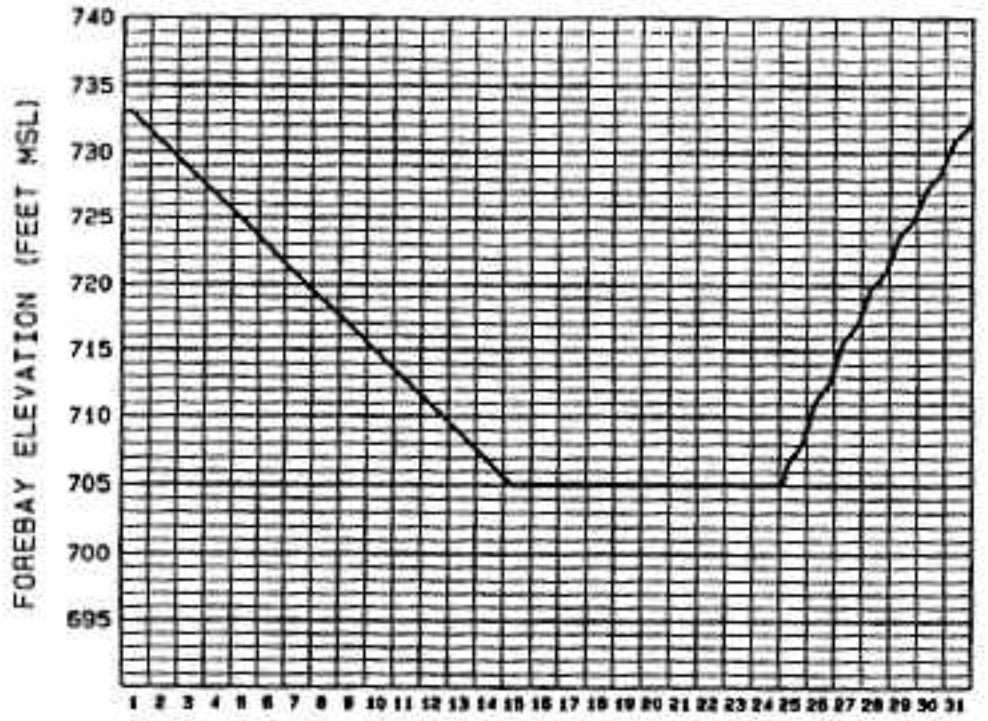
2. turbines fail to be operable and dissolved gas levels below Lower Granite exceed 125% for 12 hours

Note: Damage to the structural integrity of the dam or the levee system will likely require repair prior to refill, which will have additional impacts not addressed here (failure to refill by April 1, loss of anadromous fish passage, etc.).

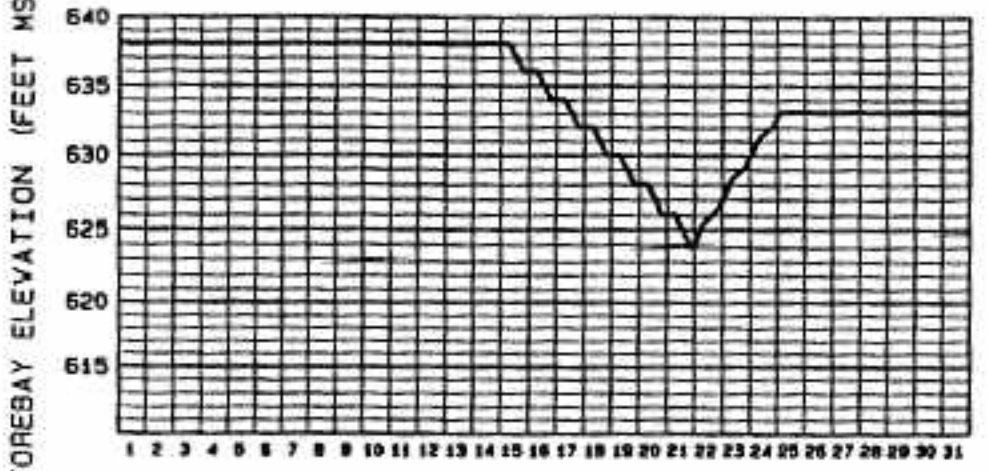
VII. ADDITIONAL MONITORING

A. Effects of in-season flow augmentation and minimum operating pool elevations - The effects of these operations will be evaluated through on-going studies. Juvenile fish travel time is monitored through the Fish Passage Center's Smolt Monitoring Program. Effect of stable pool elevations on resident fish and other aquatic organisms will be evaluated as presented in Addendum C.

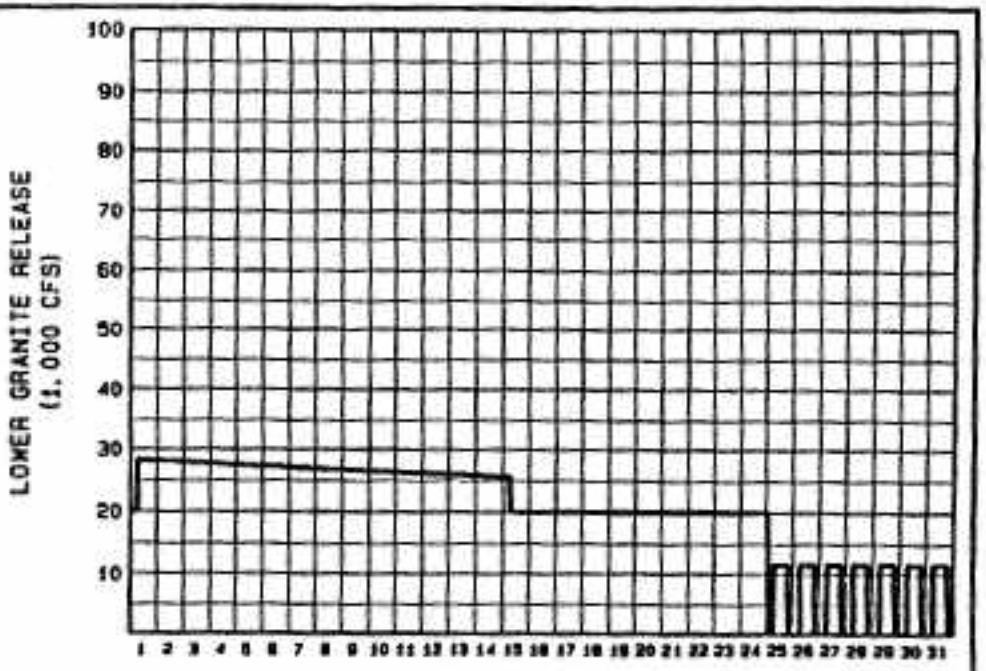
B. Lower Snake River Temperature Control - Releases of cool water from Dworshak Dam will be monitored again in 1992. The monitoring plan is being developed in cooperation with the fish agencies and tribes. Data analysis is ongoing and will be incorporated into the coming year's plans.



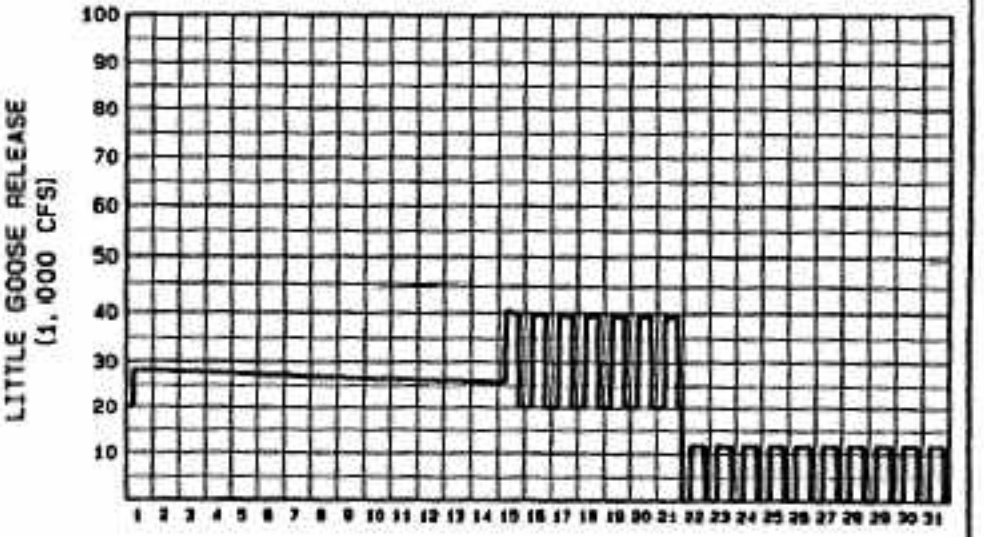
LOWER GRANITE POOL - MARCH 1992



LITTLE GOOSE POOL - MARCH 1992



MARCH 1992



MARCH 1992

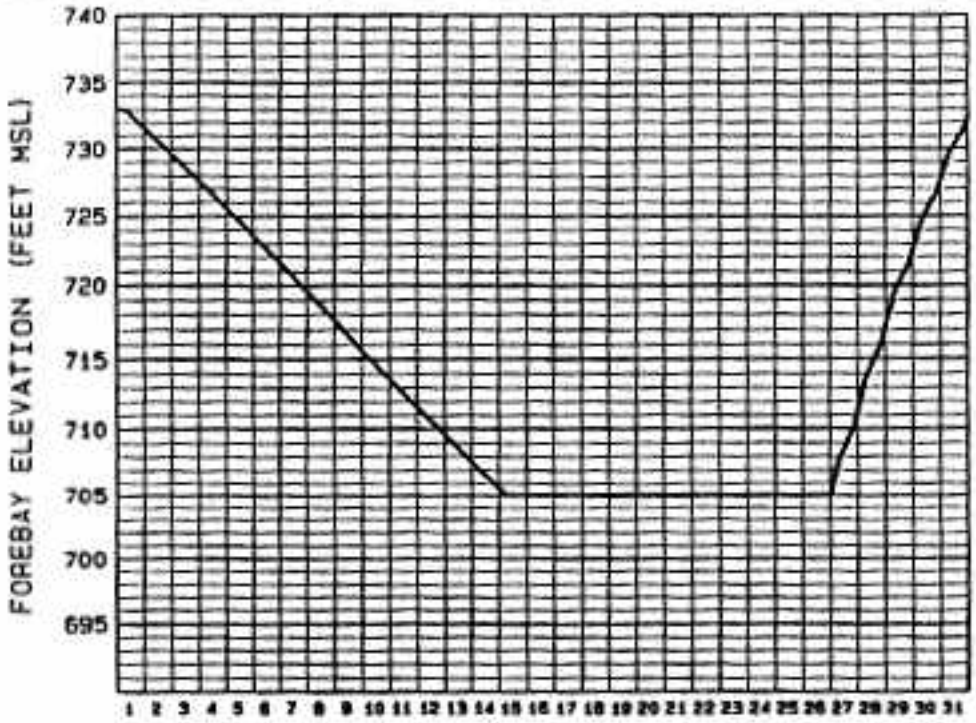
INFLOW = 20,000 CFS

SNAKE RIVER BASIN

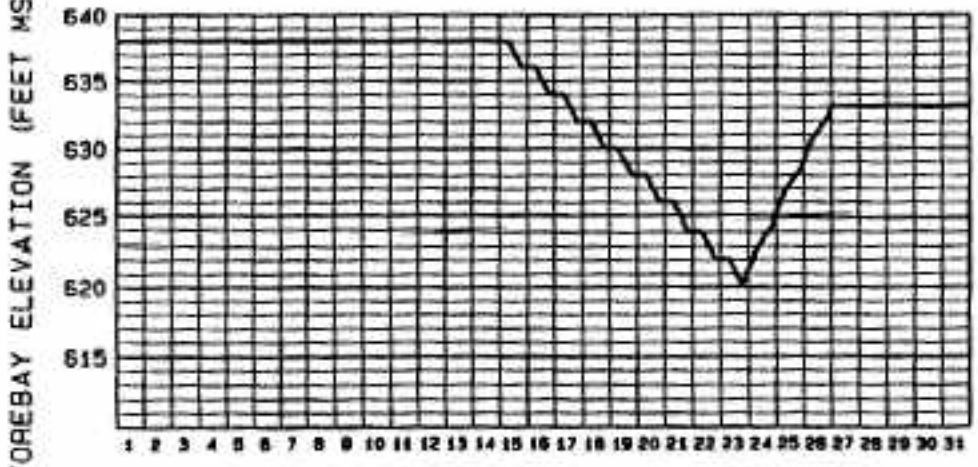
MARCH 1992 RESERVOIR DRAWDOWN TEST

U.S. ARMY ENGINEER DISTRICT
WALLA WALLA - HYDROLOGY BRANCH

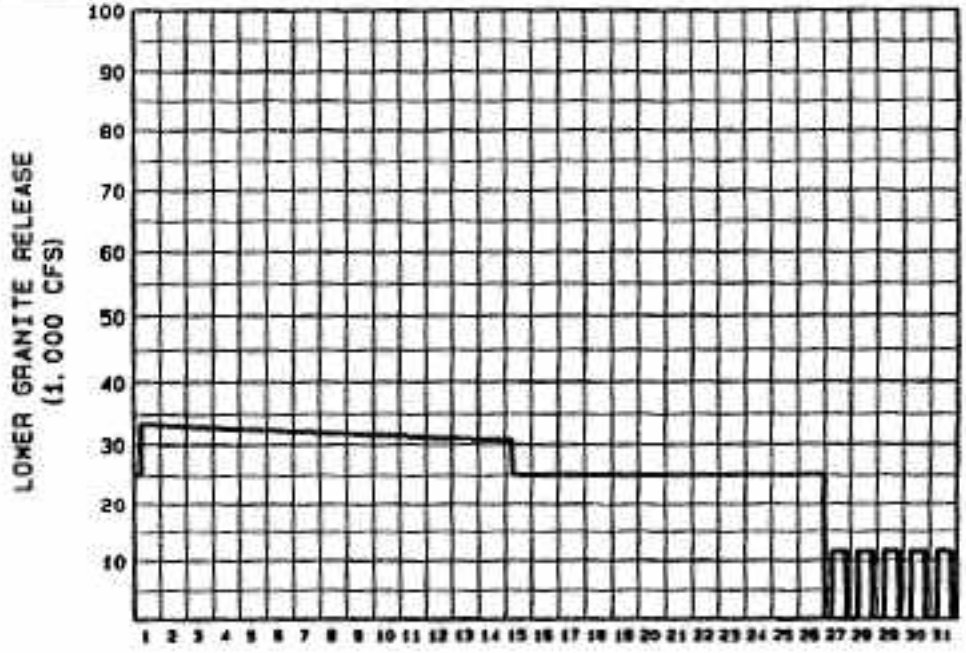
Figure 1



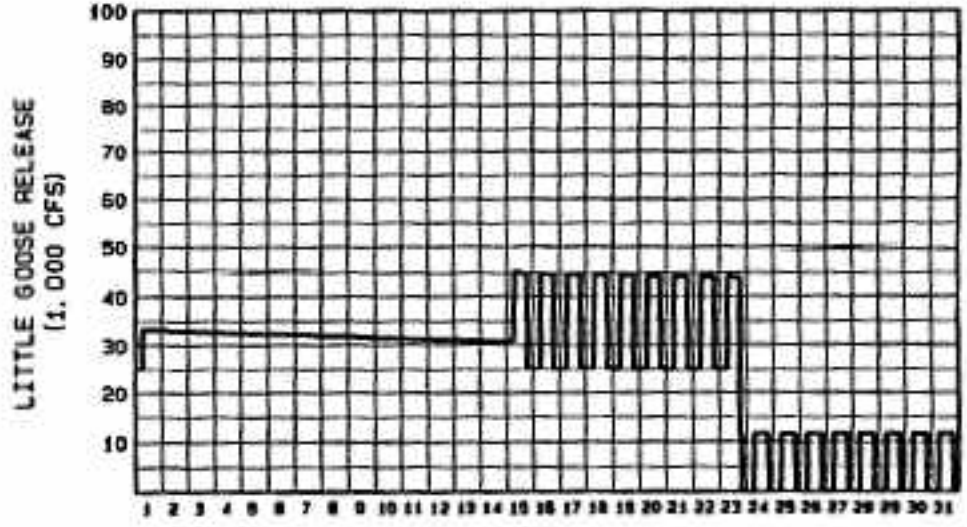
LOWER GRANITE POOL - MARCH 1992



LITTLE GOOSE POOL - MARCH 1992



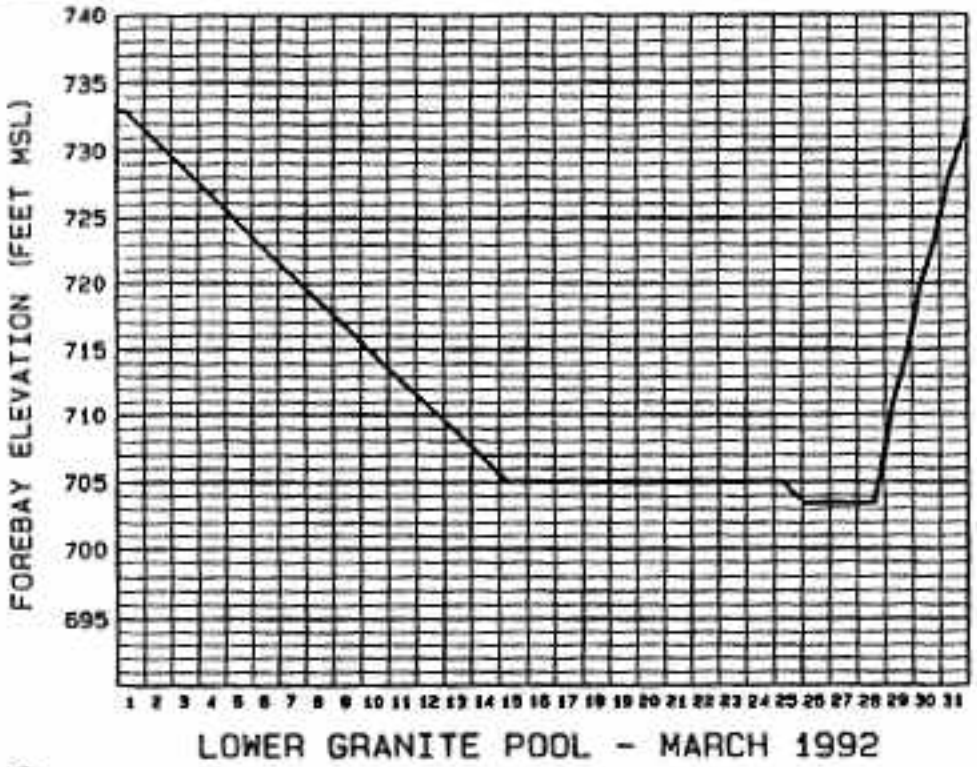
MARCH 1992

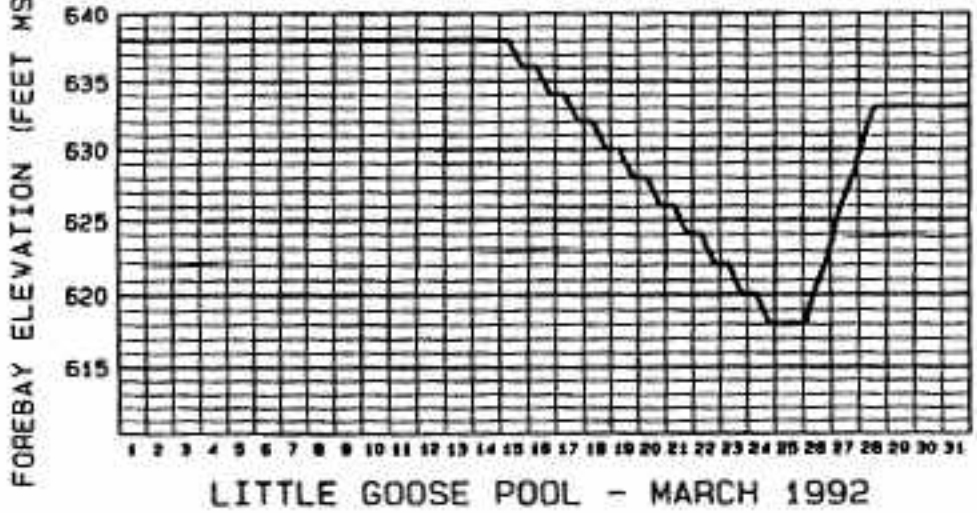


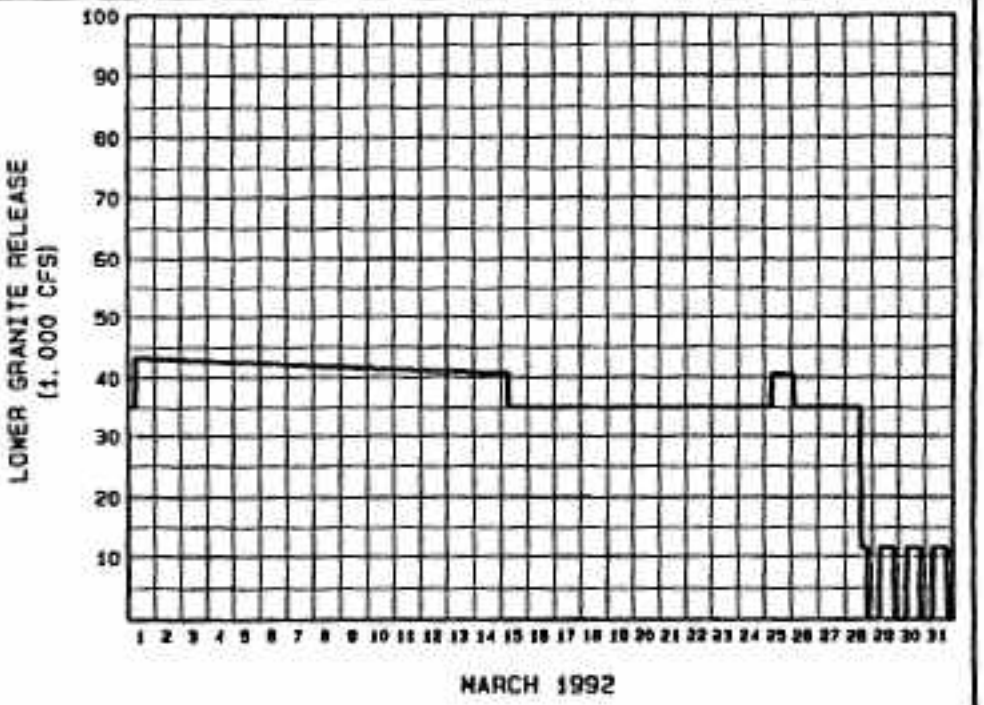
MARCH 1992

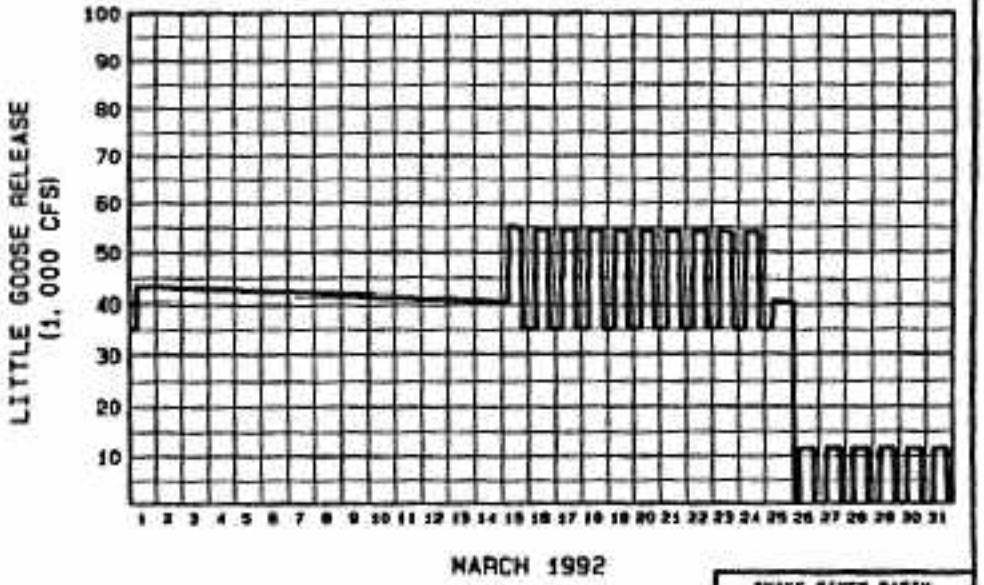
INFLOW = 25,000 CFS

SNAKE RIVER BASIN
MARCH 1992
RESERVOIR
DRAWDOWN TEST





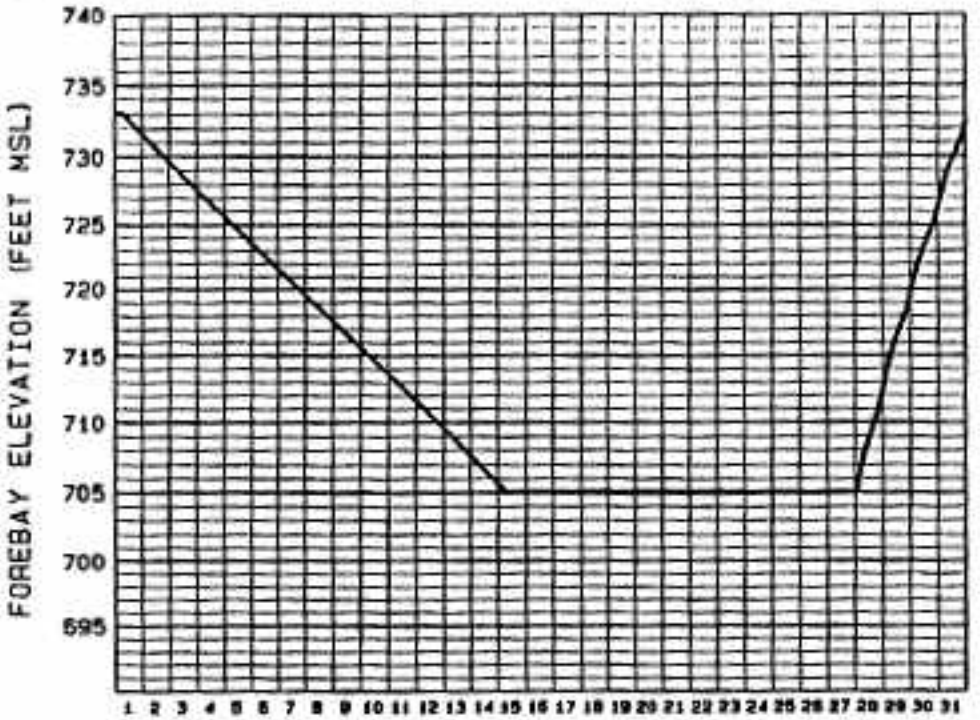




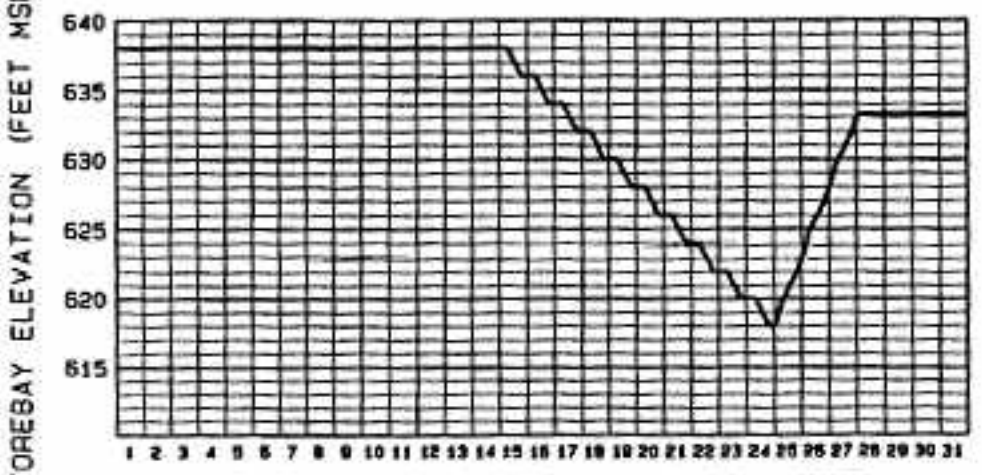
INFLOW = 35,000 CFS

SNAKE RIVER BASIN
MARCH 1992
RESERVOIR
DRAWDOWN TEST

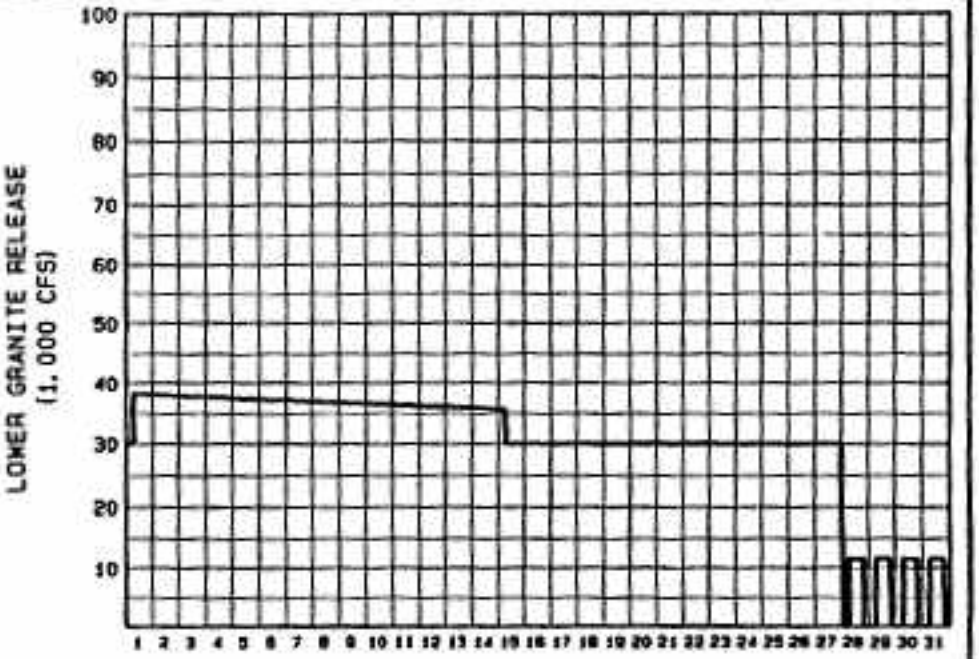
Figure 3



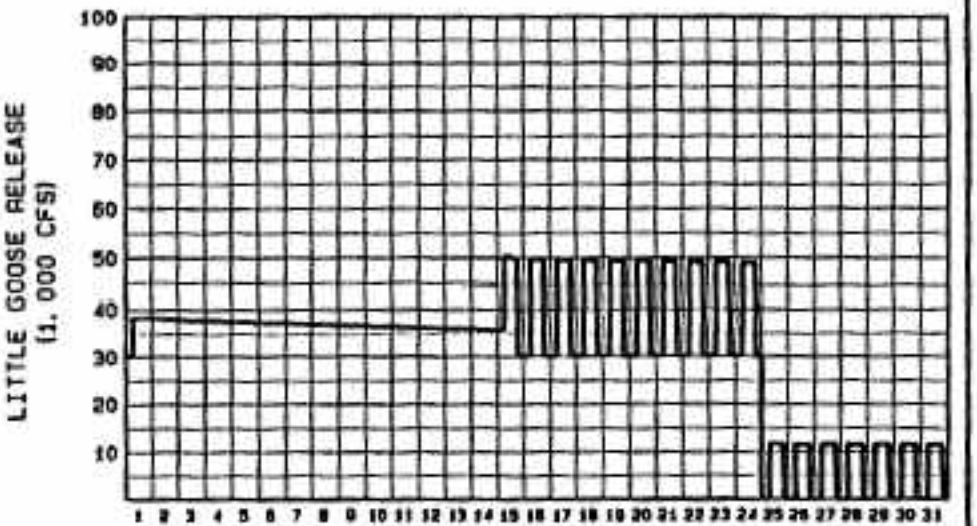
LOWER GRANITE POOL - MARCH 1992



LITTLE GOOSE POOL - MARCH 1992



MARCH 1992



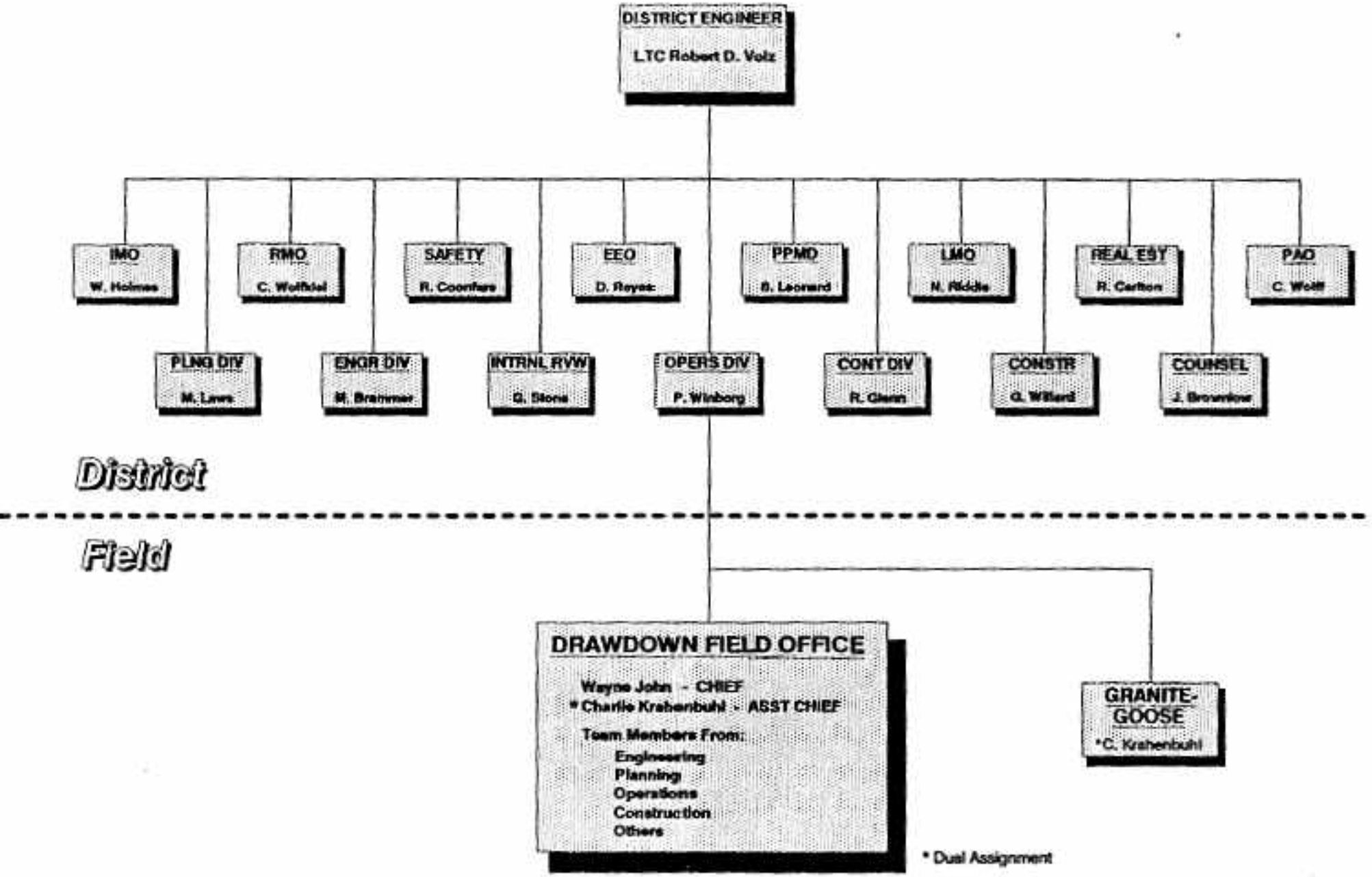
MARCH 1992

INFLOW = 30,000 CFS

SNAKE RIVER BASIN
MARCH 1992
RESERVOIR
DRAWDOWN TEST
U.S. ARMY ENGINEER DISTRICT
WALLA WALLA - HYDROLOGY BRANCH

Figure 4

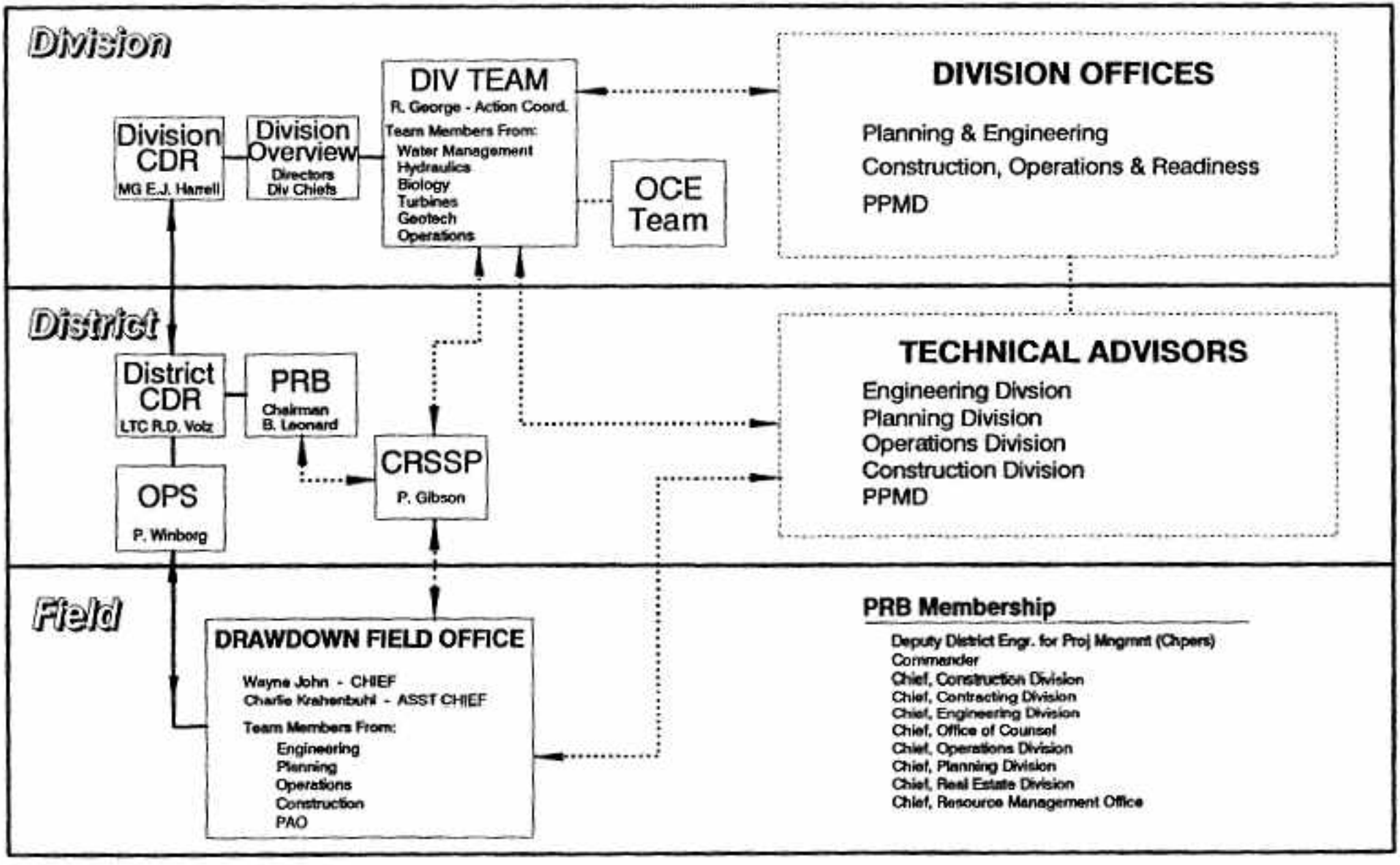
Walla Walla District
Drawdown Execution Organization



Final: 22 January 1992

Figure 5

Walla Walla Drawdown Test
Internal Management Decision And Information Process



Decision ——————

Information .....

NOTE: Telephone Directory will be furnished prior to drawdown date.

Final: 30 January 1992

Figure 6

Appendix A

Engineering Division - Surveillance Plan

RESERVOIR POOL LOWERING TEST - MARCH 1992

LOWER GRANITE AND LITTLE GOOSE DAMS, WASHINGTON

SURVEILLANCE PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

PLATES

EXHIBITS

RESERVOIR POOL LOWERING TEST - MARCH 1992

LOWER GRANITE AND LITTLE GOOSE DAMS

WASHINGTON

SURVEILLANCE PLAN

1.01. SCOPE

The purpose of this surveillance plan is to present the plan for the lowering of Lower Granite and Little Goose Reservoirs. Plates 1-15 provide project plans and reservoir plans and typical sections of principal components of the dams and Lewiston levees.

1.02. POOL LOWERING TEST.

a. General.

The pool lowering test consists of a four week drawdown of Lower Granite and Little Goose reservoir pools. The drawdown will begin on March 1, 1992 and the pools will then be refilled to minimum operating pool (MOP) by April 1, 1992. Lower Granite pool will be initially lowered to elevation 705 with the possibility of being lowered to elevation 696 (near spillway crest). Little Goose will be drafted approximately 20 feet below normal pool to provide low tailwater conditions for tests on the Lower Granite spillway and stilling basin. Lowering the Little Goose pool will be contingent on monitoring of Little Goose reservoir for salmon redds, the Lower Granite spillway tests, and the availability of water to refill Lower Granite and Little Goose by April 1.

On March 1, the Lower Granite reservoir pool will be lowered from a minimum operating forebay elevation of 733 feet above mean sea level (msl) to a forebay elevation of 705 feet msl by March 15. Pool lowering will be limited to a maximum rate of two feet per day and will be done as steadily as is practical by passing all water through the power turbines. Reservoir storage between forebay elevations of 733 and 705 feet msl is approximately 190,000 acre-feet. Required Lower Granite releases for the 733 to 705 pool lowering will average approximately 6,800 cubic feet per second (cfs) above the Lower Granite inflow.

On March 15, the Little Goose reservoir pool will begin to be lowered from a maximum normal operating forebay elevation of 638 feet msl by a steady rate of two feet per day as measured at the Little Goose forebay gage. The two foot per day pool lowering will continue until structural problems are encountered with the test or until the availability of water requires Little Goose to begin refill. Between forebay elevations of 638 and 618 feet msl, reservoir storage averages

approximately 9,600 acre-feet per foot of elevation. Little Goose releases required to meet the two foot per day target will average approximately 9,700 cfs above inflow and all releases will be passed through the power turbines.

While the Little Goose reservoir pool is being lowered two feet per day at the forebay gage, the Lower Granite pool will be operated between elevations 705 and 703 feet msl and a series of spillway-stilling basin tests will be performed. Reservoir storage between elevation 705 and 703 is approximately 11,000 acre-feet. This two foot of storage in Lower Granite reservoir plus inflow will be used to artificially simulate spillway flows near 100,000 cfs for short durations. March inflows to Lower Granite have averaged approximately 60,000 cfs since 1975. The following tabulation outlines spillway-stilling basin test durations for low, average, and high March flow conditions.

Flow Condition	Granite Inflow (cfs)	Storage Release (cfs)	(hours)	Total (cfs)
Low Flow	30,000	66,500	2	96,500
Average Flow	60,000	33,300	4	93,300
High Flow	100,000	22,200	6	122,200

The spillway-stilling basin tests will continue until completed, or until structural problems are encountered, or until availability of water requires the beginning of refill. If the spillway-stilling basin tests are completed before refill for the April 1 target date is required, Lower Granite pool will be lowered below elevation 703 feet msl at the rate of two feet per day to approach a near spillway crest condition of elevation 696 feet msl.

The date that refill will be required to begin is dependent upon availability of water during the last 10 days of March 1992 and the Lower Granite and Little Goose forebay pool elevations at that time. Little Goose will be refilled to minimum operating pool (MOP) elevation of 633 feet msl at the forebay gage first then refill of Lower Granite will begin so that elevation 733 (MOP) is reached by April 1. During the refill, a release from Lower Granite and Little Goose of 11,500 cfs or more will be maintained. If the Lower Granite pool elevation is at 705 and the Little Goose pool is at 618 when refill begins, the following tabulation outlines refill times that are required to meet the April 1 MOP targets.

Flow Condition - cfs	Refill Time - Days
Low Flow - 30,000	10.4
Average Flow - 60,000	4.0
High Flow - 100,000	2.2

During the entire pool lowering test, the turbine units and stilling basin and surrounding tailrace areas will be monitored. All six turbine units will be available for use at Lower Granite if needed and five of the six units at Little Goose will be available during March 1992. Extensive monitoring will done throughout the pool lowering test to minimize risks to structurally damaging the Lower Granite and Little Goose projects and all associated facilities. This surveillance plan includes the following appendices.

(1) APPENDIX A - OPERATION ORDER FOR POOL LOWERING

(2) APPENDIX B - RESERVOIR REGULATION PLAN

(3) APPENDIX C - OPERATION ORDER FOR CONTINGENCY PLAN

(4) APPENDIX D - SPILLWAY AND STILLING BASIN RELATED MONITORING PLAN

b. Dam Preparation Requirements for Lowering Reservoirs.

Initiation of reservoir lowering procedures is currently scheduled to begin on 1 March 1992. Preparatory measures required prior to start of drawdown are given as follows:

(1) Unclassified encapsulated fill materials located at the Port of Lewiston at the confluence of the Snake and Clearwater Rivers will be monitored by observation wells prior to and during and following the drawdown test to determine whether any leakage of leachate from the encapsulated fill has occurred as a result of the reservoir lowering procedures. These materials were placed in the encapsulated fill during the construction of the Lewiston levees in the early 1970's.

(2) A trilateration survey of both Lower Granite and Little Goose dams will be performed to establish current survey monument locations. This survey is anticipated to be completed by the beginning of 1992.

(3) Quarrying at Silcot, Tammany Creek and Bishop and stockpiling of riprap for slope protection of the Lewiston levees and Lower Granite Dam will be performed prior to the start of drawdown procedures.

(4) Coordination meetings and site inspections between railroad, State Departments of Transportations, Port Authorities, City and County officials, and other parties involved to establish damage potential to existing facilities due to drawdown operations.

(5) A pre-drawdown inspection of existing structures, facilities, roadways, bridges and embankments will be

conducted prior to lowering of the reservoirs. This inspection is to document the existing condition of structures and facilities located within the effected areas of Lower Granite and Little Goose Reservoirs prior to drawdown.

(6) Foundation exposure evaluation of selected bridges within the drawdown area will require a coordinated effort with the various state, federal and local agencies involved with the project.

(7) The District is in the process of preparing plans and specifications for evaluation, testing and exploration for the encapsulated fill at the Port of Lewiston and for piezometer integrity for Little Goose Dam, Lower Granite Dam and the Lewiston Levees.

(8) Integrity testing of piezometers in the two dams and at the Lewiston levees.

(9) Additional instrumentation will be added related to monitoring the stilling basin and related features during testing.

c. Instrumentation.

(1) General. Current instrumentation monitoring systems include settlement gages, open tube piezometers, pore pressure meters, deformation gages, uplift gages, flow monitors, monitoring wells, crack meters, and water level gages. The instrumentation programs are described in the following publications:

- Lower Granite Dam: General Design Memorandum, Letter
- Supplement No. 2, 4 November 1974.

- Lewiston Levees: Lower Granite DM29.8, 26 February 1973.

a. Little Goose Dam:

1. Foundation Report, December 1970.

2. Little Goose Lock and Dam Operation Manual, Part II, Vol 2 of 3, Chapter 6, 1974.

The instrumentation plans and locations for the above-mentioned systems are shown on Plates 16 to 31. Current instrumentation monitoring systems are in use and operational at Lower Granite Dam, Little Goose Dam and at the Lewiston Levees. The instrumentation monitoring program for the Spring 1992 drawdown will be divided into four instrument groups; one for the embankments, one for the encapsulated fill at the Port of Lewiston, one for the concrete structures and one for the

hydraulic instrumentation. The instrumentation groups are described as follows:

(a) Group 1 - Embankment monitoring of Lower Granite Dam, Little Goose Dam and the Lewiston Levees will consist of periodic reading of existing open tube piezometers, pore pressure meters and settlement gages at each of the three locations. Selected piezometers can be automated to yield continuous readout on an hourly basis. Others must be measured manually. The description of instruments and monitoring schedule for the embankments is provided on Exhibit 1.

(b) Group 2 - Encapsulated Fill Instrumentation: The instrumentation of encapsulated fill is primarily concerned with contaminant migration from the encapsulated fill. The instrumentation will also be used to monitor seepage migration during drawdown. Because of the specialized nature of this monitoring program, (which is not directly related to the embankment structural stability) the instrumentation program for this group will be performed under contract which will begin in February 1992 based on the current drawdown timeframe. The monitoring schedule for the encapsulated fill instrumentation is provided on Exhibit 2.

(c) Group 3 - Concrete Structure Instrumentation: The structural instrumentation data is currently being evaluated on a monthly basis and will be increased to a biweekly frequency. The instruments will be monitored primarily to see how the instruments are affected by the drawdown. The stability of Lower Granite Dam should not be adversely effected as long as Lower Granite is lowered prior to Little Goose and assuring that Little Goose's reservoir is raised simultaneously or ahead of Lower Granite's reservoir during reimpoundment. The structural instrumentation includes deformation gages, uplift gages and crack meters located within the navigation lock, powerhouse, spillway and central non-overflow monoliths. Forebay and tailwater elevations taken during the drawdown will be correlated with structural changes. No additional readings beyond the regular monthly readings will be required for Little Goose Dam during the drawdown procedure. The description of structural instruments and the monitoring schedule are provided on Exhibit 3.

(d) Group 4 - Hydraulic Instrumentation: Hydraulic Instrumentation during the drawdown will consist of routinely reading staff gages along the Snake and Clearwater Rivers, at the confluence and at the dams. Some gages will need to be extended because of the magnitude of the pool lowering. Also some automation modifications will need to be made to some gages that were previously read manually due to the increase in the frequency of readings during the drawdown. An extensive study of the stilling basin area will be conducted by Hydraulic Design Section and Waterways Experiment Station to be correlated

with laboratory model studies. The monitoring schedule for these instruments is given on Exhibit 4. The support work by Waterways Experiment Station (WES) will result in additional instrumentation in the stilling basin and surrounding areas (see Plate 3~~0~~5. Turbine test instrumentation information will be provided as soon as it is made available.

(2) Existing Instrumentation Data

Prior to the start of drawdown, integrity testing of selected piezometers will be performed by contract to help ensure reliability of readings during the drawdown monitoring.

d. Surveillance Teams

During the drawdown period several surveillance teams will be operating in the areas within the two reservoirs. Dam structures will be routinely inspected by designated Project Office personnel. Instruments will also be read routinely by Project Office personnel as outlined in the instrumentation schedules. Geotechnical Branch will provide a team to inspect and evaluate levee, embankment and foundation integrity daily by aerial and ground surveillance. Encapsulated fill monitoring will be accomplished by contract. The Hydraulic Design and W.E.S. study team will evaluate effects of the drawdown on the stilling basin. An H.D.C. study team will monitor the effects of the drawdown on turbine performance at the dams. The Instrumentation Section will evaluate instrument recordings and coordinate readings with appropriate technical advisors. Invariably, State DOT, railroad, and local government surveillance teams will be conducting independent and cooperative inspections with Corps of Engineers personnel during the drawdown. Coordination efforts will be implemented by the technical advisory group through the appropriate technical support group personnel.

e. After Action Report

Following completion of the reservoir lowering and all tests have been completed, a report will be prepared to document observations and provide test results related to the impacts induced on the reservoir features during the pool lowering period. This report will be a joint effort between the Project Office, surveillance teams and the Technical Advisory Group.

f. Decision to Abort Reservoir Drawdown Test

The decision to abort the drawdown test could occur at any time during the test if it is determined that the conditions are causing unacceptable adverse impacts such as:

(1) Biological Impacts (i.e., high nitrogen levels in water)

(2) Hydraulic and Structural Impacts (stilling basin and related structures)

(3) Geotechnical Impacts (embankment sliding, sinkholes, piping, erosion of fills)

(4) Turbine Related Impacts

Should an unacceptable condition exist, the authority to abort the drawdown test lies with the District Commander. However, in extreme circumstances where significant property damage or loss of life are imminent as a result of drawdown operations, the Drawdown Operations Field Coordinator is authorized to abort the test without approval from higher authority.

The execution decision tree to abort drawdown testing is illustrated on Plate 34. In this diagram a geotechnical problem is identified by the geotechnical surveillance team. The Drawdown Operation Field Coordinator (OFC) is notified in conjunction with the geotechnical technical coordinator. The technical decision group, which consists of all technical coordinators, will convene to determine the severity of the problem. If the problem is severe, the recommendation of the group will be relayed to the OFC who will decide whether to immediately abort the test or seek a decision from the District Commander depending of the nature and severity of the problem. The command and information communications network, through which such decisions will be processed is shown on Plate 32. Similarly, if a hydraulic problem is encountered during drawdown, the decision tree shown on Plate 35 will be utilized in the same fashion to determine whether the test should be stopped. Other abort decision networks for Planning Division and Operations Division are contained in their respective sections of the overall monitoring plan. After a decision has been reached to abort the test, the technical decision group will convene to determine what measures will need to be taken to effect repairs and regulate pool levels and releases depending on the nature of the problem encountered. Should a test restart be considered feasible and desirable, the Walla Walla District shall consult with North Pacific Division for authority to restart the test. If restart is approved, the technical decision group will determine the test restart procedures.

Any decision effecting the drawdown test will be coordinated through the OFC.

1.03. RESOURCE MANAGEMENT

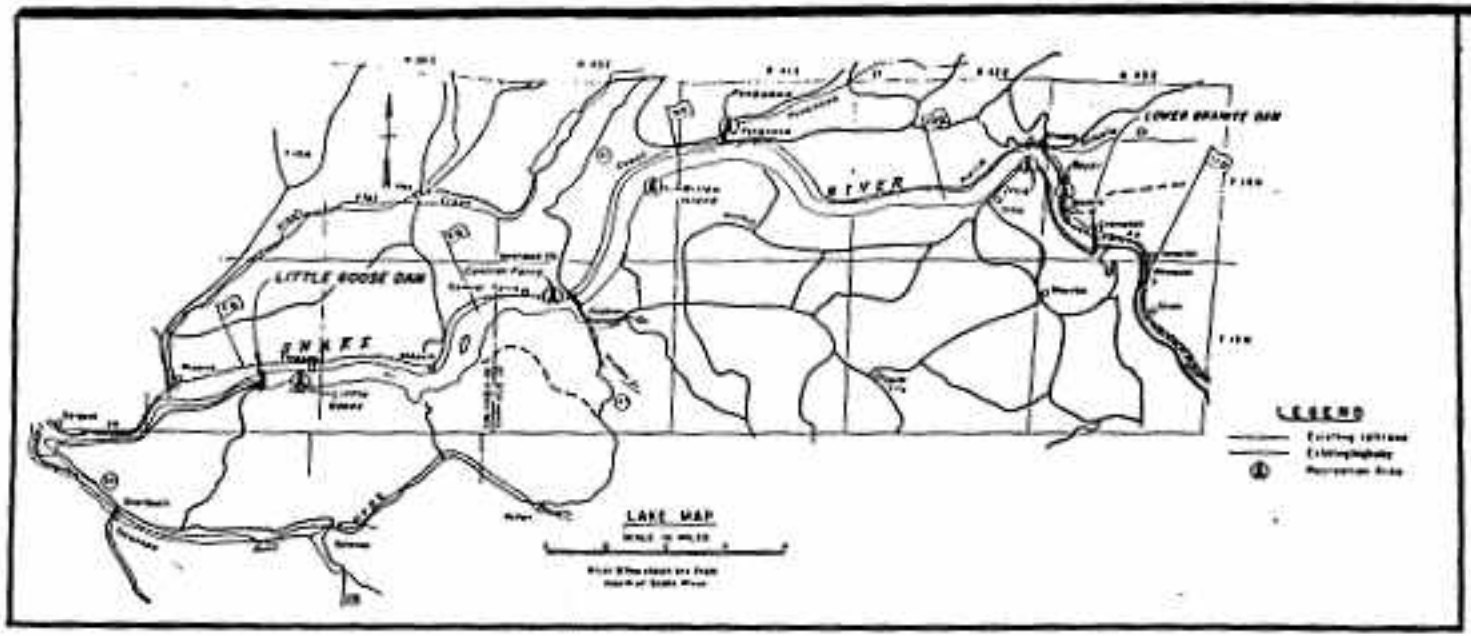
During the drawdown period, individuals from the Walla Walla District Office, Granite-Goose Project Office and other agencies will be involved in the testing, monitoring and surveillance of the associated reservoirs, dams and levees. Individuals from the District Office and Project Office will be temporarily assigned to the drawdown sites to read instruments, inspect structures and embankments, monitor studies and administer construction contracts. Required engineering division resources for the surveillance period are shown on Platt 33. This plan is tentative and is subject to change to adapt to actual field conditions. Similar resource management schemes are begin adopted by Planning Division and Operations Division to identify monitoring personnel required for reservoir regulation, instrumentation reading, environmental monitoring and supplementary operational staffing. These schemes are presented in their respective sections of the overall monitoring plan. Non-government staffing (Washington DOT, Camas Prairie Railroad, Counties) for engineering related agencies are also shown on Plate 33.

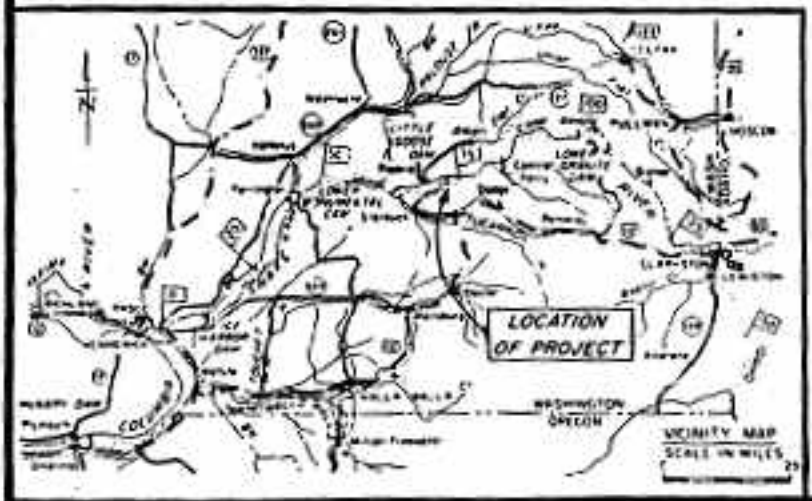
Plate 33 also provides a calendar of significant events (milestones) prior to and during the drawdown pertinent to the surveillance operation.

1.04. RECOMMENDATION.

The Commander recommends approval of this surveillance plan for the March 1992 reservoir pool lowering test at Lower Granite and Little Goose Dams.

PLATE 1

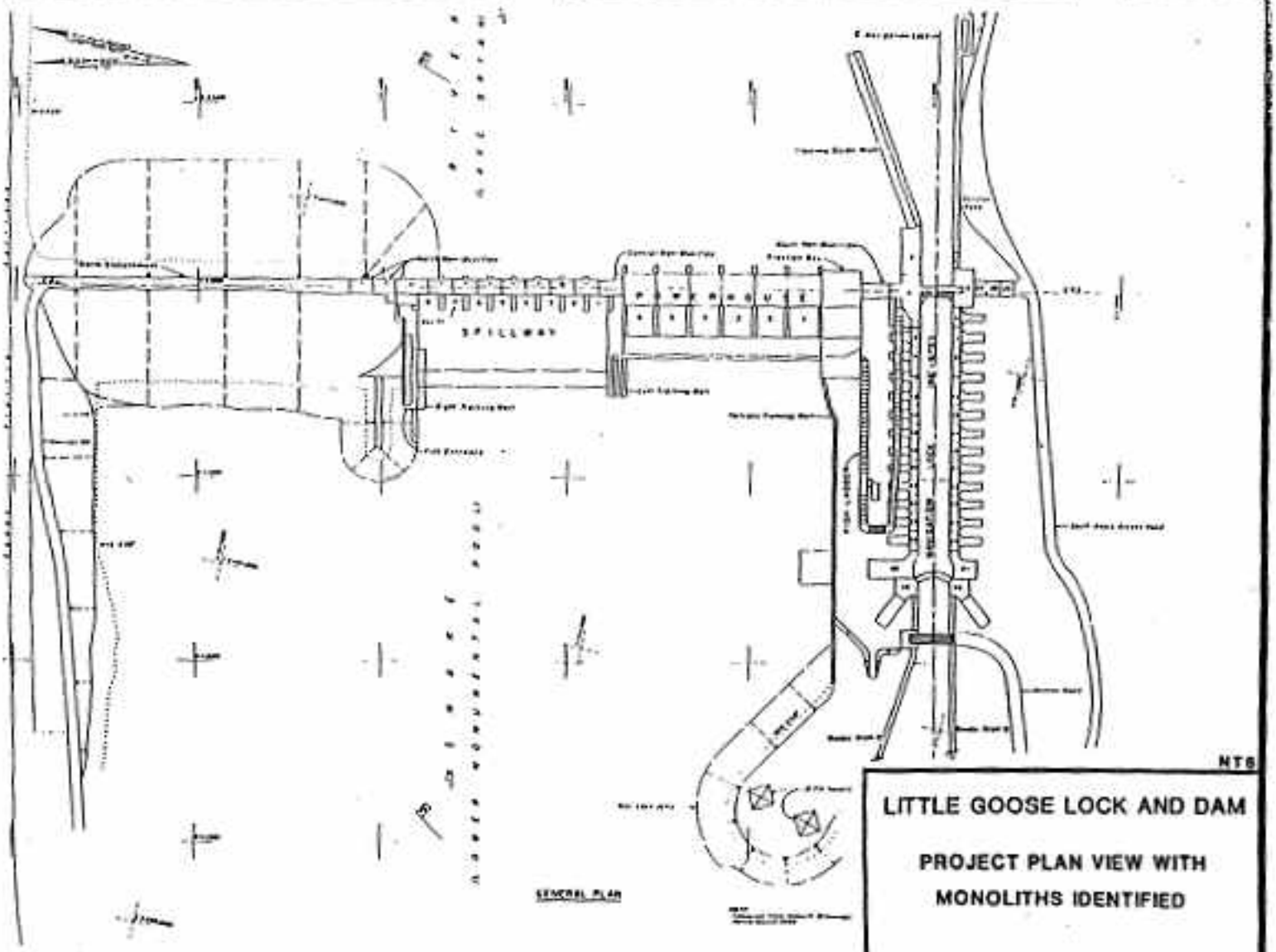




LITTLE GOOSE LOCK AND DAM

VICINITY AND LAKE MAPS

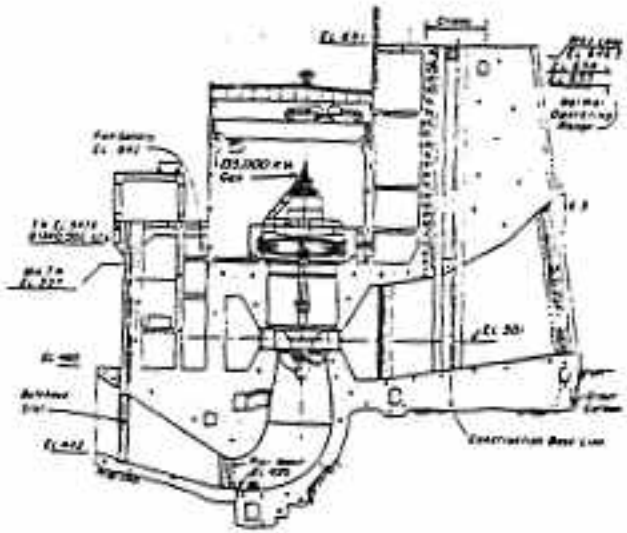
PLATE 2



NTS

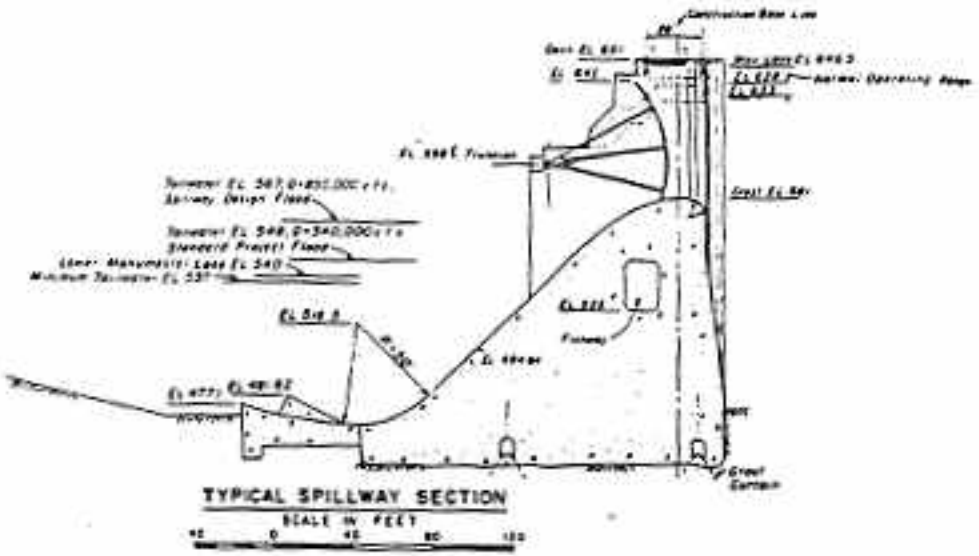
LITTLE GOOSE LOCK AND DAM

PROJECT PLAN VIEW WITH MONOLITHS IDENTIFIED



TYPICAL POWERHOUSE SECTION

SCALE IN FEET



TYPICAL SPILLWAY SECTION

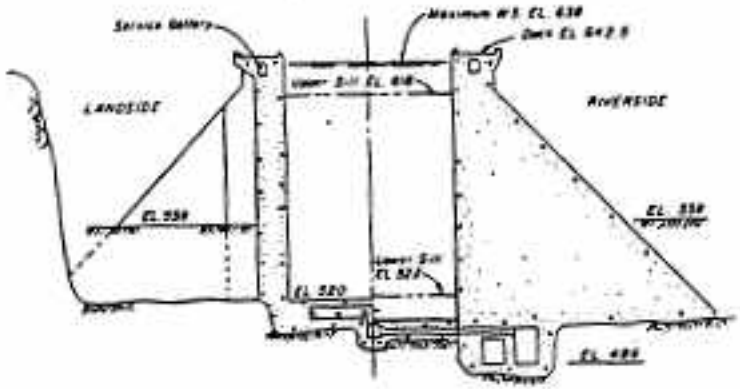
SCALE IN FEET

LITTLE GOOSE LOCK AND DAM

POWERHOUSE AND SPILLWAY

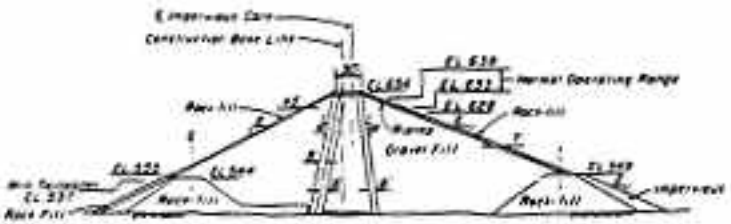
TYPICAL SECTIONS

PLATE 3



SECTION THRU LOCK

SCALE IN FEET



TYPICAL EMBANKMENT SECTION

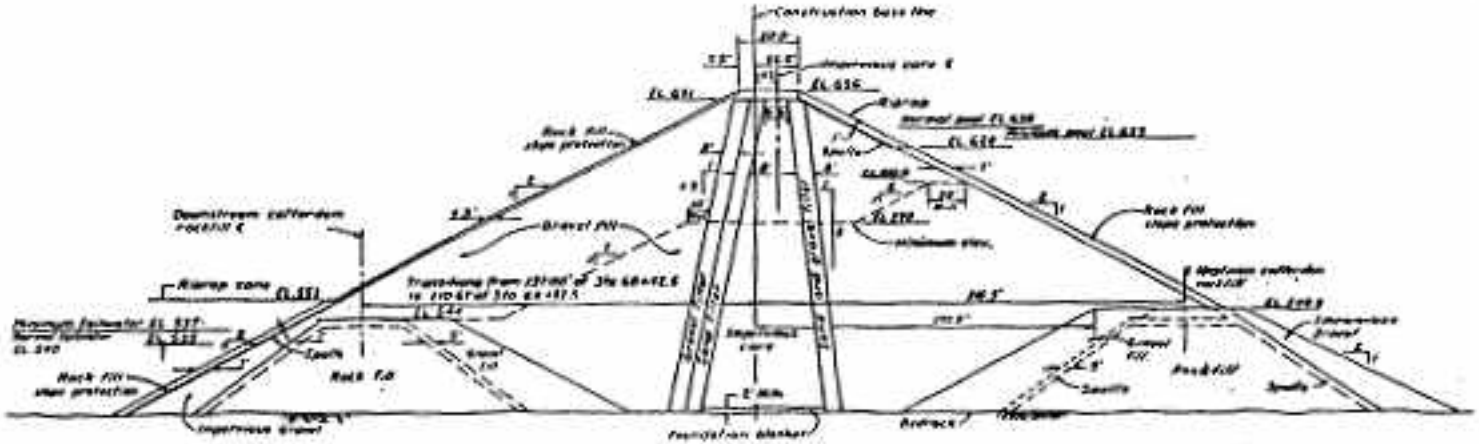
SCALE IN FEET

LITTLE GOOSE LOCK AND DAM

NAVIGATION LOCK AND NORTH EMBANKMENT

TYPICAL SECTIONS

PLATE 4



SECTION

C.R.L. STA 684+82.5

Typical from Sta 68+82.5 to Abutment Tie-in

PLATE 51

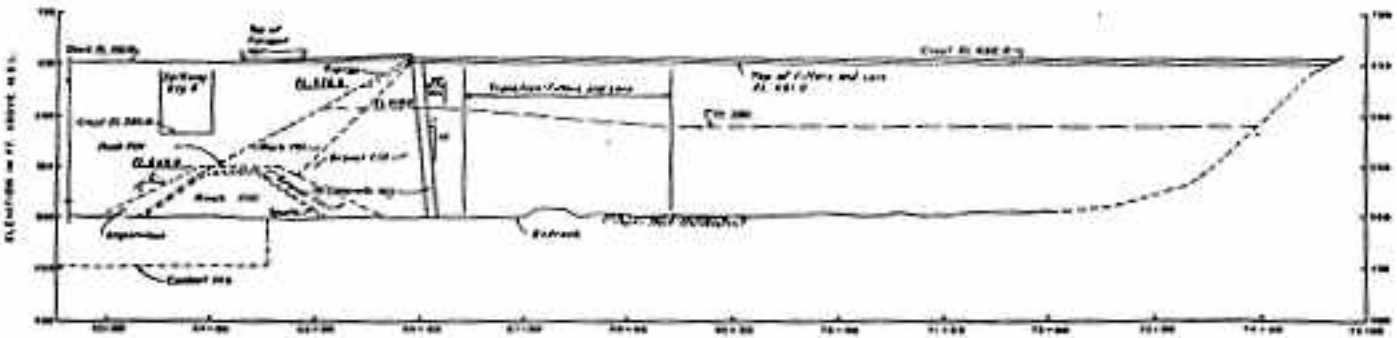
NTS

LITTLE GOOSE LOCK AND DAM

NORTH EMBANKMENT

TYPICAL SECTION

PLATE 9



PROFILE ALONG C.B.L.

