APPENDIX G.

CHIEF JOSEPH DAM HATCHERY CONCEPTUAL DESIGN

Chief Joseph Dam Hatchery Program Master Plan
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1. SUMMARY OF DESIGN

1.1 Production Programs

The proposed Chief Joseph Dam Hatchery (CJDH) is an integral part of the Hatchery Genetic Management Plan (HGMP) for restoration of Chinook salmon runs in the Okanogan Valley. The purpose of the hatchery is to support seven basic and four optional production programs, as summarized in Table 1.

TABLE 1.
SUMMARY OF PRODUCTION PROGRAMS FOR THE CHIEF JOSEPH DAM HATCHERY

Program Number[a]	Release Numbers	Release Age	Transfer Date	Transfer Size	Transfer/Release Location	Release Date	Release Size
Basic Programs							
Early Summer/Fall Chinook							
1.1	200,000	Sub-yearling	—	—	CJDH	6/15	40/lb
2.1	300,000	Yearling	—	—	CJDH	4/15	10/lb
2.2	400,000	Yearling	10/30	25/lb	Riverside Pond	4/15	10/lb
Late Summer/Fall Chinook							
3.1	300,000	Sub-yearling	4/30	100/lb	Omak Pond	6/15	50/lb
3.2	200,000	Sub-yearling	—	—	CJDH	6/15	50/lb
4.1	400,000	Yearling	10/30	25/lb	Omak Pond	4/15	10/lb
4.2	200,000	Yearling	—	—	CJDH	4/15	10/lb
Total	**2,000,000**						
Optional Programs							
Spring Chinook							
5.1	200,000	Yearling	10/30	25/lb	Ellisforde Pond	4/15	<15/lb
6.1	50,000	Yearling	10/30	25/lb	St. Mary's Mission Pond	4/15	15/lb
6.2	50,000	Yearling	10/30	25/lb	Salmon Creek	4/15	15/lb
7.1	600,000	Yearling	—	—	CJDH	4/15	15/lb
Total	**900,000**						

a. Program numbers established in the bioengineering model.

The HGMP for the Okanogan Valley includes contingencies to allow for adaptive changes as the plan evolves. In addition to the release sites listed in Table 1, there is an existing pond near Tonasket that can be used as a contingency pond for acclimation and release of CJDH fish. Also, 100,000 spring Chinook of the 200,000 release planned for Ellisforde Pond could be released from Lake Osoyoos, where acclimation would make use of floating net pens in the lake and, the 50,000 ascribed to Salmon Creek would be released from Ellistorde Pond pending suitable flow conditions in Salmon Creek and agreements with Okanogon Irrigation District.

The HGMP includes two programs that rely on fish produced at Eastbank Hatchery—one releasing 376,000 summer/fall Chinook from the Similkameen Pond and one releasing 200,000 summer/fall Chinook from the Bonaparte Pond. Both ponds are existing and neither will require improvements as part of the CJDH project.

1.2 Design Criteria

A bioengineering model was developed to analyze each of the proposed fish rearing programs. Each production program was evaluated using the model with the criteria shown in Table 2. The model uses a computer spreadsheet format that can be modified if changes in production programs or criteria are considered.

The rearing water sources are Rufus Woods Lake and the north embankment relief tunnel of the Chief Joseph Dam. The monthly average temperature data provided for these sources were converted into weekly average temperatures. The weekly temperature values were input into the bioengineering model to establish the water flow rates required of each source to meet the various rearing program temperature and biological flow requirements. Flow rates were established based upon single-pass systems with no reuse.

TABLE 2.
BIOENGINEERING CRITERIA FOR THE CHIEF JOSEPH DAM HATCHERY

Adult Fish	
Number of Fish Required (Male and Female Combined)	
• Early summer/fall Chinook:	286
• Additional early summer/fall Chinook for Riverside option:	222
• Late summer/fall Chinook:	618
• Spring Chinook:	640
Fecundity	
• Early and late arriving summer/fall Chinook:	5,000 eggs/female
• Spring Chinook:	4,400 eggs/female
Holding Survival from Capture to Spawning	
• Early and late arriving summer/fall Chinook:	90%
• Spring Chinook:	80%
Holding Requirements	
• Average adult weight:	20 lbs
• Minimum flow requirements:	1.0 gpm/fish
• Minimum pond turnovers per hour:	1.0
• Density of adults:	10.0 cu. ft./fish

Abbreviations: cu. ft. = cubic feet; gpm = gallons per minute;

TABLE 2 (continued).
BIOENGINEERING CRITERIA FOR THE CHIEF JOSEPH DAM HATCHERY

Incubation	
Incubator Information	
• Heath incubator half stacks:	8 usable trays/stack
• Water flow per half stack:	7.0 gpm
• Incubation temperature:	48.0ºF
Fertilized Egg Incubator Capacity	
• Early and late arriving summer/fall Chinook:	5,000 eggs/tray
• Spring Chinook:	4,400 eggs/tray
Estimated Egg Survivals	
• Green to eye-up	95%
• Eye-up to ponding	95%
Egg Development	
• Green to eye-up	
— Early and late arriving summer/fall Chinook:	750 ftu
— Spring Chinook:	750 ftu
• Green to ponding	
— Early and late arriving summer/fall Chinook:	1,700 ftu
— Spring Chinook:	1,700 ftu
Temporary Rearing in Start Tanks	
Size at Initial Ponding in Start Tanks	
• Early and late arriving summer/fall Chinook:	0.45 grams
• Spring Chinook:	0.33 grams
Size at Transfer to Raceways	
• Early and late arriving summer/fall Chinook:	0.50 grams
• Spring Chinook:	0.50 grams
Start Tank Density and Loading Criteria (all fish)	
• Water flow requirements:	1.0 lbs/in/gpm
• Pond turnover rate/hour(minimum):	1.0
• Fish density(maximum):	0.30 lbs/cu. ft.
Start Tank Size	
• Width (ft)	3
• Length (ft)	40
• Depth (ft)	2.50
• Volume in cu ft	300
Survival from Ponding to Transfer to Raceways (fed fry)	95.0%
Expected Growth Rate	0.04 mm/ctu/day
Condition Factor Used to Compute Length in Centimeters (K in W=KLˆ3)	0.01

Abbreviations: ctu = Celsius temperature unit; cu. ft. = cubic feet; ftu = Fahrenheit temperature unit; gpm = gallons per minute; K = condition factor; L = length in centimeters; W = weight in grams.

TABLE 2 (continued).
BIOENGINEERING CRITERIA FOR THE CHIEF JOSEPH DAM HATCHERY

Rearing in Raceways	
Size at Transfer to Raceways (fed fry)	
• Early and late arriving summer/fall Chinook:	0.50 grams
• Spring Chinook:	0.50 grams
Raceway Density and Loading Criteria (all fish)	
• Water flow requirements:	1.0 lbs/in/gpm
• Minimum pond turnover rate/hour:	1.0
• Fish density requirements:	0.75 lbs/cu. ft.
Raceway Size for Early/Late Summer/Fall Chinook	
• Width	8
• Length (feet)	100
• Depth (feet)	3.25
• Volume in cu. ft.	2,600
Raceway Size for Spring Chinook	
• Width	8
• Length (feet)	120
• Depth (feet)	4
• Volume in cu. ft.	3,800
Rearing Survivals (all fish)	
• Fed fry to fingerling (~10 grams):	95.0%
• Fingerling to smolt (~45 grams):	95.0%
Expected Growth Rate:	0.04 mm/ctu/day
Condition Factor Used to Compute Length in Centimeters (K in W=KLˆ3)	0.01
Rearing in Acclimation Ponds	
Size at Transfer to Acclimation Ponds	
• Early and late arriving summer/fall Chinook:	variable
• Spring Chinook:	variable
Pond Density and Loading Criteria (all fish)	
• Water flow:	0.7 lbs/gpm
• Pond turnover rate/hour(minimum):	1.35
• Fish density(maximum):	0.75 lbs/cu. ft.
Pond Size Ratio (all fish)	
• Width	X
• Length	4X
• Depth (feet)	6.0
• Volume	variable
Rearing Survivals (all fish), transfer to release	95.0%
Expected Growth Rate:	0.04 mm/ctu/day
Condition Factor Used to Compute Length in Centimeters (K in W=KLˆ3)	0.01

Abbreviations: ctu = Celsius temperature unit; cu. ft. = cubic feet; ftu = Fahrenheit temperature unit; gpm = gallons per minute; K = condition factor; L = length in centimeters; W = weight in grams.

1.3 Major Project Elements

Figure 1 shows the general layout of the facilities and major piping requirements for the CJDH conceptual design. The major elements of the project are as follows:

- Adult Fish Holding/Spawning—The adult fish holding/spawning facilities will include a fish ladder with additional attraction water provided by a dedicated pumping station adjacent to the fish ladder entrance. The ladder will climb part way up the embankment to a series of holding/crowding structures and a spawning facility.
- Incubation—Within the hatchery building will be an incubation area containing two systems of egg incubation. One system will be a series of jar incubators and the other a series of vertical tray incubators.
- Start Tanks—A major portion of the hatchery building will be the start tank room. After the eggs have hatched and reached the "button-up" stage, the fry will be transferred from the incubators to the start tanks, where they will be started on an artificial diet and closely monitored for disease as they grow to a size acceptable for transfer out of the start tank room.
- Raceways—Exterior to the hatchery building will be concrete raceways used to extend the growth cycle of most of the fish rearing programs.
- Acclimation Ponds—Some of the rearing programs will be continued in off-site ponds, as presented in the HGMP (Appendix A and B). Seven of these acclimation sites are ponds adjacent to the Okanogan River (five existing and two proposed). Water for the acclimation sites will be supplied primarily from surface water sources.

2. PROJECT OVERVIEW

2.1 Hatchery Site

The hatchery site, shown in Figure 1, is generally the plateau area along the right bank of the Columbia River between the Chief Joseph Dam and State Highway 17, extending northward to Half-Sun Way. At the west end of this 24.5-acre area is an existing U.S. Army Corps of Engineers (COE) visitor information and picnic area of about 13 acres. The area available for the hatchery development has a general slope from east to west, from elevation 900 feet to elevation 850 feet. The river bank drops from those elevations to the water's edge at about elevation 780 feet.

Vehicle access is provided by Half-Sun Way, which connects to SR-17 about 1,000 feet west of the site. The nearest city is Bridgeport, approximately 1 mile to the southwest across the river.

2.2 Hatchery Plan

The hatchery plan shown in Figure 2 uses the ground slope to provide as much gravity flow of water as possible. Hatchery cross-sections are shown in Figure 3. The headbox will be located at the site's upper elevation. It will receive water by gravity flow from Rufus Woods

Lake above the Chief Joseph Dam (CJD) and pumped water from the dam's relief tunnel. Both of these water supplies will be delivered to the headbox by the COE.

Adjacent to the headbox will be the hatchery building, which will contain the incubation area, a start tank room, and water treatment facilities as needed (it is anticipated that this will include a water chilling system for incubation water and drum filters and UV sterilization for treatment of Rufus Woods Lake water). The hatchery building will also contain support facilities such as a feed storage room, maintenance shop, vehicle storage, associated storage room, a biological/pathology laboratory, crew restrooms and wet gear storage, crew break room, an electrical power room, a building heat/boiler room, a standby generator room and a general overhead storage area above the start tank room.

Downhill of the hatchery building will be groups of raceways, designed to receive fry by gravity from the start tank room. Each group of raceways will be a concrete structure with a common supply channel and a common drain channel. The common supply channel is anticipated to have multiple channel slots and to have both water sources supplied to each end. This will allow the supply channel to be divided into two segments of variable lengths so that each group of raceways can be used for two separate rearing programs of different temperature requirements. The process is designed for single pass flow with no re-use, although re-use capability could be installed for emergencies or other future needs.

Vacuum cleaning wastes from the start tank room and the raceways will be discharged to an aeration/settling structure located southwest of the raceways. This cleaning system is anticipated to be operated by gravity. The aeration/settling structure will also receive the drum filter backwash. Normal rearing and drainage flows from the hatchery building and the raceways will go to a detention pond, bypassing the aeration/settling structure. This pond will be sized to provide one hour of detention at the facility's peak flow. Due to the slope and limited area of the hatchery site, the detention pond will be located west of the present COE visitor trail between the information/picnic area and the shoreline viewing platform. This pond is planned to be incorporated into a constructed wetland to improve the appearance and to enhance the visitor experience.

Flow from the detention pond can be released directly to the Columbia River or be directed to the adult holding/spawning area, which will drain down the fish ladder to the river.

The adult holding and spawning facilities shown in Figure 4 will be located along the river bank about 900 feet east of the hatchery building and at an elevation of approximately 810 feet. This will place these facilities above the probable maximum river level while keeping the fish ladder reasonably short. It also will separate the adult/spawning facilities from the incubation and rearing facilities to provide better disease control. Vehicle access to these facilities, shown in Figure 5, will be from a paved road down to the face of the dam and along an existing gravel road that intersects the paved road at an acute angle. Improvements will be required on this access route to provide a flat bed/fish hauling truck turn-around at both the junction of the gravel road with the paved road and at the spawning facility.

A 2,000-square-foot administration and visitor facility will be located at the east end of the hatchery complex. Adjacent to this building will be an area that can be developed for significant parking, including visitor buses and motor home spaces.

Housing for some of the permanent staff, and camp trailer spaces for temporary staff will be provided in a location northeast of the hatchery as shown in Figure 5.

2.3 Acclimation Ponds and Release Sites

In addition to the hatchery there will be nine acclimation sites. They include two proposed acclimation ponds, five existing acclimation ponds, and two non-pond sites. A typical design for the new acclimation ponds is shown in Figures 6 and 7. Figure 8 shows where the acclimation sites are located in relationship to the hatchery. Some of the existing ponds will require modifications. A site plan of each acclimation pond is included in Figures 9 through 15. Individual sites are described below. The proposed releases established in the HGMPs are summarized in Table 1.

2.3.1 General Design Requirements

The design or modification of the acclimation ponds will need to consider icing issues. Experience from Washington Department of Fish and Wildlife (WDFW) operations at Similkameen Pond and the Colville Tribes' operations at Ellisforde and Bonaparte Ponds will be taken into account. Design considerations will be given to pond intakes, outlets, and winter operational requirements.

Acclimation ponds that are supplied by river water will need to be designed or modified to have their outlets downstream of the water supply intakes to avoid subjecting released fish to the intake screens. The Bonaparte and Tonasket ponds have telemetry systems with telephone links to the offices and cell phones of Irrigation District employees to warn of flow or surface level anomalies. Similar telemetry systems will be installed for all acclimation ponds to warn of potential flow, temperature, dissolved oxygen, and security anomalies.

All acclimation facilities will be fitted with netting and electrical fencing to prevent avian predation and entry of land-based predators.

Integration of rearing techniques similar to the "NATURES" system will be considered during final design of the acclimation facilities. Consideration will also be given to adding structure and subsurface feeders to emulate natural conditions. The research on NATURES will be reviewed prior to final acclimation pond design to determine if survival advantages justify these types of facility additions.

Detailed design of these facilities will be determined during Step 2 of the Northwest Power and Conservation Council's (NPCC's) three-step process.

2.3.2 Proposed New Ponds

2.3.2.1 Riverside Pond (Summer/Fall Program)

Riverside Pond is on the left bank of the Okanogan River near River Mile (Rm) 49 (River Kilometer (Rkm) 79), 7 miles downstream from the town of Tonasket in Section 19, Township 36 North, Range 27 East. This pond will be constructed with a volume of 53,000 cubic feet and will be supplied with 20 cubic feet per second (cfs) of water from the river. Sufficient early arriving summer/fall Chinook sub-yearlings will be transferred from CJDH

for rearing, acclimation and the release of 400,000 fish in early to late April at a size of 10 fish per pound (fpp).

There is no existing pond at this site. Development of the pond will require construction of access, power, piping, a pump station, the pond, a structure for volitional release of fish, predator protection, controls and telemetry. A roof structure will be evaluated in place of other methods of predator protection in the next phase of design.

2.3.2.2 Omak Pond (Summer/Fall Program)

Omak Pond, shown in Figure 10, is on the left bank of the Okanogan River near Rm 32 (Rkm 52), in the town of Omak near the confluence of Omak Creek. The pond will be constructed with a volume of 53,000 cubic feet and supplied with 20 cfs of water from the river. Late arriving summer/fall Chinook sub-yearlings will be transferred from CJDH to Omak Pond for rearing, acclimation and release of 400,000 fish starting in early April, at a size of 10 fpp. In addition, following release of yearling fish in April, late arriving summer/fall Chinook sub-yearlings will be transferred from CJDH to Omak Pond for rearing, acclimation and release of 300,000 fish in late June, at a size of 50 fpp.

Development of this new pond will require construction of a water supply system, the pond, site access, power, piping, a structure for volitional release of fish, predator protection, controls and telemetry. A roof structure will be evaluated in place of other methods of predator protection in the next phase of design.

2.3.3 Existing Ponds

2.3.3.1 Tonasket Pond (Contingency Pond for Summer/Fall Program)

Tonasket Pond, shown in Figure 11, is on the right bank immediately upstream from the town of Tonasket. The pond is an open-air pond with a useable rearing volume of 74,300 cubic feet and is supplied with 25 cfs of water from the Okanogan River. The Oroville Tonasket Irrigation District (OTID) owns and operates the pond for irrigation purposes. The pond is proposed to be a contingency pond for the summer/fall program should the Riverside Pond site not be available or construction not be feasible.

No modifications to the pond are needed to make it useable for fish. Improvements that will be required are modifications to inlet piping, enhanced access for operation and maintenance, installation of an outlet structure with modifications to outlet piping for volitional release of fish and for easier cleaning, and installation of chain link fence and netting for predator protection. Consideration should also be given to enhancing the existing telemetry system to include monitoring and notification of desired fish rearing parameters to CJDH staff when fish monitoring is needed should this pond be used.

2.3.3.2 Similkameen Pond (Summer/Fall Program—Eastbank Hatchery)

Similkameen Pond, shown in Figure 12, is located on the right bank of the Similkameen River at Rm 3 (Rkm 5), near the town of Oroville. This is an existing pond, enclosed in a building, with a useable pond volume of 77,000 cubic feet and supplied with 21 cfs of water from the Similkameen River. Sufficient summer/fall Chinook will be transferred from the

Eastbank Hatchery for rearing, acclimation and release of 376,000 fish in early to mid-April at a size of 10 fpp.

The Washington Department of Fish and Wildlife owns and operates the Similkameen Pond for fish acclimation purposes. No improvements are needed or proposed.

2.3.3.3 Bonaparte Pond (Summer/Fall Program—Eastbank Hatchery)

Bonaparte Pond, shown in Figure 13, is on the left bank immediately downstream from the town of Tonasket. The pond is an existing open-air pond supplied with 25 cfs of water from the Okanogan River, with a useable rearing volume of 65,300 cubic feet at an operating depth of 5 feet. Sufficient summer/fall Chinook will be transferred from the Eastbank Hatchery for rearing, acclimation and release of 200,000 fish in early to mid-April at a size of 10 fpp.

