

**South Plume Optimization and  
Injection Demonstration Project  
Technical Specifications**

53300-TS-0001

**Operable Unit 5  
Project Order 169  
WBS No. 1.1.1.1.1.2.1  
June 1997  
Revision 0**

**INFORMATION  
ONLY**

**Environmental Remedial Action Project  
Fernald Environmental Management Project  
Fernald, Ohio  
FDF Subcontract No. 2-21487**



**PARSONS**

**25 Merchant Street  
Cincinnati, Ohio 45246**

**000001**

**South Plume Optimization and  
Injection Demonstration Project  
Technical Specifications**

**Operable Unit 5  
Project Order 169  
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FDF Subcontract No. 2-21487**



**25 Merchant Street  
Cincinnati, Ohio 45246**

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U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND  
INJECTION DEMONSTRATION PROJECT  
TECHNICAL SPECIFICATIONS

PARSONS

Approved by:



*fw*

M. Bowers, CRU-5 Project Manager

6/13/97

Date

## U.S. DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
FDF SUBCONTRACT NO. 2-21487PROJECT ORDER 169  
WBS NO. 1.1.1.1.1.2.1  
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U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND  
INJECTION DEMONSTRATION PROJECT

Division 01 - General Requirements

PARSONS

Prepared by:

 for A. Schatz 6/13/97  
Date

Checked by:

Heinrich Pubkitt 6/13/97  
Date

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SECTION 01010  
GENERAL REQUIREMENTS

**PART 1 GENERAL**

**1.1 SCOPE**

- A. These general requirements form a part of the technical divisions of these specifications.
- B. In all cases where the words "A/E Subcontractor" appear in these specifications, it shall be understood to refer to PARSONS or to such other individuals or organizations acting within the scope of the specific duties entrusted to them.
- C. In all cases where the terms "Vendor" or "Seller" or "Manufacturer" or similar terms appear in these specifications or in the appendices to these specifications, they shall be understood to refer to an individual or firm(s) providing materials, equipment, or services, as noted, under a subcontract to Fluor Daniel Fernald, Inc. (FDF).
- D. In all cases where the term "Subcontractor" appears in these specifications, it shall be understood to refer to the Construction Contractor or Subcontractor.
- E. In all cases where the words "Owner's Agent" or "Construction Manager" appear, they shall be understood to refer to FDF.
- F. The Subcontractor shall coordinate, supervise, and perform all construction acceptance tests. In addition, before the final acceptance of the work, the Subcontractor shall coordinate, supervise, and perform an Integrated system Construction Acceptance Test (ICAT). FDF retains the option to witness any or all tests. All test reports shall be submitted to FDF.
- G. ICAT shall be provided by Subcontractor in accordance with the following requirements:

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1. Construction Acceptance Testing (CAT) must be completed prior to initiation of ICAT.
2. ICAT procedure shall be written by the Subcontractor and given to FDF through the submittal process for review and comments. This cycle will continue until acceptance by FDF.
3. ICAT procedures shall be formatted per the requirements of Site Procedure RM-0034.
4. Subcontractor shall provide an administrative control process to revise ICAT procedures that is equal to or exceeds the requirements of Site Procedure MS-1001.
5. ICAT shall accomplish the following as a minimum requirement:
  - a. The performance of the system meets design requirements.
  - b. The optimum operating parameters of the system are met.
  - c. Any problems that may adversely affect operational reliability of the system have been identified and corrective action taken.

Site Procedures ED-12-6003 and RM-0034 contain the procedure and guidance for system testing.

Subcontractor ICAT procedures must meet these requirements as a minimum.

H. Generally, all field test instruments shall have been calibrated prior to use on this subcontract by a calibration laboratory whose calibration equipment and instruments are fully traceable to National Institute of Science and Technology (NIST) standards. The Subcontractor shall maintain individual certification of calibration which evidences traceability to NIST standards for all field test instruments used on this subcontract.

- I. All work shall be accomplished in accordance with the following code requirements:
1. Ohio Basic Building Code (OBBC) 1995.
  2. Uniform Building Code (UBC) 1994.
  3. Code for Safety to Life from Fire in Buildings and Structures (NFPA 101, Life Safety Code) - 1994.

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4. All other National Fire Protection Association (NFPA) Codes - All inclusive, including 1997 revisions.
5. Occupational Safety and Health Administration (OSHA) - 29 CFR 1910 and 29 CFR 1926.

## 1.2 SITE AND SCOPE

- A. The intent of these specifications is to provide all technical information required and necessary to perform and complete the work as required by the Contract.
- B. The Subcontractor shall provide all labor, services, materials, and equipment, and shall do all work necessary to accomplish this within the limits of work as defined in the accepted bid and/or Contract.

## 1.3 LISTS OF MATERIALS, MANUFACTURERS, OR EQUIPMENT SUPPLIERS

- A. The listing of materials, equipment, manufacturers' names, or equipment suppliers in these specifications in no way precludes the offerer from proposing alternate materials, equipment, manufacturers' names, or equipment suppliers of any of the items to be furnished within the scope of these specifications, except where specifically precluded by these specifications. These lists are intended to identify the types and general quality of those items that will be included in the offerer's proposal. It is the offerer's responsibility to propose the materials, manufacturers' names, or equipment that is best suited for this project in combined terms of quality and price.

## 1.4 SUBMITTALS - SHOP DRAWINGS, SAMPLES, AND OTHER DATA

- A. Section 01011 has the submittal listing. Refer to Part 6 and 7, Statement of Work, in the Invitation for Bid for other submittal requirements. Any submittals not in conformance with these requirements will be returned without review for correction and resubmittal:

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1. Assemble and submit, if required, in logically arranged folders, the following:
  - a. All instruction bulletins, diagrams, lubrication schedules, operating instructions, parts lists, and pamphlets for equipment and apparatus furnished, including vendor's or manufacturer's recommended procedure for lifting, handling, and installing equipment.
2. Submittals for equipment shall include manufacturer's catalog "cut sheets" or similar information bulletins indicating the model number or catalog number, ratings, size, weight, and performance curves and data. Indicate operating point on curves and tabular data for each piece of equipment that curves or data represent.
3. Submit wiring diagrams or connection diagrams for equipment items, accompanied by adequately defined symbols list. Schematic and wiring diagrams must be prepared in accordance with ANSI/IEEE Publication Y32E, "Electrical and Electronics Graphics Symbols and Reference Designations." Individual 8-1/2 by 11-inch elementary and wiring drawings are not acceptable.
4. Indicate all performance data, construction material finishes, and modifications to manufacturer's standard design specified.
5. Locate termination points for all required external wiring.
6. Indicate roughing-in, foundation, and support point dimensions.
7. Submit written test procedures for all required testing. Include criteria for acceptable performance. Submit test reports after completion of tests.
8. Material Safety Data Sheets (MSDSs): The Subcontractor shall submit a list of all "Hazardous Chemicals," as defined in 29 CFR 1926.59 (Hazard Communication), anticipated to be used on site by their employees and all sub-tier subcontractor employees. The list shall include the identity of the hazardous chemical, the manufacturer, the quantity to be brought on site,

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and the specific location (confined spaces, pads, etc.) where it will be used. A legible copy of the most current MSDS for each hazardous chemical to be used shall accompany this list. The list and associated MSDSs shall be submitted to FDF for conformance review by Industrial Hygiene. Hazardous chemicals in excess of project requirements shall not be brought on site.

- 9. FDF's review of such submittals shall not relieve the Subcontractor from any responsibility for deviations from contract drawings or specifications, unless the Subcontractor has in writing called FDF's attention to such deviations at the time of submission, nor shall it relieve the Subcontractor from responsibility for errors of any sort in the submittals nor from responsibility for the proper fitting and construction of the work.
- 10. Submittals will be reviewed with respect to such factors as quality of draftsmanship, legibility, and evidence that the Subcontractor is aware of the necessity and importance of adequately detailing and illustrating special features and conditions relating to the work. Dimensions, sizes, construction details, and directive notes shown will be reviewed for accuracy, compliance with the specifications, adequacy, interferences, etc., on a spot check or incomplete basis to establish that the Subcontractor has given such factors careful attention.
- 11. Any changes marked on submittals during review will be for the purpose of indicating the requirements of the contract documents, and no change in the contract amount is authorized by such markings.
- 12. When submittals are found to be satisfactory with respect to the above factors and within the scope of the review outlined above, they will be returned by FDF to the Subcontractor bearing certificate attachment permitting the Subcontractor to employ them in the furtherance of the Subcontractor's work under the contract, but only with the express understanding that such

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permission shall not relieve the Subcontractor of the responsibilities for the full performance of the work required under the contract in conformance with the contract documents governing such performance, nor for any other deficiencies in the submittals such as inaccuracies, discrepancies, omissions, interferences in the work itself, or with the work of other contractors, whether or not such deficiencies were observed or noted in the course of the review of the shop drawings.

13. The Subcontractor shall verify all field dimensions required for shop drawings.

#### 1.5 REFERENCES

- A. The publications listed in the technical specifications form part of this specification. Each publication shall be the latest revision and addendum in effect at the time of issue of contract and of issue of the specification unless notified otherwise. Except as modified herein or the details of the drawings, work included in this specification shall conform to the applicable provisions of these publications.

#### 1.6 OPERATING MANUALS AND SPARE PARTS LISTS

- A. Copies of manufacturers' recommended spare parts list shall be submitted prior to the shipment of any item of equipment.
- B. An Installation, Operation, and Maintenance (IOM) Manual shall be prepared so as to provide optimum operation and maintenance of the equipment and systems being furnished.

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- C. The cover of the IOM Manual shall include the following information:
1. Project Title -
  2. WBS No. -
  3. A/E Subcontractor - PARSONS.
  4. Construction Manager - FDF.
  5. Subcontractor (Name of Subcontractor, if any).
- D. The IOM Manuals shall be bound into one or more volumes for ease of handling and shall have an index. The manual shall include descriptive literature, drawings, performance curves and rating data, test reports, and spare parts lists. The maintenance section shall divide maintenance procedures into two categories, "Preventive Maintenance" and "Corrective Maintenance," and a subsection for "Safety Precautions." Preventive maintenance shall include cleaning and adjustment instructions. Corrective Maintenance shall include instructions and data arranged in the normal sequence of corrective maintenance (i.e., troubleshooting) (logical effect to cause), then repair and replacement of parts, then the parts list. Safety Precautions shall comprise a list of safety precautions and instructions to be followed before, during, and after making repairs, adjustments, or routine maintenance.
- E. Submit complete sets of final, approved manuals prior to the shipment of the equipment or system.

#### 1.7 SPECIFICATION EXPLANATION

- A. General: The technical specifications are of the abbreviated, simplified, or streamlined type and include incomplete sentences. Omissions of words or phrases such as "the contractor shall," "in conformity therewith," "shall be," "as noted on the drawings," "according to the plans," "a," "the," and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings.

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The Subcontractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled either on the drawings, or specified herein, or both, including all labor, materials, equipment, and incidentals necessary and required for their completion and installation.

For convenience of reference and to facilitate the letting of contracts, the specifications may be separated into titled divisions. Such separations, however, shall not operate to make the A-E/subcontractor an arbitrator to establish the limits of subcontracts in any manner. The following defines the separations referred to in the specifications.

1. Division: Separate numbered division of specifications (e.g., Div. 16)
2. Section: Separate numbered section of a division (e.g., Sec. 16020)
3. Article: Separate numbered article of a subsection (e.g., Article 2.1)

B. Definitions: Certain terms and words as used throughout the specifications shall be defined as follows, unless otherwise particularly specified:

1. "Provide": Furnish and install, complete, in place.
2. "Indicated": As shown on the drawings and/or specified.
3. "Directed,"  
"Authorized,"  
"Permitted": Shall be as directed, authorized, or permitted by FDF.
4. "Selected": Shall be as selected by the A-E/Subcontractor or FDF.
5. "Satisfactory,"  
"Acceptable": Satisfactory or acceptable to FDF.
6. "Necessary,"  
"Required,"  
"Suitable": As necessary, required, or suitable for the intended purpose as determined by FDF.
7. "Submit": Submit to FDF unless otherwise specified

1.8 **ABBREVIATIONS FOR REFERENCED STANDARDS AND SPECIFICATIONS**

- A. The following list denotes abbreviations used in the technical portions of these specifications:

<u>Abbreviation</u>	<u>Authority</u>
AASHTO	American Association of State Highway and Transportation Officials.
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGC	Associated General Contractors of America
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CFR	Code of Federal Regulations
FM	Factory Mutual System
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IMIAC	International Masonry Industry All-Weather Council
ISA	International Society for Measurement and Control
NCMA	National Concrete Masonry Association
NEC	National Electrical Code

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<u>Abbreviation</u>	<u>Authority</u>
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Science and Technology
NPCA	National Paint and Coatings Association
ODOT	Ohio Department of Transportation
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDCA	Painting and Decorating Contractors of America
PS	United States Department of Commerce, Voluntary Products Standards
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
UL	Underwriters Laboratories, Inc.

END OF SECTION

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SECTION 01011  
SUBMITTAL SUMMARY

1.1 SUBMITTAL REQUIREMENTS

- A. Submittals required include drawings and/or data for all items listed below:
1. "AA" designates that items marked are special requirements, which are in the technical sections of the specifications.
  2. "BB" designates that shop drawings are required.
  3. "CC" designates that catalog cuts are required.
  4. "DD" designates that Material Certificates are required.
  5. "EE" designates that Certificates of Conformance are required.
  6. "FF" designates that engineering calculations are required.
  7. "GG" designates that spare parts list is required.
  8. "HH" designates that an installation, operation, and maintenance manuals (IOM) are required.
  9. "II" designates that the manufacturer's material safety data sheets (MSDS) are required.
  10. "JJ" designates that wiring diagrams for power, signal, and control wiring are required.
  11. "KK" indicates that tests are required.
- B. See attached sheets for Submittals.

END OF SECTION

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**Section 01011 of Specifications  
Submittal Summary  
Division 2**

Material/Equipment/Item/Description	Special Reqts AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng Calcs FF	Spare Parts GG	IOM Manual HH	MSDS II (Note)	Wiring Diagram JJ	Witness Tests KK	LL	Samples MM	NN
Section 02100 - Site Clearing														
Traffic Control Plan	X													
Dust Control Plan	X		X											
Section 02200 - Earthwork														
Fill Material	X			X										
Compaction Test	X										X			
As-built Drawing	X													
Dewatering Plan	X													
Section 02270 - Erosion Control			X		X									
Section 02506 - Agg. Road Surface				X										
Section 02667 - Site Water Lines			X	X										
Manholes		X	X	X										
Section 02720 - Site Drainage			X	X										
Section 02831 - Chain Link Fences		X	X											
Section 02900 - Soil Prep. & Seeding					X									

Note: All MSDSs shall be submitted for all hazardous chemicals as required by General Requirements Specification 01010, Article 1.4, Paragraph A.8.

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**Section 01011 of Specifications  
Submittal Summary  
Division 3**

Material/Equipment/Item/Description	Special Reqts AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng Calcs FF	Spare Parts GG	IOM Manual HH	MSDS II (Note)	Wiring Diagram JJ	Witness Tests KK	LL	Samples MM	NN
Section 03001 - Concrete														
Reinforcing Steel Shop Drawing Showing Placement Details		X			X									
Concrete Mix Design				X										
Concrete Supplier Name and Address of Concrete Supplier, Typical Batch Ticket and History	X													
Aggregate Sources and Sieve Analysis	X			X										
Compressive Strength	X										X			

Note: All MSDSs shall be submitted for all hazardous chemicals as required by General Requirements Specification 01010, Article 1.4, Paragraph A.8.

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**Section 01011 of Specifications**  
**Submittal Summary**  
**Division 15**

Material/Equipment/Item/Description	Special Reqts AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng Calcs FF	Spare Parts GG	IOM Manual HH	MSDS II (Note)	Wiring Diagram JJ	Witness Tests KK	LL	Samples MM	NN
Section 15060 - Pipe, Fittings, Valves and Accessories	X	X	X		X	X		X			X			
Pipe					X									
Fabricated Piping Assemblies		X			X									
Pressure Test Reports	X										X			
NDE Procedures	X													
Material Certificates for Weld Consumables	X			X										
Weld Procedures	X													
NDE Testing Personnel Qualifications	X													
Fittings			X		X									
Valves and Specialty Items			X		X	X	X	X						
Section 15090 - Piping Supports and Anchors	X	X	X		X									
Section 15160 - Injection Pumps	X	X	X		X		X	X			X			
Section 15161 - Well Pumps	X	X	X		X		X	X			X			
Section 15170 - Motors			X		X			X		X	X			
Section 15250 - Insulation			X		X			X						
Section 15500 - Heating Ventilation and Air Conditioning														
Fan	X	X	X	X			X	X		X				
Electric Unit Heater	X	X	X	X			X	X		X				

Note: All MSDSs shall be submitted for all hazardous chemicals as required by General Requirements Specification 01010, Article 1.4, Paragraph A.8.

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**Section 01011 of Specifications**  
**Submittal Summary**  
**Division 16**

Material/Equipment/Item/Description	Special Reqs AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng Calcs FF	Spare Parts GG	IOM Manual HH	MSDS II (Note 1)	Wiring Diagram JJ	Witness Tests KK	LL	Samples MM	NN
Section 16050														
Motor Starters		X	X		X			X		X	X			
Selector Switches			X		X					X				
Receptacles			X		X									
Wall Switches			X		X					X				
Conduit			X		X									
Wire and Cable			X		X									
Instrument Cable			X		X									
Nameplates			X		X									
Wire Markers and Cable Tags			X		X									
Wire Way and Aux. Gutters			X		X									
Splicing and Termination Components			X		X									
Boxes			X		X									
Cabinets		X	X		X									
Supporting Devices			X		X									
Underground Warming Tape			X		X									
Electrical Testing					X						X			
Section 16129 - Fiber Optic Cables and Accessories			X		X						X			
Section 16170 - Grounding Electrodes and Conductors			X		X						X			

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**Section 01010 of Specifications**  
**Submittal Summary**  
**Division 16 (Continued)**

Material/Equipment/Item/Description	Special Reqts AA	Shop Dwgs BB	Catalog Cuts CC	Material Certif DD	Certif Conform EE	Eng Calcs FF	Spare Parts GG	IOM Manual HH	MSDS II (Note 1)	Wiring Diagram JJ	Witness Tests KK	LL	Samples MM	NN
Section 16370														
Poles			X		X									
Crossarms			X		X									
Pole Hardware			X		X									
Insulators			X		X									
Line Conductors			X		X									
Arrestors and Cut-Outs		X	X		X		X	X		X				
Pole Mtd. Dist. Trans.		X	X		X		X	X		X	X			
Anchors			X		X									
Section 16462 - Dry Type Trams/Pnlbds.		X	X		X			X		X	X			
Section 16470 - Panelboards		X	X		X			X		X	X			
Section 16500														
Luminaries & Lampholders			X		X									
Ballasts			X		X									
Lamps			X		X									
Exit Signs			X		X									
Emerg. Lighting Units			X		X									
Section 16855 - Heating Cable & Accessories	X		X		X			X			X			

Notes: All MSDSs shall be submitted for all hazardous chemicals as required by General Requirements Specification 01010, Article 1.4, Paragraph A.8.

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SECTION 01012  
SCHEDULE OF DRAWINGS

1.1 DRAWINGS

A. The following drawings are hereby made a part of this contract:

<u>DRAWING NO.</u>	<u>DRAWING TITLE</u>
1.	95X-5900-X-00410 PROJECT TITLE SHEET
2.	95X-5900-X-00411 DRAWING INDEX
3.	95X-5900-X-00412 LEGEND AND SYMBOLS
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41. 95X-5900-E-00462 ELECTRICAL - CABLE SCHEDULE (201 - 250) - SOUTH PLUME OPTIMIZATION AND RECOVERY WELLS
42. 95X-5900-E-00463 ELECTRICAL - CONDUIT SCHEDULE - SOUTH PLUME INJECTION WATER SUPPLY
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47. 95X-5900-E-00468 ELECTRICAL - POWER INSTRUMENTATION AND LIGHTING PLANS - SOUTH PLUME VALVE HOUSE
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- 60. 95X-5900-N-00273 INSTRUMENTATION - CONTROL SYSTEM  
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- 61. 95X-5900-N-00271 INSTRUMENTATION - INTERCONNECTION  
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U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND  
INJECTION DEMONSTRATION PROJECT

Division 02 - Site Work

PARSONS

Prepared by: James A. Shaw 6/13/97  
Date

Checked by: Kenneth A. Gerard 6/13/97  
Date

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SECTION 02100  
SITE CLEARING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Removal of surface debris.
- B. Clearing of plant life, including removal of trees and shrubs and their root systems in areas affected by construction.
- C. Removal of underground and aboveground utilities, only as designated on drawings.
- D. Topsoil excavation.
- E. Removal of fencing.
- F. Removal of paving.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Earthwork.
- D. Section 02270 - Erosion Control.
- E. Section 02831 - Chain Link Fences.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 SUBMITTALS**

- A. Provide submittals as required by Section 01011.

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- B. Prior to initiating site clearing or earth-moving operations, the Subcontractor shall submit a dust control plan for approval by FDF. Along with the plan, the manufacturer's Material Safety Data Sheets' recommendations for material handling and usage for any proposed additives within the water sprays shall be submitted.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Dust control materials shall be nonhazardous. Water shall be potable.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Verify that existing utilities designated to remain are staked, flagged, and identified.
- B. Verify that all utilities to be removed or tapped have been properly isolated and drained (valve turned closed and locked) prior to commencement of work. FDF is to properly isolate and drain utilities (to empty pipe) that are to be abandoned or connected to, unless wet tap is specified on drawings.
- C. Install perimeter erosion and sediment control measures prior to any clearing or grading activities.
- D. FDF will provide the Subcontractor with data on existing survey control points in the vicinity of the work. The Subcontractor is responsible for protecting these points and for setting any additional survey control points determined to be necessary for proper execution of this project.
- E. FDF is responsible for obtaining all easements, rights-of-way, and permits, and for delineating limits of work for all off-site work.

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### 3.2 ERECTION/INSTALLATION/APPLICATION

#### A. Clearing:

1. Clear only the area within a boundary approximately 10 feet beyond the stripping limits and other areas required for access to site and execution of work. Obtain written approval of clearing limits from FDF.
2. Remove trees, shrubs, and woody undergrowth.
3. Trees, shrubs, and woody undergrowth within the designated limits within the FEMP boundary shall be shredded through a chipper and spread or the material windrowed as designated by FDF.
4. During site clearing and earth-moving operations, fugitive emissions, principally dust, shall be controlled using water misting techniques. All resulting runoff water shall be contained and collected.

#### B. Removal:

1. All pavement designated for removal shall be saw cut full depth prior to removal. Adjacent pavement to remain shall be protected. If pavement edge at cut breaks off, the pieces shall be removed and replaced.

#### C. Topsoil Excavation:

1. Excavate topsoil from the designated construction areas limits only.
2. Excavate topsoil in such a manner as to prevent or minimize intermingling with underlying subsoil or other objectionable material.
3. The top six inches of all excavation shall not be reused. Material is to be stockpiled in areas as shown on drawings. Stockpile and provide erosion control in accordance Section 02270. At completion these piles are to be surrounded by chain link fence. See Section 02831 for fences.

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- D. Disposal: All materials removed, except for topsoil stockpiled, shall be disposed of at locations to be designated by FDF. Excess debris and waste generated as a result of the work shall be handled by the Subcontractor as described in Part 6, Statement of Work, of the Invitation to Bid.

### 3.3 PROTECTION

- A. Locate, identify, and protect from damage all utilities that remain.
- B. Protect trees, plant growth, and features that are outside the areas necessary for stripping, excavating, filling, or other grading work.
- C. Protect survey benchmarks, monitoring wells, and existing structures from damage or displacement.
- D. Construct temporary roads and maintain existing roadways at the construction site, and provide dust control as per approval plan.

END OF SECTION

SECTION 02200  
EARTHWORK

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Trenching for culverts and utilities.
- B. Sampling and testing of compaction.
- C. Site excavation and grading.
- D. Site restoration.
- E. Backfilling and compaction.
- F. Soil Materials.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02100 - Site Clearing.
- D. Section 02270 - Erosion Control.
- E. Section 02506 - Aggregate Road Surface.
- F. Section 02720 - Site Drainage.
- G. Section 02831 - Chain Link Fences.
- H. Section 02900 - Soil Preparation and Seeding.
- I. Section 03001 - Concrete.

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**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. State of Ohio, Department of Transportation (ODOT):
1. Construction and Material Specifications, January 1, 1997. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.
- B. American Society for Testing and Materials (ASTM):
1. ASTM C136-96 Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  2. ASTM D422-63 Standard Test Method for Particle-Size Analysis of Soils (R 1990).
  3. ASTM D698-91 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft [600 kN-m/m]).
  4. ASTM D1556-90 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
  5. ASTM D2487-93 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
  6. ASTM D2922-91 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
  7. ASTM D3017-88 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth) (R 1993).

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8. ASTM D4318-95 Standard Test Method for  
Liquid Limit, Plastic Limit,  
and Plasticity Index of Soils.

C. Occupational Safety and Health Administration, Labor Code  
of Federal Regulations (CFR):

1. 29 CFR 1926.650 Subpart P - Excavations.

#### 1.5 SYSTEM DESCRIPTION

A. This section involves earthwork, excavation, trenching,  
stockpiling, filling, backfilling, and compaction  
relating to utilities, roads, culverts, and other  
drainage features.

B. Definitions

1. Utility: Any buried pipe, conduit, or cable.

#### 1.6 SUBMITTALS

A. Provide submittals as required in Section 01011.

B. Materials Source: Submit name of imported materials  
suppliers. Change of source requires approval by FDF.

C. Provide as-built drawings of surface and grading  
features. Accurately record actual locations of  
utilities (i.e., buried pipe, conduit, or cable)  
remaining by horizontal dimensions, elevations or  
inverts, and slope gradients. Submit this information on  
as-built drawings.

D. Submit name and address of soil testing laboratory for  
FDF approval. Provide FDF with copies of all lab/field  
soil tests performed by soil testing laboratory,  
including soil proctor tests (per ASTM D 698).

E. Plans for drainage or dewatering shall be submitted to  
and approved by FDF prior to drainage or dewatering  
activities. Plans shall show method of collection,  
diversion of surface waters from trench, and planned  
points of discharge with adequate outlet protection.

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**1.7 QUALITY ASSURANCE PROGRAM**

- A. Verify that the existing utilities and drainage features are as shown on drawings, and resolve any differences or conflicts with proposed work prior to excavating.
- B. The Subcontractor shall arrange and pay for the services of a qualified, independent soil testing laboratory.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Every effort shall be made to re-use surplus materials generated by the project before importing material from off site.
- B. Subsoil Type S1: Excavated and re-used material; graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris; conforming to ASTM D2487 Group Symbol CL, ML, SC.
- C. Subsoil Type S2: Imported material; graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris; conforming to ASTM D2487 Group Symbol CL, ML, SC.
- D. Coarse Aggregate Type A2: Conforming to ODOT Item 304 - Aggregate Base.
  - 1. The aggregate shall be crushed carbonate, crushed gravel, crushed air-cooled slag, granulated slag, admixture of crushed and granulated slag, or other types of suitable materials meeting the requirement of this item. Crushed carbonate stone or mixtures of crushed and granulated slags shall meet the following gradation requirements:

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Sieve Size	Percent Passing
2 inches	100
1 inch	70-100
3/4 inch	50-90
No. 4	30-60
No. 30	9-33
No. 200	0-13

2. Physical Properties
- a. Percentage of wear, Los Angeles test, maximum (stone or gravel) 50
  - b. Unit weight, compacted, pounds minimum (slag) 65
  - c. Loss, sodium sulfate soundness test, percent maximum 15
  - d. Percentage of fractured pieces, minimum 90
  - e. Deleterious substances shall not exceed the following:  
 Shale, shaly material, and chert which disintegrates in five cycles of soundness test, percent by weight 5
3. The portion of aggregate passing the No. 4 sieve shall have a maximum liquid limit of 25 percent and a maximum plasticity index of 6 (PER ASTM D4318).

E. Fine Aggregate Type A3: Sand - natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded in accordance with ASTM C136 and D2487; within the following limits:

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Sieve Size	Percent Passing
No. 4	90-100
No. 50	7-40
No. 200	0-10

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. The Subcontractor is responsible for all earthwork layout.
  - 1. The Construction Manager will provide horizontal and vertical control points, which shall be verified by the Subcontractor prior to starting work.
  - 2. The Subcontractor shall take necessary precautions to protect control points during construction.
- B. Verify that survey benchmark and intended elevations for the work are as indicated.
- C. Identify and flag known utility locations that exist in the construction area.
- D. Maintain and protect existing utilities to remain.
- E. The Subcontractor shall notify the Construction Manager when the actual conditions differ in any manner from those specified in the contract documents, or when soft or spongy areas or other unusual soil conditions are encountered. Discontinue affected work until notified by Construction Manager to resume work.
- F. No backfill shall be placed around or on any structure/ foundation at least 7 days after placement or until it is shown that the concrete has attained 85 percent compressive strength.
- G. Install erosion and sediment control measures in accordance with Section 02270.

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**3.2 ERECTION/INSTALLATION/APPLICATION****A. Excavation:**

1. Excavate subsoil required to accommodate foundations, slabs on grade, paving, site structures, and construction operations.
2. Trenches and excavations shall be in accordance with OSHA 29 CFR 1926.650, Subpart P - Excavations.
3. Correct unauthorized excavation at no extra cost to FDF.
4. Hand-trim excavation for structural footings. Remove loose material.
5. Do not interfere with 45-degree bearing splay of existing foundations.
6. Stockpile excess soil in the area designated on the contract drawings or as directed by FDF.
7. Perform grading and other operations to maintain site drainage. No water shall be permitted to accumulate in excavations, especially under structures, paving areas, or equipment pads. Control water by means of ditches, dams, temporary pumps and piping, plastic coverings, tarps, or other methods acceptable to the Construction Manager. Water is to be handled in accordance with approved plan. See Section 02700 for permanent storm drains.
8. Areas that are disturbed or that lose firmness before concrete is poured shall be undercut, backfilled, and compacted as specified in Article 3.3, Paragraph F. At the Subcontractor's option, a lean concrete (2,500 psi at 28 days) may be installed.
9. Remove debris, lumped subsoil, boulders, and rock up to 1/3 cubic yard.

**B. Topsoil Excavation:**

1. Excavate topsoil and stockpile in accordance with Section 02100.

C. Trenching:

1. Cut trenches sufficiently wide to enable installation of utilities.
2. Excavation is to be free of loose matter.
3. Backfill trenches to required contours and elevations.
4. Trenching shall conform to OSHA requirements.

D. Rough Grading:

1. Prepare subgrade as follows:
  - a. Compact exposed subgrade to density requirements for subsequent backfill materials. When existing ground surface has a density of less than the density specified, break up the ground surface, pulverize, adjust moisture content to specified limits, and compact to specified density.
  - b. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Type S1 or S2 fill and compact to density equal to or greater than requirements for subsequent fill material.
2. Backfill areas to contours and elevations shown. Use unfrozen and unsaturated materials.
3. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
4. Unsatisfactory subgrade:
  - a. Where unsatisfactory subsurface conditions in an area of backfill are observed, excavate unsatisfactory material to satisfactory subgrade as approved by FDF.
  - b. Backfill with fill material required for specific area. Compact to density required for the area.
5. Place and compact fill materials in continuous level layers not exceeding 8 inches loose depth.
6. Maintain optimum moisture content as determined by ASTM D698 (within 3 percent) of backfill materials to attain required compaction density.
7. Backfill against foundations and pads as specified in Article 3.3, Paragraph F.
8. Slope grade away from foundations and pads a minimum 1/4 inch per foot, unless noted otherwise.

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9. Backfill simultaneously on each side of unsupported foundation walls.

E. Fill over Underground Utilities in Trenches:

1. Fill Type S1 or S2, above bedding. Layer thickness shall not exceed 6 inches loose depth.
2. Pipe bedding shall be Type A3 material compacted in layers not exceeding 6 inches loose depth.
3. For "by methods" compaction each layer of pipe bedding and trench backfill shall be compacted by five passes of compaction equipment. Each pass shall overlap each preceding pass by at least 2 inches. Compaction equipment shall be vibratory and impart at least 2,000 foot-pounds of impact energy with a frequency of 500 bpm, which is similar to a medium size excavator mounted tamping plate/ram.
4. Do not use wet soil materials. Maintain moisture of backfill materials to within 3 percent of optimum moisture as determined by ASTM D698. Do not place backfill on wet material.

F. Topsoil:

1. The top six inches of all excavation is to be handled in accordance with Section 02100. Topsoil is not to be reused.

G. Material Stockpiles: See Section 02270.

H. Dust Control: See Section 02100.

I. The Subcontractor may use lean concrete, minimum compressive strength of 2,500 psi, to correct over excavation.

J. Debris and waste shall be handled as specified in Section 02100.

**3.3 FIELD QUALITY ASSISTANCE**

A. Compaction testing will be performed in accordance with ASTM D698, ASTM D1556, ASTM D2922, and ASTM D3017. Trenches can be compacted "by methods" or tested.

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- B. Grain size analysis shall be performed in accordance with ASTM D422.
- C. If compaction test indicated that work does not meet specified requirements, remove work and replace or recompact to specified requirements. If visual inspection indicates that work has not been performed as specified, repeat procedure.
- D. Frequency of Tests:
1. Frequency of in-place density testing shall be whichever of the following requires the greatest number of tests:
    - a. Once each day of work filling.
    - b. Once every layer of fill.
    - c. Once every 500 cubic yards of fill.
    - d. Every 2,000 square feet under paving, slab on grade, or footer.
    - e. Once at each spread footing subgrade and at 50-foot centers on strip footing subgrade.
    - f. Under each foundation at subgrade.
    - g. Once every 200 feet of trench.
    - h. Continuous visual inspection will be necessary for compaction of trenches, if "by methods" compaction is used.
- E. The Subcontractor shall notify the Construction Manager of activities that will require testing/inspection prior to the start of such activities.
- F. Minimum Compaction Requirements:

Location	Required Compaction
Under foundation	100 percent Standard Proctor
Under Slabs Fill Type A2	95 percent Standard Proctor
Trenches	By Method (See Article 3.2 and note below) or 95 percent Standard Proctor

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Location	Required Compaction
Under all pavements Subsoil Fill Type A2	95 percent Standard Proctor 95 percent Standard Proctor
All other fill (roads and grading) (Fill Type S1 or S2)	95 percent Standard Proctor
Topsoil	90 percent Standard Proctor

Standard Proctor - ASTM D698.

Note: If "By Method" compaction is used and performed in accordance with Article 3.2, in trench testing of backfill is not required.

### 3.4 ADJUSTING

- A. Grading and Filling:  $\pm 1$  inch of indicated finish subgrade at structures and pavements. Other areas graded to drain at  $\pm 3$  inches.
- B. Top of Topsoil:  $\pm 3$  inches of required elevation or plane.

### 3.5 CLEANING

- A. Remove soil stockpiles, leaving the area in a clean and neat condition. Grade and stabilize site surface to prevent freestanding surface water.

### 3.6 PROTECTION

- A. Grade excavation top perimeter to prevent surface water runoff from entering into excavation or to adjacent properties.
- B. Protect finished work, existing features, and landscaping which will remain.
- C. Reshape and recompact fills subjected to vehicular traffic to final grade and to compaction requirements given in Article 3.3.

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- D. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- E. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- F. Provide erosion and sediment control in accordance with Section 02270 prior to start of any earth moving.

END OF SECTION

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SECTION 02270  
EROSION CONTROL

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Soil erosion and sedimentation control for areas of the Subcontractor's work area which are graded or disturbed as a part of the contract work.
- B. Installation, maintenance, and removal of all temporary erosion control facilities.
- C. Installation of erosion control blankets.
- D. Dumped rock for storm drain lines.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02100 - Site Clearing.
- D. Section 02200 - Earthwork.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. State of Ohio, Department of Transportation (ODOT):
  - 1. Construction and Material Specifications, January 1, 1997. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

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- B. State of Ohio, Department of Natural Resources (ODNR):
1. Rainwater and Land Development, Ohio's Standard for Stormwater Management, Land Development, and Urban Stream Protection - 1996.
- C. American Society for Testing and Materials (ASTM):
1. ASTM D1777-96 Standard Test Method for Thickness of Textile Materials.
  2. ASTM D3776-96 Standard Test Method for Mass Per Unit Area (Weight) of Woven Fabric.
  3. ASTM D3786-87 Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting.
  4. ASTM D4491-95 Standard Test Method for Water Permeability of Geotextiles by Permissivity.
  5. ASTM D4533-91 Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
  6. ASTM D4632-91 Standard Test Method for Grab Breaking Load and Elongation of Textiles.
  7. ASTM D4751-95 Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  8. ASTM D4833-88 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.

**1.6 QUALITY ASSURANCE PROGRAM**

- A. Subcontractor shall inspect sediment control measures periodically and after each rain exceeding 0.5 inches to evaluate the effectiveness of the control measures.

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Records of inspections shall be kept on file at Subcontractor's site office.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. **Stakes:** Stakes shall be a minimum of 2 feet, 8 inches in height and 2 inches by 2 inches or more in depth and width and made from hardwood.
- B. **Silt Fence:** Materials shall be as specified in ODNR's Rainwater and Land Development and the construction drawings.
- C. **Dumped Rock Fill:** Dumped rock fill shall meet the requirements of ODOT Item 601.07 for type specified on drawings.
- D. **Non-woven geotechnical fabric for dumped rock fill bedding similar to Trevira No. 1125™ as per the following table:**

<b>Minimum Physical Properties (Minimum Average Roll Values)</b>			
<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>Material</b>
Unit weight	ASTM D3776	oz/yd <sup>2</sup>	7.1
Grab Tensile	ASTM D4632	lbs	210
Grab elongation	ASTM D4632	percent	60
Mullen burst	ASTM D3786	psi	360
Puncture	ASTM D4833	lbs	95
Trapezoid tear	ASTM D4533	lbs	75
Apparent Opening size	ASTM D4751	US sieve number	70
Permissivity	ASTM D4491	gal/min/ft <sup>2</sup> / sec <sup>-1</sup>	110 1.47

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Minimum Physical Properties (Minimum Average Roll Values)			
Property	Test Method	Units	Material
Permeability	ASTM D4491	cm/sec	.35
Thickness	ASTM D1777	mils	95

E. Erosion Control Blankets: Similar to North American Green Type C125. Erosion Control Turf Reinforcement Mat shall be constructed of 100 percent coconut fiber stitch bonded between a heavy duty UV stabilized bottom net and a heavy duty UV stabilized top net. The cusped (crimped) netting shall form closely spaced ridges across the entire width of the mat. The nettings shall be stitched together on 1.5 inch centers with UV stabilized polyester thread to form a permanent three dimensional structure. The mat shall have the following physical properties and rated for 3 years service life for use on slopes of 1:1 or greater.

1. Material Content
  - a. Coconut fiber: 100 percent; 0.5 lb/yd<sup>2</sup>.
  - b. Nettings: Top - Heavy UV stabilized; polypropylene; 3 lbs per 1,000 ft<sup>2</sup>. Bottom - Heavy UV stabilized; polypropylene; 3 lbs per 1,000 ft<sup>2</sup>.
  - c. Thread: UV stabilized polyester.
2. Physical Specifications (Roll)
  - a. Width: 6.5 feet
  - b. Length: 83.5 feet
  - c. Weight: 30 lbs ±10 percent
  - d. Area: 60 yd<sup>2</sup>

### PART 3 EXECUTION

#### 3.1 FIELD CONDITIONS

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##### A. Protective Measures

1. Construct protective devices as specified herein, and as required on the contract drawings.
2. Silt Fence: Conform to requirements on the construction drawings.

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3. Stockpile areas for soil materials shall also be protected from erosion. If pile is not used for 45 days, it shall be covered with tarps or seeded. Slopes on pile shall not exceed 2:1 in steepness and shall be less than 15 feet in height. Pile shall be shaped with a drainage pitch of at least 2 per cent on all areas. The perimeter of the pile shall have proper sediment controls (i.e., silt fence). Tarps or other coverings placed on pile shall be properly anchored to withstand wind and fully cover all of the pile. The subcontractor is responsible for maintaining the controls on the piles until final acceptance or disposition.
4. Pipeline installation (trenching, pipe laying, and backfill) is to be kept to 500 feet or less in length of exposed, denuded conditions. Completed, backfilled sections can be covered with mulch, temporary seed, erosion fabric, or other method as approved by FDF, prior to final cover. Proper sediment controls (i.e., silt fence, straw bale) shall be used at denuded trench areas. Sediment controls can be re-used, if not in disrepair.

B. Silt Fences

1. Install in accordance with ODNR and manufacturer's recommendations. Place at locations shown on drawings prior to start of earthwork.

C. Erosion Control Blankets

1. Install in accordance with manufacturer's recommendations. All blankets shall be properly anchored with wire staples in patterns and sizes recommended by manufacturer. Bury edges in 6 inch deep trench, rake area smooth, and seed.
2. Erosion control blankets shall be used on all slopes steeper than 4H:1V and at all ditch inverts, to a ditch depth of 1 foot.

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**3.2 ADJUSTING**

**A. Removal of Sediment Accumulation**

1. Remove accumulated sediments, debris, and obstructions as necessary. In no case shall sediment build up to a depth greater than 1/2 the height of the protective device. Respread on site in a manner not to adversely affect protective procedures and consistent with site regulations and Subcontract Part 6 Scope of Work. Seed areas.

**B. Removal of Temporary Erosion Control Facilities**

1. Erosion control facilities shall be removed at the direction of FDF after the disturbed areas are stabilized with grass or other measures approved by FDF.

**END OF SECTION**

SECTION 02506  
AGGREGATE ROAD SURFACE

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Installation and compaction requirements for aggregate surface for roads.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Earthwork.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. State of Ohio, Department of Transportation (ODOT), Construction and Material Specifications, January 1, 1997. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Materials Source: Submit names of imported materials suppliers. Change of source requires FDF's approval.
- C. Material suppliers shall be required to certify that supplied materials meet specifications prior to use.

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- D. Submit name and address of testing laboratory for approval. Provide FDF with copies of all lab/field test results.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Aggregate materials shall meet the requirements of ODOT Item 304.

1. Aggregate: The aggregate shall be crushed carbonate stone, crushed gravel, crushed air-cooled slag, granulated slag, a mixture of crushed and granulated slags, or other types of suitable materials meeting the requirements of this item. Crushed carbonate stone, crushed gravel, crushed air-cooled slag, or mixtures of crushed and granulated slags shall meet the following gradation requirements and physical requirements.

Sieve	Total Percent Passing
2-inch	100
1-inch	70-100
3/4-inch	50-90
No. 4	30-60
No. 30	9-33
No. 200	0-13

2. Physical Properties
- a. Percentage of wear, Los Angeles test, maximum (stone or gravel) 50
  - b. Unit weight, compacted, pounds minimum (slag) 65
  - c. Loss, sodium sulfate soundness test, percent maximum 15
  - d. Percentage of fractured pieces, minimum 90
  - e. Deleterious substances shall not exceed the following:
    - Shale, shaly material, and chert which disintegrates in five cycles of soundness test, percent by weight 5

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3. The portion of aggregate passing the No. 4 sieve shall have a maximum liquid limit of 25 percent and a maximum plasticity index of 6.

- B. Geotextile fabrics shall conform to ODOT Item 712.09, Type D.

### **PART 3 EXECUTION**

#### **3.1 FIELD CONDITIONS**

- A. Verify grades and elevations of subgrade are correct.
- B. Verify that compacted subgrade is dry and not frozen, soft, or spongy.

#### **3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Prepare subgrade according to Section 02200.
- B. Place geotextile on subgrade in accordance with manufacturer's installation instructions and as follows:
  1. Geotextile fabric shall be placed directly over the subgrade. The geotextile fabric shall be placed and temporarily anchored in such a manner that placement of overlying materials will not excessively stretch or tear the fabric.
  2. Geotextile fabric shall be installed to limits and grades indicated on plans for all new work. The geotextile shall not be dragged across the subgrade. The geotextile fabric shall be unrolled as smooth as possible on the prepared subgrade. Wrinkles and folds in the geotextile shall be removed by stretching and placing of sod staples or small aggregate piles as required. The fabric shall be installed according to the manufacturer's suggestion at curve locations.
  3. The geotextile shall be field joined, factory seamed, or manufactured in seamless width. Methods of field joining shall include overlapping of adjacent edges and ends of geotextile or sewing of adjacent edges and ends of geotextile. Sand bags or other weights may be used for temporary

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anchoring. Overlap at edges and ends of geotextile shall be per manufacturer's installation instructions.

4. The geotextile fabric shall extend to the edges of the road aggregate surface.
  5. Exposure of geotextiles to elements between lay down and cover shall be a maximum of 7 days to minimize damage potential by ultraviolet light.
  6. End dumping or tailgate dumping shall not be permitted directly onto the geotextile fabric. The aggregate shall be dumped adjacent to the fabric or on previously placed stone. The aggregate shall be spread from the backdumped pile using a bulldozer, loader, track hoe, or grader, with care being taken to avoid damage to the fabric by blades, tracks, tires, or buckets. The initial lift of aggregate on the geotextile fabric shall be a minimum thickness of 6 inches after compaction and shall be compacted with a smooth drum roller to the minimum compacted density per Section 02200.
  7. Construction traffic shall not be permitted directly on the geotextile fabric.
- C. When additional aggregate material is to be added to existing compacted aggregate, scarify existing aggregate to a depth of 3 inches.
- D. Compact aggregate road surface as specified in Section 02200.

### 3.3 QUALITY CONTROL

- A. Work shall be performed in accordance with ODOT requirements.
- B. Tolerances
1. The top of the aggregate surface shall be a uniformly smooth grade surface without high or low points and shall not be more than 0.10 feet above or below specified grades.

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2. The thickness of the finished aggregate course shall be no less, at any point, than the thickness indicated on the drawings.

**END OF SECTION**

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SECTION 02667  
SITE WATER LINES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Pipe and fittings for groundwater discharge, reinjection, and treatment underground lines.
- B. Valves and tap connections.
- C. Air-relief manholes, frames, and lid.
- D. Clean-outs.
- E. Guard posts.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Earthwork.
- D. Section 03001 - Concrete.
- E. Section 15060 - Pipe, Fittings, Valves, and Accessories.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A36/A36M-96 Carbon Structural Steel.

2. ASTM A53-96 Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
3. ASTM A325-96 Structural Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength.
4. ASTM D3035-95 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
5. ASTM D3261-95 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
6. ASTM D3350-96 Standard Specification for Polyethylene Plastic Pipe and Fittings Material.

B. American Water Works Association (AWWA):

1. AWWA C104/  
A21.4-95 Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
2. AWWA C105/  
A21.5-93 Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110/  
A21.10-93 Ductile-Iron and Gray-Iron Fittings, 3-Inch through 48-Inch, for Water and Other Liquids.
4. AWWA C111/  
A21.11-95 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
5. AWWA C115/  
A21.15-94 Flanged Ductile Iron Pipe with Threaded Flanges.
6. AWWA C150/  
A21.50-91 Thickness Design of Ductile Iron Pipe.
7. AWWA C151/  
A21.51-91 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
8. AWWA C500-93 Metal-Seated Gate Valves for Water Supply Service.

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- 9. AWWA C550-90 Protective Epoxy Interior Coatings for Valves and Hydrants.
  - 10. AWWA C600-93 Installation of Ductile-Iron Water Mains and Their Appurtenances.
- C. American Welding Society, Inc. (AWS):
    - 1. AWS D1.1-96 Structural Welding Code - Steel.
  - D. State of Ohio, Department of Transportation (ODOT), Construction and Materials Specifications, January 1, 1997.
  - E. Steel Structures Painting Council (SSPC):
    - 1. SSPC SP 6-94 Surface Preparation Specification No. 6 - Commercial Blast Cleaning.

#### 1.5 SUBMITTALS

- A. Product Data: Provide data on all pipe materials, pipe fittings, valves, accessories, the methods and equipment for HDPE fusion welding, HDPE manholes, and manhole frame and cover.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Project Record Documents:
  - 1. Accurately record actual locations by NAD83 coordinates of all underground utilities, piping mains, valves, connections, and invert elevations, and show on as-built drawings.
  - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Provide detailed shop drawings for approval of all HDPE manholes. Drawings shall show plan and section view of manhole, invert of pipes, pipe sizes, pipe orientation, and weld types/details.

**1.6 QUALITY ASSURANCE**

- A. Piping and Valves: Manufacturer's name and pressure rating marked on valve body and side of pipe.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

A. Pipe

1. Ductile Iron Pipe: AWWA C151, Class 55:
  - a. Fittings: AWWA C110, Ductile iron cement lined, standard thickness per AWWA C150. All fittings and pipe at valves shall be flanged per AWWA C115.
  - b. Jackets: AWWA C105, PE encasement.
  - c. Cement Lined: AWWA C104, cement mortar lined.
  - d. Joints: AWWA C111, push-on, rubber gasket.
2. HDPE Pipe: ASTM D3035, SDR 11 for 150 psi pressure rating (150 psi test pressure rating).
  - a. Fitting: AWWA C906, molded, butt fusion weld to pipe.
  - b. Joints: Butt fusion, flanged gasket joints, and molded adapter pipe at interface connections with ductile iron or carbon steel pipe and valves.
  - c. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "water service" in large letters.
3. Carbon Steel: Refer to Piping Material Data Sheet in Section 15060.

B. Gate Valves

1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, Class 125 flanged ends, control rod, extension box, and valve key.

C. Bedding Materials

1. Bedding: Fill Type A3 as specified in Section 02200.

- D. Manhole: HDPE, ASTM D3350. Pipe resin is cell classification 3454-34C and a plastic pipe Institute Rating of PE 3408. The manhole shall have lifting lugs capable of supporting manhole during placement and shipping. The cylinder and outlet shall be fabricated from HDPE pipe with SDR, same as pipe, as indicated on drawings. All components shall be joined by butt fusion, saddle fusion, socket fusion, or extrusion welding. Hot air welding is not acceptable. Each manhole shall be identified by appropriate manhole number and visibly marked on interior and exterior. HDPE molded pipe stubs and ductile iron flanged backup rings in manholes shall be installed in manhole by shop fabrication.
- E. Manhole frame and lid shall be heavy-duty cast iron as noted on the drawings.
- F. Air Vacuum and Air Release Valve: Refer to Section 15060.
- G. Post Indicating Valves: Post Indicating Valves Assembly - U.L. listed and FM approved.
1. Sizes 4 inches - 14 inches, AWWA C500 gate valves, flanged ends Class 150, post assembly shall show open and shut, handcrank operator above ground, non-rising stem, and break-flange to separate the top works without removing the valve from the line.
- H. Guard Posts: Steel pipe, ASTM A53, Schedule 40.
- I. Protective Coatings for Valves:
1. Interior - Factory applied heat-cured epoxy coating conforming to AWWA C550.
  2. Exterior - Two coats of factory applied zinc chromate primer and two coats finish coating in accordance with metal painting specifications in Article 3.3, Paragraph F.
- J. Manhole Pipe Supports:  
Material used shall meet the following specifications:
1. Structural Steel - ASTM A36.

2. Bolts, Nuts, and Washers - ASTM A325.
3. Welding - AWS D1.1 Class E70XX electrodes.
4. Expansion Anchors: Drilled expansion bolts for securing steel to concrete.
  - a. Kwik Bolt, by Hilti, Inc.
  - b. Parabolt, by Molly Fastener Group.
  - c. Wedge Anchors, by ITW Ramset/Red Head.

## 2.2 ACCESSORIES

- A. Concrete: ODOT Item 499, Class F, 3,000 psi at 28 days. Poured against undisturbed soil or compacted fill.
- B. Reinforcing Steel: All reinforcing steel shall meet the requirements of ODOT 709.01, 60 ksi yield grade, deformed billet steel bars, plain finish.
- C. Welded Steel Wire Fabric: All welded steel wire fabric shall meet the requirements of ODOT 709.10.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions. Bring any discrepancies to FDF for resolution prior to start of work. Any discrepancies should be brought to FDF's attention in a written statement immediately upon discovery.
- B. Verify that service connection and site utility water main size, location, and invert are as indicated.

### 3.2 PREPARATION

- A. Ream pipe and tube ends and remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Excavate pipe trench in accordance with Section 02200 for work of this section. Locate all existing ~~000066~~ utilities in the area and determine if they will

interfere with the proposed utility. Notify FDF if there is an interference.

- D. Remove existing pipe to the extent necessary to make new tie ins. Tie-in locations shall be adjusted to conform to field conditions.

### 3.3 ERECTION/INSTALLATION/APPLICATION

#### A. Installation - Pipe: Ductile Iron Pipe

1. Maintain separation of water main from potable water piping (10-foot horizontal minimum, 18-inch vertical minimum).
2. Install pipe to indicated elevation to within tolerance of 5/8 inches at structures.
3. Install ductile iron piping and fittings to AWWA C600. Place polyethylene jacket around all piping exposed to earth in accordance with manufacturer's recommendations.
4. Route pipe in straight line except as shown on drawing.
5. Install pipe to allow for expansion and contraction without stressing pipe or joints as per manufacturer's recommendations.
6. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main.
7. Establish elevations of buried piping to ensure not less than 3.5 feet of cover.
8. Backfill trench in accordance with Section 02200.

#### B. Installation - Manhole and Pipe: HDPE

1. Maintain separation of water main from potable water piping (10-foot horizontal minimum, 18-inch vertical minimum).
2. Install pipe to indicated elevation to within tolerance of 5/8 inches at structures.
3. Install HDPE piping, manholes, and fittings to AWWA C906 (by butt weld fusion method, in accordance with ASTM D3261).
4. Route pipe in line as shown on drawing. The minimum bending radius shall be as specified by the pipe manufacturer. Pipe shall be in a straight route at manhole connections.

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5. Install pipe to allow for expansion and contraction without stressing pipe or joints as per manufacturer's recommendation.
6. Form and place concrete for thrust blocks at each molded elbow of pipe main.
7. Establish elevations of buried piping to ensure not less than 3.5 feet of cover.
8. Install trace wire continuous over top of pipe, 6 inches above pipe line; coordinate with Section 02200.
9. Backfill trench in accordance with Section 02200.
10. Place concrete in and around top of manhole in accordance with Section 03001.

C. Installation of Pipe and Valves: Carbon Steel, see Section 15060.

D. Installation - Guard Post

1. Excavate for post and concrete in accordance with Section 02200.
2. Hand trim and remove loose material in excavation.
3. Position pipe in hole, maintaining clearances as specified on drawings.
4. Place concrete around and in pipe in accordance with Section 03001.
5. Paint post after concrete cures in accordance with ODOT Item 514.

E. Installation - Post Indicator Valves:

1. Set post indicator valves on solid bearing of concrete.
2. Center and plumb valve box over valve. Set box cover flush with finished grade with a tolerance of +2 inches to -1 inch.
3. Center and plumb indicator post over valve. Indicator post to have plate window to show open and shut position. Indicator post to extend above grade as shown on the drawings.

F. Shop and Field Painting Specification:

For Steel Plate and Shapes, Pipe and Fittings

1. Prepare surfaces in accordance with Steel Structures Painting Council (SSPC) SP-6.

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2. Prime all bare metal not in contact with concrete/grout with one coat Tnemec Series 6 Epoxo Line Primer. Apply two-coats of Tnemec Series 66 Hi-Build Epoxoline for the finish coat. Follow SSPC Paint 13 and Paint 20.

G. Excess Debris and Waste:

1. Excess debris and waste generated as a result of the work shall be handled by the Subcontractor as described in Part 6, Statement of Work, of the Invitation for Bid.

3.4 FIELD QUALITY ASSURANCE

- A. Perform hydrostatic tests on water line in accordance with AWWA C600. Notify the Construction Manager at least 24 hours in advance of planned testing. Submit report to the Construction Manager within 1 week after completion of test.
- B. Each HDPE manhole shall be hydrostatically tested before installation by the following method:
  1. The manhole filled with potable water to within 6 inches of top.
  2. Monitor the water level for a 4 hour period. If the level drops 0.5 inches or more over this period, identify leaks and repair. Retest manhole until acceptable and drain.
- C. Manhole shall be tested twice; prior to backfill and at completion of backfill.

END OF SECTION

SECTION 02720  
SITE DRAINAGE

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Culverts including flared inlet and outlet.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 02200 - Earthwork.  
D. Section 02270 - Erosion Control.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. State of Ohio, Department of Transportation, Construction and Material Specifications, January 1, 1997 (ODOT). Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.
- B. American Association of State Highway and Transportation Officials (AASHTO):
- |                           |  |
|---------------------------|--|
| 1. AASHTO M36/<br>M36M-91 | Standard Specification for<br>Corrugated Steel Pipe,<br>Metallic-Coated, for Sewers<br>and Drains. |
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**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.

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- B. Project Record Documents: Accurately record actual locations by NAD83 coordinates and invert elevations of culverts and underground utilities, and show on as-built drawings.
- C. Product Data:
  - 1. Provide data on all pipe and culvert materials, fittings, and accessories.
- D. Submit manufacturer's certification that materials supplied meet or exceed the requirements specified.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Corrugated Metal Pipe
  - 1. Corrugated metal storm drain pipe and culverts shall be in accordance with AASHTO M36 and ODOT 707. Corrugated metal pipe shall be galvanized, of the sizes specified on the drawings.
  - 2. Storm drain pipe, culverts, and fittings shall be corrugated steel, 14-gage thickness. Culverts shall have standard metal flared end sections.
  - 3. Coupling bands shall be corrugated, galvanized steel bands in accordance with AASHTO M36. Pipe sections with rerolled ends shall be joined with annular corrugated connecting bands. Helically corrugated pipe ends shall be joined using helically corrugated connecting bands.
- B. Bedding materials for storm drain pipes and culverts shall be in accordance with ODOT 304.
- C. See Section 02270 for data on fabric under dumped rock fill and for dumped rock fill.
- D. Concrete Materials:
  - 1. All cast-in place concrete shall meet requirements of ODOT Item 499, Class F concrete (average compressive strength at 28 days of 3,000 psi).

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2. All precast concrete shall meet the requirements of ODOT 706.13 with 6 ±2 percent air void content in the hardened concrete.

E. Reinforcement Materials

1. Reinforcing Steel: All reinforcing steel shall meet the requirements of ODOT 709.01, 60 ksi yield grade, deformed billet steel bars, plain finish.
2. Welded Steel Wire Fabric: All Welded Steel Wire Fabric shall meet the requirements of ODOT 709.10.

**PART 3 EXECUTION**

**3.1 FIELD CONDITIONS**

- A. Verify that excavations are ready to receive work.

**3.2 PREPARATION**

- A. Hand trim excavations. Correct over-excavation according to the requirements of Section 02200.

**3.3 ERECTION/INSTALLATION/APPLICATION**

A. General

1. Excavation and backfill shall conform to Section 02200.
2. Backfill compaction and testing shall conform to the requirements of Section 02200.

B. Corrugated Metal Pipe

1. The pipe and fittings shall be free of foreign materials and visible defects. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.
2. All pipe shall be laid as shown in the drawings.
3. Each piece of pipe shall be carefully inspected before it is placed and no defective pipe shall be laid in trench. Prior to laying metal pipe, coat areas where the galvanizing finish has been removed or damaged with a zinc-enriched paint. Trench bottoms found to be unsuitable for foundations after pipe laying operations have

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started shall be corrected and brought to specified line and grade with approved bedding materials.

4. Joints for corrugated metal pipe shall be made with corrugated galvanized steel coupling bands in accordance with AASHTO M36.

#### 3.4 QUALITY CONTROL

- A. Inspection: After the Subcontractor has performed the inspections, and prior to testing and backfill, the Subcontractor shall notify FDF.
  1. Inspection shall include checking for proper alignment and location of all piping.
  2. Joints shall be tight and properly seated as per the manufacturer's recommendations.
  3. Inspection by FDF is required prior to and immediately after placing backfill over pipe.
  4. Piping must be free of debris, dirt, sand, silt, or other foreign matter.
- B. The Subcontractor shall notify FDF of testing/inspection activities at least 24 hours prior to the start of all tests or inspections.
- C. Testing of backfill compaction shall be as specified in Section 02200.

END OF SECTION

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SECTION 02831  
CHAIN LINK FENCES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fence framework, fabric, and accessories.
- B. Excavation for post bases; concrete foundation for posts and center drop for gates.
- C. Manual gates and related hardware.
- D. Specification applies to fence repair needed as a result of relocation or of Subcontractor's construction or site clearing activities.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02100 - Site Clearing.
- D. Section 02200 - Earthwork.
- E. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A121 Standard Specification for  
Rev. A-92 Zinc-Coated (Galvanized) Steel  
Barbed Wire.

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- |    |                        |   |
|----|------------------------|---|
| 2. | ASTM A123<br>Rev. A-89 | Standard Specification for<br>Zinc (Hot Dip Galvanized)<br>Coatings on Iron and Steel<br>Products.                  |
| 3. | ASTM A153<br>A153M-95  | Standard Specification for<br>Zinc Coating (Hot-Dip) on Iron<br>and Steel Hardware.                                 |
| 4. | ASTM A392-96           | Standard Specification for<br>Zinc-Coated Steel Chain-Link<br>Fence Fabric.   |
| 5. | ASTM A570<br>A570M-95  | Standard Specification for<br>Steel, Sheet and Strip,<br>carbon, Hot-Rolled, Structural<br>Quality.                 |
| 6. | ASTM C94-96            | Standard Specification for<br>Ready-mixed Concrete.   |
| 7. | ASTM F567-93           | Standard Practice for<br>Installation of Chain Link<br>Fence.   |
| 8. | ASTM F669-92           | Standard Specification for<br>Strength Requirements of Metal<br>Posts and Rails for Industrial<br>Chain Link Fence. |

**1.5 SYSTEM DESCRIPTION**

- A. Fence Height: 6 feet nominal (with three strands of barbed wire 1 foot high on extension arms, if applicable) as indicated on drawings.
- B. Line Post Spacing: At intervals not exceeding 10 feet.
- C. Fence Post and Rail Strength: Conform to ASTM F669.
- D. Gate Sizes: As shown on drawings.

**1.6 SUBMITTALS**

A. Provide submittals as required by Section 01011.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

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- C. As-Built Drawings: Indicate plan layout, size, type, and swing of gates.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Framing (Steel): ASTM A570; hot rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi.
- B. Fabric Wire (Steel): ASTM A392 zinc-coated, 9-gage wire fabric. Fabric wire on-site can be re-used if approved by FDF.
- C. Barbed Wire: ASTM A121 galvanized steel; 12-gage wire, three strands, four points at 5 inches on center.
- D. Concrete: FDF mix FMPC #2, ASTM C94; normal Portland cement, 3,000 psi strength at 28 days, 4 inch slump,  $\pm 1$  inch.
- E. Gates: Swing gates internally braced to prevent sag. Fabric equivalent to that of fence; secure to frame with tension bars and hook bolts. Extend top frame of gates vertically to provide three rows of barbed wire, if applicable. Fence fabric and rails may be re-used if in sound condition. Posts and fence accessories shall be new materials.
- F. Components
1. Corner and Terminal Posts: 2-7/8 inch, outside diameter.
  2. Top and Brace Rail: 1-5/8 inch, outside diameter, plain end, sleeve coupled.
  3. Tension Wire: 6-gage galvanized steel, single strand.
  4. Tie Wire: 6-gage galvanized steel wire.
  5. Line Posts: 2-3/8-inch outside diameter.
  6. Gate Posts: 2-7/8-inch outside diameter.
  7. Gate Frame: 1-7/8-inch diameter for welded fabrication.

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## 2.2 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.
- C. Extension Arms: Cast steel galvanized, to accommodate three strands of barbed wire, single arm, sloped to 45 degrees up from horizontal.
- D. Gate Hardware: Hinges shall be galvanized, malleable iron hinges. Ball and socket bottom hinge to sustain gate weight. Install gate with a positive type latching device and padlocking capabilities and double gates with center plunger rod catches. Secure gates in open position with semiautomatic outer catches to secure gates in open position.
- E. Drive Anchor: Two angles, 36-inch length, 1-1/4 inches by 1-1/4 inches by 1/4 inch.
- F. Fasteners: Galvanized steel.

## 2.3 FINISHES

- A. Components and Fabric: Galvanized to ASTM A123; 2.0 ounces/square feet coating.
- B. Hardware: Galvanized to ASTM A153, 2.0 ounces/square feet coating.
- C. Accessories: Same finish as framing.

## PART 3 EXECUTION

### 3.1 ERECTION/INSTALLATION/APPLICATION

- A. Remove existing fence as shown on the drawings and as otherwise required to perform the work. Stockpile fence fabric in tied rolls and stack posts in a neat pile. Stockpile location shall be as designated by FDF 000077

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- B. Install framework, fabric, accessories, and gates in accordance with the manufacturer's instructions and ASTM F567.
- C. Set all posts plumb in accordance with details on the drawings. Where concrete footings are used, top of footing shall be 2 inches above finish grade. Slope top of concrete for water runoff. Concrete used for fence posts does not require concrete tests. Allow posts to be driven when not corner of gate posts.
- D. Brace gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end.
- E. Provide top rail through line post tops and splice with 6-inch long rail sleeves.
- F. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less, as per manufacturer's recommendations.
- G. Position bottom of fabric 1 inch above finished grade.
- H. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
- I. Attach fabric to end and corner posts with tension bars and tension bar clips.
- J. Install bottom tension wire stretched taut between terminal posts, as per manufacturer's recommendations.
- K. Install support arms sloped outward and attach barbed wire; tension and secure.
- L. Install gates plumb, level, and secure for full opening without interference. Adjust and lubricate hardware for smooth operation.
- M. Coat areas where the galvanized finish has been damaged, using zinc-enriched paint.

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- N. Install grounding as noted on the details, in accordance with Section 16170.

**3.2 Adjusting**

**A. Erection Tolerances**

- 1. Maximum Variation from Plumb: 1/4 inch.
- 2. Maximum Offset from True Position: 1 inch.

- B. Patch, repair, or replace any material damaged by the Subcontractor to match undamaged material.

**END OF SECTION**

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SECTION 02900  
SOIL PREPARATION AND SEEDING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Seeding and mulching to stabilize disturbed areas.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Earthwork.
- D. Section 02500 - Pavement.
- E. Section 02667 - Site Water Lines.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. State of Ohio, Department of Transportation (ODOT), Construction and Material Specifications, January 1, 1997. Except as supplemented or otherwise modified herein and/or shown on the construction drawings, the entire work under this section shall be in compliance with the provisions of ODOT.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Certificates: Provide written certification from supplier of seed to state that the seed delivered to the project complies with the following:

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1. Seed varieties and mixture comply with requirements of the specifications.
2. Purity and germination rate comply with the requirements of the specifications.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver grass seed mixture in original, sealed containers. Seed in damaged packaging will not be accepted. Containers shall show:
  1. Names and percentage of each seed variety.
  2. Year of production, percentage of purity, minimum germination rate, and date of packaging.
  3. Net weight.
- B. Deliver plant nutrients and soil conditioners in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Store materials in a dry area, free from wetting and physical damage.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Seed
  1. Varieties of grass involved in the work of this section shall be as scheduled in Article 3.2.
  2. Mixture shall be clean, guaranteed 95 percent pure, and have a minimum germination rate of 85 percent within 1 year of test.
- B. Soil Materials
  1. As specified in Section 02200.
- C. Soil Conditioners
  1. Lime:
    - a. Lime shall meet the requirements of ODOT Item 659.02.
    - b. Agricultural ground limestone, with a minimum total neutralizing power (TNP) of 90 percent, at least 40 percent passing a No. 100 sieve.

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and at least 35 percent passing a No. 8 sieve, is considered to be standard grade. Other grades of agricultural liming materials may be used. Apply substitute material at rates which are dependent on the TNP and sample fineness.

**D. Plant Nutrients**

**1. Fertilizer:**

- a. Fertilizer shall meet the requirements of ODOT Item 659.08.
- b. The standard application of fertilizer shall be with 34014 or 34016 mix. Another analysis, in the same ratio, may be used by varying the application rate to produce the same values specified.
- c. Level of natural radiation levels within the fertilizer must be less than the allowable limits set by FDF.

**E. Potable Water**

1. Clean, fresh (not salt water), and free of substances or matter which could inhibit vigorous growth of grass.

**2.2 ACCESSORIES**

**A. Mulch:**

1. Mulch shall meet the requirements of ODOT Item 659.06.
2. Materials used for mulching shall be straw or hay. They shall be reasonably free of weed seed and such foreign materials as may detract from their effectiveness as a mulch or injure desired plant growth.

**PART 3 EXECUTION**

**3.1 FIELD CONDITIONS**

- A. Verify that the soil surface is ready to receive work of this section and that final dressing is within

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reasonably close conformity to lines, grades, and cross-sections.

- B. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- C. Remove debris, weeds, and undesirable plants and their roots. Manage materials in accordance with the subcontract, Part 6, Statement of Work.
- D. Scarify subsoil to a depth of 3 inches where topsoil is to be placed.
- E. Repeat cultivation in areas where equipment used for hauling and spreading of topsoil has compacted subsoil.

### 3.2 ERECTION/INSTALLATION/APPLICATION

- A. Application of Soil Conditioners:
  - 1. Apply lime conditioners at rate of 2,000 lbs per acre, or as determined by soil test. Use is subject to approval of FDF.
  - 2. Mix thoroughly into the top 2 inches of the topsoil.
- B. Application of Plant Nutrients:
  - 1. Apply fertilizer per manufacturer's specifications.
  - 2. Apply after raking topsoil smooth, and prior to roller compaction.
  - 3. Mix thoroughly into upper 4 inches of topsoil.
  - 4. Lightly water to aid the distribution of fertilizer.
- C. Seeding:
  - 1. When applying seed with a mechanical spreader, apply evenly in two intersecting directions. Rake in lightly. Apply at a minimum rate of 3 pounds per 1,000 square feet (130 lbs per acre).
  - 2. Do not seed areas in excess of that which can be mulched on same day.

3. Apply seed mixture as follows:
  - a. Permanent seeding:
    - 1) 40 percent Kentucky Bluegrass.
    - 2) 40 percent Creeping Red Fescue.
    - 3) 20 percent Annual Ryegrass.
  - b. All seeding performed between October 15 and March 15 shall be temporary seeding in accordance with ODOT Item 207.
  - c. Permanent seeding as specified above shall be performed between March 15 and October 15.
4. Lightly roll seeded area.
5. Immediately following seeding and compacting, apply mulch.
6. Apply water with a fine spray immediately after each area has been mulched. Saturate soil to approximately 4 inches deep, at a rate of 120 gallons per 1,000 square feet.
7. Hydroseeding may be used in lieu of a mechanical spreader. Follow manufacturer's recommendation.

### 3.3 QUALITY CONTROL

- A. Subcontractor shall notify FDF at least 24 hours prior to date of anticipated inspection.
  1. To qualify for acceptance, an area shall have a good, clean stand of perennial grass.
  2. Coverage shall be at least 95 percent of the area, and no bare spots shall exceed 3 square feet.
  3. Areas that fail to meet requirements of the specifications shall be repaired or re-seeded as necessary to produce an acceptable stand of grass.

**END OF SECTION**

U.S DEPARTMENT OF ENERGY

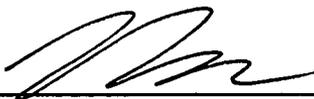
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION PROJECT

Division 03 - Concrete

PARSONS

Prepared by:  for R. Jadhav \_\_\_\_\_  
Date

Checked by:  \_\_\_\_\_  
Date 6/13/97

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SECTION 03001  
CONCRETE

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Concrete work for foundations, slabs, equipment supports, and other miscellaneous concrete.
- B. Formwork and accessories.
- C. Reinforcement and accessories.
- D. Cast-in-place concrete, grout, and accessories.
- E. Finishing and curing.
- F. Sampling and testing of concrete work by an independent testing laboratory.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Earthwork.
- D. Section 02667 - Site Water Lines.
- E. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Concrete Institute (ACI):
  - 1. ACI 301-96 Standard Specifications for Structural Concrete.

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| 2. | ACI 305R-91             | Hot Weather Concreting.   |
| 3. | ACI 306R-88             | Cold Weather Concreting.  |
| 4. | ACI 318/318R<br>Rev. 95 | Building Code Requirements for<br>Structural Concrete.                            |
| 5. | ACI SP-66-94            | ACI Detailing Manual.   |
| 6. | ACI 117-90/<br>117R90   | Standard Tolerances for<br>Concrete Construction and<br>Materials and Commentary. |

B. American Society for Testing and Materials (ASTM):

- |     |                              |   |
|-----|------------------------------|---|
| 1.  | ASTM A615/A615M<br>Rev. A-96 | Deformed and Plain Billet-<br>Steel Bars for Concrete<br>Reinforcement.                           |
| 2.  | ASTM C31/C31M-96             | Standard Practice for Making<br>and Curing Concrete Test<br>Specimens in the Field.               |
| 3.  | ASTM C33-93                  | Concrete Aggregates.  |
| 4.  | ASTM C39-96                  | Standard Test Method for<br>Compressive Strength of<br>Cylindrical Concrete<br>Specimens.         |
| 5.  | ASTM C94-96                  | Ready Mixed Concrete.   |
| 6.  | ASTM C109/<br>C109M-95       | Standard Test Method for<br>Compressive Strength of<br>Hydraulic Cement Mortars.                  |
| 7.  | ASTM C143<br>Rev. A-90       | Standard Test Method for Slump<br>of Hydraulic Cement Concrete.                                   |
| 8.  | ASTM C150-96                 | Portland Cement.  |
| 9.  | ASTM C157-93                 | Standard Test Method for<br>Length Change of Hardened<br>Hydraulic Cement Mortar and<br>Concrete. |
| 10. | ASTM C231<br>Rev. B-91       | Standard Test Method for Air<br>Content of Freshly Mixed<br>Concrete by the Pressure<br>Method.   |
| 11. | ASTM C260-95                 | Air-Entraining Admixtures for<br>Concrete.  |
| 12. | ASTM C309-95                 | Liquid Membrane-Forming<br>Compounds for Curing Concrete.   |
| 13. | ASTM C311<br>Rev. B-96       | Standard Test Methods for<br>Sampling and Testing Fly Ash<br>or Natural Pozzolans for Use         |

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14. ASTM C494-92 as a Mineral Admixture in Portland Cement Concrete. Chemical Admixtures for Concrete.
15. ASTM C618 Rev. A-96 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
16. ASTM C827 Rev. A-95 Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
17. ASTM C882-91 Standard Test for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
18. ASTM C920-95 Elastomeric Joint Sealants.

C. U. S. Department Of Commerce, Voluntary Products Standards (PS):

1. PS 1-83 Plywood.

**1.5 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01011.
- B. Shop Drawings: Indicate reinforcing bar sizes, spacings, locations, quantities, bending and cutting schedules, placing drawings, and supporting and spacing devices.
- C. Product Data: Concrete mix designs, including documentation of aggregate sources and most recent sieve analysis. Sieve analyses must not be older than 1 year.
- D. Concrete Supplier: Name and address of the transit-mix concrete supplier. Supply typical batch ticket and history per ASTM C94.
- E. Test Reports: Submit test reports for all tests required under field quality assurance.

**1.6 QUALITY ASSURANCE PROGRAM**

- A. ACI 301: References are made to ACI 301 to abbreviate text of this section. Only those portions of ACI 301 referred to specifically in this section shall apply.
- B. Amend all references to the following titles to read as follows wherever they occur in ACI 301:

<u>ACI 301</u>	<u>Change To Read</u>
Architect/Engineer	FDF
Owner	FDF

- C. Formwork shall be in accordance with Section 2 of ACI 301 unless specified otherwise in this section.
- D. Perform concrete reinforcing work in accordance with Section 3 of ACI 301, unless specified otherwise in this specification.
- E. Perform cast-in-place concrete work in accordance with Sections 4 and 5 of ACI 301, unless specified otherwise in this section.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Reinforcing bars shall be delivered to meet the construction schedule and stored as directed by the Construction Manager.
- B. Tags: Reinforcing bar tags shall be made of durable material and marked in a legible manner with waterproof markings; not less than one tag per bundle, attached by wire. Identification tags shall show the grade, number of pieces, size, and mark or length of bars.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Plywood Forms: Not less than 5/8-inch-thick, 5-ply Douglas fir plywood conforming to PS 1, and as manufactured by a member of the American Plywood

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Association; B-B Plyform, Class I, Exterior-APA, with plyform faces sanded and oiled.

- B. Prefabricated Type Forms: Matched, tight fitting, stiffened to support weight of concrete.
- C. Form Release Agent: Colorless mineral oil which will not stain concrete nor impair natural bonding characteristics of subsequent coatings.
- D. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars; plain finish.
- E. Tie Wire: Minimum 16-gage annealed type wire.
- F. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.
- G. Fabrication: Fabricate concrete reinforcing in accordance with ACI SP-66 and Chapter 7 and 12 of ACI 318.
- H. Cement:
  - 1. Normal, Portland cement, conforming to requirements of ASTM C150, Type I.
- I. Fly Ash:
  - 1. Class F, conforming to requirements of ASTM C618 and ASTM C311.
- J. Admixtures:
  - 1. Air Entrainment: Conforming to ASTM C260.
  - 2. Water Reducing and Retarding: Conforming to requirements of ASTM C494.
- K. Aggregates:
  - 1. Normal Weight Concrete: Conforming to requirements of ASTM C33.
  - 2. Maximum aggregate size: 1 inch.

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2.2

ACCESSORIES

- A. Chamfer Strips: Chamfered, wood strip type; 3/4 by 3/4-inch size.
- B. Nails, Spikes, and Anchorages: Sized as required and of sufficient strength and character to maintain formwork in place while placing concrete.
- C. Form Ties: Removable or snap-off type; designed to prevent form deflection; of adjustable length, cone type, with waterproofing washer; and free of defects that could leave holes larger than 1 inch in concrete surface.
- D. Joint Sealer: Elastomeric joint sealant conforming to ASTM C920; Type S or Type M, Grade P, Class 25.
  - 1. Acceptable products and suppliers (or equal):
    - a. Sikadur 51 SL, by Sika Corp.
    - b. Sonolastic SL-1, by Sonneborn Building Products.
- E. Nonshrink Grout Under Equipment: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agent; capable of developing minimum compressive strength of 7,000 psi in 28 days; conforming to ASTM C109 and ASTM C827.
  - 1. Acceptable products and suppliers (or equal):
    - a. Masterflow 713, by Master Builders.
    - b. SikaGrout 212, by Sika Corp.
    - c. Sealtight 588, by W.R. Meadows.
- F. Patching Grout: Premixed, nonshrink epoxy grout, capable of developing minimum compressive strength of 3,000 psi in 24 hours, conforming to ASTM C109. The grout must not shrink or expand more than 5 percent when tested in accordance with ASTM C157 and achieve a minimum bond strength of 1,200 psi in 24 hours when tested in accordance with ASTM C882.
- G. Bonding Agent: Polyvinyl acetate polymer or acrylic polymer, water resistant when cured.

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- H. Curing Compound: Conforming to the requirements of ASTM C309, clear; must not impair natural bonding characteristics of subsequent coatings.

### 2.3 FABRICATION

- A. General: All concrete used in the work shall be composed of Portland cement, fine and coarse aggregate, and the specified admixtures. Design mixes shall be submitted to FERMC0 for approval before any concrete is placed. Concrete for every part of the work shall be of homogeneous structure which, when hardened, will have the required strength and resistance to weathering. The proportions for all concrete shall be such as to produce a mixture which will work readily into the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate.

B. Mix Proportions:

1. The following mix designs shall be used for cast-in-place concrete.

a. Slabs

Specified Strength (28 days)	4,000 psi
Total Air Content:	5 ± 1-1/2 percent
Specified Slump:	4 inches ± 1 inch
Maximum Aggregate Size:	1 inch
Maximum Water/Cement Ratio:	0.35
Water Reducing and retarding admixtures as required per ASTM C494.	

b. Foundations

Specified Strength (28 days):	3,000 psi
Total Air Content:	5 ± 1-1/2 percent
Specified Slump:	4 inches ± 1 inch
Maximum Aggregate Size:	1 inch
Maximum Water/Cement Ratio:	0.46
Water Reducing and retarding admixtures as required per ASTM C494.	

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2. The work has been designed for concrete having a minimum compressive strength at 28 days as determined by ASTM C39. The water/cement ratio shall be determined by consideration of the specified strength, the water reducing admixtures, the slump required for proper placement, air entraining requirements, the maximum allowable aggregate size and its specific gravity, the fineness modulus of the fine aggregate and its specific gravity, and the amount of water carried on the aggregates. The mix designs shall be proportioned in accordance with ACI 318, Section 5.3 or Section 5.4.
3. The proportions of all materials in the concrete shall be subject to review by FERMCO. The Subcontractor shall provide all plant and equipment necessary to determine and control the actual proportions of materials entering the batch. Slumps shall be recorded for each trial batch.

C. Water Content: In calculating the total water content in any mix, the amount of water carried on the aggregate shall be included. The water on the aggregate shall be determined periodically by test, and the amount of free water on the aggregate shall be subtracted from the water allowed in the mix. In all cases, the amount of water to be used shall be the minimum amount required to produce a plastic mixture of the specified strength and slump.

D. Mixing and Delivery: Mixing and delivery of concrete shall be scheduled so that all concrete placing operations can be completed within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first, after introduction of mixing water to cement and aggregates, in accordance with Section 11 of ASTM C94. When air temperature has fallen to or is expected to fall below 40 degrees F, the recommendations for cold weather concreting contained in ACI 306R shall be followed. When the air temperature exceeds 90 degrees F, the recommendations

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for hot weather concreting contained in ACI 305R shall be followed.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Erect formwork and bracing to achieve design requirements in accordance with requirements of Section 2 of ACI 301.
1. Provide bracing to ensure stability of formwork.
  2. Align joints and make watertight. Keep number of form joints to a minimum.
  3. Provide chamfer strips on external corners of permanently exposed edges.
  4. Shore or strengthen formwork subject to overstressing by construction loads.
- B. Application - Form Release Agent: Apply form release agent on formwork in accordance with manufacturer's instructions.
1. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
  2. Keep surfaces coated prior to placement of concrete.
- C. Form Cleaning: Clean and remove foreign matter within forms as erection proceeds.
1. Clean formed cavities of debris prior to placing concrete.
  2. Flush with water or use compressed air to remove remaining foreign matter.
  3. Ensure that water and debris drain to exterior.
  4. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms.
- D. Tolerances: Construct formwork to maintain tolerances required by Section 2.3.
- E. Form Removal: Forms or bracing shall not be removed until concrete has gained sufficient strength to carry its own weight and imposed loads.

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1. Loosen forms carefully.
2. Do not wedge with pry bars, hammers, or tools against finished concrete surfaces.

F. Preparation for Grouting:

1. To ensure proper bond to concrete, all grease, oil, dirt, and other deleterious materials shall be completely removed.
2. Roughen the surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the existing concrete.
3. After concrete surfaces have been washed clean, they shall then be saturated with water for 24 hours prior to placement of cement-based grout.
4. Upon completion of saturation period, excess water shall be removed prior to grouting.

3.2 ERECTION/INSTALLATION/APPLICATION

- A. Place, support, and secure reinforcement against displacement. Do not deviate from required position. Make electrical ground system connection where required by Section 16170.
- B. Maintain concrete cover around reinforcing according to the requirements of Section 3.3.2.3 of ACI 301 and Section 7.7 of ACI 318, and as shown on construction drawings.
- C. Provide formed openings where required for work to be embedded in concrete members.
- D. Coordinate work of other sections in forming and setting openings, slots, recesses, sleeves, bolts, anchors, and other inserts.
- E. Install concrete accessories straight, level, and plumb or as called out on the construction drawings.
- F. Place concrete continuously between forms or other limits indicated on the construction drawings.
  1. Place concrete in accordance with Section 5 of ACI 301 and Chapter 5 of ACI 318.

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- 2. Notify FERMCO a minimum of 24 hours prior to commencement of operations.
- 3. Ensure that reinforcement and forms are not disturbed during concrete placement.

G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

H. Installation of Grout:

- 1. Follow the manufacturer's instructions for mixing, placing, and curing grout.

**3.3 QUALITY CONTROL**

A. Testing: The Subcontractor shall pay and provide for services of an independent testing agency. The Subcontractor shall deliver test specimens to the testing agency. The agency shall perform field tests (take slumps, air, and cylinders) and shall perform laboratory tests on the specimens. Concrete testing shall be performed in accordance with Section 1 of ACI 301 for each 50 cubic yards, or fraction thereof, of each mix design placed in any 1 day.

- 1. Slump Tests: ASTM C143. One sample for each strength test.
- 2. Air Content Tests: ASTM C231. One sample for each strength test.
- 3. Test Cylinders: ASTM C31. One set of three cylinders for above quantities.
- 4. Compressive Strength: ASTM C39. One specimen tested at 7 days and two specimens tested at 28 days.

**3.4 PROTECTION**

A. Provide concrete curing and protection in accordance with Section 5 of ACI 301.

- 1. Apply floor slab curing compound, where used, in accordance with the approved manufacturer's recommendations.

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- B. Provide finishes for formed concrete surfaces as defined in Section 5 of ACI 301.
- C. Provide finishes and tolerances for slabs in accordance with Section 5 of ACI 301 and ACI 117.
  - 1. Provide troweled finish with Class A tolerance on all exposed slabs.

END OF SECTION

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U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND  
INJECTION DEMONSTRATION PROJECT

Division 07 - Thermal and Moisture Protection

PARSONS

Prepared by:

*[Signature]* For A. Schatz 6/13/97  
Date

Checked by:

*Hein P. Dabkitt* 6/13/97  
Date

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SECTION 07900  
JOINT SEALERS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Preparing substrate surfaces.
- B. Sealant and joint backing.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittal Summary.
- C. Section 03001 - Concrete.
- D. Section 13123 - Pre-Engineered Buildings.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM C919-84 Use of Sealants in Acoustical Applications.
  - 2. ASTM C920-95 Elastomeric Joint Sealants.
  - 3. ASTM D1056-91 Flexible Cellular Materials - Sponge or Expanded Rubber.
- B. Sealant, Waterproofing, and Restoration Institute (SWRI):
  - 1. SWRI - Sealant and Caulking Guide Specification.

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**1.5 SUBMITTALS**

- A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability prior to use.
- B. Samples: Submit two samples, 1 inch by 1 inch, illustrating sealant colors for selection prior to use.
- C. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention prior to use.
- D. Certificate of Conformance: Manufacturer shall certify and provide data which indicate that all supplied products meet or exceed specification requirements prior to use.

**1.6 QUALITY ASSURANCE**

- A. Perform work in accordance with SWRI requirements for materials and installation.
- B. Perform acoustical sealant application work in accordance with ASTM C919.

**1.7 PROJECT CONDITIONS**

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience.
- C. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
- D. Any products to be used shall not contain lead or asbestos, or be defined as possible carcinogens.

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**1.8 WARRANTY**

- A. Provide 10-year warranty at completion of work.
- B. Warranty: Include coverage for installed sealants and accessories which fail to achieve air-tight seal, exhibit loss of adhesion or cohesion, or do not cure.
- C. Submit manufacturer's letter stating that actual samples have been tested for adhesion and compatibility, and that surface preparation recommendations are made based upon those tests.

**PART 2 PRODUCTS****2.1 MANUFACTURERS**

The listing of equipment suppliers below in no way precludes the offerer from proposing alternate suppliers of any of the equipment to be furnished within the scope of this specification. This list of suppliers is intended to identify the type of equipment and general quality of that equipment that will be included in the offerer's proposal. It is the offerer's responsibility to propose equipment that is best suited for this project in combined terms of quality and price.

- A. Dow Corning Corp.
- B. General Electric.
- C. W.R. Meadows Co.

**2.2 MATERIALS**

- A. Silicone Sealant (Type A): ASTM C920, Grade NS, Class 25, Use NT; single component, solvent curing, nonsagging, nonstaining, color as selected; 795 manufactured by Dow Corning.
  - 1. Elongation Capability: 25 percent.
  - 2. Service Temperature Range: -65 to 180 degrees F.
  - 3. Shore A Hardness Range: 30.

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- B. Silicone Sealant (Type B): ASTM C920, Grade NS, Class 25, Use N; single component, chemical curing, nonsagging, nonstaining, color as selected; 791 manufactured by Dow Corning.
1. Elongation Capability: 25 percent.
  2. Service Temperature Range: -65 to 180 degrees F.
  3. Shore A Hardness Range: 30.

### 2.3 ACCESSORIES

- A. Primer: Nonstaining type, (recommended by sealant manufacturer) to suit application.
- B. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

### 3.2 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions.

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- D. Protect elements surrounding the work of this section from damage or disfigurement.

### 3.3 ERECTION/INSTALLATION/APPLICATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve 2:1 width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints channel shaped.

### 3.4 CLEANING

- A. Clean adjacent soiled surfaces.

### 3.5 SCHEDULES

- A. Type A - All glazing and all building materials as indicated on drawings.
- B. Type B - All expansion and control joints.

END OF SECTION

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND  
INJECTION DEMONSTRATION PROJECT

Division 08 - Doors and Windows

PARSONS

Prepared by:  for A. Schatz 6/13/97  
Date

Checked by: Hein P. Rabbitt 6/13/97  
Date

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SECTION 08110  
STANDARD STEEL DOORS AND FRAMES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Steel doors and frames.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittal Summary.  
C. Section 08710 - Door Hardware.  
D. Section 09900 - Painting.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American National Standards Institute (ANSI):  
1. ANSIA117.1-92 Buildings and Facilities -  
Providing Accessibility and  
Usability for Physically  
Handicapped People.
- B. American Society for Testing and Materials (ASTM):  
1. ASTMA525-93 Sheet Steel, Zinc Coated  
(Galvanized) by the Hot-Dip  
Process, General Requirements.
- C. Steel Door Institute (SDI):  
1. ANSI/SDI-100-91 Standard Steel Doors and  
Frames.

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- D. Door Hardware Institute (DHI):
  - 1. The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames, and Builder's Hardware.

**1.5 SUBMITTALS**

- A. Shop Drawings: Indicate door and frame elevations, internal reinforcement, closure method, and finish.
- B. Product Data: Indicate door and frame configurations and location of cut-outs for hardware and reinforcement.
- C. Manufacturer's Installation Instructions: Indicate special installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements, and meet design loads.

**1.6 QUALITY ASSURANCE**

- A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect, and handle products to site.
- B. Protect doors with resilient packaging sealed with heat-shrunk plastic.
- C. Break seal on site to permit ventilation.

**1.8 PROJECT CONDITIONS**

- A. Verify that field measurements are as indicated on shop drawings.

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- B. Coordinate the work with door opening construction, door frame, and door hardware installation.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

The listing of equipment suppliers below in no way precludes the offerer from proposing alternate suppliers of any of the equipment to be furnished within the scope of this specification. This list of suppliers is intended to identify the type of equipment and general quality of that equipment that will be included.

- A. Steelcraft.
- B. Republic Builders Products.
- C. Amweld.

### **2.2 MATERIALS**

- A. Exterior Doors Nonthermally Broken: SDI-100 Grade II Model 1.
- B. Frames: 16-gage metal with a 2-inch face.

### **2.3 ACCESSORIES**

- A. Face: Steel sheet in accordance with ANSI/SDI-100.
- B. Core: Polyurethane with vertical steel stiffeners.
- C. Silencers: Resilient rubber, fitted to drilled hole.
- D. Removable Stops: Rolled steel shape, mitered corners; prepared for countersunk style screws.
- E. Window: Small, wired glass window to allow viewing through door.

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- F. Labels: Containing the valve house number; constructed of nonreflective materials; black characters on white background, minimum character height of 3 inches.

## **2.4 FABRICATION**

- A. Fabricate doors and frames with hardware reinforcement welded in place.
- B. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.
- C. Configure exterior doors and frames with special profile to receive recessed weatherstripping.
- D. Terminate door stops 6 inches above finished floor. Cut stop at a 45-degree angle and close.
- E. Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors without mullions.
- F. Finish:
  - 1. Steel Sheet: Galvanized to ASTM A525.
  - 2. Primer: Air dried.
  - 3. Factory Finish: Baked enamel.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that opening sizes and tolerances are acceptable.

### **3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Install doors and frames in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate installation of glass and glazing.

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- C. Coordinate installation of doors and frames with installation of hardware specified in Section 08710.
- D. Install roll-formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- E. Touch up factory finished doors in accordance with Section 09900.

**3.3 FIELD QUALITY ASSURANCE**

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

**3.4 ADJUSTING**

- A. Adjust door for smooth and balanced movement.

**END OF SECTION**

SECTION 08710  
DOOR HARDWARE

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Hardware for hollow steel doors.
- B. Thresholds.
- C. Weatherstripping, seals, and door gaskets.
- D. Products furnished but not installed under this section.
  - 1. Section 13123 - Pre-Engineered Buildings: Furnish templates for door and frame preparation.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittal Summary.
- C. Section 08110 - Standard Steel Doors and Frame.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. ANSI A117.1-92 Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
  - 2. ANSI A156.2-89 Bored and Preassembled Locks and Latches.

- B. National Fire Protection Association (NFPA):
  - 1. NFPA 80-95 Fire Doors and Windows.
  - 2. NFPA 252-95 Fire Tests of Door Assemblies.
- C. American Disabilities Act 1992 (ADA).
- D. Door Hardware Institute (DHI):
  - 1. The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames, and Builder's Hardware.

**1.5 SYSTEM DESCRIPTION**

- A. Provide all hardware as required by hardware schedule in Article 3.6. Hardware to be installed per ADA 1992.

**1.6 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data for each item of hardware.
- B. Hardware Schedule: Coordinate hardware with doors, frames, and related work.
  - 1. Organize hardware schedule into "hardware sets" indicating every item required for each door or opening, including:
    - a. Type, style, function, size, and finish of each hardware item.
    - b. Name and manufacturer of each item.
    - c. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
    - d. Mounting locations for hardware.
    - e. Door and frame sizes and materials.
    - f. Keying information.
  - 2. Submittal Sequence: Submit schedule at earliest possible date.
  - 3. Keying Schedule: Submit separate schedule indicating FDF's desired keying of locks.
- C. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

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- D. Provide special wrenches and tools applicable to each different or special hardware component.
- E. Provide maintenance tools and accessories supplied by hardware component manufacturer.
- F. Product data sheets and hardware schedule shall be submitted prior to use. All maintenance data and special tools shall be submitted at completion of work.

#### 1.7 QUALITY ASSURANCE

- A. Perform work in accordance with the following requirements:
  - 1. ANSI A117.1.
  - 2. NFPA 80.
  - 3. NFPA 252.
- B. Manufacturer: Obtain each type of hardware from a single manufacturer.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site.
- B. Tag each item of package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- C. Packaging of hardware is the responsibility of the supplier. As material is received by the hardware supplier from various manufacturers, sort, and repackage in containers clearly marked to match set numbers of approved hardware schedule.
- D. Inventory hardware jointly with hardware supplier and hardware installer to verify correct count.
- E. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

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- F. Provide secure lock-up for hardware delivered to the project but not yet installed. Control handling and installation of hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

**1.9 SEQUENCING AND SCHEDULING**

- A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

**1.10 WARRANTY**

- A. Provide 5-year warranty. Warranty shall be submitted at completion of work.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

The listing of equipment suppliers below in no way precludes the offerer from proposing alternate suppliers of any of the equipment to be furnished within the scope of this specification. This list of suppliers is intended to identify the type of equipment and general quality of that equipment that will be included in the offerer's proposal. It is the offerer's responsibility to propose equipment that is best suited for this project in combined terms of quality and price.

- A. Locks and Latches
  - 1. Sargent.
  - 2. Schlage.
  - 3. Best.
  - 4. Russwin.
- B. Cylinders
  - 1. Best (existing grandmaster keying system).
- C. Butt Hinges

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(By Building Manufacturer).

- D. Door Closers
  - 1. LCN.
  - 2. Dorma.
  - 3. Sargent.
  
- E. Silencers
  - 1. Glynn Johnson.
  - 2. Ives.
  
- F. Thresholds
  - 1. National Guard Products (NGP).
  - 2. Reese.
  - 3. Zero.

## 2.2 MATERIALS

- A. Hardware throughout to be substantially manufactured and fabricated, and assembled parts well fitted and of easy operation. Cast work to be true, free from seams, blisters, or other defects. All lines, edges, and ornamental work to be sharp and true. All hardware shall be certified under ANSI A156.2 Series 4000.
  
- B. Finish of hardware to be 26D, except as noted.
  
- C. Door Closers
  - 1. Provide drop plates, brackets, and inverted mounting for conditions where required, LCN 4000 Series or equal.
  
- D. Levers and Escutcheons
  - 1. All trim similar to Sargent 10 Line Series.
  
- E. Cylinders
  - 1. Provide appropriate type cylinders for all locks as required by the function of the lock.
  - 2. Test all cylinders and package cylinders with their respective locks.
  - 3. Provide keys as specified below for each keyed, different set.

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4. Provide cylinders with a minimum of five pin-tumblers for master or grandmaster keying.
- F. Strike Plates
1. Strike plates to be wrought, box type.
- G. Silencers: Provide silencers, Glynn Johnson GJ 64 or equal, on all interior hollow metal frames as required.
- H. Locksets and Latchsets
1. Provide heavy-duty locksets, Sargent 10 Line Series or equal.
  2. Locks to have face plates, proper backset, an anti-rejection split latch bolt, and radius strikes; and to fit ANSI standard cutout.
- I. Cylinders
1. "Best" seven pin figure eight key removable cores shall be supplied with temporary construction cores installed.
  2. Construction cores will be returned to "Best" after installation of final cores by FDF.
  3. Final cores shall be keyed to the Site Standard Master Keyed System; account #FEE125, "M" keyway, seven pin, series "BF" or modified to a keying plan.
  4. Final cores, with one key each and a control key for the construction cores, shall be shipped directly to FDF. FDF will install final cores and make additional keys as required.

## 2.3 ACCESSORIES

- A. Master Keys
1. Master key all locks to complement existing system.
  2. Grandmaster key all locks, as appropriate.