NORTH SHORE EMBANKMENT

NTS

LITTLE GOOSE LOCK AND DAM

NORTH EMBANKMENT

C.B.L. PROFILE VIEW

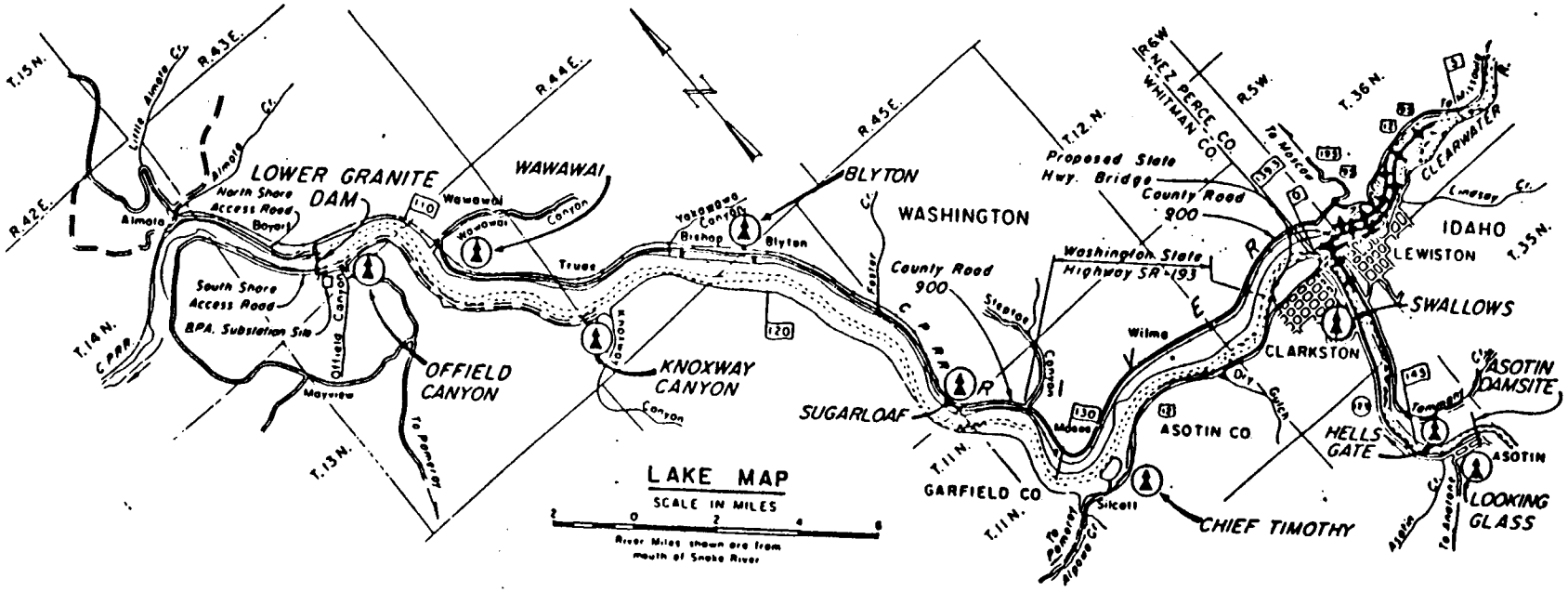
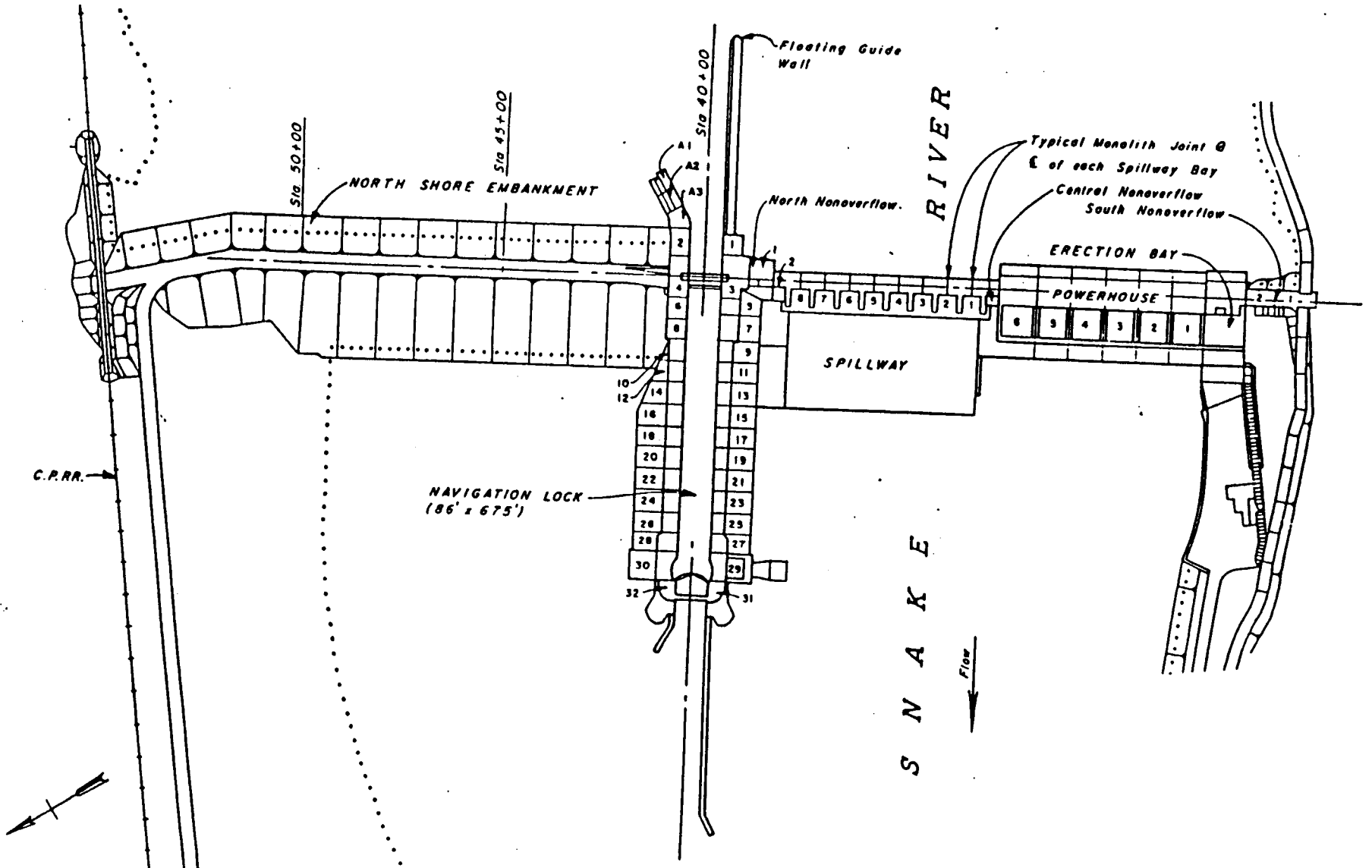


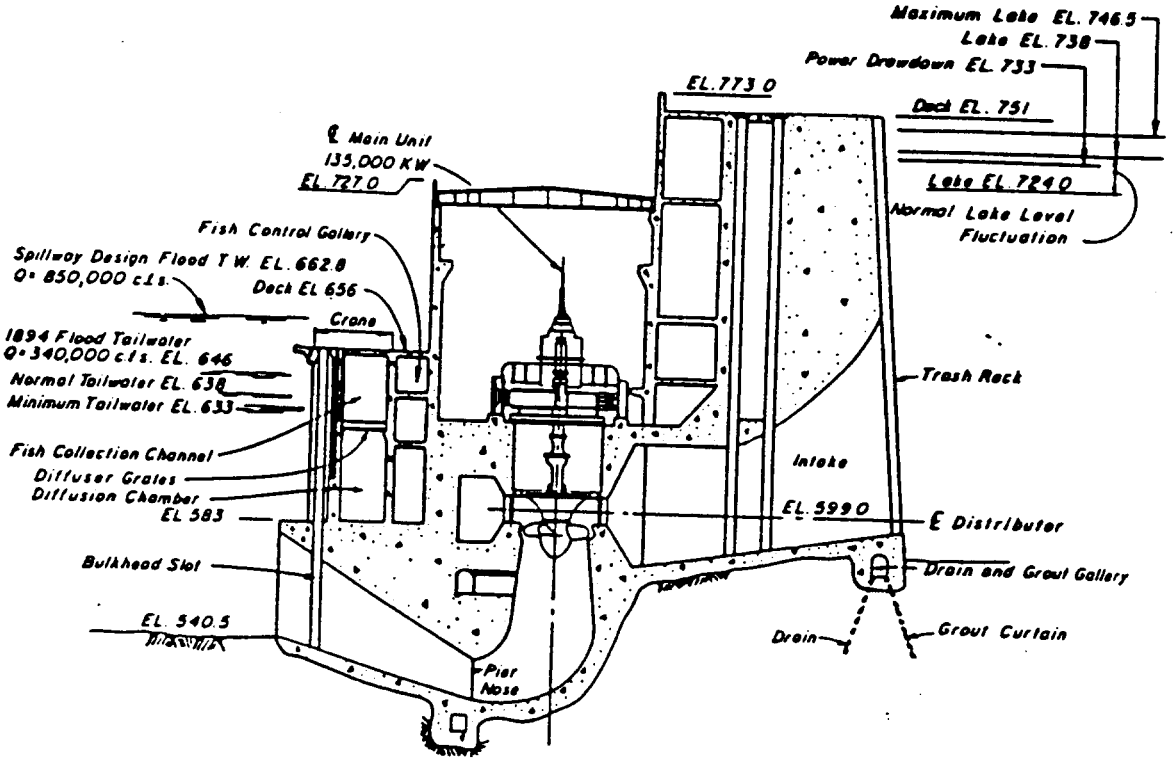
PLATE 7

LOWER GRANITE LOCK AND DAM
PROJECT LOCATION
VICINITY AND LAKE MAPS

PLATE 8



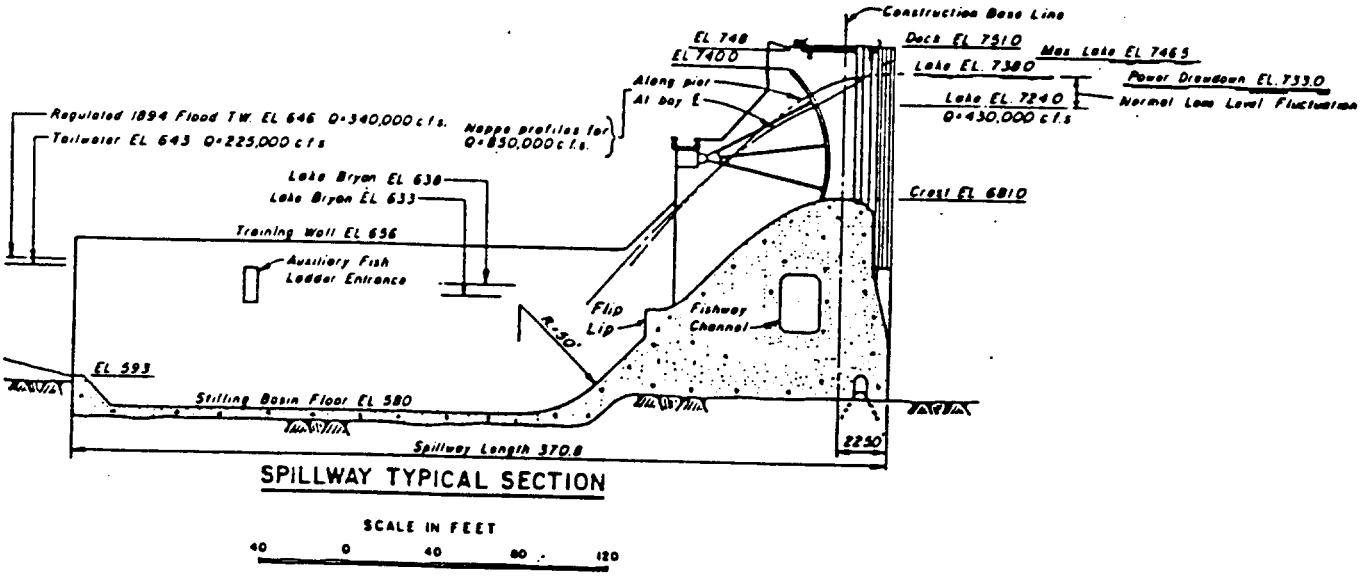
LOWER GRANITE LOCK AND DAM
MONOLITH IDENTIFICATION
PLAN VIEW



POWERHOUSE SECTION

SCALE IN FEET

40 0 40 80 120



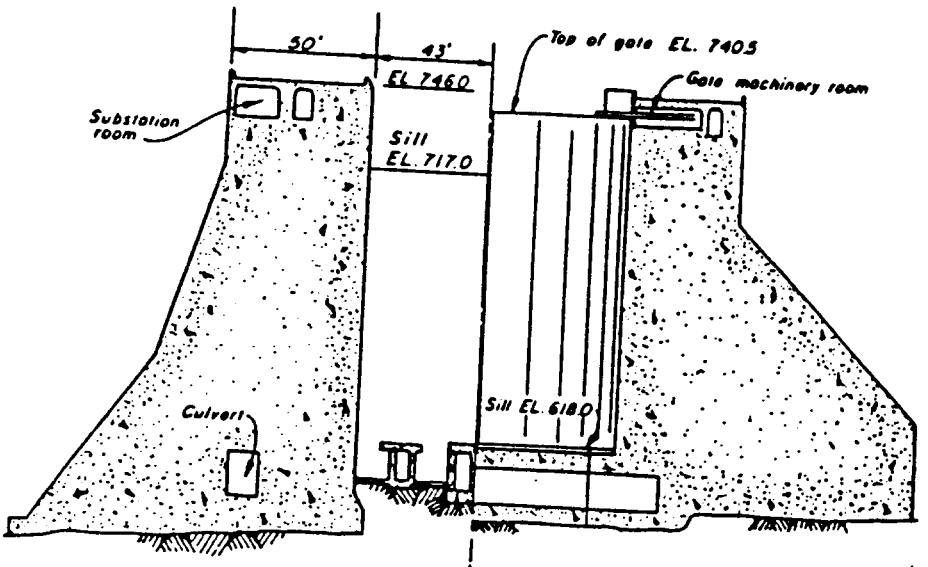
SPILLWAY TYPICAL SECTION

SCALE IN FEET

40 0 40 80 120

LOWER GRANITE LOCK AND DAM
POWERHOUSE AND SPILLWAY
TYPICAL SECTIONS

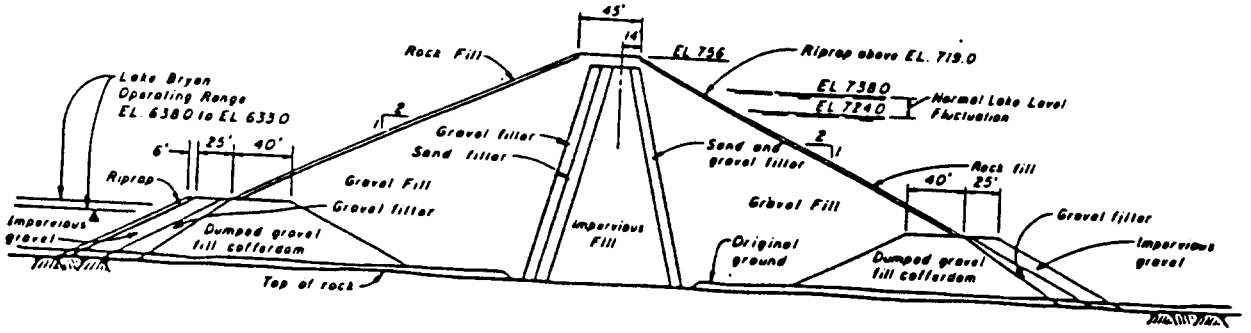
PLATE 9



TYPICAL LOCK SECTION

SCALE IN FEET

40 0 40 80 120



TYPICAL EMBANKMENT SECTION

SCALE IN FEET

60 0 60 120 180

LOWER GRANITE LOCK AND DAM
NAVIGATION LOCK AND NORTH EMBANKMENT TYPICAL SECTIONS

PLATE 10

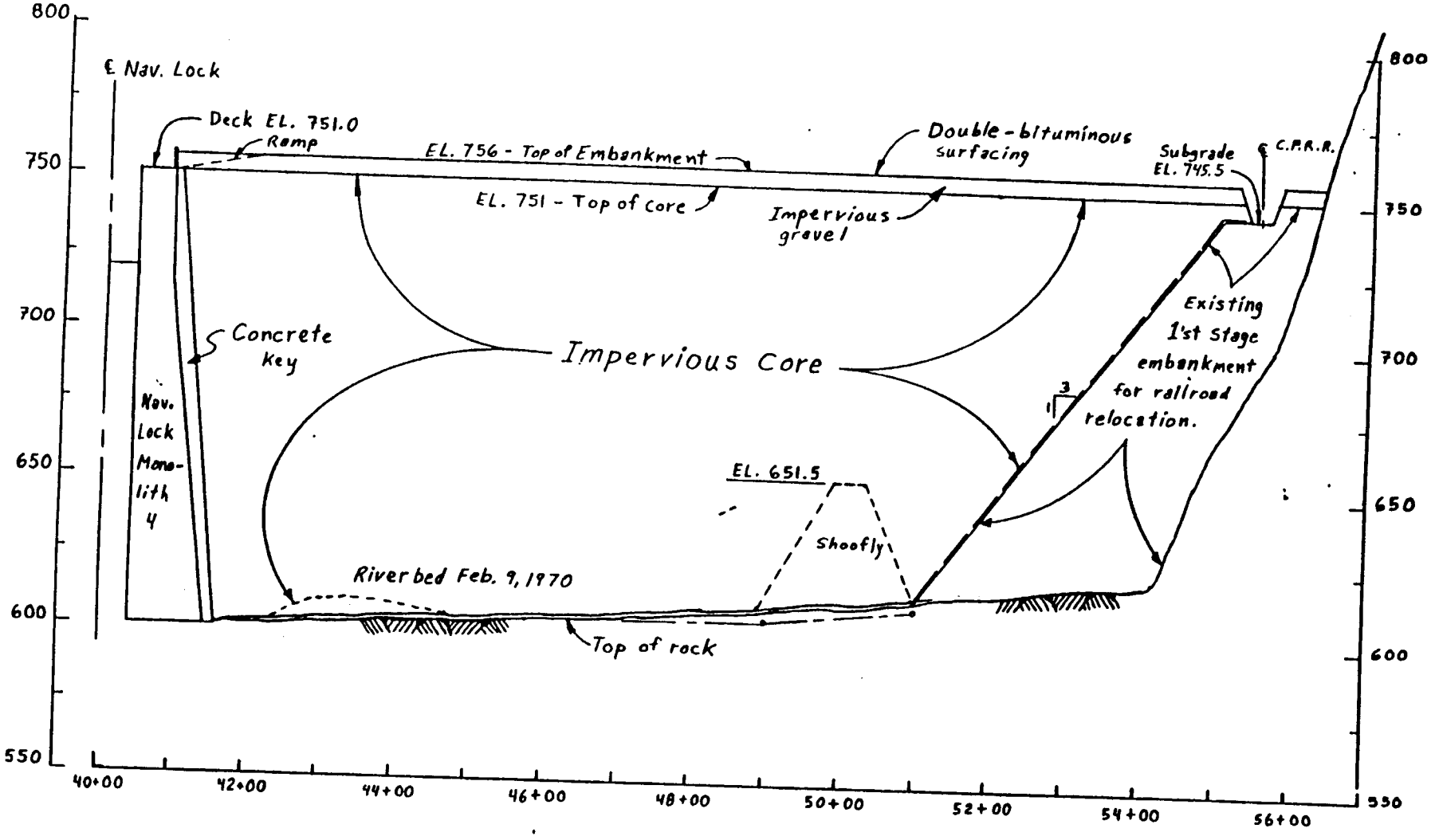
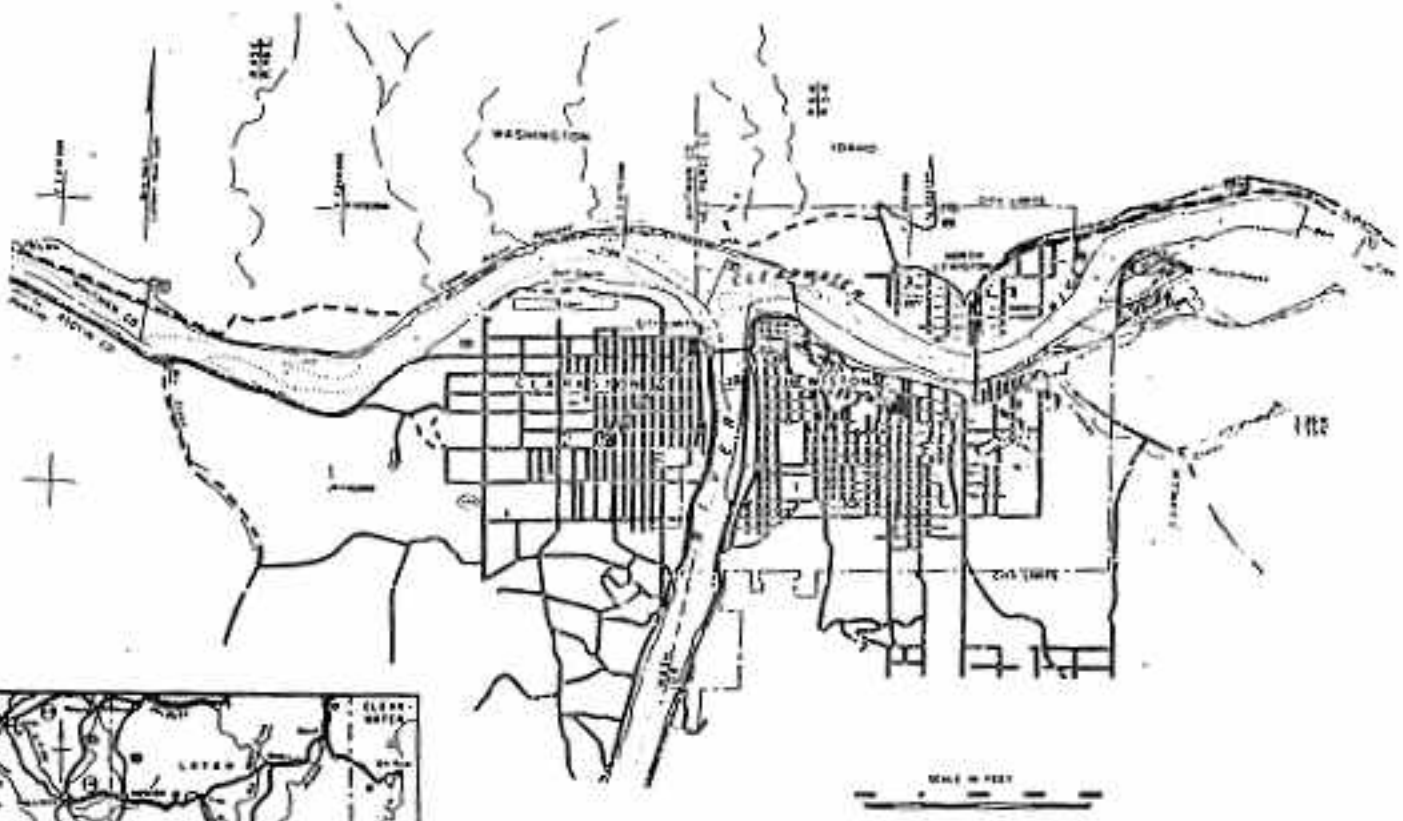


PLATE 7.1

LOWER GRANITE LOCK AND DAM
NORTH EMBANKMENT
CENTERLINE PROFILE VIEW

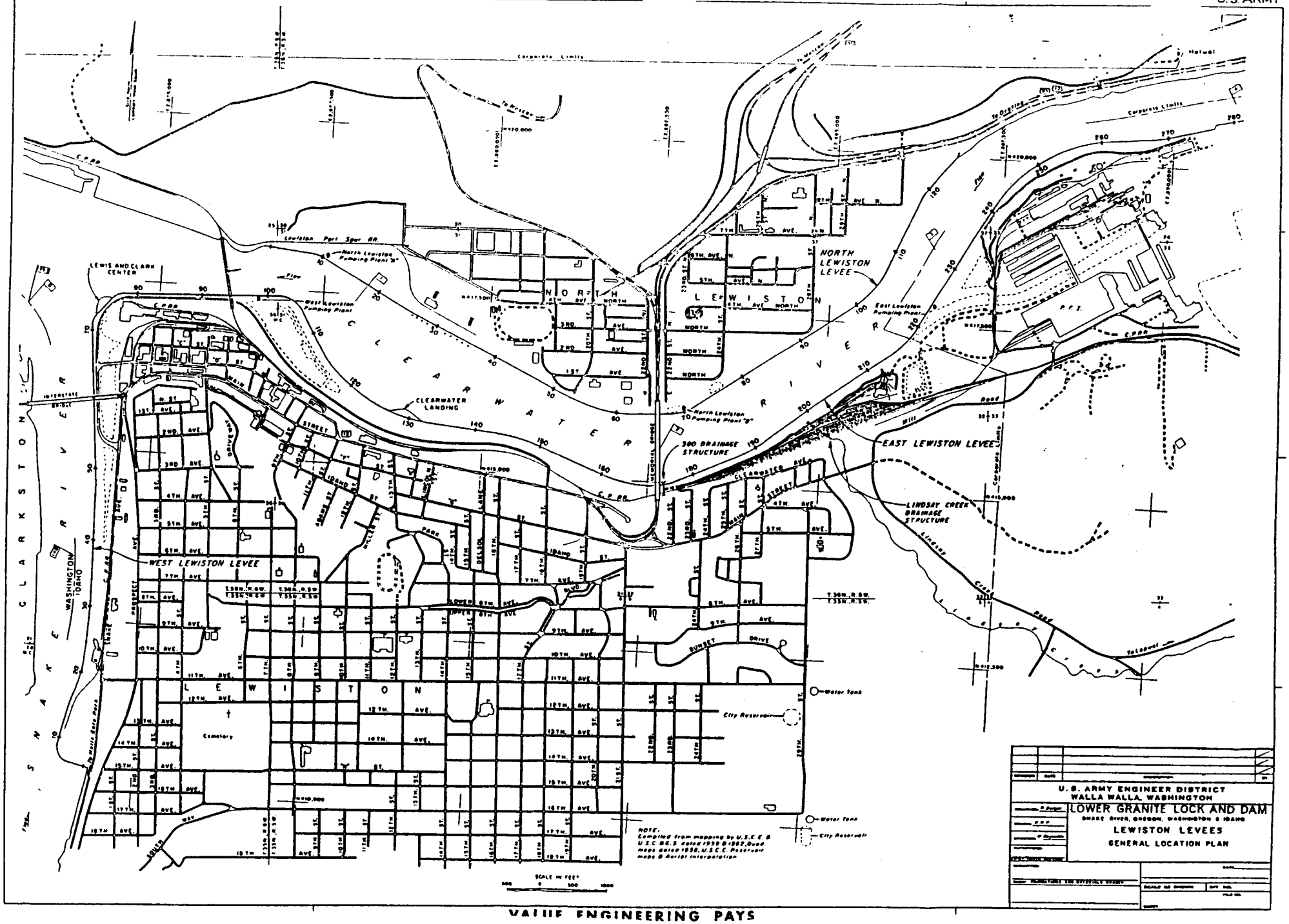
PLATE 12



LOWER GRANITE LEVEE SYSTEM

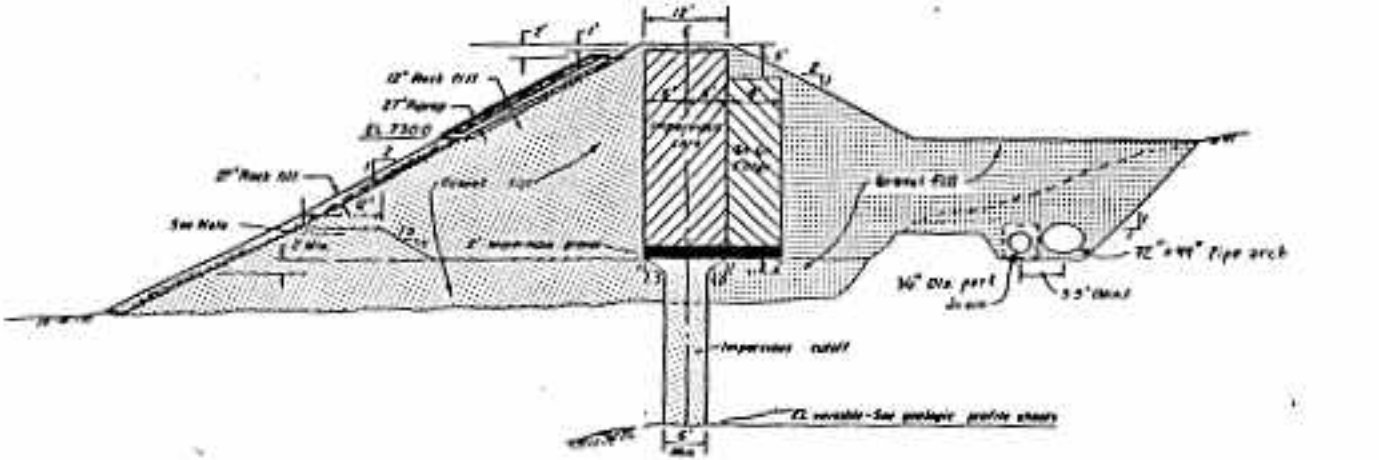
(LEWISTON LEVEES)

GENERAL LOCATION MAP

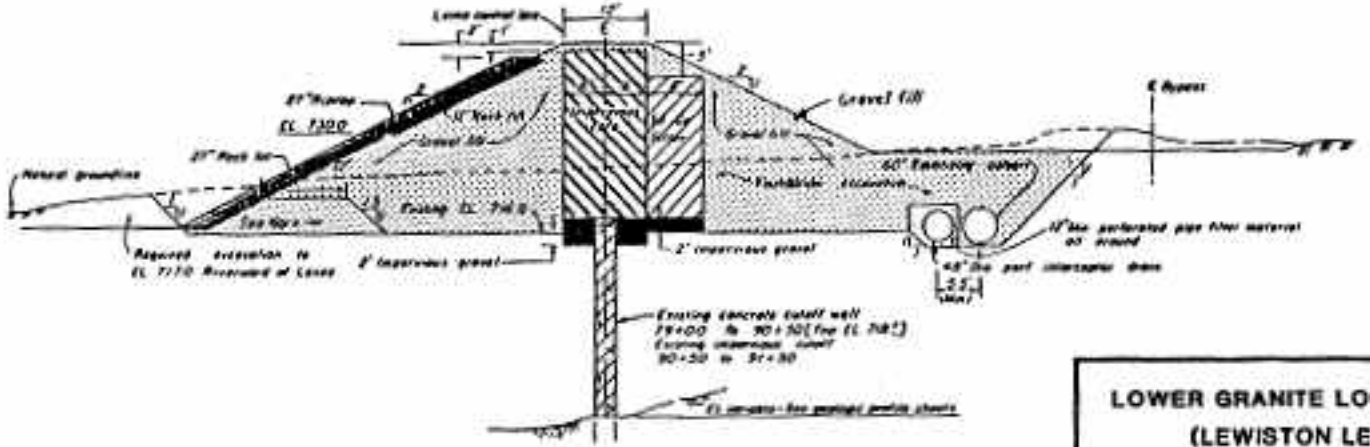


NOTE:
Compiled from mapping by U.S.C.E. & U.S.C. & G.S. dated 1939 & 1957, Quad sheet dated 1958, U.S.C.E. Reservoir made & Aerial interpolation

U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON
LOWER GRANITE LOCK AND DAM
SNAKE RIVER, OREGON, WASHINGTON & IDAHO
LEWISTON LEVEES
GENERAL LOCATION PLAN



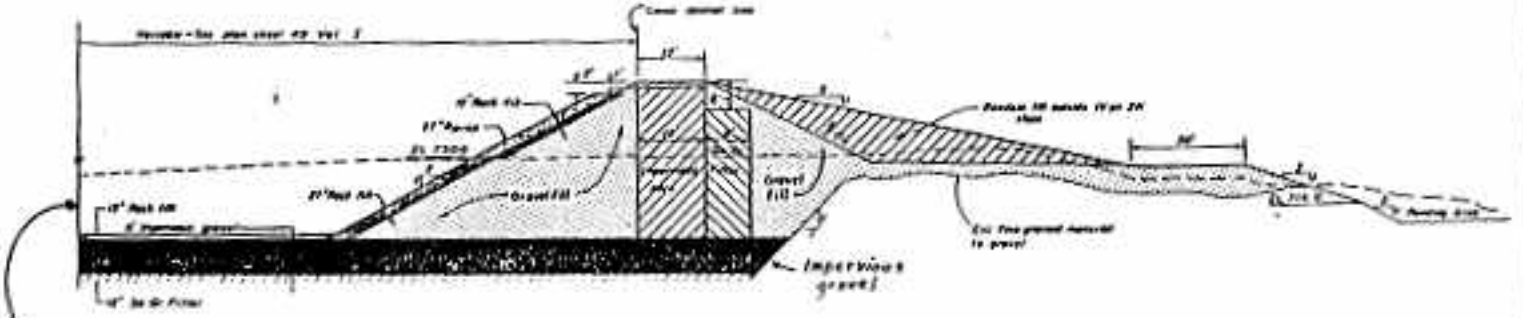
STA 164+40 TO STA 167+00



STA 79+00 TO STA 92+00

PLATE 14

LOWER GRANITE LOCK AND DAM
(LEWISTON LEVEES)
WEST LEWISTON LEVEE
TYPICAL LEVEE SECTIONS



STA. 104+00 TO STA. 120+00 (LEVEE STATIONING)

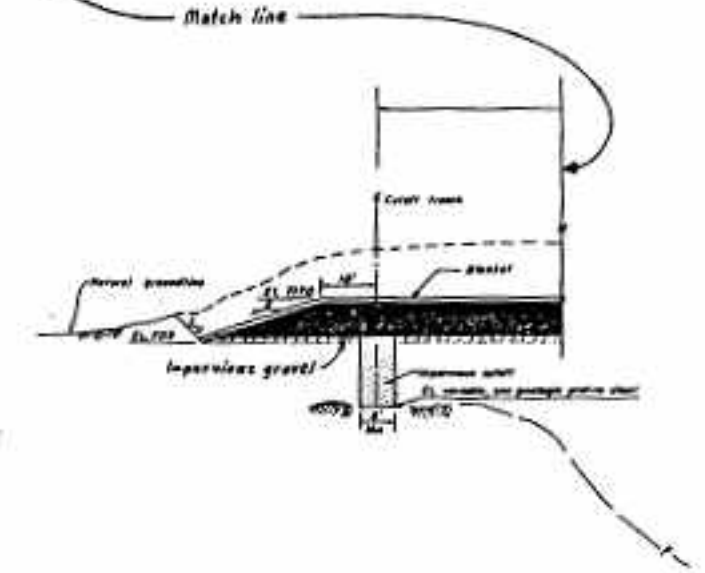


PLATE 18

LOWER GRANITE LOCK AND DAM
(LEWISTON LEVEES)
WEST LEWISTON LEVEE
TYPICAL LEVEE SECTIONS

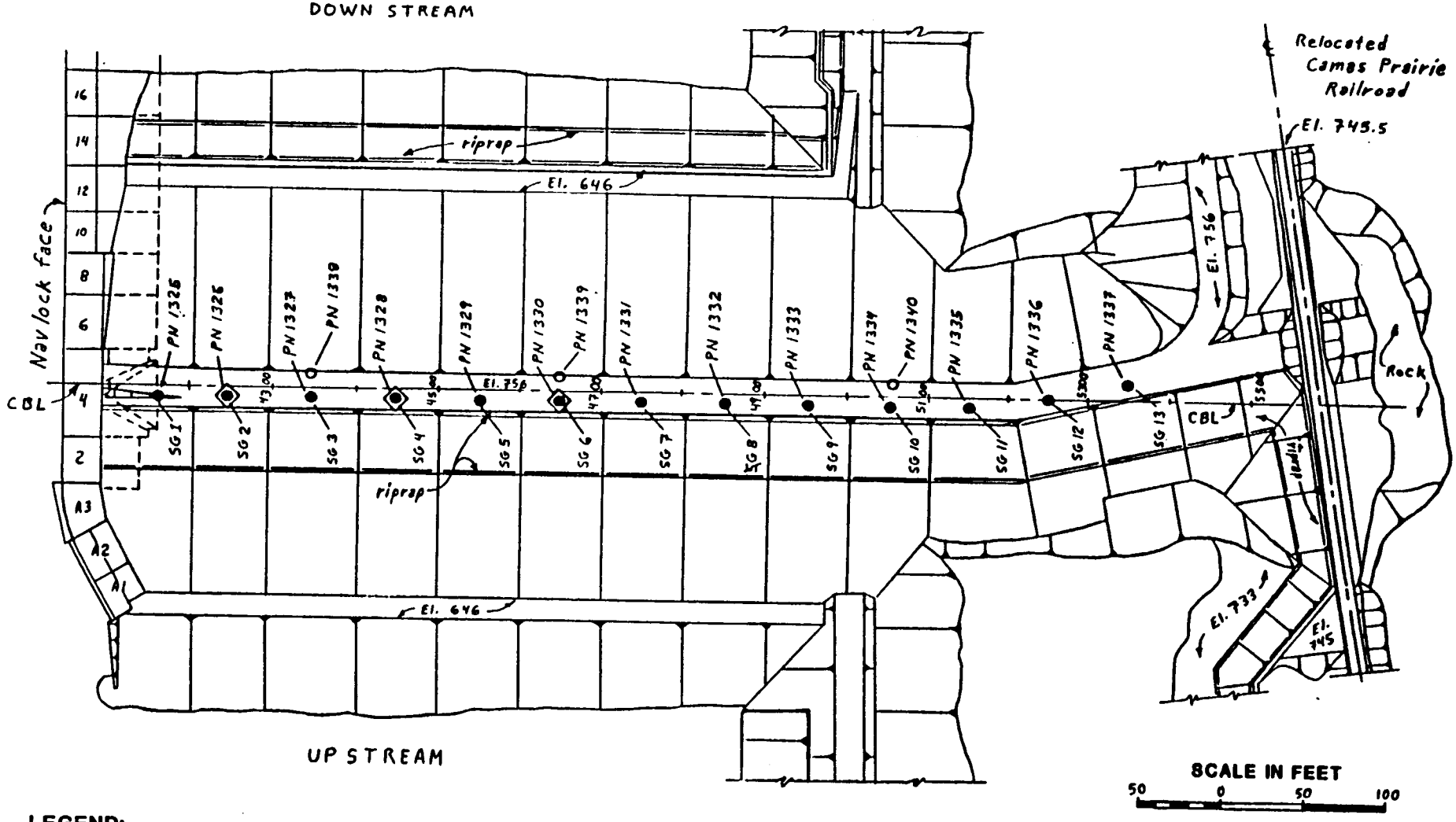


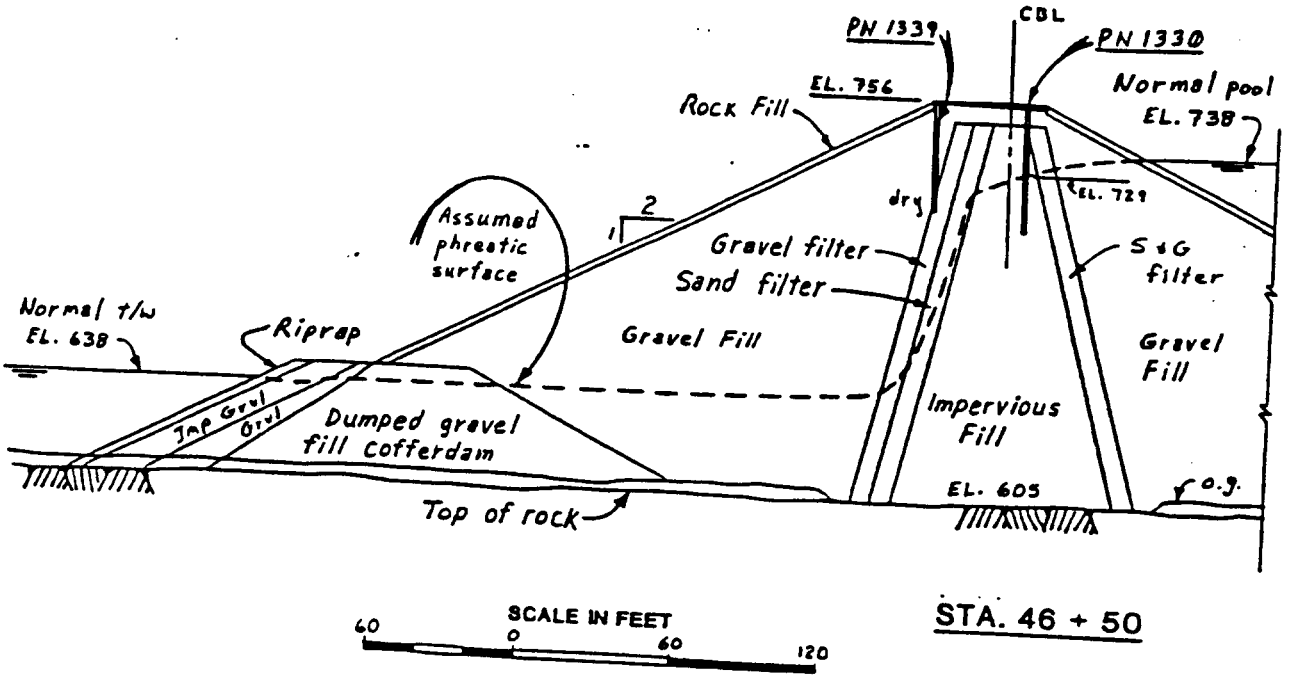
PLATE 16

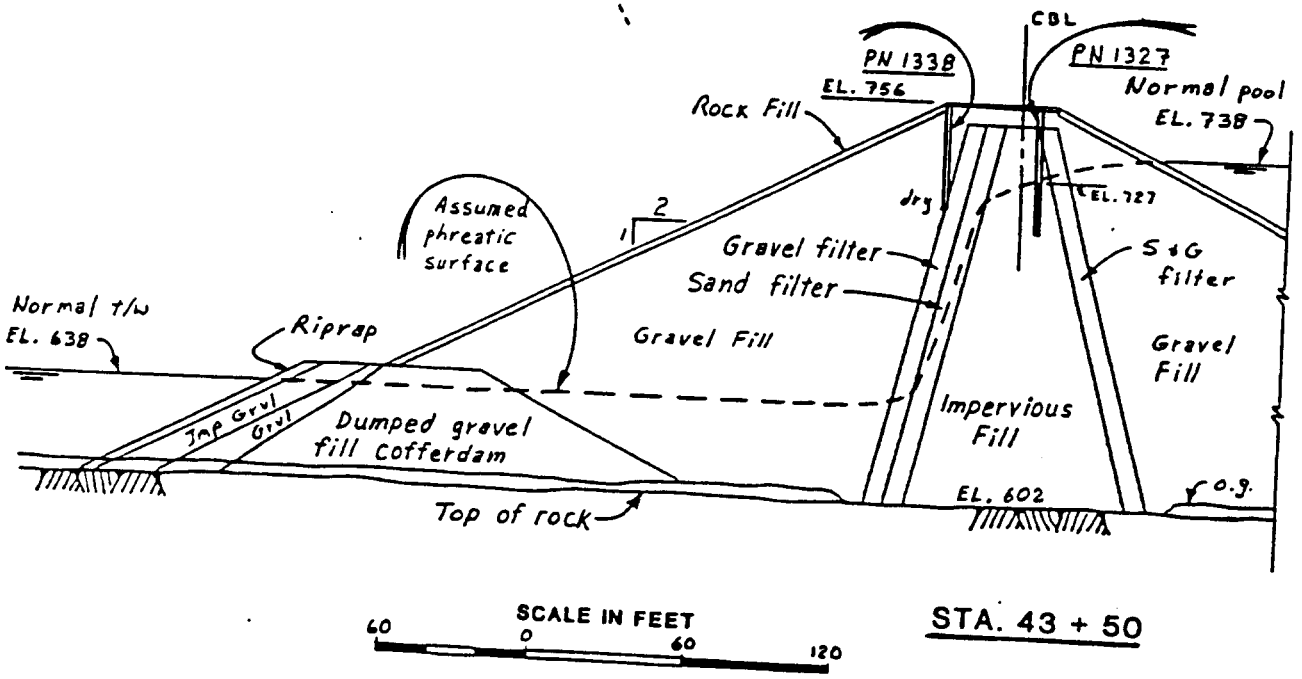
LEGEND:

- o – OPEN TUBE PIEZOMETER
- ⊡ – PORE PRESSURE METER
- ● – SETTLEMENT PIN LOCATED IN CONCRETE COLLAR AROUND HOLE CASING

Plate 16

LOWER GRANITE LOCK AND DAM
NORTH EMBANKMENT
PLAN VIEW

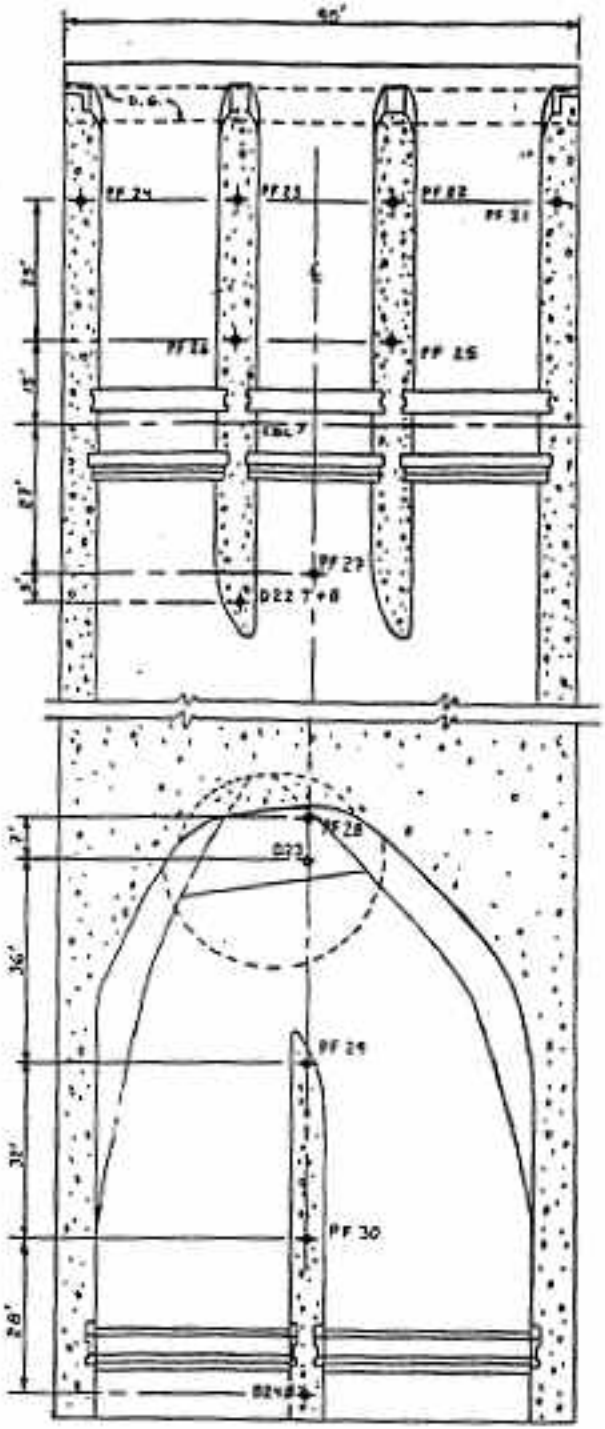




OPEN-TUBE PIEZOMETER: PN1327, PN1338, PN1339
PORE PRESSURE METER: PN1330

LOWER GRANITE LOCK AND DAM
NORTH EMBANKMENT
SECTION VIEWS

PLATE 17



LEGEND:

- DEFORMATION METERS: D21-D24
- UPLIFT PRESSURE TRANSDUCERS: PF21-PF30

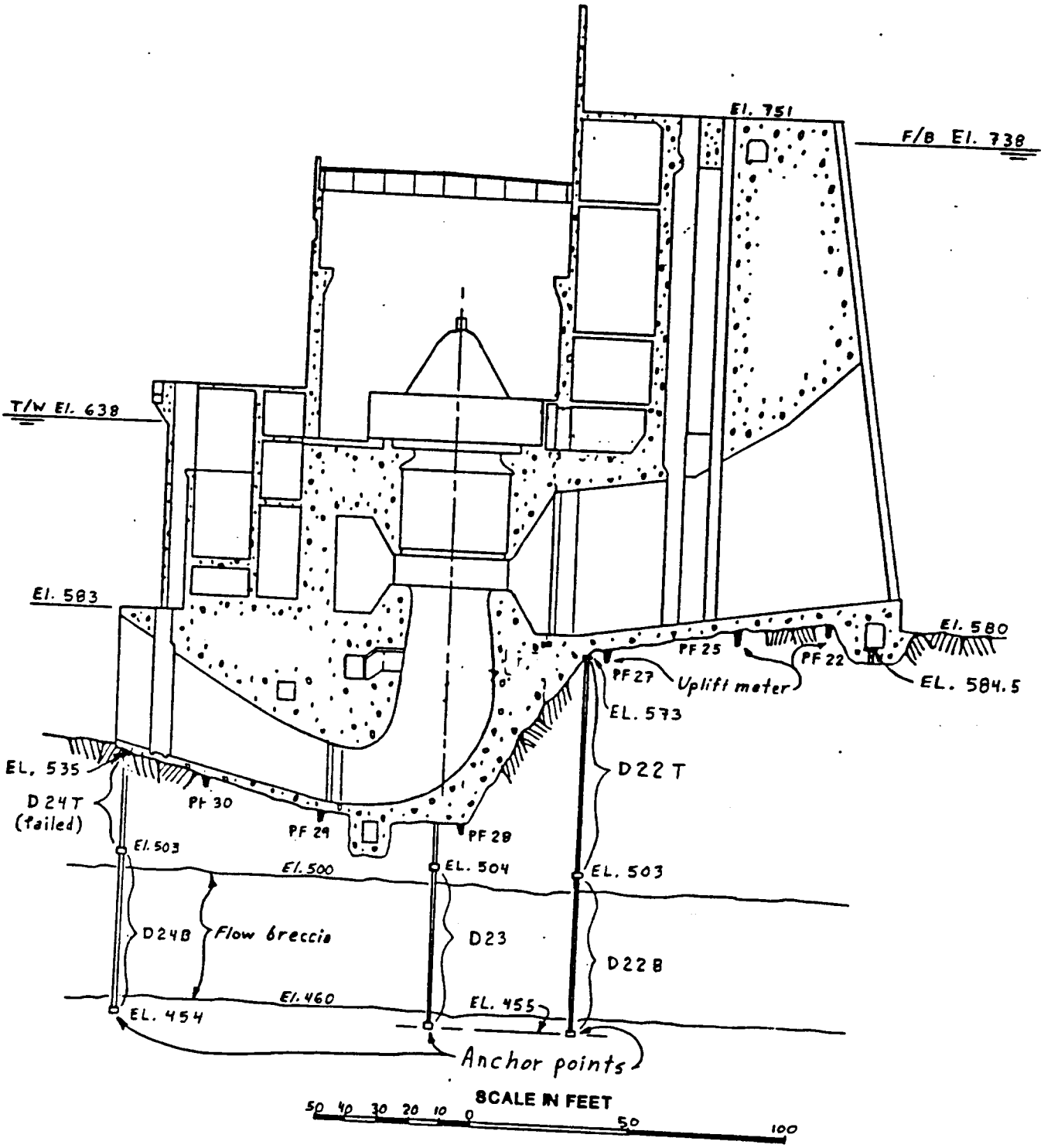
NTS

LOWER GRANITE LOCK AND DAM

POWERHOUSE BAY 2

PLAN VIEW OF INSTRUMENTATION LOCATION

PLATE 16

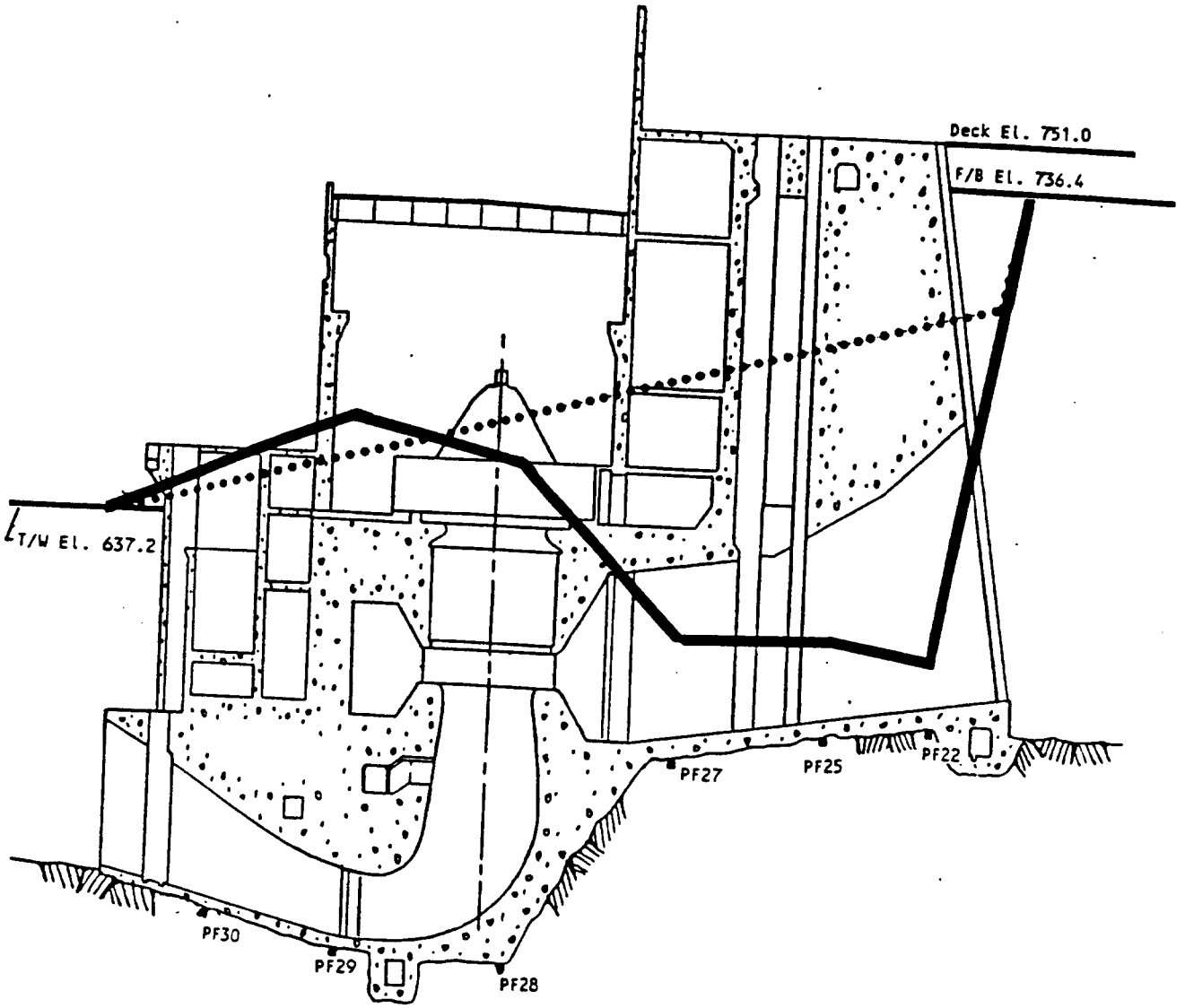


UPLIFT TRANSDUCERS: PF22, PF25, PF27–PF30

DEFORMATION METERS: D21, D22, D23, D24

LOWER GRANITE LOCK AND DAM
POWERHOUSE BAY 2
SECTION VIEW OF INSTRUMENTATION LOCATION

PLATE 19



POWERHOUSE BAY 2
SECTION VIEW

••• DESIGN UPLIFT

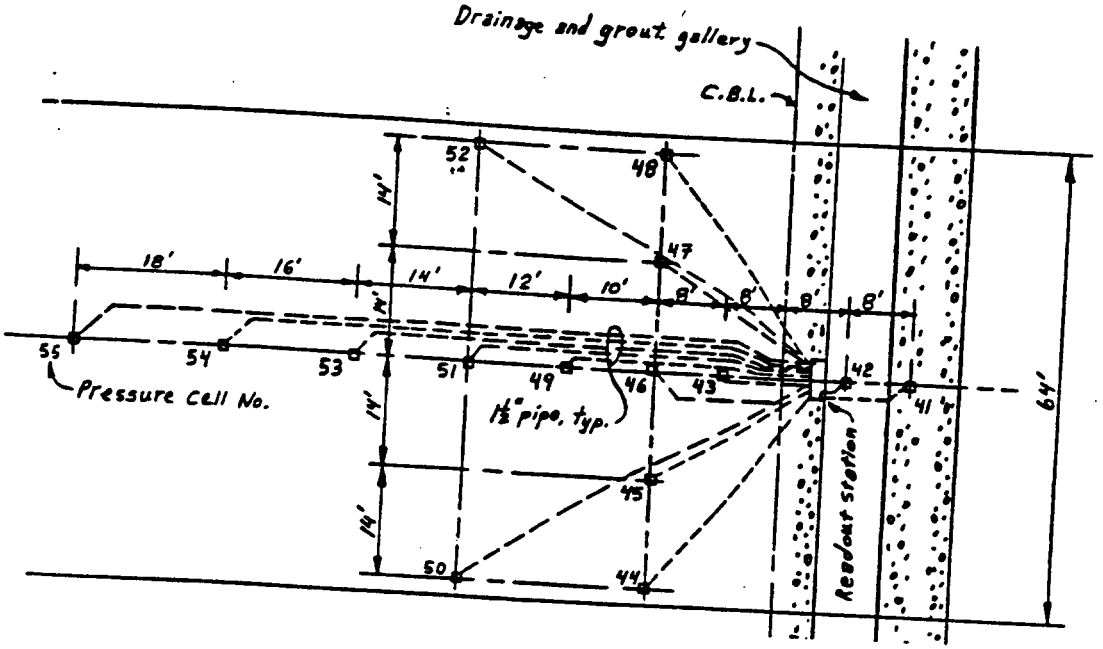
▬ MEASURED UPLIFT - 02/19/91

▫ PRESSURE TRANSDUCERS

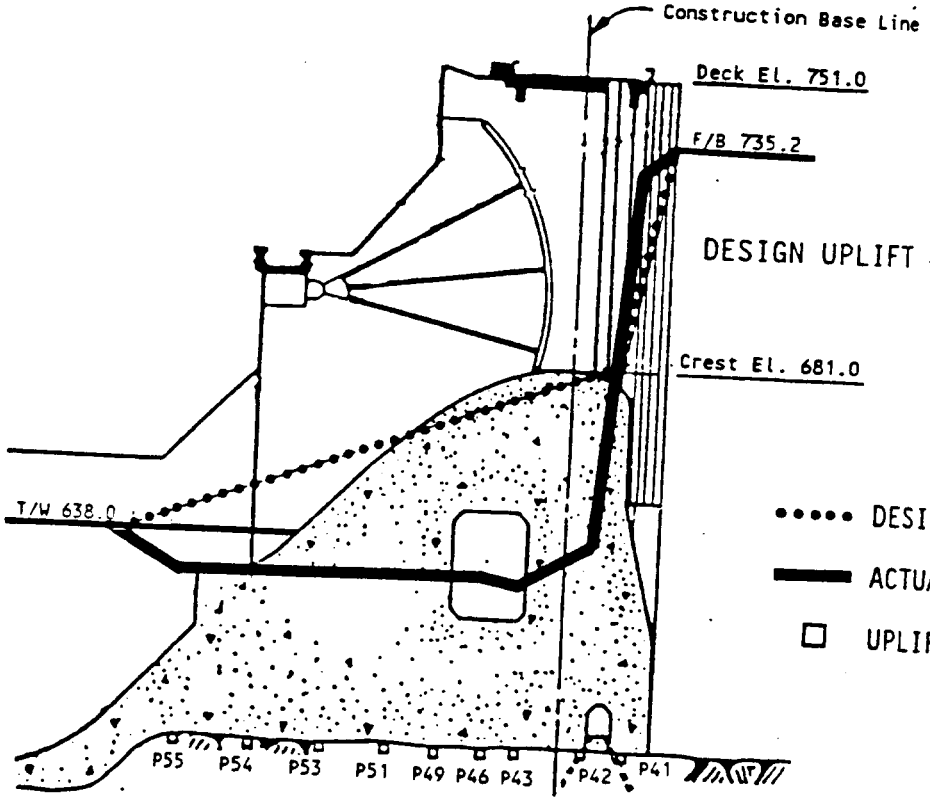
DESIGN UPLIFT = T/W + 2/3(F/B-T/W)

LOWER GRANITE LOCK AND DAM
POWERHOUSE BAY 2
DESIGN UPLIFT VERSUS MEASURED UPLIFT

PLATE 20



SPILLWAY BAY 4
PLAN VIEW



DESIGN UPLIFT = T/W + 1/2 (F/B - T/W)

●●●●● DESIGN UPLIFT

ACTUAL UPLIFT - 03/08/90

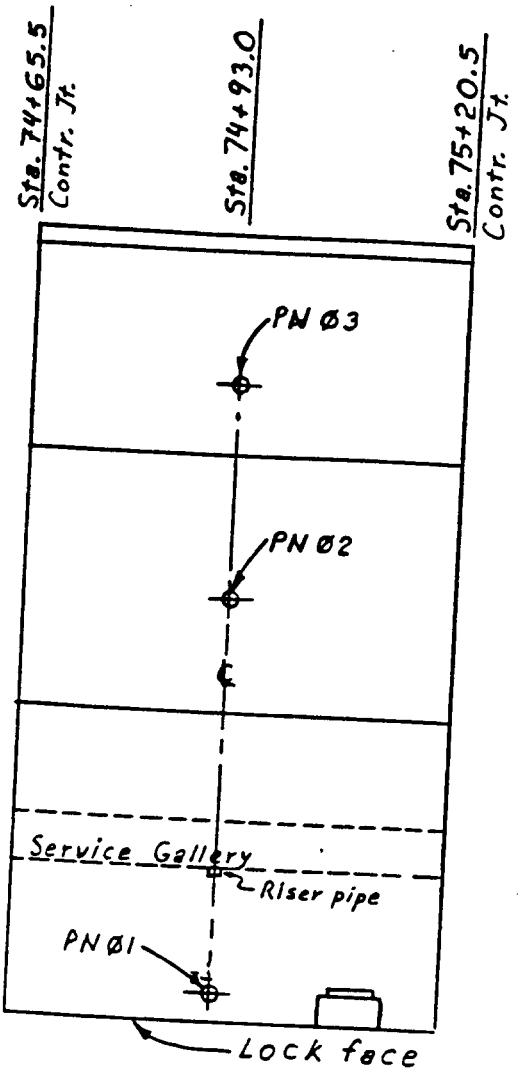
□ UPLIFT PRESSURE PIPES

SPILLWAY BAY 4
SECTION VIEW

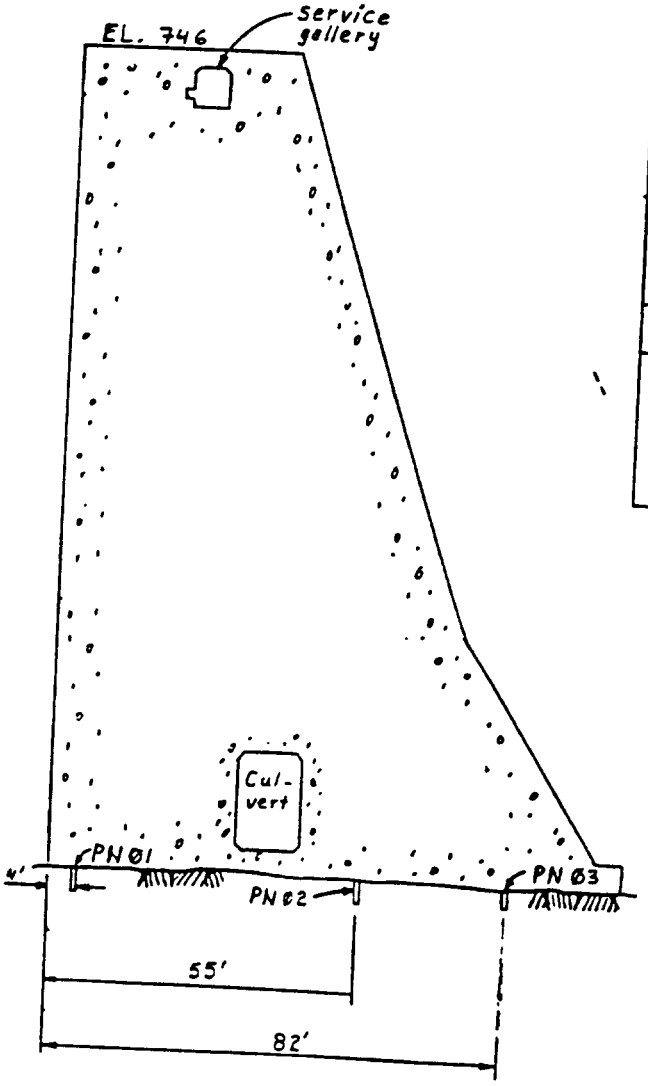
NTS

LOWER GRANITE LOCK AND DAM
SPILLWAY – UPLIFT PRESSURE PIPES LOCATIONS
DESIGN UPLIFT VERSUS MEASURED UPLIFT

PLATE 23



PLAN VIEW



SECTION VIEW

LEGEND:

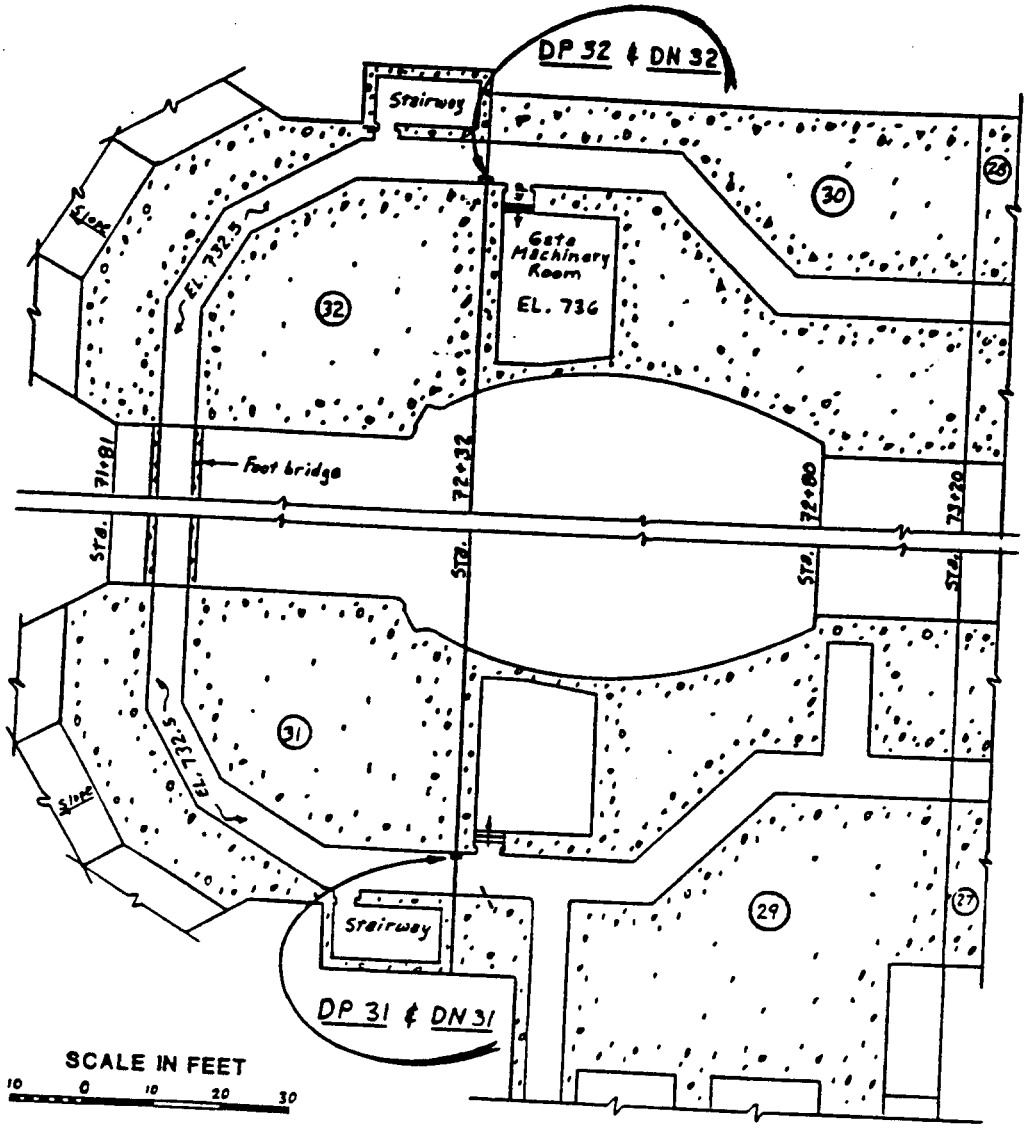
⊕ – UPLIFT PRESSURE TRANSDUCER: PN01 – PN03

NTS

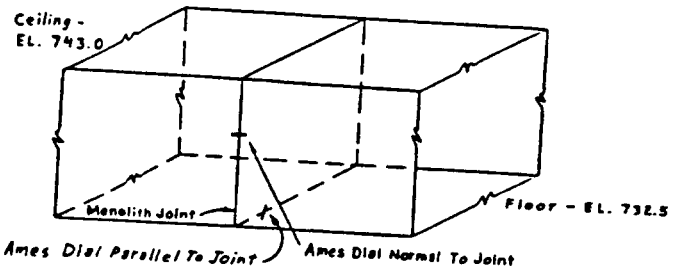
LOWER GRANITE LOCK AND DAM

NAVIGATION LOCK 22 – INSTRUMENTATION LOCATIONS PLAN AND SECTION VIEWS

PLATE 22



PLAN – EL. 740



TYPICAL GALLERY LOCATION

NOT TO SCALE

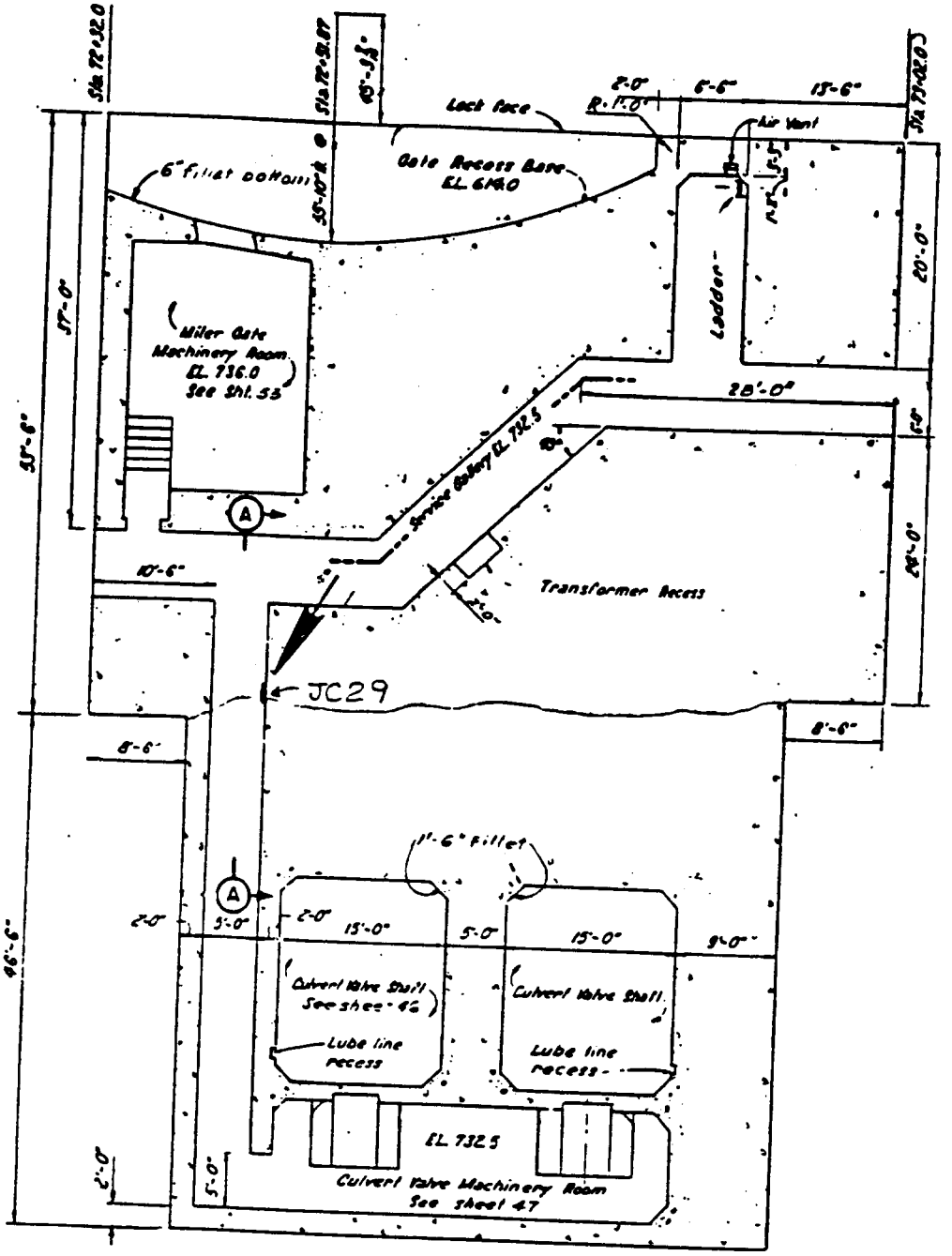
LEGEND:

AMES DIALS PARALLEL TO JOINT:
DP31, DP32 – EL. 732.5

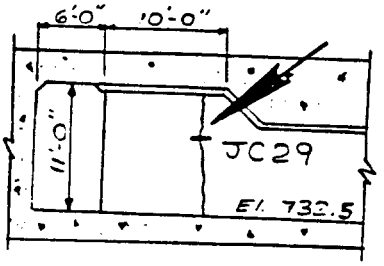
AMES DIALS NORMAL TO JOINT:
DN31, DN32 – EL. 735.0

LOWER GRANITE LOCK AND DAM
NAVIGATION LOCK MONOLITHS 29, 30, 31 & 32
PLAN VIEW – INSTRUMENTATION LOCATION

PLATE 23



PLAN VIEW



SERVICE GALLERY

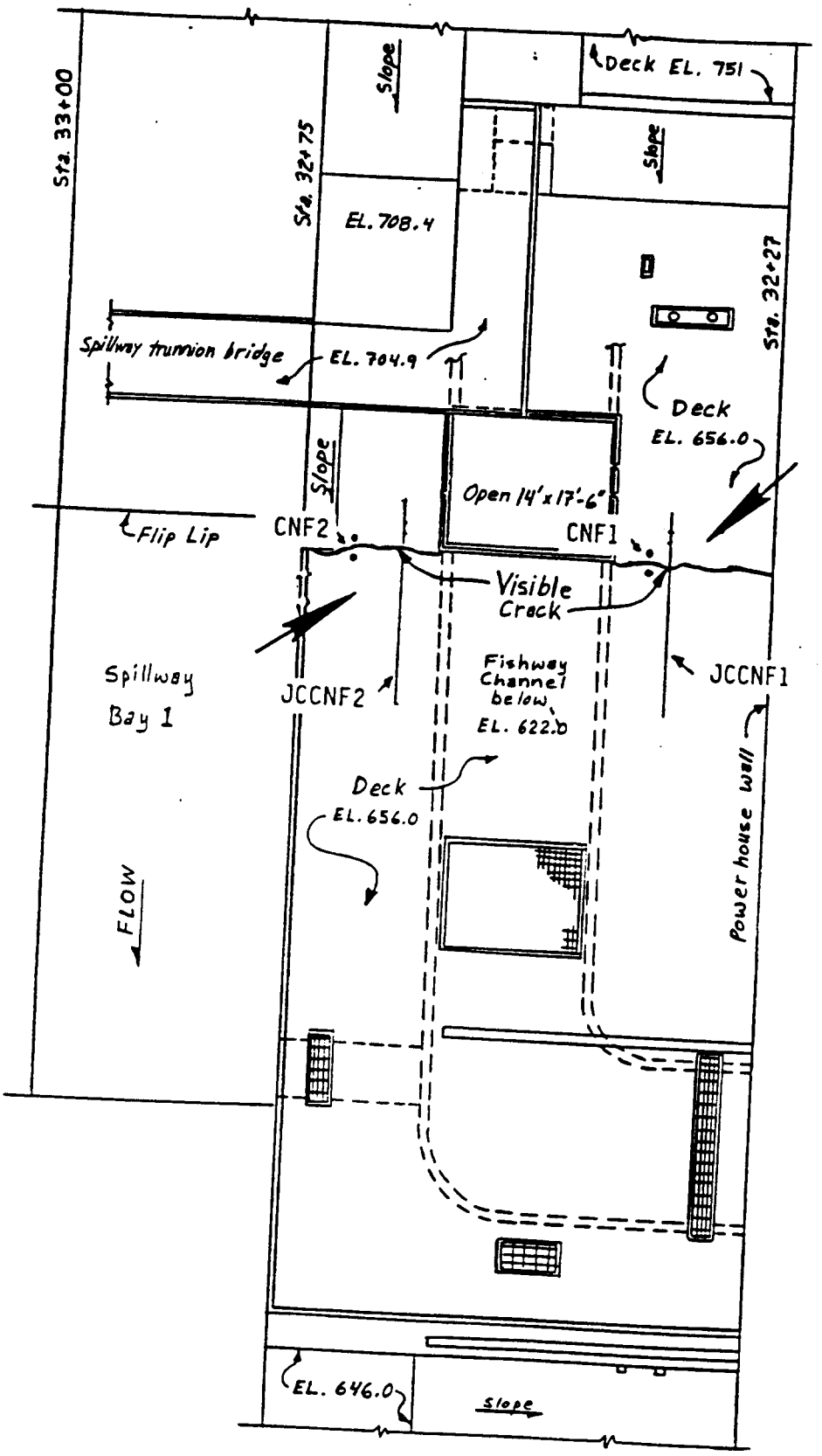
SECTION VIEW A

NTS

LOWER GRANITE LOCK AND DAM

NAVIGATION LOCK 29 – CRACK METER LOCATION PLAN AND SECTION VIEWS

PLATE 24



EXTENSOMETER POINTS
CNF1
CNF2

EXTENDED RANGE TRANSDUCERS
JCCNF1
JCCNF2

NTS

LOWER GRANITE LOCK AND DAM
CENTRAL NON-OVERFLOW
PLAN VIEW OF INSTRUMENTATION LOCATION

PLATE 25

PLATE 26

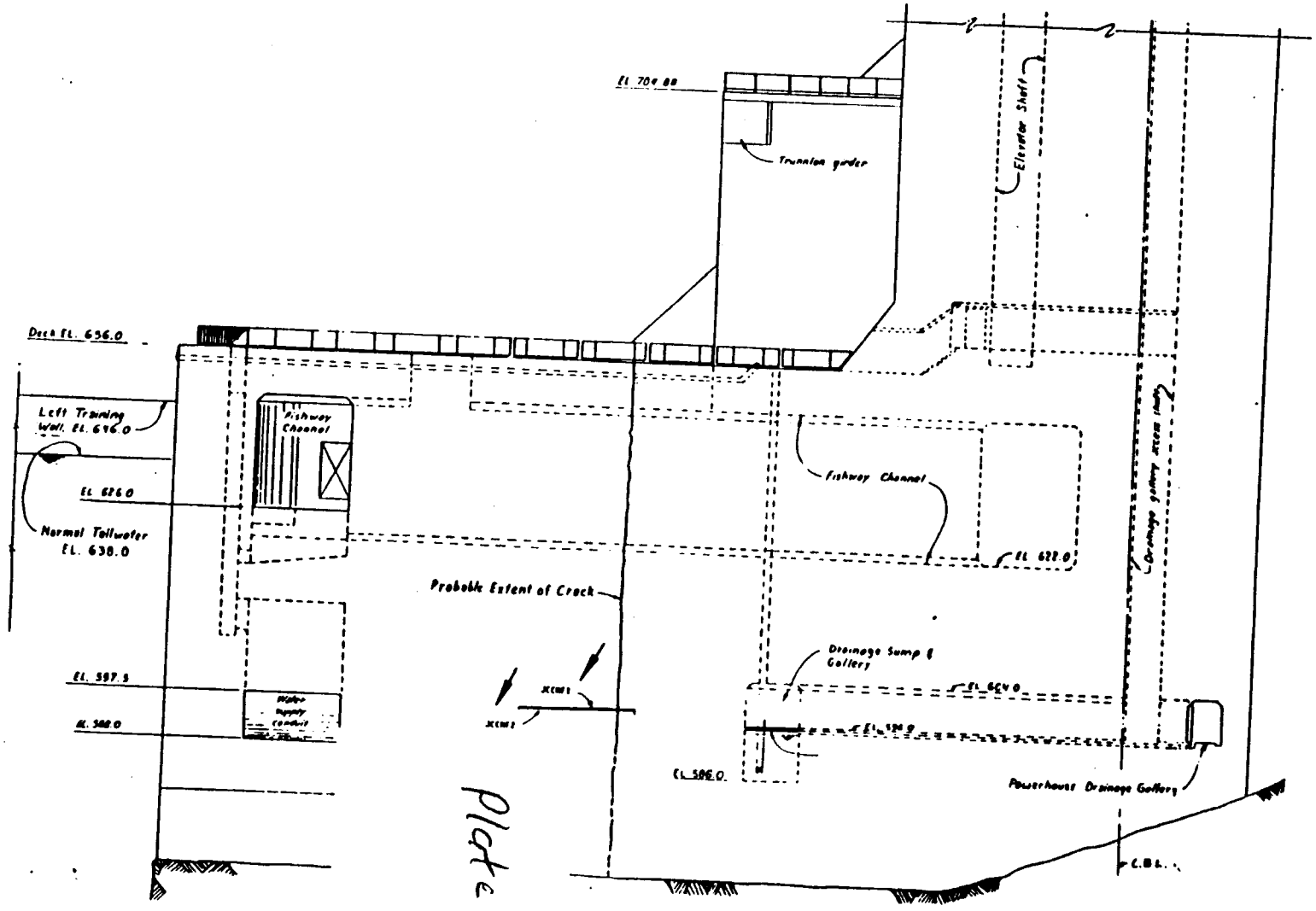


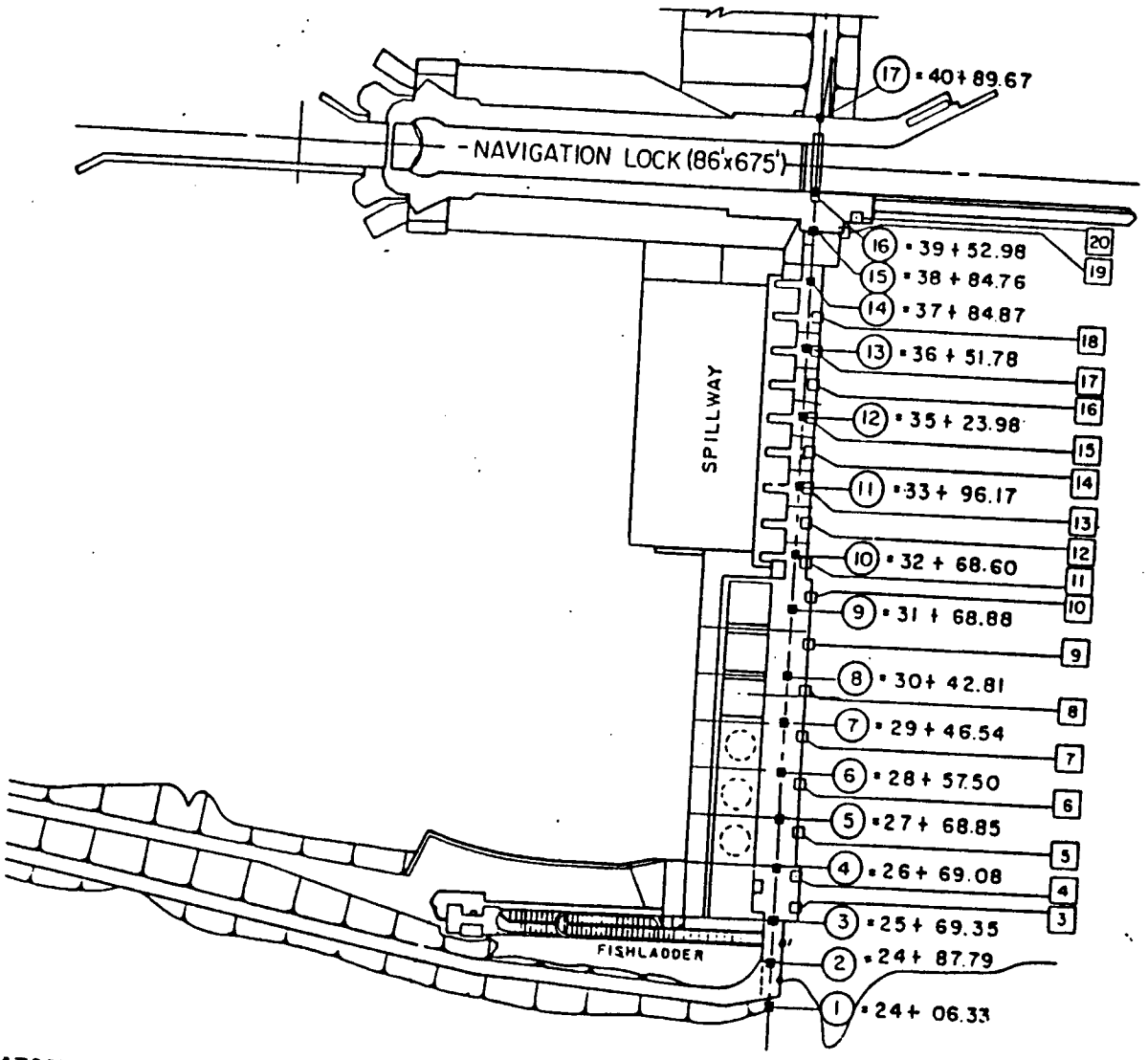
Plate 26

ELEVATION at STA. 32+27

SCALE IN FEET

LOWER GRANITE LOCK AND DAM
CENTRAL NON-OVERFLOW
SECTION VIEW OF INSTRUMENTATION LOCATION

PLATE 217



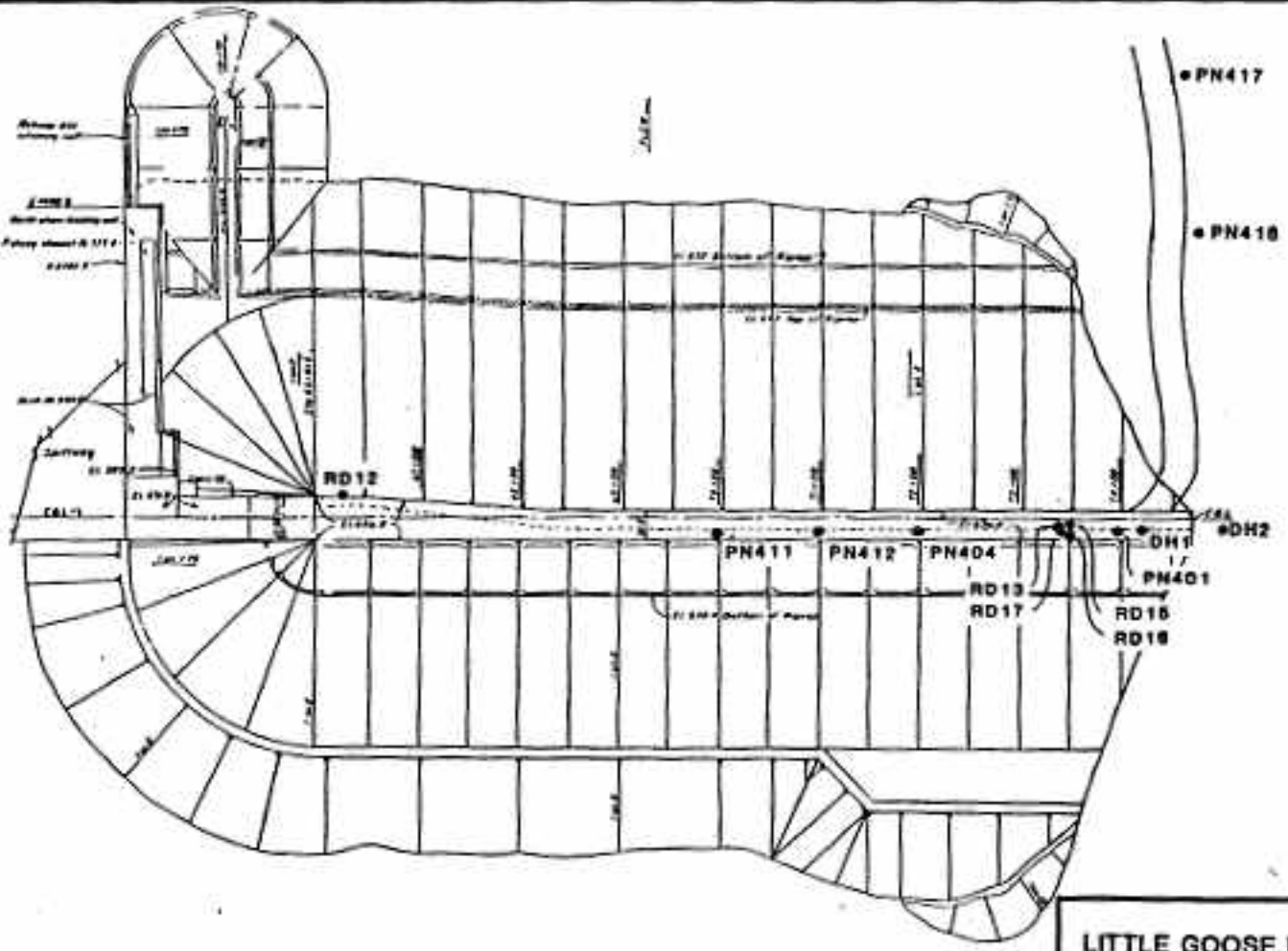
□- TRILATERATION POINT

■- PRECISE LEVEL POINT

NTS

LOWER GRANITE LOCK AND DAM
TRILATERATION AND PRECISE LEVEL SURVEYS
PLAN VIEW OF SURVEY POINTS' LOCATIONS

PLATE 28a



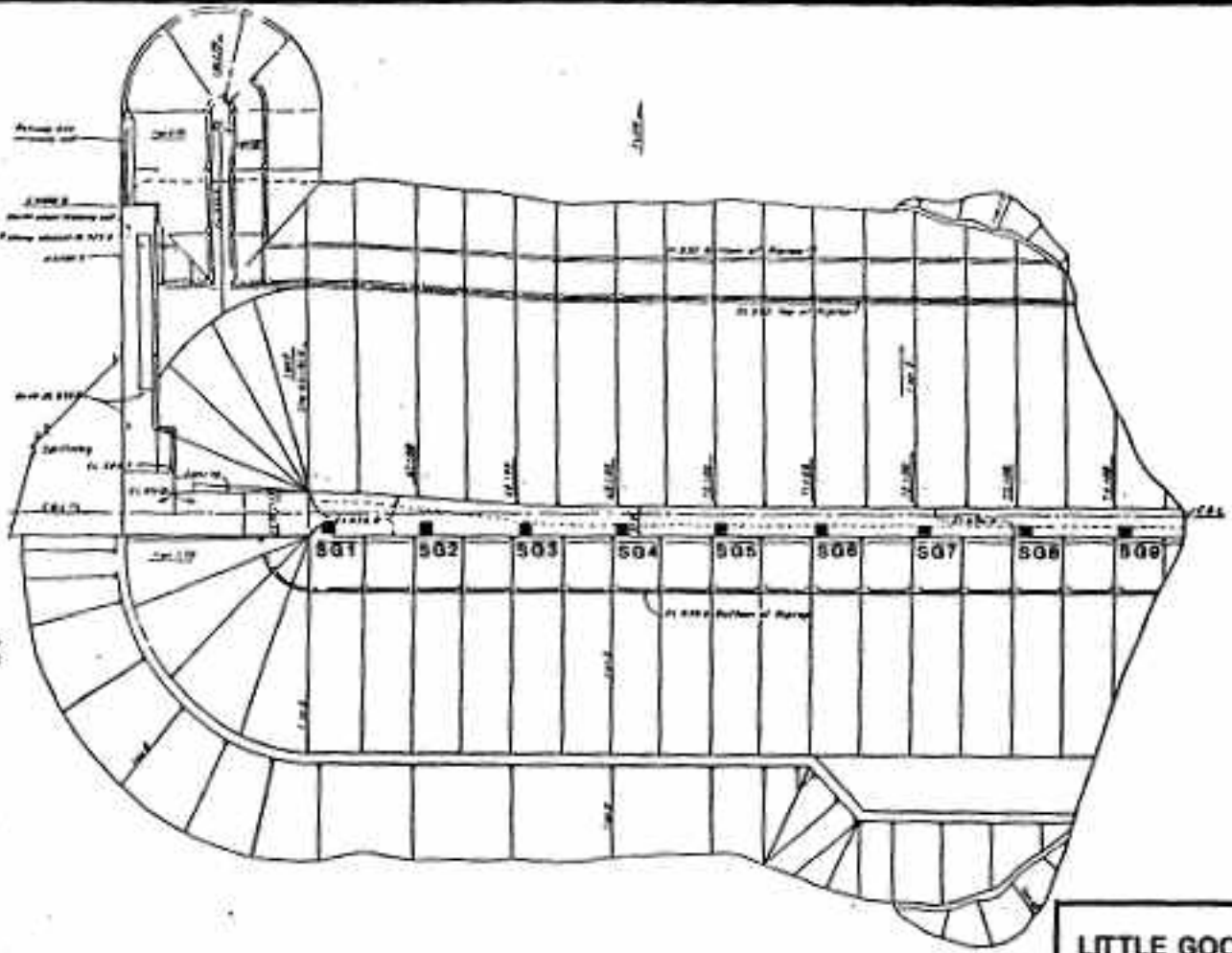
NTS

LITTLE GOOSE LOCK AND DAM

NORTH EMBANKMENT

PIEZOMETERS' LOCATIONS

PLAN VIEW



NTS

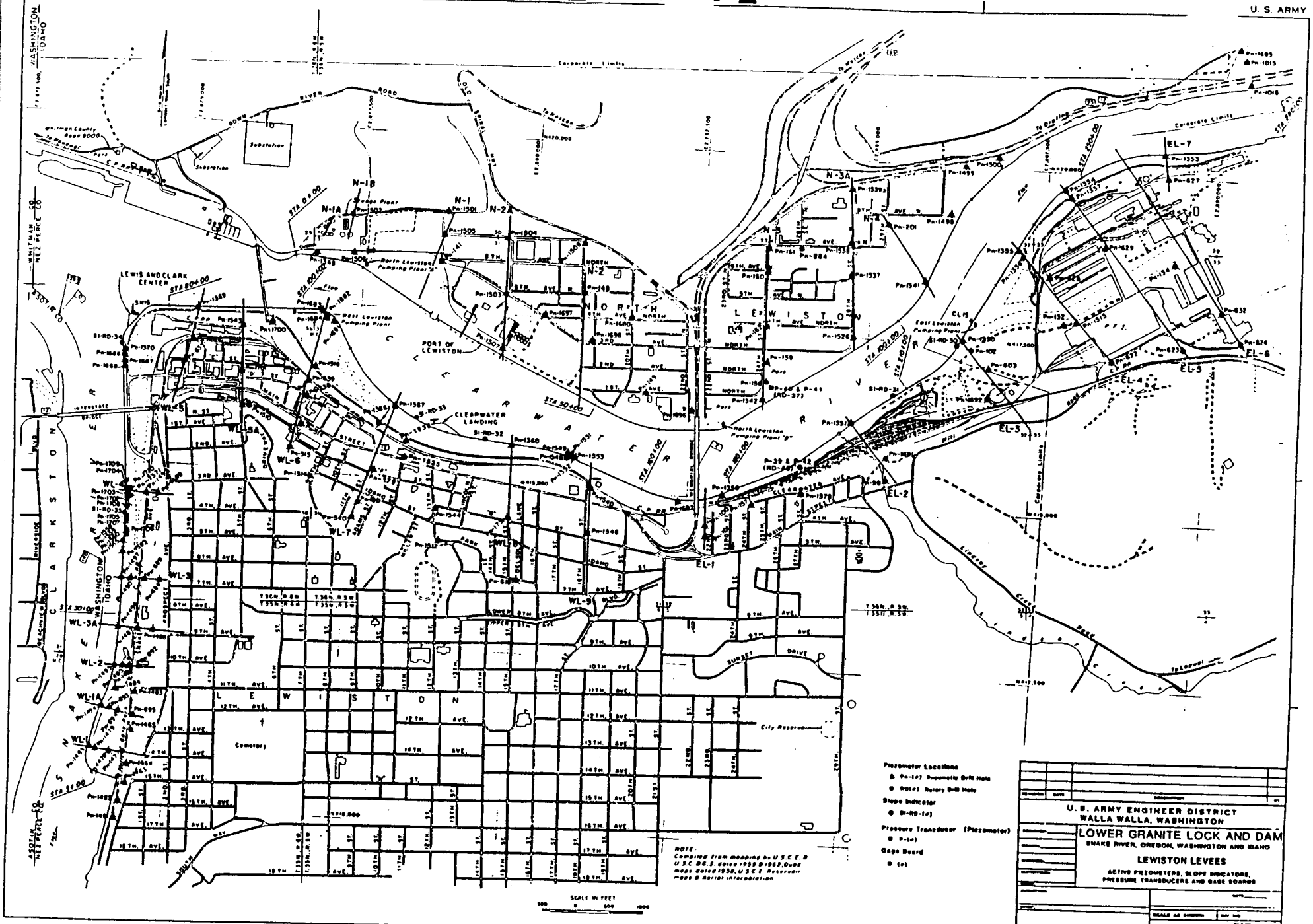
LITTLE GOOSE LOCK AND DAM

NORTH EMBANKMENT

SETTLEMENT GAGES' LOCATIONS

PLAN VIEW

PLATE A-29



U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

LOWER GRANITE LOCK AND DAM
SNAKE RIVER, OREGON, WASHINGTON AND IDAHO

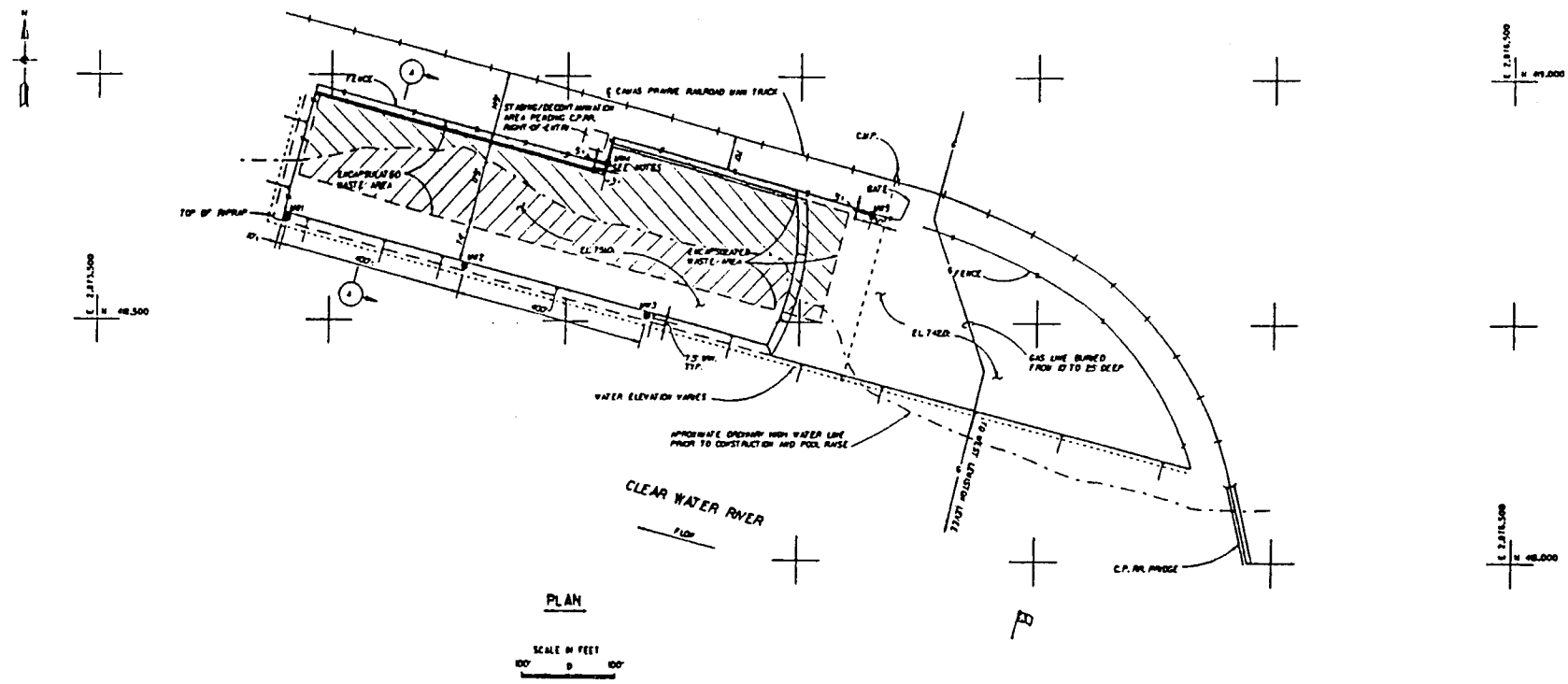
LEWISTON LEVEES
ACTIVE PIEZOMETERS, SLOPE INDICATORS, PRESSURE TRANSDUCERS AND GAGE BOARDS

04-30-87

00-03-90/1

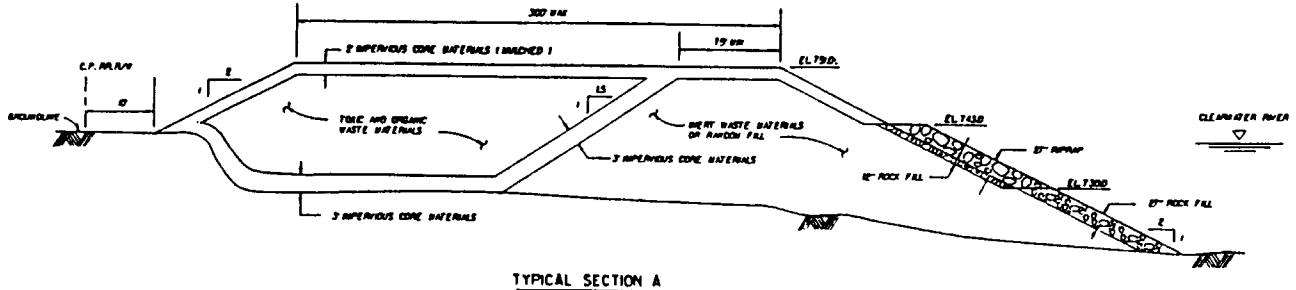
VALUE ENGINEERING PAYS

PLATE 30



PLAN

SCALE IN FEET
100' 0 100'



TYPICAL SECTION A
NTS

NOTES:

1. DRAWING COMPILED FROM AS BUILT DRAWING 73-C-496-24.
2. LOCATION OF MW4 MAY CHANGE PENDING C.P.RR. APPROVAL.

LEGEND:

ENCAPSULATED WASTE AREA (INERT MATERIALS) BELOW ORDINARY HIGH WATER LINE PRIOR TO LEVEE CONSTRUCTION AND POOL RAISE.