OTID owns and operates the pond for irrigation purposes. The pond has been modified for fish acclimation and no further modifications are required for rearing purposes. However, to improve ease of operation and maintenance, drainage and cleaning improvements should be considered. Consideration should also be given to enhancing the existing telemetry system to include monitoring and notification of rearing parameters to CJDH staff when fish monitoring is needed.

2.3.3.4 St. Mary's Mission Pond (Spring Program)

The St. Mary's Mission rearing pond, shown in Figure 14, is sometimes referred to as the Omak Creek Pond. This is an existing Colville Tribes-owned acclimation pond constructed on Omak Creek below Mission Falls near Omak, Washington. Surface water is supplied to the pond from Omak Creek. Sufficient spring Chinook sub-yearling will be transferred from CJDH to St. Mary's Mission Pond for rearing, acclimation and release of 50,000 fish in late April at a size of 15 fpp.

To avoid future fish losses, the pond requires modifications to the river intake by adding a wing wall, removal of grating and supports on the pond, installation of chain link fence around the perimeter of site, installation of bird netting, installation of channels with tail and head screens in the pond, and installation of a water level alarm system with reliable radio telemetry.

2.3.3.5 Ellisforde Pond (Spring Program)

Ellisforde Pond, shown in Figure 15, is on the left bank at Rm 62, near the community of Ellisforde. It is an existing open-air pond with a useable rearing volume of 121,500 cubic feet and is supplied with 30 cfs of water from the Okanogan River. Sufficient spring Chinook will be transferred from CJDH to Ellisforde Pond for rearing, acclimation and release of 200,000 fish in late February (mid April per HGMP) at a size of 15 fpp.

OTID owns and operates the pond for irrigation purposes. The pond has been modified for fish acclimation and has been used for that purpose. However, improvements to the outlet are required to provide for complete drainage of the pond. This will improve volitional

release of the fish and ease of operation and maintenance. Installation of a telemetry system with water level alarms and monitoring of other fish rearing parameters is needed.

2.3.3.6 Salmon Creek Site (Spring Program)

The Salmon Creek site is at the OTID's diversion dam and channel near the town of Okanogan. Sufficient spring Chinook sub-yearling will be transferred from CJDH to Salmon Creek for rearing, acclimation and release of 50,000 fish in mid-April at a size of 15 fpp.

At Salmon Creek, fish will be acclimated on creek water in the ladder pools and upper irrigation canal until mid-April, when they will be allowed volitional migration. All remaining fish will be forced from the canal. No improvements are proposed to the Salmon Creek Site.

2.3.3.7 Lake Osoyoos Site (Spring Program—Alternate Site)

The Lake Osoyoos site uses floating net pens located in Lake Osoyoos immediately above Zosel Dam, on the Okanogan River near the town of Oroville. This is an optional site that may be used for a portion of the 200,000 release planned for the Ellisforde Pond. If it is used, sufficient spring Chinook sub-yearling will be transferred from CJDH to Lake Osoyoos for rearing, acclimation and release of 100,000 fish in late February (mid April per the HGMP) at a size of 15 fpp.

Floating net pens would be 20 feet by 20 feet and 10 feet deep, with 3,400 cubic feet of capacity. Pens would be covered by a net to prevent avian predation, provide shade, and minimize unwanted human access. The pens would be located in waters where the lowest extent of a pen is at least 3 feet off the lake bottom and where water exchange in the pen would occur at least once an hour. No improvements are proposed for the Lake Osoyoos Site.

2.3.4 Release from the CJDH Site

Release of juvenile fish from the CJDH will be from the raceways through a pipe running directly from the raceway area to the river. The pipe can be either temporary or permanent.

3. HATCHERY SITE CONSIDERATIONS

3.1 Water Supply for Fish Rearing

The COE studied several sources of water and presented two sources as best suited for use by the hatchery for fish-rearing: the dam's north embankment relief tunnel and the Rufus Woods Lake reservoir. A third source may be groundwater wells in a state park about 2.5 miles upstream from the hatchery headbox.

At this time, it is understood that the COE will be responsible for development of the water sources from both the Rufus Woods Lake and the relief tunnel to the hatchery site. The COE will design and construct the facilities necessary to convey the required water volumes from each source to an agreed upon location in the vicinity of the main hatchery headbox.

In order to obtain hatchery process water from either the relief tunnel or Rufus Woods Lake, pipelines approximately 3,000 feet long will be required along the north bank of the river from the base of the spillway.

3.2 Potable Water

Potable water is supplied to the nearby COE Visitor Orientation Center from the City of Bridgeport through a 2-inch water line that crosses the river attached to the SR-17 bridge. The City of Bridgeport has indicated that it cannot add more services to its water system until significant improvements are made to the system and approval is obtained from state agencies. If in the future Bridgeport has water available to provide service to the hatchery, a larger pipeline would need to be constructed across the bridge.

There does not appear to be sufficient groundwater available near the hatchery site to develop a well. If wells are developed in the nearby state park and water lines extended to the hatchery for fish production, the water could also be used for a potable source. Further analysis and design of a potable water system will be performed in Step 2 of the NPCC's three-step process.

3.3 Power

Nespelem Valley Electric Cooperative currently has power lines crossing the site and supplying power to two irrigation pumps near the proposed hatchery facilities. This power source can be used to supply the hatchery. A new service, a transformer, and several hundred feet of power line will be required. Future power for the new project would be through 125kv/480v transformers, with further reduction transformers as required.

The cross-site power lines are about 50 feet above grade at the poles at the top of the river bank. The lines gain in elevation as they cross the site to the next set of poles on the top of the hillside (elevation 1,050 feet) north of Half-Sun Way. Existing power lines should not pose any insurmountable problems with the site planning. The original agreement between the COE and the power company, dated 1960 and expiring in 2010, appears to indicate that the COE could require the lines to be moved if needed, however the site plan is being developed with these lines remaining in place.

Consideration was given to using the dam electrical system as a source of power, but at this time the COE will not sell or provide power to the hatchery. The COE does not even supply station power to its own administrative facilities.

3.4 Telephone

Telephone service is available at the existing visitor center approximately 1,000 feet west along Half-Sun Way. Service will have to be extended along Half-Sun Way to the hatchery.

3.5 Sanitary Sewer

The nearby COE Visitor Orientation Center has an on-site sewer system that cannot be expanded for use by the hatchery. Development of the hatchery and support facilities at

this site will require construction of an on-site sanitary wastewater system or a force main across the SR-17 bridge to connect to the Bridgeport sewage system.

The City of Bridgeport has indicated that its sanitary sewer system is at 80 percent capacity and the Environmental Protection Agency has imposed a moratorium on sewer connections until a sewer capacity study is performed.

Further analysis and design of a sanitary sewer system for the hatchery will be performed in Step 2 of the NPCC's three-step process.

3.6 Irrigation System

The plateau between Half-Sun Way and the top of the river bank has been graded at a relatively uniform slope and an irrigation system has been installed. Irrigation pumps have been installed in the river bank about 100 feet east of the cross-site power lines with power provided by a power drop at the overhead power poles. Power is provided by the Nespelem Valley Electric Cooperative. The power panels indicate both a 5-hp and a 40-hp pump are being served at 207 volts. Because most of the irrigation system will be disturbed during hatchery construction, the system will be removed and replaced as necessary to adequately irrigate the site.

3.7 Drainage Structures

A drainage pipe from the irrigated orchard area northeast of the project site runs across the east end of the site at about 45 degrees to Half-Sun Way and enters a manhole on the river bank edge. At the manhole the flow is turned about 100 degrees to run down to the river at an angle headed upstream, through the general area of the planned holding and spawning facilities. Because the pipe material is HDPE and may bend along its alignment before entering the river, its exact location is not known. The pipe will probably need to be relocated to facilitate the hatchery construction. Investigation into this water's quality, to be performed in Step 2, may show that it could be drained through the proposed fish ladder. Year-round flows have been estimated by the COE as 200 gallons per minute (gpm).

4. FACILITY COMPONENTS

4.1 Fish-Rearing Water Supply

Fish-rearing water is planned to be supplied from the Rufus Woods Lake and the dam's north embankment relief tunnel. Both of these water supplies will be delivered to the hatchery headbox by the COE. A hatchery flow schematic, provided in Figure 16, shows the distribution of water through the facilities. The relief tunnel water may need to be augmented by additional well development if that source is not able to produce 20 cfs.

The bioengineering model used historical water temperatures given for these two sources and calculated the quantities needed from each source to meet fish biological needs at proposed design temperatures. When the proposed water temperature was between the two source temperatures, the model calculated how much of each source would be blended to meet the fish requirements at the proposed temperature.

4.1.1 Rufus Woods Lake

The bioengineering model showed that the maximum Rufus Woods Lake flow needed to rear the summer/fall Chinook programs is 22 cfs, based upon fish biological needs. This flow would be required during the first week of May just before the release of 200,000 late summer/fall Chinook yearlings from the hatchery complex. It is assumed that Rufus Woods Lake water will need to pass through water treatment facilities, as it is subject to possible disease pathogens and waterborne contaminants from up-reservoir sources. This treatment is anticipated to be drum filtration and ultraviolet light exposure.

The intake for the hatchery supply should include a multiport intake at different levels within the reservoir so that a selection of temperatures or water quality may be drawn off for hatchery use.

With the proposed spring Chinook program, the maximum Rufus Woods Lake supply requirements would increase to 44 cfs, based upon fish biological needs. This peak flow requirement also occurs near the first of May prior to the release of 600,000 yearling spring Chinook.

The COE has indicated that it will be able to release as much Rufus Woods Lake water as needed to meet the program requirements.

4.1.2 Relief Tunnel

The bioengineering model showed that the maximum relief tunnel flow needed to rear the summer/fall Chinook programs is 24.5 cfs, based on fish biological needs. This peak tunnel water flow would be required in the first week of November when there is a need for a large quantity of this cool source of water to offset the high Rufus Woods Lake water temperatures. 1.1 cfs of this flow would be used for the incubation of eggs because of its higher water quality and more suitable temperature.

The COE has stated that it will develop a means of supplying 20 cfs of relief tunnel water to the hatchery headbox, which is about 18 percent less than what the model shows to be needed. The time period when more than 20 cfs is needed is estimated to be the last three weeks of October just prior to the transfer of 840,000 sub-yearlings from the hatchery complex. The difference between program needs and the available supply may be reduced or eliminated by a combination of the following: changes in the rearing programs such as reduced numbers or change of release size or earlier transfer to acclimation ponds.

With the proposed spring Chinook program, the maximum relief tunnel flow requirement would increase to 36.5 cfs, based on fish biological needs. This peak requirement also occurs at the end of October, just prior to the transfer of sub-yearling Chinook to the acclimation ponds. The difference between the required 36.5 cfs and the 20 cfs to be supplied by the COE cannot be made up by minor adjustments in the rearing programs. Should the spring Chinook program be implemented, it is proposed that additional ground water be developed at a location upstream of the dam in a zone that COE staff believes to have the needed supply which can be developed in a manner that will not impact the relief tunnel water.

4.2 Incubation and Start Tank Rooms

4.2.1 Incubation Rooms

This portion of the main hatchery building will include two rooms. The first room will be a jar incubation area where jars (of various sizes if needed) will be filled with eggs and agitated with sufficient upwelling water to gently suspend and circulate them until they are transferred to the vertical tray incubators. Due to the constant motion of the eggs, initial incubation in jars reduces fungal growth that can be spread from dead eggs to live eggs.

The second room will contain the vertical tray incubators. The room will be sized for 52 full stacks (16 trays each) of incubators. The summer/fall Chinook programs require 35.5 full stacks of incubators. The spring Chinook programs require 16.5 full stacks of incubators.

4.2.2 Start Tank Room

After the eggs hatch and the fry develop to the button-up stage, they will be distributed to the start tanks in the start tank room. The start tanks will be units 3 feet wide by 40 feet long operating at an average depth of 2.5 feet. Forty units will be required for the summer/fall Chinook programs and an additional 20 start tanks will be needed for the spring Chinook programs. The tanks will be mounted in pairs (back to back) with access for feeding, cleaning and inspection from one side only. The downstream end of the start tanks will have a short portion screened off to contain the fish in the tanks. A second outlet from each tank will be used to transfer the fish to the raceways. Feeding of fry in the start tanks will be by hand. A room adjacent to the start tank room will be designated as a start tank feed storage room where feed from the bulk feed storage room will be proportioned and mixed.

A second room adjacent to the start tank room will be a storage room for equipment normally used only in the start tank room, such as tank screens, scales, buckets, etc.

4.3 Outdoor Raceways

The groups of outdoor raceways will be constructed of concrete with uniformly sloped bottoms. The head end of each group of raceways will have a head channel with mixing boxes at each end to allow two separate water temperatures to be developed in the head channel (separated by drop-in stop gates). Both Rufus Woods Lake water and relief tunnel water is to be supplied to each of the mixing boxes, with separate control valves to facilitate the mixing.

The details of raceway screens and baffles will be determined during subsequent design phases. It is anticipated that each raceway will have screens to prevent fish from entering the inlet and outlet channels, as well as screen and baffle guides throughout to allow for isolating raceway segments and inducing scouring currents to move sediment.

At the downstream end of each group of raceways will be a common drain channel that receives all normal rearing water flows after they have passed through the raceways. This flow will be directed to a detention pond. Upstream of the common drain channel, flow from

the rearing area of the raceway will pass through a screened area where plugged outlets to the fish transfer piping and to the cleaning waste piping will be located. When these outlets are plugged, the water will overflow a weir into the drain channel. The weir will be used to establish and maintain the normal rearing depth of each raceway. Fish can be released from the raceway either by pumping (using fish pumps) or gravity draining through the fish transfer outlet mentioned above. The cleaning waste outlet will be piped to the aeration/settling structure and will be used for vacuum cleaning of the raceway. Not all raceways will need a cleaning waste outlet, as the hose used for vacuum cleaning can span several raceways.

It is anticipated that the fish in each raceway will be fed using a combination of hand feeding and demand feeders. Hand feeding is anticipated to be more prevalent during the early raceway rearing period, with augmentation feeding from two demand feeders per raceway in the later rearing period.

The summer/fall Chinook raceways will be 8 feet wide, with a rearing length of 100 feet and an average depth of 3.25 feet, resulting in an individual raceway rearing volume of 2,600 cubic feet. The bioengineering model indicates that the early summer/fall Chinook programs will require about 20 raceways of this size and the late summer/fall Chinook programs will require about 24 raceways.

The spring Chinook raceways will also be 8 feet wide. Their rearing length will be 120 feet and their average depth will be 4.00 feet, resulting in an individual raceway rearing volume of 3,800 cubic feet. Design analysis using the bioengineering model indicates that if these were the same size as the summer/fall Chinook raceways, about 40 raceways would be required. With the 3,800-cubic-foot raceways, only 28 raceways are required.

4.4 Support Facilities

4.4.1 Water Treatment

Water quality data available for the two proposed water sources shows that the proposed rearing programs appear to be feasible by using one source or the other, or a mix of the two to obtain the growth desired after the eggs have hatched. However, analysis of the production programs demonstrates a need to chill relief tunnel water for incubation. The analysis shows an incubation temperature of 48ºF from the beginning of October to the end of April. During this seven-month period the relief tunnel temperature data varies from about 49.5ºF to 55.5ºF.

The chilling of a 500-gpm incubation flow for the summer/fall programs will require a 200-ton chiller and associated chilling tower. If the spring Chinook program is included, the incubation flow would increase to 730 gpm, which would require a 250-ton chiller and tower. It may be possible to reduce chilling costs by cooling the relief tunnel water with a heat exchanger and Rufus Woods Lake water during portions of the incubation period.

The Rufus Woods Lake water may need filtration and ultraviolet purification due to contamination from human or natural sources or from up-reservoir water uses such as the existing net pen fisheries operations. Based on the biological needs of the various programs,

the filtration/UV system should be designed to treat 22 cfs for the summer/fall Chinook programs or 44 cfs if the spring Chinook programs are included.

4.4.2 Food Storage and Handling

At the east end of the hatchery building will be the main food storage area, with a capacity to store the maximum amount of food required in an eight-week period plus a one-week overlap for delivery schedule, and room for sorting pallets of different-sized feeds.

An estimate of 67,200 pounds of feed will be consumed during the peak eight-week period. At 40 pounds per cubic feet, this requires a storage volume of 1,670 cubic feet. With pallets of feed being 4 feet high, the space required for feed storage would be about 400 square feet. With an allowance for pallet maneuvering, an area for empty pallets and bags and an area for bucket loading, the total area could be twice that of the palletized feed storage area. An area of 900 square feet is shown for the main feed storage area. A second food storage area will be provided adjacent to the start tank room where finer starter feeds will be prepared for delivery to the start tank room.

4.4.3 Biological Laboratory

A small laboratory, to be used for all on-site biological and rearing water analysis, will be located between the start tank room and the water treatment room. This laboratory area will provide space for storage of all chemicals and equipment needed to perform the various tests and analysis desired by the hatchery staff.

4.4.4 Shops, Garage/Equipment Storage and Loading Dock

The southeast portion of the hatchery building will contain areas for storage up to four vehicles and other mechanical equipment (shown as 2,450 square feet), an area to be divided into a carpentry shop and a separate welding shop (shown as 1,990 square feet), a loading dock, a standby generator room and an open air covered storage area. Upon further study, these and other areas of the building may be redesigned to reduce or optimize the size and shape of the overall building.

4.4.5 Crew Areas

Crew accommodations will include a break/lunch/meeting room, a pair of restrooms with showers and lockers, and a wet gear storage area.

4.5 Fish Transfer and Outmigration Facility

4.5.1 Fish Tagging/Clipping

The Colville Tribes presently own a portable trailer containing several coded wire tagging machines. There are plans to update the trailer with the purchase of additional tagging machines and revamping of the equipment layout.

Fin clipping is planned to be a manual operation requiring several crews to process all of the fish being reared at this facility, whether released directly from the CJDH or from the acclimation ponds along the Okanogan River.

Both fin clipping and tagging will be conducted with portable trailers, so no permanent facilities are shown on the site plans or included in the facility construction cost estimate.

4.5.2 Fish Transfer Facilities

With the hatchery building floor level being above the water level of the rearing raceways, the transfer of fish from the start tanks to either the raceways or to fish transfer trucks is anticipated to be a gravity process through either portable or permanently installed piping. The fish transfer truck loading station will be located low enough to also receive fish from the raceways by gravity.

4.5.3 On-Site Release

Fish to be released directly from the CJDH site will be drained through the truck loading station to the river in a pipe system that will be too steep for fish to swim against.

4.6 Adult Fish Attraction and Fish Ladder

The location shown for these facilities is tentative. The Colville Tribes are presently undertaking a study to establish the best location for the fish ladder entrance.

