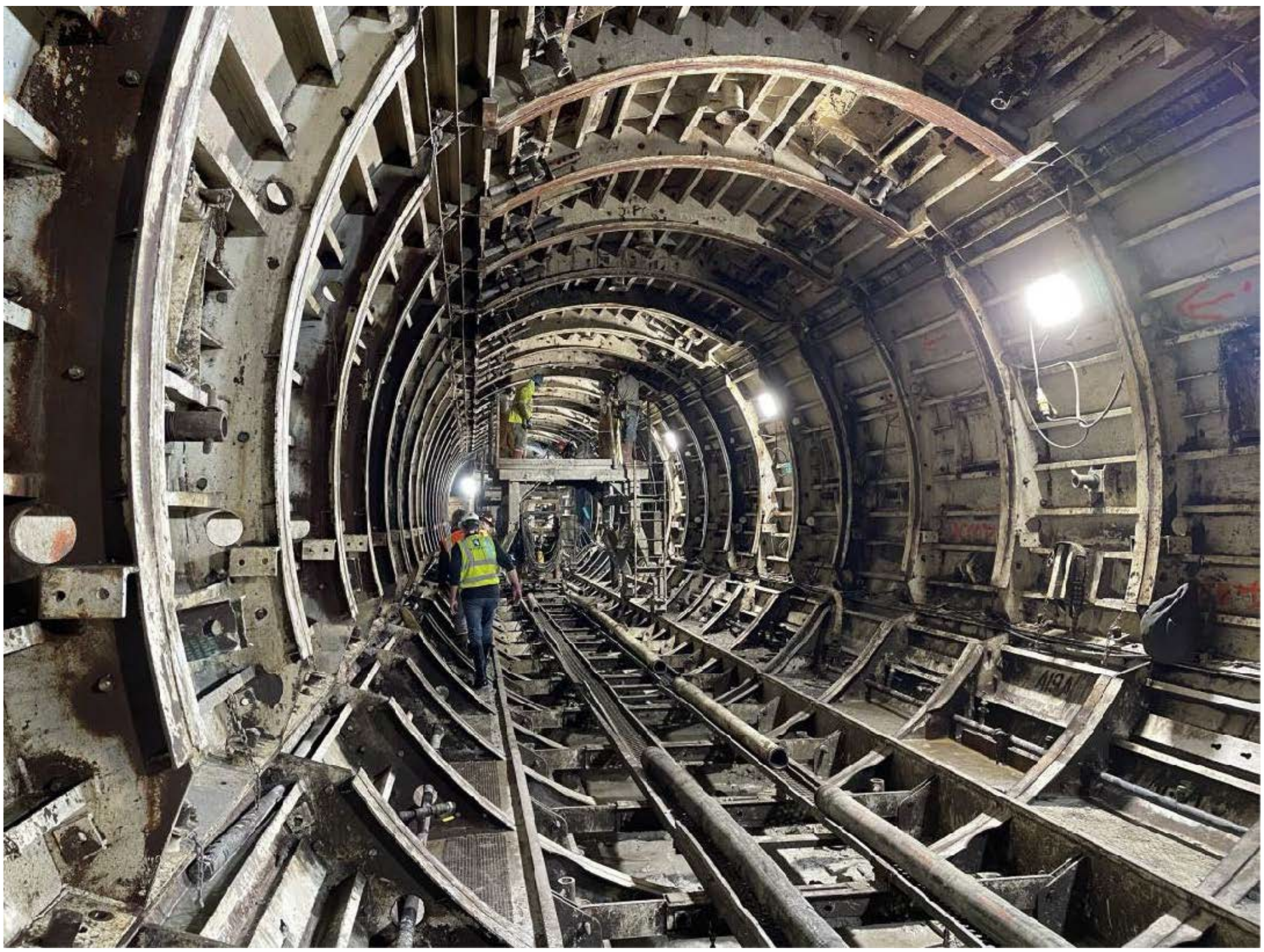
SANITARY STANDARDS MANUAL



Revision Date: January 2025

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Section	Sanitary Revision
101.05 Enforcement of Standards	Change line from “to be taken by the director…” to “to be taken by any CEG director”
103.04 Connection Fee and EDU Calculation	Added new paragraph 3 which details a $2000 sewer connection fee
201.07.2c Length	Added new section c with paragraph about stub length
201.08 Cleanouts	Updated to refer to correct detail (400.09 to 400.10)
204.02 Easements	Added new language regarding easements along frontages of new developments
204.07 Aerial Crossings, Conflict Resolution Structures, and Siphons	Added language for conflict resolution structures
502.05 Lift Stations	Minor additions relevant to Westfield, formatting, language simplification.
502.06 Lift Station Type	Updated to reflect CWA Authority and Westfield’s preferences.
502.08 Initial Pump Capacity	Addition of standby generator, automatic transfer switch, and cabling to language.
502.12 Wet Well Sizing	Formatting Changes
503.05 Power Requirements	Add line: "as normal power source (a standby generator is not considered the normal power source.)" at end of first paragraph
503.07.1 Lift Station Components	Created new section d, Corrosion Resistant Interior Lining
503.07.4 a Lift Station Components	Changed psi to psf
503.07.6 Lift Station Components	Added paragraph about interior safety hatches being provided with valve and meter vaults
503.07.10 Lift Station Components	Added text for conduits
503.07.11 Lift Station Components	Changed wording in paragraph for control and power cables
503.07.12 Removable Bollards	Updated requirements.

Revisions Summary	
503.08.4 Control System Requirements – Level 2 and 3 Lift Stations in CWA Authority	Restructured section. Level 2 and 3 lift station in CWA territory
503.08.4e Control System Requirements	Changed wording for cellular module and antennas
503.08. 6 or 5 Required Components and Standard Parts List	Updated Level 2 and 3 Station Lists
503.10 Control System Requirements in Westfield	Restructured entire section
503.11 Not Used	Removed Section 503.11: Incorporated any differences to the LS Components under section 503.07
504.11 Service Line (Grinder Pump) Connections to Gravity Mains	New section added
Westfield Constant Speed Submersible Lift Station, E-1, Sheet # 500.017	Updated Drawing
Westfield Constant Speed Submersible Lift Station, E-2, Sheet # 500.018	Updated Drawing
Westfield Constant Speed Submersible Lift Station, E-3, Sheet # 500.019	Updated Drawing
Westfield Constant Speed Submersible Lift Station, IC-1, Sheet # 500.020	Updated Drawing
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CHAPTER 100 POLICIES AND PROCEDURES

Section 101 Introduction

101.01 Purpose

This Manual provides the design and construction standards for laterals and sanitary sewer facilities constructed within the CWA Authority and/or the Citizens Wastewater of Westfield, LLC (Westfield) service territory ("Utility"). Included are submittal requirements and procedures for the issuance of Approvals and Permits, and the requirements and procedures for inspection, testing, and final acceptance of sanitary sewer facilities.

The Utility has been granted authority through the Sewage Disposal Service Tariff Rates, Terms, and Conditions for Sewage Disposal Service within Marion County, Indiana and Contiguous Areas, and the Sewage Disposal Service Tariff Rates, Terms, and Conditions for Sewage Disposal Service within Westfield, Indiana and Contiguous Areas ("Terms and Conditions").

All provisions of the Terms and Conditions and subsequent revisions, whether stated herein or not, are made fully a part of this Manual.

This Manual presumes its user will possess a basic understanding in civil engineering design, construction, or land alteration. Readers of this Manual who are not qualified by education or experience should consult with a more qualified person or persons possessing professional expertise in one or more of these fields prior to application of the requirements set forth herein.

This Manual, together with all future revisions, will be referred to as the "Citizens Energy Group Sanitary Standards".

All information required to be submitted by this Manual will be made available to any person upon written request to the Utility.

101.02 Sanitary Sewer Manual Organization

This Manual is organized to present procedures and criteria needed for the design and construction of laterals and sanitary sewer facilities.

Each chapter contains an initial introduction Section which states the intent of the Section. The remaining Sections present all the requirements applicable to the Chapter.

101.03 Updating

This Manual may be reviewed annually and updated when necessary, to reflect up-to-date engineering practices and information applicable to the CWA Authority, Inc and/or Citizens Westfield.

The Utility may make revisions or clarifications to any part of this Manual through policy prior to the annual update, if deemed necessary.

101.04 Definitions and Abbreviations

Whenever in these Standards or in any documents or instruments where the Standards govern, the following terms, abbreviations, or definitions are used, the intent and meaning will be interpreted as follows:

1. Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADF	Average Daily Flow
ANSI	American National Standards Institute
ASTM	American Society of Testing and Materials
AWWA	American Water Works Association
CADD	Computer Aided Design and Drafting
CCTV	Closed Circuit Television
CSO	Combined Sewer Overflow
DIP	Ductile Iron Pipe
DU&SE	Drainage, Utility, and Sanitary Easement
EDU	Equivalent Dwelling Unit
EPA	Environmental Protection Agency
FRP	Fiberglass Reinforced Plastic or Polyester
GFI	Ground Faulting Interrupting
GIS	Geographic Information System
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene Pipe
HOA	Homeowners Association
I/I	Inflow/Infiltration
IAC	Indiana Administrative Code
IC	Indiana Code
IDEM	Indiana Department of Environmental Management
IMS	Infrastructure Management System
INDOT	Indiana Department of Transportation
IPC	Indiana Pumping Code 675 IAC 16
ISDH	Indiana State Department of Health
LTCP	Long-Term Control Plan
MCH&CH	Marion County Health and Hospital Corporation
MCP	Motor Circuit Protector
NEMA	National Electrical Manufacturers Association
OIU	Operator Interface Unit
OSHA	Federal Occupational Safety and Health Act
P&ID	Piping and Instrumentation Drawings
PCCP	Prestressed Concrete Cyclinder Pipe
PLC	Programmable Logic Controller
PMR	Phase Monitor Relay
PVCP	Polyvinyl Choride Pipe
RCP	Reinforced Conrete Pipe
RPR	Resident Project Representative

RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
STEP	Septic Tank Elimination Program
TBH	Total Dynamic Head
TBM	Tunnel Boring Machine
TVSS	Transient-Voltage Surge Suppressor
UPC	Uniform Plumbing Code
UPS	Uninterruptible Power Supply
VCP	Vitrified Clay Pipe
VFD	Variable-Frequency Drive

2. Definitions

15-YEAR LAW AGREEMENT: A contract that effectuates an applicant's ability to construct and install a sanitary sewer facility under the provisions of Indiana Code (IC) 36-9-22 et.seq.

ACCEPTANCE: The formal written acceptance by the Utility of an entire project which has been completed in all respects in accordance with the approved plans, specifications, and this Manual including any previously approved modifications thereof.

APPLICANT: The property owner and/or their agent who requests and fills out an application for any type of permit or agreement required by this Manual.

APPROVAL: Decision that allows the applicant to proceed to the next step of the permitting process set out in this Manual.

AUGER BORING: Trenchless construction method for installing sewers.

BACKFILL: Material used to replace material removed from trenches during construction which is above the haunching (See Figure 100.01).

BEDDING: The material used in the trench to a minimum depth below the bell/barrel of the pipe for the purpose of properly supporting the pipe (See Figure 100.01).

BOARD: Board of Directors of CWA Authority, Inc.

BUILDING SEWER: An alternate term for laterals. See laterals definition.

CLEANOUT: A pipe fitting with a removable plug for inspecting and cleaning laterals.

CODE: Municipal Code of the City of Indianapolis

COMBINED SEWER: A sewer which has been designed or intended to receive both surface runoff and sewage.

COMMON laterals: A laterals which serves more than one building or residential unit.

CONNECTION FEE: Assessment to compensate the CWA Authority and/or Citizens Westfield for all the costs of capacity for the CWA Authority and/or Citizens Westfield sewer system including the entire combined sewer system and its treatment facilities.

CONTRACTOR: Any Contractor who meets the Utility's requirements to perform the work of installing sewers under the Utility's jurisdiction.

COUNTY: The county of Marion or Hamilton, State of Indiana.

DEDICATION: The inspection, and if necessary, the rehabilitation of a sanitary sewer facility for public acceptance, ownership, operation, and maintenance.

DIGITAL DATA SUBMISSION STANDARDS: Standards in which the CWA Authority and/or Citizens Westfield can integrate Computer Aided Design and Drafting (CADD) drawings into the Geographical Information System (GIS) and Infrastructure Management System (IMS) environment thus maintaining the integrity and positional accuracy of the data.

DIRECTOR: Director- Underground Engineering & Construction or authorized representative.

EASEMENT: Areas along the line of all public sanitary sewer facilities which are outside the road easements or rights-of-way, and are recorded and dedicated to the Utility granting rights along the line of the sanitary sewer facility.

EQUIVALENT DWELLING UNIT (EDU): Unit used to calculate the connection fee.

ENGINEER: The Engineer for the Owner.

FINAL BACKFILL: Material used to replace material removed from trenches during construction which is above the initial backfill (See Figure 100.01).

FORCE MAIN: A pipe that carries wastewater under pressure from a lift station.

FOUNDATION: The supporting material upon which the bedding is placed.

FOUNDATION DRAINS: Any network of pipes, pumps or drainage mechanism located at, near, or under a footing, foundation or floor slab of any building or structure that intentionally or unintentionally conveys groundwater away from a building or structure.

HAUNCHING: The area in the trench from the top of the bedding to the springline of the pipe. (See Figure 100.01).

HORIZONTAL DIRECTIONAL DRILLING (HDD): Trenchless construction method for installing sewer pipe.

INFILTRATION/INFLOW (I/I): The total quantity of water from both infiltration and inflow without distinguishing the source.

INITIAL BACKFILL: Material used in the trench above the haunching. (See Figure 100.01).

LAND SURVEYOR: A person registered as a land surveyor by the Indiana State Board of Registration as provided by IC 25-21.5.

LATERAL: A pipe used for transporting waste from the building to the public or private sewer commencing at and including the cleanout, and ending at and excluding the wye or tee fitting at the connection to the sanitary or combined sewer. Same as Building Sewer.

LATERAL CONNECTION: Shall mean the point in which a lateral is connected to a sanitary or combined sewer.

LIFT STATION: Any arrangement of pumps, valves and controls that lift, and/or convey wastewater to a higher elevation. Same as Pump Station.

LOW PRESSURE SYSTEM: A wastewater collection system in which multiple users pump wastewater into a common force main.

MANHOLE: A structure used in a sewer system to provide access for maintenance.

MANUAL: Citizens Energy Group Sanitary Standards

MANUFACTURER: The producer of those materials required by this Manual having direct responsibility and authority for the satisfaction of those minimum material specifications set forth herein.

NEW CONNECTION: Shall mean a new lateral connection to the CWA Authority and/or Citizens Westfield sewer system, or a repair, replacement or modification to an existing lateral that increases the capacity of the lateral to accommodate a proposed increase in the average daily flow.

OWNER: Any individual, partnership, firm, corporation or other entity who, as property owner, is initiating the Work.

PERMIT: Clearance to perform specific work under specific conditions at specific locations.

PIPE JACKING: Trenchless construction method for installing sewer pipe.

PLANS: Construction plans which show the location, character, dimensions, and details of the work to be done.

PRIVATE SEWER: Any sanitary sewer facility that is not dedicated as public.

PROFESSIONAL ENGINEER: A person registered as a professional engineer by the Indiana State Board of Registration for Professional Engineers under IC 25-31.

PUBLIC SEWER: Any sanitary sewer facility owned, operated, and maintained by the CWA Authority and/or Citizens Westfield.

PUMP STATION: An alternate term for a Lift Station. See Lift Station definition.

RECORD DRAWING (AS-BUILTS): Plans certified, signed and dated by a professional engineer or land surveyor registered in the State of Indiana, indicating the Plans have been reviewed and revised, if necessary, to accurately show all as-built construction and installation details including, but not limited to, key elevations, locations and distances.

RESIDENT PROJECT REPRESENTATIVE (RPR): The lead inspector in the field who is responsible for all field inspection operations.

RESIDENTIAL UNIT(S): Those units generating domestic wastewater.

RIGHT-OF-WAY: All land or interest therein which by deed, conveyance, agreement, easement, dedication or process of law is reserved for or dedicated to the use of the general public, within which the Utility shall have the right to install and maintain sanitary sewer facilities.

SANITARY SEWER: A sewer that conveys wastewater from residences, commercial buildings, industrial plants, and institutions from lateral connections, and to which storm, surface, and ground waters are not intentionally allowed to enter. Commonly referred to as a “sanitary sewer main.”

SANITARY SEWER CONSTRUCTION AGREEMENT: An agreement entered into by Owner/Contractor and the CWA Authority and/or Citizens Westfield requiring the construction of those sewer facilities to be in accordance with the technical and procedural standards of this Manual. This Agreement includes inspection services.

SANITARY SEWER FACILITY: Any sanitary sewer, lift station or other appurtenance used to transport wastewater from its source to the wastewater treatment plant, excluding the lateral.

SERVICE AREA: Any area that contributes, or has the potential to contribute, wastewater to a sanitary sewer facility.

SEWER: A pipe for carrying wastewater (sanitary sewer), storm water (storm sewer) or a combination of both (combined sewer). Wherever in these Standards the word “sewer” is used without distinguishing type, “sewer” shall mean sanitary sewer.

STANDARD DRAWINGS (DETAILS): The drawing of structures, sanitary sewer lines or devices commonly used and referred to on the Plans and in this Manual.

STANDARDS: The Citizens Energy Group Standards. The requirements for the design and construction of sanitary sewer facilities and laterals within the CWA Authority and/or Citizens Westfield as contained herein and all subsequent additions, deletions or revisions. Same as Manual.

STANDARD PROCTOR DENSITY: The maximum dry density of a backfill material as determined by those methods set forth within American Society of Testing and Materials (ASTM) D 698.

STOP WORK ORDER: An order requiring the suspension of the pertinent construction activity for any construction project within the CWA Authority and/or Citizens Westfield.

STORMWATER: Any flow occurring during or following any form of natural precipitation and resulting therefrom.

TEN STATE STANDARDS: Recommended Standards for Sewage Works, latest edition, developed by the Committee of the Great Lakes - Upper Mississippi River Board of State Sanitary Engineers.

UNIFORM PLUMBING CODE (UPC): The Uniform Plumbing Code adopted by the International Association of the Plumbing and Mechanical Officials, current edition.

UTILITY: CWA Authority (Indianapolis) and/or Citizens Westfield

UTILITY COORDINATION: Utility coordination is a process by which Agencies, Developers, and/or Designers work with utilities to avoid conflicts with existing utility facilities. The process begins prior to the completion of project plans and can conclude at the end of construction.

WASTEWATER: A combination of the liquid and water-carried wastes from residences, commercial businesses, institutions and industrial establishments and other sources, together with such groundwater, surface water and stormwater as may be present.

WATERBODY: Any area that in a normal year has water flowing or standing above ground to the extent that evidence of an ordinary high- water mark is established.

WORK: All the activities to be done under the permit, in accordance with the approved plans, specifications, these Standards, and conditions.

101.05 Enforcement of Standards

Failure to comply with requirements set forth by this Manual may necessitate one or more of the following actions to be taken by a Citizens Energy Group director.

1. Posting of a Stop-Work-Order;
2. The invoking of performance sureties; **(Not applicable in Westfield)**
3. Denial of any future permits (either owner, contractor, or both); and/or
4. Necessary legal action by the CWA Authority and/or Citizens Westfield to affect the implementation of the approved plan or restoration of the site.

Section 102 General - Procedures and Requirements for all Permits

102.01 Introduction

This Section provides the procedures and requirements common to both laterals and sanitary sewer facilities.

For specific procedures and requirements related to laterals refer to Section 103.

For specific procedures and requirements related to sanitary sewer facilities refer to Section 104.

All information related to approvals and permits pursuant to this Manual can be tracked on the Citizens Energy Group’s Website, www.citizensenergygroup.com. The Department of Metropolitan Development’s instructions for tracking the Approvals and Permits can be found on the Department of

Business and Neighborhood Services website or by contacting the Department of Business and Neighborhood Services directly.

102.02 Applicability

Lateral Permits, and Approvals and Construction Permits for sanitary sewer facilities are required to construct, repair, modify, connect, or abandon any lateral or sanitary sewer facility within the CWA Authority and/or Citizens Westfield service territory.

This does not relieve any person from obtaining any and all applicable approvals and permits from other appropriate regulatory agencies.

102.03 Exemptions

Permits and Fees as required by this Chapter must be obtained and paid before the construction of sanitary sewer facilities or laterals in the CWA Authority and/or Citizens Westfield, except for:

1. Sewer construction or lateral permits for which a fee cannot be charged by the municipality because of federal or state law; or
2. Sanitary sewer construction performed by an employee or contractor on behalf of CWA Authority and/or Citizens Westfield.

The fee exclusion only applies to the permit application fees. All other fees associated with the construction, repair, modification, abandonment or connection must be paid.

A sanitary sewer permit is not required for maintenance work performed by or on behalf of the Utility.

102.04 Fees

All applicable fees are based on the Equivalent Dwelling Unit (EDU) as listed in CWA Authority Terms and Conditions Appendix B Miscellaneous Fees and Citizens Westfield Terms and Conditions Appendix A Miscellaneous Nonrecurring Charges. Unless specified, all fees must be paid to CWA Authority, Inc. or Citizens Wastewater of Westfield, LLC. Refer to Section 103.04 for additional information.

102.05 Refunds

Fees paid under this Section will not be refunded except upon written request to the Director-Underground Engineering & Construction and only in instances where the permit was issued in error. However, the Director- Underground Engineering & Construction shall, upon a written request, refund the connection fee paid pursuant to Section 103.04, for an expired permit.

Section 102.05 Not applicable in Westfield.

102.06 Expiration of Permit

If construction activity has not commenced **within one hundred eighty (180) calendar days** from the date of issuance of the Permit, the Permit shall expire and will no longer be of any force or effect. The Director-Underground Engineering & Construction may however, for good cause shown in a written request to

Citizens Energy group, extend the validity of any such Permit for an additional period which is reasonable under the circumstances to allow commencement of the construction activity. In no event shall the extension exceed a period of **sixty (60) calendar days**.

If the construction activity has commenced, but only is partially completed, and thereafter, no visible construction activity occurs on the construction site over a period of **one hundred eighty (180) calendar days**, the Permit shall expire and no longer be of any force or effect.

102.07 Transfer of Permit

Refer to Terms and Conditions for information.

102.08 Notice of Change in Permit Information

Refer to Terms and Conditions for information.

102.09 Amendment of Permits and Plans

Refer to Terms and Conditions for information.

102.10 Revocation of Permit or Variance

Refer to Terms and Conditions for information.

102.11 Stop-Work Order

Refer to Terms and Conditions for information.

102.12 Variance Procedures

The Director of Underground Engineering & Construction has the power to modify or waive any requirement found in this Manual or in any regulations promulgated by the Board. A Variance can only be granted if an Applicant for a permit submits a completed Variance Request Form and makes a substantial showing that:

1. The design standard or regulation is unfeasible or unreasonably burdensome; and
2. An alternate plan submitted by the Applicant will achieve the same objective and purpose as compliance with the minimum requirements contained in the Manual, and
3. The alternative plan will not increase the direct cost of operation and/or maintenance to the CWA Authority and/or Citizens Westfield.

Cost to the Applicant shall not be the sole factor used to determine whether the design standards or regulations are unfeasible or unreasonably burdensome.

The Utility will respond in writing within **fourteen (14) calendar days** from receipt of the Variance Request.

If a Variance is requested for any requirement in Chapters 300, 400, 500, or 600, a review may be required with the Utility before a decision can be made. The review requirements shall be determined on a case-by-case basis depending on the complexity of the request. All costs associated with a review are the responsibility of the Applicant.

102.13 Appeals

Any person affected by the exercise of any discretionary authority delegated by this Chapter to any official of the CWA Authority, Inc, including a decision to deny or partially deny a Variance or Permit, and who objects to the decision made or action taken by such official is entitled to appeal the decision. The appeal procedure is as follows:

1. The appeal of such a decision shall be filed with the Director- Underground Engineering & Construction in writing **within twenty-one (21) calendar days** following the date of the decision.
2. If the Director- Underground Engineering & Construction denies the appeal, the appellant may file a written request for a hearing, including a statement of their objections, with the Director- Underground Engineering & Construction who will call the same to the attention of the Board. Such request shall be filed with the Director- Underground Engineering & Construction **within fourteen (14) calendar days** from the date of notification by the Director- Underground Engineering & Construction.
3. The appeal hearing shall be scheduled before the Board **within thirty (30) calendar days** after such request is filed. Notice shall be given to the appellant identifying the time, place, and date of the appeal hearing **at least seven (7) calendar days** prior to the scheduled date. The Board may hear any evidence it deems relevant. After the hearing, the Board may confirm, reverse, or modify the decision or action. The order of the Board is final. Such order shall be made **within fourteen (14) calendar days** after the hearing and must be in writing and sent to the appellant.

Section 102.13 Not applicable in Westfield.

Section 103 Laterals - Procedures and Requirements

103.01 Introduction

This Section provides procedures and requirements specific to laterals.

For general procedures and requirements common to both laterals and sanitary sewer facilities refer to Section 102.

For specific procedures and requirements related to sanitary sewer facilities refer to Section 104.

103.02 Responsibility

It shall be the responsibility of the Owner whose property is benefited to make all necessary repairs, extensions, relocations, changes, or replacements thereof and of any accessories thereto for the entire length of lateral, excluding the portion within public easements and right-of-ways unless deemed otherwise by the Utility.

These requirements may be altered, modified, or waived, at the discretion of the Utility when it is shown compliance is not possible due to extenuating circumstances.

103.03 Applicability

A Lateral Permit is required to construct, repair, modify, connect, or abandon any lateral within the CWA Authority, Inc and/or Citizens Westfield.

Lateral Permits shall not be granted for connections to sanitary sewers not dedicated and accepted in accordance with the provisions contained in Section 105.04 or 105.07 of this Manual. Requirements for Lateral Permits issued for connections to existing private systems shall be determined at the time of application. The Applicant shall supply written permission from the Owner of the private sewer and may be required to comply with the requirements of 105.07.

All work and other construction activity performed on or associated with the lateral and its connection to the sewer shall be in accordance with this Manual and the rules and regulations of the Indiana Plumbing Code.

103.04 Connection Fee and EDU Calculation

A fee shall be assessed for all new connections to the sanitary or combined sewer system prior to the issuance of a Lateral Permit.

Per the CWA Authority's Terms and Conditions Appendix B Miscellaneous Fees 1. Connection Fee, a baseline fee of $2,530 per equivalent dwelling unit (EDU) will be assessed to all new connections to the Sewage Disposal System. A new connection includes new sewer service or modification of an existing sewer service agreement. Replacement or repair of an existing individual building sewer that does not increase the EDU is not a new connection. An EDU shall be determined in accordance with industry standards and reflect the greater of the actual daily flow requirements (per 327 IAC 3), the area ratio of the water meter size serving a particular user, or such other means deemed appropriate by the Utility. One (1) EDU shall be estimated as equal to 310 gallons per day.

Per the Citizens Westfield's Terms and Conditions Appendix A Miscellaneous Nonrecurring Charges 9. Connection Fee, a baseline fee of $2,000 per equivalent dwelling unit (EDU) will be assessed to all new connections to the Sewage Disposal System after July 1, 2018. A new connection includes new sewer service or modification of an existing sewer service agreement. Replacement or repair of an existing individual building sewer that does not increase the EDU is not a new connection. An EDU shall be determined in accordance with industry standards and reflect the greater of the actual daily flow requirements (per 327 IAC 3), the area ratio of the water meter size serving a particular user, or such other means deemed appropriate by the Utility. One (1) EDU shall be estimated as equal to 310 gallons per day.

Water/wastewater usage data from similar types of facilities as the proposed is not an accepted method to determine the number of EDU and corresponding connection fees. For the Utility's purpose, one (1) EDU is intended to equal the flow equivalent of one (1) single family home.

A Lateral Connection Fee Calculation Worksheet shall be submitted with the Lateral Permit Application.

New Connections and Connection Fees shall be determined and calculated as follows:

1. New Connections

a. The following are considered New Connections:
   i. New lateral connections to the sewer system.
   ii. A repair, replacement, or modification to an existing lateral that increases the capacity of the lateral to accommodate a proposed increase in EDU's.

      The connection fee will be charged for the proposed increase in EDU's. This is calculated as the net increase in EDU's based upon new water meter size being installed as part of the project and the existing water meter size.

      Note: If there is not a water meter present to calculate the net increase in EDU's, the Utility will determine by appropriate means the increase in EDU's and the corresponding connection fee.

2. Connection Fees

Connection fees for single use properties shall be determined using one of two methods: Residential or Non-Residential. Mixed Use properties may need to use both methods.

The fee for each New Connection shall be calculated as follows:

CWA Connection Fee = Number of EDU's x $2,530

Westfield Connection Fee = Number of EDU's x $2,000

A minimum of one (1) EDU shall be used for each New Connection Fee calculation. For New Connections as defined above, the Number of EDU's for each connection shall be determined as follows:

a. Residential Use

Residential use shall be defined as a unit designed for living consisting of at least one bathroom and one kitchen. Examples include but are not limited to single family homes, apartments, condominiums, townhomes, and assisted living facilities.

The number of EDU's per residential connection shall be as follows:

Unit Type	EDU's per Unit
Single Family Home	1.0
Multi-residential Living	0.75[1,2]

[1] For Multi-Residential Living units, the total number of EDU's per connection shall be (Total number of units) x 0.75. The 0.75 multiplier shall only be used when a single lateral serves multiple units.

[2] For Multi-Residential Living units having individual laterals for each unit, the number of EDU's shall be one (1) per minimum EDU requirement.

b. Commercial

The number of EDU’s per connection shall be based on water meter size as follows:

EDU's based on Water Meter Size			
Water Meter Size, inches	No. of EDU’s	Water Meter Size, inches	No. of EDU’s
5/8 or 3/4	1.0	4.0	41
1.0	2.5	6.0	92
1.5	5.8	8.0	164
2.0	10	10.0	253
3.0	23	12.0	364

c. Mixed Use
   i. For single water metered Mixed Use premises, the residential portion shall be calculated as described per Unit Type above and the non-residential portion shall be one (1) additional EDU per floor where the non- residential use exists. The connection fee shall be the total of both.
   ii. For individually water metered Mixed Use premises, the number of EDU’s shall be based on each individual water meter size.

d. Other Uses
   i. For all other uses, see Appendix B for applicable flow rates to determine the number of EDUs.

3. Credits for Re-developed Premises Previously Connected to the Sewer System

An active and verifiable sewer connection is a sewer account for that premise within the Citizens system of record during the time specified.

a. Residential premise
   i. A credit for the number of previous EDU's per Unit Type will be applied towards a re-developed residential premise.

b. Non-Residential premise
   i. A credit for the number of previous EDU’s per Water Meter Size will be applied towards a re-developed non- residential premise.

c. Mixed Use premise
   i. For single water metered Mixed Use premises, the residential portion shall be credited as described per Unit Type above and the non-residential portion

shall be credited one (1) additional EDU per floor where the non- residential use existed.

ii. For individually water metered Mixed Use premises, the number of credited EDU’s shall be based on each individual water meter size.

Note: Credits or refunds will not be given for the removal of a water meter, the installation of a smaller water meter, or a reduction in EDU's.

103.05 Submittal Requirements for a Laterals Permit

Refer to Terms and Conditions for information.

(CWA Authority service territory Only) All appropriate fees shall be paid before a Permit will be issued.

103.06 Who May Apply

Refer to Terms and Conditions for information.

103.07 Laterals Inspection Requirements

Refer to Terms and Conditions for information.

103.08 Enforcement of Bond

Any action may be initiated in a court of competent jurisdiction relative to the bond provided for in Section 103.06 as follows:

1. The Corporation Counsel of the CWA Authority, Inc and/or Citizens Westfield may initiate proceedings to forfeit a bond:
   a. As a penalty for repeated Code violations by a contractor, his agents or employees; or
   b. To indemnify the CWA Authority, Inc and/or Citizens Westfield against any loss, damage, or expense sustained by the CWA Authority, Inc and/or Citizens Westfield by reason of the conduct of the contractor, his agents or employees.
2. A person, partnership or corporation which holds a property interest in the real estate on which work has occurred may bring an action against the bond for expenses necessary to correct code deficiencies therein after written notice of the code deficiency has been given to the contractor and after the contractor has been given a reasonable opportunity to correct performance. If such a person, partnership or corporation prevails in any action brought under this section, they may also be allowed by the court to recover as part of the judgment a sum equal to the aggregate amount of costs and expenses, including attorney's fees based on actual time expended as determined by the court to have been reasonably incurred by the plaintiff for, or in connection with, the commencement and prosecution of such action.

Section 104 Sanitary Sewer Facilities - Procedures and Requirements

104.01 Introduction

This Section provides the procedures and requirements specific to sanitary sewer facilities.

For general procedures and requirements common to both laterals and sanitary sewer facilities refer to Section 102.

For procedures and requirements specific to laterals refer to Section 103.

104.02 Utility Coordination

If any Citizens' facilities are identified to fall within or close to project limits, facility mapping shall be requested from Citizens at the on-set of a project. During early completion of plan development, designers submit plans to Citizens to allow for the review of proposed improvements and Citizens' existing utilities to determine whether there are any impacts or not. Resolution of these items occurs through the completion of work plans by Citizens that include relocation plans, and a schedule with work durations for Citizens to complete their work. Citizens typically follows the process and timeframes as established by the Indiana Administration Code 105 IAC 13.

Proposed improvements determined to be within a horizontal separation of ten (10) feet or less of Citizens Energy Group's (Citizens) existing facilities, shall be submitted to Citizens for review and approval. The Designer shall submit plans and/or information to Citizens at the earliest development of design plans to request review and approval. Subsequent submission for further review and approval by Citizens may be required. Information related to the project such as plans, maps etc., shall be submitted via email to utilitycoordination@citizensenergygroup.com.

104.03 Sanitary Sewer Approval and Construction Permit – General

Refer to Terms and Conditions for information.

104.04 Capacity Certification/ Allocation

During the Approval process, the Utility may forward a Capacity Certification/Allocation Letter to IDEM.

At the discretion of the Utility, the Applicant may be required to evaluate the downstream system if sufficient information and data are not available from the Utility. Refer to Section 202.10 for the downstream evaluation requirements.

104.05 Submittal Requirements for Approval and Construction Permit

The following are the submittal requirements for a Sanitary Sewer Approval and Construction Permit:

1. Sanitary Sewer Approval

   To obtain a Sanitary Sewer Approval, the following shall be submitted at the time of application:

   a. Application

      An application for a Construction Permit shall be made on a Form furnished by the Utility.

   b. Plans and Specifications

Plans and specifications for the construction of sanitary sewer facilities shall be developed by, or under the direction of, a Professional Engineer registered in accordance with IC 25-31-1. All sheets shall include the Professional Engineer's seal, signature, and date plans were certified including any revision dates. At a minimum, the plans and specifications shall include the following:

i. Title Sheet (Project Name, Address, Name and Address of Engineer, Name and Address of Owner, County Location Map, Vicinity Map);
ii. Index Sheet showing the overall sanitary sewer configuration and sheet where the Plan/Profile sheets can be found;
iii. Sewer and/or Lift Station Service Area Map;
iv. Revenue Allowance/Subsequent Connector/Delta Area Map;
v. Site Plan;
vi. Plan/Profile Sheets which include backfill requirements, lateral locations, and stationing;
vii. Standard Detail Sheets;
viii. Structure/Data Table;
ix. Lift Station Standard Detail Sheets (when applicable);
x. Specifications shown on plans; and
xi. Other sheets as deemed necessary for ensuring conformance to this Manual.
xii. Public/Private designation of main segments
xiii. Differentiation between work associated with and work not associated with the permit. Portions of work not associated with the permit should be grey/marked out.

The Plans must conform to the requirements of Citizens Energy Group.

c. Design Calculations

Design calculations shall be submitted on a Design Summary Form furnished by the Utility.

d. Certificate of Sufficiency of Plan

A Certificate of Sufficiency of Plan shall be submitted by a Professional Engineer registered in accordance with IC 25- 31-1 on a form furnished by the Utility.

e. Lift Station Submittal Requirements

When applicable, the requirements per Section 502.03 and/or 504.03 shall be submitted.

f. Zoning Commitments

All recorded Zoning Commitments, or Commitments being negotiated, shall be submitted.

Zoning Commitments shall not be justification to violate any provisions of this Manual, or be justification for a Variance. If Zoning Commitments violate any provision of this Manual, contact the Department of Business and Neighborhood Services to determine the necessary steps to amend the Zoning Commitments.

g. Execution of Covenant

The Citizens Energy Group Director- Underground Engineering & Construction (or designee) may require the execution of covenants and/or easements running in from the City of Indianapolis, and County of Marion by the Owner or Owners of such parcel. At a minimum in such cases, the Director- Underground Engineering & Construction shall require that the following covenant be executed by the Owner or Owners of such parcels, and which shall be included in a recorded plat:

i. It is the responsibility of the Owner of any lot or parcel of land within the area of the plat to comply at all times with the provisions of the sanitary sewer construction plan approved by the Utility, and the requirements of all sanitary sewer Construction Permits for the plan issued by the Utility.
ii. Owner further covenants that no building, structure, tree or other obstruction shall be erected, maintained, or allowed to continue on the portion of the owner's real estate in which the easement and right-of-way are granted without express written permission from the Utility. Such permission, when duly recorded, shall run with the real estate. The Utility shall have the right to ingress and egress, for temporary periods only, over the owner's real estate adjoining said easement and right-of- way, when necessary to construct, repair or maintain sanitary sewer facilities.

Any person who violates a covenant required under this Section, and/or the owner of any parcel of land who permits such a violation, who is notified in writing by the Utility that a violation exists, will be given a reasonable period of time, **not to exceed thirty (30) calendar days**, in which to correct such violation. The notice shall specify the nature of the violation and must stipulate a required correction date.

If there has been no activity on the Project during the Approval Process for more than **sixty (60) days**, the Application has expired and shall be resubmitted.

2. Construction Permit

The following shall be submitted to the Utility prior to the issuance of a Construction Permit:

a. Preliminary Plat

When applicable, the preliminary plat shall be submitted.

b. Recorded Easements

When required, easements shall be obtained and recorded.

c. Written Notification

The Citizens Energy Group Director- Underground Engineering & Construction (or designee) may require Applicants to send written notification to property owners whose properties abut the route of the proposed sewer.

d. Sanitary Sewer Construction Agreement

The Applicant shall execute the applicable Agreement for Construction.

e. Payment of Fees **(Not applicable in Westfield)**

The Applicant shall pay all applicable fees listed in CWA Authority's Terms and Conditions Appendix B Miscellaneous Fees.

f. Additional Information

Applications shall include any additional information deemed necessary by the Utility to thoroughly evaluate an application for a Construction Permit and carry out the provisions of this Manual.

104.06 Who May Apply for an Approval and Obtain a Permit

Refer to Terms and Conditions for information.

104.07 Who Can Do the Work

Refer to Terms and Conditions. for information.

Section 105 Sanitary Sewer Construction Inspection and Acceptance Procedures

105.01 Introduction

This Section provides the procedures and requirements specific to the inspection and acceptance of sanitary sewer facilities.

For the requirements for the inspection of laterals refer to Section 103.07.

105.02 General Authority for Investigations and Inspections

Refer to Terms and Conditions for information.

105.03 Construction Inspection Requirements

Refer to Terms and Conditions for information.

105.04 Requirements for Project Acceptance and Dedication

The following shall be submitted and approved prior to a sanitary sewer facility being accepted, and lateral permits being issued:

1. Three (3) Year Maintenance Bond

   The Citizens Energy Group Director- Underground Engineering & Construction (or designee) shall require the posting of a Maintenance Bond by the Contractor, in an amount not to exceed twenty (20%) percent of the contract amount, or subject to the approval by the Director- Underground Engineering & Construction, a provision for maintenance for a period of three (3) years from the date of acceptance by the Utility Said bond shall name the CWA Authority, Inc and/or Citizens Westfield as parties who can enforce the obligations thereunder.

2. Certificate of Completion and Compliance

   A Certificate of Completion and Compliance, as furnished by the Utility, shall be filed by a Professional Engineer. The Certificate of Completion and Compliance shall be filed **within fourteen (14) calendar days** after satisfactory completion of the tests on the sanitary sewer facility for which a Construction Permit was issued.

3. Final Inspection Documentation

   The completion of a final inspection and all required Forms which confirm all sanitary sewer facilities have been constructed and tested in accordance with this Manual shall be submitted prior to acceptance.

4. Record (“As-built”) Drawings

   Record ("As built") drawings shall be submitted in accordance with Section 105.05 of this Manual.
5. GIS/IMS Data Submittals

   Submittals shall be made in accordance with Section 105.06 of this Manual.

105.05 Record (“As-Built”) Drawings

As part of the final acceptance process, record drawings of the sanitary sewer facilities shall be submitted to the Utility.

Record Drawings shall be certified by a Professional Engineer or Land Surveyor registered in the State of Indiana. The Record Drawings shall include the following information and all revision dates:

1. Title Sheet;
2. Index Sheet showing the overall sanitary sewer configuration and sheet where the Plan/Profile sheets can be found;
3. Sewer and/or Lift Station Service Area Map;
4. Site Plan;

5. Plan/Profile Sheets;
6. Standard Detail Sheets;
7. Structure/Data Table;
8. Lift Station Sheets (when applicable);
9. Specifications shown on Plans;
10. Structure inverts, pipe inverts and top-of-castings;
11. Horizontal alignment of sanitary sewer and force main pipes, streets, to a minimum accuracy of +/- two (2) feet; and
12. Ownership (public or private) for each segment of main
13. Any other information deemed relevant.

Record Drawings shall be submitted in a digital format.

105.06 Digital Data Submission Standards

As part of the final acceptance process, GIS and IMS data shall be submitted in accordance with the latest version of the Digital Data Submission Standards.

105.07 Dedication of Existing Private Sewers

The Owner of a private sanitary sewer facility may apply to the CWA Authority, Inc and/or Citizens Westfield for dedication of the facility as public, provided the facility is located within the CWA Authority, Inc and/or Citizens Westfield boundaries. An Application shall be submitted on a Form furnished by the Utility.

Dedication of such sewer facilities are subject to all applicable requirements in this Manual or rehabilitated to an acceptable level as determined by the Utility. At the discretion of the Utility the following may be required to determine if the facilities are acceptable or what improvements are necessary to make the facilities acceptable:

1. Proof of legal ownership;
2. Recorded easements;
3. Flow monitoring results;
4. Closed Circuit Television (CCTV) video inspection results;
5. Three (3) year Maintenance Bond;
6. Record Drawings;
7. GIS/IMS Data Submittal; and/or
8. Any other requirements deemed necessary by the Utility.

The Owner of the private sewer facility shall, at their expense, be required to correct any deficiencies or remove any sources of clear water found as a result of any inspection, flow monitoring, CCTV, and/or other related testing.

The Utility may deny acceptance of private sewer facilities with or without cause even if the private sewer facilities meet the requirements contained in this Manual.

CHAPTER 200 DESIGN

Section 201 Lateral Design

201.01 Introduction

This Section provides design requirements specific to laterals.

For design requirements specific to gravity sanitary sewers refer to Section 202.

For design requirements specific to manholes refer to Section 203.

For design requirements specific to lift stations and low-pressure sewer systems refer to Chapter 500.

201.02 General

The design criteria for laterals shall conform to the latest edition of the 675 Indiana Administrative Code (IAC) 16 - Indiana Plumbing Code (IPC) and to these Standards, whichever is more restrictive.

201.03 Prohibited Connections

Except as provided in a written approval issued by the Utility no person shall connect a lateral to a sanitary or combined sewer when the lateral has any of the following sources of clear water:

1. Foundation/footing drains;
2. Sump pumps with or without foundation drains connected;
3. Roof drains;
4. Heat pump discharge;
5. Cooling water; or
6. Any other sources of clear water, such as, but not limited to, yard and/or driveway drains.

201.04 Maximum Number of Building Connections

Common laterals are prohibited.

No more than one (1) building will be permitted to connect to a lateral.

Common laterals for one (1) building with multiple residential or commercial units are also prohibited, except for the following:

1. Apartment or commercial buildings with a single owner.
2. Condominiums or commercial buildings where different floors have different owners.

The intent is to have individually owned residential and commercial units, or units with the potential to be individually owned, served by individual laterals.

Industrial facilities will be evaluated on a case-by-case basis.

201.05 Point of Connection

Laterals shall connect to sanitary or combined sewers at manufactured mainline fittings or terminal manholes.

Saddle connections are only allowed if an existing connection point to the sewer does not exist and shall be installed per Section 402.05.

Saddle connections to Vitrified Clay Pipe (VCP) sewers are not allowed. See Section 402.05 for installation requirements for connections to VCP without manufactured fittings.

Connection requests to existing brick or blocks sewers will be evaluated on a case-by-case basis. If allowed, connection will be made per Section 402.06.

Lateral connections to existing sewers eighteen (18) inches and larger will be reviewed on a case-by-case basis. A separate sewer may be required to be extended from an existing manhole.

No more than three (3) connections to a terminal manhole will be allowed. See Section 403.08 for installation requirements on connections to manholes.

201.06 Size, Depth, and Slope of Lateral

The minimum size, depth and slope of laterals shall be as follows:

1. Pipe size

   The minimum pipe size shall be as follows:
   a. Within the right-of-way or easement - six (6) inch.
   b. Outside the right-of-way or easement - four (4) inch.
   c. Sizes greater than 6 inch must be justified by design flow.

2. Pipe Depth

   The minimum depth from the finished grade to the crown of all laterals shall be as follows:
   a. Within the right-of-way or easement - four (4) feet.
   b. Outside the right-of-way or easement - three (3) feet.

3. Pipe Slope

   The minimum slope shall be 1.04% (1/8 inch per foot).

   For laterals greater than 6 inch, the slope may only be reduced if justified by the design flow.

201.07 Location, Length, and Spacing of Lateral

The location, maximum length, and spacing of laterals shall be as follows:

1. Location

   The location of the lateral shall be as follows:
   a. All properties shall be served from the street or alley side of the property.
   b. Where possible, laterals shall not cross abutting properties if the existing gravity sewer can be extended to serve the property.
      If crossing an abutting property is unavoidable, laterals shall not cross more than one (1) property. A dedicated easement on the abutting property shall be recorded.
   c. Properties to the rear may not be crossed.
   d. Laterals shall be located a minimum of five (5) feet from the side property lines.

2. Length

   The maximum lengths for laterals are as follows:
   a. On-site length – No maximum length. Cleanouts shall be provided per Section 201.08.
   b. Offsite Length – One hundred (100) feet.
      The off-site length includes the total distance within both the abutting property (if crossed) and the right-of-way.
   c. Stub length when the main is not within the right of way or an easement- Maximum 10 feet lateral stubs installed with sanitary sewer main extension projects if lateral does not cross the right-of-way and 10 feet lateral stub beyond the right-of-way if the lateral crosses the right-of-way.

3. Spacing between adjacent laterals

   The minimum horizontal distances between adjacent laterals and their connections are as follows:
   a. Laterals on the same side of the street/sewer – ten (10) feet.
      Common trenches for more than one lateral are not allowed, unless the minimum horizontal spacing between laterals can be maintained.
   b. Laterals on opposite sides of the street/sewer – four (4) feet.

4. Spacing between laterals and manholes

   The minimum horizontal distance between lateral connections and manholes is ten (10) feet.

201.08 Cleanouts

Cleanouts shall be installed on all laterals as follows:

1. Location

   At a minimum, cleanouts shall be installed at the following two locations:
   a. A wye cleanout located between eighteen (18) and sixty (60) inches from the building's exterior. The cleanout shall be extended to grade.
   b. If structure is more than twenty (20) feet from the right-of- way, a sweeping tee in grassy/dirt/gravel area one (1) to three (3) feet behind the right-of-way In addition to the required threaded, watertight cover; the cleanout shall be covered with a metal casting with

a minimum twelve (12) inch lid to facilitate locating. The casting shall be buried a minimum six (6) and a maximum of twelve (12) inches below finished grade. See Figure 400.10 for detail.

2. Spacing

   Cleanouts shall be spaced a maximum of every one hundred (100) feet.

3. Size

   Cleanouts shall match the size of the lateral pipe up to a maximum of eight (8) inch.

4. Cover Type

   Cleanout covers shall be a threaded-type, water tight and capped at all times. Covers within the paved areas shall be metallic and able to withstand traffic loads.

Cleanouts installed under concrete or asphalt paving shall be made accessible by yard boxes or extended flush with the paving. See Figure 400.09 for detail.

Manholes may not be used in lieu of cleanouts unless the facility has been issued an Industrial Pretreatment Permit by the Utility.

201.09 Minimum Elevation for Gravity Connection

To reduce the occurrence of sewer backups, the lowest floor elevation with gravity service shall be a minimum of one (1) foot above either the first upstream or first downstream manhole casting elevation. See Figure 200.01.

If this condition cannot be met due to the natural topography of the area, then either an alternate manhole will be evaluated or the connection to the sewer must be made using a sewage ejector pump system.

201.10 Connections Utilizing an Existing Lateral

When an existing or abandoned lateral is intended to be reused, the Owner and Contractor are responsible for verifying the lateral does not have any defects by means of a CCTV inspection. The record of the inspection shall be maintained by the Owner and Contractor for one (1) year from the date of the inspection.

Upon request, the results of the CCTV Inspection shall be submitted to the Utility for review.

If the Utility determines the existing lateral has deficiencies, the Owner will be required to either replace the existing lateral per requirements of this Manual, or rehabilitate the lateral per Utility direction. Rehabilitation requirements will be determined on a case- by-case basis.

201.11 Laterals Crossing Drainage Ways

Laterals shall be separated from existing or proposed waterbodies as required by Section 202.07.5.

Lateral's crossing proposed or existing lakes, ponds, and/or retention or detention areas (either wet or dry) are prohibited.

Laterals installed for future connections shall be terminated at the right-of-way or easement and sealed with a manufactured cap/stopper made specifically for the purpose of sealing/capping the end of the sanitary sewer to ensure 100% water tightness. Cleanout at right-of-way per Section 201.08.1 shall be installed with the sanitary sewer main at the time of construction.

A tracer wire shall be installed per Section 401.07 terminating at a one-half (½) inch metal locator rod at the end of the plugged line to within three (3) feet of the finished grade.

Section 202 Gravity Sanitary Sewer Design

202.01 Introduction

This Section provides design requirements specific to gravity sanitary sewers.

For design requirements specific to laterals refer to Section 201.

For design requirements specific to manholes refer to Section 203.

For design requirements specific to grease traps refer to Section 204.

For design requirements specific to lift stations and low-pressure sewer systems refer to Chapter 500.

202.02 General

Gravity sanitary sewers shall be extended to proposed developments per the Sanitary Sewer Masterplan. The Utility will consider alternate routes for the gravity sanitary sewer extension if the proposed route identified in the Masterplan is impractical, not possible, or a more desirable route is available. The Utility maintains and periodically updates the Sanitary Sewer Masterplan.

202.03 Sanitary Sewer Service Area Study

The Applicant shall prepare a Service Area Study for all proposed sanitary sewer facilities. The intent is to maximize the service area to the greatest extent practical. The Utility will determine if the projected service area has been maximized. The Service Area Study shall include, at a minimum, the following:

1. Service Area Map

   The map shall include, at a minimum, the following information:
   a. Project boundaries;
   b. Projected service area boundaries including the following:
      i. All on-site areas;

ii. Undeveloped off-site areas excluding floodways and existing waterbodies;
iii. Developed unsewered off-site areas, such as areas currently served by septic systems; and
iv. Other areas as deemed appropriate by the Utility.

The Engineer and Applicant shall not assume the boundaries of the projected service area to be only those areas that can be serviced by gravity sewer extensions. Other areas within the service area may need to be served by a lift station.

c. Elevation contour lines;
d. Existing sanitary sewer facilities with invert and top of casting elevations. As-built information may be used;
e. All relevant topographic information; and
f. Any other information deemed necessary.

All relevant information on the Service Area Map shall be clearly labeled and easy to read. **The Service Area Map shall be included in the Plans.**

2. Design Flow Projections

Design flow projections shall be determined for the entire service area per Section 202.04.

202.04 Design Flow

All sanitary sewer facilities shall be designed to carry the projected design flow from the projected Sanitary Sewer Service Area, as defined in Section 202.03, contributing to each respective reach of the sanitary sewer facility.

The Design Flow shall be calculated as follows:

Design Flow = Average Daily Flow X Peaking Factor

where:

Design Flow = Flow used to design a sanitary sewer facility, gpd.

Average Daily Flow = Estimated average daily flow, gpd.

Peaking Factor = Ratio of peak hourly flow to average daily flow.

The above variables shall be calculated as follows:

1. Average Daily Flow (ADF)

The ADF shall be the total ADF from the entire Service Area. Each area shall be calculated as follows:

a. Proposed Developments

The ADF for proposed residential developments shall be determined using the following flow rates multiplied by the number of units:

Unit Type	Flow, gpd
Single Family Home	310
One Bedroom Apartment/Condominium	200
Two Bedroom Apartment/Condominium	300
Three Bedroom Apartment/Condominium	350

For additional Residential-type, Commercial, Industrial, and all other land uses refer to Appendix B in these Standards for the ADF.

If a land use being proposed is not included in either Appendix B in these Standards or 327 IAC Article 3, engineering judgment may be used to estimate the flow. The Utility reserves the right to determine the appropriateness or applicability of the estimated flow.

b. Developed Unsewered Off-site Areas

The ADF for developed unsewered off-site areas may be determined using the same flow rates listed in 202.04.1.a. multiplied by the actual number of unsewered units. The Utility will determine if an alternate method may be used.

c. Undeveloped Off-site Areas

The ADF for undeveloped off-site areas shall be determined by using the greater of the following:

i. Proposed land use as shown in the most recent version of the jurisdictions Comprehensive Plan, or the Westfield Sanitary Master plan, or
ii. Three (3) Single Family Residential Units/Acre (930 gpd/Acre)

2. Peaking Factor

A peaking factor of four (4) shall be used for all calculations unless directed otherwise by the Utility.

Alternate methods to determine the peaking factor such as “Recommended Standards for Wastewater Facilities” latest edition (also known as ‘Ten States Standards’) may be approved on a case-by-case basis.

202.05 Pipe Size, Slope, and Depth

The minimum pipe size, slope, and depth shall be as follows:

1. Pipe Size

The required diameter of gravity sewers shall be determined by using the Design Flow as calculated in Section 202.04 and Manning's formula using a roughness coefficient, "n", of 0.013 or the pipe manufacturer's recommendation, whichever is greater, and the following:

a. Minimum pipe diameter - eight (8) inch.
b. Maximum depth of flow
    i. Pipe diameter up to 18 inches- three-quarters (3/4) full.
    ii. Pipe diameter 18 inches and greater-will be established on a case-by-case basis.

2. Pipe Slope

The minimum and maximum slope shall be as follows:

a. Minimum Slope

All sanitary sewers shall be designed and constructed to provide a minimum velocity of 2.0 ft/sec when flowing full.

The minimum acceptable slopes for the design and construction of sanitary sewers are as follows:

Pipe Size, inches	Minimum Slope (feet per 100 feet, %)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046
42	0.037
48	0.030
54 and larger	0.026

b. Maximum Slope

Sewers shall not be designed with a slope greater than 20% or a maximum velocity greater than 10.0 ft/sec.

3. Depth

   To protect the sanitary sewers from potential damage caused by utilities, the minimum depth to the crown of all gravity sanitary sewers and force mains shall be as follows:

   a. Gravity Sewers – 6.5 feet
   b. Force mains – 4.5 feet

   When the pipe depth is greater than twenty-five (25) feet, the engineer shall verify the pipe material selected is acceptable for the application. Upon request, the Engineer shall submit all calculations verifying the pipe selected is acceptable.

202.06 Extensions for Off-site Unsewered and/or Undeveloped Areas

To accommodate future users within the Sanitary Sewer Service Area, sanitary sewers within the proposed development shall be extended to the property boundaries at the same hydraulic capacity and grade line as the sewers immediately downstream. A reduction of size or slope may be allowed if the off-site design flow projection justifies a reduction. This will be evaluated on a case-by-case basis to make sure future development is not being unduly restricted.

Extensions to all boundaries, including along existing rights-of-way, may be required if multiple contiguous unsewered areas about the property. This will be evaluated on a case-by-case basis to make sure future development is not being unduly restricted.

202.07 Location of Sanitary Sewer Facilities

All sanitary sewer facilities, both existing and proposed, shall be located to provide adequate access for maintenance and/or repair, and as follows:

1. New Sanitary Sewers

   a. New sanitary sewers in subdivisions or developments shall be constructed in platted easements adjacent to the right-of-way. The sewer shall be installed five (5) feet outside of the right-of-way line. The easement shall be per Section 204.02.1.
   b. New sanitary sewers along roadways outside of subdivisions or developments shall be constructed in a prescriptive easement adjacent to the right-of-way. The sewer shall be installed five (5) feet outside of the right-of-way line. All sanitary mains along thoroughfares must be in a minimum twenty (20) foot easement adjacent to the right-of-way. The easement shall be per Section 204.02.1.
   c. Sanitary Sewers shall not be located in rear yards or other inaccessible areas unless directed otherwise by the Utility.
   d. Sanitary sewers must be a minimum of three (3) feet from other utilities including telephone, gas, electric, cable television, fiber optic. Sanitary sewers must maintain a minimum of 18 inch vertical separation from all other utilities. See Section 204.03 for separation requirements from water supplies.

2. Existing Sanitary Sewers

   a. The proposed development shall be configured in such a manner to provide adequate access to all existing sanitary sewers and manholes for ease of maintenance and/or repair. The Utility will determine if the site configuration provides adequate access.
      Acceptable locations for existing sanitary sewer facilities within proposed developments may be as follows:
      i. Within common areas;
      ii. Within proposed right-of-ways;
      iii. Adjacent proposed right-of-ways provided the existing sanitary sewer is in, and remains in, an exclusive sanitary sewer easement; and/or
      iv. Others as deemed acceptable by the Utility
   b. The proposed subdivision or development shall not be configured in such a manner that would cause existing sanitary sewer facilities to be located in rear yards or other areas determined to be inaccessible by the Utility.
   c. Sanitary sewers must be a minimum of three (3) feet from other utilities including telephone, gas, electric, cable television, fiber optic. See Section 204.03 for separation requirements from water supplies.

3. Lift Stations

   Existing and Proposed Lift Stations shall be located per Section 502.05.

4. Force Mains

   Existing and proposed force mains shall be located per the same requirements as sewers per the above Section 202.07.1 & 2.

5. Adjacent Waterbodies

   All sanitary sewer facilities and laterals shall be separated from existing or proposed waterbodies by a minimum twenty (20) feet horizontally as measured from the outside edge of the sanitary sewer facility to the top of bank.

   Sanitary sewers, force mains, and laterals crossing existing or proposed lakes, ponds, and/or retention or detention areas (either wet or dry) are prohibited.

6. Grease Traps

   A grease trap (interceptor) shall be installed in the waste line leading from sinks, drains and other fixtures or equipment in restaurants, cafes, lunch counters, cafeterias, bars and clubs, hotels, hospitals, factories or school kitchens; or other establishments where grease may be introduced into the drainage or sewage system in quantities that can affect line stoppage or hinder sewage treatment. Grease traps shall be sized according to criteria discussed in Section 204.08.

202.08 Location and Elevation of Sanitary Sewer Facilities within Special Flood Hazard Areas

The elevation and location of sanitary sewer facilities within Special Flood Hazard Areas shall be as follows:

1. Sanitary Sewers and Force Mains

   Sanitary sewers and force mains may be located within Special Flood Hazard Areas, but not within the floodway, unless the location is a perpendicular crossing. Refer to Section 204.06 for design criteria for crossing drainage ways.