ENCAPSULATED WASTE AREA (TOXIC AND ORGANIC MATERIALS) BELOW ORDINARY HIGH WATER LINE PRIOR TO LEVEE CONSTRUCTION AND POOL RAISE.

MW4 MONITORING WELL

COMPUTER AIDED DESIGN & DRAFTING

U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

DESIGNED
DRAWN
CHECKED
APPROVED

LOWER GRANITE LOCK AND DAM
SNAKE RIVER, ORE., WASH. & IDA.
1992 DRAWDOWN
LEWISTON LEVEES WASTE AREA
SITE PLAN AND SECTION

SCALE AS SHOWN | DWG. NO.
DATE | SHEET NO. | ADJ. NO.

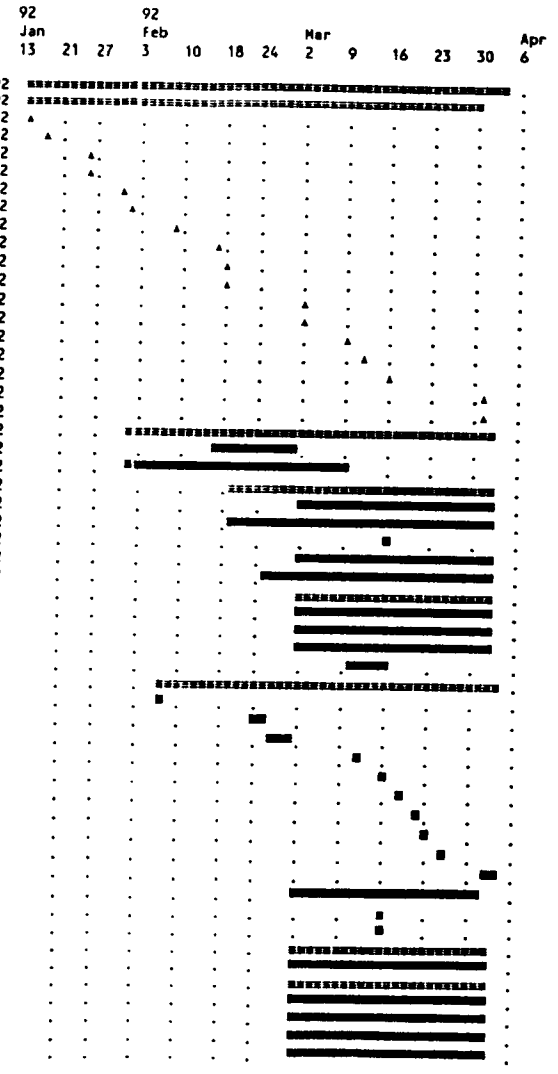
VALUE ENGINEERING PAYS

PLATE 31

REFERENCE FILES ATTACHED
DRAWING

Schedule Name : Drawdown 1992 Engineering Resource Management Plan
S le File : SLSURPL2
=Geotechnical Engineer, HE=Hydraulic Engineer, CET=Civil Engr.
EG=Engineering Geologist, ME=Mechanical Engineer,
SE= al Engineer, CS=Construction Surveyor, IE=Instrument Engineer,
CI=C ction Inspector, CE=Civil Engineer, RRI=Railroad Inspector
COE Supervisory Prefix: M=Supervisory, S=Staff

Task Name	Resources	Effort (Days)	Start Date	End Date
NPWEN CH, TECH COORD & STAFF	M BRAMMER, MIKLANCIC, FREI	820	14-Jan-92	2-Apr-92
MILESTONES		0	14-Jan-92	30-Mar-92
BEGIN PIEZOMETER TEST CONTRACT		0	14-Jan-92	14-Jan-92
FINAL EIS TO EPA		0	16-Jan-92	16-Jan-92
NOTICE TO FEDERAL REGISTER		0	24-Jan-92	24-Jan-92
FINAL SURVEILLANCE PLAN TO NPD		0	24-Jan-92	24-Jan-92
BEGIN ENCAP FILL WELL INST		0	30-Jan-92	30-Jan-92
BEGIN RIPRAP STOCKPILE CONTRAC		0	31-Jan-92	31-Jan-92
END PUBLIC REVIEW EIS		0	7-Feb-92	7-Feb-92
SIGN RECORD OF DECISION		0	14-Feb-92	14-Feb-92
END ENCAPS FILL WELL INST CONT		0	18-Feb-92	18-Feb-92
END PIEZOMETER TEST CONTRACT		0	18-Feb-92	18-Feb-92
START DRAWDOWN TEST		0	2-Mar-92	2-Mar-92
BEGIN HELICOPTER CONTRACT		0	2-Mar-92	2-Mar-92
END RIPRAP STOCKPILE CONTRACT		0	9-Mar-92	9-Mar-92
DECISION ON LGO DRAFTING		0	11-Mar-92	11-Mar-92
BEGIN STILLING BASIN TESTS		0	16-Mar-92	16-Mar-92
END DRAWDOWN TEST		0	31-Mar-92	31-Mar-92
END HELICOPTER CONTRACT		0	31-Mar-92	31-Mar-92
GEOTECHNICAL TECH COORDINATOR	WELLER	532	31-Jan-92	1-Apr-92
RAILROAD POND DEWATERING	CONTRACTOR, CI	20	14-Feb-92	28-Feb-92
RIPRAP STOCKPILE CONTRACT	SEG1, CI	52	31-Jan-92	9-Mar-92
ENCAPSULATED FILL MONITORING		77	19-Feb-92	1-Apr-92
MONITOR ENCAPS FILL STAFF	SGE2, SGE3	46	2-Mar-92	1-Apr-92
WELL MONITOR CONTRACT	CONTRACTOR	31	19-Feb-92	1-Apr-92
PHOTO FLIGHT	CONTRACTOR	1	16-Mar-92	16-Mar-92
RIPRAP PLACEMENT CONTRACT	CI, SEG1	46	2-Mar-92	1-Apr-92
EVALUATE INSTRUMENT DATA	MIE1, SIE1, SCET1	81	25-Feb-92	1-Apr-92
INSP EMBANKMENTS,FDNS,LEVEES		115	2-Mar-92	1-Apr-92
HELICOPTER SURVEY CONTRACT	CONTRACTOR, SGE1, SGE4	69	2-Mar-92	1-Apr-92
GROUND-WATER SURVEILLANCE	SGE2, SGE3	46	2-Mar-92	1-Apr-92
SURVEY SETTLEMENT GAGES	MCET1, SCS1, SCS2, SCS3	92	2-Mar-92	1-Apr-92
PUMP OUTFALL PROTECTION CONTR	CI	5	10-Mar-92	16-Mar-92
HYDRAULICS TECH COORDINATOR	LINGREN	118	6-Feb-92	2-Apr-92
DIVERS INSPECT STILL. BASIN	CONTRACTOR, SHE1	2	6-Feb-92	6-Feb-92
WES INSTALL INSTRUMENTATION	MHE2, SIE2, SCET2, SHE1	8	24-Feb-92	25-Feb-92
WES PRE-TEST SOUNDINGS	MHE2, SIE2, SCET2, SHE1	12	26-Feb-92	28-Feb-92
EVAL EMERG SR FISH LADDER EXIT	SHE1	1	11-Mar-92	11-Mar-92
WES-NPW SPILLWAY SURGE TEST 1	MHE1, SHE1, MHE2, SIE2, SCET2	5	16-Mar-92	16-Mar-92
WES-NPW SPILLWAY SURGE TEST 2	MHE1, MHE2, SIE2, SHE1, SCET2	5	18-Mar-92	18-Mar-92
WES-NPW SPILLWAY SURGE TEST 3	MHE1, MHE2, SIE2, SCET2, SHE1	5	20-Mar 92	20-Mar-92
WES-NPW SPILLWAY SURGE TEST 4	MHE1, MHE2, SIE2, SCET2, SHE1	5	23-Mar-92	23-Mar-92
WES-NPW SPILLWAY SURGE TEST 5	MHE1, MHE2, SIE2, SCET2, SHE1	5	25-Mar-92	25-Mar-92
WES POST-TEST SOUNDINGS	MHE2, SIE2, SCET2, SHE1	8	1-Apr-92	2-Apr-92
OBSERVE FLOW AT SR FISH ENTR	SHE2	22	2-Mar-92	31-Mar-92
STRUCTURAL TECH COORDINATOR	HOLLENBECK	2	16-Mar-92	16-Mar-92
LEWISTON-CLARKSTON PIER INSP	SSE1	1	16-Mar-92	16-Mar-92
CAMAS PRAIRIE RR TECH COORD	V HOES	69	2-Mar-92	1-Apr-92
CAMAS PRAIRIE RR SURVEY TEAM	RRI1, RRI2	46	2-Mar-92	1-Apr-92
WASH DOT TECH COORDINATOR	T LYON	299	2-Mar-92	1-Apr-92
WASH DOT SURVEILLANCE TEAM	CET1, CET2, CET3, CET4, CET5	115	2-Mar-92	1-Apr-92
WASH DOT BRIDGE INSP TEAM	SSE1, SE1, SE2	69	2-Mar-92	1-Apr-92
WASH DOT PIER REPAIR TEAM	CET6, CET7, CET8, CET9	92	2-Mar-92	1-Apr-92
COUNTY ENGINEER SURVEY TEAM		0	2-Mar-92	1-Apr-92



Detail Task ##### Summary Task ***** Baseline
(Progress) ==### (Progress) ▸▸▸ Conflict
– (Slack) ###— (Slack) Resource delay
Progress shows Percent Achieved on Actual ▲ Milestone
Scale: 8 hours per character

PLATE 32

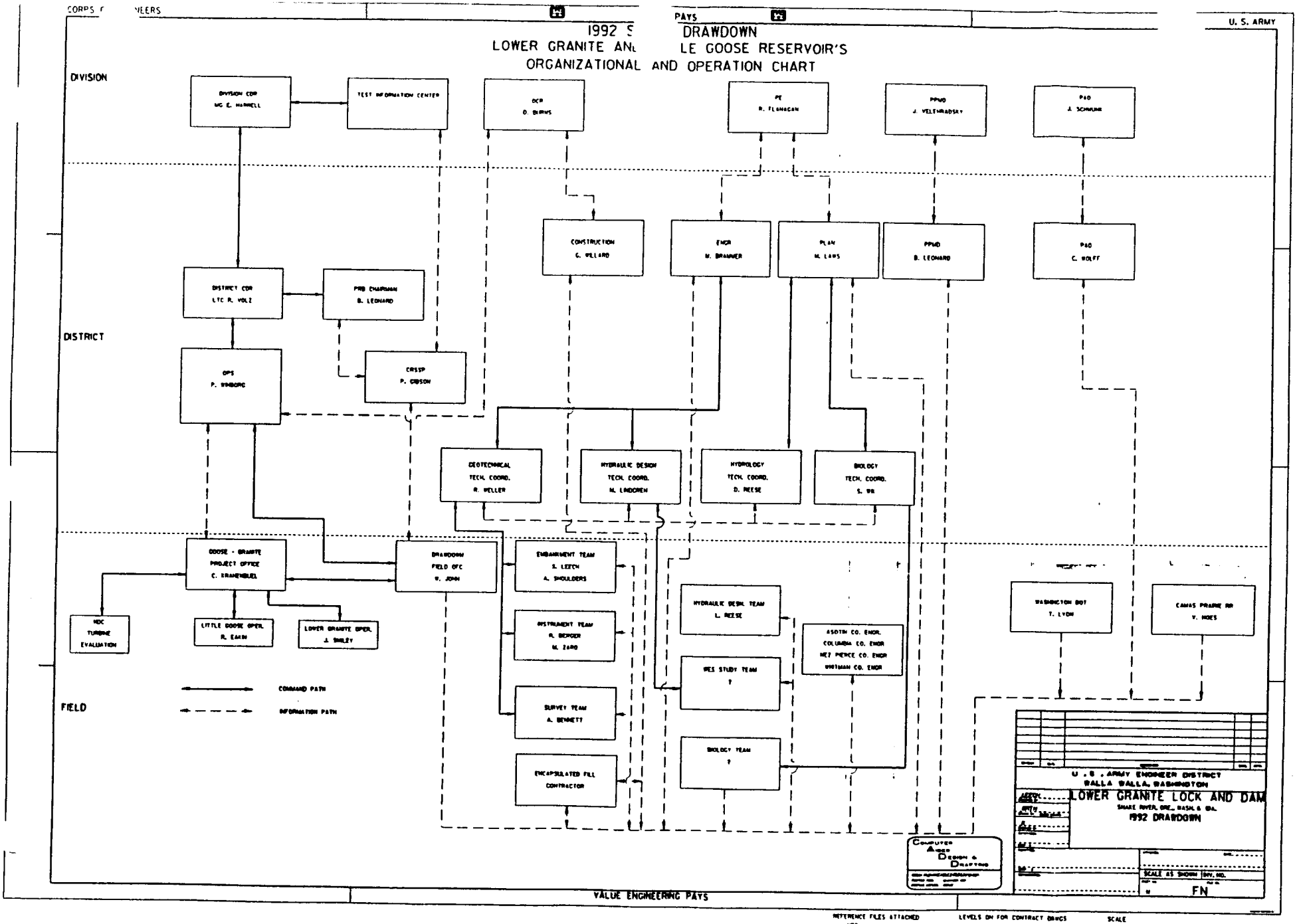
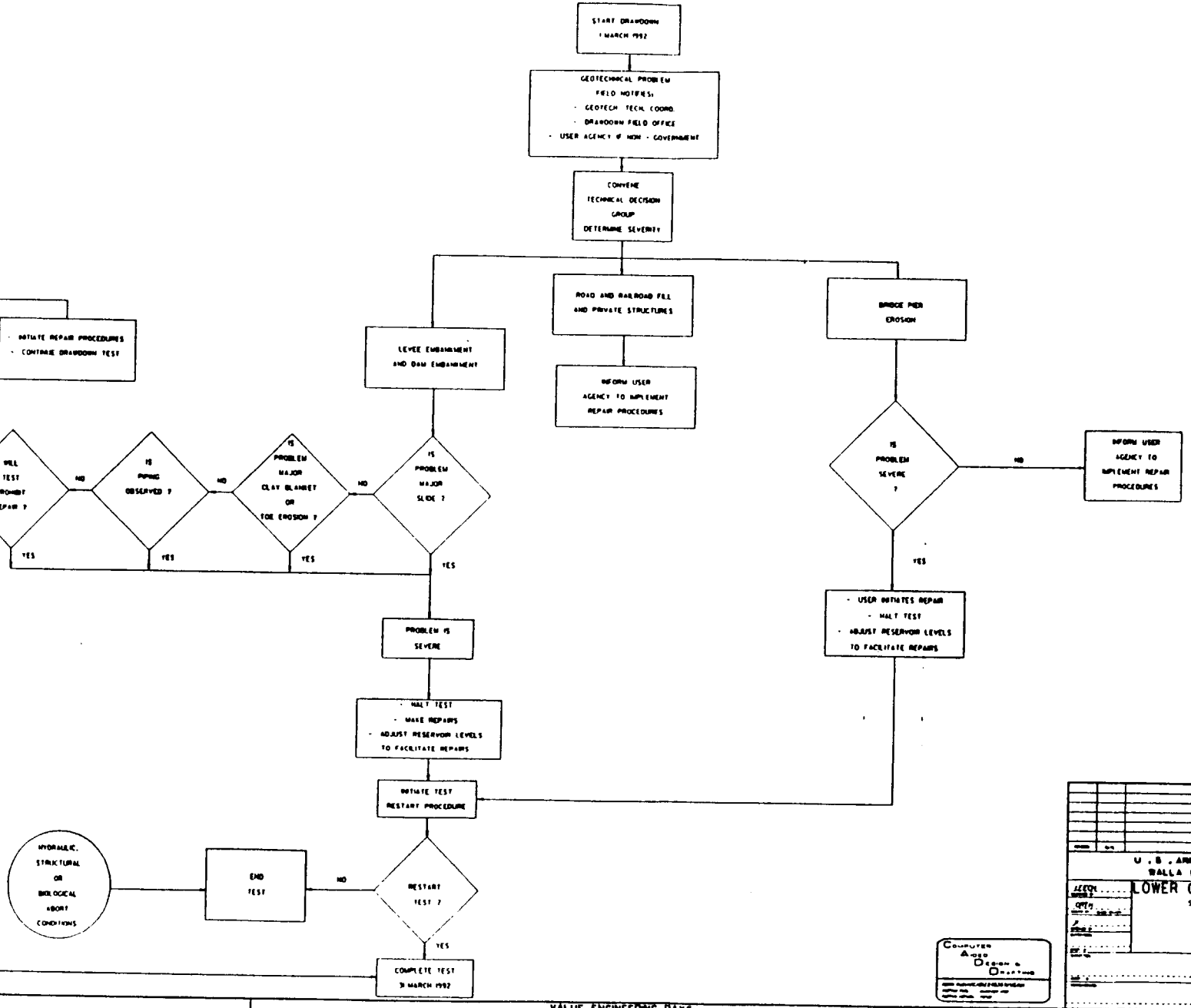

1992 S
DRAWDOWN
LOWER GRANITE AN
LE GOOSE RESERVOIR'S
ORGANIZATIONAL AND OPERATION CHART
U. S. ARMY
DIVISION
DISTRICT
FIELD
DIVISION CDR
MG E. HARRELL
TEST INFORMATION CENTER
DCR
D. BURNS
PE
R. FLANAGAN
PPMD
J. VELETNRADSKY
P&D
J. SCHRUNK
CONSTRUCTION
G. PELLARD
ENGR
M. BRANNER
PLAN
M. LAWS
PPMD
B. LEONARD
P&D
C. WOLFF
DISTRICT CDR
LTC R. VOLZ
PRB CHAIRMAN
B. LEONARD
OPS
P. HANSEN
CRSSP
P. GIBSON
GEOTECHNICAL
TECH. COORD.
R. PELLER
HYDRAULIC DESIGN
TECH. COORD.
M. LANDGREN
HYDROLOGY
TECH. COORD.
D. REESE
BIOLOGY
TECH. COORD.
S. [illegible]
GOOSE - GRANITE
PROJECT OFFICE
C. ERMENBEUEL
DRAWDOWN
FIELD OFC
W. JOHN
EMBANKMENT TEAM
S. LEECH
A. SHOULDERS
INSTRUMENT TEAM
R. BERGER
M. ZARO
SURVEY TEAM
A. BENNETT
ENCAPSULATED FILL
CONTRACTOR
HYDRAULIC DESN. TEAM
L. REESE
WES STUDY TEAM
?
BIOLOGY TEAM
?
ASOTIN CO. ENGR.
COLUMBIA CO. ENGR
NEZ PIERCE CO. ENGR
WHITMAN CO. ENGR
WASHINGTON DOT
T. LYON
CAMAS PRAIRIE RR
V. HOES
HDC
TURBINE
EVALUATION
LITTLE GOOSE OPER.
R. EAKIN
LOWER GRANITE OPER.
J. SMILEY
COMMAND PATH
INFORMATION PATH
U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON
LOWER GRANITE LOCK AND DAM
SNAKE RIVER, ORE., WASH. & IDA.
1992 DRAWDOWN
SCALE AS SHOWN
FN
VALUE ENGINEERING PAYS
REFERENCE FILES ATTACHED
YES NO
LEVELS ON FOR CONTRACT DWGS
SCALE

PLATE 33

GEOTECHNICAL ABORT DRAWDOWN DIAGRAM



U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

LOWER GRANITE LOCK AND DAM
SNAKE RIVER, OR., WASH. & IDA.
1992 DRAWDOWN

SCALE AS SHOWN | DRW. NO.

FN

Computer Aided Design & Drafting

REFERENCE FILES ATTACHED YES NO

LEVELS ON FOR CONTRACT DWGS

SCALE

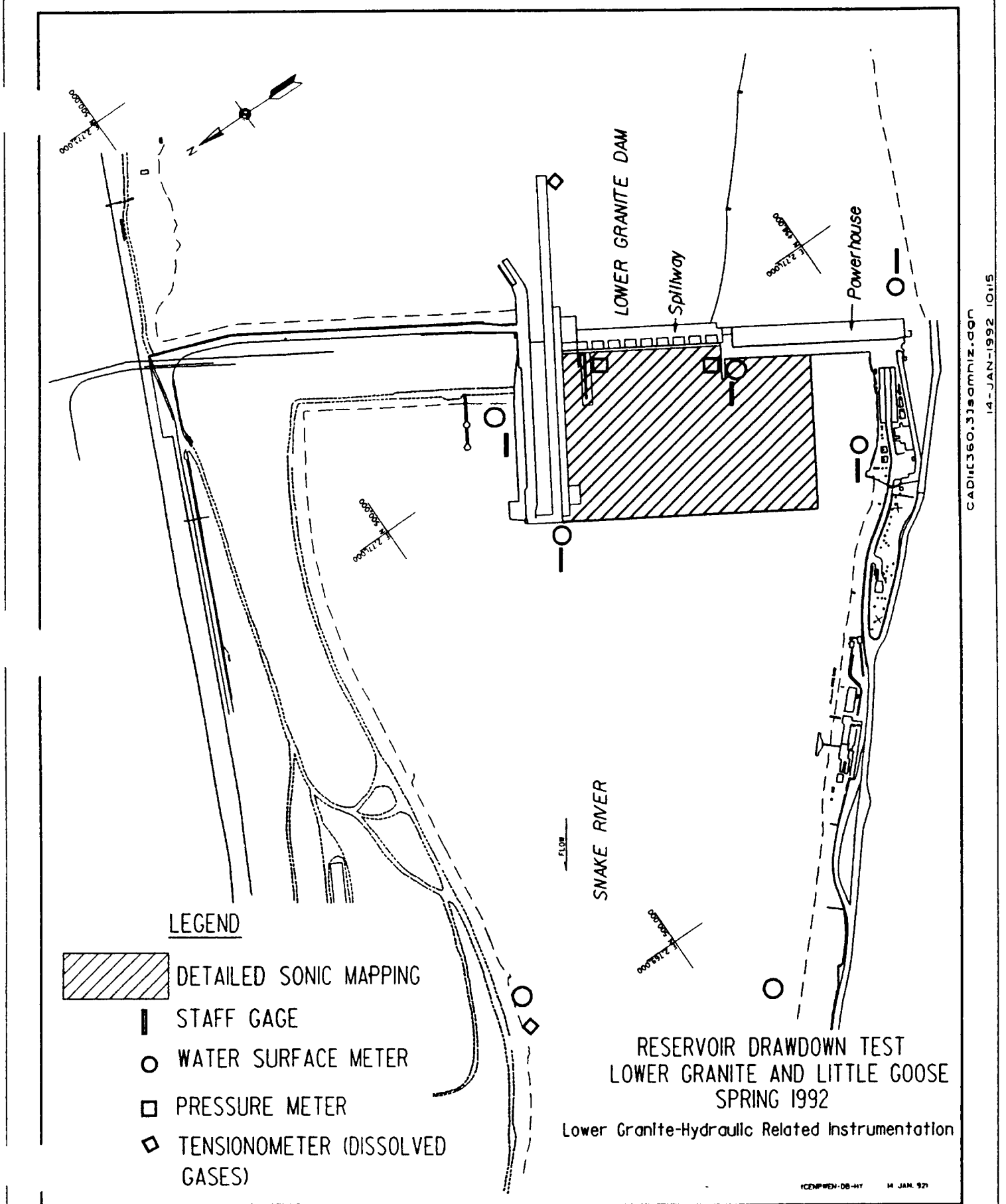

LOWER GRANITE DAM
Spillway
Powerhouse
SNAKE RIVER
FLOW
LEGEND
DETAILED SONIC MAPPING
STAFF GAGE
WATER SURFACE METER
PRESSURE METER
TENSIONOMETER (DISSOLVED GASES)
RESERVOIR DRAWDOWN TEST
LOWER GRANITE AND LITTLE GOOSE
SPRING 1992
Lower Granite-Hydraulic Related Instrumentation
CADd:[360.33]gamniz.dgn
14-JAN-1992 10:15

PLATE 36 5

EMBANKMENT INSTRUMENTATION

MONITORING SCHEDULE

LOWER GRANITE DAM

1. - Open Tube Piezometers: PN 1325, PN 1327, PN 1329, PN 1331, PN 1332, PN 1333, PN 1334, PN 1335, PN 1336, PN 1337, PN 1338, PN 1339, PN 1340, PN 1638, PN 1639, PN 1640, PN 1641.

Reading Frequency: Daily

Location: PN 1325 through PN 1340, North Embankment
PN 1638 through PN 1641, North Abutment
(Reference locations on Plates 16 and 17)

2. Pore Pressure Meters: PN 1326, PN 1328, PN 1330

Reading Frequency: Daily

Location: North Embankment
(Reference locations on Plate 16)

3. Settlement Gages: PSG1, SG2, SG3, SG4, SG5, SG6, SG7, SG8, SG9, GS10, SG11, SG12, SG13

Reading Frequency: Every other day

Location: North Embankment
(Reference locations on Plate 16)

LITTLE-GOOSE DAM

1. Open Tube Piezometers: DH1, DH2, PN401, PN404, PN411, PN412, PN417, PN418, RD13, RD15, RD16, RD17

Reading Frequency: Daily

Location: North Embankment
(Reference locations on Plate 28)

2. Settlement Gages: SG1, SG2, SG3, SG4, SG5, SG6, SG7, SG8, SG9

Reading Frequency: Every other day

Location: North Embankment
(Reference locations on Plate 29)

* Note: Reading frequency based on steady drawdown and reimpoundment rate of 2 ft/day.

EMBANKMENT INSTRUMENTATION

MONITORING SCHEDULE (CONTINUED)

LEWISTON LEVEES

1. Open Tube Piezometers: North Levee; PN 1341, PN 1342, PN 1348, West Levee; PN 1360, PN 1367, PN 1369, PN 1370, PN 1371, PN 1493, PN 1494, PN 1495, PN 1496, PN 1497, PN 1548, PN 1549, PN 1553, PN 1559, PN 1560, PN 1563, PN 1684, PN 1687, PN 1703, PN 1704, PN 1707, PN 1708 and PN 1710. East Levee; PN 1350, PN 1351, PN 1353, PN 1354, PN 1355 and PN 1359.

Reading Frequency: Daily

Location: North, West and East Levees
(Reference locations on Plate 30)

2. Open Tube Interior Piezometers: ** North Levee; PN 1498, PN 1507. West Levee; PN 694, PN 1084, PN 1479, PN 1490, PN 1492 and PN 1516. East Levee; PN 100, PN 102, PN 1356 and PN 1357.

Reading Frequency: Once before drawdown and once after pool raising is complete.

Location: North, West and East Levees
(Reference Locations on Plate 30)

3. Settlement Gages: West Levee Sta. W-34+00, North Levee Sta. N-101+00

Reading Frequency: Every other day

Location: North and West, Levees
(Reference Locations on Plate 30)

** Interior piezometers are situated along the levee perimeter inside the protected areas.

STRUCTURAL INSTRUMENTATION

MONITORING SCHEDULE

LOWER GRANITE DAM

1. Crack Meters (Transducers): JCCNF1, JCCNF2

Reading Frequency: Biweekly

Location: Central Non-overflow (Reference locations on Plates 25 and 26)

2. Deformation Gages (Rod Extensometer): D22B, D22T, D23, D24B, D32B, D32T, D33, D34B and D34T.

Reading Frequency: Biweekly

Location: Powerhouse sections 2 and 3 (Reference locations on Plates 18 and 19)

3. Uplift Gages (Transducer type): PF 21, PF22, PF23, PF24, PF25, PF26, PF27, PF28, PF29, PF30, PF31, PF32, PF33, PF34, PF35, PF36, PN01, PN02 and PN03.

Reading Frequency: Biweekly

Location: Powerhouse sections 2 and 3; Navigational lock 22 (Reference locations on Plates 18 to 20; 22)

4. Uplift Gages (Pipe Type): P41, P42, P43, P44, P45, P46, P47, P48, P49, P50, P51, P52, P53, P54 and P55.

Reading Frequency: Biweekly

Location: Spillway pier 4 (Reference locations on Plate 21)

Exhibit 2

LOCAL STREAM GAGE INSTRUMENTATION

MONITORING SCHEDULE

1. Primary Gages: Little Goose Forebay, Little Goose Tailwater, Lower Granite Forebay, Lower Granite Tailwater, Confluence, Anatone, and Spalding gages.

Reading Frequency: Hourly

2. Other Snake and Clearwater upstream gages.

Reading Frequency: Minimum every 24 hours.

Exhibit 3

ENCAPSULATED FILL INSTRUMENTATION

MONITORING SCHEDULE

1. Monitoring Wells: MW1, MW2, MW3, MW4 and MW5.

Water Sampling Frequency and Water Level Measurement: Once at pre-drawdown, once 14 days from beginning of drawdown, once before reimpoundment (minimum drawdown level).

Long Term Water Sampling: If contaminates are not detected during drawdown, sampling will continue once per year at minimum pool level.

Location: Port of Lewiston (Reference locations on Plate 31).

Exhibit 4

APPENDIX A

OPERATION ORDER FOR POOL LOWERING

I. Situation.

a. Lower Granite and Little Goose Flow Requirements. The Walla Walla District will be releasing flows from the Snake River, Clearwater and Palouse River at Lower Granite and Little Goose Dam. The detailed flow requirements for both reservoirs are addressed in Appendix B.

b. Contractors' Schedule. During the drawdown and reimpoundment procedures, several on-going contracts will be conducting work in the project areas. They are as follows:

(1) Port of Lewiston Fill Well Monitoring Contract

(2) Bridge Pier Protection (If required)

(3) Helicopter Survey Contract

(4) Lewiston Levee Pump Outfall Splash Blocks Contract

(5) Diving Contract

Operations during the drawdown and reimpoundment period will need to be coordinated with each Contractor's individual schedule.

c. Support Test Teams.

As with ongoing contracts support teams will be conducting technical evaluations at the dams. They are as follows:

(1) Waterways Experiment Station (WES) for Stilling Basin Monitoring

(2) Hydrologic Design Center (HDC) for Turbine Monitoring

II. Mission.

Perform pool lowering test at Lower Granite and Little Goose Reservoirs to implement Columbia River Salmon flow measures.

III. Execution.

a. Operation Coordination.

It is imperative that all persons cognizant of the importance of keeping the District staff elements as well as the Operations Field Coordinator and Granite-Goose Project Office fully informed.

1. NPW Hydrology will coordinate reservoir regulation within the Walla Walla District and with NPD Water Management.

2. Dam operations for both facilities will be initiated by a coordinated effort between NPW Engineering Division, and NPW Granite-Goose Project Office.

3. Dam surveillance will be a joint effort between NPW District and Project Office personnel.

4. Safety will be a concern by all persons involved.

5. Public relations will be a coordinated effort between NPW District and Project Office personnel. Public Affairs Office will issue a public statement prior to the drawdown execution date. Information transfer to external customers is detailed in the Operational Plan and Media Plan.

6. All actions and information transfer involving the drawdown test shall be coordinated through the Operations Field Coordinator (OFC).

b. Drawdown Checklist.

1. Pre-Drawdown.

(a) Complete inspection and approval of instrumentation by Project Office and Instrumentation Section.

(b) Inspection of stilling basins survey by Project Office, Hydraulic Design, Survey and A/E contract cooperative effort.

2. During Drawdown - Lower Granite and Little Goose Dams.

Flow measures during drawdown are contained in Appendix B.

c. Operations Field Coordinator (OFC).

1. The OFC will be responsible for coordinating district and field efforts during the drawdown test. Surveillance teams will transmit findings through the OFC in conjunction with the technical coordinators.

2. The Granite-Goose Project Office shall coordinate drawdown operations through the OFC.

3. Surveillance teams shall provide daily inspection reports to the OFC. The OFC shall routinely schedule situation meetings and compile field data to transmit a daily situation report.

4. The OFC shall coordinate command decisions through the Project Office, technical coordinators and the surveillance teams.

5. The OFC shall coordinate test abort and restart procedures.

d. Lower Granite and Little Goose Project Office.

1. Keep all District staff elements fully informed as to readiness and progress through the Project Manager.

2. Furnish assistance as required to District staff elements at your location, particularly in regard to VIP's, press and time-lapse photograph.

3. Coordinate with Engineering Division in the preparation of an after action letter report on operations which includes photographs, narrative, and names of personnel involved in the operation.

4. Maintain a consolidated log of problems or deficiencies discovered. Items shall also be identified in the after action report, along with the corrective action taken.

5. Maintain inspection and surveillance of the dams and Lewiston levees by performing the following:

(a) Check downstream and upstream faces and gallery of dams for signs of seepage every 8 hours. Have survey capability to identify wet spots on concrete structure faces, and boils, seeps, sinkholes, depressions and eroded areas on earthen embankments. Survey will include elevations and stations.

(b) Inspect the drainage galleries every 8 hours and take instrumentation readings on the following instruments as outlined on the instrumentation monitoring schedules shown on Exhibits 1 to 4.

(1) Record forebay and tailwater elevation at each dam hourly, and hourly monitor confluence, Spalding and Anatone gages.

(2) Read open tube piezometers.

(3) Read settlement gages.

(4) Read deformation gages.

(5) Read uplift gages.

(6) Read crack meters.

(7) Maintain a surveillance patrol on Highway 12, Camas Prairie Railroad (No. 69.87) Bridge, Red Wolfe Bridge, and constructed Camas Prairie R.R. slopes once every 2 hours.

e. Construction Division.

Support the Project Office functions.

f. Engineering Division.

1. Engineering Division will implement and monitor the dam surveillance plan and furnish technical personnel to the project as requested. Engineering Division will provide design and analysis services through the technical coordinators.

(a) Instrumentation Section will evaluate instrumentation data during drawdown and reimpoundment.

(b) Hydraulic Design Section will establish gate openings for downstream releases as prescribed by the rating curves in Appendix B. Hydraulic Design Section will also oversee monitoring activities of the stilling basin. Further information concerning spillway related hydraulic test is contained in Appendix D.

(c) Geotechnical Branch will furnish consolidated (field observation reports) briefs and impact reports on major items. Geotechnical Branch will also provide two staff engineers at the Lower Granite-Little Goose reservoirs, dams and levees to daily evaluate the integrity of the embankments, bridge foundations and levees and identify any trouble areas. This will be done by daily helicopter and vehicle visual surveys during the drawdown duration.

2. Engineering Division will prepare and maintain the capability to render 24-hour assistance to correct deficiencies.

g. Planning Division.

1. Hydrology Branch will provide estimates of projected streamflow to the Technical Advisory Group and the Granite-Goose Project Office.

2. Hydrology Branch will coordinate reservoir regulation activities within the Walla Walla District and with NPD Water Management.

3. Environmental Resources Branch will coordinate environmental monitoring efforts. Environmental monitoring procedures and testing are detailed in the Detailed Environmental Monitoring Plan of the overall plan.

h. Operations Division.

1. The Granite-Goose Project Office will assume the responsibility for operation of the project as drawdown is started. Operation will be coordinated with any Contractor's prior to project completion. Project Office will receive release schedules from NPD Water Management Reservoir Regulation Center during the pool lowering test.

2. The Granite-Goose project office will read instruments during the drawdown and reimpoundment.

i. Safety Office.

1. Establish liaison with all involved Counties Sheriff's Office on matters of controlled access and traffic control.

2. Investigate and report all serious accidents to the Commander.

j. Public Affairs Officer.

1. Be prepared to undertake all matters related to the press and radio coverage of this event.

2. Coordinate all public affairs activities with the Executive Office, Engineering Division, Planning Division, and Resident Office as appropriate.

3. Responsibilities of the Public Affairs Officer are detailed in the Media Plan of the overall plan.

IV. Support and Supply.

a. Transportation.

1. The Granite-Goose Project Office will provide vehicles for personnel assigned to that office.

2. Personnel from the District Office shall obtain vehicles from District Motor Pool. Every attempt will be made to car pool.

b. Contact with Outside Agencies.

The District Office will be responsible for the formal contact with other Federal and State agencies. The Public Affairs Office will issue the official statements. The agencies listed below may have a direct concern in the drawdown.

1. Federal Agencies (non-Corps).

(a) U.S. Geological Survey.

(b) U.S. Senators, Northwest States.

(c) U.S. Congressmen, Northwest States.

(d) U.S. Fish and Wildlife Service.

(e) National Marine Fisheries Service.

(f) Environmental Protection Agency.

(g) U.S. Bureau of Reclamation.

(h) Bureau of Land Management.

2. State Agencies.

(a) Governors of Idaho, Oregon and Washington

(b) State Senators and Congressmen of Idaho, Oregon and Washington.

(c) Fish and Game Departments of Idaho, Oregon and Washington.

(d) State Parks of Idaho, Oregon and Washington.

(e) Water Resources Departments of Idaho, Oregon and Washington.

(f) Idaho Department of Health and Welfare.

3. County Agencies. (Commissioners, Sheriffs and Engineers).

(a) Asotin Co., WA

(b) Columbia Co., WA

(c) Garfield, Co., WA

(d) Nez Pierce Co., ID

(e) Whitman Co., ID

V. Command and Signal.

a. Command.

1. The District Engineer has overall command of the operation.

2. The Operations Field Coordinator has overall charge of closure and filling operations surveillance team personnel from the District Office are under authority of the technical coordinators, but report information through the OFC in conjunction with the technical coordinators. The organizational and operations chart for the surveillance plan is shown in Plate 33.

b. Telephone numbers of key personnel follows:

1. District Office Office-Duty Hours Home Phone

DE LTC Volz	(509) 522-6506
C, Engr. M. Brammer	(509) 522-6562
C, Ops P. Windborg	(509) 522-6692
C, Const. G. Willard	(509) 522-6490
C, Geotech F. Miklancic	(509) 522-6763
C, Design D. Frei	(509) 522-6515
C, Pub. Aff. C. Wolff	(509) 522-6658
C, Safety R. Coonfare	(509) 522-6798

2. Granite-Goose Project Office

Name	Office-Day (Night)	Home Phone
Wayne John	(509) 843-1493	(1494)
Charles Krahenbuhl	(509) 843-1493	(1494)
Martin Mendiola	(509) 843-1493	(1494)
Raymond Eakin	(509) 843-1493	(1491)
Jesse Smiley	(509) 843-1493	(1491)

APPENDIX B

RESERVOIR REGULATION PLAN
for the
LOWER GRANITE AND LITTLE GOOSE POOL LOWERING TEST

I. General Overview of the Test.

Lower Granite and Little Goose are run-of-river reservoir projects located on the Lower Snake River in Southeastern Washington. Plate B-1 shows the geographical location of both projects and Plates B-2 and B-3 show details of both projects. Lower Granite Dam is located at Snake River Mile 107.5 and Little Goose Dam is at Snake River Mile 70.3. Both projects were authorized by PL 79-14 in 1945 for the purpose of navigation and power generation and are operated by the U.S. Army Corps of Engineers, Walla Walla District. Other uses include fish and wildlife, recreation, irrigation, and water quality. Initial construction was completed in 1970 for Little Goose and in 1975 for Lower Granite. Water Control Manuals for both Lower Granite and Little Goose are maintained by the Reservoir Regulation Section of Hydrology Branch in the Walla Walla District and give very detailed information on the projects and the operation and regulation of the project. During normal operation of Lower Granite, the reservoir pool fluctuates between elevation 733 and 738 feet mean sea level (msl) at the Snake-Clearwater River confluence gage located at Snake River Mile 139.5. Little Goose reservoir pool normally fluctuates between elevation 633 and 638 feet msl at the dam forebay gage. During the pool lowering test, both reservoirs will be lowered below their normal minimum operating pool (MOP) levels.

The pool lowering test consists of a four week drawdown of Lower Granite and Little Goose reservoir pools. The drawdown will begin on March 1, 1992 and the pools will then be refilled to MOP by April 1, 1992. Lower Granite pool will be initially lowered to elevation 705 with the possibility of being lowered to elevation 696 (near spillway crest) if time to refill permits. Little Goose will be drafted approximately 20 feet below normal pool to elevation 618 feet msl to provide low tailwater conditions for tests on the Lower Granite spillway and stilling basin. Lowering the Little Goose pool to 618 will be contingent on monitoring of Little Goose reservoir for salmon redds, the Lower Granite spillway tests, and the availability of water to refill Lower Granite and Little Goose by April 1.

On March 1, the Lower Granite reservoir pool will be lowered from a minimum operating forebay elevation of 733 feet msl to a forebay elevation of 705 feet msl by March 15. Pool lowering will be limited to a maximum rate of two feet per day and will be done as steadily as is practical by passing all water through the power turbines. Reservoir storage between forebay elevations of

733 and 705 feet msl is approximately 190,000 acre-feet. Required Lower Granite releases for the 733 to 705 pool lowering will average approximately 6,800 cubic feet per second (cfs) above the Lower Granite inflow.

On March 15, the Little Goose reservoir pool will be lowered from a maximum normal operating forebay elevation of 638 feet msl by a steady rate of two feet per day as measured at the Little Goose forebay gage. The two foot per day pool lowering will continue until structural problems are encountered with the test, or until elevation 618 is reached, or until the availability of water requires Little Goose to begin refill. Between forebay elevations of 638 and 618 feet msl, reservoir storage averages approximately 9,600 acre-feet per foot of elevation. Little Goose releases required to meet the two foot per day target will average approximately 9,700 cfs above inflow and all releases will be passed through the power turbines.

While the Little Goose reservoir pool is being lowered two feet per day at the forebay gage, the Lower Granite pool will be operated between elevations 705 and 703 feet msl and a series of spillway-stilling basin tests will be performed at Lower Granite. Reservoir storage between elevation 705 and 703 is approximately 11,000 acre-feet. This two foot of storage in Lower Granite reservoir plus inflow will be used to artificially simulate spillway flows near 100,000 cfs for short durations. The spillway-stilling basin tests will continue until completed, or until structural problems are encountered, or until availability of water requires the beginning of refill. If the spillway-stilling basin tests are completed before refill for the April 1 target date is required, Lower Granite pool will be lowered below elevation 703 feet msl at the rate of two feet per day to approach a near spillway crest condition of elevation 696 feet msl for further spillway-stilling basin tests.

The date that refill will be required to begin is dependent upon availability of water during the last 10 days of March 1992 and the Lower Granite and Little Goose forebay pool elevations at that time. Little Goose will be refilled to minimum operating pool (MOP) elevation of 633 feet msl at the forebay gage first then refill of Lower Granite will begin so that elevation 733 (MOP) is reached by April 1. During the refill, a release from Lower Granite and Little Goose of 11,500 cfs or more will be maintained.

II. Streamflows During the Test.

During the month of March, daily streamflows into Lower Granite reservoir can vary significantly. Low and mid elevation snowpacks (2,000 to 5,000 feet msl) react very quickly to increases in temperatures and/or warm rainstorms. Melting snowpacks can also be quickly refrozen by cold temperatures thus

District Reservoir Regulation Section. The Reservoir Regulation Section will then coordinate these project release schedules with North Pacific Division Reservoir Control Center (RCC). RCC will transmit finalized operating schedules to the Lower Granite and Little Goose control room operators for implementation. As previously outlined, the test consists of three reservoir regulation steps (1) pool lowering below MOP, (2) high flow simulation for spillway and stilling basin tests, and (3) refill to MOP. The pool lowering test as presented in the general overview outlined the test as it is currently planned; however if streamflows during March are below 30,000 cfs or if major problems are encountered during the test, the test regulation plan will require modification.

Reservoir storage-capacity curves, power unit rating curves, spillway rating curves, tailwater curves, and backwater profiles for Lower Granite and Little Goose are in the Water Control Manual for each project; but not all of this information is available for pool elevations below MOP that will occur during this test. These curves are being extended to include the test pool lowering range and will be required for reservoir regulation computations during the test. Listed below are reservoir storage-capacity table data for key pool elevations during the pool lowering test.

Lower Granite		Little Goose	
Forebay Elevation (Feet msl)	Storage (Acre-Feet)	Forebay Elevation (Feet msl)	Storage (Acre-Feet)
733.0 (MOP)	442,940	638.0	656,200
731.0	426,820	636.0	545,400
729.0	411,100	634.0	526,000
727.0	395,780	633.0 (MOP)	516,300
725.0	380,860	632.0	506,700
723.0	366,330	630.0	487,600
721.0	352,170	628.0	468,500
719.0	338,400	626.0	449,500
717.0	325,000	624.0	430,600
715.0	311,980	622.0	411,700
713.0	299,320	620.0	392,900
711.0	287,020	618.0	374,200
709.0	275,050		
707.0	263,400		
705.0	252,070		
703.0	241,060		
701.0	230,370		
699.0	220,000		
697.0	209,940		
696.0	205,020		

IV. Pool Lowering Below MOP.

drastically reducing streamflows. It must be emphasized that it is normally very difficult to accurately forecast streamflows more than approximately three days in advance during March. Plate B-4 shows the summary hydrograph for Lower Granite inflows and the following tabulation summarizes March daily inflows that occurred from 1975 through 1991.

	MAXIMUM (CFS)		MINIMUM (CFS)		MARCH
YEAR	DATE	VALUE	DATE	VALUE	AVERAGE (CFS)
1975	March 9	84,100	March 1	53,400	65,360
1976	March 27	83,200	March 6	56,000	66,865
1977	March 10	34,900	March 23	19,700	24,581
1978	March 31	101,600	March 6	47,000	65,545
1979	March 17	66,800	March 4	36,100	54,200
1980	March 12	42,000	March 30	28,800	35,526
1981	March 28	49,000	March 15	26,500	37,819
1982	March 12	123,100	March 31	75,800	102,468
1983	March 15	127,500	March 28	77,600	101,994
1984	March 24	117,600	March 5	42,400	80,765
1985	March 22	53,700	March 10	35,700	43,171
1986	March 9	166,200	March 23	94,100	126,829
1987	March 14	45,700	March 2	20,200	33,826
1988	March 10	37,100	March 18	20,200	26,581
1989	March 29	72,700	March 2	23,400	54,361
1990	March 23	48,400	March 2	27,500	36,781
1991	March 6	41,800	March 28	21,700	28,386
			PERIOD AVERAGE =		57,944

Plate B-5 shows the locations of key streamflow gages above Lower Granite Dam. The Snake-Clearwater River confluence and East Lewiston gages provide water surface elevation only while the other gages provide gage height and flow data. The Anatone and Spalding gages are the two single most important of the gages. The flow sum of these two gages very closely approximates the Lower Granite inflow. Gages above Anatone and Spalding assist in making early flow estimates for the Anatone and Spalding gages because of river routing time.

The National Weather Service - River Forecast Center (RFC) located in Portland, Oregon is responsible for making streamflow forecasts at the gage sites. During the March pool lowering test, RFC will provide daily streamflow forecasts for March to the Walla Walla District Reservoir Regulation Section. The Reservoir Regulation Section will summarize the RFC forecasts, monitor river gages, and then provide this information to District Managers and the Lower Granite-Little Goose Project Engineer.

III. Project Releases During the Test.

Lower Granite and Little Goose reservoir release schedules during the test will be coordinated through the Walla Walla

On March 1, 1992 at 0800 hours, the pool lowering at Lower Granite will begin. From an initial pool elevation of 733 feet msl as measured at the Lower Granite Forebay gage, the pool will be lowered by two feet per day at the forebay gage and will continue for fourteen days until elevation 705 is reached on March 15 at 0800 hours. The two foot per day lowering will be done as steadily as is practical to limit the risk of embankment slides during the pool lowering. Releases during the pool lowering step will be made through the turbine units only (if flows are low enough to do so) to maintain as much regulation control as possible. Required daily releases to meet the two foot per target will be computed as the sum the Lower Granite inflow and the two foot storage release for that day. After reaching elevation 705, Lower Granite forebay pool will be maintained between elevation 705 and 703 while the Little Goose pool is being lowered and the Lower Granite spillway-stilling basin tests are being conducted.

On March 15 at 0800 hours, the pool lowering at Little Goose will begin. From an initial forebay pool elevation of 638 (normal maximum operating pool), the pool will be lowered by two feet per day until (1) a forbay elevation of 618 feet msl is reached on March 25 , or (2) major problems are encoutered with the test, or (3) refill of Little Goose is required. Pool lowering is limited to the two feet per day to reduce the risk of embankment slides within the reservoir. Required daily releases to meet the two foot per day target will be computed as the sum of the Lower Granite release and the the two foot storage release for that day. Little Goose releases will be made through the turbine units (if the flows are low enough to do so) to maintain as much regulation control as possible.

V. Spillway Test Regulation.

The Lower Granite spillway-stilling basin test regulation consists of simulating spillway discharges of approximately 100,000 cfs (if Lower Granite inflows are less than that amount) by quickly releasing inflow plus the storage water between elevation 705 and 703. During this test, Lower Granite releases will be switched from the turbine units to the spillway gates and then back to the turbine units. Between elevation 705 and 703 the reservoir storage is 11,010 acre-feet. The following tabulation summarizes approximate 100,000 cfs spillway duration flows provided by release of the two foot of storage for various Lower Granite infows.

Lower Granite Inflow (cfs)	Two Foot Storage Release (cfs)	Duration (hours)
20,000	80,000	1.7
25,000	75,000	1.8

30,000	70,000	1.9
40,000	60,000	2.2
50,000	50,000	2.7
60,000	40,000	3.3
70,000	30,000	4.4
80,000	20,000	6.7
90,000	10,000	13.3
100,000	Not Needed	-------

A series of these spillway-stilling basin tests will be conducted to determine the effect on the Lower Granite stilling basin and gas content levels as the tailwater is decreasing by approximately two feet per day by the Little Goose pool lowering. The number of these tests that will be conducted is dependent upon the time available before refill and monitoring of the stilling basin for damage. If time permits before refill is required, it is also desirable to further lower the Lower Granite pool to elevation 696 (near spillway crest) more spillway-stilling basin tests.

VI. Refill of the Pools to MOP.

The time-frame of the spillway-stilling basin testing is controlled by the time to refill the Lower Granite and Little Goose pools to MOP. As outlined previously, the entire pool lowering, spillway testing, and refill process must be completed by April 1, 1992. Refill will utilize Snake River flows that are available at the time without additional releases from upstream storage at Dworshak or Brownlee Reservoirs. The following tabulation outlines approximate refill times that are required for refill to both Lower Granite and Little Goose to MOP for various Lower Granite - Little Goose pool elevation combinations and Lower Granite inflows and still provide a normal minimum release of 11,500 cfs from each project as has been done in the past. For the test, Little Goose is refilled to MOP first, then Lower Granite is refilled to MOP.

Initial Pool Elevations (Feet msl)		Lower Granite Inflow (cfs)	MOP Refill Time (Days)
Granite	Goose		
(Space= 332,970 Acre-Feet)			
705.0	618.0	20,000	19.7
705.0	618.0	25,000	12.4
705.0	618.0	30,000	9.1
705.0	618.0	40,000	5.9
705.0	618.0	50,000	4.4
705.0	618.0	60,000	3.5
705.0	618.0	70,000	2.9
705.0	618.0	80,000	2.5
705.0	618.0	90,000	2.1
705.0	618.0	100,000	1.9

(Space= 238,670 Acre-Feet)			
705.0	628.0	20,000	14.2
705.0	628.0	25,000	8.9
705.0	628.0	30,000	6.5
705.0	628.0	40,000	4.2
705.0	628.0	50,000	3.1
(Space= 380,020 Acre-Feet)			
696.0	618.0	30,000	10.4
696.0	618.0	40,000	6.7
696.0	618.0	50,000	5.0
696.0	618.0	60,000	4.0
696.0	618.0	70,000	3.3
696.0	618.0	80,000	2.8

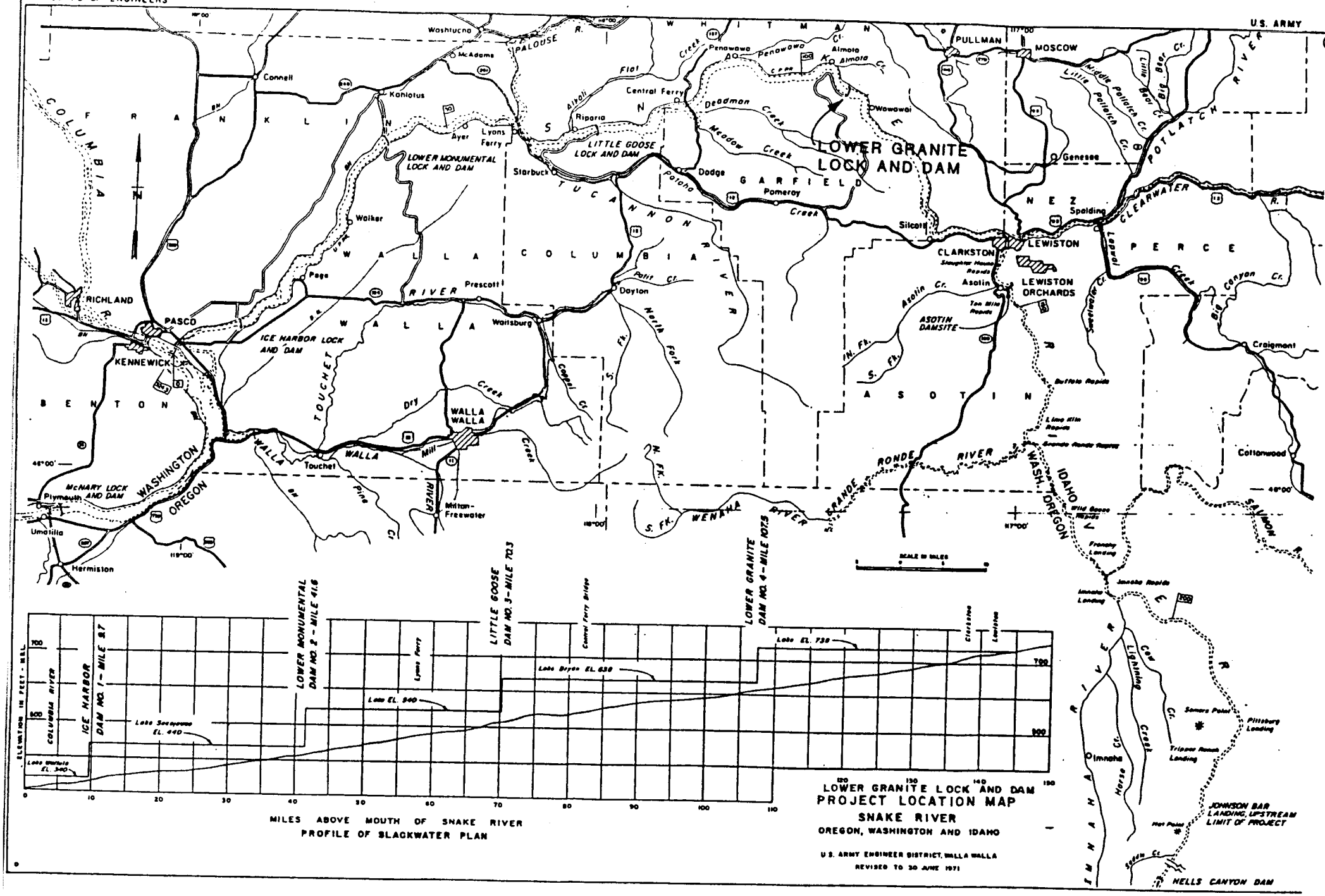
VII. Available Time for Spillway-Stilling Basin Testing.

The following tabulation outlines a summary of the maximum time that will be available for spillway-stilling basin testing given the refill constraints that were presented in paragraph VI. If Lower Granite inflows are less than 40,000 cfs during the refill period, available time for the spillway-stilling basin testing is very limited. Flows of 60,000 cfs or greater will give a lot of flexibility for the entire pool lowering test.

Initial Pool Elevations (Feet msl)		Lower Granite Inflow (cfs)	Test Time (Days)
Granite	Goose		
(Space= 332,970 Acre-Feet)			
705.0	618.0	20,000	----
705.0	618.0	25,000	----
705.0	618.0	30,000	----
705.0	618.0	40,000	10.0
705.0	618.0	50,000	11.5
705.0	618.0	60,000	12.4
705.0	618.0	70,000	13.0
705.0	618.0	80,000	13.4
705.0	618.0	90,000	13.8
705.0	618.0	100,000	14.0
(Space= 332,970 Acre-Feet)			
705.0	628.0	20,000	----
705.0	628.0	25,000	7.0
705.0	628.0	30,000	9.4
705.0	628.0	40,000	11.7
705.0	628.0	50,000	12.8

CORPS OF ENGINEERS

U.S. ARMY



LOWER GRANITE LOCK AND DAM
PROJECT LOCATION MAP
SNAKE RIVER
OREGON, WASHINGTON AND IDAHO

U.S. ARMY ENGINEER DISTRICT, WALLA WALLA
REVISED TO 30 JUNE 1971

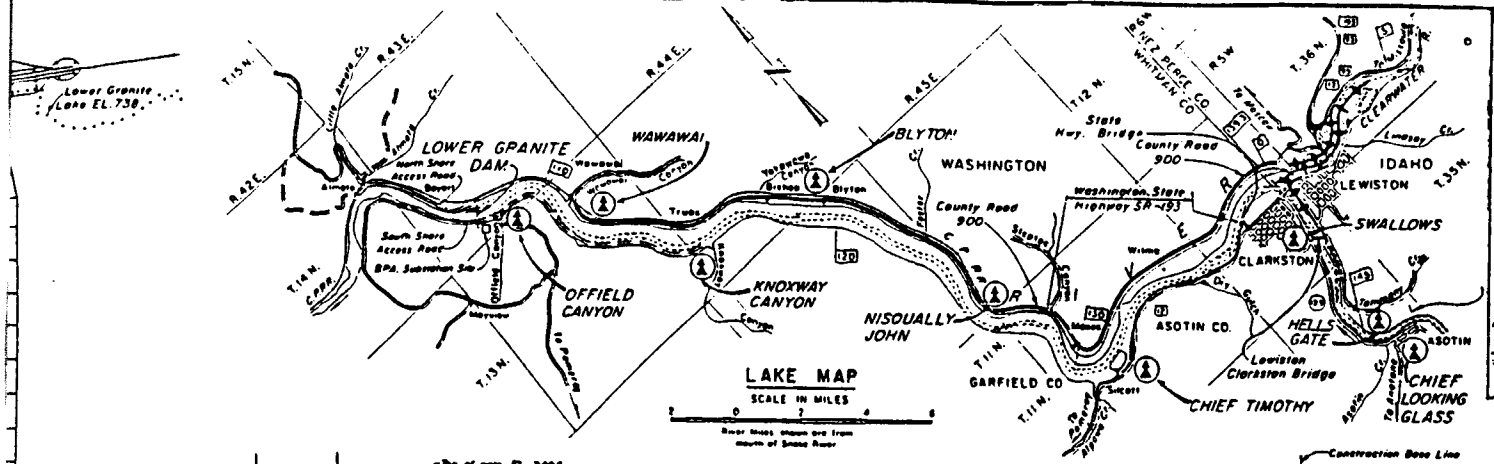
JOHNSON BAR LANDING, UPSTREAM LIMIT OF PROJECT

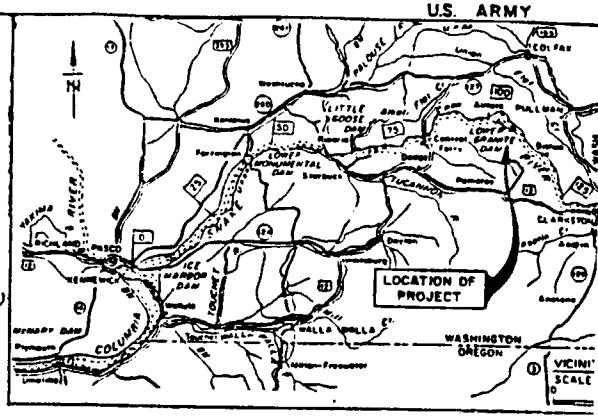
HELLS CANYON DAM

WATER CONTROL MANUAL PLATE ~~C-1~~

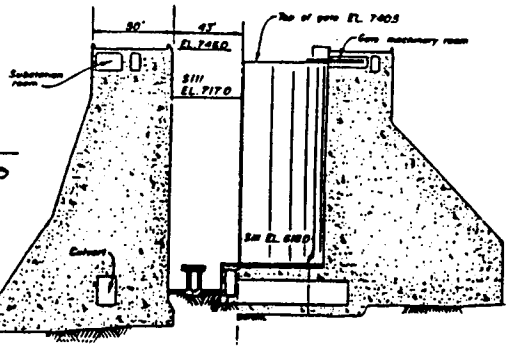
B-1

U.S. ARMY



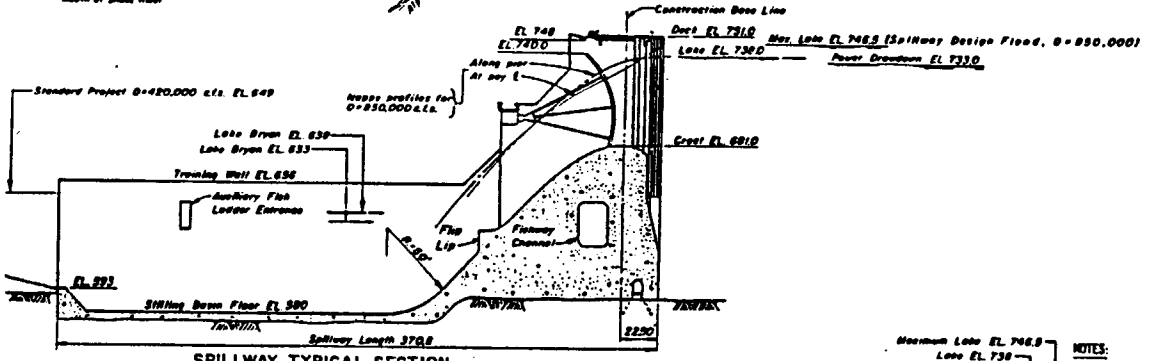


SHEET 1 of 2



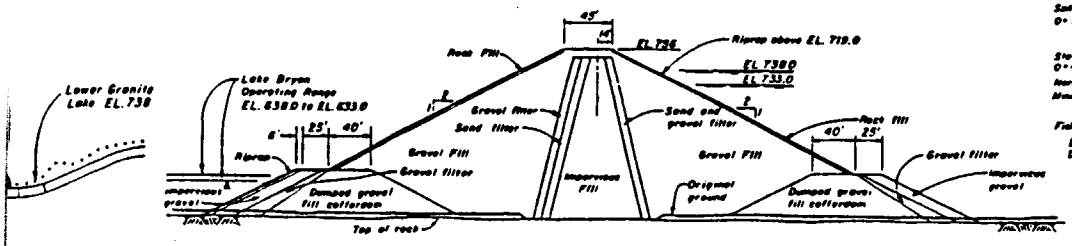
TYPICAL LOCK SECTION

SCALE IN FEET



SPILLWAY TYPICAL SECTION

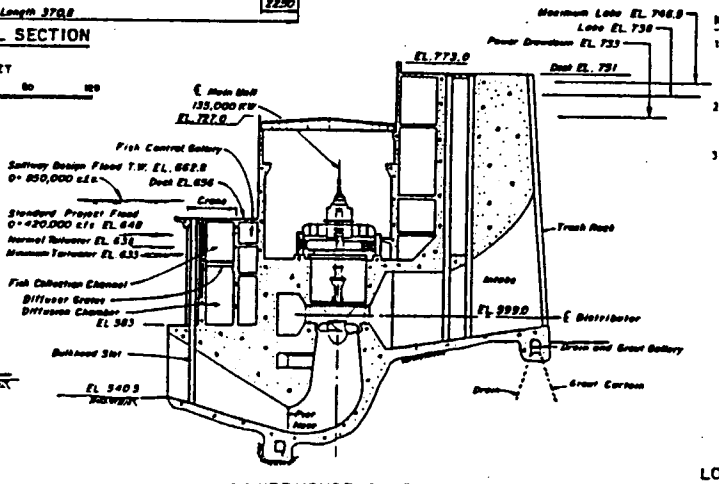
SCALE IN FEET



TYPICAL EMBANKMENT SECTION

SCALE IN FEET

PLAN



POWERHOUSE SECTION

SCALE IN FEET

NOTES:

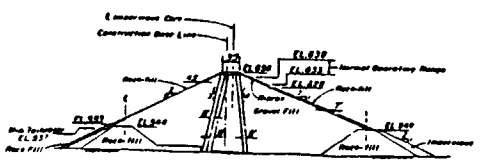
1. LOWER GRANITE LAKE WILL BE CONTROLLED AT THE TO MAINTAIN A WATER SURFACE AT LEWISTON, ID BETWEEN ELEVATIONS 738 AND 733 UNDER NORMAL OPERATING CONDITIONS.
2. ELEVATION OF LOCK UPPER SILL BLOCK SET TO BE 15-FOOT WATER DEPTH WITH RIVER FLOW OF 300,0 CONSIDERED THE PRACTICAL LIMIT FOR NAVIGATIO
3. BACKWATER LEVEES EXIST IN CLARKSTON AND LEWI AREAS.

LEGEND

- Existing Highway
- Existing Railroad
- Levees
- Recreation Area

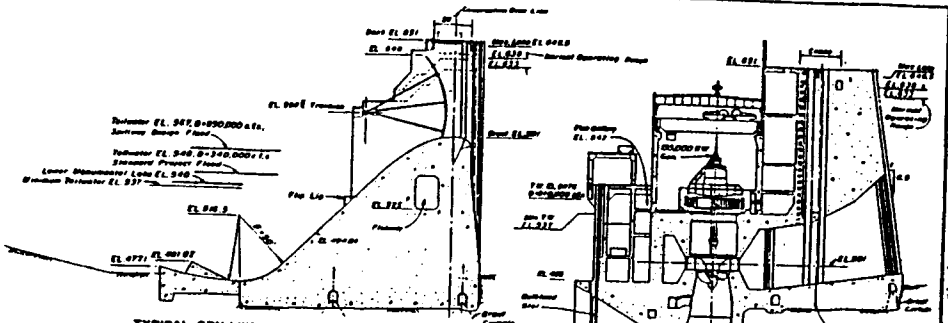
SNAKE RIVER
OREGON, WASHINGTON AND IDAHO
LOWER GRANITE LOCK AND DAM
U.S. ARMY ENGINEER DISTRICT, WALLA WALLA
REVISED TO OCT 1985

U.S. ARM



TYPICAL EMBANKMENT SECTION

SCALE IN FEET

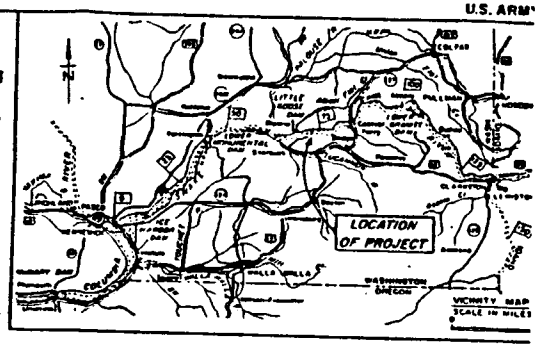


TYPICAL SPILLWAY SECTION

SCALE IN FEET

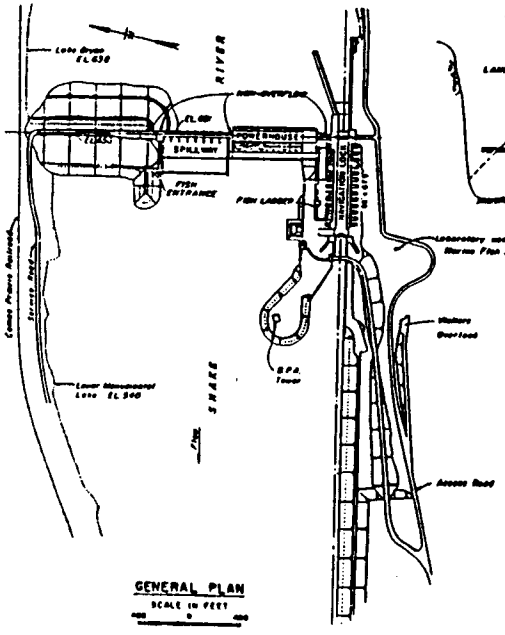
TYPICAL POWERHOUSE SECTION

SCALE IN FEET



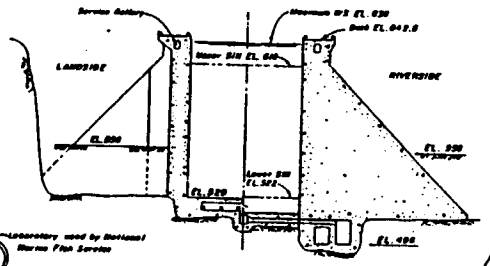
VICINITY MAP

SCALE IN MILES



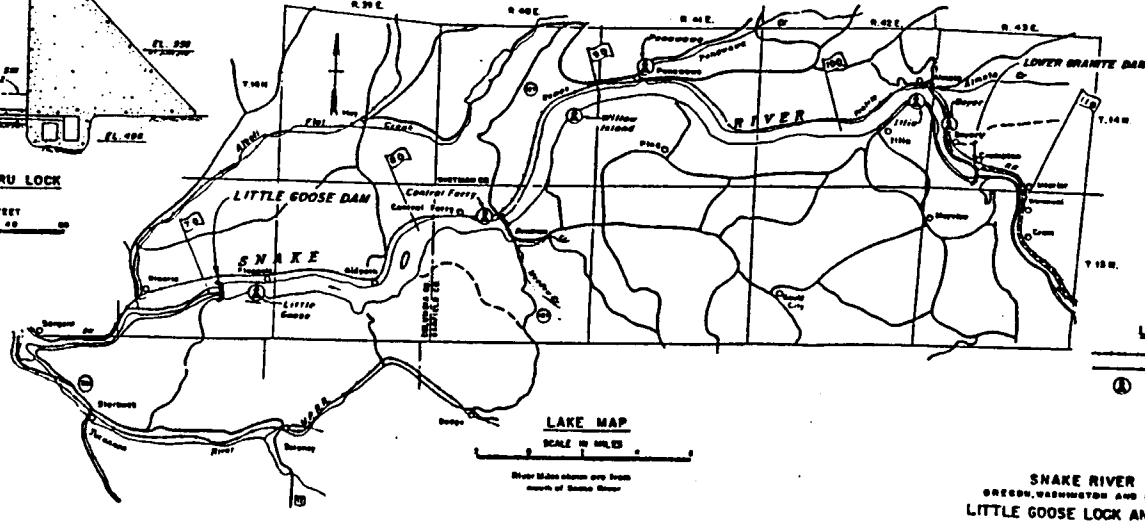
GENERAL PLAN

SCALE IN FEET



SECTION THRU LOCK

SCALE IN FEET



LAKE MAP

SCALE IN MILES

River Miles shown are from mouth of Snake River

LEGEND

Existing railroad

Existing highway

Recreation Area

SNAKE RIVER

OREGON, WASHINGTON AND IDAHO

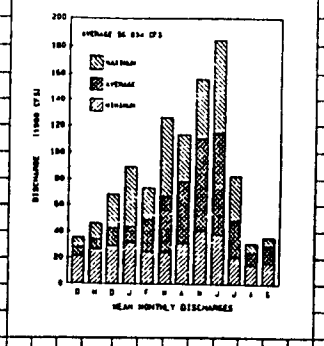
LITTLE GOOSE LOCK AND DAM

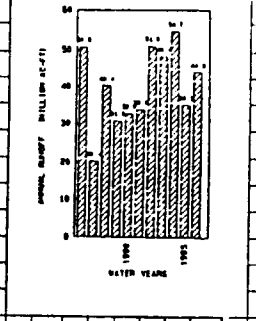
(LAKE BRYAN)

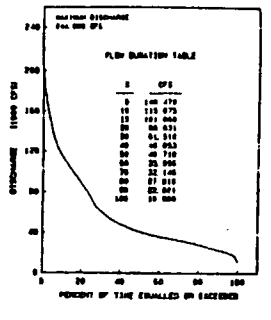
U.S. ARMY ENGINEER DISTRICT, WALLA WALLA

REVISED TO 30 SEPT. 1982

B-3







DISCHARGE IN 10,000 CFS

DISCHARGE IN 10,000 CFS

MAXIMUM MEAN DAILY DISCHARGE

5%

10%

25%

50%

75%

90%

95%

AVERAGE MEAN DAILY DISCHARGE

MINIMUM MEAN DAILY DISCHARGE

OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP

NOTES:

1. RECORDS USED:
   WATER YEARS MARCH 1975-1986, LOWER GRANITE REGULATED INFLOWS COMPUTED BY THE CORPS OF ENGINEERS, WALLA WALLA DISTRICT.
2. DRAINAGE AREA IS 100,900 SQUARE MILES.
3. COMPUTED REGULATED INFLOWS REFLECT THE EFFECTS OF UPSTREAM IRRIGATION AND RESERVOIR STORAGE.
4. EXAMPLES OF PERCENT CHANCE OF OCCURRENCE REPRESENT THE AVERAGE FLOW FOR THAT DAY. A POINT ON AN EXCEEDENCE CURVE REPRESENTS THE AVERAGE DAILY DISCHARGE FOR A SPECIFIC DAY WHICH HAS BEEN EXCEEDED THE GIVEN PERCENTAGE OF TIME.