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**PART 3 EXECUTION****3.1 PREPARATION**

- A. Factory or shop prepare all materials for installation of hardware.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Follow hardware manufacturer's instructions and recommendations.
- B. Install surface-mounted items after substrates have been completely finished; install recessed items and recessed portions of items before finishes are applied and provide suitable, effective protection.
  - 1. When surface-mounted items are installed before final finish, remove, store, and reinstall, or apply suitable effective protection.
- C. Mount at heights indicated in "Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames" by the DHI.
- D. Set units level, plumb, and true to line and location.
- E. Reinforce substrates as necessary for proper installation and operation.
- F. Set thresholds in full bed of sealant.

**3.3 ADJUSTMENT**

- A. Adjust each operating item of hardware and each door for proper operation and function; replace units which cannot be adjusted to operate freely and smoothly.
- B. Adjust door closers to compensate for operation of heating and ventilating systems.

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**3.4 CLEANING**

- A. Clean adjacent surfaces soiled by hardware installation.

**3.5 DEMONSTRATION**

- A. Deliver keys and extra blanks (two for every key) to the FDF Construction Manager.

**3.6 HARDWARE SCHEDULE**

- A. Hardware Sets
  - 1. Exterior Doors
    - a. One cylinder; Best 26D.
    - b. One lockset; Sargent 10 Line, 26D.
    - c. One closer; LCN 4010 Series Smoothee.
    - d. One threshold.

**END OF SECTION**

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION PROJECT

Division 09 - Finishes

PARSONS

Prepared by:

 for A. Schetz 6/13/97  
Date

Checked by:

Henri P. Rabbitt 6/13/97  
Date

SECTION 09900  
PAINTING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Furnish all labor, material, equipment, tools, and services required to complete all painting work as required by the drawings and/or as herein specified.
- B. Except as otherwise indicated or hereinafter specified, include all necessary preparation and complete finishing of the following:
  - 1. All miscellaneous iron items, both prime coated and galvanized.
  - 2. Field painting and/or touch-up of all piping.
  - 3. Metal doors and frames.
  - 4. Uninsulated piping, tank, exposed electric raceway, electrical cabinets, boxes, etc., in contracts for other divisions of the work and furnished either bare, zinc-coated (galvanized), or prime coated.
  - 5. Color coding or indication of piping as specified.
- C. Surfaces not painted under this section:
  - 1. Stainless steel and aluminum.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittal Summary.
- C. Section 07900 - Joint Sealers.
- D. Section 08110 - Standard Steel Doors and Frame.
- E. Section 13205 - Tanks
- F. Section 15060 - Pipe, Fittings, Valves, and Accessories.

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- G. Section 15090 - Pipe Supports and Anchors.
- H. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES, CODES, AND STANDARDS**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM D16-95 Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. National Paint and Coatings Association (NPCA):
  - 1. Guide to U.S. Government Paint Specifications - 1988.
- C. Painting and Decorating Contractors of America (PDCA):
  - 1. Architectural Specifications Manual - Rev. 90.
- D. Steel Structures Painting Council (SSPC):
  - 1. Steel Structures Painting Manual - Rev. 95.
    - a. Painting System Specification No. (SSPC-PS) 1.04-82 - Three-coat Oil Alkyd (Lead- and Chromate-Free) Painting System for Galvanized or Non-Galvanized Steel.
    - b. SSPC-PA 1 - Shop, Field, and Maintenance Painting.
    - c. SSPC-PS COM - Commentary on Painting Systems.
    - d. Paint 104 - White or tinted alkyd paint.
    - e. Paint 22 - Epoxy-polyamide paints (primers, intermediate, and topcoat).
    - f. SP-2-95 - Hand tool cleaning.
    - g. SP-3-95 - Power tool cleaning.
    - h. SP-6-94 - Commercial blast cleaning.
- E. American National Standards Institute (ANSI):
  - 1. ANSI A13.1-81 Scheme for the Identification of Piping Systems.
  - 2. ANSI Z535.1-79 Safety Color Code.

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3. ANSI Z535.5-91 Accident Prevention Tags for Temporary Hazards.
- F. Federal Specifications (Fed. Spec.):
1. Fed. Spec. Primer Coating, Alkyd, Corrosion Inhibiting, Lead and Chromate Free, Voc-compliant.  
TT-P-664D
  2. Fed. Spec. Epoxy for Steel Structures.  
MIL-C-82407
  3. Fed. Spec. Enamel, Floor, and Deck.  
TT-E-487E
  4. Fed. Spec. Enamel, Alkyd, Gloss.  
TT-E-489
- G. Federal Standards (FS):
1. FS No. 595A Colors.
- H. Occupational Safety and Health Administration (OSHA):
1. OSHA 1910.144-93 Safety Color Code for Marking Physical Hazards.
  2. OSHA 1910.145-93 Specifications for Accident Prevention Signs and Tags.

## 1.5 SYSTEM DESCRIPTION

- A. Conform to ASTM D16 for interpretation of terms used in this section.

## 1.6 SUBMITTALS

- A. Refer to Part 3, General Terms and Conditions, Paragraph A.88; and Part 6, Submittal Requirements, of the FDF Contract Documents for submittals.
- B. Product Data: Provide data on all finishing products, including a Material Safety Data Sheet for each product used.
- C. Samples: Submit two sets of samples illustrating range of colors and textures available for each surface-finishing product scheduled; color selection by the FDF Construction Manager.

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- D. Samples: Submit two sets of samples illustrating selected colors and textures for each color selected.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
- F. All product data sheets, samples, and instructions shall be submitted prior to use.

**1.7 QUALITY ASSURANCE**

- A. Manufacturer: Company specializing in manufacturing the products specified in this section, with minimum 3 years documented experience.
- B. Applicator: Company specializing in performing the work of this section, with minimum 5 years documented experience approved by manufacturer.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect, and handle products to site.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, clean-up requirements, color designation, and instructions for mixing and reducing. Labels to be kept readable at all times.
- D. Store paint materials at a minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area and a paint storage safety cabinet as required by manufacturer's instructions and where directed by the FDF Construction Manager. Keep storage space clean and accessible. Oil or paint-soaked rags or waste shall be placed in tight-covered metal containers or removed from the premises at the close of each day's work. Take every precaution to avoid damage

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by fire. In no case shall the amount of materials stored exceed that permitted by local ordinances.

#### 1.9 PROJECT CONDITIONS

- A. Exterior painting shall not be done during or immediately following rainy or frosty weather, or when the temperature is below 50 degrees F or likely to drop to freezing. Avoid the application of treatments while surfaces are exposed to hot sun, or when temperature is above 90 degrees F or likely to be, during the drying period.
- B. Interior work shall be done only when the building has been thoroughly dried out by natural or artificial heat, and when the work area is properly heated and ventilated, clean, and as dust-free as possible. Apply interior finishes only when a room temperature of at least 60 degrees F can be maintained during application of treatments and until coatings are dry.

#### 1.10 MAINTENANCE

- A. Provide 1 gallon of each color, type, and surface texture to the FDF Construction Manager.
- B. Label each container with color, type, texture, and room locations in addition to the manufacturer's label.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Generally, the naming of acceptable products and manufacturers has been avoided in specifying the kinds of materials to be used for this work; however, the FDF Construction Manager may desire that the painting Subcontractor shall, generally, use only those products of the kinds and types specified which, in the manager's judgment and based on past experience, are best for the treatments specified. Each product used must, however, be of the highest quality in its particular category and must be made by a manufacturer

having an established reputation as a maker of superior products. Manufacturer must agree to cooperate with the FDF Construction Manager and the painting Subcontractor in securing the proper use and application of the products and to accept joint responsibility with the painting Subcontractor for satisfactorily completed work. All coatings used must be satisfactory to the FDF Construction Manager.

- B. So that the major portion of the work will be covered by a single "joint responsibility" agreement, Subcontractor should propose a manufacturer who offers a comprehensive line of first quality materials of the types specified.

## 2.2 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags. Coatings shall be compatible. All coatings (i.e., primer and finish coats) shall be free of lead and chromates.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners, and other materials not specifically indicated but required to achieve the finishes specified of commercial quality.
- C. Patching Materials: Latex filler.
- D. Fastener Head Cover Materials: Latex filler.
- E. Follow NPCA guide for government specifications.
  - 1. Paints and paint types are as follows:
    - a. Finish coating, white or tinted alkyd enamel gloss paint, conforming to SSPC Paint No. 104 and Fed. Spec. TT-E-489.
    - b. Primer coating, alkyd, rust inhibiting, conforming to Fed. Spec. P-664D.

- c. Epoxy-polyamide coating conforming to Fed. Spec. MIL-C-82407.
- d. Enamel, alkyd, floor and deck coating conforming to Fed. Spec. TT-E-487E.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Before commencing work on surfaces of any type, the Subcontractor shall carefully inspect same and be satisfied that they are dry and in all other respects suitable to receive the specified treatment. If the condition of any surface is such that it cannot be put in proper condition by normal preparatory methods, and arrangements for prompt correction cannot be made at once, the Subcontractor shall not undertake surface preparation and shall instead address a written request to the FDF Construction Manager for corrections which will provide an acceptable surface.
- B. Application of any coating to a surface will constitute acceptance of the surface by the Subcontractor. If, after treatment, the completed finish (or any portion thereof) blisters, checks, peels, or otherwise shows indication of dampness or other irregular condition of surface, the Subcontractor shall remove the applied treatment and refinish the part affected at no cost to the Owner and to the satisfaction of the FDF Construction Manager. (The painting Subcontractor should determine dryness of all moisture-holding materials by use of a reliable electronic moisture meter.)

#### **3.2 PREPARATION**

- A. General
  - 1. It shall be the responsibility of the Subcontractor to properly prepare all surfaces to receive the particular treatment specified.
  - 2. All usual preparatory measures common to painters' work, as well as such special procedures as are herein stipulated, shall be employed.

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- B. Structural Steel
1. Prepare surfaces in accordance with SSPC procedure SP-6 prior to shop prime coat. Minimum field assembly surface preparation shall comply with no less than SP-2 or SP-3 for touch-up. Spot-prime all bare metal areas immediately with compatible, rust inhibiting primer. Prepare steel for final coat.
- C. Prime-coated miscellaneous and ornamental ferrous metal
1. Prepare surfaces of miscellaneous and ornamental ferrous metal items such as steel door frames, hollow metal doors, exposed lintels, railings, ornamental brackets, etc., as specified for exposed-to-view structural steel parts in Article 3.2, Paragraph B.
  2. Fill any open joints and bare tool marks in parts furnished in manufacturer's baked-on prime coat with mineral filler, to make inconspicuous; sand smooth, then spot prime.
- D. Zinc-coated metal parts; galvanized, or zinc-coated by other process
1. Unless the prime coat material to be used is recommended by its manufacturer for application over zinc-coated surfaces of the type at hand, after cleaning and any necessary de-glossing only, surfaces must be given phosphate pretreatment prior to application of prime coat; usual "vinegar etch" or acid pretreatment (wash) will not be permitted.
  2. Phosphate pretreatment: Crystalline zinc phosphate type; either "Lithoform," made by the American Chemical Paint Co., Ambler, Pa., or "Galaprep No. S," made by Neilson Chemical Co., Detroit, Michigan, as approved by the FDF Construction Manager. Follow manufacturer's directions exactly as to cleaning prior to treatment, application of treatment, and after-rinse.
  3. Preparation of surfaces for directly-applied prime coat: Clean all surfaces thoroughly with mineral spirits, naphtha, or other approved solvent,

completely removing all oil, grease, and other film. Roughen with steel wool, as necessary, to remove gloss.

4. Primer must be applied at once, following either cleaning only or phosphate pretreatment.

E. Caulking

1. Other required caulking common to painter's work shall be performed under Section 07900.
2. Use a resin-base, gun type, elastic caulking compound, free of volatile thinners; add no thinner.
3. Apply with gun and follow with tool, as required, to form a smooth coved fillet of the minimum required width, at projecting, overlapping, and fully recessed frames. Fill flush and tool slightly concave, where frame is flush, or just scant of flush. Apply well in advance of scheduled paint treatment; compound must have formed a firm, dust-free surface skin before prime coat is applied. Avoid smearing adjacent wall and/or metal; clean off any misplaced compound at once.

3.3 APPLICATION

- A. All work shall be done by skilled mechanics in a workmanlike manner; all coats flowed on, or brushed out, to a uniform film. Completed work shall be free of runs, sags, blocked angles, raised grain, and all other evidence of poor or careless workmanship. Follow PDCA instruction manual.
- B. Tint all undercoats toward the color of the final coat, with shade of each coat sufficiently different from that of work in place to permit easy identification.
- C. Allow sufficient time before recoating to ensure proper drying of the preceding coat.
- D. Exercise care to avoid getting material on a surface not intended to receive it. Remove any misplaced material or resultant stain, leaving the surface in proper condition.

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E. General

1. Following surface preparation as specified; apply coats or treatments as listed below on the several kinds of surfaces required to be treated.
2. Refer to finish schedule and architectural drawings for the extent of wall and ceiling surfaces, metal doors, frames, trim, etc., requiring finish, and to drawings and specifications for mechanical and electrical work for extent of ductwork, piping, conduit, mechanical system devices, heating units, grilles, etc.
3. All coats specified herein are in addition to primer, sealer, or other preparatory or protective coats specified in other sections of this specification package or in the specifications for other contracts.

F. Structural Steel

1. Finish Treatment: Two coats alkyd gloss enamel.

G. New Work

1. Metal doors and metal frames:
  - a. Primer: One coat primer.
  - b. Finish treatment: Two coats exterior latex gloss enamel.
2. Exposed miscellaneous steel items, lintels:
  - a. Primer: One coat primer.
  - b. Finish treatment: Two coats exterior latex gloss enamel.
3. Mechanical equipment items:
  - a. Finish treatment: First coat - exterior alkyd gloss enamel.
  - b. Second coat - exterior alkyd gloss enamel.
4. Pipe, Valves, and Fittings - Carbon Steel:
  - a. Two coats of epoxy-polyamides coating. Dry film thickness of 4 mils per coat.
5. Other Piping, Electrical Conduit in Exposed Locations:
  - a. Primed: One coat primer.
  - b. Finish Treatment: Two coats exterior alkyd gloss enamel.

6. Pipe Covering in Exposed Locations:
  - a. Primer: One coat primer.
  - b. Finish Treatment: Two coats exterior alkyd gloss enamel.

H. Miscellaneous and ornamental fabricator-primed ferrous metals

1. Includes prime-coated equipment items and their supports, in addition to parts regularly classified as "miscellaneous and ornamental ferrous metals." Any parts as named, but furnished bare, shall receive one coat of metal primer (as approved), followed by the treatment herein specified.

I. Steel ladders, steel grating, and other similarly located parts

1. Two coats alkyd porch and floor enamel.

J. Outside surfaces of ductwork, metal housings

1. Finish treatment - two coats alkyd gloss enamel.

K. Mechanical equipment items furnished in prime coat

1. Finish treatment: Two coats alkyd gloss enamel.

L. Tank Vessels

1. Two coats of epoxy-polyamides coating. Dry film thickness of 4 mils each coat.

### 3.4 CLEANING

- A. As work proceeds, promptly remove paint where spilled, splashed, or splattered.
- B. During progress of work, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and materials which may constitute a fire hazard; place in closed metal containers as directed by the FDF Construction Manager.

**3.5 PROTECTION**

- A. Provide clean drop cloths and other protection as approved to protect floors, doors, and other parts from damage. Where any work is accidentally spattered, clean promptly, and leave in satisfactory condition.

**3.6 SAFETY PAINTING**

- A. The Subcontractor shall apply safety painting for the marking of physical hazards, and identification of piping systems, as required herein and as directed by the FDF Construction Manager. Accident prevention signs will be provided by others.
- B. Safety colors shall be applied by the Subcontractor where and as required on and in the appropriate areas and equipment. The safety color code shall mark physical hazards and shall continue to provide an orderly, coordinated standard of practice for the plant and the safety of workers.
- C. Color coding and designation shall comply with current OSHA 1910.144, OSHA 1910.145, ANSI Z535.5, ANSI Z53.1, and Federal Standard No. 595A.
- D. The following safety colors shall have Federal Standard numbers as follows:
  - 1. Red - No. 11105
  - 2. Yellow - No. 13655
  - 3. Orange - No. 12246
  - 4. Green - No. 14260
  - 5. Blue - No. 15102
  - 6. Black - No. 17038
- E. The color codes shall be used for the following identifications:
  - 1. Red - Exposed fire protection systems shall be painted a continuous red.
  - 2. Vivid Orange - Vivid orange shall be restricted to surface areas, machine guards where there is the potential for cutting, crushing, thermal burns, or electrical shock to personnel.

3. Green - Green shall be the basic color for designating safety and location of first aid equipment (other than fire fighting equipment).
4. Blue - Blue is limited to electrical equipment. Main electrical disconnects in all buildings shall be identified by stencil or label.
5. Black, White, or a Combination of These Two - Black, white, or a combination of these two shall be the basic colors for designating housekeeping and traffic markings.

F. Color coding for identification of piping systems shall conform to ANSI A13.1. Piping systems are defined as conduits for the transport of gases, liquids, and semi-liquids.

1. The Contractor shall identify pipes as follows:
  - a. Content and direction of flow of piping systems shall be identified by stencil or Brady "Quik-Labels" (mastic back) painted or fixed on pipe or pipe covering. Such identification shall be located so as to ensure immediate recognition of piping system content and direction of flow.
  - b. Piping shall be color coded by applying a painted solid color band completely encircling the pipe. The band shall be a minimum of 9 inches in length, longer when necessary to accommodate the full identification, and shall provide a minimum 2-inch border. The color bands shall be applied close to all valves, branches, and changes of direction, on both sides of each floor, wall, or barrier through which the line passes, every connection to equipment or service outlet, and at a maximum of 50-foot intervals on straight runs of pipe.
2. Line identification and directional flow arrows shall be arranged and located so as to be easily read by a person standing on the floor or at the normal access location of the pipe. Color codes, service codes, service descriptions, line numbers, and other required information is provided in the Subcontract Special Conditions.

3. As an aid to the Subcontractor in identifying line numbers and flow direction, piping will have been marked in black ink with the line numbers and flow arrows at each end of each pipe spool after piping installation is complete.
  - a. The stenciled or mastic-backed labels shall include pipe content identification, line number, and unusual qualities of the pipe contents (i.e., hot, cold, pressure in lbs./sq. in.).
  - b. On service piping, either liquid or gas, apply black arrows of same height and with same background color as adjacent identification labels, to indicate direction of flow.
  - c. Lettering size shall be in accordance with the information in the chart below:

Nominal Pipe Diameter*	Size of Legend Letters*
3/4 to 1-1/4	1/2
1-1/2 to 2	3/4
2-1/2 to 6	1-1/4
8 to 10	2-1/2
Over 10	3-1/2

\* All dimensions are given in inches.

- d. Pipes to be marked shall first be wiped clean of dirt, dust, grease, and moisture. When applying mastic-backed label, pressure must be applied so that the label will lie smooth and flat. Apply a brush coat of clear lacquer after label has been applied to pipe, making sure edges of label are well covered. Stencils may be used without use of lacquer cover.

- e. Labels shall be applied only after the final inspection of the piping systems. The labels shall be applied on piping systems that require painting after the final coat has cured. Labels shall be applied in accordance with the manufacturer's recommendations.

**END OF SECTION**

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U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND  
INJECTION DEMONSTRATION PROJECT

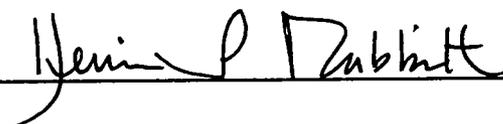
Division 10 - Specialties

PARSONS

Prepared by:

 for A Schetz 6/13/97  
Date

Checked by:

 6/13/97  
Date

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SECTION 10211  
METAL WALL LOUVERS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fixed louvers and frames.
- B. Bird screening.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittal Summary.
- C. Section 07900 - Joint Sealers.
- D. Section 13123 - Pre-Engineered Buildings.
- E. Section 15500 - Heating, Ventilating, and Air Conditioning.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. Air Movement Control Association (AMCA):
  - 1. AMCA 500-89 Test Method for Louvers, Dampers, and Shutters.

**1.5 SYSTEM DESCRIPTION**

- A. Louver: To permit passage of air at a velocity as required by AMCA 500 without blade vibration or noise.
- B. Louver: To permit 50 percent free area, minimum.

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**1.6 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Shop Drawings: Indicate the louver layout plan and elevations; opening and clearance dimensions; tolerances; head, jamb, and sill details; blade configuration; screens; blankout areas required; and frames. Submit shop drawings prior to use.
- C. Product Data: Provide data prior to use, describing design characteristics, maximum recommended air velocity, maximum free area, materials, and finishes.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements prior to use.
- E. Maintenance Data: Include lubrication schedules and adjustment requirements at completion of work.

**1.7 QUALITY ASSURANCE**

- A. Perform work in accordance with AMCA 500.
- B. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years documented experience.

**1.8 PROJECT CONDITIONS**

- A. Verify that field measurements are as indicated on shop drawings.
- B. Coordinate the work with installation of metal siding.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. American Warming and Ventilating, Inc.
- B. Louvers & Dampers, Inc.

C. Ruskin.

## 2.2 MATERIALS

- A. Furnish and install extruded aluminum drainable blade louver similar to Type LE-33A, as manufactured by the American Warming and Ventilating, Inc., Maumee, Ohio. Louvers shall be 6 inches deep. Blades and frame shall be 0.081 inch extruded aluminum, alloy 6063-T5. All louvers shall be factory finished after assembly with a Kynar® 500 coating in a color selected from the manufacturer's chart.
- B. Louvers shall bear AMCA Licensed Ratings Seals for air performance and water penetration ratings.
- C. Bird Screen: Interwoven wire mesh of aluminum, 0.063-inch-diameter wire, 1/2-inch open weave.

## 2.3 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Primer: Zinc chromate, alkyd type.
- C. Flashings: Of same material as louver frames.
- D. Sealants: Type specified in Section 07900.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that prepared openings and flashings are ready to receive work and that opening dimensions are as indicated on shop drawings.

### 3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.

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- C. Install flashings and align louver assembly to ensure that moisture is shed from flashings and diverted to exterior.
- D. Secure louvers in opening framing with concealed fasteners.
- E. Install bird screen and frame to interior of louver.
- F. Install perimeter sealant and backing rod in accordance with Section 07900.

**3.3 CLEANING**

- A. Clean surfaces and components.

**3.4 SCHEDULE**

- A. See drawings for sizes and locations of louvers.

**END OF SECTION**

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION PROJECT

Division 13 - Special Construction

PARSONS

Prepared by: D. W. Carlson 6/12/97  
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Prepared by: James H. Taylor 6/13/97  
Date

Checked by: James L. Cooper 13 JUNE 1997  
Date

Prepared by: [Signature] for A. Schatz 6/13/97  
Date

Checked by: Jerin P. Dabkitt 6/13/97  
Date

SECTION 13123  
PRE-ENGINEERED BUILDINGS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Pre-engineered, shop-fabricated metal buildings.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
 B. Section 01011 - Submittal Summary.  
 C. Section 09900 - Painting.  
 D. Section 07900 - Joint Sealers.  
 E. Section 08710 - Door Hardware.  
 F. Section 10211 - Metal Wall Louvers.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Institute of Steel Construction (AISC):  
 1. AISC S335-89 Specification for Structural Steel Buildings.
- B. American Iron and Steel Institute (AISI):  
 1. AISI SG-673 Design of Cold-Formed Steel Structural Members, Cold-Formed Steel Design Manual.  
 Part II-86
- C. American Society of Civil Engineers (ASCE):  
 1. ASCE 7-93 Minimum Design Loads for Buildings and Other Structures.

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- D. American Society for Testing and Materials (ASTM):
  - 1. ASTM A36/36M-96 Structural Steel.
  - 2. ASTM A153-95 Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
  - 3. ASTM A307-94 Standard Specification for Carbon Steel Bolts and Studs.
  - 4. ASTM A325-96 Structural Bolts, Steel, Heat-Treated 120/105 ksi, Minimum Tensile Strength.
  - 5. ASTM A525-93 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
  
- E. American Welding Society, Inc. (AWS):
  - 1. AWS D1.1-94 Structural Welding Code.
  
- F. Building Officials and Code Administrator International (BOCA):
  - 1. Ohio Basic Building Code - 1995 (OBBC).
  
- G. Metal Building Manufacturer's Association (MBMA):
  - 1. Low-Rise Building Systems Manual - 1988.

**1.5 SYSTEM DESCRIPTION**

- A. Design Requirements:
  - 1. Pre-engineered, shop-fabricated, structural steel building frame. Work of this section begins at the top of the concrete foundation slab except as required specifically otherwise herein.
    - a. Primary Framing: The buildings covered by these specifications shall be of self-framing design using the roof and wall panels as the primary structural supporting members.
    - b. Horizontal Dimensions: As shown on drawings.
    - c. Height from Slab to Eave: As shown on drawings.
    - d. Roof Slope: As shown on drawings.
  - 2. Prefinished metal wall and roof panels.
  - 3. Steel doors and frames and related hardware.
  - 4. Gutters and downspouts.

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5. Building and its components shall provide weathertight building under loads and exposure required herein.

B. Design Criteria:

1. Except as required specifically otherwise herein, prefabricated metal building shall be designed, fabricated, and erected in accordance with requirements of MBMA Low-Rise Building Systems Manual.
2. Structural steel sections or welded-up plate sections shall be designed in accordance with AISC.
3. Cold-formed steel structural members shall be designed in accordance with AISI SG-673.
4. Roof and wall panels shall be cold-formed and shall be designed in accordance with AISI SG-673.

C. Performance Requirements:

1. Design Loads:
  - a. Dead load shall include weight of building construction plus all collateral loads.
  - b. Live loads shall be as defined and stated in ASCE 7 except as stated otherwise herein.
  - c. Vertical Live Loads:
    - 1) Primary Framing (Frames): 20 psf uniformly distributed over the roof area which it supports.
    - 2) The vertical live loads shall be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.
  - d. Wind Loads:
    - 1) The site-specific basic wind speed shall be 80 mph per OBBC Section 1112.3.2. The importance factor, "I" shall be 1.07 for Category II. Use exposure C for velocity pressure coefficient.
    - 2) Load shall be proportioned and applied as horizontal and uplift forces according to the requirements of ASCE 7.
  - e. Snow Loads:

- 1) The ground snow load shall be 25 psf per OBBC Section 1112.2.
  - 2) Roof snow loads, including balanced and unbalanced loads, shall be determined in accordance with ASCE 7. The importance factor for snow loads shall be 1.0.
- f. Auxiliary and Collateral Loads:
- 1) Other static load shall be considered as a part of the design requirements and shall be combined with the design loads (wind, live, etc.) as prescribed in contract documents.
  - 2) Static Loads: 5 psf on purlins and frames.
- g. Combination of Loads: The combining of normal and auxiliary loads for design purposes shall be as prescribed and recommended by the MBMA Low Rise Building Systems Manual and the UBC, whichever produces the greater effect.
- h. Deflection:
- 1) Roof panels shall not deflect more than 1/180 of span under design loads.
  - 2) Roof purlins shall not deflect more than 1/180 of span under design loads.
  - 3) Girts shall not deflect more than 1/180 of span under design loads.
2. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
  3. Assembly shall permit movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects, when subject to temperature range of 100 degrees F.

## 1.6 SUBMITTALS

### A. Shop Drawings:

1. Indicate location, arrangement, dimensions, materials, finishes, anchorage, fastenings, closures, sealants, accessories, and relation to adjacent work.

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2. Indicate vertical and horizontal loads and forces at bearing on concrete foundation slab.
  3. Indicate framing anchor bolt settings, sizes, and locations from foundation loads.
- B. Product Data: Submit manufacturer's data on:
1. Prefinished sheet-metal items (including profiles).
  2. Accessories.
- C. Manufacturer's Installation Instructions: Submit installation and erection requirements for information only.
- D. Samples: Submit complete set of manufacturer's standard finishes to indicate color. Finish shall be actual materials on metal. Size shall be not less than 3 inches by 5 inches.
- E. Design Calculations: Submit set of design calculations to confirm compliance with structural requirements of this section. Calculations shall be signed by engineer as required under Article 1.7 and shall bear the engineer's seal.
- F. Certificate of Conformance: Manufacturer certifies that the supplied product meets or exceeds specification requirements.
- G. Work Plan: Include a clear description of how the Subcontractor will include the requirements for the design, erection, bracing, and stability of the pre-engineered building, and to mitigate potential collapse during erection. The plan shall include provisions for high wind and any other applicable safety hazards related to building erection and worker safety, including a worker's fall protection plan.

## 1.7 QUALITY ASSURANCE

- A. Design of Structural and Building Components:
1. Design of structural systems and building components shall be performed by a structural

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engineer experienced in the design of pre-engineered, prefabricated metal building systems and who is licensed and registered in the State of Ohio.

2. Engineer's signature and seal shall be placed on calculations and engineering drawings required to be submitted herein.
3. Design shall include confirmation that building will perform as required under the design loads required in this section.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed.
- B. Stack materials on platforms or pallets above grade or on concrete slab, covered with opaque tarpaulins or other approved weather-resistant ventilated covering.
- C. Store metal sheets and panels if subjected to water accumulation so they will drain freely. Do not store sheets and panels in contact with other materials which might cause staining.
- D. Damaged material must be reported to determine if replacement is required.
- E. Inspect panels to prevent moisture between panels, and secure as required.

**1.9 WARRANTY**

- A. Warranty: Include coverage for exterior prefinished surfaces to cover prefinished color coat against chipping; cracking; or crazing, blistering, peeling, chalking, or fading.
- B. Warranty: Include coverage for weathertightness of building enclosure elements after installation.

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**PART 2 PRODUCTS****2.1 MANUFACTURERS**

- A. Standard: For purposes of designating type and quality of the pre-engineered, prefabricated metal building and its accessories for work of this section, subcontract documents are based on products and systems as manufactured by Parkline, Inc., Winfield, WV 25213.
- B. Building systems equivalent to or better than those of the following manufacturers will be acceptable in addition to the manufacturer above for use on the project when approved (in writing) by the Construction Manager. Products and systems shall provide for the functions, construction, and arrangement as required by the subcontract documents.
1. Steelox Building Systems, Cincinnati, OH 45246-6522.
  2. Butler Manufacturing Co, Kansas City, MO 64141-0917.

**2.2 MATERIALS**

- A. Fasteners:
1. Fasteners for primary framing shall comply with the requirements of ASTM A325. Provide equivalent nuts and washers. Bolts, nuts, and washers shall be galvanized to provide for requirements of ASTM A153.
  2. Fasteners for secondary framing shall comply with the requirements of ASTM A307. Bolts, nuts, and washers shall be galvanized to comply with the requirements of ASTM A153.
  3. Fasteners for roof covering, wall covering, trim and flashing, gutters and downspouts, and other sheet metal work shall be AISI Alloy Type 302 or 304. Provide with neoprene gaskets where used to make weathertight.

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- B. Sealants: Tube sealant shall be a synthetic elastomer-based material which becomes tack-free in less than 2 hours at 75 degrees F but retains flexibility. Service range shall be from -30 degrees F to +160 degrees F.
- C. Tape Mastic: Preformed butyl-rubber based compound. Compound shall be nonhardening, noncorrosive to metal, and shall have excellent adhesion properties. Service range shall be from -30 degrees F to +160 degrees F.
- D. Resilient Closures: Preformed to match panel configuration. Closed-cell sponge of Ethylene Propylene Diene Monomer.
- E. Gutter Sealant: Manufacturer's standard.

**2.3 ACCESSORIES**

- A. Trim and Flashing: Trim, flashing, and metal closures shall be fabricated from the same sheet metal material (thickness, composition, and finish) as required for wall panels.
- B. Gutters and Downspouts:
  - 1. Fabricate from same material and finish as required for roofing metal.
  - 2. Form sections of gutters and downspouts in maximum possible lengths. Hem exposed edges.
  - 3. Fabricate support straps of same material and finish as roofing metal.
- C. Finishes:
  - 1. Primary framing, purlins, girts, and miscellaneous secondary framing shall be cleaned and primed with shop primer.
  - 2. Finish coat color of prefinished metal wall and roof panels and other framing members shall be as selected by FDF construction manager.

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**2.4 FABRICATION**

- A. **Primary Framing:**
1. Fabricate from structural steel plate, bar, tube, or rolled structural shapes complying with the requirements of ASTM A36 or better.
  2. Fabricate components in accordance with the requirements of AISC.
- B. **Purlins:** Cold-formed steel. Configuration and thickness shall be manufacturer's standard. Finish shall be factory-applied shop primer.
- C. **Girts:** Cold formed steel. Configuration and thickness shall be manufacturer's standard. Finish shall be factory-applied shop primer.
- D. **Framed Openings:**
1. Provide framed openings for doors, louvers, etc., as shown on subcontract drawings and as specified herein.
  2. Openings shall be designed to structurally support the panels or framing which they replace and shall support the equipment for which they are provided.
  3. Include framing, clips, and fasteners as necessary to install the opening.
- E. **Roof Panels:**
1. Roof panels shall be supplied in a single continuous length from eave line to ridge line and shall be designed to tightly interlock so that no fasteners are required at intermediate points along the panel side laps.
  2. Roof panels shall be maximum of 16 inches wide with a flat surface between the interlocking side ribs. The interlocking ribs shall be a minimum of 3 inches high and shall be turned upward. All roof panels shall be factory punched for connection at the eave line of the building.
  3. Roof panels shall be minimum 24-gage steel coated on both sides with a corrosion-resistant aluminum-zinc alloy applied by a continuous hot-dipping process. Coating weight shall be a minimum of

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0.32 ounces of aluminum-zinc alloy per square foot of coated sheet (both sides) equivalent to about 0.80 mil thickness on each side. Minimum yield strength of panel material shall be 50,000 psi.

**F. Wall Covering:**

1. Exterior wall panels of the building shall be a single continuous length from the base channel to the roof line of the building at the sidewalls and endwalls of the building except where interrupted by wall openings.
2. Wall panels shall be 16 inches wide with a 3-inch-deep, inward-turned interlocking side rib. Wall panels shall contain two 3/4-inch-deep by 3-1/8-inch-wide fluted recesses, each starting 2-7/16 inches from each panel edge.
3. Wall panels shall be fastened internally to the base channel and eave cap of the building with 3/8-inch diameter electrogalvanized machine bolts placed within the panel interlock. The fastening system shall be designed so that no wall fasteners are exposed on the exterior surfaces of the walls.
4. Wall panels shall be minimum 24-gage galvanized steel conforming to ASTM A525 specifications with the galvanized coating conforming to G90 (1-1/4 ounce) standards. Minimum yield strength of panel material shall be 40,000 psi. Panel material shall be embossed with a random pattern pebble embossure of approximately 0.007-0.008 depth.
5. The bases of the wall panels shall be closed off with closure plugs conforming to the panel profile.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Installation and erection of work of this section shall be in accordance with the requirements of the subcontract documents and approved submittals.
- B. Work shall be plumb and level, true to line and plane, rigid, and weathertight.

- C. Work shall be free of rattles and loose components. Allow for expansion and contraction to prevent damage to components.
- D. Prefinished surfaces shall be free of dents, scars, and blemishes. Repairs (if allowed by Construction Manager) shall match adjacent finish and shall match durability of adjacent finishes.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Framing Members: 1/4 inch from level, 1/8 inch from plumb.
- B. Siding and Roofing: 1/8 inch from true position.

**END OF SECTION**

SECTION 13205  
TANKS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Carbon steel injection water supply tank (TNK-2).

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 09900 - Painting.  
D. Section 13400 - Instruments and Equipment.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Petroleum Institute (API):  
1. API Std. 650-93 Welded Steel Tanks for Oil Storage, Addendum 1-1994.
- B. American Society of Civil Engineers (ASCE):  
1. ASCE 7-93 Minimum Design Loads for Buildings and Other Structures.
- C. American Society for Testing and Materials (ASTM):  
1. ASTM D5162-91 Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates.

- D. International Conference of Building Officials (ICBO):
  - 1. Uniform Building Code (UBC), 1994 Edition.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Shop drawings, design data, calculations, and product inspection and test data specially prepared for the project. Shop drawings shall state the vertical loads, lateral forces, and torque used (wind and seismic) in the tank design.
- C. Welding qualifications: Submit welder and inspector qualifications.
- D. Manufacturer's installation instructions.
- E. Material testing and construction inspection program.

**1.6 DELIVERY AND HANDLING**

- A. Tank shall be field erected at the job site in accordance with API 650.
- B. Store tank components in a clean, dry place and protect from weather prior to shipment. Provide protection from weather and from damage during transit.
- C. Loose items shall be tagged and delivered in a standard commercial package. The package shall be protected from the weather, climate conditions including temperature and humidity variations, dirt and dust, and other contaminants.
- D. FDF's acceptance of the installed tank will be contingent upon satisfactory inspection and testing at the job site.

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**PART 2 PRODUCTS****2.1 TANK**

- A. Product requirements: The design, manufacture, and testing of the steel tank shall conform to API 650. Refer to Attachment A for design data and arrangement.

**2.2 FABRICATION**

- A. Tank shall be completely field erected and tested at the site.

**2.3 ACCESSORIES**

- A. See Section 13400 for level instrumentation.

**2.4 LABELING**

- A. In addition to the nameplate required by API 650, provide a permanently attached, stainless steel nameplate indicating equipment name, equipment number, and rated capacity in gallons. The lettering shall be a minimum of 3/8-inch high and shall be stamped. The nameplate shall be located for unobstructed viewing.

**PART 3 EXECUTION****3.1 ERECTION/INSTALLATION/APPLICATION**

- A. The erection of the tank shall be in accordance with the manufacturer's instructions, erection plan, and API 650.
- B. The Subcontractor shall completely install the tank and accessories in the location shown, furnishing all items required for erection.
- C. Interior of tank and carbon steel components, including piping, shall be coated with Plasite 7122L epoxy, 12 to 15 mils thickness, or equal. Internal welds for attachments shall be continuous, suitable for coating without burrs or sharp edges. Surface preparation and

coating application shall be in accordance with epoxy manufacturer's recommendations. Dry film thickness shall be tested using a non-destructive magnetic gauge. The film shall be tested for discontinuities using the low voltage, wet sponge method in accordance with ASTM D5162.

- D. Exterior of tank and carbon steel components shall be painted in accordance with Section 09900.

### 3.2 QUALITY CONTROL

- A. The tank components shall be visually inspected by the Subcontractor upon delivery to ensure that no damage has occurred during shipping.
- B. The tank shall be tested for leaks prior to painting and coating by filling with water and inspecting for leaks after the tank has been standing full for at least 1 hour. Any leakage will be cause for rejection. Leaks shall be corrected and the tank retested.
- C. The Contractor shall notify FDF of testing/inspection activities prior to the start of all tests or inspections.
- D. Tank bottom shall be tested by vacuum method in accordance with API650.

**END OF SECTION**

ATTACHMENT A

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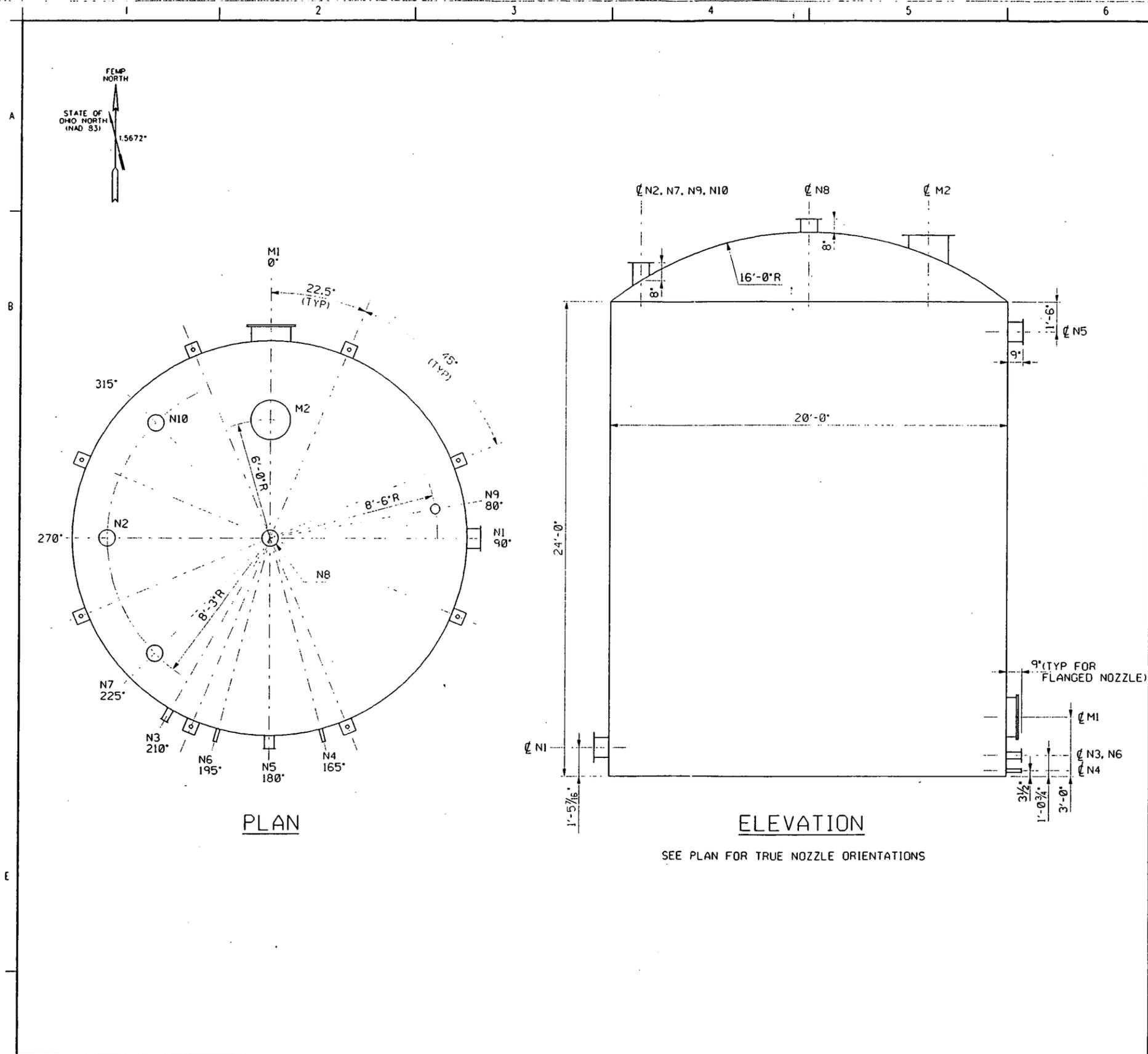
TANK DATA SHEET

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TANK DATA

**GENERAL**  
 1. CODES AND STANDARDS: API 650, ASCE 7-93, UBC-1994  
 2. NOMINAL CAPACITY: 50,000 GAL  
 3. SERVICE: GROUNDWATER

**DESIGN DATA**  
 1. FLUID TEMPERATURE: MAX AMBIENT °F, MIN AMBIENT °F  
 2. AMBIENT TEMPERATURE: MAX 95 °F, MIN -10 °F  
 3. INTERNAL PRESSURE: DESIGN ATM PSIG, OPERATING PSIG  
 4. SPECIFIC GRAVITY OF PROCESS FLUID: 1.0 AT 60 °F  
 5. CORROSION ALLOWANCE: SHELL N/A IN, ROOF N/A IN, BOTTOM N/A IN, STRUCTURAL N/A IN  
 6. FOUNDATION TYPE: REINFORCED CONCRETE SLAB  
 7. WIND: IMPORTANCE FACTOR 1.0, TABLE, EXPOSURE C, BASIC WIND SPEED 80 MPH  
 8. SNOW LOAD 25 PSF, ROOF LIVE LOAD: 20 PSF  
 9. SEISMIC: V=0.13(W) WHERE W=WEIGHT OF TANK PLUS CONTENTS

**FABRICATION**  
 1. ROOF TYPE: DOME, ROOF JOINT TYPE: PER API 650  
 2. BOTTOM TYPE: FLAT, BOTTOM TYPE JOINT: PER API 650  
 3. PAINTING: EXTERIOR PER SPECIFICATION  
 4. COATING: INTERIOR PER SPECIFICATION  
 5. INSULATION: NONE  
 6. MATERIAL: PLATE CS, FORGING CS, PIPE AND TUBE CS, GASKETS TEFLON, BOLTING PER API 650

**INSPECTION AND TEST**  
 PER API 650

**NOTES:**  
 1. PROVIDE ANCHOR SYSTEMS PER CODE REQUIREMENTS.  
 2. PROVIDE MINIMUM TWO ELECTRICAL GROUNDING ATTACHMENT LUGS ON OPPOSITE SIDES OF TANK WITH 1/16" HOLE.

**NOZZLE AND ACCESS WAY SCHEDULE**

MARK	SIZE	CLASS	TYPE	SERVICE	REMARKS
N1	12"	150	RF	OUTLET	
N2	2"	150	RF	LEVEL SWITCH	LSHH
N3	4"	150	RF	LEVEL TRANSMITTER	LIT
N4	2"	150	RF	DRAIN	
N5	10"	150	RF	OVERFLOW	
N6	2"		NPT	LEVEL SWITCH	LSLL
N7	10"	150	RF	INLET	
N8	10"	150	RF	VENT	
N9	6"	150	RF	RECIRCULATION	
N10	8"	150	RF	INLET	SPARE
M1	24"			MANWAY	WITH HINGED COVER
M2	24"			MANWAY	WITH HINGED COVER

<b>PARSONS ERA PROJECT</b>		TITLE <b>MECHANICAL PROCESS TANK DATA SHEET</b>		SPECIFICATION NO. 13205	DRAWING INDEX CODE NO. ARP/P0169	SHEET NO. 1 OF 1
PROJECT NAME <b>SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION</b>		TITLE <b>INJECTION WATER SUPPLY TANK (TNK-2)</b>		ATTACHMENT A	SKETCH NO.	REV. NO. <b>000136</b>
WBS 1.1.1.1.2.1				<b>SK-M-04401</b>		<b>0</b>

SECTION 13400  
INSTRUMENTS AND EQUIPMENT

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. This section of the instrumentation and controls that will support defines the design and performance requirements the South Plume Optimization and Injection Demonstration Project:
1. Pressure Gauge with Switch.
  2. Restriction Orifice Plates.
  3. Magnetic Flowmeters.
  4. Pressure Indicating Transmitters.
  5. Level Indicating Transmitters.
  6. Well Level Transmitters.
  7. Flow and Level Control Valves.
  8. Process Control Stations.
  9. Level Switches.
- B. Refer to the Instrument Data Sheets, Attachment A.
- C. Refer to the Instrument Index, Attachment B.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 13401 - Process Control System.
- D. Section 13405 - Installation and Calibration of Instruments.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

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#### 1.4 REFERENCES, CODES, AND STANDARDS

- A. American Society of Mechanical Engineers (ASME):
  - 1. ASME B16.5-88/B16.5A-92 Pipe Flanges and Flanged Fittings.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A105/A105M-96 Standard Specification for Carbon Steel Forgings for Piping Applications.
- C. National Fire Protection Association (NFPA):
  - 1. NFPA 70-96 National Electrical Code, 1996 Edition.
- D. National Electric Manufacturing Association (NEMA):
  - 1. NEMA ICS 6-93 Enclosures for Industrial Control and Systems; Revision 1 - March 1989.
- E. National Institute of Standards and Technology (NIST).

#### 1.5 SYSTEM DESCRIPTION

- A. General Design Requirements: For description of instrumentation equipment and detailed design requirements, reference Attachment A.
  - 1. Electronic analog transmitters and receivers shall have their input and output signals isolated from ground.
  - 2. Contact closure outputs shall be "dry" contacts isolated from ground.
  - 3. Instruments and control devices which require external power shall accept 120 volts, 60 Hz as the power source.
- B. General Performance Requirements
  - 1. For detailed performance requirements for all instrumentation for this design package, reference Attachment A.

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2. All instruments shall be accurate to the tolerance levels specified in Attachment A and shall maintain these tolerance levels under project conditions as described in Article 1.9.
3. Instrumentation shall perform to the stated requirements whether stationary or mobile, and require minimal calibration if remounted or moved.

#### 1.6 SUBMITTALS

- A. Provide submittals as required per Section 01011.
- B. Product Data: Include catalog "cut sheets," data sheets, and flow characteristic curves with bid.
- C. Shop Drawings: Include assembly drawings and wiring diagrams with shipment.
- D. Installation instructions, including recommended calibration procedures and installation details, with shipment.
  1. Include frequency of calibration required at the time after system installation and regular intervals of time thereafter.
  2. Certification of test equipment (calibration records) used to complete the work as described herein.
- E. Test reports: Test reports shall be typewritten, listing equipment used, person or persons performing the tests, date tested, device or circuit tested, and results of test; to be included with shipment.
- F. Calibration reports, with shipment.
- G. Operation and Maintenance (O&M) manuals, with shipment.
- H. Suggested spare parts inventory for each type of equipment, with bid.
- I. Valve sizing and noise calculations for flow regulating valves and actuator sizing calculations for all automatic valves with shipment.

**1.7           QUALITY ASSURANCE**

- A.       Instrumentation equipment shall be new, industrial type, of the function and type specified in Part 2.
- B.       Compatibility and Calibration: Instrumentation equipment provided shall be compatible with intended service.
  - 1.       Instrument equipment shall be calibrated to manufacturer's standards.
  - 2.       Test equipment shall be calibrated and shall be traceable by tag number, make, and model number to the instrument certified by the NIST.
- C.       Manufacturers' Qualifications: Manufacturers shall have 5 years of verifiable experience in the production of instrumentation equipment of the same type and similar performance as that specified herein.
- D.       Instrument equipment shall be calibrated as specified and commissioned in accordance with Section 13405.

**1.8           DELIVERY, STORAGE, HANDLING, AND SHIPPING**

- A.       Packing and Shipping
  - 1.       Product shipping container(s) shall contain packing materials to prevent the entrance of water to instrument surfaces, interior, and exterior.
  - 2.       Product shipping container(s) shall be clearly marked "FRAGILE - DO NOT DROP," and shall be furnished with an itemized invoice stating the contents and quantity of products contained therein.
  - 3.       Ports for process, electrical, and/or pneumatic connections shall be plugged to prevent the interior accumulation of dirt and moisture.
  - 4.       Ensure that closures used for covering, wrapping, or plugging openings shall not be made of polyvinyl chloride (PVC) or other plastics that contain chlorides.
  - 5.       Control components assembled prior to shipment shall be packaged to minimize entry of dirt and moisture.

- B. Acceptance at the FEMP
  - 1. Products arriving at the FEMP shall be examined for general damage during shipping. Those products found to be damaged shall not be accepted at the FEMP.
- C. Storage and Protection
  - 1. Instrumentation equipment shall be stored according to manufacturer's requirements for storage, if information regarding storage is provided by the manufacturer. In cases where specific storage requirements are not provided, equipment shall be stored in a clean, dry area protected from the weather until required for installation.

### 1.9 PROJECT CONDITIONS

- A. Services
  - 1. Operating Hours: 24 hours/day, 7 days/week, 52 weeks/year.
  - 2. Industrial design with a minimum instrument life of 5 years.
- B. Ambient Conditions
  - 1. Plant Location: Fernald, Ohio.
  - 2. Plant Elevation: Approximately 580 feet above sea level.
  - 3. Ambient Temperature Range: -10 to 100 degrees F.
  - 4. Barometric Pressure, inches Hg absolute (mean at 70 degrees F): 29.4.
  - 5. Relative Humidity: Varies from 20 percent to 95 percent.
- C. Electrical Supply: 120 volts, single phase, 60 Hz.

### 1.10 SEQUENCING AND SCHEDULING

- A. The sequencing of work and scheduling of tasks shall follow the project schedule and milestones approved by the Construction Manager. Acquisition/delivery of instrumentation and controls shall adhere to and support the approved project schedule.

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**1.11 WARRANTY**

- A. Special Warranty
  - 1. No special warranty requirements apply.

**1.12 MAINTENANCE**

- A. Maintenance Service
  - 1. Preventive/scheduled maintenance shall be performed per the manufacturer's instructions. Maintenance service numbers and information shall be provided along with product documentation sent in shipping. Maintenance policies and procedures shall be fully described in the maintenance documentation.
- B. Extra Materials
  - 1. Any extra/replacement parts or materials required to maintain acceptable product performance levels shall be referenced in the product documentation provided with shipping.

**PART 2 PRODUCTS**

**2.1 PRODUCTS/EQUIPMENT**

- A. Pressure Gauge with Switch (See Attachment A, Sheet 1)
  - 1. Pressure element shall be bourdon tube or diaphragm. Elements in contact with the process shall be manufactured from material suitable for specific process application.
  - 2. Gauge shall have a 4-1/2-inch dial, 1/2-inch threaded connection.
  - 3. All gauges shall be vibration and shock resistant.
  - 4. Scale shall be selected so that normal operating range is between 33 percent and 67 percent of span.

6. Switch:
    - a. The pressure switches shall be double-pole, double-throw with adjustable differential range. Minimum differential shall be less than 10 percent of range. Allowable surge pressure shall be 1.5 times range or better.
    - b. The pressure switches shall have a minimum contact rating of 0.5 amperes at 24 VDC.
    - c. Accuracy shall be  $\pm 2$  percent of full scale.
  7. Manufacturers: Dwyer, McDaniel, or Noshok.
- B. Restriction Orifice Plates (See Attachment A, Sheet 2)
1. Restriction orifice plates shall be square edge cut.
  2. Restriction Orifice Plates Basic Design: Each restriction orifice shall consist of an orifice plate, to be placed in a schedule 40 PVC solvent welded coupling.
  3. Orifice Plate Materials: Unless otherwise specified, all restriction orifice plates shall be made of 316 series stainless steel.
  4. Manufacturers: Badger Meter Inc., Fluidic Techniques, Foxboro Co.
- C. Magnetic Flowmeters (see Attachment A, Sheet 6)
1. Magnetic flowmeters shall comply with the following performance requirements:
    - a. Rangeability shall be 10 to 1, minimum.
    - b. Response time shall be adjustable to 10 seconds.
  2. Signal converters/transmitters shall produce output signal of 4-20 mA<sub>dc</sub>. Minimum output signal shall be equal to 0 percent of span and maximum output signal shall be equal to 100 percent span. Output shall be linear with respect to flow. Loop impedance shall be 750 ohms, minimum.
  3. Integral flow indicating totalizer with digital display of six digits, 0 through 9. Scale shall be in gallons, or multiplied by a power of ten, as required by operations.
  4. Manufacturer: Honeywell, Bailey/Fischer & Porter, or Fisher/Rosemount Inc.

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- D. Pressure Indicating Transmitters (see Attachment A, Sheet 10)
1. Pressure indicating transmitters shall have electronic outputs, 4-20 mA<sub>dc</sub>, and output shall be proportional to measured pressure. Loop impedance shall be 750 ohms, minimum.
  2. Pressure transmitters shall be equipped with an integral, digital indicator, 3-1/2 digits resolution, minimum.
  3. Pressure transmitters shall be equipped with independently adjustable zero and span setting devices..
  4. Transmitter accuracy shall be as stated on the data sheet(s) provided in Attachment A.
  5. Manufacturers: Fisher/Rosemount, Bailey/Fischer and Porter or Foxboro.

- E. Level Indicating Transmitter (see Attachment A, Sheet 12)
1. Level transmitter shall be a pressure sensing type to measure the head (height) of water in an atmospheric tank. Output signal shall be 4-20 mA<sub>dc</sub> and capable of driving a loop impedance of 750 ohms, minimum.
  2. Transmitter shall be equipped with a digital process indicator, 3-1/2 digits resolution minimum, calibrated in process units.
  3. Manufacturers: Fisher/Rosemount, Fischer and Porter or Foxboro.

- F. Well Level Transmitters (see Attachment A, Sheet 12)
1. Well level transmitter will be provided as a pressure sensing type to measure water height in the well casing. The sensor shall be submersible, with the electronic display and transmitter circuitry mounted remotely above grade. Interconnecting cable shall be furnished with the sensor, with field connections made at the electronic display/transmitter. Cable lengths defined on the data sheets, Attachment A.
  2. Signal output shall be 4-20 mA<sub>dc</sub>, capable of driving a loop impedance of 750 ohms, minimum.
  3. Manufacturers: In-Situ, Inc., Hawk America, Inc.

G. Flow and Level Control Valves (FCV and LCV) (See Attachment A, Sheet 16)

1. Construction:

- a. Bonnet bolting shall be manufacturer's standard for specified service. Threaded surfaces shall be coated with molybdenum disulfide except those in contact with process fluid.
- b. Control valves shall be provided with a manual operator.
- c. Flow control valve stem position shall be indicated by one position switch (SPDT), actuated at full closed position.
- d. Manufacturer: Fisher, Masoneilan, or Neles-Jamesbury.

2. Electronic Actuators:

- a. Electronic actuators shall accept a 4-20 mA<sub>dc</sub> signal as the control signal input. Nominal input impedance shall be 250 ohms.
- b. In closing direction, flow valve shall seat before actuator reaches travel limit.
- c. In opening direction, actuator shall engage a stop before actuator reaches its travel limit.
- d. Actuator materials shall be standard, unless otherwise specified, with spring treated to resist corrosion.
- e. Actuator assemblies shall be sized to provide force required to ensure total closure to ensure standard leakage rates when differential pressure in flow valve body is at maximum differential pressure.
- f. Available power for electronic actuators will be 120 VAC, 60 Hz, single phase.
- g. Manufacturers: Keystone, Worcester, or Neles-Jamesbury.

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- H. Process Control Stations (see Attachment A, Sheet 20)
1. Process Control Station operates in one of two modes; stand-alone (master) or distributed controller (slave) for a Fischer and Porter System Six Distributed Control System existing at the AWWT in accordance with Section 13401.
  2. Process Control Station will be programmable, digital display with 4-20 mAdc signal and setpoint inputs, and 4-20 mAdc output.
  3. Display shall be 96 x 48 dot matrix and programmable. Scale shall be in gallons.
  4. Setpoint bias shall be multiple 4-20 mAdc inputs, each individually programmable.
  5. Available power shall be 24 Vdc.
  6. Manufacturers: Bailey-Fisher and Porter.

- I. Level Switches (see Attachment A, Sheet 21)
1. Capacitance type level switches will be required to sense low level in tanks.
    - a. Capacitance type sensor, suitable for side mounting, 3/4 inch mnpt process connection.
    - b. DPDT output contacts, rated at 5 Amps, 120 VAC, single setpoint.
    - c. Available power is 120 VAC, 60 Hz, single phase.
    - d. Manufacturers: Magnetrol, SOR, Inc.
  2. Float (or displacer) type level switches will be required to sense high level in tanks.
    - a. Top mounted float switch assembly, float diameter not to exceed 4 inches.
    - b. DPDT output contacts, rated 5 Amps, 120 VAC, single setpoint.
    - c. Manufacturers: Magnetrol, Gems, SOR, Inc.

## 2.2 MATERIALS

- A. See data sheets, Attachment A.

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### 2.3 LABELING

- A. Instrument Tagging (see Attachment B):
1. Instruments requiring identification shall be tagged accordingly with a stainless steel 1-inch by 2 1/2-inch by 1/16-inch-thick tag (minimum). Lettering shall be minimum 1/4-inch high and stamped so that it can be easily read and identified.
  2. Tags shall be secured to the instruments by a beaded stainless steel chain so that they will remain on the instrument.

## PART 3 EXECUTION

### 3.1 CLEANING

- A. Instruments shall be cleaned in accordance with the manufacturer's recommended cleaning procedures.
- B. After cleaning, work shall be free from contamination in accordance with the following:
1. No residual contaminants present that could cause the instrument to become inoperative.
  2. No residual moisture present.
  3. No corrosion products, such as rust, present.

### 3.2 ATTACHMENTS

- A. The following Instrument Data Sheets are attached:
- |                                      |               |
|--------------------------------------|---------------|
| 1. Pressure Gauge with Switch        | 1             |
| 2. Restriction Orifice Plates        | 2 through 5   |
| 3. Magnetic Flowmeters               | 6 through 9   |
| 4. Pressure Indicating Transmitters  | 10 and 11     |
| 5. Level Indicating Transmitters     | 12            |
| 6. Well Level Transmitters           | 12 through 14 |
| 7. Flow and Level Control Valves     | 15 through 19 |
| 8. Electronic Indicating Controllers | 20 and 21     |
| 9. Level Switches                    | 22            |

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B. Instrument Index

1 through 9

**END OF SECTION**

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ARP/ID:53100/SPO:53300/169

**ATTACHMENT A**

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**INSTRUMENT DATA SHEETS**



REQUISITION NO.				VENDOR			
RESTRICTION ORIFICE PLATES				COUPLING (BY PIPING)			
1	Concentric X Other			7	Taps: _____ Flange _____ Pipe _____ Other NONE		
2	Make to ASME Standard _____ Other _____			8	Rating & Facing _____ Other _____		
3	Plate Material: 316 SS _____ Other _____			9	Type: Weld Neck _____ Other _____		
4	Bore Maximum Rate _____ Nearest 1/8" + OR - 1 MIL NOTE 4			10	Material: PVC SCHD 80 _____ Other NOTE (3)		
5	RTJ Ring Matl & Type _____ NOTE (3)			11	Tap Size 1/2 in. NPT _____ Other _____		
6	Stamp to ISA Standard _____ Other _____			12	Flanges by Matl Control _____ Other _____		
13	Tag Number				RO61B		RO63A
14	Item Number				NOTE (1)		NOTE (1)
15	Service				INJECTION WELL #8		INJECTION WELL #9
					LOW FLOW		HIGH FLOW
16	Line No.				GW-3"-B-2950		GW-4"-B-2954A
17	P&ID No./Section				95X-5900-N-00449		95X-5900-N-00449
SERVICE CONDITIONS							
18	Fluid				WATER		WATER
19	Flow Units				GPM		GPM
20	Full Scale Flow	Opr	Base		150		200
21	Norm Flow	Opr	Base		100		150
22	Press (psia)	Opr	Base		50		50
23	Barometric Pressure (psia)				14.7		14.7
24	Temperature °F	Opr	Base		60	60	60 60
25	sp gr @ 60 °F & Base Press				1		1
26	sp gr @ Opr Conditions				1		1
27	Supercomp Factor @ Opr Press				N/A		N/A
28	Vapor, Gas Mol. Wt.				N/A		N/A
29	Viscosity @ Opr Temp (cp)				1 C.P.		1 C.P.
30	Steam Qual Superheat °F				N/A	N/A	N/A N/A
31	Weep Hole Required				N/A		N/A
32	Viscosity Correction (Fc)						
33	Liquid Compressibility Factor (Fp)						
34	Density (lbs/ft³)	Opr	Base				
35	Compressibility	Opr	Base				
36	Cp/Cv						
37	Specific Volume (ft³/lb)						
MEASURING STATION DATA							
38	Actual Orifice ID in.				1.3"		1.21875"
39	Line Union ID in.				3.5"		4.5"
40	Orifice Plate Thickness in.				1/8"		1/8"
41	Seal sp gr @ 60°F				N/A		N/A
42	Meter Type				N/A		N/A
43	Diff Range in H2O Dry				299 (norm)/672 (high)		846 (norm)/1500 (high)
44	Static Range psia				N/A		N/A
45	Chart or Scale Range				N/A		N/A
46	Chart Multiplier (C)				N/A		N/A
47	Beta Ratio d/D				0.43 - SEE NOTE (1)		0.34 - SEE NOTE (1)
48	Manometer Correction (Fm)				N/A		N/A
49	Flow Equals						
50	Line: _____ Size _____ Sched _____				3"	80	4" 80

Notes:

- 1 \*\*\* INFORMATION AND OR DATA TO BE FURNISHED BY VENDOR.
- 2 VENDOR TO SUPPLY CALCULATION OF ORIFICE PLATE BORE AND BETA RATIO (d/D).
- 3 SEE PIPE SPECIFICATION (PIPING MATERIAL DATA SHEET)
- 4 BORE CALCULATION BASED UPON NEAREST 1/64" FOR FABRICATION PURPOSES. EXCEPTIONS FOR RO 065A, RO 067A AND RO 069A AS NOTED.

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PARSONS ERA PROJECT	RESTRICTION ORIFICE PLATES	Sheet 2	Job Number ARP/PO169
		Document Number 13400-ATTACHMENT A	Rev. 0

REQUISITION NO.				VENDOR					
RESTRICTION ORIFICE PLATES				COUPLING (BY PIPING)					
1	Concentric	X	Other	7	Taps:	Flange	Pipe	Other	NONE
2	Make to ASME Standard		Other	8	Rating & Facing			Other	
3	Plate Material:	316 SS	Other	9	Type: Weld Neck			Other	
4	Bore Maximum Rate		Nearest 1/8" + OR - 1 MIL	NOTE 4	10	Material:	PVC SCHD 80	Other	NOTE (3)
5	RTJ Ring Matl & Type		NOTE (3)		11	Tap Size	1/2 in. NPT	Other	
6	Stamp to ISA Standard		Other		12	Flanges by Matl Control		Other	

13	Tag Number	RO63B	RO65A	RO65B
14	Item Number	NOTE (1)	NOTE (1)	NOTE (1)
15	Service	INJECTION WELL #9	INJECTION WELL #10	INJECTION WELL #10
		LOW FLOW	HIGH FLOW	LOW FLOW
16	Line No.	GW-3"-B-2954B	GW-4"-B-2953A	GW-3"-B-2953B
17	P&ID No./Section	95X-5900-N-00449	95X-5900-N-00449	95X-5900-N-00449

SERVICE CONDITIONS							
18	Fluid	WATER		WATER		WATER	
19	Flow Units	GPM		GPM		GPM	
20	Full Scale Flow	Opr	Base	150	200	150	
21	Norm Flow	Opr	Base	100	150	100	
22	Press (psia)	Opr	Base	50	50	50	
23	Barometric Pressure (psia)			14.7	14.7	14.7	
24	Temperature °F	Opr	Base	60	60	60	60
25	sp gr @ 60 °F & Base Press			1	1	1	
26	sp gr @ Opr Conditions			1	1	1	
27	Supercomp Factor @ Opr Press			N/A	N/A	N/A	
28	Vapor, Gas Mol. Wt.			N/A	N/A	N/A	
29	Viscosity @ Opr Temp	(cp)		1 C.P.	1 C.P.	1 C.P.	
30	Steam Qual	Superheat °F		N/A	N/A	N/A	N/A
31	Weep Hole Required			N/A	N/A	N/A	
32	Viscosity Correction (Fc)						
33	Liquid Compressibility Factor	(Fp)					
34	Density (lbs/ft³)	Opr	Base				
35	Compressibility	Opr	Base				
36	Cp/Cv						
37	Specific Volume (ft³/lb)						

MEASURING STATION DATA					
38	Actual Orifice ID in.		1.00"	1.215"	1.00"
39	Line Flange ID in.		3.5"	4.5"	3.5"
40	Orifice Plate Thickness in.		1/8"	1/8"	1/8"
41	Seal sp gr @ 60°F		N/A	N/A	N/A
42	Meter Type		N/A	N/A	N/A
43	Diff Range in H2O Dry		826 (norm)/1860 (high)	857 (norm)/1523 (high)	826
44	Static Range psia		N/A	N/A	N/A
45	Chart or Scale Range		N/A	N/A	N/A
46	Chart Multiplier	(C)	N/A	N/A	N/A
47	Beta Ratio d/D		0.36 - SEE NOTE (1)	0.31 - SEE NOTE (1)	0.34 - SEE NOTE (1)
48	Manometer Correction	(Fm)	N/A	N/A	N/A
49	Flow Equals				
50	Line:	Size Sched	3"   80	4"   80	3"   80

Notes:

- 1 \*\*\* INFORMATION AND OR DATA TO BE FURNISHED BY VENDOR.
- 2 VENDOR TO SUPPLY CALCULATION OF ORIFICE PLATE BORE AND BETA RATIO (d/D).
- 3 SEE PIPE SPECIFICATION (PIPING MATERIAL DATA SHEET)
- 4 BORE CALCULATION BASED UPON NEAREST 1/64" FOR FABRICATION PURPOSES. EXCEPTIONS FOR RO 065A, RO 067A AND RO 069A AS NOTED.

PARSONS ERA PROJECT	RESTRICTION ORIFICE PLATES	Sheet	Job Number
		3	ARR/PO169
SPECIFICATION WBS 1.1.1.1.1.2.1		Document Number	Rev.
		13400-ATTACHMENT A	0

REQUISITION NO.		VENDOR					
RESTRICTION ORIFICE PLATES				COUPLING (BY PIPING)			
1	Concentric <input checked="" type="checkbox"/> Other _____	7	Taps: _____	Flange _____	Pipe _____	Other NONE	
2	Make to ASME Standard _____ Other _____	8	Rating & Facing _____			Other _____	
3	Plate Material: 316 SS _____ Other _____	9	Type: Weld Neck _____			Other _____	
4	Bore Maximum Rate _____ Nearest 1/8" + OR - 1 MIL NOTE 4	10	Material: PVC SCHD 80			Other NOTE (3)	
5	RTJ Ring Matl & Type _____ NOTE (3)	11	Tap Size 1/2 in. NPT _____			Other _____	
6	Stamp to ISA Standard _____ Other _____	12	Flanges by Mall Control _____			Other _____	
13	Tag Number	RO67A	RO67B	RO69A			
14	Item Number	NOTE (1)	NOTE (1)	NOTE (1)			
15	Service	INJECTION WELL #11	INJECTION WELL #11	INJECTION WELL #12			
		HIGH FLOW	LOW FLOW	HIGH FLOW			
16	Line No.	GW-4"-B-2952A	GW-3"-B-2952B	GW-4"-B-2951A			
17	P&ID No./Section	95X-5900-N-00449	95X-5900-N-00449	95X-5900-N-00449			
SERVICE CONDITIONS							
18	Fluid	WATER	WATER	WATER			
19	Flow Units	GPM	GPM	GPM			
20	Full Scale Flow	Opr Base 200	150	200			
21	Norm Flow	Opr Base 150	100	150			
22	Press (psia)	Opr Base 50	50	50			
23	Barometric Pressure (psia)	14.7	14.7	14.7			
24	Temperature °F	Opr Base 60	60	60	60	60	60
25	sp gr @ 60 °F & Base Press	1	1	1			
26	sp gr @ Opr Conditions	1	1	1			
27	Supercomp Factor @ Opr Press	N/A	N/A	N/A			
28	Vapor, Gas Mol. Wt.	N/A	N/A	N/A			
29	Viscosity @ Opr Temp (cp)	1 C.P.	1 C.P.	1 C.P.			
30	Steam Qual Superheat °F	N/A	N/A	N/A	N/A	N/A	N/A
31	Weep Hole Required	N/A	N/A	N/A			
32	Viscosity Correction (Fc)						
33	Liquid Compressibility Factor (Fp)						
34	Density (lbs/ft³) Opr Base						
35	Compressibility Opr Base						
36	Cp/Cv						
37	Specific Volume (ft³/lb)						
MEASURING STATION DATA							
38	Actual Orifice ID in.	1.215"	1.00"	1.215"			
39	Line Union ID in.	4.5"	3.5"	4.5"			
40	Orifice Plate Thickness in.	1/8"	1/8"	1/8"			
41	Seal sp gr @ 60°F	N/A	N/A	N/A			
42	Meter Type	N/A	N/A	N/A			
43	Diff Range in H2O Dry	857 (norm)/1523 (high)	826	857 (norm)/1523 (high)			
44	Static Range psia	N/A	N/A	N/A			
45	Chart or Scale Range	N/A	N/A	N/A			
46	Chart Multiplier (C)	N/A	N/A	N/A			
47	Beta Ratio d/D	0.31 - SEE NOTE (1)	0.34 - SEE NOTE (1)	0.31 - SEE NOTE (1)			
48	Manometer Correction (Fm)	N/A	N/A	N/A			
49	Flow Equals						
50	Line: Size Sched	4"   80	3"   80	4"   80			

Notes:

- \*\*\* INFORMATION AND OR DATA TO BE FURNISHED BY VENDOR.
- VENDOR TO SUPPLY CALCULATION OF ORIFICE PLATE BORE AND BETA RATIO (d/D).
- SEE PIPE SPECIFICATION (PIPING MATERIAL DATA SHEET)
- BORE CALCULATION BASED UPON NEAREST 1/64" FOR FABRICATION PURPOSES. EXCEPTIONS FOR RO 065A, RO 067A AND RO 069A AS NOTED.

PARSONS ERA PROJECT	RESTRICTION ORIFICE PLATES	Sheet 4	Job Number ARP/PO169
SPECIFICATION WBS 1.1.1.1.1.2.1		Document Number 13400-ATTACHMENT A	Rev. 0

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REQUISITION NO.				VENDOR					
RESTRICTION ORIFICE PLATES				COUPLING (BY PIPING)					
1	Concentric	X	Other	7	Taps:	Flange	Pipe	Other	NONE
2	Make to ASME Standard		Other	8	Rating & Facing			Other	
3	Plate Material:	316 SS	Other	9	Type: Weld Neck			Other	
4	Bore Maximum Rate		Nearest 1/8" + OR - 1 MIL	10	Material:	PVC SCHD 80		Other	NOTE (3)
5	RTJ Ring Matl & Type		NOTE (3)	11	Tap Size	1/2 in. NPT		Other	
6	Stamp to ISA Standard		Other	12	Flanges by	Mail Control		Other	

13	Tag Number		RO69B
14	Item Number		NOTE (1)
15	Service		INJECTION WELL #12
			LOW FLOW
16	Line No.		GW-3"-B-2951B
17	P&ID No./Section		95X-5900-N-00449

SERVICE CONDITIONS			
18	Fluid		WATER
19	Flow Units		GPM
20	Full Scale Flow	Opr Base	150
21	Norm Flow	Opr Base	100
22	Press (psia)	Opr Base	50
23	Barometric Pressure (psia)		14.7
24	Temperature °F	Opr Base	60 60
25	sp gr @ 60 °F & Base Press		1
26	sp gr @ Opr Conditions		1
27	Supercomp Factor @ Opr Press		N/A
28	Vapor. Gas Mol. Wt.		N/A
29	Viscosity @ Opr Temp (cp)		1 C.P.
30	Steam Qual Superheat °F		N/A N/A
31	Weep Hole Required		N/A
32	Viscosity Correction (Fc)		
33	Liquid Compressibility Factor (Fp)		
34	Density (lbs/ft³)	Opr Base	
35	Compressibility	Opr Base	
36	Cp/Cv		
37	Specific Volume (ft³/lb)		

MEASURING STATION DATA			
38	Actual Orifice ID in.		1.00"
39	Line Flange ID in.		3.5"
40	Orifice Plate Thickness in.		1/8"
41	Seal sp gr @ 60°F		N/A
42	Meter Type		N/A
43	Diff Range in H2O Dry		826
44	Static Range psia		N/A
45	Chart or Scale Range		N/A
46	Chart Multiplier (C)		N/A
47	Beta Ratio d/D		0.34 - SEE NOTE (1)
48	Manometer Correction (Fm)		N/A
49	Flow Equals		
50	Line: Size Sched	3" STD	80

Notes:

- 1 \*\*\* INFORMATION AND OR DATA TO BE FURNISHED BY VENDOR.
- 2 VENDOR TO SUPPLY CALCULATION OF ORIFICE PLATE BORE AND BETA RATIO (d/D).
- 3 SEE PIPE SPECIFICATION (PIPING MATERIAL DATA SHEET)
- 4 BORE CALCULATION BASED UPON NEAREST 1/64" FOR FABRICATION PURPOSES. EXCEPTIONS FOR RO 065A, RO 067A AND RO 069A AS NOTED.

PARSONS ERA PROJECT	RESTRICTION ORIFICE PLATES	Sheet 5	Job Number ARP/PO169
SPECIFICATION WBS 1.1.1.1.1.2.1		Document Number 13400-ATTACHMENT A	Rev. 0

REQUISITION NO.			VENDOR					
1	Loop Tag No.		FIT060		FIT062		FIT064	
2	Item No.							
3	Model No.							
4	Service		INJ. WELL #8 INFLOW		INJ. WELL #9 INFLOW		INJ. WELL #10 INFLOW	
5	Line No.		GW-4"-A-2950-ET		GW-4"-A-2954-ET		GW-4"-A-2953-ET	
6	P&ID No./Section		95X-5900-N-00449		95X-5900-N-00449		95X-5900-N-00449	
<b>SERVICE CONDITIONS</b>								
7	Fluid		WATER		WATER		WATER	
8	Normal Flow (units)		200 GPM		200 GPM		200 GPM	
9	Flow (units)	Max. Min.	200 GPM	100 GPM	200 GPM	100 GPM	200 GPM	100 GPM
10	Temperature (units)	Max. Min.	80 °F	50 °F	80 °F	50 °F	80 °F	50 °F
11	Pressure (units)	Max. Min.	110 Psig	0 Psig	110 Psig	0 Psig	110 Psig	0 Psig
12	Velocity (units)	Max. Min.	5 FPS	2.5 FPS	5 FPS	2.5 FPS	5 FPS	2.5 FPS
13	Conductivity (µMHOS/ c)	Norm. Min.	> 30	> 20	> 30	> 20	> 30	> 20
14	Specific Gravity	Max. Norm.	1	1	1	1	1	1
15	% Solids	Max. Norm.	< 3%	< 3%	< 3%	< 3%	< 3%	< 3%
16	Extra Conditions or Requirements		NO		NO		NO	
<b>MEASURING ELEMENT</b>			FE060		FE062		FE064	
17	Tube Size (units) Matl. Sched.		4"	SCH 40	4"	SCH 40	4"	SCH 40
18	Liner Material		POLYURETHANE		POLYURETHANE		POLYURETHANE	
19	End Connections & Rating / Type Material		ANSI 150# RF CARBON STEEL		ANSI 150# RF CARBON STEEL		ANSI 150# RF CARBON STEEL	
20	Electrode Material		316 STAINLESS STEEL		316 STAINLESS STEEL		316 STAINLESS STEEL	
21	Meter Casing							
22	Power Requirements / Electrical Code		120V, 60HZ	GENERAL	120V, 60HZ	GENERAL	120V, 60HZ	GENERAL
23	Enclosure Class		NEMA 4		NEMA 4		NEMA 4	
24	Grounding Type / Material		INTERNAL	316 SST	INTERNAL	316 SST	INTERNAL	316 SST
25	Ultrasonic Cleaning		NO		NO		NO	
26	Extra Features or Requirements		NO		NO		NO	
<b>TRANSMITTER</b>			FIT060		FIT062		FIT064	
27	Output Signal (units)		4-20 mA		4-20 mA		4-20 mA	
28	Calibrated Flow Range (units)		0-250 GPM		0-250 GPM		0-250 GPM	
29	Conduit Conn. Size (units)		1/2" NPT		1/2" NPT		1/2" NPT	
30	Mounting		INTEGRAL		INTEGRAL		INTEGRAL	
31	Enclosure Class		NEMA 4		NEMA 4		NEMA 4	
32	Signal Cable Length (units)							
33	Power Requirement / Elect. Code		120V, 60HZ	GENERAL	120V, 60HZ	GENERAL	120V, 60HZ	GENERAL
34	Integrator		YES		YES		YES	
35	Zero Return		YES		YES		YES	
36	Alarms		NO		NO		NO	
37	Special Modification		NO		NO		NO	
38	Extra Features or Requirements		NOTE (2)		NOTE (2)		NOTE (2)	

Notes:

1. \*\*\* INFORMATION AND OR DATA TO BE FURNISHED BY VENDOR.
2. ACCURACY SHALL BE AS A MINIMUM 1.0% AND REPEATABILITY SHALL BE 0.5% OR BETTER.

PARSONS ERA PROJECT

MAGNETIC FLOWMETERS

Sheet  
6

Job Number  
ARP/PO169

Instrument Data Sheet  
WBS 1.1.1.1.1.2.1

Document Number  
13400-ATTACHMENT A

Rev  
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28-May-97

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REQUISITION NO.				VENDOR					
1	Loop Tag No.	FIT066			FIT068		FIT072		
2	Item No.	.			.		.		
3	Model No.	.			.		.		
4	Service	INJ. WELL #11 INFLOW			INJ. WELL #12 INFLOW		OPT. WELL #RW6 FLOW		
5	Line No.	GW-4"-A-2952-ET			GW-4"-A-2951-ET		GW-6"-A-2930-IC		
6	P&ID No./Section	95X-5900-N-00449			95X-5900-N-00449		95X-5900-N-00448		
SERVICE CONDITIONS									
7	Fluid	WATER			WATER		WATER		
8	Normal Flow (units)	200 GPM			200 GPM		250 GPM		
9	Flow (units)	Max.	Min.	200 GPM	100 GPM	200 GPM	100 GPM	400 GPM	100 GPM
10	Temperature (units)	Max.	Min.	80 °F	50 °F	80 °F	50 °F	80 °F	50 °F
11	Pressure (units)	Max.	Min.	110 Psig	0 Psig	110 Psig	0 Psig	150Psig	0 Psig
12	Velocity (units)	Max.	Min.	5 FPS	2.5 FPS	5 FPS	2.5 FPS	3.9 FPS	1.1 FPS
13	Conductivity (µMHOS/ c)	Norm.	Min.	> 30	> 20	> 30	> 20	> 30	> 20
14	Specific Gravity	Max.	Norm.	1	1	1	1	1	1
15	% Solids	Max.	Norm.	< 3%	< 3%	< 3%	< 3%	< 3%	< 3%
16	Extra Conditions or Requirements	NO			NO		NO		
MEASURING ELEMENT				FE066		FE068		FE072	
17	Tube Size (units) Matl. Sched.	4" SCH 40		4" SCH 40		6" SCH 40		6" SCH 40	
18	Liner Material	POLYURETHANE			POLYURETHANE		POLYURETHANE		
19	End Connections & Rating / Type Material	ANSI 150# RF CARBON STEEL			ANSI 150# RF CARBON STEEL		ANSI 150# RF CARBON STEEL		
20	Electrode Material	316 STAINLESS STEEL			316 STAINLESS STEEL		316 STAINLESS STEEL		
21	Meter Casing	.			.		.		
22	Power Requirements / Electrical Code	120V, 60HZ   GENERAL		120V, 60HZ   GENERAL		120V, 60HZ   GENERAL		120V, 60HZ   GENERAL	
23	Enclosure Class	NEMA 4			NEMA 4		NEMA 4		
24	Grounding Type / Material	INTERNAL 316 SST		INTERNAL 316 SST		INTERNAL 316 SST		INTERNAL 316 SST	
25	Ultrasonic Cleaning	NO			NO		NO		
26	Extra Features or Requirements	NO			NO		NO		
TRANSMITTER				FIT066		FIT068		FIT072	
27	Output Signal (units)	4-20 mA			4-20 mA		4-20 mA		
28	Calibrated Flow Range (units)	0-250 GPM			0-250 GPM		0-400 GPM		
29	Conduit Conn. Size (units)	1/2" NPT			1/2" NPT		1/2" NPT		
30	Mounting	INTEGRAL			INTEGRAL		INTEGRAL		
31	Enclosure Class	NEMA 4			NEMA 4		NEMA 4		
32	Signal Cable Length (units)	.			.		.		
33	Power Requirement / Elect. Code	120V, 60HZ   GENERAL		120V, 60HZ   GENERAL		120V, 60HZ   GENERAL		120V, 60HZ   GENERAL	
34	Integrator	YES			YES		YES		
35	Zero Return	YES			YES		YES		
36	Alarms	NO			NO		NO		
37	Special Modification	NO			NO		NO		
38	Extra Features or Requirements	NOTE (2)			NOTE (2)		NOTE (2)		

- Notes:
1. \*\*\* INFORMATION AND OR DATA TO BE FURNISHED BY VENDOR.
  2. ACCURACY SHALL BE AS A MINIMUM 1.0% AND REPEATABILITY SHALL BE 0.5% OR BETTER.

PARSONS ERA PROJECT Instrument Data Sheet WBS 1.1.1.1.1.2.1	MAGNETIC FLOWMETERS	Sheet 7	Job Number ARP/PO169
		Document Number 13400-ATTACHMENT A	Rev 0

REQUISITION NO.				VENDOR			
1	Loop Tag No.	FIT076		FIT211		FIT212	
2	Item No.						
3	Model No.						
4	Service	OPT. WELL RW7 FLOW		RECOVERY WELL 3924 FLOW		RECOVERY WELL 3925 FLOW	
5	Line No.	GW-6"-A-2931-IC		GW1-6"--01		GW1-6"--01	
6	P&ID No./Section	95X-5900-N-00448		95X-5900-N-00448		95X-5900-N-00448	
<b>SERVICE CONDITIONS</b>							
7	Fluid	WATER		WATER		WATER	
8	Normal Flow (units)	250 GPM		400 GPM		400 GPM	
9	Flow (units) Max. Min.	400 GPM	100 GPM	650 GPM	200 GPM	650 GPM	200 GPM
10	Temperature (units) Max. Min.	80 °F	50 °F	80 °F	50 °F	80 °F	50 °F
11	Pressure (units) Max. Min.	150 Psig	0 Psig	150 Psig	0 Psig	150 Psig	0 Psig
12	Velocity (units) Max. Min.	3.9 FPS	0.7 FPS	4.2 FPS	1.3 FPS	4.2 FPS	1.3 FPS
13	Conductivity (µMHOS/ c) Norm. Min.	> 30	> 20	> 30	> 20	> 30	> 20
14	Specific Gravity Max. Norm.	1	1	1	1	1	1
15	% Solids Max. Norm.	< 3%	< 3%	< 3%	< 3%	< 3%	< 3%
16	Extra Conditions or Requirements	NO		NO		NO	
<b>MEASURING ELEMENT</b>							
		FE076		FE211		FE212	
17	Tube Size (units) Matl. Sched.	6"	SCH 40	6"	SCH 40	6"	SCH 40
18	Liner Material	POLYURETHANE		POLYURETHANE		POLYURETHANE	
19	End Connections & Rating / Type Material	ANSI 150# RF CARBON STEEL		ANSI 150# RF CARBON STEEL		ANSI 150# RF CARBON STEEL	
20	Electrode Material	316 STAINLESS STEEL		316 STAINLESS STEEL		316 STAINLESS STEEL	
21	Meter Casing						
22	Power Requirements / Electrical Code	120V, 60HZ	GENERAL	120V, 60HZ	GENERAL	120V, 60HZ	GENERAL
23	Enclosure Class	NEMA 4		NEMA 4		NEMA 4	
24	Grounding Type / Material	INTERNAL	316 SST	INTERNAL	316 SST	INTERNAL	316 SST
25	Ultrasonic Cleaning	NO		NO		NO	
26	Extra Features or Requirements	NO		NO		NO	
<b>TRANSMITTER</b>							
		FIT076		FIT211		FIT212	
27	Output Signal (units)	4-20 mA		4-20 mA		4-20 mA	
28	Calibrated Flow Range (units)	0-300 GPM		0-650 GPM		0-650 GPM	
29	Conduit Conn. Size (units)	1/2" NPT		1/2" NPT		1/2" NPT	
30	Mounting	INTEGRAL		INTEGRAL		INTEGRAL	
31	Enclosure Class	NEMA 4		NEMA 4		NEMA 4	
32	Signal Cable Length (units)						
33	Power Requirement / Elect. Code	120V, 60HZ	GENERAL	120V, 60HZ	GENERAL	120V, 60HZ	GENERAL
34	Integrator	YES		YES		YES	
35	Zero Return	YES		YES		YES	
36	Alarms	NO		NO		NO	
37	Special Modification	NO		NO		NO	
38	Extra Features or Requirements	NOTE (2)		NOTE (2)		NOTE (2)	

Notes:

1. \*\*\* INFORMATION AND OR DATA TO BE FURNISHED BY VENDOR.
2. ACCURACY SHALL BE AS A MINIMUM 1.0% AND REPEATABILITY SHALL BE 0.5% OR BETTER.

PARSONS ERA PROJECT Instrument Data Sheet WBS 1.1.1.1.1.2.1	MAGNETIC FLOWMETERS	Sheet 8	Job Number ARP/PO169
		Document Number 13400-ATTACHMENT A	Rev 0

REQUISITION NO.				VENDOR			
1	Loop Tag No.	FIT213		FIT214		FIT055	
2	Item No.						
3	Model No.						
4	Service	RECOVERY WELL 3926 FLOW		RECOVERY WELL 3927 FLOW		INJECTION WATER RECIRC. FLOW	
5	Line No.	GW1-6"-01		GW1-6"-01		GW-6"-A-2955-ET	
6	P&ID No./Section	95X-5900-N-00448		95X-5900-N-00448		95X-5900-N-00449	

SERVICE CONDITIONS											
7	Fluid	WATER				WATER				WATER	
8	Normal Flow (units)	400 GPM				400 GPM				400 GPM	
9	Flow (units)	Max.	Min.	650 GPM	200 GPM	650 GPM	200 GPM	800 GPM	200 GPM		
10	Temperature (units)	Max.	Min.	80 °F	50 °F	80 °F	50 °F	80 °F	50 °F		
11	Pressure (units)	Max.	Min.	150 Psig	0 Psig	150 Psig	0 Psig	150 Psig	0 Psig		
12	Velocity (units)	Max.	Min.	4.2 FPS	1.3 FPS	4.2 FPS	1.3 FPS	8.8 FPS	1.3 FPS		
13	Conductivity (µMHOS/ c)	Norm.	Min.	> 30	> 20	> 30	> 20	> 30	> 20		
14	Specific Gravity	Max.	Norm.	1	1	1	1	1	1		
15	% Solids	Max.	Norm.	< 3%	< 3%	< 3%	< 3%	< 3%	< 3%		
16	Extra Conditions or Requirements	NO				NO				NO	

MEASURING ELEMENT															
				FE213				FE214				FE212			
17	Tube Size (units) Matl. Sched.	6"		SCH 40		6"		SCH 40		6"		SCH 40			
18	Liner Material	POLYURETHANE				POLYURETHANE				POLYURETHANE					
19	End Connections & Rating / Type Material	ANSI 150# RF CARBON STEEL				ANSI 150# RF CARBON STEEL				ANSI 150# RF CARBON STEEL					
20	Electrode Material	316 STAINLESS STEEL				316 STAINLESS STEEL				316 STAINLESS STEEL					
21	Meter Casing														
22	Power Requirements / Electrical Code	120V, 60HZ		GENERAL		120V, 60HZ		GENERAL		120V, 60HZ		GENERAL			
23	Enclosure Class	NEMA 4				NEMA 4				NEMA 4					
24	Grounding Type / Material	INTERNAL		316 SST		INTERNAL		316 SST		INTERNAL		316 SST			
25	Ultrasonic Cleaning	NO				NO				NO					
26	Extra Features or Requirements	NO				NO				NO					

TRANSMITTER															
				FIT213				FIT214				FIT055			
27	Output Signal (units)	4-20 mA				4-20 mA				4-20 mA					
28	Calibrated Flow Range (units)	0-650 GPM				0-650 GPM				0-650 GPM					
29	Conduit Conn. Size (units)	1/2" NPT				1/2" NPT				1/2" NPT					
30	Mounting	INTEGRAL				INTEGRAL				INTEGRAL					
31	Enclosure Class	NEMA 4				NEMA 4				NEMA 4					
32	Signal Cable Length (units)														
33	Power Requirement / Elect. Code	120V, 60HZ		GENERAL		120V, 60HZ		GENERAL		120V, 60HZ		GENERAL			
34	Integrator	YES				YES				YES					
35	Zero Return	YES				YES				YES					
36	Alarms	NO				NO				NO					
37	Special Modification	NO				NO				NO					
38	Extra Features or Requirements	NOTE (2)				NOTE (2)				NOTE (2)					

Notes:

- \*\*\* INFORMATION AND OR DATA TO BE FURNISHED BY VENDOR.
- ACCURACY SHALL BE AS A MINIMUM 1.0% AND REPEATABILITY SHALL BE 0.5% OR BETTER.