4.6.1 Attraction Water Sources

The fish ladder attraction water supply will be separate from the fish-rearing water supply. Due to the high flows that may be released through the power generating turbines on the left bank of the river or released over the spillway, a fairly large quantity of water may need to be released from the fish ladder to attract adult fish to that structure. The quantity of fish ladder release flow for attraction purposes has been estimated at 500 cfs (see Appendix C). This quantity of flow is available from two sources, either the Rufus Woods Lake reservoir (gravity) or the CJD tailrace pool (pumped). The COE is not likely to release this flow from the reservoir as this water can produce more power going through the turbines than the power required to pump this amount from the tailrace.

Attraction water will therefore be provided from an adjacent pump station using up to five 200-hp pumps to discharge the 500 cfs into the ladder entrance. The discharge will use upwelling through a bottom grate in the fish ladder entry section to reduce fish disorientation to the flow coming down the ladder.

4.6.2 Fish Ladder Design

The fish ladder is proposed to be similar in design to the ladder constructed at the Ice Harbor Dam, except that this ladder will only be a "half structure," being about one-half as wide and having one ladder weir and orifice opening per ladder step. Each ladder step will rise at a rate of one foot per 10 feet of length from the ladder sill entrance elevation.

The ladder sill elevation is proposed to be at elevation 772 feet, based on a minimum water depth in the ladder of 5 feet and the minimum tailrace elevation during the period of 1998 to mid 2002 of 777 feet.

The ladder will run parallel to the river and rise to a bottom elevation of 790 feet before turning 90 degrees and rising an additional 3 feet, at which point it will again turn 90 degrees to again run parallel to the river at a minimum distance of 20 feet from the first ladder section. The ladder will continue to rise to a bottom elevation of 795 feet where it will change into the main holding/crowding channel. Water flowing down the ladder will originate at the upstream end of the various holding ponds that will come together in the main holding/crowding channel.

4.7 Adult Fish Holding/Crowding/Sorting Areas

The bioengineering model shows that the minimum holding volume for the summer/fall Chinook would be about 9,700 cubic feet. The minimum holding volume would need to be increased to about 10,700 cubic feet to hold the spring Chinook along with the summer/fall Chinook. The increase of only 1,000 cubic feet occurs because most of the spring Chinook are anticipated to be spawned before all of the summer/fall Chinook enter the facility. The calculated volume for adult holding should be increased to allow space for sorting, excess fish holding and program skewing. Water will be supplied through an upwelling sump at the head end of each holding/crowding/sorting raceway. This water will be supplied from the detention pond and any excess (overflow) water draining from the headbox.

These facilities are shown adjacent to an existing single lane road at an elevation of about 805 feet, which is about 15 feet above the maximum tailrace elevation recorded during the 1998 to mid-2002 period. The main holding/crowding channel, at the end of the fish ladder, will extend to a location where it is adjacent to five holding/sorting raceways. The number and configuration of raceways may change during subsequent design, but the five raceways shown can be used as follows: two for early summer/fall Chinook, two for late summer/fall Chinook, and one for excess returning fish and to acclimate broodstock coming from remote sites with 10 degree to 15 degree warmer water. Most of this summer/fall broodstock will be trucked in from remote collection sites. The late summer/fall Chinook raceways can also be used for spring Chinook earlier in the year should that program be implemented.

Each of the holding/crowding/sorting raceways is 10 feet wide and 65 to 80 feet long. With a holding depth of 5 feet, these raceways, including the distribution channel, provide a total volume of about 23,000 cubic feet. It is anticipated that the holding depth would be lowered during crowding and sorting to allow crews in the holding raceways to select and handle the fish.

4.8 Spawning and Egg-take Facilities

The spawning and egg-take facilities shown in Figure 3 include a 1,200-square-foot enclosed structure that overlaps the east end of three of the holding/sorting raceways by 10 feet to allow easy access to the crowded fish during the spawning process. Carcasses resulting from the spawning operation will be stored adjacent to the spawn building in covered totes until transported off-site. The carcass storage area can also be used as a harvest area or a transfer area for excess returning fish.

For the proposed egg-takes, the volume of fish to be spawned is not excessive (less than 200 per week). However, use of a live fish lift such as a “pescalator” may result in improved handling efficiency of these fish as well as allow for moving large numbers of excess adult

returns. A portable unit that can be moved from raceway to raceway would provide the greatest flexibility.

Spawned eggs will be briefly stored in buckets or other containers within the structure until transported to the incubation room of the hatchery building.

4.9 Effluent Treatment Facilities

4.9.1 Effluent Quality Requirements

Discharge from the CJDH site to the Columbia River must meet the requirements of the Washington State Administrative Code (WAC) Section 173-221A.

Under the requirements in the WAC, an off-line treatment process of vacuumed start tank or raceway cleaning wastes must meet the following:

- Total suspended solids—Average monthly removal of 85 percent.
- Settleable solids—Average monthly removal of 90 percent.
- Instantaneous maximum total suspended solids concentration—Not in excess of 100 milligrams per liter of effluent.
- Instantaneous maximum settleable solids concentration in the off-line settling basin effluent—Not in excess of 1.0 milliliter per liter of effluent.

Flows that pass through the normal hatchery flow path (over start tank and raceway water level control weirs or stand pipes) must meet the following:

- The instantaneous maximum total suspended solids concentration in the effluent at the point of discharge to the receiving environment shall not exceed 15 milligrams per liter of effluent.
- The average total suspended solids concentration in the effluent at the point of discharge to the receiving environment shall not exceed 5 milligrams per liter of effluent.
- The average settleable solids concentration in the effluent at the point of discharge to the receiving environment shall not exceed 0.1 milliliter per liter of effluent.
- Effluent limitations shall apply as net values, provided the criteria contained in 40 CFR 122.45 (net gross allowance) are met.

4.9.2 Aeration and Settling Facility

The aeration and settling facility will be a concrete structure near the downstream end of the spring Chinook group of raceways. This offline facility will receive the vacuum cleanings from the start tanks and raceways at a rate of less than 50 gpm. The structure will be split into two sections, each having a floating aerator and a ramp entry for access to remove solids (sludge). Supernatant from the settling process can be drained to either the detention pond or directly to the outfall pipe. Drain-down for solids removal will be drained to the detention pond.

4.9.3 Detention Pond

A 1989 report by the Washington State Department of Ecology recommended that "whole effluent should be allowed to settle at least one-hour before discharge" where whole effluent would include the vacuum cleaning wastes. Although this conceptual design includes offline treatment of cleaning wastes as indicated above, a detention pond providing 1 hour of detention at a peak flow of 50 cfs should still be planned for. The detention pond will be lined with a plastic liner covered with suitable soil to maintain wetland plants.

4.10 Administration and Visitor Areas

4.10.1 Administration Building

The COE previously performed a study to locate a new visitor center building within the area now designated for the hatchery. One option developed for the CJDH conceptual design combined this future COE facility with the hatchery administration and visitor building in a two-story, 12,500-square-foot building, but that option was not carried forward. Instead, a 2,000-square-foot administration and visitor facility for the CJDH will be located at the east end of the hatchery complex. It will contain the following spaces:

• Offices (Two @ 120 square feet)	240 SF
• Lobby/Display Area	576 SF
• Conference Room	480 SF
• Dry Storage	144 SF
• Wet Gear Lockers	160 SF
• Restroom	100 SF
• Janitor Closet	64 SF
• General Circulation @ 12% of spaces	212 SF
Total	1,976 SF

4.10.2 Site Access and Parking

Two site entry points are planned for the main hatchery area and a third entry point needs to be developed to access the proposed adult holding and spawning facilities.

Adjacent to the administration and visitor building will be an area that can be developed for significant parking, including visitor buses and motor home spaces. This area can also be used for miscellaneous covered storage. The two entry points off Half-Sun Way will provide multiple entries into this area. These entry points presently allow a circular path for large trucks, buses and private motor homes, with no backing up required.

Access to the adult holding and spawning facilities, by single-axle flat bed trucks for carcass tote hauling, delivery of broodstock and various vehicles needed to service the attraction water pumping station, will require that a new turn-around be developed at the junction of the COE's road to the face of the dam and the gravel service road to this area. The new turn-around will probably require a short wall to retain the uphill slope (see Figure 4).

At the adult holding and spawning facilities, vehicle access will be developed so that the single axle flat bed truck can loop around the complex by driving across the short section of the ladder that is oriented perpendicular to the river. This access loop will also be used by vehicles servicing the attraction water pumping station.

4.10.3 COE Trail

About 700 linear feet of the existing asphalt walking trail will be relocated southward to stay along the edge of the river bank. This relocation will allow a larger area to be developed for the large vehicle travel loop and the parking area associated with staff and visitor needs. A chain link fence surrounds the project area and parallels a major portion of the trail along the river bank.

4.11 Staff Housing

4.11.1 Location

Several locations for hatchery staff housing were reviewed. COE staff indicated that residential housing at the hatchery site is not compatible with COE land use requirements. A location that is approximately 0.8 miles to the northeast on Half-Sun Way was selected and is proposed for hatchery staff housing. The location, shown in Figure 5, is uphill from the hatchery on the upper bench at an elevation of 1,050 feet.

At the housing site, extension of power and telephone from overhead lines approximately 1,000 feet away will be required. The exact location of power and telephone has not been verified. Water and sewer service will require development of a common well and on-site septic systems. Figure 17 is a site plan of the hatchery staff housing site.

4.11.2 Permanent

Three permanent residences are proposed. Each residence will be 2,000 square feet, with a two-car attached garage. The lot size for each residence will be about 1 acre.

4.11.3 Temporary

A one acre parcel will be used for three covered camp trailer sites with utility hookups.

5. CONCEPTUAL DESIGN DEVELOPMENT PROCESS

The conceptual design for the CJDH was developed collaboratively by the Colville Tribes and consultants, the COE, and Tetra Tech/KCM, Inc. The process included the consideration of several alternative concepts through discussions during site visits and review meetings. The drawings and cost estimate in this report represent an overall feasible concept that is a work in progress. Some late developing components and details have not been incorporated, however, it is thought that the general concepts and costs present a realistic scope for this project. The following sections describe the alternatives evaluated and the overall design development process.

5.1 Review Meeting of January 8, 2004

Based on information provided in the request for proposal (RFP) for the hatchery, a pre-bid site visit and various communications, two site plans were developed for the first project review meeting in January 2004. The first plan located all of the hatchery facilities, except the headworks and the fish ladder entrance, at the west end of the hatchery site, in the widest and flattest portion of the plateau. This plan incorporated a portion of the existing COE visitor information area into the general public entry to the hatchery site. The second plan placed all of the facilities, except the aeration/settling structures and the detention ponds, east of the cross-site power lines. Both of these plans located the hatchery resident housing on the hillside north of Half-Sun Way.

Spaces shown on these plans were estimated from typical space allocations used in other fisheries projects, based on the number and size of fish to be reared, and an initial analysis of the proposed fish rearing programs for this site.

At the review meeting, COE personnel mentioned that a previous visitor center study determined that the best site for that facility was near the center of the western end of the lower plateau. The COE also preferred that the resident housing be located at the existing Colville Tribes trout hatchery site, about 3 miles west of the proposed CJDH site.

Tetra Tech/KCM was advised to plan the placement of as many of the hatchery facilities as possible east of the cross-site power lines.

5.2 Review Meeting of February 23, 2004

Prior to the second review meeting in February 2004, representatives of the Colville Tribes, the COE and Tetra Tech/KCM held a joint site visit. The site visit included a visit to the nearby Colville Tribes trout hatchery to evaluate if the CJDH residences could conveniently be located at this facility. This hatchery visit also allowed the representatives to review the possibilities of expanding existing facilities such as feed storage and of adding new facilities such as vehicle storage and maintenance areas that would be used in conjunction with the operation of CJDH facilities.

During the site visit, it was agreed that the residences would be somewhere on top of the hill north of the CJD, with the exact location undetermined.

Much of the site visit discussion revolved around the location of the planned COE visitor center, the views of the dam, maintaining the existing visitor information area facilities, and proposed facility relationships.

Two optional site plans were presented to the Colville Tribes at the February meeting. The two plans differed mainly in the size and location of the administration and visitor building. In Option A, the administration and visitor building was 2,500 square feet and located adjacent to one of the site entry points. This building contained a general visitor information/reception area sized for an occupancy of about 35 people. This option had the proposed COE visitor center at the planned location near the existing maze and visitor information facilities. In Option B, the hatchery's administration and visitor building was a two-story facility with a total floor area of 12,500 square feet. The 12,500-square-foot

building combined the proposed COE visitor center with the hatchery administration and visitor building. This combined building was shown close to the river bank and atop a portion of the fish ladder, with basement level side-window observation into the fish ladder.

Neither of these plans could be developed with all of the hatchery facilities east of the cross-site power lines due to the eastward narrowing of the site and the westward drop in grade. The plans showed the hatchery building and administration/visitor building east of the power lines, and the rearing raceways, aeration and settling structure, detention pond, holding and sorting area, and spawn house all west of the power lines. Both of these plans also showed the residences on the hillside, adjacent to a second COE visitor viewing area.

At the review meeting, the COE indicated that the residences are to be located further east, adjacent to the intersection of Jack Wells Road and Half-Sun Way. The COE also indicated that the project team should develop a series of wells to intercept the groundwater going to the relief tunnel as they are presently experiencing deterioration of that facility.

5.3 Review Meeting of March 23, 2004

The hatchery plan presented at the March 2004 review meeting was a refinement of Option A presented at the previous review meeting. It showed the residences and a dormitory for temporary staff located along Jack Wells Road. The plan also showed a series of 20 wells along the general alignment of the relief tunnel.

The hatchery facilities needed for the summer/fall Chinook programs were shown darker than those needed for the spring Chinook programs, in order to distinguish the physical impacts of adding the spring Chinook programs. The most notable impacts are the lengthening of the start tank room of the hatchery building and the addition of the group of raceways for spring Chinook rearing.

The bioengineering model was refined, resulting in the updated numbers and sizes of the rearing facilities. The largest change was in the raceway volume, previously estimated at 115,000 cubic feet, which was calculated to be about twice that amount. Further evaluation of rearing requirements will occur during future phases of the facility design.

The adult holding area allows mechanical crowding of fish out of the holding channels into a common channel leading to the spawn building. Fish could also be mechanically crowded from this common channel. This facility was designed to allow visitor viewing of some of the channels and window viewing of spawn house activities.

The COE is developing a contract to reshape and rearmor some of the river embankment in the area of the fish ladder entrance. This work will be completed during the design of the CJDH and may affect the location of the ladder entrance. A study is also now being conducted to determine where adult fish are swimming along this portion of the river in order to try to assess the best fish ladder entrance location.

At the March 2004 meeting, concern was raised about the length of the fish ladder. The fish ladder entrance is located in an apparent indent along the embankment, about 1,500 feet upstream of the adult holding area. The ladder is shown to climb along an old road grade at a 1:10 slope, requiring about 70 weir steps to rise to an open channel that continues along

the embankment to the adult holding area. Tetra Tech/KCM was given the direction to relocate the adult holding area to an elevation of about 810 feet near the fish ladder entrance. Tetra Tech/KCM was also advised that the tagging/fin clip building is to be eliminated in lieu of portable trailers holding the required equipment.

Tetra Tech/KCM was also advised that the COE will design the relief tunnel and Rufus Woods Lake water sources and will contract the construction of water systems to the hatchery. The points where these pipelines will terminate has yet to be agreed upon.

5.4 Final Conceptual Design

The plans shown in the figures accompanying this appendix show most of the hatchery facilities as developed for the March 23, 2004 review meeting, except that the adult holding and spawning area is now near the fish ladder entrance. Other changes include the elimination of the water supply systems (to be provided by COE), elimination of the tagging/fin clip building, changes to the water supply distribution piping throughout the site, and reduction of the administration and visitor facility from 2,500 square feet to 2,000 square feet. Also shown in the figures are site plans of the acclimation pond areas and specific plans for the two proposed new ponds.

6. ESTIMATED COST

A detailed cost estimate for the final conceptual design of the hatchery was developed, broken down into groups of costs associated with the following project elements, as shown in Table 3:

- Required elements for the basic summer/fall Chinook rearing programs:
  - **Facilities at the Hatchery**—This portion of the project is estimated to cost $16,220,400 with the rearing water systems being constructed by COE contract included. The COE estimate of the construction cost of the rearing water systems is $3,112,000.
  - **Improvements at the Off-Site Acclimation Pond Sites**—There are three ponds involved in this portion of the project; Riverside, Omak and Bonaparte. The estimated cost to provide these facilities is $1,150,000.
  - **Total**—The estimated total cost for the summer/fall Chinook program facilities is $17,370,400 with the COE constructed water supply systems.
- Additional elements for the optional spring Chinook rearing programs:
  - **Facilities at the Hatchery**—The estimated cost to expand the CJDH facilities to include the spring Chinook programs is $5,400,000. The additional facilities include more vertical incubator tray stacks, a separate group of 28 raceways, and water supply/drain piping needed to operate the additional raceway group. The cost also includes almost $2.5 million for the construction of an additional well water system from a park about 2.5 miles upstream of the site.

- **Improvements at the Off-Site Acclimation Pond Sites**—The estimated cost to modify the existing St. Mary's Mission Pond and the Ellisforde Pond is $170,000.
- **Total**—The total estimated additional cost for the spring Chinook programs is $5,570,000.