MAXIMUM ANNUAL MEAN DAILY DISCHARGES

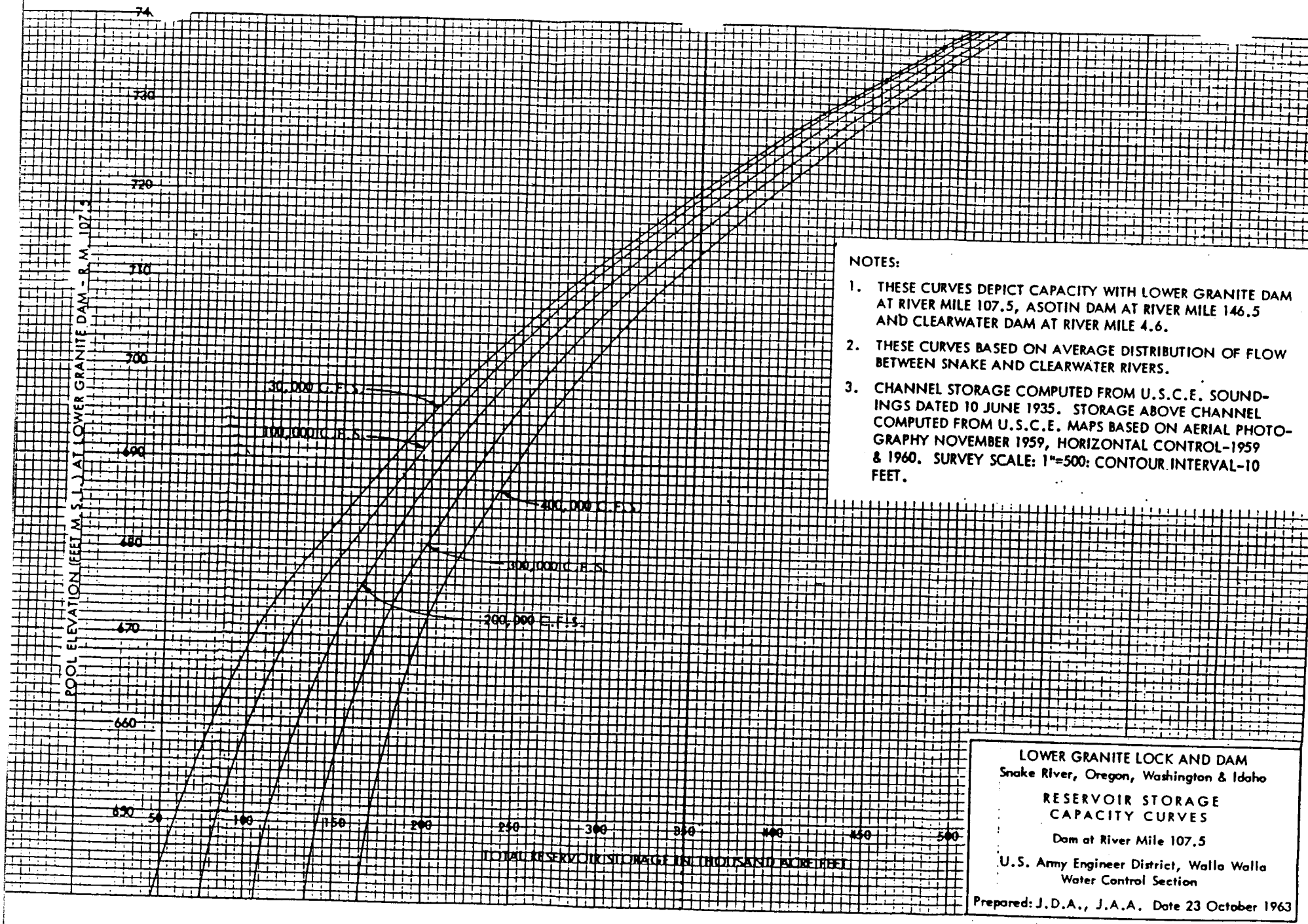
WATER YEAR	DATE	CFS		WATER YEAR	DATE	CFS
1976	MAY 11	192,000				
1977	MAY 3	62,300				
1978	JUN 9	140,000				
1979	MAY 29	161,200				
1980	JUN 13	135,200				
1981	JUN 10	176,100				
1982	JUN 10	205,600				
1983	MAY 29	194,300				
1984	MAY 31	244,000				
1985	JUN 8	124,000				
1986	JUN 1	211,000				

U.S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

LOWER GRANITE LOCK AND DAM

SNAKE RIVER, OREGON, WASHINGTON, & IDAHO

SUMMARY HYDROGRAPHS
LOWER GRANITE RESERVOIR
COMPUTED REGULATED INFLOWS



NOTES:

1. THESE CURVES DEPICT CAPACITY WITH LOWER GRANITE DAM AT RIVER MILE 107.5, ASOTIN DAM AT RIVER MILE 146.5 AND CLEARWATER DAM AT RIVER MILE 4.6.
2. THESE CURVES BASED ON AVERAGE DISTRIBUTION OF FLOW BETWEEN SNAKE AND CLEARWATER RIVERS.
3. CHANNEL STORAGE COMPUTED FROM U.S.C.E. SOUNDINGS DATED 10 JUNE 1935. STORAGE ABOVE CHANNEL COMPUTED FROM U.S.C.E. MAPS BASED ON AERIAL PHOTOGRAPHY NOVEMBER 1959, HORIZONTAL CONTROL-1959 & 1960. SURVEY SCALE: 1"=500: CONTOUR INTERVAL-10 FEET.

LOWER GRANITE LOCK AND DAM
Snake River, Oregon, Washington & Idaho

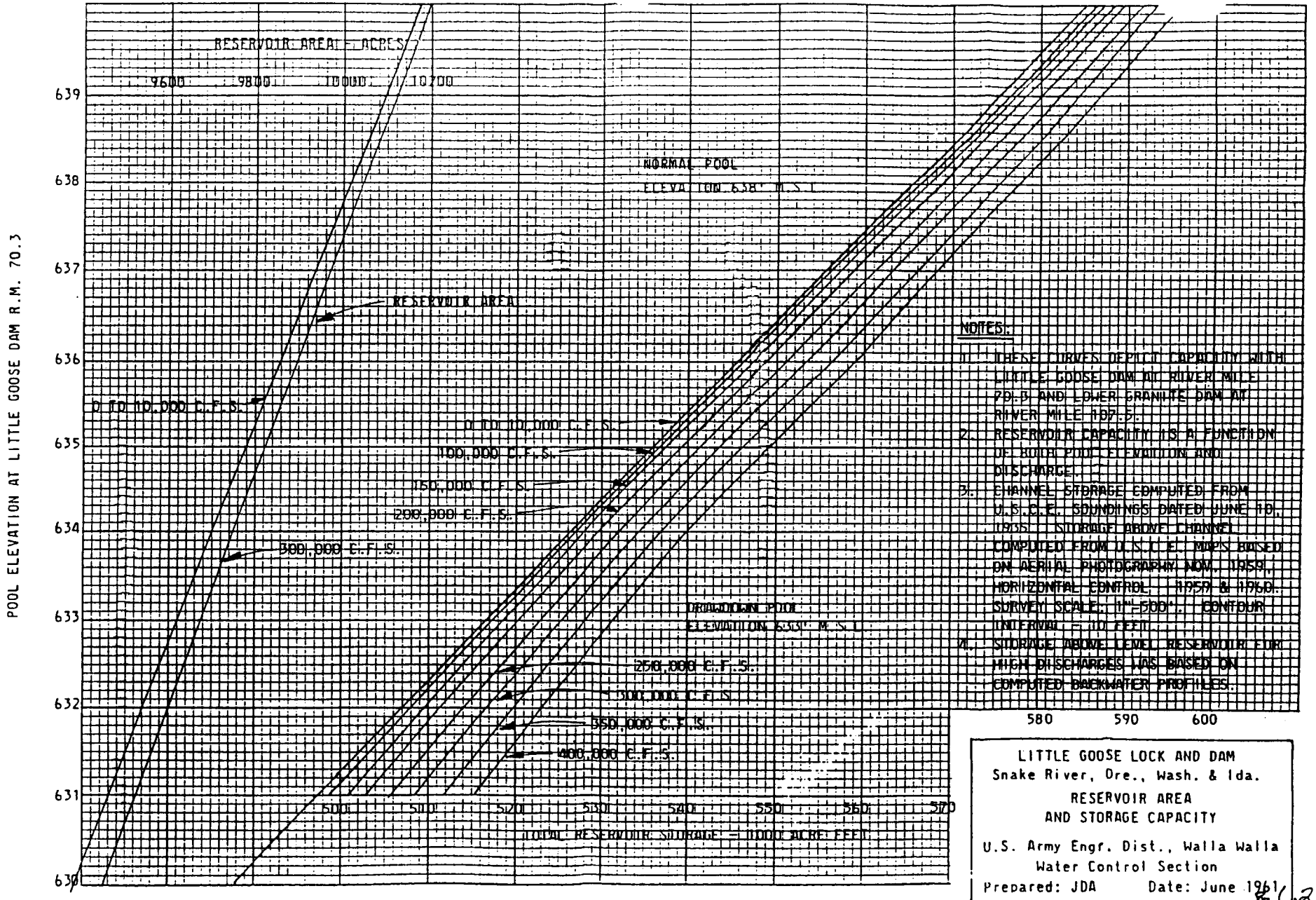
RESERVOIR STORAGE CAPACITY CURVES

Dam at River Mile 107.5

U.S. Army Engineer District, Walla Walla
Water Control Section

Prepared: J.D.A., J.A.A. Date 23 October 1963

WATER CONTROL MANUAL PLATE ~~5-10~~ B-6.1



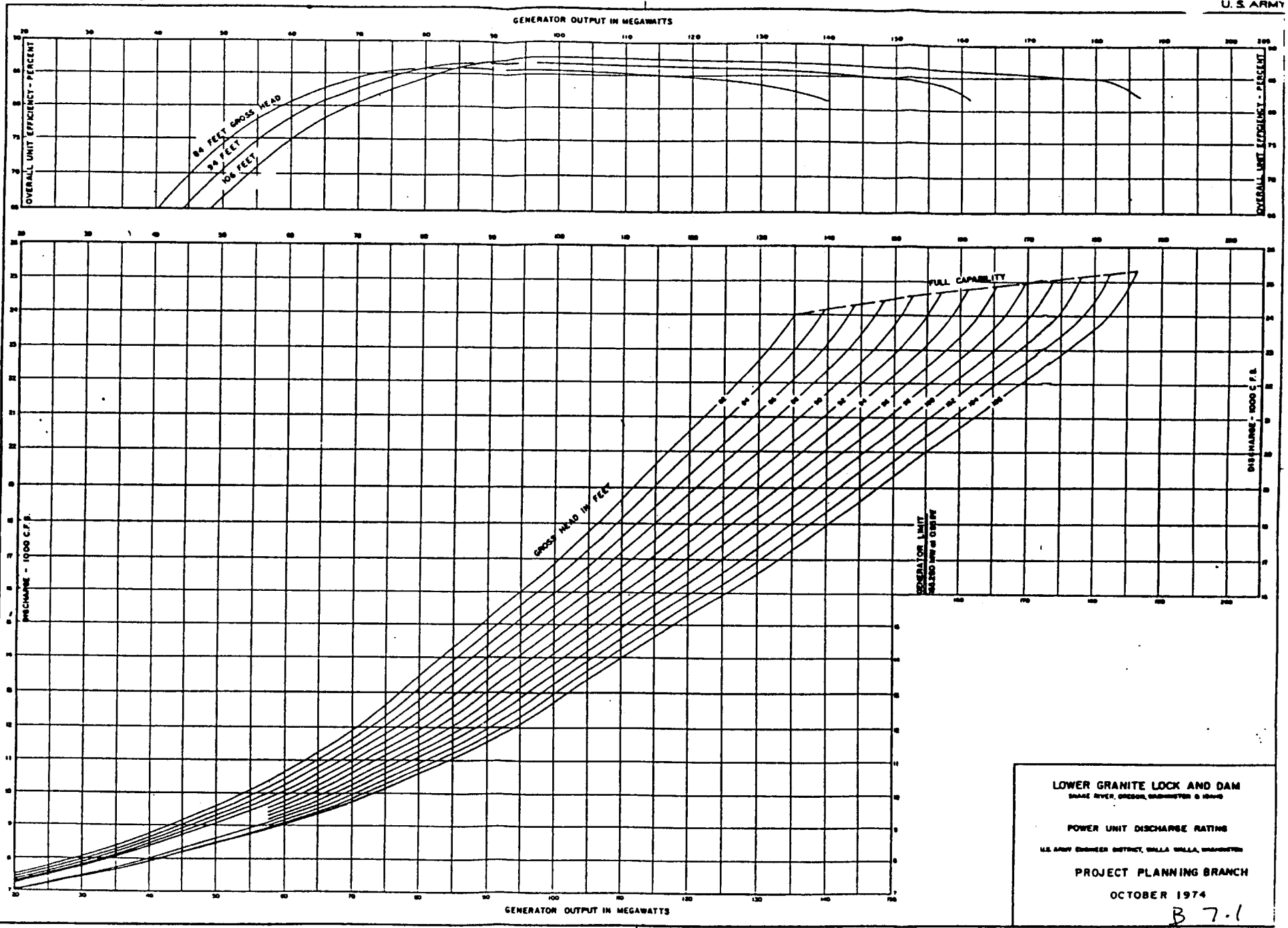
LITTLE GOOSE LOCK AND DAM
Snake River, Ore., Wash. & Ida.
RESERVOIR AREA
AND STORAGE CAPACITY
U.S. Army Engr. Dist., Walla Walla
Water Control Section
Prepared: JDA Date: June 1961

B-6.2

WATER CONTROL MANUAL PLATE ~~B-13~~ B-6.2

CORPS OF ENGINEERS

U. S. ARMY



LOWER GRANITE LOCK AND DAM

SNAKE RIVER, OREGON, WASHINGTON & IDAHO

POWER UNIT DISCHARGE RATING

U.S. ARMY ENGINEER DISTRICT, WALLA WALLA, WASHINGTON

PROJECT PLANNING BRANCH

OCTOBER 1974

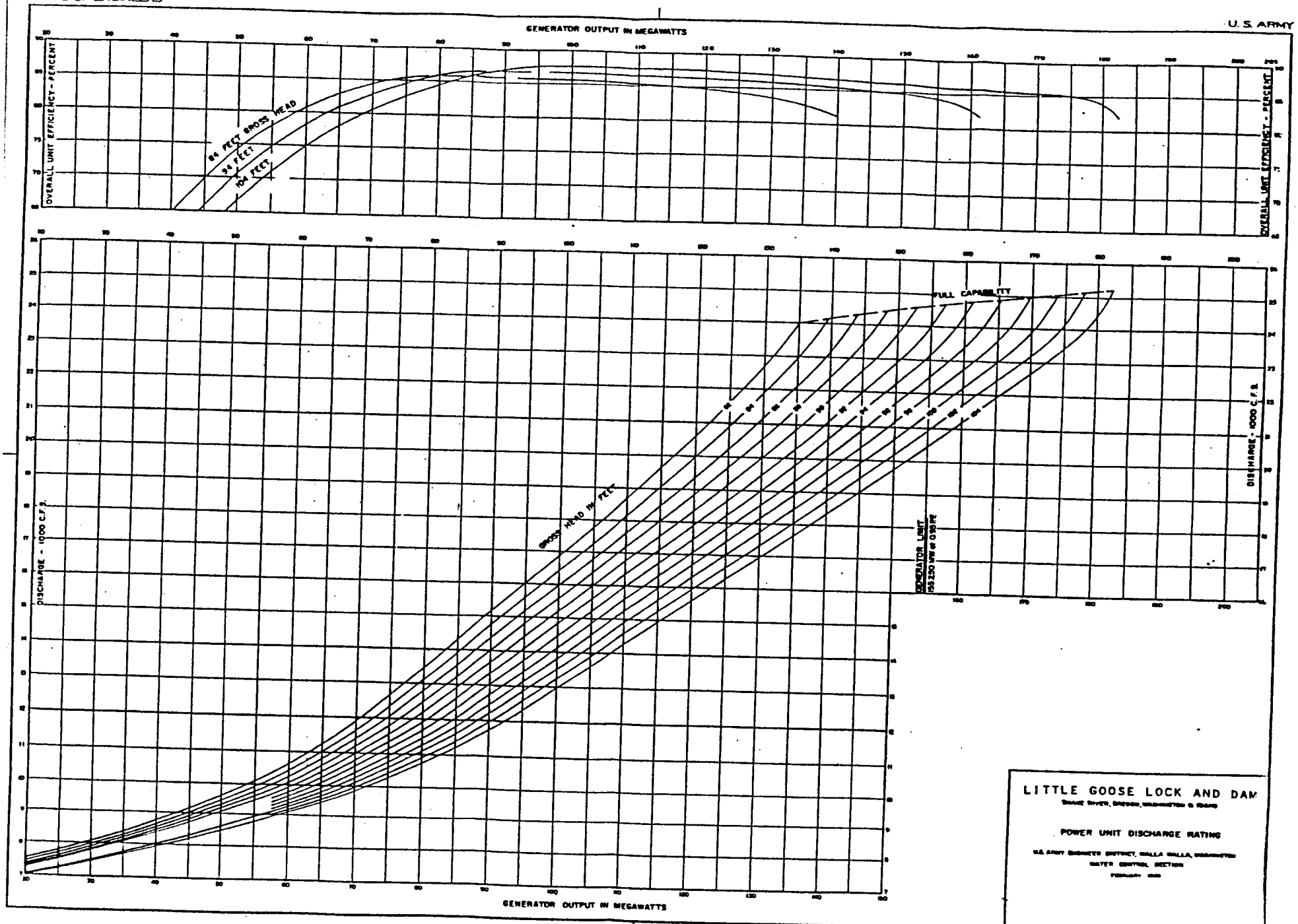
B 7.1

WATER CONTROL MANUAL PLATE ~~3~~

B-7.1

CORPS OF ENGINEERS

U.S. ARMY

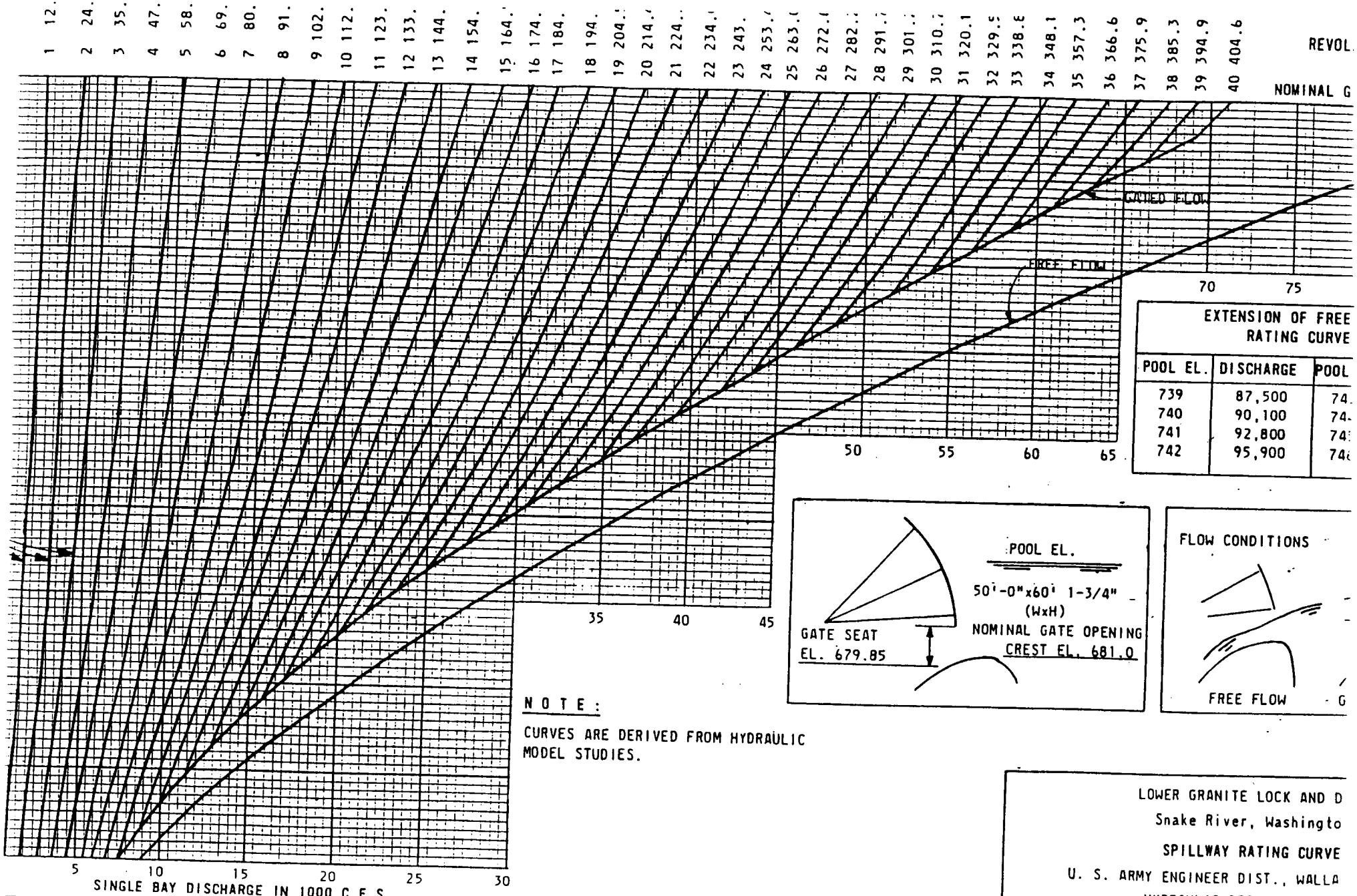


LITTLE GOOSE LOCK AND DAM

POWER UNIT DISCHARGE RATING

WATER CONTROL MANUAL PLATE

B-7.2



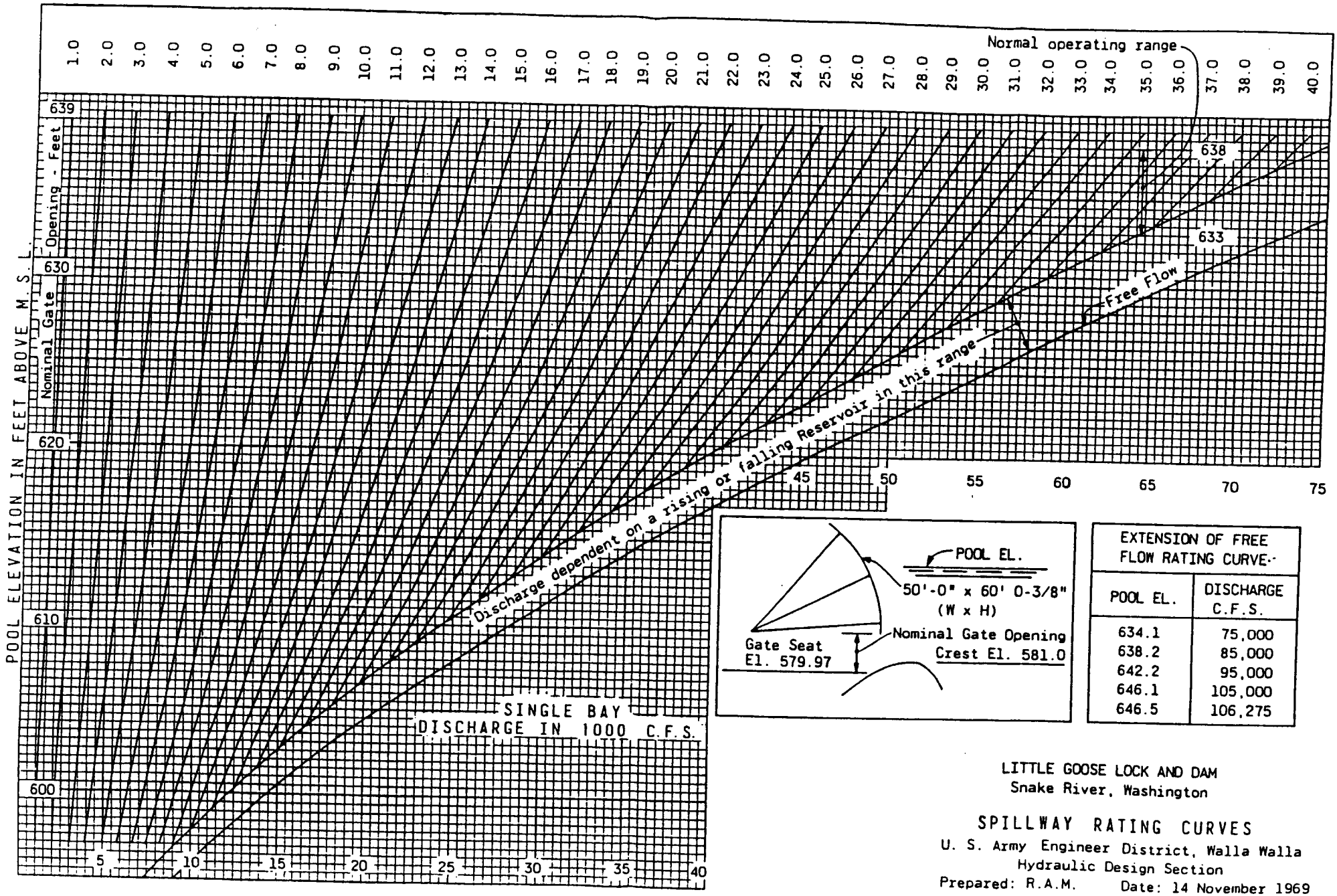
EXTENSION OF FREE RATING CURVE		
POOL EL.	DISCHARGE	POOL
739	87,500	74
740	90,100	74
741	92,800	74
742	95,900	74

NOTE:

CURVES ARE DERIVED FROM HYDRAULIC MODEL STUDIES.

LOWER GRANITE LOCK AND D
Snake River, Washingto
SPILLWAY RATING CURVE
U. S. ARMY ENGINEER DIST., WALLA
HYDRAULIC DESIGN SECTIO
PREPARED: R.A.M. DATE

PLATE B-8.1

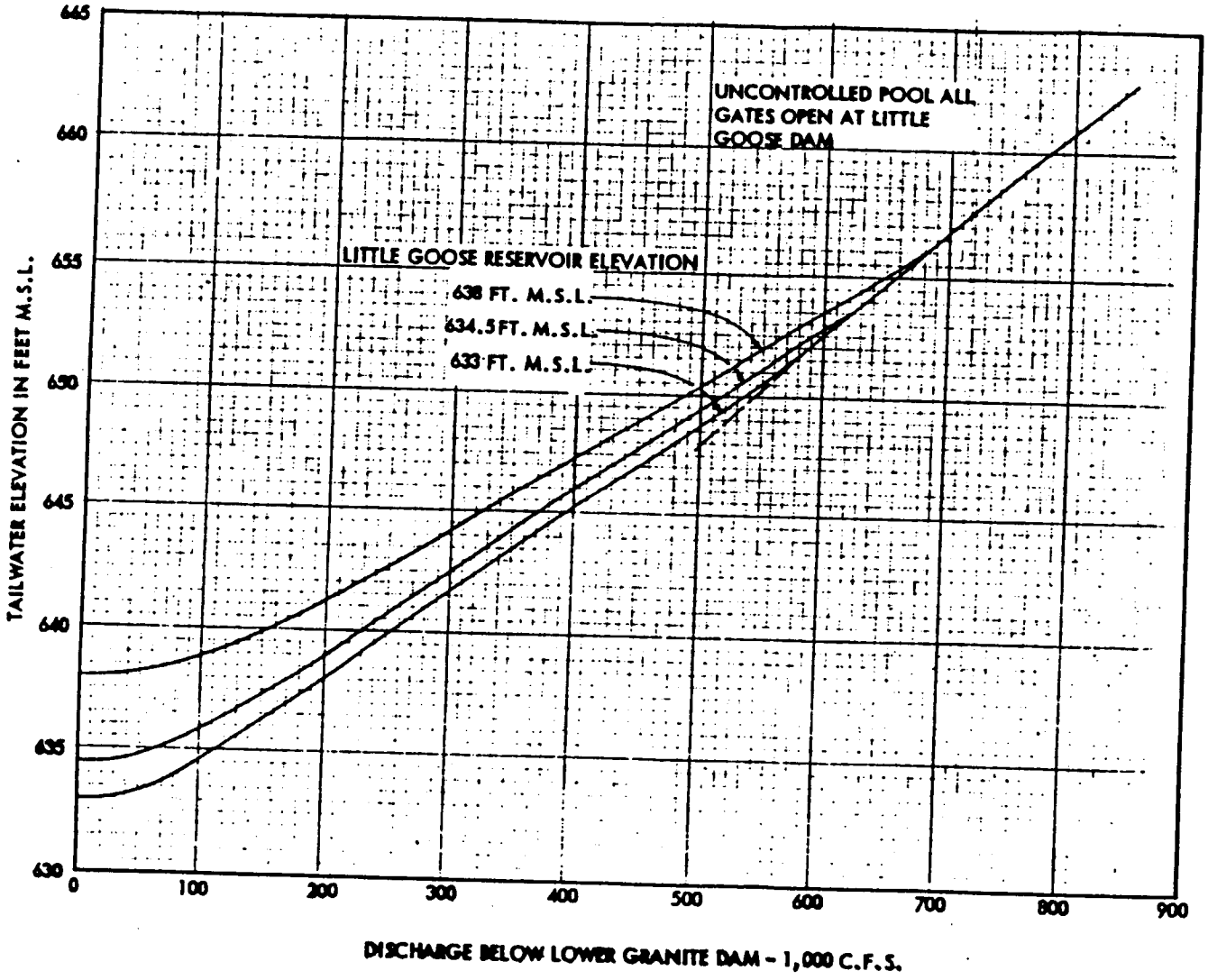


EXTENSION OF FREE FLOW RATING CURVE	
POOL EL.	DISCHARGE C.F.S.
634.1	75,000
638.2	85,000
642.2	95,000
646.1	105,000
646.5	106,275

LITTLE GOOSE LOCK AND DAM
Snake River, Washington

SPILLWAY RATING CURVES
U. S. Army Engineer District, Walla Walla
Hydraulic Design Section
Prepared: R.A.M. Date: 14 November 1969
WATER CONTROL MANUAL PLATE E-7

R-E.7



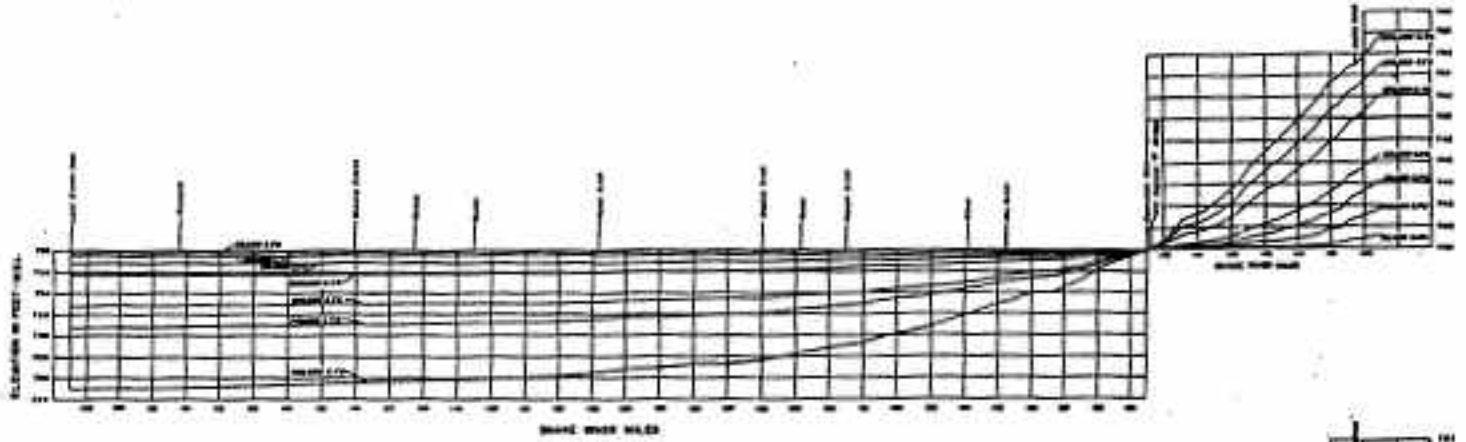
NOTES:

1. LOWER GRANITE TAILWATER CURVES ARE BASED ON BACKWATER PROFILES COMPUTED FROM LITTLE GOOSE AT RIVER MILE 70.3 AND REFLECT CONDITIONS AT RIVER MILE 107.38 (470 FEET BELOW THE AXIS OF LOWER GRANITE DAM).
2. EFFECTS OF VARIOUS COMBINATIONS OF FLOWS THROUGH THE POWERHOUSE AND SPILLWAY ARE NOT SHOWN. REFER TO TECHNICAL REPORT NO. 121-1, LOWER GRANITE DAM, SNAKE RIVER, WASHINGTON, AUGUST 1984 FOR DETAILS ON FLOW CONDITIONS FOR SELECTED DISCHARGES AND METHODS OF PROJECT OPERATION.
3. TAILWATER ELEVATION FOR THE SPILLWAY DESIGN FLOOD (850,000 CFS AT LOWER GRANITE DAM IS 662.9 FEET M.S.L. AND CORRESPONDS TO A MAXIMUM ELEVATION OF 646 FEET AT LITTLE GOOSE DAM).

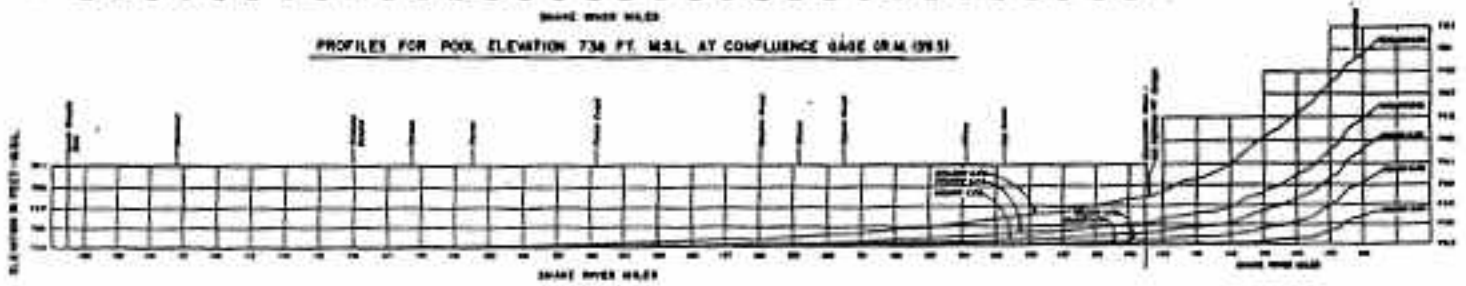
LOWER GRANITE LOCK AND DAM
Snake River, Ore., Wash. & Ida.

LOWER GRANITE TAILWATER RATING CURVES WITH BACKWATER FROM LITTLE GOOSE DAM

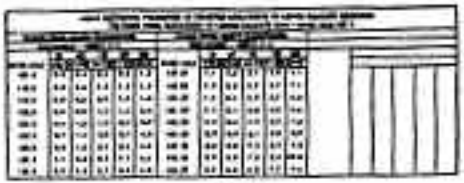
U.S. Army Engr. Dist., Walla Walla
Water Control Section
Prepared: J.A.A. Date: Aug. 1961



PROFILES FOR POOL ELEVATION 738 FT. M.S.L. AT CONFLUENCE GAGE (R.M. 139.5)



PROFILES FOR FOREBAY ELEVATION 733 FT. M.S.L. AT LOWER GRANITE DAM (R.M. 107.5)



NOTES:

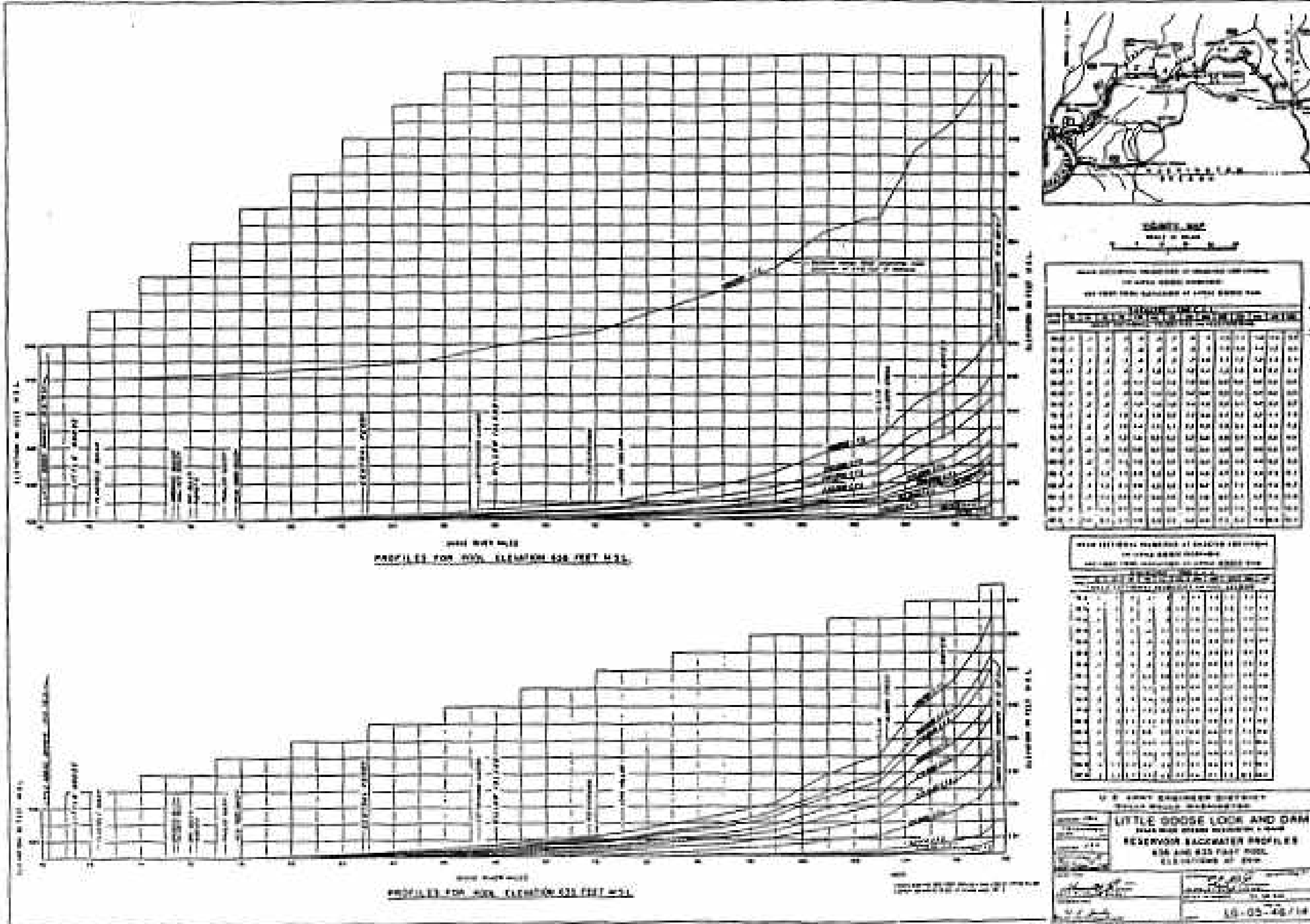
1.

2.

U.S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

LOWER GRANITE LOCK AND DAM

REVERSING BACKWATER PROFILES
738 FT. POOL EL. AT R.M. 139.5
AND 733 FT. POOL EL. AT R.M. 107.5


PROFILES FOR POOL ELEVATION 638 FEET M.S.L.
PROFILES FOR POOL ELEVATION 633 FEET M.S.L.
VICINITY MAP
U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON
LITTLE GOOSE LOCK AND DAM
RESERVOIR BACKWATER PROFILES
638 AND 633 FEET POOL
ELEVATIONS AT DAM
LG-05-48/14

APPENDIX C

OPERATION ORDER FOR CONTINGENCY PLAN

I. Situation.

The Walla Walla District will be releasing flows from Lower Granite and Little Goose Dams. If, during drawdown, inflows exceed releases, the extra water will be stored, but the reservoir will be drawn down to the planned elevations as soon and as rapidly as possible. In the event that a structural or system failure occurs or is imminent such that there is a threat of a catastrophic failure of the dams or levees, this plan will be implemented.

II. Mission.

If a situation of impending catastrophic failure of the dam develops, alert local and state authorities and begin emergency operations.

III. Execution.

a. Concept of Operation. If, in the opinion of the Operations Field Coordinator, an emergency of sufficient magnitude occurs, the Granite-Goose Project Manager's Office and the District Office shall proceed with the emergency operation plan.

b. Notification Plan.

1. Operations Field Coordinator:

(a) Involved Counties Emergency Services (Sheriff)

(b) Department of Emergency Services

2. Operations Field Coordinator will alert.

(a) District Engineer (Primary)
Deputy District Engineer (Alternate)

(b) Chief, Engineering (Primary)
Assistant Chief Engineering (Alternate)

(c) Chief, Operations (Primary)
Assistant Chief Operations (Alternate)

(d) Chief, Construction (Primary)
Assistant Chief Construction (Alternate)

(e) Executive Assistant

(f) Public Affairs Officer

c. Emergency Operation Plan.

1. Operations Field Coordinator.

(a) Warn all Corps field and Contractor's personnel and evacuate necessary areas.

(b) Verify that local emergency services have released warning information.

(c) Initiate emergency repair work using Contractor resources.

(d) Remove and secure Government property to a safe area.

(e) Keep District Office informed of situation.

2. District Office.

(a) District elements alerted by the notification plan shall notify appropriate subordinates.

(b) All notified District personnel shall proceed to the District Office, Main Conference Room for an initial briefing.

(c) Open an Emergency Operations Center in Main Conference Room and maintain contact with Resident Office.

(d) Establish contact with State and locate emergency offices.

(e) Public Affairs will prepare news releases.

(f) Prepare for procurement of emergency equipment and services.

(g) Mobilize clerical support for the Emergency Operations Center.

(h) Alert NPD Staff.

IV. Support and Supply.

a. The motor pool will provide vehicles for District personnel traveling to Lower Granite and Little-Goose Dams.

b. The Emergency Operations Center will provide travel authority, financial actions, and other administrative support.

V. Command and signal.

a. Command.

1. The District Engineer is in command of the operation.

2. The Operations Field Coordinator has authority for all operations at the project. All District personnel assigned to the project will be directly responsible to the their respective technical coordinators.

b. Telephone Numbers of Key Personnel.

1. Operations Field Coordinator Office.

Corps of Engineers Granite-Goose Project Office (509) 843-1493 (1494)

1. District Office Office-Duty Hours Home Phone

DE LTC Volz	(509) 522-6506
C, Engr. M. Brammer	(509) 522-6562
C, Ops P. Windborg	(509) 522-6692
C, Const. G. Willard	(509) 522-6490
C, Geotech F. Miklancic	(509) 522-6763
C, Design D. Frei	(509) 522-6515
C, Pub. Aff. C. Wolff	(509) 522-6658
C, Safety R. Coonfare	(509) 522-6798

1/23/92

APPENDIX D

Spillway and Stilling Basin Related Monitoring Plan Lower Granite Dam

I. General Description of Spillway and Stilling Basin Related Tests.

A. General.

1. Monitoring and evaluations of the operation of the spillway, stilling basin, and related features will be conducted before, during, and after the March 1992 test period.

2. The main purposes of this activity will include:

a. Insuring that the major structural components of the system are not damaged during the testing,

b. Monitoring dissolved gas levels for different combinations of spillway flow, forebay elevations, and tailwater elevations, and

c. Observing spillway flow patterns to document impacts related to adult fishway entrances and related features.

2. General Pool Lowering Plan and River Discharge Information.

a. A general overview of the pool lowering plan, stream flows information, project releases, and other reservoir regulation related topics can be found in Appendix B, "Reservoir Regulation Plan for the Lower Granite and Little Goose Pool Lowering Test." A detailed discussion of the pool lowering plan as it pertains to the spillway and stilling basin related tests is presented in later paragraphs.

b. Snake River inflows during the March test timeframe average around 60,000 cfs with daily average inflows reaching as low as 25,000 cfs and high as 166,000. The juvenile fish season, however, occurs from April through July with the peak fish runs coming in May and June. The average inflows during the May and June time period average around 100,000 cfs with the daily average inflows reaching as low as 20,000 cfs and as high as 245,000 cfs.

c. In order to observe and monitor the spillway and stilling basin under flow conditions that would be more typical during the juvenile fish season (i.e. May and June), special surge tests will be conducted using reservoir storage to simulate spillway discharges of about 100,000 cfs. The special surge tests are discussed in Paragraphs II and III.

d. The time available for the spillway test will primarily

be controlled by a combination of the following items:

(1) The Little Goose and Lower Granite forebays can be dropped a maximum of 2-foot per day, and

(2) The time required to refill the reservoirs to their normal minimum operating pools (MOP) by 1 April is controlled by the discharge amount in the river.

3. Hydraulic Sectional Model of the Lower Granite Spillway.

a. General.

(1) A 1:55-scale sectional model of the Lower Granite spillway reproducing one full bay width, two piers, and two partial bays has been constructed to evaluate, prior to the actual field test, flow conditions related to both normal and special reservoir drawdown conditions.

(2) The normal condition tests will be used to:

(a) Compare new model study flow conditions to original project model study conditions,

(b) Provide base conditions to compare model drawdown related tests to normal model conditions,

(c) Compare past spillway flows and existing stilling basin and related physical conditions to new model study tests,

(d) Reevaluate the original spillway gate rating curve, and

(e) Observe flow patterns related to the flow deflectors on the spillway as it pertains to original dissolved gas evaluations,

b. Overview of Model Study Tests.

Specific tests that are currently planned to be conducted include:

(1) Conducting a series of tests that will be used to obtain a quick comparison between normal project conditions and a special drawdown condition (say for a 100,000 cfs spillway discharge).

(2) Operating the spillway and stilling basin with constant minimum normal forebay and tailwater elevations assuming varying flow rates and tailwater elevations in order to establish base conditions for which to compare the model drawdown tests

results.

(3) Evaluating the spillway and stilling basin for conditions that would be encountered during the drawdown tests assuming several different combinations of spillway flows with varying forebay and tailwater elevations.

(4) Comparing the operation of the model spillway gates to the original spillway rating curves. In particular, the forebay elevation at which control for spillway discharges shift from gate control to crest control will be closely examined for various flow conditions.

(5) Observing spillway and stilling basin discharge conditions for various combinations of inflows, forebay elevations, and tailwater elevations. These observations, in addition to comparisons to the original spillway deflectors model study tests, could give an indication of how the drawdown tests might impact dissolved gas levels in the river.

c. Potential Impact of Model Tests Results.

Results from the hydraulic sectional model tests of the Lower Granite spillway could impact how the actual drawdown test is finally conducted. The test results could suggest that operating the spillway and stilling basin under drawdown conditions would not pose unacceptable risks to the structures. The test results could also set limits on what combination of flows, forebay elevations, and tailwater elevations will be allowed. Final test result will not be available until mid-February 1992.

II. Detailed Description of the Spillway and Stilling Basin Related Test Assuming No Problems are Encountered and Assuming Flows are Adequate to Complete the Full Test Sequence.

A. General.

1. The pool lowering test discussed in the following paragraphs will be accomplished in four phases (See Plate D-1). This test scenario assumes that: (a) there is sufficient river flow to allow time to complete the entire test sequence, (b) no problems have arisen that would abort the test early, and (c) the turbines are fully functional throughout the test period. The impact on the test if the above assumptions are not correct are discussed in Paragraph III.

2. Graphs in Appendix B, "Reservoir Regulation Plan for the Lower Granite and Little Goose Pool Lowering Test," show forebay elevations versus time for Lower Granite and Little Goose Dams during the tests assuming several different inflows situations.

3. For discussion purposes, the 60,000 cfs inflow assumption will be presented in the following paragraphs.

4. One reason that the Little Goose pool will be started at Elevation 638.0 (Maximum Normal Operating Pool) rather than at Elevation 633.0 (MOP) is so that data on dissolved gases can be obtained over the entire range of tailwater conditions. This will provide information that will allow the determination of when the flow deflectors on the spillway become ineffective. In addition, starting Little Goose pool at Elevation 638.0 will provide a conservatively high tailwater for the start of the spillway related tests in order to insure safe conditions with respect to dam safety issues.

5. The tailwater elevation at Lower Granite Dam will vary depending on the starting pool elevation at Little Goose Dam and on the flow in the river versus backwater effect from Little Goose to Lower Granite. In addition, during the actual spillway tests, flow conditions in the tailrace area at Lower Granite will be very turbulent with substantial wave action occurring downstream and adjacent to the spillway.

B. Phase 1 - Drawdown Lower Granite Pool from Elevation 733.0 (Minimum Operating Pool - [MOP]) to Elevation 705.

1. Starting Lower Granite pool at Elevation 733.0 (MOP) and Little Goose pool at Elevation 638.0 (Maximum Normal Operating pool), the Lower Granite pool will drop, passing river discharges through the turbines at a steady constant rate of 2-foot per day, until elevation 705.0 is reached. This will take about 15 days to accomplish.

2. The significance of elevation 705.0 (and for elevation 703.0 that is discussed later) is that for a spillway flow of about 100,000 cfs, control of the forebay elevation can be reliably maintained at these elevations with the spillway gates. For water surface elevations less than elevation 703, the forebay elevation could significantly fluctuate as control of the water surface elevation shifts between the spillway gates and the spillway crest itself.

C. Phase 2 - Spillway Tests: Periodically Conduct Surge Tests with Lower Granite Pool Ranging Between Elevations 705 and 703 and with Little Goose Pool Dropping to Provide Low Tailwater Conditions at Lower Granite.

1. With Lower Granite and Little Goose forebays at elevations 705.0 and 638.0, respectively, direct river flows passing through the turbines (up to 100,000 cfs) through the spillway. If river flows are above 100,000 cfs, continue to use part of the turbines. After the natural river flows over the spillway have stabilized (say allow about 2 hours), begin a 100,000 cfs spillway surge test quickly dropping the Lower Granite forebay

from elevation 705.0 to 703.0. The length of the test (say about 2 hours) will be limited by river flows and by possible restrictions that may be placed on how long certain levels of dissolved gases generated by the spillway test can be tolerated.

2. After the first surge test is complete, the spillway gates will be closed and all river flows will be shifted to pass water back through the turbines. The forebay will be raised back to elevation 705.0 while the Little Goose forebay will now begin to steadily drop 2-foot per day. The Little Goose forebay will be targeted to drop until the tailwater elevation at Lower Granite is at a level that would be comparable to that if spillway freeflow conditions were occurring at Little Goose. (The reason that the Little Goose pool will not have to drop to an actual spillway freeflow condition is because natural river conditions [i.e. out of the effect of the backwater from Little Goose] can be reached at Lower Granite tailrace by dropping the Little Goose pool no more than to elevation 618.0.)

3. Additional natural river and 100,000 cfs surge tests (say from 3 to 4) will be conducted at roughly equal Lower Granite tailwater elevation increments (between elevation 638.0 and to equivalent spillway freeflow elevations) . These tests will be similar in description to that previously described for the first surge test.

D. Phase 3 - Drop and Hold Lower Granite Forebay to Near Spillway Crest and Hold Little Goose Forebay (and therefore Lower Granite Tailwater) at the Low Levels Obtained During Phase 2 of the Test.

After the successful completion of the Phase 2 tests and if time and flows allow, the Lower Granite pool would continue to be steadily dropped using the turbines at a 2-foot per day rate until a near spillway freeflow elevation is reached. The flow would then be switched from the turbines to the spillway and maintained at the low levels as long a possible before refill would have to start in order to meet the 1 April refill date. A discussion related to refill times and procedures is presented in Appendix B, "Reservoir Regulation Plan for the Lower Granite and Little Goose Pool Lowering Test."

E. Refill Little Goose and Lower Granite Pools to MOP.

After completion of the first three phases of the spillway test, the spillway gates will be closed and flows passed back through the turbines. Both the Lower Granite and Little Goose pools will then be refilled to MOP.

III. General Discussion of the Spillway and Stilling Basin Test Assuming Problems are Encountered and/or that Flows are Substantially Higher Than Average.

Many things could influence how the test would proceed, as compared to the test scenario previously described, if problems arise or if high flows occur during the test. Important items/features that will be monitored and evaluated throughout the test will include turbine operations, dam and reservoir related safety issues, biological impacts (particularly dissolved gas levels), and others. Plates D-1 through D-4 show diagrams that indicate how the test sequence related to the spillway and stilling basin tests will proceed assuming different situations are encountered during the test.

IV. Pre-Test, Test, and Post-Test Monitoring.

A. Hydraulic Sectional Model of the Lower Granite Spillway.

A discussion of the hydraulic sectional model of the Lower Granite spillway as it pertains to pre-test monitoring is presented in Paragraph I.3.

B. Hydrographic Work.

1. High Resolution Sonic Mapping.

Detailed sonic mapping of the stilling basin and the surrounding downstream and adjacent tailrace area (see Plate D-5) will be conducted before and after the test period. Additional detailed sonic mapping will also be obtained after each spillway surge test.

2. Side-Scan.

Side-scan sonic data will be obtained immediately after each spillway surge test in order to provide a quick, relative change comparison of the stilling basin and channel bottom conditions between tests.

C. Divers.

Divers will be used to inspect areas of the stilling basin just downstream of the end sills where previous field survey information indicates that portions of the channel have eroded (potentially significantly) away from the structure. The divers will also examine and collect samples of materials that have been deposited in piles at various locations in the stilling basin. Depending on what is found after the initial inspection, the divers may be used during later stages of the test.

D. Hydraulic Measurements.

1. General.

Plate D-5 shows the general location of key hydraulic gages that will be use to monitor the drawdown test.

2. Water Surface Elevations.

Existing tailwater and forebay gages near the south shore will have their ranges extended to function over the entire span of the drawdown test. Additional tailwater gages will be installed: (1) at the south side of the stilling basin, (2) downstream on the navigation lock guidewall, (3) downstream of the north embankment, and (4) two gages about 2000 feet downstream of the spillway located close to the north and south shoreline. All of the gages except for those in the immediate area of the spillway will collect data that will be used to correlate and interpret water surface elevations obtained during the test to a future 3-dimensional hydraulic model of the Lower Granite Project.

3. Pressure Transducers.

Pressure transducers will be installed on the north and south sides of the stilling basin end sills in order to correlate and interpret test results to a future 3-dimensional hydraulic model of the Lower Granite Project.

E. Visual and Photographic Observations.

1. Visual observations will be constantly made throughout the actual spill tests to observe any changing flow patterns in the stilling basin and surrounding areas.

2. Videos will be taken both from the south shore and from a helicopter in order to document the test.

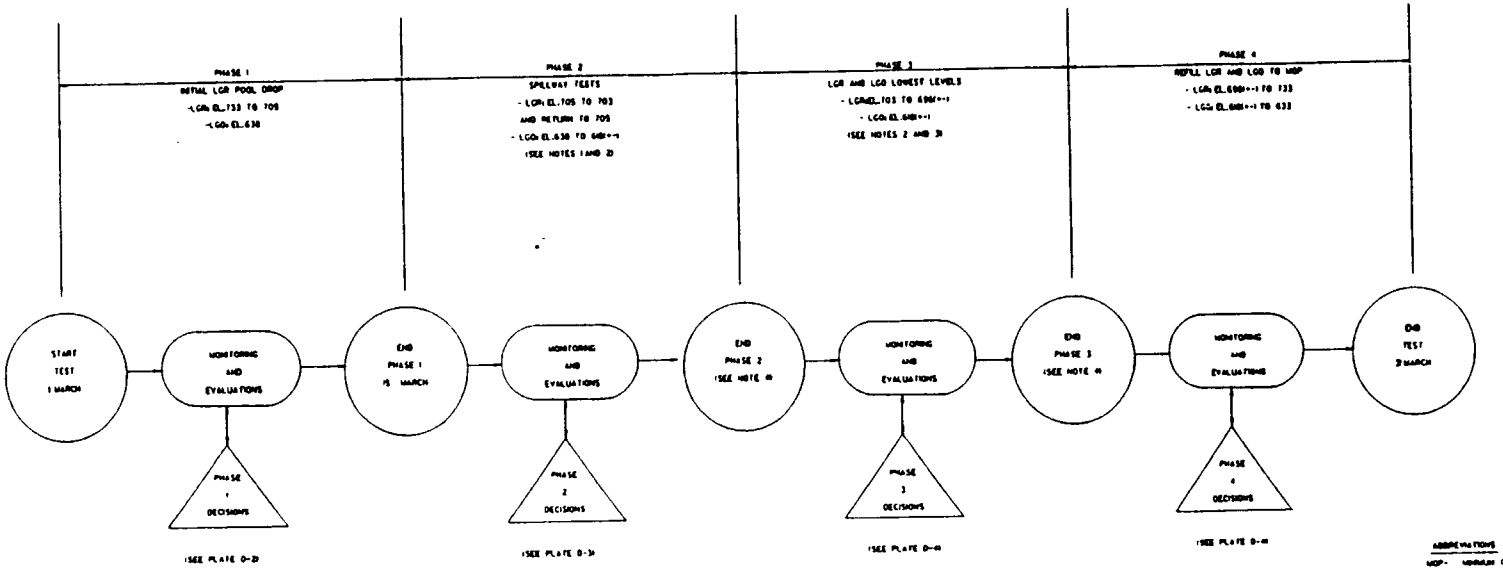
F. Dissolved Gas Monitoring.

Dissolved gas levels will be measured at fixed tensionometer locations both upstream and downstream of the dam (see Plate D-5). In addition, transects of dissolved gas levels both upstream and downstream of the dam will be taken at different locations and at different times throughout the test.

CORPS OF ENGINEERS

SAFETY PAYS

U. S. ARMY



ABBREVIATIONS

MOP- MINIMUM OPERATING POOL
LGR- LOWER GRANITE
LGO- LITTLE GOOSE

NOTES:

1. NORMAL SPILLWAY SURGE TEST. IF CONDITIONS ALLOW, WILL CONSIST OF 2 HOURS OF NATURAL INFLOWS AND 2 HOURS OF 100,000 CFS SURGE FLOWS.
2. LITTLE GOOSE POOL, IF CONDITIONS ALLOW, WILL BE DROPPED TO PROVIDE EQUIVALENT HEAD SPILLWAY FREEFLOW ELEVATIONS AT LOWER GRANITE TAILWATER.
3. LOWER GRANITE POOL, IF CONDITIONS ALLOW, WILL BE DROPPED TO NEAR SPILLWAY FREEFLOW ELEVATIONS.
4. END OF PHASE 2 AND PHASE 3 TESTS WILL BE DEPENDENT ON INFLOWS WHICH IMPACT REFILL TIMES.

Computer Aided Design & Drafting

U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

LOWER GRANITE/LITTLE GOOSE DAMS
SNAKE RIVER, ORE., WASH. & IDA.
1992 DRAWDOWN
SPILLWAY AND STILLING BASIN RELATED TESTS
GENERAL DECISION TREE

SCALE AS SHOWN | DWG. NO.
FN
PLATE D-1

VALUE ENGINEERING PAYS

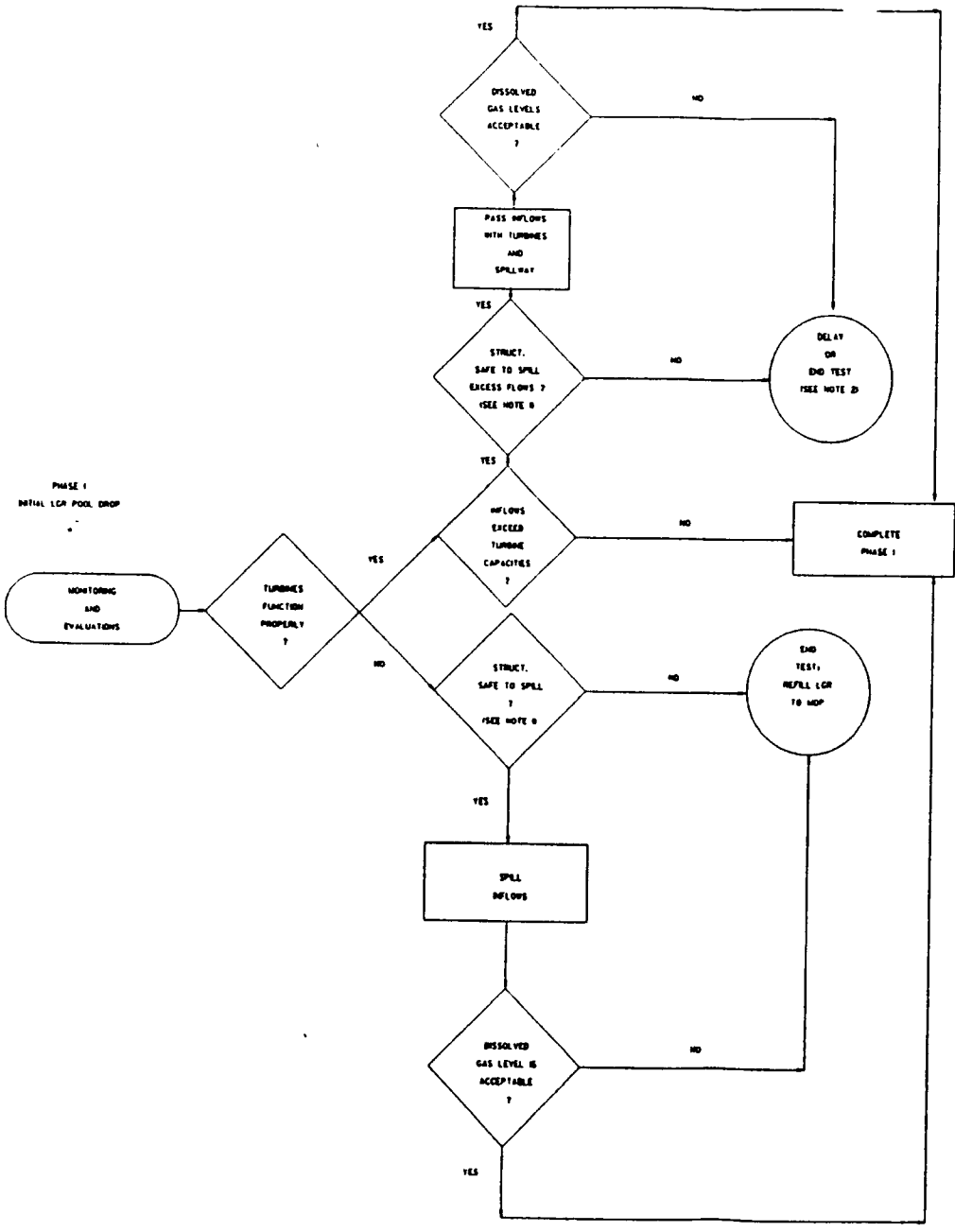
REFERENCE FILES ATTACHED YES NO

LEVELS ON FOR CONTRACT DRGS 1

SCALE 1

CORPS

U. S. ARMY



ABBREVIATIONS

MOP- MINIMUM OPERATING POOL
LGR- LOWER GRANITE
LGO- LITTLE GOOSE

NOTES:

1. HYDRAULIC SECTIONAL MODEL OF THE SPILLWAY AND STILLING BASIN, IN CONJUNCTION WITH PRE-TEST FIELD INSPECTIONS, WILL BE USED TO DETERMINE IF IT IS STRUCTURALLY SAFE TO SPILL.
2. IT MIGHT BE POSSIBLE TO DELAY TESTING FOR A SHORT PERIOD TO ALLOW EXCESS FLOWS TO DROP TO SAFE LEVELS PRIOR TO CONTINUING THE TEST.

U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

LOWER GRANITE/LITTLE GOOSE DAMS
SNAKE RIVER, ORE., WASH. & IDA.
1992 DRAWDOWN
SPILLWAY AND STILLING BASIN RELATED TESTS
PHASE I- DETAILED DECISION TREE

Completion Design & Drafting

SCALE AS SHOWN

FN

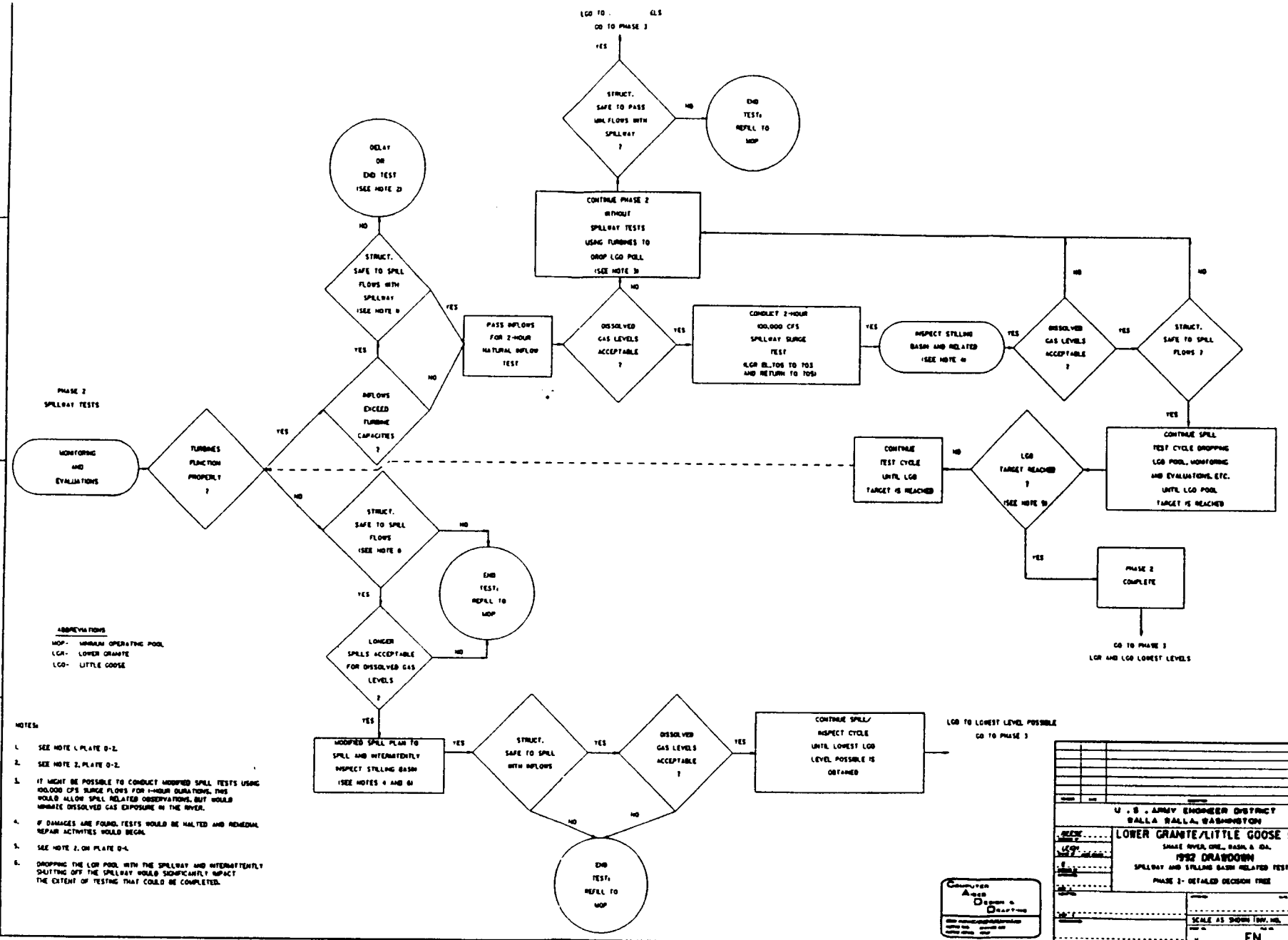
PLATE D-2

VALUE ENGINEERING PAYS

REFERENCE FILES ATTACHED YES NO

LEVELS ON FOR CONTRACT DRWGS 1

SCALE 1



ABBREVIATIONS

MOP- MINIMUM OPERATING POOL
LGR- LOWER GRANITE
LGO- LITTLE GOOSE

NOTES:

1. SEE NOTE 1, PLATE D-2.
2. SEE NOTE 2, PLATE D-2.
3. IT MIGHT BE POSSIBLE TO CONDUCT MODIFIED SPILL TESTS USING 100,000 CFS SURGE FLOWS FOR 1-HOUR DURATIONS. THIS WOULD ALLOW SPILL RELATED OBSERVATIONS, BUT WOULD MINIMIZE DISSOLVED GAS EXPOSURE IN THE RIVER.
4. IF DAMAGES ARE FOUND, TESTS WOULD BE HALTED AND REMEDIAL REPAIR ACTIVITIES WOULD BEGIN.
5. SEE NOTE 2, ON PLATE D-4.
6. DROPPING THE LGR POOL WITH THE SPILLWAY AND INTERMITTENTLY SHUTTING OFF THE SPILLWAY WOULD SIGNIFICANTLY IMPACT THE EXTENT OF TESTING THAT COULD BE COMPLETED.

U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

LOWER GRANITE/LITTLE GOOSE DAMS
SNAKE RIVER, ORE., WASH. & IDA.

1992 DRAWDOWN
SPILLWAY AND STILLING BASIN RELATED TESTS
PHASE 2- DETAILED DECISION TREE

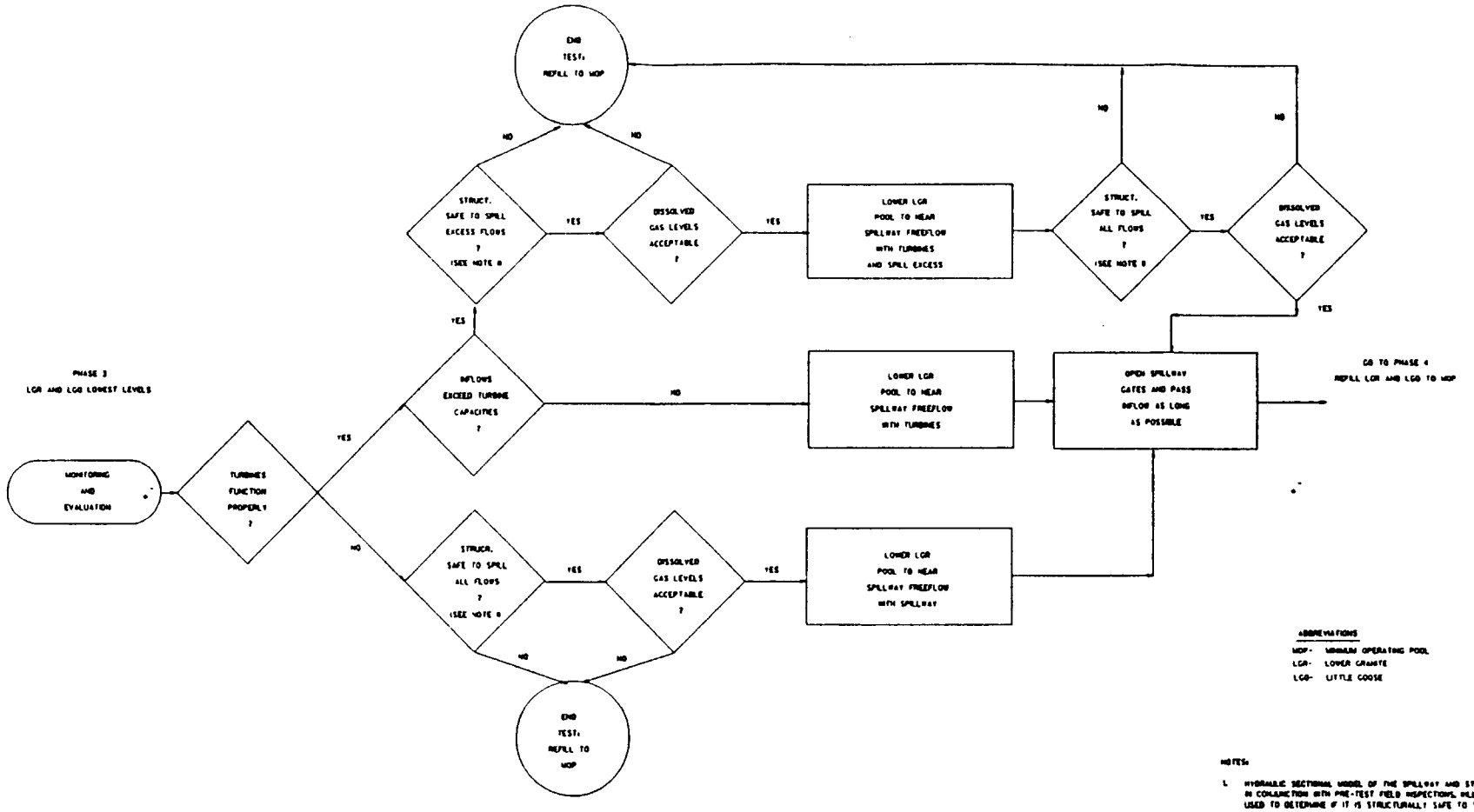
Computer Aided Design & Drafting

SCALE AS SHOWN DRW. NO.

FN

PLATE D-3

REFERENCE FILES ATTACHED YES NO
LEVELS ON FOR CONTRACT DRWGS
SCALE



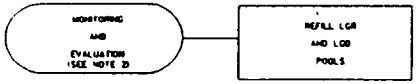
ABBREVIATIONS

MOP- MINIMUM OPERATING POOL
LGR- LOWER GRANITE
LGO- LITTLE GOOSE

NOTES:

1. HYDRAULIC SECTIONAL MODEL OF THE SPILLWAY AND STILLING BASIN, IN CONJUNCTION WITH PRE-TEST FIELD INSPECTIONS, WILL BE USED TO DETERMINE IF IT IS STRUCTURALLY SAFE TO SPILL.
2. IF DAMAGES ARE FOUND, TESTS WOULD BE HALTED AND REMEDIAL REPAIR ACTIVITIES WOULD BEGIN.

PHASE 4
REFILL LGR AND LGO TO MOP



U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

LOWER GRANITE/LITTLE GOOSE DAMS
SNAKE RIVER, ORE., WASH. & IDA.
1992 DRAWDOWN
SPILLWAY AND STILLING BASIN RELATED TESTS
PHASE 3 & 4-DETAILED DECISION TREE

SCALE AS SHOWN | DWG. NO.
FN

Computer Aided Design & Drafting

REFERENCE FILES ATTACHED YES NO | LEVELS ON FOR CONTRACT DRWGS S | SCALE S

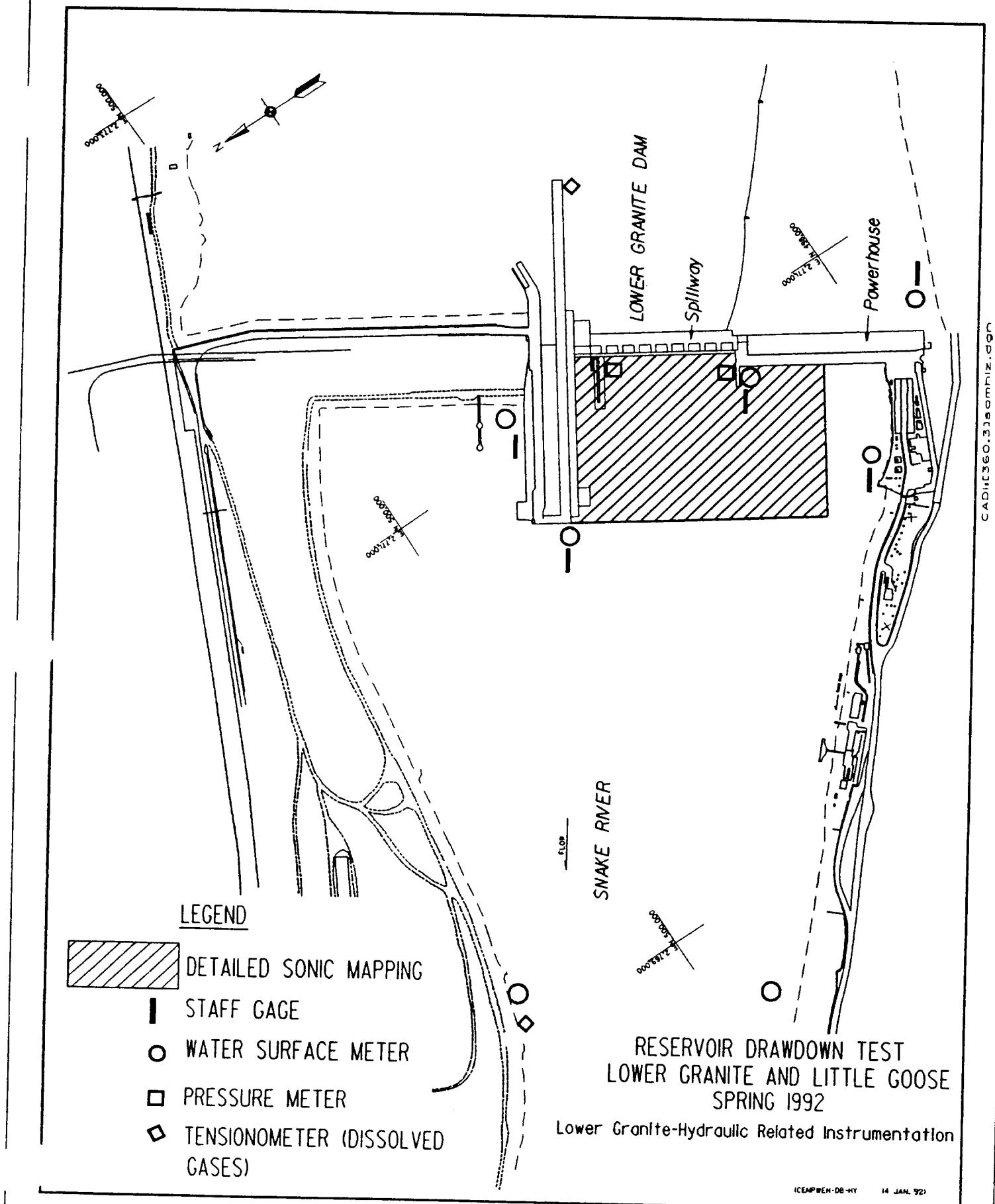

LOWER GRANITE DAM
Spillway
Powerhouse
SNAKE RIVER
FLOW
LEGEND
DETAILED SONIC MAPPING
STAFF GAGE
WATER SURFACE METER
PRESSURE METER
TENSIONOMETER (DISSOLVED GASES)
RESERVOIR DRAWDOWN TEST
LOWER GRANITE AND LITTLE GOOSE
SPRING 1992
Lower Granite-Hydraulic Related Instrumentation
(CENPWEN-DB-HY 14 JAN. '92)
CADirE360.33somniz.dgn
23-JAN-1992 11:19

PLATE D-5

ADDENDUM B

OPERATIONS DIVISION PLAN

RESERVOIR POOL LOWERING TEST - MARCH 1992

LOWER GRANITE AND LITTLE GOOSE DAMS

WASHINGTON

PROJECT OPERATIONS SURVEILLANCE PLAN

1.01. SCOPE

The purpose of this plan is to present a description of the planned objectives, methods to be utilized, and activities to be accomplished during Project Operation's participation in the reservoir pool lowering test.