PARSONS ERA PROJECT Instrument Data Sheet WBS 1.1.1.1.1.2.1	MAGNETIC FLOWMETERS	Sheet 9	Job Number ARP/PO169
		Document Number 13400-ATTACHMENT A	Rev 0

REQUISITION NO.				VENDOR			
Reference Specification Sheet No.				Model No.			
<b>GENERAL</b>				<b>AUTO MANUAL SWITCH</b> N/A			
1	Description:	<input type="checkbox"/> Recorder <input type="checkbox"/> Controller	<input checked="" type="checkbox"/> Indicator <input checked="" type="checkbox"/> Transmitter	<input type="checkbox"/> Blind	20	No. Positions	<input type="checkbox"/> External <input type="checkbox"/> Integral
2	Case:	<input type="checkbox"/> Rectangular <input type="checkbox"/> Other	<input type="checkbox"/> Circular	<input checked="" type="checkbox"/> Standard	<b>SETPOINT ADJUSTMENTS</b> N/A		
3	Case Color:	<input type="checkbox"/> Black <input type="checkbox"/> Other	<input checked="" type="checkbox"/> Standard		21	Manual:	<input type="checkbox"/> Internal <input type="checkbox"/> External
4	Mounting:	<input type="checkbox"/> Flush <input type="checkbox"/> Other	<input type="checkbox"/> Surface	<input checked="" type="checkbox"/> Yoke	22	Remote:	<input type="checkbox"/> Pneumatic <input type="checkbox"/> Electric
5	No. Points:	<input type="checkbox"/> Recording	<input checked="" type="checkbox"/> Indicating		23	Control Point Span:	<input type="checkbox"/> Fixed <input type="checkbox"/> Adjustable
6	Chart Type:	<input type="checkbox"/> 12-inch Circ.	<input type="checkbox"/> Other		24	Others	
7	Chart Range	<input type="checkbox"/> Number			<b>PRESSURE ELEMENT</b>		
8	Scale Range	<input type="checkbox"/> Type			25	<input type="checkbox"/> Spiral	<input type="checkbox"/> Bellows <input checked="" type="checkbox"/> Diaphragm <input type="checkbox"/> Bourdon <input type="checkbox"/> Helical
9	Chart Drive:	<input type="checkbox"/> Spring	<input type="checkbox"/> Electric	<input type="checkbox"/> Pneumatic	Other _____		
10	Chart Speed	<input type="checkbox"/> Wind			26	Material:	<input type="checkbox"/> Bronze <input checked="" type="checkbox"/> Stainless Steel <input type="checkbox"/> Carbon Steel
11	Volts/Hertz	<input type="checkbox"/> Explosion Proof			27	Absolute Head Compensation	_____
12	Other :	Air Pressure _____ NEMA 4X HOUSING _____			28	Static Head Compensation	_____
<b>TRANSMITTER</b>				29			
13	Type:	<input type="checkbox"/> Pneumatic	<input checked="" type="checkbox"/> Electric		Range _____		
14	Output:	<input type="checkbox"/> 3-15 psi <input type="checkbox"/> Other	<input checked="" type="checkbox"/> 4-20 mA DC		<input checked="" type="checkbox"/> psig <input type="checkbox"/> in. Mercury Vacuum <input type="checkbox"/> psia		
15	TWO (2) WIRE, ADJ. DAMPING				30	Connection	<input type="checkbox"/> 1/4 in. NPT <input checked="" type="checkbox"/> 1/2 in. NPT
<b>CONTROLLER</b> N/A				31			
16	Type :	<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Electric		Back _____		
17	Proportional	<input type="checkbox"/> Percent <input type="checkbox"/> On-Off	<input type="checkbox"/> Auto-Reset <input type="checkbox"/> Other	<input type="checkbox"/> Rate-Action	32 Filter and Regulator _____		
18	Output	<input type="checkbox"/> 3-15 psi <input type="checkbox"/> Other	<input type="checkbox"/> 4-20 mA DC		33 Air Supply Gauge _____		
19	On Measurement Increase	Output <input type="checkbox"/> Increases <input type="checkbox"/> Decreases			34 Local Indicator _____ YES		
				35 Charts and Inkset _____			
				36 Mounting Yoke _____ YES			
				37 Pulsation Dampener _____			
				38 Manifold _____			
				Alarm Switch _____			
				<input type="checkbox"/> Hermetically Sealed <input type="checkbox"/> Explosion Proof <input type="checkbox"/> General Purpose			

## Notes:

- PIT060, PIT062, PIT064, PIT066, PIT068, PIT072, PIT076, PIT211, PIT212, PIT213, AND PIT214 WILL BE PRE ASSEMBLED.
- OPERATING PRESSURE AND SET POINT: SEE TABLE ON 13400-ATTACHMENT A, SHEET 11

PARSONS ERA PROJECT		PRESSURE INSTRUMENTS		Sheet 10	Job No. ARP/PO169
Instrument Data Sheets				Document Number 13400-ATTACHMENT A	Rev. 0
WBS 1.1.1.1.1.2.1					

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REQUISITION NO.				VENDOR			
1	Tag No.	LT050		LT060		LT062	
2	Item No.						
3	Model No.						
4	Service	INJ. WATER SUPPLY TK LEVEL TRANSMITTER		INJ. WELL #8 LEVEL TRANSMITTER		INJ. WELL #9 LEVEL TRANSMITTER	
5	Vessel or Equipment No.	TNK-2		INJECTION WELL #8		INJECTION WELL #9	
6	P&ID No.	95X-5900-N-00449		95X-5900-N-00449		95X-5900-N-00449	
7	Type	PRESS. TRANSMITTER		PRESS. TRANSMITTER		PRESS. TRANSMITTER	
<b>SERVICE CONDITIONS</b>							
8	Upper Fluid	WATER		GROUNDWATER		GROUNDWATER	
9	Lower Fluid						
10	sp gr Upper	1		1		1	
	sp gr Lower	-		-		-	
11	Press Max	Normal	9 PSI	7.2 PSI	30 PSIG	15 PSIG	30 PSIG 15 PSIG
12	Temp Max	Normal	90 °F	60 °F	90 °F	60 °F	90 °F 60 °F
13							
14							
<b>BODY</b>							
15	Material	300 SERIES SST		300 SERIES SST		300 SERIES SST	
16	Size & Type Connections	4" 150# RF FLANGE		DIRECTLY SUBMERGED		DIRECTLY SUBMERGED	
17	Top Connection Location	ATMOSPHERE		ATMOSPHERE		ATMOSPHERE	
18	Bot Connection Location	TANK SHELL (BOTTOM)		SUBMERGED		SUBMERGED	
19	Case Mounting	INTERGAL		INTERGAL		INTERGAL	
20	Flange Orientation	HORIZONTAL		(NOTE 3)		(NOTE 3)	
21	Rotatable Head	N/A		N/A		N/A	
22							
<b>ELEMENT</b>							
		DIFFERENTIAL PRESSURE		DIFFERENTIAL PRESSURE		DIFFERENTIAL PRESSURE	
23	Diameter or Length, In.			>1.25" DIA.		>1.25" DIA.	
24	Extension, In.						
25	Material	316 SST		316 SST		316 SST	
26	Torque Tube Material	N/A		N/A		N/A	
27	Air Fin	N/A		N/A		N/A	
28							
<b>TRANSMITTER</b>							
29	Type	ELECTRONIC		ELECTRONIC		ELECTRONIC	
30	Output	4-20 mA DC		4-20 mA DC		4-20 mA DC	
31							
<b>CONTROL</b>							
		N/A		N/A		N/A	
32	Type						
33	Proportional %	Reset					
34	Output						
35	On Level Increase, Output						
36							
<b>ACCESSORIES</b>							
		N/A		N/A		N/A	
37	Filter & Regulator						
38	Gauge Glass Connections						
39	Gauge Glass						
40	Purge Connection						
41	Electric Switch						
42							
43							
Notes:							
1. *** - INFORMATION SUPPLIED BY MANUFACTURER.							
2. 1/2" NPT CONDUIT CONNECTION.							
3. SUBMERSIBLE LEVEL TRANSMITTER WITH BUILT-IN TEMPERATURE COMPENSATION							
PARSONS ERA PROJECT				LEVEL INSTRUMENTS		Sheet	Job Number
INSTRUMENT DATA SHEET						12	ARP/PO-169
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28-May-97

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REQUISITION NO.				VENDOR			
1	Tag No.	LT064		LT066		LT068	
2	Item No.						
3	Model No.						
4	Service	INJ. WELL #10		INJ. WELL #11		INJ. WELL #12	
		LEVEL TRANSMITTER		LEVEL TRANSMITTER		LEVEL TRANSMITTER	
5	Vessel or Equipment No.	INJECTION WELL #10		INJECTION WELL #11		INJECTION WELL #12	
6	P&ID No.	95X-5900-N-00449		95X-5900-N-00449		95X-5900-N-00449	
7	Type	PRESS. TRANSMITTER		PRESS. TRANSMITTER		PRESS. TRANSMITTER	
<b>SERVICE CONDITIONS</b>							
8	Upper Fluid	GROUNDWATER		GROUNDWATER		GROUNDWATER	
9	Lower Fluid						
10	sp gr Upper	1		1		1	
	sp gr Lower	-		-		-	
11	Press Max	30 PSIG		30 PSIG		30 PSIG	
	Normal	15 PSIG		15 PSIG		15 PSIG	
12	Temp Max	90 °F		90 °F		90 °F	
	Normal	60 °F		60 °F		60 °F	
13							
14							
<b>BODY</b>							
15	Material	300 SERIES SST		300 SERIES SST		300 SERIES SST	
16	Size & Type Connections	DIRECTLY SUBMERGED		DIRECTLY SUBMERGED		DIRECTLY SUBMERGED	
17	Top Connection Location	ATMOSPHERE		ATMOSPHERE		ATMOSPHERE	
18	Bot Connection Location	SUBMERGED		SUBMERGED		SUBMERGED	
19	Case Mounting	INTERGAL		INTERGAL		INTERGAL	
20	Flange Orientation	(NOTE 3)		(NOTE 3)		(NOTE 3)	
21	Rotatable Head	N/A		N/A		N/A	
22							
<b>ELEMENT</b>							
		DIFFERENTIAL PRESSURE		DIFFERENTIAL PRESSURE		DIFFERENTIAL PRESSURE	
23	Diameter or Length, In.	>1.25" DIA.		>1.25" DIA.		>1.25" DIA.	
24	Extension, In.						
25	Material	316 SST		316 SST		316 SST	
26	Torque Tube Material	N/A		N/A		N/A	
27	Air Fin	N/A		N/A		N/A	
28							
<b>TRANSMITTER</b>							
29	Type	ELECTRONIC		ELECTRONIC		ELECTRONIC	
30	Output	4-20 mA DC		4-20 mA DC		4-20 mA DC	
31							
<b>CONTROL</b>							
		N/A		N/A		N/A	
32	Type						
33	Proportional %	Reset					
34	Output						
35	On Level Increase, Output						
36							
<b>ACCESSORIES</b>							
		N/A		N/A		N/A	
37	Filter & Regulator						
38	Gauge Glass Connections						
39	Gauge Glass						
40	Purge Connection						
41	Electric Switch						
42							
43							
Notes:							
1. *** - INFORMATION SUPPLIED BY MANUFACTURER.							
2. 1/2" NPT CONDUIT CONNECTION.							
3. SUBMERSIBLE LEVEL TRANSMITTER WITH BUILT-IN TEMPERATURE COMPENSATION							
PARSONS ERA PROJECT				LEVEL INSTRUMENTS		Sheet 13	Job Number ARP/PO-169
INSTRUMENT DATA SHEET						Document Number 13400-ATTACHMENT A	Rev 0
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REQUISITION NO.				VENDOR			
1	Tag No.		LT071		LT075		
2	Item No.						
3	Model No.						
4	Service		OPTIMIZATION WELL #RW6 LEVEL TRANSMITTER		OPTIMIZATION WELL #RW7 LEVEL TRANSMITTER		
5	Vessel or Equipment No.		OPTIMIZATION WELL #RW6		OPTIMIZATION WELL #RW7		
6	P&ID No.		95X-5900-N-00448		95X-5900-N-00448		
7	Type		PRESS. TRANSMITTER		PRESS. TRANSMITTER		
<b>SERVICE CONDITIONS</b>							
8	Upper Fluid		GROUNDWATER		GROUNDWATER		
9	Lower Fluid		-		-		
10	sp gr Upper	sp gr Lower	1	-	1	-	
11	Press Max	Normal	30 PSIG	15 PSIG	30 PSIG	15 PSIG	
12	Temp Max	Normal	60 °F	50 °F	60 °F	50 °F	
13							
14							
<b>BODY</b>							
15	Material		300 SERIES SST		300 SERIES SST		
16	Size & Type Connections		DIRECTLY SUBMERGED		DIRECTLY SUBMERGED		
17	Top Connection Location		ATMOSPHERE		ATMOSPHERE		
18	Bot Connection Location		SUBMERGED		SUBMERGED		
19	Case Mounting		INTERGAL		INTERGAL		
20	Flange Orientation		(NOTE 3)		(NOTE 3)		
21	Rotatable Head		N/A		N/A		
22							
<b>ELEMENT</b>							
			DIFFERENTIAL PRESSURE		DIFFERENTIAL PRESSURE		
23	Diameter or Length, In.		>1.25" DIA.		>1.25" DIA.		
24	Extension, In.		-		-		
25	Material		316 SST		316 SST		
26	Torque Tube Material		N/A		N/A		
27	Air Fin		N/A		N/A		
28							
<b>TRANSMITTER</b>							
29	Type		ELECTRONIC		ELECTRONIC		
30	Output		4-20 mA DC		4-20 mA DC		
31							
<b>CONTROL</b>							
			N/A		N/A		
32	Type						
33	Proportional %	Reset					
34	Output						
35	On Level Increase, Output						
36							
<b>ACCESSORIES</b>							
37	Filter & Regulator						
38	Gauge Glass Connections						
39	Gauge Glass						
40	Purge Connection						
41	Electric Switch						
42	Output Signal Connector		(NOTE 4)		(NOTE 4)		
43							
<p>Note 1. *** - INFORMATION SUPPLIED BY MANUFACTURER.</p> <p>2. 1/2" NPT CONDUIT CONNECTION.</p> <p>3. SUBMERSIBLE LEVEL TRANSMITTER WITH BUILT-IN TEMPERATURE COMPENSATION</p> <p>4. PANEL MOUNTED WITH SCREWED CAP AND COMPATIBLE WITH OWNER'S EXISTING IN-SITU INC. HERMIT DATA LOGGER CONNECTOR.</p>							
<b>PARSONS ERA PROJECT</b>				<b>LEVEL INSTRUMENTS</b>		Sheet 14	Job Number ARP/PO-169
INSTRUMENT DATA SHEET WBS 1.1.1.1.1.2.1						Document Number 13400-ATTACHMENT A	Rev 0

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REQUISITION NO.		VENDOR			
1	Tag No.	LCV050/ZSL050	FCV060/ZSL060	FCV062/ZSL062	
2	Item No.				
3	Model No.				
4	Service	INJ WTR SUPPLY TANK	INJECTION WELL 8	INJECTION WELL 9	
		LEVEL CONTROL	FLOW CONTROL	FLOW CONTROL	
5	Line No.	GW-10"-A-2946-ET	GW-4"-A-2950-ET	GW-4"-A-2954-ET	
6	P&ID No.	95X-5900-N-00449	95X-5900-N-00449	95X-5900-N-00449	

SERVICE CONDITIONS								
7	Fluid	Units	WATER	GPM	WATER	GPM	WATER	GPM
8	Min Flow	Max Flow	100 GPM	2000 GPM	100 GPM	200 GPM	100 GPM	200 GPM
9	Normal Flow	Sizing Flow	1800 GPM	1800 GPM	200 GPM	200 GPM	200 GPM	200 GPM
10	Inlet Press Max	Norm	162 PSI	20 PSI	110 PSI	18 PSI	110 PSI	32 PSI
11	dP Max	dP - Valve Sizing	162 PSI	5 PSI	110 PSI	5 PSI	110 PSI	5 PSI
12	Temp Max	'F Norm 'F	80	50	80	50	80	50
13	sp gr @ 60 °F	@ Opr Temp	1	1	1	1	1	1
14	Viscosity @ Opr Temp	cp	-	-	-	-	-	-

BODY								
15	Body Size	Port Size	10"	N/A	4"	4"	4"	4"
16	Type of Body		BUTTERFLY VALVE		SEGMNT. BALL (NOTE 5)		SEGMNT. BALL (NOTE 5)	
17	Material		CARBON STEEL		CARBON STEEL		CARBON STEEL	
18	End Connections		150# RF FLANGE		150# RF FLANGE		150# RF FLANGE	
19	Bonnet		N/A		N/A		N/A	
20	Lubricator	Isolating Valve	NO	NO	NO	NO	NO	NO
21	Packing or Seal		BUNA-N OR NITRILE		BUNA-N OR NITRILE		BUNA-N OR NITRILE	
22	Position Indicator		YES		YES		YES	
23	Guiding		N/A		N/A		N/A	
24	No. of Ports		1		1		1	
25	Valve Characteristic		LINEAR		EQUAL PERCENTAGE		EQUAL PERCENTAGE	
26	Cage		NO		NO		NO	
27	Plug (Disc)		304 SST		304 SST		304 SST	
28	Seat		TFE		TFE		TFE	
29								
30	Cv for Sizing Flow	Furn Cv	700		72		72	

NOISE DATA			
31	Line Size	Port Schedule	
32	Insulation		
33	Sound Pressure Level	dBA	85 (MAX)

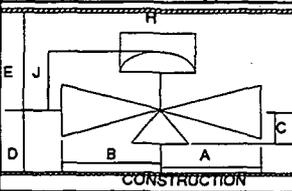
ACTUATOR AND ACCESSORIES								
34	Actuator Type		MOTORIZED (NOTE 4)		MOTORIZED (NOTE 4)		MOTORIZED (NOTE 4)	
35	Fail Position		FAIL SAFE		FAIL SAFE		FAIL SAFE	
36	Close @	Open @	4 mAdc	20 mAdc	4 mAdc	20 mAdc	4 mAdc	20 mAdc
37	dP For Actuator Sizing		162 PSI		110 PSI		110 PSI	
38	Positioner Required	w/ Filter Rgltr	NO	NO	NO	NO	NO	NO
39	Bypass	Gauges	NO	NO	NO	NO	NO	NO
40	For Input Signal of							
41	Output Shall Be							
42	Handwheel Type		MFR. STD.		MFR. STD.		MFR. STD.	

	A. Face to Face			
	B. Face to Center			
	C. Face to Center			
	D. Clearance			
	E. Clearance			
	H. Actuator Dia.			
	J. Actuator Height			

Notes:

- \*\*\* INFORMATION SUPPLIED BY MANUFACTURER.
- 3 WIRE - 115 VAC 60 Hz, COMMON, DRIVE CLOSED AND DRIVE OPEN, WITH BUILT IN THERMAL PROTECTION.
- MINIMUM TEMPERATURE OF -10 °F PROVIDE HEATER IF REQUIRED, 100 WATT MAX, 120V 60Hz.
- 3/4" NPT CONDUIT CONNECTION (TYP).
- BUTTERFLY VALVE BODY MAY BE SUBSTITUTED FOR A SEGMENTED BALL VALVE BODY.

PARSONS ERA PROJECT	CONTROL VALVES	Sheet 15	Job Number ARP/PO169
Instrument Data Sheet WBS 1.1.1.1.1.2.1		Document Number 13400-ATTACHMENT A	Rev 0

REQUISITION NO.		VENDOR						
1	Tag No.	FCV064/ZSL064		FCV066/ZSL066		FCV068/ZSL068		
2	Item No.							
3	Model No.							
4	Service	INJECTION WELL 10		INJECTION WELL 11		INJECTION WELL 12		
		FLOW CONTROL		FLOW CONTROL		FLOW CONTROL		
5	Line No.	GW-4"-A-2953-ET		GW-4"-A-2952-ET		GW-4"-A-2951-ET		
6	P&ID No.	95X-5900-N-00449		95X-5900-N-00449		95X-5900-N-00449		
<b>SERVICE CONDITIONS</b>								
7	Fluid	Units	WATER	GPM	WATER	GPM	WATER	GPM
8	Min Flow	Max Flow	100 GPM	200 GPM	100 GPM	200 GPM	100 GPM	200 GPM
9	Normal Flow	Sizing Flow	200 GPM	200 GPM	200 GPM	200 GPM	200 GPM	200 GPM
10	Inlet Press Max	Norm	110 PSI	34 PSI	110 PSI	34 PSI	110 PSI	34 PSI
11	dP Max	dP - Valve Sizing	110 PSI	5 PSI	110 PSI	5 PSI	110 PSI	5 PSI
12	Temp Max	*F	80	50	80	50	80	50
13	sp gr @ 60 °F	@ Opr Temp	1	1	1	1	1	1
14	Viscosity @ Opr Temp	cp	-	-	-	-	-	-
<b>BODY</b>								
15	Body Size	Port Size	4"	4"	4"	4"	4"	4"
16	Type of Body		SEGMNT. BALL (NOTE 5)		SEGMNT. BALL (NOTE 5)		SEGMNT. BALL (NOTE 5)	
17	Material		CARBON STEEL		CARBON STEEL		CARBON STEEL	
18	End Connections		150# RF FLANGE		150# RF FLANGE		150# RF FLANGE	
19	Bonnet		N/A		N/A		N/A	
20	Lubricator	Isolating Valve	NO	NO	NO	NO	NO	NO
21	Packing or Seal		BUNA-N OR NITRILE		BUNA-N OR NITRILE		BUNA-N OR NITRILE	
22	Position Indicator		YES		YES		YES	
23	Guiding		N/A		N/A		N/A	
24	No. of Ports		1		1		1	
25	Valve Characteristic		EQUAL PERCENTAGE		EQUAL PERCENTAGE		EQUAL PERCENTAGE	
26	Cage		NO		NO		NO	
27	Plug (Disc)		304 SST		304 SST		304 SST	
28	Seat		TFE		TFE		TFE	
29								
30	Cv for Sizing Flow	Fum Cv	72	*	72	*	72	*
<b>NOISE DATA</b>								
31	Line Size	Port Schedule						
32	Insulation							
33	Sound Pressure Level	dBA	85 (MAX)		85 (MAX)		85 (MAX)	
<b>ACTUATOR AND ACCESSORIES</b>								
34	Actuator Type		MOTORIZED (NOTE 4)		MOTORIZED (NOTE 4)		MOTORIZED (NOTE 4)	
35	Fail Position		FAIL SAFE		FAIL SAFE		FAIL SAFE	
36	Close @	Open @	4 mAdc	20 mAdc	4 mAdc	20 mAdc	4 mAdc	20 mAdc
37	dP For Actuator Sizing		110 PSI		110 PSI		110 PSI	
38	Positioner Required	w/ Filter Rgtr	NO	NO	NO	NO	NO	NO
39	Bypass	Gauges	NO	NO	NO	NO	NO	NO
40	For Input Signal of							
41	Output Shall Be							
42	Handwheel Type		MFR. STD.		MFR. STD.		MFR. STD.	
		A. Face to Face	*		*		*	
		B. Face to Center	*		*		*	
		C. Face to Center	*		*		*	
		D. Clearance	*		*		*	
		E. Clearance	*		*		*	
		H. Actuator Dia.	*		*		*	
		J. Actuator Height	*		*		*	
								
<b>Notes:</b> 1. *** INFORMATION SUPPLIED BY MANUFACTURER. 2. 3 WIRE - 115 VAC 60 Hz, COMMON, DRIVE CLOSED AND DRIVE OPEN, WITH BUILT IN THERMAL PROTECTION. 3. MINIMUM TEMPERATURE OF -10 °F PROVIDE HEATER IF REQUIRED, 100 WATT MAX, 120V 60Hz. 4. 3/4" NPT CONDUIT CONNECTION (TYP). 5. BUTTERFLY VALVE BODY MAY BE SUBSTITUTED FOR A SEGMENTED BALL VALVE BODY.								
<b>PARSONS ERA PROJECT</b>  Instrument Data Sheet WBS 1.1.1.1.1.2.1				<b>CONTROL VALVES</b>		Sheet 16		Job Number ARP/PO169
						Document Number 13400-ATTACHMENT A		Rev 0

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ENG 033

07-Jun-97

000185

REQUISITION NO.		VENDOR		
1	Tag No.	FCV072/ZSL072	FCV076/ZSL076	FCV211/ZSL211
2	Item No.			
3	Model No.			
4	Service	OPTIMIZATION WELL RW6 FLOW CONTROL	OPTIMIZATION WELL RW7 FLOW CONTROL	RECOVERY WELL 3924 FLOW CONTROL
5	Line No.	GW-6"-A-2930-IC	GW-4"-A-2931-IC	GW1-8"-01
6	P&ID No.	95X-5900-N-00448	95X-5900-N-00448	95X-5900-N-00448

SERVICE CONDITIONS								
7	Fluid	Units	WATER	GPM	WATER	GPM	WATER	GPM
8	Min Flow	Max Flow	100 GPM	400 GPM	100 GPM	400 GPM	200 GPM	650 GPM
9	Normal Flow	Sizing Flow	350 GPM	250 GPM	250 GPM	250 GPM	400 GPM	650 GPM
10	Inlet Press Max	Norm	146 PSI	86 PSI	146 PSI	80 PSI	150 PSI	90 PSI
11	dP Max	dP - Valve Sizing	146 PSI	5 PSI	146 PSI	5 PSI	150 PSI	5 PSI
12	Temp Max	*F Norm *F	80	50	80	50	80	50
13	sp gr @ 60 *F	@ Opr Temp	1	1	1	1	1	1
14	Viscosity @ Opr Temp	cp						

BODY								
15	Body Size	Port Size	6"	6"	6"	6"	8"	8"
16	Type of Body		SEGMNT. BALL (NOTE 5)		SEGMNT. BALL (NOTE 5)		BUTTERFLY VALVE	
17	Material		CARBON STEEL		CARBON STEEL		CARBON STEEL	
18	End Connections		150# RF FLANGE		150# RF FLANGE		150# RF FLANGE	
19	Bonnet		N/A		N/A		N/A	
20	Lubricator	Isolating Valve	NO	NO	NO	NO	NO	NO
21	Packing or Seal		BUNA-N OR NITRILE		BUNA-N OR NITRILE		BUNA-N OR NITRILE	
22	Position Indicator		YES		YES		YES	
23	Guiding		N/A		N/A		N/A	
24	No. of Ports		1		1		1	
25	Valve Characteristic		EQUAL PERCENTAGE		EQUAL PERCENTAGE		EQUAL PERCENTAGE	
26	Cage		NO		NO		NO	
27	Plug (Disc)		304 SST		304 SST		304 SST	
28	Seat		TFE		TFE		TFE	
29								
30	Cv for Sizing Flow	Furn Cv	165	*	120	*	300	*

NOISE DATA			
31	Line Size	Port Schedule	
32	Insulation		
33	Sound Pressure Level	dBa	85 (MAX)

ACTUATOR AND ACCESSORIES			
34	Actuator Type		MOTORIZED (NOTE 4)
35	Fail Position		FAIL SAFE
36	Close @	Open @	4 mAdc 20 mAdc
37	dP For Actuator Sizing		146 PSI
38	Positioner Required	w/ Filter Rgltr	NO NO
39	Bypass	Gauges	NO NO
40	For Input Signal of		
41	Output Shall Be		
42	Handwheel Type		MFR. STD.

	A. Face to Face	*	*	*
	B. Face to Center	*	*	*
	C. Face to Center	*	*	*
	D. Clearance	*	*	*
	E. Clearance	*	*	*
	H. Actuator Dia.	*	*	*
	J. Actuator Height	*	*	*

Notes:

- \*\*\* INFORMATION SUPPLIED BY MANUFACTURER.
- 3 WIRE - 115 VAC 60 Hz, COMMON, DRIVE CLOSED AND DRIVE OPEN, WITH BUILT IN THERMAL PROTECTION.
- MINIMUM TEMPERATURE OF -10 \*F PROVIDE HEATER IF REQUIRED, 100 WATT MAX, 120V 60Hz.
- 3/4" NPT CONDUIT CONNECTION (TYP).
- BUTTERFLY VALVE BODY MAY BE SUBSTITUTED FOR A SEGMENTED BALL VALVE BODY.

PARSONS ERA PROJECT  Instrument Data Sheet WBS 1.1.1.1.1.2.1	CONTROL VALVES	Sheet 17	Job Number ARP/PO169
		Document Number 13400-ATTACHMENT A	Rev 0

REQUISITION NO.		VENDOR					
1	Tag No.	FCV212/ZSL212		FCV213/ZSL213		FCV214/ZSL214	
2	Item No.						
3	Model No.						
4	Service	RECOVERY WELL 3925		RECOVERY WELL 3926		RECOVERY WELL 3927	
		FLOW CONTROL		FLOW CONTROL		FLOW CONTROL	
5	Line No.	GW1-8"-01		GW1-8"-01		GW1-8"-01	
6	P&ID No.	95X-5900-N-00448		95X-5900-N-00448		95X-5900-N-00448	

SERVICE CONDITIONS								
7	Fluid	Units	WATER	GPM	WATER	GPM	WATER	GPM
8	Min Flow	Max Flow	200 GPM	650 GPM	200 GPM	650 GPM	200 GPM	650 GPM
9	Normal Flow	Sizing Flow	400 GPM	650 GPM	400 GPM	650 GPM	400 GPM	650 GPM
10	Inlet Press Max	Norm	150 PSI	90 PSI	150 PSI	90 PSI	150 PSI	90 PSI
11	dP Max	dP - Valve Sizing	150 PSI	5 PSI	150 PSI	5 PSI	150 PSI	5 PSI
12	Temp Max	°F	Norm	°F	80	50	80	50
13	sp gr @ 60 °F	@ Opr Temp	1	1	1	1	1	1
14	Viscosity @ Opr Temp	cp	-	-	-	-	-	-

BODY									
15	Body Size	Port Size	8"	8"	8"	8"	8"	8"	
16	Type of Body	BUTTERFLY VALVE		BUTTERFLY VALVE		BUTTERFLY VALVE		BUTTERFLY VALVE	
17	Material	CARBON STEEL		CARBON STEEL		CARBON STEEL		CARBON STEEL	
18	End Connections	150# RF FLANGE		150# RF FLANGE		150# RF FLANGE		150# RF FLANGE	
19	Bonnet	N/A		N/A		N/A		N/A	
20	Lubricator	Isolating Valve	NO	NO	NO	NO	NO	NO	
21	Packing or Seal	BUNA-N OR NITRILE		BUNA-N OR NITRILE		BUNA-N OR NITRILE		BUNA-N OR NITRILE	
22	Position Indicator	YES		YES		YES		YES	
23	Guiding	N/A		N/A		N/A		N/A	
24	No. of Ports	1		1		1		1	
25	Valve Characteristic	EQUAL PERCENTAGE		EQUAL PERCENTAGE		EQUAL PERCENTAGE		EQUAL PERCENTAGE	
26	Cage	NO		NO		NO		NO	
27	Plug (Disc)	304 SST		304 SST		304 SST		304 SST	
28	Seat	TFE		TFE		TFE		TFE	
29									
30	Cv for Sizing Flow	Fum Cv.	300	*	300	*	300	*	

NOISE DATA								
31	Line Size	Port Schedule						
32	Insulation							
33	Sound Pressure Level	dBa	85 (MAX)		85 (MAX)		85 (MAX)	

ACTUATOR AND ACCESSORIES									
34	Actuator Type	MOTORIZED (NOTE 4)		MOTORIZED (NOTE 4)		MOTORIZED (NOTE 4)		MOTORIZED (NOTE 4)	
35	Fail Position	FAIL SAFE		FAIL SAFE		FAIL SAFE		FAIL SAFE	
36	Close @	Open @	4 mAdc	20 mAdc	4 mAdc	20 mAdc	4 mAdc	20 mAdc	
37	dP For Actuator Sizing	150 PSI		150 PSI		150 PSI		150 PSI	
38	Positioner Required	w/ Filter Rgltr	NO	NO	NO	NO	NO	NO	
39	Bypass	Gauges	NO	NO	NO	NO	NO	NO	
40	For Input Signal of								
41	Output Shall Be								
42	Handwheel Type	MFR. STD.		MFR. STD.		MFR. STD.		MFR. STD.	

	A. Face to Face	*	*	*
	B. Face to Center	*	*	*
	C. Face to Center	*	*	*
	D. Clearance	*	*	*
	E. Clearance	*	*	*
	H. Actuator Dia.	*	*	*
	J. Actuator Height	*	*	*

Notes:

- \*\*\* INFORMATION SUPPLIED BY MANUFACTURER.
- 3 WIRE - 115 VAC 60 Hz, COMMON, DRIVE CLOSED AND DRIVE OPEN, WITH BUILT IN THERMAL PROTECTION.
- MINIMUM TEMPERATURE OF -10 °F PROVIDE HEATER IF REQUIRED, 100 WATT MAX, 120V 60Hz.
- 3/4" NPT CONDUIT CONNECTION (TYP).

<b>PARSONS ERA PROJECT</b>  Instrument Data Sheet WBS 1.1.1.1.2.1	<b>CONTROL VALVES</b>	Sheet 18	Job Number ARP/PO169
		Document Number 13400-ATTACHMENT A	Rev 0

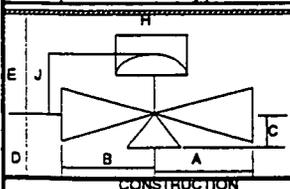
REQUISITION NO.		VENDOR	
1	Tag No.	FCV055/ZSL055	
2	Item No.		
3	Model No.		
4	Service	INJECTION WATER RECIRC. FLOW CONTROL	
5	Line No.	GW-6"-A-2955-ET	
6	P&ID No.	95X-5900-N-00449	

SERVICE CONDITIONS				
7	Fluid	Units	WATER	GPM
8	Min Flow	Max Flow	200 GPM	800 GPM
9	Normal Flow	Sizing Flow	400 GPM	600 GPM
10	Inlet Press Max	Norm	150 PSI	90 PSI
11	dP Max	dP - Valve Sizing	150 PSI	5 PSI
12	Temp Max °F	Norm °F	80	50
13	sp gr @ 60 °F	@ Opr Temp	1	1
14	Viscosity @ Opr Temp	cp		

BODY				
15	Body Size	Port Size	6"	6"
16	Type of Body	BUTTERFLY VALVE		
17	Material	CARBON STEEL		
18	End Connections	150# RF FLANGE		
19	Bonnet	N/A		
20	Lubricator	Isolating Valve	NO	NO
21	Packing or Seal	BUNA-N OR NITRILE		
22	Position Indicator	YES		
23	Guiding	N/A		
24	No. of Ports	1		
25	Valve Characteristic	EQUAL PERCENTAGE		
26	Cage	NO		
27	Plug (Disc)	304 SST		
28	Seat	TFE		
29				
30	Cv for Sizing Flow	Furn Cv	300	

NOISE DATA				
31	Line Size	Port Schedule		
32	Insulation			
33	Sound Pressure Level	dB(A)	85 (MAX)	

ACTUATOR AND ACCESSORIES				
34	Actuator Type	MOTORIZED (NOTE 4)		
35	Fail Position	FAIL SAFE		
36	Close @	Open @	4 mAdc	20 mAdc
37	dP For Actuator Sizing	150 PSI		
38	Positioner Required	w/ Filter Rgltr	NO	NO
39	Bypass	Gauges	NO	NO
40	For Input Signal of			
41	Output Shall Be			
42	Handwheel Type	MFR. STD.		



A. Face to Face	
B. Face to Center	
C. Face to Center	
D. Clearance	
E. Clearance	
H. Actuator Dia.	
J. Actuator Height	

Notes:

- \*\*\* INFORMATION SUPPLIED BY MANUFACTURER.
- 3 WIRE - 115 VAC 60 Hz, COMMON, DRIVE CLOSED AND DRIVE OPEN, WITH BUILT IN THERMAL PROTECTION.
- MINIMUM TEMPERATURE OF -10 °F PROVIDE HEATER IF REQUIRED, 100 WATT MAX, 120V 60Hz.
- 3/4" NPT CONDUIT CONNECTION (TYP).

PARSONS ERA PROJECT  Instrument Data Sheet WBS 1.1.1.1.1.2.1	CONTROL VALVES	Sheet 19	Job Number ARP/PO169
		Document Number 13400-ATTACHMENT A	Rev 0

<b>REQUISITION NO.</b>		<b>VENDOR</b> FISCHER/PORTER	
Reference Specification Sheet No.		Model No. SEE DWG 95X-5900-N-00442	
<b>GENERAL</b>		<b>AUTO-MANUAL SWITCHING</b> N/A	
1	Description: Recorder <input type="checkbox"/> Indicator <input checked="" type="checkbox"/> Controller <input checked="" type="checkbox"/> Manual Control Station <input type="checkbox"/> Trend Recorder <input type="checkbox"/> <input checked="" type="checkbox"/> Computer Control Station Other <u>DISTRIBUTED CONTROLLER FOR F/P SYSTEM 6 DCS</u>	21	No. of Positions _____ Type _____
2	Case <input checked="" type="checkbox"/> Rectangular _____ Miniature _____ NEMA 4X _____	22	Automatic _____ Manual _____ Computer _____ Ratio _____ Other _____
3	Color Case _____ Dial _____	<b>RECEIVER ELEMENT</b>	
4	Mounting _____ Flush _____ <input checked="" type="checkbox"/> Surface _____ Yoke _____	23	Spiral _____ Bellows _____ Bourdon _____ Diaphragm _____ <input checked="" type="checkbox"/> Electric _____
5	No. Points: Recording: _____ 4 _____ Indicating _____	24	Material: _____ Bronze _____ Other: _____
6	Chart Type <u>N/A</u> Inches _____ Strip _____ 12-inch Circ. _____	25	Range: _____ 3-15 psi _____ <input checked="" type="checkbox"/> 4-20 mADC _____ Other: _____
7	Scale Type _____ Fixed _____ Deviation _____ Length _____	26	Connection _____ 1/4 in. NPT _____ <input checked="" type="checkbox"/> Other: <u>ELECTRIC TERM.</u> Back _____ Bottom _____ Other: _____
8	Other _____	<b>ACCESSORIES</b>	
9	Chart Drive _____ Spring _____ Electric _____ Pneumatic _____	27	Filter and Regulator: _____
10	Chart Speed <u>N/A</u> _____ Wind _____	28	Air Supply Gauge: _____
11	Volts / Hz: <u>120 VAC, 60 HZ</u> _____ Air Press. _____ Explosion Proof _____	29	Mounting Yoke: _____
12	Other: _____	30	Restriction Dampener: _____
<b>TREND RECORDER</b> N/A		31	Manifolds: _____
12	No. of Pens _____ No. of Inputs _____	32	Charts: _____
13	Type _____ Patch Panel _____ Pushbutton _____ Pneumatic _____	33	Ink Set: _____
14	Other: _____	34	Alarm: _____
<b>CONTROLLER</b>		35	Number: _____ Actuation: _____ Internal _____ External _____ Electrical Requirements: _____ Other: _____
15	Type: _____ Pneumatic _____ <input checked="" type="checkbox"/> Electric _____	36	Computer Access interface _____ Other: _____
16	Mode: <input checked="" type="checkbox"/> Prop. (Controller) <input checked="" type="checkbox"/> Reset (Controller) <input checked="" type="checkbox"/> Rate (Controller) <input checked="" type="checkbox"/> On-Off (Switch) Other _____	<b>SINGLE LOOP CONTROLLER WITH:</b>	
17	Output _____ 3-15 psi _____ <input checked="" type="checkbox"/> 4-20 mA _____	4 - AI _____	
18	Location: <input checked="" type="checkbox"/> Integral _____ External _____	2 - AO _____	
19	Set Point _____ Manual _____ Computer _____ Cascade Switch _____ Ratio: <input checked="" type="checkbox"/> Uniform _____ Square Root _____ Setting Range: _____ Other _____	8 - DI _____	
20	Control Point Span: _____ <input checked="" type="checkbox"/> Fixed _____ Adjustable _____ Other _____	2 - DO W/DUAL RELAY BOARD _____	
		CORD SET _____	
		24VDC POWER REQUIREMENT _____	

**Notes:**

- 1.) --- - INFORMATION SUPPLIED BY MANUFACTURER
- 2.) CONTROLLER SHALL BE CAPABLE TO RECEIVING ANALOG INPUTS FROM 2 WIRE OR 4 WIRE TRANSMITTERS AND HAVE ONE ANALOG OUTPUT.
- 3.) THIS DATA SHEET REFERS TO INSTRUMENT FIC060, FIC062, FIC064, FIC066, AND FIC068.
- 4.) CONTROLLER OPERATES IN ONE OF TWO MODES; STAND-ALONE (MASTER) OR DISTRIBUTED CONTROLLER (SLAVE).

TAG NO.: PCS8  
P&ID/SECTION NO.: 95X-5900-N-000449  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME INJECTION WELL #8 WATER FLOW CONTROL

TAG NO.: PCS9  
P&ID/SECTION NO.: 95X-5900-N-000449  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME INJECTION WELL #9 WATER FLOW CONTROL

TAG NO.: PCS10  
P&ID/SECTION NO.: 95X-5900-N-000449  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME INJECTION WELL #10 WATER FLOW CONTROL

TAG NO.: PCS11  
P&ID/SECTION NO.: 95X-5900-N-000449  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME INJECTION WELL #11 WATER FLOW CONTROL

TAG NO.: PCS12  
P&ID/SECTION NO.: 95X-5900-N-000449  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME INJECTION WELL #12 WATER FLOW CONTROL

<b>PARSONS ERA PROJECT</b>	<b>RECEIVER INSTRUMENTS</b>	Sheet	Job No.
		20	ARP/PO169
SPECIFICATION		Document Number	Rev
WBS 1.1.1.1.2.1		13400-ATTACHMENT A	0

REQUISITION NO.		VENDOR FISCHER/PORTER	
Reference Specification Sheet No.		Model No. SEE DWG 95X-5900-N-00438	
<b>GENERAL</b>		<b>AUTO-MANUAL SWITCHING</b> N/A	
1 Description: Recorder <input checked="" type="checkbox"/> Indicator <input checked="" type="checkbox"/> Controller	21 No. of Positions _____ Type _____	22 _____ Automatic _____ Manual _____ Computer _____ Ratio _____ Other _____	
_____ Manual Control Station _____ Trend Recorder	<b>RECEIVER ELEMENT</b>		
<input checked="" type="checkbox"/> Computer Control Station	23 _____ Spiral _____ Bellows _____ Bourdon _____ Diaphragm <input checked="" type="checkbox"/> Electric		
Other DISTRIBUTED CONTROLLER FOR F/P SYSTEM 6 DCS	24 Material: _____ Bronze _____ Other : _____		
2 Case <input checked="" type="checkbox"/> Rectangular _____ Miniature _____ NEMA 4X	25 Range : _____ 3-15 psi _____ <input checked="" type="checkbox"/> 4-20 mA DC _____ Other : _____		
3 Color Case _____ Black <input checked="" type="checkbox"/> Standard _____	26 Connection _____ 1/4 in. NPT <input checked="" type="checkbox"/> Other : ELECTRIC TERM. _____ Back _____ Bottom _____ Other : _____		
Dial _____	<b>ACCESSORIES</b> N/A		
4 Mounting _____ Flush _____ <input checked="" type="checkbox"/> Surface _____ Yoke	27 Filter and Regulator : _____		
5 No. Points: _____ Recording : _____ 4 _____ Indicating _____	28 Air Supply Gauge : _____		
6 Chart Type N/A _____ Inches _____ Strip _____ 12-inch Circ.	29 Mounting Yoke : _____		
7 Scale Type _____ Fixed _____ Deviation _____ Length	30 Restriction Dampener : _____		
8 _____ Other _____	31 Manifolds : _____		
9 Chart Drive _____ Spring _____ Electric _____ Pneumatic	32 Charts : _____		
10 Chart Speed _____ N/A _____ Wind _____	33 Ink Set : _____		
11 Volts / Hz : 120 VAC , 60 HZ _____ Air Press. _____ Explosion Proof	34 Alarm : _____ Number : _____ Actuation: _____ Internal _____ External		
12 Other : _____	35 Electrical Requirements : _____		
<b>TREND RECORDER</b> N/A	36 Other: _____ Computer Access Interface _____		
12 No. of Pens _____ No. of Inputs _____	Other: _____ SINGLE LOOP CONTROLLER WITH: 4 - AI 2 - AO 8 - DI 2 - DO W/DUAL RELAY BOARD CORD SET 24VDC POWER REQUIREMENT		
13 Type _____ Patch Panel _____ Pushbutton _____ Pneumatic			
14 Other : _____			
<b>CONTROLLER</b>			
15 Type : _____ Pneumatic _____ <input checked="" type="checkbox"/> Electric			
Other _____			
16 Mode : _____ <input checked="" type="checkbox"/> Prop. (Controller) _____ <input checked="" type="checkbox"/> Reset (Controller)			
_____ <input checked="" type="checkbox"/> Rate (Controller) _____ <input checked="" type="checkbox"/> On-Off (Switch)			
Other _____			
17 Output _____ 3-15 psi _____ <input checked="" type="checkbox"/> 4-20 mA _____			
18 Location: _____ <input checked="" type="checkbox"/> Integral _____ External			
Other See Note 2			
19 Set Point _____ <input checked="" type="checkbox"/> Manual _____ Computer _____ Cascade Switch			
Ratio: _____ <input checked="" type="checkbox"/> Uniform _____ Square Root			
Setting Range : _____			
Other _____			
20 Control Point Span : _____ <input checked="" type="checkbox"/> Fixed _____ Adjustable			
Other _____			

Notes:

- 1.) \*\*\* - INFORMATION SUPPLIED BY MANUFACTURER
- 2.) CONTROLLER SHALL BE CAPABLE TO RECEIVING ANALOG INPUTS FROM 2 WIRE OR 4 WIRE TRANSMITTERS AND HAVE ONE ANALOG OUTPUT.
- 3.) THIS DATA SHEET REFERS TO INSTRUMENT FIC072, FIC076, FIC211, FIC212, FIC213, AND FIC214.
- 4.) CONTROLLER OPERATES IN ONE OF TWO MODES; STAND-ALONE (MASTER) OR DISTRIBUTED CONTROLLER (SLAVE).

TAG NO.: PCS6  
P&ID\SECTION NO.: 95X-5900-N-000448  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME OPTIMIZATION WELL RW6

TAG NO.: PCS3927  
P&ID\SECTION NO.: 95X-5900-N-000448  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME RECOVERY WELL 3926

TAG NO.: PCS7  
P&ID\SECTION NO.: 95X-5900-N-000448  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME OPTIMIZATION WELL RW7

TAG NO.: PCS3924  
P&ID\SECTION NO.: 95X-5900-N-000448  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME RECOVERY WELL 3924

TAG NO.: PCS3925  
P&ID\SECTION NO.: 95X-5900-N-000448  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME RECOVERY WELL 3925

TAG NO.: PCS3926  
P&ID\SECTION NO.: 95X-5900-N-000448  
SCALE RANGE: 0 - 100%  
SERVICE: S. PLUME RECOVERY WELL 3926

PARSONS ERA PROJECT	RECEIVER INSTRUMENTS	Sheet	Job No.
		21	ARP/PO169
SPECIFICATION		Document Number	Rev
WBS 1.1.1.1.1.2.1		13400-ATTACHMENT A	0

REQUISITION NO.				VENDOR			
1	Tag No.			LSLL050		LSHH050	
2	Item No.						
3	Model No.						
4	Service	INJ. WATER SUPPLY TK		INJ. WATER SUPPLY TK			
		LO-LO LEVEL		HI-HI LEVEL			
5	P&ID No.	95X-5900-N-00449		95X-5900-N-00449			
<b>SERVICE CONDITIONS</b>							
8	Upper Fluid	WATER		WATER			
	Lower Fluid						
9	Sp GR @ Opr Temp:	Upper	Lower	1.0	-	1.0	-
10	Pressure (psig)	Max	Normal	ATM	ATM	ATM	ATM
11	Temperature °F	Max	Normal	90 °F	80 °F	90 °F	80 °F
11							
<b>BODY</b>							
12	Type	RF (SIDE MNT)		DISPLACER (NOTE 2)			
13	Material: Flange	CARBON STEEL		CARBON STEEL			
14	Material: Float	Linkage		NOTE 2		316 SST	316 SST
15	Connection Size and Rating			NOTE 3		2" 150# RF FLANGE	
16	Drain Connections Size and Rating						
17	Reference Figure No.						
18	Dimension A						
19	Dimension B						
20	Dimension C	D					
21	Dimension E					1 FT. (MAX)	
22	Stress Relieving Required			NO		NO	
23	Charpy Test Required			NO		NO	
24	Input Power			120 VAC, 1 phase, 60 Hz.		N/A	
25							
<b>SWITCH</b>							
26	Type	DRY CONTACT		DRY CONTACT			
27	Enclosure	NEMA 4		NEMA 4			
28	Conduit Connection and Size	3/4" NPT		3/4" NPT			
29	Switch:	Quantity	Form	1	DPDT	2	DPDT
30	Rating:	Volts	Hertz or DC	120	60 HZ	120	60 HZ
31	Rating:	Amps @ 120 VAC	Watts	5	-	5	-
32	Differential	Fixed	Adjustable	YES	NO	NO	YES
38	Adjustment	Internal	External				
39	Contacts	Open or Close	On Level	Increase or Decrease	OPEN LEVEL DECREASE	OPEN LEVEL INCREASE	
35	Load:	Inductive	Noninductive	NONINDUCTIVE		NONINDUCTIVE	
40	Actuates			DACS INPUT		DACS INPUT	
41							
Notes:							
1. *** - INFORMATION SUPPLIED BY MANUFACTURER.							
2. WETTED METAL PARTS SHALL BE 304 OR 316 SST. OTHER PARTS SHALL BE VITON, TFE, OR RYTON.							
3. WILL BE INSTALLED ON THE END OF A HORIZONTAL 2" SCH 40 PIPE. FIELD FABRICATE THREADED ADAPTER CONSISTING OF 2" BLIND FLANGE FOR 3/4" NPT INSTRUMENT CONNECTION.							
PARSONS ERA PROJECT				LEVEL SWITCHES		Sheet	Job Number
INSTRUMENT DATA SHEET						22	ARP/PO169
WBS 1.1.1.1.2.1						Document Number	Rev
						13400-ATTACHMENT A	0

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**ATTACHMENT B**

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**INSTRUMENT INDEX**

# INSTRUMENT INDEX

LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
LCV050	INJECTION WATER SUPPLY TANK LEVEL GW-10"-A-2946-ET	VALVE	N-00449	N-00439	N-00445
LIT050	INJECTION WATER SUPPLY TANK LEVEL TNK-2	PRESS XMITR	N-00449	N-00439	N-00445
LSHH050	INJECTION WATER SUPPLY TANK LEVEL TNK-2	DISPLACER SW	N-00449	N-00439	N-00445
LSLL050	INJECTION WATER SUPPLY TANK LEVEL TNK-2	RF SWITCH	N-00449	N-00439	N-00445
ZSL050	LCV050 CLOSED LCV050	POS SW	N-00449	N-00439	N-00445
HS051	INJECTION WELL PUMP 1A L-O-R PMP-1A	SEL SW	N-00449	N-00439	N-00445
XS051	INJECTION WATER SUPPLY PUMP PMP-1A RUN PMP-1A	DCS OUTPUT	N-00449	N-00439	N-00445
ZS051	INJECTION WELL PUMP 1A RUNNING PMP-1A	AUX CONTACT	N-00449	N-00439	N-00445
PIS052	INJECTION WELL PUMP 1A DISCHARGE PRESS GW-10"-A-2949-ET	PRESS GAGE	N-00449		
PIS(H)052	INJ. WATER SUPPLY PUMP PMP-1 DISCHARGE HIGH GW-8"-A-2950-ET	PRESS SWITCH	N-00449	N-00439	N-00445

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LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
PIS(L)052	INJ. WATER SUPPLY PUMP PMP-1 DISCHARGE LOW GW-8"-A-2950-ET	PRESS SWITCH	N-00449	N-00439	N-00445
HS053	INJECTION WELL PUMP 1B HOA PMP-1B	SEL SW	N-00449	N-00439	N-00445
XS053	INJECTION WATER SUPPLY PUMP PMP-1B RUN PMP-1B	DCS OUTPUT	N-00449	N-00439	N-00445
ZS053	INJECTION WELL PUMP 1B RUNNING PMP-1B	AUX CONTACT	N-00449	N-00439	N-00445
PIS054	INJECTION WELL PUMP 1B DISCHARGE GW-8"-A-2948-ET	PRESS GAGE	N-00449		
PIS(H)054	INJ. WATER SUPPLY PUMP PMP-2 DISCHARGE HIGH GW-8"-A-2948-ET	PRESS SWITCH	N-00449	N-00439	N-00445
PIS(L)054	INJ. WATER SUPPLY PUMP PMP-2 DISCHARGE LOW GW-8"-A-2948-ET	PRESS SWITCH	N-00449	N-00439	N-00445
FCV055	INJECTION WATER PUMP RECIRCULATION GW-6"-A-2955-ET	CONTROL VALVE	N-00449	N-00439	N-00445
FIT055	INJECTION WATER PUMP RECIRCULATION GW-6"-A-2955-ET	MAG FLOW	N-00449	N-00439	N-00445
ZSL055	FCV055 CLOSED FCV055	POSITION SW.	N-00449	N-00439	N-00445
FCV060	INJECTION WELL #8 GW-4"-A-2950-ET	CONTROL VALVE	N-00449	N-00442	N-00478
FIC060	INJECTION WELL #8 GW-4"-A-2950-ET	PID CONTRLR	N-00449	N-00442	N-00478
FIT060	INJECTION WELL #8 GW-4"-A-2950-ET	MAG FLOW	N-00449	N-00442	N-00478

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LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
LT060	INJECTION WELL #8 INJECTION WELL #8	DIF PRESS XMTR	N-00449	N-00442	N-00478
PIT060	INJECTION WELL #8 GW-4"-A-2950-ET	PRESS XMIT	N-00449	N-00442	N-00478
ZSL060	FCV060 CLOSED FCV060	POSITION SW.	N-00449	N-00442	N-00478
RO061B	INJECTION WELL #8 150 GPM RESTRICTION ORIFICE GW-3"-B-2950B	ORIFICE	N-00449		
FCV062	INJECTION WELL #9 GW-4"-A-2954-ET	CONTROL VALVE	N-00449	N-00442	N-00478
FIC062	INJECTION WELL #9 GW-4"-A-2954-ET	PID CONTRLR	N-00449	N-00442	N-00478
FIT062	INJECTION WELL #9 GW-4"-A-2954-ET	MAG FLOW	N-00449	N-00442	N-00478
LT062	INJECTION WELL #9 INJECTION WELL #9	DIF PRESS XMTR	N-00449	N-00442	N-00478
PIT062	INJECTION WELL #9 GW-4"-A-2954-ET	PRESS XMITR	N-00449	N-00442	N-00478
ZSL062	FCV062 CLOSED FCV062	POSITION SW	N-00449	N-00442	N-00478
RO063A	INJECTION WELL #9 200 GPM RESTRICTION ORIFICE GW-4"-B-2954A	ORIFICE	N-00449		
RO063B	INJECTION WELL #9 150 GPM RESTRICTION ORIFICE GW-3"-B-2954B	ORIFICE	N-00449		
FCV064	INJECTION WELL #10 GW-4"-A-2953-ET	CONTROL VALVE	N-00449	N-00442	N-00478

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LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
FIC064	INJECTION WELL #10 GW-4"-A-2953-ET	PID CONTRLR	N-00449	N-00442	N-00478
FIT064	INJECTION WELL #10 GW-4"-A-2953-ET	MAG FLOW	N-00449	N-00442	N-00478
LT064	INJECTION WELL #10 INJECTION WELL #10	DIF PRESS XMTR	N-00449	N-00442	N-00478
PIT064	INJECTION WELL #10 GW-4"-A-2953-ET	PRESS XMTR	N-00449	N-00442	N-00478
ZSL064	FCV064 CLOSED FCV064	POSITION SW.	N-00449	N-00442	N-00478
RO065A	INJECTION WELL #10 200 GPM RESTRICTION ORIFICE GW-4"-B-2953A	ORIFICE	N-00449		
RO065B	INJECTION WELL #10 150 GPM RESTRICTION ORIFICE GW-3"-B-2953B	ORIFICE	N-00449		
FCV066	INJECTION WELL #11 GW-4"-A-2952-ET	CONTROL VALVE	N-00449	N-00442	N-00478
FIC066	INJECTION WELL #11 GW-4"-A-2952-ET	PID CONTRLR	N-00449	N-00442	N-00478
FIT066	INJECTION WELL #11 GW-4"-A-2952-ET	MAG FLOW	N-00449	N-00442	N-00478
LT066	INJECTION WELL #11 INJECTION WELL #11	DIF PRESS XMTR	N-00449	N-00442	N-00478
PIT066	INJECTION WELL #11 GW-4"-A-2952-ET	PRESS XMTR	N-00449	N-00442	N-00478
ZSL066	FCV066 CLOSED FCV066	POSITION SW.	N-00449	N-00442	N-00478

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LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
RO067A	INJECTION WELL #11 200 GPM RESTRICTION ORIFICE GW-4"-B-2952A	ORIFICE	N-00449		
RO067B	INJECTION WELL #11 150 GPM RESTRICTION ORIFICE GW-3"-B-2952B	ORIFICE	N-00449		
FCV068	INJECTION WELL #12 GW-4"-A-2951-ET	CONTROL VALVE	N-00449	N-00442	N-00478
FIC068	INJECTION WELL #12 GW-4"-A-2951-ET	PID CONTRLR	N-00449	N-00442	N-00478
FIT068	INJECTION WELL #12 GW-4"-A-2951-ET	MAG FLOW	N-00449	N-00442	N-00478
LT068	INJECTION WELL #12 INJECTION WELL#12	DIF PRESS XMTR	N-00449	N-00442	N-00478
PIT068	INJECTION WELL #12 GW-4"-A-2951-ET	PRESS SWITCH	N-00449	N-00442	N-00478
ZSL068	FCV068 CLOSED FCV068	POSITION SW.	N-00449	N-00442	N-00478
RO069A	INJECTION WELL #12 200 GPM RESTRICTION ORIFICE GW-4"-B-2951A	ORIFICE	N-00449		
RO069B	INJECTION WELL #12 150 GPM RESTRICTION ORIFICE GW-3"-B-2951B	ORIFICE	N-00449		
HS070	PUMP PMP-RW6 L-O-R PMP-RW6	SEL SW	N-00448	N-00438	N-00444
XS070	PMP-RW6 MOTOR PMP-RW6	DCS OUTPUT	N-00448	N-00438	N-00444
ZS070	PUMP PMP-RW6 RUNNING PMP-RW6	AUX CONTACT	N-00448	N-00438	N-00444

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LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
LT071	OPTIMIZATION WELL #RW6	DIF PRESS XMTR	N-00448		
FCV072	WELL RW6 FLOW CONTROL GW-6"-A-2930-IC	CONTROL VALVE	N-00448	N-00438	N-00444
FIT072	WELL RW6 FLOW GW-6"-A-2930-IC	MAG FLOW	N-00448	N-00438	N-00444
PIT072	PUMP PMP-RW6 DISCHARGE GW-6"-A-2930-IC	PRESS XMITR	N-00448	N-00438	N-00444
ZSL072	FCV072 CLOSED GW-6"-A-2930-IC	POSITION SW.	N-00448	N-00438	N-00444
HS074	PUMP PMP-RW7 L-O-R PMP-RW7	SEL SW	N-00448	N-00438	N-00444
XS074	PMP-RW7 RUN PMP-RW7	DCS OUTPUT	N-00448	N-00438	N-00444
ZS074	PUMP PMP-RW7 RUNNING PMP-RW7	AUX CONTACT	N-00448	N-00438	N-00444
LT075	OPTIMIZATION WELL #RW6	DIF PRESS XMTR	N-00448		
FCV076	WELL RW7 FLOW CONTROL GW-6"-A-2931-IC	CONTROL VALVE	N-00448	N-00438	N-00444
FIT076	WELL RW7 FLOW GW-6"-A-2931-IC	MAG FLOW	N-00448	N-00438	N-00444
PIT076	PUMP PMP-RW7 DISCHARGE PRESSURE GW-6"-A-2931-IC	PRESS XMITR	N-00448	N-00438	N-00444
ZSL076	VALVE FCV076 CLOSED GW-6"-A-2931-IC	POSITION SW.	N-00448	N-00438	N-00444

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LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
ZSH080	WELL RW6 ISOLATION VALVE OPEN GW-6"-A-2930-IC	POSITION SW.	N-00448	N-00438	N-00444
ZSL080	WELL RW6 ISOLATION VALVE CLOSED GW-6"-A-2930-IC	POSITION SW.	N-00448	N-00438	N-00444
ZSH082	WELL RW7 ISOLATION VALVE OPEN GW-6"-A-2931-IC	POSITION SW.	N-00448	N-00438	N-00444
ZSL082	WELL RW7 ISOLATION VALVE CLOSED GW-6"-A-2931-IC	POSITION SW.	N-00448	N-00438	N-00444
FCV211	RECOVERY WELL 3924 FLOW CONTROL GW1-6"-01	CONTROL VALVE	N-00448	N-00438	N-00444
FIT211	RECOVERY WELL 3924 FLOW GW1-6"-01	MAG FLOW	N-00448	N-00438	N-00444
HS211	RECOVERY WELL 3924 PUMP L-O-R GW1-8"-01	SEL SW	N-00448	N-00438	N-00444
LT211	RECOVERY WELL 3924	DIF PRESS XMTR	N-00448		
PT211	RECOVERY WELL 3924 DISCHARGE PRESSURE GW1-6"-01	PRESS XMITR	N-00448	N-00438	N-00444
XS211	RECOVERY WELL 3924 PUMP RUN 3924 PUMP	DCS OUTPUT	N-00448	N-00438	N-00444
ZS211	RECOVERY WELL 3924 PUMP RUNNING GW1-8"-01	AUX CONTACT	N-00448	N-00438	N-00444
ZSL211	FCV211 CLOSED FCV211	POSITION SW.	N-00448	N-00438	N-00444
FCV212	RECOVERY WELL 3925 FLOW CONTROL GW1-6"-01	CONTROL VALVE	N-00448	N-00438	N-00444

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LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
FIT212	RECOVERY WELL 3925 FLOW GW1-6"-01	MAG FLOW	N-00448	N-00438	N-00444
HS212	RECOVERY WELL 3925 PUMP L-O-R GW1-8"-01	SEL SW	N-00448	N-00438	N-00444
LT212	RECOVERY WELL 3925	DIF PRESS XMTR	N-00448		
PT212	RECOVERY WELL 3925 DISCHARGE PRESSURE GW1-6"-01	PRESS XMITR	N-00448	N-00438	N-00444
XS212	RECOVERY WELL 3925 PUMP RUN 3925 PUMP	DCS OUTPUT	N-00448	N-00438	N-00444
ZS212	RECOVERY WELL 3925 PUMP RUNNING GW1-8"-01	AUX CONTACT	N-00448	N-00438	N-00444
ZSL212	FCV212 CLOSED FCV212	POSITION SW	N-00448	N-00438	N-00444
FCV213	RECOVERY WELL 3926 FLOW CONTROL GW1-6"-01	CONTROL VALVE	N-00448	N-00438	N-00444
FIT213	RECOVERY WELL 3926 FLOW GW1-6"-01	MAG FLOW	N-00448	N-00438	N-00444
HS213	RECOVERY WELL 3926 PUMP L-O-R GW1-8"-01	SEL SW	N-00448	N-00438	N-00444
LT213	RECOVERY WELL 3926	DIF PRESS XMTR	N-00448		
PT213	RECOVERY WELL 3926 DISCHARGE PRESSURE GW1-6"-01	PRESS XMITR	N-00448	N-00438	N-00444
XS213	RECOVERY WELL 3926 PUMP RUN 3926 PUMP	DCS OUTPUT	N-00448	N-00438	N-00444

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LOOP NO.	SERVICE LINE/VESSEL NO.	INSTRUMENT TYPE	PID	I/O SCHEMATIC	LOGIC LOOP
ZS213	RECOVERY WELL 3926 PUMP RUNNING GW1-8"-01	AUX CONTACT	N-00448	N-00438	N-00444
ZSL213	FCV213 CLOSED FCV213	POSITION SW.	N-00448	N-00438	N-00444
FCV214	RECOVERY WELL 3927 FLOW CONTROL GW1-6"-01	CONTROL VALVE	N-00448	N-00438	N-00444
FIT214	RECOVERY WELL 3927 FLOW GW1-6"-01	MAG FLOW	N-00448	N-00438	N-00444
HS214	RECOVERY WELL 3927 PUMP L-O-R XS-214	SEL SW	N-00448	N-00438	N-00444
LT214	RECOVERY WELL 3927	DIF PRESS XMTR	N-00448		
PT214	RECOVERY WELL 3927 PRESSURE GW1-6"-01	PRESS XMTR	N-00448	N-00438	N-00444
XS214	RECOVERY WELL 3927 PUMP RUN 3927 PUMP	DCS OUTPUT	N-00448	N-00438	N-00444
ZS214	RECOVERY WELL 3927 PUMP RUNNING ZI-214	AUX CONTACT	N-00448	N-00438	N-00444
ZSL214	FCV214 CLOSED FCV214	POSITION SW.	N-00448	N-00438	N-00444

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SECTION 13401  
PROCESS CONTROL SYSTEM

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Design and performance requirements of a monitoring and control system for use with the South Plume Optimization and Injection Demonstration Project (SPO/ID), to include the following:
1. Hardware for interfacing with the existing AWWT Distributed Control System (DCS).
  2. Remote input/output hardware.
  3. Description of new Fischer & Porter System Six software.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals Summary.
- C. Section 13400 - Instruments and Equipment.
- D. Section 13405 - Installation and Calibration of Instruments.
- E. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. National Electric Manufacturers Association (NEMA):
1. NEMA ICS 6-93 Industrial Control and Systems Enclosures.

1.5

SYSTEM DESCRIPTION

- A. Design requirements, regardless of application, shall be as follows:
1. Signals from and to discrete instruments and controls shall be 4-20 mAdc.
  2. Electronics housing for field devices shall be NEMA ICS 6, Type 4X as a minimum.
  3. Analog output accuracy shall be  $\pm 0.25$  percent of calibrated span, including effects of linearity, hysteresis, and repeatability.
  4. Digital output accuracy shall be  $\pm 1$  percent of calibrated span.
  5. Electronic analog transmitters and receivers shall have their input and output signals isolated from ground.
  6. Contact closure outputs shall be "dry" contacts isolated from ground.
  7. Installed equipment shall not have any exposed terminals, wiring, or any other points where personnel may be exposed to live electrical voltage over 30 volts. This requirement applies to calibrating, servicing, repair, and operation of equipment.
  8. All terminals over 30 volts shall be insulated or covered to prevent electrical shock exposure.
- B. Performance Requirements: The process control system shall be furnished and installed by the Subcontractor to provide for all monitoring and control systems required to operate the SPO/ID System. Data from the SPO/ID instrumentation (see Sections 13400 and 13405) shall be sent to and controlled from the existing AWWT DCS.
1. The existing Fischer & Porter System Six microprocessor-based AWWT DCS is fully intelligent with remote hardware and interconnecting wire and conduit.
  2. The Subcontractor shall utilize the existing Fischer & Porter System Six software for programming.
  3. Provide components compatible with the DCS system as indicated on the construction drawings.

4. All graphics are to be generated using supplied display configurable tools so as to be user modifiable. These should be interactive with the process so an operator can make setpoint changes, change controller status, and manipulate outputs directly from the graphic. Faceplate and trending information shall be accessible from the graphics display directly and through windowing techniques. Standard ISA and/or Fischer and Porter library symbols shall be used to create the graphics in a P&ID format similar to the existing graphics now at the AWWT.
5. Process pipe lines shall change color when the line is energized or under pressure. Pipe lines are to be color coded (list to be provided by FDF) as to the type or kind of process.
6. Alarms shall be indicated using flashing video and an audible signal. Alerts are not to be displayed in red on graphic; yellow is preferred. To differentiate alerts from alarms, two different colored signals shall be provided in the alarm window.

#### 1.6 SUBMITTALS

- A. Provide submittals as required per Section 01011.
- B. Product Data: Provide data for each system component 2 weeks after receipt of order. Include Fischer & Porter "data sheets" for components added to the DCS.
- C. Shop Drawings and Logic:
  1. Provide cable schematic showing programmable remote transmitter unit location(s) and system configuration.
  2. List connected data points for input and output devices.
  3. Provide system graphics drawings indicating monitored systems, data point addresses, and operator notations; one drawing per screen. A sample will be furnished by the Subcontractor for approval prior to the installation in the AWWT system.

4. Show system configuration with peripheral devices, power supplies, diagrams, and interconnections.
  5. Indicate description and sequence of operation.
- D. Process Control System Test: The Subcontractor shall submit a test procedure for approval prior to testing. A final test report shall be submitted.
- E. Certificates: Submit Certification of Test Equipment (calibration records) used to complete the work as described herein.
- F. Installation, Operations and Maintenance Manuals to be provided.
1. Indicate manufacturer's installation instructions for all manufactured components.
  2. Include interconnection wiring diagrams for the complete field installed systems with identified and numbered system components and devices.
  3. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
  4. Include inspection period, cleaning methods, cleaning materials recommended, calibration tolerances, and recommended frequency of calibration.
- G. Include suggested spare parts inventory for each type of equipment.

**1.7 QUALITY ASSURANCE PROGRAM**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with minimum 3 years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section, with minimum 3 years documented experience.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging of the systems shall be in accordance with the following requirements:
1. Items to be installed in the AWWT System Control Room and remote transmitter units shall be wrapped and placed in suitable shipping containers with sufficient cushioning material to prevent damage during shipment and storage.
- B. Acceptance at the site
1. Products arriving at the FEMP shall be examined by the Subcontractor for general damage during shipping. Those products found to be damaged shall not be accepted.
- C. Storage and Protection
1. Control system components shall be stored according to manufacturer's requirements for storage, if information regarding storage is provided by the manufacturer. In cases where specific storage requirements are not provided, components shall be stored in a clean, dry area, protected from the weather, until required for installation.

**1.9 PROJECT CONDITIONS**

- A. Services
1. Operating Hours: 24 hours/day, 7 days/week, 52 weeks/year.
  2. Industrial design with instrument life of 30 years.
- B. Ambient Conditions
1. Plant Location: Fernald, Ohio.
  2. Plant Elevation: Approximately 580 feet above sea level.
  3. Ambient Temperature Range: -10 to 100 degrees F.
  4. Barometric Pressure, inches Hg absolute (mean at 70 degrees F): 29.4.
  5. Relative Humidity: Varies from 20 percent to 95 percent.

C. Electrical Supply: 120 volts, single phase, 60 Hz.

**1.10 MAINTENANCE**

A. Maintenance Service

1. Maintenance service numbers and information shall be provided along with product documentation sent in shipping. Maintenance policies and procedures shall be fully described in the maintenance documentation.

B. Extra Materials

1. Any extra/replacement parts or materials required to maintain acceptable product performance levels shall be referenced in the product documentation provided with shipping.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

A. Fischer & Porter, unless otherwise indicated.

**2.2 EQUIPMENT**

A. AWWT DCS Control Unit

1. Provide Control Unit Functions:
  - a. Monitors or controls each input/output point.
  - b. Acquires, processes, and transfers information to operator station.
  - c. Accesses both data base and control functions simultaneously.
  - d. Records, evaluates, and reports changes of state or value that occur among associated points. Continues to perform associated control functions regardless of status of network.
  - e. Performs in stand-alone mode:
    - 1) Start/stop.
    - 2) Duty cycling.
    - 3) Automatic loop control.
    - 4) Event initiated control.
    - 5) Calculated point.

- 6) Scanning and alarm processing.
  - 7) Full direct digital control.
  - 8) Trend logging.
  - 9) Global communications.
  - 10) Maintenance scheduling.
- f. Local displays and adjustments: Utilizing digital display and numerical keyboard to display and adjust:
- 1) Input/output point information and status.
  - 2) Controller setpoints.
  - 3). Controller tuning constants.
  - 4) Program execution times.
  - 5) High and low limit and alarm values.
  - 6) Set/display date and time.
  - 7) Control outputs connected to the network.
  - 8) Automatic control outputs.
  - 9) Perform control unit diagnostic testing.
  - 10) Points in "Test" mode.

B. Process Control Stations

1. Process Control Stations function in one of two modes, stand alone (master) single loop controller or as a distributed controller (slave).
2. Local displays and adjustments: Utilizing digital display and numerical keyboard to display and adjust:
  - a) Input/output point information and status.
  - b) Controller setpoints.
  - c) Controller tuning constants.
  - d) Program execution times.
  - e) High and low limit and alarm values.
  - f) Set/display date and time.
  - g) Control outputs connected to the network.
  - h) Automatic control outputs.
  - i) Perform control unit diagnostic testing.
  - j) Points in "Test" mode.
  - k) Monitor DCS communications status.

C. Communications

1. Communications system consisting of two bundle fiber optic cable transmission system is as indicated on the drawings. Communications cables required include 2-2/c 62.5/125 micron multimode fiber optic cable or equal.

D. Operating System Software: Utilize existing Fischer & Porter System Six software for operations to allow:

1. Input/Output Capability from Operator Station to:
  - a. Request display of current values or status in tabular or graphic format.
  - b. Command selected equipment to specified state.
  - c. Initiate logs and reports.
  - d. Change analog limits.
  - e. Add, delete, or change points within each application routine.
  - f. Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.
  - g. Add new input/output to system.
  - h. Modify and set up maintenance scheduling parameters.
  - i. Develop, modify, delete, or display full range of color graphic displays.
  - j. Provide capability to sort and extract data from archived files and to generate custom reports.
  - k. Support printer operations:
    - 1) Alarms: Print alarms, operator acknowledgements, action messages, system alarms, and operator sign-on and sign-off.
    - 2) Data: Print reports, page prints, and data base prints.
  - l. Select daily, weekly, or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
2. Operator System Access: Passwords and level of access shall be coordinated with FDF.
3. Alarm Processing:

- a. Off-normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and which alarms shall cause automatic dial-out.
- b. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
- c. Display alarm reports on video. Display multiple alarms in order of occurrence.
- d. Define time delay for equipment start-up or shutdown.
- e. Allow unique routing of specific alarms.
- f. Operator specifies whether alarm requires acknowledgement.
- g. Continue to indicate unacknowledged alarms after return to normal.
- h. Alarm notification:
  - 1) Automatic print.
  - 2) Display indicating alarm condition.
  - 3) Selectable audible alarm indication.

E. Test Mode Operation:

- 1. Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
  - a. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
  - b. Control output points but change only data base state or value; leave external field hardware unchanged.
  - c. Enable control actions on output points but change only data base state or value.

F. DCS and PCS Setpoints

- 1. Setpoints shall be established as follows for the SPO/ID System analog instruments. Refer to the drawings for the corresponding instrument tag numbers..

INSTRUMENT FUNCTION	VALUE AT 4 mA	VALUE AT 20 mA	LOW ALARM SETPOINT	HIGH ALARM SETPOINT
Optimization Well RW7- Flow Control Valve	0% open	100% open	N/A	N/A
Optimization Well RW7- Magnetic Flowmeter	0 gpm	400 gpm	N/A	N/A
Optimization Well RW6- Pressure Transmitter	0 psi	150 psi	50 psi	95 psi
Optimization Well RW6- Flow Control Valve	0% open	100% open	N/A	N/A
Optimization Well RW6- Magnetic Flowmeter	0 gpm	400 gpm	N/A	N/A
Optimization Well RW6- Pressure Transmitter	0 psi	150 psi	50 psi	95 psi
Recovery Well 3924- Flow Control Valve	0% open	100% open	N/A	N/A
Recovery Well 3924- Magnetic Flowmeter	0 gpm	650 gpm	N/A	N/A
Recovery Well 3924- Pressure Transmitter	0 psi	150 psi	50 psi	95 psi
Recovery Well 3925- Flow Control Valve	0% open	100% open	N/A	N/A
Recovery Well 3925- Magnetic Flowmeter	0 gpm	650 gpm	N/A	N/A
Recovery Well 3925- Pressure Transmitter	0 psi	150 psi	50 psi	95 psi
Recovery Well 3926- Flow Control Valve	0% open	100% open	N/A	N/A
Recovery Well 3926- Magnetic Flowmeter	0 gpm	650 gpm	N/A	N/A
Recovery Well 3926- Pressure Transmitter	0 psi	150 psi	50 psi	95 psi

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INSTRUMENT FUNCTION	VALUE AT 4 mA	VALUE AT 20 mA	LOW ALARM SETPOINT	HIGH ALARM SETPOINT
Recovery Well 3927- Flow Control Valve	0% open	100% open	N/A	N/A
Recovery Well 3927- Magnetic Flowmeter	0 gpm	650 gpm	N/A	N/A
Recovery Well 3927- Pressure Transmitter	0 psi	150 psi	50 psi	95 psi
Injection Water Supply Tank Level- Control Valve	0% open	100% open	N/A	N/A
Injection Water Supply Tank- Level Transmitter	0% (0 ft)	100% (20' 7")	10%	90%
Injection Water Supply Tank Recirculation- Control Valve	0% (0 gpm)	100% (800 gpm)	N/A	N/A
Injection Water Supply Tank Recirculation- Magnetic Flowmeter	0 gpm	900 gpm	N/A	N/A
Injection Well 8- Flow Control Valve	0%	100%	N/A	N/A
Injection Well 8- Magnetic Flowmeter	0 gpm	200 gpm	N/A	N/A
Injection Well 8- Pressure Transmitter	0 psi	110 psi	1 psi	N/A
Injection Well 8- Level Transmitter	0% (0 ft)	100% (13 ft)	5%	95%
Injection Well 9- Flow Control Valve	0%	100%	N/A	N/A
Injection Well 9- Magnetic Flowmeter	0 gpm	200 gpm	N/A	N/A
Injection Well 9- Pressure Transmitter	0 psi	110 psi	1 psi	N/A

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INSTRUMENT FUNCTION	VALUE AT 4 mA	VALUE AT 20 mA	LOW ALARM SETPOINT	HIGH ALARM SETPOINT
Injection Well 10- Flow Control Valve	0%	100%	N/A	N/A
Injection Well 10- Magnetic Flowmeter	0 gpm	200 gpm	N/A	N/A
Injection Well 10- Pressure Transmitter	0 psi	110 psi	1 psi	N/A
Injection Well 10- Level Transmitter	0% (0 ft)	100% (13 ft)	5%	95%
Injection Well 11- Flow Control Valve	0%	100%	N/A	N/A
Injection Well 11- Magnetic Flowmeter	0 gpm	200 gpm	N/A	N/A
Injection Well 11- Pressure Transmitter	0 psi	110 psi	1 psi	N/A
Injection Well 11- Level Transmitter	0% (0 ft)	100% (13 ft)	5%	95%
Injection Well 12- Flow Control Valve	0%	100%	N/A	N/A
Injection Well 12- Magnetic Flowmeter	0 gpm	200 gpm	N/A	N/A
Injection Well 12- Pressure Transmitter	0 psi	110 psi	1 psi	N/A
Injection Well 12- Level Transmitter	0% (0 ft)	100% (13 ft)	5%	95%

**PART 3 EXECUTION**

**3.1 SITE CONDITIONS**

- A. Verify that conditioned power supply is available to the control units. Verify that field end devices, wiring, and tubing have been installed prior to proceeding with installation.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Install control units and associated hardware in the existing Process Control Stations PCS18 and PCS22. Install distributed I/O hardware in Process Control Station enclosures as shown on Panel Layout Diagrams, Attachment A of this section.
- B. Utilize new and existing software for configuration of Process Control Stations and existing operator work station as indicated on logic drawings. Implement all features of programs to specified requirements and appropriate to sequence of operation.
- C. Provide conduit and electrical wiring in accordance with Section 16050.
- D. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

**3.3 DEMONSTRATION**

- A. Demonstrate complete and operating system to FDF.

**3.4 ATTACHMENTS**

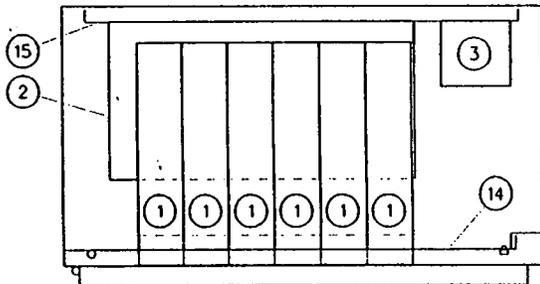
- A. Process Control Station Panel Layout Diagrams.

**END OF SECTION**

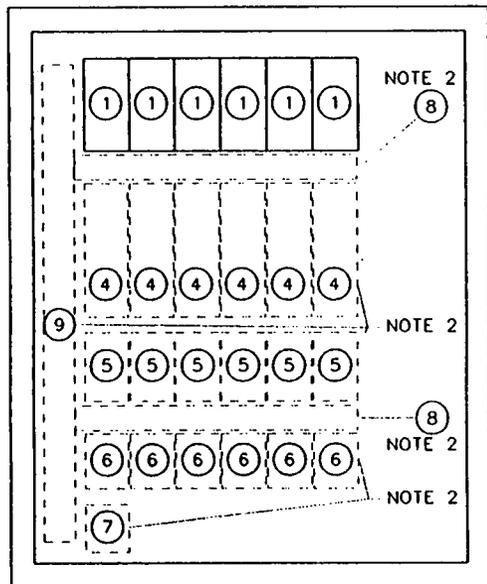
**ATTACHMENT A**

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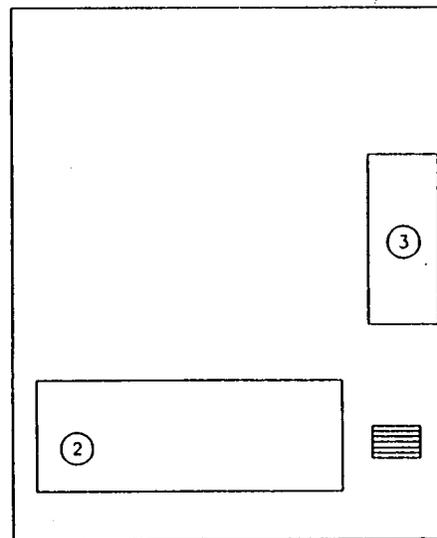
**PROCESS CONTROL STATIONS  
PANEL LAYOUT DIAGRAMS**



TOP VIEW  
NTS



HINGED PANEL LAYOUT  
NTS



SUB PANEL LAYOUT  
NTS

BILL OF MATERIAL

ITEM	QTY	USED FOR	DESCRIPTION
1	6	PROCESS CONTR STATION	FISCHER & PORTER MODEL 53MC5000 CONTROLLER
2	1	POWER SUPPLY	15A @ 24V DC REGULATED POWER SUPPLY
3	1	FIBER OPTIC CONVERTER	FIBER OPTIC DATA LINK ADAPTER
4	6	DIGITAL I/O MODULE	FISCHER & PORTER 60I/400 MODULE FOR ABOVE CONTROLLER
5	6	CORD SET MODULE	FISCHER & PORTER CORD SET MODULE FOR ABOVE CONTROLLER
6	6	DUAL RELAY OUTPUT MODULE	FISCHER & PORTER DUAL RELAY MODULE FOR ABOVE CONTROLLER
7	1	COMMUNICATIONS MODULE	FISCHER & PORTER COMMUNICATIONS MODULE FOR ABOVE CONTROLLER
8	2	1 1/2" WIREWAY	1 1/2" WIDE X 2" HIGH X LENGTH AS REQ'D SLOTTED PLASTIC WIRING DUCT W/COVER
9	1	2" WIREWAY	2" WIDE X 2" HIGH X LENGTH AS REQ'D SLOTTED PLASTIC WIRING DUCT W/COVER
10	2	FUSE TERMINAL	600V AC/DC, 10 AMP, #22 THRU #10 AWG WITH FUSE PULLER
11	2	FUSE	3 AMP, 120VAC FOR ITEM 10
12	4	TERMINAL	600V AC/DC, 30 AMP, #30 THRU #12 AWG APPROX. 4 TERMINALS PER INCH
13	1	ENCLOSURE	NEMA 4X 36"H X 30"W X 16"D SINGLE DOOR W/WINDOW WALL MOUNT ENCLOSURE
14	1	SWING OUT PANEL	3/8" ALUMINUM SWING OUT PANEL W/ HINGES AND SECURING BRACKETS
15	1	SUB-PANEL	12 GA. 33"H X 27"W SUB-PANEL

NOTES:

1. SIZE WINDOW FOR ENCLOSURE DOOR TO COMPLETELY EXPOSE THE FRONT OF THE PROCESS CONTROL STATIONS. THE DOOR AND WINDOW SHALL MEET NEMA 4X SPECIFICATIONS.
2. ITEMS SHOWN ARE MOUNDED ON BACK SIDE OF THE HINGED PANEL.

RECOVERY/OPTIMIZATION WELLS PCSVH2  
PANEL LAYOUT DIAGRAM

PARSONS ERA PROJECT

WBS 1.1.1.1.1.2.1

SHEET	1	JOB NUMBER	ARP/PO169
DOCUMENT NUMBER	13401 ATTACHMENT A	REV	0



SECTION 13405  
INSTALLATION AND CALIBRATION OF INSTRUMENTS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. This section defines the installation, testing, and calibration requirements of the instruments. The installation contractor is also required to supply instrument fittings, valves, and other accessories which will support the instruments for the South Plume Optimization and Injection Demonstration Project.
- B. Items installed but not provided under this section are shown on the detail sheets (see Attachment A of this section).

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittal Summary.
- C. Section 13400 - Instruments and Equipment.
- D. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society of Mechanical Engineers (ASME):
  - 1. ASME B31.3A-93 Chemical Plant and Petroleum Refinery Piping.
  - 2. ASME Sec IIA SA-182/SA-182M-95 Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service

- B. National Institute of Standards and Technology (NIST).

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Provide Material specifications for instrument valves and fittings, used for the containment of process fluid.
- C. Provide product data, using catalog information or data sheets to provide dimensions of components.
- D. Items to be submitted to the FDF Construction Contract's Manager for approval prior to testing:
  - 1. Inspection and functional test procedures.
  - 2. Cleaning procedures: Include a procedure for cleaning prior to connecting tubing and piping to instruments, prior to pressure testing, and after completion of testing.
  - 3. Pressure testing procedures and types of test equipment to be used.
  - 4. Repair procedures for piping and tubing materials failing pressure tests.
- E. Items to be submitted to FDF Construction Contract's Manager prior to contract closeout.
  - 1. Certification of Test Equipment (calibration records) used to complete the work as described.
  - 2. Test reports: Test reports shall be typewritten, listing equipment used, person or persons performing the tests, date tested, device or circuit tested, and results of test.
  - 3. Calibration reports.

**1.5 QUALITY ASSURANCE**

- A. Materials provided for installation and calibration of instruments shall be as specified herein, and the documentation submitted for verification of materials shall be maintained by the installation contractor for inspection by an FDF representative for inspection

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prior to release for construction or construction acceptance.

**1.6 DELIVERY, STORAGE, HANDLING, AND SHIPPING**

**A. Packing and Shipping**

1. Product shipping container(s) shall contain packing materials to prevent the entrance of water to instrument surfaces, interior, and exterior.
2. Product shipping container(s) shall be clearly marked "FRAGILE - DO NOT DROP," and shall be furnished with an itemized invoice stating the contents and quantity of products contained therein.
3. Ports for process, electrical, and/or pneumatic connections shall be plugged to prevent the interior accumulation of dirt and moisture.
4. Ensure that closures used for covering, wrapping, or plugging openings shall not be made of polyvinyl chloride (PVC) or other plastics that contain chlorides.
5. Control components assembled prior to shipment shall be packaged to minimize entry of dirt and moisture.

**B. Acceptance at the FEMP**

1. Products arriving at the FEMP shall be examined for general damage during shipping. Those products found to be damaged shall not be accepted at the FEMP.

**C. Storage and Protection**

1. Instrumentation equipment shall be stored according to manufacturer's requirements for storage, if information regarding storage is provided by the manufacturer. In cases where specific storage requirements are not provided, equipment shall be stored in a clean, dry area protected from the weather until required for installation.

**1.7 SEQUENCING AND SCHEDULING**

- A. The sequencing of work and scheduling of tasks for the SPO/SPI shall follow the project schedule and milestones approved by FDF.

**1.8 WARRANTY**

- A. Special Warranty  
1. No special warranty requirements apply.

**PART 2 PRODUCTS**

- A. Instrument Valves and Fittings  
1. Instrument Valves and fittings required for the installation of instruments shall be as listed in Attachment A, Instrument Installation details.
- B. Test and Calibration Equipment  
1. Test and calibration equipment used by the installation contractor shall be calibrated and traceable by tag number, make and model number to an instrument certified by NIST.  
2. Test gauges shall have calibration verified or performed within two months prior to use at the work location.  
3. Analog test gauges used for calibration shall have a 6-inch dial, 0-200 PSIG range, minor scale divisions of 0.5 PSI, maximum, and accuracy of  $\pm 0.25\%$ . Digital test gauges shall be 3-1/2 digit display with  $\pm 0.25\%$  accuracy.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Prior to installation, instruments and materials shall be free from contamination in accordance with the following:  
1. No residual contaminants present that could cause the instrument to become inoperative.  
2. No residual moisture present.  
3. No corrosion products present, such as rust.

### 3.2 PREPARATION

- A. Remove shipping stops from instruments before implementing procedures listed herein. Small pressure gauges or output gauges supplied with component assemblies will not require calibration.
1. Check operation of gauges. Replace defective gauges.
  2. Verify data on nameplate with respect to operating range, operating temperature, specific gravity, etc. Verify conformance to instrument data sheets.

### 3.3 ERECTION/INSTALLATION/APPLICATION

- A. General
1. Instruments shall be positioned so that the operator will have an unobstructed view of the indicators and gauges.
  2. The hand valves shall be positioned so that handwheels or handles shall be facing the operating area and are easily accessible without any obstruction or interference.
  3. Drain and blowdown valves shall be located so that they are accessible without the use of a ladder or a portable platform and away from walkways, aisles, and operating areas.
  4. Joiners (length of pipe made by welding together pieces shorter than 20 feet) shall not be permitted. Where piping line classes interface with instrument piping classes, a threaded NPT pipe connection shall be utilized.
  5. Wall-mounted instruments to be fastened to concrete shielding wall shall be fastened using expansion anchors. Expansion anchors made of lead are not acceptable. The instruments shall be fastened to the wall such that the center of the instrument is between 4.5 feet and 5 feet above grade or finished floor.
  6. Pipe stands shall be fabricated such that the center of stand-mounted instruments is between 4.5 feet and 5 feet above grade or finished floor unless otherwise indicated.

- B. Electrical Connections
1. The instruments connected to piping shall use watertight flex conduit and fittings for connection between the instrument and the rigid conduit. The length of the flex conduit shall not exceed 3 feet. All other electrical connections to instruments shall use rigid conduit as defined in the electrical specification section, Section 16050.
- C. Threaded Connections
1. When installing instruments, low-halogen nuclear grade "Never-Seez" compound shall be used for sealant. Sealant shall be applied to male threads only. Sealant compound shall cover all male threads.
- D. Instrument Tagging
1. Instruments requiring identification shall be tagged accordingly with a stainless steel 1-inch by 2 1/2-inch by 1/16-inch-thick tag (minimum). Lettering shall be minimum 1/4-inch high and stamped so that it can be easily read and identified.
  2. Tags shall be secured to the instruments by a beaded stainless steel chain so that they will remain on the instrument.
- E. In general, instrument installation, including supports, valves, instruments, fittings, and all associated work, will be inspected by the FDF Construction Contract's Manager. Defective work or failure to follow these procedures shall result in disassembly and/or rework at no additional cost to FDF.

### **3.4 FIELD QUALITY ASSURANCE**

- A. Test equipment used shall be calibrated and traceable by tag number, make, and model number to the instrument certified by NIST.
1. Test gauges shall have been calibrated within 1 week prior to testing.

2. Test gauges shall have a range of 0 to 200 psig, with marked resolution of 0.5 psig.

B. Testing: Instrument tubing shall be pneumatically pressure tested after installation, using the testing procedures which have been submitted and reviewed prior to testing.

C. Testing Procedures: Testing shall include the following:

- 1. Instrument tubing shall be pneumatically pressure tested with clean, dry, compressed air and in accordance with ASME B31.3A, Paragraph 345.5.
- 2. The pneumatic test pressure shall be continuously maintained for a minimum of 20 minutes at the required test pressure and for such additional time as may be necessary to conduct the examination of joints for leakage with a bubble type leak test.
  - a. The bubble test procedures shall be submitted for review and shall, as a minimum, include soap application procedure and soap material to be used.
- 3. Instrument impulse lines shall be pneumatically tested at 200 psig.
- 4. Joints reconnected after initial test shall be service tested in accordance with ASME B31.3A, Paragraph 345.5.
- 5. Test each field transmitter for proper operation and document the test results.
- 6. Joints shall be visibly exposed during testing of the installation.
- 7. After test, instruments, all connections, and tubing shall be cleaned and reconnected, and the system shall be tested under normal operating pressures..

D. Repairs and Retesting: Test failures shall be repaired by approved contractor's procedures and retested as specified previously.

### 3.5

### ADJUSTING

- A. Calibration: Calibrate instruments and components in accordance with manufacturer's calibration data over the full operational range; verify instruments to be within published specification and accuracy; and affix a calibration sticker.
1. Instruments shall be calibrated individually and, where applicable, as a system.
  2. Components which have adjustable features shall be carefully set for specific conditions and applications of this project.
  3. Calibration sticker shall contain the following information:
    - a. Equipment identification tag number
    - b. Range of calibration
    - c. Date and name of persons doing calibration
    - d. Date of next scheduled calibration
- B. Calibration Ranges:
1. Pressure Gauges: Check at 10 percent, 50 percent, and 90 percent of their ranges for linearity within manufacturer's stated specifications.
  2. Control Valves and Operators: Operation of control valves and operators shall be verified by impressing appropriate signals on the operator input.
    - a. Verify that control valve seats are free from foreign material and properly positioned for intended service.
  3. Field Transmitters: Check zero and span at 10 percent, 50 percent, and 90 percent of range by impressing measured signal into input or signal connections, in accordance with manufacturer's instructions.
  4. Controllers (Field Mounted): Simulate set point and measured variable signals at controller, with separate regulated signals.
- C. Instrument Calibration Requirements: For detailed performance requirements or calibration settings, refer to the instrument data sheets and the Instrument Loop Diagrams.

### 3.6 CLEANING

- A. Instruments shall be cleaned in accordance with the manufacturer's recommended cleaning procedures.
- B. After cleaning, work shall be free from contamination in accordance with the following:
  - 1. No contaminants present that could cause the instrument to become inoperative.
  - 2. No moisture present.
  - 3. No corrosion products present, such as rust.

### 3.7 DEMONSTRATION

- A. The FDF Construction Contract's Manager shall be given a minimum of two working days notification prior to site testing or retesting.

### 3.8 PROTECTION

- A. To protect sensitive instruments from overpressure damage during piping pressure test, the instruments (transmitters, pressure gauges and switches, and other instruments) shall be disconnected from the piping to be tested.
- B. Instrument openings shall be covered, capped, or plugged to prevent ingress of foreign matter.
- C. Disconnected ends of piping and tubing shall be plugged with appropriate pipe and tube fittings to allow the piping pressure test to be conducted.

### 3.9 ATTACHMENTS

- A. The following Detail Sheets are attached to this Section:
 

1. Control Valve - Electric with limit switch	1
2. Flowmeter - Magnetic Flange Style	2
3. D/P Level Transmitter Flange Mounted	3
4. Level Transmitter	4
5. Pressure Switch With Gauge	5
6. Level Switch Float Type - Top Mounted	6

7.	Level Switch - Capacitance Type	
	Vessel Side Mount	7
8.	Pressure Indicating Transmitter	8
9.	Manual Valve Position Limit Switches	9
10.	Instrument Mounting Stand	10
11.	Optimization Well Level Transmitter	11

**END OF SECTION**

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**ATTACHMENT A**

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**INSTALLATION DETAILS**





















U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION PROJECT

Division 15 - Mechanical

PARSONS

Prepared by: O.W. Carlson 6/12/97  
Date

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Date

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Date

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Date

SECTION 15060  
PIPE, FITTINGS, VALVES, AND ACCESSORIES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Pipe.
- B. Fabricated piping assemblies.
- C. Fittings.
- D. Valves.
- E. Specialty items.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 09900 - Painting.
- D. Section 15090 - Piping Supports and Anchors.
- E. Section 15250 - Insulation.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society of Mechanical Engineers (ASME):
  - 1. ASME Boiler and Pressure Vessel Code (BPVC),  
Section 1X-95, Addenda 1996.
  - 2. ASME A13.1-81 Scheme for the Identification  
of Piping Systems (R1993).
  - 3. ASME B16.5-88 Pipe Flanges and Flanged

- Fittings.
4. ASME B16.11-91 Forged Fittings, Socket Welding, and Threaded.
  5. ASME B16.25-92 Buttwelding Ends.
  6. ASME B31.3-96 Process Piping.
- B. American Society for Nondestructive Testing (ASNT):
1. ASNT SNT-TC-1A-92 Recommended Practice, December 1992 Edition.
- C. American Society for Testing and Materials (ASTM):
1. ASTM A53-96 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  2. ASTM A105/A105M-96 Standard Specification for Carbon Steel Forgings for Piping Applications.
  3. ASTM A126-95 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  4. ASTM A193/A193M Rev. A-96 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
  5. ASTM A194/A194M-96 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
  6. ASTM A216/A216M-93 Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service.
  7. ASTM A234/A234M-96 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
  8. ASTM D1784-95 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl) Chloride (CPVC) Compounds.

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- 9. ASTM D1785-96 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- 10. ASTM D2464-96 Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- 11. ASTM D2467-94 Standard Specification for Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- 12. ASTM D2564-96 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
- 13. ASTM F480-95 Standard Specification for Thermoplastic Well Casing Pipe and Couplings made in Standard Dimension Ratios (SDR), Schedule 40 and Schedule 80.
- 14. ASTM F656-96 Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

- D. American Welding Society (AWS):
  - 1. AWS A5.1-91 Carbon Steel Electrodes for Shielded Metal Arc Welding.

E. National Institute of Standards and Technology (NIST).

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Product data for pipe, fittings, valves, and accessories.
- C. Shop drawings including spool piece drawings, etc.
- D. Pressure testing procedures including cleaning and

flushing prior to testing, test equipment, safety precautions, and cleaning after completion of testing.

- E. Leak test and examination reports.
- F. Welder, procedure, and examiner qualifications, qualification records, and welding procedure specifications.
- G. Installation, operation, and maintenance instruction manuals, as appropriate.
- H. Pipe label nomenclature.

#### 1.6 QUALITY ASSURANCE PROGRAM

- A. Except where more stringent requirements are specified or indicated, the work specified herein shall conform to ASME B31.3.
- B. Welding Procedures and Qualifications
  - 1. Fabrication, assembly, and erection shall be in accordance with ASME B31.3.
  - 2. Welder qualifications shall be made available to, and approved by, FDF prior to commencement of fabrication, examination, inspection, and installation activities.
  - 3. Nondestructive testing personnel qualifications shall be in accordance with ASNT SNT-TC-1A.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaging
  - 1. Packaging shall conform to acceptable industrial practices. Materials shall be cleaned to remove chips, slag, weld spatter, oil, grease, debris, and other foreign material prior to packaging for shipment. Pipe spool openings shall be covered, capped, or plugged to prevent ingress of foreign materials during shipment and storage. Tape alone shall not be used for sealing openings. Pressure sensitive tape shall be utilized for taping covered, capped, or plugged openings. Closures

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used for covering, capping, or plugging openings shall not be made of polyvinyl chloride (PVC) or other plastics that may contain chlorine.

B. Storage and Handling

1. Piping materials and prefabricated assemblies shall be stored off the ground and handled with care so that physical damage to the piping materials does not occur. End seals of pipe, flange covers, valve covers, and similar protection shall not be removed until necessary for cleaning, fabrication, inspection, and erection.
2. Care shall be taken in the storage and handling of all piping materials and prefabricated assemblies so that contamination or corrosion does not occur.
3. Welding rods and electrodes shall be stored, handled, and identified at all times to ensure the use of the proper welding rod. Electrode ovens for the storage of low-hydrogen welding rods shall be used at all times.

**PART 2 PRODUCTS**

**2.1 PRODUCTS/EQUIPMENT**

A. Product Shipping Requirements

1. All furnished materials and equipment shall be delivered clean, undamaged, and in a workable condition.

B. Piping and Valve Specification

1. All piping materials, valves, and valve operators shall meet the requirements of the referenced specification as indicated on the piping material data sheets in Attachment A.
2. Valves shall be inherently capable of accepting a lock without use of extra equipment or devices.

C. Air Release Valves

1. Type: Float and lever operated device for venting air from pipeline.
2. Construction: Cast iron body; stainless steel

trim; Buna-N Seat; threaded connections. Body shall be rated for minimum 150 psig.

3. Capacity: Not less than 5 cfm of air at 10 psi differential. Capacities for valves in manholes shall be as shown on the Civil drawings.
4. Manufacturer: APCO or equal.

D. Air and Vacuum Valves

1. Type: Float operated device for venting or admitting air for pipeline system.
2. Construction: Cast iron body; stainless steel float; Buna-N seat; threaded connections. Body shall be rated for minimum 150 psig. Discharge orifice shall be equal in size to inlet.
3. Inlet connection size shall be as shown on the drawings.
4. Provide air release valve and associated shut-off valve as shown on the drawings.
5. Manufacturer: APCO or equal.

2.2 LABELING

A. Valve Identification

1. Each valve shall be identified with the unique valve number and description, as shown on Attachment B.
2. Label size shall be based on available lighting and anticipated reading distances. Labels shall be readable from the normal operation location or position, such that an operator need not manipulate the label to read it.
  - a. The minimum character height for a well-illuminated environment is 0.004 times the nominal reading distance (i.e., 0.122 inches height at 28 inches distance).
  - b. The minimum character height for a poorly illuminated environment is 0.006 times the nominal reading distance (i.e., 0.168 inches height at 28 inches distance).
  - c. An exception to this would be a 1/2-inch diameter pipe buried in a large bank of pipes

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on an overhead pipe bridge, which probably could not be read but should be labeled.

- 3. Labels shall be constructed of nonreflective materials. Black characters on a white background or white characters on a black background offer the best contrast and legibility. If white-on-black engraved labels are used, a clear overcoating shall be applied to prevent dirt from obscuring the white engraved characters.
- 4. Labels, including adhesives and other means of attachment, shall be made from corrosion-resistant materials that are compatible with the component and environment where they are used.
- 5. Valve identification tags on insulated valves shall be located outside the insulation jacketing and be easily accessible for inspection.

B. Pipe Identification

- 1. Identify the flow medium and the flow direction for all piping systems including insulated pipe by labeling adjacent to each valve, adjacent to where the pipe passes through a wall or floor, adjacent to abrupt pipe directional change, and at intervals of 50 feet along exposed pipe. Pipes shall be labeled as indicated on the Piping and Instrumentation Diagrams and in accordance with ASME A13.1.
- 2. Content, size, material type, line number, and insulation requirements for each pipeline are identified on the drawings as follows:

Example                      GW - 8" - A - 2900 - ET

<u>Medium Code</u>	<u>Size</u>	<u>Material Code</u>	<u>Line Number</u>	<u>Insulation</u>
GW	8"	A	2900	ET

- 3. Refer to the Piping and Instrumentation Diagram Symbols and Legend Sheet for the flowing medium, medium code, and material code relationship.
- 4. All pipe label nomenclature shall be submitted to FDF for approval prior to fabrication of labels.

C. Product Marking

1. All piping materials shall be marked and identified in accordance with the applicable ASTM specification as indicated on the piping material data sheets.
2. All bundles, boxes, or kegs in which welding rods and electrodes are delivered shall be legibly marked in accordance with AWS A5.1.
3. All welding rods and electrodes shall be identified with at least one imprint per rod showing an AWS classification number in accordance with AWS A5.1. In addition, welding rods 1/8-inch diameter and over shall be marked or stamped with positive identification marks at intervals of not more than 18 inches. Such marks shall be clearly distinguishable and shall include the classification number of the welding rod and the trade designation of the manufacturer.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Twenty percent of all fabricated piping shall be visually examined by an examiner qualified and certified in accordance with ASNT SNT-TC-1A.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Layout, Cutting, and Fitting Up
1. All piping shall be Category D Fluid Service under ASME B31.3.
  2. All assembled piping shall be installed without springing, forcing, or cold bending. Cutting or otherwise weakening of structural members to facilitate piping installation shall not be permitted.
  3. All piping shall be installed to permit free expansion and contraction without damage to joints or supports.
  4. Piping connections to equipment must ensure that mating flanges are parallel prior to bolt-up and no springing of pipe is required. All equipment

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nozzle sizes, locations, and flange facings shall be verified prior to pipe fabrication and/or installation.