HALF-SUN WAY

HALF-SUN WAY

EXIST MAZE AREA

EXIST LABYRINTH AREA

EXIST PAVED PATH

4.5 FT DEEP POND FOR 1HR DETENTION OF 50 CFS

SPRING CHINOOK RACEWAYS 253'x140' (28@ 8X100X4)

LATE S/F CHINOOK RACEWAYS 217'x120' (24@ 8X100X4)

EARLY S/F CHINOOK RACEWAYS 181'x120' (20@ 8X100X4)

SPRING CHINOOK START TANK 5,900 SF

S/F CHINOOK START TANK 12,270 SF

SUPPORT AREA 18,500 SF

HEADBOX/CONTROL STRUCTURE

HATCHERY ADMIN AND VISITOR AREA 2500 SF

PUMPED TUNNEL WATER PIPELINE

PAVED AREA FOR PARKING, STORAGE & VIEWING

GRAVITY RESERVOIR WATER PIPELINE

36" OVERFLOW

AERATION RAMP & SETTLING

SORTED HOLDING

SPAWNING BLDG 1200 SF

FISH LADDER AT 1:10 SLOPE AND ENTRANCE SILL AT EL 772

FISHWAY ATTRACTION WATER PUMP STATION

OVERFLOW/DRAIN

SMOLT DIRECT RELEASE

WATER'S EDGE 1993

WATER'S EDGE 1974

RIVER LEVELS GENERALLY VARY FROM ABOUT EL 780 TO EL 785. MAX VARIATION 1998 TO MID 2002, EL 777 TO EL 790. (DATA FROM GRAPH PROVIDED TO DESIGN TEAM)

COLUMBIA RIVER

STATE HIGHWAY 17

N

100' 0' 100' 200'

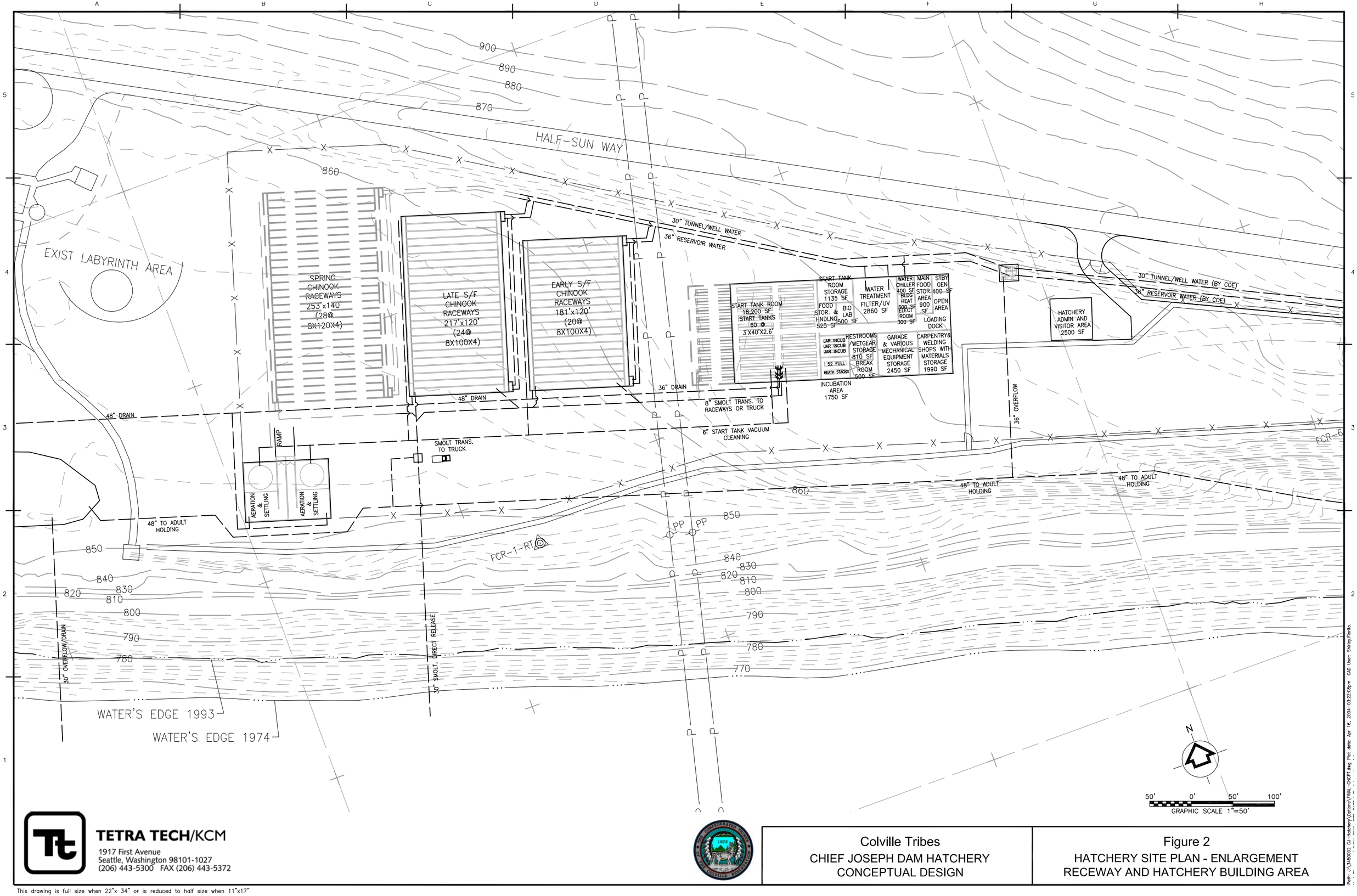
GRAPHIC SCALE 1"=100'

TETRA TECH/KCM
1917 First Avenue
Seattle, Washington 98101-1027
(206) 443-5300 FAX (206) 443-5372

Colville Tribes
CHIEF JOSEPH DAM HATCHERY
CONCEPTUAL DESIGN

Figure 1
HATCHERY SITE PLAN

This drawing is full size when 22"x 34" or is reduced to half size when 11"x17"



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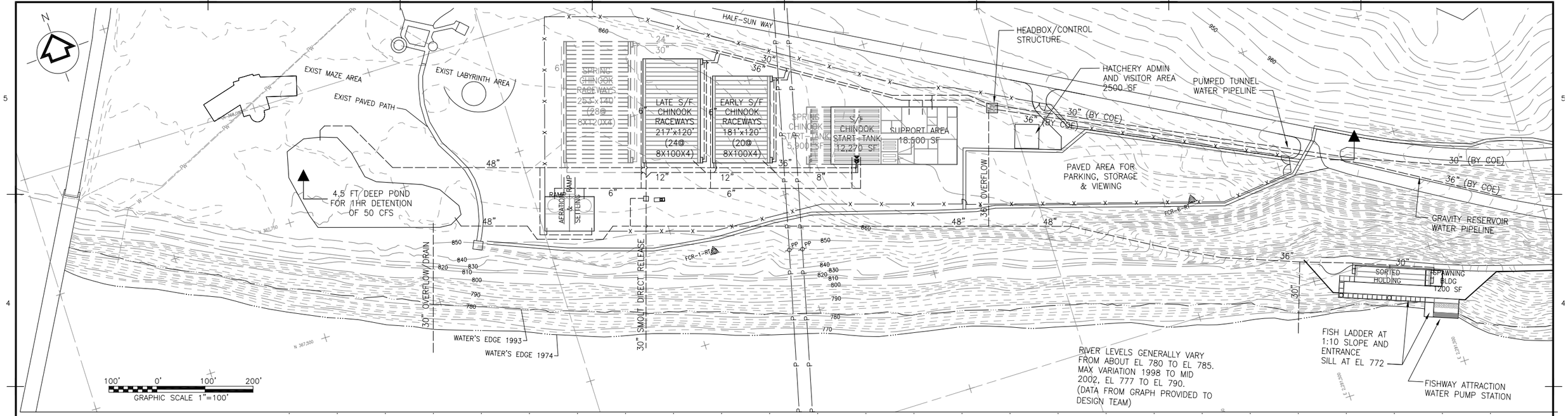
Colville Tribes
CHIEF JOSEPH DAM HATCHERY
CONCEPTUAL DESIGN

Figure 2
HATCHERY SITE PLAN - ENLARGEMENT
RECEWAY AND HATCHERY BUILDING AREA

This drawing is full size when 22"x 34" or is reduced to half size when 11"x17"

Path: J:\3450002 Ch-Hatchery\Options\FINAL-CNCPT.dwg Plot date: Apr 16, 2004-03:22:08pm CAD User: ShirleyFerris



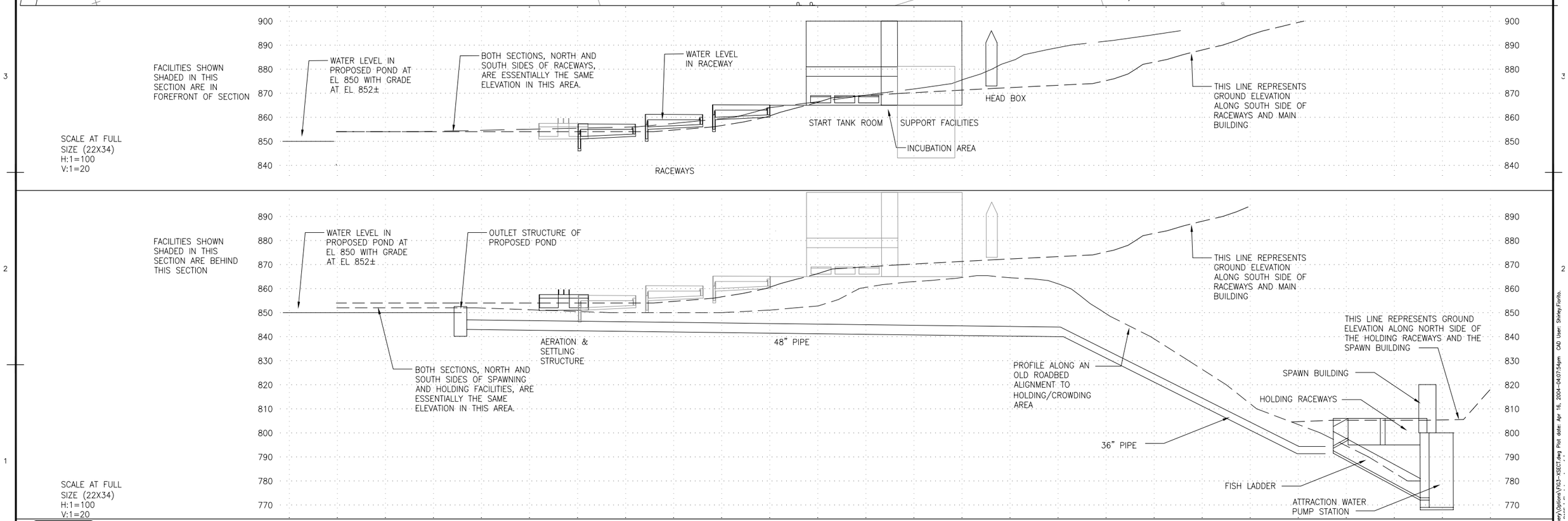


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Figure 3
HATCHERY AREA X-SECTIONS

This drawing is full size when 22"x 34" or is reduced to half size when 11"x17"

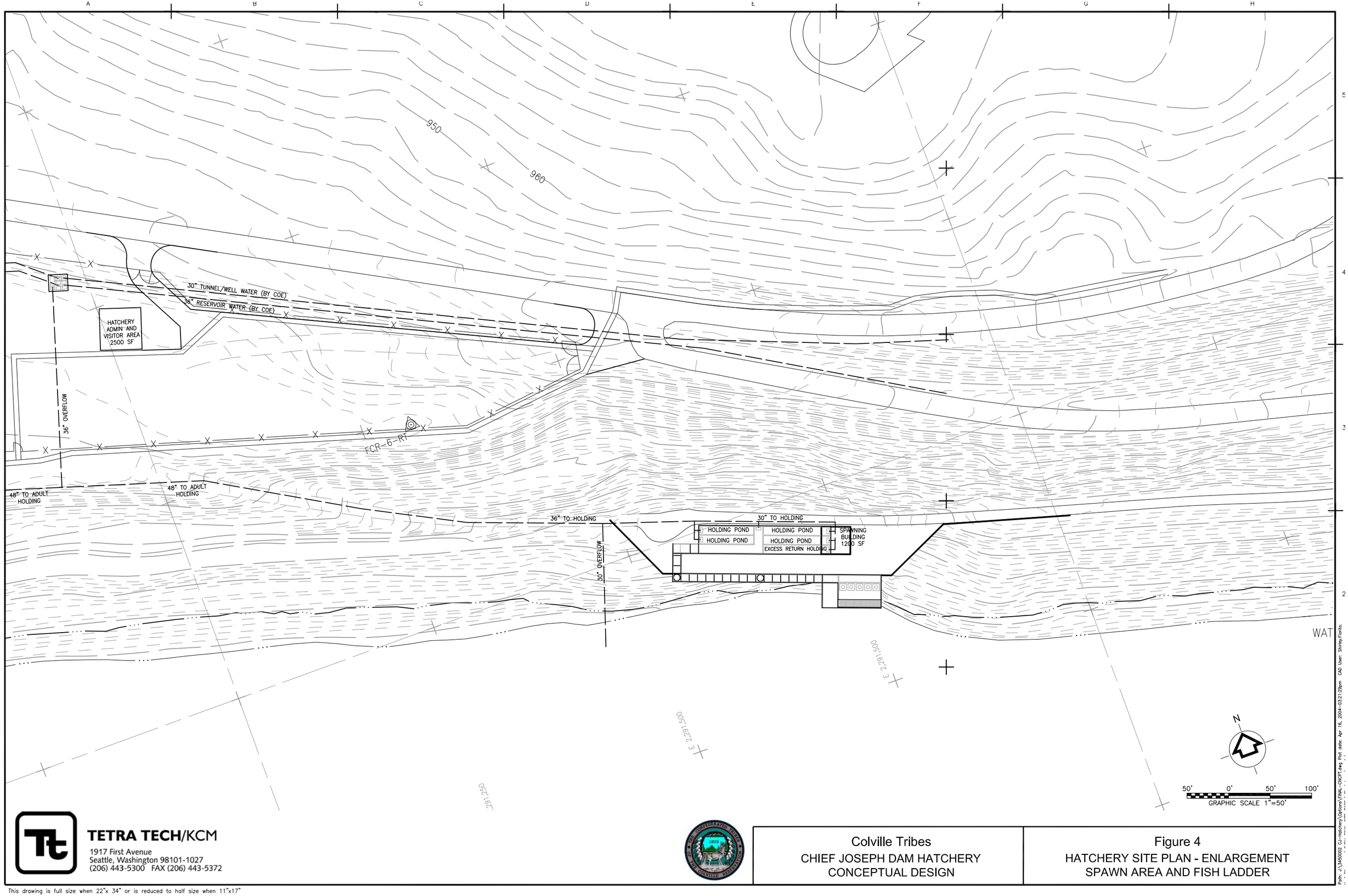

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Figure 4
HATCHERY SITE PLAN - ENLARGEMENT
SPAWN AREA AND FISH LADDER

This drawing is full size when 22"x 34" or is reduced to half size when 11"x17"

Path: J:\345002.C1-Hatchery\Option1\ENAL-ChCPT.dwg Plot date: Apr 16, 2004-03:21:29pm CAD User: Shirley Fiorito.

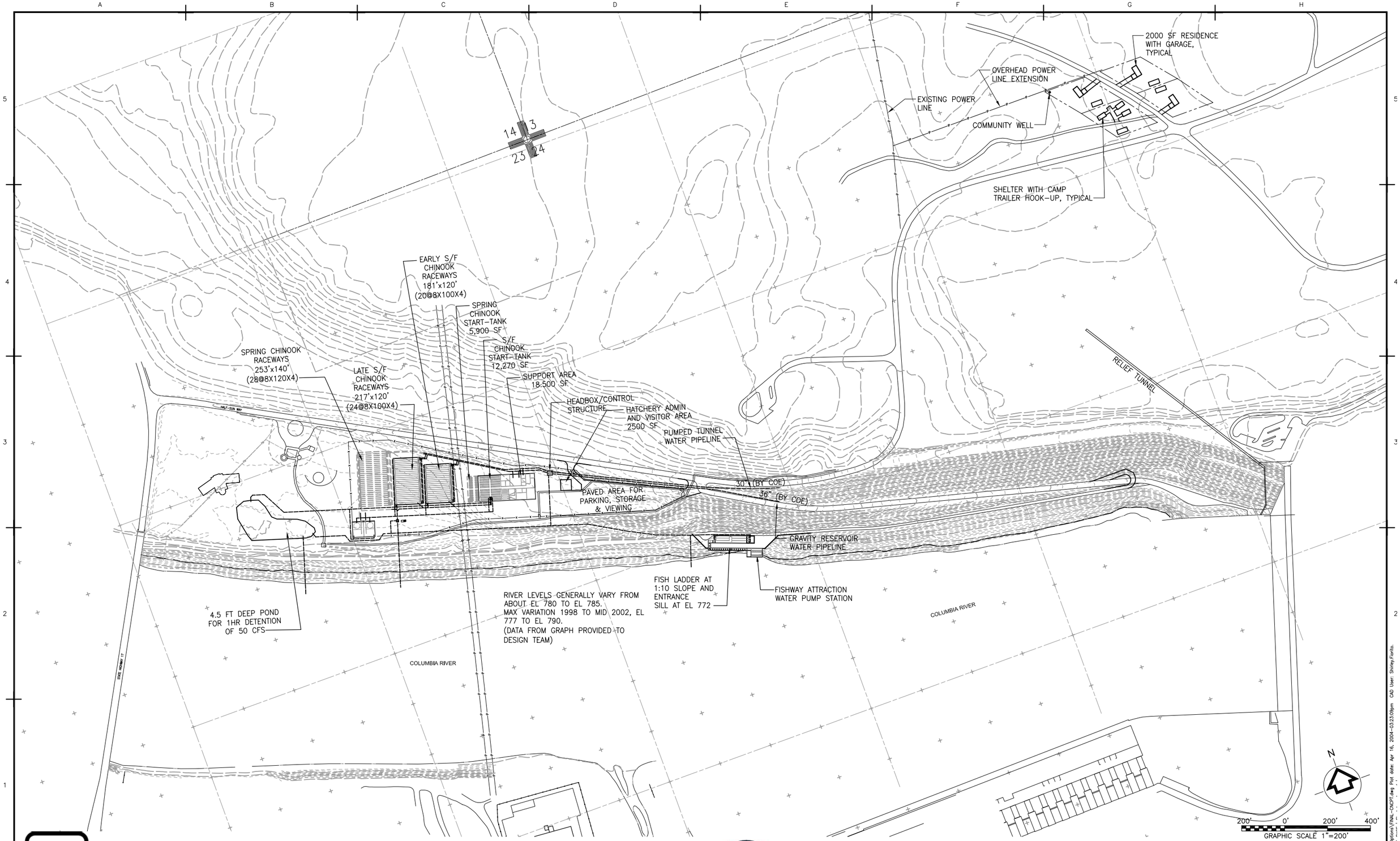

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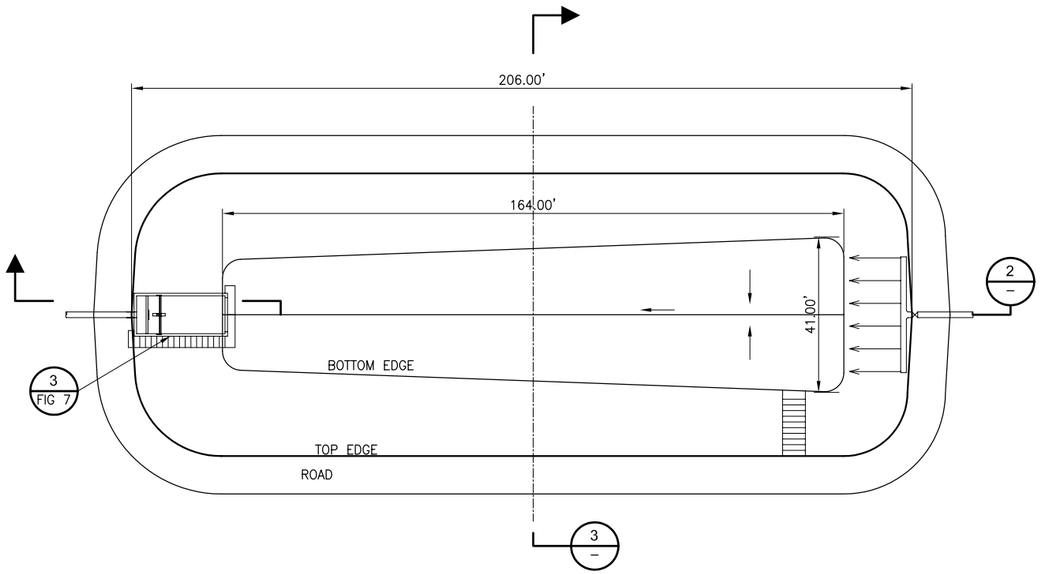
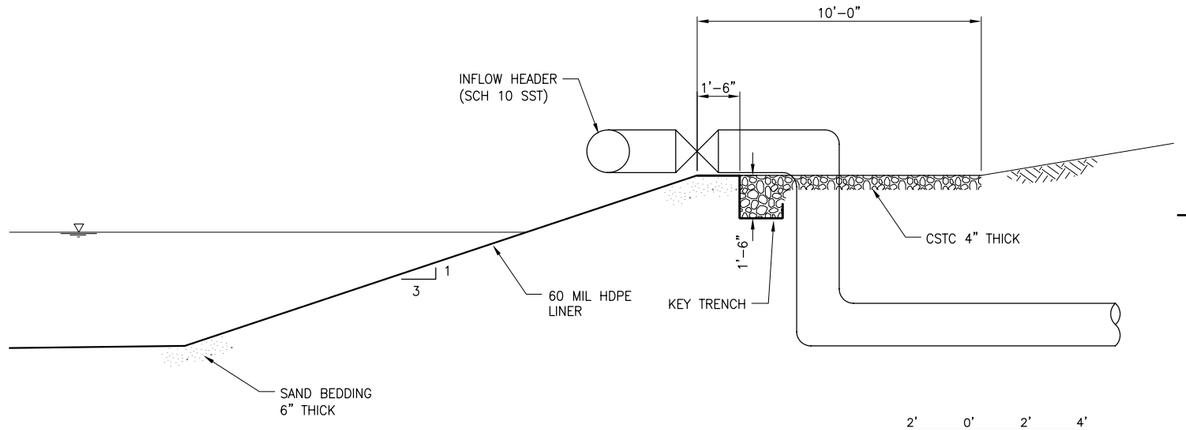
Figure 5
HATCHERY AND HOUSING AREA
SITE PLAN