2. Manholes

   The elevation of the top of casting shall be at or above the 25-year flood elevation. The surrounding ground must have a 3:1 slope. If the top of casting elevation is below the 100-year flood elevation, bolt down castings with watertight, non-rocking/self-sealing covers shall be used per Section 305.11.

3. Lift Stations

   Lift stations shall be fully operational during a 100-year flood and may be located within the Special Flood Hazard Area, but not within the floodway.

   The elevation of the lift station base slab, all above ground equipment, and access drive shall be fully protected and a minimum two (2) feet above the 100-year flood elevation.

202.09 Capacity Certification

For existing and proposed sanitary sewer facilities, the Utility is required to submit Certifications in accordance with 327 IAC 3-6-4 to the Indiana Department of Environmental Management. The required Certifications are limited to additional flow generated as a result of the construction, installation, or modification of sanitary sewers.

When determining if the Certification can be submitted to IDEM, the following factors will be considered when reviewing new sewer connection applications:

1. Capacity of receiving sewer during wet and dry weather, including contractual obligations to reserve future capacity for another party.
2. Compelling public need for the project, such as economic development or conversion of areas currently serviced by septic systems, such as the utility’s Septic Tank Elimination Program (STEP) program.
3. Mitigating or offsetting capital, operations, or maintenance projects designed to improve sewer capacity.

A downstream capacity evaluation may be required for the utility to submit the necessary Certification. Refer to Section 202.10 for guidelines for the downstream evaluation.

202.10 Downstream Evaluation

To evaluate the downstream capacity of a receiving sanitary sewer facility, the Utility will rely on the following:

1. Available Data/Information

   Available data/information may include the following:
   a. Existing flow monitoring data;
   b. Sanitary sewer studies;
   c. Maintenance records;
   d. Service Requests;
   e. Past and/or proposed Capital Improvement Projects; and/or
   f. Any other information deemed relevant by the Utility.

2. Additional Data/Information

   If adequate data/information is not available, the applicant may be required to conduct; at no cost to the Utility all the necessary tasks to assure the Utility makes an informed decision on the adequacy of the downstream sanitary sewer facilities. Such tasks may include the following:

   a. Temporary Flow Monitoring

      The requirements for temporary flow monitoring will be determined on a case-by-case basis by the Utility at the time of application. General guidelines include the following:

      i. Number of Monitors – The complexity of the downstream system will determine the number of temporary monitors required. The maximum number shall not exceed five (5).

      ii. Monitoring Duration – The monitoring duration shall be a minimum of sixty (60) days or until one and one- half (1½) inch of rainfall in a 24-hour period is recorded, whichever is the greater period of time.

      iii. Monitoring Period – If possible, part of the monitoring period shall be done during the months of March, April, May, and June. However, if monitoring cannot be done during those months, the Utility will consider an alternate time period.

         Monitoring shall not be done during the month of January.

      iv. Temporary Rain Gages – Temporary rain gages shall be installed at or near the temporary flow monitoring site(s) during the flow monitoring period unless the monitors are located within one-half (1/2) mile of an operating Utility rain gage. An alternate rainfall measuring method may be approved by the Utility on a case-by-case basis.

      v. Flow Monitoring Data and Format – At a minimum, the following shall be included:
         (1) Depth / Velocity Hydrographs;

(2) Flow Hydrographs;
(3) Scatterplots / Scattergraphs; and
(4) Any other data deemed necessary

vi. Other requirements as deemed necessary.

b. Hydraulic Modeling

The Utility may require the utilization of the sanitary sewer collection system model to the point of connection of the proposed development. Hydraulic modeling will be performed by the Utility as needed and will be based on the available and additional information noted above. To the extent that necessary data is not available, the Applicant will be required to obtain it.

c. Lift Station System Evaluation

The Utility may require an evaluation of one or more lift station systems. The evaluation may include the following systems:

i. Hydraulic;
ii. Electrical;
iii. Mechanical;
iv. Instrumentation & Control; and
v. Others as deemed necessary.

d. Other evaluations as deemed necessary

202.11 Inadequate Downstream Capacity

If the Utility determines downstream capacity is not available for the proposed flow from the development, the Applicant has the following options:

1. Make additional capacity available in the downstream system by:
   a. Increasing the capacity in the system, and/or
   b. Removing a sufficient volume of Infiltration/Inflow.
2. Connecting to an alternate point within the sanitary or combined sewer system. A downstream analysis of the alternate system may be required.

NOTE: This will be evaluated on a case-by-case basis to make sure future development is not being unduly restricted.

202.12 Connections to Existing Sanitary Sewers

Sanitary sewers and force mains shall only be connected to the existing sewer system at manholes and shall be per Section 403.08. For lateral connections refer to Section 201.05.

Blind tee connections to existing sewers are prohibited.

If an existing manhole is not available, as determined by the Utility, a new manhole shall be installed as shown in Figure 300.06 and installed per Section 403.

Connections to existing manholes will be evaluated on a case-by- case basis. Rehabilitation may be required and will be at the discretion of the Utility. Rehabilitation methods will be per Section 403.08.

Westfield - Existing manholes receiving a new force main discharge must be lined with SpectraShield or Utility approved equal.

No more than four (4) connections to existing manholes, three (3) incoming and one (1) outgoing, will be allowed.

See Section 403.08 for requirements to connect to existing brick or block manholes.

202.13 Connections in the Combined Sewer Area

The construction of new combined sewers is prohibited.

When constructing sanitary sewer facilities within the combined sewer area, the Utility will address each application on a case-by- case basis using the following guidelines:

1. Connections to Combined Sewers

   All new or proposed sanitary and storm sewers shall be separated prior to connecting to the combined system. Each system shall be connected individually to the combined sewer if a separate storm sewer is not available. The connections shall be per Section 202.12.

2. Sewer Separation

   To remove stormwater from the combined sewer system, the Utility may require an off-site extension of the proposed storm sewer if an alternate stormwater discharge location is available.

   The following factors shall be considered by the Utility when evaluating the separate storm sewer requirement:
   a. Capacity in receiving sewers to accept stormwater flow, and planned capital improvement projects identified within the Utility’s Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP), or other plans;
   b. Impacts on Water Quality;
   c. Feasibility of separation, including costs to treat, construct, and manage the sewer system as a separate or combined system; and
   d. Other appropriate factors deemed relevant by the Utility.

3. Stormwater release rates to the combined sewer system.

   The Utility shall review all proposed new connections and modifications of existing drainage connecting to the combined sewer system. This review, along with submitted evidence and documentation, will be used to determine if such connections are permissible.

4. Requirements for Stormwater Discharges to the Combined Sewer System

   Connecting new storm drainage structures to the combined sewer system (combined sanitary and storm system) and/or modifying existing drainage structures requires approved evidence and documentation showing there will be **no increase** in runoff volume or peak flow entering the combined sewer system. Any increase in peak flow or volume causes an increased risk of combined sewer overflow frequency and discharge. Specific requirements are listed below.

   a. Documentation that other alternatives, such as separation (routing a separate storm sewer to discharge location other than the combined sewer), system storage (open or closed), or stormwater infiltration are not viable options.
   b. Hydraulic analysis including the pre- and post-conditions peak discharge for the 3-month, 6-month, 2-year, 5-year, and 10-year storm water events. Please see Table A below for the rainfall depths for the 3-month and 6-month return periods.
   c. The documentation should also demonstrate compliance with the City of Indianapolis' Allowable Release Rates per Section 302.02 of their Stormwater Manual.
   d. Allowable Release Rates include Sanitary and Stormwater flows in the existing conditions and proposed post-development discharge rate calculations when applicable. The following requirements shall be met:
      i. The Proposed 3-Month release rate shall be less than or equal to the Existing 3-Month release rate;
      ii. The Proposed 6-Month release rate shall be less than or equal to the Existing 6-month release rate;
      iii. The Proposed 2-Year release rate shall be less than or equal to half of the Existing 2-Year release rate; and
      iv. The Proposed 10-Year release rate shall be less than or equal to the Existing 2-Year release rate.
   e. The final allowable release rate will be the more stringent of the requirements listed above.
   f. Within a storm sewer structure, the use of an overflow weir will not be allowable, unless approved by Citizens Energy Group.
   g. The use of an orifice plate within a storm sewer structure will require a minimum opening diameter of six (6) inch, and only as approved by Citizens Energy Group.
   h. Overflow structures within bioretention facilities will require the top of rim elevation for accepting storm water flow to match the elevation of the adjacent roadway pavement.

In addition, the combined sewer system's theoretical capacity at any inflow point must be taken into account and included in the documentation. If the total peak runoff rates exceed the conveyance capacity of the combined sewer system (i.e. the connecting sewer pipe and downstream system capacity, including sanitary flow), surcharge, sewer back-ups, and street flooding could occur. In general, storm recurrence intervals greater than a 2-Year event will exceed the conveyance capacity of the combined sewer system.

Table A - Rainfall Depths for 3-Month and 6-Month Return Periods

Duration	3-month rainfall depth (in)	6-month rainfall depth (in)
24-hr	1.57	1.99
18-hr	1.48	1.87
12-hr	1.37	1.73
6-hr	1.18	1.5
3-hr	1	1.27
2-hr	0.92	1.16
1-hr	0.74	0.94
30-min	0.58	0.74
15-min	0.42	0.53
10-min	0.33	0.42
5-min	0.19	0.24

Section 203 Sewer Structures – Manholes

203.01 Introduction

This Section provides design requirements specific to manholes.

For design requirements specific to laterals refer to Section 201.

For design requirements specific to gravity sewers refer to Section 202.

For design requirements specific to lift stations and low-pressure sewer systems refer to Chapter 500.

203.02 Location

Manholes shall be installed in the following locations:

1. At the end of each sewer segment;

2. At all changes in sewer slope, size, or alignment;

   At changes in sewer alignment and/or sizes, the energy gradient elevation shall not increase by:
   a. Matching the crown elevations when changes in pipe sizes are necessary.
   b. Providing an elevation difference between incoming and outgoing pipe inverts as follows:
      i. For sewer angles between zero (0o) degrees (straight through) to and including ninety (90o) degrees – 0.1 feet minimum;
      ii. Over ninety (90o) degrees – Not allowed.

3. At all sewer segment intersections.

4. In areas that will minimize the potential for I/I entering the sewer system.

   Manholes shall NOT be designed or installed in any drainage path such as, but not limited to, the following locations:
   a. Swales or ditches.
   b. Roadside gutters.
   c. Within 10 feet of inverted crowns of streets.
   d. Low points of paved or unpaved areas.
   e. Adjacent stormwater inlets.
   f. Other areas the Utility deems necessary.

Cleanouts shall not be used in lieu of manholes.

203.03 Protection against Ponding

To provide protection against ponding, manholes shall be designed and constructed to provide positive drainage away from the top of casting as follows:

1. Paved areas – Top of casting flush with finished grade.
2. Unpaved areas – Top of casting a minimum of three (3) inch above finished grade.

203.04 Maximum Manhole Spacing

The maximum distances between manholes shall be as follows:

Sewer Size, inches	Max. Spacing, feet
12 or less	400
15 and larger	500

203.05 Manhole Dimensions

The following Table contains the minimum manhole diameters for sanitary sewer pipes entering or exiting a sanitary sewer manhole at the given range of angles.

Pipe Size, inches	**Minimum Manhole Diameters, inches**		Reference Figure
	Pipes Entering or Leaving at a 45^{o} Angle	Pipes Entering or Leaving at a 46^{o}-90^{o} Angle	
18 or less	48	48	300.01
21-24	48	60	300.02

27	60	72	300.02
30 to 36	60	84	300.02
42	72	96	300.02
48	84	Special Design	300.02*
54 or larger	N/A	N/A	300.03

*Only for straight through pipes otherwise use Figure 300.03

The number and entrance angle of pipe connections, with consideration given to outside pipe diameter(s), shall be limited to those guidelines established in the previous Table to ensure the structural integrity of the manhole. If at any time the structural integrity of the manhole cannot be maintained, a cast-in-place structure will be required.

203.06 Drop Connections

Drop pipe connections shall be provided for all sanitary sewers or laterals entering a manhole at an elevation twenty-four (24) inches or greater above the invert of the manhole.

Inside or outside drop connections may be used and are shown in Figures 300.04 and 300.05. However, the Utility may require either an inside or outside drop connection, if conditions necessitate. The size of the drop pipe shall be the same size as the incoming sewer.

The Utility may require an increase in the slope of one or more upstream sewer segments or the lateral to eliminate the need for a drop manhole.

When inside drop connections are installed, the minimum inside diameter of the manhole shall be as follows:

Total Number of Drop Lines	Pipe Size, inches	Inside Manhole Diameter, inches
1	8 to 12	60
2 or 3	8 to 12	72

No more than three (3) inside drop connections are allowed in one manhole. The discharge of the drop structure should be extended to the top of the bench.

Sewers larger than twelve (12) inch proposing drop connections will be evaluated on a case-by-case basis.

Section 204 Other Requirements

204.01 Digital Drafting Standards

All plans for sanitary sewer facilities shall be prepared in compliance with industry standards and the latest edition of the Citizens Energy Group Digital Data Submission Standards.

204.02 Easements

When easements are required, they shall be Sanitary Sewer Easements and shall be dedicated and recorded solely for the benefit of the Utility.

Easements shall be recorded along all frontages of new developments for the benefit of Citizens future use. Frontages shall be covered as described within the Terms and Conditions.

No building, structure, tree, landscaping or other obstruction shall be allowed to be placed, erected, maintained, or allowed to be within any easement dedicated to the Utility.

Easement boundaries shall be shown on the plans, specifications, and plats as “Sanitary Sewer Easement” in lieu of “Utility Easement.” Platted common utility easements are prohibited for sanitary sewer facilities.

The minimum permanent easement widths to be dedicated to the Utility are as follows:

1. For sanitary sewers less than twenty-four (24) inches in diameter:

Depth of Sewer	Minimum Width, feet
Up to and including 10 feet	20
Greater than 10 feet to and including 20 feet	30
Greater than 20 feet	40

All sanitary sewers shall be centered in the easement. For those sanitary sewers constructed in the public right-of-way, the easement shall extend the distance outside the right-of- way necessary to provide the required easement width.

If the sewer is located outside, but within five (5) feet of the right-of-way per Section 202.07.1.a. and is fifteen (15) inch or less in diameter, the exclusive easement is only required to be ten (10) feet wide. The remainder of the required easement width may be shown as a Drainage, Utility, and Sanitary Easement (DU&SE). For sewers greater than fifteen (15) inch in diameter, the easement width shall be as shown in the above table.

2. For sanitary sewers twenty-four (24) inches and larger

   The easement width will be determined on a case-by-case basis, but shall not be less than a minimum of fifty (50) feet in width.

3. Lift Stations

   The easements for lift stations may, at the discretion of the Utility, be modified on a case-by-case basis, if justified. At a minimum, the easement requirements for lift stations are as follows:
   a. From the base slab – twenty (20) feet in all directions;
   b. From the access drive – ten (10) feet in all directions.

   The lift station easement shall not overlap any other easement.

Except for perpendicular crossings as described in Section 202.07.1.a, utility companies are not allowed to use the sewer easements for the installation of their utility lines without the expressed written permission of the Utility. If permission is granted, utilities shall agree to relocate or support their respective facilities, at no expense to the Utility if the Utility requires access to maintain or repair the sanitary sewer facility.

All site development and plan/profile sheets shall clearly identify the sanitary sewer easement and the location of all existing and proposed utilities. The plan/profile sheets shall also show the location and elevation of existing and proposed utilities, on both plan and profile sections, proposed to cross the sanitary sewer easement.

204.03 Protection of Water Supplies

To protect public and private drinking water supplies, the IDEM, Indiana State Department of Health (ISDH), and Marion County Health and Hospital Corporation (MCH&HC) have established minimum clear distances between sanitary sewer facilities and drinking water supplies. Applicant is responsible for complying with all applicable regulations. Where discrepancies are found between the requirements set forth herein and any other requirements by agencies having jurisdiction relating to water supplies, the more restrictive requirement shall be followed.

The clear distances shall be as measured from the outside edge of the sanitary sewer facility (sewer, force main, manhole, or lift station) to the outside edge of the water supply (water main or well screen).

The minimum separation distances between sanitary sewer facilities and water supplies shall be as follows:

1. Water Mains

The minimum separation distance between the following sanitary sewer facilities and existing or proposed water mains shall be as follows:

a. Sanitary Sewers / Force Mains

The minimum horizontal and vertical separation distances shall be as follows:

i. Horizontal Separation – Ten (10) feet

ii. Vertical Separation – Eighteen (18) inches

The vertical separation shall only be applicable when sanitary sewers and water mains cross. When crossing, the sewer and water main shall cross at a minimum angle of forty-five (45) degrees as measured from the centerlines of the pipes and maintain the minimum vertical separation a minimum distance of ten
(10) feet on either side of the sanitary sewer. The joints of the sanitary sewer shall be equidistant and as far as possible from the water main joints.

Separation distances less than the above will be considered and may be allowed if all the following conditions are met:

- The pipe material is pressure rated PVC, Ductile Iron Pipe (DIP), or Prestressed Concrete Cylinder Pipe (PCCP) force main material per Section 304.
- The sanitary sewer and water main are not in contact.
- The sanitary sewer joints are compression type and placed equidistant from the water main.
- The sanitary sewer and water main are laid on separate trench shelves.

b. Manholes – Eight (8) feet

c. Lift Stations – Ten (10) feet

2. Public Water System Drinking Water Wells

The minimum separation distance between the following sanitary sewer facilities and public water system drinking water wells shall be as follows:

a. Sanitary Sewers – Two hundred (200) feet

Sanitary sewers may be located within two hundred (200) feet, <u>but under no circumstances less than fifty (50) feet</u>, from a public water system drinking water well if pressure rated PVC, DIP, or PCCP force main material per Section 304 is used.

b. Manholes – Two hundred (200) feet

c. Lift Stations – Two hundred (200) feet

3. Private Water Supply Wells

   The minimum separation distance between the following sanitary sewer facilities and private water supply wells shall be as follows:

   a. Sanitary Sewers – Fifty (50) feet

      Sanitary sewers may be located within fifty (50) feet, but under no circumstances less than ten (10) feet, from a private water supply well if pressure rated PVC, DIP, or PCCP force main material per Section 304 is used.

   b. Manholes – Fifty (50) feet

   c. Lift Stations – Fifty (50) feet

204.04 Existing Utility Structures and Facilities

All existing overhead and underground utility lines and existing sewers shall be shown on the plans. Owner shall be responsible to verify the accuracy of utility locates.

204.05 Utility Coordination

It is the responsibility of the Owner or their authorized representative to coordinate with and get approvals from the various governmental agencies having jurisdiction over the work and utilities, including other Departments of the Utility for all proposed Work. Further, it is the responsibility of the Owner to get authorization to encroach upon any other utility easement(s) and secure such recorded encroachment as a requirement for dedication of the sanitary sewer facility.

204.06 Sanitary Sewers Crossing Drainage Ways

When crossing streams or rivers, sanitary sewers shall be constructed with DIP or PVC SDR 21, with mechanical joints rated to two hundred (200) psi and backfilled with stone, gravel, or coarse aggregate with a minimum cover depth as follows:

1. Under a Paved Channel – Below the pavement;
2. When located in rock - Twelve (12) inches; or
3. All other areas - Thirty-six (36) inches.

The Utility may require cover depths greater than those specified above, if justified.

204.07 Aerial Crossings, Conflict Resolution Structures, and Siphons

If possible, siphons, conflict resolution structures, and aerial crossings shall be avoided.

If not possible, the requirements shall be determined on a case-by- case basis and will be at the sole discretion of the Utility.

204.08 Grease Traps

A grease trap shall be provided for the following:

1. All commercial buildings with food service.
2. All other commercial buildings with fats, oils, and grease greater than twenty-five (25) mg/L.

Grease traps shall be:

1. A commercially manufactured grease trap or grease recovery system installed inside the building and sized according to the manufacturer's recommendations and in accordance with the Uniform Plumbing Code.
2. A commercially manufactured grease trap or grease recovery system installed outside the building and sized according to the manufacturer's recommendations. A standard grease trap details is shown as Figure 300.11.

Sewage from food service sinks, dishwashers, and kitchen floor drains shall discharge to the grease trap.

The size of the grease trap shall be determined by the following formula:

Grease trap size (in gallons) = M × W × R × S

Where: M = Meals served at peak hour
W = Waste flow rate:
With dishwashing machine = 6 gallons
Without dishwashing machine = 5 gallons
Single service kitchen = 2 gallons
Food waste disposal only = 1 gallon
R = Retention time:
With dishwasher = 2.5 hours
Single service = 1.5 hours
S = Storage factor:
Fully equipped kitchen, 8 hour operation = 1
Fully equipped kitchen, 16 hour operation = 2
Fully equipped kitchen, 24 hour operation = 3
Single service kitchen = 1.5

Minimum storage capacity shall not be less than one thousand (1,000) gallons and does not need to exceed two thousand (2,000) gallons.

CHAPTER 300 MATERIALS

Section 301 General

301.01 Introduction

This Chapter contains the minimum material requirements for construction of Sanitary sewer facilities within the CWA Authority, Inc and/or Citizens Westfield.

301.02 General for all Materials

The materials used in the construction shall be in full conformance with those guidelines set forth below and according to the applicable ASTM, American Water Works Association (AWWA), and ANSI specifications.

These material requirements are minimum requirements and are in part restatements of requirements set forth within the referenced standards, with noted exceptions. The Engineer shall be ultimately responsible for designing and selecting the appropriate material for each specific application. Information from the referenced specifications has been included within this Chapter for the convenience of the reader. However, the engineer, contractor, and manufacturer must also assume the responsibility of familiarizing themselves with these requirements. The CWA Authority, Inc and/or Citizens Westfield will not assume responsibility for noncompliance with the referenced specifications as a result of information not provided in this Manual.

301.03 Material Markings

Each length of pipe and each manhole or other structure shall be marked per the requirements of each respective ASTM, AWWA and/or ANSI standard referenced within this Chapter.

301.04 Certification of Materials

The Utility reserves the right to require material certification from the manufacturer prior to construction to ensure the material supplied conforms to the prescribed requirements.

Upon request, the Contractor shall furnish a certificate of conformance to the required ASTM, AWWA, and/or ANSI Standards, this Manual, and other conformance certifications in the form of affidavits of conformance, test results, and/or copies of test reports.

Provisions for obtaining this certification shall be the responsibility of the Applicant.

The CWA Authority, Inc and/or Citizens Westfield does not assume the responsibility for the expense of obtaining material certification.

301.05 Handling, Storage, and Color

The handling, storage and color requirements for pipe material are as follows:

1. Handling and Storage

   The manufacturer shall package the pipe in a manner designed to deliver the pipe to the project site neatly, intact, and without physical damage. The transportation carrier shall use an appropriate method to ensure the pipe is properly supported, stacked, and restrained during transport. On-site, the pipe shall be stored on clean, level ground to prevent undue scratching or gouging.

2. Color

   The pipe exterior may be colored per the manufacturer's standard color scheme with the exception of blue colored pipe or pipe with blue colored markings as well as 2-inch diameter and larger HDPE pipe which must has continuous green stripes to avoid confusion with water pipes.

Section 302 Sanitary Sewer Pipe Material

302.01 Introduction

This Section applies to materials to be used for the construction of gravity sewers.

For materials to be used for laterals refer to Section 303.

For materials to be used for force mains refer to Section 304.

For materials to be used for manholes refer to Section 305.

302.02 Allowable Pipe Materials

The following pipe materials are the only materials that may be used for gravity sanitary sewer installations:

Material	Designation	Max. Depth, ft.[1]	Sizes (Nominal Diameter, in.)	
			Minimum	Maximum
PVC	ASTM D 3034	25	8	15
	ASTM F 679	25	18	48
	ASTM D 2241	40	8	36
	AWWA C900	40	8	12
	AWWA C905	40	14	36

Reinforced Concrete Pipe (RCP)	ASTM C 76 ASTM C 655	25[2]	24	144
Ductile Iron Pipe (DIP)	ASTM A 746 AWWA C151	40	8	60
Closed Profile Large Diameter PVC Pipe	ASTM F 1803	25	18	54
Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe	ASTM D 3262	40	18	60
Prestressed Concrete Cylinder Pipe (PCCP)	AWWA C301	40	30	144

1 – The maximum depth is a guideline. Due to the variability of site conditions, the Engineer is ultimately responsible for certifying the pipe selected is acceptable for the depths listed and the specific project application.

2 – The depth can be increase to forty (40) feet provided the joints and gaskets are designed per ASTM C 361. See Section 302.06.3 for specific requirements.

The individual requirements and specifications for the above pipe materials are listed in the remainder of this Section.

Vitrified Clay Pipe (VCP) for gravity sewer construction is not allowed.

302.03 Polyvinyl Chloride Pipe (PVC)

The minimum requirements for PVC are as follows:

1. Size

   Maximum size – Forty-eight (48) inches

2. Material

   a. Pipe installations up to twenty-five (25) feet deep

Polyvinyl Chloride (PVC) sanitary sewer pipe and fittings eight (8) inches through fifteen (15) inches in diameter shall be the integral wall bell and spigot-type with elastomeric seal joints and smooth walls conforming to ASTM D 3034 and a minimum of SDR 35.

PVC sanitary sewer pipe and fittings eighteen (18) inches in diameter and larger shall be smooth wall conforming to ASTM F 679.

All fittings shall be heavy walled fittings.

Pipe shall have a minimum pipe stiffness of 46 psi when measured at 5% vertical ring deflection and tested in accordance with ASTM D 2412 and a minimum tensile strength of 34.50 MPa.

b. Pipe installations over twenty-five (25) feet deep

PVC pipe materials shall be ASTM D 2241 (SDR 26 minimum) with minimum cell classification of 12454, AWWA C900 (DR 25 min), or AWWA C905 (DR 25 min).

When pipe conforming to AWWA Standards is used, all fittings shall also be made of PVC.

3. Joints and Gaskets

a. Joints

i. Flexible gasketed joints shall be compression type so that when assembled, the gasket inside the bell will be compressed radially on the pipe spigot to form a watertight seal.

ii. Joints shall be as follows:

- For pipe conforming to ASTM D 3034 and F 679, the joint shall meet the requirements of ASTM D 3212.
- For pipe conforming to ASTM D 2241, AWWA C900, and AWWA C905, the joint shall meet the requirements of ASTM D 3139.

iii. The assembly of joints shall be in accordance with the pipe manufacturer’s recommendations.

b. Gaskets

All gaskets shall meet the requirements of ASTM F 477.

Solvent welded joints and coupling joints are not acceptable.

4. Field Cutting of Pipe

All field-cutting of pipe shall be done in a neat, trim manner using a hand or power saw, and the cut end shall be beveled using a file or wheel to produce a smooth bevel of approximately 15° and be a minimum depth of one-third (1/3) the pipe wall thickness or beveled as specifically recommended by the pipe manufacturer. Field cut pipe will only be allowed to be installed at manholes, at prefabricated tees and wyes, and at the connection of new sanitary sewer to existing sanitary sewer.

5. Rejection of Damaged Pipe

   PVC pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings as required; deep or excessive gouges or scratches of the pipe wall; fractures, punctures, or cracks passing through the pipe wall; and damaged ends where such damage would prevent making a satisfactory joint.

6. Pipe Markings

   For PVC pipe, each length of pipe must be marked per ASTM and AWWA requirements and at a minimum with the following: name of manufacturer, tradename or trademark, nominal pipe size, production/extrusion code, material and cell class designation, ASTM designation, and SDR number.

   In addition, the plain end of each pipe length shall have rings painted around the pipe at the proper location to allow field checking of the correct setting depth of the pipe in the bell.

7. Manufacture and Construction

   a. Pipes

      Pipes shall be manufactured and tested in accordance with appropriate ASTM and AWWA standards to result in a solid wall pipe.

   b. Fittings

      Tees, wyes, and other fittings shall be heavy-walled and capable of withstanding the same stresses as the pipe to which they are connected. All fittings shall be fabricated from pipe meeting the requirements of these standards.

302.04 Closed Profile Large Diameter PVC

The minimum requirements for Closed Profile PVC pipe are as follows:

1. Size

   Maximum Size – Fifty-four (54) inches

2. Materials

Pipe and fittings shall be made from polyvinyl chloride compounds which comply with the requirements as specified by ASTM F 1803 with a minimum cell classification of 12364. Minimum pipe stiffness shall be 46 psi when tested in accordance with ASTM D 2412.

The actual inside and outside diameter of the pipes shall be in accordance with current manufacturer's literature, unless otherwise agreed to by the Utility pipe shall be supplied in nominal lengths of fourteen (14) feet unless special sections are needed for construction in which case shorter or longer lengths may be used. Actual laying length shall be nominal plus or minus two (±2) inches.

3. Joints and Gaskets

   All pipe joints shall be of the bell and spigot type with elastomeric seals and conform to the requirements of ASTM D 3212.

   Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Gasket material shall conform to the requirements of ASTM F 477.

4. Rejection of Damaged Pipe

   Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings as required herein; deep or excessive gouges or scratches of the pipe wall; fractures, punctures, or cracks passing through the pipe wall or wall profile; damaged ends where such damage would prevent making a satisfactory joint, voids in the pipe walls, or other noticeable defects in pipe manufacture.

5. Marking

   Each PVC closed profile wall pipe length and fitting shall be clearly marked per ASTM F 1803 and at a minimum with the following: manufacturer's name, nominal pipe size, cell classification, pipe stiffness - 46 PSI, and certification.

6. Manufacture and Construction

   a. Pipes

      Manufacture pipe by the I-beam profile construction process to result in a non-porous, corrosion-resistant, consistent structure.

   b. Fittings

      Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding the same stresses as the pipe to which they are connected. All fittings shall be fabricated from pipe meeting the requirements of these standards. Fabricated miter joints shall be reinforced by fusion heat welding.

Closed Profile Large Diameter PVC Gravity Sewer shall be Lamson Vylon Pipe or an approved equal.

302.05 Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe

The specifications herein shall be considered as the minimum requirements for Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe. Due to the differing manufacturing processes and strength characteristics between the different manufacturers, the pipe shall be designed for site specific conditions.

The minimum requirements for Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe are as follows:

1. Size

   Maximum size – Sixty (60) inches

2. Materials

   Pipe shall be manufactured per ASTM D 3262.

   The actual inside and outside diameter of the pipes shall be in accordance with current manufacturer's literature, unless otherwise agreed to by the Utility.

   Pipe shall be supplied in nominal lengths of twenty (20) feet unless special sections are needed for construction in which case shorter or longer lengths may be used. Actual laying length shall be nominal ± two (2) inches.

   Minimum pipe stiffness shall be 46 psi when tested in accordance with ASTM D 2412.

   Applications which are to be directly jacked into place or micro- tunneled shall utilize pipe configurations specifically designed for jacking or tunneling applications with no protrusions for the joint coupling.

   a. Resin Systems

      The manufacturer shall use vinylester resin systems for greater chemical resistance. Polyester resin systems with a proven history of performance in resisting sanitary sewerage may only be used with prior written approval from the Utility and then only after the Engineer determines the greater chemical resistance is not needed.

   b. Glass Reinforcements

      The reinforcing glass fibers used to manufacture the components shall be of commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.

   c. Silica Sand

Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.

d. Additives

Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally affect the performance of the product.

3. Joints and Gaskets

Fiberglass sleeve couplings that utilize elastomeric sealing gaskets of an appropriate profile shall be the sole means to maintain joint water-tightness. The joints must meet the performance requirements of ASTM D 4161. All joints shall be certified by the pipe manufacturer to perform at fifty (50) feet of hydrostatic head at 5% deflection.

The gaskets shall be made of EDPM elastomeric membrane and shall be resistant to sewage, industrial wastes, and groundwater.

4. Rejection of Damaged Pipe

Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings as required herein; deep or excessive gouges or scratches of the pipe wall or liner; fractures, punctures, or cracks passing through the pipe wall; damaged ends where such damage would prevent making a satisfactory joint, voids in the pipe walls, delamination, cracking and crazing of liner or pipe wall, or other noticeable defects in pipe manufacture.

5. Markings

Each length of pipe shall be clearly marked per ASTM D 3262 and at a minimum with the following: manufacturer's name, tradename or trademark, nominal pipe size, pipe stiffness, production code, and ASTM number.

6. Manufacture and Construction

a. Pipes

Manufacture pipe by the centrifugal casting process to result in a dense, non-porous, corrosion-resistant, consistent composite structure. Pipes shall be tested in accordance with ASTM D 3262. MANDREL PROCESSES TO BUILD UP THE PIPE WALL ARE NOT ALLOWED.

b. Fittings

Flanges, elbows, reducers, tees, wyes, laterals, and other fittings shall be capable of withstanding the same stresses as the pipe to which they are connected. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Properly protected standard ductile iron, fusion-bonded epoxy coated steel and stainless steel fittings may also be used.

Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe shall be Hobas pipe or an approved equal.

302.06 Reinforced Concrete Pipe (RCP)

The minimum requirements for Reinforced Concrete Pipe are as follows:

1. Size

   Minimum – Twenty-four (24) inches

   Maximum – One hundred forty-four (144) inches

2. Material

   a. Reinforced Concrete:

      Reinforced concrete pipe shall be in accordance with ASTM C 76. Pipe wall thickness shall be either Wall B or Wall C as appropriate for the size and installation. When deep burial depths are greater than twenty-five (25) feet require an improved joint to resist higher head conditions, joint sections manufactured in accordance with ASTM C 361 with a joint rating of at least fifty (50) feet shall be incorporated.

      When special conditions exist and as authorized by the Utility, reinforced concrete pipe manufactured in accordance with ASTM C 655 may be used. The minimum D-load design for ASTM C 655 pipe shall be 1000 and the minimum increment of D-load shall be at least 200, if multiple pipe designs are proposed on a single project.

      For pipe designed in accordance with ASTM C 76 or C 655, factors of safety shall be 1.5 for D-loads of 2000 and less, 1.25 for D-loads of 3000 and higher and uniformly decreasing between 1.5 and 1.25 for D-loads between 2000 and 3000. The wall thickness shall not be less than the wall thickness used to verify the D-load strength.

   b. Steel Reinforcement

      Steel reinforcement shall be in accordance with and placed to the requirements of the applicable tables in ASTM C 76, ASTM C 361, or per the approved D-load design.
      Longitudinal reinforcement shall be continuous, and all reinforcement shall have a minimum concrete cover of 1 inch. Minimum cover requirements do not apply to the mating surfaces of the joint, gasket seat, or end of longitudinal. Elliptical reinforcement shall not be permitted.

   c. Lift Holes

      Lift holes are not allowed.

d. Lining

<u>All</u> reinforced concrete pipes for sanitary sewers shall be factory lined with one of the following materials: T-Lock PVC by Ameron, GSE Studliner by Grundle/SLT Environmental, Agru Sure Grip by Agru America, or approved equal.

i. Liners shall be completed with heat welded joints at all pipe joints where the liner is discontinuous across the joint. Liner sheets with adhesive backing or other non- heat welded joint overlays are not permitted.

ii. Liner shall be embedded in concrete to withstand a test pull of at least 100 pounds per linear inch, applied perpendicularly to the concrete surface for a period of one minute, without rupture of the locking extensions or withdrawal from embedment. This test shall be made at a temperature of 70-80 degrees Fahrenheit inclusive.

iii. Lining material shall have good impact resistance, shall be flexible, and shall have an elongation sufficient to bridge up to one-quarter (¼) inch settling cracks, which may occur in the joint after installation, without damage to the lining.

iv. The lining shall be repairable at any time during the life of the pipe or structure by heat welding additional materials to the liner.

v. The lining materials shall be resistant to municipal sewage.

3. Joints and Gaskets

All joints for pipes in accordance with ASTM C 76 and ASTM C 655 shall comply with the requirements of ASTM C 443.

Joints and gaskets designated to be in excess of twenty-five (25) feet of head shall be designed in accordance with ASTM C 361.

Only one style of joint system or configuration shall be permitted between adjacent manholes.

4. Rejection of Damaged Pipe

Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings; fractures in excess of 0.01 inch or cracks passing through the pipe wall; damaged ends where such damage would prevent making a satisfactory joint, voids and/or honeycombing in the pipe walls, delamination of pipe liner, cracking and crazing of liner, or other noticeable defects in pipe or liner manufacture.

5. Marking

All markings required by the appropriate ASTM specification shall be legibly marked on each section of pipe.

6. Manufacturer and Construction

   Manufacture and test pipe sections in accordance with ASTM C 76, C 361, or C 655 as appropriate for the strength, class, size, and joint design utilized.

7. Special Shaped Pipe

   Special shaped pipe shall conform to the specifications for straight pipe insofar as applicable. Special design or construction necessary for specials shall be subject to approval by the Utility on a case-by-case basis.

302.07 Ductile Iron Pipe (DIP)

The minimum requirements for DIP are as follows:

1. Size

   Maximum – Sixty (60) inches

2. Materials

   Ductile Iron Pipe shall be centrifugally cast and shall conform to ANSI/AWWA A21.51/C151 and ASTM A 746. Thickness or pressure class requirements of ductile iron pipe may be used for design in the conveyance of sanitary sewage by gravity. The minimum pipe wall thickness allowed shall be Class 250. Weights of pipe fittings shall conform strictly to the requirements of Specifications. The minimum laying lengths shall be eighteen (18) feet.

3. Coatings and Linings

   a. Coatings

      The outside surfaces of the pipe and fittings shall be bituminous-coated complying with ANSI/AWWA A21.51/C151 and ANSI/AWWA A21.10/C110.

   b. Linings

      The inside surfaces of <u>all</u> pipe, fittings, and adapters shall be lined with factory applied Protecto 401® ceramic epoxy lining, or approved equal.

4. Joints

   Mechanical, push on or restrained joints shall be provided. Flanged joints are not allowed for buried applications.

   a. Mechanical joints and accessories shall conform to AWWA C111/ ANSI A21.11. The bolts and nuts shall be corrosion resistant high strength alloy steel.

b. Ductile iron pipe push-on type joints shall conform to ANSI A21.11/AWWA C111. Fittings shall be ductile iron and shall comply with ANSI Specification A21.10/AWWA C110.

c. Restrained joints shall be manufactured in accordance with pipe manufacturers' requirements. Locking rings, tabs, inserts, or gaskets with inset steel grips may all be used for gravity sanitary sewer applications.

5. Fittings

   Fittings shall be standardized for the type of pipe and joint specified, and shall comply with ANSI A21.10/AWWA C110.

6. Rejection of Damaged Pipe

   Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings as required herein; deep or excessive gouges or scratches of the pipe wall or lining; fractures or cracks in the pipe wall or lining; damaged ends where such damage would prevent making a satisfactory joint, delamination of linings, cracking and crazing of liner, or other noticeable defects in pipe manufacture.

7. Markings

   Each pipe length shall be marked per ASTM A 746 and at a minimum the following: nominal size and class designations for the various classes of pipe and fittings shall be cast onto fittings in raised numerals, and cast or stamped on the outside of each section of pipe. Weights shall be plainly and conspicuously painted in white on the outside of each section of pipe and each fitting after the exterior coating has hardened.

8. Manufacturer and Construction

   Manufacture and test completed pipe sections in accordance with ANSI/AWWA A21.4/C104, ANSI/AWWA A21.51/C151, ANSI/AWWA A2110/C110 and AWWA C111 (ANSI A-21.11)
   as appropriate.

302.08 Prestressed Concrete Cylinder Pipe (PCCP)

The minimum requirements for pre-stressed concrete cylinder pipe for gravity applications are as follows:

1. Size

   Minimum Size – thirty (30) inches

   Maximum Size – One hundred forty-four (144) inches

2. Material

The pipe shall conform to the requirements of AWWA C301. C301 pipe shall be designed in accordance with AWWA Standard C304. The pipe design shall be based on the working pressures, surge pressures, earth cover, and live load criteria provided in the contract documents. The external load design shall be suitable for the installation conditions shown in the project plans.

3. Lining

All PCCP pipe shall be factory lined with one of the following materials: T-Lock PVC by Ameron, GSE Studliner by Grundle/SLT Environmental, Agru Sure Grip by Agru America, or approved equal.

a. Liners shall be completed with heat welded joints at all pipe joints where the liner is discontinuous across the joint. Liner sheets with adhesive backing or other non-heat welded joint overlays are not permitted.
b. Liner shall be embedded in concrete to withstand a test pull of at least 100 pounds per linear inch, applied perpendicularly to the concrete surface for a period of one minute, without rupture of the locking extensions or withdrawal from embedment. This test shall be made at a temperature of 70-80o Fahrenheit inclusive.
c. Lining material shall have good impact resistance, shall be flexible, and shall have an elongation sufficient to bridge up to one-quarter (¼) inch settling cracks, which may occur in the joint after installation, without damage to the lining.
d. The lining shall be repairable at any time during the life of the pipe or structure by heat welding additional materials to the liner.
e. The lining materials shall be resistant to municipal sewage.

4. Joints

Steel and rubber gaskets shall conform to AWWA C301.

5. Fittings and Special Sections

Fittings and special pipe sections shall be designed and fabricated to the requirements of the appropriate AWWA standards and AWWA Manual M9 Chapter 8, as applicable.

All required flanges shall conform to AWWA C207 Class D requirements for standard steel flanges corresponding to the pipe working pressures.

The PVC lining in fittings and special sections shall be attached to the mortar lining using methods acceptable to the manufacturer of the lining material.

6. Rejection of Damaged Pipe

Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings; fractures in excess of 0.01 inch, cracks passing through the pipe wall; damaged ends where such damage would prevent making a satisfactory joint, voids and/or honeycombing in the pipe walls, or other noticeable defects in pipe manufacture.

7. Marking of Pipe

   The inside of each pipe section, fitting, or special pipe section shall be plainly marked with the pipe diameter and pressure class for which the section or fitting is designed. In addition, all fittings and special pipe sections shall be marked with an identifying number or station corresponding to that shown on the layout schedule. All fittings or special sections requiring special field orientation during installation shall be properly marked.

Section 303 Laterals

303.01 Introduction

This Section applies to the materials to be used for the construction of gravity laterals.

For materials to be used for gravity sewers refer to Section 302.

For materials to be used for force mains, including low pressure systems, refer to Section 304.

For materials to be used for manholes refer to Section 305.

303.02 Lateral Materials

The minimum requirements for laterals shall conform to the following:

1. Allowable Pipe Materials:

   The following are the only materials that shall be used for laterals.

Material	Designation	Classification	
PVC	ASTM D 3034	SDR 35	Cell Class 12454 or 12364
PVC	ASTM D 2241	SDR 32.5	Cell Class 12454
PVC	ASTM D 2466	Schedule 40	Cell Class 12454
PVC	ASTM D 2467	Schedule 80	Cell Class 12454
HDPE*	ASTM F 714	DR 17	Hydrostatic Design Basis of 1600 psi

*High Density Polyethylene (HDPE) is only allowed for pipe bursting applications, shall utilize DIPS pipe sizing, and shall have a light reflective interior. Standard black interior lined pipe shall not be accepted.

Vitrified Clay Pipe (VCP) for lateral construction is not allowed.

Note: For low pressure systems, the pipe between the individual house grinder pump unit and the low pressure main is considered a lateral. Only HDPE pipe material is allowed to be used in this application. Because the pipe is also considered a force main, the material requirements, including the tapping sleeve, are shown in Section 304.04.

2. Joints

   a. For four (4) inch and six (6) inch laterals, only six (6) inch laterals will be allowed in Westfield.

      Joints shall be either flexible gasket push-on type or solvent cement type for PVC or butt fused type for HDPE to allow push-on joints for 4 inches and 6 inches laterals.

   b. For eight (8) inch and larger laterals

      Joints shall be either flexible gasket push-on type or solvent cement type for PVC or butt fused type for HDPE.

   Joints shall be installed in accordance with the manufacturer’s recommendations.

Section 304 Force Main Material

304.01 Introduction

This Section applies to materials to be used for the construction of force mains, including Low Pressure Systems.

For materials to be used for gravity sewers refer to Section 302.

For materials to be used for gravity laterals refer to Section 303.

For materials to be used for manholes refer to Section 305.

304.02 Allowable Force Main Material

The following pipe materials are the only materials that may be used for sanitary sewer force main and low pressure system installations:

Material	Designation	
	ASTM	AWWA
Polyvinyl Chloride Pipe (PVC)	D2241	C900 C905
HDPE [1]	D3035 F714	C901 [2] C906[2]
DIP	------	C151
Prestressed Concrete Cylinder Pipe	------	C301*

[1] HDPE is the only allowable pipe material for low pressure systems.

[2] Acceptable only if requested as alternate to technical standards.

304.03 Polyvinyl Chloride (PVC) Pipe

The minimum requirements for PVC pipe for force mains are as follows:

1. Material

   PVC force main pipe shall conform to ASTM D 2241, AWWA C900 or AWWA C905.

   For ASTM D 2241, the material shall conform to ASTM D 1784, Cell Class 12454 and a hydrostatic design stress of 2000 psi. The minimum pressure class/DR rating shall be Class 200/DR 21.

   For AWWA C900 the material shall conform to ASTM D 1784 for cell class 12454 and a hydrostatic design basis of 4000 psi. The minimum pressure class/DR rating shall be Class 235/DR 18.

   For AWWA C 905 the material shall conform to ASTM D 1784 for cell class 12454 and a hydrostatic design basis of 4000 psi. The minimum pressure class/DR rating acceptable shall be Class 200/DR 21.

2. Joints

   Joints shall be a bell end coupling push-on type with joint restraints as needed.

   Joint restraints shall be Megalug® style mechanical joints for PVC pipe as manufactured by EBAA IRON or approved equal.

   The push-on joint and gaskets shall meet the requirements for ASTM D 3139 and F 477.

3. Fittings

   Fittings shall be restrained joint ductile iron fittings conforming to ANSI A21.10/AWWA C110 and ANSI A21.11/AWWA C111.

Restrained joints shall be Megalug® style for PVC as manufactured by EBAA Iron, or approved equal.

4. Rejection of Damaged Pipe

   Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings as required herein; deep or excessive gouges or scratches of the pipe wall; fractures, punctures, or cracks passing through the pipe wall; damaged ends where such damage would prevent making a satisfactory joint.

5. Markings

   Each length of pipe must be marked per ASTM and AWWA and at a minimum with the following information: name of manufacturer; tradename or trademark; nominal pipe size; production/extrusion code; material and cell class designation; and ASTM designation.

304.04 High Density Polyethylene (HDPE) Pipe

The minimum requirements for HDPE pipe for force main applications are as follows:

1. Material

   Materials used for the manufacture of HDPE pipe shall be extra high molecular weight, high density ethylene/hexane copolymer PE 4710 resin meeting the requirements of ASTM D 3350 with a cell classification of 445474C for materials in accordance with ASTM F 714, ASTM D3035, AWWA C901, or AWWA C906.Pipe shall be sized in accordance with DIPS except pipe under 4 inch. All material shall have a hydrostatic design basis of 1600 psi. The minimum pressure class/DR rating acceptable shall be Class160/DR 11.

   The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All material shall be listed by the Plastic Pipe Industry in the name of the pipe manufacturer and shall be based on ASTM D 2837 and PPI TR-3 testing and validation for samples of the pipe manufacturer's production pipe.

2. Joints

   HDPE pipe shall be joined into continuous lengths on the job- site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. Electrofusion shall not be used except as needed to connect adjacent directionally drilled sections which are to be connected in the trench bottom. Mechanical joint adapters are required to mechanically connect the HDPE pipe to the main line.

   Joint restraint to prevent axial separation shall be incorporated into the design of the sleeve or coupling used to connect HDPE pipe plain ends. Internal pipe wall stiffeners must be used when restraining HDPE. Mechanical joint adapters are the preferred type of restraints for HDPE pipe. If requested by the Utility based on the connection type, a restrained coupling system such as EBAA Iron, Inc. Series 3800. or an approved equal can be used.

3. Fittings

   Fittings shall be either HDPE or ductile iron.

   HDPE fittings shall be manufactured in accordance with ASTM D 3261 by injection molding, a combination of extrusion and machining or fabricated from HPDE pipe conforming to this Standard. Fittings shall be fully pressure rated and provide a working pressure equal to the adjacent pipe with an included two (2) to one (1) safety factor.

   Ductile iron fittings shall be restrained joint ductile iron fittings conforming to ANSI A21.10/AWWA C110 and ANSI A21.11/AWWA C111 with MJ Adapters.

4. Rejection of Damaged Pipe

   Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings as required herein; deep or excessive gouges or scratches of the pipe wall; fractures, punctures, or cracks passing through the pipe wall; damaged ends where such damage would prevent making a satisfactory joint.

5. Markings

   During the extrusion production, the HDPE pipe shall be continuously marked per ASTM and AWWA with durable printing with at a minimum the following: nominal pipe size, dimension ratio, pressure rating, trade name, material classification, certification bases, and date in white lettering. For diameters 2-inch diameter and larger, pipe shall be marked with continuous green stripes to distinguish it from other utilities.

6. Handling and Storage

   In addition to the requirements in Section 301.05, when moving fused sections of pipe, chains or cable type chokers shall be avoided, nylon slings are preferred. Care must be exercised to avoid cutting or gouging the pipe.

7. Tapping Tees for Low Pressure Sewer Systems

   HDPE tapping tees for low pressure sewer systems shall be molded electrofusion or heat fusion types manufactured from PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4 and shall meet the specifications of ASTM D 3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

   Electrofusion tees shall be manufactured per ASTM F1055, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Controlled Polyethylene Pipe and Tubing. Heat fusion types shall be manufactured per ASTM D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastics Pipe and Tubing. Tapping tees shall have a minimum pressure rating equal to or greater than the pipe to which they are joined. HDPE welds for 6- inch diameter pipe and larger shall be documented using a data logger.

304.05 Ductile Iron Pipe (DIP)

The minimum requirements for ductile iron pipe for force main applications are as follows:

1. Material

   Pipe shall be centrifugally cast in metal or sand-lined molds and shall conform to ANSI A21.51/AWWA C151. The minimum pipe wall thickness allowed shall be Class 250 for all sizes.

2. Fittings

   Fittings shall be push-on or mechanical joint, iron or ductile iron conforming to ANSI A21.10/AWWA C110.

3. Coatings

   Outside surfaces of the pipe and fittings shall be bituminous- coated complying with ANSI/AWWA A21.51/C151 and ANSI/AWWA A21.10/C110.

   The inside surfaces of all pipe, fittings, and adapters shall be lined with factory applied Protecto 401® ceramic epoxy lining, or approved equal including Tnemac 431 ceramic epoxy lining.

4. Joints and Gaskets

   Pipe joints shall be push-on type or mechanical-type complying with ANSI A21.11/AWWA C111 unless otherwise noted on the drawings.

   Restrained joints shall be Megalug® by EBAA Iron, Flex-Ring or Lok-Ring by American Pipe, TR-Flex and Field Lok by US Pipe, Snap-Lok or Bolt-Lok by Griffin Pipe, or other similar manufacturer supplied systems.

   Gaskets for mechanical joints, push on joints, and restrained joints shall conform to ANSI A21.11/AWWA C111.

   Anti-corrosion (blue) T-bolts such as Xylan or FluoroKote #1shall be required for MJ fittings.

5. Rejection of Damaged Pipe

   Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings as required herein; deep or excessive gouges or scratches of the pipe wall or lining; fractures or cracks in the pipe wall or lining; damaged ends where such damage would prevent making a satisfactory joint, delamination of linings, cracking and crazing of liner, or other noticeable defects in pipe manufacture.

6. Markings

   The size and class designations for the various classes of pipe and fittings shall be cast onto fittings in raised numerals, and cast or stamped on the outside of each section of pipe.
   Weights shall be plainly and conspicuously painted in white on the outside of each section of pipe and each fitting after the exterior coating has hardened.

304.06 Prestressed Concrete Cylinder Pipe (PCCP)

The minimum requirements for pre-stressed concrete cylinder pipe for force main applications are as follows:

1. Material

   The pipe shall conform to the requirements of AWWA C301 or C303. C301 pipe shall be designed in accordance with AWWA Standard C304. C303 pipe shall be designed in accordance with the procedures shown in AWWA Manual M9, Chapter 7.

   The pipe design shall be based on the working pressures, surge pressures, earth cover, and live load criteria provided in the contract documents. The external load design shall be suitable for the installation conditions shown in the project plans.

2. Joints

   Steel and rubber gaskets shall conform to AWWA C-301 or AWWA C-303 as appropriate.

3. Fittings and Special Sections

   Fittings and special pipe sections shall be designed and fabricated to the requirements of the appropriate AWWA standards and AWWA Manual M9 Chapter 8, as applicable.

   All required flanges shall conform to AWWA C207
   requirements for standard steel flanges corresponding to the pipe working pressures.

4. Rejection of Damaged Pipe

   Pipe possessing the following defects may be rejected for installation: variation from straight centerline; elliptical shape; illegible markings; fractures in excess of 0.01 inch, cracks passing through the pipe wall; damaged ends where such damage would prevent making a satisfactory joint, voids and/or honeycombing in the pipe walls, or other noticeable defects in pipe manufacture.

5. Marking of Pipe

   The inside of each pipe section, fitting, or special pipe section shall be plainly marked with the pipe diameter and pressure class for which the section or fitting is designed. In addition, all fittings and special pipe sections shall be marked with an identifying number or station corresponding to that shown on the layout schedule. All fittings or special sections requiring special field orientation during installation shall be properly marked.

Section 305 Manhole Materials and Appurtenances

305.01 Introduction

This Section applies to the materials and specifications for manholes, wet wells, valve vaults, meter vaults and appurtenant structures.

305.02 Precast Sanitary Manholes

Precast manholes, including drop manholes, shall be per Figures 300.01 through 300.06 and the following:

1. Material

   Precast reinforced concrete manholes shall be manufactured, tested, and marked in accordance to ASTM C 478. Manhole sections shall not be installed until at least five (5) days after having been cast unless permitted in writing by the Utility.

2. Joints

   All joints between precast manhole elements (excluding adjusting rings) shall have a rubber gasket per ASTM C 443, and one-half (½) inch diameter butyl rubber rope sealant per ASTM C 990.

3. Lift Holes

   No “see through” lift holes shall be allowed on precast concrete manholes.

4. Rejection of Damaged Manholes

   Manholes possessing any of the following defects shall be subject to rejection:
   a. Fractures or cracks passing through the shell, except for a single end crack that does not exceed the depth of the joint;
   b. Defects that indicate imperfect proportioning, mixing and molding;
   c. Surface defects indicating honeycombed or open profile; damaged ends, when such damage would prevent making a satisfactory joint;
   d. The internal diameter of the manhole section shall not vary more than 1% from the nominal diameter;
   e. Deviations more than one-quarter (¼) inch from the straight edge at any point across the top of the manhole cone section or riser ring;
   f. Visible steel bars along the inside or outside surface of the manhole except for reinforcement stirrups or spacers used to position the cage during manufacture, and reinforcement bars visible at the manhole structure end, provided these reinforcement bar ends are properly grouted in conformance with applicable ASTM specifications; and/or
   g. Illegible or unmarked manhole sections not clearly marked with date of manufacture, Tradename, size designation part number, or ASTM number.

5. Other Requirements

   Precast manhole cones shall be as follows:
   a. Eccentric offset type;
   b. The top internal portion of the cone shall have a minimum four (4) inch uniform circumference to accept an internal chimney seal as shown in Figures 300.01 through 300.06; and
   c. The top of the cone shall be cast to accept the one of the precast adjusting rings as shown in Figure 300.08.

305.03 Drop Manholes

Inside or outside drop manholes shall be constructed consistent with the requirements of Section 305.02.

305.04 Monolithic (Cast-In-Place) Sanitary Sewer Structures

Monolithic pour structures will be approved on a case-by-case basis provided plans and specifications identifying the concrete mix, steel reinforcement details, pipe connections, and manhole dimensions are submitted and approved prior to construction. Substantial field changes of the approved construction drawings shall be certified by the Engineer, and receive approval of the Utility prior to completion of the proposed work.

305.05 Concrete Bases

Base sections for forty-eight (48) and sixty (60) inch diameter precast manholes shall be constructed with the base and first riser section as one complete integral (monolithic) precast unit.

The concrete base shall be as follows: a minimum of six (6) inch thickness for forty-eight (48) inch diameter structures and a minimum of eight (8) inch thickness for larger diameter structures.

Monolithic pour or precast manholes shall be constructed of Class A concrete having a compressive strength of 4000 psi.

Precast manholes seventy-two (72) inches in diameter and larger with separate base sections shall utilize a gasketed joint between the base section and first riser section.

305.06 Flow Channels and Bench Walls

The channels shall be shaped and formed for a clean transition with proper hydraulics to allow the smooth conveyance of flow through the manholes. The bench wall shall be formed from the invert to a minimum height of 80% of the inside diameter of the inlet and outlet pipes to form a “U” shaped channel. The bench top shall be constructed at a one-half (½) inch per foot slope from the manhole wall. Refer to Figure 300.07 for typical details of flow channels in manholes.

Where a flow channel is constructed as an integral part of the precast base, it shall be shaped and formed as described above, with the exception that the bottom of the flow channel may be formed from the bottom of inlet and outlet pipes if the pipe wall thickness is not greater than one (1) inch.

For cast-in-place flow channels, the bottom invert of all pipes entering a manhole shall be at least three (3) inches above the top of the base slab to the outlet invert so the finished sewer channel may be installed and shaped.

For connections to existing sanitary sewer structures, flow channels shall be shaped as if it were a new manhole.

Grout shall be used to construct a smooth transition from pipe to flow channel.

305.07 Manhole Adjusting Rings

Only concrete adjusting rings are allowed.

Concrete adjusting rings shall conform to ASTM C 478 and be free from voids, cracks, and other defects. The adjusting ring shall be from the same manufacturer as the manhole cone section to assure compatibility and a watertight seal per Figure 300.08.

The minimum thickness of the concrete adjusting ring shall be four (4) inches.

305.08 Steps

Steps shall conform to the requirements of ASTM C 478 and be manufactured using steel rods encased in polypropylene plastic. Steps shall be factory installed when the manhole is manufactured.

Steps shall not be installed in manholes within the Westfield territory.

305.09 Sewer to Manhole Connectors

Sewer pipe connections to manholes shall be made with resilient rubber connectors manufactured in accordance with ASTM C 923.

Connectors shall be secured to the manhole by either being cast-in or connected with an expandable stainless steel band. Connector shall be secured to the pipe with a stainless steel band. The stainless steel elements of the connector shall be totally non-magnetic, Series 305 stainless steel.

The connector shall be the sole element relied upon to assure a flexible, watertight seal from the sewer to the manhole.

The connectors shall be as manufactured by Kor-N-Seal, Press Seal, A-Lok, or approved equal.

305.10 Manhole Chimney Seal

Internal Manhole Chimney Seals shall consist of a flexible internal rubber sleeve, interlocking extensions, and stainless steel compression bands conforming to ASTM C 923.

The seal shall remain flexible throughout a 25-year design life, allowing repeated vertical movement of the frame of not less than two (2) inches and repeated horizontal movement of the frame of not less than one- half (½) inch. The sleeve portion of the seal shall be a minimum double pleated with a minimum unexpanded vertical height of 8, 10, or 13 inches, respectively. The sleeve and extension shall have a minimum thickness of three-sixteenths (3/16) inches and shall be made from a high quality rubber compound conforming to the applicable requirements of ASTM C 923, with a minimum 1500 psi tensile strength, a maximum 18% compression set, and a hardness (durometer) of 48 ± 5.

The area of the seal that compresses against the manhole frame/casting and the chimney/cone shall provide a watertight seal.