5. Piping arrangement shall allow easy access for maintenance, operation, and inspection of equipment. Flanges, unions, and valves shall be accessible for maintenance, operation, and inspection after installation. Piping shall be routed in such a way so as not to create a tripping hazard, or provisions shall be made to protect against a tripping hazard.
6. Threading of steel pipe shall preferably be done after bending, forging, heat treating, or welding operations. Where subsequent threading is very difficult and threads are cut first, they shall be fully protected during the above-mentioned operations. Threads shall be concentric with the outside of the pipe.
7. Pipe dope shall be applied to male threads only. Teflon tape, when used as thread dope, shall not be applied to the first two threads.
8. When welding joints involving two different pipe wall thicknesses, the joints shall be made in accordance with ASME B31.3, Chapter V.
9. Branch connections shall be made in accordance with the requirements specified in ASME B31.3, Chapter V.
10. All butt-welded pipe shall be beveled in accordance with ASME B16.25.
11. All socketwelded pipe shall be square cut to within the tolerances specified in ASME B16.11.
12. Remove plastic or elastomeric components from welded end prior to welding in-line.
13. All welded end valves shall be in the closed position prior to welding in-line. Valves with nonmetallic seats shall be disassembled and the seat material removed prior to welding. After the weld has cooled, reassemble the seat material in the valve.
14. Arc strikes and weld starts shall not be made on the base metal outside the weld groove nor inside an area which will be encompassed by a fillet or socket weld. Inadvertent arc strikes outside a

weld zone shall be removed by grinding or filing, and the arc strike area shall be visually examined under 5X magnification.

15. Branch connection joints shall be prepared to permit full penetration welds of a quality comparable to the circumferential welds in the same piping system.
16. Welding will not be permitted on galvanized carbon steel piping.

B. Welding

1. All welding electrodes shall be in accordance with AWS A5.1.
2. All socketwelds shall be made by shielded metal arc or gas tungsten arc welding process.
3. Socketweld joints shall be assembled so that the space between the end of the pipe and the bottom of the socket is no less than 1/16 inch or no more than 1/8 inch.
4. Branch connections to headers shall be per the material data sheet branch connection charts.

C. Painting

1. All non-insulated carbon steel piping shall be painted in accordance with the requirements of Section 09900.

D. Flanged Joints

1. The mating surfaces of the flanges shall be in a plane that is perpendicular to the axis of the pipe. Flanges shall be rotated so that the bolt holes straddle the flange centerlines. All gaskets shall be evenly centered between the flange faces with ring-type gaskets engaging fully upon raised-face flanges. Flanges shall mate flush and the bolts shall be tightened uniformly to draw the flanges evenly and firmly upon the gasket. Bolts shall be torqued within the flange manufacturer's recommended range and tightening sequence.
2. All flanged joints shall be made with new gasket and bolting materials. Bolts and nuts damaged during installation shall be replaced.

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3. Flat ring-type gaskets shall be used between steel flanges equipped with raised serrated faces.
4. Where flanges of different ratings are bolted together, the rating of the joint is equal to that of the lower rated flange.
5. Where metallic flanges are bolted to non-metallic flanges, both shall be flat-faced flanges. Full-face gaskets shall be used.
6. Class 150 or Class 300 steel flanges shall be bolted to flanged cast iron valves, fittings, or equipment having integral Class 125 or Class 250 flanges, respectively. When such construction is used, flat-face steel flanges shall be used with a full-face gasket.

E. PVC Pipe Jointing

1. PVC pipes and fittings shall be joined in accordance with the manufacturer's instructions.
2. Adhesive used shall be specifically recommended by the pipe manufacturer.
3. Threaded joints shall be in accordance with the Material Data Sheet.

3.3 QUALITY CONTROL

A. Inspections and Tests

1. Piping shall be leak tested in accordance with ASME B31.3, Chapter VI.
2. All testing shall be complete systems testing conducted by the Subcontractor in the presence of FDF.
3. The Subcontractor shall submit testing procedures to FDF for approval prior to the start of testing.
4. Testing shall not start until the Subcontractor's or fabricator's testing procedure has been approved by FDF.
5. All connections/joints (including welds) shall be left uninsulated, unpainted, and exposed for examination for leakage during testing.
6. The piping system shall be inspected prior to any pressure tests to ensure that all connections are tight.

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7. Test pressure gauges shall be calibrated no more than 30 days prior to the test.
8. Every precaution shall be taken during pressure testing to ensure personnel safety.
9. All pressure vessels, equipment, in-line instruments, gauge glasses, flow meter pots, and all other pressure parts of instruments shall not be included in these tests if they will be damaged by the test pressure.
10. Equipment which is not to be subjected to the pressure test shall be disconnected from the piping and a pipe spool inserted in its place, or the equipment may be isolated by way of a single-line blind. Valves may be used provided that the valve is suitable for the proposed test procedure.
11. Pressure gauges shall not be subjected to pressure in excess of their scale range. All pieces of equipment with no indicated test pressure, or with test pressures below the piping system test pressure, shall be excluded from these tests.
12. Control valves (unless being tested) shall be set and maintained in the full open position.
13. Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat.
14. Joints found to be defective shall be repaired and retested. Retest pressures shall be the same as those originally specified for the test.
15. Measurement and test equipment shall be calibrated and traceable to NIST. Gauges shall be selected so that test pressures are between 33 and 67 percent of gauge full scale.

B. Hydrostatic Testing

1. Potable water or other approved fluids shall be used for hydrostatic pressure testing in accordance with ASME B31.3, Chapter VI.
2. Hydrostatic test pressures shall be 1.5 times the design pressure as shown in the following table:

Service	Medium Code	Design Pressure (psig)	Test Pressure (psig)
Groundwater	GW	150	225

3. Hydrostatic test pressures shall not be applied until the piping system and the testing medium have reached thermal equilibrium.
4. Provide high-point vents and low-point drains as required for hydrostatic tests.
5. Upon completion of hydrostatic testing, piping shall be blown dry using filtered compressed air. Immediately following the drying operation, all openings shall be covered, capped, or plugged to prevent ingress of foreign matter.

C. Test Reports

1. The Subcontractor shall provide a report for each piping system tested containing the following information:
  - a. Date of test
  - b. Line designation number
  - c. Test fluid
  - d. Type of test
  - e. Pressure applied
  - f. Start time
  - g. Completion time
  - h. Total time at test pressure
  - i. Certification by examiner of acceptability
  - j. Fluid test temperature
  - k. Gauge number

3.4 CLEANING

A. System Cleaning and Flushing

1. The interior and exterior of all pipe shall be kept clean at all times. Piping shall be free from loose mill scale, sand, dirt, slag, weld spatter, rust, fins, burrs and other foreign matter when erected. Burrs shall be removed by reaming. Other defects shall be removed by machining, chipping,

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filing, or grinding.

2. After erection and welding of piping, all lines except air shall be flushed with potable water prior to leak testing. Upon completion of flushing, lines shall be drained at all low points.
- B. Sandblasted surfaces shall be free of residual quantities of cleaning media such as grit, aluminum oxide, or silicon prior to installation.
- C. The use of cleaning fluids containing free chlorine shall be prohibited.

END OF SECTION

ATTACHMENT A

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PIPING MATERIAL DATA SHEETS

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PIPING MATERIAL DATA SHEET

MAT'L CODE A  
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RATING: CLASS 150  
MATERIAL: CARBON STEEL

CORROSION ALLOWANCE: 0.125"  
PRESSURE LIMIT: PER ASME/ANSI B16.5  
TEMPERATURE LIMIT: -20°F TO 200°F

CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			PIPE		
		1/4" - 2"	SEAMLESS CARBON STEEL, ASTM A53 GRADE B, EXTRA STRONG. PLAIN ENDS.		
		2-1/2" - 20"	SEAMLESS CARBON STEEL, ASTM A53 GRADE B, STANDARD WEIGHT, BEVELED ENDS.		
			FLANGES		
		1/2" - 2"	CLASS 150, CARBON STEEL, RF, ASTM A105, SOCKETWELD (XS BORE).		
		2-1/2" - 20"	CLASS 150, CARBON STEEL, RFSF, ASTM A105, WELD NECK (STD WT BORE).		
		1/2" - 20"	CLASS 150 BLIND, CARBON STEEL, ASTM A105, RFSF.		
			ORIFICE FLANGES		
		2-1/2" - 20"	CLASS 300, CARBON STEEL, ASTM A105, RF WITH 1/2" SCREWED TAPS AND JACK SCREWS, WELD NECK, (STD WT BORE).		
			FITTINGS		
		1/4" - 2"	CLASS 3000, CARBON STEEL, ASTM A105; SOCKETWELD.		
		1/4" - 2"	CLASS 3000, SCREWED CARBON STEEL, ASTM A105 THREDOLET. PLUG, SQUAREHEAD. CAP. PLUG, HEX HEAD.	1 1 1 3	
		2-1/2" - 20"	SEAMLESS CARBON STEEL, BUTT WELD ENDS, ASTM A234 GRADE WPB.		
			SWAGES		
		3/8" - 4"	SCHEDULE 80 CARBON STEEL, ASTM A234, GRADE WPB, PREPARE ENDS AS REQUIRED (BEVELED, PLAIN OR THREADED).	2	
			GASKETS		
		1/2" - 20"	RED RUBBER, 1/8" THICK		

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PIPING MATERIAL DATA SHEET

MAT'L CODE  
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CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			BOLTING		
		1/2" - 20"	STUD BOLTS WITH 2 HEAVY HEX NUTS, ASTM A193 GRADE B7/ASTM A194 GRADE 2H.		
			BRANCHES		
			SEE CHART		
			BALL VALVES		
		3/8" - 2"	CLASS 300 CARBON STEEL, ASTM A105, SOCKETWELD, CHROME PLATED BALL, FEP SEATS, WRENCH OPERATOR.	4,5	
			BALL VALVES		
		2-1/2" - 8"	CLASS 150 CARBON STEEL, ASTM A216, GRADE WCB RF FLG, CHROME PLATED BALL, FEP SEATS, WRENCH OPERATOR FOR 4" AND SMALLER, GEAR OPERATOR FOR 6" AND LARGER.	4,5	
			BUTTERFLY VALVES		
		1" - 20"	CLASS 150, CAST IRON, ASTM A126, CLASS B, WAFER STYLE, 316 SS STEM AND DISC, EPDM SEAT, INTEGRAL FLANGE SEALS, LEVER HANDLE OPERATOR FOR 1-4", GEAR OPERATOR FOR 6" AND LARGER.	4,5,7	
			CHECK VALVES		
		1/2" - 2"	CLASS 150, CAST STEEL, ASTM A216, GRADE WCB, RF FLANGE, SWING TYPE, 11-13 CR TRIM.		
		2-1/2" - 20"	CLASS 150, CAST STEEL, ASTM A216, WAFER STYLE, BRONZE TRIM, STAINLESS STEEL SPRING, SILENT CHECK VALVE.		
			GLOBE VALVES		
		1/2" - 2"	CLASS 800, CARBON STEEL, ASTM A105, SOCKETWELD, BOLTED BONNET, OS&Y, 12% CHROME TRIM, HANDWHEEL OPERATOR	4,5	
		2-1/2" - 8"	CLASS 150, CARBON STEEL, ASTM A216 GRADE WCB.RF FLANGE, 12% CHROME TRIM, HANDWHEEL OPERATOR	4,5	
			GATE VALVES		
		1/4" - 2"	CLASS 800, CARBON STEEL, ASTM A105, SOCKETWELD ENDS, OS&Y, BOLTED BONNET, SOLID WEDGE, 12% CR TRIM.	4,5,6	
		2-1/2" - 8"	CLASS 150, CAST STEEL, ASTM A216, GRADE WCB, RF FLANGE, 11-13 CR TRIM, O.S. & Y	4,5	

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PIPING MATERIAL DATA SHEET				MAT'L CODE	A
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CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
			<p style="text-align: center;">PIPE NIPPLES</p> <hr/> <p>CARBON STEEL, ASTM A53, GRADE B</p> <p>1/2" - 2" SCH 80, TBE, SMLS 3" LONG                      1/2" - 2" SCH 80, TBE, SMLS 6" LONG                      1/2" - 2" SCH 80, POE-TOE, SMLS 3" LONG                      1/2" - 2" SCH 80, POE-TOE, SMLS 6" LONG                      1/2" - 2" SCH 80, PBE, SMLS 3" LONG                      1/2" - 2" SCH 80, PBE, SMLS 6" LONG</p> <hr/> <p style="text-align: center;">NOTES</p> <hr/> <ol style="list-style-type: none"> <li>1. USE FOR UNVALVED VENTS AND DRAINS.</li> <li>2. USE SWAGES WHERE SMALL END IS 2" AND SMALLER. USE WELD REDUCER WHERE SMALL END IS 2 1/2" AND LARGER.</li> <li>3. USE FOR PROCESS DRAIN.</li> <li>4. EQUIP VALVE WITH LOCKING DEVICE WITH NOT LESS THAN 3/8" DIAMETER HOLE FOR LOCK.</li> <li>5. VALVE HANDLE STEMS SHALL PROTRUDE SUFFICIENTLY THROUGH PIPE INSULATION TO ALLOW VALVE OPERATION WITHOUT HAND ABRASION OR PINCHING.</li> <li>6. USE THREADED ENDS FOR 1/4" SAND MONITORING VALVES.</li> <li>7. PROVIDE THREADED LUG STYLE BODY WHERE NOTED ON DRAWINGS.</li> </ol>		

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PIPING MATERIAL DATA SHEET  
MATERIAL CODE A  
BRANCH CONNECTION CHART

Run Size

1/4	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36	
SWT	SRT	SRT	STI	STI	STI	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				1/4
	SWT	SRT	SRT	STI	STI	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				1/2
		SWT	SRT	SRT	STI	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				3/4
			SWT	SRT	SRT	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				1
				SWT	SRT	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				1 1/2
					SWT	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL	SOL				2
						WT	WOL				2 1/2									
							WT	WOL				3								
								WT	WOL				4							
									WT	WOL				6						
										WT	WOL	WOL	WOL	WOL	WOL	WOL				8
											WT	WOL	WOL	WOL	WOL	WOL				10
												WT	WOL	WOL	WOL	WOL				12
													WT	WOL	WOL	WOL				14
														WT	WOL	WOL				16
															WT	WOL				18
																WT				20
																				24
																				30
																				36

Legend

- SOL = Sockolet
- SRT = Socketweld Reducing Tee
- STI = Socketweld Tee w/Insert
- SWT = Socketweld Tee
- WOL = Weldolet
- WT = Buttweld Tee

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PIPING MATERIAL DATA SHEET

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RATING: CLASS 150  
MATERIAL: PVC

CORROSION ALLOWANCE: None  
PRESSURE LIMIT: 100 psig  
TEMPERATURE LIMIT: -20°F TO 140°F

CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
		1/2" - 8"	PIPE POLYVINYL CHLORIDE (PVC) SCHEDULE 80, GRAY, ASTM D1784 and D1785, PLAIN ENDS.		
		1/2" - 8"	FITTINGS POLYVINYL CHLORIDE (PVC) SCHEDULE 80, GRAY, ASTM D2467 and D2464, SOLVENT WELD ENDS.	1	
			PRIMER PRIMER FOR PVC, PURPLE ASTM F656.		
			PLASTIC PIPE CEMENT HEAVY BODIED, SOLVENT CEMENT, GRAY ASTM D2564.		
			PIPE DOPE TEFLON TAPE.		
		1/2" - 8"	FLANGES CLASS 150, FLAT FACED, ANSI B16.5 DRILLING, PVC, SOCKET TYPE PER ASTM D2466.		
		1/2" - 8"	GASKETS TEFLON 1/8" THICK.		

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PIPING MATERIAL DATA SHEET

MAT'L CODE

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CODE NUMBER	ENCODER	SIZE FROM TO	DESCRIPTION	NOTES	REV
		1/2" - 8"	<p>BOLTS</p> <p>304 STAINLESS STEEL, ASTM A193, GRADE B8, CLASS 1, WITH HEAVY HEX NUTS ASTM A194, GRADE 8MN.</p>		
		1/2" - 6"	<p>BALL VALVES</p> <p>CLASS 150, PVC BODY, UNION TYPE END SCHEDULE 40 SOCKET WELD.</p>		
		1/2" - 8"	<p>CHECK VALVES</p> <p>CLASS 150, PVC BODY, FLANGED, VITON TRIM.</p>		
		2"-8"	<p>BUTTERFLY VALVES</p> <p>CLASS 150, PVC BODY, WAFER STYLE, VITON TRIM.</p>		
			<p>NOTES</p> <p>1. USE THREADED AND SOLVENT WELD FITTINGS WHERE SHOWN ON DRAWINGS. ALL OTHER PIPE JOINTS SHALL BE WITH FLUSH THREADS PER ASTM F480.</p>		

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ATTACHMENT B

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MASTER VALVE LABEL LIST

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## MASTER VALVE LABEL LIST

## Well 8

Valve #	Label Line 1	Label Line 2	P&ID Number
V271	GW-ID-V-271	IW 8 ARV Isolation Valve	95X-5900-N-00449
V270	GW-ID-V-270	IW 8 Sample Throttling Valve	95X-5900-N-00449
V269	GW-ID-V-269	IW 8 Sample Isolation Valve	95X-5900-N-00449
V272	GW-ID-V-272	IW 8 Header Isolation Valve	95X-5900-N-00449
V273	GW-ID-V-273	IW 8 PIT Isolation Valve	95X-5900-N-00449
V-275	GW-ID-V-275	IW 8 Sand Content Test Port Valve	95X-5900-N-00449
ARV-12	GW-ID-ARV-12	IW 8 Header Air Release Valve	95X-5900-N-00449

## Well 9

Valve #	Label Line 1	Label Line 2	P&ID Number
V280	GW-ID-V-280	IW 9 ARV Isolation Valve	95X-5900-N-00449
V281	GW-ID-V-281	IW 9 Header Isolation Valve	95X-5900-N-00449
V279	GW-ID-V-279	IW 9 Sample Throttling Valve	95X-5900-N-00449
V278	GW-ID-V-278	IW 9 Sample Isolation Valve	95X-5900-N-00449
V283	GW-ID-V-283	IW 9 Header Isolation Valve	95X-5900-N-00449
V285	GW-ID-V-285	IW 9 Header Isolation Valve	95X-5900-N-00449
V284	GW-ID-V-284	IW 9 Sand Content Test Port Valve	95X-5900-N-00449
V286	GW-ID-V-286	IW 9 Sand Content Test Port Valve	95X-5900-N-00449
V282	GW-ID-V-282	IW 9 PIT Isolation Valve	95X-5900-N-00449
ARV-13	GW-ID-ARV-13	IW 9 Header Air Release Valve	95X-5900-N-00449

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## MASTER VALVE LABEL LIST

### Well 10

Valve #	Label Line 1	Label Line 2	P&ID Number
V289	GW-ID-V-289	IW 10 ARV Isolation Valve	95X-5900-N-00449
V290	GW-ID-V-290	IW 10 Header Isolation Valve	95X-5900-N-00449
V288	GW-ID-V-288	IW 10 Sample Throttling Valve	95X-5900-N-00449
V287	GW-ID-V-287	IW 10 Sample Isolation Valve	95X-5900-N-00449
V292	GW-ID-V-292	IW 10 Header Isolation Valve	95X-5900-N-00449
V294	GW-ID-V-294	IW 10 Header Isolation Valve	95X-5900-N-00449
V293	GW-ID-V-293	IW 10 Sand Content Test Port Valve	95X-5900-N-00449
V295	GW-ID-V-295	IW 10 Sand Content Test Port Valve	95X-5900-N-00449
V291	GW-ID-V-291	IW 10 PIT Isolation Valve	95X-5900-N-00449
ARV-14	GW-ID-ARV-14	IW 10 Header Air Release Valve	95X-5900-N-00449

### Well 11

Valve #	Label Line 1	Label Line 2	P&ID Number
V298	GW-ID-V-298	IW 11 ARV Isolation Valve	95X-5900-N-00449
V299	GW-ID-V-299	IW 11 Header Isolation Valve	95X-5900-N-00449
V297	GW-ID-V-297	IW 11 Sample Throttling Valve	95X-5900-N-00449
V296	GW-ID-V-296	IW 11 Sample Isolation Valve	95X-5900-N-00449
V301	GW-ID-V-301	IW 11 Header Isolation Valve	95X-5900-N-00449
V303	GW-ID-V-303	IW 11 Header Isolation Valve	95X-5900-N-00449
V302	GW-ID-V-302	IW 11 Sand Content Test Port Valve	95X-5900-N-00449
V304	GW-ID-V-304	IW 11 Sand Content Test Port Valve	95X-5900-N-00449
V300	GW-ID-V-300	IW 11 PIT Isolation Valve	95X-5900-N-00449
ARV-15	GW-ID-ARV-15	IW 11 Header Air Release Valve	95X-5900-N-00449

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Well 12

Valve #	Label Line 1	Label Line 2	P&ID Number
V307	GW-ID-V-307	IW 12 ARV Isolation Valve	95X-5900-N-00449
V308	GW-ID-V-308	IW 12 Header Isolation Valve	95X-5900-N-00449
V306	GW-ID-V-306	IW 12 Sample Throttling Valve	95X-5900-N-00449
V305	GW-ID-V-305	IW 12 Sample Isolation Valve	95X-5900-N-00449
V310	GW-ID-V-310	IW 12 Header Isolation Valve	95X-5900-N-00449
V312	GW-ID-V-312	IW 12 Header Isolation Valve	95X-5900-N-00449
V311	GW-ID-V-311	IW 12 Sand Content Test Port Valve	95X-5900-N-00449
V313	GW-ID-V-313	IW 12 Sand Content Test Port Valve	95X-5900-N-00449
V309	GW-ID-V-309	IW 12 PIT Isolation Valve	95X-5900-N-00449
ARV-16	GW-ID-ARV-16	IW 12 Header Air Release Valve	95X-5900-N-00449

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## MASTER VALVE LABEL LIST

### Injection Water Supply Tank and Pumps

Value #	Label Line 1	Label Line 2	P&ID Number
V253	GW-ID-V-253	Pump Suction Header Isolation Valve	95X-5900-N-00449
V252	GW-ID-V-252	Tank Drain Valve	95X-5900-N-00449
V255	GW-ID-V-255	Sample Throttling Valve	95X-5900-N-00449
V254	GW-ID-V-254	Sample Isolation Valve	95X-5900-N-00449
V256	GW-ID-V-256	Future Pump Suction Isolation Valve	95X-5900-N-00449
V257	GW-ID-V-257	Pump Suction Isolation Valve	95X-5900-N-00449
V261	GW-ID-V-261	Pump Suction Isolation Valve	95X-5900-N-00449
V259	GW-ID-V-259	Pump Discharge Check Valve	95X-5900-N-00449
V263	GW-ID-V-263	Pump Discharge Check Valve	95X-5900-N-00449
V260	GW-ID-V-260	Pump Discharge Isolation Valve	95X-5900-N-00449
V264	GW-ID-V-264	Pump Discharge Isolation Valve	95X-5900-N-00449
V265	GW-ID-V-265	Future Pump Discharge Isolation Valve	95X-5900-N-00449
V330	GW-ID-V-330	Discharge Header ARV Isolation Valve	95X-5900-N-00449
V314	GW-ID-V-314	FCV 055 Isolation Valve	95X-5900-N-00449
V315	GW-ID-V-315	FCV 055 Isolation Valve	95X-5900-N-00449
V316	GW-ID-V-316	FCV 055 By-pass Valve	95X-5900-N-00449
ARV-18	GW-ID-ARV-18	Pump Discharge Header Air Release Valve	95X-5900-N-00449

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## MASTER VALVE LABEL LIST

## Underground Valves

Valve #	Label Line 1	Label Line 2	P&ID Number
V266	GW-ID-V-266	Future Injection PIV	95X-5900-N-00449
V267	GW-ID-V-267	Future Injection PIV	95X-5900-N-00449
V268	GW-ID-V-268	Future Injection PIV	95X-5900-N-00449
ARV-5	GW-ID-ARV-5	Injection Water Supply Air Release Valve	95X-5900-N-00448
V320	GW-ID-V-320	Injection Water Supply ARV-5 Isolation Valve	95X-5900-N-00448
ARV-6	GW-ID-ARV-6	Injection Header Air Release Valve	95X-5900-N-00448
V321	GW-ID-V-321	Injection Header ARV-6 Isolation Valve	95X-5900-N-00448
ARV-7	GW-ID-ARV-7	Injection Header Air Release Valve	95X-5900-N-00448
V323	GW-ID-V-323	Injection Header ARV-7 Isolation Valve	95X-5900-N-00448
AVV-3	GW-ID-AVV-3	Injection Header Air Vacuum Valve	95X-5900-N-00448
V322	GW-ID-V-322	Injection Header AVV-3 Isolation Valve	95X-5900-N-00448
ARV-8	GW-ID-ARV-8	Injection Header Air Release Valve	95X-5900-N-00448
V-325	GW-ID-V-325	Injection Header ARV-8 Isolation Valve	95X-5900-N-00448
AVV-4	GW-ID-AVV-4	Injection Header Air Vacuum Valve	95X-5900-N-00448
V-324	GW-ID-V-324	Injection Header AVV-4 Isolation Valve	95X-5900-N-00448
ARV-9	GW-ID-ARV-9	Injection Header Air Release Valve	95X-5900-N-00448
V-327	GW-ID-V-327	Injection Header ARV-9 Isolation Valve	95X-5900-N-00448
AVV-5	GW-ID-AVV-5	Injection Header Air Vacuum Valve	95X-5900-N-00448
V-326	GW-ID-V-326	Injection Header AVV-5 Isolation Valve	95X-5900-N-00448
ARV-10	GW-ID-ARV-10	Injection Header Air Release Valve	95X-5900-N-00448
V-328	GW-ID-V-328	Injection Header ARV-10 Isolation Valve	95X-5900-N-00448
ARV-11	GW-ID-ARV-11	Injection Header Air Release Valve	95X-5900-N-00448
V329	GW-ID-V-329	Injection Header ARV-11 Isolation Valve	95X-5900-N-00448

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**MASTER VALVE LABEL LIST**

Well RW 6

Valve #	Label Line 1	Label Line 2	P&ID Number
V220	GW-SPO-V-220	RW 6 Pump Discharge Check Valve	95X-5900-N-00448
V201	GW-SPO-V-201	RW 6 Pump Discharge Isolation Valve	95X-5900-N-00448
V200	GW-SPO-V-200	RW 6 AVV Isolation Valve	95X-5900-N-00448
V226	GW-SPO-V-226	RW 6 ARV Isolation Valve	95X-5900-N-00448
V207	GW-SPO-V-207	RW 6 Sample Throttling Valve	95X-5900-N-00448
V206	GW-SPO-V-206	RW 6 Sample Isolation Valve	95X-5900-N-00448
V203	GW-SPO-V-203	RW 6 Header Check Valve	95X-5900-N-00448
V204	GW-SPO-V-204	RW 6 Meter Isolation Valve	95X-5900-N-00448
V218	GW-SPO-V-218	RW 6 Meter Isolation Valve	95X-5900-N-00448
V202	GW-SPO-V-202	RW 6 PIT Isolation Valve	95X-5900-N-00448
V205	GW-SPO-V-205	RW 6 ARV Isolation Valve	95X-5900-N-00448
AVV-1	GW-SPO-AVV-1	RW 6 Air Vacuum Valve	95X-5900-N-00448
ARV-1	GW-SPO-ARV-1	RW 6 Air Release Valve	95X-5900-N-00448
ARV-3	GW-SPO-ARV-3	RW 6 Header Air Release Valve	95X-5900-N-00448

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## MASTER VALVE LABEL LIST

Well RW 7

Valve #	Label Line 1	Label Line 2	P&ID Number
V221	GW-SPO-V-221	RW 7 Pump Discharge Check Valve	95X-5900-N-00448
V211	GW-SPO-V-211	RW 7 Pump Discharge Isolation Valve	95X-5900-N-00448
V210	GW-SPO-V-210	RW 7 AVV Isolation Valve	95X-5900-N-00448
V227	GW-SPO-V-227	RW 7 ARV Isolation Valve	95X-5900-N-00448
V217	GW-SPO-V-217	RW 7 Sample Throttling Valve	95X-5900-N-00448
V216	GW-SPO-V-216	RW 7 Sample Isolation Valve	95X-5900-N-00448
V213	GW-SPO-V-213	RW 7 Header Check Valve	95X-5900-N-00448
V214	GW-SPO-V-214	RW 7 Meter Isolation Valve	95X-5900-N-00448
V219	GW-SPO-V-219	RW 7 Meter Isolation Valve	95X-5900-N-00448
V212	GW-SPO-V-212	RW 7 PIT Isolation Valve	95X-5900-N-00448
V215	GW-SPO-V-215	RW 7 ARV Isolation Valve	95X-5900-N-00448
AVV-2	GW-SPO-AVV-2	RW 7 Air Vacuum Valve	95X-5900-N-00448
ARV-2	GW-SPO-ARV-2	RW 7 Air Release Valve	95X-5900-N-00448
ARV-4	GW-SPO-ARV-4	RW 7 Header Air Release Valve	95X-5900-N-00448

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SECTION 15090  
PIPING SUPPORTS AND ANCHORS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Piping supports, anchors, and accessories.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 09900 - Painting.  
D. Section 15060 - Pipe, Fittings, Valves, and Accessories.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):  
1. ASTM A36/A36M-96 Standard Specification for Carbon Structural Steel.
- B. American Welding Society (AWS):  
1. AWS A5.1-91 Carbon Steel Electrodes for Shielded Metal Arc Welding.  
2. AWS D1.1-96 Structural Welding Code - Steel.
- C. Manufacturers Standardization Society (MSS):  
1. MSS SP-89-91 Pipe Hangers and Supports - Fabrication and Installation Practices.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Welder, examiner, and procedure qualifications, qualification records, and welding procedure specifications.

**1.6 QUALITY ASSURANCE**

- A. All pipe supports and auxiliary steel shall be of bolted or welded construction complying with MSS SP-89. Welded construction shall comply with AWS D1.1.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Handling
  - 1. Piping support materials and piping hanger systems shall be stored off the ground and handled with care so that physical damage to the materials does not occur.
  - 2. Care shall be taken in the storage and handling of all piping support materials and pipe hanger systems so that corrosion or contamination by grease, moisture, or other foreign matter does not occur.
  - 3. Welding rods and electrodes shall be stored, handled, and identified at all times to ensure the use of the proper welding rod. Electrode ovens for the storage of low-hydrogen welding rods shall be used at all times.

**PART 2 PRODUCTS**

**2.1 PRODUCTS/EQUIPMENT**

- A. Product Shipping Requirements
  - 1. All furnished materials and equipment shall be delivered clean, undamaged, and in good condition.

**2.2 MATERIALS**

- A. ASTM A36 steel shall be used for all plate and structural shape support components.

**2.3 FABRICATION****A. Welding**

1. All welding shall be in accordance with AWS D1.1.

**B. Shop Assembly**

1. Parts made in the supplier's shop shall be completely shop assembled, as far as practical, prior to shipment to the site.

**C. Shop/Factory Finish**

1. All carbon steel parts shall be painted in accordance with the requirements of Section 09900.

**2.4 LABELING****A. Product Marking**

1. All welding rods and electrodes shall be identified with at least one imprint per rod showing an AWS classification number in accordance with AWS A5.1. In addition, welding rods 1/8-inch diameter and over shall be marked or stamped with positive identification marks at intervals of not more than 18 inches. Such marks shall be clearly distinguishable and shall include the classification number of the welding rod and the trade designation of the manufacturer. Filler metal requirements shall conform to AWS A5.1.

**PART 3 EXECUTION****3.1 QUALITY CONTROL**

- A. The Subcontractor shall perform all quality control visual examinations. The Subcontractor shall give FDF written notice before a visual examination can be performed.

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3.2 PREPARATION

A. Protection

1. All welding/fabricating activities shall be protected from inclement weather at all times.

B. Primer Application

1. All structural steel pipe support material systems shall be prime coated after fabrication. The items that are painted as standard by the manufacturer do not require prime coating. Primer shall be in accordance with Section 09900.

3.3 ERECTION/INSTALLATION/APPLICATION

A. Installation

1. Support components shall be installed in accordance with details shown on the piping drawings.
2. Supports shall be installed at the locations shown on the piping drawings.

END OF SECTION

SECTION 15160  
INJECTION WATER SUPPLY PUMPS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Centrifugal pumps (Nos. PMP-1A and 1B)

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 15170 - Motors.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. Hydraulic Institute Standards.  
B. American Society of Mechanical Engineers (ASME):  
1. ASME B73.1M-91 Horizontal End Suction Centrifugal  
Pumps for Chemical Process.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.  
B. Product Data: Certified pump curves for each pump model supplied, showing performance characteristic with all pump and system operating points plotted, including minimum and maximum flow. Include net positive suction head curve.  
C. Completed Pump Data Sheets.

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- D. Certificates: Alignment certification, certificates of conformance to specification requirements, and certificates guaranteeing performance at design point.
- E. Installation instructions, start-up and troubleshooting instructions, operational and maintenance data, lubrication instructions, and spare parts list.

**1.6 QUALITY ASSURANCE**

- A. The Quality Assurance Plan of the Subcontractor shall be submitted to FDF for approval prior to the start of fabrication or installation.
- B. Tests will be witnessed by FDF. The Subcontractor shall provide notice to FDF 2 weeks prior to the test.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry place and protect from weather prior to shipment. Provide protection from weather and from damage during transit.
- B. Loose items shall be tagged and delivered in a standard commercial package. The package shall be protected from the weather, from climate conditions including temperature and humidity variations, and from dirt, dust, and other contaminants that could adversely affect assembly and operation of the pumps.

**PART 2 PRODUCTS**

**2.1 MANUFACTURER**

- A. Goulds Model 3196, or equal.

**2.2 EQUIPMENT**

- A. General Construction Requirements
  - 1. The balancing of the rotating parts, statically and dynamically, shall be in accordance with the manufacturer's standards.

2. All couplings shall be complete with "guarding" of any possible "nip point." This guarding shall have a maximum of 1/2-inch opening.

B. Pumps

1. See Attachment A, Pump Data sheet.

- C. Sound power levels shall not exceed 85 dBA at 3 feet.

### 2.3 FABRICATION

- A. Prior to shipment, the pump/motor assembly shall be cleaned of all dirt, dust, grease, grime, weld spatter, and other foreign material. Pumps shall be primed and painted in accordance with manufacturer's standard finish. Any open end connections shall be sealed to prevent the entrance of foreign material.

### 2.4 LABELING

- A. Equipment Identification: All pumps shall be provided with a permanently attached stainless steel nameplate indicating equipment name, number, model number, and rated capacity. Lettering shall be a minimum of 3/8-inch high and shall be stamped. Nameplates shall be located for unobstructed viewing when equipment is installed.

## PART 3 EXECUTION

### 3.1 ERECTION/INSTALLATION/APPLICATION

- A. The installation of the equipment specified and shown on the drawings shall be in accordance with the manufacturer's instructions.
- B. A copy of the manufacturer's installation instructions, start-up and troubleshooting instructions, operation and maintenance data, lubrication instructions, and spare parts list shall be available at the site.

- C. Pump manufacturer shall provide services of Service Engineer during pump installation, start-up, and testing.

### 3.2 QUALITY CONTROL

- A. Tests: Each pump shall be tested in the manufacturer's shop in accordance with the Hydraulic Institute Standards. In addition, acceptance operating tests shall be performed by the Subcontractor after installation. If the results are unsatisfactory, the Subcontractor shall adjust or replace the equipment to meet the specification requirements and retest the equipment.
- B. The Subcontractor shall notify FDF of testing and inspection activities prior to the start of all tests and inspections.
- C. Testing shall not start until the testing procedure has been approved by FDF.

### 3.3 DEMONSTRATION

- A. Demonstrate ability to meet full range of operating flow rates and operating point as shown on pump curves. Vibration shall be within manufacturer's acceptable range.

END OF SECTION

ATTACHMENT A

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PUMP DATA SHEET

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PUMP DATA SHEET									
PROJECT TITLE: South Plume Injection Demonstration						PROJECT ORDER: 169			
PUMP NAME: Injection Water Supply Pumps						QUANTITY: 2			
TYPE PUMP: Base-mounted horizontal centrifugal						EQUIP NO.: PMP-1A and 1B			
TYPE DRIVER: Electric motor (Note 1)			SUPPLY W/PUMP: YES			DRAWING NO.: 95X-5900-N-00449			
MANUFACTURER AND MODEL NO.:									
OPERATING CONDITIONS									
FLUID PUMPED:		Groundwater			AT A PUMPING TEMPERATURE OF:			60 °F	
SPECIFIC GRAVITY: 1.0 AT 60 °F		NA AT P.T.			VISCOSITY: NA		AT P.T.		
SOLIDS IN FLUID: <1 WT%		DENSITY: NA			SIZE: NA		ABRASIVE: NA		
NATURE OF SOLIDS:					FLUID VAPOR PRESSURE: NA FT. of FLUID @ P.T.				
DESIGN CAPACITY: 1000 GPM AT		200 FT. at P.T.			DESIRED RANGE:		800 GPM TO 1200 GPM		
SUCTION PRESS: 10 FT. PSIG			DISCHARGE PRESS: 210 FT. PSIG			NPSH AVAIL: flooded FT. at P.T.			
PUMP SPECIFICATIONS									
TYPE PUMP: Horizontal end suction centrifugal, direct-connected						NO. STAGES: 1		RPM: 1800	
TYPE IMPELLER: Semi-open, keyed to shaft						SIZE: IN.		MAX SIZE: IN.	
EFFICIENCY AT DESIGN CAPACITY: 78 (min) %				BHP @ DESIGN CAPACITY:		MAXIMUM BHP: 100			
TYPE BEARINGS: Oil-lubricated, anti-friction									
TYPE COUPLING: Flexible coupling with coupling guard						LUBRICATION:			
TYPE OF SEAL: Mechanical									
CONNECTIONS - SIZE & RATING									
SUCTION: IN. 150 LB. Flange					DISCHARGE: IN. 150 LB. Flanged				
VENT: IN. LB.					DRAIN: 1/2 IN. NPT w/plugs				
CONSTRUCTION MATERIALS									
RESTRICTIONS:									
CASING: Cast iron, radially split, with drain plugs					IMPELLER: 316 stainless steel				
SHAFT: Alloy steel					SHAFT SLEEVE: stainless steel				
CASE RING:					IMP. RING:				
BASE PLATE: Cast iron with integral drain rim					RELIEF VALVE: NA				
ELECTRIC MOTOR									
VOLTS	PHASE	HERTZ	H.P.	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE	
460	3	60	100 (max.)	Yes			1800	TEFC	
REMARKS: Data sheet shall be completed as required.									
Pumps shall be in accordance with ASME B73.1M.									
Note 1: See Section 15170 for electric motor requirements.									

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SECTION 15161  
WELL PUMPS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Submersible, motor-driven well pumps (Nos. PMP-RW6 and RW7).

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 15170 - Motors.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. Hydraulic Institute Standards.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Product Data: Certified pump curves for each pump supplied, showing performance characteristic with all pump and system operating points plotted, including minimum and maximum flow. Include net positive suction head curve.
- C. Completed pump data sheets.
- D. Certificates: Alignment certification, certificates of conformance to specification requirements, and certificates guaranteeing performance at design point.

- E. Installation instructions, start-up and troubleshooting instructions, operational and maintenance data, lubrication instructions, and spare parts list.

**1.6 QUALITY ASSURANCE**

- A. The Quality Assurance Plan of the Subcontractor shall be submitted to FDF for approval prior to the start of fabrication or installation.
- B. Tests will be witnessed by FDF. The Subcontractor shall provide notice to FDF 2 weeks prior to the test.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry place and protect from weather prior to shipment. Provide protection from weather and from damage during transit.
- B. Loose items shall be tagged and delivered in a standard commercial package. The package shall be protected from the weather, from climate conditions including temperature and humidity variations, and from dirt, dust, and other contaminants that could adversely affect assembly and operation of the pumps.

**PART 2 PRODUCTS**

**2.1 MANUFACTURER**

- A. Byron Jackson, or equal.

**2.2 EQUIPMENT**

- A. General Construction Requirements
  - 1. The balancing of the rotating parts, statically and dynamically, shall be in accordance with the manufacturer's standards.
- B. Pumps
  - 1. See Attachment A, Pump Data Sheets.

2.3 FABRICATION

- A. Prior to shipment, the pump/motor assembly shall be cleaned of all dirt, dust, grease, grime, weld spatter, and other foreign material. Pumps shall be primed and painted in accordance with manufacturer's standard finish. Any open end connections shall be sealed to prevent the entrance of foreign material.

PART 3 EXECUTION

3.1 SCHEDULES

- A. For well data and pump heads, see Attachment A.

3.2 ERECTION/INSTALLATION/APPLICATION

- A. The installation of the equipment specified and shown on the drawings shall be in accordance with the manufacturer's instructions.
- B. A copy of the manufacturer's installation instructions, start-up and troubleshooting instructions, operation and maintenance data, lubrication instructions, and spare parts list shall be available at the site.
- C. Pump manufacturer shall provide services of Service Engineer during pump installation, start-up, and testing.

3.3 QUALITY CONTROL

- A. Tests: Each pump shall be tested in the manufacturer's shop in accordance with the Hydraulic Institute Standards. In addition, acceptance operating tests shall be performed by the Subcontractor after installation. If the results are unsatisfactory, the Subcontractor shall adjust or replace the equipment to meet the specification requirements and retest the equipment.

- B. The Subcontractor shall notify FDF of testing and inspection activities prior to the start of all tests and inspections.
- C. Testing shall not start until the testing procedure has been approved by FDF.

**3.4 DEMONSTRATION**

- A. Demonstrate ability to meet full range of operating flow rates and operating point as shown on pump curves. Vibration shall be within manufacturer's acceptable range.

**END OF SECTION**

**ATTACHMENT A**

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**WELL DATA AND PUMP DATA SHEETS**

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Table A-1 - South Plume Optimization Well Data (Elevations in Feet)

Well Number	Ground Elevation	SWL Elevation (see Note 2)	TOS Elevation (see Note 3)	BOS Elevation (see Note 4)	PWL Elevation (see Note 5)	Pump intake Elevation (see Note 7)	Bottom of Well (Approx.)	Pumping Head at Discharge Flange (ft) (see Note 6)
RW6	578.26	515	505.5	465.5	510.5	485.5	460.5	180
RW7	581	515	515.5	465.5	510.5	485.5	460.5	250

Notes:

1. All wells have 12-inch I.D. Casing and a 5-foot deep sump below the screen.
2. Static Water Level (SWL) is minimum of 1994 site data for each well location.
3. Top of Screen (TOS) elevation is 9.5 feet below SWL.
4. Bottom of Screen (BOS) elevation is 40 feet below TOS. (Screen length to be verified by sampling and sieve analysis results.)
5. Pumping Water Level (PWL) assumes a net drawdown of 4.5 feet for all wells at maximum rated pump capacity.
6. Pump heads are at 300 gpm flow.
7. Elevation given is  $\pm$  1 foot.

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## SUBMERSIBLE PUMP DATA SHEET

PUMP NAME: Submersible Pump		EQUIP. NO.: PMP-RW6 and RW7		PROJECT ORDER: 169				
PROJECT TITLE: South Plume Optimization and Injection Demonstration			QUANTITY: 2					
DRAWING NO.: 95X-5900-N-00448								
TYPE PUMP: Submersible		TYPE DRIVER: Submersible Electric motor		SUPPLY W/PUMP: (Note 6)				
<b>OPERATING CONDITIONS</b>								
FLUID PUMPED: Groundwater		pH Range: 7 to 9		TSS: 3 mg/L				
DESIGN CAPACITY: 250 gpm		Range: 100 gpm to 300 gpm						
HEAD AND WELL DATA: See Table A-1								
<b>PUMP SPECIFICATIONS</b>								
TYPE PUMP: Submersible pump, underground discharge								
STAGES: Multistage			RPM: Maximum 1,750					
EFFICIENCY: Minimum 70%			TYPE IMPELLER: Closed					
<b>CONNECTIONS</b>								
DISCHARGE: 6-inch								
<b>CONSTRUCTION MATERIALS</b>								
DISCHARGE COLUMN: Carbon steel, 4-inch diameter, threaded sleeve-type connections (Note 1)								
COLUMN LINE SHAFT: N/A								
BEARINGS: Water lubricated rubber/bronze for bowl; grease or oil lubricated thrust bearing.								
BOWL ASSEMBLY: Enameled cast iron								
IMPELLER: Bronze		IMPELLER SHAFT: Stainless Steel						
INLET STRAINER: Corrosion-resistant (Note 2)								
DISCHARGE HEAD: See Note 4								
WATER LEVEL INDICATOR: N/A								
SOLE PLATE: N/A								
<b>ELECTRIC MOTOR</b>								
VOLTS	PHASE	HERTZ	HP	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE
460	3	60	30	YES			1750	Totally Enclosed for Submersible Use (Note 3)
<b>REMARKS:</b>								
Note 1: Discharge column shall be supplied in maximum 10-foot-long interchangeable sections; plus one spare 5-foot-long section to allow for field adjustment. Column shall be epoxy coated inside and outside for protection against iron deposits. Coating shall be Tnemec Series 20 "Po Pox," or equal. Apply in accordance with manufacture's recommendations.								
Note 2: Net inlet area of strainer shall be greater than or equal to four times suction pipe area.								
Note 3: For additional details, see Section 15170.								
Note 4: Provide carbon steel pitless adapter unit with 6" flanged discharge and provide opening for 1/2 inch chlorine injection tubing.								
Note 5: Data sheet shall be completed by vendor as required.								
Note 6: Pump and motor shall be procured from same vendor.								

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SECTION 15170  
MOTORS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Low-voltage, three phase induction motors.
- B. Low-voltage, three phase induction motors, submersible.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 15160 - Injection Water Supply Pumps.
- D. Section 15161 - Well Pumps.
- E. Section 15500 - Heating, Ventilating, and Air Conditioning.
- F. Section 16050 - Basic Electrical Materials and Methods.
- G. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American Bearing Manufacturers Association (ABMA):
  - 1. ABMA 9-90 Load Ratings and Fatigue Life for Ball Bearings.
  - 2. ABMA 11-90 Load Ratings and Fatigue Life for Roller Bearings.

- B. Institute of Electrical and Electronics Engineers (IEEE):
1. IEEE 112-91 Standard Test Procedure for Polyphase Induction Motors and Generators.
- C. National Electrical Manufacturers Association (NEMA):
1. NEMA MG 1-93 Motors and Generators.
  2. NEMA MG 13-84 Frame Assignments for AC Integral-Horsepower Induction Motors.
- D. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code, 1996 Edition.
- E. Underwriters Laboratories, Inc. (UL):
1. Electrical Construction Materials Directory-96.

#### 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011.
- B. Product Data: Provide full load amps, impedances, normal and short-circuit current ratings, NEMA frame size, and additional standard nameplate data. Provide efficiency and power factor for each of 1/2, 3/4, and full load. Provide dimensional enclosure details.
- C. Test Reports: Indicate satisfactory completion of required tests and inspections. Submit results verifying performance in accordance with IEEE 112.

#### 1.6 QUALITY ASSURANCE PROGRAM

- A. Conform to NFPA 70 and NEMA MG 1.
- B. Motors shall be listed in the UL Electrical Construction Materials Directory for the purpose specified and indicated.

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**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers:
  - 1. Reliance Electric.
  - 2. U. S. Motors.
  - 3. General Electric.
  
- B. Acceptable Manufacturers, submersible:
  - 1. Byron Jackson.

**2.2 EQUIPMENT**

- A. General Construction and Requirements
  - 1. Electrical Service: Refer to related sections of the specifications and the drawings for required characteristics. Motors shall be suitable for driven equipment.
  - 2. Motors: Design for continuous operation at a temperature of 40 degrees C ambient, and for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
  - 3. Visible Nameplate: Indicating motor horsepower, voltage, phase, frequency, rpm, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, serial number, and bearing numbers. Nameplate shall be stainless steel, permanently attached to the motor frame.
  - 4. Electrical Connection: Conduit connection boxes, threaded for conduit and designed to allow for 90-degree step rotation of the conduit entrance. Oversize conduit boxes shall be provided.
  - 5. Motor Service Factor: Furnish motors with service factors required herein. Motor size in hp shall be selected to serve the driven equipment over its full performance range as though the service factor were 1.0.

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6. Motors drawing less than 250 W that are intended for intermittent service may be germane to equipment manufacturer and need not conform to these specifications.

B. Three Phase - Squirrel Cage Induction Motors

1. Motors shall be 460 V, three phase, 60 Hz.
2. Motors shall have a 1.15 service factor or higher.
3. The motor connection diagram shall be stainless steel, permanently stamped and attached to the motor either inside the conduit box or on the same side as the conduit box.
4. Starting Torque: To be matched to the driven equipment.
5. Starting Current: Not to exceed six times full-load current.
6. Power Output, Locked Rotor Torque, Breakdown or Pullout Torque: NEMA Design B characteristics or as required by the driven equipment.
7. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors or as required by the driven equipment.
8. Insulation System: Non-hygroscopic NEMA Class F or better.
9. Testing Procedure: In accordance with IEEE 112, Test Method B. Load test motors to determine freedom from electrical or mechanical defects and for compliance with performance data.
10. Motor Frames: NEMA MG 13 standard T-frames of steel, or cast iron with end brackets of cast iron.
11. Bearings: Grease lubricated, anti-friction ball bearings with housings equipped with plugged provision for prelubrication, rated for minimum ABMA 9 and 11, L-10 life of 20,000 hours.
12. Sound Power Levels: To NEMA MG 1.
13. Motors shall be high-efficiency type.
14. Motors shall be totally enclosed fan cooled (TEFC), unless specified or indicated otherwise.
15. Nominal Efficiency: Meet or exceed values in schedules as given herein at full load and rated voltage when tested in accordance with IEEE 112.

16. Nominal Power Factor: Meet or exceed values in schedules as given herein at full load and rated voltage when tested in accordance with IEEE 112.
17. Noise: Ensure motors generate noise levels less than 85 dBA under normal operating conditions at 5 feet.

C. Turbine pump motors special requirements:

1. Where motor general requirements (article 2.2.A) conflict with manufacturer's normal submersible motor design, written exception shall be taken.
2. Motors shall be submersible.
3. Motors shall be filled with a high dielectric strength food grade mineral oil which shall serve as cooling medium. The oil shall be continuously circulated and filtered.
4. Water flow across the motor shall not be required for cooling.
5. Motor cable shall be supplied suitable for submersible construction, sealed against moisture for all penetration of pump/ motor unit. Cable and any plugs and splices shall be tested for anticipated water pressure. High potential tests on the cable shall have been performed under water at twice rated voltage plus 1000 volts.

D. Performance Schedule: Three Phase - Standard efficiency, TEFC.

HP Factor	RPM (Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor
1-1/2	3600	143T	82	85
2	3600	145T	82	87
3	3600	145T	84	85
5	3600	182T	85	86
7-1/2	3600	184T	86	88
10	3600	213T	87	86
15	3600	215T	89	89
20	3600	254T	90	89
25	3600	256T	90	92
30	3600	284T	91	91
40	3600	286T	92	92
50	3600	324T	93	89
60	3600	326T	93	91
75	3600	364T	93	88
100	3600	365T	92	88
125	3600	444T	95	88
1	1800	143T	82	84
1-1/2	1800	145T	84	85
2	1800	145T	84	85
3	1800	182T	86	86
5	1800	184T	87	87
7-1/2	1800	213T	88	86
10	1800	215T	89	85
15	1800	256T	91	85
20	1800	256T	91	86
25	1800	284T	91	85
30	1800	286T	92	88
40	1800	324T	92	83
50	1800	326T	93	85
60	1800	364T	93	88
75	1800	365T	93	88
100	1800	404T	93	83
125	1800	444T	95	88

For motors larger than 125 hp, provide manufacturer's standard high-efficiency motor.

**PART 3 EXECUTION**

**3.1 ERECTION/INSTALLATION/APPLICATION**

A. Install motors in accordance with manufacturer's instructions.

- B. Motors shall be aligned with the respective driven equipment as specified in related sections.
- C. External metal frames of motors and their respective driven equipment shall be connected to ground as specified in Section 16170.

END OF SECTION

SECTION 15250  
INSULATION

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Pipe and equipment insulation.

## 1.2 RELATED SECTIONS

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 15060 - Pipe, Fittings, Valves, and Accessories.
- D. Section 16855 - Heating Cables.

## 1.3 REFERENCE DRAWINGS

- A. See Section 01012 for the Schedule of Drawings.

## 1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM B209-96 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 2. ASTM C534-94 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
  - 3. ASTM C552-91 Standard Specification for Cellular Glass Thermal Insulation.
  - 4. ASTM D1056-91 Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

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**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.

**1.6 DELIVERY, STORAGE, AND HANDLING**

A. Insulation Materials

1. Insulation materials shall be identified, inspected, controlled, and protected in a manner that will ensure conformance with the referenced codes and standards.
2. Care shall be taken in the storage and handling of all insulation material so that contamination by grease, moisture, or other foreign matter does not occur. Insulation materials shall be stored off the ground, protected from the weather, and handled so that physical damage to the insulation material does not occur.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Anti-condensation flexible cellular elastomeric insulation: Slit pipe or sheet insulation in accordance with ASTM C534 and ASTM D1056, RE - 41.
- B. Cellular glass: Board and molded (rigid) inorganic maximum "k" value of 0.345 Btu-inch per hour per square foot per degree F at 75 degrees F, conforming to ASTM C552.
- C. Aluminum jacketing - Alloy 3003, H14 temper, 0.02 inches thick, embossed, conforming to ASTM B209.
- D. Jacketing - Underground Heat Trace Applications: Wrapping consisting of polymer modified bituminous compound with a 4-mil, high-density, cross laminate, polyethylene top film and release paper backing, total thickness of 40 mils and permeability of less than .02 perm inches.

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- E. Elbow insulation covers: Aluminum, Alloy 1100, H14 temper, embossed.
- F. Bedding Compound: Nonvolatile, 0.008 perm inch; service temperature range of -60 degree F to 180 degree F; application temperature 40 degree F to 100 degree F.

## 2.2 ACCESSORIES

- A. Insulation Bands:
  - 1. Piping: 1/2-inch wide by 0.015-inch thick, 304 stainless steel bands.
  - 2. Equipment: 3/4-inch by 0.015-inch thick, 304 stainless steel bands.
- B. Screws: Number 8, by 1/2 inch, sheet metal type 302 or 304 stainless steel.
- C. Adhesives: Fire-resistant adhesive shall be compatible with insulation.

## PART 3 EXECUTION

### 3.1 ERECTION/INSTALLATION/APPLICATION

- A. Piping, which includes valves, fittings, and flanges, shall be insulated when the suffixes "IC" or "-ET" appear in the pipe line number as indicated on the drawings. Equipment shall also be insulated when required on the drawings.
- B. Piping and equipment shall be insulated and jacketed as follows:

Pipeline Number Suffix	Type	Material	Minimum Thickness (inches)	Jacketing
ET	heat trace	cellular glass	1½	aluminum
ET (below grade)	heat trace	cellular glass	1½	polymer modified bituminous compound
IC	anti-condensation	flexible cellular elastomeric	1	none
Equipment	heat trace	cellular glass	2	aluminum

- C. Install materials in accordance with the manufacturer's instructions.
- D. Flanges shall have removable insulation and aluminum jacketing to permit servicing of take-down joints. Removable covers may be fabricated from segments of block insulation or from preformed sectional pipe covering and premolded components. A removable cover shall be of the same material as the adjoining pipe insulation.
- E. Fill joints and seams with bedding compound to form smooth surface.
- F. All insulation shall be stopped at a sufficient distance from flanges to permit ease of bolt removal. Insulation shall be beveled at a 45-degree angle at this point.
- G. Install aluminum jacketing with screws on 3-inch centers on all fittings, valves, and equipment where banding is not possible.

H. Labels indicating "asbestos-free" shall be attached to the outside of all insulation jacketing and adjacent to all piping and equipment identification labels.

I. Pipe Insulation

1. All piping and heat tracing shall be tested in accordance with Section 15060 and Section 16855 before installing insulation.
2. Insulation shall be applied in a single layer with joints tightly butted. Secure cellular glass insulation in place with bands on 12-inch centers. Seal butt joints and seams of anti-condensation insulation with adhesive.
3. Aluminum jacketing shall be applied directly over cellular glass insulation (except underground applications). Minimum lap for longitudinal joints shall be 1 inch and minimum lap for circumferential joints shall be 2 inches. The jacketing shall be secured in place with bands on 9-inch centers. All bending shall have secured ends with no jagged edges.
4. Premolded elbow insulation and aluminum elbow covers shall be used with cellular glass insulation. Aluminum jacketing shall be used for all other fittings, valves, and flanges.
5. Lap all seams against weather.
6. Finish insulation at supports, protrusions, and interruptions. At pipe supports, remove only enough insulation to provide a snug fit.
7. Inserts shall be the same thickness, material, and contour as adjoining piping insulation. For intersection at tees or other equipment, use block or curved segments. Miter cut to fit neatly on the surface, with joints tightly butted.
8. Seal jacketing below ground per manufacturer's recommendation.
9. All insulated valves and piping systems shall be labeled in accordance with Section 15060.

J. Equipment Insulation

1. Apply insulation board directly to equipment surfaces which are electric heat traced with joints staggered and tightly butted. Secure

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- insulation in place with stainless steel bands on 18-inch centers.
2. Board insulation shall be cemented to irregular surfaces and all voids shall be filled with bedding compound.
  3. All insulation shall be stopped at a sufficient distance from the flanged nozzles to permit ease of bolt removal and to allow installation of flange covers. Insulation shall be beveled back at a 45 degree angle at this point.
  4. Apply aluminum jacketing over insulation with 3-inch minimum lap on longitudinal and circumferential joints. Secure in place with stainless steel bands on 18-inch centers.
  5. Insulation shall be cut away from and beveled at a 45-degree angle around all equipment identification nameplates.
  6. All equipment and heat tracing shall be tested before installing insulation.

**END OF SECTION**

SECTION 15500  
HEATING, VENTILATING, AND AIR CONDITIONING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Furnish all labor, materials, equipment, and services necessary to construct, install, and test the complete and operable heating and ventilation systems as defined in this specification and as shown on the Architectural drawing.
1. Propeller fans and backdraft damper.
  2. Inlet air damper.
  3. Electrical unit heater.
  4. Controls.
- B. Items furnished and installed by others:
1. Electrical power supply.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 10211 - Metal Wall Louvers.
- D. Section 15170 - Motors.
- E. Section 16050 - Basic Electrical Material and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. Air Movers and Controllers Association (AMCA):
1. AMCA 99-86 Standards Handbook.
  2. AMCA 210-85 Laboratory Methods of Testing Fans for Rating.

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3. AMCA 300-94 Reverberant Room Method for Sound Testing of Fans.
4. AMCA 301-90 Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

B. Anti-Friction Bearing Manufacturers Association (AFBMA):

1. AFBMA 9-90 Load Ratings and Fatigue Life for Ball Bearings.

C. National Fire Protection Association (NFPA):

1. NFPA 70 National Electrical Code, 1996 Edition.
2. NFPA 90A-93 Installation of Air Conditioning and Ventilating Systems.

D. Underwriters Laboratories, Inc. (UL):

1. UL 705-94 Standards for Safety Power Ventilators.
2. UL 1025-80 Electric Air Heaters.

### 1.5 SYSTEM DESCRIPTION

- A. The design basis for ventilation is to provide air for cooling in summer to maintain a maximum of 100 degrees F summer design temperature in the buildings. The design basis for heating is to maintain a minimum of 50 degrees F winter design temperature in the buildings.

### 1.6 SUBMITTALS

- A. Provide submittals as required by Section 01011.
- B. Data on propeller fans and accessories, including fan curves, sound power levels, and electrical characteristics and connection requirements.

### 1.7 QUALITY ASSURANCE

- A. All equipment operations and testing of materials shall be in compliance with NFPA 70 and UL 705.

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- B. All internal components shall be labeled with manufacturer's name, serial number, and/or power rating information.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be stored in a clean, dry place and protected from weather prior to shipment. Provide protection from weather and from damage during transit.
- B. Loose items shall be tagged and delivered in a standard commercial package. The package shall be protected from the weather; climate conditions including temperature and humidity variations; dirt and dust; and other contaminants that could adversely affect assembly and operation of the fans.
- C. Protect motors, shafts, and bearings from weather and construction dust or any other physical damage.

#### 1.9 PROJECT CONDITIONS

- A. The design is based on the following outdoor design conditions:
  1. Summer: 92 degrees F Db/73 degrees F Wb.
  2. Winter: 1 degree F Db.

### PART 2 PRODUCTS

#### 2.1 EQUIPMENT

- A. Sidewall Propeller Fans
  1. General
    - a. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
    - b. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
    - c. Fabrication: Conform to AMCA 99.
    - d. Performance Base: At 580 feet elevation.
    - e. Temperature Limit: Maximum 150 degrees F.
    - f. Performance: See attached data sheet.

2. Wheel and Housing
  - a. Heavy-duty stamped steel propeller, consisting of six steel blades securely attached to a heavy-gage spider by means of steel rivets, heavily reinforced on each side. The fan frame and venturi shall be constructed of heavy-gage painted steel with the fan assembly bolted to the venturi for ease of removal and service.
3. Bearings and Drives
  - a. Bearings: AFBMA 9, L-50 life at 100,000 hours, heavy-duty pillow block type, self-aligning, grease-lubricated ball bearings.
  - b. Shafts: Hot-rolled steel, ground and polished, with key-way, protectively coated with lubricating oil, and shaft guard.
  - c. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable pitch. Drives shall be designed for 150 percent of rated horsepower capabilities.
4. Accessories
  - a. Backdraft Damper: Frame shall be galvanized steel, and blades shall be aluminum with felt strips on closing edges.
  - b. Wall-Mounted Collar: Heavy-gage steel with thermally fused polyester finish.
  - c. Fan Guard: OSHA motor side guard.
5. Inlet Air Damper: Heavy-duty motor operated. Frame shall be galvanized steel, and blades shall be aluminum with felt strips on closing edges. Motor shall be operated from 120-volt source.
6. Electrical Characteristics and Components (see attached data sheet)
  - a. Motor: Shall conform to Section 15170.
  - b. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized according to NFPA 70.
  - c. Wiring terminations shall be sized to conform to NFPA 70.

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7. Manufacturers
  - a. Cook, Inc.
  - b. Hartzell, Inc.
  - c. Greenheck, Inc.

B. Electric Horizontal Discharge Unit Heaters

1. The unit heaters shall be factory assembled, electric-type complete with built-in thermostat, wall-mounted Hand-Off-Auto (HOA) fan switch, heater contactor, and mounting bracket.
2. Casing shall be fabricated of die-formed heavy-gage steel and finished in high-gloss, baked enamel. Supply air shall be drawn and discharged through an outward venturi. Adjustable discharge louvers shall be provided to control the direction of air flow.
3. Heating elements shall be high mass, all steel, tubular finned type.
4. Motors shall be TEFC, industrial rated, with sealed bearings to ensure permanent lubrication.
5. Fan blades shall be of the axial type design.
6. Heaters shall be designed for a single circuit, with elements, motor, and control circuits subdivided with fuses to conform to NFPA 70 and UL Standard 1025.
7. The heaters shall be equipped with automatic reset thermal overloads.
8. Controls and control circuit transformers shall be factory installed and wired. Built-in fan override shall be provided to purge unit casing of excess heat after unit shutdown. The heaters shall be listed by UL.

9. Electric Unit Heaters Data Sheet

Tag Number	UH- (1)
Heater capacity, kW	5
Air flow, cfm	700
Electric power Volts/phase/Hz	240/2/60
Arrangement	Horiz.
Built-in thermostat	yes
Hand-off-auto switch w/heater contactor	yes
Wall mounting bracket	yes

10. Manufacturers:

- a. Trane Company.
- b. Modine Manufacturing Company.
- c. Indeeco Company.

C. Controls and Instrumentation

1. Thermostats (T):

Single-stage room thermostats with temperature operating range 50 degrees F to 100 degrees F shall be provided. Thermostats shall have heavy-duty contacts suitable for 5 amp, 120V, single phase, 60 Hz operation. Contacts shall be dry contact isolated from ground. Units shall include integral thermometer. Enclosure shall be indoor type. Units shall be bellows actuated and shall have removable set point adjust knob.

a. Manufacturers

- 1) Honeywell, Inc.
- 2) Johnson Controls, Inc.
- 3) Mercoid Corporation.

2. Motor for dampers:

Two position spring-return motors to operate dampers are normally closed, operate on line voltage (120 V) with internal transformer.

- a. Manufacturers
- 1) Honeywell, Inc.
  - 2) Johnson Controls, Inc.
  - 3) Mercoid Corporation.

2.2 EXTRA MATERIALS

- A. Provide two sets of belts for the fan, one installed and the other as a spare.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all equipment as shown on the contract drawings as listed in Article 1.3 and in strict accordance with manufacturer's installation instructions. Ventilation system shall comply with the requirements of NFPA 90A.
- B. Unit heaters shall be started by thermostat set at 50 degrees F, or manually. Exhaust fans shall be started by thermostat set at 100 degrees F, or manually, and shall be interlocked with intake air dampers.

END OF SECTION

**ATTACHMENT 1**

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**FAN DATA SHEET**

R	NO.	DATE	BY	CK	APP	DESCRIPTION	R	NO.	DATE	BY	CK	APP	DESCRIPTION
E							E						874
V							V						
S							S						

**DESIGN OPERATING CONDITIONS**

Elevation ASL 580 Installation  Indoors  Outdoors Ambient Temp Min      °F Max 92 °F  
 Application Exhaust  
 Gas Temp Design 100 °F Min      °F Max 100 °F Vol 2230 cfm Static Pressure 0.25 in. WG (1)  
 Fan Inlet Density 0.071 lb./cu ft. Design Outlet Vel      fpm (± 10%) Allow Noise Level 85 db (2)  
 Service  Continuous  Intermittent Environment  Rel Clean  Dusty  Corrosive  Other     

**FAN PHYSICAL DATA**

Rotation  CW  CCW Inlet  Single  Double Discharge  Single Width  Double Width  
 Arrangement Sidewall Propeller Fan  
 Drive  Direct  V-Belt (3) (4)  Other      Motor (6) Position     

Fan Housing -  Standard  Other      Bearings (8)  Pillow Block Ball  Sleeve  Ball  
 Connection -  Inlet  Flanged  Slip-on  Split Housings  Solid Housings  
 Disch  Flanged  Slip-on  Grease Lube  Oil Lube  Other       
 Drain  Flanged  Thd Pipe Cplg Discharge Damper - Opposed Blade Req  Yes  No  
 Access Door  Bolted Plate  Quick Release Parallel Blade Req  Yes  No  
 Wheel (7) Type  Backward Incl  Forward Curved Vaned Inlet Damper Required  Yes  No  
 Other Propeller Drive  Direct  Rigid Coupling  Direct Coupling  
 Const  Standard  Other       V-Belt  Fixed  Adjustable (4)  
 Spark Resistant Req'd  Yes  No Guard (5) Required  Yes  No  
 Type  A  B  C Vibration - Isolators Required  Yes  No  
 Shaft  Standard  Other      Isolation Base Required  Yes  No  
 Seal Required  Yes  No Painting - Mfr Standard  Yes  No  
 Heat Slinger Required  Yes  No Other       
 Insulation Clips Required  Yes  No Motor and Drive Weather Cover Required  Yes  No  
 Screen Req'd-Inlet  Yes  No Outlet  Yes  No OSHA Motor Side Guard

- (1) At Design Temperature and Elevation.
- (2) Performance ratings shall be based on tests made in accordance with the latest AMCA codes.
- (3) V-belt drive shall be rated 1.5 times rated motor horsepower.
- (4) Adjustable V-belt drive shall be adjustable 10% above and 10% below design fan rpm.
- (5) V-Belt Drive guard shall have a 3-inch diameter tachometer test hole at drive and driven shafts.
- (6) Refer to Standard Motor Specifications for motor characteristics.
- (7) Wheel and shaft shall be statically and dynamically balanced as a unit.
- (8) Bearings shall be self-aligning. Grease fittings shall be of the extended hydraulic type.

**TO BE COMPLETED BY VENDOR**

Fan Mfr      Model      Size      Class       
 Fan rpm @ Design Conditions      Mfr Max      Sound  (re: 10<sup>-2</sup>W)  Pressure (db re: 0.0002 Microbar)  
 Brake hp @ Design Conditions      Min. Temp      Band 1      2      3      4      5      6      7      8       
 @ 10% Above Design rpm      Weights Fan Wheel      lb Shaft      lb  
 Motor hp      No. Drive Belts      Hp/Belt      Fan Excluding Motor and Drive      lb  
 Design Outlet Velocity      fpm Tip Speed      fpm Fan Including Motor and Drive      lb  
 WR<sup>2</sup>      lb ft<sup>2</sup> Blade Frequency      Hz Housing Material      Thickness      in

Does the proposed equipment meet all requirements as specified on this Data Sheet?  Yes  No  
 If not, have all deviations been identified and alternates proposed?  Yes  No

NOTES: Motor requirements: 1/3 hp, 120V, 1-phase, 60 Hz, 1750 rpm  
 Attachment to Specification 15500

Tag No. 1 EF-(1)  
 (95X-5900-A-00429)

<b>DATA SHEET PARSONS</b>	<b>PROPELLER FAN</b>	Sheet: 1 of 1	Job Number PO-169
		Doc. Num.	Revision 0

U.S DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FDF Subcontract No. 2-21487

SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION PROJECT

Division 16 - Electrical

PARSONS

Prepared by:

Thomas P. Deell

6/13/97

Date

Checked by:

James L Cooper

13 JUNE 1997

Date

SECTION 16050  
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Combination magnetic motor starters.
- B. Selector switches.
- C. Receptacles.
- D. Wall switches.
- E. Cabinets.
- F. Disconnect Switches.
- G. Conduit.
- H. Wire and cable.
- I. Instrument cable.
- J. Nameplates.
- K. Wire markers and cable tags.
- L. Wireway and auxiliary gutters.
- M. Splicing and termination components.
- N. Boxes.
- O. Supporting Devices.
- P. Underground Warning Tape.
- Q. Surge Arresters.
- R. Electrical Testing, General.

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1.2 RELATED SECTIONS

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Earthwork.
- D. Section 13123 - Pre-Engineered Buildings.
- E. Section 13400 - Instruments and Equipment.
- F. Section 13401 - Process Control System.
- G. Section 13405 - Installation and Calibration of Instruments.
- H. Section 15160 - Injection Water Supply Pumps.
- I. Section 15161 - Well Pumps.
- J. Section 15170 - Motors.
- K. Section 15500 - Heating, Ventilating, and Air Conditioning.
- L. Section 16118 - Underground Ductbanks and Ducts.
- M. Section 16170 - Grounding and Bonding.
- N. Section 16370 - Overhead Power Distribution.
- O. Section 16462 - Dry Type Transformers/Panelboards.
- P. Section 16470 - Panelboards.
- Q. Section 16500 - Lighting.
- R. Section 16855 - Heating Cables.

1.3 REFERENCE DRAWINGS

- A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

A. National Fire Protection Association (NFPA):

- 1. NFPA 70 National Electrical Code, 1996 Edition.

B. American National Standards Institute (ANSI):

- 1. ANSI C80.1-90 Rigid Steel Conduit-Zinc Coated.

C. Underwriters Laboratories Inc. (UL):

- 1. UL 360-86 UL Standard for Safety Liquid-Tight Flexible Steel Conduit.
- 2. UL 486A-91 UL Standard for Safety Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- 3. UL 510-94 UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
- 4. UL 854-96 UL Standard for Safety Service-Entrance Cables.
- 5. UL 870-91 UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings.
- 6. Electrical Construction Materials Directory - 96.

- D. National Electrical Manufacturers Association (NEMA):
1. NEMA AB 1-93 Molded Case Circuit Breakers and Molded Case Switches.
  2. NEMA ICS 1-93 Industrial Control and Systems General Requirements.
  3. NEMA ICS 2-93 Industrial Control and System Controllers, Contractors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.
  4. NEMA ICS 4-93 Industrial Control and Systems Terminal Blocks.
  5. NEMA ICS 6-93 Industrial Control and Systems - Enclosures.
  6. NEMA KS 1-90 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
  8. NEMA LA 1-92 Surge Arresters.
  9. NEMA OS 1-89 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
  10. NEMA WD 1-83 General Requirements for Wiring Devices.
  11. NEMA WD 6-88 Wiring Devices - Dimensional Requirements.
  12. NEMA 250-91 Enclosures for Electrical Equipment (1,000 Volts Maximum).

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.

**1.6 QUALITY ASSURANCE PROGRAM**

- A. All work shall comply with NFPA 70. Use of conduit for equipment ground is prohibited.
- B. Products shall be listed in the UL Electrical Construction Materials Directory, for the purpose specified and indicated.

## PART 2 PRODUCTS

## 2.1 EQUIPMENT

## A. Combination Magnetic Motor Starters

1. Combination Magnetic Motor Starters: NEMA ICS 1, NEMA ICS 2, AC general purpose Class A magnetic starter for induction motors for the rated horsepower combined with a magnetic circuit breaker, NEMA AB 1, with instantaneous magnetic trip in each pole. Starter, circuit breaker, and control power transformer shall be in a common enclosure. Terminals, minimum 75 degrees C rated.
2. Provide externally operable handle interlocked to prevent opening of cover with circuit breaker in the ON position. Allow handle to be lockable in the OFF position.
3. Contactor Coil Operating Voltage: 120 V, 60 Hz.
4. Overload Relay: NEMA ICS 2, bimetal.
5. Control Power Transformer: 120 V secondary, 50 VA minimum. Provide fused primary and secondary of transformer, and ground unfused leg of secondary to enclosure.
6. Enclosure: NEMA ICS 6, Type 3R, outdoor; or Type 12, indoor.
7. Heater elements shall be included, as required, for the described service conditions.
8. Two auxiliary contacts (electrically dry), one each, normally closed and normally open, in addition to the hold-in contact, shall be provided.

## B. Selector Switches

1. Enclosure, NEMA ICS 6, Type 3R or 4.
2. Two-position, maintained contact (start/stop).
3. Three-position, maintained contact (hand/off/auto or local/off/remote).

C. Receptacles

1. Convenience Receptacle: 125 V, 15/20 A, NEMA WD 1, heavy-duty, general use with metal cover plate; conforming to NEMA WD 6, Configuration 5-20. 125 V, 30 A, NEMA WD 1, heavy-duty, general use with metal cover plate; conforming to NEMA WD 6, Configuration 5-30. Furnish with weatherproof covers for outdoors, wet or industrial locations.
2. Convenience receptacles in potentially wet environments, in addition to those required by NFPA 70, shall be GFCI type for personnel protection with covers to protect the receptacle from water during usage.

D. Wall Switches

1. Description: NEMA WD 1, heavy duty, specification grade. AC only general use snap switch. Three-way switches by exits are required.
2. Device Body: Ivory plastic with toggle handle.
3. Ratings: Match branch circuit and load characteristics.

E. Cabinets

1. Boxes: Galvanized steel with removable endwalls.
2. Box Size: As indicated in Section 13400.
3. Fronts: Steel, surface type with concealed trim clamps, door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.
4. Knockouts: Provide as required for conduits indicated plus 25 percent spare.
5. Provide metal barriers to form separate compartments for wiring of different systems and voltages.
6. Provide accessory feet for free-standing equipment.

7. Terminal Blocks: NEMA ICS 4.
  - a. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
  - b. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
8. Provide ground bus and ground terminal block, each connector bonded to enclosure.
9. Provide plastic channel with hinged or snap-on covers for internal wiring raceway.

F. Disconnect Switches

1. Nonfusible Switch Assemblies: NEMA KS 1, Type HD quick-make, quick-break, visible blade, load interrupter knife switch in NEMA 3R or 4, outdoors, and 12, indoors, enclosures with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Ratings as indicated.

## 2.2 MATERIALS

A. Conduit

1. Rigid steel, heavy wall, galvanized conduit conforming to ANSI C80.1. Rigid steel intermediate metal conduit (IMC) shall be acceptable for interior spaces. Conduit shall be 1/2 inch diameter minimum.
2. Liquid-tight flexible metal conduit conforming to UL 360. Conduit shall be 1/2 inch diameter minimum, 5 feet in length (maximum) unless indicated on drawings.
3. All conduit connections shall be threaded.

B. Wire and Cable

1. Single conductor, 600-volt insulated copper conductor. Conductors for power branch circuits shall not be smaller than No. 12 AWG. Conductors No. 12 AWG and larger shall be stranded. Conductors for control shall not be smaller than No. 14 AWG stranded. Conductors for Class 1 remote-control and signal circuits shall be enclosed in cable and shall comply with NFPA 70. Power and lighting conductor insulation shall be Type THW, XHHW, or THWN. Conductors required to be rated 90 degrees C in accordance with NFPA 70 shall be insulation Type XHHW-2 or THW-2. Direct burial cable shall be type USE, conforming to UL 854.

C. Instrument Cable

1. Instrumentation cable shall be No. 16 AWG stranded tinned copper conductors. Conductors shall be polyethylene insulated and rated 600 volts, 60 degrees C. Conductors shall be twisted with aluminum-polymer shield; No. 18 AWG stranded, tinned copper drain wire. Cable shall have overall-chrome gray FR-PVC jacket.

D. Nameplates

1. Nameplates shall be engraved, three-layer laminated plastic, 5/16-inch bold style, black letters on white background.

E. Wire Markers and Cable Tags

1. Wire markers shall be single-conductor slip on, heat-shrinkable sleeve with typed or printed black letters on a white background. Wire markers shall be W. H. Brady Co. computer-printable "Bradysleeve" or approved equal.
2. Cable tags shall be rectangular, flat, non-heat shrinkable tags with 1/8-inch-high letters. Cable markers shall be Raychem-type TMS or approved equal.

## F. Wireway and Auxiliary Gutters

1. Wireway and Auxiliary Gutters: General purpose, NEMA ICS 6, Type 3R enclosure with knockouts on bottom.
2. Size: As required.
3. Cover: Screw cover with full gasketing.
4. Fittings: UL 870, lay-in type with removable top, bottom, and side; captive screws.
5. Material: Carbon steel.
6. Finish: Rust-inhibiting primer coating with gray enamel finish.

## G. Splicing and Termination Components

1. Wire connectors, UL 486A, as applicable.
2. Insulation tape, UL 510.
3. Provide solderless terminal lugs, rated 75 degrees C minimum, on stranded conductors.

## H. Boxes and Cover Plates

1. Junction and Pull Boxes
  - a. Junction and pull boxes shall be sized as indicated in accordance with NFPA 70, Article 370.
  - b. Junction and pull boxes located indoors shall be code-gauge, galvanized sheet steel and shall be of welded construction with conduit knockouts or raceway openings and hinged or screwed covers as indicated. Type 3R, according to NEMA 250.
  - c. Junction and pull boxes located outdoors shall have screwed, gasketed covers, and watertight hubs. Type 3R, according to NEMA 250.
2. Device and Outlet Boxes
  - a. Device and outlet boxes shall be pressed steel, zinc, or cadmium coated in accordance with NEMA OS 1 unless otherwise indicated.
  - b. Outlet boxes shall not be smaller than 4 inches octagonal by 1-1/2 inches deep and shall be provided with the proper size knockouts for the conduits intended. Unused knockouts shall remain closed or shall be sealed with knockout closures.

- c. Device or outlet boxes shall be of unit construction of a size required for the number of switches or outlets called for on the project design drawings. No sectional device boxes shall be permitted.
- d. Surface-mounted outlet boxes for receptacles, switches, or similar devices shall be cast type.

I. Supporting Devices

- 1. Support Channel shall be galvanized or painted steel as specified in Section 13123.
- 2. Support hardware and accessories shall be corrosion resistant.
- 3. Supports shall be of all-welded construction.

J. Underground Warning Tape

- 1. 4-inch-wide plastic tape, colored yellow with suitable warning legend describing buried electrical lines.

K. Surge Arresters

- 1. Surge arresters shall conform to NEMA LA 1, rated 0.675 kV.

**PART 3 EXECUTION**

**3.1 ERECTION/INSTALLATION/APPLICATION**

A. Conduit

- 1. Route conduit parallel or at right angles to building lines. Provide conduit supports at 8-foot intervals. Route conduit so as not to create a hazard for tripping or to compromise head clearance. Minimum height above floor shall be 7 feet, 6 inches.
- 2. Cut conduit square using saw or pipecutter. All cut ends of conduit shall be reamed smooth.

3. Install no more than the equivalent of three 90 degree bends between junction boxes. Use hydraulic one-shot conduit bender or factory elbows for conduit diameter larger than 1-1/2 inch.
4. Use Form 8 conduit bodies to make sharp changes in direction. Avoid moisture traps, provide junction box with weep hole.
5. Provide cast metal boxes such as FS or FD in damp or wet locations.
6. Provide 1/8-inch nylon pull cord in empty conduits. Cap empty conduits to prevent entry of moisture and foreign objects.
7. Final conduit connections to motors or other vibrating equipment shall be made with approximately 3-foot liquid-tight flexible metal conduit.
8. Conduit and supports are to be field routed. They are not indicated explicitly on drawings.

B. Wire and Cable

1. Swab conduit before installing cable. Remove burrs, dirt, or other debris. For existing conduit, pull a mandrel through before pulling cable to verify roundness and bending radii.
2. When pulling cable into conduit, use wire pulling compound.
3. Splices shall be made only in outlet or junction boxes.
4. Provide equipment grounding conductor along with phase conductors in all conduits.
5. Multiconductor cables shall contain an integral ground conductor.
6. Grounding conductors shall be connected to equipment with compression lugs. Grounding connections shall be made to clean, dry surfaces. Scale, rust, grease, and dirt shall be removed from surfaces to which grounding connections are to be made.

7. Conductors shall be color coded. Conductors No. 6 AWG and larger shall be identified using colored tape at terminals and splice points. Conductors No. 8 AWG and smaller shall be identified using colored insulation or jacket. Color coding shall be as follows:

480Y/277V Phase A	Yellow
Phase B	Orange
Phase C	Brown
Neutral (grounded)	Gray
Ground	Green
208Y/120V Phase A	Black
Phase B	Red
Phase C	Blue
Neutral (grounded)	White
Ground	Green
Plant Fire	Red and Yellow
Alarm System	Brown and Yellow

8. Install cables buried directly in earth in the following manner:
- Excavate cable trenches according to Section 02200. Provide a minimum cable cover of 24 inches below finished grade for power conductors operated at 600 volts and less. Trenches shall be not less than 8 inches wide, and shall be in straight lines between cable markers. Cable plows shall not be used. Bends in trenches shall have a radius of not less than 36 inches. Where two or more cables are laid parallel in the same trench, space cables laterally at not less than 3 inches apart.
  - When rock is encountered, remove to a depth of at least 3 inches below the cable and fill the space with sand or clean earth free from particles larger than 1/4 inch.
  - Do not unreel and pull cables into the trench from one end. Unreel cable on grade and lift into position onto bedding as indicated.
  - Provide warning tape, minimum 12 inches above top of cable.

- e. Bury cables directly in earth, except under roadways, where cables shall be installed in plastic ducts encased in concrete, as indicated. Slope ducts to drain.
- f. Use heat shrink adhesive coated caps on cable ends or tape cable ends immediately after cutting to prevent moisture from entering the cable. Varnish the tape when cable is not expected to be connected for at least 72 hours.
- g. Separate cables crossing other cables or metal piping from each other by not less than 12 inches of well tamped earth.
- h. Provide cables in one piece without splices between connections except where the distance exceeds the lengths in which cables are manufactured.
- i. Bends in cables shall have an inner radius not less than 12 times the cable diameter.
- j. Leave a horizontal slack of approximately 3 feet in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought aboveground, leave additional slack to make necessary connections.

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- k. Provide an identification slab at each change of direction of cable, over the ends of ducts or conduits which are installed under paved areas and roadways, and over each splice. Identification slabs shall be of concrete approximately 20 inches square by 6 inches thick and shall be set flat in the ground so that top surface projects not less than 3/4 inch, nor more than 1 1/4 inches above ground. The concrete shall have a compressive strength of not less than 3000 psi and have a smooth troweled finish on exposed surface. Inscribe an identifying legend such as "electric cable" on the top surface before concrete hardens. Inscribe circuit numbers as indicated on drawings on slabs as directed. Letters or figures shall be approximately 2 inches high and grooves shall be approximately 1/4 inch in width and depth. Install slabs so that the side nearest the inscription on top shall include an arrow indicating the side nearest the cable.

C. Nameplates

1. Clean surfaces prior to installing nameplates.
2. Install nameplates parallel to equipment lines. Secure nameplates permanently to equipment fronts using self-tapping screws.

D. Wire and Cable Markers

1. Provide wire markers on each conductor in pull boxes and junction boxes and at each load connection. Provide cable tags in pull boxes for multiconductor cables.
2. Wire and cable tags shall identify panel and circuit number or control wire number, as required.

E. Disconnect Switches

1. Mounting supports shall not be fastened to or penetrate wall panels.

## F. Receptacles

1. Install convenience receptacles 48 inches above finished floor. Receptacle mounting supports shall not be fastened to or penetrate wall panels.
2. Label receptacles with panelboard and circuit number from which they are served.

## G. Combination Magnetic Motor Starters

1. Install motor controllers where indicated on drawings.
2. Install motor controller with center line of disconnect operator 54 inches above finished floor.
3. Install overload heater element in motor controller to match motor characteristics.
4. Provide engraved nameplate identifying motor served.

## H. Selector Switches

1. Mount selector switches at a mounting height of 54 inches above the floor adjacent to the equipment controlled. Provide slotted channel mounting supports where building column or wall is not suitable for support.

## I. Clearances

1. Clearances from points of access to electrical equipment and other devices shall conform to the requirements of NFPA 70.
2. All equipment control devices and other electrical equipment requiring operation or maintenance shall have a minimum working clearance of 3 feet from the surface of operation or access, unless greater clearance is required by NFPA 70.

## J. Boxes

1. Coordination of Box Locations
  - a. Provide electrical boxes as indicated and as required for splices, taps, wire pulling, and equipment connections.
  - b. Electrical box locations indicated are approximate unless dimensioned.
  - c. Locate and install boxes to allow access.

- d. Do not install boxes back to back in walls. Provide 6-inches (minimum) separation in non-acoustic rated walls and 24 inches (minimum) separation in acoustic rated walls.
  - e. Coordinate mounting heights of boxes and locations of outlets mounted above counters, benches, and backsplashes to ensure locations are useful.
  - f. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
2. Outlet Box Installation
- a. Firmly secure in place outlet or utility boxes concealed in the construction. Set outlet or utility boxes true, square, and flush with the finish surfaces for the application of the appropriate cover plate.
  - b. Provide knockout closures for unused knockout openings.
  - c. Support boxes independently of conduit except for cast boxes when connected to two rigid metal conduits, both supported within 12 inches of the box to be supported.
  - d. Use multiple gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
3. Pull and Junction Box Installation
- a. Support pull and junction boxes independently of conduit.

K. Cabinets

- 1. Install cabinet fronts plumb.

L. Supporting Devices

- 1. Installation of structural steel framing, concrete pads, etc., shall be complete before installing supporting devices.
- 2. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structures in accordance with manufacturer's recommendations as indicated.
- 3. Use expansion anchors for support on concrete surfaces.

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4. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
5. Do not drill structural steel members for installing support devices.
6. Fabricate supports from structural steel or steel channel. Rigidly bolt to structural steel to present a neat appearance. Use hexagon head bolts with spring lock washers under nuts.
7. Install freestanding electrical equipment on concrete pads.
8. Install surface mounted cabinets and enclosures with four anchors (minimum). Provide steel channel supports to stand cabinets and enclosures 1 inch from the wall.

### 3.3 QUALITY CONTROL

#### A. Electrical Inspection and Testing - General

1. All electrical inspection and testing for work in this section and in other electrical sections shall conform to the following requirements and to NETA ATS. Tests required by NETA ATS for electrical work on this project shall be performed unless specific instruction is provided otherwise. Any additional requirements or exceptions shall be as noted in the other electrical sections for the specific electrical work of that section only. Test reports shall be provided for all tests, inspections and observations.
2. Testing shall be witnessed by FDF, CQC Consultant-Quality Control personnel (who must approve results) and manufacturer's service representative(s), if required. Notice of testing must be furnished 7 days in advance.
3. Submit test results and calibration data on approved forms within 5 working days of completion of test.
4. Perform operational tests to demonstrate control and interlocking wiring.
5. Visual inspections shall be performed for phasing and connections. Phasing shall be A, B, C clockwise at all three phase disconnects.

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6. Repair or replacement of all components where test results are unacceptable, including those damaged during testing process, is required.

B. Electrical Inspection and Testing - This Section

1. Perform continuity and operation tests on power and control circuits. Low voltage thermographic survey of cable connections required by NETA ATS are not required. Wire insulation for conductors No. 6 AWG and larger shall be megger tested between each conductor and ground. A 1000-volt megger shall be used for insulation rated 600 volts. Minimum resistance shall be 100 megohms.
2. Insulation resistance tests shall not be performed on solid state equipment unless authorized by its manufacturer and in strict accordance with the manufacturer's recommendations. Solid state equipment includes static ground fault devices, such as ground fault circuit interrupters.
3. Confirm that electrical connections to utilization equipment have been made in accordance with manufacturer's instructions.
4. Perform motor tests according to NETA ATS.
5. Motor windings shall be checked for continuity.
6. Motor windings rated 460 volts nominal shall be megger tested with a 1,000-volt megger prior to connection of power leads. Minimum acceptable resistance shall be 100 megohms. Motor and phase rotation shall be checked with a phase rotation tester manufactured by G. Biddle Company (Catalog No. 56060) or equal on equipment which could be damaged by reverse rotation.
  - a. Motor and phase rotation shall be verified before energizing motors.

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- b. All motors shall be "bumped" to check for proper direction of rotation prior to performing operational tests on the equipment in the presence of Fluor-Daniel, Fernald personnel or their representative.

END OF SECTION

SECTION 16118  
UNDERGROUND DUCTBANKS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Underground Ductbanks.
- B. Cincinnati Gas & Electric Co. (CG & E) Pad and Duct Bank Transformer Requirements.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 02200 - Earthwork.
- D. Section 03001 - Concrete.
- E. Section 16050 - Basic Electrical Materials and Methods.
- F. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. ANSI C80.1-90 Rigid Steel Conduit - Zinc-Coated.
- B. Institute of Electrical and Electronic Engineers (IEEE):
  - 1. IEEE C2-97 National Electrical Safety Code.

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- C. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
  
- D. National Electrical Manufacturers Association (NEMA):
  - 1. NEMA TC 3-90 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
  - 2. NEMA TC 6-90 PVC and ABS Plastic Utilities Duct for Underground Installation.
  
- E. Underwriters Laboratories, Inc. (UL):
  - 1. Electrical Construction Materials Directories, 1996.

**1.5 SYSTEM DESCRIPTION**

- A. Install underground duct to CG & E transformer and pole as indicated on the drawings and conforming to CG & E requirements attached.

**1.6 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70 and IEEE C2.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.
- C. Backfill, pouring of concrete, and other final work shall not be performed prior to confirmation of underground duct and transformer pad layout by CG & E.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect, and handle products to site.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

**1.8 PROJECT CONDITIONS**

- A. Verify routing and termination locations of ductbank prior to excavation for rough-in.

**PART 2 PRODUCTS****2.1 MATERIALS**

- A. Rigid Steel Conduit and Fittings: ANSI C80.1.
- B. Plastic Utilities Duct: NEMA TC 6; PVC.
- C. Plastic Utility Duct Fittings: NEMA TC 3.

**2.2 ACCESSORIES**

- A. Underground Warning Tape: 4-inch-wide plastic tape, colored yellow with suitable warning legend describing buried electrical lines.

**PART 3 EXECUTION****3.1 EXAMINATION**

- A. Verify that excavation, base material installation, and compaction are completed.
- B. Verify routing and termination locations of ductbank prior to excavation for rough-in. Verify locations of CG & E transformer and pole conduit stub-ups prior to excavating for installation.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Underground Duct:
  - 1. Install power ductbank 36 inches (minimum) to top of ductbank below finished grade.
  - 2. Install duct with minimum slope of 4 inches per 100 feet.
  - 3. Cut duct square using saw or pipe cutter; de-burr cut ends.

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4. Insert duct to shoulder of fittings; fasten securely.
5. Join nonmetallic duct using adhesive as recommended by manufacturer.
6. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
8. Provide suitable fittings to accommodate expansion and deflection where required.
9. Stagger duct joints vertically in concrete encasement 6 inches minimum.
10. Use suitable separators and chairs installed not greater than 4 feet on centers.
11. Band ducts together before placing concrete.
12. Securely anchor duct to prevent movement during concrete placement.
13. Place concrete under provisions of Section 03001. Use mineral pigment to color concrete red.
14. Provide minimum 3-inch concrete cover at bottom, top, and sides of ductbank.
15. Provide pull rope in each duct except sleeves and nipples. Minimum 1/2-inch, 4,000 psi tensile strength polypropylene.
16. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
17. Perform excavations and backfill trenches under provisions of Section 02200 of this specification package.
18. Coordinate installation of underground warning tape with backfilling. Install tape 6 inches below finished grade (or surface).
19. All exposed portions (stub-ups) of duct above grade shall be rigid galvanized steel. All final 90-degree bends from underground to stub-ups shall be rigid steel. Stub-ups shall be 3 inches above grade or floor.
20. Direct-buried duct, not encased in concrete, shall conform to the above requirements, except those pertaining to concrete, and to the following requirements:
  - a. Excavate trenches for the duct, depths as indicated, not less than 12 inches wide.

Bends in trenches shall have a radius of not less than 36 inches.

- b. When rock is encountered, remove to a depth of at least 3 inches below the duct and fill the space with sand or clean earth free from particles larger than 1/4 inch.
- c. Use PVC conduit under concrete slabs; use rigid galvanized steel conduit for portions not covered by slabs.

END OF SECTION

**ATTACHMENT A**

---

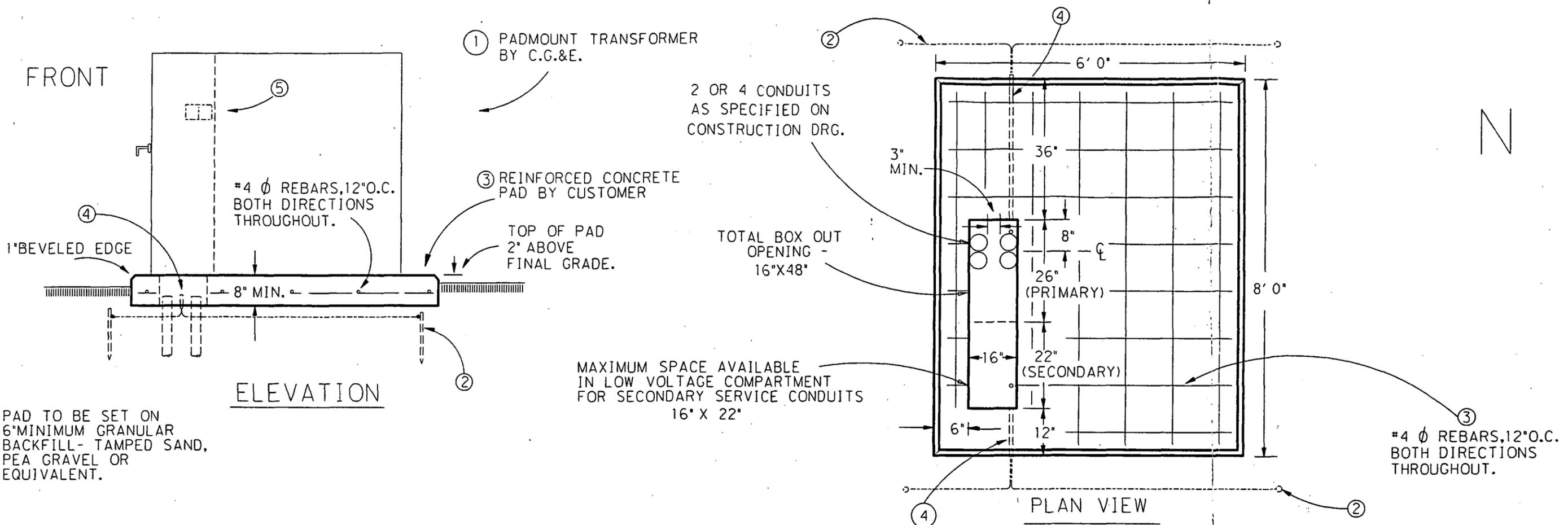
**CG & E TRANSFORMER PAD & DUCT BANK REQUIREMENTS**

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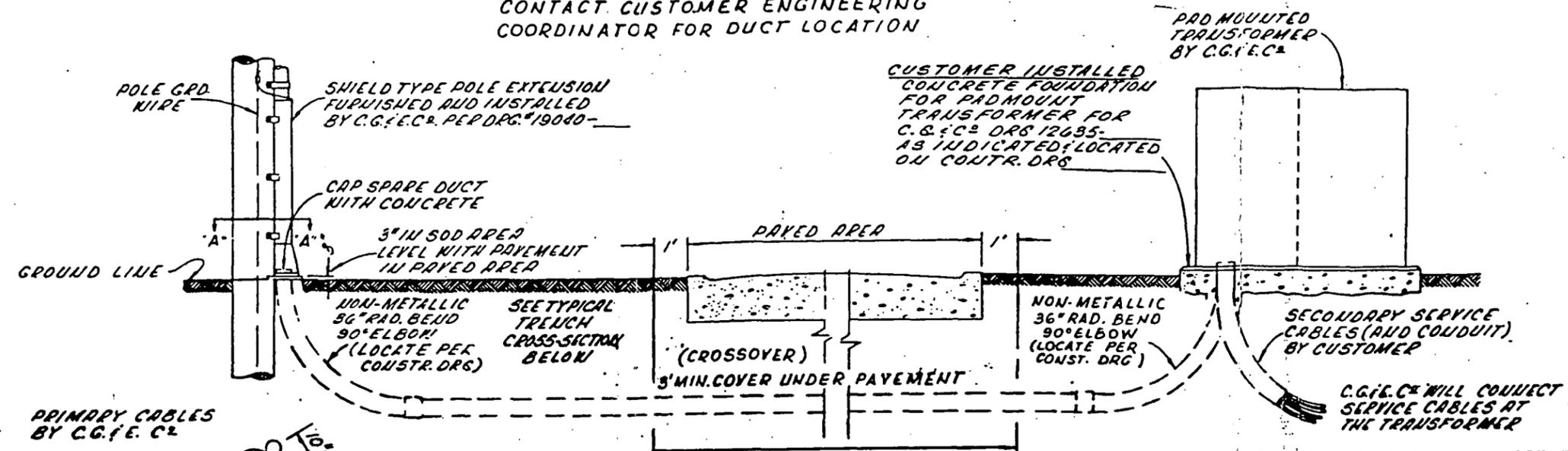
- ① PADMOUNT TRANSFORMER FURNISHED & INSTALLED BY C.G.&E. CO.  
 THE FOLLOWING ITEMS ARE TO BE APPROVED BY CG&E BEFORE INSTALLATION:  
 LOCATION- TRANSFORMER INSTALLATION MUST BE LOCATED SO THAT IT IS ACCESSIBLE FOR INSTALLATION, OPERATION, & MAINTENANCE BY STANDARD COMPANY EQUIPMENT. THIS LOCATION MUST BE APPROVED BY C.G.&E. REPRESENTATIVE.  
 CLEARANCE- (a) CLEARANCES OF TRANSFORMERS FROM BUILDINGS AND BUILDING OPENINGS AS REQUIRED BY LOCAL CODES OR CG&E CO. SPECIFICATIONS WILL BE NOTED ON CG&E CONSTRUCTION DRAWING.  
 (b) SPACE REQUIRED FOR COMPLETE 180 DEG. SWING OF TRANSFORMER DOORS.  
 (c) 4' WIDE X 10' DEEP SPACE REQUIRED IN FRONT OF TRANSFORMER AND/OR SWITCH UNIT FOR SWITCHING OPERATION.  
 PROTECTION- TRANSFORMER INSTALLATION SHALL BE SUITABLY PROTECTED BY CUSTOMER FROM VEHICULAR TRAFFIC, ETC. WHEN REQUIRED BY C.G.&E. REPRESENTATIVE.
- ② GROUND RODS AND GROUND WIRES FURNISHED & INSTALLED BY C.G.&E. CO.
- ③ REINFORCED CONCRETE PAD BY CUSTOMER TO PROVIDE ADEQUATE BASE FOR PAD MOUNTED TRANSFORMER WITH CONSIDERATION GIVEN TO STRUCTURAL STRENGTH, FROST ACTION, AND LOCAL SOIL CONDITIONS. PAD MUST BE FLAT AND SMOOTH. TOP SURFACE MUST BE LEVEL TO WITHIN 2" IN BOTH DIRECTIONS. SUGGESTED DESIGN: 8" MINIMUM THICKNESS USING MINIMUM 3000 P.S.I. CONCRETE AND #4 φ REBARS SPACED 12" O.C.

