UMATILLA HATCHERY FINAL PREDESIGN REPORT

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Project No. 84-33
Contract No. DE-AI79-86BP62251

April 1988

UMATILLA FISH HATCHERY

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SECTION 1 - INTRODUCTION

1.01 SCOPE

This report provides information on the preliminary design of Umatilla Fish Hatchery near Irrigon, Oregon, by the U.S. Army Corps of Engineers, Walla Walla District (see Figure 1 - Map).

1.02 DESCRIPTION OF HATCHERY

The fish hatchery will be capable of rearing steelhead and chinook with an initial capacity of 290,000 pounds. Future expansion will allow for a total capacity of 500,000 pounds if the initial production goals are met. The hatchery will consist of both Oregon and Michigan style ponds. The Oregon ponds are similar to those at Irrigon. The Michigan ponds are more narrow and shallow, are self cleaning, and use oxygen supplementation to obtain higher rearing densities as is currently being done in the state of Michigan. The Oregon ponds are a two-pass system with the capability to convert to Michigan style ponds, if this mode of operation proves to be an effective method in the west. The Michigan ponds are three-pass with the capability to expand to four-pass. The general description of the hatchery is as follows (also see Figure 2 - Site Plan):

a. Water Supply System

The water supply to the hatchery will consist of one collector well, with pump station, and the main transmission line, which will carry water from the pump station to the aeration/head structure at the head of the hatchery water supply piping.

b. Aeration/Head Structure

The aeration/head structure will provide for gravity flow of all incoming water through packed columns to raise oxygen and lower nitrogen content. The aeration equipment will be on top of the head structure. The hatchery supply will be obtained from a portion of the structure that is higher than the main supply because of the hatchery building's head requirement.

c. Rearing Ponds

There are LO Oregon style ponds arranged in 2 batteries of 3 and 2 batteries of 2. The Michigan ponds are arranged in six batteries of four. Michigan pond design is approximately 114 feet long by 9 feet wide by 4 feet deep. The Oregon ponds are twice as wide and a foot deeper than the Michigan ponds. The capability to convert to a Michigan style pond is obtained by the addition of a wall down the middle, baffles, pumps, and oxygen supply. The reason for making the Oregon ponds similar size and shape as the Michigan ponds is to allow for easier construction and conversion, while still allowing them to be operated in the typical Oregon mode. Future expansion will require the addition of two banks of four Michigan style ponds as a fourth pass to the Michigan side, along with the addition of four Michigan style ponds to the Oregon side. Conversion of the Oregon ponds to the Michigan type will also be possible.

d. Buildings

(1) The hatchery will have a main hatchery building, a generator and pump station building, and a mechanical building. The hatchery building will have facilities for egg incubation and early juvenile rearing, fish food storage and preparation, administrative office and crew room, laboratory, visitors area, restrooms for visitors and workmen, storage areas, garage and shop area, and space for mechanical and electrical equipment.

(2) The generator and pump building will house the emergency generator and the water supply pumping equipment.

(3) The mechanical building will house the oxygen equipment, domestic well pump and tank, fire pump, and emergency generator for the hatchery building.

e. Pollution Abatement System

A pollution abatement system will be provided for permit compliance and will consist of an asphalt-lined and paved settling basin to service the rearing ponds during pond cleaning. The settling basin has been located to provide for gravity conveyance of cleaning wastewater and will discharge directly to the Columbia River. A sludge tank will be used to collect cleaning wastes from the Michigan type ponds. Overflow from this tank will discharge into the