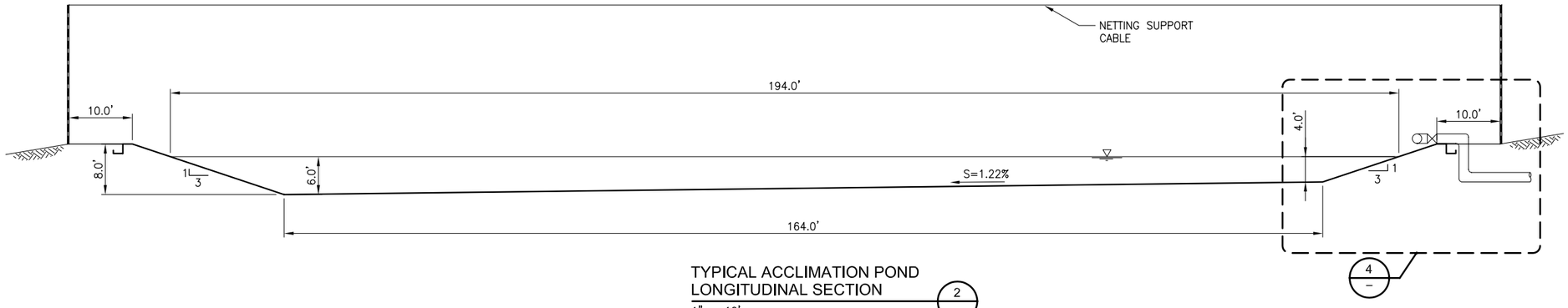
TYPICAL ACCLIMATION POND
PLAN VIEW
1" = 20'
1

20' 0' 20' 40'
GRAPHIC SCALE 1"=20'

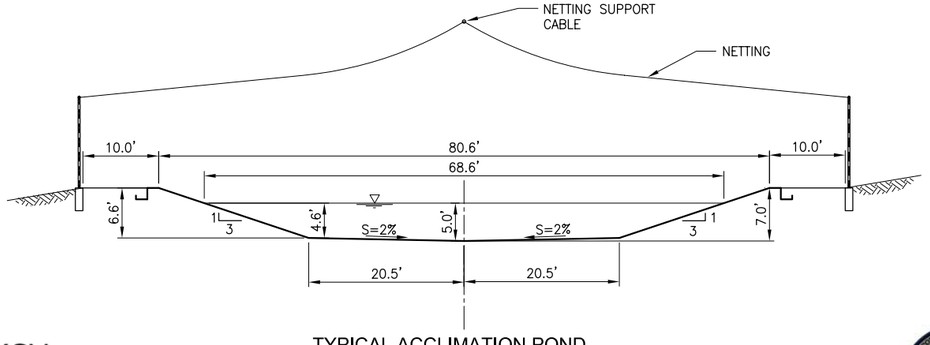


POND EDGE ENLARGEMENT
3/8" = 1'-0"
4

2' 0' 2' 4'
GRAPHIC SCALE 3/8"=1'-0"



TYPICAL ACCLIMATION POND
LONGITUDINAL SECTION
1" = 10'
2



TYPICAL ACCLIMATION POND
CROSS SECTION
1" = 10'
3

10' 0' 10' 20'
GRAPHIC SCALE 1"=10'

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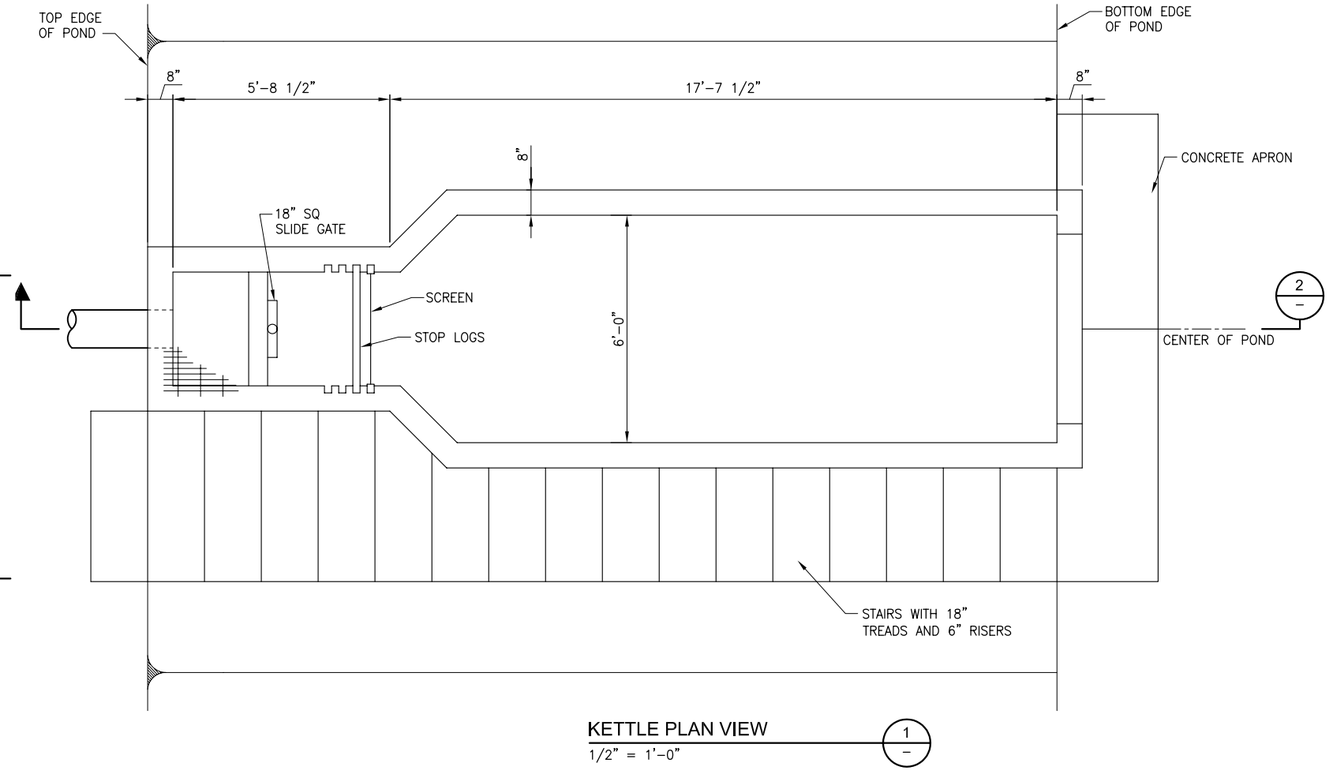
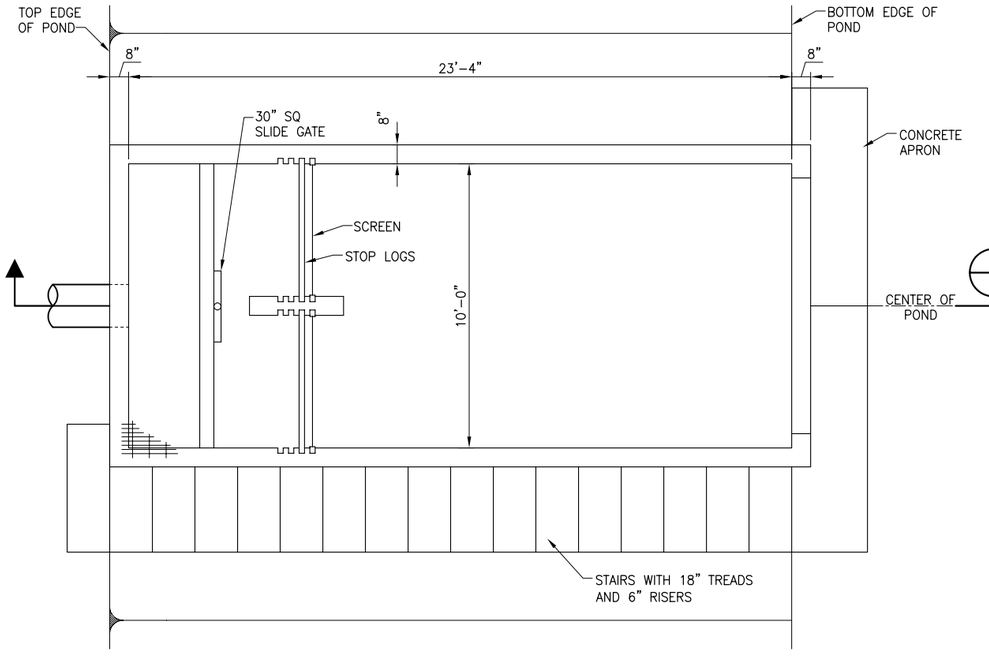
Figure 6
ACCLIMATION POND - 40,000 CF
TYPICAL PLAN AND SECTIONS

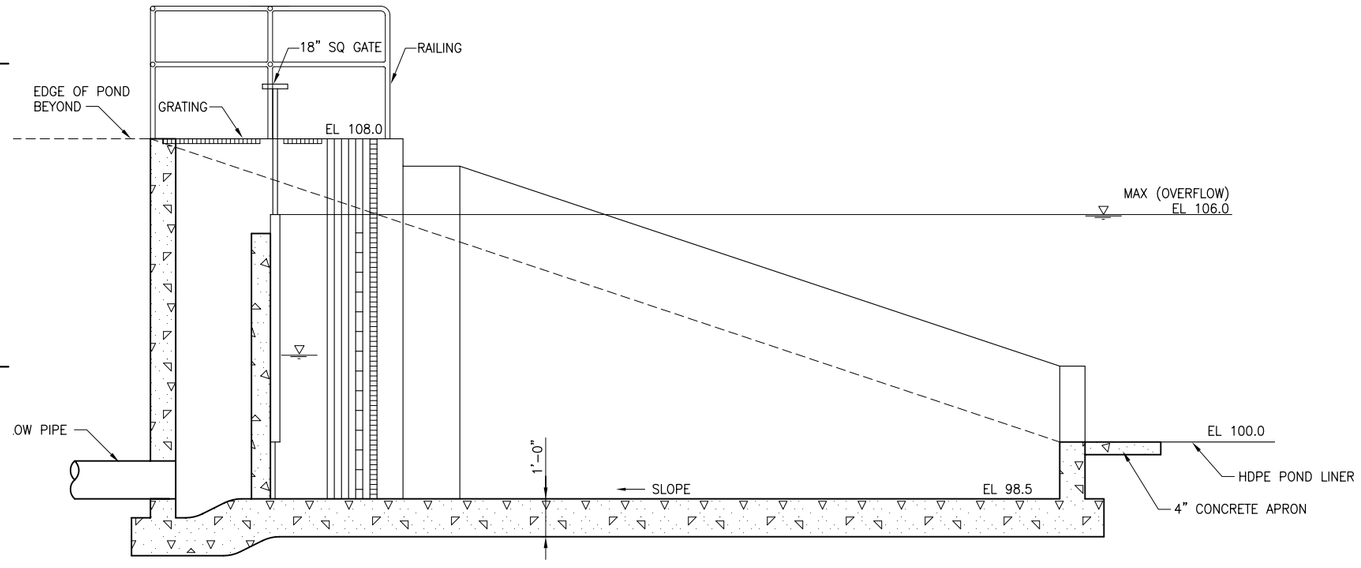


KETTLE PLAN VIEW
1/2" = 1'-0"
1



KETTLE (HIGH FLOW) PLAN VIEW
3/8" = 1'-0"
3

2' 0' 2' 4'
GRAPHIC SCALE 3/8"=1'-0"



KETTLE SECTION
1/2" = 1'-0"
2

1' 0' 2' 4'
GRAPHIC SCALE 1/2"=1'-0"

ACCLIMATION POND OUTLET KETTLE
TYPICAL PLAN AND SECTION

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Figure 7
ACCLIMATION POND OUTLET KETTLE
TYPICAL PLAN AND SECTION

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3450002/AcclimationSites.fh10

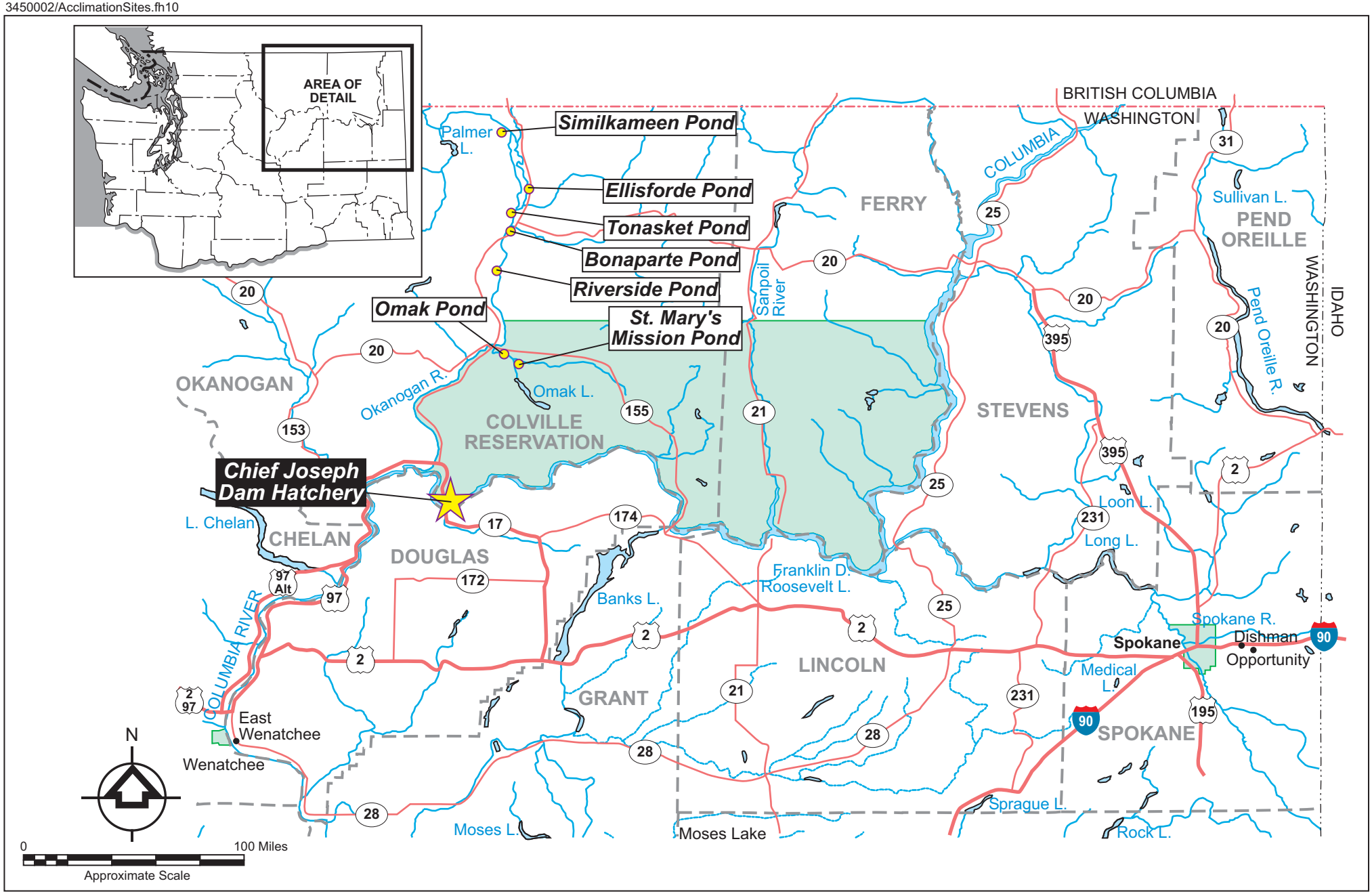

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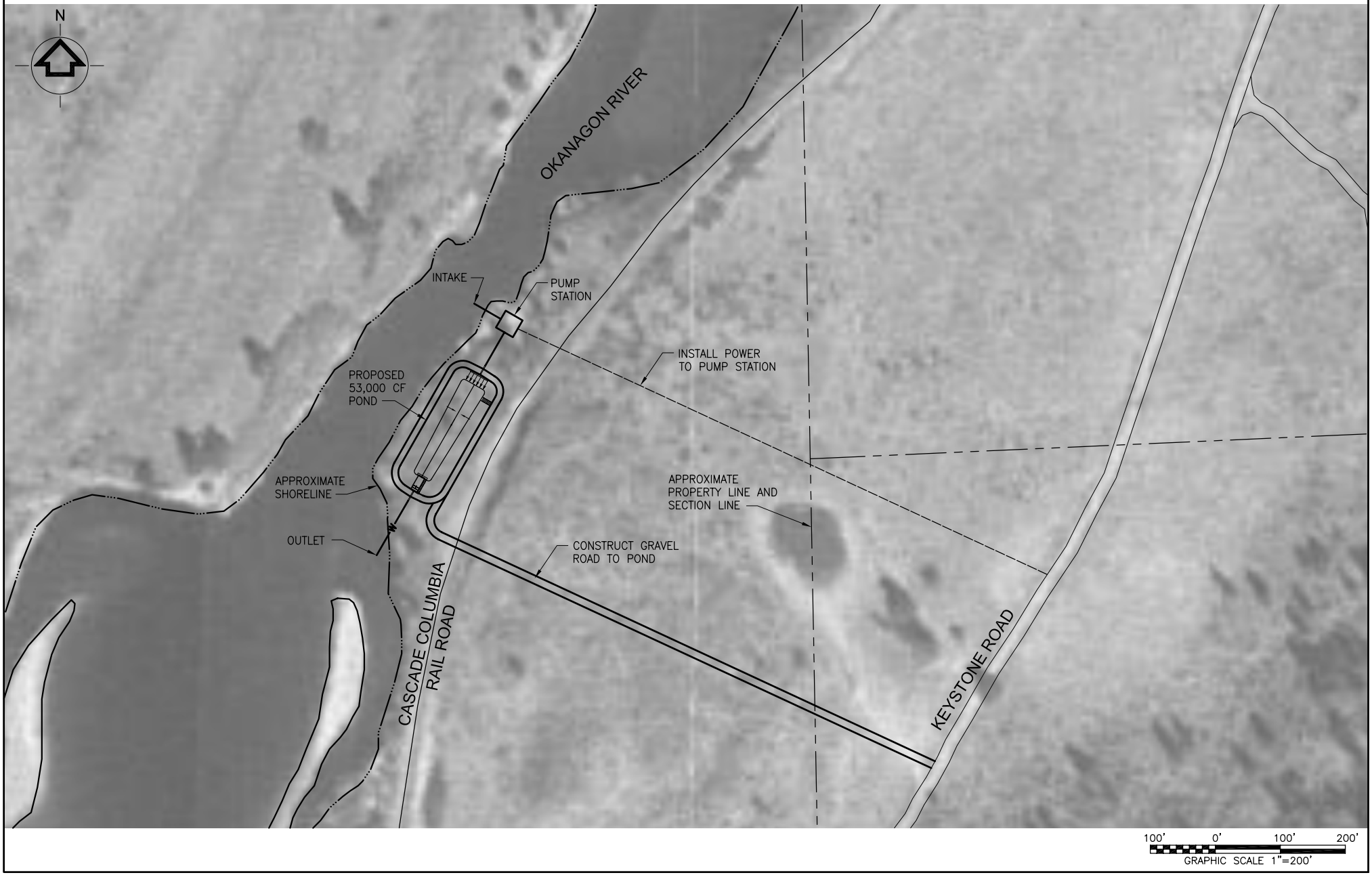
Figure 8.
ACCLIMATION POND SITES

