NOMINAL PIPE SIZE, INCHES	MINIMUM TESTING TIME, MIN/100 FEET
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0

2) Record drop in pressure during testing period.

3) If air pressure drops more than 1.0 psi during testing period, piping has failed.

4) If 1.0 psi air pressure drop has not occurred during testing period, piping is acceptable; discontinue testing.

5) If piping fails, test reach of piping in incremental stages until leaks are isolated, repair leaks, and retest entire reach between manholes.

B. Testing of Pressure Piping:

1. Test system according to AWWA C600 and the requirements of Section 33 13 00, Testing and Disinfection of Water Utility Piping.

C. Deflection Testing of Plastic Sewer Piping:

1. Perform vertical ring deflection testing on PVC and acrylonitrile butadiene styrene (ABS) sewer piping after backfilling has been in place for at least 30 days but not longer than 12 months.

2. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.

3. Perform deflection testing using properly sized rigid ball or "go, no go" mandrel.

4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe, as determined by ASTM standard to which pipe is manufactured; measure pipe diameter in compliance with ASTM D2122.

5. Perform testing without mechanical pulling devices.

6. Locate, excavate, replace, and retest piping that exceeds allowable deflection.

D. Testing of Manholes:

1. Description:

   a. Option of air testing or exfiltration testing.

   b. If air testing, test whenever possible prior to backfilling in order to more easily locate leaks.

   c. Repair both outside and inside of joint to ensure permanent seal.

   d. Test manholes with manhole frame set in place.

2. Vacuum test according to ASTM C1244 and following:

   a. Plug pipe openings; securely brace plugs and pipe.

   b. Inflate compression band to create seal between vacuum base and structure.

   c. Connect vacuum pump to outlet port with valve open, then draw vacuum to 10 in. Hg.

   d. Close valve.

   e. Testing:

      1) Determine manhole testing duration using following table:

MANHOLE DIAMETER (feet)	TEST PERIOD
4	60 seconds
5	75 seconds
6	90 seconds

      2) Record vacuum drop during test period.

      3) If vacuum drop is greater than 1 in. Hg during testing period, repair and retest manhole.

      4) If vacuum drop of 1 in. Hg does not occur during test period, manhole is acceptable; discontinue testing.

      5) If vacuum test fails to meet 1 in. Hg drop in specified time after repair, repair and retest manhole.

3. Exfiltration Testing:

   a. Plug pipes in manhole.

   b. Remove water from manhole.

   c. Observe plugs over period of not less than two hours to ensure that there is no leakage into manhole.

   d. Determine ground water level outside manhole.

e. Fill manhole with water to its rim at the start of the test.

f. Prior to testing, allow manhole to soak from minimum of four hours to maximum of 72 hours.

g. After soak period, adjust water level to rim of manhole.

h. Leakage in the manhole shall not exceed 0.2 gallons per foot of head above the highest invert after a one-hour test period.

4. If unsatisfactory testing results are achieved, repair manhole and retest until result meets criteria.

5. Repair visible leaks regardless of quantity of leakage.

END OF SECTION

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SECTION 33 31 10 – GRAVITY SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes pipe materials, manholes, and accessories normally used with gravity sanitary sewers.

B. Section includes:

1. Sanitary sewerage pipe and fittings.
2. Pipe markers.
3. Connection to existing manholes.
4. Manholes.
5. Wye branches and tees.
6. Sanitary laterals.
7. Bedding and cover materials.

C. Related Sections:

1. Section 03 21 00 - Reinforcing Steel
2. Section 03 11 00 - Concrete Work
3. Section 03 60 00 - Grouting
4. Section 09 90 00 – Painting and Coating
5. Section 31 05 13 - Soils for Earthwork
6. Section 31 05 16 - Aggregates for Earthwork
7. Section 31 23 16 - Excavation
8. Section 31 23 17 - Trenching
9. Section 31 23 23 - Fill
10. Section 33 30 10.13 - Sewer and Manhole Testing
11. Section 33 05 13 - Manholes

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. Clean Water Services standards.

C. ASTM International (ASTM):

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

5. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

6. ASTM C1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.

7. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

8. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

9. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

10. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

11. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

12. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

13. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

14. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

15. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

16. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

17. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

D. American Water Works Association (AWWA):

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.

4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.

6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.

7. AWWA C153 - Ductile-Iron Compact Fittings.

8. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

1.3 COORDINATION

A. Notify affected utility companies at least 72 hours prior to construction.

1.4 SUBMITTALS

A. Product Data: Submit Manufacturer catalog cuts and other information indicating proposed materials, accessories, details, and construction information.

B. Shop Drawings:

1. Indicate layout of sewer system and appurtenances.

2. Show size, materials, components of system, and burial depth.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. The certificate shall be signed by an authorized agent of the Manufacturer.

D. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.

E. Manufacturer Instructions:

1. Indicate special procedures required to install specified products.
2. Submit detailed description of procedures for connecting new sewer to existing sewer line.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes, and cleanouts.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Materials:

1. Unless otherwise noted, all water works materials provided for the Project shall be new, of first-class quality and shall be made by reputable manufacturers.

2. All material of a like kind shall be provided from a single manufacturer unless otherwise approved by the Owner’s Representative.

3. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage, and handling.

4. All pipe and fittings shall be manufactured in the United States of America, unless otherwise approved by the Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

B. Storage:

1. Store materials according to Manufacturer instructions.

C. Protection:

1. Protect materials from moisture, dust, and direct sunlight by storing in clean, dry location remote from construction operations areas.

2. Block individual and stockpiled pipe lengths to prevent moving.

3. Provide additional protection according to Manufacturer instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 SANITARY SEWERAGE PIPE AND FITTINGS

A. Plastic Pipe:

1. Material:

a. Polyvinyl chloride (PVC), manufactured from rigid polyvinyl chloride compounds conforming to ASTM D1784, Class 12454-B.

b. At locations indicated in the Drawings, pipe shall conform to AWWA C900.

2. Fittings: PVC.

3. Pipe and fittings 4 inches to 15 inches in diameter:

a. Comply with ASTM D3034, SDR 35.

4. Pipe and fittings 18 inches and larger in diameter:

a. Comply with ASTM F679, PS46.
b. Pipe shall have a minimum stiffness of 46 pounds per square inch (psi).

5. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.

6. Joints:

    a. Integral bell push-on type: Comply with ASTM D3212.
    b. For use with AWWA C900 pipe: Integral bell push-on type: Comply with ASTM D3139.

7. Gaskets:

    a. Factory installed.
    b. Elastomeric gaskets: Comply with ASTM F477.

2.2 FLEXIBLE COUPLINGS

A. Description:

1. Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling.
2. Attachment: Two Series 300 stainless-steel clamps, screws, and housings.

2.3 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

A. Description:

1. Material: Ethylene propylene rubber (EPDM).
2. Comply with ASTM C923.
3. Attachment: Stainless-steel clamp and hardware.

4. Manufacturer: KOR-N-SEAL

2.4 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 03 30 00, Cast-in-Place Concrete.
2. Strength: Minimum 3,000 psi at 28 days.
3. Air entrained.
4. Finish: Rough troweled.

B. Concrete Reinforcement: As specified in Section 03 20 00 - Concrete Reinforcing.

2.5 MANHOLES

A. Description:

1. As specified in Section 33 05 13 - Manholes.

2.6 MATERIALS

A. Bedding and Cover:

1. Pipe Bedding: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

2. Pipe Zone Backfill: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

3. Trench Backfill from Pipe Zone to Finish Grade:

    a. Material type varies by location, as shown in the Drawings.

    b. Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

    c. Subsoil Type S2, as specified in Section 31 05 13, Soils for Earthwork.

2.7 MIXES

A. Grout: As specified in Section 03 60 00, Grouting.

2.8 ACCESSORIES

A. Underground Pipe Markers: As specified in Section 31 23 17, Trenching.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that trench cut, or excavation base is ready to receive Work.
B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Correct over-excavation in accordance with Section 31 23 17, Trenching.

B. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

C. Protect and support existing sewer lines, utilities, and appurtenances.

D. Utilities:

1. Maintain profiles of utilities.
2. Coordinate with other utilities to eliminate interference.
3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION

A. Bedding:

1. Excavate pipe trench as specified in Section 31 23 17, Trenching.

2. Excavate to lines and grades as indicated on Drawings, or as required to accommodate installation of utility.

3. Pipe base shall be observed by Engineer prior to placement of the pipe.

4. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.

5. Provide sheeting and shoring as specified in Section 31 23 17, Trenching.

6. Placement:

    a. Place bedding material at trench bottom.
    b. Level materials in continuous layer not exceeding 6 inches compacted depth.
    c. Compact to 95 percent of maximum density.

B. Piping:

1. Install pipe, fittings, and accessories according to standards listed below, and seal joints watertight.

    a. PVC: Comply with ASTM D2321.

2. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

3. Lay pipe to slope gradients and line as indicated on Drawings.

4. Variations:

    a. Maximum Variation from Indicated Line: 1/32-inch per inch of pipe diameter, but no more than 1/2-inch, providing that such variation does not result in a level or reverse-sloping invert.

    b. Maximum Variation from Indicated Grade: 1/32-inch per inch of pipe diameter, but no more than1/4-inch.

    c. Variation in the invert elevation between adjoining ends of pipe, include fittings, shall not exceed 1/64-inch per inch of pipe diameter, or 1/2-inch maximum.

5. Begin at downstream end and progress upstream.

6. Assemble and handle pipe according to Manufacturer's instructions, except as may be modified on Drawings or by Engineer.

7. Make straight field cuts without chipping or cracking pipe.

8. Keep pipe and fittings clean until Work has been completed and accepted by Engineer.

9. Assemble pipe joints in accordance with Manufacturer's recommendations/specifications.

10. Cap open ends during periods of Work stoppage.

11. Lay bell and spigot pipe with bells upstream.

12. Polyethylene Pipe Encasement: Conform to AWWA C105.

13. Backfill and compact as specified in Section 31 23 17, Trenching.

14. Do not displace or damage pipe when compacting.

15. Pipe Markers: As specified in Section 31 23 17, Trenching.

C. Joints:

1. Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean, and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap.

2. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned.

3. Before the joint is fully “home,” the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the Pipe Manufacturer.

4. If the gasket is found not to be in proper position, the pipes shall be separated, and the damaged gasket replaced.

5. The pipe is then forced “home” firmly and fully.

6. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

D. Connection to Existing Manholes:

1. Drilling:

   a. Core drill existing manhole to clean opening.
   b. Use of pneumatic hammers, chipping guns, and sledgehammers are not permitted.

2. Install watertight neoprene gasket and seal with non-shrink concrete grout.

3. Encasement:

   a. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint.
   b. Use epoxy binder between new and existing concrete.

4. Prevent construction debris from entering existing sewer line when making connection.

E. Manholes:

1. Install manholes as specified in Section 33 05 13, Manholes and Structures.

F. Wye Branches and Tees:

1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated on Drawings.

2. Use standard fittings of same material and joint type as sewer main.

3. Maintain minimum 5-foot separation distance between wye connection and manhole.

4. Use saddle wye or tee with stainless-steel clamps for taps into existing piping.

5. Mount saddles with solvent cement or gasket and secure with metal bands.

6. Lay out holes with template and cut holes with mechanical cutter.

G. Sanitary Laterals:

1. Construct laterals from wye branch to terminal point at right-of-way or where otherwise shown in the Drawings.

2. Where depth of main pipeline warrants, construct riser-type laterals from wye branch.

3. Minimum Depth of Cover over Piping: 2 feet.

4. Minimum Separation Distance between Laterals: 5 feet.

5. Install watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral.

6. Marker Stake:

a. Install temporary marker stake extending from end of lateral to 12 inches above finished grade.

b. Paint top 6 inches of stake with fluorescent orange paint.

H. Backfilling:

1. Backfill around sides and to top of pipe as specified in Section 31 23 23, Fill.

2. Maintain optimum moisture content of bedding material as required to attain specified compaction density.

3.4 FIELD QUALITY CONTROL

A. Request inspection by Engineer prior to and immediately after placing bedding.

B. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.

2. Pipe Testing: As specified in Section 33 30 10.13, Sewer and Manhole Testing.

3. Compaction Testing: See Section 31 23 17, Trenching for Compaction Testing requirements for piping trenches.

3.5 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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SECTION 33 41 10 - STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes pipe materials and accessories normally used with gravity storm drainage sewers.

B. Section includes:

1. Storm drainage piping
2. Piping accessories
3. Connection to existing manholes
4. Catch basins and area drains
5. Cleanouts
6. Bedding and cover materials

C. Related Sections:

1. Section 03 11 00 – Concrete Work
2. Section 03 60 00 - Grouting
3. Section 31 05 13 - Soils for Earthwork
4. Section 31 05 16 - Aggregates for Earthwork
5. Section 31 23 16 - Excavation
6. Section 31 23 17 - Trenching
7. Section 31 23 23 - Fill
8. Section 33 30 10.13 - Sewer and Manhole Testing
9. Section 33 05 13 - Manholes

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. Clean Water Services standards.

C. ASTM International (ASTM):

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

5. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.

6. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

7. ASTM C1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.

8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

9. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

10. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

11. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

12. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

13. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

14. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

15. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

16. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

17. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

18. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

D. American Water Works Association (AWWA):

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

4. AWWA C150 - Thickness Design of Ductile-Iron Pipe.

5. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.

6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

1.3 COORDINATION

A. Notify affected utility companies at least 72 hours prior to construction.

1.4 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Procedures.

B. Product Data: Submit Manufacturer catalog cuts and other information indicating proposed materials, accessories, details, and construction information.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. The certificate shall be signed by an authorized agent of the Manufacturer.

D. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.

E. Manufacturer Instructions:

1. Indicate special procedures required to install specified products.

2. Submit detailed description of procedures for connecting new storm sewer to existing storm sewer line.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes, and cleanouts.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer’s original packaging and inspect for damage.

B. Storage:

1. Store materials according to Manufacturer instructions.

C. Protection:

1. Protect materials from moisture, dust, and direct sunlight by storing in clean, dry location remote from construction operations areas.

2. Block individual and stockpiled pipe lengths to prevent moving.

3. Provide additional protection according to Manufacturer instructions.

1.7 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Polyvinyl Chloride (PVC) Pipe:

1. Material:

a. Manufactured from rigid polyvinyl chloride compounds conforming to ASTM D1784, Class 12454-B.

b. At locations indicated in the Drawings, pipe shall conform to AWWA C900.

2. Pipe and fittings 4 inches to 15 inches in diameter, non-pressurized:

a. Comply with ASTM D3034, SDR 35.

3. Pipe and fittings 18 inches and larger in diameter, non-pressurized:

a. Comply with ASTM F679, PS46.
b. Pipe shall have a minimum stiffness of 46 pounds per square inch (psi).

4. AWWA C900 Pipe:

a. At locations shown in the Drawings.
b. Four inches to 12 inches in diameter.
c. DR 25.
d. Pipe shall have minimum stiffness of 149 psi.

5. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.

6. Joints:

a. Integral bell push-on type: Comply with ASTM D3212.

b. For use with AWWA C900 pipe: Integral bell push-on type comply with ASTM D3139.

7. Gaskets:

a. Factory installed.
b. Elastomeric gaskets: Comply with ASTM F477.

B. Ductile Iron Pipe:

1. Comply with AWWA C151.

2. Minimum Special Thickness Class: 52.

3. End Connections: Bell and spigot or plain, as shown in the Drawings.

4. Outside Coating:

    a. Type: Asphaltic coating, minimum 1-mil uniform thickness.
    b. Comply with AWWA C151.

5. Lining:

    a. Cement mortar lined.
    b. Comply with AWWA C104.

6. Fittings:

    a. Material: Ductile iron.
    b. Comply with AWWA C153 or AWWA C110.
    c. Lining: Cement-mortar lined according to AWWA C104.

7. Coating:

    a. Asphaltic exterior coating in accordance with AWWA Standard C151.

8. Joints:

    a. Rubber gasket joint devices.
    b. Comply with AWWA C111.

C. High Density Polyethylene (HDPE) Pipe:

1. Double wall, ribbed pipe with smooth interior.

2. Solid pipe, perforated pipe, and fittings shall meet the requirements of ASTM F-405 and F-667

3. Pipe 3 inches to 10 inches in diameter: Comply with AASHTO M-252.

4. Pipe 12 inches to 36 inches in diameter: Comply with AASHTO M-294.

5. Joints: Integral bell push-on type.

6. Manufacturers:

    a. ADS, N-12 with Pro Link joints, or equal.

D. Acrylonitrile-Butadiene-Styrene (ABS) Pipe:

1. Single walled. Comply with ASTM D2680, SDR 23.5.

2. Perforated.

    a. Three-eighths-inch diameter holes, 3 inches on center.

3. Inside Nominal Diameter: 4 inches.

    a. Minimum Wall Thickness: 0.140 inches.

    b. One row of perforations on each side of pipe, approximately 45 degrees above bottom centerline of pipe.

4. Inside Nominal Diameter: 6 inches.

    a. Minimum Wall Thickness: 0.200 inches.

    b. Two rows of perforations on each side of pipe, approximately 45 degrees above bottom centerline of pipe.

5. Ends:

    a. Style: Bell and spigot.
    b. Type: Solvent sealed.

6. Fittings: ABS.

7. Joints:

    a. Type: Solvent weld.
    b. Comply with ASTM D2235.

2.2 FLEXIBLE COUPLINGS

A. Description:

1. Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling.
2. Attachment: Two Series 300 stainless-steel clamps, screws, and housings.

2.3 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

A. Description:

1. Material: Ethylene propylene rubber (EPDM).
2. Comply with ASTM C923.
3. Attachment: Stainless-steel clamp and hardware.

2.4 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 03 11 00, Concrete Work.
2. Strength: Minimum 3,000 psi at 28 days.
3. Air entrained.
4. Finish: Rough troweled.

B. Concrete Reinforcement: As specified in Section 03 11 00, Concrete Work.

2.5 MANHOLES

A. Description:

1. As specified in Section 33 05 13 - Manholes and Structures.
2. Material: Reinforced precast or cast-in-place concrete.
3. Diameter: As shown in the Drawings.
4. Top: Eccentric.
5. Frames and Covers: Watertight cast iron.
6. Cover Inscription: “S”.

2.6 CATCH BASINS AND AREA DRAINS

A. Construction:

1. Material: Reinforced precast concrete pipe sections.

a. Minimum compressive strength of 3,000 psi at 28 days.
b. Precast concrete inlets shall conform to ASTM C913.

2. Joints: Lipped male/female.

3. Nominal Interior Dimensions: As shown in the Drawings.

B. Lids and Frames:

1. Materials: Cast iron.

2. Lid:

a. Removable.
b. Design: Linear grill.

3. Nominal Lid and Frame Size: As shown in the Drawings.

2.7 CLEANOUTS

A. Construction:

1. Per details provided in the Drawings.

B. Lids and Frames:

1. Materials: Cast iron. Meet H-20 load requirement.

2.8 MATERIALS

A. Bedding and Cover:

1. Pipe Bedding: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

2. Pipe Zone Backfill: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

3. Trench Backfill from Pipe Zone to Finish Grade:

   a. Material type varies by location, as shown in the Drawings.

   b. Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

   c. Subsoil Type S2 as specified in Section 31 05 13, Soils for Earthwork.

2.9 MIXES

A. Grout: As specified in Section 03 60 00, Grouting.

2.10 ACCESSORIES

A. Underground Pipe Markers: As specified in Section 31 23 17, Trenching.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that trench cut, or excavation base is ready to receive Work.
B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Correct over-excavation in accordance with Section 31 23 17, Trenching.

B. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

C. Protect and support existing sewer lines, utilities, and appurtenances.

D. Utilities:

1. Maintain profiles of utilities.
2. Coordinate with other utilities to eliminate interference.
3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION

A. Bedding:

1. Excavate pipe trench as specified in Section 31 23 17, Trenching.

2. Excavate to lines and grades as indicated on Drawings, or as required to accommodate installation of utility.

3. Pipe base shall be observed by Engineer prior to placement of the pipe.

4. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.

5. Provide sheeting and shoring as specified in Section 31 23 17.

6. Placement:

    a. Place bedding material at trench bottom.
    b. Level materials in continuous layer not exceeding 6 inches compacted depth.
    c. Compact to 95 percent of maximum density.

B. Piping:

1. Install pipe, fittings, and accessories according to standards listed below, and seal joints watertight.

    a. PVC, HDPE, ABS: Comply with ASTM D2321.
    b. Ductile Iron: Comply with AWWA C600.

2. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

3. Lay pipe to slope gradients and line as indicated on Drawings.

4. Variations:

    a. Maximum Variation from Indicated Line: 1/32-inch per inch of pipe diameter, but no more than 1/2-inch, providing that such variation does not result in a level or reverse-sloping invert.

    b. Maximum Variation from Indicated Grade: 1/32-inch per inch of pipe diameter, but no more than 1/4-inch.

    c. Variation in the invert elevation between adjoining ends of pipe, include fittings, shall not exceed 1/64-inch per inch of pipe diameter, or 1/2-inch maximum.

5. Begin at downstream end and progress upstream.

6. Assemble and handle pipe according to Manufacturer's instructions, except as may be modified on Drawings or by Engineer.

7. Make straight field cuts without chipping or cracking pipe.

8. Keep pipe and fittings clean until Work has been completed and accepted by Engineer.

9. Assemble pipe joints in accordance with Manufacturer's recommendations/specifications.

10. Cap open ends during periods of Work stoppage.

11. Lay bell and spigot pipe with bells upstream.

12. Backfill and compact as specified in Section 31 23 17, Trenching.

13. Do not displace or damage pipe when compacting.

14. Pipe Markers: As specified in Section 31 23 17, Trenching.

C. Joints:

1. Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean, and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap.

2. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned.

3. Before the joint is fully “home,” the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the Pipe Manufacturer.

4. If the gasket is found not to be in proper position, the pipes shall be separated, and the damaged gasket replaced.

5. The pipe is then forced “home” firmly and fully.

6. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

D. Connection to Existing Manholes:

1. Drilling:

a. Core drill existing manhole to clean opening.

b. Use of pneumatic hammers, chipping guns, and sledgehammers are not permitted.

2. Install watertight neoprene gasket and seal with non-shrink concrete grout.

3. Encasement:

a. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint.
b. Use epoxy binder between new and existing concrete.

4. Prevent construction debris from entering existing sewer line when making connection.

E. Manholes:

1. Install manholes as specified in Section 33 05 13, Manholes.

F. Wye Branches and Tees:

1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated on Drawings.

2. Use standard fittings of same material and joint type as sewer main.

3. Maintain minimum 5-foot separation distance between wye connection and manhole.

4. Use saddle wye or tee with stainless-steel clamps for taps into existing piping.

5. Mount saddles with solvent cement or gasket and secure with metal bands.

6. Lay out holes with template and cut holes with mechanical cutter.

G. Catch Basins

1. Form bottom of excavation clean and smooth, and to indicated elevation.

2. Cast-in-place Concrete Construction:

a. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.

b. Level top surface of base pad.

c. Sleeve concrete shaft sections to receive storm sewer pipe sections.

d. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

3. Mount lid and frame level in grout, secured to top cone section to indicated elevation.

H. Backfilling:

1. Backfill around sides and to top of pipe as specified in Section 31 23 23, Fill.

2. Maintain optimum moisture content of bedding material as required to attain specified compaction density.

3.4 FIELD QUALITY CONTROL

A. Request inspection by Engineer prior to and immediately after placing bedding.

B. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.

2. Pipe Testing: As specified in Section 33 30 10.13, Sewer and Manhole Testing.

3. Compaction Testing: See Section 31 23 17, Trenching for Compaction Testing requirements for piping trenches.

3.5 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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SECTION 33 42 13 - PIPE CULVERTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corrugated steel pipe culvert.
2. Concrete pipe culvert.
3. Joints and accessories.
4. Bedding.
5. Slope protection at pipe end.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

C. Related Sections:

1. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
2. Section 31 23 16 - Excavation: Excavating for culvert piping.
3. Section 31 23 17 - Trenching: Excavating and backfilling
4. Section 31 23 23 - Fill: Backfilling.
5. Section 31 37 00 - Riprap

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M 86M/M 86 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe.

2. AASHTO M 170 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

3. AASHTO M 170M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).

4. AASHTO M 206M/M 206 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.

5. AASHTO M 207M/M 207 - Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.

6. AASHTO M288 - Standard Specification for Geosynthetic Specification for Highway Applications.

7. AASHTO M294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.

8. AASHTO T180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM A929/A929M - Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe.

2. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

3. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

4. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

5. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).

6. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

7. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).

8. ASTM C506 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.

9. ASTM C506M - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric).

10. ASTM C507 - Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.

11. ASTM C507M - Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Metric).

12. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 12,400 ft-lbf/ft3

13. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft3

14. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 PRESINSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Requirements for preinstallation meeting.
B. Convene minimum two weeks prior to commencing Work of this Section.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit Manufacturer information regarding pipe, fittings, and accessories.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Manufacturer Instructions: Submit special procedures required to install specified products.
E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 NOT USED

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform Work according to State of Oregon Department of Transportation and Municipality of Oregon City Department of Public Works standards.

PART 2 PRODUCTS

2.1 CONCRETE CULVERT PIPE

A. Reinforced Circular Concrete Pipe:

1. Comply with ASTM C76 (C76M) Class V and Wall Type B.

2.2 NOT USED

2.3 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type A1, as specified in Section 31 05 16 - Aggregates for Earthwork
2. Cover: Fill Type A1, as specified in Section 31 05 16 - Aggregates for Earthwork Mixes

B. Fill at Pipe Ends:

1. Riprap as specified in Section 31 37 00 - Riprap.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that trench cut is ready to receive Work.

C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Correct over-excavation with coarse aggregate.

C. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

A. Excavation and Bedding:

1. Excavate culvert trench to as shown in drawings and specified in Section 31 23 17 - Trenching.

2. Hand trim excavation for accurate placement of piping to indicated elevations.

3. Place bedding material at trench bottom.

B. Culvert:

1. Positioning:

a. Lift or roll culvert into position; do not drop or drag culvert over prepared bedding.

b. Shore culvert to required position and retain in place until after compaction of adjacent fills.

c. Ensure that pipe remains in correct position and to required slope.

2. Backfilling and Compaction:

a. As shown in drawings and specified in Section 31 23 23 – Fill.

C. Pipe Ends:

1. Place fill at pipe ends.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

3.5 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 40 05 13 - COMMON WORK RESULTS FOR PROCESS PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section applies to the furnishing and installation of piping inside a building, structure, enclosure piping and miscellaneous yard piping.

1.2 RELATED SECTIONS

A. Section 09 90 00, Painting and Coating
B. Section 33 13 00, Testing and Disinfecting of Water Utility Piping

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B1.20.1 Pipe Threads, General Purpose (inch)
2. ASME A13.1 - Scheme for the Identification of Piping Systems.
3. ASME B31.9 - Building Services Piping.

B. ASTM International (ASTM):

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile.

3. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

4. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

5. ASTM D2000 - Classification System for Rubber Products in Automotive Applications.

6. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

7. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

C. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code.

D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:

1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

E. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.4 COORDINATION

A. Coordinate installation of specified items with installation of valves and equipment.

1.5 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit manufacturer catalog information for each product specified.

C. Shop Drawings:

1. Identification:

a. Submit list of wording, symbols, letter size, and color coding for pipe identification.
b. Comply with ASME A13.1.

2. Provide all necessary dimensions and details on pipe joints, restraints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists.

3. Provide detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, couplings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

D. Manufacturer's Statement: Certifying pipe fabrication and products meet or exceed specified requirements.

E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS and ASME qualification within previous 12 months.

F. Manufacturer Instructions: Submit special procedures and setting dimensions.

G. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping appurtenances.
B. Identify and describe unexpected variations to pipe routing or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Drawings:

1. Piping layouts shown in the Drawings are intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

B. Inspection:

1. All pipe shall be subject to inspection at the place of manufacture.

2. During the manufacture of the pipe, the Engineer shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

C. Welding:

1. All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWS D1.1.

2. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. Welders:

1. Skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used shall do all welding.

2. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local approved testing agency prior to commencing work on the pipeline.

3. Machines and electrodes similar to those used in the Work shall be used in qualification tests.

4. The Contractor shall furnish all material and bear the expense of qualifying welders.

E. Tests: Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards. Welds shall be tested as specified. The Contractor shall perform all tests at no additional cost to the Owner.

1.8 MATERIAL DELIVERY, STORAGE, AND INSPECTION

A. Inspection:

1. Accept materials on Site in manufacturer's original packaging and inspect for damage.

2. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition.

B. Storage:

1. Store materials according to manufacturer instructions.

2. Store materials off the ground, to provide protection against oxidation caused by ground contact

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.

3. Provide additional protection according to manufacturer instructions.

D. All defective or damaged materials shall be replaced with new materials.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

B. All process piping materials shall be as shown on the Drawings.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. See Article 2.1.B, WATER PIPING of Section 33 11 10, Water Utility Distribution and Transmission Piping.

2.3 RESTRAINED FLANGE ADAPTERS FOR DUCTILE IRON PIPE

A. Description:

1. ASTM A536, ductile iron.

2. Flange bolt circles compatible with ANSI/AWWA C115/A21.15.

3. Restraint for the flange adapter shall consist of a plurality of individually actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of the gripping wedges.

4. Capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6-inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

5. Safety factor of 2:1 minimum.

6. Manufacturer:

a. EBAA Iron, Series 2100 Megaflange or approved equal.

2.4 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Materials:

1. Conforms to the requirements of ASTM D1784, Cell Classification 12454.

B. Pipe:

1. Schedule 80 PVC unless noted otherwise

2. Pipe shall be manufactured in strict compliance with ASTM D1785 for physical dimensions and tolerances.

3. Where noted on the drawings, pipe shall be clear.

C. Fittings:

1. Schedule to match Pipe.

2. ASTM D2466 and ASTM D2467 for socket weld type and ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.

D. Joints:

1. Solvent socket weld except where connection to flanges or where threaded valves and equipment may require future disassembly. Joining shall be provided per ASTM D2855.

2. Flanges: One-piece, molded hub type PVC flat face flange in accordance with Fittings above, ASME B16.1, Class 125 drilling

    a. Flat Face Mating Flange and In Corrosive Areas: ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

    b. Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts, ASTM A563 Grade A heavy hex head nuts and ASTM F436 hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

3. Gaskets:

    a. Flat Face Mating Flange: Full faced 1/8 inch-thick ethylene propylene (EPR) rubber.

    b. Raised Face Mating Flange: Flat ring 1/8 inch ethylene propylene (EPR) rubber with filler gasket between optical density (OD) of raised face and flange OD to protect the flange from bolting moment.

E. Solvent Cement: Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds requirements of ASTM F656, chemically resistant to the fluid service, and as recommended by pipe and fitting manufacturer. Solvent weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service, IPS Weld-On 724 or approved equal.

2.5 HIGH-PRESSURE BRAIDED PVC TUBING (PVC TUBING)

A. Material:

1. Clear, Flexible Polyvinyl Chloride (PVC) with Polyester Internal Braided Reinforcement with Durometer hardness of 70-80 (Shore A)

B. Tubing: Inside diameter to be the nominal diameter as shown on the Drawings. Transition to other piping materials via barbed adapter with stainless steel worm clamp. Barbed adapter material shall be selected for compatibility with the process service.

1. Metallic barbed adapters are not acceptable for use with Sodium Hypochlorite service.

2.6 STAINLESS STEEL PIPE

A. General

1. Pipe materials, connections, and installation shall meet all of the requirements described within the pipe schedule located in the drawings.

B. Material

1. ASTM A778, type 304 seamless, pickled and passivated, schedule as shown on drawings.

C. Fittings and Joints

1. 1-1/2-inches and smaller: Threaded. Forged 1,000 CWP minimum, ASTM A182/A182M, grade F304 or cast Class 150, ASTM A351/A351m, Grad CF8/304.

2.7 ACKFLOW PREVENTERS

A. Manufacturers:

1. Nibco.
2. Watts.

B. Double Check Valve Backflow Preventer Assemblies:

1. Size: 1/2-inch to 3 inches.

2. Comply with AWWA C510.

3. Materials:

a. Body: Bronze.
b. Internal Parts: Corrosion resistant.
c. Springs: Stainless steel.

4. Check Valves:

a. Quantity: Two, operating independently.
b. Intermediate atmospheric vent.

5. Ball Valves:

a. Type: Full port, resilient seated.
b. Quantity: Two.
c. Operation: Quarter turn.
d. Material: Bronze.

6. Accessories: Strainer and test cocks.

C. Double Check Valve Backflow Preventer Assemblies:

1. Size: 2-1/2 inches to 10 inches.

2. Comply with AWWA C510.

3. Materials:

a. Heavy-duty cast iron.
b. Finish: Fusion epoxy coating inside and outside.
c. Springs: Stainless steel.

4. Check Valves:

a. Quantity: Two, operating independently.

5. Gate Valves:

    a. Type: Resilient seated according to AWWA C509.
    b. Quantity: Two.
    c. Operation: Non-rising stem.

6. Accessories: Strainer.

2.8 PIPE SUPPORTS

A. Floor Support for Pipe:

1. Flanged Pipe Support:

    a. Construction:

        1) Adjustable vertical pipe support, flange plate, extension pipe from base cup to top collar cup with threaded stud.

        2) Bolts directly to flange.

        3) Anchorable base plate.

    b. Material: Steel, comply with ASTM A36.

    c. Finish: Corrosion resistant, electro-galvanized, or prime coated.

    d. Manufacturers:

        1) Standon - Model S89.

2. Cradle Pipe Support:

    a. Construction:

        1) Adjustable vertical pipe support with saddle strap, extension pipe from base cup to top collar cup with threaded stud.

        2) Anchorable base plate.

    b. Material: Steel, comply with ASTM A36.

    c. Finish: Corrosion resistant, electro-galvanized, or prime coated.

    d. Manufacturers:

        1) Standon - Model S92.

2.9 PIPE PENETRATIONS

A. Sleeves for Pipes through Walls and Floors:

1. Material: Galvanized steel.

2. Thickness: Schedule 40.

3. Inside surface of all wall sleeves shall be coated with coal-tar.

4. Annular space between penetrating pipe and wall sleeve shall be filled with an approved permanently flexible sealant.

5. Diameter of wall sleeve shall be as shown in the Drawings.

B. Mechanical Sleeve Seals:

1. Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2. Manufacturer: Link-Seal or approved equal.

C. Pipes Cast-In Walls and Floors:

1. Material: Ductile iron or steel pipe, as required by the Drawings and the intended service.
2. Diameter: As shown in the Drawings.
3. End Type: As shown in the Drawings.

D. Seep Rings:

1. Material: 3/8-inch thick steel plate conforming to ASTM A36, unless otherwise noted.

2. Inside diameter: Equal to the outside diameter of the pipe or sleeve to which it is attached plus 1/4-inch.

3. Outside diameter: As shown in the Drawings.

4. Attach to the pipe or sleeve by means of a continuous seal weld located on both sides of the ring.

2.10 PIPE COATINGS

A. See Section 09 90 00, Painting and Coating.

2.11 PIPE INSULATION

A. General:

1. Pipe Insulation shall be installed for exterior piping, or as shown on the Drawings.

2. Tubular, continuous with minimum butt joints.

3. Complying with ASTM C534, Type I.

4. For use in Interior/Exterior Locations.

5. Thermal Conductivity: 0.27 Btu-in./h.-ft^2-°F at 75 °F.

6. Operating Temperature Range: -70 to 180 °F.

7. Insulation for fittings shall be single or multi-piece fabrication matching the material of the adjoining pipe insulation

B. Material:

1. Flexible, closed-cell elastomeric.
2. Thickness: 1-inch Minimum.

3. Jacketing:

a. Aluminum with protective liner, complying with ASTM B209, 0.016-inch thickness Minimum.

C. Manufacturers and Products:

1. Armacell, ArmaFlex.
2. Or Equal.

2.12 HEAT TRACING

A. General:

1. Self-regulating, low-temperature heating cable, with varied output to maintain set temperature of the heating surface (pipe or vessel). Heat tracing shall be able to be cut in the field.

2. Heat tracing shall be designed to provide heating to plastic and metallic pipes.

3. Minimum Startup Temperature: 0°F

4. Setpoint Temperature: 50°F

5. Power Supply: 120 VAC

6. Output: 5 W/ft

B. Material:

1. Cable: two (2) 16 AWG minimum nickel-plated copper bus wires within a polymeric core, polyolefin jacket, copper braid, and protective outer jacket.

2. Protective Tape: aluminum, for use on plastic pipe and vessels.

3. Control: Single point, UL listed microprocessor based temperature control, monitoring and power distribution system within NEMA 4X enclosure.

C. Manufacturers and Products

1. Chromalox, SRL
2. OR Equal

2.13 IDENTIFICATION LABELS

A. Pipe Labels (Type 1)

1. Labels: Self-Adhesive tape, with separate directional flow arrows.

2. Material: Pressure-sensitive vinyl.

3. Letters and Arrows: Colors as shown on the Pipe Schedule on the Drawings.

4. Color Field and Letter Height per ASME A13.1

5. Message: Process Piping Service as shown on the Pipe Schedule on the Drawings.

6. Manufacturer and Products:

a. Brady Signmark, B946 Self-sticking Vinyl Pipe Markers and Vinyl Arrows.
b. Seton Identification Products, Opti-code Markers and Directional Arrows.

B. Pipe Labels (Type 2)

1. Snap-on, reversible type with lettering and directional arrows, sized for outside diameter of pipe insulation.

2. Provided with ties or straps for pipes of 6-inches in diameter and over.

3. Designed to firmly grip pipe so labels remain fixed in vertical pipe runs.

4. Material: Heavy-duty vinyl or polyester, suitable for exterior use, long lasting, and resistant to moisture, grease, and oils.

5. Letters and Arrows: Colors as shown on the Pipe Schedule on the Drawings.

6. Color Field and Letter Height per ASME A13.1

7. Message: Process Piping Service as shown on the Pipe Schedule on the Drawings.

8. Manufacturer and Products:

a. Brady Signmark, B915 Brady Snap-on and Stap-on Pipe Markers.
b. Seton Identification Products, Ultra-mark Pipe Markers.

PART 3 EXECUTION

3.1 GENERAL

A. Furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill, and encasement, to provide a functional installation.

B. Pipe shall be installed in accordance with good trade practice. The methods employed in handling and placing of pipe, fittings, and equipment shall be such as to insure that after installation and testing they are in good condition. Should damage occur to the pipe, fitting or equipment, repairs satisfactory to the Engineer shall be made.

3.2 INSTALLATION

A. Buried Piping Systems:

1. Establish elevations of buried piping with not less than 3 feet of cover.

2. Remove scale and dirt from inside of piping before assembly, as may be required.

3. Excavate pipe trench as specified in Section 31 23 17, Trenching.

4. Install pipe to accurate lines, elevations, and grades as shown on the Drawings.

5. Where grades are not shown, pipe shall be laid to grade between control elevations shown on the Drawings.

6. Place bedding material at trench bottom to provide uniform bedding for piping.

7. Level bedding material in one continuous layer not exceeding 6 inches compacted depth.

8. Install pipe on prepared bedding.

9. Route pipe in straight line.

10. Install pipe to allow for expansion and contraction without stressing of pipe or joints.

11. Install shutoff and drain valves at locations as indicated on Drawings and as specified in this Section.

12. Pipe Cover and Backfilling:

    a. Backfill trench as specified in Section 31 23 17, Trenching.

13. All buried non-ferrous piping shall be installed with detectable tracer tape.

    a. Tape shall be buried 12 inches above the top of the pipe or as recommended by manufacturer.

    b. Tape shall be continuous and labeled the same as the piping system.

B. Interior Piping Systems:

1. Install non-conducting dielectric connections wherever joining dissimilar metals.

2. Establish elevations of buried piping outside valve vault to obtain not less than 3 feet of cover.

3. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting as specified in Section 09 90 00, Painting and Coating.

4. Install water piping according to ASME B31.9.

5. Install unions downstream of valves and at equipment or apparatus connections.

6. Install brass male adapters each side of valves in copper piped system, solder adapters to pipe.

C. Backflow Preventer Assemblies:

1. Install backflow preventers of type, size, and capacity indicated.
2. Comply with applicable code and authority having jurisdiction.
3. Install airgap fitting on units with atmospheric vent connection.
4. Pipe relief outlet drain to nearest floor drain.
5. Do not install bypasses around backflow preventers.

D. Pipe Supports and Hangers

1. Install pipe supports according to MSS SP-58 & ASME B31.10.

2. All pipe shall be secured in place by use of blocking, hangers, brackets, clamps or other approved methods, and the weight thereof shall be carried independently of pump casings or equipment.

3. Special hangers and supports are shown on the Drawings.

4. The Contractor shall be responsible for determining the location of and providing all additional supports.

5. Hanger supports shall be as noted below with at least one support adjacent to the joint for each length of pipe, at each change in direction and at each branch connection. Sufficient hangers shall be provided to maintain proper slope without sagging. Support spacing shall not exceed manufacturer's recommendations, nor as listed in the following table.

Pipe	Maximum SupportSpacing (Feet)
Steel Pipe	
Under 3 inches	6
3 inches and Over	12
Cast or Ductile Iron	
Under 4 inches	6
4 inches and Over	12
Stainless Steel and Galvanized Iron	
Under 1-1/2 inches	4
1-1/2 inches to 4 inches	6
Over 4 inches	12
Copper Pipe	6
PVC Pipe	
Under 2-1/2 inches	4
2-1/2 inches and Over	6

6. Spacing of clamps for support of vertical piping shall be close enough to keep the pipe in alignment as well as to support the weight of the piping and contents unless other vertical support is shown, but in no case shall be more than 12 feet.

7. Provide adjustable hangers for all pipes, complete with adjusters, swivels, rods, etc. Size hangers to clear insulation and guide where required, as well as support piping. All rigid hangers shall provide a means of vertical adjustment after erection. Hanger rods shall be machine threaded. Continuous threaded rods will not be allowed.

8. Clevis or band-type hangers (B-Line FIG B3100) or approved equal shall be provided as required. Strap hangers not permitted.

9. Provide floor stands, wall bracing, concrete piers, etc., for all lines running near the floors or near walls and which cannot be properly supported or suspended by the walls or floors. Pipelines near concrete or masonry walls may also be hung by hangers carried from wall brackets at a higher level than pipe. Hanging of any pipe from another is prohibited.

10. Equipment shall be positioned and aligned so that no strain shall be induced within the equipment during or subsequent to the installation of pipework.

11. When temporary supports are used, they shall be sufficiently rigid to prevent any shifting or distortion of the piping or related work.

E. Pipe Penetrations:

1. Exterior Watertight Entries: Seal with mechanical sleeve seals or grout, as shown in the Drawings.

2. Whenever a pipeline of any material terminates at or through a structural wall or floor, install piping or sleeve in advance of pouring of concrete required for the particular installation.

3. Plastic pipe shall not be cast in concrete or masonry walls.

4. Set sleeves in position in forms and provide reinforcing around sleeves.

5. Size sleeves large enough to allow for movement due to expansion and contraction and provide for continuous insulation wrapping.

6. Extend sleeves through floors 1-inch above finished floor level and caulk sleeves.

7. Pipe other than concrete, to be cast in water-bearing walls or more than 4 feet below grade shall have seep rings.

8. All buried piping entering structures shall have a flexible connection installed less than 2 feet outside the structure line or as close to the wall as practical.

F. Insulation:

1. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

2. Fire-Rated Penetrations:

    a. Continue insulation through penetrations of building assemblies or portions of assemblies having fire-resistance rating of one hour or less.

    b. Provide intumescent firestopping when continuing insulation through assembly.

    c. Finish at supports, protrusions, and interruptions.

3. Closed-Cell Elastomeric Insulation:

    a. Push insulation onto piping.
    b. Miter joints at elbows.
    c. Seal seams and butt joints with Manufacturer's recommended adhesive.
    d. If application requires multiple layers, apply with staggered joints.

4. Insulated and Heat Traced Piping Exterior to Building:

    a. Size insulation large enough to enclose pipe and heat tracing.

    b. Install heat tracing per manufacturers recommendations.

    c. Provide vapor-retarder jacket.

    d. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass-mesh-reinforced, vapor-retarder cement.

    e. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping, with overlap facing down to shed water, or on bottom side of horizontal piping.

    f. Provide necessary pipe identification on the insulated piping system as specified herein.

3.3 IDENTIFICATIONS LABELS

A. Pipe Labels:

1. Each new exposed pipeline (or tubing) greater than 5/8-inch outside diameter shall be labeled with the name of the fluid contained in the piping and alongside this text and arrow shall be placed indicating the direction of the flow of the fluid. Piping that is insulated shall have marked placed on the outside of the insulation. If a piping service is not listed, the Engineer shall provide text as part of the submittal review process. Place pipe markers and arrows so that they are readily visible from adjoining walkways and operating positions.

2. A pipe marker and flow direction arrow shall be applied to each exposed pipeline

    a. On each side of interior walls, floors, and ceiling the pipe penetrates.

    b. At a maximum of 50 feet on center on long runs; no less than two labels to identify the start and end of a pipe.

    c. At each intersection and branching of the piping.

d. At each tank fill, tank overflow, tank or piping drain, and tank or piping connection point.

e. At each control and pressure relief valve.

f. At each piece of equipment connected to piping.

g. At intervals along piping with changes in direction not greater than 5 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.

h. At exposed piping not normally in view, such as above suspended ceiling and in closets and cabinets.

i. Locate at connects to equipment, valves.

3. An arrow marker indicating the direction of flow shall also be placed next to each isolation or check valve, pressure relief valve, and flow meter. For some pipelines, flow may be possible in either direction and shall be so marked.

4. After the initial installation of pipe markers and flow arrows, provide 100 additional custom pipe identification markers with text up to 25 characters ranging in widths from 1 inch to 6 inches. Provide 2 additional 108 feet long rolls of 2-inch-wide arrow tape. Apply pipe identification markers and flow direction arrow tape at the facilities where directed by the Engineer.

   a. Use Type 1 (Adhesive) labels for pipes larger than 6 inches in diameter.
   b. Use Type 2 (Snap-on) labels for pipes 6 inches in diameter and smaller.
   c. Apply to pipe after painting in vicinity is complete, or as approved by Engineer.
   d. Install in accordance with manufacturer's instructions.

3.4 CLEANING, TESTING, AND DISINFECTION

A. Testing and Disinfection: Piping shall be hydrostatically tested, flushed, and disinfected as specified in Section 33 13 00, Testing and Disinfecting of Water Utility Piping.

END OF SECTION

SECTION 40 05 51 – COMMON REQUIREMENTS FOR PROCESS VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes basic materials and methods related to valves used for the process systems.

B. Section Includes:

1. Valves.
2. Valve actuators.

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

B. ASTM International (ASTM):

1. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Contractor shall be solely responsible to coordinate Work of this Section with piping, equipment, and appurtenances.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit Manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.

2. Submit valve cavitation limits.

3. Submit Manufacturer data for actuator with model number and size indicated.

C. Shop Drawings:

1. Provide Shop Drawings for actuated valves.

2. Submit description of proposed installation, including associated wiring diagrams and electrical data as may be specified elsewhere in the contract documents.

3. Provide assembly drawings indicating parts list, materials, sizes, position indicators, limit switches, control system, actuator mounting, wiring diagrams, and control system schematics.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit installation instructions and special requirements, including storage and handling procedures.

F. Lining and coating data.

G. Valve Labeling Schedule: Indicate valve locations and nametag text.

H. Certification of Valves Larger than 12 inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

I. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

J. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, including factory-applied coatings.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and actuators.
B. Operation and Maintenance Data: Submit information for valves.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of Manufacturer's recommended spare parts.

B. Tools:

1. Furnish special wrenches and other devices required for Owner to maintain equipment.
2. Furnish compatible and appropriately labeled toolbox when requested by Owner.

1.7 QUALITY ASSURANCE

A. Cast Manufacturer's name, pressure rating, size of valve, and year of fabrication into valve body.

B. Valve Testing: Each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

C. Certification: Prior to shipment, submit for all valves over 12 inches in diameter, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc. Valves tested and supplied shall be trackable and traceable by serial number, tagged or otherwise noted on valve, upon arrival to Site.

D. Maintain clearances as indicated on Drawings and Shop Drawings.

E. Unless otherwise noted, all water works materials provided for the Project shall be new, of first-class quality and shall be made by reputable manufacturers.

F. All material of a like kind shall be provided from a single manufacturer, unless otherwise approved by the Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

B. Store materials according to Manufacturer instructions.

1. Store materials in areas protected from weather, moisture, or other potential damage.
2. Do not store materials directly on ground.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.

3. Provide additional protection according to Manufacturer instructions.

D. Handle products carefully to prevent damage to interior or exterior surfaces.

E. All defective or damaged materials shall be replaced with new materials at no cost to the Owner.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

B. Abbreviations:

1. Cold Working Pressure (CWP).
2. Steam Working Pressure (SWP or WSP).
3. Water Oil Gas (WOG).

2.2 VALVES

A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required and shown in the Drawings.

B. Valve Construction:

1. Bodies: Rated for maximum temperature and pressure to which valve will be subjected as specified in valve Sections or as shown on the Drawings.

C. Connecting Nuts and Bolts: Stainless steel.

D. Manual Actuators:

1. All valves shall be furnished with manual actuators, unless otherwise indicated in the Drawings.

2. Operation:

a. Open by turning counterclockwise; close by turning clockwise.

b. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

3. Provide actuators with position indicators for shutoff valves 6 inches and larger.

4. Chain Actuator:

a. Manually actuated valves mounted with a centerline elevation over 6 feet above finished floor level shall be furnished with chain lever or chain wheel operators in lieu of lever, or handwheels, respectively.

b. Chain guides and stainless steel operating chain shall extend to 4-1/2 feet above finished floor level.

c. Chain Wheels: Sprocket-rim type.

d. Furnish chain storage if chains may interfere with pedestrian traffic.

2.3 PLASTIC BUTTERFLY VALVES

A. General:

1. Resilient seated with integral flange seals.
2. Rated to 150 psi working pressure.
3. Travel stops on the interior of the valve's body is not permitted.
4. Valves for use with actuators shall have an integra ISO mounting pad.

B. Material:

1. Body: PVDF.

2. Disc: PVDF.

3. Resilient Seat: EPDM.

4. Shaft Seals: O-ring of the same material as the Resilient Seat.

5. Shaft/Stem: 316 Stainless Steel.

6. Operator: As shown on the Drawings.

a. Electric motor actuators for motor operated ball valves shall be reversable, 120VAC, 60hz single-phase, two single-pole double throw switches within NEMA Type 4X enclosure and come equipped with declutchable manual override. Series 94, Asahi/America, or equal.

7. End-Type: Lugged conforming to ASME/ANSI B16.1 Class 125, including lug inserts.

C. Manufacturers and Products:

1. Asahi/America, Type 57.
2. Spears Manufacturing.
3. Or Equal.

2.4 BRASS BALL VALVES

A. General:

1. Two-Piece Design.
2. Blow-out proof stem.
3. Adjustable packing gland.
4. 600-psi rated WOG up to 2-inch diameter, 400-psi rated WOG up to 4-inch diameter.
5. 150 psi rated SWP.
6. Valves in accordance with NSF/ANSI 61 and NSF 372.

B. Material:

1. Body: Bronze or brass.
2. Ball: Hard Chrome-Plated solid bronze or brass.
3. Stem: bronze or brass.
4. Stem packing: PTFE or RPTFE.
5. Seat: PTFE or RPTFE.
6. Operator: Zinc-coated steel with vinyl grip lever.
7. End Type: FNPT or as shown in the Drawings.
8. Port: Full.

C. Manufacturers and Products:

1. Apollo, 77 Series.
2. Bray Controls, Series S51.
3. Watts, Series LFFBV-3C-M1.
4. Or Equal.

2.5 STAINLESS STEEL BALL VALVES

A. General:

1. Two-Piece Design.
2. Blow-out proof stem.
3. Adjustable packing gland.
4. 1000-psi rated CWP up to 3-inch diameter.
5. 150 psi rated SWP.
6. In accordance with NSF/ANSI 61 and NSF 372.
7. Air Equipment rated ball valves shall be equipped with locking handles and safety vent to purge downstream air pressure in the closed position.

B. Material:

1. Body: 316 Stainless Steel.
2. Ball: 316 Stainless Steel.
3. Stem: 316 Stainless Steel.
4. Stem packing: PTFE.
5. Seat: RPTFE.
6. Operator: Stainless Steel with vinyl grip lever.
7. End Type: FNPT or as shown in the Drawings.
8. Port: Full.

C. Manufacturers and Products:

1. Apollo, 76F-100-A Series.
2. Bray Controls, Series 80.

3. Watts, Series S-FBV-1.
4. Or Equal.

2.6 PLASTIC BALL VALVES

A. General:

1. Valves shall be Schedule 80, rated to 150 psi working pressure.

2. Full-port double union design.

3. Blow-out proof stem.

4. Ball valves for chemical solutions that produce off-gas, such as sodium hypochlorite, shall be provided with vented balls with pressure relief hole drilled on low pressure side by the ball valve manufacturer.

5. Valves for use with actuators shall have an integra ISO mounting pad.

6. In accordance with NSF/ANSI 61 and NSF 372.

B. Material:

1. Body/Ball/Stem: PVC.

2. Seat: PTFE.

3. O-Ring: FKM.

4. Operator: Lever

5. End Type: Socket, Threaded, Flanged as shown on the Drawings.

a. Flanged valves shall conform to ASME/ANSI B16.5, Class 150.

C. Manufacturers and Products:

1. Asahi/America, T-21 Series
2. Nibco, 45TB Series
3. Spears Manufacturing
4. Or Equal

2.7 3-WAY VALVE

A. General:

1. Non-lubricated, resilient seated one-piece tapered plug.
2. Valve shall have a double-wheel actuator for drip tight shut off.
3. Valves shall be rated to 125 psi.
4. 3-Way plug shall be single-type design, with full rotation available without travel stops.

B. Material:

1. Body/Cover: Cast Iron ASTM A126 Class B.
2. Plug: Cast Iron ASTM A126 Class B or Ductile Iron ASTM 536 Grade 65-45-12.
3. Plug Coating: NBR.
4. Bearings: 316 stainless steel.
5. Packing/Stem Seal: V-Type or U-Type NBR.
6. Coating: Fusion-Bonded Epoxy per AWWA C550.
7. End Type: Flanged, conforming to ASME/ANSI B16.5, Class 150.

C. Manufacturers and Products:

1. DeZurik, PTF Series.
2. Or Equal.

2.8 SOLENOID VALVES

A. General:

1. Two-way internal pilot operated, resilient seat for air or water, solenoid coil molded epoxy, NEMA insulation Class F, 120 volts AC, 60 Hz, unless otherwise indicated.

2. Solenoid enclosure NEMA 250, Type 4 unless otherwise indicated.

3. Normal position (when de-energized) as indicated on the Drawings.

4. Valves shall be rated to 125 psi working pressure.

5. In accordance with NSF/ANSI 61 and NSF 372.

B. Materials:

1. Body: Brass
2. Diaphragm: NBR
3. End Type: FNPT

C. Manufacturers and Products:

1. ASCO.
2. Or Equal.

2.9 PRESSURE RELIEF VALVES

A. General:

1. Direct-acting diaphragm, spring controlled, pressure relief valve, rated to 150 psi.
2. No metallic wetted parts.
3. Pressure setpoint shall be continuously adjustable from 10 to 100 psi.
4. Pattern shall be as shown on the Drawings.
5. In accordance with NSF/ANSI 61 and NSF 372.

B. Material:

1. Body: PVC.
2. Shaft: PTFE.
3. Seals: EPDM.
4. Adjusting Nut/Fasteners: Stainless Steel.
5. Control Spring: Coated Steel or Stainless Steel.
6. End Type: FNPT.

C. Manufacturers and Products:

1. Plast-O-Matic, Series RVT
2. Griffco, Back Pressure Valve
3. Primary Fluid Systems, TOP Valve
4. Or Equal.

2.10 PLASTIC CHECK VALVES

A. General:

1. Valves shall be rated to 100 psi working pressure.

2. Valves shall be solid thermoplastic construction. Sizes 1/2 inch through 2 inch shall be true union design. Sizes 3-inch and greater shall be single union design.

3. In accordance with NSF/ANSI 61 and NSF 372.

B. Material:

1. Body/Ball: PVC.
2. Seat/O-Ring: EPDM.
3. End Type: As Shown on the Drawings.

C. Manufacturers and Products:

1. Asahi/America, True Union/Single Union Ball Check Valves.
2. Spears Manufacturing, True Union Ball Check Valves.
3. Or Equal.

2.11 SOURCE QUALITY CONTROL

A. Testing: Test valves according to Manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping system is ready for valve installation.

3.2 PREPARATION

A. Access: All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

B. Valve Accessories: Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the Contractor to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

3.3 INSTALLATION

A. Install valves, actuators, extensions, and accessories according to Manufacturer instructions.

B. Firmly support valves to avoid undue stresses on piping.

C. Coat studs, bolts, and nuts with anti-seizing lubricant.

D. Clean field welds of slag and splatter to provide a smooth surface.

E. Install valves with stems upright or horizontal, not inverted.

F. Install valves with clearance for installation of insulation and allowing access.

G. Provide access where valves and fittings are not accessible.

H. Comply with Division 40 - Process Interconnections for piping materials applying to various system types.

I. Valve Applications:

1. Install shutoff and drain valves at locations as indicated on Drawings and as specified in this Section.

2. Install shutoff and isolation valves.

3. Isolate equipment, part of systems, or vertical risers as indicated on Drawings.

4. Install valves for throttling, bypass, or manual flow control services as indicated on Drawings.

J. Disinfection of Water Piping System:

1. Flush and disinfect system as specified in Section 33 13 00, Testing and Disinfection of Water Utility Piping.

3.4 FIELD QUALITY CONTROL

A. Valve Field Testing:

1. Test for proper alignment.

2. If specified by valve Section, field test equipment to demonstrate operation without undue leakage, noise, vibration, or overheating.

3. Engineer will witness field testing.

END OF SECTION

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SECTION 40 05 51.15 - GATE VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes gate valves for use in buried service. Coordinate with Section 33 12 16, Water Utility Distribution and Transmission Valves and Section 40 05 13.19, Stainless Steel Process Piping.

B. Section Includes:

1. Resilient-seated gate valves.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.
3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
4. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASTM International (ASTM):

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
3. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Water Works Association (AWWA):

1. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
2. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.

D. NSF International (NSF):

1. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects
2. NSF/ANSI Standard 372 - Drinking Water System Components - Lead Content

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. As required by Section 33 12 16, Water Utility Distribution and Transmission Valves and/or Section 40 05 51, Common Requirements Results for Process Valves.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 RESILIENT-SEATED GATE VALVES

A. Description:

1. Comply with AWWA C509.

2. Minimum Pressure Rating: 150 psig.

3. End Connections: As shown in the Drawings.

a. Standard mechanical joint ends comply with ANSI/AWWA C111.

b. Flanged end dimensions and drilling comply with ANSI/ASME B16.1, class 125. Comply with AWWA C115 & ASME 16.5.

1) The Contractor shall coordinate with pipe, valve, and fitting suppliers to make certain pipe, valve, and fitting flanges match in bolt pattern.

4. Gear Actuators: Conforming to AWWA C509 for manual valves.

5. Linings and Coatings:

a. Corrosion-resistant fusion bonded epoxy conforming to AWWA C550 and NSF 61.
b. All internal and external ferrous surfaces.
c. Do not coat flange faces of valves.

6. Bi-directional flow.

B. Operation:

1. Non-rising stem.

2. Open counterclockwise when viewing the valve from above, unless otherwise indicated in the Drawings.

3. Buried Valves: All buried valves shall be provided with 2-inch square operating nuts.

4. In-Plant Service Valves: Valves for in-plant or exposed service shall be furnished with handwheel operators, unless otherwise specified in Section 40 05 51, Common Requirements Results for Process Valves.

C. Materials:

1. Wedge:

a. ASTM A126, cast iron or ASTM A536, ductile iron.
b. Fully encapsulated with molded rubber.

2. Body and Bonnet:

a. ASTM A126, cast iron or ASTM A536, ductile iron.

3. Stem, Stem Nuts, Glands, and Bushings: ASTM B584, bronze.

4. Valve Body Bolting: Stainless steel.

D. Manufacturers:

1. Clow Valve Company.
2. M&H Valve.
3. U.S. Pipe.
4. American Flow Control.
5. Mueller Company.
6. AVK Group
7. East Jordan

2.3 SOURCE QUALITY CONTROL

A. Testing: Test gate valves according to AWWA C509.

PART 3 EXECUTION

3.1 INSTALLATION

A. As required by Section 33 12 16, Water Utility Distribution and Transmission Valves and/or Section 40 05 51, Common Requirements Results for Process Valves.

B. Install according to Manufacturer's instructions.

C. Support valves in plastic piping to prevent undue stresses on piping.

END OF SECTION

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SECTION 43 05 10 - COMMON WORK RESULTS FOR GAS HANDLING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Work under this section includes furnishing, installation, start-up, testing and training for new completely installed, field assembled compressed air systems.

The compressed air system shall supply service air for the chemical fill station.

B. Equipment to be furnished and installed includes:

1. Self-contained compressor package, consisting of duplex receiver mounted compressor(s), horizontal receiver, refrigerant type air dryer, filter, automatic drain traps, and controls;
2. Motor starter and controls, shipped loose for field installation.
3. Pressure relief valves.
4. Pressure regulators.
5. Check, isolation, and solenoid valves.
6. Drain valves.
7. Air piping.
8. Pressure indicators and pressure switches.
9. Ancillary equipment as specified herein and shown in the drawings as required for a complete and functional compressed air system.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:

1. ASME Boiler and Pressure Vessel Code (BPVC), Section IX - Welding, Brazing, and Fusing Qualifications: Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.
2. ASME Boiler and Pressure Vessel Code (BPVC), Section VIII – Rules for Construction of Pressure Vessels Division 1
3. ASME PTC 9 – Displacement Compressors, Vacuum Pumps and Blowers
4. ASME PTC 25 - Pressure Relief Devices: Performance Test Codes.

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS QC1 - Standard for AWS Certification of Welding Inspectors.

C. Occupational Safety and Health Administration (OSHA):

1. 29 CFR 1910 - Occupational Safety and Health Standards.

1.3 COORDINATION

A. Coordinate Work of this Section with location and placement of utilities and piping.

1.4 SUBMITTALS

A. As specified in Section 01 33 00, Submittal Procedures.

B. Product Data:

1. Submit characteristic curves, schematics, diagrams, panel layouts, ladder diagrams, and sequences of operation.

2. Submit a wiring diagram of field connections, with identification of terminations between local control panels, junction terminal boxes, and equipment items.

3. Air Receivers: Submit Manufacturer's recommended procedures for cleaning and coating.

C. Shop Drawings:

1. Indicate assembly, foundation, and installation with location, including critical dimensions, sizes, and support locations.

2. Furnish installation drawings, including shaft size, seal, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

3. Anchorage as recommended by the manufacturer shall be furnished and installed. Anchorage design by a licensed structural engineer in the state of Oregon shall be submitted prior to furnishing.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Source Quality-Control Submittals: Indicate results of shop tests and inspections. These tests shall be at a minimum:

1. Visual inspection of all equipment.
2. Start-up and testing of compressor.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statements:

1. Submit qualifications for Manufacturer and installer.
2. Submit Manufacturer's approval of installer.
3. Welder Certificates: Submit welder certification in accordance with ASME BPVC-IX.
4. Submit qualifications of certified welding inspector.

H. Maintenance Material Submittals

1. As specified in Section 01 78 23, Operation and Maintenance Data.

2. Spare Parts:

a. Furnish one set of Manufacturer's recommended spare parts.
b. Furnish special wrenches and other devices required for Owner to maintain and calibrate.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by Manufacturer.

C. Welders: ASME qualified within previous 12 months for employed weld types.

D. Welding Inspector: According to AWS QC1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

B. Store materials according to Manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide additional protection according to Manufacturer instructions.

1.7 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.8 WARRANTY

A. A single warranty shall cover all components and assembly of the compressed air system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Quincy Compressor
B. Or equal.

2.2 AIR COMPRESSOR PACKAGE

A. Packaged air compressor shall be furnished as a complete and assembled packaged unit. Air compressor package shall include the following:

1. Rotary compressor
2. Motor
3. Drive assembly
4. Integrally mounted starter panel
5. Two air filters (Quincy QWS 35 and QMF 32, or equal)
6. Compressor control system
7. Lubrication system
8. Oil and water separator system
9. Integral compressed air receiver
10. Vibration isolators

2.3 AIR COMPRESSORS

A. Rotary screw air compressor.

B. Belt driven compressor with high efficiency TEFC electric motor.

C. Mount close-coupled unit on steel base attached to receiver.

D. Equip with combination air intake filter silencer, discharge cushion chamber, and three additional intake filter cartridges.

E. Unit to include thermal overload protection, pressure switch with unloader, and check valve with unloader port.

F. Receiver:

1. In accordance with ASME BPVC-IX requirements.

2. Provide service valve, pressure gauge, safety valve, and condensate drain with automatic float-type trap.

G. Operation:

1. Performance Requirements:

a. Chemical Fill Station Compressed Air

1) Manufacturer: Quincy QGS-10 or equal.
2) Tank Capacity: 120 gallons.
3) Air Flow: 30 SCFM at 175 psig.
4) Power Supply: 460, three phase, 60-hz.
5) Maximum Compressed Air Discharge Temperature: 100 degrees F.
6) Maximum Sound Level: 65 dB(A) w/ low sound enclosure.
7) Air Filters: Quincy QWS 35 and QMF 32, or equal
8) Integrated Dryer: Yes.
9) Provide safety valve in discharge line when no receiver provided.

10) Provide pressure regulator at fill station sized for application.
11) Provide shutoff valve on compressor discharge.

2. Control Panels:

a. Control panel shall allow operation in manual start/stop or an automatic start/stop mode.

b. On/off and alarm pressure setpoints shall be individually operator selectable.

c. Control panel shall provide automatic restart following power failure.

d. Control panel shall include control input capability from a remote dry contact for remote enable/disable operation.

e. Control panel shall include dry contacts rated for 120V, 2 amps minimum for remote monitoring as follows:

1) One dry contact to indicate compressor running.
2) One dry contact for a common alarm for any warning/maintenance condition.
3) One dry contact for a common alarm for any fault/fail condition.

3. Controls: Unloaded start with enclosed diaphragm-type pressure switch automatically controlling start and stop.

4. Disconnect Switch: Factory mounted on equipment.

5. Compressors shall be rated by the manufacturer for continuous operation in an unattended location.

6. Stainless steel braided leader hose, or other approved and appropriate reinforced flexible connection, shall be provided between the compressor discharge and the air system piping.

2.4 AIR RECEIVER

A. Comply with ASME BPVC Section VIII, Division 1.

B. Furnish and install welded steel air receivers as shown on drawings. Receivers shall be suitable for a working pressure of 250 psig.

C. Provide gauge, and pressure safety relief valve.

D. Provide pressure indicators with pressure ranges.

E. Air receivers shall be equipped with automatic, pneumatically-controlled, no loss drain valves. Plumb to nearest floor drain.

2.5 PRESSURE RELIEF VALVES

A. Comply with ASME BPVC Section VIII, Division 1.

2.6 COMPRESSED AIR PIPING

A. All compressed air piping shall be schedule 80 stainless steel, grade 304, and sized as shown on plans.

B. Valves and fittings shall be Schedule 80 stainless steel, NPT threaded, and rated for compressed air service at 250 psig. Valves shall comply with Section 40 05 51 Common Requirements Results for Process Valves.

C. Drain: Drain piping for all required condensate drains shall be ¼" copper tubing constructed to drain to nearest floor drain.

2.7 MATERIALS

A. Fasteners:

1. High strength.
2. Stainless Steel.

2.8 SOURCE QUALITY CONTROL

A. Testing:

1. Compressors: Test according to ASME PTC 9.
2. Receivers: Air test to 1.5 times specified working pressure.
3. Relief Valves: Test according to ASME PTC 25.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that designated areas, clearances, structural requirements, piping, utility connections, and electronic signals are ready to receive equipment.

3.2 INSTALLATION

A. According to Manufacturer instructions.

B. Equipment Bases and Supports:

1. Provide housekeeping pads as shown in the Drawings.

2. Install anchor bolts and accessories for mounting and anchoring equipment.

3. Supports:

a. As shown in the Drawings.
b. Brace and fasten with flanges bolted to equipment structure.
c. Provide flexible connections as required to isolate equipment from piping.

C. Gauges:

1. Pressure Gauges: Provide at compressor discharge piping.

2. If subject to shock or vibrations, wall-mount gauges or attach gauges to galvanized channel floor stands and connect with flexible connectors.

D. Lubricants:

1. Provide necessary oil and grease for initial operation.

3.3 FIELD QUALITY CONTROL

A. Testing:

1. Test for proper alignment and freedom from binding, scraping, shaft runout, or other defects.

2. Test control system by operating hardware and process control logic under supervision of Manufacturer's representative.

3. Start up, inspect, and operate unit over its entire speed range.

4. If unit is driven by variable speed drive, test at 100-rpm increments; if unit is driven at constant speed, test at maximum rpm.

5. Confirm that bearings are not overheating.

B. Manufacturer Services: Furnish services of Manufacturer's representative experienced in installation of products furnished under this Section for not less than 3 days on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in maintenance of equipment.

C. Contractor shall schedule required Washington Department of Labor & Industries Boiler Inspections. Certification of inspection or approval shall be provided to Owner prior to placing air receivers into operation.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of Manufacturer's representative.

E. Furnish installation certificate from Equipment Manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

END OF SECTION

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SECTION 43 23 13.27 – CENTRIFUGAL PUMPS

1.1 SUMMARY

A. Section Includes:

1. Booster Pumps
2. Pressure Switch

1.2 REFERENCE STANDARDS

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. American Iron and Steel Institute:

1. AISI 1045 - Medium Carbon Steel.

C. ASME International:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

D. ASTM International:

1. ASTM A27/A27M - Standard Specification for Steel Castings, Carbon, for General Application.
2. ASTM A29/A29M - Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.
3. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
4. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
5. ASTM A536 - Standard Specification for Ductile Iron Castings.
6. ASTM B91 - Standard Specification for Magnesium-Alloy? Forgings.
7. ASTM B505/B505M - Standard Specification for Copper Alloy Continuous Castings.

E. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Product Data: Submit Manufacturer information, including installation instructions, accessories, performance curves with specified operating point plotted, capacities and

pressure differentials, power, rpm, sound power levels for both inlet and outlet at rated capacity, electrical characteristics, and connection requirements.

C. Shop Drawings:

1. Furnish diagrams showing complete layout of system, including equipment, piping, valves, wiring and ladder diagrams, controls, and control sequences.

2. Indicate size and configuration of assembly, mountings, weights, and accessory connections.

3. Indicate Manufacturer's specified displacement tolerances for vibration at operational speed as specified for pumps.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures, anchoring, and layout.

F. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Manufacturer Reports: Certify that equipment has been installed according to Manufacturer instructions.

I. Qualifications Statements:

1. Submit qualifications for Manufacturer and installer.

1.4 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

B. Store materials according to Manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide additional protection according to Manufacturer instructions.

1.6 WARRANTY

A. Furnish Manufacturer's warranty for pumps.

PART 2 PRODUCTS

2.1 HORIZONTAL END SUCTION PUMPS

A. Manufacturers: Grundfos, CMBE Twin Booster, 10-54 or equal

B. <5 hp, 200-240 V motors

C. Performance and Design Criteria for Packaged System (Twin Pumps):

1. Design Flow Rate: 50 gpm
2. Design Flow Total Dynamic Head: 85 ft
3. Minimum Efficiency at Design Flow Rate: 50 percent.
4. Minimum Flow Rate: 20 gpm.
5. Maximum Flow Rate: 140 gpm.
6. Net Positive Suction Head (NPSH) Available: 2 ft.
7. Service Liquid: water.
8. Specific Gravity: 1.0.
9. Liquid Temperature: 1 to 30 Centigrade

D. Package System:

1. Provide complete package system with pumps, pressure switch.
2. End Connections: 2-inch

PART 3 EXECUTION

3.1 INSTALLATION

A. According to Manufacturer instructions.

B. Provide and connect piping, power, and control conduit, and wiring to make system operational and ready for startup.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of Manufacturer's representative.

D. Furnish installation certificate from Equipment Manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.2 ADJUSTING

A. Check control functions and adjust as required.

3.3 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

END OF SECTION

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SECTION 43 40 02 - FIBERGLASS REINFORCED PLASTIC TANK

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section includes Fiberglass Reinforced Plastic (FRP) Tanks for storage of water treatment chemicals.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):

a. B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.
b. RTP-1, Reinforced Thermoset Plastic Corrosion Resistant Equipment.

2. ASTM International (ASTM):

a. C582, Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment.

b. D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

c. D2584, Standard Test Method for Ignition Loss of Cured Reinforced Resins.

d. D3299, Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks.

e. D4097, Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks.

f. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

3. Occupational Safety and Health Act (OSHA): Part 1910.24, Subpart D, Walking-Working Surfaces.

4. United States Pharmacopeia (USP)

1.3 DEFINITIONS

A. FRP: Fiberglass reinforced plastic.

1.4 DESIGN REQUIREMENTS

A. Design Loads: In accordance with Section 01 33 17, Structural Design, Support and Anchorage.

B. Tanks specified to be fabricated to ASME RTP-1 requirements shall be designed, fabricated, and code stamped. ASME RTP-1 shall be all inclusive for tanks so specified.

C. The User's Basic Requirements Specification (UBRS) for RTP-1 tanks is a part of this specification.

D. Design tank, including resin selection (unless specified), wall thickness, methods and locations of support, and stiffener requirements. Design shall be prepared and sealed by designer meeting requirements of Part 1.6, Quality Assurance.

1.5 SUBMITTALS

A. Action Submittals:

1. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

2. Shop Drawings:

a. Indicate complete plan, elevation, and sectional drawings showing critical dimensions, location and size of fittings and openings.

b. Fabricators catalog information, descriptive literature, specifications, and identification of materials of construction, including complete resin system information.

c. Letter from resin manufacturer stating that selected resin is suitable for intended service.

d. Tank data indicating equipment number, pressure rating, diameter, straight shell lengths, overall lengths, wall thickness, corrosion barrier thickness, and details of nozzle designs.

e. Tank capacity chart indicating gallons for each inches of depth and cumulative total from bottom.

f. Fabricator's detailed requirements for tank foundations.

g. Recommended bolt torque for bolted FRP connections.

h. Seismic anchorage and bracing drawings and cut sheets, as required by Section 01 33 17, Structural Design, Support and Anchorage

1) Tank pad dimensions shall be verified by the Contractor and manufacturer to confirm sufficient edge distance for seismic restraints and tie downs. Dimensions less than 4 inches from the outside of bolt to edge of concrete shall be brought to the attention of the Engineer.

3. Samples: Laminate sample representative of production quality of surface finish and visual imperfections.

4. Accessories:

a. Submit product information for tank accessories as shown in Drawings and specified herein, including but not limited to handrail details and access hatch details.

B. Informational Submittals:

1. Manufacturer's Certificate:

a. Certify that products meet or exceed specified requirements and applicable industry standards.

b. Submit certified list of tank installations storing same liquid and solids and concentrations, in service for period of not less than 10 years.

c. All tanks shall be constructed by a single firm that has at least 10 years prior experience in construction of fiberglass tanks for similar applications and comparable sizes. All tanks shall meet the requirements of ASME RTP-1.

d. Owner Installation Certificate: Obtain from tank manufacturer's representative and submit, attesting that tank has been properly installed and is ready for startup and testing.

2. Complete design calculations for tanks and supports

3. Certification to ASME RTP-1.

4. Quality Assurance Inspection:

a. Qualifications of Independent FRP Quality Assurance Inspector.
b. Initial QA Inspection Report.
c. Certification of Factory Testing.

5. Certification that access nozzles have been coordinated with actual equipment being furnished.

6. Special shipping, storage and protection, and handling instructions.

7. Fabricator's printed installation and tank support instructions.

8. Qualifications of Acoustic Emission Testing Agency.

1.6 QUALITY ASSURANCE

A. Fabricator's Quality Assurance Supervisor: Minimum of 5 years' experience in fabrication of fiberglass structures.

B. Designer: Registered professional engineer licensed in Oregon.

C. Independent FRP Quality Assurance Inspector:

1. Minimum 5 years' experience as FRP inspector.

2. Representing a corporately and financially independent organization that can function as an unbiased inspection authority.

3. Professionally independent of manufacturers, suppliers, and installers of systems being inspected.

D. Acoustic Emission Testing Agency: Minimum 5 years' experience in acoustic emission testing of fiberglass structures.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 10 years' experience in constructing tanks in similar size and aspect ratio as shown on Contract Drawings.

B. Manufacturer shall provide appropriate handling and installation instructions to the Contractor and certify the Contractor has been instructed as well as installation is acceptable, meeting all requirements to meet warranty standards.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Prepare and protect tank for shipment as follows:

1. Mount tank on padded cradles if shipped horizontally or on a suitable skid if shipped vertically.

2. Protect flanged nozzles with wooden blinds bolted to flange and having a diameter of 2 inches greater than outside diameter of flange.

3. Provide either rigid plugs inside ends to prevent deflection or wooden boxes for unflanged components. Brace open end of tank with suitable stiffening member to prevent deflection.

4. Do not ship components or other pieces loose inside tank.

5. Load tank with at least 2 inches of clearance between tank (including fittings) and bulkheads, or bed of vehicle.

6. Regardless of mode of transportation, firmly fasten and pad components to prevent shifting of load or flexing of components while in transit.

7. Inspection: Accept materials on site in manufacturer's original packaging and inspect for damage.

8. Store materials according to manufacturer's instructions.

9. Protection:

a. Protect materials from moisture and dust by storing in a clean, dry location remote from construction operations areas.

b. Provide additional protection according to manufacturer's instructions.

1.9 WARRANTY

A. The manufacturer shall warrant in writing that the equipment furnished is appropriate for the intended service and shall be free of manufacturing and fabrication defects in design, material, and workmanship for a period of seven (7) years after substantial completion overall project.

1.10 SEQUENCING AND SCHEDULING

A. Do not ship tank from factory until Engineer's review of Certification of Factory Testing is completed.

PART 2 PRODUCTS

2.1 SUPPLEMENTS

A. Some specific requirements relative to this section are attached as supplements at the end of section.

2.2 SERVICE CONDITIONS

A. Operating Pressure: Atmospheric.

2.3 MANUFACTURERS

A. Belco Manufacturing Company, Belton, Texas;
B. An-Cor Industrial Plastics, Inc., North Tonawanda, New York;
C. Plas-Tanks Industries, Inc., Hamilton, Ohio;
D. Or equal.

2.4 FRP TANKS

A. Contact-Molded: Fabricate in accordance with ASTM D3299-18, Grade 1.

B. Like items of materials, equipment shall be the end products of one manufacturer in order to provide standardization for appearance, operation, maintenance, spare parts and manufacturer's services.

C. Tanks shall be vertical type with flat bottom and dished top. Tank top shall be provided with non-slip finish.

D. Tanks shall be non-insulated suitable for outdoor installation.

E. There shall be no vertical joints (in axial direction) in the cylindrical shell. Joint overlays for secondary bonds in the cylindrical shell shall be for Type II laminates.

F. The entire thickness of the cylindrical shell (inner surface, interior layer, and exterior layer) shall be built up prior to removal of the shell from the mandrel.

G. The axial strength of the cylindrical shell shall be at least 25 percent of the hoop strength. Regardless of the theoretical design requirements, the minimum total laminate thickness of the tank shall NOT BE LESS THAN 3/8-IN WITHOUT EXCEPTION. The corrosion resistant layer shall not be counted as part of this thickness. The wall shall be a constant thickness over the entire straight side of the tank and not taper from top to bottom.

H. Dished top heads shall have a minimum thickness of 5/16-in. Flat bottoms shall have a minimum thickness as required by ASME RTP-1 but not less than 0.50-in., where the corrosion allowance in the flat bottom will also include an additional three layers of 1.5 ounce random

strand mat and this additional corrosion barrier material shall be shown in the laminate sequence provided on the shop drawings submitted for review.

I. Tanks shall be completely fabricated in the shop. No field assembly is permitted.

J. Design of FRP equipment for fabrication under these specifications shall be provided by the manufacturer. The design shall allow for the most severe combinations of conditions in accordance with ASME RTP-1 requirements. Design calculations will become part of each design package. Where applicable, calculations shall include but are not limited to the following considerations:

1. Internal pressure
2. External pressure
3. Design and upset temperatures
4. Thermal gradient
5. Static head
6. Accessory loads (handrails, mixers, valves, actuators, platforms, etc.)
7. Transportation and erection loads
8. Stiffener rings
9. Wind, seismic
10. Flange thickness
11. Secondary bond overlays
12. Unsupported span (pipe)
13. Hold-down flanges, lugs, or ring supports
14. Knuckle radius of bottom
15. Compressive loading
16. Therman expansion stresses
17. Internal supports
18. Live loads.

K. Resin:

1. Suitable for intended service.

2. Premium grade and corrosion resistant, such as chlorendic polyester, vinyl ester, or bisphenol A fumarate polyester.

3. Use same resin throughout entire tank shell.

4. Add clear ultraviolet absorbers to surfacing resin to improve weather resistance.

5. No dyes, pigments, or colorants, except in exterior gel coat.

6. No fillers or thixotropic agents.

7. Additives may be added to achieve fire retardancy. The Flame-Spread Rating of finish laminate shall be less than 25, as determined by ASTM E84. Additives shall not be added to interior layer, unless specifically required.

8. Curing System:

    a. As recommended by resin manufacturer or as specified herein.
    b. Cure products as specified in ASTM D3299-18.
    c. Measure Barcol hardness according to ASTM D2583.

9. Post-cure tank and appurtenances in accordance with resin manufacturer's recommendation for time and temperature. Post-curing should be completed with warm-to-hot dry air, free of combustion products. Hot spots shall be avoided.

10. For hypochlorite service, no MEKP cobalt catalyst system shall be allowed in liner. Cure liner with benzoyl peroxide-dimethyl aniline. Structural layer may be cured with either catalyst system.

L. Reinforcements:

1. Surfacing Veil for tanks: Resin rich (~90% resin) corrosion resistant surfacing layer comprised of 2 layers of 14 mil Neus 115-00005 non-apertured surfacing veil for a minimum thickness of 28 mils.

2. Surfacing Veil for brine tank: Chemical surfacing mat, two layers of polyester fabric, 12 mils to 16 mils thick, with a finish and a binder compatible with the lay-up resin.

3. Other Reinforcements: In accordance with ASTM D3299-18.

M. Laminate:

1. Consists of inner surface (corrosion barrier), interior layer, and exterior layer (structural layer).
2. Meet visual acceptance criteria in ASTM C582.
3. Meet requirements of mechanical properties in ASTM D3299-18.
4. Reinforce inner surface with resin-rich surfacing veil as specified herein.
5. Apply a color coat after inspection of laminate has been completed.

N. Marking:

1. Identify each tank with fabricator's name, capacity in gallons, maximum temperature, design pressure/vacuum, specific gravity, pH, resin, minimum thickness, tank number, tank name, and date of manufacture.

2. Provide permanent marking. Seal decals, labels, etc., into laminate exterior with clear resin.

3. Calibration Strips:

    a. Translucent, 6 inches wide.
    b. Calibration: Multiples of 100 gallons or less.
    c. Stencil gallonage in 2-inch-high numerals.

O. Nozzles:

1. Gusset 4-inch or smaller nozzles with conical or plate type gussets. Larger nozzles shall be gusseted, if noted.

2. Finish flush with inside surface of tank, unless otherwise indicated.

3. Gaskets:

   a. Provide two per nozzle, 1/8-inch-thick, full-face elastomeric material having a hardness of Shore A 60±5.

   b. Material shall be suitable for intended service.

4. Flanged Nozzles: Rated at 100 psi, with other dimensions and bolting corresponding to ASME B16.5 for 150-pound steel flanges.

5. Back face of flanges shall be spot-faced, flat and parallel to flange face of sufficient diameter to accept SAE metal washer under bolthead or nut.

P. Dip-Pipes:

1. Provide inside and outside surfaces of dip-pipes with corrosion barrier.

2. Surfacing veil for this corrosion barrier shall be same as specified for tank.

3. Corrosion barrier shall consist of appropriate surfacing veil, backed by two layers of fiberglass mat.

4. If “ready-made” pipe is used, it shall have an equivalent internal corrosion barrier and shall have specified corrosion barrier applied to outside surface.

2.5 APPURTENANCES

A. Sight Glass:

1. USP Type as specified.

2. Calibrate in 100-gallon increments.

3. Abrasion and corrosion resistant.

4. Mount using 1/2-inch Tygon tubing, PVC fittings, PVC isolation ball valve, and stainless steel hose clamps.

B. Supports:

1. Pipe Supports:

   a. Provide for tank overflow pipes, loading pipes and recirculation pipes.

   b. Spacing of supports shall be as recommended by fabricator, but shall not be greater than 4 feet on center.

   c. As shown on Drawings, shall allow removal of pipe.

   d. FRP complete with necessary bolts, nuts, and washers.

2. Level Probe Supports: FRP.

C. Platforms, Ladders, Handrails, and Kickplates:

1. Material: FRP

2. Fasteners: FRP

3. Supports: FRP: Locate as required for field installation of ladders, platforms, or handrails.

4. For tanks under roof or canopy, provide overhead clearance in accordance with OSHA 1910.24.

D. Lifting Lugs: Provide suitably attached for tank weighing over 100 pounds.

E. Anchor Bolts: Type 316 stainless steel bolts, by fabricator and as specified in Section 05 50 00, Metal Fabrications.

F. Manway Bolts: Type 316 stainless steel bolts and nuts as specified in Section 05 50 00, Metal Fabrications.

G. Brine Tank Salt Level Measurement: Binmaster SmartBob II, SBR II SS or equal. Coordinate with manufacturer to provide complete brine and salt level monitoring system.

H. Brine Tank: Fill Pipe Dust Control System

I. Liquid Level Sensor: Coordinate mounting location and method of equipment mounting and installation of liquid level sensor as provided by the onsite sodium hypochlorite generator manufacturer.

J. Openings for instruments shall be coordinated with equipment supplied by others.

2.6 SOURCE QUALITY CONTROL

A. Independent FRP Inspector:

1. To be present at point of manufacture at time fabrication is started, to perform the following:

a. Observe manufacturing methods, machinery, and techniques to ensure compliance with industry standards and these Specifications.

b. Observe initial fabrication to verify compliance with these Specifications.

c. Observe quality control methods for mixing resins and testing of completed equipment.

d. Generally observe quality of other ongoing fabrication.

e. Prepare Initial QA Inspection Report.

2. To be present at point of manufacture, upon completion of fabrication and prior to shipment, to perform or witness the following:

a. Visual inspection to requirements of ASTM C582.

b. Barcol Hardness measurements per ASTM D2583.

c. Acetone sensitivity test for internal secondary bonds.

d. Glass content by ignition loss on three cutouts per ASTM D2584.

e. Hydrostatic Leak Test:

1) Perform on each tank.
2) Fill to top nozzle; allow to stand for 2 hours with no visible leakage.

3. Prior to beginning repair work, repairs deemed acceptable by Independent FRP Inspector shall be approved by Engineer.

B. Identify and retain cutouts. Engineer may select certain cutouts for testing for physical properties of laminate.

C. Factory Test Reports:

1. Certify results, by signature, of the following:

a. Inspections.
b. Results of hydrostatic testing.
c. Test reports of physical properties of standard laminates.

PART 3 EXECUTION

3.1 INSTALLATION

A. In accordance with fabricator's written instructions.

B. Accurately place anchor bolts using templates furnished by fabricator, and as specified in Section 05 50 00, Metal Fabrications.

C. Install tanks as indicated on Drawings.

D. Connect piping to tanks.

E. Install tank accessories not factory mounted to complete installation.

3.2 FIELD QUALITY CONTROL

A. Functional Test:

1. Conduct on each tank.

2. Hydrostatic leak test with tank full of clean water. Allow water to stand for 24 hours to verify no leakage.

3.3 MANUFACTURER'S FIELD SERVICES

A. Provide fabricator's representative at Site for installation assistance, inspection and certification of proper installation for specified component, subsystem, equipment, or system.

3.4 SUPPLEMENTS

A. The supplements listed below, following “End of Section” are part of this Section.

1. FRP Tank Schedule.

END OF SECTION

FRP TANK SCHEDULE		
Name of Tank	Brine Tank	Sodium Hypchlorite Tank (Typ of 2)
Equipment Number(s)	70TNK-1-20	70TNK-1-70 70TNK-2-70
Filament-wound or Contact-molded	Filament-wound	Filament-wound
Maximum Capacity Measured to High Solution Level (gallons)	7,100	10,000
Installation (Vertical/Horizontal)	Vertical	Vertical
Diameter (feet)	9	11
Support (saddles, flat pad, legs)	Flat pad	Flat pad
Type of Bottom Head	Flanged only	Flanged only
Type of Top Head	Flanged only	Flanged only
Ladder Required (Yes/No)	Yes	Yes
Tank Location (indoor/outdoor)	Outdoor	Indoor
Ambient Temperature Range (F)	23-95	55-75
Exterior Loading (psf):		
Personnel Roof Loads	20	20
Pipe Supports and Appurtenances	As required	
Operating Contents:		
Temperature (degrees F, not to exceed 180)	23-95	55-75
Chemical Composition	ClH_2NaO	NaOCl
Specific Gravity	1.2	1.012
Concentration	26.4%	0.8%
pH Range	5-9	11-14
Sight Glass Type (1 or 2)	Type 2	Type 2
Sight Glass Tube Length	13-4”	13’-4”
Insulation/Heat Tracing (Yes/No)	No	No

SECTION 43 41 17 – HYDROPNEUMATIC TANK SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

A. This section includes materials, testing, and installation of ASME-rated pressure vessel tanks for hydropneumatic tank use in water supply systems including air compressor assembly, water level and pressure controls, pressure vessel, level gauges, pressure gauge, level probes, and accessory gauges and piping.

B. American Iron and Steel (AIS) Compliance: Materials provided under work of this Section shall comply with the AIS requirements of the Water Infrastructure Finance and Innovation Act (WIFIA). All materials provided and incorporated into this Project shall meet the AIS requirements of P.L. 113-76, Consolidated Appropriations Act, 2014.

1.2 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions

B. Submit layout drawings showing dimensions of equipment, accessories, supports, connections, and piping and outlets. Show equipment weights and anchor bolt designs. Show weight of pressure vessel, both empty and filled with water.

C. Provide dimensional drawings and layouts.

D. Submit manufacturer's product information showing selection of tank based on service pressure conditions as listed in the subsection "Service Conditions".

E. Submit certification that pressure vessels meet the ASME Boiler and Pressure Vessel Code requirements.

1.3 PRESSURE VESSEL

A. Materials for the tank, design, and shop fabrication and inspection shall comply with Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code with only the plate steels in Table UCS-23 of said code being used. Provide ASME code stamp and pressure rating on pressure vessel.

B. Design pressure shall be at least 10% above the system pressure-relief setting. Minimum design pressure shall be as listed in the subsection on "Service Conditions." Provide corrosion allowance of 1/16 inch or one-sixth the calculated plate steel thickness at design pressure, whichever is greater. Perform hydrostatic test in shop. Test pressure shall be 130% of the design pressure defined above.

C. Provide tank with steel support structures, bearing plate, and pads prepared to be bolted to concrete footings.

1.4 OUTLETS AND NOZZLES

Outlets shall be 2-inch minimum and shall be of the flanged nozzle type. Nozzles shall be Schedule 80 per ASME B36.10. Length from face of tank shell to face of flange shall be 6 to 8 inches. Flanges shall be slip-on or weld-neck type per ASME B16.5 or slip-on type per AWWA C207. Where connecting to piping smaller than 2 inches, provide a tapped blind flange or a companion flange with threaded connection per NACE SP0178-2007, Figure A10. Coat outlets the same as the tank. Flanges shall be flat faced.

1.5 PRESSURE GAUGES

Provide type of pressure gauge with isolation ball valve per manufacturer recommendations.

A. Provide isolation ball valve (try valve) with ball checks at each end of tube to prevent loss of liquid upon gauge breakage. Valves shall be offset pattern with integral bonnet. Valve bodies shall be bronze (ASTM B61 or B62). Provide drain cock or drain ball valve on the lower valve. Valves shall comply with ASME Boiler and Pressure Vessel Code.

B. Valves and gauges shall have a minimum pressure rating (water service) as indicated in the subsection on “Service Conditions.” Gauges and valves shall be:

Model	Maximum Pressure (psi)
Penberthy K3A, Ernst E6155, Eugene Ernst EEP 6155	200
Penberthy K3B, Ernst E53A, Eugene Ernst EEP53A	300
Ernst E366, Eugene Ernst EEP36A	500

1.6 AIR MUFFLERS

Provide muffler on air-vent solenoid valves/discharges. Products: Allied-Witan, Norgren Quietaire, or equal.

1.7 SAFETY-RELIEF VALVE

Safety-relief valve shall comply with the ASME Boiler and Pressure Vessel Code for air service. Valves shall be of the spring-actuated type with an external lifting lever. Valve shall close when pressure drops to allowable range. Valve size shall not be less than that required to maintain the hydropneumatic tank at its ASME design pressure while the air compressor is discharging at that pressure. Valves shall have a pressure rating as indicated in the subsection on “Service Conditions.” Bodies (including caps, bases, and bonnets) shall be bronze (ASTM B61 or B62) or Type 304 or 316 stainless steel with bottom inlet and side outlet. Inlet shall have male threads, ASME B1.20.1. Discs and springs shall be Type 304, 316, or 420 stainless steel. Valve shall incorporate a calibrated spring set to allow the valve to open at the pressure stated in the subsection on “Service Conditions.” Valve shall be Crosby Series 900, Consolidated Figure 1541, Birket-Richards Series B, or equal.

1.8 AIR-RELEASE VALVE

Provide an air-release valve with isolation ball valve on the tank at the bottom 10% volume level. The valve shall serve to vent air from the tank in the event the air compressor fails to stop after the normal low-water level is reached. Size the valve to release the capacity of the compressor at the design pressure of the tank. Pressure rating of the air-release and associated isolation valves shall be at least that of the tank.

1.9 PRESSURE SWITCHES FOR HYDROPNEUMATIC TANK

Pressure rating shall be at least 125 psi. Bourdon tube, bellows, and diaphragms shall be ASTM Type 403 stainless steel.

PART 2 EXECUTION

2.1 SERVICE CONDITIONS

A. Hydropneumatic tank service conditions shall be set to match the existing building utility water hydropneumatics tank service pressure conditions. Maximum operating pressure shall not exceed 90 psig.

B. Tanks shall be minimum total volume 211 gallons per tank.

C. Tanks shall be plumbed to fill and drain in parallel to minimize utility water pump cycling for tank fill cycles.

2.2 INSTALLATION

A. Cast anchor bolts in concrete foundation piers as embedded items. Use rigid template for each set of bolts.

B. After installation of tank on its foundation, temporarily cap nozzles and fill the tank with water to surcharge the foundation

2.3 FIELD TESTING

A. Adjust water level add-air and vent-air controls to the specified settings. Check the ability of these controls to restore proper water level with normal pressure variations in the tank.

2.4 DISINFECTION

Disinfect per AWWA specifications.

END OF SECTION

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SECTION 43 41 43 –POLYETHYLENE TANKS

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section includes single- and double-wall liquid storage tanks made from high density cross-linked polyethylene, and accessories, for storage of water treatment chemicals.

1.2 REFERENCE STANDARDS

A. American Society of Testing Materials (ASTM).

1. D1998, Standard Specification for Polyethylene Upright Storage Tanks.

B. ANSI Standards:

1. B-16.5, Pipe Flanges and Flanged Fittings

C. Building Code: International Building Code

1. IBC, 2021

D. NSF/ANSI Standard 61

1.3 SUBMITTALS

A. Drawings: drawings shall be approved by the Owner prior to the manufacturing of the tanks. Submit the following as a single, complete initial submittal.

1. Location and orientation of openings, fittings, accessories, restraints and supports, demonstrating compliance with the locations shown on the Drawings.

2. Details of manways, flexible connections, and vents.

B. Product Data: Sufficient data to show that the product conforms to the requirements of this specification and the Drawing. Provide the following additional information:

1. Tank and Fitting Material

a. Resin Manufacturer Data Sheet
b. Fitting Material
c. Gasket style and material
d. Bolt material
e. Details of level indication gages
f. Details of the seismic restraint system

2. Calculations shall be stamped and signed by a Structural Engineer registered in the State of Oregon.

a. Tank restraint system. Show seismic criteria.

b. Wall thickness. Hoop stress shall be calculated in accordance with ASTM D1998. In no case shall the tank thickness be less than design requirements per ASTM D1998. Tanks shall be designed using a hoop stress no greater than 600 psi and the Barlow formula.

C. Manufacturer’s warranty.

D. Manufacturer's unloading procedure.

E. Manufacturer's installation instructions.

F. Supporting information on Manufacturer’s Quality Management System.

G. Supporting documentation of Manufacturer’s certification to NSF/ANSI Standard 61.

H. Manufacturer’s Qualifications: Submit to Engineer a list of 5 installations with tanks in the same service as proof of Manufacturer's qualifications.

I. Electrical heat tracing and foam insulation data sheets, as required.

J. Factory Test Report

1. Wall thickness verification.
2. Fitting placement verification.
3. Visual inspection
4. Impact test
5. Gel test
6. Hydrostatic test

1.4 QUALITY ASSURANCE

A. The Contractor shall supply tanks of high-density, cross-linked polyethylene. Tanks furnished under this Section shall be supplied by a manufacturer who has been regularly engaged in the design and manufacture of chemical storage tanks for a minimum of 5 years.

B. Tanks shall be manufactured from virgin materials.

C. Tanks shall be manufactured from materials certified to NSF/ANSI Standard 61 for chemical storage and submit form from NSF supporting chemical certification.

1.5 WARRANTY

A. The Supplier shall provide the Manufacturer’s 5-year, full replacement limited warranty for the specific service application. Prorated warranties are not acceptable.

PART 2 PRODUCTS

2.1 GENERAL

A. Tanks shall be rotationally molded, high density cross-linked polyethylene, tanks.

B. Tanks shall be rotationally molded, one piece and of seamless construction.

C. Tanks shall be designed for above-ground, vertical installation and shall be designed to store the specified chemicals at atmospheric pressures

D. Tanks shall be adequately vented.

E. The ancillary mechanical fittings and accessories specified herein shall be provided by the Tank Manufacturer.

F. Tanks shall be marked to identify the Manufacturer and date of manufacture. The serial number for each tank shall be permanently embossed into the tank.

2.2 POLYETHYLENE STORAGE TANKS

A. Service: Chemical storage tanks shall be suited for the following operating conditions:

1. Specific gravity: See HDPE Tank Schedule at the end of this Section.

2. Interior locations:

a. Temperature range: 40 degrees Fahrenheit to 105 degrees Fahrenheit.

3. Mechanical fill and Pneumatic fill.

B. High Density Cross-linked Polyethylene resin used in the tank manufacture shall contain ultraviolet stabilizer as recommended by the Resin Manufacturer. Tank colors shall be natural, un-pigmented polyethylene, unless indicated otherwise.

C. The polyethylene shall be virgin material. Any use of regrind, recycled, or reprocessed materials or combinations of such materials shall not rely upon the performance data of their original constituents, but must meet the requirements of this standard in its own right.

D. Wall thickness for a given hoop stress shall be calculated in accordance with ASTM D1998. Under no conditions shall the tank thickness be less than design requirements of ASTM D1998.

1. The wall thickness of any cylindrical portion at any fluid level shall be determined by the following equation:

$T = P \times OD/2SD$ or $0.433 \times SG \times H \times OD/2SD$

Where:
T = wall thickness; in
P = pressure; psi
SG = specific gravity; grams/cubic centimeter
H = fluid head; ft
OD = outside diameter; ft
SD = hydrostatic design stress

a. The minimum wall thickness shall be sufficient to support its own weight in an upright position without external support but shall not be less than 0.187” thick.

b. The hydrostatic design stress shall be derated for service above 100 degrees Fahrenheit and for mechanical loading of the tank.

c. The minimum design specific gravity shall be 1.9.

2. On closed top tanks, the top head shall be integrally molded with the cylindrical wall. The minimum top head thickness shall be equal to the thickness of the top of the straight sidewall. Flat areas shall be provided for attachment of large fittings on the dome of the tank, as shown in the Drawings.

3. The bottom head shall be integrally molded with the cylindrical wall. Knuckle radius shall be a minimum of 1-inch for tank diameters less than or equal to 6 feet and 1.5-inches for tank diameters greater than 6 feet.

4. Lifting lugs shall be provided for tanks of greater than 3,000 gallons and the lugs shall be designed for lifting the tank when empty.

5. Unless otherwise indicated in the Drawings, for indoor pneumatic fill, manways shall be 24-in diameter or greater and equipped with an emergency pressure relief device with pressure relief at 6-inches water column to prevent over-pressurization. The manway shall be chemically compatible with the chemical being stored. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.

6. Tank Vents: Each tank shall be vented for the material and for the anticipated flow and withdrawal rates.

   a. Tanks shall be vented to allow for performance at atmospheric pressure, in accordance with the following matrix:

Venting Requirements For Polyethylene Tanks

Mechanical Pump Fill	**Pneumatic Fill**								
IF ≤ 1000 gallons	**IF** - Vent length ≤ 3 feet			**IF** - Vent length > 3' and ≤ 30'			**IF** - Scrubber Application		
Vent size should equal size of largest fill or discharge fitting	**AND - Vent** screen mesh size ≥ 1/4" or no screen used			**AND -** 3 or less 90° elbows with no other restrictions or reduction in pipe size			**Vent pipe size throughout scrubber system CANNOT be reduced!** Centerline of dispersion pipe not to be submersed > 6 inches		
IF > 1000 gallons	**Emergency Pressure Relief Cover Required**			**Emergency Pressure Relief Cover Required**			Perforated dispersion pipe must be same diameter or larger, as vent. Sum of perforations ≥ cross sectional area of pipe		
Vent size should exceed the largest fill or discharge fitting by 1 inch	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size
	2"	2"	4"	2"	2"	6"	2"	2"	6"
	3"	2"	6"	3"	2"	6"	3"	2"	8"
	3"	3"	6"	3"	3"	8"	3"	3"	10"

(2) 2 inch vents **DO NOT EQUAL** 4 inch venting capacity rev. Nov 2006

For detailed venting guidelines, please visit our Technical Resources at www.polyprocessing.com

2.3 MANUFACTURER

A. Poly Processing Company.
B. Norwesco.
C. Snyder.
D. Or equal.

2.4 TANK ACCESSORIES

A. Restraint System:

1. Metal components shall be stainless steel, edge softeners, and tension ring with stainless steel cables and clamps.

2. Tank restraint system shall be supplied by the Tank Manufacturer.

3. Seismic restraint shall be designed by a Structural Engineer registered in the State of Oregon. Design shall conform to the most recent edition of the IBC code for seismic load.

4. Anchor bolts as required by the calculations shall be supplied by the Tank Manufacturer.

B. Fittings: Each tank shall have the following fittings if they are shown on the Drawings. Fitting locations and size shall be as shown in the Drawings.

1. Fill connection with interior drop pipe.

2. Connection for vent pipe.

3. Bolted, one-piece sidewall fitting on the interior tank wall with siphon leg inside the main tank to fully utilize tank storage volume and bellows style transitional fitting on exterior tank wall for secondary containment of chemical, if required.

4. Bulkhead fitting on a vertical face for overflow pipe.

5. Universal ball dome bulkhead fitting on the top face or slope for vertical installation of a non-contacting level sensor.

C. Level Indication

1. As shown on the Drawings.

2.5 TANKS

A. Tank Schedule as shown in the Drawings and as further specified herein.

B. Note that approximate overall height is measured along the straight cylindrical portion of the tank. Maximum height is from the outside base of the tank to the dome top or the threaded cap on the dome, whichever is higher.

C. Fittings

1. Threaded fittings shall use American Standard Pipe Threads.

2. Bolted flange fittings shall be constructed of one 150 lb. flange with ANSI bolt pattern, one flange gasket and stud bolts with gaskets. Stud bolts shall have chemical resistant polyethylene injection molded heads and gaskets to provide a sealing surface between the bolt head and the interior tank wall. Stud bolt heads shall be color coded, according to the following schedule, for ease of visual identification.

a. Green for 316 Stainless Steel,

b. Black for Titanium,
c. Red for Alloy C-276
d. Blue for Monel.

3. All materials shall be compatible with chemical service and as indicated in the fitting schedule above. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.

4. For sodium hypochlorite and sulfuric acid storage, Bolted One-Piece Sure Seal (B.O.S.S.), double flange fittings constructed of virgin polyethylene shall be supplied. Bolts shall be welded to a common backing ring and encapsulated with polyethylene to prevent fluid contact with the metal material. Flanges will have one full face gasket to provide a sealing surface against inside tank wall. All materials shall be compatible with chemical service and as indicated in the fitting schedule above. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.

5. Down Pipes and Fill Pipes: Down pipes and fill pipes shall be supported at intervals of no more than 6-feet. Down pipes and fill pipes shall be PVC or other material compatible with the chemical stored.

6. Expansion joints shall meet the following minimum performance requirements:

a. Axial Compression ≥ 0.67”
b. Axial Extension ≥ 0.67”
c. Lateral Deflection ≥ 0.51”
d. Angular Deflection ≥ 14º
e. Torsional Rotation ≥ 4º

2.6 FACTORY TESTING

A. Material Testing

1. Perform gel and low temperature impact tests in accordance with ASTM D1998 on condition samples cut from each polyethylene chemical storage tank.

2. Degree of Crosslinking. Use Method C of ASTM D1998- Section 11.4 to determine the ortho-xylene insoluble fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.

B. Tank Testing

1. Dimensions: Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D1998. Fitting placement tolerance shall be +/- 1/2-in vertical and +/- 1 degree radial.

2. Visual: Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, and delamination.

3. Hydrostatic test: Following fabrication, the bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1 hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. Sharp objects on trailers shall be avoided.

B. All fittings shall be installed at the factory to confirm proper installation. All fittings that the Manufacturer recommends be shipped separately shall be removed for shipping. Manufacturer's instructions for reinstallation of removed fittings shall be provided with the tanks and accessories.

3.2 INSTALLATION

A. Manufacturer shall provide detailed instructions for tank installation.

B. Manufacturer shall provide a check list for review of the installed tanks by Owner and Contractor prior to Manufacturer's review of the installed tank systems.

C. After the Contractor has installed the tanks, Manufacturer shall inspect installed tanks to verify proper installation of flexible outlet and drain connections, venting pipe connections, fill pipe connections, overflow, reverse level gauge and other fittings.

D. Manufacturer shall provide a minimum 1-hour training session to instruct Owner's operators on servicing and maintaining the tank system. Included in the training session will be three complete sets of training manuals.

E. Manufacturer's trained, certified technician shall conduct an onsite inspection of the completed installation. Inspection will verify chemical application, plumbing connections, venting, and applicable ancillary equipment such restraints. Manufacturer shall supply Owner with a certificate verifying proper installation when equipment has passed the installation checklist.

F. Tank manuals will consist of installation check lists, record tank drawings, fitting drawings referencing nozzle schedule on tank drawing, materials of construction, and recommended maintenance program.

3.3 ANCHORING

A. Furnish and install equipment anchoring as specified in Section 01 33 17, Structural Design, Support and Anchorage and the recommendations of the equipment manufacturer's literature and calculations, including anchoring methods and leveling criteria.

3.4 FIELD TESTING

A. All tanks shall be hydrotested for 24 hours prior to commissioning.

3.5 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this Section.

1. HDPE Tank Schedule.

END OF SECTION

HDPE TANK SCHEDULE		
Name of Tank	Alum Tank (Typ of 2)	Polymer Tank
Equipment Number(s)	72TNK-1-70 72TNK-2-70	74TNK-1-70
Filament-wound or Contact-molded	Contact-molded	Contact-molded
Maximum Capacity Measured to High Solution Level (gallons)	6,000	6,000
Installation (Vertical/Horizontal)	Vertical	Vertical
Diameter (feet)	8.5	8.5
Support (saddles, flat pad, legs)	Flat pad	Flat pad
Type of Bottom Head	Flanged only	Flanged only
Type of Top Head	Flanged only	Flanged only
Ladder Required (Yes/No)	No	No
Tank Location (indoor/outdoor)	Indoor	Indoor
Ambient Temperature Range (F)	55-75	55-75
Exterior Loading (psf):		
Personnel Roof Loads	20	20
Pipe Supports and Appurtenances	As required	
Operating Contents:		
Temperature (degrees F, not to exceed 180)	55-75	55-75
Chemical Composition	$Al_2(SO_4)_3 \cdot 14H_2O$	N/A
Specific Gravity	1.35	1.14
Concentration	25%	50%
pH Range	1.2-2.5	5-9
Insulation/Heat Tracing (Yes/No)	No	No

SECTION 43 41 43 –POLYETHYLENE TANKS

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section includes single- and double-wall liquid storage tanks made from high density cross-linked polyethylene, and accessories, for storage of water treatment chemicals.

1.2 REFERENCE STANDARDS

A. American Society of Testing Materials (ASTM).

1. D1998, Standard Specification for Polyethylene Upright Storage Tanks.

B. ANSI Standards:

1. B-16.5, Pipe Flanges and Flanged Fittings

C. Building Code: International Building Code

1. IBC, 2021

D. NSF/ANSI Standard 61

1.3 SUBMITTALS

A. Drawings: drawings shall be approved by the Owner prior to the manufacturing the tanks. Submit the following as a single, complete initial submittal.

1. Location and orientation of openings, fittings, accessories, restraints and supports, demonstrating compliance with the locations shown on the Drawings.

2. Details of manways, flexible connections, and vents.

B. Product Data: Sufficient data to show that the product conforms to the requirements of this specification and the Drawing. Provide the following additional information:

1. Tank and Fitting Material

a. Resin Manufacturer Data Sheet
b. Fitting Material
c. Gasket style and material
d. Bolt material
e. Details of level indication gages
f. Details of the seismic restraint system

2. Calculations shall be stamped and signed by a Structural Engineer registered in the State of Oregon.

a. Tank restraint system. Show seismic criteria.

1) Tank pad dimensions shall be verified by the Contractor and manufacturer to confirm sufficient edge distance for seismic restraints and tie downs. Dimensions less than 4 inches from the outside of bolt to edge of concrete shall be brought to the attention of the Engineer.

b. Wall thickness. Hoop stress shall be calculated in accordance with ASTM D1998. In no case shall the tank thickness be less than design requirements per ASTM D1998. Tanks shall be designed using a hoop stress no greater than 600 psi and the Barlow formula.

C. Manufacturer's warranty.

D. Manufacturer's shipping, storage and protection, and handling procedures.

E. Manufacturer's unloading procedure.

F. Manufacturer's installation instructions.

G. Supporting information on Manufacturer's Quality Management System.

H. Supporting documentation of Manufacturer's certification to NSF/ANSI Standard 61.

I. Manufacturer's Qualifications: Submit to Engineer a list of 5 installations with tanks in the same service as proof of Manufacturer's qualifications.

J. Electrical heat tracing and foam insulation data sheets, as required.

K. Factory Test Report

1. Wall thickness verification.
2. Fitting placement verification.
3. Visual inspection
4. Impact test
5. Gel test
6. Hydrostatic test

1.4 QUALITY ASSURANCE

A. The Contractor shall supply tanks of high-density, cross-linked polyethylene. Tanks furnished under this Section shall be supplied by a manufacturer who has been regularly engaged in the design and manufacture of chemical storage tanks for a minimum of 5 years.

B. Tanks shall be manufactured from virgin materials.

C. Tanks shall be manufactured from materials certified to NSF/ANSI Standard 61 for chemical storage and submit form from NSF supporting chemical certification.

1.5 WARRANTY

A. The Supplier shall provide the Manufacturer's 5-year, full replacement limited warranty for the specific service application. Prorated warranties are not acceptable.

PART 2 PRODUCTS

2.1 GENERAL

A. Tanks shall be rotationally molded, high density cross-linked polyethylene, single-wall tanks.

B. Tanks shall be rotationally molded, one piece and of seamless construction.

C. Tanks shall be designed for above-ground, vertical installation and shall be designed to store the specified chemicals at atmospheric pressures.

D. Tanks shall be adequately vented.

E. The ancillary mechanical fittings and accessories specified herein shall be provided by the Tank Manufacturer.

F. Tanks shall be marked to identify the Manufacturer and date of manufacture. The serial number for each tank shall be permanently embossed into the tank.

2.2 POLYETHYLENE STORAGE TANKS

A. Service: Chemical storage tanks shall be suited for the following operating conditions:

1. Specific gravity: See HDPE Tank Schedule at the end of this Section.

2. Interior locations:

a. Temperature range: 40 degrees Fahrenheit to 105 degrees Fahrenheit.

3. Mechanical fill and Pneumatic fill.

B. High Density Cross-linked Polyethylene resin used in the tank manufacture shall contain ultraviolet stabilizer as recommended by the Resin Manufacturer. Tank colors shall be natural, un-pigmented polyethylene, unless indicated otherwise.

C. The polyethylene shall be virgin material. Any use of regrind, recycled, or reprocessed materials or combinations of such materials shall not rely upon the performance data of their original constituents, but must meet the requirements of this standard in its own right.

D. Wall thickness for a given hoop stress shall be calculated in accordance with ASTM D1998. Under no conditions shall the tank thickness be less than design requirements of ASTM D1998.

1. The wall thickness of any cylindrical portion at any fluid level shall be determined by the following equation:

$T = P \times OD/2SD$ or $0.433 \times SG \times H \times OD/2SD$

Where:
T = wall thickness; in
P = pressure; psi
SG = specific gravity; grams/cubic centimeter
H = fluid head; ft
OD = outside diameter; ft
SD = hydrostatic design stress

a. The minimum wall thickness shall be sufficient to support its own weight in an upright position without external support but shall not be less than 0.187" thick.

b. The hydrostatic design stress shall be derated for service above 100 degrees Fahrenheit and for mechanical loading of the tank.

c. The minimum design specific gravity shall be 1.9.

2. On closed top tanks, the top head shall be integrally molded with the cylindrical wall. The minimum top head thickness shall be equal to the thickness of the top of the straight sidewall. Flat areas shall be provided for attachment of large fittings on the dome of the tank, as shown in the Drawings.

3. The bottom head shall be integrally molded with the cylindrical wall. Knuckle radius shall be a minimum of 1-inch for tank diameters less than or equal to 6 feet and 1.5-inches for tank diameters greater than 6 feet.

4. Lifting lugs shall be provided for tanks of greater than 3,000 gallons and the lugs shall be designed for lifting the tank when empty.

5. Unless otherwise indicated in the Drawings, for indoor pneumatic fill, manways shall be 24-in diameter or greater and equipped with an emergency pressure relief device with pressure relief at 6-inches water column to prevent over-pressurization. The manway shall be chemically compatible with the chemical being stored. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.

6. Tank Vents: Each tank shall be vented for the material and for the anticipated flow and withdrawal rates.

a. Tanks shall be vented to allow for performance at atmospheric pressure, in accordance with the following matrix:

Venting Requirements For Polyethylene Tanks

Mechanical Pump Fill	**Pneumatic Fill**								
IF ≤ 1000 gallons	**IF** Vent length ≤ 3 feet			**IF** Vent length > 3 and ≤ 30'			**IF** Scrubber Application		
Vent size should equal size of largest fill or discharge fitting	**AND - Vent** screen mesh size ≥ 1/4" or no screen used			**AND** 3 or less 90° elbows with no other restrictions or reduction in pipe size			**Vent pipe size throughout scrubber system CANNOT be reduced!** Centerline of dispersion pipe not to be submersed > 6 inches		
IF > 1000 gallons	**Emergency Pressure Relief Cover Required**			**Emergency Pressure Relief Cover Required**			Perforated dispersion pipe must be same diameter or larger as vent. Sum of perforations ≥ cross sectional area of pipe		
Vent size should exceed the largest fill or discharge fitting by 1 inch	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size	Tanker Discharge	Inlet/Fitting Size	Minimum Vent Size
	2"	2"	4"	2"	2"	6"	2"	2"	6"
	3"	2"	6"	3"	2"	8"	3"	2"	8"
	3"	3"	6"	3"	3"	8'	3'	3"	10'

(2) 2 inch vents **DO NOT EQUAL** 4 inch venting capacity rev Nov 2008

For detailed venting guidelines, please visit our Technical Resources at www.polyprocess.com

2.3 MANUFACTURER

A. Poly Processing Company.
B. Norwesco.
C. Snyder.
D. Or equal.

2.4 TANK ACCESSORIES

A. Restraint System:

1. Metal components shall be stainless steel, edge softeners, and tension ring with stainless steel cables and clamps.

2. Tank restraint system shall be supplied by the Tank Manufacturer.

3. Seismic restraint shall be designed by a Structural Engineer registered in the State of Oregon. Design shall conform to the most recent edition of the IBC code for seismic load.

4. Anchor bolts as required by the calculations shall be supplied by the Tank Manufacturer.

B. Fittings: Each tank shall have the following fittings if they are shown on the Drawings. Fitting locations and size shall be as shown in the Drawings.

1. Fill connection with interior drop pipe.

2. Connection for vent pipe.

3. Bolted, one-piece sidewall fitting on the interior tank wall with siphon leg inside the main tank to fully utilize tank storage volume and bellows style transitional fitting on exterior tank wall for secondary containment of chemical, if required.

4. Bulkhead fitting on a vertical face for overflow pipe.

5. Universal ball dome bulkhead fitting on the top face or slope for vertical installation of a non-contacting level sensor.

C. Level Indication

1. As shown on the Drawings.

2.5 TANKS

A. Tank Schedule as shown in the Drawings and as further specified herein.

B. Note that approximate overall height is measured along the straight cylindrical portion of the tank. Maximum height is from the outside base of the tank to the dome top or the threaded cap on the dome, whichever is higher.

C. Fittings

1. Threaded fittings shall use American Standard Pipe Threads.

2. Bolted flange fittings shall be constructed of one 150 lb. flange with ANSI bolt pattern, one flange gasket and stud bolts with gaskets. Stud bolts shall have chemical resistant polyethylene injection molded heads and gaskets to provide a sealing surface between the bolt head and the interior tank wall. Stud bolt heads shall be color coded, according to the following schedule, for ease of visual identification.

a. Green for 316 Stainless Steel,

b. Black for Titanium,
c. Red for Alloy C-276
d. Blue for Monel.

3. All materials shall be compatible with chemical service and as indicated in the fitting schedule above. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.

4. For sodium hypochlorite and sulfuric acid storage, Bolted One-Piece Sure Seal (B.O.S.S.), double flange fittings constructed of virgin polyethylene shall be supplied. Bolts shall be welded to a common backing ring and encapsulated with polyethylene to prevent fluid contact with the metal material. Flanges will have one full face gasket to provide a sealing surface against inside tank wall. All materials shall be compatible with chemical service and as indicated in the fitting schedule above. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.

5. Down Pipes and Fill Pipes: Down pipes and fill pipes shall be supported at intervals of no more than 6-feet. Down pipes and fill pipes shall be PVC or other material compatible with the chemical stored.

6. Expansion joints shall meet the following minimum performance requirements:

a. Axial Compression ≥ 0.67”
b. Axial Extension ≥ 0.67”
c. Lateral Deflection ≥ 0.51”
d. Angular Deflection ≥ 14º
e. Torsional Rotation ≥ 4º

2.6 FACTORY TESTING

A. Material Testing

1. Perform gel and low temperature impact tests in accordance with ASTM D1998 on condition samples cut from each polyethylene chemical storage tank.

2. Degree of Crosslinking. Use Method C of ASTM D1998- Section 11.4 to determine the ortho-xylene insoluble fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.

B. Tank Testing

1. Dimensions: Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D1998. Fitting placement tolerance shall be +/- 1/2-in vertical and +/- 1 degree radial.

2. Visual: Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, and delamination.

3. Hydrostatic test: Following fabrication, the bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1 hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

A. The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. Sharp objects on trailers shall be avoided.

B. All fittings shall be installed at the factory to confirm proper installation. All fittings that the Manufacturer recommends be shipped separately shall be removed for shipping. Manufacturer's instructions for reinstallation of removed fittings shall be provided with the tanks and accessories.

3.2 INSTALLATION

A. Manufacturer shall provide detailed instructions for tank installation.

B. Manufacturer shall provide a check list for review of the installed tanks by Owner and Contractor prior to Manufacturer's review of the installed tank systems.

C. After the Contractor has installed the tanks, Manufacturer shall inspect installed tanks to verify proper installation of flexible outlet and drain connections, venting pipe connections, fill pipe connections, overflow, reverse level gauge and other fittings.

D. Manufacturer shall provide a minimum 1-hour training session to instruct Owner's operators on servicing and maintaining the tank system. Included in the training session will be three complete sets of training manuals.

E. Manufacturer's trained, certified technician shall conduct an onsite inspection of the completed installation. Inspection will verify chemical application, plumbing connections, venting, and applicable ancillary equipment such restraints. Manufacturer shall supply Owner with a certificate verifying proper installation when equipment has passed the installation checklist.

F. Tank manuals will consist of installation check lists, record tank drawings, fitting drawings referencing nozzle schedule on tank drawing, materials of construction, and recommended maintenance program.

3.3 ANCHORING

A. Furnish and install equipment anchoring as specified in Section 01 33 17, Structural Design, Support and Anchorage and the recommendations of the equipment manufacturer's literature and calculations, including anchoring methods and leveling criteria.

3.4 FIELD TESTING

A. All tanks shall be hydrotested for 24 hours prior to commissioning.

3.5 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this Section.

1. HDPE Tank Schedule.

END OF SECTION

HDPE TANK SCHEDULE		
Name of Tank	Alum Tank (Typ of 2)	Polymer Tank
Equipment Number(s)	72TNK-1-70 72TNK-2-70	74TNK-1-70
Filament-wound or Contact-molded	Contact-molded	Contact-molded
Maximum Capacity Measured to High Solution Level (gallons)	6,000	6,000
Installation (Vertical/Horizontal)	Vertical	Vertical
Diameter (feet)	8.5	8.5
Support (saddles, flat pad, legs)	Flat pad	Flat pad
Type of Bottom Head	Flanged only	Flanged only
Type of Top Head	Flanged only	Flanged only
Ladder Required (Yes/No)	No	No
Tank Location (indoor/outdoor)	Indoor	Indoor
Ambient Temperature Range (F)	55-75	55-75
Exterior Loading (psf):		
Personnel Roof Loads	20	20
Pipe Supports and Appurtenances	As required	
Operating Contents:		
Temperature (degrees F, not to exceed 180)	55-75	55-75
Chemical Composition	$Al_2(SO_4)_3 \cdot 14H_2O$	N/A
Specific Gravity	1.35	1.14
Concentration	25%	50%
pH Range	1.2-2.5	5-9
Insulation/Heat Tracing (Yes/No)	No	No

SECTION 46 20 00 - MISCELLANEOUS CHEMICAL FEED EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish and install miscellaneous chemical feed equipment as listed below and as shown in the Contract Drawings for all chemical feed systems. Chemical feed systems shall be submitted and procured as packaged skids in coordination with the pump supplier.

B. This section includes materials, testing, and installation of chemical feed systems. Components include:

1. Skid frame to secure and contain chemical feed system.
2. Metering pumps to convey chemical from the bulk storage tank to the point of application (see Section 46 30 00, Chemical Feed Pumps).
3. Interconnecting piping, located within the skid assembly for the chemical feed system.
4. Isolation and control valves, located within the skid assembly for the sodium hypochlorite system.
5. Pulsation dampeners, calibration columns, backpressure valves, pressure relief valves, and pressure gauges.
6. Connections to plant utility water, as indicated in Contract Drawings.
7. Electrical power and control wiring and conduit between the above components.

C. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI)
2. American Society of Civil Engineers (ASCE)
3. American Water Works Association (AWWA)
4. ASTM International
5. International Building Code (IBC)
6. National Sanitation Foundation (NSF), NSF 61 – Drinking Water System Components

1.2 COORDINATION

A. Coordinate Work of this Section with Work of other Sections.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals

B. Product Data:

1. Submit Manufacturer information for system materials and component equipment, including electrical characteristics and connection requirements, specification (such as AISI, ASTM, SAE, or CDA), and grade or type.

2. Submit proof of NSF 61 certification for the piping, valves, and other equipment in contact with the chemical listed in the Service Conditions.

C. Shop Drawings:

1. Submit structural drawings showing the design of the fabricated skid. Show support systems for pumps and piping. Show materials of construction by ASTM reference and grade. Show sizes of members. Show welding, bolting, or other assembly arrangements.

2. Submit installation and arrangement drawings showing dimensions and locations of equipment on the fabricated skid. Show locations of pumps, piping, electrical conduits and equipment, pipe and valve supports, and control panels.

3. Submit electrical wiring drawings showing wiring and conduit, controls, interlocks, terminals, and power disconnects. Show number and sizes of power and control wiring. Label each terminal showing which control or electrical power wire connects to each terminal.

4. Submit shop drawings for the individual pieces of equipment per those equipment specifications.

5. Submit data as a single complete package for pumps, piping, structural skid or base design, valves and actuators, motor control center components, control panels, instrument components, power and instrumentation conduits and wiring, and other items.

6. As part of the shop drawing submittal package for the chemical feed systems, submit proposed format for reporting the results of the factory testing. Describe procedure for performing the pressure testing of the skid piping and how results (including correcting defective piping components) will be tabulated or reported. Include the format for reporting the results of factory testing for individual system components and pieces of equipment, as described in the specifications for those components or pieces of equipment.

D. Manufacturer's Certificate:

1. Certify that the products meet or exceed specified requirements.

E. Manufacturer Instructions:

1. Submit instructions on installation and storage requirements.
2. Submit operations and maintenance manuals.

F. Manufacturer Reports:

1. Certify that equipment has been installed according to Manufacturer instructions.
2. Indicate activities on Site, adverse findings, and recommendations.

G. Source Quality-Control Submittals:

1. At least 30 days prior to factory testing, provide the Owner with written notification stating the schedule of the factory test so that the Owner can plan in advance to witness the testing.

2. Submit report on results of factory testing. Do not ship systems until the Owner's Representative has reviewed the report.

H. Field Quality-Control Submittals:

1. Indicate results of Contractor-furnished tests and inspections.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

B. Tools: Furnish special tools and other devices required for Owner to maintain and calibrate chemical feed pump provided that the Owner does not currently have such tools.

1.5 QUALITY ASSURANCE

A. Perform work according to Oregon State Building Code standards.

1.6 QUALIFICATIONS

A. Manufacturer:

1. Company specializing in manufacturing products specified in this Section with minimum five (5) years' documented experience.

B. Installer:

1. Company specializing in performing Work of this Section with minimum five (5) years' documented experience and approved by Manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Conform to transporting, handling, storing, and protecting products according to manufacturer's requirements.

1.8 MANUFACTURER AND SYSTEM RESPONSIBILITY

A. The Contractor shall assign the design and fabrication of the chemical feed system to a single system manufacturer. Assemble the complete system on a single fabricated skid or base. Assemble and factory test as a complete system, including pumps, piping, valves, controls, and motor starters. The packaged chemical feed system manufacturer shall coordinate the skid components such as pump-to-motor couplings and motor power rating such that the system is completely integrated with compatible components.

B. The packaged chemical system manufacturer shall determine and verify quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and the packaged chemical system manufacturer shall review and coordinate each submittal with the requirements of the contract documents.

PART 2 MATERIALS

2.1 SUMMARY

A. Acceptable Skid Manufacturers

1. USA Bluebook
2. PumpTech
3. Or approved equal

2.2 FABRICATED SKID OR BASE-GENERAL REQUIREMENTS

A. Design skid or base and the associated supports and anchor bolts to support the equipment per IBC, Section 1613 and ASCE 7, Chapter 15:

B. Provide a common drip or drain pan having a minimum depth of 2 inches under all the pumps to collect leakage. Construct pan of 3/8-inch-thick (minimum) HDPE or 3/8-inch thick (minimum) FRP. Resin shall be Ashland Derakane 411 or 470, Reichhold Dion 9800, or Ashland Hetron 922. The pan shall extend under the pumps so that any leakage is contained within the skid or base. Slope the pan at least 1:20 toward a single side of the skid, where a drain opening of at least 1/2 inch shall be provided to effect drainage. Pipe joints and pipe flange faces, including pump suction and discharge connections, shall be within the drain pan or drain collection area.

C. Provide the skid or base with four lifting lugs, one at each corner, designed to lift the weight of the complete skid or base with all equipment attached to it. Alternatively, provide the base with cutouts, designed to lift the weight of the complete skid or base with equipment attached to it, for forklift tangs or cables.

D. Provide a design such that each pump is individually bolted to a baseplate. A single common baseplate, or individual pump baseplates, may be provided, but each pump shall be individually bolted so that it is removable.

E. Each pump shall be removable by disconnecting only the piping connected to its inlet and outlet connections. It shall not be necessary to disconnect or remove any adjacent piping or electrical conduit or wiring in order to remove or replace any pump.

2.3 FABRICATED THERMOPLASTIC OR FRP SKID OR BASE

A. Skid or base shall be fabricated with FRP. Use a combination of wide flange members, C-channels, hollow structural fiberglass tubing, and plates or sheets to construct the skid or base. Minimum plate, sheet, or member thickness shall be 1/2 inch. Provide reinforcing gussets inside the superstructure, beneath the deck, to provide increased stiffness.

B. Alternatively, fabricate skid and base using thermally welded PVC or high-density polyethylene plastic. Use plates or sheets to construct the skid or base. Minimum plate, sheet, or member thickness shall be 5/8 inch. Provide reinforcing gussets, as needed, beneath the deck to provide increased stiffness. Plates shall be heat welded to form permanent continuous bond. Design and construct skid such that the thermoplastic structural members and sheet material are supported so that the skid does not bend or sag. Thermoplastic welding shall conform to the applicable ASTM standards for the material used. Welds shall have a smooth and uniform finish.

C. Fasteners for skids in chemical service shall be stainless steel and shall comply with ASTM A193, Grade B8M or ASTM F593, Type 316. Nuts shall be ASTM A194, Grade 8M or ASTM F594, Type 316. Use ASTM A194 nuts with ASTM A193 bolts; use ASTM F594 nuts with ASTM F593 bolts. Provide washer for each nut and bolt head. Washers shall be of the same material as the nuts.

2.4 METERING PUMPS

See Section 46 30 00 Chemical Feed Pumps.

2.5 ISOLATION AND PRESSURE-RELIEF VALVES WITHIN THE SKID OR BASE

Piping Service	Valve Type
Sodium hypochlorite	Double Union CPVC Ball Valves
Alum, Polymer	Double Union PVC Ball Valves

A. Provide Double Union CPVC Ball Valves: Isolation valves for use in sodium hypochlorite service shall be vented CPVC ball valves, 3 inches and smaller and shall be rated at a pressure of 150 psi at a temperature of 105°F and rated at a pressure of 85 psi at a temperature of 140°F. Provide machined vent hole, deburred, in the ball to allow gases to vent. Body, ball, and stem shall be CPVC conforming to ASTM D1784, Type 4, Grade 1. Seats shall be Teflon. O-ring seals shall be Viton. Valve ends shall be of the union design with two-way blocking capability. Ends shall be socket welded except where threaded or flanged-end valves are specifically shown in the drawings. Valves shall have handle for manual operation. Valves shall be Plast-O-Matic "Z-MBV-Vent," Asahi/America Type 21, or equal.

B. Provide pressure-relief and backpressure valves in discharge piping of all metering pumps.

C. Provide an isolation valve on the suction and discharge piping of each pump. Provide an isolation valve for each calibration column. Provide an isolation valve for each drain/flush connection.

2.6 PULSATION DAMPENERS

A. Provide a pulsation dampener on the discharge piping of the metering pumps. The pulsation dampener shall be of the appendage type having a gas-charged bladder in a pressure vessel. Dampener shall be a pressure vessel per the ASME Pressure Vessel Code, Section VIII. Sizing shall result in no more than ±5% variation in average pressure in the discharge line. Variation shall be checked and confirmed on pressure gauge installed upstream of discharge dampener.

Mount a gas charging valve and liquid-filled pressure gauge on each dampener. Pulsation dampeners shall be Greer Bladder Accumulator, Pulsafeeder Pulsatrol, Blacoh, or equal.

1. For sodium hypochlorite service: Dampener body PVC or PVDF; Teflon coated EPDM diaphragm; Viton O-rings.

2.7 CALIBRATION TUBE

A. Provide a clear calibration tube in the piping between the metering pumps and the suction inlet. Provide isolation valve between the tube and the piping.

B. Calibration cylinder and fittings shall be made of inert clear PVC, shall have a cap, and have calibration marks. Provide at least 10 calibration lines, with a minimum of one line every 100 mL. Provide columns with NPT or PVC union connections at the bottom and also the top for vent pipe connection.

C. Capacities shall allow for a 1-minute test.

2.8 POWER, WIRING AND CONDUIT WITHIN THE SKID OR BASE

A. Provide wiring diagrams and install wiring per the NEC.

B. Provide all signals through an ethernet connection. Where not feasible all discrete inputs and outputs shall be rated at 24V DC. All analog signals shall be rated 4-20mA.

C. Color-code control wiring in switching and control assemblies per ICEA Method 1, NEC applications, Option A. Jacket shall be black PVC. Lay out conductors neatly so they may be followed by eye form one terminal to another. Wiring shall be vertical or horizontal. Color-coding shall be such that electrically common interconnections of devices are the same color. The colors may be used more than once but not in the same circuit or cable grouping.

D. Power and control cable shall be copper, insulated for 600 volts, 75°C wet and 90°C dry locations, UL Type THWN or XHHW, and shall comply with UL 83. Insulation jacket shall be nylon. Install bare or green insulated copper conductors in power circuits for grounding connections.

E. VFDs starter panel provided by others as required on Contract Drawings. Manufacturer shall be coordinated with VFD supplier.

2.9 DEGASSING VALVES

A. Degassing valves shall be placed at high points in the sodium hypochlorite system as whon on the Contract Drawings. If not shown, additional degassing valves shall be placed in the sodium hypochlorite piping as required by physical piping configuration at high points in the system, and in sections of the sodium hypochlorite piping that can be isolated by valves.

B. Valve materials shall be compatible with sodium hypochlorite and the gasses produced by sodium hypochlorite. Chemical compatibility shall be confirmed in writing by valve manufacturer.

C. Valve manufacturer shall confirm adequate sizing of the valve product. All degassing valves shall be drained by clear plastic tubing the same diameter of the valve discharge and run to a bucket, drainage trench, containment area, or sump.

D. Manufacturers:

1. Plastomatic.
2. Accu-vent.
3. Or equal.

2.10 FACTORY TESTING

A. Each chemical feed system shall be subjected to a non-witnessed factory performance test. Test each package system by using water. Provide a separate water supply test tank and operate the control system by simulating the external control signals. Verify that the control system automatically controls the packaged system in response to the specified external control signals. Verify that metering pumps respond to the external flow-pacing signals.

B. Verify that the various specified alarm signals are generated and transmitted from the system control panel. Simulate metering pump running, flow switch activation, and high and low pressure alarms.

C. Pressure test skid piping (except for overflow and vent piping) to a pressure of 150 psi for duration of 2 hours. There shall be no leakage at any pipe joint or connection to any valve or piece of equipment. Repair or replace any defective pipe joint or connection and retest.

PART 3 EXECUTION

3.1 MANUFACTURER'S SERVICES

A. Provide three labor days to check the installation and advise during start-up, testing, and adjustment of the systems.

B. See the individual equipment specification sections for additional labor days for manufacturer's services for the pieces of equipment.

3.2 ASSEMBLING SKID OR BASE

A. Assemble and mount components on the fabricated skid or base at the factory. Provide a 4-inch minimum clearance between pipes and around equipment.

B. Design skid to provide access to the manual stroke control knobs located with the metering pumps.

C. Design skid to provide clearance for and access to the automatic stroke positioners located with the metering pumps.

D. The front of the skid shall be clear of any piping or conduits to allow for maintenance access to the skid components.

3.3 ASSEMBLING SKID PIPING AND ELECTRICAL CONDUIT

A. Provide separate supports for pulsation dampener and calibration tube. Do not mount unsupported devices directly on the piping.

B. Provide fiberglass with Type 316 stainless steel fasteners and hardware for the piping. Provide a support for each pipe at its termination point at the edge of the skid, within 3 inches of any isolation valve.

C. Route electrical conduit around the ends and sides of the skid or base. Do not install conduit overhead. Install wiring on the skid or base in aluminum rigid conduit with a minimum size of 3/4 inch. Install power and control wiring in separate conduits. Terminate conduits at the control panel.

D. Do not run any conduit or piping beneath the drain pan.

3.4 ISOLATION VALVE LOCATIONS

A. Provide isolation valves at the following points:

1. Inlet connection to each pump.
2. Outlet connection from each pump.

3.5 PRESSURE-RELIEF VALVE LOCATIONS

A. Provide pressure-relief valve on the discharge piping of each metering pump. Size valve to match the associated metering pump capacity.

3.6 PIPE TERMINATIONS

Locate connections to skid drain pan, metering pump suction and discharge piping as shown on the plans.

3.7 FIELD TESTING

A. Test each package system by using the actual chemical for the system. The Contractor shall provide sufficient chemical for a test period as specified in the General Conditions (Volume 1). Fill each tank and operate the control system. Verify that the control system automatically controls the packaged system in response to the specified external control signals. Verify that metering pumps respond to the external flow-pacing signal.

B. Verify that the various specified alarm signals are generated and transmitted from the system control panel. Verify metering pump running, tank overflow, tank high and low alarm levels, drain pan liquid level, flow switch activation, and high and low pressure alarms.

END OF SECTION

SECTION 46 30 00 - CHEMICAL FEED PUMPS

PART 1 GENERAL

1.1 SCOPE

The Contractor shall furnish and install all chemical feed pumps, piping, valves, miscellaneous fittings, and appurtenances for complete chemical feed systems with the number of pumps and capacities per pump as shown in this section. Integrated skid systems for chemical feed pumps shall be provided per Section 46 20 00 Miscellaneous Chemical Feed Equipment.

Electronic metering pumps shall be drive capable of accepting a 4-20mA signal from a pump control unit supplied by the same manufacturer as the pump supplier and shall include accessories as noted below.

Pump control panels shall include ethernet communication modules and shall be skid mounted.

1.2 PRESUBMITTALS FOR BIDDING APPROVAL

If products other than the listed acceptable product are to qualify for bidding, the following prebid submittals are required.

A. Exceptions to these specifications along with justification for each exception.

B. Manufacturer and type designation.

C. Catalog and/or specification data confirming conformance to specified design, material, and equipment requirements.

D. Installation requirements.

E. Operation and maintenance information per Section 01 78 23 Operation and Maintenance Data.

1.3 SUBMITTALS FOR CONSTRUCTION

A. Submit shop drawings in accordance with the General Conditions.

B. Submit dimensional drawings.

C. Submit manufacturer's catalog data and detail drawings showing metering pump parts and describe by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Show stroke speed at the specified flow. Show linings and coatings. Identify each metering pump by tag number to which the catalog data and detail sheets pertain.

D. Submit operation and maintenance information per Section 01 78 23 Operation and Maintenance Data.

1.4 MANUFACTURER'S SERVICES

A. Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

1. Three labor days to check the installation and advise during start-up, testing, and adjustment of the equipment.

PART 2 MATERIALS

2.1 MANUFACTURERS

A. Electronic-actuated diaphragm metering pumps shall be UGSI Encore 700, or equal, preapproved by the Engineer.

2.2 PUMP DESIGN AND CONSTRUCTION

A. The diaphragm-metering pump shall be a direct drive motor driven, positive displacement, disc or tubular diaphragm pump. Pump materials of construction are designated in the subsection on "Service Conditions."

B. Provide the pump with a dial knob for manual stroke length adjustment. The stroke adjustment system shall allow 0% to 100% of full stroke length while the pump is operating.

C. Provide the pump with a separate dial knob for stroke length adjustment. Provide VFD control of inverter duty motor for remote adjustment of stroke frequency (speed).

D. The metering pump drive shall be totally enclosed with no exposed moving parts. Gearbox shall be mechanical gear driven, oil bath design.

E. Pressure-relief bypass shall automatically release chemical to pump suction when discharge pressure exceeds the value specified in the subsection on “Service Conditions.” Alternatively, provide a design in which the pump ceases its stroking action when the backpressure exceeds the strength of the magnetic force developed by the power coil.

F. Metering pump valves shall be ball type, with balls seating on combination valve seat and seal ring. Valve seat and seal rings shall be renewable by replacing only the combination seat-seal ring.

2.3 POWER SUPPLY

Power supply shall be 230/460 volts, three phase, 60 hertz.

2.4 SUCTION AND DISCONNECTIONS

Contractor shall provide fittings to adapt the pump suction and discharge connections to system piping as shown on the Drawings. .

2.5 EXTERNAL INTERFACE SIGNALS

A. Provide interface to accept a remote start/stop signal to the metering pump in the remote mode.

B. Provide a remote status indication of “pump running” with an isolated contact closure, rated for 5 amperes at 120-volt ac.

C. Provide a remote status indication of local/remote switch position with an isolated contact closure, rated for 5 amperes at 120-volt ac.

D. Provide a percent of speed with 4- to 20-mA d-c output corresponding to 0% to 100% speed for remote indication of metering pump.

E. Provide a 4- to 20-mA input signal for stroke speed control.

2.6 LIQUIDS PUMPED

Liquids pumped are described below. See the subsection on “Service Conditions” to determine which pumps handle the particular liquid described.

A. Sodium Hypochlorite 0.8% solution

Specific gravity	1.0 to 1.2
Viscosity	1 centipoise
Temperature	45°F to 120°F

B. Aluminum Sulfate Hydrate, 14 (50%)

Specific gravity	1.35
pH	1.9 to 2.4
Viscosity	20 to 30 centipoise
Temperature	45°F to 120°F

C. Hexafloc, 14 (97%)

Specific gravity	0.6 to 0.9
pH	5 to 9
Viscosity	20 to 30 centipoise
Temperature	45°F to 120°F

2.7 SPARE PARTS

A. Provide the following spare parts for each pump:

Quantity	Item
1	Diaphragm
2	Ball check valve assemblies
1	Seat and seal ring assembly

B. Provide additional spare parts as recommended by manufacturer for one (1) complete pump re-build kit per pump type.

C. Pack spare parts in a wooden box; label with the job location, pump type and model, manufacturer's name and local representative's name, address, and telephone number and attach list of materials contained within.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Provide the manufacturer's recommended lubricants for each piece of equipment.

3.2 SERVICE CONDITIONS

A. Pump hydraulic performance conditions and design data shall be as shown below.

B. Sodium Hypochlorite Pump Tag Numbers: SFWB-70MP-1-90, SFWB-70MP-2-90, SFWB-70MP-3-90

Location	Chemical Feed Building
No. Pumps	3
Liquid pumped	Sodium Hypochlorite
Capacity range	60-660 gph
Motor	1 HP
Maximum design discharge pressure	45 psig
Pressure-relief valve setting	165 psig
Maximum required suction lift	3.5 feet
Remote run/stop signal required?	Yes
Remote status indication of pump running required?	Yes
Remote status indication of local/remote operation required?	Yes
4- to 20-mA output signal for remote indication of pump speed required?	Yes
4- to 20-mA input signal for remote control of pump speed required?	Yes
Toggle switch for selecting internal manual stroke frequency/external remote signal?	Yes
Pump ball check valve construction	Ceramic
Seat and seal ring construction	PTFE
Pump head construction	PVDF
Fittings and connections at pump head	PVDF
Connection Size, NPT	1-1/2"
Diaphragm construction	PTFE
Diaphragm Size	6-1/2"
Drive	Direct Drive w/ variable speed inverter duty motor
Manufacturer and model	UGSI Encore 700, Double Simplex

C. Alum Pump Tag Numbers: SFWB-72MP-1-90 and SFWB-72MP-2-90

Location	Chemical Feed Building
No. Pumps	2
Liquid pumped	Aluminum Sulfate Hydrate 14
Capacity range	1.5-77 gph
Maximum design discharge pressure	130 psig
Pressure-relief valve setting	165 psig
Maximum required suction lift	3.5 feet
Remote run/stop signal required?	Yes
Remote status indication of pump running required?	Yes
Remote status indication of local/remote operation required?	Yes
4- to 20-mA output signal for remote indication of pump speed required?	Yes
4- to 20-mA input signal for remote control of pump speed required?	Yes
Toggle switch for selecting internal manual stroke frequency/external remote signal?	Yes
Pump ball check valve construction	Ceramic
Seat and seal ring construction	PTFE
Pump head construction	PVDF
Fittings and connections at pump head	PVDF
Connection Size, NPT	¾”
Diaphragm construction	PTFE
Diaphragm Size	4”
Drive	Direct Drive w/ variable speed inverter duty motor (50:1 turndown required)
Manufacturer and model	UGSI Encore 700, Simplex

D. Polymer Pump Tag Numbers: SFWB-74MP-1-90 and SFWB-42MP-2-90

Location	Chemical Feed Building
No. Pumps	2
Liquid pumped	Hexafloc AD-10EP
Capacity range	0-26 gph
Maximum design discharge pressure	175 psig
Pressure-relief valve setting	200 psig
Maximum required suction lift	3.5 feet
Remote run/stop signal required?	Yes
Remote status indication of pump running required?	Yes
Remote status indication of local/remote operation required?	Yes
4- to 20-mA output signal for remote indication of pump speed required?	Yes
4- to 20-mA input signal for remote control of pump speed required?	Yes
Toggle switch for selecting internal manual stroke frequency/external remote signal?	Yes
Pump ball check valve construction	Ceramic

Location	Chemical Feed Building
No. Pumps	2
Seat and seal ring construction	PTFE
Pump head construction	PVDF
Fittings and connections at pump head	PVDF
Connection Size, NPT	½"
Diaphragm construction	PTFE
Diaphragm Size	2"
Drive	Direct Drive w/ variable speed inverter duty motor
Manufacturer and model	UGSI Encore 700, Simplex

3.3 FIELD TESTING

Field testing shall be completed in coordination with and under direct supervision of the Owner. Operate each pump, using the fluid they are to normally pump, for eight consecutive hours during which time no repairs shall be required. Assure that manual stroke length and frequency adjustments on the pumps perform over the specified adjustment range. Assure that diaphragms do not leak or tear. Repair or replace any leaking diaphragms at no additional cost to the Owner. Assure that backpressure and pressure-relief valves have been provided and set as specified and shown in the Contract Drawings. Repair or replace any valves not set or operating as specified at no additional cost to the Owner.

END OF SECTION

SECTION 46 33 13 - ON-SITE HYPOCHLORITE GENERATION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. This Section covers the work necessary to furnish, certify installation, test and make ready for operation an on-site sodium hypochlorite generation system (OSHG) at the South Fork Water Board Water Treatment Plant.

B. The system includes, but is not limited to, the sodium hypochlorite generator, water softener, salt storage/brine saturator tank, hypochlorite solution storage tanks, internal piping, valves, hydrogen blowers, hydrogen monitoring system, power and control equipment, seismic anchorage/bracing system, and support services as specified herein.

C. See Section 01 20 20 Measurement and Payment for bid price description.

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. National Electric Manufacturer's Association (NEMA).
2. National Science Foundation (NSF).
3. OSHA, Safety standards concerning personnel protection against machinery and the handling of dangerous chemicals.

1.3 DESIGN REQUIREMENTS

A. Design loads: In accordance with current IBC requirements.

B. Seismic anchorage and bracing systems shall be designed by a qualified professional engineer registered in the State of Oregon. For specific requirements and design criteria for anchorage and bracing systems, see section 01 33 17 Structural Design, Support, and Anchorage.

1.4 SUBMITTALS

A. Action Submittals and Shop Drawings:

1. Make, model, weight, and horsepower of each equipment assembly.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Performance data on blowers.
4. Detailed dimensional drawings for all equipment, including mounting requirements and piping connection sizes and locations.
5. Power and control wiring diagrams, including terminals and numbers.

6. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.

7. Manufacturer's materials compatibility information, confirming compatibility of wetted parts with specified pumped chemicals.

8. Factory finish system.

9. Process flow diagrams.

10. Dimensioned inlet/outlet system connections.

11. The acceptable range of water pressure for proper system operation.

12. External utility requirements such as water, power, venting, and drain for each component.

13. Functional description of internal and external instrumentation and controls including list of parameters monitored, controlled, or alarmed.

14. Control panel elevation drawings showing construction and placement of operator interface devices and other elements.

15. Materials and equipment's weights, center of mass, hole sizes and locations for anchors, and other physical requirements for Equipment Supplier's use in seismic anchor and bracing design as required by the 2006 International Building Code (IBC) and ASCE 7-05.

B. Informational Submittals:

1. Manufacturer's standard factory reports of each test and inspection.

2. Special shipping, storage and protection, and handling instructions.

3. Manufacturer's printed installation instructions.

4. Field performance test procedures.

5. Field test reports for each functional and performance test of equipment.

6. Manufacturer's Certificate of Proper Installation.

7. Suggested spare parts list to maintain the equipment in service for a period of 1 year and 5 years.

8. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.

9. Complete PLC and OIT program listings in both hard copy and electronic media. Documentation shall include complete data mapping of all process parameters, status and alarm variables that are required to provide for remote monitoring as required by other sections of this specification.

10. Onsite Hypochlorite Generation Equipment Vendors: Each named OSHG manufacturer must submit the completed economic evaluation table to the Engineer at the Bid opening.

11. Items as listed in the following sections:

    a. Part 1.7, Manufacturers.
    b. Part 1.8, Warranty.
    c. Part 1.10, Factory Acceptance Test (FAT)

C. Closeout Submittals:

1. O&M Manuals: One electronic copy and three hard copies.

1.5 EXTRA MATERIALS

A. Furnish one set of the following spare parts:

1. One (1) complete set of fuses.

2. One (1) set of electrolytic cell level and temperature switches and/or sensors.

3. One (1) spare electrolytic cell.

    a. Spare cell not required for manufacturer, DeNora, Clortec.

B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the Owner.

C. Furnish an initial supply of all cleaning materials greases and lubricants required to start operations. Supply an amount of these materials equivalent to one year of continuous operation for each system.

D. Furnish an electrode cell clean-in-place system or portable cell bath with bypass spool.

1.6 OPERATING COST INFORMATION

A. The OSHG manufacturer shall provide the following guaranteed operation cost information within the Bid Form to assess life cycle cost for operating the OSHG system:

1. Salt Efficiency defined as the mass of salt in pounds required to generate 1 pound of chlorine.

2. Power Efficiency defined as the amount of energy in Kilowatt-hours required to generate 1 pound of chlorine.

1.7 QUALIFICATIONS

A. OSHG Supplier’s Qualifications:

1. The OSHG supplier/manufacturer shall have at least 15 systems installed of 1,000 lbs/day chlorine equivalent or larger. As part of their submittal package, the system manufacturer shall submit the following:

    a. Evidence that equipment of similar capacity and service capability has been in successful operation in at least fifteen separate installations including five references.

b. Current NSF Standard 61 Certification for the system being offered.

c. The sodium hypochlorite generation equipment shall be functionally tested at the job site. Electrical component testing and hydraulic pressure testing of electrolytic cells will be conducted at factory prior to shipment.

1.8 WARRANTY

A. Prior to acceptance (by the Owner) of the OSHG system, the OSHG Supplier shall provide written warranty that includes the following statements:

1. OSHG supplier has inspected the installation during and after completion and the OSHG system is free from faults and defects and is in conformance with the Contract Documents.

2. OSHG supplier shall provide the following after-sales services:

a. 24-hour, 365-day toll free service hot line.

b. Onsite technician availability.

c. Same day or overnight parts availability.

d. Evidence of spare parts availability on this system such as electrodes, rectifiers, control cabinets, brine and water proportioning components.

3. The entire OSHG system shall have a full 2-year warranty covering all parts and labor from date of equipment acceptance. Additionally, the electrode cells and housings are warranted on a prorated basis for years 3 through 5 from date of equipment acceptance. Should the electrodes or any part of the cell assembly fail during the first 2 years, the entire cell assembly shall be replaced free of charge.

4. The OSHG supplier warrants that the equipment will meet or exceed the efficiency requirements as submitted in Part 1.6, Operating Cost Information. If the equipment should not meet the efficiency requirements, the Supplier shall pay the Owner the difference between the actual salt and electrical usage and the stated levels for a period of 10 years.

1.9 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for delivery, storage, and handling of the OSHGs in accordance with the Manufacturer's recommendations.

B. During long-term storage or long shut-down period, the Contractor shall be responsible for periodically preserving and maintaining each piece of equipment of the OSHG system and re-conditioning them prior to startup.

1.10 FACTORY ACCEPTANCE TEST (FAT)

A. The OSHGS supplier shall test plumbed assemblies, control panels and junction boxes prior to shipment.

B. Pre-plumbed Assemblies, testing shall consist of the following:

1. Visual inspection of general workmanship.
2. Visual verification that the arrangement and dimensions of the assembly matches the fabrication drawings.
3. Visual verification of nameplates information.
4. Hydrostatic Leak test. The OSHGS Supplier shall perform a hydrostatic leak test on the OSHG Rack or Skid assembly by filling the unit with water, venting all air, and pressurizing the entire system to 30 psig and holding it for 15 minutes.
5. Measure the concentration of sodium hypochlorite solution (as chlorine equivalent) generated by the system.
6. Document all test data on a Test Record Form.

C. Control panels, testing shall consist of the following.

1. Visual inspection of general workmanship.
2. Visual verification that the panel layout matches the layout and schematic drawings.
3. Visual verification of nameplates information.
4. Simulation of I/O's to verify correct wiring and correct software.
5. Continuity test to verify wiring.
6. Confirm and document all instruments' set-points, system alarms and faults as shown on the electrical control panel drawings and control philosophy.

D. Hypochlorite generator rack or skid wiring, testing shall consist of the following:

1. Visual inspection of general workmanship.
2. Visual verification that the rack or skid wiring matches the electrical schematic drawings and field wiring diagram.
3. Continuity test to verify wiring.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: DeNora Clortec 900-C.

B. Modifications to the design will be required based on final manufacturer selection, including but not limited to: general equipment arrangement; water and brine inlet locations; vent, drain, and sodium hypochlorite discharge locations; electrical connections; and alarms and process interlocks.

C. Shop drawings showing complete onsite generation system layout, including all piping connections, piping routing within the WQSB, vent, drain, water, and power connections based on final manufacturer selection shall be submitted to the Engineer for review and approval. All costs associated with a modified design shall be borne by the Contractor.

D. Onsite Hypochlorite Generation System shall be manufactured by:

1. DeNora.
2. PSI Water Technologies.
3. Evoqua.

2.2 SERVICE CONDITIONS

A. Feed Points: Under normal operating conditions, site generated sodium hypochlorite (nominally 0.8 percent) shall be injected into the process at two points:

1. Prior to coagulation; and
2. After the filtration basins.

B. Under emergency conditions the system shall allow commercially available sodium hypochlorite (12 to 15 percent solution) to be used in the hypochlorite storage tanks in lieu of the generated sodium hypochlorite solution.

C. Functional Requirements:

1. Instrumentation, controls, logic, programming, interlocks and valving shall be provided as a package.

2. General arrangement, piping sizes and accessories are shown on the Drawings.

D. Jobsite Elevation: 324.20 feet above mean sea level.

2.3 SODIUM HYPOCHLORITE GENERATOR

A. Two (2) Sodium Hypochlorite Generators as shown on the Drawings:

1. SFWB-70G-1-45.
2. SFWB-70G-2-45.

B. Each Sodium Hypochlorite Generator shall be capable of producing at least 1,000 pounds per day equivalent chlorine in a 0.8% sodium hypochlorite solution.

C. The electrolytic system shall generate an aqueous solution of a minimum concentration of 0.8 percent (plus or minus 0.05 percent) by weight sodium hypochlorite expressed as chlorine.

D. The electrolytic cell shall consume a maximum of 3 pounds of salt per pound of chlorine equivalent output, using solar salt containing no organic binders, flow control agents or resin cleaning material, and meeting the following specifications:

Component	Percent by Weight
NaCl: Dry Basis Wet Basis	 96.3 percent minimum 93.3 percent minimum
Fluoride	0.02 percent
Manganese	0.0002 percent
Calcium Sulfate	0.30 percent maximum
Magnesium Chloride	0.06 percent maximum
Calcium Chloride	0.10 percent maximum
Magnesium Sulfate	0.02 percent maximum
Insoluble	0.1 percent maximum
Moisture (as H_2O)	3.0 percent maximum
Lead	0.0007 percent maximum
Copper	0.0003 percent maximum
Iron (as Fe)	0.002 percent maximum

E. The electrolytic cell shall consume a maximum of 2.0 AC kilowatt-hours of electricity per pound of chlorine equivalent output.

F. The electrolytic cell shall consume a maximum of 15 gallons of water per pound of chlorine equivalent output.

G. The generator shall have no waste products associated with its use other than hydrogen gas which is to be vented to the atmosphere (outside the building), and brine generated from reactivating the water softener. Hydrogen gas will be vented to the atmosphere; brine will be discharged to the sanitary sewer.

H. The generator package shall be mounted in the general location shown on the Drawings and shall be factory wired, plumbed, assembled and tested. The generation system frame shall be painted carbon steel or Type 304 stainless steel or epoxy-coated steel. The equipment shall be installed per the clearances as shown on the Drawings.

I. The generator package shall consist of the electrolytic cell(s), flow control panel, rectifier cabinet, and control panel containing system controls, water softener with flow meter, water heater, and all necessary hardware, and hydrogen venting.

J. Each rectifier power supply shall be 480V AC, three-phase, 60 Hz with a draw of not more than 200 full load amps (FLA) and shall be equipped with soft start constant current with built-in DC volt and amp display, emergency shut-off switch and disconnect.

K. The transformer shall be frame mounted in a NEMA 3 or 4 enclosure, air cooled, and shall be Class H insulation with an 80 degrees C temperature rise.

L. The flow control panel shall function to automatically dilute concentrated brine with softened water to be delivered to the cell(s). The flow control panel shall have valving for cleaning purposes.

M. Electrolytic Cell:

1. The electrolytic cell shall be constructed of materials compatible with the corrosive environment in the electrode cell and shall be vertically or horizontally oriented.

2. Cell construction shall allow for electrodes to be removed easily and intact. Any necessary joining of cell materials shall be by materials compatible with the corrosive environment in the electrode cell. No penetrations are allowed into the electrode cell.

3. The electrode cells shall be factory tested to 1.5 times the maximum operating pressure, for a period of 30 minutes, prior to final assembly and shipment.

4. The electrodes shall be titanium and the anodes coated with a mixed metal oxide catalytic coating for electrical efficiency and maximum longevity.

N. The generator package shall have the following redundant interlocked safety features:

1. Cell high temperature switch, for each cell.

2. Cell low level switch, for each cell.

3. Water flow switch.

4. Rectifier over voltage switch.

5. Transformer high temperature switch.

6. Automatic Voltage and Current Regulation: All of the above safety features shall be interlocked so as to prevent operation if any of the normal parameters are exceeded. In the event of a trip condition an alarm contact set shall be made signaling a shutdown condition. Each alarm condition, along with normal operating status, shall be communicated to the plant control system via the data highway.

O. The process shall operate in continuous and batch environments allowing for consistent hypochlorite concentrations and greatest efficiencies.

P. Install a solenoid valve on the water softener discharge to operate from the control panel. OSHG System Supplier shall coordinate solenoid valve electrical and hydraulic requirements.

Q. Makeup water will consist of chlorinated water from Owner, at 55 to 78 degrees F and a pressure up to 80 psi. Manufacturer required to pretreat or adjust temperature and pressure as needed for generation of hypochlorite.

2.4 STORAGE TANKS

A. See Section 43 40 02, Fiberglass Reinforced Plastic Tank.

2.5 CHEMICAL METERING PUMPS

A. See Section 43 30 00, Chemical Feed Pumps.

2.6 CONTROL SYSTEM

A. Instrumentation and Control Components, as further defined or modified herein.

B. Provide one PLC/control panel for the complete system. The PLC shall be the manufacturer's standard system and shall be equipped with Ethernet TCP/IP interface for interconnectivity to the plant-wide process control data network system. IP addresses and Ethernet communications shall be coordinated with the Equipment Supplier and Owner to ensure compatibility with other control system network components. PLC program and documentation shall be provided in both electronic and printed form.