The bands shall be fabricated from 16 gauge stainless steel with no welded attachments and shall have a minimum adjustment range of two (2) diameter inches. Any screws, bolts, or nuts used to lock the band in place shall be stainless steel.

The internal seals shall be as manufactured by Cretex Specialty Products, NPC Specialty Products, or an approved equal.

305.11 Casting, Frames and Covers

Castings shall be as follows:

1. Catalog Number

   The frame and cover shall be as follows:

   a. Neenah Regular:

      Frame:1772198 (frame/lid set) / 1772-2302 (frame)
      Lid: 1772198 (frame/lid set) / 1772-5727 (lid)

      or

   b. EJ (East Jordan Iron Works) Regular:

      Frame: 1022Z1 / 00102310
      Lid: 1020AGS / 001020111

   All castings shall have a machined bearing surface with Type F concealed pickholes.

2. Markings

   Sanitary sewer manhole covers shall be a solid lid casting as detailed in Figure 300.09 and,300.10, for Neenah and EJ, respectively. The words “Sanitary Sewer” must be cast in recess letters per the Figures.

3. Requirements

   Castings shall be manufactured in accordance with ASTM A 48 - Class 35B, and have a minimum tensile strength of 35,000 psi.

Boltdown castings shall be provided in Special Flood Hazard Areas.

Casting shall be of uniform quality, free from blow holes, porosity, hard spots, shrinkage, distortion, or other defects. They shall be smooth and well-cleaned by shot blasting or other approved method.

All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall be of non-rocking design or shall have machined horizontal bearing surfaces to prevent rocking and rattling under traffic. All castings shall be fully interchangeable.

CHAPTER 400 INSTALLATION

Section 401 Installation Requirements Applicable to Sanitary Sewers, Force Mains, and Laterals

401.01 Introduction

This Section provides the minimum installation requirements common to sanitary sewers, force mains, and laterals.

For specific installation requirements for laterals refer to Section 402.

For specific installation requirements for manholes, wet wells, valve vaults, and other appurtenant structures refer to Section 403.

For trenchless installation requirements refer to Section 404.

401.02 Workmanship

The minimum workmanship requirements during construction are as follows:

1. Establishment of Line and Grade

   The Contractor, Engineer, and/or Land Surveyor shall furnish and set all line and grade stakes (HUB).

   A Professional Engineer or Land Surveyor registered in the State of Indiana will be required to set, or oversee the setting of, all bench mark stakes necessary for the installation of any sanitary sewer facility being constructed. Bench marks shall be set in strategic locations within the project to facilitate the installation of grade stakes. Horizontal and vertical control will be required to be provided with record drawings to be submitted to the Utility upon completion of the project.

   The method of establishing and following line and grade in conformance with the approved construction plans may be determined by the Contractor.

2. Material Handling

   Suitable tools and equipment shall be used for the safe and convenient handling of all materials and for the installation of all sanitary sewer facilities. All material shall be unloaded with care. Care shall be taken to prevent pipe coatings, encasements or wrappings from being damaged.

   Each section of pipe shall be carefully examined for cracks and other defects prior to installation. Pipe or fittings found to be cracked, broken, or otherwise defective either before, during, or after installation, shall be removed and replaced with material free from defects.

   All pipes, gaskets, and other fittings shall be thoroughly cleaned prior to installation and shall be kept clean during construction.

3. Point of Commencement and Direction of Laying Pipe

   The point of commencement for laying pipe should be the lowest point in the proposed line. Provisions for beginning construction at other than the lowest point in the proposed line shall be approved by the RPR. All bell and spigot pipe shall be laid with the bell end, or with the receiving groove end of tongue and groove pipe pointing upgrade or toward the lift station end of force mains.

   Each pipe shall be laid on an even firm bed, as required in Section 401.06 throughout its length, so that no uneven strain will come to any single portion of the pipe. Particular care shall be taken to prevent the total load from bearing on the pipe sockets. All bells of bell and spigot pipes shall be carefully placed into a receiving hole excavated into the pipe bedding material.

   All pipes shall be properly joined utilizing the manufacturer's assembly marks. Adequate pressure shall be applied to the center of each tongue and groove pipe to ensure the proper joint seal is achieved.

4. Construction Bulkheads

   Before extending a sanitary sewer, the Contractor shall provide a watertight bulkhead or seal, in the existing sewer immediately downstream of the point of connection or the most practical location as determined by the RPR. This bulkhead shall be left in place until the new sanitary sewer has been cleaned of all accumulated water and debris and accepted by the Utility.

   During all work stoppages in construction of the sanitary sewer, the open face of the last pipe laid shall be plugged with a watertight seal to prevent sand, water, earth, or other materials from entering the pipe.

   Whenever pipe and special castings are required to be cut, the cutting shall be done by skilled workers in such manner as to leave a smooth end at right angles to the axis of the pipe without damage to the pipe casting or lining. CUTTING TORCHES SHALL NOT BE USED.

5. Minimum Construction Cover

   Until such time as a minimum of fifty-four (54) inches feet of compacted fill material has been placed over the installed sanitary sewer, lateral, or force main, the Contractor shall not use heavy equipment in such a way as to cause damage to these pipelines or structures.

6. Laying of Pipe in Cold Weather

   The Utility reserves the right to order pipe installation discontinued whenever, in their opinion, there is danger of the quality of work being impaired because of cold weather. The Contractor shall be responsible for heating the pipe and jointing material so as to prevent freezing of joints. No flexible or semi- rigid pipe shall be laid when the air temperature is less than 32° F unless proper precautions, per the manufacturer's recommendations, are taken by the Contractor and the method is approved by the Engineer <u>and</u> the Utility.

When pipes with rubber gaskets or resilient-type joints are to be laid in cold weather, sufficiently warm the gasket or joint material to facilitate making a proper joint.

No portion of a sanitary sewer facility shall be installed directly onto frozen ground or backfilled with frozen material.

7. Construction Activities within the Public Right-of Way

   All construction activities within the public right-of-way, including but not limited to surface removal, backfilling, and restoration, shall be per the latest version of the Department of Metropolitan Developments “Regulations for Cuts within the Public Right-of- Way.” and the City of Westfield Construction Standards and Specifications or other applicable requirements or the Westfield Standards of Roadway Construction.”

401.03 Trench Box and Sheeting

When required by the Occupational Safety and Health Act (OSHA) or any other entity having jurisdiction to protect life, property, or the work, sufficient protective measures shall be utilized in accordance with 29 CFR Part 1926 or any other applicable regulation.

Upon completion of the work, all temporary forms, shores, and bracing, other than as specified herein, shall be removed. The minimum required density of structural backfill shall not be reduced due to trench box pulling. All voids left by the removal of sheeting shall be carefully filled with properly compacted bedding material.

The Contractor shall employ adequate safeguards to prevent movement of the pipe joint. If movement should occur, the Contractor shall reinstall the pipe.

Any damage to pavement or other structures due to sheeting, shoring, or bracing shall be repaired by the Contractor at his own expense.

Sheeting and bracing which is to remain in place after construction shall be cut off three (3) feet below the finished grade elevation.

The CWA Authority, Inc and/or Citizens Westfield will not assume any liability for the actions of the Owner, Contractor, or their agent(s), in the performance of the required sheeting, shoring, and bracing operations.

401.04 Trench Dewatering

Where groundwater is encountered, the Contractor shall make every practical effort necessary to secure a dry trench bottom prior to laying pipe and/or the installation of the sanitary sewer facility. The Contractor shall provide, install, and operate sufficient trenches, sumps, pumps, hoses, piping, wellpoints or other means necessary to depress and maintain the groundwater level below the base of the excavation. In addition, the dewatering shall be sufficient to stop weeping and running water from displacing soil and entering the trench through the trench walls.

If unable to remove the standing water in the trench, the Contractor shall over-excavate the proposed bottom grade of the sewer bedding, and place not less than six (6) inches of either No. 2 crushed stone, No. 8 crushed stone, or No. 8 fractured faced aggregate in the over- excavated area.

The Contractor shall be responsible for diverting or removing surface runoff and other accumulations of surface water from excavations in compliance with all applicable rules and regulations.

The CWA Authority, Inc and/or Citizens Westfield will not assume any liability for the actions of the Owner, or their agent(s), in the performance of the required dewatering operations.

The Utility shall reserve the right to cease installation activities when trench conditions are not in conformance with this Manual.

Under no circumstances shall surface water and/or groundwater be discharged to, disposed of, or allowed to flow into the CWA Authority, Inc and/or Citizens Westfield sanitary sewer system except as provided in an Industrial Discharge Pretreatment Permit.

401.05 Trench Installations

The minimum requirements for trench installations are as follows:

1. Trench Width

   The minimum width of the trench at and below the top of the sanitary sewer, lateral, or force main shall be only as wide as necessary for proper installation and backfilling.

   The minimum trench width for sanitary sewers, laterals, and force mains shall not be less than the greater of the following:

   Minimum Width = Pipe O.D. + 16 inches

   or

   Minimum Width = (Pipe O.D. x 1.25) + 12 inches

   Under no circumstances shall the distance from the trench wall to the outside edge of the pipe be less than six (6) inches for pipes six (6) inches and less, and eight (8) inches for pipes eight (8) inches and larger.

   For flexible conduits, the lateral resistance of in-situ soils shall be of sufficient stiffness to provide the required pipe support. Where unstable trench sidewall conditions exist, or where trench depth dictates the use of a moveable trench box, the Engineer shall determine the width of compacted bedding and backfill material necessary to provide adequate pipe side support.

   The minimum and maximum trench widths above the top of the sanitary sewer, lateral, and force main shall be determined by the Contractor and shall be in conformance with all applicable safety regulations including, but not limited to, those promulgated by OSHA.

2. General Trenching Requirements

   Whenever pipe trenches are inadvertently excavated below the designed bedding bottom, the Contractor shall fill the over-excavated area with compacted No. 8 crushed stone or No. 8 fractured face aggregate and shaped to form a firm, uniform trench base.

   In cases where a firm foundation is not encountered at the required grade, the Contractor shall remove the unstable material to a sufficient depth not less than six (6) inches and replaced with either No. 2 crushed stone, No. 8 crushed stone, or No. 8 fractured faced aggregate. When compacted and properly shaped, the fill material shall produce a uniform and stable foundation along the entire length of the pipe. If more than one (1) foot of unstable material is encountered, the Contractor shall take additional measures to ensure that additional stabilization is provided, such as geotextile fabric wrapping of the trench section or as approved by the Utility.

   All rocks, boulders and stones six (6) inches in diameter and larger shall be removed. Boulders or rocks are not to be used for any portion of the trench backfill.

   The pipe trench shall not be excavated more than one hundred (100) feet in advance of pipe laying unless approved by the RPR or Utility.

   In cases where material is deposited along open trenches, the material shall be placed and protected so that no damage will result to the work or adjacent property as a result of rain or surface wash.

401.06 Bedding and Backfill Requirements

Bedding, haunching, initial backfill, and final backfill requirements are the same for sanitary sewers, laterals, and force mains.

The minimum requirements are shown in Figures 400.01 through 400.03 and are as follows:

1. Bedding, Haunching, and Initial Backfill.

   The requirements are determined by the type and size of pipe being installed and are as follows:

   a. Gravity Flexible Pipe – PVC, HDPE, Centrifugally Cast Fiberglass Reinforced Polymer Mortar, and Closed Profile Large Diameter PVC

      Bedding, Haunching, and Initial Backfill – No.8 crushed stone or No. 8 fractured-faced aggregate. The minimum depths shall be as follows:

Pipe Size, inches	Depth Below Barrel, inches	Depth Above Top of Pipe, inches
6 or less	4	4

8 to 15	4	12
18 and larger	8	12

b. Gravity Semi-Rigid Pipe – DIP

Bedding, Haunching, and Initial Backfill – No. 8 crushed stone or No. 8 fractured-faced aggregate. The minimum depths shall be as follows:

Pipe Size, inches	Depth Below Barrel, inches	Depth Above Top of Pipe, inches
8 to 16	4	6
18 and larger	8	6

c. Gravity Rigid Pipe – RCP and PCCP

i. Bedding and Haunching - No. 8 crushed stone or No. 8 fractured faced aggregate a minimum of eight (8) inches below the pipe barrel to the springline (1/2 the outside diameter) of the pipe.

ii. Initial Backfill - Clean fill material free of rocks larger than six (6) inches in diameter, frozen lumps of soil, wood, or other extraneous material unless the construction is within five (5) feet of pavement then Section 401.06.2.b.i. shall apply.

d. Force Mains

For all installations, the bedding material shall be placed in the trench bottom and compacted prior to laying the pipe.

The bell holes shall be excavated for bell and spigot pipe so the entire pipe barrel rests on the bedding. The bedding shall be such that after the pipe has been placed to line and grade, there remains a four (4) inch minimum depth of material below the pipe barrel and a minimum of three (3) inches below the bell.

For all installations, the haunching material shall be shovel sliced or otherwise carefully placed and “walked” or hand tamped to the springline (1/2 the outside diameter) to ensure compaction of the haunch area and complete filling of all voids. The initial backfill shall be added in six (6) inch lifts “walked” in for compaction.

2. Final Backfill

Final backfill requirements are determined by the location of the excavation and are as follows:

a. Excavations within existing roadways or public right-of-ways.

Final backfill requirements shall be per the latest revision of the Department of Metropolitan Developments "Regulations For Cuts Within The Public Right-of-Way." and the City of Westfield Construction Standards and Specifications or other applicable requirements.

b. For all other installations.

Final backfill requirements are as follows:

i. Within five (5) feet of the edge of pavement, curbs, gutters, or similar structures:

Trenches shall be backfilled with structural "B-Borrow" for structural installations per Indiana Department of Transportation (INDOT) Standard Specifications - Section 211. Backfill shall be compacted to achieve not less than 95% Standard Proctor Dry Density per INDOT Standard Specifications Section 203.23. The Contractor shall use in-house or independent testing to verify proper compaction. The Utility may require independent testing to verify Contractor results at any time during the duration of the project.

Backfill shall be added and compacted in twelve (12) inch balanced lifts by means of mechanical tampers. If the Contractor can demonstrate, through testing, the compaction requirements can be met with lifts greater than twelve (12) inches; it may be approved on a case- by-case basis. The maximum compaction depth shall not exceed six (6) feet.

Flowable fill may be used as a substitute for structural "B-Borrow."

Westfield – Sanitary Sewers shall be covered with at least twelve (12) inches of bedding material and forty- two (42) inches of approved backfill.

ii. Outside five (5) feet of the edge of pavement, curbs, gutters, or similar structures:

Trench shall be backfilled with clean fill material free of rocks larger than six (6) inches in diameter, frozen lumps of soil, wood, or other extraneous material.

Jetting or flooding of the backfill shall <u>not</u> be used to meet the compaction requirements.

401.07 Locating (Tracer) Wire

For all force main and lateral installations, a green colored 10-gauge solid copper insulated locating (tracer) wire shall be installed as follows:

1. Force Mains

Wire shall be installed on top of the initial backfill in one continuous length between the lift station valve vault and the force main discharge manhole.

The wire shall be brought up to ground level every five hundred (500) feet (maximum) through a #54 Valve Box Section with a D-5 Cover (if in sidewalk or street) or a 3 inches Box with a 2-1/2 inches Repair Lid (if in the dirt or grass).

If any appurtenant structure, such as an air release valve, is required as part of the force main installation, the wire shall be cut with each end entering the structure under the casting frame.

2. Laterals

   Wire shall be installed (taped) on the top of the pipe along the entire length of the lateral from the sewer to the cleanout. The lateral may be installed in either one or two phases. The requirements for each phase are as follows:

   a. One phase

      When the entire lateral is to be constructed in one phase (from the sanitary sewer to the cleanout), the wire shall be installed in one continuous length along the entire length of the lateral. The wire shall be exposed at the cleanout for access.

   b. Two phases

      When the lateral is installed in two phases, the first as part of the sewer construction to the edge of the right-of-way (lateral stub) and the second as part of the building construction from the lateral stub to the cleanout, the wire shall be installed as follows:

      i. Lateral as part of the sanitary sewer installation from the sewer to the right-of-way (lateral stub):

         Wire shall be installed along the length of lateral beginning at the sanitary sewer and terminating at the stub or locating rod. The wire shall be easily accessible for future extension to the cleanout.

      ii. Lateral as part of the building construction from the lateral stub to the cleanout:

      Wire shall be connected to the wire at the lateral stub and installed along the remaining length of lateral terminating at the cleanout. The wire shall be exposed at the cleanout for access.

      All wire-to-wire connections, such as those for laterals installed in two phases, shall be joined using a DBR Direct Burial Splice Kit as manufactured by 3M Electrical Products Division or a Department approved equal.

      Wire Connectors shall be Snake Bite DryConn or Utility approved equal.

401.08 Embankment Installations

For embankment installations, a minimum width of properly compacted bedding and backfill material is required to ensure that adequate stiffness of the pipe envelope is developed.

The Engineer shall determine the minimum embedment width, utilizing those bedding and backfill materials specified herein, in full conformance with those minimum standards set forth by the American Association for State Highway and Transportation Officials Standard Specifications for Highway Bridges, latest revision. Such factors as pipe stiffness, embedment stiffness, nature of in-situ soil, and anticipated construction and service loading shall be evaluated.

401.09 Abandoning Sanitary Sewer Facilities

Sanitary Sewer Facilities shall be abandoned as follows:

1. Combined Sewers, Sanitary Sewers, and Force Mains

   Combined sewers, sanitary sewers, or force mains to be abandoned shall be bulkheaded with mortar and an eight (8) inch thick concrete brick wall. The facility being abandoned shall be filled with sand or cellular concrete and plugged, unless an alternate plan is approved by the Utility.

   Service shall be maintained within sanitary and combined sewers until the Utility orders bulkheads placed.

   No timber bulkheads shall be allowed.

2. Laterals

   Numerous existing buildings use common or shared laterals. The Contractor shall determine if the lateral is common/shared prior to construction.

   The requirements to abandon laterals, shown in Figure 400.04, are as follows:

   a. If the lateral serves one building and is <u>NOT</u> part of a common/shared lateral:

      The end of the lateral shall be sealed with a manufactured watertight cap/stopper made specifically for the purpose of sealing/capping the end of a sanitary sewer. The cap/stopper shall be installed per manufacturer's recommendation and in such a way to prevent any source of water from entering the sanitary sewer system. Any device or material that may slide into the lateral and potentially cause a blockage or obstruction in the mainline sewer will not be allowed.

      At the cap/stopper, a one-half (1/2) inch cast iron locator rod or magnetic locator tape shall be installed to within three (3) feet of the ground surface to provide for ease of location of the stub.

   b. If the lateral serves more than one building and IS part of a common/shared lateral:

      i. If at least one service from the common lateral is intended to remain, the connecting fitting for the laterals shall be removed and replaced with an elbow of sufficient angle to provide a smooth transition between the existing portions of the lateral. Elbow shall be a manufactured fitting and shall be installed per manufacturer's recommendation to assure a watertight seal.

ii. If all services from the common lateral are to be abandoned, requirements per Section 401.08.2.a shall apply.

When connections are made between non-similar pipe materials, a non-shear flexible coupling shall be used such as manufactured by Mission, Fernco, or approved equal.

Bedding and backfill requirements for abandoning any lateral shall be per Section 401.06.

3. Structures

Unless otherwise specified, all structures to be abandoned shall be removed to a depth of three (3) feet below the proposed ground elevation, or existing street grade, whichever is lower.
The portions of the structure which are abandoned and left in place shall have holes drilled in a sufficient number to allow groundwater to enter and exit. The structure shall be backfilled with sand or B-Borrow and compacted to 95% Standard Proctor Dry Density. The Utility may modify the requirements if deemed necessary.

All existing pipe, equipment, or any other material are the property of the CWA Authority, Inc and/or Citizens Westfield. When abandoning any sanitary sewer facility, the contractor shall contact the Utility to determine if any of the abandoned material is to be salvaged. The determination will be at the sole discretion of the Utility. The Contractor shall deliver all salvageable material and/or equipment to a location within the CWA Authority, Inc and/or Citizens Westfield as determined by the Utility. The Contractor shall be responsible for disposal of all material not being salvaged.

For embankment installations, a minimum width of properly compacted bedding and backfill material is required to ensure that adequate stiffness of the pipe envelope is developed.

The Engineer shall determine the minimum embedment width, utilizing those bedding and backfill materials specified herein, in full conformance with those minimum standards set forth by the American Association for State Highway and Transportation Officials Standard Specifications for Highway Bridges, latest revision. Such factors as pipe stiffness, embedment stiffness, nature of in-situ soil, and anticipated construction and service loading shall be evaluated.

Section 402 Installation Requirements Specific to Laterals

402.01 Introduction

This Section provides the minimum installation requirements specific to laterals.

For installation requirements common to sanitary sewers, force mains, and laterals refer to Section 401.

For specific installation requirements for manholes, wet wells, valve vaults, and other appurtenant structures refer to Section 403.

For trenchless installation requirements refer to Section 404.

402.02 General Requirements

Unless specifically stated in this Section, all other installation requirements for laterals shall be per Section 401.

Laterals shall be installed under the same or similar requirements and guidelines as sanitary sewers. Several critical clarifications for certain requirements, not intending to be all inclusive, are as follows:

1. Trench installation requirements, including but not limited to trench widths shall be the same as for sanitary sewers per Section 401.05.
2. Bedding and backfill requirements shall be the same as for sanitary sewers per Section 401.06.
3. Only materials listed in Section 303.02 shall be used for laterals.
4. Connections to sanitary sewers shall be made per Section 201.05.
5. Locating wire shall be installed per Section 401.07.

Typical Lateral Connections are shown in Figures 400.05 and 400.06.

402.03 Lateral Stubs

Laterals are often installed in two phases: the first as part of the sanitary sewer installation, the lateral stub, and the second as part of the lateral installation when the building is constructed.

When installing the portion of the lateral as part of the sanitary sewer installation (the lateral stub), the Contractor shall terminate the lateral at the right-of-way line or easement, and plug the end with a manufactured watertight plug. A one-half (1/2) inch metal locator rod and copper tracer wire per Section 401.07 shall be installed at the end of the plugged line to within three (3) feet of finished grade to provide for ease of location of the stub.

402.04 Controlled Settlement Joint

A Controlled Settlement Joint, or “Slip Joint”, shall be installed per manufacturer’s recommendation on all lateral riser pipes exceeding five (5) feet in vertical length. Figures 400.06 and 400.07 show a typical installation of the Controlled Settlement Joint and the maximum angle in which the joint should be installed.

The controlled settlement joint shall be a double gasketed joint made specifically for the purpose of allowing axial movement of the riser pipe for forces from 500 lb/ft to 1970 lb/ft.

The allowable movement within the joint shall be 5 ½ inches.

The controlled settlement joint shall be manufactured by Plastic Trends Inc. or approved equal.

The riser pipe and fittings shall be bedded per Section 401.06.

402.05 Saddle Connections to Sewers

Saddle connections are only allowed if a manufactured fitting is not available, and the sewer is not VCP.

Saddle connections shall be as follows:

1. The connections shall be a seated saddle that will not allow the lateral to protrude into the mainline sewer.
2. The saddle shall have at least two (2) stainless steel bands connecting around the existing sewer.
3. The cut into the existing sewer shall be core drilled. Saw cuts and hammer taps are not allowed.

When a manufactured fitting has not been installed at the time of construction of the main line when connecting to a VCP sewer, the connection shall be made by installing a new PVC manufactured wye fitting. Non-shear couplings shall be used to connect the new manufactured fitting to the existing sewer.

402.06 Connections to Brick Sewers

Connections to brick sewers will be evaluated on a case-by-case basis. Depending on the existing sewer's condition, rehabilitation may be required as determined by the Utility. Potential rehabilitation work may include lining, replacement, and/or other adjustments necessary.

If the connection is allowed, a concrete collar shall be installed to provide reinforcement to the brick sewer as shown in Figure 400.08. The connection shall be core-drilled after the collar has been installed.

A rubber connector with a stainless steel clamp meeting the requirements of ASTM C 923 shall be used for the connection. The connector shall be a Kor-N-Tee or approved equal.

Once an approved connection is complete, the Contractor will perform a video inspection and provide it to the Utility for review. The Utility will determine if additional rehabilitation work is needed by the Contractor based on the video inspection.

If connections to the brick sewer can be avoided, the Utility may require the lateral to be connected to an alternate connection point.

402.07 Connections to Pressure-rated PVC Pipe

When connecting laterals to gravity sewers that use pressure-rated PVC pipe (ASTM D 2241, AWWA C 900, or AWWA C905), adapters may be required to assure proper connection to the sewer.

The adapters shall meet the same requirements as the pressure-rated pipe.

402.08 Connections to HDPE Low Pressure Sewer Systems

The installation of HDPE tapping tees for low pressure sewer systems shall be per manufactures recommendations, the latest version of the Plastic Pipe Institute (PPI) Handbook of PE Pipe (https://www.plasticpipe.org/Drainage/Shared_Content/Shop/PE-Handbook.aspx), the MAB Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe (

(https://www.plasticpipe.org/Drainage/Shared_Content/Shop/PE-Handbook.aspx), and ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

No person shall make a tap on a low pressure sewer system unless that person is qualified for the type of tap to be made. All personnel involved with the installation of the tapping tees shall be trained and certified by the manufacture or manufacturer's representative through a formal training and certification process for the type of tee being used. A certificate or other form of certification shall be made available to the Utility upon request at any time of a project.

Fusion equipment and tools must be maintained according to the manufacturer's requirements. Electrofusion or butt fusion equipment that is not maintained can be the cause of installation problems.

402.09 Grinder Pump Installation

The Contractor installing the low pressure system must provide proof that they have been certified by the low pressure system's manufacturer or supplier to install the proposed system.

Section 403 Installation of Precast Manholes, Wet wells, Valve Vaults, or other Appurtenant Structures

403.01 Introduction

This Section provides the minimum installation requirements for manholes, wet wells, valve vaults, and other appurtenant structures.

For clarity, only manholes are referenced throughout this Section. Unless noted, all other structures are to be installed in accordance with the same requirements.

The minimum requirements are show in Figures 300.01 through 300.06.

403.02 Bedding

The bedding for all manholes shall be a minimum of six (6) inches of No. 8 crushed stone or No. 8 fractured-face aggregate.

The stone and/or aggregate shall be placed to form a stable base.

Where poor or unstable soil conditions exist, or over excavation has occurred, additional No. 8 crushed stone, No. 8 fractured faced aggregate, No. 2 stone, or Class B concrete shall be used to form a stable base.

403.03 Backfilling

Manhole backfilling and compaction requirements shall comply with the minimum requirements for the adjacent sanitary sewer pipe as stated in Section 401.06.

403.04 Placement of Manhole Sections

Precast manhole sections shall be placed and aligned to provide vertical sides. The completed manhole shall be rigid, true to dimensions, and watertight.

The joints between manhole sections shall be properly sealed utilizing an approved rubber gasket and butyl rubber rope.

403.05 Placement of Adjusting Rings

Where one (1) solid riser or barrel section cannot be used, final adjustments in elevation of the casting frame and cover shall be accomplished by the use of precast concrete adjusting rings of a minimum thickness of four (4) inches per Section 305.07 and as shown in Figure 300.08. The total number of adjusting rings shall not exceed three (3) and the total height of adjusting rings shall not exceed twelve (12) inches.

Concrete adjustment rings less than four (4) inches thick are not allowed.

A watertight seal shall be provided between the cone section of the manhole and adjusting ring, each adjoining adjusting ring, and between the adjusting ring and casting by the use of two (2) rows of one-half (1/2) inch diameter cords of extrudable preformed gasket material, non- asphaltic mastic, or trowelable grade butyl rubber, as shown on Figure 300.08. This material shall be placed in joints and keyways and be of sufficient quantity to completely fill the joint cavity.

The use of brick or block in lieu of adjustment rings is not allowed.

403.06 Butyl Rubber Backplaster

A trowelable grade butyl rubber base exterior backplaster material one- quarter (1/4) inch minimum thickness, when dry, shall be installed on the outside of the manhole at each joint, extending six (6) inches above and below the joint. It shall also be placed on the chimney section from two (2) inches below the bottom adjustment ring on the cone section to, and covering, the base of the casting.

403.07 Internal Manhole Chimney Seal

Internal Chimney Seals per Section 305.10 shall be installed on the joints of all manholes between the casting frame and the cone section per manufacturer’s recommendation.

403.08 Connections To Manholes

Sanitary sewer connections to existing manholes shall be core-drilled and made using a flexible rubber connector per Section 305.09.

Saw cutting and hammer taps are prohibited.

All connections shall provide for a watertight seal between the pipe and the manhole. The connector shall be the sole element relied upon to assure a flexible watertight seal of the pipe to the manhole.

When connecting new pipe to existing manholes, a flow channel and bench walls shall be installed per Section 305.06. Depending on the existing manhole's condition, rehabilitation may be required as determined by the Utility. Potential rehabilitation work may include: chimney seals, linings, patches, replacement, and/or other adjustments necessary. If connecting to an existing manhole requires a drop pipe, the Utility will consider request on case-by-case basis. The Utility will provide details if the drop connection is approved.

For brick or block manholes, at a minimum, a structural liner approved by the Utility shall be installed prior to the connection of the new sanitary sewer. Brick or block manholes may need to be replaced in lieu of a structural liner.

403.09 Groundwater Monitoring Points

An air pressure test is required for all sanitary sewers. When performing the test, an adjustment to the starting air pressure is required to compensate for groundwater above the top of pipe.

The measurement of groundwater is optional. However, this Section provides a recommendation on the number of groundwater monitoring points and their locations.

If the Contractor chooses not to install the groundwater monitoring point(s), the air pressure adjustment shall be the maximum required per Section 602.03 (2.0 psi adjustment, starting air pressure 6.0 psi).

If groundwater monitoring points are installed as part of the project, then one (1) or more monitoring points shall be installed adjacent the manhole(s). The monitoring points may be a three (3) inch diameter PVC pipe, slotted at the bottom with a well screen, located adjacent to the manhole. The elevation of the bottom of the PVC pipe shall be at approximately the same elevation as the top of the highest adjacent sanitary sewer pipe.

The number of monitoring points shall be as follows:

1. If groundwater is <u>not</u> present during pipe installation, one (1) monitoring point is required.

2. If groundwater is present during pipe installation, the number of monitoring points shall be as follows:

Number of Manholes	Number of Monitoring Points
1 – 10	1
11 – 20	2
21 – 30	3
31 – 40	4
41 – 50	5
51 or More	6

The monitoring points shall be installed adjacent to selected manholes and spaced as evenly as possible throughout the project. The Contractor shall submit the locations to the RPR for approval.

If dewatering wells are used during construction to draw down the groundwater elevation, the site shall be considered to have groundwater present.

In both instances, one (1) of the monitoring points shall be installed at the furthest downstream manhole installed as part of the project unless directed otherwise by the RPR. If the development has more than one connection point to existing sewers, the manhole with the lowest invert elevation shall be selected.

Section 404 Trenchless Installation

404.01 Introduction

This Section provides the minimum requirements for the allowable trenchless methods for construction in the CWA Authority, Inc and/or Citizens Westfield.

404.02 General Requirements

The following three trenchless methods, with their specific applications, are allowed:

1. Auger Boring and Pipe Jacking (Section 404.03) - All installations.
2. Horizontal Directional Drilling (Section 404.04) – Force main installations.
3. Pipe Bursting (Section 404.05) – Existing lateral rehabilitation.

The use of an alternate method for site specific conditions will be evaluated on a case-by-case basis. At a minimum, the alternate method will be reviewed through the variance process as contained in Section 102.12. At the discretion of the Utility, the alternate method may be required to undergo a thorough evaluation by the Utility before any deviations will be considered. The applicant shall be responsible for all variance and product review fees.

404.03 Auger Boring and Pipe Jacking

The following are the minimum requirements when using boring and jacking installation methods.

1. General

   Boring and jacking will be allowed for the installation of force mains, gravity sanitary sewers, and laterals.

   The casing pipe or jacked pipe shall extend beyond a minimum of a 1:1 slope extending downward and outward from the edge of pavement plus four (4) feet on each end of the bore and jack alignment.

   The Engineer or Applicant shall be responsible for obtaining the necessary agency permits for boring and jacking under highways and railroads.

2. Specific requirements for Carrier, Casing, and Jacking pipes are as follows:

   a. Carrier Pipe

      Carrier pipe for insertion within casing pipe shall conform to the requirements of Chapter 300 of these Standards and the following requirements:

      i. Provisions shall be made to prevent over-homing of joints in all acceptable carrier pipe materials to prevent damage during insertion into the casing pipe. RCP, PCCP, and HDPE do not require such provisions;

      ii. All force main pipe shall have restrained joints.

   b. Casing Pipe

      Casing pipe for installation by jacking and augering shall be steel pipe per ASTM A 139 Grade B and shall have a smooth exterior wall. Additional requirements are as follows:

      i. Joints - Pipe joints shall be butt welded with a continuous circumferential weld.

      ii. Size - The inside diameter of the casing pipe shall be a minimum of six (6) inches greater than the largest outside diameter of the carrier pipe, bells, or fittings which are placed inside of the casing pipe.

      iii. Pipe wall thickness - Minimum pipe wall thicknesses are as follows:

Minimum Wall Thicknesses for Steel Casing Pipe			
Casing Pipe		**Highway Crossing**	**Railroad Crossing**
Nominal Size, in.	**Actual O.D., in.**	**Bare**	**Bare**
8	8 5/8	0.250	0.250
10	10 3/4	0.250	0.250
12	12 3/4	0.250	0.250
14	14	0.281	0.250
16	16	0.281	0.281
18	18	0.312	0.312
20	20	0.312	0.344
24	24	0.312	0.375
30	30	0.375	0.469
36	36	0.469	0.532
42	42	0.500	0.625
48	48	0.500	0.688

54	54	0.500	0.781
60	60	0.563	0.844
66	66	0.625	0.938
72	72	0.688	1.000

NOTE: The Contractor shall conform to the requirements of agencies having jurisdiction over the work, such as INDOT or railroads, where such requirements are greater than those shown above.

c. Jacking Pipe

Jacking pipe shall be used in a one pass method where the jacked pipe acts as the carrier pipe.

Only RCP and centrifugally cast fiberglass reinforced mortar pipe are acceptable for pipe jacking.

RCP and centrifugally cast fiberglass reinforced mortar pipe for jacking shall meet the requirements of Chapter 300 of these Standards and the following:

i. Size - Pipe shall be thirty-six (36) inches in diameter or larger;

ii. RCP shall be Class III or greater and centrifugally cast fiberglass reinforced mortar pipe shall be specifically manufactured for jacking;

iii. RCP and centrifugally cast fiberglass reinforced mortar pipe shall have a constant outside diameter (no bell or joint protrusions);

iv. For RCP pipe, steel reinforcement shall be concentric with the pipe wall, and where required, additional reinforcement shall be provided at the ends of the pipe.

3. Auger Boring and Pipe Jacking Equipment and Construction

The holes shall be bored from the low or downstream end, unless site conditions dictate otherwise.

The Contractor shall provide boring equipment which is capable of advancing the bore hole within the required limits of accuracy and can be adjusted during installation to return to the planned alignment if deviations are discovered.

Installations shall have a bored hole essentially the same diameter as the outside of the installed pipe. If voids develop or if the bored diameter is greater than the outside diameter of the pipe by more than one (1) inch, grouting shall be used to fill such voids.

Provisions for removal of boulders or other large obstructions shall be included without retracting the casing pipe.

When boring in loose, granular, or running soils, the cutting head shall be retracted inside the casing an adequate amount to prevent voiding. For crossings performed in granular materials under the water table, adequate dewatering shall be installed to lower the water table to below the invert of the casing.

All cutting heads shall be removable without retracting the casing pipe.

Following installation, the casing pipe shall be carefully inspected to ensure the carrier pipe can be properly placed.

During placement of the carrier pipe in the casing, the carrier pipe shall be blocked or otherwise supported with casing pipe spacers or wood blocking to secure the proper flow line elevations throughout its full length and to ensure backfilling around the pipe can be done without any displacement or floating.

The annular space between the carrier pipe and the casing pipe shall be completely filled with grout and/or cellular grout with minimum compression strength of 150 psi. Details on the material to be used to fill the void and the method of construction shall be submitted to the RPR.

4. Pipe Jacking Equipment and Construction

   Pipe jacking equipment shall meet all the requirements for boring equipment under No. 3 above.

   Excavation may be performed by hand milling or with the utilization of a tunnel boring machine (TBM).

   When utilizing RCP or centrifugally cast fiberglass reinforced mortar pipe, wood cushion rings or other resilient materials which do not affect joint integrity shall be placed between the joints and at the thrust rings to prevent point loading of the joints.

   The jacked pipe shall be constructed to prevent leakage of the pipe throughout its length.

   Soil, earth, and other material removal methods shall be installed, operated, and removed in such a manner that prevents damage to interior linings of jacked pipe. Auger removal of materials is not allowed on lined RCP or centrifugally cast fiberglass reinforced mortar pipe.

5. Unforeseen Obstructions

   If an obstruction stops progress of the pipe during installation, the installation method shall be modified to best suit the conditions encountered, except that line and grade may not be changed. Before proceeding, the Contractor shall notify the RPR in writing of the difficulty, diagnosis and proposed procedural modification. If the Contractor proposes abandonment of in-place piping and initiation of a new attempt at an alternate location, such a proposal will be considered only under the following conditions:

a. The Contractor assures the RPR, in writing, that he will perform all proposed work in compliance with applicable laws, regulations, requirements of agencies having jurisdiction, and this Manual.
b. In-place pipe shall be left in place and filled with grout with minimum compression strength of 150 psi.

Note: The contractor may use ASCE, Manuals and Reports on Engineering Practice No. 106, "Horizontal Auger Boring Projects" as a reference.

404.04 Horizontal Directional Drilling (HDD)

The following are the minimum requirements when using the HDD installation method.

1. General

   HDD is only allowed for force main construction and only after a detailed review by the Utility of the specific pumping and force main design and installation conditions associated with the project. The Utility concerns are related to the potential for creating unknown high points in the force main as part of the directional drilling process, which may then accumulate air, and the sensitivity of centrifugal pumps to such air accumulations.

   All HDPE pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations, or these Standards, whichever is more stringent. Joining, laying, and pulling of HDPE pipe shall be accomplished by personnel experienced in working with HDPE pipe. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe. Bore PROFILE is required for HDD installed pipe.

2. Utility Locations

   All buried crossing or parallel utilities, including laterals, within ten (10) feet of the proposed alignment shall be accurately located and marked in plan and elevation. If sufficient information is not available from surface techniques, the Contractor shall excavate as required to establish with certainty the location of the utility.

3. Pipe Material

   Only smooth-walled HDPE pipe (minimum DR 11) is acceptable per Section 304.04.

   All piping system components shall be the products of one manufacturer and shall conform to this Manual and the following:

   a. Mechanical connections of the HDPE pipe to auxiliary equipment (pipe or structures) shall be through flanged connections which shall consist of the following:

      i. A polyethylene "stub end" shall be thermally butt-fused to the ends of the pipe.

ii. Provide ASTM A 240, Type 304 stainless steel backing flange, 125-pound, ANSI B16.1 standard, and gaskets as required by the manufacturer.

iii. Stainless Steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer's standard.

MJ Adapters may be used when joining HDPE pipe to pipe of other materials.

b. Connections to manholes or other structures shall be restrained from movement by special fittings at each connection point specifically designed to prevent pullout, or extension into the structures as a result of thermal or other forces.

4. Drilling Fluid

Bentonite, used in the drilling process, shall be environmentally safe.

5. Installation

HDD shall consist of the drilling of a small diameter pilot bore from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. It is recommended the pipeline shall be assembled, supported, and pretested prior to installation in the directional drill tunnel. The Contractor shall be required to remove and reinstall the pipeline if the test fails after the inspection.

The pipe shall be joined using the thermal butt fusion method per Section 304.04. The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities.

Prior to commencement of drilling operations, drill path shall be surveyed for any surface geo-magnetic variations or anomalies.

Directional drilling machines shall consist of a hydraulically powered system to rotate and push hollow drilling pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The drill pipe shall be a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work.

A smoothly drilled pilot bore shall follow the design centerline of the pipe profile and alignment described on the construction drawings. The X, Y and Z axis locations relative to the planned alignment and planned elevations shall be monitored along the course of the pilot bore. An electronic guidance system capable of continuously monitoring the location of the drilling head and providing readout of the inclination and azimuth on the drilling head to an accuracy of 1% incline and 1o bearing shall be available and utilized. The indicated pipe elevation from location readings shall be accurate to within 2% of the depth vertically at all depths up to fifty (50) feet in any soil condition including hard rock. Pipe elevation may not be based on the depth below the indicated surface grade on the profile drawings but shall be shown based on surveyed USGS elevations.

The position shall be determined a minimum of once every twenty (20) feet by personnel trained and experienced with electronic guidance systems. All data and readouts pertaining to the position of the bore head and the fluid pressures and flows shall be accessible to the Utility and the RPR at all times. The pilot bore location shall be compared to the designed location to determine the deviation. This information shall be submitted to the RPR for approval prior to pipe installation. Refer to Section 404.04.9, Testing and Inspection, for guidelines on acceptable deviations.

Reaming operations shall be conducted to enlarge the pilot after acceptance of the pilot bore location. The number and size of such reaming operations shall be conducted as the operation dictates but in no case shall the size of the reaming operations result in a hole greater than 150% of the O.D. of the installed pipe. Note: For crossings under INDOT right-of-way, INDOT Specification Section 716 where this method is limited to a maximum reamer size of twenty-four (24) inches unless otherwise approved by INDOT.

The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to 75% of the maximum allowed by the pipe manufacturer so the pipe or joints are not over stressed. If necessary, the pipelines shall be adequately supported by rollers, skids, slings, or other low friction devices to prevent over stressing, over bending, excessive tensile forces, or buckling during the pullback operation. The method of pipe support shall be part of the Installation Plan which shall be made available to the RPR or Utility upon request.

The HDPE pipe shall at all times be handled in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced. Appropriate steps shall be taken during pullback to ensure that the HDPE pipe will be installed without damage.

When adjacent sections of directionally drilled pipe are to be connected together, the Contractor shall excavate a sufficiently large area at the planned grade to assure the adjoining sections of pipe can be installed without sags or humps. Joining of the pipe shall be performed utilizing butt fused mechanical joint fittings or electrofusion couplings.

6. Locating (Tracer) Wire

All lines installed by HDD shall be provided with a minimum two (2) continuous type TW insulated #8 solid copper tracer wires. The wire shall be installed along the pipe, fastened securely to the pipe at five (5) foot intervals, and terminated above ground with the lead taped around each structure.

The wire shall be brought up to ground level every four hundred (400) feet through a vinyl coated aluminum riser pipe with cap and/or at all line valve boxes. The tracer wires shall be connected using DBR Direct Burial Splice Kit manufactured by 3M Electrical Products Division, Austin, TX or equal. The riser pipe and cap shall not be placed in areas subject to vehicular traffic.

The tracer wire shall be capable of, and demonstrated to have, continuous transmission of tracing signal along the full length of the installed pipe.

7. Environmental Provisions

The Contractor shall be responsible for additional environmental provisions associated with the HDD operation beyond those covered by Section 405.03. The HDD operation is to be operated in a manner to prevent the discharge of water, drilling mud, and cuttings to adjacent creeks or land areas involved during the construction process. Equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste may be provided. All excavated pits used in the drilling operation shall be constructed to completely contain the drill fluid and prevent its escape to waterways and/or groundwater.

The Contractor shall be responsible for submitting to the RPR the proposed plan for erosion control/environmental protection. At a minimum the Contractor shall have on site in sufficient quantity equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies for use in the event of inadvertent leaks, seeps or spills. Waste drilling mud and cuttings shall be disposed by the Contractor to an approved offsite location.

8. Pipe Relaxation

After the pipe has been installed, allow pipe manufacturer's recommended amount of time, but not less than four (4) hours, for cooling and relaxation due to tensile stressing prior to hydrostatic testing.

9. Testing and Inspection

The pipe is ONLY required to be hydrostatically tested one (1) time, after the complete installation.

However, to identify any defects prior to installation, the Utility recommends the pipe be hydrostatically tested a total of three (3) times: after joining into continuous pullback sections prior to installation, after installation of each pullback section, and again when all the pullback sections are joined together end-to-end. Hydrostatic testing shall be performed in accordance with Section 603. Any material not passing the hydrostatic testing shall be replaced.

A horizontal tolerance of up to three (3) feet left or right of the planned alignment will be permitted at any point on the alignment provided the pipeline is still within the easement or right-of-way where it was planned.

Tolerances for vertical alignment compared to planned alignment will be judged on a case-by-case basis depending on the location relative to surrounding utilities, creation of new high or low points, required relocation of air/vacuum valves, and the effect on the pumping system curves.

There shall be no allowance for length. The alignment of each pilot bore must be approved by the RPR before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the RPR may require a new pilot boring to be made.

10. Submittals

    The Contractor shall use a data logger during construction and submit a bore profile at the completion of the HDD installation.

    The Contractor shall submit data logger information for HPDE weld on 6-inch diameter pipe and larger.

404.05 Pipe Bursting (Lateral Rehabilitation Only)

Pipe bursting shall only be used for lateral rehabilitation/replacement and shall conform to the latest editions of the UPC (IAPMO IS 26-2003) and the following requirements.

1. General

   The Contractor shall be certified by the particular pipe-bursting system manufacturer and personnel shall be certified as fusion technicians by a manufacturer of HDPE pipe. Certifications shall be submitted with the lateral application.

The Contractor shall perform a pre-construction Closed Circuit Television (CCTV) inspection to evaluate the condition of the existing pipe and determine whether the pipe-bursting method is a valid alternative for repair. Inspection video shall be made available to the Utility upon request.

2. Materials

   Only HDPE and butt fusion joints per Section 303.02 or 304.04 shall be used for lateral pipe bursting applications.

3. Construction – General

   At a minimum, the Contractor shall adhere to the following requirements during construction:

   a. Defects and Obstructions

      Contractor shall perform all necessary point repairs and remove all obstructions when pre-construction CCTV inspection reveal heavy solids, offset joints, sags in the pipe, or collapsed pipe that will prevent the completion of the pipe bursting process.

      If preconstruction CCTV inspection reveals a sag in the lateral that is greater than one half (1/2) the diameter of the existing pipe, Contractor shall excavate and replace those sections of pipe to result in acceptable grade without the sag.

   b. Utility Location and Required Clearances

A minimum of one foot of clearance (vertical or horizontal) from the outside edge of the lateral to the outside edge of the utility pipe, wire or structure is required. Contractor shall confirm this clearance exists based on above-ground evidence including utility location marks or as-built drawings.

Due to the hazards associated with pipe-bursting near natural gas lines, all natural gas lines, including but not limited to distribution mains, transmission mains, and service lines, marked within four (4) feet of the existing lateral shall be uncovered (pot-holed) to confirm the required clearance exists. If the existing gas line is installed parallel and within four (4) feet horizontally to the existing lateral, the gas line shall be uncovered a minimum of once every one hundred (100) feet along the length of the lateral.

c. Pipe Relaxation

After the pipe has been installed, allow pipe manufacturer's recommended amount of time, but not less than four (4) hours, for cooling and relaxation due to tensile stressing prior to reconnecting to the lateral or sewer.

d. Reconnections to Existing Laterals

Connections to existing laterals shall be made with a watertight non-shear coupling such as manufactured by Mission, Fernco, or approved equal.

e. Bedding and Backfill Requirements

Bedding and backfill for all point repairs or connections to the existing lateral shall be per Section 401.06.

4. Post-Construction CCTV Inspection

Contractor shall repair any sections of pipe that do not meet the requirements of this Section. The inspection video shall be made available to the Utility upon request.

404.06 Pipe Lining on Lateral Repairs and Private Sewers

Pipe lining on lateral repair and private sewers is evaluated on a case- by-case basis and requires a variance approved by the Utility.

Variance applications must include the following information:

1. Lining material. Stryrene liners are prohibited.
2. Curing method.
3. Installation contractor including contact information.

If a variance is approved, Contractor shall perform pre-construction inspection to document the existing conditions. Contractor shall also perform a post-construction CCTV inspection to verify the repair was successful and acceptable. If the inspection is unsuccessful, the Contractor is required to complete repairs and request a new inspection. These inspection videos shall be made available to the Utility upon request.

Section 405 Erosion Control, Site Restoration, and Safety

405.01 Introduction

This Section provides the minimum erosion control requirements, site restoration requirements, and safety guidelines for the construction of all sanitary sewer facilities.

This Section is not intended to replace any applicable safety requirements such as, but not limited, to OSHA requirements. The Contractor and Applicant shall follow all applicable OSHA Standards and any other applicable safety regulations during all phases of the project.

405.02 General Requirements

The Contractor and Owner are responsible for ensuring safe working conditions and safety procedures are being followed at the work site.

The CWA Authority, Inc and/or Citizens Westfield, or any authorized representative of the CWA Authority, Inc and/or Citizens Westfield, is <u>NOT</u> responsible for policing the Contractor's safety program.

A Stop Work order may be issued per Section 102.11 of this Manual if work is, in the opinion of the Utility, or RPR, proceeding in an unsafe manner.

405.03 Erosion Control

In Indianapolis, erosion control requirements shall be per the latest edition of "Chapter 600 Erosion and Sediment Control" of the City of Indianapolis Stormwater Design and Construction Specifications Manual or the City of Westfield "Construction Standards and Specifications". All sites shall be in compliance with applicable regulations promulgated by the applicable local jurisdiction and IDEM.

405.04 Site Restoration

Site restoration for all disturbed areas within the project shall be as follows:

1. For off-site areas

    a. All areas shall be restored to the original or better condition.
    b. Paved areas within the public right-of-way shall be restored per the latest revision of the Department of Metropolitan Development's "Regulations of Cuts Within the Public Right- of-Way." and the City of Westfield Construction Standards and Specifications or other applicable requirements.

2. For on-site areas

    The area shall be restored per approved construction plans.

405.05 Final Cleanup

When construction is complete, the Contractor shall remove all surplus material, trash, and debris from the site.

Contractor shall be responsible for repairs of all unsatisfactory work.

405.06 Traffic Control

The Contractor shall maintain vehicular and pedestrian traffic during all operations as required by all the permits issued by the Utility. It is the responsibility of the Contractor to apply for and obtain all necessary permits.

Protection of vehicular and pedestrian traffic shall be the sole responsibility of the Contractor.

The Contractor shall comply with the latest edition of the “Indiana Manual on Uniform Traffic Control Devices for Streets and Highways” during work operations and for the duration of the project.

405.07 Trench Safety Systems

The Contractor shall be responsible for the design, installation, and maintenance, of any required trench safety system in compliance with, all applicable OSHA and other Federal, State, and Local regulations and requirements.

CHAPTER 500 LIFT STATIONS AND LOW PRESSURE SYSTEMS

Section 501 Requirements Common to Both Lift Stations and Low Pressure Systems

501.01 Introduction

This Section provides the planning, design, and submittal requirements common to both lift stations and low pressure sewer systems.

For requirements specific to lift stations refer to Section 502 and 503.

For requirements specific to low pressure sewer systems refer to Section 504.

501.02 General

When possible, gravity sewers shall be extended to the proposed development. Lift Stations will be allowed if ALL the following conditions are met:

1. The proposed lift station or low pressure system is justified per Section 501.03;
2. The force main is designed per Section 502.15; and
3. Existing Service Area boundaries are not crossed.

Sanitary Sewer Service Area boundaries shall not be crossed to avoid extending gravity sanitary sewers.

When an existing lift station requires a capacity upgrade for a proposed development, the entire lift station system will be evaluated to determine the necessary upgrades. The requirements shall be determined on a case-by-case basis and shall be at the discretion of the Utility. The intent is to upgrade the existing lift station to the Standards set forth in this Manual.

501.03 Justification

Lift stations and low pressure systems shall be justified and will only be approved if the installation of a gravity sanitary sewer alternative exceeds the 50-year life cycle cost for the proposed system AND the criteria in Section 501.02 are met.

An accurate cost estimate to construct a gravity sanitary sewer alternative and a 50-year life cycle cost estimate for the proposed lift station shall be submitted prior to Approval.

The Utility, at its sole discretion, may choose to estimate the 50-year life cycle cost for the proposed lift station.

Section 502 Lift Station Design

502.01 Introduction

This Section provides the planning, design, and submittal requirements for lift stations with pumping capacities of 1,000 gpm or less. Requirements for lift stations with capacities greater than 1,000 gpm will be determined by the Utility on a case-by-case basis

502.02 General

Due to the variability of site conditions, each site and proposed lift station will be evaluated on a case-by-case basis. If deemed necessary, the Utility may make additional requirements not covered in this Manual.

To avoid unnecessary delays in the Permitting process, a pre-submittal meeting with the Utility during the planning stages of the project is recommended.

To ensure proper asset management upon completion, request the lift station number from the Utility during planning and design.

502.03 Submittal Requirements for Approval and Construction Permit

When submitting for an Approval and a Construction Permit, the following are required:

1. Lift Station Service Area – Per Section 502.04.
2. Lift Station Justification – Per Section 501.03
    a. 50-year life cycle analysis.
    b. Gravity sewer alternative cost estimate.
3. Lift Station Calculations
    a. Pumping Capacity – Per Section 502.07.
    b. Total Dynamic Head (TDH) Calculations – Per Section 502.09.
    c. Pump and System Head Curves – Per Section 502.10.
4. Standard Lift Station Details

    The most recent version of the Standard Lift Station Detail Sheets, as furnished by the Utility, shall be submitted for lift stations.
5. Pre-Construction Submittal Requirements - Per Section 503.04.
6. Any other information the Utility deems necessary to review and evaluate the proposed pumping system.

502.04 Lift Station Service Area

The Applicant shall prepare a Lift Station Service Area Study in accordance with all the requirements in Section 202.03.

In addition to the requirements of Section 202.03, if it determined an existing lift station can be abandoned and connected to the proposed sanitary sewer system, the area served by the existing lift station shall be included in the proposed Lift Station Service Area.

502.05 Lift Station Location

Lift station locations will be evaluated by the Utility on a case-by-case basis. At a minimum, the lift station shall be located to assure the following:

1. Supervisory Control and Data Acquisition (SCADA) Connectivity
    a. The lift station shall be located within the proposed development to assure connectivity to the CWA Authority, INC and/or Citizens Westfield SCADA wireless monitoring and control network.
    b. 4G cellular communication is preferred by the CWA Authority for all lift stations. Radio communications may be used if approved by CWA Authority.
    c. 4G cellular communication will be considered by Citizens Westfield when modifying existing lift stations. New lift stations in Citizens Westfield will use radio communications with provisions for cellular connectivity as required by the Utility.
    d. Connectivity shall be verified prior to Approval.
        i. The Applicant shall coordinate with the Utility to schedule a site investigation at the physical address of the proposed lift station.
        ii. For cellular communications the Applicant is responsible to test the signal strength. The cost of 4G reception signal strength testing is to be paid for by the Applicant.
        iii. When 4G communication is not available or radio communication is preferred, connectivity will be verified by a radio path test completed by the Utility, or a representative of the Utility, and paid for by the Applicant.
        iv. If the location does not provide adequate connectivity, an alternate location shall be chosen.
    e. To assure future connectivity, the development shall be configured in such a way to provide for a thirty (30) feet wide by seven hundred (700) feet long “clear zone” between the antenna at the lift station and the designated receiving radio tower. The clear zone is not excluded from being extended onto adjacent properties. However, if site conditions allow, the Utility may require an alternate location for the proposed lift station to have the entire clear zone, or as much as practical, located within the project boundaries.
    f. If possible, the clear zone shall be located in obstruction-free areas that cannot be built upon such as, but not limited to, right-of-ways, easements, common areas, flood hazard areas, or detention areas.
    g. If any of the above conditions cannot be met, the Utility will evaluate alternatives, including building height restrictions, on a case-by-case basis.
    h. The clear zone shall be shown on the plans.
    i. Citizens Operation Technology (OT) has a network design standard for CWA Authority and Citizens Wastewater of Westfield. This new design standard optimizes network traffic flow and other SCADA operations, and centers on the Layer 2 environment and specific IP scheme. When new equipment is installed, it should follow the Citizens OT team approved method and design.

2. Adequate Access
    a. The lift station shall be located adjacent public roads to assure adequate access is available for operation and maintenance activities.
    b. Clearance requirements are as follows:
        i. Concrete Pad
            1. To adjacent property lines – twenty (20) feet minimum;
            2. To public right-of-way – thirty (30) feet maximum;
            3. To private paved streets or paved areas – twenty (20) feet minimum and thirty (30) feet maximum; and
            4. To structures or buildings – thirty (30) feet minimum
        ii. Access Drive
            1. To adjacent property lines – ten (10) feet minimum.
    c. Lift stations shall not be located in areas the Utility determines to be inaccessible such as, but not limited to, rear yards.
    d. If access from a public road is not possible, a variance request must be submitted demonstrating why access to a public road is not possible. All private roads having the potential to be used for access shall be designed to local public street standards to support loads from maintenance vehicles and to provide an adequate turning radius on the roads to accommodate Utility's maintenance equipment. Submitting the variance request does not guarantee approval.
3. Flood Hazard Areas – See section 202.08 for requirements within Flood Hazard Areas.

502.06 Lift Station Type

CWA Authority: Only submersible duplex lift stations will be allowed.

Westfield Territory: Submersible duplex lift stations are preferred. Submersible triplex lift stations may be required as directed by the utility.

The configuration shall be per the Utility's most recent version of the Standard Lift Station Detail Sheets.

502.07 Pumping Capacity

The pumping capacity shall be calculated as follows:

Q = Design Flow / 1440 *where:*

Q = Pumping rate, gpm

Design Flow = Flow as determined per Section 202.04, gpd

1440 = Conversion from gpd to gpm

Each pump in a duplex station shall have a pumping capacity of *Q*. The second pump shall act as a backup in the event one (1) pump is out-of-service.

Q shall be rounded up in increments of 10 gpm (i.e. 233 gpm shall be rounded up to 240 gpm).

The Utility may require the pumping capacity to be increased or decreased, if deemed necessary.

The minimum pumping capacity shall be 100 gpm.

502.08 Initial Pumping Capacity

Because proposed developments may only be a portion of the overall Lift Station Service Area, the Utility may allow or require the pumping capacity to be reduced for the proposed development if the following conditions are met:

1. The area of the proposed development is less than 50% of the Lift Station Service Area.
2. The required Pumping Capacity for the proposed development is less than 50% of the required Pumping Capacity for the Lift Station Service Area.

At a minimum, each pump shall be sized to accommodate the Design Flow of the proposed development plus 20%.

Meeting the above criteria does not guarantee a reduction will be allowed.

The specific equipment requirements and allowable reductions will be at the discretion of the Utility and will be evaluated on a case-by-case basis.

1. Only the pumps, motors, standby generator, automatic transfer switch, cabling, and relevant control panel equipment will be considered for allowable reductions.
2. The wet well, valve and meter vaults, piping, valves, and force main shall be sized for the overall Lift Station Service Area.

502.09 Total Dynamic Head Calculations

The Total Dynamic Head (TDH) shall be calculated for the pumping capacity of the lift station.

The TDH is the sum of the static head and friction losses for a given pumping rate in a defined pumping system. TDH shall be calculated as follows:

$$TDH = \text{Static Head} + h_f + h_m$$

where:

TDH = Total Dynamic Head, feet

Static Head = Elevation difference between the force main discharge elevation and the pump off elevation, feet

h_f = Piping friction losses, feet

h_m = Minor losses, feet

The above variables shall be calculated as follows:

1. Static Head, feet

   Static Head = Force Main Discharge Elevation – Pump Off Elevation

   When the high point in a force main is not at the discharge elevation, the elevation of the high point shall be evaluated to determine if the pump performance characteristics are adversely affected.