1.02. OBJECTIVES

Project Operation's objectives for the test fall into three general categories; the protection of the safety of people, the prevention of damage to structures and equipment, and the evaluation of project structures, systems, and equipment operation during the conditions presented in the test.

a. The primary objective is to conduct the reservoir pool lowering test in a manner that successfully provides a thorough evaluation of environmental, structural, and physical effects of reservoir draw down while ensuring the safety of the public and personnel involved.

b. Structures, equipment, and other property will be protected from damage through preventive action taken prior to the test and through monitoring and adjustment during the test.

c. Project systems and equipment operating characteristics will be determined for operation during low pool and head conditions. Of specific interest and concern are the operational characteristics of the hydroelectric turbine/generators during decreasing head and tailwater conditions.

1.03. TEST SAFETY

The pool lowering test program will be implemented and controlled at the Lower Granite-Little Goose Project under the direction of the Technical Advisor Group. All project and reservoir related structures, facilities, roadways, bridges and embankments will be monitored throughout the test to ensure that their integrity is not compromised as a result of test operations.

All test operations will be analyzed to ensure that they do not compromise the safety of the people involved or present a likelihood of damage to project structures, systems, or equipment.

The Lower Granite-Little Goose Project will maintain a constant communications capability with the Technical Advisor Group and will respond immediately to any threat to safety. Responses will be appropriate to the type of threat imposed, with impending catastrophic failure of the dams or levees responded to in accordance with the Operation Order for Contingency Plan, Appendix C, and applicable Lower Granite-Little Goose Project Standing Orders.

1.04. TEST PREPARATIONS

The pool lowering test will involve operating the Lower Granite-Little Goose Project with forebay and tailwater levels that would cause damage to some project equipment if preventive measures were not taken prior to the start of the test. Other equipment, such as the turbine/generators, are theoretically expected to be capable of operation at the lower pool elevations, but at reduced efficiencies and at an increased level of risk of damage to the equipment. This equipment will have additional instrumentation installed in order to provide the monitoring capability required to assess the equipment's operating conditions during the test.

The following test preparations will be undertaken by Project Operations in order to prevent damage to project structures or equipment and in order to provide the increased equipment monitoring capability required for key project systems:

a. Lower Granite Trash Shear Boom. The trash shear boom will be disconnected from its upstream and downstream anchor points and allowed to settle to the bottom of the reservoir as the pool level lowers. This action is necessary in order to prevent damage to the boom due to inadequate movement capability in the end points of the boom. This action will be completed by 28 Feb 92 using project employees.

b. Water Level Indication. New floatwells will be installed to measure the forebay levels at Little Goose Dam and the forebay and tailwater levels at Lower Granite Dam. Existing water level indication equipment is not capable of operation at the lower levels anticipated during the test. This action will be completed by 10 Feb 92 using contracted diving services.

c. Floating Navigation Lock Guidewall. The floating guidewalls at Lower Granite Dam and Little Goose Dam will be disconnected from the navigation lock structure and moved into the lock channel, where it will be secured by three winches with slip clutches. The existing guidewall-to-lock structure connection does not have the capability to move to the water levels expected during the test. This action will be completed by 28 Feb 92 at Lower Granite and by 8 Mar 92 at Little Goose, and will be accomplished using contracted diving and tug

services. The winches required for holding the guidewalls in place during the test will be delivered on site by 15 Feb 92 and will be installed by project personnel.

d. Extended Length Fish Screens. One set of bar screens, simulating extended length fish screens, will be installed in the intake for turbine/generator Unit 5 at Lower Granite Dam. This installation will enable the evaluation of the effect of extended fish screens on the operation of Unit 5 at lower water levels. This action will be accomplished by 26 Feb 92 by contracted services.

e. Draft Tube Bulkheads. One set of draft tube bulkheads will be moved from Little Goose Dam to Lower Granite Dam. It may be necessary to install one draft tube bulkhead section in each Lower Granite turbine/generator unit in order to operate the unit without excessive turbine cavitation at the lower head and tailwater levels expected in the test. Although calculations indicate that the units will be capable of operation at the expected water levels, the bulkheads will be positioned on site to be available if necessary. This action will be accomplished by contract services.

f. Turbine/Generator Instrumentation. Additional instrumentation will be installed on Units 3, 4, and 5 at Lower Granite Dam and at Little Goose Dam. This additional instrumentation, along with existing devices, will enable the units to be closely monitored during the test in order to determine unit operating characteristics at the lower water levels involved. It will also improve the project's ability to monitor the units for conditions that would cause damage and allow remedial action prior to unit failure. The additional instrumentation will allow monitoring the following unit conditions:

1) Turbine Blade Position. A more accurate transducer will be installed in order to better evaluate unit efficiency. The new transducers will be delivered by 13 Feb 92. Installation will be accomplished by project personnel.

2) Wicket Gate Position. A more accurate transducer will be installed in order to better evaluate unit efficiency. The new transducers will be delivered by 13 Feb 92. Installation will be accomplished by project personnel.

3) Turbine Discharge. Pressure transducers will be installed in the Winter-Kennedy ports of the units in order to get water discharge information for evaluation of unit efficiency. The new transducers will be delivered by 31 Jan 92. Installation will be accomplished by project personnel.

4) Turbine/Generator Shaft Runout. Proximity probes will be installed on the units in order to evaluate the magnitude

of shaft runout during operation. If shaft runout becomes excessive during the test, the turbine/generators may have to be shut down in order to prevent damage to the units. The probes will be installed by project personnel.

5) Cooling Water Temperature. New resistance temperature devices (RTDs) have been installed to measure cooling water temperatures supplied to, and discharged from, unit generators and unit thrust bearings.

6) Cooling Water Flow. Transducers will be installed to measure cooling water flows to the generator and the thrust bearing. Delivery of the new transducers is expected by 29 Jan 92. They will be installed by project personnel.

7) Vibration. Vibration sensors will be installed to measure vibration amplitudes in the unit turbine bearing housing, the head cover, and the draft tube mandoor. Vibration amplitudes in the unit will be monitored as a relative indicator of the smoothness of unit operation. Vibration transducers will be delivered by 6 Feb 92 and will be installed by project personnel.

8) Pressure. A pressure transducer will be installed in the unit head cover to measure the pressures seen on that component. The transducers will be delivered by 31 Jan 92 and will be installed by project personnel.

1.05 MONITORING

Project Operations personnel will be involved in several aspects of the test operations and the monitoring of structures, systems, and equipment during the test.

a. Water Level Monitoring and Control. Forebay and tailwater levels will be controlled throughout the test by the project operator. Water level readings from forebay and tailwater float wells at Lower Granite and Little Goose Dams will be routed to the powerhouse control system and monitored in the powerhouse control rooms. The powerhouse control systems will archive this data at five minute intervals. Water level control will be achieved through control of turbine/generator discharges, coupled with spillway discharges during portions of the test period.

b. Dam Safety. Project personnel will conduct daily inspections of the dam structures throughout the test. Project personnel will also take biweekly readings of the existing structural instrumentation throughout the test period.

c. Embankment Instrumentation. Project personnel will perform daily readings of embankment piezometers and gages at both dam sites and at the Lewiston levees.

1.05.1 Turbine/Generator Monitoring

The turbine/generators will be monitored to determine if the units can operate safely during pool lowering operations. It will be determined if any modifications will be necessary to continue operation should lower pool conditions become routine.

The following actions will be implemented during the test in order to provide accurate surveillance data:

a. Automatic Generation Control of the turbine/generators will not be used once pool lowering operations have begun. All units will be under local control and "block" loaded at a setting that is within one percent of best efficiency. Figure 1 (Units 1-3) and Figure 2 (Units 4-6) will be utilized to select appropriate load settings.

b. The units which have had additional instrumentation installed (Units 3, 4, and 5) at each plant will be in operation continuously throughout the entire test period, or as close to continuously as test conditions permit. The remaining units will be started and stopped as required. However, as stated above, the load will be within one percent of best efficiency. Furthermore, the load will not be changed during the period that daily readings are being taken.

c. Readings will be recorded on daily intervals for all units that have had additional instrumentation installed. The exact time the readings are taken is arbitrary, but once selected, all succeeding readings will be taken at approximately the same time each day.

d. The sequence of readings will be as follows:

1) All units with no additional instrumentation installed that are in operation will remain at a fixed output until the daily readings have been completed. Stop blocks will not be utilized for these units. The gate limit and speed adjust may be used for blocking one of the units with additional instrumentation installed.

2) Block the gate position at the maximum output for each additionally instrumented unit as per Figure 1 or 2, as appropriate. Servomotor blocks will be used for these units.

3) Initiate the powerhouse Data Acquisition and Control System (DACS) data recording sequence.

4) Manually record all other readings not recorded by DACS. These readings will be initiated at the same time the DACS recording is initiated.

5) Observe forebay water surface for formation of

vortices at the inlet to units. If vortices are observed, a video camera will be used to record a two minute segment. Each video segment will be voice identified. The minimum information provided will be date, time, unit number, forebay elevation, head and power output.

6) Block the gate at Mid-range settings as per Figure 1 or 2, as appropriate. Then repeat step 3.

7) Block the gates at the minimum setting as per Figure 1 or 2, as appropriate. Then repeat step 3.

8) Units that have not had additional instrumentation installed will be started and stopped as required. If on line, they will be set to operate within one percent of best efficiency as per Figure 1 or 2.

e. Limitations have been placed on key points that will be monitored. The units will not be operated in conditions that cause these limitations to be exceeded. These limitations have been selected to avoid potentially hazardous operation of the turbine/generators. The points selected and limitations imposed are:

1) Shaft runouts - 80% of bearing clearance.

2) Bearing temperatures - existing shut down points.

f. The following turbine/generator operating characteristics will be monitored automatically by DACS:

1) Unit output in megawatts.

2) Turbine blade position.

3) Wicket gate position.

4) Turbine discharge, as indicated by the Winter-Kennedy port differential pressure readings.

5) Head cover pressure.

6) Generator cooling water flow.

7) Thrust bearing cooling water flow.

8) Turbine bearing temperature.

9) Upper guide bearing temperature.

10) Lower guide bearing temperature.

11) Thrust bearing #1 temperature.

12) Thrust bearing #2 temperature.

13) Stator #1 temperature.

14) Stator #2 temperature.

15) Stator #3 temperature.

16) Forebay water level.

17) Tailwater level.

18) Net head.

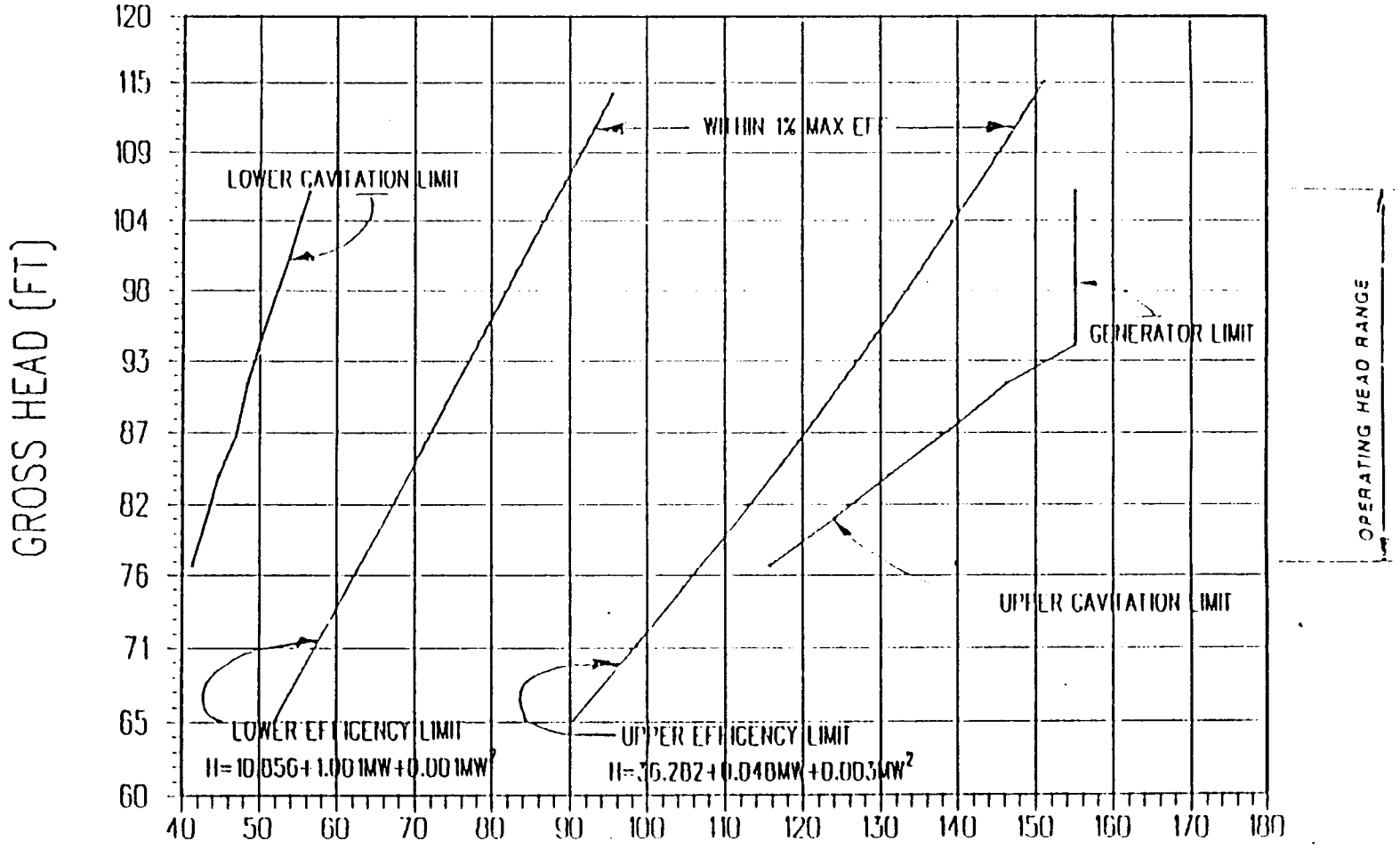
19) Cooling water intake temperature.

All temperature points, thrust bearing water flows, and headcover pressure readings for each unit will be sampled every minute and an average value computed and recorded every 15 minutes. All other points are to be recorded with instantaneous values every 5 minutes.

Figure 1

LOWER SNAKE 1-3 TURBINE BEST OPERATING RANGE
(WITHIN ONE PERCENT MAXIMUM EFFICENCY)

LOWER GRANITE LITTLE GOOSE LOWER MONUMENTAL



GROSS HEAD VS POWER OUTPUT

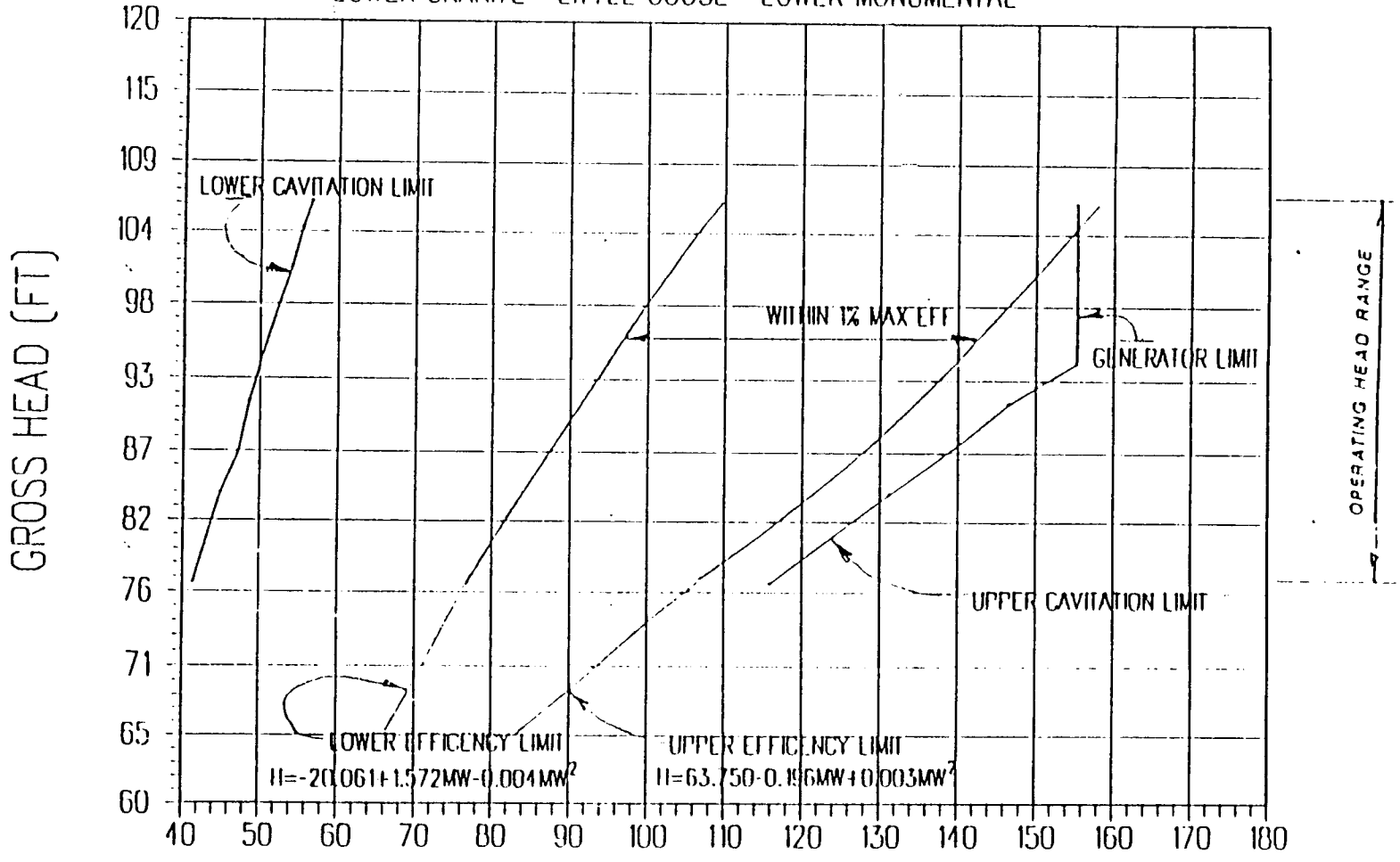
REVISION 2

PREPARED BY CENPD-PE-HD 10/28/91

Figure

LOWER SNAKE 4-6 TURBINE BEST OPERATING RANGE
(WITHIN ONE PERCENT MAXIMUM EFFICENCY)

LOWER GRANITE LITTLE GOOSE LOWER MONUMENTAL



GROSS HEAD VS POWER OUTPUT

REVISION 2

PREPARED BY CENPD-PE-HD 10/28/91

RESERVOIR POOL LOWERING TEST - MARCH 1992

LOWER GRANITE AND LITTLE GOOSE DAMS

RESOURCE MANAGEMENT SECTION SURVEILLANCE PLAN

1.01. SCOPE

The purpose of this plan is to describe the objectives, and implementation of activities to be accomplished by Resource Management Section in preparation of and during the test.

1. OBJECTIVES

Resource Management Section's objectives for the drawdown include public and employee safety, prevention of damage to structures and equipment, and providing support to the overall evaluation of the test drawdown.

2. IMPLEMENTATION

a. Public/Employee Safety. All patrols will be targeted to provide information to the public, monitor activities in the drawdown areas, and enforce Title 36 Rules and Regulations to insure public safety and to protect the resource. A park ranger stationed at the Clarkston Resource office will patrol the Clarkston, Lewiston, and North Shore areas on a daily basis, seven days a week throughout the drawdown. A jet boat will be stationed at the Resource office for public safety patrol. The ranger will also monitor known archeological sites to prevent the removal of artifacts. The Resource Section has been in contact with the District Archeologist and will continue to coordinate their efforts. The ranger will also provide employees with daily updates on areas of safety concern so that work near these areas is conducted in a safe manner.

Depending upon work load, a fish biologist from Granite and/or park ranger from Goose will provide for public safety in the Lower Granite Dam area. A boat for patrol purposes will be stationed at Lower Granite and vehicle patrol will occur on a daily basis. Still under consideration is the designation of a "No Boats Beyond This Point" zone just upstream of Boyer Park. If it is determined that the boating public would be endangered upstream of Boyer, the designation will go into effect.

During the second half of the drawdown when the Little Goose pool is lowered, the park ranger from Goose will provide patrol of the Little Goose area and the Lower Granite fish biologist will provide primary public safety patrol of the Lower Granite area.

The Resource Section will develop Public Safety Announcements (PSA) concerning the drawdown for dissemination after the Record of Decision is signed. All PSA will be coordinated with Operations Division and the Public Affairs Office.

b. Structure and Equipment Monitoring. The levees and pump plants will be monitored on a daily basis, seven days a week, by 1 WG-8. Selected piezometers will be monitored as directed by the District and information forwarded through appropriate channels. The effects of outfall from the pump plants will also be monitored and any erosion to the levee structures reported.

The Resource Section maintenance staff will remove, relocate, or allow to settle to the bottom all docks, walk ramps, and the Resource Office boat house, according to the pln in Appendix A.

c. Evaluation. One fish biologist at Lower Granite and one or two of his maintenance personnel will dip the gatewells twice per week. In addition, the entire Resource Section staff will be available to provide comments on the overall evaluation of the drawdown.

APPENDIX A

DRAWDOWN WORK PLAN

WORK ITEM	LOCATION	HOURS	EMPLOYEES	COSTS
1. Remove Boat House	Resources Office	120	1-WS-9 3-WG-8	$3538
2. Remove Walk Ramps to Docks	Levees & Swallows	40	3-WG-8 1-WG-5	1038
3. Remove Docks	Levees	18	3-WG-8	485
4. Break Docks Loose	Swallows & Greenbelt	8	1-WG-8 1-WG-5	200
	North Shore Sites	10	1-WG-8 1-WG-5	250
	Offield Landing	4	1-WG-10 1-WG-8	103
	Willow & LGO Landings	12	1-WG-8 1-WG-7	323
5. Reservoir Surveillance	Levees & other Sites	336	1-WG-8	9054
6. Move Barges	LGR to LGO	Contract		

Based on: WG-5 = $12.66/Hr.
WG-7 = 13.56/Hr.
WG-8 = 14.77/Hr.
WG-10 = 13.85/Hr.

Items 1-5 above will be started during the two weeks prior to drawdown, but will be continued during the drawdown period as needed. Costs will be about doubled when you consider time needed to return items to their original conditions.

APPENDIX A

PROJECT FISH HANDLING PLAN

Lower Granite Dam

1. Adult Fish Passage Facilities.

A. Fish Ladder. The adult fish ladder will be operational at Lower Granite Dam following winter maintenance until the reservoir reaches el. 733 at the beginning of the drawdown test. At that time, the fish ladder exit will be bulkheaded and two auxiliary pumps will be operated to maintain ladder flow. The false weir and its related pump will not be operated so fish will not be injured in the emergency bypass pipe as water from the reservoir will back up the pipe. Project personnel should monitor ladder conditions and watch for problems associated with fish building up at the top of the ladder. When the reservoir reaches el. 719, the third auxiliary pump will be started and the false weir activated so fish can exit the fish ladder. Periodically, project personnel shall monitor the fish ladder exit to verify that fish are using the overflow weir. According to the drawdown schedule, el. 719 will be reached on March 8. The ladder will be operated in this mode until the reservoir reaches el. 711. At that time, the adult fish ladder will be shut down and any fish in the ladder will be removed. This will require a carefully sequenced shutdown so that most of the fish will move down the ladder with the receding water level and will not have to be handled. After the fish ladder is dewatered and all of the fish safely returned to the river, the exit bulkhead should be removed so the ladder will be ready for normal operation when the reservoir returns to normal operating levels.

B. Powerhouse Collection System. The powerhouse collection system will be full of water when the fish ladder is dewatered. Prior to dewatering the fish ladder, the auxiliary water supply pumps for the powerhouse collection system will be turned off. The water surface of the collection system will not be impacted until Little Goose reservoir is drawn down, beginning March 15. The floor of the powerhouse collection system is at el. 628 through turbine unit 4. At turbine unit 5, the floor drops to el. 626. After turbine unit 6, the floor of the channel to the north shore entrances drops another 4 feet to el. 622. On the day that the tailrace is scheduled to drop from el. 630 to el. 628, project personnel shall walk the collection channel to unit 5 and herd any fish in the channel into deeper water. If necessary, the powerhouse collection channel may be bulkheaded at unit 5 to keep the fish in the deeper channel. As the tailrace continues to drop, fish in the deeper portion of the powerhouse collection channel should be herded into the north shore channel. This channel should remain full of water during the drawdown test. If it appears that it is not holding water, project personnel shall drain the channel, collect any fish found in

the channel, and return them to the river.

C. Schedules.

(1). March 1: LGR el. 733; Convert to auxiliary water supply system for fish ladder flow. Bulkhead ladder exit and start two auxiliary pumps.

(2). March 8: LGR el. 719; start third auxiliary pump for fish ladder, activate false weir and emergency exit.

(3). March 11: In late afternoon, turn off the powerhouse collection system auxiliary water supply pumps.

(4). March 12: LGR el. 711; dewater ladder slowly, turning off one pump at a time, remove fish and return them to the river.

(5). March 19: LGO el. 630; Begin powerhouse collection channel fish removal.

(7). April 1: LGR el. 733, LGO el. 633. Resume normal operation of adult fish passage facilities.

D. Personnel Required.

(1). Deactivating and activating systems: powerhouse crew.

(2). Fish handling: fish biologist, assistant fish biologist, Natural Resources crew, powerhouse crew.

2. Juvenile Fish Passage Facilities.

A. Gatewells. Fish screens will be installed in all units prior to the drawdown test (Unit 5 will have simulated extended screens in the fish screen slots also). Although fish numbers have been low in the past, early collection in late March has been up to 100 fish per day and may be higher with increased water particle travel time through the lowered reservoir. Drawing down the reservoir will expose the gatewell orifices which are located at el. 729. When this happens, all fish deflected up the gatewell slots by the traveling screens will be trapped in the slots. Project personnel shall remove juvenile fish collected in turbine unit gatewells to assess juvenile fish passage during the drawdown and to avoid delaying migrating juvenile salmonids. To accomplish this, all gatewells will be dipped prior to the drawdown test to remove any accumulation of fish that may be in them. Initially when the drawdown test begins, all gatewells will be dipped twice per week. Fish collected will be anesthetized and evaluated for species composition and condition. A 650 gallon trailer mounted tank will be used as a recovery tank for the anesthetized fish and for the transportation vehicle. Fish will be transported to a release site in the Lower Granite tailrace below turbine unit

one. If gatewell dipping recovers more than _____ fish per day, collected fish will be released directly into the transport tank from the dip basket and will not be handled. If gatewell dipping recovers _____ fish per day, the frequency of gatewell dipping will be increased to avoid the accumulation of too many fish in the gatewells and to minimize delay to migrating juvenile salmonids. If the collected number of fish exceeds what can be safely transported in the 650 gallon tank, one of the 3,500 transport trailers will be used instead. When the Lower Granite reservoir is refilled, the juvenile bypass system will be watered up for normal juvenile fish collection.

B. Schedules.

(1). Prior to March 1: Install STS's and fixed bar screens.

(2). Prior to March 1: Remove accumulated fish from gatewell slots.

(3). March 1 to March 31: Initiate gatewell dipping program.

(4). April 1: Water up juvenile bypass system.

C. Personnel Required.

(1). Installing STS's and fixed bar screens: powerhouse crew and contractor.

(2). Gatewell dipping program: fish biologist, assistant fish biologist, Natural Resources crew, IDFG transport biologist.

Little Goose Dam

1. Adult Fish Passage Facilities.

A. Fish Ladder. The adult fish ladder at Little Goose Dam will be operational until the Little Goose reservoir is lowered below minimum operating pool. This is scheduled to happen on March 17. On March 16, project personnel shall turn off the auxiliary water supply pumps to the adult fish collection system to allow. This will allow fish that are in the fish ladder sufficient time to exit the ladder without attracting additional fish into the ladder that will have to be handled when the ladder is unwatered. On March 17, project personnel will unwater the fish ladder while there is sufficient water in the system to allow a controlled dewatering of the fish ladder to avoid injuring any adult fish that may be in the ladder. When the Little Goose reservoir is refilled, project personnel shall water up the fish ladder when the reservoir reached minimum operating level (MOP). Since the Little Goose tailwater will not be lowered, the adult fish collection system will not have to be

dewatered for the drawdown test.

B. Schedules.

(1). March 1: LGO el. 638, drawdown test begins, Little Goose facilities under normal operation.

(2). March 16: LGO el. 636, turn off auxiliary water supply pumps.

(3) March 17: LGO el. 634, dewater adult fish ladder.

(4) April 1: LGO 633+, adult facilities back in normal operation.

C. Personnel Required.

(1). Deactivating and activating systems: powerhouse crew.

(2). Fish handling: fish biologist, assistant fish biologist, Natural Resources crew, powerhouse crew.

2. Juvenile Fish Passage Facilities.

A. Juvenile Bypass System. The STS's at Little Goose shall be installed after the navigation lock outage to allow normal watering up of the juvenile bypass system when the drawdown test is completed.

ADDENDUM C

PLANNING DIVISION - MONITORING AND EVALUATION PLAN

LOWER SNAKE RESERVOIR DRAWDOWN TEST

LOWER GRANITE AND LITTLE GOOSE

MARCH 1992

PLANNING DIVISION

I. SCOPE

Specific information regarding test design, including an overview of monitoring efforts, is found in the overall plan (additional details are included in the other addenda). This addendum contains specific scopes of work for environmental monitoring during the reservoir drawdown, as discussed in the overall plan document. It includes a biological decision tree, which is to be used together with those from Engineering Division. Plans for evaluating flow improvement measures during the fish migration periods are included for informational purposes.

The following Appendices include the detailed plans and/or scopes of work (agency/organization accomplishing the work is in parentheses):

1. Appendix A: Sediment transport, turbidities, and water velocities. (U. S. Geological Survey).

2. Appendix B: Pre-Migratory salmonids, resident fish, and minimum pool operations. (U.S. Fish and Wildlife Service, Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Dr. David Bennett.)

3. Appendix C: Fall chinook, benthic organisms, and aquatic habitat. (Corps of Engineers, and Battelle Pacific Northwest Laboratories.)

4. Appendix D: Dissolved gas. (Corps of Engineers and Common Sensing Inc., Dr. Brian D'aoust.)

5. Appendix E: Wildlife. (Corps of Engineers.)

6. Appendix F: Cultural resources. (Washington State University.)

II. CONTINGENCIES

There are several biological issues, in addition to the engineering concerns, that could result in modification or termination of the reservoir drawdown test. Please refer to Figure 1 for the biological decision tree described below.

As discussed in Addendum A, there are four phases to this test:

Phase 1. Initial drafting of Lower Granite reservoir from

elevation 733 MSL to elevation 705 MSL.

Phase 2. Spill testing and drafting of Little Goose reservoir from full pool, elevation 638 MSL to elevation 618 MSL.

Phase 3. Continued drafting of Lower Granite reservoir to a minimum elevation of 696 MSL.

Phase 4. Refill.

A. **Phase 1**

There are four main areas of potential concern during this phase: loss of turbine operation, fish stranding, collection of salmonids in the gatewells, and evidence of significant fish kill or predation activities.

Lower Granite reservoir will be drafted using the turbines, but in the event the turbines fail to function properly, the only alternative would be to use spill. This method would only be acceptable as long as dissolved gas supersaturation levels remained 125% or below. If dissolved gas levels exceed 125% and remain for 12 hours, spill will be terminated and refill begun. This value was based on agreement of the reservoir drawdown design team that this level is regularly achieved without any noticeable detrimental effects to fish populations. (Note: This value does not guarantee protection of potential fall chinook within redds below Lower Granite Dam.)

As the pool is drafted, fish may become stranded in shallow water areas and/or in pools behind embankments. State and local personnel will be monitoring these areas and will remove fish as required. Delay in drafting may be necessary to prevent fish loss. Shoreline areas in Lower Granite pool will also be monitored (by Corps contract) for fall chinook redds. If any are observed, drafting will be terminated and the National Marine Fisheries Service will be consulted as to further test actions.

Pre-migratory salmonids will be monitored in Lower Granite reservoir (by U.S. Fish and Wildlife Service, and tentatively Idaho Department of Fish and Game at their Snake River smolt trap). If it appears that these fish are being forced through the pool because of higher velocities, and are ending up in the gatewells at the dam in excessive numbers (greater than 100 salmonids per day), National Marine Fisheries Service will be consulted as to the appropriate plan of action.

If evidence of significant predation occurs, and evidence suggests that it could be on salmonids, the National Marine Fisheries Service will be consulted.

There is no known reason, other than those listed above, that could cause fish kills (salmonids or resident) during Phase 1, but in the event this should happen, National Marine Fisheries Service

will be consulted (and/or the appropriate state agencies for resident fish) as to the appropriate plan of action.

B. **Phase 2**

All of the above discussion applies during this phase. In addition, this phase includes spill tests and drafting of Little Goose reservoir.

Spill tests may result in elevated dissolved gas levels below Lower Granite Dam for short periods of time. The reservoir drawdown design team concluded that there should be no adverse effect from these levels when kept to a two to four hour time frame. However, monitoring of salmonids and resident fish in Little Goose pool will occur on a limited basis and if any of the fish sampled exhibit symptoms of gas bubble disease the spilling will be terminated and National Marine Fisheries Service will be consulted as to the appropriate plan of action.

Research by the U.S. Fish and Wildlife Service's Idaho Cooperative Fish and Wildlife Research Unit indicates fall chinook are spawning in Little Goose pool (based on collection of fall chinook fry). An attempt to locate spawning sites was made, but was unsuccessful. To protect these sites, intensive monitoring of the shoreline will take place as Little Goose reservoir is drafted. The drafting will occur during daylight hours only.

The current plan is to assign individuals to approximately areas of likely spawning and have them patrol these areas constantly as the pool is lowered. Personnel will radio a central location if any potential sites are spotted and an expert from either Battelle or National Marine Fisheries Service will be dispatched to the site to confirm. At the same time, drafting will be suspended until a decision is made. These activities will be coordinated through the reservoir drawdown field office. A more detailed plan, including maps and photographs, is being developed in conjunction with Battelle and will be added to this plan upon completion.

C. **Phase 3**

See Phase 1.

D. **Phase 4**

Refill will constitute a relatively short time frame and no adverse impacts are expected.

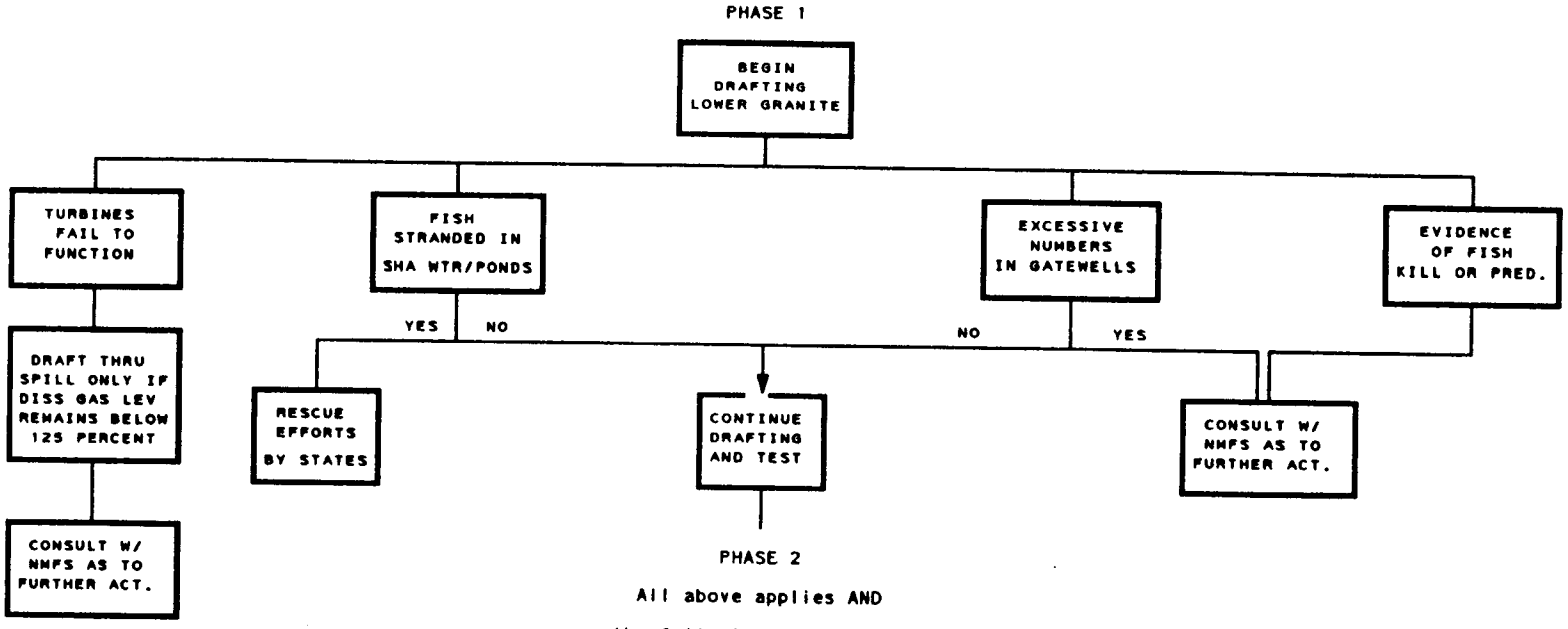
III. Miscellaneous Actions

Adult salmonids will be able to pass Lower Granite for a short period of time during the drawdown. This will be visually monitored, as well as evaluated through the Evaluation of Lower Snake River Adult Fish Passage, Dr. Ted Bjornn, U.S. Fish and Wildlife Service's Idaho Cooperative Fish and Wildlife Research Unit. For an

explanation of how the adult fish facilities will operate, see Addendum B.

Some adult fish may be drawn back through the turbines and end up in the gatewells. Any adults retrieved from the gatewells during dipping efforts will be placed in small tanks or large buckets and released below Lower Granite (the state agencies are currently discussing the possibility of their assisting in efforts to transport the fish to the head of Lower Granite reservoir).

RESERVOIR DRAWDOWN TES[illegible]OLOGICAL DECISION TREE



1. IF TURBINES FAIL, AND SPILL RESULTS IN DISSOLVED GAS LEVELS IN EXCESS OF 125 PERCENT FOR 12 HOURS, TEST WILL BE TERMINATED.
2. LITTLE GOOSE DRAFTING WILL OCCUR DAYLIGHT HOURS ONLY.
3. ALL STEPS WILL BE COORDINATED WITH APPROPRIATE PARTIES IN CORPS AND FISH AGENCIES.
4. IF REDDS ARE LOCATED IN LOWER GRANITE POOL, NMFS WILL BE CONSULTED AS TO FURTHER ACTION.

APPENDIX A

SEDIMENT TRANSPORT, TURBIDITY, VELOCITIES

PROJECT PROPOSAL

Lower Granite Reservoir Experimental Drawdown Study

Background:

During the 1950s and 1960s a series of dams were built on the Snake River in Washington. These multipurpose reservoirs provide storage capacity for flood control and downstream hydro-power production. Each dam includes locks for the passages of large barges, and the interconnected reservoirs allow slack-water navigation from the Columbia River to Lewiston, Idaho.

Problem:

The decline in numbers of salmonoid species returning to spawn in headwater streams in Idaho has raised concern among State and Federal resource agencies and wildlife-oriented citizen organizations. It has been theorized that immature salmonoids (smolts) during their out-migration journey become delayed and/or disoriented in the long, quiet reservoirs and fall prey to disease and predation. It has been estimated that only a small minority of smolts find their way through the reservoir system to return to the sea.

The 1991 listing of the Snake River Sockeye as an endangered species, and the probable listing of the Snake River Fall Chinook has provided the impetus to find a solution and reverse the decline in salmonoid populations in the Snake River system.

Among the measures being considered is the planned draw-down of some or all of the reservoirs on the lower Snake River during the period of maximum smolt out-migration. The phased draw-down would return part of the reservoir system to the natural riverine condition and increase flow-velocity in the remaining smaller impoundments. This change from the interconnected reservoir environment might enhance smolt out-migration and significantly reduce losses.

One of the possible consequences of this reservoir management scheme is the re-entrainment of sediments deposited under still-water conditions in the upper end of reservoirs. The movement and redistribution of large amounts of sediment may adversely impact the migrating smolts.

Objective:

Although computer simulated models have been developed to describe the changing environment during reservoir draw-down, an actual draw-down of Lower Granite and Little Goose reservoirs is planned during March 1992 to allow for the collection of data to test the models.

Scope:

Five periods of intense data collection activity are planned to collect sediment transport data, turbidity and temperature profiles, velocity profiles in river and reservoir cross-sections, and time-of-travel of water through the Lower Granite pool at maximum draw-down.

Two major rivers, the Snake and the Clearwater have their confluence in the upper end of the Lower Granite Reservoir. Two stream-gaging stations - Clearwater River at Spalding, Idaho and Snake River near Anatone, Washington, have been in continuous operation for many years just upstream of reservoir backwater to monitor reservoir inflow. During this project, data from these

key stations will be integrated with data collected at and below the confluence to provide important background information.

Approach:

The Idaho District of the U.S. Geological Survey will provide project coordination and will be responsible for assembling boats, crews, and data collection instrumentation from throughout the Survey's Pacific Northwest Area.

First Week:

During the week of February 24-28, 1992, before draw-down begins, a two-man crew will obtain discharge measurements and sediment samples at the Spalding and Anatone gaging stations. Sediment samples will include components of suspended load, bedload and bed material. Simultaneously, a three-man crew operating from a boat will collect the same comprehensive sediment samples from the two rivers just above their confluence and then from two reservoir cross-sections. Reservoir cross-sections to be sampled are at Snake River mile 137.17 below Red Wolf bridge and at River mile 132.05 just above Silcott Island. Above the confluence, sediment samples will be collected at Snake River mile 139.43, below the Interstate bridge, and at Clearwater River mile 0.41, midway between the railroad bridge and the confluence.

Another three-man crew working from a second boat will be using a modern Doppler Velocity Profiler to provide discharge measurements at the boat cross-sections just before and after the sediment samples are collected.

This crew will also be responsible for obtaining velocity profiles, temperature profiles using a recording thermometer, and turbidity observations using a light transmissiometer at a total of twelve transections of the reservoir basin. (See table 1 for a listing by River mile of all cross-sections to be integrated in the Lower Granite Reservoir.)

Near the face of Lower Granite dam, if depths are encountered that will not allow full penetration by the Doppler Profiler, velocity profiling will be augmented by suspending a Price current meter below the boat. Velocity readings from the current meter will be obtained at 0.2, 0.4, 0.6, and 0.8 of total depth in about 10 positions in the transect.

It is planned that the sediment sampling will be accomplished on February 25 and 26. The velocity profiling will be accomplished on February 25, 26, and 27.

Second Week:

During the week of March 2-6, when the drawdown of Lower Granite Reservoir is estimated to be at about the midpoint, sediment sampling will be done a second time using the same crews and procedures as outlined for February 24-28. Velocity, turbidity and temperature profiling is planned at Snake River miles - 137.17, 130.66, 120.46, and 108.31. Profiling on the Clearwater River is planned at River mile 2.34 and 1.26. It is planned that the sediment sampling and associated discharge measurements will be obtained on March 4 and 5 with the reservoir profiling completed on March 6.

Third Week:

During the week of March 9-13, only the velocity profiling crew will be involved. The scene of operation will be the Little Goose Reservoir which is scheduled to remain at normal full-operating level until about March 14.

It is planned that the velocity profiling will require all or most of March 10 and 11. If depths greater than about 70 feet are encountered near Little Goose Dam, velocity profiling will be done using the Price current meter and the technique described above for use near Lower Granite Dam.

Five transections of the Little Goose Reservoir basin are planned at the following locations:

Snake River mile 106, at Davis bar

Snake River mile 101 at Schultz bar

Snake River mile 85

Snake River mile 79.2, just above New York Island

Snake River mile 70.9, just above Little Goose Dam

At Shultz bar, the moving sand bed may not allow the use of the Doppler Profiler requiring that velocity profiling be done manually using the Price current meter technique.

Fourth Week

During the week of March 16-20, the Lower Granite Reservoir will be drawn down to about elevation 705 (ft. ab. MSL) and remain at that level for several days. During this period of maximum drawdown, the most intense data collection activity will occur.

Sediment sampling and velocity/turbidity/temperature profiling will occur similar to that outlined for the week of February 24-28. It is expected that a riverine environment will extend into the reservoir basin to a point near Silcott Island about River mile 132.

It is planned that the sediment sampling will be accomplished on March 17 and 18. The profiling will be accomplished on March 17, 18, and 19.

At approximately 1200 hours on March 17, about 285 pounds of Rhodamine WT dye will be dumped at River mile 138.34. A chase boat will be stationed at River mile 132.05 to begin sampling for the dye concentrations which should arrive about 1300 hours. A second chase boat will begin sampling at River mile 126 at about 1430 hours. Boat one will move down to River mile 120.46 and begin sampling for the dye at about 1730 hours. Sampling for the dye will continue at a total of six transections. The movement of the dye through the length of Lower Granite Reservoir is estimated to require 48 to 56 hours. Sampling for the dye will continue through the night and around-the-clock until the trailing edge of the dye has exited the reservoir.

The dye sampling will be done by three man crews in two chase boats and a larger support crew on a large river boat. It will be necessary to rotate crews on and off the boats to avoid over taxing the crews and subjecting them to undue safety hazards.

At each cross-section selected for dye sampling, crews will obtain samples from about five positions along the section. Sampling will begin with the first appearance of the dye and will be repeated periodically to obtain a time-concentration (T-C) curve at each location. (See table 1 for a listing by River mile of all transections where dye sampling will be done and for which T-C curves will be derived.) Van Dorne sampling bottles will be used to sample for the dye in the vertical dimension at each reservoir section sampling position.

Each of the three boats will have a portable fluorometer on board for rapid analyses of the dye samples.

At about 0700 hours on March 19, about 15 pounds of Rhodamine WT Dye will be dumped at Snake River mile 148 above the town of Asotin, Washington. A chase boat will be stationed at River mile 145 to begin sampling for the dye which should arrive around 0800 hours.A second chase boat will begin sampling for the dye about 0900 hours at River mile 142. Boat one will move down to River mile 139, below the Interstate bridge and begin sampling for the dye which should arrive about 1030 hours. Sampling for the dye will continue at this location until about 1530 hours when the trailing edge of the dye cloud should have passed below the confluence.

Also on the morning of March 19, velocity/turbidity/temperature profiling will begin at Snake River mile 148 at 0600 hours. The crew will move into the Lower Granite Reservoir basin obtaining the triple profiles at Snake River miles 145, 142, 139, 132.05, 120.46, 119, and 108.31 near the Dam. That crew should finish this phase of data collection at 1800 hours.

Fifth Week:

During the week of March 23-27, it is planned that the Little Goose Reservoir will be drawn down as far as possible; perhaps as low as elevation 618 (ft. ab. MSL). The velocity profiling crew will again be required to obtain velocity profiles at the same five transects covered during the March 10-11 effort. It is planned that the pool will be at maximum drawdown and the velocity profiling will be completed on March 24 and 25. This should conclude the Survey's field activity in support of this experimental drawdown project.

At the conclusion of each of the three sediment-sampling exercises, the sediment will be transported for analysis to the USGS Cascade Volcano Observatory Laboratory at Vancouver, Washington. Bedload and bottom material will be passed through sieves to obtain a complete size analysis. Each of the three components of sediment from each sediment cross-section will be composited and undergo analysis as a three-unit sample. Total sediment transport through each cross-section will be related to stream discharge and be reported in tons-per-day.

Personnel:

Because of the amount of work that must be done in a very short time and the high level of coordination required, it must be understood that *this is not a training exercise*. Only experienced USGS employees who have demonstrated their ability to perform data collection tasks at an unusually high skill level will be included in this task force.

Supervision of the task force and management of the project will be provided by a Supervisory Hydrologist, GM-13. The task force will consist of:

1 or more GS-13 Hydrologists
2 GS-12 Hydrologists
2 GS-11 Hydrologists
1 GS-9 Hydrologist
2 GS-11 Hydrologic Technicians
2 GS-10 Electronic Technicians
2 GS-10 Hydrologic Technicians
2 GS-8 Hydrologic Technicians
1 or 2 each GS-7, GS-6, and GS-5 Hydrologic Technicians

The size of the task force on site will vary from four or five during the velocity profiling on Little Goose Reservoir to eighteen or twenty at the height of the simultaneous sediment sampling, velocity profiling and dye sampling on March 18-19 on Lower Granite. Reservoir.

A technician will be provided at $800 per day plus expenses by R.D. Instruments for the first week to guide and assist in the use of the leased Doppler Velocity Profiler.

Reports:

A full report of USGS data collection activities and tables of data collected, including the results of the dye, time-of-travel study and copies of memory disks generated by the portable field computers will be provided to the Walla Walla District, Corps of Engineers by April 30, 1992.

Costs:

Refer to table of costs on separate sheet. Receipt of a DA 2544 transferring funds to the Survey must be received prior to data collection activities. Upon completion of the project, the Survey will provide an accounting of expenditures by object class to the Corps of Engineers, Walla Walla District. Any unexpended monies will be returned to the Corps by a modification or reissuance of DA 2544. Modification or reissuance of the DA 2544 for reasonable expenditures in excess of the estimated cost of the Survey's participation in the project will be processed after the work is completed.

Should it be necessary for the Corps to terminate the project before completion of data described herein because of environmental or safety reasons, all costs will be identified and transfer of funds by DA 2544 modified accordingly.

In order to minimize USGS costs and to expedite the data collection effort, the Corps of Engineers agrees to:

1. Flag or otherwise mark all proposed cross-sections.
2. Make available an adequate back-up boat in the event one is needed thus eliminating the need for a second large USGS-owned river boat during the project
3. Provide ready and immediate access to boat fuel during drawdown of Lower Granite and Little Goose Reservoir.
4. Provide means to remove boats and personnel from both reservoirs.
5. Other reasonable assistance, as needed, during the project

TABLE 1

Lower Granite Reservoir Study Cross-Sections

Velocity	Sediment	Dye
108.31 nr Dam		108.31
		114
119.0 on dredge spoils berm		
120.46 above berm		120.46
		126
130.66 bel. Silcott Island		
132.05 ab. Silcott Island	132.05	132.05
	137.17 bel. Red Wolf Bridge	
138.34 bel. confluence		138.34
		139
	139.43 bel Interstate Bridge	
141.21 upstream end levies		
142		142
145		145
148		148
	167.2 Anatone streamgage	

Clearwater River

	0.41
1.26 Port of Lewiston	
2.34 ab. Memorial Bridge	
	11.6 Spalding streamgage

SEDIMENT TRANSPORT DATA COLLECTION
FOR LOWER GRANITE POOL DRAWDOWN TEST

Hydrology Branch. LLC 13 Dec 1991

1. The purpose of this test is to measure the increased sediment transport in the upper reservoir resulting from the pool drawdown. It is assumed that the conversion of the upper part of the pool into a free-flowing river will result in measurable reentrainment of sediment previously deposited in this reach.

2. It is suggested that at least two total load (suspended sediment as well as bed load) measurements be made during the course of the drawdown at the following locations:

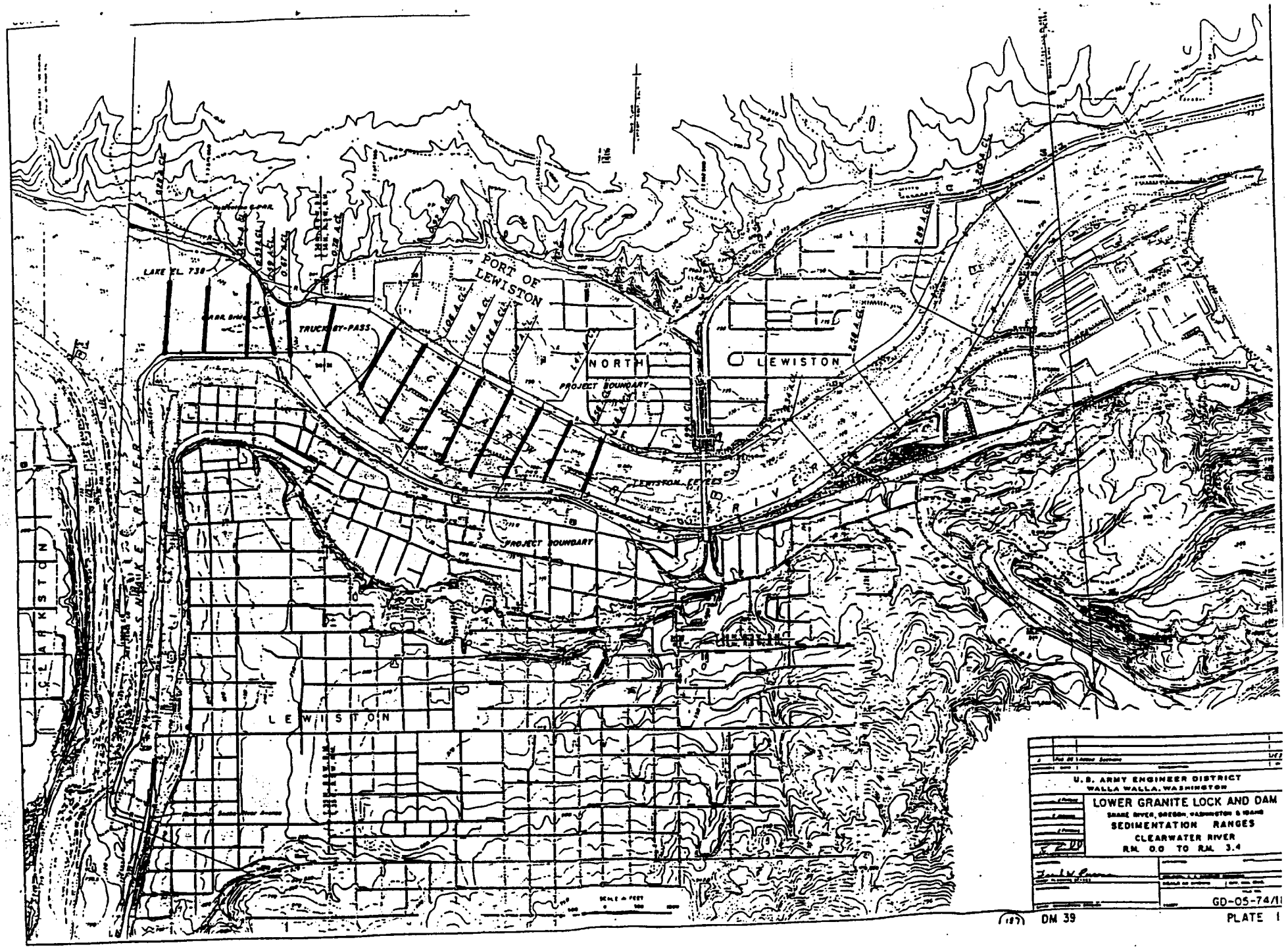
a. The USGS gage at Anatone
b. Sediment Range 139.43 or Interstate 12 Bridge on the Snake River.
c. The USGS gage at Spaulding
d. Sediment Range 0.28 or the Railroad Bridge on the Clearwater River.
e. Sediment Range 137.17 or Red Wolf Bridge.

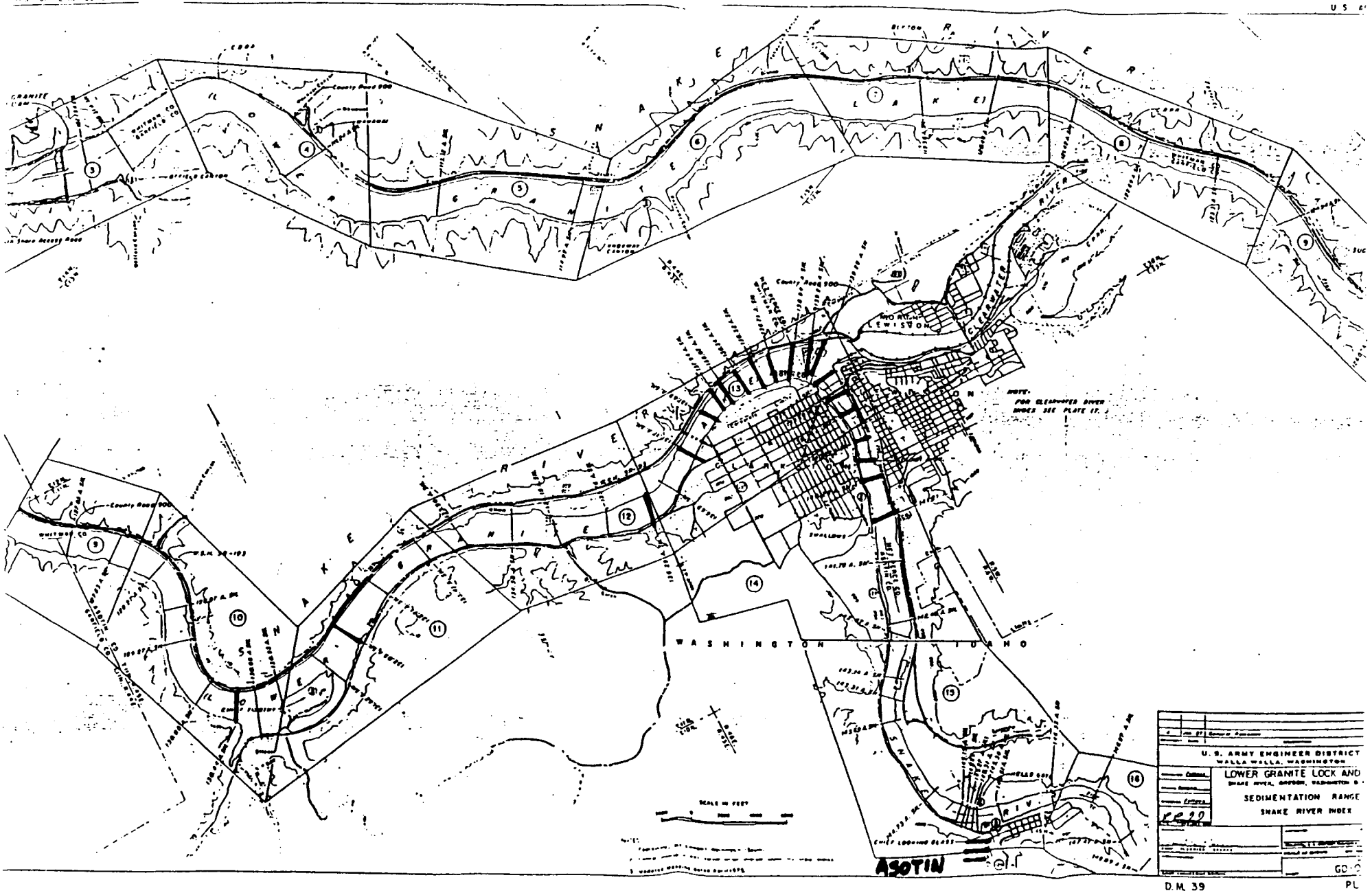
3. Aerial photographic coverage of the reservoir would be useful in identifying sources of turbidity. A flight just before drawdown is initiated and just after the reservoir has reached the minimum level would be useful. No cost estimate is presented for aerial photography assuming use can be made of photography accomplished for other purposes during the test.

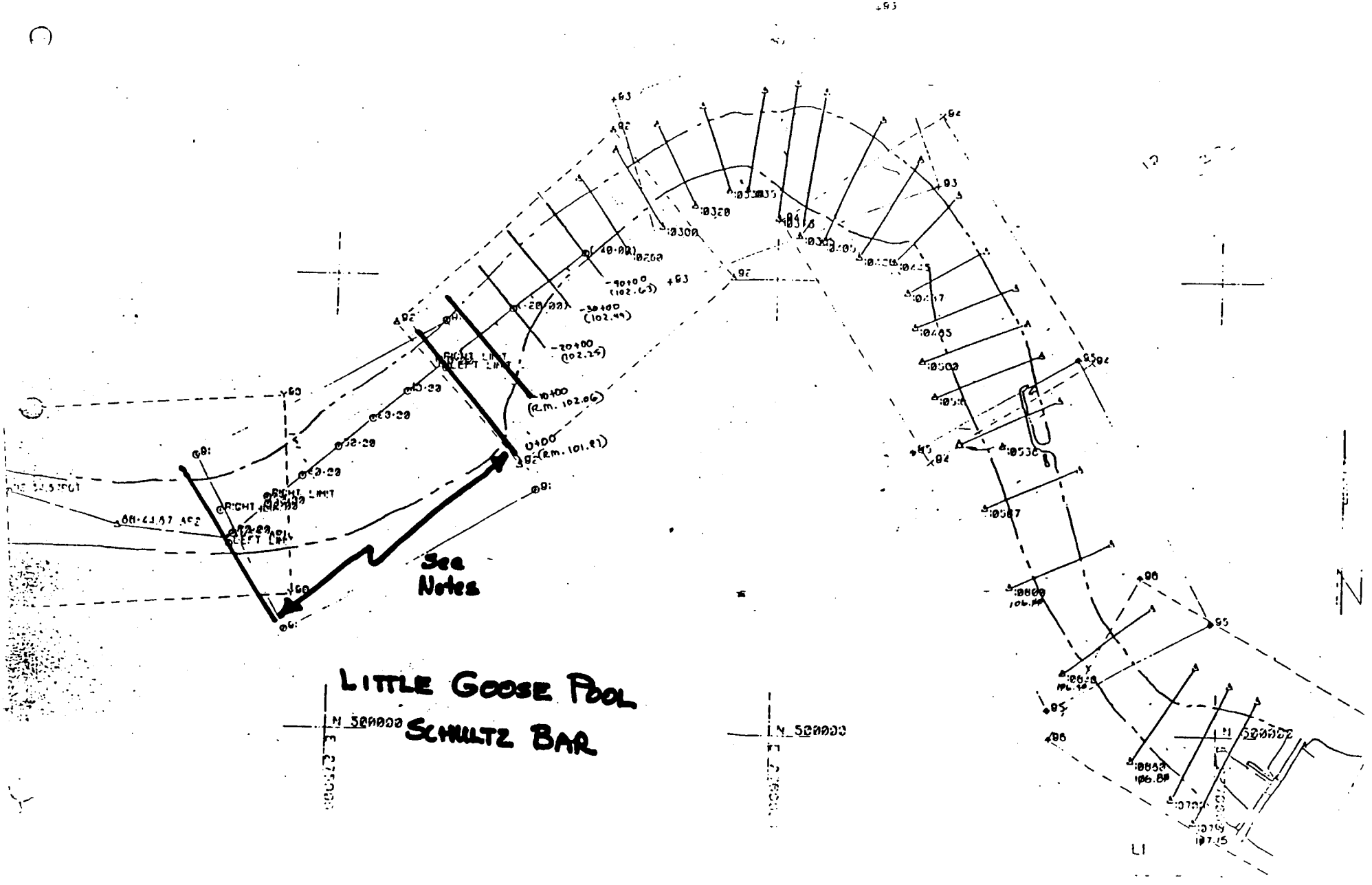
4. It is suggested that a minimum of two complete sediment load measurements be made; one about one week into the drawdown when the reservoir is about one-half way down to the minimum level, and another about one week later when the drawdown is at a free overflow condition. If funds permit a control measurement taken before the drawdown begins would be useful.

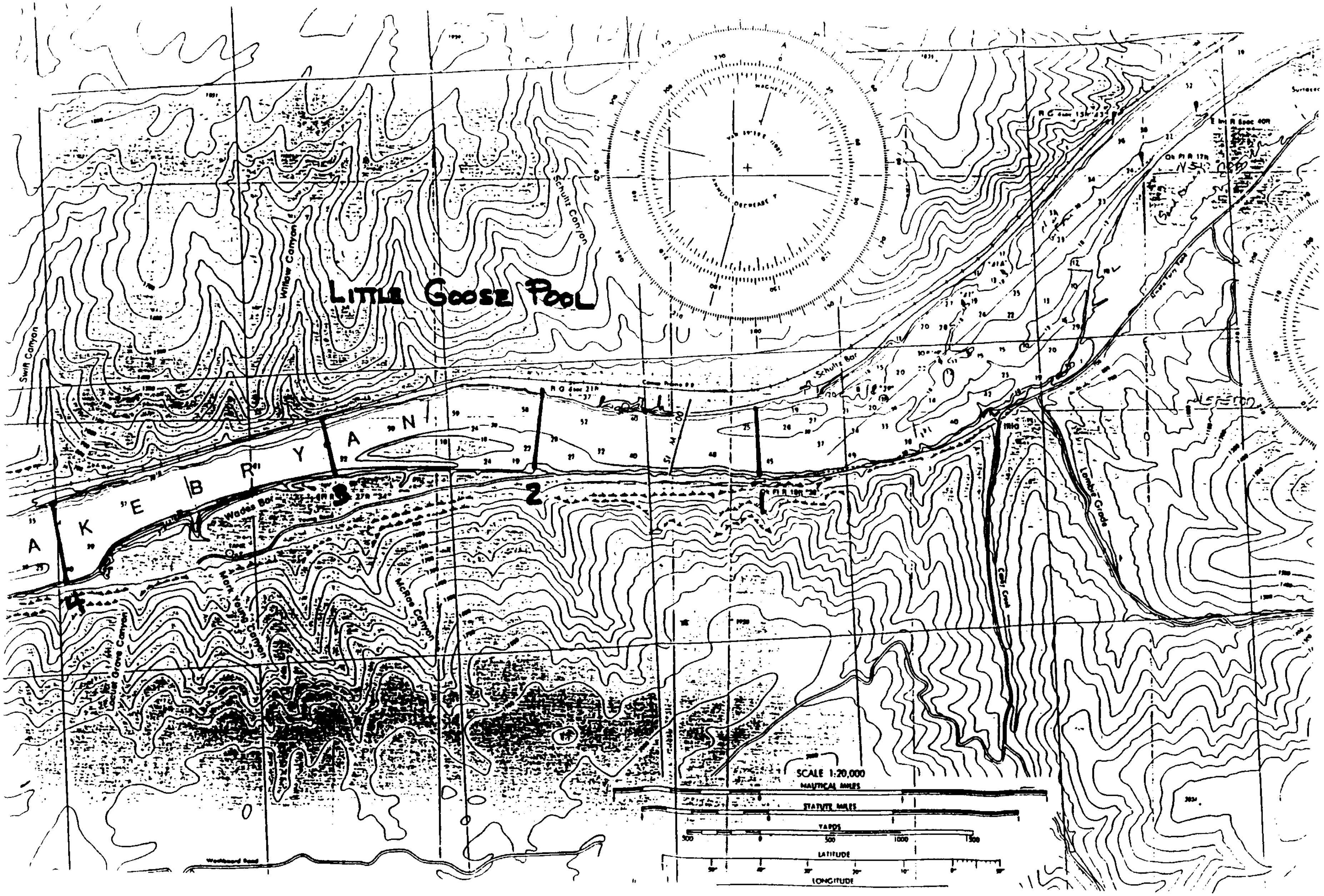
5. Cost Estimate:

Assume 3 days for each measuring effort @ $1500/day
Cost per meausuring effort: 3x1500= $4,500
Total cost: 3x2x1500= $9,000


PORT OF LEWISTON
LAKE EL. 738
TRUCK BY-PASS
NORTH LEWISTON
PROJECT BOUNDARY
LEWISTON
CLARKSTON
SNAKE RIVER
CLEARWATER RIVER
PROJECT BOUNDARY
U.S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON
LOWER GRANITE LOCK AND DAM
SNAKE RIVER, OREGON, WASHINGTON & IDAHO
SEDIMENTATION RANGES
CLEARWATER RIVER
R.M. 0.0 TO R.M. 3.4
GD-05-74/11
DM 39
PLATE 1


SNAKE RIVER
CLEARWATER RIVER
LEWISTON
CLARKSTON
WASHINGTON
IDAHO
ASOTIN
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON
LOWER GRANITE LOCK AND
SEDIMENTATION RANGE
SNAKE RIVER INDEX


LITTLE GOOSE POOL
SCHULTZ BAR
See Notes
N 500000
N 500000
N 500000


LITTLE GOOSE POOL
L A K E B R Y A N
1
2
3
4
Swift Canyon
Willow Canyon
Schultz Canyon
Schultz Bar
Wades Bar
McRae Canyon
SCALE 1:20,000
NAUTICAL MILES
STATUTE MILES
YARDS
LATITUDE
LONGITUDE

Revised from 21 Jan 92

SURVEYS FOR RESERVOIR DRAWDOWN TEST
Hydrology Branch. LLC 30 January 1992

SURVEYS REQUIRED TO DOCUMENT CHANNEL SCOUR AND AGGRADATION CAUSED BY RESERVOIR DRAWDOWN ON LITTLE GOOSE AND LOWER GRANITE POOLS.

1. LOWER GRANITE POOL:

SNAKE RIVER	CLEARWATER RIVER	ASOTIN CREEK
130.44*	0.28	0.07*
132.05*	0.41	0.14*
136.29	0.53	0.20*
137.17	0.59	
137.69	0.67	
137.94	0.78	
138.07	0.92	
138.34	1.06	
138.52	1.16	
138.71	1.26	
138.94	1.36	
139.22	1.47	
139.29	1.56	
139.43	1.66	
139.64*		
139.91*		
140.51*		
140.75*		
141.21*		

The above 36 ranges should be surveyed after the area in which the range is located has been dredged but before the March 1 drawdown begins. Resurvey the 36 ranges immediately after the drawdown test is complete. In order to complete the survey it may be necessary to start surveying ranges which will not be dredged and then progress to areas where dredging has been completed. The ranges marked with an asterisk can be surveyed immediately since they are out of the dredging area. Other ranges can be surveyed as the dredging is completed in each area. See PLATES 1 and 2.

A condition survey for the deep-water disposal site should be performed immediately after disposal in this area is completed, but before the 1 March drawdown begins. The survey will consist of a channel cross section at STA 106+00, and 10 profiles varying from 3400 to 4400 feet long. See PLATE 3. Due to the critical timing this survey should probably be scheduled last. This survey should be repeated immediately after the drawdown test is completed.

Cost for range survey @ 500 Per Range: $36,000
Cost for condition survey assuming 2 crew days: $3,000

2. LITTLE GOOSE POOL

A. Schultz Bar Surveys

Prior to 1 March survey the ranges marked 1 through 4 on PLATE 4. The 4 ranges will again be surveyed after the drawdown test is completed. Since these ranges are needed only for aggradation studies the coordinates and elevation do not have to be tied into any existing datum. A marked aluminum capped monument should be set at each end of the range. Subsequent surveys of these ranges should be performed along the same line between the monuments using the same elevation so changes in the geometry of the section can be documented.

<u>After the drawdown test is complete</u> perform a profile survey along the dredging base line from STA 0+00 through STA 88+44.87 (AP2) as indicated on Plate 3. Then survey a cross section at RM 102.06; STA 0+00 THRU 30+00 every 600 ft; and STA 33+00 THRU 60+00 every 300 ft. See Plate 4.

B. Almota Surveys

Survey the following ranges (See PLATE 5) after drawdown is complete:

103.57
103.73
103.25
104.05
104.26
104.45

3. Since aggradation or degradation will be evaluated on the basis of differences between successive surveys, it is very important that the sounding equipment be kept calibrated. At least two bar checks should be made during each day of the test. The equipment should be calibrated to bar checks made at a depth near the maximum in the area surveyed to assure that the measured elevation for the pool bottom at the deepest point is as close as possible to the correct value.

Only that portion of each range which can be surveyed by the sounding boat is required.

Survey 4 ranges before drawdown test:	$2,500
Survey 21 ranges after test at Schultz Bar:	$6,500
Survey 6 ranges after test at Almota:	$3,000
TOTAL COST FOR LITTLE GOOSE SURVEY:	$12,000

TOTAL ESTIMATED SURVEY COSTS FOR BOTH PROJECTS: $51,000

CORPS OF ENGINEERS

U S ARMY

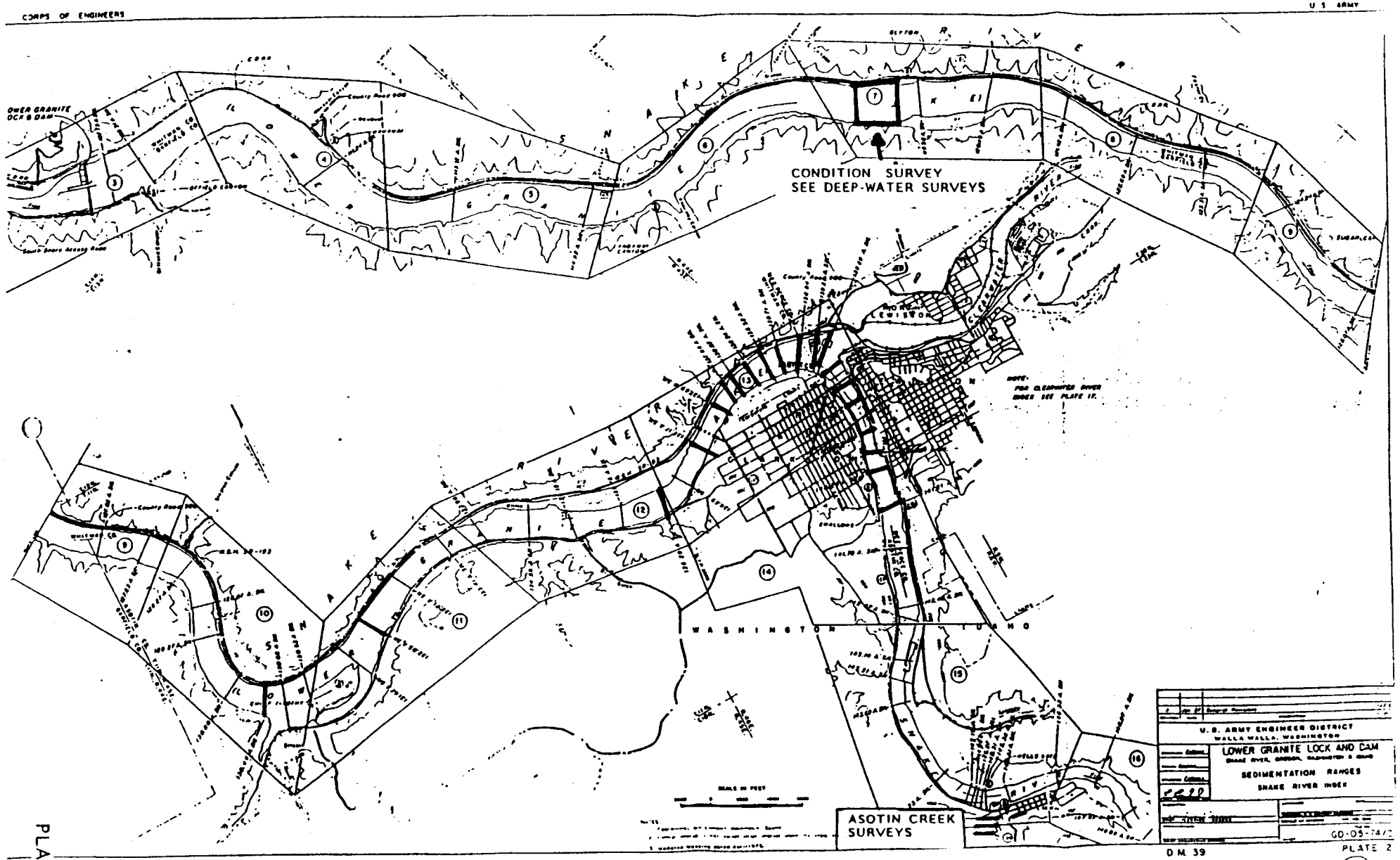


PLATE 1

D.M. 39

(7)

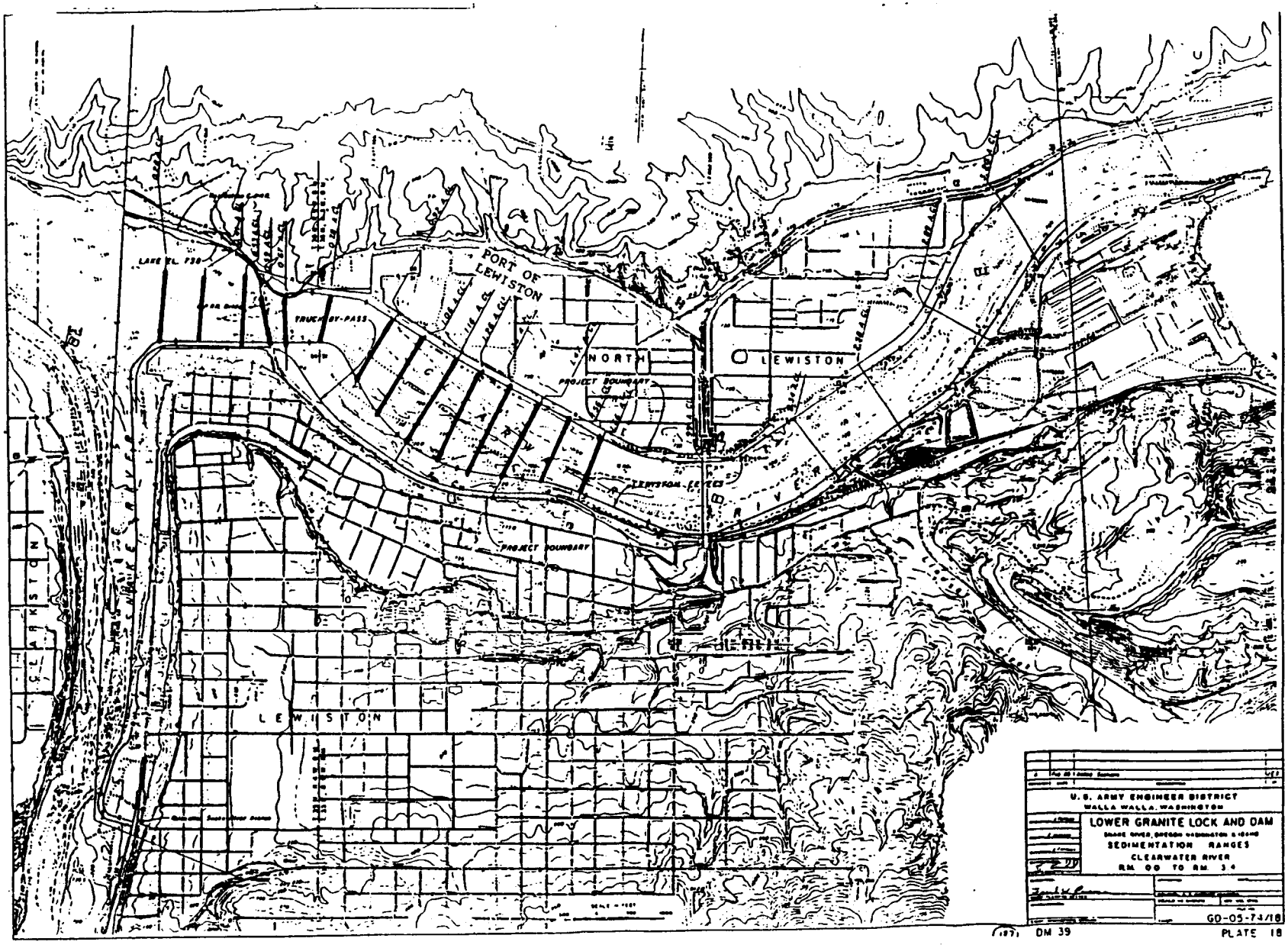
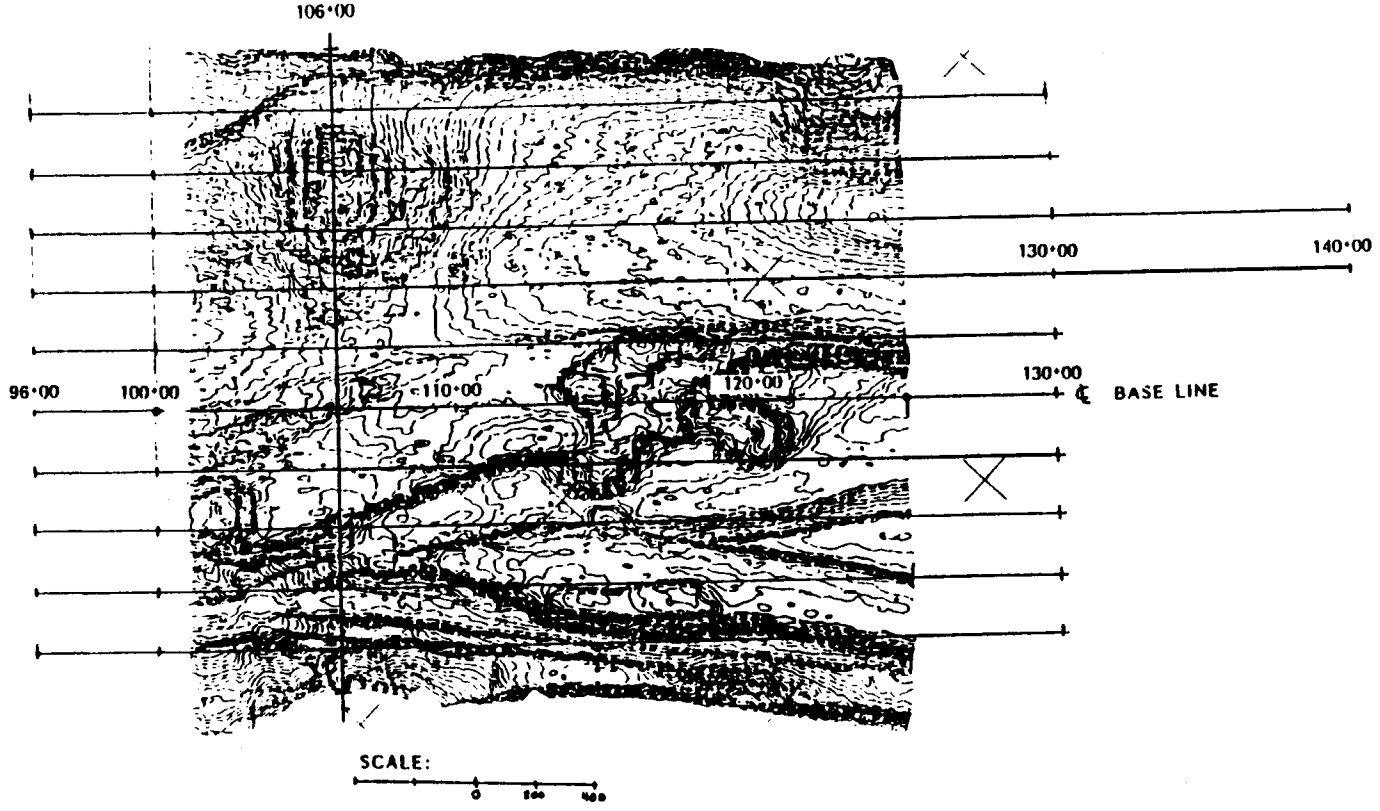

PORT OF LEWISTON
NORTH LEWISTON
PROJECT BOUNDARY
LEWISTON
LEWISTON
U.S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON
LOWER GRANITE LOCK AND DAM
SEDIMENTATION RANGES
CLEARWATER RIVER
GD-05-74/18
(187) DM 39
PLATE 18

PLATE 2

(8)



REQUIRED SURVEYS

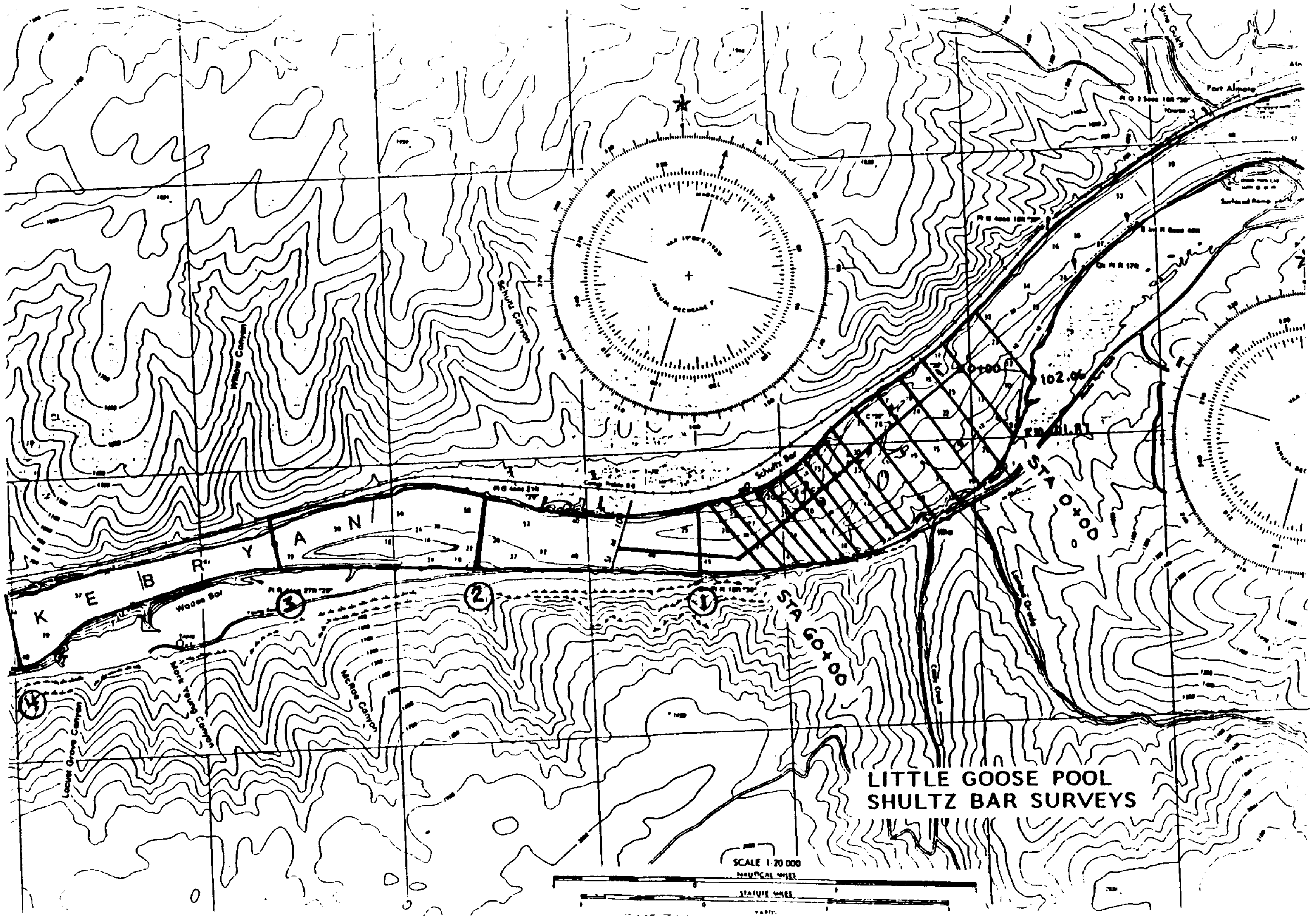
1. Survey a complete river cross section at Base Line Station 106+00.