C. The control panel shall provide for complete system control in automatic and manual modes and shall display all relevant operating parameters, modes, status, and/or alarm conditions on a color graphic touch screen Operator Interface Terminal (OIT).

D. The PLC/control panel power supply shall be 120V AC, single-phase, three-wire, 60 Hertz with a maximum draw of 30 amps. The control panel shall be able to provide 120VAC power to ancillary equipment.

E. The painted carbon steel or Type 304 stainless steel NEMA 4X control cabinet shall be UL 508 approved, to house the PLC, hydrogen blower controls, and terminal strips to fully support the functions of generator operation, and tank levels.

F. The control cabinet logic shall function at the PLC level where operating parameters shall be measured, corrected, scaled, reported and controlled.

G. The PLC shall come shipped with fully debugged and annotated application software, for both the PLC and the OIT panels. Control system functionality shall include making available through the Ethernet communication network, all key process parameters, status, and alarm conditions for monitoring by the separate plant control system. The software shall include security measures to prevent unauthorized modification of PLC code or parameters. All passwords, etc. shall be provided to the owner upon completion of system commissioning.

H. The generator PLC and display shall control and monitor all functions and operational parameters including, but not limited to, the following:

1. Electrolytic cell safety devices.

2. Rectifier control.

3. DC amperage and voltage.

4. Hypochlorite tank levels.

5. Blower controls.

6. Generator operating mode, including FAIL/ON/REMOTE/RUN/LOW-LOW controls and status indications.

7. Start permissive from the plant process control system.

8. Alarm history.

9. Security protection.

I. Generator Operation:

1. The generator shall automatically start and stop based on the high and low levels in the sodium hypochlorite storage tanks.

2. The generator shall automatically start and stop based on the high and low levels in the Sodium Hypochlorite Storage Tanks.

3. The water softener resin shall automatically be regenerated with salt solution from the brine tank.

4. The generator shall shut down and alarm for the following conditions:

a. Cell is not full.

b. Hypochlorite temperature exceeds 50 degrees C.

c. Inlet flow falls below a preset value.

d. Rectifier high voltage.

e. Rectifier high temperature.

f. Chemical Room Hydrogen Dilution Blower Failure:

1) No pressure differential.

g. Hydrogen Dilution Blower Failure:

1) No pressure differential.

h. Hydrogen sensor.

5. The following additional alarms shall be provided on the control panel:

a. Low-low level for sodium hypochlorite storage tank.
b. High-high level for sodium hypochlorite storage tank.

J. The OSHG supplier shall be responsible for programming the OSHG system package control software.

K. The OSHG supplier shall perform functional, performance and start-up testing of the Sodium Hypochlorite System.

L. Start shall be based on liquid level of priority tank.

2.7 CARTRIDGE FILTERS

A. In-line orientation.

B. Reinforced clear PVC housing.

C. Rated for particle removal at design flow rate. OSHG system supplier shall define particle retention and flow rate.

2.8 WATER SOFTENERS

A. The water softener shall be dual tank, continuously operational and capable of automatically regenerating without the use of electric timers or gear motors. Supply water to the softener is chlorinated with a free residual of 0.4 mg/l to 1.0 mg/l. The softener shall be capable of treating water with a hardness ranging from 80 to 150 mg/L as $CaCO_3$ to acceptable levels for hypochlorite generation.

2.9 WATER SUPPLY PRESSURE CONTROL VALVE

A. Install a pressure control pressure reducing valve on the main water supply pipe if required. The OSHG system supplier shall size the pressure control pressure reducing valve to meet the system flow and pressure requirements.

1. The plant potable water supply (W2) pressure range is approximately 65 psi to 75 psi.

B. Manufacturer: Watts or an approved equal.

2.10 HYDROGEN GAS MONITOR

A. Monitor ambient room conditions for hydrogen gas. In the filter room in the vicinity of hypochlorite storage tanks and within the chemical room near the OSHG.

B. The hydrogen detector shall constantly monitor all sodium hypochlorite generation and indoor storage environments for unsafe levels of hydrogen gas (H_2). The hydrogen transmitter shall be loop powered at 24V DC with relay outputs for local alarms and shall transmit an analog 4 to 20 mA signal proportional to the hydrogen level detected. The 4 to 20 mA analog signal shall be transmitted to the generator control panel for continuous monitoring. The transmitter shall be equipped with LCD graphical display showing gas concentration in units of % LEL.

C. The hydrogen detector sensor shall be catalytic bead type and shall be supplied with an explosion-proof separation kit, thus allowing the sensor to be installed at the highest point in the room while the transmitter shall be installed at eye level. Hydrogen detector shall include a calibration kit consisting of H_2 bottle at 2 percent concentration by volume along with connecting hose, regulating valve and carrying case. A remote calibration adapter shall be supplied allowing the calibration of the sensor head to be performed at eye level.

D. Manufacturer and product shall be per onsite generation manufacturer.

2.11 DILUTION BLOWERS

A. Four (4) hydrogen dilution blowers as shown on the Drawings:

1. SFWB-70B-1-60.
2. SFWB-70B-2-60.
3. SFWB-70B-1-45.
4. SFWB-70B-2-45.

B. The blowers shall be sized and provided by the OSHG manufacturer. The blowers shall purge out all residual hydrogen and sufficiently ventilate the OSHG conveyance system and storage tanks.

C. Equipped with safety interlocks and powered, controlled and monitored by the generator control panel.

D. OSHG manufacturer shall design a dilution blower system and provide controls that maintain the hydrogen concentration at or below 25 percent of the hydrogen level for all portions of the OSHG system.

E. OSHA Lower Explosive Limit Manufacturer: New York Blower Co., or equal.

2.12 AIR PRESSURE SWITCH

A. Provide air pressure switch and any necessary piping flow elements located on the tank vent piping.

2.13 FABRICATION

A. In general, workmanship and finish of all metalwork shall be of the highest grade and equal to the best practice of modern shops. Exposed surfaces shall have smooth finish and sharp, well defined lines. Methods of fabrication not specified herein shall be adequate for the service encountered, and as reviewed by the Engineer.

PART 3 EXECUTION

3.1 GENERAL

A. Furnish all necessary material such as gaskets, bolts, hangers, minor supports, grout, and weld rod as shown on the Drawings and as required for installation of the equipment under this section in full operational condition.

3.2 INSTALLATION SERVICES

A. A manufacturer’s representative will be responsible for assisting the supervision of the installation, in startup and testing the equipment, and in training the Owner’s staff in proper operation and maintenance of the equipment.

B. Direct the Equipment Supplier to provide a drain for each piece of equipment.

C. Apply and supply required lubricants and cleaning materials to equipment and furnish 12 month run time supply to Owner.

D. Provide equipment necessary to test high strength (0.8%) hypochlorite solution.

3.3 FIELD TESTS

A. Functional Test: Prior to plant startup, all equipment shall be inspected by the manufacturer for proper installation, quiet operation, and proper connection by means of a functional test. Verify structures, equipment, pumps and motors are compatible for an efficient system. Make equipment adjustments required to place system in proper operating condition. If the OSHG system fails to meet any of the specified performance requirements, modify and/or replace defective equipment until it meets specified requirements. Re-test system to verify satisfactory operation.

B. Hydrostatic Test: Perform hydrostatic test on the tanks after installed but before piping connections are made. Block all outlets and fill each tank with water to again check for leaks. No leakage shall be permitted.

C. Performance Test: Conduct on each system assisted by manufacturer's representative in the presence of the Engineer. Perform under actual or approved simulated operating conditions for a continuous 8-hour period without malfunction.

3.4 MANUFACTURER'S SERVICES

A. A manufacturer's representative for the equipment specified herein shall be present at the jobsite and/or classroom designated by the Owner for the minimum person-days listed for the services hereinunder, travel time excluded:

1. 3 person days for installation assistance, inspection, and completion of Manufacturer's Certificate of Proper Installation.

2. 2 person day for functional testing and performance testing.

3. 1 person day for prestartup classroom or jobsite training.

B. Manufacturers shall provide manufacturer field services in coordination with Contractor and Owner.

C. Manufacturer shall provide equipment testing and facility startup in coordination with Contractor and Owner.

END OF SECTION

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SECTION 46 36 33 – SODA ASH BULK BAG UNLOADER SYSTEM

PART 1 GENERAL

1.1 REFERENCES

A. This Section covers the work necessary to furnish, certify installation, test and make ready for operation a soda ash bulk bag unloader system (soda ash system) at the South Fork Water Board Water Quality Systems Building (WQSB).

B. The system includes, but is not limited to a volumetric feeder, feed hopper, bulk bag unloader, soda ash solution tank, mechanical mixer, solution tank level sensor, solution metering pump, water control components, controls, and support services as specified herein.

C. The bid price shall include all labor, equipment, and material necessary to manufacture the soda ash system, and include, but not be limited to, all the elements and components needed to assemble the soda ash system meeting the specification and performance requirements. Bid price shall also include shipping, spare parts, cleaning equipment, testing, factory service support, training services, start-up, and warranty.

D. Scheduling and Startup Date: Delivery of all equipment shall be made by the date specified within the Special Conditions of this Bid Document. After successful startup, and after the equipment is determined to be operating as specified, the Utility will issue a formal acceptance of the equipment.

E. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. National Electric Manufacturer's Association (NEMA).
3. National Science Foundation (NSF).

1.2 DESIGN REQUIREMENTS

A. Design loads: In accordance with current IBC requirements.

B. Seismic anchorage and bracing systems shall be designed by a qualified professional engineer registered in the State of Oregon. For specific requirements and design criteria for anchorage and bracing systems, see section 01 33 17 Structural Design, Support, and Anchorage.

1.3 SUBMITTALS

A. Action Submittals and Shop Drawings:

1. Make, model, weight, and horsepower of each equipment assembly.

2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.

3. Detailed dimensional drawings for all equipment, including mounting requirements and piping connection sizes and locations.

4. Power and control wiring diagrams, including terminals and numbers.

5. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.

6. Manufacturer's materials compatibility information, confirming compatibility of wetted parts with specified pumped chemicals.

7. Factory finish system.

8. Process flow diagrams.

9. Dimensioned inlet/outlet system connections.

10. The acceptable range of water pressure for proper system operation.

11. External utility requirements such as water, power, and drain for each component.

12. Functional description of internal and external instrumentation and controls including list of parameters monitored, controlled, or alarmed.

13. Control panel elevation drawings showing construction and placement of operator interface devices and other elements.

14. Material's and equipment's weights, center of mass, hole sizes and locations for anchors, and other physical requirements for Equipment Supplier's use in seismic anchor and bracing design as required by the 2006 International Building Code (IBC) and ASCE 7-05.

B. Informational Submittals:

1. Manufacturer's standard factory reports of each test and inspection.

2. Special shipping, storage and protection, and handling instructions.

3. Manufacturer's printed installation instructions.

4. Field performance test procedures.

5. Field test reports for each functional and performance test of equipment.

6. Manufacturer's Certificate of Proper Installation.

7. NSF Certification.

8. Suggested spare parts list to maintain the equipment in service for a period of 1 year and 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.

9. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.

10. Complete PLC and OIT program listings in both hard copy and electronic media. Documentation shall include complete data mapping of all process parameters, status and

alarm variables that are required to provide for remote monitoring as required by other sections of this specification.

11. Soda Ash Bulk Bag Unloader Equipment Vendors: Each named soda ash system manufacturer must submit the completed economic evaluation table to the Engineer at the Bid opening.

12. O&M Manuals:

    a. See Section 01 78 23, Operation and Maintenance Data.
    b. One electronic copy and three hard copies.

1.4 EXTRA MATERIALS

A. Furnish an initial supply of all cleaning materials, greases and lubricants required to start operations. Supply an amount of these materials equivalent to one year of continuous operation for each system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The soda ash system shall be furnished by a single supplier, with all manufacturing and assembly of the equipment and controls carried out in the supplier's facilities.

B. The soda ash system shall be able to feed soda ash into the WQSB at a rate of 116 dry pounds per 12-hour day for a 2% soda ash solution.

C. Soda Ash System Supplier's Qualifications:

1. The soda ash system supplier/manufacturer shall have at least 15 installed systems of equivalent capacity or larger. The supplier shall have a minimum of 40 years of experience in providing similar equipment in municipal installations. As part of their submittal package, the system manufacturer shall submit the following:

    a. Evidence that equipment of similar capacity and service capability has been in successful operation in at least fifteen separate installations including five references.

    b. Current NSF Standard 61 Certification for the system being offered.

    c. The soda ash system equipment shall be functionally tested at the job site.

D. Acceptable Manufacturers

1. Chemco Systems
2. Or equivalent

2.2 WARRANTY REQUIREMENTS

A. Prior to acceptance of the soda ash system, the supplier shall provide written warranty that includes the following statements:

1. Soda ash system supplier has inspected the installation during and after completion and the soda ash system is free from faults and defects and is in conformance with the Contract Documents.

2. The entire soda ash system shall have a full 1-year warranty covering all parts and labor from date of equipment start-up and acceptance.

2.3 SERVICE CONDITIONS

A. Under normal operating conditions, soda ash shall be injected into the process after the filtration basins.

B. Functional Requirements:

1. Instrumentation, controls, logic, programming, interlocks, and valving shall be provided as a package.
2. General arrangement, piping sizes and accessories are shown on the Drawings.

C. Height Requirement: The soda ash system shall be no greater than 17 feet and 2 inches in height so as to provide at least 14 inches of clearance between the tallest part of the soda ash system and the roof trusses in the chemical feed building.

2.4 VOLUMETRIC FEEDER

A. The feeder shall produce uniform product density for accurate and continuous material feed without flooding, bridging, or voids. The feeder housing shall be dust-tight. The feeder shall be heavy-duty and designed to provide easy cleaning without the need for removing the feeder from its mounting, or disassembling flexible connectors, hoppers, or removing the dissolving tank.

B. The feeder housing shall be constructed to provide complete access to its internal components for repairs or periodic maintenance.

C. All chemical contact areas of the feeder including the augers, drive shafts, seal housing and discharge cylinder shall be constructed of 304 stainless steel; the seals shall be synthetic. Minimum sheet metal thickness shall be 11 gauge and all welds shall be continuous.

D. The feeder shall be powered by no less than a single, 1/2 HP, 460 volt, 3 phase, 60 hertz totally enclosed TEFC variable speed duty motor.

E. The feeder shall employ a mechanism to prevent bridging and ensure that the auger flighting is filled during normal operation.

F. The feeder shall be mounted on cross members of the bulk bag unloader support structure.

G. The feeder shall have a maximum volumetric metering accuracy within of +/- 2% (error) of the desired set point value for non-free flowing chemicals based on a given number of consecutive one-minute samples.

2.5 FEEDER HOPPER

A. The feeder shall be supplied with an integral supply hopper to provide a minimum of 2 cubic feet of storage capacity.

B. The hopper shall be constructed of 304 stainless steel.

2.6 FEEDER HOPPER LEVEL SWITCH

A. Furnish one low level switch that shall be mounted in the hopper to detect a low level and signal a low hopper level alarm.

2.7 BULK BAG UNLOADER

A. The feed system shall be provided with an integral bulk bag (super-sack) unloading system to provide an effective means for discharging the chemical from the bulk bag and into the feeder. The bulk bag unloader shall be capable of lifting, supporting, and discharging bulk bags.

B. The system shall be designed for use with bulk bags of the following dimensions.

1. Bag dimensions: 3-feet wide x 3-feet deep x 3-feet tall
2. Bag weight: 2000 lbs.

C. The system shall consist of all but not limited to a support structure with I-beam, a motorized hoist and trolley, a bag holder and vibrating support bed, a manual iris valve, and a bag spout untying receptacle.

D. The bulk bag unloader support structure shall be constructed of epoxy painted carbon steel and designed to support the unloader accessories and a full bag of product. Product contact areas shall be constructed of 304 stainless steel.

E. The bulk bag unloader shall be equipped with an electrically operated chain hoist and trolley rated for a minimum of 1-ton. The trolley and hoist shall have its own separate power feed. The trolley and hoist shall be mounted an I-beam with travel safety stops.

F. The bulk bag unloader shall have a carbon steel vibrating bag support tray. And connected to the support structure with vibration dampening connections to minimize transfer of vibration to the support structure.

G. The bulk bag unloader shall utilize controlled vibration to produce reliable discharge of material from within bulk bags and into the feeder beneath. Vibration shall be produced by an adjustable, permanently lubricated rotary electric vibrator powered by a TEFC variable speed motor with a 120-volt, 1 phase, 60 hertz power requirement. The low-level probe in the feeder hopper shall trigger the operation of the bulk bag unloader.

H. To ensure minimal operator contact with chemical dust, a 15-inch diameter, manually operated iris valve shall be mounted under the vibrating bed to seal off the bag prior to untying the spout upon loading, and prior to tying the spout of an empty bag upon its removal. The iris valve shall have an unobstructed bore for unrestricted flow of material. The body of the iris valve shall be constructed of 304 stainless steel.

I. A flexible connection sleeve shall be furnished either before or after the iris valve but somewhere between the vibrating bag support bed and the feeder hopper to isolate the vibration from the integral components of the volumetric feeder. The sleeve shall be fastened at the ends with stainless steel band clamps.

J. Under the iris valve, the system shall include bag spout untying receptacle, which shall include a gasketed, dust-tight door. The door shall be provided with quick-clamps, to ensure the door stays closed and sealed.

K. Systems relying on air or massaging paddles to promote material flow will not be considered acceptable.

2.8 WATER CONTROL COMPONENTS

A. The solution tank shall be equipped with an inlet water line assembly complete with a manually operated brass isolation ball valve, a pressure reducing valve with integral strainer, a low-pressure switch, a pressure gauge, a suitably sized PVC/acrylic rotameter, a normally closed brass solenoid valve, a manually operated by-pass ball valve, and a brass/bronze throttling globe valve to control water inflow to the dissolving tank. Components shall be provided loose for installation by the contractor. One pipe branch shall be run to the pump suction for pump flush purposes. Piping shall be suitable sized schedule 80 PVC pipe.

2.9 SOLUTION TANK

A. The solution tank shall be fabricated of at least 11 gauge, 304 or 316 stainless steel, and have a minimum working capacity of 50 gallons for mixing soda ash and water to achieve a concentration of 2%.

B. The solution tank shall be complete with all necessary connections and openings. It shall be equipped with couplings for a water supply inlet, overflow, drain, two pump suction connections for discharge, and a bottom flange for fastening it to the base or floor. The solution tank shall also be equipped with openings for a mixer, level sensor, feeder discharge, and access hatch.

C. The feeder discharge housing, where material is fed into the dissolving tank, shall be equipped with a removable inspection cover.

D. The tank cover shall be equipped with a bolted and gasketed access hatch to allow for operator access to the tank internals.

E. Furnish an overflow and drain line assembly on the solution tank complete with a manually operated isolation ball valve. Piping shall be suitably sized schedule 80 PVC pipe.

F. The tank shall be equipped with a baffle to ensure proper wetting of the material before it is discharged, and to prevent short-circuiting.

G. Plastic tanks will not be considered acceptable.

2.10 MECHANICAL MIXER

A. A gear driven, mechanical mixer shall be furnished on the solution tank for complete mixing of the soda ash and water to achieve a solution concentration of 2% by weight.

B. The mixer shall be equipped with a 316 stainless steel shaft and impeller designed for maximum mixing efficiency, driven by a minimum 1 HP, totally enclosed motor, directly coupled to the mixer shaft. Power requirements for mixer shall be 460-volt, 3 phase, 60 Hz.

2.11 LEVEL PROBES

A. A level sensor(s) shall be furnished on the solution tank for monitoring the solution level.

B. The sensors shall be either a pair of 316 stainless steel conductance probe type or a radar type, designed for a harsh duty application with background suppression and temperature compensation.

C. If the sensors are of the conductance probe type, they shall be used for monitoring “high” and “low” solution levels for alarm purposes.

D. If the sensor is of the radar type, which monitors “high”, “operating”, and “low” levels, it shall have a 4-20 mA analog output wired to a 0-100% level display device located in the soda ash system control panel.

E. The level sensor housing shall be NEMA 4X.

2.12 SOLUTION METERING PUMP

A. Furnish two (2) soda ash solution metering pumps capable of pumping between 0.5 gpm and 15 gpm of soda ash solution at 2% concentration. Pumps shall be supplied, installed, piped, and wired on the bulk bag unloader skid.

B. One pump is for duty, the other pump is for standby service.

C. The pumps shall be peristaltic hose type with a close-coupled gear motor.

D. The pump housing shall be constructed of cast iron and equipped with cast iron rotor, aluminum rotor shoes located 180° apart, and hose leakage detector.

E. Suction and discharge flanges shall be ANSI 150 316 stainless steel.

F. The drive shall be a 2 HP, 460-volt, 3 phase, 60 Hz, totally enclosed TEFC inverter duty, AC motor attached to a gear reducer and controlled by a variable frequency drive mounted in the system control panel. The gear motor assembly shall be close coupled to the pump.

G. Pump manufacturer shall be Watson Marlow Bredel 40 or equal.

H. Pump suction line:

1. The pump suction line assembly shall be equipped with a manually operated isolation valve, flexible connection, and a flush connection with manually operated isolation ball valve.

2. Piping shall be suitably sized schedule 80 PVC pipe.

I. Pump discharge line:

1. The pump discharge assembly shall be equipped with a flexible connection, a manually operated pressure instrument assembly isolation ball valve, a pressure sensor with gauge, and pressure switch.

2. One pressure relief valve piped to solution tank.

3. One pump discharge manual drain valve piped to drain by the Contractor.

4. One pulsation dampener assembly with isolation ball valve.

5. The pump discharge line shall be connected to the pump that is in service.

6. Piping shall be suitably sized schedule 80 PVC pipe.

2.13 CONTROLS

A. A NEMA 4 type 304 stainless steel control enclosure shall be supplied loose for field mounting. The enclosure shall house the variable frequency drive (VFD) motor controllers for the feeder and two (2) metering pumps. A main disconnect switch shall also be provided. Hand/off/auto switches with indicator lights shall be provided for all controlled devices either as physical components or within an OIT touch screen. The Control panel shall operate on 460-volt, 3 phase, 60 Hz power.

B. Control systems that use programmable logic controllers with embedded I/O are not acceptable.

C. The control panel shall include, but not limited to the following:

1. Main disconnect circuit breaker

2. Transformer

3. Fuses

4. IEC type combination motor starter/protectors

a. Bulk Bag Unloader Vibrator
b. Screw Feeder Vibrator, if necessary
c. Solution Tank Mixer

5. Switches

a. Bulk Bag Unloader Vibrator “Hand/Off/Auto”

In auto, the Bulk Bag Unloader Vibrator will operate on demand from the level sensor in the feeder hopper.

b. Feeder “Hand/Off/Auto”

c. Feeder Vibrator “Hand/Off/Auto”, if necessary

d. Solution Tank Inlet Solenoid Valve “Hand/Off/Auto”

e. Solution Metering Pump 1 “Hand/Off/Auto”

f. Solution Metering Pump 2 “Hand/Off/Auto”

6. Push Buttons

a. Alarm Silence
b. Emergency Stop

7. Indicating lights

NOTE: All motor running lights should flash to indicate a motor tripped condition.

a. Bulk Bag Unloader Vibrator “Running”
b. Feeder “Running”
c. Feeder Vibrator “Running”, if necessary
d. Solution Tank Inlet Solenoid Valve “Open“
e. Mixer “Running”
f. Hopper “Low Level Alarm“
g. Solution Tank “Low Level Alarm”
h. Solution Tank “High Level Alarm”
i. Solution Tank Metering Pump 1 “Running”
j. Solution Tank Metering Pump 2 “Running”
k. System “Low Water Pressure”

8. Dry Contacts as required

9. Variable Frequency Drive (VFD)

a. Feeder “Speed Control”
b. Metering Pump 1 “Speed Control”
c. Metering Pump 2 “Speed Control”

D. Operation

1. The soda ash solution make-down is initiated by a low operating level in the solution/slurry tank, such as 80%. The tank will operate in batch mode. Upon receiving the low-level signal, the water supply solenoid valve shall open and the feeder shall start. The bulk bag unloader vibrator will operate periodically with the frequency dependent on the feeder speed. The soda ash and water will be mixed in the solution tank by the mechanical mixer. Soda ash solution make-down shall stop when the high operating level is reached in the solution tank. The mixer shall be energized any time there is solution in the solution tank and the tank is not in a low-level state. A low water pressure signal will stop the solution make-down and the horn and “low water pressure” light will be activated.

2. If solution tank “high” level is reached, the horn and solution tank “high” level light will be activated. If solution tank “low” level is reached, the horn and solution tank “low” level

light will be activated. If solution tank level is in the normal “operating” range, and make-up is being called for, the solution tank “operating” level light will be activated. The “operating” level light will go out when the high operating level is reached and remain out while the level drops through the normal operating level, until the low operating level is reached and make-up is called for.

3. Pressing the “alarm silence” push button will silence the horn. The alarm light will go from flashing to steady on until the fault that caused the alarm is no longer present.

2.14 FACTORY ASSEMBLY

A. The soda ash system shall be factory assembled to the maximum practical extent with consideration for methods of installation through the SFWB WQSB overhead door. Factory assembly shall include all pipe and wire as specified below.

B. Factory pre-wiring shall include all wire and conduit from the system control panel to all components located on the equipment skid.

1. Conduit shall be PVC.
2. Wire shall be THHN rated.

C. Factory pre-piping shall include all water and solution piping from the edge of the skid to the respective equipment located on the skid.

1. Water lines shall be schedule 80 PVC pipe.
2. Solution lines shall be Schedule 80 PVC pipe.

D. The system shall be factory tested prior to shipment to the jobsite.

2.15 PAINTING

A. Piping

1. PVC pipe shall be left unpainted.

B. Except for stainless steel, installed equipment shall receive manufacturer’s standard paint coatings and color.

2.16 FABRICATION

A. In general, workmanship and finish of all metalwork shall be of the highest grade and equal to the best practice of modern shops. Exposed surfaces shall have smooth finish and sharp, well-defined lines. Methods of fabrication not specified herein shall be adequate for the service encountered, and as reviewed by the Engineer.

2.17 SOURCE QUALITY CONTROL

A. Factory Tests and Adjustments: Test all equipment furnished.
B. Factory Test Report: Include test data sheets.
C. Functional Test: Perform manufacturer’s standard test on equipment.
D. Manufacturer’s standard inspections.

PART 3 PART 3 EXECUTION

3.1 GENERAL

A. Furnish all necessary material such as gaskets, bolts, hangers, minor supports, grout, and weld rod as shown on the Drawings and as required for installation of the equipment under this section in full operational condition.

3.2 INSTALLATION SERVICES

A. The system shall be installed by the contractor in strict conformance with the manufacturer's written installation instructions. A manufacturer's representative will be responsible for assisting the supervision of the installation, in startup and testing the equipment, and in training the Owner's staff in proper operation and maintenance of the equipment.

B. Apply and supply required lubricants and cleaning materials to equipment and furnish 12 month run time supply to Owner.

C. Provide equipment necessary to test high strength (2%) soda ash solution.

3.3 FIELD TESTS

A. Functional Test: Prior to plant startup, all equipment shall be inspected by the manufacturer for proper installation, quiet operation, and proper connection by means of a functional test. Verify structures, equipment, pumps and motors are compatible for an efficient system. Make equipment adjustments required to place system in proper operating condition. If the soda ash system fails to meet any of the specified performance requirements, modify and/or replace defective equipment until it meets specified requirements. Re-test system to verify satisfactory operation.

B. Performance Test: Conduct on each system assisted by manufacturer's representative in the presence of the Engineer. Perform under actual or approved simulated operating conditions for a continuous 8-hour period without malfunction.

3.4 MANUFACTURER'S SERVICES

A. A manufacturer's representative for the equipment specified herein shall be present at the jobsite and/or classroom designated by the Owner for the minimum person-days listed for the services hereinunder, travel time excluded:

1. One trip and 3 person days for:

a. Installation assistance, inspection, and completion of Manufacturer's Certificate of Proper Installation.

b. Functional testing and performance testing.

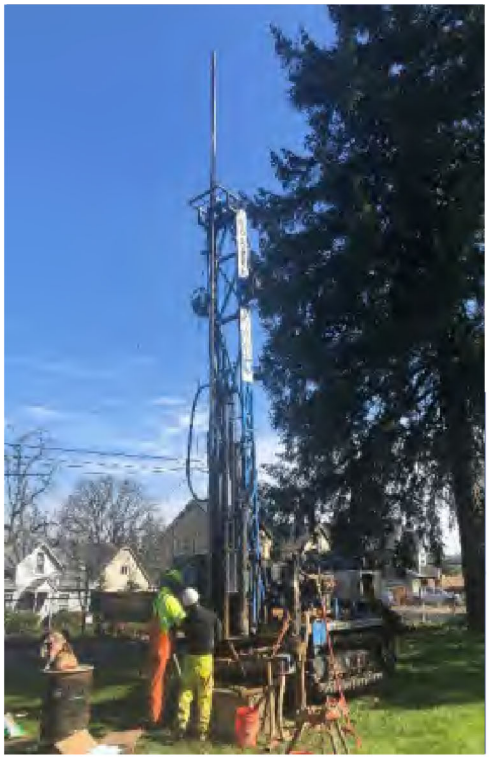
c. Prestartup classroom or jobsite training.

B. Manufacturers shall provide manufacturer field services in coordination with Plant Contractor and Owner.

C. Manufacturer shall provide equipment testing and facility startup in coordination with Plant Contractor and Owner.

END OF SECTION

GEOTECHNICAL ENGINEERING REPORT
SHANNON & WILSON, SEPTEMBER 2021



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GEOTECHNICAL ENGINEERING REPORT

South Fork Water Board Water Treatment Plant Chemical Feed Building

OREGON CITY, OREGON





SHANNON & WILSON

September 2021

Shannon & Wilson No: 106235

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Submitted To: Murraysmith
888 SW 5th Avenue, Suite 1170
Portland, Oregon 97204
Attn: Lee Odell, PE

Subject: GEOTECHNICAL ENGINEERING REPORT
SOUTH FORK WATER BOARD
WATER TREATMENT PLANT
CHEMICAL FEED BUILDING,
OREGON CITY, OREGON

Shannon & Wilson prepared this report and participated in this project as a subconsultant to Murraysmith. Our scope of services was specified in Task Order 21-3045.00, dated February 24, 2021. This report presents the findings from our geotechnical explorations and recommendations to support the design of the proposed Chemical Feed Building and was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON, INC.



Elliott Mecham, PE
Senior Associate | Engineer

Kevin Wood, PE
Senior Engineer

KJW:ECM:JLJ/las:mmb

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ACRONYMS

ASCE	American Society of Civil Engineering
ASTM	American Society for Testing and Materials
bgs	Below Existing Ground Surface
bpf	Blows per Foot
CFB	Chemical Feed Building
CPT	Cone Penetration Testing
CSZ	Cascadia Subduction Zone
DOGAMI	Oregon Department of Geology and Mineral Industries
GPS	Global Positioning System
IBC	International Building Code
MCE	Maximum Considered Earthquake
OSHA	Occupational Safety and Health Administration
OSSC	Oregon Structural Specialty Code
OWRD	Oregon Department
pci	pounds per cubic inch
PGA	Peak Ground Acceleration
psf	Pounds Per Square Foot
SFWB	South Fork Water Board
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VWP	Vibrating Wire Piezometer
WTP	Water Treatment Plant

1 INTRODUCTION

1.1 Project Understanding and Site Description

We understand that a new Chemical Feed Building (CFB) is proposed at the existing South Fork Water Board (SFWB) Water Treatment Plant (WTP) Site located at 15962 Hunter Ave, in Oregon City, Oregon. Murraysmith is leading the civil design of the project and is the prime design consultant. Stantec is leading the structural design and Shannon & Wilson is leading the geotechnical design as subconsultants to Murraysmith. The owner is the SFWB.

The new CFB will consolidate most water treatment chemicals used onsite into one facility and will include installation of new tanks/storage, pump skids, piping, and other ancillary equipment. The building will also accommodate an ADA-accessible meeting room. Based on preliminary design information provided by Murraysmith, the CFB will have a footprint of 49.3 feet by 123.3 feet and will be located on the northern portion of the existing WTP site. Recessed containment areas with sumping pits will underlie the proposed chemical storage tanks. We understand that the recessed containment areas may be up to approximately 3 to 4 feet bgs.

Based on discussion with the structural engineer, Matthew Perkins, loads underlying the heavy tanks are anticipated to be up to 1,000 psf. We understand that for purposes of seismic design, the new CFB is going to be considered a Category III structure.

The proposed location of the CFB is just south of Thurman Street within an unpaved grass field. The existing topography of the site is relatively flat with what appears to be a slight north-south gradient. The general location of the project area is shown on Figure 1, Vicinity Map.

1.2 Scope of Services

Shannon & Wilson's services were conducted in general accordance with the scope of services specified in the Task Order between Murraysmith and Shannon & Wilson executed on February 24, 2021. The scope of services performed for this study consisted of the following tasks:

- Perform two subsurface explorations near the approximate location of the proposed chemical feed building;
- Perform laboratory testing on representative samples collected from the explorations;

- Evaluate geologic and seismic hazards near the WTP site;
- Provide shallow foundation design recommendations;
- Provide discussion related to geotechnical construction considerations; and
- Prepare this Geotechnical Engineering Report.

After submittal of the draft report, pavement thickness estimates were added to our scope. Pavement thicknesses presented in this report are based on our engineering judgment from experiences at similar facilities and assumed traffic loadings. If traffic loadings in excess of 3 to 7 trucks per day from a two-axle freight truck are anticipated, then we should be notified to evaluate if our pavement thicknesses should be revised.

2 GEOLOGIC AND SEISMIC SETTING

2.1 Geologic Setting

Oregon City, together with the greater Portland metropolitan area, lies within the topographical and structural depression of the Portland Basin (Beeson and others, 1991; Madin 2009). The Portland Basin began forming as a syncline in the early Miocene (23 to 16 million years ago). Since the early Miocene as the basin developed, it has been inundated by the lava flows of the Columbia River Basalts, as well as millions of years of sediment deposition from alluvial, eolian, and catastrophic processes.

Overlying the lava flows of the Miocene (23 to 5.3 million years ago) Columbia River Basalts in much of the Portland Basin area, is the Miocene to Pliocene (5.3 to 2.58 million years ago) Sandy River Mudstone and Troutdale Formation. These sediments were deposited as a broad alluvial plain by the ancestral Columbia River and rivers draining the Cascade Range into the Portland Basin as the basin was progressively subsiding (Madin, 2009). The Sandy River Mudstone consists of lakebeds composed of silt, siltstone, and claystone, and can contain small interbeds of gravel and conglomerate (Trimble, 1963). The Troutdale Formation consists of sandstones, siltstones, conglomerate, silt, sand, and gravels.

Stream cutting and erosion of the units was followed by deposition of Quaternary (2.6 million years ago to present) terrace deposits and alluvium along the Clackamas River (Hull, 1979). The terrace deposits typically overlie both the Sandy River Mudstone and Troutdale and can reach 150-feet in thickness. Deposition of alluvium deposits within the project vicinity continues to present day as the valley of the Clackamas River forms.

The project area was mapped by Hull (1979) and shows the project site is underlain by Pleistocene Terrace Deposits consisting of clay, sand, and gravel. Other units mapped in the vicinity include Troutdale Formation and landslide deposits.

2.2 Seismic Setting

Earthquakes in the Pacific Northwest occur largely as a result of the region's proximity to an active convergent plate boundary, the Cascadia Subduction Zone (CSZ). In the CSZ dense oceanic crust of the Explorer, Juan de Fuca, and Gorda Oceanic Plates are subducting beneath the overriding, less dense, westward-moving, continental crust of the North American Plate. Oblique convergence of these plates not only results in east-west compressive strain, but also in dextral shear, clockwise rotation, and north-south compression of accreted crustal blocks that form the leading edge of the North American Plate (Wells and others, 1998).

The CSZ extends about 750 miles from northern California to southern British Columbia and lies approximately 155 miles west of the project site. Within the present understanding of the regional tectonic framework and historical seismicity, three broad seismogenic sources have been identified:

- A mega-thrust source at an interface between the North American and Juan de Fuca plates in the CSZ;
- A deep subcrustal zone (intraslab) in the subducted Juan de Fuca Plate in the CSZ; and
- A shallow crustal zone within the North American Plate.

The following sections briefly describe the location, characteristics, and seismicity of each of the sources.

2.2.1 Cascadia Subduction Zone: Mega-Thrust Interface Source

CSZ mega-thrust earthquakes originate along the interface between the subducting oceanic plates and the North American plate. Because of the significant uncertainty of the landward extent of a potential rupture surface, estimates of the closest distance between the project and potential rupture surface range from about 40 to 80 miles. Focal depths for megathrust earthquakes are commonly on the order of about 15 to 25 miles. Rupture of the interface could result in earthquakes with moment magnitudes on the order of 8.5 to over 9.0, with strong shaking that lasts for several minutes. No large earthquakes have occurred in this zone during historic times (the last 170 years). However, geologic evidence suggests that coastal estuaries have experienced rapid subsidence at various times within the last 2,000 years (e.g., Atwater, 1987; Atwater and Hemphill-Haley, 1997). It appears that ruptures of

this zone have occurred at irregular intervals that span from about 100 to more than 1,200 years, with an average recurrence interval of about 300 to 500 years (Atwater and Hemphill-Haley, 1997). Based on historical tsunami records in Japan (Satake and others, 1996) the most recent interplate event on the CSZ was a moment magnitude (Mw) 9 event on January 26, 1700.

2.2.2 Cascadia Subduction Zone: Intraslab Source

CSZ intraslab earthquakes originate from within the subducting oceanic plates because of down-dip tensional forces and bending caused by mineralogical and density changes in the plates at depth. These earthquakes typically occur 28 to 37 miles beneath the surface. Because intraslab events involve high-angle normal faulting, the area of the rupture surface and magnitude is strongly dependent on the thickness of the subducting slab. Young subduction zones, such as the CSZ, generally have relatively thin subducting slabs. Thermal modeling of the CSZ (Hyndman and Wang, 1993), and the observed geometry of the Wadati-Benioff Zone (Jarrard, 1986) confirm the likelihood that the subducting slab is relatively thin.

Worldwide observations indicate that the largest intraslab earthquakes are on the order of M8, with the 12 largest of these occurring in older subducting slabs. The largest recorded intraslab earthquake beneath the Puget Lowland, the 1949 Olympia earthquake, was a surface wave magnitude M7.1 event. Ludwin and others (1991) estimate that the maximum magnitude from this source zone would be about 7.5.

At the project site, ground shaking produced by intraslab earthquakes would generally be less intense and less prolonged than ground motions generated by large subduction zone interface earthquake events. Historic seismicity from this source zone includes the 1949 magnitude 7.1 Olympia earthquake; the 1965 magnitude 6.5 earthquake between Tacoma and Seattle; and the 2001 magnitude 6.8 Nisqually earthquake. While intraslab events have occurred frequently in the Puget Sound area, they are historically rare in Oregon.

2.2.3 Shallow Crustal Source

Shallow crustal earthquakes within the North American Plate have historically occurred in a diffuse pattern within western Oregon, typically within the upper 4 to 19 miles of the continental crust. The largest known crustal earthquake in the Pacific Northwest is the 1872 North Cascades earthquake at magnitude 6.8. Other examples include the 1993 magnitude 5.6 Scotts Mill earthquake and 1993 magnitude 6.0 Klamath Falls earthquake.

2.2.4 Local Quaternary Faults and Folds

Quaternary crustal faults and folds throughout Oregon and Washington have been located and characterized by the United States Geological Survey (USGS). The USGS provides approximate fault locations and a detailed summary of available fault information in the USGS Quaternary Fault and Fold Database. The database defines four categories of faults, Class A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (within the last 2.6 million years). For Class A faults, geologic evidence demonstrates that a tectonic fault exists and that it has likely been active within the Quaternary period. For Class B faults, there is equivocal geologic evidence of Quaternary tectonic deformation, or the fault may not extend deep enough to be considered a source of significant earthquakes. Class C and D faults lack convincing geologic evidence of Quaternary tectonic deformation or have been studied carefully enough to determine that they are not likely to generate significant earthquakes.

According to the USGS Quaternary Fault and Fold database (USGS, 2020), there are 12 Class A features within approximately 30 miles of the project site. Their names, general locations relative to the site, and the time since their most recent deformation are summarized in Table 2-1.

Table 2-1: USGS Class A Faults Within a 30-Mile Radius of the Project Site

Fault Name	USGS Fault Number	Approximate Length	Approximate Distance and Direction from Project Site[1]	Slip Rate Category[2]	Time Since Last Deformation[3]
Oatfield Fault	875	18.0 miles	0.3 miles SW	< 0.2 mm/yr	< 1.6 Ma
Portland Hills Fault	877	30.4 miles	0.83 miles NE	< 0.2 mm/yr	< 15 ka
Damascus-Tickle Creek Fault	879	9.9 miles	2.7 miles NE	< 0.2 mm/yr	< 750 ka
Canby-Mollala Fault	716	31.1 miles	5.5 SW	< 0.2 mm/yr	< 15 ka
Grant Butte Fault	878	6.2 miles	7.1 miles NE	< 0.2 mm/yr	< 750 ka
East Bank Fault	876	18.0 miles	9.9 miles NW	< 0.2 mm/yr	< 15 ka
Beaverton Fault Zone	715	9.3 miles	12.4 miles NW	< 0.2 mm/yr	< 750 ka
Lacamas Lake Fault	880	14.9 miles	16.8 miles NE	< 0.2 mm/yr	< 750 ka
Newberg Fault	717	3.1 miles	18.9 miles SW	< 0.2 mm/yr	< 1.6 Ma
Helvetia Fault	714	4.3 miles	20.4 miles NW	< 0.2 mm/yr	< 1.6 Ma
Mt. Angel Fault	873	18.6 miles	22.1 miles SW	< 0.2 mm/yr	< 15 ka
Gales Creek Fault Zone	718	45.4 miles	24.9 miles NW	< 0.2 mm/yr	< 1.6 Ma

NOTES:

1 Approximate distance between project site and nearest extent of fault mapped at the ground surface.

2 mm = millimeters; yr = year.

3 ka = "Kilo-annum" or one thousand years ago.

3 REVIEW OF EXISTING EXPLORATIONS

We reviewed existing boring logs that were provided to us and were completed in support of an additional Clearwell at the site. The existing boring logs were included in the Geotechnical Data Report prepared by CH2M Hill in January 2007. There were two borings, designated B-1 and B-2, completed to depths of 41.5 and 100.3 feet below the ground surface. The two borings encountered primarily soft to stiff fine-grained material in the upper approximately 66.5 feet. The fine-grained material transitioned to a very dense sand at approximately 70 feet in boring B-2. Logs of the existing explorations are included in Appendix C.

4 GEOTECHNICAL FIELD EXPLORATIONS

Shannon & Wilson explored subsurface conditions at the project site with two geotechnical borings, designated B-1 and B-2. The borings were drilled on March 4, 2021, using mud rotary drilling techniques. The borings were advanced to depths of 25.9 and 41.5 feet below ground surface (bgs). The borings were drilled using a Mobile B-57 truck-mounted drilling rig provided and operated by Holt Services, Inc., out of Vancouver, Washington. Standard Penetration Test (SPT) samples were collected at 2.5-foot intervals to 15 feet and then 5-foot intervals to the bottom of the borings. To measure groundwater, a vibrating wire piezometer (VWP) was installed in boring B-1. The approximate boring locations are shown on the Site and Exploration Plan, Figure 2.

Shannon & Wilson geology staff were on-site throughout the exploration program to locate the borings, observe drilling, collect samples, and log the materials encountered. Details of the drilling program and logs of the materials encountered are presented in Appendix A, Field Explorations.

5 LABORATORY TESTING

The samples we obtained during our subsurface explorations were transported to our laboratory for further examination. We then selected a sample for Atterberg limits testing and samples for corrosion testing, which was performed by Cooper Testing Labs, Inc. in accordance with applicable American Society for Testing and Materials (ASTM) standards. The results of the laboratory testing are presented in Appendix B and the Atterberg limit results are shown on the boring logs in Appendix A.

6 SUBSURFACE CONDITIONS

6.1 Major Stratigraphic Units

We grouped the materials encountered in our field explorations into two geotechnical units, as described below. Our interpretation of the subsurface conditions is based on the explorations and regional geologic information from published sources. An interpretive profile is shown on Figure 3, Interpretive Subsurface Profile of Section A-A'. The geotechnical units are as follows:

6.1.1 Pleistocene Terrace Deposits

Pleistocene Terrace Deposits were encountered in both borings from ground surface to approximately 7 to 8 feet below ground surface (bgs). The layer consisted of medium dense, brown, Clayey Gravel with Sand (GC), and loose to medium dense/stiff, brown Clayey Gravel to Gravelly Clay (GC/CL). The soil was typically moist and fines were medium plasticity. SPT blow counts (N-Values) in this layer ranged from 6 to 12 blows per foot (bpf) with an average N-Value of 9 bpf. A single natural moisture content performed in the unit was 30.8 percent.

6.1.2 Troutdale Formation

Troutdale Formation was encountered in both borings below the Pleistocene Terrace Deposits. Both borings were also terminated in this unit. The unit consisted of medium stiff to hard Fat Clay (CH), very stiff to hard Fat Clay with Sand (CH), medium dense to dense Clayey Sand (SC), dense to very dense Silty Gravel with Sand with possible cobbles (GM), and dense to very dense Clayey Gravel with Sand with possible cobbles (GC). The gravel constituent was typically fine to coarse and was subrounded to rounded. SPT N-Values in the unit ranged from 7 bpf to refusal and averaged 40 bpf. An Atterberg limits test on one specimen of Troutdale Formation indicated a plasticity index of 62 percent with a USCS designation of CH.

6.2 Groundwater

As mentioned in Section 3, a VWP was installed in boring B-1 to measure groundwater. A reading was collected from the VWP on March 10, 2021, that indicated that groundwater was approximately 17.2 feet below the existing ground surface. Groundwater levels should be expected to vary with changes in topography and precipitation. Generally, groundwater highs occur at the end of the wet season in late spring or early summer, and groundwater lows occur towards the end of the dry season in the early to mid-fall.

6.3 Infiltration Testing

Two in situ infiltration tests were completed using the open-pit method in general accordance with Appendix D of the Oregon City Stormwater and Grading Design Standards (2015). The infiltration tests performed in the two open pits were dug by South Fork Water Treatment Plant Staff. The pits were advanced through clayey gravel to a depth of 2 feet and had dimensions of approximately 2 feet by 2 feet wide at the ground surface. After the overnight presoak period, water was again added to the hole to return the level to approximately 1 foot over the test surface at the base of the pit, and the drawdown was

measured by a qualified member of Shannon & Wilson's staff at regular intervals. Measurements were taken over a period of three (3) hours. Infiltration test results are presented in Figures A4 and A5 of Appendix A.

The measured infiltration rates over the final hour of testing were 0.25 in/second and 0.88 in/second for TP-1 and TP-2 respectively. Table D-1 of the Oregon City Stormwater and Grading Design Standards provides a recommended correction factor of 2 for Open Pit Falling Head testing. The corrected infiltration rate with a correction factor of 2 is 0.13 in/second and 0.44 in/second for TP-1 and TP-2 respectively. Based on information from the Oregon City Stormwater and Grading Design Standards factored rates of greater than 0.5 inches/hour are typically required to support an infiltration facility. However, the manual also notes that the determination of the factor of safety shall include consideration of project-specific conditions such as soil variability, testing methods, consequences of system failure, complexity of proposed construction, and other pertinent conditions.

Based on the relatively low infiltration rates at the site, we understand that on-site infiltration will not be used. We would recommend that the stormwater collection systems associated with the proposed CFB be routed to a suitable discharge point away from the building.

7 GEOLOGIC AND SEISMIC HAZARD EVALUATION

7.1 Seismic Design Ground Motions

Our seismic hazard evaluation was performed in accordance with the criteria in the 2019 Oregon Structural Specialty Code (OSSC) and the 2018 International Building Code (IBC). The 2018 IBC refers to ASCE's Minimum Design Loads for Buildings and Other Structures, 2016 Edition (ASCE 7-16) Chapter 20 for determination of Site Class, and the 2019 OSSC follows the 2018 IBC. In accordance with the site classification criteria in ASCE 7-16, we recommend using a Site Class D for the WTP site. This classification is based on Standard Penetration Test (SPT) N-values from the boring logs. We understand that the CFB is designated as Risk Category III. Code-based seismic design parameters are presented in Table 7-1.

Table 7-1: ASCE 7-16 Seismic Design Parameters for Site Class D

Seismic Parameter	Value
MCE Peak Ground Acceleration (PGA)[1]	0.374g
MCE Bedrock Spectral Acceleration, 0.2 second period (S_S)	0.831g
MCE Bedrock Spectral Acceleration, 1.0 second period (S_1)	0.370g
Short-Period Site Factor, F_a	1.167
Long-Period Site Factor, F_v[2]	1.930
Site Coefficient for Peak Ground Acceleration, FPGA	1.226
Soil MCE Spectral Acceleration, 0.2 second period, Site Class D (S_{MS})	0.971g
Soil MCE Spectral Acceleration, 1.0 second period, Site Class D (S_{M1})[2]	0.714g
Risk-Modified Peak Ground Acceleration (PGA_M)	0.458g
Soil Design Spectral Acceleration, 0.2 second period, Site Class D (S_{DS})	0.647g
Soil Design Spectral Acceleration, 1.0 second period, Site Class D (S_{D1})[2]	0.478g

NOTES:

1 PGA corresponds to the spectral acceleration at a period of zero seconds

2 Based on Cs values calculated in accordance with ASCE 7-16 Equation 12.8-2

7.2 Liquefaction

Liquefaction is a phenomenon in saturated soils in which pore water pressure in loose to medium dense, non-plastic to low plasticity silts and granular soils increases to nearly the effective overburden pressure during seismic ground shaking. The increase in pore pressure results in a reduction of soil shear strength. Primary factors in determining the susceptibility of a soil to liquefaction include relative density, fines content (percent of soil by weight smaller than 0.075 millimeters, passing the No. 200 sieve), and the plasticity characteristics of the fines. Relative density is estimated based on methods including Standard Penetration Test (SPT) N-values, CPT tip resistances, and shear wave velocity.

Based on the measured depth to groundwater being within the high relative density material of the underlying Troutdale Formation, **we consider the risk of liquefaction at this site to be low**.

7.3 Fault Rupture

The closest active mapped fault to the site is the Oatfield Fault, located approximately 0.3 miles to the southwest of the project site. In our opinion, given the distance between the site and the fault, the potential for a hazard posed by **ground surface fault rupture at the site is low**.

7.4 Slope Instability

The proposed Chemical Building site location is located in a flat portion of the treatment plant site in a location mapped as having a low landslide risk (landsliding unlikely) in the DOGAMI GeoHazard database.

There are mapped historic landslides to the north and west of the WTP site that are documented in the DOGAMI GeoHazard database. The mapped landslide north of the site is over 500 feet from the CFB in an area where slopes are approximately 1.5H:1V and was documented as having occurred in 1996 during a period of high rainfall. The mapped landslide to the west of the site is over 1,200 feet from the proposed CFB and occurred in an area where slopes exceed 1.5H:1V. The landslide west of the site is documented as being pre-historic (i.e. greater than 150 years old). Based on the subsurface conditions encountered in our explorations and the distance from the site to the crest of the slopes, we consider the risk of a landslide impacting the CFB as being low.

8 GEOTECHNICAL DESIGN RECOMMENDATIONS

8.1 Bearing Capacity and Settlement

Based on the subsurface conditions encountered in our explorations and our understanding of the project, we recommend that shallow foundations be designed using a **net allowable bearing capacity of 2,000 psf**. For evaluations considering transient loads, such as seismic loads, an increased net allowable bearing pressure increase of 1/3 or approximately 2,600 psf may be used. This bearing capacity is based on a minimum embedment depth of 18 inches bgs, which will be required for exterior footings to be below the frost depth. We recommend a minimum embedment of 12 inches for interior footings. We recommend that 1 foot of crushed rock be placed and compacted below the planned footing subgrades. Over-excavation should be performed beyond the proposed foundation limits so that the zone that is within a 1H:1V line extending from the exterior of the foundation is encompassed. Placement and compaction of the crushed rock is discussed in Section 8.2. If foundations are placed on the recommended crushed rock and designed for the allowable bearing capacity described previously, then we estimate that **total settlements will be less than 1 inch**. Differential settlement is typically taken as half of the total settlement and can be evaluated based on the maximum length of the building. If less settlement is necessary, then additional over excavation and replacement with crushed will be required. For foundations prepared as described above and in accordance the earthwork section of this report a **subgrade modulus of 150 pci** may be used for design.

8.2 Lateral Earth Pressures on Permanent Embedded Walls

We recommend that permanent embedded walls be evaluated as non-yielding walls by applying at-rest earth pressures. We recommend a static at-rest earth pressure of 53H (where H is the height of the wall retaining soil). Static earth pressure should be evaluated as a triangular distribution. Evaluation of seismic loading should be performed by applying an additional seismic earth pressure of 18H on portions of the wall retaining soil. The additional seismic earth pressure should be evaluated as a uniform distributed pressure increase. This seismic earth pressure should be applied with the static at-rest pressure value. Additional surcharge pressures may be appropriate for evaluation if dead of live loads, such as traffic loads, are anticipated to be present. Note that hydrostatic pressures are not included as the measured groundwater is anticipated to be below the base of the embedded portions of the structure. However, to prevent the build of hydrostatic pressures on the building from perched water, we recommend that any buried basement walls greater than 4 feet in height be backfilled with a minimum 12-inch-wide zone of free-draining crushed rock material (i.e. 1 1/2 inch minus with less than 3 percent passing the No 200 sieve). To protect this 1-foot crushed rock zone, we recommend a non-woven geotextile such as Mirafi 140 N surround this zone on the side and on the top. This vertical crushed rock drain should be connected to the perimeter footing drain and drain away from the building.

Surcharge loads, if applicable, should be added to static and seismic earth pressures. If vehicle traffic will be operating near the walls, then typically a 250 psf surcharge load is applied as a uniform pressure. If construction traffic surcharge pressures in excess of 250 psf will be applied at the ground surface adjacent to the buried building wall during or after construction, we recommend that those surcharge pressures be modeled as a uniform rectangular pressure acting on the face of the non-yielding wall as 0.44q, where q is the surcharge load as shown in Figure 4. Other surcharge loading conditions should be evaluated, as applicable, with the use of the general equations and diagrams shown on Figure 5.

8.3 Lateral Resistance

Typically, the lateral resistance of shallow foundations is a combination of passive resistance along the buried portions of the foundation and sliding resistance along the base of the foundation. Passive resistance on buried foundations can be calculated based on granular backfill material with a friction angle of 34 degrees, a saturated unit weight of 120 pcf, and the lateral pressure coefficient presented in Table 8-3.

Table 8-3: Lateral Earth Pressure Coefficient

Coefficient	Ultimate Value	Allowable Value
Passive	3.50	1.75

For estimating the lateral resistance contribution from the partial passive pressure, we recommend ignoring the upper 1-foot of soil due to potential for post-construction disturbance. For friction against the bottom of buried structures, we recommend that a coefficient of friction of 0.45 be used between cast-in-place concrete and imported backfill. This value includes a factor of safety of 1.5.

8.4 Pavement Design Recommendations

Note, that we did not perform a formal pavement analysis for this site and have based the following pavement recommendations on analyses that have been performed at similar sites

We understand that the proposed pavement may be subjected to traffic loading from passenger vehicles and occasional chemical trucks during normal operations. The pavement section thicknesses recommended below can accommodate up to 100,000 ESALs over a 20-year design life, which correlates to average annual daily traffic of approximately 3 to 7 passes from a 2-axle freight truck. We recommend that the traffic loading be reviewed by others to confirm that it is suitable for this site. If traffic loading conditions need to be revised, then the pavement section thicknesses recommended below may need to be revised.

The recommended pavement section based on our judgment is 4-inches of asphalt over 12-inches of base aggregate with a non-woven geotextile placed below the base aggregate and on the prepared subgrade, see Sections 9.2 and 9.3 for details.

9 CONSTRUCTION CONSIDERATIONS

9.1 Earthwork and Building Subgrade Preparation

Site preparation will include clearing, grubbing, and stripping and excavations with subgrade preparation. If temporary shoring is needed, the design of such shoring is typically the responsibility of the contractor.

All subgrades should be neatly trimmed and carefully prepared. Any deleterious, loose, or softened material should be removed from the excavation and any loose subgrade compacted prior to placing crushed rock. Based on the loose to medium dense Pleistocene

Terrace Deposits encountered in our explorations, we recommend that foundation subgrades be over-excavated by 1 foot and backfilled with compacted crushed rock.

We recommend that the subgrade preparation be observed by the Geotechnical Engineer of Record, or their representative, prior to placing crushed rock to evaluate the suitability of the exposed subgrade; that the recommendations of this report have been followed; and that conditions encountered are as anticipated. Any deleterious, soft or unsuitable materials deemed unacceptable by the Geotechnical Engineer should be removed and replaced with crushed rock. We recommend a contingency be placed in the budget for further over-excavation and stabilization of the subgrade.

9.2 Pavement Subgrade Preparation

We recommend that the exposed subgrade be inspected to identify any soft or weak spots prior to the placement of pavement material. Where feasible, subgrade inspection should consist of proof-rolling the subgrade with a fully loaded dump truck. Where pavement areas are of insufficient size to proof-roll, or for subgrade consisting of primarily fine-grained soil that is wet and sensitive, the subgrade should be evaluated by probing by a qualified geotechnical engineer. Soft or weak spots should be over-excavated and replaced with imported compacted granular material.

9.3 Pavement Material Recommendations

Based on guidance presented in the ODOT Pavement Design Guide (ODOT, 2019), we recommend the asphalt mix design level, gradation, and binder grade be a Level 2, 1/2-inch design-graded HMAC with PG 64-22 binder.

We recommend that new imported base aggregate be in accordance with ODOT Standard Specifications for Construction Section 02630.10 and correspond with a 3/4-inch minus gradation. The aggregate base should be compacted to 95 percent of a modified proctor.

We recommend that a non-woven subgrade separation geotextile meeting the requirements of ODOT Standard Specifications for Construction (ODOT, 2021) Section 00350 be placed between the aggregate base course and subgrade to reduce the potential for fines to migrate into the aggregate base.

9.4 Structural Fill Placement and Compaction

We recommend that structural fill consists of free-draining imported crushed rock. The imported crushed rock should be maximum 3/4-inch particle size and contain less than

5 percent passing the No. 200 sieve based on a washed sieve analysis (ASTM D1140). Sand should not be used for structural fill or backfill.

Unless otherwise noted, structural fill should be compacted to 92 percent of the modified Proctor test (ASTM D1557). The structural fill should be placed in maximum lifts of 8 inches of loose material. The structural fill materials should be compacted within the range of ±2 percent the optimum moisture content value or with moisture content allowing compaction requirements to be obtained. Over-excavation should be performed beyond the proposed foundation limits so that the zone that is within a 1H:1V line extending from the exterior of the foundation is encompassed. Each lift of compacted structural fill should be tested by the project's special inspection firm and the results provided to the Geotechnical Engineer for their review, prior to placement of subsequent lifts.

All new structural fill material placed directly beneath shallow foundations should consist of imported, crushed rock compacted, as described above. **We do not recommend re-using excavated onsite soils as structural fill**.

9.5 Wet Weather Construction

Excavation and construction operations may expose the on-site soils that are sensitive to inclement weather conditions. The stability of exposed soils may rapidly deteriorate due to a change in moisture content (i.e. wetting or drying) or the action of heavy or repeated construction traffic. Accordingly, excavations should be adequately protected from the elements and from the action of repetitive or heavy construction loadings. Exposed subgrade should be covered with crushed rock as soon as practical to prevent water from softening the subgrade resulting in the need for additional over-excavation. Exposed subgrade should not be left open overnight during the rainy season which typically extends from mid-October to June. If water accumulates in the excavation for any reason, prior to placing crushed rock, the water should be sump pumped out with an engineered sump system to protect from removal of soils fines during pumping, and subgrade surface reobserved by the Geotechnical Engineer of Record.

9.6 General Excavation

We anticipate that temporary excavations will be necessary during construction. Temporary excavations are typically the responsibility of the contractor and should comply with applicable local, state, and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

10 LIMITATIONS

The analyses, interpretations, conclusions, and recommendations contained in this report are based on site conditions as they presently exist and further assume that the explorations are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the past and current explorations. If future phases of work at the site uncover subsurface conditions different from those encountered in these explorations, we should be advised at once so that we can review these encountered conditions and reconsider our interpretations and conclusions, where necessary. If there is a substantial lapse of time between the submission of this report and the start of future phases of work at the site, or if conditions have changed because of natural forces or construction operations at or adjacent to the site, we recommend that we review our report to determine the applicability of the conclusions and recommendations.

Within the limitations of scope, schedule, and budget, the analyses, interpretations, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied. These interpretations and conclusions were based on our understanding of the project as described in this report and the site conditions as observed previously and at the time of our current explorations.

This report was prepared for the exclusive use of Murraysmith, its subconsultants, and the South Fork Water Board, as covered in this report. During future phases of work involving construction, the data contained in this report should be provided to the contractors for their information, but our report interpretations and conclusions should not be construed as a warranty of subgrade conditions as included in this report.

The scope of our present services did not include environmental assessments or evaluations regarding the presence or absence of wetlands, or hazardous or toxic substances in the soil, surface water, groundwater, or air, on or below or around this site, or for the evaluation or disposal of contaminated soils or groundwater should any be encountered.

Shannon & Wilson, Inc., has prepared and included, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of our reports.

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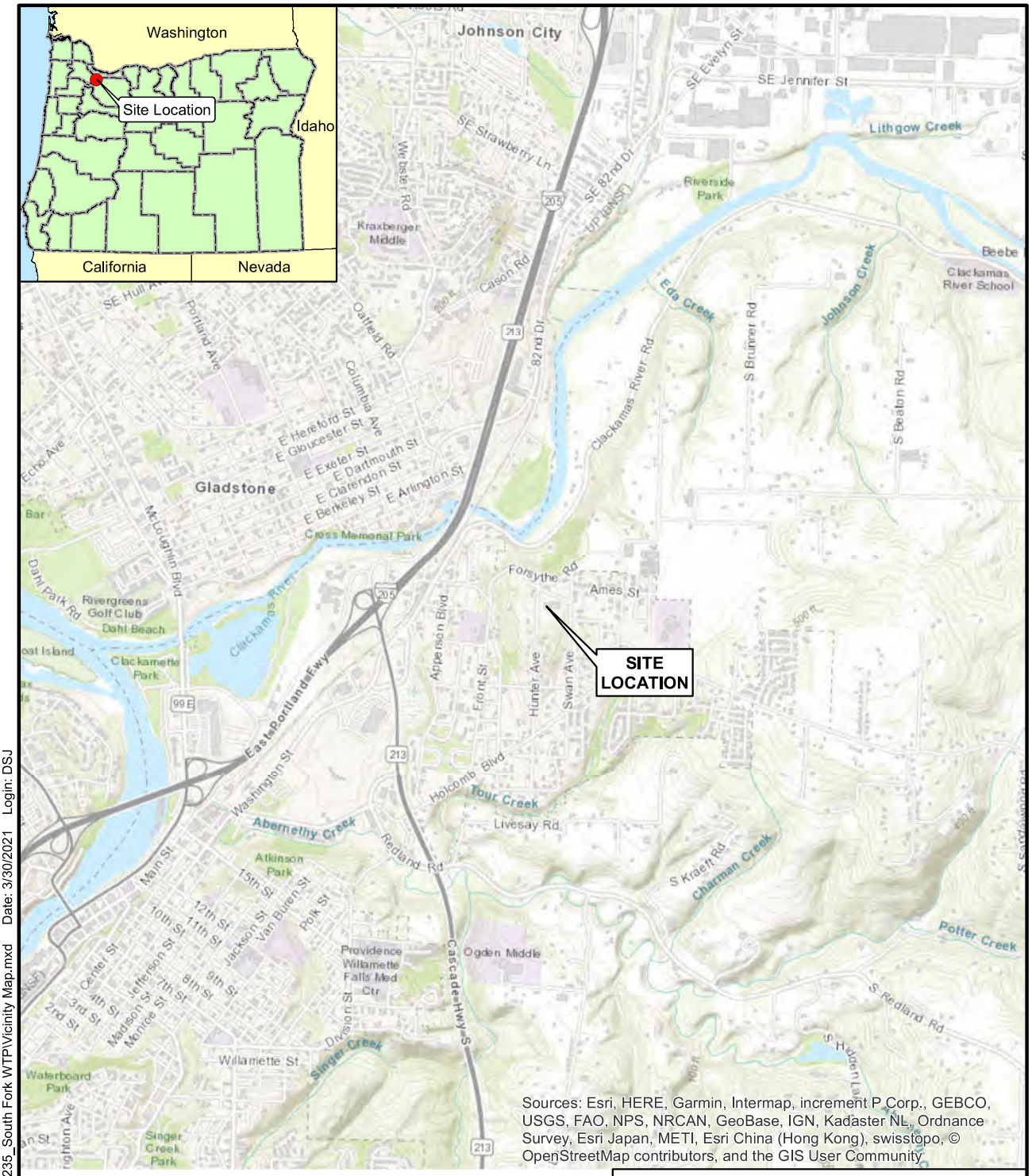

0 0.25 0.5 1

Scale in Miles

N

South Fork Water Board
Chemical Feed Building
Oregon City, Oregon

VICINITY MAP

May 2021 106235

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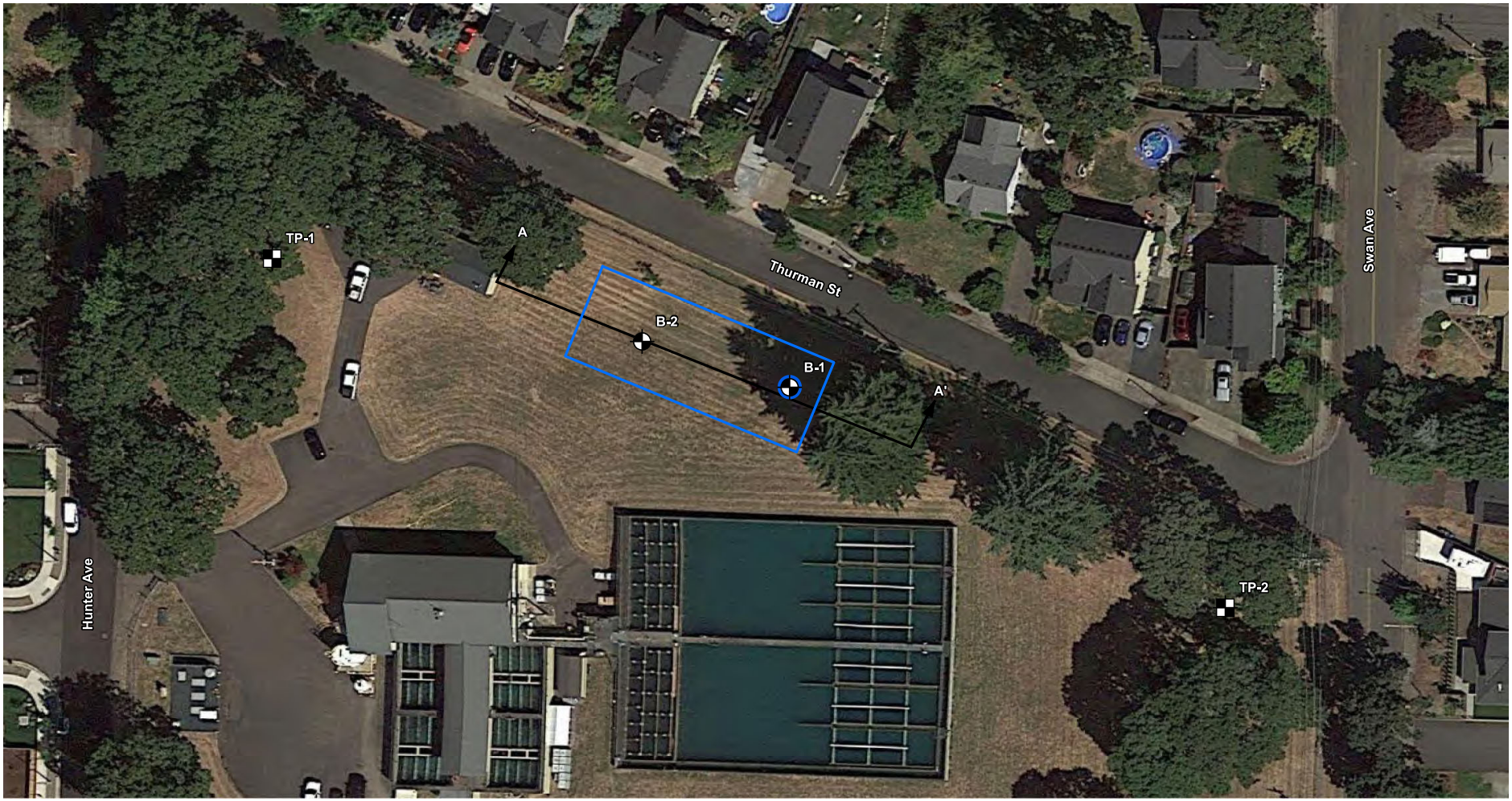
FIG. 1

Filename: T:\Projects\PDX\106000s\106235_South Fork WTP\Vicinity Map.mxd Date: 3/30/2021 Login: DSJ



LEGEND

- Location and Designation of Geotechnical Boring with Vibrating Wire Piezometer
- Location and Designation of Geotechnical Boring
- Location and Designation of Infiltration Test Pits
- Approximate Chemical Building Footprint
- Profile Line A-A'

0 25 50 100

Scale in Feet

South Fork Water Board Filter
Chemical Building
Oregon City, Oregon

SITE AND EXPLORATION PLAN

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FIG. 2

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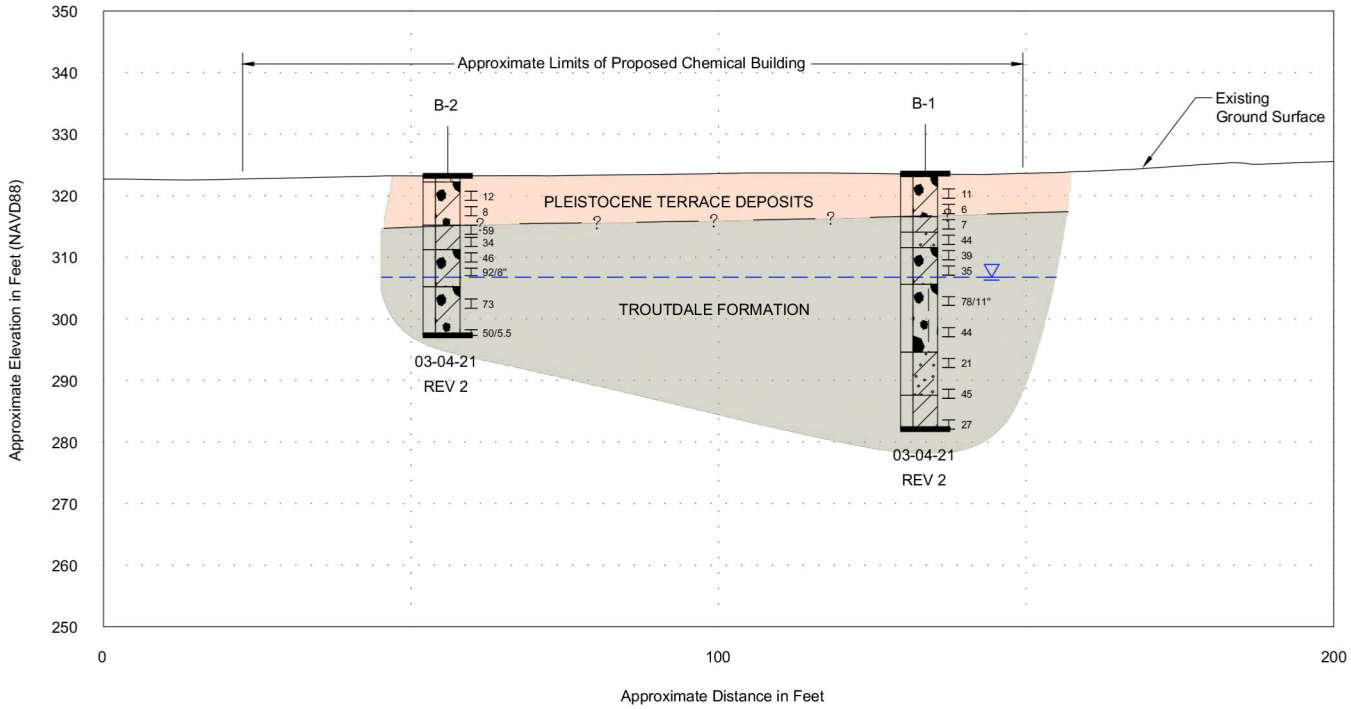

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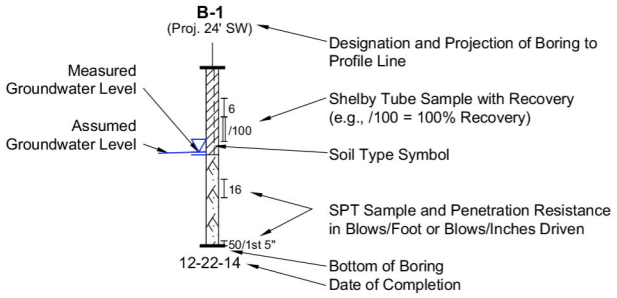

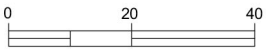

NOTES

1. Ground surface derived from CAD file provided by Centerline Concepts Land Surveying on April 8, 2021.
2. Profile generalized from materials reported in borings. Variations may exist between profile and actual conditions. See Appendix A for complete boring logs.
3. See Figure 2 for profile location.

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INTERPRETIVE SUBSURFACE PROFILE A-A'

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FIG. 3

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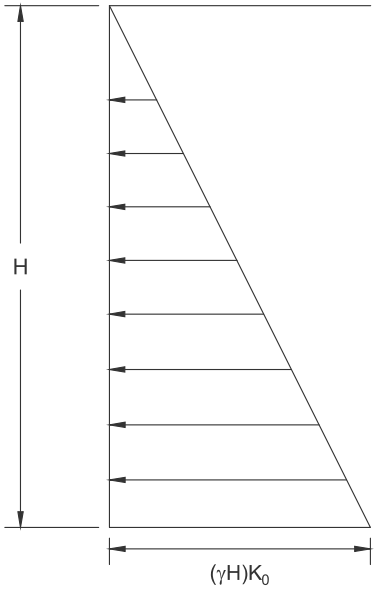
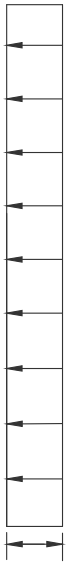
File: I:\EF\PDX\106000s\106235 South Fork Wate\DRAFTING\LateralEarthPressures.dwg Date: 05-11-2021 Author: KJW

STATIC COMPONENT



+

SURCHARGE COMPONENT



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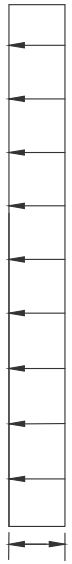
SEISMIC COMPONENT



At-Rest Condition

NOT TO SCALE

MATERIAL PROPERTIES			
Material ID	Material Name	Unit Weight, γ (pcf)	At-rest K_o
1	Granular Fill	120	0.44

NOTES

1. Based on static groundwater elevation measured in boring B-1, the groundwater is assumed to be below the base of the permanent embedded walls.
2. Typical traffic surcharge, q, of 250 psf is recommended to be included as a uniform pressure distribution.

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LATERAL EARTH PRESSURE DISTRIBUTION ON PERMANENT EMBEDDED WALLS

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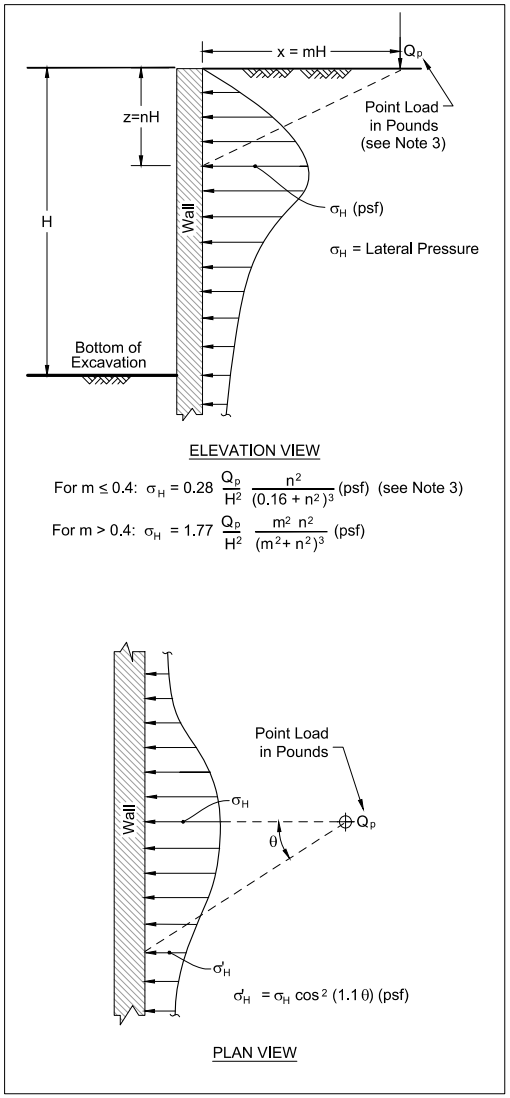
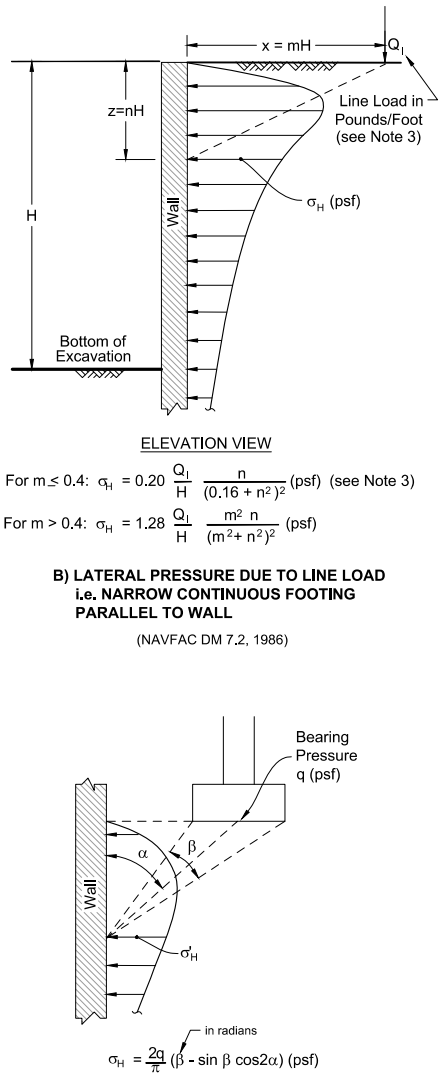
FIG. 4

FIG. 4



A) LATERAL PRESSURE DUE TO POINT LOAD i.e. SMALL ISOLATED FOOTING OR WHEEL LOAD

(NAVFAC DM 7.2, 1986)

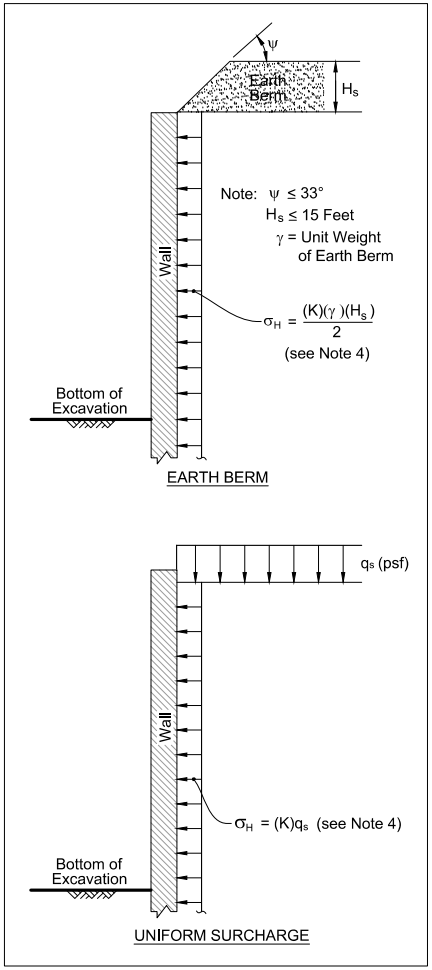


B) LATERAL PRESSURE DUE TO LINE LOAD i.e. NARROW CONTINUOUS FOOTING PARALLEL TO WALL

(NAVFAC DM 7.2, 1986)

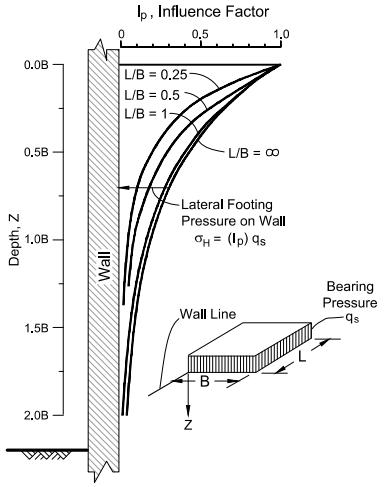
C) LATERAL PRESSURE DUE TO STRIP LOAD

(derived from Fang, *Foundation Engineering Handbook*, 1991)



D) LATERAL PRESSURE DUE TO EARTH BERM OR UNIFORM SURCHARGE

(derived from Poulos and Davis, *Elastic Solutions for Soil and Rock Mechanics*, 1974; and Terzaghi and Peck, *Soil Mechanics in Engineering Practice*, 1967)



E) LATERAL PRESSURE DUE TO ADJACENT FOOTING

(derived from NAVFAC DM 7.2, 1986; and Sandhu, *Earth Pressure on Walls Due to Surcharge*, 1974)

NOTES

1. Figures are not drawn to scale.
2. Applicable surcharge pressures should be added to appropriate permanent wall lateral earth and water pressure.
3. If point or line loads are close to the back of the wall such that m ≤ 0.4, it may be more appropriate to model the actual load distribution (i.e., Detail E) or use more rigorous analysis methods.
4. See Figure 4 for recommended K value.

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RECOMMENDED SURCHARGE LOADING FOR PERMANENT WALLS

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FIG. 5

File: I:\App\Autocad Support Files\Standard Figures\SURCH TMP-PERM WALL (BIG).dwg Date: 05-11-2021 Author: KJW

APPENDIX A: FIELD EXPLORATIONS

Appendix A

Field Explorations

CONTENTS

A.1 General A-1
A.2 Geotechnical Borings A-1
A.2.1 Disturbed Sampling A-1
A.3 Material Descriptions A-2
A.4 Logs of Borings A-2
A.5 Instrumentation and Borehole Abandonment A-2

Figures

Figure A1: Soil Description and Log Key
Figure A2: Log of Boring B-1
Figure A3: Log of Boring B-2
Figure A4: TP-01 Infiltration Test Results
Figure A5: TP-02 Infiltration Test Results

APPENDIX A: FIELD EXPLORATIONS

A.1 GENERAL

Subsurface explorations for the South Fork Water Board Filter CFB project consisted of performing a total of two geotechnical borings, designated B-1 and B-2 and the installation of a single vibrating wire piezometer in B-1. Locations of the explorations were measured in the field from existing structures, and GPS points were taken to reference the locations. The approximate exploration locations are shown on the Site and Exploration Plan, Figure 2. This appendix describes the techniques used to perform the explorations, presents logs of the materials encountered.

A.2 GEOTECHNICAL BORINGS

Borings B-1 and B-2 were completed on March 4, 2021, using a track-mounted Mobile B-57 drill rig provided and operated by Holt Services, Inc. of Vancouver, Washington. The borings were advanced to between the depths of 25.9 and 41.5 feet below ground surface using open-hole mud rotary drilling techniques. A Shannon & Wilson geologist was present during the explorations to locate the borings, observe the drilling, collect soil samples, and log the materials encountered.

A.2.1 Disturbed Sampling

Disturbed samples were collected in the borings, typically at 2.5- to 5-foot depth intervals, using a standard 2-inch-outside-diameter (O.D.) split spoon sampler in conjunction with Standard Penetration Testing. In a Standard Penetration Test (SPT), ASTM D1586, the sampler is driven 18 inches into the soil using a 140-pound hammer dropped 30 inches. The number of blows required to drive the sampler the last 12 inches is defined as the standard penetration resistance, or N-value. The SPT N-value provides a measure of in situ relative density of cohesionless soils (silt, sand, and gravel), and the consistency of cohesive soils (silt and clay). All disturbed samples were visually identified and described in the field, sealed to retain moisture, and returned to our laboratory for additional examination and testing.

SPT N-values can be significantly affected by several factors, including the efficiency of the hammer used. Automatic hammers generally have higher energy transfer efficiencies than cathead-driven (manual) hammers. For reference, cathead hammers are typically assumed to have an average energy efficiency of 60 percent. All N-values presented in this report are in blows per foot, as counted in the field. No corrections of any kind have been applied.

An SPT was considered to have met refusal where more than 50 blows were required to drive the sampler 6 inches. If refusal was encountered in the first 6-inch interval (for example, 50 for 1.5"), the count is reported as 50/1st 1.5". If refusal was encountered in the second 6-inch interval (for example, 48, 50 for 1.5"), the count is reported as 50/1.5". If refusal was encountered in the last 6-inch interval (for example, 39, 48, 50 for 1.5"), the count is reported as 98/7.5".

A.3 MATERIAL DESCRIPTIONS

In the field, soil samples were identified visually in general accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Consistency, color, relative moisture, degree of plasticity, peculiar odors and other distinguishing characteristics of the samples were noted. Once returned to the laboratory, soil samples were re-examined, various standard classification tests were performed, and field identifications were modified as necessary. We refined our visual-manual soil identifications based on the results of the laboratory tests, using elements of the Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM D2487. However, ASTM D2487 was not followed in full, because it requires a suite of tests be performed to classify a single sample. In most cases, we did not have enough of any one sample to perform all the tests required to fully classify it by ASTM D2487. The specific terminology used in the soil identifications is defined on the Soil Description and Log Key, Figure A1.

A.4 LOGS OF BORINGS

Summary logs of all Shannon & Wilson geotechnical borings are presented in Figures A2 to A3. Material descriptions and interfaces on the logs are interpretive, and actual changes may be gradual. The left-hand portion of the boring logs provides description, identification, and geotechnical unit designation for the materials encountered in the boring. The right-hand portion of the boring logs shows a graphic log, sample locations and designations, backfill details, and a graphical representation of N-values, natural water contents, Atterberg limits, and sample recovery.

A.5 INSTRUMENTATION AND BOREHOLE ABANDONMENT

A single vibrating wire piezometer also referred to as a vibrating-wire pressure transducer (Geokon model 4500S, 350kPa) was installed in boring B-1 to allow for ongoing

groundwater measurements. The vibrating-wire pressure transducer (VWPs) was installed at a depth of 40 feet below ground surface in B-1. A VWP measures pressure using a pressure-sensitive diaphragm with a vibrating-wire element attached to it. A cable runs from the transducer to the ground surface, where a readout device can be attached. Pressure acting on the outside face of the diaphragm causes it to deflect, which changes the tension of the wire element and the frequency of its vibration. The readout device measures the frequency of the induced vibration, which is converted to pressure, or head of groundwater above the transducer.

The VWP was grouted into place in the borehole and prior to insertion, an initial "zero" reading was taken at "zero" head. With the VWP in place, the hole was tremie grouted from the bottom up. The cable leading up from the VWP was protected at the surface in a flush monument. Installation details for the VWP is indicated on the boring log along with the highest water level, measured in the boring.

Boring B-2, which was not equipped with a VWP, was backfilled in accordance with Oregon Department of Water Resources regulations, using bentonite chips.

A.6 INFILTRATION TESTING

Two in situ infiltration tests were completed using the open pit method in general accordance with Appendix D of the Oregon City Stormwater and Grading Design Standards (2015). The infiltration tests were performed in two open pits dug by South Fork Water Treatment Plant Staff. The pits were advanced through clayey gravel to a depth of 2 feet and had dimensions of approximately 2 foot by 2 foot wide at the ground surface. After the overnight presoak period, water was again added to the hole to return the level to approximately 1 foot over the test surface at the base of the pit, and the drawdown was measured by a qualified member of Shannon & Wilson's staff at regular intervals. Measurements were taken for over a period of three (3) hours. Infiltration test results are presented in Figures A4 and A5.

The measured infiltration rates over the final hour testing were 0.25 in/second and 0.88 in/second for TP-1 and TP-2 respectively. Table D-1 of the Oregon City Stormwater and Grading Design Standards provides a recommended correction factor of 2 for Open Pit Falling Head testing. The corrected infiltration rate with a correction factor of 2 is 0.13 in/second and 0.44 in/second for TP-1 and TP-2 respectively. Based on information from the Oregon City Stormwater and Grading Design Standards factored rates of greater than 0.5 inches/hour are typically required to support an infiltration facility.

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

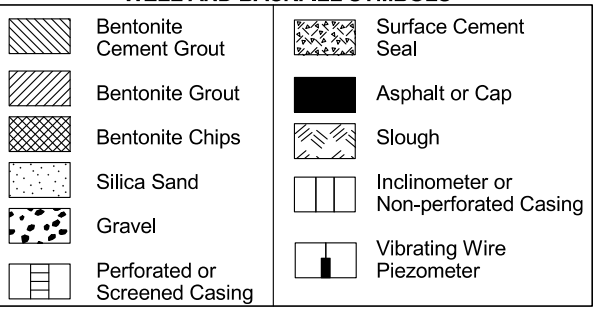
PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS



PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

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SOIL DESCRIPTION AND LOG KEY

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FIG. A1
Sheet 1 of 3

2013_BORING_CLASS1 106235.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 9/20/21

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW		Well-Graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW		Well-Graded Sand; Well-Graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL		Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH		Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat or other highly organic soils (see ASTM D4427)
FILL	Placed by humans, both engineered and nonengineered. May include various soil materials and debris.				The Fill graphic symbol is combined with the soil graphic that best represents the observed material

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the *CL-ML* area of the plasticity chart.
2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.
3. The soil graphics above represent the various USCS identifications (i.e., *GP*, *SM*, etc.) and may be augmented with additional symbology to represent differences within USCS designations. *Sandy Silt (ML)*, for example, may be accompanied by the *ML* soil graphic with sand grains added. Non-USCS materials may be represented by other graphic symbols; see log for descriptions.

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SOIL DESCRIPTION AND LOG KEY

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FIG. A1
Sheet 2 of 3

2013_BORING_CLASS2 106235.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 9/20/21

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4%
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10%
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20%
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20%

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
approx.	Approximate/Approximately
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.
[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

South Fork Water Board
Chemical Feed Building
Oregon City, Oregon

SOIL DESCRIPTION AND LOG KEY

September 2021 106235

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A1
Sheet 3 of 3

2013_BORING_CLASS3 106235.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 9/20/21

Total Depth:	41.5 ft.	Northing:	~ 629,873 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 324 ft.	Easting:	~ 7,669,265 ft.	Drilling Company:	Holt Services, Inc.	Rod Type:	NWJ
Vert. Datum:	EGM96	Station:	~	Drill Rig Equipment:	Mobile B-57 Rig #13	Hammer Type:	Automatic
Horiz. Datum:	WGS84	Offset:	~	Other Comments:	Hammer Efficiency = 89.9%		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Topsoil: 6-inches thick — 323.5 / 0.5

Medium dense, brown, *Clayey Gravel with Sand (GC)*; moist; fine to coarse, subangular to subrounded gravel; fine to coarse sand; medium plasticity fines.

Driller notes gravelly drilling

PLEISTOCENE TERRACE DEPOSITS

Driller notes softer material at 7 feet — 317.0 / 7.0

Medium stiff, light brown, *Fat Clay (CH)*; moist; trace to few fine to medium sand; high plasticity.

TROUTDALE FORMATION

Driller notes significantly harder material at 9.5 feet — 314.5 / 9.5

Dense, tan, brown and orange-brown, *Clayey Sand (SC)*; moist; trace fine subangular to subrounded gravel; fine to medium sand; low to medium plasticity fines; slight iron oxidation and staining.

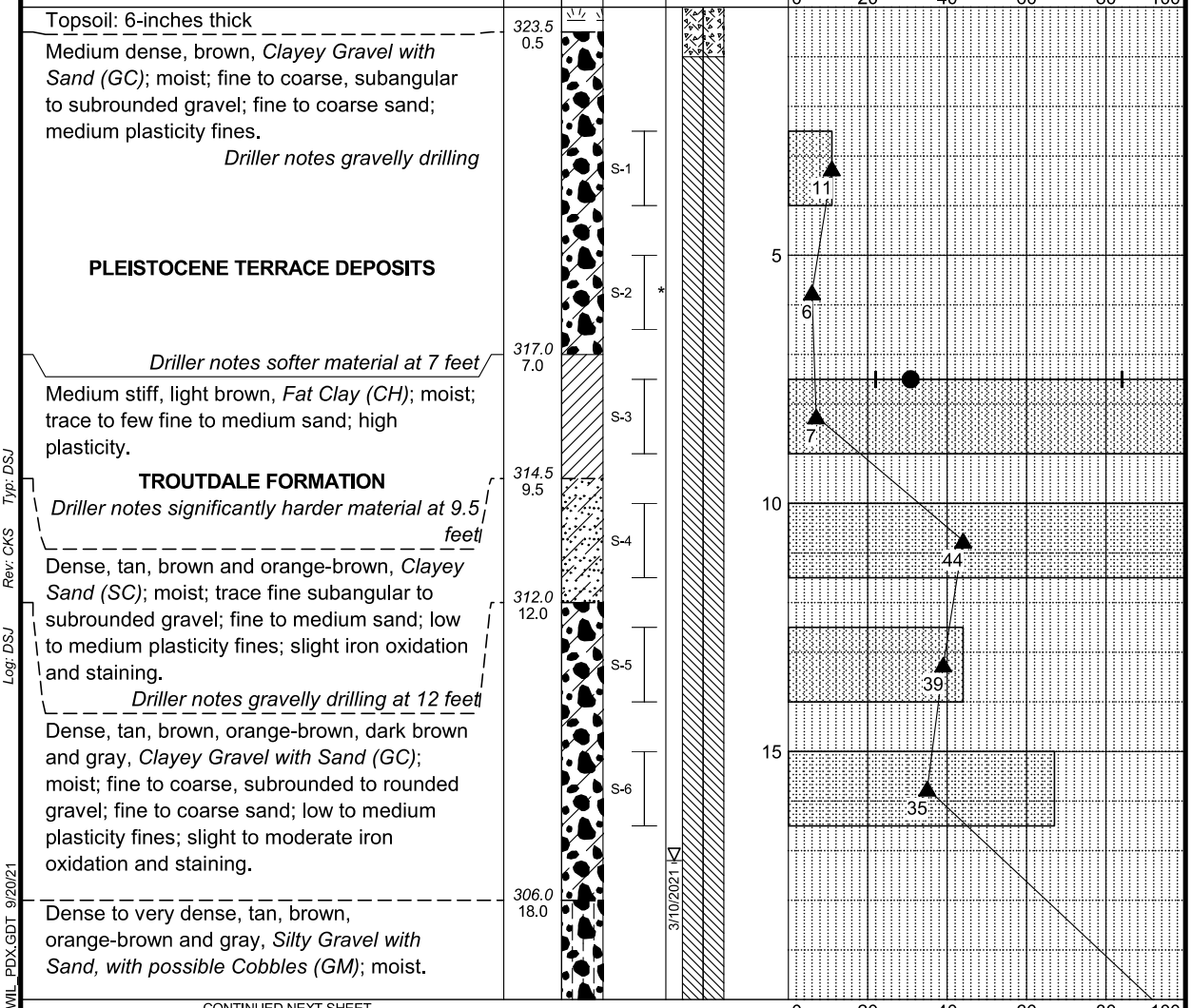
Driller notes gravelly drilling at 12 feet — 312.0 / 12.0

Dense, tan, brown, orange-brown, dark brown and gray, *Clayey Gravel with Sand (GC)*; moist; fine to coarse, subrounded to rounded gravel; fine to coarse sand; low to medium plasticity fines; slight to moderate iron oxidation and staining.

306.0 / 18.0

Dense to very dense, tan, brown, orange-brown and gray, *Silty Gravel with Sand, with possible Cobbles (GM)*; moist.

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered

Standard Penetration Test

Groundwater Level on Date Shown

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

South Fork Water Board
Chemical Feed Building
Oregon City, Oregon

LOG OF BORING B-1

September 2021 106235

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A2
Sheet 1 of 3

REV 3

MASTER_LOG_E_106235.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 9/20/21 Log: DSJ Rev: CKS Typ: DSJ

Total Depth:	41.5 ft.	Northing:	~ 629,873 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 324 ft.	Easting:	~ 7,669,265 ft.	Drilling Company:	Holt Services, Inc.	Rod Type:	NWJ
Vert. Datum:	EGM96	Station:	~	Drill Rig Equipment:	Mobile B-57 Rig #13	Hammer Type:	Automatic
Horiz. Datum:	WGS84	Offset:	~	Other Comments:	Hammer Efficiency = 89.9%		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

Continued:

Dense to very dense, tan, brown, orange-brown and gray, *Silty Gravel with Sand, with possible Cobbles (GM)*; moist; fine to coarse, subrounded to rounded gravel; fine to coarse sand; low plasticity fines; slight iron oxidation and staining.

S-7 — 78/11"

TROUTDALE FORMATION

25

S-8 — 44

Driller notes smooth drilling at 29 feet.

295.0
29.0

Medium dense to dense, brown and orange-brown, *Clayey Sand (SC)*; moist; fine to medium sand; low to medium plasticity fines; moderate iron oxidation and staining; micaceous.

30

S-9 * — 21

35

S-10A

288.0
36.0

S-10B — 45

Very stiff to hard, tan-brown, brown and orange-brown, *Fat Clay with Sand (CH)*; moist; fine to medium sand; high plasticity; slight to moderate iron oxidation and staining; micaceous.

CONTINUED NEXT SHEET

0 20 40 60 80 100

Recovery (%)

LEGEND

* Sample Not Recovered

Standard Penetration Test

Groundwater Level on Date Shown

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

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Chemical Feed Building
Oregon City, Oregon

LOG OF BORING B-1

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FIG. A2
Sheet 2 of 3

REV 3

Log: DSJ Rev: CKS Typ: DSJ

MASTER_LOG_E_106235.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 9/20/21

Total Depth:	41.5 ft.	Northing:	~ 629,873 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 324 ft.	Easting:	~ 7,669,265 ft.	Drilling Company:	Holt Services, Inc.	Rod Type:	NWJ
Vert. Datum:	EGM96	Station:	~	Drill Rig Equipment:	Mobile B-57 Rig #13	Hammer Type:	Automatic
Horiz. Datum:	WGS84	Offset:	~	Other Comments:	Hammer Efficiency = 89.9%		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: 140 lbs / 30 inches

0 20 40 60 80 100

Continued:

Very stiff to hard, tan-brown, brown and orange-brown, *Fat Clay with Sand (CH)*; moist; fine to medium sand; high plasticity; slight to moderate iron oxidation and staining; micaceous.

282.5
41.5

TROUTDALE FORMATION

Geokon vibrating wire piezometer (S/N:2105049) installed at 40 feet

Completed: March 4, 2021

S-11

27

45

50

55

0 20 40 60 80 100

Recovery (%)

LEGEND

* Sample Not Recovered

Standard Penetration Test

Groundwater Level on Date Shown

● % Water Content

Plastic Limit ⊢—⊣ Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

South Fork Water Board
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Oregon City, Oregon

LOG OF BORING B-1

September 2021 106235

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FIG. A2
Sheet 3 of 3

REV 3

MASTER_LOG_E_106235.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 9/20/21 Log: DSJ Rev: CKS Typ: DSJ

Total Depth:	25.9 ft.	Northing:	~ 629,896 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 324 ft.	Easting:	~ 7,669,191 ft.	Drilling Company:	Holt Services, Inc.	Rod Type:	NWJ
Vert. Datum:	EGM96	Station:	~	Drill Rig Equipment:	Mobile B-57 Rig #13	Hammer Type:	Automatic
Horiz. Datum:	WGS84	Offset:	~	Other Comments:	Hammer Efficiency = 89.9%		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Topsoil: 12-inches thick

323.0 / 1.0

Loose to medium dense/Stiff, brown, *Clayey Gravel to Gravelly Clay (GC/CL)*; moist; fine to coarse, subangular to rounded gravel; few fine to coarse sand; medium plasticity fines; slight iron oxidation and staining; micaceous.

Driller notes slightly smoother at 4 feet

PLEISTOCENE TERRACE DEPOSITS

316.0 / 8.0

Hard, tan, yellow-brown, brown and orange-brown, *Fat Clay (CH)*; moist; trace fine subangular gravel; trace fine to medium sand; medium to high plasticity; slight iron oxidation and staining.

TROUTDALE FORMATION

312.0 / 12.0

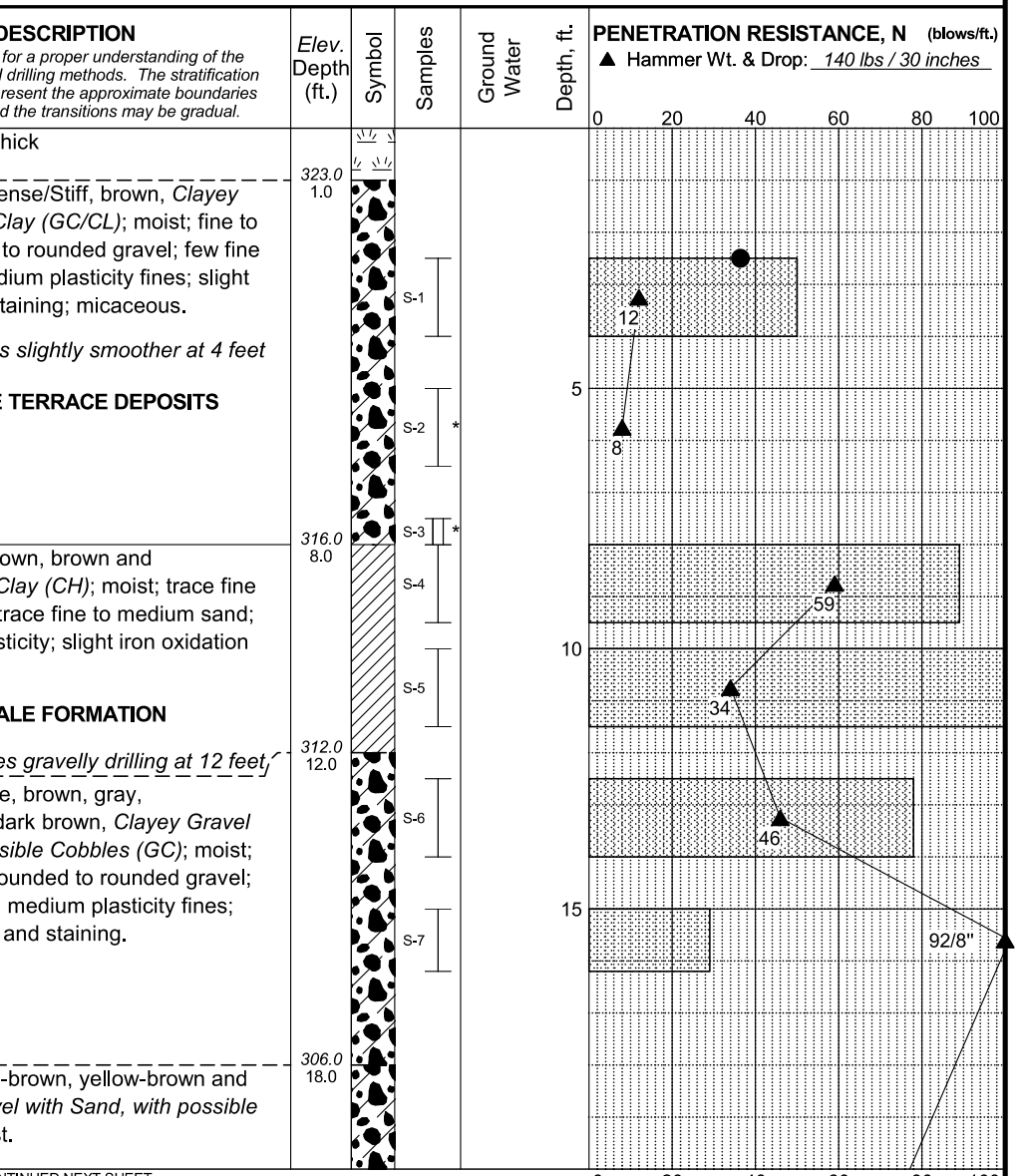
Driller notes gravelly drilling at 12 feet

Dense to very dense, brown, gray, orange-brown and dark brown, *Clayey Gravel with Sand, with possible Cobbles (GC)*; moist; fine to coarse, subrounded to rounded gravel; fine to coarse sand; medium plasticity fines; slight iron oxidation and staining.

306.0 / 18.0

Very dense, orange-brown, yellow-brown and brown, *Clayey Gravel with Sand, with possible Cobbles (GC)*; moist.

CONTINUED NEXT SHEET



LEGEND

* Sample Not Recovered

Standard Penetration Test

3" O.D. Shelby Tube

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

South Fork Water Board
Chemical Feed Building
Oregon City, Oregon

LOG OF BORING B-2

September 2021 106235

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FIG. A3
Sheet 1 of 2

REV 3

MASTER_LOG_E_106235.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 9/20/21 Log: DSJ Rev: CKS Typ: DSJ

Total Depth:	25.9 ft.	Northing:	~ 629,896 ft.	Drilling Method:	Mud Rotary	Hole Diam.:	5 in.
Top Elevation:	~ 324 ft.	Easting:	~ 7,669,191 ft.	Drilling Company:	Holt Services, Inc.	Rod Type:	NWJ
Vert. Datum:	EGM96	Station:	~	Drill Rig Equipment:	Mobile B-57 Rig #13	Hammer Type:	Automatic
Horiz. Datum:	WGS84	Offset:	~	Other Comments:	Hammer Efficiency = 89.9%		

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

Continued:

Very dense, orange-brown, yellow-brown and brown, *Clayey Gravel with Sand, with possible Cobbles (GC)*; moist; fine to coarse, subrounded to rounded gravel; fine to coarse sand; low plasticity fines; moderate iron oxidation and staining.

TROUTDALE FORMATION

298.1
25.9

Completed: March 4, 2021

S-8

S-9

73

50/5.5

0 20 40 60 80 100

25

30

35

0 20 40 60 80 100

Recovery (%)

● % Water Content

Plastic Limit ⊢——⊣ Liquid Limit

LEGEND

* Sample Not Recovered

Standard Penetration Test

3" O.D. Shelby Tube

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

South Fork Water Board
Chemical Feed Building
Oregon City, Oregon

LOG OF BORING B-2

September 2021 106235

SHANNON & WILSON, INC.
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FIG. A3
Sheet 2 of 2

REV 3

MASTER_LOG_E_106235.GPJ SW2013LIBRARYPDX.GLB SHANWIL_PDX.GDT 9/20/21 Log: DSJ Rev: CKS Typ: DSJ

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Location: South Fork Water Board, CFB	**Date:** 7/28/2021 **Job Number:** 106235	**Infiltration Test Number:** TP-1
Depth to bottom of hole: 2.0 ft	**Dimension of hole:** 2'x2'	**Test Method:** Open Pit

Tester's Name: Rex Whistler
Tester's Company: Shannon & Wilson, Inc.

Depth (feet):	Soil Texture:
0.0 to 2.0	*Brown Clayey Gravel (GC)*

Time	Time Interval (minutes)	Measurement (inches)	Head (inches)	Drop in Water Level (inches)	Infiltration rate (inches per hour)	Remarks
7/28/2021 9:48	0	2.50	13.50	--	--	
7/28/2021 9:58	10	2.25	13.25	0.25	1.50	
7/28/2021 10:08	20	2.00	13.00	0.25	1.50	
7/28/2021 10:28	40	1.88	12.88	0.13	0.38	
7/28/2021 10:48	60	1.75	12.75	0.13	0.38	
7/28/2021 10:58	70	2.50	13.50	--	--	
7/28/2021 11:18	90	2.44	13.44	0.06	0.19	
7/28/2021 11:38	110	2.38	13.38	0.06	0.19	
7/28/2021 11:58	130	2.25	13.25	0.13	0.38	
7/28/2021 12:00	132	2.50	13.50	--	--	
7/28/2021 12:20	152	2.44	13.44	0.06	0.19	
7/28/2021 12:40	172	2.38	13.38	0.06	0.19	
7/28/2021 13:00	192	2.25	13.25	0.13	0.38	

Lowest Measured Rate = 0.25 in/hr Average for 1 hour test, Lowest Measured Rate with Factor of Safety of 2 is 0.13 in/hourr

South Fork Water Board
Chemical Feed Building
Oregon City, Oregon

INFILTRATION TEST RESULTS TP-1

September 2021 106235

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FIG. A4

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Location: South Fork Water Board CFB	**Date:** 7/28/2021 **Job Number:** 106235	**Infiltration Test Number:** TP-2
Depth to bottom of hole: 2.0 ft	**Dimension of hole:** 2'x2'	**Test Method:** Open Pit

Tester's Name: Rex Whistler
Tester's Company: Shannon & Wilson, Inc.

Depth (feet):	Soil Texture:
0.0 to 2.0	*Brown Clayey Gravel (GC)*

Time	Time Interval (minutes)	Measurement (inches)	Head (inches)	Drop in Water Level (inches)	Infiltration rate (inches per hour)	Remarks
7/28/2021 9:50	0	9.00	14.00	--	--	
7/28/2021 10:00	10	8.88	13.88	0.13	0.75	
7/28/2021 10:10	20	8.75	13.75	0.13	0.75	
7/28/2021 10:30	40	8.38	13.38	0.38	1.13	
7/28/2021 10:50	60	8.13	13.13	0.25	0.75	
7/28/2021 10:53	70	9.00	14.00	--	--	
7/28/2021 11:13	90	8.75	13.75	0.25	0.75	
7/28/2021 11:33	110	8.50	13.50	0.25	0.75	
7/28/2021 11:53	130	8.13	13.13	0.38	1.13	
7/28/2021 12:05	132	9.00	14.00	--	--	
7/28/2021 12:25	152	8.75	13.75	0.25	0.75	
7/28/2021 12:45	172	8.50	13.50	0.25	0.75	
7/28/2021 13:05	192	8.13	13.13	0.38	1.13	

Lowest Measured Rate = 0.88 in/hr
Average for 1 hour test,
Lowest Infiltration Rate with Factor of Safety of 2 = 0.44 in/hour

South Fork Water Board
Chemical Feed Building
Oregon City, Oregon

INFILTRATION TEST RESULTS TP-2

September 2021 106235

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FIG. A4

APPENDIX B: LABORATORY TESTING

Appendix B

Laboratory Testing

CONTENTS

B.1 Introduction B-1

B.2 Soil Testing B-1

B.2.1 Moisture (Natural Water) Content B-1

B.2.2 Atterberg Limits B-1

B.2.3 Corrosivity Testing B-2

Figure

Figure B1: Atterberg Limits Results

Attachment

Cooper Testing Laboratory, Inc., Corrosivity Report, dated March 16, 2021

APPENDIX B: LABORATORY TESTING

B.1 INTRODUCTION

The soil samples obtained during the field explorations were described and identified in the field in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM D2488. The specific terminology used is presented in Appendix A, Figure A1.

We refined our visual-manual soil descriptions and identifications based on the results of the laboratory tests, using elements of the Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM D2487. The refined descriptions and identifications were then incorporated into the logs of borings, presented in Appendix A. Note that ASTM D2487 was not followed in full because it requires that a suite of tests be performed to fully classify a single sample.

Laboratory testing was performed by Cooper Testing of Palo Alto, California in accordance with applicable ASTM International (ASTM) standards. General descriptions of the tests are summarized in the following paragraphs.

B.2 SOIL TESTING

B.2.1 Moisture (Natural Water) Content

Natural moisture content analyses were performed on selected samples in accordance with ASTM D2216. The natural moisture content is a measure of the amount of moisture in the soil at the time the explorations are performed and is defined as the ratio of water weight to dry soil weight, expressed as a percentage. The results of moisture content determinations are presented in the Logs of Borings in Appendix A.

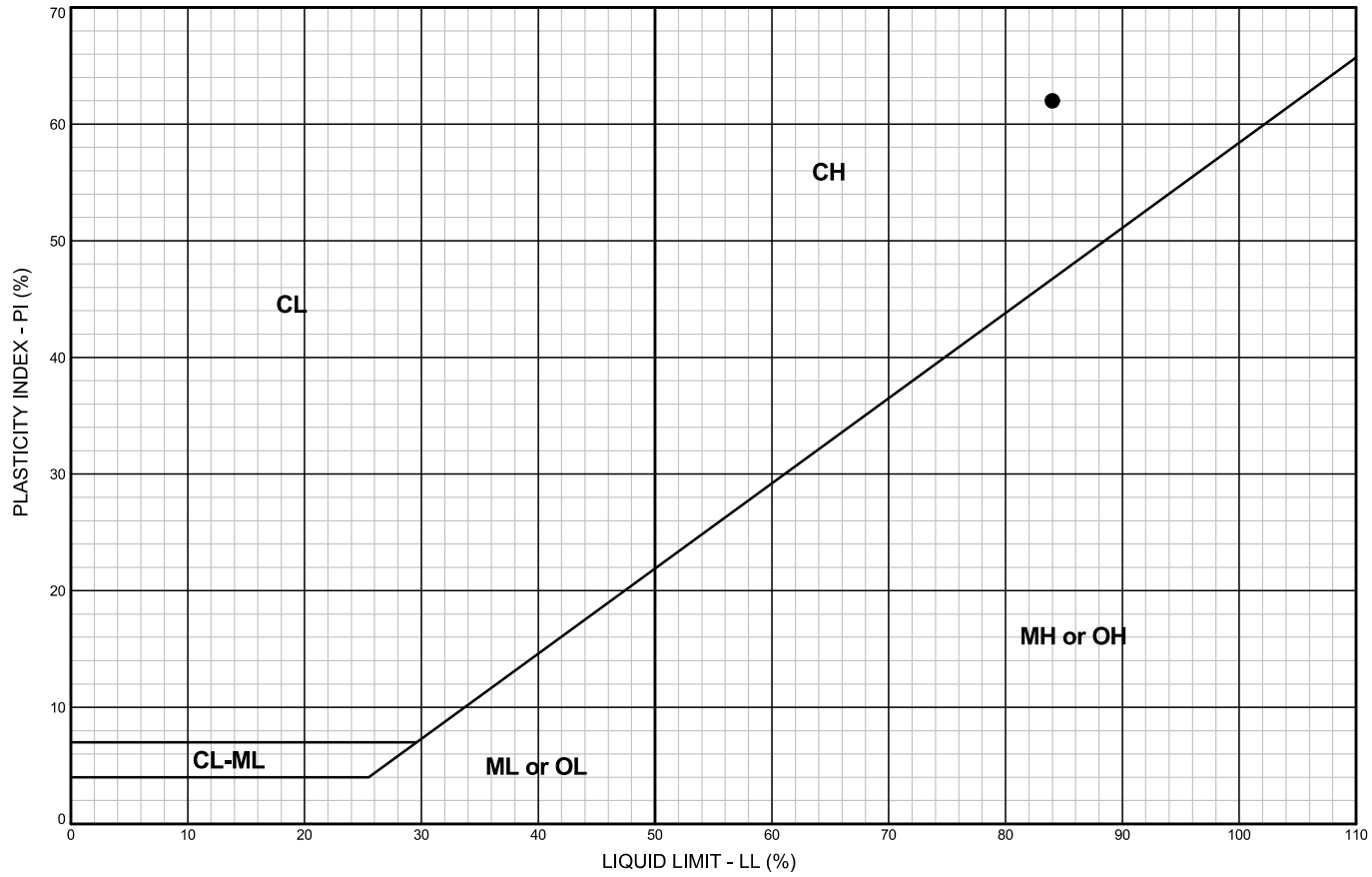
B.2.2 Atterberg Limits

Atterberg limits were determined for a select sample in accordance with ASTM D4318. This analysis yields index parameters of the soil that are useful in soil identification, as well as in a number of analyses, including liquefaction analysis. An Atterberg limits test determines a soil's liquid limit (LL) and plastic limit (PL). These are the maximum and minimum moisture contents at which the soil exhibits plastic behavior. A soil's plasticity index (PI) can be determined by subtracting PL from LL. The LL, PL, and PI of tested samples are presented on Figure B1, Atterberg Limits Results. The results of the Atterberg limits tests are also presented in the Logs of Borings in Appendix A. For the purposes of soil

description, Shannon & Wilson uses the term nonplastic to refer to soils with a PI less than 4, low plasticity for soils with a PI range of 4 to 10, medium plasticity for soils with a PI range of 10 to 20, and high plasticity for soils with a PI greater than 20.

B.2.3 Corrosivity Testing

Analytical testing was performed on specimens from select borings to evaluate the corrosivity potential of the soil at the site. The corrosivity test suite included redox potential, resistivity, chloride concentration, soil pH, sulfide and sulfate concentration. Analytical testing was performed by Cooper Testing Laboratory of Palo Alto, California.



NOTES

1) Atterberg limits tests were performed in general accordance with ASTM D4318 unless otherwise noted in the report.

2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

3) Plasticity adjectives used in sample descriptions correspond to plasticity index as follows:
- Nonplastic (NP) (< 4%)
- Low Plasticity (4 to 10%)
- Medium Plasticity (10 to 20%)
- High Plasticity (> 20%)

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	LL %	PL %	PI %[3]	NAT. W.C. %	FINES %
● B-1, S-3	7.5	*CH*	*Fat Clay*	84	22	62	31	

South Fork Water Board
Chemical Feed Building
Oregon City, Oregon

ATTERBERG LIMITS RESULTS

September 2021 106235

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B1

FIG. B1

ATT MAIN 106235.GPJ SHAN WIL.GDT 9/20/21

Corrosivity Tests Summary

CTL # 645-083 **Date:** 3/16/2021 **Tested By:** JC **Checked:** PJ
Client: Shannon & Wilson **Project:** South Fork Chemical Building **Proj. No:** 106235
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP (Redox)		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		E_H (mv)	At Test	Qualitative by Lead	At Test %	
						Dry Wt.	Dry Wt.	Dry Wt.						
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
B-1	S3	7.5-9	527	-	-	5	71	0.0071	4.7	489	19	-	30.8	Olive Brown Fat CLAY
B-2	S1	2.5-4	13,493	-	-	<2	34	0.0034	5.2	530	18	-	36.4	Dark Brown Sandy CLAY w/ Gravel

APPENDIX C – HISTORIC EXPLORATIONS PERFORMED BY OTHERS

Appendix C

Historic Explorations Performed by Others

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
354937.LS.PD.GE	B-1	SHEET 1 OF 2

SOIL BORING LOG

PROJECT : SFWB 2MG Clearwell, Oregon City, OR — LOCATION : West side of property (629550.3 N, 7669029.1 E)

ELEVATION : 324.1 ft — DRILLING CONTRACTOR : Boart Longyear Tualatin, OR

DRILLING METHOD AND EQUIPMENT : Truck mounted CME 75 with automatic hammer, Mud Rotary

WATER LEVELS : --- — START : 1/25/07 13:30 — END : 1/26/07 08:30 — LOGGER : T. Valentine

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5	5.0					
	6.5	0.5	1-SS	1-3-8 (11)	**Elastic SILT with gravel (MH)** Tan, moist to wet, stiff, high plasticity, 20 percent to 25 percent fine to coarse gravel, 5 percent to 10 percent fine sand.	Driller comments 5 feet silty sand with scattered cobble (possibly fill). Drove split spoon around a big rock.
10	10.0					
	11.5	1.5	2-SS	3-2-2 (4)	**Upper 0.2 feet: Elastic SILT with gravel (MH), Lower 1.3 feet: Elastic SILT (MH)** Yellowish-orange, moist, soft, high plasticity, 5 percent to 10 percent fine sand.	WC = 72%
	13.0					
	15.0	0.0	3-ST	push	No Recovery.	Sample slid out while lifting from hole. Cleared out sample before proceeding.
15	17.0	0.5	4-ST	push	**Elastic SILT (MH)** Tan, moist to wet, high plasticity, 5 percent to 10 percent fine sand.	
	18.5	0.1	5-SS	5-5-6 (11)	**Elastic SILT with sand (MH)** Tan, wet, stiff, high plasticity, 20 percent to 25 percent fine sand, 10 percent to 15 percent gravel, 1/2 inch maximum particle size.	
	19.0					
20	21.0	1.5	6-ST	push	**Upper 0.5 feet: Fat CLAY (CH)** Tan, wet, stiff. **Lower 1.0 feet: Lean CLAY (CL)** Gray, wet, stiff.	At 19.5 feet: LL = 94, PL = 32, TV = 0.55 tsf, PP = 2.5 tsf, WC = 73% At 19.9 feet: TV = 0.55 tsf, PP = 2.5 tsf At 21.0 feet: LL = 49, PL = 27, PP = +4.0 tsf, WC = 35%
	22.5	1.5	7-SS	4-8-8 (16)	**Elastic SILT (MH)** Brown, moist, very stiff, moderate to high plasticity, 10 percent fine sand.	
25	25.0					
	26.5	1.5	8-SS	10-20-19 (39)	**Upper 0.3 feet: Elastic SILT (MH) Lower 1.2 feet: Layered SILT with sand (ML) and poorly graded sand (SP)** Silt is brown, moist, hard, low plasticity, 25 percent fine sand, some cementation. 1/4 inch sand layers.	
30						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
354937.LS.PD.GE	B-1 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : SFWB 2MG Clearwell, Oregon City, OR LOCATION : West side of property (629550.3 N, 7669029.1 E)

ELEVATION : 324.1 ft DRILLING CONTRACTOR : Boart Longyear Tualatin, OR

DRILLING METHOD AND EQUIPMENT : Truck mounted CME 75 with automatic hammer, Mud Rotary

WATER LEVELS : --- START : 1/25/07 13:30 END : 1/26/07 08:30 LOGGER : T. Valentine

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
30.0					**Upper 1.2 feet: SILT with sand (ML)** Brown, moist to wet, hard, low plasticity, 25 percent fine grained sand, some cementation. **Lower 0.3 feet: SILT (ML)** Dry to moist.	
31.5	1.5	9-SS		14-18-18 (36)		
35 35.0						
36.5	1.5	10-SS		6-6-10 (16)	**Upper 1.4 feet: SILT with sand (ML)** Brown, moist, very stiff, low plasticity, 15 percent fine sand, some cementation. **Lower 0.1 feet: SILT with sand (ML)** Wet, 25 percent fine grained sand.	WC = 53%, LL = 47, PL = 40 Driller comments hit a new layer at 38.0 feet.
40 40.0						
41.5	1.5	11-SS		4-10-15 (25)	**SILT (ML)** Brown, dry to moist, very stiff, low to moderate plasticity, 50 percent fine sand.	
45					Bottom of Hole at 41.5 ft below ground surface	Piezometer installation with flush mounted monument. 40.0 feet to 17.0 feet: Colorado Sand. 40.0 feet to 0 feet: 1 inch PVC pipe with screen from 40 feet to 20 feet. Screen from 20.0 feet to 40.0 feet and sand to 17.0 feet. Tag No: 191681 Label: L84134. Borehole abandoned in accordance with OAR 690-240.
50						
55						
60						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
354937.LS.PD.GE	B-2 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : SFWB 2MG Clearwell, Oregon City, OR
LOCATION : Southwest corner of poperty (629327.0 N, 7669023.0 E)
ELEVATION : 323.1 ft
DRILLING CONTRACTOR : Boart Longyear Tualatin, OR
DRILLING METHOD AND EQUIPMENT : Truck mounted CME 75 with automatic hammer, Mud Rotary
WATER LEVELS : ---
START : 1/24/07 09:15 END : 1/25/07 11:30 LOGGER : T. Valentine

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5	5.0					
	6.5	0.9	1-SS	4-7-8 (15)	**SILT with Gravel (ML)** Brown and tan, moist to wet, stiff, low plasticity, 20 percent to 25 percent fine to coarse round gravel, 5 percent fine to coarse sand.	Driller comments: 0 feet to 5 feet silt, sand, and gravel with scattered cobble (possibly fill).
10	10.0					
	11.5	1.5	2-SS	1-2-2 (4)	**Elastic SILT (MH)** Tan and orange brown, wet, soft, high plasticity, some iron oxide staining.	Driller comments: 5 feet to 10 feet scattered with cobble. About 9.5 feet soil softened. PP approximately 1 to 1.5 TSF. WC = 72%
	12.5					
	14.5	2.0	3-ST	push	**Elastic SILT (MH)** Tan, wet, stiff, high plasticity with laminations.	WC = 78%, LL = 53, PL = 31, TV = 0.5, 0.85, 0.8 tsf, PP = 2.0, 2.0, 2.2 tsf, CONSOL: UWD = 54.8 pcf
15	16.0	1.5	4-SS	1-2-3 (5)	**Elastic SILT (MH)** Tan and orange brown, wet, soft, high plasticity, some iron oxide staining. Same as 2-SS.	WC = 83%
	17.5					
	19.0	1.5	5-SS	1-2-2 (4)	**Elastic SILT (MH)** Tan, wet, soft, high plasticity.	WC = 86%
20	20.0					
	21.5	1.5	6-SS	5-12-16 (28)	**Fat CLAY with Sand (CH)** Brown, wet, very stiff, moderate plasticity, 15 to 20 percent fine sand.	Driller comments: soil stiffened at 19.5 feet. WC = 38%, LL = 78, PL = 30
25	25.0					
	26.5	1.5	7-SS	9-16-23 (39)	**Upper 0.5 feet: Silty SAND (SM)** **Lower 1.0 feet: Fat CLAY with sand (CH)** Brown, moist, hard, high plasticity, 20 percent to 25 percent fine sand.	
30						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
354937.LS.PD.GE	B-2 SHEET 2 OF 4

SOIL BORING LOG

PROJECT : SFWB 2MG Clearwell, Oregon City, OR
LOCATION : Southwest corner of poperty (629327.0 N, 7669023.0 E)
ELEVATION : 323.1 ft
DRILLING CONTRACTOR : Boart Longyear Tualatin, OR
DRILLING METHOD AND EQUIPMENT : Truck mounted CME 75 with automatic hammer, Mud Rotary
WATER LEVELS : ---
START : 1/24/07 09:15 END : 1/25/07 11:30 LOGGER : T. Valentine

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0 31.0	0.9	8-ST	push	**Fat CLAY (CH)** Tan, wet, hard, orange vertical laminations (weathered rock).	Driller comments: First 6 inches were soft then became stiff.
	32.5	1.5	9-SS	7-9-11 (20)	**Fat CLAY (CH)** Brown, moist, very stiff, high plasticity.	WC = 44% and 53% PP = +4.0 tsf
35	35.0					
	36.5	1.5	10-SS	5-7-8 (15)	**Fat CLAY (CH)** Gray, moist, stiff, high plasticity.	Residual rock structure. WC = 51%, LL = 82, PL = 29
40	40.0					
	41.5	1.5	11-SS	6-11-15 (26)	**Fat CLAY (CH)** Gray, moist, stiff, high plasticity.	
45	45.0					
	46.5	1.5	12-SS	12-15-22 (37)	**SILT (ML)** Brown and red, moist, hard, 5 percent to 10 percent fine sand, moderate plasticity, iron oxide staining.	WC = 37%
50	50.0					
	51.5	1.5	13-SS	8-10-12 (22)	**SILT (ML)** Brown, moist, very stiff, low plasticity, some cementation.	
55	55.0					
	56.5	1.5	14-SS	17-18-20 (38)	**SILT with sand (ML)** Brown with dark brown areas, moist, hard, low plasticty, 10 percent to 15 percent fine sand. 55.5 feet to 56.0 feet dark brown.	WC = 42%
60						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
354937.LS.PD.GE	B-2	SHEET 3 OF 4

SOIL BORING LOG

PROJECT : SFWB 2MG Clearwell, Oregon City, OR
LOCATION : Southwest corner of poperty (629327.0 N, 7669023.0 E)
ELEVATION : 323.1 ft
DRILLING CONTRACTOR : Boart Longyear Tualatin, OR
DRILLING METHOD AND EQUIPMENT : Truck mounted CME 75 with automatic hammer, Mud Rotary
WATER LEVELS : —
START : 1/24/07 09:15 END : 1/25/07 11:30 LOGGER : T. Valentine

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0					
	61.5	1.3	15-SS	14-24-26 (50)	**Upper 1.0 feet: SILT with Sand (ML)** Dark brown, moist, hard, low plasticity, 20 percent to 25 percent fine sand. **Lower 0.3 feet: Silty SAND (SM)**	
65	65.0					
	66.5	1.5	16-SS	3-5-11 (16)	**Fat CLAY (CH)** Tan, moist to wet, very stiff, high plasticity, 5 percent to 10 percent fine sand, iron oxide stain.	Driller comment: 65 feet sticky material. WC = 73%, LL = 99, PL = 40
70	70.0					
	70.8	0.8	17-SS	43-50/3½ (50/3")	**Silty SAND (SM)** Dark brown, moist to wet, very dense, low plasticity fines, 26 percent fine silt, fine to medium grained sand, some cementation.	Gravel = 2% Sand = 72% P200 = 26%
75	75.0					
	75.4	0.3	18-SS	50/5 (50/5")	**Poorly graded SAND (SP)** Dark brown, moist, very dense, fine grained sand.	
80	80.0					
	80.9	0.7	19-SS	39-50/5 (50/5")	**Poorly graded SAND (SP)** Dark brown, moist, very dense, fine to medium grained sand, about 5 percent fines (silt).	
85	85.0					
	86.5	1.0	20-SS	21-21-35 (56)	**Top 0.3 feet: Poorly graded SAND (SP)** **Bottom 0.7 feet: Poorly graded SAND with silt (SP-SM)** Light brown with alternating layers of white, very dense, fine to medium grained sand, about 10 percent to 15 percent fines (silt).	
90						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
354937.LS.PD.GE	B-2 SHEET 4 OF 4

SOIL BORING LOG

PROJECT : SFWB 2MG Clearwell, Oregon City, OR
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DRILLING METHOD AND EQUIPMENT : Truck mounted CME 75 with automatic hammer, Mud Rotary
WATER LEVELS : —
START : 1/24/07 09:15 END : 1/25/07 11:30 LOGGER : T. Valentine

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90.0						
91.5	1.0	21-SS	19-22-29 (51)		**Poorly graded SAND with silt (SP-SM)** Light brown, moist, very dense, 10 percent low plasticity fines (silt), fine to medium grained sand.	
95 95.0						
96.5	0.6	22-SS	21-16-37 (53)		**Poorly graded SAND with silt (SP-SM)** Light brown, moist, very dense, 10 percent low plasticity fines (silt), fine to medium grained sand.	
100 100.0						Driller comments: 98 feet stiffened up.
100.3	0.2	23-SS	50/4 (50/4")		**Poorly graded SAND with gravel (SP)** Brown, moist, very dense, fine grained sand, 30 percent to 40 percent gravel (round).	
					Bottom of Hole at 100.3 ft below ground surface	Bottom of hole at 100.3 feet below ground surface. Borehole abandoned in accordance with OAR 690-240. Borehole backfilled with bentonite holeplug to ground surface. 16 bags of bentonite was used.
105						
110						
115						
120						

SHELBY TUBE VISUAL DESCRIPTION

Job South Fork Water Board 2MG Clearwell
Job No. 07-2180
Exploration No B-1
Sample No. 6-ST
Depth of Sample 19.1 – 21.0'
Sampled Length (from log) 19.0-21.0' (feet)
Sample Recovery 6.9' (feet)

Date February 8, 2007
Sample Pushed by Richard G. Sheets, Sr.
Sample Logged by Richard G. Sheets, Sr.
Type of Sample X shelby ___ other
Diameter of Sample 2.85 (inches)
Sample Quality X good __fair __poor __ Disturbed

Specimen saved	Water content (%)	Test Type	Depth (ft)	Core	Classification and Description
			18.5		
			19.0		Top of Recovery
	73	ATTB	19.5		Disturbed Stiff, wet, tan Clay (CH) TV=.55 TSF, PP=2.5 TSF Attb.; LL=94, PL=32, PI=62
	32		20.0		Laminations Very stiff – stiff, wet, brown, Clay (CL) Trace Organics TV=.55 TSF, PP=2.5 TSF
	35	ATTB	20.5		Stiff, wet, grey Clay PP=+4.0 TSF, Attb.; LL= 49, PL=27, PI=22
			21.1		Bottom of Recovery

Soil Technology
07-2180

IMPORTANT INFORMATION

Important Information

About Your Geotechnical Report

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas

IMPORTANT INFORMATION

not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

IMPORTANT INFORMATION

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland

ARBORIST REPORT

INTEGRATED ARBORICULTURAL SOLUTIONS, MARCH 2021

OREGON CITY

Community Development

698 Warner Parrott Road | Oregon City OR 97045
Ph (503) 722-3789 | Fax (503) 722-3880

Natural Resource Overlay District (NROD)

Application for Exemption from NROD Review

Staff use:

File Number: NROD-21-00003 Reviewed By: _____ Date: _____

Decision: __ Approved __ Denied

APPROVED
pwalter , 09:37:33, 04/19/2021

Site Address or Clackamas County Map and Tax Lot: 15962 Hunter Ave, Oregon City, OR 97045

Applicant Name/Company: Chris Whitman/Integrated Arboricultural Solutions Phone Number: 971-335-1414

Email Address: chris@integratedarbsolutions.com

The following uses are allowed within the NROD and do not require the issuance of an NROD permit. Indicate which exemption your project falls under:

___ Stream, wetland, riparian, and upland restoration or enhancement projects as authorized by the City.
___ Farming practices as defined in ORS 215.203 and farm uses, excluding buildings and structures, as defined in ORS 215.203.
___ Utility service using a single utility pole.
___ Boundary and topographic surveys leaving no cut scars greater than three inches in diameter on live parts of native plants listed in the Oregon City Native Plant List.
___ Soil tests, borings, test pits, monitor well installations, and other minor excavations necessary for geotechnical, geological or environmental investigation, provided that disturbed areas are restored to pre-existing conditions as approved by the Community Development Director.
___ Trails meeting all of the following:
1. Construction shall take place between May 1 and October 30 with hand held equipment;
2. Widths shall not exceed forty-eight inches and trail grade shall not exceed twenty percent;
3. Construction shall leave no scars greater than three inches in diameter on live parts of native plants;
4. Located no closer than twenty-five feet to a wetland or the top of banks of a perennial stream, or no closer than ten feet of an intermittent stream;
5. No impervious surfaces; and
6. No native trees greater than one-inch in diameter may be removed or cut, unless replaced with an equal number of native trees of at least two-inch diameter and planted within ten feet of the trail.

___ Land divisions provided they meet the following standards, and indicate the following on the final plat:
1. Lots shall have their building sites (or buildable areas) entirely located at least five feet from the NROD boundary shown on the City's adopted NROD map. For the purpose of this subparagraph, "building site" means an area of at least 3,500 square feet with minimum dimensions of forty feet wide by forty feet deep;
2. All public and private utilities (including water lines, sewer lines or drain fields, and stormwater disposal facilities) are located outside the NROD;
3. Impervious streets, driveways and parking areas shall be located at least ten feet from the NROD; and

4. The NRDD portions of all lots are protected by:
    a. A conservation easement; or
    b. A lot or tract created and dedicated solely for unimproved open space or conservation purposes.

____ Site Plan and Design Review applications where all new construction is located outside of the NRD D boundary shown on the City's adopted NROD map, and the NROD area is protected by a conservation easement approved in form by the City.

____ Routine repair and maintenance of existing structures, roadways, driveways and utilities.

____ Replacement, additions, alterations and rehabilitation of existing structures, roadways, utilities, etc., where the ground level impervious surface area is not increased.

____ Measures approved by the City of D regon City to remove or abate nuisances or hazardous conditions.

X Tree Removal. The Community Development Director may permit the removal of any tree determined to be a dead, hazardous, or diseased tree as defined in OCMC 17.04. Any tree that is removed in accordance with this Section (L) shall be replaced with a new tree of at least ½-inch caliper or at least six foot overall height. An exception to this requirement may be granted if the applicant demonstrates that a replacement tree has already been planted In anticipation of tree removal, or if the existing site conditions otherwise preclude tree replacement (due to existing dense canopy coverage or other ecological reasons).

The replacement tree(s) shall be located in the general vicinity of the removed tree(s), somewhere within NRD D on the property. The replacement tree(s) shall be identified on the D regon City Native Plant List or other locally adopted plant list (e.g. Metro or Portland). The property owner shall ensure that the replacement tree(s) survives at least two years beyond the date of its planting.

____ Planting of native vegetation and the removal of non-native, invasive vegetation (as identified on the Oregon City Native Plant List or other locally adopted plant list (e.g. Metro or Portland), or as recommended by an environmental professional with experience and academic credentials in one or more natural resource areas such as ecology, arboriculture, horticulture, wildlife biology, botany, hydrology or forestry), and removal of refuse and fill, provided that:
    1. All work is done using hand-held equipment;
    2. No existing native vegetation is disturbed or removed; and
    3. All work occurs outside of wetlands and the top-of-bank of streams.

____ Activities in which no more than one hundred square feet of ground surface is disturbed outside of the bankfull stage of water bodies and where the disturbed area is restored to the pre-construction conditions, notwithstanding that disturbed areas that are predominantly covered with invasive species shall be required to remove the invasive species from the disturbance area and plant trees and native plants pursuant to this Chapter.

____ New fences meeting all of the following:
    1. No taller than three and a half feet and of split rail or similar open design.;
    2. Two feet width on both sides of fence shall be planted or seeded with native grasses, shrubs, herbs, or trees to cover any bare ground;
    3. Six inches of clearance from ground level;
    4. Fence posts shall be placed outside the top-of-bank of streams and outside of delineated wetlands.

____ Gardens, fences and lawns within the NRD D that existed prior to the time the overlay district was applied to a subject property are allowed to be maintained but cannot expand further into the overlay district.

Describe how your project meets one of the items In the list above.

Canopy cover in the NRDD is extremely dense and the area is heavy clay as a result of SFWB Plant activity. Replacement trees have limited chance of survival.

Attach a map showing the location of the proposed work. (Attached in previous report)

Attach any other documentation, such as photos, plans, or reports needed to demonstrate compliance with the code.

Pete Walter

From:	Integrated Arboricultural Solutions <chris@integratedarbsolutions.com>
Sent:	Monday, March 29, 2021 5:05 PM
To:	Pete Walter
Subject:	Re: South Fork Water Board Tree Removal
Attachments:	Screen Shot 2021-03-29 at 5.02.34 PM.png; nrod_exemption_application.pdf

Pete,

Completed form attached for you along with a photo of the area for reference. Thank you for taking the time to jump on this....much appreciated.

Regards,
Chris

On Mon, Mar 29, 2021 at 2:03 PM Pete Walter <pwalter@orcity.org> wrote:

Hi Chris,

Attached is the Site Plan approval. I have to approved it with a condition for REMOVAL OF two trees in the south east corner of the site which fall within the Natural Resources Overlay District. I have marked them on the site plan application.

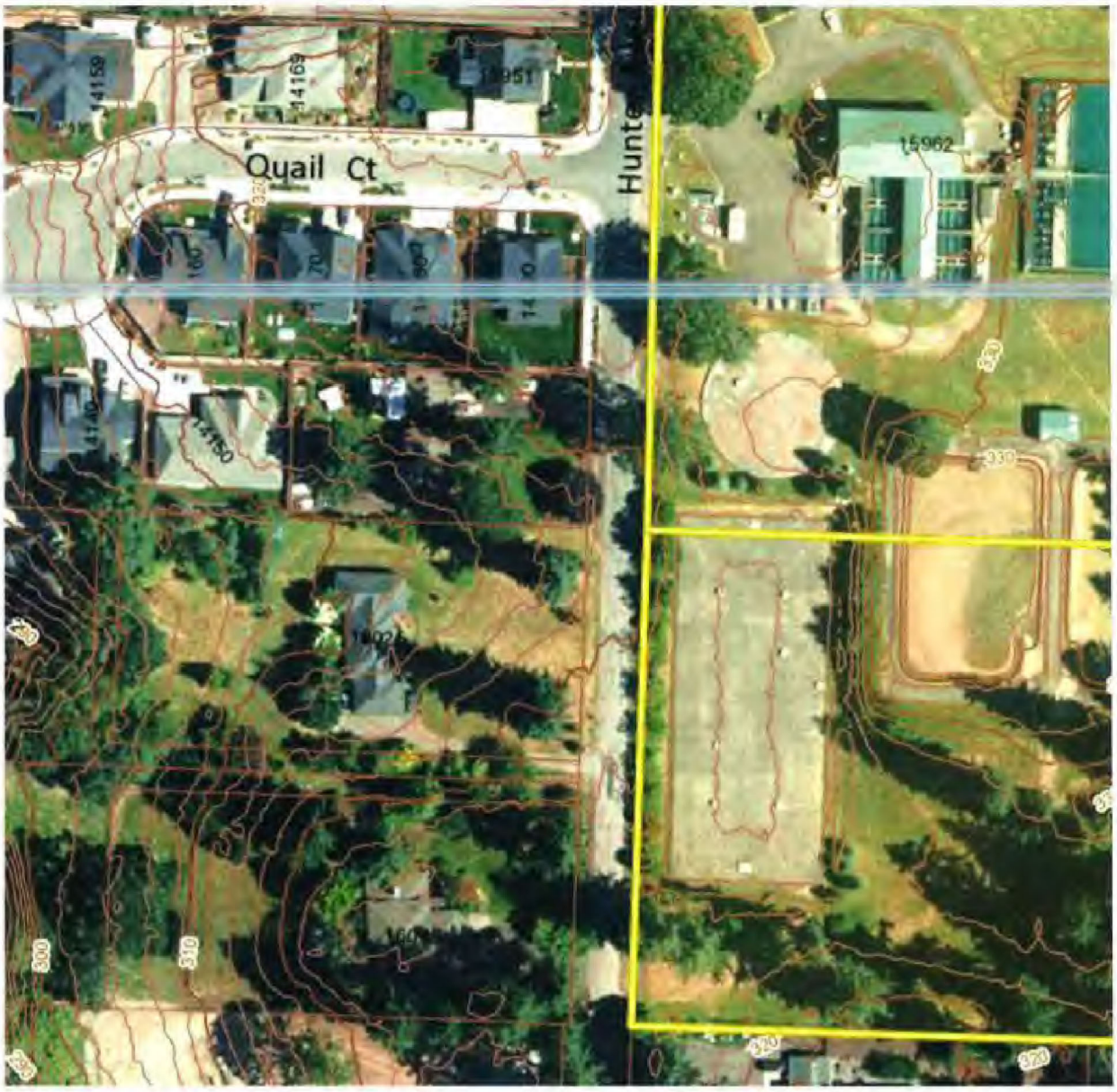
A separate exemption application form needs to be filled out.

https://www.orcity.org/sites/default/files/fileattachments/planning/page/12582/nrod_exemption_application.pdf

Per code: OCMC 17.49.080.

L. Tree Removal. The community development director may permit the removal of any tree determined to be a dead, hazardous, or diseased tree as defined in OCMC 17.04. Any tree that is removed in accordance with this subsection L shall be replaced with a new tree of at least one-half-inch caliper or at least six foot overall height. An exception to this requirement may be granted if the applicant demonstrates that a replacement tree has already been planted in anticipation of tree removal, or if the existing site conditions otherwise preclude tree replacement (due to existing dense canopy coverage or other ecological reasons).

The replacement tree(s) shall be located in the general vicinity of the removed tree(s), somewhere within NROD on the property. The replacement tree(s) shall be identified on the Oregon City Native Plant List or other locally adopted plant list (e.g. Metro or Portland). The property owner shall ensure that the replacement tree(s) survives at least two years beyond the date of its planting.



Let me know if the owner would rather re-plant two trees or if you think the overstory would preclude successful replanting due to shade.

Once you complete the NROD exemption application I will send you an invoice.

Pete

Peter Walter, AICP, Senior Planner (he / him)

Community Development Department

695 Warner Parrott Rd, Oregon City, OR 97045

(503) 867-2574 ***Mobile***

(503) 496-1568 ***Desk***

(503) 722-3789 ***Main Office***

Today in Black History

What's your Vision for Oregon City?

Interactive Maps and Apps

On-Line Submittal of Land Use Applications

COVID-19 (Coronavirus) Information

The City of Oregon City is open for business and continues to offer services and programs online and virtually. Some City facilities are open to the public, find current openings here, we encourage visitors to wear a mask, practice physical distancing, and reschedule in-person visits if you are feeling unwell.

The City has installed additional shielding and is providing hand sanitizer as well as occupancy limits to ensure our staff and visitors have a safe, no touch experience. Our goal is to be responsive to our community throughout this pandemic; we appreciate your understanding and cooperation.

PUBLIC RECORDS LAW DISCLOSURE: This e-mail is subject to the State Retention Schedule and may be made available to the public.

OREGON CITY

Community Development

698 Warner Parrott Road | Oregon City OR 97045
Ph (503) 722-3789 | Fax (503) 722-3880

Type I Site Plan and Design Review

Office/Mixed Use/Commercial/Multi-Family/Industrial Uses

Staff use:

File Number: SP-21-00050 Reviewed By: Pete Walter Date: 3.29.2021

Decision: ☐ Approved ☒ Approved with Conditions ☐ Denied

Type I NROD Exemption required for tree removal within NROD. Trees must be replaced within NROD per OCMC 17.49.080.(L). Apply for separate NROD Exemption

Site Address or Clackamas County Map and Tax Lot: 15962 Hunter Ave, Oregon City, OR 97045

Project Description: Tree Removal

Applicant Name/Company: Chris Whitman / IAS Phone Number: 971-335-1414

Email Address: chris @integratedarbsolutions.com

Use of Property:

Zoning District: R-10

What is the current or proposed use of the property?

Water Treatment Facility - South Fork Water Board

Over the Counter: $81 for Up to Two Items, $162 for Three or More Items
Extended Review: $270 for Each Item

Over the Counter Review

- ☐ Addition to a Legal Non-Conforming Single or Two-Family Dwelling
- ☐ Replacement of Exterior Building Materials
- ☐ Modifications of Windows/Doors
- ☐ Modifications to Parapets or Rooflines
- ☐ Building Entrance Alterations
- ☐ Reroof Only
- ☐ Temporary Structures
- ☐ Modifications to Awnings or Projections

Over the Counter Review

- ☐ Installation of Mechanical Equipment
- ☐ Parking Lot Repaving
- ☐ Shared Parking Agreement
- ☐ Changes to Bicycle Parking
- ☐ Changes to Landscaping
- ☐ ADA Upgrades
- ☐ Modifications to Fence or Wall
- ☐ Outdoor Lighting Alterations
- ☐ Refuse Enclosure Alterations
- ☐ Changes to Pedestrian Circulation
- ☐ Demolition of structure
- ☒ Tree Removal
- ☐ Mobile Food Cart – 5 Hours or Less

Extended Review

- ☐ Addition of up to 200 Square Feet
- ☐ Addition to an Industrial Use up to 1,000 SF
- ☐ Change in Parking Lot Circulation or Layout
- ☐ Removal/Relocation of Parking Stalls
- ☐ Phased subdivision/occupancy plan*

*For issuance of an early certificate of occupancy when the full development is not yet constructed

In addition to this application, addendums are required based on the scope of the project. For submittal requirements and to determine which addendums are required, please refer to the Site Plan and Design Review Addendum Guide.

Applicable Overlay Zones

Please identify all overlay districts identified on your Property Zoning Report. The presence of an overlay district may require public review in a Type II Minor Site Plan and Design Review process.

- ☐ Individually Designated Historic Structure
- ☐ Historic Overlay District
- ☐ Barlow Trail Corridor
- ☐ Willamette River Greenway Overlay District
- ☒ High Water Table
- ☒ Geologic Hazards Overlay District
- ☐ Flood Management Overlay District
- ☐ Sewer Moratorium Area
- ☐ Natural Resources Overlay District
- ☐ Not Applicable

General Standards

Demonstrate compliace with previous proposals and associated conditions (attach separate document if needed).

☒ Not Applicable

Attachments included in this application (check all that apply):

- ☒ Site Plan (required)
- ☐ Elevation drawings
- ☐ Vicinity Map
- ☒ Photos
- ☒ Other Arborist Report

The proposed development shall be adequately maintained. Will the proposed development be adequately maintained? ☒ Yes ☐ No

Does the location of the proposed development include any public easement? If so, please contact the Development Services Department for all required approvals. ☐ Yes ☒ No

Does the proposal include any work within or projections over the right-of-way? ☐ Yes ☒ No
If yes, please contact the Development Services Department for all required approvals.

Does the proposal include any utility work or changes to storm water facilities? ☐ Yes ☒ No
If yes, please contact the Development Services Department for all required approvals.

Staff Only

Is the project eligible for Type I Site Plan and Design Review? ☒ Yes ☐ No Initial PJW

Note Type I NROD Exemption required for tree removal within NROD. Trees must be replaced within NROD

OREGON CITY

Community Development
698 Warner Parrott Road | Oregon City OR 97045
Ph (503) 722-3789 | Fax (503) 722-3880

Type I Site Plan and Design Review

Addendum 4b: Landscaping – Tree Removal

Changes to landscaping must be in compliance with Oregon City Municipal Code Section 17.62.050.A.1, 17.62.050.A.9 and 17.52.060.

USE THIS ADDENDUM ONLY IF TREE REMOVAL IS PROPOSED, FOR ALL OTHER LANDSCAPING CHANGES PLEASE USE ADDENDUM 4a.

On-Site Tree Removal

Tree removal must be in compliance with Oregon City Municipal Code Section 17.41.060.

Does the proposal include removal of on-site trees? If so, please complete this section. If not, please proceed to the next section. ☒ Yes ☐ No

Please note, onsite trees do not include required parking lot trees. If required parking lot trees are proposed to be removed, please complete Addendum 4a.

Describe the proposed tree removal, including size, species, and reason for removal.

See Attached Report...

Is mitigation (replanting) required?

☐ Yes

☐ No, the tree is an invasive species: _____

☒ No, the tree is dead, diseased, dying, or hazardous and I have an arborist letter

☐ No, the tree is dead, diseased, dying, or hazardous and the condition of the tree can be verified by staff (attach photos)

Mitigation required for NROD tree removal

If mitigation is required, please identify the option for tree mitigation:

☐ Replacement - All replacement trees shall be protected by a permanent restrictive covenant or easement approved in form by the city.

Size of tree removed (DBH*)	Number of Trees Proposed to be Removed	# of Trees Replanted for Each Tree Removed *If removed tree is **within** construction area*	# of Trees Replanted for Each Tree Removed *If removed tree is **outside of** construction area*	Number of Mitigation Trees Required
6 to 12"		1	3	
13 to 18"		2	6	

Size of tree removed (DBH*)	Number of Trees Proposed to be Removed	# of Trees Replanted for Each Tree Removed *If removed tree is **within** construction area*	# of Trees Replanted for Each Tree Removed *If removed tree is **outside of** construction area*	Number of Mitigation Trees Required
19 to 24"		3	9	
25 to 30"		4	12	
31 and over"		5	15	

Total Mitigation Trees Required N/A

*DBH means inches of trunk diameter, measured at 4 ½ feet above ground level.

Size. The mitigation trees shall be a minimum of 2" in caliper or a 6' conifer.
Size Proposed: N/A

Species. The species shall be listed on the City's Native Tree List, Street Tree List or approved by a certified arborist.

❑OC Native Tree List ❑OC Street Tree List ❑Approved by a certified arborist

Species Proposed*: N/A

*Removal of white oak species requires replacement with the same species.

❑ Cash in Lieu.

Number of Trees Proposed to Use the Cash in Lieu: N/A

_____ x fee-in-lieu:_____ = N/A Total Amount Due

Attach a tree mitigation plan showing the proposed location of mitigation trees, species, and proposed planting date.

Mitigation plans must be prepared by a certified arborist, horticulturalist, forester, or other environmental professional, though tree inventories for the purposes of mitigation calculations may be prepared by a licensed surveyor. Please provide the information of the qualified professional who completed the tree mitigation plan.

Name Chris Whitman Company Integrated Arboricultural Solutions

Phone Number 971-335-1414 Email Address chris @integratedarbsolutions.com

☒Certified Arborist ❑ Horticulturalist

❑Forester ❑ Other Environmental Professional _____

Certification Number (if applicable) WE-10291BU

Staff Only

Standards met? ☒ Yes ❑ No ❑ Not Applicable Initial DJW


Natural Resource
Overlay District
Replacement
Required per OCMC
17.49.080.(L)
Apply for exemption



Arborist Report

Prepared for South Fork Water Board

15962 Hunter Ave. Oregon City, Oregon 97045

Prepered by Chris Whitman

BCMA WE-10291BU, TRAQ

March 8th, 2021

Integrated Arboricultural Solutions

PO Box 66012 Portland, Oregon 97267

(971) 335-1414

chris@integratedarbsolutions.com

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Background

The client and I established contact on March 3rd 2021. Mark Cage, Senior Plant Operator, requested an assessment of damage that occurred as a direct result of a large ice storm that occurred a few weeks prior. The facility sustained a fair amount of damage. It was determined an inventory map of damaged trees, a report detailing the damage, and permit application for removal would be needed.

At approximately 1pm on March 3rd, 2021 the client and I conducted an initial review and established the scope of work and goals of the project. Over the course of the following 3 days, the most significantly damaged and destroyed trees were mapped and numbered using ArcGIS software and tree diameter measurements were taken as well as a limited visual assessment conducted in order to determine the extent of damage. No formal hazard assessment was undertaken or is implied and the content of this report should not be interpreted as such.

Subject Trees

Subject tree species represent: Douglas Fir (*Pseudotsuga menziesii*), Big Leaf Maple (Acer Macrophyllum), Oregon White Oak (*Quercus garryana*), Pacific Madrone (*Arbutus menziesii*) and Hawthorn (*Crataegus monogyna*). Trunk diameters varied from 6 inches in diameter at breast height (DBH) up to 62 inches DBH. Affected trees were found growing throughout the property as indicated on the GIS map appended to this report.

Results

Subject trees were surveyed for suitability of retention and the likelihood of future failure based on damage sustained. All trees underwent a basic visual assessment and no advanced testing or diagnostics were performed. Trees recommended for removal sustained significant enough damage to render the structure of the tree unsafe.

Priority Area 1:

Soils appear well drained and stable in the northwest quadrant of the property. Most trees in this area are of a similar age and exhibit a comparable growth pattern. Smaller trees (<20" DBH) show strong phototropic response with poor branch structure and uncorrected leans. Trunk taper on 20"+ DBH trees is acceptable and root flares are exposed. No signs of root disease or other pathology were noted. The average structure of trees to be removed was rated poor and the average of the trees to be retained was moderate. There is little evidence of pruning or care regarding the structure of these trees.

It is recommended to follow up with a reinspection in 6-9 months after the first round of clean up and pruning. Initial pruning should focus on damage mitigation **only.**

Subsequent pruning(s) should be focused on improving the structure of the affected trees. Aftercare in the form of deep root feeding and supplemental irrigation applied through summer is recommended to allow the trees to recover from the damage and loss of nutrient storage.

Priority Area 2:

Damage in this area is less widespread, likely due to the protected nature of the trees by those to the south and west. Failures follow the same profile as others on this site though, showing the inherent issues associated with lack of pruning and care resulting in heavy end weight and over-extended branches. Soils appear somewhat poorly drained and saturated towards the corner of Thurman St and Swan Ave in the northeast quadrant of the property. Most trees in this area are of a similar age and exhibit a comparable growth pattern. No signs of root disease or other pathology were noted. Tree #36 was a whole tree failure and showed very minimal anchoring root development and also appeared to have been backfilled 9-10" above the root flare, likely contributing to blowdown. This is something to be aware of in nearby trees, especially considering the use of the site and dispersal of discarded materials on site. Tree #25 has minimal storm damage and also shows damage from a previous lightning strike on the west face of the trunk in the upper canopy at approximately 70'. Lightning strike wounds often serve as a vector for the entry of fungal pathogens and subsequently result in top failures. It would be prudent to have a qualified arborist inspect this area further, especially after the heavy ice loading and wind of late. The average structure of trees to be removed was rated poor and the average of the trees to be retained was moderate. There is little evidence of pruning or care regarding the structure of these trees.

It is recommended to follow up with a reinspection in 6-9 months after the first round of clean up and pruning. Initial pruning should focus on damage mitigation **only.** Subsequent pruning(s) should be focused on improving the structure of the affected trees. Aftercare in the form of deep root feeding and supplemental irrigation applied through summer is recommended to allow the trees to recover from the damage and loss of nutrient storage.

Priority Area 3:

Damage in this area is minimal as the trees in this portion of the property are well protected. Two Douglas Firs, on the southeast edge of the stand, were minimally damaged. Most maples sustained damage resulting from poor structure, and all Hawthorns had broken tops and are recommended for removal. Soils in the southeast quadrant appear somewhat poorly drained and saturated, consisting of non native material and heavy clay. Most trees in this area are of a similar age and exhibit a typical growth pattern. Severe root compaction and anaerobic soils were noted throughout. Some Fir show positive signs of red ring rot (*Phellinus pini)* in the form of visible fruiting

bodies in the upper half of the canopy. Phellinus is not a particularly aggressive pathogen but does have a tendency to move to adjacent trees and should be monitored. Monitoring of this area on a 1-2 year rotation is advisable to monitor disease progression and decline of the stand. The average structure of trees to be removed was rated poor and the average of the trees to be retained was moderate. There is little evidence of pruning or care regarding the structure of these trees.

---This area intentionally blank---

Inventory Table

Tree #	Species	"DBH	Structure Rating (1-5)	Health Rating (1-3)	Retain	Work Needed	Priority
1	Oak	38	3	2	Y	C,P,A,I	1
2	Oak	25	3	2	Y	C,P,A,I	1
3	Oak	28	1	1	N	C,R,D ✔	1
4	Oak	14	1	1	N	C,R,D ✔	1
5	Oak	28	1	1	N	C,R,D ✔	1
6	Oak	23	1	1	N	C,R,D ✔	1
7	Oak	24	1	1	N	C,R,D ✔	1
8	Oak	37	1	1	N	C,R,D ✔	1
9	Oak	22	2	2	Y	C,P,A,I	1
10	Oak	21	2	2	Y	C,P,A,I	1
11	Oak	18	1	1	N	C,R,D ✔	1
12	Oak	23	3	2	Y	C,P,A,I	1
13	Oak	34	3	2	Y	C,P,A,I	1
14	Oak	18	1	1	N	C,R,D ✔	1
15	Oak	46	1	1	N	C,R,D ✔	1
16	Oak	45	3	2	Y	C,P,A,I	1
17	Oak	27	3	2	Y	C,P,A,I	1
18	Oak	26	1	1	N	C,R,D ✔	1
19	Oak	16	1	1	N	C,R,D ✔	1
20	Oak	22	1	1	N	C,R,D ✔	1
21	Oak	37	1	1	N	C,R,D ✔	1
22	Oak	41	3	2	Y	C,P,A,I	1
23	Douglas Fir	38	4	3	Y	C,P,A,I	2
24	Douglas Fir	42	4	3	Y	C,P,A,I	2
25	Douglas Fir	48	3	2	Y	C,P,A,I	2
26	Madrone	37	1	1	N	C,R,D ✔	2
27	Oak	36	3	2	Y	C,P,A,I	2
28	Oak	32	3	2	Y	C,P,A,I	2
29	Oak	23	1	1	N	C,R,D ✔	2
30	Oak	26	1	1	N	C,R,D ✔	2
31	Oak	25	1	1	N	C,R,D ✔	2
32	Oak	43	3	2	Y	C,P,A,I	2
33	Oak	21	2	2	Y	C,P,A,I	2
34	Oak	22	2	2	Y	C,P,A,I	2
35	Oak	23	2	2	Y	C,P,A,I	2
36	Oak	24	1	1	N	C,R,D ✔	2
37	Douglas Fir	40	3	2	Y	C,P,A,I	3
38	Douglas Fir	44	3	2	Y	C,P,A,I	3
39	Maple	18	2	1	N	C,R,D ✔	3
40	Maple	18	2	1	N	C,R,D ✔	3
41	Hawthorn	6	2	1	N	C,R,D ✔	3
42	Hawthorn	6	2	1	N	C,R,D ✔	3
43	Hawthorn	6	2	1	N	C,R,D ✔	3
44	Hawthorn	6	2	1	N	C,R,D ✔	3
45	Hawthorn	6	2	1	N	C,R,D ✔	3
46	Oak	62	3	2	Y	C,P,A,I	1
47	Oak	37	3	2	Y	C,P,A,I	1
48	Oak	38	3	2	Y	C,P,A,I	1

Repair Item Legend:

C=Cleanup - W=Wound repair - P=Pruning - R=Tree removal - SS=Support system - I=Supp Irrigation M=Mulch - TR=Tree replacement -SR=Shrub replacement - OP=Other plantings - S=Soil renovation H=Hardscape repair - D=Debris removal - A=Aftercare

Conclusion

Damage represents a typical failure profile for each of the species of trees located on site. Future damage can be mitigated by establishing a proactive pruning cycle for all trees. To restore damaged trees in areas 1 and 2 it is recommended that a qualified arborist be engaged to conduct structural pruning annually for the following 2 years and then a 3 year pruning cycle be established. Trees in area 3 should be inspected every 1-2 years for hazards and addressed as needed.