2. h_f = Piping friction losses, feet

   Piping friction losses shall be calculated as follows:

$$h_f = 10.44 \ L \ \frac{Q^{1.85}}{C^{1.85} D^{4.8655}}$$

where:

D = pipe diameter, inches

Q = pumping rate, gpm

C = pipe roughness coefficient (100, 120, & 140)*

L = force main length, feet

* A roughness coefficient of C = 120 shall be used to determine the Operating Point. However, due to changing force main conditions over time, the TDH shall also be calculated using C = 100 at the Pump Off elevation and C = 140 at the Pump On elevation. See Section 502.10 for Pump Selection Criteria and further explanation.

3. h_m = Minor losses, feet

   Minor losses are due to pipe fittings and shall be calculated as follows:

$$h_m = \frac{KV^2}{2g}$$

where:

K = proportionality constant**

V = velocity, ft/sec

g = gravitation constant = 32.2 ft/sec^2

** The proportionality constant, *K*, is dependent on the type of fitting. Unless justified, *K*, shall be as follows:

Fitting	K
Check Valve	2.5
Plug Valve	1.5
Tee	0.9
90^o Elbow	0.3
45^o Elbow	0.2

Alternate methods to determine minor losses, such as using Equivalent Lengths, may be allowed on a case-by-case basis with prior approval from the Utility.

502.10 Pump Selection

The Pumping Capacity and TDH, as calculated in Sections 502.07 and 502.09, shall be used as the Operating Point when selecting the pump make and model.

Per Section 502.09, a roughness coefficient of C = 120 was used to determine the Operating Point. However, each pump shall be within the pumps operating range when C = 100 at the Pump Off elevation and C = 140 at the Pump On elevation. The pump, motor, and impeller shall be non-overloading throughout the entire operating range for all roughness coefficients.

The system head curves for each roughness coefficient shall be plotted on the pump performance curve to determine the operating characteristics.

Engineering judgment may be used when evaluating pump alternatives. If justified, the Utility may require a different operating point or an alternate pump to be used.

502.11 Variable Speed Pumping Systems

The need for variable speed pumping systems will be evaluated on a case-by-case basis and shall be at the discretion of the Utility.

Variable Speed Pumping systems may be required if <u>ANY</u> of the following conditions are met:

1. Horsepower – Greater than sixty (60) hp;
2. TDH – Greater than fifty (50) feet;

3. Pump Capacity – Greater than 500 gpm;
4. Hydraulic Transients (water hammer) – When the potential for damaging transients exist;
5. Buildout conditions – If the design flow as determined in Section 202.03 justifies; and
6. Others – If pump system conditions justify.

Lift stations with constant speed pumping systems shall be designated as “Level 3” Lift Stations and those with variable speed pumping systems shall be designated as a “Level 2” Lift Stations.

Constant speed control system requirements for Level 3 Lift Stations shall be per Section 503.08.

Variable speed control system requirements for Level 2 Lift Stations shall be per Section 503.08.

502.12 Wet Well Sizing

The wet well shall be sized for the entire Lift Station Service Area.

The minimum size of the wet well shall be as follows:

1. Diameter of Wet Well
    a. CWA Authority Territory: The minimum wet well diameter shall be six (6) feet.
    b. Westfield Territory: The minimum wet well diameter shall be eight (8) feet. A variance for reduced wet well size will be considered on a case-by-case basis.

2. Depth of Wet Well, below the invert of the incoming sewer

    a. The minimum required depth of the wet well below the invert of the incoming sewer shall be calculated as follows:

        Depth = 3 feet + Operating Depth + Height of pump

        where:

        i. 3 feet = Difference between the lowest incoming gravity sewer invert and the lead pump on elevation.

        ii. Height of Pump = Distance from the bottom of the wet well to the top of the pump, feet. Pump must be fully submerged during entire operating range.

        iii. Operating Depth = Depth between the lead pump on and pump off elevations, feet.

        iv. The operating depth is a function of the volume and diameter.

v. The minimum Operating Depth shall be 2.5 feet

b. The volume shall be based on four (4) starts per hour and shall be calculated as follows:

$$V = \frac{t\,Q}{4}$$

Where:

i. V = Volume, gallons
ii. t = 15 minutes (15 minutes station cycle time)
iii. Q = Pumping rate per 502.07, gpm.
iv. When variable Speed Pumps are required per section 502.11, the Utility may consider or require a reduction of the volume.

3. Only one (1) incoming sewer connection is allowed per Section 502.17.

4. Both pumps shall remain fully submerged at all times during the full pumping cycle.

5. Detention Time
   a. The maximum detention time (pump off time) shall be thirty (30) minutes based on the average daily flow.

There may be some situations when one or more of the above wet well sizing criteria cannot be met. The Utility will evaluate those instances on a case-by-case basis.

Note: If noticeable odors are being generated at any time before the Maintenance Bond expires, the Applicant shall determine the cause and construct an odor control facility at either the wet well or the discharge end of the force main. The method used for odor control will be approved by the Utility on a case-by-case basis. Cost for the installation of selected odor control solution shall be borne by the Applicant.

502.13 Operating Setpoints

The elevation of the set points for the operation of the lift station shall be as follows:

1. Primary level sensor - Pressure Transducer (Per Section 503.08).

   a. Alarm Level = 0.5 feet below the lowest incoming invert;
   b. Lag Pump On = 1.0 feet below the lowest incoming invert;
   c. Lead Pump On = 3 feet below the lowest incoming invert;
   d. Pump Off = (Lead Pump On Elev. – Operating Depth per Section 502.12.)

2. Backup (Alarm) level sensors - Ball Floats (Per Section 503.08)

   a. Pump On = (Lowest incoming pipe invert + 1/2 diameter of pipe.)
   b. Pump Off = 0.5 feet below the lowest incoming pipe invert.

502.14 Valve and Meter Vaults

The minimum vault dimensions for Level 2 and Level 3 lift stations shall be per the most recent version of the Standard Lift Station Detail Sheets.

502.15 Force Main Design

The force main shall be designed as follows:

1. Lift stations shall not pump downhill.

   Prior to discharging into the receiving manhole, the force main shall not flow downhill. When possible, the receiving gravity sewer shall be extended a sufficient distance to avoid downhill pumping.

   The discharge elevation of the force main at the discharge location shall not be below the elevation in the valve vault and greater than two (2) feet above the invert of the receiving sewer.

2. The size, depth, slope, and location shall be as follows:

   a. Size

      The diameter shall be sized using the Pumping Capacity as determined in Section 502.07 with the following velocities:

      i. Minimum Velocity – 2.5 ft/sec

      ii. Maximum Velocity – 6.0 ft/sec

         Higher velocities will be considered and evaluated on a case-by-case basis.

         If the Pumping Capacity is reduced per Section 502.08, the minimum velocity may be reduced to 2.0 ft/sec when using the Initial Pumping Capacity.

      The minimum diameter force main shall an ID of 4 inches.

   b. Depth

      The minimum depth to the top of the pipe shall be 4.5 feet.

The depth may be required to be increased if air release valves can be avoided or the minimum slope cannot be achieved.

c. Slope

i. The minimum slope for force mains shall be greater than 0%

The Utility may limit the length installed with HDD or require open cut installation if the number of air release valves can be reduced.

d. Location

Existing and proposed force mains shall be located per Section 202.07.1 & 2.

3. Air Release / Vacuum Relief Valves

When possible, force mains shall be designed to avoid the need for air release valves.

When high points cannot be avoided, A.R.I. S-020, air release valves shall be installed per Figure 400.12 and at each high point where air could become trapped.

Force mains 24-inch and greater shall use the larger model ARI – S-025 to allow higher volumes of air to escape.

If conditions specifically require a vacuum release valve, and only if specifically approved by the Utility, an A.R.I. D-020 stainless steel combination air and vacuum release valve shall be used.

4. Force Main Anchorage

Force mains shall be anchored to resist thrusts at all bends, angles, tees, etc. in the force main pipe. The required anchorage shall be achieved by installing restrained pipe joints and concrete thrust blocks or anchor blocks as designed by the Engineer, and shown on the plans.

Restrained joints shall be per Section 304.

The Engineer shall determine the number of joints and/or length of pipe to be restrained on each side of all bends. The number of restrained joints or length of pipe shall be shown on the plans.

a. Connections to force mains are prohibited, except for connections to common force mains in Low Pressure Systems.

5. Force Main Discharge

Force main discharge design must include corrosion protection. Both will be evaluated by the Utility on a case-by- case basis. The engineer should provide a full detail of the proposed force main discharge into any new or existing manhole and the proposed corrosion protection approach.

502.16 Buoyancy

The wet well shall be designed to prevent "floating" by assuring:

Opposing Forces > Buoyancy Forces where:

Opposing Forces = Weight resisting buoyancy forces (lbs).

Buoyancy Forces = Uplifting forces due to groundwater (lbs).

The groundwater elevation shall be assumed to be at the surface elevation immediately adjacent the base slab.

502.17 Connections to the Wet Well

For proposed lift stations, only one (1) incoming connection to the wet well will be allowed. The connection shall be of sufficient depth and size to provide service to the entire Lift Station Service Area.

Section 503 Lift Station Equipment and Operating Requirements

503.01 Introduction

This Section provides the equipment and operating requirements for lift stations.

503.02 General

Lift station equipment meeting or exceeding the requirements set herein will be approved. However, the Utility may modify any of the requirements in this Section, if justified.

All components of the lift station exposed to weather shall be constructed of material that is resistant to corrosion and will not require surface protection throughout the expected life of the lift station. In general, these materials are stainless steel, aluminum, and ultraviolet stabilized PVC.

503.03 Equipment Vendors

Equipment shall be an integral package supplied by the pump supplier with local representation so as to provide undivided responsibility.

503.04 Submittal Requirements: Pre-Construction

Prior to construction, the Contractor shall submit a cover letter from the Engineer and Contractor indicating all proposed equipment and components meet the requirements of this Manual and the approved Plans.

503.05 Power Requirements

Only electric-utility-delivered 3-phase, 60 Hz, 4-wire wye, or delta power will be allowed as normal power source (a standby generator is not considered the normal power source.)

The use of phase converters or variable frequency drives to derive 3- phase power from 1-phase power is prohibited.

503.06 Pump Equipment

Pumps shall be as follows:
CWA Authority Territory: Hydromatic, Flygt, or Utility mandated alternate.

Westfield Territory: Hydromatic, Flygt, Grundfos, or Utility mandated alternate.

Pump Equipment shall be as follows:

1. Pumps

   Pumps shall be of the submersible type for handling raw unscreened sewage. Pump volute, motor, and seal housing shall be high quality gray cast iron. Impeller shall be either cast iron or cast bronze of a non-clog design capable of handling minimum three (3) inch sphere solids, fibrous material, heavy sludge, and other matter found in normal sewage applications. Impeller shall have pump out vanes on the back shroud of the impeller to keep pumped material away from the seal area and increase operating life. Impeller shall be either slip fit or taper fit with key to securely lock the impeller to the driving shaft. The pump volute shall be fit with a replaceable bronze wear ring to minimize wear on the impeller and help achieve longer balance operating life. All fasteners shall be of stainless steel.

2. Mating Surfaces

   All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber O-rings. Sealing shall be accomplished when metal-to-metal contact is made, resulting in controlled compression of the rubber O-rings without requirement of a specific torque limit.

3. Seal System

   The pump shall be provided with a mechanical rotating shaft seal system running in an oil reservoir having separate, constantly lubricated lapped seal faces. The lower seal unit between the pump and oil chamber shall consist of one (1) stationary seat and one (1) rotating ring held in place by its own spring. The lower seal shall be removable without disassembling the seal chamber. The upper seal between the motor and the seal chamber shall be of the same design with its own separate spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. <u>Shaft seals with conventional double seal utilizing a single spring between the two (2) seals and requiring a pressure differential to offset external pressure shall not be considered acceptable nor equal to the dual independent seal system specified.</u> The shaft sealing system shall be capable of operating submerged to pressures equivalent to two hundred (200) feet. No seal damage shall result from operating the pump unit out of its liquid environment. The seal system shall not rely upon the pumped media for lubrication.

The seal chamber shall also be equipped with a seal failure sensor probe which will sense water intrusion through the lower seal. This sensor shall be connected to an alarm in the control panel to indicate lower seal failure.

4. Housing

The stator winding, rotor and bearings shall be mounted in sealed submersible type housing. Insulation utilized in the stator windings shall be Class H with maximum temperature capability of 180^{o} C. Motor housing shall be filled with a high dielectric oil to give superior heat transfer and allow the bearing to run in a clean, well lubricated environment; or the housing shall be air filled with grease lubricated bearings. The pump and motor are to be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. The pump shall not require cooling water jackets. Stator shall be securely held in place with a removable end ring and threaded fasteners so that it may be easily removed in the field without use of heat or press. Shaft shall be stainless steel and supported by ball bearings. Motor shall be provided with heat sensing units attached to the motor windings which shall be connected to the control panel to shut down pump if overheating occurs.

5. Cables

Pump motor cable and heat sensor/seal failure sensor cable shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors. Cable of the proper length shall be provided to eliminate need for splices or junction boxes between pump and “control center.” The cable shall enter the motor through a cord cap assembly which is double sealed allowing disassembly and disconnect of the wires and the motor and still not damage the sealed characteristics of the motor housing. Each individual conductor shall be color coded in accordance with generally accepted industry standards. The color coding shall designate the application of the conductor.

6. Mounting Base

The pump mounting base shall include adjustable guide rail supports and a discharge connection with a one hundred twenty-five (125) pound standard flange. The base and the discharge piping shall be permanently mounted in place. The base plates shall be anchored in place utilizing epoxy type anchors with stainless steel studs and nuts as manufactured by HILTI Fasteners, Inc. or equal.

7. Guide Rails

A rail system shall be provided for easy removal of the pump and motor assembly for inspection and service. The system shall not require a man to enter the wet well to remove the pump and motor assembly. Two (2) rails of two (2) inch stainless steel pipe for Flygt or Grundfos pumps or one rail of FRP I-Beam for Hydromatic pumps shall be provided for each pump unless the size of the pump dictates otherwise. The guide rails shall be positioned and supported by the pump mounting base. The guide rails shall be aligned vertically and supported at the top by attachment to the access hatch frame. One (1) intermediate guide rail support shall be required for each nine (9) feet of guide rail length for FRP and fifteen (15) feet for stainless steel pipe. All mounting equipment shall be stainless steel.

8. Rail Guide and Lifting Chain

   The pumps shall be equipped with sliding brackets or rail guides. To insure easy removal of the pumps, the rail guides attached to each pump shall not encircle the rails.

   A stainless steel lifting chain of adequate length for the basin depth shall be provided for each pump. Each pump shall be equipped with a permanent, stationary lifting handle with a minimum clearance of twelve (12) inches between the top of the pump and bottom of the handle.

   The rails and the rail guide shall function to allow the complete weight of the pumping unit to be lifted on dead center without binding and stressing the pump housing. The rail system shall function to automatically align the pumping unit to the discharge connection by a simple downward movement of the pump. No twisting or angle approach will be considered acceptable. The actual sealing of the discharge interface may be of the hydraulically sealing diaphragm type assembly with removable Buna-N diaphragm as supplied by Hydromatic Pump or may be of the metal-to-metal contact as provided by Flygt or Grundfos Pump.

9. Warranty

   Pump warranty shall be provided by the pump manufacturer and shall warrant the units being supplied to the Owner and CWA Authority, Inc and/or Citizens Westfield against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. The warranty shall be in printed form and apply to all similar units. A copy of the warranty statement shall be submitted with the approval drawings.

503.07 Lift Station Components

The lift station shall be configured and shall include all components shown on the most recent version of the Lift Station Details Sheets (Figure 500.01) and the following:

1. Wet Well, Valve and Meter Pits, Flat Top, and Base Slab

   a. Material

      The wet well, valve and meter vaults, flat tops and base slabs shall be constructed of precast concrete meeting the requirements of ASTM C 478. Cast-in-place monolithic structures may be substituted with the prior written approval from the Utility.

   b. Joints

All joints between precast sections shall be per Section 305.02.

c. Waterproofing

The outside wall below grade shall be coated with bituminous waterproofing material.

d. Corrosion Resistant Interior Lining
Citizens Westfield: Wet well interior shall be coated with Spectra Shield or Utility approved equal corrosion resistant liner.

2. Concrete Pad

The wet well and valve and meter vaults shall be enclosed at grade level with a minimum eight (8) inch thick reinforced concrete pad rectangular in shape. The wet well, valve, and meter vaults shall have rebar dowel material penetrated at grade level to connect to surrounding reinforced concrete pad.

3. Access Drive

The Lift Station shall be provided with a minimum eight (8) inch thick by fifteen (15) feet wide reinforced concrete access drive conforming to the latest DOT Standards for Design of Driveways.

4. Access Hatches and Frames

a. An aluminum two (2) door access hatch frame and door assembly that includes a gasket to provide a tight seal shall be installed in the concrete top for the wet well. This door assembly shall provide access for removal of the pumps and shall support the guide rails. It shall be provided with a lifting handle, safety latch to hold the door in the open position, and a hasp suitable for a padlock. The doors shall have a non-skid finish and be designed with a minimum 300 psf, live loading.

Hatches shall have an interior safety hatch. The safety hatch shall be designed to cover the complete opening maintaining a fall through protection per all applicable OSHA Standards and provide access for removal of pumps when in the open position.

Westfield covers shall have diamond pattern.

Hatches shall be manufactured by Halliday Products, Inc., USF Fabrication Inc. or Bilco.

Safety grating shall open in the same direction as the access hatch door.

b. Valve and Meter Vaults

An aluminum single door access hatch frame and door assembly with similar requirements to the one described in 503.07.4.a for the wet well shall be installed in the concrete top for the valve and meter vaults. Minimum opening shall be thirty-six (36) inches by thirty-six (36) inches.

Hatches shall be manufactured by Halliday Products, Inc., USH Fabrication or Bilco.

c. See section 503.14 for odor control measures.

5. Check and Shutoff Valves

A swing check valve with a weight operated external swing arm and an eccentric plug valve without operators shall be installed in the valve vault on each pump's discharge piping. A minimum clearance of twelve (12) inches shall be allowed on the top, bottom and all sides of the valve from the bottom of the valves to the invert of the vault.

A drain pipe and check valve shall be installed to drain the valve vault back to the wet well but not allow the wet well liquid to enter the valve vault. Check valve shall be installed on the downstream end of the drain pipe in the wet well. In addition, a tee or cross with bleedable blind flange shall be provided in the valve vault.

6. Magnetic Flow Meter and Shutoff Valves

CWA Authority:

When variable speed pumping systems are required, a magnetic flow meter and an eccentric plug valve shall be installed on the discharge piping per Section 503.08. A minimum clearance of twelve (12) inches shall be allowed between the top, bottom and all sides of the valves to allow maintenance. Provide stainless steel flanged spool piece for magnetic flow meter.

The Utility may require flow meters and eccentric plug valves on constant speed pumping systems. Determination to be made on a case-by-case basis.

Westfield Territory:

Magnetic flow meter, meter vault, and associated piping and valves required for all stations with capacity greater than 250 gpm.

Straight sections of pipe upstream and downstream of the magnetic flow meter shall be per manufacture's recommendation.

7. Internal Drop Pipes and Bowls

Drop pipes shall be installed in all incoming pipes four (4) feet or greater above the pump-on elevation or as directed by the Department of Underground Engineering & Construction.

a. The drop bowl and drop pipe should typically be sized 2 inch to 4 inch larger than the inlet pipe, and designed to accommodate full flow.
b. The drop bowl shall be fiberglass, pvc, or stainless steel. The drop pipe should be pvc. All brackets and hardware shall be stainless steel.
c. The 45 or 90 at the bottom of the drop pipe should be angled slightly away from the wall to create a swirl motion in the wet well. The swirl motion will help prevent a grease ring and debris buildup on top of the wet well.
d. For inlet pipes that drop directly on top of a pump, a drop bowl and drop pipe shall be used to prevent associated problems with the pump.
e. Acceptable manufacturer for the drop bowl/drop pipe is Reliner. Other manufacturers can be acceptable if reviewed and approved.

See Figures 400.15 and 400.16.

See section 503.14 for odor control measures for lift station drop pipes.

8. Pipe Coatings

The outside surfaces of exposed pipe and fittings within the wet well and valve vault shall be first coated with a zinc primer followed by an epoxy based coating applied per coating manufacturer's recommendation.

9. Fall Protection

In addition to the required safety hatches specified in Section 503.07.4, a Miller Bolt-on Anchor Plate model DH-AP-12 shall be installed with four (4) anchor bolts meeting the manufacturer strength requirements (Ex: Hilti HIT-HY 200 adhesive anchors with 5/8 inch HAS/HIT-V threaded rod and 4 inch embedment) per manufacturers recommendation. The Bolt-on Anchor plate will be used in conjunction with compatible Utility supplied Portable Fall Arrest Anchor Post Model DH-AP-1 or equal.

10. Conduits

Buried conduits to wet wells and valve and meter vaults for power and control cables shall be Schedule 40 PVC pipe.

Above grade conduit sections with power and control cables to wet wells and valve and meter vaults shall be UV rated schedule 80 PVC pipe.

Grounding electrode conductors shall be installed in schedule 80 PVC.

Conduits that are exposed for their entire length shall be thick wall rigid galvanized steel (RMC).

Conduits that do not connect to wet well and are exposed for a section of their run may be RMC or schedule 80 PVC for their entire run. Or these runs may transition from RMC or schedule 80 PVC to schedule 40 PVC at the end of an elbow, below grade.

PVC coated steel conduits are not allowed. Schedule 40 PVC conduits shall not be exposed.

11. Control and Power Cables

    All control and power cables shall be wrapped in a braided stainless steel protective, strain-relief sleeve where they enter the wet well.

12. Removable Bollards

    Removable bollards shall be installed as needed to prevent vehicles from driving over wet well, valve or meter vault access doors

    The Utility has final approval on quantity, spacing, and required offsets for bollards. Where required, bollards shall follow Figure 400.14 or an approved equal.

13. Fencing

    Lift station fence and gate materials shall be determined and approved by the Utility.

503.08 Control System Requirements – Level 3 and Level 2 Lift Stations in CWA Territory

The Control System Requirements for Level 3 & level 2 lift stations shall be per the current Underground Engineering & Construction specifications, Figures 500.016 & 500.013, or as follows:

1. Overall Lift Station Control System Enclosure Requirements

   a. General Requirements:

      i) Control and electrical components shall be individually equipment rack mounted as shown on schematics and as follows in the attached schematic.
         - Pump Control Panel NEMA 4X stainless steel with dead front and internal swing out panel door. Include pump controls, operator interface, telemetry equipment, and uninterruptible power supply.
         - Pump Control Panel:
           - Level 3 Sites: Motor Control Panel. NEMA 4X stainless steel. Include phase monitor, surge protection devices, branch circuit breakers, and motor starters.
           - Level 2 Sites: VFD Control Panel. NEMA 4X stainless steel. Include phase monitor, surge protection devices, branch circuit breakers, transformer, Fans, and VFDs.
           - Level 2 Sites: Electrical Distribution Panel. NEMA 4X stainless steel. Include branch circuit breakers.

- Utility approved meter socket.
- Emergency Power Generator Connection. Connection shall use a 3 phase/4 wire, NEMA 4X generator docking station that utilizes J-Series male "Cam-Lok" panel mounts with flip covers and phase rotation monitor. Docking station shall have padlockable swinging front door. Access to cable connectors shall be via the bottom hinged door. The internal bus bar shall be silver plated copper. Assembly shall use UL listed components and be rated 65AIC. The generator docking station shall be Trystar GDS, Power Temp Systems or an approved equal.

ii) Enclosures shall be mounted on lift station concrete pad. The concrete pad shall be a minimum of three inches higher than the adjacent ground. The concrete pad shall be a minimum of one foot larger in dimension than enclosure plus radius of door swings. Orientate panel placement so that panel doors do not open over or near wet well opening.

iii) Provide enclosures with following additional accessories:
- Drip shield.
- Padlock hasp.
- Stainless steel 3-point latch to allow panel opening without tools.
- In addition to above, Pump Control Panel shall be provided with:
  - LED door switch activated light.
  - Ground Fault Interrupting (GFI) 120 VAC receptacle.
  - Thermostatically controlled heaters sized to maintain panel internal temperature at 50°F with outdoor temperature of -20°F.
  - Buried conduits to control and power panels shall be PVC pipe. Above grade conduits to control and power panels shall be UV rated PVC pipe. PVC coated steel conduits are not allowed.

2. Wiring, Termination, and Labeling Requirements

a. Wiring:

i) In addition to NEC and NEMA requirements, wiring shall conform to following:
- Power: 12 AWG stranded minimum, type MTW, 600 V.
- Control: 16 AWG stranded minimum, type MTW, 300 V.
- Analog Signal: Twisted pair, 18 AWG, Beldon 8760 or equal.

ii) Wire color code:
- AC neutral conductor: White.
- AC hot conductor: Black.
- AC UPS powered: Red.
- Grounding conductor: Green.
- AC control conductor, powered from within panel: Red.
- AC control conductor, powered from remote source: Yellow.
- DC (+) power conductor: Blue.
- DC (-) power conductor: White/Blue.
- DC control conductor: Blue

- DC control conductor, powered from remote source: Orange.
- Twisted pair cable (-) signal conductor: White.
- Twisted pair cable (+) signal conductor: Black.
- Intrinsically safe conductors: Light Blue.
- All wire must be labeled according to the drawings.

iii) Design control panels to keep 3-phase power, 120-vac power and discrete signals, and analog and other low voltage signals separated.
- Do not run 3-phase power, 120-vac power, and discrete signals, and analog or other low voltage signals in the same conduit or wire-duct.
- Where 3-phase power, 120-vac power, and discrete signals, and analog or other low voltage signals must cross, they shall do so at right angles.

iv) Internal Panel Wiring Within Wire Duct:
- Wherever feasible plastic wire duct with cover shall be used for routing of wire within control panel.
- Size wire duct to be no more than 50% full.
- Maintain 2 inch clearance between wire duct and terminals.

v) Internal Panel Wiring outside of wire duct.
- Wiring outside of ducts shall be restrained by the use of plastic wire-ties.
- Restrain wiring a minimum of every six inches.
- Provide abrasion protection for wires passing through holes or across abrasive metal edges.
- Adhesive type wire fasteners shall not be used. Hard screw type shall be employed.

b. Terminations:

i) Wiring within control panel shall be continuous and terminated only at terminal blocks or equipment terminals. Splices or butt connectors shall not be used within panel.

ii) Other than terminal to terminal bussing as described below, no more than one wire shall be terminated at any one terminal.

iii) Make external connections by way of numbered terminal blocks on numbered terminal strips.
- Provide integral bussing system on terminal block array where more than two terminations require common source or drain connection. Wired jumper terminations shall not be acceptable.
- Include provisions for grounding of shields on shielded twisted pair cables entering or leaving panel. Cable shields shall be grounded at terminal block end only.

iv) Provide separate locations on terminal strips for each of the following types of signals.
- 480 or 240-vac power circuits.
- 120-vac power circuits.
- 120-vac discrete signals.
- 24 or 48 Vdc discrete signals.
- Analog signals

v) Provide a separate terminal strip for intrinsically safe circuits. Intrinsically safe wiring shall be separated by non-conducting or grounded barrier within panel, and not combined with any other wiring within conduit or wire duct.

c. Power Distribution:

i) Panels having 3-phase power supply:
- Provide circuit breakers for all pump control devices provided. This includes motor starters and VFDs.
- Provide phase monitor relay (PMR).
- Provide motor current transducer for each motor to produce 4-20 mA DC signal to PLC.
- Provide intrusion detection switch for each panel.
- If panel includes separate 120 vac control power supply, provide auxiliary contact to isolate control power when main circuit breaker is opened.
- 480(240, 208) / 120 control power transformer requirements:
  - Both primary leads shall be protected by a circuit breaker.
  - First secondary lead shall be protected by a circuit breaker.

ii) Panels having 120 vac power supply:
- Provide circuit breaker on power supply entering panel.
- Provide a separate circuit breaker to each major panel component.
- Panels using modular or solid state I/O devices.
  - Provide a separate circuit breaker for panel powered I/O signals entering panel from field devices. Provide a separate circuit breaker for each module type.
  - Include an external slimline relay for each output in the panel.
  - Include an isolated converter for each analog in the panel.
- Relays and isolated converters must be supplied for each available IO point in the system, not just IO used.

3. Field Instrument Requirements

Required	Level 2	QTY	Level 3	QTY
Float Switches	Connery Model 2900	2	Connery Model 2900	2
Submersible Level	Ametek model 575	1	Ametek model 575	1
Flow Meter	Varies, see below	1*	Varies, see below	0

*Some Sites require 2 flow meters, refer to contract drawings for exact count

a. Level Transmitter

i) Provide submersible level transmitter to sense level in wet well and control pump on/off operation.
- Hydrostatic pressure measurement.
  - Loop powered.
  - 4 – 20 mA DC output signal.

  - 316 stainless steel submersible housing and diaphragm, Viton grommet and O-ring. Provide stainless steel braided support cable to prevent transmitter from being supported by signal cable.
  - Accuracy +/- 0.25% of span including linearity, hysteresis, and repeatability.
  - Provide lightning and surge protector to be mounted in panel.
  - CSA is approved intrinsically safe when used with appropriate barrier.
  - Ametek model 575.

ii) In high grease or other applications, ultrasonic level sensor may be used with approval from OWNER.

- Ultrasonic level measurement.
- 120 VAC powered.
- 4 – 20 mA DC output signal.
- Accuracy +/- 0.1 % of span including linearity, hysteresis, and repeatability.
- Provide lightning and surge protector to be mounted in Pump Control Panel.
- Suitable for use in Class 1, Division 1, and Group D hazardous classified location.
- Manufacturers:
  - Siemens SITRANS LUT420
  - Endress and Hauser Prosonic M
  - No substitutions allowed.

b. Float Switches

i) Provide wet well float switches to sense high and low level in wet well and control standby pump on/off operation. Standby pump operation shall be independent of PLC.

- SPST NO contacts, rated 1 amp at 150 VAC/VDC inductive, mechanical life 10 million operations.
- 316 stainless steel mounting hardware. Mounting shall not require entry to wet well for cleaning or replacement.
- Conery Model 2900 pear shaped neoprene covered mercury switch ball float of standard size.

ii) For lift stations containing a dry well, or areas prone to flooding due to pump seal or piping failure, provide dry well float switch to sense dry well flooding.

- SPST NO contacts, rated 1 amp at 150 VAC/VDC inductive, mechanical life 10 million operations.
- Connery Model 2900 pear shaped neoprene covered mercury switch ball float of standard size.

c. Intrusion Detection Switches

i) Provide intrusion detection switches.

- When control and electrical components are mounted outdoors, provide intrusion detection switches for electrical and control equipment enclosure.
- When control and electrical components are mounted indoors, provide intrusion detection switches for all entrances into the pump station.
- Reed switch enclosed in ABS plastic case, normally closed contact.

d. Flow Meters

i) Provide magnetic flow meter.
- Size meter to maintain average velocity of 3 ft/sec.
- System accuracy of +/- 25% of flow rate with 10:1 turndown.
- Meter body:
- Utilize low frequency dc pulse.
- Accidental submergence rating of 30 ft. water for 48 hours.
- Polyurethane or hard rubber liner, 316 stainless steel electrodes.
- Provide with 316 stainless steel grounding rings, use of grounding probes not acceptable.
- Suitable for Class 1, Division II, Hazardous classified location.
- Include isolating plug valves before and after meter body to facilitate meter removal. Include spool piece of same dimensions as meter body.
- Maintain minimum of 5 upstream and 3 downstream unobstructed pipe diameters before and after meter body. Provide a separate meter vault if required to meet dimensional requirements.
  - The meter vault shall be provided with a sump and flood alarm float switch.

ii) Transmitter:
- 120 VAC, 60 Hz power.
- For outdoor locations, mount on Pump Control Panel internal swing out panel as shown.
- Provide pulsed DC voltage to meter body magnet coils.
- Integral keypad/display.
- Automatic empty pipe detection.
- Manufacturers:
  - Rosemount
  - Krohne
  - ABB
  - Foxboro
  - Endress + Hauser
  - No substitutions allowed.

4) Pump Control Panel Requirements

i) A Pump Control Panel shall be provided to house the PLC, OIU, Ethernet switch, radio, lightning, and surge protection devices.

ii) A Pump Control Panel mounted outdoors must be equipped with a low temperature switch, set at 40 degrees F, mounted within the enclosure to alarm failure of heater.

iii) The automatic pump operation, automatic pump lead-lag alteration, and all control logic commands shall be performed by the PLC. The PLC shall be Allen Bradley CompactLogix model 5069-L306ER, with no substitutions allowed, and shall meet the following table of quantities for different components and the requirements:
- Real time clock
- Floating point math

- PID control
- Circuit breakers, 24vdc supply, terminals, relays, heaters, etc. as needed to wire as a fully functional control panel

In the event a PLC with increased processing power is required, a Allen Bradley CompactLogix mode 5069-L320ER shall be used.

Required	Level 2	Quantity	Level 3	Quantity
PLC	5069-L306	1	5069-L306	1
Digital Input	5069-IB16	4	5069-IB16	2
Digital Output	5069-OB16	1	5069-OB16	1
Analog Input	5069-IF8	2	5069-IF8	1
Analog Output	5069-OF8	1	5069-OF8	0
UPS	Alpha Supply UPS 120V	1	Alpha Supply UPS 120V	1

iv) OIU shall be Rockwell Automation PanelView Plus 7 model 2711P-B7C22D9P meeting the following requirements:
• 7” color di1s5p5lay
• Keypad
• NEMA 12/4X
• Ethernet Interface
• DC Powered

a. PLC I/O Signals:

i) OIU shall be configured to allow.
- Display pump run, fail, automatic mode, overload, seal fail, motor over-temperature, accumulated pump run time, and accumulated pump number of starts for each pump.
- Display all discrete and analog signals input to PLC, and calculated or derived parameters including communication fail, crew on site, intrusion, and float control mode.
- Wet well level, high and low level alarms.
- “Lead Pump 1 / Lead Pump 2 / Lead Pump Alternate” selection.
- Calculated lift station flow rate and accumulated flow total.
- Display communications fail (to SCADA central).
- Display status of all input signals to PLC.
- Capability to place pumps “Out of Service”. Display “Out of Service” status at OIU.
- Configure to allow “Crew on Site” input. Allow entry of operator’s 4 digit identification number after “Crew on Site” has been entered. This function is to work in conjunction with the Intrusion switch. Once an intrusion has been

detected the crew will have a set amount of time to enter a valid code before the intrusion alarm is activated.

- Operator data entry for adjustable set points, including pump on/off levels, time delays, etc. Allow for operator entry of 4 digit password prior to accepting parameter changes.

b. System programming guidelines:

i) Provide program documentation for all OIU and PLC program files developed for the system. PLC program documentation shall include comments for all registers used and sufficient rung comments to describe operation of logic used within program. Provide a digital copy of the program to Citizens Energy Group.
ii) Automatic pump control shall start and stop pumps in a lead and lag fashion based on wet well level input.
iii) Provide lead pump alternation on each successive lead pump shutdown when automatic alternation is selected.
iv) Provide pump fault logic to sense discrepancy between pump-required output being turned on and no pump run signal being received. Configure system to generate fault on any condition including motor overload, motor over temperature, seal failure or power disconnect.
v) Provide time delay on pump required outputs, initially set at 10 seconds and 20 seconds, to prevent simultaneous pump restart on restoration of control power.
vi) “Out of Service” entry shall remove pump from operating sequence and prevent alarms from being generated for pump.
vii) All alarms shall automatically reset when the alarm condition has cleared. An adjustable 0-15 minute time delay relay shall be activated and timed-out prior to transmitting the high or low wet well level condition.
viii) Pump accumulated run time shall be calculated for each pump.
ix) Pump accumulated number of starts shall be calculated for each pump.
x) Provide routine to calculate lift station draw down time. Draw down time data shall be time stamped and indicate which pump(s) running during draw down event.
xi) Program to ensure that regardless of configuration of backup hardware, (re: back up ball floats when primary level control device is pressure transducer) primary level control device automatically takes over when level of wet well returns to desired operating level.
xii) In the absence of a flow meter provide routine to calculate lift station flow rate and accumulated lift station accumulated flow total. Calculation shall be based on following:
    - Wet well dimensions, include adjustable offset for equipment, piping, or other items affecting wet well volume and account for cross-sectional changes between minimum and maximum levels. Calculation shall be made such that changes to pump on and off level set-points shall not require change to flow calculation routine.
    - Wet well level rate of rise shall be used to calculate inflow rate when pump are not operating.
    - During pump run events, inflow rate shall be calculated as the average inflow rate occurring immediately before and after pump run event.

xiii) PLC shall be configured to periodically transfer information to SCADA Central HMI. Transfer of information shall occur periodically based on information requests from SCADA Central HMI and be initiated by lift station PLC on occurrence of alarm condition. Periodic data transfer of information to SCADA Central HMI shall include:

- Lift station accumulated flow total.
- 10 minute averaged flow rate data. Time stamped average flow rate data values shall be logged internally to PLC memory. Logged data shall be retained until data successfully transferred to HMI, at which point it shall be deleted.
- Pump draw down data. Time stamped data values shall be logged internally to PLC memory. Logged data shall be retained until data successfully transferred to HMI, at which point it shall be deleted.
- Pump elapsed run time data
- Accumulated number of starts for each pump.
- Coordinate programming requirements with the Utility
- Data transfer shall be configured to allow SCADA Central HMI to emulate all data input and display functions present at OIU, including display all discrete and analog signals input to PLC, and calculated or derived parameters including communication fail, crew on site, intrusion, and float control mode.
- Data transfer to and from SCADA Central HMI shall take place using contiguous PLC register locations to maximize efficiency of data transfer. Register usage and addressing shall be coordinated with CWA Authority, Inc and/or Citizens Westfield.
- Include provision for periodic receipt of current time and date SCADA Central HMI.

xiv) Contractor shall coordinate with Utility about required modifications to the Lift Station Central SCADA system monitoring software at the Wastewater Treatment Plant. The Utility or the Utility's designated vendor may perform the integration work. If the Contractor is responsible for the integration work, the Utility shall approve the integrator prior to commencing.

c. UPS Requirements

i) The UPS must meet the requirements below.

- Provide true on-line non switching UPS.
- UPS shall supply power to Programmable Logic Controller (PLC), Operator Interface Unit (OIU), radio, Ethernet switch, field instruments, and other low voltage control devices. UPS shall have enough capacity to power these devices for a period of 2 hours after the utility power has failed. Provide with extended battery module to meet this requirement.
- UPS shall provide dry contacts to PLC for utility fail and low battery power alarms.
- Minimum UPS size shall be 650 VA.
- Double power conversion on-line operation including rectifier and inverter, constantly conditioned AC output.
- Provide make before break manually operated bypass switch or other means to bypass UPS to allow operation of system controls in event of UPS failure.

d. Ethernet Switch, Radio, Antenna, and Antenna Mounting Requirements

i) Provide Ethernet switch, radio, antenna, antenna cable, and antenna mounting pole.

- Radio, antenna cable, antenna, and lightning and surge protection devices shall be purchased from the CWA Authority, Inc and/or Citizens Westfield's approved radio equipment supplier to ensure compatibility with the CWA Authority, Inc and/or Citizens Westfield's radio based SCADA communication network used for lift station monitoring. Contact the Utility for more information about the required radio requirements.
- Ethernet switch and radio shall be mounted within Pump Control Panel.
- Contractor shall determine signal strength available at lift station locations. Available signal strength shall be tested at elevations of 20' and 15' above ground level and signal strength test results shall be supplied to CWA Authority, Inc and/or Citizens Westfield.
- Contractor shall determine the most suitable location for the antenna based on the results of signal strength testing. Antenna pole shall be affixed to lift station concrete pad.
- Based on the results of signal strength testing, the Contractor shall purchase either the 900 MHz or 5.7 GHz radio, as selected by the Utility approved radio equipment supplier. Contact the Utility for more information about the required radio requirements.
- Contractor shall mount the antenna in the selected location and provide antenna cable in conduit.
- Where lift station structure does not exist or is unsuitable for antenna mounting, antenna mounting pole shall be up to 20 feet tall, 4 inch in diameter, composite material, and set within concrete or firmly affixed to pump station.
- Where lift station structure is suitable for antenna mounting, antenna mounting pole shall be 2 inch in diameter, aluminum, and firmly affixed to pump station.
- Provide grounding of antenna pole in accordance with NEC requirements.
- The programming of the radio shall be by the Contractor.

e. 4G Cellular Requirements

i) Contractor shall provide the following equipment:

- IR1101-K9 CISCO - HW ROUTERS L/M - Cisco IR1101 Industrial Integrated Services Router Rugged
- SL-IR1101-NE CISCO - HW ROUTERS L/M - Network Essentials License for Cisco IR1101 Industrial ISR
- IR1101-DINRAIL CISCO - HW ROUTERS L/M - Din Rail kit for the IR1101
- IR-CAB-CON-USB CISCO - HW ROUTERS L/M - Console Cable 6ft with USB Type A and mini-B
- P-LTE-MNA CISCO - HW ROUTERS L/M - Multi-carrier band-14 CAT4 LTE Pluggable for North America

- IRM-1100-SP CISCO - HW WIRELESS - Expansion module for the IR1101 with pluggable / SFP
- IR1100-P-BLANK CISCO - HW ROUTERS L/M - IR1100 Blank Pluggable
- CON-SNT-IR101K9K CISCO - CISCO CCW SERVICES -SNTC-8X5XNBD Industrial ISR 1101
- LGAM-BC3G-26-3SP Panorama Antennas - 698 MHz to 960 MHz, 1710 MHz to 3800 MHz, 1562 MHz to 1612 MHz - 26 dB -Cellular Network, GPS, GLONASS - Black -Rigid Mount - Omni-directional - SMA Connector

ii) The Utility provides the sim card of 4G router for the Contractor's 4G connectivity. Detailed information can be coordinated with the Utility.

f. Surge Suppression Requirements

i) All Surge protectors shall be provided by I & C with the main service entrance surge protector installed by Electrical Contractor in the field.

ii) Level 2 Stations

- Approved Manufacturer: SSI/nVent - Surge Protectors to be provided by Energy Conservancy Group, LLC. Contact: Rick Berkowitz 317-999-5079
  - No Substitute:
- Service Entrance Disc. – 277/480V, 3Ph,4W - Model# CTMB12-3Y2E30X3-64
- Electrical Dist. Panel – 480V, 3Ph,3W - Model# STMB9-3N4-64
- Pump Control Panel – 120V, Single Phase - Model# USPT1P1-64
- Surge protectors to be Purchased by I & C – Coordinate surge protection location inside the panels with Rick Berkowitz.
- Service Entrance Disc. – Surge protector to be installed by Electrical Contractor in the field. – Install at the bottom of Disc. Direct Connect with preinstalled ¾ inch Meyers hub. Paying close attention to keeping leads as short as physically possible. Install the metal hub directly to the panel no conduit should ever be used. (Coordinate installation with Rick Berkowitz) * If the service entrance disconnect for level 2 is the power companies, then install on Docking station the same as Level 3 station)*
  - The main service surge protector is in a NEMA 4 enclosure the ¾ Meyers Hub can only be mounted on the end of the device. These will have to be mounted horizonal they are 9 ½ inches long. If mounted on the side.

iii) Level 3 Stations

- Approved Manufacturer: SSI/nVent – Surge Protectors to be provided by Energy Conservancy Group, LLC. Contact: Rick Berkowitz 317-999-5079
  - No Substitute:
- Docking Station Disc. – 277/480V, 3Ph,4W Model# CTMB12-3Y2E30X3-64
- Electrical Dist. Panel – 480V, 3Ph,3W Model # STMB9-3N4-64
- Pump Control Panel – 120V, Single Phase Model# USPT1P1-64
- Surge protectors to be purchased by I & C – Coordinate surge protection location inside the panels with Rick Berkowitz

- Docking Station Disc. – Surge protector to be installed by Electrical Contractor in the field. – Install on the upper right side direct connect with preinstalled ¾ inch Meyers hub. Paying close attention keeping leads as short as physically possible. Install Metal hub directly to the panel no conduit should eve be used. (coordinate installation with Rick Berkowitz).
    - The main service surge protector is in a NEMA 4 enclosure the ¾ Meyers hub can only be mounted on the end of the device. These will have to be mounted horizontal they are 9 ½ inches long.

5. Pump Control Panels

	Level 2	Level 3
Motor Control Panel	None	Required
VFD Control Panel	2*	None
Electrical Distribution Panel	Required	None

*Some sites will require 3 VFD panels, please refer to contract documents for exact number.

i) The lift station shall have electric-utility-delivered 3-phase, 60Hz, 4-wire wye, or delta power. All stations powered by 3-phase primary voltage shall have a minimum 2.0 KVA single-phase, 480/240 to 120/240 VAC transformer. Use of phase converters to derive 3-phase power from 1-phase power source is prohibited.

a. Motor Control Panel (MCP) Requirements

i) Motor starters shall be NEMA-rated magnetic type with a 120 volt control coil, and three thermal overload relays with a minimum size of NEMA-1.
ii) Provide the following front of panel mounted devices to be labeled as indicated. For outdoor locations, devices shall be mounted to swing out panel door.
- Branch circuit breakers shall be raised to the dead front using a custom built bracket, no extended handles will be allowed.
- “Hand-Off-Automatic” selector switch for each pump, with the hand mode wired for manual operation independent of the PLC.
- “Float Mode” selector switch, to select which pump will turn on during float override mode.
- Process indictor to show wet well level.
- Reset PB for each overload relay present.

iii) Suitable for outdoor mounting, with maximum ambient temperature of 105°F
iv) Include thermostatically controlled heaters sized to maintain panel internal temperature at 50°F with outdoor temperature of -20°F.

b. Variable Frequency Drive (VFD) Control Panel Requirements

i) Provide pulse width modulated VFDs.

ii) Provide with bypass contactor to allow across the line operation.
  - Ensure VFD line and load contactors are included to prevent back feed into the VFD.

iii) Suitable for outdoor mounting, with maximum ambient temperature of 105°F.

iv) Mount in pad-lockable NEMA 4X stainless steel rated dead-front enclosure.

v) Include thermostatically controlled heaters sized to maintain drive panel internal temperature at 50°F with outdoor temperature of -20°F.

vi) Use of air conditioning or heat exchangers to allow operation of VFD in elevated ambient temperatures is prohibited. Include externally mounted heat sinks (one per VFD) sized to maintain drive panel internal temperature at 100°F with outdoor temperature of 105°F. If required to meet specified ambient temperature requirements, derate drive capacity to meet temperature requirements. Provide with a high temperature switch, set at 110°F, mounted within the enclosure to alarm high drive temperature.

vii) Capable of withstanding line voltage transients up to 3000 V in accordance with ANSI 37.90.1.

viii) IGBT switching.

ix) Match output power to motor, 0.5% speed regulation, 110% overload capacity for 60 seconds, 100% rated torque from 60 Hz to required turndown.

x) 3% input line reactors.

xi) Instantaneous over-current trip shutdown, under-voltage protection with automatic restart.

xii) Include keypad/display mounted within enclosure, accessible when enclosure is opened.

xiii) Manufacturers
  - Yaskawa.
  - Allen Bradley.
  - No substitutions allowed.

xiv) Branch circuit breakers shall be raised to the dead front using a custom built bracket, no extended handles will be allowed.

c. Electrical Distribution Panel Requirements

i) Branch circuit breakers shall be raised to the dead front using a custom built bracket, no extended handles will be allowed.

ii) Electrical Distribution must be provided with spacing and a cutout for 6 breakers. Any empty space will need to have a cover plate made which can be removed when expansion takes place.

iii) Must include power distribution blocks or terminal blocks to allow for easy field wiring of breakers.

iv) Main distribution blocks must have at least 8 load openings with at least 3 openings being able to accept a 2/0 wire.

6. Required Components and Standard Parts List

a. The below parts are a quick summary of parts and pieces required in each lift station regardless of size. This list is updated yearly. The Required Parts chart shows parts where no alternative will be accepted. The Flexible Parts shows parts with a tier list of acceptability and highlights more common components. The main rule is that parts must be interchangeable within the different manufacturers and/or meet the part requirements. If there is a part not listed in either of these two tables, it is up to the discretion of the system integrator to find appropriate parts.

Required Parts

Category	Manufacturer	PN	Description
PLC	AB	5069-L306ER	COMPACTLOGIX 600KB ETHERNET CONTROLLER
PLC	AB	5069-IF8	COMPACT 5000 8 CHANNEL ANALOG INPUT MODULE
PLC	AB	5069-IB16	16CH COMPACT I/O INPUT 24V DC SINK
PLC	AB	5069-OB16	COMPACT I/O 16 CHANNEL 24V DC SOURCE OUTPUT MODULE
PLC	AB	5069-OF8	COMPACT 5000 8 CHANNEL ANALOG OUTPUT MODULE
OIU	AB	2711P-B7C22D9P	PANELVIEW PLUS 7 GRAPHIC TERMINAL
OIU	PR	5714	PROGRAMMABLE LED INDICATOR FOR LEVEL
UPS	ALPHA	FXM HP 650-24	RUGGESD UPS MODULE BASED ON RUNTIME CALCULATION
UPS	ALPHA	FXM HP 650-48	RUGGESD UPS MODULE BASED ON RUNTIME CALCULATION
4G COM	CISCO	IR1101-K9	HW ROUTERS L/M - Cisco IR1101 Industrial Integrated Services Router Rugged
4G COM	CISCO	SL-IR1101-NE	HW ROUTERS L/M - Network Essentials License for Cisco IR1101 Industrial ISR
4G COM	CISCO	P-LTE-MNA	HW ROUTERS L/M - Multi-carrier band-14 CAT4 LTE Pluggable for North America
4G COM	CISCO	IR1101-Dinrail	HW ROUTERS L/M - Din Rail kit for the IR1101
4G COM	CISCO	IR1100-P-BLANK	HW ROUTERS L/M - IR1100 Blank Pluggable
4G COM	CISCO	IR-CAB-CON-USB	HW ROUTERS L/M - Console Cable 6ft with USB Type A and mini-B

4G COM	CISCO	IRM-1100-SP	HW WIRELESS - Expansion module for the IR1101 with pluggable / SFP
4G COM	CISCO	CON-SNT-IR101K9K	CISCO CCW SERVICES -SNTC-8X5XNBD Industrial ISR 1101
4G COM	Panorama Antennas	LGAM-BC3G-26-3SP	698 MHz to 960 MHz, 1710 MHz to 3800 MHz, 1562 MHz to 1612 MHz - 26 dB -Cellular Network, GPS, GLONASS - Black -Rigid Mount - Omni-directional - SMA Connector
CIRCUIT PROTECTION	PR	3104	SLIMLINE HOUSING ISOLATED CONVERTER
ISB	PR	5115B	EX SIGNAL CALCULATOR ISB FOR ANALOG SIGNALS AND ANALOG DUPLICATION
ISB	PR	5202B2	PULSE ISOLATOR ISB FOR DIGITAL SIGNALS
CT	AcuAMP	Must be split core	CURRENT TRANSDUCE, 1-PHASE, SPLIT CORE
PHASE MONITOR	ATC	SUA-440-ASA	Phase Monitoring Relay, 430-480 V, SPDT, 10A/240VAC, 8-Pin Octal, SLA Series
PHASE MONITOR	ATC	SLA-230-ASA	Phase Monitoring Relay, 190-270 V, SPDT, 10A/240V, 8-Pin Octal, SLA Series
SPD	SSI	CTMB12-3Y2E30X3-64	See section 4F for more details
SPD	SSI	STMB9-3N4-64	See section 4F for more details
SPD	SSI	USPT1P1-64	See section 4F for more details

Flexible parts

Category	Part Type	Requirements	T1	T2	T3	T4
Relay	4 Pole Ice Cube Relay	4 CO Contacts Ice Cube	Weidmuller	AB	Phoenix Contact	Finder
Relay	1 Pole Slim Line Relay	6.4mm Socket Relay	Weidmuller	AB	Phoenix Contact	Finder
Circuit Breaker	Miniature CBs	AC/DC Rated CB, must be ~18mm in width	Noark	AB	Phoenix Contact	ABB

Operators	All	Must be 30MM	AB	Eaton	Schnieder Electric	
24VDC PSU	All	Unit must be at least 10A	Any			
Lights	All	Must be 120V and activated via door switch	Any			
Heaters	All		Any			
Thermostat	All		Any			
Terminals	All		Any			

7. IO List

   a. Below are IO lists for Level 2 and Level 3 Lift Stations. This contains both where each point should be landed as well as what each point should have as a description. Pump 3 are considered spares and placeholder for future pumps if there is not one currently.

Level 2 Station

Name	IO Type	Voltage	Physical IO Point
Pump 1 In Auto	DI	24	I:1/0
Pump 1 In Bypass	DI	24	I:1/1
Pump 1 Bypass Running	DI	24	I:1/2
Motor Breaker Trip	DI	24	I:1/3
Starter Overload	DI	24	I:1/4
VFD 1 Running	DI	24	I:1/5
VFD 1 Fault	DI	24	I:1/6
VFD 1 High Temp	DI	24	I:1/7
VFD 1 Low Temp	DI	24	I:1/8
VFD 1 Panel Door	DI	24	I:1/9
Pump 1 Seal Fail	DI	24	I:1/10
Pump 1 Overtemp	DI	24	I:1/11

Spare	DI	24	I:1/12
Spare	DI	24	I:1/13
Spare	DI	24	I:1/14
Spare	DI	24	I:1/15
Pump 2 In Auto	DI	24	I:2/0
Pump 2 In Bypass	DI	24	I:2/1
Pump 2 Bypass Running	DI	24	I:2/2
Motor Breaker Trip	DI	24	I:2/3
Starter Overload	DI	24	I:2/4
VFD 2 Running	DI	24	I:2/5
VFD 2 Fault	DI	24	I:2/6
VFD 2 High Temp	DI	24	I:2/7
VFD 2 Low Temp	DI	24	I:2/8
VFD 2 Panel Door	DI	24	I:2/9
Pump 2 Seal Fail	DI	24	I:2/10
Pump 2 Overtemp	DI	24	I:2/11
Spare	DI	24	I:2/12
Spare	DI	24	I:2/13
Spare	DI	24	I:2/14
Spare	DI	24	I:2/15
Pump 3 In Auto	DI	24	I:3/0
Pump 3 In Bypass	DI	24	I:3/1
Pump 3 Bypass Running	DI	24	I:3/2

Motor Breaker Trip	DI	24	I:3/3
Starter Overload	DI	24	I:3/4
VFD 3 Running	DI	24	I:3/5
VFD 3 Fault	DI	24	I:3/6
VFD 3 High Temp	DI	24	I:3/7
VFD 3 Low Temp	DI	24	I:3/8
VFD 3 Panel Door	DI	24	I:3/9
Pump 3 Seal Fail	DI	24	I:3/10
Pump 3 Overtemp	DI	24	I:3/11
Spare	DI	24	I:3/12
Spare	DI	24	I:3/13
Spare	DI	24	I:3/14
Spare	DI	24	I:3/15
Alarm Ack	DI	24	I:4/0
High Level Float	DI	24	I:4/1
Low Level Float	DI	24	I:4/2
Panel Door	DI	24	I:4/3
Panel Low Temp	DI	24	I:4/4
UPS Alarm	DI	24	I:4/5
Low Battery	DI	24	I:4/6
Utility Power Fail	DI	24	I:4/7
Phase Fail	DI	24	I:4/8
Meter Vault Flood	DI	24	I:4/9
Dry Weel Flood	DI	24	I:4/10

Generator Run	DI	24	I:4/11
Spare	DI	24	I:4/12
Spare	DI	24	I:4/13
Spare	DI	24	I:4/14
Spare	DI	24	I:4/15
Pump 1 Required	DO	24	O:5/0
Pump 1 Required Bypass	DO	24	O:5/1
Pump 2 Required	DO	24	O:5/2
Pump 2 Required Bypass	DO	24	O:5/3
Pump 3 Required	DO	24	O:5/4
Pump 3 Required Bypass	DO	24	O:5/5
Alarm Light	DO	24	O:5/6
Spare	DO	24	O:5/7
Spare	DO	24	O:5/8
Spare	DO	24	O:5/9
Spare	DO	24	O:5/10
Spare	DO	24	O:5/11
Spare	DO	24	O:5/12
Spare	DO	24	O:5/13
Spare	DO	24	O:5/14
Spare	DO	24	O:5/15
Pump 1 Speed	AI	24	I:6.0

Pump 1 Current	AI	24	I:6.1
Pump 2 Speed	AI	24	I:6.2
Pump 2 Current	AI	24	I:6.3
Pump 3 Speed	AI	24	I:6.4
Pump 3 Current	AI	24	I:6.5
Wetwell Level	AI	24	I:6.6
Mag Meter Flow Rate	AI	24	I:6.7
Spare	AI	24	I:7.0
Spare	AI	24	I:7.1
Spare	AI	24	I:7.2
Spare	AI	24	I:7.3
Spare	AI	24	I:7.4
Spare	AI	24	I:7.5
Spare	AI	24	I:7.6
Spare	AI	24	I:7.7
Pump 1 Speed Control	AO	24	O:8.0
Pump 2 Speed Control	AO	24	O:8.1
Pump 3 Speed Control	AO	24	O:8.2
Spare	AO	24	O:8.3
Spare	AO	24	O:8.4
Spare	AO	24	O:8.5
Spare	AO	24	O:8.6
Spare	AO	24	O:8.7

Level 3 Station

Name	IO Type	Voltage	Physical IO Point
Pump 1 In Auto	DI	24	I:1/0
Pump 1 Running	DI	24	I:1/1
Pump 1 Breaker Tripped	DI	24	I:1/2
Pump 1 Overload	DI	24	I:1/3
Pump 1 High Temp	DI	24	I:1/4
Pump 1 Seal Fail	DI	24	I:1/5
Spare	DI	24	I:1/6
Spare	DI	24	I:1/7
Pump 2 In Auto	DI	24	I:1/8
Pump 2 Running	DI	24	I:1/9
Pump 2 Breaker Tripped	DI	24	I:1/10
Pump 2 Overload	DI	24	I:1/11
Pump 2 High Temp	DI	24	I:1/12
Pump 2 Seal Fail	DI	24	I:1/13
Spare	DI	24	I:1/14
Spare	DI	24	I:1/15
MCP Door Open	DI	24	I:2/0
MCP High Temp	DI	24	I:2/1
MCP Low Temp	DI	24	I:2/2
Phase Fail	DI	24	I:2/3

High Level Float	DI	24	I:2/4
Low Level Float	DI	24	I:2/5
Door Open	DI	24	I:2/6
Control Panel Low Temp	DI	24	I:2/7
UPS Alarm	DI	24	I:2/8
UPS Low Battery	DI	24	I:2/9
Utility Power Fail	DI	24	I:2/10
Alarm Ack	DI	24	I:2/11
Spare	DI	24	I:2/12
Spare	DI	24	I:2/13
Spare	DI	24	I:2/14
Spare	DI	24	I:2/15
Pump 1 Required	DO	24	O:3/0
Spare	DO	24	O:3/1
Pump 2 Required	DO	24	O:3/2
Spare	DO	24	O:3/3
Alarm Light	DO	24	O:3/4
Spare	DO	24	O:3/5
Spare	DO	24	O:3/6
Spare	DO	24	O:3/7
Spare	DO	24	O:3/8
Spare	DO	24	O:3/9
Spare	DO	24	O:3/10

Spare	DO	24	O:3/11
Spare	DO	24	O:3/12
Spare	DO	24	O:3/13
Spare	DO	24	O:3/14
Spare	DO	24	O:3/15
Wet Well Level	AI	24	I:4.0
Pump 1 Amps	AI	24	I:4.1
Pump 2 Amps	AI	24	I:4.2
Spare	AI	24	I:4.3
Spare	AI	24	I:4.4
Spare	AI	24	I:4.5
Spare	AI	24	I:4.6
Spare	AI	24	I:4.7

503.09 * Not Used *

503.10 Control System Requirements in Westfield Territory

The Control System Requirements for Constant Speed & Variable Speed lift stations shall be per the current Underground Engineering & Construction specifications, standard drawings, or as follows:

1. Overall Lift Station Control System Enclosure Requirements

   a. General Requirements:

      i. Enclosures must be sized to house all equipment required to provide all the control and monitoring functions and features, including space for future increase in pump size and spare components, if required.

ii. Control and electrical components shall be individually mounted as shown on schematics and as follows.