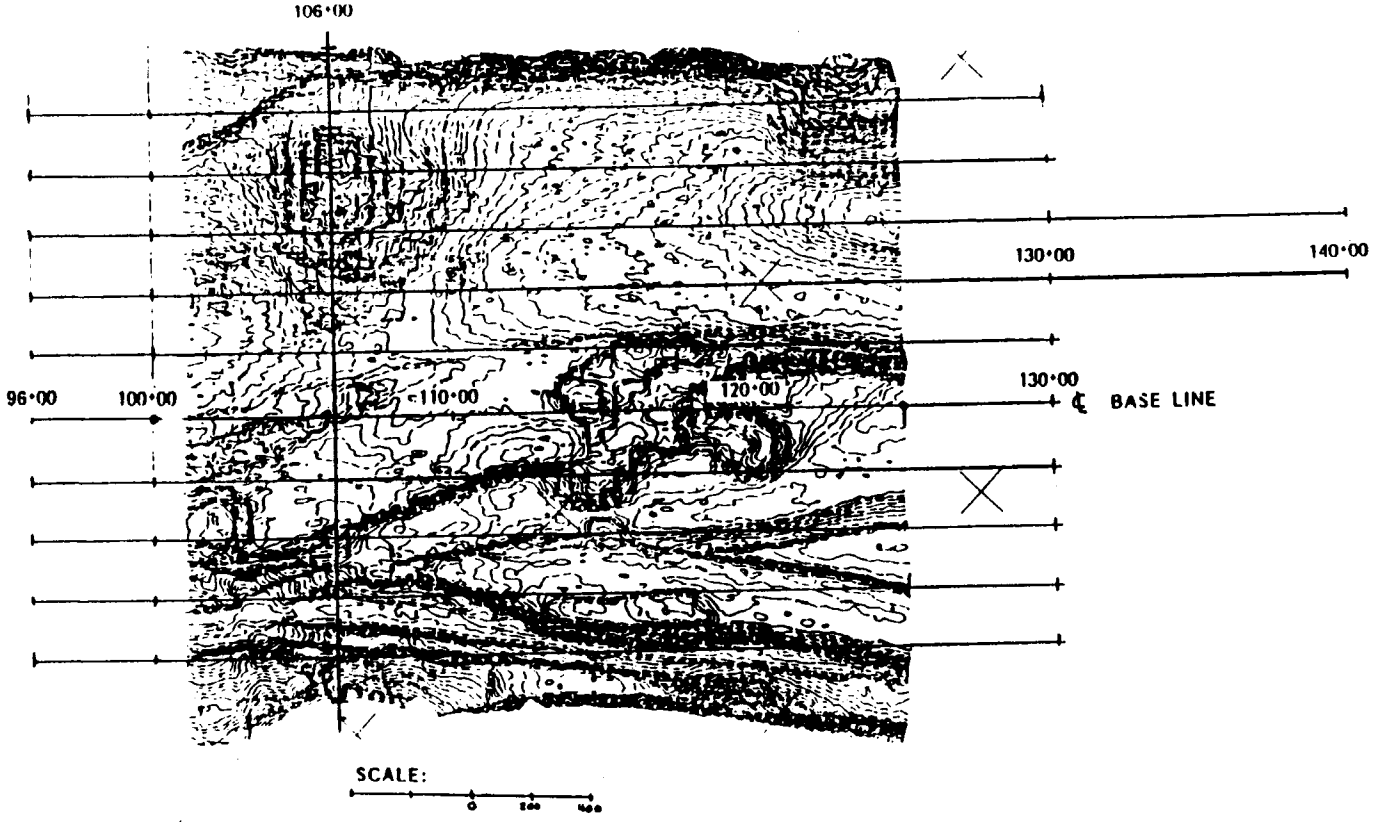
2. Survey ten profile lines spaced 200 ft apart parallel to the Disposal Base Line. The profiles should start at STA 96+00 and end at STA 130+00 except two lines which extend to STA 140+00.

DEEP-WATER DISPOSAL SITE SURVEYS
FOR RESERVOIR DRAWDOWN TEST

PLATE 3

PLATE 4


LITTLE GOOSE POOL
SHULTZ BAR SURVEYS
STA 0+00
STA 60+00
102.0
SCALE 1:20 000
K E B R Y A N
Schultz Canyon
Port Almota



REQUIRED SURVEYS

1. Survey a complete river cross section at Base Line Station 106+00.

2. Survey ten profile lines spaced 200 ft apart parallel to the Disposal Base Line. The profiles should start at STA 96+00 and end at STA 130+00 except two lines which extend to STA 140+00.

DEEP-WATER DISPOSAL SITE SURVEYS FOR RESERVOIR DRAWDOWN TEST

PLATE 3

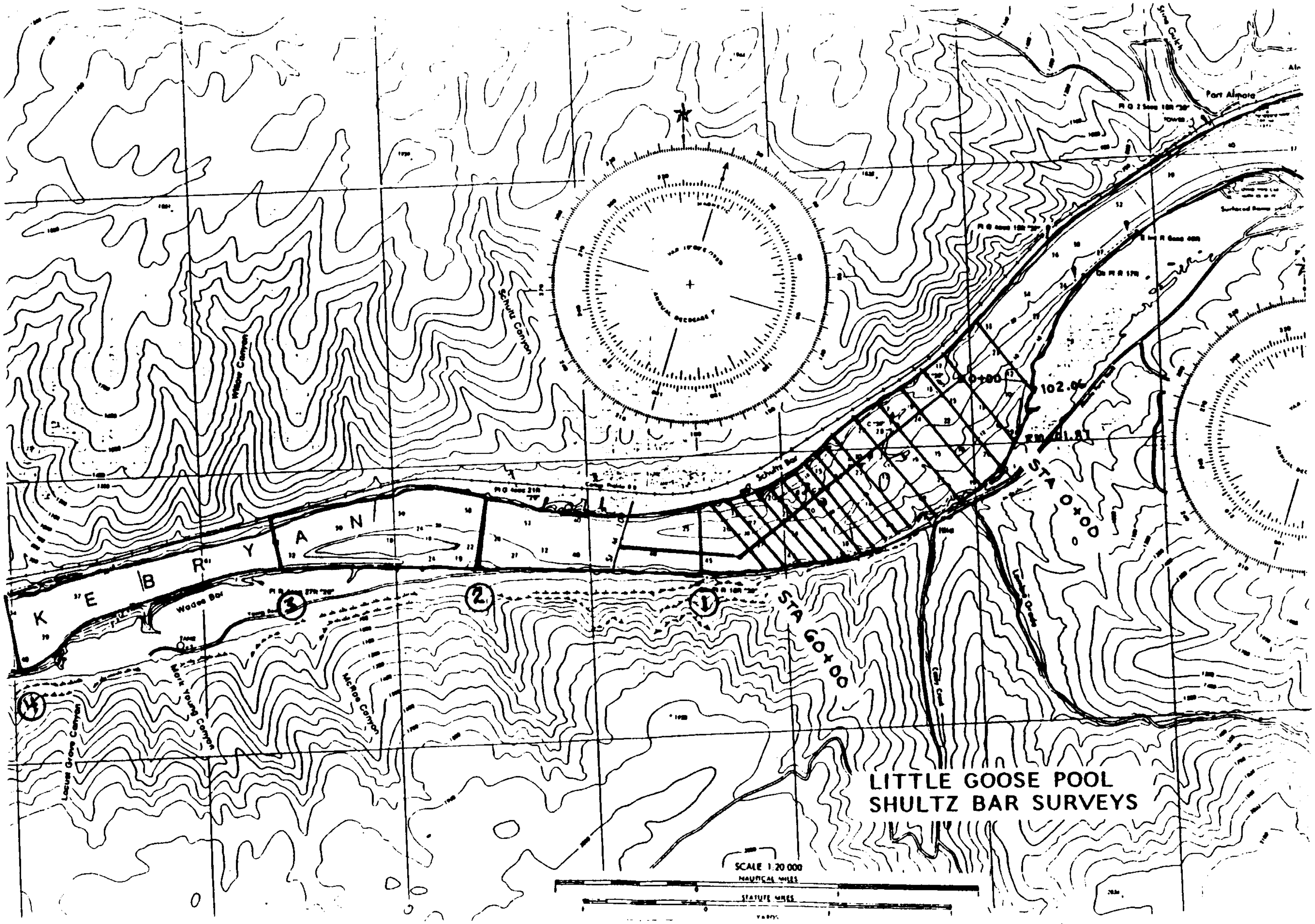

LITTLE GOOSE POOL
SHULTZ BAR SURVEYS
STA 0+00
STA 60+00
K E B R Y A N
Schultz Canyon
Wade Canyon
Wades Bar
Schultz Bar
Port Almota
McRae Canyon
Locust Grove Canyon
SCALE 1:20 000
NAUTICAL MILES
STATUTE MILES

PLATE 4

Slime Gulch
Port Almota
103.57
103.73
103.85
104.05
104.26
104.47
Fl G 2.5sec 18ft "39"
TOWER
SILO
Fl G 4sec
Surfaced Ramp
Fl G 4sec 18ft "37"
E Int R 6sec 40ft
Qk Fl R 17ft
E Int R 6sec 28ft
Qk Fl 20ft
TOWERS
SNAKE
Boyer Marina
Mile 103
MAGNETIC
Illia
LITTLE GOOSE POOL
ALMOTA SURVEYS

PLATE 5

GROUND-WATER EFFECTS OF A TEMPORARY DRAWDOWN OF LOWER GRANITE RESERVOIR, SOUTHEASTERN WASHINGTON

Introduction.--

The U.S. Army Corps of Engineers (CE) recently announced plans to modify its operations of several reservoirs along the Snake River in an attempt to increase the speed and ease with which the Idaho sockeye fishery can navigate the river in question on its way to spawning grounds in Idaho. As part of a complex, long-term plan, the CE will draw the lower Granite Reservoir down 35-50 feet for about one month beginning March 1, 1992 as a short-term test of the likely hydrologic effects of its long-term plan. The effects of such a drawdown on the local ground-water system are unknown but could be significant.

Previous ground-water studies of the Lower Granite area by the U.S. Geological Survey (GS) indicate that the Snake River in this area cuts through basalt of Miocene age which is overlain, on the uplands, by eolian loess of Quaternary age. Alluvium is present locally along the river banks. Some wells along the banks of the river (or reservoir) are relatively shallow and finished in basalt or alluvium. It is likely that water levels in those wells closely follow fluctuations in river stage. The upland loess is largely unsaturated; accordingly, wells on the uplands are relatively deep and finished in basalt. Water levels in these wells, however, are as much as 1,500 feet higher than river stage and most likely would not be affected by the proposed drawdown.

Objective.--

The objective of this study is to measure the effects, if any, of a short-term drawdown of lower Granite Reservoir on ambient ground-water conditions.

Approach.--

The GS will inventory 20-25 wells in the immediate vicinity of the reservoir -- along the shoreline, below lower Granite Dam, and on the uplands on both sides of the reservoir in both Washington and Idaho. About 10-12 of the inventoried wells will be selected for water-level monitoring prior to, during, and after the proposed pilot drawdown. At least two water-level measurements will be made in each well prior to the onset of drawdown. During drawdown and recovery, which are expected to take 3-7 days each, measurements will be made at least every other day. Once the reservoir stage is stable, measurements will be made every 3 days. Some of the observation wells will be selected as control wells; that is, the wells will be in geohydrologic environments not thought likely to be affected by the drawdown. The resulting water-level data will be entered into the GWSI computerized data base.

Findings...

The cooperator will be furnished a map of the well locations, and the resulting water-level data in both tabular and hydrograph form.

Costs(FY92).-- $26,000, to be paid by the cooperator (CE).

APPENDIX B

PRE-MIGRATORY SALMONIDS, RESIDENT FISH, AND MINIMUM POOL OPERATIONS

EVALUATION OF THE PROPOSED DRAWDOWN IN LOWER GRANITE AND LITTLE GOOSE RESERVOIRS AND RESERVOIR OPERATIONS AT MINIMUM OPERATING POOL

by

David H. Bennett

Department of Fish and Wildlife
College of Forestry, Wildlife and Range Sciences
University of Idaho
Moscow, Idaho 83843

February, 1992

BACKGROUND

Population characteristics of fishes residing in reservoirs that are subjected to significant changes in water levels can be substantially affected. Fish population studies on Long Lake, Spokane River, Washington (Hatch 1991), and Box Canyon Reservoir, Pend Oreille River, Washington (Liter 1991), have suggested that emigration can occur in resident fish population inhabiting reservoirs that are subjected to increased flows events or drawdowns. Resident fishes are believed to over-winter close to cover in deeper waters. Loss of these cover/over-winter areas associated wtih pool evacuations could stimulate excessive downstream mugration especially in smaller fishes. Anadromous fishes that are subjected to abrupt changes in flow patterns may exhibit downstream migration that could ultimately contribute to increased mortality or other adverse affects. At present, little information exists on the presence and abundance of juvenile anadromous salmonid fishes in the lower Snake River reservoirs during winter and early spring. Sampling in Little Goose Reservoir in 1979 indicated that numerous juvenile rainbow trout/steelhead *Oncorhynchus mykiss* were abundant in late fall samples and were still present in spring 1980 prior to the spring out-migration (Bennett et al. 1983). Sampling in fall and winter 1985-1986 indicated that juvenile kokanee/sockeye salmon *O. nerka*, chinook salmon *O. tshawytscha* and steelhead were present in Lower Granite Reservoir to varying levels of abundance depending upon the year. Sampling was limited to specific stations in the reservoir although numbers collected suggested fairly large numbers of fish could

have been present.

The proposed drawdown of the Lower Granite and Little Goose reservoirs on the Snake River would create conditions far more significant than a drawdown of a few feet. As proposed, Lower Granite Reservoir will be drawndown from minimum operating pool (733 ft) to 705 ft or about 28 ft. The potential for out-migration of resident fishes and premature downstream migration of anadromous salmonids in Lower Granite Reservoir seems significant and will be investigated in this study.

Widely fluctuating water levels are commonly associated with decreased recruitment of some fishes. Maintaining operations at minimum water levels in the lower Snake River reservoirs could potentially have beneficial effects on recruitment of fishes that require stable water levels for spawning and/or rearing in shallow water. For example, predator species such as northern squawfish *Ptychocheilus oregonenesis* and smallmouth bass *Micropterus dolomieui* that rear in shallow water may have increased survival compared to that under "normal" operating conditions where water levels fluctuate about 5 ft in the lower Snake River reservoirs. Preliminary comparison of larval fish abundance on Lower Granite Reservoir has indicated that the abundance of larval fishes increased substantially in 1991 when reservoir pool levels were maintained at minimum operating levels (MOP). Numerous differences occur from year to year in the timing and magnitude of peak flows, temperature, nutrient levels, and reservoir operations. However in 1991, one major difference in Lower Granite Reservoir was operating at

minimum operating pool or 733 ft elevation. These levels were maintained for the spring and early summer with about a 1 ft fluctuation. Water levels in 1991 were considerably more stable than those in the past that have fluctuated frequently from 738 to 733 ft elevation. Stable water levels could enhance recruitment of fishes and especially potential salmonid predators. Part of this study will be directed at evaluating the effects of maintaining a constant water level at minimum operating pool in Lower Granite Reservoir.

OBJECTIVES

1. To assess the presence of juvenile salmonid fishes in Lower Granite Reservoir in winter/spring 1992, prior to the drawdown, and in Little Goose Reservoir following the drawdown;

2. To assess the occurrence of Gas Bubble Disease in juvenile salmonids in Little Goose Reservoir during and immediately following the drawdown in 1992;

3. To assess the occurrence of outmigration of anadromous and resident fishes from Lower Granite Reservoir associated with the proposed drawdown;

4. To assess the effect of the drawdown on size and species composition of fishes in Lower Granite Reservoir;

5. To assess the effects of drawdown in Lower Granite Reservoir on white sturgeon *Acipenser transmontanus* distribution and abundance;

6. To assess year-class strength of potential predator species from 1991 in rearing habitat in Lower Granite Reservoir;

7. To quantify larval fish abundance in 1992 when water levels in Lower Granite Reservoir are maintained at minimum operating pool (MOP) during the spring and early summer of 1992; and

8. To compare abundance of larval fishes from 1992 with that from previous years of fluctuating and MOP operations in Lower Granite Reservoir.

PROCEDURES

To assess the abundance of juvenile salmonids in Lower Granite Reservoir, we would sample along the shoreline and pelagically during the daytime and along the shoreline at night at random locations. Previous sampling indicated that juvenile salmonids were predominantly shoreline oriented during the winter. We would make replicate samples with a 100 x 8 ft beach seine with a 8 x 8 x 8 bag at 35 random locations in Lower Granite Reservoir. We would also sample at night using shoreline electrofishing using the same design. At 35 locations we would sample for 10 minutes of effort at each of the locations. From these samples, we would be able to expand our estimates using a simple randomized sampling design and estimate the number of salmonids by species. We would also calculate 90% confidence intervals on our estimate (Scheaffer et al. 1986).

Pelagic sampling would be conducted by using a two boat surface trawl. We would randomly sample transects in Lower Granite and Little Goose reservoirs to assess the abundance of salmonid fishes in pelagic waters. From pelagic sampling we would be able to expand our estimates of abundance to the entire reservoir and compute confidence intervals.

To assess the effects of drawdown on resident fishes in Lower Granite Reservoir, we would conduct extensive fish community sampling in Lower Granite and Little Goose Reservoirs. Sampling would consist of shoreline electrofishing, beach seining and gill netting conducted at random locations throughout the reservoir in the spring and summer. Beach seining would be conducted during the daytime whereas

electrofishing and gill netting would be conducted at night. Fish would be netted, examined for marks, measured and released. Sampling was conducted in Lower Granite Reservoir during spring through fall, 1991 to assess gear selectivity. All fish were fin clipped or opercle punched to identify them at some later time. Sampling in both reservoirs would provide and opportunity to assess their presence in Lower Granite or outmigration into Little Goose Reservoir. We will also attempt to electrofish during the period of water level stabilization at 705 ft elevation. All fish would be fin clipped for future identification and possible recovery in either Lower Granite Reservoir or Little Goose Reservoir.

Extensive fish sampling has been conducted in Lower Granite Reservoir from previous studies. The size composition and species composition of the community has been determined for littoral, pelagic and profundal habitats in Lower Grnaite Reservoir (Bennett and Shrier 1987; Bennett et al. 1988, 1990, 1991). We will compare the species and size composition of Lower Granite Reservoir following drawdown with that prior to drawdown to assess the effects of the drawdown on Lower Granite Reservoir.

To assess differences in community structure from pre-to post drawdown, comparisons of catch/effort of the more abundant species and proportional composition will be made. Random sampling in Lower Granite and Little Goose reservoirs will facilitate these comparisons. Also, sampling at specific stations as part of another research effort in Lower Granite Reservoir will provide additional information.

We would also sample for sturgeon during the drawdown and following to further assess the effects of the drawdown on resident fishes. Extensive sampling conducted in 1990 and 1991 has provided background information on distribution, abundance and size composition. Sampling in 1992 will provide a comparison with results from the 1990 and 1991 sampling that was also conducted seasonally. Selected areas in Lower Granite Reservoir provided substantially higher catch rates than others; catch rates in these areas will be compared between pre and post drawdown years.

Larval fish abundance would be determined as in previous years using 1/2 m tow nets and a hand drawn beam trawl (Bennett et al. 1991). We would sample twice at biweekly intervals from June through mid-September 1992. Paired nets would be towed at night approximately 1.6m/s at the surface and 1 m in depth for 3 min at each depth. Thre paired hauls would be made at each station each night we sampled. Samples from each net would be preserved separately which would provide six samples/smalpling location/sampling date. The beam trawl (LaBolle et al. 1985) would be pulled along the shoreline by two people over a standard distance of 15 m during the daytime. Three hauls would be made along the shoreline in shallow (<1m) and deeper (>1m) water for a total of six hauls/station/sampling date. All samples would be preserved in 10% formalin for later enumeration.

To assess year-class strength of predator fishes from 1991, we would beach seine selected shallow water habitats in Lower Granite Reservoir during spring and summer 1992. Beach seining would be

conducted in a standardized fashion, identically to previous years to facilitate comparison of results (Bennett and Shrier 1987; Bennett et al. 1988, 1990, 1991). We would sample during the day twice monthly during May, June, July and August using a 100 x 8 ft (30.5 x 2.4m) seine constructed of 1/4 inch (0.64cm) knotless nylon mesh with a 8 x 8 x 8 ft ($25.4m^3$) bag. A standard haul would be made by setting the seine parallel to the shoreline using 50 ft (15m) extension ropes which sample approximately 0.08 acres ($454m^2$). Three hauls/station would be made each time sampling was conducted.

Comparison of abundance among years would be made by analysis of variance (P=0.10). Because of the assumptions of normality and equal variances using analysis of variance, we would transform the catches into ranks and use the ranks in the analysis.

REFERENCES

Bennett, D.H., P.M. Bratovich, W. Knox, D. Palmer, and H. Hansel. 1983. Status of the warmwater fishery and the potential of improving warmwater fish habitat in the lower Snake reservoirs. Completion Report. U.S. Army Corps of Engineers, Walla Walla, WA.

Bennett, D.H. and F.C. Shrier. 1986. Effects of sediment dredging and in-water disposal on fishes in Lower Granite Reservoir, Idaho-Washington. Completion Report. U.S. Army Corps of Engineers, Walla Walla, WA.

Bennett, D.H., L.K. Dunsmoor, and J.A. Chandler. 1988. Fish and benthic community abundance at proposed in-water disposal sites, Lower Granite Reservoir. Completion Report. U.S. Army Corps of Engineers, Walla Walla, Washington.

Bennett, D.H., J.A. Chandler, and L.K. Dunsmoor. 1990. Lower Granite Reservoir in-water disposal test: Results of the fishery, benthic, and habitat monitoring program-year 1 (1988). Completion Report. U.S. Army Corps of Engineers, Walla Walla, Washington.

Bennett, D.H., J.A. Chandler, and G. Chandler. 1991. Lower Granite Reservoir in-water disposal test: Results of the fishery, benthic, and habitat monitoring program-year 2 (1989). Completion Report. U.S. Army Corps of Engineers, Walla Walla, Washington.

Hatch, D. 1991. Factors limiting largemouth bass in Long Lake, Spokane County, Washington. Master's of Science thesis. University of Idaho, Moscow.

LaBolle, L. Jr., H.W. Li, and B.C. Mundy. 1985. Comparison of two samplers for quantitatively collecting larval fishes in upper littoral habitats. Journal of Fish Biology 26(2):139-146.

Liter, M. 1991. Factors limiting largemouth bass in Box Canyon Reservoir,Pend Oreille River, Washington. Master's thesis. University of Idaho, Moscow.

Scheaffer, R.L., W. Mendenhall, and L. Ott. 1986. Elementary survey sampling. Duxbury Press, Boston, Massachusetts.

FAX MEMO

pages 2 DATE 2/20/92 FAX# 509/522/6943
CO. US Army COE
ATTN: Sarah Wik
FROM DH Bennett
PH 208/885-6332 FAX# 885-6226

ELECTROFISHING DESIGN

Lower Granite Reservoir was divided into 440 yard sections, for a total of 250 sampling units. Each 440 yard sampling unit was assigned a number corresponding to an associated shoreline habitat type. The following were the 5 categories of shoreline habitat:

1- Talus
2- Rip Rap
3- Sand
4- Embayment
5- Cliff

With the above breakdown, the number of possible sampling units for each habitat were as follows:

Talus	RipRap	Sand	Embayment	Cliff
35	122	22	1	70

To determine the number of sample units needed to be sampled within each habitat type we used a Proportional Allocation formula (Scheaffer et al.1990), because we are interested only in the total mean.

Proportional Allocation:

$$n_i = n(N_i/N)$$

n = Number of possible sampling units,
N_i = Total number of samples to be taken, (an arbitrary number, we chose 80 sampling units for our effort),
N = Total number of sample units.

Example: Talus (35 possible Units)
$n_i = n(N_i/N) = 35(80/250)$
n_i = 12 transects need to be for Talus shorelines.

Number of samples needed for each shoreline habitat type.

Talus	RipRap	Sand	Embayment	Cliff
12	39	7	1	22

The total mean for all shoreline habitat is computed with the following formula:

mean

$$\bar{y}_{st} = 1/250\left(\frac{\bar{y}_1}{35} + \frac{\bar{y}_2}{122} + \frac{\bar{y}_3}{22} + \frac{\bar{y}_4}{1} + \frac{\bar{y}_5}{70}\right)$$

Variance

$$\hat{V}(\bar{y}_{st}) = 1/250^2\left(\frac{1}{35^2}\left(\hat{V}_{or}\right)(\bar{y}_1) + \ldots\right.$$

Bound - $2\sqrt{\hat{V}(\bar{y}_{st})}$

SURFACE TRAWLING DESIGN

Lower Granite Reservoir was divided into three reaches. Upper reach (RM 139.0-RM 127.0), mid-reach (RM 127.0-RM 119.0) and lower reach (RM 119.0-107.5). Each reach was divided into 1 mile transects. The upper reach has 24 sampling units, the mid-reach has 16 sampling units and the lower reach has 24 sampling units, for a total of 64 sampling units. We selected 35 as the number of samples to be taken by surface trawling.

The number of sample units needed in each reach was also determined by the Proportional Allocation formula.

$$n_i = n(N_i/N)$$

The number of samples to be taken in each reach are as follows:

Upper Reach - 14
Mid- Reach - 9
Lower Reach - 14

The same variance and bound formulas will be used.

APPENDIX C

FALL CHINOOK, BENTHIC ORGANISMS, AND AQUATIC HABITAT

ASSISTANCE IN COLUMBIA RIVER SALMON MITIGATION ANALYSIS

Task 1 - Monitor Snake River Drawdown Areas for
Salmon Redds,
Dewatered Benthic Habitats,
and Macrophytes/Other Aquatic Habitats

to

Department of the Army
Walla Walla District, Corps of Engineers
Walla Walla, Washington 99362-9265

February 1992

Pacific Northwest Laboratory
P.O. Box 999
Richland, Washington 99352

ASSISTANCE IN COLUMBIA RIVER
SALMON MITIGATION ANALYSIS

Task 1 - Monitor Snake River Drawdown.Areas for
Salmon Redds,
Dewatered Benthic Habitats,
and Other Aquatic Habitats

SALMON REDDS

There are areas in the Little Goose and Lower Granite Reservoirs that may have been used by fall chinook salmon *Oncorhynchus tshawytscha* during the 1991 spawning season. If salmon did spawn in these areas, it is possible that eleutheroembryos and pre-emergent alevins are still in the gravel and may be dewatered during the 1992 reservoir drawdown. Chinook salmon require about 1,000 thermal units (TU) degrees centigrade (1,800 TU °F) to develop from fertilization to the stage where they will emerge from the gravel and enter the water column (Leitritz and Lewis 1976, Alderdice and Velsen 1978). One TU equals one degree centigrade above freezing (0 C) for a period of 24 hours. At 10 C, it will take about 51 days for a fall chinook salmon egg to hatch and about an equal amount of time before the alevin will emerge from the redd.

The eleutheroembryo and pre-emergent alevin are sensitive to dewatering. In tests conducted by the Pacific Northwest Laboratory, eleutheroembryos were dewatered for 1, 2, 4, and 8 hours per day for 20 days. Survival of eleutheroembryos among controls and the 1-hour dewaterings was near 98%. Survival declined to 90, 56, and 11% for the 2-, 4-, and 8-hour daily dewaterings, respectively. Pre-emergent alevins were less tolerant of daily dewatering than eleutheroembryos (Becker et al. 1982). Other tests subjecting fall chinook salmon to one-time dewaterings indicated similar sensitivities (Becker et al. 1983). Pre-emergent alevins underwent near total mortality when dewatered 6 consecutive hours. Thus, it is important to monitor the areas of the reservoirs that will be dewatered during the March 1992 drawdown.

Objectives for Salmon Redds

The two objectives of this study plan are:

Objective 1: To monitor the shoreline and other areas of the reservoirs to identify salmon redds before they are dewatered..

To achieve this objective, we will provide teams of field technicians to continually monitor dewatered and near-dewatered areas. Potential redds will be brought to the attention of Corps pf Engineer and National Marine Fisheries Service biologists that are working on the monitoring task team. PNL will provide senior level fisheries scientist to supervise all "redd monitoring" staff. The fisheries biologist will be prepared to partiality excavate potential redds to determine if eggs or embryos are present.

Objective 2: To use the data gathered in Objective 1 to assess its usefulness for future evaluation and monitoring of dewatering operations.

To achieve this objective, we will evaluate the methods and results used in Objective 1 to assess their suitability and usefulness in designing evaluation and monitoring plans for use in future dewatering operations.

Description of Tasks for Salmon Redds

PNL biologists will identify and survey potential spawning areas in Little Goose and Lower Granite dam reservoirs. The survey area will be determined based on recommendations of U.S. Army Corps (ACOE) of Engineers fisheries biologists familiar with the site and spawning features of known fall chinook salmon spawning areas, i.e., general shoreline, and geologic and bathymetric features of the tailrace area. PNL biologists will walk shoreline areas during daylight hours from March 17 to 24 and look for potential redds. Potential redds will be excavated with a shovel to determine if fall chinook salmon embryos are present.

Potential spawning sites in the Snake River upstream of the Lower Granite Pool will also be surveyed during the drawdown period of March 1 to March 15. PNL biologists will look at known spawning sites in Asotin Creek and areas upstream of Clarkston, Washington in the Snake River. Surveys will also be conducted of Alpowa Creek to determine the potential for the drawdown to influence access and/or spawning of steelhead. PNL biologists will conduct a minimum of two surveys at these sites during the drawdown period.

A summary of PNL observations during the drawdown period will be provided in a report to the Corps. The report will present results of the field surveys, applicable supporting figures and tables, and an assessment of impacts, if any, to salmon and steelhead resources in the Snake River.

Schedule for Redd Monitoring

Lower Granite Dam pool surveys (March 4/5 and March 12/13)

Lower Granite Dam tailrace monitoring (March 16- 24)

Draft letter report for review- May 1

Specifications of the Reports to be Supplied for Redd Monitoring

The report for the Redd Monitoring subtask will contain a description of areas surveyed, specific locations of confirmed spawning sites, and an assessment of the impacts of drawdown , if any, on the spawning sites. Site descriptions will include shoreline features, including bathymetry, substrate, and other general observations. Where applicable, information from other agencies will be incorporated into our assessment.

Points-of-Contact for Redd Monitoring

Dr. Dennis Dauble will be the PNL "point-of-contact" for the Redd Monitoring subtask. Dr. Dauble can be reached via phone at (509) 376-3631, FTS 444-3631. His FAX number is (509) 376-9201 or FTS 444-9601.

The Project Contact for the "Assistance in Columbia River Salmon Mitigation Analysis" will be Duane A. Neitzel during the conduct of the Redd Monitoring. Mr. Neitzel can be reached at (509) 376-0602, FTS 444-0602. His FAX is (509) 376-0302, FTS 444-0302.

Itemized listing of Government Furnished Materials/Services for Redd Monitoring

We are planning that the ACOE will provide the PNL redd monitoring staff with four hand-held two-way radios for in-field communication during the monitoring.

References for Redd Monitoring

Alderdice, D.F., and F.P.J. Velsen. 1978. Relation between temperature and incubation time for eggs of chinook salmon *Oncorhynchus tshawytscha*. Journal of the Fisheries Research Board of Canada 35:69-75.

Becker, C.D., D.A. Neitzel, and D.H. Fickeisen. 1982. Effects of dewatering on chinook salmon redds: tolerance of four developmental phases to daily dewaterings. Transactions of the American Fisheries Society 111:624-637.

Becker, C.D., D.A. Neitzel, and C.S. Abernethy. 1983. Effects of dewatering on chinook salmon redds: tolerance of four developmental phases to one-time dewatering. North American Journal of Fisheries Management 3:373-382.

Leitritz, E., and R.C. Lewis. 1976. Trout and salmon culture. California Department of Fish and Game, Fish Bulletin 164.

BENTHOS

Benthic invertebrates are an important food source for many fish species. In Lower Granite Reservoir, they are utilized by migrating salmon and steelhead as well as several resident species (Bennett 1988, 1990, 1991). In addition to being important food organisms, they also play various roles in the ecosystem in terms of processing organic matter, etc. Thus, it is important to ascertain the potential impacts of the experimental dewatering of Lower Granite Reservoir on this community.

Potential impacts upon the benthic community include: (1) desiccation and death, (2) scouring and transport by increased water current, (3) loss of habitat by scouring, and (4) forced migration, either by following the receding water levels or into the hyporheic zone if it is available. Of these potential impacts, the first is of vital concern, and can be quantified by appropriate sampling (see below).

Although our study efforts will be concentrated upon the benthic organisms inhabiting the soft-bottomed areas of the reservoir, there are two other biological communities affected by dewatering which should also be mentioned. These are the macroinvertebrates living on the rock rip-rap and the periphyton attached to the rip-rap. Caddisflies, mayflies, and other invertebrates inhabit the surfaces of the rock rip-rap (D. Bennett, personal communication). However, these organisms are insignificant as food items for the fish populations which feed mainly on the chironomids and oligochaetes inhabiting the soft bottom regions of the reservoir. Because the rip-rap fauna are not important as fish food, and also because they are extremely difficult to sample quantitatively without the use of artificial substrata, we will perform only a qualitative evaluation of the dewatering impact on this community as described below. The periphyton community is also an important component in many aquatic ecosystems in terms of energy fixation and as a food source for a variety of organisms. However, we do not believe that it would critical to assess the impact of reservoir dewatering on this community in detail simply because (1) the community, *per se*, does not contribute directly to the salmonid food-web, and, most importantly, (2) it recovers rapidly (usually within a few weeks), and thus any loss because of desiccation would be rapidly replaced with little long-term impact upon ecosystem processes.

Recovery of the benthic invertebrate community is complex. In the soft bottom habitat, some organisms may survive a temporary dewatering by migrating into the hyporheic zone where moisture is still present. Others may encyst or have other mechanisms for surviving desiccation. Still other species, such as crayfish and some molluscs, are mobile enough to move with the receding water levels and thus avoid desiccating conditions. Recovery of this habitat, in terms of the timing of this experimental dewatering in spring, should also be relatively rapid for the insects because new colonizers will be emerging and ovipositing in spring and summer, as contrasted to a dewatering during winter when emerging insects are absent.

Objectives for Benthos

The two objectives of this Task are:

Objective 1: To quantify the impact of the experimental dewatering upon the benthic invertebrate community and determine the temporal sequence of recovery of the invertebrates following refilling.

To achieve this objective, it will be necessary to conduct sampling prior to the dewatering and subsequent to the dewatering, as described in more detail below.

Objective 2: To use the data gathered in Objective 1 to assess its usefulness for future evaluation and monitoring of dewatering operations.

To achieve this objective, we will evaluate the methods and results used in Objective 1 to assess their suitability and usefulness in designing evaluation and monitoring plans for use in future dewatering operations.

Description of Tasks for Benthos

Benthos Task 1. Determine the pre-dewatering population composition and density of the benthic macroinvertebrate community at three representative sites.

This will involve taking replicate benthic samples at three study sites in Lower Granite Reservoir. One study site will be selected in each of the three distinctive reservoir regimes found; they are: (1) from Lower Granite Dam (RM 109) to RM 127, (2) RM 127 to Silcott Island, and (3) Silcott Island to the confluence with the Clearwater River (D. Bennett, personal conversation). Samples of the soft-bottom habitats will be collected in the same three water strata as described in Bennett et al. (1988, 1990, 1991) using suitable dredge samplers. This will allow us to integrate their findings with those of this study. These strata are 0-15', 15-60', and >60'. Fifteen (15) samples will be collected in each stratum at each sampling site, a total of 135 samples (15 samples/depth x 3 depths x 3 sites = 135). Samples will be sieved on-site, preserved, and returned to the laboratory for sorting to taxon, counting, and weighing. Appropriate statistical methods will be used to evaluate the pre- and post-watering collections.

Benthos Task 2. Examine hyporheic habitats.

Where possible, qualitative examinations will be made in the hyporheous of dewatered habitats to attempt to determine if any organisms are avoiding desiccating conditions by retreating into these zones. Survivors will be important in terms of predicting recolonization dynamics. This task will be accomplished in both Little Goose and Lower Granite reservoirs when they are dewatered.

Benthos Task 3. Assess impact of dewatering on rip-rap benthos.

Following dewatering and before refill, qualitative examinations will be made of the rip-rap rock surfaces in Little Goose and Lower Granite reservoirs to evaluate the impact of desiccation upon the invertebrates and periphyton inhabiting this habitat. An attempt will be made to determine if any of these species could survive by either migrating with the receding water level or seeking refuge in the hyporheos.

Benthos Task 4. Assess the impact of dewatering and subsequent repopulation of the benthic macroinvertebrates.

Following refill of the reservoir, the benthic sampling described in Task 1 will be repeated immediately after refilling, and again and 1, 3, and 9 months following refill. This will involve collection of 540 samples (15 samples/depth x 3 depths x 3 sites x 4 visits = 540 samples). Sample processing will be the same as for Benthos Task 1.

Benthos Task 5. Assess the usefulness of this program in terms of future evaluation and monitoring of dewatering operations.

Following completion of the data analyses and conclusions found in Objective 1, we will assess the data and results in terms of their usefulness in designing future programs to monitor and evaluate dewatering operations.

Schedule for Benthos

Pre-dewatering

Quantitative sampling of macroinvertebrates at all study sites

During drawdown

Hyporheic examination
Examination of rip-rap benthic communities

Post-dewatering (immediately after refill and 1, 3, and 9 months after refilling)

Quantitative sampling of macroinvertebrates at all study sites

Specifications of the Reports to be Supplied for Benthos

Points-of-Contact for Benthos

Dr. C.E. (Burt) Cushing will be the PNL "point-of-contact" for the Benthos subtask. Dr. Cushing can be reached via phone at (509) 376-9670, FTS 444-9670. His FAX number is (509) 376-0302 or FTS 444-0302.

The Project Contact for the "Assistance in Columbia River Salmon Mitigation Analysis" will be Duane A. Neitzel during the conduct of the Redd Monitoring. Mr. Neitzel can be reached at (509) 376-0602, FTS 444-0602. His FAX is (509) 376-0302, FTS 444-0302.

References for Benthos

Bennett, D.H., L.K. Dunsmoor, and J.A. Chandler. 1988. Fish and benthic community abundance at proposed in-water disposal sites, Lower Granite Reservoir (1987). Completion report to U.S.A. C.E., 140 pp.

Bennett, D.H., J.A. Chandler, and L.K. Dunsmoor. 1990. Lower Granite Reservoir in-water disposal test: results of the fishery, benthic and habitat monitoring program-year 1 (1988). Completion report to U.S.A. C.E., 251 pp.

Bennett, D.H., J.A. Chandler, and G. Chandler. 1991. Lower Granite Reservoir in-water disposal test: monitoring fish and benthic community activity at disposal and reference sites in Lower Granite Reservoir, Washington Year 2 (1989). Draft completion report to U.S.A. C.E., 168 pp.

MACROPHYTES AND OTHER HABITATS

Aquatic macrophytes are important in aquatic ecosystems in that they provide shelter for organisms, substratum for attachment by certain sessile organisms, oxygen to the water, and, upon death and decomposition, an important detrital food source for many organisms. Dewatering of the Lower Granite and Little Goose reservoirs will likely impact macrophyte beds, and it is important to determine what, if any, impact the dewatering has upon these communities.

Macrophyte beds may not be prominent at this time of year, and may consist only of the rooted parts and masses of last year's dead growth. Depending upon the time of year, dewatering could potentially impact macrophytes by desiccation and possible scouring of the substrate if increased current velocities occur.

Objectives for Macrophytes and Other Habitats

The two objectives of this Task are:

Objective 1: To assess the impact of dewatering on aquatic macrophytes and other aquatic habitats.

To achieve this objective we will make qualitative observations of any macrophyte beds found in the dewatered zones of both Little Goose and Lower Granite reservoirs.

Objective 2: To use the data gathered in Objective 1 to assess its usefulness for future evaluation and monitoring of dewatering operations.

To achieve this objective, we will evaluate the methods and results used in Objective 1 to assess their suitability and usefulness in designing evaluation and monitoring plans for use in future dewatering operations.

Description of Tasks for Macrophytes and Other Habitats

Macrophytes and Other Habitats Task 1. Assess the impact of dewatering on aquatic macrophytes.

Following dewatering, observations will be made to determine if aquatic macrophyte beds were impacted. This will be largely qualitative in nature, and entail observations of the extent of macrophyte beds which are uncovered, and the fate of the above sediment parts, if any.

Macrophytes and Other Habitats Task 2. Assess the usefulness of this program in terms of future evaluation and monitoring of dewatering operations.

Following completion of the examination of macrophyte beds, we will assess our observations in terms of their usefulness in designing future programs to monitor and evaluate dewatering operations.

Schedule for Macrophytes and Other Habitats

During drawdown

Visually assess the condition and impacts to macrophyte beds

Specifications of the Reports to be Supplied for Macrophytes and Other Habitats

Points-of-Contact for Macrophytes and Other Habitats

Dr. C.E. (Burt) Cushing will be the PNL "point-of-contact" for the Benthos subtask. Dr. Cushing can be reached via phone at (509) 376-9670, FTS 444-9670. His FAX number is (509) 376-0302 or FTS 444-0302.

The Project Contact for the "Assistance in Columbia River Salmon Mitigation Analysis" will be Duane A. Neitzel during the conduct of the Redd Monitoring. Mr. Neitzel can be reached at (509) 376-0602, FTS 444-0602. His FAX is (509) 376-0302, FTS 444-0302.

APPENDIX D

DISSOLVED GAS

WATER QUALITY MONITORING

DISSOLVED GAS

(This work will be accomplished by both Corps of Engineers personnel, and Dr. Brian D'aoust, Common Sensing, Inc.)

The primary objective of this monitoring is to determine the levels of dissolved gas supersaturation that will occur with consecutive reservoirs at near spillway crest elevations, and over as wide a flow range as possible. Dissolved gas levels will be monitored above and below Lower Granite Dam before, during, and after periods of spill during the stilling basin test, and during any subsequent tests performed once both pools are at near spillway crest elevations. Stationary tensionometers will be mounted on the upstream face of the dams and on the spillway shore approximately one-quarter mile downstream (all four lower Snake dams). These instruments will record dissolved gas levels and temperatures on an hourly basis. Immediately prior to initiation of spill, transects will be taken across the reservoir in the forebay of Lower Granite Dam. Dissolved gas levels will be recorded at surface and 15' depth (compensation point) at approximately 1000 foot distances. Following a one-hour stabilization period, transects (at north, center, and south locations across the river, surface and 15' depths at each) will be taken in line with the downstream stationary tensionometers, and at one-mile intervals for the remainder of the spill duration. Dissipation rates will also be evaluated through use of the forebay instruments at subsequent dams. This test procedure will be repeated each day during the stilling basin test operations.

Upon completion of stilling basin tests and reservoir drafting of pools to near spillway crest elevation and to natural river flow conditions below Lower Granite (if flows will allow), the following monitoring procedures will be implemented under each of the scenarios noted in Table 1, which are dependent on flows. (It is assumed that all flow possible will be passed through the powerhouse during the night, and testing of spillway versus powerhouse flows will occur during the regular working day.) Stationary tensionometers will continue to record dissolved gas levels on an hourly basis. Transects will be taken, as explained above, except that the additional time frame up to 8-10 hours (instead of only 2+) may be used to track the rate of dissolved gas level dissipation as the supersaturated water moves downstream. Transects will be taken every mile for the first four miles, then every other mile for the next six, and finally every five miles after that until reaching Little Goose forebay. (If Little Goose is forced to spill, this procedure will also take place below this project as well, using Corps personnel.)

Data will be analyzed to determine at what head and tailrace levels the conditions are created which result in increased dissolved gas supersaturation. These data potentially will be

TABLE 1

Near Spillway Crest
Possible Evaluation Schedule

River Flow and NSC	Days at Near Spillway C. (both pools)	Spill Only	Spill and Turbines
80 kcfs 696	2	- 1 day 100% spill - 1 day various spill levels fluctuating FB ± 1 foot.	- 1 day 100% spill - 1 days of alternating 60 k spill/20 k turbine 40 k spill/40 k turbine 20 k spill/60 k turbine
100 kcfs 698	4	- 1 day 100% spill - 3 days various spill levels fluctuating FB ± 1 foot.	- 1 day 100% spill - 3 days of alternating 80 k spill/20 k turbine 60 k spill/40 k turbine 40 k spill/60 k turbine 20 k spill/80 k turbine

Example of various spill levels:
60 kcfs spill for 2 hours
40 kcfs spill for 2.5 hours, FB raises 1 foot
60+ kcfs spill to lower pool
60 kcfs spill again
40 kcfs spill again

Acceptable spill levels will depend upon results from stilling basin test an sectional model analysis.

evaluated along with sectional model studies ongoing at Waterways Experiment Station and to further calibrate dissolved gas mathematical models under these extreme operating conditions. Model studies, and possibly observations made at near spillway crest elevation, might be used to investigate what, if any, structural adjustments could/should be made to ameliorate dissolved gas levels.

In the event that turbines cannot be operated as the reservoirs are drafted and refilled during this test process, and model tests indicate that spill is acceptable as long as Lower Granite tailwater is maintained within normal operating pool elevations, water flow may be passed over the spillway. The decision on this element will be made sometime in late January based on modelling results. If spill is acceptable, dissolved

gas levels will be monitored. Should dissolved gas supersaturation levels exceed those acceptable to fall chinook fry, the test will be stopped and refill initiated. This is to protect possible fall chinook fry below Lower Granite.

APPENDIX E

WILDLIFE

WILDLIFE MONITORING
PLAN OF ACTION

1992 RESERVOIR DRAWDOWN

The monitoring plan of action as follows will cover the entire period of the drawdown for 1992. Activities will begin on March 1 and end July 31. There will be two phases to monitoring of wildlife concerns.

The first phase (Phase I) will run concurrently with the drawdown test, March 1-31. Goal will be to account for impacts caused to wildlife and their habitats due to the near spillway crest drawdown of the Lower Granite Reservoir and it's associtated carryover to Little Goose Reservoir. Phase II will concentrate on monitoring the aftermath of noted impacts to habitat and wildlife populations. This period will begin April 1 and end July 31. Phase II efforts will be less intensive, however, may provide a better look at the impacts.

OBJECTIVES

The objectives of this monitoring plan of action include:

1. Evaluate impacts to Canada Goose, other waterfowl and shorebirds.

2. Monitor impacts to wetalnd and riparian habitats.

3. Monitor impacts to furbears.

4. Document observations of all impacts ands predation which could be used in preparation of long-term monitoring and mitigation recommendations.

PHASE I

The following actions will be taken:

ACTION 1: Two fixed wings aerial photography flights will be made. The first flight will be done on Little Goose and Lower Granite Reservoirs. The initial flight will be scheduled and flown at the begin of the drawdown when the two reservoirs are at Minimum Operating Pool (MOP). The second flight will coincide with the lowest level the two reservoirs will reach. Both of these will have to initiated by a individual who controls the drawdown actions so the flights are conducted as near the target elevations as possible.

ACTION 2: In addition, there will be requested oblique photography required of designated locations along both reservoirs to provide close to ground perspectives of the impacts. The obliques known to be needed at this point include:

LOWER GRANITE RESERVOIR

1. Areas above Asotin, WA where the slack pool transitions into free flowing river.
2. Asotin Slough
3. Confluence of the Clearwater River with the Snake River.
4. Both Goose Pastures on the Clearwater River, as well as Upper and Lower Hog Island.
5. Confluence Island
6. Wilma HMU
7. Chief Timothy HMU
8. Silcott Island
9. Alpowa HMU
10. Moses HMU
11. Steptoe Canyon Pond
12. All miscellaneous ponding landward of the railroad tracks on the North Shore
13. Kelly Bar and Centennial Island
14. Knoxway Canyon
15. Klug Canyon
16. Wawawai Canyon/Pond
17. All new islands that appear in the reservoir

Little Goose Reservoir

1. Illia Dunes - Downstream Half
2. Almota Canyon
3. Beckwith Bar HMU
4. Schultz Bar HMU & Island
5. Swift Bar HMU
6. Penawawa HMU
7. Rice Bar HMU
8. Willow Bar HMU
9. New York Bar HMU
10. New York Island
11. New York Gulch
12. Ridpath HMU
13. Dry Gulch
14. Deadman Creek
15. Meadow Creek
16. All new islands that appear in the reservoir
17. All miscellaneous ponding landward of the railroad tracks on the North Shore

ACTION 3: Physically monitor on a weekly basis selected areas within and along Lower Granite and Little Goose Reservoirs noting changes. Those areas requiring monitoring include:

1. All existing islands, looking for land bridge development.
2. River channel, looking for the reappearance of previous islands, eliminated by reservoir development.
3. Behavior patterns of Canada goose populations.
4. Existing goose nesting structures and their vulnerability caused by being made high and dry. Locate new sites for possible relocation of the tubs.
5. Exposed shorelines for the invasion of pioneer vegetation, as well as changes in established shoreline vegetation.
6. Signs of predation caused by ground predators on other wildlife species. Likely occurrance on nesting islands and shorelines of embayments/ponds which have been drawn down and increased exposure for wildlife.
7.

ACTION 4: Locate dens and areas of concentrated activity and monitor impacts through field observation of furbearer use in the Lower Granite and Little Goose Reservoirs. The primary furbearer of concern is the river otter as identified by the Lower Snake River Habitat Evaluation Program. The otter was selected as the species which is representative of furbearers for the Lower Snake River. Steps to be taken include:

1. Evaluate the HEP data for possible locations for dens and other activity.
2. Work with the Nez Perce Tribe to expand their existing radio telemetry efforts, to possibly incorporate otter activity of individuals.

ACTION 5: Locate and plant aquatic vegetation in selected locations. This work would be done within the upper three feet below MOP in the Lower Granite Reservoir. Develop a monitoring plan for the following four months of the study to determine the success of the plantings. Planting will be accomplished during the drawdown period. This work will be contracted out. The intent of the effort is to establish a reference point to determine mitigation requirements for long term drawdowns which might possibly be proposed. By selecting various plant species and utilizing several techniques, we will be able to monitor how effectively and economically we can mitigate for losses to shoreline in terms of wildlife protection and soil stabilization

PHASE II

The following actions will be taken:

ACTION 1: The photography will be used as the base to develop digital information using IRAS and the GIS system for creation of an area database and associated graphics. Acres and miles of exposed shoreline will be determined. In addition, the existing Lower Snake River cover type database will be overlayed to evaluate the impacts a long term drawdown would have on water associated vegetation. This work will be accomplished using in-house personnel.

ACTION 2: Goose nesting surveys will be conducted in early April and again in early May. In addition, a cliff nest survey will be conducted utilizing a helicopter and two observers. The cliff survey will be conducted as previous years, except restricted to Lower Granite and Little Goose Reservoirs. Ground surveys will be conducted by Corps personnel. Cliff nest surveys will be conducted under contract. Survey imformation will be compared to previous years and the average for all years.

ACTION 3: If radio telemetry work is initiated under Phase I, the monitoring of tagged individuals will continue through Phase II. This work would monitor the behavior and activities of only new individuals identified under this work. Individuals previously tagged and being montiored by the Nez Perce Tribe would not be included here. Observations of other furbearers would be noted during this work. The objective is to define the possible impact the drawdown would have on furbearers, in particular the river otter.

ACTION 4: The shorelines would be monitored for vegetation which pioneered on newly exposed shoreline, as well as the long term affect of the drawdown on water associated vegetation. Activities will also include monitoring of soil stability, soil accretion, soil moisture levels, and soil nutrient levels. The newly planted vegetation will be evaluated from the standpoint of ability to survive the environmental conditions, ability to stabilize the soil, value as a food source for waterfowl, value as a cover for numerous species of wildlife, and ability to outcompete undesirable plants.

APPENDIX F

CULTURAL RESOURCES

CHAPTER 7

A PROPOSED MONITORING PROGRAM FOR CULTURAL RESOURCES IN THE WALLA WALLA AND PORTLAND DISTRICTS

INTRODUCTION

Provisions must be made to monitor those sites eligible or deemed potentially eligible for inclusion in the National Register of Historic Places. In addition, the proposed drawdown scenarios for the reservoirs of concern may expose new cultural resources eligible for inclusion in the National Register. An effective cultural resource monitoring program for any reservoir or waterway must recognize that there are discrete zones of differential impact within a typical reservoir (Lenihan et al. 1981; Ware 1989). The three impact zones most critical to the archaeological resources in the study area and concerned projects are: (1) the conservation pool, (2) the fluctuation zone, and (3) the backshore zone (Lenihan et al. 1981; Ware 1989). A successful monitoring program and management strategy for cultural resources must therefore understand the primary impacts that occur within each of these zones.

As noted by Ware (1989:20), mechanical impacts dominate during the initial flooding of a reservoir. Once the final conservation pool level is established, however, biochemical processes stemming from sediment and water storage predominate (assuming underwater soil movement and slumping has stopped) (Lenihan et al. 1981). In contrast to the conservation zone, the fluctuation zone is continually affected by mechanical processes associated with wave and wind action; human activities and biochemical processes are also very active in this zone (Lenihan et al. 1981; Ware 1989). In contrast, the backshore zone is seldom affected by inundation, but is subjected to varying degrees impacts associated with human activities and development (Lenihan et al. 1981; Ware 1989). Of the three reservoir zones, the fluctuation zone is by far the most seriously impacted zone in terms of adverse impacts to cultural resources. Any monitoring program of cultural resources within a reservoir should therefore give priority to those resources in the fluctuation zone.

According to Webster's II New Riverside Dictionary (1984:765), the term monitor is defined as "A device for recording or controlling a process or activity," and "To check systematically or scrutinize for the purpose of collecting specified categories of data." The monitoring program proposed here is focused on the field examination of known or potentially significant cultural resources in each of the Walla Walla and Portland projects (reservoirs) so that their condition and state of preservation can be evaluated and documented. The methods of field recordation and types of data that should be documented are discussed below.

In the proposed monitoring program presented here, priority is given to those significant or potentially significant cultural resources

in the fluctuation zone. Priority is given to these cultural resources because the fluctuation zone is the area within a reservoir where "virtually all categories of resource impacts are magnified, with mechanical hydrological impacts constituting the greatest threat to cultural resources" (Ware 1989:26). Cultural resources in the backshore zone are given lower priority in the proposed monitoring program as they are and will be least affected by the drawdowns. Long-term management recommendations (i.e., monitoring) of significant or potentially significant cultural resources located in the conservation pool are discussed separately.

A PROPOSED MONITORING PROGRAM FOR CULTURAL RESOURCES IN THE WALLA WALLA AND PORTLAND DISTRICT PROJECTS

Monitoring Cultural Resources in the Fluctuation Zone

Pedestrian Shoreline Surveys

Continued monitoring of the impacts of raising and lowering the reservoirs to facilitate salmon runs should be implemented to assess the impacts of the proposed drawdowns on significant and potentially significant cultural resources. The monitoring program for the fluctuation zone should also be structured to locate and record any new cultural resources that might be exposed. . At Wells Reservoir, for example, a shoreline monitoring program was implemented as a result of a two-foot increase in pool level (Chatters 1986). Monitoring was annual for the first three years, and once every three years thereafter. Thirteen new sites were discovered in the first three years, several of which were tested or protected in place (Grabert and Griffin 1984; Griffin and Griffin 1985; Reid and Zweiffel 1986).

However, the pool level fluctuations proposed for the seven projects in this study will be of greater magnitude than the pool level fluctuations at Wells Reservoir; additionally, the proposed drawdowns will be implemented on an annual basis to enhance the success rate of the salmon runs. Assuming the reservoirs of concern in this study are lowered on an annual basis on the Columbia and Lower Snake rivers, the frequency of pedestrian shoreline monitoring will probably need to be more frequent. If annual drawdowns are implemented to enhance salmon runs, it is recommended that field monitoring via surveys be conducted on an annual basis during the first two-three years to assess their impacts on the identified significant or potentially significant cultural resources on a project to project basis as needed. Specifically, it is recommended that all known or potentially significant cultural resources in each project be monitored during the first year, with follow-up monitoring during the following year. Depending on the findings of the monitoring program, a third consecutive year of monitoring may be necessary. If all seven projects will affected by drawdowns on an annual basis, sites of concern in each should be monitored on an annual basis for the first two-three years. If selected reservoirs will be affected on an annual basis, only they should be monitored annually during the first two-three years. After monitoring of the concerned sites has been completed for the first two

or three years, additional monitoring on a three-four year cycle is recommended to assess all impacts caused by the drawdowns.

Monitoring and Recordation Procedures

A total of 248 sites in the fluctuation zone of the Walla Walla and Portland projects have been identified as significant or potentially significant cultural resources that will require monitoring as a result of the proposed drawdowns (Table 7.1). The sites listed in Table 7.1 also includes those known to contain or possibly containing the remains of Native Americans (see below). Of the 100 sites recommended for monitoring in the Portland District, 12 are in the Bonneville Project, 13 are in The Dalles Project, and 75 are in the John Day Project. Among the remaining 148 sites selected for monitoring in the Walla District, 1 is in the McNary Project, 31 are in the Ice Harbor Project, 19 are in the Granite Goose Project, and 97 are in the Dworshak Project. The high number of sites in the Dworshak Project are due to the extreme high (1600 ft.) and low (1445 ft.) annual pool levels. Monitoring and field recordation procedures recommended for both Corps Districts are as follows.

Field inspection of significant or potentially significant sites in the fluctuation zone will require a minimum of two to four individuals. Once a site to be monitoried is located, it is recommended that the site area exposed in the drawdown zone be walked over at 10-15 m transects. The width of the transects can vary depending on the type of landform being surveyed. In most instances, transects will be most easily walked parallel to the reservoir, particularly on steeper terrain; parallel and/or perpendicular transects can be walked on flatter terrain. The transects should be walked in zig-zag fashion to increase coverage of the site area. During the survey, pinning flags should be used to mark the location of temporally or functionally diagnostic artifacts for surface collection; features such as hearths, clusters of artifacts such as bone, cores, fire-cracked rock, debitage, or possible depressions should also be flagged and their location plotted on a detailed topographic site map keyed to a permanent datum point (see below). Flagging of cultural material will also be necessary to delimit site boundaries and relative artifact densities; pacing, 50 m tapes, a transit, or a combination of all three methods should be used to determine the horizontal dimensions of each site. Evidence of vandalism should also be documented and noted on the topographic map.

Once the drawdown zone has been inspected, attention should then be given to the cutbank to determine whether artifacts, features, or volcanic ashes are present. The presence or absence of cultural material in the cutbank may be critical in determining whether intact cultural deposits remain. Bank-facing may be needed in some instances when slumpage obscures the cutbank. Likewise, areas inland from the cutbank should be inspected for cultural material if the vegetation cover permits to determine how far inland the site extends from the cutbank. Rodent burrow tailings, disturbed areas, and other areas devoid of vegetation should be inspected during this time. Although augering or shovel probes could be used to determine the extent of subsurface deposits inland from the cutbank, field time and costs to

examine each site in such a manner would also be increased significantly. The location of paleoenvironmental features such as volcanic ashes should be plotted on the site map. Once the boundaries and distribution of cultural materials has been determined, the site should then be recorded on appropriate USGS maps and U.S. Army Corps of Engineers topographic maps (1"=500 ft.). The location and boundary of each site will also need to be compared to extant site forms and maps to assess the accuracy of previous recordation procedures.

Site mapping is strongly recommended as a means of establishing control over the provenience of features, topography, the location of surface collected artifacts, and erosion. All site mapping should make use of a permanent datum point set in concrete (Lenihan et al. 1981:10-7) tied to a feature or landmark above the high pool level when possible, "a USGS bench mark or similar permanent point" is desirable (Lenihan et al. 1981:10-7). The permanent datum should be used to establish photographic reference points, as well as markers for monitoring erosion. Contour intervals sufficient to demonstrate the terrain and changes in elevation should be used; the detail of each map, however, will vary depending on its size and complexity (Lenihan et al. 1981). Secondary datums should also be established above the maximum pool level as a precaution should the primary datum be disturbed or removed. The primary and secondary datums "should be clearly marked or labeled: 'Federal Property Do Not Remove' as suggested by Lenihan et al. (1981:10-8).

If the sites of concern are monitored annually for two or three years, it is recommended that some means of determining erosional rates be implemented. Several techniques or methods might be used, including the placement of plastic PVC pipe, steel pipe, rebar, or other reference markers along the cutbank and a set distance inland from the cutbank (Lenihan et al. 1981:10-5). These markers can be labeled or number in some fashion and their location included in the site topographic map. The markers placed along the cutbank can be used during follow-up monitoring visits to calculate the rate of erosion along the cutbank from the previous year. The use of a transit will enhance the accuracy of such an undertaking. If the markers placed near the edge of the cutbank are gone during the following monitoring inspection, it can be assumed they were claimed by erosion or displaced by other causes. Measurements taken from the inland markers, however, can then be made to determine how much of the cutbank was lost (if any). A more detailed discussion of monitoring erosion at the site and project level is presented below.

During the course of this project, site inventory forms from both the Walla Walla and Portland Districts were extensively utilized. Although similar types of information are included on each form, there were also considerable differences. Several important information categories such as cultural affiliation, elevation, site size, and site condition were either completely absent or stated in such a general manner it was unclear what was being described. In some cases, for example, it was uncertain whether a site was completely or partially inundated. In other cases, the observed cultural material or features were not described. It is strongly recommended, therefore, that the

site forms for both Districts be standardized during the monitoring project so that the recorded data for each site in each project is comparable to one anther at the intra- and inter-project level.

At a minimum, it is recommended that each cultural resource inventory form include the following information categories: (1) date compiled; (2) name of the form compiler(s); (3) county and site number/ site name; (4) field or other site designation (e.g., temporary site number/name); (5) site location data (UTM coordinates and legal description, as well as elevation); (6) USGS map quad name, series, and date, as well as other maps (type, source, and date); (6) drainage (major or minor) and river mile; (7) aspect and slope; (8) description of site location (general to specific), including how to relocate site; (9) narrative description of site; (10) site type; (11) cultural affiliation; (12) site dimensions (length, width, and depth) and method of measurement; (13) type of vegetation present; (14) landform type (e.g. stream margin, terrace, fan, etc.); (15) narrative description of observed cultural material and features; (16) method of collection if applicable; (17) site age if known or estimated on basis of temporally diagnostic artifacts; (18) site condition (e.g., severely eroded, stable, etc.); (19) who observed the site and their affiliation, and the date the observations were made; (20) previous work (references); (21) site ownership; (22) photographic documentation (e.g., color slides, roll number x, frames a and b, etc.); (23) space for the attachment of a xerox copy of the appropriate USGS quadrangle section showing site location, name of quad, series, and date; and (24) a sketch map of the site showing known and/or possible boundary, scale, north arrow, and location of features, artifact clusters, or other site attributes that would make relocation and identification easier. U.S. Army Corps of Engineers reservoir maps showing the location of individual sites might also be included as part of the documentation if available. Should tools or other artifacts be collected during monitoring, sketches or photographs should be made and included as part of the inventory form, as well as an artifact inventory form that lists the provenience, artifact type, and finder; if the artifacts are curated, the location of the curation facility should be identified as well.

The existing inventory form used by the Walla Walla District is two pages in length, while many of the older Portland District forms are one page long. The categories of information proposed above will require a form that is at least 5 to 6 pages long. As a consquence, more time will be required to complete each form for each site inspected during the monitoring program. The proposed form format, however, will alleviate the need of referring to separate topographic maps, forms, and relevant references to ascertain the status of individual sites. The present system used by both Districts has been time consuming in terms of consolidating information from a variety of sources into tabular form presented in this report.

Photographic documentation of the monitored sites using both black and white prints and color slides should be accomplished. The photographs should include a general view of the site area; depending upon site size, several photographs may be needed to better document the extent of the cultural resource. It is strongly recommended that these

photographs be taken from established reference points that can be relocated during later monitoring efforts. If reference points can not be located from which photographs can be taken, datums may need to be established using rebar or brass hubs anchored in concrete. Such reference points or datums should be located on a topographic map of the site. Ideally, a compass should be used so that the angle at which the photograph was taken can be logged by azimuth (i.e., compass bearing taken clockwise in degrees from magnetic north). Additional photographs of visible features, artifact concentrations, volcanic ashes exposed in cutbanks, and other salient attributes of the site should also be taken. It is also strongly recommended that photographs be taken of the cutbanks so that the extent of erosion caused by the fluctuating pool levels can be documented during each site visit. Such documentation will be critical for assessing the general nature and rate of erosion at each site. Following Lenihan et al. (1981:10-11), the following information should be recorded on photographic record forms:

Name of reservoir
Date
Site number/site name
Type of film used (B/W, color slides)
ASA

Camera and lens type

Photographic station from which picture was taken

Camera direction

Subject description (e.g., feature number or type, artifact type, and so forth)

Frame number

Photograph catalogue number

Monitoring of Known or Possible Burial Sites

In Chapter 3, a number of archaeological sites in all the Corps projects were identified that either contained Native American human remains, or had one or more burials removed during the course of testing projects or during data recovery. Known or possible burial sites located in the fluctuation zone that may be adversely affected by the proposed drawdowns are listed in Table 7.1.

Both Oregon and Washington (Public Law 101-601--Nov. 16, 1990) have passed burial laws that makes the intentional disturbance of Indian burials a felony. Briefly, both the Oregon and Washington burial laws state that individuals 1) shall not willfully remove, deface, mutilate, or destroy any cairn or grave; 2) can not possess artifacts removed from a Native American burial; 3) can not publicly display Native human remains; 4) can not sell Native American artifacts or human remains removed from a grave; 5) archaeologists can not excavate a Native American cairn or grave without written permission from the State

Historic Preservation Office and the written consent of the appropriate Indian group of concern; and 5) that all artifacts and human remains removed during the course of archaeological excavation be reinterred under the supervision of the concerned Indian group at the expense of the archaeologist.

Given the number of sites in all project areas known or suspected of containing the remains of Native Americans, it is strongly recommended that any monitoring program implemented by the Corps of Engineers as a result of the proposed drawdowns include the annual inspection of such sites. Field inspection should include sites along the reservoir margin. Depending on the magnitude of the drawdowns within each project, those sites known or suspected of containing human remains that will be exposed in the conservation zone of each project should be considered for monitoring as well; whether these sites (Table 7.2) should be included as part of the immediate site monitoring program is contingent on how low each reservoir will be lowered to facilitate salmon runs.

It is recommended that such monitoring take place annually for no less than two years. If monitoring during the first two years fails to locate eroding human remains, or only occasional evidence of burial erosion, field inspections may be reduced to once every three to four years. The annual inspections may need to be continued, however, in areas or sections of projects if human remains are found eroding or exposed on a regular basis.

Input from all Native American groups of concern should also be considered in this aspect of the proposed monitoring program. Some groups may wish the remains of their ancestors to be left as is in the reservoir, even though they are being exposed or eroded. Other groups may want the human remains collected for reburial elsewhere. In either case, it will be necessary that the Native American group of concern be consulted and alerted to the fact that remains are exposed or being eroded. Any decision made concerning the fate of newly discovered Native American remains should be made in close consultation with the group of concern and the State Historic Preservation Office. Human remains should not be subjected to laboratory processing, cataloguing, or scientific examination without the consent of the concerned Native American group as well.

Monitoring Cultural Resources in the Backshore Zone

The lowest priority for the monitoring of cultural resources in each project should be given to those prehistoric and historic sites located in the backshore zone. This is not to say these cultural resources are not as important as those located in the fluctuation zone, but that they are affected primarily by human and land use related activities rather than mechanical processes associated with fluctuating pool levels. As noted in a recent government publication, "Perhaps the most important area for future research....associated with cultural resource management is the reservoir backshore area" (U.S. Army Corps of Engineers 1990f:6; see also Ware 1989; Lenihan et al. 1981).

The backshore areas along the margins of the reservoirs have attracted campgrounds, picnic areas, housing developments, boat ramps, trail networks, roads, parking areas, livestock grazing, and other developments (Ware 1989:29). While monitoring backshore resources along thousands of miles of inland shoreline is possible, it would be a costly and time consuming undertaking, and may be only a partial solution to resolving impacts to archaeological sites (Ware 1989:32). A summary of cultural resource sites located in the backshore zone of the concerned projects is presented in Table 7.2. Among the -- backshore sites in both the Portland and Walla Districts, nine are in the Bonneville Project, 31 are in The Dalles Project, 46 are in the John Day Project, 8 are in the McNary Project, six are in the Ice Harbor Project, and 36 are in the Granite/Goose Project.

In many instances, backshore areas managed by the Corps of Engineers consists of recreational facilities that are maintained on regular basis. It is proposed here that Corps personnel or contractors responsible for maintaining these facilities be alerted to the presence of cultural resources and to inspect their condition periodically. Although casual artifact collection will, in all likelihood, go unnoticed, intentional acts of vandalism such as illegal digging or defacing of rock art will be detectable and can be reported to the proper authorities. Likewise, backshore areas within the boundaries of recreational facilities operated by the Corps and known to be frequented regularly by relic collectors could be inspected on a more frequent basis by Corps personnel. Additionally, any plans for construction or development that might involve ground disturbing activities should be cleared with the District archaeologist to determine whether a cultural resource will be adversely affected. Long-term management considerations for periodically monitoring all backshore zone cultural resources are further discussed below as part of long-term management and monitoring options.

LONG-TERM MANAGEMENT AND MONITORING OPTIONS

Because of the magnitude of erosion and other mechanical processes that have negative impacts on cultural resources, sites located within the fluctuation zone have been given priority in terms of monitoring because of the proposed drawdowns. Once the initial field monitoring has been completed, however, other techniques of monitoring negative impacts to cultural resources in the fluctuation zone should be considered as part of a long-term management plan. In this section, aerial photography as a means of monitoring both site erosion and vandalism are considered. The monitoring of backshore cultural resources and newly exposed cultural resources in the conservation and fluctuation zones are also discussed.

Aerial Monitoring of Bank Erosion and Vandalism

Archaeological resources, whether historic or prehistoric that will be or have been innundated by reservoir construction and operation have to varying degrees been located and documented through surface surveys. Under various historic preservation laws, the adverse affects

to those sites have been mitigated by recordation, testing, and/or data recovery excavations. In many instances, however, sites with significant or potentially significant value and located above the maximum pool elevations are generally not accorded the same treatment (Ebert et al. 1987). As mandated by various laws, such sites when located on Federal property are to be managed equally. Unfortunately, many of these sites are presently being subjected to bank erosion, a problem not fully anticipated when the reservoirs were constructed. It is a ongoing problem that will ultimately result in the loss of many of the cultural resources in the study area.

A recent study undertaken by Ebert et al. (1987) examined the feasibility of photo-interpretation and measurement of bank erosion using sequential, historical aerial photographs to 1) document the loss of sites located along reservoir margins; 2) model natural and cultural factors affecting rates of erosion between and within sites; 3) predict the location and rate of future bank erosion; and 4) compile priority lists for the treatment of sites as part of a project management plan.

During the study by Ebert and his associates initiated in 1986, a suite of twelve sites recommended by the U.S. Army Corps of Engineer Omaha District located along the Middle Missouri River. Their analysis focussed on:

> a) the site, a more or less arbitrarily defined unit based on the extent of cultural features like housepits...;
>
> b) bank erosion, and variability in that erosion within site "areas"- a 2 km long shoreline section with the site at its center; and
>
> c) bank erosion, and its predictability, from the perspective of the overall Middle Missouri River system (Ebert et al. 1987:17).

The investigators used aerial photographs from several government repositories taken in series between 1938 and 1986. The earliest photographs documented prereservoir erosion and conditions. Stereo photo-interpretation was aimed at distinguishing bank (more grayish) from beach (very light toned) from waterline (almost black) (Ebert et al. 1987:20) on black and white photos.

To measure site erosion, an electronic enlargement-enhancement process was developed to examine the site areas, which were enlarged and electronically edge- and contrast-enhanced using analog video equipment. The results were photographed from video screens and further enlarged by projection onto base maps at a scale of about 1:1000. The position of the bank on each sequential aerial photograph for each site was then marked on the base maps, and the area of each site remaining at each date was measured digitally. The authors were able to determine that the change in site area was generally linear and amenable to linear regression models. This finding suggested that erosion rates are either relatively constant through time (although location dependent, or that initial erosion rates are high and then progressively decrease through

time (Gatto and Doe 1983, 1987). "With either possibility, however, the study sites, and other sites along the banks at Missouri River reservoirs, clearly are being destroyed at a predictable rate by bank erosion" (Ebert et al. 1987:23). The authors concluded that several sites would be completely eroded within the next 10 to 30 years. The study of the aerial photographs also revealed additional features missed or left unrecorded by previous investigators.

The study by Ebert et al. (1987) indicates that archaeologically relevant bank erosion can be measured using sequential aerial photographs. The accuracy and precision of such measurements can be quite high, especially when using larger-scale photographs. They also report that bank erosion, at least based on their study, was extremely variable even within sites. However, they propose that the observed variability was due to shore aspect, shore slope, and variations in fetch, factors that are predictable and thus may assist managers in prioritizing cultural resource management. On-site inspection, however, suggests that bank height may be the most important factor affecting erosion.

Grady (1986) conducted a photointerpretive evaluation of erosion and vandalism at Mud Springs Pueblo in Colorado using large-scale (1:20,000) black-and-white aerial photographs provided by the Soil Conservation Service. The purpose of the study was to determine whether this scale of photography could provide information sufficient to assess rates of archaeological site degradation resulting from natural causes and vandalism (U.S. Army Corps of Engineers 1990d). Additional photo coverage by Grady shot at an approximate scale of 1:3,600 were also evaluated. Although the 1:20,000 scale photographs were useful in measuring erosional rates through time, surface features and other site attributes could not be analyzed in detail. In contrast, however, the 1:3,600 scale photographs provided the detail necessary to identify small-scale vandalism such as illegal digging, as well as inform on site features and spatial relationships.

On-Site Monitoring of Erosion

Assuming aerial photographs are used as a means of monitoring erosion rates in each project, the results or conclusions measured or interpreted from this type of data should be verified with field inspections. Measurements of portions of bank lines at a sample of sites within each project from the ground should be compared to those measurements taken from aerial photographs to verify their accuracy or consistency through time. Field inspections will also facilitate ground photographs characterizing bank conditions and allow supportive observations (Ebert et al. 1989).

Ideally, a detailed contour map of each site should be used (or constructed if necessary) tied to two or more permanent datum points such as brass disks set in concrete (Baker 1988; U.S. Army Corps of Engineers 1989a). The datum points should be established at the upstream and downstream ends of the site a minimum of 25 m inland from the reservoir margin when the site is located at and/or near the maximum pool level. Control points to be used to match mapped bank lines from

aerial photographs should also be shot in during mapping. Datum points placed at sites contained entirely in the drawdown zone may require attachment to short poles or concrete blocks that protrude well above the site surface to ensure their being relocated during subsequent inspections. This technique will ensure establishing both vertical and horizontal control during future work at each site.

Once established, the base line can provide points from which erosion rates can be measured (Baker 1988). If the baseline is established so as to parallel the reservoir channel, distances can be taken at 90 degree increments from the baseline. The intervals of measurement to monitor the rates of erosion will vary from site to site depending on the types of sediment present and the perceived rate of erosion; areas clearly showing signs of active erosion should, however, be monitored at close intervals to more accurately characterize the continuing rate of erosion.

Monitoring Cultural Resources in the Backshore Zone

Long-term management of cultural resources presently located in the backshore zone of each project should include a monitoring program whereby sites are inspected by professional archaeologists. Although Corps personnel may be able to monitor the status and condition of sites on properties such as campgrounds and parks, many sites of concern are well-removed from such public areas and therefore can not be routinely inspected to assess their condition. It is likely, however, that in some areas a drawdown will provide pedestrian access to areas normally avoided by or inaccessible to the general public. Such conditions may lead to increased acts of vandalism to cultural resources.

In general, the methodologies for monitoring cultural resources in the backshore zone should mirror those proposed for sites in the fluctuation zone. Topographic maps for each site that include a permanent datum and photographic stations are strongly recommended to ensure that each monitoring event are comparable to one another. The topographic maps should include site boundaries, any surface features that might be present, the locations of artifact clusters, and the locations of any temporally or functionally diagnostic artifacts that might be collected. Any evidence of site vandalism should also be plotted on the topographic maps. Photographic documentation of each site should also follow those procedures outlined for sites in the fluctuation zone.