3450002 Riverside 1=200 April, 2004



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3450002 Bonaparte 1=200 April, 2004

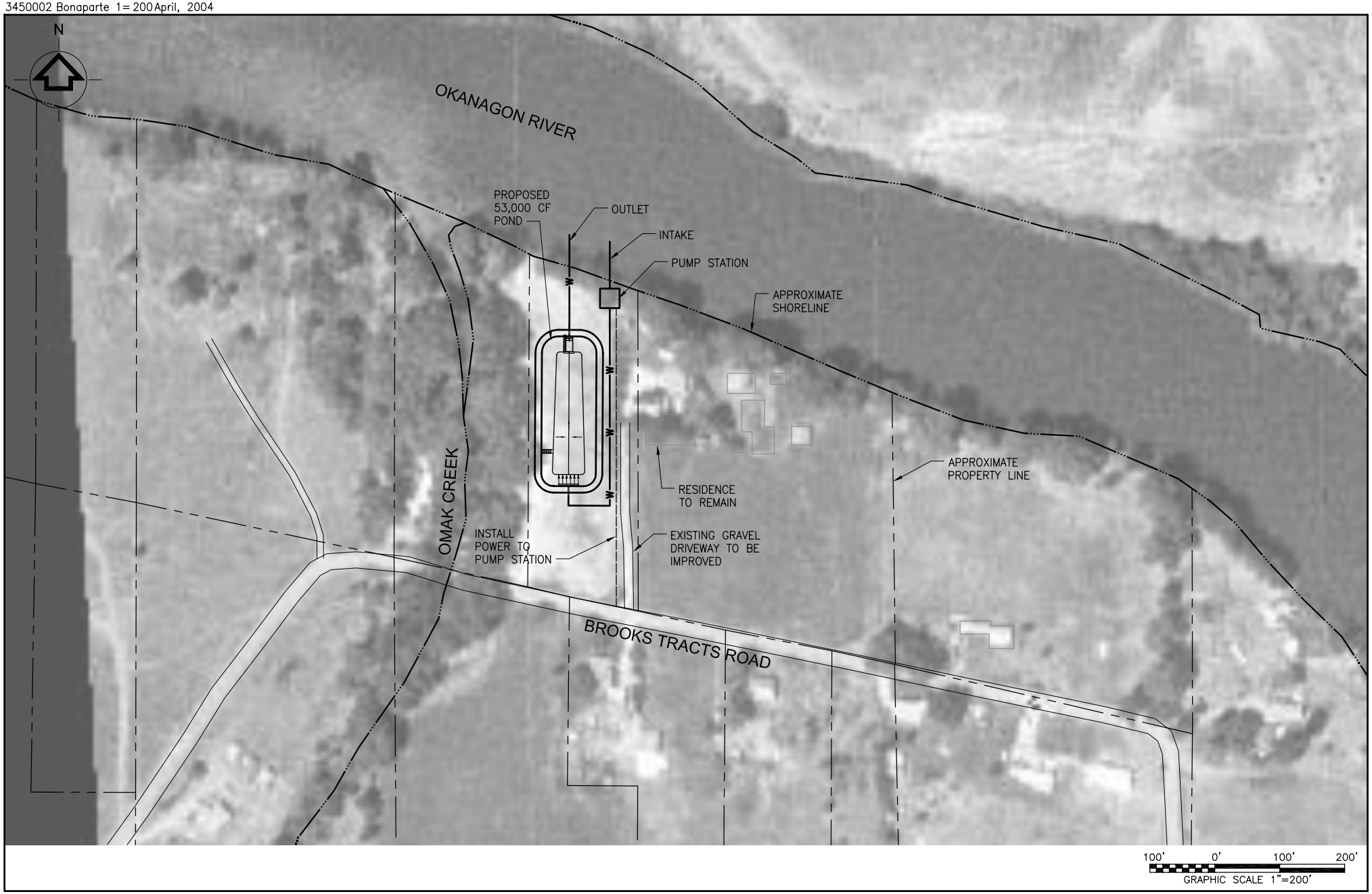

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Figure 10
ACCLIMATION POND SITE PLAN
PROPOSED OMAK POND

3450002 Tonasket 1=200 April, 2004

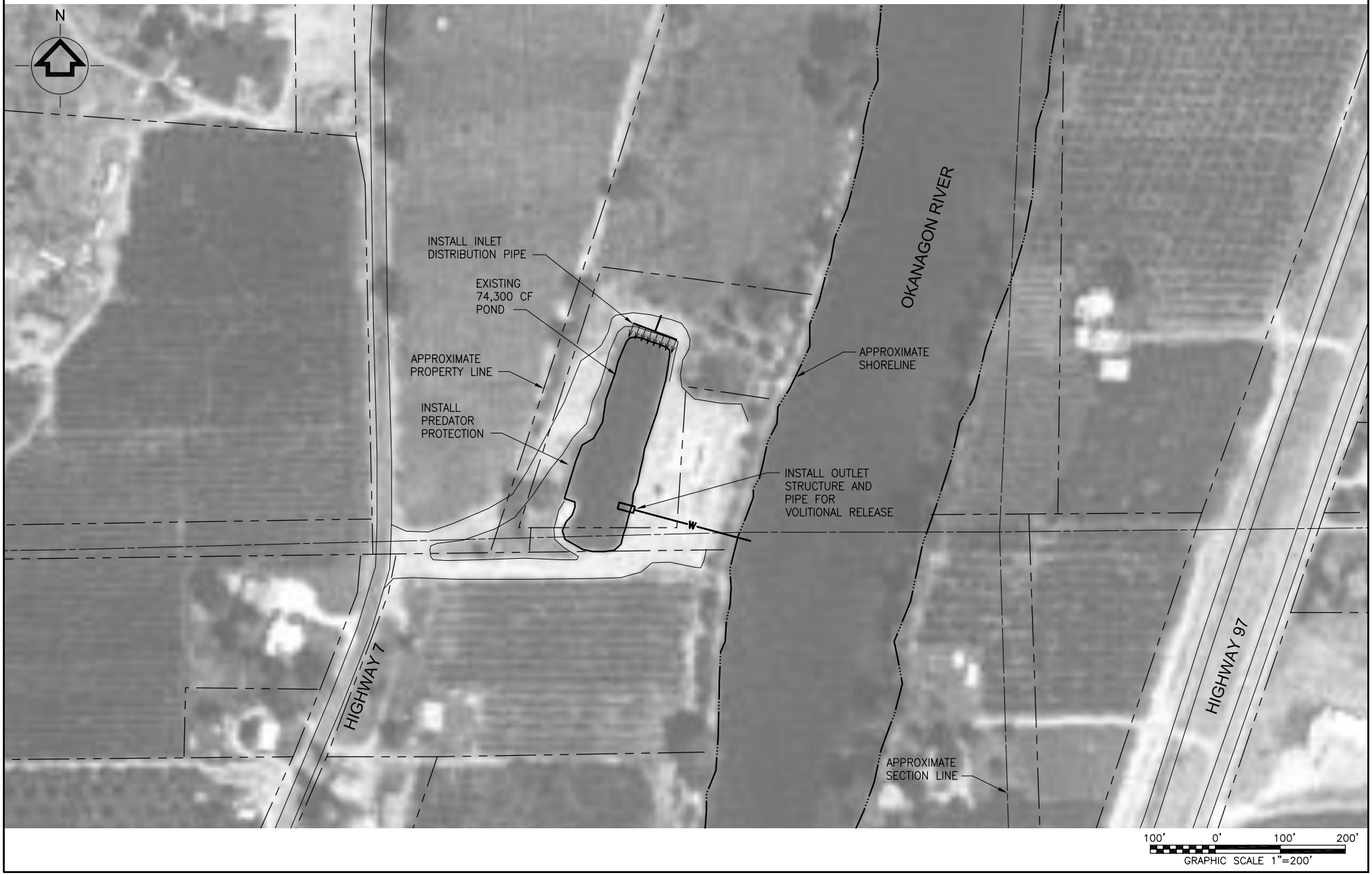

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Figure 11
ACCLIMATION POND SITE PLAN
MODIFICATIONS TO TONASKET POND

3450002 Similkame 1= 200 April, 2004

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Figure 12
ACCLIMATION POND SITE PLAN
EXISTING SIMILKAMEEN POND

3450002 Bonaparte 1= 200 April, 2004

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Figure 13
ACCLIMATION POND SITE PLAN
MODIFICATIONS TO BONAPARTE POND

3450002 Mission 1=200 April, 2004

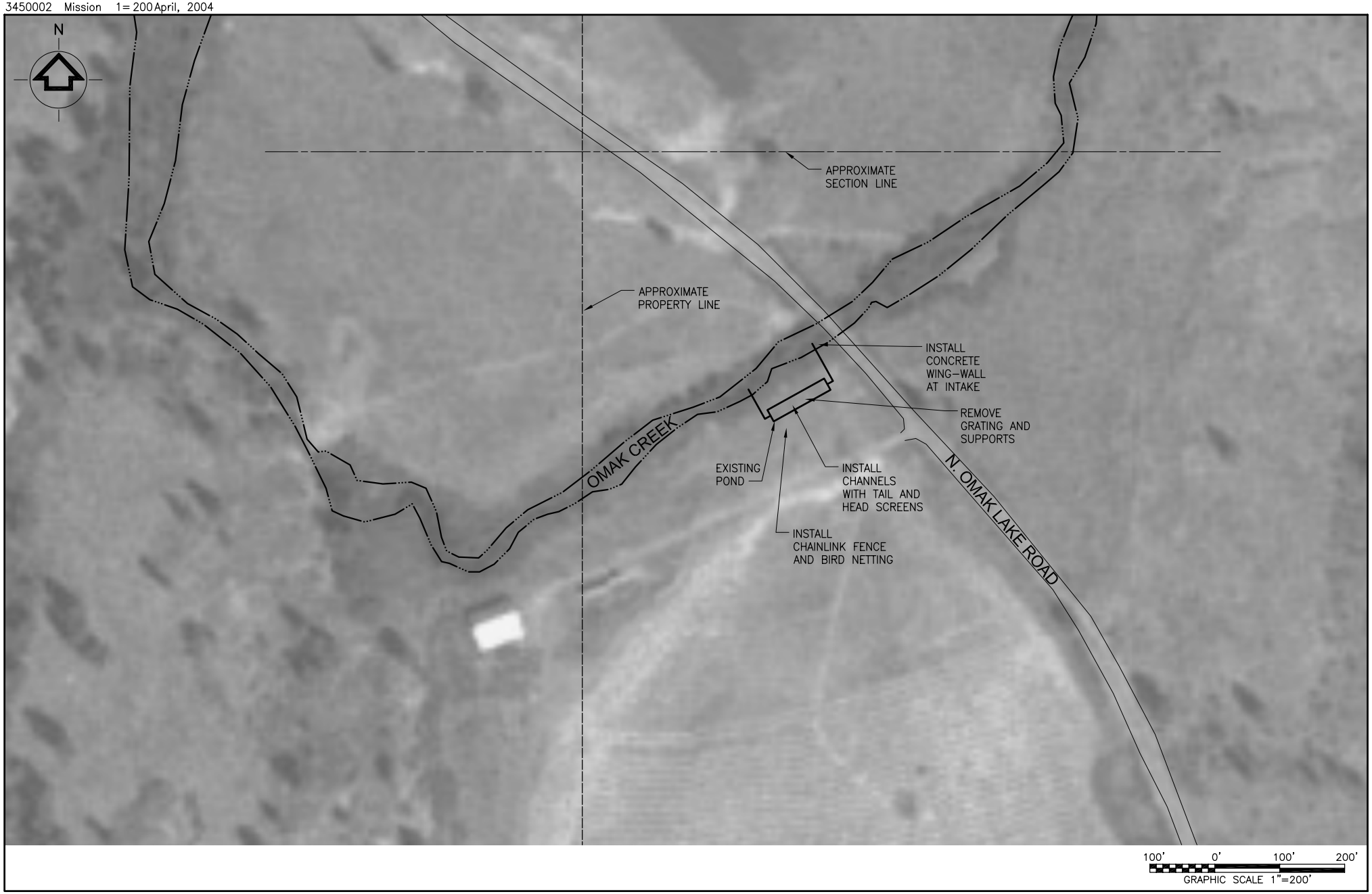

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Figure 14
ACCLIMATION POND SITE PLAN
MODIFICATIONS TO ST MARY'S MISSION POND

3450002 Ellisforde 1=200 April, 2004

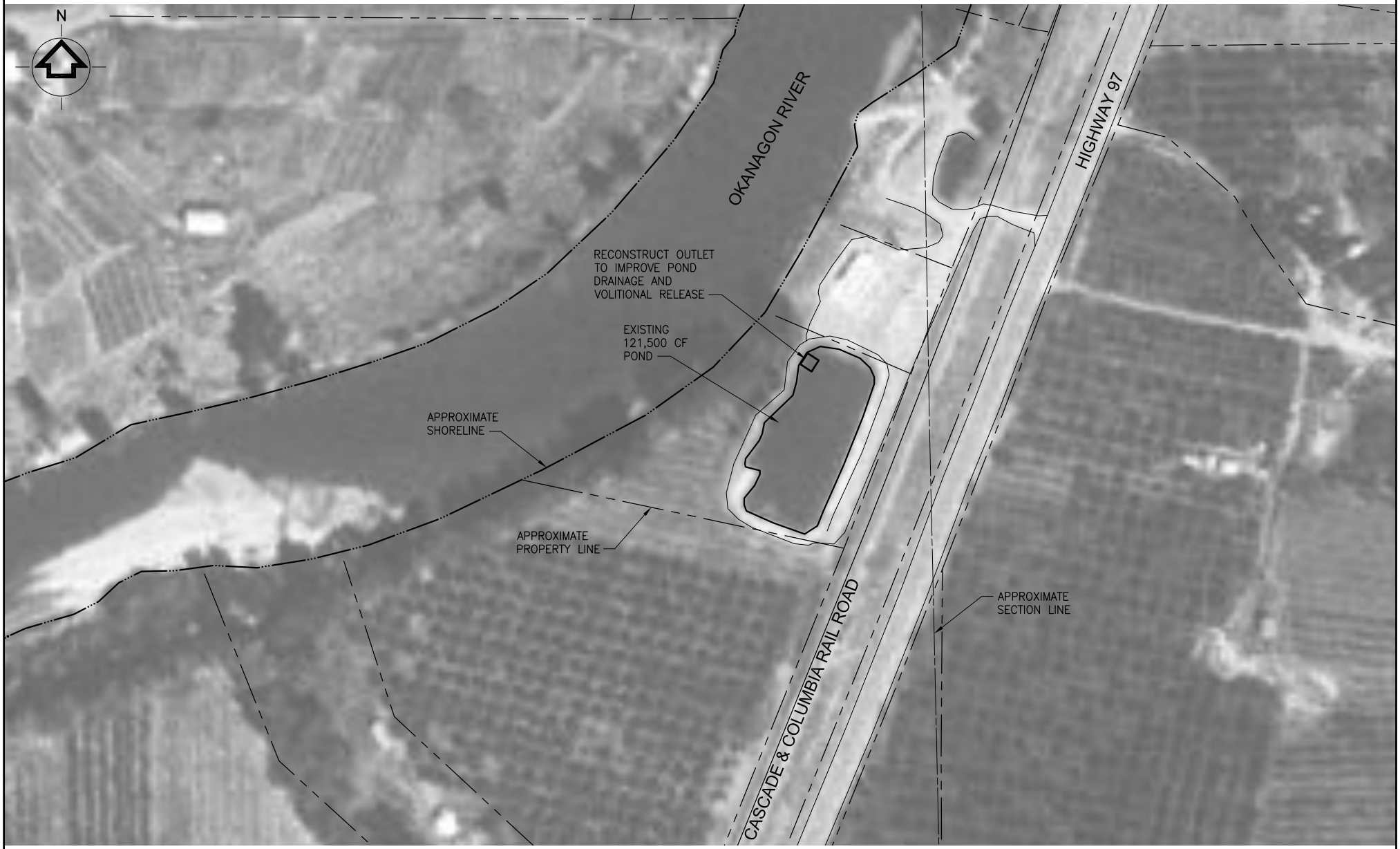

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Figure 15
ACCLIMATION POND SITE PLAN
MODIFICATIONS TO ELLISFORDE POND

*NOTE: TO OBTAIN DESIRED REARING TEMPERATURES, MIXING OF TREATED WATERS WILL NEED TO OCCUR PRIOR TO ENTERING THE REARING UNITS.