1. NEMA 4X stainless steel enclosures.
2. RTU Panel: Include operator interface, telemetry equipment, uninterruptible power supply, and Ground Fault Interrupting (GFI) 120 VAC receptacle.
3. Pump Control Panel: Dead front and internal swing out panel door. Include pump controls and monitoring.
4. Pump Control Panel:
   - Include branch circuit breakers and surge protection devices.
   - Constant Speed Sites: Motor Control Panel. Include phase monitor and motor starters.
   - Variable Speed Sites: VFD Control Panel. Include phase monitor, transformer, Fans, and VFDs.
5. Mini Power Center: NEMA 4X stainless steel (NEMA 3R with approval from Utility).
6. Manual Transfer Switch: NEMA 4X stainless steel.
7. Utility approved meter socket.
8. Utility approved CT/PT panel.
9. For sites operating at over 200 gpm include a hardwired connection to a permanently installed standby generator. Cummins, Kohler, Caterpillar, or Utility approved equal.
10. For sites with under 200 gpm, or where otherwise indicated include Emergency Power Generator Connection. Provide portable generator receptacle as follows:

Voltage	Metric Model No.		
	Receptacle	Angle Box	Dust Cap
480V	37-98043	39-9A053-080-212	31-9A126
230V	37-28073	39-2A053-080-212	35-2A126

iii. Enclosures shall be mounted on lift station concrete pad. The concrete pad dimensions shall be according to the Standard Drawings, or a minimum of one foot larger in front dimension than enclosure plus radius of door swings. Orientate panel placement so that panel doors do not open over or near wet well opening. Rear and side pad dimensions shall extend a minimum of 3 inches beyond enclosure. Equipment pad shall be installed with a 1-inch, 45-degree chamfer around all sides.

iv. Provide enclosures with following additional accessories:

1. Drip shield.
2. Padlock hasp.
3. Stainless steel 3-point latch to allow panel opening without tools.

v. Provide Pump Control and RTU Panel with the following:

1. 4000K LED hard wired door switch activated light.
2. Thermostatically controlled heaters sized to maintain panel internal temperature at 50°F with outdoor temperature of -20°F.
3. Padlock hasp.
4. Ground Fault Interrupting (GFI) 120 VAC receptacle.
5. Vent/drain fittings, designed and installed to maintain enclosure's NEMA 4X rating. Two fitting in pump control cabinet, one in RTU cabinet. Install fittings on bottom of pump control, in opposite sides of enclosure.
6. Ground bus bar bonded to enclosure.

2. Wiring, Termination, and Labeling Requirements

a. 7BWiring:

i. In addition to NEC and NEMA requirements, wiring shall conform to following:

1. Power: 12 AWG stranded minimum, type MTW, 600 V.
2. Control: 16 AWG stranded minimum, type MTW, 300 V.
3. Analog Signal: Twisted pair, 18 AWG, Beldon 8760 or equal.

ii. Wire color code:

1. AC neutral conductor: White.
2. AC hot conductor: Black.
3. AC UPS powered: Red.
4. Grounding conductor: Green.

5. AC control conductor, powered from within panel: Red.
6. AC control conductor, powered from remote source: Yellow.
7. DC (+) power conductor: Blue.
8. DC (-) power conductor: White/Blue.
9. DC control conductor: Blue
10. DC control conductor, powered from remote source: Orange.
11. Twisted pair cable (-) signal conductor: White.
12. Twisted pair cable (+) signal conductor: Black.
13. Intrinsically safe conductors: Light Blue.
14. All wire must be labeled according to the drawings.

iii. Design control panels to keep 3-phase power, 120-vac power and discrete signals, and analog and other low voltage signals separated.

1. Do not run 3-phase power, 120-vac power, and discrete signals, and analog or other low voltage signals in the same conduit or wire-duct.
2. Where 3-phase power, 120-vac power, and discrete signals, and analog or other low voltage signals must cross, they shall do so at right angles.

iv. Internal Panel Wiring Within Wire Duct:

1. Wherever feasible plastic wire duct with removable covers shall be used for routing of wire within control panel.
2. Size wire duct to be no more than 50% full.
3. Maintain 2” clearance between wire duct and terminals.

v. Internal Panel Wiring outside of wire duct.

1. Wiring outside of ducts shall be restrained by the use of plastic wire-ties.
2. Restrain wiring a minimum of every six inches.
3. Provide abrasion protection for wires passing through holes or across abrasive metal edges.

4. Adhesive type wire fasteners shall not be used. Hard screw type shall be employed.

b. 10BTerminations:

i. Wiring within control panel shall be continuous and terminated only at terminal blocks or equipment terminals. Splices or butt connectors shall not be used within panel.

ii. Other than terminal to terminal bussing as described below, no more than one wire shall be terminated at any one terminal.

iii. Make external connections by way of numbered terminal blocks on numbered terminal strips.

1. Provide integral bussing system on terminal block array where more than two terminations require common source or drain connection. Wired jumper terminations shall not be acceptable.
2. Include provisions for grounding of shields on shielded twisted pair cables entering or leaving panel. Cable shields shall be grounded at terminal block end only.

iv. Provide separate locations on terminal strips for each of the following types of signals.

1. 480 or 240-vac power circuits.
2. 120-vac power circuits.
3. 120-vac discrete signals.
4. 24 or 48 Vdc discrete signals.
5. Analog signals

v. Provide a separate terminal strip for intrinsically safe circuits. Intrinsically safe wiring shall be separated by non-conducting or grounded barrier within panel, and not combined with any other wiring within conduit or wire duct.

c. 11BPower Distribution:

i. General:

1. Provide intrusion detection switch for each panel.
2. If panel includes separate 120 vac control power supply, provide auxiliary contact to isolate control power when main circuit breaker is opened.
3. Provide a separate circuit breaker to each major panel component.
4. Panels using modular or solid state I/O devices.
   - Provide a separate circuit breaker for panel powered I/O signals entering panel from field devices. Provide a separate circuit breaker for each module type.

- Include an external slimline relay for each output in the panel.
- Include an isolated converter for each analog in the panel.

5. Relays and isolated converters must be supplied for each available IO point in the system, not just IO used.

ii. Panels having 3-phase power supply:

1. Provide power rated terminal blocks for input power (Main service entrance disconnect must be insight of the panel).
2. Provide separate circuit breakers for all pump control devices provided. This includes motor starters and VFDs.
3. Provide phase monitor relay (PMR).
4. When requested by the Utility, provide motor current transducer for each motor to produce 4-20 mA DC signal and contract closure signal to Programmable Logic Controller (PLC). PLC to use signal for speed reference or to generate a motor fail to start alarm.
5. 480(240, 208) / 120 control power transformer requirements:
   - Both primary leads shall be protected by a circuit breaker.
   - First secondary lead shall be protected by a circuit breaker.

iii. Panels having 120 vac power supply:

1. Provide circuit breaker on power supply entering panel.

3. Field Instrument Requirements

Required	Variable Speed	QTY	Constant Speed	QTY
Float Switches	Connery Model 2900	2	Connery Model 2900	2
Submersible Level*	Ametek 4-20 mv / 0-15 psi model 851	1	Ametek 4-20 mv / 0-15 psi model 851	1
Flow Meter	Varies, see below	1*	Varies, see below	0

*See below for exception at high grease locations

a. Level Transmitter

i. Provide submersible level transmitter to sense level in wet well and control pump on/off operation.

1. Hydrostatic pressure measurement.

    - Loop powered.
    - 4 – 20 mA DC output signal.
    - 316 stainless steel submersible housing and diaphragm, Viton grommet and O-ring. Provide stainless steel braided support cable to prevent transmitter from being supported by signal cable.
    - Accuracy +/- 0.25% of span including linearity, hysteresis, and repeatability.
    - Provide lightning and surge protector to be mounted in panel.
    - CSA is approved intrinsically safe when used with appropriate barrier.
    - Ametek 4-20 mv / 0-15 psi model 851.

ii. In high grease or other applications, ultrasonic level sensor may be used with approval from Utility.

1. Ultrasonic level measurement.
2. 120 VAC powered.
3. 4 – 20 mA DC output signal.
4. Accuracy +/- 0.1 % of span including linearity, hysteresis, and repeatability.
5. Provide lightning and surge protector to be mounted in Pump Control Panel.
6. Suitable for use in Class 1, Division 1, and Group D hazardous classified location.
7. Manufacturers:

    - Siemens SITRANS LUT420
    - Endress and Hauser Prosonic M
    - No substitutions allowed.

b. Float Switches

i. Provide wet well float switches to sense high and low level in wet well and control standby pump on/off operation. Standby pump operation shall be independent of PLC.

1. SPDT contacts, rated 1 amp at 150 VAC/VDC inductive, mechanical life 10 million operations.
2. 316 stainless steel mounting hardware. Mounting shall not require entry to wet well for cleaning or replacement.
3. Conery Model 2900 pear shaped neoprene covered mercury switch ball float of standard size.

c. Intrusion Detection Switches

i. Provide intrusion detection switches.

1. When control and electrical components are mounted outdoors, provide intrusion detection switches for electrical and control equipment enclosure.
2. When control and electrical components are mounted indoors, provide intrusion detection switches for all entrances into the pump station.
3. Reed switch enclosed in ABS plastic case, normally closed contact.

d. Flow Meters

i. Provide magnetic flow meter for all stations with pumping capacity greater than 250 gpm.

1. Size meter to maintain average velocity of 3 ft/sec.
2. System accuracy of +/- 25% of flow rate with 10:1 turndown.
3. Utilize low frequency dc pulse.
4. Accidental submergence rating of 30 ft. water for 48 hours.
5. Polyurethane or hard rubber liner, 316 stainless steel electrodes.
6. Provide with 316 stainless steel grounding rings, use of grounding probes not acceptable.
7. Suitable for Class 1, Division II, Hazardous classified location.
8. Include isolating plug valves before and after meter body to facilitate meter removal. Include spool piece of same dimensions as meter body.
9. Maintain minimum of 5 upstream and 3 downstream unobstructed pipe diameters before and after meter body. Provide a separate meter vault if required to meet dimensional requirements.
   - The meter vault shall be provided with a sump and flood alarm float switch.

ii.Transmitter:

1. 120 VAC, 60 Hz power.
2. For outdoor locations, mount on Pump Control Panel internal swing out panel as shown.
3. Provide pulsed DC voltage to meter body magnet coils.
4. Integral keypad/display.
5. Automatic empty pipe detection.

iii.Manufacturers:

1. Endress + Hauser
2. Rosemount
3. Krohne
4. ABB
5. Foxboro
6. No substitutions allowed.

4. RTU Panel Requirements

i.The RTU Panel shall be provided to house the PLC, OIU, Ethernet switch, radio, lightning, UPS, and surge protection devices.

ii.The RTU Panel must be equipped with a low temperature switch, set at 40 degrees F, mounted within the enclosure to alarm failure of heater.

iii.The automatic pump operation, automatic pump lead-lag alteration, and all control logic commands shall be performed by the PLC.

iv.The PLC shall be Allen Bradley, with no substitutions allowed, and shall meet the following requirements:

1. Minimum 16 Discrete Inputs
2. Minimum 16 Discrete Outputs
3. Ethernet Port
4. 2 Serial Communication Ports
5. 8 Pin Analog Input Card
6. 4 Pin Analog Output Card

v. OIU shall be Allen Bradley

vi. The Ethernet switch shall meet the following requirements:

1. 4 RJ45 ports
2. 10/100 Mbits/s
3. 0 to 55 °C operating temperature
4. DC Powered

vii. Display pump run, fail, automatic mode, overload, seal fail, motor over-temperature, accumulated pump run time, and accumulated pump number of starts for each pump.

viii. Display all discrete and analog signals input to PLC, and calculated or derived parameters including communication fail, crew on site, intrusion, and float control mode.

1. Wet well level, high and low level alarms.
2. “Lead Pump 1 / Lead Pump 2 / Lead Pump Alternate” selection.
3. Display calculated lift station flow rate and accumulated flow total.
4. Display communications fail (to SCADA central).
5. Display status of all input signals to PLC.
6. Capability to place pumps “Out of Service”. Display “Out of Service” status at HMI.
7. Configure to allow “Crew on Site” input. Allow entry of operator’s 4 digit identification number after “Crew on Site” has been entered. This function is to work in conjunction with the Intrusion switch. Once an intrusion has been detected the crew will have a set amount of time to enter a valid code before the intrusion alarm is activated.
8. Operator data entry for adjustable set points, including pump on/off levels, time delays, etc. Allow for operator entry of 4 digit password prior to accepting parameter changes.

b. System programming guidelines:

i. Provide program documentation for all HMI and PLC program files developed for the system. PLC program documentation shall include comments for all registers used and sufficient rung comments to describe operation of logic used within program. Provide a digital copy of the program to Citizens Energy Group.

ii. Automatic pump control shall start and stop pumps in a lead and lag fashion based on wet well level input.

iii. Provide lead pump alternation on each successive lead pump shutdown when automatic alternation is selected.

iv. Provide pump fault logic to sense discrepancy between pump-required output being turned on and no pump run signal being received. Configure system to generate fault on any condition including motor overload, motor over temperature, seal failure or power disconnect.

v. Provide time delay on pump required outputs, initially set at 10 seconds and 20 seconds, to prevent simultaneous pump restart on restoration of control power.

vi. "Out of Service" entry shall remove pump from operating sequence and prevent alarms from being generated for pump.

vii. All alarms shall automatically reset when the alarm condition has cleared. An adjustable 0-15 minute time delay relay shall be activated and timed-out prior to transmitting the high or low wet well level condition.

viii. Pump accumulated run time shall be calculated for each pump.

ix. Pump accumulated number of starts shall be calculated for each pump.

x. Provide routine to calculate lift station draw down time. Draw down time data shall be time stamped and indicate which pump(s) running during draw down event.

xi. Program to ensure that regardless of configuration of backup hardware, (re: back up ball floats when primary level control device is pressure transducer) primary level control device automatically takes over when level of wet well returns to desired operating level.

xii. In the absence of a flow meter provide routine to calculate lift station flow rate and accumulated lift station accumulated flow total. Calculation shall be based on following:

1. Wet well dimensions, include adjustable offset for equipment, piping, or other items affecting wet well volume and account for cross-sectional changes between minimum and maximum levels. Calculation shall be made such that changes to pump on and off level set-points shall not require change to flow calculation routine.

2. Wet well level rate of rise shall be used to calculate inflow rate when pump are not operating.

3. During pump run events, inflow rate shall be calculated as the average inflow rate occurring immediately before and after pump run event.

xiii. PLC shall be configured to periodically transfer information to SCADA Central HMI. Transfer of information shall occur periodically based on information requests from SCADA Central HMI and be initiated by lift station PLC on occurrence of alarm condition. Periodic data transfer of information to SCADA Central HMI shall include:

1. Lift station accumulated flow total.

2. 10 minute averaged flow rate data. Time stamped average flow rate data values shall be logged internally to PLC memory. Logged data shall be retained until data successfully transferred to HMI, at which point it shall be deleted.
3. Pump draw down data. Time stamped data values shall be logged internally to PLC memory. Logged data shall be retained until data successfully transferred to HMI, at which point it shall be deleted.
4. Pump elapsed run time data
5. Accumulated number of starts for each pump.
6. Coordinate programming requirements with the Utility
7. Data transfer shall be configured to allow SCADA Central HMI to emulate all data input and display functions present at HMI, including display all discrete and analog signals input to PLC, and calculated or derived parameters including communication fail, crew on site, intrusion, and float control mode.
8. Data transfer to and from SCADA Central HMI shall take place using contiguous PLC register locations to maximize efficiency of data transfer. Register usage and addressing shall be coordinated with Citizens Westfield.
9. Include provision for periodic receipt of current time and date SCADA Central HMI.

xiv. Contractor shall coordinate with Utility about required modifications to the Lift Station Central SCADA system monitoring software at the Wastewater Treatment Plant. The Utility or the Utility's designated vendor may perform the integration work. If the Contractor is responsible for the integration work, the Utility shall approve the integrator prior to commencing.

c. UPS Requirements

i. The UPS must meet the requirements below.

1. Provide true on-line non switching UPS.
2. UPS shall supply power to PLC, OIU, radio, Ethernet switch, field instruments, and other low voltage control devices.
3. UPS shall have enough capacity to power these devices for a period of 2 hours after the utility power has failed. Provide with extended battery module to meet this requirement.
4. UPS shall provide dry contacts to PLC for utility fail and low battery power alarms.
5. Minimum UPS size shall be 650 VA.
6. Double power conversion on-line operation including rectifier and inverter, constantly conditioned AC output.

7. Provide make before break manually operated bypass switch or other means to bypass UPS to allow operation of system controls in event of UPS failure.

d. Ethernet Switch, Radio, Antenna, and Antenna Mounting Requirements

i. Provide Ethernet switch, radio, antenna, antenna cable, and antenna mounting pole.

1. Radio, antenna cable, antenna, and lightning and surge protection devices shall be purchased Citizens Westfield's approved radio equipment supplier to ensure compatibility with Citizens Westfield's radio-based SCADA communication network used for lift station monitoring. Contact the Utility for more information about the required radio requirements.

2. Ethernet switch and radio shall be mounted within RTU Panel.

3. Contractor shall determine signal strength available at lift station locations. Available signal strength shall be tested at elevations of 30', 20' and 15' above ground level and signal strength test results shall be supplied to Citizens Westfield.

4. Contractor shall determine the most suitable location for the antenna based on the results of signal strength testing. Antenna pole shall be affixed to lift station concrete pad.

5. Based on the results of signal strength testing, the Contractor shall purchase either the 900 MHz or 5.7 GHz radio, as selected by the Utility approved radio equipment supplier. Contact the Utility for more information about the required radio requirements.

6. Contractor shall mount the antenna in the selected location and provide antenna cable in conduit.

7. Where lift station structure does not exist or is unsuitable for antenna mounting, antenna mounting pole shall be required.

8. Where lift station structure is suitable for antenna mounting, antenna mounting pole shall be 2" in diameter, aluminum, and firmly affixed to pump station.

9. Where lift station structure does not exist or is unsuitable for antenna mounting, antenna mounting pole shall be up to 30 foot tall, telescopic aluminum, and firmly affixed to pump station.

10. Provide grounding of antenna pole in accordance with NEC requirements.

11. The programming of the radio shall be by the Contractor.

e. 4G Cellular Requirements

i. Contact Utility prior to design to determine if Cellular communication will be required.

f. Provide service entrance-rated Surge Protection Device (SPD) to protect all equipment mounted within the enclosure from switching surges and lightning induced surges.

i. The SPD shall be Bussman., Model BSPH2AJ SODJ SOLVR, or most recent comparable product as approved by the Utility.

5. Pump Control Panels

	Variable Speed	Constant Speed
Motor Control Panel	None	Required
VFD Control Panel	2*	None
Electrical Distribution Panel	Required	None

*Some sites will require 3 VFD panels, please refer to contract documents for exact number.

a. The lift station shall have electric-utility-delivered 3-phase, 60Hz, 4-wire wye, or delta power. All stations powered by 3-phase primary voltage shall have a minimum 2.0 KVA single-phase, 480/240 to 120/240 VAC transformer. Use of phase converters to derive 3-phase power from 1-phase power source is prohibited.

b. Motor Control Panel (MCP) Requirements

i. Motor starters shall be NEMA-rated magnetic type with a 120 volt control coil, and three thermal overload relays with a minimum size of NEMA-1.

ii. Provide the following front of panel mounted devices to be labeled as indicated. For outdoor locations, devices shall be mounted to swing out panel door.

1. Branch circuit breakers shall be raised to the dead front using a custom built bracket, no extended handles will be allowed.
2. “Hand-Off-Automatic” selector switch for each pump, with the hand mode wired for manual operation independent of the PLC.
3. “Float Mode” selector switch, to select which pump will turn on during float override mode.
4. Process indictor to show wet well level.
5. Reset PB for each overload relay present.

iii. Suitable for outdoor mounting, with maximum ambient temperature of 105°F

iv. Include thermostatically controlled heaters sized to maintain panel internal temperature at 50°F with outdoor temperature of -20°F.

c. Variable Frequency Drive (VFD) Control Panel Requirements

i. Provide pulse width modulated VFDs.

ii. Provide with bypass contactor to allow across the line operation.

1. Ensure VFD line and load contactors are included to prevent back feed into the VFD.

iii. Suitable for outdoor mounting, with maximum ambient temperature of 105°F.

iv. Mount in pad-lockable NEMA 4X stainless steel rated dead-front enclosure.

v. Include thermostatically controlled heaters sized to maintain drive panel internal temperature at 50°F with outdoor temperature of -20°F.

vi. Use of air conditioning or heat exchangers to allow operation of VFD in elevated ambient temperatures is prohibited. Include externally mounted heat sinks (one per VFD) sized to maintain drive panel internal temperature at 100°F with outdoor temperature of 105°F. If required to meet specified ambient temperature requirements, derate drive capacity to meet temperature requirements. Provide with a high temperature switch, set at 110°F, mounted within the enclosure to alarm high drive temperature.

vii. Capable of withstanding line voltage transients up to 3000 V in accordance with ANSI 37.90.1.

viii. IGBT switching.

ix. Match output power to motor, 0.5% speed regulation, 110% overload capacity for 60 seconds, 100% rated torque from 60 Hz to required turndown.

x. 3% input line reactors.

xi. Instantaneous over-current trip shutdown, under-voltage protection with automatic restart.

xii. Include keypad/display mounted within enclosure, accessible when enclosure is opened.

xiii. Manufacturers

1. Allen Bradley
2. Yaskawa.
3. No substitutions allowed.

xiv. Branch circuit breakers shall be raised to the dead front using a custom built bracket, no extended handles will be allowed.

d. Electrical Distribution Panel Requirements

i. Branch circuit breakers shall be raised to the dead front using a custom built bracket, no extended handles will be allowed.

ii. Electrical Distribution must be provided with spacing and a cutout for 6 breakers. Any empty space will need to have a cover plate made which can be removed when expansion takes place.

iii. Must include power distribution blocks or terminal blocks to allow for easy field wiring of breakers.

iv. Main distribution blocks must have at least 8 load openings with at least 3 openings being able to accept a 2/0 wire.

6. Required Components and Standard Parts List

a. The below parts are a quick summary of parts and pieces required in each lift station regardless of size. This list is updated yearly. The Required Parts chart shows parts where no alternative will be accepted. The Flexible Parts shows parts with a tier list of acceptability and highlights more common components. The main rule is that parts must be interchangeable within the different manufacturers and/or meet the part requirements. If there is a part not listed in either of these two tables, it is up to the discretion of the system integrator to find appropriate parts.

Required Parts

Category	**Manufacturer**	**Product No.**	**Description**
PLC	PULS	UPS	24VDC UPS with Battery
PLC	Allen Bradley	5069-L306	CPU
PLC	Allen Bradley	5069-IB16	DC Input, 16 pt
PLC	Allen Bradley	5069-OB16	DC Output, 16 pt
PLC	Allen Bradley	5069-IF8	Analog Input, 8 pt
PLC	Allen Bradley	5069-OF8	Analog Output, 8 pt
PLC	Allen Bradley	2711P-T4W21D8S	OIU - 4” PanelView Plus 7 Standard
PLC	MDS	EL805- MD9X J AFCDOWN	Radio Modem MDS Transnet
SPD	Emerson	IE- J 20	20 Amp Surge Protection with Filter
SPD	Bussmann	BSPH2AJ SODJ SOLVR	Transient Voltage Surge Suppression

7. IO List

a. Below are IO lists for Variable Speed and Constant Speed Lift Stations. This contains both where each point should be landed as well as what each point should have as a description. Pump 3 are considered spares and placeholder for future pumps if there is not one currently.

Variable Speed Station

Name	IO Type	Voltage	Physical IO Point
Pump 1 In Auto	DI	24VDC	DI 1-1
Pump 1 VFD Running	DI	24VDC	DI 1-2
Pump 1 VFD Fault	DI	24VDC	DI 1-3
Pump 1 Overtemp	DI	24VDC	DI 1-4
Pump 1 Seal Fail	DI	24VDC	DI 1-5
Pump 1 in Drive	DI	24VDC	DI 1-6
Pump 1 in Bypass	DI	24VDC	DI 1-7
Pump 1 Bypass Running	DI	24VDC	DI 1-8
Pump 1 Bypass Overload	DI	24VDC	DI 1-9
Wet Well Level Low-Low	DI	24VDC	DI 1-10
Wet Well Level Low	DI	24VDC	DI 1-11
Wet Well Level High	DI	24VDC	DI 1-12
Pump Power Panel Door Switch	DI	24VDC	DI 1-13
Pump Power Panel High Temp	DI	24VDC	DI 1-14
Pump Power Panel Low Temp	DI	24VDC	DI 1-15
Phase Fail OK	DI	24VDC	DI 1-16
Pump 2 In Auto	DI	24VDC	DI 2-1
Pump 2 VFD Running	DI	24VDC	DI 2-2
Pump 2 VFD Fault	DI	24VDC	DI 2-3
Pump 2 Overtemp	DI	24VDC	DI 2-4
Pump 2 Seal Fail	DI	24VDC	DI 2-5
Pump 2 in Drive	DI	24VDC	DI 2-6
Pump 2 in Bypass	DI	24VDC	DI 2-7
Pump 2 Bypass Running	DI	24VDC	DI 2-8
Pump 2 Bypass Overload	DI	24VDC	DI 2-9
Spare	DI	24VDC	DI 2-10
Door Keypad Entered	DI	24VDC	DI 2-11
Line Power Normal	DI	24VDC	DI 2-12
UPS Normal	DI	24VDC	DI 2-13

RTU CP Door Switch	DI	24VDC	DI 2-14
RTU Control Panel High Temp	DI	24VDC	DI 2-15
RTU Control Panel Low Temp	DI	24VDC	DI 2-16
Pump 3 In Auto	DI	24VDC	DI 3-1
Pump 3 VFD Running	DI	24VDC	DI 3-2
Pump 3 VFD Fault	DI	24VDC	DI 3-3
Pump 3 Overtemp	DI	24VDC	DI 3-4
Pump 3 Seal Fail	DI	24VDC	DI 3-5
Pump 3 in Drive	DI	24VDC	DI 3-6
Pump 3 in Bypass	DI	24VDC	DI 3-7
Pump 3 Bypass Running	DI	24VDC	DI 3-8
Pump 3 Bypass Overload	DI	24VDC	DI 3-9
Wet Well Hatch Open	DI	24VDC	DI 3-10
Spare	DI	24VDC	DI 3-11
Spare	DI	24VDC	DI 3-12
Spare	DI	24VDC	DI 3-13
Spare	DI	24VDC	DI 3-14
Spare	DI	24VDC	DI 3-15
Spare	DI	24VDC	DI 3-16
Pump 1 Run	DO	24VDC	DO 1-1
Pump 1 Force Off	DO	24VDC	DO 1-2
Pump 2 Run	DO	24VDC	DO 1-3
Pump 2 Force Off	DO	24VDC	DO 1-4
Pump 3 Run	DO	24VDC	DO 1-5
Pump 3 Force Off	DO	24VDC	DO 1-6
Spare	DO	24VDC	DO 1-7
Spare	DO	24VDC	DO 1-8
Spare	DO	24VDC	DO 1-9
Spare	DO	24VDC	DO 1-10
Spare	DO	24VDC	DO 1-11
Spare	DO	24VDC	DO 1-12
Spare	DO	24VDC	DO 1-13
Spare	DO	24VDC	DO 1-14
Spare	DO	24VDC	DO 1-15
Alarm Horn	DO	24VDC	DO 1-16

Wet Well Level	AI	24VDC	AI 1-1
Spare	AI	24VDC	AI 1-2
Pump 1 Speed Feedback	AI	24VDC	AI 1-3
Pump 2 Speed Feedback	AI	24VDC	AI 1-4
Pump 3 Speed Feedback	AI	24VDC	AI 2-1
Spare	AI	24VDC	AI 2-2
Spare	AI	24VDC	AI 2-3
Spare	AI	24VDC	AI 2-4
Pump 1 Speed Command	AO	24VDC	AO 1-1
Spare	AO	24VDC	AO 1-2
Pump 2 Speed Command	AO	24VDC	AO 1-3
Spare	AO	24VDC	AO 1-4
Pump 3 Speed Command	AO	24VDC	AO 2-1
Spare	AO	24VDC	AO 2-2
Spare	AO	24VDC	AO 2-3
Spare	AO	24VDC	AO 2-4

Constant Speed Station

Name	IO Type	Voltage	Physical IO Point
Pump 1 Running	DI	24VDC	DI 1-1
Pump 2 Running	DI	24VDC	DI 1-2
Float Low	DI	24VDC	DI 1-3
Float High	DI	24VDC	DI 1-4
Power Fail	DI	24VDC	DI 1-5
Control Panel Door Open	DI	24VDC	DI 1-6
RTU Panel Door Open	DI	24VDC	DI 1-7
Pump 1 Fail	DI	24VDC	DI 1-8
Pump 2 Fail	DI	24VDC	DI 1-9
Spare	DI	24VDC	DI 1-10
Pump 1 Overtemp	DI	24VDC	DI 1-11
Pump 1 Seal Fail	DI	24VDC	DI 1-12
Pump 2 Overtemp	DI	24VDC	DI 1-13

Pump 2 Seal Fail	DI	24VDC	DI 1-14
Common Pump Temp or Seal Fail	DI	24VDC	DI 1-15
Control Panel High Temp	DI	24VDC	DI 1-16
Control Panel Low Temp	DI	24VDC	DI 2-1
RTU Panel High Temp	DI	24VDC	DI 2-2
TRU Panel Low Temp	DI	24VDC	DI 2-3
Transducer High	DI	24VDC	DI 2-4
Transducer Low	DI	24VDC	DI 2-5
Spare	DI	24VDC	DI 2-6
Spare	DI	24VDC	DI 2-7
Spare	DI	24VDC	DI 2-8
Pump 1 Run	DO	24VDC	DO 1-1
Pump 1 Force Off	DO	24VDC	DO 1-2
Pump 2 Run	DO	24VDC	DO 1-3
Float Switch on Transducer Fail	DO	24VDC	DO 1-4
Spare	DO	24VDC	DO 1-5
Spare	DO	24VDC	DO 1-6
Spare	DO	24VDC	DO 1-7
Alarm Horn	DO	24VDC	DO 1-8
Wet Well Level	AI	24VDC	AI 1-1
Spare	AI	24VDC	AI 1-2
Spare	AI	24VDC	AI 1-3
Spare	AI	24VDC	AI 1-4

503.11 * Not Used *

503.12 Operation & Maintenance Manuals

Two (2) hard copies of Operation and Maintenance Manuals shall be submitted to the Utility. Electronic versions of the manuals in pdf format shall be submitted via cloud sharing services.

Manuals shall include, at a minimum, the following:

1. Warranty Statement;

2. Pump down test from the initial start-up test;

3. Operation instructions;

4. Maintenance instructions;

5. Recommended spare parts list;

6. Lubrication schedules;

7. Structural diagrams;

8. As-built wiring diagrams;

9. Piping and Instrumentation Drawings (P&ID); and

10. Bill of materials including part numbers, manufacturer and serial numbers

Three (3) electronic copies of the PLC and HMI programs shall also be submitted to the Utility. The Contractor shall coordinate with the Utility to designate the recipients of the electronic PLC and HMI programs.

503.13 Station Warranty

Warranties for the lift station and all equipment, except for the pumps, shall be three (3) years from the date of acceptance per Citizens Energy Group Maintenance Bond requirements.

Warranty for the pumps shall be five (5) years from the date of acceptance and per Section 503.06.

503.14 Lift Station Odor Control

If the utility determines odor control is necessary, the following options should be considered from based on the size and location of the station as well as the length of the forcemain and retention time in the forcemain.

1. Lift Station Hatches

   All new lift stations regardless of odor concerns shall be supplied with hatches that contain a gasket to provide a tight seal to minimize air escaping from the wet well through the hatches. Without sealed hatches adding odor control equipment now or in the future will be less effective.

2. Vent Filters with Odor Control Media

   a. For lift stations that will be thought to have a minor or nuisance level for odor concerns, a vent filter should be installed on the vent pipe of the station. Lift stations that are installed in residential areas or very close to homes should have vent filters or the ability to add a vent filter in the future. Vents should be PVC pipe and 4 inch, 6 inch, or 8 inch diameter.

b. Vent shall be candy-cane style so that vent discharge faces downward toward the ground and not the sky with enough room to add a vent filter on the end. A downward facing vent will prevent rain-water from getting into the media.
c. Vent filters shall be “peacemaker” vent filters with “persnickety” media. Installed with wing-nuts and removable for easy change out of media.
d. Whenever a vent filter is installed, the conduits that go into/out of the wet well for the electrical power and control cables shall be sealed with spray foam to force air through the vent filter.

3. Drop pipes, Mechanical Mixing, or Aeration

a. Drop Pipes shall be installed where appropriate for lift station wet-wells and forcemain discharges and foror lift stations that have a minor or potentially moderate level for odor concerns.

b. See Section 503.07. 7 for Drop Pipes & Bowls requirements. Mechanical Mixing

i. Mechanical mixing will be evaluated on a case by case basis. Any recommended mechanical mixing systems shall need to be submitted for review before usage may be approved.

c. Aeration

i. Wet well aeration systems will be evaluated on a case by case basis. Any recommended aeration systems shall need to be submitted for review before usage may be approved.

4. Carbon Scrubbers & Air Injection

a. Carbon Scrubbers For stations with a moderate to severe odor concern and a moderate to low flow with intermittent pumping cycles and long forcemain with long retention time, a carbon scrubber shall be evaluated for installation. A carbon scrubber shall be properly sized and designed for the application. Stations with a high volume of continuous flow and a severe concern may also require chemical treatment.

b. Possible applications:

i. The inlet wet-wells for Large Level 1 lift stations are candidates for carbon scrubbers, particularly if they are in residential areas.
ii. The discharge structure for large level 1 lift stations are candidates for carbon scrubbers particularly if they are in residential areas
iii. Large level 1 stations with long forcemains are candidates for chemical addition and carbon scrubbers.
iv. Level 2 and level 3 stations with long forcemains that have have intermittent pumping leading to a long residence time would also be candidates for a carbon scrubber at the discharge location.

v. If the discharge location of a long forcemain is into another station, the wet well or upstream manhole of the receiving station may also be a candidate for a carbon scrubber.

c. Small carbon scrubbers or drums

i. 55 Gallon PVC drum(s) with screen at bottom
ii. Sized so that media lasts 1-2 years between media change out
iii. Acceptable media
  1. Carbon (strictly H2S removal)
  2. Carbon with oxidant (H2S and other odorant removal, residential areas)
  3. Dual layer – carbon layer & carbon with oxidant (high volume of treatment needed, residential areas)
  4. Iron sponge media (may be acceptable depending on application and location of the scrubber)
iv. Utilize a small blower to pull air out of the vent and through the scrubber
v. PVC piping and stainless steel hardware
vi. H2S meter on discharge, tied into scada, with Alarm at 2.0 PPM H2S to alert when media is spent. Scott H2S meter or other manufacturers as approved.
vii. Concrete pad required
viii. Area fenced in with lift station padlock

d. Medium to large carbon scrubbers

i. Custom design Large diameter scrubbers. Acceptable manufacturers
  1. Purafil
  2. Marcab
  3. Others as evaluated or approved
ii. Sized so that media lasts 1-2 years between media change out
iii. Fiberglass or stainless steel housing
iv. Acceptable media
  1. Carbon (strictly H2S removal)
  2. Carbon with oxidant (H2S and other odorant removal, residential areas)
  3. Dual layer – carbon layer & carbon with oxidant (residential areas)
  4. Iron sponge media (may be acceptable depending on application and location of the scrubber)
v. Utilize a blower to pull air out of the discharge structure or wet-well and through the scrubber
vi. PVC piping and stainless steel hardware
vii. H2S meter on discharge, tied into SCADA, with Alarm at 2.0 PPM H2S to alert when media is spent. Scott H2S meter or other manufacturers as approved.
viii. Concrete pad required
ix. Area fenced in with lift station padlock

e. Air Injection

   i. Air or Oxygen/Oxone injection into the forcemain will be evaluated on a case by case basis. Any recommended air injection systems such as Anue Water Technologies ForSe2 system, shall need to be submitted for review before usage may be approved.

5. Chemical Addition
   a. For stations with a moderate to severe odor concern and a high volume of flow and continuous pumping with a long forcemain and retention time, a chemical injection system shall be evaluated for installation. A chemical system shall be properly sized and designed for the application. These applications are often paired with a carbon scrubber at the discharge location and for large Level 1 stations there may also need to be a carbon scrubber at the station itself if in a residential area.

   b. Preference of chemical by order

      i. Ferrous Chloride
      ii. Bioxide or nitrate
      iii. Peroxide

   c. Sized so tanks can hold 2 weeks worth of chemical

   d. Tank materials, rated for chemical that is being used. Fiberglass, pvc , etc

   e. Piping – pvc with stainless steel hardware

   f. HVAC – any HVAC should be external to the building with fiberglass ductwork

   g. Lighting should be LED and rated for corrosion, with stainless steel hardware

   h. Handrailing – Aluminum or fiberglass

   i. Storage building is required, area to be fenced in with lift station lock core and padlock

   j. Secondary containment required, fill and spill containment required

   k. Chemical pumps required, Watson Marlow or approved equal

   l. Tank level indicators and overflow alarm required

   m. System integrated into scada. Pump run status, tube burst, and pump speed, tank level indicators (chemical usage), tank overflow alarm.

Section 504 Low Pressure Pump Stations and Appurtenances

504.01 Introduction

This Section describes, in general terms, the guidelines and requirements for the planning, design, and submittal requirements for low pressure sewer systems.

504.02 General

Low-pressure systems will only be considered in areas where sanitary sewers currently serve the surrounding areas and where conventional sanitary sewer facilities (gravity sewers and/or lift stations) cannot be constructed or are not feasible.

Only HDPE pipe material is allowed for low pressure systems. See Section 304 for material requirements.

504.03 Submittal Requirements for Approval and Construction Permit

Approval of low-pressure sewer systems will be evaluated on a case-by-case basis and will only be allowed with prior written approval from the Utility.

At the discretion of the Utility, a lift station may be required in lieu of a low pressure system.

When submitting for an Approval and Construction Permit, the following are required:

1. Written approval from the Utility ;
2. Low pressure system service area – Per Section 504.04;
3. Low pressure system justification – Per Section 501.03;
    a. 50-year life cycle analysis; and
    b. Gravity sewer alternative cost estimate.
4. Low pressure system calculations – Per manufacturer's recommendations and at a minimum the following:
    a. Calculation worksheet – Per manufacturer;
    b. Individual pump curves; and
    c. Make and model number of pumps.
5. Standard Low Pressure System Detail Sheets (Figures 500.02, 500.03, & 500.04);

6. Identification of the person/entity responsible for the maintenance of the pumps and other components of the system that are not the responsibility of the CWA Authority, Inc. and/or Citizens Westfield;

7. Homeowners Association Covenants and Restrictions, if applicable; and

8. Any other information the Utility deems relevant to review and evaluate the proposed low-pressure system.

504.04 Low Pressure System Service Area

The Applicant shall prepare a Low Pressure System Service Area Study in accordance with all the requirements in Section 202.03.

504.05 Responsibility

CWA Authority, Inc and/or Citizens Westfield will only be responsible for the operation and maintenance of the common force main and the portion of the lateral from the common force main to, and including, the shutoff valve that is to be installed at the R/W or easement line.

The homeowner shall be responsible for all piping, pumping equipment, and appurtenances between the building and the shutoff valve.

For low-pressure systems CWA Authority, Inc and/or Citizens Westfield is NOT responsible for assuring replacement equipment is compatible with the existing equipment in the system.

504.06 System Design and Layout

Due to the variability of each site, the design of low-pressure systems shall rely on sound engineering judgment and manufacturer's recommendations. The Utility may, if reasonably justified, make any requirement deemed necessary to assure the system performs as intended.

The minimum requirements for the design and layout of low- pressure systems shall be per the most recent version of the Standard Detail Sheets, the manufacturers' recommendations, and as follows:

1. Pipe Size

   Pipe size shall be per pump manufacturer's recommendations with a minimum size of two (2) inches for the common force main and one and one-quarter (1- 1/4) inches between the grinder pump and the common force main. The Engineer shall assure adequate cleansing velocities in the common force main.

2. Overall System Design/Layout

   The design shall be as follows:

a. Sufficient to achieve a cleansing velocity of two (2) feet per second in the common force main; and
b. Without any "loops" or parallel pumping segments in the system.

3. Flushing Station

   Flushing Stations shall be per pump manufacturers recommendations but at a minimum the following locations:

   a. At the terminal end of each common force main;
   b. When two (2) or more common force mains are connected; and
   c. Every 1,000 feet.

4. Air Release Valves

   Air release valves shall be installed at the following locations:

   a. All high points in the system; and
   b. At intervals of 2,000 feet on all horizontal runs lacking a clearly defined high point.

5. Lateral Assembly Installation

   A lateral assembly installation shall be installed on each service line.

6. Other requirements as deemed necessary.

   See Figures 500.011, 500.012, 500.013, 500.014, 500.015, 500.016, 500.017, 500.018, 500.019, 500.020, 500.021, 500.022, 500.023, 500.024, 500.025, 500.026, and 500.027 located in the Appendix for details and requirements.

504.07 Maximum Connections to Grinder Pump Units

No more than one (1) building will be permitted to connect to a Grinder Pump Unit.

Common Grinder Pumps for one (1) building with multiple residential units are also prohibited, except for the following:

1. Apartment buildings (only one apartment building per grinder pump unit); and

2. Condominiums where different floors have different owners (only one building per grinder pump unit).

The intent is to have individual residential units be served by individual Grinder Pump Units.

Industrial facilities will be handled on a case-by-case basis.

504.08 Grinder Pump Types

The Engineer and manufacturer are responsible for assuring the system will operate as intended. Design calculations will be provided to the Utility by the Engineer.

To assure all the Grinder Pump Units are compatible, all units shall be the same Make, Model Number, and have the same pump performance characteristics, unless justified.

Replacement units shall be the same make and model as was originally approved by the Utility.

Pump specifications and pump replacement requirements shall be part of the Homeowners Association (HOA) Covenants and Restrictions if a HOA is planned.

For connections to gravity sewers, the allowable types of pumps a are as follows:

1. Positive Displacement Pumps

2. Semi-Positive Displacement Pumps

3. Centrifugal Pumps

Connections to existing low pressure sewer systems will be evaluated on a case-by-case basis.

504.09 Grinder Pump Equipment

Simplex or duplex grinder pumps may be used for single dwelling units. For uses other than single dwelling units, duplex grinder pumps are required.

General equipment requirements are as follows:

1. Grinder Pump Station

   The grinder pump stations shall be a complete package consisting of all equipment and appurtenances required for a fully operable pumping system. Pump level controls, starter, alarm, piping, fittings, valves, and all accessories shall be part of a factory fabricated package so that after burying the wet well, the field connection of the gravity lateral, discharge line and electrical service line to the control box will complete the installation.

2. Manufacturer

   Each grinder pump station shall be manufactured and assembled by a single manufacturer.

3. Pumps

   The pumps shall be capable of macerating all material in normal domestic and commercial sewage, including reasonable amounts of foreign objects such a wood, plastic, glass, rubber, disposable diapers and the like to a fine slurry that will pass freely through the pump and one and one-quarter (1-1/4) inch discharge pipe.

4. Electrical Motor and Level Controls

   Electrical and level controls shall be provided by the pump manufacturer. All controls shall be mounted so they can be cleaned or replaced without disturbing the pump or piping.

5. Control Panels

   The control panels and all associated components on each standard unit shall be U.L. Approved and installed per manufacturer's recommendations. All equipment associated with each unit shall meet the current requirements of all applicable Federal, State, and Local electrical codes.

   An Electrical Permit is required for each grinder pump unit.

The Engineer and manufacturer are responsible for assuring the equipment is designed properly and will operate in a safe manner.

For installation and contractor certification requirements, see Section 402.09, Grinder Pump Installation.

504.10 Service Line (Grinder Pump) Connections to Low Pressure Mains

For grinder pump connections to HDPE low pressure mains, only electrofusion and heat fusions tees are allowed. Making the connection using compression fittings/couplings is prohibited.

For material requirements see Section 304.04 Tapping Tees for Low Pressure Systems.

For installation and contractor certification requirements see Section 402.08, Connections to HDPE Low Pressure Sewer Systems.

504.11 Service Line (Grinder Pump) Connections to Gravity Mains

Low pressure laterals shall connect to gravity mains utilizing a gravity lateral wye and/or reducer.

CHAPTER 600 TESTING

Section 601 General

601.01 Introduction

This Section provides the testing requirements common to all sanitary sewer facilities.

For testing requirements specific to sanitary sewers refer to Section 602.

For testing requirements specific to force mains refer to Section 603.

For testing requirements specific to manholes refer to Section 604.

For testing requirements specific to lift stations refer to Section 605.

601.02 General Testing Requirements

All testing shall be performed under the observation of the RPR. It is the Contractor's responsibility to schedule the testing.

Test results obtained in the absence of the Utility’s RPR will not be accepted.

The Contractor shall be responsible for providing all testing equipment at no cost to the CWA Authority, Inc and/or Citizens Westfield.

All pressure gages used shall be calibrated within one (1) year of use for any test. Calibration papers and test date information shall be made available at the request of the Utility’s RPR.

The CWA Authority, Inc and/or Citizens Westfield will not assume any liability for the actions of the Owner, Contractor, or their agent(s), in the performance of the required tests.

Section 602 Gravity Sanitary Sewer Testing Requirements

602.01 Introduction

This Section provides the testing requirements specific to gravity sanitary sewers.

For testing requirements specific to force mains refer to Section 603.

For testing requirements specific to manholes refer to Section 604.

For testing requirements specific to lift stations refer to Section 605.

For testing requirements common to all sanitary sewer facilities refer to Section 601.

602.02 General Requirements

All sanitary sewers twenty-four (24) inches and less shall be air tested by means of a low pressure air test per Section 602.03. All sewers larger than twenty-four (24) inches shall be joint tested per Section 602.04.

All sanitary sewers constructed of flexible pipe (PVC and Centrifugally Cast Fiberglass Reinforced Polymer Mortar) shall be tested for deflection by means of a mandrel test per Section 602.06.

602.03 Low Pressure Air Test

All sewers twenty-four (24) inches and less shall be tested by means of a low-pressure air test to detect damaged piping and/or improper jointing. Testing shall be done per ASTM F 1417 for flexible and semi-rigid pipe and ASTM C 924 for RCP. The use of the low pressure air test for flexible and semi-rigid pipe larger that twenty-four (24) inches will be evaluated on a case-by-case basis.

The Contractor is responsible for assuring the test is conducted in a safe manner and all applicable safety procedures are followed.

Do not enter, or allow anyone to enter, the manhole during testing.

The low pressure air test shall be as follows:

1. Waiting Period

   The air test may be done immediately after final backfill is placed in the trench.

2. Equipment

   At a minimum, the following shall be provided:

   a. Mechanical or pneumatic plugs;

   b. Air control panel;

   c. Shut-off valve, pressure regulative valve, pressure relief valve, and input pressure gauge. The pressure regulator or relief valve shall be set no higher than 9 psig (6 psig for RCP) to avoid over pressurization;

   d. Continuous monitoring pressure gauge having a range of 0 to at least 10 psi. The gauge shall be no less than four (4) inches in diameter with minimum divisions of 0.10 psi and an accuracy of ± 0.04 psi;

   e. To reduce the potential for sewer line over-pressurization, two (2) separate hoses shall be used to:

      i. Connect the control panel to the sealed line for introducing low pressure air; and

ii. Constantly monitor air pressure buildup in the line.

If pneumatic plugs are utilized, a separate hose shall be required to inflate the pneumatic plugs.

3. Testing Procedures

The Test Data Sheet per Appendix B shall be used when conducting the air test.

The procedures for the low pressure air test are as follows:

a. Plug Installation

After a segment of pipe has been backfilled to final grade, securely place and brace suitable test plugs in the ends of the sewer segment and in all lateral stubs included in the test.

All plugs shall be securely restrained and braced prior to and during the test.

b. Line Pressurization

Add air slowly to the test section until the pressure inside the pipe reaches 4.0 psig PLUS the necessary adjustment for groundwater (Maximum 2.0 psig adjustment for a 6.0 psig maximum total).

The air pressure adjustment for groundwater shall be determined by the following:

Adjustment = Depth of Groundwater x 0.43

where:

Adjustment = Adjustment added to the starting pressure of the low-pressure air test, psig. **The maximum adjustment shall be 2.0 psig.**

Depth of Groundwater = As measured above the top of pipe, feet.

0.43 = Conversion factor

Do not exceed 6.0 psig at any time during the low- pressure air test.

The groundwater monitoring wells installed per Section
403.09 shall be used to determine the depth of groundwater. If more than one well was installed, take the average depth of the nearest downstream and nearest upstream monitoring locations. If the monitoring wells were not installed, the adjustment shall be 2.0 psig.

c. Pressure Stabilization

After a constant pressure of 4.0 psig (PLUS the necessary adjustment for groundwater) is reached, the air supply shall be throttled to maintain that internal pressure for at least two (1) minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

d. Timing Pressure Loss

When temperatures have been equalized and the pressure stabilized at 4.0 psig (PLUS the necessary adjustment for groundwater), the air hose from the control panel to the air supply shall be shut off or disconnected.

The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (PLUS the necessary adjustment for groundwater). At this reading, or any convenient observed pressure reading between 3.5 psig and 4.0 psig (PLUS the necessary adjustment for groundwater), timing shall begin.

A timed pressure drop of either 1.0 psig or 0.5 psig shall be used. The RPR shall determine the appropriate pressure drop. The allowable time shall be predetermined using either Table 601.01 or 601.02, depending on which pressure drop is used.

When testing RCP sewers, a 1.0 psig pressure drop shall be used.

e. Time adjustment for laterals

No time adjustment for lateral lengths will be allowed.

f. Determination of Line Acceptance

If the time shown for the designated pipe size and length elapses before the pressure drops (1.0 or 0.5 psig), the section of pipe being tested shall have passed the test.

The test may be discontinued once the prescribed time has elapsed even though the pressure drop has not occurred.

g. Determination of Line Failure

If the pressure drops before the appropriate time has elapsed, the air loss rate shall be considered excessive, and the section of pipe being tested shall have failed the test.

The Contractor shall be required to uncover, replace, or repair any section of sewer not passing the test. The method of repair shall be per approval of the Utility. Grouting is not an acceptable method of repair.

602.04 Joint Test

All sewers greater than twenty-four (24) inches shall be joint tested using air or water under low pressure. All joints shall be tested. Testing procedures shall be per ASTM C 1103 and as follows:

1. Waiting Period

   The joint test may be done immediately after final backfill is placed.

2. Equipment

   Equipment used shall be made specifically for joint testing of pipelines.

3. Testing Procedures

   a. Joint Test Apparatus Installation

      i. Clean the joint and interior joint surfaces.

      ii. Move the joint test apparatus into the sewer line to the joint to be tested and position it over the joint. Make sure the end element sealing tubes straddle both sides of the joint and the hoses are attached. For the water test, the bleed-off petcock must be located at top dead center.

      iii. Inflate end element sealing tubes with air in accordance with equipment and manufacturer's instructions.

   b. Joint Air Test

      i. Pressurize the void volume with air to 3.5 psi PLUS the necessary adjustment for groundwater above the top of pipe (maximum 2.0 psi adjustment for a 5.5 psi maximum total). Allow the air pressure and temperature to stabilize before shutting off the air supply. Start the timing of the test.

         The air pressure adjustment shall be per Section 602.03.3.b.

      ii. Measure the pressure drop for five (5) seconds.

      iii. After the joint test is completed, exhaust void volume, then exhaust end element tubes prior to removal of the testing apparatus.

   c. Joint Water Test

      i. Introduce water into the void volume until water flows evenly from open petcock. Close the petcock and pressurize with water to 3.5 psi PLUS the necessary adjustment for groundwater above the top of pipe (maximum 2.0 psi adjustment for a 5.5 psi maximum total). Shut off the water supply and start test timing.

ii. Measure the pressure drop for five (5) seconds.

iii. After the joint test is completed, exhaust end element tubes which will automatically release the water from the void volume, prior to removal of the testing apparatus.

d. Determination of Line Acceptance

If the pressure holds or drops less than one (1) psi for the five (5) second test time, the joint shall have passed the test.

e. Determination of Line Failure

If the pressure drops one (1) psi or more during the five (5) second test time, the joint shall have failed the test.

If the joint fails, the Contractor shall repair and retest as necessary. The method of repair shall be per approval of the Utility. Grouting is not an acceptable method of repair.

602.05 Water Infiltration Test

All gravity sanitary sewers shall be watertight and free from leakage.

The rate of infiltration into the sanitary sewer system between any two adjacent manholes or the entire system shall not be in excess of 100 gallons per inch of pipe diameter per mile per day (100 gpd/in-dia/mi).

The Contractor may be required to conduct a weir test to determine if the 100 gal/in/mi/day maximum allowable infiltration rate is being exceeded.

The weir test will be required if water is observed in the sewer at any time during the acceptance process. The weir test will be at the sole discretion of the Utility.

The Contractor shall be required to repair all visible leaks, even if the allowable infiltration requirements are met. The method of repair shall be per the approval of the Utility.

Grouting of the joint or crack to repair the leakage shall not be permitted. If the defective portion of the sanitary sewer cannot be located, the Contractor shall remove and reconstruct as much of the work as necessary to obtain a system that passes infiltration requirements.

602.06 Mandrel Deflection Test for Flexible Pipe

All sanitary sewers using flexible pipe shall be tested for deflection by means of a go/no-go mandrel gage or other methods as approved by the Utility.

The mandrel deflection test shall be as follows:

1. Waiting Period

   The mandrel deflection test shall be done no sooner than thirty (30) days after final backfill has been placed.

2. Equipment

   Mandrels shall be constructed with nine (9) or ten (10) arms. Mandrels with fewer than nine (9) arms are not allowed.

   The Length (L) shall be measured between points of contact on the mandrel arm.

   The Diameter (D) mandrel dimension shall carry a tolerance of + 0.01 inches.

3. Allowable Deflection

   The allowable deflection shall be based on the pipe type as follows:

   a. PVC Pipe

      The allowable deflection for PVC pipe shall be 5% of the base inside diameter as determined by ASTM D 3034 and F 679. The dimensions are as follows:

DIMENSIONS FOR MANDREL			
Nominal Pipe Diameter, inches	Length (L) of Mandrel, inches	Base ID of Pipe, inches	Diameter (D)[1] for Deflection of 5**%**, inches
8	8.0	7.665	7.28
10	10.0	9.563	9.08
12	10.0	11.361	10.79
15	12.0	13.898	13.20

      [1] – The diameter is based on SDR 35 pipe thickness, if thicker pipe is used, the diameter may be adjusted accordingly.

   b. Closed Profile PVC

      The allowable deflection for Closed Profile PVC shall be 5% based on the inside diameter as determined on a case-by- case evaluation of the pipe design.

   c. Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe

i. Polyester Resin

The allowable deflection for Centrifugally Cast Fiberglass Reinforced Polymer Mortar pipe made with polyester resin shall be 4% based on the inside diameter as determined on a case-by-case evaluation of the pipe design.

ii. Vinyl Ester Resin

The allowable deflection for Centrifugally Cast Fiberglass Reinforced Polymer Mortar pipe made with vinyl ester resin shall be 3% based on the inside diameter as determined on a case-by-case evaluation of the pipe design.

The Contractor shall provide proving rings to check the mandrel. The proving rings shall be clearly labeled with the dimensions and ASTM Standard.

4. Testing Procedure

   a. The mandrel shall be hand pulled through all sections of the sewer lines.

   b. Determination of Line Acceptance

      If the mandrel can be hand pulled through the entire length of the section tested, the section shall have passed the test.

   c. Determination of Line Failure

      If the mandrel cannot be hand pulled through the entire length of the section tested, the section shall have failed the test.

      The Contractor shall be required to uncover, replace, or repair any section of sewer not passing the mandrel test.

602.07 Air Test or Mandrel Test Failures

To determine the location of any failure, a visual inspection by means of closed circuit televising (CCTV) is recommended when the air or mandrel tests fail.

The pipe shall be thoroughly cleaned before televising.

If a CCTV inspection was conducted, then a digital copy of the inspection shall be submitted to the Utility for review.

602.08 CCTV Inspection

The Contractor shall clean and televise all sanitary sewers prior to acceptance by the utility. A digital copy of the inspection shall be submitted to the Utility for review. Deformed or damaged mainline pipe, laterals, and joints, damaged controlled settlement lateral joints, infiltration, or any other conditions observed by the utility and deemed unacceptable shall be repaired by the contractor prior to acceptance.

Section 603 Force Main Testing Requirements

603.01 Introduction

This Section provides the testing requirements for force mains and low pressure systems.

For testing requirements specific to sanitary sewers, refer to Section 602.

For testing requirements specific to manholes refer to Section 604.

For testing requirements specific to lift stations refer to Section 605.

For testing requirements common to all sanitary sewer facilities refer to Section 601.

603.02 General Requirements

All force mains for lift stations and common force mains in low pressure systems shall be tested for leakage by a Hydrostatic Leak Test per Section 603.03.

603.03 Hydrostatic Leak Test

The hydrostatic leak test shall be done in accordance with AWWA standards based on force main material, in accordance with ASTM E 1003, and as follows:

1. Waiting Period

   The hydrostatic test may be done immediately after final backfill is placed and the air and/or vacuum release valves are installed.

2. Equipment

   At a minimum, the following shall be provided:

   a. Hydrostatic Test Pump (jockey pump).
   b. Continuous monitoring pressure gage having a range of 0 – 150 psi graduated in 1 psi increments. The gauge shall be no less than four (4) inches in diameter.
   c. Pipe plugs and/or caps. The plugs/caps shall be equipped with a minimum of two (2) openings for filling/draining the force main and for bleeding air from the line.
   d. Calibrated/graduated container to measure the quantity of water required to be added during the hydrostatic test to maintain the test pressure.

3. Testing Procedures

   The procedures for the hydrostatic test are as follows:

a. Plug/cap installation

After the force main has been backfilled to final grade, securely plug and/or bulkhead the ends being tested. Thrust blocking restraints shall be installed at each bulkhead in accordance with the bulkhead manufacturer's requirements.

b. Air and/or Vacuum Release Valves

All air and/or vacuum release valves shall be installed and in normal (open) in-service position during the test.

c. Line Pressurization

i. The force main shall be slowly pressurized with water to 1.5 times the working pressure, or 100 psi, whichever is greater.
ii. Trapped air shall be expelled through high point bleed off valves as the force main is being filled.
iii. When the pressure has been reached, the test pump shall be shut off.
iv. After the force main has been pressurized, measure the pressure drop for two (2) hours.

d. Determination of Force Main Acceptance

If no pressure drop occurs within the two (2) hour test time, the force main shall have passed the test.

e. Determination of Force Main Failure

If a pressure drop occurs within the two (2) hour test time, the force main shall have failed the test.