As previously mentioned, all trees should be reinspected in 6-9 months to reassess for new hazards. It is advised to remove wood debris from site or quarantine in accordance with ODFW guidelines as stored wood can harbor and attract pests. This is especially common after storm events.

In order to ensure no further damage to the retained trees, vehicle traffic should be minimized under trees and no materials or debris stored against the trunks.

Limits of Assignment

My observations in this can have been limited to above-ground observations of the subject trees and the surrounding site. Information gathered was based solely upon my site inspection between March 9th through 12th, 2021 and any information provided to me by SFWB. It is presumed that all of the historical information and data provided to me regarding the project and the trees is factual. If any information is later revealed to be false or inaccurate, the findings and valuations in this report may be invalidated.

This report does not serve as a tree risk assessment. Further, knowledge in this matter is limited to arboriculture. This report is not intended to be legal advice. I do not and cannot guarantee the safety, health, or condition of the subject trees. No warranty or guarantee is expressed or implied. The tree's in this report are subject to nature and forces beyond human control, there can be no guarantee that problems or deficiencies may not arise in the future.

Arborists are experts who use their knowledge, education, training, and experience to examine trees, recommend measures to enhance them, provide guidance, and attempt to mitigate the risk of living trees. The client is ultimately responsible for choosing whether to accept or disregard the recommendations of the arborist, or to seek additional advice.

Arborists cannot detect every condition that could possibly lead to structural failure of a tree. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period of time. Trees can be managed, but they cannot be controlled. To live near trees is to accept some degree of risk. The only way to eliminate all risk associated with trees is to eliminate all trees.

I certify the information provided in this report is true and accurate to the best of my knowledge based on the facts provided to me, the information collected by me and the Limitations of Assignment listed above.

Name: Chris Whitman Title: Board Certified Master Arborist (WE-10291-BU)

Signature: Chris Whitman Date: March 11th, 2021

COVID-19 (Coronavirus) Information

Submission #95

Previous submission Next submission

Print Resend e-mails

Submission information

Form: Online Submittal of Land Use Applications
Submitted by Visitor (not verified)
Tue, 03/16/2021 - 10:26am
73.157.234.194

Applicant Name(s) South Fork Water Board

Applicant's Representative
Chris Whitman

Company Integrated Arboricultural Solutions

Mailing Address PO Box 68012 Portland, OR 97267

Phone Number 971-335-1414

Email Address chris@integratedarbsolutions.com

Application Type
Type I Site Plan and Design Review

Project Description
Hazard Tree Removals

feedback

Project Address 15962 Hunter Ave. Oregon City, OR 97045

Map and Taxlot Number

Additional information
Arborist Report and map with removals (red pins) attached.

Application Form
type_i_site_plan_main_application.pdf

Site Plan/ Layout
screen_shot_2021-03-16_at_10.20.49_am.png

Other Application Materials
addendum_4b_tree_removal.pdf

Other Application Materials (2)
sfwb_arborist_report-6.pdf

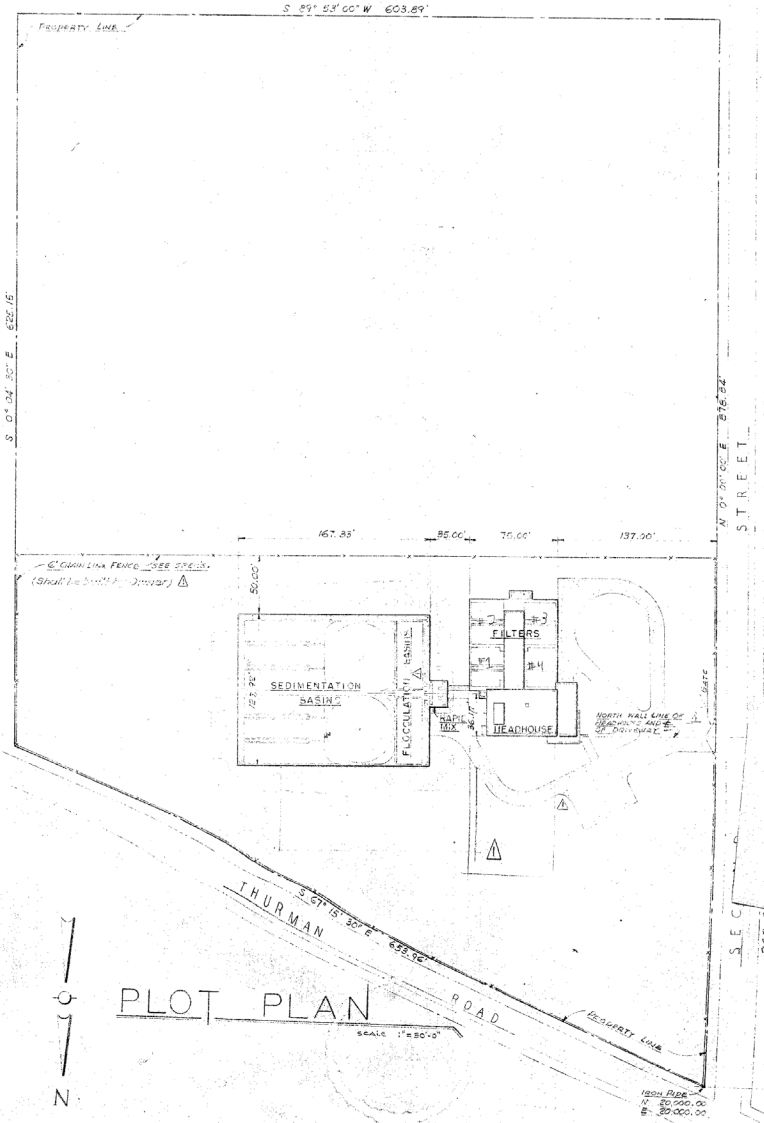
Other Application Materials (3)

Other Application Materials (4)

Disclaimer
Select to acknowledge you read and understand the paragraph below.

Previous submission Next submission

RECORD DRAWINGS



PLOT PLAN

SCALE 1"=50'-0"

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	A3	OUTSIDE PIPING
	A4	FLOOR PLANS
	A5	ROOF PLAN & DETAILS
	A6	ELEVATIONS & DETAILS
	A7	DOOR & WINDOW DETAILS
	A8	INTERIOR DETAILS
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	M8	HEATING PLAN & DETAILS
	E1	ELECTRICAL PLAN-EL. 333.5
	E2	ELECTRICAL PLAN-EL. 321.5
	E3	ELECTRICAL PLAN-EL. 322.25 & EL. 314.0
	E4	ELECTRICAL DETAILS
	E5	ELECTRICAL DETAILS
	E6	ELECTRICAL WIRING DIAGRAMS
	E7	MAIN CONTROL PANEL
	E8	BLOCK DIAGRAM OF FACILITIES

RAW WATER INTAKE STRUCTURE

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	C1-2	ARCHITECTURAL DETAILS
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	C1-9	CROSS SECTIONS
	C1-10	MISC. DETAILS
	C1-11	ELECTRICAL PLAN & DETAILS

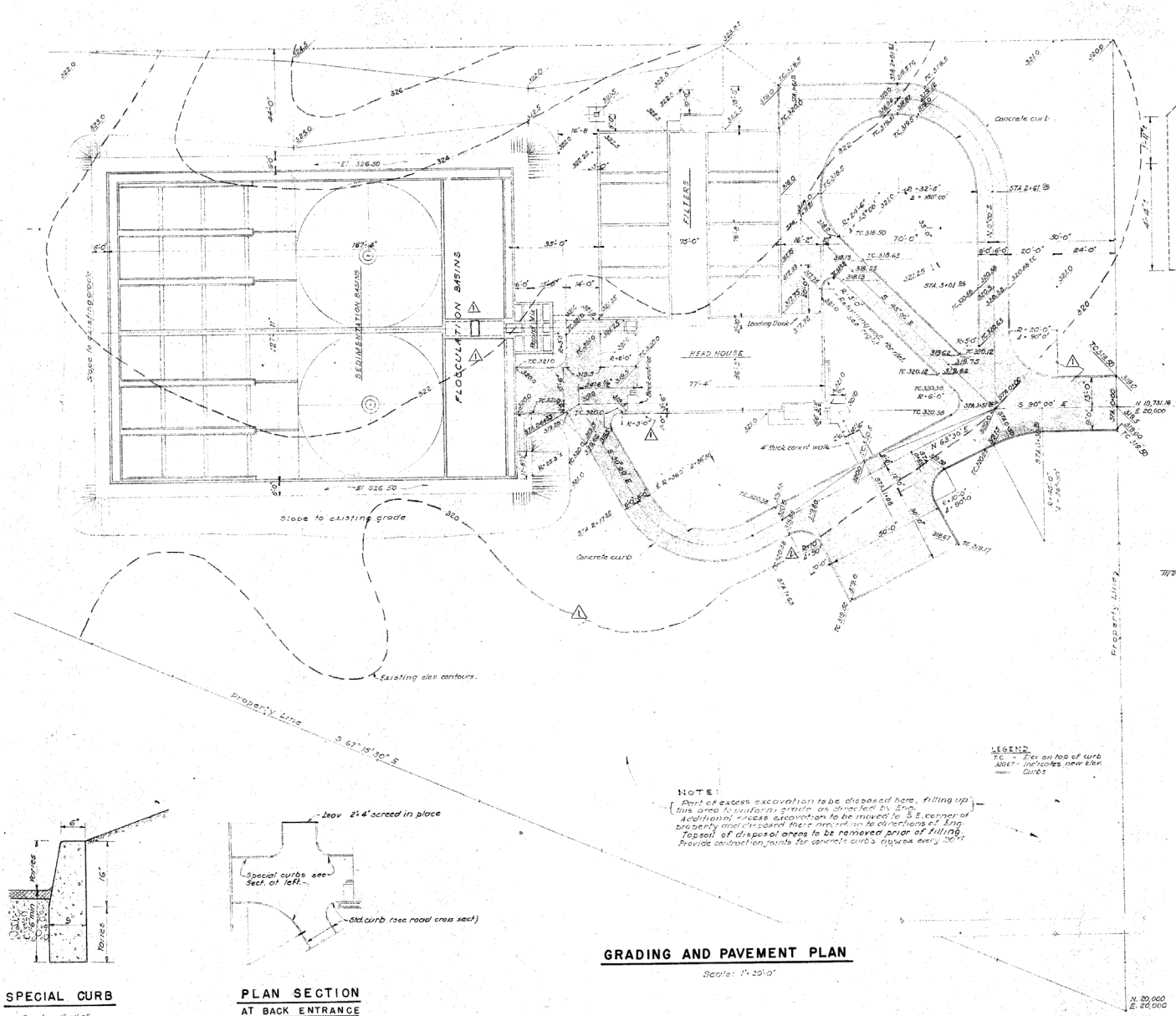
DIVISION STREET PUMPING STATION

	C3-1	ARCHITECTURAL ELEVATIONS & VALVE BOX
	C3-2	STRUCTURAL DETAILS
	C3-3	PLOT PLAN-DRYWELL & ELECTRICAL DIAGRAM
	C3-4	PIPING LAYOUT & ELECTRICAL LAYOUT
	C3-5	CROSS SECTION & DETAILS

PIPE LINE WORK

	C4-1	STA. 147+00 TO STA. 162+79±
	C4-2	STA. 132+00 TO STA. 147+00
	C4-3	STA. 117+00 TO STA. 132+00
	C4-4	STA. 102+00 TO STA. 117+00
	C4-5	STA. 87+00 TO STA. 102+00
	C4-6	STA. 70+00 TO STA. 87+00
	C4-7	STA. 55+00 TO STA. 70+00
	C4-8	STA. 40+00 TO STA. 55+00
	C4-9	STA. 25+00 TO STA. 40+00
	C4-10	STA. 10+00 TO STA. 25+00
	C4-11	STA. 0+00 TO STA. 10+00
	C4-12	INTAKE TO TREATMENT PLANT.

STEVENS & THOMPSON
2234 S. W. FIFTH AVENUE
OREGON CITY - WE
WATER SUPPLY P
SOUTH FORK WATER
WATER PURIFICATION
PLOT PLAN
& INDEX TO DRAWING

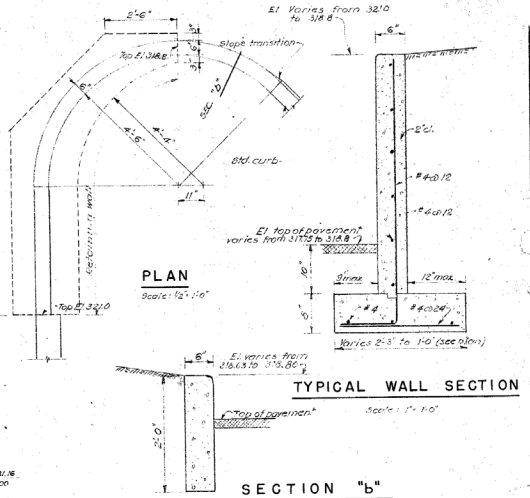


LEGEND
T.C. - Elev on top of curb
320.67 - Indicates new elev.
Curbs

NOTE:
Part of excess excavation to be disposed here, filling up this area to uniform grade as directed by Eng.
Additional excess excavation to be moved to S.E. corner of property and disposed there according to directions of Eng.
Topsoil of disposal areas to be removed prior of filling.
Provide contraction joints for concrete curbs approx every 30 FT

GRADING AND PAVEMENT PLAN

Scale: 1" = 20'-0"

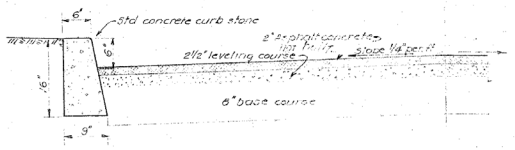


PLAN
Scale: 1/2" = 1'-0"

TYPICAL WALL SECTION
Scale: 1" = 1'-0"

SECTION "b"
Scale: 1" = 1'-0"

DETAILS OF RETAINING WALL AT LOADING DOCK



TYPICAL ROAD CROSS-SECTION
Scale: 1" = 1'-0"

SPECIAL CURB
Scale: 1" = 1'-0"

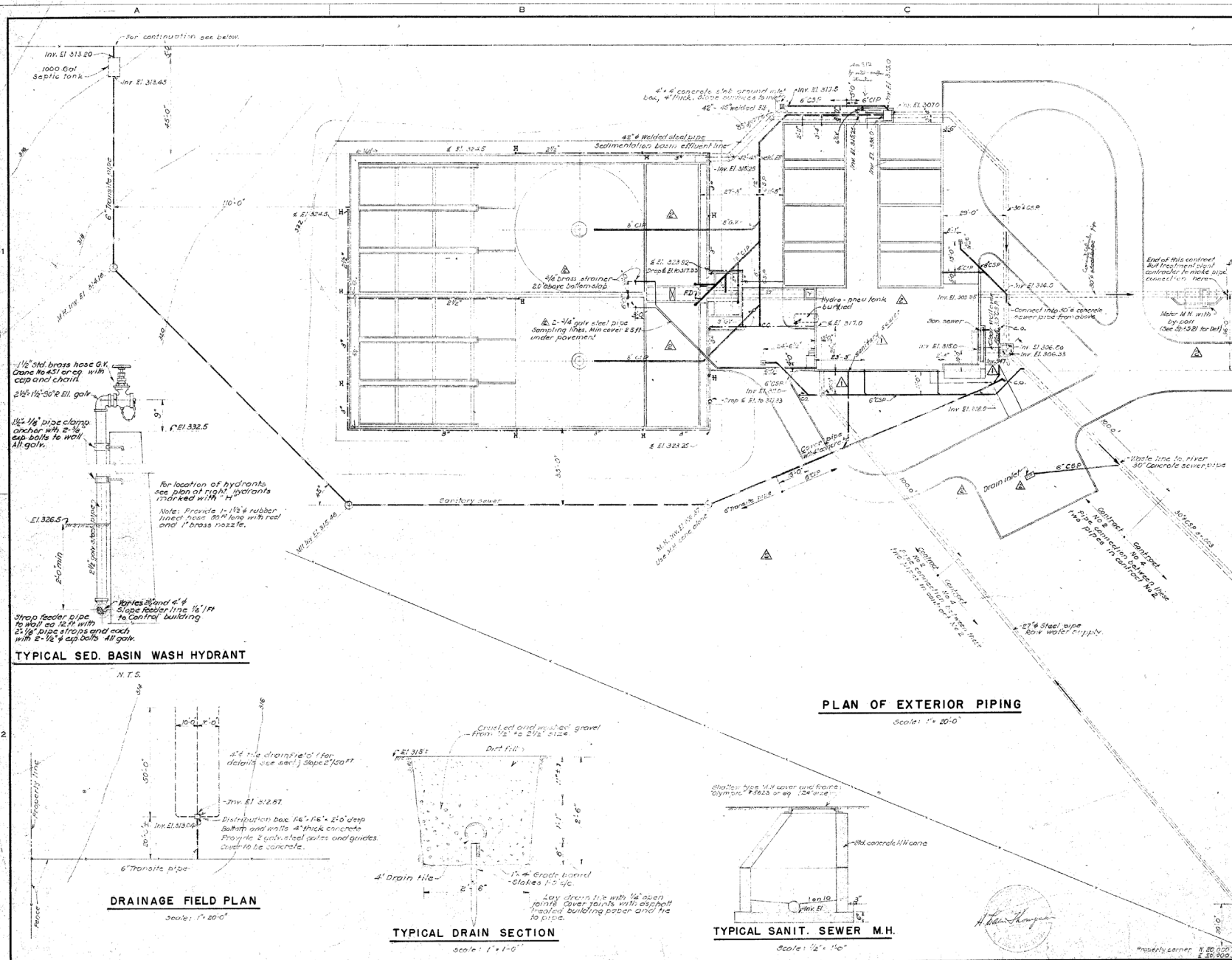
PLAN SECTION
AT BACK ENTRANCE
Scale: 1" = 20'-0"

DATE	NO.	REVISION	BY
5-29-59	1	As built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY – WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
ROADS & GRADING

DESIGNED F.F.H.	APPROVED BY H. Lee Thompson	SHEET A2	OF 77
DRAWN F.F.H.	SCALE As shown		
CHECKED H.L.T.	DATE 8-1-57 FILE 1160-3029		

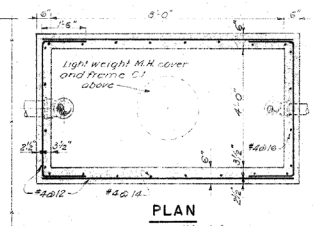


PLAN OF EXTERIOR PIPING

Scale: 1" = 20'-0"

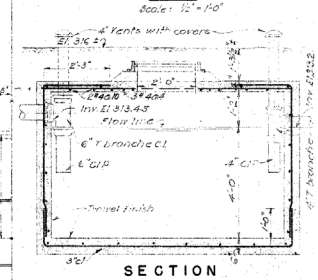
TYPICAL SED. BASIN WASH HYDRANT

N.T.S.



PLAN

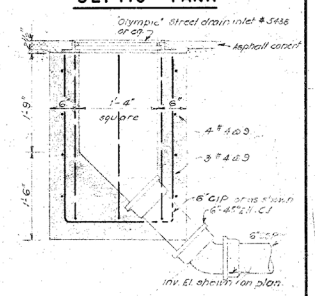
Scale: ½" = 1'-0"



SECTION

Scale: ½" = 1'-0"

SEPTIC TANK



TYPICAL STREET DRAIN INLET

Scale: 1" = 1'-0"

△2 Inlet boxes used correspond to standard "Oregon City" street drain inlets

DRAINAGE FIELD PLAN

Scale: 1" = 20'-0"

TYPICAL DRAIN SECTION

Scale: 1" = 1'-0"

TYPICAL SANIT. SEWER M.H.

DATE	NO.	REVISION	BY
5-29-59	2	As built	ATS
11-1-57	1	Sanitary sewer relocated	J.M.H.

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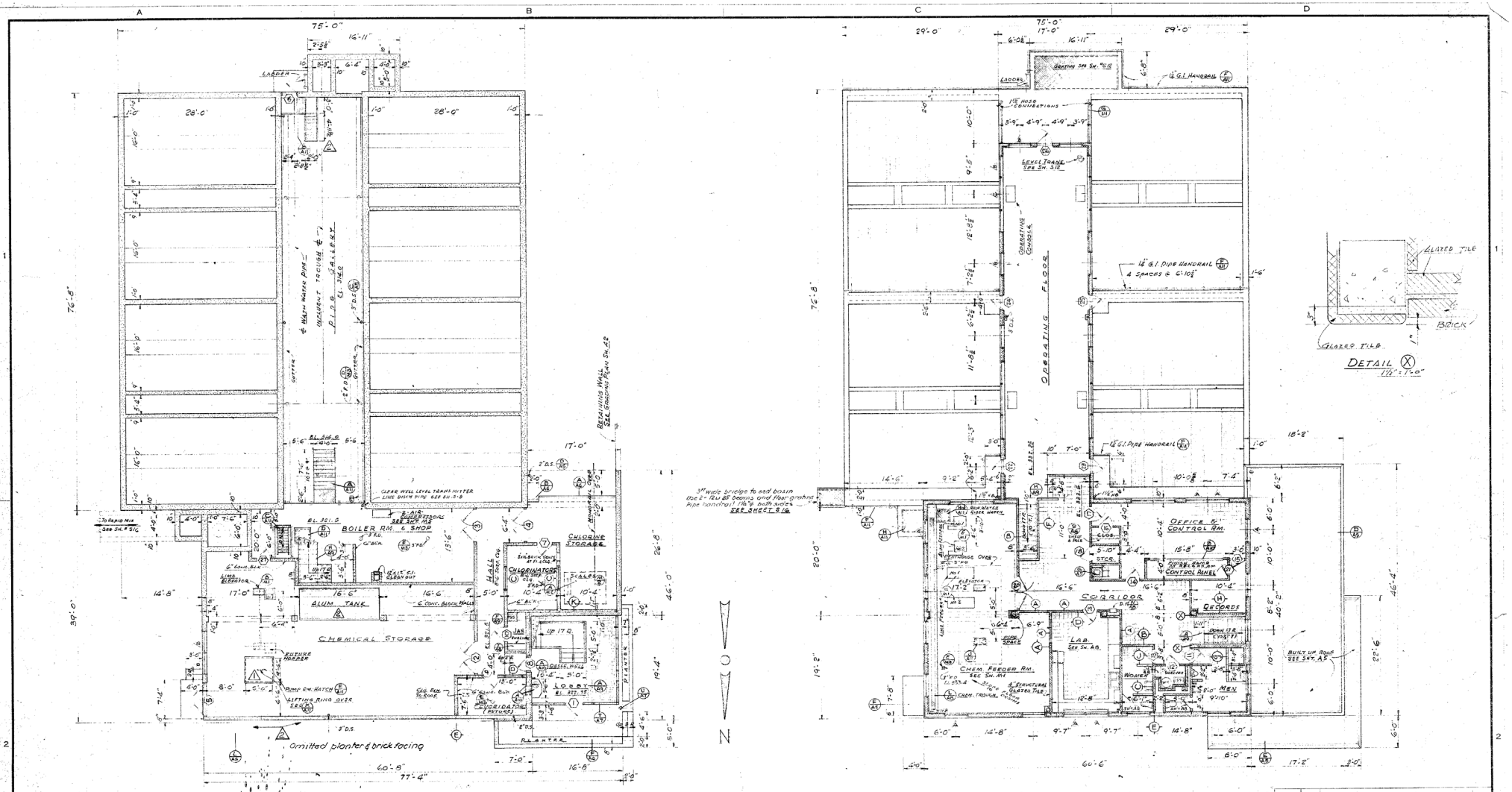
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY – WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS

OUTSIDE PIPING

DESIGNED	F. F. H.	APPROVED BY	H. Allen Thompson	SHEET	A3
DRAWN	F. F. H.	SCALE	As shown	OF	77
CHECKED	H. L. T.	DATE 8-1-57	FILE 1160-3090		



LEGEND

- CONCRETE
- CONCRETE BLOCK
- FACE BRICK
- STRUCTURAL GLAZED TILE
- EXTERIOR WINDOWS SEE SH. A7 FOR DETAILS
- DOOR NUMBER SEE SH. A7 FOR DETAILS
- INTERIOR WINDOWS SEE SH. A7 FOR DETAILS
- INTERIOR WALL DETAILS SEE SH. A8 FOR DETAILS
- DETAIL DESIGNATION
- DRAWING NUMBER

DATE	NO.	REVISION	BY
5-29-59	2	As built	ATS
12-27-57	1	PUMP ROOM HATCH RELOCATED	J.M.H.

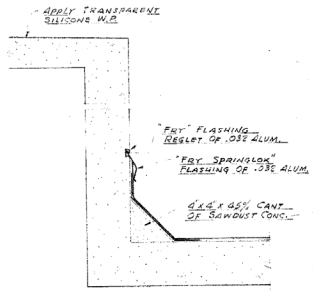
STEVENS & THOMPSON *Consulting Engineers*
2234 S. W. FIFTH AVENUE — PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

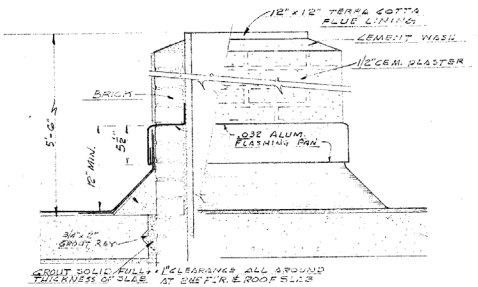
WATER PURIFICATION WORKS

HEADHOUSE & FILTERS
FIRST & SECOND FLOOR PLANS

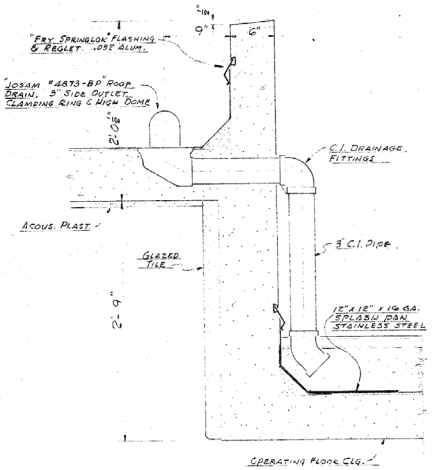
DESIGNED J.M.H.	APPROVED BY H. Lee Thompson	SHEET A4 OF 77	
DRAWN J.M.H. PLK	SCALE As noted		
CHECKED J.M.H.	DATE 8-1-57	FILE 1160-8051	



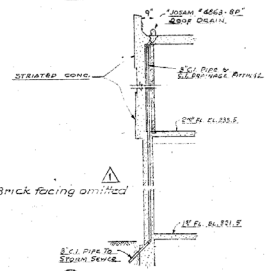
(H) PENTHOUSE FLASHING
1½" = 1'-0"



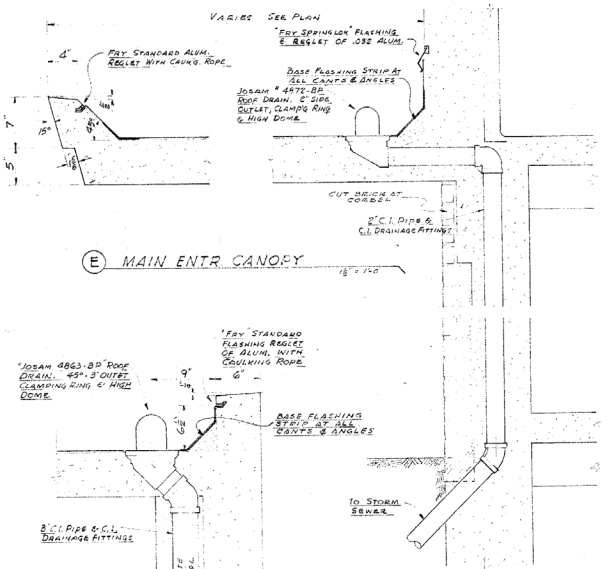
(G) CHIMNEY FLASHING
1½" = 1'-0"



(A) MAIN ROOF PARAPET & DRAIN TO OPER. FL. ROOF

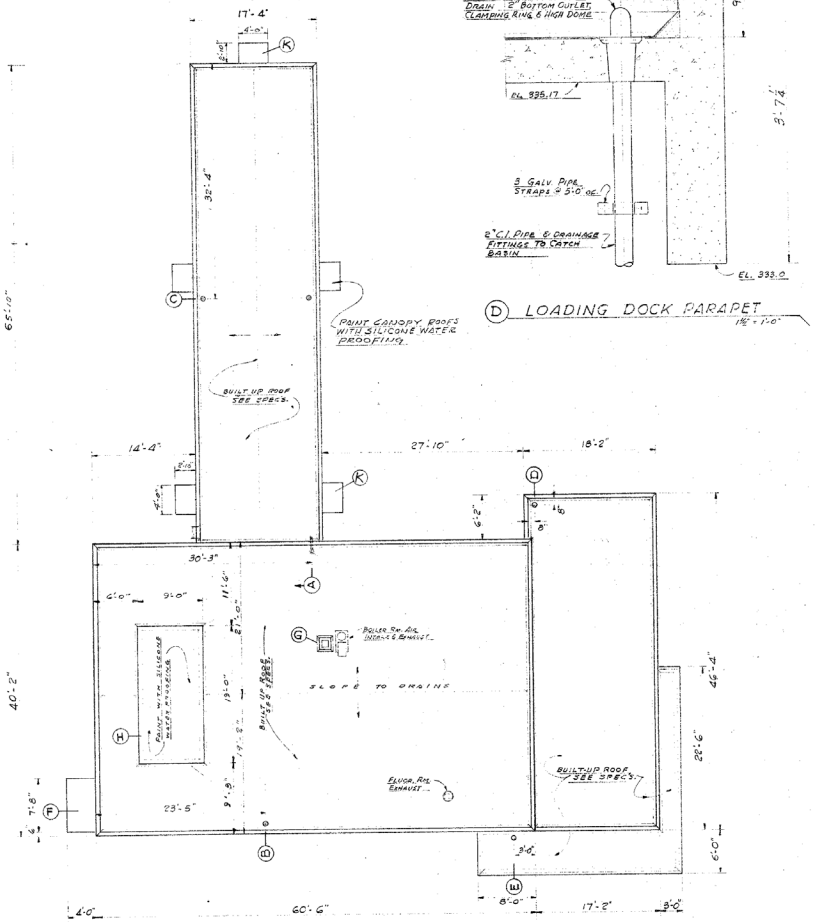


(B) MAIN ROOF DRAIN (NORTH ELEVATION)
1½" = 1'-0"



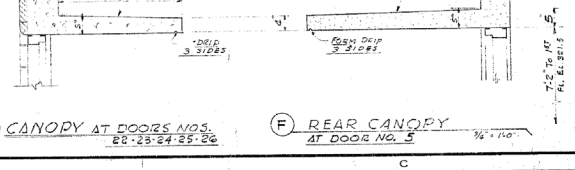
(E) MAIN ENTR CANOPY
1½" = 1'-0"

(C) OPERATING FLOOR ROOF & PARAPET
1½" = 1'-0"



ROOF PLAN
1/16" = 1'-0"

(D) LOADING DOCK PARAPET
1½" = 1'-0"



(K) CANOPY AT DOORS NOS. 22-23-24-25-26

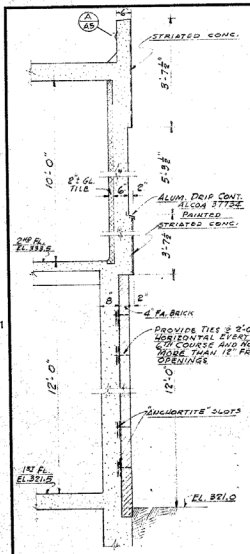
(F) REAR CANOPY AT DOOR NO. 5
3/16" = 1'-0"

5-29-59	1	As built	ATS
DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

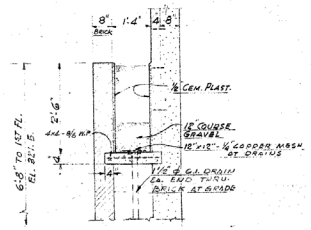
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
HEADHOUSE & FILTERS
ROOF PLAN & DETAILS

DESIGNED	PLW	APPROVED BY	SHEET OF
DRAWN	PLW	SCALE SHOWN	A5 77
CHECKED	JMH	DATE 8-1-51	FILE 1160-3035



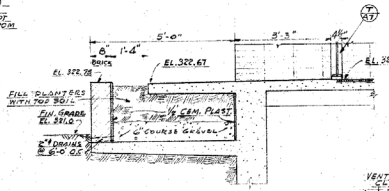
(E) NORTH WALL SECTION
1/8" = 1'-0"

Brick facing omitted. see North Elevation below ⚠

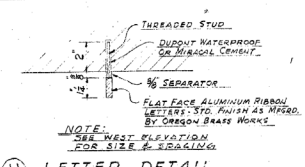


(L) PLANTER DETAIL
N.E. CORNER
1/2" = 1'-0"

Planter omitted ⚠

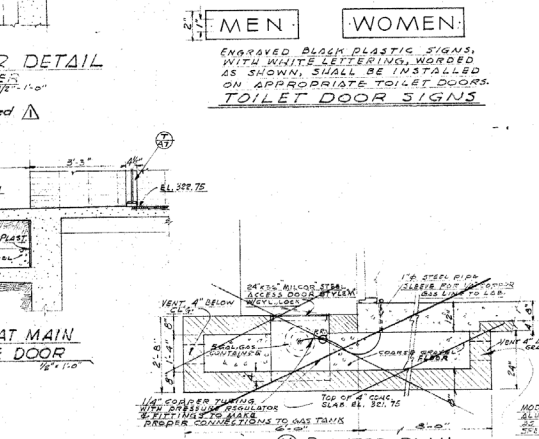


(F) PLANTER AT MAIN ENTRANCE DOOR
1/2" = 1'-0"



NOTE: SEE WEST ELEVATION FOR SIZE & SPACING

(H) LETTER DETAIL
3" = 1'-0"



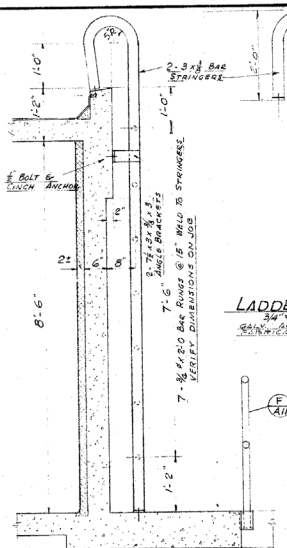
ENGRAVED BLACK PLASTIC SIGNS, WITH WHITE LETTERING, WORDED AS SHOWN, SHALL BE INSTALLED ON APPROPRIATE TOILET DOORS.

TOILET DOOR SIGNS

MODEL E-B CAST ALUMINUM VENT SALEND AS DISTRIBUTED BY ALLIED BUILDING SPECIALTIES CO., PORTLAND, ORE.

(M) PLANTER PLAN
1/2" = 1'-0"

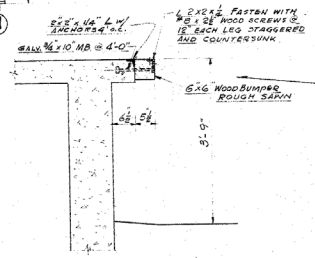
Planter omitted ⚠



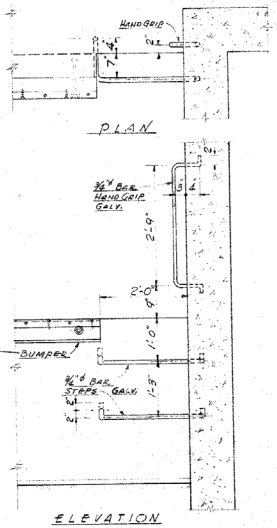
(D) ROOF ACCESS LADDER
1/2" = 1'-0"

NOTE: GALVANIZE AFTER FABRICATION VERIFY DIMENSIONS ON JOB

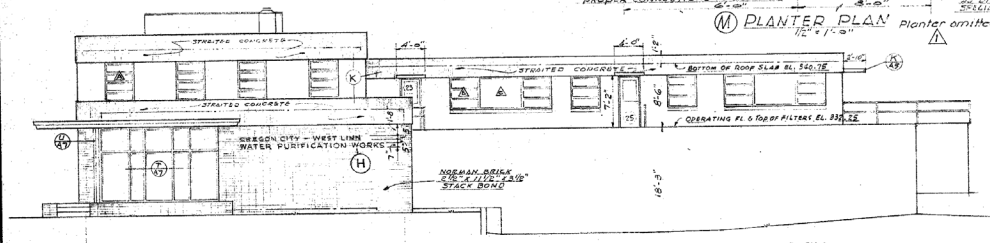
LADDER (N)



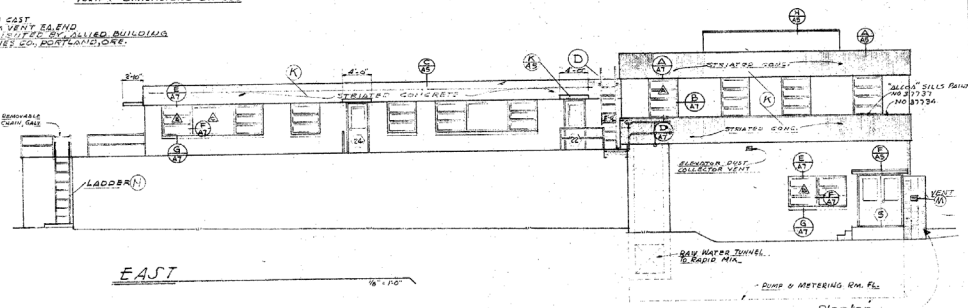
(A) DOCK BUMPER
1/2" = 1'-0"



(B) DOCK STEPS
1/2" = 1'-0"



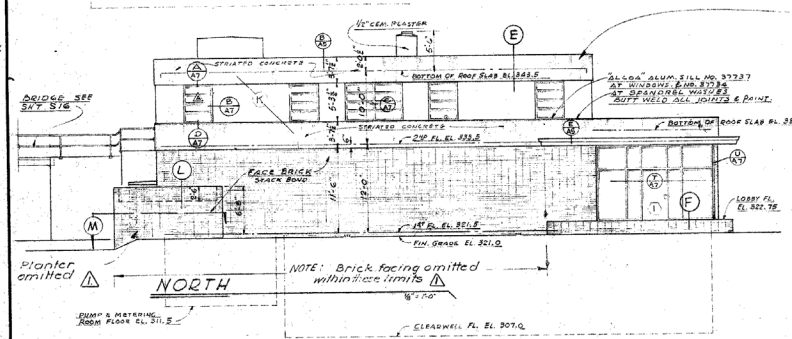
WEST
1/8" = 1'-0"



EAST
1/8" = 1'-0"

Planter omitted ⚠

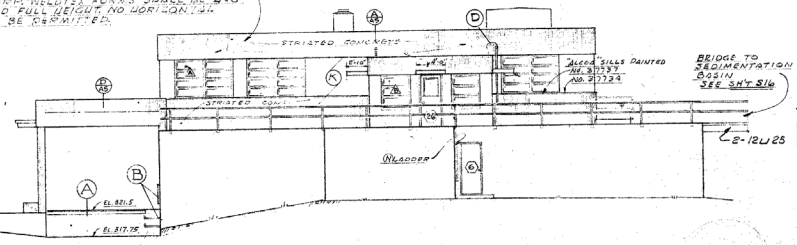
NOTE (K) WHERE STRIATED CONCRETE IS CALLED FOR ON ELEVATIONS THE VERTICAL STRIATIONS SHALL BE OBTAINED BY FORMING CONCRETE WITH "WELDTEX" STRIATED PLYWOOD AS MANUFACTURED BY U.S. PLYWOOD CORP. "WELDTEX" FORMS SHALL BE 4'-0" IN WIDTH AND FULL HEIGHT. NO HORIZONTAL JOINT WILL BE PERMITTED.



Planter omitted ⚠

NOTE: Brick facing omitted within these limits ⚠

NORTH
1/8" = 1'-0"



SOUTH
1/8" = 1'-0"

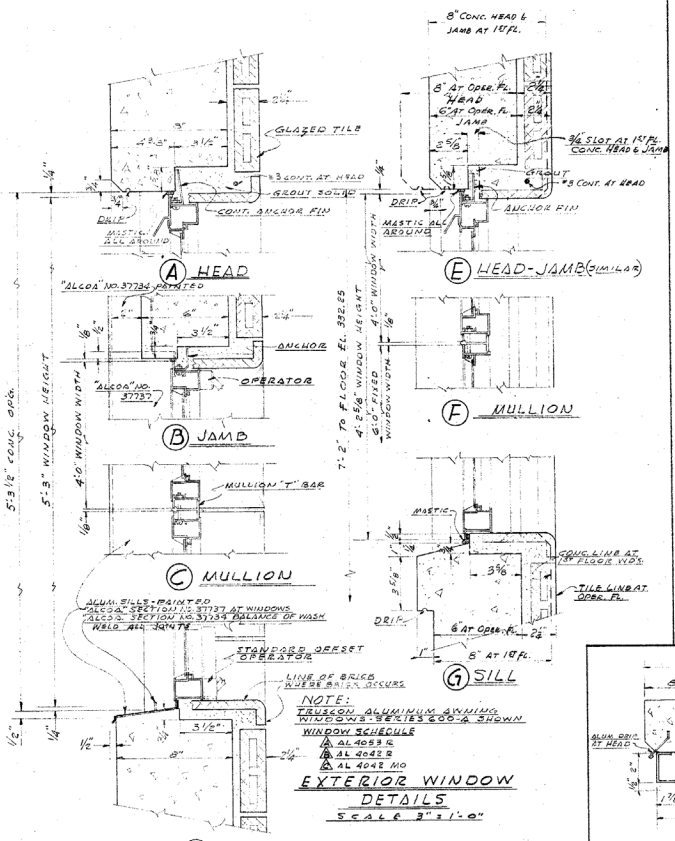
E 2-12-25

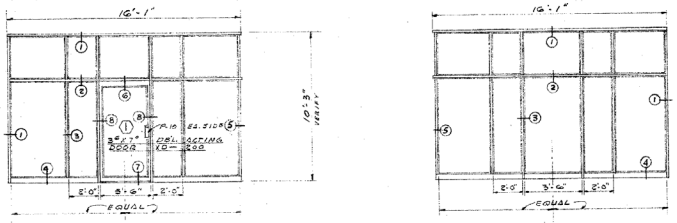
DATE	NO.	REVISION	BY
5-29-59	⚠	As built	ATC

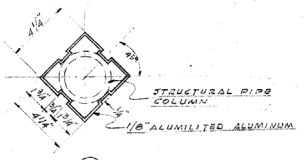
STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

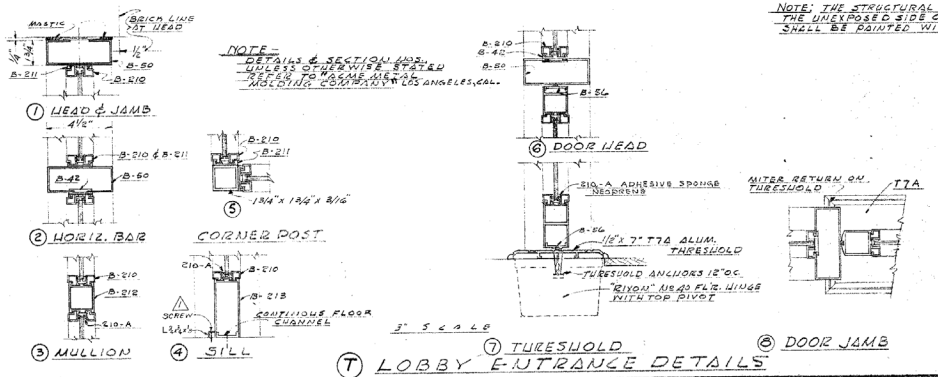
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
HEADHOUSE & FILTERS
ELEVATIONS & DETAILS

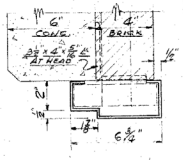
DESIGNED J.M.H.	APPROVED BY	SHEET	A6
DRAWN P.L.K.-J.M.H.	SCALE SHOWN		
CHECKED J.M.H.	DATE 8-1-57	FILE 160-3039	77

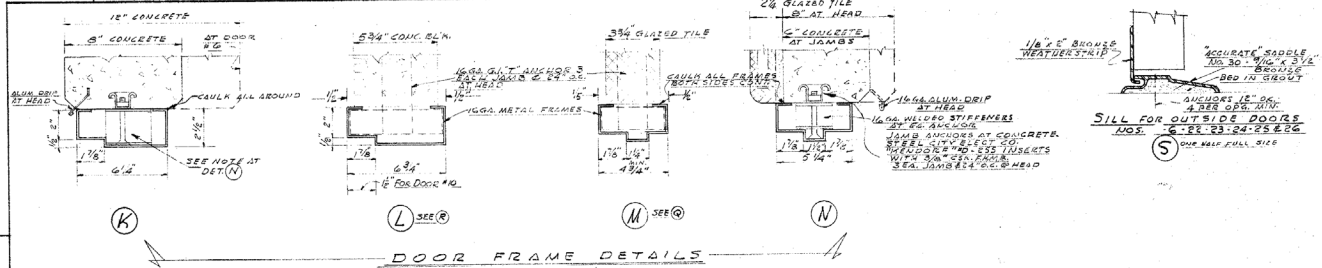


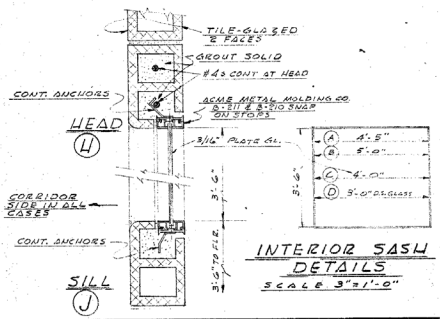


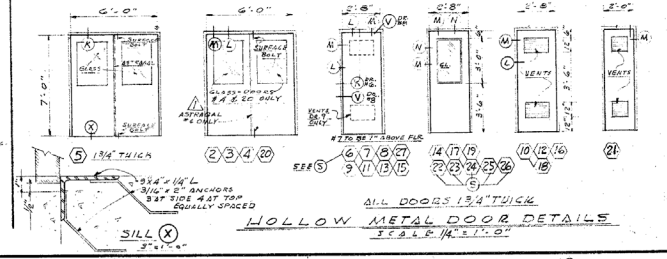


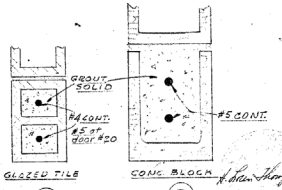










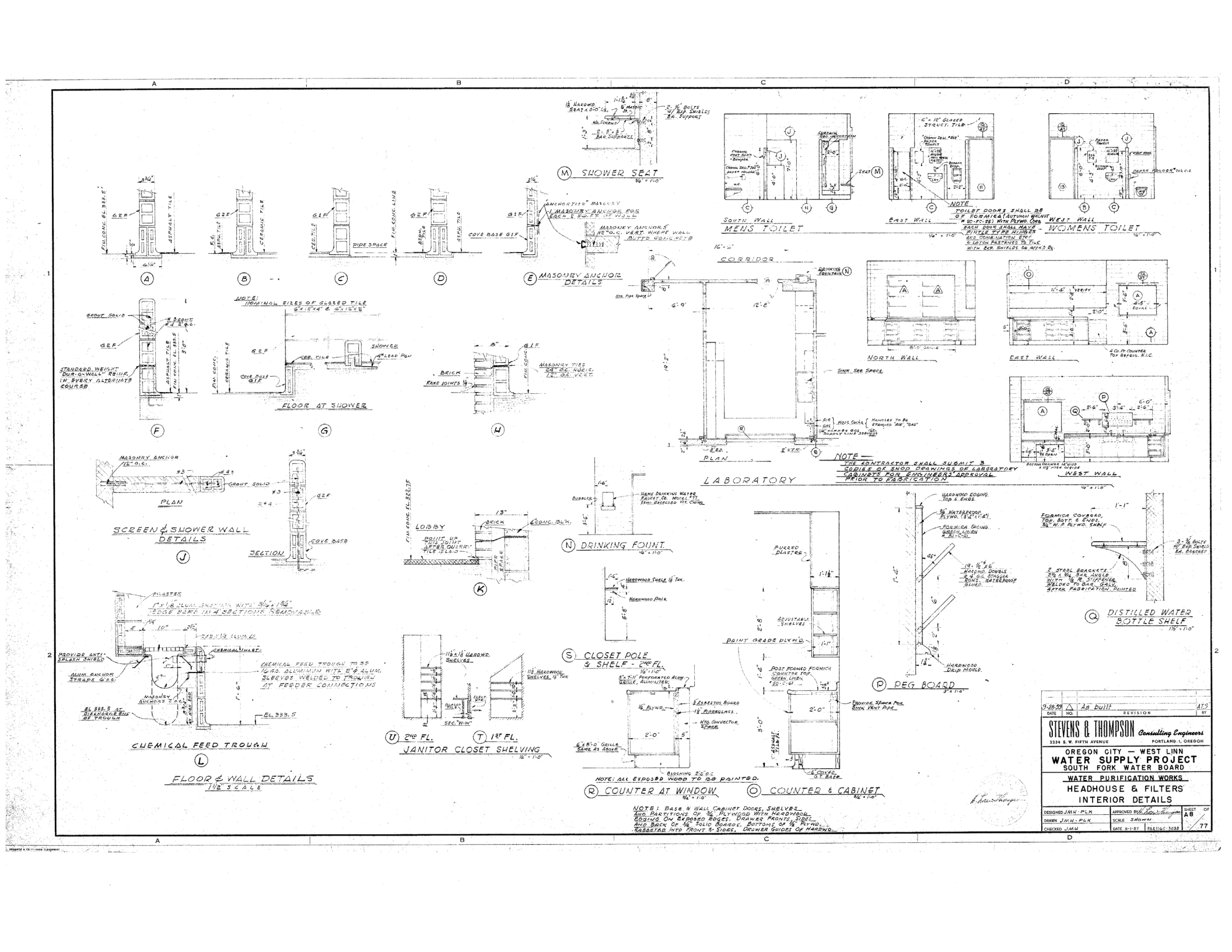


9-23-58	1	As Built	ATS
DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
HEADHOUSE & FILTERS
DOOR, WINDOW & ENTR. DETAILS

DESIGNED JMW	APPROVED BY	SHEET	OF
DRAWN JMH	SCALE 3"=1'-0"	A7	77
CHECKED PLK	DATE 8-1-57	FILE 160-3934	



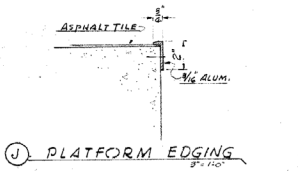
DATE	NO.	REVISION	BY
9-28-59	△	As built	ATS

STEVENS & THOMPSON Consulting Engineers
2334 S. W. FIFTH AVENUE PORTLAND 1, OREGON

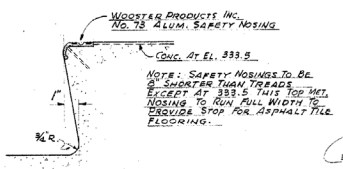
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS
HEADHOUSE & FILTERS
INTERIOR DETAILS

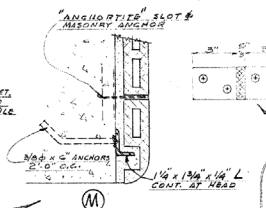
DESIGNED JMH - PLK	APPROVED W.W. Thompson	SHEET OF AB 77
DRAWN JMH - PLK	SCALE SHOWN	
CHECKED JMH	DATE 8-1-57	FILE NO. 5038



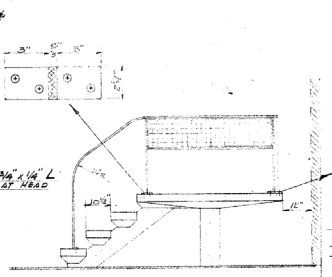
J PLATFORM EDGING
3" = 1'-0"



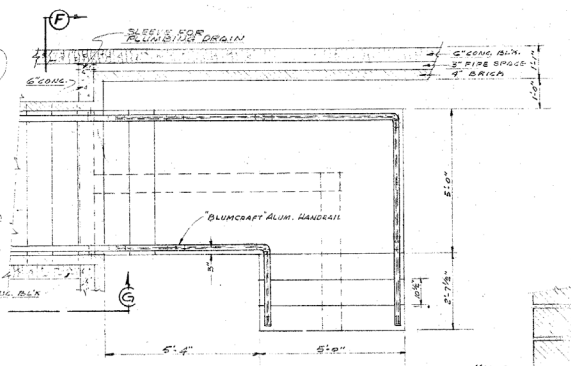
K STEP DETAIL
3" = 1'-0"



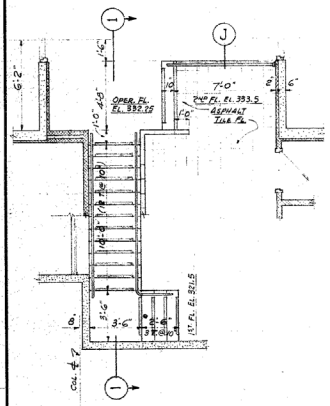
M



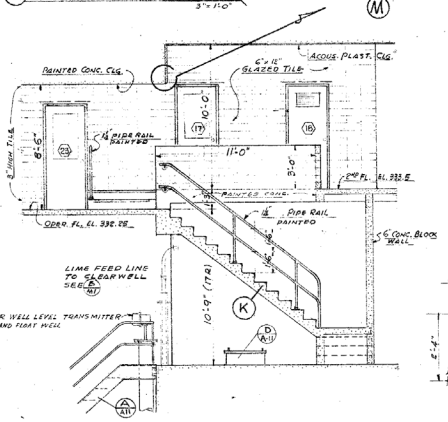
C END ELEVATION



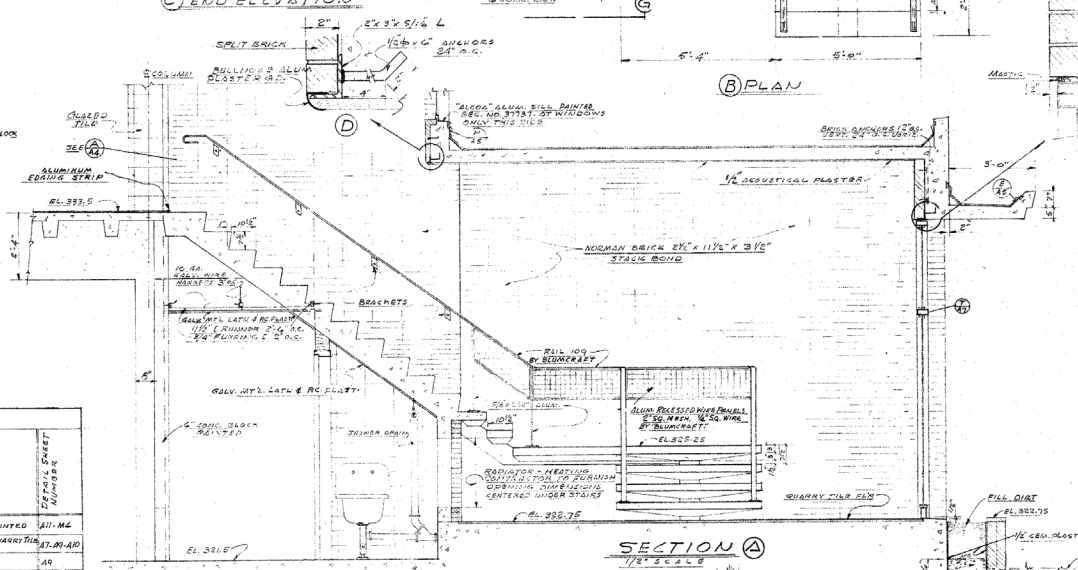
B PLAN



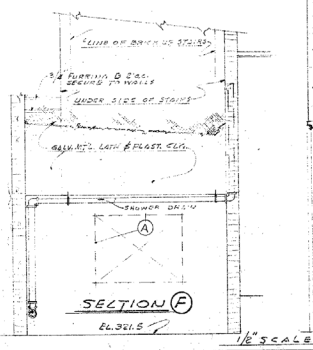
H PLAN - STAIRS BOILER RM. TO OPERATING FLOOR
1/4" = 1'-0"



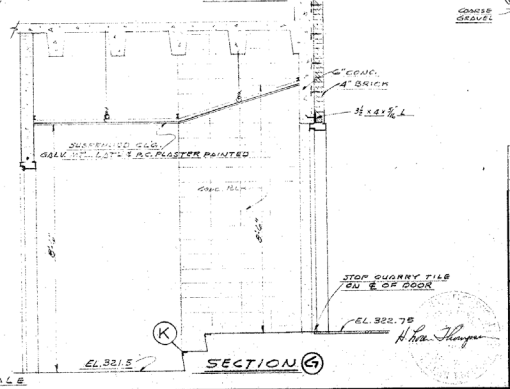
SECTION "1-1"
1/4" = 1'-0"



SECTION A
1/2" SCALE



SECTION F
EL. 321.5



SECTION G

1/2" SCALE

INTERIOR FINISH SCHEDULE

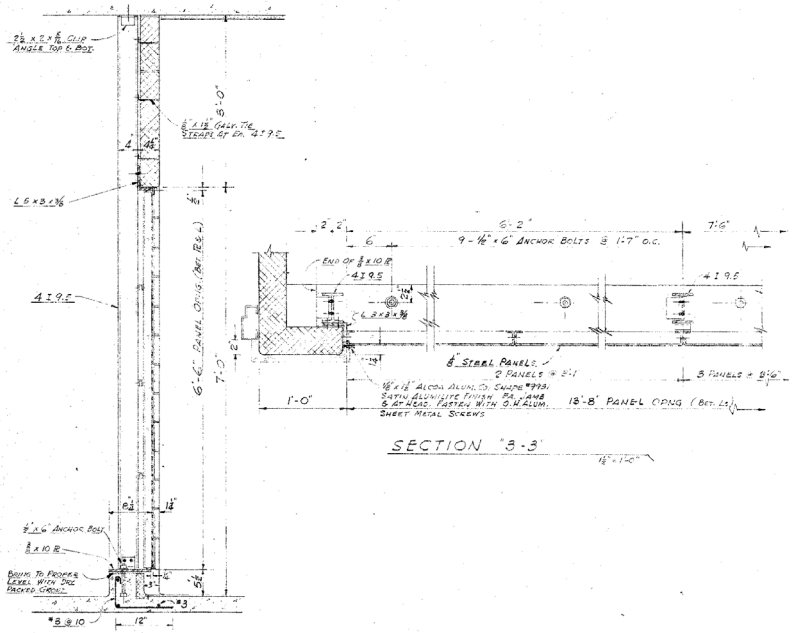
FLOOR ELEV.	DESCRIPTION OF ROOM	FLOOR: CONCRETE	FLOOR: QUARRY TILE	FLOOR: ASPHALT TILE	FLOOR: CERAMIC TILE	BASE: WOOD	BASE: GLAZED TILE	WALLS: CONCRETE	WALLS: BACK PLASTER	WALLS: PAINTED CONC. BLOCK	WALLS: PAINTED PLASTER	WALLS: GLAZED TILE	CEILING: CONCRETE	CEILING: ACOUSTICAL PLASTER	CEILING: SUSP. P.C. PLASTER	CEILING: PAINTED CONC.	CEILING: PAINTED P.C. PLASTER	REMARKS	DETAIL SHEET NUMBER
311.5	PUMP & METERING RM.	●				●		●					●					MET. STAIRS & HANDRAIL PAINTED	A11-M2
322.75	ENTRANCE LOBBY		●			●			●					●				OBSERVATION WELL: PED. QUARRY TILE & WALL OF GLASS	A7-M1-A10
321.5	HALL	●				●				●	●				●			SAFETY NOSING ON STEPS PAINTED CEILING	A9
"	FLUORIDATOR RM.	●				●				●	●					●		PAINTED CL'G. HARDWOOD SHELVES PAINTED	A8-A9
"	JANITOR	●				●				●	●				●			HAND-RAIL & LIFTING BAR @ CHLORINE CONTAINER COVERS PAINTED	M2
"	CHLORINE STORAGE & DOCK	●				●				●	●					●		PAINTED CEILING	M2
"	CHLORINATOR RM.	●				●				●	●				●			MISCMT'L. & ALUM TANKS PAINTED	A11-M1
"	CHEMICAL STORAGE	●				●				●	●					●		MT'L. WATER COVER PAINTED	A11
"	BOILER RM. & SHOP	●				●				●	●					●		MET. STAIRS & HANDRAILS PAINTED	A11 M5-M6-M7
314.0	PIPE GALLERY	●				●		●					●					MET. SAFETY NOSINGS. MET. HANDRAILS PAINTED	A9
321.5 & 333.5	STAIRWAY - BOILER RM. TO 2ND FL.	●				●				●	●					●			A9
322.75 & 333.5	STAIRWAY - LOBBY TO 2ND FL.	●				●			●					●					A9
333.5	CORRIDOR		●			●						●		●					A8
"	MEN'S TOILET				●	●						●					●		A8
"	WOMENS TOILET				●	●						●					●		A8
"	JANITOR		●			●						●				●		HARDWOOD SHELVES PAINTED	A8
"	LABORATORY		●			●						●		●				FURRED ACOUS. PLAST. OVER CABINETS	A8
"	CHEMICAL FEEDER RM.	●				●						●				●		FLOOR PLATES & MISC. MT'L PAINTED	A8-A11-M1
"	STORAGE RM.		●			●						●				●			
"	OFFICE & CONTROL RM.		●			●						●		●					A10
"	RECORDS	●				●						●				●			
"	CLOSET		●			●						●				●		HARDWOOD SHELF & POLE PAINTED	A8
332.25	OPERATING FLOOR	●				●						●				●			A9-M7

DATE	NO.	REVISION	BY
9-28-59	△	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

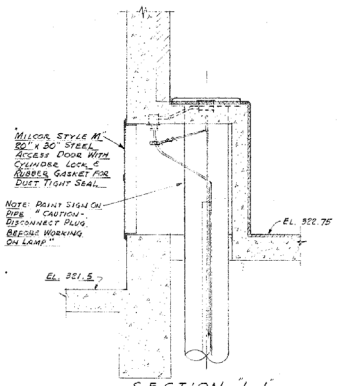
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
HEADHOUSE & FILTERS
FINISH SCHEDULE & STAIRS DET'LS

DESIGNED JMH	APPROVED H. Lee Thompson	SHEET NO. A9	OF 77
DRAWN PLA-JMH	SCALE SHOWN		
CHECKED JMH	DATE 8-1-57	FILE 1160-3056	

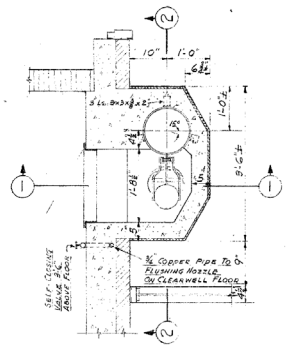


SECTION "4-4"

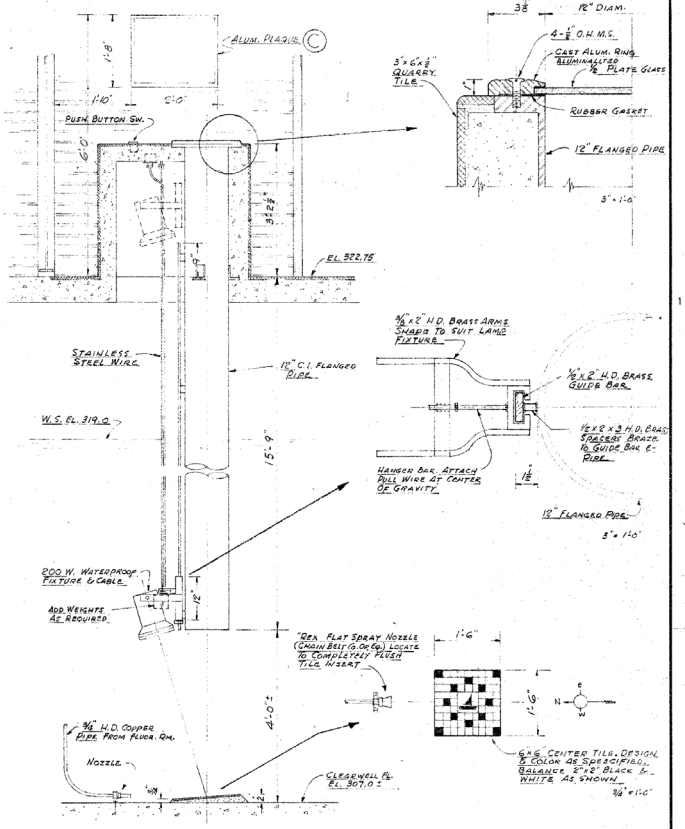
SECTION "3-3"



SECTION "1-1"

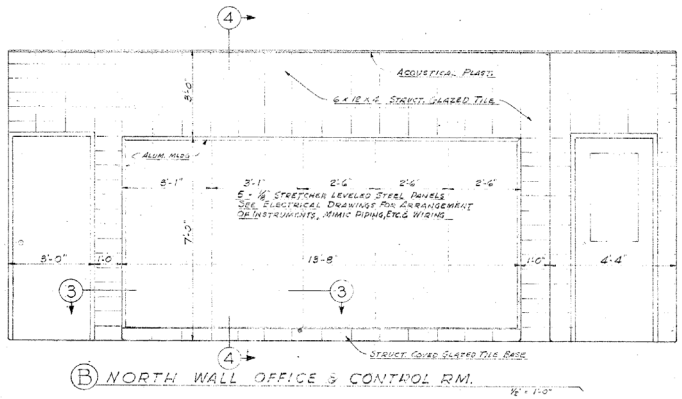


PLAN



SECTION "2-2"

Ⓐ OBSERVATION WELL IN ENTR. LOBBY



Ⓑ NORTH WALL OFFICE & CONTROL RM.

WATER PURIFICATION WORKS	LETTER SIZE	
BUILT 1958	NUMBER OF LETTERS	
	22	5/8
	9	3/8
SOUTH FORK WATER BOARD	19	1/2
WILLIAM LITTLE, CHAIRMAN	21	3/4
MERLE BROWN — G. GEORGE HOLTZER	23	
HARDING DICENZO — PETER LAING	23	
ROBERT D. CLUTE, MANAGER	19	
ZELLA BOWERS, SECRETARY	20	1
OREGON CITY — CITY COMMISSION — G. GEORGE HOLTZER, MAYOR — PETER LAING — MERLE BROWN	WEST LINN — CITY COUNCIL — WILLIAM LITTLE, MAYOR — HOWARD BOTTEMILLER — HARDING DICENZO — CLEM DOLLAR — PAUL PRITCHETT — ERWIN LANGE — MAUDE WILLSON	15 1/2 5/8
STEVENS & THOMPSON — CONSULTING ENGINEERS — PORTLAND, OREGON		15 3/4
JOHN DOE, CONTRACTOR		182 3/4
		822 1/8

Surface Mounted, Concealed Fastening. Aluminum Plaque, Oregon Brass Works No. 7 Serifed, Flat Face Block Letters. On Dark Pebble Back. Submit Shop Drawing For Approval.

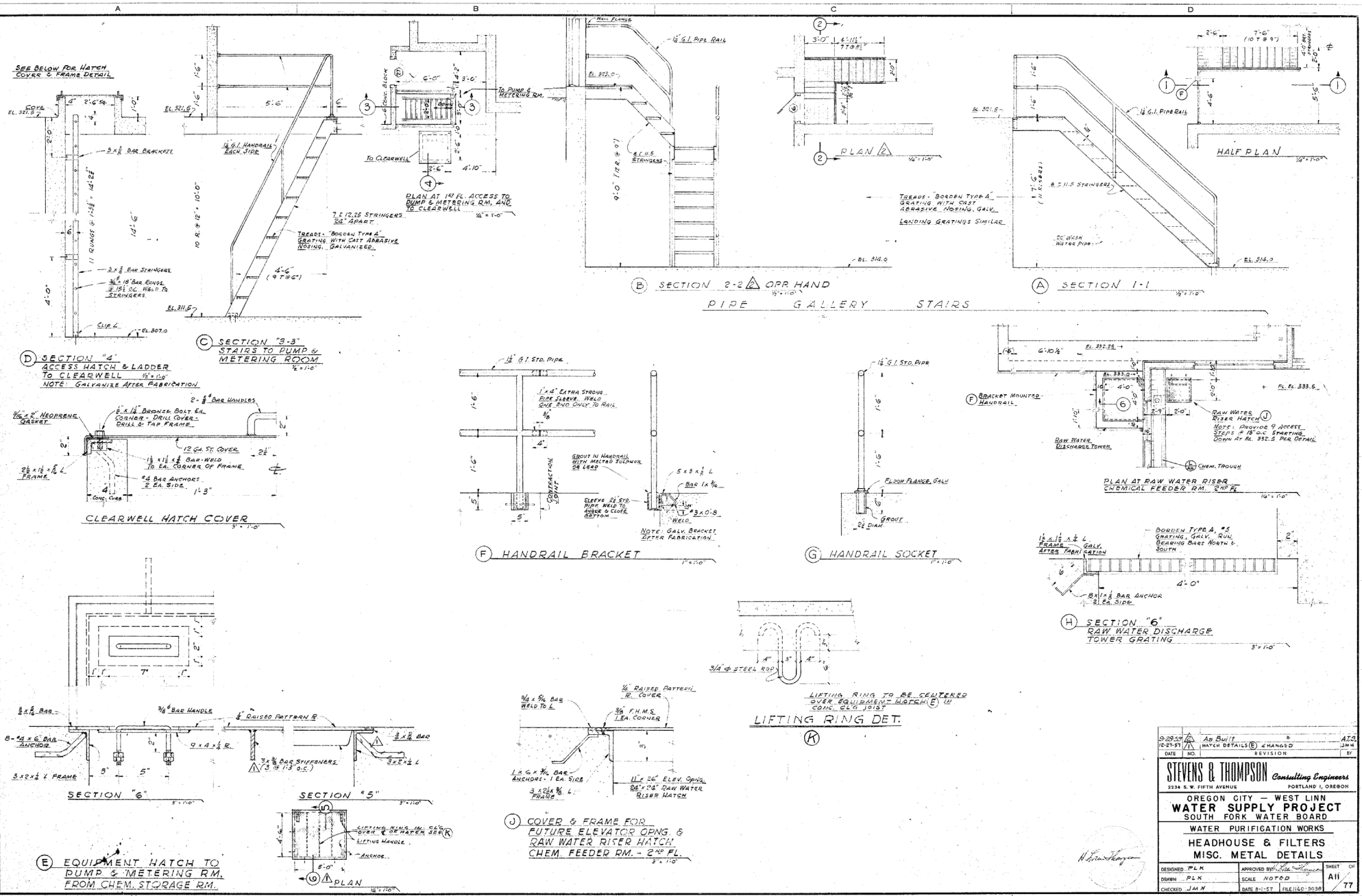
Ⓒ ALUMINUM PLAQUE

DATE	NO.	REVISION	BY
9-28-59	△	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
MISC. INTERIOR DETAILS

DESIGNED REB - PLK	APPROVED BY H. Lewis Thompson	SHEET	A10
DRAWN PLK	SCALE SHOWN	OF	77
CHECKED REB	DATE 8-11-59	FILE 1150-5087	



DATE	NO.	REVISION	BY
9-29-59	4	As Built	AJG
12-21-57	1	HATCH DETAILS (E) & HANGER	JMN

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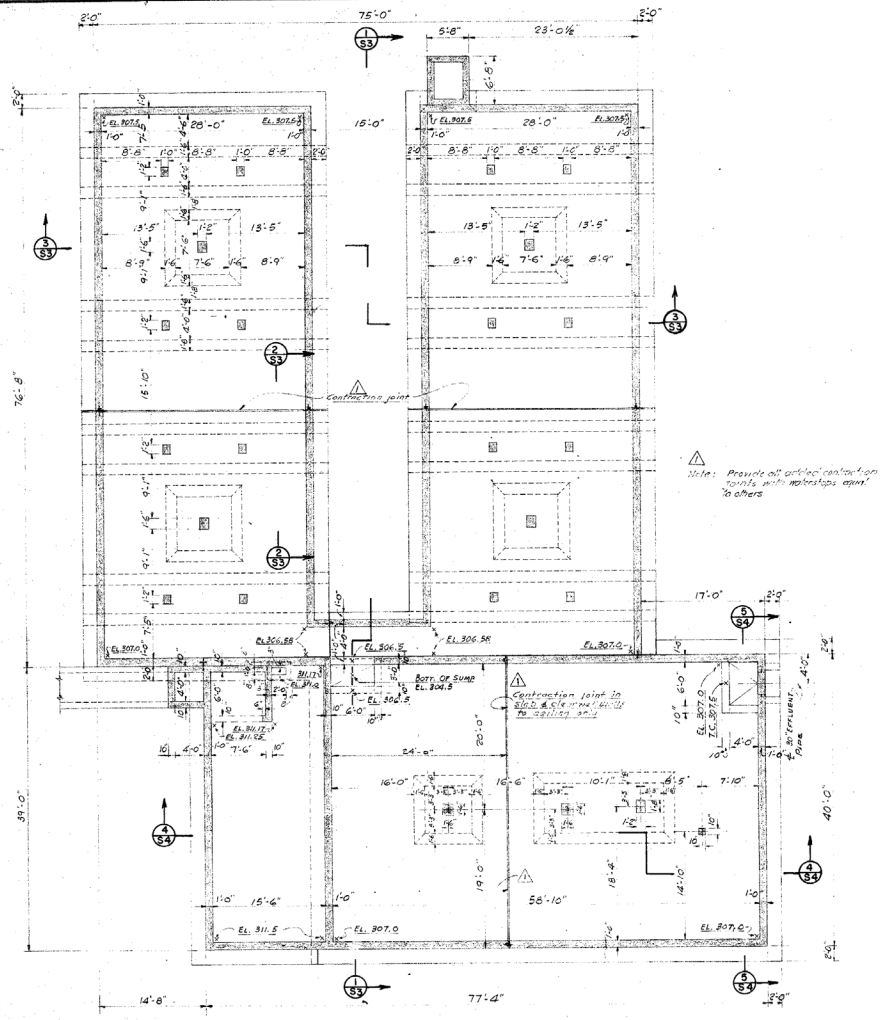
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

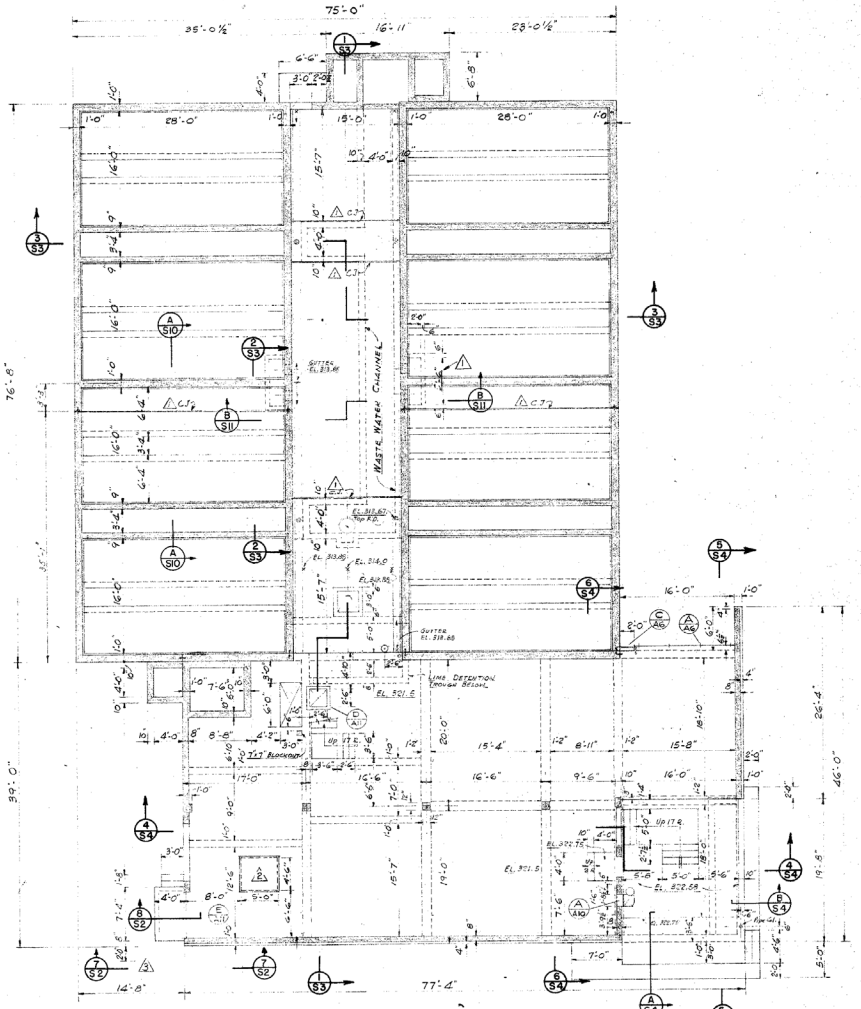
WATER PURIFICATION WORKS

HEADHOUSE & FILTERS
MISC. METAL DETAILS

DESIGNED PLK	APPROVED BY	SHEET	OF
DRAWN PLK	SCALE NOTED	A11	77
CHECKED JMN	DATE 8-1-57	FILE 1160-3038	



FOOTING PLAN



FIRST FLOOR PLAN

DATE	NO.	REVISION	BY
9-18-57	4	As Built	ATS
12-27-57	3	Pump Room Match Relocated	JMH
11-13-57	1	Contraction joints added, dim. changed	JMH

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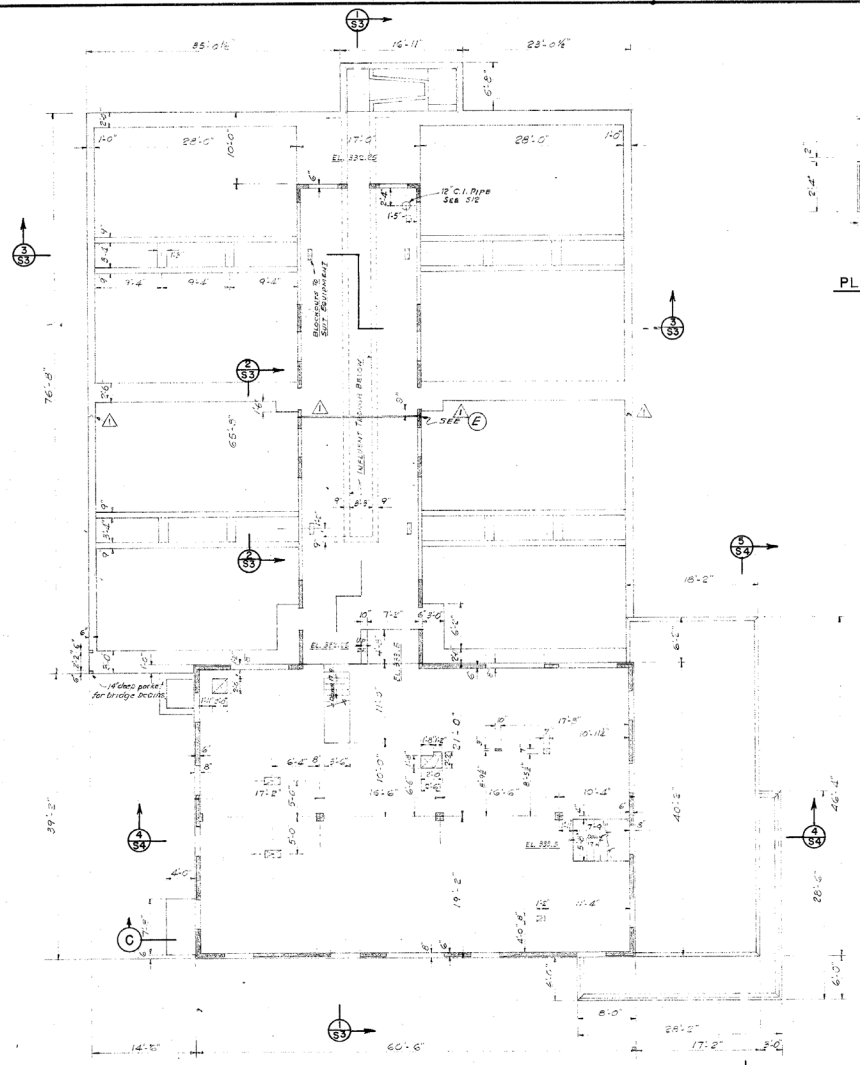
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

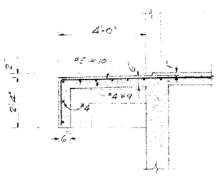
WATER PURIFICATION WORKS

CONCRETE OUTLINE
CLEARWELL & FIRST FLOOR PLAN

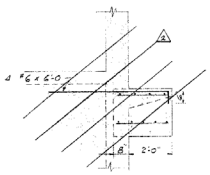
DESIGNED	B.A.S.	APPROVED BY	SHEET S1 OF 77
DRAWN	P.E.N.	SCALE	1/8" = 1'-0"
CHECKED	B.A.S.	DATE	8-1-57 FILE 1160-3038



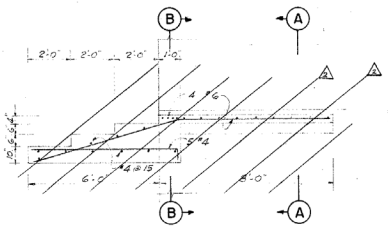
SECOND FLOOR PLAN



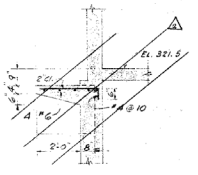
PLATFORM SECT. 8 /S1



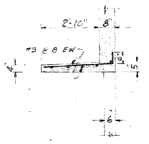
SECT. B-B



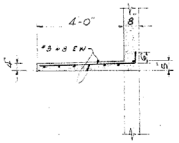
PLANTER SUPPORT ELEV. 7-7/S1



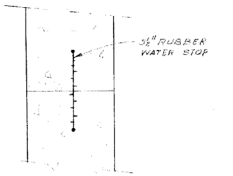
SECT. A-A



CANOPY A/S3



CANOPY C



CONTRACTION JOINT DETAIL FOR ROOF & EXTERIOR WALLS

E

DATE	NO.	REVISION	BY
9-25-59	2	As Built contraction joints & details added	ATC JMH
11-18-57	1		

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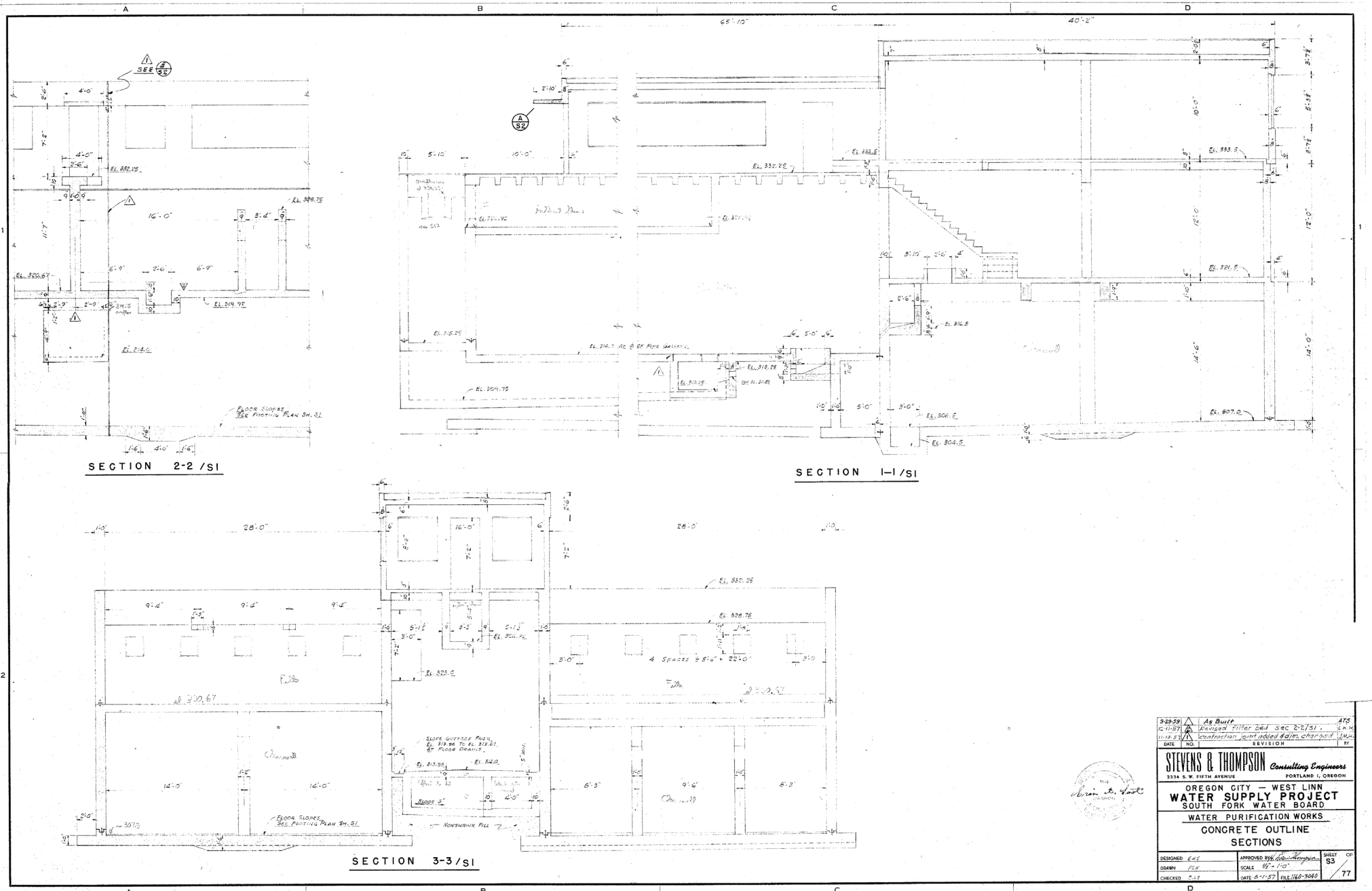
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS

CONCRETE OUTLINE
SECOND FLOOR PLAN

DESIGNED EAS	APPROVED [illegible]	SHEET	OF
DRAWN PLK	SCALE As noted	S2	77
CHECKED EAS	DATE 8-1-57 FILE 160-3639		



9-29-59	2	As Built	AKS
12-11-57	1	Revised Filter bed Sec 2-2/S1.	L.K.H.
11-13-57	1	contraction joint added & dim. changed	J.M.H.
DATE	NO.	REVISION	BY

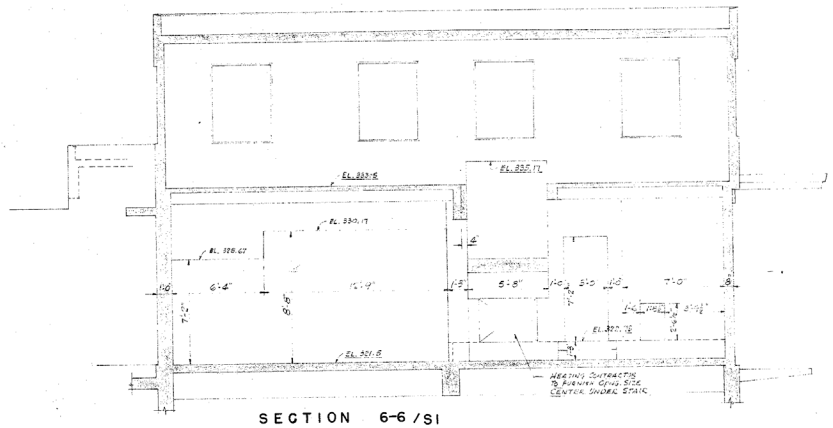
STEVENS & THOMPSON Consulting Engineers
2334 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

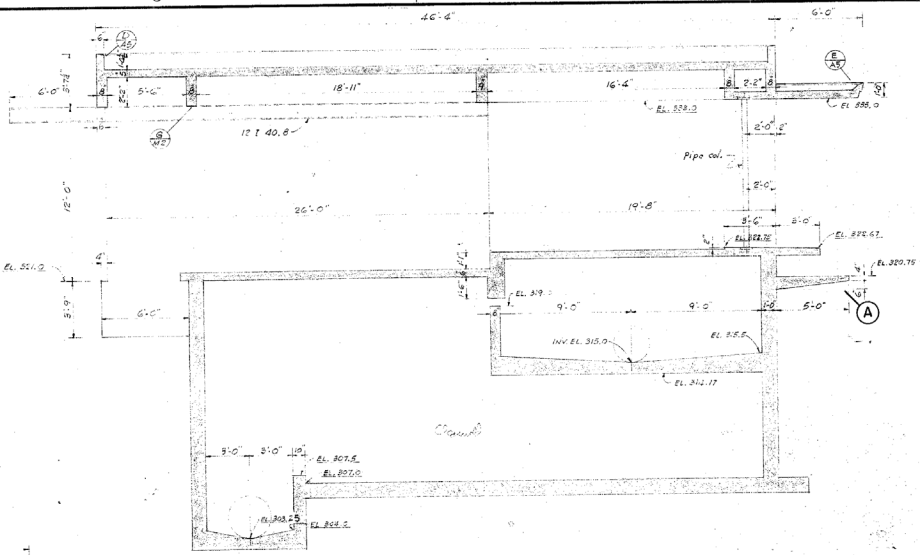
WATER PURIFICATION WORKS

CONCRETE OUTLINE
SECTIONS

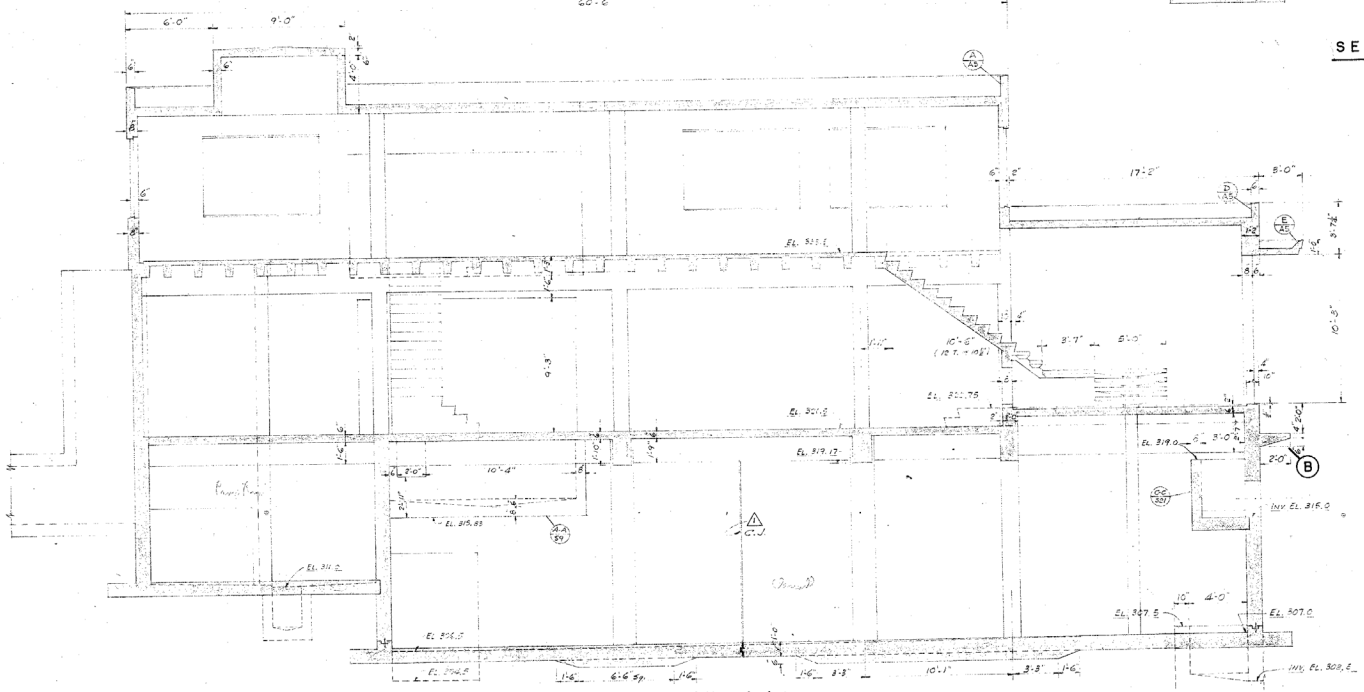
DESIGNED EAS	APPROVED BY	SHEET S3 OF 77
DRAWN FLK	SCALE 1/4" = 1'-0"	
CHECKED EAS	DATE 8-1-57	FILE 1160-3040



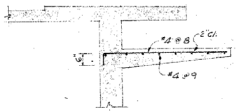
SECTION 6-6 / S1



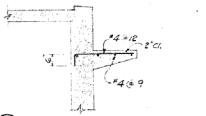
SECTION 5-5 / S1



SECTION 4-4 / S1



(A) PLANTER BRACKET



(B) PLANTER BRACKET

DATE	NO.	REVISION	BY
9-29-59	1	As Built	ATS
11-13-57	1	contraction joint added	JAH

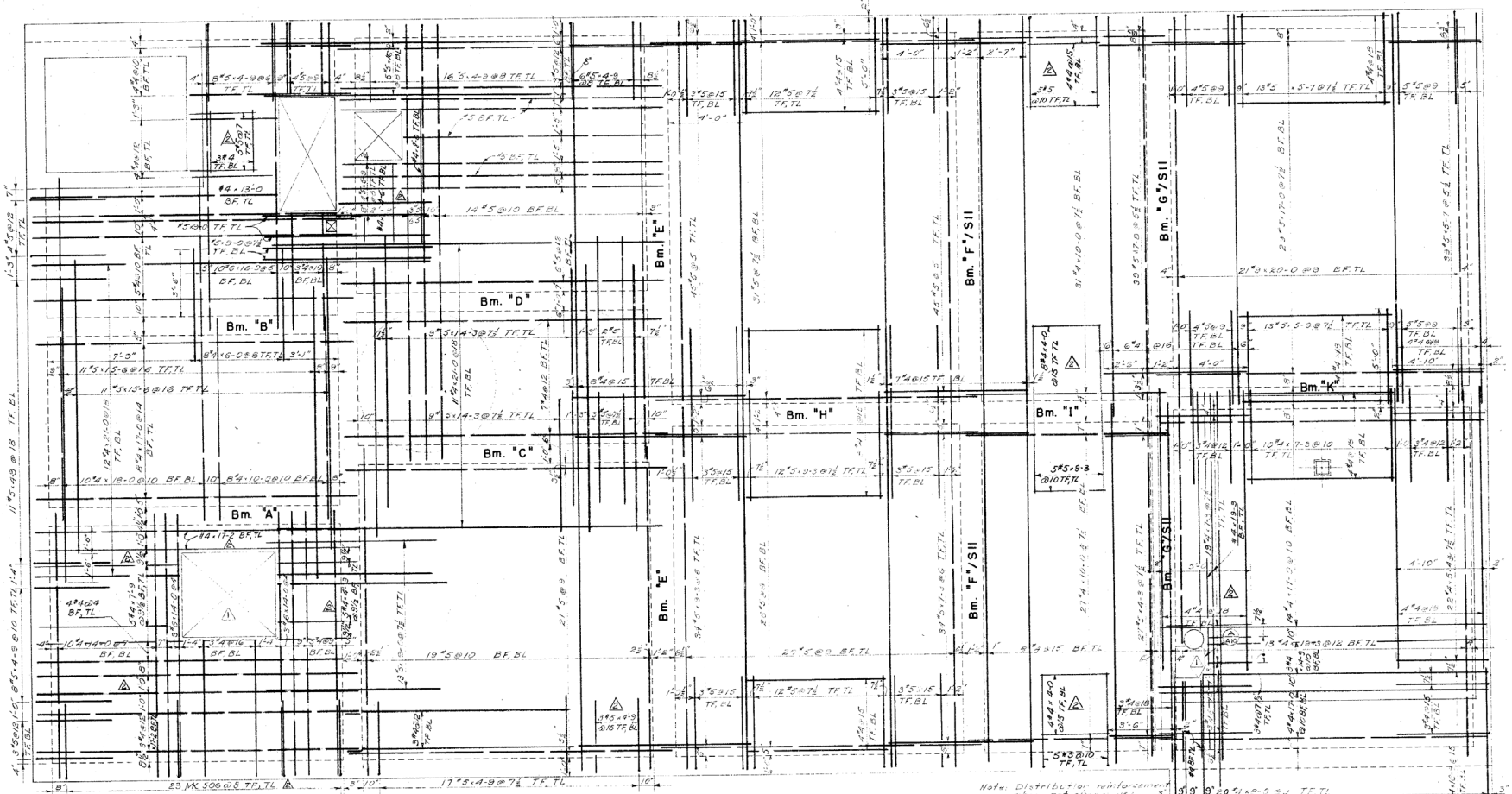
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

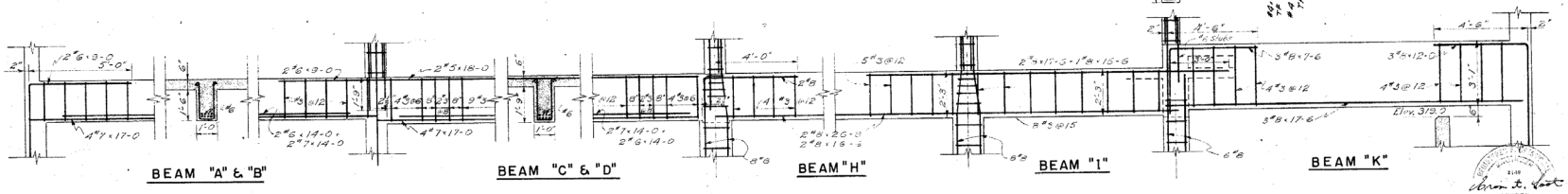
WATER PURIFICATION WORKS.

CONCRETE OUTLINE SECTIONS

DESIGNED E.A.S.	APPROVED BY	SHEET	OF
DRAWN P.E.K.	SCALE As noted	S4	77
CHECKED E.A.S.	DATE 8-1-57	FILE 1160-3041	



PLAN



DATE	NO.	REVISION	BY
5-29-58	2	As built	ATC
12-27-57	1	Pump Sm Watch Relocated, Observation Well Added	RK

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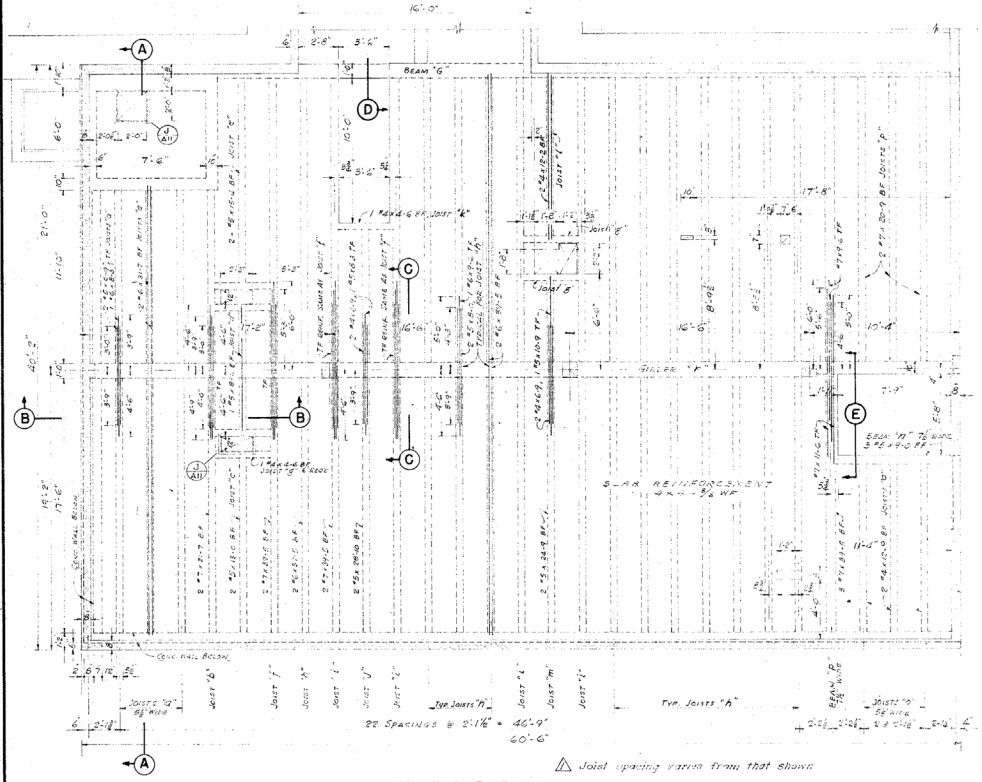
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS

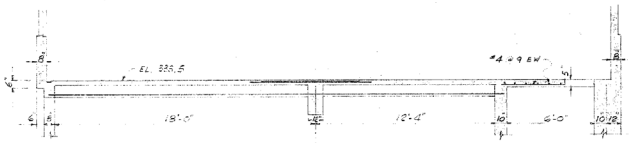
HEADHOUSE
FIRST FLOOR REINFORCEMENT

DESIGNED	H.A.S.	APPROVED BY	SHEET S8 OF 77
DRAWN	H.S.	SCALE 3/8" = 1'-0"	
CHECKED	E.A.S.	DATE 8-1-57	FILE 1160-3045

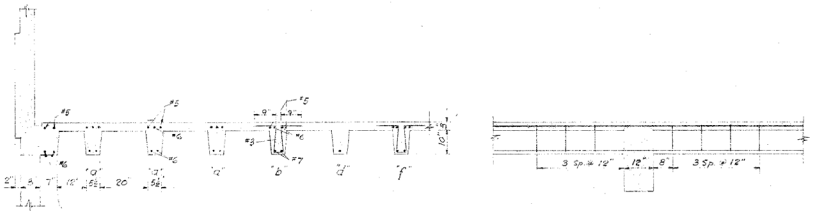


△ Joist spacing varies from that shown

SECOND FLOOR PLAN
½" = 1'-0"

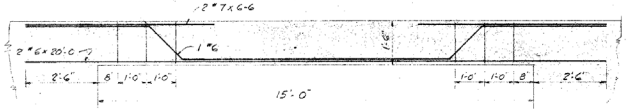


SECTION A-A
½" = 1'-0"

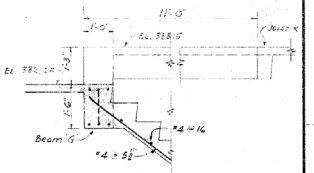


SECTION B-B
½" = 1'-0"

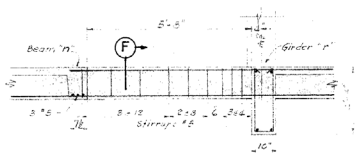
SECTION C-C
½" = 1'-0"



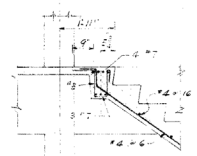
BEAM "G"
½" = 1'-0"



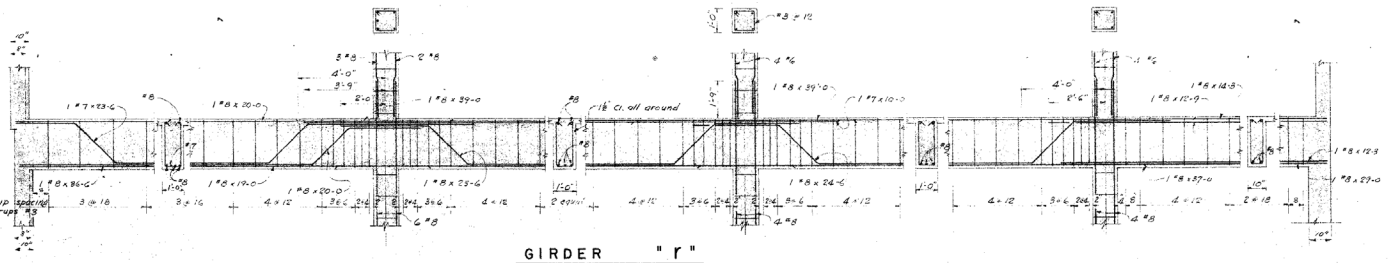
SECTION D
½" = 1'-0"



SECTION E
½" = 1'-0"



SECTION F
½" = 1'-0"



GIRDER "r"
⅜" = 1'-0"

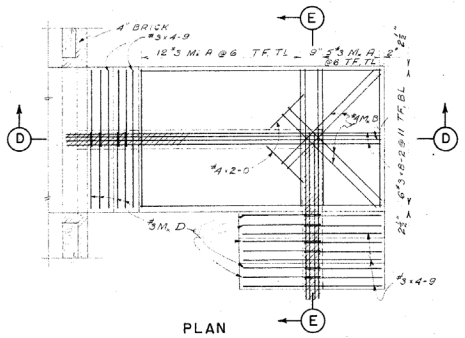
DATE	NO.	REVISION	BY
9-20-58	1	As Built	ATC

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

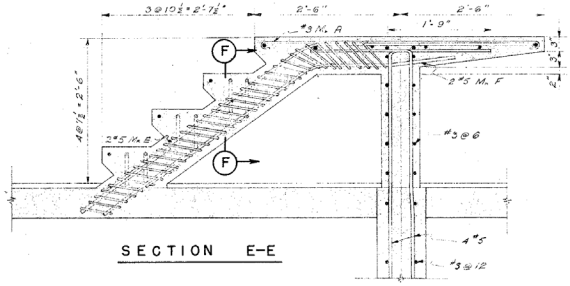
WATER PURIFICATION WORKS
HEADHOUSE
SECOND FLOOR REINFORCEMENT

DESIGNED H.A.S	APPROVED	SHEET	OF
DRAWN P.K	SCALE As noted	S6	77
CHECKED E.A.S	DATE 8-1-57	FILE 1160-5044	

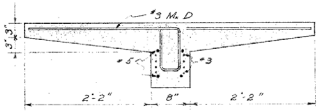


PLAN

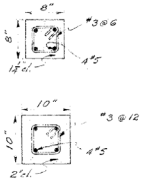
Scale: 1½" = 1'-0"

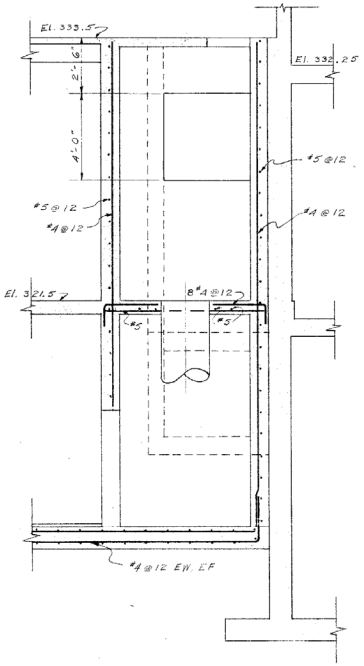


SECTION E-E

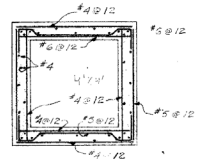


SECTION F-F

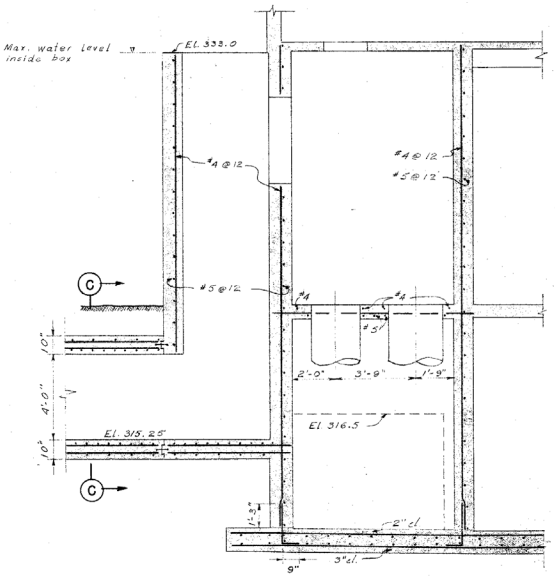




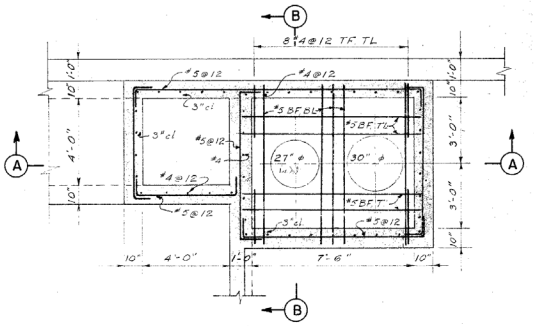
SECTION B-B



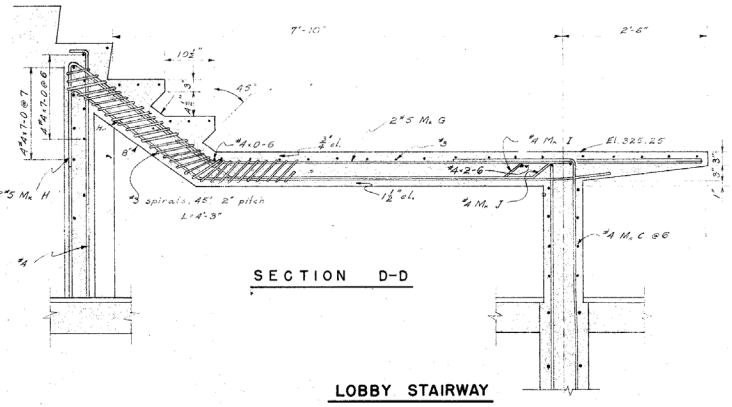
SECTION C-C



SECTION A-A



PLAN SECTION AT ELEV. 322.0



SECTION D-D

LOBBY STAIRWAY

Scale: 1" = 1'-0"

RAW WATER INTAKE

Scale: ⅜" = 1'-0"

M.	SKETCH	OUT TO OUT DIMENSIONS a	b	c	d	e	f
A		4-9					
B		0-3	4-6				
C		0-5½					
D		0-7	2-7				
E			1-3	4-0	2-6	3-11½	
F			3-6	1-1½	1-2	2-0	2-0½
G		0-6	3-1	2-5½	1-9½	2-6	
H		1-4	2-8	2-3⅝	6-2	0-9	0-1½
I		1-5	2-1	2-11	4-5	0-3¾	3-1
J		1-3	2-1	2-11	5-2	0-8¾	2-5

DATE	NO.	REVISION	BY
8-29-58	△	As built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

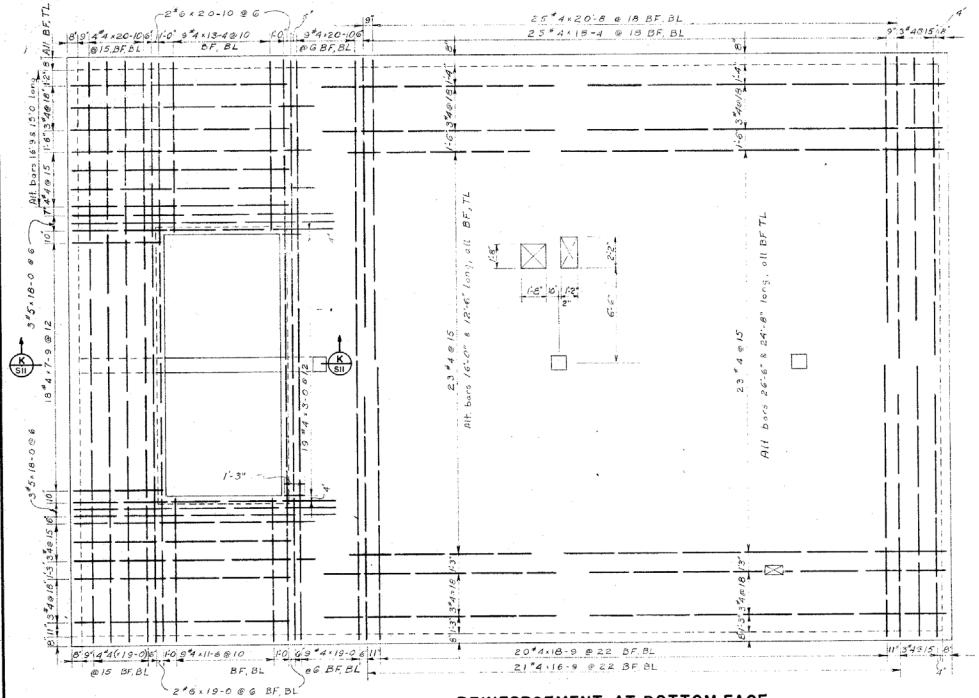
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS

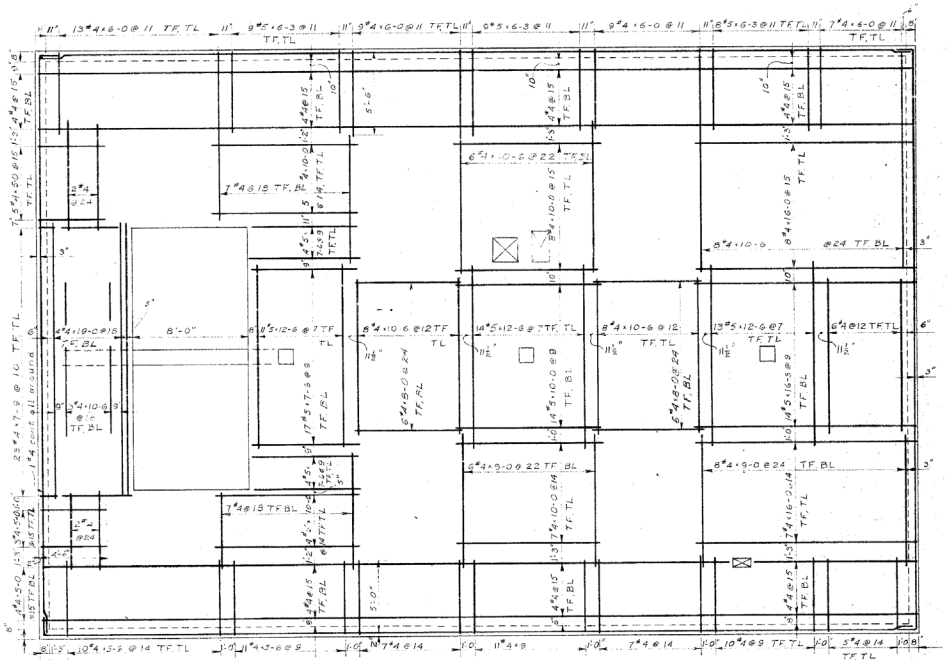
RAW WATER INTAKE BOX & MAIN STAIRS

DESIGNED	H A S	APPROVED BY	
DRAWN	H S	SCALE	As Shown
CHECKED	E A S	DATE	4-1-57
		FILE	160-3046

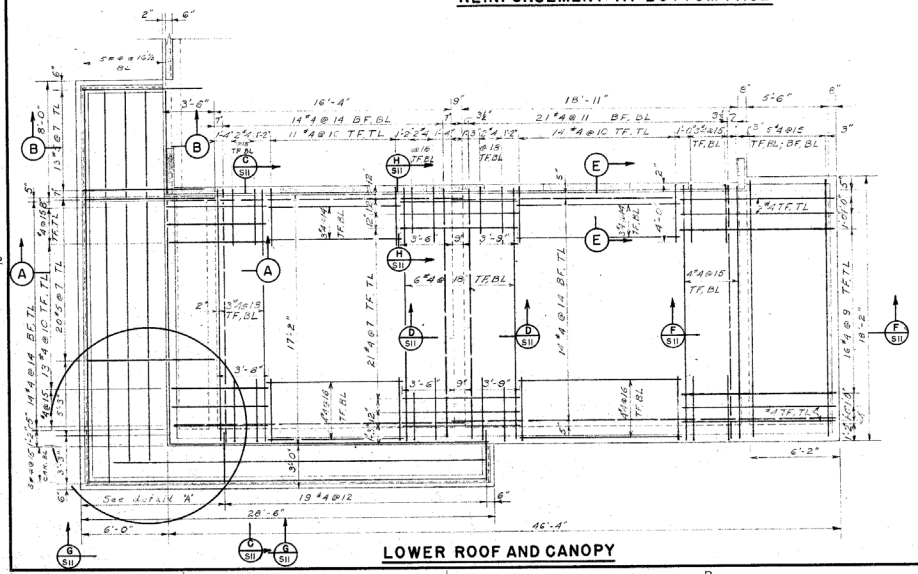
SHEET S8 OF 77



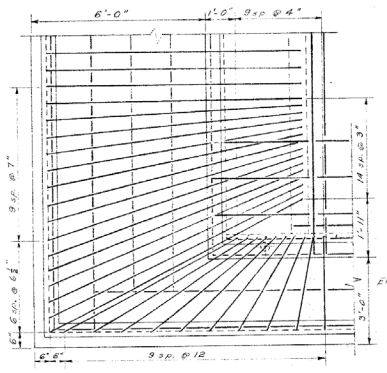
REINFORCEMENT AT BOTTOM FACE



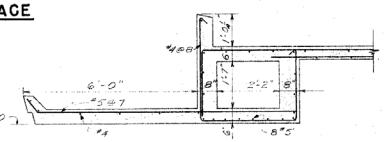
REINFORCEMENT AT TOP FACE



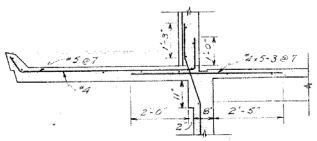
LOWER ROOF AND CANOPY



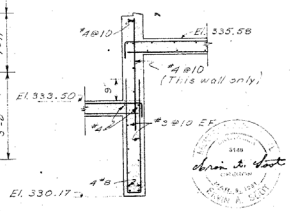
DETAIL "A"
Scale: ½"-1'-0"



SECTION A-A



SECTION B-B



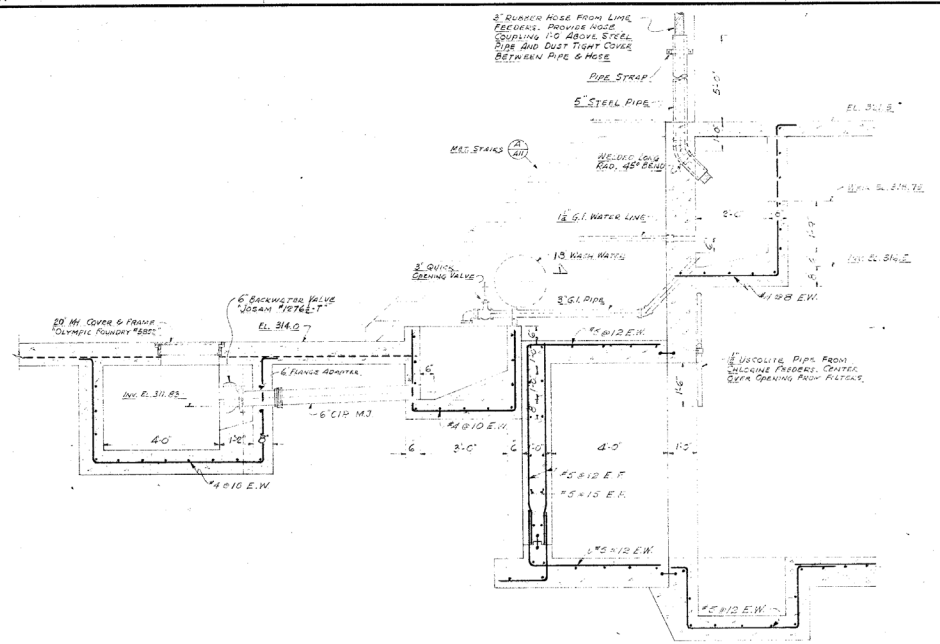
SECTION E-E

NO.	DATE	REVISION	BY
	9-2359	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

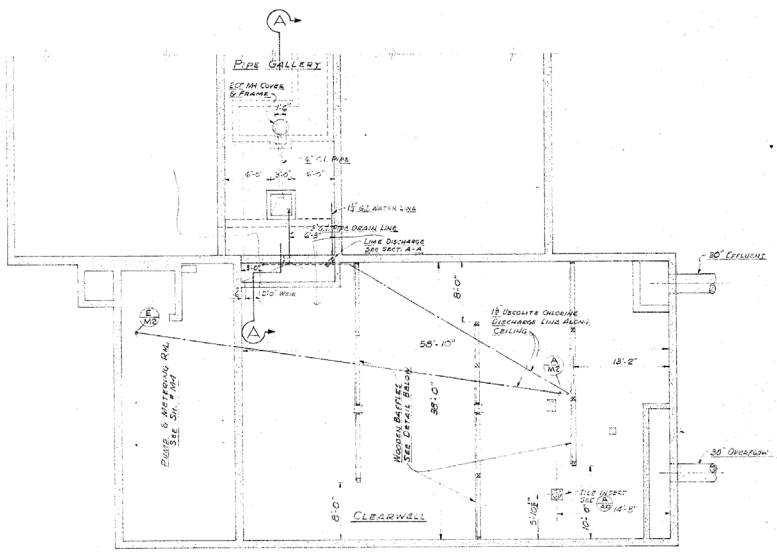
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
HEADHOUSE
ROOF REINFORCEMENT

DESIGNED	EAS, HAS	APPROVED BY	SHEET OF
DRAWN	HS	SCALE	S7 / 77
CHECKED	EAS	DATE 8-1-57	FILE 1960-3045



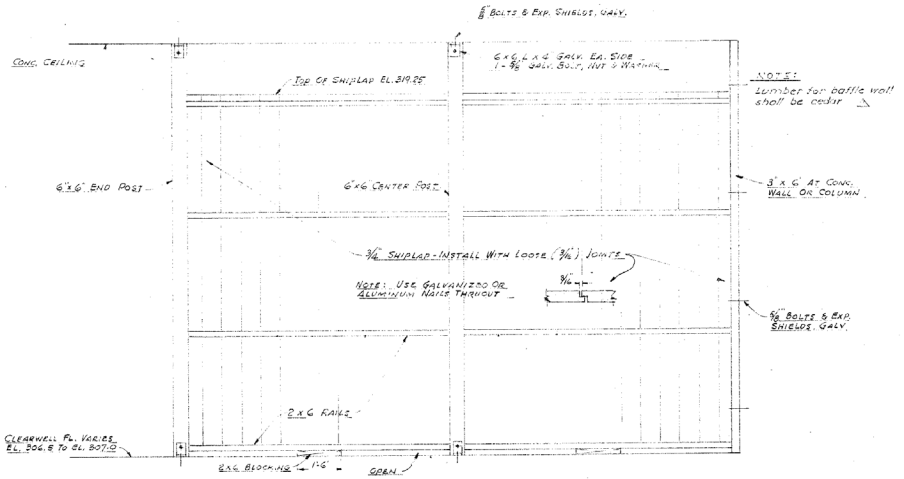
SECTION A-A

Scale: 1/2" = 1'-0"



PLAN

Scale: 1/8" = 1'-0"



CLEARWELL BAFFLE WALL

Scale: 1/2" = 1'-0"

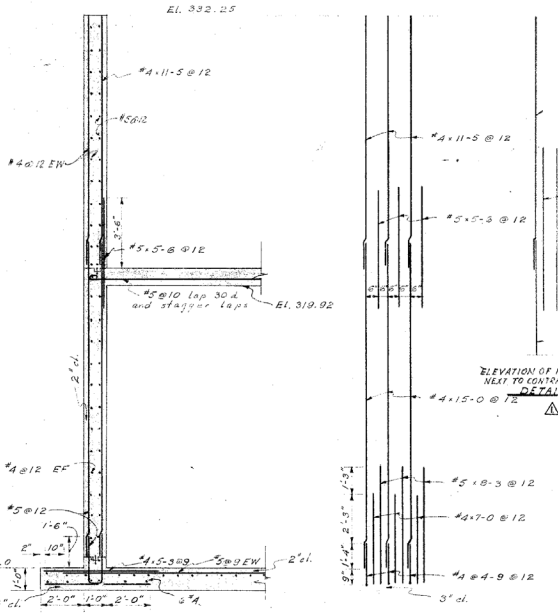
DATE	NO.	REVISION	BY
9-29-55	1	As Built	ATS

STEVENS & THOMPSON *Consulting Engineers*
2234 S.W. FIFTH AVENUE — PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

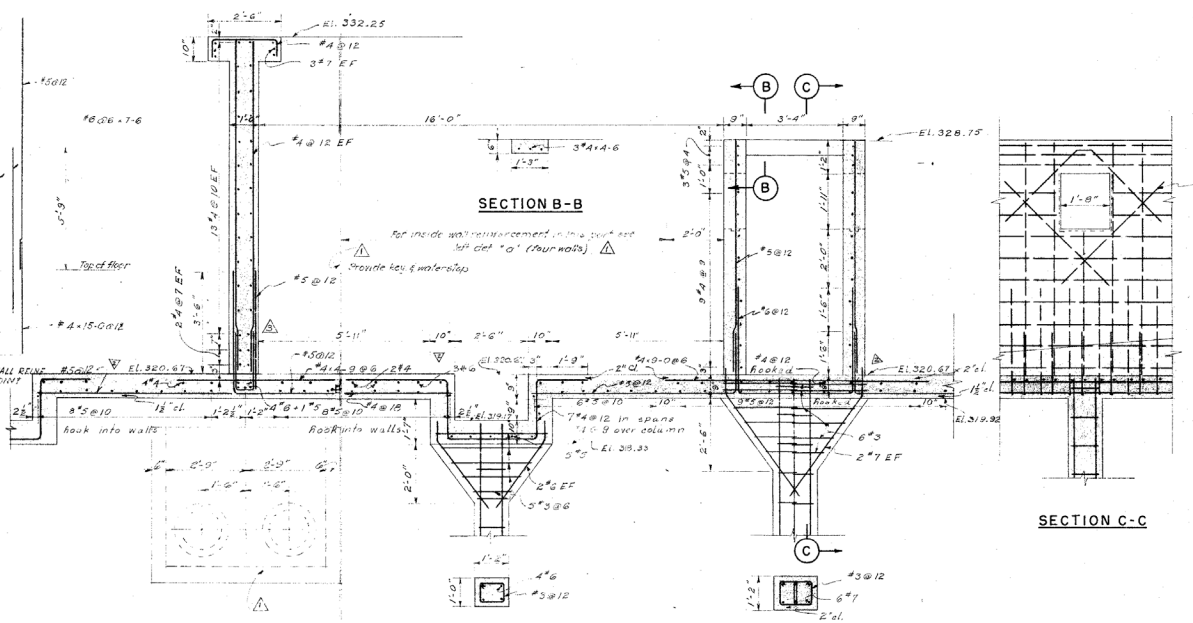
WATER PURIFICATION WORKS
CLEARWELL BAFFLE WALLS & LIME TROUGH DETAILS

DESIGNED F.F.H.	APPROVED BY	SHEET	OF
DRAWN P.L.K.	SCALE AS SHOWN	S9	77
CHECKED F.T.K.	DATE 8-1-51	FILE 1160-3047	



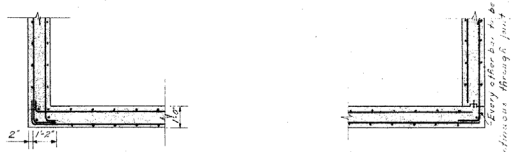
WALL SECTION

ELEVATION OF INSIDE REINFORCEMENT

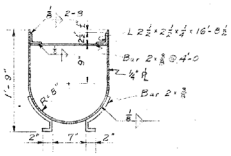


SECTION B-B

SECTION C-C

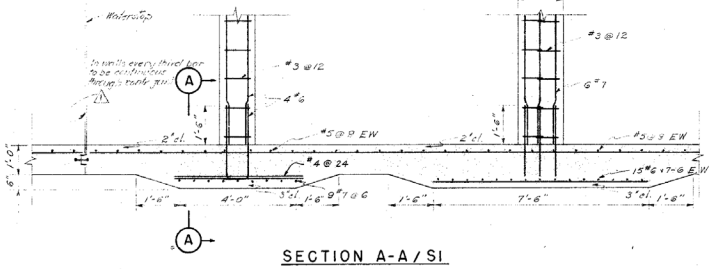


WALL CORNERS



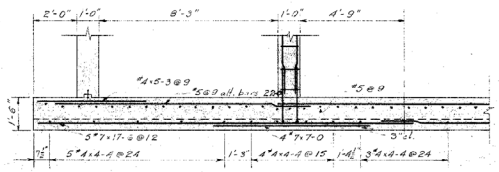
WASH TROUGH

Scale: 1" = 1'-0"



SECTION A-A / SI

Scale: ½" = 1'-0"



SECTION A-A

Scale: ⅜" = 1'-0"

DATE	NO.	REVISION	BY
9-23-59	3	As Built - Removed shoulder	ATS
12-14-57	2	Revise Filter bottom Sec. A-A	LKN
11-13-57	1	Contraction joint detail added	LKN

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

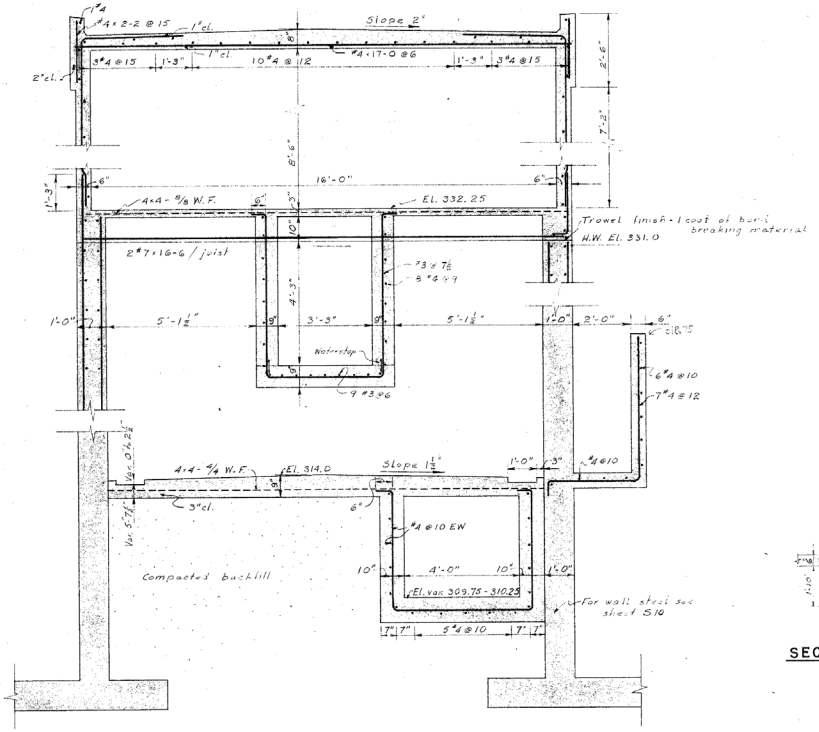
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS
FILTER SECTIONS
REINFORCEMENT

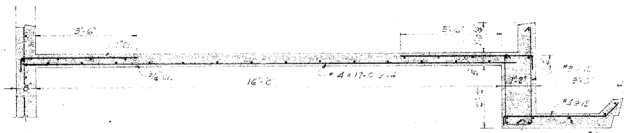
DESIGNED	E.A.S.	APPROVED	
DRAWN	H.S.	SCALE	As shown
CHECKED	E.A.S.	DATE	8-1955

FILE 1160-30-48

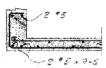
SHEET S10 OF 77



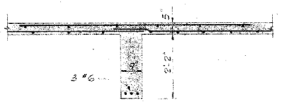
SECTION B-B / S1



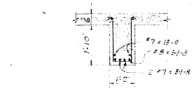
SECTION C-C / S7



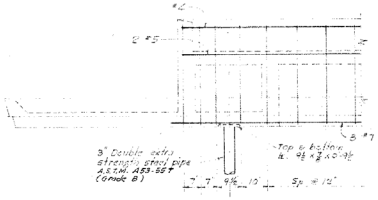
SECTION H-H / S7



SECTION D-D / S7

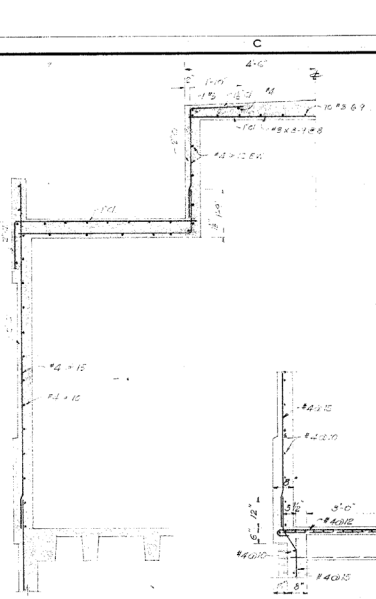


SECTION A-A



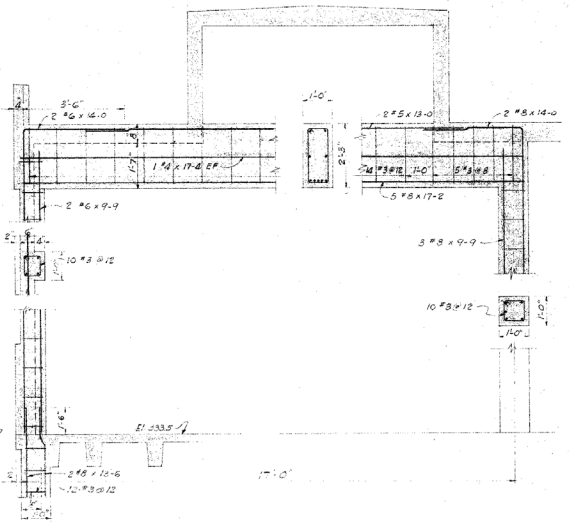
SECTION F-F / S7

SECTION G-G / S7

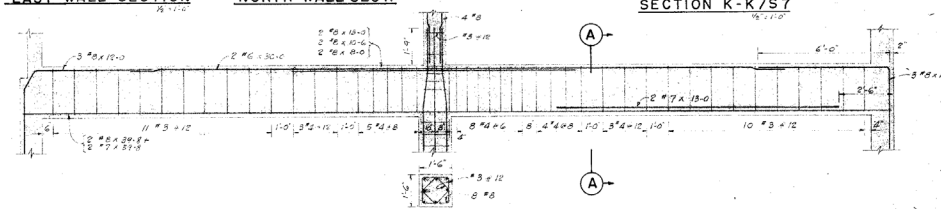


EAST WALL SECTION

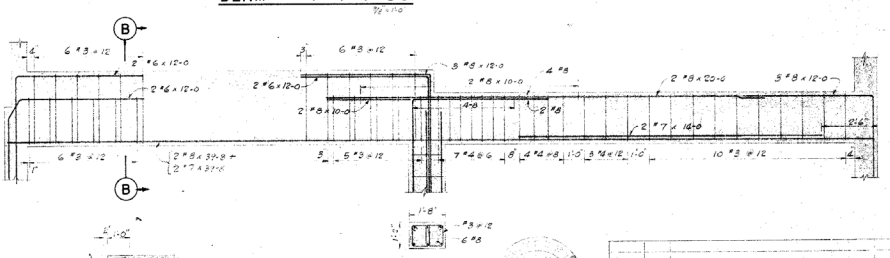
NORTH WALL SECT.



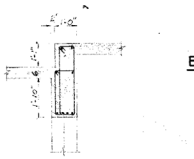
SECTION K-K / S7



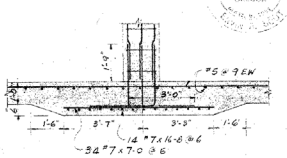
BEAM F-F / S5



BEAM G-G / S5



SECTION B-B



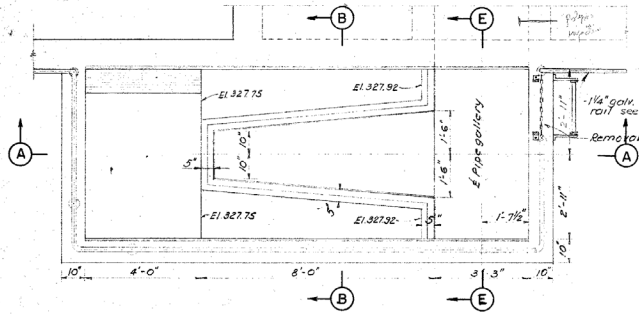
9-29-89	△	As Built	ATS
DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2334 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
MISCELLANEOUS DETAILS REINFORCEMENT

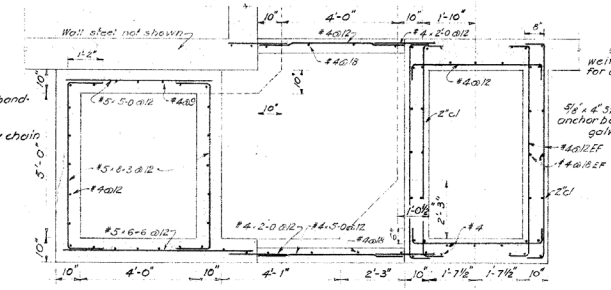
DESIGNED	E.A.S.	APPROVED BY	
DRAWN	P.L.K. - H.S.	SCALE	As noted
CHECKED	E.A.S.	DATE 8-1-87	FILE 1160-3049

SHEET S11 OF 77



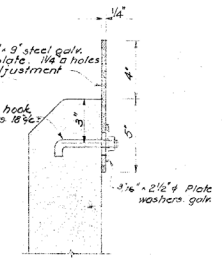
PLAN

Scale: 1/2" = 1'-0"



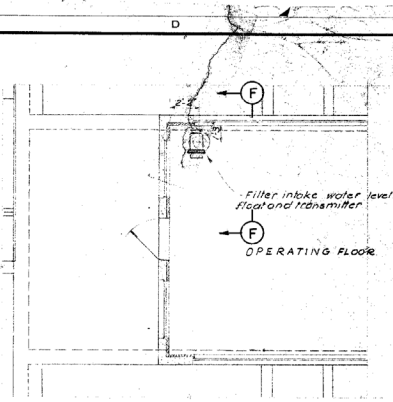
PLAN SECTION C-C

Scale: 1/2" = 1'-0"



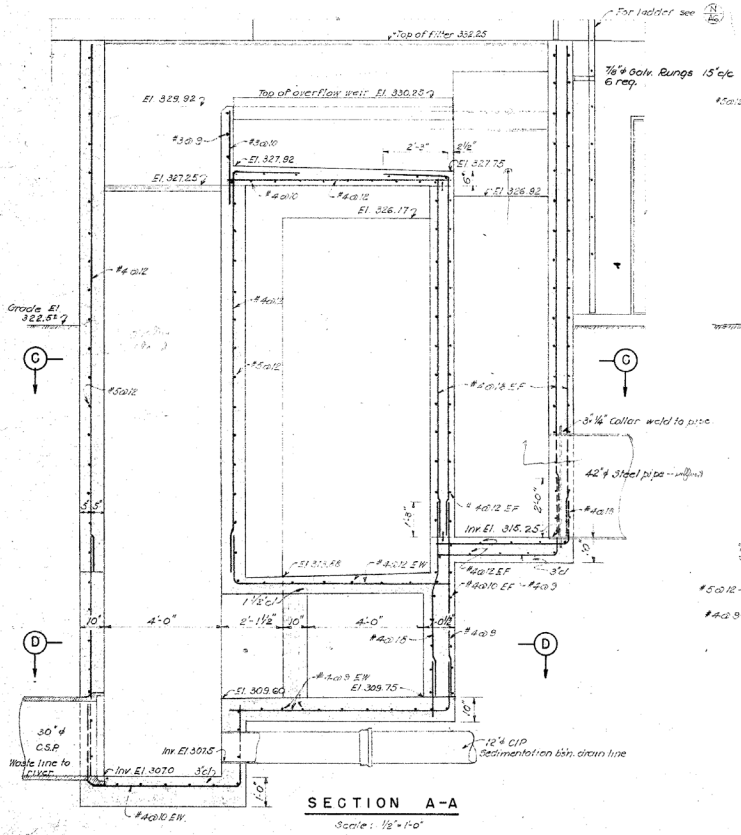
OVERFLOW WEIR DETAIL

Scale: 3" = 1'-0"



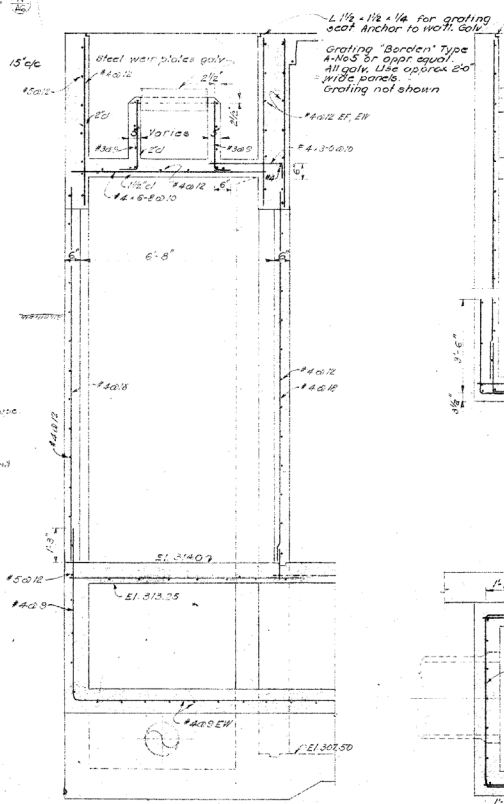
LOCATION PLAN

Scale: 1/4" = 1'-0"



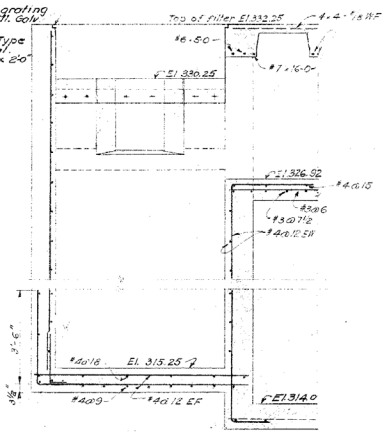
SECTION A-A

Scale: 1/2" = 1'-0"



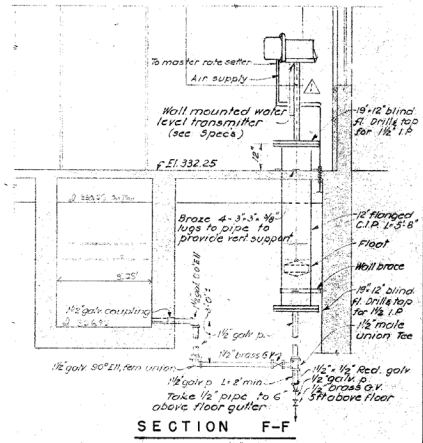
SECTION B-B

Scale: 1/2" = 1'-0"



SECTION E-E

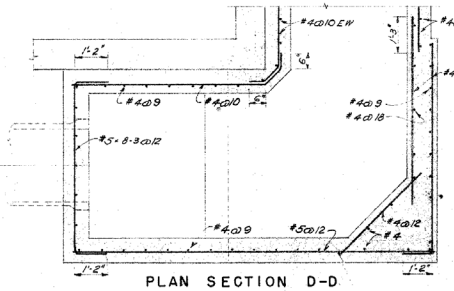
Scale: 1/2" = 1'-0"



SECTION F-F

Scale: 1/2" = 1'-0"

FILTER WATER LEVEL TRANSMITTER



PLAN SECTION D-D

Scale: 1/2" = 1'-0"

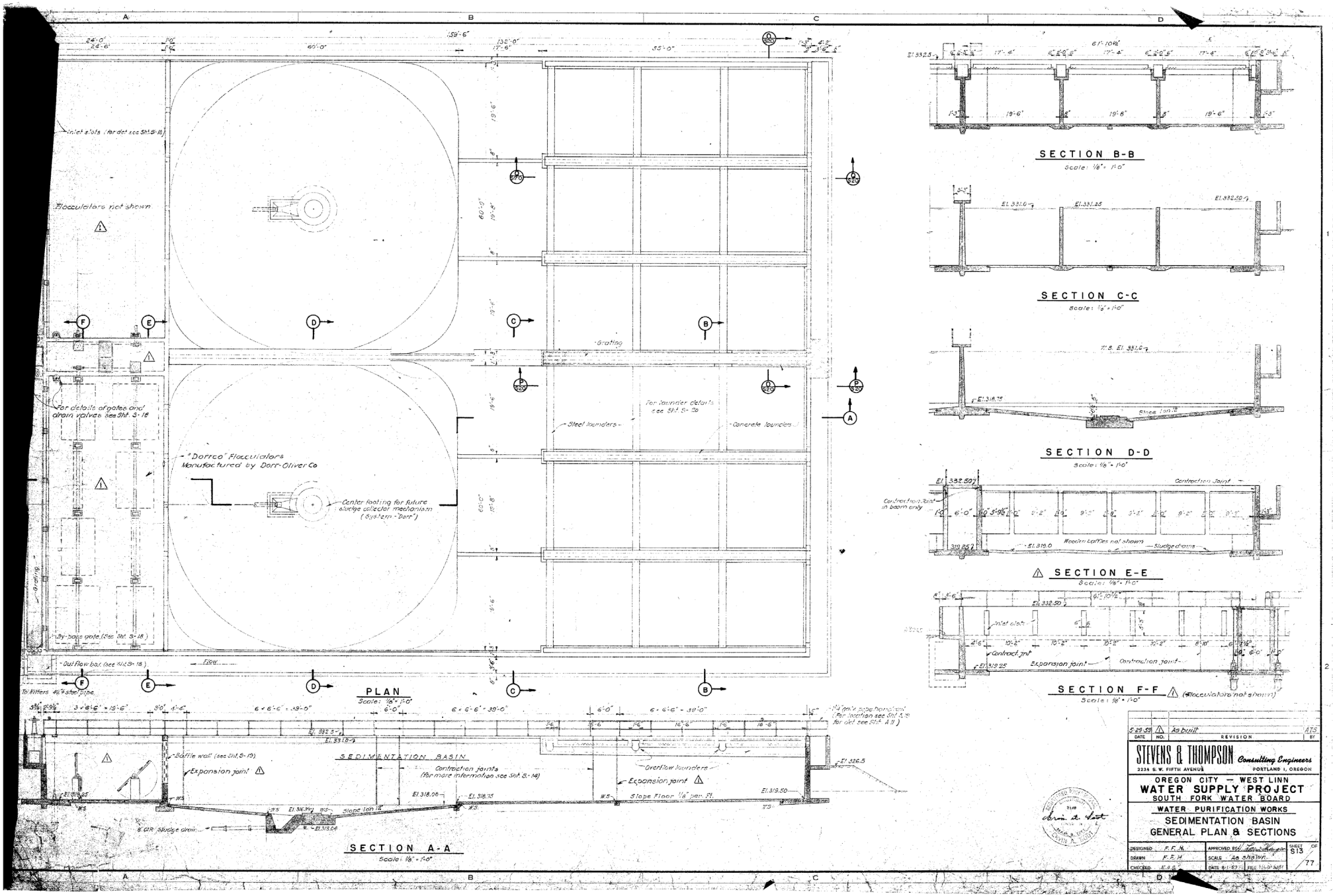
FILTER INFLUENT, OVERFLOW AND WASTE DISCHARGE BOX

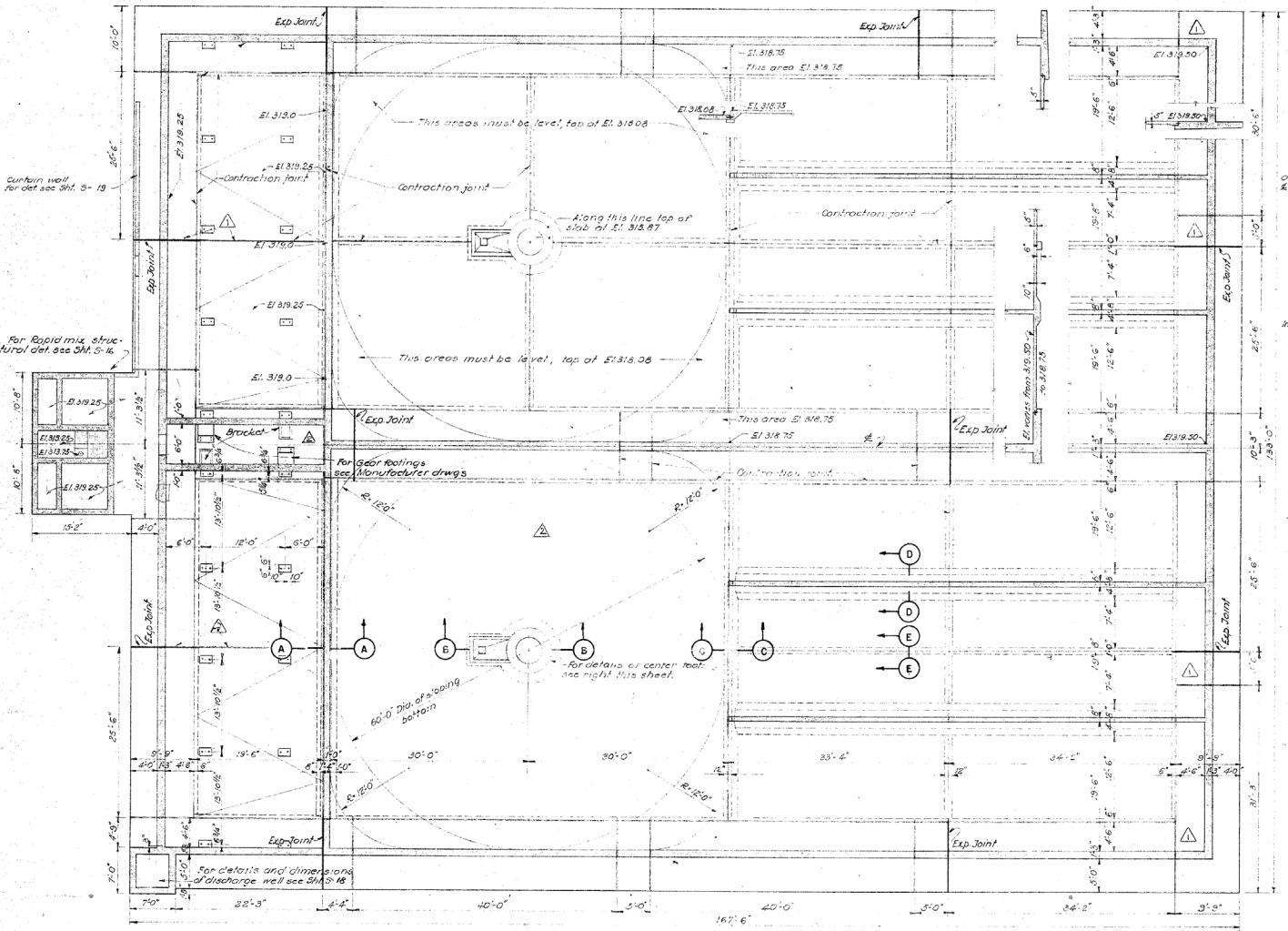
DATE	NO.	REVISION	BY
3-18-59	1	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY – WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
FILTER INTAKE & OVERFLOW BOX

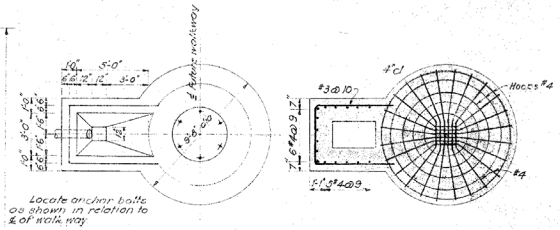
DESIGNED	F. F. H.	APPROVED BY		SHEET	OF
DRAWN	F. F. H.	SCALE	As shown	S 12	
CHECKED	R. A. S.	DATE	8-1-57	FILE	60-2053


PLAN
Scale: 1/8" = 1'-0"
Inlet slots (for det see Sht. S-18)
Flocculators not shown
For details of gates and drain valves see Sht. S-18
"Dorrco" Flocculators Manufactured by Dorr-Oliver Co
Center footing for future sludge collector mechanism (System - "Dorr")
Grating
For launder details see Sht. S-20
Steel launders
Concrete launders
By-pass gate (See Sht. S-18)
Out flow box (see Sht. S-18)
Flow
To Filters 4½" steel pipe
SECTION A-A
Scale: 1/8" = 1'-0"
SEDIMENTATION BASIN
Baffle wall (see Sht. S-19)
Expansion joint
Contraction joints (for more information see Sht. S-14)
Overflow launders
Slope Floor 1/8" per Ft.
Slope 1 on 12
6" CIR Sludge drain
SECTION B-B
Scale: 1/8" = 1'-0"
SECTION C-C
Scale: 1/8" = 1'-0"
SECTION D-D
Scale: 1/8" = 1'-0"
Contraction Joint
Contraction Joint in beam only
Wooden baffles not shown
Sludge drains
SECTION E-E
Scale: 1/8" = 1'-0"
Inlet slots
Contract. jnt
Expansion joint
Contraction joint
SECTION F-F
Scale: 1/8" = 1'-0"
(Flocculators not shown)
5-29-59 | 1 | As built | ATS
DATE | NO. | REVISION | BY
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
SEDIMENTATION BASIN
GENERAL PLAN & SECTIONS
DESIGNED F.F.H.
DRAWN F.F.H.
CHECKED E.A.S.
APPROVED BY
SCALE As shown
DATE 8-1-57
FILE 1160-3351
SHEET S13 OF 77



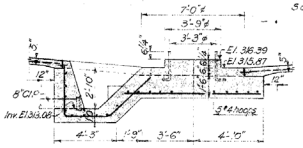
FOUNDATION PLAN

Scale : 1/8" = 1'-0"



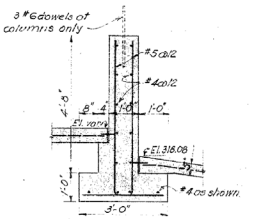
PLAN CENTER FOOTING REINFORCING

Scale : 1/4" = 1'-0"



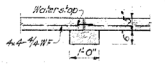
SECTION B-B

Scale : 1/4" = 1'-0"



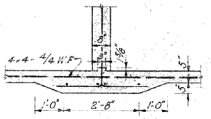
SECTION A-A

Scale : 1/2" = 1'-0"



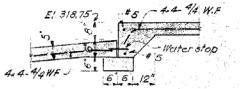
SECTION E-E

Scale : 1/2" = 1'-0"



SECTION D-D

Scale : 1/2" = 1'-0"



SECTION C-C

Scale : 1/2" = 1'-0"

DATE	NO.	REVISION	BY
5-29-58	2	As built	ATS
10-11-57	1	Relocated & added contraction joints	FRH

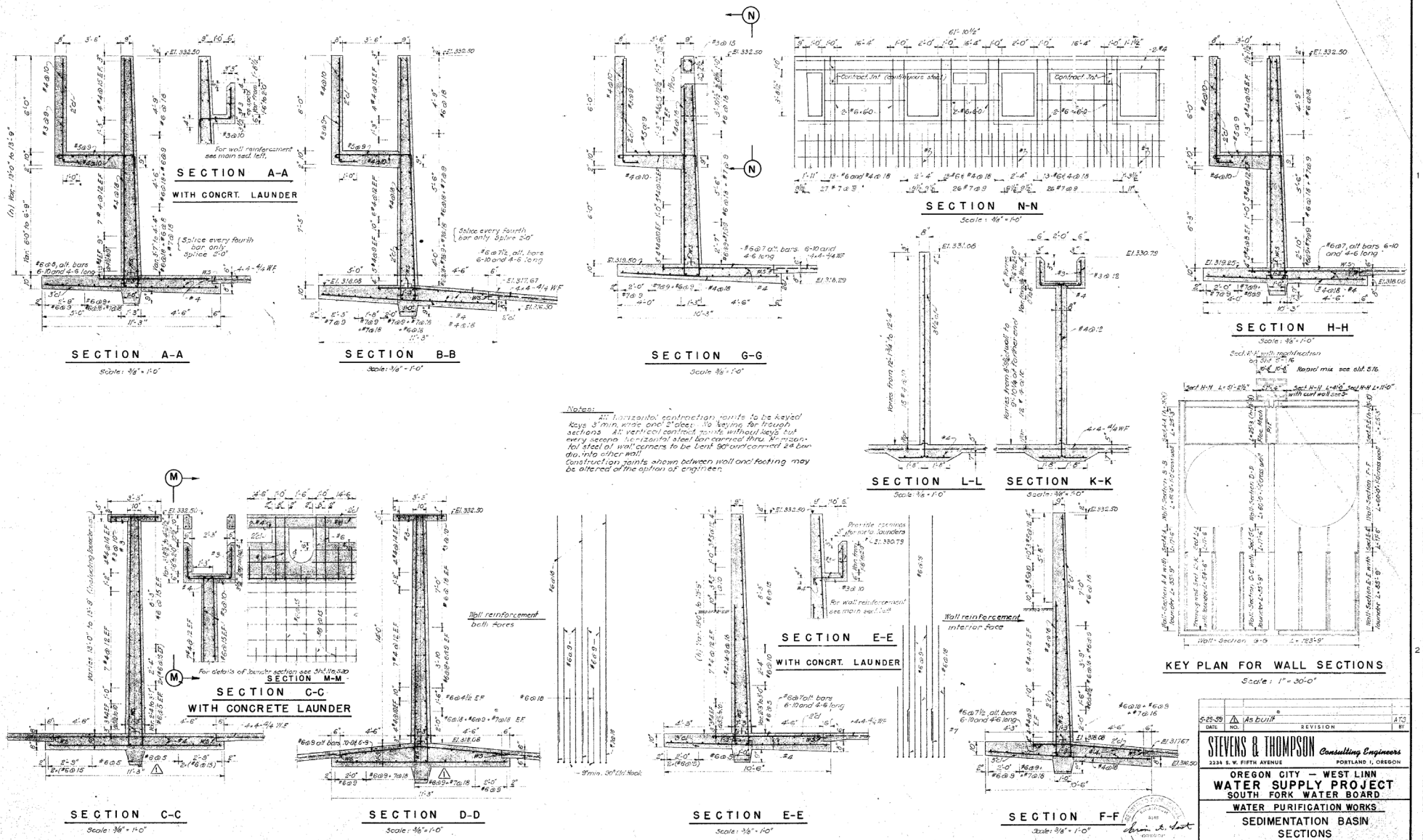
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY – WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS

SEDIMENTATION BASIN FOOTINGS

DESIGNED	F.F.H.	APPROVED BY	H. Peterson
DRAWN	F.F.H.	SCALE	As shown
CHECKED	E.A.S.	DATE	8-1-57
		FILE	1160-3088



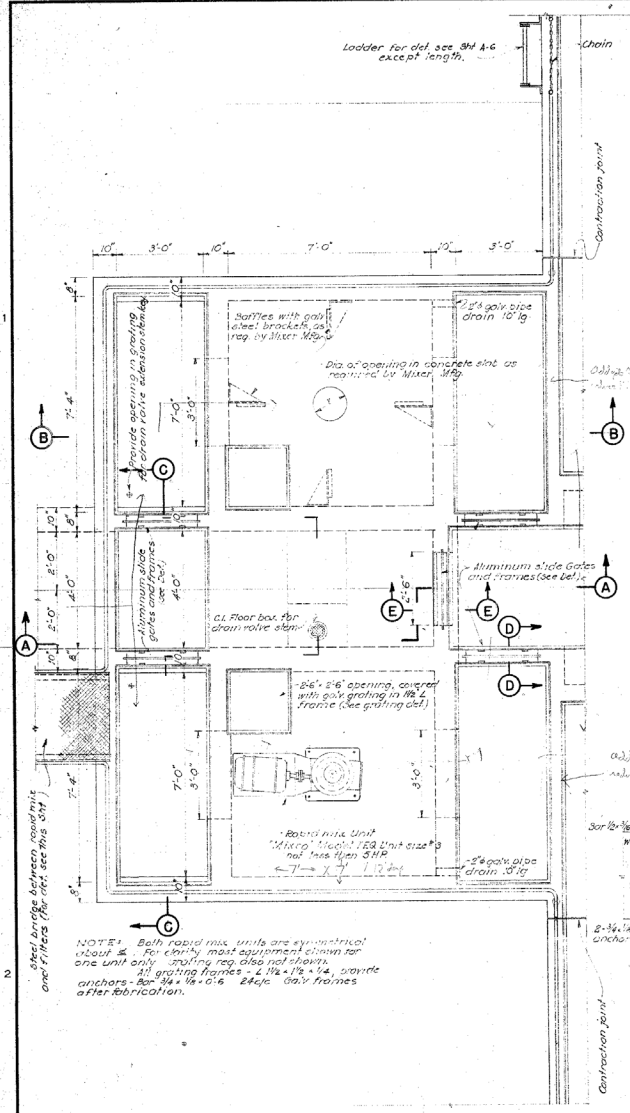
DATE	NO.	REVISION	BY
5-29-59	1	As built	ATJ

STEVENS & THOMPSON *Consulting Engineers*
2234 S. W. FIFTH AVENUE — PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

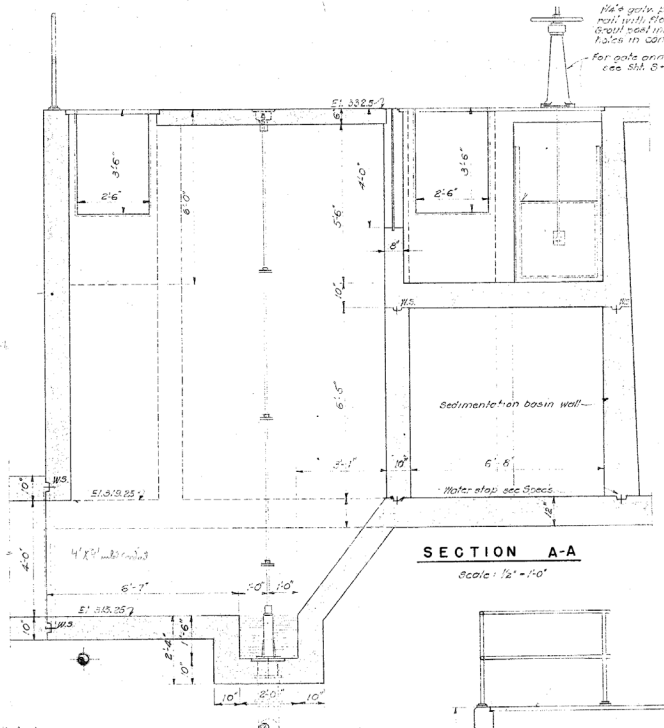
WATER PURIFICATION WORKS
SEDIMENTATION BASIN
SECTIONS

DESIGNED EAS F.F.H	APPROVED BY [signature]	SHEET S15 OF 77	
DRAWN F.F.H	SCALE As shown		
CHECKED EAS	DATE 8-1-57	FILE 1160-3058	



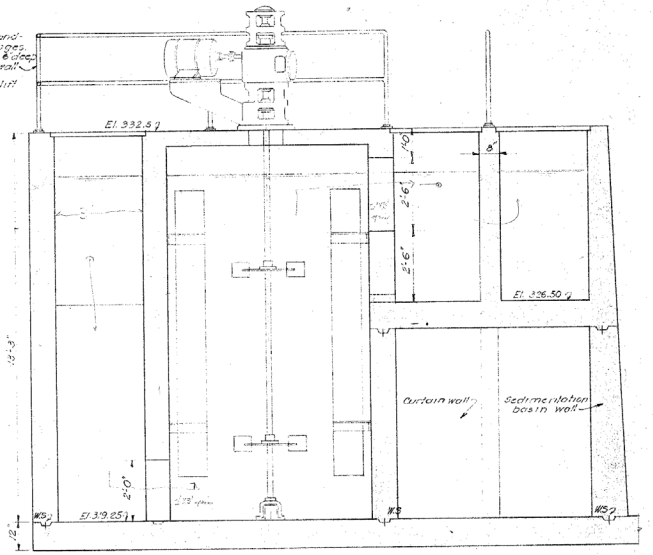
PLAN OF RAPID MIX UNIT

Scale: ½" = 1'-0"



SECTION A-A

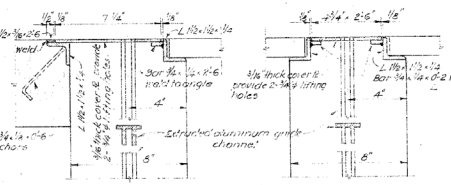
Scale: ½" = 1'-0"



SECTION B-B

Scale: ½" = 1'-0"





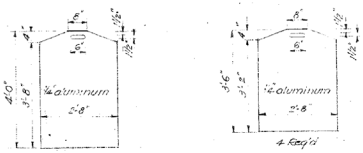
SECTION E-E

Scale: 3" = 1'-0"

SECTION D-D

Scale: 3" = 1'-0"

Note: All frames & ℄ to be galv.