WELL

RESERVOIR

HEADBOX/CONTROL STRUCTURE

PUMPED TUNNEL WATER (FROM WELLS)

RACEWAYS

RACEWAYS

RACEWAYS

START TANK ROOM

INCUBATION AREA

WATER CONDITIONING AREA

FILTERING AND OTHER TREATMENTS

CHILLED WELL

TREATED RESERVOIR

FILTER WASTE

OVERFLOW

GRAVITY RESERVOIR WATER PIPELINE

DRAIN

FISH TRANSFER STATION

DRAIN

DRAIN

FISH TRANSFER

START TANK/RACEWAY VACUUM CLEANINGS

1HR DETENTION POND

AERATION & SETTLING

AERATION & SETTLING

HOLDING/CROWDING

HOLDING/CROWDING

SPAWN AREA

OVERFLOW/DRAIN

RELEASE TO RIVER

BYPASS TO RIVER

FISH LADDER

FISHWAY ATTRACTION WATER PUMP STATION

CHIEF JOSEPH DAM

COLUMBIA RIVER

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Figure 16
HATCHERY FLOW SCHEMATIC

This drawing is full size when 22"x 34" or is reduced to half size when 11"x17"

Path: J:\1450002 Ci-Hatchery\Options\FIG16-FLOWSCH.dwg Plot date: Apr 16, 2004-08:30:31am CAD User: Shirley.Fortis.
Xref Filename:

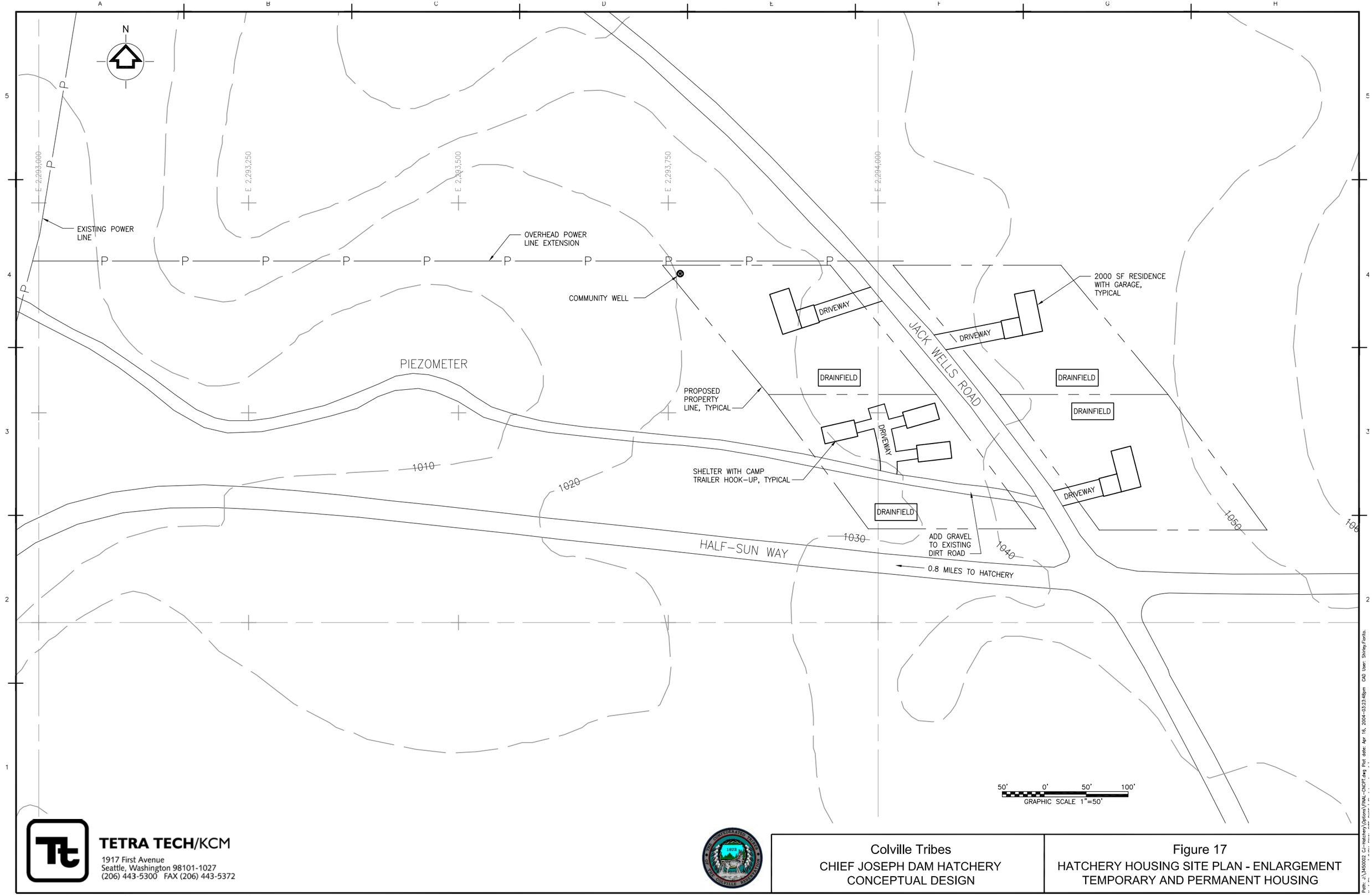

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Figure 17
HATCHERY HOUSING SITE PLAN - ENLARGEMENT
TEMPORARY AND PERMANENT HOUSING

This drawing is full size when 22"x 34" or is reduced to half size when 11"x17"

Path: J:\345000\ Cu-Hatchery\Options\FINAL-ChCPT.dwg Plot date: Apr 16, 2004-03:23:48pm CAD User: Shirley.Fonto.

Project: Chief Joseph Dam Fish Hatchery
Summer/Fall Chinook Program

Date: ***4/15/2004-5pm***
Type of Estimate: ***Conceptual Design***

LINE ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	COST
	COE water systems for hatchery rearing shown in line item 169				
	Piping based upon COE termination at 10 feet from headbox.				
1	**30" diam, HDPE, Tunnel water to headbox**	40	lf	$ 135	$ 5,400
2	**36" diam, HDPE, Reservoir water to headbox**	40	lf	$ 155	$ 6,200
3	**36"Butterfly valve on reservoir water at headbox w/electrical controls**	1	ea	$ 10,000	$ 10,000
4	**36" diam, HDPE overflow to 48" drain**	250	lf	$ 155	$ 38,750
			Total to headbox		$ 60,350
	Headbox with drum filter on Reservoir supply				
5	**Concrete footings, 12"**	40	cy	$ 300	$ 12,000
6	**Concrete slab on grade, 6"**	8	cy	$ 300	$ 2,400
7	**Concrete slab, 2nd level, 8"**	24	cy	$ 400	$ 9,600
8	**Concrete exterior walls, 9"**	240	cy	$ 500	$ 120,000
9	**Concrete weir walls, 9"**	30	cy	$ 400	$ 12,000
10	**Grating, fiberglass**	304	sf	$ 7	$ 2,128
11	**Drum Filter system**	1	ls	$ 500,000	$ 500,000
12	**Stairs, galv steel, 4' wide, 50 risers**	50	risers	$ 225	$ 11,250
13	**Landings, 4x4**	2	ea	$ 600	$ 1,200
14	**Doors, metal, 36x78, with hardware**	2	ea	$ 350	$ 700
15	**Roof, Metal**	650	sf	$ 10	$ 6,500
16	**Louvers, SS, 36x36**	2	ea	$ 400	$ 800
			Total for headbox		$ 678,578
	Piping from headbox to S/F raceways				
17	**36" diam, HDPE, Reservoir water**	660	lf	$ 155	$ 102,300
18	**30" diam, HDPE, Well water**	660	lf	$ 135	$ 89,100
19	**36" various fittings**	1	ls	$ 25,000	$ 25,000
20	**30" various fittings**	1	ls	$ 20,000	$ 20,000
21	**24" flow meter**	2	ea	$ 2,500	$ 5,000
22	**30" flow meter**	2	ea	$ 3,000	$ 6,000
23	**24"x24" sluice gate at raceways**	4	ea	$ 10,000	$ 40,000
24	**30"x30" sluice gate at raceways**	4	ea	$ 12,000	$ 48,000
			Total to raceways		$ 335,400
	500cfs Pumped Fish Ladder Attraction Water				
	Vert turb pumps within screened 50wx40dx30h				
	structure beside entrance to fish ladder				
25	**Concrete slabs, 12"**	120	cy	$ 350	$ 42,000
26	**Concrete walls, 12"**	288	cy	$ 500	$ 144,000
27	**(100cfs)45,000gpm/10'TDH, 150hp, 430rpm pump**	5	ea	$ 25,000	$ 125,000
	Hydro-foil pump 48PL				
28	**Inlet screen structure (1" ss rods @ 1.5" c-c)**	18200	lb	$ 10	$ 182,000
29	**Sheet pile around excavation, drive & extract**	13000	sf	$ 12	$ 156,000
30	**Excavation, 1cy clam shell, haul 1/2 mi**	4000	cy	$ 10	$ 40,000
31	**Backfill and use for access road fill**	4000	cy	$ 10	$ 40,000
32	**Rock armor replacement**	1	ls	$ 20,000	$ 20,000
33	**Access road to structure**	1	ls	$ 10,000	$ 10,000
34	**Electrical Panels and misc**	1	ls	$ 20,000	$ 20,000
35	**Gratings, fiberglass**	1700	sf	$ 7	$ 11,900
36	**Structural steel**	8000	lb	$ 10	$ 80,000
			Total for attraction water		$ 870,900
	Early S/F Chinook Raceways (bank of 20 units)				
37	**Concrete slabs, 6"**	384	cy	$ 350	$ 134,400
38	**Concrete walls, 9"**	414	cy	$ 400	$ 165,600
39	**Sluice gates, 36"x18", inlet, topping**	20	ea	$ 3,000	$ 60,000
40	**Stop logs, 3"x 6'x4'**	1440	bf	$ 3	$ 4,320
41	**Flow distribution plate, SS, 1/4"**	633	sf	$ 10	$ 6,330
42	**Sreens, SS, 4 per raceway, var sizes, 50% redun.**	5400	sf	$ 10	$ 54,000
43	**Grating, fiberglass, supply & drain channels**	1600	sf	$ 7	$ 11,200
44	**Grating, fiberglass, center walls**	1680	sf	$ 10	$ 16,800
45	**Feeders, demand, 2 per raceway**	40	ea	$ 1,200	$ 48,000
46	**Misc. metals, braces, hangers, channels**	1	ls	$ 17,000	$ 17,000
47	**6" Raceway vacuum cleaning drain to connection w/ 6" from Late S/F**	375	lf	$ 45	$ 16,875
			Total for Early S/F raceway bank		$ 534,525

	Late S/F Chinook Raceways (bank of 24 units)				
48	**Concrete slabs, 6"**	461	cy	$ 350	$ 161,350
49	**Concrete walls, 9"**	496	cy	$ 400	$ 198,400
50	**Sluice gates, 36"x18", inlet, topping**	24	ea	$ 3,000	$ 72,000
51	**Stop logs, 3"x 6'x4'**	1728	bf	$ 3	$ 5,184
52	**Flow distribution plate, SS, 1/4"**	760	sf	$ 10	$ 7,600
53	**Sreens, SS, 4 per raceway, var sizes, 50% redun.**	6480	sf	$ 10	$ 64,800
54	**Grating, fiberglass, supply & drain channels**	1920	sf	$ 7	$ 13,440
55	**Grating, fiberglass, center walls**	2020	sf	$ 10	$ 20,200
56	**Feeders, demand, 2 per raceway**	48	ea	$ 1,200	$ 57,600
57	**Misc. metals, braces, hangers, channels**	1	ls	$ 17,000	$ 17,000
58	**6" Raceway vacuum cleaning drain to aeration/settling facility**	480	lf	$ 45	$ 21,600
			Total for Late S/F raceway bank		$ 639,174
	Spawn House				
59	**Building Area, Concrete lower walls w/ upper metal, roof at 6:12 slope**	1224	sf	$ 60	$ 73,440
60	**Pumps for sorting tubes water supply**	1	ea	$ 1,000	$ 1,000
61	**Valves for fish sorting tubes**	1	ls	$ 2,000	$ 2,000
62	**Mechanical, plumbing/air compressor**	1	ls	$ 2,000	$ 2,000
63	**Electrical- pump controls/lighting/power**	1	ls	$ 4,000	$ 4,000
64	**Misc. equipment for anesthetic treatment**	1	ls	$ 4,000	$ 4,000
			Total for spawn house		$ 86,440
	Fish ladder and holding/sorting tanks				
65	**Excavation w/1.5 cy hoe and haul 1 mile**	500	cy	$ 8	$ 4,000
66	**Slab on grade and footings**	134	cy	$ 300	$ 40,200
67	**Exterior walls, 9"**	460	cy	$ 400	$ 184,000
68	**Weir walls, 9"**	33	cy	$ 500	$ 16,500
69	**Backfill and compaction**	2150	cy	$ 15	$ 32,250
70	**Grating cover**	1800	sf	$ 10	$ 18,000
71	**Vehicle fish ladder crossing cover**	36	ea	$ 600	$ 21,600
			Total for ladder and holding/sorting		$ 316,550
	Start tank building for S/F Chinook				
72	**Footings, 12"**	50	ls	$ 300	$ 15,000
73	**Slabs, 9"**	360	ls	$ 350	$ 126,000
74	**Exterior walls, 9"**	200	ls	$ 400	$ 80,000
75	**Ceiling/2nd floor beam/truss system**	12000	sf	$ 15	$ 180,000
76	**Stairs, metal, 25 risers**	25	risers	$ 225	$ 5,625
77	**Roof system**	12640	sf	$ 10	$ 126,400
78	**Piping, four systems for supply, throughout building**	2	systems	$ 75,000	$ 150,000
79	**Piping, drain and fish transfer to raceways**	1	ls	$ 20,000	$ 20,000
80	**Lighting and power**	1	ls	$ 20,000	$ 20,000
81	**Start tanks, alum. 4X40X3deep**	40	ea	$ 4,000	$ 160,000
82	**6" start tank vacuum drain to 6" line from Early S/F raceways**	600	lf	$ 45	$ 27,000
83	**36" drain pipe, HDPE, to Early S/F 48" raceway drain**	300	lf	$ 155	$ 46,500
			Total for S/F Chinook start tank building		$ 956,525
	Support building: includes start tank store room, bio lab, incubation rooms,crew restrooms, crew room, water treatment room, larger food storage area, start tank feed storage room, garage and and shop spaces. Total foot print area of 18,500sf				
84	**Footings, 12"**	140	ls	$ 300	$ 42,000
85	**Slab, 6"**	370	ls	$ 350	$ 129,500
86	**High interior walls, 9"**	340	cy	$ 400	$ 136,000
87	**Low interior walls and exterior walls, 9"**	340	cy	$ 400	$ 136,000
88	**Ceiling/2nd floor beam/truss system**	7000	sf	$ 15	$ 105,000
89	**Roof System**	21000	sf	$ 10	$ 210,000
90	**Mechanical, air handling/plumbing/hydro tank**	1	ls	$ 20,000	$ 20,000
91	**Mechanical, fire sprinklers and pump, specials**	1	ls	$ 100,000	$ 100,000
92	**Shop work bench, welding vent., other specials**	1	ls	$ 30,000	$ 30,000
93	**Pressure filter system**	1	ls	$ 90,000	$ 90,000
94	**200 ton water chilling (for incubation water)**	1	ls	$ 100,000	$ 100,000
95	**Building heat system**	1	ls	$ 100,000	$ 100,000
96	**Diesel fuel storage**	1	ls	$ 30,000	$ 30,000
97	**UV System**	1	ls	$ 60,000	$ 60,000
98	**Incubation, full heath stacks, w/head trough and piping**	36	ea	$ 4,000	$ 144,000
99	**Electrical, MCCs and other load center panels**	1	ls	$ 500,000	$ 500,000
100	**Power and lighting, general building**	1	ls	$ 50,000	$ 50,000
101	**Roll-up doors 14'x14'**	4	ea	$ 3,200	$ 12,800
102	**Loading dock, adjustable, bumpers**	1	ea	$ 8,000	$ 8,000
			Total for support building		$ 2,003,300
	Aeration/settling structure				
103	**Slabs, 6"**	130	cy	$ 350	$ 45,500
104	**Walls, 9"**	95	cy	$ 400	$ 38,000
105	**Ramp, 8"**	16	cy	$ 350	$ 5,600
106	**Access gates, double**	2	ea	$ 1,000	$ 2,000
107	**Aerator and electrical controls**	2	ea	$ 5,000	$ 10,000
			Total for aeration/settling structure		$ 101,100