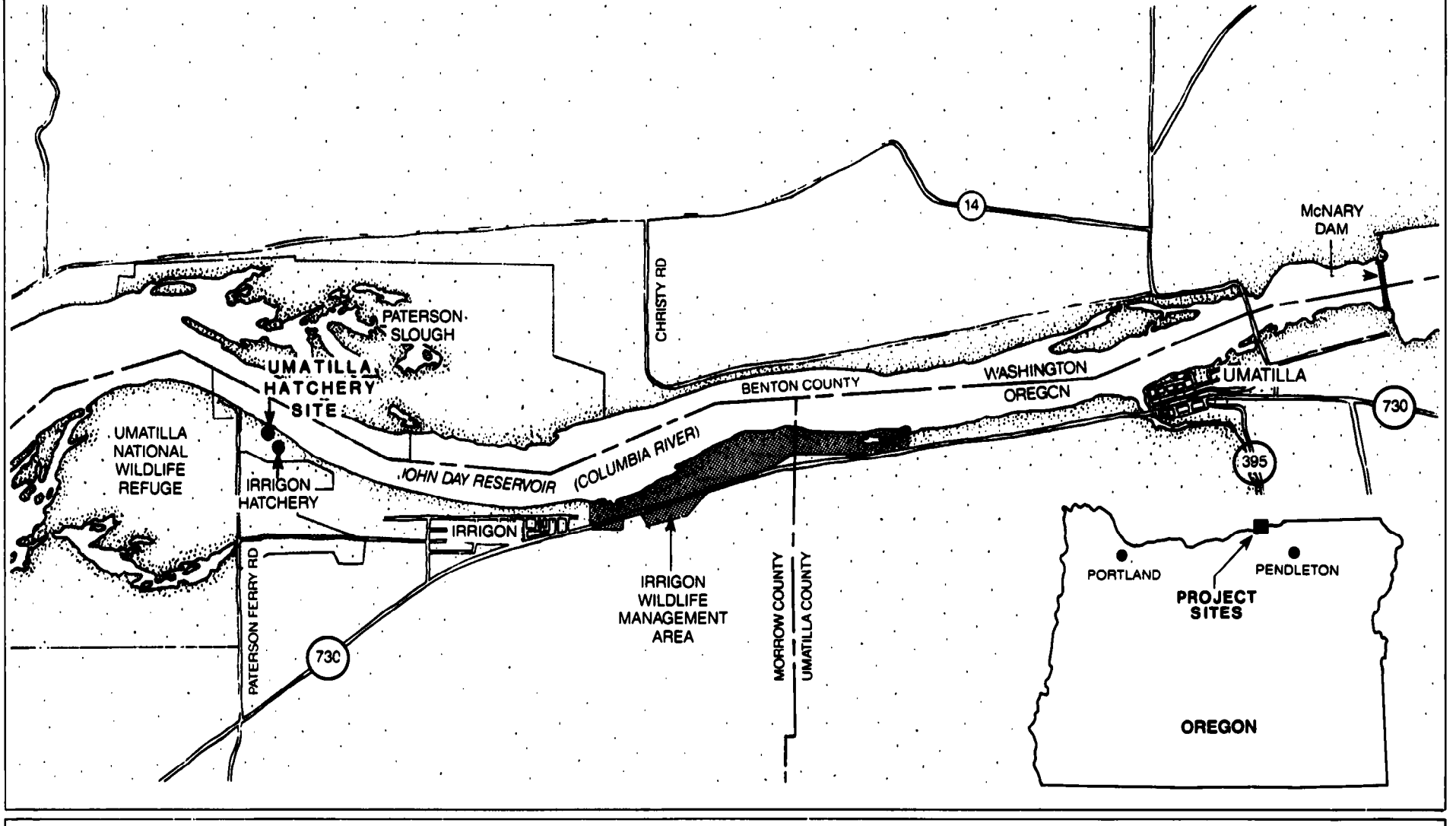
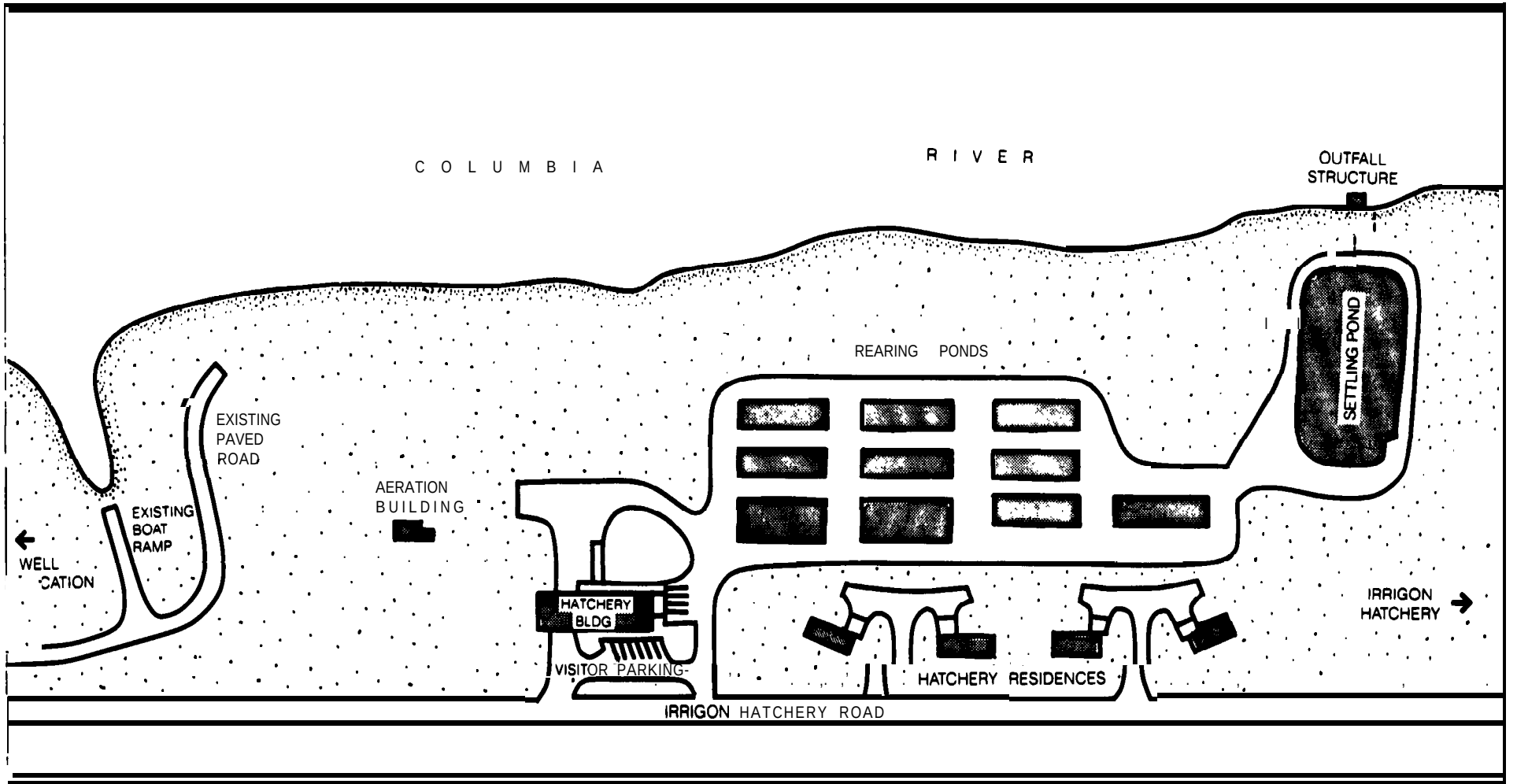


Figure 1
Location of BPA Umatilla
Fish Hatchery, near Irrigon, Oregon



SCALE IN FEET

50 0 50

Figure 2

UMATILLA HATCHERY
Site Plan

sedimentation pond. Part of the sludge tank will consist of a lift station that will pump the cleaning waste because the slope of the waste line will not permit gravity flow through the tank and into the sedimentation pond.

f. Hatchery Outfall

Concrete outfall structures will be provided to discharge hatchery outflows in the Columbia River and prevent fish in the river from entering hatchery piping.

g. Water Supply and Drainage System

The water supply and drainage system will consist of a gravity supply pipeline, distribution piping, and individual and main drain lines.

h. Dwellings

Four 3-bedroom dwellings will be provided for hatchery personnel and families. The dwellings will be single-story, wood-frame buildings without basements.

i. Utilities

Electric power and telephone service will be provided by local utilities. Domestic and fire water and domestic sewage disposal will be provided for on the site.

j. Entrance Road

Entrance to the hatchery will be provided from the Irrigon Hatchery west access road.

SECTION 2 - WATER SUPPLY

2.01 GENERAL

The availability of groundwater at the Paterson Ferry Road site was evaluated and alternatives were investigated for the water system which would best accommodate the future production goal of 500,000 pounds of fish. The selected water supply collector system will be located in a stratum which has been proven to be an excellent water producer and will be constructed far enough from the Irrigon Hatchery collectors so that the influence on the static water level will be minimal. Test well data indicates the selected source will produce the required amount of water. Test data details are shown in the "Umatilla Steelhead Hatchery Water Supply Study", transmitted to Bonneville Power Administration on March 14, 1986.