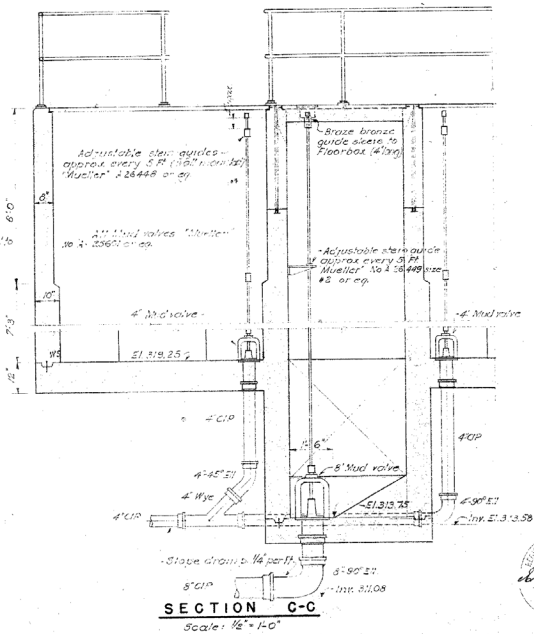


1 Req'd

4 Req'd

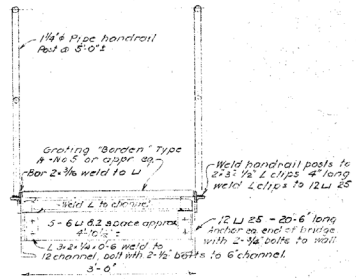
ALUMINUM SLIDE GATES

Scale: ½" = 1'-0"



SECTION C-C

Scale: ½" = 1'-0"



BRIDGE CROSS SECTION

Scale: 1" = 1'-0"

DATE	NO.	REVISION	BY
3-29-59	1	As Built	ATS

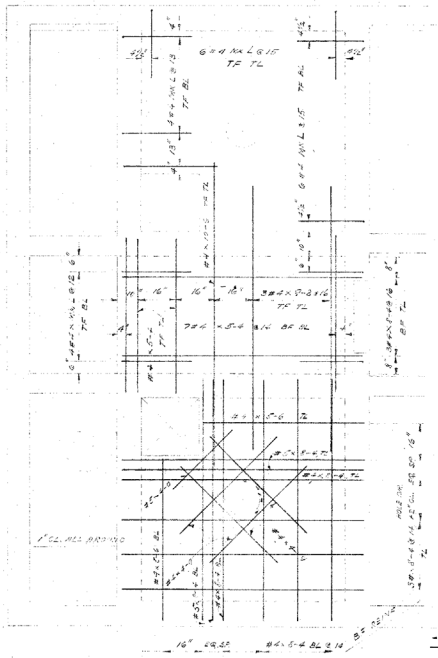
STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

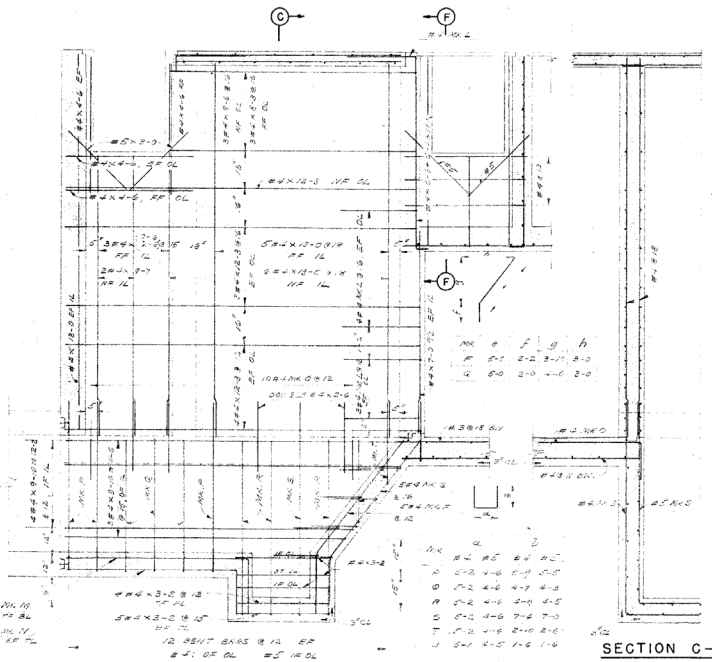
WATER PURIFICATION WORKS

SEDIMENTATION BASIN
RAPID MIX

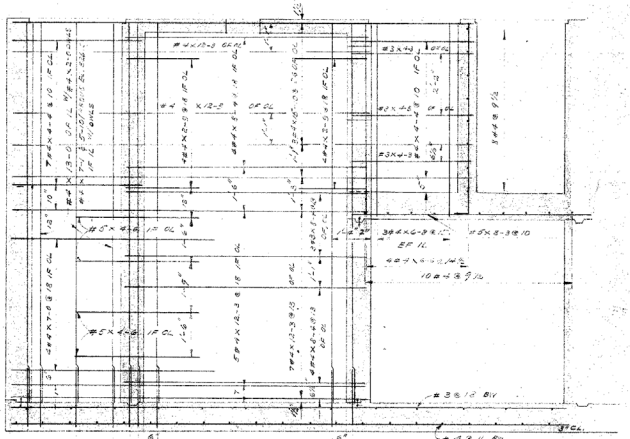
DESIGNED F.F.H.	APPROVED BY	SHEET	OF
DRAWN F.F.H.	SCALE As shown	S16	
CHECKED E.A.S.	DATE 8-11-57	FILE 11-60-3084	77



TOP SLAB

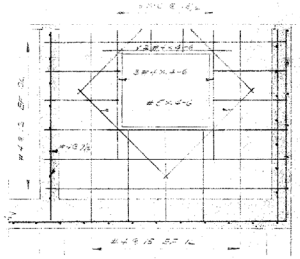


SECTION A-A

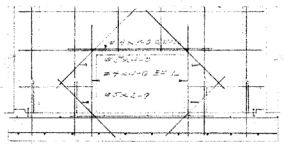


SECTION B-B

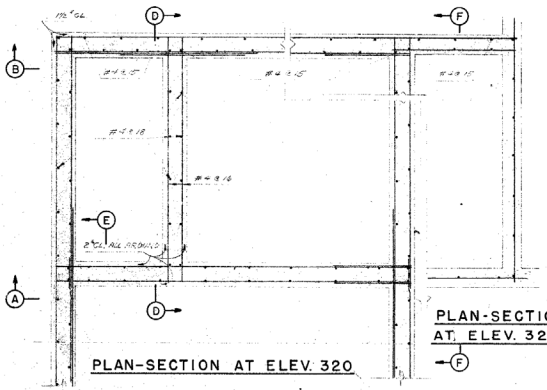
SECTION C-C



SECTION F-F

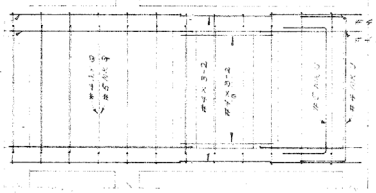


SECTION D-D

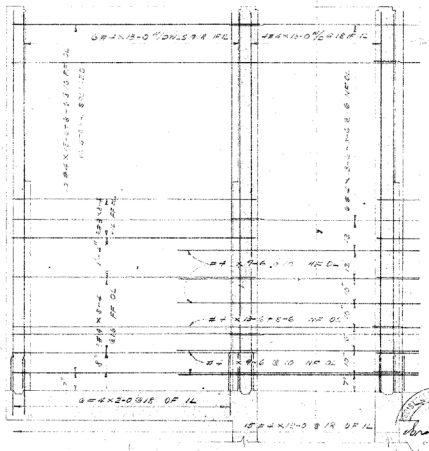


PLAN-SECTION AT ELEV. 320

PLAN-SECTION AT ELEV. 327



PLAN AT ELEVATION 319.25



SECTION E-E

3-29-57 DATE	As Built NO.	REVISION	ATS BY

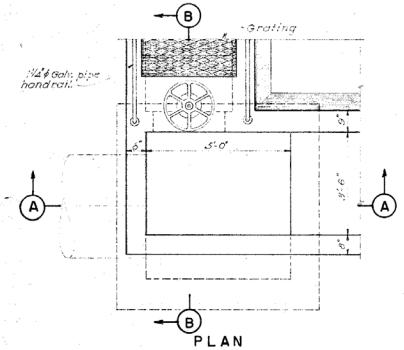
STEVENS & THOMPSON *Consulting Engineers*
2234 S. W. FIFTH AVENUE — PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

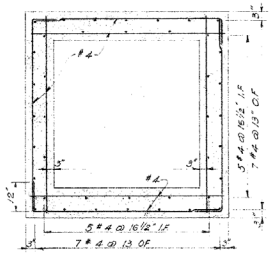
WATER PURIFICATION WORKS

SEDIMENTATION BASIN
RAPID MIX REINFORCEMENT

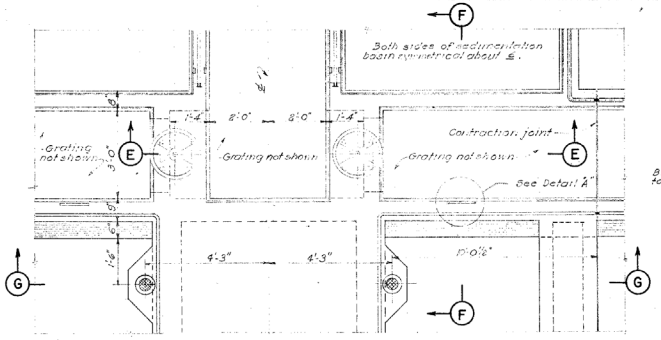
DESIGNED M.H.S	APPROVED BY	SHEET	OF
DRAWN M.H.S	SCALE 1/2" = 1'-0"	S17	77
CHECKED E.A.S	DATE 8-1-57	FILE 1160-3085	



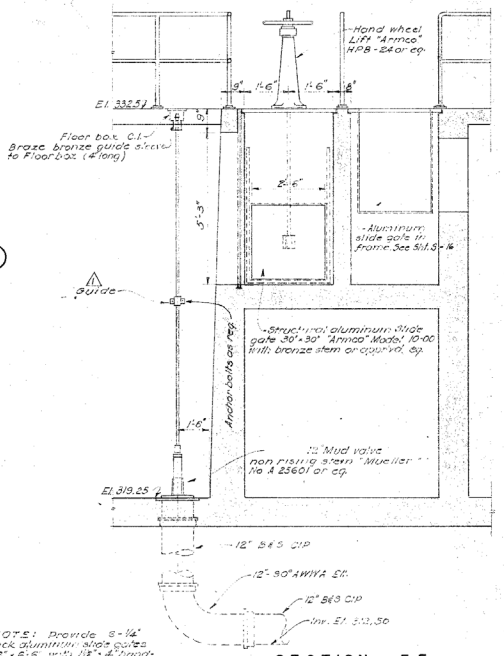
PLAN
Scale: ½" = 1'-0"



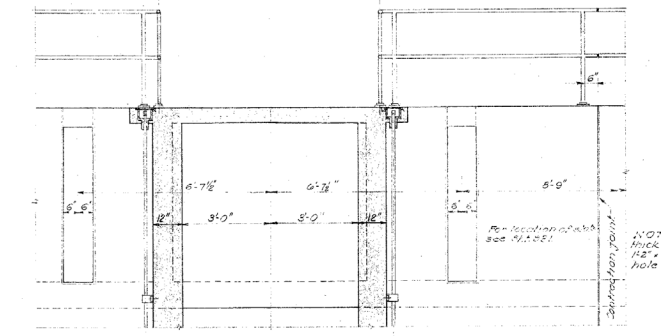
SECTION C-C
Scale ½" = 1'-0"



PLAN
Scale: ½" = 1'-0"

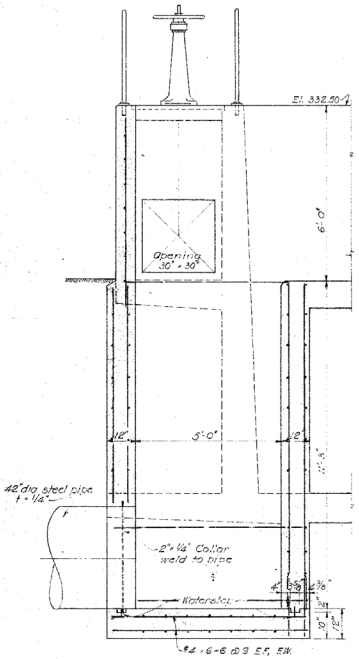


SECTION F-F
Scale: ½" = 1'-0"

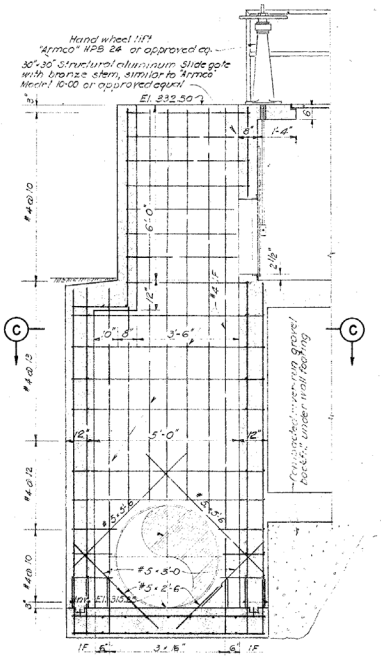


NOTE: Provide 6-¼" thick aluminum slide gates 1'-2" × 6'-6" with 1½" × 4" hand-hole slot on upper end

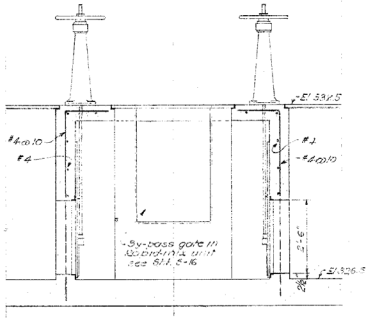
SECTION G-G
Scale: ½" = 1'-0"



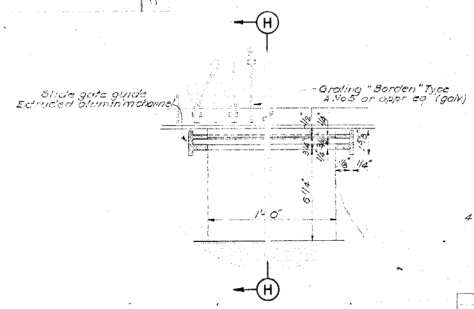
SECTION A-A
Scale: ½" = 1'-0"



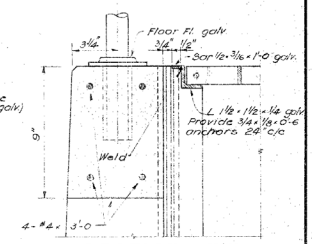
SECTION B-B
Scale: ½" = 1'-0"



SECTION E-E
Scale: ½" = 1'-0"



DETAIL "A"
Scale: 3" = 1'-0"



SECTION H-H
Scale: 3" = 1'-0"

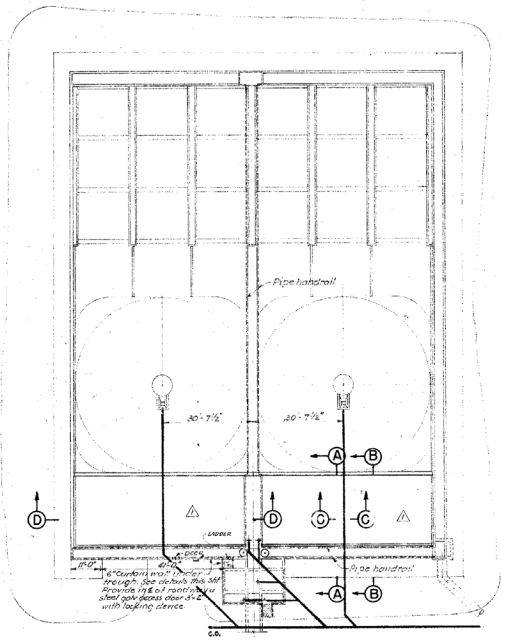
DATE	NO.	REVISION	BY
9.29.59	1	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

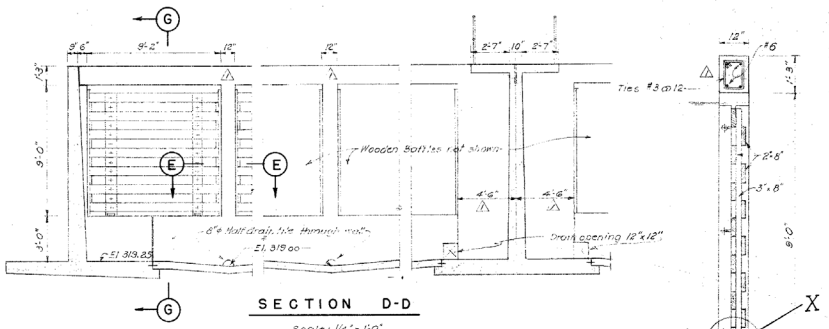
WATER PURIFICATION WORKS
SEDIMENTATION BASIN
DETAILS

DESIGNED F.F.H.	APPROVED BY [signature]	SHEET S18	OF 77
DRAWN F.F.H.	SCALE As shown		
CHECKED E.A.S.	DATE 8-1-57 FILE 1140-50-86		



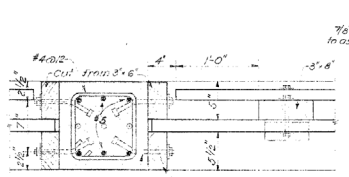
PLAN

Scale: 1" = 20'-0"



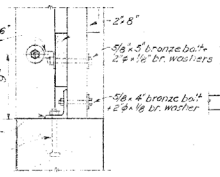
SECTION D-D

Scale: 1/4" = 1'-0"



SECTION E-E

Scale: 1½" = 1'-0"

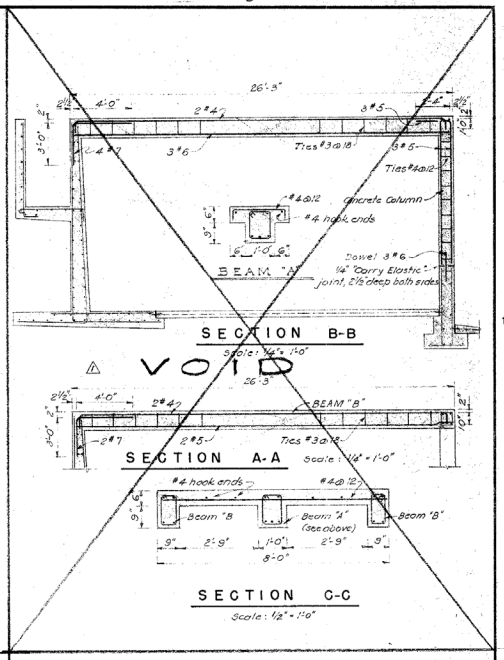


DETAIL "X"

Scale: 1½" = 1'-0"

SECTION G-G

Scale: ½" = 1'-0"



SECTION B-B

Scale: ¼" = 1'-0"

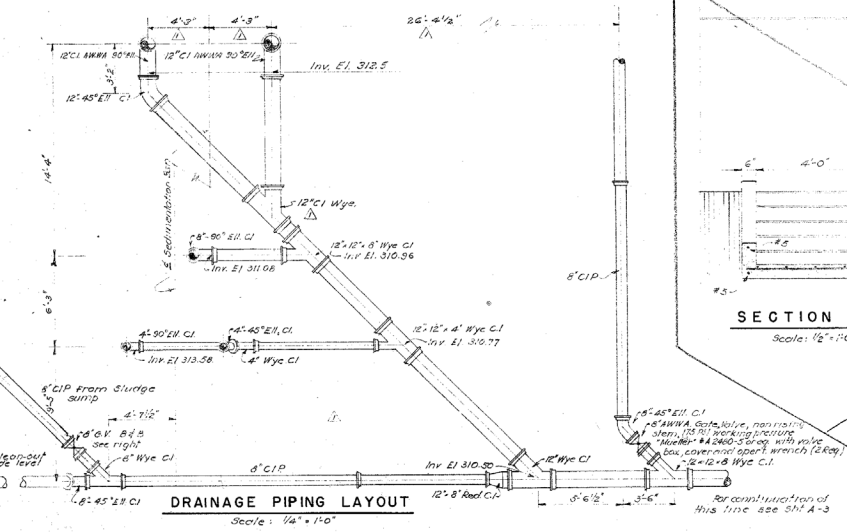
SECTION A-A

Scale: ¼" = 1'-0"

SECTION C-C

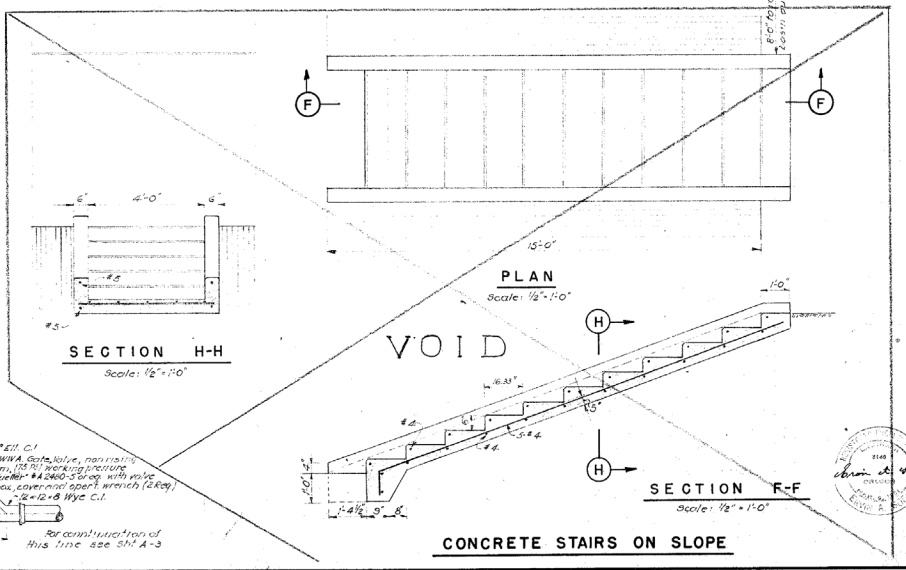
Scale: ½" = 1'-0"

FLOCCULATION BASIN BAFFLE WALL

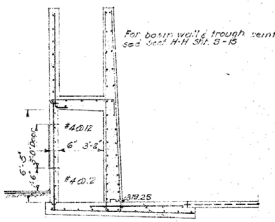


DRAINAGE PIPING LAYOUT

Scale: 1/4" = 1'-0"



CONCRETE STAIRS ON SLOPE



CURTAIN WALL DETAIL

(For location see "Plan" at left)

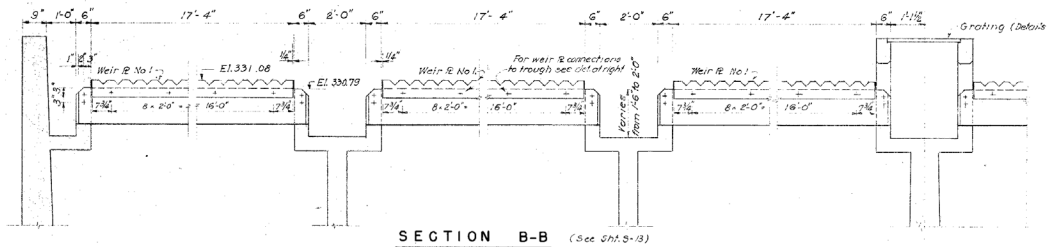
Scale: ¼" = 1'-0"

DATE	NO.	REVISION	BY
10-16-57	1	As Built - Deleted Beams 4 Sect AA, BB & CC	MDS

STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

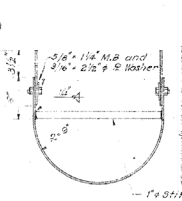
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
SEDIMENTATION BASIN DETAILS

DESIGNED F.F.H.	APPROVED BY	SHEET	S 19
DRAWN F.F.H.	SCALE As shown	OF	77
CHECKED E.A.S.	DATE 8-1-57	FILE 1460-3057	



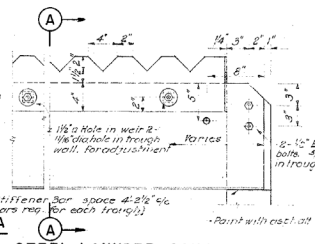
SECTION B-B (See Sht. S-13)

Scale : 1/2" = 1'-0"



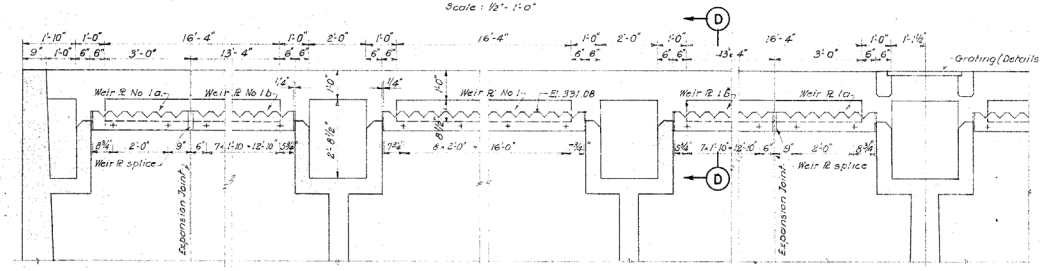
SECTION A-A

Scale: 1 1/2" = 1'-0"



STEEL LAUNDER CONNECTION

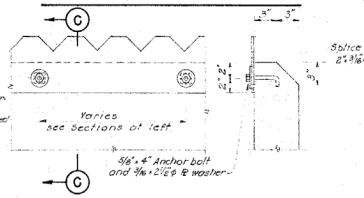
Scale: 1 1/2" = 1'-0"



SECTION O-O (See Sht. S-13)

Scale : 1/2" = 1'-0"

NOTE: Use 5/8" x 4" Std. Hook Anchor Bolts for matching weir № to corresponding trough. Embed Bolt 3" from end.

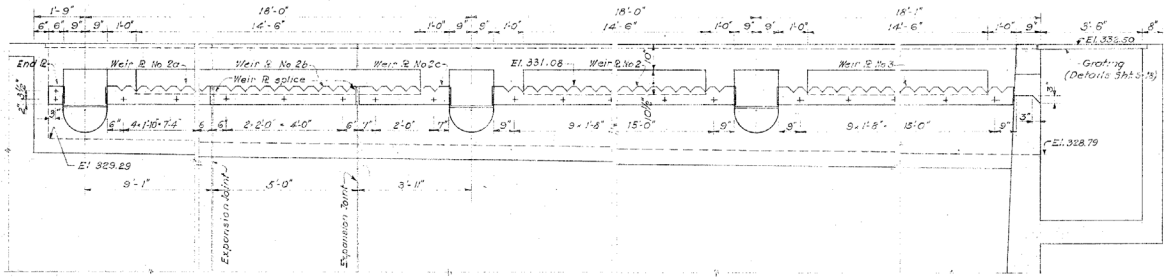


SECTION D-D

Scale: 1 1/2" = 1'-0"

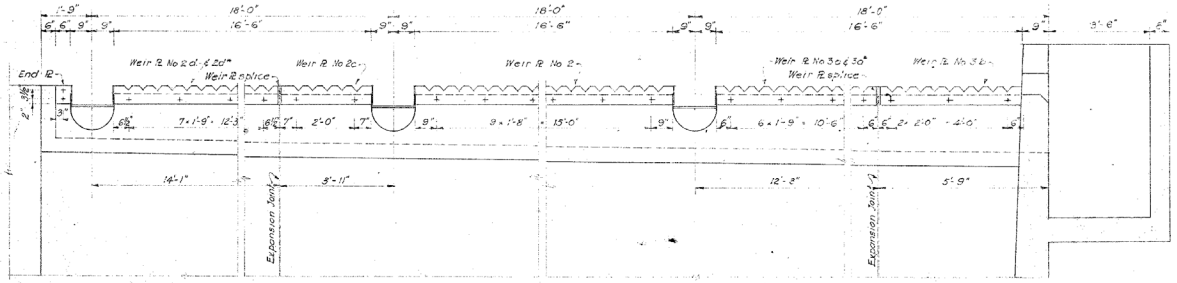
SECTION C-C

Scale: 1 1/2" = 1'-0"



SECTION P-P (See Sht. S-13)

Scale : 1/2" = 1'-0"



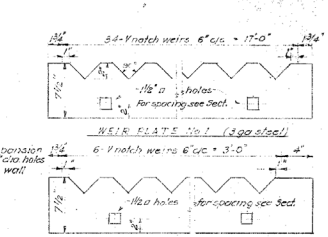
SECTION Q-Q (See Sht. S-13)

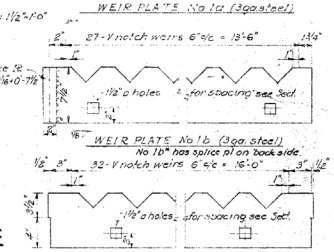
Scale : 1/2" = 1'-0"

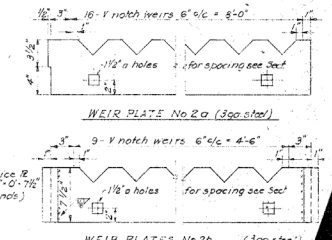
⚠ NOTE: Expansion joints relocated

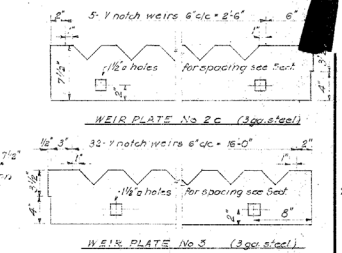
LIST OF WEIR PLATES:

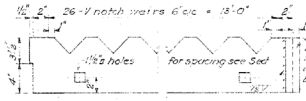
No	Ea	No	Ea
1	38	2d'	5
1a	4	2d"	5
1b	2	3	2
1b*	2	3a	5
2	12	3a*	5
2a	2	3b	10
2b	2	End №	12
2c	12		

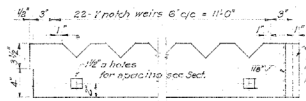


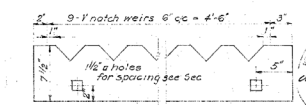












DATE	NO.	REVISION	BY
9-29-59	1	As Built	AJS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

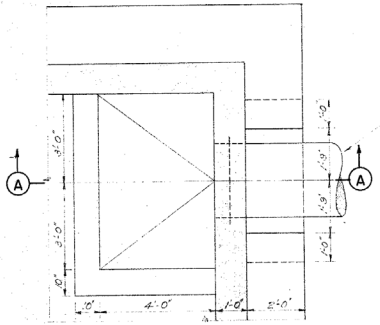
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS

SEDIMENTATION BASIN LAUNDERS

DESIGNED	F.F.H.	APPROVED	
DRAWN	F.F.H.	SCALE	As shown
CHECKED	E.A.S.	DATE	8-1-57
		FILE	160-3958

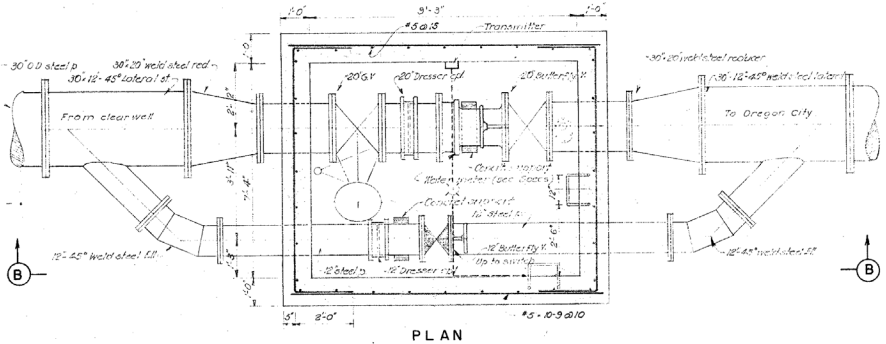
SHEET S20 OF 77



PLAN OF EFFLUENT BOX

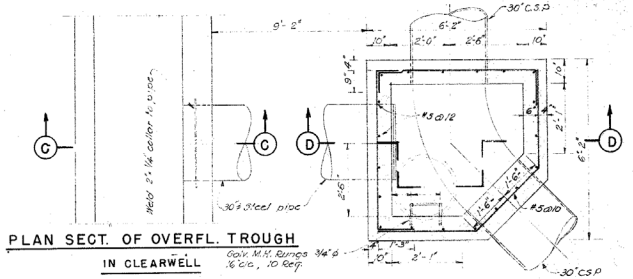
IN CLEARWELL

Scale: 1/2" = 1'-0"



PLAN

Scale: 1/2" = 1'-0"



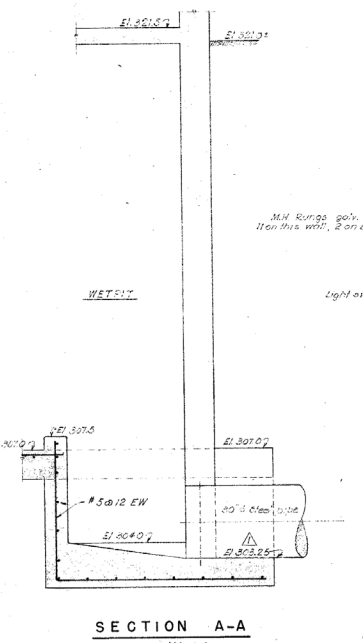
PLAN SECT. OF OVERFL. TROUGH

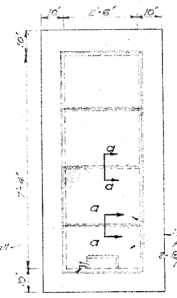
IN CLEARWELL

Scale: 1/2" = 1'-0"

PLAN SECTION OF M.H.

Scale: 1/2" = 1'-0"



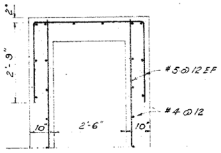


TOP VIEW

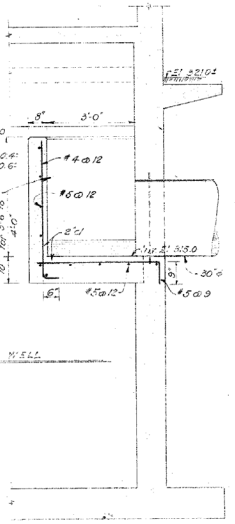
Scale: 1/2" = 1'-0"

SECTION B-B

Scale: 1/2" = 1'-0"

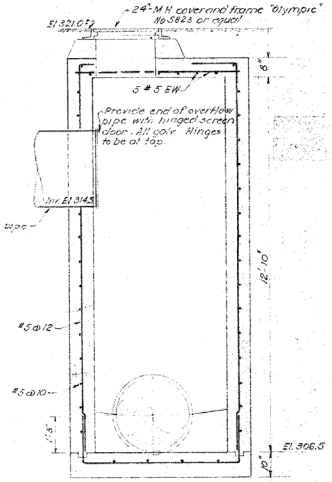


HALF SECTION E-E



SECTION C-C

Scale: 1/2" = 1'-0"



SECTION D-D

Scale: 1/2" = 1'-0"

CLEARWELL OVERFLOW M.H.

SECTION A-A

Scale: 1/2" = 1'-0"

METER M.H.

DATE	NO.	REVISION	BY
9-29-59	1	As Built	ATS

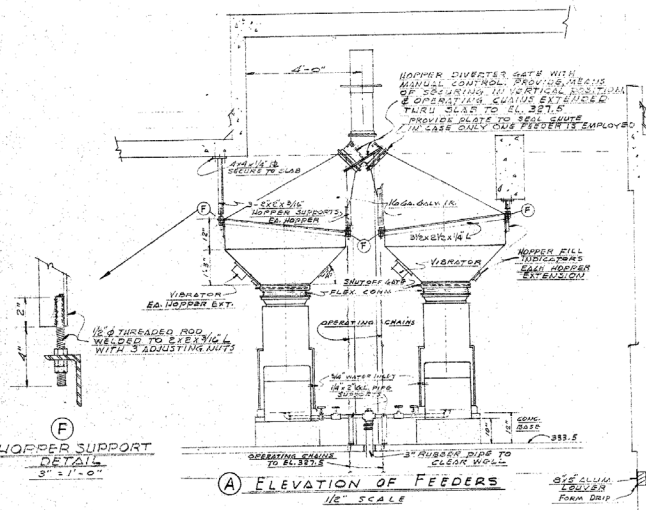
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS

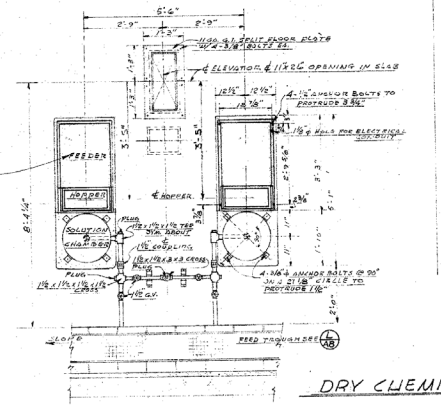
METER M.H. & CLEARWELL OVERFLOW

DESIGNED F.F.H.	APPROVED BY	SHEET	OF
DRAWN F.F.H.	SCALE As noted	S 21	77
CHECKED E.A.S.	DATE 6-1-57	FILE 1960-8054	



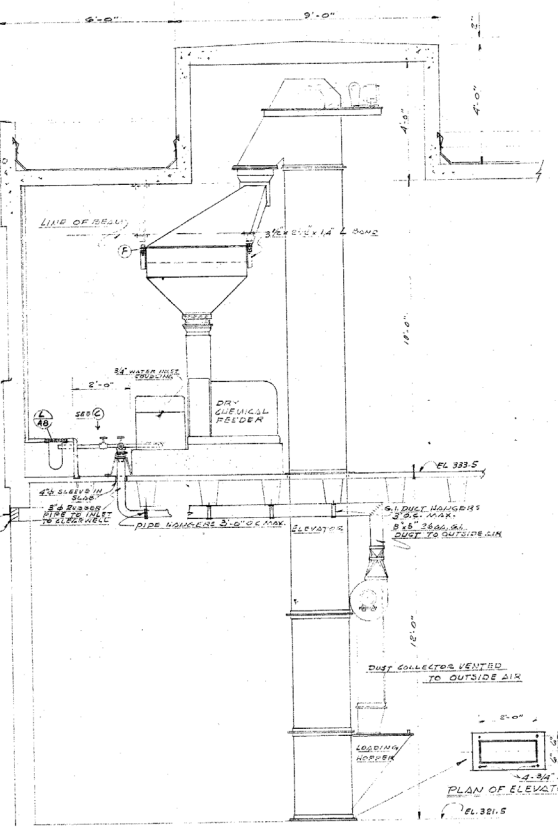
F HOPPER SUPPORT DETAIL
3" = 1'-0"

A ELEVATION OF FEEDERS
1/8" SCALE



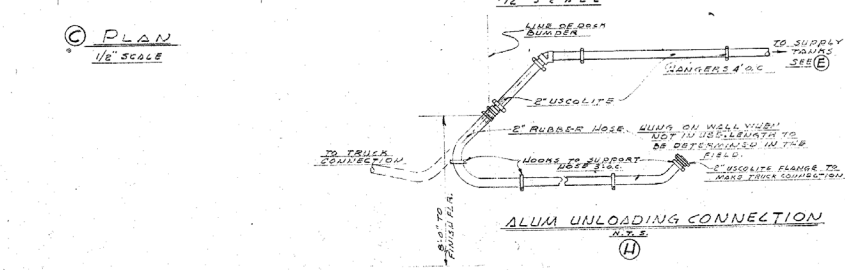
C PLAN
1/8" SCALE

Not included in present contract

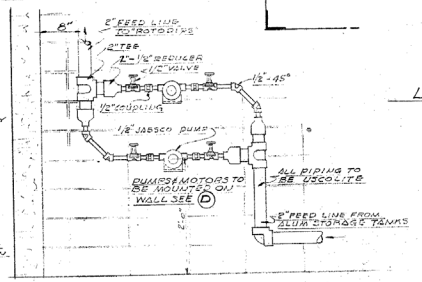


B SIDE ELEVATION - ELEVATOR & FEEDER
1/2" SCALE

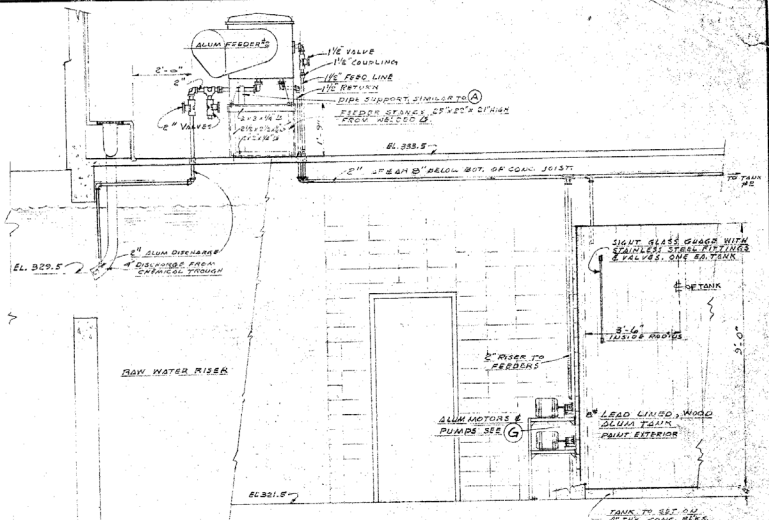
DRY CHEMICAL FEEDERS & ELEVATOR DETAILS
1/2" SCALE



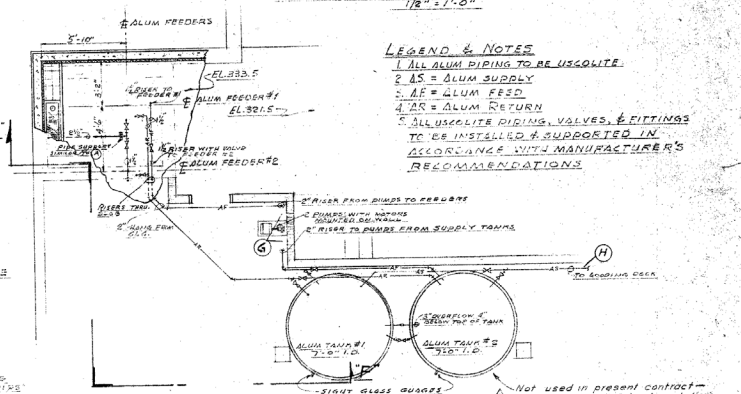
ALUM UNLOADING CONNECTION
N.T.S.
H



ALUM PUMP DETAILS
1" SCALE
G



D SECTION "F-F"
1/2" = 1'-0"



E PLAN 1/4"=1'-0"

Not used in present contract — Single horizontal tank installed per specifications.

LIQUID CHEMICAL DETAILS

LEGEND & NOTES
1. ALL ALUM PIPING TO BE USCOLITE
2. AS = ALUM SUPPLY
3. AF = ALUM FEED
4. AR = ALUM RETURN
5. ALL USCOLITE PIPING, VALVES, & FITTINGS TO BE INSTALLED & SUPPORTED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS

DATE	NO.	REVISION	BY
9-29-59	1	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

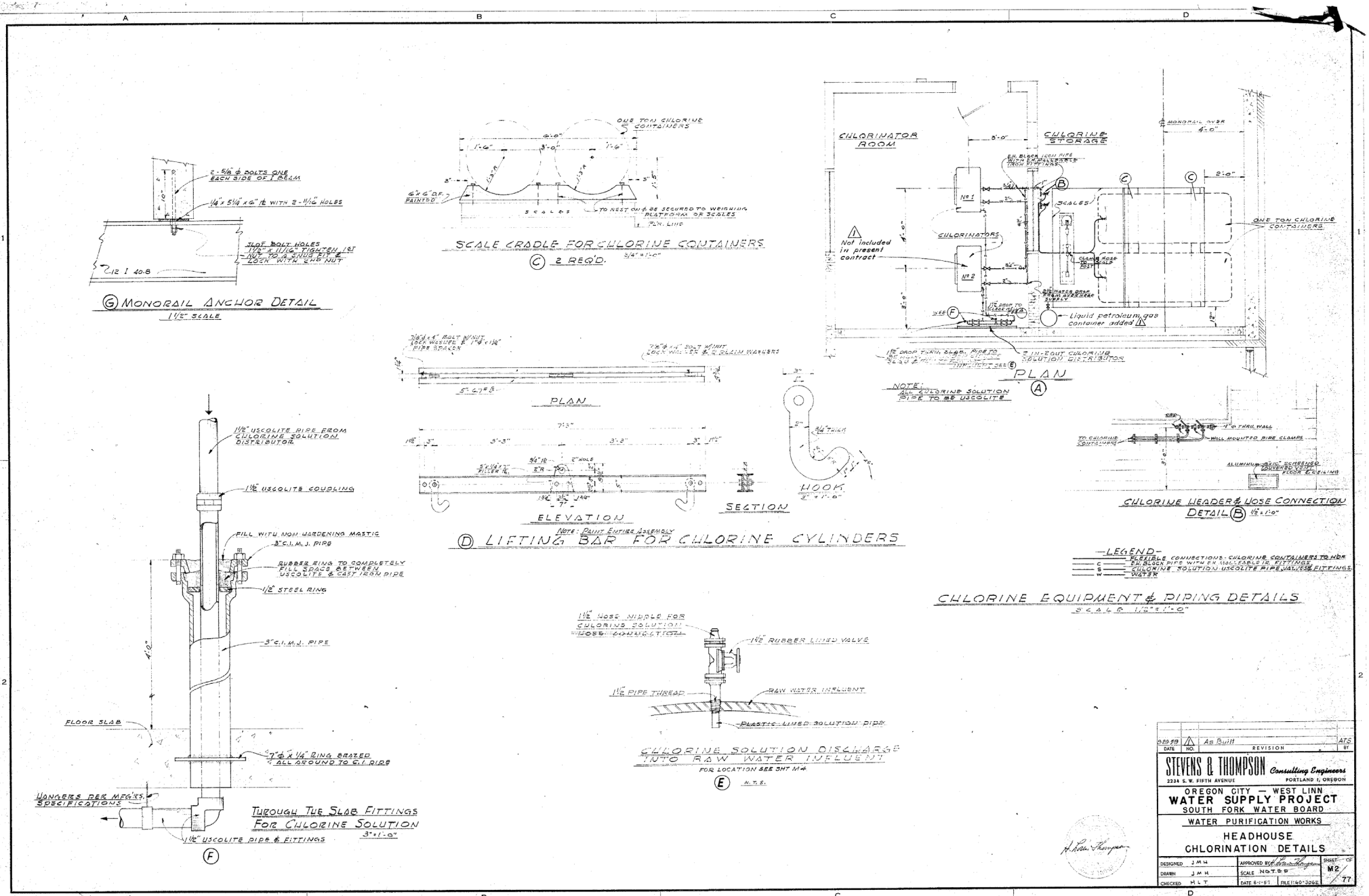
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS

HEADHOUSE - CHEMICAL FEEDERS & ELEVATOR DETAILS

DESIGNED	J.M.H.	APPROVED BY	
DRAWN	J.M.H.	SCALE	NOTED
CHECKED	H.L.T.	DATE	8-1-57

FILE 160-5861

SHEET M1 OF 77



(G) MONORAIL ANCHOR DETAIL
1 1/2" SCALE

SCALE CRADLE FOR CHLORINE CONTAINERS
(C) 2 REQ'D. 3/4" = 1'-0"

PLAN (A)
NOTE: ALL CHLORINE SOLUTION PIPE TO BE USCOLITE

NOTE: PAINT ENTIRE ASSEMBLY
(D) LIFTING BAR FOR CHLORINE CYLINDERS

CHLORINE HEADER & HOSE CONNECTION DETAIL (B) 1/2" = 1'-0"

THROUGH THE SLAB FITTINGS FOR CHLORINE SOLUTION
3" = 1'-0"
(F)

CHLORINE SOLUTION DISCHARGE INTO RAW WATER INFLUENT
FOR LOCATION SEE SHT M4
(E) N.T.S.

-LEGEND-
FLEXIBLE CONNECTIONS - CHLORINE CONTAINERS TO HDR
C — E.H. BLOCK PIPE WITH E.H. GALLEABLE IR. FITTINGS
S — CHLORINE SOLUTION USCOLITE PIPE, VALVES & FITTINGS
W — WATER

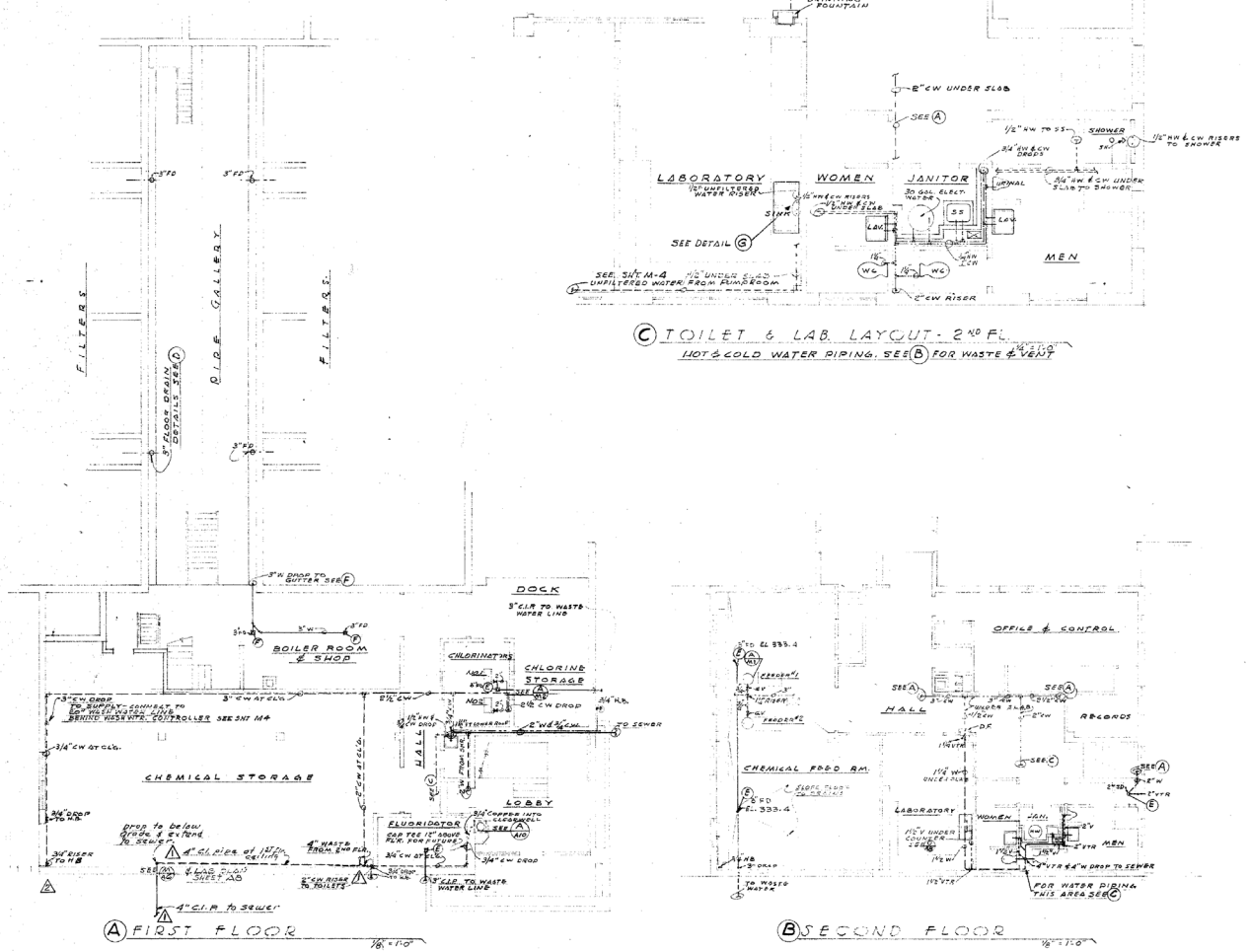
CHLORINE EQUIPMENT & PIPING DETAILS
SCALE 1/2" = 1'-0"

DATE	NO.	REVISION	BY
9-20-79	1	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
HEADHOUSE
CHLORINATION DETAILS

DESIGNED J M H	APPROVED BY H. Lou Thompson	SHEET M2 OF 77
DRAWN J M H	SCALE NOTED	
CHECKED H L T	DATE 8-1-57	FILE 1140-3062



DATE	NO.	REVISION	BY
9-29-58	1	As Built	ATS
11-1-67	2	sanitary waste relocated conc. increased underpipe & drains	JMH

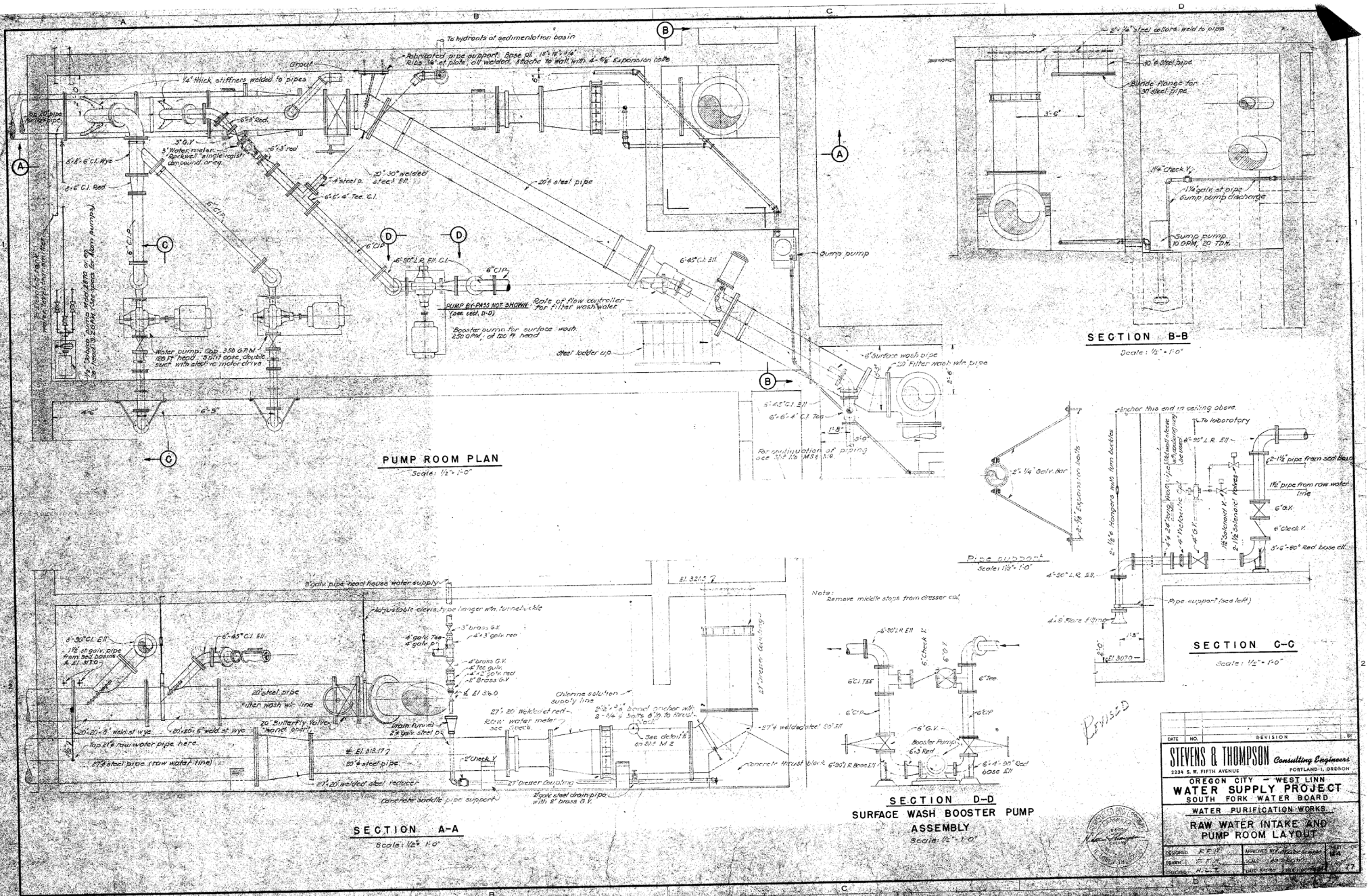
STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

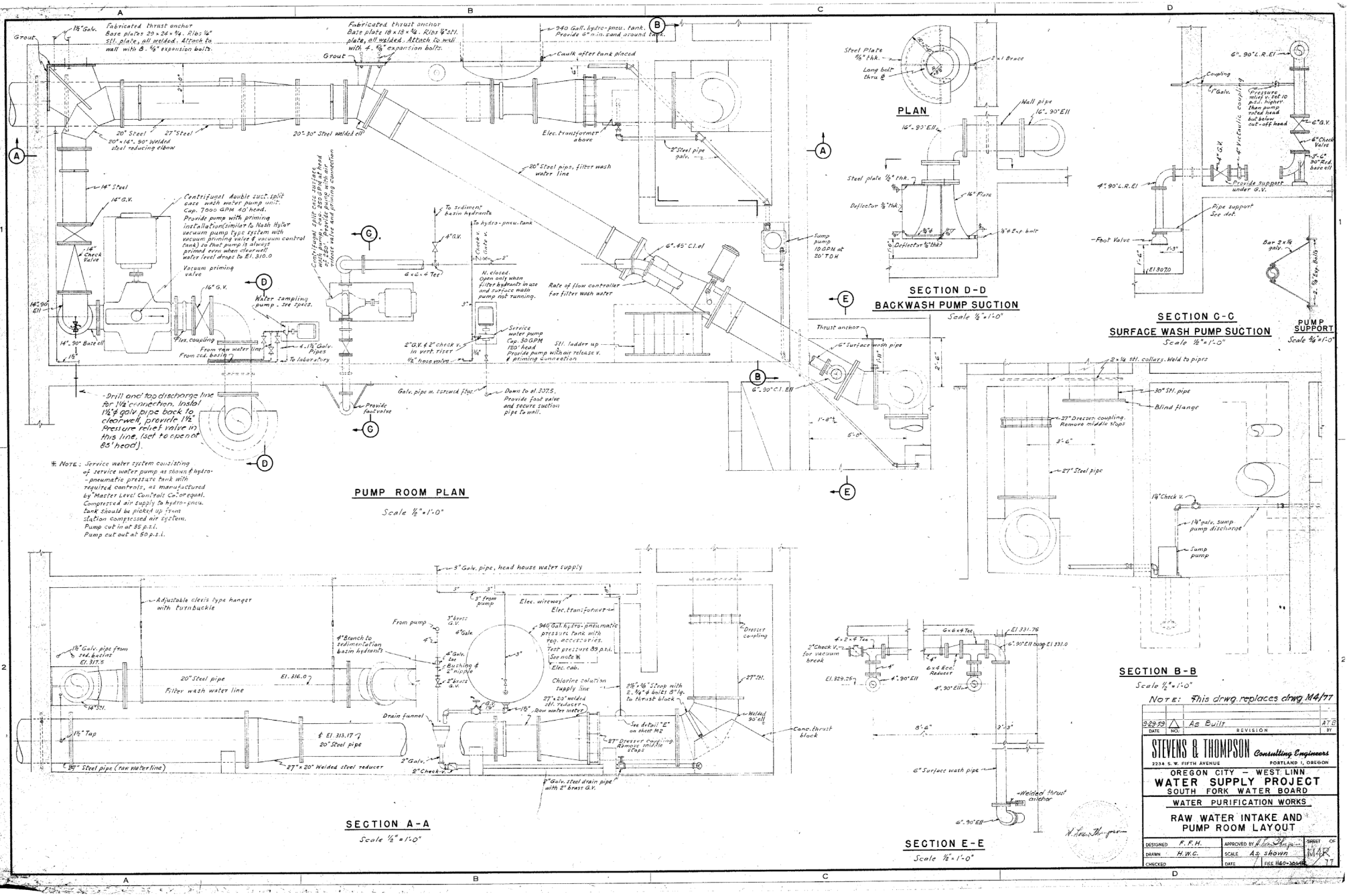
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS

HEADHOUSE & FILTERS
PLUMBING LAYOUT & DETAILS

DESIGNED J.M.H.	APPROVED BY	SHEET	OF
DRAWN J.M.H.	SCALE NOTED	M3	77
CHECKED P.L.K.	DATE 5-1-57	FILE 1140-3063	


To hydrants at sedimentation basin
Fabricated pipe support. Base pl. 18"x18"x3/4" with 1/4" pl. stiff welded. Attache to wall with 4-5/8" Expansion bolts
Grout
1/4" thick stiffners welded to pipes
20" steel pipe
6"CIP
6"x6"x4" Tee. C.I.
20" 30° welded steel S.E.
4" steel p.
6"x6"x3" red
3" G.V.
3" Water meter - Sparling "Tapcwel" single-register compound, or eq.
6"x6"x6" C.I. Wye
6"x6" C.I. Red
4"x6" C.I. Red
6"x4" C.I. Red
6"x6"x6" C.I. Wye
6"x6" C.I. Red
6"CIP
4"-90° L.R. Ell. C.I.
PUMP BY-PASS NOT SHOWN (see sect. D-D)
Rate of flow controller for filter wash water
"Booster pump for surface wash 250 GPM, @ 120 ft. head
Water pump: cap. 350 G.P.M. 180 ft. head, 3 unit case, double suct. with electric motor drive
Steel ladder u/o
Bump pump
6"-45° C.I. Ell.
6"x6"x4" C.I. Tee
6"Surface wash pipe
20" Filter wash w/in pipe
11.5"
5'-0"
For continuation of piping see 11-1 to 11-3 & M.S.& I. 4
4'-6"
6'-9"
PUMP ROOM PLAN
Scale: 1/2" = 1'-0"
2"-1/4" steel collars weld to pipe
30" ø steel pipe
Bonide flange for 30 steel pipe
3'-6"
1 1/4" Check V.
1 1/4" galv. st. pipe Bump pump discharge
Sump pump 10 GPM, 20 T.D.H.
SECTION B-B
Scale: 1/2" = 1'-0"
8" galv. pipe wood house water supply
Adjustable clevis type hanger w/in turnbuckle
3" brass G.V.
4"x3" galv. red
4" galv. Tee
4" gate p.
4" Brass G.V.
4" Tee galv.
4"x2" galv. red
2" Brass G.V.
E El. 336
E El. 321.5
27" Intake Casing
Chlorine solution supply line
6'-3"x3/4" bonnd anchor with 2-3/4" ø bolts 6" to thread
27" 20° Welded steel red.
Rich water meter see sheet
See detail 'E' on Sht. M 2
27"x4" welded steel S.E.
Concrete thrust u/o
27" Diaster Coupling
6" Check V.
E El. 318.17.2
20" steel pipe.
27"x20" welded steel reducer
Concrete saddle pipe support
Rigid steel drain pipe with 2" brass G.V.
6'-3" C.I. Ell.
1 1/2" st. galv. pipe from test Basin E. El. 317.0
20" steel pipe
Main wash w/e line
20"x20"x8" weld. st. wye
20"x20"x6" weld. st. wye
Top 21"ø raw water pipe here
27"ø steel pipe (raw water line)
20" Butterfly Valve bonnet apart
SECTION A-A
Scale: 1/2" = 1'-0"
Note: Remove middle stops from dresser cpl.
6"-90° L.H. Ell.
6" Check V.
6"CI TEE
6" Tee.
6"CIP
6"G.V.
Booster Pump 6"x3 Red
6"x4"-90° Red base Ell.
6"-90° L.R. Base Ell.
SECTION D-D
SURFACE WASH BOOSTER PUMP ASSEMBLY
Scale: 1/2" = 1'-0"
Anchor this end to ceiling above
To laboratory
6"-90° L.R. Ell.
2-1/2" pipe from soft Basin
1 1/2" pipe from raw water line
6" G.V.
6" Check V.
3'-6"-90° Red base ell.
2-1/2" Solenoid V.
2-1/2" Solenoid Valves
2-1/2"ø Hangers with turnbuckle adjusting (see detail)
3/4" ø 24" Strap
4" Nipple
4" G.V.
4"-90° L.R. Ell.
Pipe support (see left)
4'-8" Flange fitting
2'-0"
El 307.0
SECTION C-C
Scale: 1/2" = 1'-0"
2'-1/4" Galv. Bar
2'-5/8" Expansion bolts
2-1/2"ø Hangers with turnbuckle
Pipe support
Scale: 1/2" = 1'-0"
REVISED
DATE NO. REVISION BY
STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON
OREGON CITY - WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
RAW WATER INTAKE AND PUMP ROOM LAYOUT
DESIGNED E.F.T.
DRAWN E.F.T.
CHECKED H.L.T.
APPROVED
SCALE AS SHOWN
DATE AUG. 1951
SHT. 4
27



✻ NOTE: Service water system consisting of service water pump as shown & hydro-pneumatic pressure tank with required controls, as manufactured by "Master Level Controls Co" or equal. Compressed air supply to hydro-pneu. tank should be picked up from station compressed air system. Pump cut in at 35 p.s.i. Pump cut out at 50 p.s.i.

NOTE: This drwg. replaces drwg M4/77

DATE	NO.	REVISION	BY
9-29-79	1	As Built	ATS

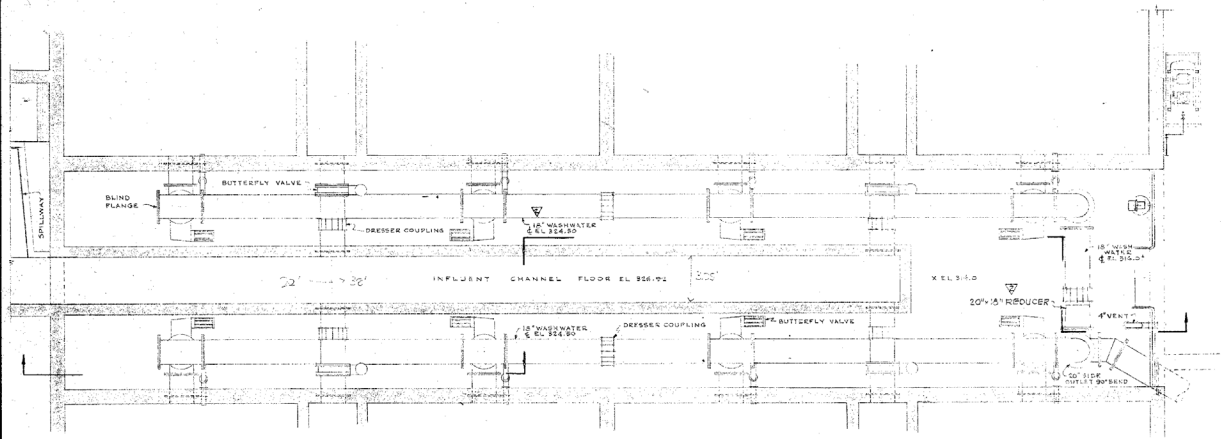
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY – WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS

RAW WATER INTAKE AND PUMP ROOM LAYOUT

DESIGNED	F. F. H.	APPROVED BY	H. Lee Thompson
DRAWN	H. W. C.	SCALE	As shown
CHECKED		DATE	FILE H60-30MR

SHEET M4R OF 77

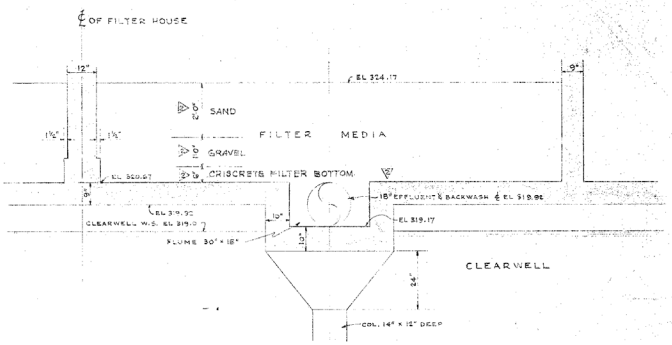


PLAN

ARRANGEMENT IN PIPE GALLERY

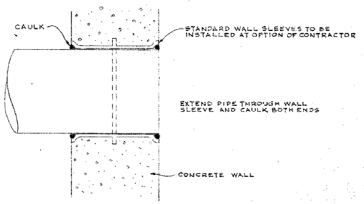
(SUPPLY PIPING TO FILTER BED AGITATORS OMITTED)

SCALE: 1/4" = 1'-0"



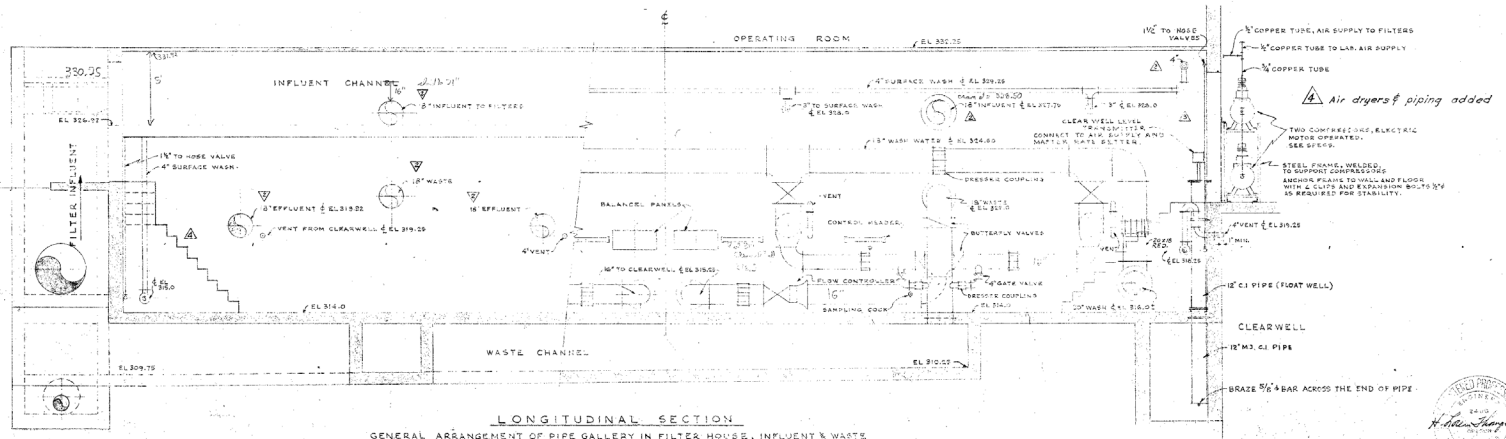
SECTION THROUGH FILTER

SCALE: 1/4" = 1'-0"



ALTERNATE WALL SLEEVE

NOT TO SCALE



LONGITUDINAL SECTION

GENERAL ARRANGEMENT OF PIPE GALLERY IN FILTER HOUSE, INFLUENT & WASTE

SCALE: 1/4" = 1'-0"

Air dryers & piping added

DATE	NO.	REVISION	BY
9-23-59	3	As built	ATS
12-18-57	2	SIPHON BREAKER REMOVED	H.W.C.
12-11-57	2	REVISE FILTER BOTTOM, CHANGE PIPE SIZE	H.W.
11-19-57	1	SIPHON BREAKER ADDED TO SURFACE WASH	H.W.

STEVENS & THOMPSON Consulting Engineers

2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN

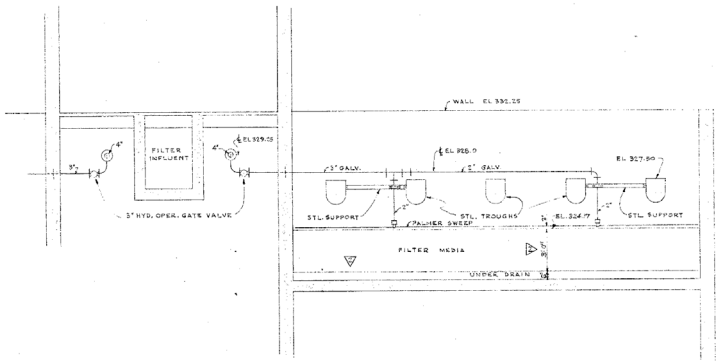
WATER SUPPLY PROJECT

SOUTH FORK WATER BOARD

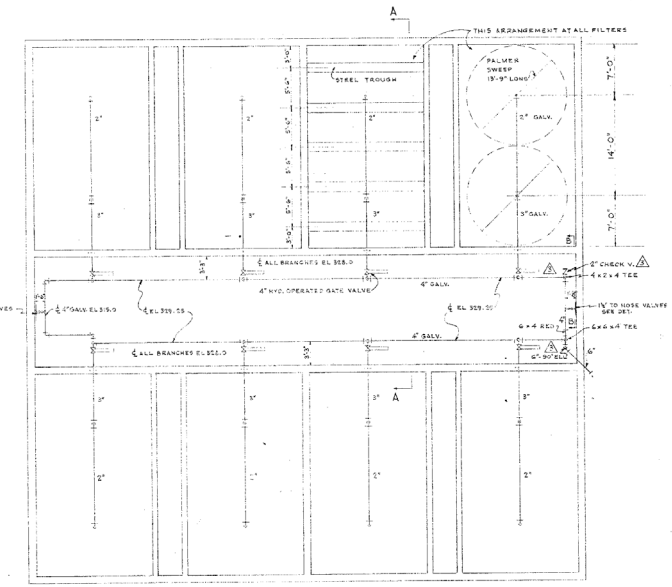
WATER PURIFICATION WORKS

FILTERS — PLAN OF PIPE GALLERY & SECTIONS

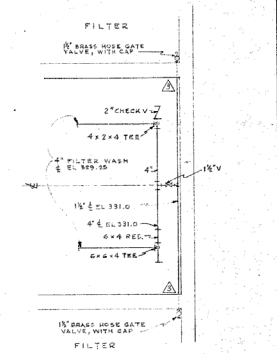
DESIGNED	H.L.T.	APPROVED BY	SHEET	OF
DRAWN	H.W.C.	SCALE	M5	77
CHECKED	H.L.T.	DATE 8-1-57	FILE 1160-3068	



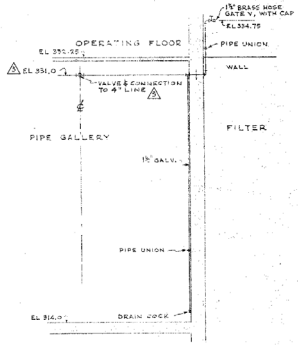
SECTION A-A
SCALE: ¼" = 1'-0"



PLAN
ARRANGEMENT OF PALMER FILTER BED AGITATORS, PIPING & VALVES
SCALE: ⅛" = 1'-0"

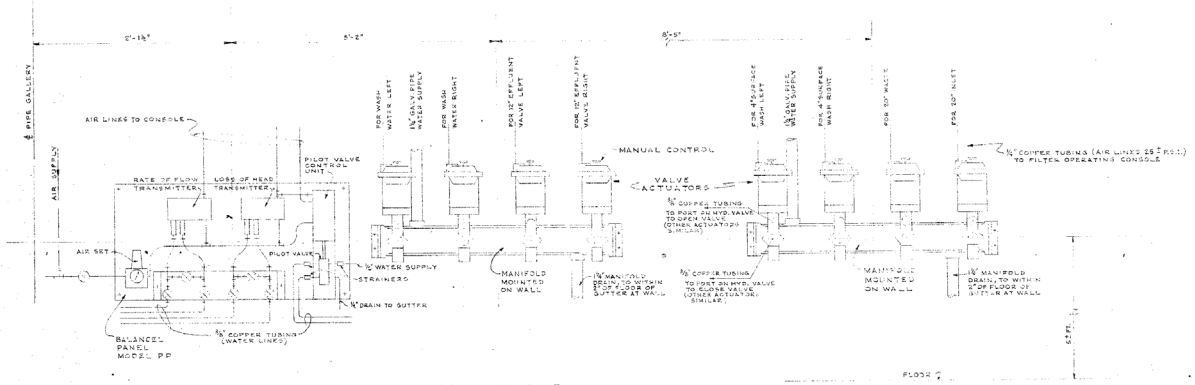


PLAN
SCALE: ¼" = 1'-0"



SECTION B-B

TYPICAL ARRANGEMENT OF HOSE VALVE (4 REQ'D)
SCALE: ¼" = 1'-0"



TYPICAL ARRANGEMENT OF BALANCEL PANEL, WITH AIR OPERATED DIAPHRAGM VALVES & MANIFOLD, TO OPERATE HYDRAULIC CYLINDERS OF BUTTERFLY VALVES

NOT TO SCALE

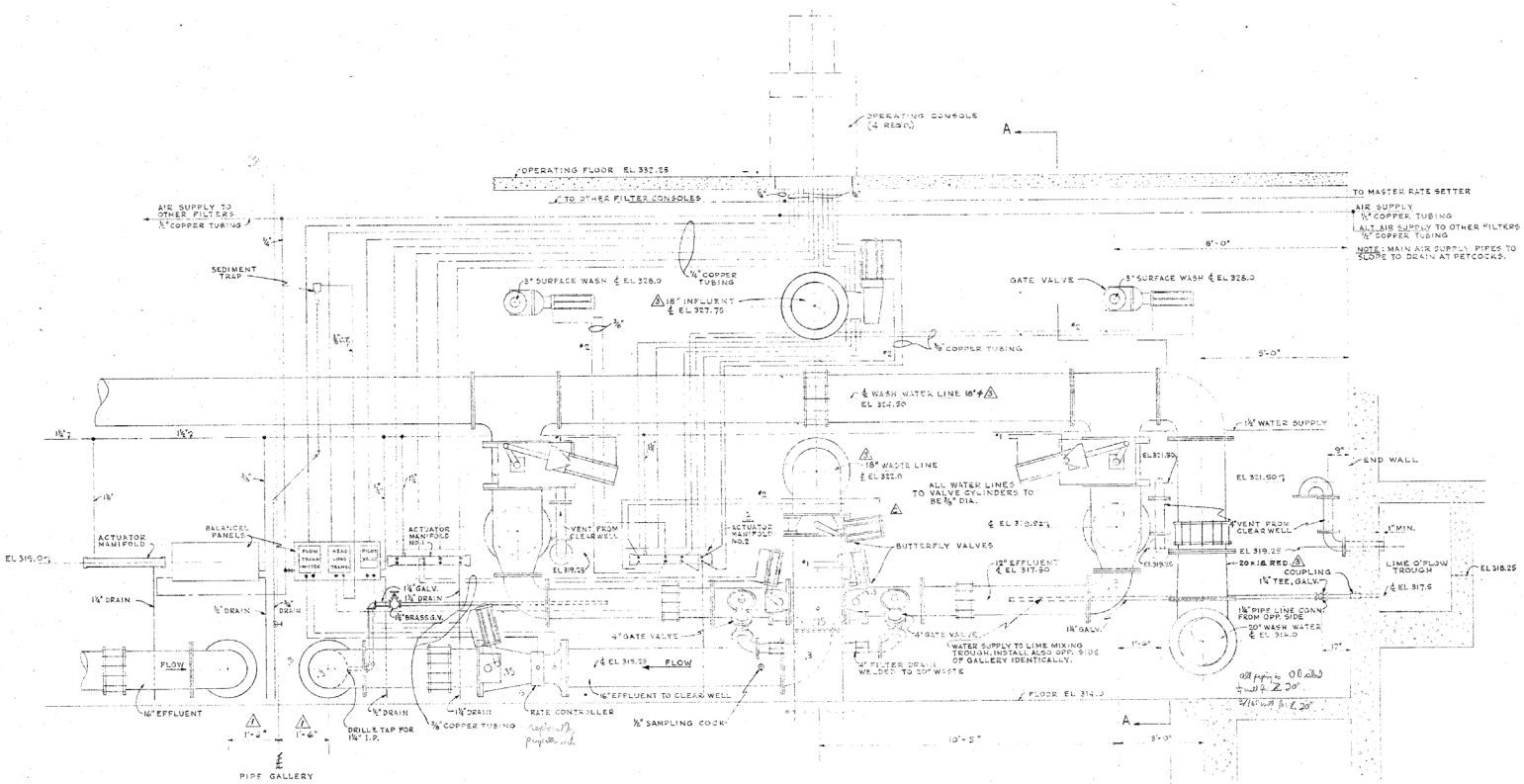
DATE	NO.	REVISION	BY
9-29-59	1	As Built	ATS
12-18-57	3	MOVED 1 SIP'N. BKR., REMOVED 1 SIP'N. BKR., ALTERED PIPG	H.W.G.
12-21-57	2	REVISE FILTER BOTTOM, SEC. A-A	L.K.H.
11-19-57	1	STRINGER BREAKER ADDED TO SURFACE WASH	J.M.H.

STEVENS & THOMPSON *Consulting Engineers*
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS
FILTER PLAN & SECTIONS
MISC. PIPING DETAILS

DESIGNED	HLT	APPROVED BY		SHEET M6 OF 77
DRAWN	HWC	SCALE		
CHECKED	HLT	DATE 8-1-57	FILE 1160-3066	



TYPICAL PIPING FOR EACH FILTER

FOUR REQUIRED, WITH TWO (ONE L.H. & ONE R.H.) ON EACH SIDE OF PIPE GALLERY

PIPING DETAIL

SCALE: ½" = 1'-0"

LEGEND

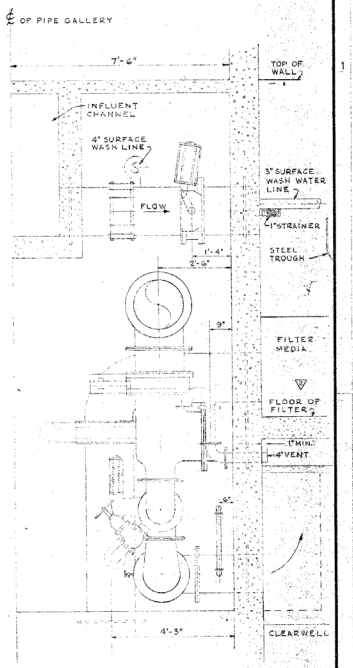
——— WATER LINE

— - — - — AIR LINE

NOTES

1. OPERATING PRESSURES ON WATER OPERATED CYLINDERS 35 P.S.I. CYLINDERS TO BE TESTED TO 150 P.S.I.
2. BUTTERFLY VALVES TO BE A.W.W.A. C504 (PRATT), CLASS AS BELOW:

EFFLUENT	CLASS 25-B
INFLUENT	CLASS 25-B
WASTE	CLASS 25-B
WASHWATER	CLASS 50-B



SECTION A-A

TYPICAL ARRANGEMENT OF PIPES ON ONE SIDE OF PIPE GALLERY (IDENTICAL LAYOUT BOTH SIDES)

SCALE: ½" = 1'-0"

DATE	NO.	REVISION	BY
9-29-59	3	As Built	ATS
12-17-57	2	Reduced north water & waste lines from 20" to 18"	HWC
10-17-57	1	Revised Filter Bottom. Eliminated Gold lines	J.K.H.
9-13-57	0	Dimensions Changed	J.M.T.

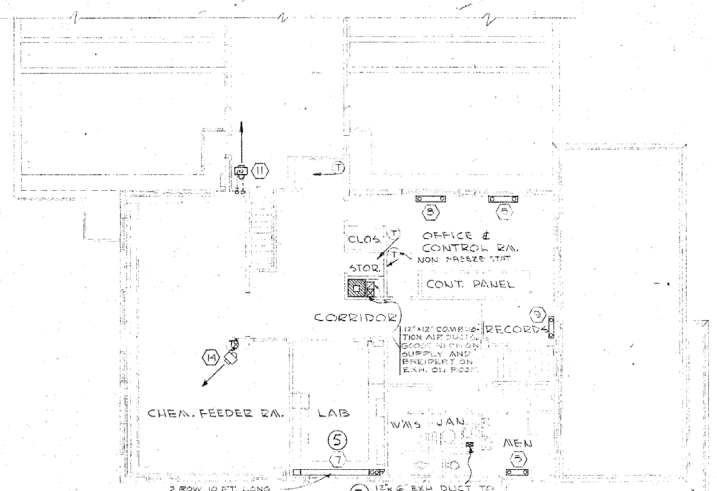
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

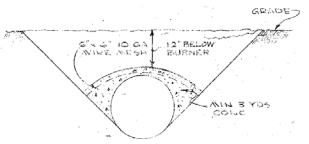
WATER PURIFICATION WORKS

TYPICAL PIPING FOR FILTER

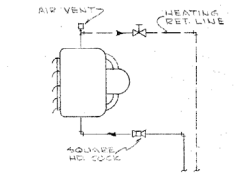
DESIGNED	H L T	APPROVED BY	SHEET M7 OF 77
DRAWN	H W C	SCALE As noted	
CHECKED	H L T	DATE 8-1-57	FILE 1160-3961



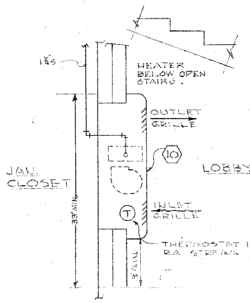
SECOND FLOOR - HEATING
SCALE - 1/8" = 1'-0"



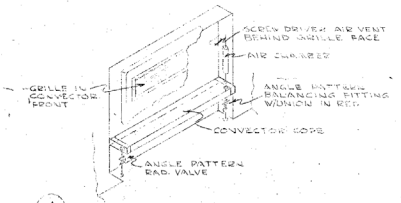
(1) OIL TANK HOLD DOWN DETAIL
NO SCALE



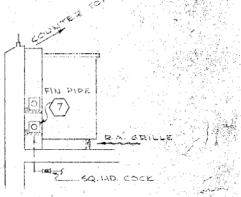
(2) UNIT HEATER PIPING DIAGRAM
NO SCALE



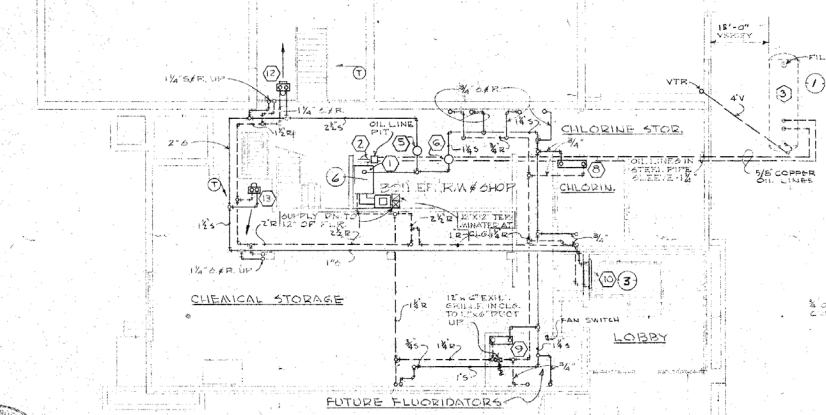
(3) SEMI-RECESSED FORCE FLOW CONVECTOR
NO SCALE



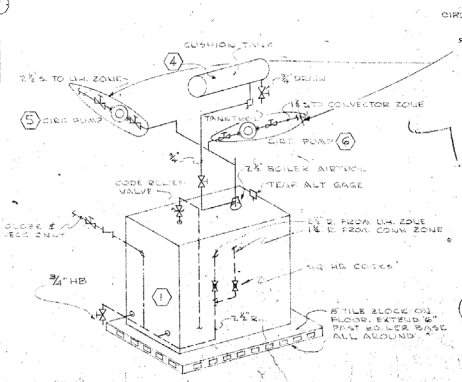
(4) CONVECTOR PIPING DIAG.
NO SCALE



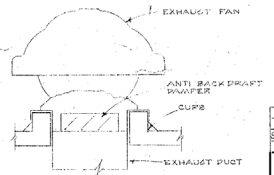
(5) LAB. FIN PIPE DETAIL
NO SCALE



FIRST FLOOR PIPING
SCALE - 1/8" = 1'0"



(6) BOILER PIPING DIAGRAM
NO SCALE



(7) EXHAUST FAN DETAIL
NO SCALE

EQUIPMENT LIST

MARK NO.	DESCRIPTION	SIZE AND/OR CAPACITIES	REMARKS
1.	BOILER - (WATER)	338 MBH NET I=B= 2255 SQ FT. WATER NET I=B=	TRIM FOR 30 PSI WATER
2.	OIL BURNER	5 GPH DIESEL SET AT 4.5 GPH	
3.	OIL STORAGE TANK	1000 GAL. CAP. DIESEL	UNDERWRITERS APPROVED
4.	CUSHION TANK	40 GAL CAP. 13"x 71"	
5.	UNIT HEATER ZONE CIRC. PUMP	33 GPM @ 12 HEAD	
6.	CONVECTOR ZONE CIRC. PUMP	17 GPM @ 9' HEAD	
7.	FIN PIPE RADIATION	1" IPS - 3 5/8" x 3 3/8" FINS, AVG. 1300 S" WET. EQUIV. HIGH 180°F AVG. WATER	
8.	CONVECTOR	32" HIGH, (36" FL. TO TOP) 10' WIDE, 48" LONG, 12.7 MBH 180°F AVE. WATER, 10°F DROP	WALL HUNG, FRONT OUTLET TYPE
9.	CONVECTOR	32" HIGH (36" FL. TO TOP) 4' WIDE, 32" LONG, 8.4 MBH 180°F AVE WATER 10°F DROP	WALL HUNG, FRONT OUTLET TYPE
10.	FORCE FLOW CONVECTOR	800 CFM STD AIR, 35,000 BTU/HR 180°F AVE WATER 10°F DROP	SEMI RECESSED WITH SELF CONTAINED THERMOSTAT
11.	OVERHEAD UNIT HEATER	40,000 BTU/HR, 180°F AVE WATER 60°F EA. @ 10°F DROP	MAX. RPM - 1500
12.	PIPE COILED UNIT HEATER	40,000 BTU/HR 180°F AVE WATER 60°F EA. @ 10°F DROP	MAX. RPM. - 1500
13.	CHEMICAL STORE UNIT HEATER	35,000 BTU/HR 180°F AVE WATER 60°F EA. @ 10°F DROP	MAX. RPM - 1500
14.	CHEM. FEEDER RM. UNIT HEATER	50,000 BTU/HR 180°F AVE WATER 60°F EA. @ 10°F DROP	MAX. RPM - 1500
15.	FLOOR SIDE WALL EXH. FAN	240 CFM @ 1/8 S.P. 2800 FPM MAX TIP.	1/20 HP

DATE	NO.	REVISION	BY
9-29-59	△	As Built	ATS

STEVENS & THOMPSON Engineers - Architects
PORTLAND OREGON

OREGON CITY - WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS

HEATING PLAN & DETAILS

DESIGNED B.M. | APPROVED BY
DRAWN T. | SCALE NOTED | SHEET OF M8 / 77
CHECKED H.O. | DATE 8-1-57 | FILE 1960-3081

REGISTERED PROFESSIONAL ENGINEER
OREGON
MAY 9, 1951
BRUCE MACMASTER

TYPE	FIXTURE SCHEDULE
A	ABOLITE NO. RF-200 AWSN, VENTED RLM TYPE, 200W
B	Mc PHILBEN NO. 92-88, SATIN ALUMN. FINISH, 200W
C	Mc PHILBEN, SIMILAR TO NO. 43-45 BUT FOR 200W. SATIN AL.
D	Mc PHILBEN, NO. 43-45, SATIN ALUMN. FINISH, 100W
E	DAY-BRITE NO. 2501 RECESSED UNIT-2-60W. ALUMN. TRIM
F	PRESCO LITE SIMILAR TO NO. AX-54 WITH 2-150W FLDS. ALFIN.
G	STEBER LITE NO. S-5001, 1-150W FLD. LIGHT (PAR 38)
H	STEBER LITE NO. S-5002, 2-150W FLD. LIGHTS (PAR 38)
I	STEBER LITE NO. S-5003, 3-150W FLD. LIGHTS (PAR 38)
K	ALABAX NO. AL-859, PORCELAIN, PULL-CHAIN 4⅝" DIA.
L	ALABAX NO. 2380, PORCELAIN, BRKT, WITH ONE OUTLET
M	ABOLITE NO. RF-100 AWSN, VENTED RLM TYPE, 100W
N	APPLETON NO. VC2050G, SCREW TYPE 200W
O	HOLOPHANE NO. 415 BRKT, ALUMN. FINISH, 100W.
P	ALLBRITE AREA-LITER NO. 10248-RS & FAOTIERS LAMP
Q	GOODRICH NO. 67750, 500W, 2" PIPE COL, HOPE BOX "HH2100
R	WESTINGHOUSE NO. AH-16NS FLD. LIGHT, STIPPLED, 1000W

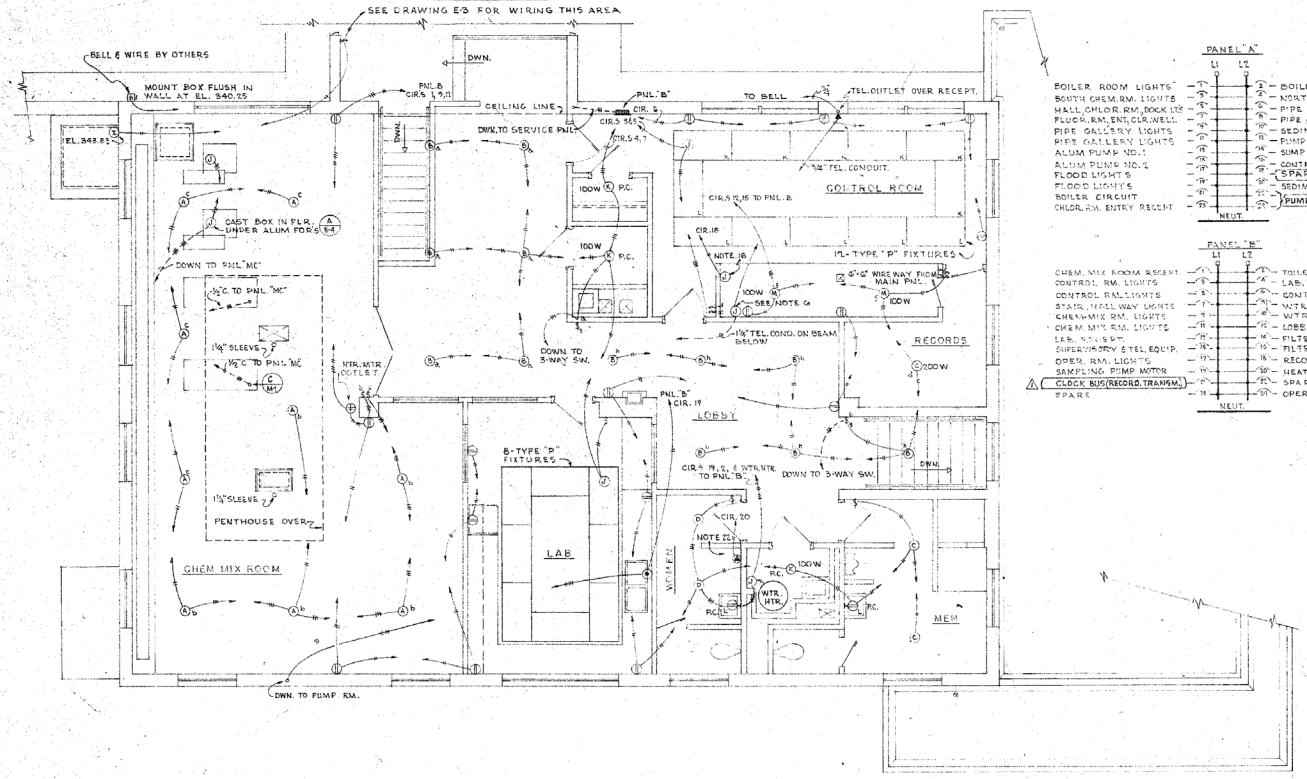
NOTE: ALL FIXTURES TO BE FURNISHED COMPLETE WITH LAMPS

LEGEND

- BRACKET LIGHT WITH OUTLET
- BRACKET LIGHT
- 120V DUPLEX "T" SLOT, 10AMP. RECEPT.
- MOTOR
- BELL
- CEILING LIGHT (TYPE A INDICATED)
- S.P.S.T. WALL SWITCH RATED
- 3-WAY SWITCH, "T" RATED 20AMP, 120V. (CONTROLS OUTLETS MARKED "d")
- MOMENTARY CONTACT, 5AMP, 120V
- MOTOR CONTROL STATION AT MOTOR
- TELEPHONE OUTLET
- JUNCTION BOX
- CONDUIT IN FLOOR SLAB OR UNDERGROUND
- CONDUIT IN WALLS OR CEILING OR EXPOSED
- FORCED AIR HEATER OUTLET (SIMILAR TO P&S NO. 57B1)
- SPECIAL CONTROL OUTLET (SEE NOTE 21)
- 1000 W. MTR. FLUSH MOUNTED
- 37.5 KVA, 10 DRY TYPE TRANSFORMER

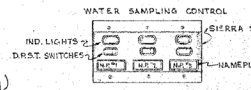
NOTES

1. THESE DRAWINGS ARE DIAGRAMMATIC & ARE INTENDED TO SHOW LOCATION OF ELECTRICAL OUTLETS & COMPONENTS RELATIVE TO DOORS, WINDOWS, WALLS & MACHINERY. DO NOT SCALE DWGS FOR DIMENSIONS.
2. REFER TO ARCHITECTURAL DWGS FOR ROOM FINISHES & DIMENSIONS.
3. ALL WIRING WITHIN HEAD HOUSE TO BE CONCEALED WITH THE FOLLOWING EXCEPTIONS: (a) WIRING IN PIPE GALLERY (b) WIRING IN PUMP RM. (c) 1¼" TEL. SERVICE CONDUIT (d) THAT SHOWN EXPOSED IN DETAILS.
4. THE CONNECTED LOAD SERVED BY PNLS A & B TO BE BALANCED BETWEEN L1 & L2 AS NEAR AS POSSIBLE.
5. INSTALL ONE RECEPT. IN CEILING NEAR UNIT HEATERS & RUN RUBBER CORD TO FAN MOTOR. VERIFY LOCATION OF OUTLETS AT UNIT HEATERS IN FIELD BEFORE ROUGH-IN.
6. INSTALL 4⅝" SQ. BOX ON WALL, RUN ¾" TEL. CONDUIT ON SURFACE TO CEILING. CONCEAL CONDUIT FOR BALANCE OF RUN.
7. MOUNT FIXTURES TYPE "A" & "M" ON STEMS. BOTTOM OF REFLECTORS TO BE 10'-0" UP FROM FLOOR.
8. MOUNT WALL SWITCHES 48" UP TO CENTER.
9. MOUNT CONVENIENCE OUTLETS 12" UP TO CENTER IN VERTICLE POSITION EXCEPT THOSE SHOWN OVER WORK BENCHES & COUNTERS WHICH WILL BE 40" UP TO CENTER.
10. TELEPHONE OUTLET TO BE 90" UP TO CENTER IN VERT. POSITION.
11. MOUNT BRACKET LIGHTS TYPE "L" 6'-6" UP & CENTERED OVER BASIN.
12. MOUNT PANEL "B" 48" UP TO BOTTOM.
13. MOUNT FIXTURE TYPE "T" ON 14" STEM.
14. CIRCUIT 21 TO SERVE CIRCULATING PUMPS MARK 5 & 6 (SEE HEATING DWG. M-8) LOCATION OF OUTLET BOXES FOR THESE ITEMS TO BE DETERMINED IN FIELD.
15. FLD. LIGHT S.P.S.T. SW. ON CONSOLE MOUNTED BY MANUFACTURER.
16. MOUNT JCT. BOX ON WALL AT EL. 339.5 FOR RECORDER MTR. BUS.
17. WIRING FOR ELECTRICAL METERING TRANSMITTERS NOT SHOWN. INSTALLATION TO BE MADE FOR ELECTRICAL OR PNEUMATIC TRANSMITTERS SUPPLIED AS DIRECTED BY THE ENGINEER.
18. TIME CLOCK TO HAVE ASTRONOMICAL DIAL, 30A RATING, ONE ON, ONE OFF PERIOD IN 24 HRS. SUITABLE FOR FLOOD LIGHT SERVICE. SANGAMO OR PARAGON.
19. MOUNT JCT. BOX IN CEILING. INSTALL BOX EXTENSION ON FLUSH BOX & RUN EXPOSED CONDUIT TO COMPRESS. MOTORS & PRESS. SW'S. CONNECTION TO MOTOR TO BE FLEX.
20. RUN TWO ¾" CONDUITS FROM PNL. (MC) TO JCT. BOX IN CEILING.
21. PROVIDE SUITABLE BACKING FOR ALL OUTLETS MOUNTED ON SUSPENDED CEILING.
22. INSTALL 3-10A, 120V D.P.S.T. DESPARD SWITCHES AND 3-5WATT NEON PILOT LIGHTS IN A 3-GANG BOX. MOUNT NAMEPLATE UNDER EACH SWITCH. SEE DETAIL "A" BELOW.
23. INSTALL 1000 W. FLUSH MTR. WESIX NO. 10 PC. IN WALL 6" UP FROM FLR. TO BOTTOM.
24. INSTALL ¾" CONDUIT FROM PNL. (MC) TO JCT. BOXES ON WALL NEAR CEILING IN PIPE GALLERY EXTEND CONTROL CIRCUIT FROM JCT. BOXES TO CONSOLES IN OPERATING ROOM ABOVE WITH FLEXIBLE CONDUIT. SEE SCHEMATIC WIRING DIAGRAMS.
25. CONNECTIONS OF CONTROL & POWER CABLES SHALL BE MADE UP ON APPROVED TERMINAL STRIPS OR DEVICES. WIRES BETWEEN TERMINALS SHALL NOT BE SPLICED.



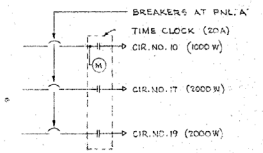
SWITCH & OUTLET SCHEDULE

DEVICE	120V. RATE	COLOR	MAKE
OUTLETS	10 AMP.	BLACK	BRYANT
SWITCHES	20AMP	BLACK	BRYANT
PLATES	—	STN. STL.	SIERRA



DETAIL A

(SEE SHT. E2 FOR SCHEMATIC DIA.)



CIRCUITS CONTROLLED BY TIME CLOCK

DATE	NO.	REVISION	BY
11-18-57	1	REVISED CIR. SCHEDULE FOR PNL'S A & B ADD DRY-TYPE TRANS. SYMBOL	KM

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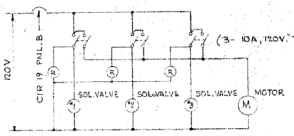
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

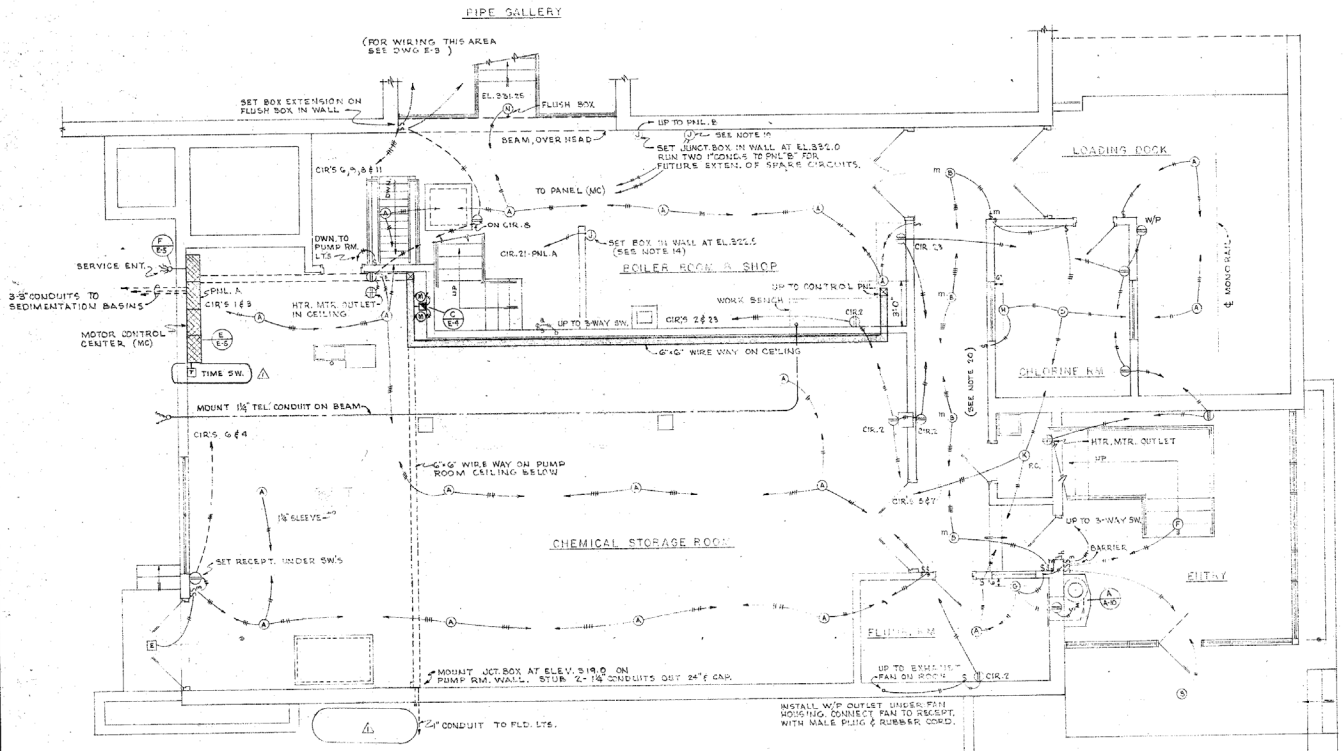
WATER PURIFICATION WORKS

ELECTRICAL PLAN EL. 333.5

DESIGNED REK	APPROVED BY	SHEET	OF
DRAWN KM	SCALE 1/4"=1'-0"	E1	77
CHECKED REK	DATE 8-1-57 FILE 1560-3063		



SAMPLING PUMP & SOLENOID VALVE SCHEMATIC DIAGRAM



(FOR GENERAL NOTES SEE SHT. E1)

DATE	NO.	REVISION	BY
12-18-61	1	REMOVED 1"C. TO WTR. TWR. ADD'N.	K.M.

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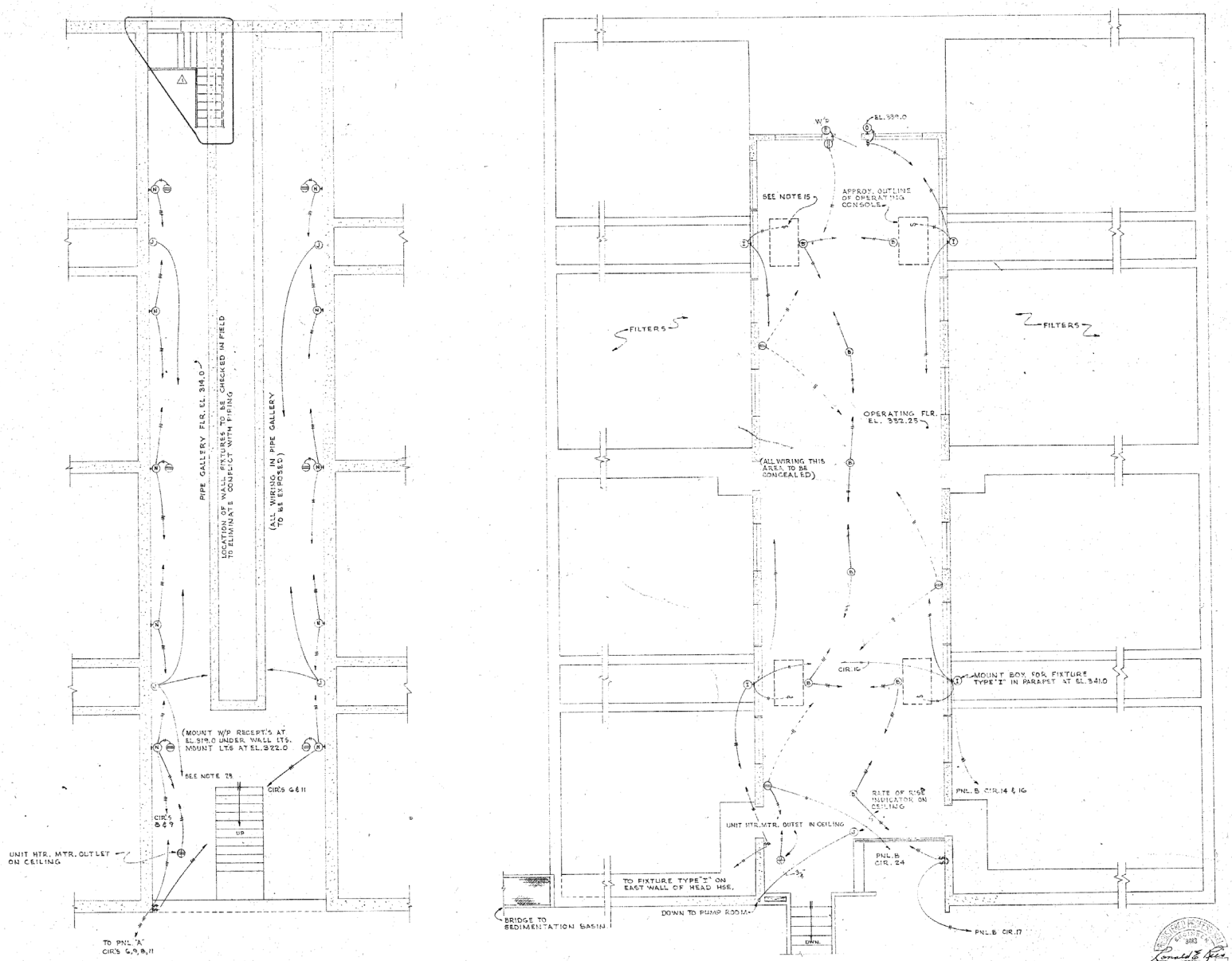
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS

ELECTRICAL PLAN EL. 321.5

DESIGNED	R.E.R.	APPROVED BY	SHEET E2 OF 77
DRAWN	K.M.	SCALE 1/4" = 1'-0"	
CHECKED	R.E.R.	DATE 8-1-57	FILE 1160-80-70



(FOR GENERAL NOTES SEE SHT. E1)

DATE	NO.	REVISION	BY
10-1-59	1	CHG'D STAIRWAY IN PIPE GAL. AS BUILT	FM

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OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

WATER PURIFICATION WORKS
ELECTRICAL PLAN
EL. 332.25 & EL. 314.0

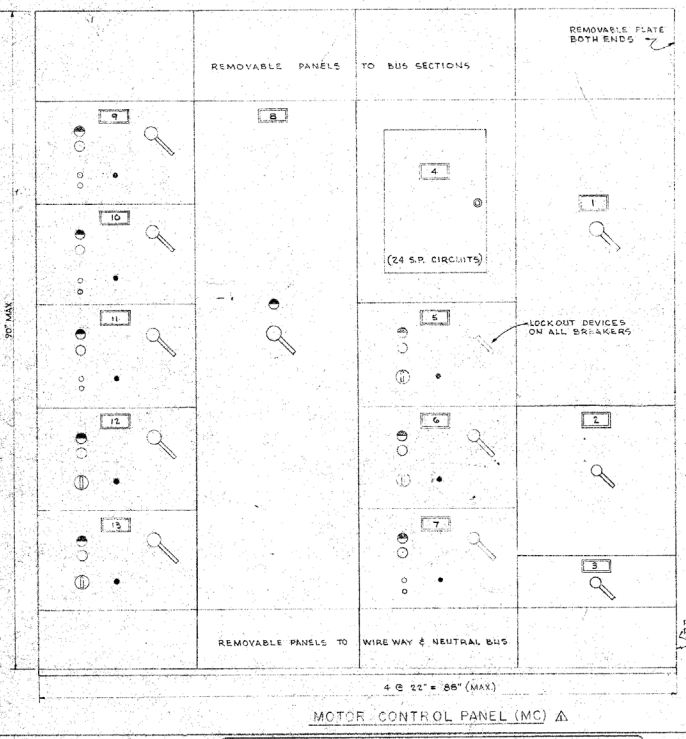
DESIGNED RER	APPROVED BY [signature]	SHEET E3 OF 77
DRAWN KM	SCALE 1/4" = 1'-0"	
CHECKED RER	DATE 8-1-57	FILE 1160-3071

REGISTERED PROFESSIONAL ENGINEER 3483 OREGON MAY 8, 1958 RONALD E. RIES

(NAME PLATES)

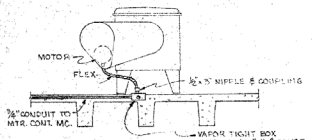
NO.	DISCRIPTION
1	MAIN SERVICE BRK.
2	37.5 KVA LIGHTING TRANS. BKR.
3	CHEMICAL ELEV. & AIR CLEAN. MTRS.
4	LIGHTING PNL."A"
5	AIR COMPRESSOR NO.1
6	AIR COMPRESSOR NO.2
7	PALMER SWEEP PUMP
8	WASH WATER PUMP
9	FLOCCULATOR MOTOR NO.1
10	FLOCCULATOR MOTOR NO.2
11	RAPID MIX NO.1
12	LIME FEEDER NO.1
13	ALUM FEEDER NO.1

LEGEND
- RED INDICATING LT.
- GRN. INDICATING LT.
- H.O.A. SELECTOR SW.
- RESET BUTTON
- START-STOP P.B.
- SWITCH OPER. HANDLE

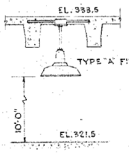


MOTOR CONTROL PANEL (MC) ⚠

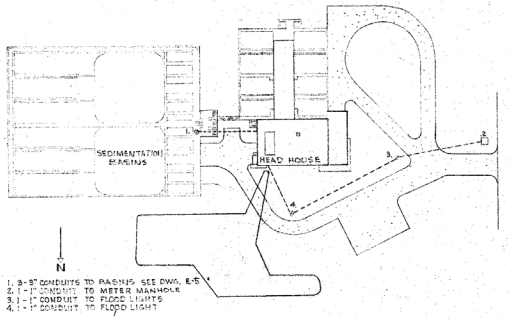
⚠ SEE WESTINGHOUSE ELEC. CORP. CONTROL CENTER DWG. NO. SE-5-C-221



ALUM FEEDER DETAIL A

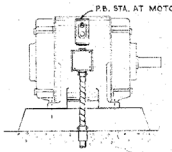


DETAIL B

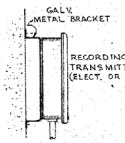


1. 3-8" CONDUITS TO BASINS SEE DWG. E-5
2. 1-1" CONDUIT TO METER MANHOLE
3. 1-1" CONDUIT TO FLOOD LIGHTS
4. 1-1" CONDUIT TO FLOOD LIGHT

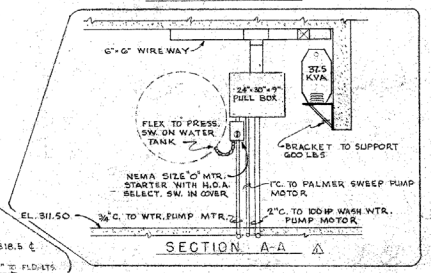
PLOT PLAN
SCALE 1"=40'



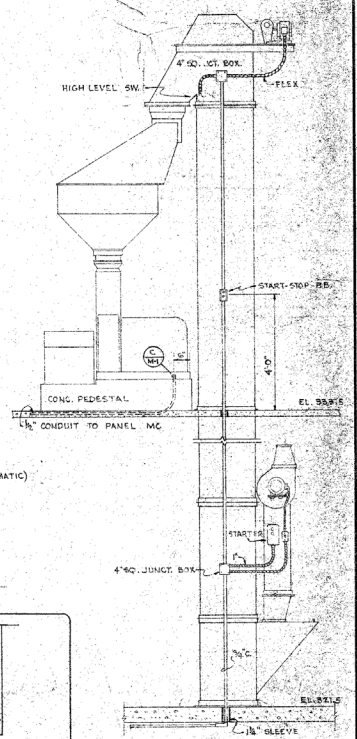
TYPICAL P.B. STATION AT MOTOR



TYPICAL RECORD. TRANSMITTER MOUNTING DETAIL

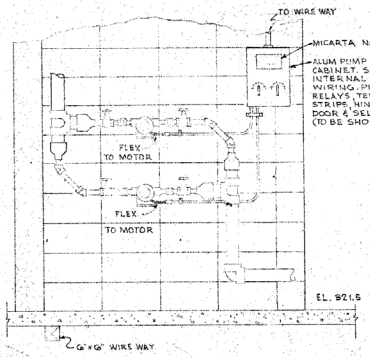


SECTION A-A ⚠

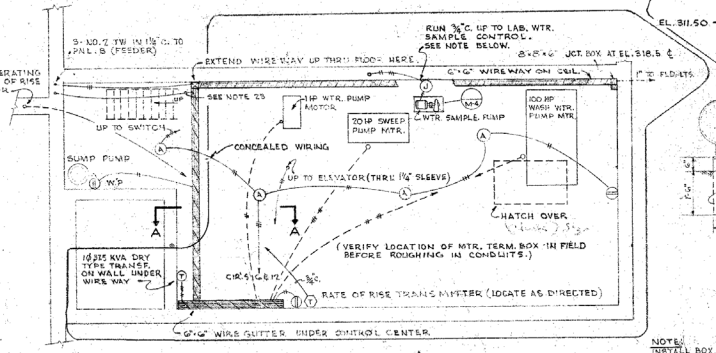


ELEVATOR WIRING DETAIL E

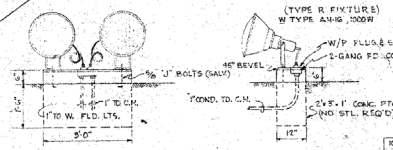
(FOR GENERAL NOTES SEE SHT. E1)



ALUM PUMPS DETAIL C



PUMP ROOM LAYCUT ⚠
SCALE 1/4"=1'-0"



FLOOD LIGHT DETAIL D

NOTE:
INSTALL BOX EXTENSION ON FLUSH BOX IN WALL & RUN FLEX TO MOTOR & SOLENOID VALVES. RUN ¾" PIPE FROM JCT. BOX TO CONTROL SW'S IN LABORATORY.

DATE	NO.	REVISION	BY
10-1-59	2	ADDED MANUF. DWG. NO.'S AS BUILT	FM
12-15-67	1	REVISED PNL. "MC" REMOVED WTR. TWR. REVISED PUMP ROOM LAYOUT & EQUIPT.	KM

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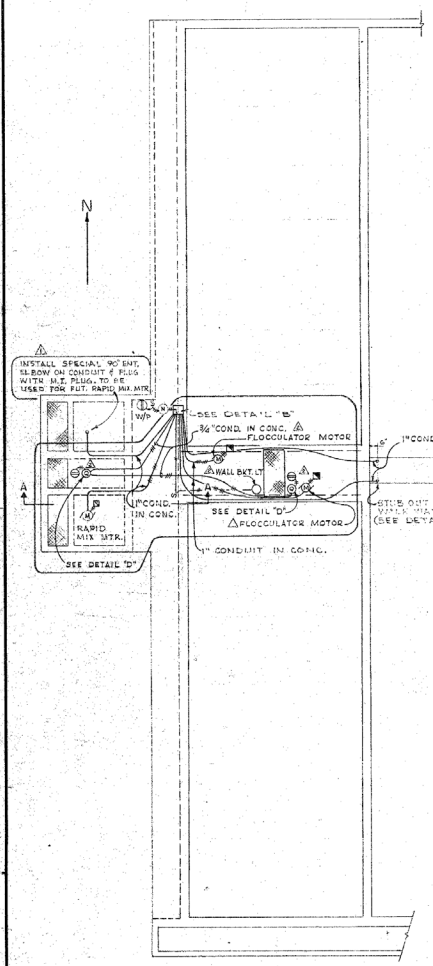
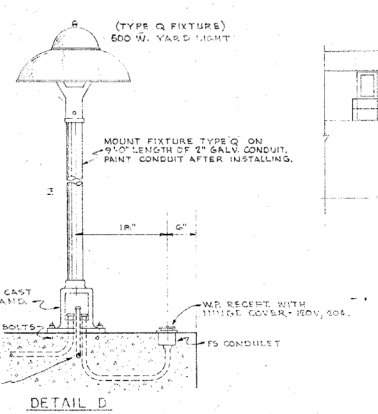
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
ELECTRICAL DETAILS

DESIGNED	REP	APPROVED	
DRAWN	KM	SCALE	UNOTED
CHECKED	KER	DATE	4-17-57

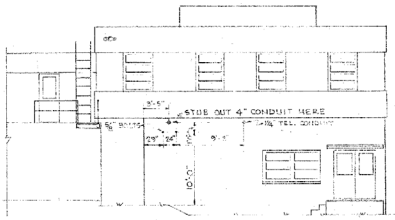
SHEET NO. E4 OF 77 SHEETS
FILE NO. 3002



PLAN AT FLOCCULATION BASINS

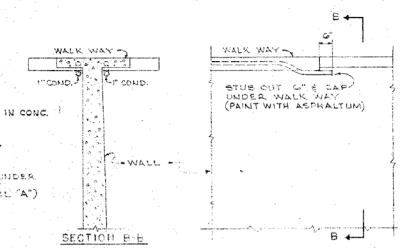


DETAIL D

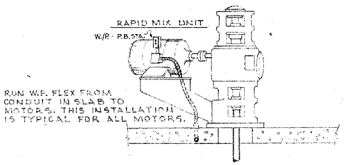


POWER SERVICE LOCATION

DETAIL F

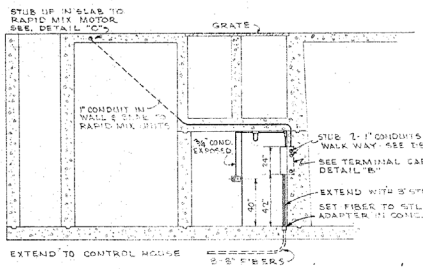


DETAIL A

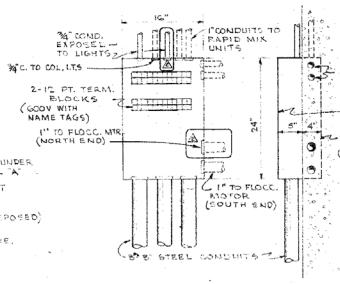


TYPICAL MOTOR CONNECTION

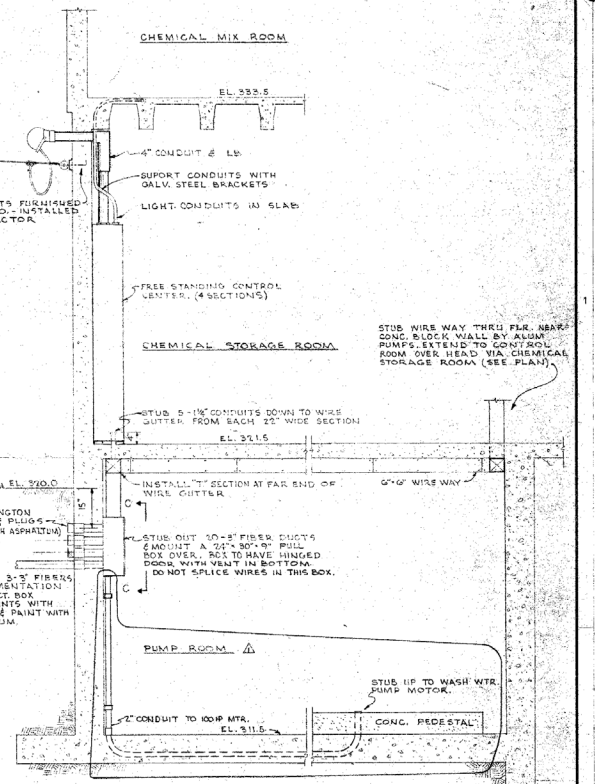
DETAIL C



SECTION A-A



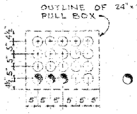
DETAIL B



SECTION AT MAIN SERVICE LOOKING SOUTH

DETAIL E

SCALE ½"=1'-0"



SECTION C-C

(FOR GENERAL NOTES SEE SHT. E1)

DATE	NO.	REVISION	BY
10-1-59	2	RELOCATED FLOC. MTRS & LTS. AS BUILT	F.M.
12-19-57	1	REVISED DETAIL "B", REMOVED RAPID MIX	K.M.

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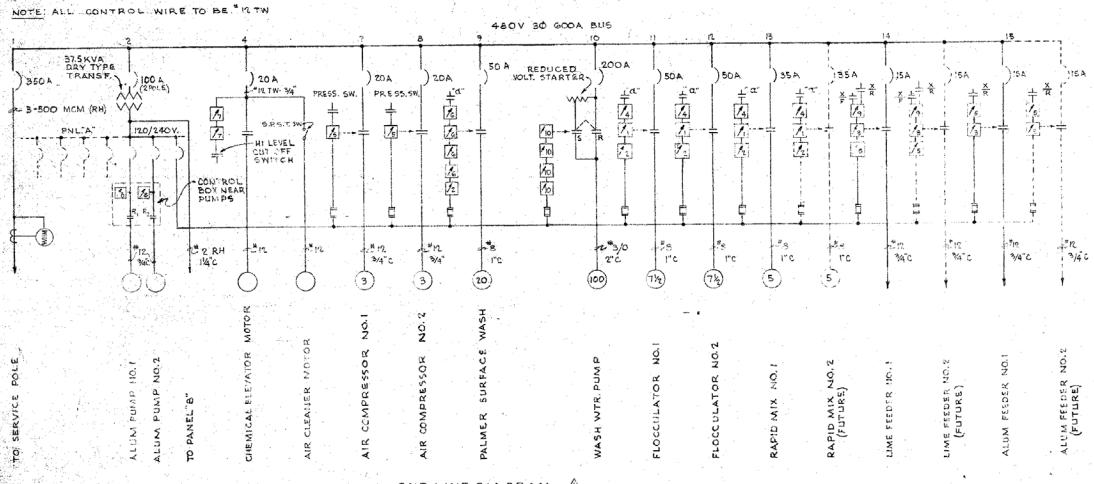
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
ELECTRICAL DETAILS

DESIGNED	R.E.R.	APPROVED BY	
DRAWN	K.M.	SCALE	NOTED
CHECKED	R.E.R.	DATE	8-1-57

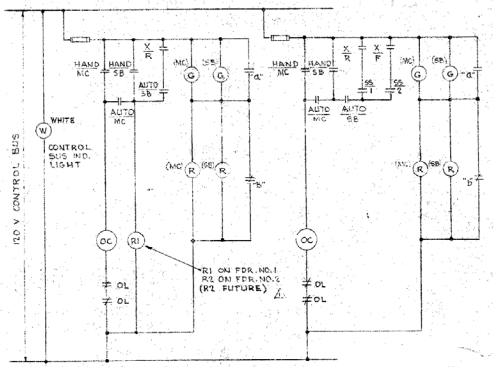
SHEET NO. E5 OF 77
FILE NO. 20078

REGISTERED PROFESSIONAL ENGINEER OREGON 3623 Ronald E. Rice RONALD E. RICE

NOTE: ALL CONTROL WIRE TO BE #12 TW

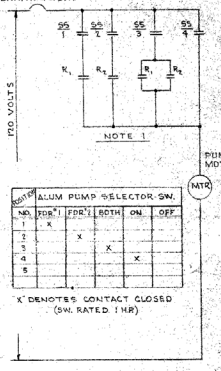


ONE LINE DIAGRAM ⚠



ALUM FEEDERS 1 & 2
(NO. 2 FUTURE)

LIME FEEDERS 1 & 2
(NO. 2 FUTURE)



"X" DENOTES CONTACT CLOSED (SW. RATED 1 HR)

ALUM PUMPS 1 & 2

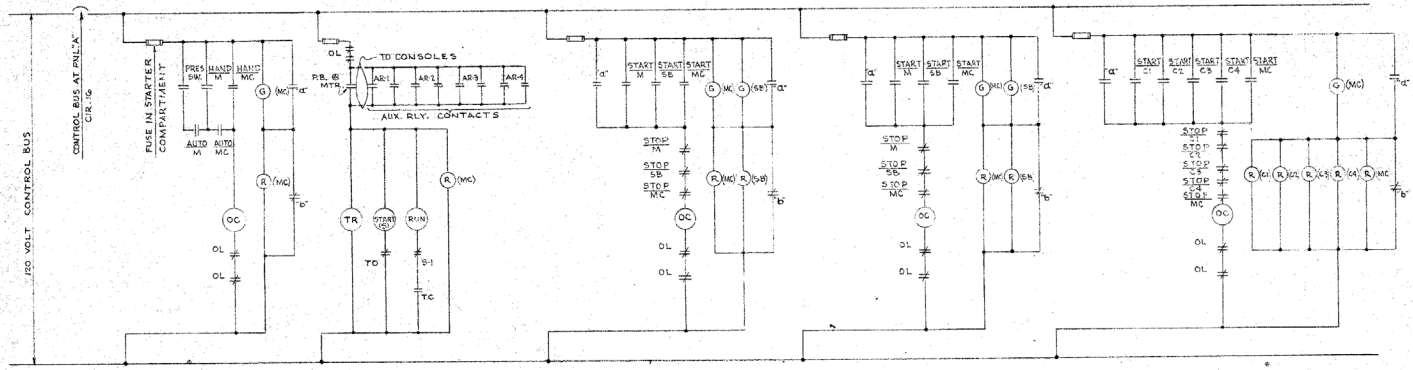
NOTE:
1. AUXILIARY RELAYS R1 & R2 TO BE MOUNTED IN ALUM. PUMP CONTROL CABINET. SEE SHT. E4 FOR LOCATION - CONTRACTOR TO SUBMIT EQUIPT. & LAYOUT FOR APPROVAL. RELAYS TO BE SQ. D. #A0-40 WITH 4 NO. CONTACTS. SEL. SWITCHES TO BE 3 POSITION PER CONTACT SHOWN ABOVE.
2. MOTOR HTRS. TO BE DETERMINED FROM EQUIPT. PURCHASED.
3. MANUFACTURER OF CONTROL CENTER TO FURNISH LAYOUT DWGS. & INDIVIDUAL COMPARTMENT SCHEMATIC DIAGRAMS FOR APPROVAL BEFORE FABRICATION. INDICATE WIRE TERMINAL MARKINGS IN EACH CASE

NO.	LIME FDR. SEL. SW. RAW WTR	FILTER WTR
1	X	
2		X

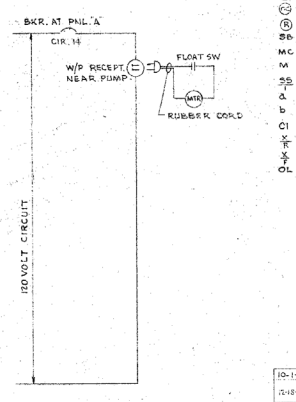
(SW. RATED 1 HR.)

LEGEND

- A MOMENTARY START-STOP SW. ON SWBD.
- A MOMENTARY START-STOP SW. ON MOTOR PNL.
- A H.O.A. SELECT. SW. ON SWBD.
- A MOMENTARY START-STOP SW. ON MOTOR
- A H.O.A. SELECT. SW. ON MOTOR CONTROL PNL.
- A MOMENTARY START-STOP SW. ON CONT. CONSOLE
- A MOMENTARY START-STOP SW. ON ELEVATOR
- A SELECTOR SW. ON ALUM. PUMP CONTROL BOX
- A TRANSFER SW. ON SWBD.
- A CONTROL SW. ON CONSOLES
- G GREEN INDICATING LIGHT
- OC OPERATING COIL
- R RED INDICATING LIGHT
- SB SWITCH BOARD
- MC MOTOR CONTROL CENTER
- M MOTOR
- SS SELECTOR SWITCH (CONTACT NO.1)
- a "a" SWITCH ON STARTER-OPEN IF STARTER OPEN
- b "b" SWITCH ON STARTER-CLOSED IF STARTER OPEN
- C1 CONTROL CONSOLE NO.1
- RECORDER CONTACT FOR RAW WATER
- RECORDER CONTACT FOR FILTERED WATER
- OL OVER LOAD CONTACT



AIR COMPRESSORS 1 & 2 | WASH WATER PUMP ⚠ | RAPID MIX 1 & 2 | FLOCCULATORS 1 & 2 | PALMER SWEEP PUMP



SUMP PUMP

MOTOR CONTROL SCHEMATIC DIAGRAMS

⚠ SEE WESTERN SWITCHBOARD CO. DWGS. ELEMENTARY DIAG. & WIRING DIAG. NO.'S 04-7946-109 & 02-7946-109 RESPECTIVELY.

(FOR GENERAL NOTES SEE SHT. E1)

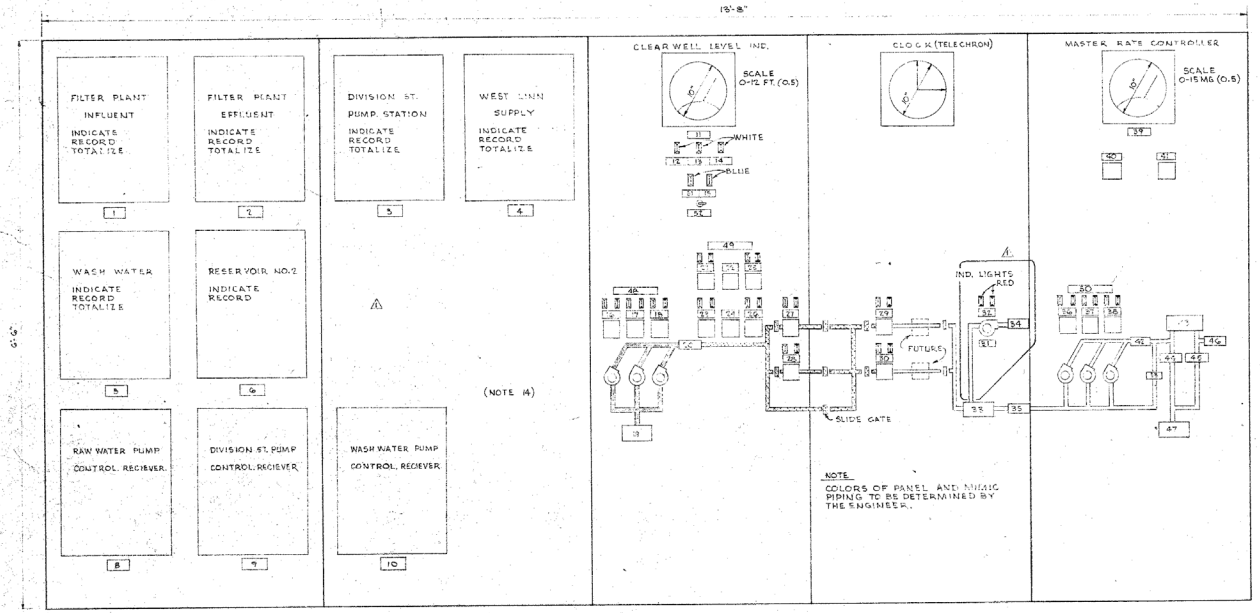
DATE	NO.	REVISION	BY
10-11-59	2	ADDED MANUF. DWG. NO.3 - AS BUILT	P.M.
12-18-57	1	REVISED ONE LINE DIA.-MAJOR REVISIONS	K.M.

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS

ELECTRICAL WIRING DIAGRAMS

DESIGNED	R.E.R.	APPROVED BY	SHEET E8 OF 77
DRAWN	K.M.	SCALE	
CHECKED	R.E.R.	DATE 8-1957	FILE E-SD-0-14



MAIN CONTROL PANEL (SB)

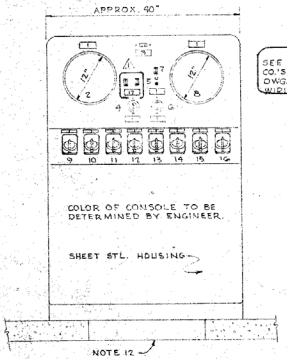
SEE WESTERN SWITCHBOARD CO'S ARRANGEMENT DWG. NO. 01-7946-109 ⚠

NO.	SIZE	NAMEPLATE SCHEDULE (NOTE 9)
1	1"x 3"	FILTER PLANT INFLUENT
2		FILTER PLANT EFFLUENT
3		DIVISION ST. PUMPING STATION
4		WEST LINN SUPPLY
5		WASH WATER SUPPLY
6		RESERVOIR NO. 2, 10 MG
7		
8		RAW WATER PUMPS - CONTROLLER
9		DIVISION ST. PUMPS - CONTROLLER
10		WASH WATER PUMPS - CONTROLLER
11		CLEAR WELL LEVEL
12		CONTROL BUS
13		RECORDER BUS
14		TELEMETERING BUS
15		RESERVOIR LOW-LEVEL ALARM
16	1"x 2½"	PUMP NO.1
17		PUMP NO.2
18		PUMP NO.3
19	1½"x 5½"	CLACKAMAS RIVER INTAKE
20	1"x 9"	FILTER PLANT INFLUENT METERING
21	1 x 2½	LIME FEEDER NO.1
22		LIME FEEDER NO.1 SELECTOR SW.
23		LIME FEEDER NO.2
24		LIME FEEDER NO.2 SELECTOR SW.
25		ALUM FEEDER NO.1
26		ALUM FEEDER NO.2
27		RAPID MIX NO.1
28		RAPID MIX NO.2
29		FLOCCULATOR NO.1
30		FLOCCULATOR NO.2
31		WASH WATER PUMP
32		RATE 1 - RATE 2
33	1½"x 3½"	FILTER PLANT CLEAR WELL
34	1"x 5"	FILTERS
35	1"x 5"	FILTER PLANT EFFLUENT METERING
36	1"x 2½"	PUMP NO.1
37		PUMP NO.2
38		PUMP NO.3
39	1"x 5"	MASTER RATE CONTROLLER
40	1"x 1½"	CONTROLLER SELECTOR SW.
41	1"x 2½"	MASTER RATE SETTER
42	1"x 5"	DIVISION ST. EFFLUENT METERING
43	2"x 5"	RESERVOIR NO.2, 10 MG
44	1"x 5"	WEST LINN METERING
45		WEST LINN METERING
46		MOUNTAIN SUPPLY METERING
47	1½"x 3½"	WEST LINN SUPPLY
48	1"x 6"	CLACKAMAS RIVER PUMPING STATION
49		CHEMICAL FEEDERS
50		DIVISION ST. PUMPING STATION
51	1"x 3"	CLEARWELL HI-LEVEL ALARM
52	1"x 2½"	ALARM CUTOUT SWITCH
53	1"x 2½"	PRESSURE REDUCG. VALVE

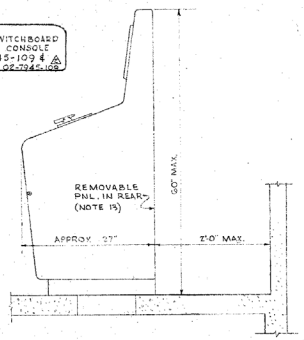
NOTES:
1. SEE ARCHITECTURAL SHEET A10 FOR PANEL MOUNTING.
2. MOUNT "S" ALARM AND OTHER AUXILIARIES ON REAR OF PANEL.
3. NO BOLTS, RIVETS OR FASTENERS TO SHOW ON FRONT OF PANEL.
4. PANELS TO BE WIRED IN NEAT MANNER WITH CLAMPS, WIRE LUGS, NO.12 AVE GOVT ASBESTOS WIRE AND MARKED TERMINAL STRIPS.
5. GROUP ALL WIRES ON REAR OF PANEL FLAT WITHOUT CROSSOVERS. ALLOW NO MORE THAN TWO LUGS PER TERMINAL.
6. ALL BENDS TO BE OF EQUAL RADIUS, BUTTED JOINTS TO FIT SNUG & TRUE.
7. SEE ARCHITECTURAL DRAWINGS FOR DOOR OPENINGS TO DETERMINE MAXIMUM SHIPPING CRATE DIMENSIONS.
8. ARRANGEMENT OF EQUIPMENT SHOWN MAY BE MODIFIED BY THE MANUFACTURER IF REQUESTED AND APPROVED BY THE ENGINEER.
9. ALL NAMEPLATES TO HAVE ROUND CORNERS & BEVELED SIDES.
10. SEE SHT. E7 FOR SCALES OF RECORDING DEVICES.
11. PROVIDED CONSOLES COMPLETELY WIRED TO 600 VOLT TERMINAL STRIP LOCATED IN BOTTOM. (USE TW NO. 12 AWG)
12. DIMENSIONS OF FLOOR OPENING TO BE DETERMINED BY CONSOLE MANUFACTURER.
13. PROVIDE REMOVABLE COVERS FOR ACCESS TO CONTROL PIPING & WIRING.
14. RECORDERS SHALL BE BRISTOL SERIES 500 OR APPROVED EQUAL
15. CONTROL SWITCH RATED CLOCKWISE ONLY FROM OFF TO POS.1 TO POS.2 TO OFF, POSITION 2 TO "MAKE" BEFORE POSITION 1 "BREAKS."

LEGEND OF CONSOLE CONTROL VALVES & DEVICES

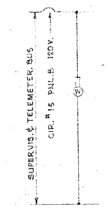
DEVICE NO.	DESCRIPTION	REMARKS
1	LAMICOID NAMEPLATE	APPROX. 1"x3" (NOTE 9)
2	RATE OF FLOW	INDICAT., RECORD, TOTALIZE, 12", 7 DAY
3	S.P.S.T. LIGHT SWITCH	10 AMP. 120V. "T" RATED.
4	BACK WASH RATE SETTER	CLOCK WISE ROT. POS. OFF-1-2 (SEE NOTE 15) ⚠
5	SURFACE WASH PUMP	START-STOP P.B. (MOMENTARY)
6	FILTER RATE SETTER	
7	RED INDICATING LIGHT	INDICAT. SURFACE WASH PUMP "ON"
8	LOSS OF HEAD GAUGE	INDICAT. & RECORD. 12", 7 DAY
9	INFLUENT VALVE	OPERATOR & INDICATOR
10	EFFLUENT VALVE (LEFT)	
11	EFFLUENT VALVE (RIGHT)	
12	WASTE VALVE	
13	BACK WASH (LEFT)	
14	BACK WASH (RIGHT)	
15	SURFACE WASH (LEFT)	
16	SURFACE WASH (RIGHT)	
17	NAME PLATE 1"x3"	RATE 1 - RATE 2



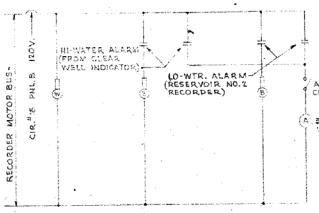
SEE WESTERN SWITCHBOARD CO'S OPERATING CONSOLE DWG. NO. 01-7945-109 & WIRING DWG. NO 01-7945-108 ⚠



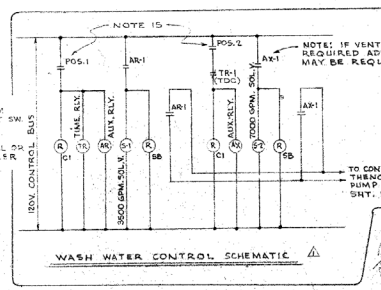
OPERATING CONSOLE DETAIL



SUPERVIS. & TELEMETER. BUS INDICATOR



WATER LEVEL ALARMS



WASH WATER CONTROL SCHEMATIC ⚠

NO.	BY	DATE	REVISION
2	FM	10-1-59	ADDED SHOP DWG. NO.5 - AS BUILT
1	KM	11-17-57	REVISED WASH WTR. SYSTEM & MIMIC PIPING ON SWBD. ADD. W.WTR. CONT. SCHEM.

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2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

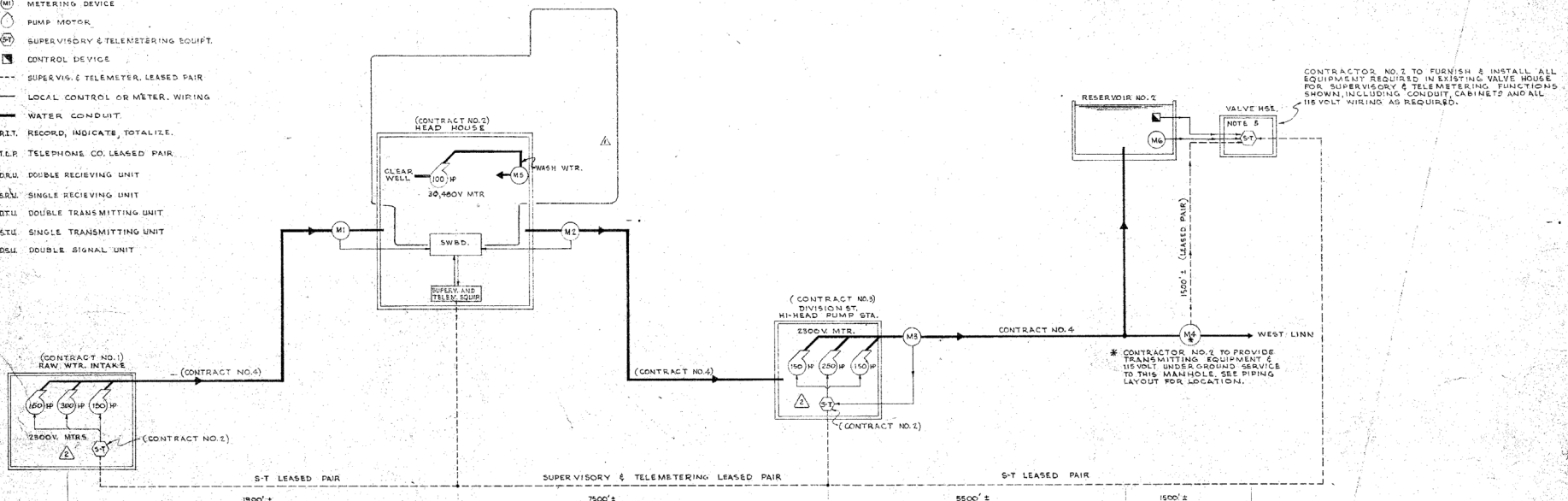
OREGON CITY - WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
MAIN CONTROL PANEL (SB)

DESIGNED RBR | APPROVED BY
DRAWN KM | SCALE
CHECKED RBR | DATE 8-1-57 | FILE NO. 30-15

SHEET E7 OF 77

LEGEND

- (M1) METERING DEVICE
- PUMP MOTOR
- (S-T) SUPERVISORY & TELEMETERING EQUIPT.
- CONTROL DEVICE
- --- SUPERVIS. & TELEMETER. LEASED PAIR
- —— LOCAL CONTROL OR METER. WIRING
- ▬▬ WATER CONDUIT
- R.I.T. RECORD, INDICATE, TOTALIZE.
- T.L.P. TELEPHONE CO. LEASED PAIR
- D.R.U. DOUBLE RECIEVING UNIT
- S.R.U. SINGLE RECIEVING UNIT
- D.T.U. DOUBLE TRANSMITTING UNIT
- S.T.U. SINGLE TRANSMITTING UNIT
- D.S.U. DOUBLE SIGNAL UNIT



BLOCK DIAGRAM

TELEMETERING SCHEDULE

METER NO.	METERED QUANTITY	FUNCTION	TRANSMITTER LOCATION	RECORDER LOCATION	TYPE OF RECORDER	TRANSFER OF SIGNAL	TYPE OF TRANSMITTER	RANGE	IND. SCALE DIVISIONS	CHART SPEED
M1	PLANT INFLUENT	R. I. T.	HEAD HSE.	MAIN CONTROL BOARD "SB" AT HEAD HOUSE	ELECTRICAL OR PNEUM.	LOCAL	ELECTRICAL OR PNEUM.	0-15 MGD	(0-15) 0.25	7 DAY
M2	PLT. WTR. EFFL.	R. I. T.	HEAD HSE.		ELECTRICAL	LOCAL	ELECTRICAL	0-15 MGD	(0-15) 0.25	
M3	DIVISION ST. EFFL.	R. I. T.	PUMP STA.		ELECTRICAL	T. L. P.	ELECTRICAL	0-15 MGD	(0-15) 0.25	
M4	WEST LINN	R. I. T.	VALVE HSE.		ELECTRICAL	T. L. P.	ELECTRICAL	0-10 MGD	(0-10) 0.25	
M5	WASH WTR.	R. I. T.	HEAD HSE.		ELECTRICAL OR PNEUM.	LOCAL	ELECTRICAL OR PNEUM.	0-10000 GPM	(0-10) 0.50	
M6	RESERVOIR LEVEL	R. I.	VALVE HSE.		ELECTRICAL	T. L. P.	ELECTRICAL	0-25 FT.	(0-25) 1.00	

SUPERVISORY CONTROL

CONT. DEVICE	CONTROLLER	CONTROLLER LOCATION	FUNCTIONS REQ'D	CONTROL VOLTAGE
RAW. WTR. VALVES	WATER LEVEL	HEAD HSE. CLEAR WELL	START-STOP MANUALLY	240 V.
DIVISION ST. PUMPS	RES. NO. 2 LEVEL	VALVE HOUSE	START-STOP AUTOMATIC	240 V.
			INDICATE ACRES	

PARTIAL LIST OF TONE EQUIPMENT REQUIRED

LOCATION	TYPE OF SIGNAL	S.R.U.	D.T.U.	D.R.U.	D.S.U.	CABINET	CABINET SIZE	REMARKS
HEAD HSE.	CONTINUOUS TONE	1	3	1	0	OPEN RACK OR NEMA 1	MINIMUM 10 UNITS	NOTE 5 7 & 8
RAW. WTR. STA.		1	0	1	0	W/P WALL MOUNT HAMMARLUND	MINIMUM 6 UNITS	NOTE 7
DIV. ST. STA.		0	0	1	1	W/P WALL MOUNT HAMMARLUND	MINIMUM 6 UNITS	NOTE 7
RES. VALVE HSE.		0	1	0	0	W/P WALL MOUNT HAMMARLUND	MINIMUM 6 UNITS	NOTE 7

(* TRANSMITTER & RECIEVER)

NOTES:

1. ALL SUPERVISORY & TELEMETERING EQUIPMENT SHOWN & REQUIRED IS TO BE FURNISHED & INSTALLED UNDER CONTRACT NO. 2
2. CONDUITS, BOXES, WEATHER HEADS ETC. REQUIRED AT PUMPING STATIONS FOR TELEMETERING OR SUPERVISORY EQUIPMENT TO BE INSTALLED BY PUMPING STATION CONTRACTORS. WIRE & WIRING REQUIRED, TO BE DONE UNDER CONTRACT NO. 2.
3. DISTANCES SHOWN ARE APPROXIMATE STRAIGHT LINE - POINT TO POINT.
4. SCALE TO BE DETERMINED BY ENGINEER FROM RESERVOIR MANUFACTURERS APPROVED DRAWINGS.
5. RESERVOIR LEVEL TRANSMITTER TO BE CONNECTED TO 20" LINE IN VALVE HSE.
6. THIS DRAWING IS PRESENTED ONLY FOR GENERAL INFORMATION. ACTUAL LOCATION OF EQUIPMENT, PIPING ETC. SHOULD BE DETERMINED FROM LAYOUT DRAWINGS FOR EACH PARTICULAR STRUCTURE.
7. PROVIDE ONE COMPLETE SET OF FUSES, TUBES, & ONE "RELAY "PX KGG 9" AT EACH LOCATION (I.E. HEAD HSE, RAW WTR. STA., DIV. ST. STA., & RESERVOIR VALVE HSE.) FOR TELEMETER. & SUPERVISORY EQUIPMENT.
8. PROVIDE ONE TEST SET AT HEAD HOUSE FOR TEL. & SUPERVISORY EQUIPMENT.