Contractor shall repair any defects and retest, or retest per the Alternate Testing Procedure.

4. Alternate Testing Procedure

a. Plug/Cap Installation

Same as the above Testing Procedures

b. Line Pressurization

The force main shall be slowly pressurized with water to a test pressure 1.5 times the working pressure or 100 psi, whichever is greater. Water shall be added to maintain the test pressure for two (2) hours.

c. Determination of Force Main Acceptance

The amount of water added during the line pressurization shall be measured. The allowable leakage, in gallons per hour, shall be calculated as follows:

i. For PVC Pipe

$$L = (ND(P)^{1/2}) / 7400$$

ii. For Ductile Iron Pipe

$$L = (SD(P)^{1/2}) / 133{,}200$$

where:

L = allowable leakage, gph

N = number of joints in the pipeline tested

S = length of pipe tested, feet

D = nominal diameter of the pipe, in.

P = average test pressure (psi)

If the amount of water added is less than the allowable leakage, the force main shall have passed the test.

d. Determination of Force Main Failure

If the amount of water added is greater than the allowable leakage, the force main shall have failed the test.

The Contractor shall be required to uncover, replace, or repair the force main and/or air release valve and retest.

603.04 Force Main Continuity Testing

The contractor shall perform continuity testing on all tracing wire place during force main installation. Any wire found not to be continuous shall be repaired or replaced by the Contractor and re-tested.

Section 604 Manhole Testing Requirements

604.01 Introduction

This Section provides the testing requirements for manholes.

For testing requirements specific to sanitary sewers refer to Section 602.

For testing requirements specific to force mains refer to Section 603.

For testing requirements specific to lift stations refer to Section 605.

For testing requirements common to all sanitary sewer facilities refer to Section 601.

604.02 General Requirements

All manholes shall be tested for infiltration by means of a negative air (vacuum) pressure test per Section 604.04.

All internal chimney seals shall be tested per Section 604.05.

604.03 Leakage

All manholes shall be watertight and free from leakage.

Each manhole shall be visually inspected for leakage by the Utility after assembly and backfilling.

If the manhole shows signs of leakage, the manhole shall be repaired to the satisfaction of the Utility and reinspected.

604.04 Negative Air (Vacuum) Test

All manholes shall be tested for infiltration by means of a Negative Air (Vacuum) Pressure Test. Testing shall be done per ASTM C 1244.

All joints between the top of casting to the bottom of the manhole base shall be included in the test.

The vacuum test shall be as follows:

1. Waiting Period

   If possible, each manhole shall be tested immediately after assembly and prior to backfilling. If the test is done after backfilling, the Contractor shall be responsible for re-excavation to locate and correct any leaks that have been identified.

   The vacuum test shall be done <u>BEFORE</u> the chimney seal is installed and tested.

2. Equipment

   Equipment used shall be made specifically for vacuum testing of manholes.

3. Testing Procedures

   a. Plug Installation

All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

b. Test Head Installation

The test head shall be placed at the top of the manhole casting in accordance with the manufacturer’s recommendations.

c. Air Evacuation

A vacuum of ten (10) inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off.

d. Timing Pressure Rise

The time for the vacuum reading to drop from ten (10) inches to nine (9) inches of mercury shall be measured. The allowable time shall be determined by using the following:

Minimum Test Times			
Manhole Depth, feet	**Manhole Diameter, in**		
	48	**60**	**72**
	Time, seconds		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

e. Determination of Manhole Acceptance

If the time shown for the designated manhole depth and diameter elapses before the vacuum reading drops one (1) inch, the manhole shall have passed the test.

f. Determination of Manhole Failure

If the vacuum reading drops more than one (1) inch before the appropriate time has elapsed, the manhole shall have failed the test.

The Contractor shall be required to uncover, replace, or repair any or all sections of the manhole and retest.

604.05 Chimney Seal Leakage Test

All internal chimney seals shall be tested using a leakage test.

The leakage test shall be as follows:

1. Waiting Period

   The leakage test shall be done AFTER the manhole has passed the vacuum test.

2. Testing Procedures

   a. Install the chimney seal and only the bottom expansion band per manufacturer's recommendation. Fully tighten the bottom band. Do not install the top expansion band.
   b. Pulling the top of the seal away from the manhole frame, pour one (1) gallon of water behind the seal.
   c. Observe the bottom seal for a minimum of one (1) minute for leakage.
   d. Drain the water by folding the top of the chimney seal down.
   e. If the chimney seal passes the test, install the top expansion band per manufacturer's recommendation.

3. Determination of Chimney Seal Acceptance

   If the bottom expansion band holds water without leaking, the chimney seal will have passed the test.

4. Determination of Chimney Seal Failure

   If the bottom expansion band has any leakage during the test time, the chimney seal will have failed the test.

   The Contractor shall be required to remove, replace, or reposition the bottom expansion band and retest.

Section 605 Lift Station Testing

605.01 Introduction

This Section provides the testing requirements for lift stations.

For testing requirements specific to sanitary sewers refer to Section 602.

For testing requirements specific to force mains refer to Section 603.

For testing requirements specific to manholes refer to Section 604.

For testing requirements common to all sanitary sewer facilities refer to Section 601.

605.02 General Requirements

The force main and all gravity sanitary sewers constructed as part of the project shall have passed all required tests prior to the startup and final acceptance of the lift station.

605.03 Wet Well Leakage Testing

All wet wells shall be watertight and free from leakage.

The wet well shall be visually inspected for leakage by the Utility after assembly and backfilling.

All dewatering activities shall be ceased a minimum of eight (8) hours prior to the leak testing.

If the wet well shows signs of leakage, it shall be repaired to the satisfaction of the Utility and reinspected.

605.04 Lift Station Testing

All equipment testing shall be observed by the Utility during the lift station's final inspection.

Partial testing will not be accepted. The testing must be done on the complete lift station.

It is not the Utility's responsibility to engage in ANY activity or supply ANY equipment to test and/or accept the lift station.

The Contractor shall provide the clean water to run the pumps and perform all tests.

The startup and final inspection shall be as follows:

1. Waiting Period

   The waiting period shall be after BOTH of the following:

   a. AFTER the force main, gravity sewers and manholes constructed as part of the project have passed all required tests contained in Sections 602, 603, and/or 604.

   b. After ALL equipment has been installed, been determined to be in working order by the Contractor and manufacturer, and been previously tested by the manufacturer.

2. Equipment

   The Contractor or manufacturer shall provide all necessary equipment to safely complete all the tasks necessary to test and accept the lift station.

3. Testing Procedures

A lift station checklist provided by the Utility shall be completed during the start-up and final inspection.

The test shall verify all equipment performs in accordance with the design and the requirements of this Manual. Procedures for each component shall be determined by the Utility at the time of startup. At a minimum, the following shall be tested:

a. Pumping rate for all pumps in gpm;
b. Communications equipment;
c. Programmable Logic Controller;
d. All electronic equipment;
e. All mechanical equipment;
f. All instrumentation and control equipment;
g. All programming;
h. Incoming power;
i. The overall operating condition of the lift station; and
j. Any other test the Utility deems necessary.

4. Calibration

All measuring equipment supplied for the lift station shall be calibrated prior to acceptance. Calibration test results shall be made available upon request.

The measuring equipment shall include at a minimum the following:

a. Level Transducers;
b. Flow Meters;
c. Gauges; and
d. Other equipment as deemed necessary by the Utility.

5. Determination of Lift Station Acceptance

If the station performs to the satisfaction of the Utility, as designed, and per the requirements of this Manual, the lift station shall have passed the test.

6. Determination of Lift Station Failure

If the station does not perform to the satisfaction of the Utility, as designed, and per the requirements of this Manual, the lift station shall have failed the test.

The Contractor shall be required to correct all deficiencies and retest.

TABLE 601.01

MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP

FOR SIZE AND LENGTH OF PIPE FOR ALL PIPE

1 Pipe Diameter (in)	2 Minimum Time (min:sec)	3 Length for Minimum time (ft)	4 Time for Longer Length	Specification Time for Length (L) Shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46		
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42		
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08		
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49		
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47		
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	44:31
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	64:06
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	87:15
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	113:57
27[1]	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:57	129:48	144:13
30[1]	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	178:03
33[1]	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	215:26
36[1]	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	256:40
Reinforced Concrete Pipe (RCP)												
24	3.6	100	0.036L	3:36	5:24	7:12	9:00	10:48	12:36	14:24	16:12	18:00

[1]- Per Section 602.03, the low pressure air test for these pipe diameters can only be conducted with prior approval of the Utility

TABLE 601.02

MINIMUM SPECIFIED TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP

FOR SIZE AND LENGTH OF PIPE FOR FLEXIBLE AND SEMI-RIGID PIPE

1 Pipe Diameter (in)	2 Minimum Time (min:sec)	3 Length for Minimum time (ft)	4 Time for Longer Length	Specification Time for Length (L) Shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53		
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51		
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04		
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54		
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24		
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02	22:16
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51	32:03
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16	43:38
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17	56:59
27[1]	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54	72:06
30[1]	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07	89:01
33[1]	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57	107:43
36[1]	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23	128:12

[1-] Per Section 602.03, the low pressure air test for these pipe diameters can only be conducted with prior approval of the Utility.

APPENDIX A- EXAMPLE LOW PRESSURE AIR TESTS

A. GENERAL

The purpose of this Section is to illustrate the proper application of this recommended practice with regard to appropriate test time selection. The examples that follow include a variety of conditions which may be encountered in the field.

1. EXAMPLE A

A manhole to manhole reach of nominal 12-inch pipe is 350 feet long. No lateral connections exist in the reach. What is the required test time for a 0.5 psig pressure drop?

Solution: The required test time can be read directly from Table 601.02. For 350 feet of 12-inch pipe, the required test time is 9:58 (9 minutes and 58 seconds).

2. EXAMPLE B

What should the required test time be for a 1.0 psig pressure drop in 327 feet of nominal 8-inch diameter pipe between two manholes?

Solution: The exact test time is easily calculated by using Table 601.01. Table 601.01 is used because a 1.0 psig pressure drop is specified. Since 327 feet exceeds the minimum test time for an 8-inch pipeline, the fourth column in Table 601.01 shall be used to quickly calculate the required test time as follows:

$$T = 1.520\ L$$

$$T = 1.520 \times 327\ \text{ft.} = 497\ \text{seconds}$$

Therefore, the required test time for a 1.0 psig pressure drop is 497 seconds, or 8 minutes and 17 seconds (8:17).

3. EXAMPLE C

A manhole-to-manhole reach of nominal 24-inch pipe is 82-feet long. What is the required test time for a 0.5 psig pressure drop?

Solution: Table 601.02 must be used because a 0.5 psig pressure drop is specified. Since 82 feet is less than the 99 foot length associated with the minimum test for a 24- inch pipeline, the minimum test time shall apply. Thus, the required test time for a 0.5 psig pressure drop must be 11 minutes and 20 seconds (11:20).

4. EXAMPLE D

A 412 foot section of nominal 15-inch sewer pipe has been readied for air testing. A total of 375 feet of nominal 6-inch lateral piping and 148 feet of nominal 4-inch lateral piping branch off of the 15-inch sewer line. All laterals have been capped and/or plugged and will be tested together with the 15-inch main line. The specified pressure drop which will be timed is 0.5 psig. What is the appropriate test time for this pipe network?

Solution: All lateral sewer sizes and lengths may be disregarded since their influence is generally not significant enough to warrant computation. Table 601.02 must be used for a 0.5 psig pressure drop. The fourth column in the Table provides the appropriate formula for calculating the required test time because 412 feet is longer than the third column valve of 159 feet.

$$T = 2.671\ L$$

$$T = 2.671 \times 412 = 1{,}100 \text{ seconds.}$$

The required test time is 1,100 seconds or 18 minutes, 20 seconds (18:20).

APPENDIX B- ESTIMATED AVERAGE DAILY FLOW (ADF)

Agricultural labor camp	50 per occupant
Airport	3 per passenger plus 20 per employee
Apartment/Condominium, multi-family dwelling: one bedroom	200 per unit
Apartment/Condominium, multi-family dwelling: two bedroom	300 per unit
Apartment/Condominium, multi-family dwelling: three bedroom	350 per unit
Apartment/Condominium, one and two family dwelling	150 per bedroom
Assembly Hall	3 per seat
Athletic field (baseball, soccer, football, etc.)	1 per participant and spectator with additions for concessions
Auction and flea market: with full kitchen	5 per customer
Auction and flea market: with warming kitchen	4 per customer
Auction and flea market: without kitchen	3 per customer
Banquet caterer	10 per person
Bar (without food)	10 per seat
Barber shop	90 per chair
Beauty salon: perm or color changes	35 per customer
Beauty salon: cut with wash	10 per customer
Beauty salon: cut without wash	5 per customer
Bed and breakfast	150 per bedroom
Bowling alley (with bar and/or food)	125 per lane
Bowling alley (without food	75 per lane
Bus station	3 per passenger
Campground (organizational) with flush toilets, showers, central kitchen	40 per camper
Campground (organizational) without flush toilets, privy use, central dining hall, no showers, hand washing	20 per camper
Campground (recreational) with individual sewer connection	100 per campsite
Campground (recreational) without individual sewer connection	50 per campsite
Car Wash	240 per sq. ft. inside
Church with full kitchen	5 per sanctuary seat
Church with warming kitchen	4 per sanctuary seat
Church without kitchen	3 per sanctuary seat
Conferences	10 per attendee
Correctional facilities	120 per inmate
Day care center	20 per person
Dentist	200 per chair plus 75 per employee
Doctor’s office	75 per doctor, 75 per nurse, 20 per support staff
Estimated Average Daily Flow (ADF)	ADF (gallons per day)
Factory (industrial discharger) with showers	35 per employee
Factory (industrial discharger) without showers	20 per employee
Fire station: manned	75 per firefighter

Fire station: unmanned	35 per firefighter
Food service operations: cocktail lounge or tavern	35 per seat
Food service operations: restaurant (not open 24 hours)	35 per seat
Food service operations: restaurant (open 24 hours)	50 per seat
Food service operations: restaurant (not open 24 hours but located along an interstate)	50 per seat
Food service operations: (open 24 hours but located along an interstate)	70 per seat
Food service operations: tavern	35 per seat
Food service operations: curb service (drive-in)	50 per car space
Golf comfort station	3 per 50% of maximum number of golfers
Golf main clubhouse	5 per golfer with additions for food service and showers
Hospital, medical facility	200 per bed
Hotel	100 per room
Kennels and vet clinics (sum of all of the following services at a facility):	
1) a. cages	5 per cage
b. inside runs	10 per run
c. outside runs	20 per run
d. grooming	10 per animal
e. surgery plus	50 per surgery room
2) staff	75 per veterinary doctor plus 7 per veterinary assistant plus 20 per support staff
Laundry	200 per machine
Mental health facility	100 per patient
Mobile home park	200 per lot
Motel	100 per bed
Nursing home	100 per bed
Office building without showers	20 per employee
Office building with showers	35 per employee
Outpatient surgical center	50 per patient
Picnic area	5 per visitor
Race tracks	5 per attendee, 20 per staff
Rooming house	100 per renter
School: elementary	15 per pupil
School: secondary	25 per pupil
School with dormitory	100 per bed
Service station: convenience store/service center	1,000 with additions for food preparations and seating
Service station with only two (2) restrooms	400 per restroom
Service station with only unisex restroom	600 per restroom
Service station: automatic self-cleaning bathroom	60 per day
Shopping center	0.1 per square foot of floor space plus 20 per employee
Swimming pool bathhouse	10 per swimmer
Theater: drive-in	5 per car space
Theater: inside building	5 per seat

APPENDIX C- TEST REPORTS

Sewer Force Main Alternate Test Method

Date: ________________

Weather: ________________

Right-of-Way:	**Project/Subdivision Name:**
Contractor:	**Reference Plan:**
Testing Conducted by:	**RPR:**

Testing procedure shall be as specified in AWWA C600 and/or C900 (latest revisions) – Standard Hydrostatic Test Method Of DIP and Polyvinyl Chloride Pipe (PVCP) Sewer Force Mains, further as modified by the required test time shall be two (2) hours, the required pressure shall be 1.5 times the working pressure of the pipe or 100 psi and the allowable leakage shall not exceed "L" in the following formulas:

For PVC Pipe

$$L = (ND(P)^{1/2})/7400$$

For Ductile Iron Pipe

$$L = (SD(P)^{1/2})/133{,}200$$

Where:
L = allowable leakage (gph)
N = number of joints in the pipeline tested
S = length of pipe tested (feet)
D = nominal diameter of the pipe (in)
P = average test pressure (psi)

Pipe Diameter & Type	Pipe Length Tested, ft.	Starting Pressure (psi)	Amount of Water Added (gal)	Allowable Leakage (gph)	Actual Leakage (gph)	Pass Or Fail

Comments:____
____
____

Sewer Force Main Test Report

Hydrostatic Leak Test

Date: ________________

Weather: ________________

Right-of-Way:	**Project/Subdivision Name:**
Contractor:	**Reference Plan:**
Testing Conducted by:	**RPR:**

Testing procedure shall be as specified in AWWA C600 and/or C900 (latest revisions) – Standard Hydrostatic Test Method Of (DIP and PVCP) Sewer Force Mains and ASTM 1003.

The required test time shall be two (2) hours, the required pressure shall be 1.5 times the working pressure of the pipe or 100 psi whichever is greater.

Pipe Diameter (inches)	**Pipe Type**	**Pipe Length Tested, ft**	**Starting Pressure (psi)**	**Ending Pressure (psi)**	**Pressure Loss (psi)**	**Pass Or Fail**

Comments:____
____
____

Sewer Force Main Test Report

Date: _________________
Weather: _________________

Right-of-Way:	Project/Subdivision Name:
Contractor:	Reference Plan:
Testing Conducted by:	RPR:

Testing procedure shall be as specified in AWWA C600 and/or C900 (latest revisions) – Standard Hydrostatic Test Method Of (DIP and PVCP) Sewer Force Mains, further as modified by the required test time shall be two (2) hours, the required pressure shall be 1.5 times the working pressure of the pipe and the allowable leakage shall not exceed "L" in the following formulas:

For PVC Pipe

$$L = (ND(P)^{1/2})/7400$$

For Ductile Iron Pipe

$$L = (SD(P)^{1/2})/133{,}200$$

Where:
L = allowable leakage (gph)
N = number of joints in the pipeline tested
S = length of pipe tested (feet)
D = nominal diameter of the pipe (in)
P = average test pressure (psi)

Pipe Diameter & Type	Pipe Length Tested	Starting Pressure (psi)	Ending Pressure (psi)	Allowable Leakage (gph)	Actual Leakage (gph)	Pass Or Fail

Comments:____
____
____

Sewer Manhole Test Report

Date: ________________________
Weather: ________________________

Right-of-Way:	**Project/Subdivision Name:**
Contractor:	**Reference Plan:**
0Testing Conducted by:	**RPR:**

Testing procedure shall be as specified in ASTM C1244 (latest revision) – Standard Test Method For Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test, further as modified by the allowable vacuum loss shall not exceed 1 inch Hg (mercury) within one (1) minute for all manhole sizes.

Station/ Manhole No.	Manhole Diameter & Depth	Starting Vacuum (Inch Hg)	Ending Vacuum (Inch Hg)	Vacuum Loss (Inch Hg)	Pass or Fail

Comments:____
____
____

Sewer Manhole Test Report

Page 2

Station/ Manhole No.	Manhole Diameter & Depth	Starting Vacuum (Inch Hg)	Ending Vacuum (Inch Hg)	Vacuum Loss (Inch Hg)	Pass or Fail

Comments:____

Air Pressure Test Data Sheet

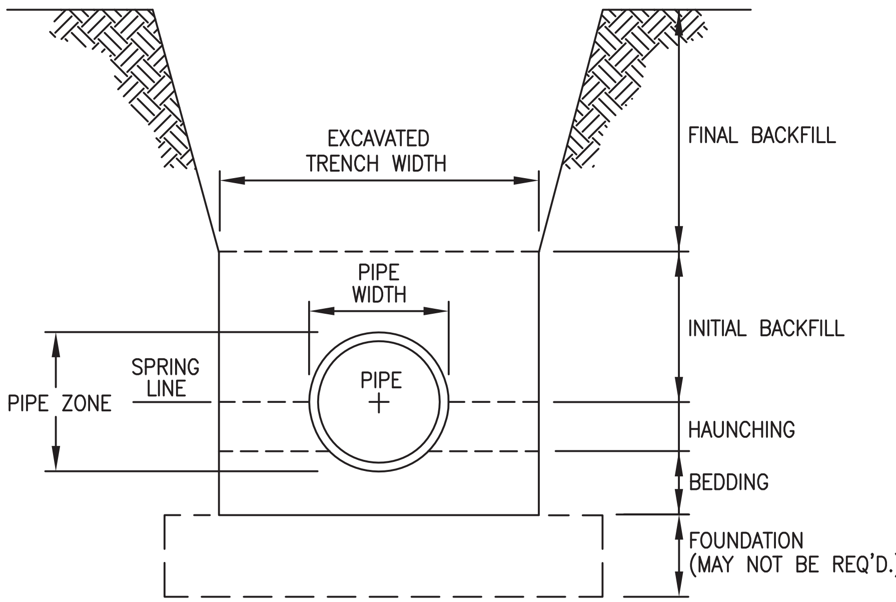
Test No. ___________________________

Job Name, Location, Project Number or Subdivision
Name____

Field Test Date (To be filled in by Inspector)

Date				Specified Maximum Pressure Drop:________________________psig							
Identification of Pipe Material Installed											
Pipe under Test				Field Test Operations Data							
Upstream MH No.	Downstream MH No.	Dia. D (in)	Length L (ft)	Time from Table (min:sec)	Air Pressure Adjustment (psig)	Initial Pressure (psig)	Time allowed for pressure to stabilize (min)	Start Pressure (psig)	Stop Pressure (psig)	Elapsed Time (min:sec)	Pass or Fail (P or F)
Inspectors name and title:											
Signature of Inspector:											
If a section fails, the following items must be completed:											
Identify section(s) that failed:											
Leak (was) (was not) identified. Method used:											
Description of leak:						Corrective Action taken:					
Results after repair refer to Test No.:						Inspector:					

APPENDIX D- DRAWINGS

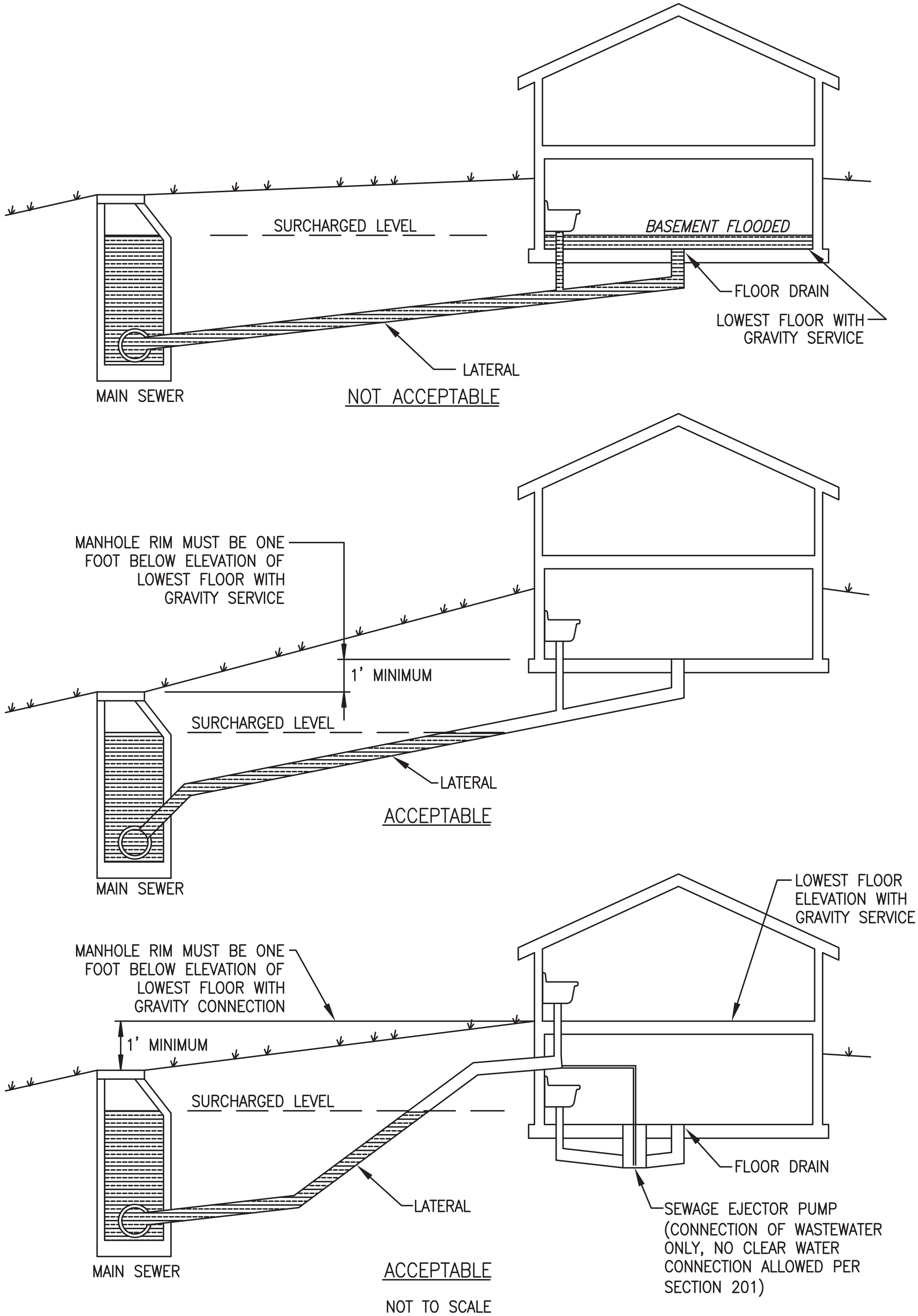


NOT TO SCALE

CITIZENS ENERGY GROUP

TERMS USED IN TRENCH DETAILS

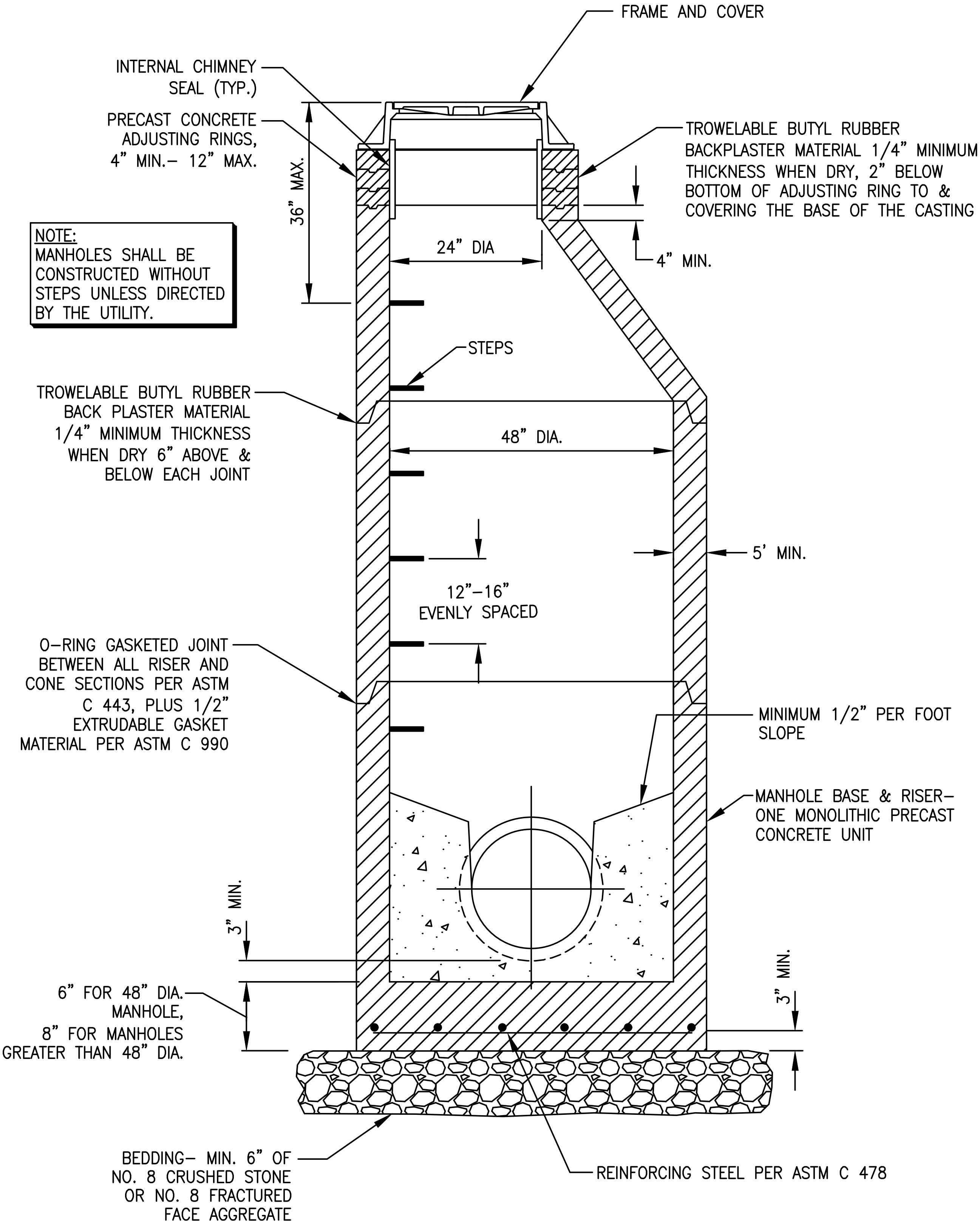
FIGURE 100.01



CITIZENS ENERGY GROUP

MINIMUM ELEVATIONS FOR GRAVITY CONNECTION

FIGURE 200.01

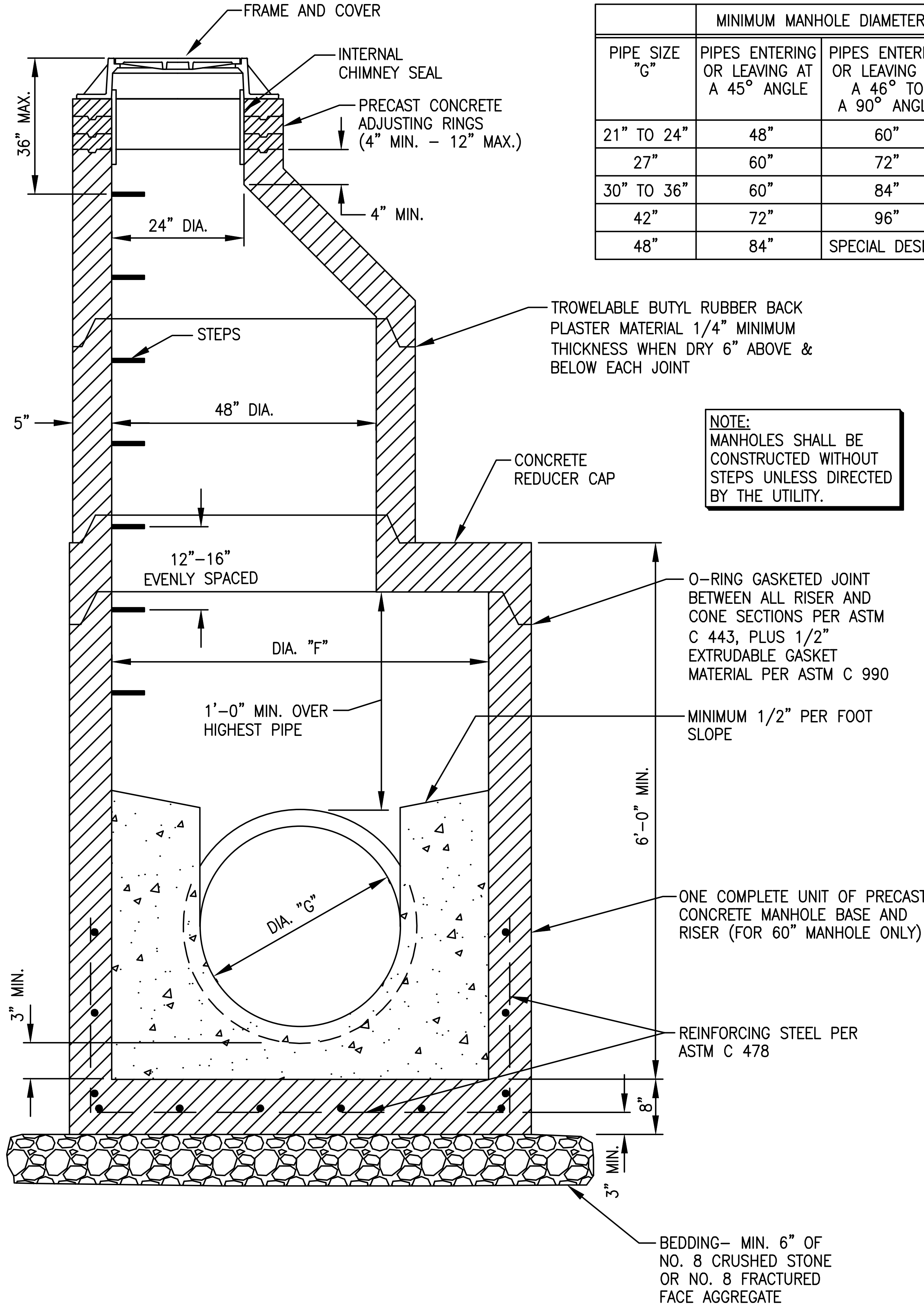


NOT TO SCALE

CITIZENS ENERGY GROUP

STANDARD MANHOLE FOR PIPE SIZES 8"–24" (STRAIGHT THROUGH)

FIGURE 300.01



	MINIMUM MANHOLE DIAMETERS	
PIPE SIZE "G"	PIPES ENTERING OR LEAVING AT A 45° ANGLE	PIPES ENTERING OR LEAVING AT A 46° TO A 90° ANGLE
21" TO 24"	48"	60"
27"	60"	72"
30" TO 36"	60"	84"
42"	72"	96"
48"	84"	SPECIAL DESIGN

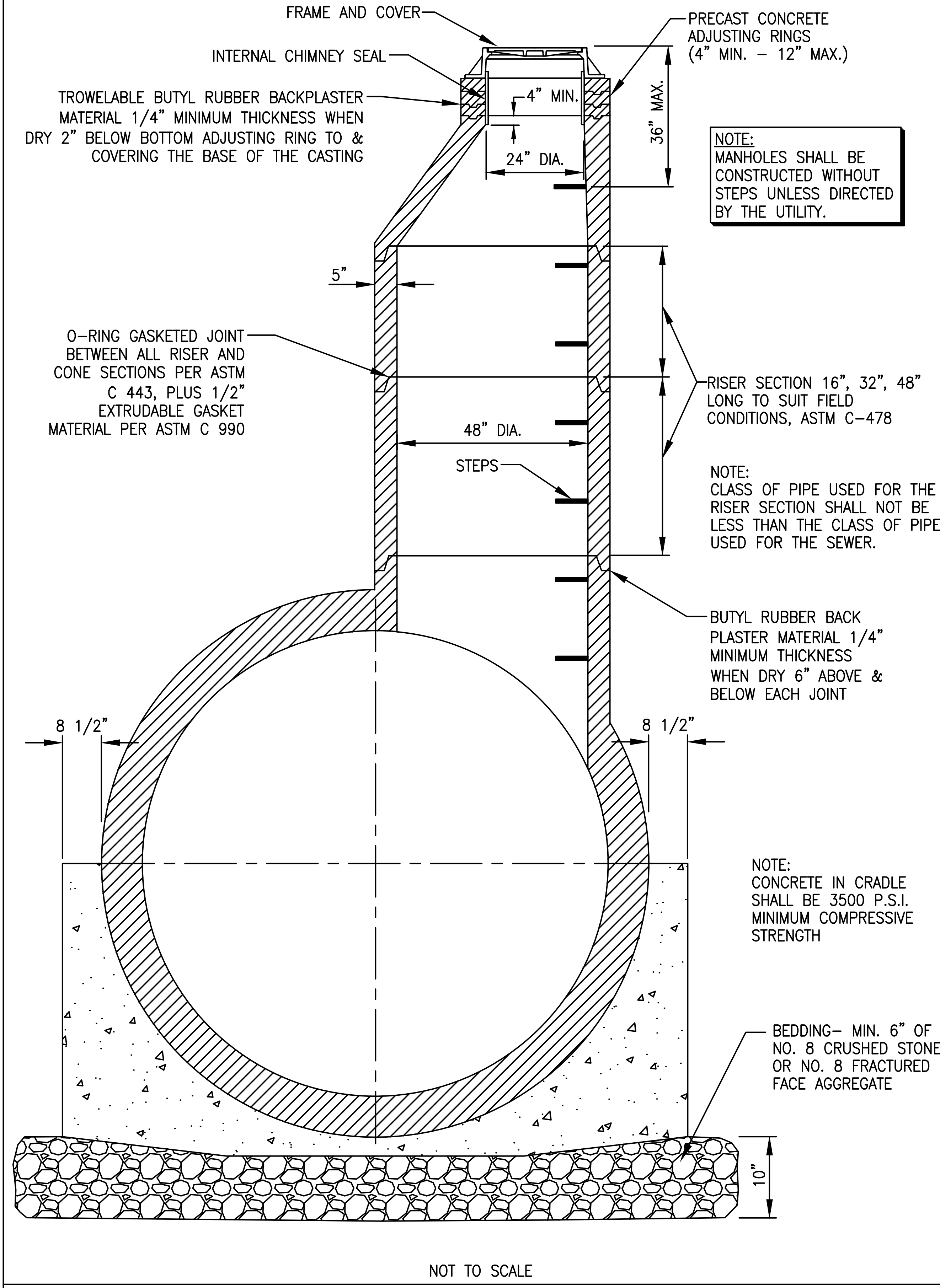
NOTE:
MANHOLES SHALL BE CONSTRUCTED WITHOUT STEPS UNLESS DIRECTED BY THE UTILITY.

NOT TO SCALE

CITIZENS ENERGY GROUP

MANHOLE BASE, RISER & REDUCER CAP FOR PIPES 21"–48"

FIGURE 300.02

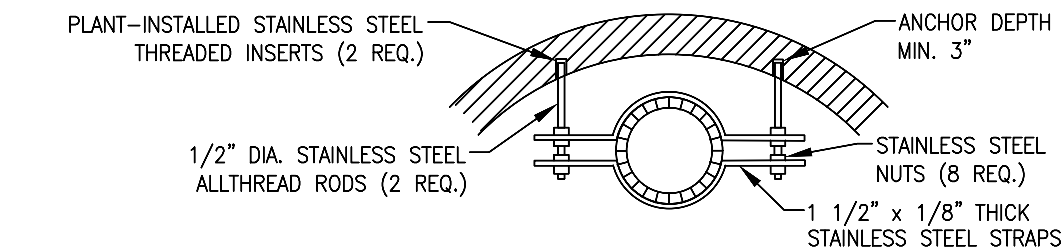


NOT TO SCALE

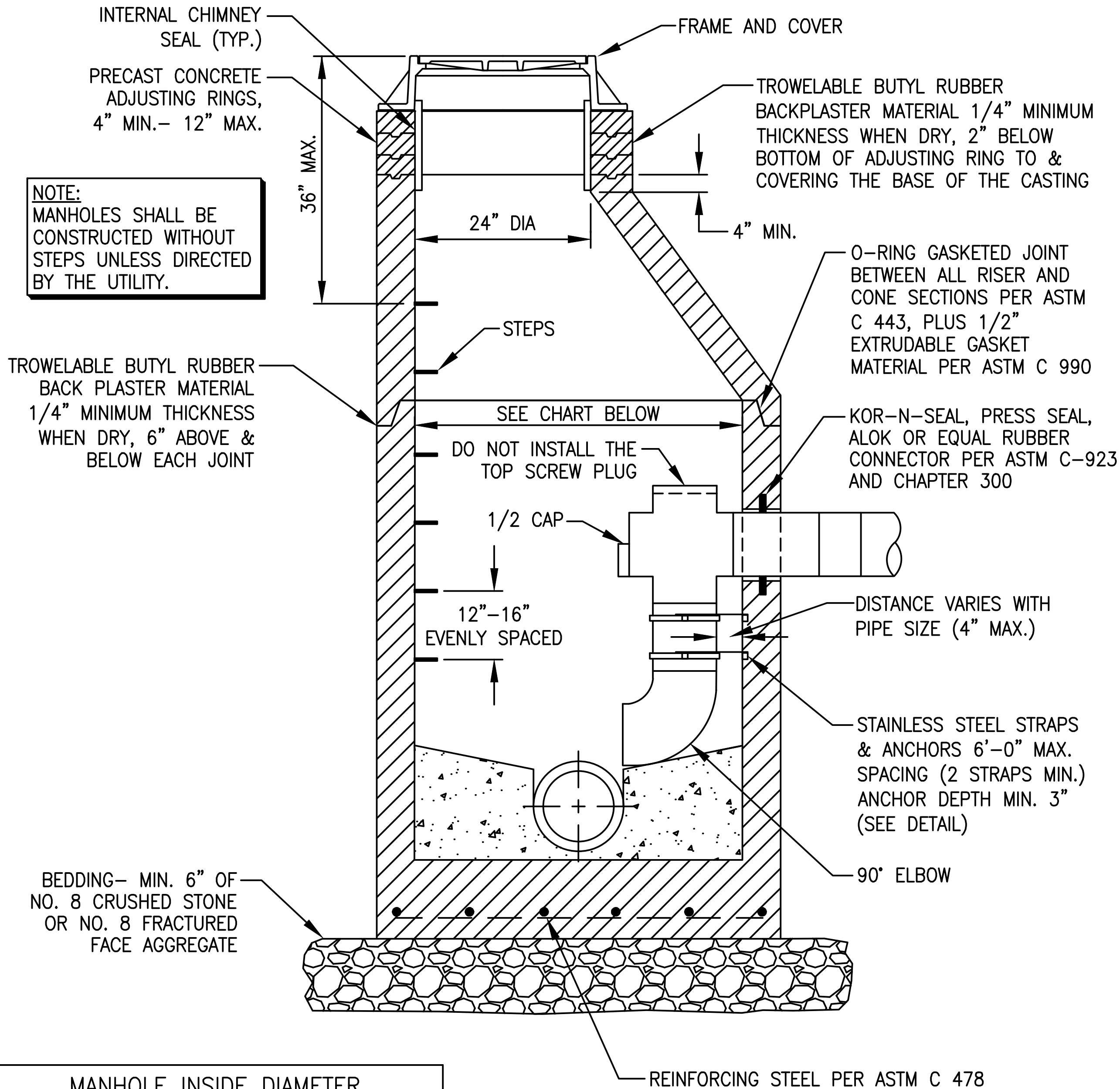
CITIZENS ENERGY GROUP

SPECIAL MANHOLE, 48"–144" SEWERS

FIGURE 300.03



DROP PIPE ANCHOR DETAIL
TOP VIEW



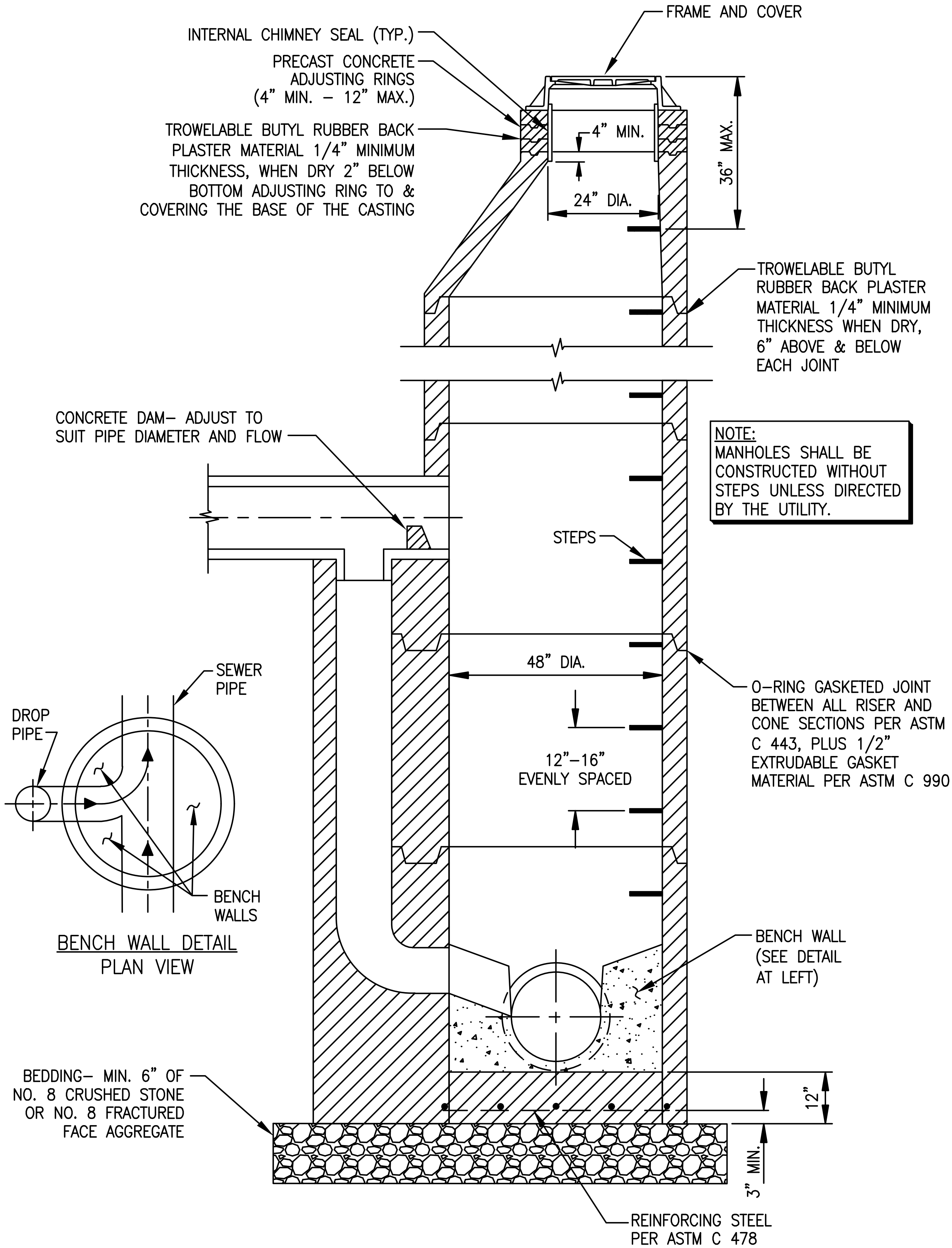
MANHOLE INSIDE DIAMETER		
TOTAL NUMBER OF INCOMING LINES	PIPE SIZE	INSIDE MANHOLE DIAMETER
1	8"–12"	60"
2 OR 3	8"–12"	72"

NOT TO SCALE

CITIZENS ENERGY GROUP

INTERNAL DROP MANHOLE

FIGURE 300.04

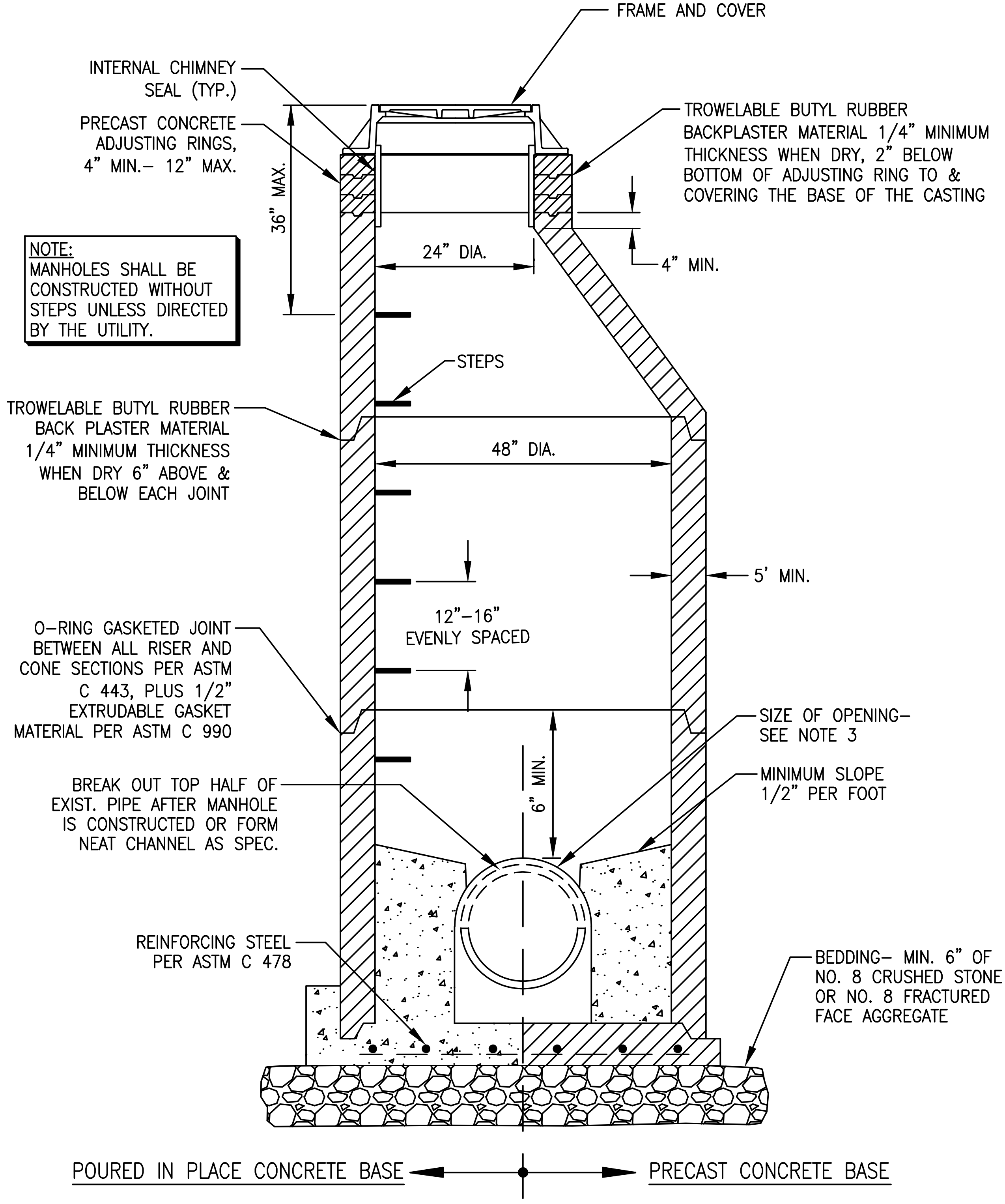


NOT TO SCALE

CITIZENS ENERGY GROUP

PRECAST DROP MANHOLE

FIGURE 300.05



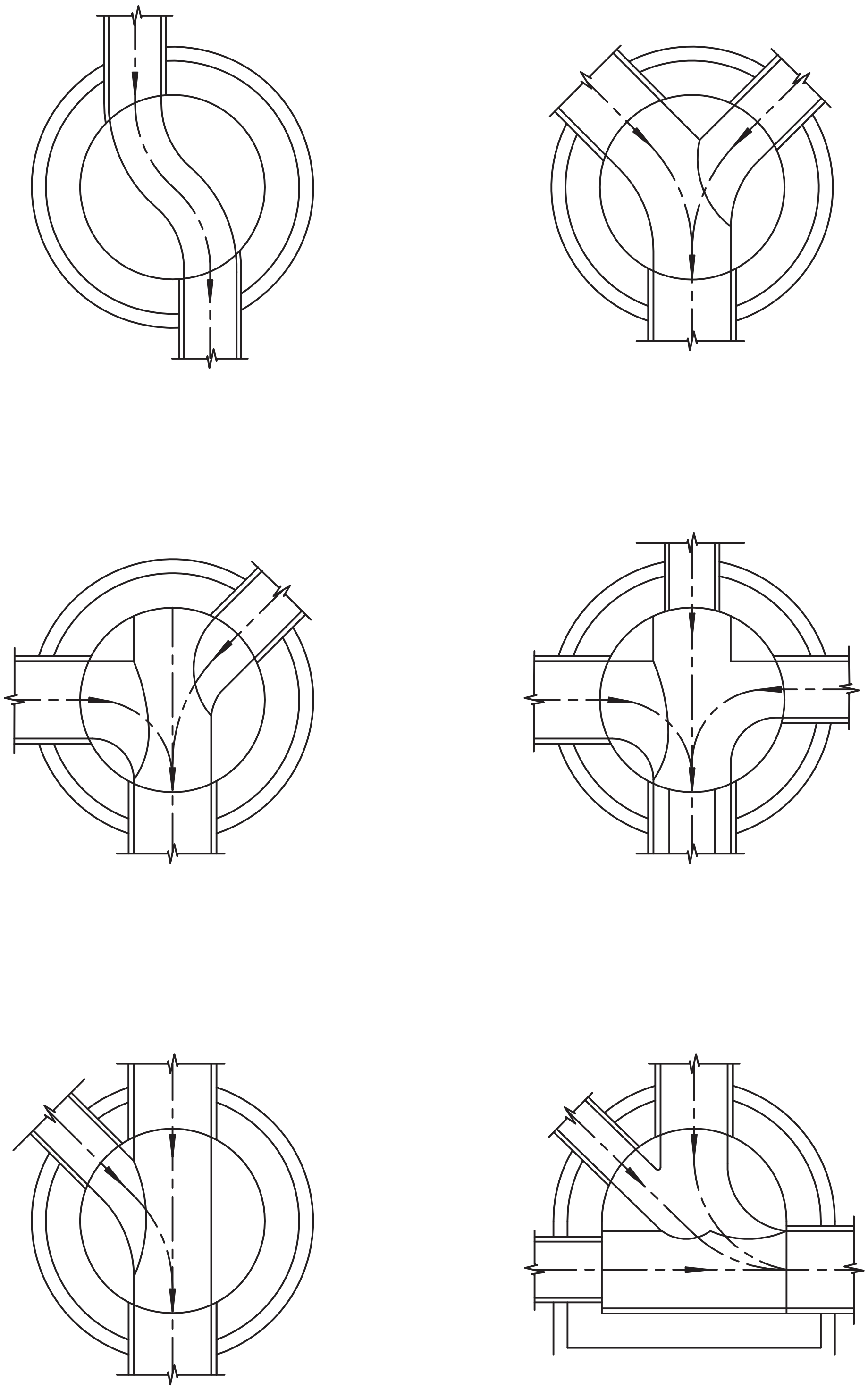
NOTES
1. DOGHOUSE OPENING MAY ONLY BE USED WHEN PLACING A NEW MANHOLE OVER AN EXISTING LINE; OTHERWISE, THE OPENING MUST BE CAST. SIZE, LOCATION AND ANGLE OF ENTRY SHOULD BE AS REQUIRED BY THE PLANS.
2. OPENINGS IN PRECAST UNITS ARE TO BE 4" MINIMUM TO 8" MAXIMUM LARGER THAN THE OUTSIDE DIAMETER OF THE PROPOSED PIPE.
3. INVERT SHAPING TO CONFORM TO FIGURE 300.07.