2.02 HATCHERY WATER SUPPLY REQUIREMENT

A minimum water supply requirement of approximately 15,000 gpm is needed for fish rearing and ancillary uses at the proposed hatchery complex. The requirement will be met by construction of a collector system similar to that which is currently in use in the Irrigon Hatchery. The collector will be located approximately 2,000 feet west of the hatchery site.

2.03 COLLECTOR FEATURES AND DESIGN

a. The caisson or collector will have an inside diameter of 13 feet and a minimum wall thickness of 18 inches. The caisson will be constructed of reinforced concrete and will be sunk in 11.5-foot successively formed and placed sections to its final depth by excavation of the material from within the caisson. The caisson will sink to the desired depth without any additional force other than its weight, in addition to the weight of each new added section at the surface. After the final depth is reached, a concrete bottom seal will be placed to allow dewatering of the caisson.

b. After dewatering the contractor will construct eight horizontal laterals for water collection. The laterals are perforated pipe which will be hydraulically jacked out into the aquifer from inside the caisson. Each of the eight water-collecting laterals will be 45 degrees from the adjacent lateral. The pro jected laterals will be about 4 feet above the bottom of the caisson and will be installed in 11.5-foot lengths. A total of 1,848 lineal feet of laterals will produce the minimum 15,000 gpm. The removal of fines from the water collection laterals prior to final development will occur by utilization of the differential in hydrostatic pressure between the water in the ground and the atmospheric pressure in the unwatered caisson.

2.04 FINAL DEVELOPMENT

Each horizontal water collecting lateral and surrounding area of the aquifer will be further developed by a device designed to concentrate flow in any restricted zone of the lateral, and thereby permit removal of the fines. Compressed air and/or water will be injected through a sand removal device to agitate and dislodge all sand and fines . This process will be continued until the water is clear.

2.05 PERFORMANCE TEST

After final development, the collector will be pumped at the design rate of 15,000 gpm for a continuous period of 48 hours. The test will determine the quantity and quality of the water available for use in the hatchery complex.

2.06 DOMESTIC WATER

A pump having approximately 150 gpm capability will be installed in a separate well and will adequately serve as the source of the domestic water needs of the hatchery. Treatment of the domestic water, if required, will be accomplished by equipment in the mechanical building.

SECTION 3 - CIVIL DESIGN

3.01 SCOPE

The civil design concerns the site development including: (1) the site plan, (2) sewage disposal, (3) pollution abatement, and (4) earth-work. Factors considered in the design included existing land used, hatchery personnel requirements, traffic flow, and future facilities.

3.02 SITE PLAN

a. The site plan (see Figure 2) was influenced to a great extent by the size and shape of the area, the topography, hydraulics, and operational considerations. The result is a simple, straightforward arrangement of the hatchery building, rearing ponds, settling pond, and residences which essentially parrallel the long axis of the site.

b. Employee and visitor parking and an unloading area for feed delivery trucks will be provided at the hatchery building. Employee parking will be located adjacent to the crew room and offices on the east end of the building. Visitor parking will be on the south side, providing easy access to the visitor center from the West Hatchery Entrance Road. Feed de1 ivery trucks will be directed to the north side of the building, where a loading dock and ample maneuvering space is provided.

c. Access to the downstream ends of the rearing ponds by fish transport trucks was the primary concern in the rearing pond layout. Therefore, a WB-50 design vehicle was used to provide clearances around the ponds for any vehicle that might be used. Also, space for additional rearing ponds has been provided should future expansion be required.

d. The residences are located on the south side of the site to take advantage of the higher topography, which provides an elevated view of the hatchery facilities while minimizing fill requirements. Walkways from the residences will provide easy access to the hatchery building and rearing ponds.

The cul-de-sac style driveway for each pair of residences has been employed to provide access to the residences, which are separated from the hatchery activities, and to provide safe:- access to the West Hatchery Entrance Road.

e. Asphaltic concrete pavement surfacing will be provided in high traffic areas, namely: around the hatchery building and the rearing ponds and on the residence cul-de-sacs. Crushed surfacing will be utilized on the settling pond perimeter road and on the access to the aeration/head building and water supply pump station, where less traffic is expected.

f. Finished grades have been designed to direct surface runoff from the hatchery site to the Columbia River. Drainage under the existing Irrigon west hatchery entrance road, provided by two existing culverts, will be maintained through the site; and, other culverts will be added as required.

3.03 EARTHWORK

a. General

The hatchery area is located on an undeveloped area on the left bank of the Columbia River ar river mile **276.0±.** Foundation material at the site consists of silty sand overlaying gravel, cobbles, and boulders. The depth of silty sand varies from 2 to 6 feet deep. The thickest section of silty sand exists on the upstream end of the hatchery site. Groundwater levels in the area reflect the John Day Reservoir and are at a depth of approximately 8 to 10 feet below the ground surface.

b. Excavation

Excavation required at the site will be in conmmon material, silty sand and gravel. The majority of the excavation will be required for the site adaptation to provide gravity flow conditions for the rearing ponds. Excavation of the fine-grained materials to gravel will be provided under the rearing ponds and water containment concrete structures to curtail uneven settlement.

c. Embankments

Gravel fill will be under the rearing ponds and water containment concrete structures to provide adequate bearing. Other embankment areas will consist of fine-grained and/or gravel materials from required excavation and borrow.

3.04 SEWAGE DISPOSAL

a. Onsite disposal of sewage flows will be by conventional septic tanks and drainfield systems. Each of the residences will be provided with individual septic tanks but will be combined in pairs into a single drain field, with space provided for replacement drainfields should the need arise. A lift station will be required for one pair of residences. The hatchery building will be on a separate septic tank and drainfield system.