DATE	NO.	REVISION	BY
7-3-58	2	RELOCATE LARGER PUMPS IN CENTER	JAG
12-18-57	1	REMOVED EL. TANK & CONTROL	KM

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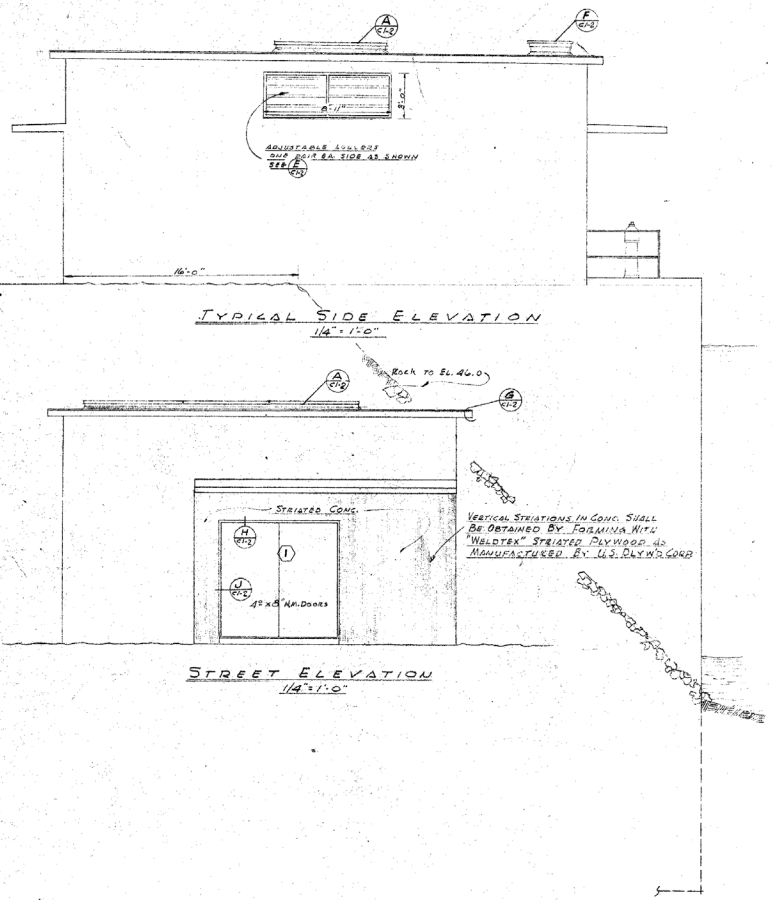
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
WATER PURIFICATION WORKS
BLOCK DIAGRAM OF FACILITIES

DESIGNED	R.E.R.	APPROVED BY	
DRAWN	K.M.A.	SCALE	NONE
CHECKED	E.B.R.	DATE	8-1-57

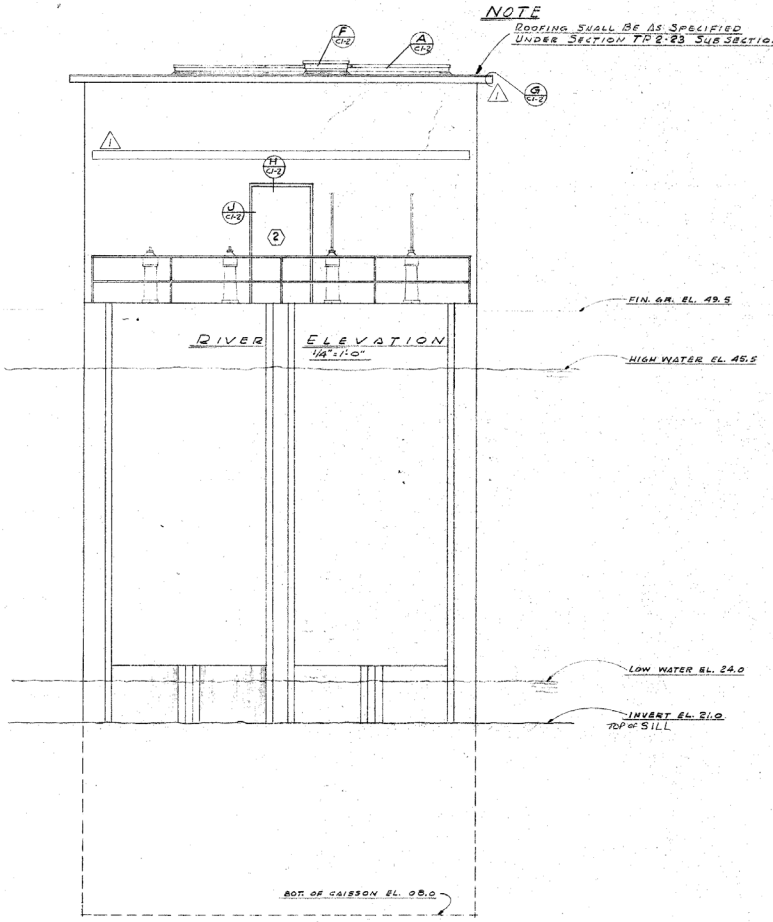
SHEET NO. 17



TYPICAL SIDE ELEVATION
1/4" = 1'-0"

STREET ELEVATION
1/4" = 1'-0"

NOTE
ROOFING SHALL BE AS SPECIFIED UNDER SECTION TP 2.23 SUB SECTION "C"



RIVER ELEVATION
1/4" = 1'-0"

DATE	NO.	REVISION	BY
6-1-59	1	As Built	ATS

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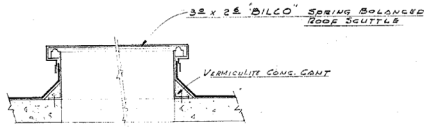
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

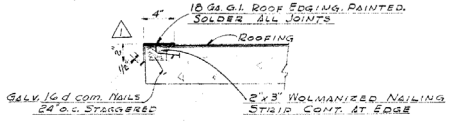
RAW WATER INTAKE STRUCTURE

ARCHITECTURAL ELEVATIONS

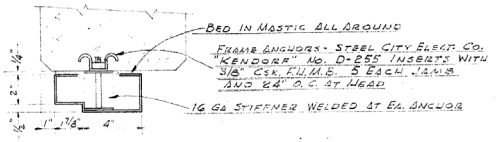
DESIGNED J.M.H.	APPROVED BY	SHEET	OF
DRAWN J.M.H.	SCALE WATCH	C1-1	
CHECKED L.K.W.	DATE 8-3-57	PUBLICATION DRAWING	



DETAIL (F)
ROOF ACCESS HATCH

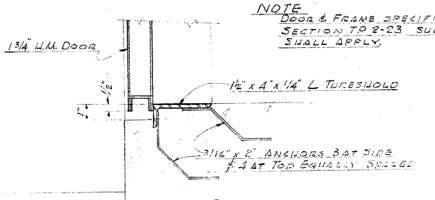


DETAIL (G)
ROOF EDGING
1 1/2" = 1'-0"



HEAD & JAMB (H)

NOTE
DOOR & FRAME SPECIFICATIONS UNDER SECTION TP 2-23 SUB-SECTION "d" SHALL APPLY.

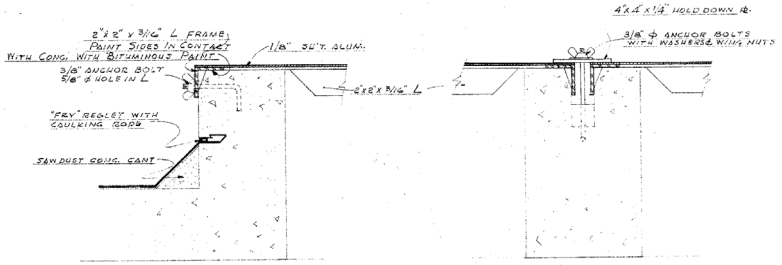


SILL (J)
DOOR DETAILS
3" = 1'-0"

NOTE:
HARDWARE SPECIFICATIONS UNDER SECTION TP 2-23 SUBSECTION "j" SHALL APPLY.

DOOR AND HARDWARE SCHEDULE

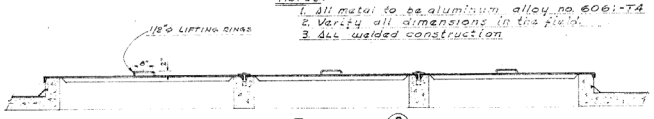
DOOR	No.	SIZE	KIND	LOCK	BUTTS	FLUSH BOLTS
①	2 -	4'0" x 8'0" x 1 3/4"	FLUSH HOLLOW METAL	C 80 PD	2 pr. 4 1/2 EA. DOOR	2 - # 1116 - 12"
②	1 -	4'0" x 8'0" x 1 3/4"	F. H.M.	" " "	" " "	" " "
③	2 -	4'0" x 8'0" x 1 3/4"	F. H.M. LOUVERED	" " "	" " "	" " "



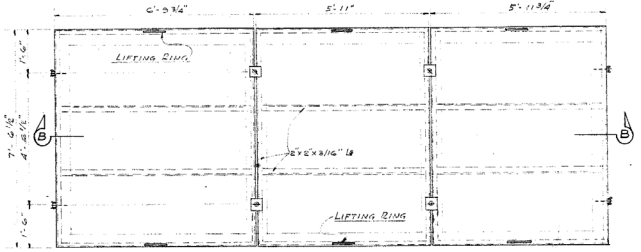
DETAIL (C)
3" = 1'-0"

DETAIL (D)
3" = 1'-0"

NOTES:
1. All metal to be aluminum alloy no. 606:-T4
2. Verify all dimensions in the field.
3. All welded construction

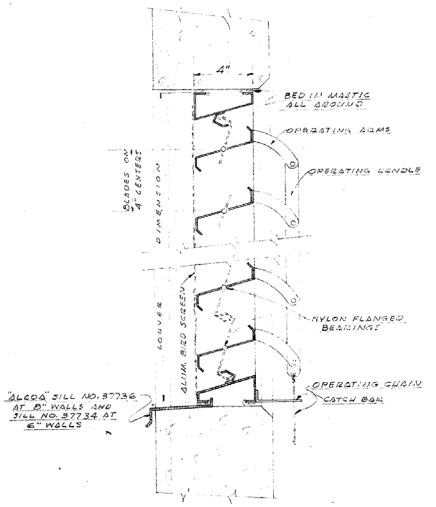


SECTION (B)
1/8" = 1'-0"



PLAN (A)
1/2" = 1'-0"

ROOF ACCESS PANELS



DETAIL (E)
3" = 1'-0"

ADJUSTABLE ALUMINUM LOUVER AS MANUFACTURED BY THE AIROLITE COMPANY MAGISTY, OHIO

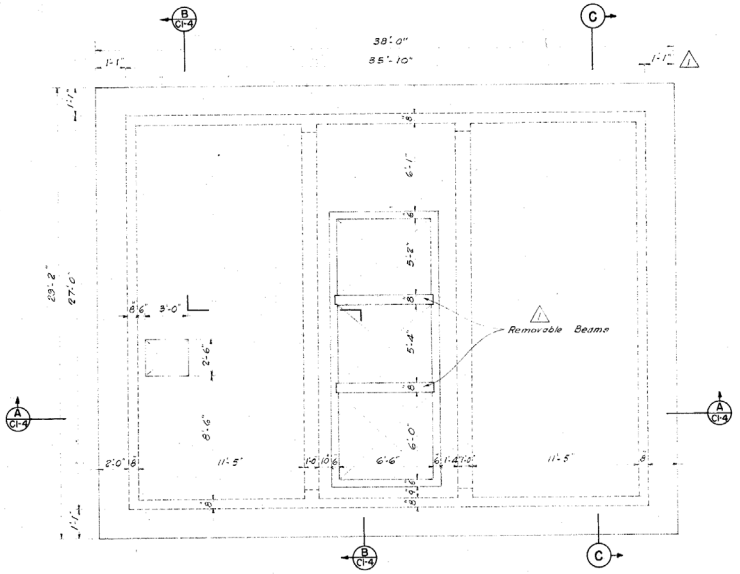
DATE	NO.	REVISION	BY
6-1-59	1	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

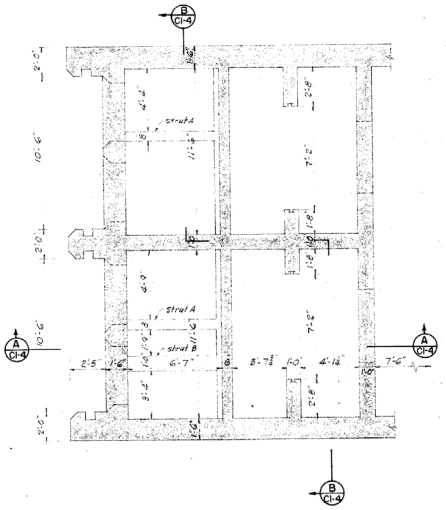
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
RAW WATER INTAKE STRUCTURE
ARCHITECTURAL DETAILS

DESIGNED JMH | APPROVED
DRAWN JMH | SCALE NOTED
CHECKED GKW | DATE 8-1-57 | FILE 1160-3016

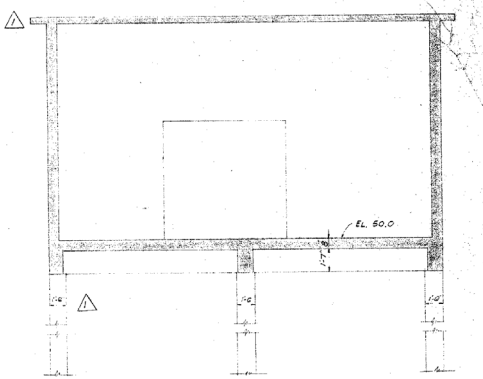
SHEET C1-2 OF 77



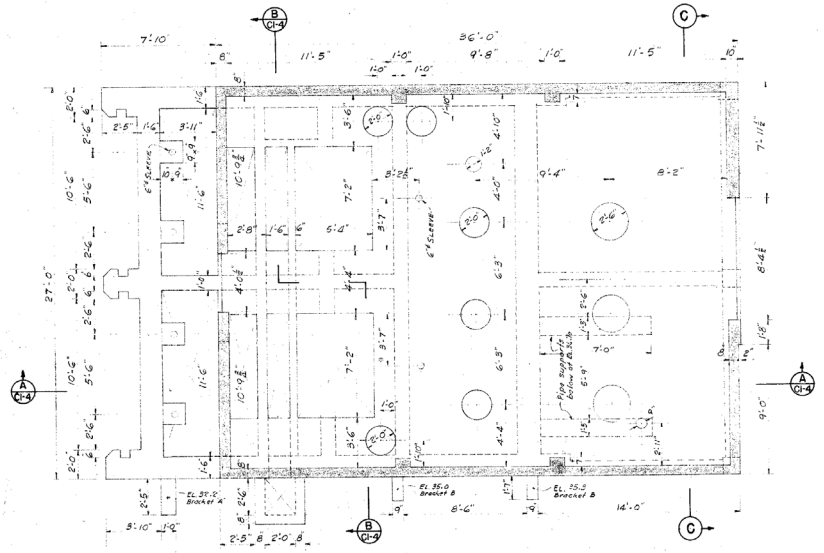
ROOF PLAN



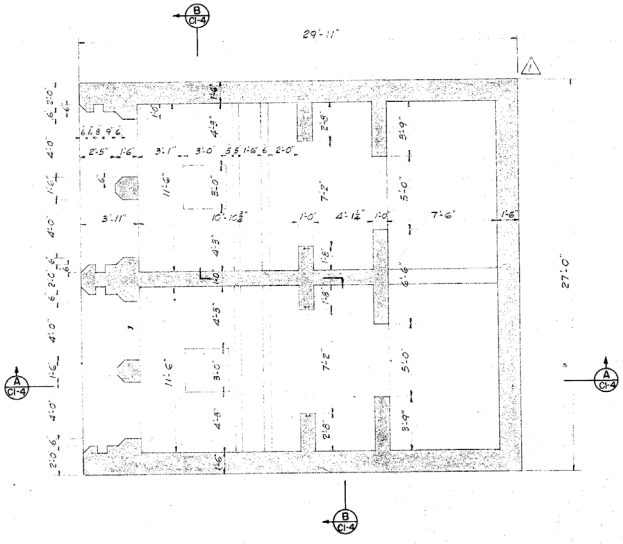
PART PLAN AT ELEV. 32.0



SECTION C-C



PUMP FLOOR PLAN



CAISSON FLOOR PLAN

DATE	NO.	REVISION	BY
6-1-59	1	As Built	A.T.S.

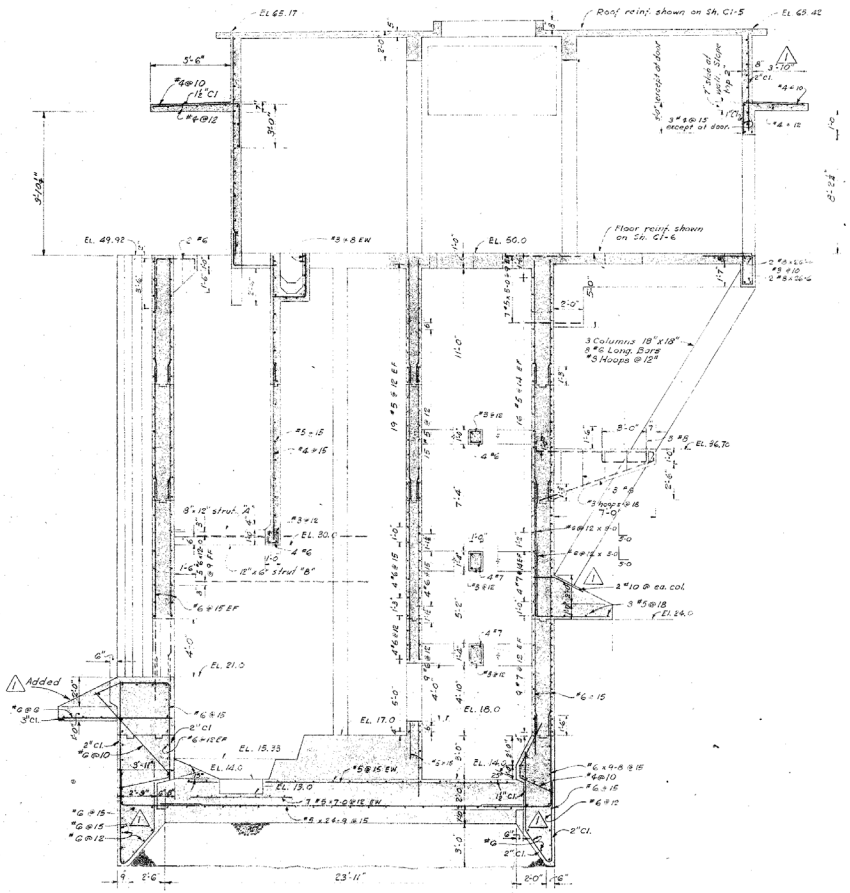
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

RAW WATER INTAKE STRUCTURE

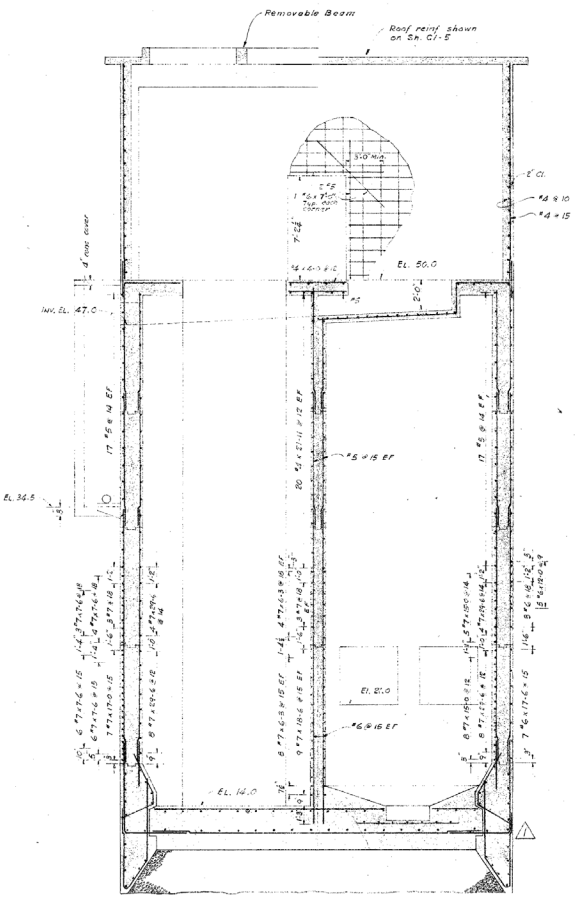
CONCRETE OUTLINE — PLANS

DESIGNED EAS	APPROVED BY	SHEET C1-3 OF 77
DRAWN PLK	SCALE 1/4" = 1'-0"	
CHECKED EAS	DATE 8-1-57	FILE 1160-3079



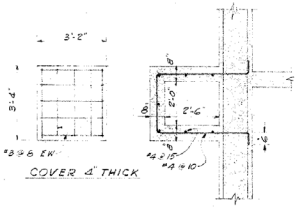
SECTION A-A / C1-3

1/4" = 1'-0"



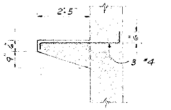
SECTION B-B / C1-3

1/2" = 1'-0"



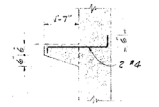
DROP MANHOLE REINF.

1/8" = 1'-0"



PIPE BRACKET "A"

One req'd. 1/8" = 1'-0"



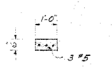
PIPE BRACKET "B"

Two req'd 1/8" = 1'-0"



STRUT "A"

Two req'd. 1/8" = 1'-0"



STRUT "B"

One req'd. 1/8" = 1'-0"

DATE	NO.	REVISION	BY
6-28-93	1	As Built	ATS

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2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN

WATER SUPPLY PROJECT

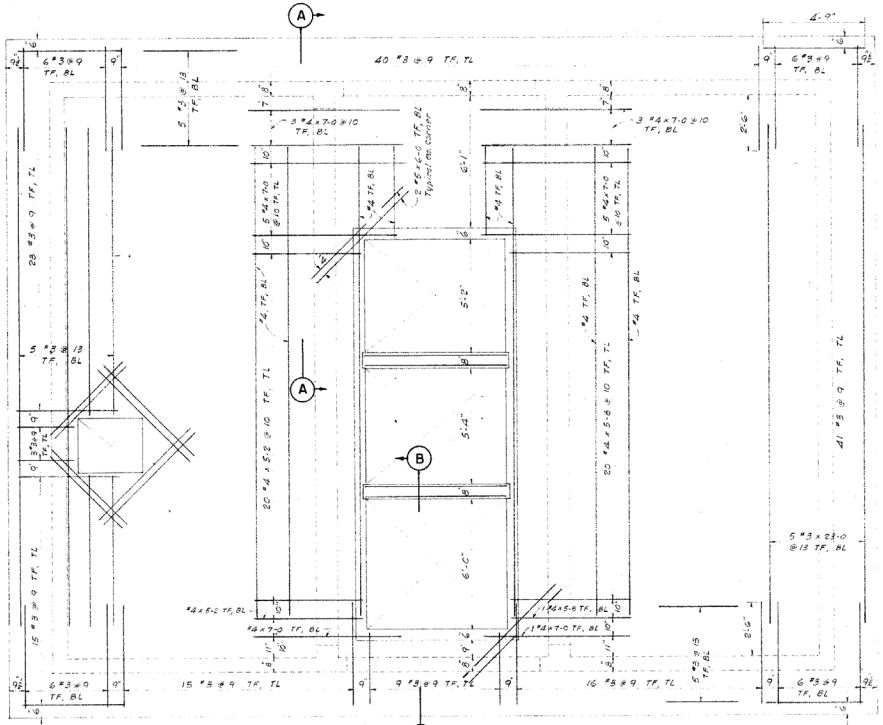
SOUTH FORK WATER BOARD

RAW WATER INTAKE STRUCTURE

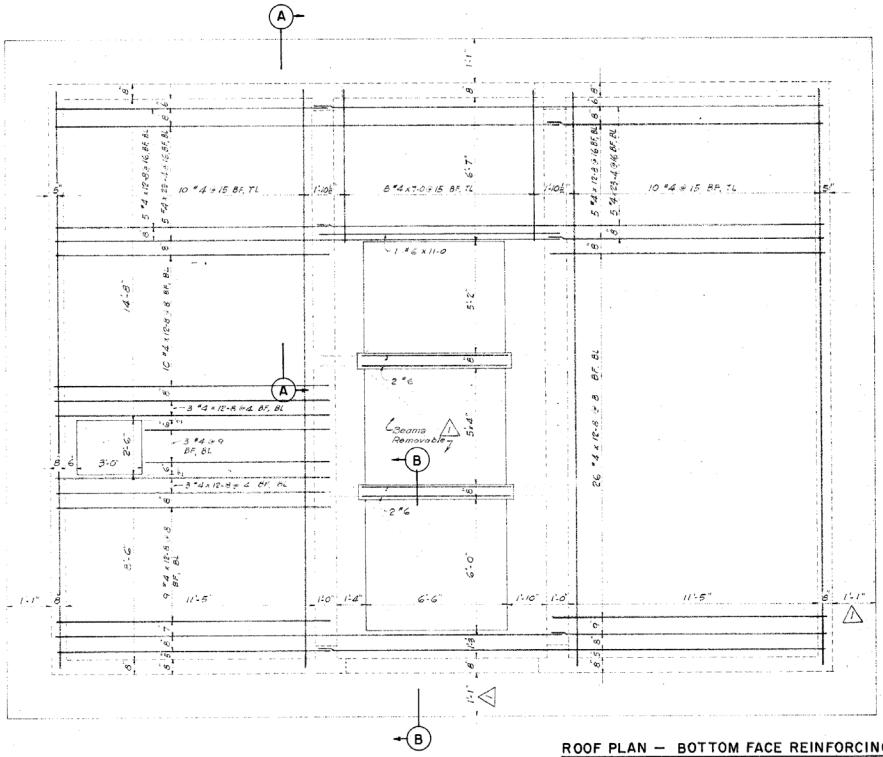
CONCRETE OUTLINE SECTIONS & REINFORCEMENT DETAILS

DESIGNED	E.A.S.	APPROVED BY	W. Glen Thompson
DRAWN	P.L.K.	SCALE	As noted
CHECKED	E.A.S.	DATE	6-1-93
		FILE	1180-6-80

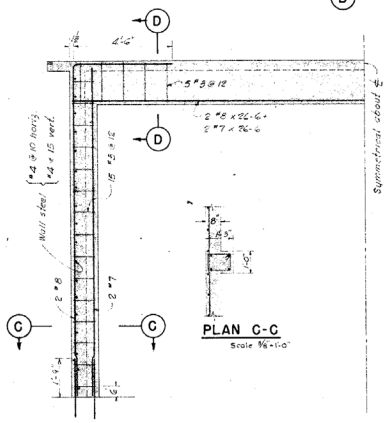
SHEET C1-4 OF 77



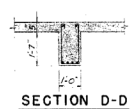
ROOF PLAN - TOP FACE REINFORCING
Scale 3/8" = 1'-0"



ROOF PLAN — BOTTOM FACE REINFORCING
Scale 3/8" = 1'-0"

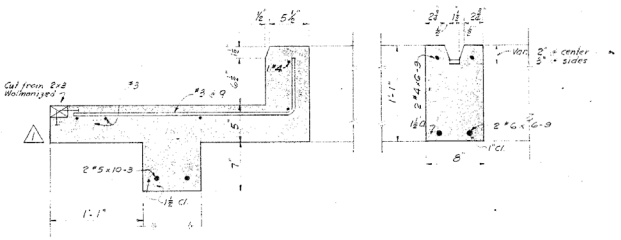


SECTION A-A
Scale 3/8" = 1'-0"



SECTION D-D
Scale 3/8" = 1'-0"

PLAN C-C
Scale 3/8" = 1'-0"



SECTION B-B
Scale 1½" = 1'-0"

DATE	NO.	REVISION	BY
6-1-59	1	As Built	ATS

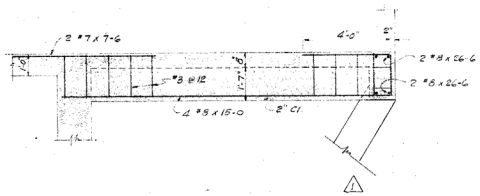
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

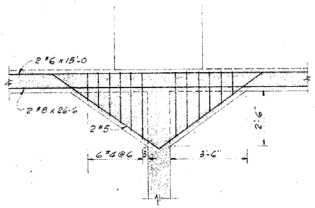
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

RAW WATER INTAKE STRUCTURE

ROOF REINFORCEMENT

DESIGNED EAS	APPROVED BY H. Lowe Thompson	SHEET CI-5 OF 77
DRAWN PLK	SCALE As Noted	
CHECKED EAS	DATE 8-1-57	FILE 1160-20M

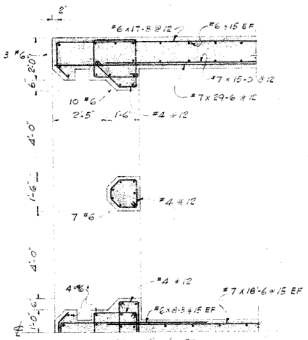




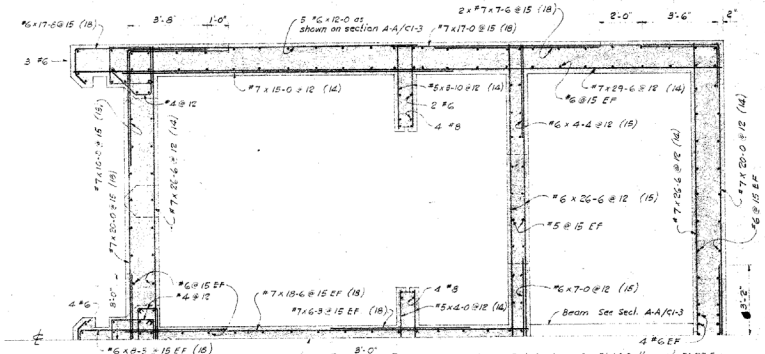
SECTION A-A

Note:- End beams similar

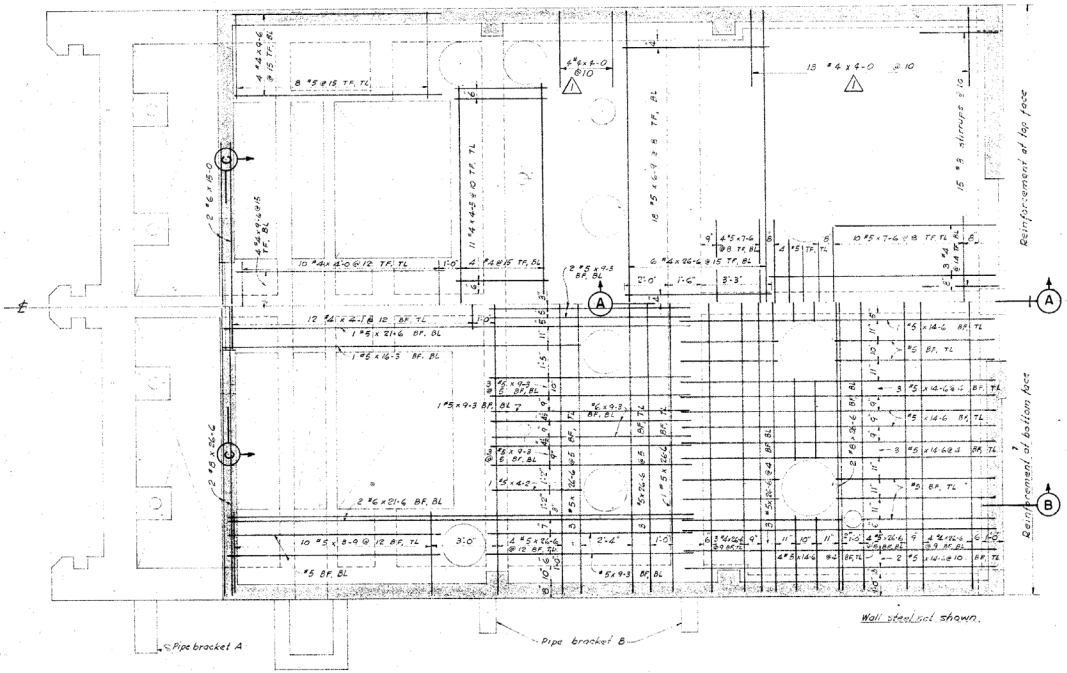
SECTION C-C

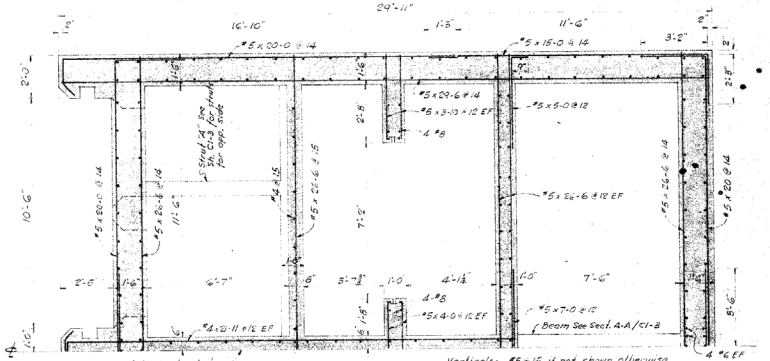


PLAN AT INTAKE EL. 21.0

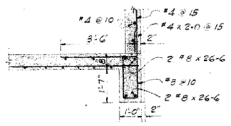


PLAN AT EL. 14.0 THROUGH EL. 30.0





PLAN ABOVE EL. 30.0



SECTION B

DATE	NO.	REVISION	BY
5-2959	1	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

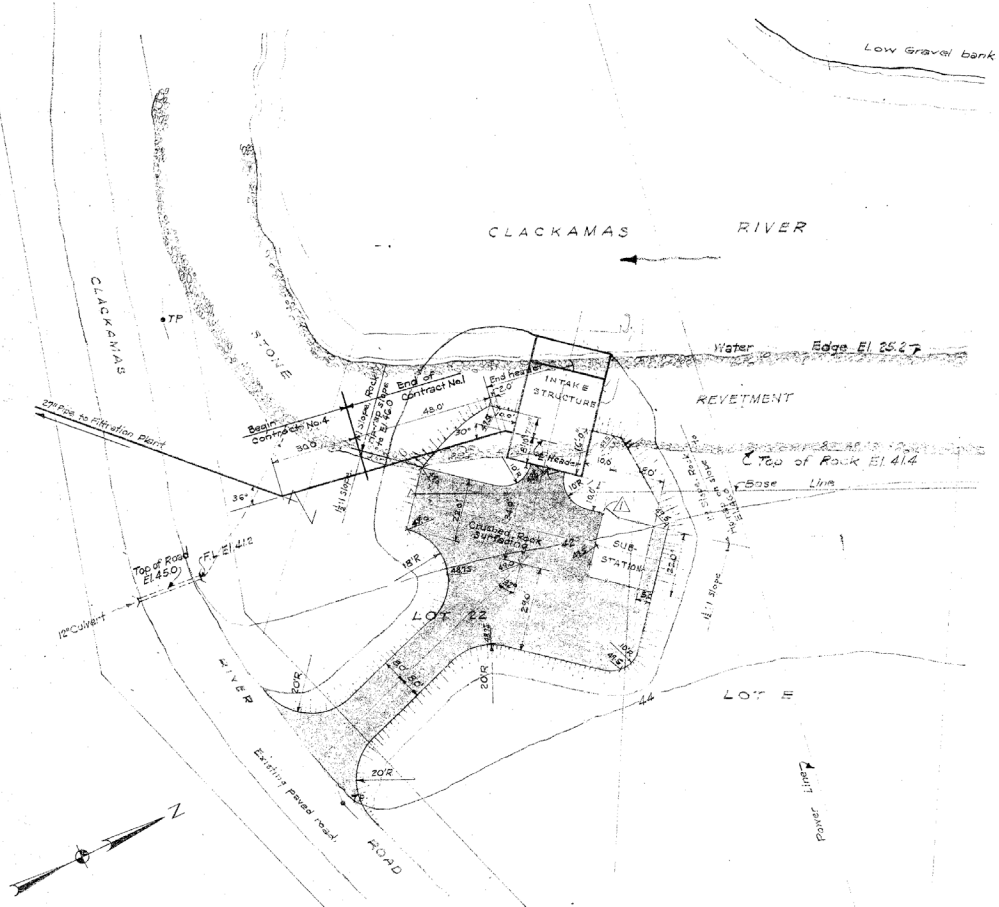
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

RAW WATER INTAKE STRUCTURE

REINFORCEMENT DETAILS

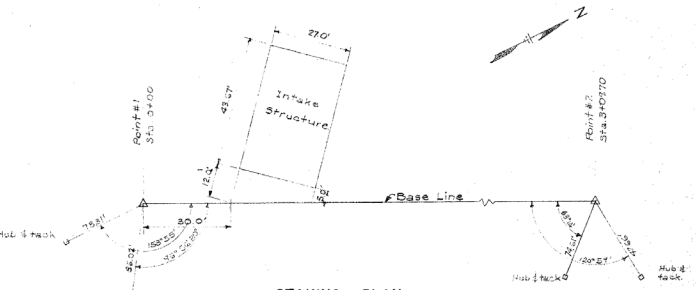
DESIGNED	EAS	APPROVED	W. Grant Thayer
DRAWN	PLK	SCALE	3/8" = 1'-0"
CHECKED	EAS	DATE	8-1-57 FILE 1160-2088

SHEET OF CI-6 77



LOCATION & GRADING PLAN

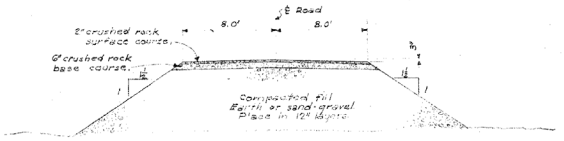
Scale: 1" = 20'



STAKING PLAN

Not to Scale.

NOTES:
1- Surface course rock is ¾" minus.
2- Base rock is 2½" minus.
3- Fill in 6 inch layers and roll each layer thoroughly. Surface course must be rolled.
4- The 2" course rock surfacing shall be used in all the shaded areas shown on Location and Grading Plan.



TYPICAL CROSS-SECTION OF ACCESS ROAD

Not to Scale.

DATE	NO.	REVISION	BY
6-1-59	1	As Built	MTS

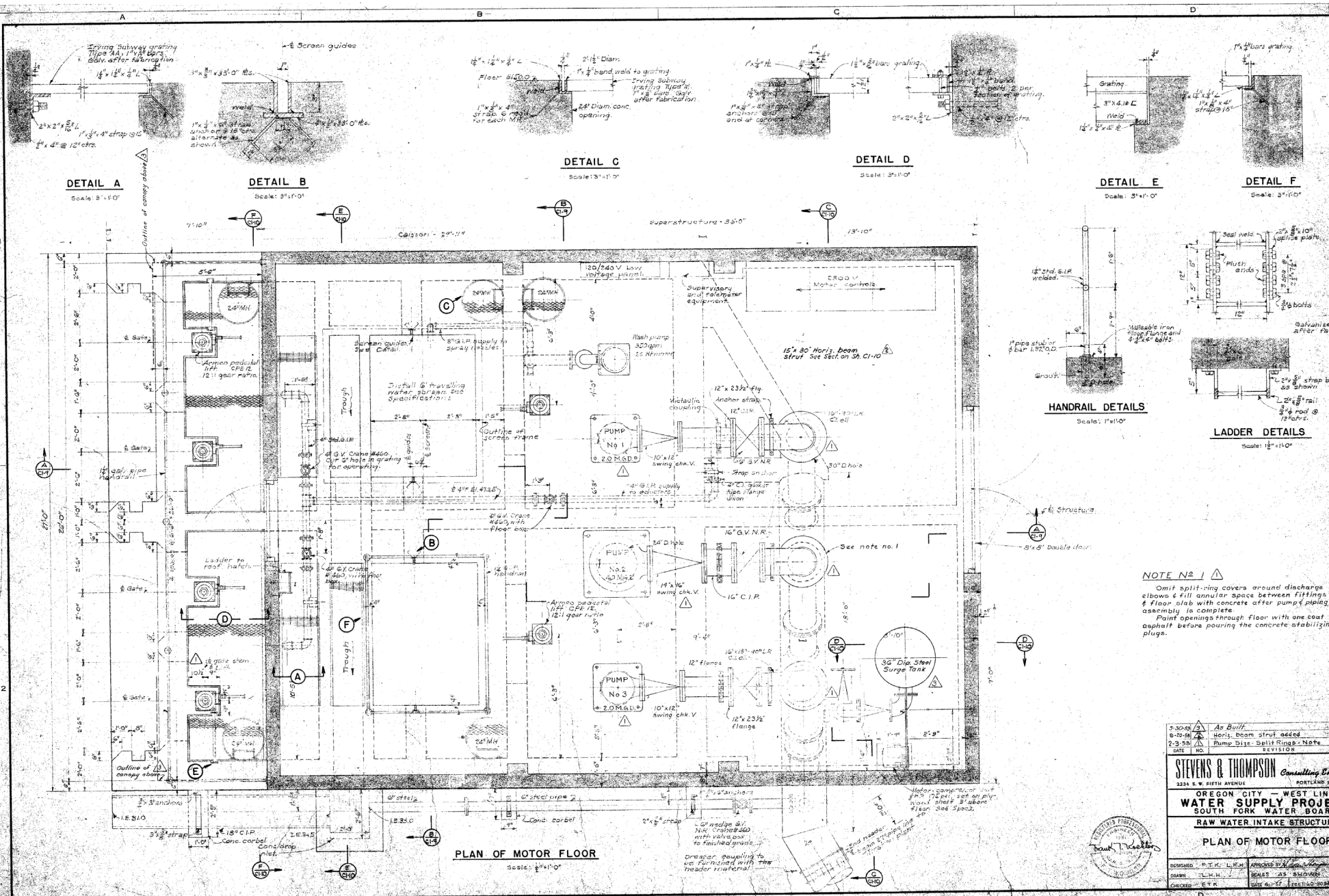
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

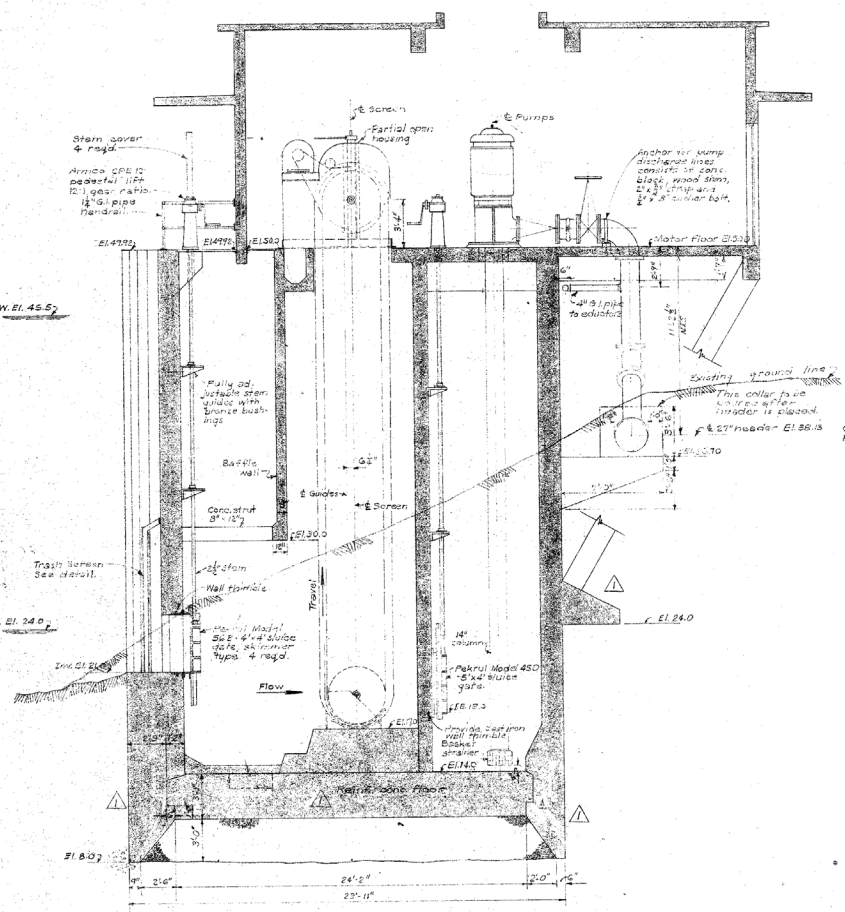
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

RAW WATER INTAKE STRUCTURE

LOCATION & GRADING PLAN

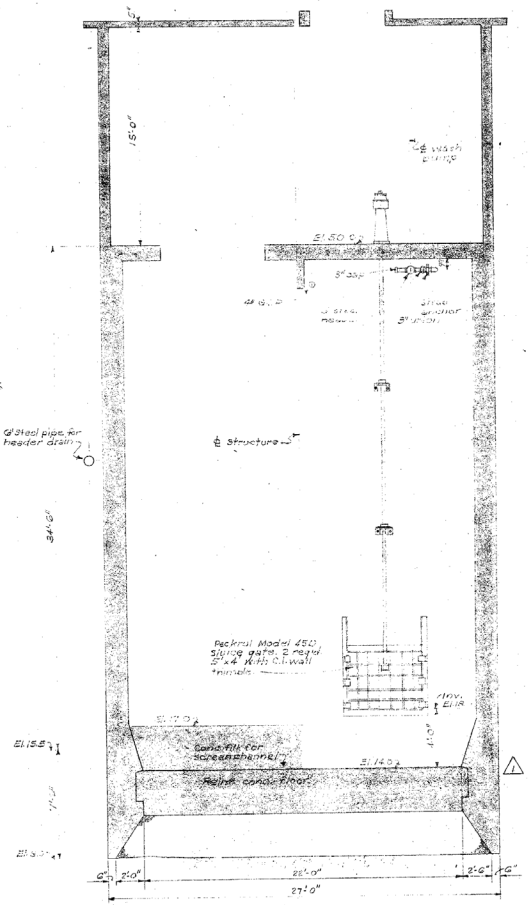
DESIGNED	F.T.K. L.K.H.	APPROVED BY	SHEET NO. C1-7
DRAWN	L.K.H.	SCALE	AS SHOWN
CHECKED	F.T.K.	DATE 6-1-57	FILE 160-1085


DETAIL A
Scale: 3"=1'-0"
DETAIL B
Scale: 3"=1'-0"
DETAIL C
Scale: 3"=1'-0"
DETAIL D
Scale: 3"=1'-0"
DETAIL E
Scale: 3"=1'-0"
DETAIL F
Scale: 3"=1'-0"
HANDRAIL DETAILS
Scale: 1"=1'-0"
LADDER DETAILS
Scale: 1½"=1'-0"
PLAN OF MOTOR FLOOR
Scale: ½"=1'-0"
Superstructure - 33'-0"
Caisson - 29'-11"
Outline of canopy above
Outline of screen frame
Install 6' travelling water screen. See Specifications
Wash pump 350 gpm 20 Hf motor
Supervisory and telemeter equipment
2300 V Motor controls
15"x 30" Horiz. beam strut See Sect. on Sh. C1-10
PUMP No 1 2.0 M.G.D.
PUMP No 2 4.0 M.G.D.
PUMP No 3 2.0 M.G.D.
See note no. 1
36" Dia. Steel Surge Tank
Ladder to roof hatch
Armco pedestal lift CPE 12, 12:1 gear ratio
Trough
Drawer coupling to be furnished with the header material
Motor compressor unit H.P. 175 psi set on plywood shelf 3' above floor See Spec. 2
NOTE No 1
Omit split-ring covers around discharge elbows & fill annular space between fittings & floor slab with concrete after pump & piping assembly is complete.
Paint openings through floor with one coat asphalt before pouring the concrete stabilizing plugs.
5-30-59 As Built
8-20-58 Horiz. beam strut added
2-3-58 Pump Size - Split Rings - Note
DATE NO. REVISION BY
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
RAW WATER INTAKE STRUCTURE
PLAN OF MOTOR FLOOR
DESIGNED F.T.K. L.K.H.
DRAWN L.H.H.
CHECKED E.T.K.
APPROVED BY
SCALES AS SHOWN
DATE 6-1-57
SHEET C1-8 OF 77



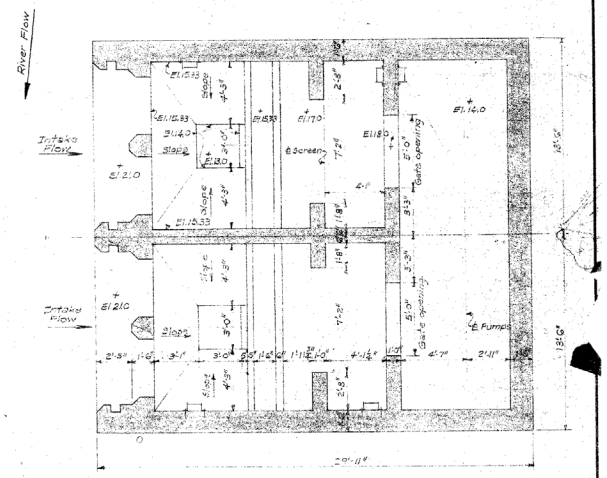
SECTION A-A

Scale: ¼"=1'-0"



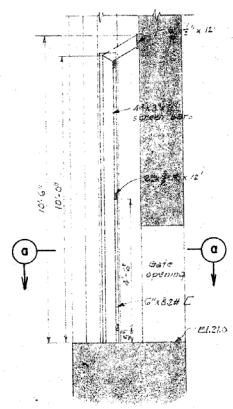
SECTION B-B

Scale: ¼"=1'-0"



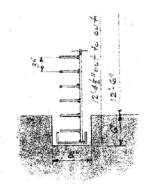
CAISSON FLOOR PLAN

Scale: ¼"=1'-0"



DETAILS OF TRASH SCREEN

Scale: ¼"=1'-0"



SECTION a-a

Scale: 1"=1'-0"

NOTES.
1- Trash screens are removable.
2- All welded const.
3- Approx wt for l = 3175 lbs
4- 2 screens req'd

DATE	NO.	REVISION	BY
5-29-59	1	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

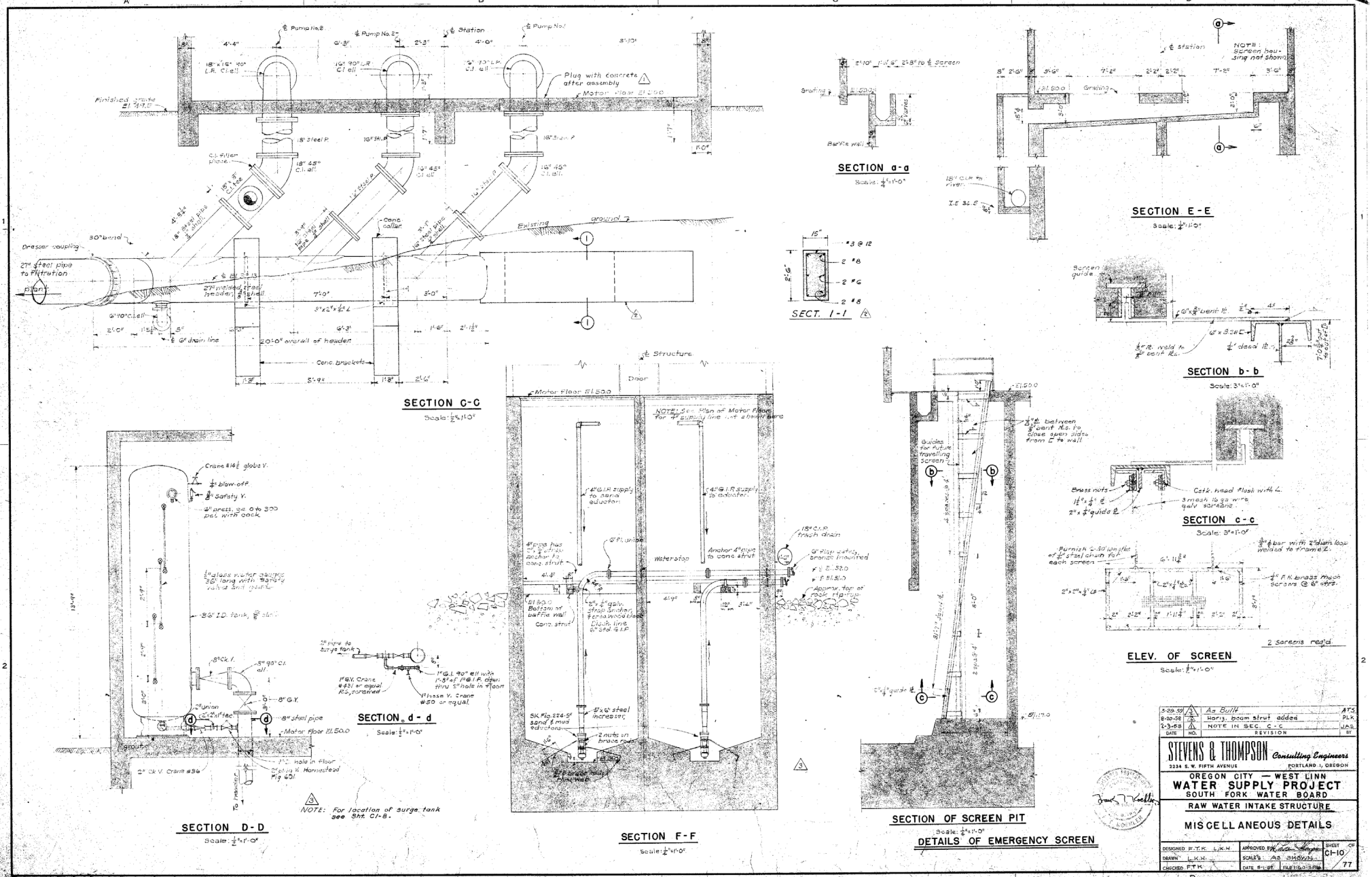
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

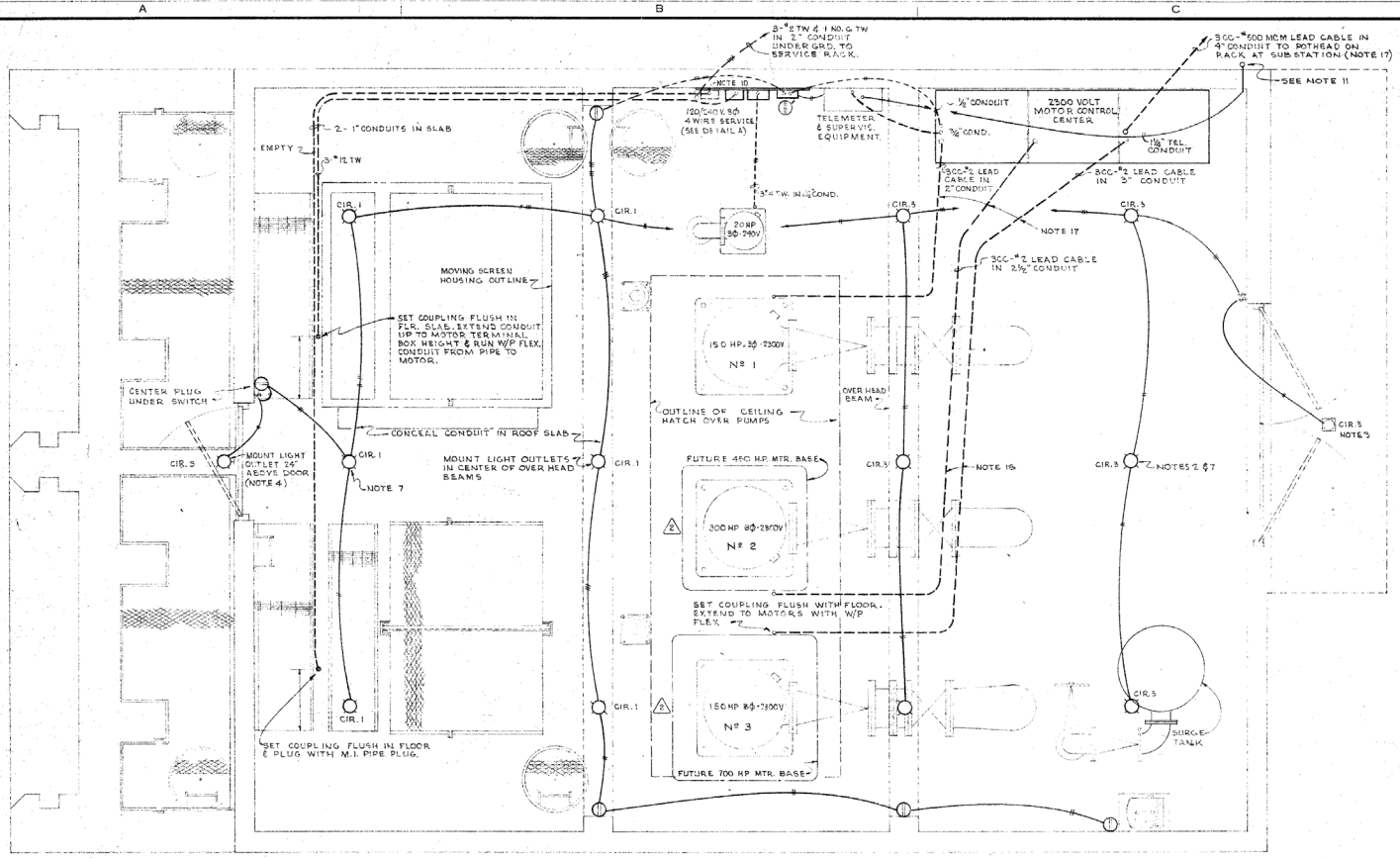
RAW WATER INTAKE STRUCTURE

CROSS SECTIONS

DESIGNED F.T.K. L.K.H.	APPROVED BY		SHEET CI-9 OF 77
DRAWN L.K.H.	SCALES AS SHOWN		
CHECKED F.T.K.	DATE 10-1-57	FILE 1160-5085	

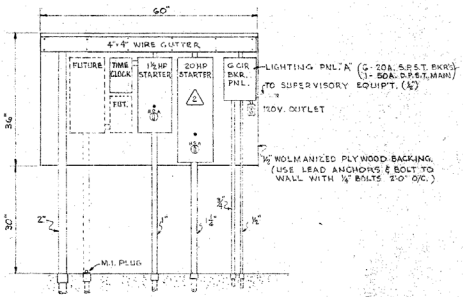
REGISTERED PROFESSIONAL ENGINEER 1901 OREGON MAR. 8, 1959 F. T. KOEHLER


SECTION C-C
Scale: 1/2"=1'-0"
SECTION a-a
Scale: 1/4"=1'-0"
SECTION E-E
Scale: 1/4"=1'-0"
SECT. 1-1
SECTION b-b
Scale: 3"=1'-0"
SECTION c-c
Scale: 3"=1'-0"
ELEV. OF SCREEN
Scale: 1/2"=1'-0"
2 Screens req'd.
SECTION D-D
Scale: 1/2"=1'-0"
SECTION d-d
Scale: 1/2"=1'-0"
NOTE: For location of surge tank see Sht. C1-8.
SECTION F-F
Scale: 1/4"=1'-0"
SECTION OF SCREEN PIT
Scale: 1/4"=1'-0"
DETAILS OF EMERGENCY SCREEN
Plug with concrete after assembly
Motor Floor El. 50.0
Finished grade El. 49.5
Existing ground
Dresser coupling
27" steel pipe to filtration plant
20'-0" overall of header
Conc. brackets
Conc. collar
Crane #14 1/2 globe V.
Motor Floor El. 50.0
Water stop
Anchor 4" pipe to conc. strut
Guides for future travelling screen
Brass nuts
Cstk. head flush with L.
Screen guide
Furnish 6-40 lengths of 1/4" steel chain for each screen
Motor Floor El. 50.0
Crane #36
Horiz. beam strut added
NOTE IN SEC. C-C
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE
PORTLAND 1, OREGON
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
RAW WATER INTAKE STRUCTURE
MISCELLANEOUS DETAILS
DESIGNED F.T.K. L.K.H.
DRAWN L.K.H.
CHECKED F.T.K.
APPROVED BY
SCALE: AS SHOWN
DATE 8-1-57
SHEET CI-10 OF 77

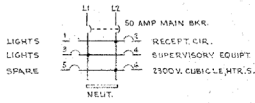


NOTES

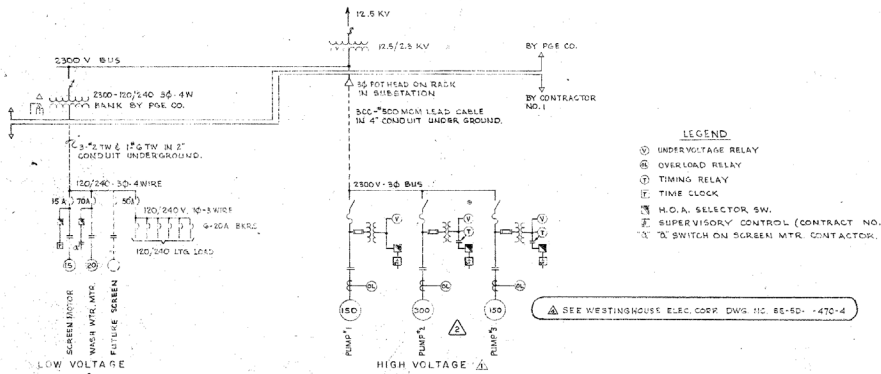
1. THIS DRAWING IS DIAGRAMATIC & IS INTENDED TO SHOW LOCATIONS OF ELECTRICAL OUTLETS & EQUIPMENT RELATIVE TO DOORS, WINDOWS, WALLS & MACHINERY. DO NOT SCALE FOR DIMENSIONS.
2. ALL OVERHEAD LIGHTS TO BE ABOLITE NO. RF-200 AWSN WITH 200W LAMP.
3. OMNIPY LIGHT TO BE DAYBRITE NO. 2501 WITH 2-60 W. LAMPS.
4. REAR BRACKET LIGHT TO BE GOODRICH NO. G-57816 MOUNTED ON GOOSENECK HANGER. USE 200 W. LAMP.
5. MOUNT WALL RECEPTACLES 36" TO CENTER FROM FLR.
6. ALL RECEPTACLES TO BE 10 AMP. 120 V GROUNDING TYPE & WEATHER PROOF.
7. MOUNT OVERHEAD LIGHTS 12'-0" UP FROM FLR. TO BOTTOM OF UNITS USE BALL HANGERS FOR VERTICAL ALIGNMENT WHERE REQ'D.
8. MOUNT WALL SWITCHES 48" UP TO CENTER FROM FLR., SW'S TO BE T.T. RATED, 10A-120V.
9. SWITCH LIGHTS ON CIR. 3 AT DOOR, SWITCH LIGHTS ON CIR. 1 AT PNL. 'A'
10. SET COUPLING FLUSH IN FLR. & PLUG CONDUIT RUN WITH M.I. PIPE PLUG.
11. INSTALL 1½" TELEPHONE CONDUIT EXPOSED ON WALL, PROVIDE WEATHER HEAD & EXTEND CONDUIT TO TELEMETERING EQUIPMENT. SEE ACTUAL LOCATION OF CONDUIT ENTRANCE TO BLDG. TO BE DETERMINED BY ENGINEER.
12. ALL CONDUIT TO BE RIGID GALV. STEEL.
13. VERIFY LOCATIONS OF CONDUITS STUBBED UP TO EQUIPMENT IN FIELD BEFORE ROUGH-IN.
14. CONDUITS EXPOSED IN PUMP PIT TO BE PAINTED WITH ASPHALTUM. NO CONDUIT TO BE INSTALLED BELOW EL. 47.50
15. MOUNT 500 W. HEATERS IN EACH 2300 V. CUBICLE IN SUITABLE LOCATION.
16. NO WIRE SMALLER THAN NO. 12 TW TO BE USED.
17. CONDUIT SIZED FOR 5KV LEAD COVERED 3CC CABLE, MAX. CONDUIT FILL TO BE 40% IF CABLES OF GREATER O.D. ARE USED CONDUIT SIZES MAY ALSO HAVE TO BE INCREASED.
18. CONDUITS TO BE SET FOR FUTURE MOTOR SIZE.
19. REFER TO HEAD HSE. DRAWING E1 FOR GENERAL NOTES.
20. PROVIDE PROTECTED CABLE GROUND TO WATER PIPE
21. THIS CONTRACTOR TO PROVIDE CONDUITS, METER BASES, ETC. FOR PRIMARY METERING. LOCATE AS DIRECTED.



DETAIL A
N.T.S.



PANEL A



PUMPING PLANT ONE-LINE DIAGRAM

LEGEND
- (V) UNDERVOLTAGE RELAY
- (O) OVERLOAD RELAY
- (T) TIMING RELAY
- (T) TIME CLOCK
- H.O.A. SELECTOR SW.
- (S) SUPERVISORY CONTROL (CONTRACT NO. 2)
- "A" SWITCH ON SCREEN MTR. CONTACTOR.

⚠ SEE WESTINGHOUSE ELEC. CORP. DWG. NO. 88-60-470-4

DATE	NO.	REVISION	BY
10-1-59	4	ADDED MANUF. DWG. NO., AS BUILT	FM
2-3-58	3	Meters No 2 & 3 exchange positions	JAS
2-3-58	2	HP change - Small mtr. 15 HP to 20 HP.	JAS
12-18-57	1	CHANGED MTR. RATE OF PUMPS 1 & 2	KM

STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

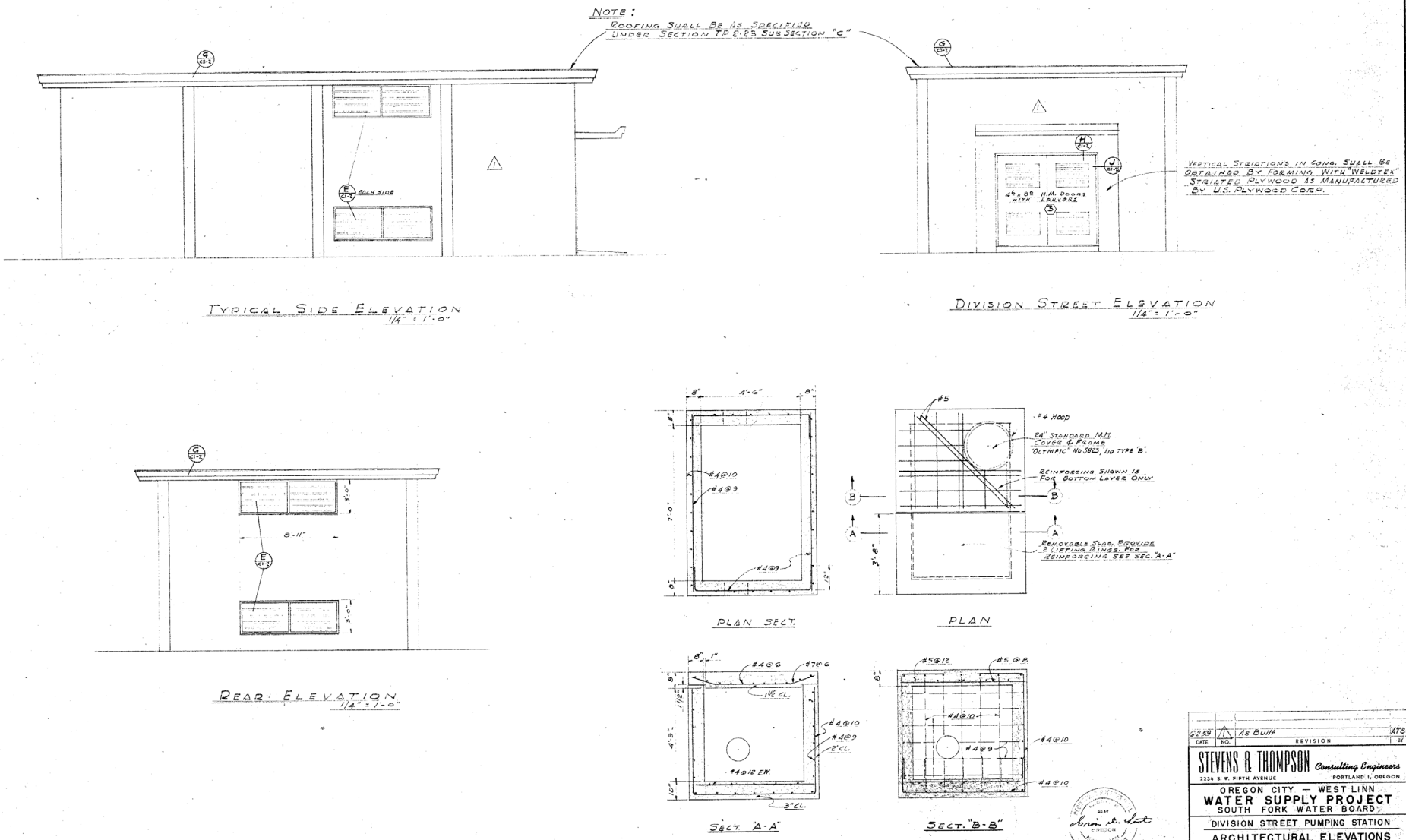
RAW WATER INTAKE STRUCTURE

ELECTRICAL PLAN & DETAILS

DESIGNED	R.E.R.	APPROVED BY	
DRAWN	K.M.	SCALE	⅛"=1'-0"
CHECKED	R.E.R.	DATE	8-1-57
		FILE NO.	2057

SHEET E-11 OF 77

REGISTERED PROFESSIONAL ENGINEER 2083 OREGON JULY 6, 1955 RONALD E. RICE



DATE	NO.	REVISION	BY
6-2-59	1	As Built	ATS

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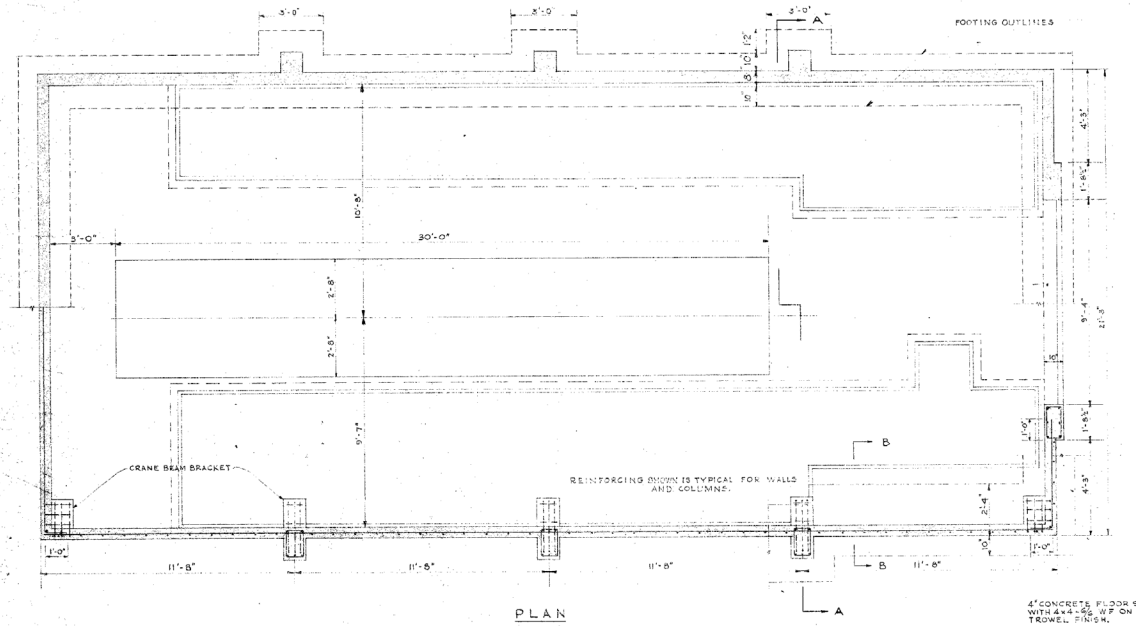
2234 S. W. FIFTH AVENUE — PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

DIVISION STREET PUMPING STATION
ARCHITECTURAL ELEVATIONS & VALVE BOX

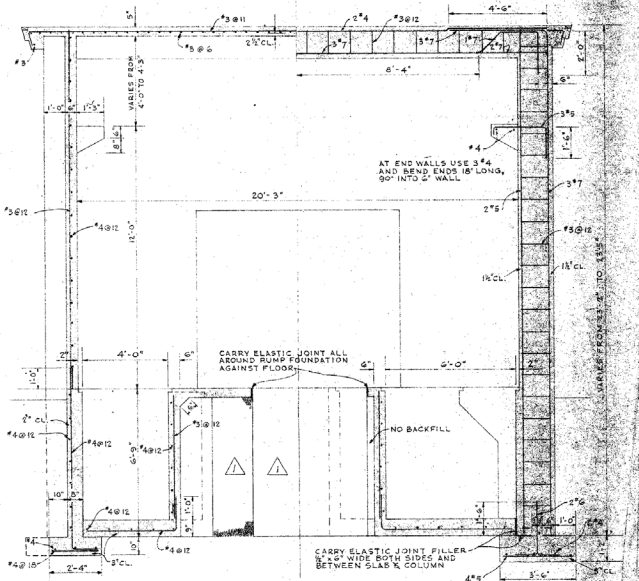
DESIGNED J.M.H. - EAS	APPROVED BY [signature]	SHEET C3-1 OF 77
DRAWN JMH	SCALE NOTED	
CHECKED EAS	DATE 8-1-57 FILE: 60-3089	



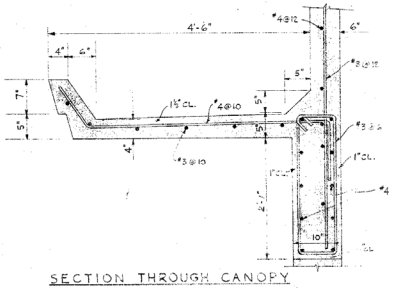
PLAN
SCALE: 3/8" = 1'-0"

4" CONCRETE FLOOR SLAB, REINFORCE WITH 4x4-6/6 WF ON 6" GRAVEL BASE TROWEL FINISH.

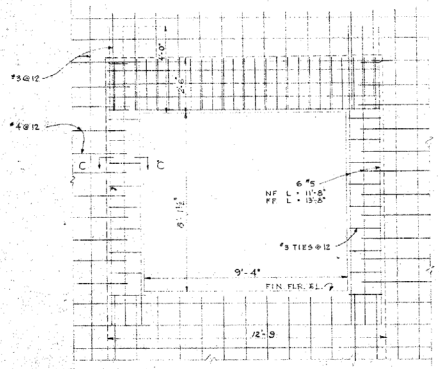
PROVIDE AROUND ALL WALL OPENINGS 2 #5 BARS AND EXTEND 30" BEYOND THE CORNERS



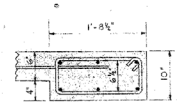
SECTION A-A
SCALE: 3/8" = 1'-0"



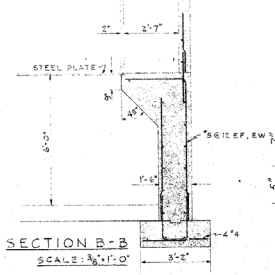
SECTION THROUGH CANOPY
SCALE: 1" = 1'-0"



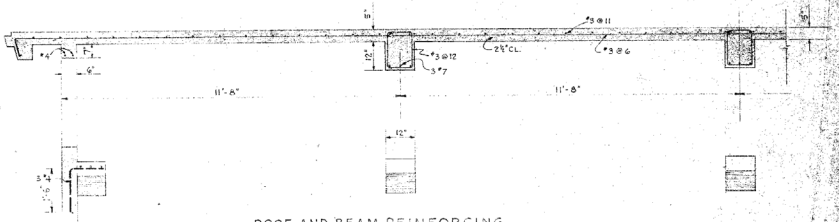
REINFORCING AROUND DOORWAY
SCALE: 3/8" = 1'-0"



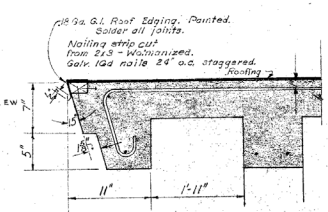
SECTION C-C
SCALE: 1" = 1'-0"



SECTION B-B
SCALE: 3/8" = 1'-0"



ROOF AND BEAM REINFORCING
SCALE: 1/2" = 1'-0"



DETAIL G
1 1/2" = 1'-0"

DATE	NO.	REVISION	BY
6-1-59	1	As Built	

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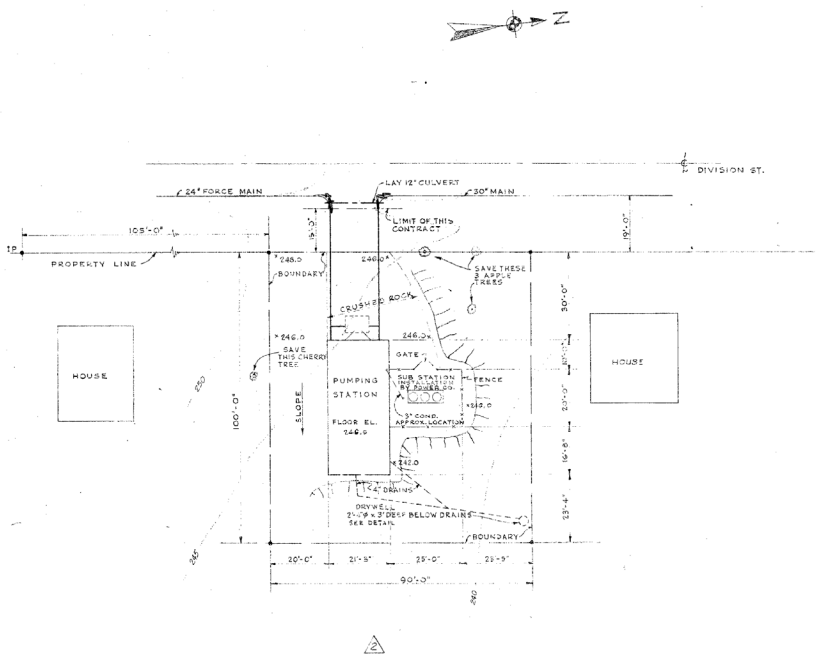
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
DIVISION ST. PUMPING STATION

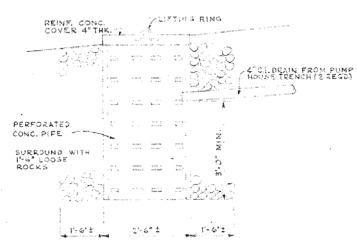
STRUCTURAL DETAILS

DESIGNED FFH	APPROVED BY	SHEET	OF
DRAWN RWC	SCALE As noted	C3-2	77
CHECKED EAS	DATE 9-1-57		



PLOT PLAN

SCALE: 1" = 20'

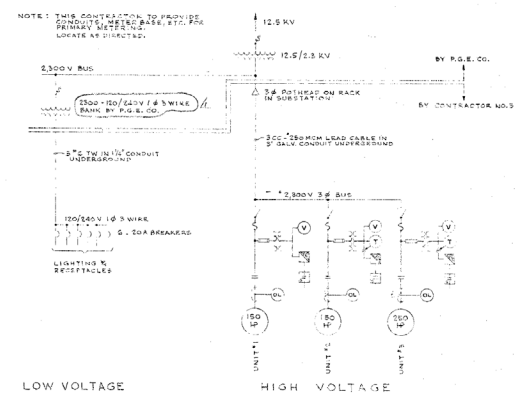


DRY WELL

NO SCALE

LEGEND

- (V) UNDERVOLTAGE RELAY
- (OL) OVERLOAD RELAY
- (T) TIMING RELAY
- H.O.A. SELECTOR SWITCH
- SUPERVISORY CONTROL (CONTRACT NO. 2)



ONE LINE DIAGRAM

ELECTRICAL INSTALLATION

DATE	NO.	REVISION	BY
6259	2	As Built	ATS
	1	CHANGED MTR. NO. 2 & LOW VOLT. TRANS.	KM

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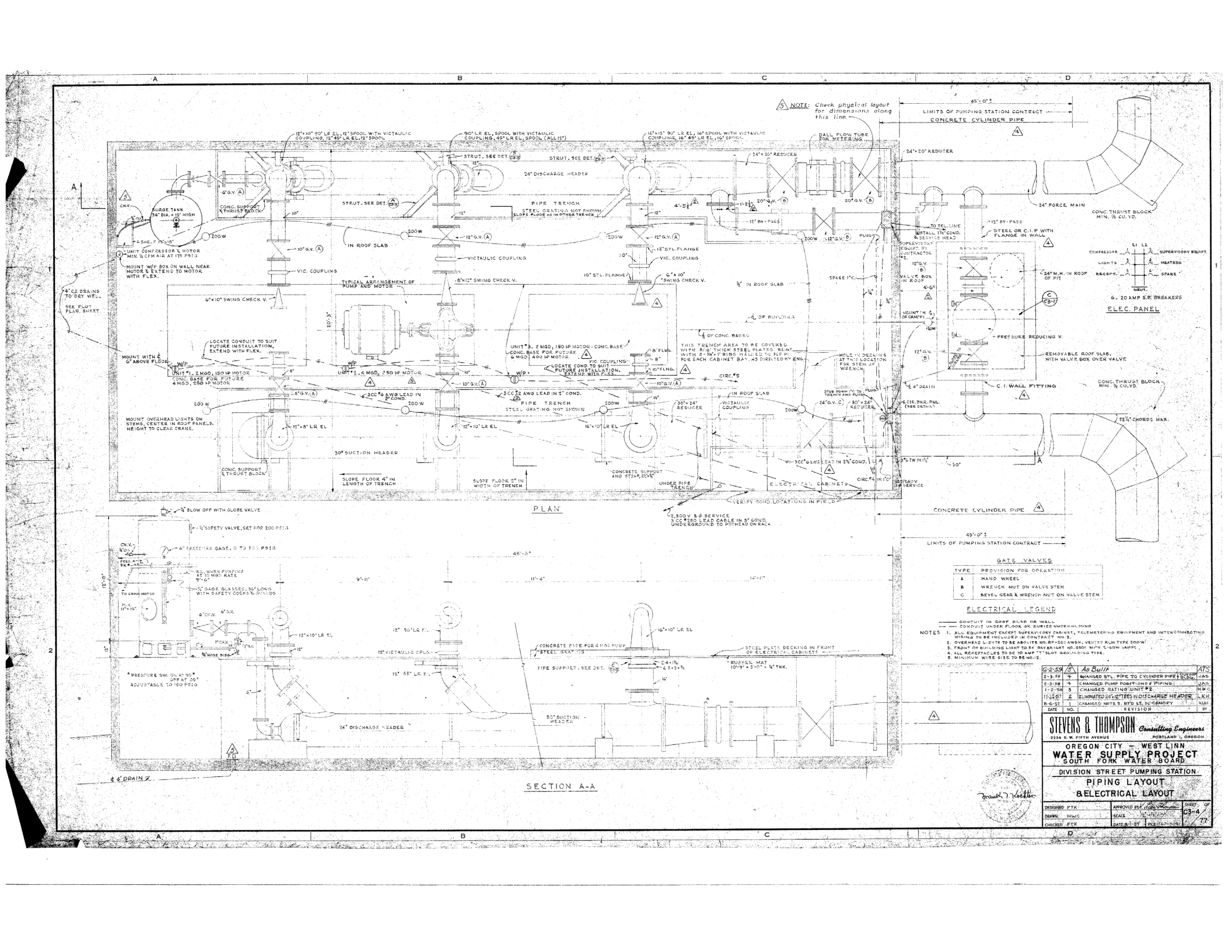
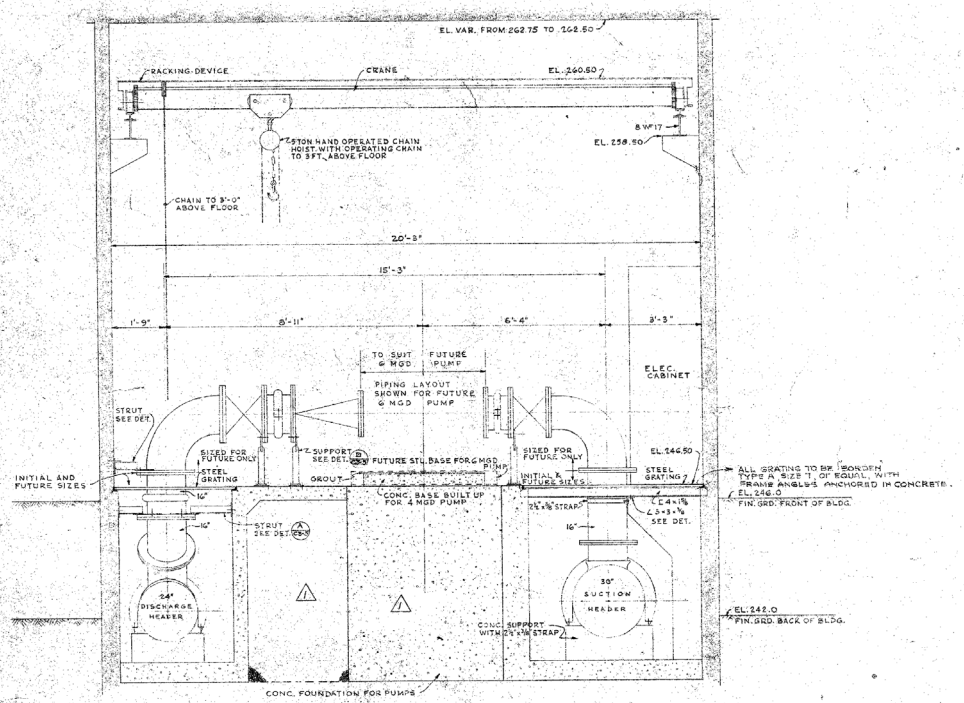
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

DIVISION STREET PUMPING STATION

PLOT PLAN, DRYWELL & ELECTRICAL
ONE LINE DIAGRAM

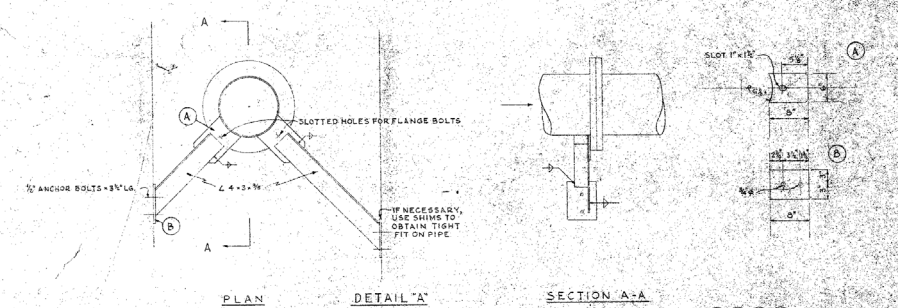
DESIGNED F.T.K.	APPROVED BY	SHEET C3-3	OF 77
DRAWN H.W.C.	SCALE As Noted		
CHECKED E.T.K.	DATE 8-1-77	FILE 160-3070	


NOTE: Check physical layout for dimensions along this line.
LIMITS OF PUMPING STATION CONTRACT
CONCRETE CYLINDER PIPE
45'-0"±
12"x10" 90° LR EL, 12" SPOOL WITH VICTAULIC COUPLING, 12"45° LR EL, 12" SPOOL
90° LR EL, SPOOL WITH VICTAULIC COUPLING, 45° LR EL, SPOOL (ALL 12")
10"x12" 90° LR EL, 16" SPOOL WITH VICTAULIC COUPLING, 16" 45° LR EL, 10" SPOOL
DALL FLOW TUBE FOR METERING
24"x20" REDUCER
24" DISCHARGE HEADER
STRUT. SEE DET.
PIPE TRENCH
STEEL GRATING NOT SHOWN
SLOPE FLOOR AS IN OTHER TRENCH
24" FORCE MAIN
CONC. THRUST BLOCK MIN. ½ CU. YD.
12" BY-PASS
8" STEEL OR C.I.P. WITH FLANGE IN WALL
TO TEL. LINE
INSTALL 1"# COND. & SERVICE HEAD
SURGE TANK 36" DIA. x 15' HIGH
CONC. SUPPORT & THRUST BLOCK
CHV
6" G.V.
4" VENT
2-SHE-P 15"x18"
UNIT COMPRESSOR & MOTOR MIN. ¼ CFM AIR AT 175 PSIG
MOUNT W/P BOX ON WALL NEAR MOTOR & EXTEND TO MOTOR WITH FLEX.
4" C.I. DRAINS TO DRY WELL
SEE PLOT PLAN, SHEET
IN ROOF SLAB
VICTAULIC COUPLING
TYPICAL ARRANGEMENT OF PUMP AND MOTOR
6"x10" SWING CHECK V.
6"x12" SWING CHECK V.
10" STL. FLANGE
12" STL. FLANGE
6"x10" SWING CHECK V.
SUPERVISORY EQUIPT. BY CONTRACTOR
SPARE 1"C.
¾" IN ROOF SLAB
℄ OF BUILDING
℄ OF CONC. BASES
24" M.H. IN ROOF OF PIT
LI L2
COMPRESSOR
LIGHTS
RECEPT.
SUPERVISORY EQUIPT.
HEATERS
SPARE
NEUT.
6 - 20 AMP S.P. BREAKERS
ELEC. PANEL
PRESSURE REDUCING V.
REMOVABLE ROOF SLAB, WITH VALVE BOX OVER VALVE
C.I. WALL FITTING
CONC. THRUST BLOCK MIN. ½ CU. YD.
72½° CHORDS MAX.
LOCATE CONDUIT TO SUIT FUTURE INSTALLATION, EXTEND WITH FLEX.
MOUNT WITH ℄ 6" ABOVE FLOOR
W/P
UNIT #1 - 2 MGD, 150 HP MOTOR
CONC. BASE FOR FUTURE 4 MGD, 250 HP MOTOR
UNIT #2 - 4 MGD, 250 HP MOTOR
UNIT #3 - 2 MGD, 150 HP MOTOR - CONC. BASE
CONC. BASE FOR FUTURE 6 MGD, 400 HP MOTOR
VIC. COUPLING TO SUIT FUTURE INSTALLATION, EXTEND WITH FLEX.
THIS TRENCH AREA TO BE COVERED WITH 3/16" THICK STEEL PLATES, REINF. WITH 2-4"x4" I RIBS WELDED TO FLR PL FOR EACH CABINET BAY, AS DIRECTED BY ENG.
HOLE IN DECKING AT THIS LOCATION FOR STEM OF WRENCH
STEEL PLATE DECKING IN FRONT OF ELECTRICAL CABINETS
STUB DOWN I"C TO PLUGS TRENCH AND PLUG
CIR. BKR. PNL. (SEE DETAIL)
CIRC. #5
3CC #2 AWG LEAD IN 2" COND.
3CC #6 AWG LEAD IN 2" COND.
4" DRAIN
MOUNT OVERHEAD LIGHTS ON STEMS, CENTER IN ROOF PANELS. HEIGHT TO CLEAR CRANE.
12"x8" LR EL
12"x10" LR EL
16"x10" LR EL
30"x24" REDUCER
VICTAULIC COUPLING
30" SUCTION HEADER
CONC. SUPPORT & THRUST BLOCK
SLOPE FLOOR 4" IN LENGTH OF TRENCH
SLOPE FLOOR 2" IN WIDTH OF TRENCH
CONCRETE SUPPORT AND STRAP, 20'c
UNDER PIPE TRENCH
ELECTRICAL CABINETS
CIRC. #4 IN 1"C
480/240 V 3Ø SERVICE
VERIFY COND. LOCATIONS IN FIELD
PLAN
2,300 V 3Ø SERVICE 3CC #250 LEAD CABLE IN 3" COND. UNDERGROUND TO POTHEAD ON RACK
CONCRETE CYLINDER PIPE
45'-0"±
LIMITS OF PUMPING STATION CONTRACT
¼" BLOW OFF WITH GLOBE VALVE
½" SAFETY VALVE, SET FOR 200 PSIG
6" PRESSURE GAGE, 0 TO 300 PSIG
CHV
6" G.V.
FREE 4"C. SW. ▲
TO COND. MOTOR
M-4 11"x15"
½" GAGE GLASSES, 30" LONG WITH SAFETY COCKS & SHIELDS
6" CHV.
6" G.V.
1" CORP.
¾" HOSE BIBB
12"x10" LR EL
12" 90° LR EL
12" VICTAULIC COUPLING
12" 45° LR EL
* PRESSURE SW. ON AT 95# OFF AT 05# ADJUSTABLE TO 150 PSIG
24" DISCHARGE HEADER
30" SUCTION HEADER
CONCRETE PIER FOR 4 MGD PUMP
PIPE SUPPORT, SEE DET.
STEEL PLATE DECKING IN FRONT OF ELECTRICAL CABINETS
RUBBER MAT 10'-9" x 3'-0" x ¾" THK.
℄ DRAIN
SECTION A-A
GATE VALVES
TYPE | PROVISION FOR OPERATION
A | HAND WHEEL
B | WRENCH NUT ON VALVE STEM
C | BEVEL GEAR & WRENCH NUT ON VALVE STEM
ELECTRICAL LEGEND
CONDUIT IN ROOF SLAB OR WALL
CONDUIT UNDER FLOOR OR BURIED UNDERGROUND
NOTES
1. ALL EQUIPMENT EXCEPT SUPERVISORY CABINET, TELEMETERING EQUIPMENT AND INTERCONNECTING WIRING TO BE INCLUDED IN CONTRACT NO. 3.
2. OVERHEAD LIGHTS TO BE 300 WATTS NO. RF-150 AWSN., VENTED R.L.M. TYPE 200W
3. FRONT OF BUILDING LIGHT TO BE DAYBRIGHT NO. 2501 WITH 2-60W LAMPS.
4. ALL RECEPTACLES TO BE 10 AMP "T" SLOT GROUNDING TYPE.
5. MINIMUM WIRE SIZE TO BE NO. 12.
6-2-59 | A | As Built | ATS
2-3-59 | 4 | CHANGED STL. PIPE TO CYLINDER PIPE & BLDG. OUTLINE | JAS
2-3-58 | 4 | CHANGED PUMP POSITIONS & PIPING | JAS
1-2-58 | 3 | CHANGED RATING UNIT #2 | H.W.C
11-25-57 | 2 | ELIMINATED 24"x12" TEES IN DISCHARGE HEADER | K.H.
8-6-57 | 1 | CHANGED NOTE 5. RTD LT. IN CANOPY | KLM
DATE | NO. | REVISION | BY
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
DIVISION STREET PUMPING STATION
PIPING LAYOUT & ELECTRICAL LAYOUT
DESIGNED FTK
DRAWN HWC
CHECKED FTK
APPROVED BY
SCALE 1/4"=1'-0"
DATE 8-1-57 FILE 1470-3001
SHEET OF C3-4 77



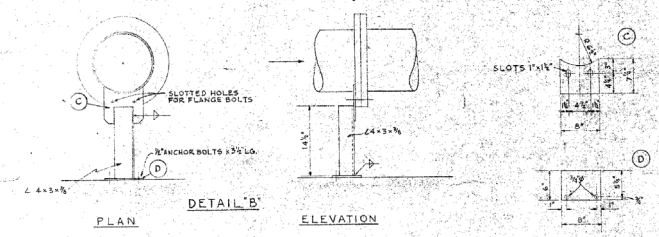
CROSS-SECTION THROUGH PUMP HOUSE

SCALE: ½" = 1'-0"



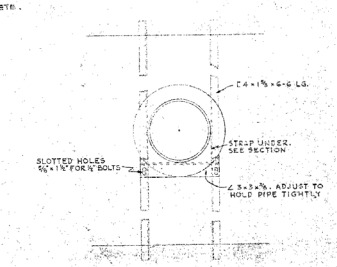
UNDERFLOOR STRUTS FOR 12" DISCHARGE PIPE

SCALE: 1" = 1'-0"



ABOVEFLOOR STRUT FOR 12" DISCHARGE PIPE

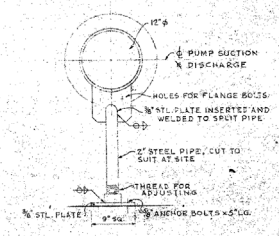
SCALE: 1" = 1'-0"



CLAMP FOR 12" SUCTION PIPE

DETAIL "C"

SCALE: 1" = 1'-0"



TYPICAL PIPE SUPPORT FOR USE NEAR PUMP

DETAIL "D"

DATE	NO.	REVISION	BY
2-2-59	1	As Built	AJS

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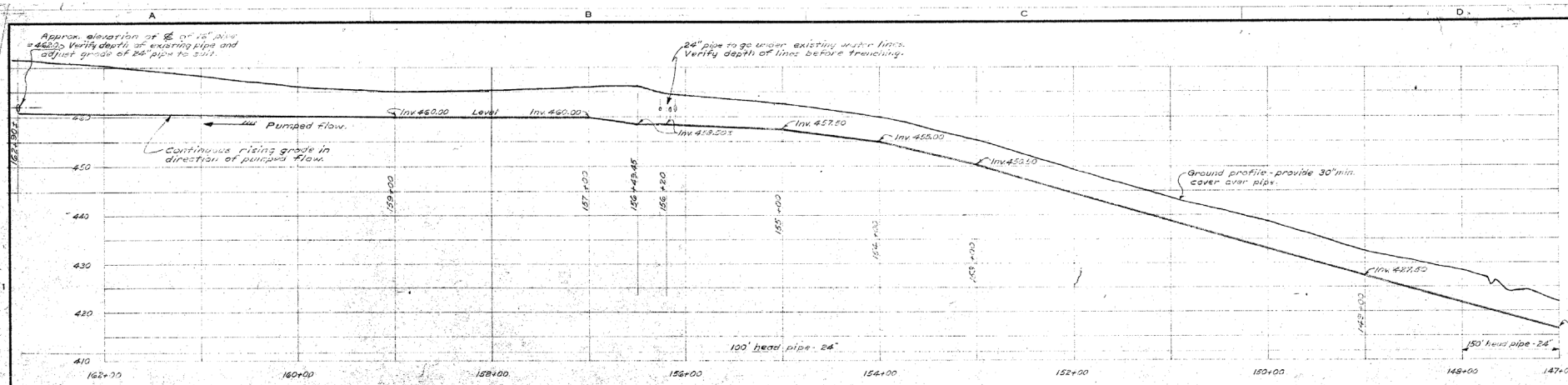
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

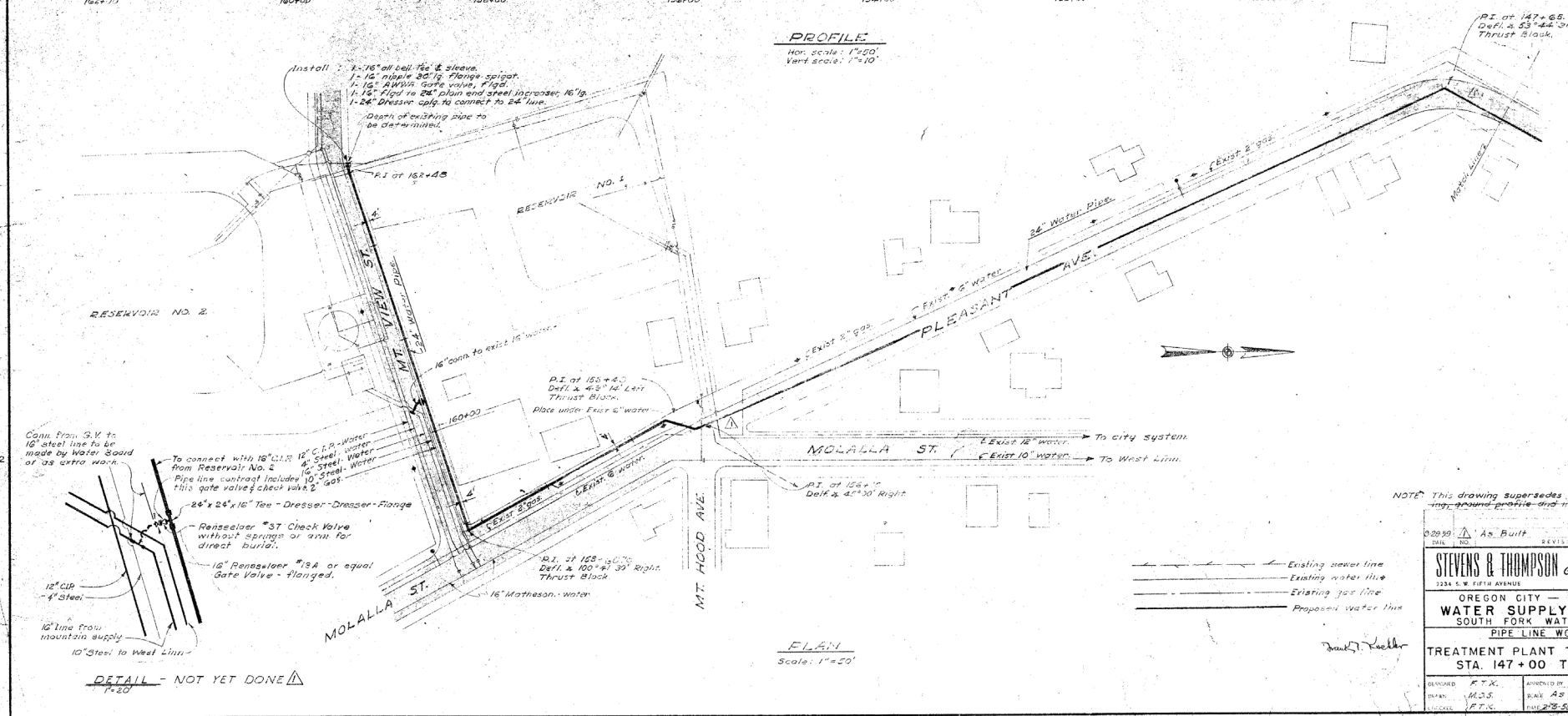
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
DIVISION STREET PUMPING STATION

CROSS SECTION & DETAILS

DESIGNED FTK	APPROVED BY	SHEET C3-5 OF 77
DRAWN HWC	SCALE NOTED	
CHECKED FTK	DATE 8-1-57	



PROFILE
Hor. scale: 1"=50'
Vert. scale: 1"=10'



DETAIL - NOT YET DONE △1
1"=20'

PLAN
Scale: 1"=50'

Existing sewer line
Existing water line
Existing gas line
Proposed water line

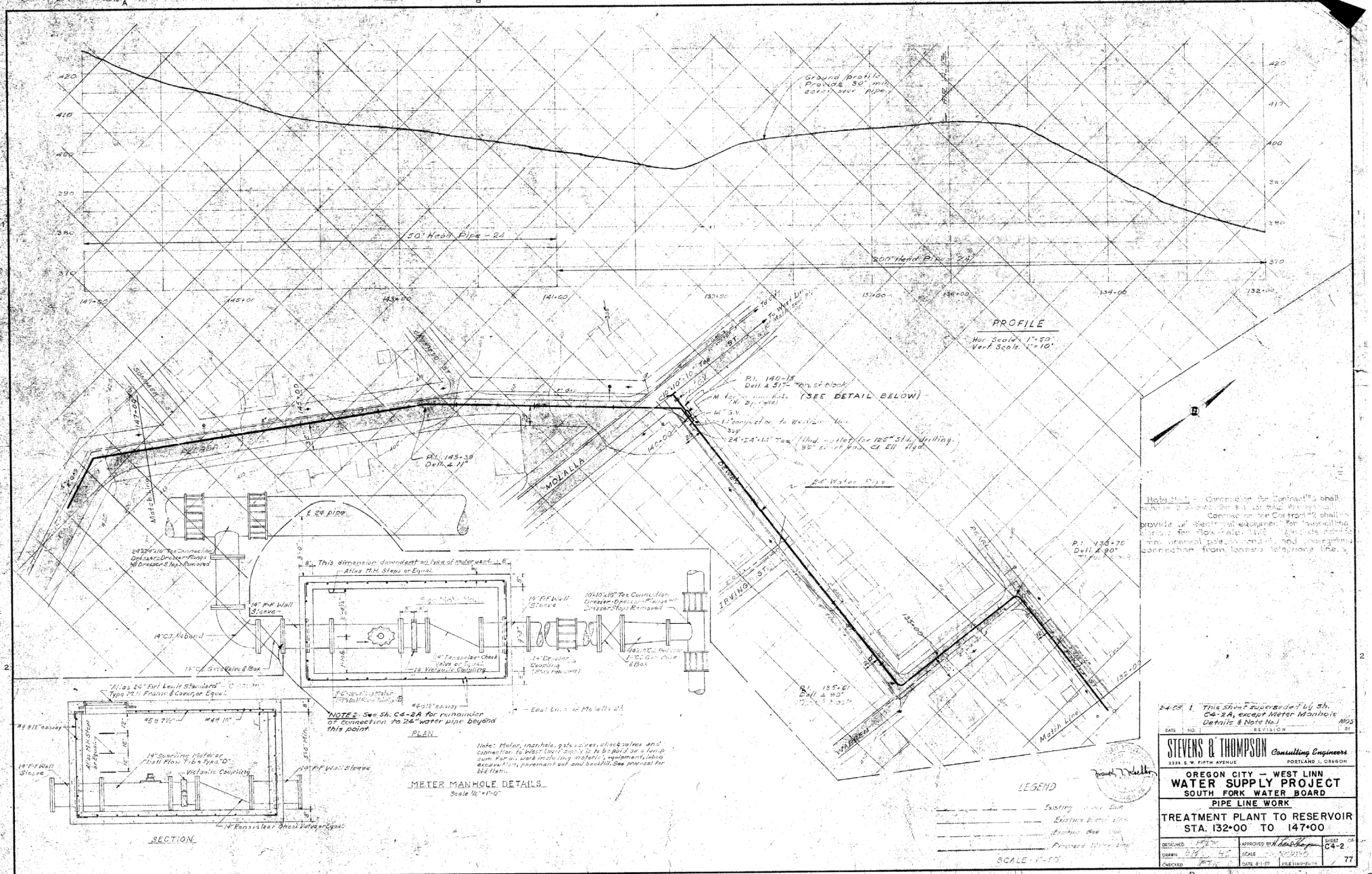
NOTE: This drawing supersedes C4-1 ~~as to stationing, ground profile and invert grade line.~~ △1

DATE	NO.	REVISION	BY
9-29-59	△1	As Built	ATS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK
TREATMENT PLANT TO RESERVOIR
STA. 147+00 TO 162+90±

DESIGNED F.T.K.	APPROVED BY		SHEET C4-1A
DRAWN M.D.S.	SCALE As Shown		
CHECKED F.T.K.	DATE 2-8-58	FILE 1160-3095A	77



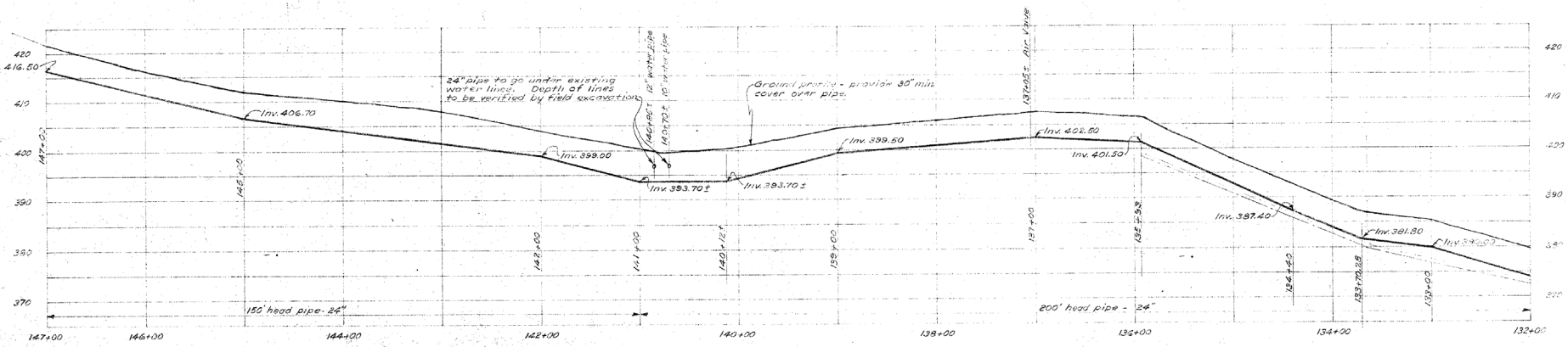
Note No. 1 - Contractor for Contract #3 shall provide 2 sheets for all contract drawings. Contractor for Contract #2 shall provide all electrical equipment for transmitting signals for flow rate. This will include remote from nearest pole to control, and underground connection from leased telephone line.

DATE	NO.	REVISION	BY
2-4-58	1	This Sheet superseded by Sh. C4-2A, except Meter Manhole Details & Note No. 1	MOS

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

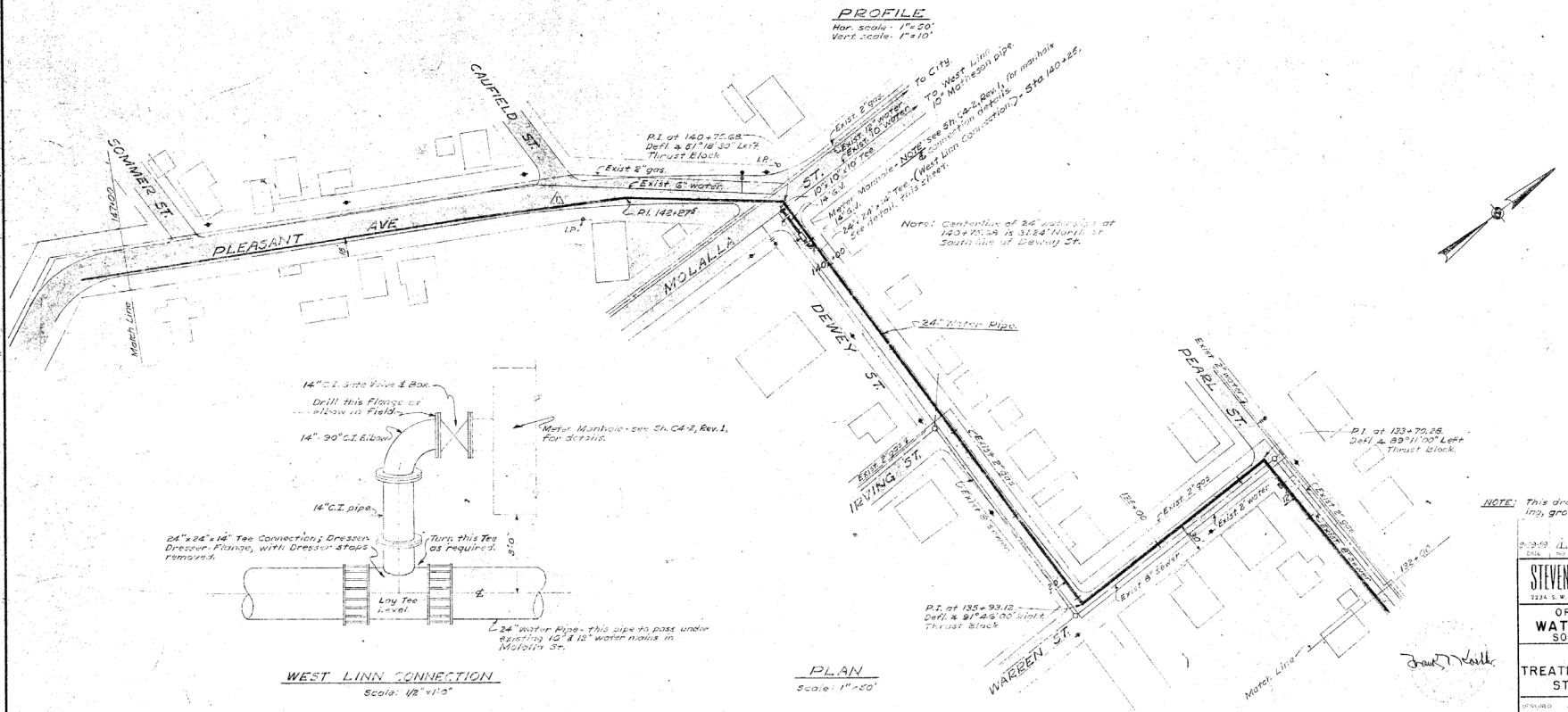
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK
TREATMENT PLANT TO RESERVOIR
STA. 132+00 TO 147+00

DESIGNED	FTK	APPROVED BY	SHEET C4-2 OF 77
DRAWN		SCALE	
CHECKED	FTK	DATE 8-1-57	FILE 1169-5074



PROFILE

Hor. scale: 1"=50'
Vert. scale: 1"=10'



WEST LINN CONNECTION

Scale: 1/2"=1'-0"

PLAN

Scale: 1"=50'

NOTE: This drawing supersedes C4-2 as to stationing, ground profile & invert grade line.

DATE	NO	REVISION	BY
9-29-59	1	As Built	FJ

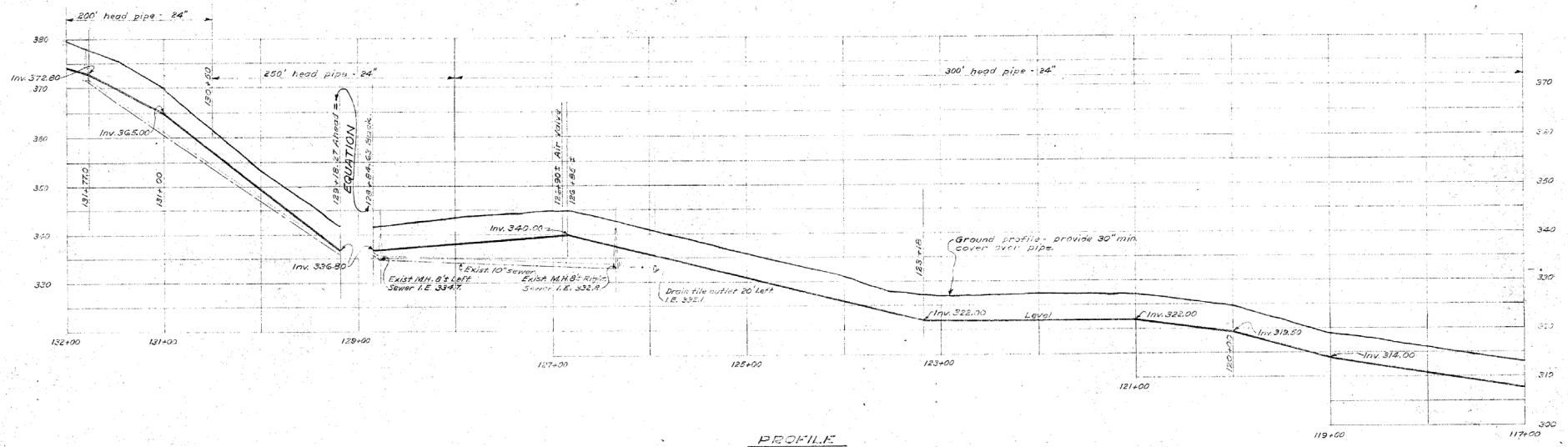
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

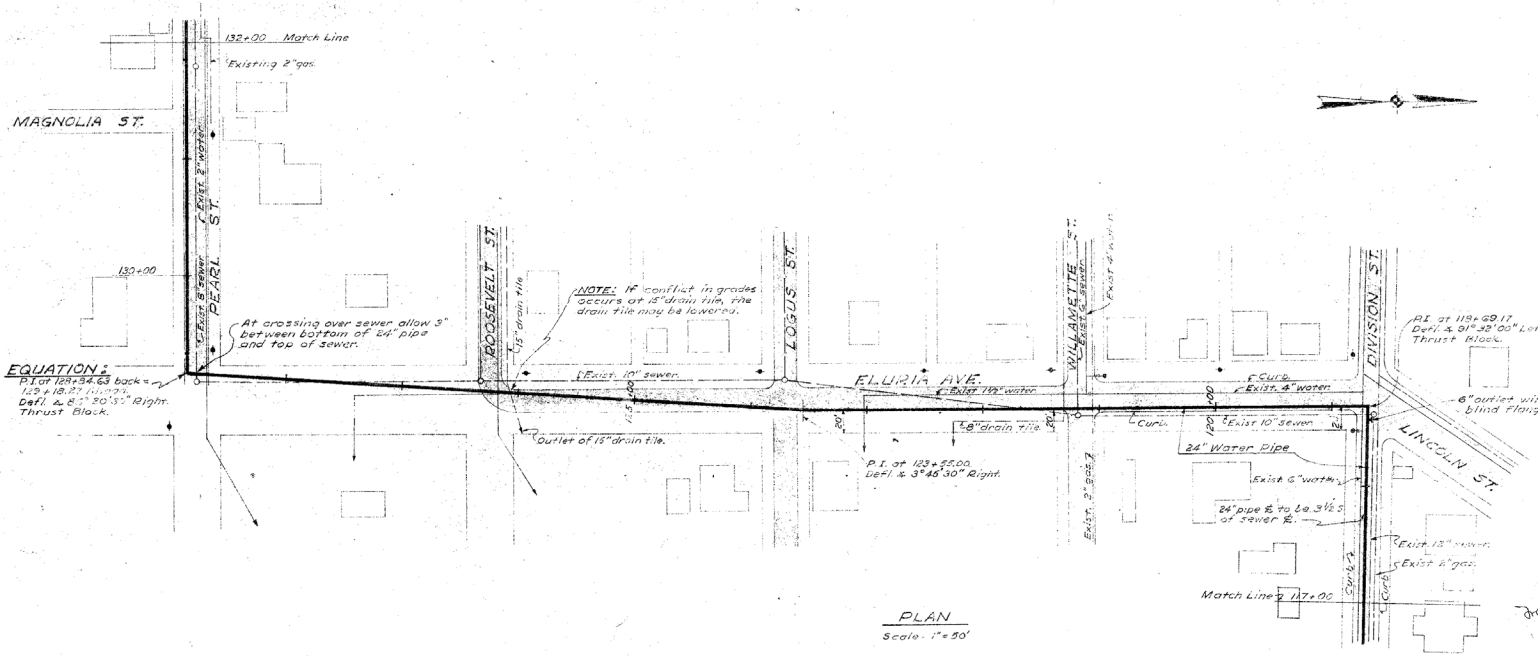
PIPE LINE WORK

TREATMENT PLANT TO RESERVOIR
STA. 132+00 TO 147+00

DESIGNED	F.T.K.	APPROVED BY	SHEET NO.
DRAWN	M.D.S.	SCALE As Shown	C4-2A
CHECKED	F.T.K.	DATE 2-5-58 FILE 1160-3691A	77



PROFILE
Hor. scale: 1"=50'
Vert. scale: 1"=10'



PLAN
Scale: 1"=50'

NOTE: This drawing supersedes C4-3 as to stationing ground profile & invert grade line.

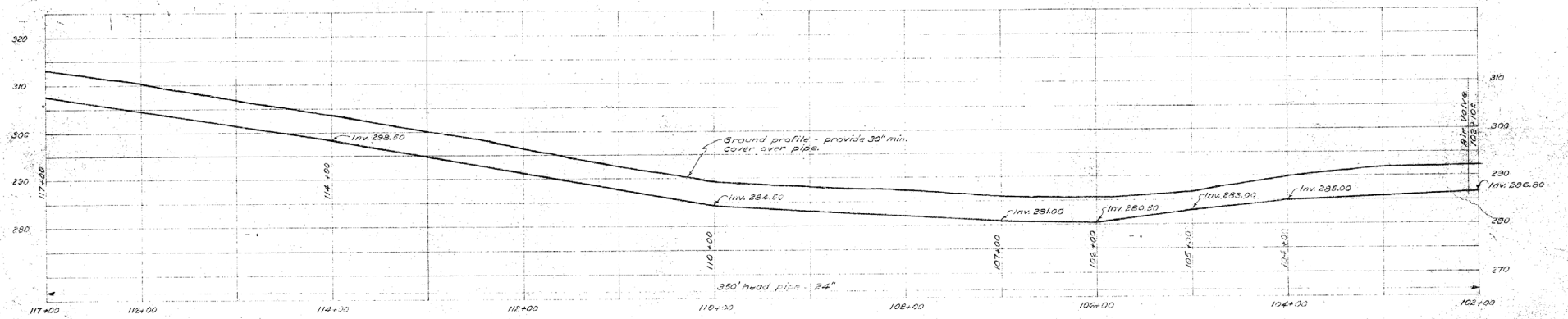
DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK

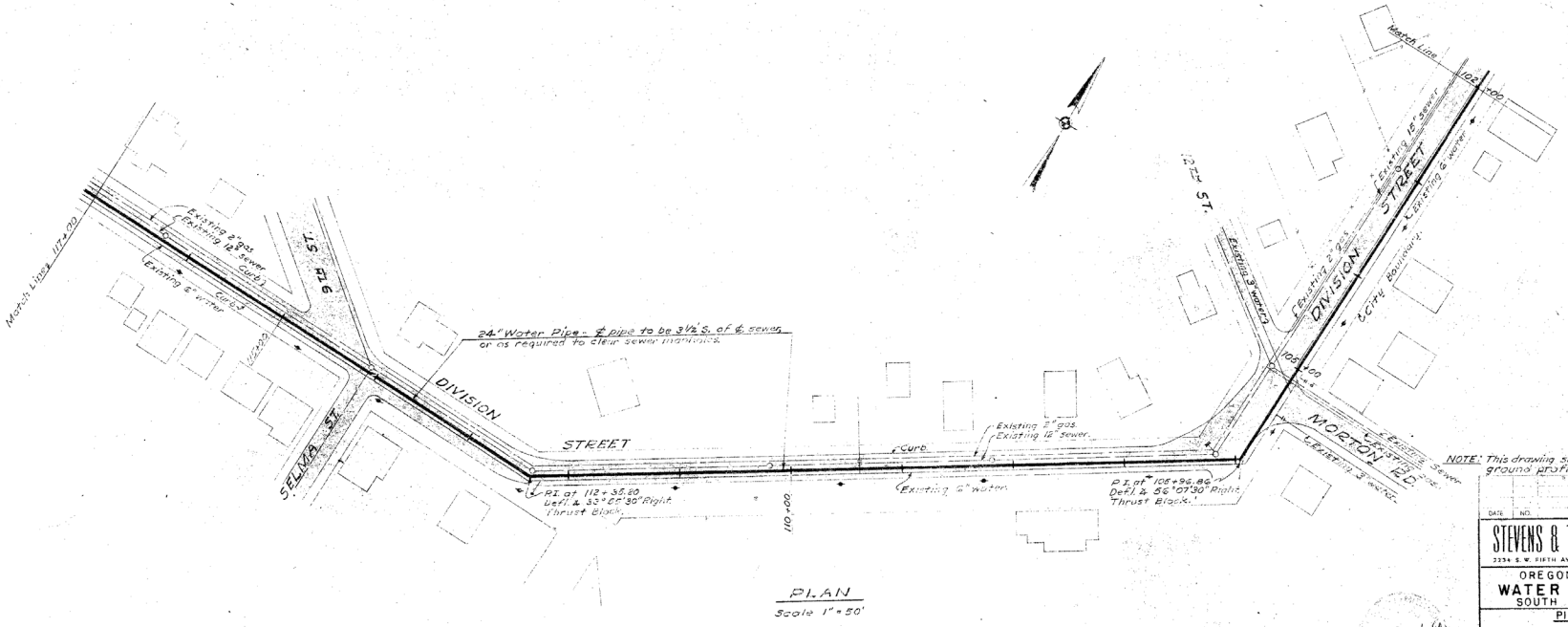
TREATMENT PLANT TO RESERVOIR
STA. 117+00 TO 132+00

DESIGNED F.T.K.	APPROVED BY		SHEET C4-3A
DRAWN M.O.S.	SCALE As Shown		
CHECKED F.T.K.	DATE 2-5-58	FILE 1160-3095A	77



PROFILE

Hor. scale 1"=50'
Vert. scale 1"=10'



PLAN

Scale 1"=50'

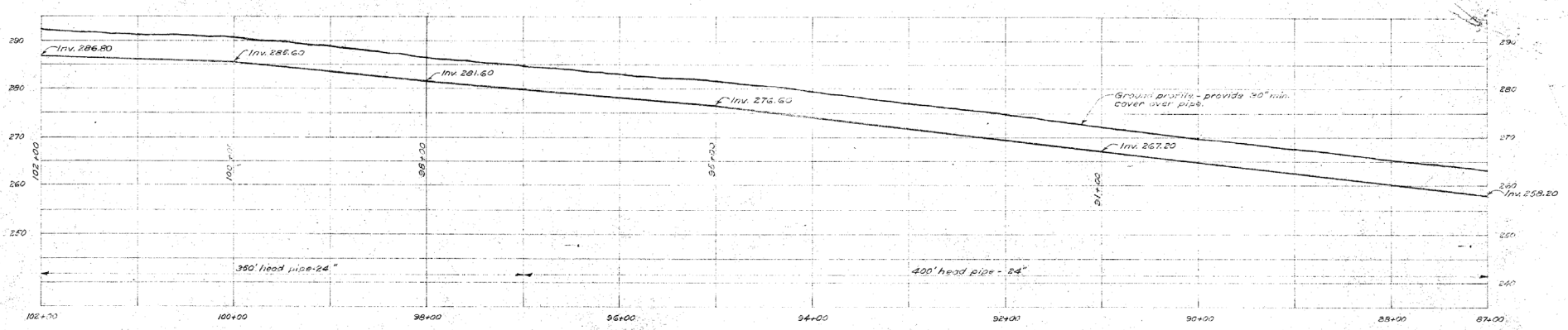
NOTE: This drawing supersedes C4-4 as to stationing, ground profile & invert grade line.

DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

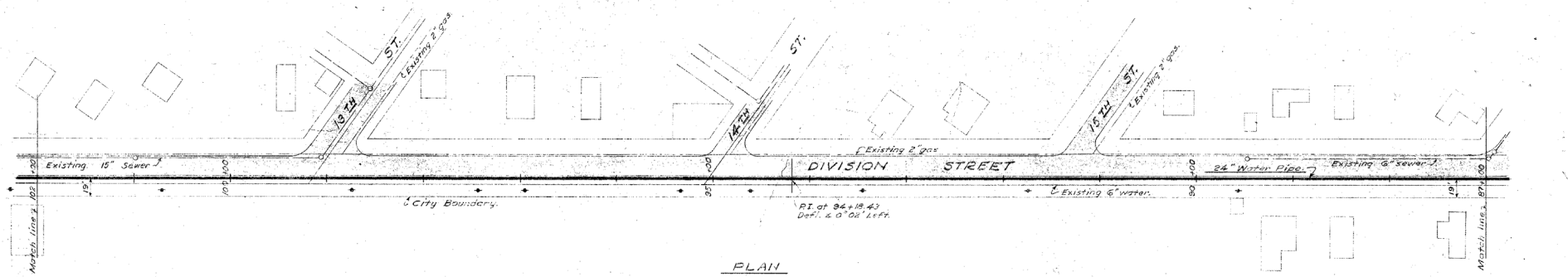
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK
TREATMENT PLANT TO RESERVOIR
STA. 102+00 TO 117+00

DESIGNED	F.T.K.	APPROVED BY	DRAWING C4-4A
DRAWN	M.J.S.	SCALE As Shown	
CHECKED	F.T.K.	DATE 2-5-58 FILE 1160-3076A	



PROFILE

Hor. Scale: 1"=50'
Vert. Scale 1"=10'



PLAN

Scale 1" = 50'

NOTE: This drawing supersedes C4-6 as to stationing ground profile & invert grade line.

DATE	NO.	REVISION	BY

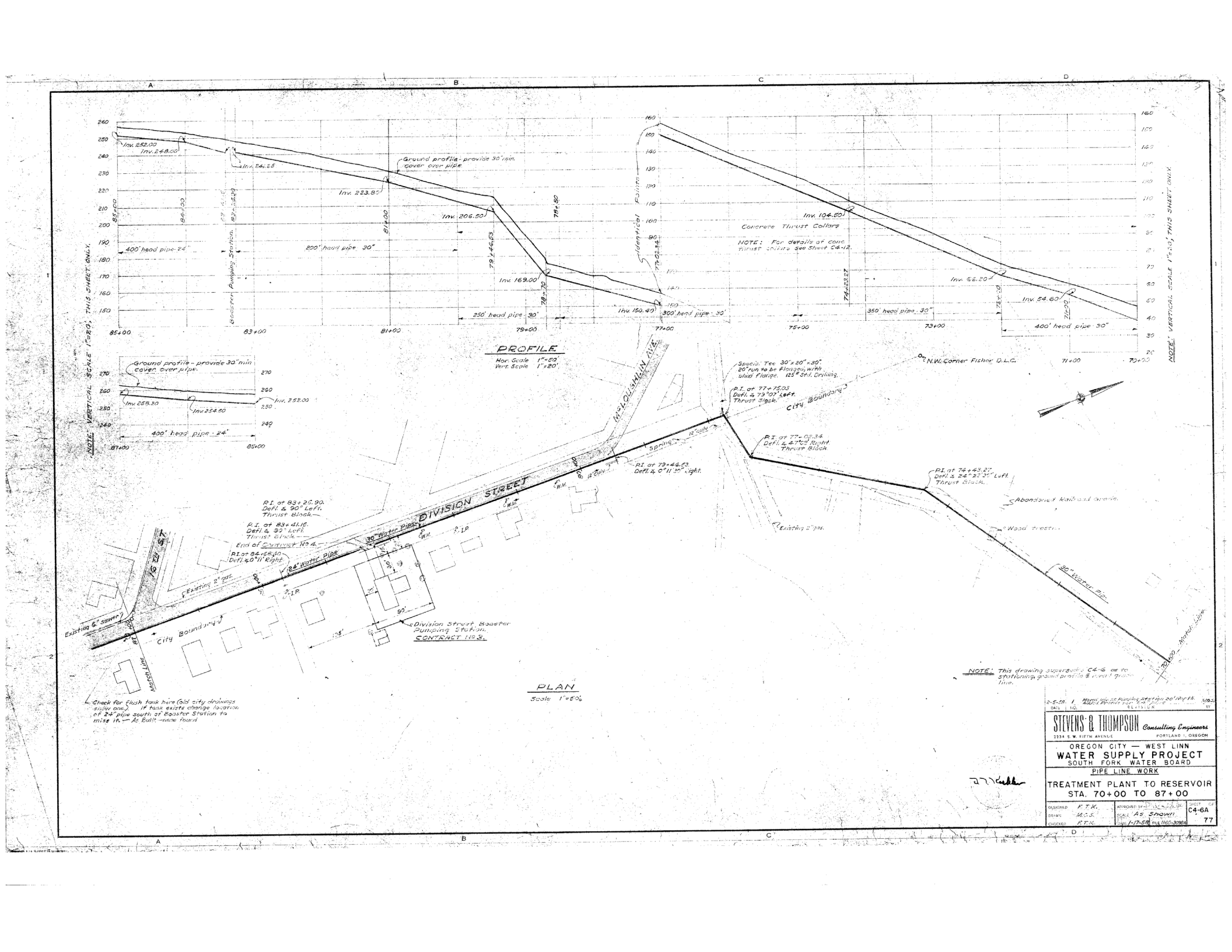
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

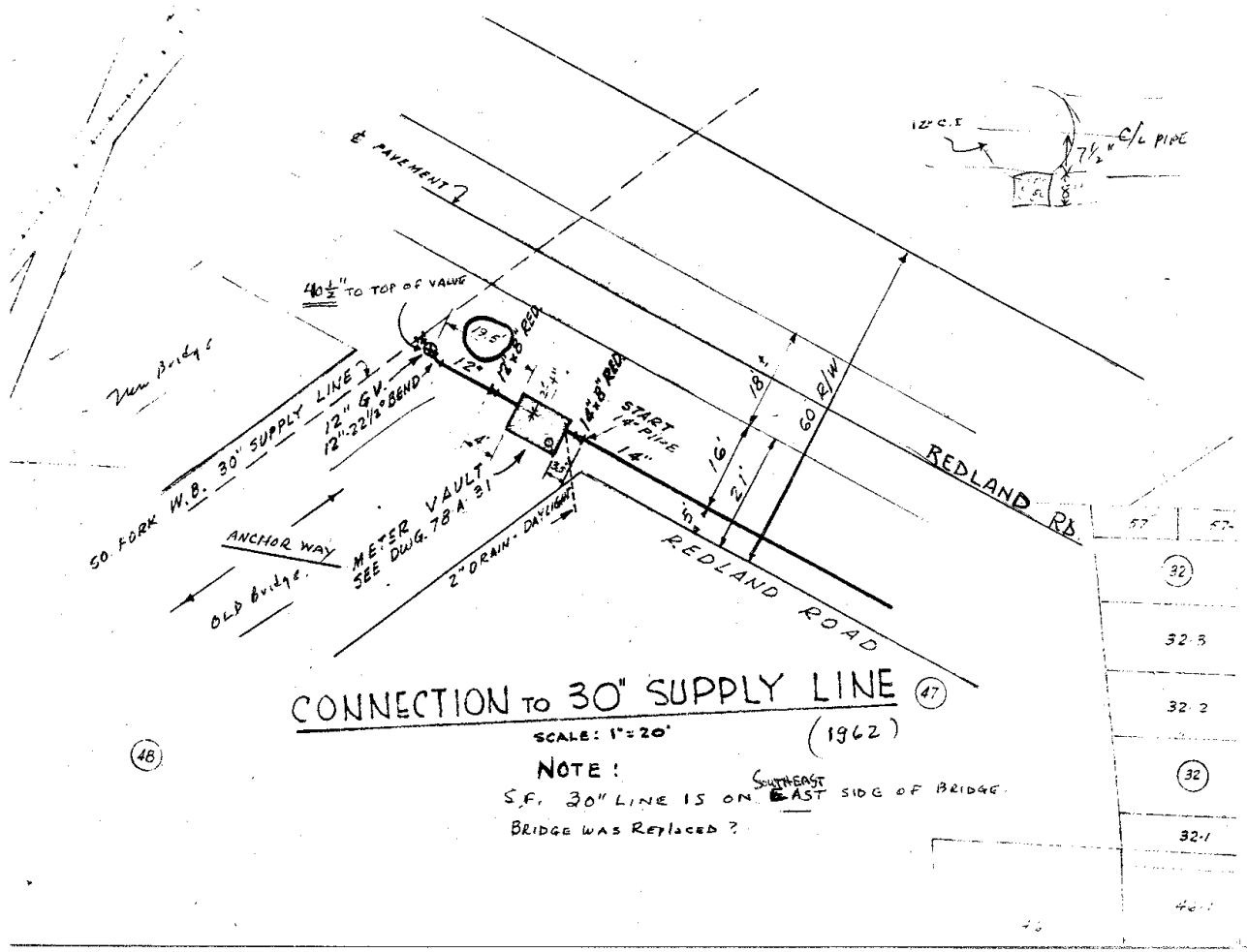
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

PIPE LINE WORK

TREATMENT PLANT TO RESERVOIR
STA. 87+00 TO 102+00

DESIGNED F.T.K.	APPROVED BY		SHEET OF
DRAWN M.D.S.	SCALE As Shown		C4-5A
CHECKED F.T.K.	DATE 2-5-58	FILE NEO-3050A	


PROFILE
Hor. Scale 1"=50'
Vert. Scale 1"=20'
NOTE: VERTICAL SCALE 1"=20', THIS SHEET ONLY.
Inv. 252.00
Inv. 248.00
Inv. 241.25
Ground profile - provide 30" min. cover over pipe.
Inv. 223.85
Inv. 206.50
Inv. 169.00
Inv. 150.49
Inv. 104.80
Inv. 66.20
Inv. 54.60
400' head pipe - 24"
200' head pipe - 30"
250' head pipe - 30"
300' head pipe - 30"
350' head pipe - 30"
400' head pipe - 30"
Division Street Pumping Station
Theoretical P.I.
Concrete Thrust Collars
NOTE: For details of conc. Thrust collars see Sheet C4-1A.
Inv. 258.20
Inv. 254.50
Inv. 252.00
400' head pipe - 24"
PLAN
Scale 1"=50'
DIVISION STREET
HASKELL SHELLIN AVE.
City Boundary
Special Tee 30"x20"x30", 20" run to be Flanged, with blind Flange. 125# S.R.I. Drilling.
N.W. Corner Fisher D.L.C.
P.I. at 77+75.03 Defl. ∆ 73°07' Left. Thrust Block.
P.I. at 77+02.34 Defl. ∆ 47°03' Right Thrust Block.
P.I. at 74+43.27 Defl. ∆ 24°23'30" Left Thrust Block.
P.I. at 73+46.53 Defl. ∆ 0°11'30" Right.
P.I. at 83+25.90 Defl. ∆ 90° Left. Thrust Block.
P.I. at 83+41.16 Defl. ∆ 32° Left. Thrust Block.
End of Contract No 4.
P.I. at 84+68.40 Defl. ∆ 0°11' Right.
30" Water Pipe
24" Water Pipe
12" CMP
Spring
W.M.
V.C.
P.I.P.
Existing 2" gas.
Existing 6" sewer
Abandoned railroad grade.
Wood trestle.
Existing 2" gas.
Division Street Booster Pumping Station. CONTRACT 110-B.
City Boundary
Check for flush tank here (old city drawings show one). If tank exists change location of 24" pipe south of Booster Station to miss it. — As Built — none found
NOTE: This drawing supersedes C4-6 as to ... ground profile & ... line.
2-5-58 1 Moved site of Pumping Station 20' North
DATE NO. REVISION BY
STEVENS & THOMPSON Consulting Engineers
2334 S.W. FIFTH AVENUE PORTLAND 1, OREGON
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK
TREATMENT PLANT TO RESERVOIR
STA. 70+00 TO 87+00
DESIGNED F.T.K.
DRAWN M.S.S.
CHECKED F.T.K.
APPROVED BY
SCALE AS SHOWN
DATE 1-17-58 FILE 1160-30984
SHEET C4-6A
OF 77



CONNECTION TO 30" SUPPLY LINE (47)

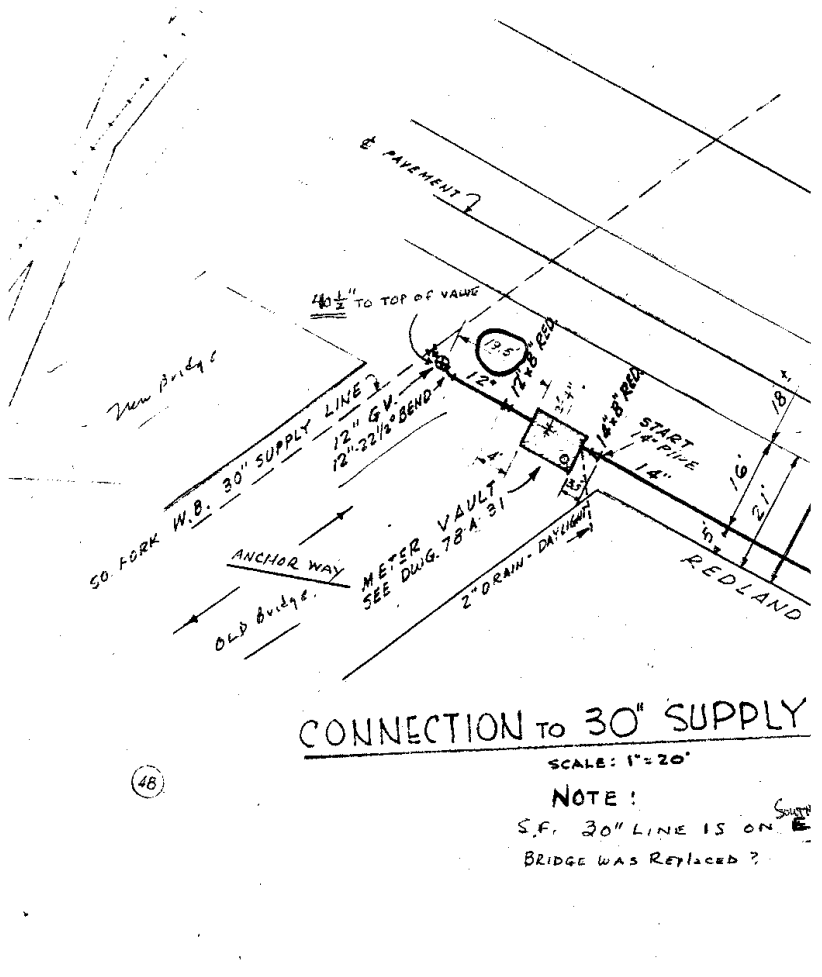
SCALE: 1"=20' (1962)

(48)

NOTE:

S.F. 30" LINE IS ON SOUTHEAST EAST SIDE OF BRIDGE

BRIDGE WAS Replaced ?



CONNECTION TO 30" SUPPLY

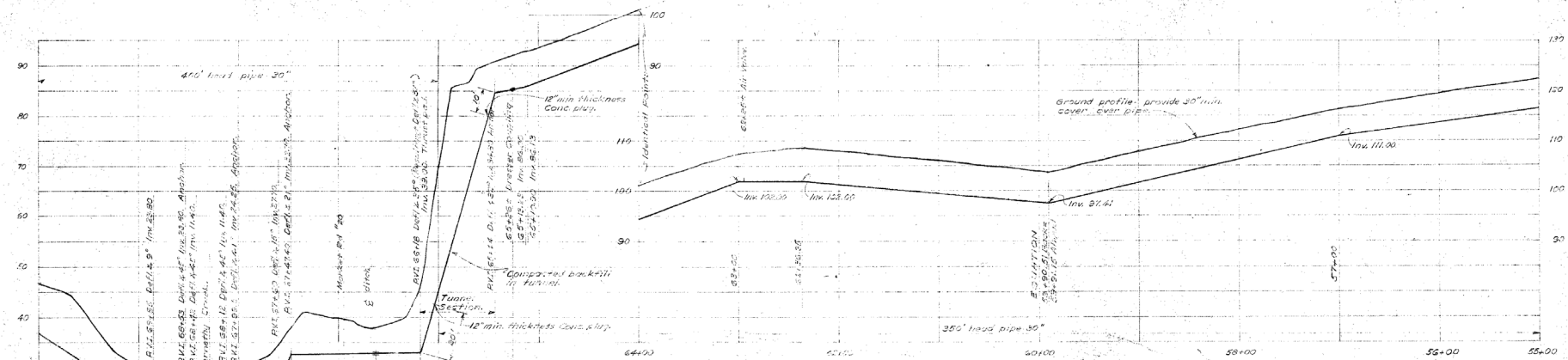
SCALE: 1"=20'

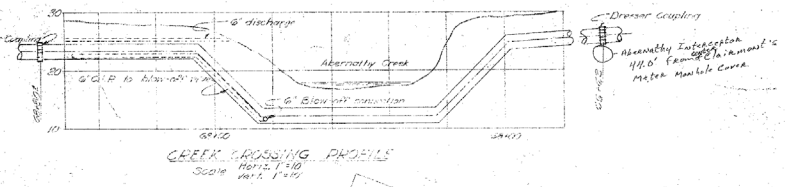
(48)

NOTE:

S.F. 30" LINE IS ON

BRIDGE WAS Replaced ?

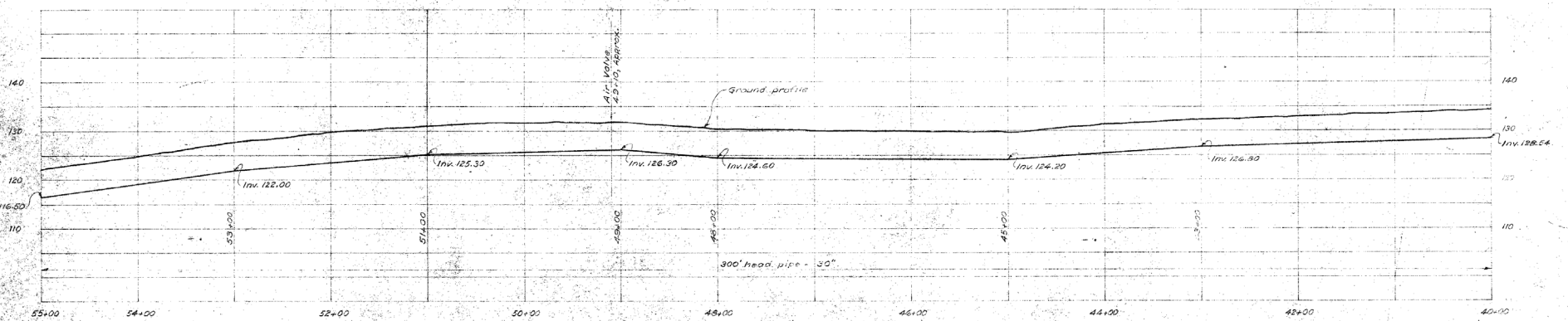




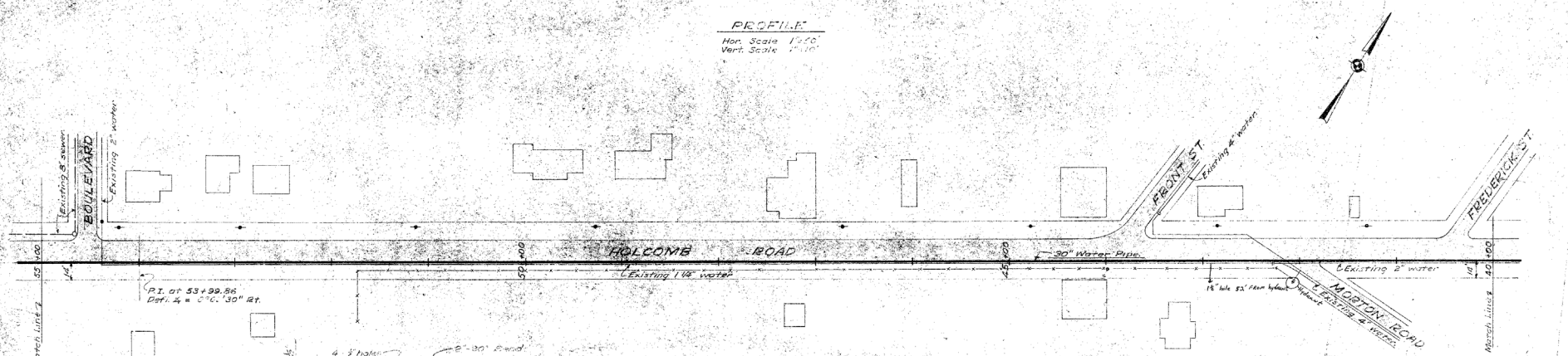
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK
TREATMENT PLANT TO RESERVOIR
STA. 55+00 TO 70+00

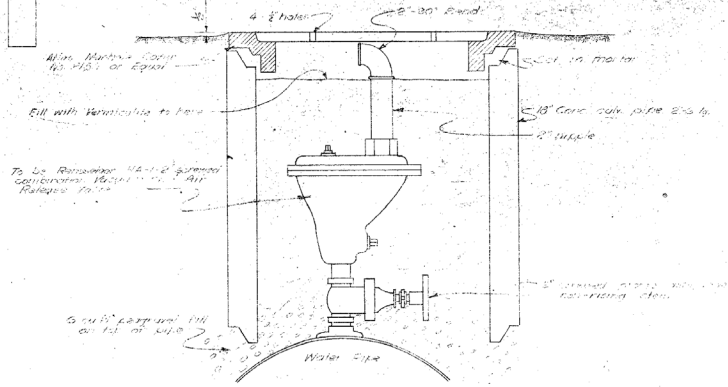
DESIGNED	F.T.K.	APPROVED BY	SHEET OF C4-7A
DRAWN	M.G.S.	SCALE As Shown	
CHECKED	F.T.K.	DATE 1-17-68 FILE 116-00504	77



PROFILE
Hor. Scale 1"=50'
Vert. Scale 1"=10'



PLAN
Scale 1" = 50'



AIR VALVE DETAIL

LEGEND
- Existing Sewer Line
- Existing Water Line
- Existing Gas Line
- Proposed Water Line

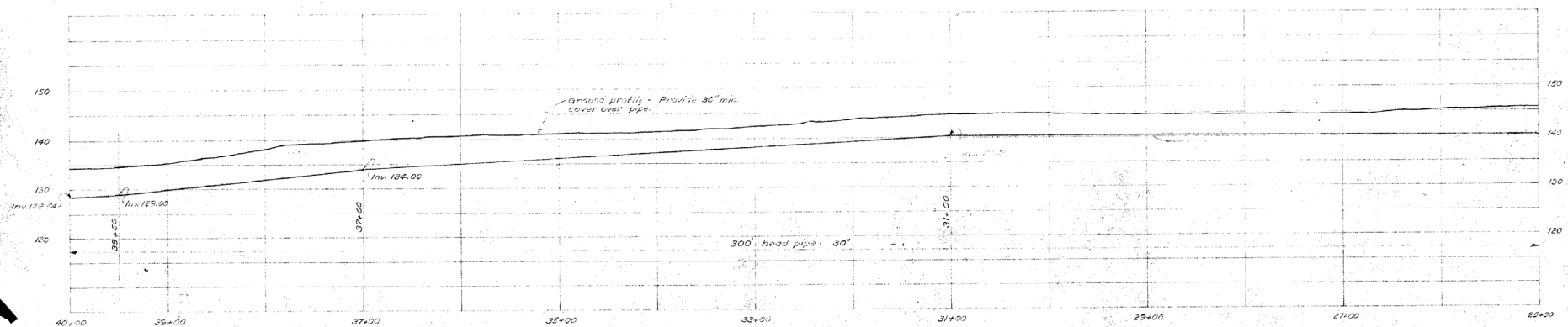
NOTE: This drawing supersedes C4-8 as to stationing, ground profile & invert grade line.

DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2334 S. W. FIFTH AVENUE PORTLAND 1, OREGON

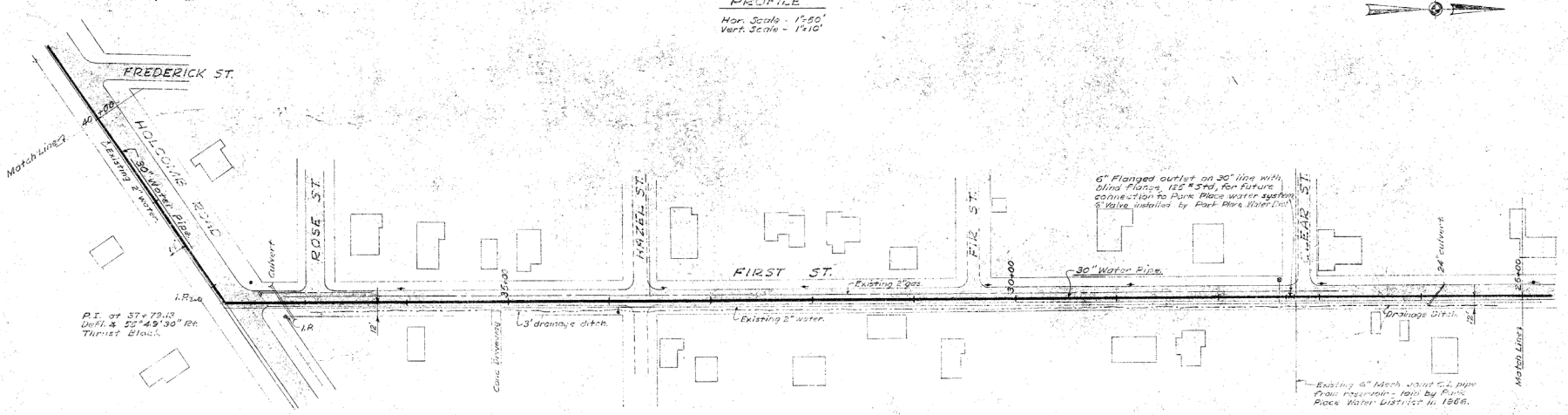
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK
TREATMENT PLANT TO RESERVOIR
STA. 40+00 TO 55+00

DESIGNED	F.T.K.	APPROVED BY		SHEET
DRAWN	M.C.S.	SCALE	As Shown	C4-8A
CHECKED	F.T.K.	DATE	1-17-58	FILE WC-3100



PROFILE

Hor. Scale - 1"=50'
Vert. Scale - 1"=10'



PLAN

Scale 1"=50'

NOTE: This drawing supersedes C4-9 as to stationing, ground profile & liver + grade line.

DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

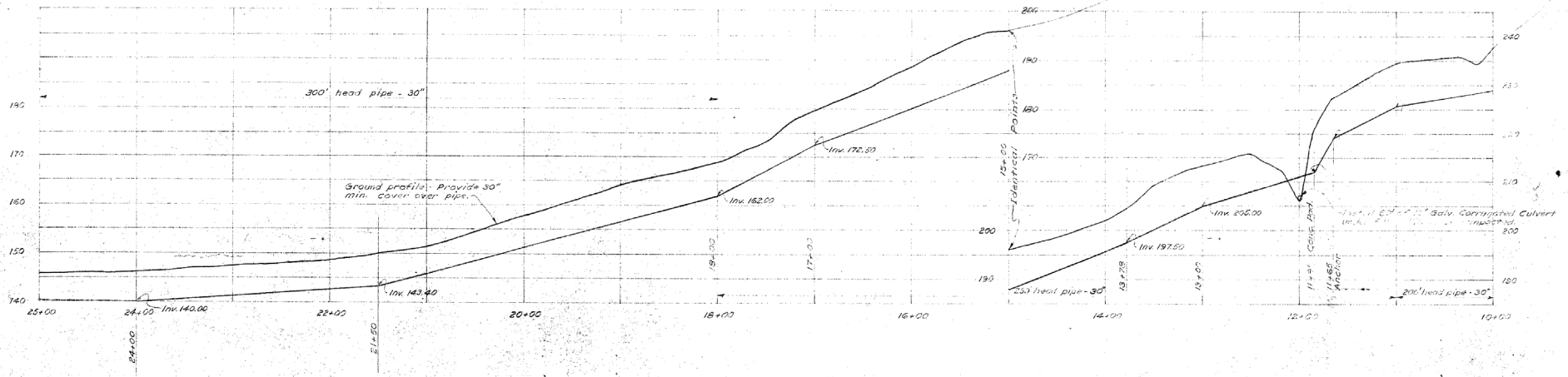
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK

TREATMENT PLANT TO RESERVOIR
STA. 25+00 TO 40+00

DESIGNED	F.T.K.	APPROVED	L.L.
DRAWN	M.G.S.	SCALE	As Shown
CHECKED	F.T.K.	DATE	1-17-58

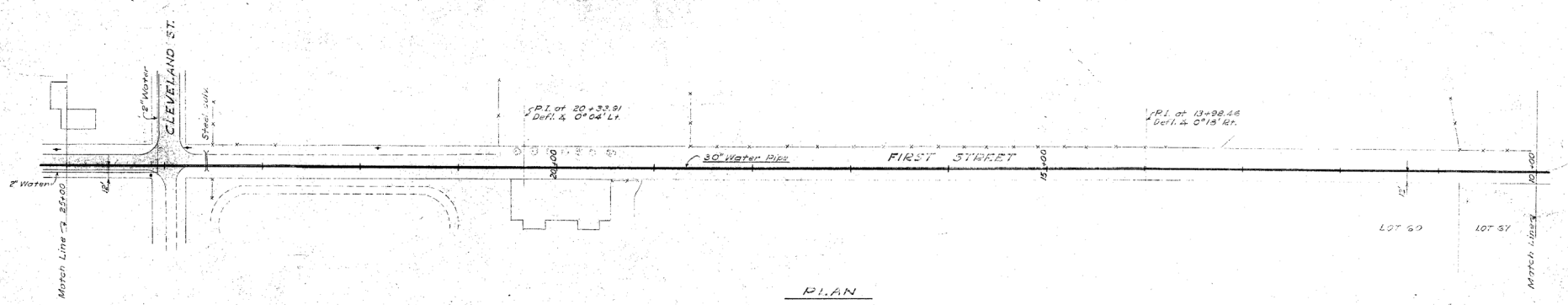
FILE 1160-301A

SHEET C4-9A
OF 77



PROFILE

Hor. Scale 1"=50'
Vert. Scale 1"=10'



PLAN

Scale 1"=50'

NOTE: This drawing supercedes C4-10 as to stationing, ground profile & invert grade line.

DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2234 S.W. FIFTH AVENUE PORTLAND 1, OREGON

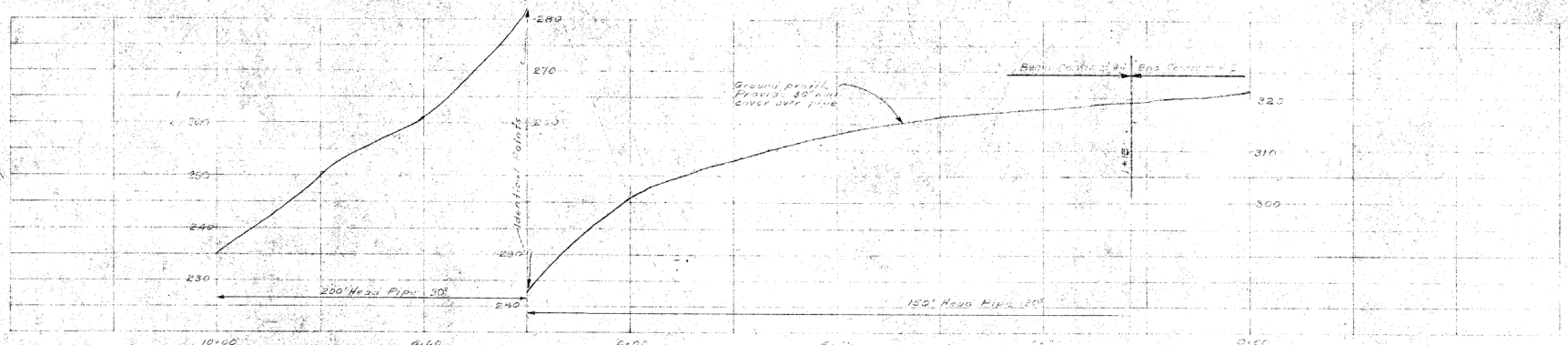
OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD

PIPE LINE WORK

TREATMENT PLANT TO RESERVOIR
STA. 10+00 TO 25+00

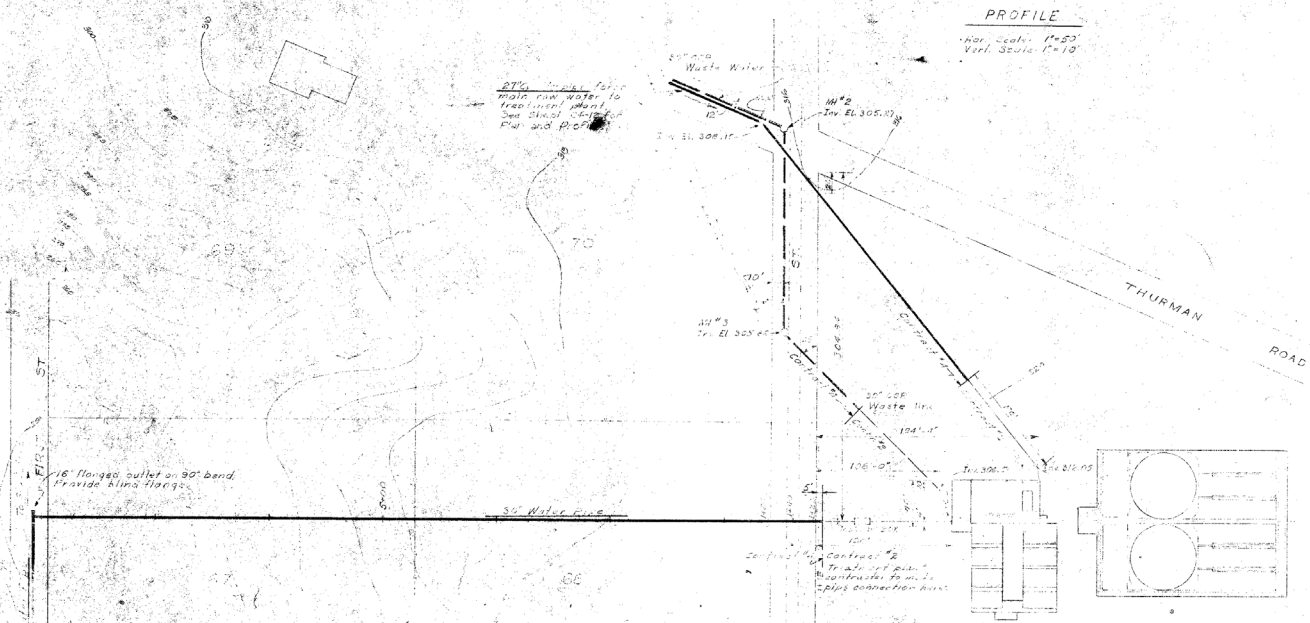
DESIGNED	F.T.K.	APPROVED BY		DWG.	C4-10A
DRAWN	M.S.S.	SCALE	AS SHOWN		
TRACED	F.T.K.	DATE	1-17-58	FILE	1150-302A

77



PROFILE

Hor. Scale: 1"=50'
Vert. Scale: 1"=10'



Note:
See Sht C4-11A

LEGEND

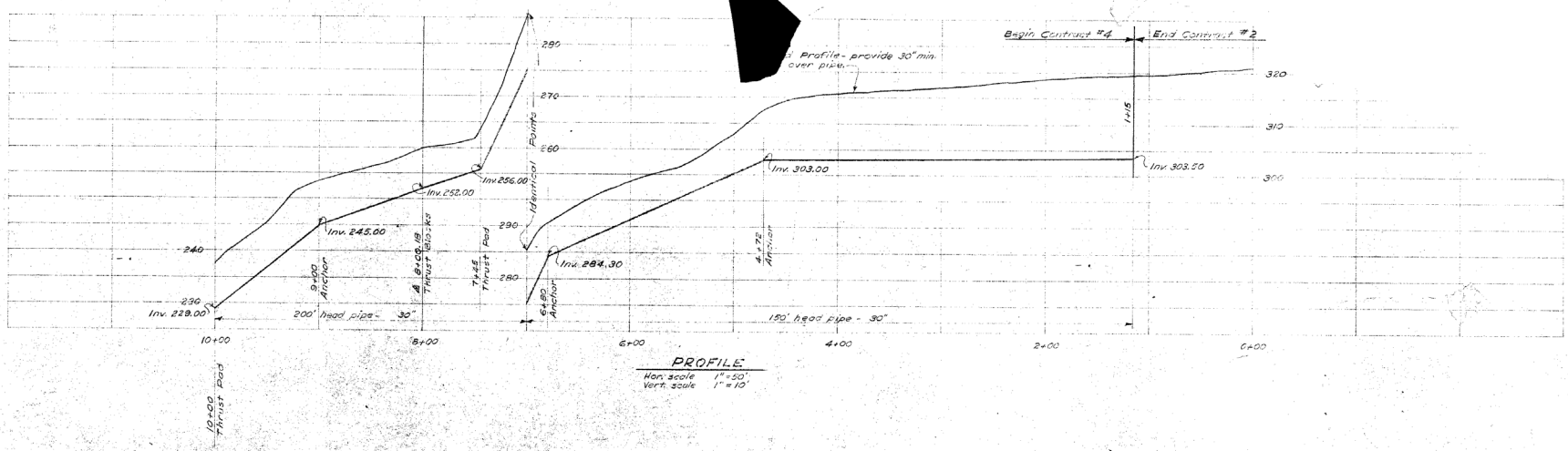
Existing Sewer Line
Existing Water Line
Existing Gas Line
Proposed Structure

DATE	NO.	REVISION	BY

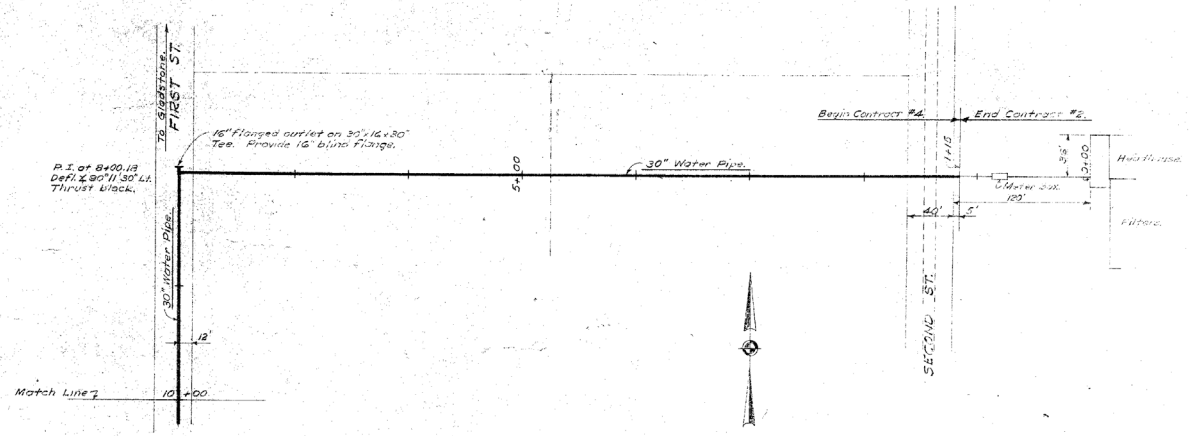
STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY – WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK
TREATMENT PLANT TO RESERVOIR
STA. 0+00 TO 10+00

DESIGNED F.T.K.	APPROVED	SHEET OF	C4-11
DRAWN E.M. H.C.	SCALE As Shown		77
CHECKED F.T.K.	DATE 8-1-57	JOB NO. 3103	



PROFILE
Hor. scale 1"=50'
Vert. scale 1"=10'



PLAN
Scale 1"=50'

NOTE: This drawing supersedes C4-11 as to sheet showing ground profile & invert grade line.