NOT TO SCALE

CITIZENS ENERGY GROUP

SANITARY SEWER DOGHOUSE MANHOLE

FIGURE 300.06



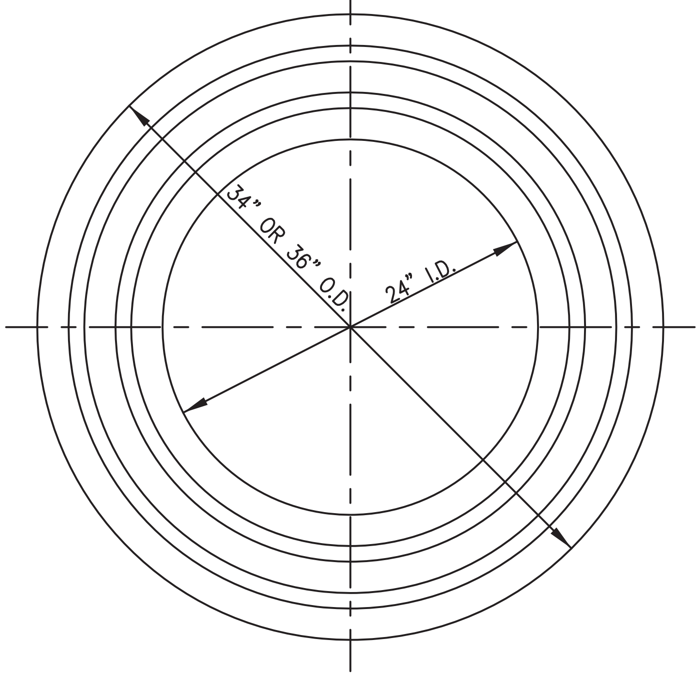
SANITARY SEWER
BENCH SLOPE: 1/2" PER FOOT

NOT TO SCALE

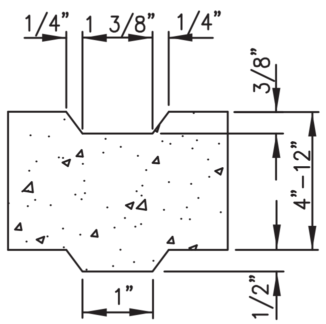
CITIZENS ENERGY GROUP

STANDARD MANHOLE BENCHES

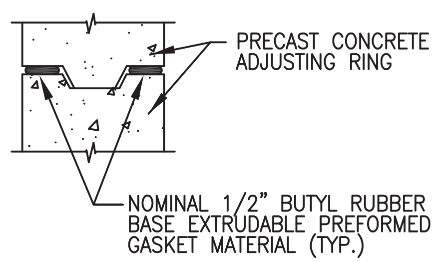
FIGURE 300.07



PLAN VIEW



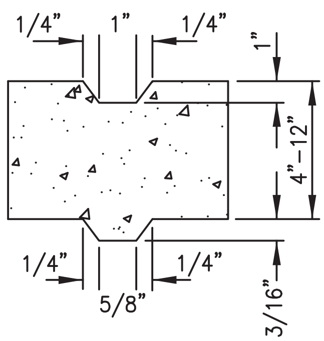
SECTION



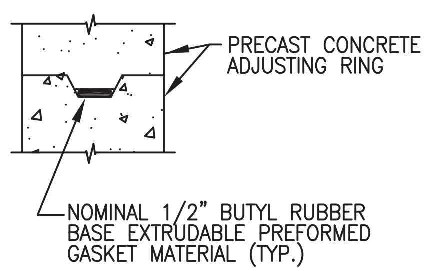
GASKET DETAIL

– OR –

– OR –



SECTION



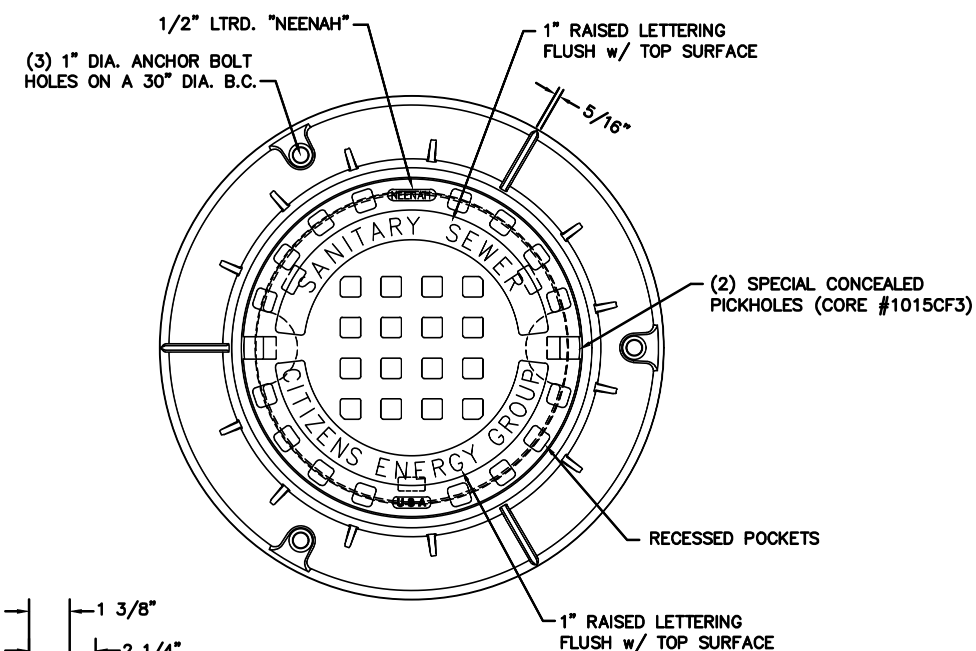
GASKET DETAIL

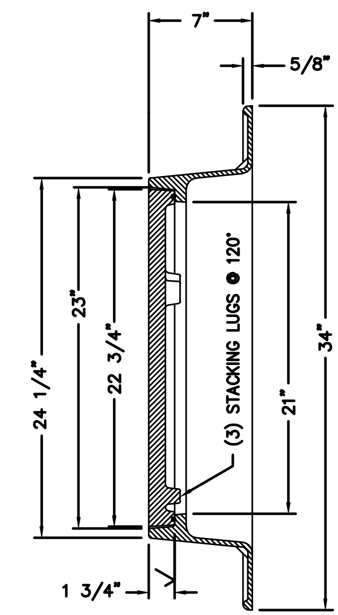
NOT TO SCALE

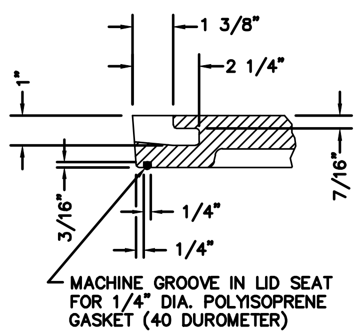
CITIZENS ENERGY GROUP

ADJUSTING RING

FIGURE 300.08







CONCEALED PICKHOLE/SELF-SEAL DETAIL

QUARTER SCALE

CATALOG NUMBER:

THE FRAME AND COVER SHALL BE AS FOLLOWS:

NEENAH REGULAR:
- FRAME: 1772198 (FRAME/LID SET) / 1772-2302 (FRAME)
- LID: 1772198 (FRAME/LID SET) / 1772-5727 (LID)

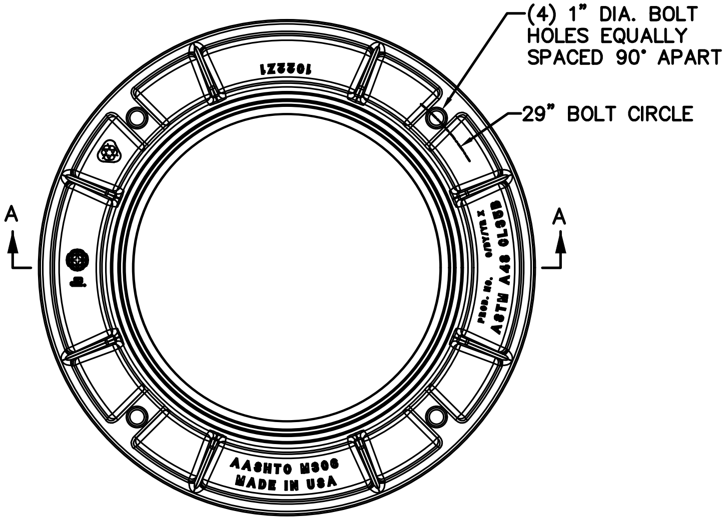
CITIZENS ENERGY GROUP

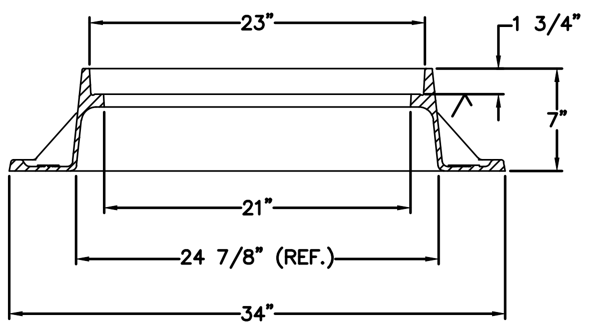
SANITARY SEWER MANHOLE NEENAH

STANDARD MANHOLE FRAME AND COVER

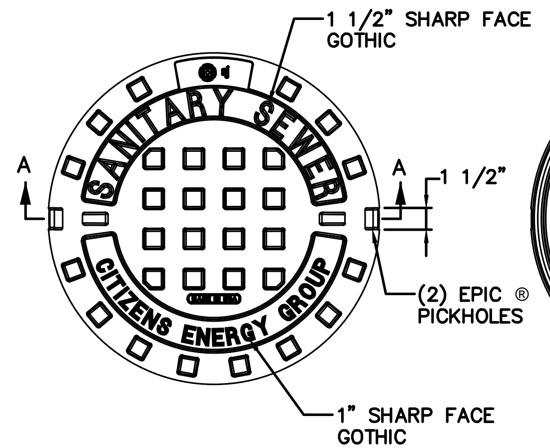
SHEET NO.

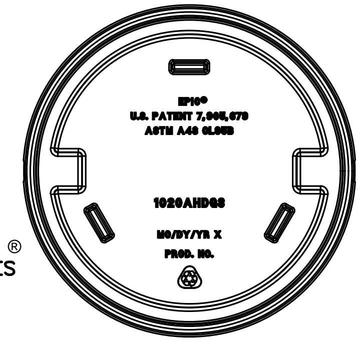
300.09



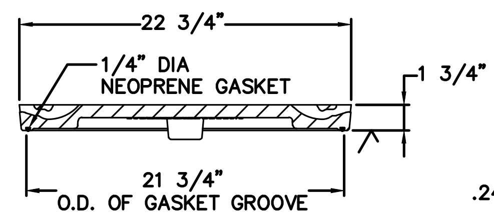


SECTION A–A

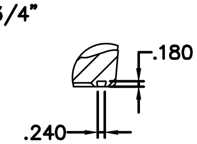




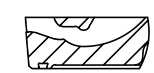
BOTTOM VIEW



SECTION VIEW



GROOVE DETAIL



EPIC® DETAIL

CATALOG NUMBER:

THE FRAME SHALL BE AS FOLLOWS:

EJ (EAST JORDAN IRON WORKS) REGULAR:
- FRAME: 1022Z1 / 00102310

CATALOG NUMBER:

THE COVER SHALL BE AS FOLLOWS:

EJ (EAST JORDAN IRON WORKS) REGULAR:
- LID: 1020AGS / 00102111

CITIZENS ENERGY GROUP

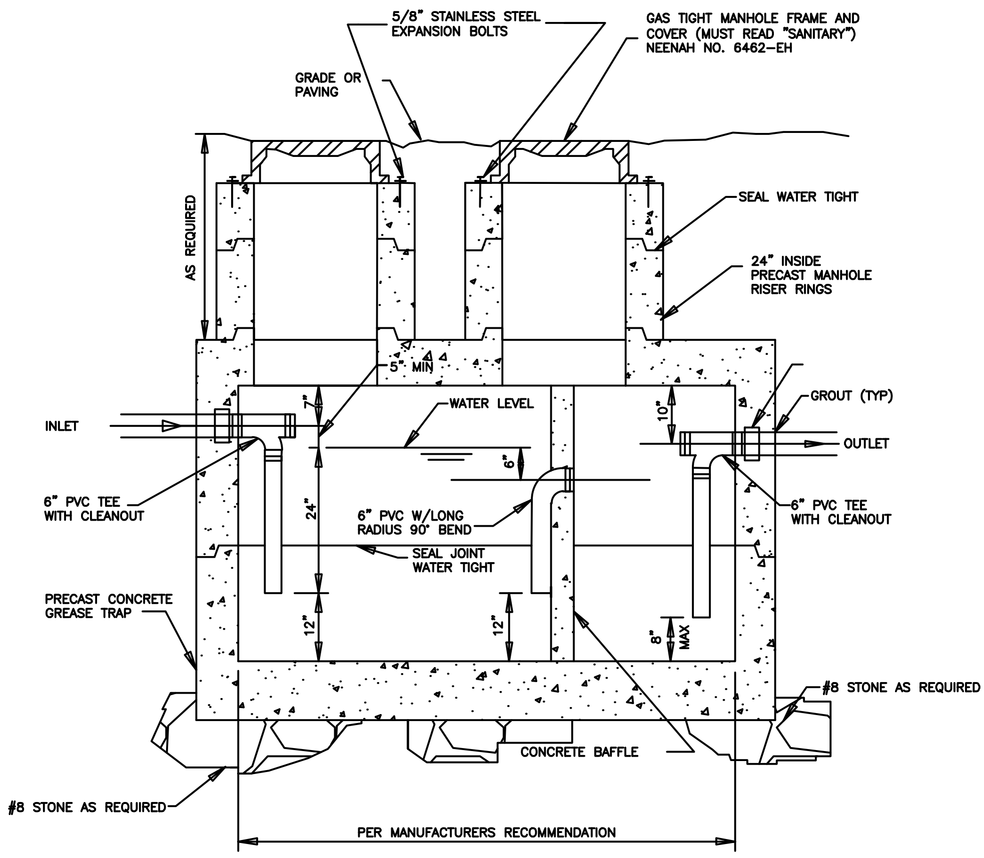
SANITARY SEWER MANHOLE EAST JORDAN

STANDARD MANHOLE FRAME AND COVER

SHEET NO.

300.10

GENERAL NOTES
1. ALL TANK JOINTS SHALL BE SEALED WATERTIGHT WITH BUTYL RUBBER EXTRUDIBLE PERFORMED GASKET MATERIAL, HAMILTON KENT-SEAL OR EQUAL.
2. ALL OUTSIDE RISER RINGS SHALL BE WATERPROOFED 1/8" WITH TROWELABLE GRADE BUTYL RUBBER BACK PLASTER.
3. PIPE SEALS SHALL BE TUF-TITE, POLYLOK, OR EQUAL.
4. CITIZENS MAY ACCEPT ALTERNATE GREASE TRAP DESIGNS ON A CASE-BY-CASE BASIS

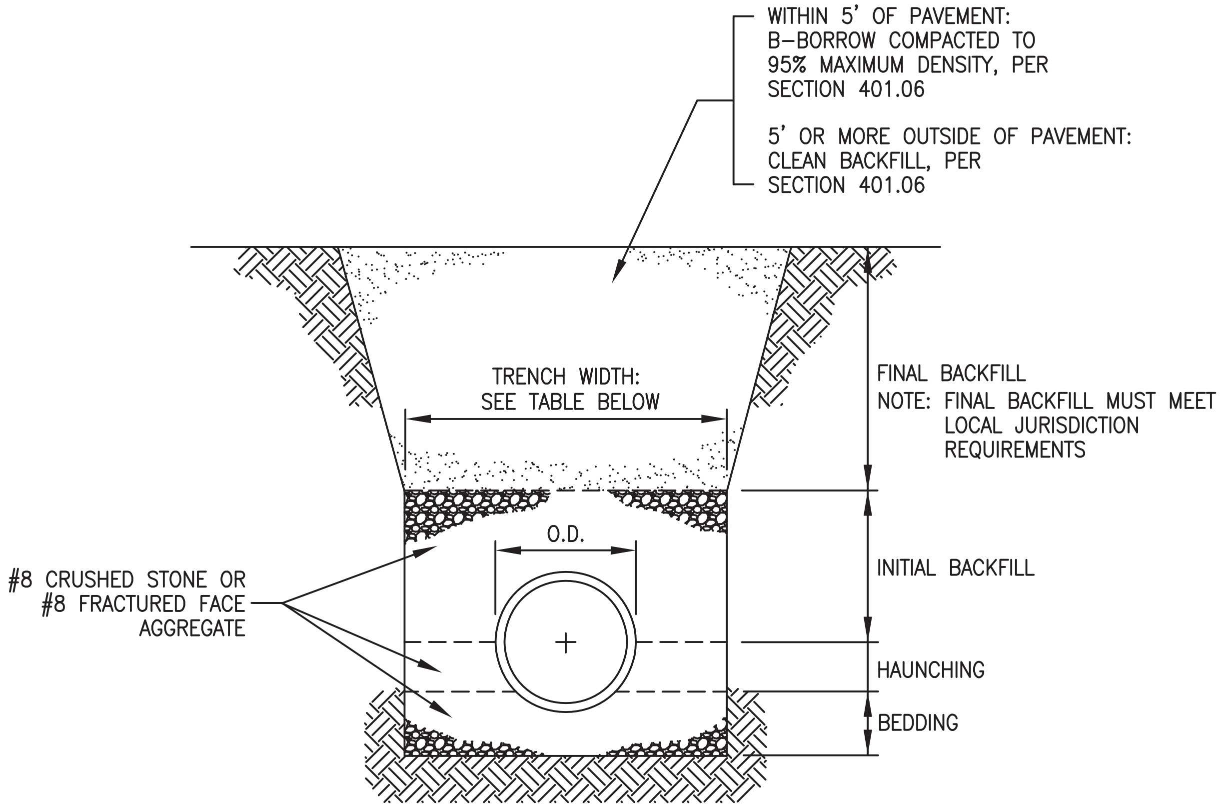


NOT TO SCALE

CITIZENS ENERGY GROUP

GREASE TRAP DETAIL

FIGURE 300.11



MINIMUM BEDDING, HAUNCHING, AND INITIAL BACKFILL DEPTHS		
PIPE SIZE	BEDDING (BELOW PIPE BARREL)	HAUNCHING AND INITIAL BACKFILL (ABOVE TOP OF PIPE)
UNDER 8"	4" MIN.	4" MIN.
8" TO 15"	4" MIN.	12" MIN.
18" & OVER	8" MIN.	12" MIN.

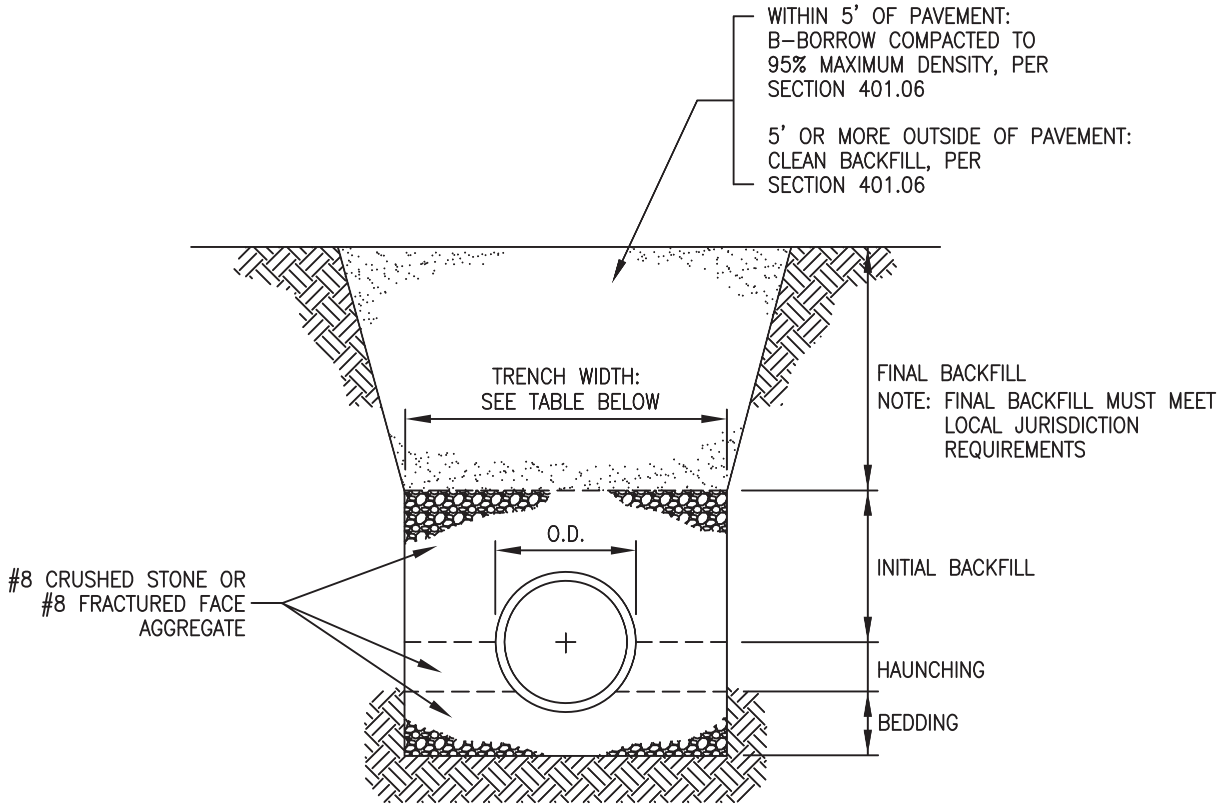
MINIMUM TRENCH WIDTHS	
PIPE SIZE	MINIMUM WIDTH
UP TO 18"	O.D. + 16"
18" & OVER	(O.D. x 1.25) + 12"

NOT TO SCALE

CITIZENS ENERGY GROUP

FLEXIBLE PIPE BEDDING & BACKFILL REQUIREMENTS

FIGURE 400.01



MINIMUM BEDDING, HAUNCHING, AND INITIAL BACKFILL DEPTHS		
PIPE SIZE	BEDDING (BELOW PIPE BARREL)	HAUNCHING AND INITIAL BACKFILL (ABOVE TOP OF PIPE)
8" TO 15"	4" MIN.	6" MIN.
18" & OVER	8" MIN.	6" MIN.

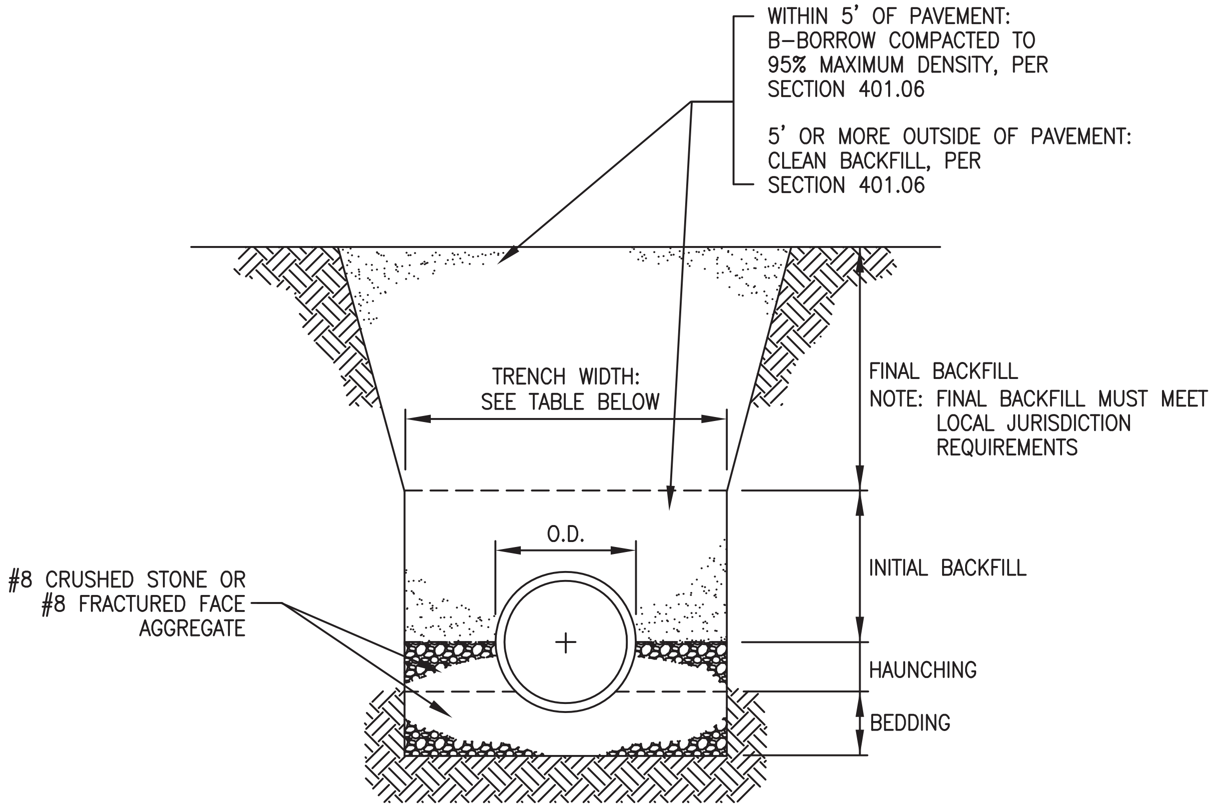
MINIMUM TRENCH WIDTHS	
PIPE SIZE	MINIMUM WIDTH
UP TO 18"	O.D. + 16"
18" & OVER	(O.D. x 1.25) + 12"

NOT TO SCALE

CITIZENS ENERGY GROUP

SEMI-RIGID PIPE BEDDING AND BACKFILL REQUIREMENTS

FIGURE 400.02



MINIMUM BEDDING, HAUNCHING, AND INITIAL BACKFILL DEPTHS		
PIPE SIZE	BEDDING (BELOW PIPE BARREL)	HAUNCHING AND INITIAL BACKFILL (ABOVE TOP OF PIPE)
24" & GREATER	8" MIN.	1/2 OD. MIN.

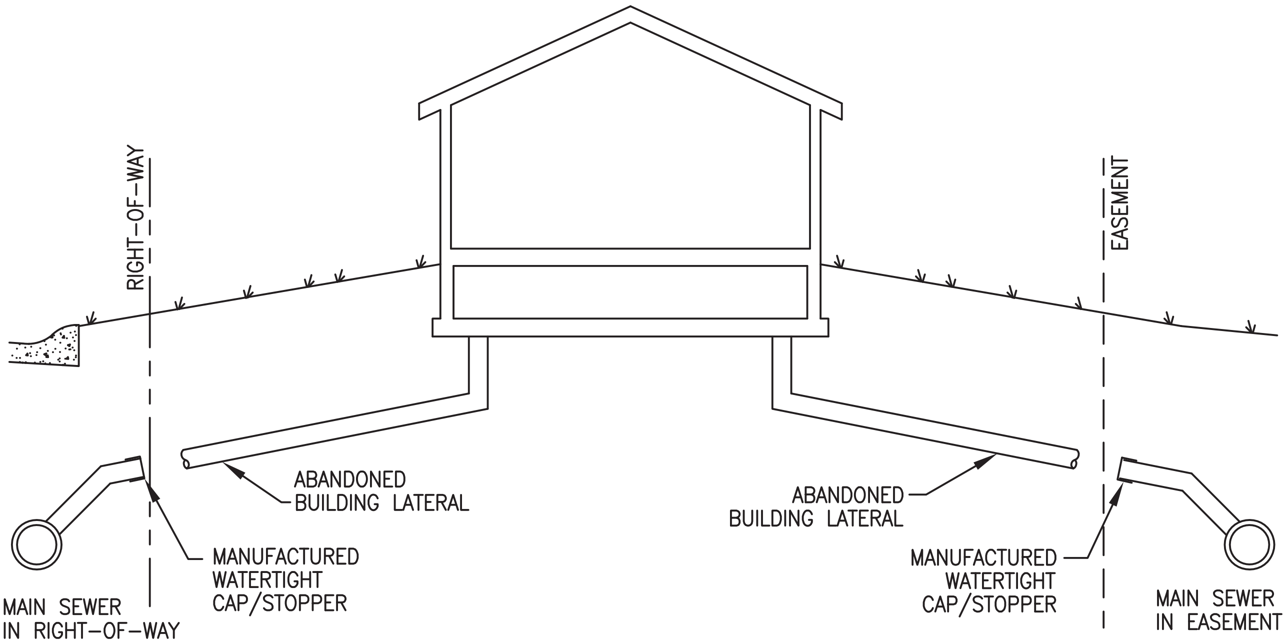
MINIMUM TRENCH WIDTHS	
PIPE SIZE	MINIMUM WIDTH
24" AND GREATER	(O.D. X 1.25) + 12"

NOT TO SCALE

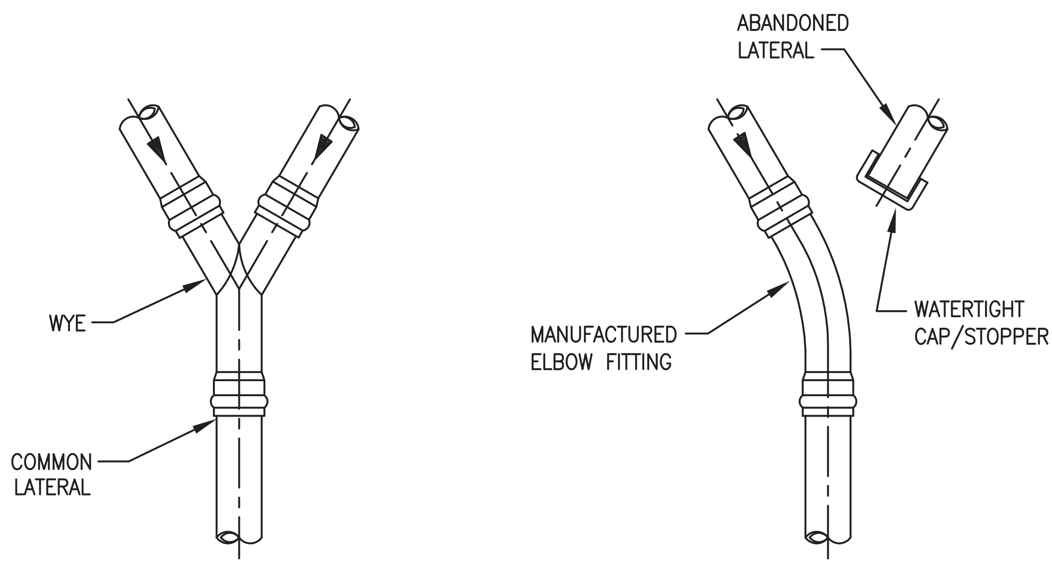
CITIZENS ENERGY GROUP

RIGID PIPE BEDDING & BACKFILL REQUIREMENTS

FIGURE 400.03



INDIVIDUAL LATERAL CAP LOCATION
CROSS-SECTION VIEW



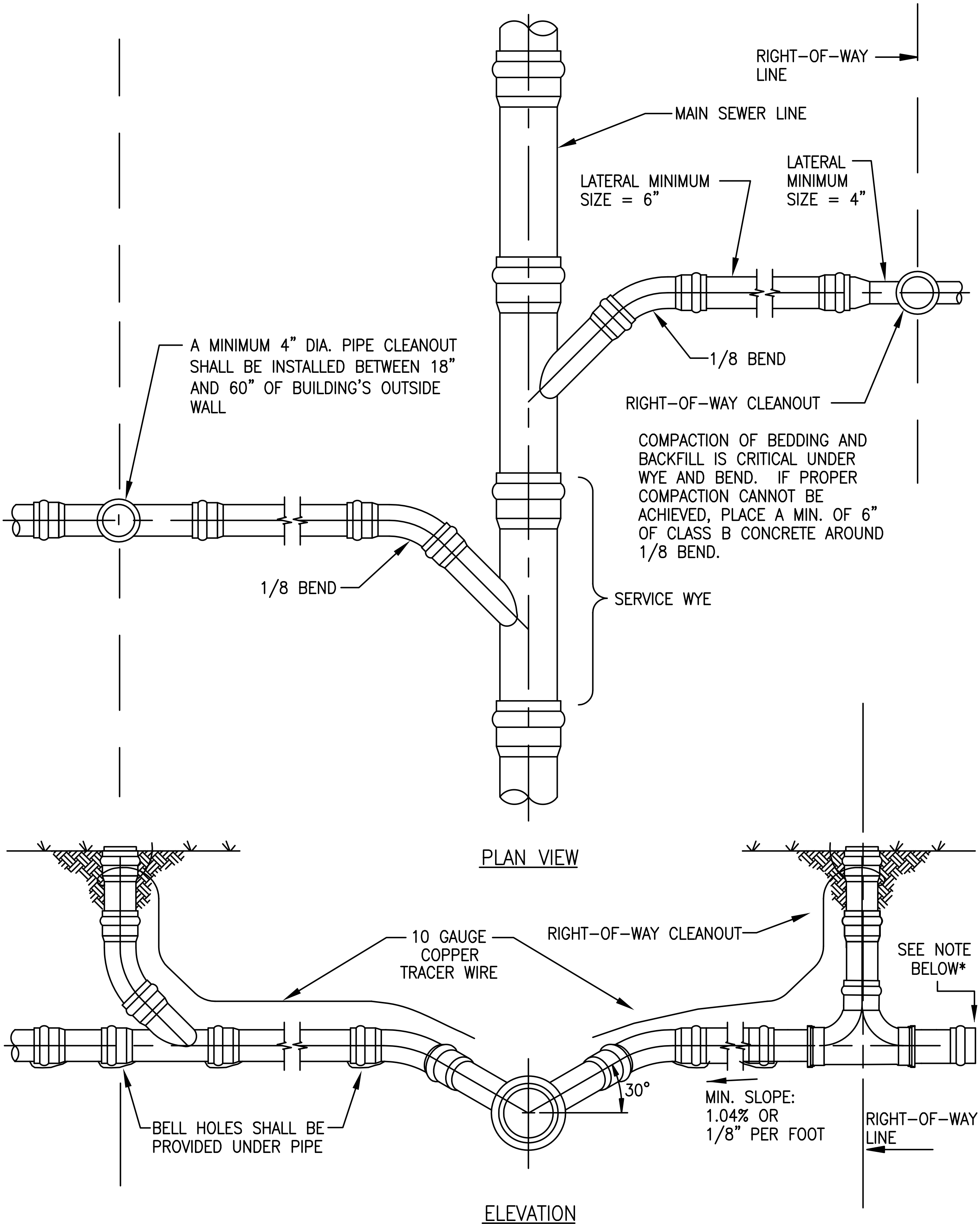
SHARED LATERAL CAP LOCATION
PLAN VIEW DETAIL

NOT TO SCALE

CITIZENS ENERGY GROUP

ACCEPTED METHODS OF CAPPING AN ABANDONED SEWER LATERAL

FIGURE 400.04



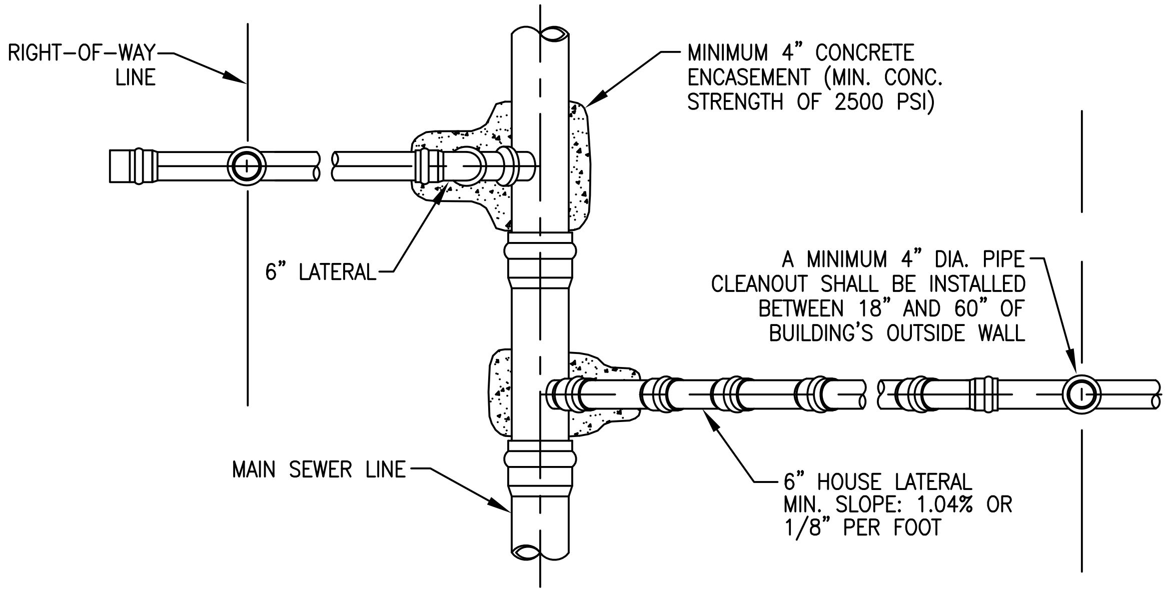
*NOTE:
CONNECT TO EXISTING SERVICE OR SEAL WITH WATERTIGHT PLUG FOR FUTURE CONNECTION.

NOT TO SCALE

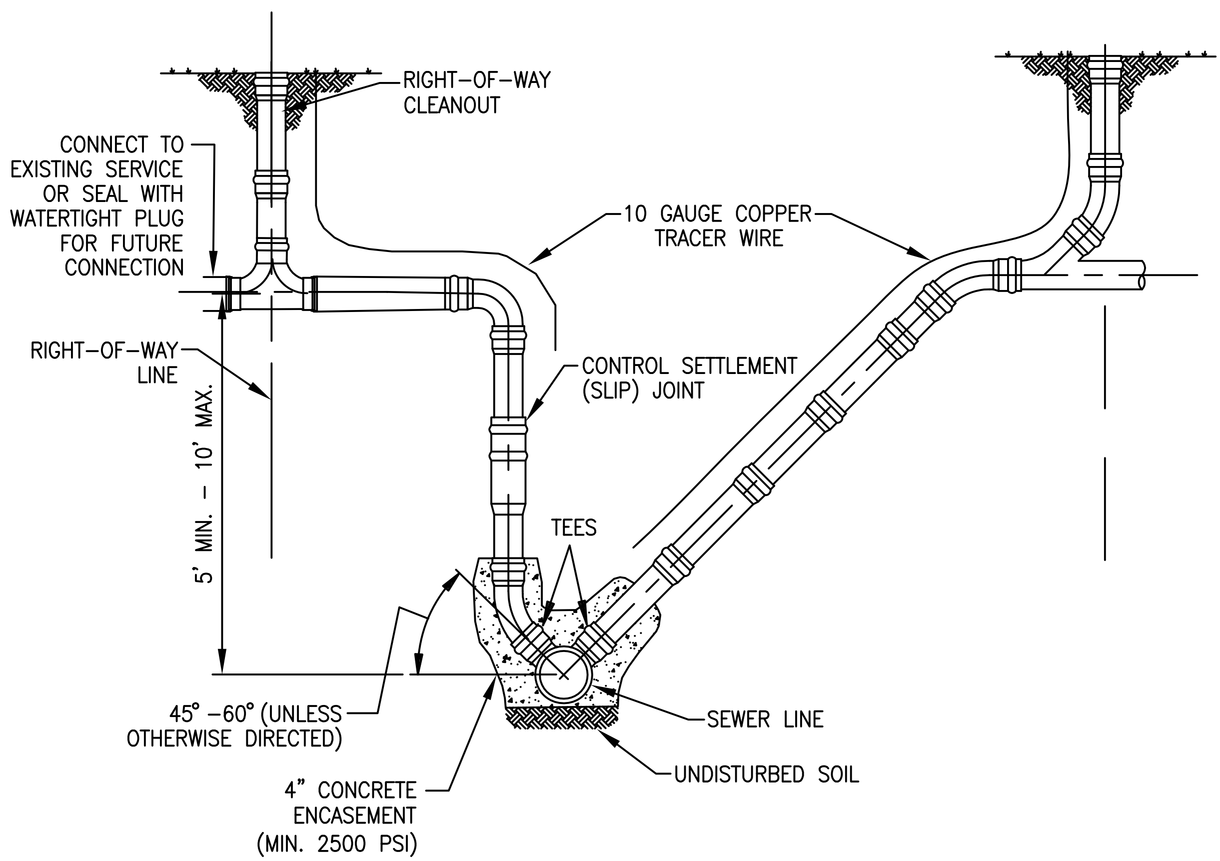
CITIZENS ENERGY GROUP

SERVICE CONNECTION FOR SHALLOW SEWERS (Less than 15' deep)

FIGURE 400.05



PLAN



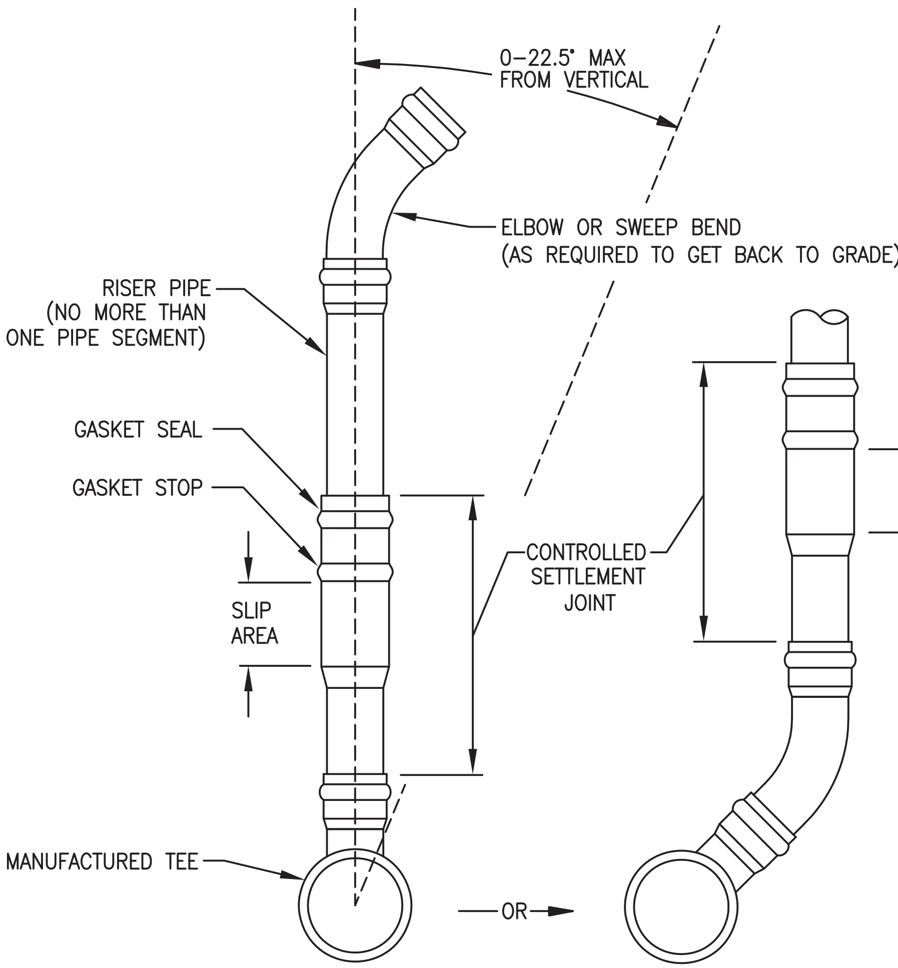
ELEVATION

NOT TO SCALE

CITIZENS ENERGY GROUP

SERVICE CONNECTION FOR DEEP SEWERS (15' deep and over)

FIGURE 400.06

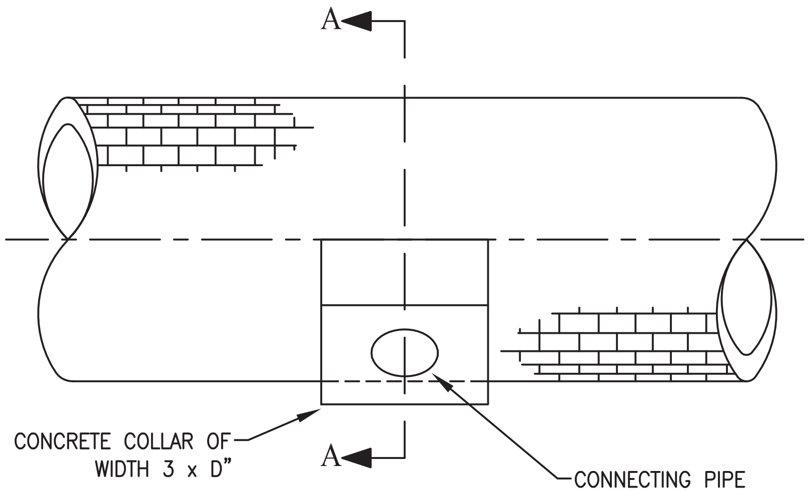


NOT TO SCALE

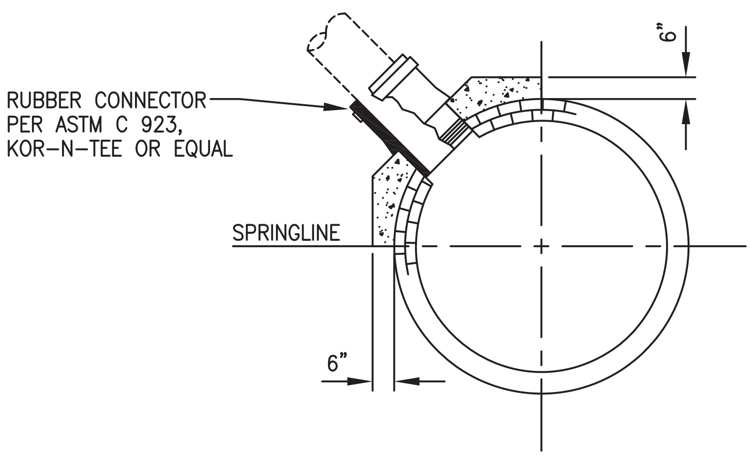
CITIZENS ENERGY GROUP

CONTROLLED SETTLEMENT JOINT INSTALLATION

FIGURE 400.07



PLAN



NOTE:
CORE DRILL HOLE FOR LATERAL CONNECTION AFTER CONCRETE COLLAR IS POURED

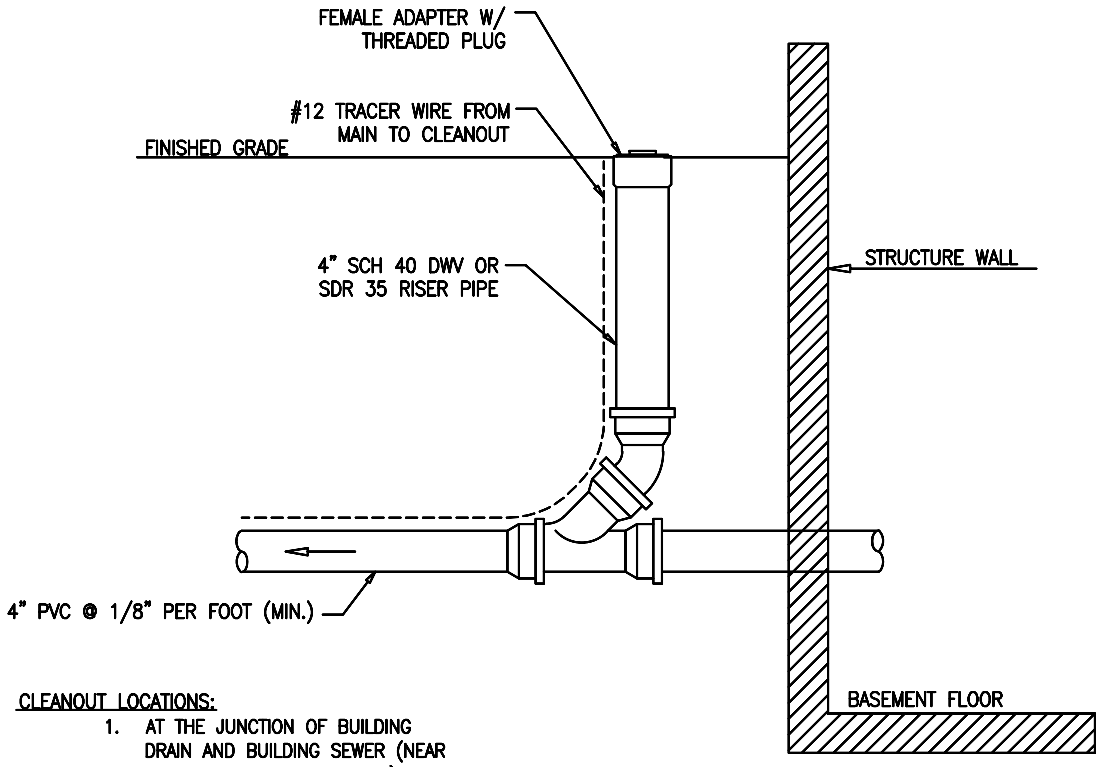
SECTION "A-A"

NOT TO SCALE

CITIZENS ENERGY GROUP

CONCRETE COLLAR DETAIL

FIGURE 400.08



CLEANOUT LOCATIONS:

1. AT THE JUNCTION OF BUILDING DRAIN AND BUILDING SEWER (NEAR EXTERIOR FACE OF BUILDING)
2. IF BUILDING SEWER IS MORE THAN 100 FEET FROM MAIN LINE SEWER, CLEAN-OUTS SPACING SHALL NOT EXCEED 100 FEET.
3. A CLEANOUT IS REQUIRED AT EACH BEND THAT IS GREATER THAN 45 DEGREES.
4. THERE SHALL BE NO BASEMENT DRAINS CONNECTED TO SERVICE CONNECTION

GENERAL REQUIREMENTS

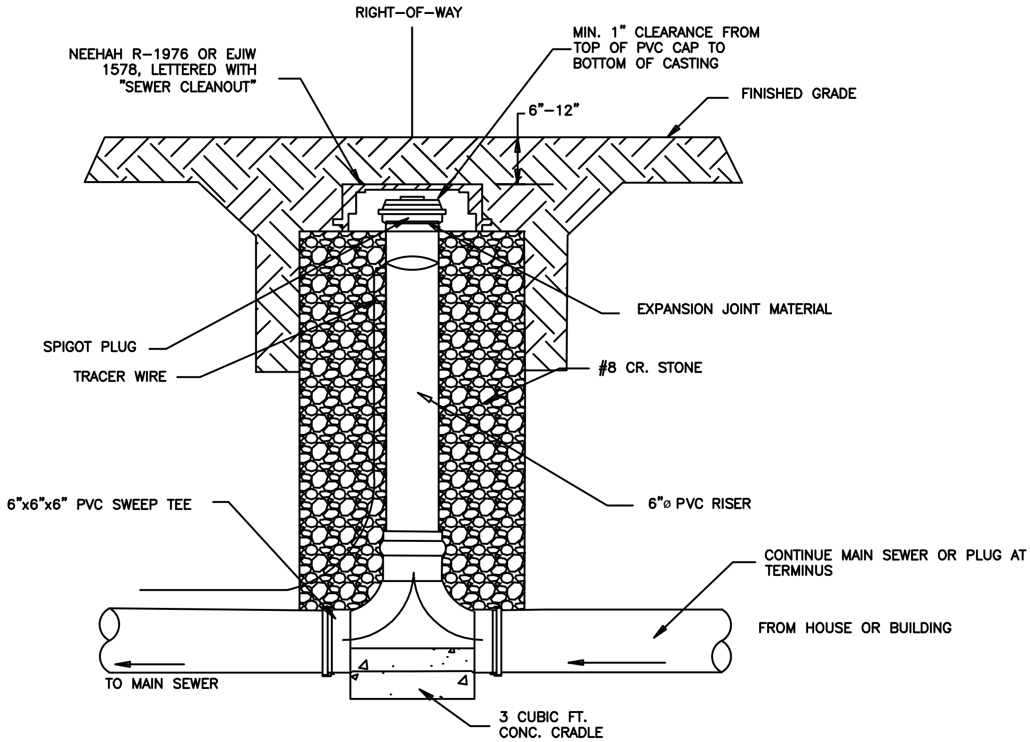
1. THE LOWEST FLOOR ELEVATION RECEIVING GRAVITY SERVICE MUST BE A MIN. ONE (1.0) FEET ABOVE TOP NEAREST MANHOLE RIM

NOT TO SCALE

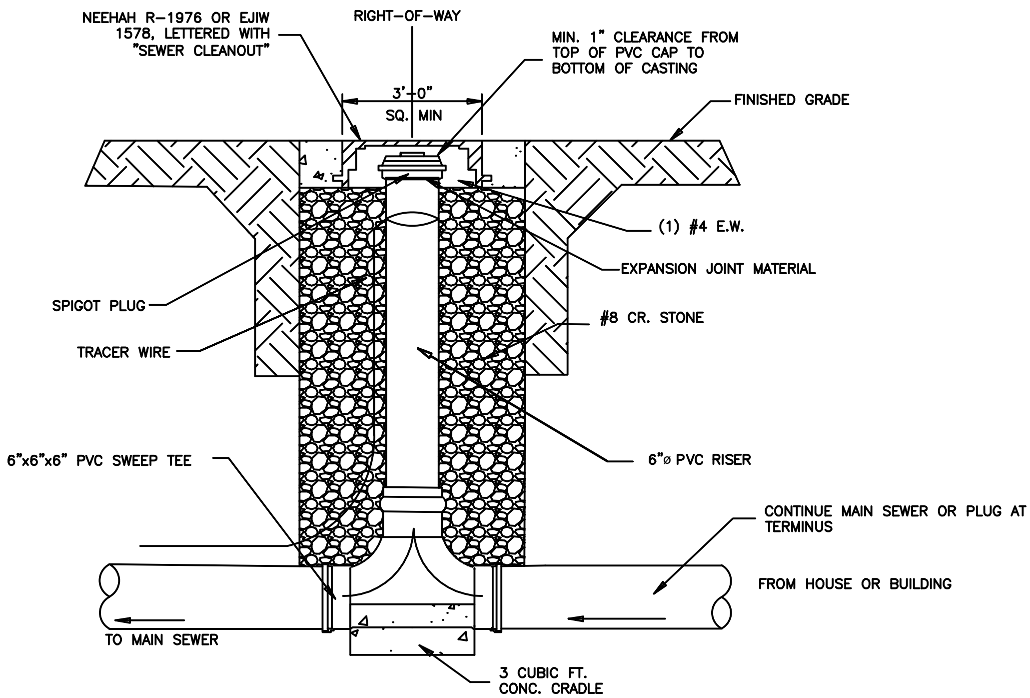
CITIZENS ENERGY GROUP

HOUSE/BUILDING SERVICE CLEAN-OUT DETAIL

FIGURE 400.09



OUTSIDE PAVEMENT



WITHIN PAVEMENT

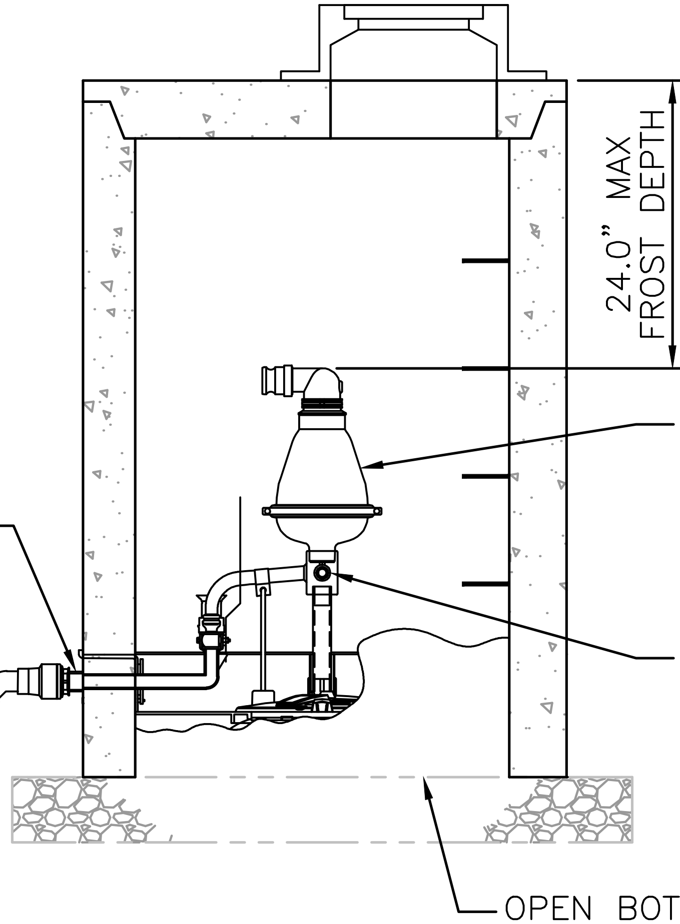
NOTES:
1. CONCRETE APRON AND CASTING SHALL BE INSTALLED SO THAT THEY DO NOT CONTACT THE CLEANOUT RISER PIPE OR CAP

NOT TO SCALE

CITIZENS ENERGY GROUP

RIGHT-OF-WAY CLEAN-OUT DETAIL

FIGURE 400.10



NOTES:

1. ALL ITEMS SHOWN IN DASHED LINES ARE FOR REFERENCE ONLY, AND ARE SUPPLIED BY OTHERS.

AIR RELEASE STATION – LOW PRESSURE SYSTEM

NOT TO SCALE

citizens energy group

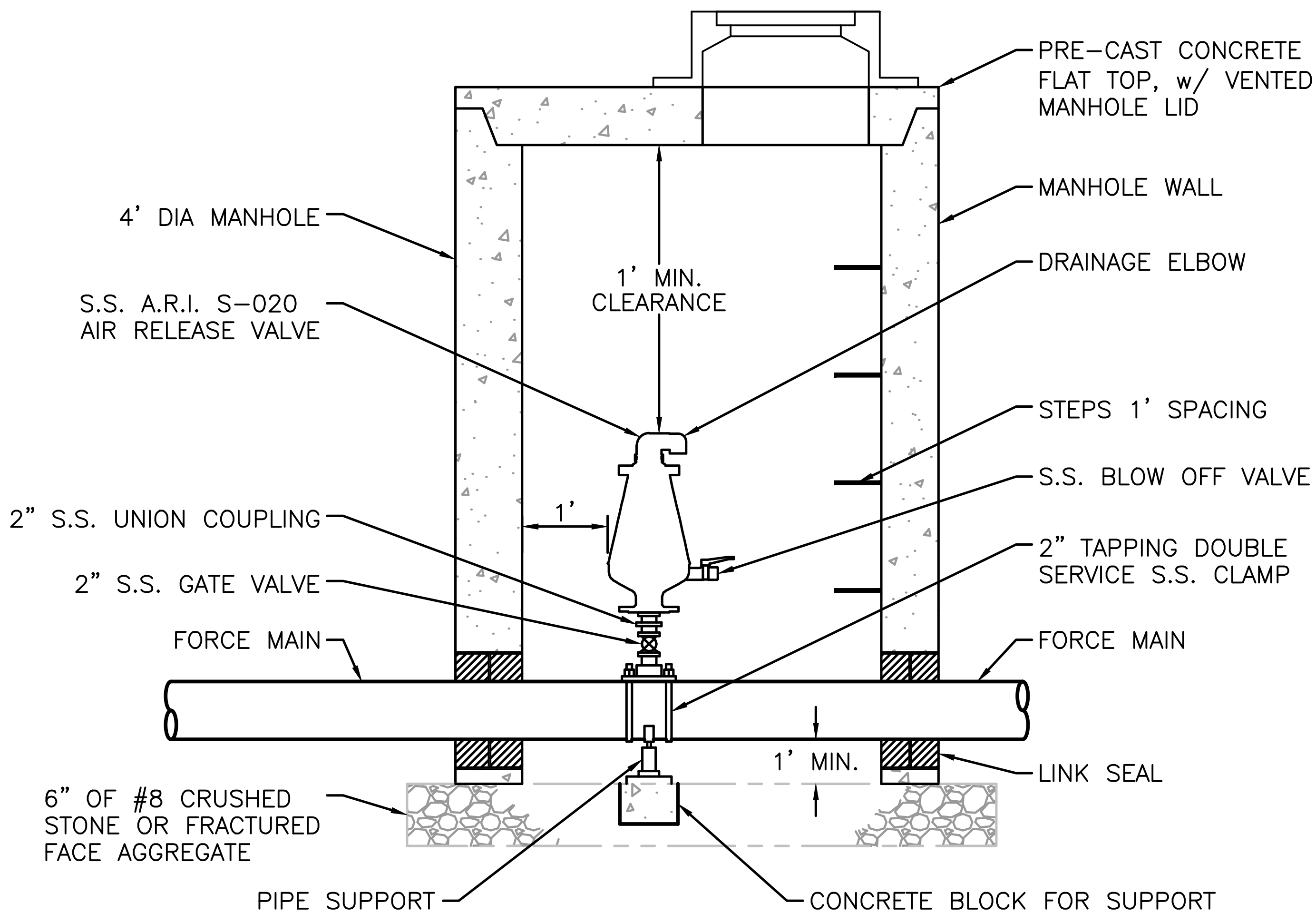
CITIZENS ENERGY GROUP

AIR RELEASE STATION – LOW PRESSURE SYSTEM

STANDARD DETAILS

FIGURE NO.

400.11



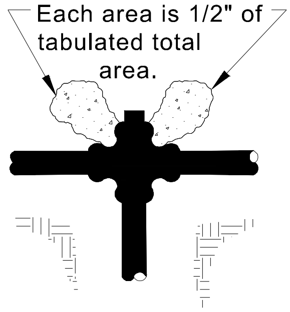
NOTE: FORCE MAINS 24-INCH AND GREATER SHALL USE THE LARGER MODEL ARI-S-025 TO ALLOW HIGHER VOLUMES OF AIR TO ESCAPE.

TYPICAL AIR RELEASE VALVE DETAIL

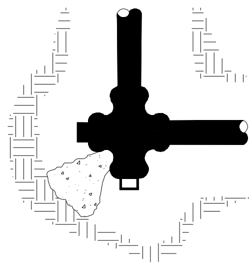
NOT TO SCALE

CITIZENS ENERGY GROUP
TYPICAL AIR RELEASE VALVE
STANDARD DETAILS

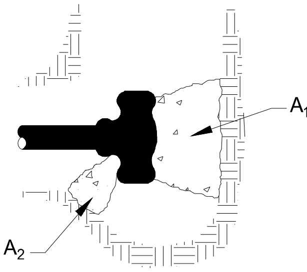
FIGURE NO.
400.12



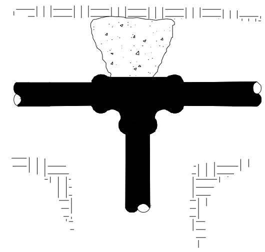
PLUGGED CROSS



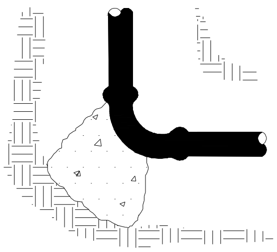
PLUGGED CROSS



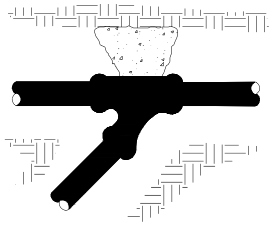
TEE



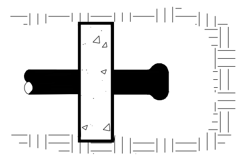
TEE



BEND



WYE



PLUG OR CAP

NOTES:

1) CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH.
2) KEEP CONCRETE CLEAR OF JOINT AND ACCESSORIES.
3) POLYETHYLENE ENCASEMENT SHALL BE PLACED BETWEEN CONCRETE AND FITTINGS.
4) ALL POURED IN PLACE CONCRETE SHALL HAVE A 28 DAY STRENGTH OF 3,000 P.S.I., 2" TO 4" SLUMP AND INCLUDE WIRE MESH FOR REINFORCEMENT.
5) MINIMUM SOIL BEARING SURFACE AREA REQUIREMENTS ARE PROVIDED BELOW BASED ON 150 P.S.I. WATER PRESSURE PLUS 100 P.S.I. WATER HAMMER AND SOIL BEARING CAPACITY OF 3,000 POUNDS PER SQUARE FOOT.