- ④ CUSTOMER TO INSTALL 1" CONDUIT, NOT TO EXCEED A MAXIMUM DEPTH OF 12" FROM BOX OUT TO OUTER EDGE OF PAD FOR INSTALLATION OF GROUND WIRE BY CG&E CO.
- ⑤ CUSTOMER TO INSTALL SERVICE LATERAL CONDUCTORS TO A MINIMUM HEIGHT OF 6FT. ABOVE TOP OF PAD TO ALLOW FOR CONNECTION TO TRANSFORMER BY C.G.&E. CO. THE MAXIMUM CONDUCTOR SIZE TO BE USED IS 750MCM.

CUSTOMER \_\_\_\_\_  
 LOCATION \_\_\_\_\_

REV. 8-19-96 SHIFT BOX OUT			
12" DOWN---R. HOFF			
REV. 4-28-93 CHG. BOX OUT	REV. 3-14-94 REV. NOTES PER	REV. 1-19-96 Rev. Title Block	
OPENING SIZE	J. WILSON		J. Cruse
DATE 8/19/91	THE CINCINNATI GAS & ELECTRIC CO.		APP'D.
DRAWN	ELECTRIC DISTRIBUTION ENGINEERING		APP'D.
CHK'D.	CUSTOMER INSTALLED FOUNDATION DETAIL		W.O.
TECH.	FOR 13KV & 35KV DEAD FRONT TRANSFORMER		FILE 17
ENGR. R. HOFF	75KVA THRU 300KVA - 6' X 8' PAD		DRG. 12635-83

CONTACT CUSTOMER ENGINEERING COORDINATOR FOR DUCT LOCATION



PRIMARY CABLES BY C.G.E.C.



POSITION OF DUCTS IF TWO ARE REQUIRED

TRENCHING, BACKFILLING AND PRIMARY CONDUITS BY CUSTOMER.

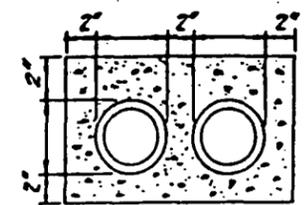
GENERAL CONDITIONS

1. THE CUSTOMER WILL FURNISH & INSTALL ALL CONDUIT, INCLUDING "CROSSOVERS" (UNDER PAVED AREAS).
2. THE CUSTOMER WILL INSTALL CONCRETE FOUNDATION FOR EACH CINCINNATI GAS & ELECTRIC COMPANY PAD-MOUNTED TRANSFORMER PER C.G.&E. CO. SPECIFICATION DRAWING NO. 12635-
3. THE CUSTOMER WILL, IN ACCORDANCE WITH SPECIFICATION OF THE COMPANY AND LOCAL INSPECTION AUTHORITY, FURNISH, INSTALL, OWN, AND MAINTAIN THE SECONDARY SERVICE CABLES. CONNECTION OF THESE CABLES AT THE TRANSFORMER WILL BE MADE BY THE COMPANY.
4. A. THE COMPANY SHALL DETERMINE THE ROUTE OF ALL COMPANY OWNED UNDERGROUND ELECTRIC LINE EXTENSIONS. SUCH FACILITIES MUST BE LOCATED SO AS TO BE ACCESSIBLE AT ALL TIMES FOR SWITCHING AND MAINTAINING.  
B. THE POINT WHICH THE UNDERGROUND DISTRIBUTION SYSTEM BEGINS SHALL BE DETERMINED BY THE COMPANY. THE OVERHEAD PRIMARY EXTENSIONS TO THIS POINT MAY BE INSTALLED AS OPEN-WIRE CONDUCTORS.  
C. THE COMPANY SHALL DETERMINE ALL EQUIPMENT LOCATIONS, AND SUCH FACILITIES MUST BE ACCESSIBLE FROM ADEQUATE DRIVEWAYS PROTECTED FROM MECHANICAL HAZARDS AND PLACED SO AS TO MAINTAIN PROPER CLEARANCE FROM BUILDING OPENINGS.
5. THE CUSTOMER SHALL COMPLETE FINAL GRADE OF THE DISTRIBUTION LINE ROUTE BEFORE CONSTRUCTION WORK IS STARTED AND BE RESPONSIBLE FOR MAINTAINING SAME DURING CONSTRUCTION. THE COMPANY SHALL PERMIT A MAXIMUM CUT OF SIX INCHES FOR SIDEWALK AND DRIVEWAYS AFTER THEIR FACILITIES HAVE BEEN INSTALLED. NO FILL WILL BE PERMITTED AFTER THE COMPANY'S FACILITIES HAVE BEEN INSTALLED EXCEPT BY WRITTEN PERMISSION FROM THE COMPANY.
6. THE UNDERGROUND CONSTRUCTION AREA SHALL BE CLEAR OF ALL OTHER CONSTRUCTION FORCES. AFTER THE UNDERGROUND CONSTRUCTION HAS BEGUN, IT SHALL NOT BE INTERRUPTED BY OTHER CONSTRUCTION FORCES.

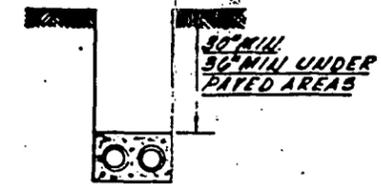
FOR CONCRETE ENCASED SYSTEMS  
PE OR PVC CONDUIT, TYPE EB (NEMA TC-6)  
OR SCHEDULE A (NEMA TC-2), 90°C. RATED.  
FOR DIRECT BURIED SYSTEMS  
PE OR PVC CONDUIT DB (NEMA TC-6)  
OR SCHEDULE 40 (NEMA TC-2), 90°C. RATED.

WHEN NECESSARY TO PREVENT PHYSICAL DAMAGE TO THE CONDUCTORS FROM ROCK, SLATE, OR FROM VEHICULAR TRAFFIC, ETC., SUPPLEMENTARY PROTECTION SUCH AS SAND, SUITABLE SLEEVES, OR OTHER APPROVED MEANS MUST BE EMPLOYED.

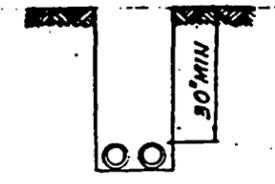
MAINTAIN A MINIMUM 5' HORIZONTAL CLEARANCE FROM GAS LINES; AND ALL WATER LINES AND 1 FOOT FROM ALL OTHER UTILITIES UNLESS ADDITIONAL CLEARANCES ARE REQUIRED BY LOCAL BUILDING CODES.



TYPICAL DETAIL OF DUCTS IN CONCRETE  
2-4" OR 2-5" DUCTS AS SPECIFIED ON CONST. DRG.



TYPICAL TRENCH CONDUITS IN CONCRETE  
2-4" OR 2-5" DUCTS AS SPECIFIED ON CONST. DRG.



TYPICAL TRENCH CONDUITS WITHOUT CONCRETE  
2-4" OR 2-5" DUCTS AS SPECIFIED ON CONST. DRG.

NOTE  
TYPE "DB" 90°C. NEMA RATED DUCTS SHOULD BE USED ONLY FOR SYSTEMS CONTAINING UTILITY OWNED CABLES. DUCT FOR CUSTOMER OWNED CABLE SYSTEMS MUST BE "LISTED" ELECTRICAL CONDUIT TO SATISFY THE NATIONAL ELEC. CODE.

CUSTOMER \_\_\_\_\_  
LOCATION \_\_\_\_\_  
CONST. DRG# \_\_\_\_\_

N.T.S.

NO.	REV.	DESCRIPTION	DATE	BY	CHKD.
5	EXTRA	ADD 90° ELBOW NOTE			
4	4-30-85	PAD END RECKERS			
3	2-12-85	ADD TRENCH DETAIL WITHOUT CONC. HOPE			
2	1-21-85	CHG. CROSSOVER NOTE R.W.			
1	1-21-85	CHG. CROSSOVER PER S. DIETZMAN			
		SET THE CONDUITS PER R. HOPE			

THE CINCINNATI GAS & ELECTRIC CO.  
ELECTRIC DEPARTMENT

TYPICAL UNDERGROUND PRIMARY SERVICE FROM OVERHEAD LINE FOR COMMERCIAL AND INDUSTRIAL CUSTOMERS

ISSUED BY: H. CRABTREE DATE: 8-24-75

CHANGED BY: H. CRABTREE DATE: 11-5-75

ISSUED BY: H. CRABTREE DATE: 11-5-75

CHANGED BY: H. CRABTREE DATE: 11-5-75

DRG. 12635-01 000335

SECTION 16129  
FIBER OPTIC CABLE AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Loose-tube fiber optic cable and accessories (multimode).

1.2 RELATED SECTIONS

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 13401 - Process Control System.  
D. Section 16370 - Overhead Power Distribution.

1.3 REFERENCE DRAWINGS

- A. See Section 01012 for the Schedule of Drawings.

1.4 REFERENCES

- A. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA):

- |    |                               |   |
|----|-------------------------------|---|
| 1. | EIA/TIA 455-60-89<br>FOTP-60  | Measurement of Fiber or Cable Length Using an OTDR.                       |
| 2. | EIA/TIA 455-61-89<br>FOTP-61  | Measurement of Fiber or Cable Attenuation Using an OTDR.                  |
| 3. | EIA/TIA 526-14-90<br>OFSTP-14 | Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant. |

- B. Institute of Electrical and Electronics Engineers (IEEE):

- |    |             |  |
|----|-------------|--|
| 1. | IEEE 812-84 | Standard Definition of Terms Relating to Fiber Optics. |
|----|-------------|--|

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**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01010.
- B. Submit product data for information with each reel of cable. Include the customer purchase order number, cable part number, weight of cable and reel length of cable, beginning and ending length markings, and manufacturer's certified inspection and test report.

**1.6 DEFINITIONS**

- A. Terms shall be as defined by IEEE 812.

**PART 2 PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Siecor Corporation.
- B. Chromatic Technologies.
- C. Belden Wire and Cable.

**2.2 MATERIALS**

- A. General
  - 1. One hundred percent all-dielectric, loose-tube fiber optic cable assembly suitable for use in aerial applications. Assembly shall consist of two multimedia fibers cabled into a single multifiber cable.
  - 2. Each fiber shall have a glass optical core, a core cladding of low-density glass concentric about the optical core, and a protective acrylate buffer coating to protect the outer surface of the fiber.

- 3. The core assembly of the cable shall consist of a single layer of the gel-filled loose buffer tubes stranded around an all-dielectric, antibuckling central member. The core assembly shall be wrapped with a binder tape to maintain the alignment of the buffer tubes. An aramid fiber tensile strength member shall be applied over the binder tape, followed by an outer jacket of black polyethylene. The outer jacket shall be medium- or high-density polyethylene (MDPE or HDPE).
- 4. The interstices in the cable core shall be filled with a water-blocking compound to prevent water penetration and migration. The filling compound shall be electrically nonconductive, homogeneous, and free from dirt and other foreign matter.
- 5. A dielectric rip cord shall be provided under the outer jacket to permit jacket removal without damage to the optical fibers. The rip cord shall be continuous in any length of cable.
- 6. Individual fibers shall be enclosed in color-coded, plastic buffer tubes (loose buffer construction) which are filled with a stable viscosity gel throughout the entire cable length.
- 7. The cable shall contain individual buffer tubes with each buffer tube containing no more than six multimode fibers. Both the buffer tubes and the individual fibers within a single buffer tube shall be color coded in accordance with the following table.

<u>Fiber or Buffer Tube No.</u>	<u>Color</u>
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White

- 8. Splices are not permitted within the cable. The fiber optic cable shall be shipped on reels from the manufacturer in continuous lengths without splices.

B. Multimode Optical Fiber

1. Fiber Type: Graded-index, dual window, multimode fiber.
2. Core Diameter:  $62.5 \pm 3.0$  microns.
3. Core Noncircularity:  $< 6.0$  percent.
4. Cladding Outside Diameter:  $125 \pm 2.0$  microns.
5. Cladding Noncircularity:  $\pm 2.0$  percent.
6. Concentricity Error:  $< 6.0$  percent.
7. Protective Coating Diameter:  $250 \pm 15$  microns.
8. Numerical Aperture:  $0.27 - 0.29$ .
9. Maximum Attenuation:  $3.75$  dB/km @  $850$  nm,  $1.5$  dB/km @  $1,300$  nm.
10. Minimum Bandwidth:  $160$  MHz-km @  $850$  nm,  $500$  MHz-km @  $1,300$  nm.

C. Cable Mechanical Specifications

1. Nominal Jacket Wall Thickness:  $0.055$  in.
2. Maximum Tensile Loading - Installation:  $> 600$  lbs.
3. Maximum Tensile Loading - Maintained:  $> 100$  lbs.
4. Minimum Bending Radius - Installation:  
 $< 20 \times$  Cable OD.
5. Minimum Bending Radius - Maintained:  
 $< 12 \times$  Cable OD.

D. The attenuation of the multimode fibers shall not vary more than  $0.50$  dB/km at  $1,300$  nm, and the attenuation of the single-mode fibers shall not vary more than  $0.20$  dB/km at  $1,550$  nm for the following environmental conditions:

1. Operation:  $-40$  degrees C to  $+65$  degrees C.
2. Installation:  $-30$  degrees C to  $+60$  degrees C.
3. Storage:  $-50$  degrees C to  $+70$  degrees C.

E. Cable Markings

1. Cable markings shall be imprinted with white characters on the outer cable jacket.
2. The cable markings shall be permanent, insoluble in water, and legible for the cable life.

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3. The following identification markings shall be imprinted on the cable jacket at intervals of not more than 1 meter:
  - a. Manufacturer.
  - b. Year of manufacture.
  - c. "OPTICAL CABLE."
  - d. Manufacturer's part number.
  
4. All cables shall have sequentially numbered feet or meter length markings imprinted on the jacket.
  - a. The length markings shall not be reset to zero along the length of the cable.
  - b. Actual cable length shall be within  $\pm 1$  percent of the length as indicated by the length markings.
  
- F. Approximately 2 meters of cable on the inboard of each cable shall be accessible for optical time domain reflectometer (OTDR) testing of the cable.
  
- G. Cable Termination
  1. Fiber optic cable shall be terminated with a ST-style physical contact (PC) 2.5 mm bayonet connector with a strain relief boot.
  2. The ferrule material shall be zirconia ceramic, and the connector housing shall be nickel-plated zinc.

### PART 3 EXECUTION

#### 3.1 SITE CONDITIONS

- A. Verify that new and existing conduit is suitable for use.
  
- B. Verify that new and existing aerial messenger cable is suitable for use.

#### 3.2 INSTALLATION

- A. Install in new and existing conduit and directly buried, where indicated.

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- B. Install wall-mounted and pole-mounted fiber optic cable pull boxes.
- C. Install fiber optic cables in accordance with manufacturer's installation instructions.
- D. Attach fiber optic cables to existing aerial messengers in accordance with manufacturer's installation instructions.

### 3.3 QUALITY CONTROL

- A. Provide all test equipment, including the OTDR, power meters, LED sources, laser sources, connector adapters, launch and receive cable, attenuators, and other devices necessary for these tests. All sources and OTDRs shall operate within the range of  $850 \pm 30$  nm and  $1,300 \pm 20$  nm. A high-resolution OTDR shall be used for providing signature traces.
- B. Before installation, use an OTDR to test the fiber optic cable after it is delivered to the site and while it is still on the reel. Each fiber in each reel of cable shall be tested; fibers shall be tested at the 1,300 nm wavelength. A hard copy and an electronic copy of the OTDR trace shall be provided as part of the overall testing documentation; the OTDR trace shall show the placement of measurement cursors and shall include the measured fiber length, the measured attenuation (dB/km), the operating wavelength, the cable reel number, and the specific fiber in the cable being tested. Test as required by EIA/TIA FOTP-60 and -61.
- C. After installation/before splicing, a second OTDR test shall be performed for each installed length of cable to ensure that no damage was done to the fibers during installation. Perform the test on each single fiber in each buffer tube for each link of cable. OTDR traces of these tests are not required.

- D. After splicing, a third OTDR test shall be performed for each completed fiber optic link. Every fiber in each cable, including spares, shall be tested, and a hard copy and an electronic copy of the OTDR trace shall be provided as part of the overall testing documentation. The OTDR trace shall show the placement of measurement cursors and shall include the measured fiber length, the measured attenuation (dB/km), the operating wavelength, the cable identification numbers, and the specific fiber in the cable being tested. Test as required by EIA/TIA FOTP-60 and -61.
- E. Insertion loss tests conforming to EIA/TIA Standard 526-14-90 (Method B) shall be performed for each installed fiber optic link (i.e., after the pigtailed fibers are spliced to the trunk cable fibers). Multimode fibers shall be tested with an LED source at the 850 nm and 1,300 nm wavelengths. The effects of modal distribution on connector and fiber loss shall be minimized. Each fiber will be tested in both directions. Launch and receive cables, which match the fiber type being tested, shall be used to connect the test instrumentation to the fiber link. The launch and receive cables shall be 3 meters in length. The test procedure is described below. Replace all dust caps after testing is completed.
1. Attach one end of the launch cable to the source and the other end to the fiber optic power meter. Adjust the source power to a convenient value such as 0 dBu (-30 dBm); this is the reference power level ( $P_{ref}$ ).
  2. Disconnect the launch cable from the power meter and reconnect it to a test connector coupling. Do not disconnect the launch cable from the source after recording  $P_{ref}$ . Connect one end of the receive cable to the other side of the test connector coupling, and attach the other end to the fiber optic power meter. Verify that the attenuation added by the receive cable is not greater than 1.0 dB.

3. Remove the test connector coupling. Attach the launch cable to the fiber link to be tested by connecting it to the appropriate connector coupling in the local distribution frame. Attach the receive cable to the opposite end of the fiber link under test by connecting it to the appropriate connector coupling in the remote distribution frame. Record the link loss (i.e., the measured power level,  $P_{test}$ , minus  $P_{ref}$ , in dB) on the accompanying form (Attachment B).
  4. Compare the measured values to the maximum losses specified. If a fiber fails to meet these specifications, the connectors shall be cleaned, inspected with a microscope, and retested. If the fiber still fails the insertion loss test, an OTDR test will be performed to determine the corrective action necessary.
- F. Prepare a separate Fiber Optic Test Report (Attachment A) for each type of test performed (i.e., the before installation OTDR test, the after installation/before splicing OTDR test, the after splicing OTDR test, and the insertion loss test). Refer to Attachment B for the insertion loss test report (Link Loss Certification Test Report). Assemble test reports and OTDR traces, including electronic traces, in a complete, bound manual.

END OF SECTION

**ATTACHMENT A**

---

**FIBER OPTIC TEST REPORT**

ATTACHMENT A  
FIBER OPTIC TEST REPORT

Project Title: \_\_\_\_\_

Page \_\_\_ of \_\_\_

Date: \_\_\_\_\_

Type of Test: \_\_\_\_\_

Section of 16129 Defining Test: \_\_\_\_\_

Test Instrument: \_\_\_\_\_

Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_ Calibration Date: \_\_\_\_\_

Test Instrument: \_\_\_\_\_

Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_ Calibration Date: \_\_\_\_\_

Source (Type): \_\_\_\_\_ Wavelength: \_\_\_\_\_

Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_ Calibration Date: \_\_\_\_\_

Source (Type): \_\_\_\_\_ Wavelength: \_\_\_\_\_

Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_ Calibration Date: \_\_\_\_\_

Source (Type): \_\_\_\_\_ Wavelength: \_\_\_\_\_

Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_ Calibration Date: \_\_\_\_\_

Test Performed By: \_\_\_\_\_ Organization: \_\_\_\_\_

Test Supervised By: \_\_\_\_\_ Organization: \_\_\_\_\_

Test Witnessed By: \_\_\_\_\_ Organization: \_\_\_\_\_

Construction Engineer: \_\_\_\_\_

**ATTACHMENT B**

---

**LINK LOSS CERTIFICATION TEST REPORT**

ATTACHMENT B  
LINK LOSS CERTIFICATION TEST REPORT

PROJECT: \_\_\_\_\_

TEST PERFORMED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

PAGE: \_\_\_ OF \_\_\_

CABLE NO.: \_\_\_\_\_

FROM (TRANSMIT): \_\_\_\_\_

TO (RECEIVE): \_\_\_\_\_

FIBER NO.	TYPE (MM/SM)	CALCULATED LOSS VALUE		MEASURED LOSS VALUE		DIFFERENCE	
		850 nm	1300 nm	850 nm	1300 nm	850 nm	1300 nm
1	mm						
2	mm						
3	mm						
4	mm						
5	mm						
6	mm						

SECTION 16170  
GROUNDING AND BONDING

**PART 1      GENERAL**

**1.1          SECTION INCLUDES**

- A.      Grounding electrodes and conductors.
- B.      Equipment grounding conductors.
- C.      Bonding.
- D.      Fence grounding.
- E.      Grounding test well.

**1.2          RELATED SECTIONS**

- A.      Section 01010 - General Requirements.
- B.      Section 01011 - Submittals.
- C.      Section 02831 - Chain Link Fences.
- D.      Section 15170 - Motors.
- E.      Section 16050 - Basic Electrical Materials and Methods.
- F.      Section 16370 - Overhead Power Distribution.

**1.3          REFERENCE DRAWINGS**

- A.      See Section 01012 for the Schedule of Drawings.

**1.4          REFERENCES**

- A.      InterNational Electrical Testing Association (NETA):
  - 1.      NETA ATS-95                      Acceptance Testing  
   Specifications for Electrical  
   Power Distribution Equipment  
   and Systems.

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- B. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
- C. Underwriters Laboratories, Inc. (UL):
  - 1. UL 467-93 UL Standard for Safety Grounding and Bonding Equipment.
  - 2. Electrical Construction Materials Directory-96.

**1.5 SYSTEM DESCRIPTION**

- A. Rod electrode and grounding connections.
- B. Grounding System Resistance: 5 ohms maximum.

**1.6 SUBMITTALS**

- A. Provide submittals as required by Section 01011.
- B. Provide certification of ground testing instrumentation.
- C. Provide record of as-built locations of grounding electrodes, if grounding electrodes are required.

**1.7 QUALITY ASSURANCE PROGRAM**

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed in the UL Electrical Construction Materials Directory as suitable for the purpose specified and indicated.
- C. Provide certification of ground testing instrumentation according to NETA ATS.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers
1. Mechanical Connectors
    - a. Burndy.
    - b. Ideal.
    - c. Ilsco.
  2. Exothermic Connections
    - a. Cadweld.
    - b. Thermoweld.

2.2 MATERIALS

- A. Rod Electrode
1. Copper-clad steel, 3/4-inch diameter, 10-foot length.
- B. Mechanical Connectors
1. Bronze.
- C. Wire
1. Stranded copper.
    - a. Grounding Conductor: Size to meet NFPA 70 requirements.
- D. Grounding and bonding materials shall conform to UL 467.
- E. Grounding Test Well
1. Well Pipe: Clay tile pipe with belled end, 12-inch I.D. by 24 inches long.
  2. Well Cover: Cast iron with legend "GROUND" embossed on cover, with recessed lifting handle.

PART 3 EXECUTION

3.1 SITE CONDITIONS

- A. Verify that final backfill and compaction have been completed before driving rod electrodes.

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- B. Verify that underground utilities will not interfere with the proposed rod locations prior to driving rod electrodes.

### 3.2 ERECTION/INSTALLATION/APPLICATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install additional rod electrodes as required to achieve specified resistance to ground.
- C. Equipment Grounding Conductor: Provide separate, insulated conductor with each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Install grounding test well pipe with cover as indicated on the drawings. Install well pipe top flush with finished grade.
- E. Connect ground conductors to reinforcing bars in foundation before pouring concrete. Tie to structural steel members when they are installed, by exothermic connection.
- F. Ground all metal equipment enclosures by attachment to ground rod system, the building steel, or existing periphery grounding system.
- F. Ground pole-mounted equipment and static line conductors as indicated on the drawings.
- E. Fence Grounding: Fences shall be grounded with a ground rod at each fixed gate post and at each corner post:
  - 1. Drive ground rods until the top is 12 inches below grade.

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2. Attach a No. 4 AWG copper conductor, by fusion weld process, to the ground rods and extend it underground to the immediate vicinity of the fence post.
3. Lace the conductor vertically into 12 inches of fence mesh and fasten it by two approved bronze compression fittings, one to bond the wire to the post and the other to bond the wire to the fence. Each gate section shall be bonded to its gatepost by a 1/8-inch by 1-inch flexible braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

### 3.3 QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation as defined by contract documents and manufacturer's instructions. Accurately record as-built locations of grounding electrodes if required, and submit to FDF. Test instrumentation shall conform to NETA ATS. Provide certification for instrumentation.
- B. Measure the system's resistance to the ground; perform testing in accordance with instrument manufacturer's recommendations using the fall-of-potential method. Provide written test reports indicating overall resistance to ground and resistance of each electrode to ground.

END OF SECTION

SECTION 16370  
OVERHEAD POWER DISTRIBUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Poles.
- B. Crossarms.
- C. Pole hardware.
- D. Insulators.
- E. Line conductors.
- F. Arresters and cut-outs.
- G. Pole mounted distribution transformers.
- H. Anchors.

1.2 RELATED SECTIONS

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 16050 - Basic Electrical Materials and Methods.
- D. Section 16170 - Grounding and Bonding.
- E. Section 16129 - Fiber Optic Cable and Accessories.

1.3 REFERENCE DRAWINGS

- A. See Section 01012 for the Schedule of Drawings.

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#### 1.4 REFERENCES

- A. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code, 1996 Edition.
- B. American National Standards Institute (ANSI):
1. ANSI C2-97 National Electrical Safety Code.
  2. ANSI C29.2-92 Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type.
  3. ANSI C29.4-89 Wet-Process Porcelain Insulators - Strain Type.
  4. ANSI C29.5-84 Wet-Process Porcelain Insulators - Low and Medium Voltage Types.
  5. ANSI C29.9-83 Wet-Process Porcelain Insulators - High Voltage Line-Post Type.
  6. ANSI C37.42-89 Switchgear - Distribution Cutouts and Fuse Links - Specification.
  7. ANSI C135.1-79 Galvanized Steel Bolts and Nuts for Overhead Line Construction.
  8. ANSI C135.22-88 Zinc Coated Galvanized Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction.
  9. ANSI O5.1-92 Wood Poles Specifications and Dimensions.
- C. American Society for Testing and Materials (ASTM):
1. ASTM A36/A36M-96 Standard Specification for Carbon Structural Steel.
  2. ASTM A475-95 Standard Specification for Zinc-Coated Steel Wire Strand.
  3. ASTM A675/A675M Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.  
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4. ASTM B232-92 Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR).
5. ASTM D698-91 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft<sup>3</sup>).

D. American Wood-Preservers Association (AWPA):

1. AWPA C4-89 Poles - Pressure Process.
2. AWPA C25-89 Standard for the Preservative Treatment of Crossarms by the Pressure Process.

E. National Electrical Manufacturers Association (NEMA):

1. NEMA LA 1-92 Surge Arresters.
2. NEMA WC 7-88 Cross-Linked-Thermosetting Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

F. Underwriters Laboratories, Inc. (UL):

1. UL 96-94 UL Standard for Lightning Protection Components.
2. Electrical Construction Materials Directory-96.

### 1.5 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70 and ANSI C2.
- B. Furnish products, where available, listed in the UL Electrical Construction Materials Directory as suitable for the purpose specified and indicated.
- C. Installation shall comply with ANSI C2, heavy loading district, Grade B construction.

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## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect poles from damage and decay by stacking to provide free circulation of air. Maintain 1 foot (300 mm) minimum spacing between bottom pole and ground or ground vegetation. Do not store poles above decayed or decaying wood.
- B. Stack poles stored for more than 2 weeks on decay-resistant skids arranged to support poles without noticeable pole distortion.
- C. Handle treated poles with tools which will not produce an indentation greater than 1 inch (25 mm) deep. Do not drag treated poles along ground. Do not apply tools to that section of treated poles between 1 foot (300 mm) above and 2 feet (600 mm) below ground line.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Poles
  1. Wood Poles: ANSI 05.1; treated southern pine poles of length and class indicated.
  2. Select poles for straightness, minimum sweeps, and short crooks.
  3. Preservative: ANSI 05.1 and AWPA C4, Pentachlorophenol.
  4. Apply preservative to poles as required by AWPA C4 with minimum net retention of 12 lbs/ft<sup>3</sup> (285 kg/m<sup>3</sup>). Obtain complete sapwood penetration.
- B. Crossarms
  1. Crossarms: Straight-grained southern pine, free of twists to within 0.1 inch per foot of length, with bends and twists in only one direction.
  2. Apply preservative to crossarms as required by AWPA C25 with minimum net retention of 8 lbs/cu ft (190 kg/cu m).

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3. Crossarm Dimensions: as indicated.

#### C. Pole Hardware

1. Miscellaneous Pole Hardware: Hot-dipped galvanized after fabrication.
2. Crossarm Braces: Flat structural steel zinc coated to ASTM A675, span, as indicated, formed in one piece from 1/4 by 1-1/4 inch steel.
3. Eye Bolts and Nuts: ANSI C135.1.
4. Ground Rods: Copperweld 3/4 inch O.D. by 10 foot -0 inches long.
5. Butt Plate: Copper.
6. Pole-top Insulator Pins: ANSI C135.22.
7. Hot-line Clamps: Screw type with concealed threads. Fill thread chamber with corrosion-resistant compound.
8. Guy Strand: High strength, seven-strand steel cable galvanized to ASTM A475, Class A or B.
9. Guy Termination: Preformed wire type.
10. Guy Guards: 8-foot (2 m) long plastic, colored yellow.
11. Ground Wire: Soft drawn solid copper conductors, No. 4 AWG minimum size.
12. Air Terminal: UL 96; 18-inch copper air terminal.
13. Guy Adapter: Tripleye.

#### D. Insulators

1. Insulators: Radio interference free wet process porcelain insulators with minimum wet flashover rating of 80 kV.
2. Line Post Insulators: ANSI C29.7; Class 57.1.
3. Suspension Insulators: ANSI C29.2; Class 52.9.
4. Pin Insulators: ANSI C29.5; Class 55.5.
5. Guy Strain Insulators: ANSI C29.4; Class 54.1.

#### E. Line Conductors

1. Medium-voltage Line Conductors: Bare aluminum conductor steel reinforced, size as indicated: ASTM B232.

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- C. Shorten poles when required by cutting from top end. Apply hot preservative to shortened end of pole.
- D. Set poles in straight line. Place curved poles with curvature in line with lead pole. Maintain an even grade.
- E. Dig setting holes large enough to permit use of power tampers to full depth. Place earth in maximum 6-inch (150 mm) layers and pack to 95 percent density per ASTM D698.
- F. Rake poles located at corners, angles, and dead ends so that poles are vertical after line installation.
- G. Do not install poles along the edge of cuts and embankments or where soil may be washed out.
- H. Identify each pole using aluminum marker stamped with characters 2-1/2 inches (60 mm) high, minimum. Locate to provide maximum visibility from roadway and fasten with aluminum nails. Obtain identifying numbers from the FDF Construction Manager.
- I. Minimum depths in normal firm ground, measured from lower side of pole:

OVERALL LENGTH	DEPTH FOR STRAIGHT LINES	DEPTH AT CURVES, CORNERS, AND POINTS OF EXTRA STRAIN
30'	5'-6"	5'-6"
35'	6'-0"	6'-0"
40'	6'-6"	6'-6"
45'	7'-0"	7'-6"
50'	7'-6"	8'-0"
60'	8'-6"	8'-6"

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- J. Set crossarms at right angles to line for straight runs; and to bisect the angle of turns in line direction.
- K. Provide two braces for each crossarm.
- L. Install conductors to ANSI C2.
- M. Install guys and anchors according to ANSI C2 requirements.
- N. Use small diameter steel probe to verify area is free of underground obstructions prior to installation of anchors.

END OF SECTION

SECTION 16462  
 DRY TYPE TRANSFORMER/PANELBOARDS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Dry type, two-winding transformers integrated with primary and secondary main breakers and feeder breakers.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
 B. Section 01011 - Submittals.  
 C. Section 16050 - Basic Electrical Materials and Methods.  
 D. Section 16170 - Grounding and Bonding.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. National Electrical Manufacturers Association (NEMA):
- |    |                |  |
|----|----------------|--|
| 1. | NEMA AB 1-93   | Molded Case Circuit Breakers and Molded Case Switches.   |
| 2. | NEMA PB 1-90   | Panelboards.   |
| 3. | NEMA PB 1.1-91 | General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less. |
| 4. | NEMA ST 20-92  | Dry Type Transformers for General Applications.  |

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5. NEMA 250-91 Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code, 1996 Edition.
- C. Underwriters Laboratories, Inc. (UL):
1. Electrical Construction Materials Directory-95.

#### 1.5 SUBMITTALS

- A. Provide submittals as required by Section 01011.
- B. Product Data: Include outline and support point dimensions of enclosures and accessories; unit weight; voltage; kVA, number of phases, impedance ratings, and characteristics; X/R ratio; tap configurations; insulation system type; rated temperature rise; and main bus ampacity, integrated short circuit ampere rating, circuit breaker, arrangement, and sizes.
- C. Transformer Test Reports:
1. Factory Test: NEMA ST 20. Indicate loss data; efficiency at 25, 50, 75, and 100 percent rated loads; and sound level.
  2. Field Test: Indicate primary and secondary voltages as measured.

#### 1.6 QUALITY ASSURANCE PROGRAM

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed in the UL Electrical Construction Materials Directory for the purpose specified and indicated.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver transformers/panelboards individually wrapped for protection and mounted on shipping skids.

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- B. Accept transformers/panelboards on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer/panelboards' internal components, enclosure, and finish.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Siemens.
- B. Westinghouse.
- C. Square D.

### 2.2 EQUIPMENT

- A. Two-winding transformers
  1. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers; ratings as indicated on contract drawings.
  2. Insulation system and average winding temperature rise for rated kVA as follows:
    - a. 1-30 kVA: Class 185 with 115 degrees C rise.
    - b. 16-500 kVA: Class 220 with 115 degrees C rise.
  3. Case Temperature: Do not exceed 40 degrees C rise above ambient at warmest point.
  4. Winding Taps:
    - a. Transformers: NEMA ST 20. Transformers shall have four full current taps, two at 2-1/2 percent each above and two at 2-1/2 percent each below normal voltage.

5. Sound Levels: NEMA ST 20, not to exceed 85 dBA at 3 feet.
6. Basic Impulse Level (BIL): 10 kV, minimum.
7. Ground core and coil assembly to enclosure by means of a visible, flexible copper grounding strap.
8. Mounting: Suitable for wall or floor mounting.
9. Coil Conductors: Continuous windings with terminations brazed or welded.
10. Enclosure: NEMA ST 20. Provide lifting eyes or brackets.
11. Isolate core and coil from enclosure, using vibration-absorbing mounts.
12. Nameplate: Include connection data and overload capacity based on rated allowable temperature rise.

B. Branch Circuit Panelboards

1. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
2. Enclosure: NEMA PB 1; Type 3R conforming to NEMA 250.
3. Cabinet Size: As shown on manufacturer's drawings.
4. Cabinet Front: Hinged cover with paddle lock hinge.
5. Provide an integrated unit with transformer. Finish in manufacturer's standard gray enamel.
6. Provide panelboards with copper bus, ratings as scheduled on drawings. Provide copper ground bus in each panelboard.
7. Minimum Integrated Short Circuit Rating: as indicated, 10,000 amperes rms symmetrical minimum.
8. Molded Case Circuit Breakers: NEMA AB 1; plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, rated for 75 degrees C copper conductors. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where required. Provide 20 percent spare breakers installed in the panelboard.

PART 3 EXECUTION

3.1 ERECTION/INSTALLATION/APPLICATION

- A. Install transformer/panelboards in accordance with NEMA PB 1.1.
- B. Install plumb, and in accordance with manufacturer's instructions, and as indicated on contract drawings.
- C. Height: 6 feet, 6 inches to top of transformer section.
- D. Provide grounding connections in accordance with Section 16170.
- E. Provide filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- G. Provide permanently fastened, engraved plastic nameplates identifying transformer/panelboard equipment number.

3.2 QUALITY CONTROL

- A. Test according to general requirements of Section 16050.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, grounding, and conformance of installation to contract documents and manufacturer's instructions. Check tightness of wiring and mounting connections for circuit breakers and transformer prior to energizing.
- C. Record primary and secondary voltages; submit to Construction Manager.

- D. Measure steady state load currents at each panelboard feeder. Rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 16470  
PANELBOARDS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Power panelboards.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. National Electrical Manufacturers Association (NEMA):
1. NEMA AB 1-93 Molded Case Circuit Breakers and Molded Case Switches.
  2. NEMA PB 1-90 Panelboards.
  3. NEMA PB 1.1-91 General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
  4. NEMA 250-91 Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. InterNational Electrical Testing Association (NETA):
1. NETA ATS-95 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

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- C. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
- D. Underwriters Laboratories, Inc. (UL):
  - 1. Electrical Construction Materials Directory-96.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.

**1.6 QUALITY ASSURANCE PROGRAM**

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

**1.7 PROJECT CONDITIONS**

- A. Project Record Documents:
  - 1. Record actual locations of products; indicate actual branch circuit arrangement.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Siemens.
- B. Westinghouse.
- C. Square D.

## 2.2 EQUIPMENT

- A. Circuit Breaker Panelboards:
1. Circuit Breaker Panelboards: NEMA PB 1, circuit breaker type.
  2. Panelboard Bus: Copper, ratings as indicated on contract drawings. Provide copper ground bus in each panelboard. Incoming bus shall have lugs suitable for cables indicated.
  3. Minimum Integrated Short Circuit Rating: 18,000 amperes rms symmetrical, or as indicated on contract drawings.
  4. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type, thermal magnetic trip circuit breakers with common trip handle for all poles, lockable using external devices. Provide UL-listed circuit breakers. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Breakers shall have lugs suitable for cables indicated.
  5. Enclosure: NEMA 250, Type 12 (indoor) or Type 3R (outdoor).
  6. Cabinet Box: 6 inches deep; 20 inches wide.
  7. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

## PART 3 EXECUTION

### 3.1 ERECTION/INSTALLATION/APPLICATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards horizontal and plumb. Install in accordance with manufacturer's instructions.
- C. Height: 6 feet to top of panelboard.
- D. Install panelboards as indicated on contract drawings.
- E. Provide filler plates for unused circuit breaker spaces.

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- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- G. Provide engraved plastic nameplates, permanently attached with self-tapping screws.
- H. Provide working clearance in accordance with NFPA 70, minimum 36 inches from front.

### 3.2 QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits. Submit recordings of steady load currents after balancing.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.
- C. Inspect and test accordance with NETA ATS except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

END OF SECTION

SECTION 16500  
LIGHTING**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Luminaries and lampholders.
- B. Ballasts.
- C. Lamps.
- D. Exit signs.
- E. Emergency lighting units.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.
- B. Section 01011 - Submittals.
- C. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
  - 2. NFPA 101-94 Code for Safety to Life from Fire in Buildings and Structures.
- B. National Electrical Manufacturer's Association (NEMA):
  - 1. NEMA WD 6-88 Wiring Devices - Dimensional Requirements.

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- C. American National Standards Institute (ANSI):
  - 1. ANSI C82.4-85 Ballasts for High Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Types).
- D. Underwriters Laboratories, Inc. (UL):
  - 1. Electrical Construction Materials Directory-96.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01010.
- B. Product Data: Provide dimensions, ratings, and performance data including photometric and beamsread plots.

**1.6 QUALITY ASSURANCE PROGRAM**

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101.
- C. Products shall be listed in the UL Electrical Construction Materials Directory, for the purpose specified and indicated.

**PART 2 PRODUCTS**

**2.1 EQUIPMENT**

- A. Luminaries
  - 1. Furnish high pressure sodium fixtures as indicated on drawings.
  - 2. Factory install ballasts, lamps, and accessories.
  - 3. Pendant luminaries: Provide swivel hangers, pendant rods, tubes, and chains as required to install luminaries at appropriate height.
- B. Exit Signs
  - 1. Description: LED type exit sign fixture suitable for use as emergency lighting unit.
  - 2. Housing: Extruded aluminum.

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3. Face: Translucent face with red letters on white background.
4. Directional Arrows: Universal type for field adjustment.
5. Mounting: Universal for field selection.
6. Battery: 6 volt, nickel-cadmium type, with 1.5 hour capacity.
7. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within 12 hours.
8. Input Voltage: 120 volts, 60 Hz.

C. Emergency Lighting Units

1. Description: Self-contained emergency lighting unit with rechargeable battery.
2. Input voltage: 120 volts, 60 Hz.
3. Battery: Nickel-cadmium type with 1.5 hour capacity.
4. Battery Charger: Dual rate type capable of recharging discharged battery to full charge within 12 hours.
5. Lamps: 12 watt, sealed-beam type.
6. Electrical connection: 6-foot cord with NEMA WD 6-type 5-15 plug cap.

## 2.2 ACCESSORIES

A. Ballasts

1. High Intensity Discharge (HID) Ballast:
  - a. Description: ANSI C82.4 HID lamp ballast.
  - b. Description: HID lamp ballast.
  - c. Provide ballast suitable for lamp specified.
  - d. Voltage: Match luminaire voltage.

B. Lamps

1. High-Pressure Sodium Lamps: Clear, suitable for ballast, furnished in luminaire, and for all burning positions.

C. Photoelectric Control

1. Control above maximum footcandles: provide with adjustable cutoff point.
2. Load control: Sized for fixture, 120 volts.

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3. Provide photoelectric controls for exterior lighting.

**PART 3 EXECUTION**

**3.1 SITE CONDITIONS**

- A. Examine substrate and supporting grids for luminaries.
- B. Examine each luminaire to determine suitability for lamps specified.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install suspended luminaries and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at height indicated on drawings.
- C. Support luminaries independent of ceiling framing.
- D. Install surface-mounted luminaries and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

**3.3 QUALITY CONTROL**

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

**3.4 ADJUSTING**

- A. Adjust exit sign directional arrows.
- B. Relamp luminaries that have failed lamps at substantial completion.

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**3.5 CLEANING**

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

**3.6 DEMONSTRATION**

- A. Provide minimum of 2 hours demonstration of luminaire operation.

END OF SECTION

SECTION 16855  
HEATING CABLES

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Heating cable and accessories.

**1.2 RELATED SECTIONS**

- A. Section 01010 - General Requirements.  
B. Section 01011 - Submittals.  
C. Section 15060 - Pipe, Fittings, Valves, and Accessories.  
D. Section 15250 - Insulation.

**1.3 REFERENCE DRAWINGS**

- A. See Section 01012 for the Schedule of Drawings.

**1.4 REFERENCES**

- A. National Fire Protection Association (NFPA):  
1. NFPA 70 National Electrical Code, 1996 Edition.
- B. National Electrical Manufacturers Association (NEMA):  
1. NEMA ICS 6-93 Industrial Controls and Systems Enclosures.
- C. Underwriters Laboratories, Inc. (UL):  
1. Electrical Construction Materials Directory-96.

**1.5 SUBMITTALS**

- A. Provide submittals as required by Section 01011.  
B. Annotated drawings reflecting installed features requiring freeze protection, for approval.

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**1.6 SYSTEM DESCRIPTION**

- A. Heat tracing for pipe and any other outdoor equipment requiring freeze protection with outside temperature at -30 degrees F. Pipes and other outdoor equipment to be protected are indicated on contract P&ID drawings. Work includes design of heat trace system as well as products and execution herein specified.

**1.7 QUALITY ASSURANCE PROGRAM**

- A. All work shall comply with NFPA 70. Use of conduit for equipment ground is prohibited.
- B. Products shall be listed in the UL Electrical Construction Materials Directory, for the purpose specified and indicated.

**1.8 SEQUENCING AND SCHEDULING**

- A. Coordinate installation of heating cable with installation of piping and piping insulation.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers:
  - 1. Raychem.
  - 2. Chromalox.
  - 3. Thermon.

**2.2 MATERIALS**

- A. Heating Cable
  - 1. Self-limiting, parallel resistance electric tracing cable with grounding shield around conductors. Maximum output temperature 150 degrees F.
  - 2. Rating: 120V or as required.

**2.3 ACCESSORIES**

- A. Thermostat: Type 4X according to NEMA ICS 6, adjustable setpoint, suitable for -30 degrees F to 140 degrees F.
- B. Pilot light: Red.
- C. Power termination kits, splice kits, tee kits, and end seals shall be utilized.
- D. Provide stainless steel identification tags for all devices. Include assembly and circuit numbers.

**PART 3 EXECUTION**

**3.1 SITE CONDITIONS**

- A. Verify that the piping system is complete, tested, and ready for heating equipment.
- B. Verify field measurements shown on drawings. Where installation differs from drawings, Subcontractor shall annotate drawings and submit for approval before installation.
- C. Verify that required utilities are available, in proper locations, and ready for use.

- D. Follow these guidelines for cable wattage and maximum circuit length, or provide Supplier information to support alternate lengths:

Pipe OD	Cable Wattage	Max. Length, ft. (20A, 120V)	Max. Length, ft. (30A, 120V)
1-1/2 inch or less	3 watts/ft	265	330
1-1/2 to 3 inch	5 watts/ft	185	270
3 inch to 6 inch	8 watts/ft	130	200
8 inch	10 watts/ft	105	160
10 inch	15 watts/ft	80	120
12 inch	15 watts/ft	80	120

### 3.2 ERECTION/INSTALLATION/APPLICATION

- A. Install heat trace material on piping system and other outdoor equipment as indicated on drawings. Install to allow for heat trace cable to be moved aside during maintenance of piping system.
- B. Install in accordance with manufacturer's instructions and NFPA 70.
- C. Avoid pinching and making sharp bends in cable.
- D. Prevent damage by sharp objects during installation.
- E. Do not install electric tracing cables across expansion joints.
- F. All electric heat trace cables shall be installed in the 7 and 8 o'clock positions or in the 4 and 5 o'clock positions on horizontal runs of pipes.
- G. Accurately record actual locations of heating cable, thermostats, and branch circuit connections.

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**3.3 QUALITY CONTROL**

- A. Test continuity of heating cable.
- B. Measure insulation resistance to manufacturer's recommended values. Use test instruments in accordance with manufacturer's instructions.
- C. Perform continuity and insulation resistance test on completed cable installation prior to installation of thermal insulation.
- D. Measure voltage and current at each unit.

**3.4 DEMONSTRATION**

- A. Demonstrate operation of heating cable controls.

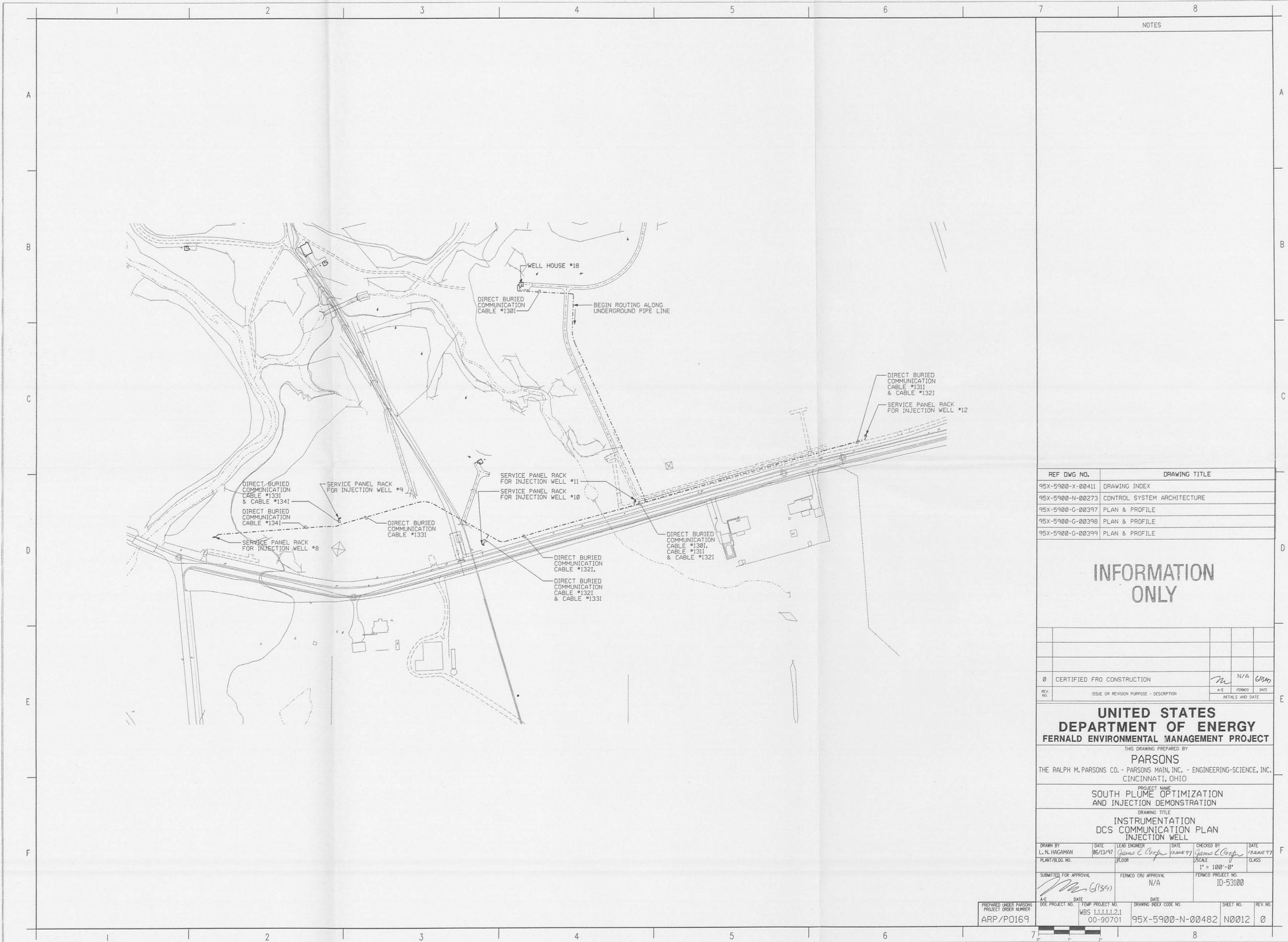
**3.5 RECORD DRAWINGS**

- A. Provide drawings showing actual heating cable installation. Include cable lengths, cable catalog numbers, indicating lights, and other similar details.

**END OF SECTION**







NOTES

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-N-00273	CONTROL SYSTEM ARCHITECTURE
95X-5900-G-00397	PLAN & PROFILE
95X-5900-G-00398	PLAN & PROFILE
95X-5900-G-00399	PLAN & PROFILE

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	<i>M</i>	N/A	6/28/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERMITS	DATE
		INITIALS AND DATE		

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
 DRAWING TITLE  
**INSTRUMENTATION DCS COMMUNICATION PLAN INJECTION WELL**

DRAWN BY L. N. HAGAMAN	DATE 05/13/97	LEAD ENGINEER <i>James C. Cooper</i>	DATE 05/20/97	CHECKED BY <i>James C. Cooper</i>	DATE 05/20/97
PLANT FIELD NO.	FLOOR	SCALE 1" = 100'-0"		CLASS	
SUBMITTED FOR APPROVAL <i>M</i> (13/97)	FERNCO CRU APPROVAL N/A	FERNCO PROJECT NO. ID-53100			

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	DOE PROJECT NO. WBS 1.1.1.1.1.2.1	FEMP PROJECT NO. 00-90701	DRAWING INDEX CODE NO. 95X-5900-N-00482	SHEET NO. N0012	REV. NO. 0
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PREPARED UNDER PROVISIONS OF PROJECT OPEN NUMBER  
 APP/P0169  
 WBS 11.11.21  
 00-90701  
 95X-5900-N-00478  
 N0011  
 0

DATE: 5/21/97  
 CHECKED BY: J. COOPER  
 5/30/97  
 DATE: 5/21/97  
 CHECKED BY: J. COOPER  
 5/30/97

PROJECT NAME: SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION  
 DRAWING TITLE: LOGIC DIAGRAM  
 INSTRUMENTATION LOGIC DIAGRAM

THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PARSONS  
 DEPARTMENT OF ENERGY  
 FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
 UNITED STATES

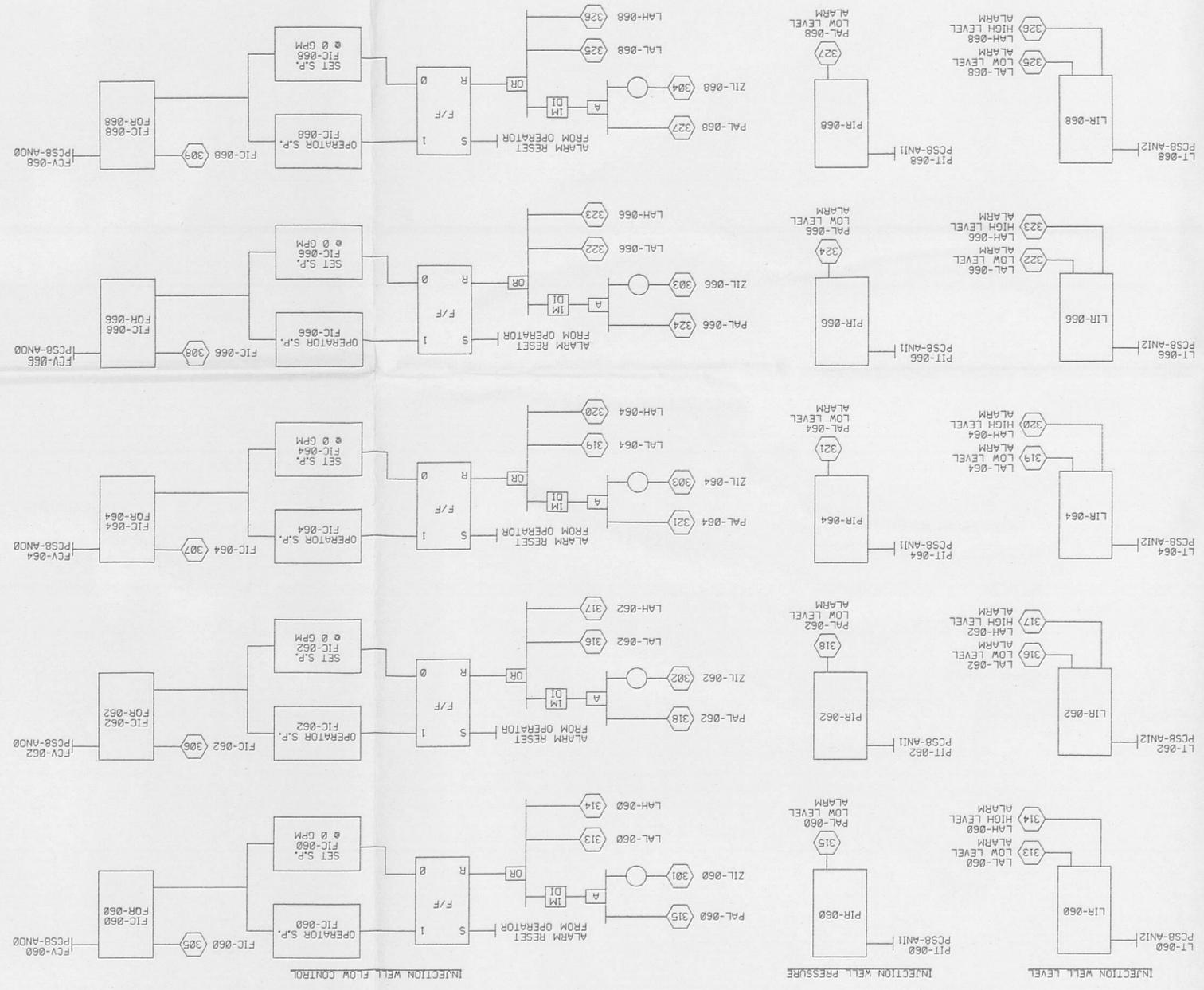
REV.	NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	DATE
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**INFORMATION ONLY**

REF DWG NO. 95X-5900-X-00411 DRAWING INDEX  
 95X-5900-N-00442 INTERCONNECTION DIAGRAM  
 95X-5900-N-00442 INJECTION SYSTEM

1. SEE DRAWING 95X-5900-N-00442 FOR I/O INTERCONNECTION DIAGRAM.  
 2. THE AWMIT DCS AND THE LOCAL PCS'S SHALL BE PROGRAMMED AS SHOWN ON THIS DRAWING. THE LOCAL PCS'S PROGRAMMING SHALL ONLY INCLUDE COMPONENTS DIRECTLY WIRED TO THE PCS.  
 3. WITH A COMMUNICATIONS FAILURE BETWEEN THE AWMIT DCS AND LOCAL PCS, THE PCS SETPOINTS WILL BE THE SAME AS THE DCS SETPOINTS.

NOTES

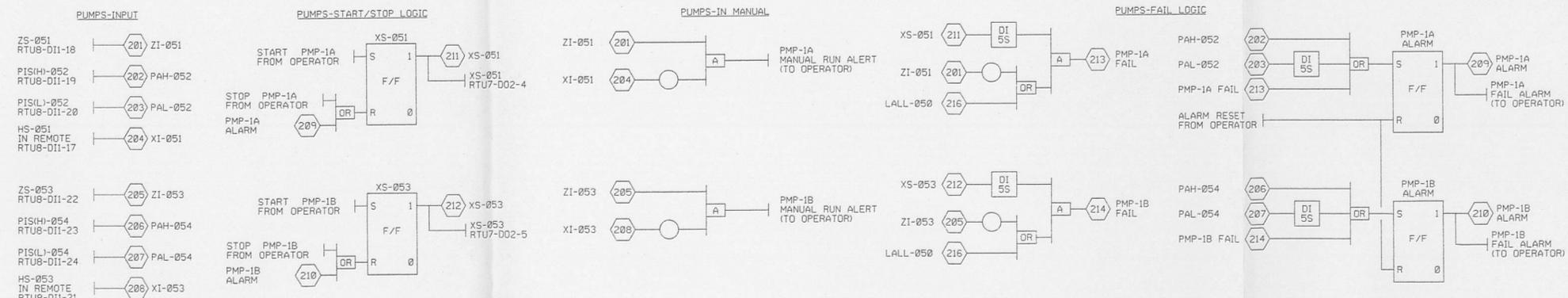


INJECTION WELL LOGIC

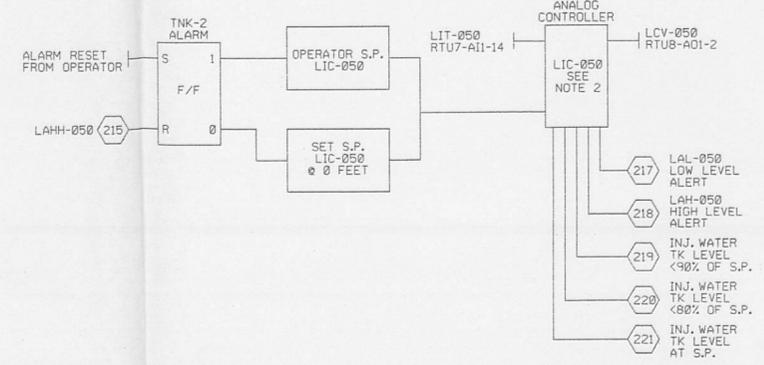
NOTES

- SEE DRAWING 95X-5900-N-00439 FOR I/O DIAGRAM.
- THE EXISTING TANK 297 MAKE-UP WATER VALVE LOGIC IS TO BE MODIFIED AS SHOWN. THE EXISTING LOGIC IS SHOWN ON DRAWING 95X-5900-N-00321.
- THE OPERATOR SET POINT FOR LIC-050 WILL BE USED AS THE SET POINT FOR LY-050. THE REVERSE ACTING OUTPUT OF LY-050 WILL BE USED AS SET POINT, 1800 - 0 GPM, FOR LIC-1150.

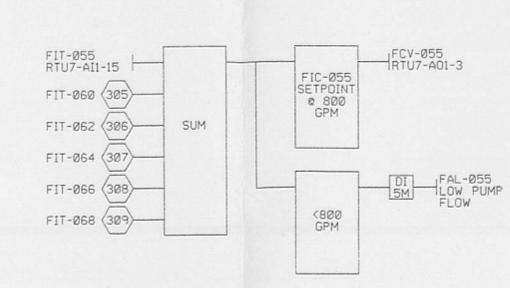
INJECTION WATER PUMP LOGIC



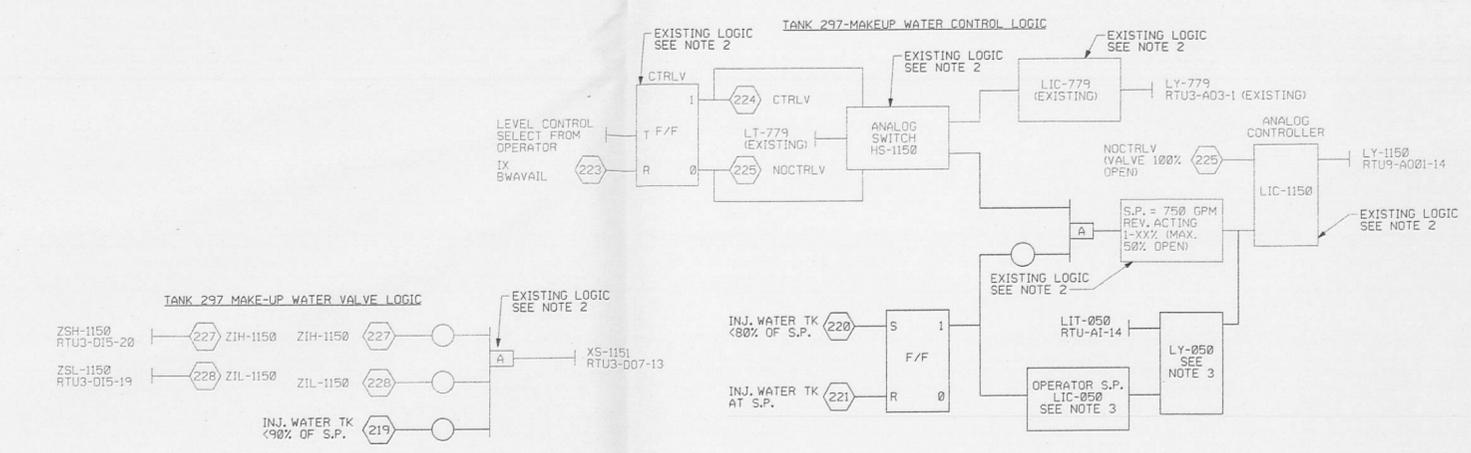
INJECTION WATER SUPPLY TANK LEVEL CONTROL LOGIC



INJECTION WATER PUMP MINIMUM FLOW CONTROL LOGIC



TANK 297 INTERFACE LOGIC



REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-N-00439	I/O DIAGRAM
95X-5900-N-00321	AWWT EXPANSION PROJECT LOGIC DIAGRAM

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION			
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**INSTRUMENTATION LOGIC DIAGRAM**

DRAWN BY D. TOPE	DATE 10/31/95	LEAD ENGINEER [Signature]	DATE 10/31/95	CHECKED BY R. HOLLAND	DATE 11/21/95
PLANT/BLDG. NO.	FLOOR	SCALE	NONE	CLASS	
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL N/A	FERMCO PROJECT NUMBER 10-53100			

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DOE PROJECT NO. WBS 1.1.1.1.2.1 00-90701	TEMP PROJECT NO. 95X-5900-N-00445	DRAWING INDEX CODE NO.	SHEET NO. N0010	REV. NO. 0
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OPTIMIZATION/RECOVERY WELL PUMP LOGIC

NOTES

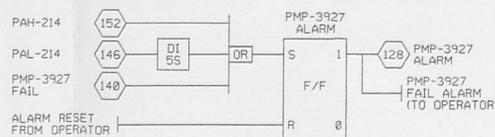
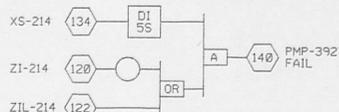
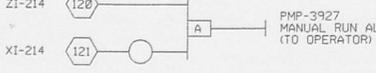
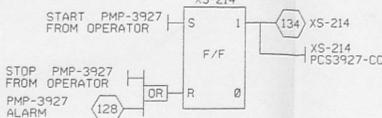
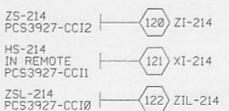
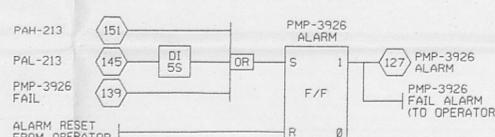
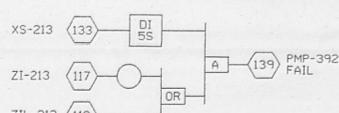
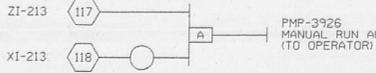
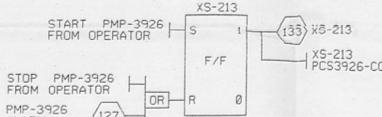
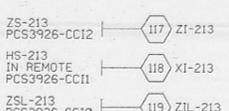
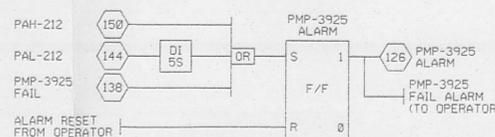
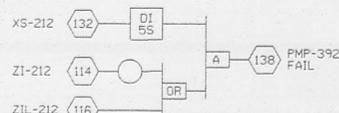
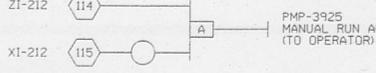
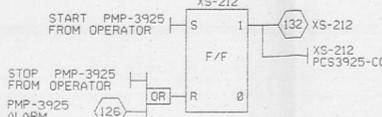
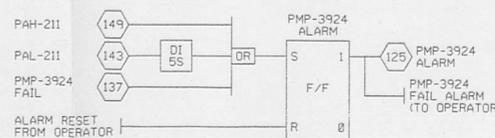
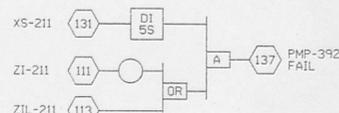
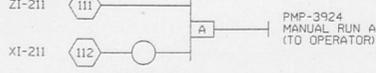
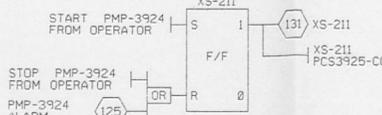
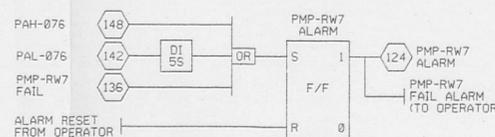
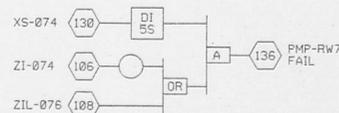
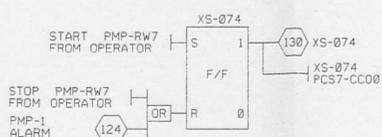
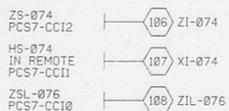
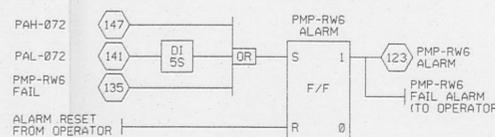
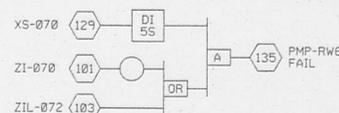
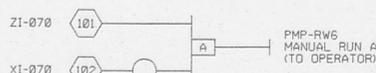
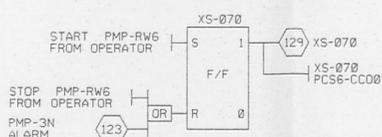
- SEE DRAWINGS 95X-5900-N-00438 FOR I/O DIAGRAMS.
- THE AWWT DCS AND THE LOCAL PCS'S SHALL BE PROGRAMMED AS SHOWN ON THIS DRAWING. THE LOCAL PCS'S PROGRAMMING SHALL ONLY INCLUDE COMPONENTS DIRECTLY WIRED TO THE PCS.
- WITH A COMMUNICATIONS FAILURE BETWEEN THE AWWT DCS AND LOCAL PCS, THE PCS SETPOINTS WILL BE THE SAME AS THE DCS SETPOINTS.

PUMPS-INPUT

PUMPS-START/STOP LOGIC

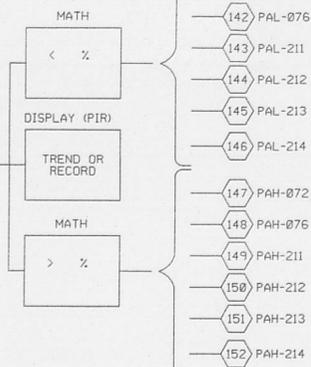
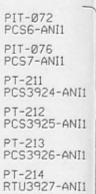
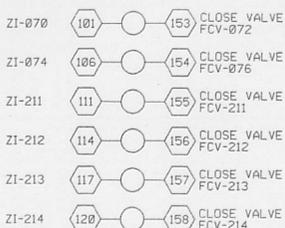
PUMPS-IN MANUAL

PUMPS-FAIL LOGIC

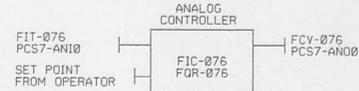
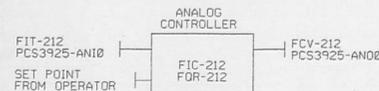
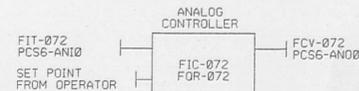


TYPICAL (6 REQUIRED)

OUTPUT TO CORRESPONDING ALARM



OPTIMIZATION & RECOVERY WELL FLOW LOGIC



PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-N-00438	I/O DIAGRAMS

INFORMATION ONLY

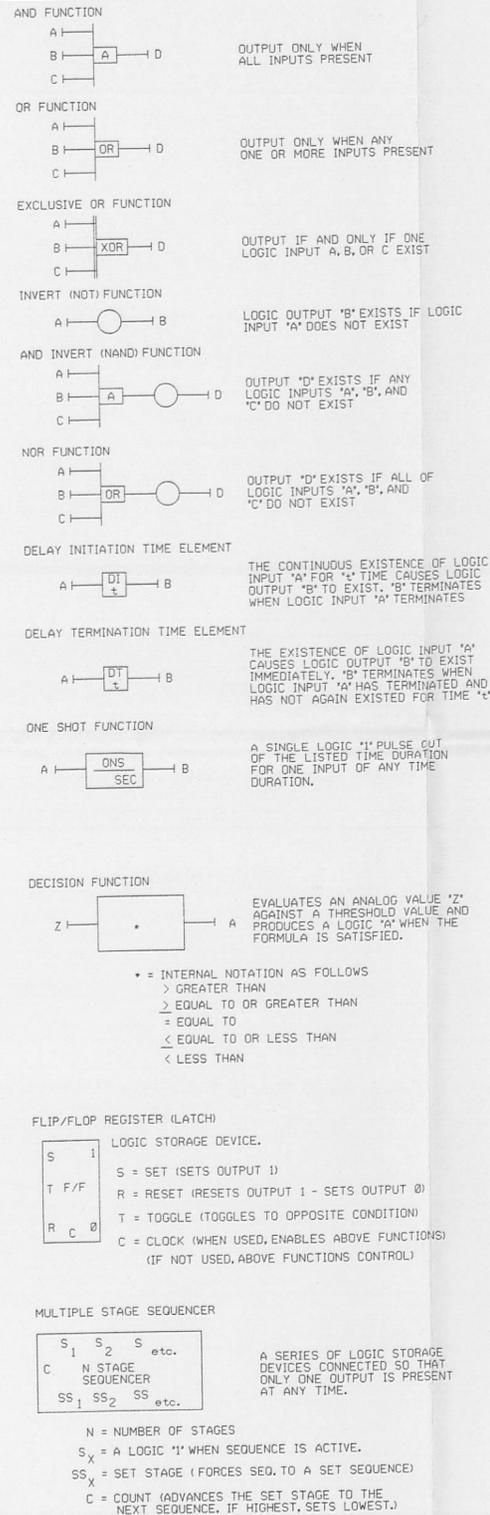
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REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERIOD DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
 DRAWING TITLE  
**INSTRUMENTATION LOGIC DIAGRAM**

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
D. TOPE	10/31/96	Grady	11/21/96	R. HOLLAND	11/21/96
PLANT/BLDG. NO.	FLOOR	SCALE	NONE	CLASS	
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL		FERMCO PROJECT NUMBER	
Grady		N/A		SPO-53300	
DOE PROJECT NO.	FERM PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.	
WBS 1.1.1.1.1.2.1	00-90701	95X-5900-N-00444	N0009	0	

TAG NO.	ACRONYM	DESCRIPTION
101	ZI070	PUMP PMP-RW6 RUNNING INDICATION
102	XI070	PUMP PMP-RW6 IN REMOTE POSITION
103	ZIL072	FLOW CONTROL VALVE FCV072 CLOSED
106	ZI074	PUMP PMP-RW7 RUNNING INDICATION
107	XI074	PUMP PMP-RW7 IN REMOTE POSITION
108	ZIL076	FLOW CONTROL VALVE FCV074 CLOSED
111	ZI211	PUMP PMP-3924 RUNNING INDICATION
112	XI211	PUMP PMP-3924 IN REMOTE POSITION
113	ZIL211	FLOW CONTROL VALVE FCV211 CLOSED
114	ZI212	PUMP PMP-3925 RUNNING INDICATION
115	XI212	PUMP PMP-3925 IN REMOTE POSITION
116	ZIL212	FLOW CONTROL VALVE FCV212 CLOSED
117	ZI213	PUMP PMP-3926 RUNNING INDICATION
118	XI213	PUMP PMP-3926 IN REMOTE POSITION
119	ZIL213	FLOW CONTROL VALVE FCV213 CLOSED
120	ZI214	PUMP PMP-3927 RUNNING INDICATION
121	XI214	PUMP PMP-3927 IN REMOTE POSITION
122	ZIL214	FLOW CONTROL VALVE FCV214 CLOSED
123		PUMP PMP-RW6 ALARM
124		PUMP PMP-RW7 ALARM
125		PUMP PMP-3924 ALARM
126		PUMP PMP-3925 ALARM
127		PUMP PMP-3926 ALARM
128		PUMP PMP-3927 ALARM
129	XS070	START PMP-RW6
130	XS074	START PMP-RW7
131	XS211	START PMP-3924
132	XS212	START PMP-3925
133	XS213	START PMP-3926
134	XS214	START PMP-3927
135		PUMP PMP-RW6 FAIL
136		PUMP PMP-RW7 FAIL
137		PUMP PMP-3924 FAIL
138		PUMP PMP-3925 FAIL
139		PUMP PMP-3926 FAIL
140		PUMP PMP-3927 FAIL
141	PAL072	PUMP PMP-RW6 LOW PRESSURE ALARM
142	PAL076	PUMP PMP-RW7 LOW PRESSURE ALARM
143	PAL211	PUMP PMP-3924 LOW PRESSURE ALARM
144	PAL212	PUMP PMP-3925 LOW PRESSURE ALARM
145	PAL213	PUMP PMP-3926 LOW PRESSURE ALARM
146	PAL214	PUMP PMP-3927 LOW PRESSURE ALARM
147	PAH072	PUMP PMP-RW6 HIGH PRESSURE ALARM
148	PAH076	PUMP PMP-RW7 HIGH PRESSURE ALARM
149	PAH211	PUMP PMP-3924 HIGH PRESSURE ALARM
150	PAH212	PUMP PMP-3925 HIGH PRESSURE ALARM
151	PAH213	PUMP PMP-3926 HIGH PRESSURE ALARM
152	PAH214	PUMP PMP-3927 HIGH PRESSURE ALARM
153		CLOSE VALVE FCV072
154		CLOSE VALVE FCV076
155		CLOSE VALVE FCV211
156		CLOSE VALVE FCV212
157		CLOSE VALVE FCV213
158		CLOSE VALVE FCV214
201	ZI051	PUMP PMP-1A RUNNING INDICATION
202	PAH052	PUMP PMP-1A HIGH PRESSURE ALARM
203	PAL052	PUMP PMP-1A LOW PRESSURE ALARM
204	XI051	PUMP PMP-1A IN REMOTE POSITION
205	ZI053	PUMP PMP-1B RUNNING INDICATION
206	PAH054	PUMP PMP-1B HIGH PRESSURE ALARM
207	PAL054	PUMP PMP-1B LOW PRESSURE ALARM
208	XI053	PUMP PMP-1B IN REMOTE POSITION
209		PUMP PMP-1A ALARM
210		PUMP PMP-1B ALARM
211	XS051	START PMP-1A
212	XS053	START PMP-1B
213		PUMP PMP-1A FAIL
214		PUMP PMP-1B FAIL
215	LAH050	TANK TNK-2 HIGH HIGH LEVEL ALARM
216	LAL050	TANK TNK-2 LOW LOW LEVEL ALARM
217	LAL050	TANK TNK-2 LOW LEVEL ALERT
218	LAH050	TANK TNK-2 HIGH LEVEL ALERT
219		INJ. WATER TK LEVEL <90% OF S.P.
220		INJ. WATER TK LEVEL <80% OF S.P.
221		INJ. WATER TK LEVEL AT S.P.
300	ZIL060	FLOW CONTROL VALVE FCV060 CLOSED
301	ZIL062	FLOW CONTROL VALVE FCV062 CLOSED
302	ZIL064	FLOW CONTROL VALVE FCV064 CLOSED
303	ZIL066	FLOW CONTROL VALVE FCV066 CLOSED
304	ZIL068	FLOW CONTROL VALVE FCV068 CLOSED
305	FTC060	INJECTION WELL #8 FLOW
306	FTC062	INJECTION WELL #9 FLOW
307	FTC064	INJECTION WELL #10 FLOW
308	FTC066	INJECTION WELL #11 FLOW
309	FTC068	INJECTION WELL #12 FLOW
313	LAL060	INJECTION WELL #8 LOW LEVEL ALARM
314	LAH060	INJECTION WELL #8 HIGH LEVEL ALARM
315	PAL060	INJECTION WELL #8 LOW PRESSURE ALARM
316	LAH062	INJECTION WELL #9 HIGH LEVEL ALARM
317	PAL062	INJECTION WELL #9 LOW PRESSURE ALARM
318	LAL064	INJECTION WELL #10 LOW LEVEL ALARM
319	LAH064	INJECTION WELL #10 HIGH LEVEL ALARM
320	PAL064	INJECTION WELL #10 LOW PRESSURE ALARM
321	LAL066	INJECTION WELL #11 LOW LEVEL ALARM
322	LAH066	INJECTION WELL #11 HIGH LEVEL ALARM
323	PAL066	INJECTION WELL #11 LOW PRESSURE ALARM
324	LAL068	INJECTION WELL #12 LOW LEVEL ALARM
325	LAH068	INJECTION WELL #12 HIGH LEVEL ALARM
326	PAL068	INJECTION WELL #12 LOW PRESSURE ALARM
327		

LOGIC LEGEND



NOTES  
 1. SEE DRAWINGS 95X-5900-N-00444 AND N-00445 FOR LOGIC DIAGRAMS.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-N-00444	LOGIC DIAGRAM
95X-5900-N-00445	LOGIC DIAGRAM

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	DATE	INITIALS
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	INITIALS AND DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

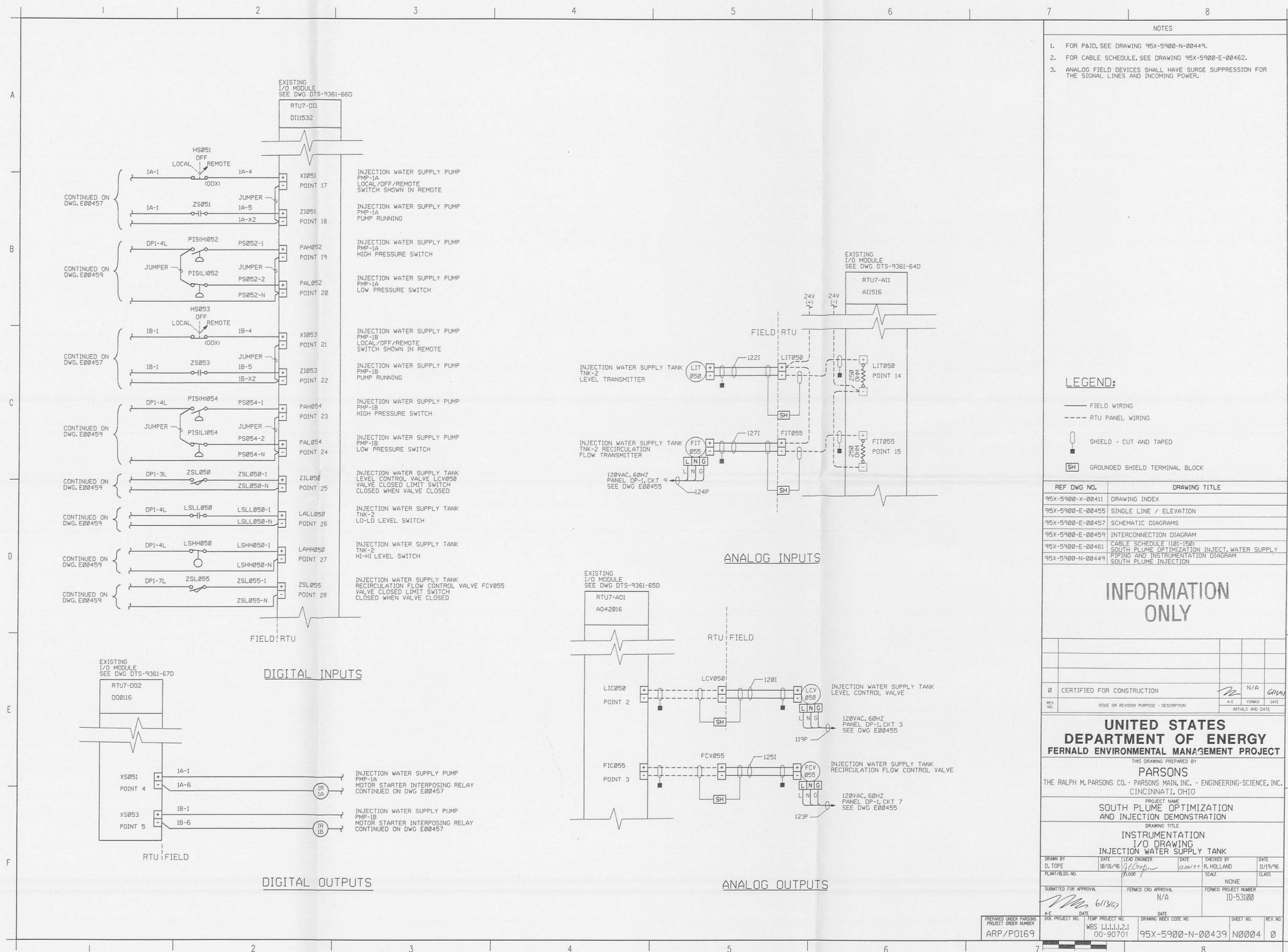
PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
 DRAWING TITLE  
**INSTRUMENTATION LOGIC DIAGRAM ACRONYM LIST**

DRAWN BY D. TOPE	DATE 11/11/96	LEAD ENGINEER R. HOLLAND	DATE 12/20/97	CHECKED BY R. HOLLAND	DATE 11/19/96
PLANT/FIELD NO.	SCALE	CLASS	NONE		
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL N/A	FERMCO PROJECT NUMBER 10-53100 SP0-53300			

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DOE PROJECT NO. WBS 1.1.1.1.2.1 00-90701	FEMP PROJECT NO. 95X-5900-N-00443	DRAWING INDEX CODE NO.	SHEET NO. N0008	REV. NO. 0
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- NOTES
- FOR P&ID, SEE DRAWING 95X-5900-N-00449.
  - FOR CABLE SCHEDULE, SEE DRAWING 95X-5900-E-00462.
  - ANALOG FIELD DEVICES SHALL HAVE SURGE SUPPRESSION FOR THE SIGNAL LINES AND INCOMING POWER.

- LEGEND:
- FIELD WIRING
  - RTU PANEL WIRING
  - SHIELD - CUT AND TAPED
  - SH GROUNDED SHIELD TERMINAL BLOCK

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-E-00455	SINGLE LINE / ELEVATION
95X-5900-E-00457	SCHEMATIC DIAGRAMS
95X-5900-E-00459	INTERCONNECTION DIAGRAM
95X-5900-E-00461	CABLE SCHEDULE (101-150)
95X-5900-N-00449	SOUTH PLUME OPTIMIZATION INJECT. WATER SUPPLY PIPING AND INSTRUMENTATION DIAGRAM SOUTH PLUME INJECTION

INFORMATION ONLY

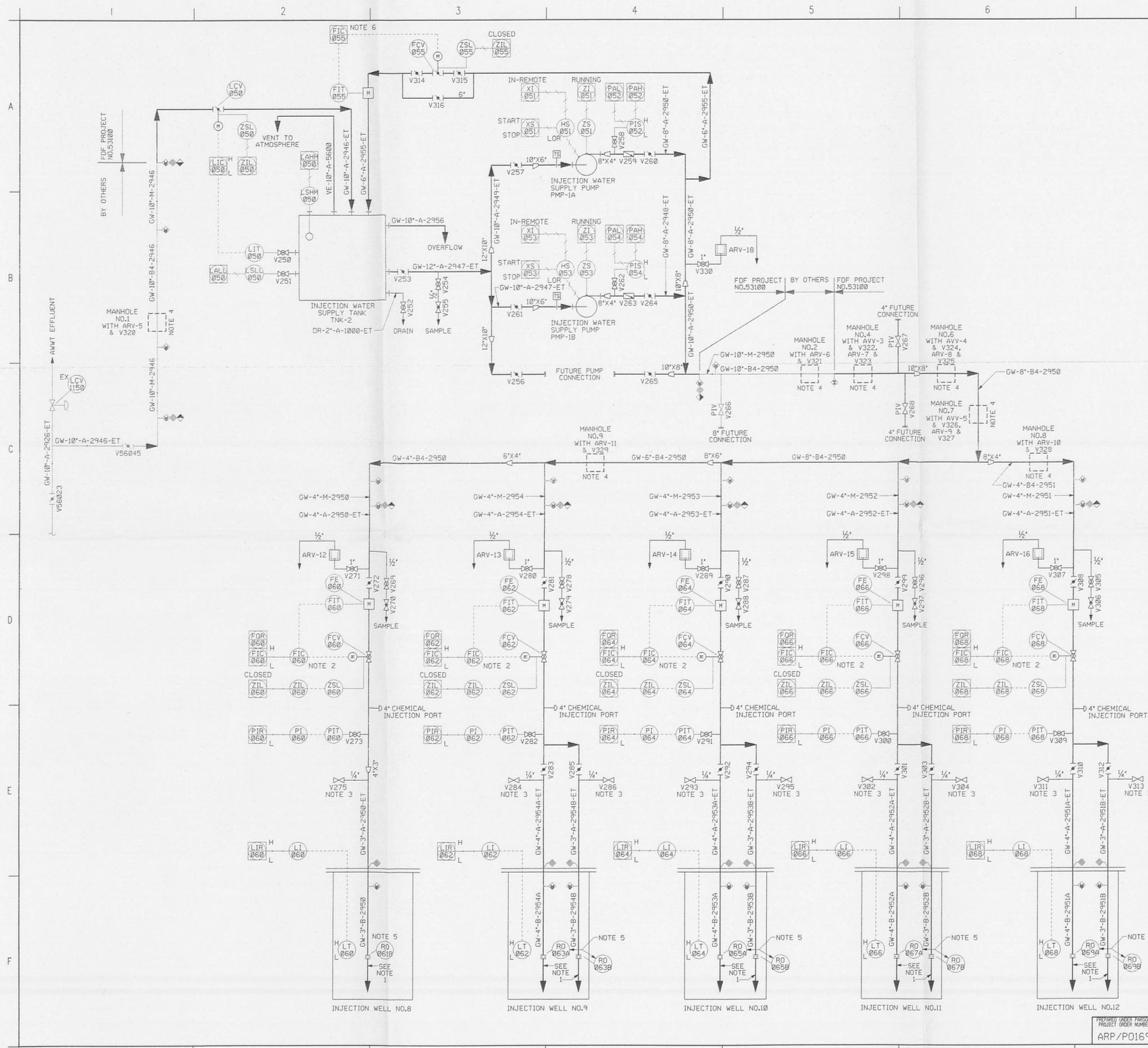
0	CERTIFIED FOR CONSTRUCTION	N/A	6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FORMED DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
 DRAWING TITLE  
**INSTRUMENTATION I/O DRAWING INJECTION WATER SUPPLY TANK**

DRAWN BY D. TOPE	DATE 10/16/96	LEAD ENGINEER J. G. ...	DATE 10/20/97	CHECKED BY R. HOLLAND	DATE 11/19/96
PLANT/FLOOR NO.	FLOOR	SCALE	NONE		
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL		FERMCO PROJECT NUMBER	
6/13/97		N/A		10-53100	

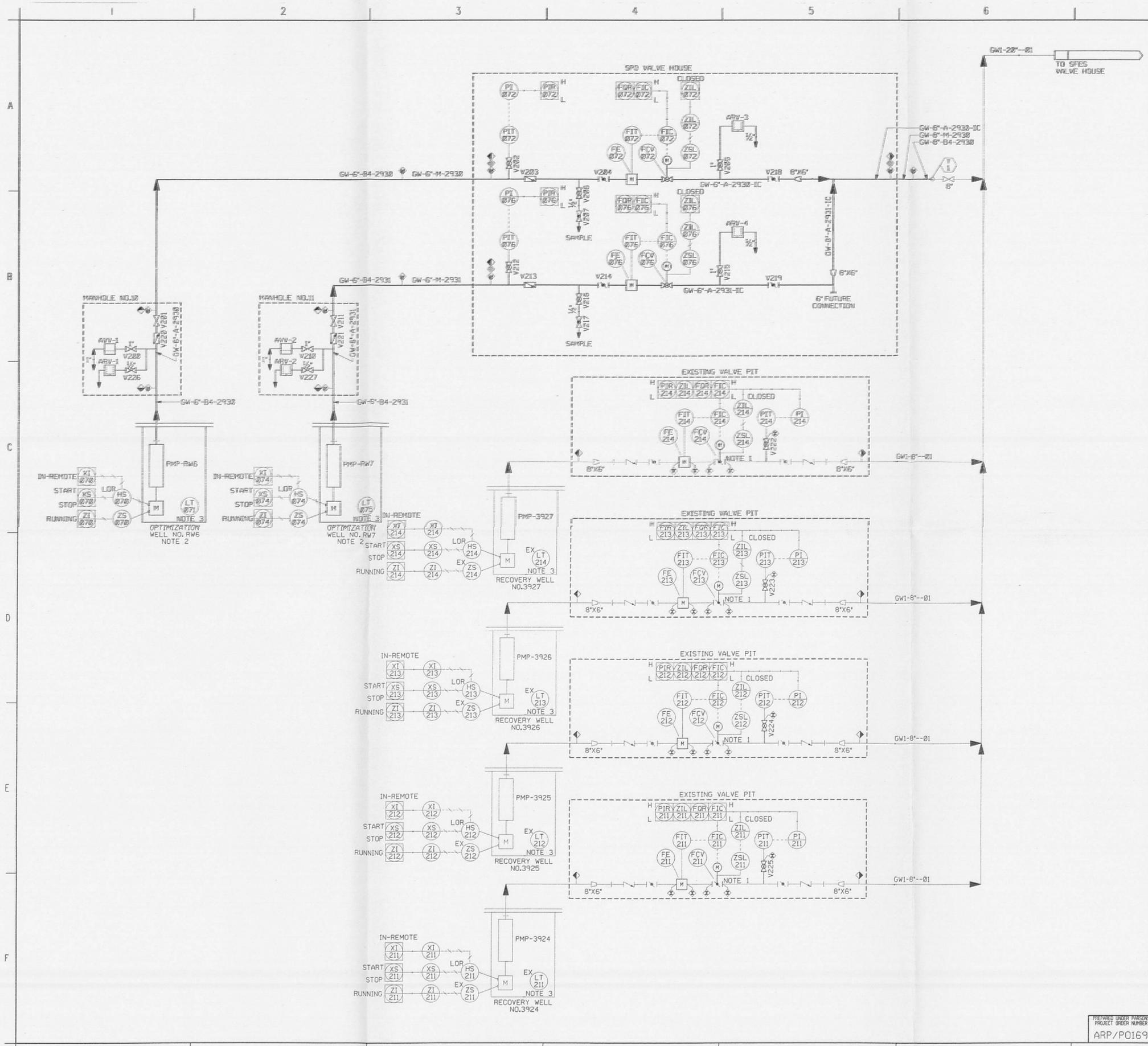
PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	DATE 10/16/96	TEMP PROJECT NO. WBS 111.11.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-N-00439	SHEET NO. N0004	REV. NO. 0
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- NOTES
1. EACH WELL INJECTION TUBE SHALL HAVE PERFORATED FLOW DISTRIBUTION OUTLETS.
  2. CONTROLLER INITIATES CLOSING OF VALVE ON LINE PRESSURE BELOW SET POINT, OR WELL LEVEL ABOVE HIGH OR BELOW LOW SET POINTS.
  3. SAND CONTENT TEST PORT.
  4. AIR VALVE MANHOLE, SEE CIVIL DRAWINGS FOR DETAILS.
  5. THE 'A' SUFFIX RESTRICTION ORFICE IS SIZED FOR 150 GPM AND THE 'B' SUFFIX RESTRICTION ORFICE IS SIZED FOR 100 GPM.
  6. FIC055 SHALL CONTROL FCV055 BASED ON THE SUM OF FLOWS FROM FIT055, FIT060, FIT062, FIT064, FIT066, AND FIT068.

REF DWG NO.		DRAWING TITLE	
95X-5900-X-00411	DRAWING INDEX		
95X-5900-N-00447	SYMBOLS AND LEGEND		
95X-5900-N-00448	P&ID - SOUTH PLUME OPTIMIZATION		
INFORMATION ONLY			
0	CERTIFIED FOR CONSTRUCTION		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	INITIALS AND DATE

<b>UNITED STATES</b>			
<b>DEPARTMENT OF ENERGY</b>			
<b>FERNALD ENVIRONMENTAL MANAGEMENT PROJECT</b>			
THIS DRAWING PREPARED BY			
<b>PARSONS</b>			
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO			
PROJECT NAME			
<b>SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION</b>			
DRAWING TITLE			
<b>MECHANICAL PROCESS PIPING AND INSTRUMENTATION DIAGRAM SOUTH PLUME INJECTION</b>			
DRAWN BY	DATE	LEAD ENGINEER	DATE
L. N. HAGAMAN	11/05/96	<i>[Signature]</i>	12/04/97
PLANT/REG. NO.	FLOOR	SCALE	NONE
SUBMITTED FOR APPROVAL		FERNCO CRU APPROVAL	FERNCO PROJECT NO.
<i>[Signature]</i> 6/13/97		N/A	10 - 53100
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DATE	TEMP PROJECT NO.	DRAWING INDEX CODE NO.
ARP/PO169		WBS 1.1.1.1.2.1 00-90701	95X-5900-N-00449
			SHEET NO. REV. NO.
			N0003 0



- NOTES
- EXISTING PIPING IN THE VALVE PITS SHALL BE PROVIDED WITH IC INSULATION. EXISTING FLOW CONTROL VALVE, FLOW METER, PRESSURE GAUGE, AND PRESSURE SWITCH TO BE REPLACED WITH NEW FLOW CONTROL VALVE, FLOW METER, AND PRESSURE INDICATING TRANSMITTER AS SHOWN.
  - WELL SHALL BE PROVIDED WITH A 1/2" POLYETHYLENE CHLORIDE INJECTION TUBE.
  - THE LEVEL TRANSMITTERS SHOWN IN THE RECOVERY AND OPTIMIZATION WELLS ARE ACCESSIBLE FOR LOCAL INDICATION USING FID, INC. PORTABLE DATA LOGGERS.
  - USE THREADED LUG STYLE WAFER VALVE WITH BLIND FLANGE.