3.05 POLLUTION ABATEMENT SYSTEM

a. Pollution abatement will be provided by means of a concrete sludge collection tank, for cleaning waste flows of the Michigan-type rearing ponds, and an asphaltic concrete-lined settling pond, for cleaning waste flows of the Oregon-type rearing ponds.

b. Wastewater, resulting from vacuum cleaning operations in the Michigan-type rearing ponds, will flow by gravity to a lift station and then be pumped into the sludge collection tank. The effluent from the tank then flows by gravity into the settling pond, which acts as a stabilization pond. The effluent from this pond flows into the Columbia River. Two rearing ponds will be cleaned at one time, resulting in 100 gpm of wastewater flow. This quantity of waste flow was used to size the sludge collection tank for gravity settling of fish waste solids, storage of solids for later removal , and a 2-hour detention time when the storage volume is depleted.

c. Wastewater, resulting from cleaning operations in the Oregon-type rearing ponds, will flow by gravity to the settling pond for settling of the fish waste solids. The effluent from the settling pond then flows by gravity to the Columbia River. At the beginning of the cleaning cycle, water depth in a raceway is lowered to 8 inches by removal of stoplogs on the downstream end of the raceway. This flow is diverted to the river along with process water from other rearing ponds. Then a standpipe is removed from the cleaning drainpipe at the downstream end of the raceway to receive cleaning waste flows. Two rearing ponds will be cleaned at one time, resulting in 2,400 gpm of wastewater flow being diverted into the cleaning waste drainpipe and passing to the settling pond for gravity settling of fish waste solids, storage of solids for later removal, and Z-hour detention time when the storage volume is depleted.

d. Removal of sludge from the settling basin can be accomplished when the rearing pond cleaning operation is not required. Therefore, only a single-cell settling basin has been provided. A ramp will be provided to allow access into the pond. Sludge removal can be by portable sludge pump and tank trucks and/or be front-end loader and trucks. Removal of sludge from the sludge tank will be by portable sludge pump with space provided adjacent to the tank for tank trucks.

e. The normal water level for the settling basin will allow for the design inflow of 2,400 gpm at a John Day Dam reservoir elevation of 268 msl or lower. The invert elevation at the downstream end of the settling basin will be at the normal operating reservoir elevation of 265 msl.

SECTION 4- HYDRAULIC DESIGN

4.01 SCOPE

This section presents information on the hydraulic considerations pertinent to piping design of hatchery process water supply and hatchery drainage system for Phase I and Phase II of the proposed hatchery construction.

4.02 GENERAL CRITERIA

a. The Hazen-Williams equation was used in the computation of friction losses for pressure pipes. Conservative values for the Hazen-Williams coefficient (Ch) were used to account for the change in roughness due to the aging and use of the pipes.

b. Manning's equation was used in the design of open channel flow in pipes. Conservative values of "n" were used to account for the change in roughness due to the aging and use of the pipes.

c. Drainage pipes were designed for a minimum of 2.0 feet per second (fps) to prevent sediment deposition in the pipes.

4.03 GRAVITY WATER SUPPLY FROM AERATION/READ TANK

a. The 36-inch-diameter hatchery supply pipe will carry a maximum of 15,000 gallons per minute (gpm) from the aeration/head tank to the rearing ponds by gravity flow. This quantity of flow will satisfy maximum present and future demands for both Phase I and Phase II operation of Michigan and Oregon-type rearing ponds.

b. A 20-inch-diameter hatchery supply pipe. This short 20-inch-diameter pipe exits to a sump pump. Hatchery building process water is pumped up to an aertion tower and then flows by gravity to the hatchery building. This pipe will carry a maximum flow of 900 gpm considering future expansion of incubation trays within the hatchery building.

c. All primary water supply lines will be buried a minimum of 24 inches. This should prevent formation of ice in the pipelines.

4.04 OUTDOOR REARING PONDS

a. Water from the hatchery supply pipe enters manifold pipes to divide the flow into the 13 rearing ponds (eight Michigan-type and five Oregon-type) that will be operated after Phase I construction. Each Michigan rearing pond is designed to carry a flow of 1,000 gpm at a water depth of 2.5 feet. Oregon rearing ponds carry 1,200 gpm at a water depth of 3.5 feet.

b. After Phase II construction, all rearing ponds will be operated as Michigan-type rearing ponds. Each of the 14 rearing ponds, in the first bank, will receive process water at 1000 gpm and operate at a water depth of 2.5 feet.

C. Auxiliary supply piping is provided to the second-pass Oregon rearing ponds. This piping provides process water to these rearing ponds when upstream rearing ponds are drawn down to an 8-inch water depth during the cleaning cycle.

4.05 GRAVITY DRAINAGE SYSTEM

a. Process water exits the rearing ponds by passing over stoplog weirs and entering a manifold pipe system. This process water is routed to the Columbia River. For Phase I operation, flow exits the third bank of the Michigan-type rearing ponds and flow will exit from the fourth bank to the river. The maximum drainage flow is 15,000 gpm. The drain line terminates in an outfall structure.

b. Refer to paragraphs 3.05 a. and b. for a description of the amount of cleaning waste flows and how they are routed through the pollution abatement system.

C. The process water from the hatchery building is routed directly to the river. Cleaning of the rearing troughs will be minimal, since fry will be moved to outdoor rearing ponds as soon as possible. Therefore, cleaning waste flows are not treated before release to the river.

d. The outlet pipe from the settling basin to thr river is sized to carry the maximum pond cleaning water flow of 2,400 gpm. The pipe is 24-inch-diameter concrete pipe and exits at an outfall structure. The flow is carried by gravity, but the pipe flows full when the river water surface elevation is above 270.0 feet msl.

e. An overflow pipe is provided at the aeration/head tank to carry rejected and surge flows to the Columbia River.

SECTION 5 - STRUCTURAL DESIGN

5.01 SCOPE

This section contains design codes, loadings, structural systems, and material properties used in the structural design of the hatchery facilities.

5.02 APPLICABLE DESIGN CODES AND REFERENCES

- Army TM 5-809-1, Load Assumption for Buildings
- Army TM 5-809-2, Concrete-Structural Design for Buildings
- Army TM 5-809-3, Masonry, Structural Design for Buildings
- Army TM 5-809-10, Siesmic Design for Buildings
- Army TM 5-818-1, Procedures for Foundation Design of Buildings and Other Structures
- AISC A58.1 - 1982 (Wind and Snow Loads)
- AC1 318-83, Building Code Requirements for Reinforced Concrete
- AC1 350R-83, Concrete Sanitary Engineering Structures
- Structural Welding Code, AWS Dl.l-84
- Steel Deck Institute, Design Manual for Composite Decks, Form Decks, and Roof Decks
- Steel Joist Institute, standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joists Girders
- Bureau of Reclamation, Moments and Reactions for Rectangular Plates, Engineering Monograph No. 27

5.03 DESIGN CRITERIA AND LOADS

a. Snow (ANSI A58.1 - 1982)