	Detention Pond				
108	**Excavation, 11cy scraper, haul 5000 ft**	10370	cy	$ 4	$ 41,480
109	**Dozer spread, no compaction**	10370	cy	$ 2	$ 20,740
110	**Liner, 60 mil HDPE**	5150	sy	$ 12	$ 61,800
111	**Fill over liner, 1ft deep, suitable for wet-land plantings, dozer**	46	msf	$ 800	$ 37,080
112	**Outlet control structure**	1	ls	$ 3,000	$ 3,000
113	**Overflow piping, 18" HDPE**	250	lf	$ 90	$ 22,500
114	**Fencing, rustic, 3 rail ceder, blend into wetland plantings**	1000	lf	$ 15	$ 15,000
115	**Wetland style plantings**	1	ls	$ 10,000	$ 10,000
			Total for detention pond		$ 211,600
	Hatchery office and small visitor display building				
116	**Structure, single level**	2000	sf	$ 100	$ 200,000
			Total for Office/Visitor area		$ 200,000
	Site work				
117	**Field testing, allowance**	1	ls	$ 100,000	$ 100,000
118	**Temporary power, sani cans, water delivery**	1	ls	$ 50,000	$ 50,000
119	**Temporary site fencing, silt fence and dust control**	1	ls	$ 20,000	$ 20,000
120	**Topsoil stripping, 300hp dozer**	3500	cy	$ 0.65	$ 2,275
121	**Grading, for pavement and gravel areas**	18000	sy	$ 1	$ 18,000
122	**Excavation, all facilities except fishway, ladder and attraction water ps**	1	ls	$ 100,000	$ 100,000
123	**Backfill and compaction, various**	1	ls	$ 100,000	$ 100,000
124	**Retaining wall along Half-Sun Road, est 500lf**	1	ls	$ 50,000	$ 50,000
125	**Pavement, 6" base & 4" top**	10000	sy	$ 13	$ 130,000
126	**Storm drainage system**	1	ls	$ 20,000	$ 20,000
127	**Site lighting**	1	ls	$ 30,000	$ 30,000
128	**Fencing, security, 6ft, 9ga aluminized steel**	3500	lf	$ 30	$ 105,000
129	**Gates, double swing, 20' open**	4	ea	$ 2,000	$ 8,000
	Site piping, various as shown				
130	**8" smolt transfer pipe, portable, Start tanks to Raceways**	500	lf	$ 35	$ 17,500
131	**8" smolt transfer pipe, buried, Raceways to smolt transfer area**	600	lf	$ 45	$ 27,000
132	**36" start tank room drain to raceway drain**	300	lf	$ 155	$ 46,500
133	**48" raceway drain to detention pond**	750	lf	$ 180	$ 135,000
134	**30" detention pond drain/overflow**	250	lf	$ 135	$ 33,750
135	**48" detention pond drain toward fish ladder**	1290	lf	$ 180	$ 232,200
136	**36" continuation to adult holding area**	470	lf	$ 155	$ 72,850
137	**30" within adult holding/spawning area**	450	lf	$ 135	$ 60,750
138	**30" butterfly valves on piping into adult holding facilities**	6	ea	$ 8,000	$ 48,000
139	**8" raceway vacuum cleaning drains to aeration/settling facility**	900	lf	$ 55	$ 49,500
140	**12" aeration/settling facility drain**	180	lf	$ 70	$ 12,600
141	**8" butterfly valve on raceway cleaning drain**	2	ea	$ 700	$ 1,400
142	**12" butterfly valve on aeration drain**	2	ea	$ 1,200	$ 2,400
143	**Main site power w/ stand-by generator**	1	ls	$ 100,000	$ 100,000
144	**Site communications for instrumentation/alarms**	1	ls	$ 50,000	$ 50,000
145	**Sewage process system, 10,000 gpd**	1	ls	$ 150,000	$ 150,000
146	**Landscaping**	1	ls	$ 20,000	$ 20,000
147	**Trail relocate**	1	ls	$ 15,000	$ 15,000
			Total for site items		$ 1,807,725
	CJD Hatchery Housing Complex - 3 residences and 3 trailer shelters w/utils				
148	**Clear and Grub**	1	ac	$ 4,000	$ 4,000
149	**Soil Excavation - Excavate, Haul, Dispose**	100	cy	$ 18	$ 1,800
150	**Select Fill - Load, Haul, Spread, Compact**	100	cy	$ 61	$ 6,100
151	**Grading - Fine**	500	sy	$ 4	$ 2,000
152	**Roadway Improvements - Gravel Road**	450	sy	$ 20	$ 9,000
153	**Driveways - Gravel**	500	sy	$ 20	$ 10,000
154	**2000 Square Foot House with 2- car Garage**	3	ea	$ 100,000	$ 300,000
155	**Sheltered trailer site with utility hookups**	3	ea	$ 10,000	$ 30,000
156	**Well - 6 inch diameter, 400 feet deep**	1	ea	$ 12,000	$ 12,000
157	**Well Pump - 5 HP**	1	ea	$ 2,500	$ 2,500
158	**Group B Water System Approval**	1	ea	$ 5,000	$ 5,000
159	**Pipe - Water supply to residences, 1 inch PVC**	1000	lf	$ 12	$ 12,000
160	**On site Septic System - 3 Bedroom house**	3	ea	$ 5,000	$ 15,000
161	**On site Septic System - Serves 3 - 3 person trailer sites**	1	ea	$ 5,000	$ 5,000
162	**On site Septic System Design and Approval**	4	ea	$ 2,000	$ 8,000
163	**Telephone**	1	ea	$ 1,700	$ 1,700
164	**Power**	1	ls	$ 10,000	$ 10,000
			Total for Hatchery Housing Complex items		$ 434,100
165	**Subtotal Raw Costs Hatchery Site with 15% O& 15% P**				$ 9,236,267
166	**Mobilization/demobilization**				$ 270,000
167	**Sales Tax @ 9%**				$ 831,264
168	**Contingency @ 30%**				$ 2,770,880
	Total Estimated Cost for Summer/Fall Chinook Programs At CJDH site without COE supplied rearing water				$ 13,108,411
169	**Well and reservoir water will be supplied to the hatchery site per COE. Cost shown is for Relief Tunnel Revisions, Intake Diversion Revisions, Pipeline(s) from dam to hatchery and includes contractor mark-ups for Mob & Demob, site and home office bonds and insurance, B&O tax, and State sales tax.**				$ 3,111,950
	Total Estimated Cost for Summer/Fall Chinook Programs At CJDH site *with* COE supplied rearing water				**$ 16,220,361**

Acclimation ponds for Summer/Fall Programs

	Riverside Pond - New 53,000 cubic feet acclimation pond				
170	**Clear and Grub**	1	ac	$ 4,000	$ 4,000
171	**Dewater**	1	ls	$ 3,000	$ 3,000
172	**Erosion Control - Silt Fence**	250	lf	$ 1	$ 250
173	**Soil Excavation - Excavate, Haul, Dispose**	1500	cy	$ 18	$ 27,000
174	**Rock Excavation - Excavate, Haul, Dispose**	150	cy	$ 27	$ 4,050
175	**Select Fill - Load, Haul, Spread, Compact**	300	cy	$ 61	$ 18,300
176	**Grading - Fine**	1500	sy	$ 4	$ 6,000
177	**Roadway Improvements - Gravel Road**	2000	sy	$ 20	$ 40,000
178	**Rail Road Crossing**	1	ls	$ 3,000	$ 3,000
179	**Pond Liner - 60 mil HDPE**	1800	sy	$ 10	$ 18,000
180	**Pond Liner - Attachment to Concrete**	100	lf	$ 50	$ 5,000
181	**Fencing - Chain Link**	1200	lf	$ 15	$ 18,000
182	**Fencing - Gate**	2	ea	$ 1,100	$ 2,200
183	**Fencing - Overhead Netting with supports**	25000	sf	$ 4	$ 100,000
184	**Pipe - Outflow, 18" HDPE**	300	lf	$ 50	$ 15,000
185	**Pipe Fittings - Outflow, 18" HDPE**	4	ea	$ 450	$ 1,800
186	**Pipe - Supply, 18" PVC**	200	lf	$ 60	$ 12,000
187	**Pipe Fittings - Supply, 18" PVC**	4	ea	$ 650	$ 2,600
188	**Pipe - Supply Header, 12" SCH 10 SST**	1	ea	$ 1,600	$ 1,600
189	**Valves - Supply, 12" Butterfly**	1	ea	$ 1,250	$ 1,250
190	**Outfall - In River with Erosion Protection**	1	ea	$ 2,500	$ 2,500
191	**Outlet Structure - Concrete**	25	cy	$ 600	$ 15,000
192	**Outlet Structure - Screens, 5 FT Wide**	2	ea	$ 1,150	$ 2,300
193	**Outlet Structure - Stop Logs, 5 FT Wide**	2	ea	$ 1,150	$ 2,300
194	**Outlet Structure - Slide Gate Valve**	1	ea	$ 3,550	$ 3,550
195	**Supply Pump Station - Concrete**	25	cy	$ 600	$ 15,000
196	**Supply Pump Station - Dual pumps, pipes, valves**	1	ea	$ 21,000	$ 21,000
197	**Supply Pump Station - River inlet and screen**	1	ea	$ 3,700	$ 3,700
198	**Power**	1	ls	$ 12,500	$ 12,500
199	**Controls, Instrumentation, Telemetry**	1	ls	$ 4,500	$ 4,500
		Total for Riverside Pond items			$ 365,400
	Omak Pond - New 53,000 cubic feet acclimation pond				
200	**Clear and Grub**	1	ac	$ 4,000	$ 4,000
201	**Dewater**	1	ls	$ 3,000	$ 3,000
202	**Erosion Control - Silt Fence**	250	lf	$ 1	$ 250
203	**Demolition - Buildings, Conc, Asphalt**	1	ls	$ 3,000.00	$ 3,000
204	**Soil Excavation - Excavate, Haul, Dispose**	1700	cy	$ 18	$ 30,600
205	**Rock Excavation - Excavate, Haul, Dispose**	200	cy	$ 27	$ 5,400
206	**Select Fill - Load, Haul, Spread, Compact**	375	cy	$ 61	$ 22,875
207	**Grading - Fine**	1500	sy	$ 4	$ 6,000
208	**Roadway Improvements - Gravel Road**	600	sy	$ 20	$ 12,000
209	**Utility Relocations**	1	ea	$ 1,000	$ 1,000
210	**Pond Liner - 60 mil HDPE**	2200	sy	$ 10	$ 22,000
211	**Pond Liner - Attachment to Concrete**	100	lf	$ 50	$ 5,000
212	**Fencing - Chain Link**	1200	lf	$ 15	$ 18,000
213	**Fencing - Gate**	2	ea	$ 1,100	$ 2,200
214	**Fencing - Overhead Netting with supports**	25000	sf	$ 4	$ 100,000
215	**Pipe - Outflow, 24" HDPE**	300	lf	$ 60	$ 18,000
216	**Pipe Fittings - Outflow, 24" HDPE**	4	ea	$ 550	$ 2,200
217	**Pipe - Supply, 18" PVC**	200	lf	$ 60	$ 12,000
218	**Pipe Fittings - Supply, 18" PVC**	4	ea	$ 550	$ 2,200
219	**Pipe - Supply Header, 18" SCH 10 SST**	1	ea	$ 2,000	$ 2,000
220	**Valves - Supply, 18" Butterfly**	1	ea	$ 1,550	$ 1,550
221	**Outfall - In River with Erosion Protection**	1	ea	$ 2,500	$ 2,500
222	**Outlet Structure - Concrete**	25	cy	$ 600	$ 15,000
223	**Outlet Structure - Screens, 5 FT Wide**	2	ea	$ 1,150	$ 2,300
224	**Outlet Structure - Stop Logs, 5 FT Wide**	2	ea	$ 1,150	$ 2,300
225	**Outlet Structure - Slide Gate Valve**	1	ea	$ 3,550	$ 3,550
226	**Supply Pump Station - Concrete**	25	cy	$ 600	$ 15,000
227	**Supply Pump Station - Dual pumps, pipes, valves**	1	ea	$ 21,000	$ 21,000
228	**Supply Pump Station - River inlet and screen**	1	ea	$ 3,700	$ 3,700
229	**Power**	1	ls	$ 6,000	$ 6,000
230	**Controls, Instrumentation, Telemetry**	1	ls	$ 4,500	$ 4,500
		Total for Omak Pond items			$ 349,125

	Bonaparte Pond - Modify an existing 65,300 cubic feet acclimation pond				
231	**Soil Excavation - Excavate, Haul, Dispose**	100	cy	$ 18	$ 1,800
232	**Select Fill - Load, Haul, Spread, Compact**	50	cy	$ 61	$ 3,050
233	**Grading - Fine**	100	sy	$ 4	$ 400
234	**Pond Liner - 60 mil HDPE**	100	sy	$ 10	$ 1,000
235	**Pond Liner - Attachment to Concrete**	100	lf	$ 50	$ 5,000
236	**Pipe - Outflow, 24" HDPE**	300	lf	$ 60	$ 18,000
237	**Pipe Fittings - Outflow, 24" HDPE**	4	ea	$ 550	$ 2,200
238	**Outlet Structure - Concrete**	25	cy	$ 600	$ 15,000
239	**Outlet Structure - Screens, 5 FT Wide**	2	ea	$ 1,150	$ 2,300
240	**Outlet Structure - Stop Logs, 5 FT Wide**	2	ea	$ 1,150	$ 2,300
241	**Outlet Structure - Slide Gate Valve**	1	ea	$ 3,550	$ 3,550
242	**Instrumentation & Telemetry - Water level alarm**	1	ls	$ 2,700	$ 2,700
		Total for Bonaparte Pond items			$ 57,300
243	**Subtotal Acclimation ponds with 15% O& 15% P**				$ 771,825
244	**Mobilization/demobilization**				$ 77,183
245	**Sales Tax @ 9%**				$ 69,464
246	**Contingency @ 30%**				$ 231,548
	Total, summer/fall chinook acclimation ponds				**$ 1,150,019**

TOTAL for Summer/Fall Chinook Programs with COE supplied water systems **$ 17,370,380**

Additional Cost for Spring programs at CJDH site

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	COST
	Develop well water supply from park 2.5 miles upstream. See note 3 below				
247	Wells to supply 2.5cfs ea.	10	ls	$ 70,000	$ 700,000
248	30" collection and main piping to hatchery	13200	lf	$ 135	$ 1,782,000
			Total for additional wells		$ 2,482,000
	Piping from S/F raceways to Spring raceways				
249	30" diam, HDPE	400	lf	$ 135	$ 54,000
250	24" diam, HDPE	400	lf	$ 115	$ 46,000
251	48" diam, HDPE	20	lf	$ 180	$ 3,600
252	30" various fittings	1	ls	$ 15,000	$ 15,000
253	24" various fittings	1	ls	$ 10,000	$ 10,000
254	48" various fittings	1	ls	$ 5,000	$ 5,000
255	30" flow meter	1	ea	$ 3,000	$ 3,000
256	24" flow meter	1	ea	$ 2,500	$ 2,500
257	24"x24" sluice gate at raceways	2	ea	$ 10,000	$ 20,000
258	30"x30" sluice gate at raceways	2	ea	$ 12,000	$ 24,000
			Total to raceways		$ 183,100
	Spring Chinook Raceways (bank of 28 units)				
259	Concrete slabs, 6"	323	cy	$ 350	$ 113,050
260	Concrete walls, 9"	521	cy	$ 400	$ 208,400
261	Sluice gates, 36"x18", inlet, topping	28	ea	$ 3,000	$ 84,000
262	Stop logs, 3"x 6'x4'	2420	bf	$ 3	$ 7,260
263	Flow distribution plate, SS, 1/4"	1064	sf	$ 10	$ 10,640
264	Sreens, SS, 4 per raceway, var sizes, 50% redun.	9072	sf	$ 10	$ 90,720
265	Grating, fiberglass, supply & drain channels	2688	sf	$ 7	$ 18,816
266	Grating, fiberglass, center walls	2828	sf	$ 10	$ 28,280
267	Feeders, demand, 2 per raceway	56	ea	$ 1,200	$ 67,200
268	Misc. metals, braces, hangers, channels	1	ls	$ 23,000	$ 23,000
269	6" raceway vacuum cleaning drains to aeration/settling facility	300	lf	$ 45	$ 13,500
			Total for Spring Chinook raceway bank		$ 664,866
	Start tank building & incubation area for Spring Chinook				
270	Footings	20	ls	$ 300	$ 6,000
271	Slabs	204	ls	$ 350	$ 71,400
272	Exterior walls	61	ls	$ 400	$ 24,400
273	Ceiling/2nd floor beam/truss system	6000	sf	$ 15	$ 90,000
274	Roof system	6360	sf	$ 10	$ 63,600
275	Piping, extend two water supply systems	2	systems	$ 37,000	$ 74,000
276	Piping, drain and fish transfer to raceways	1	ls	$ 10,000	$ 10,000
277	Lighting and power	1	ls	$ 5,000	$ 5,000
278	Increase of chiller size to handle increased incubator flow	1	ls	$ 40,000	$ 40,000
279	Heath Incubators	16	stacks	$ 4,000	$ 64,000
280	Start tanks, alum. 4X40X3deep	20	ea	$ 4,000	$ 80,000
281	6" Start tank vacuum cleaning pipe to S/F raceways	110	ls	$ 45	$ 4,950
			Total for Spring Chinook start tank building		$ 533,350
282	Subtotal Raw Costs with 15% O& 15% P				$ 3,863,316
283	Mobilization/demobilization				$ 30,000
284	Sales Tax @ 9%				$ 347,698
285	Contingency @ 30%				$ 1,158,995
	Additional Cost at CJDH for Spring Chinook Programs				**$ 5,400,009**

Acclimation ponds for Spring Programs

	Saint Mary's Mission Pond - Modify an existing acclimation pond				
286	Dewater	1	ls	$ 3,000	$ 3,000
287	Demolition - Remove pond grating and supports	1	ls	$ 1,000.00	$ 1,000
288	Grading - Fine	100	sy	$ 4	$ 400
289	Fencing - Chain Link	300	lf	$ 15	$ 4,500
290	Fencing - Gate	2	ea	$ 1,100	$ 2,200
291	Fencing - Overhead Netting with supports	4000	sf	$ 4	$ 16,000
292	Channels - Concrete	25	cy	$ 600	$ 15,000
293	Channel - Tail and Head Screens	2	ea	$ 1,150	$ 2,300
294	River Intake - Concrete Wing Wall	10	cy	$ 600	$ 6,000
295	Power - Backup system for Well	1	ls	$ 3,700	$ 3,700
296	Instrumentation & Telemetry - Water level alarm	1	ls	$ 2,700	$ 2,700
			Total for St. Mary's Mission Pond items		$ 56,800

	Ellisforde Pond - Modifications to an existing 121,500 cubic feet acclimation pond				
297	**Soil Excavation - Excavate, Haul, Dispose**	100	cy	$ 18	$ 1,800
298	**Select Fill - Load, Haul, Spread, Compact**	50	cy	$ 61	$ 3,050
299	**Grading - Fine**	100	sy	$ 4	$ 400
300	**Pond Liner - 60 mil HDPE**	100	sy	$ 10	$ 1,000
301	**Pond Liner - Attachment to Concrete**	100	lf	$ 50	$ 5,000
302	**Pipe - Outflow, 24" HDPE**	300	lf	$ 60	$ 18,000
303	**Pipe Fittings - Outflow, 24" HDPE**	4	ea	$ 550	$ 2,200
304	**Outlet Structure - Concrete**	25	cy	$ 600	$ 15,000
305	**Outlet Structure - Screens, 5 FT Wide**	2	ea	$ 1,150	$ 2,300
306	**Outlet Structure - Stop Logs, 5 FT Wide**	2	ea	$ 1,150	$ 2,300
307	**Outlet Structure - Slide Gate Valve**	1	ea	$ 3,550	$ 3,550
308	**Instrumentation & Telemetry - Water level alarm**	1	ls	$ 2,700	$ 2,700
		Total for Ellisforde Pond items			$ 57,300
	Total, spring chinook acclimation ponds				$ 114,100
309	**Subtotal Spring Acclimation Pond Costs with 15% O& 15% P**				$ 114,100
310	**Mobilization/demobilization**				$ 11,410
311	**Sales Tax @ 9%**				$ 10,269
312	**Contingency @ 30%**				$ 34,230
	Additional Cost for Ponds for Spring Chinook Programs				**$ 170,009**

TOTAL for all facilities for the Spring Chinook Programs **$ 5,570,018**

Summary

313	**Total Estimated Cost for Summer/Fall Chinook Programs at CJDH with COE supplied rearing water**	$ 16,220,361
314	**Total, summer/fall chinook acclimation ponds**	$ 1,150,019
	TOTAL for all Summer/fall chinook programs	**$ 17,370,380**
315	**Additional Cost at CJDH for Spring Chinook Programs**	$ 5,400,009
316	**Additional Cost for Spring Chinook acclimation ponds**	$ 170,009
	TOTAL for all Spring chinook program facilities	**$ 5,570,018**

TOTAL for All Chinook Programs with COE supplied water systems **$ 22,940,399**

NOTES:

1. **Site piping cost portion attributed to increased pipe sizes due to Spring Chinook program is about $150,000.**
2. **An item not included in the above cost estimate is an Electric fish directing fence.**
3. **Well water supply concept based upon information from COE about availability of water in upstream park.**