LAST VALVE NUMBER: V227

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-N-00447	SYMBOLS AND LEGEND
95X-5900-N-00449	P&ID - SOUTH PLUME INJECTION

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERIOD DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**MECHANICAL PROCESS PIPING AND INSTRUMENTATION DIAGRAM SOUTH PLUME OPTIMIZATION**

DRAWN BY L. N. HAGAMAN	DATE 11/01/96	LEAD ENGINEER J. C. CRISP	DATE 12/01/97	CHECKED BY S.G. / R.H.	DATE 11/15/96
PLANT/BLDG. NO. FLOOR 0	SCALE		CLASS		

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NO.
	N/A	SPD - 53300

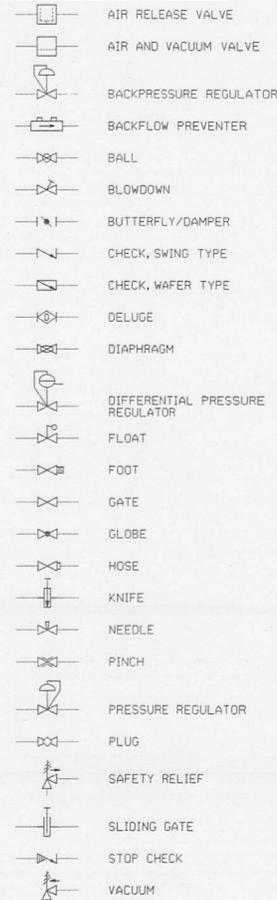
PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	DOE PROJECT NO. WBS 1.1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-N-00448	SHEET NO. N0002	REV. NO. 0
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PIPING VALVES

CONFIGURATIONS FOR VALVE TYPE



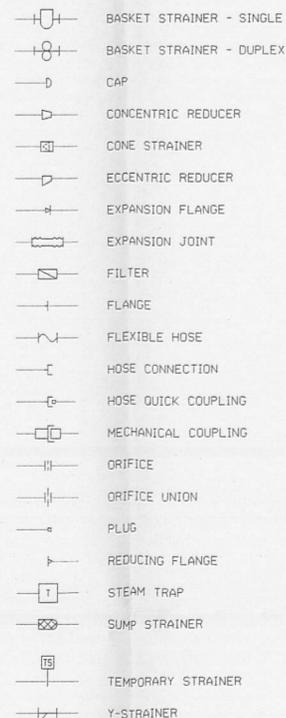
VALVE TYPES



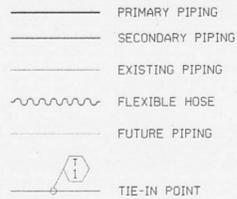
PIPING SEGMENT BREAKS

- Construction Requirements, Insulation Requirements, Piping Material Requirements, Underground Routing (shaded area indicates direction of underground).

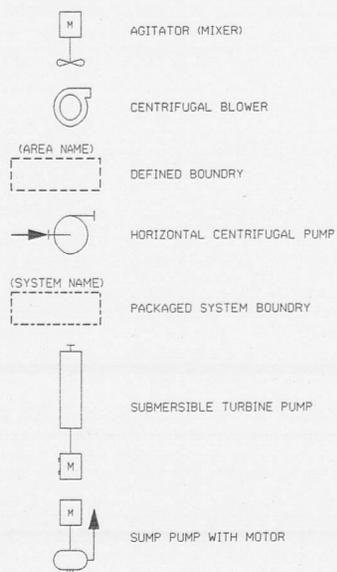
PIPING FITTINGS



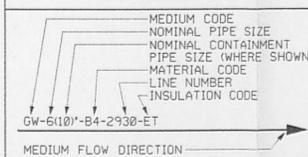
PIPING SYMBOLOGY



EQUIPMENT SYMBOLS



PIPING LINE NUMBER FORMAT



ABBREVIATIONS

Table of abbreviations including AC (Air to Close), AG (Agitator), AD (Air to Open), ARV (Air Release Valve), AVV (Air and Vacuum Valve), AWWT (Advanced Wastewater Treatment), BLW (Blower), BTU (British Thermal Unit), CFM (Cubic Feet/Minute), CD (Clean Out), CU FT (Cubic Feet), ECC (Eccentric), EF (Exhaust Fan), FC (Fail Closed), FO (Fail Open), GPH (Gallons per Hour), GPM (Gallons per Minute), GV (Gravity Ventilator), HDPE (High Density Polyethylene), IA (Instrument Air), KW (Kilowatt), LB/HR (Pounds per Hour), MATL (Material), MED (Medium), MS (Mist Eliminator), NC (Normally Closed), NO (Normally Open), PIV (Post Indicator Valve), PMP (Pump), RED (Reducer), RH (Relative Humidity), SCFM (Standard Cubic Feet/Minute), SFES (South Field Extraction System), SWRB (Stormwater Retention Basin), TBD (To be Determined), TF (Top Flat), TNK (Tank), TYP (Typical), UH (Unit Heater), 1 (Solenoid Valve Common Port), 2 (Solenoid Valve Norm. Open Port), 3 (Solenoid Valve Norm. Closed Port), ID (Injection Demonstration), SPO (South Plume Optimization).

PIPING SPECIFICATIONS

Table of piping specifications with columns for Flowing Medium, Med. Code, and Matl. Code. Includes items like Back Wash, Blower Air, Chilled Water, Chlorine, Condensate, Condenser Water, Cooling Water, Drain, Filtrate Effluent, Flocculant, Flush Water, Force Main, Ground Water, Instrument Air, Melter Off-Gas, Nitric Acid, Perched Gnd Water, Phosphoric Acid, Plant Air, Polished Water, Potable Water, Process Water, Process Wastewater, Raw Water, Recycle Water, Scrubber Recycle, Slurry, Sodium Carbonate, Sodium Hydroxide, Sodium Silicate, Storm Water, Sulfuric Acid, Sump Discharge, Thickener Overflow, Vacuum, Ventilation Air, and Waste Water.

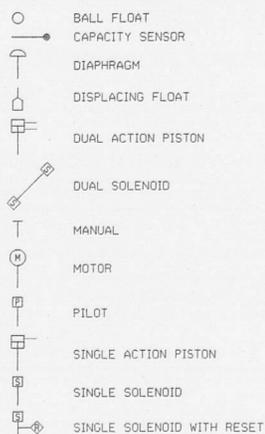
Table of material codes and descriptions: A (A53 Seamless Carbon Steel), B (PVC), B1 (PVDF), B2 (PVDF, 100PSI), B3 (CPVC), B4 (HDPE), B5 (Corrugated HDPE), C1 (Class 150 Copper Tubing), L (Fiberglass Reinforced Plastic), M (Ductile Iron), T (304L Stainless Steel), T1 (316L Stainless Steel), W (A53, GR. A, Galvanized Steel).

Table of insulation codes and descriptions: ET (Electric Traced and Insulated), IC (Anti-Condensation Insulation), ST (Steam Traced and Insulated).

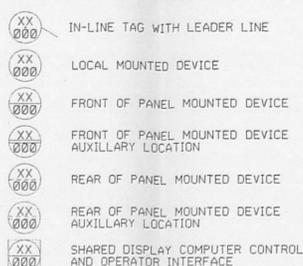
NOTES

- 1. ELECTRIC HEAT TRACE AND INSULATE PUMP(S) WHERE PIPING SYSTEM IS HEAT TRACED AND INSULATED.
2. INSULATE AND ELECTRIC HEAT TRACE ALL VENTS, DRAINS, AIR RELEASE VALVES, AND SAMPLE LINES THROUGH LAST VALVE OR HIGH PART OF THE LINE AS APPLICABLE FOR ALL HEAT TRACE SYSTEMS.
3. SEE CIVIL DRAWINGS FOR SFES PIPING INSTALLED AS PART OF THIS PROJECT.

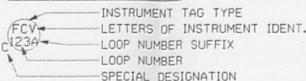
INSTRUMENT ACTUATOR LABELS



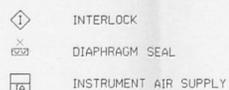
INSTRUMENT DEVICE TAG TYPES



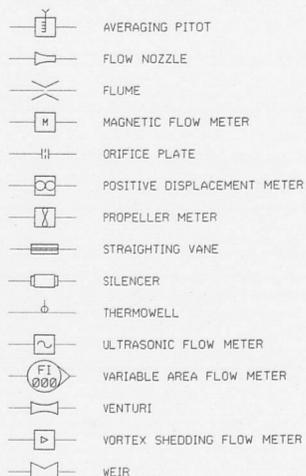
EXAMPLE OF TAG CALLOUTS



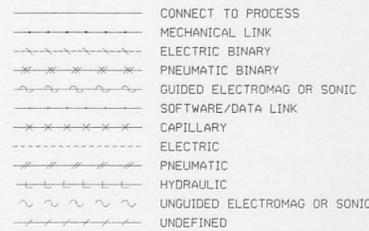
MISC. INSTRUMENTATION SYMBOLS



INSTRUMENT IN-LINE DEVICES



INSTRUMENT SIGNAL LINES



INSTRUMENT SPECIAL DESIGNATIONS

Table of instrument special designations with columns for Designation and Function / Abbreviation. Includes entries like C (Closed), DIF (Differential), EX (Existing Instrumentation), H (High), HH (High High), HL (High Low), HOA (Hand-Off-Auto), IA (In-Auto), I/I (Current to Current), I/O (Input/Output), I/P (Current to Pneumatic Transducer), L (Low), LL (Low Low), LOR (Local-Off-Remote), O (Open), OA (Off-Auto), OCA (Open-Closed-Auto), R (Running), and Y (Undetermined Computing Relay).

LETTERS OF INSTRUMENT IDENTIFICATION

Table of letters of instrument identification with columns for Letter, 1st Letter, 2nd Letter, and 3rd or 4th Letter. Includes categories like Measured or Initiating Variable, Modifier, and Read Out or Passive Function.

FUNCTION LABELS

Table of function labels with columns for Symbols and Description. Includes entries like A (Averaging), B (Bias Minus), + (Bias Plus), +/- (Bias Plus/Minus), D (Derivative), / (Dividing), I (Intergal), X (Multiplying), K (Proportional), P (Raise to Power), REV (Reverse Action), and S (Root Extract).

INFORMATION ONLY

0 CERTIFIED FOR CONSTRUCTION

ISSUE OR REVISION PURPOSE - DESCRIPTION

UNITED STATES DEPARTMENT OF ENERGY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

PARSONS THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO

SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION

MECHANICAL PROCESS PIPING AND INSTRUMENTATION DIAGRAM SYMBOLS AND LEGEND

DRAWN BY L.N. HAGAMAN DATE 11/12/96 LEAD ENGINEER J.L. GARDNER DATE 12/20/97 CHECKED BY O.W.C. / J.N.S. DATE 11/15/96

PLANT/REG. NO. SCALE NONE SUBMITTED FOR APPROVAL FERNCO CRU APPROVAL FERNCO PROJECT NO. 10 - 53100 SPO - 53300

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169 FERNCO PROJECT NO. WBS 1.1.1.1.1.2.1 00-90701 DRAWING INDEX CODE NO. 95X-5900-N-00447 SHEET NO. N0001 REV. NO. 0

ELECTRICAL PLAN SYMBOLS

NOTES

SWITCH AND RECEPTACLE SYMBOLS

- 1 CKT SWITCH, SINGLE POLE WALL MOUNTED FLUSH
- 3 CKT SWITCH, THREE-WAY
- 4 CKT SWITCH, FOUR-WAY
- INDICATES DISTRIBUTION PANEL AND CIRCUIT BREAKER NUMBER FROM WHICH POWER IS SUPPLIED (TYPICAL)
- 1 CKT SINGLE RECEPTACLE
- 1 WP CKT SINGLE RECEPTACLE WP = WEATHER PROOF
- 1 G CKT DUPLEX RECEPTACLE G = GROUND FAULT TYPE (GFCI)
- 1 WELDING OR POWER RECEPTACLE
- 1 DS(X) 100A DISCONNECT SWITCH WITH AMP RATING
- 1 TX(X) 50KVA TRANSFORMER WITH KVA RATING
- 1 T THERMOSTAT

LIGHTING SYMBOLS

- 1 CKT FLUORESCENT FIXTURE
- 70W CKT WALL MOUNTED LIGHT FIXTURE WITH LAMP WATTAGE AS SHOWN
- 1 CKT EMERGENCY LIGHT WITH RECHARGEABLE BATTERIES
- 1 CKT EXIT LIGHT
- 250W HPS CKT CEILING OR PENDANT MOUNTED HIGH PRESSURE SODIUM LIGHT, WITH LAMP WATTAGE AS SHOWN
- 70W HPS CKT POLE MOUNTED, WITH PHOTO CONTROL, HIGH PRESSURE SODIUM FLOOD LIGHT, WITH LAMP WATTAGE AS SHOWN
- 150W INC CKT STANCHION MOUNTED INCANDESCENT LIGHT WITH LAMP WATTAGE AS SHOWN
- 150W INC CKT WALL MOUNTED INCANDESCENT LIGHT WITH LAMP WATTAGE SHOWN

COMMUNICATIONS SYMBOLS

- PA < PUBLIC ADDRESS SPEAKER WITH SINGLE HORN.
- PA < PUBLIC ADDRESS SPEAKER WITH DUAL HORN.
- PA PUBLIC ADDRESS SPEAKER FLUSH CEILING MOUNTED
- TEL TELEPHONE OUTLET
- B BELL
- H HORN
- EH EVACUATION SYSTEM HORN/SPEAKER

FIRE ALARM SYMBOLS

- SD SMOKE DETECTOR
- HD HEAT DETECTOR
- MS MANUAL PULL STATION
- LP LIGHTNING PROTECTOR
- H HORN
- TS TAMPER SWITCH
- FS FLOW SWITCH
- FIRE ALARM PANEL

GROUNDING SYMBOLS

- G GROUNDING CABLE EXPOSED
- G GROUNDING CABLE EMBEDDED OR DIRECT BURIED
- G GROUNDING CONNECTION
- G GROUNDING ROD CONNECTION TO GROUNDING CABLE
- G GROUNDING ROD TEST WELL, BOLTED CONNECTIONS TO GROUNDING CABLE
- G GROUNDING CABLE WITH PARALLEL TAP TO TO STUB-UP WITH PIGTAIL

CONDUIT, LINE AND DUCTBANK SYMBOLS

- CONDUIT, EXPOSED
- CONDUIT, ROUTED BELOW PLAN ELEVATION, EMBEDDED OR DIRECT BURIED
- CONDUIT TURNING TOWARDS
- CONDUIT TURNING AWAY
- CONDUIT AND CABLE HOMERUN TO LOCATION INDICATED
- DISCONNECT AND REMOVE CONDUIT (D&R)
- FLEXIBLE CONDUIT AND CONNECTOR AT END OF RIGID CONDUIT RUN
- SEALED CONDUIT CONNECTOR FOR FIRE PROTECTION, VAPOR BARRIER
- CONDUIT GROUPINGS ALONG FLOOR OR WALL
- 3-1/C#10, 3/4" CONDUIT AND CABLE RUNS NOT LISTED IN CONDUIT AND CABLE SCHEDULE
- CONDUIT NUMBER AS IDENTIFIED ON CONDUIT SCHEDULE
- CONDUIT IDENTIFICATION BUBBLE
- CONDUIT SIZE AS IDENTIFIED ON CONDUIT SCHEDULE

PUSHBUTTON AND PANEL SYMBOLS

- PUSH BUTTON OR SELECTOR SWITCH, REMOTE MOUNTED, SINGLE
- PUSH BUTTON OR SELECTOR SWITCH, REMOTE MOUNTED, TWO OR MORE
- LP(X) LIGHTING PANEL, SURFACE MOUNTED AND I.D. NUMBER
- POWER PANEL, FLUSH MOUNTED AND I.D. NUMBER
- TELEPHONE PANEL
- TEL(X)
- ANNUN ANNUNCIATOR

MISCELLANEOUS SYMBOLS

- M HORIZONTAL MOTOR
- M VERTICAL MOTOR
- EXISTING POWER POLE
- EXISTING CG&E POWER POLE
- NEW UTILITY POLE BY CG&E
- PROPOSED NEW POLE
- POLE NUMBER (12) POLE HEIGHT-CLASS (35-5)
- NEW LIGHT POLE
- EXISTING LIGHT POLE
- POLE DOWN-GUY AND ANCHOR

CABLE TRAY SYMBOLS

- COVER CABLE TRAY - END VIEW
- CABLE TRAY - SIDE VIEW
- CABLE TRAY - VERTICAL CURVE (TURNING DOWN)
- CABLE TRAY - VERTICAL CURVE (TURNING UP)
- TRAY SECTION DESIGNATION: I = INSTRUMENTATION (ANALOG), P = POWER, C = CONTROL (DIGITAL)
- TRAY WIDTH

MONITOR SYMBOLS

- CM CRITICALITY MONITOR WITH EMERGENCY POWER CIRCUIT
- RM RADIATION MONITOR
- AM AIR MONITOR STATION
- CO CARBON MONOXIDE MONITOR PANEL
- INSTRUMENT
- XXXX - DEVICE NUMBER

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	MA	N/A	6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
 DRAWING TITLE  
**ELECTRICAL SYMBOLS AND LEGEND**

DRAWN BY R.FROSKI	DATE 04-14-97	LEAD ENGINEER J.L. COOPER	DATE 12/21/97	CHECKED BY J.L. COOPER	DATE 4/16/97
PLANT/BDG. NO.	FLOOR	SCALE NONE	CLASS		
SUBMITTED FOR APPROVAL MA 6/13/97		FERMCO CRU APPROVAL N/A			

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DOE PROJECT NO. WBS Pa0019	FEMP PROJECT NO. 00-90701	DRAWING INDEX CODE NO. 95X-5900-E-00474	SHEET NO. E0019	REV. NO. 0
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SINGLE LINE DIAGRAM SYMBOLS

ARRESTER		*YY* INDICATES SPECIAL IDENTIFIER *XXXX* INDICATES ID NO.
CIRCUIT BREAKER, LOW VOLTAGE		*FFFF* INDICATES FRAME RATING AMPS (SHOWN ON SWITCHGEAR ONLY) *TTTT* INDICATES TRIP RATING AMPS
CIRCUIT BREAKER, MEDIUM VOLTAGE		*FFFF* INDICATES FRAME RATING AMPS *TTTT* INDICATES TRIP RATING AMPS
COMBINATION STARTER, NON-REVERSING		*TTTT* INDICATES TRIP RATING AMPS *ZZZZ* INDICATES NEMA SIZE EQUIPMENT OUTLINE (TYP)
CURRENT TRANSFORMER		*YY* INDICATES NO. OF CT(S) *ZZZZ* INDICATES CT RATIOS(S)
DISCONNECT SWITCH		*FFFF* INDICATES FRAME RATING AMPS
DRAW-OUT DEVICE/RECEPTACLE		*FFFF* INDICATES FRAME RATING AMPS *TTTT* INDICATES FUSE TRIP RATING AMPS
FUSED DISCONNECT SWITCH		*FFFF* INDICATES FRAME RATING AMPS *TTTT* INDICATES FUSE TRIP RATING AMPS
FUSE		*XXXX* INDICATES ID NO. *YY* INDICATES SPECIAL IDENTIFIER *TTTT* INDICATES FUSE TRIP RATING AMPS
GENERATOR		
INDICATING METER		*XXXX* INDICATES ID NO. *YYY* INDICATES SPECIAL INDICATOR
LOAD, NON-MOTOR		*ZZZ* INDICATES EQUIPMENT SIZE IN KVA OR KW
MOTOR		*ZZZ* INDICATES HORSEPOWER SIZE
MOTOR OVERLOAD RELAY		*ZZ* INDICATES NEMA SIZE
MOTOR STARTER CONTACT		*ZZ* INDICATES NEMA SIZE
PANEL MOUNTED SWITCH		*YY* INDICATES SPECIAL IDENTIFIER *XXXX* INDICATES ID NO.
POTENTIAL TRANSFORMER		*ZZZZ* INDICATES VOLTAGE RATIO (TYP. 14.4K/120)
SYMBOL, 3 PHASE DELTA		
SYMBOL, 3 PHASE WYE GROUNDED		*YY* INDICATES SPECIAL IDENTIFIER *XXXX* INDICATES ID NO.
TRANSFER SWITCH		*YY* INDICATES SPECIAL IDENTIFIER *XXXX* INDICATES ID NO.
WELDING/POWER RECEPTACLE		
TRANSFORMER		*XXXX* INDICATES ID NO. *ZZZZ* INDICATES TRANSFORMER RATINGS - KVA, 1 OR 3 PHASE, VOLTAGE RATIO, IMPEDANCE

ELEMENTARY DIAGRAM SYMBOLS

CIRCUIT BREAKER		*TTTT* INDICATES TRIP RATING AMPS
CONTACT		NORMALLY OPEN, CLOSES WHEN COIL IS ENERGIZED, *XXXX* INDICATES ID NO., *YY* INDICATES SPECIAL IDENTIFIER
CONTACT		NORMALLY CLOSED, OPENS WHEN COIL IS ENERGIZED, *XXXX* INDICATES ID NO., *YY* INDICATES SPECIAL IDENTIFIER
CONTROL POWER XFMR		
DISCONNECT SWITCH		*FFFF* INDICATES FRAME RATING AMPS
DISCONNECT SWITCH, 3 PHASE		*XXXX* INDICATES ID NO. *FFFF* INDICATES FRAME RATING AMPS
EQUIPMENT LOAD, 1 PHASE		*ZZZZ* INDICATES EQUIPMENT SIZE IN "KVA" OR "KW"
EQUIPMENT LOAD, 1 PHASE		*ZZZZ* INDICATES EQUIPMENT SIZE IN "KVA" OR "KW"
EQUIPMENT LOAD, 3 PHASE		*ZZZZ* INDICATES EQUIPMENT SIZE IN "KVA" OR "KW"
FUSE		*XXXX* INDICATES ID NO. *TTTT* INDICATES TRIP RATING AMPS *YY* INDICATES SPECIAL IDENTIFIER
GROUND		*ZZZ* INDICATES HP SIZE
MOTOR, 1 PHASE		*ZZZ* INDICATES HP SIZE
MOTOR, 1 PHASE		*ZZZ* INDICATES HP SIZE
MOTOR, 3 PHASE		*ZZZ* INDICATES HP SIZE
OVERLOAD ELEMENT		
PILOT LIGHT		*XXXX* INDICATES ID NO. *YY* INDICATES SPECIAL IDENTIFIER
PUSH-TO-TEST LIGHT		*XXXX* INDICATES ID NO. *YY* INDICATES SPECIAL IDENTIFIER
RELAY		*XXXX* INDICATES ID NO. *YY* INDICATES SPECIAL IDENTIFIER
RELAY, TIME DELAY		TIME DELAY AFTER ENERGIZED, *XXXX* INDICATES ID NO., *TTTT* INDICATES TIMING SET POINT
RELAY, TIME DELAY		TIME DELAY AFTER DE-ENERGIZED, *XXXX* INDICATES ID NO., *TTTT* INDICATES TIMING SET POINT
RESISTOR		*XXXX* INDICATES ID NO. *ZZZZ* INDICATES SIZE IN OHMS
SOLENOID VALVE COIL		*XXXX* INDICATES ID NO.
THERMAL OVERLOAD CONTACT		NORMALLY CLOSED, OPENS WHEN OVERLOAD RELAY(S) TRIP

WIRING BY SUB-CONTRACTOR  
WIRING BY VENDOR

SWITCHES

FLOW SWITCH		NORMALLY CLOSED, OPENS ABOVE SET FLOW
FLOW SWITCH		NORMALLY OPEN, CLOSES ABOVE SET FLOW
FOOT SWITCH		NORMALLY OPEN, CLOSES WHEN ACTUATED
FOOT SWITCH		NORMALLY CLOSED, OPENS WHEN ACTUATED
LEVEL SWITCH		NORMALLY CLOSED, OPENS ABOVE SET LEVEL
LEVEL SWITCH		NORMALLY OPEN, CLOSES ABOVE SET LEVEL
LIMIT SWITCH		NORMALLY CLOSED, OPENS BY MECHANICAL OPERATION
LIMIT SWITCH		NORMALLY OPEN, CLOSES BY MECHANICAL OPERATION
VACUUM SWITCH		NORMALLY OPEN, CLOSES BELOW SET PRESSURE
VACUUM SWITCH		NORMALLY CLOSED, OPENS BELOW SET PRESSURE
PRESSURE SWITCH		NORMALLY CLOSED, OPENS ABOVE SET PRESSURE
PRESSURE SWITCH		NORMALLY OPEN, CLOSES ABOVE SET PRESSURE
PUSHBUTTON		MOMENTARY OR MAINTAIN CONTACT (XX = MCI, NORMALLY OPEN CONTACT)
PUSHBUTTON		MOMENTARY OR MAINTAIN CONTACT (XX = MCI, NORMALLY CLOSED CONTACT)
PUSHBUTTON, MUSHROOM HEAD		MOMENTARY OR MAINTAIN CONTACT (XX = MCI, NORMALLY OPEN CONTACT)
PUSHBUTTON, MUSHROOM HEAD		MOMENTARY OR MAINTAIN CONTACT (XX = MCI, NORMALLY CLOSED CONTACT)
SELECTOR SWITCH (GENERAL)		*XXXX* INDICATES ID NO. *YY* INDICATES NAME OF CURRENT SWITCH POSITION, *ZZ* INDICATES NAME OF OTHER SWITCH POSITIONS *X* INDICATES CLOSED CIRCUIT POSITION *Y* INDICATES OPEN CIRCUIT POSITION
TEMPERATURE SWITCH		NORMALLY CLOSED, OPENS ABOVE SET TEMPERATURE
TEMPERATURE SWITCH		NORMALLY OPEN, CLOSES ABOVE SET TEMPERATURE
TIMER SWITCH		NORMALLY CLOSED, OPENS ON TIME DELAY AFTER COIL IS ENERGIZED
TIMER SWITCH		NORMALLY OPEN, CLOSES ON TIME DELAY AFTER COIL IS ENERGIZED
TIMER SWITCH		NORMALLY CLOSED, CLOSES ON TIME DELAY AFTER COIL IS DE-ENERGIZED
TIMER SWITCH		NORMALLY OPEN, OPENS ON TIME DELAY AFTER COIL IS DE-ENERGIZED
TORQUE SWITCH		NORMALLY OPEN, CLOSES BELOW SET POINT
TORQUE SWITCH		NORMALLY CLOSED, OPENS ABOVE SET POINT

NOTES

SPECIAL IDENTIFIERS

A	AMBER LIGHT OR AMMETER
AS	AMMETER SWITCH
ATS	AUTOMATIC TRANSFER SWITCH
C	CLEAR LIGHT
CB	CIRCUIT BREAKER
CL	CURRENT LIMITING FUSE
CR	CONTROL RELAY
CS	CONTROL SWITCH
E	HIGH SPEED, MEDIUM VOLTAGE FUSE
G	GREEN LIGHT
LA	LIGHTNING ARRESTER
LR	LATCHING RELAY
M	MOTOR RELAY
MTS	MANUAL TRANSFER SWITCH
PF	POWER FACTOR METER
R	RED LIGHT
SA	SURGE ARRESTER
SP	SPARE
T	TIME DELAY FUSE
V	VOLTMETER
VS	VOLTMETER SWITCH
W	WATTMETER
WH	WATTHOUR METER
WHD	WATTHOUR DEMAND METER

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	<i>[Signature]</i>	N/A	<i>[Signature]</i>
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERNO.	DATE

UNITED STATES DEPARTMENT OF ENERGY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

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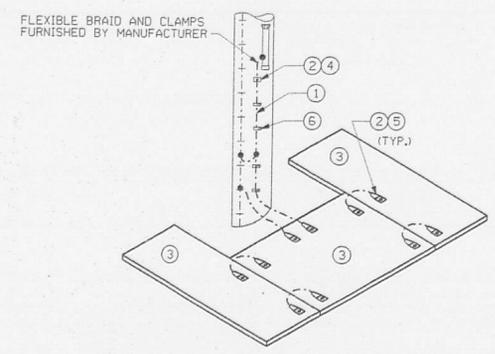
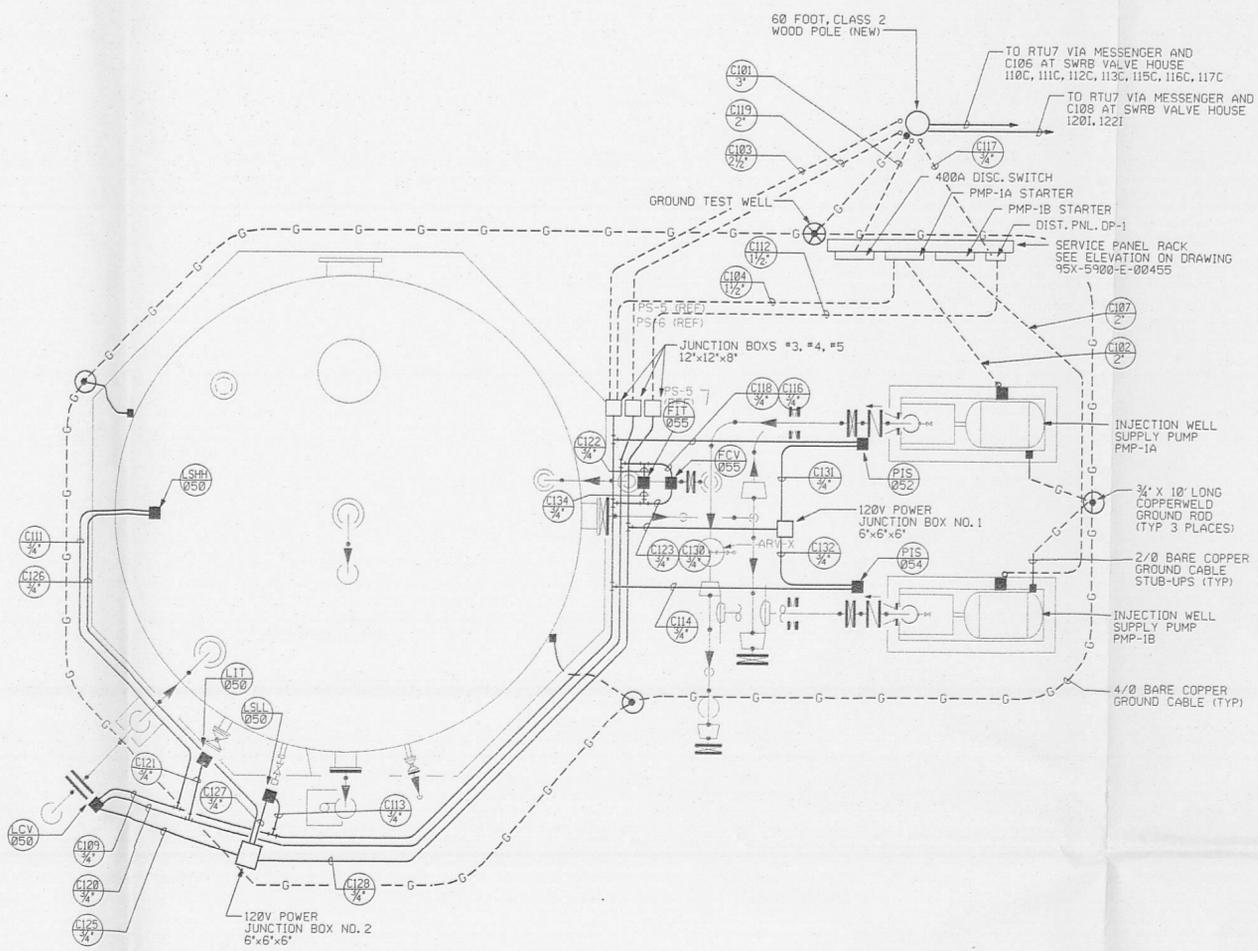
PROJECT NAME SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION

DRAWING TITLE ELECTRICAL SYMBOLS AND LEGEND

DRAWN BY R. PROSKI	DATE 04-14-97	LEAD ENGINEER <i>[Signature]</i>	DATE 03-20-97	CHECKED BY J. L. COOPER	DATE 4/16/97
PLANT/BLDG. NO.	FLOOR	SCALE NONE	CLASS		

SUBMITTED FOR APPROVAL <i>[Signature]</i>	DATE 04/13/97	FERNACO CRU APPROVAL N/A
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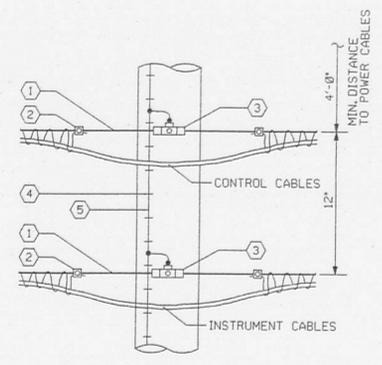
PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	DOE PROJECT NO. WBS 1.1.1.1.2.1	FERNACO PROJECT NO. 00-90701	DRAWING INDEX CODE NO. 95X-5900-E-00473	SHEET NO. E0018	REV. NO. 0
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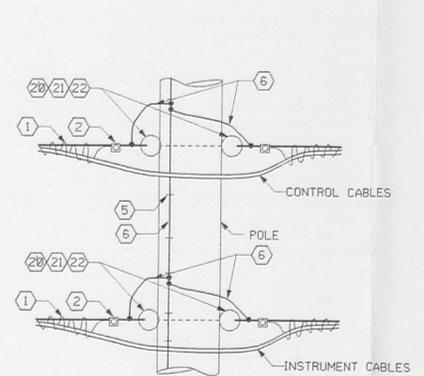
LIST OF MATERIAL		
ITEM	REQ'D.	DESCRIPTION
1	20	2/0 COPPER CABLE (FT.)
2	12	CONNECTORS FOR 2/0 COPPER
3	3	GROUNDING PLATFORM PLATE
4	1	3/8" x 1" EVERDUR BOLT NUT & LOCK WASHER
5	10	3/8" x 1 1/2" EVERDUR BOLT NUT & LOCK WASHER
6	6	1 1/2" LONG COPPERCLAD STAPLES

NOTE:  
LOCATE GROUNDING PLATE TO PERMIT OPERATOR TO REMAIN ON PLATE AT ALL TIMES DURING OPENING OR CLOSING OF SWITCH. THIS ARRANGEMENT IS INTENDED AS A GUIDE ONLY. CONNECTIONS SHOULD BE MADE AS FIELD CONDITIONS PERMIT.

DETAIL 2 REF E00466 E00465 NTS



DETAIL 3 REF E00466 E00465 NTS



DETAIL 4 REF E00466 E00465 NTS

NOTES  
1. CONDUIT RUNS ARE SHOWN DIAGRAMATICALLY. ACTUAL RUNS MAY BE DETERMINED BY THE SUB-CONTRACTOR TO FACILITATE INSTALLATION.

REF DWG NO.	DRAWING TITLE
95X-5900-E-00411	DRAWING INDEX
95X-5900-E-00455	SINGLE LINE / ELEVATION
95X-5900-E-00465	SITE POWER PLAN
95X-5900-E-00461	CABLE SCHEDULE
95X-5900-E-00463	CONDUIT SCHEDULE

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	Cal 12/8/96
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FEMCO DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
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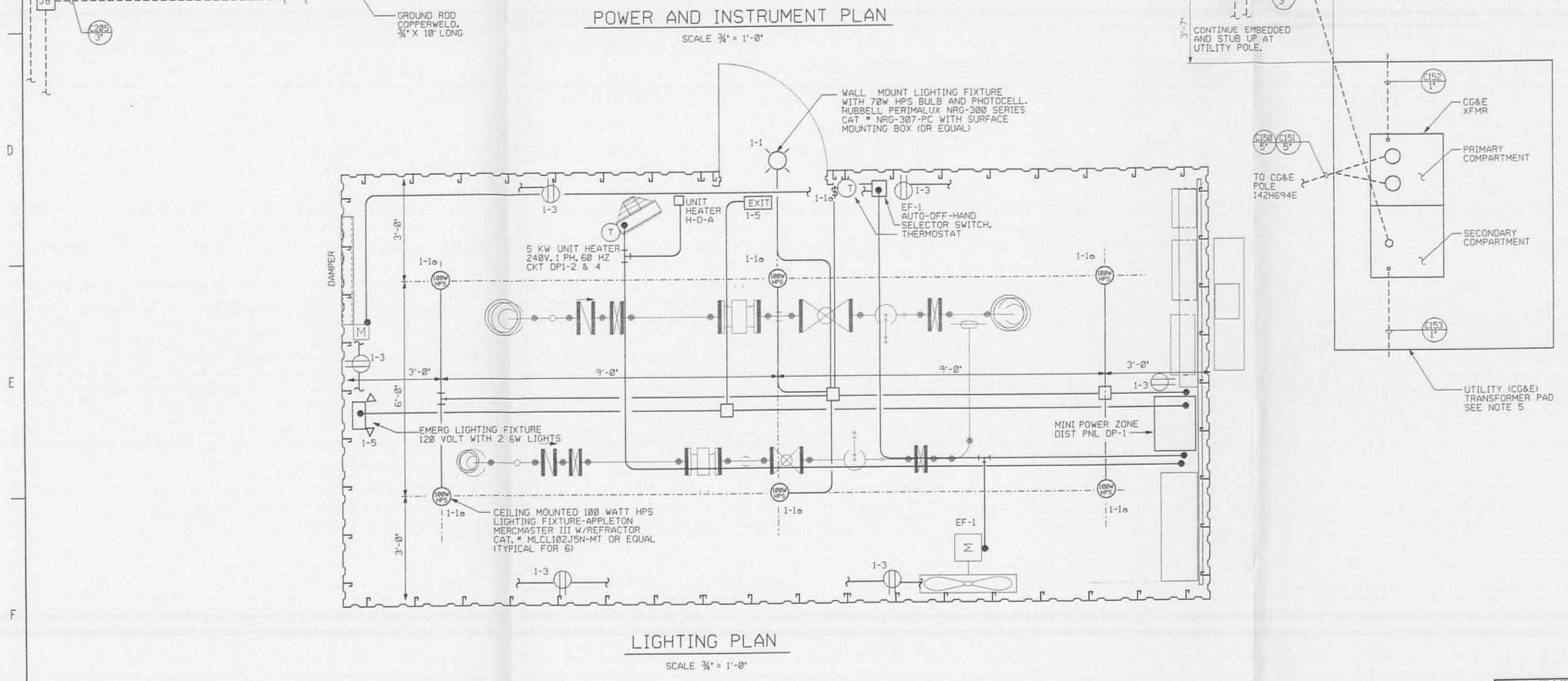
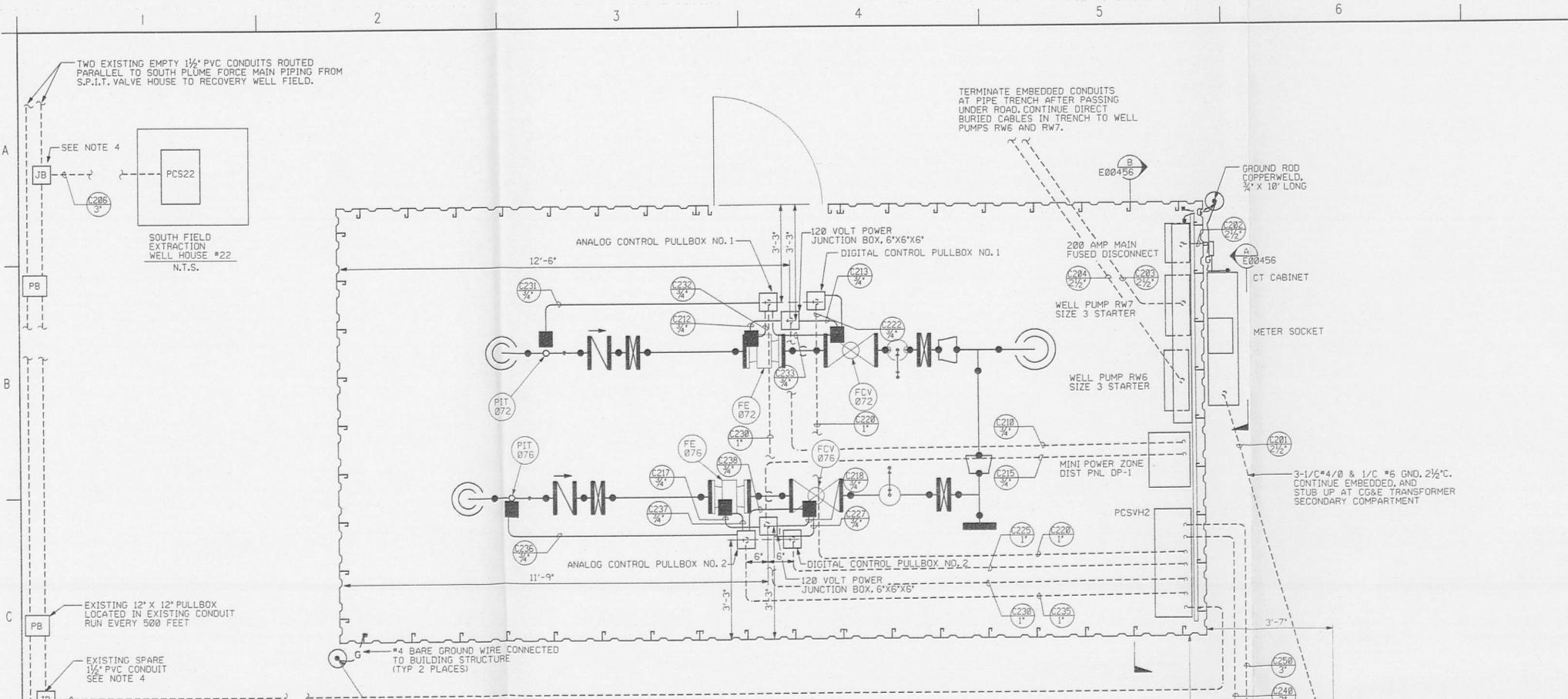
PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**ELECTRICAL POWER PLAN AND DETAILS S. PLUME INJECTION WATER SUPPLY TANK AND PUMPS**

DRAWN BY R.B. CATO	DATE 11/17/96	LEAD ENGINEER R.L. HOLLAND	DATE 10/20/97	CHECKED BY R.L. HOLLAND	DATE 11/20/96
PLANT/RELCD. NO.		SCALE 3/8" = 1'-0"		CLASS	

SUBMITTED FOR APPROVAL  
FEMCO CRU APPROVAL  
FEMCO PROJECT NO. 10-53100

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DOB PROJECT NO. WBS 1.1.1.1.1.2.1 00-90701	FEMP PROJECT NO. N/A	DRAWING INDEX CODE NO. 95X-5900-E-00469	SHEET NO. E0017	REV. NO. 0
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- NOTES
- CONDUIT IS SHOWN DIAGRAMMATICALLY. FIELD ROUTE AND SUPPORT CONDUITS AS NECESSARY SUBJECT TO APPROVAL OF THE CONSTRUCTION MANAGER.
  - SUPPORT PENDANT LIGHTING FIXTURES FROM UNISTRUT (OR EQUAL) FIELD FABRICATED SUPPORTS.
  - ALL CONDUITS SHOWN ARE 3/4" UNLESS OTHERWISE INDICATED.
  - EXISTING EMPTY CONDUIT, SUBCONTRACTOR TO LOCATE AND INSTALL JUNCTION BOXES, CONDUIT AND CABLES AS SHOWN TO CONNECT PCS22 TO PCSVH2
  - CONFIRM TRANSFORMER PAD LAYOUT WITH CG&E PRIOR TO INSTALLATION. CABLE 101P SHALL HAVE 6 FEET (MINIMUM) EACH WIRE ABOVE STUB-UP AT TRANSFORMER FOR CG&E TERMINATION.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-E-00456	SINGLE LINE / ELEVATIONS OPTIMIZATION WELLS VALVE HOUSE
95X-5900-E-00462	CABLE SCHEDULE (201-250)
95X-5900-E-00464	CONDUIT SCHEDULE

INFORMATION ONLY

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERM'D	DATE
0	CERTIFIED FOR CONSTRUCTION		N/A	6/18/95

UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

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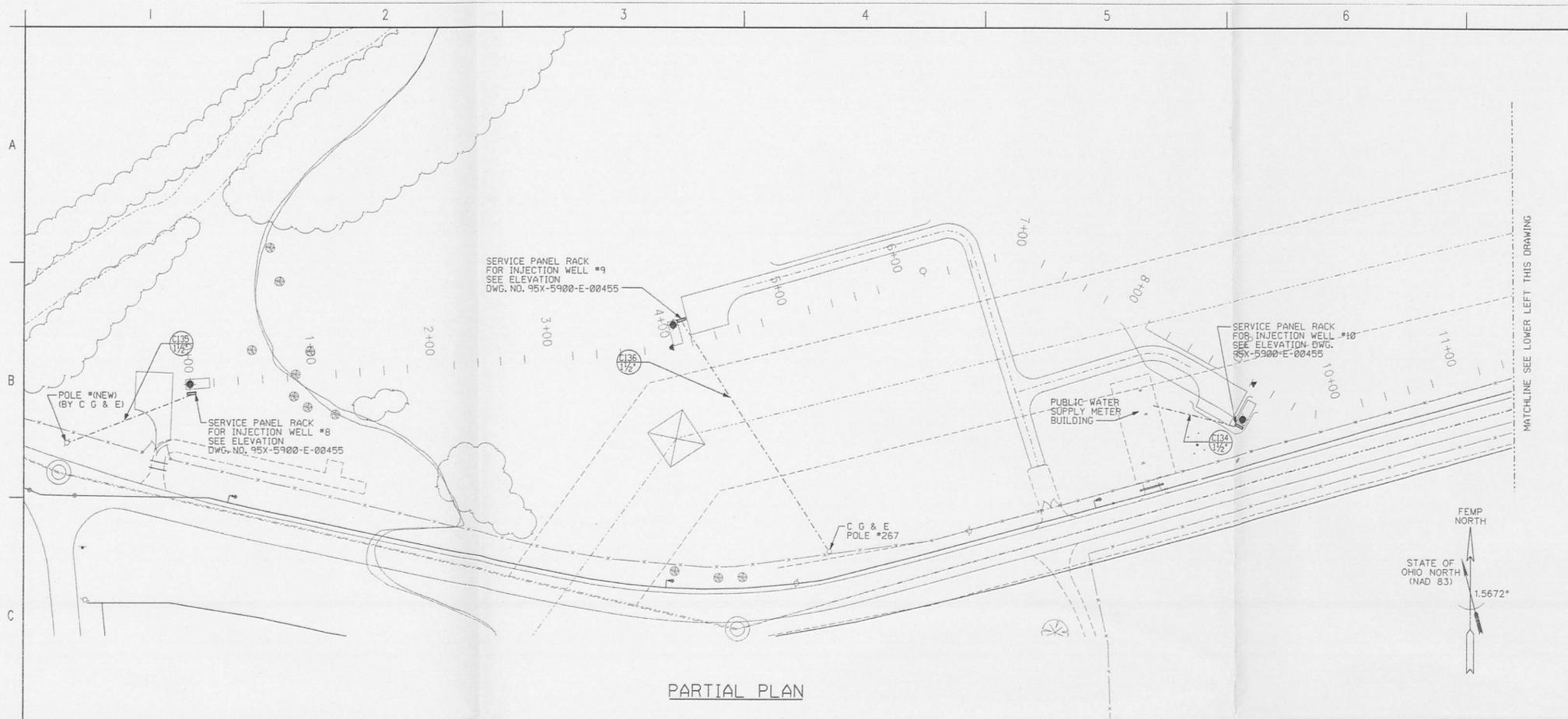
PROJECT NAME  
**SOUTH PLUME OPTIMIZATION  
AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**POWER INSTRUMENTATION AND LIGHTING PLANS  
SOUTH PLUME OPTIMIZATION VALVE HOUSE**

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. D. PROSKI	10/30/96	<i>[Signature]</i>	12/04/97	R.L. HOLLAND	11/20/96

SCALE: 3/4" = 1'-0"

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	TEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
ARP/PO169	WBS 1.1.1.1.2.1 00-90701	95X-5900-E-00468	E0016	0	0



PARTIAL PLAN



PARTIAL PLAN

NOTES

REF DWG NO.	DRAWING TITLE
95X-5900-E-0411	DRAWING INDEX
95X-5900-E-0455	SINGLE LINE / ELEVATION
95X-5900-E-0465	SITE POWER PLAN

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION				
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FEMCO	DATE	INITIALS AND DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
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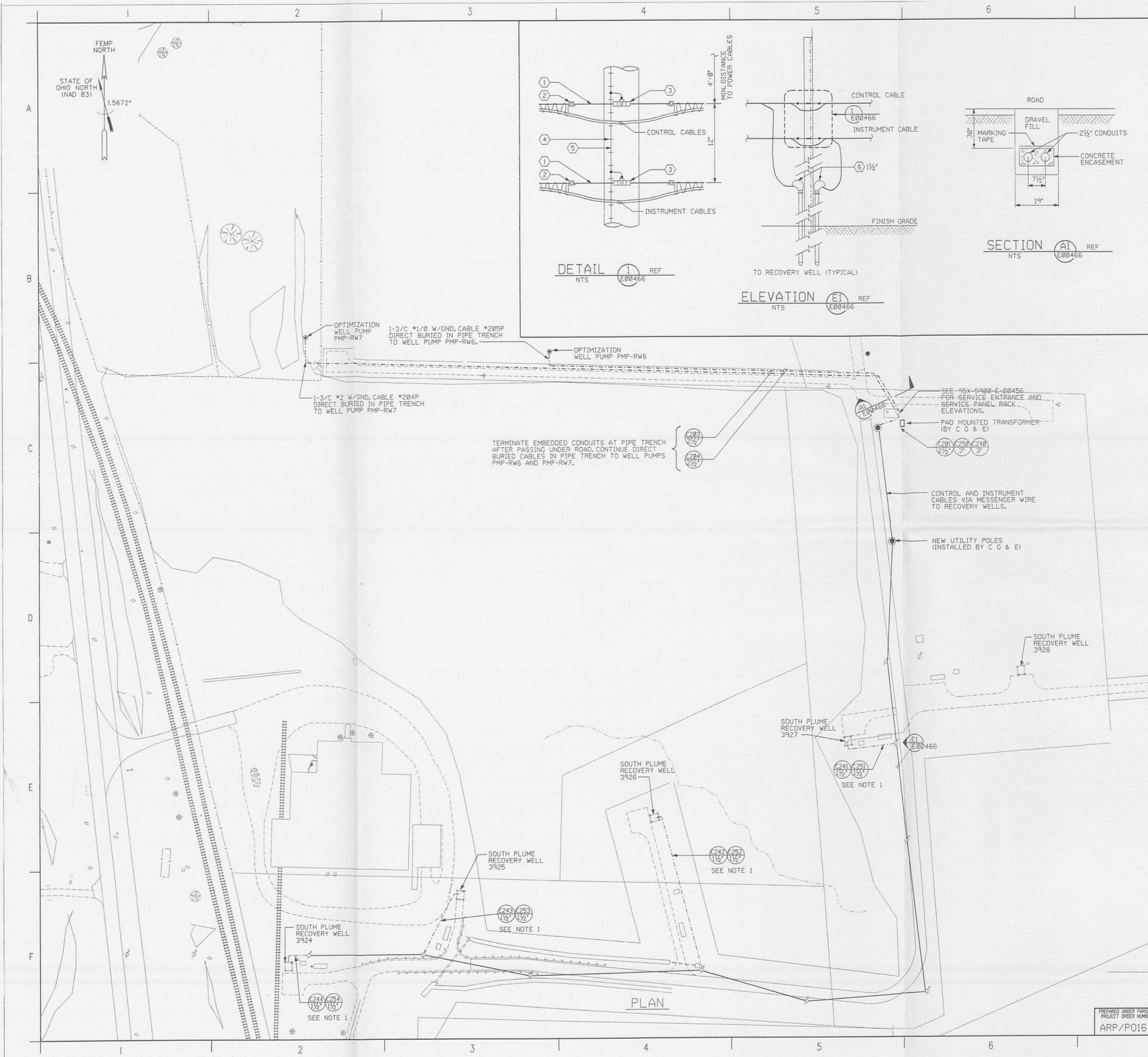
PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**ELECTRICAL SITE POWER PLAN SOUTH PLUME INJECTION WELL AREA**

DRAWN BY R.B. CATO	DATE 11/08/96	LEAD ENGINEER J.J. Cropper	DATE 12/20/97	CHECKED BY R.J. HOLLAND	DATE 11/20/96
PLANT/BLDG. NO.	FLOOR	SCALE 1" = 40' - 0"	CLASS		

SUBMITTED FOR APPROVAL <i>Ma</i> 6/13/97	FEMCO CRU APPROVAL N/A	FEMCO PROJECT NO. ID-53100
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PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DDE PROJECT NO. WBS 1.1.1.1.2.1 00-90701	FEMP PROJECT NO. 95X-5900-E-00467	DRAWING INDEX CODE NO.	SHEET NO. E0015	REV. NO. 0
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NOTES

1. FIELD TO ROUTE 2 CONDUITS FOR CONTROL AND INSTRUMENT CABLES TO MOTOR AND LOCAL INSTRUMENTS.

- MATERIAL LIST**
- ① 3/8" DIAMETER, 7 STRAND, HIGH STRENGTH, GALVANIZED STEEL STRAND MESSENGER
  - ② LASHING AND WIRE CLIP, SIZE AS REQUIRED.
  - ③ CLAMP, SUSPENSION, FOR 3/8" MESSENGER.
  - ④ STAPLE, COPPERCLAD, 1 1/2" LONG.
  - ⑤ #4 AWG, BARE SOLID COPPER GROUND CONDUCTOR.
  - ⑥ WEATHERHEAD, CONDUIT, OUTDOOR, WEATHERTIGHT, (SIZE INDICATED ON DETAIL).

REF DWG NO.	DRAWING TITLE
95X-5900-E-00411	DRAWING INDEX
95X-5900-E-00456	SINGLE LINE / ELEVATION
95X-5900-E-00468	POWER, INSTRUMENTATION AND LIGHTING PLANS
95X-5900-E-00462	CABLE SCHEDULE (201 - 250)
95X-5900-E-00464	CONDUIT SCHEDULE
95X-5900-E-00471	SCHEMATIC DIAGRAM

**INFORMATION ONLY**

0	CERTIFIED FOR CONSTRUCTION	N/A	(01/20/95)
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

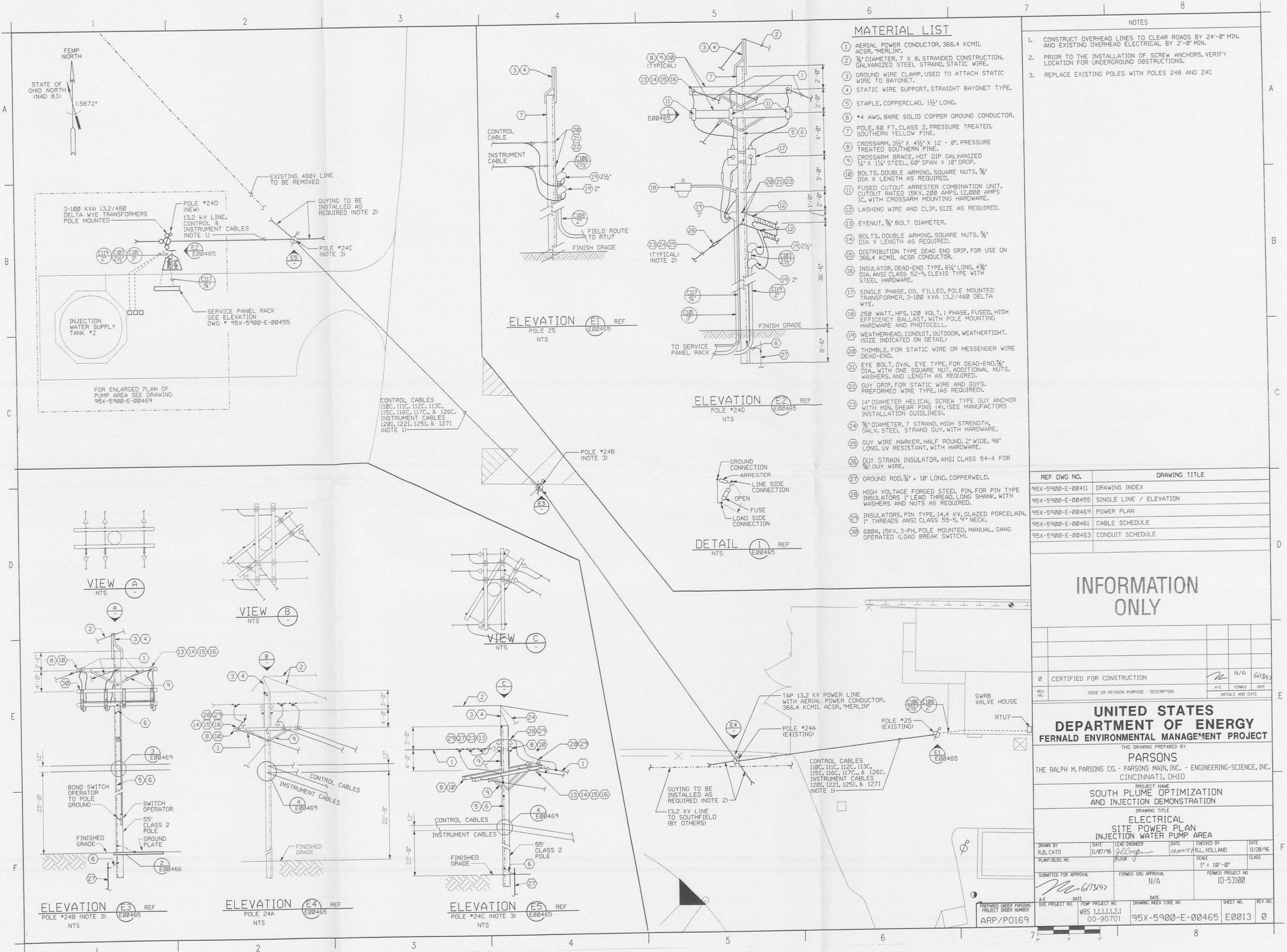
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 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**ELECTRICAL SITE POWER PLAN SOUTH PLUME OPTIMIZATION WELL AREA**

DRAWN BY R.B. CATO	DATE 11/11/95	LEAD ENGINEER [Signature]	DATE 12/21/97	CHECKED BY R. L. HOLLAND	DATE 11/20/95
PLANT/BLDG. NO.	FLOOR	SCALE 1" = 50'-0"	CLASS		
SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL N/A	FERNCO PROJECT NO. SPO-53300			

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	DATE 11/11/95	FERNCO PROJECT NO. WBS 1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-E-00466	SHEET NO. E0014	REV. NO. 0
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MATERIAL LIST

- 1 AERIAL POWER CONDUCTOR, 366.4 KCMIL ACSR, 'MERLIN'.
- 2 3/4" DIAMETER, 7 X 8, STRANDED CONSTRUCTION, GALVANIZED STEEL STRAND, STATIC WIRE.
- 3 GROUND WIRE CLAMP, USED TO ATTACH STATIC WIRE TO BAYONET.
- 4 STATIC WIRE SUPPORT, STRAIGHT BAYONET TYPE.
- 5 STAPLE, COPPERCLAD, 1 1/2" LONG.
- 6 #4 AWG, BARE SOLID COPPER GROUND CONDUCTOR.
- 7 POLE, 60 FT CLASS 2, PRESSURE TREATED, SOUTHERN YELLOW PINE.
- 8 CROSSARM, 3/4" X 4 1/2" X 12' - 0", PRESSURE TREATED SOUTHERN PINE.
- 9 CROSSARM BRACE, HOT DIP GALVANIZED 1/4" X 1 1/4" STEEL, 60" SPAN X 18" DROP.
- 10 BOLTS, DOUBLE ARMING, SQUARE NUTS, 5/8" DIA X LENGTH AS REQUIRED.
- 11 FUSED CUTOFF ARRESTER COMBINATION UNIT, CUTOFF RATED 15KV, 200 AMPS, 12,000 AMPS IC, WITH CROSSARM MOUNTING HARDWARE.
- 12 LASHING WIRE AND CLIP, SIZE AS REQUIRED.
- 13 EYENUT, 5/8" BOLT DIAMETER.
- 14 BOLTS, DOUBLE ARMING, SQUARE NUTS, 5/8" DIA X LENGTH AS REQUIRED.
- 15 DISTRIBUTION TYPE DEAD END GRIP, FOR USE ON 366.4 KCMIL ACSR CONDUCTOR.
- 16 INSULATOR, DEAD-END TYPE, 6 1/2" LONG, 4 3/4" DIA, ANSI CLASS 52-9, CLEVIS TYPE WITH STEEL HARDWARE.
- 17 SINGLE PHASE, OIL FILLED, POLE MOUNTED TRANSFORMER, 3-100 KVA 13.2/480 DELTA WYE.
- 18 250 WATT, HPS, 120 VOLT, 1 PHASE, FUSED, HIGH EFFICIENCY BALLAST, WITH POLE MOUNTING HARDWARE AND PHOTOCELL.
- 19 WEATHERHEAD, CONDUIT, OUTDOOR, WEATHERTIGHT, (SIZE INDICATED ON DETAIL)
- 20 THIMBLE, FOR STATIC WIRE OR MESSENGER WIRE DEAD-END.
- 21 EYE BOLT, OVAL EYE TYPE, FOR DEAD-END, 5/8" DIA., WITH ONE SQUARE NUT, ADDITIONAL NUTS, WASHERS, AND LENGTH AS REQUIRED.
- 22 GUY GRIP, FOR STATIC WIRE AND GUYS, PREFORMED WIRE TYPE, (AS REQUIRED).
- 23 1 1/4" DIAMETER HELICAL SCREW TYPE GUY ANCHOR WITH MIN. SHEAR PINS (4), (SEE MANUFACTURERS INSTALLATION GUIDELINES).
- 24 5/8" DIAMETER, 7 STRAND, HIGH STRENGTH, GALV. STEEL STRAND GUY, WITH HARDWARE.
- 25 GUY WIRE MARKER, HALF ROUND, 2" WIDE, .96" LONG, UV RESISTANT, WITH HARDWARE.
- 26 GUY STRAIN INSULATOR, ANSI CLASS 54-4 FOR 5/8" GUY WIRE.
- 27 GROUND ROD, 3/4" X 18" LONG, COPPERWELD.
- 28 HIGH VOLTAGE FORGED STEEL PIN, FOR PIN TYPE INSULATORS 1" LEAD THREAD, LONG SHANK, WITH WASHERS AND NUTS AS REQUIRED.
- 29 INSULATORS, PIN TYPE, 14.4 KV, GLAZED PORCELAIN, 1" THREADS ANSI CLASS 55-5, 4" NECK.
- 30 600A, 15KV, 3-PH, POLE MOUNTED, MANUAL, GANG OPERATED (LOAD BREAK SWITCH).

NOTES

1. CONSTRUCT OVERHEAD LINES TO CLEAR ROADS BY 24'-0" MIN. AND EXISTING OVERHEAD ELECTRICAL BY 2'-0" MIN.
2. PRIOR TO THE INSTALLATION OF SCREW ANCHORS, VERIFY LOCATION FOR UNDERGROUND OBSTRUCTIONS.
3. REPLACE EXISTING POLES WITH POLES 24B AND 24C

ELEVATION E1 REF E00465 POLE #25 NTS

ELEVATION E2 REF E00465 POLE #24D NTS

DETAIL 1 REF E00465 NTS

VIEW A NTS

VIEW B NTS

VIEW C NTS

ELEVATION E3 REF E00465 POLE #24B (NOTE 3) NTS

ELEVATION E4 REF E00465 POLE #24A NTS

ELEVATION E5 REF E00465 POLE #24C (NOTE 3) NTS

REF DWG NO.	DRAWING TITLE
95X-5900-E-00411	DRAWING INDEX
95X-5900-E-00455	SINGLE LINE / ELEVATION
95X-5900-E-00469	POWER PLAN
95X-5900-E-00461	CABLE SCHEDULE
95X-5900-E-00463	CONDUIT SCHEDULE

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	ISSUED DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
 DRAWING TITLE  
**ELECTRICAL SITE POWER PLAN INJECTION WATER PUMP AREA**

DRAWN BY R.B. CATO	DATE 11/07/96	LEAD ENGINEER J. [Signature]	DATE 12/01/97	CHECKED BY R.L. HOLLAND	DATE 11/28/96
PLANT/BLDG. NO.	FLOOR	SCALE 1" = 10'-0"	CLASS	FERMCO PROJECT NO. 10-53100	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DOE PROJECT NO. WBS 1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-E-00465	SHEET NO. E0013	REV. NO. 0
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# CABLE SCHEDULE

CABLE NO	FROM	TO	CONDUCTOR				WIRE TERMINATIONS												ROUTING	REF DWG	REMARKS		
			NUMBER	SIZE	INSUL	FUNCTION	1	2	3	4	5	6	7	8	9	10	11	12					
101P	CG&E TRANSFORMER	400A DISCONNECT SWITCH	5-1/C 1-1/C	*4/0 #2 GND	600V	480V AC PWR FDR	X1-A	X1-B	X2-A	X2-B	X3-A	X3-B	GND							C101	E00455	TERMINATION AT XFMR BY CG&E	
102P	400A DISCONNECT SWITCH	TAP IN WIREWAY	5-1/C 1-1/C	*4/0 #4 GND	600V	480V AC PWR FDR	L1-A	L1-B	L2-A	L2-B	L3-A	L3-B	GND							FIELD ROUTE	E00455	FIELD ROUTE THRU CONDUIT NIPPLE	
103P	INJECTION WELL PUMP PMP-1A STARTER	INJECTION WELL PUMP MOTOR PMP-1A	3-1/C 1-1/C	*2/0 #6 GND	600V	MOTOR POWER	1A-T1	1A-T2	1A-T3	1A-G										C102	E00455		
104P	INJECTION WELL PUMP PMP-1B STARTER	INJECTION WELL PUMP MOTOR PMP-1B	3-1/C 1-1/C	*2/0 #6 GND	600V	MOTOR POWER	1B-T1	1B-T2	1B-T3	1B-G										C107	E00455		
105P	TAP IN WIREWAY	DISTRIBUTION PANEL DP-1	3-1/C 1-1/C	*8 #6 GND	600V	120/240VAC PWR FDR	DP1-L1	DP1-L2	DP1-L3	DP1-G										C110	E00455		
106P	DISTRIBUTION PANEL DP-1 CKT.1	250W HPS LTG.	1-3/C	*12	600V	120V AC PWR FDR	DP1-1L	DP1-1N	DP1-1G											C117	E00455		
110C	INJECTION WELL PUMP PMP-1A STARTER	RTU7	1-5/C	*14	600V	CONTROL	1A-X2	1A-1	1A-4	1A-5	1A-6									C104,JB3,C103,OVERHEAD, C106	E00459		
111C	PRESSURE SWITCH PSH052	RTU7	1-3/C	*16	600V	CONTROL	PS052 -1	PS052 -2	PS052 -N												C116,C109,JB3,C103, OVERHEAD,C106	E00459	
112C	INJECTION WELL PUMP PMP-1B STARTER	RTU7	1-5/C	*14	600V	CONTROL	1B-X2	1B-1	1B-4	1B-5	1B-6										C105,C104,JB3,C103, OVERHEAD,C106	E00459	
113C	PRESSURE SWITCH PSH054	RTU7	1-3/C	*16	600V	CONTROL	PS054 -1	PS054 -2	PS054 -N												C114,C109,JB3,C103, OVERHEAD,C106	E00459	
115C	LEVEL SWITCH LSHH050	RTU7	1-2/C	*16	600V	CONTROL	LSHH0 50-1	LSHH0 50-N													C111,C109,JB3,C103, OVERHEAD,C106	E00459	
116C	LEVEL SWITCH LSLLO50	RTU7	1-2/C	*16	600V	CONTROL	LSLLO 50-1	LSLLO 50-N													C113,C109,JB3,C103, OVERHEAD,C106	E00459	
117C	CONTROL VALVE LCV050	RTU7	1-2/C	*16	600V	CONTROL	ZSL050 -1	ZSL050 -N													C109,JB3,C103, OVERHEAD,C106	E00459	
119P	DISTRIBUTION PANEL DP-1 CKT.3	CONTROL VALVE LCV050 VIA 120V PWR, J.B. NO. 2	1-3/C	*12	600V	120V AC PWR FDR	DP1-3L	DP1-3N	DP1-3G												C225,JB2,C228,JB5,C112	E00459	
120I	CONTROL VALVE LCV050	RTU7	1 PAIR TWSH	*16	BELDEN 8719	DCS I/O	LCV050 (+)	LCV050 (-)													C220,JB4,C119, OVERHEAD,C108	N00439	
121P	DISTRIBUTION PANEL DP-1 CKT.4	PRESS. SW. PIS052, PIS054, LEVEL SW. LSHH050, LSLLO50	1-3/C	*12	600V	120V AC PWR FDR	DP1-4L	DP1-4N	DP1-4G												FIELD ROUTE	E00459	SEE DWG. E00469 FOR CONDUIT ROUTING
122I	LEVEL TRANSMITTER LIT050	RTU7	1 PAIR TWSH	*16	BELDEN 8719	DCS I/O	LIT050 (+)	LIT050 (-)													C221,C220,JB4,C119, OVERHEAD,C108	N00439	
123P	DISTRIBUTION PANEL DP-1 CKT.7	CONTROL VALVE FCV055	1-3/C	*12	600V	120V AC PWR FDR	DP1-7L	DP1-7N	DP1-7G												C118,C128,JB5,C112	E00459	
124P	DISTRIBUTION PANEL DP-1 CKT.9	FLOW TRANSMITTER FIT055	1-3/C	*12	600V	120V AC PWR FDR	DP1-9L	DP1-9N	DP1-9G												C122,C118,C120,JB5,C112	E00459	
125I	CONTROL VALVE FCV055	RTU7	1 PAIR TWSH	*16	BELDEN 8719	DCS I/O	FCV055 (+)	FCV055 (-)													C118,C120,JB4,C119, OVERHEAD,C108	N00439	
126C	CONTROL VALVE FCV055	RTU7	1-2/C	*16	600V	CONTROL	ZSL055 -1	ZSL055 -N													C118,C109,JB3,C103, OVERHEAD,C106	E00459	
127I	FLOW TRANSMITTER FIT055	RTU7	1 PAIR TWSH	*16	BELDEN 8719	DCS I/O	FIT055 (+)	FIT055 (-)													C122,C118,C120,JB4, C119,OVERHEAD,C108	N00439	
130I	PCS18	PCS11	2/BNDL	62.5/125 MULTIMOD	FIBER OPTIC	COMM	1	2													FIELD ROUTE DIRECT BURIAL	N00482 N00442	
131I	PCS11	PCS12	2/BNDL	62.5/125 MULTIMOD	FIBER OPTIC	COMM	1	2													FIELD ROUTE DIRECT BURIAL	N00482 N00442	
132I	PCS12	PCS10	2/BNDL	62.5/125 MULTIMOD	FIBER OPTIC	COMM	1	2													FIELD ROUTE DIRECT BURIAL	N00482 N00442	
133I	PCS10	PCS9	2/BNDL	62.5/125 MULTIMOD	FIBER OPTIC	COMM	1	2													FIELD ROUTE DIRECT BURIAL	N00482 N00442	
134I	PCS9	PCS8	2/BNDL	62.5/125 MULTIMOD	FIBER OPTIC	COMM	1	2													FIELD ROUTE DIRECT BURIAL	N00482 N00442	
146C	INJECTION WELL NO. 8 PCS8	INJECTION WELL NO. 8 LIMIT SWITCH ZSL060	2-1/C	*14	600V	CONTROL	ZS060 -1	ZS060 -2	ZS060 -3												FIELD ROUTE	N00442	
147C	INJECTION WELL NO. 9 PCS9	INJECTION WELL NO. 9 LIMIT SWITCH ZSL062	2-1/C	*14	600V	CONTROL	ZS062 -1	ZS062 -2	ZS062 -3												FIELD ROUTE	N00442	
148C	INJECTION WELL NO. 10 PCS10	INJECTION WELL NO. 10 LIMIT SWITCH ZSL064	2-1/C	*14	600V	CONTROL	ZS064 -1	ZS064 -2	ZS064 -3												FIELD ROUTE	N00442	
149C	INJECTION WELL NO. 11 PCS11	INJECTION WELL NO. 11 LIMIT SWITCH ZSL066	2-1/C	*14	600V	CONTROL	ZS066 -1	ZS066 -2	ZS066 -3												FIELD ROUTE	N00442	
150C	INJECTION WELL NO. 12 PCS12	INJECTION WELL NO. 12 LIMIT SWITCH ZSL068	2-1/C	*14	600V	CONTROL	ZS068 -1	ZS068 -2	ZS068 -3												FIELD ROUTE	N00442	

NOTES

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-E-00455	SINGLE LINE / ELEVATION
95X-5900-E-00459	INTERCONNECTION DIAGRAM
95X-5900-N-00439	I/O DRAWING - INJECTION WATER SUPPLY TANK
95X-5900-N-00482	DCS COMMUNICATIONS PLAN INJECTION WELLS

INFORMATION  
ONLY

<input type="checkbox"/> CERTIFIED FOR CONSTRUCTION	N/A 6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION
A-E	DATE
INITIALS AND DATE	

**UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

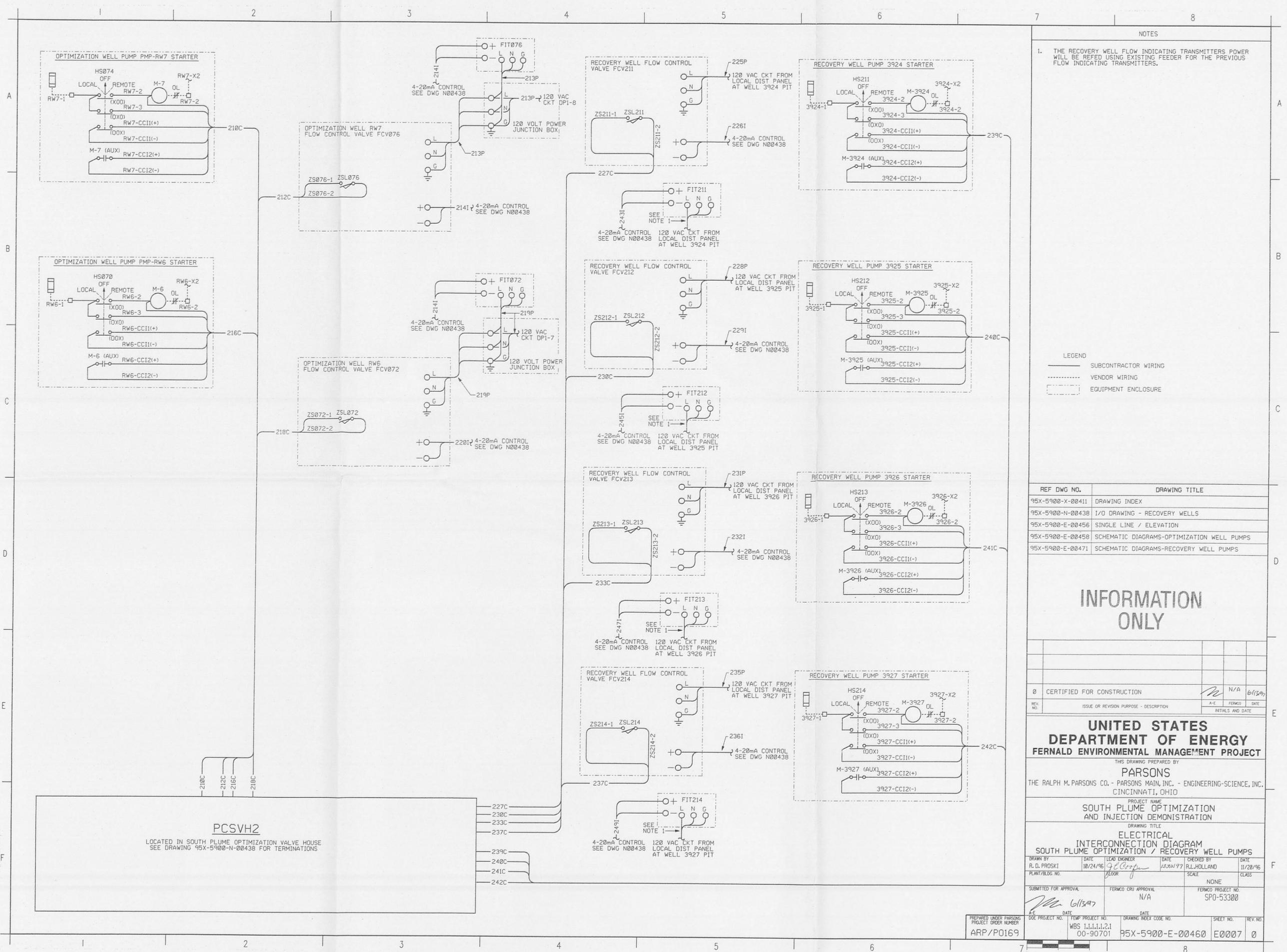
THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION  
AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**ELECTRICAL  
CABLE SCHEDULE (101-150)  
SOUTH PLUME INJECTION WATER SUPPLY**

DRAWN BY R.B. CATO	DATE 11/11/96	LEAD ENGINEER <i>James Clough</i>	DATE 12/20/97	CHECKED BY R.L. HOLLAND	DATE 11/20/96
PLANT/BLDG. NO.	FLOOR	SCALE	NONE		
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL		FERMCO PROJECT NO.	
<i>M</i> 6/13/97		N/A		ID-53100	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	DOE PROJECT NO. WBS 111.11.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-E-00461	SHEET NO. E0008	REV. NO. 0
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NOTES

1. THE RECOVERY WELL FLOW INDICATING TRANSMITTERS POWER WILL BE REPEATED USING EXISTING FEEDER FOR THE PREVIOUS FLOW INDICATING TRANSMITTERS.

LEGEND

- SUBCONTRACTOR WIRING
- VENDOR WIRING
- EQUIPMENT ENCLOSURE

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-N-00438	I/O DRAWING - RECOVERY WELLS
95X-5900-E-00456	SINGLE LINE / ELEVATION
95X-5900-E-00458	SCHEMATIC DIAGRAMS-OPTIMIZATION WELL PUMPS
95X-5900-E-00471	SCHEMATIC DIAGRAMS-RECOVERY WELL PUMPS

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	<i>M</i>	N/A	6/13/97
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**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

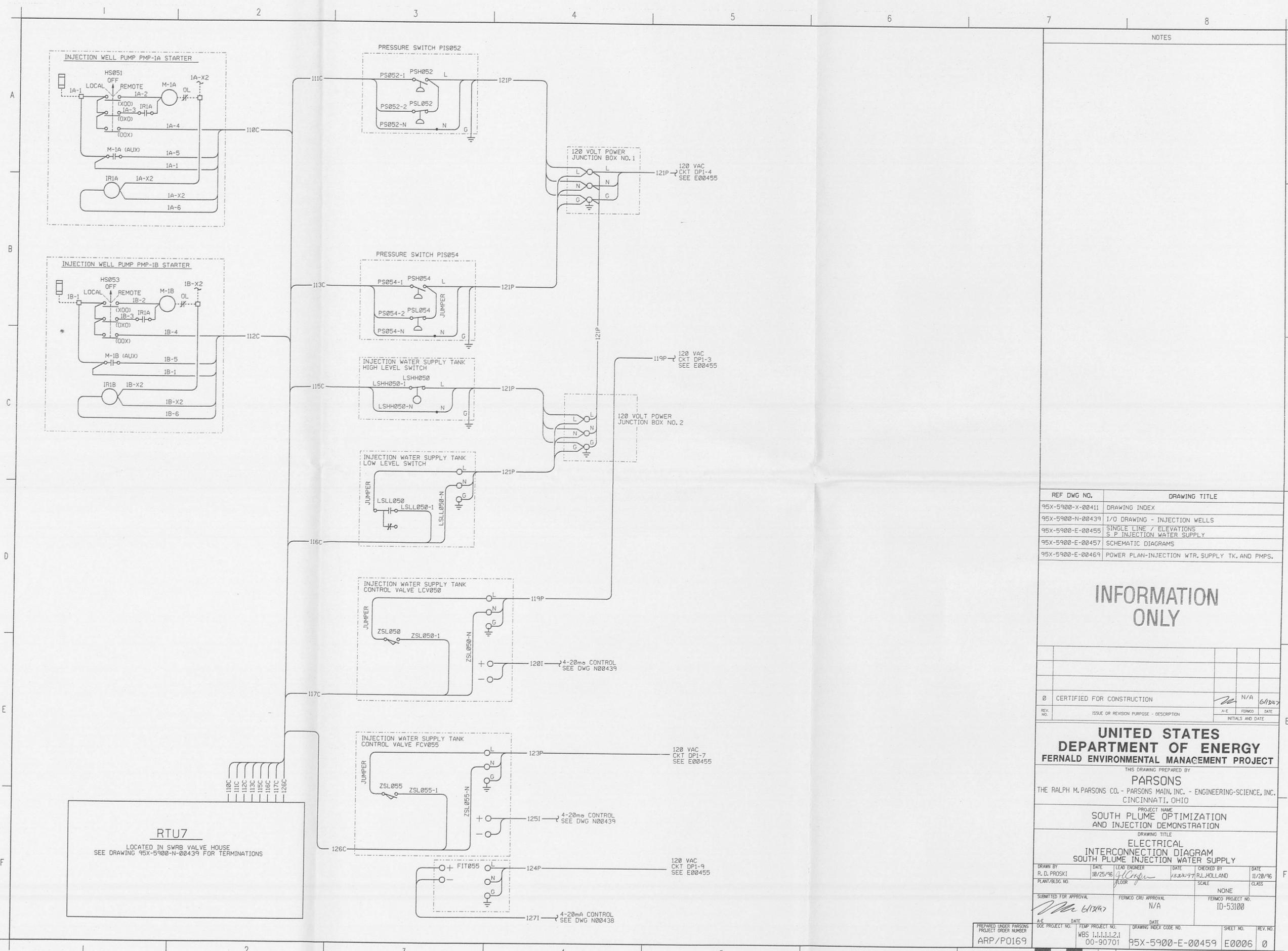
DRAWING TITLE  
**ELECTRICAL INTERCONNECTION DIAGRAM SOUTH PLUME OPTIMIZATION / RECOVERY WELL PUMPS**

DRAWN BY R. D. PROGKI	DATE 10/24/96	DATE 10/24/96	DATE 11/28/96
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS

SUBMITTED FOR APPROVAL	FERNALD CRU APPROVAL	FERNALD PROJECT NO.
<i>M</i> 6/13/97	N/A	SP0-53300

DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
WBS 1.1.1.1.2.1	00-90701	95X-5900-E-00460	E0007	0

PREPARED UNDER PARSONS PROJECT ORDER NUMBER  
 ARP/P0169



NOTES

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-N-00439	I/O DRAWING - INJECTION WELLS
95X-5900-E-00455	SINGLE LINE / ELEVATIONS S.P. INJECTION WATER SUPPLY
95X-5900-E-00457	SCHEMATIC DIAGRAMS
95X-5900-E-00469	POWER PLAN-INJECTION WTR. SUPPLY TK. AND PMPs.

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO DATE INITIALS AND DATE

**UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

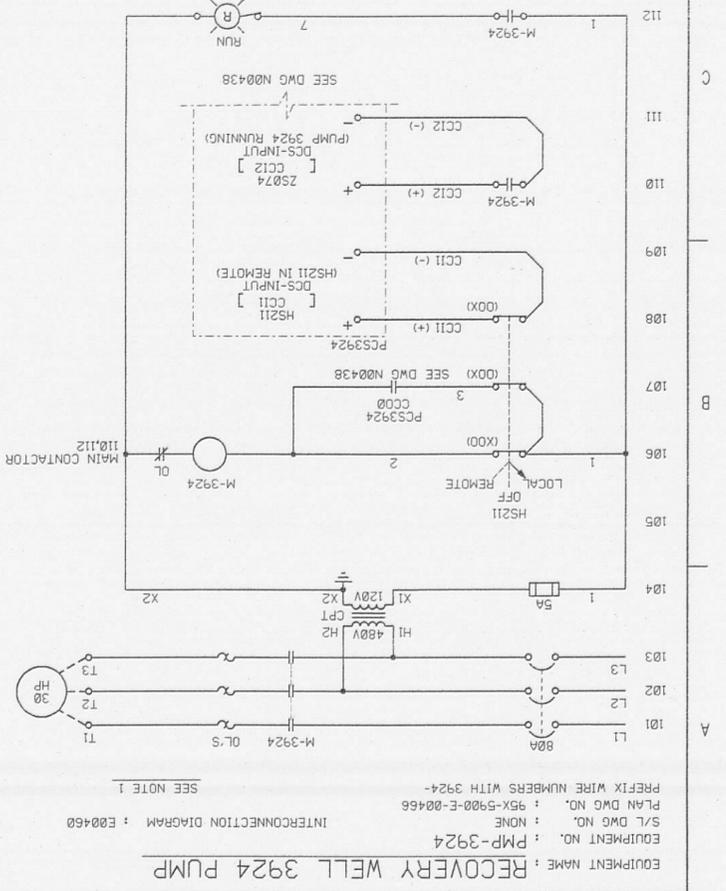
PROJECT NAME  
**SOUTH PLUME OPTIMIZATION  
AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**ELECTRICAL  
INTERCONNECTION DIAGRAM  
SOUTH PLUME INJECTION WATER SUPPLY**

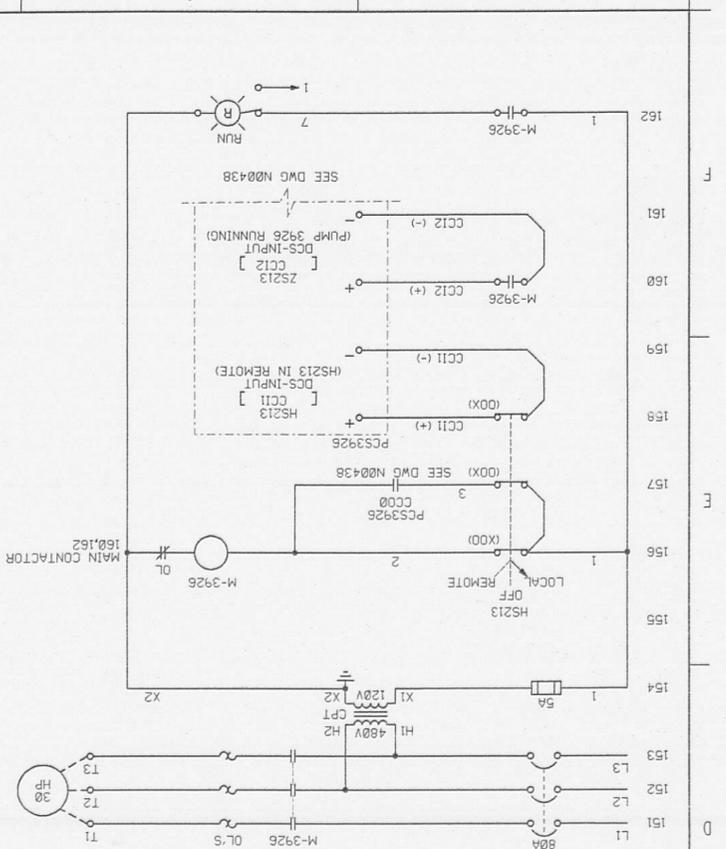
DRAWN BY R. D. PROSKI	DATE 10/25/96	LEAD ENGINEER <i>[Signature]</i>	DATE 12/21/97	CHECKED BY R.L. HOLLAND	DATE 11/20/96
PLANT/BLDG. NO.	FLOOR	SCALE	NONE	FERMCO PROJECT NO. 10-53100	CLASS

SUBMITTED FOR APPROVAL <i>[Signature]</i>	DATE 6/13/97	FERMCO CRU APPROVAL N/A	FERMCO PROJECT NO. 10-53100
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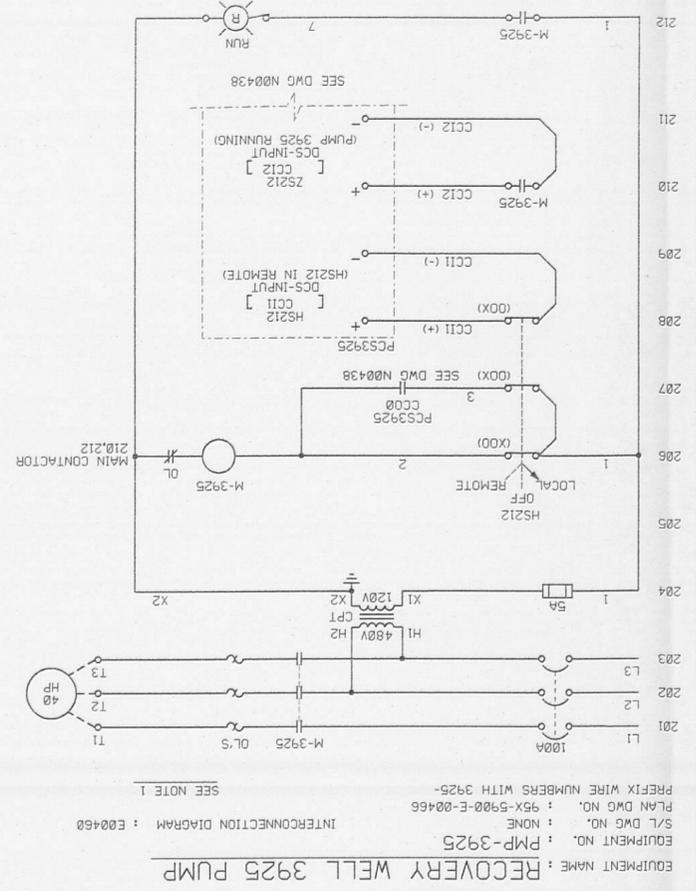
PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DOE PROJECT NO. WBS 1.1.1.1.2.1 00-90701	DATE 12/21/97	DRAWING INDEX CODE NO. 95X-5900-E-00459	SHEET NO. E0006	REV. NO. 0
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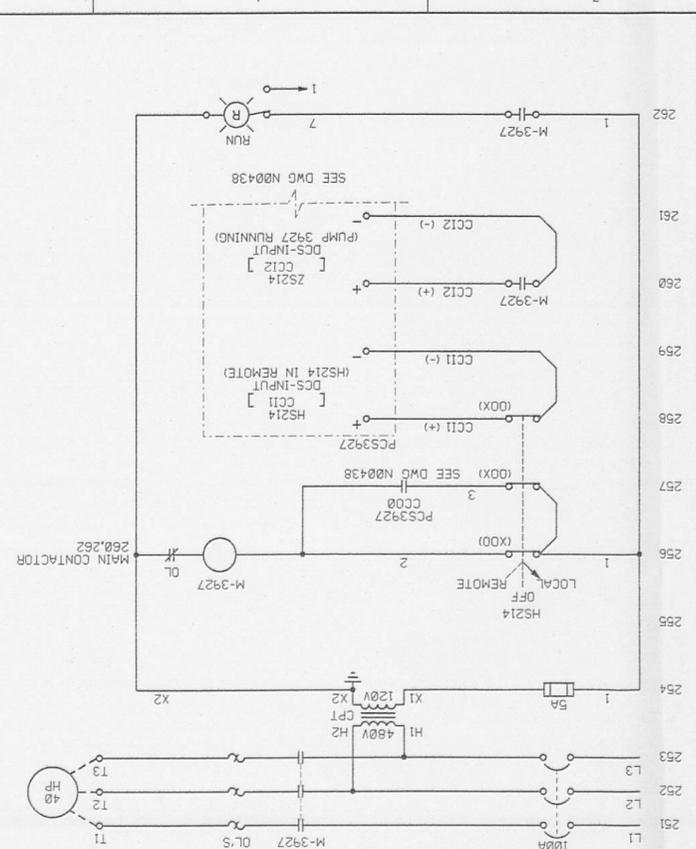
EQUIPMENT NAME : RECOVERY WELL 3924 PUMP  
 EQUIPMENT NO. : PMP-3924  
 S/L DWG NO. : NONE  
 PLAN DWG NO. : 95X-5900-E-00466  
 PREFIX WIRE NUMBERS WITH 3924-



EQUIPMENT NAME : RECOVERY WELL 3926 PUMP  
 EQUIPMENT NO. : PMP-3926  
 S/L DWG NO. : NONE  
 PLAN DWG NO. : 95X-5900-E-00466  
 PREFIX WIRE NUMBERS WITH 3926-



EQUIPMENT NAME : RECOVERY WELL 3925 PUMP  
 EQUIPMENT NO. : PMP-3925  
 S/L DWG NO. : NONE  
 PLAN DWG NO. : 95X-5900-E-00466  
 PREFIX WIRE NUMBERS WITH 3925-



EQUIPMENT NAME : RECOVERY WELL 3927 PUMP  
 EQUIPMENT NO. : PMP-3927  
 S/L DWG NO. : NONE  
 PLAN DWG NO. : 95X-5900-E-00466  
 PREFIX WIRE NUMBERS WITH 3927-

NOTES  
 1. REWIRE EXISTING RECOVERY WELL PUMP STARTERS AS SHOWN. INSTALL 3 POSITION, MAINTAINED, LOCAL-OFF-REMOTE SELECTOR SWITCH IN THE STARTER ENCLOSURE.