- Ground snow load: 15 psf
- Exposure factor Ce: 1.0 (snow removal by wind cannot be relied on)
- Thermal factor Dt: 1.0 (heated structure)
- Importance factor I: 1.0 (low occupancy)

b. **Wind (ANSI A58.1 - 1982)**

- Base wind velocity: 70 mph
- Importance factor I: 1.0 (low occupancy)
- Exposure category: C (open terrain)

C. Seismic (TM 5-809-10)

- Seismic Zone 2: Z = 0.375
- Low occupancy: I = 1.0
- Box system: K = 1.33
- cs: Maximum valve = 0.14

d. Soil

- Active pressure: 40 pcf equivalent fluid pressure
- At-rest pressure: 50 pcf equivalent fluid pressure
- Surcharge due to AS20 wheel loads: 100 psf
- 2,000 psf allowable bearing pressure

Floor Loads

- Food preparation, thaw, four freezer areas: 300 psf
- Garage, mechanical, incubation, and tank areas: 250 psf
- All other floor areas: 100 psf

5.04 STRUCTURAL SYSTEMS AND CONSIDERATIONS

a. Hatchery and Mechanical Buildings

The hatchery and mechanical buildings utilize a box system consisting of a metal roof deck, open-web joists, concrete masonry unit (CMU) walls, and wall footings. The roof deck transfers vertical loads to open-web joists and serves as a semiflexible diaphragm, collecting horizontal forces from wind and earthquake loadings. Both vertical and horizontal forces are then conveyed through CMU load-bearing shear walls to footings and subsequently to the ground.

b. Pump Station Building

The pump station will be housed in a pre-engineered building.

C. Hydraulic Structures

These structures include the railways, aeration/head structures, sludge tank, outfall structure, and the settling pond outlet structure. The design of these structures is fairly standard in that a l-foot strip of wall is treated as a cantilever resisting lateral loads from earth, surcharge, and hydrostatic pressures. Where the aspect ratio, wall length to width between support, is small, two-way slab action is considered.

A major concern with these structures is water tightness of the concrete. To minimize concrete crack width, thus providing water tightness, allowable stresses on concrete and reinforcement are reduced as outlined in ACI 350R-83, Concrete Sanitary Engineering Structures.

5.05 MATERIAL PROPERTIES

- Aluminum: 6061-T6 or 5052-H32
- CMU: ASTM C90, Grade N-l
- Concrete: Compressive strength of 3,000 psi and 4,000 psi for nonwater-holding and water holding structures, respectively
- Grout: 2,000-psi compressive strength
- Mortar: Type M, 2,500-psi compressive strength
- Stainless steel: Type 304 or 304L
- Steel reinforcement: Bars - ASTM A-615, grade 60; welded wire fabric - ASTM A-185
- Structural steel: Bars, plates, and shapes - A36; structural tubing - A500, grade B; steel pipe - A53, grade B
- Welding electrodes: 70.0-ksi-minimum tensile strength
- Wood: Douglas fir-larch, grades as required by design

SECTION 6 - ARCHITECTURAL DESIGN

6.01 GENERAL

a. Hatchery operations at this site will require eight buildings in the initial phase: a hatchery building, a mechanical building, a generator/well building, aeration/head building, and four residences for hatchery personnel.

b. The design of all structures is based on four general goals: (1) ease of operation, (2) operational economy, (3) minimal maintenance, and (4) harmony with the existing Irrigon Hatchery complex.

C. The facility will be constructed with materials and finishes to match those at the Irrigon Hatchery. All buildings will be low profile, unobtrusive structures sited to maximize functional efficiency and security.

d. The color scheme will use subtle earth tones to blend with the local environment. Reflective and bright colors will be avoided.

e. Due to the disruption and expense involved in structural alteration, the hatchery building has been designed to accommodate a future increase in production capacity without alterations to the building envelope. This flexibility is achieved by: (1) providing for the future conversion of the garage and shop into additional incubation area, (2) sizing the freezer for storage capacity in excess of first phase requirements, and (3) providing crew areas that are proportioned to accommodate increased staffing.

6.02 HATCHERY BUILDING

a. The hatchery building serves five primary functions: (1) administration and personnel support, (2) incubation and initial rearing, (3) visitor orientation and support, (4) storage and preparation of fish food, and (5) general facility operation and maintenance.

b. Administration and personnel areas consist of an office, crew room, laboratory, wet gear storage, staff restrooms, and a shower. The crew room will have a kitchen area with wall and base cabinets for storage; a countertop with sink, range, and exhaust hood; and space for a refrigerator. Space will also be provided for two vending machines. The laboratory will have wall and base cabinets and a countertop with sink. The staff restrooms will have a vanity, sink, and water closet. The men's restroom will also have a wall mounted urinal.

C. The indoor rearing area consists of a tank room with adjacent space for incubation stacks. The tank room is provided with an 8-foot-wide rollup door to facilitate installation or removal of equipment and egg/fish handling. A small storage area, adjacent to the tank room, will hold operational supplies and equipment.

d. Visitor facilities at this site will be minimal due to the proximity of existing facilities at the adjacent Irrigon Hatchery. A small visitors lobby and restrooms will be provided. The lobby will permit wall-mounted interpretive displays and provide a viewing window into the tank room area. The restrooms will be accessible to the handicapped and will feature a sink and wall-mounted water closet. Visitor access to the hatchery building and raceways will be routed across the south side of the building to provide some separation from truck traffic and visual surveillance from the hatchery office and crew room.

e. A fish food preparation area is located adjacent to the tank room. Its position minimizes the distance to the tank room and the outside rearing ponds. The room is sized for the storage of a forklift and a small quantity of dry food. Wall and base cabinets with a countertop and sink also are provided. The preparation area is connected to a refrigerated thaw room that adjoins a -10°F freezer for moist food. All three spaces are interconnected with 6-foot-wide sliding doors to permit forklift access. Room for at least two food pallets (4,000 pounds) is provided in the thaw room. Floor space for 32 food pallets (64,000 pounds) is available in the feezer. Increased capacity is possible by stacking pallets.

f. Additional spaces in the hatchery building include mechanical and electrical rooms, a combined garage and shop, outside storage, and a mechanical/utility room in the administrative area. The outside storage room is enclosed in concrete masonry due to the potential presence of flammable materials such as gasoline and paint.

g. The hatchery building has a total net area of 6,362 square feet for a 90-percent utility rating. Individual room areas are as follows;