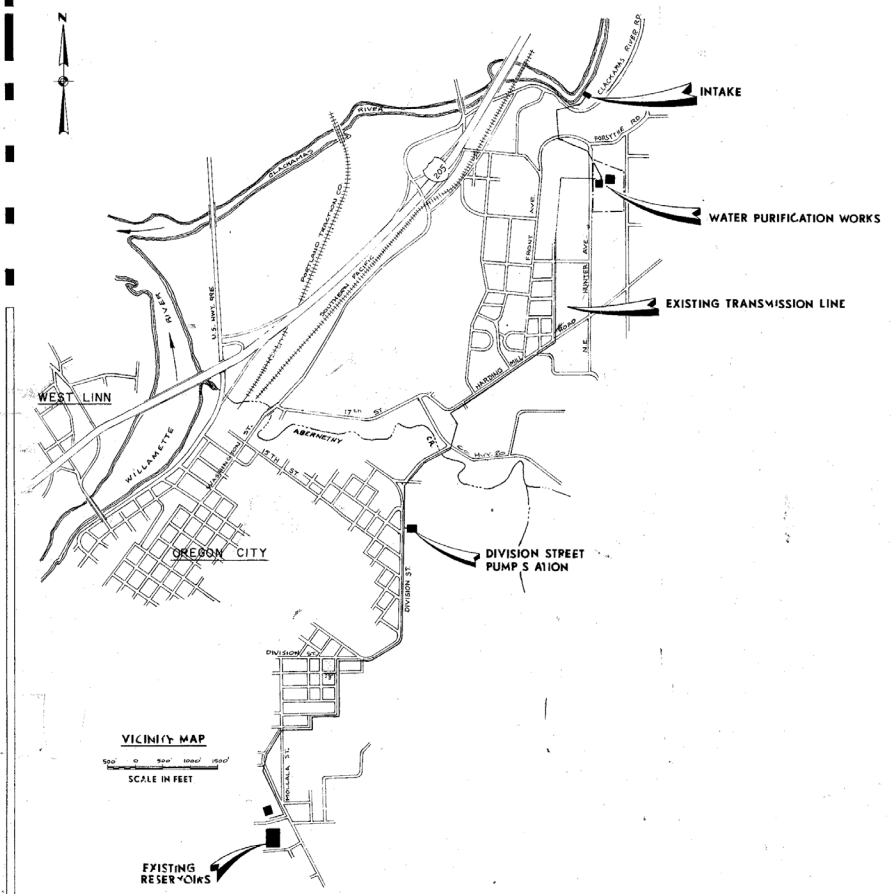
DATE	NO.	REVISION	BY

STEVENS & THOMPSON Consulting Engineers
2234 S. W. FIFTH AVENUE PORTLAND 1, OREGON

OREGON CITY — WEST LINN
WATER SUPPLY PROJECT
SOUTH FORK WATER BOARD
PIPE LINE WORK

TREATMENT PLANT TO RESE
STA. 0+00 TO 10

DRAWN F.T.K. APPROVED BY
DATE SCALE



SOUTH FORK WATER BOARD
OREGON CITY - WEST LINN

WATER WORKS MODIFICATIONS

INDEX OF DRAWINGS

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G2	GRADING PLAN	73 PT 757.002 - 14849
G3	SLUDGE LAGOON SECTIONS AND DETAILS DECANT STRUCTURE PLAN AND SECTIONS	73 PT 757.002 - 14850
	ARCHITECTURAL	
A1	DIVISION STREET PUMP STATION ARCHITECTURAL MODIFICATIONS	73 PT 757.002 - 14851
	STRUCTURAL	
S1	NEW CLEARWELL FLOOR PLAN-SECTIONS, DETAILS AND NOTES	73 PT 757.002 - 14853
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M5	HEAD HOUSE MODIFICATIONS-SECOND FLOOR PLAN	73 PT 757.002 - 14861
M6	HEAD HOUSE MODIFICATIONS-PUMP ROOM AND FILTER GALLERY	73 PT 757.002 - 14862
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M8	FILTER MODIFICATIONS PLAN AND DETAIL	73 PT 757.002 - 14864
M9	FILTER MODIFICATIONS SECTIONS AND DETAILS	73 PT 757.002 - 14865
M10	RAPID MIX BASIN MODIFICATIONS PLAN AND SECTIONS	73 PT 757.002 - 14866
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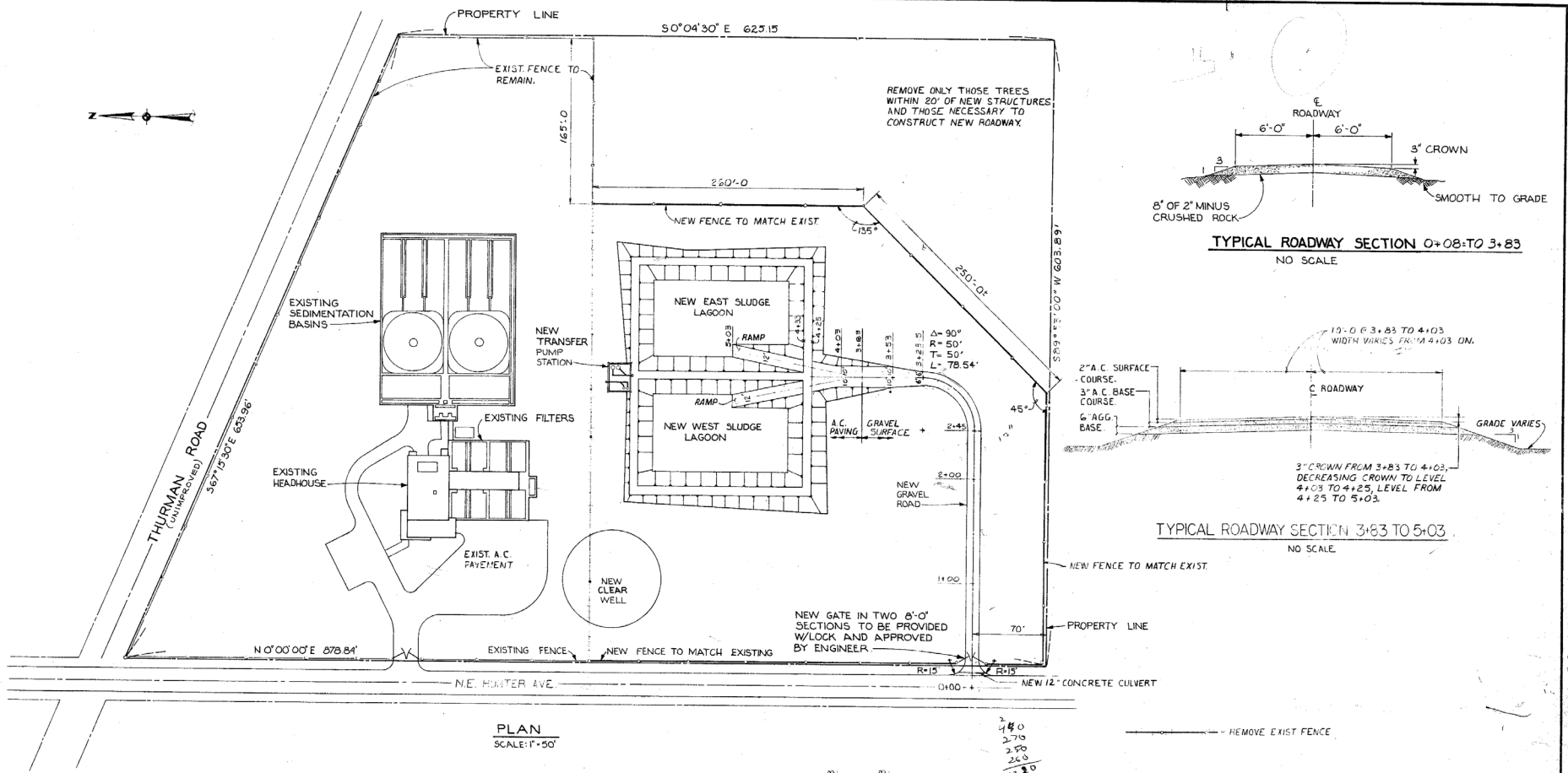
E6	DIVISION STREET PUMP STATION	73 PT 757.002 - 14884

Stevens, Thompson & Runyan, Inc.
Engineers / Planners
PORTLAND · SEATTLE · BOISE · SPOKANE



DATE	NO.	REVISION	BY

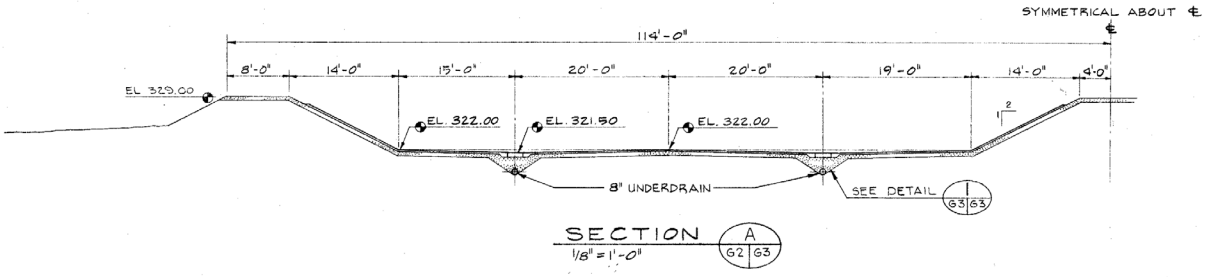
DESIGNED JRS
DRAWN CGR
CHECKED JRS
APPROVED
SCALE AS SHOWN
DATE MAY, 1975
FILE PT0757.002 - 1868

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SALEM SPOKANE BOISE

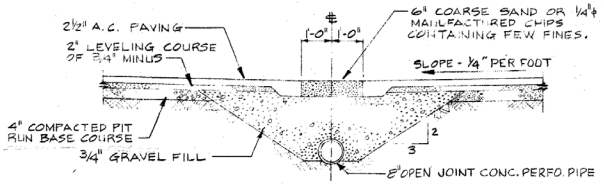
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

SITE PLAN

G1 / 3

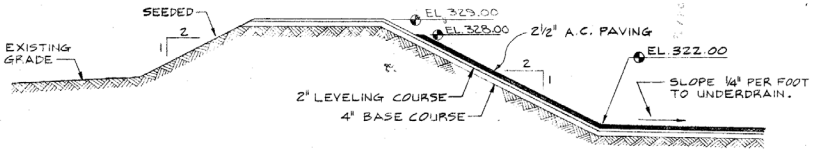


SECTION A G2|G3
1/8" = 1'-0"

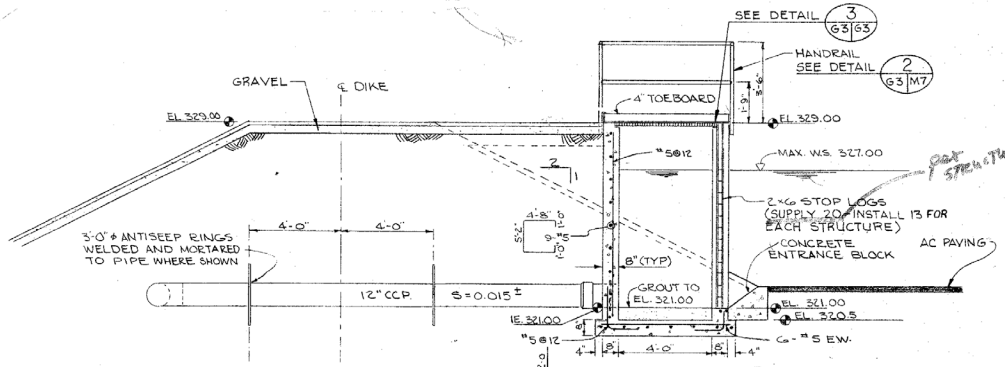


SEE SHT. M1 & M2 FOR INVERT ELEV. AND GRADE

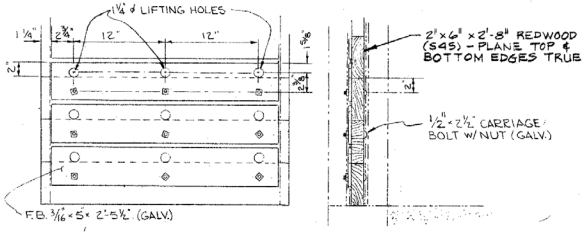
UNDERDRAIN DETAIL 1 G3|G3
1/2" = 1'-0"



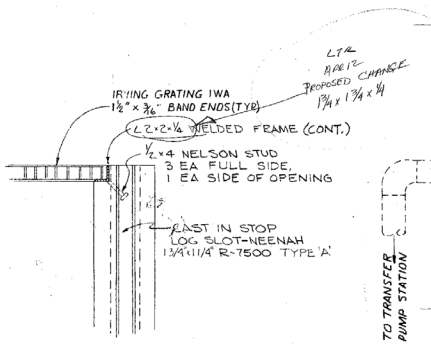
DIKE SECTION B G2|G3
1/4" = 1'-0"



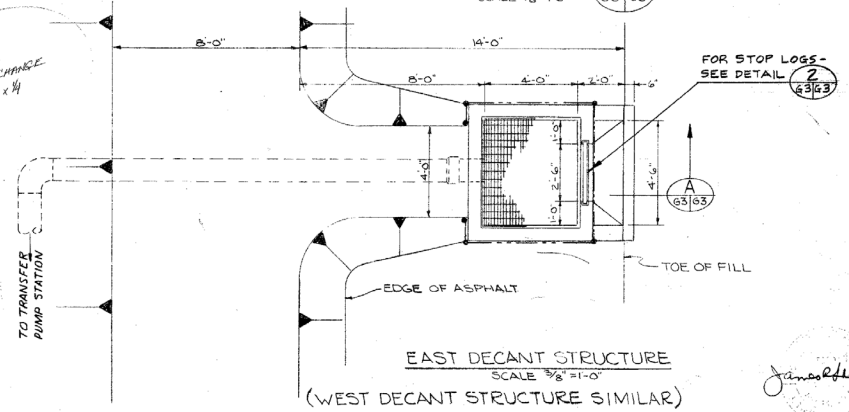
SECTION A G3|G3
SCALE 3/8" = 1'-0"



STOP LOG DETAIL 2 G3|G3
SCALE 1½" = 1'-0"



DETAIL 3 G3|G3
SCALE 1½"=1'-0"



EAST DECANT STRUCTURE
SCALE 3/8" = 1'-0"

(WEST DECANT STRUCTURE SIMILAR)

DATE	NO.	REVISION	BY

DESIGNED JRS | APPROVED
DRAWN DGB | SCALE AS NOTED | DATE MAY, 1975
CHECKED HWT | FILE PT. 0737.002-14850

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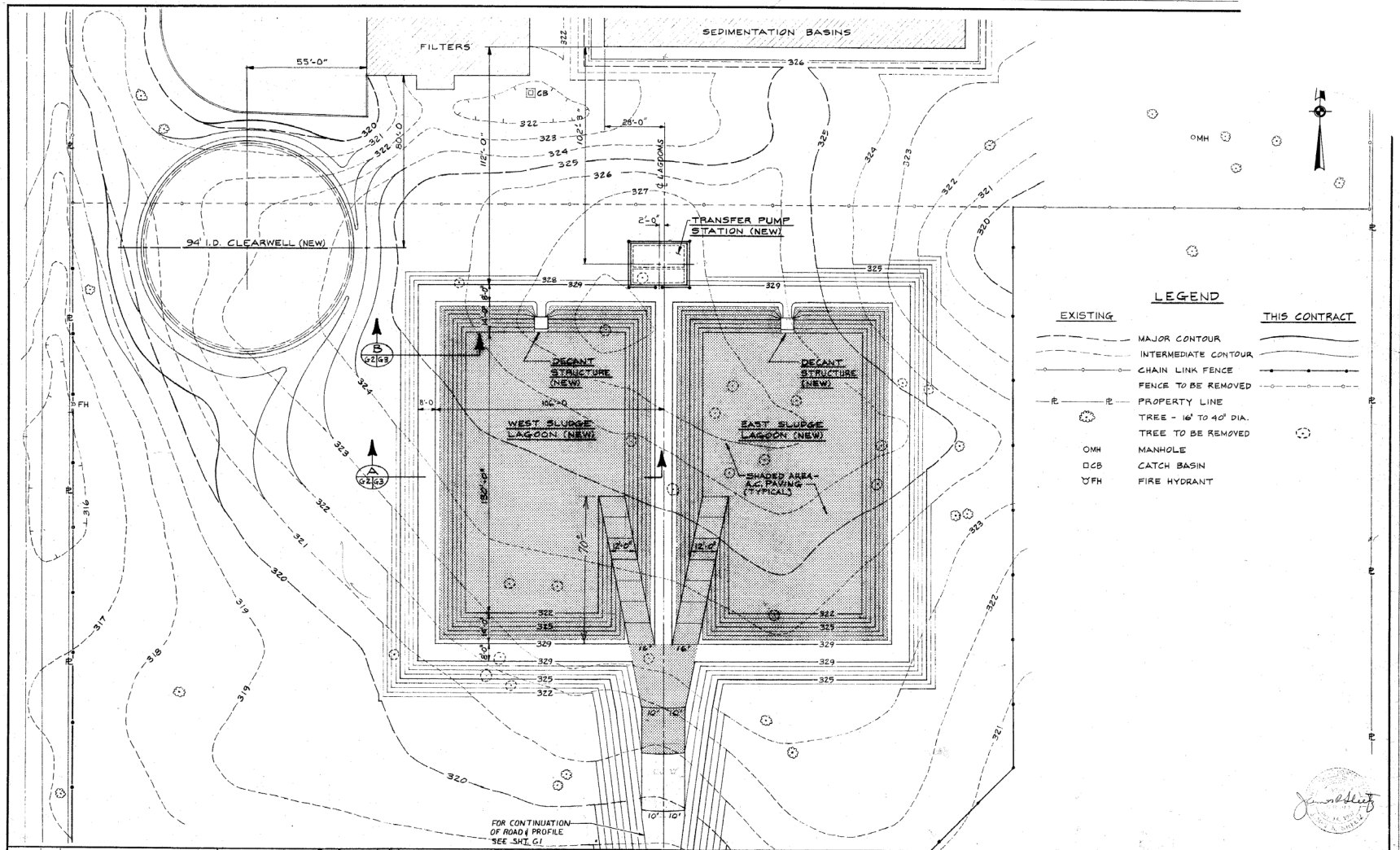
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

SLUDGE LAGOON SECTIONS AND DETAILS
DECANT STRUCTURE PLAN AND SECTIONS

G3
3

CSP. INC.—10001 CLEARPRINT



LEGEND

EXISTING		THIS CONTRACT
———	MAJOR CONTOUR	———
- - - -	INTERMEDIATE CONTOUR	- - - -
—o—o—	CHAIN LINK FENCE	—•—•—
	FENCE TO BE REMOVED	—o—o—
℘ ——— ℘	PROPERTY LINE	℘ ——— ℘
	TREE - 16" TO 40" DIA.	
	TREE TO BE REMOVED	
OMH	MANHOLE	
CB	CATCH BASIN	
FH	FIRE HYDRANT	

DATE	NO.	REVISION	BY

DESIGNED JRS/HWT APPROVED
DRAWN DGB SCALE 1" = 20' DATE MAY, 1975
CHECKED JRS FILE FT. 0757.002-14849

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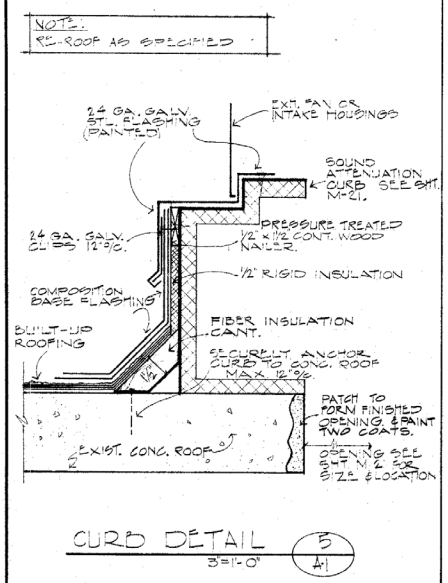
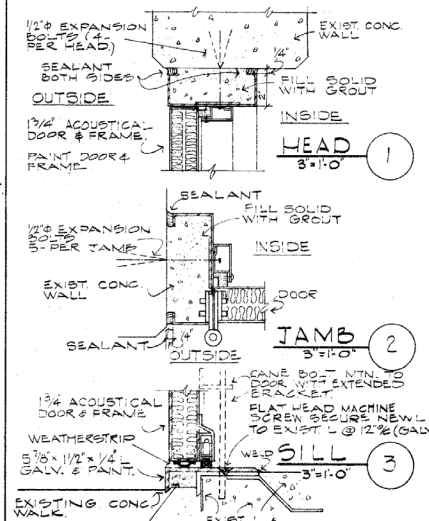
WATER WORKS MODIFICATIONS

GRADING PLAN

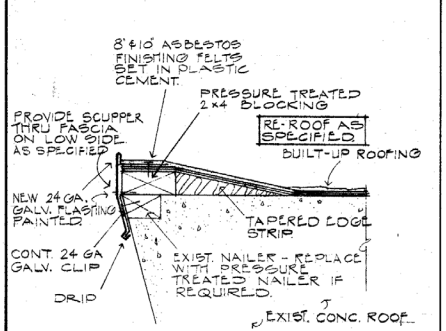
G2 / 3



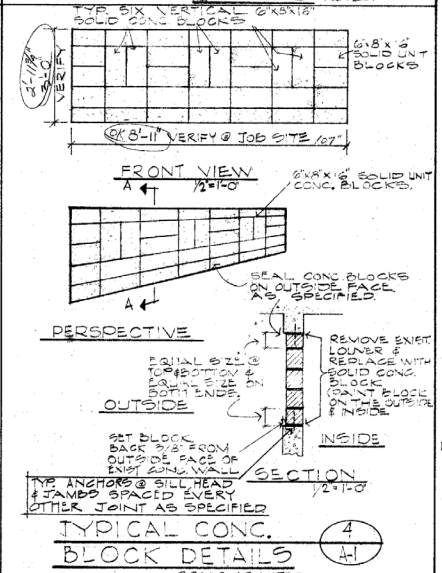
CURB DETAIL 5 / A-1
3"=1'-0"



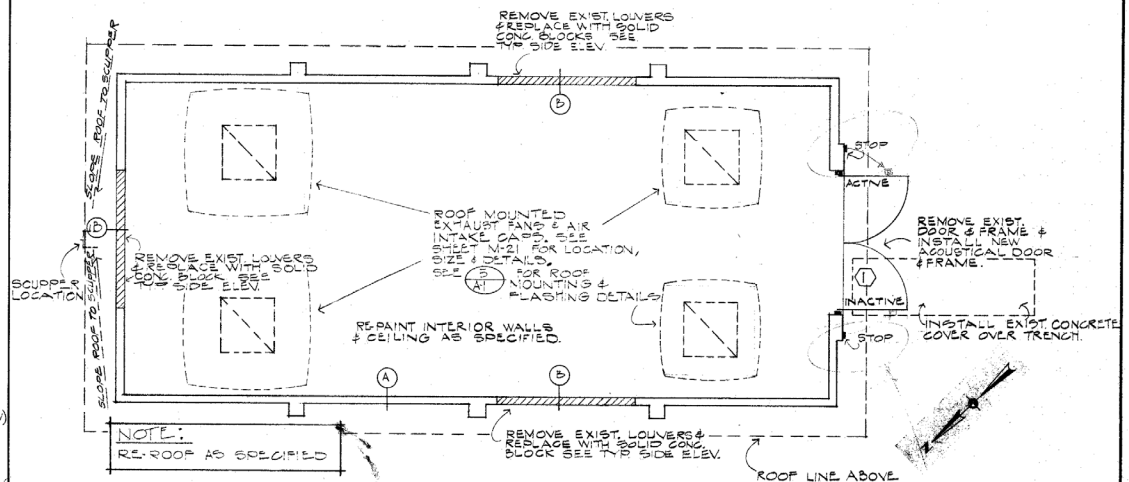
DOOR DETAILS SCALE AS NOTED



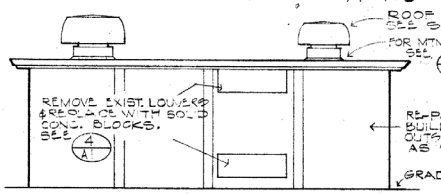
FASCIA DETAIL 6 / A-1
3"=1'-0"



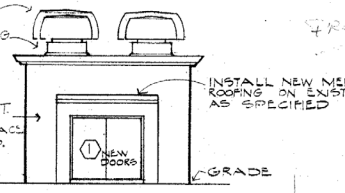
TYPICAL CONC. BLOCK DETAILS 4 / A-1
SCALE AS NOTED



FLOOR PLAN
1/4"=1'-0"



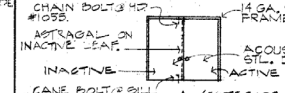
TYPICAL SIDE ELEVATION
1/8"=1'-0"



DIVISION ST. ELEVATION.
1/8"=1'-0"

DOOR & HARDWARE SCHEDULE

NO.	DOOR SIZE	DOOR MAT.	DOOR TYPE	DOOR FRAME	DOOR FINISH	DOOR DETAIL	HARDWARE BUTTS	HARDWARE LOCK	HARDWARE CLOSER	HARDWARE THRESHOLD	HARDWARE WEATHERSTRIP	HARDWARE STOP	REMARKS
1.	1 PR. 6'-0" x 8'-0" (VERIFY)	STL.	A	STL.	ENAMEL AS SPECIFIED	2 & 3	5 BB 5515-4.5D NRP 8 PR-8"x6"	B-8204 LR 32D RHR	—	—	#52 J STL.	2 STWB ONE FOR EA. DOOR WITH V.P. SCREWS	SEE NOTE ①



A (EXTERIOR ELEVATION)

NUMBERS LISTED IN THE HARDWARE SCHEDULE HAVE BEEN TAKEN FROM THE FOLLOWING CATALOGUES.

BUTTS . . . . . LAWRENCE
LOCKS . . . . . SARGENT
STOPS . . . . . GLYNN JOHNSON
WEATHERSTRIP . . . . ZERO
BOLTS . . . . . STANLEY

NOTES:

① ASTRAGAL TO BE MOUNTED ON INACTIVE LEAF, ON THE INSIDE. (ASTRAGAL TO BE FURNISHED BY DOOR MANUFACTURER.)

② CANE BOLT BRACKETS TO PROJECT BEYOND DOOR AUTOMATIC DROP SEAL.

ABBREVIATIONS

V.P. ---- VANDAL PROOF GA. -- GAUGE
STL. --- STEEL
(A) EXIST. CONC. WALL
(B) NEW SOLID CONC. BLOCK

REGISTERED ARCHITECT Raymond Kunz PORTLAND, OREGON STATE OF OREGON

DATE	NO.	REVISION	BY

DESIGNED R.S.S. | APPROVED
DRAWN D.S. | SCALE AS NOTED | DATE MAY 1975
CHECKED R.S.S. | FILE PT-0757.002-14851

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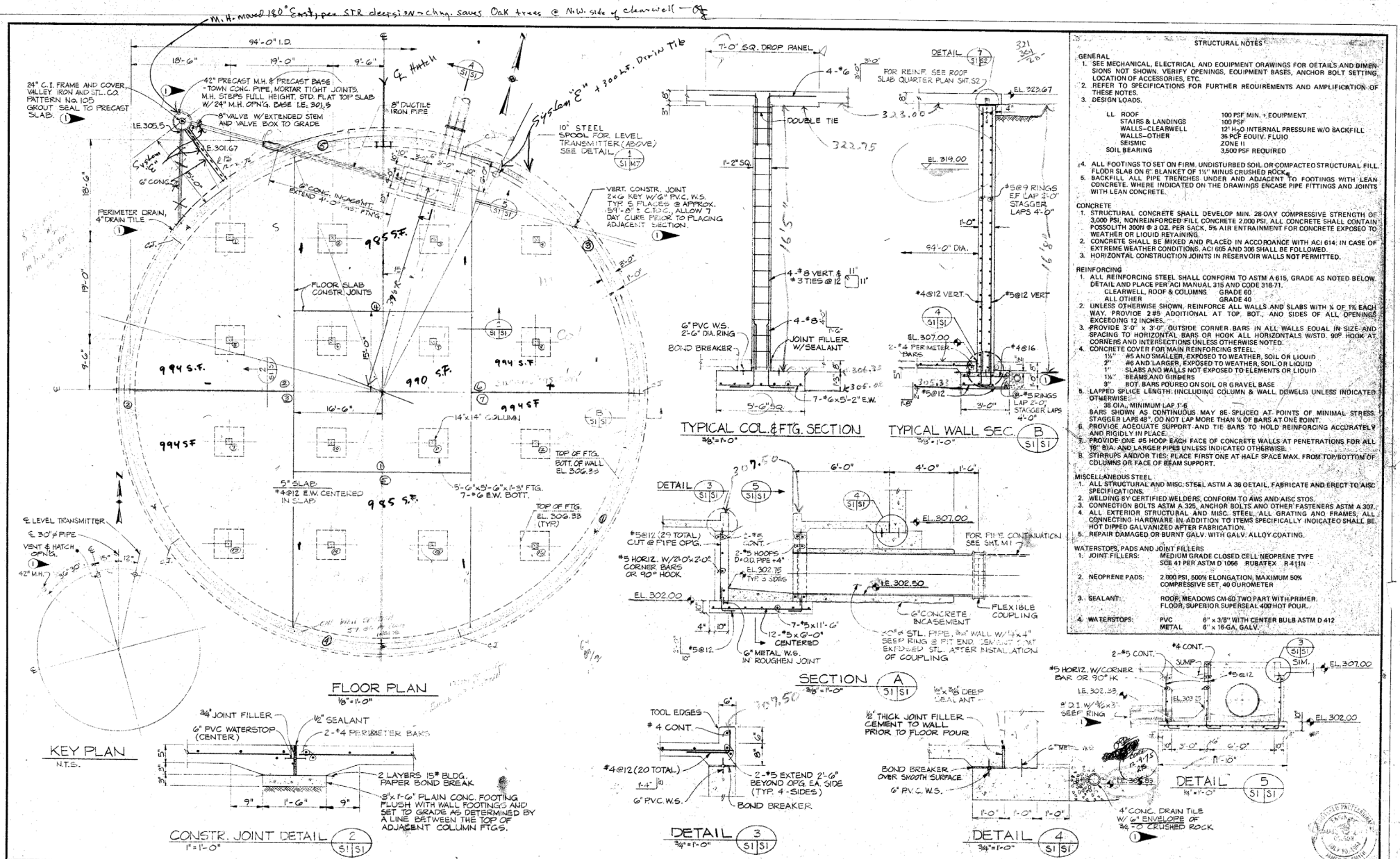
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

DIVISION ST. PUMP STATION
ARCHITECTURAL MODIFICATIONS

A1 / 1



9-5-75	1	GEN. REVISIONS	J.E.C.	DESIGNED C.K.	APPROVED	
DATE	NO.	REVISION	BY	DRAWN J.E.C.	SCALE AS SHOWN	DATE MAY, 1975
				CHECKED A.A.P.	FILE PT. 0757.002 - 14853	

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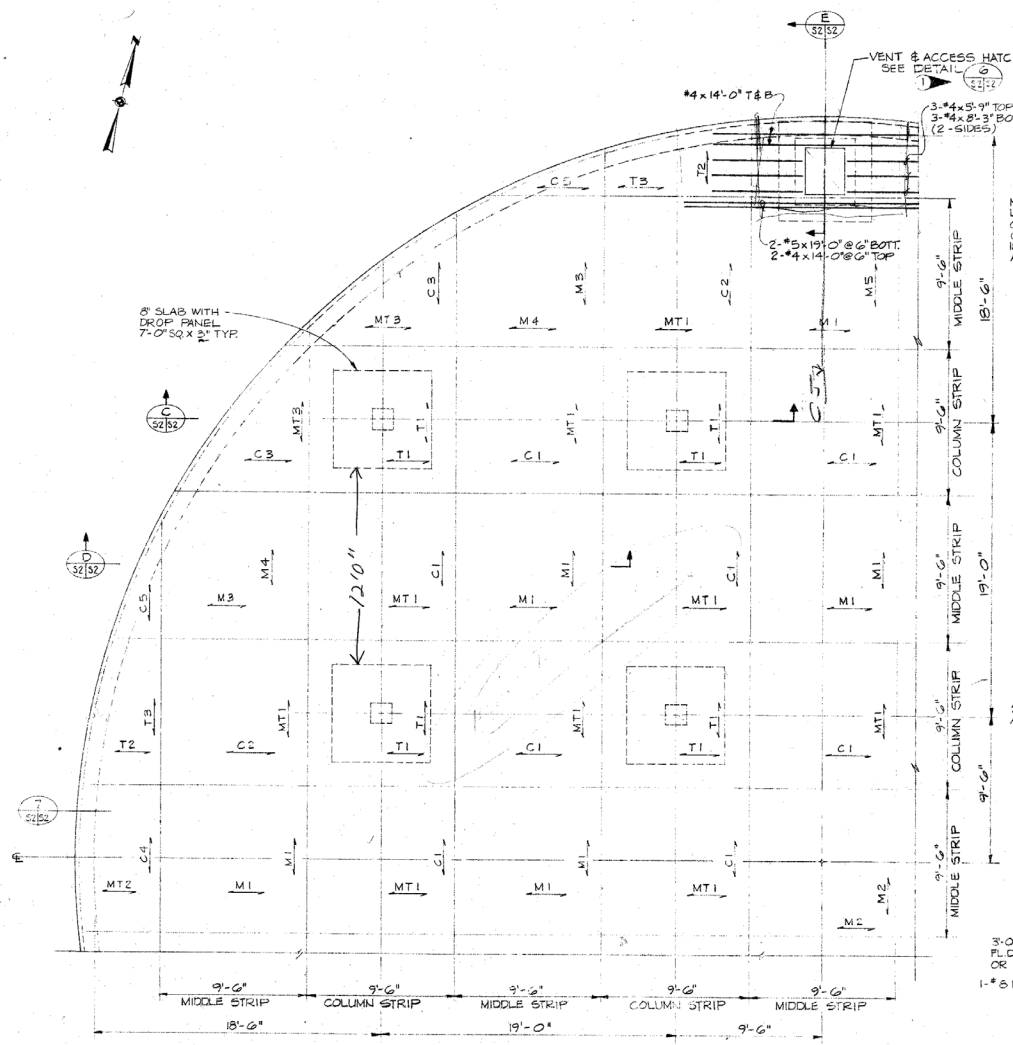
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

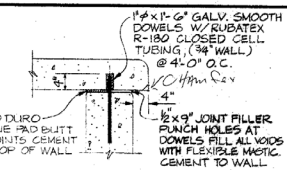
NEW CLEARWELL
FLOOR PLAN - SECTIONS, DETAILS AND NOTES

S1
3



ROOF SLAB - QUARTER PLAN

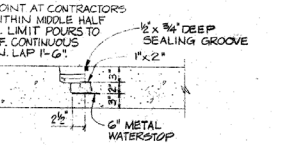
1/4" = 1'-0"



DETAIL 7 (S1|S2)

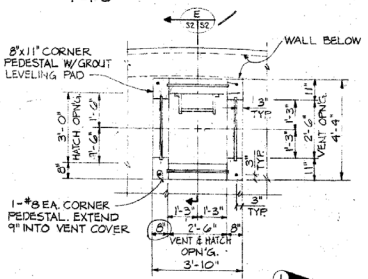
3/4" = 1'-0"

NOTE:
LOCATE CONSTR. JOINT AT CONTRACTORS OPTION. PLACE WITHIN MIDDLE HALF OF MIDDLE STRIPS. LIMIT POURS TO 1800 S.F. ALL REINF. CONTINUOUS ACROSS JOINT. MIN. LAP 1'-6".



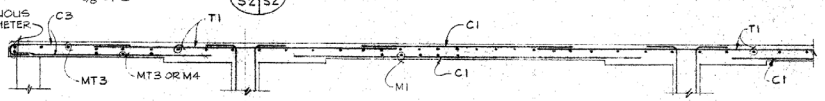
ROOF CONSTR. JOINT DETAIL

1" = 1'-0"



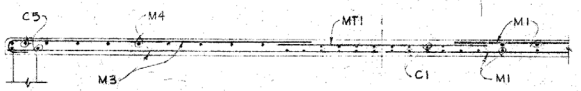
VENT & HATCH DETAIL 6 (S2|S2)

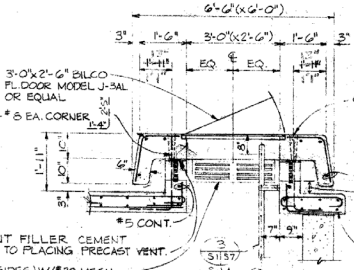
3/8" = 1'-0"



COLUMN STRIP SECTION C (S2|S2)

3/8" = 1'-0"





MIDDLE STRIP SECTION D (S2|S2)

3/8" = 1'-0"

1"x2" NEOPRENE JOINT FILLER CEMENT TO TOP OF GRILL PRIOR TO PLACING PRECAST VENT.

2-8"x16" C.I. GRILL (4 SIDES) W/ #20 MESH SCREEN, CAST-IN-PLACE. SET GRILL FLUSH W/TOP OF PEDESTAL. NET CONC. OPN'G. 7"x2'-6"

S.I.M.

SECTION E (S2|S2)

1/2" = 1'-0"

ROOF SLAB REINFORCING SCHEDULE

TOTAL NO. OF SETS	MARK	BOTTOM BARS	TOP BARS	REMARKS
32	T1	—	8-#5 x 13'-0" 7-#5 x 8'-4"	
8	T2	—	8-#4 x VARY	EDGE OF SLAB TO 1'-0 LAP WITH T1
8	T3	—	5-#4 x 8'-4"	—
24	C1	12-#4 x 15'-0"	8-#4 x 9'-0"	LAP TOP BARS 1'-6" WITH T1 (TYPICAL)
8	C2	12-#5 x VARY	—	EDGE OF SLAB TO 1'-6" FROM COLUMN ℄
8	C3	12-#4 x VARY	8-#4 x VARY	BOTTOM - SAME AS C2. TOP - EDGE OF SLAB TO LAP W/T1
3	C4	6-#4 x 15'-0"	5-#4 x 13'-8"	LAP TOP BARS WITH T3
8	C5	3-#4 x VARY	3-#4 x VARY	BOTTOM - SAME AS C2 TOP - EDGE OF SLAB TO LAP W/T3
23	M1	7-#4 x 19'-0" 7-#4 x 13'-4"	7-#4 x 13'-0"	LAP TOP BARS 1'-6 (TYP) W/MT1 OR MT2
2	M2	14-#4 x 19'-0" 2-#4 x 8'-6" (AT OPG.)	6-#4 x 13'-0" 2-#4 x 5'-6" (AT OPG.)	TOP - LAP W/MT1. PLACE 2-#4 x 19'-0" BOTT. @ 6" EA. SIDE OF OPG.
8	M3	14-#4 x VARIES	7-#4 x VARIES	BOTT. - EDGE OF SLAB TO COLUMN ℄ TOP - EDGE OF SLAB TO LAP W/MT1
8	M4	14-#4 x VARIES TO 19'-0"	7-#4 x VARIES TO 13'-0"	BOTT. - EDGE OF SLAB TO COL. ℄ OR ℄ TO ℄. TOP - LAP W/MT1 & MT3
1	M5	4-#4 x 15'-6" (AT OPG.) 12-#5 x 19'-0"	1-#4 x 12'-6" (AT OPG.) 6-#4 x 16'-0"	PLACE 3-#5 BOTT. @ 6" EA. SIDE OF OPG. LAP TOP BARS W/MT1
32	MT1	—	12-#4 x 9'-0"	—
3	MT2	—	12-#4 x 5'-0"	—
8	MT3	8-#4 x VARIES	8-#4 x VARY	TOP - FROM EDGE OF SLAB TO WITHIN 3" OF COL. STRIP BOUNDARY BOTT. - FROM EDGE OF SLAB TO COLUMN ℄

NOTES:
1. HOOK TOP BARS AT EDGE OF SLAB AND AT OPENINGS.
2. DIMENSIONS ARE OUT TO OUT OF BARS. ADD FOR HOOKS
3. SLAB REINFORCING : fy = 60,000 P.S.I.

DATE	NO.	REVISION	BY
9-4-75	1	REVISED VENT AND HATCH	J.E.C.

DESIGNED C.K. | APPROVED
DRAWN J.E.C. | SCALE AS SHOWN | DATE MAY, 1975
CHECKED A.A.P. | FILE PT.0757.002 - 14854

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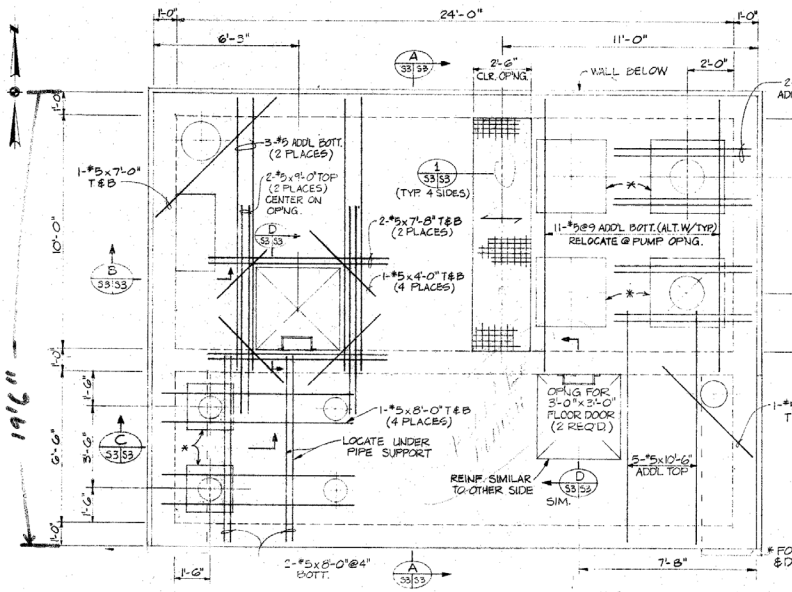
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

NEW CLEARWELL
ROOF PLAN - SECTIONS AND DETAILS

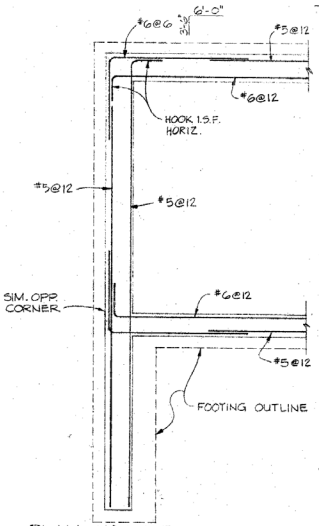
S2 / 3



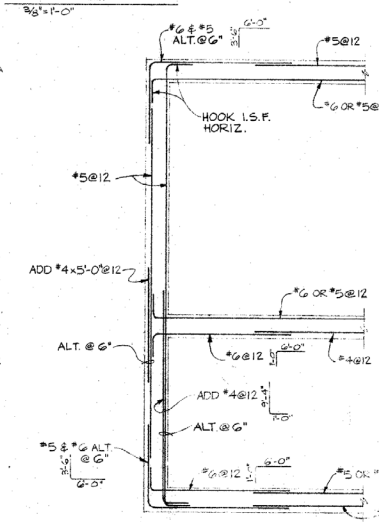
TOP PLAN
3/8"=1'-0"

NOTE: HOOK ALL TOP BARS AT OPENINGS

* FOR PAD LOCATION & DETAILS SEE SHT. M6

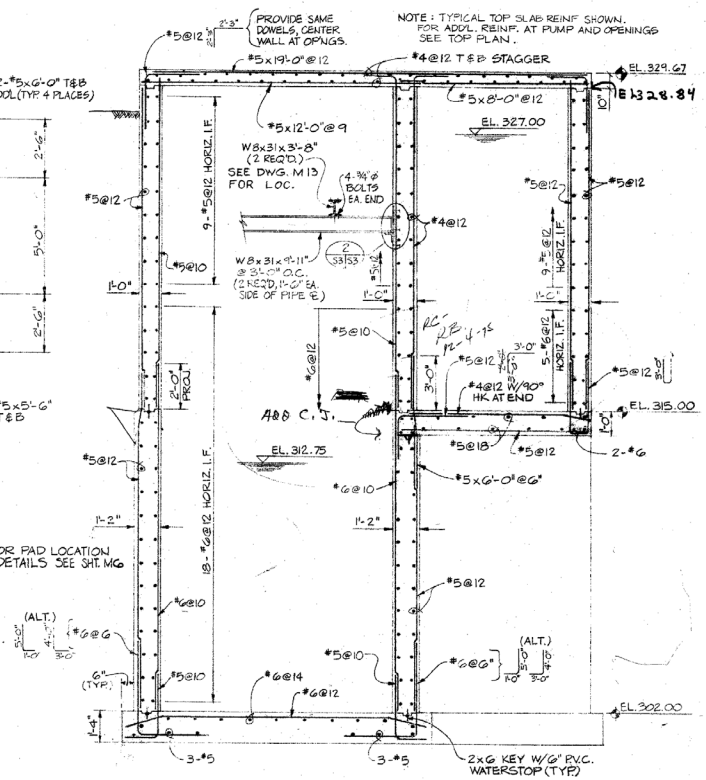


PLAN - HORIZ. REINFORCING AT CORNERS BELOW EL. 315.00

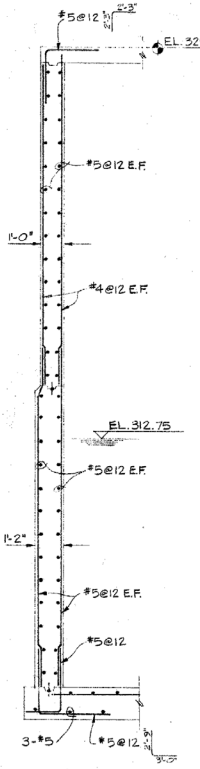


PLAN - HORIZ. REINFORCING AT CORNERS ABOVE EL. 315.00

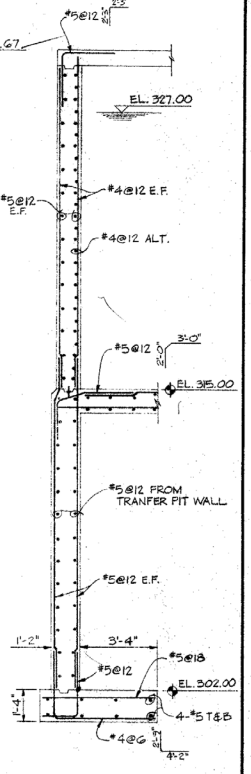
SCALE: 3/8"=1'-0"



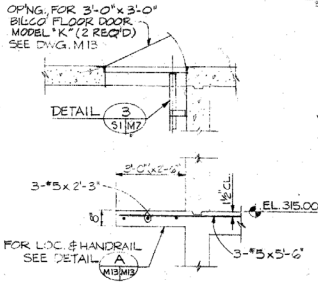
SECTION A
3/8"=1'-0"
S3 | S3



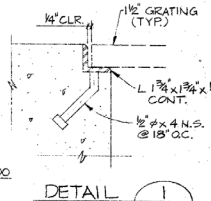
SECTION B
3/8"=1'-0"
S3 | S3



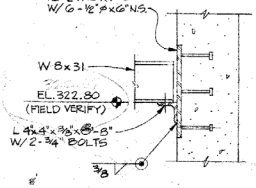
SECTION C
3/8"=1'-0"
S3 | S3



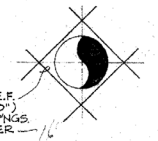
SECTION D
3/8"=1'-0"
S3 | S3



DETAIL 1
3"=1'-0"
S3 | S3



DETAIL 2
1"=1'-0"
S3 | S3



TYP. PIPE PENETRATION DETAIL
N.T.S.

DATE	NO.	REVISION	BY

DESIGNED C.K. | APPROVED James S. Smith
DRAWN J.E.C. | SCALE AS SHOWN | DATE MAY, 1975
CHECKED A.A.P. | FILE PT. 0757.002 - 14855

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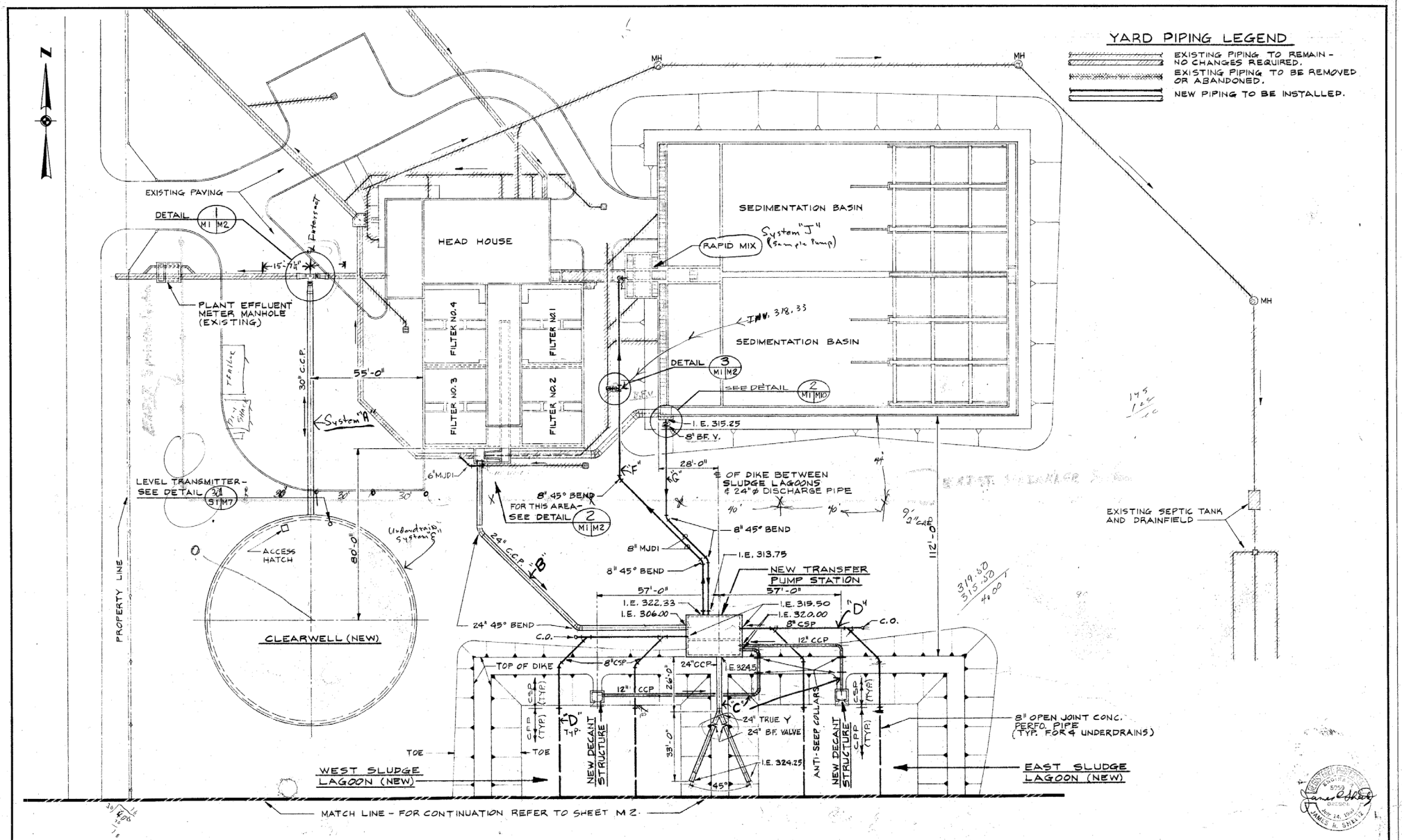
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

TRANSFER PUMP STATION
PLAN - SECTIONS AND DETAILS

S3
3



DATE	NO.	REVISION	BY

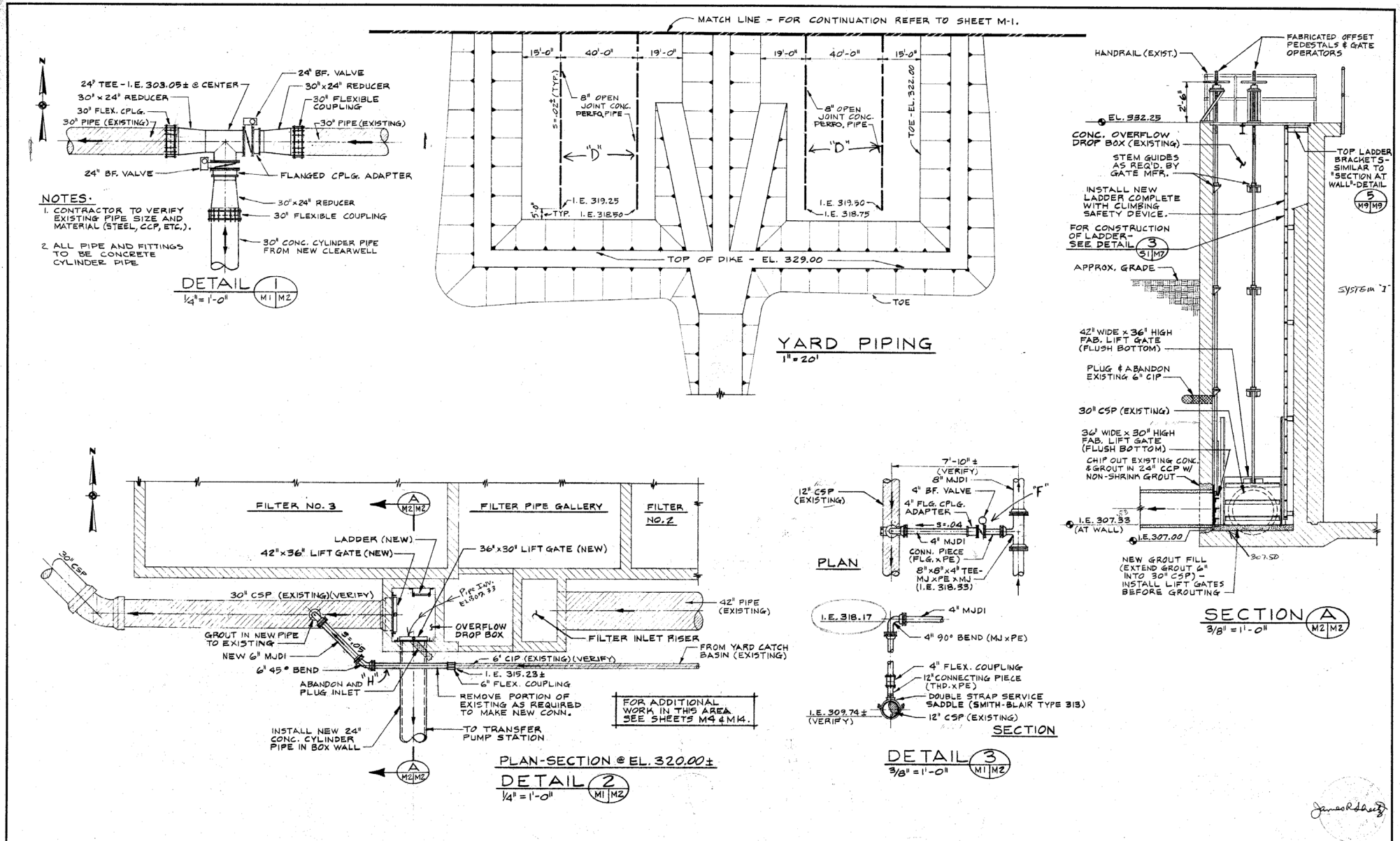
DESIGNED JRS/HWT APPROVED
DRAWN DGB SCALE 1" = 20' DATE MAY, 1975
CHECKED JRS FILE PT. 0757.002-14 B57

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

YARD PIPING SHEET I

M1
21



DATE	NO.	REVISION	BY

DESIGNED JRS/HWT | APPROVED [signature]
DRAWN DGB | SCALE AS SHOWN | DATE MAY, 1975
CHECKED JRS | FILE PT. 0757.002-14858

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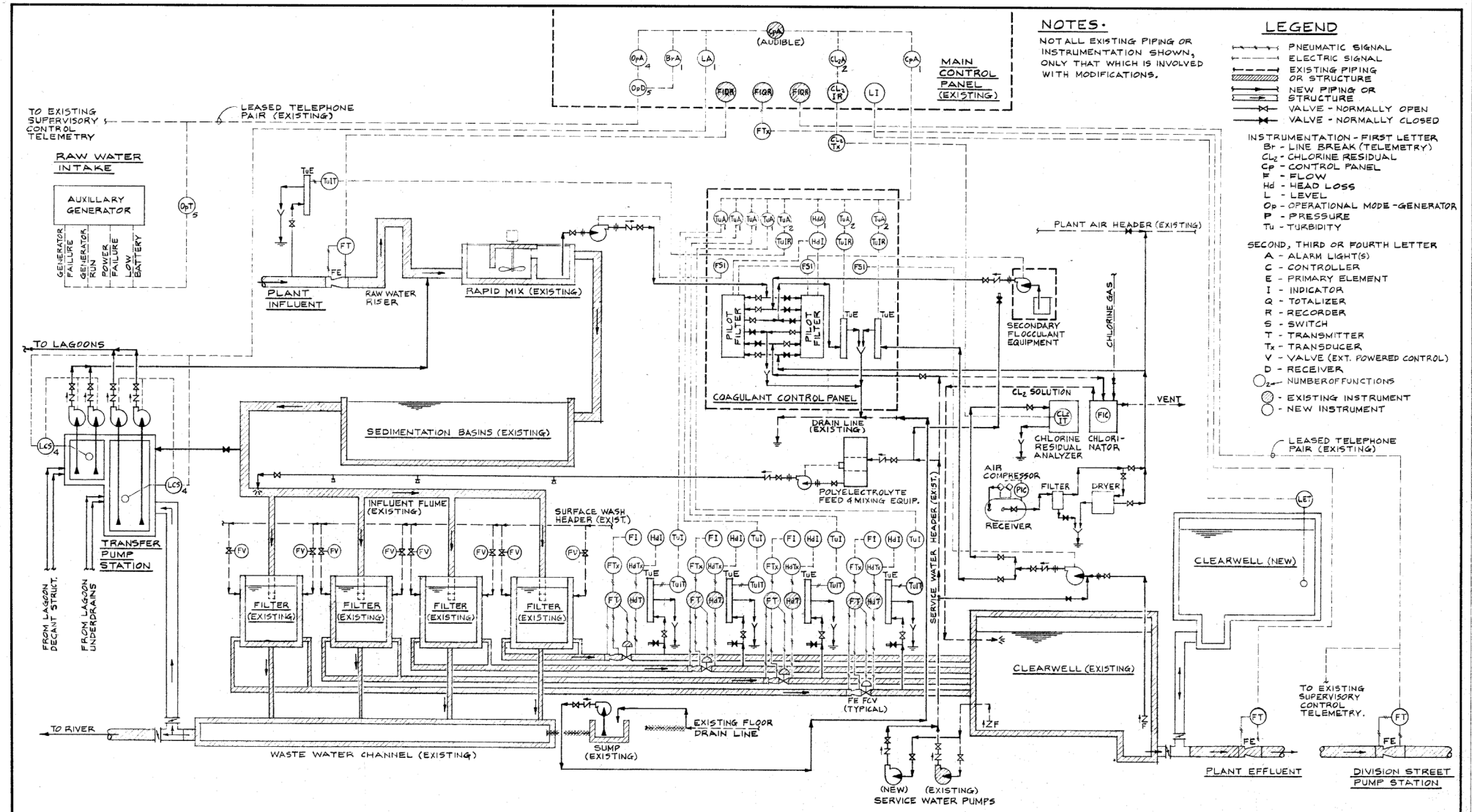
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

YARD PIPING SHEET II AND DETAILS

M2/21



DATE	NO.	REVISION	BY

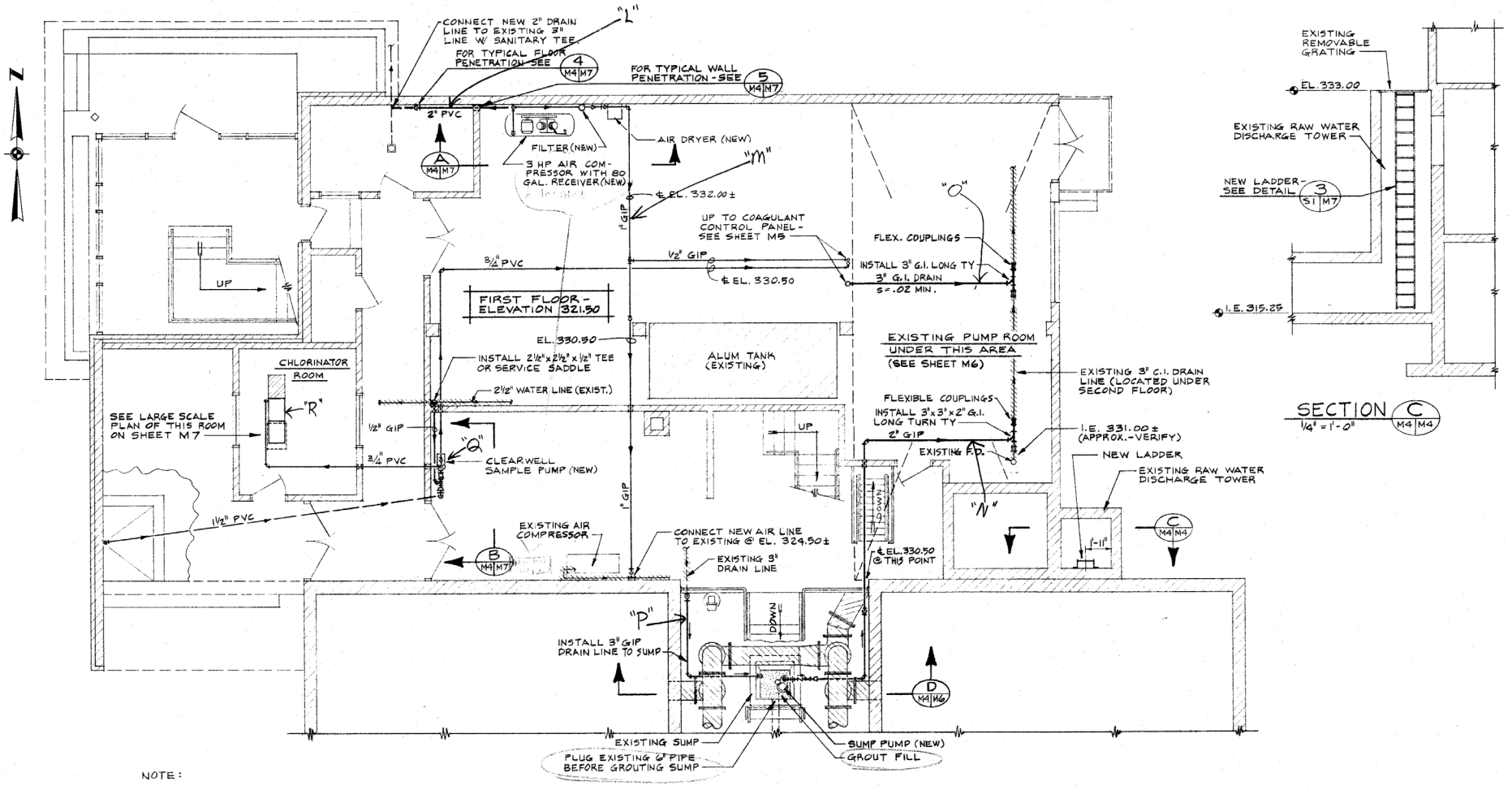
DESIGNED JRS/HWT | APPROVED [signature]
DRAWN DGB | SCALE NONE | DATE MAY, 1975
CHECKED JRS | FILE PT. 0757.202-14859

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY-WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

INSTRUMENTATION, CONTROL & TELEMETRY-MODIFICATIONS SCHEMATIC

M3/21



NOTE:

NEW PIPING ELEVATIONS ARE APPROXIMATE. FIELD VERIFY RUNS SO THERE IS NO CONFLICTION WITH EXISTING PIPING.

FIRST FLOOR PLAN

¼" = 1'-0"

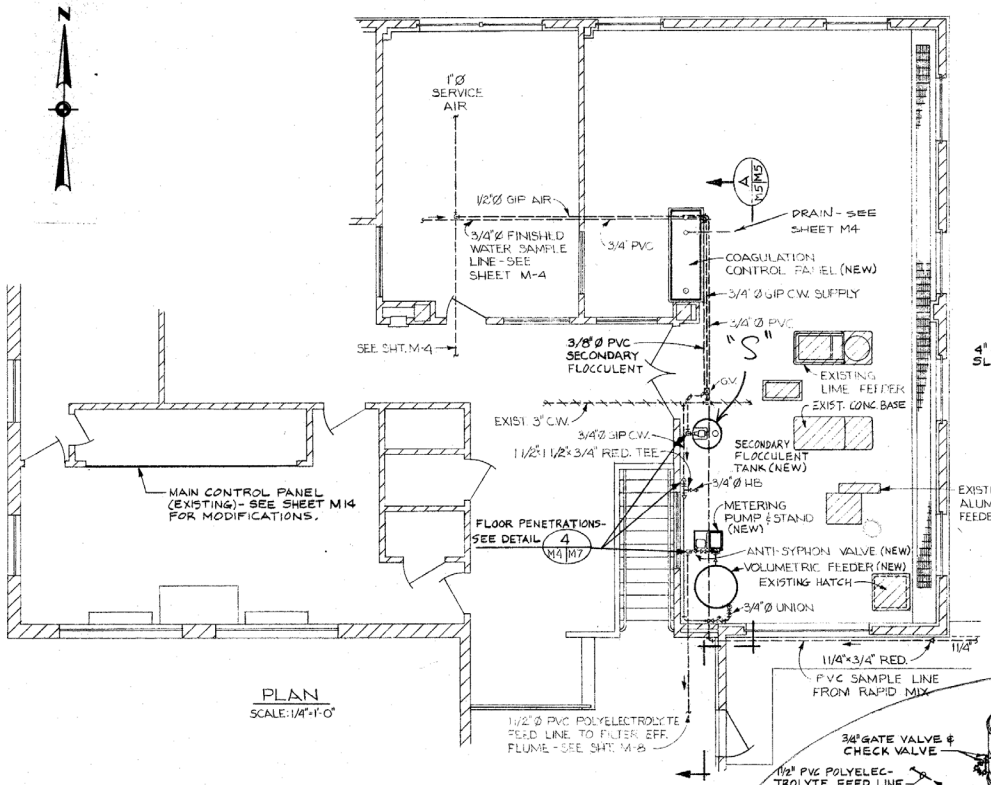
DATE	NO.	REVISION	BY	DESIGNED JRS/HWT	APPROVED
				DRAWN DGB	SCALE AS SHOWN DATE MAY 1975
				CHECKED JRS	FILE PT. 0757.002-14860

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

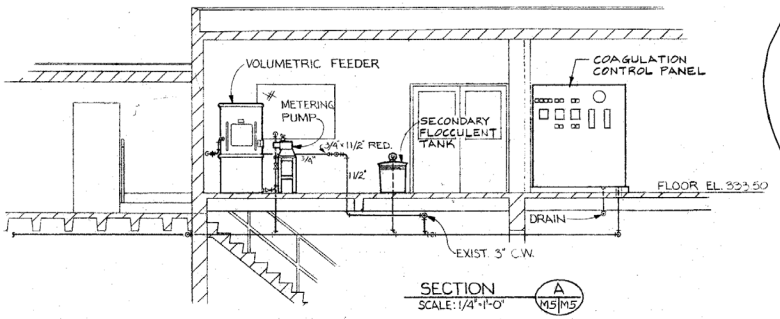
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

HEAD HOUSE MODIFICATIONS
FIRST FLOOR PLAN

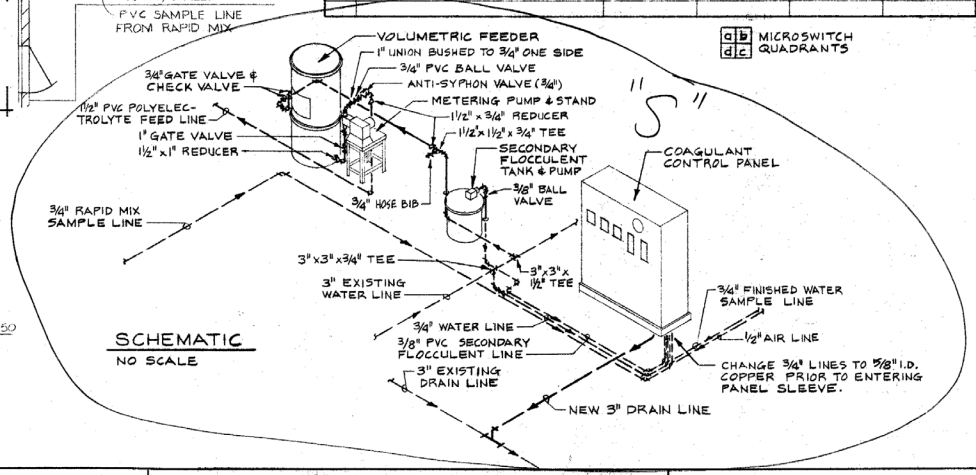
M4
21



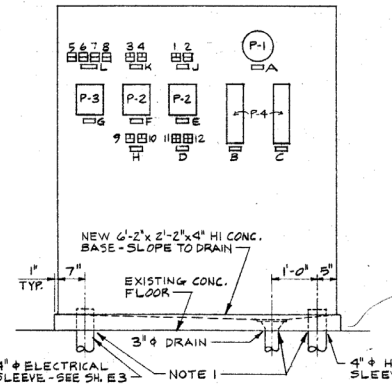
PLAN
SCALE: 1/4"=1'-0"



SECTION A M5 M5
SCALE: 1/4"=1'-0"



SCHEMATIC
NO SCALE



COAGULANT CONTROL PANEL
3/4" = 1'-0"

INSTRUMENTS

ITEM	MODE	FUNCTION	GRADUATION
P-1	DIFF.-PRESS.	HEADLOSS INDICATOR	0-25 FEET
P-2	ELECTRIC	TURBIDITY INDICATOR - RECORDER	0-30 FTU
P-3	ELECTRIC	" " "	0-5000 FTU
P-4	—	PILOT FILTER VIEWPORT	—

NAME PLATES

ITEM	SIZE	LINE 1	LINE 2
A	1"x4"	PILOT FILTER HEADLOSS	
B	1"x3"	PILOT FILTER NO. 1	
C	1"x3"	PILOT FILTER NO. 2	
D	1"x4"	NO. 1 - NO. 2	PILOT FILTER OPERATION
E	1"x3"	PILOT FILTER TURBIDITY	
F	1"x3"	CLEARWELL TURBIDITY	
G	1"x3"	RAW WATER TURBIDITY	
H	1"x3"	SAMPLE PUMPS	
J	1"x3"	PILOT FILTER ALARM	
K	1"x3"	TURBIDITY ALARM	
L	1"x4"	TURBIDITY ALARM	PLANT FILTERS

GENERAL NOTES:

1. CUT HOLES IN EXISTING 3" THICK FLOOR FOR NEW PIPE SLEEVES. FORM AND POUR INTEGRAL WITH NEW CONCRETE BASE.
2. PANEL AND NAMEPLATE COLORS TO BE DETERMINED BY THE ENGINEER.
3. SEE SHEET E3 FOR ADDITIONAL DRILLED HOLES FOR ELECTRICAL REQUIREMENTS.

MICROSWITCHES

ITEM	TYPE	a QUADRANT	b QUADRANT	d QUADRANT	c QUADRANT	COLOR *
1	INDICATOR, 3 WAY SPLIT (2 LAMP)	HIGH	LOW	TURBIDITY		a-R, b-Y, c, d-W
2	" , HORIZONTAL SPLIT (2 LAMP)	HIGH		HEADLOSS		a, b-R, c, d-W
3	" , 3 WAY SPLIT (2 LAMP)	HIGH	LOW	RAW WATER		a-R, b-Y, c, d-W
4	" , 3 " " " "	"	"	CLEARWELL		" " "
5	" , HORIZONTAL SPLIT (2 LAMP)	HIGH		FILTER NO. 1		a, b-R, c, d-W
6	" , " " " "	"		" " 2		" "
7	" , " " " "	"		" " 3		" "
8	" , " " " "	"		" " 4		" "
9	SELECTOR, 3 WAY SPLIT (2 LAMP)	ON	OFF	RAPID MIX		a-G, b-R, c, d-W
10	" 3 " " " "	"	"	CLEARWELL		" " "
11&12	SELECTOR, 4 WAY SPLIT (4 LAMP)	AUTO	ON	BACK-WASH	OFF	a-A, b-G, c-R, d-B

* COLORS
A - AMBER
B - BLUE
G - GREEN
R - RED
W - WHITE
Y - YELLOW

a | b
d | c MICROSWITCH QUADRANTS

DATE	NO.	REVISION	BY

DESIGNED JRS/HWT APPROVED
DRAWN CGR/D&B SCALE AS SHOWN DATE MAY, 1975
CHECKED JRS FILE PT 0757.002-14861

Stevens, Thompson & Runyan, Inc.
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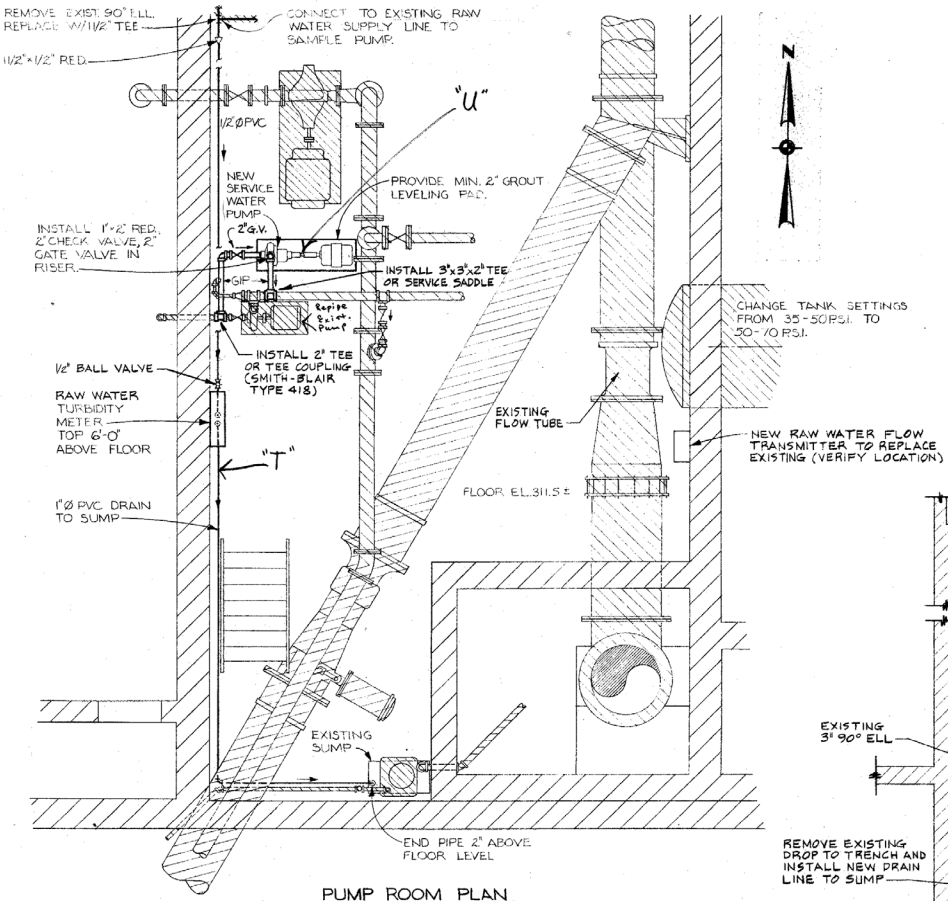
PORTLAND SEATTLE SPOKANE BOISE

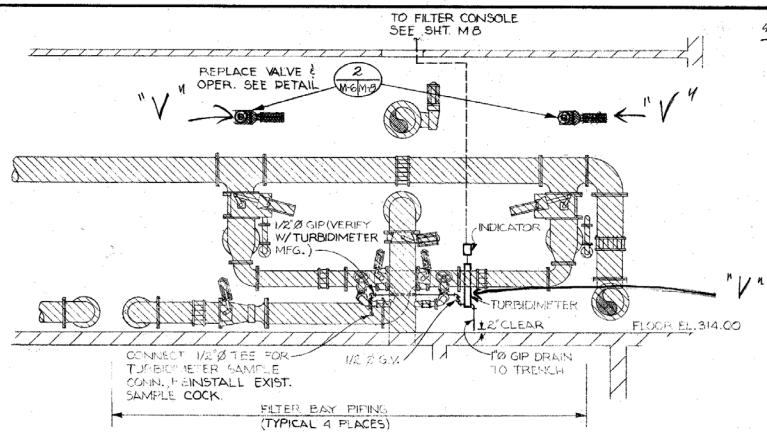
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

HEAD HOUSE MODIFICATIONS
SECOND FLOOR PLAN

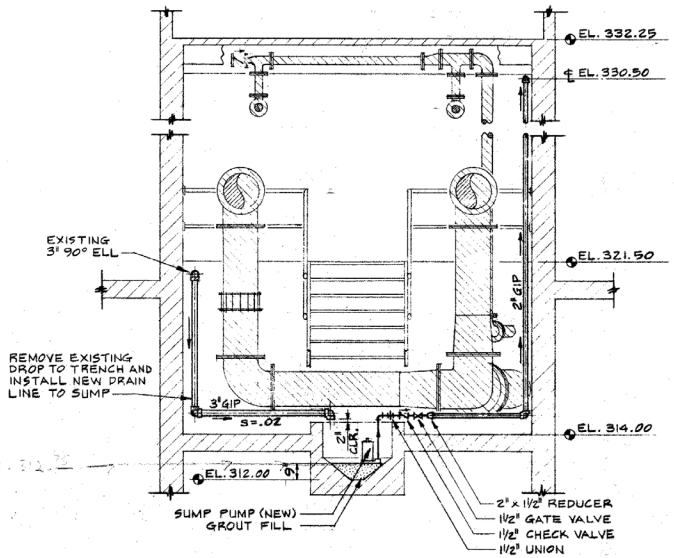
M5
21



PUMP ROOM PLAN
SCALE: 1/2"=1'-0"

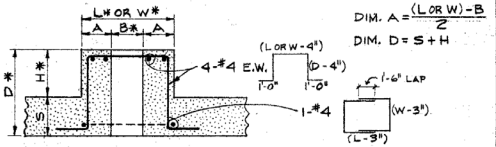


PARTIAL FILTER GALLERY ELEVATION
SCALE: 1/4"=1'-0"

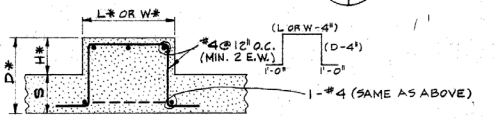


SECTION D (M4 | M6)
3/8"=1'-0"

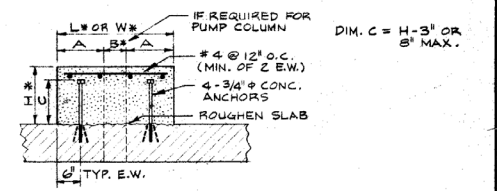
TYPICAL CONCRETE PAD DETAILS



PUMP BASE - NEW SLAB 1 (M13 | M6)



EQUIPMENT BASE - NEW SLAB 2 (M13 | M6)



EQUIP. BASE - EXISTING SLAB 3 (M16 | M6)

NOTE: * DIMENSIONS TO BE SIZED IN ACCORDANCE WITH EQUIP. MANUFACTURER'S DRAWINGS.

DATE	NO.	REVISION	BY

DESIGNED JRS | APPROVED
DRAWN CGR | SCALE AS SHOWN | DATE MAY, 1975
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Stevens, Thompson & Runyan, Inc.
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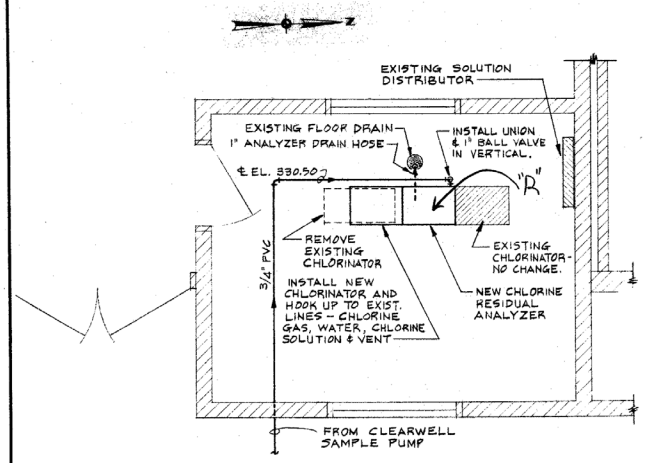
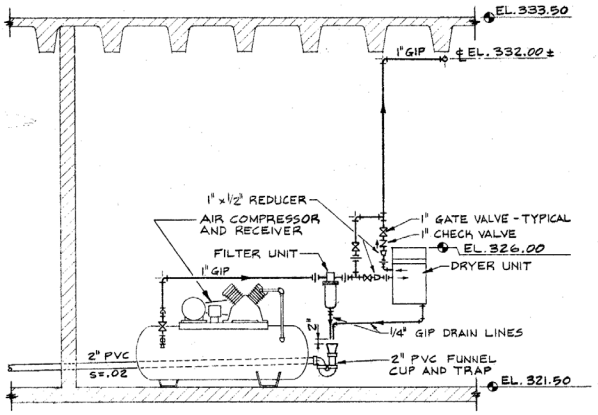
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

HEAD HOUSE MODIFICATIONS
PUMP ROOM AND FILTER GALLERY

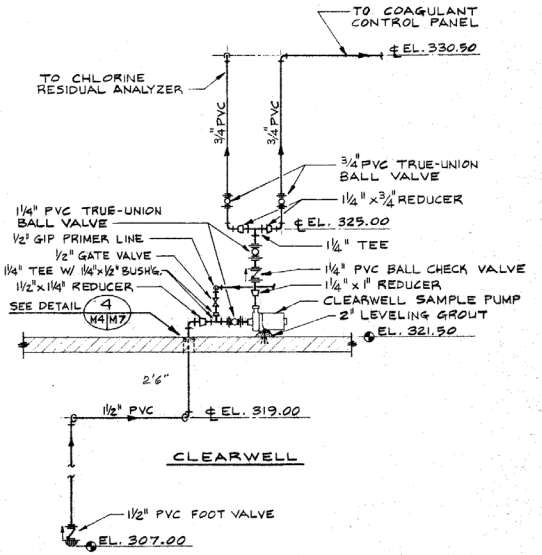
M6/21



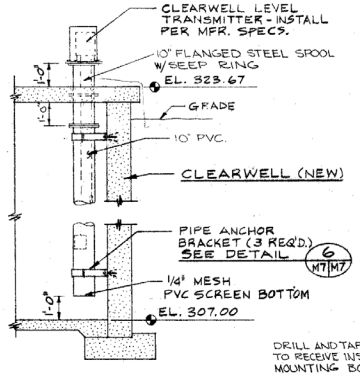
CHLORINATOR ROOM - PLAN
1/2" = 1'-0"



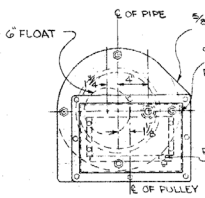
SECTION A
1/2" = 1'-0"
M4 | M7



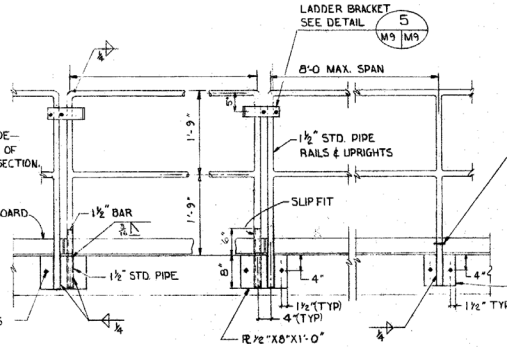
SECTION B
1/2" = 1'-0"
M4 | M7



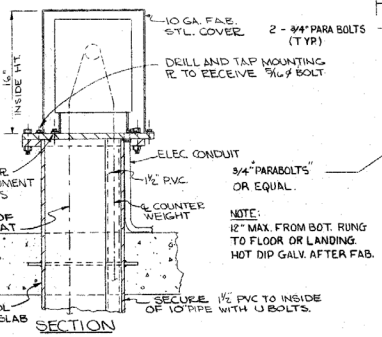
DETAIL 1
3/8" = 1'-0"
S1 | M7



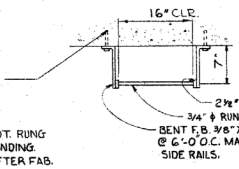
TOP VIEW



HANDRAIL DETAIL 2
NO SCALE
G3 | M7

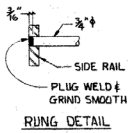


SECTION

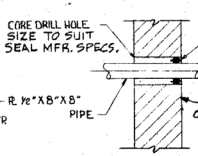


NOTE:
12" MAX. FROM BOT. RUNG TO FLOOR OR LANDING.
HOT DIP GALV. AFTER FAB.

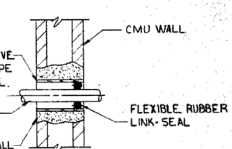
LADDER SECTION 3
1" = 1'-0
S1 | M7



RUNG DETAIL



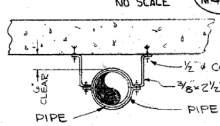
EXISTING CONC. WALL OR FLOOR



MASONARY WALL

DETAIL 4
NO SCALE
M4 | M7

DETAIL 5
NO SCALE
M4 | M7



PIPE SUPPORT DETAIL 6
NO SCALE
M7 | M7

REGISTERED PROFESSIONAL ENGINEER 3909 OREGON JULY 14, 1978 JAMES R. SHEELY

DATE	NO.	REVISION	BY

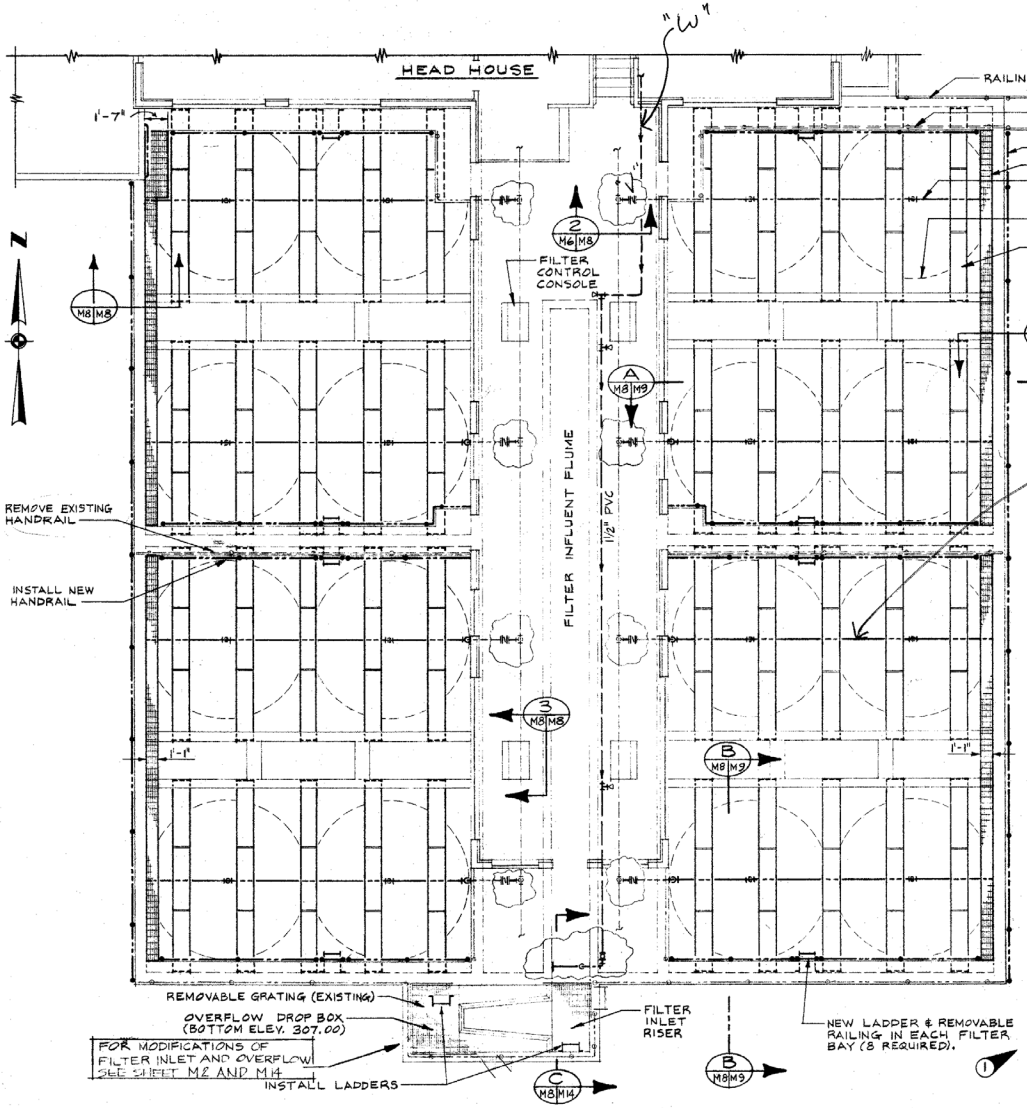
DESIGNED JRS/HWT | APPROVED
DRAWN DGB | SCALE AS SHOWN | DATE MAY, 1975
CHECKED JRS | FILE PT. 0757.002 - 14863

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

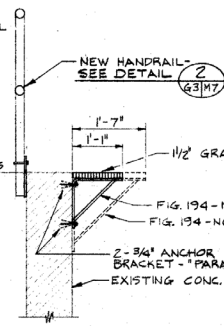
HEAD HOUSE DETAILS
MISCELLANEOUS DETAILS

M7
21



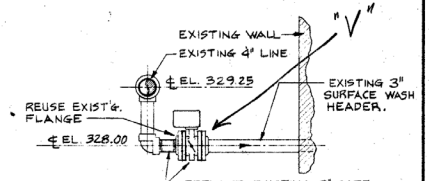
PLAN OF EXISTING FILTERS

3/16" = 1'-0"



DETAIL 1 (M8 | M8)

3/4" = 1'-0"



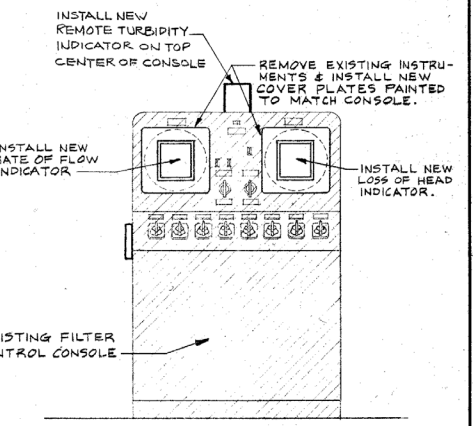
DETAIL 2 (M6 | M8)

3/4" = 1'-0"

FILTER WORK NOTES

(NOTES ARE NOT IN SEQUENCE)

1. REMOVE EXISTING STEEL TROUGHS.
2. CUT OFF AND REMOVE EXISTING SURFACE WASH HEADER PIPING IN FILTER BAYS.
3. REMOVE FOR REUSE EXISTING SURFACE WASH AGITATORS.
4. REMOVE EXISTING 3" SURFACE WASH GATE VALVES AND OPERATORS.
5. REMOVE EXISTING FILTER MEDIA AND GRAVEL.
6. INSTALL NEW FILTER MEDIA AND GRAVEL.
7. INSTALL NEW 3" SURFACE WASH BUTTERFLY VALVES AND OPERATORS WITH REQ'D. SPOOLS.
8. INSTALL NEW FIBERGLASS TROUGHS.
9. INSTALL NEW SURFACE WASH HEADER PIPING AND REINSTALL AGITATORS AT NEW ELEVATIONS.
10. INSTALL NEW WALKWAY GRATINGS.
11. INSTALL NEW LADDERS - ONE IN EACH FILTER BAY, FILTER INLET RISER & OVERFLOW DROP BOX.
12. REMOVE PORTIONS OF EXISTING HANDRAIL AS REQUIRED.
13. INSTALL GALV. TOEBOARD (CONTINUOUS) ON EXISTING HANDRAILS.
14. INSTALL NEW HANDRAILS.
15. INSTALL NEW POLYELECTROLYTE FEED LINE AND DIFFUSER.
16. MODIFY EXISTING FILTER CONTROL CONSOLES.
17. INSTALL NEW TURBIDIMETERS IN FILTER PIPE GALLERY. SEE SHEET M6.
18. REMOVE PAINT FROM INTERIOR WALLS OF ALL 4 FILTERS. SEE SPECIFICATIONS.

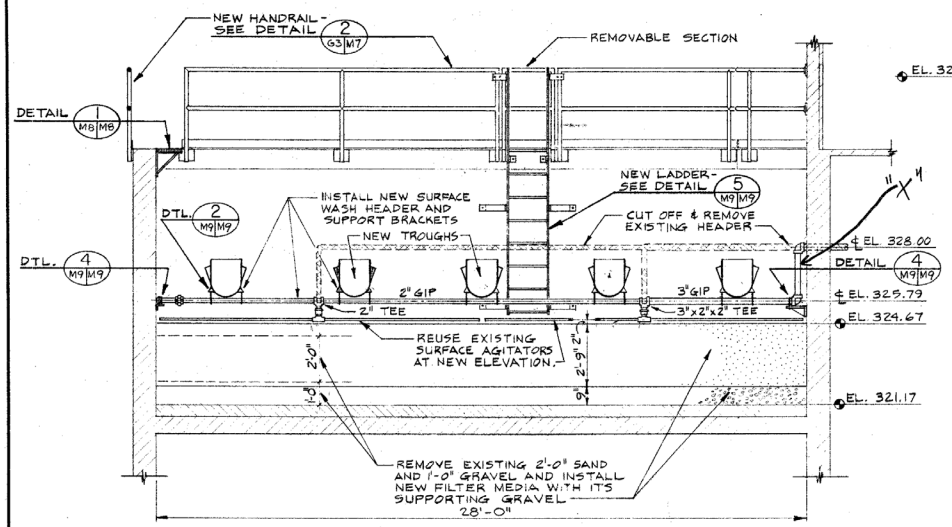


DETAIL 3 (M8 | M8)

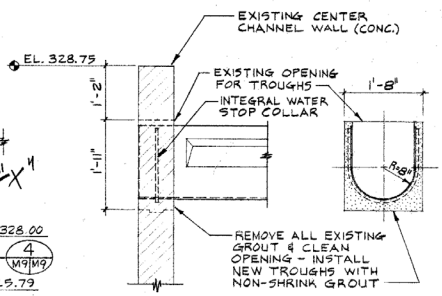
NO SCALE

8-20-75	1	ADDED NOTE #18.	D&B	DESIGNED JRS/HWT	APPROVED	Stevens, Thompson & Runyan, Inc. Engineers/Planners PORTLAND SEATTLE SPOKANE BOISE	OREGON CITY - WEST LINN SOUTH FORK WATER BOARD WATER WORKS MODIFICATIONS	FILTER MODIFICATIONS PLAN AND DETAILS	M8 / 21
DATE	NO.	REVISION	BY	DRAWN DGB	SCALE AS SHOWN DATE MAY, 1975				
				CHECKED JRS	FILE PT. 0757.002-14864				

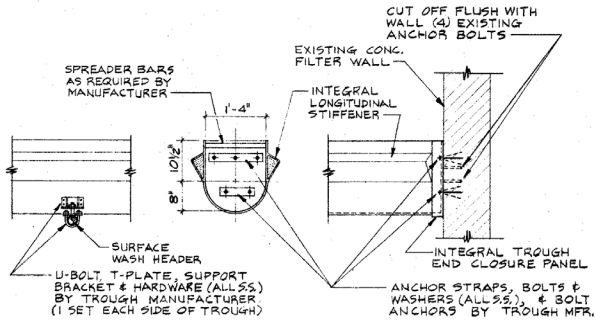
CBP INC — 1000H CLEARPRINT



SECTION A
3/8" = 1'-0"
M8 M9

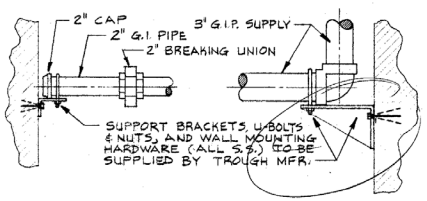


DETAIL 1
3/4" = 1'-0"
M9 M9

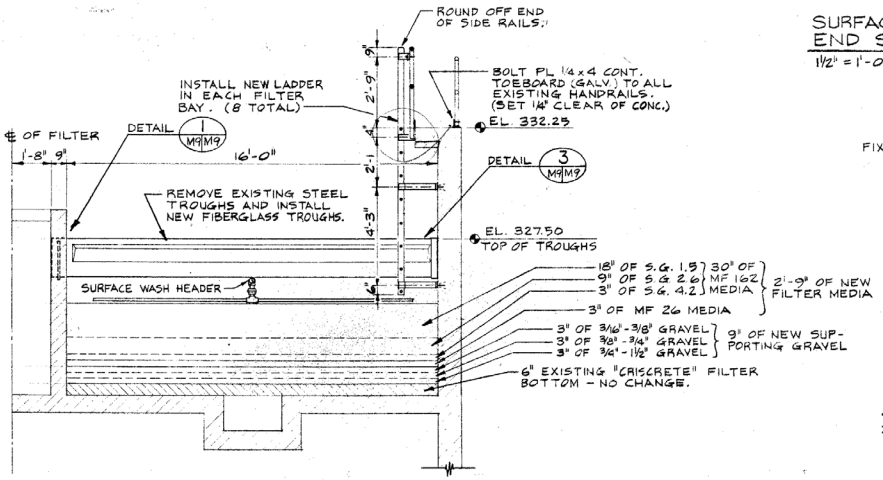


DETAIL 2
3/4" = 1'-0"
M9 M9

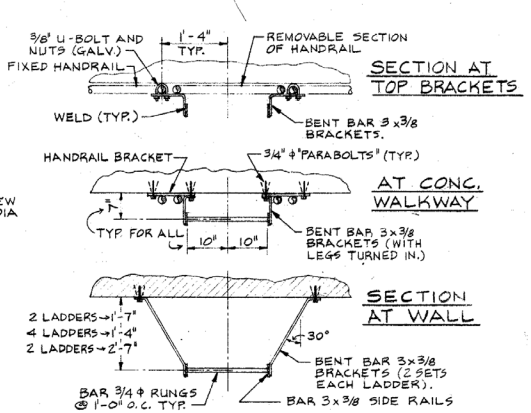
DETAIL 3
3/4" = 1'-0"
M9 M9



SURFACE WASH HEADER END SUPPORTS-DETAIL 4
1½" = 1'-0"
M9 M9



SECTION B
3/8" = 1'-0"
M8 M9



NOTE: LADDERS TO BE HOT DIPPED GALVANIZED AFTER FABRICATION.

FILTER LADDER SECTIONS - DETAIL 5
3/4" = 1'-0"
M9 M9

DATE	NO.	REVISION	BY

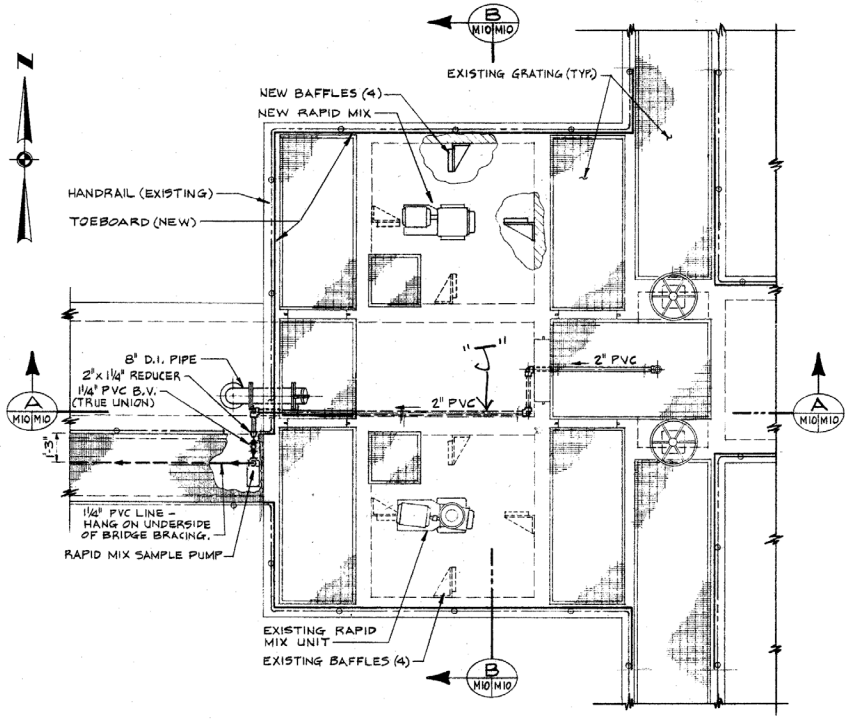
DESIGNED JRS/HWT | APPROVED
DRAWN DGB | SCALE AS SHOWN | DATE MAY, 1975
CHECKED JRS | FILE PT. 0757.002-14865

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

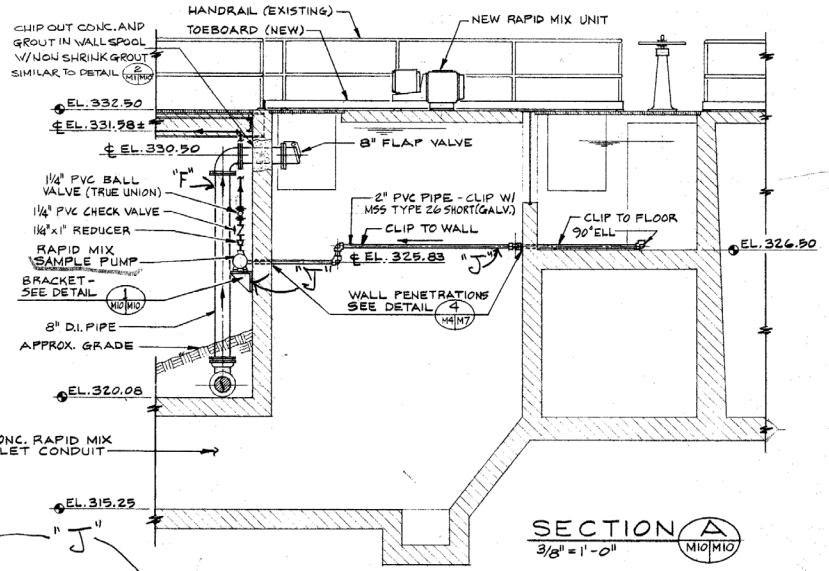
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

FILTER MODIFICATIONS
SECTIONS AND DETAILS

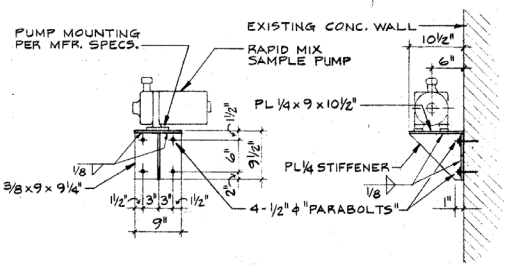
M9
21



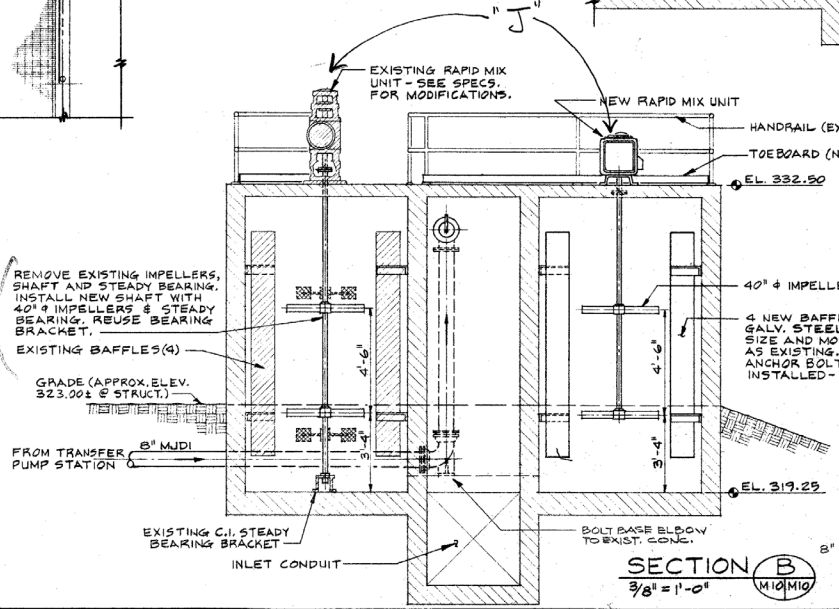
PLAN
3/8" = 1'-0"



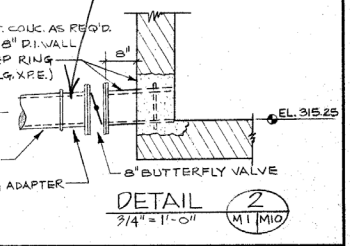
SECTION A
3/8" = 1'-0"



BRACKET DETAIL 1 M10|M10
1" = 1'-0"



SECTION B
3/8" = 1'-0"



DETAIL 2 M1|M10
3/4" = 1'-0"

DATE	NO.	REVISION	BY	CHECKED JRS	DESIGNED JRS/HWT	APPROVED
					DRAWN DGB	SCALE AS SHOWN
						FILE PT. 0757.002 - 14866

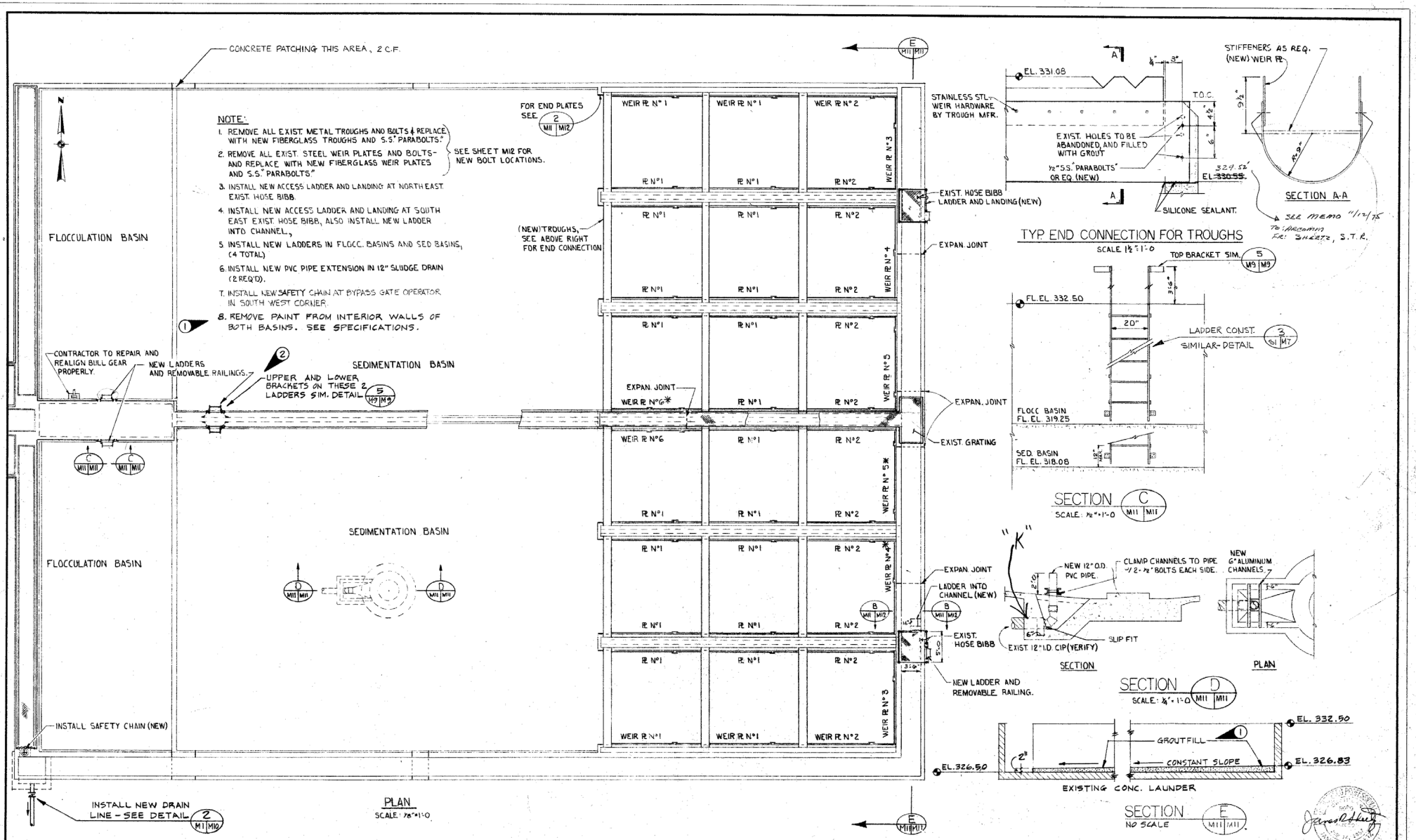
Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

RAPID MIX BASIN MODIFICATIONS
PLAN AND SECTIONS

M10
21

CEF. INC.—1000H CLEARPRINT



NO.	DATE	REVISION	DES	DRAWN	CHECKED
2		MOVED 2 LADDERS.	DGB		
1	8-20-75	ADDED NOTE, DELETED "EPOXY"	DGB	JAK	JRS

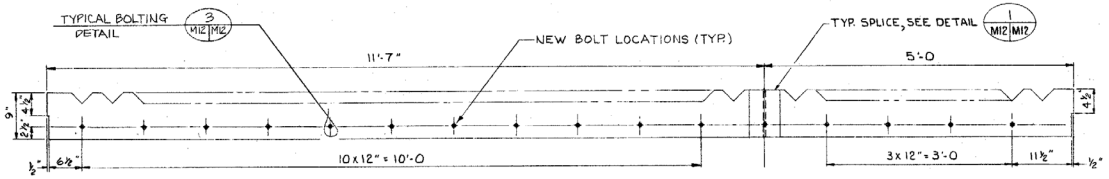
DESIGNED HWT/JRS | APPROVED | SCALE AS SHOWN | DATE MAY 1975 | FILE PT.0757.002-14-867

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

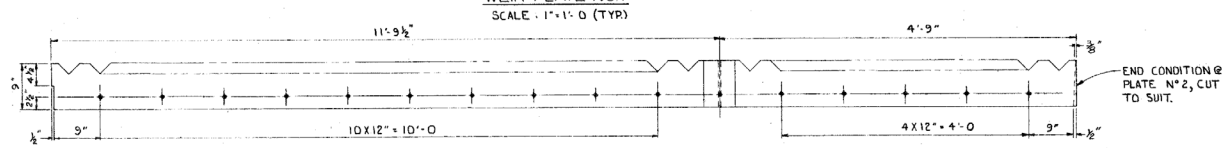
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

SEDIMENTATION BASIN MODIFICATIONS
PLAN AND DETAILS

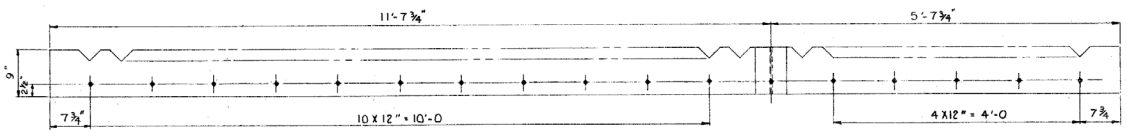
M11 / 21



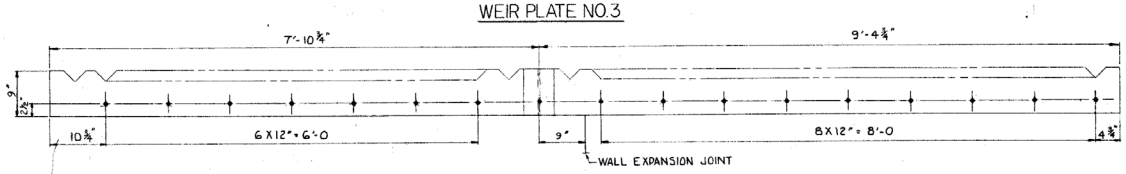
WEIR PLATE NO.1
SCALE: 1" = 1'-0 (TYP.)



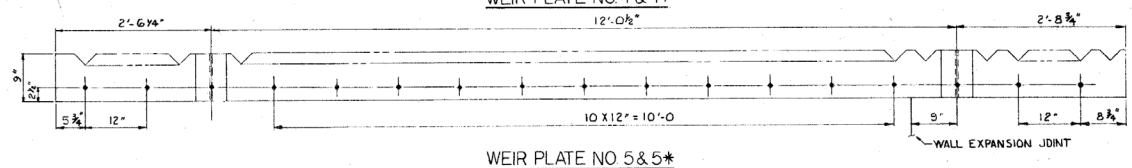
WEIR PLATE NO.2



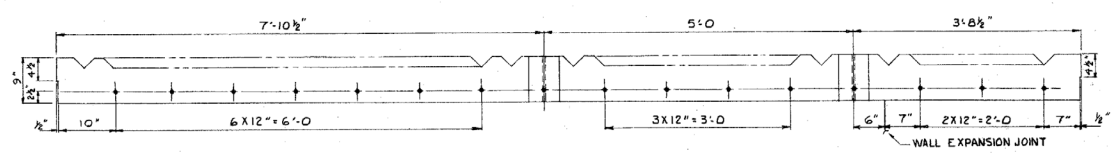
WEIR PLATE NO.3



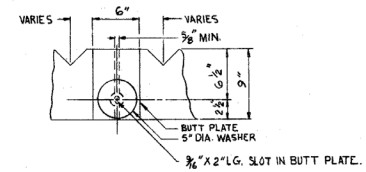
WEIR PLATE NO.4 & 4*



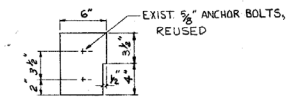
WEIR PLATE NO.5 & 5*



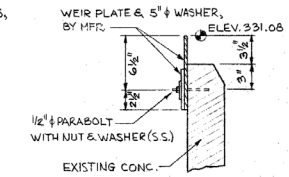
WEIR PLATE NO.6 & 6*



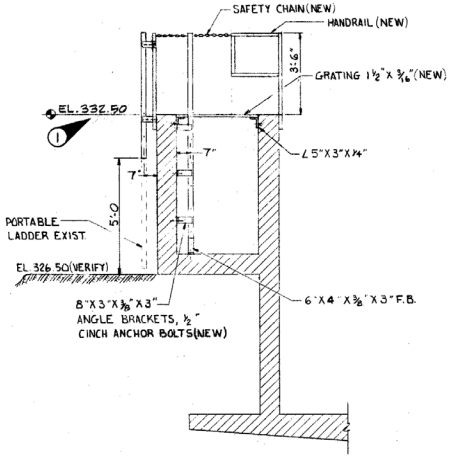
SPLICE DETAIL 1 M12 M12
NO SCALE



END PLATE 2 M11 M12
NO SCALE



TYPICAL DETAIL 3 M12 M12
NO SCALE



SECTION B M11 M12
SCALE 3/8" = 1'-0

NOTES:
1. FIELD VERIFY ALL BOLT LOCATIONS.
2. ALL NOTCHES ARE 2" DEPTH, 90-VEE
3. CONTRACTOR TO VERIFY ALL WEIR PLATE DIMENSIONS IN THE FIELD PRIOR TO PLATE FABRICATION.
4. ALL NEW BOLTS ARE ½" ϕ S.S. "PARABOLTS" W/ S.S. NUTS AND WASHERS
5. * DENOTES WEIR PLATE MIRROR IMAGE OF PLATE SHOWN.

DATE	NO.	REVISION	BY
8-20-75	1	CHANGED EL. FROM 325.50 TO 332.50	DGB

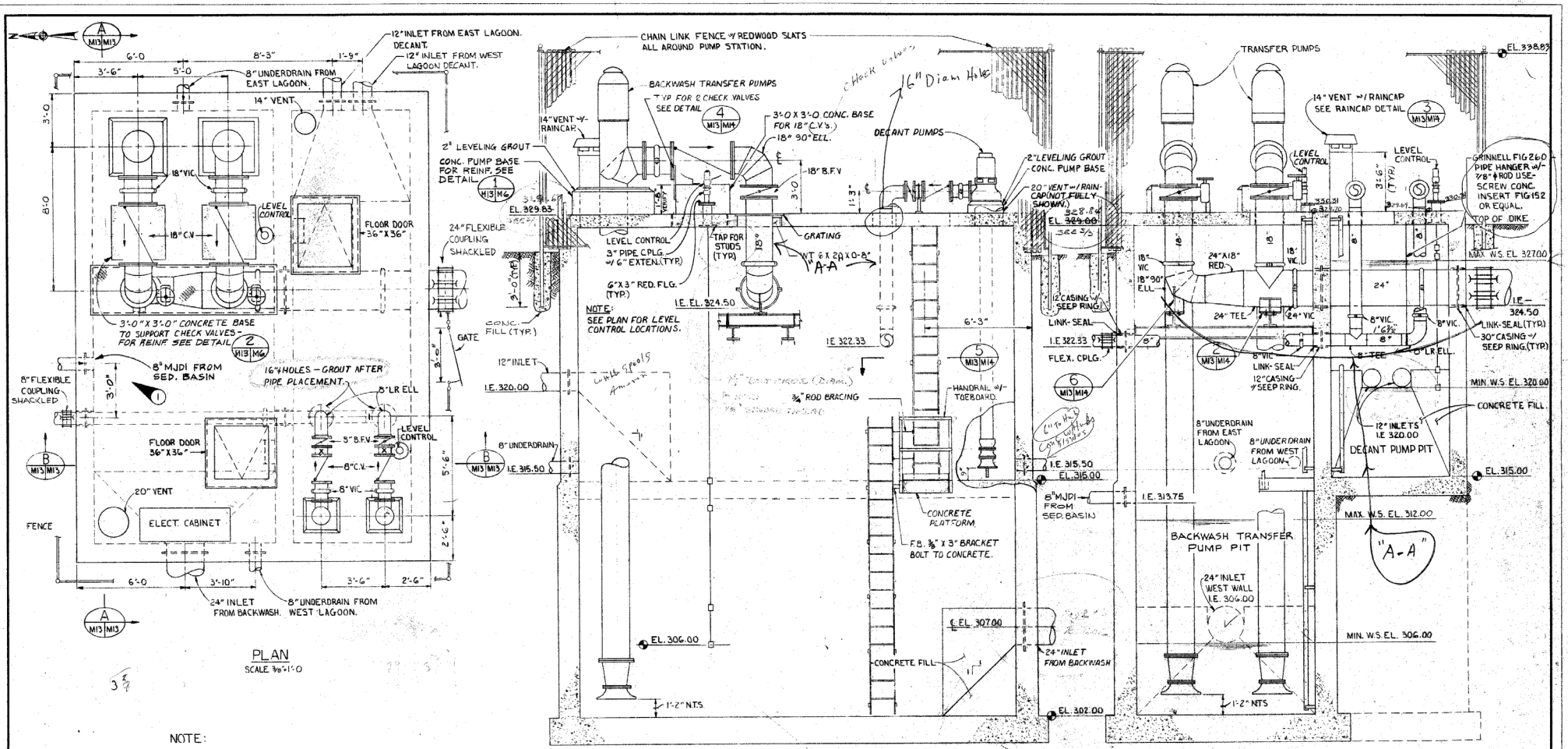
DESIGNED HWT/JRS
DRAWN JAK
CHECKED JRS
APPROVED [signature]
SCALE AS SHOWN DATE MAY 1975
FILE PT.0757.002-14868

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY-WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

SEDIMENTATION BASIN MODIFICATIONS
WEIR PLATES

M12/21



NOTE:

1a. CONTRACTOR TO VERIFY ALL CONCRETE EQUIPMENT BASE SIZES WITH MFR.

b. FOR TYP. REINFORCING DETAILS SEE SHT. M6

2. LOCATE FENCE 1'-0" FROM SLAB, TYP.

3. STEEL PIPING ABOVE TOP SLAB TO BE CONSIDERED INTERIOR FOR PURPOSES OF DIMENSIONING AND DETAILING.

4. PROVIDE FLEXIBLE CONNECTIONS 2'-0" OR CLOSER TO WALL ON ALL WALL PENETRATIONS. SEE SPECS.

DATE	NO.	REVISION	BY
8-20-75	1	ADDED PIPE IN PLAN & NOTE 4.	DGB

DESIGNED JRS/HWT
DRAWN JAK
CHECKED JRS
APPROVED [signature]
SCALE AS SHOWN
DATE MAY 1975
PT 0757 C02-14869

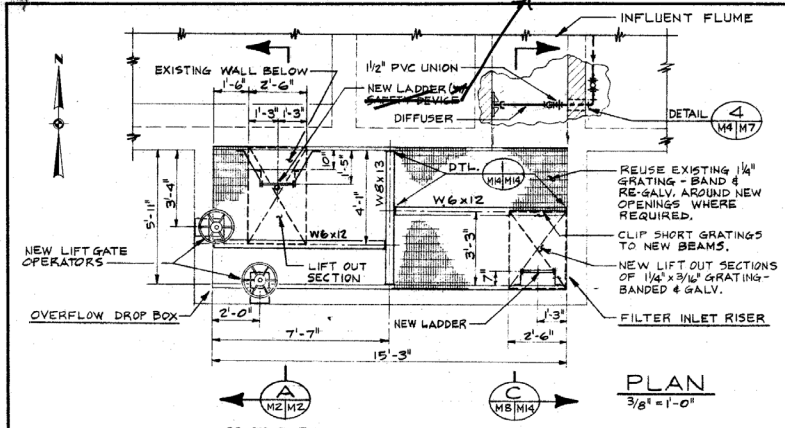
Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY-WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

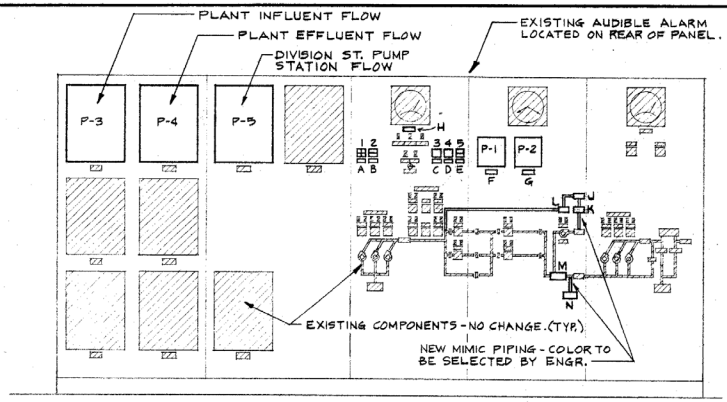
TRANSFER PUMP STATION
PLAN AND SECTIONS

M13/21

Deleted in Addendum #3



PLAN
3/8" = 1'-0"



MAIN CONTROL PANEL (EXISTING)
3/4" = 1'-0"

INSTRUMENTS (NEW)

ITEM	MODE	FUNCTION	GRADUATION
P-1	ELECTRIC	LEVEL INDICATOR	0-15 FT/0.5 FT
P-2	ELECTRIC	Cl_2 RESIDUAL INDICATOR-RECORDER	0-2 MG/L
P-3	ELEC.-EXIST.	INDICATOR-RECORDER-TOTALIZER	0-25 MGD
P-4	PNEU.-ELEC.	" " "	0-25 MGD
P-5	ELEC.-EXIST.	" " "	0-25 MGD

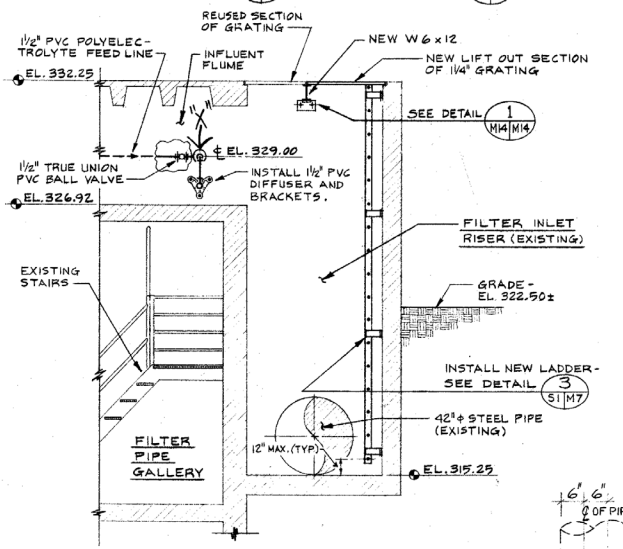
EXISTING INSTRUMENTS TO BE MODIFIED PER SPECIFICATIONS, ARE P-3, P4 & P5.

NAME PLATES (NEW)

ITEM	SIZE	FIRST LINE/SECOND LINE
A	1" x 2½"	WATER INTAKE / STANDBY GENERATOR
B	1" x 2½"	WATER INTAKE
C	1" x 2½"	TRANSFER PUMP STATION
D	1" x 2½"	COAGULANT / CONTROL PANEL
E	1" x 2½"	CHLORINE RESIDUAL / ALARM
F	1" x 3"	CLEARWELL NO. 2 LEVEL
G	1" x 3"	CHLORINE RESIDUAL
H	1" x 3"	CLEARWELL NO. 1 LEVEL
J	1" x 3"	LAGOONS
K	1" x 3"	TRANSFER PIT / TRANSFER PUMP STATION
L	1" x 3"	DECANT PIT / TRANSFER PUMP STATION
M	1½" x 3½"	FILTER PLANT / CLEARWELL NO. 1
N	1½" x 3½"	FILTER PLANT / CLEARWELL NO. 2

NOTE: NAME PLATE STYLE, COLOR AND LETTERING TO MATCH EXISTING PLATES.

System "X"

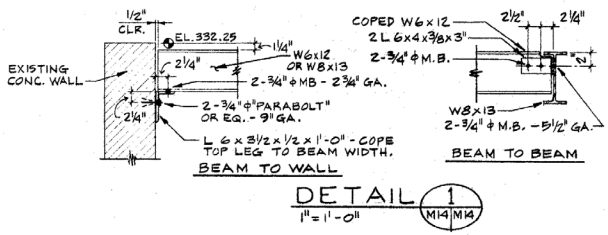


SECTION C
3/8" = 1'-0"
M8 M14

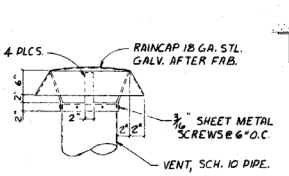
MICROSWITCHES

ITEM	TYPE	a QUADRANT	b QUADRANT	d QUADRANT	c QUADRANT	COLOR*
1	INDICATOR, 4 WAY SPLIT (4 LAMP)	POWER FAILURE	GEN. RUN	LOW BATTERY	GEN. FAILURE	a,c,d-R, b-A
2	" , HORIZONTAL SPLIT (2 LAMP)	FAILURE		TELEMETRY LINE		a,b-R, c,d-W
3	" , FULL DISPLAY (4 LAMP)	HIGH LEVEL		ALARM		a,b,c,d-R
4	" " " " "	GENERAL		ALARM		a,b,c,d-R
5	" , HORIZONTAL SPLIT (4 LAMP)	HIGH RESIDUAL		LOW RESIDUAL		a,b-R, c,d-Y

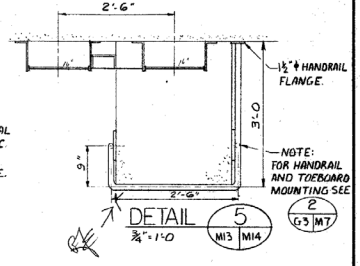
* COLORS ARE: A-AMBER, R-RED, W-WHITE, Y-YELLOW.



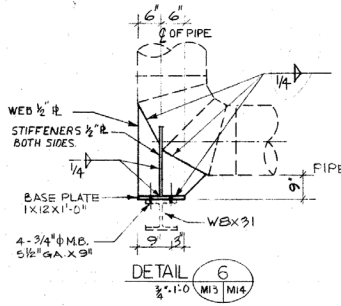
DETAIL 1
1" = 1'-0"
M14 M14



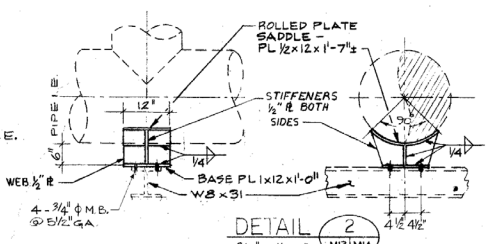
DETAIL 3
NO SCALE
M13 M14



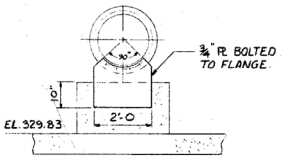
DETAIL 5
¾" = 1'-0
M13 M14
2
G3 M7



DETAIL 6
¾" = 1'-0"
M13 M14



DETAIL 2
3/4" = 1'-0"
M13 M14



DETAIL 4
NO SCALE
M13 M14

REGISTERED PROFESSIONAL ENGINEER OREGON JULY 14, 1967 JAMES N. SHEETZ

DATE	NO.	REVISION	BY

DESIGNED JRS/HWT APPROVED
DRAWN DGB-JAK SCALE AS SHOWN DATE MAY, 1975
CHECKED JRS FILE PT. 0757.002-14870

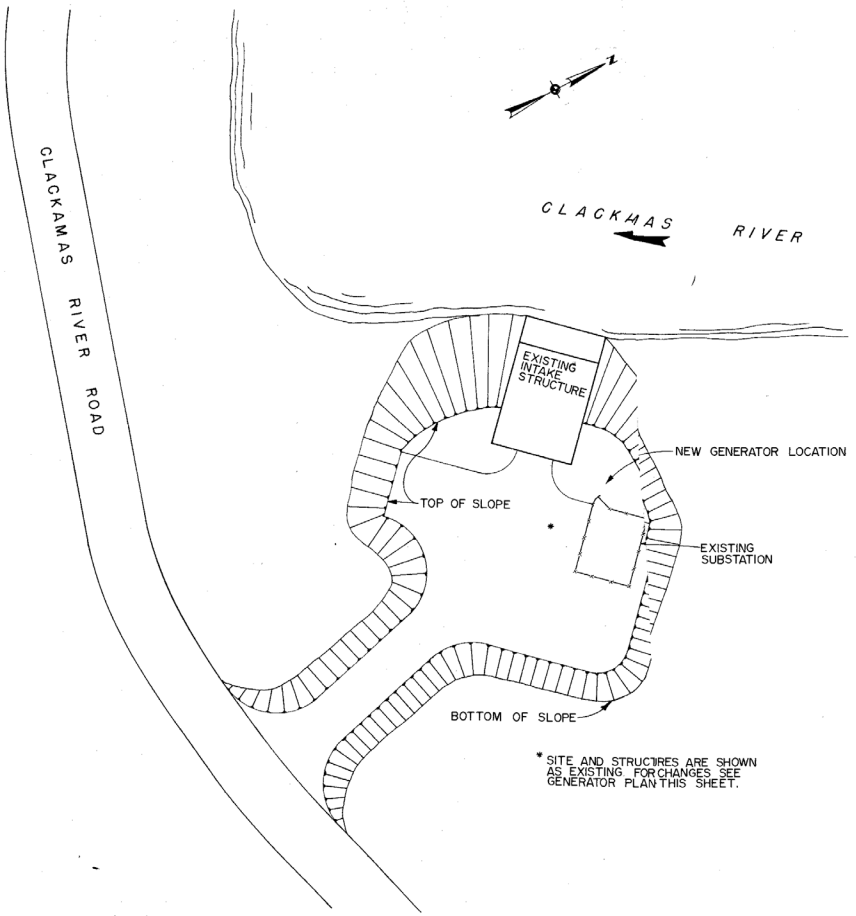
Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

MAIN CONTROL PANEL MODIFICATIONS - MISCELLANEOUS DETAILS

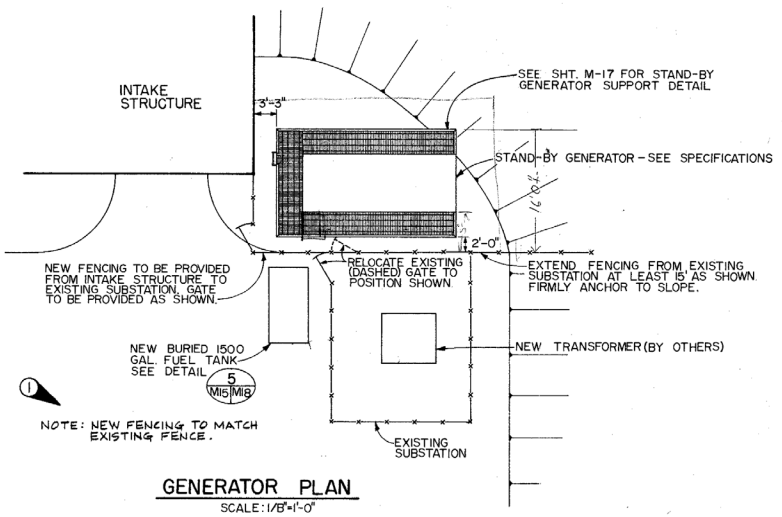
M14
21

CSK INC.—1000H CLEARPRINT



SITE PLAN

SCALE: 1"=20'



GENERATOR PLAN

SCALE: 1/8"=1'-0"

DATE	NO.	REVISION	BY
8-20-75	1	ADDED FENCING NOTE.	DAB

DESIGNED JRS/HWT | APPROVED Howard W. Taylor
DRAWN CGR | SCALE AS SHOWN | DATE MAY, 1975
CHECKED JRS | FILE PT 0757.002-14871

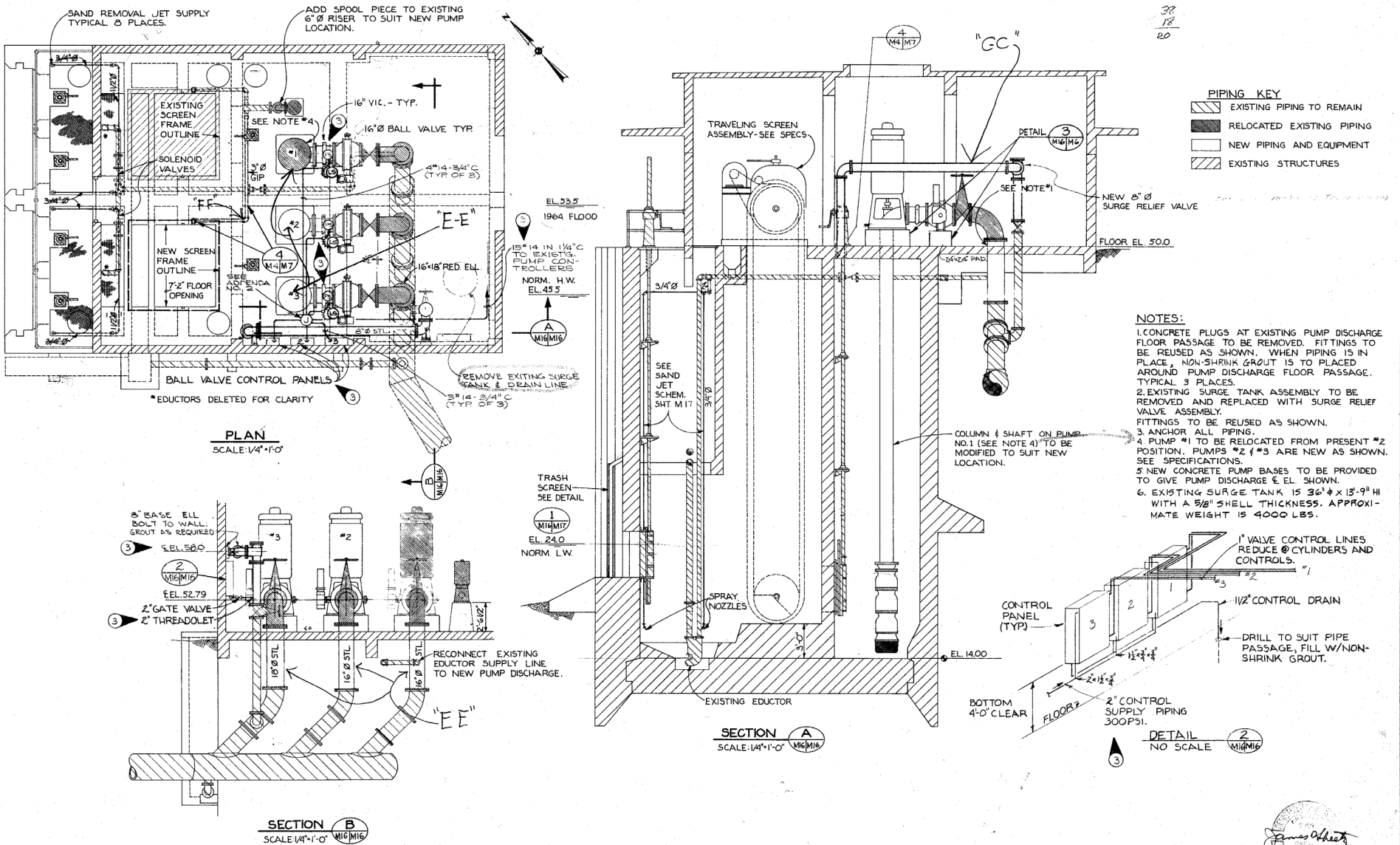
Stevens, Thompson & Runyan, Inc.
Engineers / Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

WATER INTAKE STRUCTURE
SITE PLAN & GENERATOR PLAN

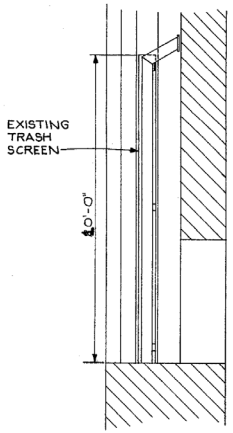
M15
21

IF INC.—100% CLEARPRINT

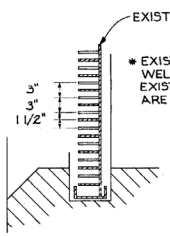


AUG. '75	3	ADDED ELEC FOR BALL VALVES, ELEC RAISED SURGE LINE, ADD. BLV CONT.	DESIGNED JRS, HWT	APPROVED	Stevens, Thompson & Runyan, Inc. Engineers/Planners PORTLAND SEATTLE SPOKANE BOISE	OREGON CITY - WEST LINN SOUTH FORK WATER BOARD WATER WORKS MODIFICATIONS	WATER INTAKE STRUCTURE PLAN AND SECTIONS	M16/21
DATE	NO	REVISION BY	DRAWN CGR	SCALE AS SHOWN DATE MAY, 1975				
			CHECKED JRS	FILE PT0757.002-14872				

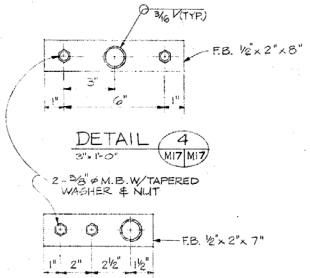
CPC INC.—TOUGH CLEARPRINT

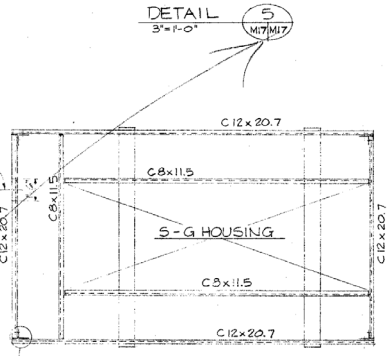


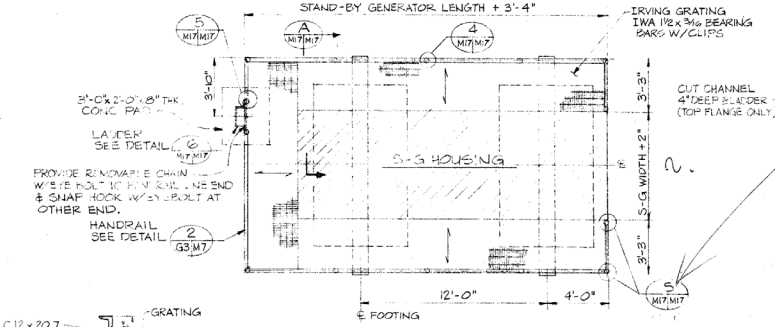
SECTION
SCALE: 1/4"=1'-0"



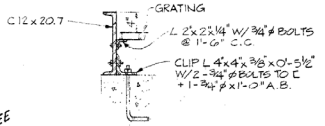
PLAN
SCALE: 1"=1'-0"



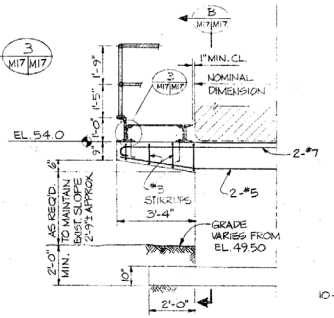




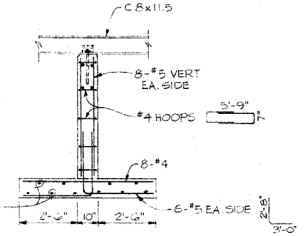
PLAN
1/4" = 1'-0"



DETAIL 3
1" = 1'-0"
M17 M17



SECTION A
3/8" = 1'-0"
M17 M17



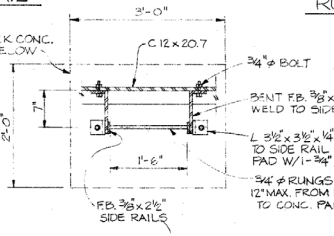
SECTION B
3/8" = 1'-0"
M17 M17

STAND-BY GENERATOR SUPPORT DETAIL

FOR LOCATION OF GENERATOR SEE DWG. M 15

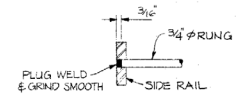
FRAMING PLAN

1/4" = 1'-0"



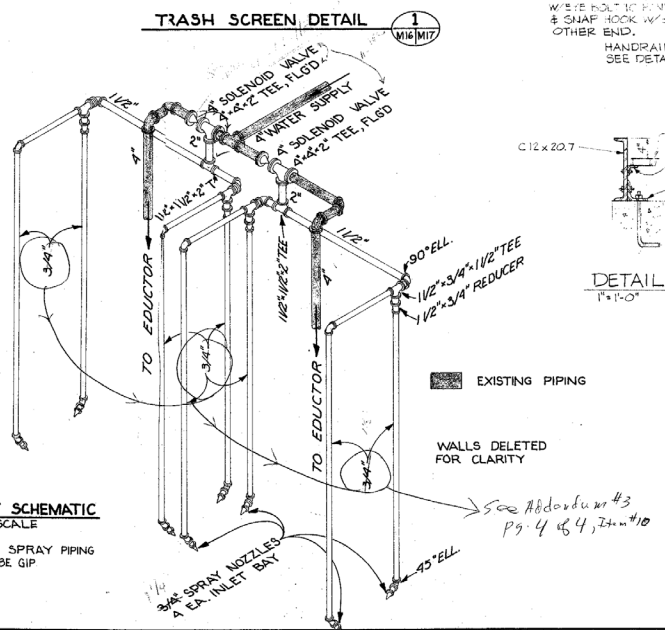
DETAIL 6
1" = 1'-0"
M17 M17

NOTE: FOR LADDER TO HANDRAIL TOP BRACKETS CONNECTION SEE DETAIL 5 M17 M19



RUNG DETAIL

TRASH SCREEN DETAIL 1 M16 M17



EXISTING PIPING

WALLS DELETED FOR CLARITY

SAND JET SCHEMATIC

NO SCALE

ALL SPRAY PIPING TO BE GIP

See Addendum #3 pg. 4 of 4, Item #10

DATE	NO.	REVISION	BY	CHECKED JAS	DESIGNED JRS	APPROVED	DRAWN CGR, JEC	SCALE AS SHOWN	DATE MAY, 1975	FILE PT 0757.002-14873

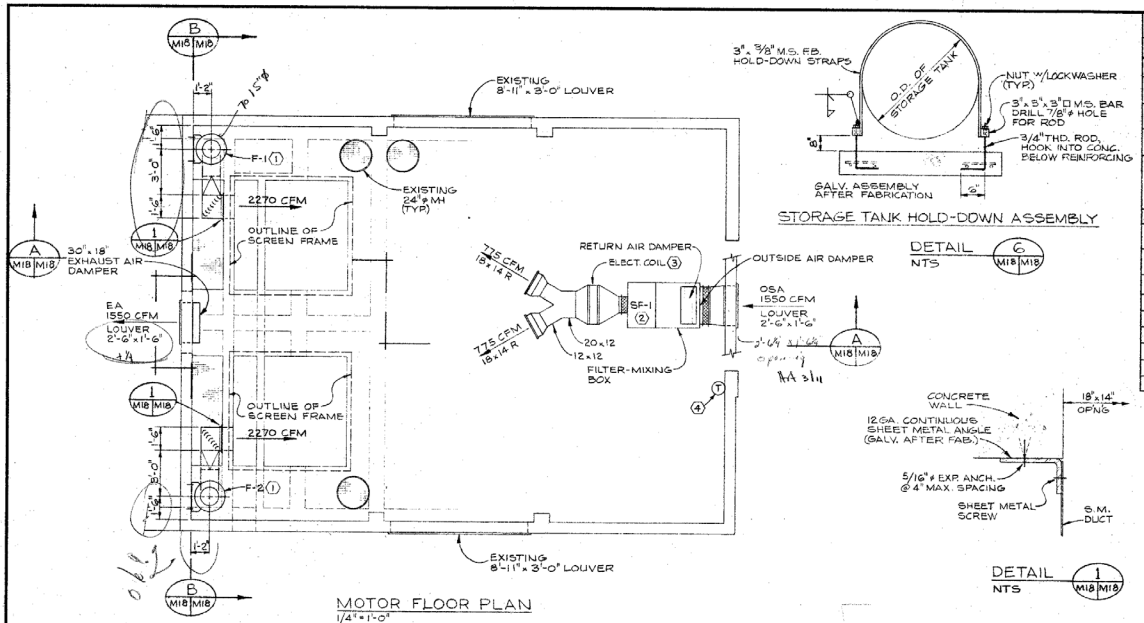
Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

WATER INTAKE STRUCTURE
MISCELLANEOUS DETAILS

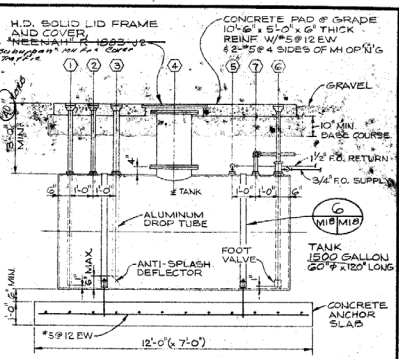
M17 / 21

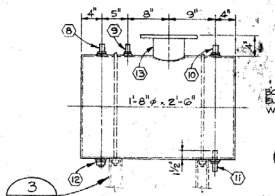
CSP, INC.—HIGH CLEARPRINT

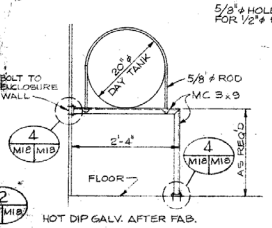


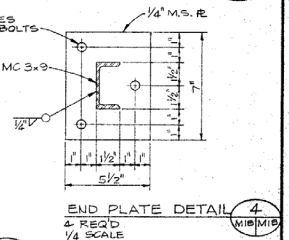
NOZZLE SCHEDULE

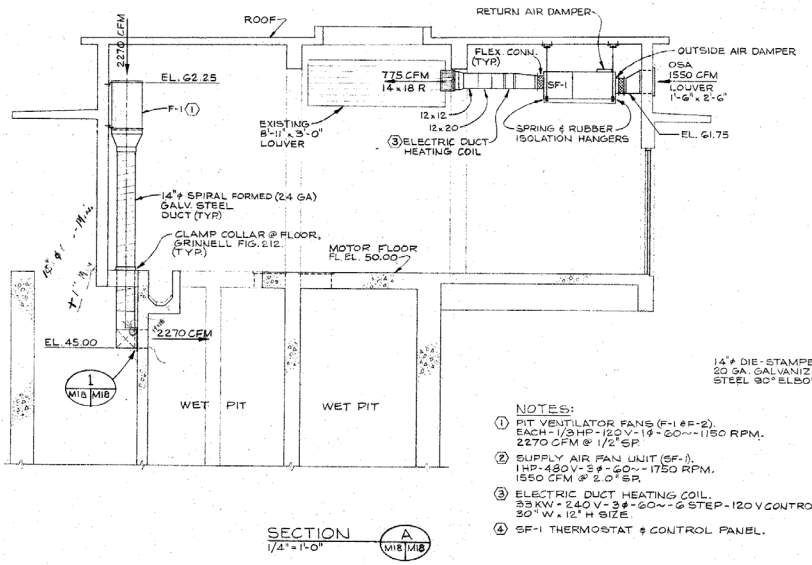
MARK	SIZE	DESCRIPTION	REMARKS
		FUEL STORAGE TANK	
(1)	2"	PUMP OUT W/2" FILL BOX CAP	"EMCO-WHEATON" A-0571
(2)	2"	GAUGING WELL W/2" FILL BOX CAP	"EMCO-WHEATON" A-0571
(3)	3"	FILL PIPE W/3" FILL BOX CAP	"EMCO-WHEATON" A-0571
(4)	18"	MH, 150# FLG'S W/EXT. FABRICATE EXTENSION FROM 18" STD. PIPE, O.375" WALL, W/150# F.S. S.O. FLG'S & 150# BLIND FLG.	
(5)	1½"	FUEL OIL RETURN NOZZLE	
(6)	1½"	SUCTION PIPE W/FOOT VALVE 3/4" NOZZLE & EXTRACTOR	"EMCO-WHEATON" A-0438 "EMCO-WHEATON" A-7400
(7)	1½"	VENT PIPE TO PROJECT ABOVE ENCLOSURE ROOF	"EMCO-WHEATON" A-0785
		DAY TANK	
(8)	1"	FILL, SCREWED CONNECTION	
(9)	3/4"	EXCESS FUEL RETURN, SCRD. CONNECTION	
(10)	1"	PRESSURE, VACUUM VENT, SCRD. CONNECTION	
(11)	3/4"	ENGINE SUPPLY, SCRD. CONNECTION	
(12)	1"	DRAIN, SCREWED CONNECTION W/PLUG	
(13)	6"	LEVEL CONTROL, FLG'D. CONN., 150# F.S. S.O. FLG.	

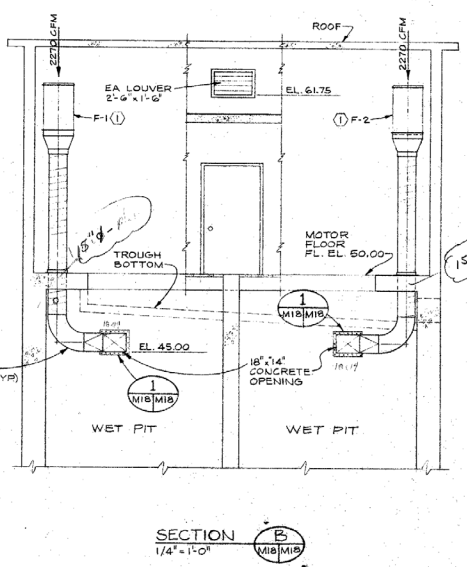




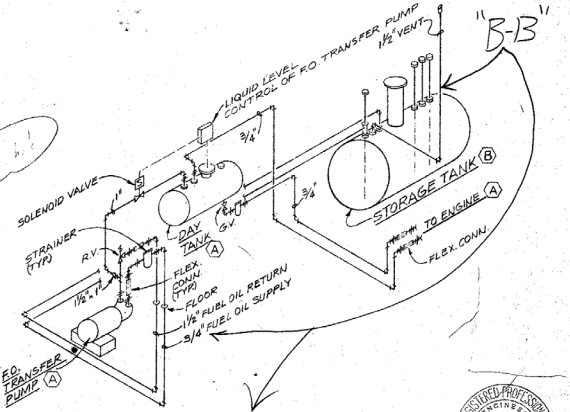








NOTES:
1. PIT VENTILATOR FANS (F-1 & F-2). EACH - 1/3 HP - 120 V - 1 Ø - 60 ~ - 1150 RPM. 2270 CFM @ 1/2" S.P.
2. SUPPLY AIR FAN UNIT (SF-1). 1 HP - 480 V - 3 Ø - 60 ~ - 1750 RPM. 1550 CFM @ 2.0" S.P.
3. ELECTRIC DUCT HEATING COIL. 33 KW - 240 V - 3 Ø - 60 ~ - 6 STEP - 120 V CONTROL. 30" W x 12" H SIZE.
4. SF-1 THERMOSTAT & CONTROL PANEL.



NOTES:
- (A) WITHIN ENGINE GENERATOR ENCLOSURE.
- (B) UNDERGROUND.