LEGEND  
 ALL DEVICES ARE LOCATED IN THE STARTER UNLESS NOTED AS BELOW:  
 ⊕ INDICATES FIELD MOUNTED LOCAL DEVICE  
 DCS I/O DESIGNATION  
 RTU NUMBER  
 MODULE NUMBER  
 POINT NUMBER  
 2201-1-21

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	INITIALS AND DATE
0	CERTIFIED FOR CONSTRUCTION	N/A 6/13/97

REF DWG NO. DRAWING TITLE

95X-5900-X-00411	DRAWING INDEX
95X-5900-E-00460	INTERCONNECTION DIAGRAM
95X-5900-N-00436	I/O DRAWING

DEPARTMENT OF ENERGY  
 UNITED STATES  
 FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
 PARSONS  
 THE RALPH W. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 SOUTH PLUME OPTIMIZATION  
 AND INJECTION DEMONSTRATION  
 ELECTRICAL  
 SCHEMATIC DIAGRAMS  
 SOUTH PLUME RECOVERY WELLS

DRAWN BY: DATE: 11/28/96  
 CHECKED BY: DATE: 11/28/96  
 R. D. PROSKY  
 L. J. HOLLAND

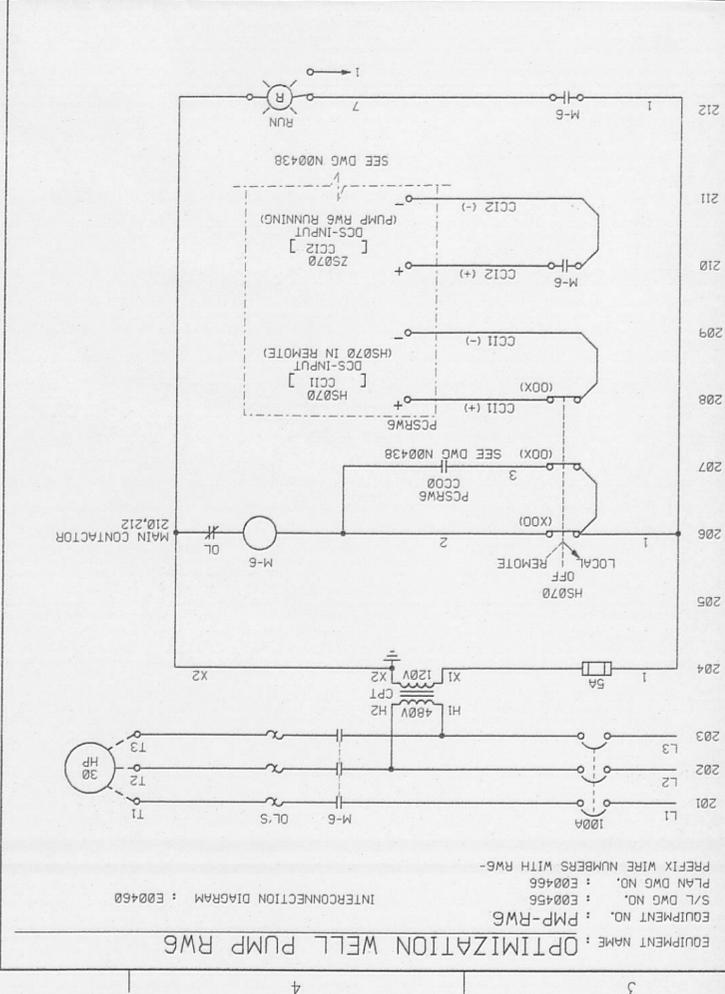
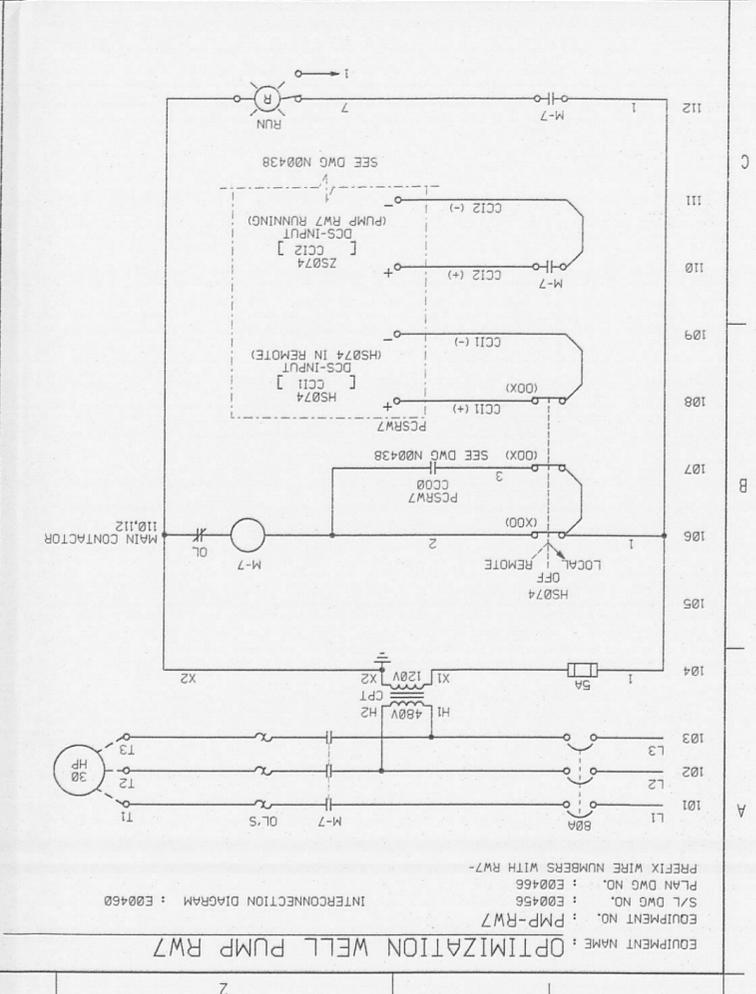
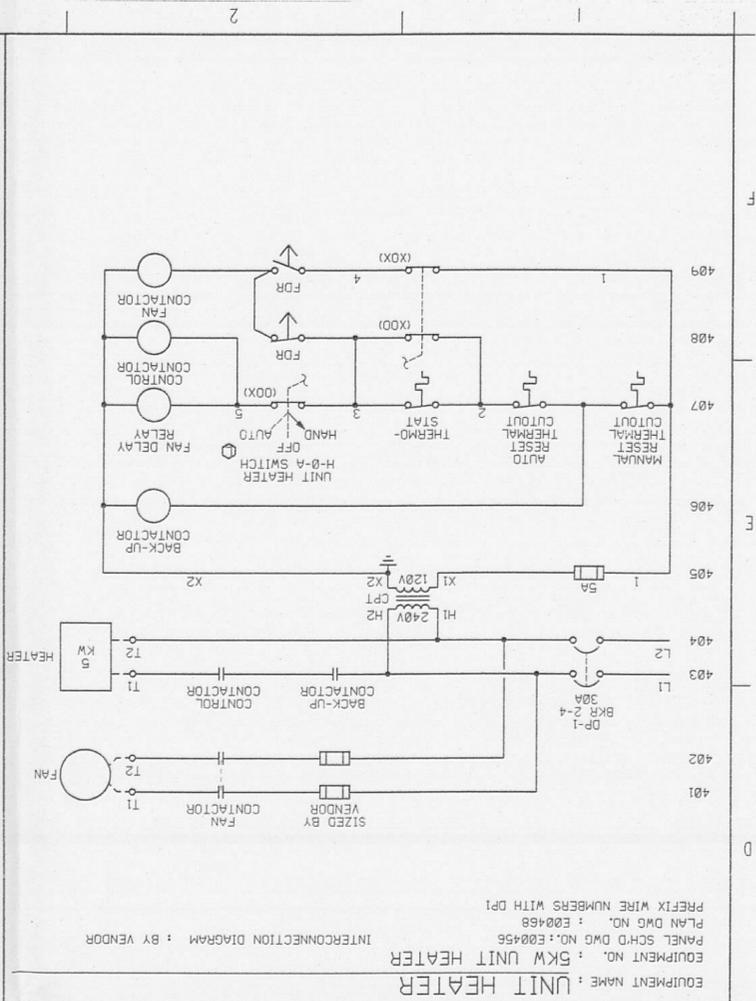
DATE: 6/13/97  
 SUBMITTED FOR APPROVAL: FERMCO CRU APPROVAL: N/A  
 FERMCO PROJECT NO.: SPO-53300  
 NONE

DATE: 00-90701  
 FERM PROJECT NO.: WBS 11.11.1.21  
 PROJECT DSCR NUMBER: ARP/P0169

INFORMATION ONLY

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REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE
0	CERTIFIED FOR CONSTRUCTION	6/13/96

REV. NO.	DATE	BY	DESCRIPTION
0	11/20/96	R.D. PROSKI	PLANNING
1	10/24/96	9/22/96	LEAD ENGINEER
2	10/24/96	9/22/96	CHECKED BY
3	11/20/96	11/20/96	CLASS

DATE	DATE	DATE	DATE
11/20/96	10/24/96	10/24/96	10/24/96

DATE	DATE	DATE	DATE
11/20/96	10/24/96	10/24/96	10/24/96

DATE	DATE	DATE	DATE
11/20/96	10/24/96	10/24/96	10/24/96

REF. DWG. NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-E-00456	SINGLE LINE DIAGRAM
95X-5900-E-00460	INTERCONNECTION DIAGRAM
95X-5900-E-00466	SITE POWER PLAN
95X-5900-E-00468	OPTIMIZATION WELL AREA
95X-5900-E-00468	POWER AND UTILITY PLANS
95X-5900-E-00468	OPTIMIZATION WELL VALVE HOUSE
95X-5900-N-00438	I/O DRAWING

DATE	DATE	DATE	DATE
11/20/96	10/24/96	10/24/96	10/24/96

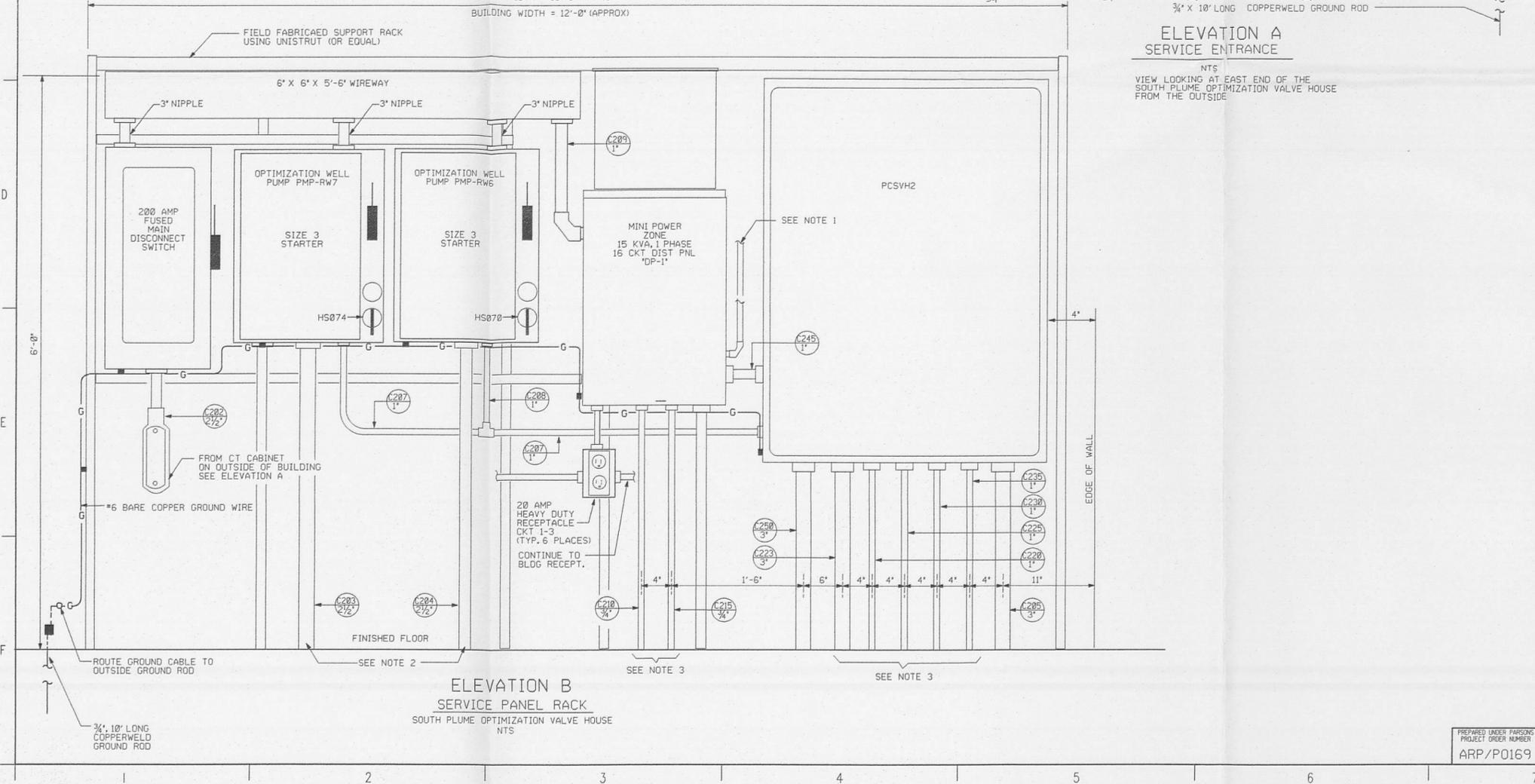
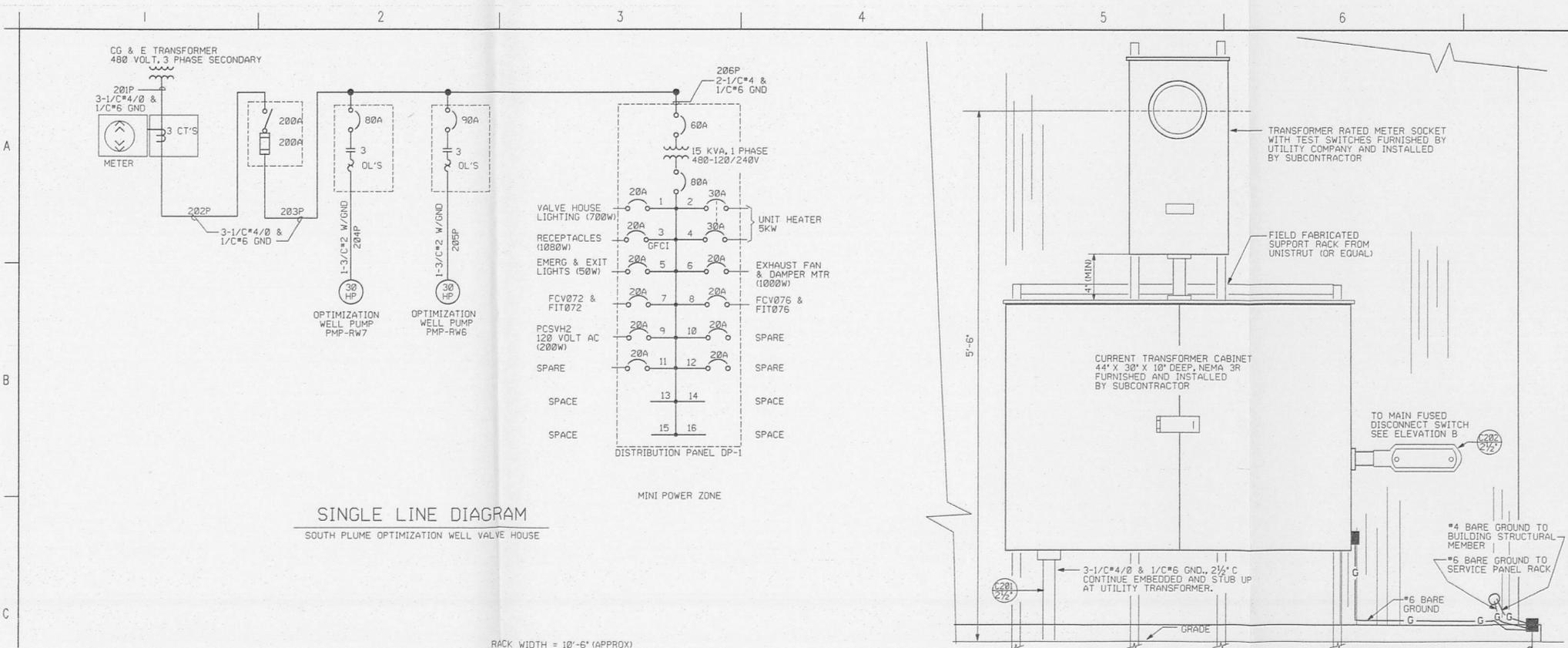
  

DATE	DATE	DATE	DATE
11/20/96	10/24/96	10/24/96	10/24/96

DATE	DATE	DATE	DATE
11/20/96	10/24/96	10/24/96	10/24/96





- NOTES
- FOR CONDUITS TO BUILDING LIGHTS, EXHAUST FAN AND CONTROLS, AND UNIT HEATER SEE LIGHTING PLAN ON DRAWING 95X-5900-E-00468.
  - TERMINATE EMBEDDED CONDUITS AT PIPE TRENCH AFTER PASSING UNDER ROAD. CONTINUE DIRECT BURIED CABLES IN PIPE TRENCH TO WELL PUMPS PMP-RW6 AND PMP-RW7.
  - CONTINUE CONDUITS EMBEDDED IN FLOOR SLAB; SEE POWER PLAN ON DRAWING 95X-5900-E-00468 FOR CONTINUATION.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-E-00458	SCHEMATIC DIAGRAMS
95X-5900-E-00460	INTERCONNECTION DIAGRAM
95X-5900-E-00468	POWER & INSTRUMENT AND LIGHTING PLANS
95X-5900-N-00438	1/0 DRAWING-OPTIMIZATION AND RECOVERY WELLS

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/13/95
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**SINGLE LINE / ELEVATIONS SOUTH PLUME OPTIMIZATION VALVE HOUSE**

DRAWN BY R. D. PROSKI	DATE 10/26/95	DESIGNED BY J. J. HOLLAND	DATE 11/20/95
PLANT/REG. NO.	FLOOR 1	SCALE	CLASS

SUBMITTED FOR APPROVAL	FERNALD CRU APPROVAL	NONE	FERNALD PROJECT NO.
	N/A		SPO-53300

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DOE PROJECT NO. WBS 1.1.1.1.2.1	DATE 00-90701	DRAWING INDEX CODE NO. 95X-5900-E-00456	SHEET NO. E0002	REV. NO. 0
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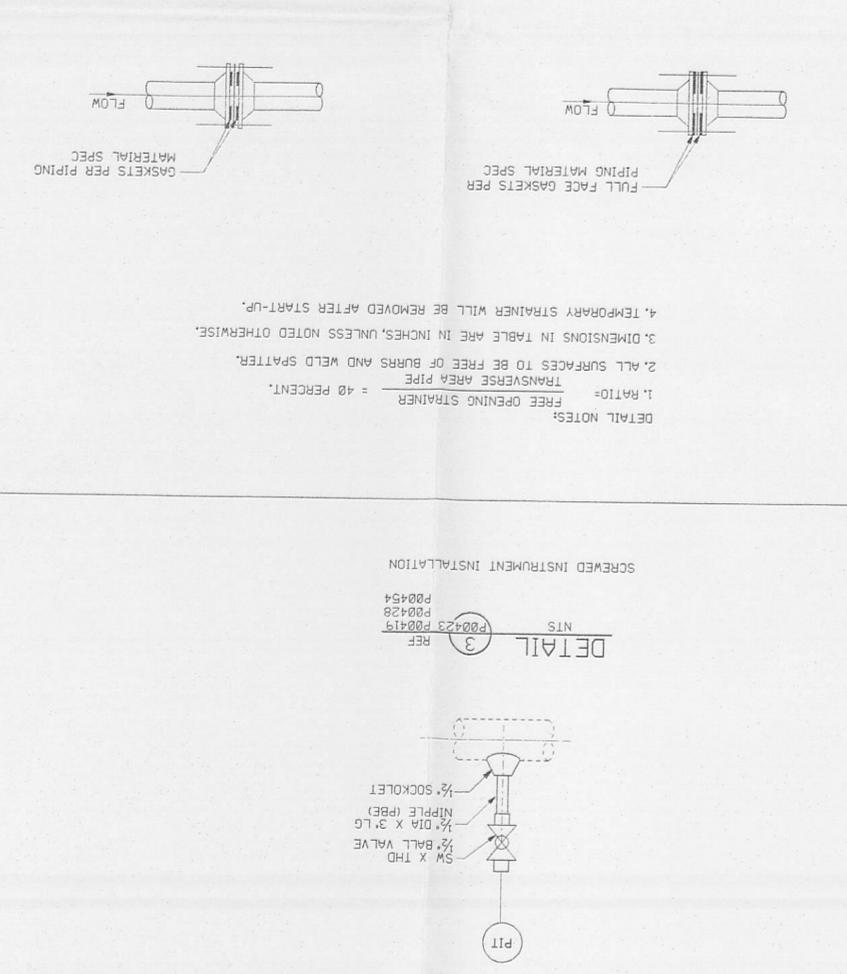
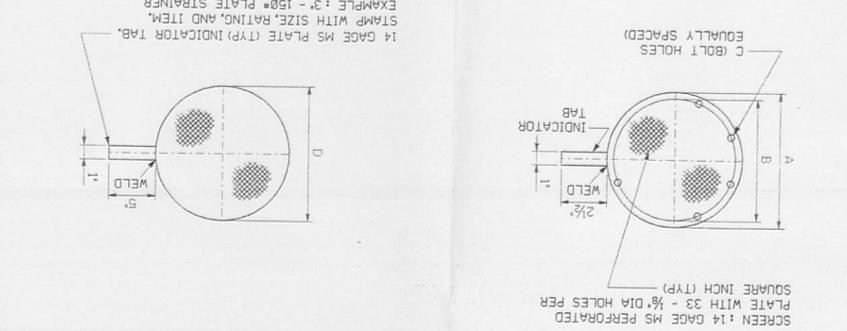
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	BY
0	CERTIFIED FOR CONSTRUCTION	6/28/96	N/A
INITIALS AND DATE			
NO.	REV.	DATE	BY
0			

**INFORMATION ONLY**

REF DWG NO.	95X-5900-X-00411
DRAWING INDEX	
DRAWING TITLE	
DATE	11-13-96
CLASS	NONC
SCALE	N/A
FLOOR	
LEAD ENGINEER	M. M. M. M.
DATE	8-29-96
DRWN BY	D. P. P. K. N.
DATE	6/13/97
CHECKED BY	
DATE	
PROJECT MAKE	
DRAWING TITLE	PIPE SUPPORT DETAILS
PROJECT NAME	SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION
THE RALPH W. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.	
CINCINNATI, OHIO	
THIS DRAWING PREPARED BY	PARSONS
DEPARTMENT OF ENERGY	
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT	

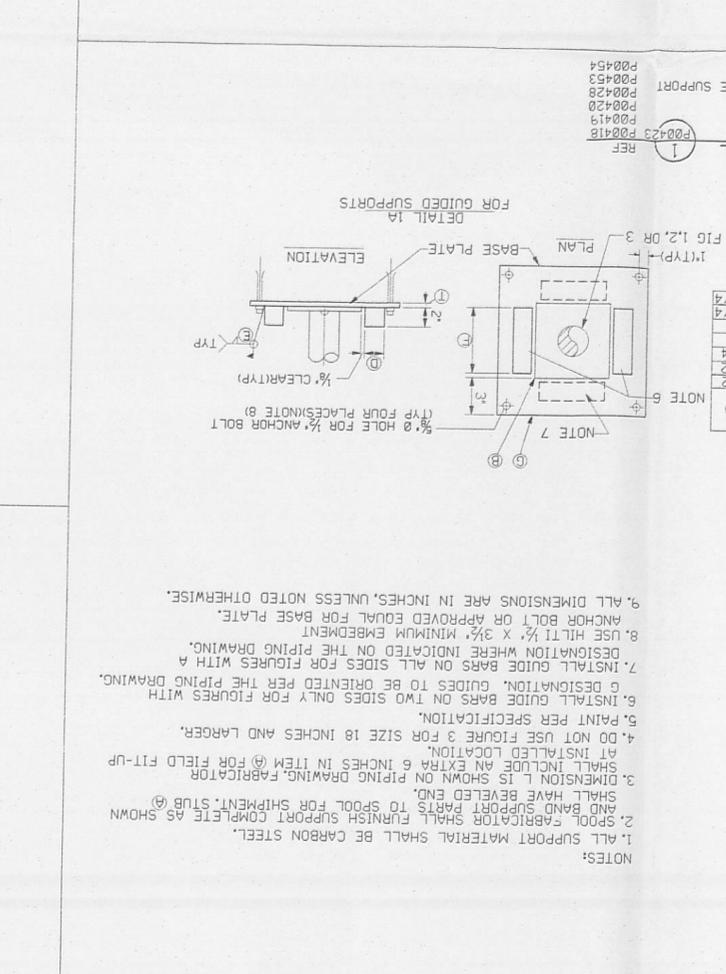
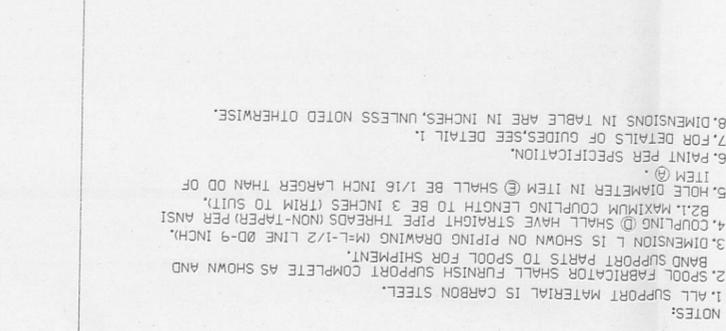
APR/P0169  
 PROJECT DUCHEM NUMBER  
 MBS 1.1.1.1.2.1  
 00-90701  
 95X-5900-P-00423 P0007 0

LINE SIZE	A	B	C	NUMBER OF HOLES	D
12	19	17	1	12	16
10	16	14-1/4	1	12	13-1/4
8	13-1/2	11-3/4	7/8	8	10-7/8
6	11	9-1/2	7/8	8	8-5/8
4	9	7-1/2	3/4	8	6-3/4
3	7-1/2	6	3/4	4	5-3/4
2	4-3/4	3/4	4	4	4-1/4
	6	300	150	300	600



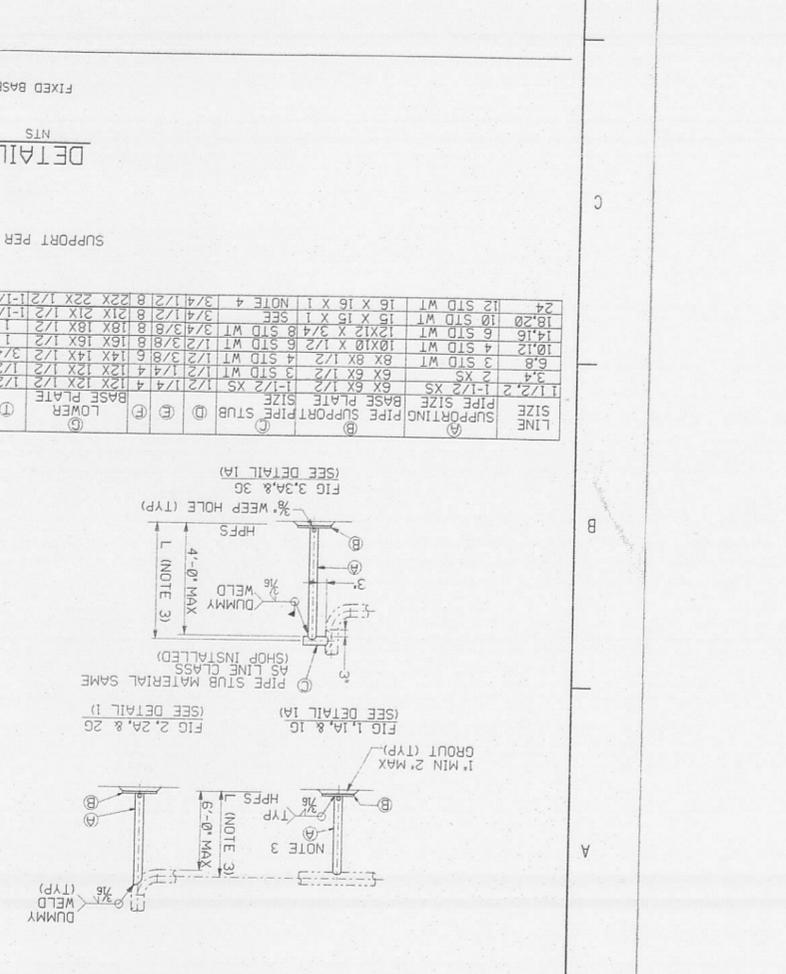
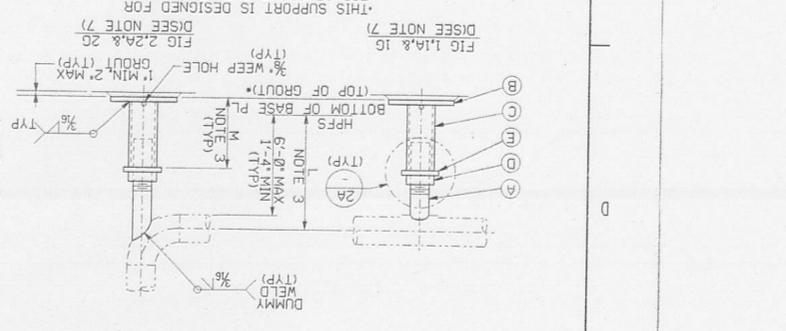
DETAIL 3  
 NTS  
 P00428  
 P00429  
 P00454  
 REF

LINE SIZE	A	B	C	NUMBER OF HOLES	D
12	19	17	1	12	16
10	16	14-1/4	1	12	13-1/4
8	13-1/2	11-3/4	7/8	8	10-7/8
6	11	9-1/2	7/8	8	8-5/8
4	9	7-1/2	3/4	8	6-3/4
3	7-1/2	6	3/4	4	5-3/4
2	4-3/4	3/4	4	4	4-1/4
	6	300	150	300	600



DETAIL 2  
 NTS  
 P00423  
 P00418  
 P00419  
 P00420  
 P00428  
 P00453  
 P00454  
 REF

LINE SIZE	A	B	C	NUMBER OF HOLES	D
12	19	17	1	12	16
10	16	14-1/4	1	12	13-1/4
8	13-1/2	11-3/4	7/8	8	10-7/8
6	11	9-1/2	7/8	8	8-5/8
4	9	7-1/2	3/4	8	6-3/4
3	7-1/2	6	3/4	4	5-3/4
2	4-3/4	3/4	4	4	4-1/4
	6	300	150	300	600



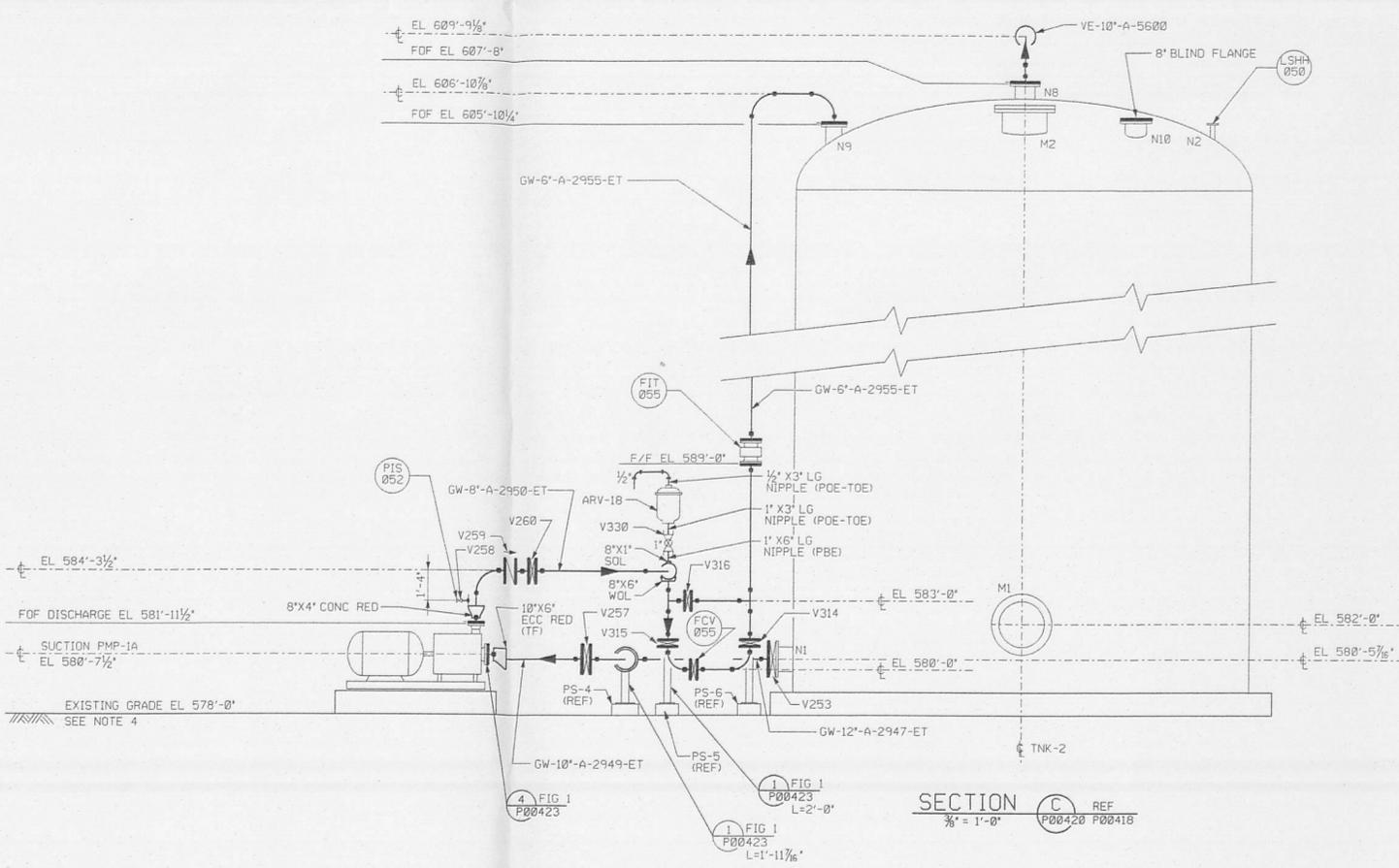
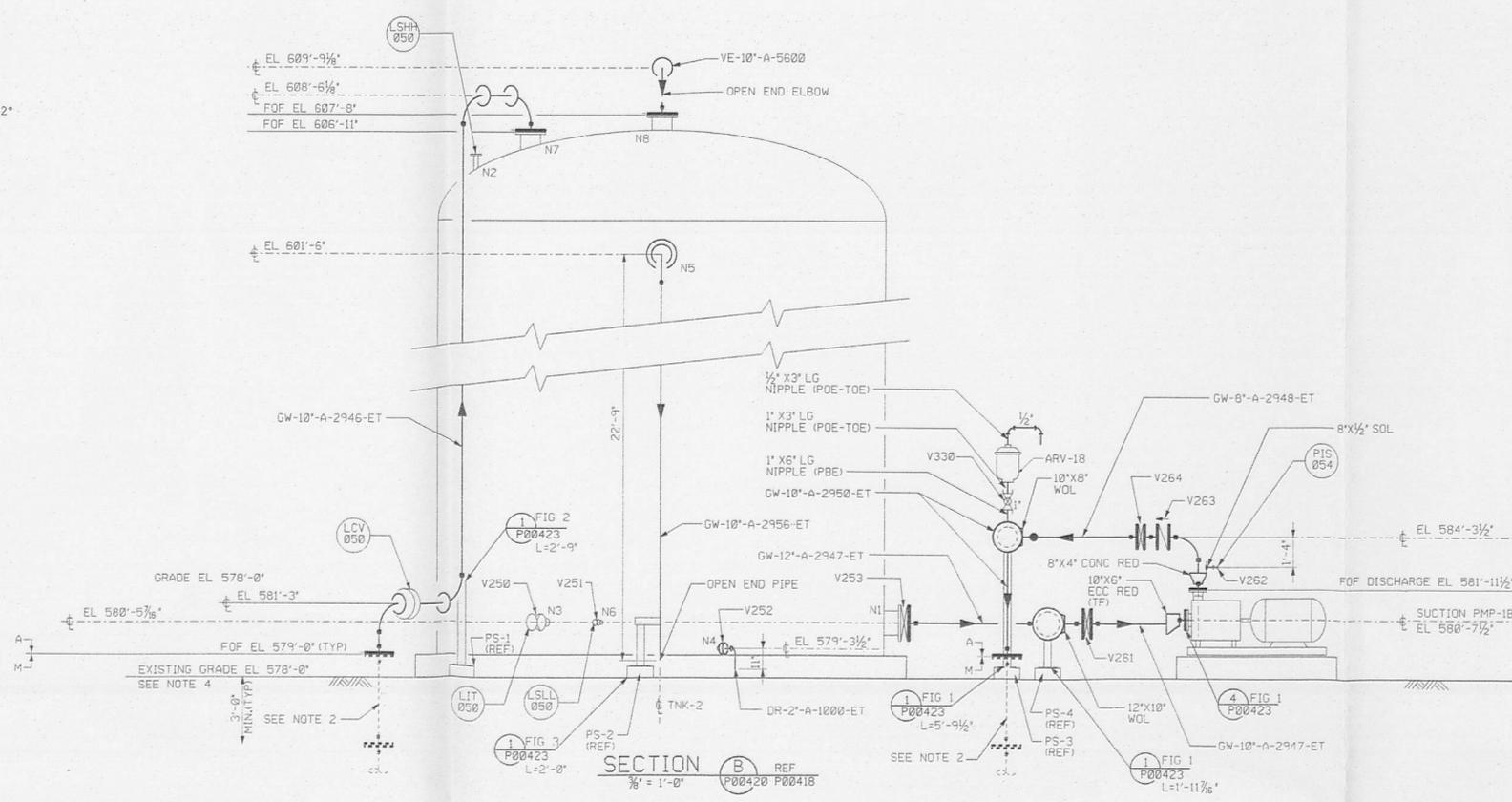
DETAIL 1  
 NTS  
 P00423  
 P00418  
 P00419  
 P00420  
 P00428  
 P00453  
 P00454  
 REF











- NOTES
1. ALL DIMENSIONS SHALL BE FIELD VERIFIED PRIOR TO FABRICATION AND INSTALLATION OF PIPING.
  2. UNDERGROUND LINES ARE BY OTHERS, ELECTRIC TRACE AND INSULATE GW-10"-M-2946 AND GW-10"-M-2950 TO A MINIMUM 3'-0" BELOW GRADE.
  3. FOR TANK AND PUMPS FOUNDATIONS SEE DRAWING 95X-5900-S-00431.
  4. EXISTING GRADE ELEVATION TO BE FIELD VERIFIED.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-P-00418	PIPING PLAN AND SECTION INJECTION WATER SUPPLY TANK AND PUMPS
95X-5900-P-00423	PIPE SUPPORT DETAILS
95X-5900-S-00431	STRUCTURAL - PLAN, SECTIONS, AND DETAILS
95X-5900-N-00449	MECHANICAL PROCESS F & ID SOUTH PLUME INJECTION

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/18/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO DATE
		INITIALS AND DATE	

UNITED STATES DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

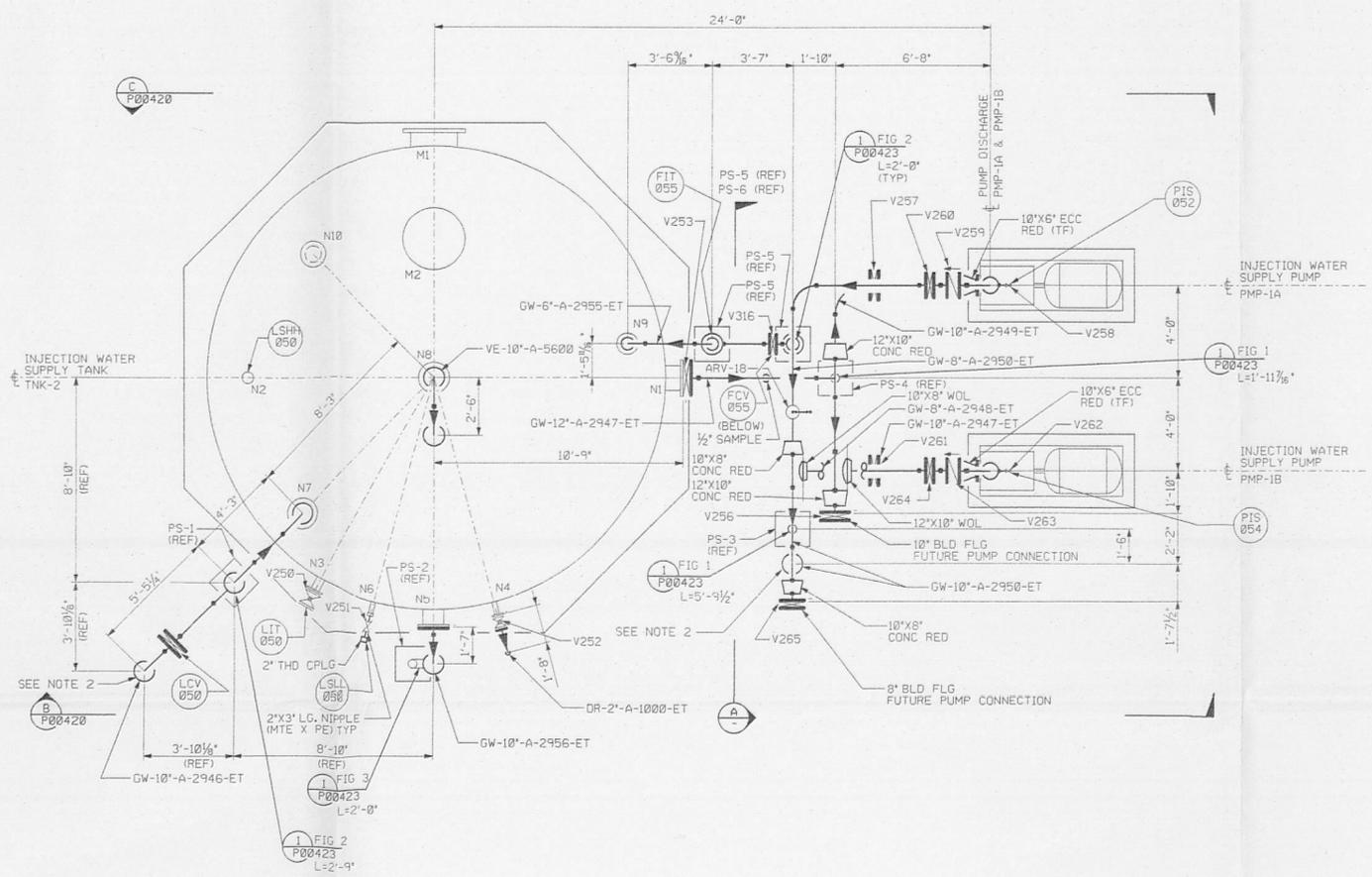
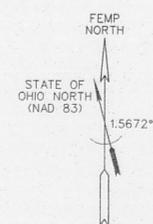
PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**PIPING/PLANT DESIGN INJECTION WATER SUPPLY TANK AND PUMPS**

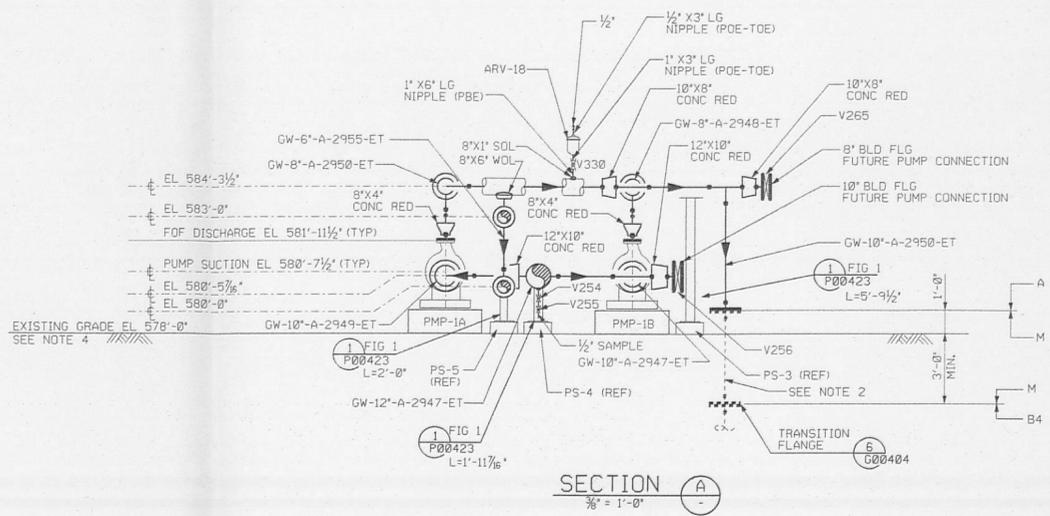
DESIGNED BY R. COLLADO	DATE 10-22-96	LEAD ENGINEER M. J. COLLADO	DATE 6/15/97	CHECKED BY D. PIPKIN	DATE 11-8-96
PLANT/BLDG. NO.	FLOOR	SCALE 3/8" = 1'-0"	FERNCO PROJECT NO. 10-53100	CLASS	

SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL	N/A	
A-E	DATE	DATE	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	FEMP PROJECT NO. WBS 1.1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-P-00420	SHEET NO. P0002	REV. NO. 0
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PLAN



SECTION A-A  
3/8\"/>

NOTES

1. ALL DIMENSIONS SHALL BE FIELD VERIFIED PRIOR TO FABRICATION AND INSTALLATION OF PIPING.
2. UNDERGROUND LINES ARE BY OTHERS, ELECTRIC TRACE AND INSULATE GW-10\"/>

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-P-00420	PIPING SECTIONS INJECTION WATER SUPPLY TANK AND PUMPS
95X-5900-P-00423	PIPE SUPPORT DETAILS
95X-5900-S-00431	STRUCTURAL - PLAN, SECTIONS, AND DETAILS
95X-5900-N-00449	MECHANICAL PROCESS P & ID SOUTH PLUME INJECTION

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/13/97
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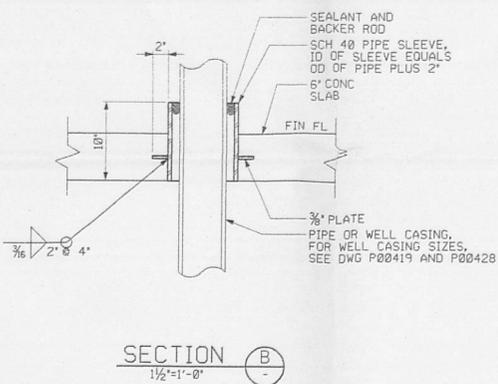
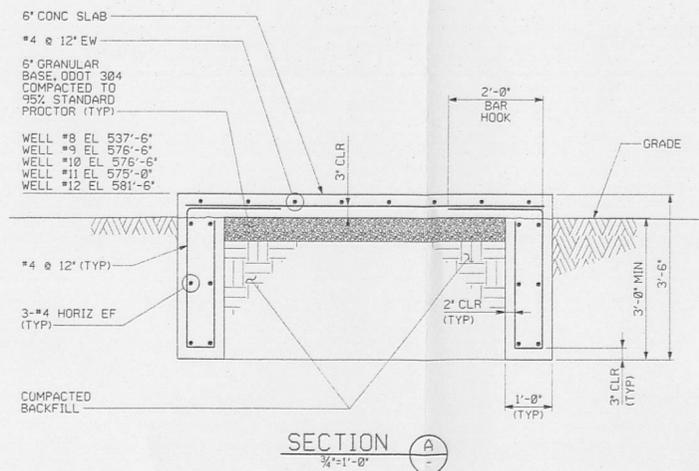
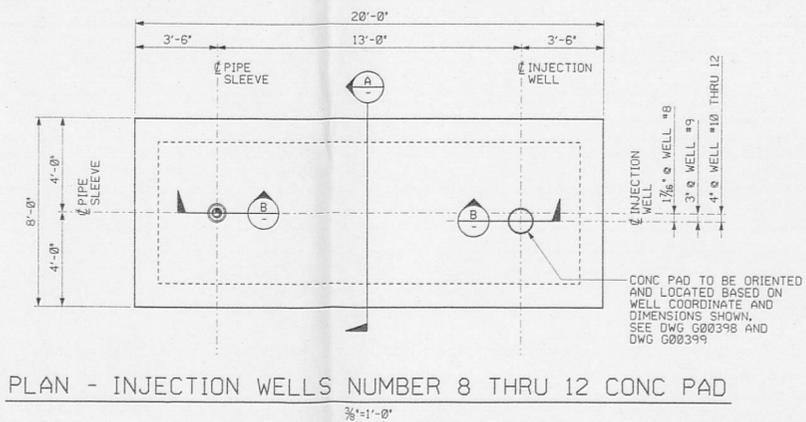
UNITED STATES DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
DRAWING TITLE  
**PIPING/PLANT DESIGN INJECTION WATER SUPPLY TANK AND PUMPS**

DRAWN BY R. COLLADO	DATE 11-4-96	LEAD ENGINEER M. McMillan	DATE 6/13/97	CREATED BY D. PIPKIN	DATE 11-8-96
PLANT/BLDG. NO.	FLOOR	SCALE 3/8\"/>			
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NO. ID-53100			

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	FEMP PROJECT NO. WBS 1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-P-00418	SHEET NO. P0001	REV. NO. 0
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NOTES  
1. FOR GENERAL CONCRETE NOTES, SEE DRAWING 95X-5900-S-00431.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-S-00431	PLANS, SECTIONS, AND DETAILS
95X-5900-G-00398	PLAN AND PROFILE - 4 OF 6
95X-5900-G-00399	PLAN AND PROFILE - 5 OF 6
95X-5900-P-00419	PIPING PLAN AND SECTION
95X-5900-P-00428	PIPING PLAN AND SECTION

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/18/97
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REV. NO. ISSUE OR REVISION PURPOSE - DESCRIPTION INITIALS AND DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**STRUCTURAL PLAN, SECTIONS, AND DETAILS INJECTION WELLS NUMBER 8 THRU 12 PADS**

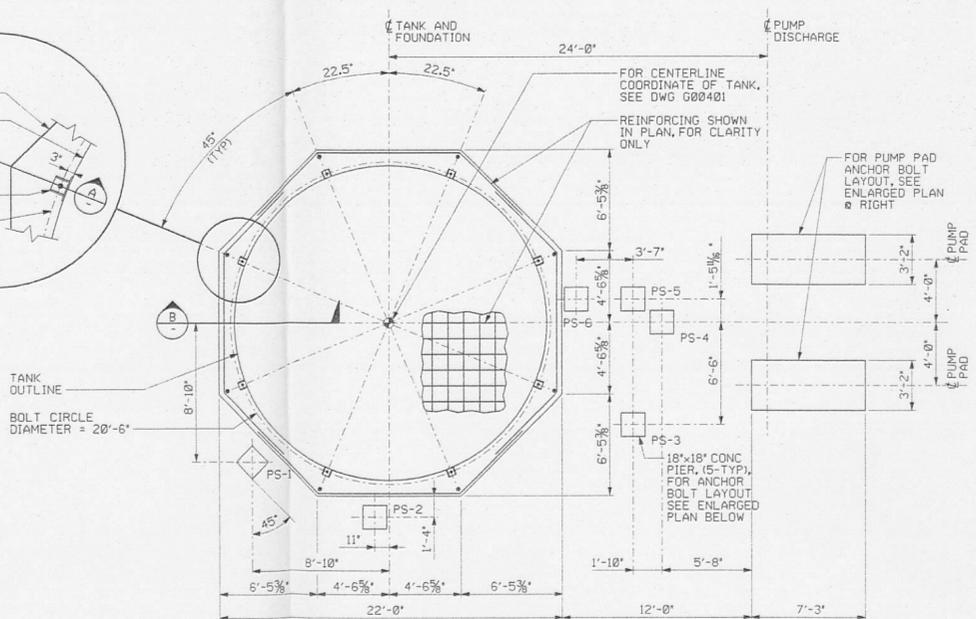
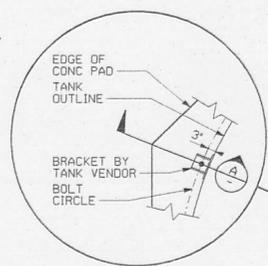
DRAWN BY K.L. RABBITT	DATE 09/18/96	LEAD ENGINEER G.D. Whiss	DATE 6/13/97	CHECKED BY R.B. JADHAV	DATE 11/07/96
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS	AS NOTED	FERMCO PROJECT NO.

SUBMITTED FOR APPROVAL Ma G113/97	FERMCO CRU APPROVAL N/A	FERMCO PROJECT NO. ID-53100
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PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	FERMCO PROJECT NO. WBS 1.1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-S-00432	SHEET NO. S0002	REV. NO. 0
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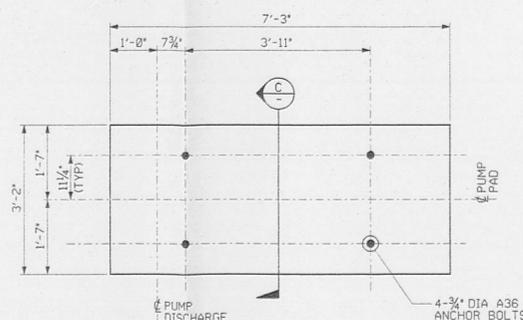
STATE OF OHIO NORTH (NAD 83)

FEMP NORTH  
Z=1.5672'

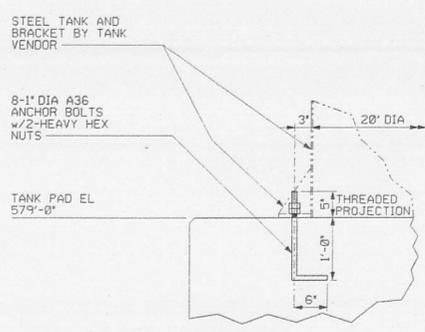


PLAN - INJECTION WATER SUPPLY TANK AND PUMPS

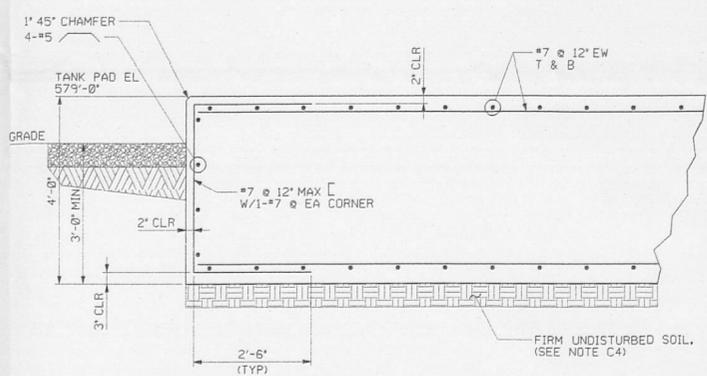
NOTE: FOR TANK AND PUMPS PIPING PLAN, SEE DRAWING P00418



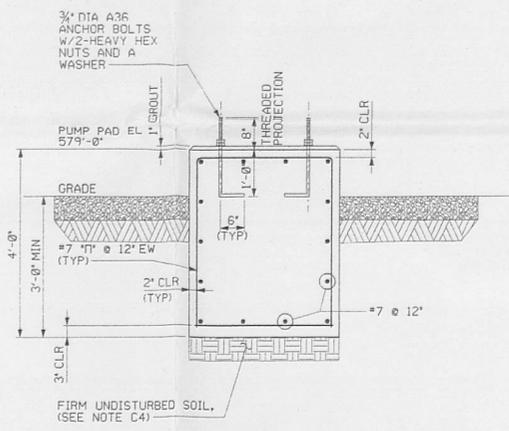
ENLARGED PLAN-PUMP PAD



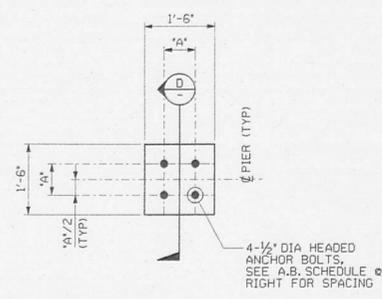
SECTION A



SECTION B

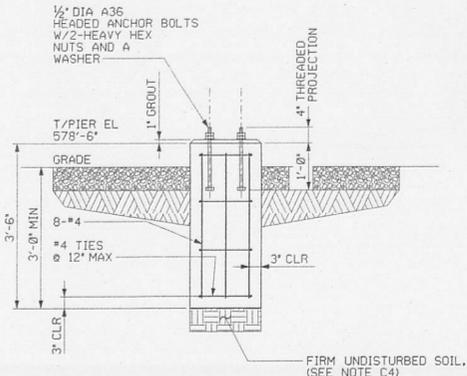


SECTION C



ENLARGED PLAN-CONC PIER

A.B. SCHEDULE	
PIPE SUPPORT	"A"
PS-1	8"
PS-2	8"
PS-3	8"
PS-4	8"
PS-5	6"
PS-6	6"



SECTION D

- NOTES
- GENERAL CONCRETE NOTES
- DESIGN, MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03001.
  - CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS.
  - REINFORCING STEEL SHALL CONFORM TO ASTM SPECIFICATION A-615, GRADE 60.
  - FOUNDATION DESIGN IS BASED ON NET ALLOWABLE SOIL BEARING PRESSURE OF 2000 PSF. IF ANY SOFT, WET, ORGANIC, OR LOOSE SOIL OR ANY OLD FILL IS ENCOUNTERED, THE FOP CONSTRUCTION CONTRACTS MANAGER SHALL BE INFORMED AND THE CONDITIONS RESOLVED BEFORE CONTINUATION OF THE PROJECT.
  - ALL DIMENSIONS, ANCHOR BOLT SIZES, AND LOCATIONS SHALL BE VERIFIED FROM CERTIFIED VENDOR DRAWINGS BEFORE INSTALLATION OF TANK FOUNDATION AND PUMP PADS.
  - THE TOP OF THE CONCRETE FOUNDATION UNDER THE TANK SHELL SHALL BE LEVEL WITHIN  $\pm 1/8$  INCH IN ANY 10 FEET OF CIRCUMFERENCE.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00401	50K HOLDING TANK AREA ENLARGEMENT
95X-5900-P-00418	PIPING PLAN AND SECTION

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/13/97
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**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

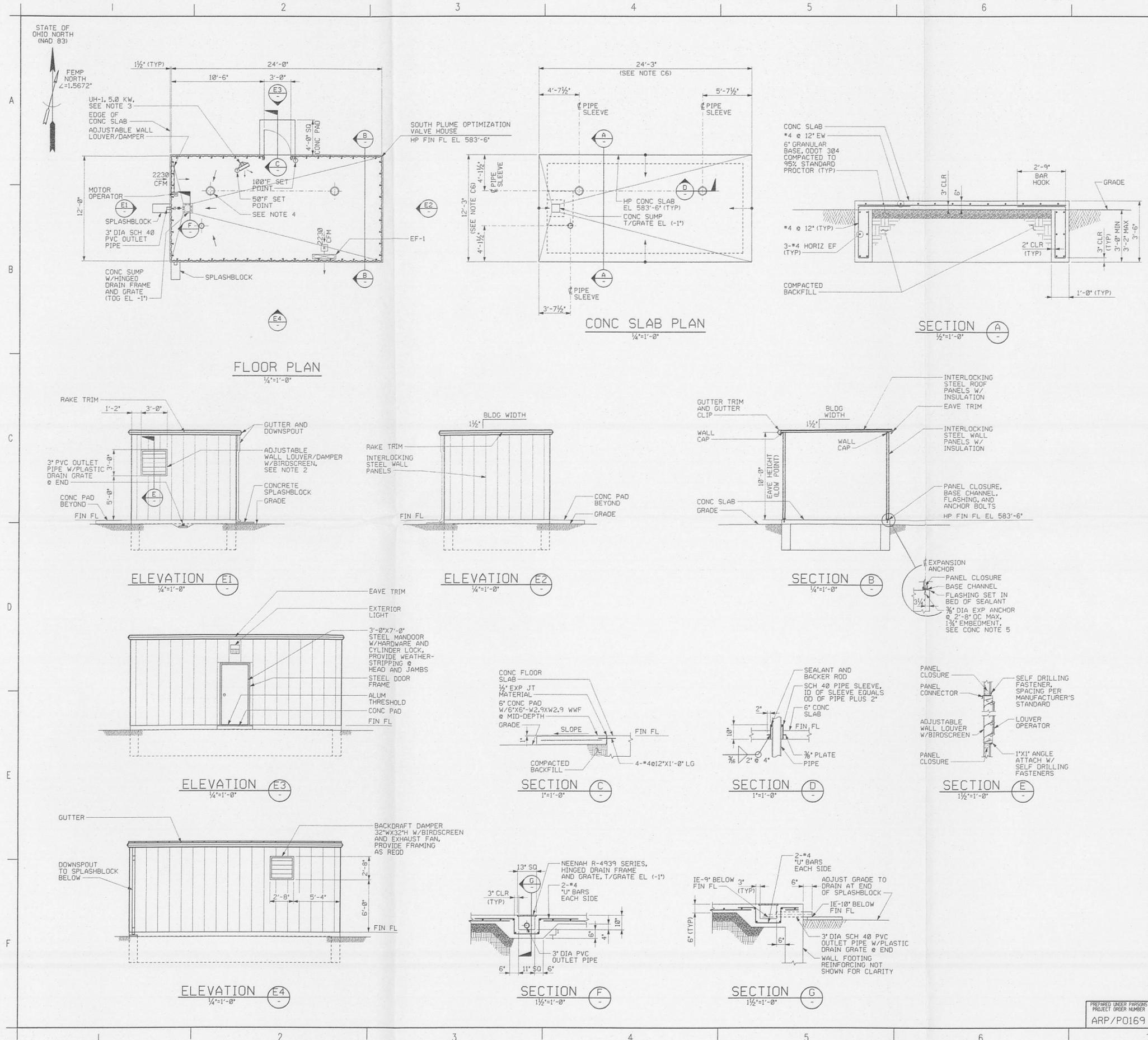
DRAWING TITLE  
**STRUCTURAL PLANS, SECTIONS, AND DETAILS INJECTION WATER SUPPLY TANK AND PUMP PADS**

DRAWN BY K.L. RABBITT	DATE 09/18/96	LEAD ENGINEER [Signature]	DATE 6/13/97	CHECKED BY R.B. JADHAV	DATE 11/07/96
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PLANT/BLDG. NO.	FLOOR	SCALE AS NOTED	CLASS
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SUBMITTED FOR APPROVAL [Signature]	DATE 6/13/97	FERMCO CRU APPROVAL N/A	DATE	FERMCO PROJECT NO. ID-53100
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PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DOE PROJECT NO. WBS 1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-S-00431	SHEET NO. S0001	REV. NO. 0
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- NOTES
- SEE SPECIFICATION SECTION 15500 FOR EXHAUST FAN AND UNIT HEATER.
  - THE ADJUSTABLE LOUVER MOTOR OPERATORS SHALL BE INTERLOCKED WITH THE EXHAUST FAN.
  - UNIT HEATER SHALL BE INSTALLED A MINIMUM OF 6'-8" CLEAR ABOVE FINISH FLOOR.
  - SEE CIVIL DRAWING 95X-5900-G-00400 FOR CENTERLINE OF 6" GROUNDWATER PIPING COORDINATES. LOCATE SOUTH PLUME OPTIMIZATION VALVE HOUSE BASE ON THESE COORDINATES.
  - PROVIDE DOOR SIGNAGE AS REQUIRED BY FOF SITE PROCEDURE ED-12-4016, EQUIPMENT AND PIPING LABELING.
  - FOR GROUNDING SYSTEM CONNECTION TO REINFORCEMENT AND ELECTRICAL CONDUIT STUB UP LOCATIONS, SEE DRAWING 95X-5900-E-00468.
- GENERAL CONCRETE NOTES
- DESIGN, MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03000.
  - CONCRETE FOR SLAB ON GRADE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS.
  - REINFORCING STEEL SHALL CONFORM TO ASTM SPECIFICATION A-615, GRADE 60.
  - FOUNDATION DESIGN IS BASED ON ASSUMED NET SOIL BEARING PRESSURE ALLOWABLE OF 2000 PSF. SITE SPECIFIC GEOLOGICAL INVESTIGATION WAS NOT PERFORMED. IF ANY SOFT, WET, ORGANIC OR LOOSE SOIL OR ANY OLD FILL IS ENCOUNTERED, THE FOF CONSTRUCTION MANAGER SHALL BE INFORMED AND THE CONDITIONS RESOLVED BEFORE CONTINUATION OF CONCRETE WORK.
  - ANCHOR BOLTS FOR PRE-ENGINEERED BUILDING BASE CHANNEL LOCATIONS AS SHOWN WERE DETERMINED USING PARLINE BUILDING CATALOG INFORMATION. FOUNDATION SIZE AND ANCHOR BOLT LOCATIONS SHALL BE CONFIRMED BY SELECTED PRE-ENGINEERED BUILDING VENDOR'S CERTIFIED DRAWINGS, BEFORE CONSTRUCTION OF THE FOUNDATION.
  - HOLD PLAN DIMENSION OF CONCRETE FOUNDATION +1/4", -0" FOR ANCHOR BOLT EDGE DISTANCE REQUIREMENTS.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00400	PLAN AND PROFILE - 6 OF 6
95X-5900-E-00468	POWER INSTRUMENTATION AND LIGHTING PLANS

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	N/A	6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FEMCO DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

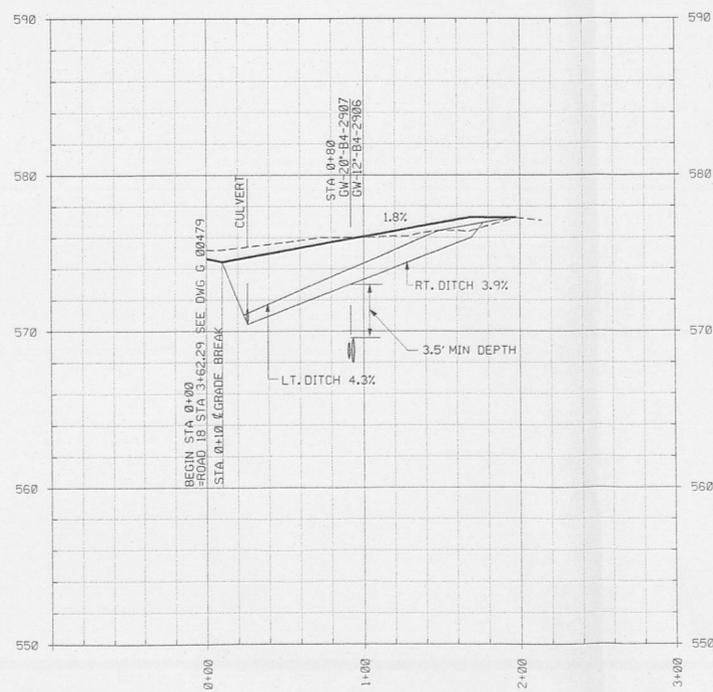
THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

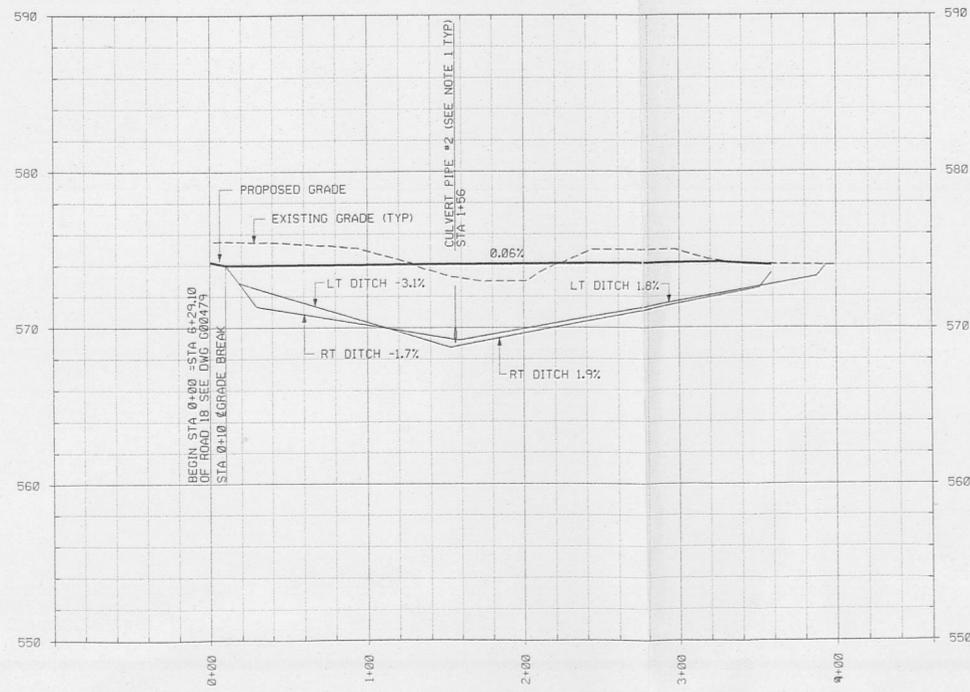
DRAWING TITLE  
**ARCHITECTURAL PLAN, ELEVATIONS, SECTIONS, AND DETAILS SPO VALVE HOUSE**

DRAWN BY K.L. RABBITT	DATE 09/18/96	LEAD ENGINEER R.B. JADHAV	DATE 4/13/97	CHECKED BY R.B. JADHAV	DATE 11/07/96
PLANT/BLDG. NO.	FLOOR	SCALE	AS NOTED	CLASS	
SUBMITTED FOR APPROVAL M. 6/13/97			FEMCO CRU APPROVAL N/A	FEMCO PROJECT NO. SPO-53300	

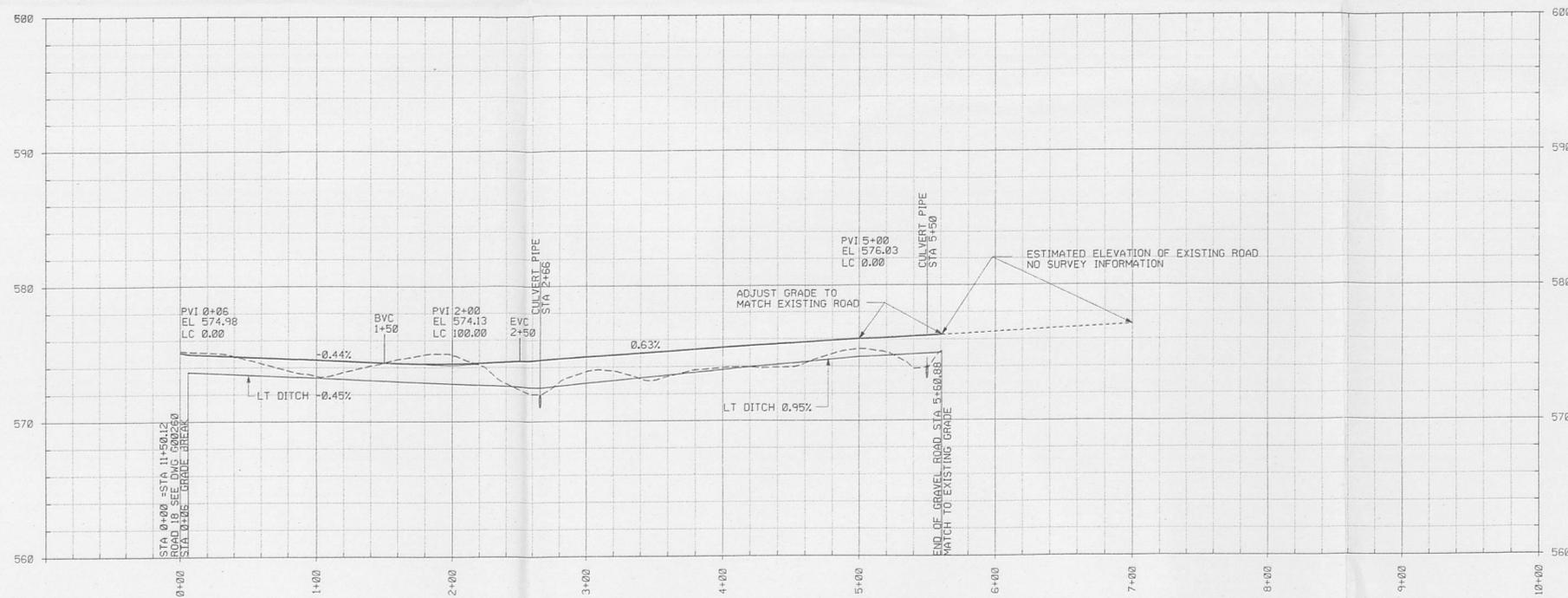
PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	DOE PROJECT NO. WBS 1.1.1.1.2.1 00-90701	FEMP PROJECT NO. 95X-5900-A-00429	DRAWING INDEX CODE NO. A0001	SHEET NO. 0	REV. NO.
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**ROAD 20 PROFILE**  
VERT: 1" = 4'  
HORIZ: 1" = 40'



**ROAD 19 PROFILE**  
VERT: 1" = 4'  
HORIZ: 1" = 40'



**GRAVEL ROAD PROFILE**  
VERT: 1" = 4'  
HORIZ: 1" = 40'

NOTES

1. FOR LENGTH, SIZE, AND COORDINATES OF CULVERT PIPE SEE PIPE DETAIL 3 ON DRAWING 95X-5900-G-00451.
2. PROFILE IS FOR CENTERLINE OF ROAD. SEE PIPELINE PROFILE FOR INFORMATION ON EXTRACTION WELL PIPELINE.
3. SEE DRAWINGS 95X-5900-G-00396 AND 95X-5900-G-00397 FOR GRADING AND LOCATION, TYPICAL.
4. SEE DRAWING 95X-5900-G-00479 FOR ABBREVIATIONS.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00396	GRADING/UTILITY PLAN - 2 OF 2
95X-5900-G-00397	PLAN AND PROFILE - 3 OF 6
95X-5900-G-00451	DETAILS - 5 OF 5
95X-5900-G-00479	ROAD 18 PROFILE

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	NA	6/13/95
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**UNITED STATES DEPARTMENT OF ENERGY**  
BERNARD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**CIVIL ROAD 19 AND ROAD 20 PROFILES**

DRAWN BY M. LIU	DATE 05/28/95	LEAD ENGINEER R. Grand	DATE 6/1/95	CHECKED BY K. GERARD	DATE 07/31/95
PLANT/BUILDG. NO.	FLOOR	SCALE	AS SHOWN	CLASS	

SUBMITTED FOR APPROVAL M. (6/13/95)	DATE 6/13/95	FERMCO CRU APPROVAL NA	DATE
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DOE PROJECT NO. ARP/P0169	FEMP PROJECT NO. WBS 1.1.1.5.3 00-90701	DRAWING INDEX CODE NO. 95X-5900-G-00480	SHEET NO. G0018	REV. NO. 0
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REV. NO.	DATE	DESCRIPTION
0	07/23/95	CERTIFIED FOR CONSTRUCTION
INITIALS AND DATE		
NA		
NA		

DATE	LEAD ENGINEER	DATE	LEAD ENGINEER
05/28/95	<i>[Signature]</i>	05/28/95	<i>[Signature]</i>
DATE	CHECKED BY	DATE	CHECKED BY
07/23/95	K. GERRARD	07/23/95	K. GERRARD
CLASS	SCALE	AS NOTED	

THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INSPECTION DEMONSTRATION**  
 DRAWING TITLE  
**ROAD 18 PROFILE**

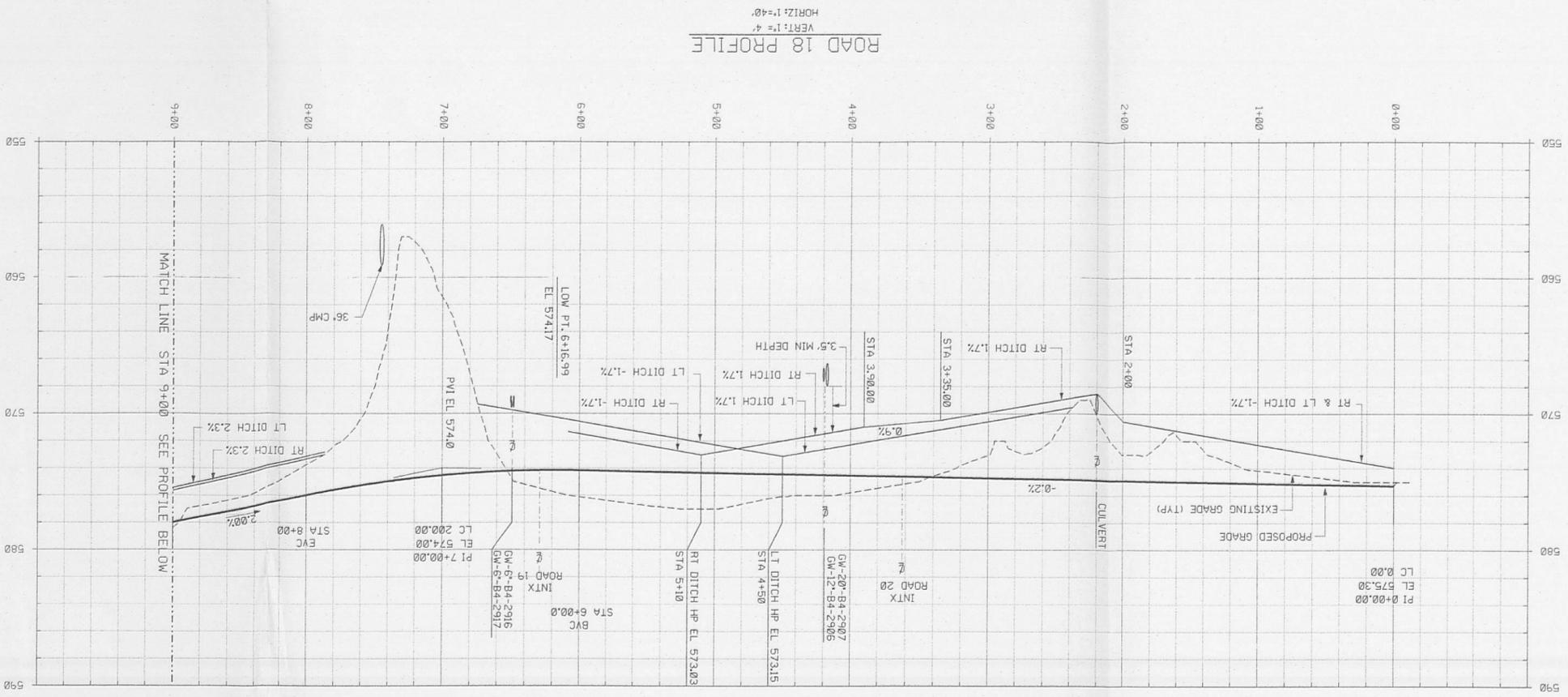
REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00396	GRADING/UTILITY PLAN - 2 OF 2
95X-5900-G-00451	DETAILS - 5 OF 5

**ABBREVIATIONS**

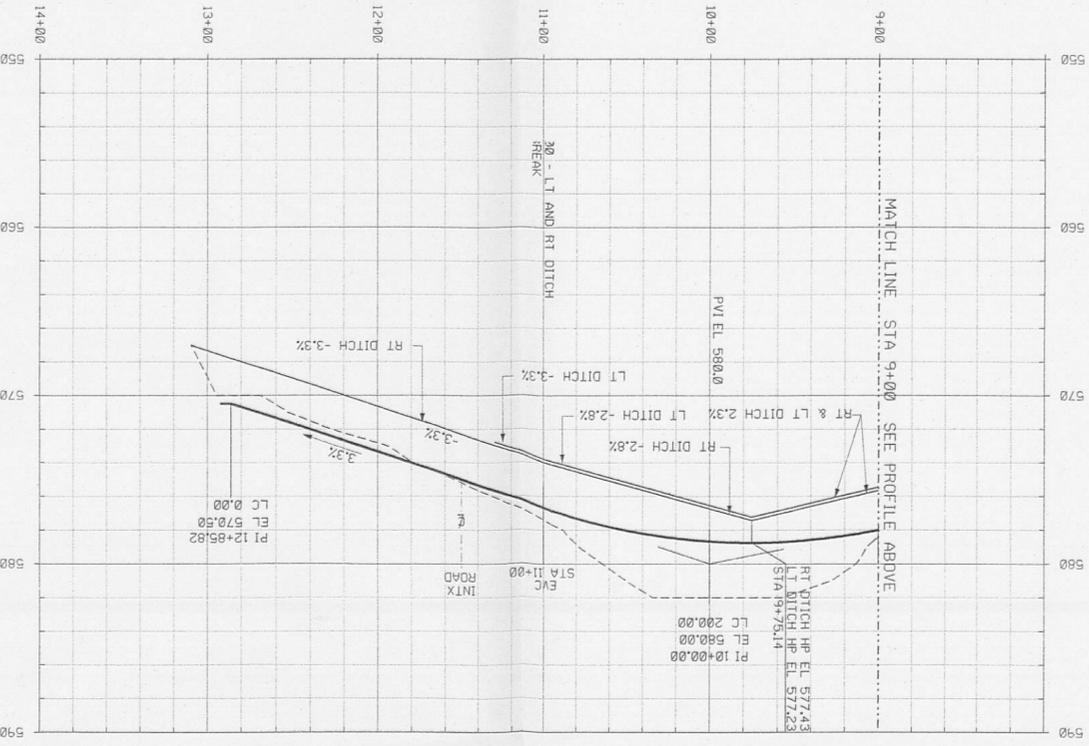
C = CENTERLINE  
 LT = LEFT  
 RT = RIGHT  
 INTX = INTERSECTION  
 STA = STATION  
 EL = ELEVATION  
 LC = LENGTH OF VERTICAL CURVE  
 BVC = BEGIN VERTICAL CURVE  
 EVC = END VERTICAL CURVE  
 P1 = POINT OF INTERSECTION  
 PI = POINT OF INTERSECTION  
 HP = HIGH POINT  
 LP = LOW POINT

**NOTES**

- FOR LOCATION OF ROAD SEE PLAN 95X-5900-G-00396.
- LOCATION AND DEPTH OF UNDERGROUND FEATURES AND UTILITIES ARE APPROXIMATE. CONTRACTOR IS TO LOCATE FEATURES AND UTILITIES PRIOR TO EXCAVATION FOR CONSTRUCTION. IF LOCATION AND DEPTH ARE DIFFERENT OR UNKNOWN UNCHARTED UTILITIES ARE DISCOVERED, CONTRACTOR IS TO INFORM FERNCO CONSTRUCTION MANAGER BEFORE PROCEEDING.
- UNLESS OTHERWISE NOTED ALL MATERIALS SHALL CONFORM TO THE STATE OF OHIO DEPARTMENT OF TRANSPORTATION DATED JANUARY 1, 1997.
- PIPE DETAIL 3 ON DRAWING 95X-5900-G-00451.
- FOR LENGTH, SIZE, AND COORDINATES OF CULVERT PIPE SEE PROFILE IS FOR CENTERLINE OF ROAD. SEE PROFILE PROFILES FOR INFORMATION ON EXTRACTION WELL PIPELINES.
- SEE DRAWING 95X-5900-G-00396 FOR GRADING AND LOCATION. TYPICAL.

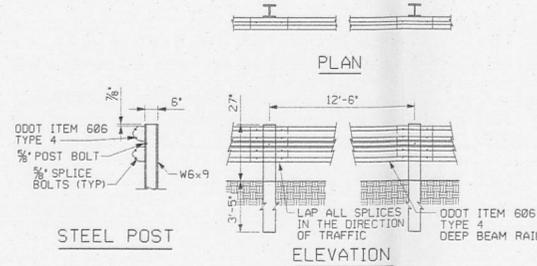


ROAD 18 PROFILE  
 VERT. 1"=4'  
 HORIZ. 1"=40'

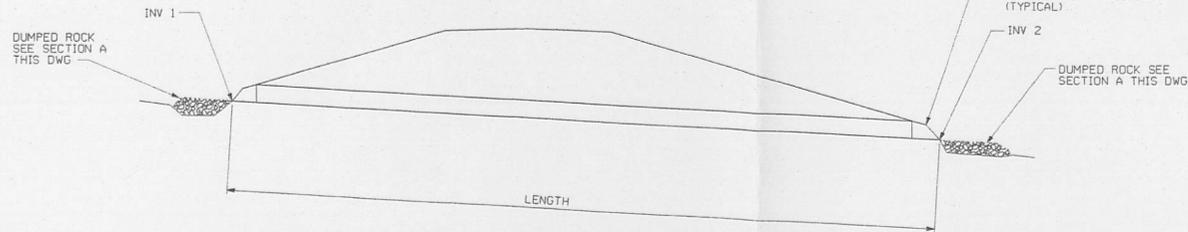


ROAD 18 PROFILE  
 VERT. 1"=4'  
 HORIZ. 1"=40'





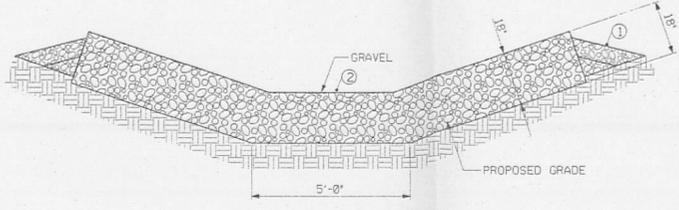
**GUARD RAIL DETAIL** (1) REF G00451 G00396 NTS



NOTE: ALL STORM DRAIN PIPE TO BE CORRUGATED METAL PIPE WITH ANNULAR CORRUGATION, 14 GAUGE PER ODOT ITEM 707.04 UNLESS STATED OTHERWISE.

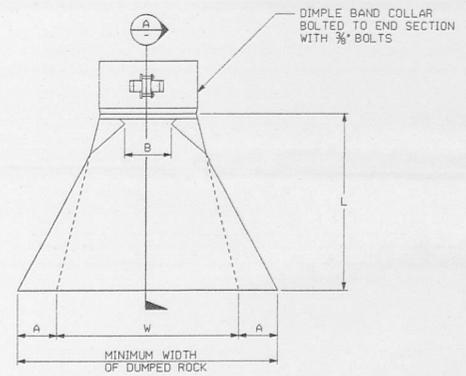
PIPE	SIZE (IN)	LENGTH (FT)	INV 1		INV 2	
			COORDINATE	ELEV.	COORDINATE	ELEV.
PIPE 1	36	168	N 477244.6, E 1349466.3	559.5	N 477228.6, E 1349298.7	553.5
PIPE 2	12	69	N 477407.5, E 1349255.3	569.2	N 477338.9, E 1349248.5	568.7
PIPE 3	18	70	N 477748.8, E 1349514.6	569.2	N 477756.9, E 1349445.1	566.0
PIPE 4	12	56	N 477588.2, E 1349429.3	570.9	N 477643.1, E 1349437.6	570.9
PIPE 5	12	59	N 476748.3, E 1349176.4	572.5	N 476716.8, E 1349127.0	568.9
PIPE 6	12	59	N 476484.6, E 1349297.5	574.5	N 476475.1, E 1349239.7	570.8

**CULVERT PIPE DETAIL** (3) REF G00451 G00396 G00397



- ① ODOT ITEM 304 STABILIZED CRUSHED AGGREGATE (2-6" COURSES) ON FILTER FABRIC, ODOT ITEM 712, TYPE D.
- ② GRAVEL TO BE ODOT ITEM 601.07, TYPE C TOP WIDTH TO BE 2 FEET.

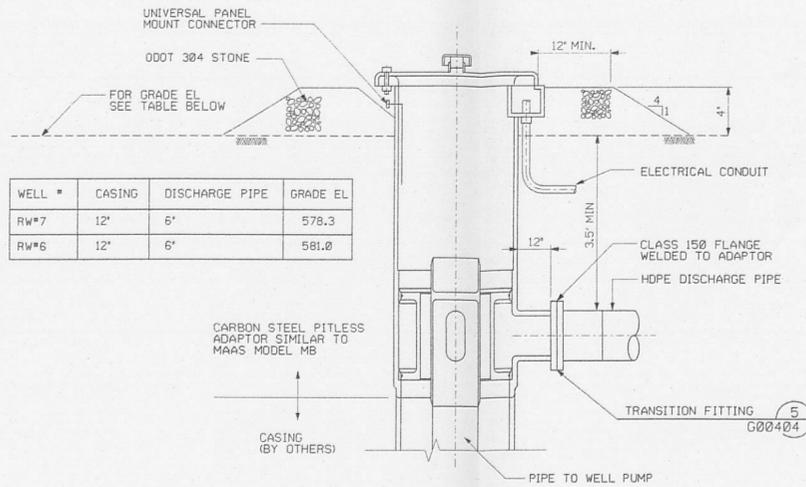
**GRAVEL EROSION CONTROL DETAIL** (2) REF G00451 G00396 G00397 NTS



**STANDARD FLARED END SECTION DETAIL** (4) REF G00451

- 1. INSTALL PER MANUFACTURER'S INSTRUCTIONS.
- 2. MATERIAL TO BE GALVANIZED STEEL.
- 3. LENGTH OF DUMPED ROCK IS 5' UNLESS NOTED OTHERWISE ON SITE/GRADING/UTILITY PLAN
- 4. DIMENSIONS, IN INCHES, ARE AS FOLLOWS:

12" DIA	15" DIA	18" DIA	36" DIA
A=6.5 (1"±)	A=7.5 (1"±)	A=8 (1"±)	A=14.5 (1"±)
L=21 (1.5"±)	L=26 (1.5"±)	L=31 (1.5"±)	L=60 (1.5"±)
W=24 (2"±)	W=30 (2"±)	W=36 (2"±)	W=72 (2"±)
B=6.5 MAX	B=8 MAX	B=8 MAX	B=12 MAX



WELL #	CASING	DISCHARGE PIPE	GRADE EL
RW#7	12"	6"	578.3
RW#6	12"	6"	581.0

**TYPICAL PITLESS ADAPTOR** (5) REF G00451 G00400

NOTE: PROVIDE EACH WELL WITH A 1/2" POLYETHYLENE CHLORINE INJECTION TUBE STRAPPED TO THE PUMP DISCHARGE COLUMN WITH NON CORRODING FASTENERS AT 10' INTERVALS. TERMINATE LOWER END NEAR PUMP INLET SCREEN. CLAMP UPPER END OF TUBE TO PITLESS ADAPTOR UPPER CASING AND LEAVE SUFFICIENT LENGTH, COILED INSIDE UPPER CASING TO EXTEND 3' ABOVE GRADE.

NOTES	
1.	UNLESS OTHERWISE NOTED ALL MATERIALS SHALL CONFORM TO THE STATE OF OHIO DEPARTMENT OF TRANSPORTATION (ODOT) CONSTRUCTION AND MATERIAL SPECIFICATIONS DATED JANUARY 1, 1997.
2.	UNLESS OTHERWISE NOTED ALL CONCRETE SHALL BE 3000 PSI AS SPECIFIED IN THE SPECIFICATIONS.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00395	GRADING/UTILITY PLAN
95X-5900-G-00396	GRADING/UTILITY PLAN
95X-5900-G-00397	PLAN AND PROFILE
95X-5900-G-00400	PLAN AND PROFILE
95X-5900-G-00404	DETAILS - 3 OF 5

**INFORMATION ONLY**

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FORMO	DATE
0	CERTIFIED FOR CONSTRUCTION	NA	6/1/96	

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**CIVIL DETAILS**  
 5 OF 5

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. LINDGREN	6/28/96	K. Gernard	6/13/97	E. KLUBRIN	11/11/96

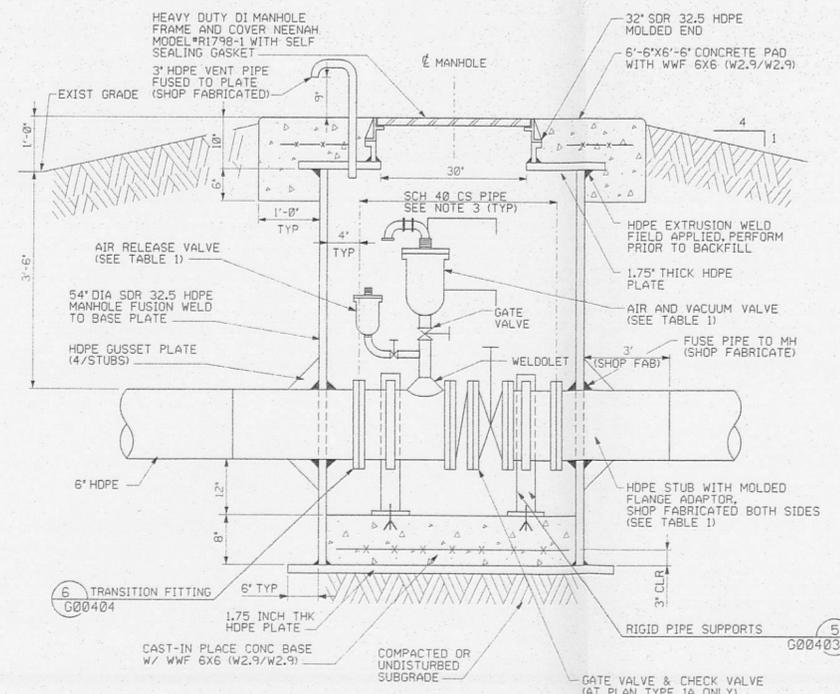
PLANT/BUILDG. NO.	FLOOR	SCALE	NONE	CLASS

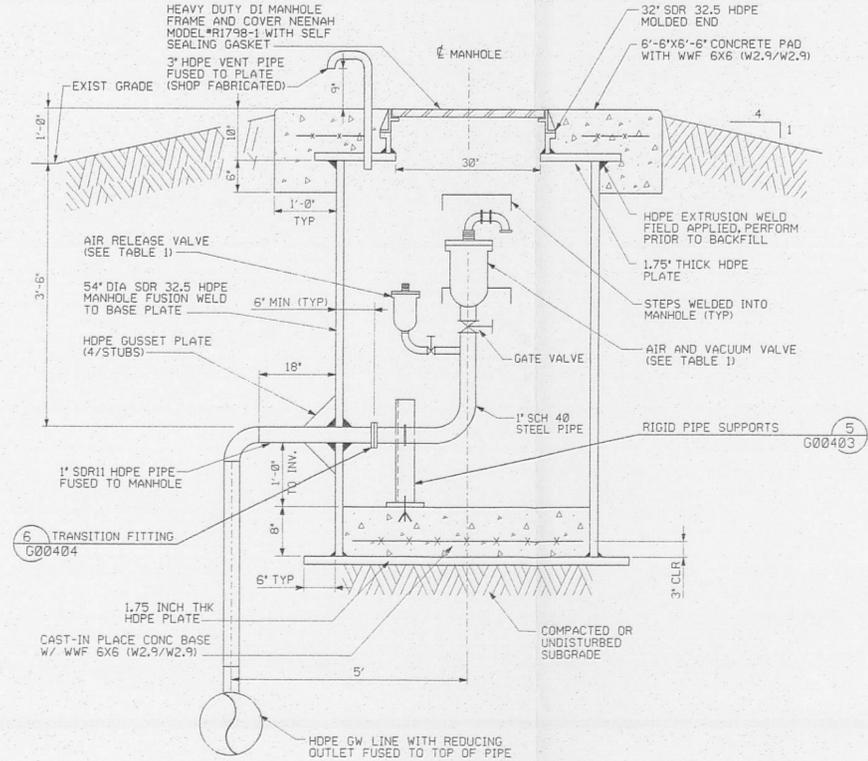
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NO.
NA	NA	SPO-53300

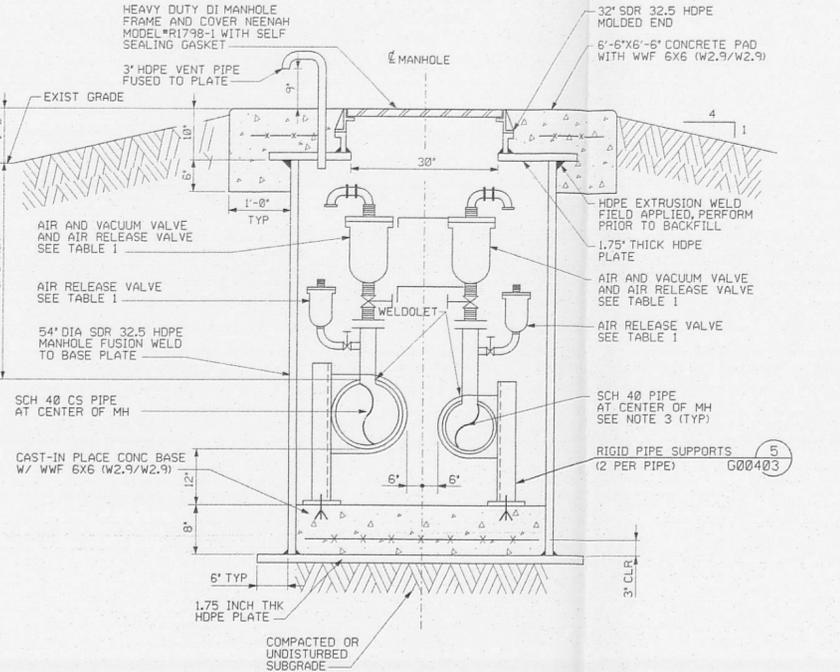
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOC PROJECT NO.	FORM PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
ARP/P0169	WBS 11.1.1.1.2.1	00-90701	95X-5900-G-00451	G0015	0



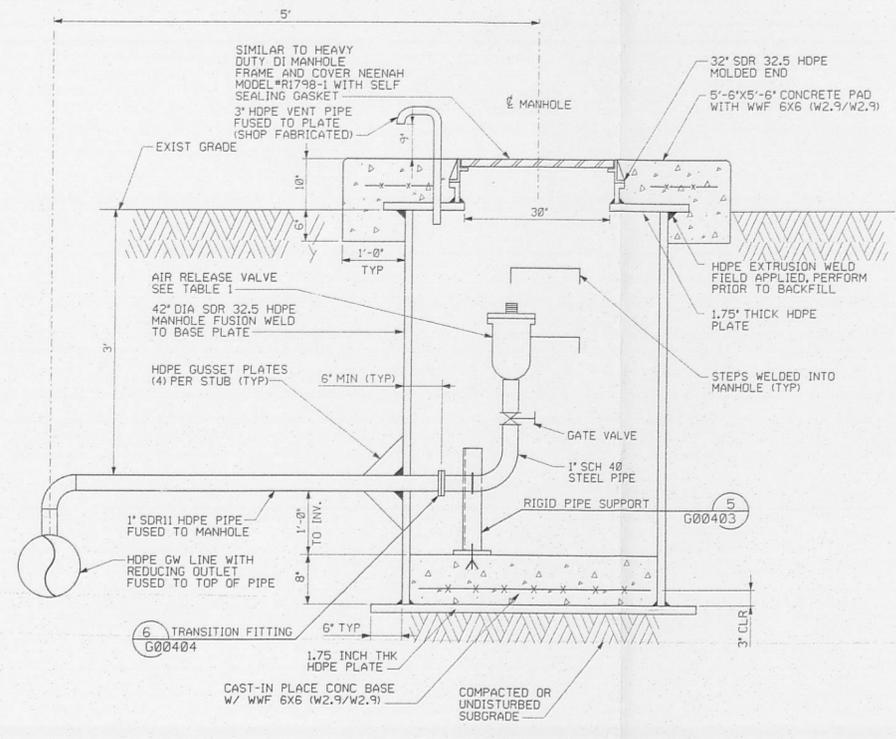
PLAN TYPE 1 & 1A  
AIR RELEASE MANHOLE DETAIL (1) REF G00405 G00408  
NTS



PLAN TYPE 2  
AIR RELEASE MANHOLE DETAIL (2) REF G00405 G00396  
NTS



PLAN TYPE 3  
AIR RELEASE MANHOLE DETAIL (3) REF G00405 G00396  
NTS



PLAN TYPE 4  
AIR RELEASE MANHOLE DETAIL (4) REF G00405 G00397 G00398 G00399  
NTS

NOTES

- UNLESS OTHERWISE NOTED ALL MATERIALS SHALL CONFORM TO THE STATE OF OHIO DEPARTMENT OF TRANSPORTATION (ODOT) CONSTRUCTION AND MATERIAL SPECIFICATIONS DATED JANUARY 1, 1995.
- UNLESS OTHERWISE NOTED ALL CONCRETE SHALL BE 3000 PSI AS SPECIFIED IN THE SPECIFICATIONS.
- HDPE PIPE STUB (BEYOND) SHALL BE FUSED TO MANHOLE. PIPE STUB WITH MOLDED FLANGE ADAPTOR AND FLANGE SHALL BE SHOP FABRICATED, BOTH SIDES. 4 HDPE GUSSET PLATES PER PIPE SHALL BE ATTACHED TO MANHOLE AND PLATE, DETAILS SIMILAR TO PLAN TYPE 2, THIS DRAWING.