No.	Freezer	Net Square Feet
10	Freezer	881
11	Thaw	180
12	Storage (Outside)	39
13	Food Preparation	266
14	Electrical	89
15	Mechanical	572
16	Garage and Shop	543
17	Incubation	640
18	Tank Room	1,491
19	Visitors Lobby	304
20	Storage	85
21	Men's Restroom (Visitor)	49
22	Women's Restroom (Visitor)	40
23	Men's Restroom (Staff)	128
24	Women's Restroom (Staff)	128
25	Janitor	15
26	Office	107
27	Wet Gear Storage	60
28	Corridor	100
29	Corridor	82
30	Shower	29
31	Mechanical/Utility	87
32	Laboratory	95
33	Crew Room	343
	Total Net Area	6,362
	Total Gross Area	7,040

h. The hatchery building will use the same materials palette as the Irrigon Hatchery. Exterior walls will be split-faced CMU. A metal fascia will wrap around the entire structure with separate canopy/fascia at the visitors lobby and above doors and windows at the east end of the building. The canopy fascia will mimic the geometry of the entry fascia at Irrigon. Fascia panels will be a factory-finished architectural-profile type. The roof system will utilize a steel deck diaphragm on steel open-web joists. As EPDM membrane roof will be adhered to rigid composite insulation board mechanically attached to the steel deck. A vapor barrier will be included between the steel deck and the insulation.

i. Interior wall finishes will be unpainted CMU, painted gypsum wallboard (GWB) or, in the restrooms, ceramic tile (CT). Floors in most rooms will be steel troweled concrete. Personnel areas such as the office and laboratory will be sheet vinyl while the restrooms will be ceramic mosaic tile (CMT). Ceilings will be suspended gypsum board or acoustical tile in personnel areas, gypsum board in the outside storage room and garage, and the exposed steel roof deck in all others.

j. The hatchery building will be insulated. The roof insulation will provide a minimum "R" value of 30. Exterior CMU walls will have all hollow cells filled with vermiculite-type loose fill insulation. Additionally, at personnel areas, the outside wall will have an interior 2-inch layer of rigid insulation covered with gypsum wallboard.

k. The hatchery building will comply with Oregon Building Code requirements for Type II-N structures with B-l/B-2 occupancies and NFPA code requirements.

1. All personnel doors will be hollow metal with hollow metal frames. Exterior doors will be insulated. Exterior rollup doors will be heavy-duty steel construction, insulated and weatherstripped. Electric operators with chain backup will be provided.

m. Windows in personnel areas will be extruded aluminum storefront type with awning vent units. Exterior windows will have insulating glazing. All windows in the visitors lobby will be laminated safety glazing. Glass block windows will be utilized at the tank room and the wall opposite the visitor restrooms because of its light control properties and durability.

n. An alarm system shall be provided in the hatchery building. The system will be interconnected with the Irrigon alarm system so that either hatchery is made aware of a problem at its neighbor facility.

6.03 MECHANICAL BUILDING

a. The mechanical building will house various systems required for the support of fish rearing and general hatchery operations. This will include the compressors, air dryers and related equipment necessary for oxygenation of the '*Michigan-style** raceways, a domestic well and water storage tank for hatchery

and residential demand, and an emergency engine generator set to support essential hatchery power requirements. Total floor area required will be approximately 1,300 square feet.

b. Materials used for this structure will match the hatchery building to provide a coordinated site appearance consistent with the existing Irrigon facility. Structural systems will also mirror those of the hatchery building.

C. Interior finishes will be utilitarian, reflecting the industrial function of the building. Walls will be unpainted CMU. The floor will be steel troweled concrete. Open web trusses and a steel roof deck will be exposed and painted.

d. The mechanical building will be insulated. Roof insulation will provide a minimum "R" value of 30. The exterior CMU walls will be vermiculite filled at all hollow cells.

e. This structure will comply with Oregon Building Code requirements for type II-N structures with E-2 occupancy and NFPA code requirements.

f. Exterior personnel doors will be insulated hollow metal with hollow metal frames. Louvers will be roll-formed, factory finished aluminum with weather resistant blades.

g. Critical equipment in the mechanical building will have function alarms interconnected to the Umatilla/Irrigon alarm system.

6.04 GENERATOR/WELL BUILDING

a. This building will have two basic functions: to shelter the water collection system and to house an emergency generator dedicated to the water supply system. The generator will be isolated from the well structure to reduce the risk of accidental fuel contamination.

b. The generator/well building will utilize the same materials and systems (rigid steel frame with steel roof and wall panels) as the existing Irrigon Hatchery Pump Station No. 2 for design and construction economy.

C. The structure will be oriented so that all necessary air intake and exhaust louvers for the generator system are located away from prevailing winds.

d. Openings in the roof and walls of the structure will be sized to permit simplified equipment removal or repair for either the pumping system or the engine generator.

e. Since the generator/well is outside the fenced perimeter of the facility and thus more difficult to monitor, all openings will be designed to be vandal resistant.

6.05 RESIDENCES

a. Four residences shall be provided for hatchery personnel. Onsite dwellings are required due to the need for site surveillance and rapid response in the event of a systems failure.

b. The Irrigon residence design will be used with only minor adjustments. Each unit will have approximately 1,600 square feet. The plan features a living room, dining room, kitchen, laundry, full bath, three bedrooms, and a single-car garage.

Additional amenities include a patio and wood stove.

c. Residences will be of standard wood frame construction with prefabricated wood roof trusses.

d. Exterior finishes will be wood siding and a composition shingle roof. Earth tones shall be used to harmonize with the hatchery building. Shingled roof will be a dark brown tone.

e. Interior finishes will be painted gypsum board on walls and ceilings. Floors will be carpet or sheet vinyl except for the garage which will be a concrete slab-on-grade.

f. The residences will be insulated. Walls will be insulated with batt insulation to achieve an “R” value of 19, while ceilings will meet a minimum of R-38.

g. Dwellings will be connected to the Irrigon/Umatilla alarm system and will have an annunciator panel in the hallway outside of the bedrooms.

SECTION 7 - MECHANICAL DESIGN

7.01 SCOPE

This section provides criteria and design concepts pertinent to design of the mechanical systems.