REGISTERED PROFESSIONAL ENGINEER — OREGON — JOHN C. SPALDING

DATE	NO.	REVISION	BY

DESIGNED JCS | APPROVED J.C. Spalding
DRAWN PBB | SCALE AS SHOWN | DATE MAY, 1975
CHECKED JCS | FILE PT-0757.002-14.874

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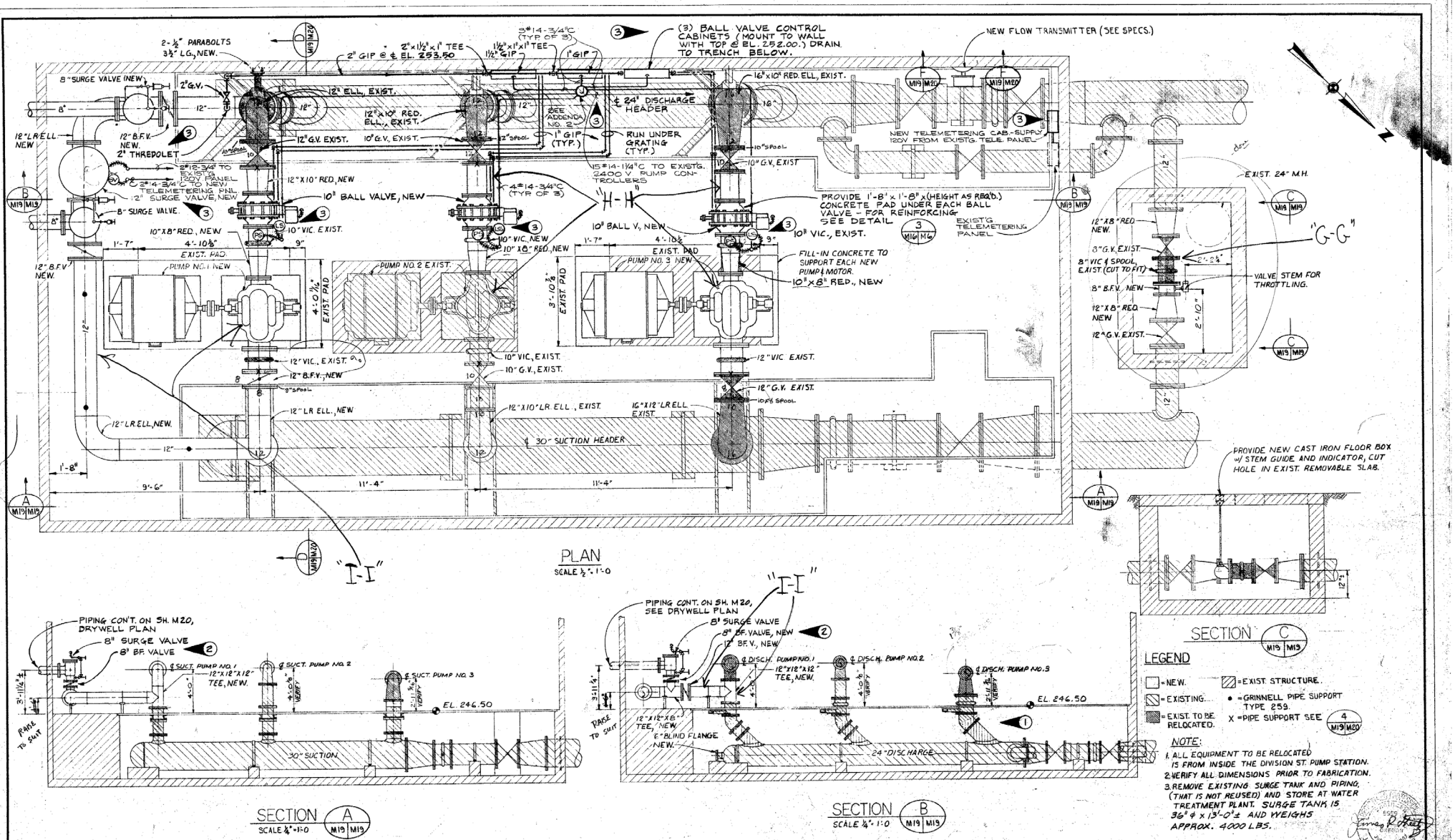
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

WATER INTAKE STRUCTURE
HEATING & VENTILATING
PLAN, SECTIONS & DETAILS

M18 / 21



DATE	NO.	REVISION	BY
8-27-75	3	ADDED ELEC. FOR B.V. & S.R. VALVE	DLF
8-27-75	3	SHOWED B.V. CONTROL & PIPING.	DGB
	2	ADDED 2-8" BF. VALVES.	DGB
8-20-75	1	ADDED HATCHING OF EXIST. PIPING.	DGB

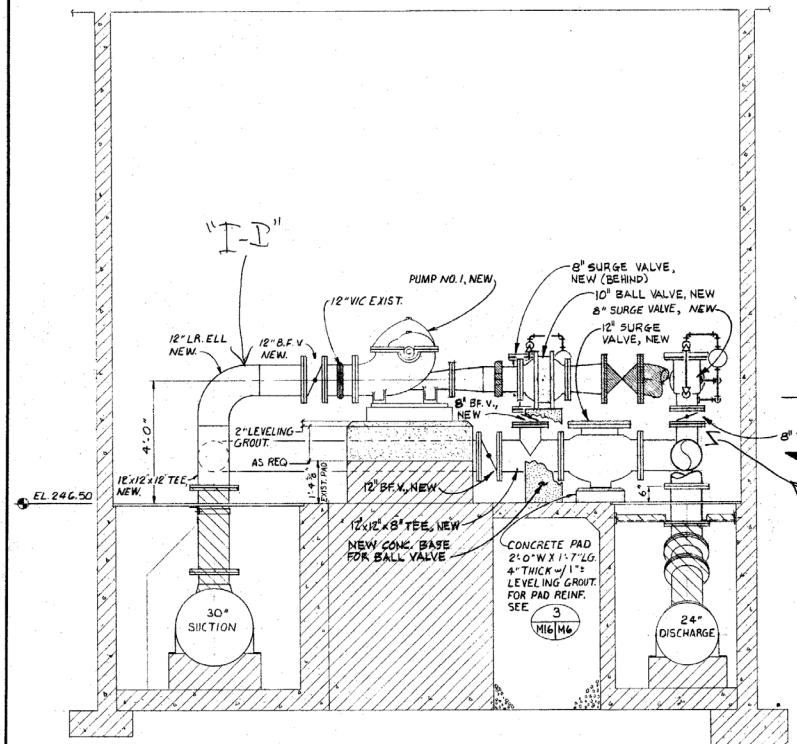
DESIGNED H.W.T./J.R.S. APPROVED
DRAWN JAK SCALE AS SHOWN DATE MAY 1975
CHECKED JRS FILE PT 0757.002-14875

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
PORTLAND SEATTLE SPOKANE BOISE

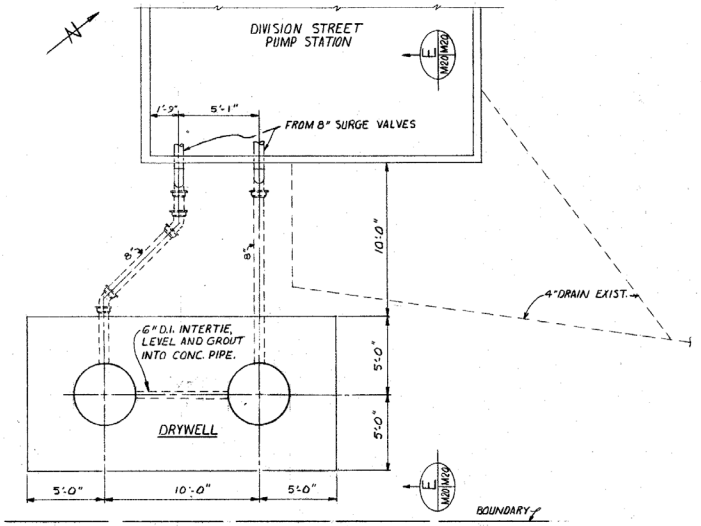
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

DIVISION ST. PUMP STATION PLAN AND SECTIONS

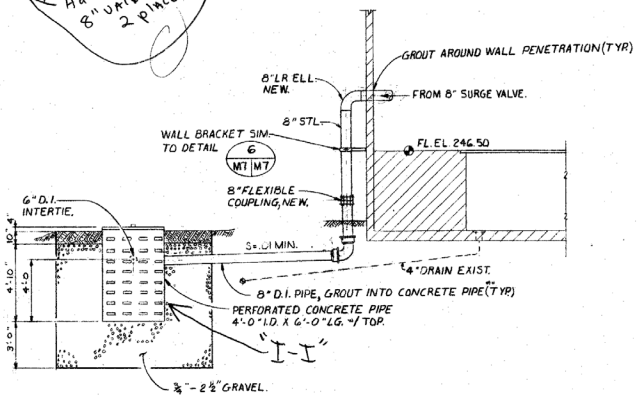
M19/21



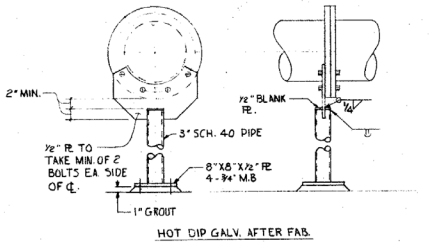
SECTION D
SCALE ½" = 1'-0 M19 M20



NEW DRYWELL PLAN
SCALE ¼" = 1'-0

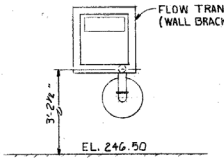


SECTION E
SCALE ½" = 1'-0 M20 M20



HOT DIP GALV. AFTER FAB.

PIPE SUPPOPT DETAIL TYP. 4 M19 M20
NO SCALE



SECTION F
NO SCALE M19 M20

DATE	NO.	REVISION	BY
	2	ADDED 2-8" B.F.V. - PUT IN PUMP PIPING	D&B

DESIGNED H.W.T./J.R.S. APPROVED
DRAWN JAK SCALE AS SHOWN DATE MAY 1975
CHECKED JRS FILE PT0757.002-1487G

Stevens, Thompson & Runyan, Inc.
Engineers/Planners
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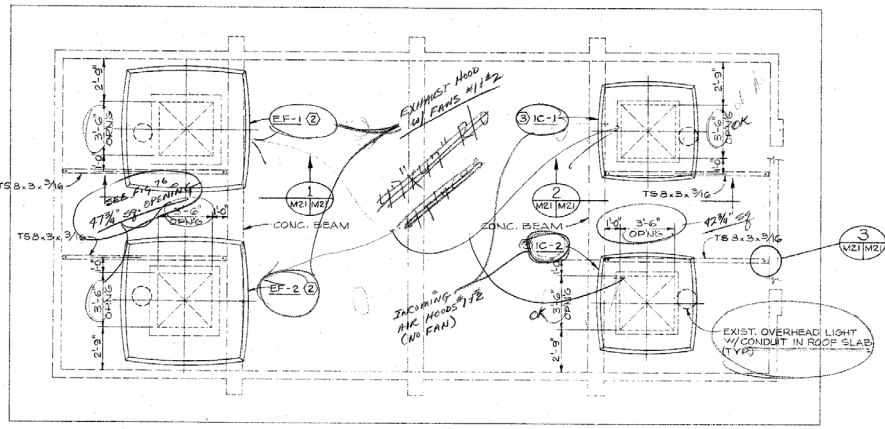
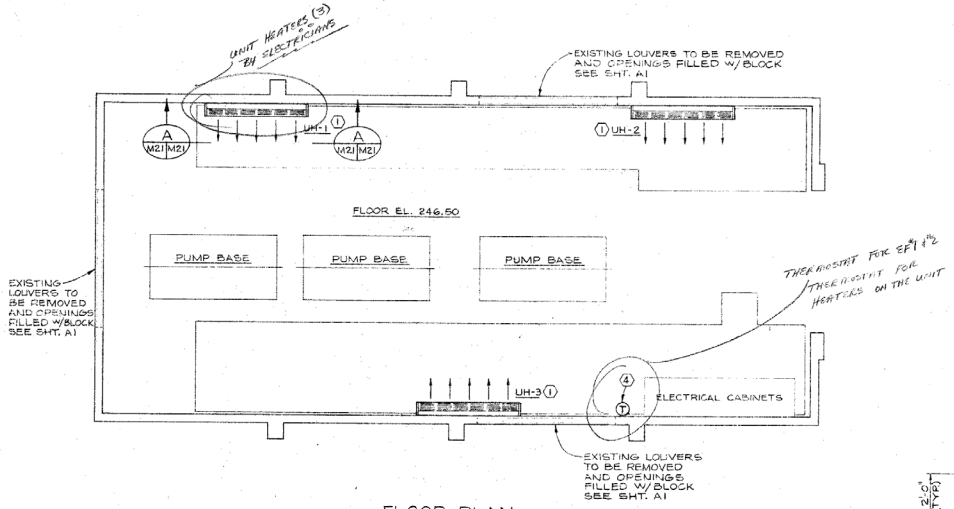
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

DIVISION ST. PUMP STATION
SECTION AND DETAILS

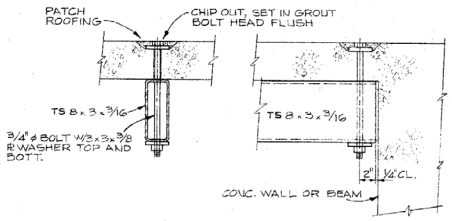
M20
21



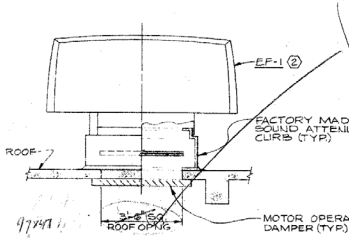
ROOF PLAN
1/4" = 1'-0"



FLOOR PLAN
1/4" = 1'-0"

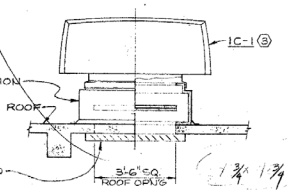


DETAIL 3
1½" = 1'-0"
M21 | M21



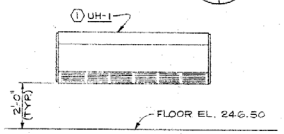
ROOF MOUNTED EXHAUST AIR FAN

DETAIL 1
3/8" = 1'-0"
M21 | M21



ROOF MOUNTED AIR INTAKE CAP

DETAIL 2
3/8" = 1'-0"
M21 | M21



SECTION A
3/8" = 1'-0"
M21 | M21

NOTES:

1. CABINET UNIT HEATERS (UH-1, UH-2 & UH-3)
   8 KW - 240 V - 3ø
   BUILT-IN THERMOSTAT
   CHROMALOX MODEL CUI-5FT-524.
2. EXHAUST FANS (EF-1 & EF-2)
   7½ HP - 240 V - 3ø
   13800 CFM @ 1-INCH S.P.
   PACE - SKYCAP MODEL CRE-36F.
3. INTAKE CAPS (IC-1 & IC-2)
   13800 CFM @ 0.25-INCH S.P.
   PACE - SKYCAP VENT SIZE 48 x 48-CAP SIZE 72.
4. EF-1 & EF-2 THERMOSTAT & CONTROL PANEL.

REGISTERED PROFESSIONAL ENGINEER
9143
OREGON
MARCH 6, 1981
JOHN C. SPALDING

DATE	NO.	REVISION	BY

DESIGNED JCS-JGS | APPROVED J. C. Spalding
DRAWN PBB | SCALE AS SHOWN | DATE MAY, 1975
CHECKED JCS | FILE PT-0757.002-14.877

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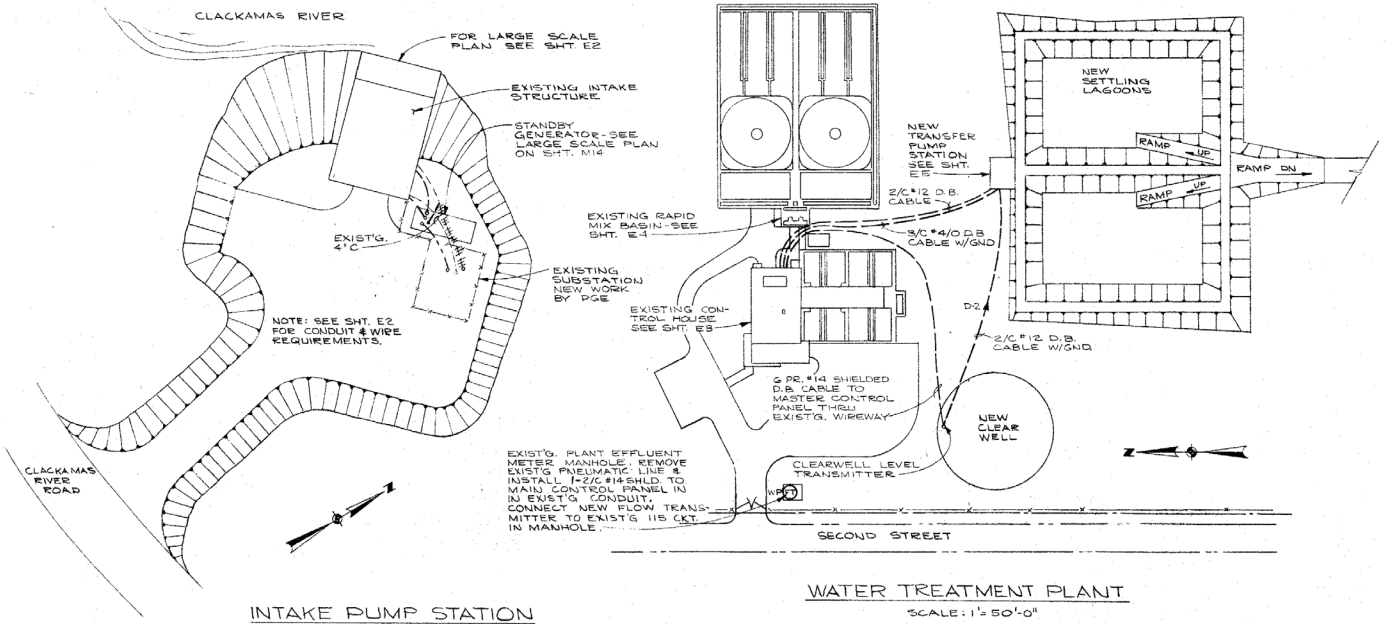
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

DIVISION ST. PUMP STATION
HEATING & VENTILATING
PLANS, SECTIONS & DETAILS

M21
21



INTAKE PUMP STATION

SCALE: 1" = 20'-0"

WATER TREATMENT PLANT

SCALE: 1" = 50'-0"

LEGEND

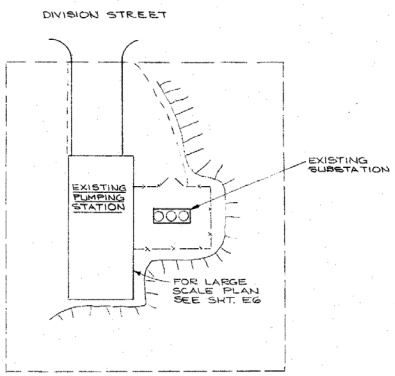
- CLG. MOUNTED LUMINAIRE BELOW SLAB
- POLE MOUNTED LUMINAIRE
- GFCI DUPLEX RECEPTACLE, 15A FOR 20A CIRCUIT
- S - SINGLE POLE SWITCH
- J - JUNCTION BOX
- BRANCH CIRCUIT OR FEEDER EXPOSED WITH GENERAL ROUTE INDICATED.
- BRANCH CIRCUIT OR FEEDER CONCEALED IN SLAB OR EARTH.
- MCP-3 - HOME RUN TO PANEL W/PANEL DESIGNATION & CIRCUIT NUMBER INDICATED. CROSSBARS DENOTE NO. OF CONDUCTORS.
- FLEXIBLE METALLIC CONDUIT
- CIRCUIT UP
- CIRCUIT DOWN
- M 60 - MOTOR, HP INDICATED
- FC - FLOAT CONTROL
- FT - FLOW TRANSMITTER
- PS - PRESSURE SWITCH
- SV - SOLENOID VALVE
- T H - THERMOSTAT
- D.B. - DIRECT BURIAL
- SH - HATCH SWITCH - CLOSES WHEN HATCH OPENS
- A - AMBER INDICATING LIGHT - "G" DENOTES GREEN - "R" DENOTES RED - "B" DENOTES BLUE

SUBSCRIPT ADDED TO ANY SYMBOL DENOTES:

- WP - WEATHERPROOF, NEMA 4 OR EQUIV.
- +8'-0" - MOUNTING HEIGHT ABOVE FLOOR.

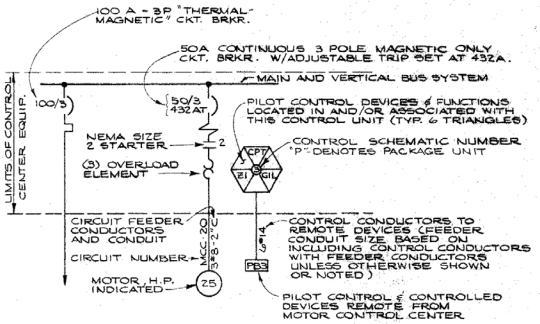
CONTROL KEY

- AIL - AMBER INDICATING LIGHT
- PBI - START-STOP PUSHBUTTON STATION
- SLI - HAND-OFF-AUTO SELECTOR SWITCH
- PS - PRESSURE SWITCH
- RTM - RUNNING TIME METER
- YPE - PERMISSIVE ELEMENT
- CR - CONTROL RELAY
- TR - TIMING RELAY
- HR - HEATING RELAY
- WH - WINDING HEATING (INCLUDES RELATED COMPONENTS)
- SH - STRIP HEATER
- ALT - ALTERNATOR
- GFI - GROUND FAULT INTERRUPTER
- TSR - TRANSFER SWITCH RELAY
- XS - REMOTE STATUS
- XCN - REMOTE CONTROL STATION



DIVISION STREET PUMP STATION

SCALE: 1" = 20'-0"



TYPICAL ONE LINE DIAGRAM

REGISTERED PROFESSIONAL ENGINEER STATE OF OREGON JULY 14, 1950 LEWIS C. KNUDSON

DATE	NO.	REVISION	BY	CHECKED ANE	FILE PT. 757.002-14879
				DRAWN ECS	SCALE AS SHOWN DATE JULY '75
				DESIGNED JFM	APPROVED Ernest C. Knudson

Stevens, Thompson & Runyan, Inc.
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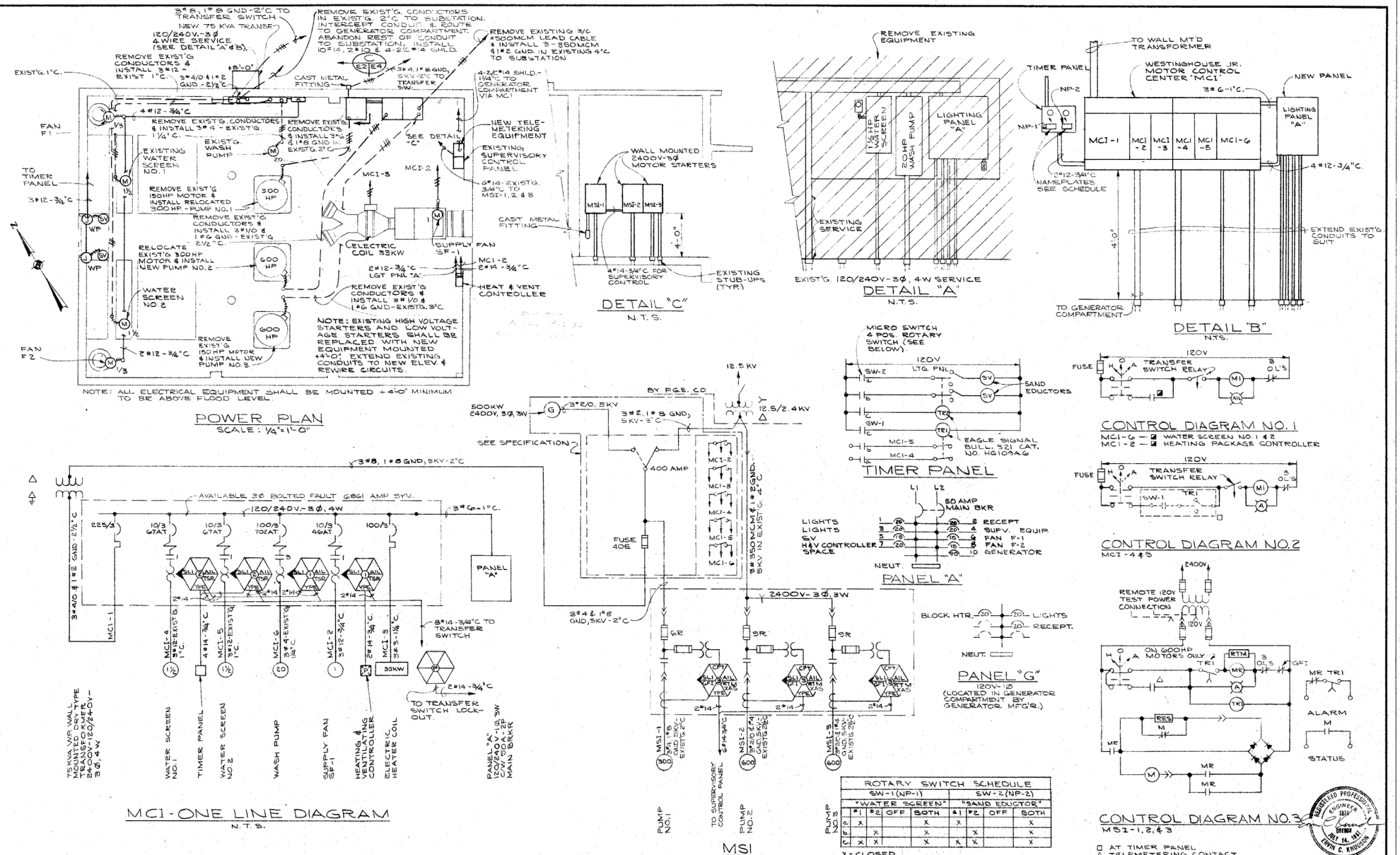
OREGON CITY WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

SITE PLANS

E1 / 6



DATE	NO.	REVISION	BY

DESIGNED JFM | APPROVED Erwin C Knudsen
DRAWN E.C.S | SCALE AS SHOWN | DATE JULY '75
CHECKED ANE | FILE PT. 757.002-14880

Stevens, Thompson & Runyan, Inc.
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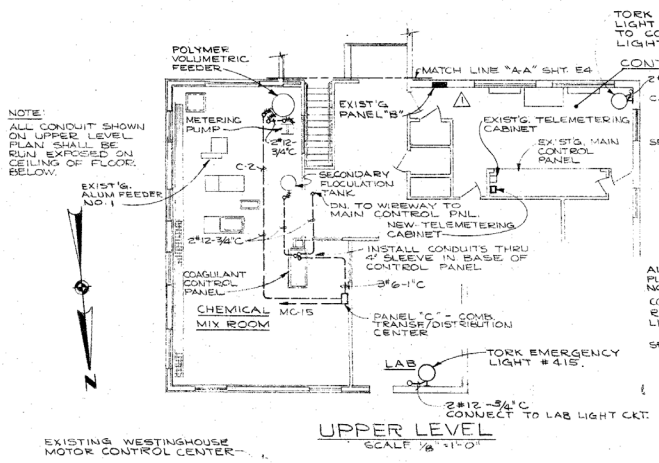
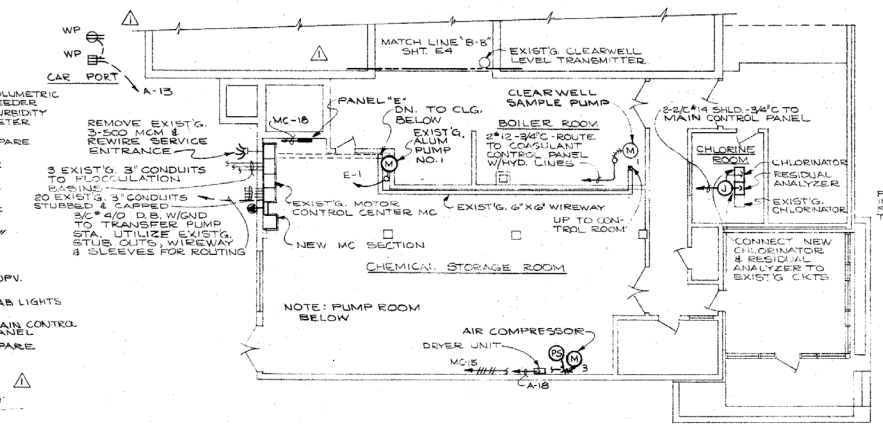
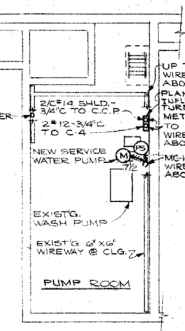
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

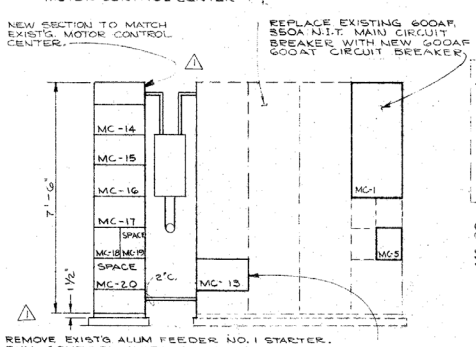
WATER INTAKE STRUCTURE

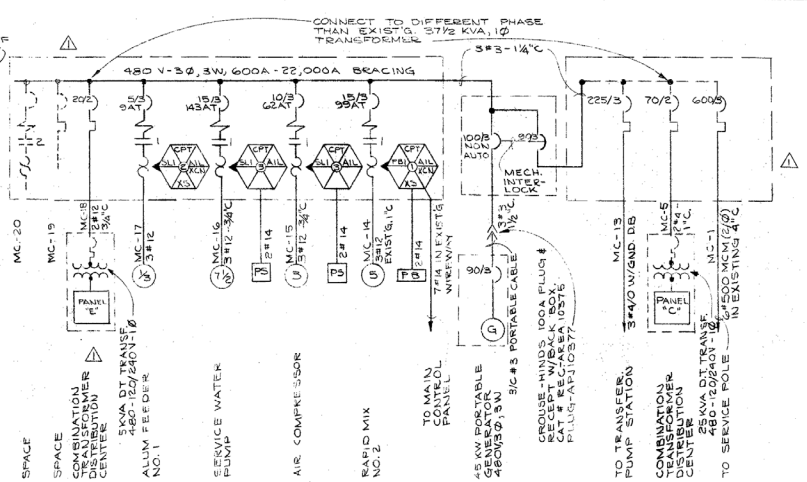
E2
6



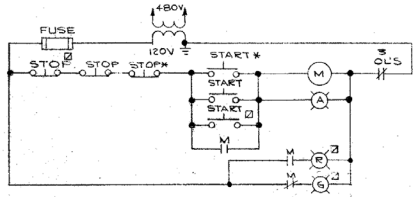


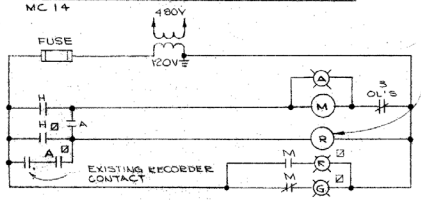


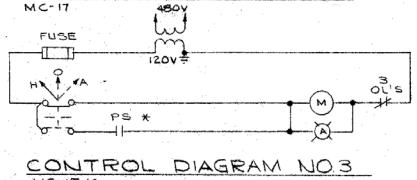




NAME PLATE	
NO.	DESCRIPTION
14	RAPID MIX NO. 2
15	AIR COMPRESSOR
16	SERVICE WATER PUMP
17	ALUM FEEDER PUMP NO. 1
18	PANEL "E" FEEDER
19	SPACE
20	SPACE
1	MAIN BREAKER
5	PANEL "C" FEEDER
13	TRANSFER PUMP STATION





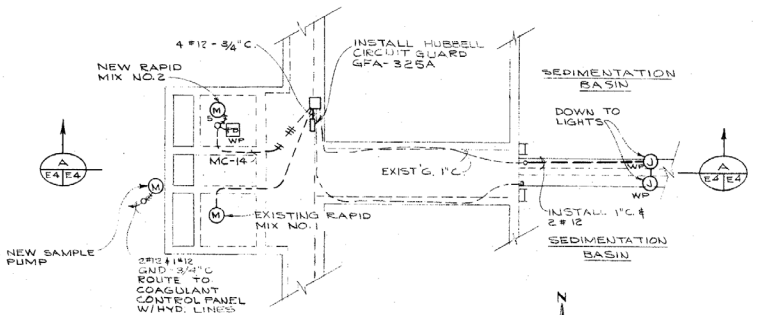


⚠ NOTE: RECIRCUIT ALUM PUMP NO. 1 FEEDER FROM PNL. A-13; CONTROL ROOM LIGHTS, PNL. B-3,5; LAB LIGHTS, PNL. B-4; SUPERVISORY & TEL. EQUIP, B-13; AND MAIN CONTROL PANEL, PNL. B-18, TO NEW PANEL "E".

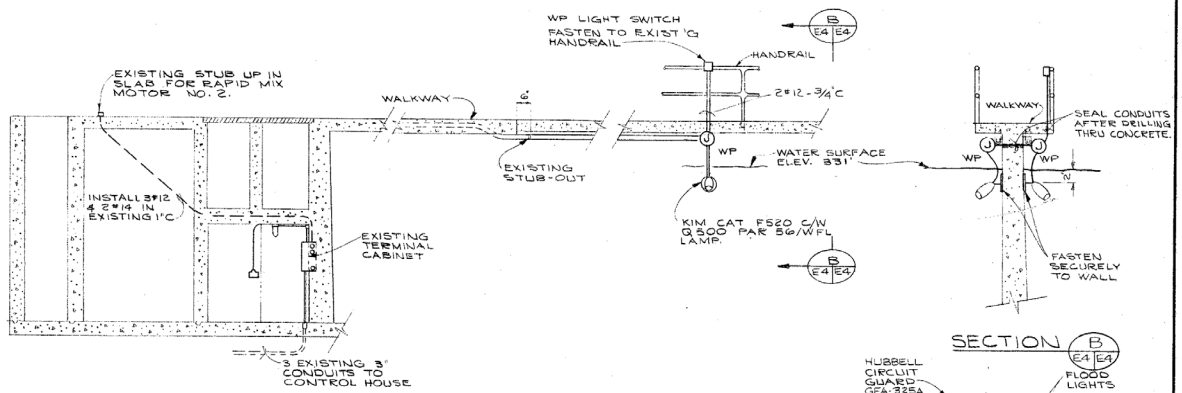
*=LOCATED REMOTE @ MOTOR
Ø=EXIST'G LOCATED REMOTE @ MAIN CONTROL PANEL

REGISTERED PROFESSIONAL ENGINEER STATE OF OREGON JULY 14, 1981 ERWIN C. KNUDSEN

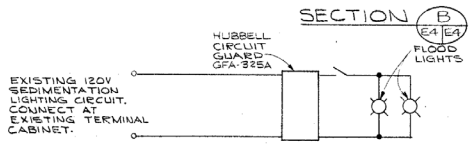
8-75	⚠	ADD STANDBY GENERATOR	JPM	DESIGNED JFM	APPROVED Erwin C. Knudsen	Stevens, Thompson & Runyan, Inc. Engineers / Planners PORTLAND · SEATTLE · BOISE · SPOKANE · HOUSTON	OREGON CITY - WEST LINN SOUTH FORK WATER BOARD WATER WORKS MODIFICATIONS	CONTROL HOUSE MODIFICATIONS	E3/6
DATE	NO.	REVISION	BY	DRAWN ECS	SCALE AS SHOWN DATE JULY '75				
				CHECKED ANE	FILE PT. 757.002-1488				



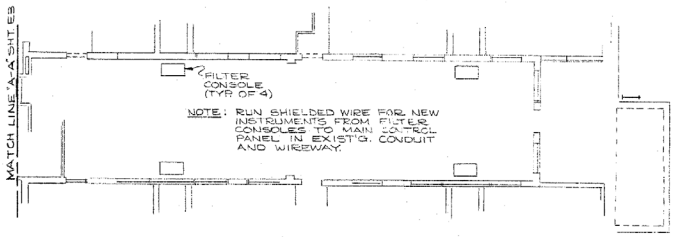
PARTIAL PLAN
RAPID MIX BASINS
SCALE 1/8"=1'-0"



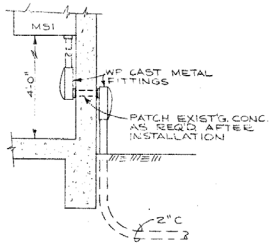
SECTION A
SCALE 1/4"=1'-0"

SECTION B


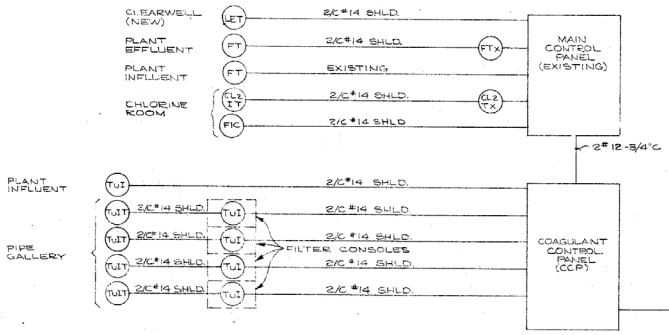
FLOODLIGHT WIRING DIAGRAM



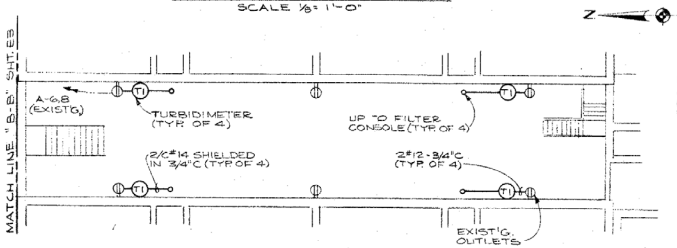
OPERATING FLOOR
SCALE 1/8"=1'-0"



SECTION C
SCALE: 1/2"=1'-0"



PARTIAL INSTRUMENTATION DIAGRAM
NOTE: FOR LEGEND AND COMPLETE PROCESS DWG. - SEE SHEET M3



PIPE GALLERY
SCALE 1/8"=1'-0"

NOTE:
CONNECT ALL EXIST'G. OUTLETS IN PIPE GALLERY ON EXIST'G. CKT. A-6, WIRE THE TURBIDIMETERS TO EXIST'G. CKT. A-8.

DATE	NO.	REVISION	BY	CHECKED A.N.E.
				DESIGNED J.F.M.
				DRAWN E.C.S.

APPROVED Erwin C. Knudson
SCALE AS SHOWN DATE JULY '75
FILE P.T. 757.00-14883

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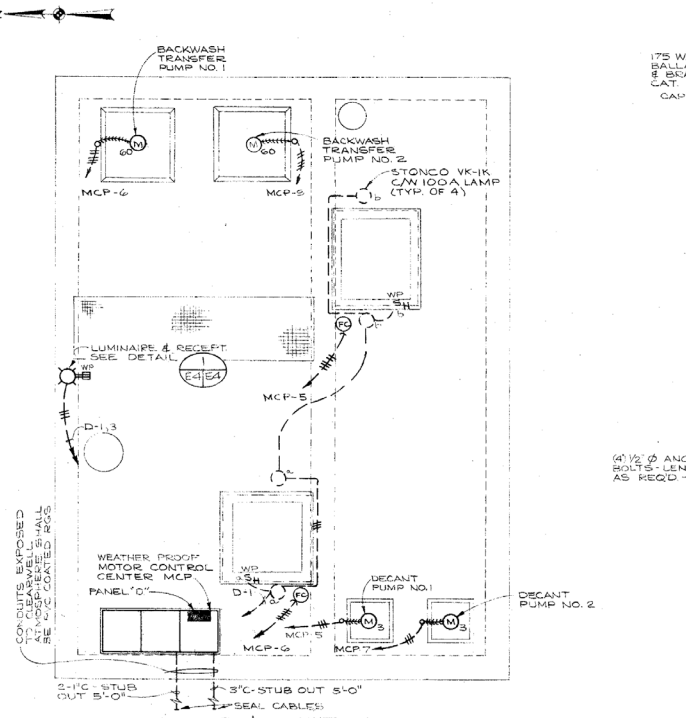
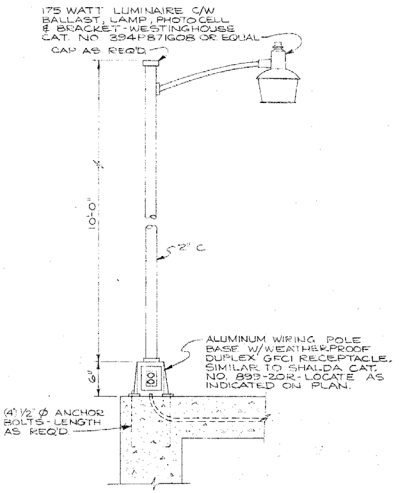
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

RAPID MIX BASIN AND FILTER GALLERY

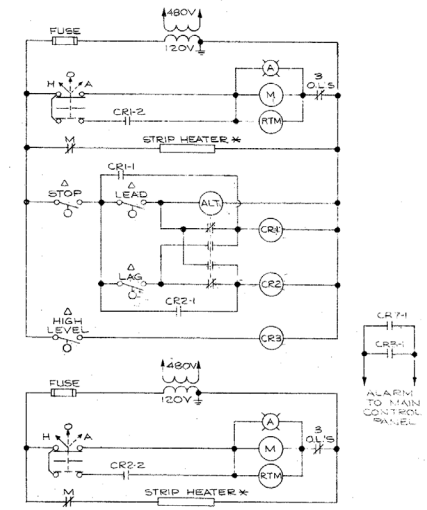
E4
6



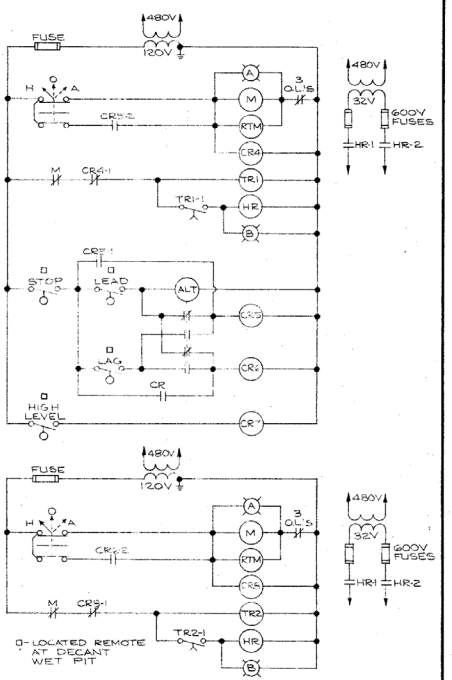
POWER & LIGHTING PLAN
SCALE: 3/8"=1'-0"



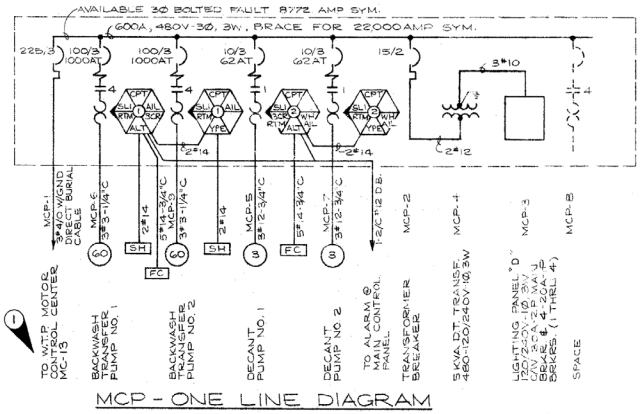
DETAIL 1/E4 E4
SCALE: 1"=1'-0"



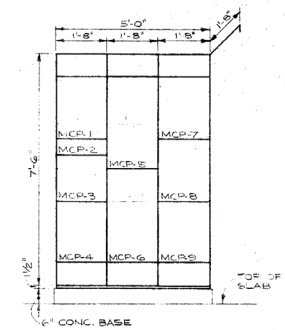
CONTROL DIAGRAM NO. 1
MCP-6 & 9



CONTROL DIAGRAM NO. 2
MCP-5 & 7
NOTE: "WH" INCLUDES CR, TR, HR, BIL & CPT



MCP - ONE LINE DIAGRAM



MCP - ELEVATION
SCALE: 1/2"=1'-0"

DATE	NO.	REVISION	BY
8-20-75	1	CHANGED "MC-20" TO "MC-13".	DGB

DESIGNED JFM
DRAWN DLF
CHECKED ANE
APPROVED Erwin C. Kaufman
SCALE AS SHOWN
DATE JULY 75
FILE P.757.002-14884

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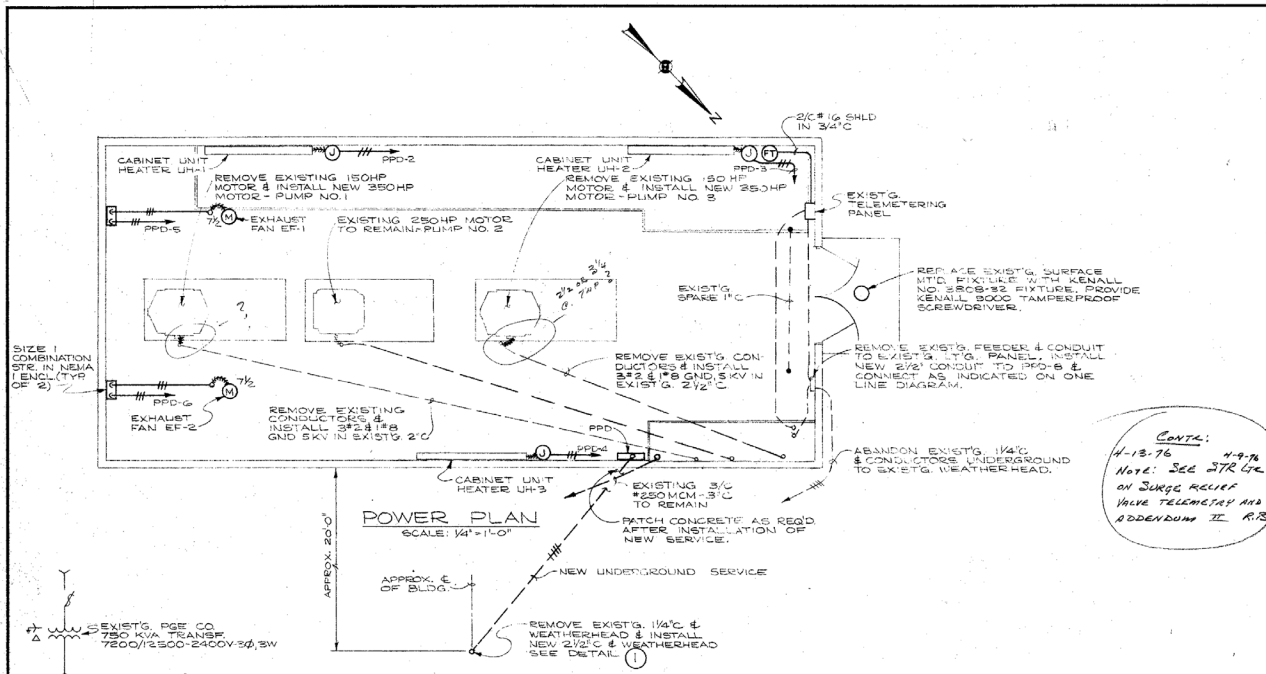
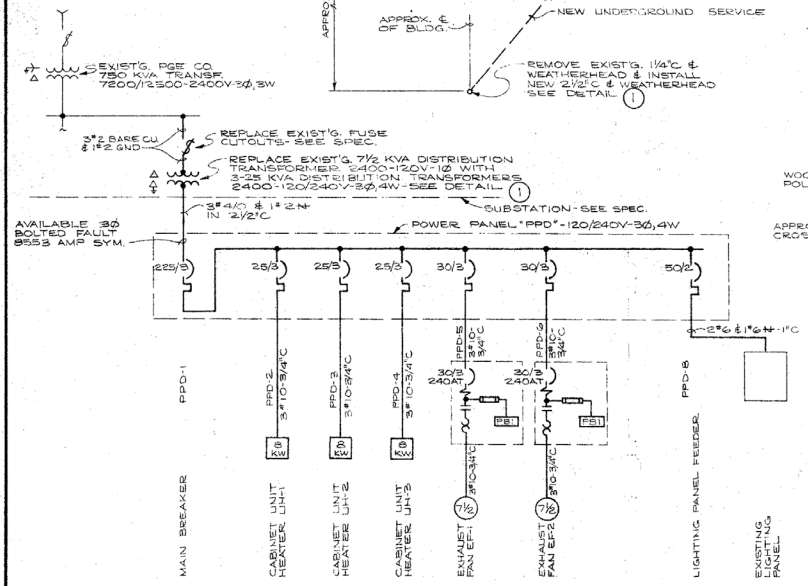
TRANSFER PUMP STATION

E5 / 6



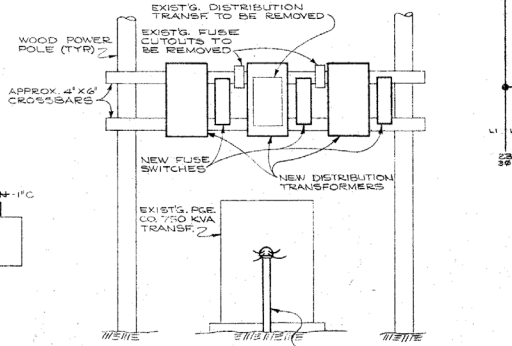
POWER PLAN

SCALE: 1/4" = 1'-0"



ONE LINE DIAGRAM

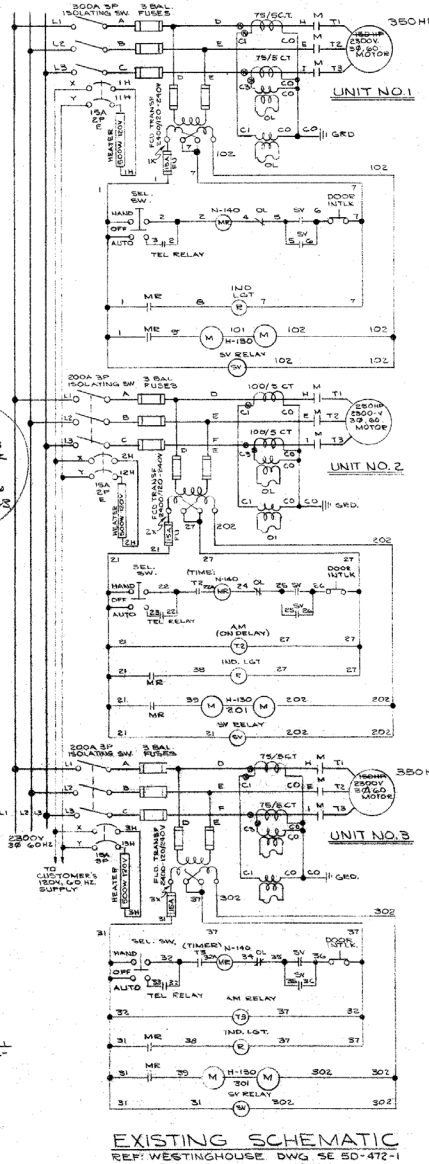
N.T.S.



DETAIL 1

N.T.S.

CONT'L:
H-13-76 4-9-76
NOTE: SEE STR Ltr ON SURGE RELIEF VALVE TELEMETRY AND ADDENDUM II R.R.



REMOVE	INSTALL
3 - FUSES	3 - FUSES
2 - 75/5 CT	3 - ″ /5 CT
2 - OL	3 - OL
	1 - 100/5 CT
	1 - OL
3 - FUSES	3 - FUSES
2 - 75/5 CT	3 - ″ /5 CT
2 OL	3 - OL

NOTE:
* CONNECT 3RD OVERLOAD INTO CONTROL CIRCUIT. SIZE ALL NEW MATERIALS PER WESTINGHOUSE RECOMMENDATION.

EXISTING SCHEMATIC

REF: WESTINGHOUSE DWG SE 5D-472-1

REGISTERED PROFESSIONAL ENGINEER OREGON JULY 14, 1950 ERWIN C. KNUDSEN

DATE	NO.	REVISION	BY

DESIGNED J F M | APPROVED Erwin C Knudsen
DRAWN D L F | SCALE AS SHOWN | DATE JULY '75
CHECKED A N E | FILE PT 757.002 - 14885

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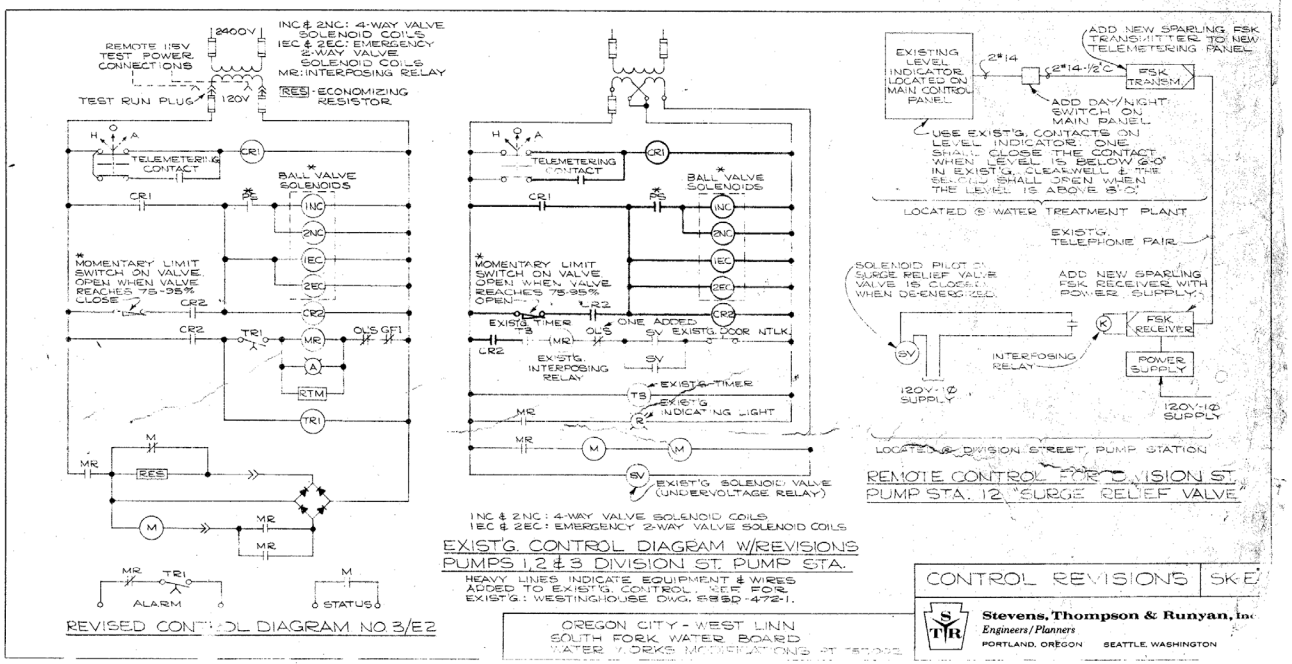
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS

DIVISION STREET PUMP STATION

E6
6


2400V
REMOTE 115V TEST POWER CONNECTIONS
TEST RUN PLUG
120V
1NC & 2NC: 4-WAY VALVE SOLENOID COILS
1EC & 2EC: EMERGENCY 2-WAY VALVE SOLENOID COILS
MR: INTERPOSING RELAY
RES - ECONOMIZING RESISTOR
TELEMETERING CONTACT
BALL VALVE SOLENOIDS
MOMENTARY LIMIT SWITCH ON VALVE OPEN WHEN VALVE REACHES 75-95% CLOSE
ALARM
STATUS
REVISED CONTROL DIAGRAM NO 3/E2
EXISTING LEVEL INDICATOR LOCATED ON MAIN CONTROL PANEL
ADD NEW SPARLING FSK TRANSMITTER TO NEW TELEMETERING PANEL
FSK TRANSM.
ADD DAY/NIGHT SWITCH ON MAIN PANEL
USE EXIST'G. CONTACTS ON LEVEL INDICATOR. ONE SHALL CLOSE THE CONTACT WHEN LEVEL IS BELOW 6'-0" IN EXIST'G. CLEARWELL & THE SECOND SHALL OPEN WHEN THE LEVEL IS ABOVE 8'-0"
LOCATED @ WATER TREATMENT PLANT
EXIST'G. TELEPHONE PAIR
SOLENOID PILOT OF SURGE RELIEF VALVE IS CLOSED WHEN DENERGIZED
ADD NEW SPARLING FSK RECEIVER WITH POWER SUPPLY
FSK RECEIVER
POWER SUPPLY
INTERPOSING RELAY
120V-1Ø SUPPLY
120V-1Ø SUPPLY
LOCATED @ DIVISION STREET PUMP STATION
REMOTE CONTROL FOR DIVISION ST. PUMP STA. 12 "SURGE RELIEF VALVE
EXIST'G TIMER
ONE ADDED
EXIST'G. DOOR NTLK.
EXIST'G. INTERPOSING RELAY
EXIST'G TIMER
EXIST'G INDICATING LIGHT
EXIST'G SOLENOID VALVE (UNDERVOLTAGE RELAY)
1NC & 2NC: 4-WAY VALVE SOLENOID COILS
1EC & 2EC: EMERGENCY 2-WAY VALVE SOLENOID COILS
EXIST'G. CONTROL DIAGRAM W/REVISIONS
PUMPS 1, 2 & 3 DIVISION ST. PUMP STA.
HEAVY LINES INDICATE EQUIPMENT & WIRES ADDED TO EXIST'G. CONTROL. REF FOR: EXIST'G: WESTINGHOUSE DWG. 685D-472-1.
OREGON CITY - WEST LINN
SOUTH FORK WATER BOARD
WATER WORKS MODIFICATIONS AT TRUCKEE
CONTROL REVISIONS
SK-E
Stevens, Thompson & Runyan, Inc
Engineers/Planners
PORTLAND, OREGON
SEATTLE, WASHINGTON

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South Fork Water Board

Cities of Oregon City and West Linn, Oregon

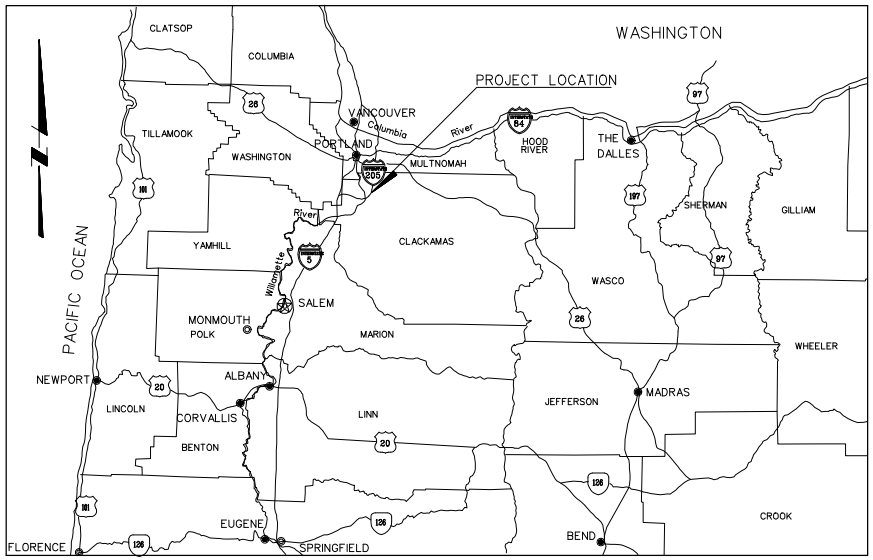
2004 System Capacity Improvements

Volume: 2 of 2 – Contract Drawings

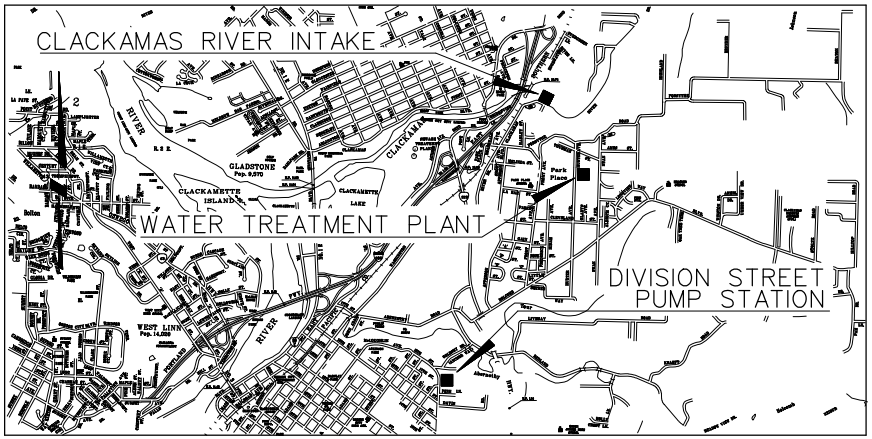
January 2007

MWH

Portland
Oregon



VICINITY MAP
SCALE: NTS



LOCATION MAP
SCALE: 1"=1600'

LIST OF DRAWINGS

GENERAL
G-01 COVER SHEET
G-02 VICINITY AND LOCATION MAPS, AND LIST OF DRAWINGS
G-03 ABBREVIATIONS
G-04 SYMBOLS

CIVIL
GC-01 CIVIL DETAILS
C-01 WTP SITE PLAN AND NOTES
C-02 CLACKAMAS RIVER INTAKE/PUMP STATION SITE PLAN AND NOTES
C-03 DIVISION STREET PUMP STATION SITE PLAN AND NOTES
C-04 DSPS VALVE VAULT AND DETAILS (DELETED FROM CONTRACT)

MECHANICAL
GM-01 MECHANICAL DETAILS
GM-02 MECHANICAL/STRUCTURAL DETAILS
M-01 PIPE AND EQUIPMENT SCHEDULES AND DESIGN CRITERIA
M-02 WTP RAW WATER METER ROOM PLAN AND SECTION
M-03 WTP FILTER INFLUENT PIPE PLAN AND SECTION
M-04 WTP FILTER INFLUENT PIPE SECTIONS AND DETAILS
M-05 PIPE GALLERY STAIRS DETAILS
M-06 INTAKE/PUMP STATION PLAN AND SECTION
M-07 DSPS PLAN AND DETAILS

ELECTRICAL
GE-01 ELECTRICAL SYMBOLS-1
GE-02 ELECTRICAL SYMBOLS-2
GE-03 ELECTRICAL NOTES AND ABBREVIATIONS
E-01 WTP ELECTRICAL PLAN, NOTES AND DETAILS
E-02 INTAKE/PUMP STATION DEMOLITION/RELOCATION NOTES AND DETAILS
E-03 INTAKE/PUMP STATION ELECTRICAL PLAN, NOTES AND DETAILS
E-04 DSPS DEMOLITION/RELOCATION NOTES AND DETAILS
E-05 DSPS ELECTRICAL PLAN, NOTES AND DETAILS
E-06 INTAKE/PUMP STATION SINGLE LINE DIAGRAM
E-07 DSPS SINGLE LINE DIAGRAM
E-08 INTAKE PS CONTROL DIAGRAMS
E-09 DIVISION ST. P.S. CONTROL DIAGRAMS
E-10 WTP FILTER VALVES CONTROL DIAGRAMS
E-11 DIVISION ST. BURIED VALVE CONTROL DIAGRAM

INSTRUMENTATION
GI-01 INSTRUMENTATION NOTES, SYMBOLS AND ABBREVIATIONS
GI-02 INSTRUMENTATION SYMBOLS
I-01 NOT USED
I-02 PROCESS AND INSTRUMENTATION DIAGRAM - WTP FILTER GALLERY PIPING
I-03 PROCESS AND INSTRUMENTATION DIAGRAM - INTAKE/PUMP STATION
I-04 PROCESS AND INSTRUMENTATION DIAGRAM - DSPS

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED R.WARNER
DRAWN C.KITTS
CHECKED P.KREFT

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MWH
Portland Oregon

South Fork Water Board
15962 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS
VICINITY AND LOCATION MAPS AND LIST OF DRAWINGS

SHEET G-02

Job No: 1530509 File: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$ Plot Date: Plot Date: 15-FEB-2007 Time: 12:27

A	AIR
AB	ANCHOR BOLT
ABBR	ABBREVIATION
ABS	ABSOLUTE TEMPERATURE
AC	ACTIVATED CARBON, ASPHALTIC CONCRETE, OR ALTERNATING CURRENT
A/C	AIR CONDITIONING
ACOUS	ACOUSTIC OR ACOUSTICAL
ACP	ASPHALTIC CONCRETE PAVEMENT OR ASBESTOS CEMENT PIPE
ADJ	ADJUSTABLE
AER	AERATION
AL	ALUMINUM OR ALUM
ALUM	ALUMINUM
AMB	AMBIENT
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE (FORMERLY A.S.A.)
API	AMERICAN PETROLEUM INSTITUTE
APPD	APPROVED
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
ASA	AMERICAN STANDARDS ASSOCIATION (NOW ANSI)
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIAL
ASSY	ASSEMBLY
AT	ACOUSTICAL TILE
ATM	ATMOSPHERE
AVAR	AIR VACUUM AND AIR RELEASE VALVE
AWWA	AMERICAN WATER WORKS ASSOCIATION

BC	BEGIN CURVE, BOLT CIRCLE OR BETWEEN CENTERS
BCR	BEGIN CURB RETURN
BD	BOARD
BF	BLIND FLANGE
BFP	BACK FLOW PREVENTER
BHP	BRAKE HORSEPOWER
BLDG	BUILDING
BLD FLG	BLIND FLANGE
BLK	BLACK OR BLOCK
BLKG	BLOCKING
BM	BEAM OR BENCH MARK
BO	BLOW-OFF ASSEMBLY
BOD	BIOCHEMICAL OXYGEN DEMAND
BOT	BOTTOM
BPV	BACK PRESSURE VALVE
BRK	BRICK
B & S	BELL AND SPIGOT
BSMT	BASEMENT
BT	BOLT
BTU	BRITISH THERMAL UNIT
BV	BUTTERFLY VALVE
BVC	BEGIN VERTICAL CURVE
BWV	BACK WATER VALVE

C	CENTIGRADE
CAB	CABINET
CAP	CAPACITY
CB	CATCH BASIN OR CHALK BOARD
CC	CENTER TO CENTER
CD	CEILING DIFFUSER
CLR	CLEAR
CEM	CEMENT
CER	CERAMIC
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHEM	CHEMICAL
CHG	CHANGE
CHK V	CHECK VALVE
CHKD PL	CHECKERED PLATE
CI	CAST IRON
CJ	CONSTRUCTION JOINT
CL	CHLORINE GAS, CHLORINATOR, CHAIN LINK, CLEARANCE OR CENTERLINE
CLG	CEILING
CLOS	CLOSET
CLR	CLEAR
CM	CENTIMETER
CML & C	CEMENT MORTAR LINED AND COATED
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COL	COLUMN
CONC	CONCRETE OR CONCENTRIC
COND	CONDENSER OR CONDENSATE
CONN	CONNECTION
CONSTR	CONSTRUCTION OR CONSTRUCT
CONT	CONTINUED OR CONTINUOUS
CONTR	CONTRACTOR
COMP	COMPRESSOR
COTG	CLEAN-OUT TO GRADE
CPLG	COUPLING
CPVC	CHLORINATED POLYVINYL CHLORIDE
CS	CAUSTIC SODA OR CAST STEEL
CT	CERAMIC TILE
CTSK	COUNTERSUNK
CTR	CENTER
CU	COPPER OR CUBIC
CYL	CYLINDER

d	PENNY
DBL	DOUBLE
DC	DIRECT CURRENT
DET	DETAIL
DF	DRINKING FOUNTAIN OR DOUGLAS FIR
DG	DOOR GRILLE
DI	DUCTILE IRON
DIA	DIAMETER
DIAG	DIAGONAL
DIAPH	DIAPHRAGM
DISCH	DISCHARGE
DISP	DISPENSER
DN	DOWN OR DECANT
DO	DISSOLVED OXYGEN
DR	DOOR OR DRAIN
DS	DRENCH SHOWER AND EYE WASH
DWG	DRAWING
DIFF	DIFFUSER OR DIFFERENTIAL

E	EAST
EA	EACH
EB	EXPANSION BOLT OR ANCHOR
EC	END CURVE
ECC	ECCENTRIC
ECR	END CURB RETURN
EF	EACH FACE OR EXHAUST FAN
EFF	EFFLUENT
EG	EXHAUST GRILLE OR EXISTING GRADE
EL	ELEVATION
ELEC	ELECTRICAL OR ELECTRONIC
ENG	ENGINE
EPT	ETHYLENE PROPYLENE
ENCL	ENCLOSURE
ENT	ENTRANCE
EQ	EQUAL
EQUIP	EQUIPMENT
EVAP	EVAPORATOR
EVC	END VERTICAL CURVE
EW	EACH WAY OR EYE WASH
EXH	EXHAUST
EX-HY	EXTRA HEAVY
EXIST	EXISTING
EXP JT	EXPANSION JOINT
EXT	EXTERIOR OR EXTENSION
EXTR	EXTRUDED

F	FAHRENHEIT OR FINISH
FABR	FABRICATION, FABRICATE OR FABRICATED
FAI	FRESH AIR INTAKE
FB	FLAT BAR, FLOOR BEAM OR FIELD BOOK
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDR	FEEDER
FE	FIRE EXTINGUISHER OR FINAL EFFLUENT
FEM	FEMALE (PIPE THREAD)
FF	FLAT FACE OR FAR FACE
F TO F	FACE TO FACE
FG	FINISHED GRADE
FH	FIRE HYDRANT
FIG	FIGURE
FIN	FINISHED
FIX	FIXTURE
FL	FLOWLINE OR FLOOR
FLEX	FLEXIBLE
FLOCC	FLOCCULATOR OR FLOCCULATION
FLG	FLANGE OR FLOORING
FLGD	FLANGED
FLR	FLOOR
FM	FACTORY MUTUAL (LAB. APPROVED)
FMH	FLEXIBLE METAL HOSE
FND	FOUNDATION
FOC	FACE OF CONCRETE
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOW	FACE OF WALL
FPC	FLEXIBLE PIPE COUPLING
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FR	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FS	FAR SIDE, FLOOR SINK, FINISHED SURFACE, FORGED STEEL
	FROTH SPRAY OR FACTOR OF SAFETY
FT	FEET OR FOOT
FT. LB	FOOT-POUND
FTG	FOOTING
FUT	FUTURE

GA	GAGE OR GAUGE
GAL	GALLON
GALV	GALVANIZED
GEN	GENERAL OR GENERATOR
GFA	GROOVED FLANGE ADAPTER
GI	GALVANIZED IRON
GL	GLASS
GL/BM	GLUE LAMINATED BEAM
GLV	GLOBE VALVE
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GRD	GRADE OR GROUND
GR BRK	GRADE BREAK OR GRADE CHANGE
GRTG	GRATING
GV	GATE VALVE
GYP	GYPSUM

H/B	HOSE BIBB
HDR	HEADER
HDW	HARDWARE
HEX	HEXAGONAL
Hg	MERCURY
HGR	HANGER
HGT	HEIGHT
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HP	HORSEPOWER OR HIGH PRESSURE
H/P	HIGH POINT
HR	HEATING RETURN OR HOUR
HTG	HEATING
HTR	HEATER
H & V	HEATING AND VENTILATING
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HWL	HIGH/WATER LEVEL
HWD	HARDWOOD
HWO	HANDWHEEL OPERATED
HV	HORIZONTAL AND VERTICAL CONTROL POINT
HYD	HYDRAULIC OR HYDRANT

ID	INSIDE DIAMETER
IF	INSIDE FACE
IN	INCH
INF'L	INFLUENT
IN. LB	INCH-POUND
INSL	INSULATION OR INSULATED
INSTR	INSTRUMENT
INT	INTERIOR
INV	INVERT ELEVATION
IP	IRON PIPE
IPS	IRON PIPE SIZE
IRRG	IRRIGATION

JAN	JANITOR
JT	JOINT

K	KELVIN, KILO OR KARAT
KG	KILOGRAM
KM	KILOMETER
KV	KILOVOLT
KW	KILOWATT
KWH	KILOWATT HOUR

L/P	LOW POINT
L	LITER OR LENGTH
LAB	LABORATORY
LAM	LAMINATED
LAV	LAVATORY
LB	POUND
LDG	LANDING
LEV	LEVEL
LG	LENGTH OR LONG
LT	LEFT OR LIGHT
LWL	LOW WATER LEVEL
LWR	LOWER

QT	QUARRY TILE
QTY	QUANTITY

M	METER OR MALE (PIPE THREAD)
MAG	MAGNETIC
MAN	MANUAL
MACH	MACHINE
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MECH	MECHANICAL
MED	MEDIUM
MEMB	MEMBRANE
MFR	MANUFACTURER
MFR'D	MANUFACTURED
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MI	MALLEABLE IRON
MICRON	1/1,000,000 METER
MIL	MILITARY, 1/1,000 INCH
MIN	MINIMUM OR MINUTE
MIR	MIRROR
MISC	MISCELLANEOUS
MK	MARK
MO	MOTOR OPERATED OR MANSONRY OPENING
MOD	MODEL
MS	MOP SINK
MTC	MECHANICAL-TYPE COUPLING
MTD	MOUNTED
MTG	MOUNTING
MTL	MATERIAL OR METAL
MTR	MOTOR

N	NORTH
NBS	NATIONAL BUREAU OF STANDARDS
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NF	NEAR FACE
NG	NATURAL GRADE OR NATURAL GAS
NIC	NOT IN CONTRACT
NO	NUMBER OR NORMALLY OPEN
NOM	NOMINAL
NPS	**NOMINAL** PIPE SIZE (FORMERLY I.P.S.)
NPT	NATIONAL PIPE THREAD
NRS	NON-RISING STEM
NS	NEAR SIDE
NTS	NOT TO SCALE

OC	OVER-CROSSING OR ON CENTER
OD	OUTSIDE DIAMETER OR OVERALL DIMENSION
OF	OVERFLOW OR OUTSIDE FACE
OFF	OFFICE
OH	OVER HEAD
OPER	OPERATOR OR OPERATING
OPNG	OPENING
OS & Y	OUTSIDE SCREW AND YOKE
OWG	OIL, WATER, GAS
OZ	OUNCE

P/S	POLE AND SHELF
P	POLE, PAGE OR PIPE
PART	PARTITION
PAVMT	PAVEMENT
PB	POLYBUTYLENE
PC	PRIMARY CLARIFIER OR PORTLAND CEMENT
PCC	PORTLAND CEMENT CONCRETE
PCOTG	PRESSURE CLEANOUT TO GRADE
PE	PLANT EFFLUENT, POLYELECTROLYTE POLYMER OR
	POLYETHYLENE
PG	PRESSURE GAGE
pH	HYDROGEN ION CONCENTRATION
PI	PLANT INFLUENT OR POINT OF INTERSECTION
PL	PLATE, PROPERTY LINE OR PLACE
PLAS	PLASTER OR PLASTIC
PLYWD	PLYWOOD
PNEU	PNEUMATIC
PNL	PANEL
PM	PRESSED METAL
PP	POWER POLE OR POLYPROPYLENE
PLT	PLANT
PPD	POUNDS PER DAY
PPH	POUNDS PER HOUR
PPM	PARTS PER MILLION
PR	PAIR
PRCT	PRECAST
PREFAB	PREFABRICATED
PRESS	PRESSURE
PRV	PRESSURE REGULATING, RELIEF OR REDUCING VALVE
PS	PRESSURE SWITCH
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
PT	PAINT
PTDF	PRESSSURE TREATED DOUGLAS FIR
PTFE	POLYTETRAFLUOROETHYLENE (TEFLON®)
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVDF	POLYVINYLIDENE FLUORIDE (KYNAR®)

R	RADIUS, RISER, RETURN OR RATE OF SLOPE
RAG	RETURN AIR GRILLE
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN, ROUND, OR ROAD
RDWD	REDWOOD
RECIRC	RECIRCULATED
RED	REDUCER OR REDUCING
REF	REFERENCE OR REFER
REG	REGULATING
REIN	REINFORCE OR REINFORCED
RE-STL	REINFORCING STEEL
REQD	REQUIRED
RESIL	RESILENT
REV	REVISION
RFG	ROOFING
RF	ROOF OR RAISED FACE
RM	ROOM
RO	ROUGH OPENING
RPM	REVOLUTIONS PER MINUTE OR REINFORCED PLASTIC MORTAR
RR	RAILROAD
RS	RISING STEM
RT	RIGHT
RTP	REINFORCED THERMOSETTING PLASTIC
R/W	RIGHT OF WAY
RW	REDWOOD
RWL	RAINWATER LEADER

S	SOUTH, SCUM, SINK, SECOND OR SLOPE
SA	SAMPLE
SBR	STYRENE BUTADENE (RUBBER)
SC	SPARE CHEMICAL OR SECONDARY CLARIFIER
SCD	SCREWED
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SDR	STORM DRAINS
SEC	SECONDARY
SECT	SECTION
SER	SERIES
SETT	SETTLING
SH	SHOWER
SHT	SHEET OR SHELF
SHTG	SHEATHING
SIM	SIMILAR
SL	SLUDGE OR SLOPE
SOLN	SOLUTION
SLDG	SLIDING
SP	STATIC PRESSURE
SPECS	SPECIFICATIONS
SPECF	SPECIFIED
SQ	SQUARE
SS	SANITARY SEWER, STAINLESS STEEL OR SERVICE SINK
SSU	SECONDS SAYBOLT UNIVERSAL
STA	STATION
STC	SLEEVE-TYPE COUPLING
STD	STANDARD
STL	STEEL
STM	STEAM
STN	STAINLESS
STN STL	STAINLESS STEEL
STRUCT	STRUCTURAL OR STRUCTURE
SUCT	SUCTION
SV	SOLENOID VALVE
SWR	SIDEWALL REGISTER
SYM	SYMMETRICAL OR SYMBOL
SYS	SYSTEM

T	THERMOSTAT, TREAD OF STAIR, TANGENT OR TOP
TB	TACK BOARD
T & B	TOP AND BOTTOM
TBE	THREAD BOTH ENDS
TBM	TEMPORARY BENCH MARK
TC	TOP OF CURB
TEMP	TEMPERATURE OR TEMPORARY
T & G	TONGUE AND GROOVE
THK	THICK OR THICKNESS
THR	THRESHOLD
THR'D	THREADED
TK	TANK
TOE	THREAD ONE END
TOL	TOILET
TP	TELEPHONE POLE OR TELEGRAPH POLE
TRANS	TRANSITION OR TRANSMITTER
TSB	TOP SET BASE
TV	THERMOSTATIC VALVE OR TELEVISION
TW	TOP OF WALL OR THERMOMETER WELL
TYP	TYPICAL

UB	UNION BONNET
UC	UNDER-CROSSING
UG	UNDERGROUND
UGC	UNDERGROUND CONDUIT
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORIES
UR	URINAL

V	VACUUM, VALVE, VERTICAL, VENT, VOLT OR VOLUME
VAR	VARIES OR VARIABLE
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
VOL	VOLUME
VTC	VENT TO CEILING
VTR	VENT THROUGH ROOF
VWC	VINYL WALL COVERING

W	WEST OR WASTE
W/	WITH
WC	WATER COLUMN OR WATER CLOSET
WCO	WALL CLEANOUT
WD	WOOD
WH	WATER HEATER
WI	WROUGHT IRON
W/O	WITHOUT
WOG	WATER, OIL OR GAS WORKING PRESSURE
WP	WATER PROOFING
WS	WATER SURFACE
WSTP	WATER STOP
WT	WEIGHT
WWM	WELDED WIRE MESH
WWP	WATER WORKING PRESSURE

XS	EXTRA STRONG
XXS	DOUBLE EXTRA STRONG

YD	YARD
YR	YEAR

Z	ZERO OR ZONE
ZN	ZINC

NOTES:

ADDITIONAL PIPING ABBREVIATIONS SHOWN ON PIPE SCHEDULE SHEET

ELECTRICAL ABBREVIATIONS SHOWN ON ELECTRICAL SHEETS

ADDITIONAL HEATING, VENTILATING AND AIR CONDITIONING ABBREVIATIONS SHOWN ON MECHANICAL SHEETS

ADDITIONAL ABBREVIATIONS CONFORM TO ANSI STANDARD ABBREVIATIONS Z32. 2.3

Plot Date: 15-FEB-2007 Time: 08:07:47

File: \\\\\\\\\\\\\\\\\\\\\\directory\filename\\\\\\\\\\\\\\\\\\\\\\

Job No: 1530509

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED MWH STANDARD
DRAWN MWH STANDARD
CHECKED R.WARNER

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MWH
Portland Oregon

South Fork Water Board
16982 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS

ABBREVIATIONS

SHEET G-03

CAST IRON
STEEL
GRAVEL
CONCRETE
EARTH
SAND
ALUMINUM OR METAL DECKING
CHECKERED PLATE
RAILING
DIRT ROADS (UNIMPROVED)
FOOT PATHS
PAINTED LINES
RAILROAD
EDGE OF WATER
EDGE OF SWAMP
NEW A.C. PAVING
EXISTING A.C. PAVING
SIGN
MAILBOX
SECTION LINE — SECTION LINE
R/W LINE — RIGHT OF WAY LINE
EASEMENT LINE
CENTERLINE
PROPERTY LINE
NEW STRUCTURE OR FACILITY
EXISTING STRUCTURE OR FACILITY
FUTURE STRUCTURE OR FACILITY
NEW FENCE
EXISTING FENCE
NEW PIPELINE (CIVIL SHEETS) 36" DIA. AND LARGER
NEW PIPELINE (CIVIL SHEETS) 12" DIA. TO 34" DIA.
NEW PIPELINE (CIVIL SHEETS) 10" DIA. AND SMALLER
4" GM — EXISTING GAS MAIN W/SIZE CALLOUT
12" PW — EXISTING POTABLE WATER MAIN W/SIZE CALLOUT
8" RW — EXISTING RAW WATER MAIN W/SIZE CALLOUT
UG ELEC — EXISTING UNDERGROUND ELECTRIC CABLE
8" SS — EXISTING SANITARY SEWER MAIN W/SIZE CALLOUT
8" FM — EXISTING FORCE MAIN W/SIZE CALLOUT
36" SDR — EXISTING STORM DRAIN W/SIZE CALLOUT
UG TEL — EXISTING UNDERGROUND TELEPHONE CABLE
UG CTV — EXISTING UNDERGROUND CABLE T.V.
XXX — FUTURE UTILITY W/SIZE CALLOUT
LD — TRAFFIC SIGNAL LOOP DETECTOR
EXISTING WATER METER AND BOX
EXISTING ELECTRIC JUNCTION BOX
SS — EXISTING SANITARY SEWER MANHOLE
EXISTING TELEPHONE JUNCTION BOX
C — EXISTING CABLE T.V. JUNCTION BOX
PS — EXISTING PUMP STATION

MINOR CONTOUR LINE, EXISTING GRADE
20 — MAJOR CONTOUR LINE, EXISTING GRADE
123.20 — FINISHED ELEVATION
(123.20) — EXISTING ELEVATION
TOP / TOE — CUT OR FILL SLOPE TO BE CONSTRUCTED
SHRUB
TREE
PINE TREE
PALM TREE
FIRE HYDRANT AND VALVE
COMBINATION POWER/TELEPHONE POLE
COMBINATION POWER/TELEPHONE POLE W/LIGHT
SIGNAL LIGHT POLE (TRAFFIC AND RAILROAD)
STREET LIGHT POLE
GUY WIRE
MH — MANHOLE
PCOTG — PRESSURE CLEANOUT TO GRADE
WCO — WALL CLEANOUT
FCO — FLOOR CLEANOUT
COTG — CLEANOUT TO GRADE
BLOW OFF ASSEMBLY
HUB DRAIN
FLOOR DRAIN
FLOOR SINK
SOIL BORING
BENCH MARK
HORIZONTAL AND VERTICAL CONTROL POINT
CHANGE IN PIPING MATERIAL
ROUND OR DIAMETER
SQUARE
AT
ANGLE
24" RW-RCP — PIPE SIZE, FLUID ABBREVIATION AND TYPE OF PIPE
42" RW — PIPE CALLOUT (SEE PIPING SCHEDULE)
ME-2 — EQUIPMENT NUMBER (SEE EQUIPMENT SCHEDULE)
BACKWATER VALVE
BACKFLOW PREVENTER

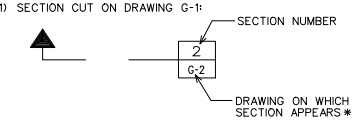
GATE VALVE, BURIED WITH VALVE BOX
BUTTERFLY VALVE, BURIED WITH VALVE BOX
ECCENTRIC PLUG VALVE, BURIED WITH VALVE BOX
LUBRICATED PLUG VALVE, BURIED WITH VALVE BOX
GATE VALVE
BUTTERFLY VALVE
ECCENTRIC PLUG VALVE
LUBRICATED PLUG VALVE
GLOBE VALVE
BALL VALVE
DIAPHRAGM VALVE
CHECK VALVE
PRESSURE REGULATING VALVE
BACK-PRESSURE VALVE
M — P — MOTOR OPERATOR FOR VALVES (M - ELECTRIC, P - PNEUMATIC)
TEMPERATURE CONTROL VALVE
S — SOLENOID VALVE
MULTIPORT VALVE - 3 WAY
MULTIPORT VALVE - 4 WAY
FLOAT OPERATED VALVE
NEEDLE VALVE
PRESSURE RELIEF VALVE
ANGLE VALVE
HOSE BIBB (H/B)
B — BUBBLER LEVEL CONTROL
CENTRIFUGAL OR TURBINE PUMP OR FAN
METERING PUMP
PROGRESSING CAVITY, POSITIVE DISPLACEMENT PUMP
BLOWER OR COMPRESSOR
INJECTOR OR EDUCTOR
FLAME ARRESTER
AIR VACUUM AND AIR RELEASE ASSEMBLY
THERMOMETER
PIPE ANCHOR

T — ROOM THERMOSTAT
G — PRESSURE GAUGE
PRESSURE GAUGE WITH DIAPHRAGM SEAL
S — PRESSURE SWITCH
PRESSURE SWITCH WITH DIAPHRAGM SEAL
FLANGED FITTING
WELDED FITTING
MECHANICAL-TYPE FITTING (GROOVED)
SCREWED, SOCKET-WELD, BELL AND SPIGOT OR HUBLESS FITTING
SLEEVE-TYPE COUPLING
FLANGED ADAPTER COUPLING
FLANGED ADAPTER - SET SCREW TYPE
EXPANSION JOINT
MECHANICAL TYPE COUPLING
FLEXIBLE COUPLING
UNION
QUICK DISCONNECT COUPLER
CAPPED END OR PLUGGED END
BLIND FLANGE
REDUCER OR INCREASER
CUT PIPE
STRAINER
DRAIN
FLOW TUBE
M M — MAGNETIC METER
D M — DENSITY METER
P M — PROPELLER METER
ORIFICE PLATE AND FLANGES
ROTAMETER
T — CONDENSATE TRAP
PIPE SUPPORT (IN PLAN ONLY)
CB — CATCH BASIN
PULSATION DAMPENER
EXPANSION CHAMBER WITH RUPTURE DISC
RUPTURE DISC
FG — FLOW SIGHT GLASS

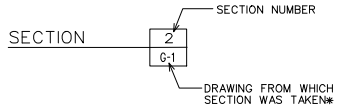
SECTION AND DETAIL IDENTIFICATION

SECTION IDENTIFICATION

(1) SECTION CUT ON DRAWING G-1:

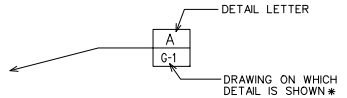


(2) ON DRAWING G-2 THIS SECTION IS IDENTIFIED AS:

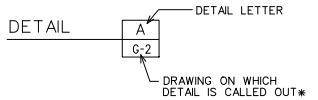


DETAIL IDENTIFICATION

(1) DETAIL CALL-OUT ON DRAWING G-2 AS:

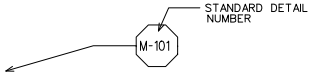


(2) ON DRAWING G-1 THIS DETAIL IDENTIFIED AS:

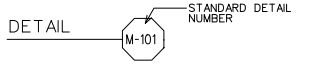


STANDARD DETAIL IDENTIFICATION

(1) DETAIL CALL-OUT ON PLAN OR SECTION:



(2) ON DRAWING THIS DETAIL IDENTIFIED AS:



NOTE: IF PLAN AND SECTION (OR DETAIL CALL-OUT AND DETAIL) ARE SHOWN ON SAME DRAWING, DRAWING NUMBER IS REPLACED BY A LINE.

NOTES:

(1) ELECTRICAL SYMBOLS SHOWN ON ELECTRICAL SHEETS.

(2) FOR WELDING SYMBOLS USE AMERICAN WELDING SOCIETY STANDARD SYMBOLS. SEE AMERICAN INSTITUTE OF STEEL CONSTRUCTION MANUAL.

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED MWH STANDARD
DRAWN MWH STANDARD
CHECKED R.WARNER

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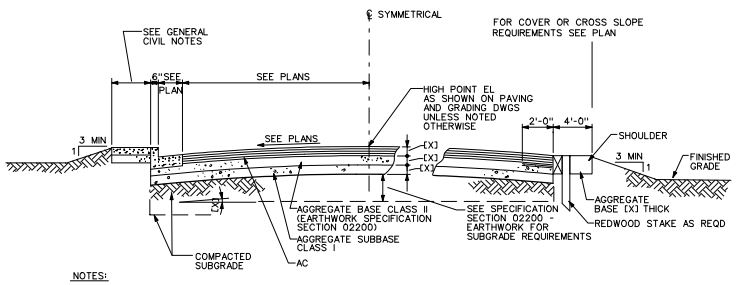
16982 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS

SYMBOLS

SHEET G-04

Plot Date: 15-FEB-2007 Time: 11:47
File: \\\\



NOTES:

1. DETAILS SHOWN ARE TYPICAL ROAD SECTIONS UNLESS NOTED OTHERWISE
2. SEE GENERAL NOTES FOR DIMENSION REQUIREMENTS
3. PROVIDE PAVING PER OREGON CITY REQUIREMENTS

AC ROAD SECTION

REV 040302 C-130

A. FLEXIBLE PIPE REFERS TO ALL STEEL, DUCTILE-IRON AND PLASTIC PIPES.

B. TYPICAL TRENCH SECTIONS (I, II AND III) ARE TO BE USED ONLY WHERE STABLE, COMPACT SOIL CONDITIONS EXIST. IF BOULDER OR LARGE OBSTRUCTIONS WOULD BE ENCOUNTERED, TRENCH SECTIONS MAY BE DEEPER OR WIDER THAN SHOWN. THE ENGINEER SHOULD BE ADVISED SHOULD THIS OCCUR.

C. THE NEED FOR PROTECTIVE SYSTEMS, AND EXCAVATION SLOPES SHALL BE DETERMINED CONSIDERING APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS AND GEOTECHNICAL CONSULTANTS' RECOMMENDATIONS.

D. PROTECTIVE SYSTEMS SHALL BE DESIGNED AND BUILT IN ACCORDANCE WITH THE APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS.

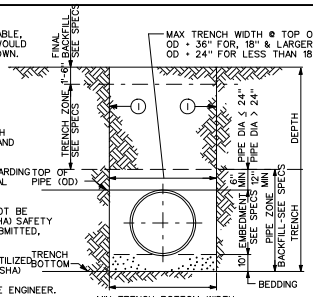
E. SUPPORTING DOCUMENTATION SHALL BE SUBMITTED TO THE ENGINEER REGARDING PIPE DESIGN AND COMPLIANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS.

F. UNSUPPORTED VERTICAL AND/OR SLOPING TRENCH WALL SLOPES SHALL NOT BE STEEPER THAN ALLOWED BY APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS, UNLESS SUPPORTING DOCUMENTATION IS SUBMITTED, ACCORDING TO AFOREMENTIONED SAFETY STANDARDS.

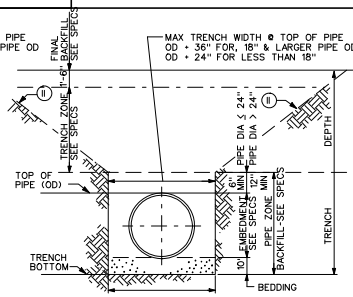
G. TRENCH SECTIONS OTHER THAN THE TYPICAL SECTIONS SHOWN MAY BE UTILIZED PROVIDED THEY COMPLY WITH APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS. DOCUMENTATION SUPPORTING THIS COMPLIANCE AND PIPE DESIGN CALCULATIONS SHALL BE SUBMITTED TO THE ENGINEER.

H. IF OVER-EXCAVATION DUE TO POOR FOUNDATION MATERIAL IS ORDERED BY THE ENGINEER, THE BACKFILL MATERIAL SHALL BE ACCORDING TO THE EARTHWORK SECTION OF THE SPECIFICATIONS ARTICLE ENTITLED, "USE OF FILL, BACKFILL AND EMBANKMENT MATERIAL TYPES."

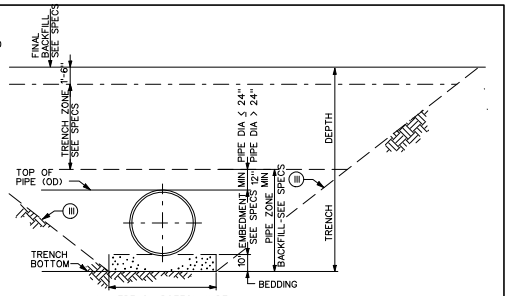
I. IF DURING CONSTRUCTION, THE WATER TABLE WILL BE DISCOVERED TO BE ABOVE THE TRENCH BOTTOM, THE ENGINEER SHALL BE NOTIFIED, AND APPROPRIATE DEWATERING SHALL BE IMPLEMENTED TO LOWER THE WATER LEVEL BELOW THE TRENCH BOTTOM. THE BACKFILL MATERIAL SHALL BE ACCORDING TO THE EARTHWORK SECTIONS OF THE SPECIFICATIONS, OR AS ORDERED BY THE ENGINEER.



TRENCH SECTION - TYPE I



TRENCH SECTION - TYPE II



TRENCH SECTION - TYPE III

TRENCH SECTION
FLEXIBLE PIPE

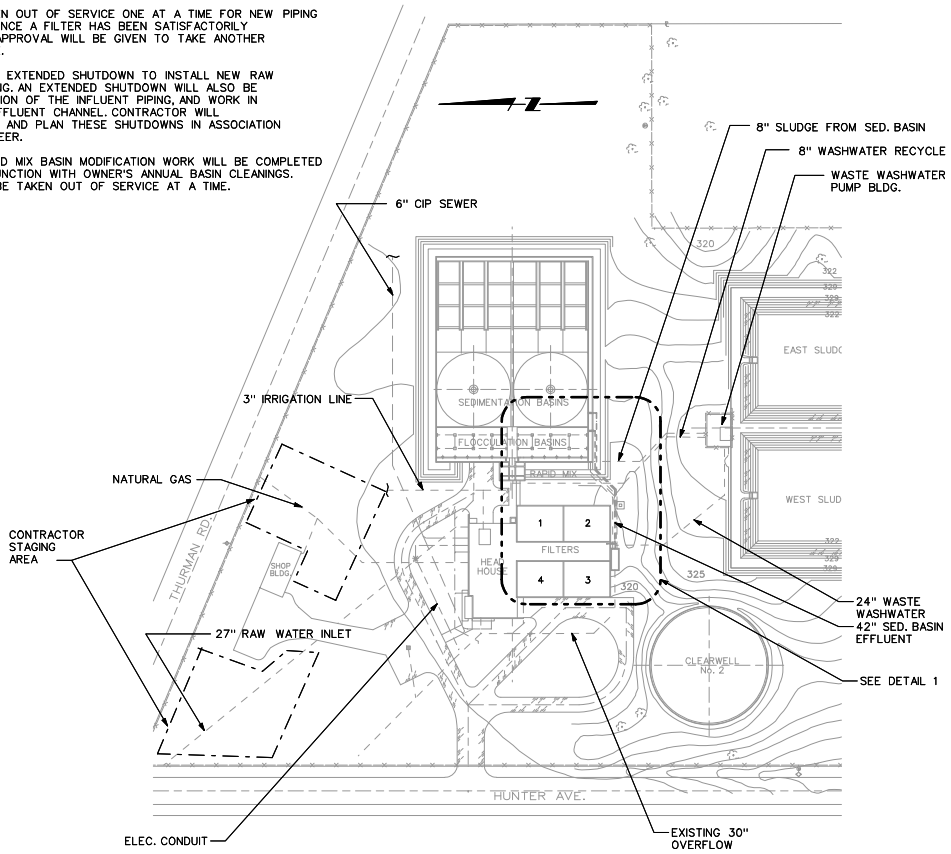
REV 010301 C-601

Plot Date: 15-FEB-2007 Time:

File: \\\\\\\\\\\\\\\\\\\\\\directory\filename\\\\\\\\\\\\\\\\\\\

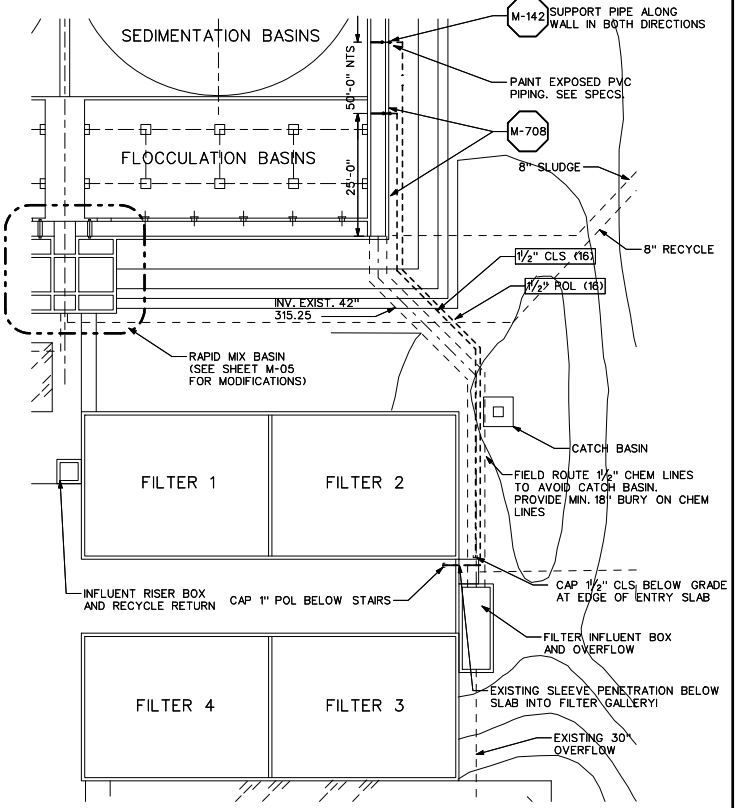
NOTES:

1. PROTECT BURIED PIPE AND OTHER SUBGRADE UTILITIES FROM DAMAGE DURING CONSTRUCTION. SEE AS-BUILT PLANT DRAWINGS FOR LOCATION OF BURIED PIPING. PAY PARTICULAR ATTENTION TO SHALLOW IRRIGATION PIPING AND PIPING IN AREA BETWEEN FILTERS AND FLOCCULATION BASIN.
2. REPAIR DAMAGED STORAGE, STAGING, PARKING, AND OTHER AREAS IMPACTED BY CONSTRUCTION TO THEIR ORIGINAL CONDITION.
3. WTP HEADHOUSE AND RESTROOM FACILITIES ARE UNAVAILABLE FOR CONTRACTOR USE.
4. WTP SHALL REMAIN IN SERVICE DURING CONSTRUCTION. CONTRACTOR TO PROTECT EXISTING SYSTEMS AND PROTECT THE WORKING ENVIRONMENT FROM NOISE, DUST, FUMES, ETC.
5. FILTERS SHALL BE TAKEN OUT OF SERVICE ONE AT A TIME FOR NEW PIPING AND CONTRACT WORK. ONCE A FILTER HAS BEEN SATISFACTORILY TESTED AND STARTED, APPROVAL WILL BE GIVEN TO TAKE ANOTHER FILTER OUT OF SERVICE.
6. PLANT WILL REQUIRE AN EXTENDED SHUTDOWN TO INSTALL NEW RAW WATER METER AND PIPING. AN EXTENDED SHUTDOWN WILL ALSO BE REQUIRED FOR CONNECTION OF THE INFLUENT PIPING, AND WORK IN SEDIMENTATION BASIN EFFLUENT CHANNEL. CONTRACTOR WILL CAREFULLY COORDINATE AND PLAN THESE SHUTDOWNS IN ASSOCIATION WITH OWNER AND ENGINEER.
7. FLOCCULATION AND RAPID MIX BASIN MODIFICATION WORK WILL BE COMPLETED IN APRIL 2005 IN CONJUNCTION WITH OWNER'S ANNUAL BASIN CLEANINGS. ONLY ONE BASIN WILL BE TAKEN OUT OF SERVICE AT A TIME.



SITE PLAN
1" = 50'

PROPOSED FLOCCULATION AND RAPID MIX MODIFICATIONS PER SHEET M-05 WERE DELETED FROM CONTRACT AND NOT CONSTRUCTED.



DETAIL 1
SCALE: 3/16"=1'-0"

NEW CHEMICAL PIPING TO SEDIMENTATION BASIN EFFLUENT CHANNEL

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED R.WARNER
DRAWN C.KITTS
CHECKED P.KREFT

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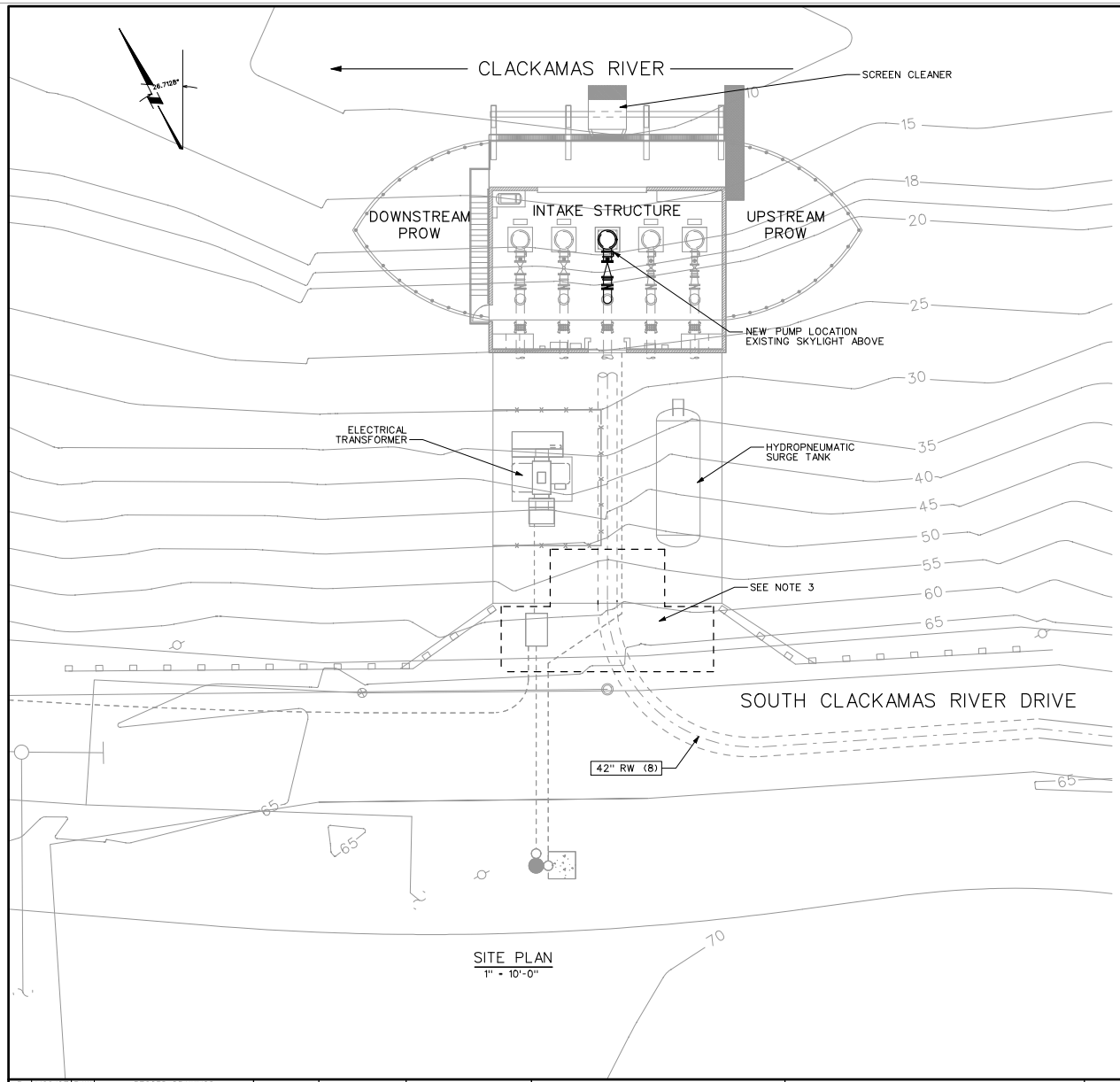
Portland Oregon

South Fork Water Board
16962 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS
WTP SITE PLAN AND NOTES

SHEET C-01

Job No: 1530509
File: ##########directory\filename##########
Plot Date: 15-FEB-2007 Time: 08



SITE PLAN
1" = 10'-0"

NOTES:

1. NO PARKING BY EMPLOYEES ALLOWED AT INTAKE GATE. OFF SITE PARKING AND TRANSPORTATION IS THE RESPONSIBILITY OF THE CONTRACTOR. WORKER PARKING MAY BE AT THE OLD SFWB INTAKE APPROXIMATELY 1/4 MILE EAST. COORDINATE WITH OWNER.
2. LIMITED SHUTDOWNS ARE ALLOWED TO COMPLETE WORK AS REQUIRED. RAW WATER PIPELINE WILL REQUIRE PARTIAL DRAINING TO INSTALL NEW PIPING AND VALVES. CAREFULLY COORDINATE SHUTDOWNS WITH OWNER AND ENGINEER.
3. LIMITED CRANE & EQUIPMENT SETUP AREA, SEE SPECIFICATION 01313 FOR ADDITIONAL SCHEDULING AND CONSTRUCTION CONSTRAINTS.
4. INSTALLATION OF NEW PUMP AND MOTOR WILL LIKELY REQUIRE A COMPLETE SHUTDOWN OF CLACKAMAS RIVER DRIVE. CONTRACTOR TO PROVIDE AT LEAST 14 DAYS NOTICE PRIOR TO PUMP INSTALLATION TO ALLOW COORDINATION OF ROAD CLOSURE W/ CLACKAMAS COUNTY. CONTRACTOR TO AQUIRE ROAD CLOSURE PERMIT FROM COUNTY AND PROVIDE NOTIFICATIONS AS REQUIRED.
5. FOLLOW SPECIFIC ROAD CLOSURE PERMIT CONDITIONS FOR CLACKAMAS COUNTY.
6. REMOVE AND REPLACE SKYLIGHT ROOF HATCH FOR INSTALLATION OF NEW PUMP AND MOTOR. HATCH ACCESS MAY ALSO BE REQUIRED FOR NEW VFD INSTALLATION. HATCH SHALL BE PROPERLY RE-INSTALLED AND VERIFIED LEAK-TIGHT.
7. SEE SHEET M-06 FOR INTAKE IMPROVEMENTS.

Job No: 1530509 File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$ Plot Date: Plot Date: 15-FEB-2007 [illegible]

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED R.WARNER
DRAWN C.KITTS
CHECKED P.KREFT

RECORD DRAWING

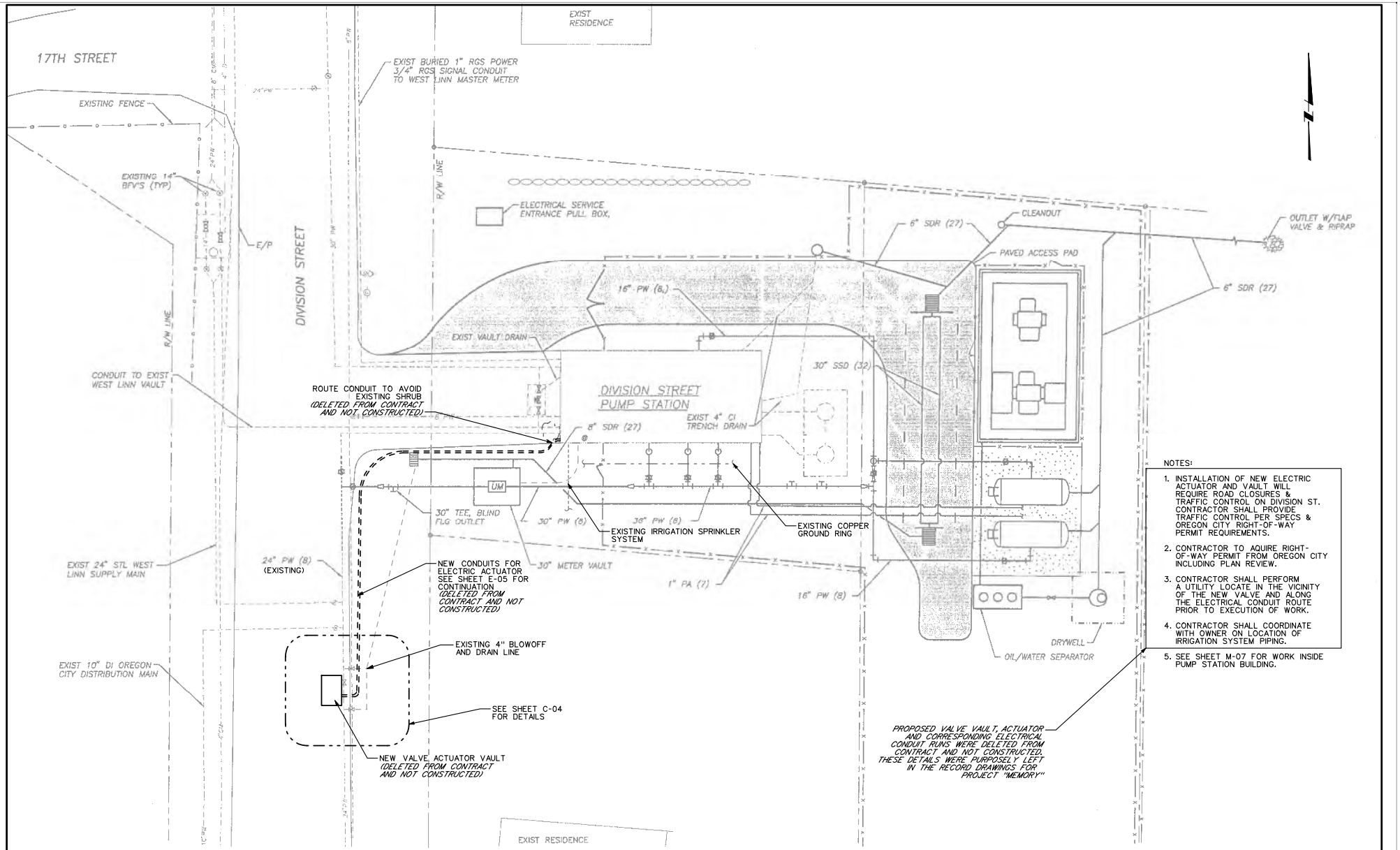
This record drawing has been prepared, entirely or in part on the basis of unverified information compiled and furnished by others to the preparer who is not responsible for any inaccuracies, errors or omissions which may have been incorporated into the document as a result

MWH
Portland Oregon

South Fork Water Board
15962 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS
CLACKAMAS RIVER INTAKE/
PUMP STATION
SITE PLAN AND NOTES

SHEET C-02



NOTES:

1. INSTALLATION OF NEW ELECTRIC ACTUATOR AND VAULT WILL REQUIRE ROAD CLOSURES & TRAFFIC CONTROL ON DIVISION ST. CONTRACTOR SHALL PROVIDE TRAFFIC CONTROL PER SPECS & OREGON CITY RIGHT-OF-WAY PERMIT REQUIREMENTS.
2. CONTRACTOR TO AQUIRE RIGHT-OF-WAY PERMIT FROM OREGON CITY INCLUDING PLAN REVIEW.
3. CONTRACTOR SHALL PERFORM A UTILITY LOCATE IN THE VICINITY OF THE NEW VALVE AND ALONG THE ELECTRICAL CONDUIT ROUTE PRIOR TO EXECUTION OF WORK.
4. CONTRACTOR SHALL COORDINATE WITH OWNER ON LOCATION OF IRRIGATION SYSTEM PIPING.
5. SEE SHEET M-07 FOR WORK INSIDE PUMP STATION BUILDING.

Job No: 1530509 File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$ Plot Date: Plot Date: 15-FEB-2007 Time: 11:28

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE 1" = 10'-0"

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MWH Portland Oregon

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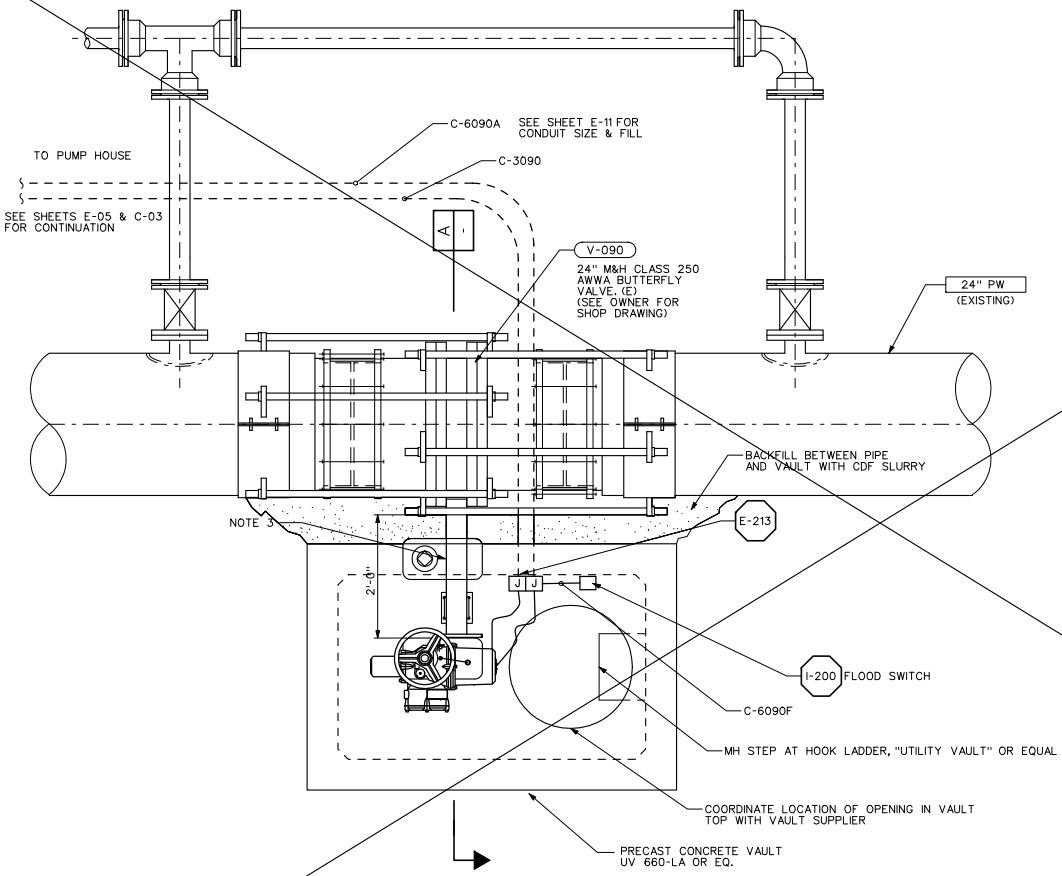
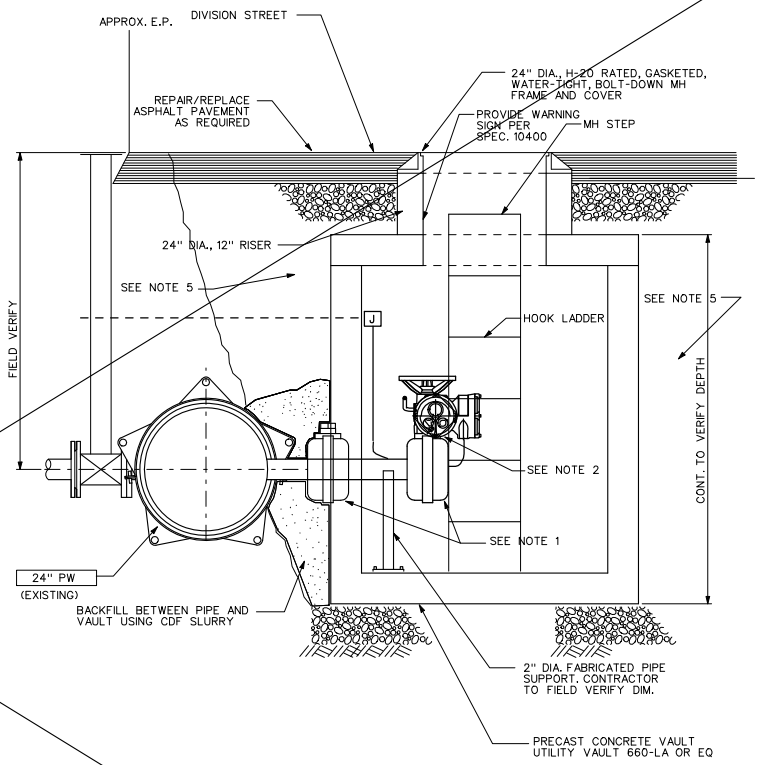
2004 SYSTEM CAPACITY IMPROVEMENTS
DIVISION STREET PUMP STATION
SITE PLAN AND NOTES

SHEET C-03



VALVE VAULT PLAN
SCALE: 1"=1'-0"



SECTION A
1"=1'-0"

NOTES:

1. REMOVE EXISTING WORM GEAR OPERATOR FROM VALVE INSTALL NEW SHAFT EXTENSION AND TORQUE TUBE ON VALVE. REINSTALL WORM GEAR OPERATOR ON NEW TORQUE TUBE. WORK SHALL BE COORDINATED WITH ACTUATOR SUPPLIER
2. ADAPT NEW ELECTRIC ACTUATOR TO DRIVE OF RELOCATED WORM GEAR OPERATOR. WORK SHALL BE COORDINATED WITH ACTUATOR SUPPLIER.
3. SEAL PENETRATION OR SLOT IN VAULT WITH NON-SHRINK GROUT OR OTHER APPROVED METHOD.
4. CONTRACTOR SHALL PROVIDE UTILITY LOCATE IN VICINITY OF NEW VAULT PRIOR TO INSTALLATION OF VAULT AND ACTUATOR.
5. BACKFILL VAULT WITH 1-1/2" MINUS AGGREGATE COMPACTED TO 95% AND PER OREGON CITY R-O-W PERMIT REQMTS
6. CONTRACTOR SHALL PROVIDE SHEETING/SHORING AS NECESSARY SEE SPECIFICATION 02160
7. REFER TO DETAIL C-601 FOR EXCAVATION NOTES AND DETAILS.

PROPOSED VALVE VAULT, ACTUATOR AND CORRESPONDING ELECTRICAL CONDUIT RUNS WERE DELETED FROM CONTRACT AND NOT CONSTRUCTED. THESE DETAILS WERE PURPOSELY LEFT IN THE RECORD DRAWINGS FOR PROJECT "MEMORY".

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

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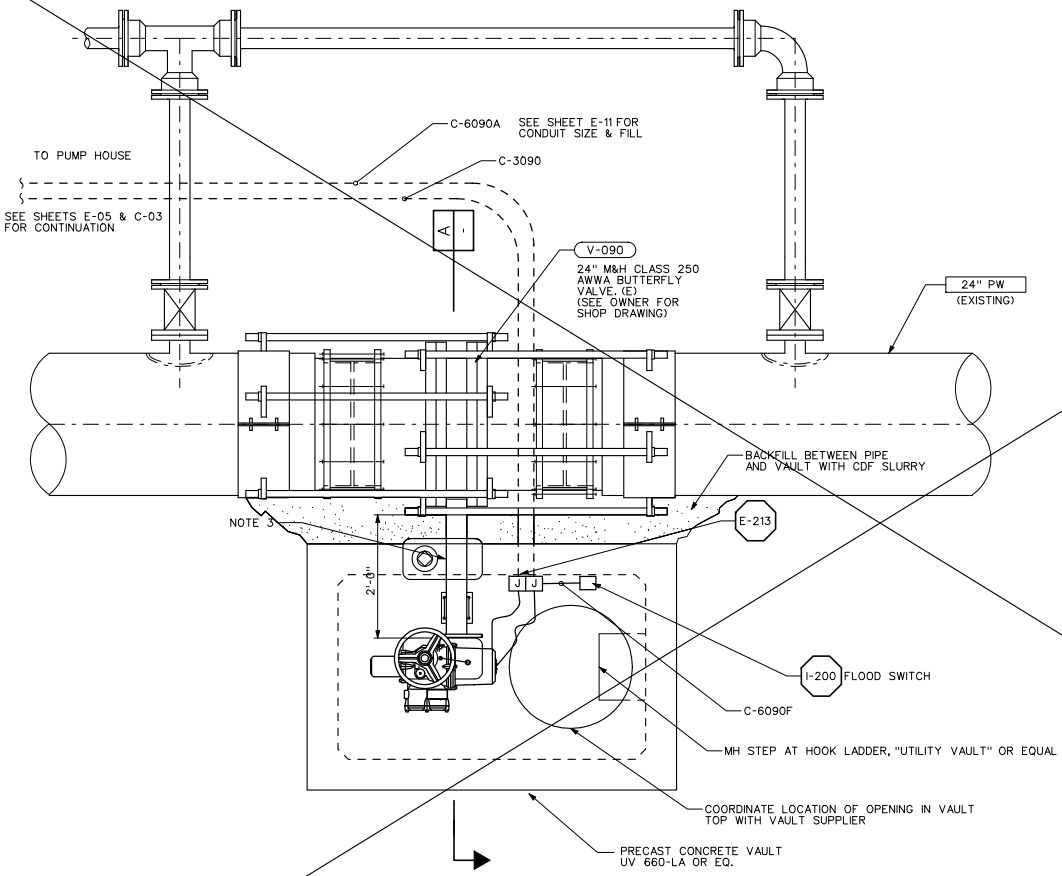
2004 SYSTEM CAPACITY IMPROVEMENTS

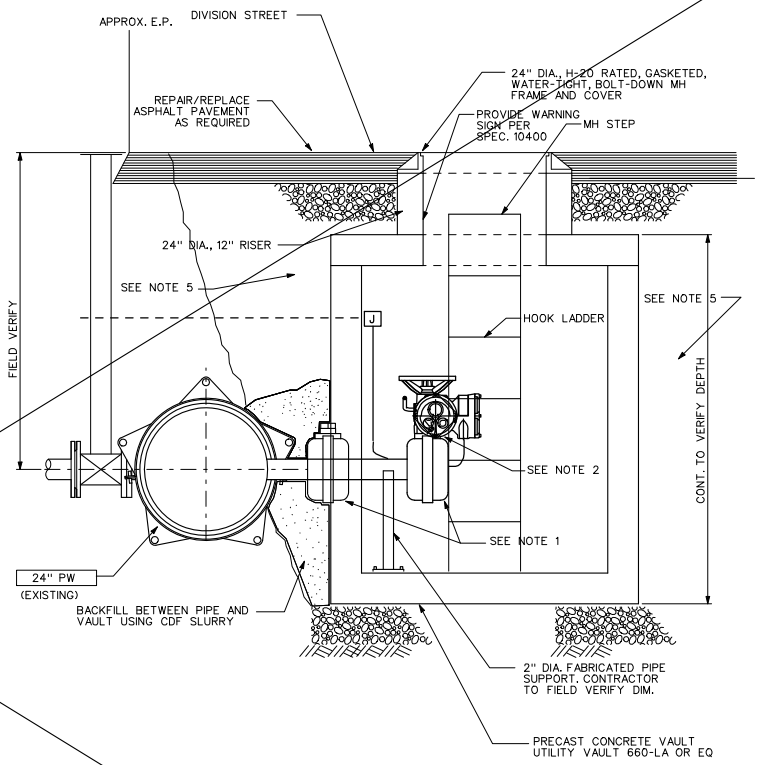
DSPS VALVE VAULT AND DETAILS

SHEET C-04

Job No: 1530509
File: ########################directory\filename########################
Plot Date: Plot Date: 07-FEB-########:##:32



VALVE VAULT PLAN
SCALE: 1"=1'-0"



SECTION A
1"=1'-0"

NOTES:

1. REMOVE EXISTING WORM GEAR OPERATOR FROM VALVE INSTALL NEW SHAFT EXTENSION AND TORQUE TUBE ON VALVE. REINSTALL WORM GEAR OPERATOR ON NEW TORQUE TUBE. WORK SHALL BE COORDINATED WITH ACTUATOR SUPPLIER
2. ADAPT NEW ELECTRIC ACTUATOR TO DRIVE OF RELOCATED WORM GEAR OPERATOR. WORK SHALL BE COORDINATED WITH ACTUATOR SUPPLIER.
3. SEAL PENETRATION OR SLOT IN VAULT WITH NON-SHRINK GROUT OR OTHER APPROVED METHOD.
4. CONTRACTOR SHALL PROVIDE UTILITY LOCATE IN VICINITY OF NEW VAULT PRIOR TO INSTALLATION OF VAULT AND ACTUATOR.
5. BACKFILL VAULT WITH 1-1/2" MINUS AGGREGATE COMPACTED TO 95% AND PER OREGON CITY R-O-W PERMIT REQMTS
6. CONTRACTOR SHALL PROVIDE SHEETING/SHORING AS NECESSARY SEE SPECIFICATION 02160
7. REFER TO DETAIL C-601 FOR EXCAVATION NOTES AND DETAILS.

PROPOSED VALVE VAULT, ACTUATOR AND CORRESPONDING ELECTRICAL CONDUIT RUNS WERE DELETED FROM CONTRACT AND NOT CONSTRUCTED. THESE DETAILS WERE PURPOSELY LEFT IN THE RECORD DRAWINGS FOR PROJECT "MEMORY".

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

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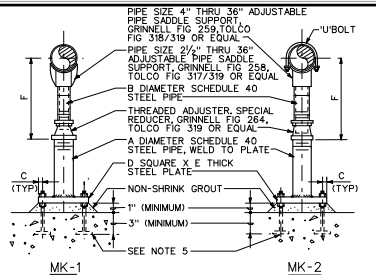
2004 SYSTEM CAPACITY IMPROVEMENTS

DSPS VALVE VAULT AND DETAILS

SHEET C-04

Job No: 1530509
File: ########################directory\filename########################
Plot Date: Plot Date: 07-FEB-########:##:32



NOTES:

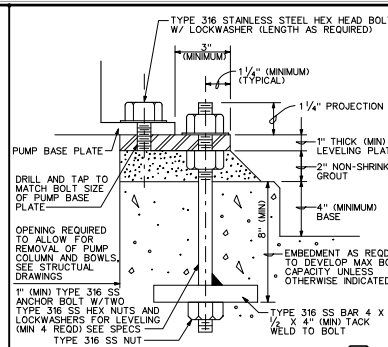
1. FOR ADDITIONAL REQUIREMENTS SEE SPEC SECTION 'PIPE SUPPORTS'.
2. GALVANIZE ALL PARTS AFTER FABRICATION.
3. WHERE PIPE SUPPORT OCCURS ON GRADE REFER TO STRUCTURAL DRAWINGS FOR DETAILS.
4. THIS PIPE SUPPORT IS LIMITED TO PIPE FROM 2½" DIAMETER TO 36" DIAMETER INCLUSIVE.
5. GALVANIZED ANCHOR BOLT OR CONCRETE ANCHOR WITH TWO NUTS AND ONE LOCKWASHER. PROVIDE BAR 4 X ½ X 4" WELDED TO BOLT. (TYP OF 4) SEE SPECIFICATIONS.

DIMENSIONS IN INCHES							
NOMINAL PIPE SIZE	A	B	C	D	E	F (APPROX) (MINIMUM)	F (APPROX) (MAXIMUM)
2½	2	1½	1	6	⅜	7	11½
3	2	1½	1	6	⅜	7 5/16	11 13/16
3½	2	1 1/2	1	6	⅜	7 3/16	12 1/16
4	3	•2½/3	1⅛	7½	½	10¼	14¾
6	3	•2½/3	1⅛	7½	½	11 3/16	16 1/16
8	3	•2½/3	1¼	7½	½	13 3/16	18 1/16
10	3	•2½/3	1⅛	7½	½	14 5/16	19 1/8
12	3	•2½/3	1⅛	7½	½	15 5/16	20 1/8
14	4	3	1¼	9	⅝	18 1/8	23 5/16
16	4	3	1¼	9	⅝	19 1/8	24 5/16
18	6	4	1½	11	¾	22¼	26¾
20	6	4	1½	11	¾	23¼	27¾
24	6	4	1½	11	¾	26½	31
30	6	4	1½	11	¾	29 5/16	34 1/16
32	6	4	1½	11	¾	30 5/16	35 1/16
36	6	4	1½	11	¾	32 5/16	37 1/16

* SEE MANUFACTURER

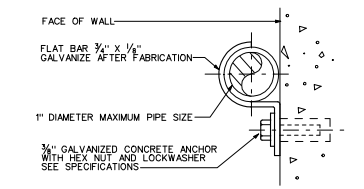
ADJUSTABLE PIPE SUPPORT WITH OR WITHOUT 'U' BOLT

(FOR PIPE 36" DIAMETER AND SMALLER) REV 011402 — M-108



VERTICAL PUMP MOUNTING BASE

REV 042202 — M-135

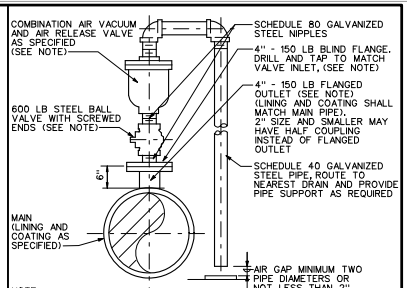


NOTES:

1. WHERE SUBMERGED, FLAT BAR, BOLT, WASHER, SHIELD AND CONCRETE ANCHOR TO BE TYPE 316 STAILESS STEEL
2. WHEN USED WITH PVC OR FIBERGLASS PIPE, PROVIDE STEEL SHIELD WITH LOOSE FIT AROUND PIPE AT CLAMP. WRAP COPPER TUBING WITH 2" WIDE STRIP OF RUBBER FABRIC AT CLAMP.
3. FOR ADDITIONAL REQUIREMENTS SEE SPECIFICATION SECTION 'PIPE SUPPORTS'

PIPE CLAMP FOR INDIVIDUAL PIPES

(FOR PIPE 1" DIAMETER AND SMALLER) REV 072501 — M-142

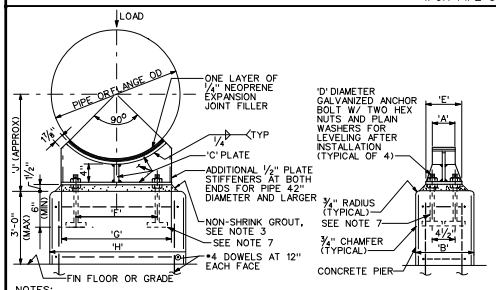


NOTE:

FOR PIPING SYSTEM WITH SERVICE PRESSURE CLASS GREATER THAN 150 PSI, ALL COMPONENTS FURNISHED SHALL BE SUITABLE FOR THE HIGHER PRESSURE

AIR-VACUUM AND AIR-RELEASE VALVE ASSEMBLY 3" AND SMALLER

REV 061801 — M-804



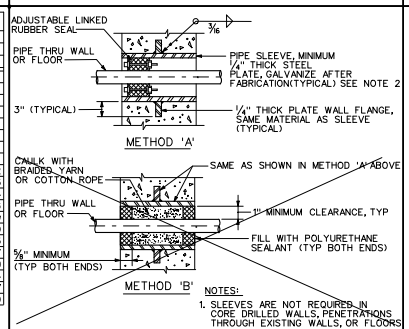
NOTES:

1. WHEN SUPPORTING PIPE AND FLANGE ALTERNATELY ON THE SAME LINE, CONCRETE PIERS FOR PIPE SUPPORTS SHALL ALL HAVE THE SAME DIMENSION 'H' FOR FLANGE SUPPORT
2. PIPE SUPPORTS SHALL BE LOCATED IN PLAN AT POINTS MARKED THUS (X)
3. WHERE DIFFERENTIAL SETTLEMENT IS LIKELY TO OCCUR, OMIT GROUT AS DIRECTED BY THE ENGINEER
4. GALVANIZE ALL PARTS AFTER FABRICATION
5. WHERE DIRECTED BY THE STRUCTURAL ENGINEER, BOTTOM OF PIERS SHALL EXTEND BELOW BOTTOM OF SLAB
6. WHERE PIPE SUPPORT OCCURS ON GRADE REFER TO STRUCTURAL DRAWINGS FOR DETAILS.
7. GALVANIZED ANCHOR BOLT OR CONCRETE ANCHOR WITH TWO NUTS AND ONE LOCKWASHER. PROVIDE BAR 4 X ½ X 4" WELDED TO BOLT. (TYP OF 4) SEE SPECIFICATIONS

DIMENSIONS IN INCHES														
NOMINAL PIPE SIZE						SUPPORTING PIPE					FLANGE			
	A	B	C	D	E	F	G	H	J		F	G	H	J
6	4	12	⅜	⅝	6	4½	6	12	10	6½	9	16	13	
8	4	12	⅜	⅝	6	5	8	13	11	7½	9	16	14	
10	4	12	⅜	⅝	6	6	9	15	12	9	13	18	15	
12	4	12	⅜	⅝	6	7	11	17	13	10	15	20	16	
14	4	12	⅜	⅝	6	8	12	17	14	11	16	21	17	
16	4	12	⅜	⅝	6	9	13	19	15	12	18	24	18	
18	4	12	⅜	⅝	6	10	14	20	16	13	19	24	19	
20	5	12	⅜	⅝	6	10	15	21	17	15	21	26	21	
22	5	12	⅜	⅝	6	12	18	24	18	16	23	28	22	
24	5	12	⅜	¾	6	13	19	24	19	16	24	30	23	
26	5	12	⅜	¾	6	14	21	27	20	18	26	32	24	
30	5	12	⅜	¾	6	16	23	28	22	20	29	34	26	
34	5	15	⅜	¾	6	18	26	32	24	22	33	39	29	
36	6	15	⅜	¾	6	19	27	32	25	24	34	40	30	
42	6	18	½	1	8	21	31	36	28	27	39	45	33	
48	6	18	½	1	8	24	36	42	31	30	44	50	37	
54	6	18	½	1	8	28	40	46	34	34	48	56	40	
60	6	18	½	1⅛	8	32	45	52	37	36	54	60	44	
66	6	18	½	1⅛	8	33	49	56	40	40	59	66	47	
72	6	18	½	1⅛	8	36	53	60	43	44	63	70	50	

PIPE SUPPORT

(FOR PIPE 72" DIAMETER AND SMALLER) REV 011402 — M-109

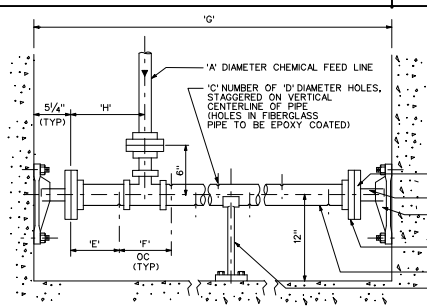


NOTES:

1. SLEEVES ARE NOT REQUIRED IN CORE DRILLED WALLS, PENETRATIONS THROUGH EXISTING WALLS, OR FLOORS

SLEEVED PIPE OPENING

REV 011402 — M-111

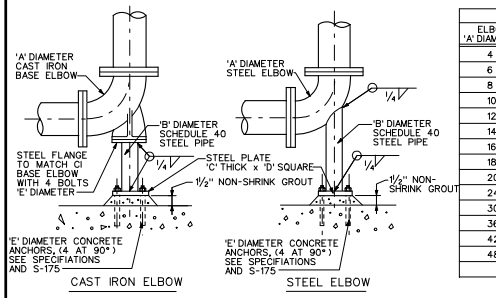


IDENTIFICATION MARK	CHEMICAL	GPM	DIMENSIONS IN INCHES 'A'	'B'	'C'	'D'	'E'	'F'	'G'	'H'
I	POL		1½"	1½"	8"	¼"	3"	4"	3'-6"	6"
II	SHC		1½"	1½"	8"	¼"	3"	4"	3'-6"	6"

PVC BLIND FLANGE, DRILL AND TAP FOR 1⅝" DIAMETER STUD, (TYPICAL)
1⅝" DIAMETER S.S. STUD, TAPPED INTO FLANGE, (TYPICAL)
PVC DIFFUSER SUPPORT BRACKET, (TYPICAL), ATTACH TO CONCRETE WITH S.S. CONCRETE ANCHORS, NUTS AND LOCKWASHERS
150 LB PVC FLANGE WITH S.S. NUTS AND BOLTS, (TYPICAL)
'B' DIAMETER FIBERGLASS OR SCHEDULE 80 PVC PIPE
FOR CHANNELS WIDER THAN 6'-0" PROVIDE INTERMEDIATE SUPPORTS AT MAXIMUM 5'-0" OC. SUPPORTS TO BE RUBBER COATED TYPE 316 STAINLESS STEEL. ATTACH TO CONCRETE WITH CONCRETE ANCHORS, HEX NUTS, AND LOCKWASHERS, AS SPECIFIED.

CHEMICAL DIFFUSER

CHANNEL TYPE REV 061801 — M-708



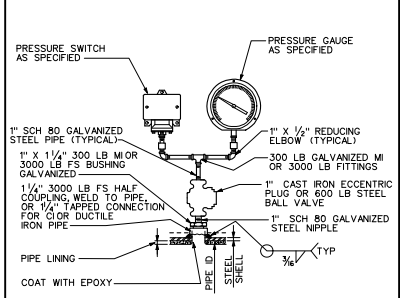
NOTE:

FOR ADDITONAL REQUIREMENTS SEE SPECIFICATION SECTION 'PIPE SUPPORTS'.

DIMENSIONS IN INCHES				
ELBOW 'A' DIAMETER	'B' DIAMETER	'C' THICK	'D' SQUARE	'E' DIAMETER
4	2	⅜	6	⅝
6	2½	⅜	7	⅝
8	4	½	9	⅝
10	4	½	9	⅝
12	6	½	11	¾
14	6	½	11	¾
16	6	½	11	¾
18	8	½	13½	¾
20	8	½	13½	¾
24	8	½	13½	¾
30	10	¾	16	⅞
36	12	¾	19	⅞
42	16	¾	23½	1
48	18	¾	25	1⅛

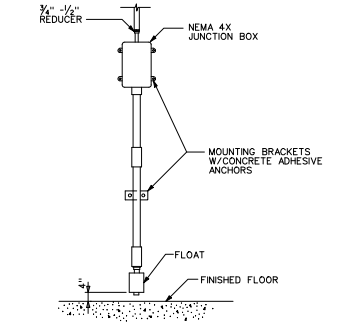
ELBOW SUPPORT

(FOR PIPE 48" DIAMETER AND SMALLER) REV 062702 — M-140



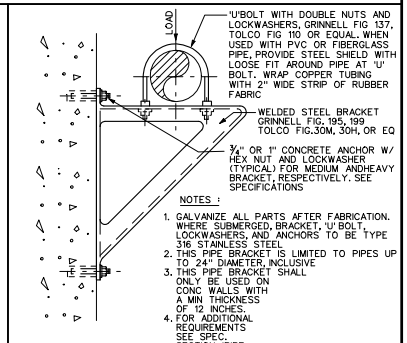
PRESSURE GAUGE AND SWITCH

REV 093002 — I-303



FLOOD SWITCH

REV 093002 — I-200



NOTES :

1. GALVANIZE ALL PARTS AFTER FABRICATION. WHERE SUBMERGED, BRACKET, 'U' BOLT, LOCKWASHERS, AND ANCHORS TO BE TYPE 316 STAINLESS STEEL.
2. THIS PIPE BRACKET IS LIMITED TO PIPES UP TO 24" DIAMETER, INCLUSIVE
3. THIS PIPE BRACKET SHALL ONLY BE USED ON CONC WALLS WITH A MIN THICKNESS OF 12 INCHES.
4. FOR ADDITIONAL REQUIREMENTS SEE SPEC. SECTION 'PIPE SUPPORTS'.

PIPE BRACKET

(FOR PIPE 24" DIAMETER AND SMALLER) REV 072501 — M-104

R	1/26/07	RAW	RECORD DRAWINGS
REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN R.WARNER
CHECKED P.KREFT

RECORD DRAWING I-303 NOTES TO DESIGNER: NO STANDARD APPLICATION

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2004 SYSTEM CAPACITY IMPROVEMENTS

MECHANICAL DETAILS

SHEET GM-01

Plot Date: 15-FEB-2007 08:58
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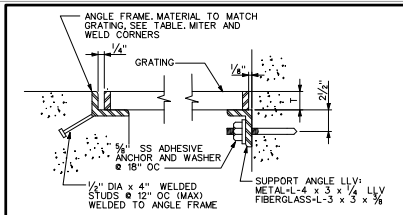
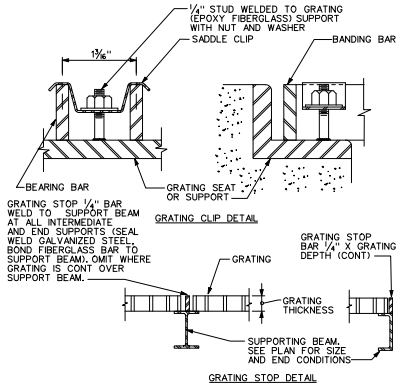


GRATING FRAME TABLE SIZED TO MATCH GRATING (FOR FIBERGLASS USE CONTINUOUS PULTRUDED FIBERGLASS SEAT & ANCHOR)				
GRATING DEPTH T	FRAME ANGLE (STEEL)		GRATING DEPTH T	FRAME ANGLE
1"	1¾ x 1¼ x ¼ (1¼X 1¼X 1/4)		2"	*2½ x 2½ x ½
1¼"	2 x 1½ x ¼ (1½X 1½X 1/4)		2¼"	2½ x 2½ x ¼
1½"	1¾ x 1¾ x ¼		2½"	3 x 3 x ½
1¾"	2 x 2 x ¼			

* OR USE 2½ x 2½ x ¼ W/1¼" SHIM PLATE WELDED TO BOTTOM

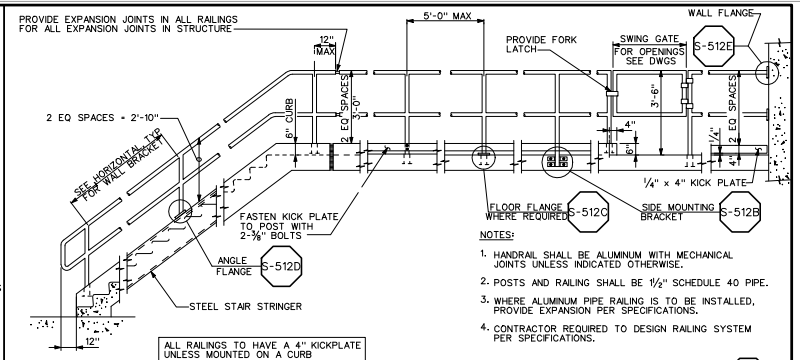


NOTES:

1. UNLESS INDICATED OTHERWISE, ALL GRATING SHALL MATCH EXISTING
2. GRATING DEPTH TO BE DETERMINED BY MANUFACTURER AND APPROVED BY ENGINEER (UNO)
3. ALL ENDS AND OPENINGS SHALL BE BANDED
4. WEIGHT OF GRATING SECTION SHALL NOT EXCEED 80 LBS
5. METAL BEARING BARS SHALL BE DEPTH T x 3/16" @ 1 3/16" OC CROSS BARS SHALL BE @ 4" OC
6. PROVIDE A MINIMUM OF 4 CLIPS PER GRATING PANEL, APPROX 4" FROM PANEL CORNERS. MAXIMUM CLIP SPACING AT 36" OC
7. MATERIALS:
   a. ALUMINUM GRATING - USE ALUMINUM ANGLE SUPPORTS AND STAINLESS STEEL BOLTS AND CLIPS
   b. GALVANIZED STEEL GRATING - USE STEEL ANGLE SUPPORTS, BOLTS AND CLIPS. GALVANIZE AFTER FABRICATION
   c. STAINLESS STEEL GRATING - USE STAINLESS STEEL ANGLE SUPPORTS, BOLTS AND CLIPS
   d. FIBERGLASS GRATING - USE FIBERGLASS FOR ALL COMPONENTS EXCEPT DRILLED ANCHORS; ALL CUT EDGES SHALL BE SEALED WITH RESIN: BONDING: USE EPOXY ADHESIVE BONDING AGENT

GRATING

REV 102403 — S-501



NOTES:

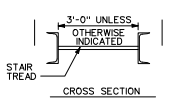
1. HANDRAIL SHALL BE ALUMINUM WITH MECHANICAL JOINTS UNLESS INDICATED OTHERWISE.
2. POSTS AND RAILING SHALL BE 1½" SCHEDULE 40 PIPE.
3. WHERE ALUMINUM PIPE RAILING IS TO BE INSTALLED, PROVIDE EXPANSION PER SPECIFICATIONS.
4. CONTRACTOR REQUIRED TO DESIGN RAILING SYSTEM PER SPECIFICATIONS.

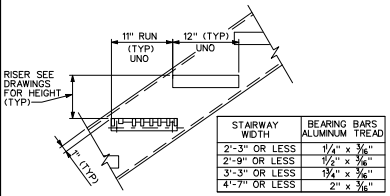
TWO-RAIL RAILING

REV 041502 — S-515

NOTES:

1. STEEL STAIRS SHALL CONSIST OF STEEL C10x15.3 STRINGERS AND SERRATED ALUM GRATING TREADS
2. ALL BOLTS AND CONCRETE ANCHORS SHALL BE SS
3. STAIR HANDRAIL NOT SHOWN FOR CLARITY

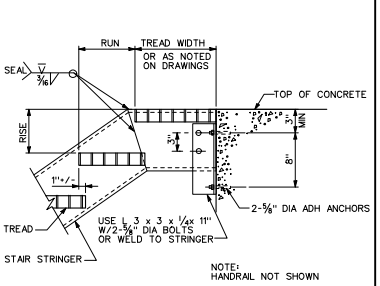




STAIRWAY WIDTH	BEARING BARS ALUMINUM TREAD
2'-3" OR LESS	1¼" x ⅜"
2'-9" OR LESS	1½" x ⅜"
3'-3" OR LESS	1¾" x ⅜"
4'-7" OR LESS	2" x ⅜"

METAL STAIR

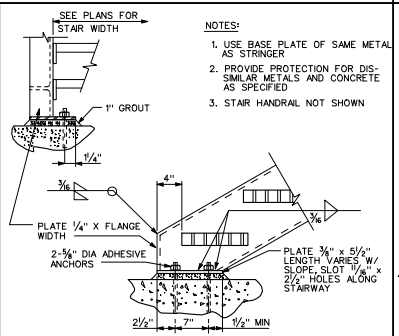
OPEN RISER — REV 091803 — S-544



NOTE: HANDRAIL NOT SHOWN

STAIR TOP CONNECTION TO CONCRETE

REV 081899 — S-541

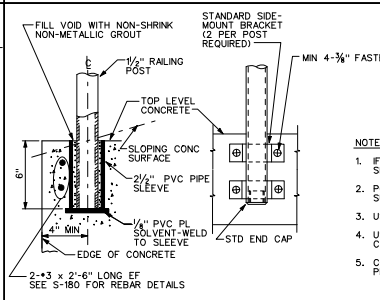


NOTES:

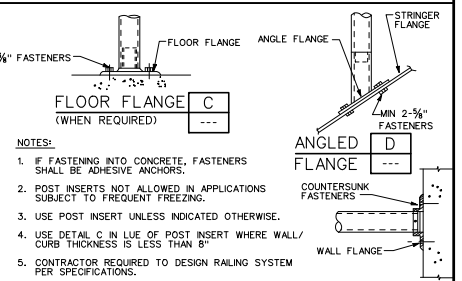
1. USE BASE PLATE OF SAME METAL AS STRINGER
2. PROVIDE PROTECTION FOR DISSIMILAR METALS AND CONCRETE AS SPECIFIED
3. STAIR HANDRAIL NOT SHOWN

STAIR BOTTOM TO CONCRETE CONNECTION

REV 081899 — S-545



SIDE-MOUNTING BRACKET — B



NOTES:

1. IF FASTENING INTO CONCRETE, FASTENERS SHALL BE ADHESIVE ANCHORS.
2. POST INSERTS NOT ALLOWED IN APPLICATIONS SUBJECT TO FREQUENT FREEZING.
3. USE POST INSERT UNLESS INDICATED OTHERWISE.
4. USE DETAIL C IN LUE OF POST INSERT WHERE WALL/CURB THICKNESS IS LESS THAN 8"
5. CONTRACTOR REQUIRED TO DESIGN RAILING SYSTEM PER SPECIFICATIONS.

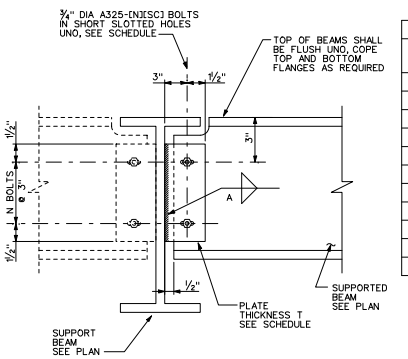
FLOOR FLANGE (WHEN REQUIRED) — C

ANGLED FLANGE — D

WALL FLANGE — E

RAILING, GUARDRAIL AND HANDRAIL SUPPORT

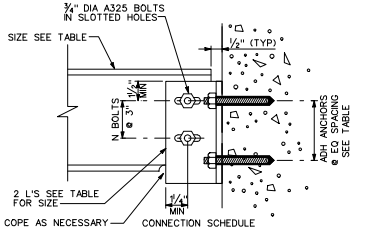
REV 092303 — S-512



BEAM TO BEAM CONNECTION SCHEDULE				
SUPPORTED BEAM SIZE	NO OF BOLTS N	PLATE THICKNESS T	WELD SIZE A	COMMENTS
W8 OR C8	2	¼	3/16	-
W10 OR C10	2	¼	3/16	-
W12 OR C12	3	¼	3/16	-
W14 OR C15	3	¼	3/16	-
W16	4	¼	3/16	-
W18	4	¼	3/16	-
W21	5	¼	3/16	-
W24	6	5/16	¼	-
W27	7	5/16	¼	-
W30	8	⅜	5/16	-
W36	9	7/16	⅜	-

BEAM TO BEAM CONNECTION

PLATE CONNECTION — REV 102003 — S-562

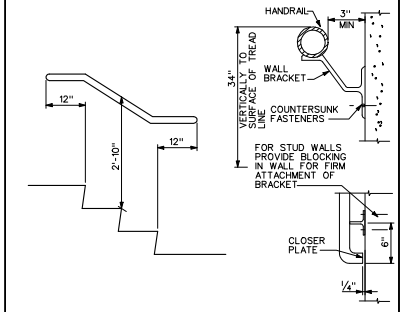


CONNECTION SCHEDULE

BEAM SIZE	DOUBLE ANGLE SIZE	# OF BOLTS N	ADHESIVE ANCHORS NUMBER AND SIZE
W8	L4x4x1/4	2	4 EA -⅝" DIA

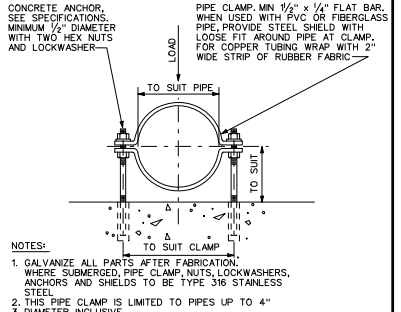
BEAM TO CONCRETE CONNECTION

REV 010201 — S-563



STAIR HANDRAIL

REV 010201 — S-510



NOTES:

1. GALVANIZE ALL PARTS AFTER FABRICATION. WHERE SUBMERGED, PIPE CLAMP, NUTS, LOCKWASHERS, ANCHORS AND SHIELDS TO BE TYPE 316 STAINLESS STEEL
2. THIS PIPE CLAMP IS LIMITED TO PIPES UP TO 4"
3. DIAMETER INCLUSIVE FOR ADDITIONAL REQUIREMENTS SEE SPECIFICATIONS SECTION 'PIPE SUPPORTS'

PIPE CLAMP

(FOR PIPE 4" DIAMETER AND SMALLER) — M-101

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED R.WARNER
DRAWN R.WARNER
CHECKED K.MARTIN

RECORD DRAWING

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MWH — Portland Oregon

South Fork Water Board
15982 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS

MECHANICAL/STRUCTURAL DETAILS

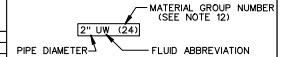
SHEET GM-02

Plot Date: 15-FEB-2007 File: ********** Job No: 1530509

PIPING SCHEDULE

FLUID ABBREVIATION	FUNCTION	PIPING MATERIALS (SEE SCHEDULE BELOW)				FIELD TEST REQUIREMENTS (SEE NOTE 3 AND NOTE 4)		
		EXPOSED PIPING (SEE NOTE 14)		BURIED PIPING (SEE NOTE 13)		MINIMUM TEST PRESSURE PSI	TEST MEDIUM	LEAKAGE ALLOWANCE (SEE NOTE 2)
		2 IN. DIA. AND SMALLER	2-1/2IN. DIA. AND LARGER	2 IN. DIA. AND SMALLER	2-1/2IN. DIA AND LARGER			
RW	RAW WATER, INSIDE	—	8	N/A	N/A	200	WATER	(A)
PW	POTABLE WATER	2, 24	8	N/A	N/A	150	WATER	(A)
FI	FILTER INFLUENT	—	8	N/A	N/A	25	WATER	(A)
RWL	RAIN WATER LEADER	4, 12	4, 12, 40	N/A	N/A	5	WATER	
CLS	CHLORINE SOLUTION	16	16	16	16	125	WATER	(A)
POL	LIQUID POLYMER	16	16	16	16	125	WATER	(A)
PA	PLANT AIR	7	7	7	7	250	AIR	(A) (D)
UW	UTILITY WATER	2, 24	2, 11	2, 24	2, 11, 19	125	WATER	(A)

TYPICAL PIPE DESIGNATION:



PIPING MATERIAL SCHEDULE (SEE NOTE 4)

GROUP NO.	PIPE (SEE NOTE 13)	FITTINGS	VALVES, 6 INCHES AND SMALLER (SEE NOTE 1, NOTE 11 AND NOTE 16)
1	STEEL, ASTM A53, SCHEDULE 40, BLACK WELDED.	2-1/2 INCH AND SMALLER, MALLEABLE IRON, ANSI B16.3, THREADED, BANDED, BLACK, 150 PSI OR STEEL, ANSI B16.9, BUTT-WELDED. 3 INCH AND LARGER, CAST IRON, ANSI B16.1, 125 PSI FLANGED OR MECHANICAL COUPLINGS.	BRONZE, THREADED, GATE, CRANE NO. 428 UB OR STOCKHAM B-105, GLOBE, CRANE NO. 14-1/2P OR STOCKHAM B-29, CHECK, CRANE NO. 37 OR STOCKHAM B-319. STEEL, LUBRICATED PLUG, ROCKWELL FIG. 142 OR 143 OR POWELL FIG 2200 OR 2201, ECCENTRIC PLUG, DEZURIK SERIES 118 OR KEYSTONE 1512. BALL, JENKINS NO.900T OR JAMESBURY FIG.351
2	STEEL, ASTM A53, SCHEDULE 40 WELDED, GALVANIZED.	2-1/2 INCH AND SMALLER, MALLEABLE IRON, ANSI B16.3, THREADED, BANDED, GALVANIZED 150 PSI. 3 INCH AND LARGER, CAST IRON, ANSI B16.1, 125 PSI FLANGED OR WELDED.	2-1/2 INCH AND SMALLER, ECCENTRIC PLUG, SYNTHETIC RUBBER FACED, DEZURIK 118S OR HOMESTEAD 1512. BALL, JENKINS NO. 900T OR JAMESBURY FIG. 351 3 INCH AND LARGER, ECCENTRIC PLUG, SYNTHETIC RUBBER FACED, DEZURIK 118F OR KEYSTONE 1522 OR 1532 EWG. GATE, AWWA C500. BUTTERFly - Flg., AWWA, FLANGED.
4	SAME AS GROUP NO. 1	CAST IRON, ANSI B16.12, THREADED DRAINAGE PATTERN	---
6	STEEL, ASTM A106, OR A53, SCHEDULE 40, SEAMLESS, BLACK.	STEEL, ANSI B16.9, BUTT-WELDED. CAST IRON, ANSI B16.1, 125 PSI, FLANGED. FORGED STEEL, SOCKET WELDED, ANSI B16.11, 2000 PSI OR STEEL, ANSI B16.5, 150 PSI FLANGED.	CAST IRON, FLANGED, LUBRICATED PLUG ROCKWELL FIG 143 OR POWELL FIG 2201.
8	WELDED STEEL, AWWA C200, EPOXY LINED AND PAINTED	WELDED STEEL PIPE - COATING SAME AS PIPE, AWWA C200, C205, C208	AS INDICATED ON DRAWINGS
11	DUCTILE IRON, ANSI A21.51, (AWWA C150) CLS2 BELL AND SPIGOT, MECHANICAL JOINTS, MECHANICAL COUPLINGS, OR FLANGED (TYPICAL SERVICE - WATER LINES)	DUCTILE IRON OR , ANSI A21.10, OR AWWA C110, BELL AND SPIGOT, MECHANICAL COUPLINGS, FLANGED OR MECHANICAL JOINTS, 250 PSI, (PRESSURE RATING)	GATE, AWWA C500, 'O' RING SEALS, MECHANICAL JOINTS ENDS, MUELLER A-2380-20, OR EDDY-IOWA (CLOW) F-5155. BUTTERFLY - Flg., AWWA. ECCENTRIC PLUG, DEZURIK SERIES 118 OR KEYSTONE 1512, OR BALL, PRATT OR W-K-M.
12	CAST IRON SOIL, ANSI/ASTM A-74, SERVICE WEIGHT, BELL AND SPIGOT OR HUBLESS. AT THE OPTION OF THE CONTRACTOR, DUCTILE IRON, (GROUP 11) MAY BE SUBSTITUTED	CAST IRON SOIL, ANSI/ASTM A-74, SERVICE WEIGHT, BELL AND SPIGOT OR HUBLESS. AT THE OPTION OF THE CONTRACTOR, DUCTILE IRON (GROUP NO.11) MAY BE SUBSTITUTED.	AS INDICATED ON DRAWINGS
16	POLYVINYL CHLORIDE, SCHEDULE 80, NORMAL IMPACT. ASTM D1785	POLYVINYL CHLORIDE, SCHEDULE 80, NORMAL IMPACT, SOCKET SOLVENT WELD JOINTS, ASTM D2467.	POLYVINYL CHLORIDE, BALL, DIAPHRAGM, BUTTERFLY, BALL OR LIFT CHECK. CHEMTROL, HILLS-MCCANNA OR GSR-R.G. SLOAN CO.
24	COPPER, ASTM B88, TYPE K, SOFT TEMPERED WHERE BURIED HARD TEMPERED WHERE EXPOSED	WROUGHT COPPER OR CAST BRONZE, ANSI B16.22, SOLDER JOINT, 150 PSI, OR COMPRESSION FITTINGS (FOR OXYGEN PIPING USE SILVER SOLDER, FOR COMPRESSED AIR, USE 95-5 TIN-ANTIMONY SOLDER)	BRONZE, SOLDER JOINT, GLOBE: CRANE *1310 OR STOCKHAM B-14T. CHECK: CRANE *134 2 OR 36, OR STOCKHAM B-309 OR B-345. GATE: CRANE *426 OR STOCKHAM B-104 OR B-105.
40	ABS SOLID PIPE, SCH 40 HIGH IMPACT ASTM D2661.	ABS SCH 40, HIGH IMPACT, SOCKET SOLVENT WELD JOINTS	---

NOTES

NOTE 1
PROPRIETARY NAMES HAVE BEEN QUOTED FOR IDENTIFICATION PURPOSES ONLY. SUBSTITUTIONS WILL BE PERMITTED SUBJECT TO PROVISIONS OF THE SPECIFICATIONS.

NOTE 2
LEAKAGE ALLOWANCE IS AS FOLLOWS:
(A) PIPES SO DESIGNATED SHALL SHOW ZERO LEAKAGE.
(B) PIPES SO DESIGNATED SHALL SHOW ZERO LEAKAGE FOR UNBURIED PIPE AND NOT MORE THAN 0.02 GALLON PER HOUR PER INCH DIAMETER PER 100 FEET OF BURIED PIPE.
(C) PIPES SO DESIGNATED SHALL NOT SHOW A LEAKAGE OF MORE THAN 0.15 GALLON PER HOUR PER INCH OF DIAMETER PER 100 FEET OF PIPE.
(D) PIPES SO DESIGNATED SHALL NOT SHOW A LOSS OF PRESSURE OF MORE THAN 5 PERCENT.

NOTE 3
FOR FIELD TEST PROCEDURES AND ADDITIONAL TEST REQUIREMENTS, SEE PIPING SECTION OF SPECIFICATIONS.

NOTE 4
ANY DEVIATION FROM THE PIPING MATERIALS OR FIELD TEST REQUIREMENTS SHOWN WILL BE NOTED IN THE SPECIFICATIONS OR ON THE DRAWINGS. THE VALVE TYPE SHOWN SHALL TAKE PRECEDENCE OVER THIS TABLE.

NOTE 5
PIPING GROUP NUMBER SHOWN THUSSHALL BE INSULATED, SEE PIPING SECTION OF SPECIFICATIONS FOR INSULATING MATERIALS.

NOTE 6
STATIC WATER TEST WITH SURFACE 5 FEET ABOVE HIGH POINT OF PIPE.

NOTE 7
INSPECTION AND TESTING SHALL BE IN ACCORDANCE WITH APPLICABLE PLUMBING CODE.

NOTE 8
NO APPARENT LEAKS UNDER NORMAL OPERATING CONDITIONS.

NOTE 9
NOT USED

NOTE 10
PIPING MATERIALS SHALL BE IN ACCORDANCE WITH NATIONAL FIRE PROTECTION ASSOCIATION STANDARDS.

NOTE 11
FOR VALVES 8 INCHES AND LARGER SEE VALVE SCHEDULE. FOR SPECIAL VALVES SEE SPECIFICATIONS.

NOTE 12
CHANGE IN PIPING MATERIAL GROUP NUMBER IS INDICATED THUS: ——◆

NOTE 13
FOR PIPE LINING AND COATING, SEE SPECIFICATIONS.

NOTE 14
EXPOSED PIPING SHALL BE PAINTED IN ACCORDANCE WITH SPECIFICATIONS. COLORS TO BE SELECTED BY ENGINEER.

NOTE 15
CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL NUTS, BOLTS, WASHER, ETC. NECESSARY FOR THE INSTALLATION OWNER-FURNISHED VALVES.