Because the backshore zone sites will not be directly impacted by fluctuations in the pool level, the procedures discussed for monitoring erosional rates are not applicable for the sites of concerned. How often each significant or potentially significant site in the backshore area should be monitored, however, is difficult to determine. It is therefore proposed here that priority be given to those sites known to be frequented by vandals. Based on the present site forms available for several projects (e.g., The Dalles, John Day), vandalism appears to vary considerably from project to project in terms of frequency and magnitude. Several vandalized rock art sites in The Dalles project, for example, are suspected of containing human remains and/or associated

subsurface cultural deposits (see Chapter 3). These sites should be given priority in terms of systematic monitoring. Sites located in areas scheduled for future development or other ground disturbing activities should also receive priority in terms of monitoring. Lowest priority in terms of monitoring is recommended for those sites that appear stable and unaffected by vandalism or other activities that might lead to their destruction.

OTHER MANAGEMENT CONCERNS: DREDGING AND AGRICULTURAL ACTIVITIES

Two secondary impacts to cultural resources that may arise as a result of the proposed drawdowns--dredging and agriculture (irrigation stations)--have not been addressed in the proposed monitoring program require brief mention as potential management concerns. Because both activities are considered secondary rather than primary impacts to cultural resources associated with the proposed drawdowns, they have not been included in the monitoring program for several reasons. First, the occurrence and magnitude of both activities will no doubt vary depending on how low each reservoir is dropped, the time of year, and the duration of the drawdown in each project. Unlike the anticipated fluctuations that will occur along the reservoir margins, therefore, dredging and irrigation-related activities that may adversely affect cultural resources will probably occur on a more or less random manner within each project and should be treated accordingly. Secondly, a dredging project or the construction of a new irrigation pumping station(s) will be site or area specific. As a consequence, on-site monitoring during each project or a pre-project survey of a proposed dredging or pumping station site will require individual attention, probably by one archaeologist.

Dredging Projects

In lieu of the proposed drawdown scenarios being considered by the Corps of Engineers for at least some reservoirs, the opportunity to dredge navigation channels and/or ports may present it self, particularly in those areas where extensive siltation has occurred. Field monitoring of such undertakings by a professional archaeologist is recommended so that previously unknown and unrecorded sites can be documented. Likewise, dredging in areas containing known but inundated sites of uncertain provenience should also be monitored to determine their exact location. Areas selected for the deposition of dredge spoils should also be surveyed for cultural resources that might be inadvertently buried by such activities prior to such an undertaking.

As noted in Chapter 5, there is growing evidence suggesting that archaeological materials displaced from sites during dredging or channelization activities still retain some scientific value. Even though the cultural materials have been displaced, they are generally placed in the general vicinity of the submerged site. As such, site locational data for recorded or even unknown cultural resources inundated within a reservoir can be established. Faunal remains and artifacts indicative of subsistence practices and site activities may also be located in dredge spoils. Studies of such deposits in

conjunction with historic data concerning site size and/or geologic data may allow reasonable reconstructions of the character of the site (U.S. Army Corps of Engineers 1988c). Additionally, material deposited by large mechanical dredges may exhibit or contain stratigraphic and contextual integrity.

Agricultural Activities (Irrigation Stations)

Should the proposed drawdowns drop reservoir levels below normal minimum operating levels, it is anticipated that some irrigation systems and pumping stations will be affected. Specifically, some irrigation systems may be left "high-and-dry," requiring the extension of pipe lines and perhaps additional pumps to irrigate orchards or other crops. It is recommended, therefore, that any such undertakings be monitored to ensure that known or unknown cultural resources are not adversely impacted. Ideally, a pre-construction survey of the proposed construction site is recommended to identify any cultural resource(s) that may be present and adversely impacted by such construction.

MONITORING OF SITES PROTECTED-IN-PLACE

Sites that may be selected for protection-in-place should also be considered for periodic monitoring once each stabilization project is completed. The initiation of a preservation technique does not guarantee that the decay or erosion process will be halted or slowed. In some instances, the selected preservation technique may fail or not provide the anticipated control. It is therefore recommended that an effective program of site preservation must include as one component periodic site inspections to record site condition, changes in site condition since the site was recorded or last inspected, evaluate the success or failure of preservation attempts, and recommend upgrading or maintenance of the preservation strategies employed (U.S. Army Corps of Engineers 1989a).

Monitoring of each site should include regularly scheduled inspections for the purpose of continuing the protection of the cultural resource. At a minimum, the monitoring should ascertain and record the condition of the site and the in-place protection technique employed. Any problems of stability should be identified, documented with photographs and measurements if necessary, and possible solutions identified. Although problems with the protection method may be easily identified, problems with monitoring the condition of buried or protected archaeological resource may be more difficult. If the site was buried as a means of protection, for example, it will be impossible to view the resource and its condition. Consequently, evaluation procedures should be considered into the total burial plan.

Post-burial tests may be necessary over the span of several years. Such tests can include test excavation by standard archaeological means, or boring placements. If the location of features is known, all tests should avoid them to prevent damage or destruction. Electronic monitoring of subsurface conditions might also be considered using

various metering gauges to record pressure and soil movement both vertically and horizontally.

To ensure some degree of compatibility and continuity in site inspections when several individuals or institutions will be involved in monitoring over an extended period of time, it is recommended that an archaeological site condition evaluation form be compiled. This form should include the sites number and name, locational data (state and county, legal description, UTM coordinates), site type and size, map reference, cultural affiliation, resource/project area, and date of the inspection. Summary areas for site condition, categories of site impacts and percentage of site impacted, specific impacts, methods of site stabilization, descriptions of current impacts, changes since last inspection, date of last inspection, estimates of future impacts, effectiveness of prior stabilization efforts, maintenance required, recommendations for future stabilization and cost factors, recommendations for current mitigation and cost factors, and recommendations and cost factors for future mitigation might also be included as part of this form (see Limp 1986). Additionally, the name and date of the recorder should be specified. This monitoring form or packet should also contain illustrations showing site location, details of site layout, and black-and-white photographs of the site area and any visible features. These figures will be useful in locating the site and specific areas of concern, determine the amount of deterioration that has occurred since the last visit, and assess the status of the stabilization method. During each visit, new black-and-white photographs should be taken of the site and areas of concern being monitored. These photographs can be compared against previous photo documentation, or used during later monitoring events (U.S. Army Corps of Engineers 1990e; Firor 1986; Firor and Eininger 1987).

SUMMARY AND DISCUSSION

To summarize, an effective cultural resource monitoring and management plan for reservoirs such as those associated with this study must recognize and understand that there are three primary impact zones within a typical reservoir: (1) the conservation pool, (2) the fluctuation zone, and (3) the backshore zone. Monitoring and management strategies must therefore reflect an understanding of all primary impacts to cultural resources that occur in each of these zones. Additionally, there are other factors that must be considered in terms of cultural resources present within each reservoir project. These considerations are discussed below.

Resurvey of Reservoirs

Surveys to locate, record, and evaluate cultural resources prior to passage of the National Environmental Policy Act in 1969 and subsequent issuance of Executive Order 11593 by former President Richard Nixon may not have been adequate by todays standards:

> Surveys done prior to passage of NEPA and issuance of Executive Order 11593 are often, if not usually, inadequate

> to assure compliance with the procedures. The idea of locating all possible historic properties and developing means of protecting their value was little developed when most surveys were being conducted under terms of the Reservoir Salvage Act...as were the techniques of systematic archaeological (and other) survey, description, and evaluation (King, Hickman, and Berg 1977:181).

During the River Basin Surveys, extremely large areas of terrain were surveyed by small crews in relatively short periods of time. Shiner (1950:1-2), for example, reports the John Day Reservoir was surveyed in June and July of 1950 by a two person crew, "aided during the first 10 days by" a third party. Among the 88 archaeological sites located, eight sites were recommended for excavation, 22 sites were recommended for testing, and three rock art sites were recommended for study (Shiner 1950:7).

Drucker's (1948) report on archaeological resources in McNary Reservoir indicates the work was accomplished by a two person crew during the summer of 1947. A total of 120 site were found in the pool area. Based on surface indicators, 21 sites were recommended for excavation, and 28 were recommended for testing. Historic investigations was recommended for one site. Drucker's (1948:9-10) recommendations did, however, recognize the importance of investigating major sites as well as less intensively used sites to gather a broad range of cultural material representative of the prehistory of the area.

Osborne (1948) describes the surveys of Ice Harbor, Lower Monumental, Little Goose, and Lower Granite reservoirs in his 1948 report. Ice Harbor was surveyed by a two person crew in the summer of 1948; no boat was available so several islands were not examined. Among the 16 recorded sites, three sites were deemed worthy of extensive work, and three others were deemed worthy of testing (Osborne 1948). The same survey crew examined Lower Monumental Reservoir and recorded 10 archaeological sites and one paleontological site. Four sites were recommended for extensive test pitting or trenching, and four were recommended for testing (Osborne 1948:10). Both Little Goose and Lower Granite were surveyed by two individuals. Among the 19 sites found in Little Goose, six were recommended for examination of which two were considered "worthy of excavation" (Osborne 1948:15). Two of 12 sites recorded in Lower Granite were recommended for excavation (Osborne 1948: 17), and three were deemed worthy of testing.

As can be seen by this brief review of the River Basin Surveys, field work was usually accomplished by small crews in relatively brief periods of time. Occasionally, some areas such as islands were not examined because a boat was not available. Funding levels for these surveys was also extremely low. Criteria used for the recording of sites was also different during the River Basin Surveys than criteria used during later surveys. Surveys during the 1950s, 1960s, and 1970s in some reservoirs identified additional sites missed during the River Basin Surveys. Limited but more intensive surveys in the 1980s have continued to add more sites to the cultural resource inventories for each reservoir considered in this study resulting in the site totals

summarized in tabular form in Chapter 3. Given the nature and magnitude of the proposed drawdowns being considered for some projects as an option to save salmon runs on the Snake and Columbia Rivers, there can be little doubt that recorded but unevaluated sites will be exposed, and that new sites will be exposed and require documentation and evaluation. It is therefore proposed that long-term management plans consider systematic resurveys of projects that will be affected by drawdowns that reach or near pre-reservoir stream levels.

Any archaeological resurvey initiated as a consequence of the proposed drawdowns within the projects of concern should, at a minimum, meet the following criteria:

(1) The completed fieldwork should be detailed enough that the significance or potential significance of each recorded site can be assessed in a preliminary fashion. Additionally, "the general nature of environmental and archaeological variability in a study area" should be documented (Doelle 1977:208).

(2) "Based upon the knowledge gained from the reconnaissance, plus the existing literature, *appropriate* research problems should be developed" (Doelle 1977:208). Specifically, the research questions posed should be "addressable" by subsequent study of cultural resources known to be present.

(3) Effective data collection and recordation methods should be developed. Site size, elevation, condition, solar exposure, distance from permanent water source, artifact categories and densities, environmental setting, and other relevant site attributes or characteristics should be recorded. Standardization of site inventory forms might also be considered so that inter-project comparisons can be made.

(4) Scheduling and budgetary concerns should be addressed well before a survey is initiated so that the above needs can be properly met during the fieldwork and reporting phases of specific projects.

Site Testing and Data Recovery

In addition to the above monitoring techniques, any long term plan for site management should be drafted that addresses site testing and/or data recovery in addition to other measures that might be recommended to reduce the impact of erosion and other destructive forces associated with reservoir drawdowns on archaeological sites. The National Reservoir inundation study of impacts to cultural resources concluded that detailed documentation and excavation of cultural resources within the conservation pool and shoreline fluctuation zone was usually the most effective and nearly always the least expensive method of mitigating adverse impacts prior to construction and inundation of the reservoir (Lenihan et al. 1981).

However, this study does not address cultural resources within the conservation pool zone that were not archaeologically sampled but were subsequently inundated with little or no knowledge of their content,

age, or integrity. As noted above, many archaeological sites went undetected during the "pioneering" surveys or were not recorded because they did not appear to be important. By todays standards, many of the sites excavated during the River Basin Surveys would be considered tested sites rather than mitigated ones. Additionally, the criteria used for selecting sites for testing and/or data recovery were most often governed by site visibility, artifact densities, and/or the presence of human remains. While future management of the cultural resources in the fluctuation and backshore zones in each project may entail some level of excavation to determine their integrity and significance or protection in place to prevent their loss, little consideration has been given to the future of sites in the conservation zone.

Lenihan et al. (1981), Ware (1989), and Brauner et al. (1975) report that the greatest damage to archaeological sites in the conservation zone occurs during dam construction (borrow pit excavation, vegetation removal, road construction, etc.) and initial filling of the reservoir. Concerning the potential integrity of inundated sites in the conservation zone, Ware (1989:21) states the following:

> "If cultural resources survive the initial filling episode, they may be expected to be buried under a silt mantle where stable anaerobic conditions may actually enhance long-term preservation of cultural values. Until such burial occurs, there is the likelihood of biochemical decomposition of cultural materials, especially perishable organics. In general, decay rates for organic materials will be highest in the shallow littoral zones of reservoirs, where aerobic conditions contribute to organic decay. Decay rates decrease with depth and are lowest in the anaerobic bottom sediments in the deepwater zones of reservoirs."

Substantial drawdowns to levels at or near the prereservoir stream level will expose large numbers of sites to mechanical and cultural processes that may impact them:

> "...In the event of a severe drawdown, a variety of mechanical and other impacts may occur that degrade or destroy cultural resources that survived the impacts of dam construction and initial reservoir filling. During severe drought-related drawdowns in several California reservoirs in the mid-1970s, the empty, vegetation-free reservoir basins attracted large numbers of off-road vehicles that virtually destroyed a number of archaeological sites that had survived for years under the silt and water column of the reservoir" (Ware 1989:22).

Ware (1989:22) further states that "If cultural resources survive the mechanical effects of the initial filling and subsequent drawdown episodes, the primary impacts to cultural resources in the conservation pool will be biochemical in nature." These biochemical impacts have been briefly described in a previous chapter and will not be discussed here further (see Lenihan et al. 1981, Vol. 2 for a detailed discussion).

It is likely, therefore, that many significant or potentially significant sites are located in the conservation zone. The vast majority of known residential or semipermanent winter villages are located in this zone, but were minimally examined before inundation, as were a number of rockshelters containing both cultural and ecological data sets (Table 7.). Large open sites including temporary camps, fishing locations, and so forth were also inundated without being properly recorded or examined. To understand the whole gamut of prehistoric cultural adaptations in each reservoir as manifested in the archaeological record, a sample of these sites will require reassessment via survey and some level of excavation to determine their integrity and significance. The number of sites to be examined will of course depend on the magnitude and frequency of the drawdowns proposed for each reservoir. Assuming the drawdowns are minor, relatively few sites in the conservation zone will be exposed.

ADDENDUM D

PUBLIC AFFAIRS PLAN

DEPARTMENT OF THE ARMY CENPW-PA 360-1-3
Walla Walla District, Corps of Engineers
City-County Airport
Walla Walla, Washington 99362

Regulation
No. 360-1-3

22 January 1992

Army Public Affairs
1992 COLUMBIA RIVER SALMON FLOW MEASURES OPTIONS ANALYSIS/EIS
RESERVOIR DRAWDOWN TEST

1. Purpose. To establish objectives, principles, guidelines and responsibilities for the leadership of the Walla Walla District, U.S. Army Corps of Engineers in the execution of a comprehensive and active Public Affairs program for the 1992 March Drawdown Test of the Columbia River Basin Hydroelectric Projects. It is a key element of the 1992 Columbia River Salmon Flow Measures Options Analysis/Environmental Impact Statement (OA/EIS).

2. Scope. This plan supplements the Walla Walla District Public Affairs Plan for "Shaping the Army of the 1990s and Beyond." This plan identifies tasks, provides guidance and delineates responsibilities for supporting the missions, objectives and initiatives of the Corps of Engineers in the execution of a positive, active and well-coordinated plan in support of the 1992 March Drawdown Test.

3. Applicability. This plan applies to the Corps' Walla Walla District staff and field elements before and during the four-week, two-reservoir physical Drawdown Test, which begins March 1, 1992. The Drawdown Test covers Lower Granite Reservoir, 38 miles from River Mile 107.5 to 70.3, and Little Goose Reservoir, 37 miles from River Mile 70.3 to River Mile 41.6 (see Project Maps, Appendix B).

4. Situation.

a. On Nov. 20, 1991, the National Marine Fisheries Service (NMFS) announced their decision to list Snake River sockeye salmon as endangered under the Endangered Species Act, effective Dec. 20, 1991. Spring/summer and fall chinook salmon stocks are expected to be listed as threatened/endangered species in early 1992.

b. The Corps, Bonneville Power Administration (BPA) and the Bureau of Reclamation (BOR) released an interagency draft OA/EIS on Sept. 27, 1991, identifying several options for operating Corps/BOR Columbia/Snake River hydroelectric projects in 1992 to:

(1) Assist several salmon species;
(2) Test project operations

c. Under the National Environmental Protection Act (NEPA) process, the Corps publicly announced its preferred alternative

at a region-wide news conference on Jan. 10, 1992.

d. At the request of NMFS, the Corps is preparing a biological assessment, including a four-week physical Drawdown Test of Snake River projects below normal operating range, beginning March 1,1992. The current Drawdown proposal (see Appendices C, D) is to lower:

(1) Lower Granite Reservoir to near spillway crest;
(2) Little Goose Reservoir 4 - 15 feet below minimum operating pool.

e. A Drawdown Test after March is unacceptable because of adverse effects on migrating salmon.

f. A minimum of four weeks is required to draw down the reservoirs, conduct tests and refill the reservoirs.

g. Preservation and timing of all operational options has become an important regional and national issue.

h. The decline of wild salmon stocks in the Pacific Northwest and its direct and indirect impacts on the Pacific Northwest region of the country offer opportunities to enlighten the Corps' publics on its new environmental direction and its stewardship in environmental matters.

i. It is important to note that, in the planning of Corps public affairs and public involvement activities for the Drawdown Test, the Walla Walla District gives due consideration to the vital roles played by BPA, BOR and fishery agencies in its operational and maintenance responsibilities.

j. The Walla Walla District has a small professional public affairs and public involvement contingent and, through an active Public Information program of regional public meetings and workshops, has an ongoing mechanism for public input into the March Drawdown Test (see Appendix A). The district:

(1) Publishes a weekly Information Bulletin and a quarterly news magazine with project news for the Corps family, and during abnormally high or low water conditions in its reservoirs, takes an active stance in cultivating public understanding.

(2) Is heavily involved in the preparation and publication of audiovisual information programs, news releases, newsletters, fact sheets, and brochures.

(3) Has a Public Outreach Program with an active Speakers Bureau and special school instructional programs.

k. The Corps retains important decision-making responsibili-

ties, especially regarding flood and emergency operations and the analysis and changes of regulation schedules. Accordingly, the Corps must be in a position to also assume public affairs responsibilities for the project.

1. The operational and public affairs actions and schedules cover potential emergency situations in the project area in the Columbia River Basin. They are designed to ensure that developing situations and operational activities trigger the effective implementation of positive and active public affairs action.

5. 1992 Drawdown Issues. Issues that will command attention and pose challenges include effects on the structural integrity of the project; dissolved gas supersaturation and gas bubble disease; effects on anadromous and resident fish populations and other aquatic organisms; effects on wildlife habitat; water velocities and water quality; sediment transport at Lower Granite reservoir; impacts on cultural resource sites; embankment stability and bank erosion; groundwater and recreation (see Appendix F).

6. Objectives.

a. To gain and maintain public understanding and support for the manner in which the Corps exercises its responsibilities for the drawdown test.

b. To increase recognition of Corps' efforts to save wild salmon stocks.

c. To present the Corps' engineering capabilities for meeting new challenges.

d. To champion environmentally sustainable development and increase recognition of the Corps' role in environmental protection.

e. To highlight the Corps' traditional missions and management capabilities.

f. To tell the public at every opportunity that protection of the environment today is a primary mission of the Corps of Engineers.

7. Work Tasks.

a. Close coordination and cooperation with the Walla Walla District Information Coordinator, Field Coordinator, Fish Program Manager, and other district staff elements; North Pacific Division Public Affairs Office, and Headquarters, USACE, Public Affairs office.

b. Provide maximum assistance to media personnel at all times.

c. Develop and maintain media contacts and mailing lists in the affected areas for the distribution of fact sheets and news releases. Develop and maintain a special media contact list (see Appendix E) for the use of "backgrounders," news conferences, and special mailings.

d. Prepare a special list of personnel knowledgeable on the OA/EIS and Drawdown Test and publicize their availability for media interviews.

e. Provide speakers upon request for appearances before civic, community and special interest groups, and identify four or five special briefings for the District Commander with local government/industry leaders, user and environmental groups prior to the Drawdown Test.

f. Develop a standard slide presentation on the OA/EIS and Drawdown Test for public speaking engagements.

g. Establish and maintain open channels of communication with residential agricultural and environmental interests. Keep them informed of potential Corps actions that could affect them.

h. Plan and coordinate news conferences prior to and at the conclusion of the Drawdown Test.

i. After Record of Decision is signed, arrange for the District Commander to hold editorial board meetings with the Lewiston Tribune, the Tri-Cities Herald, and the Spokesman Review.

j. Prepare fact sheets, and news releases as necessary for dissemination to the media and other interested groups to keep them informed of actions taken by the Corps in the management and operations of the Drawdown Test. Keep the public and media informed about planned actions and their effects before the effects are felt.

k. Produce 4-page flyer on OA/EIS Drawdown Test for public distribution after Record of Decision is signed. This would be done by existing public involvement contractor under a Purchase Order Agreement.

l. Produce Speakers' Bureau Brochure for distribution to schools, civic and service organizations. Work would be performed under a Purchase Order Agreement.

m. Produce Safety PSAs, "beepers" for local media outlets.

n. Prepare weekly Information Bulletins, updates to district staff on Drawdown Test, and devote a special edition of Intercom, the district's quarterly news magazine, to the Drawdown Test.

o. Establish a Public Information Center at the Clarkston Resources Office and a satellite Public Affairs Office at Lower Granite Visitor Center to respond to requests and inquiries from the media, public and elected officials. A Public Information Coordinator, two Public Affairs Specialists, and two Photographers, would operate out of the Lewiston Center; one Public Affairs Specialist would be assigned to the north Visitor Center at Lower Granite; and two Public Affairs Specialists and an Editorial Assistant would staff the District Public Affairs Office.

p. Formulate and develop a photographic program (still and television) within district/division capabilities to insure that significant events and happenings are documented. Make sure such material is made available to higher headquarters and media as required.

q. Organize and arrange Drawdown Visitation Days at the height of the drawdown (March 17, 18, and 19) for media, elected government officials and Corps officials from higher headquarters to help familiarize them with the project and its operations. Invite local, regional, and national media as appropriate.

r. Identify possible points of controversy on planned Corps courses of action and prepare in advance position papers and/or answers to anticipated public and media queries.

s. Emphasize whenever possible the Corps' cooperation with all regional interests in seeking solutions to impacts from the Drawdown Test.

t. Encourage district staff to prepare technical articles on the Drawdown Test for various engineering publications.

u. Promote Drawdown Test and district's engineering achievements during National Engineers Week.

v. Provide an After Action Report summarizing all activities performed under this Public Affairs Plan.

8. Responsibility.

a. The Chief, Public Affairs Office, in coordination with appropriate staff chiefs and field staff, is responsible for the development, implementation and monitoring of the Public Affairs Plan for the 1992 Salmon Flow Measures OA/EIS Drawdown Test by:

(1) establishing and maintaining close coordination and cooperation with the Public Affairs Officers at North Pacific Division, Portland District, and Headquarters, USACE, and keeping the NPW PAO informed of significant events and potential district actions;

(2) preparing and distributing fact sheets, news releases, tip sheets, PSAs, internal command information, and background information for print and electronic media;

(3) coordinating speakers and interviewees to appear before civic and other interested groups and media personnel;

(4) developing and maintaining special media contact and mailing lists;

(5) responding to media inquiries accurately and as rapidly as possible to meet deadlines;

(6) coordinating and arranging for news conferences and site visitations/events;

(7) responding immediately to congressional and public inquiries;

(8) coordinating and preparing position papers and/or advance answers to possible questions on Corps' planned courses of action; pre-answering questions through timely release of information on controversial actions;

(9) serving as the coordinator for media for on-site visits and interviews with Subject Matter Experts;

(10) monitoring and analyzing media coverage, and furnishing district and higher headquarters with daily clippings on the Drawdown Test; and

(11) monitoring rumor control.

b. The Public Information Coordinator, in coordination with appropriate staff chiefs and field staff, is responsible for:

(1) coordinating visits to Lower Granite Dam and other project sites by public, elected public officials, media, district personnel, and officials from higher headquarters;

(2) assisting with furnishing information for news releases, situation reports, news advisories, fact sheets, presentations and background information;

(3) keeping the Public Affairs Officer and own district/division/USACE stovepipes informed of ongoing and/or new developments, problems that surface;

(4) assisting Drawdown Field Coordinator in "crowd control," to minimize disruptions to ongoing operations at the Command Center;

(5) responding immediately and accurately to public information queries;

(6) assisting in formulating answers to media inquiries, always keeping PAO informed;

(7) assisting in the preparation of position papers and advance answers to possible questions;

(8) arranging transporation and in coordination with the Public Affairs Officer and the Executive Assistant, arranging schedules/itineraries for VIP/Media events;

(9) providing PAO a copy of the daily sitreps on water levels and discharges;

(10) distributing public information materials to visitor centers, kiosks, libraries, chamber offices, etc.

(11) coordinating purchase of a flyer or fact sheet on the draw down.

(12) performing other duties, as assigned by the Field Coordinator and the Executive Office staff or designated representative.

c. The Field Coordinator is responsible for:

(1) submitting names to PAO of qualified individuals and making them available as required to represent the district in their field of expertise concerning EIS and Drawdown issues;

(2) assisting in providing factual information and material for preparation of news releases and advisories, fact sheets, PSAs, and other public information materials;

(3) assisting in answering media inquiries, always keeping PAO informed;

(4) assisting in furnishing resources necessary to accommodate the media (i.e., desks, computers, phones, cars/vans, etc.); and

(5) overseeing operations of the Command Center at Lower Granite.

9. Coordinating Instructions.

a. This plan is effective for planning and implementation upon receipt.

b. Maximum coordination and cooperation among elements of the Corps, BPA, BOR and fishery agencies are a must for successful execution of this plan.

c. Feedback is strongly encouraged to identify successful and unsuccessful elements of this plan.

FOR THE COMMANDER:

CAROL A. WOLFF
Chief, Public Affairs Office

6 Appendices
Appendix A Public Information Program/PA Action Calendar
Appendix B Lower Granite and Little Goose Project Maps
Appendix C Lower Granite and Little Goose Project Data Sheets
Appendix D EIS Drawdown Test Charts/Diagrams
Appendix E Columbia Basin Media Lists
Appendix F Project Newspaper Clippings

APPENDIX A

PUBLIC INFORMATION PROGRAM FOR THE 1992 COLUMBIA RIVER

SALMON FLOW MEASURES OA/EIS RESERVOIR DRAWDOWN TEST

Introduction

The maximum value of providing a Public Information and Public Involvement program for the Drawdown Test on Granite and Goose reservoirs would be gained by educating the general public, elected officials, organized groups, agency heads and technical staff, community leaders, special interest groups potentially involved and interested in the ongoing anadromous fish programs, and the media prior to the activity.

However, based on the opinions of Office of Counsel, concerning prejudicing the NEPA process and the changing data which effects the Draw Down decision and procedures, specific information about the Draw Down cannot be released to the general public until the ROD is signed. Maximizing our opportunities for positively influencing elected officials, activating the media, and gaining public support in the affected Drawdown areas has been a difficult and challenging effort under this scenario.

As currently scheduled, the decision to do the Drawdown Test will not be confirmed until 14 February 1992. This timing allows only fourteen days before the Draw Down begins. Limited information on the proposed Draw Down has been released on a broad regional scale as the Plan of Action in the Final EIS, but only with the premise that the final decision to do the work has not been legitimatized.

The short window to inform the public and media about the Drawdown Test between 14 February and 1 March, dictates that work will be limited to news releases, two public information meetings (these actually take place prior to the ROD), a news conference, preparation of information and activities for the Draw Down, and incidental presentations to small user and leader groups, as time allows.

TASKS

The following tasks involve(d) the CENPW-PL-ER Public Information Coordinator:

Pre-ROD Activities

News Conference - A news conference was held 10 January 1992 in Kennewick, Wash., to announce the cooperating agencies preferred

Plan of Action for 1992. This was our first opportunity to tell the public about the upcoming Drawdown Test.

Public Information Meetings - Two public information meetings for (28 and 29 January) to discuss the preferred Plan of Action for 1992 as addressed in the Final EIS. Meetings held in Lewiston, Idaho, and Pasco, Washington, and provide the public the opportunity to ask specific questions about the activity. These meetings will occur prior to the Record of Decision and so the Drawdown Test will continue to be labeled proposed (10 paid advertisements and two news releases have been accomplished for this activity).

Drawdown Preparation

EIS Information Number - The EIS information number, 509-522-6944, will continue to be advertised to provide answers pertaining to the EIS process. This is an answering machine service and does not provide quick response.

Toll-Free Hotline Number - A 1-800-emergency number(electronic switchboard) will be established at the Clarkson resources office to provide immediate response to public concerns, problems accruing from the Drawdown Test. A separate 1-800 toll-free hotline will provide automated recorded voice mail messages on scheduled Drawdown activities and a list of public information numbers.

Printed Materials/Photos - An information handout (flyer or fact sheet) will be prepared, providing details of the Drawdown activities. Information handouts can be used at recreation area kiosks, activity desks at local motels, visitor information bureaus, etc. This information also may be provided to the public, media personnel, and government officials. Photos will be provided for media use.

Media Contacts - Local media sources will be contacted prior to the Drawdown Test to ascertain their requirements and desires for information, tours, etc.

Initial News Release - A news release will be completed and distributed with signing of the Record of Decision. The releases will explain the Plan of Action, provide a calendar of events for Drawdown activities, discuss public safety, and furnish information numbers.

Daily Reports - Daily status reports/news advisories will be sent to media and government officials. This will be a one-page form

with limited information. Status reports will be completed at Walla Walla and faxed as required each morning.

News Releases - News releases will be prepared and disseminated throughout the March Drawdown activity.

News Conferences - News conferences are scheduled for 27 February and 3 April 1992, in Lewiston, Idaho, to discuss the Drawdown Test and results of the actions. Locations and times to be announced.

Media/Government Official Visitation Day - A site visit is scheduled for 17 March 1992 (lowest pool and possible spill), for the media and local, state and federal elected officials. The tour will include a brief presentation by LTC Volz, a tour of lower Granite Dam and the Lewiston area by vehicle and boat, if possible. Invitations will be coordinated by the Executive Assistant and the Public Affairs Officer. Media kits will be provided.

Corps Visitation Day - A site visit and tour is scheduled for 18 March 1992, for Corps employees. This may include District, NPD and HQUSACE personnel. This will be important to allow other Snake River Project personnel an opportunity to understand the activities. The tour will include a presentation by LTC Volz and a tour of Lower Granite Dam and the Lewiston area by vehicle and boat, if possible.

Public Information Coordinator - This individual will be assigned to the Clarkston Resources office to respond to public inquiries and to coordinate visits to the Lower Granite Dam site as appropriate and possible.

Public Affairs Officer - The PA Officer will provide two public affairs specialists for the Clarkston Resources Information office and one public affairs specialist at Lower Granite Dam to assist with media requests, tours, news releases, documentaries, etc.

Media Information Room - Locations will be provided at Lower Granite Dam and Clarkston for media personnel use. These locations will be used to brief the media, distribute information, and provide them a location to send stories to their offices.

Photographer/Videographer - Two or three photographers will be provided from IMO to record activities throughout the reservoir Drawdown Test. Slides, photos, and video may be required to provide to the media with a short turn-around. One-hour photo and slide processing will be required in the Clarkston area.

January 1992

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
		1	2	3
6	7	8	9	10 News conference on EIS Preferred Plan of Action -- 10 a.m. in Kennewick.
13	14	15	16	17
20	21 Draft Public Info. Plan to PAO from Planning EIS mtgs notice to media. Identify PAO DD resources	22 Send draft PAO Plan to CENPW Field Coordinator	23	24 Office of Counsel to issue policy stmt on aerial flyovers for media Planning to complete DD Speech for Public mtgs PAO to obtain mtg rms for news conferences on 28 Feb, 3 Apr. EIS released to public
27 Planning to arr purchase order w/Ebasco for 4-pg Flyer on DD PAO to do "comps" for Spker's Bureau Brochure PAO to seek TDY assistance	28 EIS public mtg in Lewiston	29 EIS Public Mtg in Pasco	30 Planning to dev EIS/DD Speech for non-choir audiences	31

February 1992

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
3	4 PAO to provide Field Coordinator, others with list of Commander's Drawdown speaking engagements	5 Update Media List, as necessary Begin work on Speaker's Brochure.	6 PA Plan to be presented to NPD Public Affairs Officer. Briefing to Gen. Harrell, NPD staff on Drawdown Schedule. PAO/Engineering to coordinate Engr Wk activs w/Westing-House Hanford for school science fairs, incl. DD activs. for wk of 2/17/92.	7 NPW Division Chiefs to receive memo requesting list of available Drawdown speakers. PA, Planning & Exec. Asst. to draft itinerary of events for Media Day, congl visits. LTC Volz to address ROA on DD Plan of Action.
10 IPR on Drawdown Schedule. Prepare briefing books for PA staff, LTC Volz	11 Sharon Murphy Odle to fly in from HQUSACE to assist PAO Team in DD activities.	12 PAO, Planning, etc. to orient Odle on DD PA Plan, etc.	13 Staff Mtg. and CMR	14 Field Coordinator to provide PAO with DD SMEs, phone numbers CENPW-PL to provide Media Transportation Plan for DD Visitation Days. ROD to be signed. News Release to come out from NPD. NPW PAO to assist with distribution, beepers
17 HOLIDAY	18 LTC Volz, PAO, and other members of DD Team to hold town hall mtg with district employees -- 8:30 a.m. Mess Hall. Editorial Board mtg with Lewiston Tribune -- 2 p.m. Begin developing Radio, TV Spots, Safety PSA's Mtgs w/user grps, local officials TBA**	19 LTC Volz, Kyle Shaw to appear on SAME luncheon program, Walla Walla. Editorial Board mtg with Tri-Cities Herald, 3 p.m. KRLC to interview Sara Wik on DD -- 9 a.m. Lewiston. Two shows to be taped. Wayne John also involved. News Release on "27th"	20 Editorial Board mtg. with Spokesman Review and Chronicle, 10 a.m. in Spokane. Camera Ready Speaker's Brochure to Repro Mtg tentatively sched w/ Spokane Ch of Commerce Exec Brd. Mtg w/local officials TBA	21 Planning to have DD Flyer or Fact Sheet ready for public distribution
24 IMO to complete automation of Info. Papers on LAN System.	25 PA Staff field trip to Clarkston Resources Office and Lower Granite for dry-run on DD PA operations. PAO, Planning, Exec. Asst. finalize prog for Media/Legis/ Corps visitation days to DD Sites. (May need to shift to 24th or 26th)	26	27 News Conference on DD Operations 10 a.m. in Lewiston.	28 Lock Outage begins. DD starts 1 March. Begin issuing media advisories, notices on DD opns to user grps, congressionals.

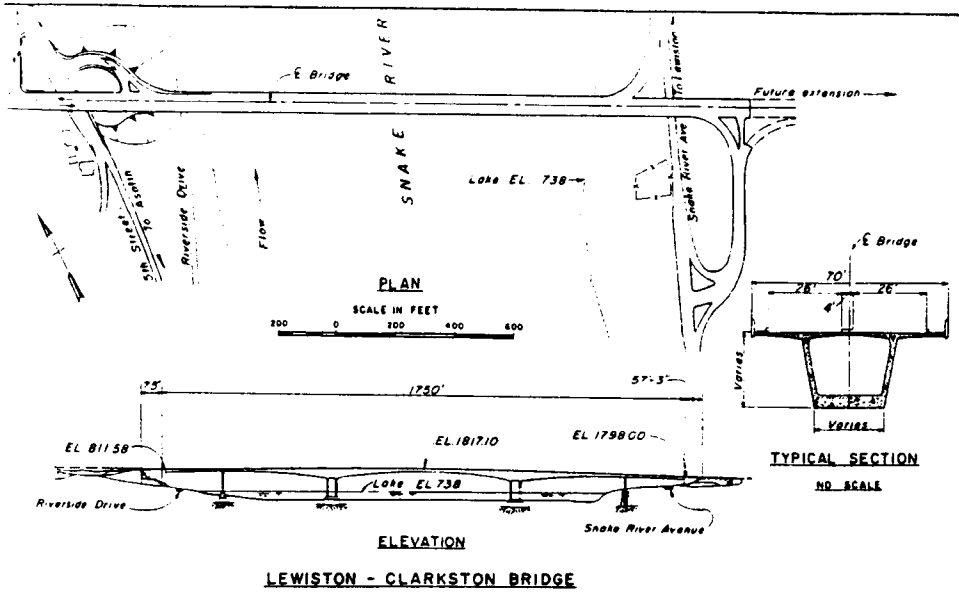
** LTC Volz to meet w/Cnty Commissioners, Port Officials in Lewiston

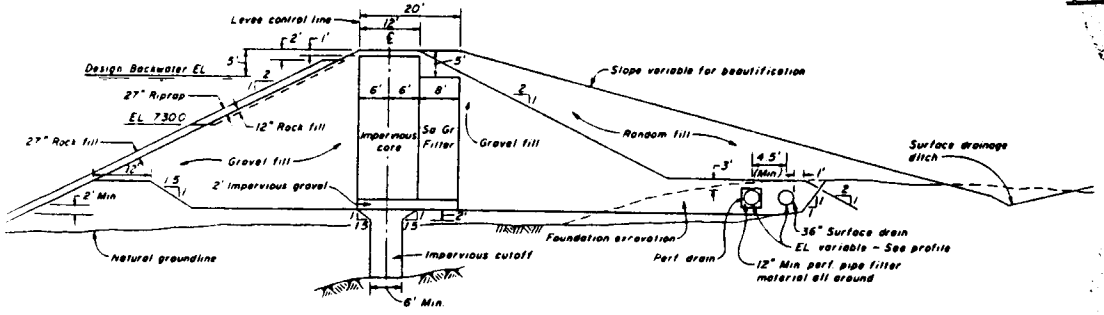
March 1992

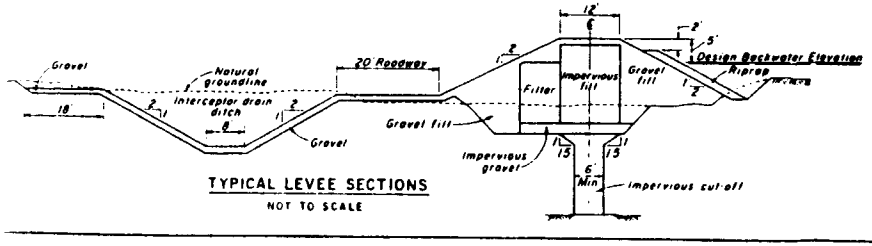
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
2 PA Field Opns in Full Swing	3	4	5	6
9	10	11	12	13
16 aker's Brochure eady for distribution.	17 Media Day Event -- Lower Granite	18 Legislator's Day -- Lower Granite	19 Corps Day -- Lower Granite	20
23	24	25	26	27
30	31 Draw Down Ends!			

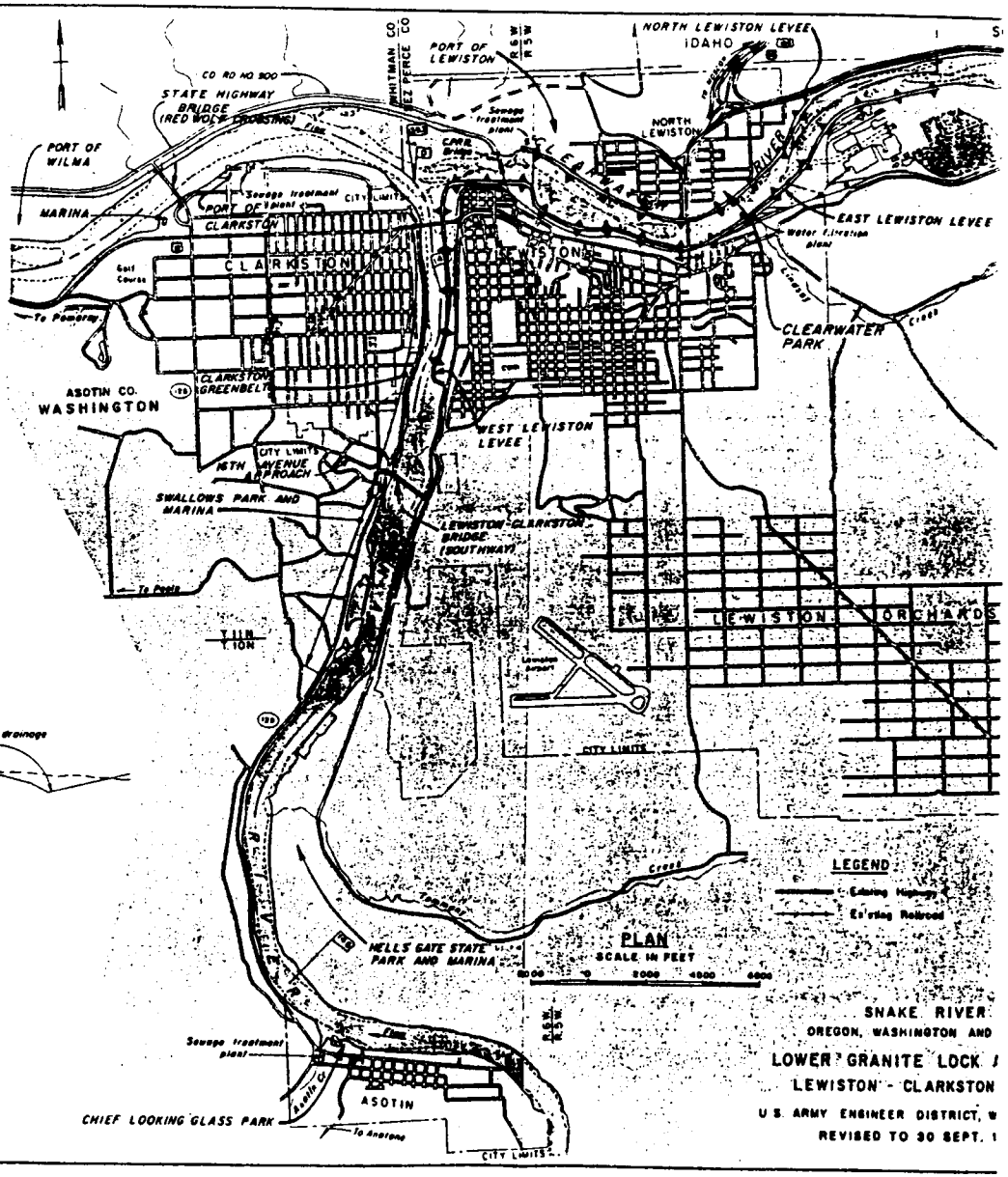
April 1992

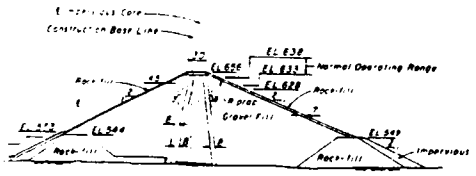
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
		1 Prepare info. for Friday's news conference on results of DD Test. Line up speaking engagements for LTC Volz, DD participants	2	3 News Conference scheduled at 10 a.m. at Ramada Inn in Lewiston.
6 Begin After Action Report on DD	7 Work on Special DD issue of Intercom for release by 1 May.	8	9	10 PAO DD Operations end.
13	14	15	16 PA After Action Report Due to DD Field Coordinator	17
20	21	22	23	24
27	28	29	30	


PLAN
SCALE IN FEET
200 0 200 400 600
SNAKE RIVER
Lake EL 738
Riverside Drive
Flow
5th Street Bridge
Snake River Ave
To Lewiston
Future extension
ELEVATION
EL 811.58
EL 817.10
EL 798.00
1750'
75'
57.3'
Riverside Drive
Lake EL 738
Snake River Avenue
TYPICAL SECTION
NO SCALE
70'
28'
26'
4'
Varies
LEWISTON - CLARKSTON BRIDGE


Levee control line
20'
12'
Design Backwater EL
27" Riprap
EL 730.0
27" Rock fill
12" Rock fill
Gravel fill
2' Impervious gravel
2' Min
Natural groundline
Impervious core
Sa Gr Filter
Gravel fill
Impervious cutoff
6' Min.
Foundation excavation
Slope variable for beautification
Random fill
Surface drainage ditch
4.5' (Min)
3'
36" Surface drain
EL variable - See profile
Perf drain
12" Min perf pipe filter material all around

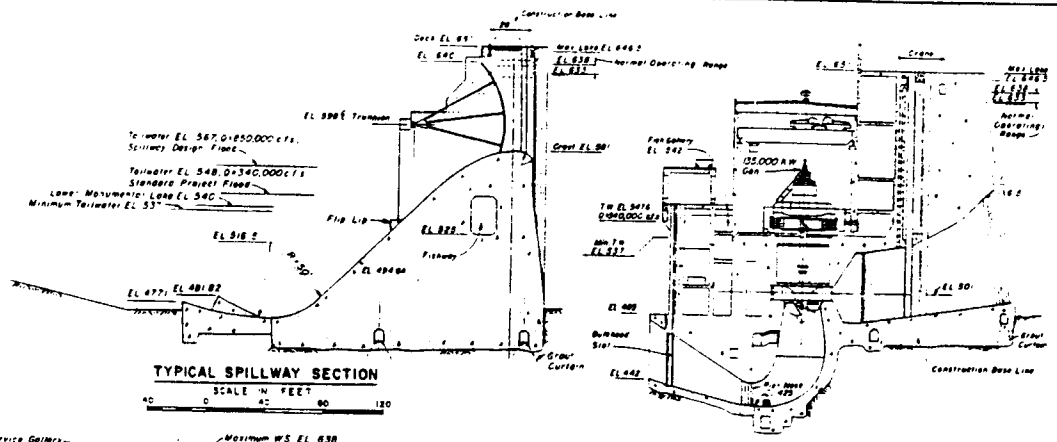

Gravel
Natural groundline
Interceptor drain ditch
20' Roadway
Gravel
Gravel fill
Impervious gravel
Filter
Impervious fill
Gravel fill
Riprap
Design Backwater Elevation
6' Min
Impervious cut-off
TYPICAL LEVEE SECTIONS
NOT TO SCALE


NORTH LEWISTON LEVEE
IDAHO
PORT OF LEWISTON
WHITMAN CO
NEZ PERCE CO
R5W
R6W
CO RD NO 300
STATE HIGHWAY BRIDGE (RED WOLF CROSSING)
Sewage treatment plant
Flow
CAPE Bridge
NORTH LEWISTON
PORT OF WILMA
MARINA
PORT OF CLARKSTON
CITY LIMITS
CLARKSTON
LEWISTON
EAST LEWISTON LEVEE
Water filtration plant
Golf Course
To Pomeroy
CLEARWATER PARK
CLARKSTON GREENBELT
ASOTIN CO.
WASHINGTON
WEST LEWISTON LEVEE
16TH AVENUE APPROACH
SWALLOWS PARK AND MARINA
LEWISTON-CLARKSTON BRIDGE (SOUTHWAY)
To Pomeroy
LEWISTON ORCHARDS
TIN TON
Lewiston Airport
CITY LIMITS
Creek
LEGEND
Existing Highway
Existing Railroad
HELLS GATE STATE PARK AND MARINA
PLAN
SCALE IN FEET
2000 0 2000 4000 6000
Sewage treatment plant
Flow
R5W
R6W
CHIEF LOOKING GLASS PARK
Asotin Cr
ASOTIN
To Anatone
CITY LIMITS
SNAKE RIVER
OREGON, WASHINGTON AND
LOWER GRANITE LOCK
LEWISTON - CLARKSTON
U.S. ARMY ENGINEER DISTRICT, W
REVISED TO 30 SEPT. 1



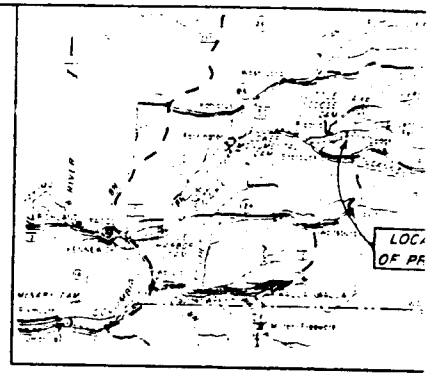
TYPICAL EMBANKMENT SECTION

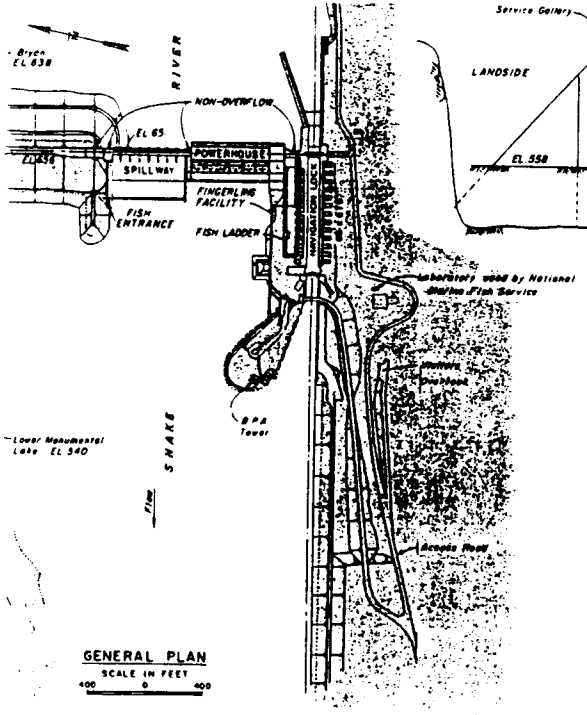
SCALE IN FEET



TYPICAL SPILLWAY SECTION

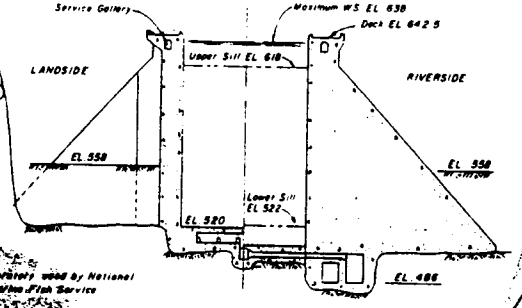
SCALE IN FEET





GENERAL PLAN

SCALE IN FEET

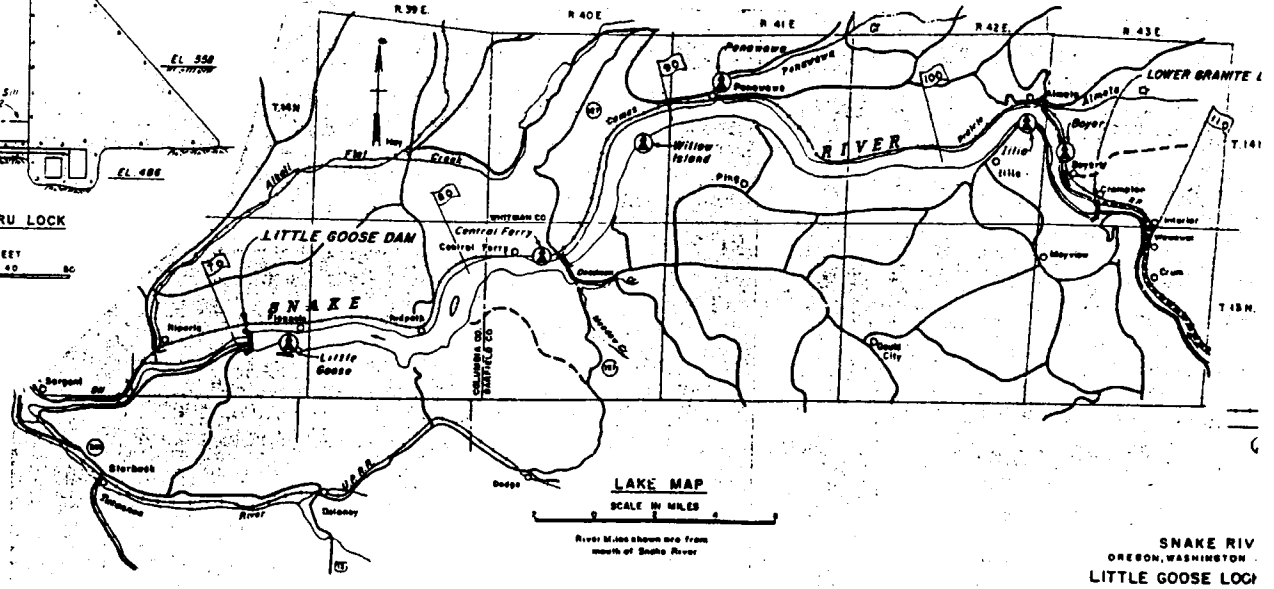


SECTION THRU LOCK

SCALE IN FEET

TYPICAL POWERHOUSE SECTION

SCALE IN FEET



LAKE MAP

SCALE IN MILES

River Miles shown are from mouth of Snake River

SNAKE RIV

OREGON, WASHINGTON

LITTLE GOOSE LOCK

(LAKE BRYA

U. S ARMY ENGINEER DISTRI

REVISED TO 30 SEP

22 JAN 92

APPENDIX C

LOWER GRANITE LOCK AND DAM

PERTINENT DATA

GENERAL

Stream miles from mouth of Snake River	107.5
River miles upstream from Little Goose Dam	37.2
River miles downstream from Clarkston	31.8
Drainage area, square miles	103,500
Length of dam at crest, feet	3,200
Discharges in cubic feet per second	
Minimum of record, August 1931	10,600
Mean annual flow	49,800
Unregulated maximum of record, June 1894	409,000
Regulated maximum of record, June 1974, controlled by existing structures	332,000
Spillway design flood	850,000

SPILLWAY DAM

Type of Construction	Concrete Gravity
Completed	February 1975
Maximum Capacity	850,000 cfs
Crest Elevation	581 feet
Overall Length, feet	512
Control Gates:	
Type	Radial
Size, width by height	50 by 60.5 feet
Number	8

POWERPLANT

Length	656 feet
Width	243 feet
Generating Units:	
Number Installed	6
Rating Each	135,000 KW
Total Capacity Installed	810,000 KW
Maximum Structural Height	246 feet
First Power-On-Line	April 1975

NAVIGATION LOCK AND CHANNELS

Clear Width	86 feet
Clear Length	675 feet
Lift:	
Minimum	95 feet

LITTLE GOOSE LOCK AND DAM

PERTINENT DATA

eam miles from mouth of Snake River	70.3 miles
er miles downstream from Little Goose Dam	28.7 miles
er miles upstream from Clarkston	50 miles
rainage area, square miles	103,900
gth of dam at crest, feet	2,655
charges in cubic feet per second:	
Minimum of Record	6,660
Mean annual flow	48,950
Maximum of record (1894)	409,000
Maximum of record (1974) controlled by existing structures	332,000
Spillway design flood	850,000
AY DAM	
pe of Construction	Concrete Gravity
mpleted	January 1970
kimum Capacity	850,000 cfs
est vation	581 feet
eral length, feet	512 feet
ntrol Gates:	
Type	Radial
Size, Width by height	50 by 60 feet
	22 January 1992
mber	8
ANT	
ngth	656 feet
ith	243 feet
ING UNITS	
mber installed	6
ing, Each	135,000 KW
al Capacity Installed	810,000 KW
imum Structural Height	244 feet
st Power-On-Line	March 1970
ION LOCK AND CHANNELS	
ar Width	86 feet
ar Length	675 feet

PROJECT COSTS THROUGH 1991

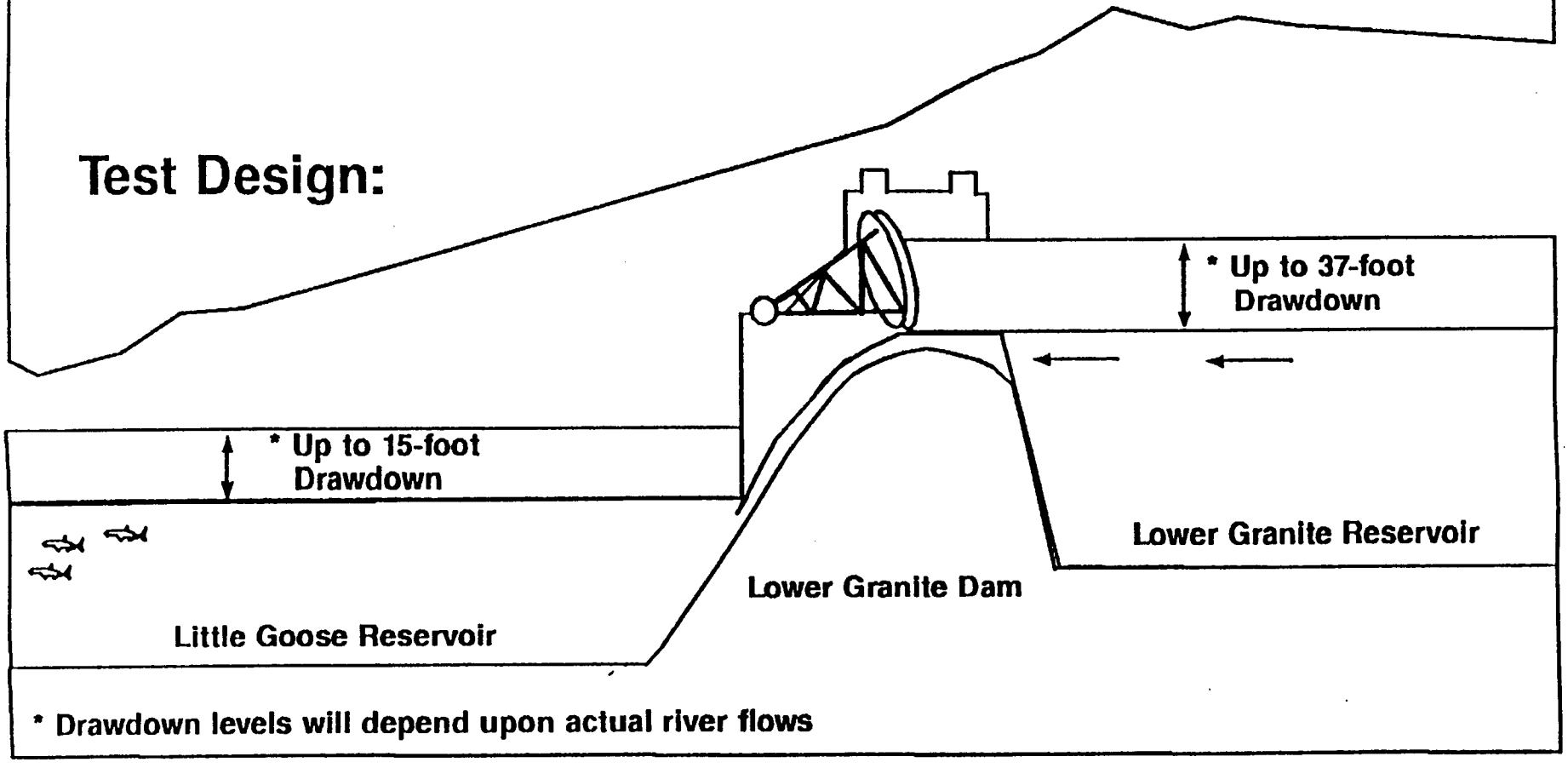
Initial Project	$160,413,215
Additional Units	60,941,807
Other Construction	23,300,000
Total	$391,080,315
Total Generation, kilowatt hours	51.69 billion
Average annual revenue to U.S. Treasury	$23,122,000

ANEWX002 IMG 12/

Two Reservoir Physical Test
March 1 - 31, 1992

Purpose: Evaluate Physical Effects of Reservoir Drawdown

Test Design:



* Drawdown levels will depend upon actual river flows

1992 Preferred Plan of Action

- **Measures to Improve Fish Migration**

  Drawdown

  - **Lower Snake Dams to near minimum pool, April 1 - July 31**
  - **John Day near 262.5 pool elevation, beginning May 1**

  Flow Augmentation

  - **Snake River - Up to 900,000 acre-feet from Dworshak**
  - **Columbia - Sustain 200,000 cfs flow at the Dalles, May 1 - June 30 from Arrow (Canada) and Grand Coulee Reservoirs**

  Water Temperature Control

  - **Dworshak Releases - Up to 20-foot drawdown in August (358,000 acre-feet)**
  - **200,000 acre-feet in September**

- **Two Reservoir Drawdown Test**
  - **Lower Granite, March 1 - March 31**
  - **Little Goose, March 15 - March 31**

MEDIA LISTS (NEWSPAPERS)

IDAHO

Boise- THE IDAHO STATESMAN, P.O. BOX 40, 83807
(208) 377-6200.
Managing Editor: Bill Stuebner
Environmental Reporter: Pete Zimowsky
Fish & Wildlife Writer: Ms. Mitchell Cole

Lewiston- LEWISTON MORNING TRIBUNE, P.O. Box 957, 83501
(208) 743-9411
Managing Editor: Paul Emerson
Outdoor Reporter: Bill Lofton
Editorial Page Editor: Jim Fisher

Moscow- IDAHONIAN: 107 South Grand, Suite B. Pullman, WA.
Managing Editor: Kristen Moulton
Outdoor Writer: Ken Olson
Editorial Page Editor: Kenton Bird

Nampa- IDAHO PRESS TRIBUNE: P.O. Box 9399, 83652
(208) 467-9251
Managing Editor: Wayne Cornell
Fish & Wildlife Writer: Aaron Knox
Editorial Page Editor: Wayne Cornell

OREGON

Pendleton- EAST OREGONIAN: P.O. Box 1089, 97801
(503) 276-2211
Managing Editor: Bill Crampton
Outdoor Writer: Steve Brown
Editorial Page Editor: Bill Crampton

WASHINGTON

Pullman: (See Daily News under Moscow, Idaho.)

Spokane: SPOKESMAN-REVIEW, P.O. Box 2160, 99210
SPOKANE CHRONICLE (509) 459-5423
Managing Editor: Chris Peck
Environmental Reporter: Karen Dorn Steele
Fish & Wildlife Writer: Julie Titone
Editorial Page Editor: Doug Floyd

Tri-Cities- (Kennewick, Pasco, Richland) TRI-CITY HERALD
P.O. Box 2608, Tri-Cities, WA 99302
(509) 582-1515
Managing Editor: Ken Robertson
Environmental Reporter: Chris Sivula
Fish & Wildlife Writer: Ken Hoopengarner
Editorial Page Editor: Matt Taylor

NEWSPAPERS (WASHINGTON)

Walla Walla- WALLA WALLA UNION BULLETIN: P.O. Box 1358, 99362
(509) 525-3300
Managing Editor: Rick Doyle
Outdoor Writer: Becky Kramer
Editorial Page Editor: Rick Eskil

Wenatchee- WENATCHEE DAILY WORLD: P.O. Box 1511, 97801
(509) 663-5161--FAX 662-5413
Managing Editor: Rufus Woods
Outdoor Reporter: Rich Steigmeyer
Editorial Page Editor: George Richardson

Yakima- YAKIMA HERALD-REPUBLIC: P.O. Box 9668, 98909
Managing Editor: Dan Coleman
Outdoor Writer: Spencer Hatton
Editorial Page Editor: Bill Lee

Moses Lake- COLUMBIA BASIN HERALD, P.O. Box 910, (98837)
Editor: Lyle Hicks
Managing Editor: Dick Lowry

NEWSPAPER SERVICE

THE ASSOCIATED PRESS:

Boise: Bob Fick, P.O. Box 1187, 83701
(208) 343-1894

Spokane: John Wiley, P.O. Box 2173, 99210
(509) 624-1258

Yakima: Nick Geranious, P.O. Box 1349, 98907
(509) 453-1951

TELEVISION STATIONS

IDAHO

Boise- KAID-TV, CH. 4 (PBS) 1910 University Dr., 83725
(208) 385-3344
News Director: Roger Fuhrman
Assignment Editor: Roger Fuhrman

KCBI-TV, CH. 2 (CBS) P.O. Box 2, 83707
(208) 336-5222
News Director: Dick Larsen
Assignment Editor: Susan Hawkes

KTVB-TV, CH. 7 (NBC) P.O. Box 7, 83707
(208) 375-7277
News Director: Rod Gramer
Assignment Editor: Lindsay Nothern

Lewiston- KLEW-TV, Ch. 3 (CBS) P.O. Box 615, 83501
(208) 746-3636
News Director/Assignment Ed: Joe Martin

Nampa- KIVI-TV, Ch.6 (ABC) 1866 E. Chisholm Dr., 83687-6899
(208) 467-3301
News Director: Chris Houston
Assignment Editor: Steve Ritter

KTRV-TV, Ch. 12 (IND) 679 Sixth St. N. Ext., 83651
(208) 466-1200 or 888-1200 (FAX-208-467-6958)
News Director: Bill Hatch

Pocatello- KPVI-TV, Ch.6 (ABC) P.O. Box 667, 83204
(208) 233-6667
News Director: Dan Hovel
Assignment Editor: Bruce Kamp

Idaho Falls- KIFI-TV, Ch. 8 (NBC) P.O. Box 2148, 83403
(208) 525-8888
News Director: Kates Frank
Assignment Editor: Mary Gonzalez

KIDK-TV, Ch. 3 (CBS) P.O. Box 2008, 83403
(208) 522-5100
News Director: Donna Evans
Assignment Editor: Donna Evans

Twin Falls- KKVI-TV, Ch. 35 (ABC) 1061 Blue Lakes BLvd,
83301. (208) 733-0035. News Dir: Dick McMahon

KMVT-TV, Ch. 11 (CBS) 1100 Blue Lakes Blvd,
83301, (208) 733-1280. News Dir: Geo. Brown,
Assignment Editor: Charles Lemmon

TELEVISION STATIONS (WASHINGTON)

Spokane

KREM-TV, Ch. 2 (CBS) P.O. Box 8037, 99203-8037
(509) 838-7351
News Director: Paul Brandt
Assignment Editor: Rod Smith

KXLY-TV, Ch. 4 (ABC) West 500 Boone Ave., 99201
(509) 328-3086
News Director: Robin Briley

KHQ-TV, Ch. 6 (NBC) P.O. Box 8088, 99203-8088
(509) 448-4656
News Director: Paul Dughi
Assignment Editor: Steve Miller

Tri-Cities

KEPR-TV, (CBS) P.O. Box 2648, 99302 (Pasco)
(509) 783-6151
News Director: Jim Hall
Assignment Editor: Jim Hall

Yakima

KAPP-TV, Ch. 35 (ABC) 1610 S. 24th Ave., 98202
(509) 453-0351
News Director: Rachel Scheuring

KIMA-TV, Ch. 29 (CBS) P.O. Box 702, 98907-0702
(509) 575-0029
News Director: T.J. Close
Assignment Editor: Lisa McGonigle

KNDO-TV, Ch. 23 (NBC) 1608 S. 24th St., 98202
(509) 248-2300
News Director: Shelley Swanke
Assignment Editor: Shelley Swanke

RADIO STATIONS (IDAHO)

Boise

KBOI-AM, P.O. Box 1280, 83701
(208) 336-3670 (FAX-208-336-3734)
News Director/ Assignment Ed: Bill Scott

KBSU-FM, 1910 University Dr., BSU, 83725
(208) 385-3663 (FAX-208-344-6631)
News Director: Jyl Hoyt

KFXD, P.O. Box 107, 83701
(208) 888-3790 (FAX- 208-888-2841
News Director: Walt Wooun

KGEM, 5601 Cassia, 83705
(208) 344-1970 (FAX- 208-336-3264)
News Director: J. Lloyd Day

KHEZ, 3100 N. Lakeharbor Lane, #202, 83703
(208) 384-1033 (FAX-208-343-2103)
News Director/Assignment Ed: Greg Williamson

KIDO, P.O. BVox 63, 83707
(208) 344-6363
News Director: Stephanie Simko
Assignment Ed: Gene Hayes

KIZN-FM, P.O. Box 488, 83701
(208) 343-5991 (FAX-208-343-5994)
News Director: Chris Walton

KLCI-FM, 419 N, Curtis, Suite 130, 83706
(208) 375-9777 (FAX-208-375-9788)
News Director: Brian Rodgers

KANR-AM - KCIX-FM, 5257 Fairview, 83706
(208) 376-6666
News Director: Larry Gebert

KSPD, 5201 Overland Road, 83705
(208) 345-3790
News Director/Assignment Ed: Scott Riggan

Blackfoot

KBLI-AM, KLCE-FM, P.O. 699, 83221
(208) 785-1400
ews Director: Carol Lambert

Burley

KBAR, 1841 W. Main, 83318
(208) 678-2244
News Dir: Mark Maier

RADIO STATIONS (IDAHO)

Caldwell

KBGN-AM, 3303 E. Chicago, 83605
(208) 459-3635
News Dir: Don Dutton

KCID-AM-FM, P.O. 1175, 83606
(208) 459-3608
News Dir: Sam Bass

Grangeville

KORT-AM-FM, P.O. Box 510, 83530
(208) 983-1230
News Director: Mia Carlson

Idaho Falls

KFTZ, 1190 Lincoln Rd., 83401
208) 523-3722 (FAX-208-525-2725
News Director: Mindy Kary

KID-AM, KSIF-FM, 1655 Woodruff, 83404
(208) 524-5900 (FAX-208-523-6715)
News Director: Bob Ziel

KUPI-AM-FM, 854 Lindsay Blvd., 83402
(208) 522-1101 (FAX-208-522-6110)
News Director: John Balginy

Jerome

KART-AM, KFMA-FM, 47 N. 100 W. 83338
(208) 324-8181
News Director: Sharon Becker

Ketchum

KECH-FM, P.O. 2158, 83340
(208) 726-5324 (FAX-208-726-5459)
News Director: Gary Stivers

RADIO STATIONS (IDAHO)

Lewiston

KATW-FM, 301 D St., Suite 302, 83501
(208) 743-6564 (FAX-208-746-6397)
General Mgr: Mark Bolland

KOZE-AM-FM, P.O. 936, 83501
(208) 743-2502 (FAX-208-743-1995)
News Director: Paul Carpenter

KRLC-AM, KMOK-FM, 805 Stewart, 83501
(208) 746-5056
News Director: John Thomas

Moscow

KRPL-AM, KZFN-FM, P.O. 8849, 83843
(208) 734-4357
Station Mgr: Dennis Deccio

Mountain Home
KLVJ-AM-FM, P.O. 704, 83647
(208) 587-8424
News Director: Terry Clark

Orofino

KLER-AM-FM, P.O. 32, 83544
(208) 476-5702
News Director: Paul Carpenter

Pocatello

KSEI-AM-FM, P.O. Box 40, 83204
(208) 233-2121
News Director: Rown J. Caldwell

KWIK-AM, KPKY-FM, P.O. 998, 83204
(208) 233-1133
News Director: J.D. Kelly

Rexburg

KADQ-FM, P.O. 66, 83440
(208) 356-7323
News Director: Dave Piourde

KRXK-AM-FM, P.O. 458, 83440
(208) 356-3631
News Director: Don Ellis

Rupert

KBBK-AM, KNAQ-FM, Box 427- 83350 (208) 436-4757. News Director: Tom Morhlang

Salmon

KSRA-AM-FM, 315 Hy 93-N. 83467 (208) 756-2218. News Director: Renee Smith

Twin Falls

KAWZ-FM, P.O. 271, 83301
208) 882-2551
News Dir: Rick Brown

KEZJ-AM-FM, P.O. 346,
83303, (208)733-7512
News Dir: Kelly Klaas

KTFI-AM, P.O. 2820,83303
(208) 733-3381
News Dir: Carol Stephens

Weiser

KWEI-AM-FM, P.O. 791, 83672
(208) 549-0886
News Director: Jim Assborn

RADIO STATIONS (WASHINGTON)

Spokane

KGA, S. 6228 Regal St. 99223
(509) 448-2311
News Director: Dave Marz

KJRB, P.O. Box 8007 (99223)
(509) 448-1000
News Dir: Scott Carlon

KZZU-FM, S. 140 Arthur (99202)
(509) 536-4100
News Director: Lyn Daniels

Tri-Cities

KONA-AM-FM, 99302
(509) 547-1618

KALE AM, KIOK-FM, P.O. "K"
310 W. Kennewick Ave., 99302
(509) 586-2151

KOTY-AM, KHWK-FM
P.O. Box 6127
Kennewick, WA 99336
(509) 586-4165

Pasco

KORD-AM, KZZK-FM
2621 West A St. 99302
(509) 547-9791

Othello

KRSC-AM-FM, P.O. 566 (99344)
(509) 488-2791

Prosser

KARY-AM, P.O. Box 1310 (99350)
(509) 786-1310 or 882-3500

KXLY, W. 500 Boone Ave., 99201
(509) 328-6292. News Director:
Robin Briley

KAQQ, P.O. 8036 (99202)
(509) 448-4666
News Dir: Steve Nelson

KPBX, 2319 N. Monroe 99205
(509) 328-5729
News Dir: Doug Nadvornick

Pullman

KQQQ-AM-FM, P.O. Box 1
(99163) (509) 332-6551

Sunnyside

KREW-AM-FM, P.O. Box 149
(98944) (509) 837-2277

Clarkston

KCLK-AM-FM, P.O. Box 86
(98403) (509) 758-3361

RADIO STATIONS (WASHINGTON)

Walla Walla

KAFR-AM-FM, P.O. Box 796 (99362)
(509) 525-3190

KTEL-AM, P.O. Box 948 (99362)
(509) 525-4103

KUJ-AM-FM, Route 5, Box 513
(99362) (509) 529-8000

Wenatchee

PQ-AM-FM, P.O. Box 159 (98801)
(509) 663-5121

KUEN-AM, KYJR-FM, 1022 Wenatchee
Ave., (98801) (509) 663-5186

KWWW-AM, P.O. Box 638 (98801)
(509) 662-7135

Yakima

KBBO-AM, KRSE-FM, P.O. 9188 (98909)
(509) 248-1390

KMWX-AM, KFFM-FM, P.O. 1460 (98907)
(509) 248-1460

KUTI-AM, KXDD-FM, P.O. 2309 (98907)
(509) 248-3110

RADIO STATIONS (OREGON)

Ontario

KIOV-AM, KQXR-FM, 2880 S.W.
(503) 881-1450, 2880 S.W.
4th, Suite 13 (97914)
Program Dir: Bob Lee

KSRV-AM-FM, 1725 N. Oregon
(97914) (503) 889-8651
News Director: Dave Adams

SATURDAY

Tri-City Herald

C

nuary 11, 1992 Pasco, Kennewick, Richland, Washington 50 cents Circulation 586-2138 Classified 586-6181 Main

Drawdown discussion

Herald/Dorothy Adcock

LTC Robert Volz, district engineer with the Corps of Engineers, left, chats Friday with Mike Wohld of Western Farmer-Stockman Magazines, Spokane. The men were discussing the 1992 preferred plan of action to improve fish migration, following a press conference at the Quality Inn on Clover Island in Kennewick.

Corps urging drawdown

By CHRIS SIVULA
Herald staff writer

The Army Corps of Engineers wants to drastically lower two reservoirs on the Snake River for four weeks in March, officials said Friday.

Lt. Col. Robert Volz, district engineer for the Corps' Walla Walla office, announced the proposal during a press conference in Kennewick. Plans for the drawdown call for a three-step program aimed at improving salmon runs in the Columbia and Snake River system.

Additional measures include efforts to cool the rivers while adult salmon are returning and to increase flow when juvenile salmon are migrating to the Pacific.

The proposal represents the best compromise for competing interests, according to Volz and other Corps' officials.

Efforts to develop a plan for saving threatened and endangered fish have often run into objections from one or more groups with a stake in the river — environmentalists, commercial fisherman, Indians, recreational fisherman, boaters, barge operators, electric utilities and farmers.

The Corps' preferred alternative limits drawdowns below minimum pool levels to the Little Goose and Lower Granite reservoirs on the lower Snake River — a major concession to irrigators.

Neither reservoir is used by growers, according to the Corps. "There will be no impact on irrigators," said Greg Graham, study manager for the environmental impact statement.

Scheduling the drawdown in March also will limit the impact on barge traffic. Each year, the Snake River locks are shut down for two weeks in March for maintenance anyway. The monthlong experiment will keep the river closed for just two weeks more than normal.

Lowering the reservoirs when few fish are migrating also alleviates some of the National Marine Fisheries Service's concerns. Without modifications to existing dams, the drawdowns will leave fish ladders high and dry.

Graham said the Corps' is hoping that the proposal balances the various interests enough to stave off any opposition.

It may have satisfied farmers.

Please see CORPS, Page A2 ►

Corps

Continued from Page A1

"I think this is a pretty good plan," said Ron Reiman of T&R Farms.

Reiman is among irrigators opposed to lowering the river below minimum operating levels until more is known about the impact on salmon runs. His farm is irrigated from the Ice Harbor reservoir.

But the Corps' plan may not keep the issue out of federal court.

Ed Chaney, a save the salmon advocate from Idaho, told farmers this week that the salmon issue will probably end up in court this spring.

"No one likes to go to court but when all else fails a coalition of state, regional and national sportsmen, fish and environmental groups are ready to go to court," he said.

The Corps' proposal calls for an experimental drawdown at the Little Goose Reservoir on the lower Snake River to as much as 15 feet below the minimum pool level.

It also calls for a drawdown of the Lower Granite Reservoir, immediately upstream of Little Goose, by as much as 37 feet below the minimum pool level.

The test will help determine the effect of drawdowns on water speed, the movement of sediment that lines the reservoirs, electrical turbines in the dams, and on highways and railbeds along the river, Volz said.

It also will give the Corps a better idea of what modifications would be required on Snake and Columbia River dams if reservoirs are lowered to help speed juvenile salmon to the sea.

Biologists believe that travel delays created by dams along the river are one reason for dwindling salmon runs.

The proposal is part of the region's response to a decision by federal officials last year to include the Snake River sockeye salmon on the endangered species list.

Spring, summer and fall runs of chinook salmon also are expected to make the threatened or endangered species lists.

A full environmental impact statement — a 1,200-page document detailing the tradeoffs called for in various options for the river system's reservoirs — will be released Jan. 24.

If all goes as planned, the Corps officially will adopt its preferred proposal in mid-February following a public comment period.

A public hearing is scheduled in Pasco on Jan. 29.

Measures to improve fish migration include:

- Drawing down reservoirs behind lower Snake River dams to near minimum operating pools from April 1-July 31.
- Releasing up to 900,000 acre feet of water from the Dworshak Reservoir in Idaho to augment flows on the Snake.
- Maintaining flows of 200,000 cubic feet per second on the Columbia at the Dalles Dam from May 1 to June 30, using water from Arrow and Grand Coulee reservoirs.

Measures to control river temperatures include:

- Up to a 20-foot drawdown of Dworshak in August to provide cooler water for migrating fish and an 11-foot drawdown in September.

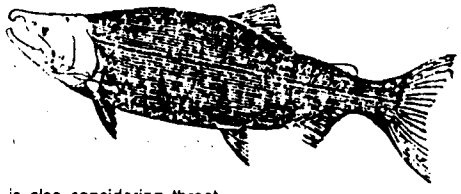
WALLA WALLA UNION-BULLETIN, WALLA WALLA, WA

123rd Year Friday, January 10, 1992

Salmon facts

■ Wild salmon and steelhead runs returning in the Columbia River basin once numbered up to 16 million. Today, about 2 5 million wild and hatchery fish return to the Columbia basin to spawn. An estimated 500,000 of those are wild fish.

■ The Snake River sockeye salmon has been added to the federal endangered species list.



The National Marine Fisheries Service is also considering threatened status for Snake River spring and summer chinook. An announcement on those runs is expected in mid-February.

■ A number of factors are blamed for the demise of the salmon and steelhead, including dam construction, over-harvesting, mining, grazing, logging, irrigation diversion and loss of habitat through development.

■ Some of the adverse effects for salmon associated with dams are slower river flow rates and higher water temperatures.

The fish must also make a perilous journey through the dams, and the fishes predators tend to artificially congregate around the dams.

■ The single largest area of remaining spawning and rearing habitat in the basin is the Snake River System, upstream of Lower Granite Dam and downstream of Hells Canyon. In order to reach this spawning ground, fish must pass through eight dams.

■ Salmon and steelhead spawn in the tributaries of the Columbia Basin. When young fish reach 1-2 years, they begin a biochemical process called smoltification.

Smoltification triggers an urge to migrate and adapts the fish to survive in saltwater. The young fish move from their native streams to the ocean during spring and summer, when natural river flows would be at their highest.

■ Salmon and steelhead mature in the ocean, where food is more abundant. After one to five years, they become sexually mature and return to freshwater. Most return to spawn in the stream where they were hatched.

Corps gives thumbs up to drawdowns for fish

Reservoirs behind dams will drop for salmon

SUMMARY: *A plan to study the impact of drawing down the reservoirs on the Snake River was announced today. The study may determine whether drawdowns will be used to help endangered salmon.*

By BECKY KRAMER
Of the Union-Bulletin

KENNEWICK — Reservoirs behind the Snake River's Little Goose and Lower Granite dams will drop drastically in March under a trial drawdown performed by the Army Corps of Engineers.

Drawdowns are part of long-range plans to recoup endangered salmon runs in the Columbia River Basin by speeding up water flows and lowering river temperatures.

Reservoir levels behind Lower Granite and Little Goose will plunge to as much as 37 and 15 feet respectively as part of the March test. Both levels are below minimum operating pools, the lowest level at which a dam can operate and still provide a wide range of functions.

The March test is a trial run to help the corps determine how power generation and other aspects of dam operation would be affected by lower reservoirs.

The March test was announced today by the corps' Walla Walla District Commander, Robert Volz, at a press conference in Kennewick. In addition to the test, the corps plans to release water from storage dams on the upper Snake and Columbia rivers to cool water temperatures for fish migrating upstream in August and September.