7.02 CODES AND STANDARDS

- American Society of Heating, Refrigerating, and Air Conditioning Engineers, Handbook of Fundamentals (1985 Edition).
- American National Standards Institute, ANSI Standards.
- American Society for Testing and Materials, Annual Books of ASTM Standards.
- National Standard Plumbing Code (1983 Edition).
- National fire Protection Association, National Fire Codes NFPA (1986 Edition).
- Occupational Safety and Health Standares, Part 1910 of Title 29 of the Code of Federal Ragulations.

7.03 WATER SUPPLY

a. Water supply will be obtained from a collector similar to that at Irrigon Hatchery. Section 2 describes this system. The water supply system will deliver water for production of 290,000 pounds of fish initially. This same water supply will allow future expansion to 500,000 pounds if initial production goals are met. Thirty stacks of three 4-tray incubation units and 12 16-tray units are provided to meet incubation needs of 290,000 pound production. Each 4-tray and 16-tray unit requires4 gpm for a total of 408 gpm. Future use of the shop area will allow for 18 16-tray units and space for four future 16-tray units in the tank room for a total future flow of 88 gpm. An additional 384 gpm is required for process chiller water. Eight early rearing tanks will be provided in the hatchery building. Tank flow requirement will be 60 gpm each for a maximum of 480 gpm. The tanks will be supplied with well water only. The Oregon ponds require 1,200 gpm, while the Michigan ponds require 1,000 gpm.

b. The following flow schedule was established:

Month	Rearing	Incubation	Troughs	Process Waste	Total
May	14,600	72	300	187	15,159
Jun	800	56	480	103	1,439
Jul	2,400	0	0	0	2,400
Aug	4,700	48	0	84	4,832
Sep	9,000	48	0	84	9,132
Oct	11,500	32 *	0	84	11,616
Nov	4,800	392 *	0	393	5,585
Dec	9,500	392	0	393	10,285
Jan	13,000	392	0	393	13,785
Feb	14,600	16 *	480	84	15,180
Mar	14,600	16 *	480	84	15,180
Apr	14,600	72 *	300	187	15,159

* Denotes periods when there is a need for truck filling.

Process waste is chiller process water. Critical flow months are February, March, April, and May. The flow for these months is above the design capacity of the well, but only by 1 percent. Based on this flow schedule, five pumps will be used to obtain flexibility in flow control for process water. The following are the design flows for the pumps:

Pump	Flow (gpm)
1	5,000
2	5,000
3	2,600
4	1,200
5	1,200
Total	15,000

C. If the hatchery is expanded in the future, flows in the hatchery building will increase by 88 gpm for incubation. Outdoor rearing flow would not change because of the multipass system.

7.04 HATCHERY BUILDING PROCESS PIPING

a. The hatchery building supply line will deliver water from the aeration/head structure to the hatchery building where distribution piping carries water to the incubators, tanks, and the chillers. The piping is arranged so the incubation trays can be supplied with a mix of unchilled water and available chilled water. A 16-inch PVC header will be used above the incubators to mix and supply the required flow. Piping conveys chilled water through booster pumps to the incubators only. Four packaged chiller units will be provided to maintain incubation water temperature at or below 48°F. The tube-and-shell chiller barrel will have stainless steel tubes in contact with process water since copper would be toxic to fish and eggs. Each chiller will be a package unit complete with control center, compressors, cooler, water-cooled condenser, refrigerant piping, gauges and indicator lights, solid state step controller to sense entering and leaving water temperatures, and accessories. Six booster pumps will be provided ahead of the chillers--two operating as backups.

b. Early rearing tanks are supplied with well water only. Two sorting troughs will be provided. These troughs will be supplied with well water only.

C. Incubators and tanks will drain to trenches for process flow and during cleaning. The trenches drain to the sedimentation basin.

d. Incubation and tank piping will be PVC. Piping below grade will be ductile iron.

7.05 INCUBATOR STACKS

Incubator stacks will be as shown on the driwings and will utilize standard HEATH-TECHNA type cabinets. Thirty stacks of three 4-tray incubation units and 12 16-tray units are provided to meet incubation needs of 290,000-pound production. Future use of the shop area will allow for 18 16-tray units and space for four future 16-tray units in the tank room. Each stack will be isolated from adjacent stacks by means of aluminum backs and sides to minimize the risk of spread of disease.

7.06 EARLY REARING TANKS

Commercially available standard fiberglass tanks similar to those at Lookinglass Fish Hatchery will be used.

7.07 HEATING, VENTILATING, ANTI AIR CONDITIONING SYSTEMS

a. Design Data

- Outdoor Temperature

Summer	94°F	Dry Bulb
	64°F	Wet Bulb
Winter	30°F	Dry Bulb

- Indoor Temperature

Hatchery Building Office Area	Winter	68°F
	Summer	80°F
Hatchery Building Tank and Incubation Room, Electrical and Mechanical Rooms, Shop	Winter	50°F
Hatchery Building Feed Room	Winter	68°F

b. The hatchery guilding office area will be heated and cooled by a water source heat pump system. Air return and supply ducts will be provided with grilles and diffusers. Exhaust fans will be provided in the restrooms.

C. The tank incubation rooms will have wall-mounted electric unit heaters and electric exhaust fans. The heaters will be operating to prevent freezeup of the piping and mechanical equipment. The exhaust fans in the incubation and tank rooms would be running while the incubators and starter tanks are operating to exhaust the moist air from the room. This would not be concurrent with the heavy heating season.

d. The feed room will be heated by a wall-mounted electric unit heater. An exhaust fan will ventilate the feed room when temperatures exceed 80°F.

e. The shop and mechanical and electrical rooms will be heated by wall-mounted electric unit heaters to prevent freezing. Ventilators will operate when temperatures exceed 85°F in the mechanical and electrical rooms, and on demand in the shop.

f. The pump station building will have intake shutters and exhaust louvers as required for the engine-generator set.

7.08 REARING POND FEEDERS

Manufactured units consisting of hopper, compressors, food transfer tubes with regularly spaced outlets, and necessary controls will be installed at the rearing ponds. The controls will provide for amount of food per cycle, number of cycles per feeding, and number of feedings per hour or time of day for each feeding. Air and electrical outlets will be provided at the pond divider walls for connection of the feeders. Pond wa 1 kways will be designed to be compatible with the feeders.