NOTE 16
VALVES 2- 1/2 INCH AND SMALLER MAY HAVE SCREWED ENDS
VALVES 3 INCH AND LARGER SHALL HAVE FLANGED ENDS, UNLESS OTHERWISE SHOWN OR SPECIFIED.

NOTE 17
(NOT USED)

EQUIPMENT SCHEDULES

VALVE SCHEDULE

VALVE	LOCATION	SERVICE	TYPE	SIZE	VALVE CLASS	ACTUATOR	REMARKS
V-1B	WTP-FILTER*1 INLET	FILTER INFLUENT	BUTTERFLY-WAFER	18"	ANSI 125	ELEC O/C-480V 3P	With Remote Valve Control Station
V-2B	WTP-FILTER*2 INLET	FILTER INFLUENT	BUTTERFLY-WAFER	18"	ANSI 125	ELEC O/C-480V 3P	With Remote Valve Control Station
V-3B	WTP-FILTER*3 INLET	FILTER INFLUENT	BUTTERFLY-WAFER	18"	ANSI 125	ELEC O/C-480V 3P	With Remote Valve Control Station
V-4B	WTP-FILTER*4 INLET	FILTER INFLUENT	BUTTERFLY-WAFER	18"	ANSI 125	ELEC O/C-480V 3P	With Remote Valve Control Station
V-06	WTP-F.I. ISOLATION	FILTER INFLUENT	BUTTERFLY-WAFER	24"	ANSI 125	MANUAL HW	
V-07	WTP-F.I. ISOLATION	FILTER INFLUENT	BUTTERFLY-WAFER	24"	ANSI 125	MANUAL HW	
V-5A	RW INTAKE-PUMP CHECK	RAW WATER	SWING CHECK	16"	CLASS 250	W/ LIMIT SWITCH	Oil Controlled Bottom Buffer
V-5B	RW INTAKE-PUMP ISO.	RAW WATER	BUTTERFLY-FLANGED	16"	CLASS 250	MANUAL HW	
V-990	DIV. ST.-MTN VIEW RES ISO.	POTABLE WATER	EXISTING BFV-BURIED	24"	EXISTING	ELEC O/C 240V 3P	With Remote Valve Control Station
						DELETED FROM CONTRACT	AND NOT CONSTRUCTED

PUMP SCHEDULE

PUMP	LOCATION	SERVICE	TYPE	GPM	TDH (ft)	HP	REMARKS
P-5	RW INTAKE PUMP	RAW WATER	VERTICAL TURBINE	7400	350	800	WITH 4160V VFD
P-2	DIVISION ST. P.S.	POTABLE WATER	VERTICAL TURBINE	7000	215	500	WITH 4160V VFD (REMOVE EXIST. PUMP)

MISC. EQUIPMENT SCHEDULE

EQUIPMENT NO.	LOCATION	SERVICE	TYPE	SIZE	COMMENTS
FE-010	WTP-RAW WATER LINE	RAW WATER	MAGNETIC FLOWMETER (W/REMOTE XMTR)	24"	REMOVE EXISTING 20"

DESIGN CRITERIA

WATER TREATMENT PLANT

MAXIMUM FLOW FOR SUMMER PEAKING = 23 TO 25 MGD
FLOCCULATION TIME @ 25 MGD = 14.0 MINUTES
SEDIMENTATION TIME @ 25 MGD = 70.0 MINUTES
FILTRATION RATE (WITH ALL 4 FILTERS) = 4.9 gpm/sf

MAXIMUM FLOW DURING WINTER = 15 MGD
FLOCCULATION TIME @ 15 MGD = 23.0 MINUTES
SEDIMENTATION TIME @ 15 MGD = 117.0 MINUTES
FILTRATION RATE (WITH ALL 4 FILTERS) = 2.9 gpm/sf

MINIMUM FLOW = 10 MGD

ULTIMATE FLOW = 30 MGD

MINIMUM FILTER INFLUENT CHLORINE RESIDUAL = 0.2 mg/L

CLACKAMAS RIVER INTAKE/PUMP STATION

CURRENT MAXIMUM FLOW = 25 MGD (38.6 CFS) WITH EXISTING 27-INCH RAW WATER PIPELINE
FIRM FLOW = 30 MGD (46.4 CFS) WITH ONE 800 HP PUMP OUT OF SERVICE, WITH NEW RAW WATER PIPELINE
ULTIMATE FIRM FLOW = 42.6 MGD (65.9 CFS) WITH FIVE 800 HP PUMPS, WITH NEW RAW WATER PIPELINE

DIVISION STREET PUMP STATION

CURRENT DESIGN FLOW = 16.0 MGD (25 CFS) WITH TWO 600 HP PUMPS OPERATING
ULTIMATE DESIGN FLOW = 32.0 MGD (50 CFS) WITH FIVE 600 HP PUMPS TOTAL

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED R.WARNER
DRAWN R.WARNER
CHECKED P.KREFT

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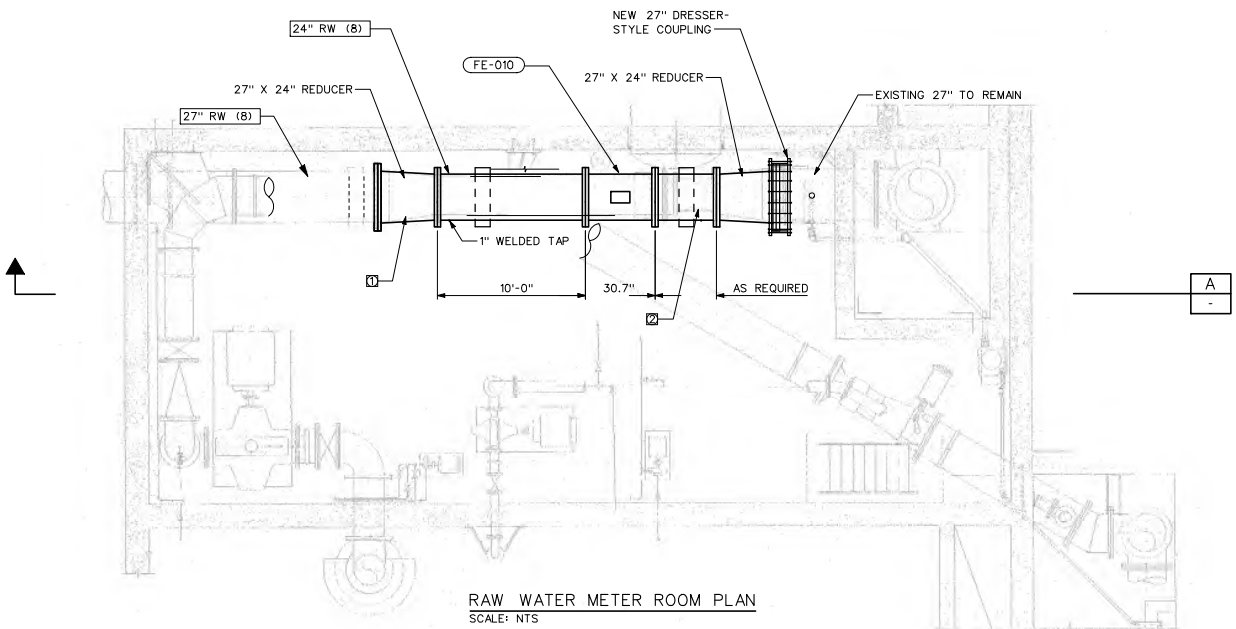
MWH
Portland Oregon

South Fork Water Board
16982 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS
PIPE AND EQUIPMENT SCHEDULES AND DESIGN CRITERIA

SHEET M-01

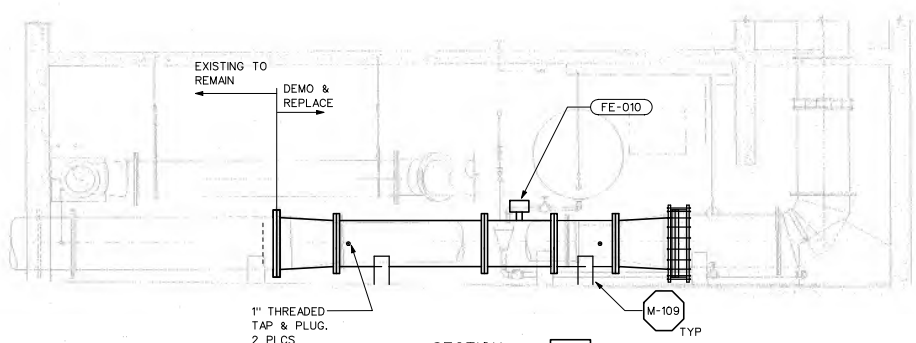
Plot Date: 15-FEB-2007 Time: 08:28
File: \\\\



RAW WATER METER ROOM PLAN
SCALE: NTS

NOTES:

1. REMOVE AND DISPOSE OF EXISTING 27" X 20"REDUCERS, 20" PIPE, EXISTING COUPLING, & PIPE SUPPORTS.
2. REMOVE EXISTING 20" MAGNETIC FLOW METER, CABLE, XMTTR & RETURN TO OWNER.
3. PLANT SHUTDOWN AND RW LINE DEWATERING TO BE COORDINATED WITH THE OWNER. SEE SECT 01313
4. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS PRIOR TO SHOP DRAWING SUBMITTALS
5. INSTALL NEW FLOW METER FACTORY CABLE AND NEW TRANSMITTER FOR FLOW METER. CONTRACTOR SHALL VERIFY LENGTH OF EXISTING FACTORY CABLE PRIOR TO SUBMITTING FLOW METER SHOP DRAWINGS. REFER TO SHEET E-01 FOR ELECTRICAL REQUIREMENTS FOR NEW FLOW METER.
6. PAINT NEW PIPING-SHERWIN WILLIAMS COROTHANE II MOISTURE CURE POLYEURTHANE, TO MATCH EXISTING.



SECTION A
SCALE: NTS

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN C.KITTS
CHECKED P.KREFT

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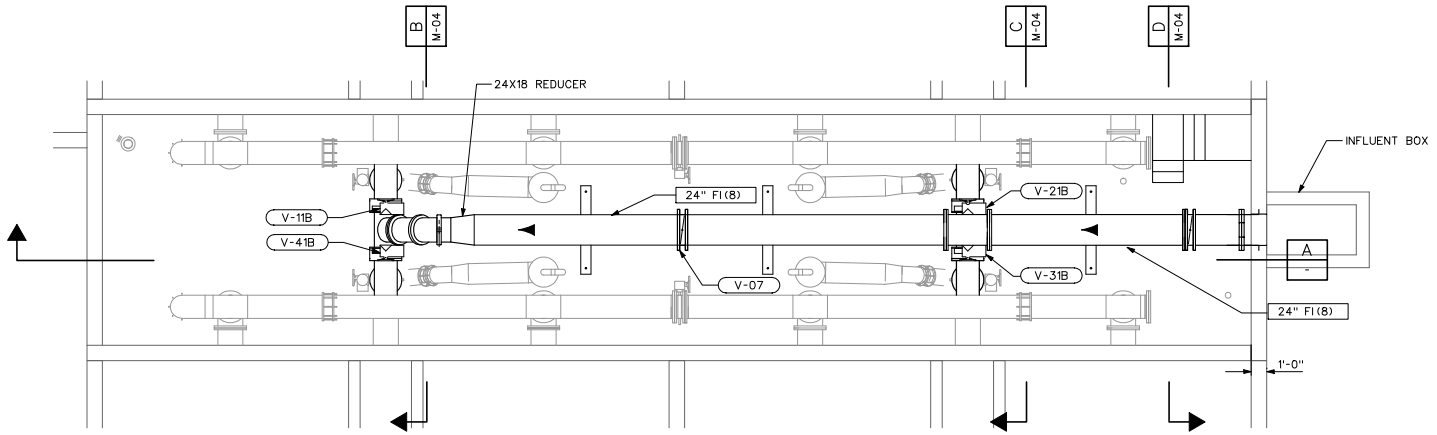
2004 SYSTEM CAPACITY IMPROVEMENTS
WTP RAW WATER METER ROOM PLAN AND SECTION

SHEET M-02

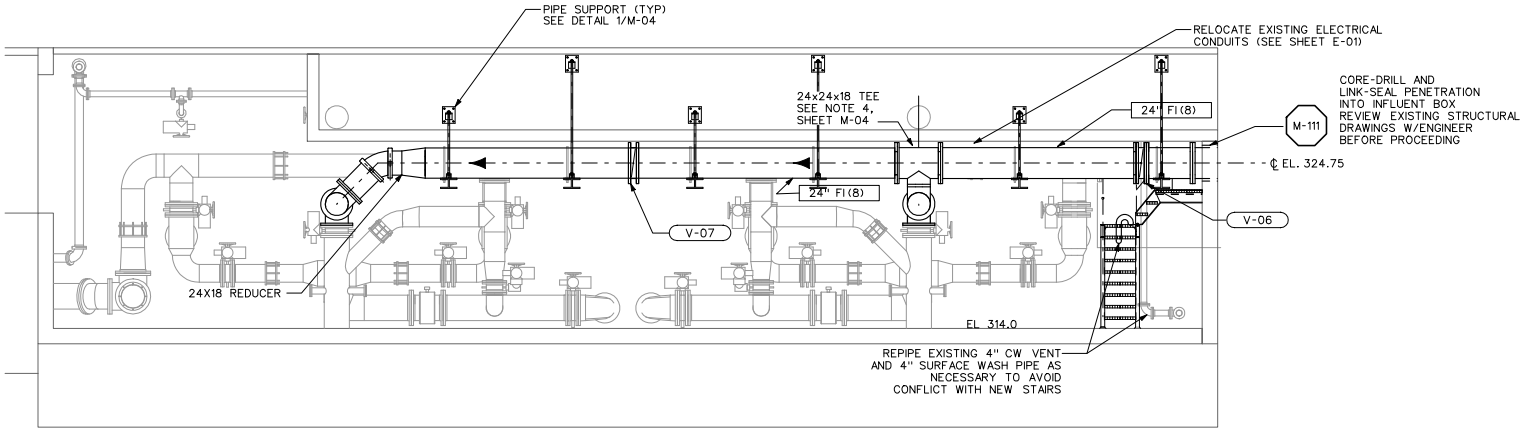
Job No: 1530509 File: $$$$directory/filename$$$$ Plot Date: 15-FEB-2007

NOTES

1. DEMO EXISITNG SOUTH GALLERY STAIRS



FILTER GALLERY INTERMEDIATE PLAN
SCALE: 1/4" = 1'-0"



SECTION A
SCALE: 1/4" = 1'-0"

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN J.SCHULZ
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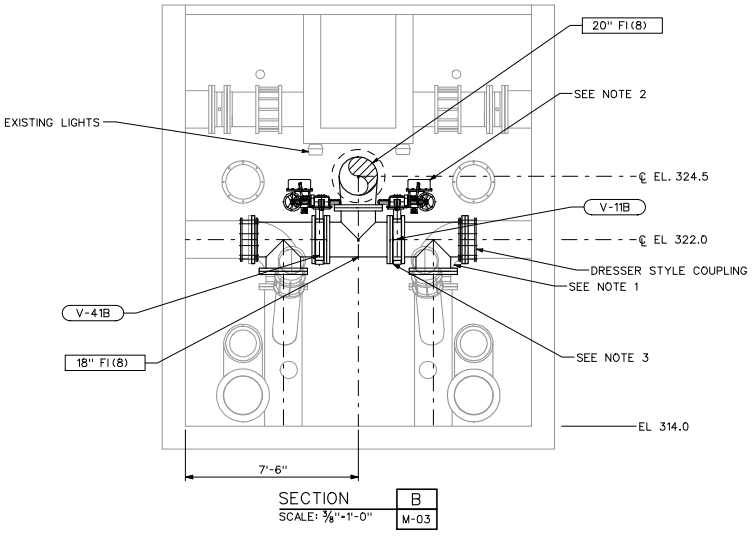
2004 SYSTEM CAPACITY IMPROVEMENTS
WTP FILTER INFLUENT PIPE
PLAN AND SECTION

SHEET M-03

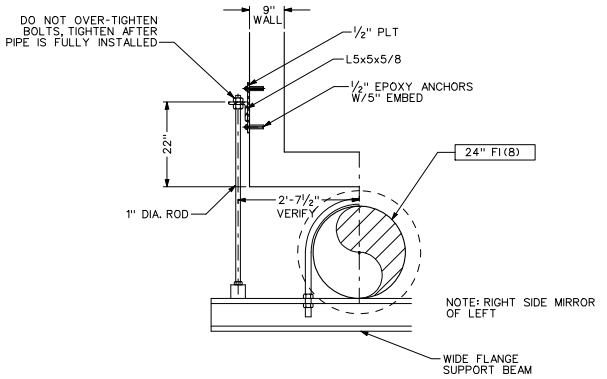
Job No: 1530509
File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$
Plot Date: Plot Date: 15-FEB-2007 [illegible]

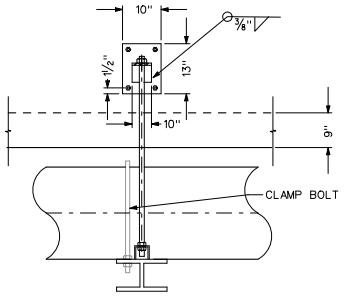


SECTION B
SCALE: 3/8"=1'-0" M-03

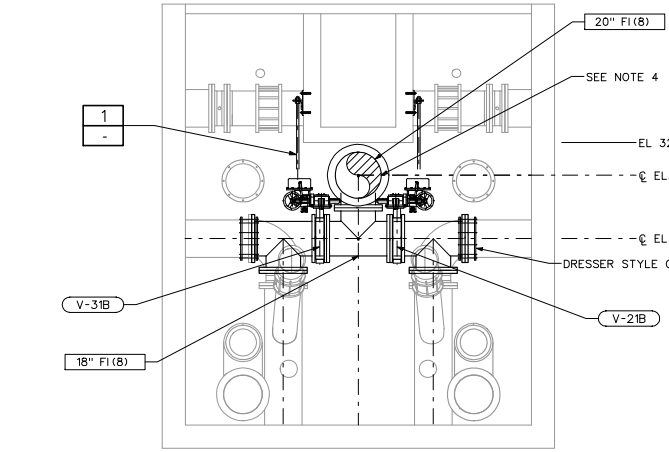
NOTES:

1. CONTRACTOR SHALL REMOVE AND DISPOSE OF EXISTING 18" DI 90'S AT WASHWATER OUTLETS AND REPLACE WITH NEW FABRICATED STEEL TEES. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS ON EXISTING PIPES PRIOR TO PIPE SUBMITTALS AND FABRICATION.
2. CONTRACTOR SHALL COORDINATE ORIENTATION OF ACTUATORS TO AVOID INTERFERENCES.
3. PROVIDE CUSTOM FABRICATED SPACER FLANGES BETWEEN TEES AND VALVES, THICKNESS AS NECCESARY. TYP.
4. CUSTOM-FABRICATED 24" X 24" X 18" WSP TEE. MAX 17" ℄ TO FLANGE OF 18" OUTLET TO MAINTAIN PIPE CENTERLINE ELEVATION OF 324.75.
5. REPIPE EXISTING 4" CLEARWELL VENT AND 4" SURFACE WASH PIPING AS NECCESSARY TO AVOID CONFLICT WITH NEW STAIRS AND LANDING.
6. PAINT NEW PIPING & SUPPORTS WITH SHERWIN-WILLIAMS COROTHANE II MOISTURE CURED POLYEURTHANE, TO MATCH EXISTING.

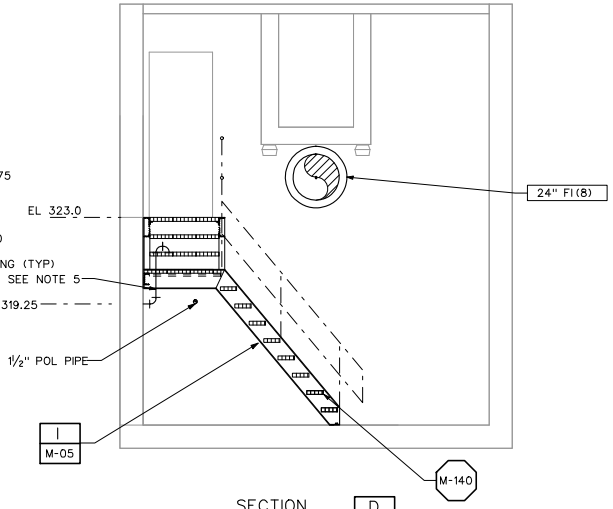




PIPE SUPPORT HANGERS 1 / -



SECTION C
SCALE: 3/8"=1'-0" M-03



SECTION D
SCALE: 3/8"=1'-0" M-03

R	1/26/07	RAW	RECORD DRAWINGS
REV	DATE	BY	DESCRIPTION

SCALE: AS SHOWN

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED R.WARNER
DRAWN J.SCHULZ
CHECKED P.KREFT K.MARTIN

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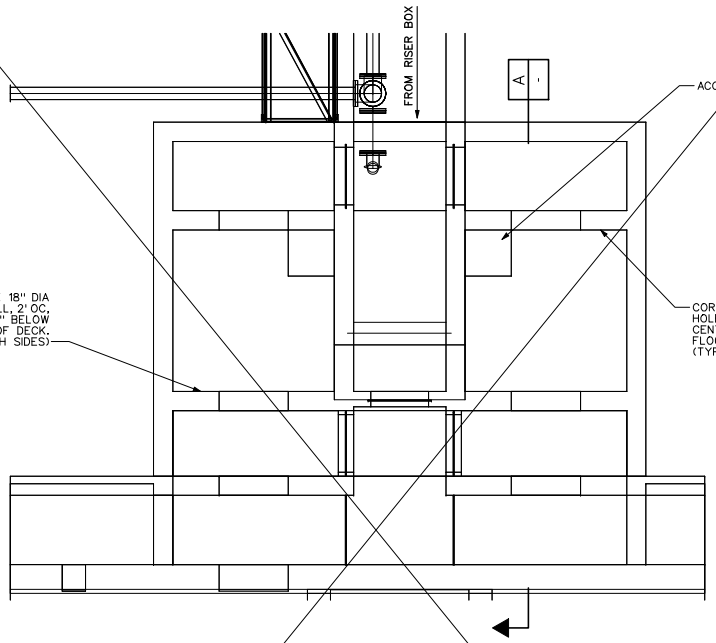
2004 SYSTEM CAPACITY IMPROVEMENTS
WTP FILTER INFLUENT PIPE SECTIONS AND DETAILS

SHEET M-04

Job No: 1530509
File: ##########directory\filename##########
Plot Date: Plot Date: 15-FEB-2007

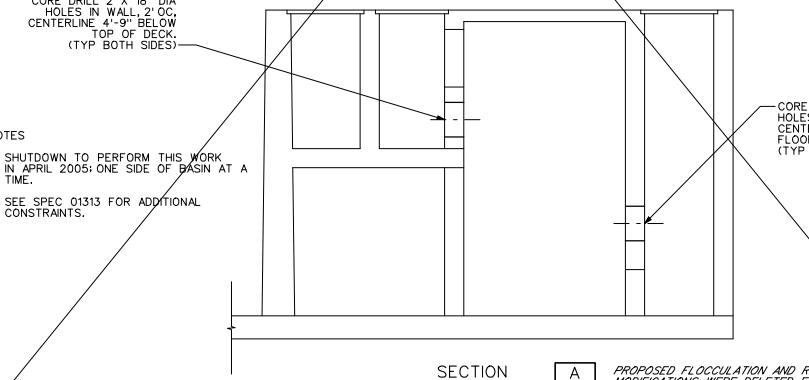
FLOCCULATION AND RAPID MIX BASIN MODIFICATIONS

ALTERNATIVE BID ITEM



FLOCCULATION AND RAPID MIX BASIN PLAN

SCALE: 3/8" = 1'-0"



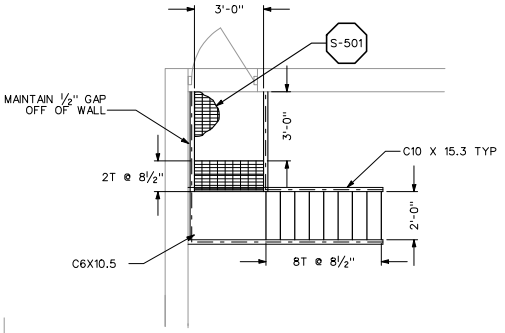
NOTES

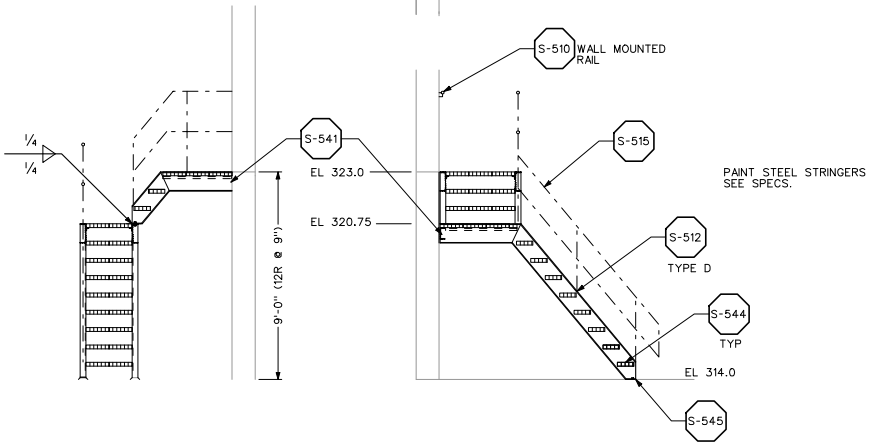
1. SHUTDOWN TO PERFORM THIS WORK IN APRIL 2005; ONE SIDE OF BASIN AT A TIME.
2. SEE SPEC 01313 FOR ADDITIONAL CONSTRAINTS.

SECTION A

SCALE: 3/8" = 1'-0"

PROPOSED FLOCCULATION AND RAPID MIX MODIFICATIONS WERE DELETED FROM CONTRACT AND NOT CONSTRUCTED. THESE DETAILS WERE PURPOSELY LEFT IN THE RECORD DRAWINGS FOR PROJECT "MEMORY".





PIPE GALLERY SOUTH STAIRS | I

SCALE: 3/8" = 1'-0" | M-04

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

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DRAWN R.WARNER

CHECKED P.KREFT K.MARTIN

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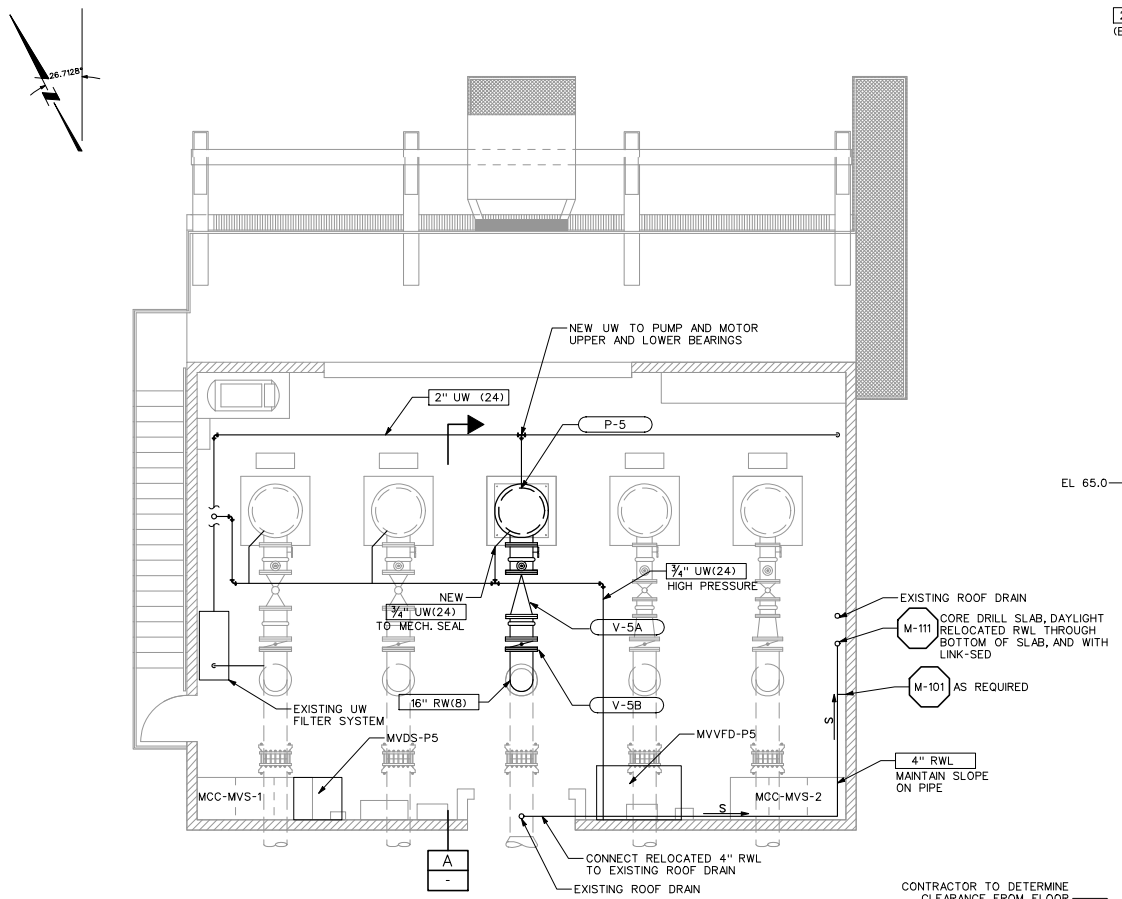
2004 SYSTEM CAPACITY IMPROVEMENTS
WTP FLOCCULATION AND RAPID MIX BASIN MODIFICATIONS AND DETAILS

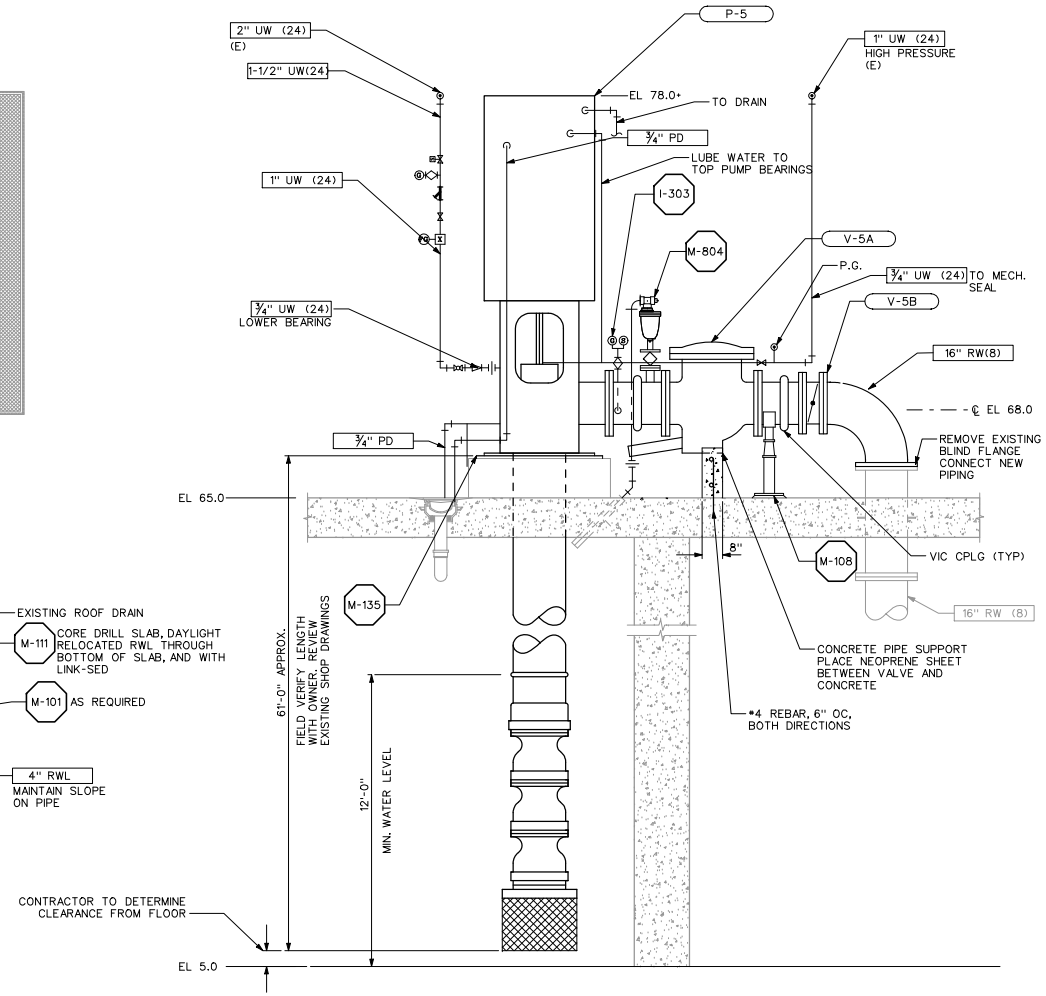
SHEET M-05

Job No: 1530509

File: ***\



PUMP ROOM PLAN
SCALE: ¼"=1'-0"



PUMP SECTION A
SCALE: ½"=1'-0"

NOTES:

1. TIE IN NEW PUMP TO EXISTING DISCHARGE HEADER WILL REQUIRE COMPLETE STATION SHUTDOWN AND DEWATERING OF A PORTION OF THE RW LINE. COORDINATE SHUTDOWN WITH OWNER AND ENGINEER.
2. CONTRACTOR SHALL COORDINATE VFD ANCHORAGE REQUIREMENTS WITH VFD MANUFACTURER.
3. SEE SHEET C-02 FOR ADDITIONAL CONSTRAINTS.
4. MIMIC UTILITY WATER PIPING AND CONNECTIONS FOR LUBRICATION & SEAL WATER AS PER P-1 & P-2. CONFIRM CONFIGURATION WITH PUMP SUPPLIER.

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

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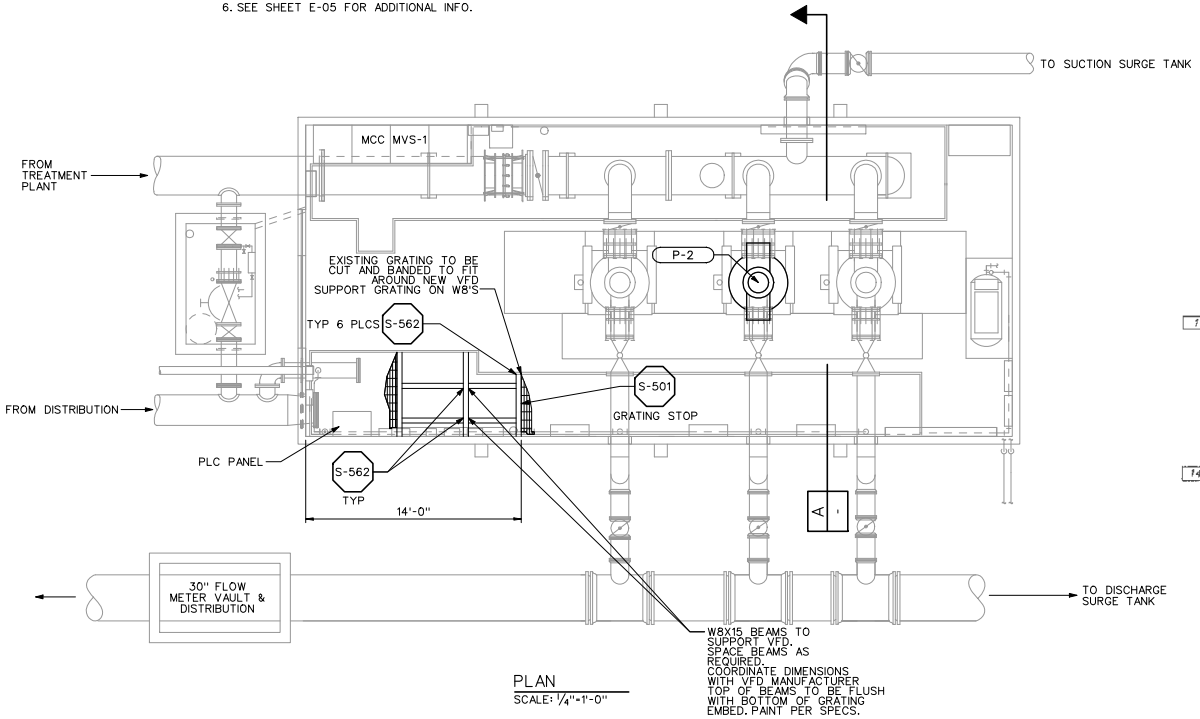
2004 SYSTEM CAPACITY IMPROVEMENTS
INTAKE/PUMP STATION PLAN AND SECTION

SHEET M-06

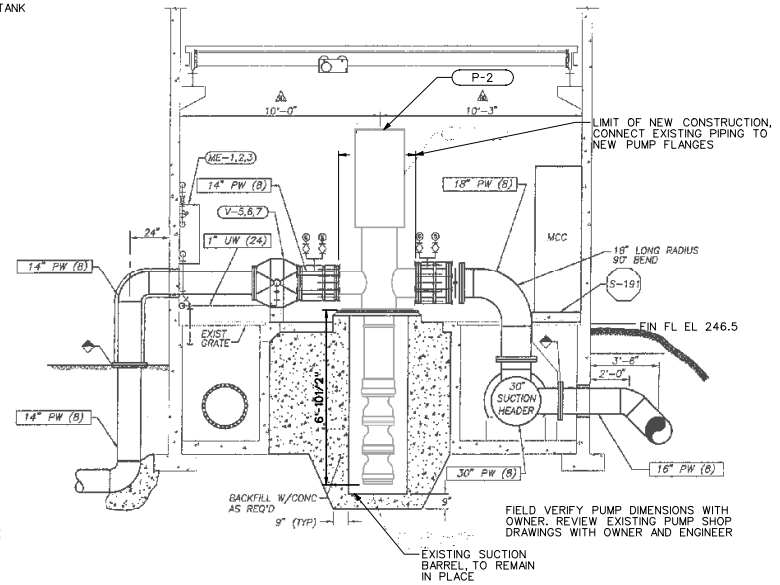
Job No: 1530509
File: $$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$
Plot Date: Plot Date: 15-FEB-2007 Time: 12:29

NOTES:

1. CONTRACTOR SHALL DISCONNECT PIPING AND APPURTANCES ON PUMP P-2 TO ALLOW REMOVAL OF EXISTING PUMP AND MOTOR.
2. CONTRACTOR SHALL REMOVE EXISTING PUMP P-2 AND TRANSPORT TO THE OLD SFWB INTAKE FOR STORAGE. PUMP AND MOTOR SHALL BE DISCONNECTED AND MOTOR STORED UPRIGHT.
3. CONTRACTOR SHALL INSTALL NEW PUMP AND MOTOR P-2. IT IS INTENDED THAT ALL PIPE, FITTINGS, AND APPUTANCES BE RECONNECTED AND REUSED. CONTRACTOR SHALL COORDINATE PUMP DIMENSIONS TO MATCH EXISTING.
4. CONTRACTOR SHALL COORDINATE ANCHORAGE OF VFD TO SUPPORT BEAMS WITH VFD MANUFACTURER.
5. PAINT PUMP, PIPING, AS REQUIRED TO MATCH EXISTING.
6. SEE SHEET E-05 FOR ADDITIONAL INFO.



PLAN
SCALE: 1/4"=1'-0"



SECTION A
NTS

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

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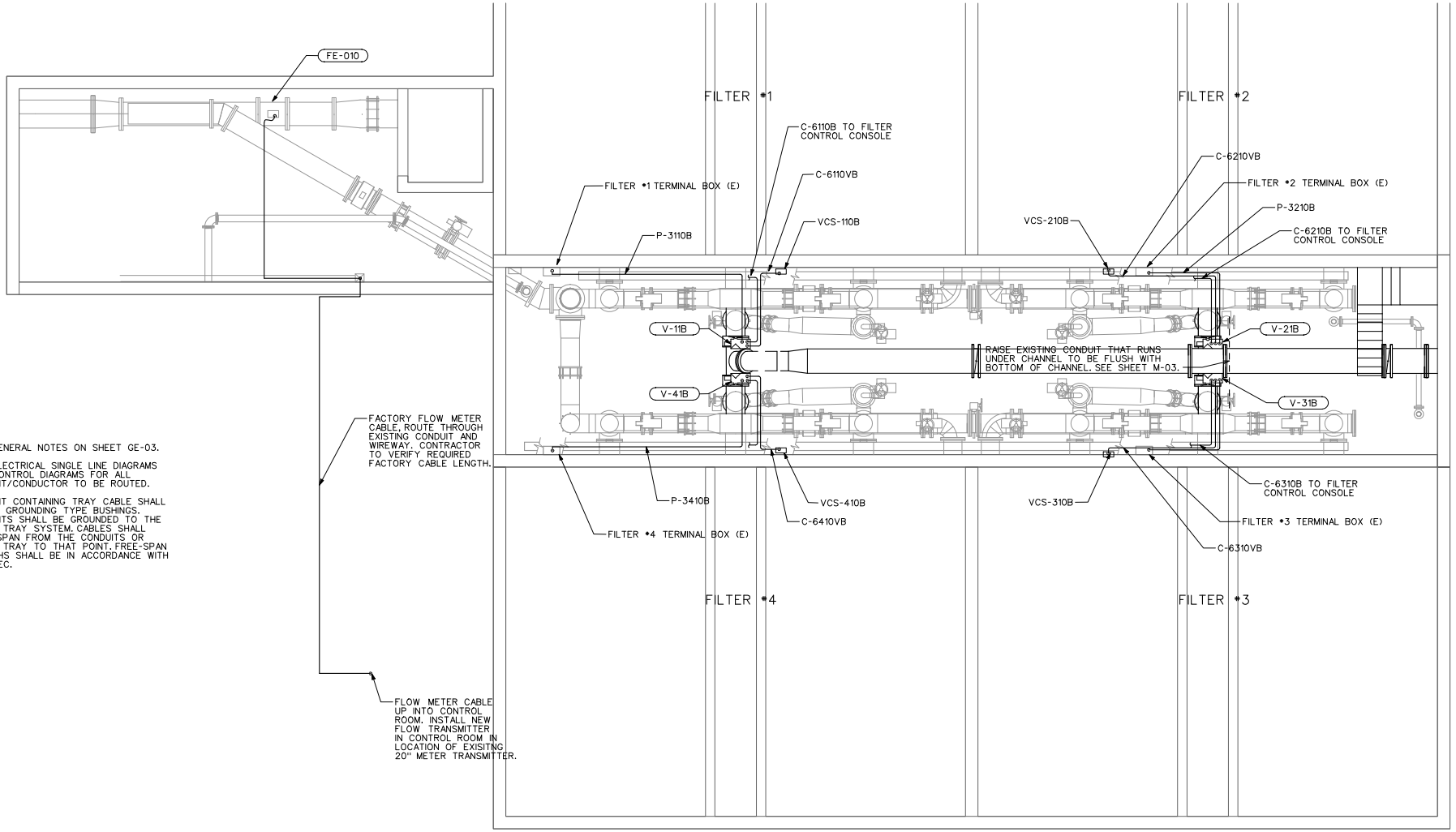
2004 SYSTEM CAPACITY IMPROVEMENTS
DSPS PLAN AND DETAILS

SHEET M-07

Job No: 1530509
File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$
Plot Date: Plot Date: 15-FEB-2007



NOTES:

1. SEE GENERAL NOTES ON SHEET GE-03.
2. SEE ELECTRICAL SINGLE LINE DIAGRAMS AND CONTROL DIAGRAMS FOR ALL CONDUIT/CONDUCTOR TO BE ROUTED.
3. CONDUIT CONTAINING TRAY CABLE SHALL END IN GROUNDING TYPE BUSHINGS. CONDUITS SHALL BE GROUNDED TO THE CABLE TRAY SYSTEM. CABLES SHALL FREE-SPAN FROM THE CONDUITS OR CABLE TRAY TO THAT POINT. FREE-SPAN LENGTHS SHALL BE IN ACCORDANCE WITH THE NEC.

Job No: 1530509 File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$ Plot Date: Plot Date: 15-FEB-2007 [illegible]

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE 1/4" = 1'-0"

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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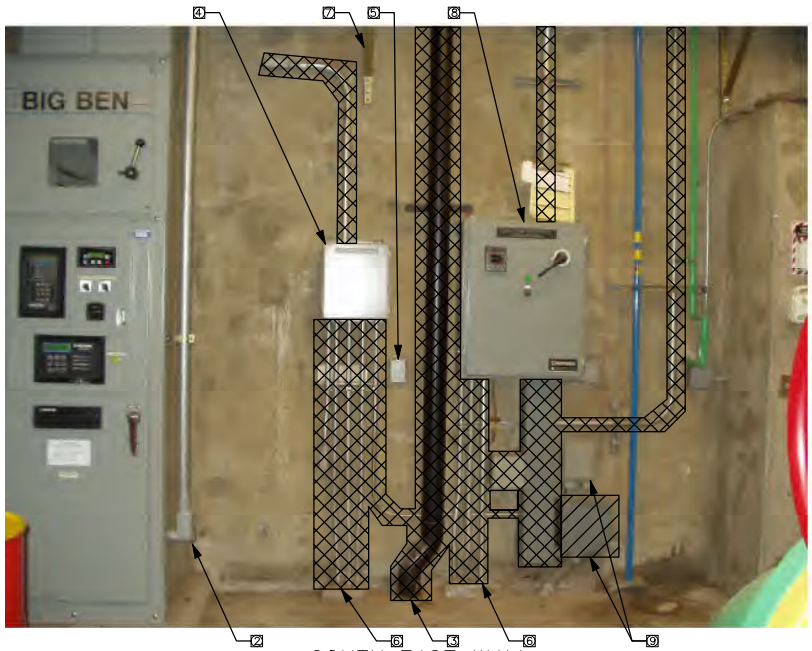
2004 SYSTEM CAPACITY IMPROVEMENTS

WTP ELECTRICAL PLAN, NOTES AND DETAILS

SHEET E-01



SOUTH EAST WALL
ELECTRICAL DEMOLITION



REMOVE EXISTING CONDUIT AND WIRING BETWEEN MCC MVS-1 AND PLC TO ALLOW INSTALLATION OF NEW MVDS-P5. INSTALL NEW CONDUIT MVS1-PLCC5 TO REPLACE EXISTING AND CONTAIN NEW WIRES FROM MVDS-P5. SEE NOTE 1, SHEET E-04.

SOUTH WEST WALL
ELECTRICAL DEMOLITION

NOTES:

1. ALL EQUIPMENT MOVED/DISTURBED/MODIFIED SHALL BE THOROUGHLY DOCUMENTED BEFORE ANY WIRES ARE DISCONNECTED OR DISTURBED. DOCUMENTATION SHALL INCLUDE ALL WIRING AND TERMINATIONS TO BE MOVED/ DISTURBED/MODIFIED AND WIRE TYPE, WIRE COLOR, AND TERMINAL NUMBERS AT EACH END.

2. DISCONNECT CONTROL WIRING IN BENSHAW UNITS AND PULL BACK TO CONDUIT. REPLACE EXISTING LB CONDUIT WITH NEW LL TO ALLOW CONDULET COVER TO FACE TOWARDS THE ROOM. RETERMINATE WIRES.

3. DEMO EXISTING RAINWATER LEADER. CUT FLUSH WITH SLAB. FILL PENETRATION WITH GROUT. SEE MECHANICAL FOR PIPE RELOCATION.

4. RELOCATE HEAT TRACE CONTACTOR PANEL, PROVIDE NEW CONDUIT, WIRE, ETC. SEE SHEET E-03 FOR NEW LOCATION. SEE NOTE 1 ON THIS SHEET.

5. REMOVE EXISTINIG RECEPT. AND COVER. SAFETY-OFF EXISTING POWER CONDUCTORS AND INSTALL BLANK COVER.

6. DEMO EXISTING CONDUITS THROUGH SLAB AFTER DEVICES RELOCATED. PLUG ABANDONED CONDUITS.

7. RELOCATE EXISTING UNISTRUT CONDUIT SUPPORT TO ALLOW VERTICAL CLEARANCE OF NEW VFD.

8. RELOCATE SURGE TANK CONTROL PANEL. PROVIDE NEW CONDUIT, WIRE, ETC. SEE SHEET E-03 FOR NEW LOCATION. SEE NOTE 1 ON THIS SHEET.

9. DEMO EXISTING METAL J-BOX FROM AROUND EXISTING TELEPHONE LINE. LEAVE EXISTING FLOOR PENETRATION, RELOCATE TELEPHONE TERMINAL BOX, AND EXISTING CABLE TO CLEAR VFD.

Job No: 1530509 File: $$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$ Plot Date: Plot Date: 15-FEB-2007 Plot Date: 15-FEB-2007 Plot Date: 15-FEB-2007

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NTS

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN C.KITTS
CHECKED R SCHUBACH

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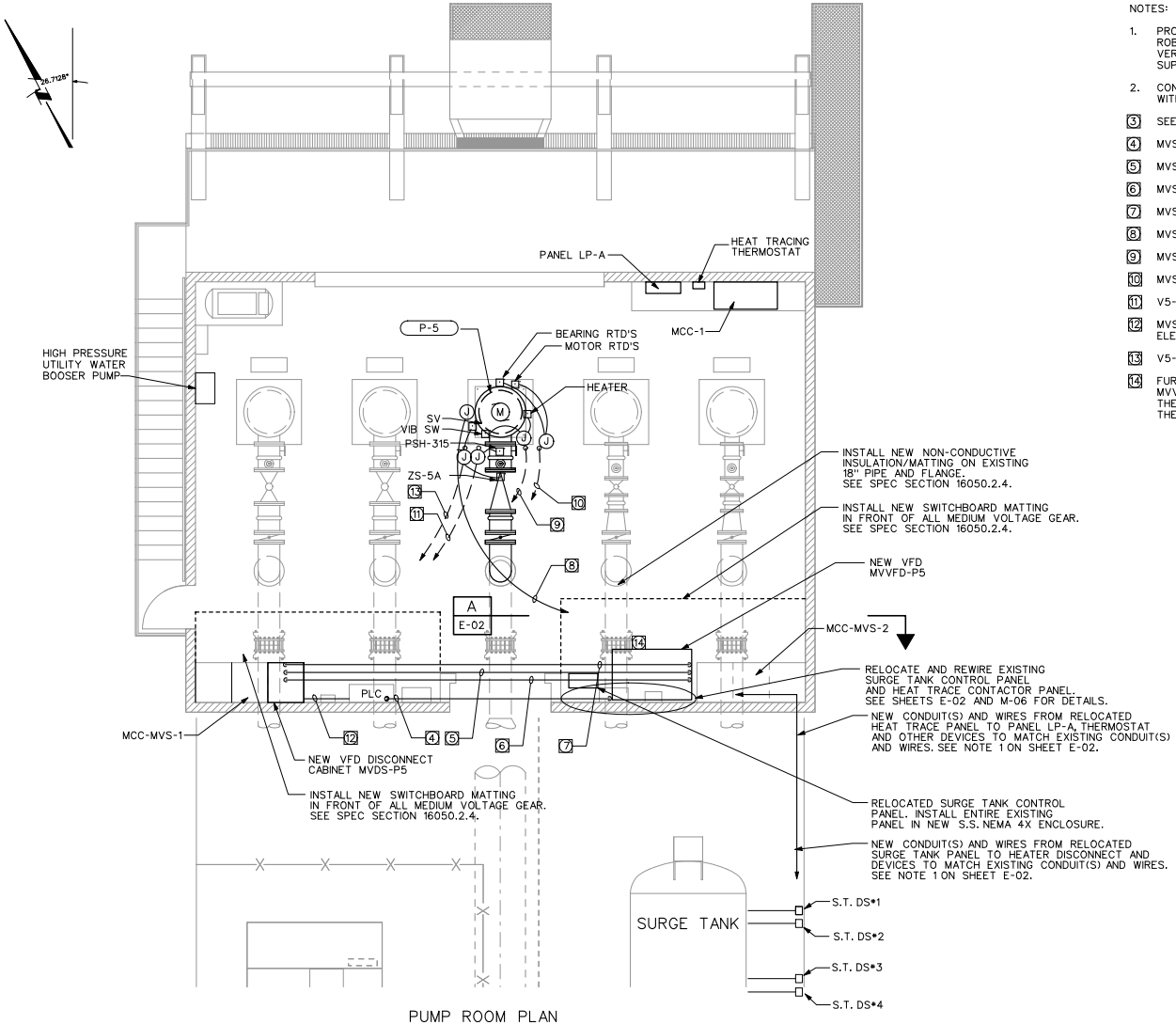
2004 SYSTEM CAPACITY IMPROVEMENTS
INTAKE PUMP STATION
DEMOLITION/RELOCATION
NOTES AND DETAILS

SHEET E-02

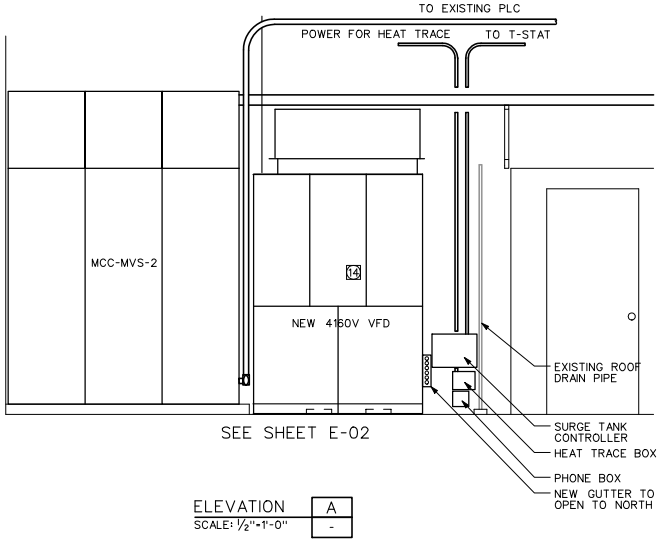


PUMP ROOM PLAN
SCALE: 1/4"=1'-0"

NOTES:

1. PROPOSED VFD LOCATION AND DEVICE RELOCATION BASED UPON ROBICON MICROHARMONY VFD EQUIPMENT. CONTRACTOR SHALL VERIFY/ADJUST RELOCATED DEVICES BASED UPON DIMENSIONS OF SUPPLIED VFD. SEE SHEET E-02. SEE NOTE 1 ON SHEET E-02.
2. CONTRACTOR SHALL COORDINATE CONDUIT ENTRANCE LOCATIONS WITH VFD MANUFACTURER.

3. SEE SHEET E-06 FOR CONDUIT DEVELOPMENT
4. MVS1-PLCS5
5. MVS1-P5A
6. MVS1-VFD-P5C
7. MVS1-VFD-P5CT
8. MVS1-P5
9. MVS1-C5. USE EXISTING CONDUIT.
10. MVS1-S5. USE EXISTING CONDUIT.
11. V5-MVS-1. USE EXISTING CONDUIT.
12. MVS1-PLCC5. SEE NOTE ON SHEET E-02 FOR SOUTH WEST WALL ELECTRICAL DEMOLITION. SEE SHEET E-06.
13. V5-MVS-1. USE EXISTING CONDUIT.
14. FURNISH AND INSTALL WARNING PLACARD ON DOOR OF NEW VFD MVVFD-P5 THAT READS: "DANGER HIGH VOLTAGE: 4160VAC. THE ELECTRICAL INSULATION MATTING MUST BE INSTALLED OVER THE PUMP P-3 DISCHARGE PIPING BEFORE OPENING THE VFD DOOR."



SEE SHEET E-02

ELEVATION A
SCALE: 1/2"=1'-0"

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: AS SHOWN

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN C. KITTS
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2004 SYSTEM CAPACITY IMPROVEMENTS
INTAKE/PUMP STATION
ELECTRICAL PLAN, NOTES AND DETAILS

SHEET E-03

Job No: 1530509
File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$
Plot Date: Plot Date: 15-FEB-2007 [illegible]

DEMOLITION/RELOCATION NOTES:

1. EQUIPMENT MOVED/DISTURBED/MODIFIED SHALL BE THOROUGHLY DOCUMENTED BEFORE ANY WIRES ARE DISCONNECTED OR DISTURBED. DOCUMENTATION SHALL INCLUDE ALL WIRING AND TERMINATIONS TO BE MOVED/DISTURBED/MODIFIED, AND SHALL INCLUDE WIRE SIZE, WIRE TYPE, WIRE COLOR, & TERMINAL NUMBERS AT EACH END. DOCUMENTATION SHALL BE SUMITTED TO THE ENGINEER PRIOR TO RELOCATION/MODIFICATIONS.

[2] DEMO AND DISPOSE OF EXISTING HEATER. REMOVE EXISTING POWER CONDUCTORS FROM HEATER TO L.P. DEMO CONDUIT TO HEATER.

[3] EXISTING LB THROUGH WALL FOR FLOW METER FIELD CABLE TO REMAIN.

[4] RELOCATE AND REWIRE EXISTING FLOW METER PANEL. REUSE EXISTING WIRING TO FIELD DEVICE.

[5] RELOCATE AND REWIRE EXISTING FLOW DISPLAY. DEMO EXISTING POWER AND CONTROL WIRING AND CONDUITS.

[6] RELOCATE AND REWIRE EXISTING VALVE CONTROL BOXES. DEMO EXISTING POWER AND CONTROL WIRING AND CONDUITS.

[7] DEMO UNUSED CONDUITS.

[8] PLUG ALL HOLES IN PLC CABINET.

NOTES CONTINUED:

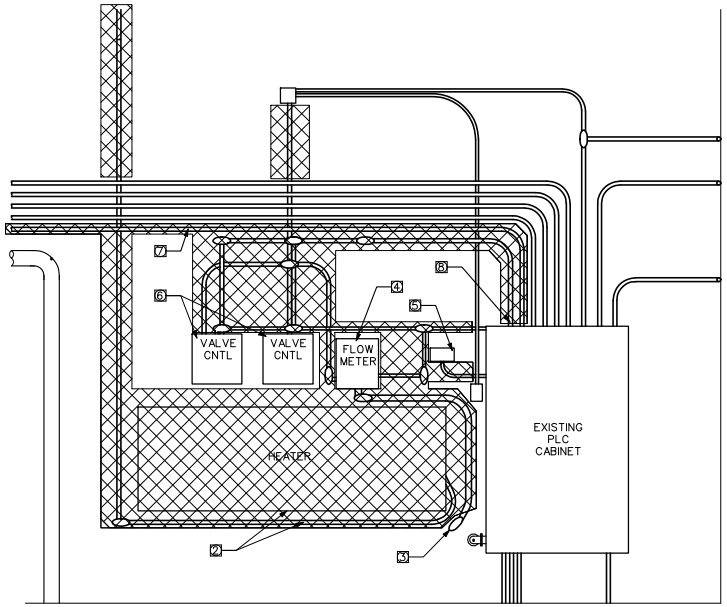
9. CONTRACTOR SHALL VERIFY/ ADJUST RELOCATED DEVICE LOCATIONS BASED UPON DIMENSIONS OF SUPPLIED VFD.

[10] PROVIDE NEW POWER AT CONTROL CONDUIT AND WIRING FOR RELOCATED DEVICES.

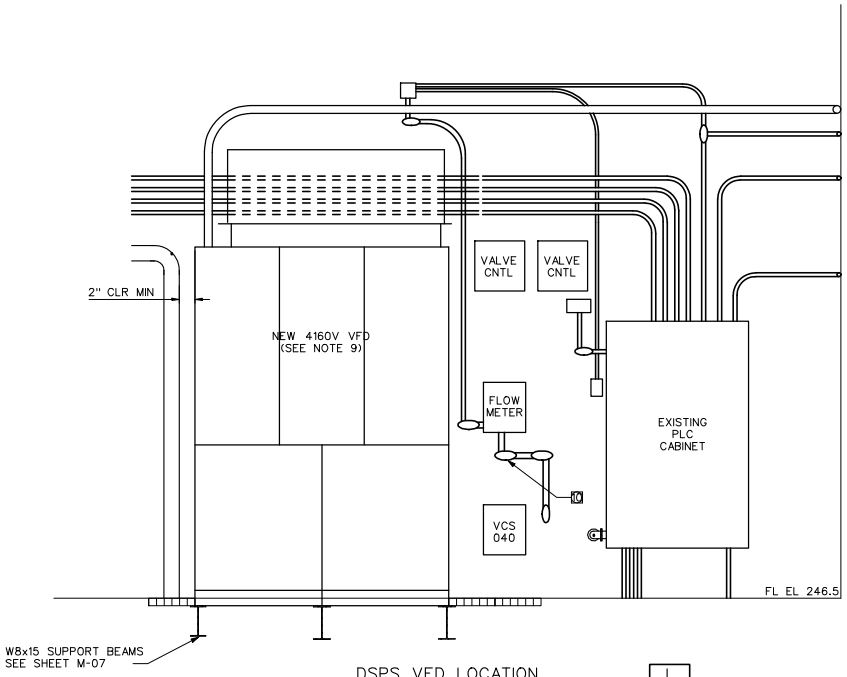
11. COORDINATE TIMING OF ALL DEVICE RELOCATIONS WITH OWNER.

12. CONTRACTOR SHALL COORDINATE CONDUIT ENTRANCE LOCATION WITH VFD MANUFACTURER.

13. SEE C-03 FOR ADDITIONAL CONSTRAINTS.



DSPS SOUTH WALL ELEC
DEMO/RELOCATION



DSPS VFD LOCATION AND DEVICE RELOCATION

1
E-05

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

C. KITTS

SCALE: 3/4" = 1'-0"

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED R.WARNER
DRAWN C.KITTS
CHECKED R SCHUBACH

RECORD DRAWING

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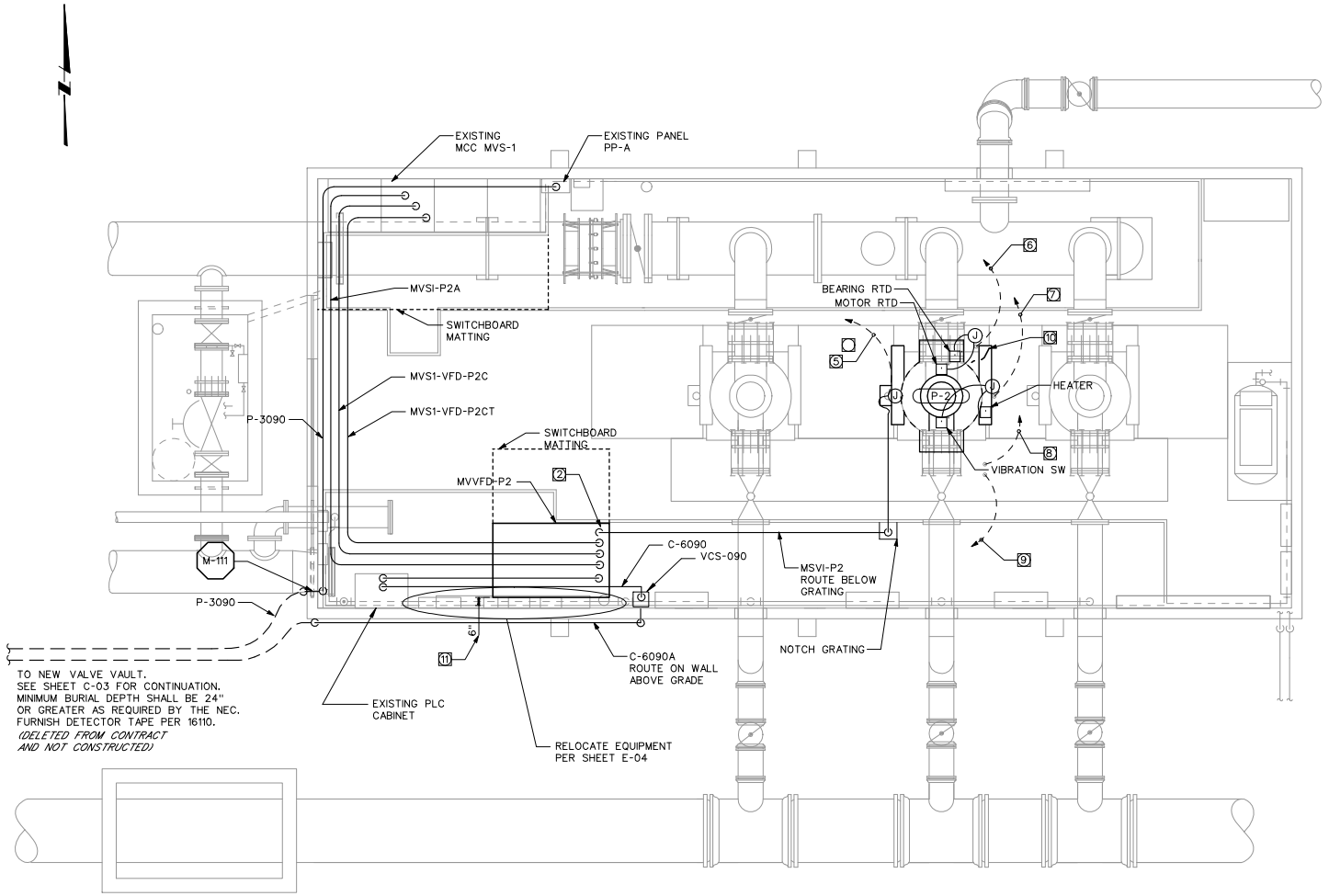
MWH
Portland Oregon

South Fork Water Board
15962 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS
DSPS DEMOLITION/RELOCATION NOTES AND DETAILS

SHEET
E-04

Job No: 1530509
File: ##########directory/filename##########
Plot Date: 15-FEB-2007 15:50



PLAN

PROPOSED VALVE VAULT, ACTUATOR AND CORRESPONDING ELECTRICAL CONDUIT RUNS WERE DELETED FROM CONTRACT AND NOT CONSTRUCTED. THESE DETAILS WERE PURPOSELY LEFT IN THE RECORD DRAWINGS FOR PROJECT "MEMORY".

NOTES:

1. TOSHIBA INSTALLED.
2. CONTRACTOR SHALL VERIFY LOCATIONS OF CONDUIT ENTRY AND EXIT WITH VFD MANUFACTURER.
3. CONTRACTOR SHALL DE-ENERGIZE AND DISCONNECT ALL EXISTING ELECTRICAL APPURTANCES ON PUMP P-2 TO ALLOW REMOVAL OF EXISTING PUMP AND MOTOR.
4. EQUIPMENT MOVED/DISTURBED/MODIFIED SHALL BE THOROUGHLY DOCUMENTED BEFORE ANY WIRES ARE DISCONNECTED OR DISTURBED. SEE NOTE 1 ON SHEET E-04.
5. DISCONNECT AND REMOVE EXISTING #1/0 FEEDERS BETWEEN EXISTING P-2 AND MVS-1. REMOVE EXISTING FLEX CONNECTION TO MOTOR. CAP EXISTING CONDUIT AT MOTOR.
6. MVS1-C5 EXISTING CONDUIT/CONDUCTORS BETWEEN MCC-MVS1 AND P-2. REMOVE EXISTING CONDUCTORS, REPLACE WITH NEW CONDUCTORS FOR RTD'S PER DWG. E-07.
7. MVS1-C2 EXISITNG CONDUIT/CONDUCTORS BETWEEN MCC-MVS2 AND P-2. REMOVE EXISTING CONDUCTORS, REPLACE WITH NEW CONDUCTORS FOR VIBRATION SWITCH AND HEATER PER DWG. E-07
8. EXISTING CONDUIT/CONDUCTORS BETWEEN MCC-MVS1 AND P-2 FOR HARDWIRED INTERLOCKING TO REMAIN.
9. EXISTING CONDUIT/CONDUCTORS TO PLC TO REMAIN
10. RECONNECT EXISTING GROUNDING CABLE TO NEW PUMP.
11. SET VFD APPROX 6" OFF OF STRUCTURE SOUTH WALL TO ALLOW CLEARANCE OF EXISTING CONDUITS BEHIND VFD.

REGISTERED PROFESSIONAL ENGINEER 64440PE OREGON JAN. 12, 1988 JOHN C. DEERWOOD EXPIRES: 12/31/05

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: 3/8" = 1'-0"

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED R.WARNER
DRAWN R.WARNER
CHECKED R SCHUBACH

RECORD DRAWING

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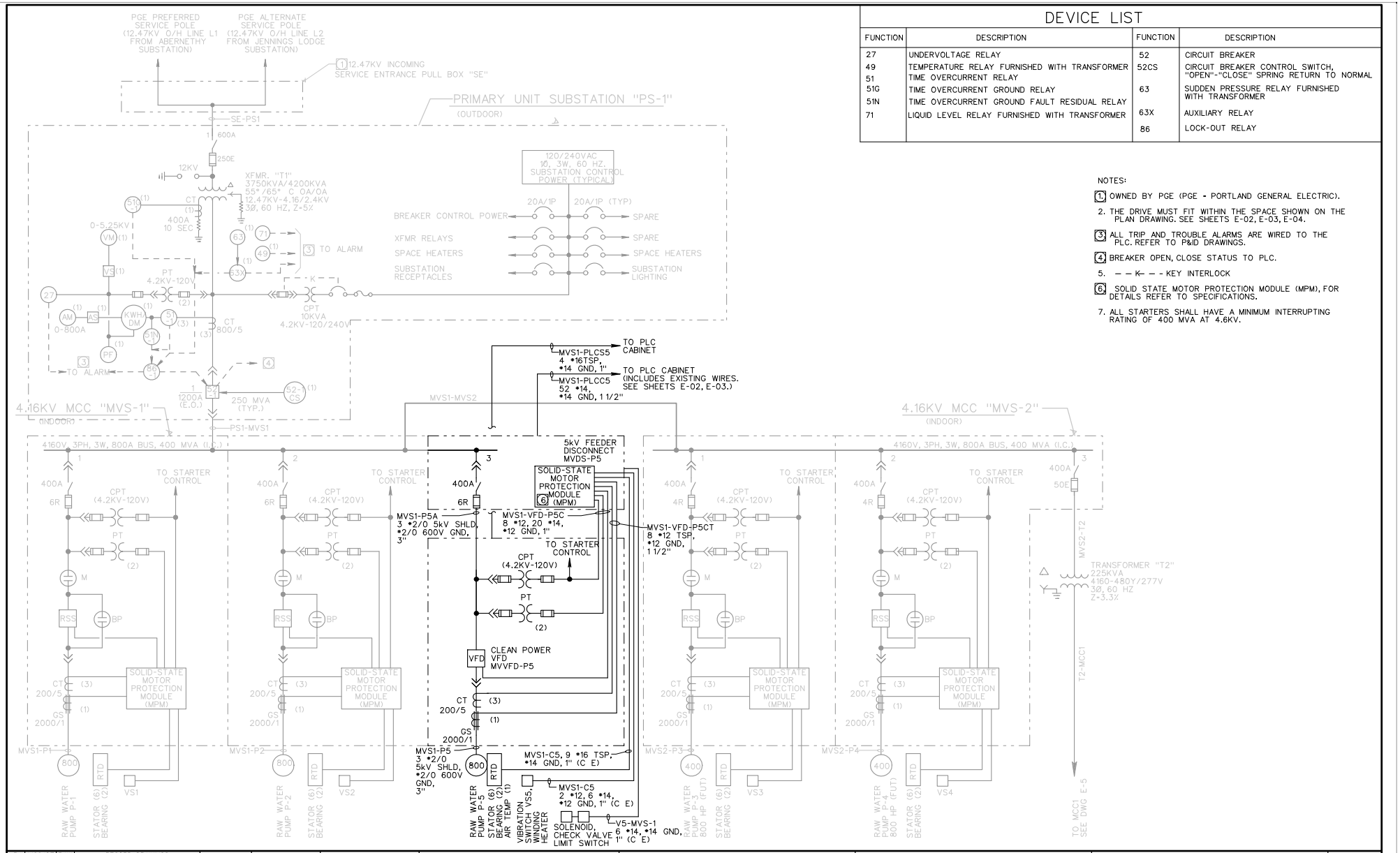
2004 SYSTEM CAPACITY IMPROVEMENTS

DSPS ELECTRICAL PLAN, NOTES AND DETAILS

SHEET E-05

Job No: 1530509 File: $$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$ Plot Date: Plot Date: 15-FEB-2007 Time: 16:00



DEVICE LIST

FUNCTION	DESCRIPTION	FUNCTION	DESCRIPTION
27	UNDERVOLTAGE RELAY	52	CIRCUIT BREAKER
49	TEMPERATURE RELAY FURNISHED WITH TRANSFORMER	52CS	CIRCUIT BREAKER CONTROL SWITCH, "OPEN"-"CLOSE" SPRING RETURN TO NORMAL
51	TIME OVERCURRENT RELAY	63	SUDDEN PRESSURE RELAY FURNISHED WITH TRANSFORMER
51G	TIME OVERCURRENT GROUND RELAY	63X	AUXILIARY RELAY
51N	TIME OVERCURRENT GROUND FAULT RESIDUAL RELAY	86	LOCK-OUT RELAY
71	LIQUID LEVEL RELAY FURNISHED WITH TRANSFORMER		

NOTES:

1. OWNED BY PGE (PGE - PORTLAND GENERAL ELECTRIC).
2. THE DRIVE MUST FIT WITHIN THE SPACE SHOWN ON THE PLAN DRAWING. SEE SHEETS E-02, E-03, E-04.
3. ALL TRIP AND TROUBLE ALARMS ARE WIRED TO THE PLC. REFER TO P&ID DRAWINGS.
4. BREAKER OPEN, CLOSE STATUS TO PLC.
5. – – K– – – KEY INTERLOCK
6. SOLID STATE MOTOR PROTECTION MODULE (MPM), FOR DETAILS REFER TO SPECIFICATIONS.
7. ALL STARTERS SHALL HAVE A MINIMUM INTERRUPTING RATING OF 400 MVA AT 4.6KV.

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN J DEERKOP
CHECKED R SCHUBACH

RECORD DRAWING

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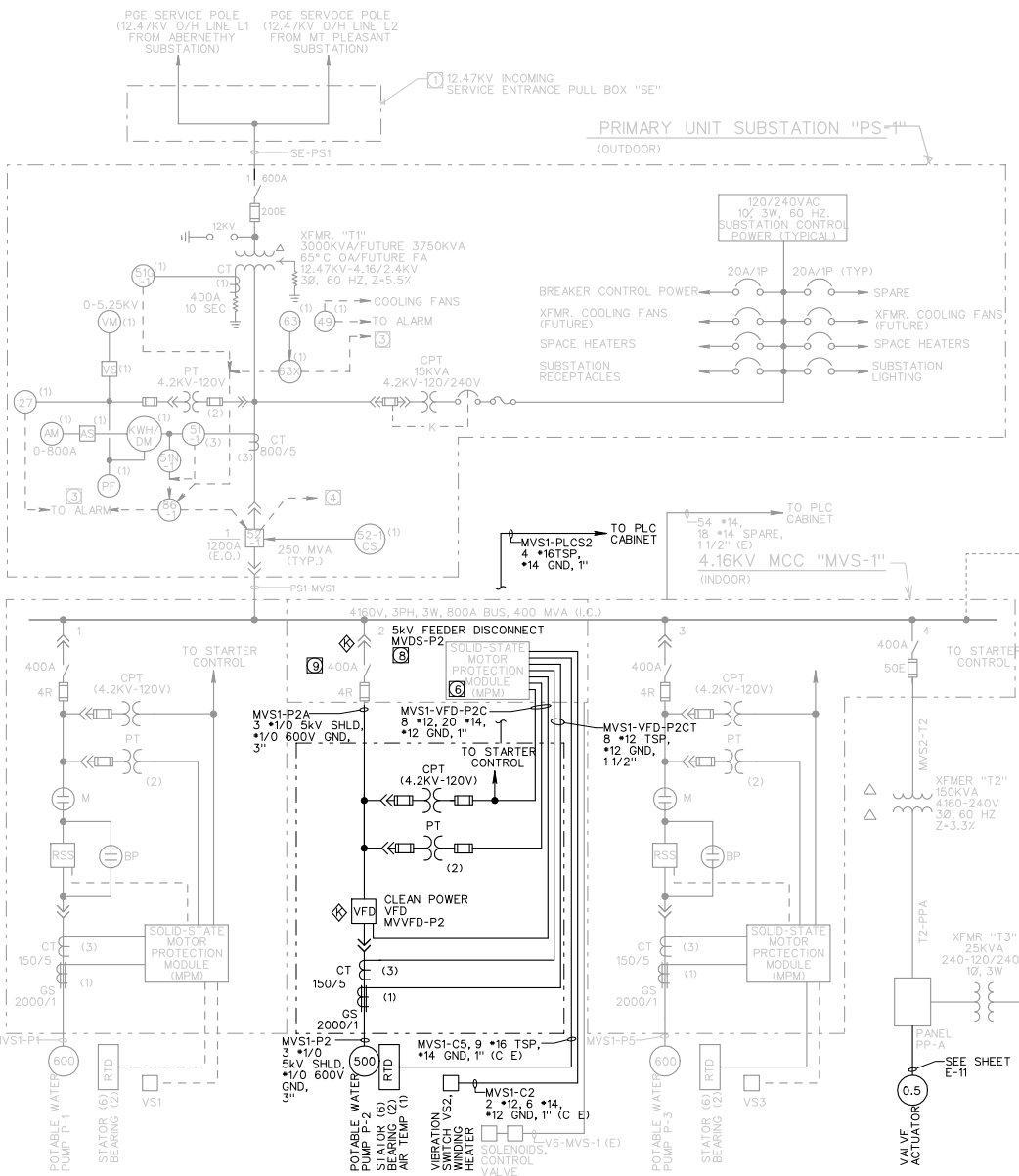
2004 SYSTEM CAPACITY IMPROVEMENTS

INTAKE/PUMP STATION
SINGLE LINE DIAGRAM

SHEET
E-06

Job No: 1530509
File: \$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$directory/filename\$
Plot Date: 15-FEB-2007 16:50



DEVICE LIST

FUNCTION	DESCRIPTION	FUNCTION	DESCRIPTION
27	UNDERVOLTAGE RELAY	52	CIRCUIT BREAKER
49	TEMPERATURE RELAY FURNISHED WITH TRANSFORMER	52CS	CIRCUIT BREAKER CONTROL SWITCH, "OPEN"-"CLOSE" SPRING RETURN TO NORMAL
51	TIME OVERCURRENT RELAY	63	SUDDEN PRESSURE RELAY FURNISHED WITH TRANSFORMER
51G	TIME OVERCURRENT GROUND RELAY	63X	AUXILIARY RELAY
51N	TIME OVERCURRENT GROUND FAULT RESIDUAL RELAY	86	LOCK-OUT RELAY
71	LIQUID LEVEL RELAY FURNISHED WITH TRANSFORMER		

NOTES:

1. OWNED BY PGE (PGE = PORTLAND GENERAL ELECTRIC).
2. THE DRIVE MUST FIT WITHIN THE SPACE SHOWN ON THE PLAN DRAWING. SEE THE PLAN DRAWING E-05.
3. ALL TRIP AND TROUBLE ALARMS ARE WIRED TO THE PLC. REFER TO P&ID DRAWINGS.
4. BREAKER OPEN, CLOSE STATUS TO PLC.
5. — — K— — - KEY INTERLOCK
6. REPLACE EXISTING MPM WITH NEW GE MULTILIN 369. FOR DETAILS REFER TO SPECIFICATIONS.
7. ALL STARTERS SHALL HAVE A MINIMUM INTERRUPTING RATING OF 400 MVA AT 4.6KV.
8. USE EXISTING SOFT-STARTER DISCONNECT SWITCH AND FUSES TO FEED NEW VFD. USE EXISTING SOFT-STARTER MOTOR PROTECTION MODULE (MULTI-LIN) AND CONTROL RELAYS TO PROTECT NEW MOTOR. REMOVE AND TURN OVER TO OWNER ALL SOFT-STARTER COMPONENTS REMOVED FROM STARTER CABINET.
9. ADD KIRT-KEY INTERLOCK BETWEEN VFD AND STARTER PANEL.

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN J DEERKOP
CHECKED R SCHUBACH

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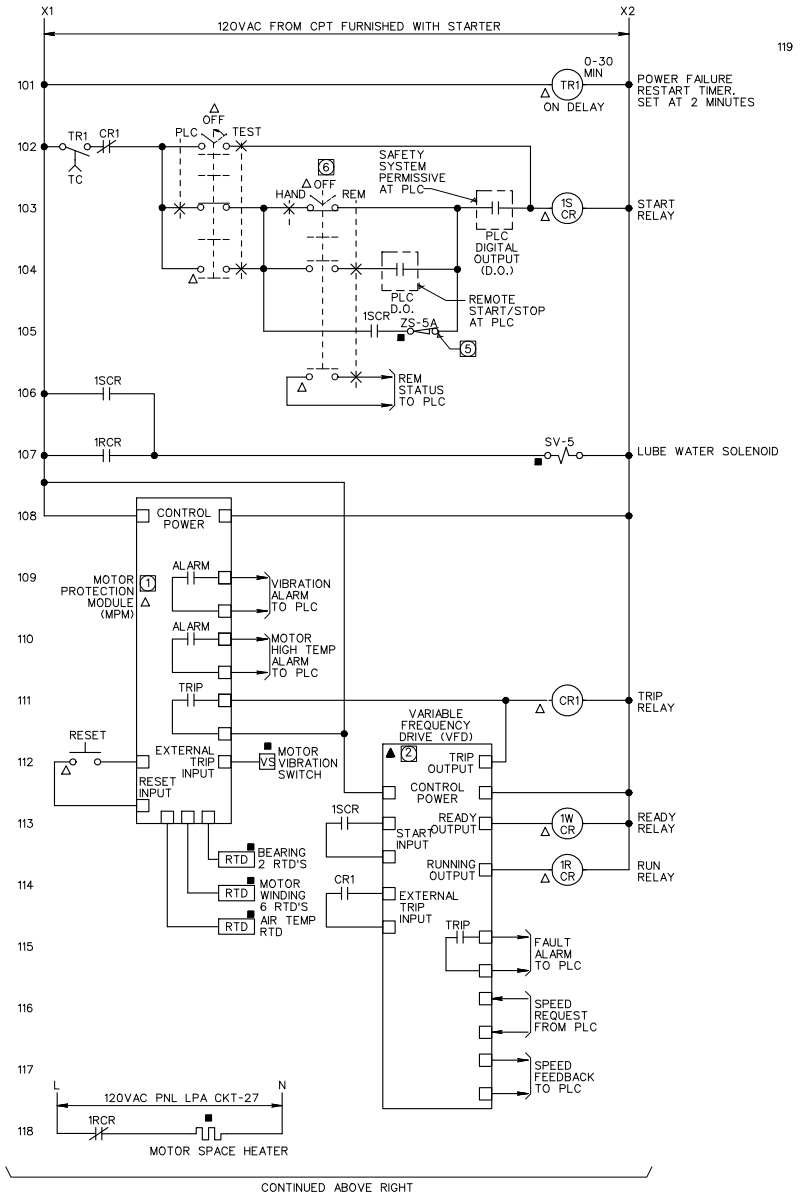
2004 SYSTEM CAPACITY IMPROVEMENTS

DIVISION STREET PUMP STATION
SINGLE LINE DIAGRAM

SHEET E-07

Job No: 1530509
File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$
Plot Date: 15-FEB-2007



119



3 CONTROL DIAGRAM

NOTES:

1. SOLID STATE MOTOR PROTECTION MODULE, REFER TO SPECIFICATIONS.
2. MEDIUM VOLTAGE SOLID STATE, REDUCED VOLTAGE STARTER, REFER TO SPECIFICATIONS.
3. ALL DEVICES ARE LOCATED IN THE FEEDER DISCONNECT CABINET MVDS-5 UNLESS OTHERWISE NOTED.
4. NOTE NOT USED.
5. VALVE LIMIT SWITCH CLOSES WHEN CONTROL VALVE BEGINS TO OPEN AND OPENS WHEN THE CONTROL VALVE IS COMPLETELY CLOSED.
6. FOR TESTING OF THE PUMP CHECK VALVE AND THE MOTOR, THE HAND-OFF-REMOTE SELECTOR SWITCH HAS TO BE IN THE "HAND" POSITION. FOR TESTING OF THE MOTOR ONLY, THE SELECTOR SWITCH CAN BE IN THE "OFF" OR "REMOTE" POSITION.

LEGEND:

- △ LOCATED IN 5kV DISCONNECT CABINET, MVDS-P5.
- ■ LOCATED IN THE FIELD (AT MOTOR OR VALVE).
- ▲ LOCATED IN VARIABLE FREQUENCY DRIVE (VFD) CABINET, MVVFD-P5.

Job No: 1530509

File: $$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$

Plot Date: Plot Date: 15-FEB-2007 Time: 11:30

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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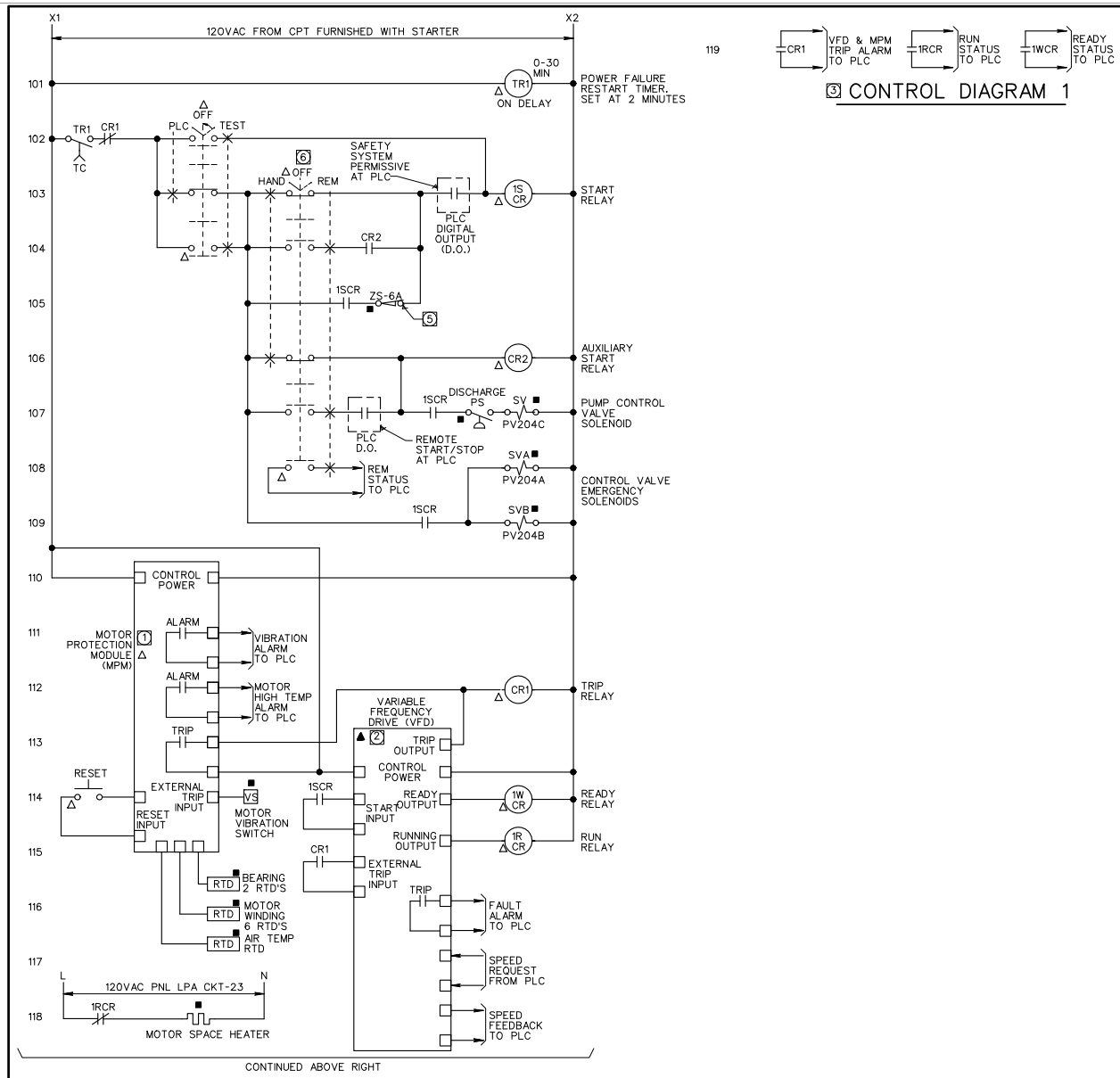
2004 SYSTEM CAPACITY IMPROVEMENTS
INTAKE/PUMP STATION
CONTROL DIAGRAM

SHEET E-08



3 CONTROL DIAGRAM 1

NOTES:

1. SOLID STATE MOTOR PROTECTION MODULE, REFER TO SPECIFICATIONS.
2. MEDIUM VOLTAGE SOLID STATE, REDUCED VOLTAGE STARTER, REFER TO SPECIFICATIONS.
3. ALL DEVICES ARE LOCATED IN THE FEEDER DISCONNECT CABINET MVDS-5 UNLESS OTHERWISE NOTED.
4. NOTE NOT USED.
5. VALVE LIMIT SWITCH CLOSES WHEN CONTROL VALVE BEGINS TO OPEN AND OPENS WHEN THE CONTROL VALVE IS COMPLETELY CLOSED.
6. FOR TESTING OF THE PUMP CONTROL VALVE AND THE MOTOR, THE HAND-OFF-REMOTE SELECTOR SWITCH HAS TO BE IN THE "HAND" POSITION. FOR TESTING OF THE MOTOR ONLY, THE SELECTOR SWITCH CAN BE IN THE "OFF" OR "REMOTE" POSITION.

LEGEND:

- △ LOCATED IN 5kV DISCONNECT CABINET, MVDS-P2.
- ■ LOCATED IN THE FIELD (AT MOTOR OR VALVE).
- ▲ LOCATED IN VARIABLE FREQUENCY DRIVE (VFD) CABINET, MVVFD-P2.

Job No: 1530509

File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$

Plot Date: Plot Date: 15-FEB-2007 [illegible]

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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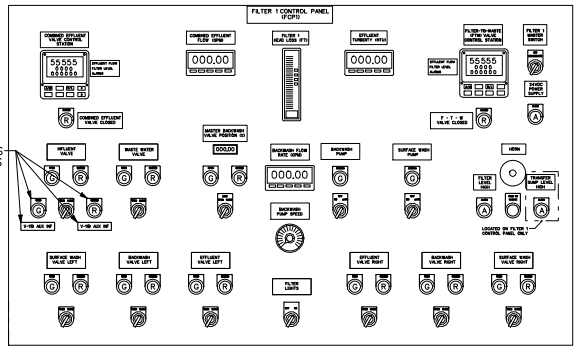
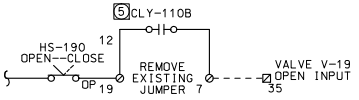
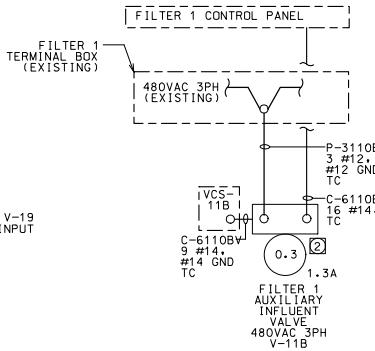
2004 SYSTEM CAPACITY IMPROVEMENTS
DIVISION STREET PUMP STATION
CONTROL DIAGRAM

SHEET E-09



REPLACE ALL FILTER CONTROL PANEL INDICATING LIGHT LAMPS WITH LED CLUSTER TYPE LAMPS - SEE SECTION 16485.2.1. TYP 4 PANELS.

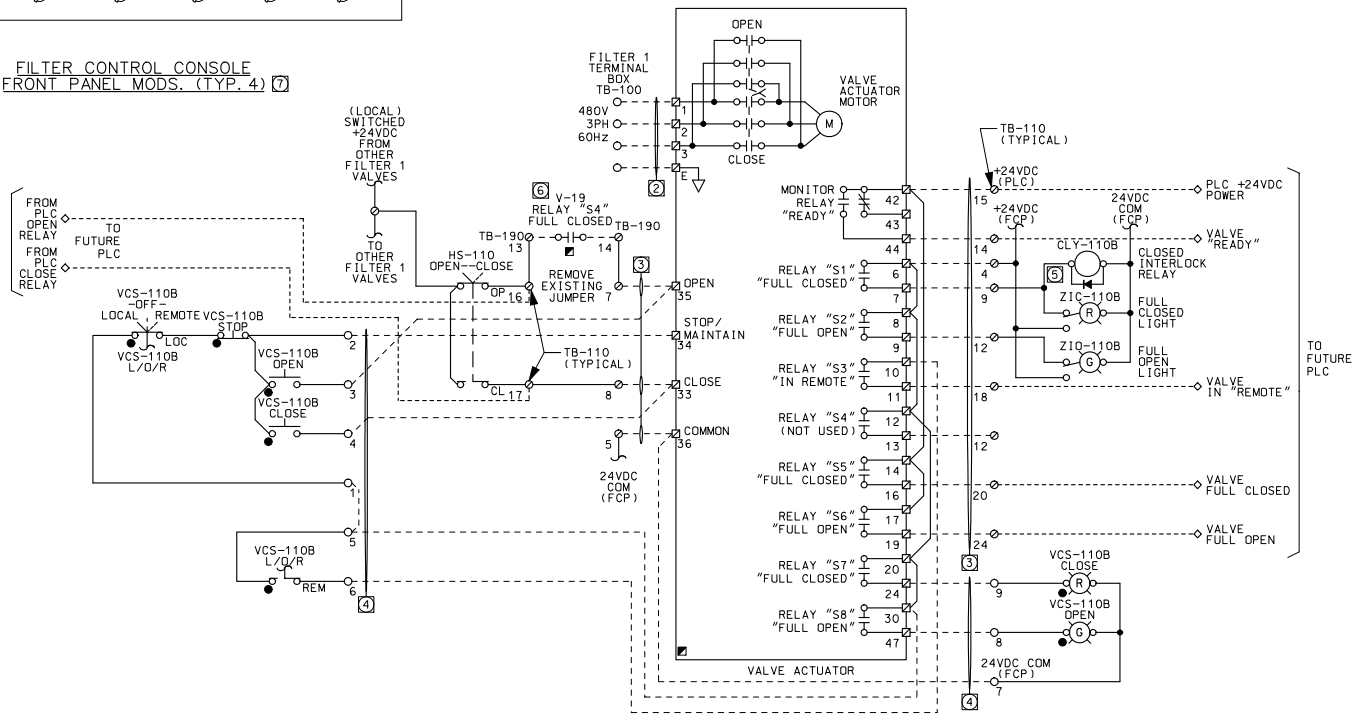




NOTES:

1. SEE GENERAL NOTES ON SHEET GE-2.
2. CONDUCTORS NOTED ARE PART OF A SINGLE 480VAC 3PH POWER TRAY CABLE.
3. CONDUCTORS NOTED ARE PART OF A SINGLE 24VDC CONTROL TRAY CABLE.
4. CONDUCTORS NOTED ARE PART OF A SINGLE 24VDC CONTROL TRAY CABLE.
5. ADD CLOSED INTERLOCK RELAYS IN THE EXISTING FILTER CONTROL PANELS FOR THE NEW AUXILIARY INFLUENT VALVES, V-11B, V-21B, V-31B, V-41B. WIRE A CONTACT FROM THE AUXILIARY INFLUENT VALVE IN SERIES WITH THE WASTE WASHWATER VALVES, V-19, V-29, V-39, V-49. OPEN CIRCUIT AS SHOWN.
6. PROGRAM THE EXISTING WASTE WASHWATER VALVES, V-19, V-29, V-39, AND V-49. ACTUATOR RELAY "S4" TO BE CLOSED WHEN THE VALVE IS "FULL CLOSED". ADD JUMPERS IN THE EXISTING FILTER CONTROL PANEL TO WIRE THE RELAY TO INTERLOCK WITH THE AUXILIARY INFLUENT VALVE OPEN CIRCUIT AS SHOWN.
7. FOR ALL FOUR FILTER CONTROL CONSOLES REPLACE ALL THE EXISTING INDICATING LIGHT LAMPS WITH LED CLUSTER TYPE LAMPS.
8. SEE SPECIFICATION SECTIONS 15200 AND 15201. VALVE ACTUATORS SHALL BE ROTORK TO MATCH THE OWNERS EXISTING VALVE ACTUATORS. TERMINAL NUMBERS ARE TYPICAL OF THE ANTICIPATED ROTORK VALVE TERMINAL NUMBERS. CONTRACTOR SHALL CONFIRM TERMINAL NUMBERS WITH VALVE FURNISHED AND ADJUST DIAGRAM ACCORDINGLY.

FILTER CONTROL CONSOLE
FRONT PANEL MODS. (TYP. 4) 7



LOCATIONS
- ● FIELD, VALVE CONTROL STATION (VCS)
- ■ RELAY PANEL
- ◩ VALVE ACTUATOR
- FILTER CONTROL PANEL (FCP) (EXISTING)
- ♦ EXISTING EQUIPMENT (LOCATION VARIES)
- ◆ FUTURE PROGRAMMABLE LOGIC CONTROLLER (PLC)

TERMINALS
- ○ FIELD TERMINAL, VALVE CONTROL STATION (VCS), OR DEVICE PIN
- □ RELAY PANEL TERMINAL
- ◪ VALVE ACTUATOR TERMINAL
- ⊘ FILTER CONTROL PANEL (FCP) TERMINAL (EXISTING)
- ◊ EXISTING EQUIPMENT (TYPE VARIES)
- ◇ FUTURE PROGRAMMABLE LOGIC CONTROLLER (PLC)

CONTROL DIAGRAM - OPEN/CLOSE VALVE WITH VCS, V-11B - AUXILIARY INFLUENT VALVE
(TYPICAL FOR VALVES V-11B, V-21B, V-31B, V-41B)

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J DEERKOP
DRAWN J DEERKOP
CHECKED R SCHUBACH

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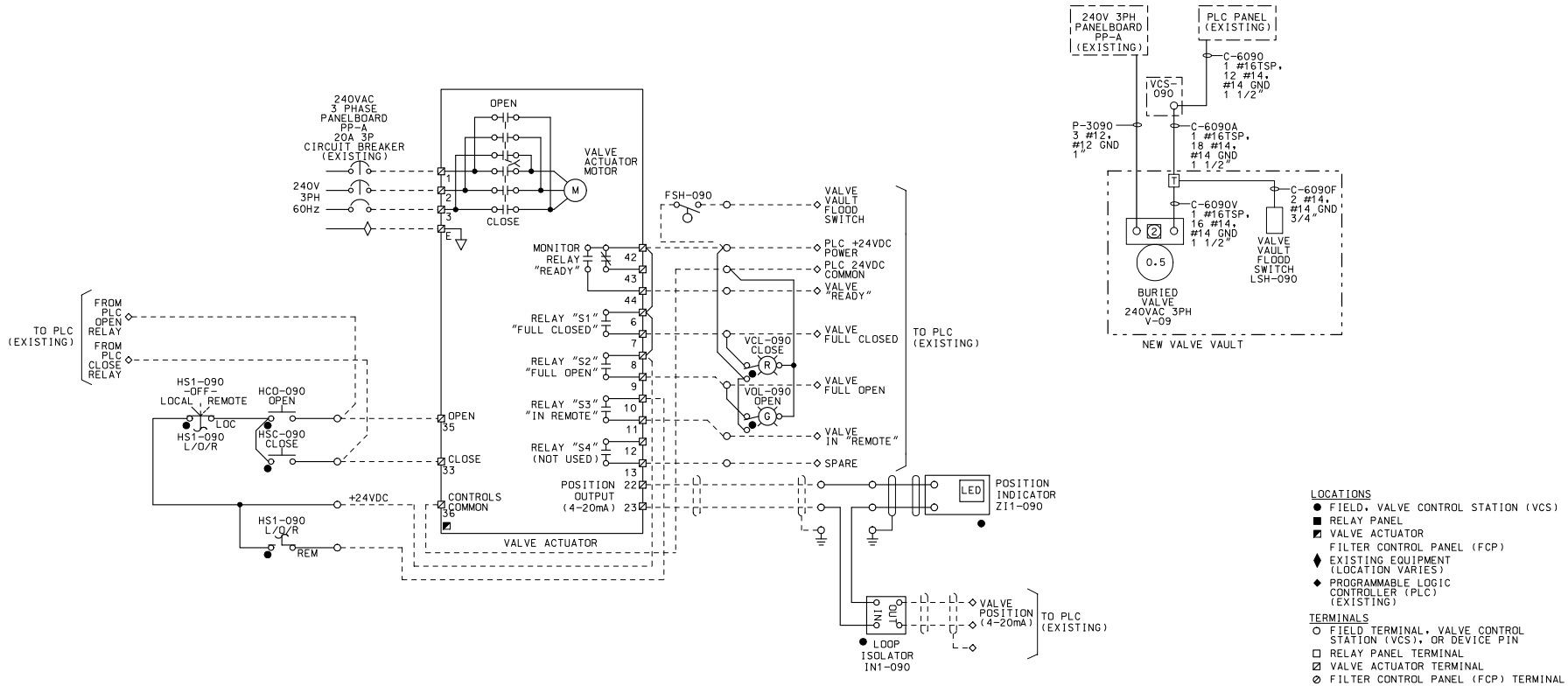
2004 SYSTEM CAPACITY IMPROVEMENTS
WATER TREATMENT PLANT
FILTER VALVES
CONTROL DIAGRAM

SHEET E-10

Job No: 1530509
File: ##########directory/filename##########
Plot Date: 15-FEB-2007 Time: 11:41

NOTES:

1. SEE GENERAL NOTES ON SHEET GE-2.
2. VALVE ACTUATOR FURNISHED BY MANUFACTURER IN ACCORDANCE WITH THE NEC AND APPLICABLE CODES. ACTUATOR INTERIOR DEVICES ARE PARTIALLY SHOWN ON THE CONTROL DIAGRAM.
3. SEE SPECIFICATION SECTIONS 15200 AND 15201. VALVE ACTUATORS SHALL BE ROTORK TO MATCH THE OWNERS EXISTING VALVE ACTUATORS. TERMINAL NUMBERS ARE TYPICAL OF THE ANTICIPATED ROTORK VALVE TERMINAL NUMBERS. CONTRACTOR SHALL CONFIRM TERMINAL NUMBERS WITH VALVE FURNISHED AND ADJUST DIAGRAM ACCORDINGLY.



LOCATIONS

- ● FIELD, VALVE CONTROL STATION (VCS)
- ■ RELAY PANEL
- ◪ VALVE ACTUATOR
- FILTER CONTROL PANEL (FCP)
- ♦ EXISTING EQUIPMENT (LOCATION VARIES)
- ◆ PROGRAMMABLE LOGIC CONTROLLER (PLC) (EXISTING)

TERMINALS

- ○ FIELD TERMINAL, VALVE CONTROL STATION (VCS), OR DEVICE PIN
- □ RELAY PANEL TERMINAL
- ⊠ VALVE ACTUATOR TERMINAL
- ⊘ FILTER CONTROL PANEL (FCP) TERMINAL
- ◊ EXISTING EQUIPMENT (TYPE VARIES)
- ◇ PROGRAMMABLE LOGIC CONTROLLER (PLC) (EXISTING)

CONTROL DIAGRAM - OPEN/CLOSE VALVE WITH VCS, V-090

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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2004 SYSTEM CAPACITY IMPROVEMENTS
DIVISION STREET PUMP STATION
BURIED VALVE
CONTROL DIAGRAM

SHEET E-11

Job No: 1530509
File: ##########directory\filename##########
Plot Date: 15-FEB-2007 Plot By: ##########

ELECTRICAL SYMBOLS

PLAN

- EXPOSED OR CONCEALED CONDUIT
- CONDUIT RUN UNDERGROUND OR IN CONCRETE
- CONDUIT RUN - CHANGE IN ELEVATION
- CONDUIT TURNING UP
- CONDUIT TURNING DOWN
- CONDUITS GROUPED TOGETHER BUT SHOWN AS A SINGLE LINE FOR CLARITY
- FROM FLOOR ABOVE TO FLOOR BELOW
- CONDUIT CAPPED, OR SEALED
- HOMERUN TO EQUIPMENT INDICATED (3/4" CONDUIT, 2 #12, 1 #12 GND UNLESS OTHERWISE INDICATED)
- RACEWAY BOX
  * - BOX TYPE
  MH---- MANHOLE
  HH---- HANDHOLE
  PB---- PULLBOX
- JUNCTION BOX OR FITTING
- CONDUIT X - CONDUIT NUMBER (SEE CONDUIT SCHEDULE FOR DETAILS)
- INCANDESCENT, HPS OR MH FIXTURE
  X - LIGHTING PANEL DESIGNATION
  * - CIRCUIT NUMBER, a - SWITCH DESIGNATION
- UNSWITCHED FIXTURE (NIGHT LIGHT)
- WALL MOUNTED FIXTURE
- POLE, BRACKET, ARM AND STREETLIGHT
- FLUORESCENT LIGHTING FIXTURE
- FLUORESCENT LIGHT FIXTURE, UNSWITCHED
- EMERGENCY LIGHT FIXTURE, BATTERY OPERATED
- EXIT LIGHT, SHOWN WITH TWO ILLUMINATED SIDES, ARROWS INDICATE DIRECTION OF EXIT
- A - FIXTURE TYPE
  (SEE LIGHTING FIXTURE SCHEDULE FOR DETAILS)
  * INDICATES APPROX. MOUNTING HEIGHT ABOVE FINISHED FLOOR.
  CLG INDICATES CEILING MOUNT
- LIGHT SWITCH
  X - LIGHITING PANEL DESIGNATION
  * - CIRCUIT DESIGNATION
  a - SWITCH DESIGNATION
  * - SWITCH TYPE
  3-----3 WAY
  4-----4 WAY
  D-----DIMMER
  M-----MANUAL MOTOR STARTER

- 120V DUPLEX RECEPTACLE, NEMA CONFIGURATION 5-20R (WALL MOUNT)
  X - LIGHTING PANEL DESIGNATION
  * - CIRCUIT DESIGNATION
  * -TYPE
  WP---- WEATHERPROOF
  XP---- EXPLOSION PROOF
  GFCI-- GROUND FAULT CIRCUIT INTERRUPTER
- 120V DUPLEX RECEPTACLE, NEMA CONFIGURATION 5-20R (FLOOR MOUNT)
- SINGLE SPECIAL PURPOSE RECEPTACLE 240V 1 PHASE, ASTRISK INDICATES AMPERAGE
- WELDING RECEPTACLE ASTRISK INDICATES AMPERAGE
- SPECIAL PURPOSE RECEPTACLE 480 VAC, ASTRISK INDICATES AMPERAGE
- FLOOR TYPE TELEPHONE OUTLET
- WALL TYPE TELEPHONE SYSTEM OUTLET
- WALL TYPE COMPUTER OUTLET
- LIGHTING PANEL
- POWER PANEL
- DISCONNECT SWITCH
- MOTOR
- THERMOSTAT
- HORN
- GROUND ROD AND GROUND WELL
- GROUND ROD ¾" x 10'-0" (UNLESS OTHERWISE NOTED)
- GROUND CONNECTION BOLTED TYPE
- GROUND CONNECTION - EXOTHERMIC TYPE
- BARE COPPER GROUND TO GROUND WIRE IN SLAB, OR UNDERGROUND GROUND GRID, SIZE AS NOTED

- ALARM HORN WITH STROBE
- AMPLIFIER/LOUDSPEAKER
- DETECTOR, * INDICATES TYPE
  SD----SMOKE DETECTOR
  HD----HEAT DETECTOR
  CD----COMBINATION DETECTOR
- FIRE ALARM PULL STATION
- SEPARATE OR ACCESSORY STROBE LIGHT
- FIRE BELL WITH STROBE LIGHT
- FIRE SUPRESSION SWITCH
- END-OF-LINE TERMINATOR
- INTERCOM SPEAKER
  * INDICATES TYPE, REFER TO SPECIFICATIONS
- INTERCOM SPEAKER WITH STROBE LIGHT
  * INDICATES TYPE, REFER TO SPECIFICATIONS
- INTERCOM WALL JACK
- INTERCOM HANDSET, WALL MOUNTED
- VIDEO CAMERA
  * INDICATES TYPE
  F---- FIXED
  PTZ-- PAN-TILT-ZOOM
- SECURITY ACCESS DEVICE, * INDICATES TYPE
  CR----CARD READER
  KS----KEY SWITCH
  PS----DIGITAL KEYPAD
- SEE NOTE, * INDICATES NUMBER

CABLE NUMBER LEGEND

XXX = 3 DIGIT CIRCUIT NUMBER
(SAME AS EQPT TAG/LOOP NUMBER)

T-XXX = TELEPHONE
P-1XXX = 12.47kVAC POWER
P-2XXX = 4.16kVAC POWER
P-3XXX = 480VAC POWER
P-4XXX = 120/208/240VAC POWER

C-5XXX = 120VAC CONTROL
C-6XXX = 24VDC CONTROL

S-7XXX = 4-20mA SIGNAL
S-8XXX = OTHER SIGNAL(S)

D-9XXX = DATA COMM/NETWORK

SINGLE LINE DIAGRAM

- MEDIUM VOLTAGE VACUUM DRAW-OUT STARTER
- 52 MEDIUM VOLTAGE DRAWOUT BREAKER
- ANSI RELAY DEVICE
  * INDICATES ANSI DEVICE
  (*) INDICATES QUANTITY
  25------ SYNCHRONISM CHECK RELAY
  27------ UNDERVOLTAGE
  27/47--- UNDERVOLTAGE, PHASE SEQUENCE, UNBALANCED VOLTAGE
  32------ DIRECTIONAL POWER RELAY
  41------ FIELD CONTACTOR
  43------ SELECTOR SWITCH
  49------ HIGH OIL TEMPERATURE
  50/51--- INSTANTANEOUS AND TIME OVERCURRENT
  50/51N-- INSTANTANEOUS AND TIME RESIDUALLY CONNECTED GROUND OVERCURRENT
  51G----- GROUND FAULT
  60------ VOLTAGE BALANCE
  62------ TIME DELAY
  63------ SUDDEN PRESSURE
  67------ AC DIRECTIONAL CURRENT RELAY
  71L----- LOW OIL LEVEL
  81------ FREQUENCY RELAY
  83------ CONTROL POWER TRANSFORMER
  86------ LOCKOUT
  87TL---- TRANSFORMER DIFFERENTIAL
  87M----- MOTOR DIFFERENTIAL

THERMAL MAGNETIC

- FRAME (AMPS)
- TRIP (AMPS)

MCP

- CONTINUOUS AMPS
- TRIP SETTING BASED ON MOTOR HORSEPOWER

- LOW VOLTAGE DRAWOUT CIRCUIT BREAKER
- COMBINATION NEMA RATED STARTER WITH MCP DISCONNECT AND CONTROL POWER TRANSFORMER
  ROMAN NUMERIAL - NEMA SIZE
  * - STARTER TYPE
  NO SUBSCRIPT---- FULL VOLTAGE NON-REVERSING
  RVAT---------- REDUCED VOLTAGE AUTO TRANSFORMER
  FVR ---------- FULL VOLTAGE REVERSING
  2S2W --------- TWO SPEED TWO WINDING
  2S1W --------- TWO SPEED ONE WINDING
- VFD VARIABLE FREQUENCY DRIVE
  * INDICATES AMPERE RATING
- RVSS REDUCED VOLTAGE SOLID STATE STARTER
  * INDICATES AMPERE RATING
- PACKAGED EQUIPMENT
  * INDICATES KW, KVA OR HP RATING AS INDICATED
- KEY INTERLOCK
- GENERATOR, RATINGS AS INDICATED
- MANUAL OR AUTOMATIC TRANSFER SWITCH RATINGS AS INDICATED

- METERING DEVICE
  * INDICATES METER TYPE
  WHM------ WATT HOUR METER
  WM------- WATT METER
  AM------- AMMETER
  VM------- VOLTMETER
  PFM------ POWER FACTOR METER
- AS AMMETER SWITCH
- VS VOLTMETER SWITCH
- POTENTIAL TRANSFORMER, RATIO AND NUMBER OF PT'S AS NOTED
- CURRENT TRANSFORMER, RATIO AND NUMBER OF CT'S AS NOTED
- 5A FUSE, SIZED AS NOTED
- 7½ * MOTOR, HORSEPOWER AS NOTED
  * INDICATES FULL LOAD AMPS
- TRANSFORMER WITH GROUNDED SECONDARY, KVA SIZE & VOLTAGE RATIO AS INDICATED
- FUSED CONTROL POWER TRANSFORMER
- MOV ELECTRICAL MOTOR OPERATED VALVE, WITH INTEGRAL REVERSING STARTER
- 30A DISCONNECT SWITCH, SIZE AS NOTED
- FUSED DISCONNECT SWITCH, SIZED AS NOTED
- CAPACITOR
- TVSS TRANSIENT VOLTAGE SURGE SUPRESSOR
- SSM SOLID STATE METERING DEVICE
- SSMP SOLID STATE MOTOR PROTECTIVE DEVICE
- LIGHTNING ARRESTOR AND SURGE CAPACITOR
- CROSSING OF CONDUCTORS-NOT CONNECTED
- CONDUCTORS CONNECTED

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED MWH STANDARD
DRAWN MWH STANDARD
CHECKED R SCHUBACH

RECORD DRAWING

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Portland Oregon

South Fork Water Board
16982 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS
ELECTRICAL SYMBOLS - 1

SHEET GE-01

Job No: 1530509
File: \\\\\\\\\\\\\\\\\\\\\\directory\filename\\\\\\\\\\\\\\\\\\\\\\
Plot Date: 15-FEB-2007 [illegible]

ELECTRICAL SYMBOLS

SCHEMATIC DIAGRAM

CONTROL RELAY OR COIL
* INDICATES DEVICE
CR ---- CONTROL RELAY
TD ---- TIME DELAY RELAY
(TIMING RANGE AS INDICATED)
M ---- MOTOR STARTER
PC ---- PHOTOCLELL

NORMALLY OPEN CONTACT

NORMALLY CLOSED CONTACT

TIMED CONTACTS - CONTACT ACTION DELAYED AFTER COIL IS:

ENERGIZED

NORMALLY OPEN WITH TIME DELAY CLOSING

NORMALLY CLOSED WITH TIME DELAY OPENING

DE-ENERGIZED

NORMALLY OPEN WITH INSTANT CLOSING AND TIME DELAY OPENING

NORMALLY CLOSED WITH INSTANT OPENING AND TIME DELAY CLOSING

NORMALLY OPEN PUSHBUTTON

NORMALLY CLOSED PUSHBUTTON,

NO/NC MAINTAINED PUSHBUTTON

THREE-POSITION SELECTOR SWITCH.
H ---- HAND
M ---- MANUAL
R ---- REMOTE
L ---- LOCAL
A ---- AUTOMATIC
O ---- OFF

TWO-POSITION SELECTOR SWITCH:

THREE POSITION SPRING RETURN-TO-CENTER MOMENTARY CONTACT SWITCH

SINGLE POLE TOGGLE SWITCH

VACUUM OR PRESSURE SWITCH, CLOSE ON RISING PRESSURE

VACUUM OR PRESSURE SWITCH, OPEN ON RISING PRESSURE

FLOAT LEVEL SWITCH, CLOSE ON RISING LEVEL

FLOAT LEVEL SWITCH, OPEN ON RISING LEVEL

NORMALLY OPEN

NORMALLY CLOSED

NORMALLY OPEN HELD CLOSED

NORMALLY CLOSED HELD OPEN

MAINTAINED POSITION

TEMPERATURE SWITCH, CLOSE ON RISING TEMPERATURE

TEMPERATURE SWITCH, OPEN ON RISING TEMPERATURE

FLOW SWITCH, CLOSE ON INCREASING FLOW

FLOW SWITCH, OPEN ON INCREASING FLOW

TORQUE SWITCH OPENS ON INCREASING TORQUE

DI — DIGITAL INPUT TO PLC/RTU/DCS

DIGITAL OUTPUT FROM PLC/RTU/DCS NORMALLY OPEN

DIGITAL OUTPUT FROM PLC/RTU/DCS NORMALLY CLOSED

AI — ANALOG INPUT TO PLC/RTU/DCS 4-20 mA UNLESS OTHER OTHERWISE NOTED

AO — ANALOG OUTPUT FROM PLC/RTU/DCS 4-20 mA UNLESS OTHER OTHERWISE NOTED

SV — SOLENOID VALVE

PILOT LIGHT
* INDICATES LENS COLOR
R ---- RED
G ---- GREEN
A ---- AMBER
W ---- WHITE

PILOT LIGHT PUSH-TO-TEST SEE ABOVE FOR LENS COLORS

HORN

ETM — ELAPSED TIME METER

HEATER

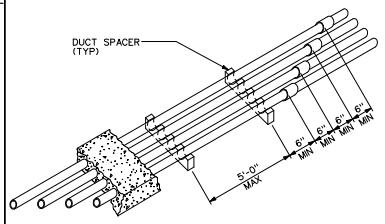
GROUND CONNECTION

CROSSING OF CONDUCTORS-NOT CONNECTED

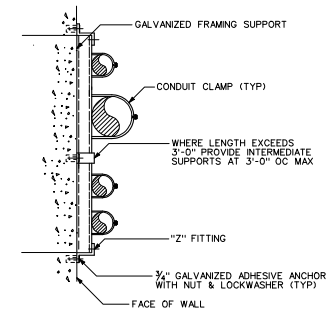
CONDUCTORS CONNECTED

FUSE

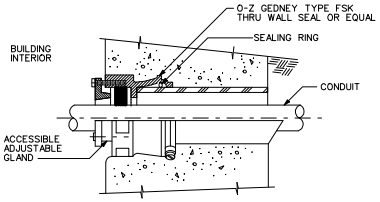
VOLTAGE SURGE SUPPRESSOR



TYPICAL DUCTBANK
JOINT/SUPPORT SPACING REV 042999 E-108



CONDUIT SUPPORT
FLUSH MOUNT REV 042599 E-212



NOTE:
USE WATERTIGHT CONDUIT SEAL WHERE CONDUIT PENTRATIONS OF EXTERIOR WALLS ARE BELOW GRADE.

WATERTIGHT CONDUIT SEAL
BELOW GRADE EXTERIOR WALLS REV 042599 E-213

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

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DESIGNED MWH STANDARD
DRAWN MWH STANDARD
CHECKED R SCHUBACH

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Portland Oregon

South Fork Water Board
15962 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS
ELECTRICAL SYMBOLS - 2

SHEET GE-02

Job No: 1530509
File: $$$$$$$$$$$$$$$$$$$$directory/filename$$$$$$$$$$$$$$$$$$$$
Plot Date: Plot Date: 15-FEB-2007 Time: 11:01

ABBREVIATIONS

A	AMPERE, AUTOMATIC
AC	ALTERNATING CURRENT
AF	CIRCUIT BREAKER FRAME SIZE
AM	AMMETER
ANN	ANNUNCIATOR
AS	ADJUSTABLE SPEED
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AWG	AMERICAN WIRE GAUGE
BATT	BATTERY
BC	BARE COPPER
BKR	BREAKER
C	CONDUIT, CLOSED
CAP	CAPACITOR
CB	CIRCUIT BREAKER
CKT	CIRCUIT
CLF	CURRENT LIMITING FUSE
COM	COMMON
COMP	COMPARTMENT
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY, CARD READER
CT	CURRENT TRANSFORMER
DCS	DISTRIBUTED CONTROL SYSTEM
DISC	DISCONNECT
DISTR	DISTRIBUTION
DPDP	DOUBLE POLE DOUBLE THROW
DPST	DOUBLE POLE SINGLE THROW
E	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
ENCL	ENCLOSURE
ETM	ELAPSED TIME METER
F	FREQUENCY, FUSE, FIXED
FDR	FEEDER
FLA	FULL LOAD AMPS
FLUOR	FLUORESCENT
FM	FREQUENCY METER
FO	FIBER OPTIC
FVR	FULL VOLTAGE REVERSING
FVNR	FULL VOLTAGE NON-REVERSING
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
H	HAND
HD	HEAT DETECTOR
HH	HAND HOLE

HID	HIGH INTENSITY DISCHARGE
HOA	HAND-OFF-AUTOMATIC
HPS	HIGH PRESSURE SODIUM
HS	HAND SWITCH
HZ	HERTZ
IMC	INTERMEDIATE METALLIC CONDUIT
INCAND	INCANDESCENT
IND	INDICATION
INST	INSTANTANEOUS
I/O	INPUT/OUTPUT
Isc	SHORT CIRCUIT CURRENT, AMPS
ISO	ISOLATION
J	JUNCTION BOX
KA	THOUSAND AMPERES
KAIC	THOUSAND AMP INTERRUPTING CURRENT
KCMIL	THOUSAND CIRCULAR MILS
KVA	KILOVOLT AMPERE
L	LOCAL
LCP	LOCAL CONTROL PANEL
LCS	LOCAL CONTROL STATION
LOC	LOCAL
LOR	LOCAL-OFF-REMOTE
LOS	STOP LOCKOUT PUSHBUTTON
LP	LIGHTING PANEL
LRA	LOCKED ROTOR AMPS
LS	LEVEL SWITCH
LTG	LIGHTING
LTS	LIGHTS
M	MOTOR CONTACTOR COIL
mA	MILLIAMPERE
MCP	MOTOR CIRCUIT PROTECTOR
MLO	MAIN LUGS ONLY
MOV	MOTOR OPERATED VALVE
MS	MANUAL MOTOR STARTER
MTS	MANUAL TRANSFER SWITCH
MWH	MOTOR WINDING HEATER
NEUT	NEUTRAL
NP	NAMEPLATE
O	OPEN, OFF
OL	OVERLOAD
PA	PUBLIC ADDRESS
PB	PUSHBUTTON, PULLBOX
PC	PHOTOCELL
PCM	PROCESS CONTROL MODULE
PF	POWER FACTOR
PFM	POWER FACTOR METER
PH	PHASE

PL	PILOT LIGHT
PNBLD	PANELBOARD
PP	POWER PANELBOARD
POS	POSITION
POT	POTENTIOMETER
PRI	PRIMARY
PT	POTENTIAL TRANSFORMER
PTZ	PAN-TILT-ZOOM
PWR	POWER
R	REMOTE
RECPT	RECEPTACLE
RGS	RIGID GALVANIZED STEEL
RMS	ROOT MEAN SQUARE
RTU	REMOTE TERMINAL UNIT
RVSS	REDUCED VOLTAGE SOLID STATE
SEL SW	SELECTOR SWITCH
SEQ	SEQUENCE
SHLD	SHIELDED
SIG	SIGNAL
SP	SPARE
SPDT	SINGLE POLE DOUBLE THROW
SSM	SOLID STATE METER
SSMP	SOLID STATE MOTOR PROTECTOR
SP HTR	SPACE HEATER
SPST	SINGLE POLE SINGLE THROW
ST, SH	SHUNT TRIP
STR	STARTER
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TACH	TACHOMETER
TB	TERMINAL BOX
TERM	TERMINAL
TM	REPEAT CYCLE TIMER
TD	TIME DELAY RELAY
TS	TEMPERATURE SWITCH
TSH	TEMPERATURE SWITCH, HIGH
UPS	UNINTERRUPTABLE POWER SUPPLY
V	VOLTAGE, VOLTS
VA	VOLT AMPERE
VAR	VOLT AMPERE REACTIVE
VFD	VARIABLE FREQUENCY DRIVE
VM	VOLTMETER
VP	VAPOR PROOF
W	WATTS, WIRE
WM	WATT METER
WP	WEATHERPROOF
XFMR	TRANSFORMER
XMTR	TRANSMITTER
XP	EXPLOSION PROOF

GENERAL NOTES

1. ALL RACEWAYS AND EQUIPMENT SHALL BE INSTALLED AND GROUNDED IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE AND APPLICABLE LOCAL CODES.
2. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATION OF TERMINAL BOXES AND CONDUIT ENTRANCES OF ALL EQUIPMENT AGAINST APPROVED SHOP DRAWINGS BEFORE STUBBING UP CONDUITS.
3. CONDUIT RUNS ARE SHOWN DIAGRAMMATICALLY ONLY AND SHALL BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT OR STRUCTURAL CONDITIONS. EXPOSED CONDUIT SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO BEAMS AND WALLS. REFER TO SPECIFICATION 16110 FOR ADDITIONAL REQUIREMENTS RELATED TO CONDUIT INSTALLATION..
4. IN THE EVENT OF INTERFERENCE BETWEEN ELECTRICAL EQUIPMENT SHOWN ON THE DRAWINGS AND OTHER EQUIPMENT, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN WRITING AND THE ENGINEER SHALL APPROVE PROPOSED CHANGES BEFORE THEY ARE MADE.
5. ALL SURFACE MOUNTED PANELS AND PANELBOARDS ON THE INTERIOR OF EXTERIOR WALLS ABOVE GRADE OR IN OTHER LOCATIONS CONSIDERED DAMP OR WET SHALL BE MOUNTED SO AS TO MAINTAIN A1/4" (MINIMUM) AIR SPACE BETWEEN THE ENCLOSURE AND THE WALL.
6. LOCATION OF PULLBOXES ARE APPROXIMATE. THE CONTRACTOR SHALL COORDINATE EXACT LOCATION OF PULLBOXES WITH MECHANICAL PIPING AND SHALL BE 6" (MINIMUM) AWAY FROM MECHANICAL PIPING FLOW LINES.
7. ONLY MAJOR PULLBOXES ARE SHOWN. THE CONTRACTOR SHALL PROVIDE ADDITIONAL PULLBOXES WHERE REQUIRED TO MAKE A WORKABLE INSTALLATION.
8. THE WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE DETAILS WHETHER OR NOT THEY ARE REFERENCED ON THE DRAWINGS.
9. ALL CONDUIT RUNS CROSSING EXPANSION JOINTS SHALL HAVE EXPANSION OR EXPANSION AND DEFLECTION TYPE FITTINGS. FOR LOCATIONS OF EXPANSION JOINTS, REFER TO THE STRUCTURAL DRAWINGS.
10. NOTE NOT USED.
11. THE WIRING DIAGRAMS, QUANTITY AND SIZE OF WIRES AND CONDUIT REPRESENT A SUGGESTED ARRANGEMENT BASED UPON SELECTED STANDARD COMPONENTS OF ELECTRICAL EQUIPMENT. MODIFICATIONS ACCEPTABLE TO THE ENGINEER MAY BE MADE BY THE CONTRACTOR TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED. THE BASIC SEQUENCE AND METHOD OF CONTROL MUST BE MAINTAINED AS INDICATED ON THE DRAWINGS AND/OR SPECIFICATIONS.
12. MCC AND SWITCHGEAR COMPARTMENT DESIGNATIONS SHALL BE AS INDICATED BELOW:
    BLANK/SPACE: CONTAINS NECESSARY BUS AND HARDWARE FOR FUTURE ADDITION OF BREAKERS OR STARTERS.

    SPARE: CONTAINS A COMPLETE INSTALLED BREAKER OR STARTER AVAILABLE FOR FUTURE USE.
13. SEPARATE POWER, CONTROL AND INSTRUMENTATION WIRING (SEE SPECIFICATION 16050). PROVIDE SEPARATE CONDUIT, PULL AND JUNCTION BOXES. PROVIDE SUITABLE CABLE BARRIER WITHIN PULL OR JUNCTION BOXES WHERE SEPARATION OF WIRING IS NOT SHOWN ON THE DRAWINGS.
14. NOTE NOT USED.
15. THE ELECTRICAL UTILITY WILL NOT BE RUNNING POWER TO THE SITE UNTIL AUGUST 2004 AT THE EARLIEST. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE ALL CONSTRUCTION POWER UNTIL AFTER THE UTILITY BRINGS POWER TO THE SITE.
16. FURNISH, INSTALL AND CONNECT CONDUIT AND WIRE FOR ALL PANELBOARD AND MISCELLANEOUS LOADS, THEIR CONTROLS AND APPURTENANCES. CONDUIT AND WIRE SHALL BE INSTALLED IN ACCORDANCE WITH THE SPECIFICATIONS AND APPLICABLE CODES. MINIMUM CONDUIT SIZE FOR PANEL-BOARD LOADS SHALL BE 3/4" FOR SURFACE MOUNTED AND 1" FOR ENCASED CONDUITS IN ACCORDANCE WITH SECTION 16110. MINIMUM WIRE FILL SHALL BE 3-#12, #12 GROUND FOR 3 PHASE LOADS AND 2-#12, #12 GROUND FOR 1 PHASE LOADS, OR LARGER AS SHOWN OR REQUIRED BY CODE IN ACCORDANCE WITH SECTION 16120. LAST TWO DIGITS OF CABLE NUMBER FOR LOADS FED FROM PANELBOARDS SHALL BE THE CIRCUIT/POLE NUMBER.
17. NOTE NOT USED.
18. FURNISH, INSTALL AND CONNECT CONDUIT AND WIRE FOR ALL EQUIPMENT.
19. SEE DRAWINGS OF OTHER DISCIPLINES. INFORMATION WHICH AFFECTS ELECTRICAL SCOPE AND WORK IS SHOWN IN THE DRAWINGS OF OTHER DISCIPLINES, I.E. MECHANICAL, CIVIL, ETC.
20. EQUIPMENT LOCKOUTS SHALL BE IN STRICT ACCORDANCE WITH OWNER'S REQUIREMENTS.
21. ELECTRICAL DEMOLITION NOTES, WHERE APPLICABLE:
    BIDDING CONTRACTORS SHALL VISIT THE SITE TO ASSESS THE SCOPE OF DEMOLITION, REMOVAL AND MODIFICATION WORK.

    ELECTRICAL CONTRACTOR AND THE OWNER SHALL DE-ENERGIZE ALL WIRING PRIOR TO REMOVAL OF EQUIPMENT, DEVICES, MOTORS, INSTRUMENTATION CONTROL PANELS, ETC. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM THE OWNER.

    ELECTRICAL CONTRACTOR SHALL FIELD VERIFY CONDUIT RUNS PRIOR TO DEMOLITION AND REMOVAL.

    EXPOSED RACEWAYS: REMOVE CONDUIT, WIRES AND BOXES. PATCH TO MATCH EXISTING FINISH ALL OPENINGS IN WALLS AND FLOORS.

    CONCEALED CONDUITS IN THE SLAB: REMOVE EXISTING WIRES TO THE EXTENT POSSIBLE AND ABANDON CONDUITS IN THE SLAB. CUT CONDUIT FLUSH AND PATCH THE FLOOR TO MATCH EXISTING.

    CONTROL PANEL: ELECTRICAL CONTRACTOR SHALL DE-ENERGIZE AND REMOVE ALL CONDUIT AND WIRE AS DESCRIBED ABOVE. CONTRACTOR SHALL REMOVE PANELS AS NOTED ON THE CONTRACT DRAWINGS. REFER TO NOTE ABOVE FOR DISPOSITION OF ENCASED CONDUITS.

    MOTOR CONTROL CENTERS: DISCONNECT AND REMOVE ALL CONDUITS AND WIRING TO EXISTING STARTERS AND/OR BREAKERS, PANELBOARDS, BRANCH CIRCUITS, INTERLOCKS AND STATUS WIRING WITHIN THE MCC.

    REFER TO SECTION 16050 FOR ADDITIONAL ELECTRICAL DEMOLITION AND REMOVAL REQUIREMENTS.
22. THE CONTROL DIAGRAMS ARE DRAWN BASED ON THE EQUIPMENT AND DEVICES OF A SINGLE MANUFACTURER. THE LCP SUPPLIER AND SUPPLIER OF THE MCC PLC SECTION MUST MODIFY THE DIAGRAMS TO REFLECT THE ACTUAL EQUIPMENT BEING FURNISHED, AND COORDINATE WITH THE MCC SUPPLIER.

Plot Date: 15-FEB-2007 File: ##########directory/filename########## Job No: 1530509

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED MWH STANDARD
DRAWN MWH STANDARD
CHECKED R SCHUBACH

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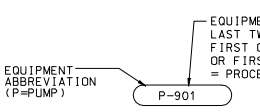
2004 SYSTEM CAPACITY IMPROVEMENTS
ELECTRICAL NOTES AND ABBREVIATIONS

SHEET
GE-03

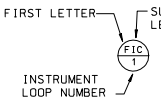
INSTRUMENTATION SYMBOLS

- INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED IN THE FIELD
- INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED INSIDE LOCATION AS MARKED
- INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED ON FRONT OF LOCATION AS MARKED
- SINGLE INSTRUMENT OR OTHER COMPONENT HAVING MULTIPLE FUNCTIONS
- INSTRUMENT OR OTHER COMPONENT TO BE FURNISHED AND INSTALLED BY OTHERS IN THE FUTURE
- INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED ON FRONT OF LOCATION AS MARKED
- INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED INSIDE LOCATION AS MARKED
- INDICATING LIGHT MOUNTED IN THE FIELD; MAY BE MOUNTED ON A CONTROL STATION
- INDICATING LIGHT MOUNTED ON THE FRONT OF LOCATION AS MARKED
- PROGRAMMABLE LOGIC CONTROLLER INPUT / OUPUT
- POWER DEVICE COMPONENT TO BE MOUNTED INSIDE LOCATION AS MARKED
- SHARED DISPLAY/CONTROL MOUNTED ON FRONT OF LOCATION AS MARKED

- HIGH/LOW SELECTOR
- RELATED DEVICE PERFORMS LINEARIZING OR SQUARE ROOT FUNCTION
- RELATED DEVICE PERFORMS MULTIPLYING, SUMMATION, OR DIVISION FUNCTION
- GENERALIZED FOR COMPLEX INTERLOCK LOGIC - SEE SCHEMATICS OR SPECIFICATIONS
- PNEUMATIC PRESSURE (P) SIGNAL
- (3) INDICATES QUANTITY OF SIGNALS (THREE)
- ELECTRIC SIGNAL
- ELECTRIC POWER
- HYDRAULIC LINE
- MAIN PROCESS PIPING
- SONIC SIGNAL
- CAPILLIARY TUBING (FILLED SYSTEM)
- 24VDC POWER SUPPLY AS NOTED (24VDC; ETC)
- EXISTING POWER SUPPLY
- A.S. AIR SUPPLY (20 PSIG TO INSTRUMENTS, 60 PSIG TO VALVES)
- INDICATES VENDOR PACKAGE
- CABLE (MULTICONDUCTER OR COAXIAL) FURNISHED WITH EQUIPMENT
- (E) EXISTING ITEM (SEE NOTE 8)
- (F) FUTURE ITEM
- (FO) FURNISHED BY OWNER
- (R) EXISTING ITEM TO BE RELOCATED



MECHANICAL EQUIPMENT CALLOUT



INSTRUMENT TAG NUMBER

SUPERVISORY CONTROL, ALARM, & DATA ACQUISITION (SCADA) SYMBOLS

- INDICATOR/CONTROLLER/RECORDER OR ALARM NORMALLY ACCESSIBLE TO OPERATOR FROM MMI.
- INTERNAL FUNCTION NOT NORMALLY ACCESSIBLE TO OPERATOR
- DATA LINK
- GENERALIZED FOR COMPLEX INTERLOCK LOGIC PERFORMED IN SOFTWARE. SEE SCHEMATICS OR SPECIFICATIONS FOR DETAILS.
- = DISCRETE (DIGITAL) INPUT
- = DISCRETE (DIGITAL) OUTPUT
- = ANALOG INPUT
- = ANALOG OUTPUT

MISCELLANEOUS ABBREVIATIONS

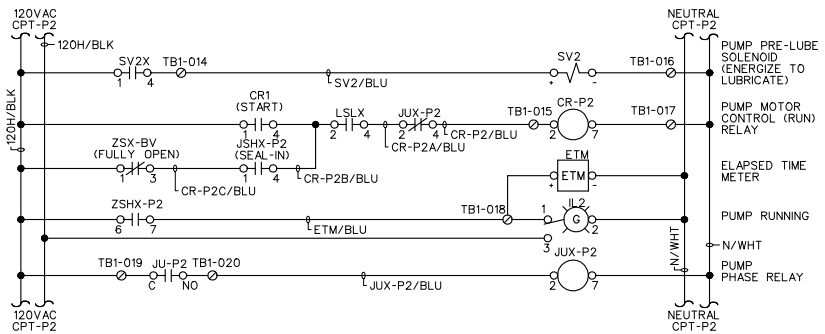
(SEE THE GENERAL ELECTRICAL SHEETS FOR ADDITIONAL ABBREVIATIONS)

AM	AUTO/MANUAL	N.C.	NORMALLY CLOSED
ATM	ATMOSPHERE	N.O.	NORMALLY OPEN
CB	CIRCUIT BREAKER	O/C	OPEN/CLOSE
DEV	DEVIATION	O/C/A	OPEN/CLOSE/AUTO
EQPT	EQUIPMENT	OL	OVERLOAD
F.C.	FAIL CLOSED	O/L/H	OFF/LOW/HIGH
F.O.	FAIL OPEN	O/O	ON/OFF
F/O/S	FAST/OFF/SLOW	O/S/C	OPEN/STOP/CLOSE
F/R	FORWARD/REVERSE	PCT	PERCENT
H/A	HAND/AUTOMATIC	PLC	PROGRAMMABLE LOGIC CONTROLLER
H/L	HIGH/LOW	P/O/T	PLC/OFF/TEST
HMI	HUMAN-MACHINE INTERFACE	PDT.	POTENTIONMETER
H/A/O	HAND/AUTOMATIC/OFF	RDY	READY
H/L	HIGH/LOW	REM	REMOTE
H/O/L	HIGH/OFF/LOW	R/S	RUN/STOP
H/O/A	HAND/OFF/AUTOMATIC	R/S/L	RAISE/STOP/LOWER
H/O/R	HAND/OFF/REMOTE	RTU	REMOTE TERMINAL UNIT
HYD	HYDRAULIC	SD	SHUTDOWN
I/D	INCREASE/DECREASE	SEL	SELECT
I/I	CURRENT AMPLIFIER	S/M	STROKES/MINUTE
I/O	INPUT/OUTPUT	S/O/F	SLOW/OFF/FAST
I/O/E	INTERNAL/OFF/EXTERNAL	SP	SET POINT
K/O	TIMER/OFF	S/S	START/STOP
I/P	CURRENT TO PNEUMATIC	T/O/P	TEST/OFF/PLC
LCP	LOCAL CONTROL PANEL (BY CONTRACTOR)	T/O/R	TEST/OFF/RTU
		TSP	TWISTED SHIELD PAIR
L/O/A	LOCAL/OFF/AUTO	TST	TWISTED SHIELD TRIAD
L/O/R	LOCAL/OFF/REMOTE	VCP	VENDOR CONTROL PANEL (BY VENDOR/EQPT. MFR.)
LOS	LOCK-OUT-STOP		
L/R	LOCAL/REMOTE	USF	US FILTER (FURNISHED BY)
M/A	MANUAL/AUTO		(INSTALLED AND CONNECTED BY CONTRACTOR)
MCC	MOTOR CONTROL CENTER	VFD	VARIABLE FREQUENCY DRIVE
MFR	MANUFACTURER	WTP	WATER TREATMENT PLANT
NOR/BU	NORMAL/BACKUP	WWTP	WASTE WATER TREATMENT PLANT

INSTRUMENT IDENTIFICATION TAG LETTERS

LETTER	FIRST LETTER: MEASURED OR INITIATING VARIABLE	FIRST LETTER: MODIFIER	SUCCEEDING LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING LETTERS: OUTPUT FUNCTION	SUCCEEDING LETTERS: MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROLLER	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW/FUEL	RATIO			
G	GAGING (DIMENSIONAL)		GLASS		
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELEC)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME SCHEDULE			CONTROL STA.	
L	LEVEL		LIGHT(PILOT)		LOW
M	MOISTURE OR HUMIDITY				MIDDLE OR INTERMEDIATE
N	TORQUE		ISOLATOR		
O	USER'S CHOICE		ORIFICE		
P	PRESSURE OR PNEUMATIC		POINT		
Q	QUANTITY	INTEGRATE TOTALIZE			
R	RADIOACTIVITY		RECORD OR PRINT		
S	SPEED / FREQUENCY			SWITCH	
T	TEMPERATURE			TRANSMITTER	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VISCOSITY / VIBRATION			VALVE DAMPER OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE			RELAY OR COMPUTE	
Z	POSITION				

CL2	CHLORINE RESIDUAL	SCD	STREAMING CURRENT DETECTOR
D.O.	DISSOLVED OXYGEN	SCU	STREAMING CURRENT UNIT
H2S	HYDROGEN SULFIDE	SS	SUSPENDED SOLIDS
LEL	LOWER EXPLOSIVE LIMIT	Tu	TURBIDITY
02	OXYGEN CONCENTRATION	UPS	UNINTERRUPTIBLE POWER SUPPLY
03	OZONE	UV	ULTRAVIOLET (RADIATION)
PART	PARTICLES (COUNTER)		
pH	HYDROGEN ION CONCENTRATION		



SAMPLE CONTROL DIAGRAM - MINIMUM REQUIRED

NOTES

1. ADDITIONAL INSTRUMENTATION AND CONTROL SYMBOLS MAY BE USED AS REQUIRED. SYMBOLS AND NOMENCLATURE ARE BASED ON ISA STANDARD S 5.1.
2. SEE ASSOCIATED ELECTRICAL AND MECHANICAL SYMBOL SHEETS FOR ADDITIONAL SYMBOLS AND ABBREVIATIONS.
3. FOR DETAILS OF METER COUPLING AND OTHER MECHANICAL EQUIPMENT (e.g. VALVES, PUMPS, ETC.) SEE MECHANICAL DRAWINGS AND SPECIFICATIONS.
4. CONTRACTOR TO MEET THE PARTICULAR CHARACTERISTICS (e.g. VOLTAGE AND CURRENT REQUIREMENTS) OF COMPONENTS IN EACH LOOP OR SYSTEM.
5. ALL FIELD SWITCHES FOR ELECTRIC MOTOR OPERATION SHALL BE SUPPLIED UNDER THE ELECTRICAL SPECIFICATIONS. EXCEPTIONS ARE WHEN SWITCHES ARE MOUNTED ON PANELS SUPPLIED BY THE SYSTEM INTEGRATOR, OR PART OF VENDOR PACKAGES SUCH AS VALVE ACTUATORS, FIRE PUMPS, ETC.
6. CONTRACTOR IS RESPONSIBLE FOR ALL COORDINATION BETWEEN ALL DIVISIONS OF WORK AND ALL TRADES.
7. CONTRACTOR SUBMITTAL DRAWINGS SHALL INCLUDE DEVICE TAGNAMES, DEVICE PIN NUMBERS, WIRE NUMBER, WIRE COLOR, EXPLANATORY COMMENTS TO CLARIFY DEVICE OPERATION AND INTERLOCKING STATES.
8. ALL EQUIPMENT, DEVICES, ETC. SHOWN ARE NEW TO BE FURNISHED, INSTALLED AND CONNECTED BY THE CONTRACTOR UNLESS SPECIFICALLY NOTED OTHERWISE.

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED MWH STANDARD
DRAWN MWH STANDARD
CHECKED R SCHUBACH

RECORD DRAWING

This record drawing has been prepared, entirely or in part on the basis of unverified information compiled and furnished by others to the preparer who is not responsible for any inaccuracies, errors or omissions which may have been incorporated into the document as a result

MWH
Portland Oregon

South Fork Water Board
16982 S. Hunter Ave. Oregon City, OR 97045
"Pure Water Since 1915"

2004 SYSTEM CAPACITY IMPROVEMENTS
INSTRUMENTATION
NOTES, SYMBOLS AND ABBREVIATIONS

SHEET GI-01

Job No: 1530509
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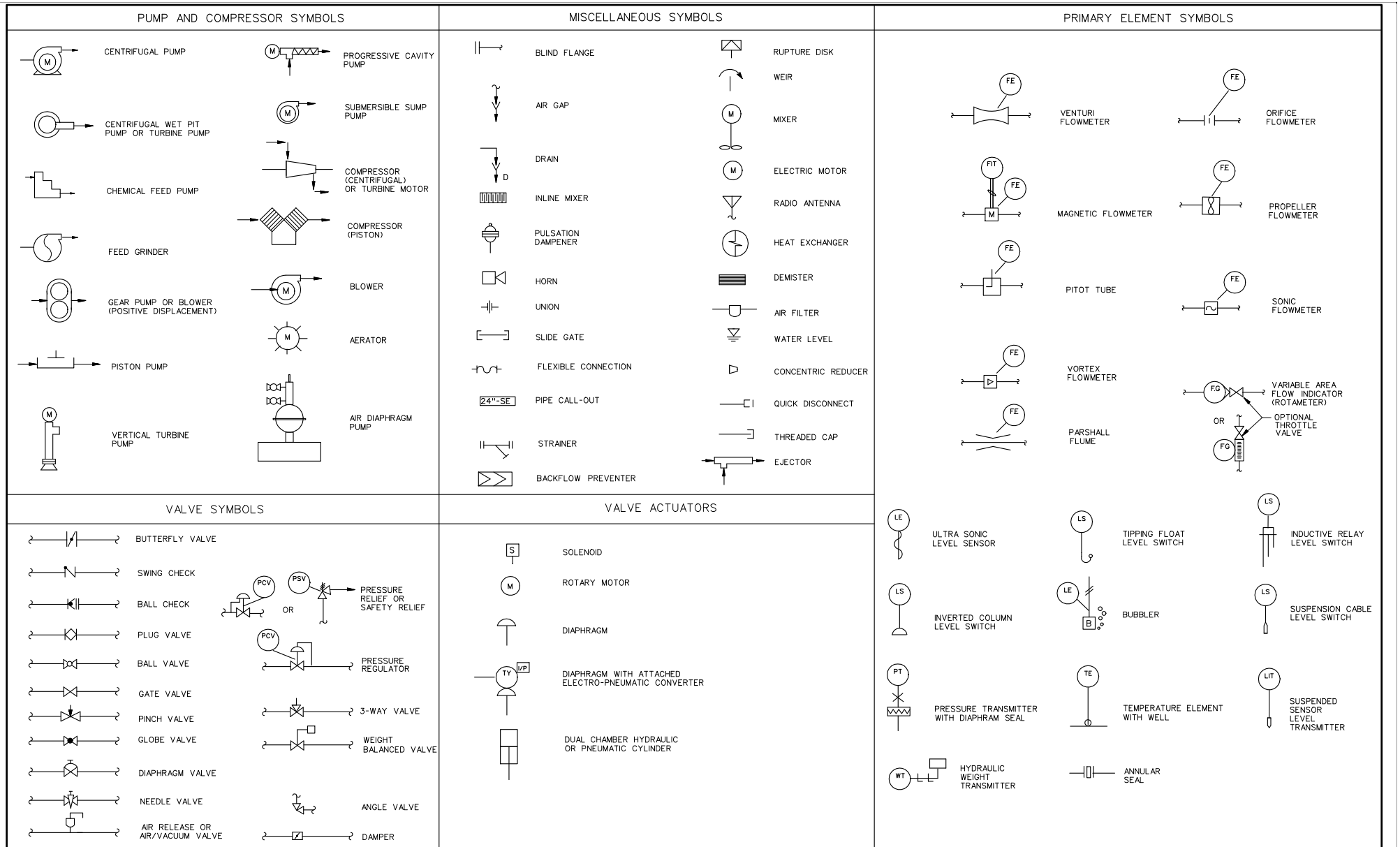

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

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DRAWN MWH STANDARD
CHECKED R SCHUBACH

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2004 SYSTEM CAPACITY IMPROVEMENTS
INSTRUMENTATION SYMBOLS

SHEET GI-02

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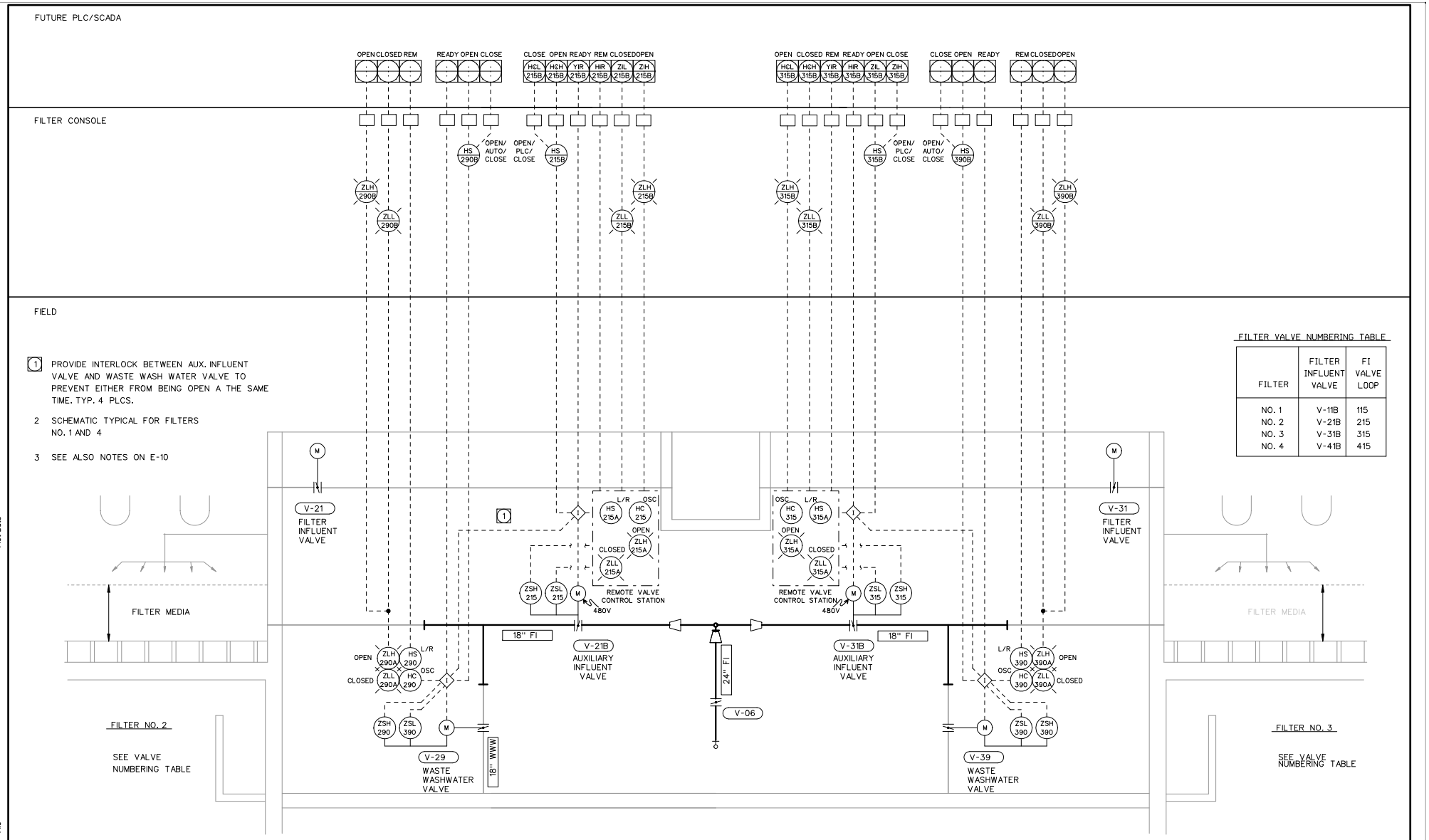

REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

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DESIGNED R WARNER
DRAWN R WARNER
CHECKED R SCHUBACH

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2004 SYSTEM CAPACITY IMPROVEMENTS
PROCESS AND INSTRUMENTATION DIAGRAM
WTP FILTER GALLERY PIPING

SHEET I-02

Job No: 1530509
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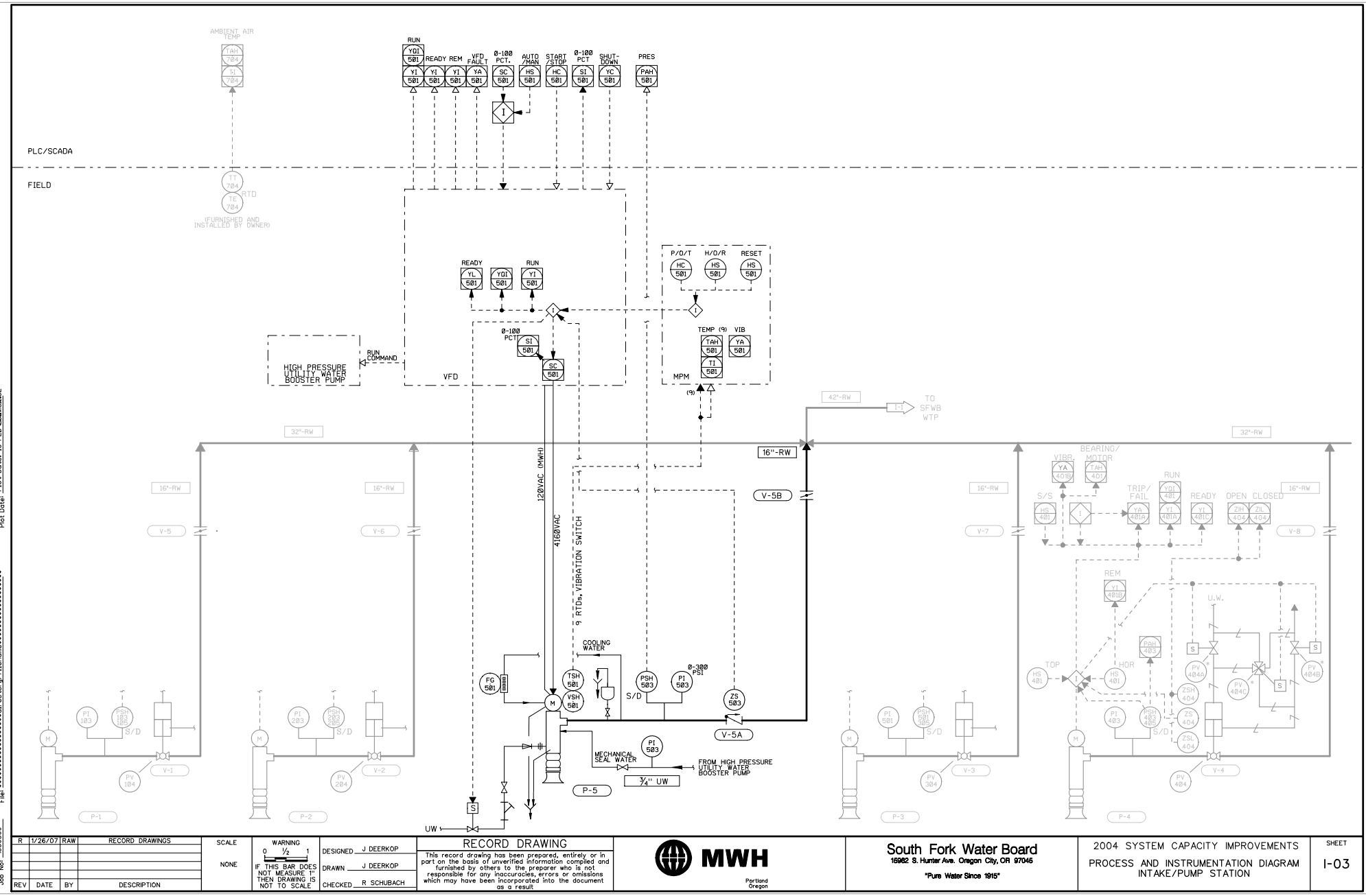
Plot Date: 15-FEB-2007 [illegible]



Plot Date: 15-FEB-2007 Time: 15:42

File: ########################directory/filename########################

Job No: 1530509

R	1/26/07	RAW	RECORD DRAWINGS
REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J DEERKOP
DRAWN J DEERKOP
CHECKED R SCHUBACH

RECORD DRAWING

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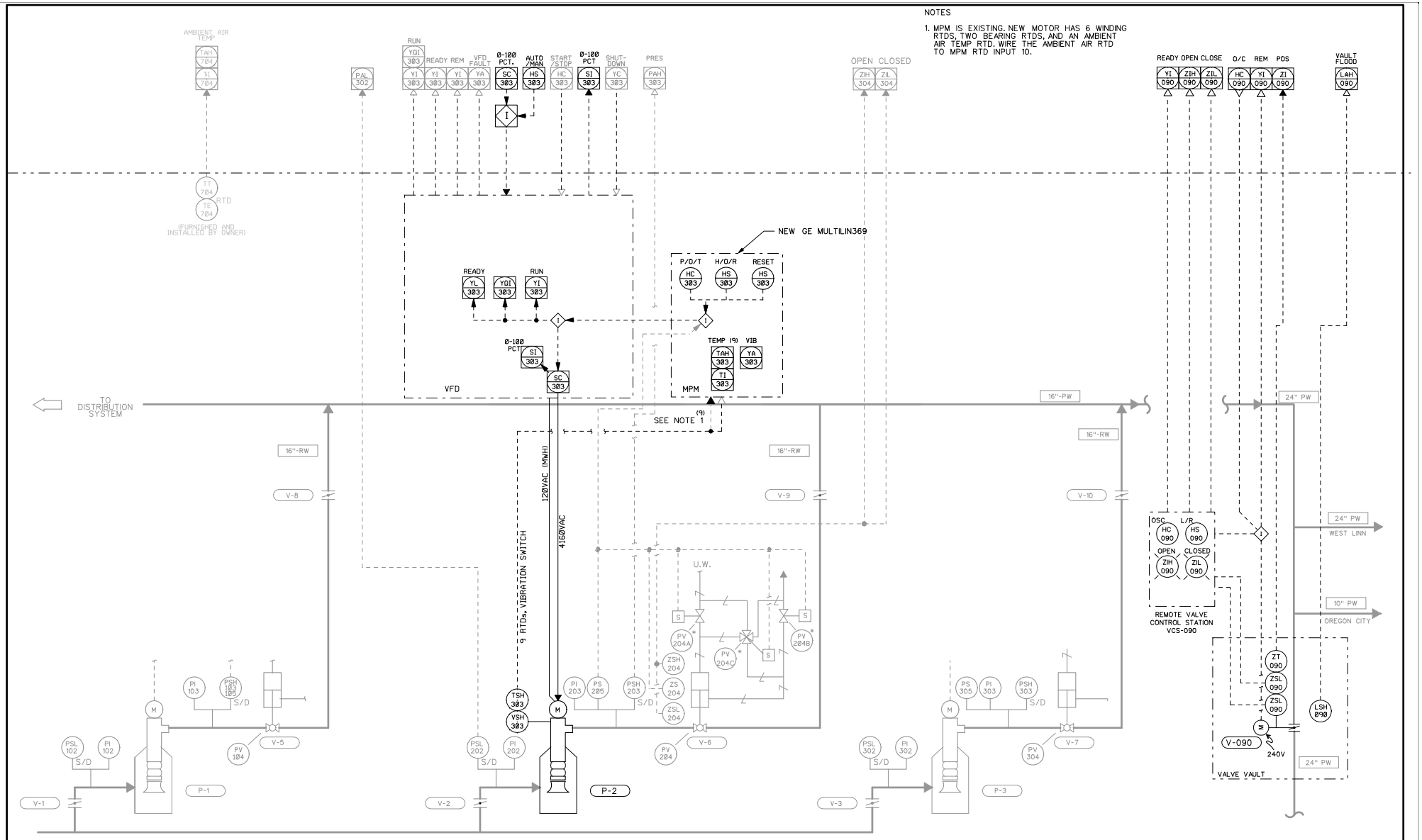
2004 SYSTEM CAPACITY IMPROVEMENTS

PROCESS AND INSTRUMENTATION DIAGRAM
INTAKE/PUMP STATION

SHEET
I-03

NOTES

1. MPM IS EXISTING. NEW MOTOR HAS 6 WINDING RTDS, TWO BEARING RTDS, AND AN AMBIENT AIR TEMP RTD. WIRE THE AMBIENT AIR RTD TO MPM RTD INPUT 10.



REV	DATE	BY	DESCRIPTION
R	1/26/07	RAW	RECORD DRAWINGS

SCALE: NONE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J DEERKOP
DRAWN J DEERKOP
CHECKED R SCHUBACH

RECORD DRAWING

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2004 SYSTEM CAPACITY IMPROVEMENTS
PROCESS AND INSTRUMENTATION DIAGRAM
DIVISION STREET PUMP STATION

SHEET I-04

Job No: 1530509
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Plot Date: 15-FEB-2007