TABLE 1

MH#	PLAN TYPE	VALVES **			
		INJECTION		OPTIMIZATION/EXTRACTION	
		AIR & VACUUM	AIR RELEASE	AIR & VACUUM	AIR RELEASE
1	4	---	1/2" (3 CFM)	---	---
2	4	---	1/2" (3 CFM)	---	---
3	5	2" (140 CFM)	3/4" (8 CFM)	3" (670 CFM)	1" (14 CFM)
4	5	2" (140 CFM)	3/4" (8 CFM)	2" (270 CFM)	3/4" (5 CFM)
5	2	---	---	3" (670 CFM)	1" (14 CFM)
6	3	2" (140 CFM)	3/4" (8 CFM)	2" (270 CFM)	3/4" (5 CFM)
7	4	---	1/2" (3 CFM)	---	---
8	4	---	1/2" (3 CFM)	---	---
9	4	---	1/2" (3 CFM)	---	---
10	1A	---	---	1" (60 CFM)	1/2" (3 CFM)
11	1A	---	---	1" (60 CFM)	1/2" (3 CFM)

\*\* MODELS SIMILAR TO APCO OR CRISPIN  
\* BY OTHERS

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00393	PLAN AND PROFILE
95X-5900-G-00394	PLAN AND PROFILE
95X-5900-G-00396	GRADING/UTILITY PLAN
95X-5900-G-00397	PLAN AND PROFILE
95X-5900-G-00398	PLAN AND PROFILE
95X-5900-G-00399	PLAN AND PROFILE
95X-5900-G-00400	PLAN AND PROFILE
95X-5900-G-00404	DETAILS

INFORMATION ONLY

0 CERTIFIED FOR CONSTRUCTION  
REV. NO. ISSUE OR REVISION PURPOSE - DESCRIPTION  
A-E FERMCO DATE INITIALS AND DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

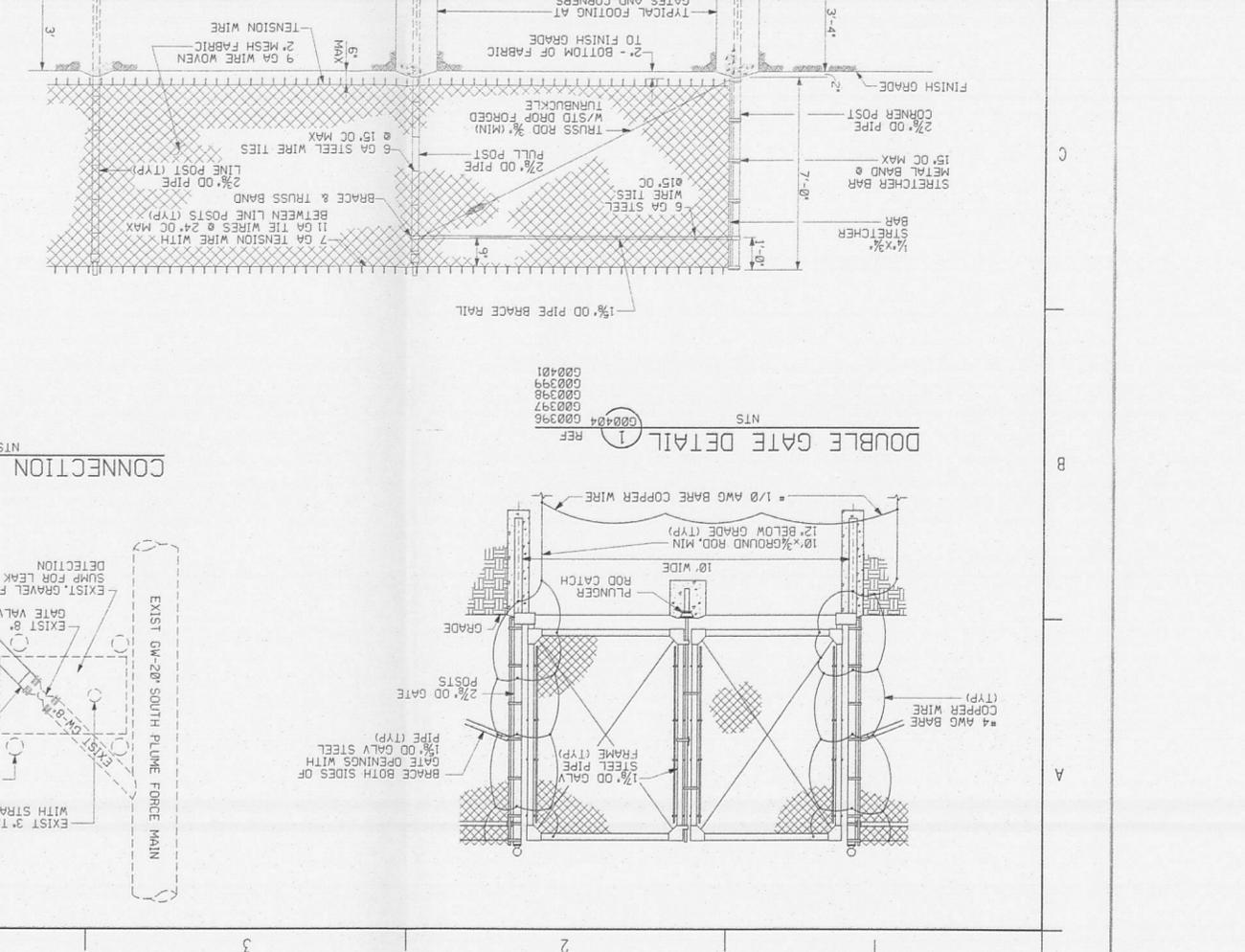
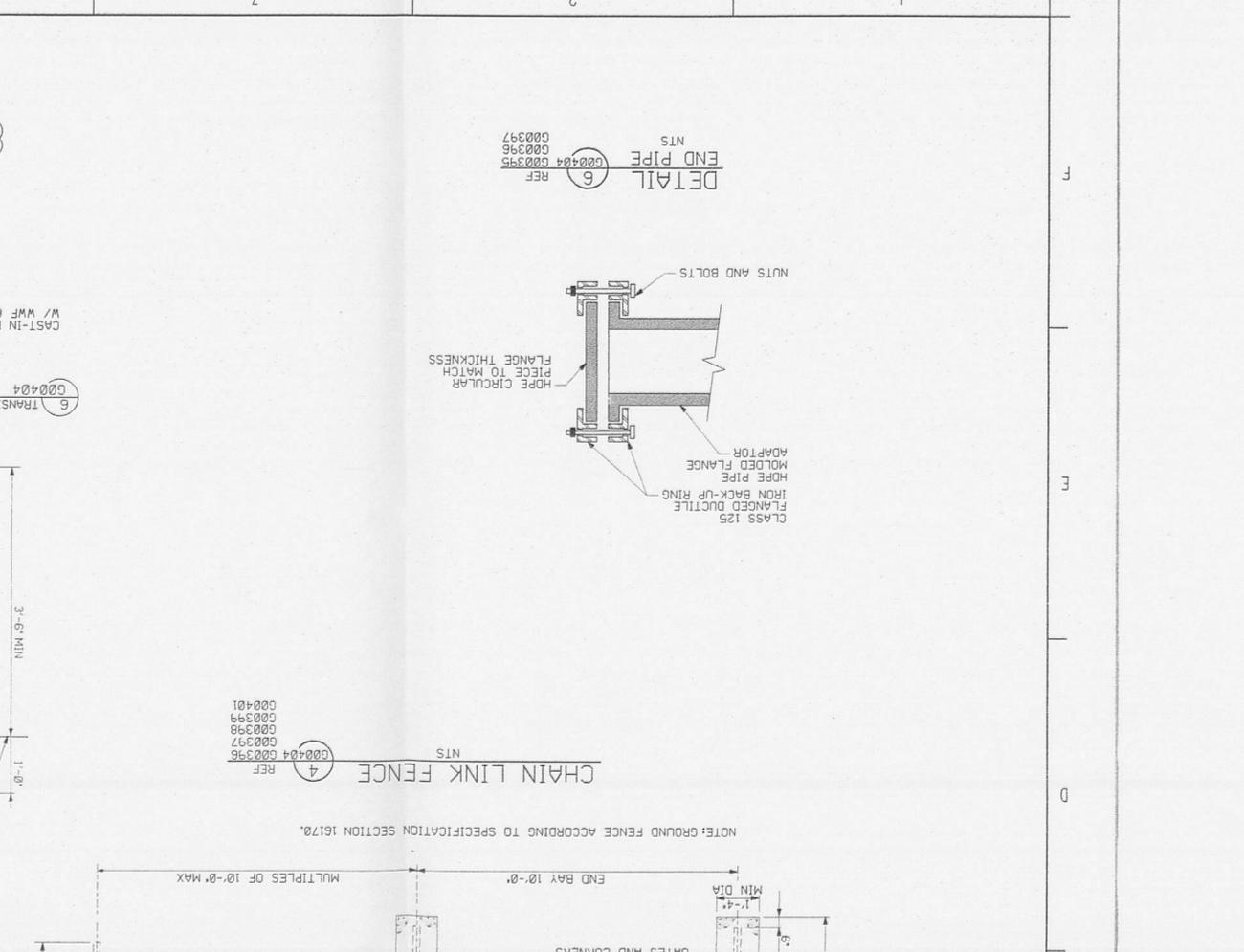
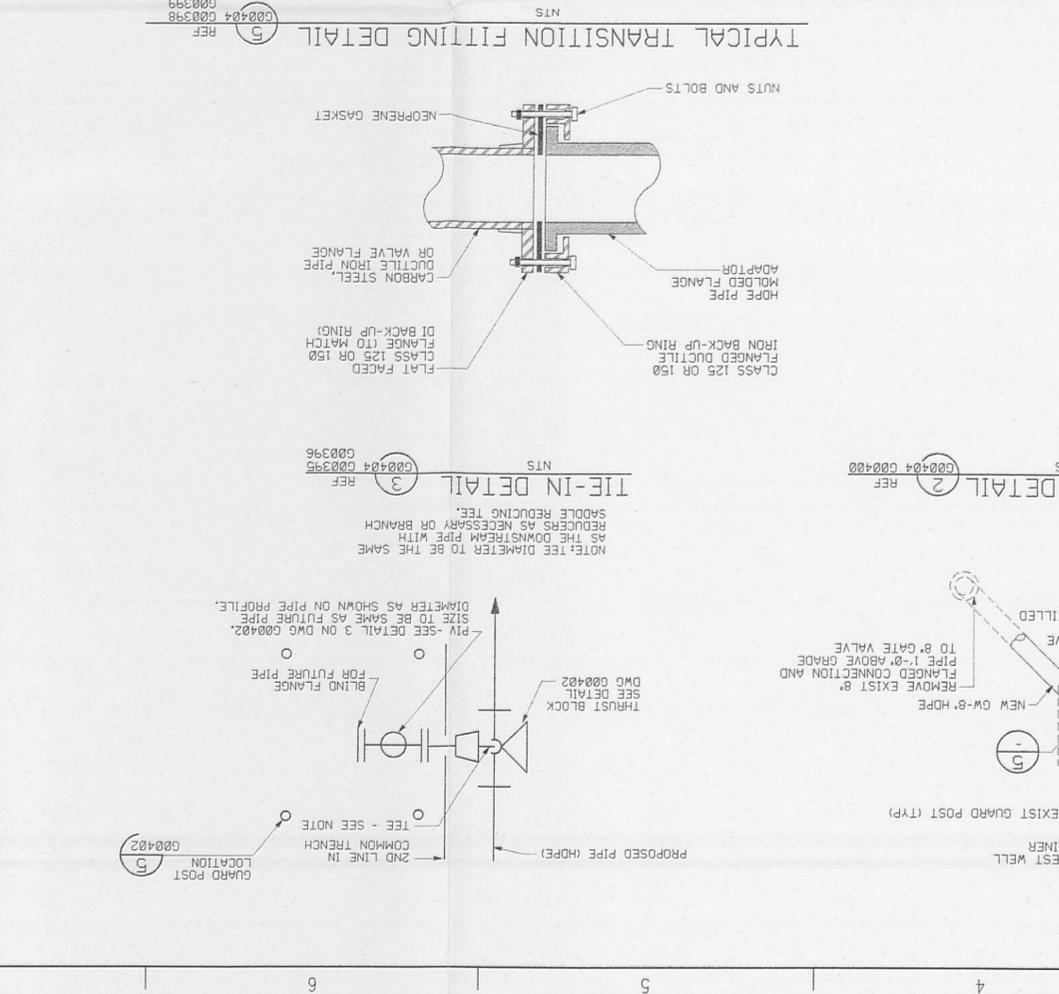
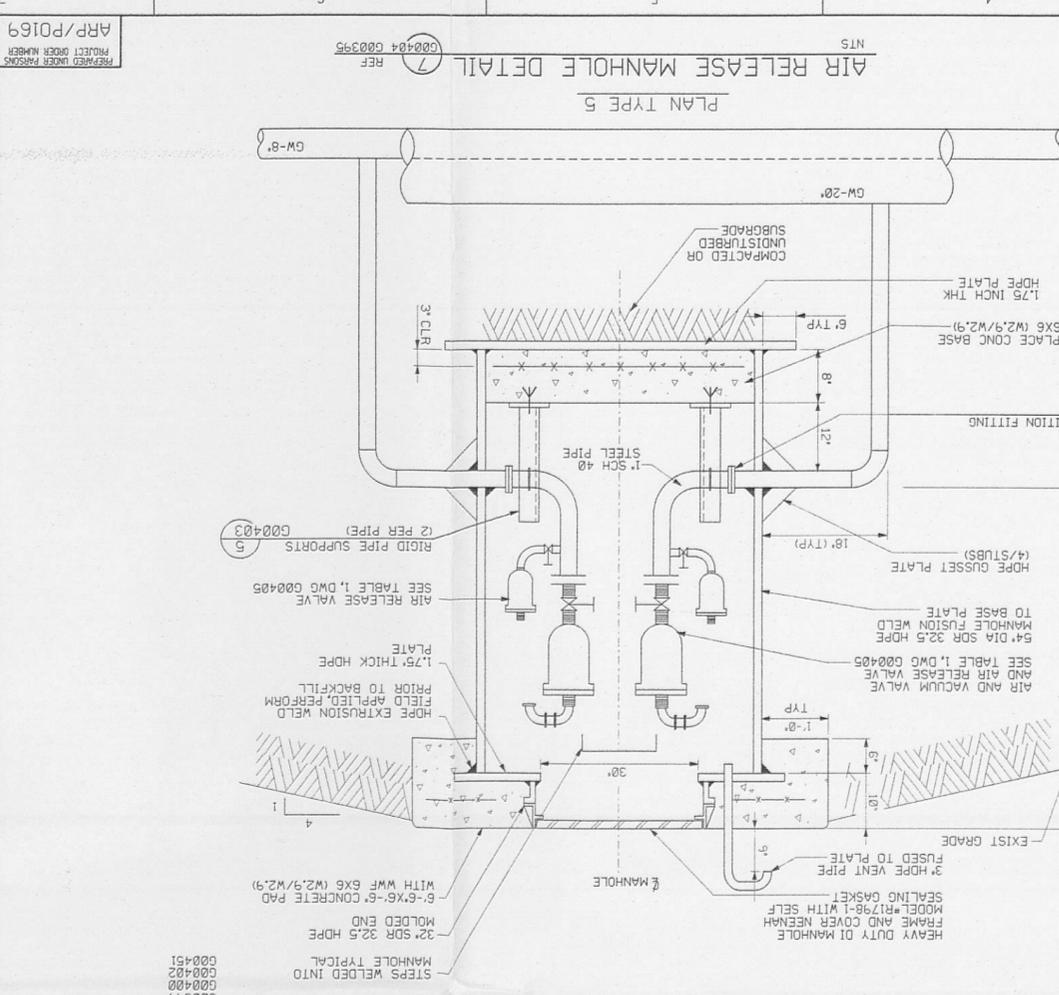
PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
DRAWING TITLE  
**CIVIL DETAILS 4 OF 5**

DRAWN BY R. LINDGREN	DATE 06/28/98	LEAD ENGINEER G. G. G. G.	DATE 06/29/97	CHECKED BY E. KUBRIN	DATE 11/11/96
PLANT/BLDG. NO.	FLOOR	SCALE	NONE	FERMCO PROJECT NO.	CLASS
SUBMITTED FOR APPROVAL M. G. G. G.			FERMCO CRU APPROVAL NA		
SPO-53300			ID-53100		

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	TEMP PROJECT NO. WBS 1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-G-00405	SHEET NO. G0014	REV. NO. 0
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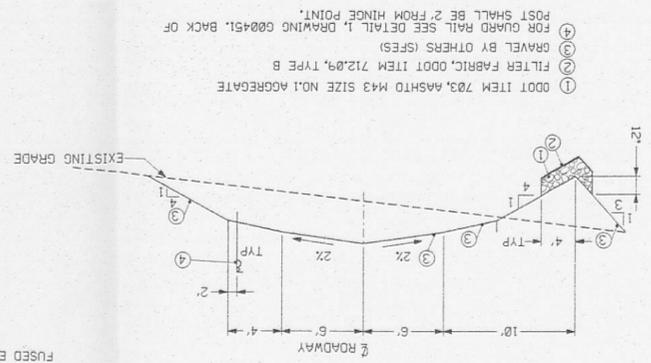
PROJECT TITLE <b>UNITED STATES DEPARTMENT OF ENERGY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT</b>		PROJECT NAME <b>PARSONS</b>		THE RALPH W. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO	
SOUTH PLUME OPTIMIZATION AND INSPECTION DEMONSTRATION		DRAWING TITLE <b>CIVIL DETAILS</b>		DRAWING NO. <b>SP0-53300</b>	
SUBMITTED FOR APPROVAL DATE: 11/11/96 CHECKED BY: E. KUBRIN		DRAWN BY DATE: 06/28/96 R. LINDGREN		SCALE NONE	
CLASS NONE		FLOOR 3 OF 5		SHEET NO. <b>0</b>	
REV. NO. 0		CERTIFIED FOR CONSTRUCTION DATE: 01/12/97 NA		ISSUE OR REVISION PURPOSE - DESCRIPTION NA	
REF DWG NO. 95X-5900-X-00411		DRAWING INDEX LEGEND AND SYMBOLS		95X-5900-X-00412	
REF DWG NO. 95X-5900-C-00399		PLAN AND PROFILE GRADING/UTILITY PLAN		95X-5900-C-00398	
REF DWG NO. 95X-5900-C-00400		PLAN AND PROFILE AIR RELEASE VALVE		95X-5900-C-00401	
REF DWG NO. 95X-5900-C-00402		DETAILS - 1 OF 5		95X-5900-C-00403	
REF DWG NO. 95X-5900-C-00403		DETAILS - 2 OF 5		95X-5900-C-00404	
REF DWG NO. 95X-5900-C-00404		DETAILS - 3 OF 5		95X-5900-C-00405	
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**INFORMATION ONLY**

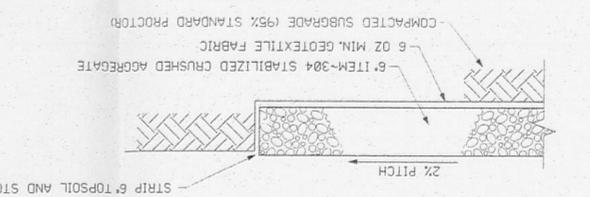


NOTES

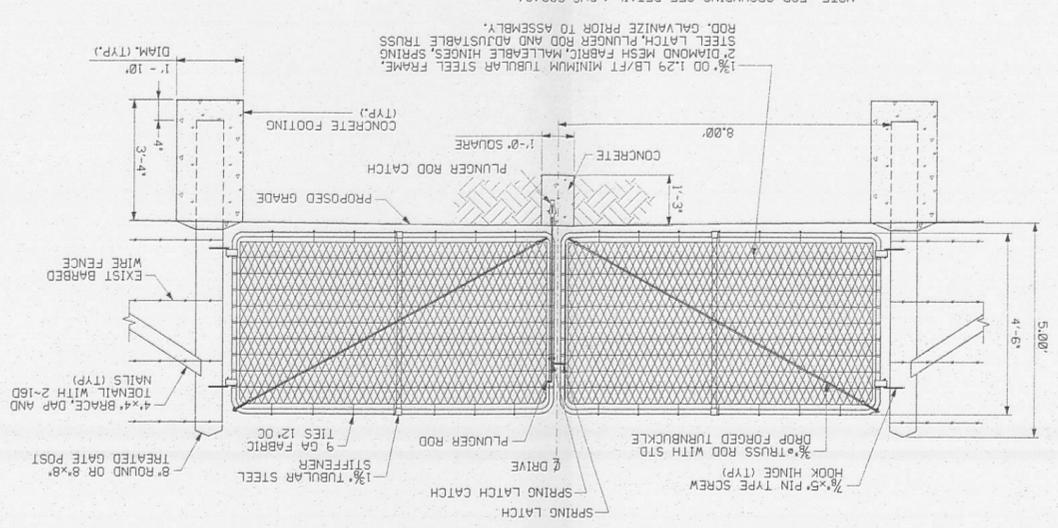
TYPICAL ROAD SECTION  
NTS  
REF: G00403 G00396



GRAVEL ACCESS DRIVE  
NTS  
REF: G00403 G00398 G00399 G00401

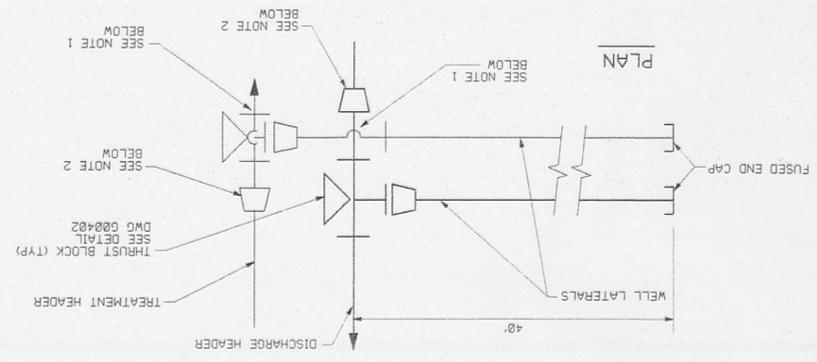
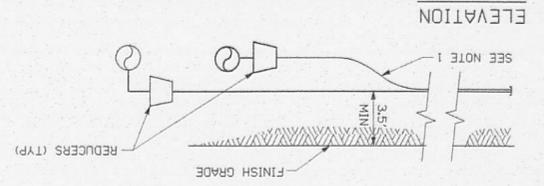


DOUBLE SWING GATE DETAIL  
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REF: G00403 G00400 G00399

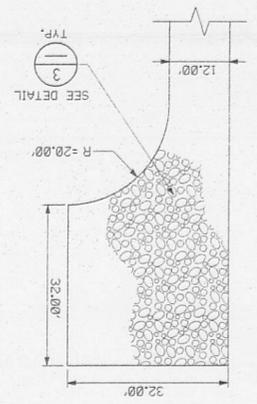


TIE-IN DETAIL  
NTS  
REF: G00403 G00396

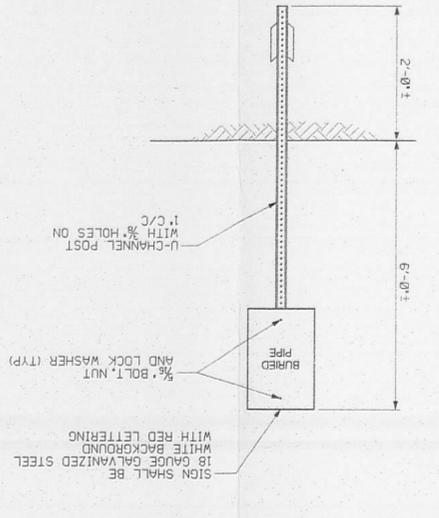
- NOTES:
1. BEND TREATMENT LATERAL AND HEADERS TO PROVIDE 8\"/>



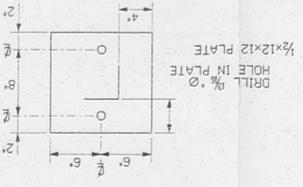
DRIVE END DETAIL  
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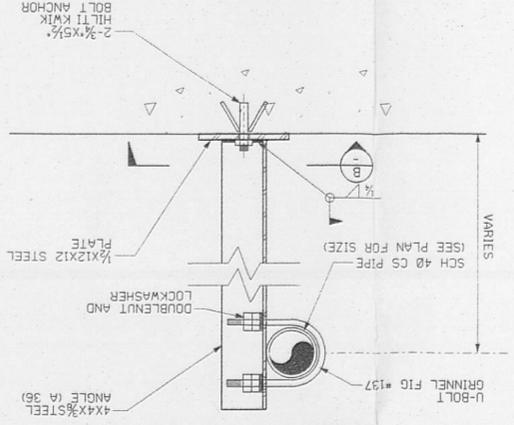
TYPICAL PIPE LINE MARKER DETAIL  
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REF: G00403 G00395 G00396 G00397 G00398 G00399



SECTION B  
NTS



PIPE SUPPORT  
NTS  
REF: G00403 G00405



REV. NO.	DATE	DESCRIPTION
0	6/13/97	CERTIFIED FOR CONSTRUCTION

DATE	BY	CHECKED BY	SCALE	CLASS
11/11/96	R. LINDGREN	E. KUBRIN	AS SHOWN	NONE

DATE	DATE	DATE	DATE
00-90701	00-90701	00-90701	00-90701

REF. DWG. NO.	DRAWING INDEX	LEGEND AND SYMBOLS	GRADING/UTILITY PLAN	GRADING/UTILITY PLAN	GRADING/UTILITY PLAN	PLAN AND PROFILE	DETAILS - 5 OF 5	DETAILS - 4 OF 5	DETAILS - 3 OF 5	DETAILS - 2 OF 5				
G00395														

DATE	DATE	DATE	DATE
00-90701	00-90701	00-90701	00-90701

INFORMATION ONLY

UNITED STATES DEPARTMENT OF ENERGY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

PARSONS THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO

SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION PROJECT TITLE

CIVIL DETAILS 2 OF 5

APPROVED FOR CONSTRUCTION

DATE 11/11/96

PROJECT NO. 95X-5900-G-00403

DATE 00-90701

PROJECT NO. 95X-5900-G-00403

DATE 00-90701

PROJECT NO. 95X-5900-G-00403



PROJECT UNDER PARSONS PROJECT ORDER NUMBER APP/P0169	DATE 00-90701	DATE 00-90701	DATE 00-90701
PROJECT NO. 95X-5900-G-00401	DRAWING INDEX CODE NO. 95X-5900-G-00401	SHEET NO. 0	REV. NO. 0
DATE 01/26/96	DATE 01/26/96	DATE 01/26/96	DATE 01/26/96
DATE 01/26/96	DATE 01/26/96	DATE 01/26/96	DATE 01/26/96
DATE 01/26/96	DATE 01/26/96	DATE 01/26/96	DATE 01/26/96
DATE 01/26/96	DATE 01/26/96	DATE 01/26/96	DATE 01/26/96
DATE 01/26/96	DATE 01/26/96	DATE 01/26/96	DATE 01/26/96
DATE 01/26/96	DATE 01/26/96	DATE 01/26/96	DATE 01/26/96
DATE 01/26/96	DATE 01/26/96	DATE 01/26/96	DATE 01/26/96
DATE 01/26/96	DATE 01/26/96	DATE 01/26/96	DATE 01/26/96

DRAWN BY: Y. AP-SHAR  
 CHECKED BY: E. KUBRIN  
 DATE: 11/4/95  
 CLASS: 11-101  
 SCALE: 1"=10'  
 FLOOR: NA  
 PROJECT NO.: NA  
 FEMCO PROJECT NO.: NA  
 SUBMITTED FOR APPROVAL: NA  
 FEMCO PROJECT NO.: NA  
 ID-53100

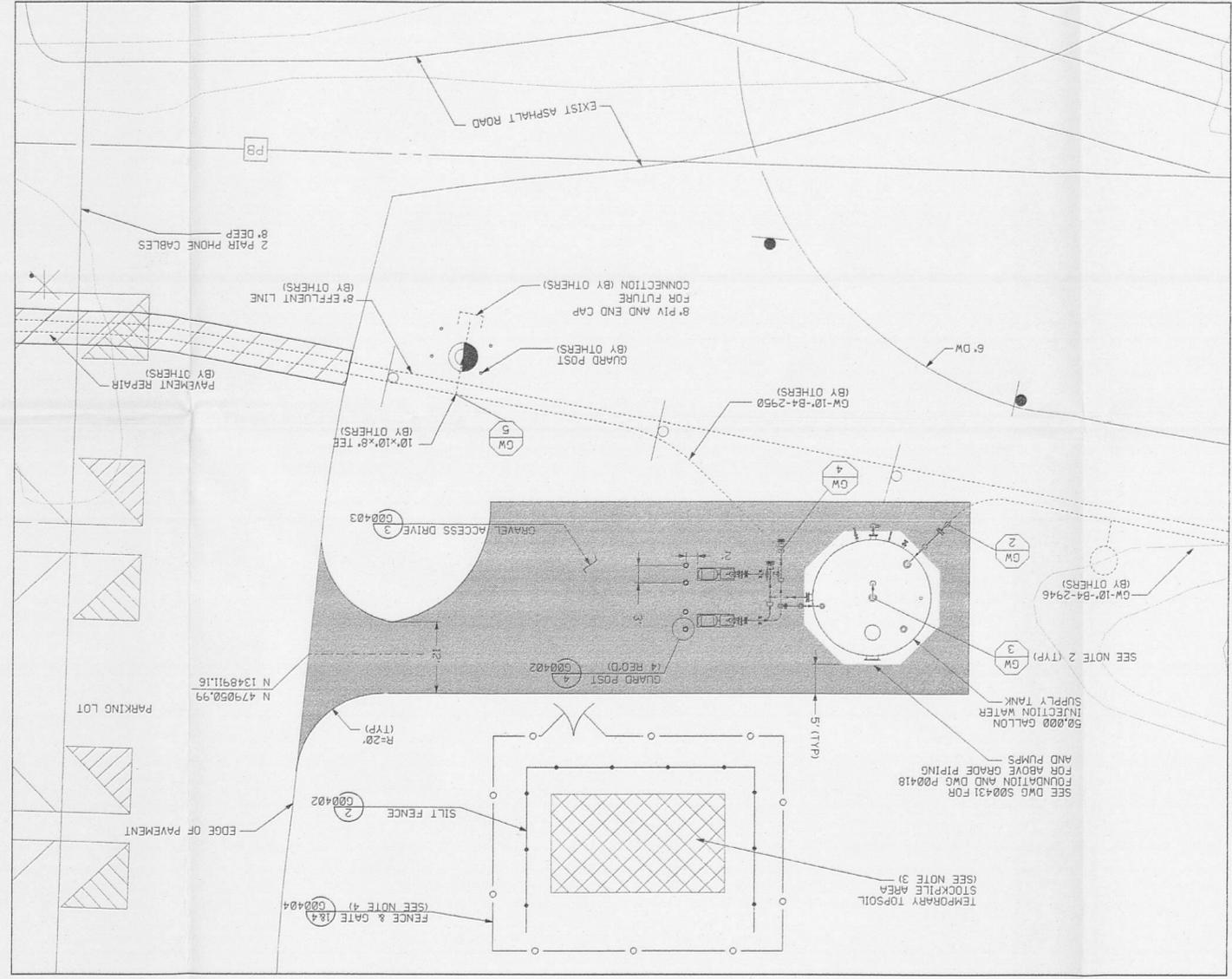
THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
 DRAWING TITLE  
**50K HOLDING TANK AREA ENLARGEMENT**

REV. NO.	DATE	DESCRIPTION
0	01/26/96	CERTIFIED FOR CONSTRUCTION

REF DWG NO. \_\_\_\_\_ DRAWING TITLE \_\_\_\_\_

REF DWG NO.	DRAWING INDEX	LEGEND AND SYMBOLS	PLAN AND PROFILE	DETAILS - 1 OF 5	DETAILS - 2 OF 5	PILING/PLANT DESIGN - PILING PLAN AND SECTION	STRUCTURAL - PLAN SECTIONS AND DETAILS
95X-5900-X-00411	95X-5900-X-00411	95X-5900-G-00393	92X-5900-G-00402	95X-5900-G-00403	95X-5900-P-00418	95X-5900-S-00431	

**INFORMATION ONLY**



1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA LISTED BELOW. EXISTING SITE DATA SOURCE (IN PLANT FILES) FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS PARSONS TOPOGRAPHY, 1992  
 2. SEE DRAWING 95X-5900-G-00393 FOR COORDINATES.  
 3. THE TOP 6" OF ALL EXCAVATIONS/GRADING MATERIAL SHALL NOT BE REUSED. MATERIAL IS TO BE HANDLED SEPARATELY AND STOCKPILED AT LOCATIONS SHOWN. GRADE AND SEED STOCKPILES IN ACCORDANCE WITH SPECIFICATIONS.  
 4. FENCE LOCATION WILL VARY, DEPENDING ON QUANTITY OF MATERIAL STOCKPILED. MAINTAIN 10' MINIMUM DISTANCE FROM THE TOE OF STOCKPILE TO FENCE.

REV. NO.	DATE	DESCRIPTION
0	6/13/94	CERTIFIED FOR CONSTRUCTION
INITIALS AND DATE		
NA		

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-C-00402	DETAILS - 1 OF 5
95X-5900-C-00403	DETAILS - 2 OF 5
95X-5900-C-00404	DETAILS - 3 OF 5
95X-5900-C-00405	DETAILS - 4 OF 5
95X-5900-C-00406	DETAILS - 5 OF 5
95X-5900-P-00453	PIPING/PLANT DESIGN - PIPING PLAN
95X-5900-A-00429	ARCHITECTURAL - PLAN, ELEVATION AND DETAILS

PROJECT NAME	SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION
PROJECT NO.	95X-5900-G-00400
PROJECT LOCATION	CINCINNATI, OHIO
CLIENT	UNITED STATES DEPARTMENT OF ENERGY
DESIGNED BY	PARSONS
DESIGNED FOR	THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.

DATE	CHECKED BY	DATE	DESIGNED BY
11/4/96	E. KIRBRIN	06/27/96	R. GILBERT
CLASS	SCALE	FLOOR	PROJECT NO.
AS SHOWN	NA	NA	95X-5900-G-00400
PLANNING NO.	DATE	DATE	DATE
SP-0-533300	6/11/97	00-90701	00-90701

PROJECT ORDER NUMBER	ARR/P0169
PROJECT NO.	95X-5900-G-00400
PROJECT NAME	SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION
PROJECT LOCATION	CINCINNATI, OHIO
CLIENT	UNITED STATES DEPARTMENT OF ENERGY
DESIGNED BY	PARSONS
DESIGNED FOR	THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.

DATE	CHECKED BY	DATE	DESIGNED BY
11/4/96	E. KIRBRIN	06/27/96	R. GILBERT
CLASS	SCALE	FLOOR	PROJECT NO.
AS SHOWN	NA	NA	95X-5900-G-00400
PLANNING NO.	DATE	DATE	DATE
SP-0-533300	6/11/97	00-90701	00-90701

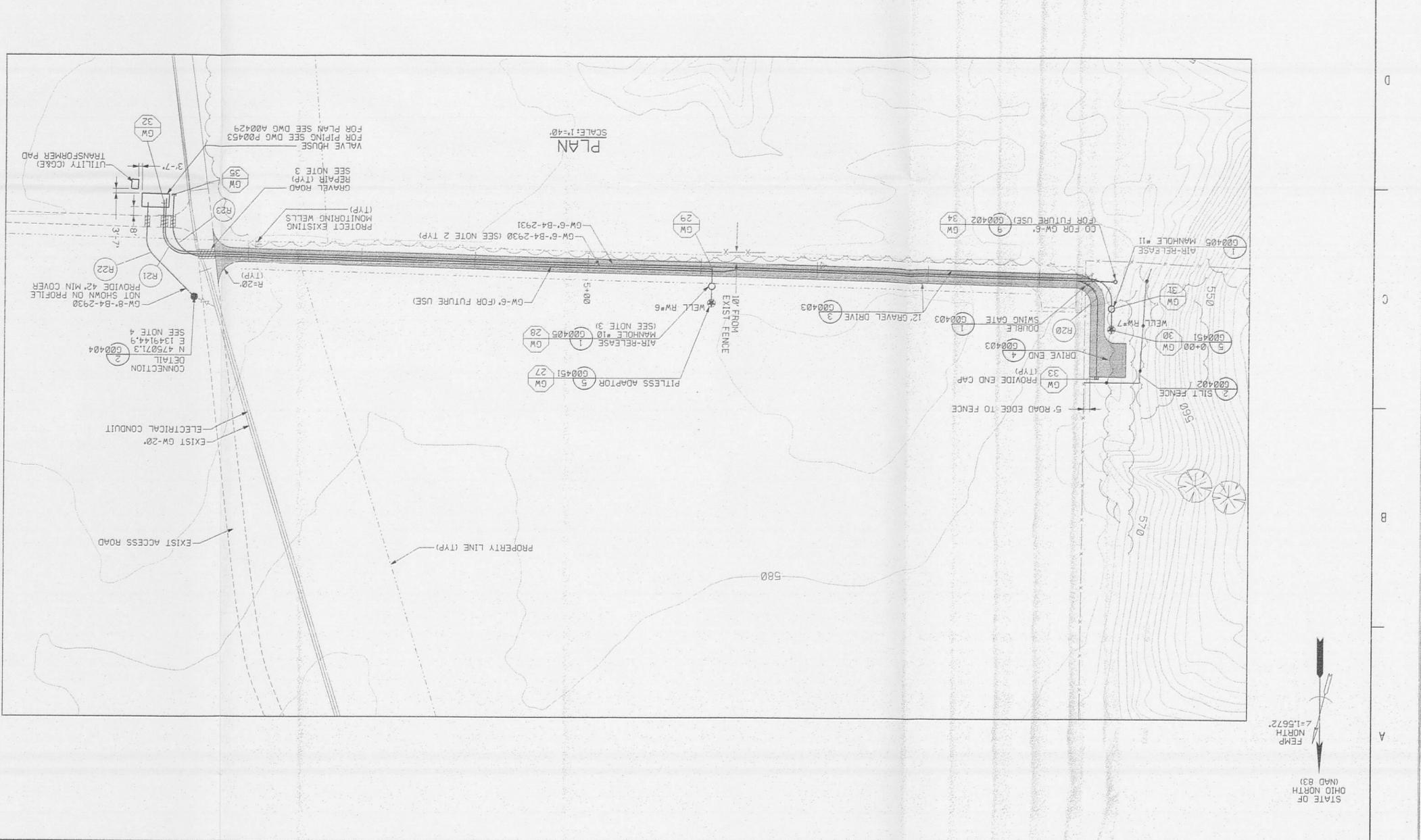
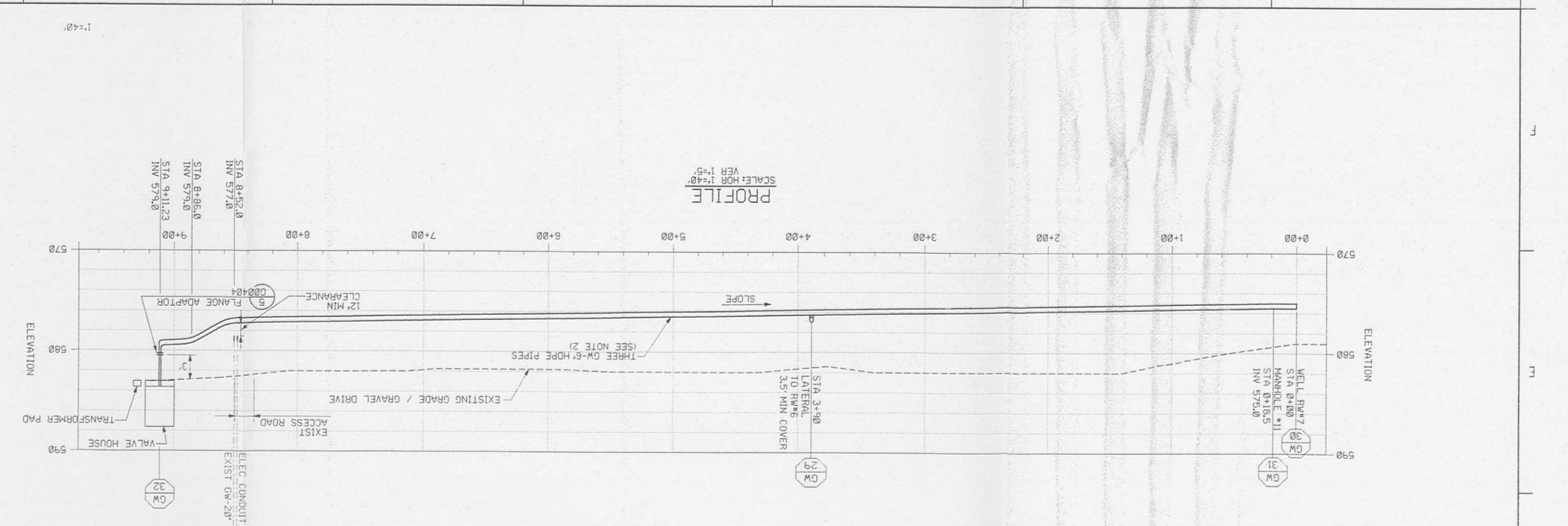
REV. NO.	DATE	DESCRIPTION
0	6/13/94	CERTIFIED FOR CONSTRUCTION
INITIALS AND DATE		
NA		

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-C-00402	DETAILS - 1 OF 5
95X-5900-C-00403	DETAILS - 2 OF 5
95X-5900-C-00404	DETAILS - 3 OF 5
95X-5900-C-00405	DETAILS - 4 OF 5
95X-5900-C-00406	DETAILS - 5 OF 5
95X-5900-P-00453	PIPING/PLANT DESIGN - PIPING PLAN
95X-5900-A-00429	ARCHITECTURAL - PLAN, ELEVATION AND DETAILS

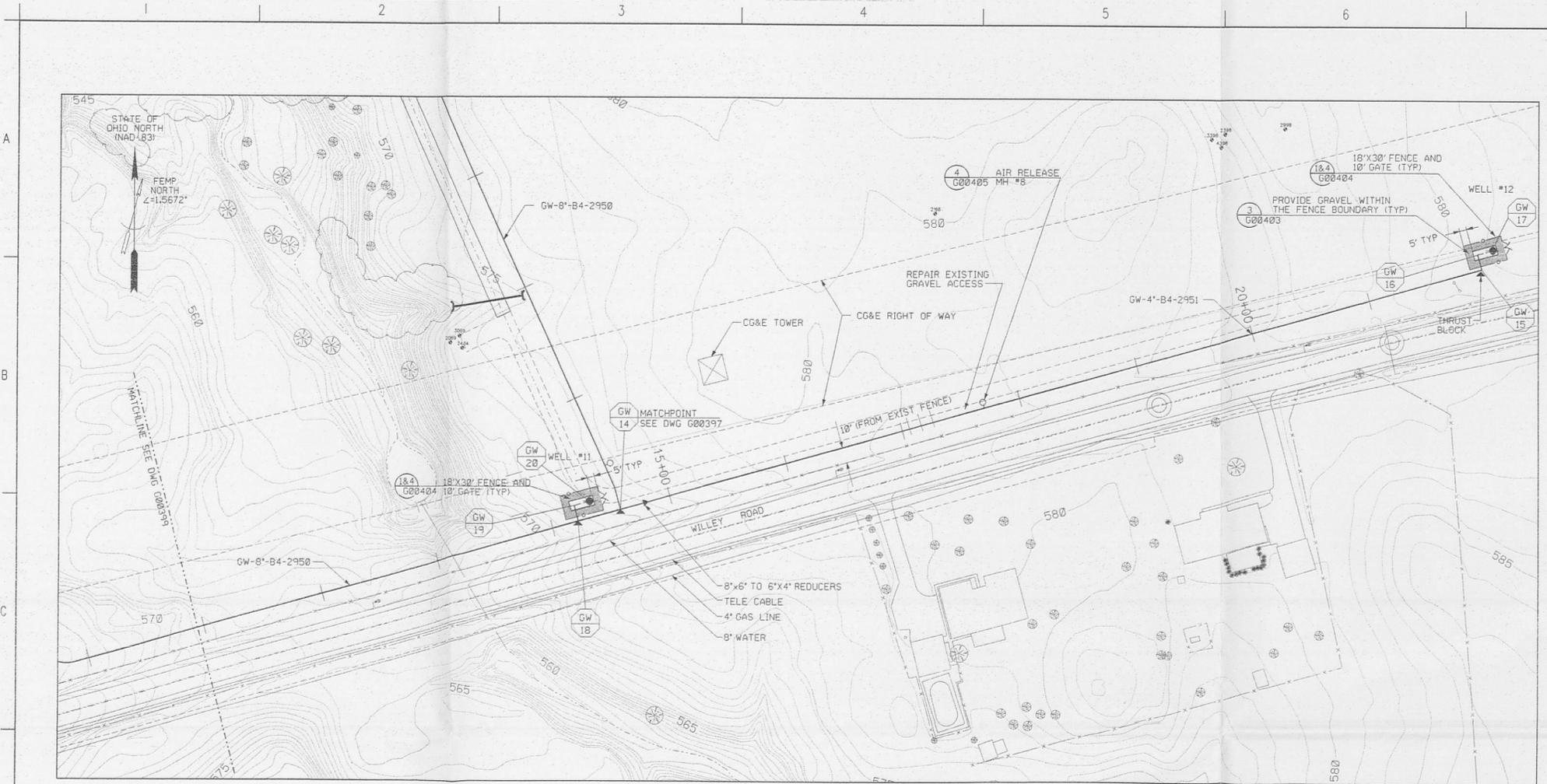
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95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-C-00402	DETAILS - 1 OF 5
95X-5900-C-00403	DETAILS - 2 OF 5
95X-5900-C-00404	DETAILS - 3 OF 5
95X-5900-C-00405	DETAILS - 4 OF 5
95X-5900-C-00406	DETAILS - 5 OF 5
95X-5900-P-00453	PIPING/PLANT DESIGN - PIPING PLAN
95X-5900-A-00429	ARCHITECTURAL - PLAN, ELEVATION AND DETAILS

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-C-00402	DETAILS - 1 OF 5
95X-5900-C-00403	DETAILS - 2 OF 5
95X-5900-C-00404	DETAILS - 3 OF 5
95X-5900-C-00405	DETAILS - 4 OF 5
95X-5900-C-00406	DETAILS - 5 OF 5
95X-5900-P-00453	PIPING/PLANT DESIGN - PIPING PLAN
95X-5900-A-00429	ARCHITECTURAL - PLAN, ELEVATION AND DETAILS

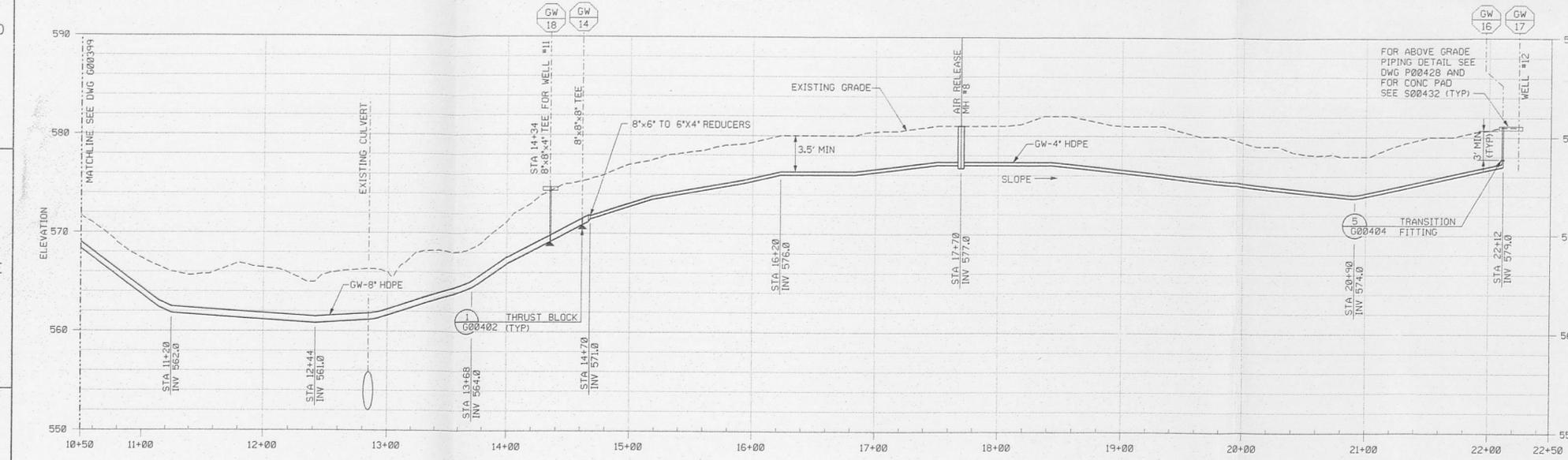
REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-C-00402	DETAILS - 1 OF 5
95X-5900-C-00403	DETAILS - 2 OF 5
95X-5900-C-00404	DETAILS - 3 OF 5
95X-5900-C-00405	DETAILS - 4 OF 5
95X-5900-C-00406	DETAILS - 5 OF 5
95X-5900-P-00453	PIPING/PLANT DESIGN - PIPING PLAN
95X-5900-A-00429	ARCHITECTURAL - PLAN, ELEVATION AND DETAILS







PLAN  
SCALE: 1"=40'



PROFILE  
SCALE: HOR 1"=40'  
VER 1"=5'

- NOTES
- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA LISTED BELOW:  
EXISTING SITE DATA SOURCE (IN PLANT FILES)  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
PARSONS TOPOGRAPHY, 1992

UNDERGROUND UTILITY COORDINATES			
POINT	NORTHING	EASTING	DESCRIPTION
14	476309.99	1349378.63	8" TEE
15	476509.22	1350090.11	90° BEND
16	476521.73	1350086.60	90° BEND
17	476525.24	1350099.12	INJECTION WELL #12
18	476300.42	1349343.75	8" x 4" TEE
19	467313.05	1349340.42	90° BEND
20	476316.55	1349352.94	INJECTION WELL #11

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00397	PLAN AND PROFILE
95X-5900-G-00399	PLAN AND PROFILE
95X-5900-G-00402	DETAILS - 1 OF 5
95X-5900-G-00404	DETAILS - 3 OF 5
95X-5900-G-00405	DETAILS - 4 OF 5
95X-5900-P-00428	PIPING/PLANT DESIGN - PIPING PLAN AND SECTION
95X-5900-S-00432	STRUCTURAL - PLAN, SECTION AND DETAILS

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	NA	6/30/96
REV	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERIOD DATE INITIALS AND DATE

UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**CIVIL PLAN AND PROFILE 4 OF 6**

DRAWN BY Y. AFSHAR	DATE 05/27/96	LEAD ENGINEER S. Ground	DATE 6/13/97	CHECKED BY E. KUBRIN	DATE 11/4/96
PLANT/BLDG. NO.	FLOOR	SCALE	AS SHOWN	CLASS	

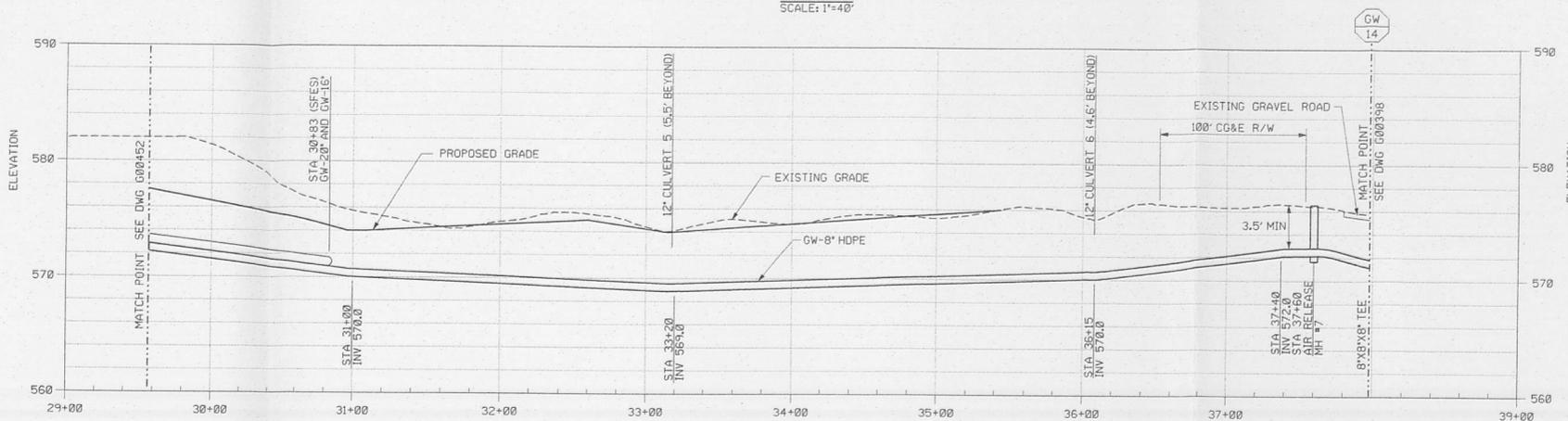
SUBMITTED FOR APPROVAL M. G. [Signature]	FERMCO CRU APPROVAL NA	FERMCO PROJECT NO. ID-53100
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PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DATE 11/11/92	PROJECT NO. WBS 1.1.1.1.2.1	DATE 00-90701	DRAWING INDEX CODE NO. 95X-5900-G-00398	SHEET NO. G0007	REV. NO. 0
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STATE OF OHIO NORTH  
(NAD 83)  
FEMP NORTH  
±1.5672'



PLAN  
SCALE: 1"=40'



PROFILE  
SCALE: HOR 1"=40'  
VER 1"=5'

NOTES

- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA LISTED BELOW:  
EXISTING SITE DATA SOURCE (IN PLANT FILES)  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
PARSONS TOPOGRAPHY, 1992
- ADJUST HORIZONTAL AND VERTICAL ALIGNMENT TO MATCH FIELD CONDITIONS.
- FOR LENGTH, SIZE AND COORDINATES OF CULVERT PIPE SEE PIPE DETAIL 3 ON DWG 95X-5900-G-00451.
- BEND 20' LINE AS NECESSARY TO OBTAIN 7' SEPARATION AT THE END, FOR FUTURE FUSION CONNECTION. MINIMUM BENDING RADIUS IS 40' PIPE DIAMETER. 15' (MIN) OF STRAIGHT ROUTE IS REQUIRED AT THE END OF PIPE.
- GRAVEL FOR ROADS IS BY OTHERS (SFES).
- FENCE LOCATION WILL VARY, DEPENDING ON QUANTITY OF MATERIAL STOCKPILED, MAINTAIN 10' MINIMUM DISTANCE FROM THE TOE OF STOCKPILE TO FENCE.
- ALL DISTURBED SURFACES SHALL BE SEEDED AT PROJECT COMPLETION UNLESS OTHERWISE NOTED.

ROAD CURVE DATA

CURVE NO.	Δ	R	T	PI	
				NORTHING	EASTING
(R14)	27°49'48"	200.00'	49.55'	N 476827.64	E 1349116.21

DISCHARGE PIPE CURVE DATA

CURVE NO.	Δ	R	T	PI	
				NORTHING	EASTING
(R14)	87°1'13"	30.00'	45.51'	N 476967.42	E 1349146.75
(R15)	26°41'2"	100.00'	46.56'	N 476836.15	E 1349141.77

(GW) UNDERGROUND UTILITY COORDINATES

POINT	NORTHING	EASTING	DESCRIPTION
13	476967.81	1349175.23	POINT OF REVERSE CURVE
14	476310.00	1349378.63	TEE

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00396	GRADING/UTILITY PLAN
95X-5900-G-00398	PLAN AND PROFILE
95X-5900-G-00402	DETAILS - 1 OF 5
95X-5900-G-00403	DETAILS - 2 OF 5
95X-5900-G-00404	DETAILS - 3 OF 5
95X-5900-G-00405	DETAILS - 4 OF 5
95X-5900-G-00451	DETAILS - 5 OF 5
95X-5900-G-00452	PIPE PROFILE
95X-5900-G-00480	ROAD 19 AND ROAD 20 PROFILES

INFORMATION ONLY

0 CERTIFIED FOR CONSTRUCTION *M* NA 6/13/97

UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**CIVIL  
PLAN AND PROFILE  
3 OF 6**

DRAWN BY Y. AFSHAR	DATE 06/27/96	LEAD ENGINEER B. Gural	DATE 6/13/97	CHECKED BY E. KUBRIN	DATE 11/4/96
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS	AS SHOWN	FERMCO PROJECT NO.

SUBMITTED FOR APPROVAL <i>M</i> 6/13/97	FERMCO CRU APPROVAL NA	FERMCO PROJECT NO. ID-53100
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PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	DATE 00-90701	FEMP PROJECT NO. WBS 1.1.1.1.2.1	DRAWING INDEX CODE NO. 95X-5900-G-00397	SHEET NO. G0006	REV. NO. 0
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DISCHARGE PIPE CURVE DATA

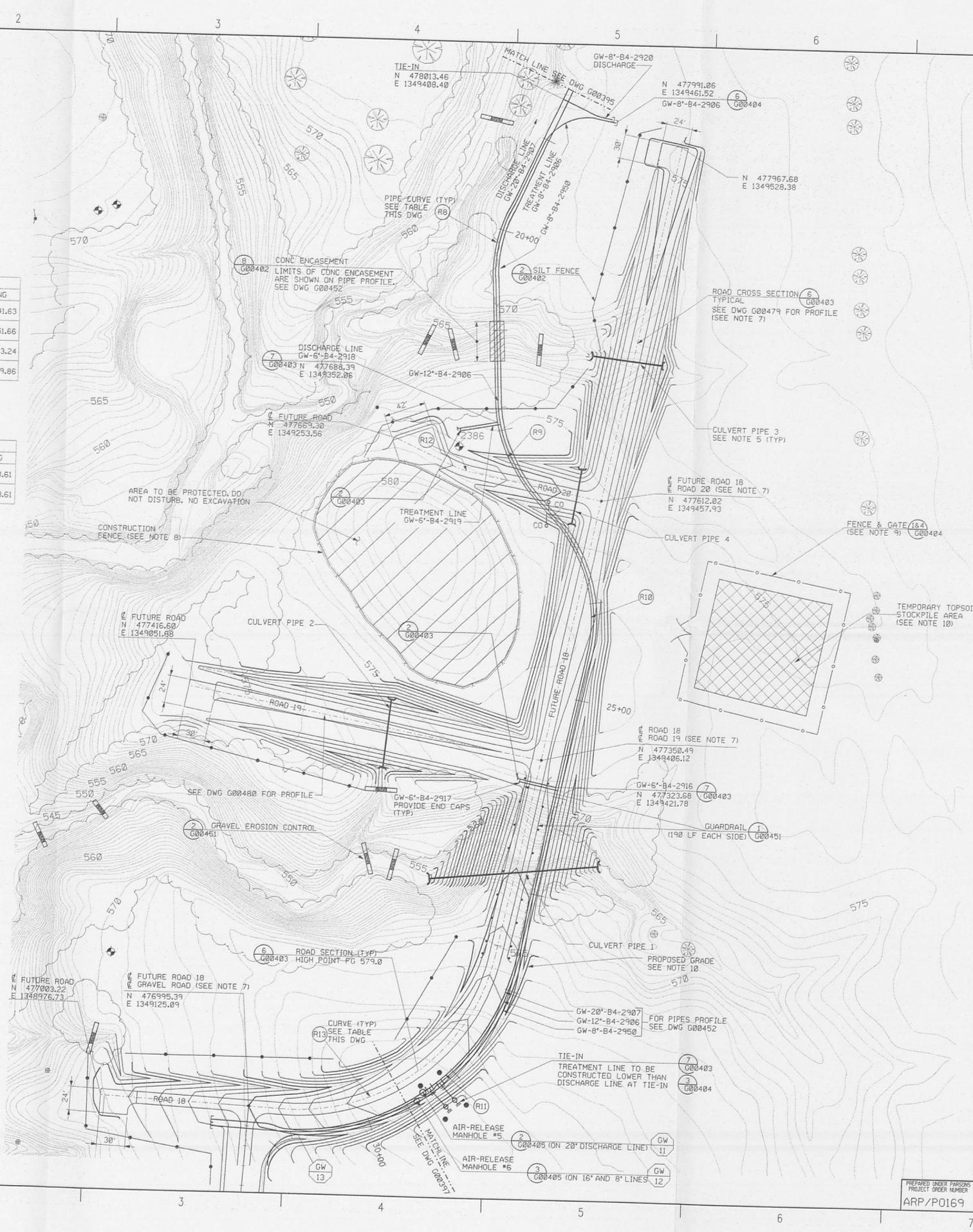
CURVE NO.	Δ	R	T	PI	
				NORTHING	EASTING
(R8)	27°28'50"	150.00'	36.49'	N 477869.36	E 1349341.63
(R9)	40°52'43"	150.00'	55.89'	N 477653.30	E 1349351.66
(R10)	54°44'17"	150.00'	77.65'	N 477535.86	E 1349463.24
(R11)	81°49'07"	220.00'	190.63'	N 476963.49	E 1349349.86

ROAD CURVE DATA

CURVE NO.	Δ	R	T	PI	
				NORTHING	EASTING
(R12)	13°18'55"	100.00'	11.68'	N 477639.62	E 1349318.61
(R13)	81°48'57.15"	200.00'	173.30'	N 476984.39	E 1349333.61

UNDERGROUND UTILITY COORDINATES (GW)

POINT	NORTHING	EASTING	DESCRIPTION
11	477814.07	1349299.22	MH #5
12	477805.13	1349293.31	MH #6
13	476967.81	1349175.23	POINT OF TANGENT



- NOTES
- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.  
PARSONS TOPOGRAPHY 1992  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
FERMCO FIELD SURVEY 6/95
  - LOCATION AND DEPTH OF UNDERGROUND FEATURES AND UTILITIES ARE APPROXIMATE. CONTRACTOR IS TO LOCATE FEATURES AND UTILITIES PRIOR TO EXCAVATION FOR CONSTRUCTION. IF LOCATION AND DEPTH ARE DIFFERENT, OR UNKNOWN UNCHARTED UTILITIES ARE DISCOVERED, CONTRACTOR IS TO INFORM FDF CONSTRUCTION MANAGER BEFORE PROCEEDING.
  - UNLESS OTHERWISE NOTED ALL MATERIALS SHALL CONFORM TO THE STATE OF OHIO DEPARTMENT OF TRANSPORTATION (ODOT) CONSTRUCTION AND MATERIAL SPECIFICATIONS DATED JANUARY 1, 1997.
  - ALL DISTURBED SURFACES SHALL BE SEEDED AT PROJECT COMPLETION UNLESS OTHERWISE NOTED.
  - FOR LENGTH, SIZE, AND COORDINATES OF CULVERT PIPE SEE PIPE DETAIL 3 ON DWG 95X-5900-G-00451.
  - INSTALLATION OF THE GW-8" LINE SHALL BE IN A COMMON TRENCH WITH THE DISCHARGE LINE AND TREATMENT LINE. A CLEARANCE OF 1'-0" SHALL BE MAINTAINED BETWEEN THE PIPES, WITH A MINIMUM COVER OF 3'-6" OVER THE PIPES.
  - GRAVEL FOR ROAD IS BY OTHERS (SFES).
  - LOCATION AND PLACEMENT OF THE CONSTRUCTION FENCE AROUND THE AREA NOT TO BE DISTURBED SITE WILL BE SUPERVISED BY FDF.
  - LOCATION OF FENCE WILL VARY, DEPENDENT ON QUANTITY OF MATERIAL STOCKPILED. MAINTAIN 10' MIN. FROM TOE OF STOCKPILE TO FENCE.
  - THE TOP 6" OF ALL EXCAVATION/GRADING SHALL NOT BE REUSED. MATERIAL IS TO BE HANDLED SEPARATELY AND STOCKPILED AT LOCATIONS SHOWN. GRADE AND SEED STOCKPILE IN ACCORDANCE WITH SPECIFICATIONS.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00395	PLAN AND PROFILE
95X-5900-G-00397	PLAN AND PROFILE
95X-5900-G-00402	DETAILS - 1 OF 5
95X-5900-G-00403	DETAILS - 2 OF 5
95X-5900-G-00404	DETAILS - 3 OF 5
95X-5900-G-00405	DETAILS - 4 OF 5
95X-5900-G-00451	DETAILS - 5 OF 5
95X-5900-G-00452	PIPE PROFILE
95X-5900-G-00479	ROAD 18 PROFILE
95X-5900-G-00480	ROAD 19 AND ROAD 20 PROFILES

**INFORMATION ONLY**

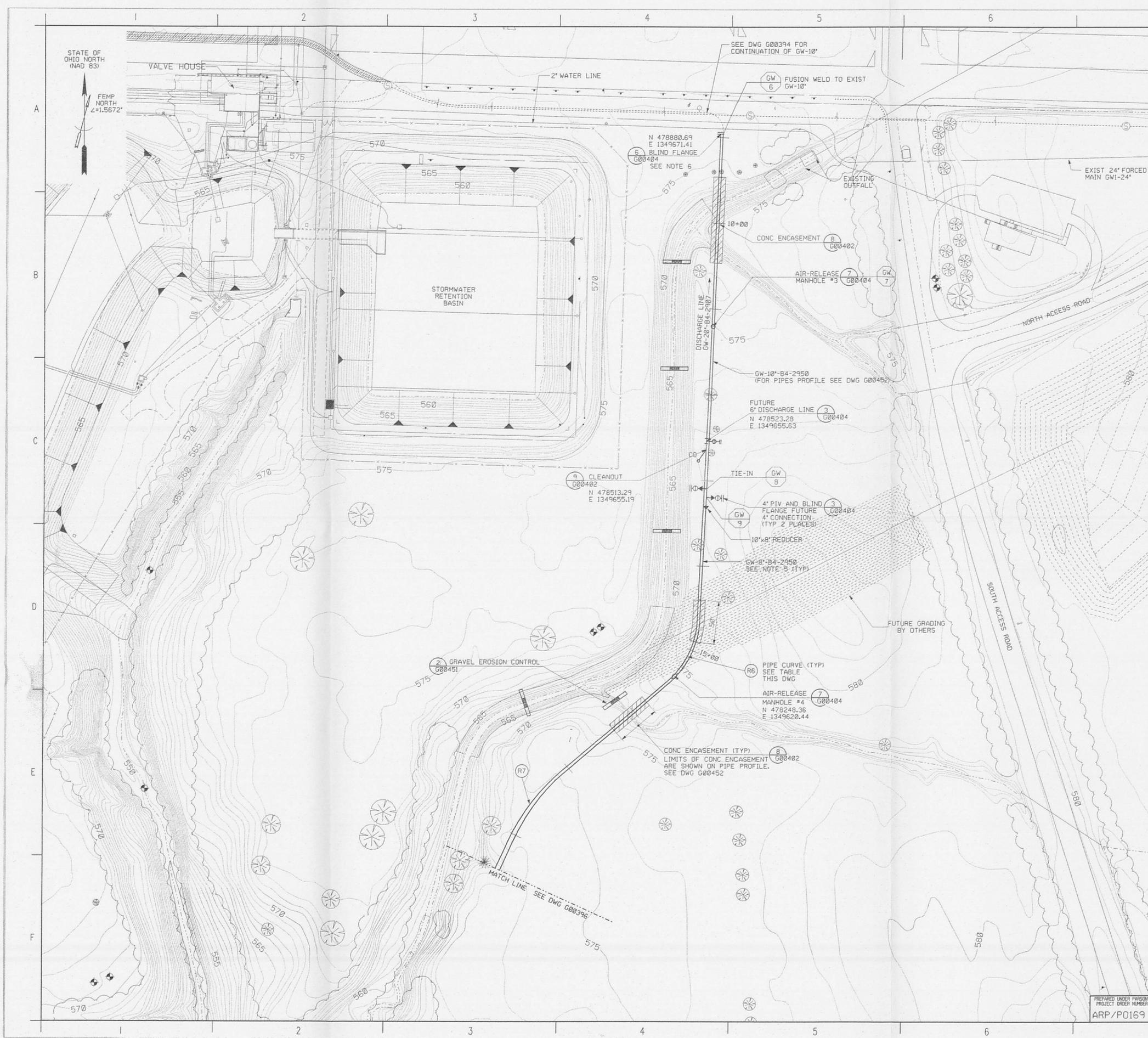
0	CERTIFIED FOR CONSTRUCTION	NA	6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**  
 DRAWING TITLE  
**CIVIL GRADING/UTILITY PLAN**  
 2 OF 2

DRAWN BY Y. HFSHAR	DATE 10/08/95	LEAD ENGINEER R. GARDNER	DATE 6/13/97	CHECKED BY E. KUBRIN	DATE 11/4/96
PLANT/REG. NO.	FLOOR	SCALE 1" = 40'	CLASS	FERMCO PROJECT NO. ID-53100	REV. NO.

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DATE 6/13/97	FERMCO PROJECT NO. WBS 1.1.1.5.3 00-90701	DRAWING CHECK CODE NO. 95X-5900-G-00396	SHEET NO. G0005	REV. NO. 0
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- NOTES
- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.  
PARSONS TOPOGRAPHY 1992  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
FERMCO FIELD SURVEY 6/95
  - LOCATION AND DEPTH OF UNDERGROUND FEATURES AND UTILITIES ARE APPROXIMATE. CONTRACTOR IS TO LOCATE FEATURES AND UTILITIES PRIOR TO EXCAVATION FOR CONSTRUCTION. IF LOCATION AND DEPTH ARE DIFFERENT, OR UNKNOWN UNCHARTED UTILITIES ARE DISCOVERED, CONTRACTOR IS TO INFORM FDF CONSTRUCTION MANAGER BEFORE PROCEEDING.
  - UNLESS OTHERWISE NOTED ALL MATERIALS SHALL CONFORM TO THE STATE OF OHIO DEPARTMENT OF TRANSPORTATION (ODOT) CONSTRUCTION AND MATERIAL SPECIFICATIONS DATED JANUARY 1, 1997.
  - ALL DISTURBED SURFACES SHALL BE SEEDED AT PROJECT COMPLETION UNLESS OTHERWISE NOTED.
  - INSTALLATION OF THE GW-10\" OR GW-8\" LINE SHALL BE IN A COMMON TRENCH WITH THE GW-20\" DISCHARGE LINE. A CLEARANCE OF 1'-0\" SHALL BE MAINTAINED BETWEEN THE PIPES, WITH A MINIMUM COVER OF 3.5' OVER THE PIPES.
  - TIE-IN OF GW-20\" TO GWI-24\" WILL BE DONE BY OTHERS (SFES).

DISCHARGE PIPE CURVE DATA

CURVE NO.	Δ	R	T	P1	
				NORTHING	EASTING
(R6)	46°46'40"	100.00'	43.25'	N 478270.14	E 1349673.91
(R7)	24°36'49"	250.00'	54.55'	N 478102.27	E 1349448.71

(GW) UNDERGROUND UTILITY COORDINATES

POINT	NORTHING	EASTING	DESCRIPTION
6	478880.55	1349674.43	EXIST CAP
7	478656.59	1349663.03	MH #3
8	478467.69	1349656.19	10\" x 4\" TEE
9	478457.67	1349655.75	10\" x 4\" TEE
10			NOT USED

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00394	PLAN AND PROFILE
95X-5900-G-00396	GRADING/UTILITY PLAN
95X-5900-G-00402	DETAILS - 1 OF 5
95X-5900-G-00404	DETAILS - 3 OF 5
95X-5900-G-00452	PIPE PROFILE

INFORMATION ONLY

0	CERTIFIED FOR CONSTRUCTION	NA	6/19/96
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO DATE

UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

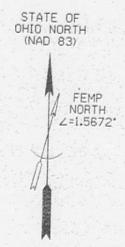
PROJECT NAME  
**SOUTH PLUME OPTIMIZATION  
AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**CIVIL  
GRADING/UTILITY PLAN  
1 OF 2**

DRAWN BY Y. AF SHAR	DATE 10/08/96	LEAD ENGINEER E. KUBRIN	DATE 6/13/97	CHECKED BY E. KUBRIN	DATE 11/4/96
PLANT/BLDG. NO.	FLOOR	SCALE 1" = 40'	CLASS	SUBMITTED FOR APPROVAL	
FERMCO CRU APPROVAL NA		FERMCO PROJECT NO. ID-53100		DATE 6/13/97	
PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/PO169	FEMP PROJECT NO. WBS 1.1.1.15.3 00-90701	DRAWING INDEX CODE NO. 95X-5900-G-00395	SHEET NO. G0004	REV. NO. 0	







- NOTES
- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA LISTED BELOW:  
EXISTING SITE DATA SOURCE (IN PLANT FILES)  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
PARSONS TOPOGRAPHY, 1992
  - UTILITIES SHALL BE ROUTED IN COMMON TRENCH WITH OTHER PROPOSED UTILITIES (FOR THE SOUTH FIELD EXTRACTION SYSTEM (SFES)).
  - WORK RELATED TO SOUTH PLUME OPTIMIZATION WELLS WILL BE FLUOR DANIEL FERNALD PROJECT NO. SPO-53300, AND WORK RELATED TO INJECTION DEMONSTRATION WELLS WILL BE FLUOR DANIEL FERNALD PROJECT NO. ID-53100.
  - ALL PIPING IS TO BE SLOPED AWAY OR AT 0% BETWEEN AIR RELEASE VALVES.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS
95X-5900-G-00393	PLAN AND PROFILE
95X-5900-G-00394	PLAN AND PROFILE
95X-5900-G-00395	GRADING/UTILITY PLAN
95X-5900-G-00396	GRADING/UTILITY PLAN
95X-5900-G-00397	PLAN AND PROFILE
95X-5900-G-00398	PLAN AND PROFILE
95X-5900-G-00399	PLAN AND PROFILE
95X-5900-G-00400	PLAN AND PROFILE

INFORMATION ONLY

<input type="checkbox"/>	CERTIFIED FOR CONSTRUCTION	NA	6/18/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	INITIALS	DATE

UNITED STATES DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION**

DRAWING TITLE  
**CIVIL OVERALL SITE PLAN**

DRAWN BY Y. AFSHAR	DATE 05/27/96	LEAD ENGINEER K. Grand	DATE 4/13/97	CHECKED BY E. KUBRIN	DATE 11/14/96
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS	1"=200'	FEMP/DOE PROJECT NUMBER

SUBMITTED FOR APPROVAL  
DATE  
6/18/97

FEMP/DOE PROJECT NO. WBS 1.1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-G-00392	SHEET NO. G0001	REV. NO. 0
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PREPARED UNDER PARSONS PROJECT ORDER NUMBER  
ARP/P0169



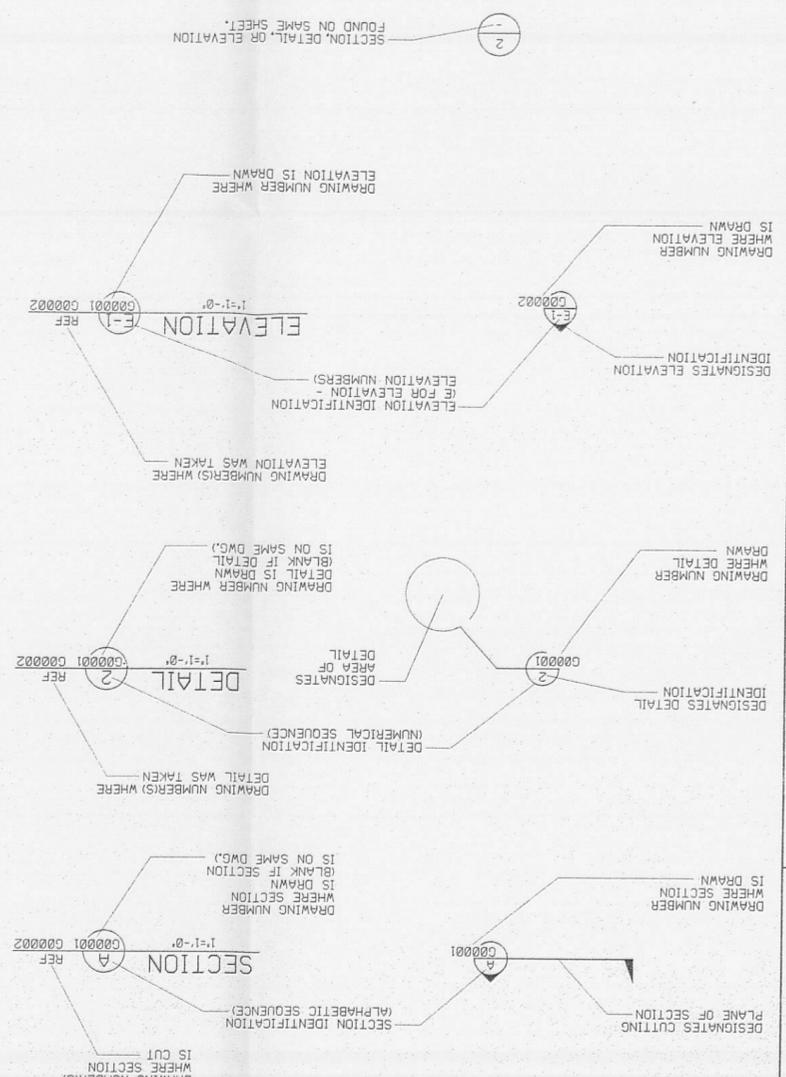
CONSTRUCTION BY OTHERS

- AWT ADVANCED WASTEWATER TREATMENT
- FEMP FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
- SFE3 SOUTH FIELD EXTRACTION SYSTEM
- SPO SOUTH PLUME OPTIMIZATION
- ID INJECTION DEMONSTRATION
- SDR STANDARD DIMENSION RATIO

ABBREVIATIONS

NOTE:  
DIMENSIONS AND/OR ELEVATIONS MARKED BY CONSTRUCTION SHALL BE VERIFIED IN THE FIELD. DIMENSIONS AS SHOWN, DO NOT SCALE. (NOT TO SCALE) IS SHOWN ONLY WHERE DIMENSION IS OBVIOUSLY OUT OF SCALE.

NOTE:  
ABBREVIATED DRAWING NUMBERS WILL BE USED FOR ALL SECTIONS, DETAILS, ELEVATIONS, AND WITHIN NOTES AND CALL OUTS IN THE BODY OF THE DRAWING. FOR EXAMPLE: 95X-5900-0-00002 = DRAWING NUMBER G00002 = ABBREVIATED DRAWING NUMBER



GENERAL LEGEND

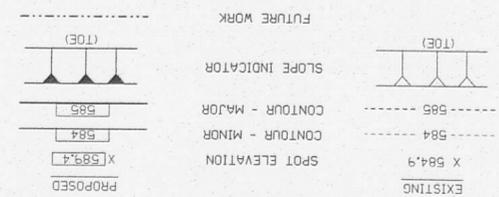
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FG	FG
DW	DW
FOI	FOI
LS	LS
WS	WS
WR	WR
TW	TW
CE	CE
FT	FT
DF	DF
PW	PW
BR	BR
RW	RW
A	A
CN	CN
VE	VE
SD	SD
SL	SL
E	E
OE	OE
T	T
G	G
PA	PA
SA	SA
ST	ST
SN	SN
FG	FG
DW	DW
FOI	FOI
LS	LS
WS	WS
WR	WR
TW	TW
CE	CE
FT	FT
DF	DF
PW	PW
BR	BR
RW	RW
A	A
CN	CN
VE	VE
SD	SD
SL	SL
E	E
OE	OE
T	T
G	G
PA	PA
SA	SA

UTILITY SYMBOLS

BALLOON LEGEND

- ST STORM SEWER
- SN SANITARY SEWER
- FG FUEL GAS
- DW DRINKING WATER
- FOI FIRE PROTECTION
- LS LIVE STEAM
- WS WATER SUPPLY
- WR COOLING WATER RETURN
- TW PROCESS WATER
- CE CONTAMINATE WATER
- FT FILTERATE OR EFFLUENT
- DF DEIONIZED FEED
- PW DEIONIZED WATER
- BR BRINE
- RW RAW WATER
- A ALARM
- CN STEAM CONDENSATE
- VE VENT LINES
- SD SUB-SURFACE DRAINAGE
- SL SUMP LIQUOR
- E ELECTRICAL
- OE OVERHEAD ELECTRICAL
- T TELEPHONE
- G ELECTRIC GROUND
- PA PLANT AIR
- SA ABANDONED INSTRUMENT AIR SUPPLY

GRADING SYMBOLS



SYMBOLS LEGEND

- | PROPOSED                      | EXISTING                      |
|-------------------------------|-------------------------------|
| POST INDICATOR VALVE (PIV)    | POST INDICATOR VALVE (PIV)    |
| FIRE HYDRANT (FH)             | FIRE HYDRANT (FH)             |
| MANHOLE (MH)                  | MANHOLE (MH)                  |
| CATCH BASIN (CB)              | CATCH BASIN (CB)              |
| POLE                          | POLE                          |
| PIPE SUPPORT                  | PIPE SUPPORT                  |
| PIPE MANHOLE                  | PIPE MANHOLE                  |
| TELEPHONE MANHOLE             | TELEPHONE MANHOLE             |
| STREET WASHERS                | STREET WASHERS                |
| VALVE BOX                     | VALVE BOX                     |
| MONITORING WELL               | MONITORING WELL               |
| SURFACE DRAINAGE FLOW         | SURFACE DRAINAGE FLOW         |
| GRAVEL ROADWAY/DRIVEWAY       | GRAVEL ROADWAY/DRIVEWAY       |
| ASPHALT ROADWAY/DRIVEWAY      | ASPHALT ROADWAY/DRIVEWAY      |
| CONCRETE PAD/ROADWAY/DRIVEWAY | CONCRETE PAD/ROADWAY/DRIVEWAY |
| BUILDING/TRAILER              | BUILDING/TRAILER              |
| RAILROAD TRACK                | RAILROAD TRACK                |
| OU BOUNDARY                   | OU BOUNDARY                   |
| FENCE                         | FENCE                         |
| TREE LINE                     | TREE LINE                     |
| DECIDUOUS TREE                | DECIDUOUS TREE                |
| CONIFEROUS TREE               | CONIFEROUS TREE               |
| CENTRAL DRAINAGE DITCH        | CENTRAL DRAINAGE DITCH        |
| RIVER/CREEK                   | RIVER/CREEK                   |
| TO BE REMOVED                 | TO BE REMOVED                 |
| SILT FENCE                    | SILT FENCE                    |
| ELECTRICAL TRANSFORMER        | ELECTRICAL TRANSFORMER        |
| HEADWALL                      | HEADWALL                      |
| BENCH MARK                    | BENCH MARK                    |
| CONSTRUCTION/WIND BARRIER     | CONSTRUCTION/WIND BARRIER     |
| FENCE                         | FENCE                         |
| SIGN                          | SIGN                          |
| BOLLARD/GUARD POST            | BOLLARD/GUARD POST            |
| ELECTRICAL PULL BOX           | ELECTRICAL PULL BOX           |
| SURVEY CONTROL POINT          | SURVEY CONTROL POINT          |
| ROAD CENTERLINE OR BASELINE   | ROAD CENTERLINE OR BASELINE   |
| BEND                          | BEND                          |
| TEE                           | TEE                           |
| THRUST BLOCK                  | THRUST BLOCK                  |
| REDUCER                       | REDUCER                       |
| UNKNOWN                       | UNKNOWN                       |
| STRAW BALE SILT BARRIER       | STRAW BALE SILT BARRIER       |
| FENCE GATE                    | FENCE GATE                    |
| INJECTION WELL                | INJECTION WELL                |
| OPTIMIZATION WELL             | OPTIMIZATION WELL             |

LEGEND AND SYMBOLS

PROJECT NAME: SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION  
 PROJECT NO: 95X-5900-X-00412  
 DRAWING NO: 95X-5900-X-00412

INFORMATION ONLY

REV	NO.	DATE	DESCRIPTION
0		6/13/99	CERTIFIED FOR CONSTRUCTION

REF DWG NO.	DRAWING TITLE
95X-5900-X-00410	PROJECT TITLE SHEET
95X-5900-X-00411	DRAWING INDEX

NOTES

UNITED STATES DEPARTMENT OF ENERGY  
 FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NO: 95X-5900-X-00412  
 DRAWING NO: 95X-5900-X-00412  
 SHEET NO: 0

INDEX CODE NO.	DRAWING NO.	SHEET NO.	REVISION NO.	DRAWING TITLE	REMARKS
95X-5900-X-00410	X0001	0	0	PROJECT TITLE SHEET	
95X-5900-X-00411	X0002	0	0	DRAWING INDEX	
95X-5900-X-00412	X0003	0	0	LEGEND AND SYMBOLS	
95X-5900-C-00392	G0001	0	0	CIVIL - OVERALL SITE PLAN	
95X-5900-C-00393	G0002	0	0	CIVIL - PLAN AND PROFILE - 1 OF 6	
95X-5900-C-00394	G0003	0	0	CIVIL - PLAN AND PROFILE - 2 OF 6	
95X-5900-C-00395	G0004	0	0	CIVIL - GRADING/UTILITY PLAN - 1 OF 2	
95X-5900-C-00396	G0005	0	0	CIVIL - GRADING/UTILITY PLAN - 2 OF 2	
95X-5900-C-00397	G0006	0	0	CIVIL - PLAN AND PROFILE - 3 OF 6	
95X-5900-C-00398	G0007	0	0	CIVIL - PLAN AND PROFILE - 4 OF 6	
95X-5900-C-00399	G0008	0	0	CIVIL - PLAN AND PROFILE - 5 OF 6	
95X-5900-C-00400	G0009	0	0	CIVIL - PLAN AND PROFILE - 6 OF 6	
95X-5900-C-00401	G0010	0	0	CIVIL - 50K HOLDING TANK AREA ENLARGEMENT	
95X-5900-C-00402	G0011	0	0	CIVIL - DETAILS - 1 OF 5	
95X-5900-C-00403	G0012	0	0	CIVIL - DETAILS - 2 OF 5	
95X-5900-C-00404	G0013	0	0	CIVIL - DETAILS - 3 OF 5	
95X-5900-C-00405	G0014	0	0	CIVIL - DETAILS - 4 OF 5	
95X-5900-C-00451	G0015	0	0	CIVIL - DETAILS - 5 OF 5	
95X-5900-C-00452	G0016	0	0	CIVIL - PIPE PROFILE	
95X-5900-C-00479	G0017	0	0	CIVIL - ROAD 18 PROFILE	
95X-5900-C-00480	G0018	0	0	CIVIL - ROAD 19 AND ROAD 20 PROFILES	
95X-5900-S-00431	S0001	0	0	STRUCTURAL - PLANS, SECTIONS, AND DETAILS - INJECTION WATER SUPPLY TANK AND PUMP PADS	
95X-5900-S-00432	S0002	0	0	STRUCTURAL - PLAN, SECTIONS, AND DETAILS - INJECTION WELLS NUMBER 8 THRU 12 PADS	
95X-5900-P-00418	P0001	0	0	PIPING/PLANT DESIGN - PIPING PLAN AND SECTION - INJECTION WATER SUPPLY TANK AND PUMPS	
95X-5900-P-00420	P0002	0	0	PIPING/PLANT DESIGN - PIPING SECTIONS - INJECTION WATER SUPPLY TANK AND PUMPS	
95X-5900-P-00419	P0003	0	0	PIPING/PLANT DESIGN - PIPING PLAN AND SECTION - INJECTION WELL NUMBER 8	
95X-5900-P-00428	P0004	0	0	PIPING/PLANT DESIGN - PIPING PLAN AND SECTION - INJECTION WELLS NUMBER 9 THRU 12	
95X-5900-P-00453	P0005	0	0	PIPING/PLANT DESIGN - PIPING PLAN - SOUTH PLUME OPTIMIZATION VALVE HOUSE	
95X-5900-P-00454	P0006	0	0	PIPING/PLANT DESIGN - PIPING SECTIONS - SOUTH PLUME OPTIMIZATION VALVE HOUSE	
95X-5900-P-00423	P0007	0	0	PIPING/PLANT DESIGN - PIPE SUPPORT DETAILS	
95X-5900-E-00455	E0001	0	0	ELECTRICAL - SINGLE LINE/ELEVATION - SOUTH PLUME INJECTION WATER SUPPLY	
95X-5900-E-00456	E0002	0	0	ELECTRICAL - SINGLE LINE/ELEVATIONS - SOUTH PLUME OPTIMIZATION VALVE HOUSE	
95X-5900-E-00457	E0003	0	0	ELECTRICAL - SCHEMATIC DIAGRAMS - SOUTH PLUME INJECTION WATER SUPPLY PUMPS	
95X-5900-E-00458	E0004	0	0	ELECTRICAL - SCHEMATIC DIAGRAMS - SOUTH PLUME OPTIMIZATION WELL PUMPS	
95X-5900-E-00471	E0005	0	0	ELECTRICAL - INTERCONNECTION DIAGRAM - SOUTH PLUME OPTIMIZATION/RECOVERY WELL PUMPS	
95X-5900-E-00459	E0006	0	0	ELECTRICAL - INTERCONNECTION DIAGRAM - SOUTH PLUME INJECTION WATER SUPPLY	
95X-5900-E-00480	E0007	0	0	ELECTRICAL - SCHEMATIC DIAGRAMS - SOUTH PLUME RECOVERY WELLS	
95X-5900-E-00461	E0008	0	0	ELECTRICAL - CABLE SCHEDULE (101-150) - SOUTH PLUME INJECTION WATER SUPPLY	
95X-5900-E-00470	E0009	0	0	ELECTRICAL - CABLE SCHEDULE (151-200) - SOUTH PLUME INJECTION WATER SUPPLY	
95X-5900-E-00462	E0010	0	0	ELECTRICAL - CABLE SCHEDULE (201-250) - SOUTH PLUME OPTIMIZATION AND RECOVERY WELLS	
95X-5900-E-00463	E0011	0	0	ELECTRICAL - CONDUIT SCHEDULE - SOUTH PLUME INJECTION WATER SUPPLY	
95X-5900-E-00464	E0012	0	0	ELECTRICAL - CONDUIT SCHEDULE - SOUTH PLUME OPTIMIZATION AND RECOVERY WELLS	
95X-5900-E-00465	E0013	0	0	ELECTRICAL - SITE POWER PLAN - INJECTION WATER PUMP AREA	
95X-5900-E-00466	E0014	0	0	ELECTRICAL - SITE POWER PLAN - SOUTH PLUME OPTIMIZATION WELL AREA	
95X-5900-E-00467	E0015	0	0	ELECTRICAL - SITE POWER PLAN - SOUTH PLUME INJECTION WELL AREA	
95X-5900-E-00468	E0016	0	0	ELECTRICAL - POWER INSTRUMENTATION AND LIGHTING PLANS - SOUTH PLUME VALVE HOUSE	
95X-5900-E-00469	E0017	0	0	ELECTRICAL - POWER PLAN - S. PLUME INJECTION WATER SUPPLY TANK AND PUMPS	
95X-5900-E-00473	E0018	0	0	ELECTRICAL - SYMBOLS AND LEGEND	
95X-5900-E-00474	E0019	0	0	ELECTRICAL - SYMBOLS AND LEGEND	
95X-5900-N-00447	N0001	0	0	MECHANICAL PROCESS - PIPING AND INSTRUMENTATION DIAGRAM - SYMBOLS AND LEGEND	
95X-5900-N-00448	N0002	0	0	MECHANICAL PROCESS - PIPING AND INSTRUMENTATION DIAGRAM - SOUTH PLUME OPTIMIZATION	
95X-5900-N-00449	N0003	0	0	MECHANICAL PROCESS - PIPING AND INSTRUMENTATION DIAGRAM - SOUTH PLUME INJECTION	
95X-5900-N-00439	N0004	0	0	INSTRUMENTATION - I/O DRAWING - INJECTION WATER SUPPLY TANK	
95X-5900-N-00438	N0005	0	0	INSTRUMENTATION - INTERCONNECTION DIAGRAM - OPTIMIZATION AND RECOVERY WELLS	
95X-5900-N-00442	N0006	0	0	INSTRUMENTATION - INTERCONNECTION DIAGRAM - INJECTION SYSTEM	
95X-5900-N-00472	N0007	0	0	INSTRUMENTATION - RENOVATE TERMINAL UNIT 22 - PANEL WIRING DIAGRAM	
95X-5900-N-00443	N0008	0	0	INSTRUMENTATION - LOGIC DIAGRAM ACRONYM LIST	
95X-5900-N-00444	N0009	0	0	INSTRUMENTATION - LOGIC DIAGRAM	
95X-5900-N-00445	N0010	0	0	INSTRUMENTATION - LOGIC DIAGRAM	
95X-5900-N-00478	N0011	0	0	INSTRUMENTATION - LOGIC DIAGRAM	
95X-5900-N-00482	N0012	0	0	INSTRUMENTATION - DCS COMMUNICATIONS PLAN - INJECTION WELLS	
95X-5900-N-00273	N0005	1	1	INSTRUMENTATION - CONTROL SYSTEM ARCHITECTURE	
95X-5900-N-00271	N0006	1	1	INSTRUMENTATION - INTERCONNECTION DIAGRAM - WELL HOUSE DCS PCS	

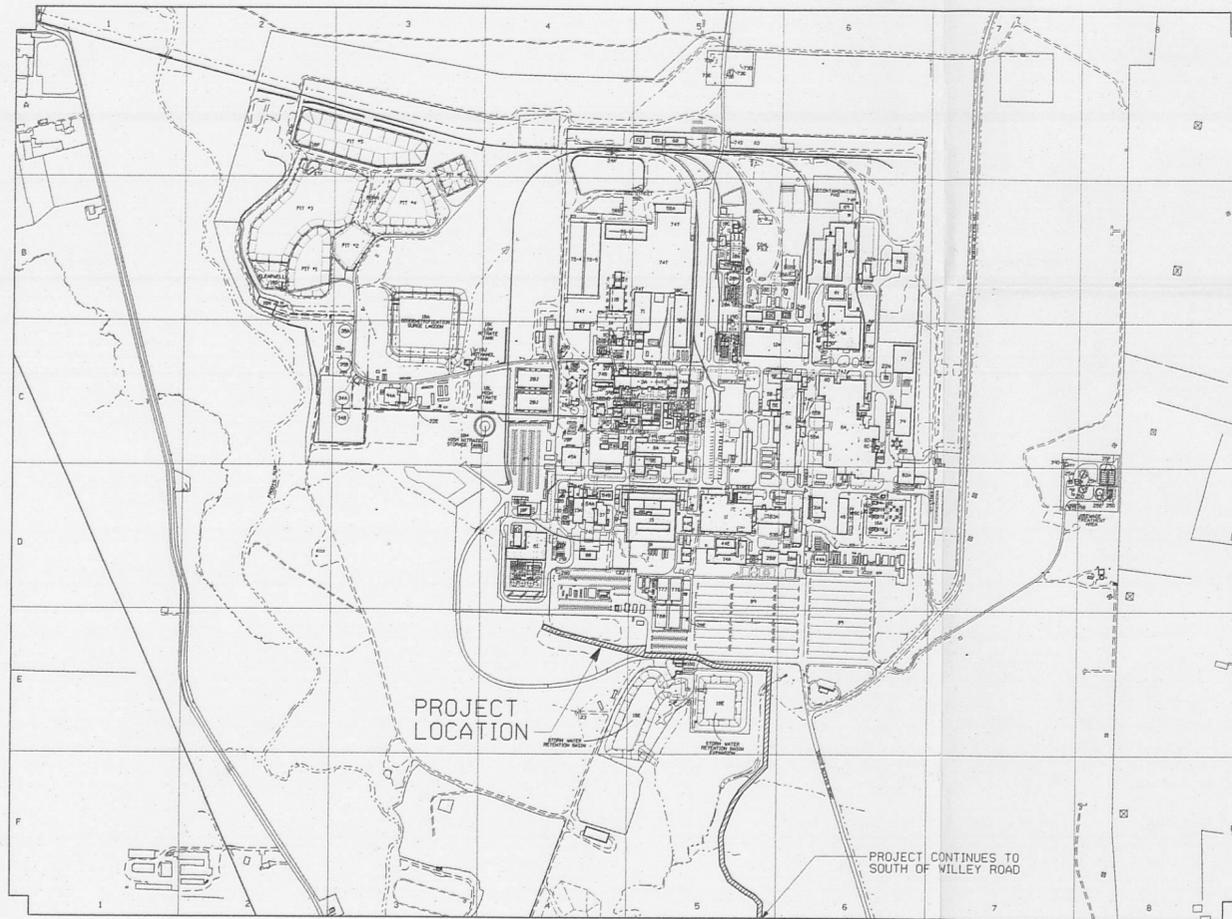
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REF DWG NO.	DRAWING TITLE
95X-5900-X-00410	PROJECT TITLE SHEET
95X-5900-X-00412	LEGEND AND SYMBOLS
<b>INFORMATION ONLY</b>	
0	CERTIFIED FOR CONSTRUCTION
DATE	INITIALS AND DATE
6/15/97	
A-E	REVISION
N/A	
PROJECT NAME <b>DEPARTMENT OF ENERGY</b> <b>UNITED STATES</b> <b>FERNALD ENVIRONMENTAL MANAGEMENT PROJECT</b>	
THIS DRAWING PREPARED BY <b>PARSONS</b> THE RALPH W. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO	
DRAWING TITLE <b>SOUTH PLUME OPTIMIZATION</b> <b>AND INJECTION DEMONSTRATION</b>	
DRAWING INDEX	
DRAWN BY R. LINDGREN	DATE 08/28/96
CHECKED BY J. GIBLIN	DATE 11/11/96
SCALE NONE	CLASS NONE
SUBMITTED FOR APPROVAL DATE 6/15/97	FERNALD ENVIRONMENTAL MANAGEMENT PROJECT NO. N/A
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DRAWING INDEX DATE 11/11/96	SHEET NO. X0099
DRAWING INDEX DATE 11/11/96	SHEET NO. X0100

# UNITED STATES DEPARTMENT OF ENERGY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

## SOUTH PLUME OPTIMIZATION AND INJECTION DEMONSTRATION

### PROJECT ORDER 169



PARSONS

The Ralph M. Parsons Company \* Parsons Main, Inc. \* Engineering-Science, Inc.

ARCHITECTS - ENGINEERS  
CINCINNATI, OHIO

NOTES

1. WORK RELATED TO SOUTH PLUME OPTIMIZATION WELLS WILL BE FLUOR DANIEL FERNALD PROJECT NO. SPO-53300, AND WORK RELATED TO INJECTION DEMONSTRATION WELLS WILL BE FLUOR DANIEL FERNALD PROJECT NO. ID-53100.

REF DWG NO.	DRAWING TITLE
95X-5900-X-00411	DRAWING INDEX
95X-5900-X-00412	LEGEND AND SYMBOLS

INFORMATION  
ONLY

<input checked="" type="checkbox"/>	CERTIFIED FOR CONSTRUCTION	<i>M</i>	N/A	6/13/97
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A/E	FEMCO	DATE

**UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**SOUTH PLUME OPTIMIZATION  
AND INJECTION DEMONSTRATION**  
DRAWING TITLE

PROJECT TITLE SHEET

DRAWN BY K.L. RABBITT	DATE 06/28/96	LEAD ENGINEER <i>R. G. ...</i>	DATE 06/13/97	CHECKED BY E. KUBRIN	DATE 11/11/96
PLANT/BLDG. NO.	FLOOR	SCALE	NONE	CLASS	
SUBMITTED FOR APPROVAL <i>M</i>		FEMCO CRU APPROVAL N/A	FEMCO PROJECT NO. SPO-53300	ID-53100	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER ARP/P0169	DATE 06/28/96	FEMCO PROJECT NO. WBS 1.1.1.1.1.2.1 00-90701	DRAWING INDEX CODE NO. 95X-5900-X-00410	SHEET NO. X0001	REV. NO. 0
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