The corps also plans to lower the Snake River reservoirs to minimum operating levels from April through July in an effort to lop a day off fish travel time. The John Day pool will also be lowered, for as long as possible without affecting the irrigators who depend on it, Volz said.

Annual drawdowns on the Snake River have emerged in a number of salmon recovery plans, in-

See ↙ CORPS, Page 2

Corps' plan will test drawdowns on reservoirs behind dams

Continued from page 1

cluding one released by the Northwest Power and Planning Council this fall.

The construction of eight dams on the Columbia and Snake rivers has tamed the spring floods that once swept young salmon from their spawning grounds to the ocean in a number of days. Arriving at the ocean on time is crucial to the young salmon, which undergo a biological process that transforms them from freshwater to saltwater fish.

The longer journey also increases risk from predators, and biologists say that the higher river temperatures are also detrimental to young salmon survival.

The corps hopes to learn a number of things from the test, including:

- Effects on power generation and general operation of the dam.
- Whether lower water levels will affect river bank stability.
- How a drawdown will affect dissolved gas levels in the river. High saturated gas levels, caused by river turbulence, can be lethal to young salmon.
- Water quality and temperature.

The plan announced today was the one expected throughout the region.

Volz said the March test of Little Goose and Lower Granite will have little affect on irrigation and is timed to prevent large shipping disruptions on the river. Few farmers irrigate out of Little Goose or Lower Granite pools, and March is the tail end of the shipping season for many growers.

The March test won't directly benefit young salmon, however, because they don't begin migrating until April. The drawdown was purposely scheduled before migrations started, because the dams have not been altered to allow fish through at low reservoir levels, corps officials said. Volz said.

He cautioned however, that the plan is not set in stone at this point. Several public hearings on planned on the corp's final draft of its environmental impact statement on 1992 water flow actions. Meetings are scheduled for Jan. 28 in Lewiston and Jan. 29 in Pasco. The Pasco meeting is planned for 7 p.m. at the Red Lion, 2525 N. 20th St.

Final approval of the plan will come after the additional public input, Volz said. The final plan is expected to be released by mid-February.

JAN 1 3 1992
LEWISTON, ID

SNAKE RIVER DRAWDOWN

Corps gives it a try

Test during March will see Lower Granite drop as much as 42 feet

By Bill Loftus
of the Tribune

The U.S. Army Corps of Engineers plans to announce today its proposal to draw down Lower Granite Reservoir by as much as 42 feet in March. Little Goose Reservoir will also be drawn down as much as 20 feet.

The corps notified governors and the Northwest's congressional delegations of its plans for the Snake River reservoirs Thursday. The Lewiston Tribune obtained a copy of that announcement.

The corps plans a meeting Jan. 28 at Lewiston's Ramada Inn from 7 to 9 p.m. to provide more information about its plan. A similar meeting is scheduled at Pasco Jan. 29.

Spokesmen for Washington Gov. Booth Gardner and Idaho Gov. Cecil D. Andrus said the announcement offered hope that the region was on track to solving the problems facing the Snake's salmon runs.

"It's very close to what Gov. Gardner wanted," said Dan Silver, a Gardner aide at Olympia. "We need to settle this issue of the drawdowns over the next several years and without an experiment in 1992 we would just be delayed inappropriately," he added.

Scott Peyron, Andrus' press secretary, said the corps plan was being reviewed at Boise.

"The governor's encouraged by any meaningful steps we take to collect good data and move on with the process of modifying the dams and their operations," Peyron added.

"I even think those who have opposed drawdowns over the long term will be pleased," Silver added.

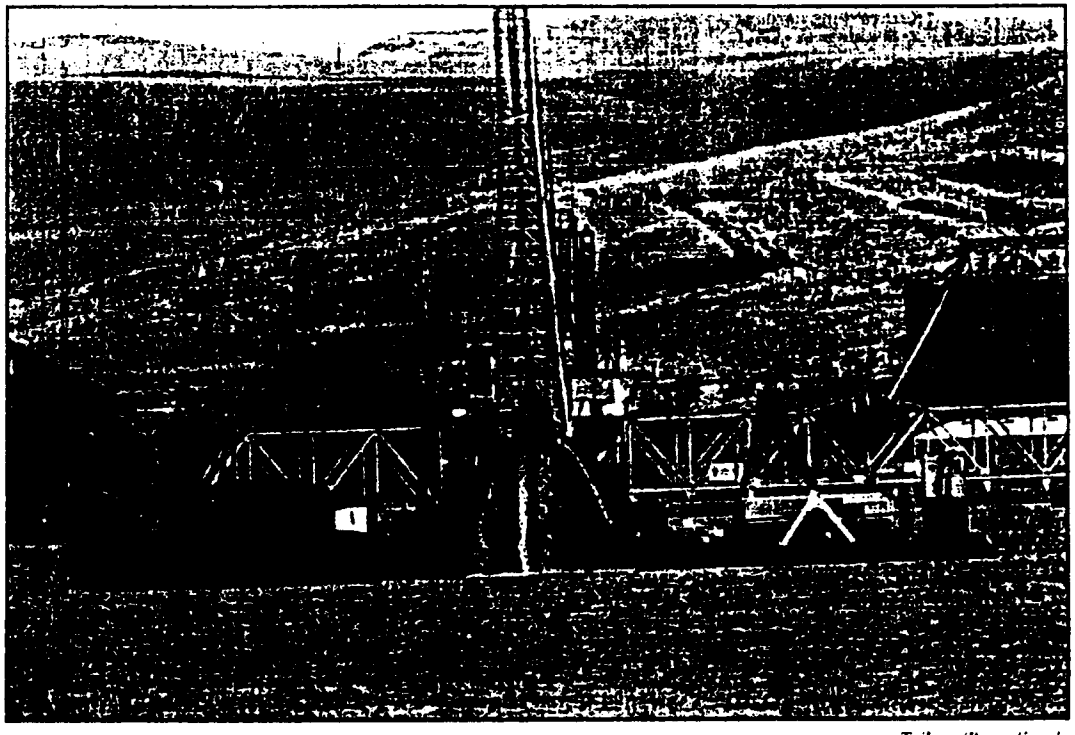
A shipping company spokesman said the corps plan followed the expected course that has been discussed widely. Three weeks of the drawdown, which will occur from March 1 to 31, coincide with the maintenance closure of Lower Granite's navigation lock.

"We have pretty much suspected that that might be the case. And although we really haven't had that information confirmed, I can tell you we don't like it," said R.K. (Skip) Hart of Tidewater Barge Lines at Vancouver, Wash.

The shutdown of shipping will cause a disruption, although how much is difficult to predict. "But 10 days is better than two months, let's put it that way," Hart added.

Lt. Col. Robert D. Volz, the corps' Walla Walla District commander, refused to discuss the plan Thursday afternoon. "We're just going to share it

See *Corps*, Page 7A



Tribune/Barry Kough

Dredge material is lifted from the river bottom west of the confluence of the Snake and Clearwater rivers to ensure a passage for barges. Dredging is done periodically, but this year more of the river bottom will be exposed during a planned test drawdown of the river system in March.

Corps From 1A

with everyone tomorrow (today)," he said.

The plan's reception will depend on who is speaking, Volz predicted.

Those who accused the corps of dragging its heels may be the most surprised. "There are a lot of people who I think feel the corps has an institutional bias against taking certain actions," he added.

The drawdown is part of a physical test to see what happens to railroad tracks and highways built on fill along the reservoir's shore, Lewiston's levees and other structures.

The test will also include tests to determine how quickly water flows through the reservoir, the effects on Lower Granite Dam's hydroelectric turbines and its fish ladder and bypass system.

Salmon advocates and biologists believe lowering the reservoir level will speed the Snake's current. Young salmon must migrate to the ocean quickly or die.

The sockeye salmon that climb the Snake toward spawning grounds in the Salmon River's headwaters were recently declared an endangered species by the National Marine Fisheries Service.

The agency also recommended the Snake River spring-summer and fall chinook runs for threatened species status. A final decision is expected within a month on those runs.

Hart said Tidewater officials were pleased the test would occur. "We at least suggested that as an alternative to find out if this has any merit behind it," he added.

According to the corps' plan, the water level of Lower Granite Reservoir will begin dropping slowly March 1. The drawdown will continue until the water level reaches 33 feet below full.

The water level of Little Goose will begin dropping next and will fall as much as 20 feet below full.

Once Little Goose is drawn down, Lower Granite may drop an additional nine feet if the Snake's flow is enough to allow the reservoir to refill by April 1.

To minimize problems, the corps has indicated it will gradually lower the reservoir levels at a rate of two feet a day.

The agency also plans to operate all four lower Snake reservoirs near minimum operating levels from April 1 to July 31.

In addition, John Day Reservoir on the Columbia will be drawn down to 5½ feet above minimum, a level at which irrigation pumps can still operate.

The corps also may shift flood control space from Dworshak Reservoir to Grand Coulee Reservoir again this year to store more water at Dworshak to help flush migrating salmon.

The corps said it would also draw down Dworshak if its chances of refill by July 31 were 70 percent or higher. In addition, the corps plans to draw down Dworshak in August by as much as 20 feet to cool the Snake.

Last year, Dworshak's level dropped five feet in late August in an effort to cool the Snake and help migrating adult salmon.

Inside

JAN 11 1992
THE SPOKESMAN-REVIEW, SPOKANE, WA

Drawdowns will test plan to protect salmon

By Nicholas K. Geranios
Associated Press

KENNEWICK — Reservoirs at two Snake River dams will be lowered in March to test whether such drawdowns can help endangered salmon survive their migration to the sea, the U.S. Army Corps of Engineers said Friday.

The drawdown will involve Lower Granite and Little Goose reservoirs in southeastern Washington and will last the entire month of March, the corps said.

The test will gauge the impact of such drawdowns on water speed, electrical turbine operations, riverbed sediment and the erosion of highways and railbeds along the river, said Lt. Col. Robert Volz, head of the Walla Walla District office of the corps.

"Few fish are migrating in the river at this time," Volz said. "This is an environmental and structural test."

Under the test, Lower Granite's pool will be drawn down 28 feet, and could be lowered another nine feet. Lower Goose could be lowered as much as 15 feet, Volz said.

The drawdown plan is one of several recommendations in the preferred plan of action for 1992 in the Columbia and Snake rivers, he said. The 1,200-page environmental impact statment is to be released Jan. 24 for public review.

The drawdown comes in response to last year's federal declaration of the Snake River sockeye salmon as an endangered species and the expected announcement within a month that the spring, summer and fall runs of chinook salmon are threatened.

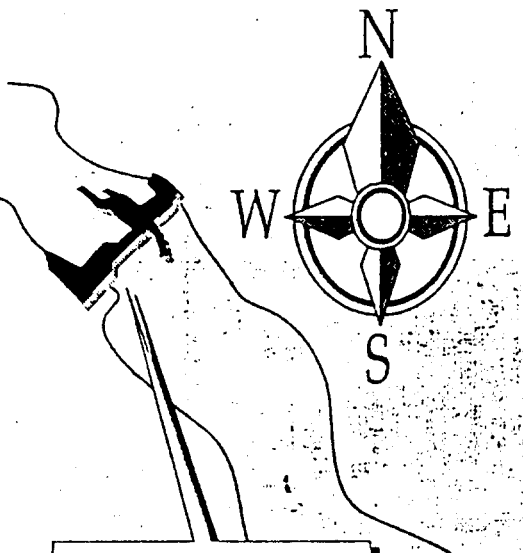
The idea is that speeding up river flows during critical migration seasons will speed the journey of juvenile salmon to the sea, increasing their survival rate, said corps fish biologist Sarah Wik.

Salmon stocks have declined dramatically since a network of hydroelectric dams was built on the Columbia-Snake river system earlier this century. The dams block adult fish swimming upstream to spawn, while many young salmon migrating to the ocean are swept into power turbines and killed.

Irrigators are pleased with the test, since it will allow the corps to gauge the true effects of drawdowns, said Ron Reimann of the Columbia-Snake River Irrigators Association.

"Drawdowns are not as advantageous as some people believe," he said.

LEWISTON MORNING TRIBUNE, LEWISTON, ID
N 1 2 1992



GOIN' DOWN!

LOWER GRANITE

■ The drawdown above this, the first dam downstream from Lewiston and Clarkston, will be as much as 42 feet.

Starting March 1, the Snake River as we know it will begin to look a lot like the river of its historical origin as part of a test to aid fish passage.

Like with the limbo, the question for more than a year confronting Snake River watchers has been: How low will it go?

Murky prospects began to clear Friday with the U.S. Army Corps of Engineers' plan to alter Snake and Columbia river flows during 1992 to help restore imperiled salmon runs.

Lower Granite Reservoir is going down. Its fall brings new questions to the surface.

How will the rivers look? Will Holbrook Island rise again from the Clearwater? Will the Lewiston and Clarkston city beaches face each other again across the Snake? What will we find? How will it smell?

For Lower Granite, the plan means a slow retreat. The Snake will reclaim its status as a river again foot by foot as the reservoir begins to drop March 1.

By March 15, according to the plan, the reservoir will drop 33 feet from full. At that level, the Clearwater will flow free again to its confluence with the Snake.

The Snake will be a river again for another two miles to near the Red Wolf Crossing Bridge at Clarkston's northern edge.

If Lower Granite falls another nine feet, as the corps plan says it may, a freed Snake may re-emerge again beyond Chief Timothy State Park.

Some boaters are already eager to see an old acquaintance. River rafter John A.K. Barker of Lewiston looks at an aerial photo and remembers.

"This was the Lewiston City Beach. This was Clarkston's city beach. There used to be a real nice little piece of water right here," he says, pointing.

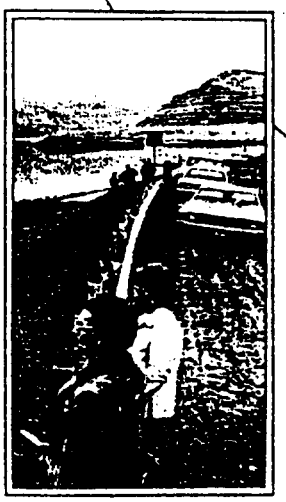
After 17 years submerged beneath a reservoir, will the rivers emerge their former selves? Sarah Wik, a corps biologist at Walla Walla, foresees changes. "My guess is it will be a new, remodeled Snake."

Another corps official, Phillip L. Hixson at Clarkston, says one guess is as good as another. "You can't just say it is going to drop into the old river channel because it might cut a new one. Nobody knows what it's going to look like."

One clear advantage this year's drawdown has is timing, Hixson replies, when asked what acres of exposed mud flats might smell like. "I would think in March it wouldn't be nearly what it could be in June, July and August."

Lewiston Police Chief John P. (Jack) Baldwin said he will be interested to see what the receding waters reveal, too. "I'm sure we'll pursue it. It would be kind of an interesting diversion."

— **Bill Loftus**

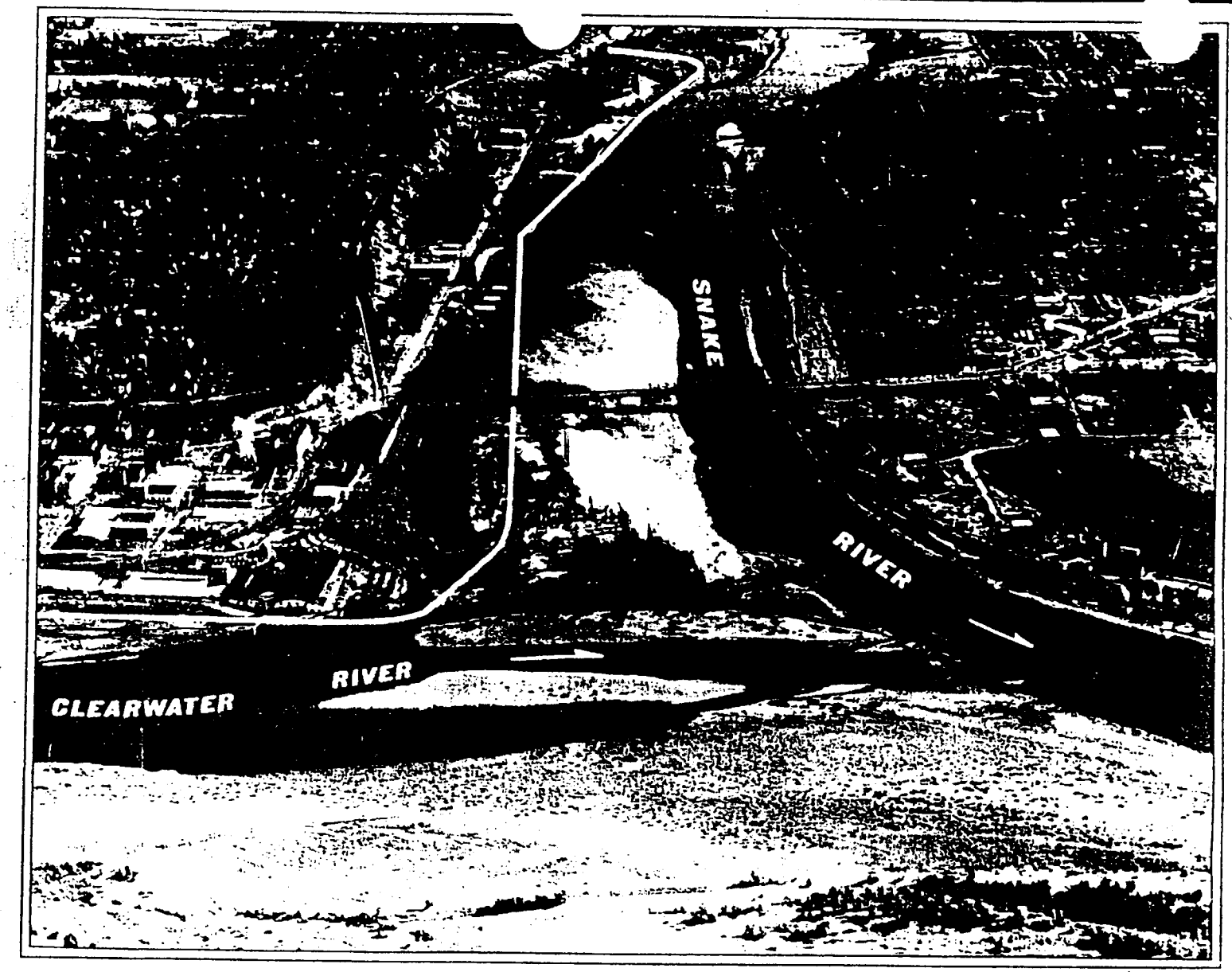


LEFT, the raising of the Snake River's level drew crowds to shoreline Feb. 18, 1975. A drawdown of the river this March may again attract a lot of curious onlookers.

Tribune graphic / Todd Adams

CHIEF TIMOTHY

■ This state park sits on Silcott Island, formed when the level of the Snake was raised. The drawdown may expose much of the former fields, which lie submerged in the river channel.



ABOVE, with the exception of the levee (indicated by the white lines), the confluence of the Snake and Clearwater rivers will appear more like it did before the arrival of slackwater. **BELOW**, broad flats scraped bare by machinery hugged the Snake River shoreline west of Clarkston's Red Wolf Marina before slackwater arrived.

THE IDAHO STATESMAN, BOISE, ID

4C Wednesday, January 1, 1992

Corps preparing for drawdown

Shippers notified of lock closures

The Associated Press

LEWISTON — The U.S. Army Corps of Engineers will announce its choice Jan. 10 for the timing of a spring drawdown test in lower Snake River reservoirs to help salmon recovery efforts.

It also has begun notifying river shippers about plans for the annual maintenance closure of navigation locks at lower Snake dams.

The corps' preferred alternative for drawdowns aimed at improving salmon migrating conditions will be unveiled at a Kennewick, Wash., news conference.

The Snake's sockeye salmon was listed as an endangered species in November by the National Marine Fisheries Service. The agency also is considering threatened-species status for the spring-summer and fall chinook salmon runs in the Columbia and Snake river systems.

Corps of Engineers drawdown plan for 1992 will form the heart of an environmental impact statement due for release in late January.

Corps officials have insisted they have not yet chosen a plan for altering operations at the Snake's dams and reservoirs this spring. But many of those monitoring salmon recovery efforts believe the corps will propose drawing down at least Lower Granite Reservoir during March.

The level of Little Goose Reservoir, which impounds the Snake to the base of Lower Granite Dam 32 miles west of Clarkston, Wash., also is a likely drop as part of a drawdown test this spring.

In its announcement of the Snake's navigation lock closures, the corps appeared to bolster the likelihood of a March drawdown.

The corps announced Lower Granite's locks would close the morning of Feb. 28 and reopen at midnight March 21. The locks at downstream dams would close more than a week later, beginning 12:01 a.m. March 8 at Little Goose Dam.

Lock closures would follow at 8 a.m. March 8 at Lower Monumental Dam, 29 miles downstream, and at 1 p.m. at Ice Harbor Dam, 32 miles downstream from Lower Monumental.

Shipping interests have asked that any drawdown take place during the annual lock maintenance shutdown to minimize the time river shipping would be stalled.

Gov. Cecil Andrus and salmon advocates have called for drawing down the lower Snake reservoirs to allow the river to flow more naturally. The swifter currents would speed young salmon on their seaward migration. Slack water behind dams is considered a major cause of the salmon runs' declines.

D.M. "Mike" Satterwhite, Trout Unlimited's Pacific salmon representative in Lewiston, said he believes the corps will draw Lower Granite Reservoir down as much as 45 feet during March. He said Little Goose Reservoir likely will be dropped 15 to 20 feet during at least part of the test.

A March test has gained the most support because it would offer a way to test the physical impacts of a drawdown with minimum jeopardy to fish.

Front Page Main Section
JAN 12 1992

WALLA WALLA UNION-BULLETIN, WALLA WALLA, WA

Drawdowns may stir ripple impact on wheat exports

BY BECKY KRAMER

Drawdowns or no drawdowns, Walla Walla County farmers probably won't have any trouble barging future shipments of wheat to Portland.

Most of the 12 million or so bushels of wheat grown annually by Walla Walla farmers reaches Portland long before downstream salmon migration begins, said Don Schmidt, general manager of Walla Walla Grain Growers.

Even if future plans to save endangered salmon stocks include drawdowns of Snake and Columbia River reservoirs in April, May or June, Walla Walla farmers aren't likely to take a hit, Schmidt said.

By that time, most farmers here need or want to have their grain sold to pay bills, Schmidt said.

But for Joe Stegner of Lewiston, much more is at stake.

Stegner and his brothers operate a grain terminal in the Lewiston-Clarkston area that serves farmers in Washington, Idaho, Montana and North Dakota. Because grain comes from more distant farmers, it is sold later in the year.

Bad roads and harsh winter weather conditions frequently mean that some wheat doesn't

See WHEAT, Page 2

Wheat officials will eye drawdown

Continued from page 1

reach Stegner's elevator until spring. About 20 percent of the grain stored in his elevators is sold and barged to Portland during the months of March, April and May.

"It's not the peak. It's not the most damaging time for a drawdown," Stegner concedes.

But an extended spring drawdown still has the potential to put him out of business, he says. And even more worrisome, create a negative ripple impact on the export market for soft white wheat, he says.

Wheat officials are also keeping a wary eye on the situation.

Reservoirs behind the Snake River's Lower Granite and Little Goose reservoirs will drop dramatically this spring under a test drawdown performed by the Corps of Engineers.

The March drawdown is timed to have little effect on irrigation or wheat shipments. However, it may pave the way for more extensive drawdowns in the future.

Annual drawdowns on the four Snake River dams have emerged in a number of recovery plans for endangered salmon runs. To date, April, May and June drawdowns appear to hold the most promise for helping young salmon migrate to the ocean.

A drawdown longer than a month would be devastating to farmers who ship through Lewiston and Clarkston and it could affect the export market as well, Stegner said.

Between 85-90 percent of the soft white wheat grown in the Northwest leaves the country for overseas markets. Most of that wheat travels through Portland, one of the largest grain-export ports in the nation.

About 50 percent of the grain traveling through the Columbia-Snake River system originates from elevators in the Lewiston-Clarkston area, Stegner said.

The inability of this area to supply export markets might hinder the availability of grain from Portland, Stegner said.

"Absolutely. It's a big concern," said Greg Doud, spokesman for U.S. Wheat Associates, a trade organization in Portland that seeks to increase export opportunities for American-grown wheat. "We could be talking millions and millions of dollars."

"It could affect our ability to respond to a customer," added Tom Winn, administrator of the Oregon Wheat Commission.

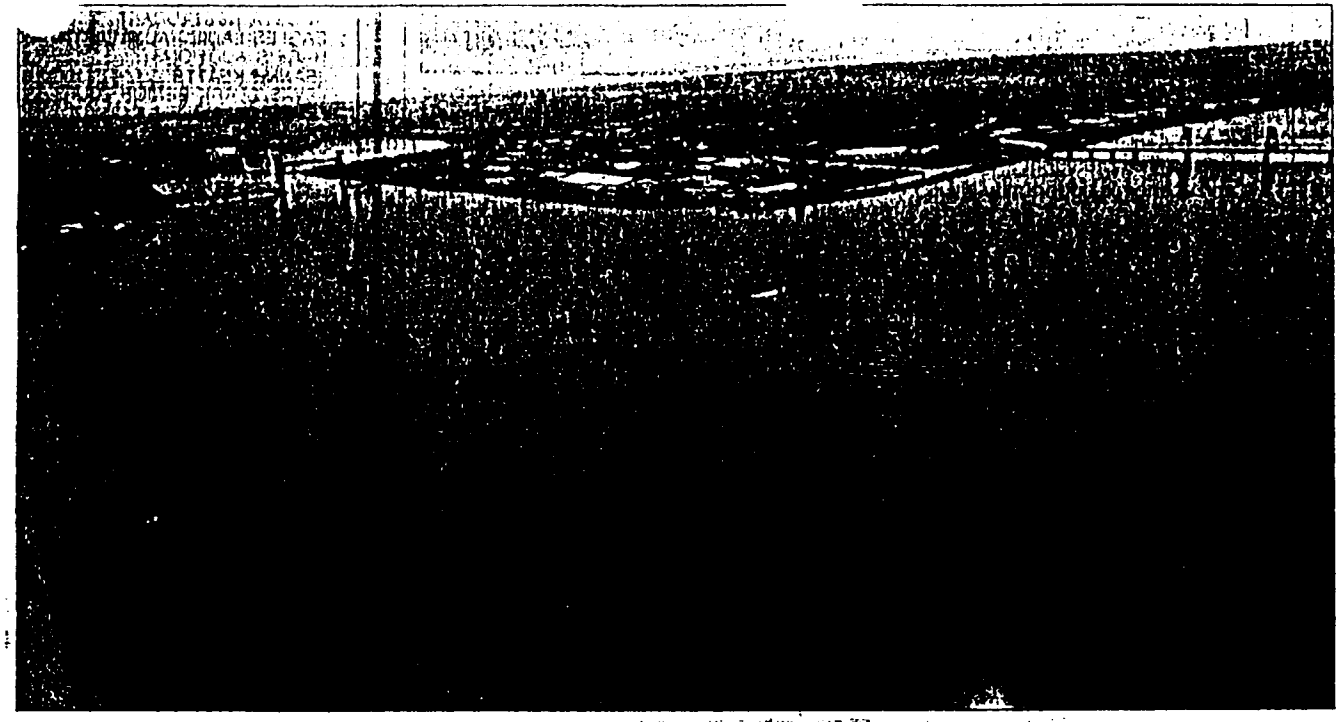
Most, if not all, of the soft white wheat grown in the Northwest travels by barge to Portland, Winn said.

If a drawdown is kept to four or six weeks, the industry would be able to adapt. But a longer drawdown would require costly adjustments that would hurt farmers, Winn said.

Sending wheat by truck or rail jacks up transportation costs significantly. One possibility would be to truck the wheat from Lewiston and Clarkston to the Tri-Cities and barge it to Portland from there, he said. But even that would sharply boost transportation costs, he said.

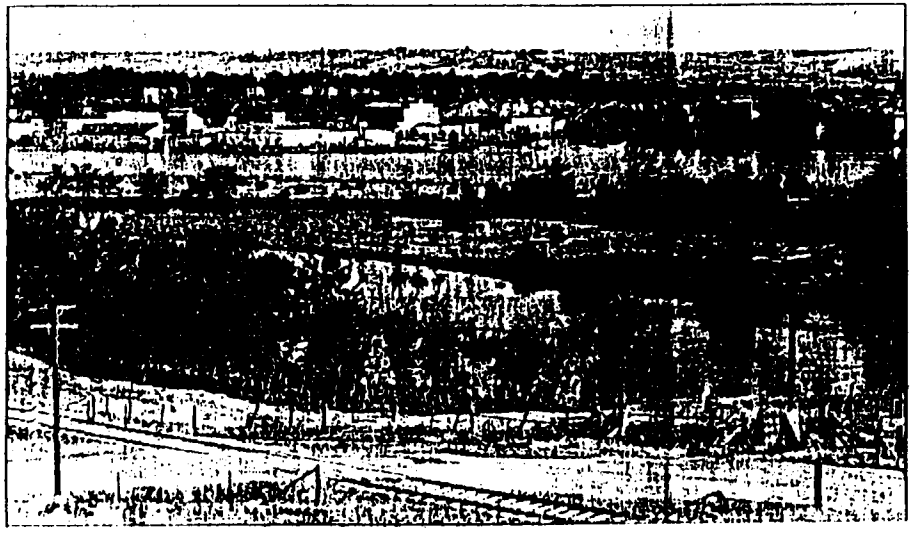
LEWISTON MORNING TRIBUNE, LEWISTON, ID
JAN 11 1992
p-14

Businesses fear impact



Tribune/Barry Keough

A recent aerial view of the confluence of the Snake and Clearwater rivers, above, shows slack water where islands and other land features once were. Some of those features may reappear during the drawdown in March. A 1963 photograph from the Lewiston Tribune's files, below, shows islands in the confluence. Lewiston's Twin City Foods complex is in the background.



Corps plans series of flow changes

■ Formal program unveiled

By Bill Loftus
of the Tribune

KENNEWICK— The U.S. Army Corps of Engineers unveiled formally Friday a complex series of tests to help chart future efforts to rebuild Snake River salmon runs.

The corps plans a mix of reservoir drawdowns and changes in Snake flows to rebuild imperiled salmon runs.

From a conference room overlooking the Port of Kennewick with the Columbia River as a backdrop, Lt. Col. Robert D. Volz announced the agency's plans to draw down Lower Granite and Little Goose reservoirs on the Snake.

The two Snake reservoirs were chosen in part, Volz said, because few farmers depend on them for irrigation. The effects would be limited mostly to ship-

See *Plan*, Page 5A

■ River comme. marinas will be left high and dry in March

By Julie Bailey
and Bill Loftus
of the Tribune

Snake River sockeye salmon aren't the only ones facing extinction, s.. some businessmen affected by plans to draw down Lower Granite Reservoir.

Commercial interests along the Snake River and neighboring Dworshak Reservoir would be affected by plans to alter the Snake's flow to help imperiled sockeye and chinook salmon runs.

The U.S. Army Corps of Engineers Friday released its plan to save the fish. Business interests ranging from manufacturers to ports are anticipating damages the falling reservoir could bring.

Robert B. Gilchrist, Northwest Travel and Recreation president, said he expects his Red Wolf Marina at Clarkston to sustain heavy damage when Lower Granite Reservoir's level drops.

The marina's docks and moorages aren't designed to survive large fluctuations of the reservoir's level. As a result, there's nothing he can do to avoid damage to utility lines, docks or mooring cables.

"There really isn't. We've got 12 to 15 feet of water and those docks and moorages have to settle as the water goes down. We may have to rebuild the whole outfit," he said.

The damage has begun already as boaters steer clear of a reservoir with a murky future, he added. Houseboat rental cancellations began last summer. This winter he closed the marina's store.

He couldn't justify running it at a loss through the lean months of winter to get an early jump on spring. The March drawdown will break the continuity anyway, Gilchrist said.

Once the water drops below the minimum operating level he and others once thought was guaranteed by law, he said, the reservoir's attraction for developers will go down the drain, too.

"I don't know anyone in his right mind who would put money in that river right now without some guarantees that the water will be there," Gilchrist said.

Port of Clarkston Commission Chairman Jerry Cox complained that decision makers failed to consider how recreation interests would be affected by a drawdown.

"I don't think all our impacts have been given a full airing," Cox said. "Everyone thinks they will have the pool and everything will be normal later ... and I think that's far from accurate."

To help pleasure boaters, Clarkston

See Impact, p

CENPW-PA April 22 Jan 92

Plan

From 1A

ping interests and marinas.

Irrigators had been vocal opponents of plans for deep drawdowns of the Snake's two most downstream reservoirs or those on the Columbia.

The corps plan calls for Lower Granite Reservoir at Lewiston and Clarkston to drop as much as 42 feet in March and Little Goose Reservoir downstream to drop as much as 20 feet.

The plan also calls for drawing down Dworshak Reservoir at Ahsahka 20 feet in August to help cool the Snake. Dworshak will also supply more water during the spring to help young salmon migrating to sea.

This year's drawdowns will be conducted during March because salmon aren't migrating then in the Snake.

The corps will gather information about how drawdowns affect currents through the reservoirs, erosion of sediments, highway and railroad embankments and other physical features.

Idaho Gov. Cecil D. Andrus and some salmon advocates called for immediate drawdowns last year as regional interests gathered at the Salmon Summit to hatch a salmon plan.

This year's test will help show what changes must be made in the dams so fish can survive the trip through them at lower water levels.

Volz said the test must still pass through final legal hoops before it occurs.

The plan resulted from a concerted effort by the corps, Bonneville Power Administration and the U.S. Bureau of Reclamation. "It was not a capricious decision," Volz said.

The final hurdle will be a "record of decision" scheduled to be signed Feb. 14.

Andrus aide Andy Brunelle, contacted at Boise, said observers expect few changes if any in the corps plan. "They'd be minor if there are any," he added.

The March timetable for the testing resulted largely from reservations by National Marine Fisheries Service biologists about the drawdowns.

"There will be fish migrating after that time and we don't want to interfere with the migration," said J. Gary Smith, the service's deputy regional director at Seattle.

At Lapwai, Nez Perce Tribal Executive Committee chairman Charles H. (Pete) Hayes questioned the extent of the drawdown test. "I think it may be too ambitious, that drastic of a drawdown," he said.

Hayes said he believed more water should be released from upstream reservoirs such as Dworshak or Brownlee to help the fish migrate.

"All of the drastic measures have been termed as ocular or something that does not benefit the fish, something that's more for show," he added.

The tribe also plans to keep track of the drawdown's progress and its effect on archeological sites that may be exposed.

At Kennewick, Volz said he knew of no interests that have notified the corps they will attempt to block the plan. Second-or third-hand reports, he acknowledged, indicate there may be, however.

One possibility that could derail the Little Goose drawdown would be the discovery of fall chinook salmon redds or nests below Lower Granite Dam, said Sarah Wik, a corps fishery biologist.

Divers are scheduled to begin searching the shoreline for the redds Tuesday, she said.

How low the reservoirs go will depend on water flows, Wik said. The test at Lower Granite, for example, calls for a 33-foot drawdown by March 15. The reservoir may fall an additional nine feet if the corps can be sure it will refill by April 1, she added.

"It will be a day-by-day decision," she said. A review of March flows in the Snake during the past decade shows a range of 20,000 cubic feet of water per second to nearly 100,000 cfs.

Impact

From 1A

port officials plan to make their crane available to haul out large boats that would otherwise be aground during the drawdown.

Other than Red Wolf Marina's impending woes, Cox said the Port of Clarkston has much less immediately at stake than the ports of Lewiston and Whitman County.

Recreational docks at Boyer Park and wells at Central Ferry and Almota may be damaged and cause losses for port tenants during the drawdown, according to Port of Whitman County Manager James Weddell.

Weddell worries that NuChem, a Pullman agricultural chemicals company with a plant at Central Ferry, won't have any water to mix the chemicals once the river and the water table is lowered.

If the well goes dry in March because of the drawdown, NuChem will be left high and dry at the beginning of its busiest season.

Drawing down the river also poses potential structural problems for the many grain elevators along the river. The elevators sit at least partially over the river in order to load barges.

At Clarkston, Beamer's Hells Canyon Excursions and Tours recently moved into a $450,000 facility at Wilma.

Weddell said the now-floating docks would be sitting in the mud during a drawdown. Officials remain unclear about where the docks should be moved to remain floating in March, he said.

"It's a mess," Weddell said. "In many ways, if we have to do a test ... this is about as good a time as you could pick to do it. ... We hope people really look carefully at the results."

"We're setting ourselves up so we don't get caught in a bind," said Lewis-Clark Terminal Association manager W. Arvid Lyons at Lewiston.

The grain terminal has been shipping a river of wheat west to Portland for the past two months. This year's stockpile was already modest as a result of last summer's reduced harvest.

Much of the shipping in recent months, Lyons acknowledged, has occurred because demand has been strong.

The association does not plan to stockpile grain downriver or pursue alternate shipping methods during the drawdown, Lyons said. The judgment about whether the terminal needs to adjust will await the outcome of this spring's test, he added.

Port of Lewiston Manager F. Ron McMurray was not surprised by the corp's plan, and says the port is prepared to work around the March drawdown schedule.

"We appreciate the fact that they stepped the (announcement) time up to let us know, so we can position our products accordingly," McMurray said.

The lead time will allow the Port of Lewiston to either arrange to run goods down the river ahead of time, store them in its new warehouse facilites, or arrange for truck or rail transportation.

To keep grain flowing down the river, the port has temporarily stopped construction on the new Inland 465 super-warehouse project. The 150,000-square-foot building is complete, but the railroad spur has not yet been built.

"We stopped that contract from total completion because it would interrupt the loading of grain cars," McMurray said. "When the river goes down, we'll finish."

McMurray said the drawdown wouldn't keep companies from doing business with area ports.

Potlatch Corp. officials also were glad the corps chose to draw the river down during the regular lock maintenance time. But they will still have to take steps to ensure that their business will continue uninterrupted in March.

"Obviously, our water intake will be a factor, and we are going to take the necessary steps to ensure that we can have water during that part of the drawdown," Potlatch spokesman Todd L. Maddock said.

The company plans to dredge the river bottom alongside the mill site in order to catch the downstream flow, Maddock said.

In addition, the company will use more truck and rail transportation during the drawdown to continue operations. Maddock said it would be more costly, but did not have specific figures.

Potlatch Corp. ships primarily paperboard to Pacific Rim customers out of the Port of Lewston.

But for everyone, it remains speculation until the plug is pulled on the reservoir system.

"We'll just have to wait and see," Maddock said.

The Lewiston-Clarkston Valley isn't alone in watching the corps' plans with trepidation.

At Orofino, Jerry O. Olin dreads the test's effect on Dworshak Reservoir, which calls for a 20-foot drawdown there in August. Dworshak's cool waters will be released in an effort to cool the Snake to help adult salmon migrating upriver.

"It will have a very devastating effect on me as sole owner and operator of Dworshak Excursions," said Olin. His houseboat rental and excursion business draws most of its customers during August.

After attending several meetings on the subject, Olin has resigned himself to the idea 1992 will be a year of experimentation.

"But with the salmon lifecycle spread over three or four years, I don't know if one year is going to prove anything. I have my doubts," Olin added.

JAN 2 1 1992

WALLA WALLA UNION-BULLETIN, WALLA WALLA, WA

20, 1992

Salmon beds may alter drawdowns

EDITOR'S NOTE: The continuation of this story, which began on page 1 and was to have run on page 2 Sunday, was omitted. The following is the story in its entirety.

LEWISTON (AP) — Tentative evidence that fall chinook salmon are spawning in the Snake River just below Lower Granite Dam could alter U.S. Army Corps of Engineers plans to test drawdowns of the reservoir system, an agency biologist says.

If confirmed, the discovery of salmon redds, or nests, at the upper end of Little Goose Reservoir could change proposals to draw down that reservoir by 15 feet in March.

Officials from the corps and National Marine Fisheries Service discussed the findings Friday, said Sarah Wik, a corps fish biologist at Walla Walla.

"It is tentative but we think we have located some sites. We are trying to get that confirmed," she said.

A team of divers from the U.S. Bureau of Reclamation began searching the river below Lower Granite Dam Tuesday and completed a preliminary search Friday.

The divers found the redds in five to 12 feet of water about three-quarters of a mile downstream from the dam, Wik said. They videotaped the river bottom for review by scientists.

If the areas are redds, their discovery confirms suspicions fall chinook are spawning in the portion of Little Goose Reservoir with the swiftest currents.

National Marine Fisheries Service officials last June recommended fall chinook for a federal threatened species listing. The agency is expected to make a final ruling within a month.

Wik said the discovery could lead the fisheries service to rule out corps plans to draw down Little Goose Reservoir. The drawdown of Lower Granite Reservoir would continue as planned, she said.

But some of the tests planned at Lower Granite Dam during the drawdown might have to be changed as a result, she added.

The drawdowns of the two reservoirs are planned to gather information on how the river current would accelerate through the slackwater, and how levees and railroad fills along the banks are affected.

The drawdown was limited to March because of fears it could harm migrating adult or juvenile spring chinook salmon.

The corps requested the divers because of questions about whether fall chinook might spawn in the area, she said.

University of Idaho and U.S. Fish and Wildlife Service teams captured young fall chinook in Little Goose Reservoir this summer that had apparently hatched there.

"We knew it was a possibility, and it's still a possibility until we can confirm it. But we wouldn't want to do anything to adversely affect those critters," Wik said.

It may still be possible to draw down Little Goose a bit. Or the corps could proceed with present plans and still protect the redds, she said.

Wik said she hopes to get divers down to search the river again as soon as possible. The divers estimated they had covered about 5 percent of the potential spawning area.

Main Section JAN 11 1992 THE TIMES-NEWS, TWIN FALLS, ID

Snake River drawdown test in March

KENNEWICK, Wash. (AP) — Reservoirs at two Snake River dams will be lowered in March to test whether such drawdowns can help endangered salmon survive their migration to the sea, the U.S. Army Corps of Engineers said Friday.

The drawdown will involve Lower Granite and Little Goose reservoirs in southeastern Washington and will last the entire month of March, the corps said.

The test will gauge the impact of such drawdowns on water speed, electrical turbine operations, riverbed sediment and the erosion of highways and railbeds along the river, said Lt. Col. Robert Volz, head of the Walla Walla District office of the corps.

"Few fish are migrating in the river at this time," Volz said. "This is an environmental and structural test."

Under the test, Lower Granite's pool will be drawn down 28 feet, and could be lowered another 9 feet. Lower Goose could be lowered as much as 15 feet, Volz said.

Colfax, WA
Gazette
(Cir. W. 4,692)

DEC 26 1991.

Allen's P. C. B Est. 1888

River drawdown could hike grain shipping rate

2102

Shippers with elevators on the Snake River could face cost increases of over 10 cents a bushel if the drawdowns proposed by the Army Corps of Engineers take place, according to WSU ag economics professor Ken Casavant. Those with inland elevators could face only a three to five cent increase per bushel due to increased competition from trucking companies, he added.

The Army Corps of Engineers recently proposed a test drawdown of 40 feet below minimum pool at Lower Granite Dam and 20 feet below minimum pool at Little Goose Dam.

The target drawdown date is March 1-30 plus one week before and after to remove a floating guide wall. This would replace the planned Jan. 20-21 test drawdown.

This drawdown schedule could force farmers to ship before they want to or wait until the river is back in operation, Casavant noted.

The general consensus is farmers will suffer the most from any drawdown, not shippers.

"Those farmers with access to rail are in a better position than those that must rely on truck/barge," Casavant noted.

Railroad rates could rise an average of one to three cents across the region as the barge competition disappears though, he said.

Bob Holmes, manager or Whitman County Growers, said this is as good a year as any to do a major drawdown since this year's wheat crop is smaller and has sold faster.

In 1990, farmers had 31.5 million bushels to market and soft white wheat was selling for $2.90 a bushel in Portland.

This year, farmers had 20.8 million bushels and the Portland price was $4.63 per bushel, up from $4.32 in November and $3.39 in August. The present shipping cost is 43 cents.

"It is better to do it this year. We can only hope the drawdown test fails and the Corps decides not to do (regular drawdowns)."

If the Corps does regular drawdowns as proposed, it would have a dramatic effect on shippers and farmers, Holmes exclaimed.

Shippers and farmers would have to find alternative transportation for up to six months during the year if the initial test is successful, he said.

A small shipper would be full in no time if they couldn't ship during the drawdown period, Holmes explained.

Farmers would need to find a different way to go but fortunately there isn't a lot left to market this year, he added.

The proposed drawdown may not have a major impact on most shippers but it won't help farmers who need to ship during that seven week drawdown and repair period, said Curtis Scholz from S&R Grain.

They either need to hold their grain or unload it by rail, he noted. So if the market drops during that drawdown time those farmers could lose money.

It also is a logistics problem to match barges with truck shipments, especially this year when more grain than usual is being shipped due to the increased prices, Scholz added. Barges are limited so grain is piling up.

Railroad cars also are harder to come by than barges due to decreased attention from the railroads, he explained. The railroads are concentrating on large long haul shipments from the Midwest.

Under the Endangered Species Act, the National Marine Fisheries Service normally would have two years to develop a recovery plan. In this case, the time frame is compressed to six to twelve months because the situation is considered so critical.

The Northwest Power Planning Council decided last week on a plan dealing with water flows, power production and salmon harvests on the river.

The plan will help develop a river operations plan and a detailed program of reservoir drawdowns in response to the listing of the Snake River sockeye salmon as an endangered species.

Estimated costs of a recovery plan range from $200 to $1 billion over four years.

The NMFS will use the power council plan as a starting point for developing a recovery plan.

Irrigators ponder dry future

Farmers who depend on water worry about drawdowns

SUMMARY: Irrigation turned the arid regions of Walla Walla County into land capable of producing high value crops. But talk of drawdowns to save salmon leaves irrigators wondering what the future holds for them.

By BECKY KRAMER
Of the Union-Bulletin

NORTH OF BURBANK — Below the platform of Leon Mehlenbacher's pump station, the waters of the Snake River flow murky and calm.

Five pumps, 250- and 500-horse power giants, pull up the water and pipe it through five miles of line on Mehlenbacher's 1,400-acre farm.

The difference water makes in this arid region is stark. With water, Mehlenbacher and his two sons can grow potatoes, sweet and field corn, alfalfa hay and freezer peas.

Without water, the land is "high desert pasture." The covering of cheat grass and sagebrush is so sparse that a cow would starve on less than 30 acres, Mehlenbacher says.

The advent of high-lift pumps and circle irrigation brought the lush green fields to the dusty landscape along the Columbia and Snake rivers in the late 1960s and early 1970s.

But recovery plans to aid endangered salmon runs have left Mehlenbacher and others wondering what the future holds for irrigated farming in the area.

Water in the reservoirs behind the dams may not be as abundant in the future. As a salmon-saving measure, conservationists have urged spring reservoir drawdowns to increase water velocity and speed up young salmon's trip to the ocean.

This March, the Army Corps of Engineers will lower reservoirs behind Lower Granite and Little Goose dams to test operations during a drawdown. The Northwest Power and Planning Council has called for a full scale drawdown as early as 1995. And drawdowns appear to hold the most promise for increasing fish survival when they're timed to the young salmon's migration period — which begins in April.

But it's in April that Mehlenbacher switches on his pumps for the spring irrigation season, and the irrigation doesn't stop until September. Some of his neighbors, who operate vineyards and orchards, need the water even earlier for frost control.

Farmers can't afford to gamble with water levels and availability, Mehlenbacher said.

When crops need the water, they need it.

"And if you suck any air at all, it destroys the pump."

More is at stake than the livelihood of a few farmers, he says.

"The thing we can't lose sight of is the ripple effect. How it correlates to the region as a whole," says Mehlenbacher, a slow-speaking, deliberate man.

About 180,000 acres of cropland draw water from the Columbia and Snake river dam reservoirs in Washington, according to the Columbia-Snake River Irrigators Association in Prosser.

Irrigation turns western Walla Walla County — which receives an annual rainfall of six to seven inches per year, — into land capable of growing potatoes and corn — crops that require 40 inches of water during their growing season.

The last 10-15 years has also spurred the development of vineyards and orchards in the county. Broetje Orchards and Snake River Vineyards are among the largest of their kind of operations in the state. And Ice Harbor Farms — also located in western Walla Walla County — is believed to be the largest asparagus farm in the world.

Along with talk of future drawdowns have

See ☞ DRAWDOWN, Page 2

JAN 16 1992

WALLA WALLA UNION-BULLETIN, WALLA WALLA, WA

☞ Drawdowns whet worries of western Walla Walla Co. irrigators

Continued from page 1

come reassurances that irrigators won't be left high and dry.

Members of the Northwest Power and Planning Council have said that if drawdowns occur, irrigators will be given the time and money they need to make the expensive modifications necessary to operate pumps at lower water levels.

But such promises aren't very comforting to Van Walkley, who also irrigates his western Walla Walla County farm from the Snake River.

Walkley mortgaged his farm last year to make $400,000 worth of updates to his irrigation system. Modifying his pump station to operate at lower water levels might cost an additional $100,000-$300,000. At some point, it becomes too expensive to be feasible, Walkley said.

"When I first heard of (drawdowns), I thought it was so ludicrous it would never happen," he says bitterly.

Others irrigators are skeptical about the likelihood of a government bailout.

"At first, we were told, 'Oh, well. There will be money from the federal government,'" said Carol Mercer, executive secretary for the Columbia-Snake River Irrigators Association.

But after talking to congressmen in Oregon, Washington and Idaho, irrigators started to wonder if the money really would materialize.

"No one can identify where it will come from," Mercer says.

However, Norm Whittlesey, a professor of agricultural economics at Washington State University, said drawdowns are unlikely without some aid to farmers.

Given the political sensitivity to agriculture, Whittlesey doubts a final salmon recovery plan would contain "uncompensated" or "unmitigated" impacts to lower Snake River irrigators.

But given the current recession, Ice Harbor Farms president Tom Paulus said he too wonders about the chances of private farmers receiving a check from the government.

If mitigation money comes, Paulus believes it will come from the Bonneville Power Administration. And that money will be generated through higher power rates.

"Bonneville doesn't print money. It's you and I and everyone else that will end up paying for it," he said.

Corps wants four-week drawdown of lower Snake for salmon

The Walla Walla District, U.S. Army Corps of Engineers has proposed a four-week drawdown test of Lower Granite and Little Goose reservoirs on the lower Snake River, beginning March 1.

The proposed drawdown test, part of efforts to recover endangered Columbia Basin salmon, is one of several recommendations the Corps unveiled as its "Preferred Plan of Action" for 1992 water management actions in the Columbia-Snake River System at a news conference last week in Kennewick.

The Corps is recommending a combined option of reservoir drawdowns, flow augmentations and a water temperature control test "to improve fish migration this year," Lt. Col. Robert D. Volz, district engineer, said. Implementation of the preferred plan "would begin around March 1," he said.

Under the reservoir drawdown proposal, the four lower Snake River reservoirs would be lowered to near minimum pool (up to 5 feet below normal full pool) from April 1 to July 31. John Day pool on the Columbia River would be lowered to elevation 262.5 (5.5 feet above minimum operating pool), starting May 1.

"This level would be maintained during the juvenile fish-migration period (Aug. 31) for as long as possible without affecting the irrigators who rely on the John Day pool," Volz said.

Flow augmentation, the second option, is proposed for both the Snake and Columbia rivers.

Up to 900,000 acre-feet of water would be released from Dworshak reservoir to augment Snake River flows. "This is in addition to normal minimum releases and any shift of flood control storage to other reservoirs," Volz said.

Releases of up to 6.4 million acre feet from Grand Coulee and Arrow projects will be used to sustain a flow of 200,000 cubic feet per second in the lower Columbia River at The Dalles from May 1 until June 30.

"This is up to 3 million acre feet over the existing volume reserved for fish," he said.

Release of cool water from Dworshak Reservoir is proposed during August and September as a water temperature control test "to evaluate the benefits to upriver migration of adult fall chinook and steelhead," Volz added. "These fish migrate quicker with fewer health problems in cooler water, whereas high temperatures can reduce their survival."

The test calls for drawing down the reservoir in August by "as much as 20 feet below full pool," he said. An additional 200,000 acre feet would be released in September.

To study potential future actions, a four-week drawdown test is proposed at Lower Granite and Little Goose Reservoirs in March. Volz said the test would provide valuable information in the effects of reservoir drawdown, which can be used for ongoing and future drawdown studies.

The drawdown would begin on March 1, and the pools would be returned to minimum operating level by April 1.

"The Lower Granite pool will initially be drawn down 28 feet," he said. "Depending upon the actual river flows, Lower Granite could be drawn down an additional 9 feet and the Little Goose pool by as much as 15 feet." During the test, the Corps will monitor both environmental and structural effects, including changes in the speed of the water in the reservoir; water quality; movement of sediment; operation of turbines during drawdown; railroad and highway embankments, and erosion at the base of the spillway.

Before the proposed plan can be implemented, "a number of activities must be completed," Volz said, including public release of the final 1992 Columbia River Salmon Flow Measures Environmental Impact Statement.

The 1200-page document, which was prepared by the Corps in cooperation with the Bonneville Power Administration and the Bureau of Reclamation, is scheduled for release on Jan. 24.

Final approval of the EIS is expected in mid-February, following a 15-day public review period, which ends Feb. 7. The review process, Volz said, includes consultation with the National Marine Fisheries Service under Section 7 of the Endangered Species Act.

Initially, the cooperating agencies did not identify a preferred alternative for "92 river operations in the draft EIS," Volz said. It took an analysis of available information, comments received during the review process, and recommendations from the Northwest Power Planning Council and the National Marine Fisheries Service, to come up with "a set of options as the preferred Plan of Action for 1992."

Public information meetings to explain the preferred plan and actions required to implement it will be held at 7 p.m. Tuesday, Jan. 28, at the Ramada Inn, 621 21st St., Lewiston, Idaho, and at 7 p.m. Wednesday, Jan. 29, at the Red Lion Inn, 2525 N. 20th, Pasco. A fact sheet describing the Preferred Plan of Action is available by contacting the EIS at (509) 522-6944.

THE IDAHO STATESMAN, BOISE, ID JAN 11 1992

Reservoirs will drop for salmon testing

By Nicholas K. Geranios
The Associated Press

KENNEWICK, Wash. — Reservoirs at two Snake River dams will be lowered in March to test whether such drawdowns can help endangered salmon survive their migration to the sea, the U.S. Army Corps of Engineers said Friday.

The corps said its test period was selected to provide a minimal impact to irrigators, navigation and migrating fish. Dam locks are normally closed for two weeks during the period for maintenance, the corps said.

The drawdown will involve Lower Granite and Little Goose reservoirs in southeastern Washington and will last the entire month of March, the corps said.

The test will gauge the impact of such drawdowns on water speed, electrical turbine operations, riverbed sediment and the erosion of highways and railbeds along the river, said Lt. Col. Robert Volz, head of the Walla Walla District office of the corps.

"Few fish are migrating in the river at this time," Volz said. "This is an environmental and structural test."

Under the test, Lower Granite's pool will be drawn down 28 feet, and could be lowered another 9 feet. Lower Goose could be lowered as much as 15 feet, Volz said.

The drawdown plan is one of several recommendations in the preferred plan of action for 1992 in the Columbia and Snake rivers, he said. The 1,200-page environmental impact statement is to be

See Salmon/2C

OTHER RECOMMENDATIONS

The corps plan also recommends:

- Four lower Snake River dams be drawn down to near minimum operating pools, up to 5 feet below normal full pool, from April 1-July 31.

Also, John Day reservoir would be reduced to 5.5 feet above minimum pool as long as possible without hurting irrigators.

- Up to 900,000 acre feet of water be released from Dworshak Reservoir to augment flows on the Snake.

Also flows of 200,000 cubic feet per second be maintained on the Columbia at the Dalles Dam, using 6.4 million acre feet of water from Arrow and Grand Coulee reservoirs. That is 3 million acre feet more than existing volume for fish.

- That a 20-foot drawdown of Dworshak occur in August to provide cooler water in reservoirs as fish try to migrate. Higher temperatures contribute to salmon mortality.

The Idaho Statesman

Salmon

From 1C

released Jan. 24 for public review.

The drawdown comes in response to last year's federal declaration of the Snake River sockeye salmon as an endangered species and the expected announcement within a month that the spring, summer and fall runs of chinook salmon are threatened.

The idea is that speeding up river flows during critical migration seasons will speed the journey of juvenile salmon to the sea, increasing their survival rate, said corps fish biologist Sarah Wik.

Salmon stocks have declined dramatically since a network of hydroelectric dams was built on the Columbia-Snake river system earlier this century.

Irrigators are pleased with the test, since it will allow the corps to gauge the true effects of drawdowns, said Ron Reimann of the Columbia-Snake River Irrigators Association.

"Drawdowns are not as advantageous as some people believe," he said.

Some effects from the drawdown will be felt. Dave Stegner, owner of Stegner Grain Co. at Clarkston's Port of Wilma, said his company would stop shipping grain until the river reopens, but will continue receiving grain as long as storage holds out.

"Fortunately, there's been a lot of grain shipped already," he said.

Statesman Journal, Salem, Ore., Sunday, January 19, 1992

Discovery of spawning beds threatens tests in Idaho

The Associated Press

LEWISTON, Idaho — Tentative evidence that fall chinook salmon are spawning in the Snake River just below Lower Granite Dam could alter U.S. Army Corps of Engineers plans to test drawdowns of the reservoir system, an agency biologist says.

If confirmed, the discovery of salmon redds, or nests, at the upper end of Little Goose Reservoir could change proposals to draw down that reservoir by 15 feet in March.

Officials from the corps and National Marine Fisheries Service discussed the findings Friday, said Sarah Wik, a corps fish biologist at Walla Walla, Wash.

"It is tentative, but we think we have located some sites. We are trying to get that confirmed," she said.

Divers from the U.S. Bureau of Reclamation began searching the river below Lower Granite Dam Tuesday and completed a preliminary search Friday.

The divers found the redds in five to 12 feet of water about three-quarters of a mile downstream from the dam, Wik said. They videotaped the river bottom for review by scientists.

If the areas are redds, their discovery confirms suspicions fall chinook are spawning in the portion of Little Goose Reservoir with the swiftest currents.

National Marine Fisheries Service officials last June recommended fall chinook for a federal threatened species listing. The agency is expected to make a final ruling within a month.

Wik said the discovery could lead the fisheries service to rule out corps plans to draw down Little Goose Reservoir. The drawdown of Lower Granite Reservoir would continue as planned, she said, but some of the tests there might have to be changed as a result.

The drawdowns of the two reservoirs are planned to gather information on how the river current would accelerate through the slackwater, and how levees and railroad fills along the banks are affected.

The drawdown was limited to March because of fears it could harm migrating adult or juvenile spring chinook salmon.

The corps requested the divers because of questions about whether fall chinook might spawn in the area, she said. University of Idaho and U.S. Fish and Wildlife Service teams captured young fall chinook in Little Goose Reservoir this summer that had apparently hatched there.

"We knew it was a possibility, and it's still a possibility until we can confirm it. But we wouldn't want to do anything to adversely affect those critters," Wik said.

It may still be possible to draw down Little Goose a bit. Or the corps could proceed with present plans and still protect the redds, she said.

Drawdowns receive go-ahead; nests not found

SUMMARY: Plans for a test drawdown of Little Goose and Lower Granite reservoirs will be able to proceed as planned.

By BECKY KRAMER
Of the Union-Bulletin

Two divers from the National Marine Fisheries Service have determined that gravel deposits downstream of Lower Granite Dam are not the nests of spawning salmon.

The divers checked the area last weekend after previous divers thought they spotted the redds, or nests, of fall chinook salmon.

Snake River fall chinook are among the salmon runs being considered for threatened listing by the National Marine Fisheries Service. Had the divers discovered redds, they would have put a kink in the Army Corps of Engineers' plans to test drawdowns on Little Goose and Lower Granite reservoirs in March.

"This certainly makes my job easier," said Sarah Wik, a corps fisheries biologist, after announcing that the divers hadn't found any nests.

Wik is part of the corps' team working on the March drawdown, which is scheduled to test how the dams will function with significantly lower reservoir levels. The test at Little Goose and Lower Granite may pave the way for more extensive drawdowns.

Drawing down reservoirs has emerged in a number of salmon recovery plans as a way to increase river velocity and therefore speed young salmon on their trip to the ocean.

However, had redds been discovered below Lower Granite Dam, the corps would have been caught in a Catch-22. Lowering water levels in Little Goose reservoir could have destroyed the nests of potentially endangered fish.

Past surveys from University of Idaho officials have indicated that fall chinook may be spawning in that pool, Wik said. But the two divers last weekend determined that chinook would be difficult to find. As a precaution, the corps will monitor the reservoir carefully during the drawdown to make sure no nesting sites are dried out, she said.

Corps officials will hold a public hearing on the proposed March drawdown and other salmon recovery measures proposed for this year at 7 p.m. Wednesday at the Red Lion Motor Inn in Pasco.

Under the proposal, the reservoir behind Lower Granite Dam will drop 28-37 feet below minimum operating pool, and the reservoir behind Little Goose will drop 15 feet or more.

The March 1-31 test is intended to shed light on a number of unknowns — including how drawdowns will affect power generation and stability of levees along the Snake River's banks. However, the test will not benefit salmon migration, which doesn't begin until April.

In a worst-case scenario, the drawdowns could cause levees to collapse. But engineers believe that drawing down the reservoirs two feet at a time will prevent major structural damage, says Charles Krahenbuhl, project manager for Lower Granite and Little Goose dams.

"We believe we won't have serious problems, but there is a spark of uncertainty," he said.

Also unknown is whether the drawdowns will increase the dissolved gasses in the river to levels lethal to fish. Greater water turbulence amplifies the amount of dissolved gas in the water, which create a situation in fish similar to the "bends" that divers experience.

The corps will take public comment on the March drawdown plan until Feb. 7. A final decision on the proposed test is expected the end of February.

JAN 29 1992 LEWISTON MORNING TRIBUNE, LEWISTON, ID

OVER THE DAM

Drawdown draws flak from crowd

■ More than 100 turn out for corps hearing

By Bill Loftus
of the Tribune

The U.S. Army Corps of Engineers brought its road show to Lewiston Tuesday evening to explain its plans for changing operations of federal dams to help save the Snake River's imperiled salmon runs.

Corps officials found a feisty crowd of more than 100 waiting for an explanation.

One member of the standing-room-only audience complained a vague plan had been rammed down the public's throat.

"This was conducted as a public process within the reach of the law," responded Lt. Col. Robert Volz, Walla Walla District engineer.

Norma Farmer of Orofino didn't hesitate to disagree with the colonel. "I have to agree with this gentleman that we haven't been given adequate information. I have to concur. This is terrible," she said as applause swelled in the room.

"I have to assume that's more of a comment than a question," Volz returned.

"Take it any way you want to, colonel," Farmer replied.

The corps scheduled the public meeting at Lewiston to explain why it will draw down Lower Granite and Little Goose reservoirs along the Snake in March.

Later in the meeting, Volz said he had come to Lewiston to test the waters and take the heat if necessary.

The corps was under no legal obligation to hold the public meeting, he said. "I wanted to be here and look you in the eye," he added.

The corps plans to slowly drop the level of Lower Granite starting March 1. Little Goose will drop as much as 20 feet. Dworshak Reser-

See **Drawdown,** Page 9A

Andrus pledges to get aid for farmers, shippers hurt by plan

■ Help needed, governor tells chamber

By Marty Trillhaase
of the Tribune

BOISE — Gov. Cecil D. Andrus Tuesday pledged to insist on mitigation money to help Lewiston area farmers and shippers cope with disproportionately high costs of a salmon recovery effort.

Speaking to about a dozen Lewiston Chamber of Commerce members in Boise, Andrus said the Pacific Northwest must share in the costs to preserve the salmon, which may be protected by the federal Endangered Species Act.

But chamber members noted Port of Lewiston operations would suffer during a projected four-week shutdown this spring to draw down two lower Snake River reservoirs.

Among their concerns about a drawdown are the impact on dikes and levees, how it might disrupt wheat shipments from the ports and whether it might affect Potlatch Corp. operations.

The source of mitigation money would be the Bonneville Power Administration. Andrus said he expects any subsequent rate increases to be "miniscule, contrary to what BPA says."

Chamber members also questioned the emphasis on enhancing juvenile fish runs while international commercial harvesting of salm-

See **Pledges,** Page 9A

Drawdown

From 5A

voir at Ahsahka will also drop 20 feet in August.

The March drawdowns are planned as part of a physical test of whether lowering the reservoirs could help flush young salmon to sea faster. A faster trip would help more of the young fish survive, many biologists believe.

Those plans and more are part of a regional effort to restore the Snake River's sockeye salmon, which are classed as an endangered species. The Snake's chinook salmon runs have also been proposed for protection as threatened species.

"Basically you're saying to hell with us and that's upsetting," said James V. Wilson of Orofino, a Clearwater County commissioner.

"When you start putting finned and feathered critters ahead of us and let them tell us what to do, then we have a problem with that," Wilson added.

Rick Davis, Port of Clarkston manager, said the corps must weigh carefully the damage a drawdown could cause to existing developments along the reservoirs.

"I think we need to take a look at this. I don't think the ports or the taxpayers should have to pay for this all over again," Davis said.

Al Hecker of Kamiah said the corps seems to be trying hardest to protect river users on the Columbia River. "There seems to be a lot of accommodation for downriver users but little for Idaho," he said.

Greg Graham, the corps' environmental impact study manager, said the corps had taken the Columbia Basin's irrigated farming industry into account. But all areas will be affected in the effort to save the fish.

"This isn't a problem you can blame on one person or one state. You have to look at this thing holistically," he added.

Several speakers said commercial fisheries in the Columbia or the Pacific Ocean should be cut back more to help save the fish.

Wilson touched that theme, too. "They haven't developed a smart net yet that can let a Snake River sockeye come upriver," he said.

Several in the audience questioned how the corps would monitor damage to federal property, such as the Lewiston levees, and private property.

Private property owners will need to protect their own property and report damage to the corps. No specific compensation is available for damages, however.

Volz sought to reassure the audience that while the corps will watch the levees and dams closely for signs of damage, safety fears have been studied carefully.

"If we thought failure was likely, something that would endanger the public, we wouldn't do it. We would just not do it," he said.

Pledges

From 5A

on continues.

Negotiations with Japanese and Pacific Rim nations so far have produced rhetoric but little action, Andrus said.

"It's the same thing George Bush found out with automobiles," Andrus said.

While harvests can be curtailed in the Columbia River and Pacific, the key to preserving the salmon involves the juvenile fish, he said.

"If you can't get a smolt downstream, you're not going to have an adult to fight over," Andrus said.

On other matters, Andrus promoted his decision last week to name former state Sen. Mike P. Mitchell of Lewiston to the state Transportation Board. Mitchell last year retired as Andrus' chief of staff.

"I have a tremendous amount of respect for the man," Andrus said.

Andrus predicted the state Senate will confirm Mitchell to the post. Last week, the appointment was questioned as an attempt to remove Transportation Director Kermit Kiebert. Both Andrus and Mitchell have said they did not discuss Kiebert.

Sitting on that three-member board, Mitchell will much to say about how state and federal highway money is spent. A federal highway bill will allocate $811 million to Idaho over the next six years.

But the state may need more local matching dollars next year to get its full share, Andrus said.

"The next year we're going to have to look at a little more gas money in this state to make a match," Andrus said.

Meanwhile, he reiterated his opposition to a Lewiston chamber-backed measure that two years ago shifted the burden for verifying sales tax exemptions from the state's 35,000 merchants to customers.

Andrus signed the 1990 bill into law, but did so with concerns that it would cost the state some $13.5 million in lost revenue. Andrus won an assurance problems with the bill would be corrected the following year.

What emerged was a controversial credit card system that farmers and producers have blasted as overzealous. Lawmakers are contemplating repeal.

"It's kind of a little late to say I told you so, but that's where we stand," Andrus said, adding he will accept a bill repealing the legislation.

Lewiston chamber Legislative Task Force Chairman Max Smolinski, who helped push the 1990 legislation, said the governor has been "consistent" on that issue.

"He's saying the same thing today that he said three years ago," Smolinski said.

Idahoans attack dam drawdowns

Associated Press

LEWISTON — Northern Idaho residents accused the U.S. Army Corps of Engineers of favoring downstream interests and threatening public safety in its plan to help save Snake River salmon by draining reservoirs.

"Basically you're saying to hell with us and that's upsetting," James Wilson of Orofino said at a public meeting Tuesday. "When you start putting finned and feathered critters ahead of us and let them tell us what to do, then we have a problem with that."

Lt. Col. Robert Volz, Walla Walla District engineer, was in Lewiston to explain why the corps will draw down Lower Granite and Little Goose reservoirs as much as 20 feet in March.

The March drawdowns are aimed at finding out whether lowering the reservoirs could help flush young salmon to sea faster. Many biologists believe a faster trip would help more of the young fish survive.

Those plans and more are part of a regional effort to restore the Snake River's sockeye salmon, which are classed as an endangered species. The Snake's chinook salmon runs have also been proposed for protection as threatened species.

Al Hecker of Kamiah said the corps seems to be trying hardest to protect river users on the Columbia River.

"There seems to be a lot of accommodation for downriver users but little for Idaho," Hecker said.

Greg Graham, the corps' environmental impact study manager, said the corps had taken the Columbia Basin's irrigated farm land into account. But all areas will be affected in the effort to save the fish.

"This isn't a problem you can blame on one person or one state. You have to look at this thing holistically," he said.

Others said commercial fisheries in the Columbia or the Pacific Ocean should be cut back more to help save the fish.

"They haven't developed a smart net yet that can let a Snake River sockeye come upriver," Wilson said.

And several people questioned how the corps would monitor damage to federal property.

"I think we need to take a look at this. I don't think the ports or the taxpayers should have to pay for this all over again," said Rick Davis, manager of the Port of Clarkston in Washington.

Private property owners will need to protect their own property and report damage to the corps. But no specific compensation is available for damages.

Volz said the corps will watch the levees and dams closely for signs of damage, and that safety issues have been studied.

TRI-CITY HERALD, PASCO KENNEWICK RICHLAND, WA

Corps says salmon plan to cost up to $145 million

By ROBERT WOEHLER
Herald staff writer

Drawdown and flow tests to help salmon on the Columbia and Snake rivers will cost $2 million to $3 million this year, Lt. Col. Robert Volz of the Corps of Engineers said in Pasco Wednesday night.

On top of those costs is the possibility of a $142 million loss in power revenues this spring and summer as dams are drawn do[illegible]d less water is sent through tur[illegible]id Tom Morse of the Bonneville [illegible]dministration.

Even drawing down reservoirs to minimum operating levels could increase irrigation pumping costs by $1 to $2 an acre, said Martin Wistisen, manager of AgriNorthwest of Kennewick, which irrigates out of the John Day and Ice Harbor reservoirs.

The Corps' Walla Walla office was holding the second of two regional meetings Wednesday on its proposal to test the concept of drawing down reservoirs and increasing the flows in the Columbia and Snake rivers to help speed the downstream migration of juvenile salmon.

Most of the people attending the meeting asked questions about the Corps plan and how it might affect certain river uses and the integrity of the dams and reservoir shorelines.

The Corps is doing the study ahead of any plans by the National Marine Fisheries Service to propose recovery plans if three species of Snake River salmon are listed as threatened or endangered under the national Endangered Species Act.

The Pasco meeting drew about 100 people.

A similar meeting in Lewiston Tuesday attracted nearly 250 people, said Greg Graham, who is preparing an Environmental Impact Statement for the Corps on the drawdown and increased-flow plans.

Besides the drawdowns, the Corps is looking at releasing water from Dworshak Dam on the Clearwater River to cool the temperature of the Snake in the late summer to encourage the fish to enter the river. It also would assure a proper flow in the river in drought years.

There would be similar releases from Grand Coulee Dam and Canada's Arrow Dam on the Columbia River to help with the flow in low water years.

Lower Granite reservoir, which stretches to Lewiston and Clarkston, would be lowered 28 feet below minimum operating level during March, while Little Goose would be lowered by up to 15 feet below minimum operating level. Both are on the Snake River.

Lower Monumental, Ice Harbor and John Day dams on the Columbia River would be lowered to minimum operating levels or to three to five feet below their normal operating levels during the spring and summer.

Volz said no irrigation pumps would be left without water.

Not involved in the tests are McNary, The Dalles and Bonneville dams.

The Corps will monitor the drawdowns closely, Volz said.

"We've never considered drawing down these reservoirs this much before, so there is a lot (of information) we hope to learn," he said.

The Corps is prepared to halt the drawdowns if it appears fish would be harmed by increased gases in the water due to a greater spill over the dams.

If any major safety hazard to a shoreline or structure crops up when the support of the water is removed the test also could be stopped, Volz said.

Low life ahead for Corps

Drawdown test to alter roles of engineers

By ROBERT WOEHLER
Herald staff writer

Engineers will be herding salmon on foot rather than building dams during test drawdowns of two Snake River reservoirs next month.

They'll be guarding exposed archaeological sites from artifact hunters and making dawn helicopter patrols to make sure river banks are not sliding away when reservoirs behind Lower Granite and Little Goose dams are lowered.

The Army Corps of Engineers has plenty of experience building dams and filling reservoirs. But when it comes to draining a reservoir, the Corps is like a fish out of water.

That's why the experimental drawdown will be watched so closely and involve about 50 people.

The four-week test is expected to cost the Corps between $2 million and $3 million.

Officials hope to see if they can help speed young salmon on their downriver migration, and to find out what happens to the reservoirs and dams when the water is lowered.

Lower Granite reservoir, which backed up to Lewiston and Clarkston when it was filled in 1975, will be drawn down by 37 feet. The river channel at Lewiston and Clarkston will look much like it did 189 years ago when Lewis and Clark passed through.

Little Goose is scheduled to be drawn down by 15 feet.

In the process, fish ladders will dry up.

That's where salmon herding comes in, said Wayne Johns of the Corps' Walla Walla office. He will be coordinating the small army overseeing the test.

Corps employees in waders will haze any salmon or other fish left in the ladders back down to the river.

Johns said at the peak of the test there will be 40 Corps employees and at least 10 more people from other agencies working on the project. Included are a variety of civil, mechanical and hydrologic engineers, fish and wildlife biologists, park rangers, archaeologists, clerks and powerhouse and dam workers.

There also will be a contingent of public relations people to

Please see DAMS, Page A2 ▶

TRI-CITY HERALD, PASCO, KENNEWICK RICHLAND, WA FEB 02 1992

Dams

Continued from Page A1

handle reporters' questions.

The test drawdown is part of the environmental impact statement the Corps is preparing. The National Marine Fisheries Service (NMFS) will be one of the agencies participating in the test.

Others include the U.S. Geological Survey, Washington Department of Wildlife, Washington State University and state agencies from Oregon and Idaho.

NMFS has declared Snake River sockeye as endangered under the Endangered Species Act. The agency is expected to soon declare two other Snake River species — the combined spring and summer chinook run and the fall chinook run — as threatened or endangered.

Some salmon advocates, including Idaho Gov. Cecil Andrus, have urged that all four Snake River dam reservoirs be drawn down during the spring and summer.

Others have advocated similar drawdowns on the Columbia, especially of the John Day reservoir, the largest and longest of the reservoirs.

Generally the Corps operates the reservoirs three to five feet above the minimum operating levels.

The Corps has many questions on what a drawdown would do to the turbines, dams, levees, highway and railroad beds along the shoreline and to fish and wildlife, including adult salmon.

Areas to be watched include:

■ **Water quality.** As more water is flushed over the dams in a drawdown and less through the powerhouse, nitrogen levels increase in the spilling water, which could kill nearby fish.

Biologists will be watching fish below the spillways, and if gas levels get too high the experiment could be halted, Johns said.

■ **Chinook spawning beds.** There have been reports that some fall chinook nests — known as "redds" — are just below Lower Granite, but Corps divers have not been able to confirm this.

Biologists will be watching as Little Goose is lowered. If it exposes or jeopardizes any redds, the drawdown could be halted, Johns said.

■ **Archaeological resources.** John Leier, Corps staff archaeologist, said he hopes to observe what has happened to known Indian camps, villages and burial sites after being underwater for 17 to 22 years.

Little Goose was filled in 1970 and Lower Granite in 1975.

"One of the more interesting things will be whether we can relocate these sites after they have been covered with silt," he said.

WSU officials will assist with this work. Part of the job will be guarding the sites from illegal artifact hunters.

■ **Water speed.** U.S. Geological survey officials will put a harmless dye in the water, which will not only help tell travel time but also what happens at different water levels in the reservoir.

■ **Movement of sediment.** Swifter water could stir up more sediment. The Corps wants to know what would be the effect if there is any long-term drawdowns in the future.

■ **Turbines.** Dam turbines are designed to operate at full capacity. There are concerns if they could be damaged by operating for prolonged periods at reduced capacity.

"We will have the turbines heavily instrumented to see what happens," Johns said.

If it appears turbines are ready to shake apart or be seriously damaged, the tests could be stopped.

■ **Bank, shoreline and dam integrity.** When the water is lowered below the riprap rocks, there is the chance the exposed dirt, sand and gravel could slide.

Highway 12 is on one side of the shoreline behind Lower Granite. A county road and the Camas Prairie Railroad is on the other side. There are also levees at Lewiston and Clarkston.

Johns said the Corps is prepared to make repairs if needed and will monitor shorelines daily using a helicopter and ground crews.

Corps engineers will have survey equipment on the dams themselves to see if there are any structural changes because of the drawdowns, he said. There is concern that as more water is spilled over the dams, a scouring effect could occur at the dam bases, reducing their structural integrity.

Johns said the drawdown will start March 1, going down about two feet a day, and will probably reach the lowest level March 14.

The reservoir will be exposed from 10 to 15 days, depending on how fast the Corps judges the reservoir can be refilled, Johns said.

Information gained during the drawdown will be reviewed at the Corps test laboratory in Vicksburg, Miss.

Drawdown to reveal tackle, not towns

Fishermen could have a field day recovering lost lures when the Lower Granite Dam reservoir is drawn down 37 feet in March.

Corps of Engineers officials are not sure what lowering the reservoir will uncover, but they are betting there will be a lot of fishing tackle.

"I guess a lot of guys will be looking for lost lures," said Wayne Johns of the Corps of Engineers' Walla Walla office.

The drawdown will leave much of the shoreline in the Lewiston-Clarkston area like a smelly tideflat. It also will expose old highways and railroad beds.

Ponds between highway and railroad fills and the river will be drained. This could leave some fish flapping in the mud. Mostly bass, crappie, carp and suckers are in these impoundments.

No townsites or historical sites were flooded when the reservoirs were filled, but several archaeological sites are expected to be exposed.

People can look at these sites, but the Corps warns it is a federal crime to disturb anything.

The famous Marmes site, where evidence of civilization 10,000 years old was found in a rock cave, is not in either reservoir. It's under water behind the Lower Monumental Dam.

Boaters will have to be careful about launching because many of the concrete ramps will be high and dry. Officials fear if a vehicle goes below a ramp, it could get mired in the mud.

FEB 04 1992

THE SPOKESMAN-REVIEW, SPOKANE, WA

Drawdown may uncover treasures

KENNEWICK — A test drawdown of two reservoirs on the Snake River could uncover a treasure trove of fishing lures and other curiosities next month.

U.S. Army Corps of Engineers officials are not sure what else will be uncovered when the Lower Granite Dam reservoir is drawn down 37 feet in March, but are betting there will be a lot of fishing tackle.

"I guess a lot of guys will be looking for lost lures," said Wayne Johns of the corps' Walla Walla office.

The reservoirs are being lowered to see whether that will help young salmon migrate to the ocean by speeding up water flow along the Snake and Columbia rivers. A number of salmon stocks are at dangerously low levels, and the drawdowns could become one part of a larger plan to help their numbers rebound.

No town sites or historical sites were flooded when the reservoirs were filled, but several archaeological sites are expected to be exposed.

ADDENDUM E

MASTER SCHEDULE

1992 Drawdown Test
Special Activity Calendar

Date	Activity
14 Feb	Signing of Record of Decision
18 Feb	Drawdown Plan Town Hall Meeting
25 Feb	Main Field Office Operational
	Field Personnel Training Session
	Pre-Drawdown Spill Test
27 Feb	News Conference in Lewiston, Idaho
	Pre-Drawdown Spill Test
28 Feb	Lower Granite Navigation Lock Out of Service
1 Mar	Lower Granite Reservoir Drawdown Begins (Phase 1)
5 Mar	Drawdown Design Team Meeting - LWG Visitors Center
8 Mar	Little Goose Navigation Lock Out of Service
11 Mar	SOR Anadromous Fish Workgroup Meeting - LWG Visitors Center
12 Mar	Dewater Lower Granite Fish Ladder
15 Mar	Lower Granite Reservoir Reaches El. 705
	Stilling Basin Tests Begin
	Little Goose Reservoir Drawdown Begins (Phase 2)
17 Mar	SOR Wildlife Workgroup Meeting - Reservoir Boat Tour
18 Mar	Media/Legislator's Tour Day - Lower Granite Dam
	Dewater Little Goose Fish Ladder
19 Mar	Interested Parties/Agencies Tour Day - Lower Granite Dam
	Begin Refill if at 20,000 CFS River Flow
20 Mar	FPDEP Technical Coordinating Committee Meeting - LWG Visitors Center
22 Mar	Begin Refill if at 30,000 CFS River Flow
25 Mar	Begin Refill if at 40,000 CFS River Flow

27 Mar	Begin Refill if at 60,000 CFS River Flow
31 Mar	Lower Granite Reservoir Reaches MOP - Fish Facilities Back in Service
2 Apr	Lower Granite Navigation Lock Back in Service
	Dworshak Town Hall Meeting
3 Apr	Final Drawdown News Conference in Lewiston, Idaho
21 Apr	Tentative After Action Meeting
Jun	Draft After Action Report

* 14 Feb 1992 Version 1.0

** Please contact Dave Hurson, ext. 6710, to schedule major activities.