7.09 DOMESTIC WATER SYSTEM

The domestic water system will provide for distribution of well water to the four residences, hatchery building plumbing system, outside hose bibs, and landscaping irrigation system. The system will include a well pump and hydropneumatic tank located in the mechanical building. The tank will be equipped with appropriate control and pneumatic equipment. The domestic system will be sized to provide a 200-gpm-maximum instantaneous capacity and includes irrigation and heat pump demands. Demand is based on the hatchery guilding and four residences. Treatment of the domestic water will be provided by untraviolet sterilization if treatment is required.

7.10 FIRE WATER SYSTEM

a. A fire water system will be provided and will be designed to supply 150 gpm to any hydrant at a hydrant residual pressure of **75** psi. Hydrants and hose cabinets will be located so that any portion of any building or residence can be reached with a fire stream. Hydrants will be similar to those at Irrigon.

b. Water for the fire system will be provided by one of two options:

(1) Electrically driven fire pump located in the mechanical building. The pump will draw from the domestic supply line.

(2) Utilize the Irrigon Fish Hatchery fire system.

C. The fire pump will be energized by the standby generator in the event of electric service failure. The fire pump will be pressure-switch started when auto/hand/off switch is on automatic.

7.11 SEWER SYSTEM

a. Domestic sewage from the residences and hatchery building will be disposed of by means of septic tanks and drain fields. Septic tanks will be located near the buildings they serve. Flow to drain fields will be by gravity.

b. All elements of the system will comply with applicable State of Oregon regulations governing subsurface disposal of domestic sewage.

7.12 GATES AND VALVES

a. Slide gates will be standard manufactured cast iron gates with carbon steel stems. Lifts will be as appropriate to specific installations. Design seating and unseating head specified will be as appropriate to the conditions.

b. All buried valves will be resilient seated gear actuated valves complying with AWWA C-504 Class 75B and suitable for buried service.

C. Above-grade valves and actuators will be specified as appropriate to specific conditions.

d. Check valves will also be selected to be appropriate to specific conditions.

e. Plug valves, Class 150, will be used in the domestic and fire **water sys tems.**

SECTION 8 - ELECTRICAL DESIGN

8.01 SCOPE

The electrical portion of the design covers provision of the power supply and distribution system for motor driven equipment, indoor and outdoor lighting, convenience outlets, heating, and ventilating. The electric service to the residences and to the water supply pump station will be separate from the hatchery electrical system.

8.02 COMMERC IAL POWER

Normal electric service will be provided by Umatilla Electric Cooperative Association of Bermiston from the existing **12.5-kv,** 3-phase, 4-wire Wye-connected line. The serving utility will provide the transformers, meters, and other service equipments. The total connected load for the hatchery system will be approximately 350 kVA. Pump stations and dwellings will be separately connected.

8.03 EMERGENCY POWER SUPPLY

a. The main hatchery emergency power will be automatically transferred from a lOO-kw, 480-V. 3-phase standby generator located in the mechanical building and designed to operate a selected number of loads.

b. The pump station emergency power will be automatically transferred from a 600-kW, 480-V, 3-phase standby generator located in the pumphouse. This generator shall be sized for sequenced starting of all pumps. Transfer for the Ranney pumps will be by means of an automatic transfer switch.

8.04 POWER DISTRIBUTION

a. An outdoor pad-mounted tranformer supplied by the power company will be located near the mehanical building and will feed the main destribution panel located in the mechanical building. Loads will be **served** from the main distribution panel and subdistribution panels.

b. All outside wiring will be in buried, rigid metallic raceways or PVC conduit . Wiring will be installed indoors in rigid conduit or electrical metallic conduit.

C. The design and installation of the electrical distribution system will be in full compliance with the National Electrical Code.

8.05 LIGHTING SYSTEM

a. The lighting within buildings will consist of incandescent and flourescent fixtures arranged to provide illumination consistent with IES standards and current practice for the application. Visitor areas will be lighted in conformance with the architectural treatment of the buildings. Emergency lighting will be provided in the event of loss of commercial power.

b. Area lighting will be provided at the pump station and at the hatchery as shown. Area lighting will consist of high-pressure sodium fixtures. All area lights will be controlled by a photoelectric cell and hand-off-auto switch.

8.06 CONTROL SYSTEMS

a. Electrical control systems will provide for control of the incubation water supply chillers, domestic pump, and pneumatic sys tern. All other motors will be provided with individual motor controllers.

b. Low voltage for winding heat will be required for all motors not equipped with encapsulated windings. The heaters are to keep the motors warm when the motors are not being used. Thermal overload relays, time delay relays, magnetic starters, and other related equipment will be built integrally with the motor control center cabinets.

8.07 TELEPHONES

Alarm system will be designed to annunciate high and low pond fire and pumphouse intrusion, and any other alarms required by Oregon Fish and Wildlife. Regardless of the system used, a connection between the annunciation panel at the Umatilla site will be made to the annunciation panel at Irrigon. Any alarm occurrence at Umatilla would then alarm at Irrigon and vice versa.

8.08 PROVISION FOR FUTURE LOADS

Sufficient capacity will be provided for connection of future circuits at each of the distribution and subdistribution panels.

8.09 DWELLINGS

Services to the dwellings will be at 1201240-V. single-phase, and rated 200 amperes. This is adequate for water heating, range, clothes dryer, laundry, lighting, refrigeration, and miscellaneous. A 200-ampere meter base will be provided with provision for underground service entrance. Serving agency will be Umatilla Electric Cooperative Association which will provide a pad-mounted transformer at each residence for the primary feed. Umatilla Electric will bill each tenant at residential rates applicable to the area. Outdoor receptacles will be provided with ground fault circuit interrupt protection. The domestic water system trenching will be utilized as far as possible for underground residential electric and telephone distribution, subject to satisfactory agreement with the serving agencies.

SECTION 9 - COST ESTIMATE

9.01 SUMMARY COST ESTIMATE

The following is a summary of the construction cost estimate:

a.	Site Work	$ 368,088
b.	Hatchery Building	830,720
c.	Rearing Ponds	1,196,944
d.	Pumping Station	1,215,200
e.	Aeration/Head Tank	100,000
f.	Mechanical Building	261,750
g.	Sludge Tank	20,000
h.	Utilities	105,000
i.	Hatchery Piping	607.000
j.	Exterior Electrical	97,000
k.	Residences	246,000
1.	Automatic Fish Feeders	315,000
m.	Landscaping	60,000
	Subtotal	$5,422,702
	Contingencies @ ± 20%	1,084,298
	Total Project Construction Cost	$6.507.000