Minimum Soil Bearing Surface Area (ft2)
(Assuming 3,000 psf Soil Bearing Capacity)

Pipe Size	Horizontal Bends			Tee or Dead End (Plug/Cap)
	22-1/2°	45°	90°	
6"		6	8	6
8"		6	8	6
12"	4	6	11	8
16"	6	11	22	15
20"	9	18	36	24
24"	13	27	50	36
30"	20	45	76	57
36"	31	59	115	80

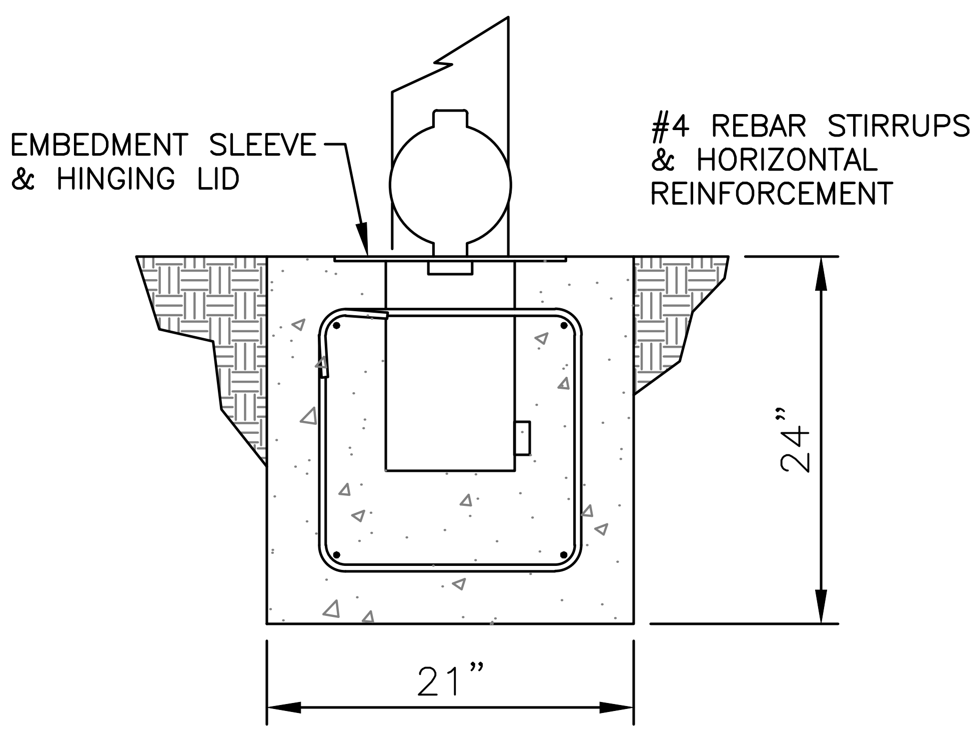
CITIZENS ENERGY GROUP

THRUST BLOCKING

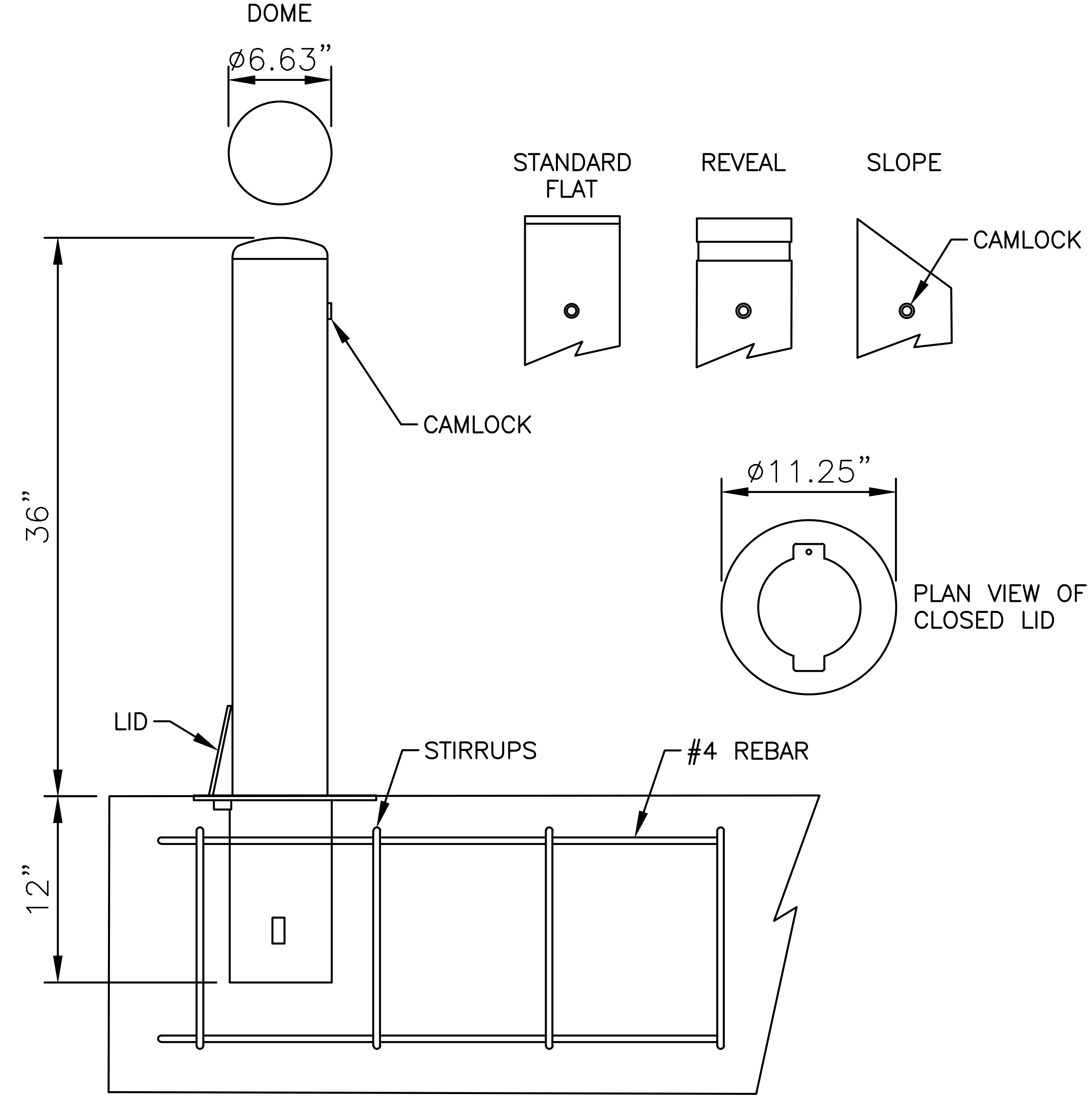
FIGURE 400.13

NOTE:

1. 1-800-BOLLARDS, INC. SERIES #XX-S060-XX OR APPROVED EQUAL.



END VIEW - FOUNDATION



ELEVATION VIEW - FOUNDATION (CONCEPTUAL DESIGN ONLY)

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Filename
Project No.
Project Date

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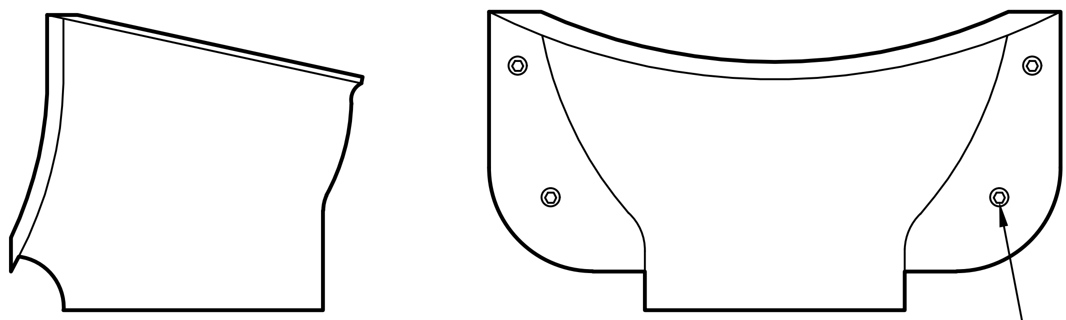
6-IN INTERNAL LOCKING REMOVABLE BOLLARD

STANDARD DETAILS

FIGURE NO.

400.14



DROP BOWL

NOTE:
RELINER/DURAN, INC. MANUFACTURER OR APPROVED EQUAL. ALL SIZES ARE FOR RETROFIT OR NEW CONSTRUCTION. FABRICATED IN MARINE GRADE FIBERGLASS AND FINISHED IN BRIGHT WHITE GEL COAT.

USE 4 RELINER ANCHOR ASSEMBLIES TO ATTACH DROP BOWL TO STRUCTURE WALL. USE RELINER STAINLESS STEEL PIPE BRACKETS TO SUPPORT DOWN PIPE. EXTERNAL PIPE COUPLER REQUIRED. PROVIDE SWEEP AT DOWN PIPE OUTLET.

OUTLET SIZES GREATER THAN 18-INCHES SHALL BE APPROVED BY THE UTILITY.

OUTLET SIZE	STRUCTURE DIAMETER	PART NUMBER
4-inch	6-8 feet	A4R96
6-inch	6-8 feet	A6R96
8-inch	6-8 feet	B8DBR84
10-inch	6-8 feet	B10R96
12-inch	4-6 feet	24/12R60
12-inch	7-8 feet	24/12R96
18-inch	4-6 feet	30/18R60
18-inch	7-8 feet	30/18R96

NOT TO SCALE

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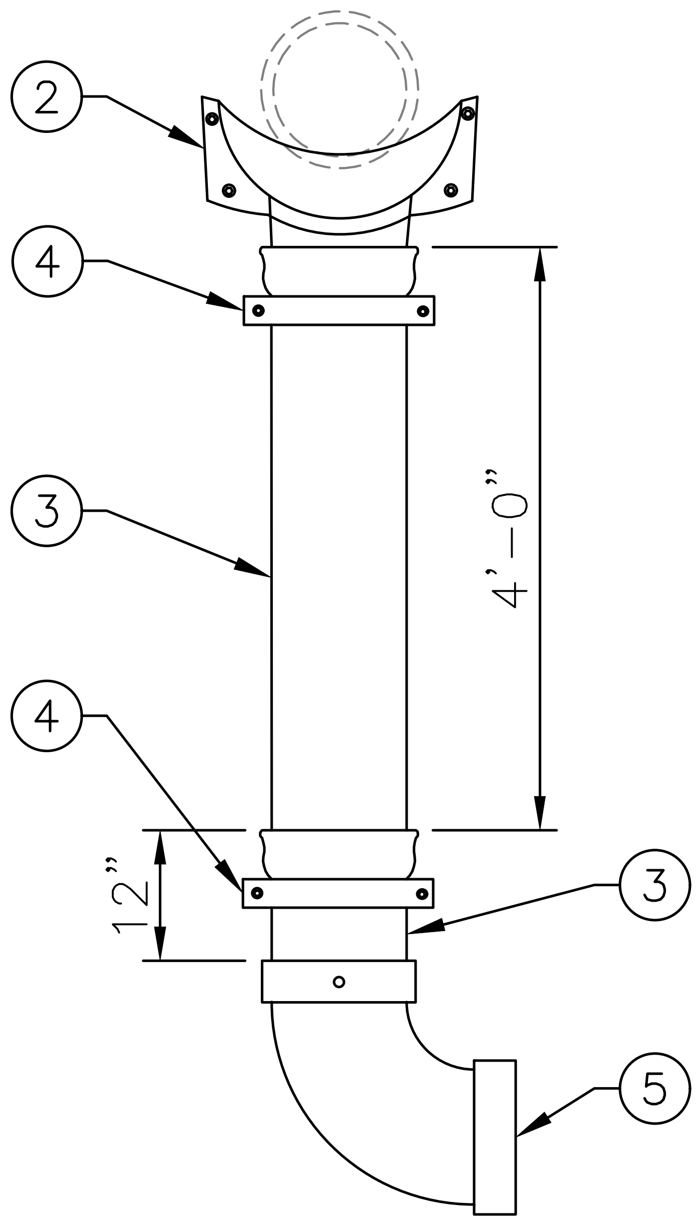
DROP BOWL FOR ROUND WALLS

FIGURE 400.15



CONSTRUCTION NOTES:

1. NEW DROP BOWL AND DROP PIPE TO BE INSTALLED WHILE WET-WELL IS IN SERVICE. CONTRACTOR TO USE FORCED AIR VENTILATION AND GAS MONITORING EQUIPMENT. DROP PIPE TO BE INSTALLED BELOW 10" INCOMING SEWER LINE.

2. INSTALL NEW DROP BOWL (RELINER DROP BOWL-B10R96). MOUNT TO WALL WITH 3/8" STAINLESS STEEL ANCHOR BOLTS.

3. INSTALL 10" PVC PIPE WITH BELL END, TWO SEGMENTS.

4. INSTALL STAINLESS STEEL PIPE BRACKETS. MOUNT TO WALL WITH 3/8" STAINLESS STEEL ANCHOR BOLTS.

5. INSTALL 10" PVC 45 OR 90 DEGREE ELBOW. ADD STAINLESS STEEL NUTS AND BOLTS TO SECURE ELBOW TO PIPE. ANGLE 15 DEGREE OFF OF WALL.

DROP BOWL AND PIPE INSTALLATION

NOT TO SCALE

Date	Checked By	Drawn By	Revision Description	Revision Number

Filename
Project No.
Project Date

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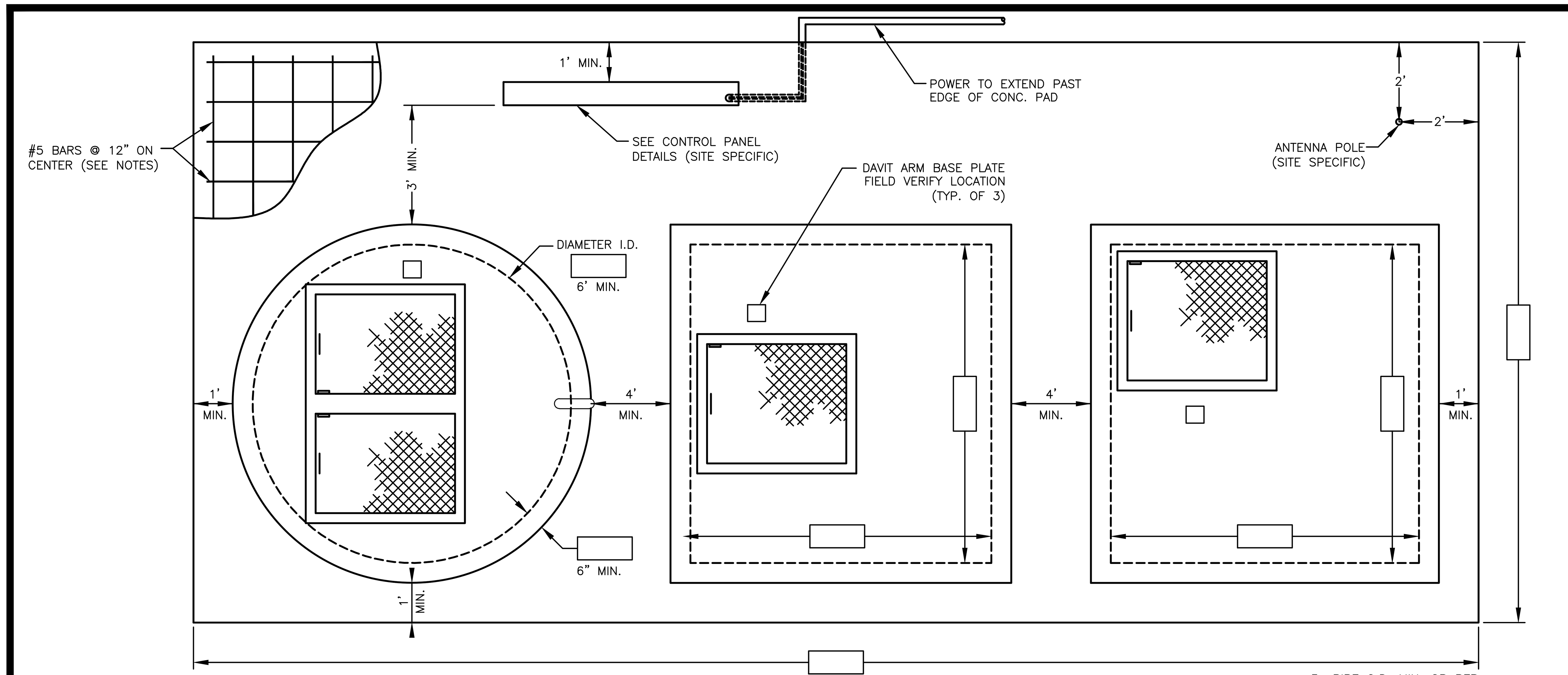
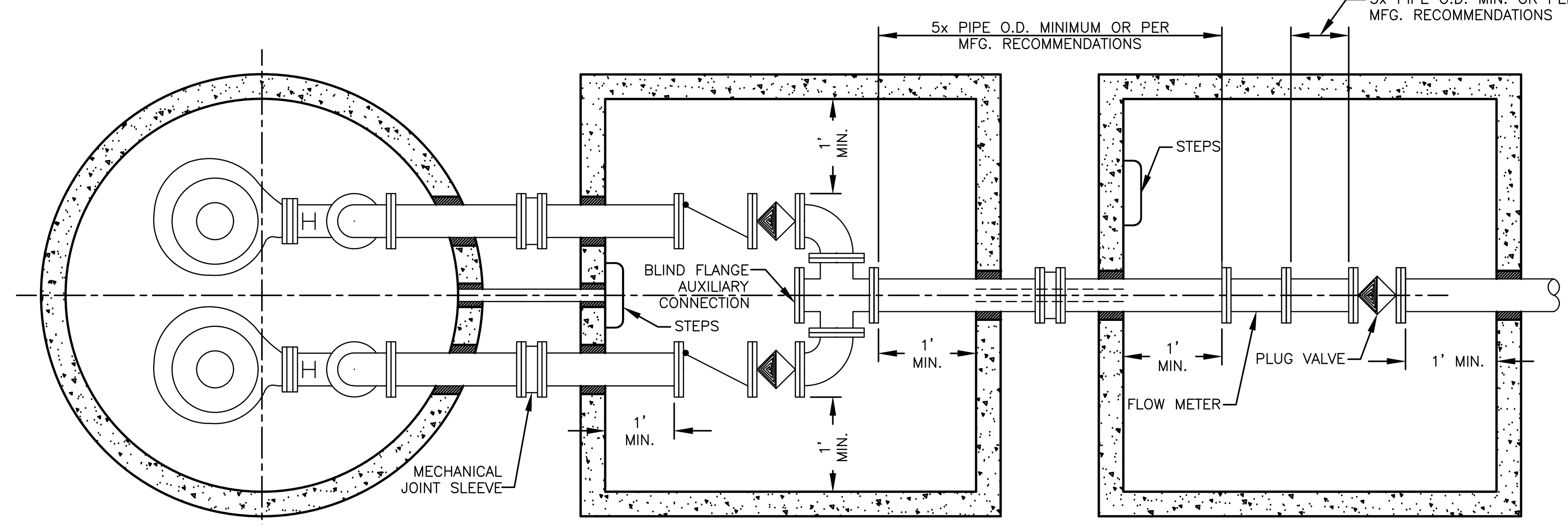
DROP BOWL AND PIPE INSTALLATION

STANDARD DETAILS

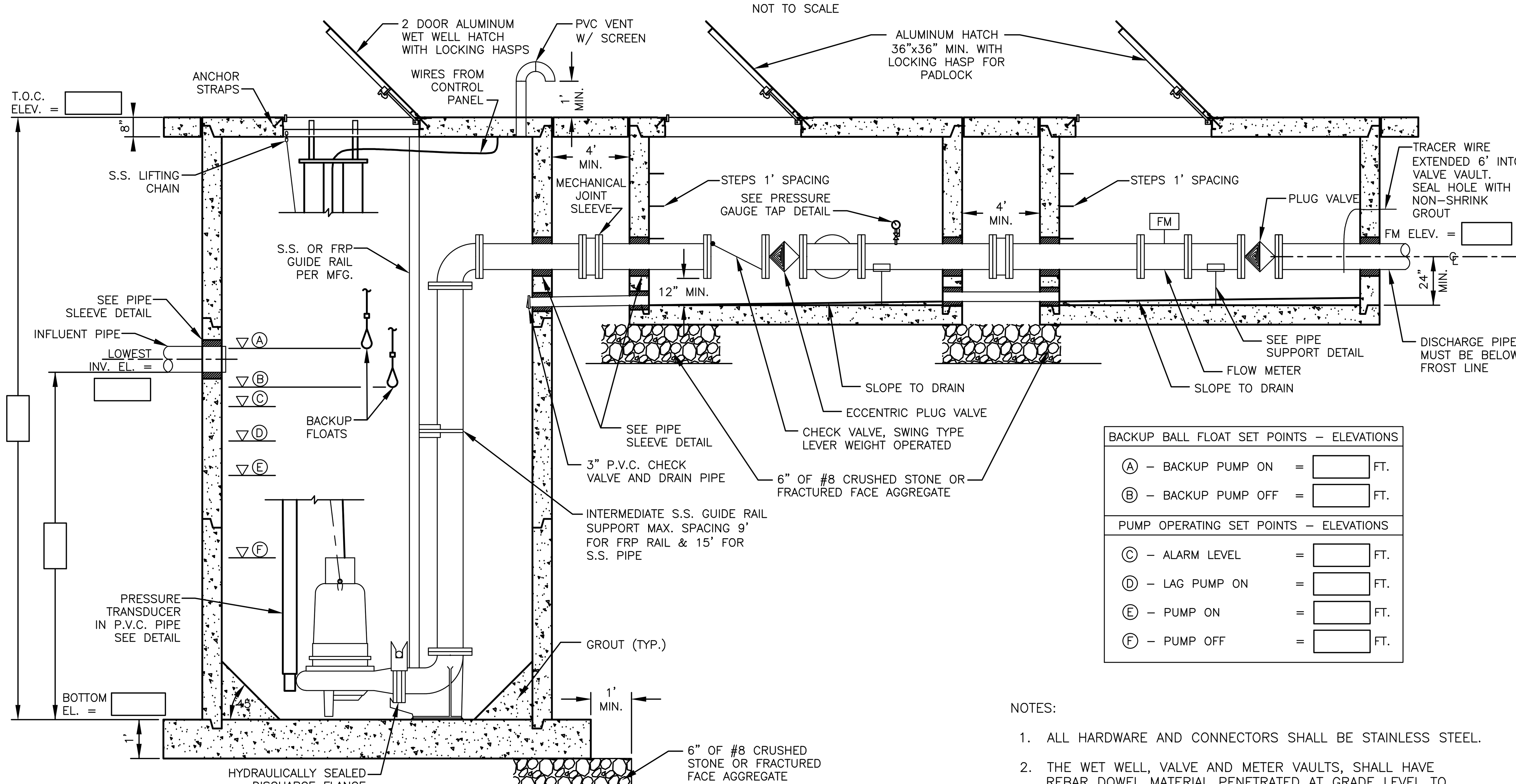
FIGURE NO.

400.16





PLAN VIEW
NOT TO SCALE



SECTION VIEW
NOT TO SCALE

BACKUP BALL FLOAT SET POINTS – ELEVATIONS		
Ⓐ – BACKUP PUMP ON	=	FT.
Ⓑ – BACKUP PUMP OFF	=	FT.
PUMP OPERATING SET POINTS – ELEVATIONS		
Ⓒ – ALARM LEVEL	=	FT.
Ⓓ – LAG PUMP ON	=	FT.
Ⓔ – PUMP ON	=	FT.
Ⓕ – PUMP OFF	=	FT.

NOTES:

1. ALL HARDWARE AND CONNECTORS SHALL BE STAINLESS STEEL.
2. THE WET WELL, VALVE AND METER VAULTS, SHALL HAVE REBAR DOWEL MATERIAL PENETRATED AT GRADE LEVEL TO CONNECT TO SURROUNDING REINFORCED CONCRETE PAD.

INFORMATION

COUNTY: ____________ TOWNSHIP: ____________

SECTION: ________ TWP: ________ RANGE: ________

PROJECT: ____________

LOCATION: ____________

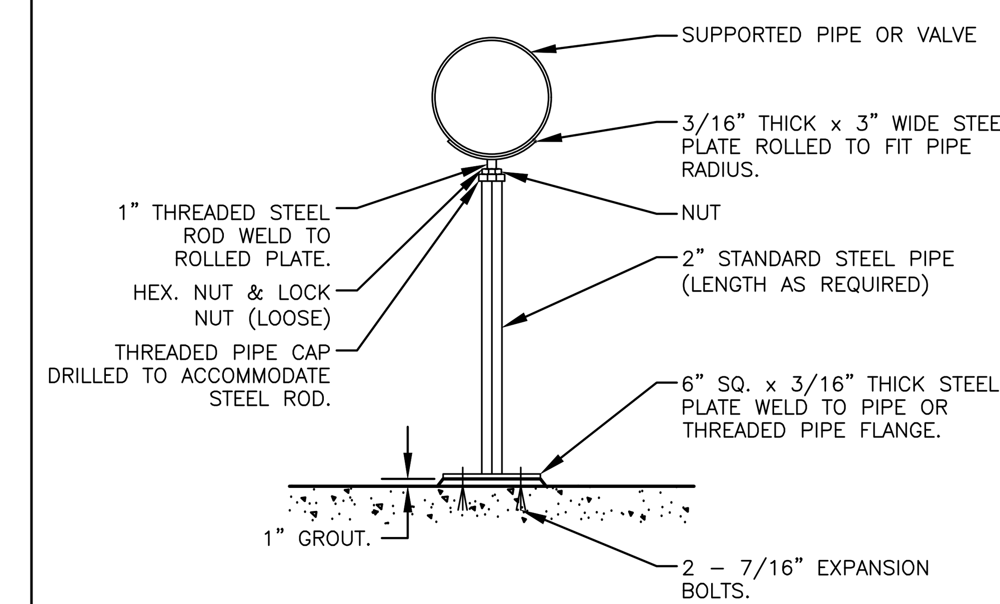
STATION PIPE SIZE, INCHES: ________ FORCE MAIN TYPE: ________

FORCE MAIN SIZE, INCHES: ________ LIFT STATION I.D.: ________

FORCE MAIN LENGTH, FEET: ________

PUMP DATA

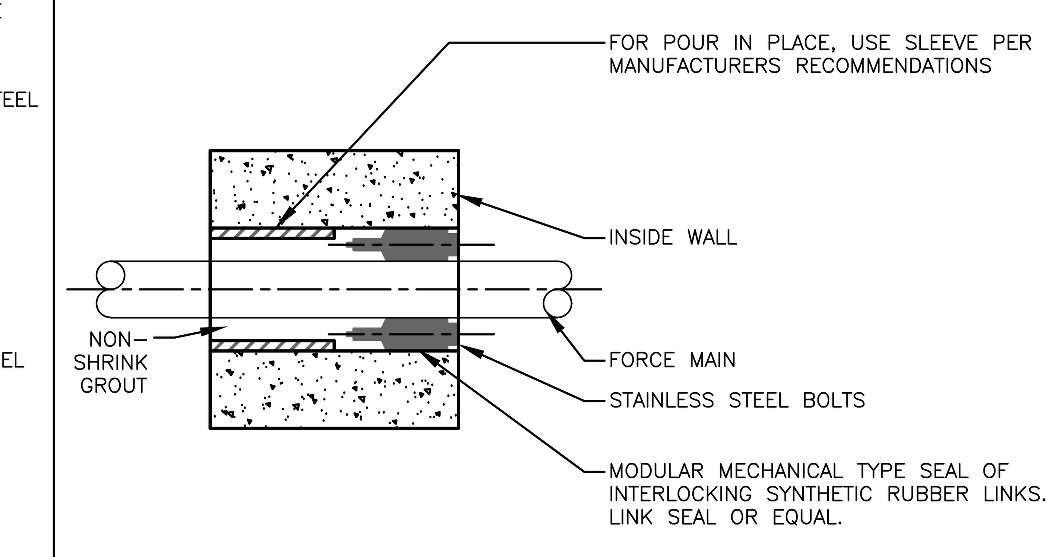
	INITIAL	ULTIMATE
DISCHARGE SIZE:		
GPM:		
TDH:		
HP:		
RPM:		
VOLTAGE:		
PHASE:		
MANUFACTURER:		
MODEL:		
IMPELLER SIZE:		



NOTES:

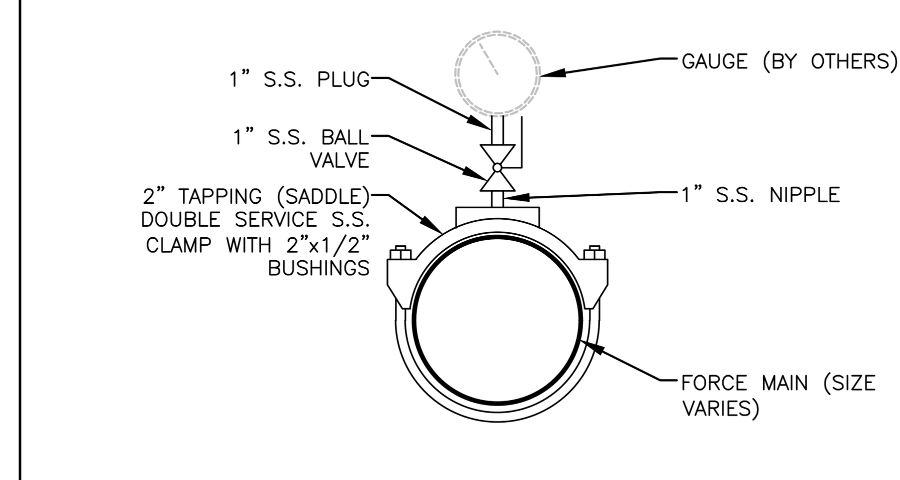
1. PIPE SUPPORTS SHALL BE SPACED NOT MORE THAN 12'-0" ON CENTER. PIPE TO BE SUPPORTED NEAR EACH SIDE OF VALVES, FLOW METERS, AND COUPLINGS.

ADJUSTABLE PIPE SUPPORT DETAIL
NOT TO SCALE



WALLS SHALL BE CORE DRILLED

PIPE SLEEVE DETAIL
FOR ALL WALL PENETRATIONS
NOT TO SCALE



PRESSURE GAUGE TAP DETAIL (TYP.)
NOT TO SCALE

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Revision Number	Revision Description	Drawn By	Checked By	Date

Filename

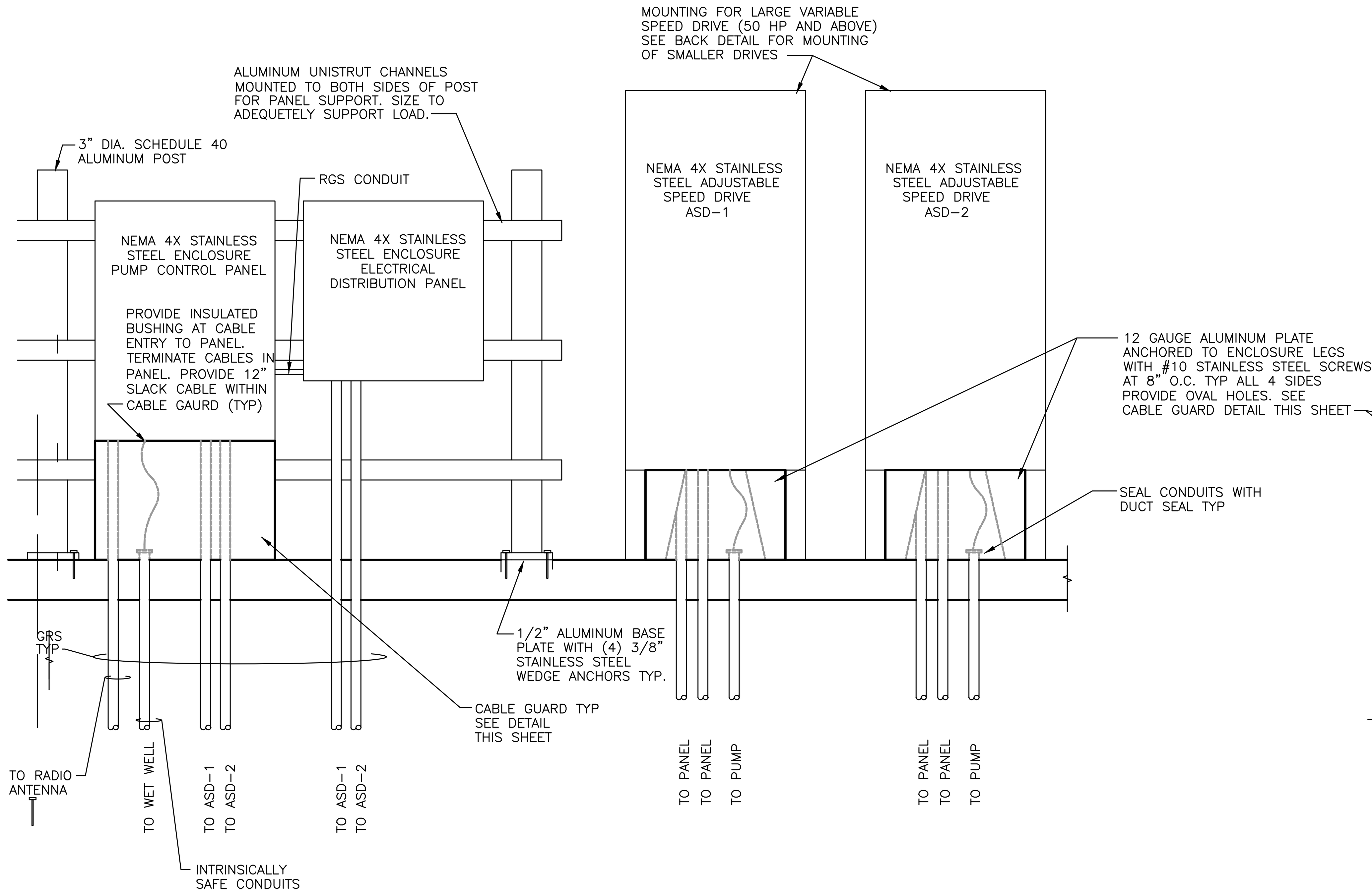
Project No.

Project Date

CITIZENS ENERGY GROUP
LEVEL 2 SUBMERSIBLE LIFT STATION
STANDARD DETAILS

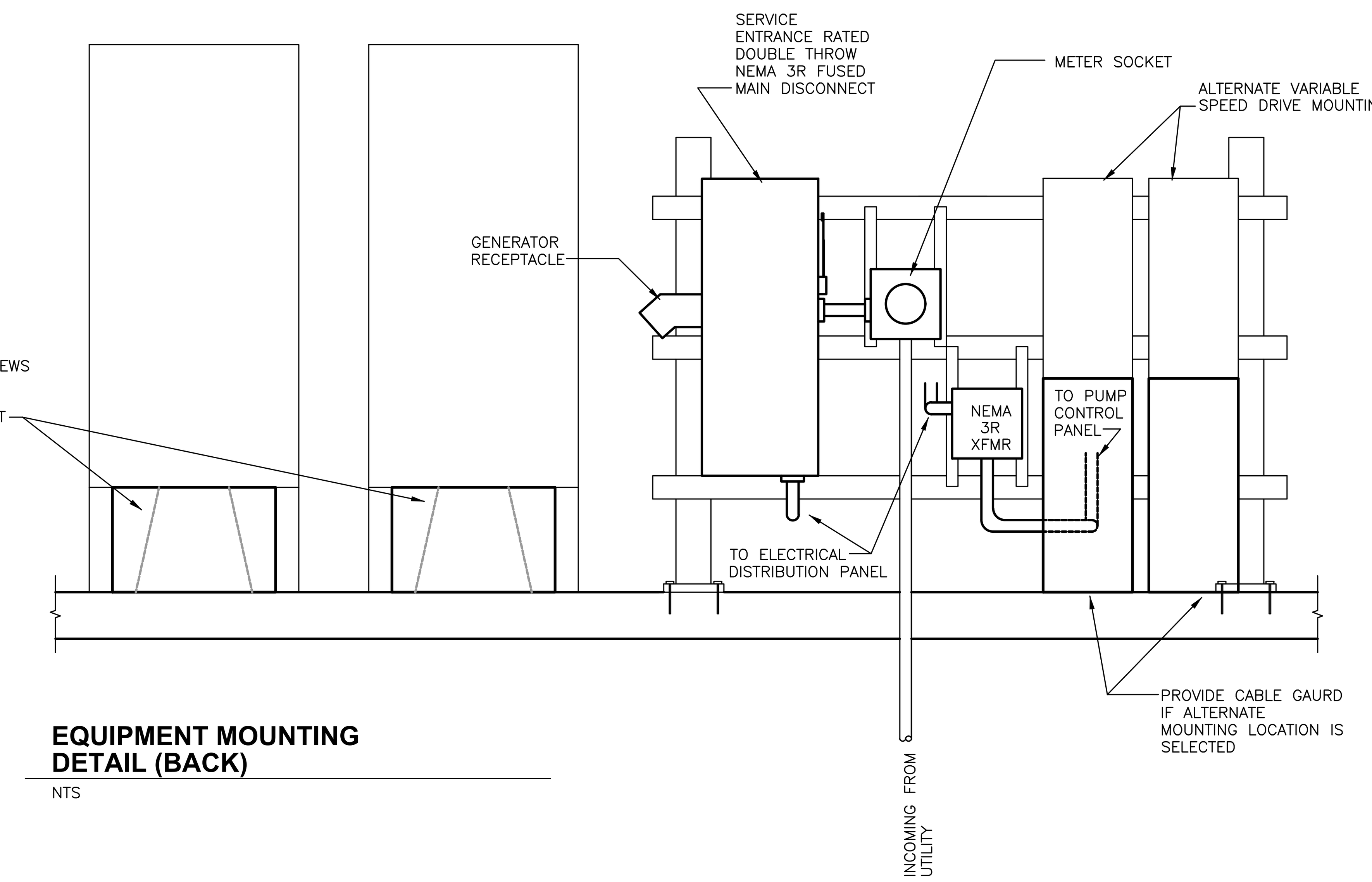
FIGURE NO.

500.011



EQUIPMENT MOUNTING DETAIL (FRONT)

NTS

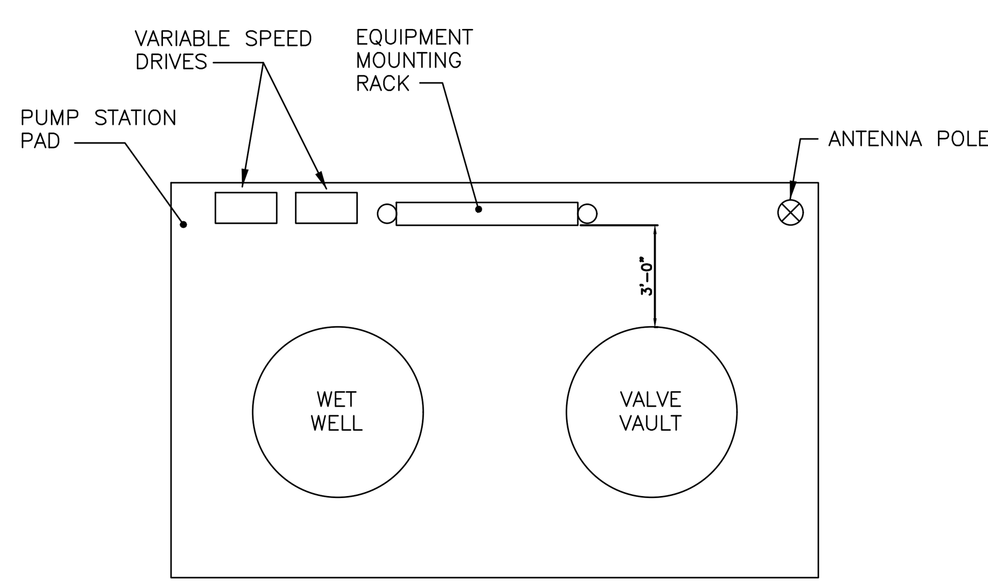


EQUIPMENT MOUNTING DETAIL (BACK)

NTS

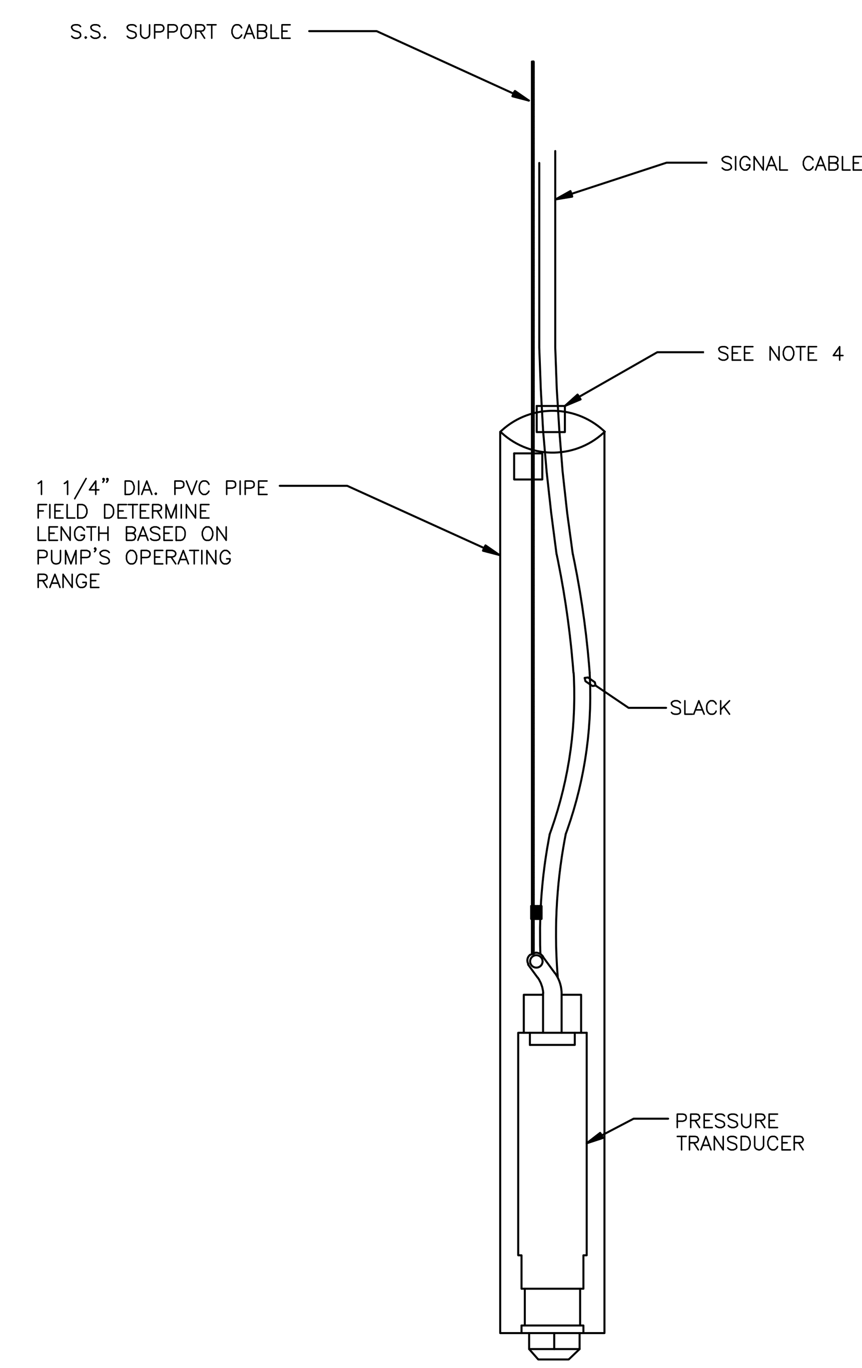
CABLE GUARD DETAIL

NTS



TYPICAL PLAN VIEW

NTS



PRESSURE TRANSDUCER DETAIL

NTS

NOTES:

1. SECURE GUARD TO EQUIPMENT ENCLOSURE WITH 1/4" S.S. BOLTS AND TO CONCRETE WITH 1/4" S.S. WEDGE ANCHORS.
2. PROVIDE VENT ON EACH SIDE.
3. FIELD DETERMINE GUARD DIMENSIONS BASED ON EQUIPMENT PANEL SIZE AND LOCATION.
4. CONSTRUCT GUARD WITH NON-FERROUS MATERIAL SUCH AS FIBERGLASS COMPOSITE, STAINLESS STEEL OR ALUMINUM BASED ON EQUIPMENT PANEL SIZE AND LOCATION.

BEFORE INSTALLATION

1. DO NOT DISASSEMBLE THE TRANSDUCER OR LOOSEN THE COMPRESSION NUT AT THE SIGNAL CABLE ENTRY. THIS WILL VOID WARRANTY.
2. DO NOT NICK OR CUT THE SIGNAL CABLE JACKET TO PREVENT LEAKAGE THAT WILL VOID WARRANTY. AVOID ROLLING THE CABLE SPOOL OVER ROCKS, STONES, OR OTHER SHARP OBJECTS.
3. CONFIRM THE CONNECTION BETWEEN THE TRANSDUCER SIGNAL CABLE LEADS AND THE METER OR TRANSMITTER TERMINALS TO ENSURE PROPER OPERATION. REFER TO OPERATOR'S MANUAL. IF NEEDED, DISCONNECT THE SIGNAL CABLE LEADS FROM THE METER OR TRANSMITTER BEFORE INSTALLATION. DO NOT CONNECT THE SIGNAL CABLE LEADS TO ANY OTHER POWER SOURCE.

INSTALLATION

4. DRILL HOLE NEAR TOP OF PVC PIPE (TYP. 2). LOOSELY SECURE THE FREE ENDS OF THE SIGNAL CABLE AND SUPPORT CABLE, IF APPLICABLE, WITH ZIP TIES BEFORE LOWERING INTO THE WET WELL. PROPER INSTALLATION WILL ALLOW RETRIEVAL OF TRANSDUCER FOR MAINTENANCE.
5. HANDLE THE SIGNAL CABLE AND TRANSDUCER WITH CARE DURING INSTALLATION.
6. FOR DEPTHS OVER 300 FEET, USE A SUPPORT CABLE TO CARRY THE WEIGHT OF THE TRANSDUCER. PROVIDE SLACK IN THE SIGNAL CABLE TO PREVENT THE TRANSDUCER'S WEIGHT FROM PULLING ON THE SIGNAL CABLE (SEE DETAIL. ALSO REFER TO THE OPERATOR'S MANUAL).
7. DO NOT ROUTE THE SIGNAL CABLE NEXT TO HIGH VOLTAGE POWER LINES.
8. PROVIDE MEANS TO REMOVE THE TRANSDUCER IF NEEDED IN THE FUTURE.

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Revision Number	Revision Description	Drawn By	Checked By	Date

Revision Date: 10/31/2018

CITIZENS ENERGY GROUP

LEVEL 2 SUBMERSIBLE LIFT STATION

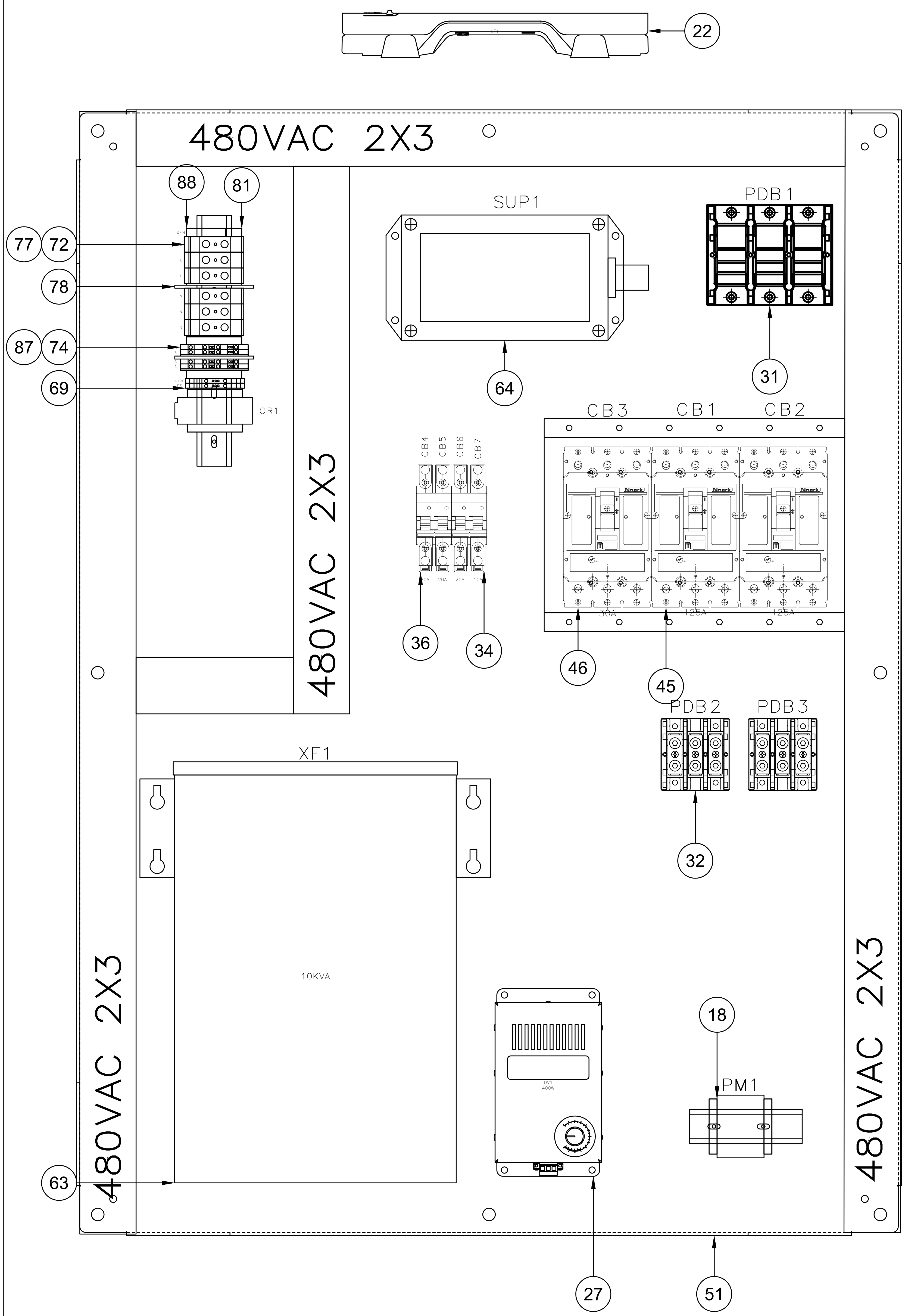
ELECTRICAL DETAILS

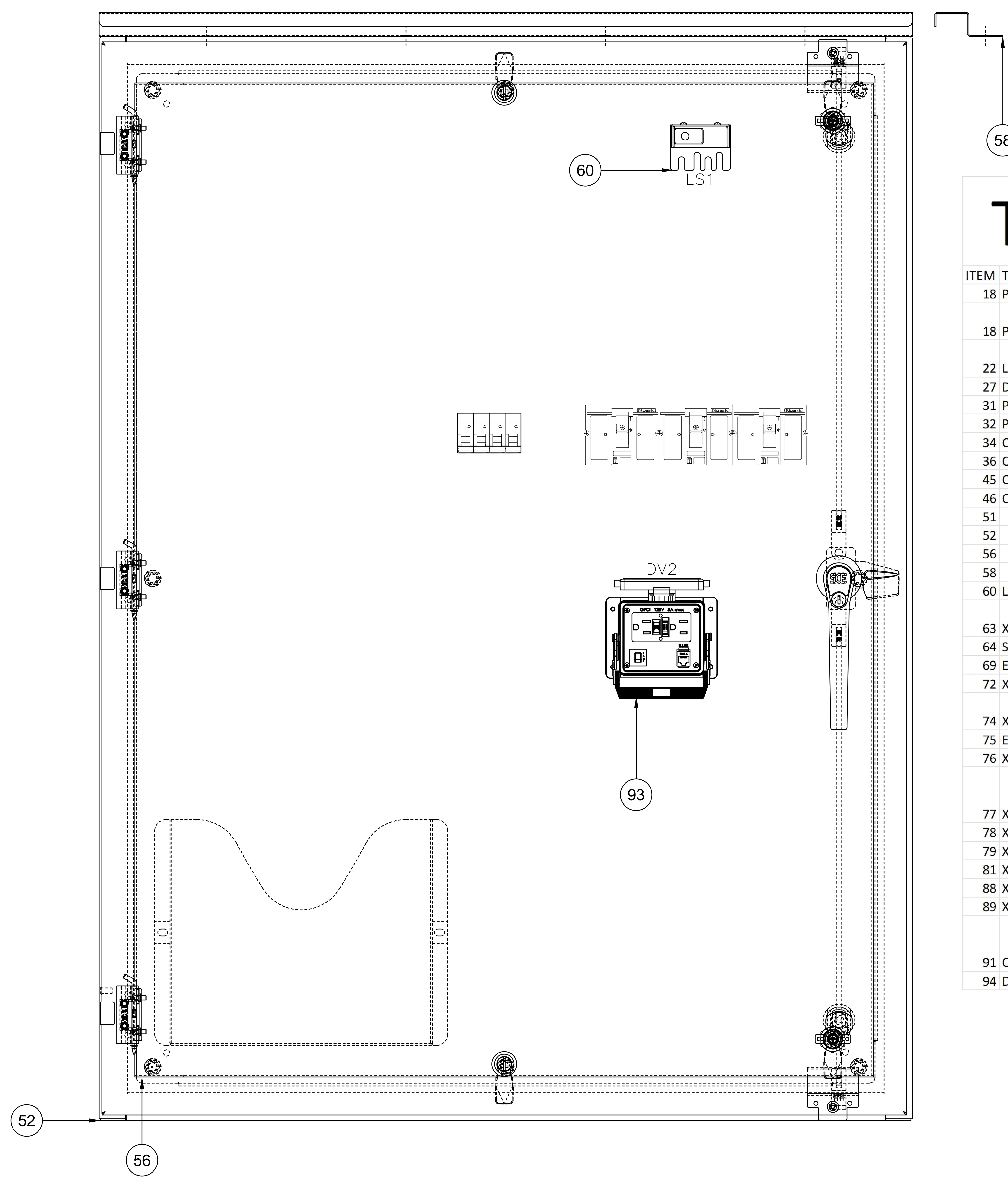
FIGURE NO.

500.012

CITIZENS ENERGY GROUP
CLSXXX
LEVEL 2 STANDARD

citizens energy group	NOTES:	TITLE: TABLE OF CONTENTS	DATE: 10/29/24
		DRAWING #: LEVEL 2 STANDARD-1	VERSION: 2025
		FIGURE 500.013 CEG LEVEL 2 LIFT STATION STANDARD	





TYPICAL BILL OF MATERIALS

ITEM	TAGS	QTY	SUB	CATALOG	ASSYCODE	MFG	DESC
18	PM1	1	1	SUA-440-ASA		ATC	PHASE MONITORING RELAY
18	PM1		1	700-HN125		AB	SCREW TERMINAL TUBE BASE SOCKET, OPEN STYLE CONSTRUCTION
22	LT1	1	1	7L4302302100		FINDER	PANEL LIGHT, 600 LUMENS, 6W, 110/240VAC/DC MOTION SWITCH WITH PUSH IN TERMINALS
27	DV1	1	1	DAH4001B		HOFFMAN	400W ELECTRIC HEATER, 120V
31	PDB1	1	1	LFD35533Z	LPBC33	LITTELFUSE	1LINE 6 LOAD POWER DISTRIBUTION BLOCK
32	PDB2,PDB3	2	1	LFS25723Z		LITTELFUSE	PWR SPLICE BLOCK 3POS 175A 600V
34	CB7	1	1	B1N1C10		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
36	CB4,CB5,CB6	3	1	B1N1C20		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
45	CB1,CB2	2	1	M1N125T3L		NOARK	M1N SERIES MCCB, UL489, 3 POLE, LUG-LINE/LOAD CONNECTION
46	CB3	1	1	M1N30T3L		NOARK	M1N SERIES MCCB, UL489, 3 POLE, LUG-LINE/LOAD CONNECTION
51		1	1	SCE-48P36		SAGINAW CON	BACK PANEL THAT FITS 48X36 ENCLOSURE
52		1	1	SCE-48EL3612SSLPPL		SCE	S.S. LPPL Enclosure
56		1	1	SCE-DF48EL36LP		SCE	DEAD FRONT PANEL
58		1	1	SCE-DS36SS		SCE	SHIELD, SS DRIP
60	LS1	1	1	SCE-LSA		SCE	ASSEMBLY, LIGHT SWITCH
63	XF1	1	1	HS5F10AS		SolaHD	10KVA NON VENTILATED AUTOMATION TRANSFORMER, 240 X 480V PRIMARY, 120/240V SECONDARY
64	SUP1	1	1	STMB9-3N4-64		SSI	STMx9 SERIES 90kA PER PHASE, TYPE 2 SPD, Ln =20kA
69	EDP	2	1	1020000000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 2.5
72	XFR	6	1	1020500000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 35
74	XFR	4	1	1041100000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDK 2.5 (W/ ZQV JUMPERS)
75	EDP	1	1	1050000000		WEIDMULLER	END PLATE/PARTITION - WAP 2.5-10
76	XFR	2	1	1050100000		WEIDMULLER	END PLATE/PARTITION - WAP 16-35
77	XFR	2	1	1053160000		WEIDMULLER	Cross-connector (terminal), when screwed in, yellow, 112 A, Number of poles: 10, Pitch in mm (P): 16.00, Insulated: Yes, Width: 9.85 mm
78	XFR	2	1	1058800000		WEIDMULLER	END PLATE/PARTITION - WTW
79	XFR	2	1	1059100000		WEIDMULLER	END PLATE/PARTITION - WAP
81	XFR	7	1	1061200000		WEIDMULLER	END BRACKET - WEW 35/2
88	XFR	2	1	1527690000		WEIDMULLER	PUSH IN JUMPER (10)
89	XFR	1	1	2593450000		WEIDMULLER	
91	CR1	1	1	8921050000		WEIDMULLER	RIDERSERIES RCM, Relay module, Number of contacts: 4, CO contact AgNi, Rated control voltage: 115 V AC, Continuous current: 6 A, Screw connection
94	DV2	1	1	ZP-PGA-32-201		ZIPport	PANEL INTERFACE CONNECTOR

NOTES:
ALL BREAKERS MUST BE RAISED TO SWING OUT PANEL VIA CUSTOM MADE BRACKET. NO ROD EXTENSIONS WILL BE ALLOWED.

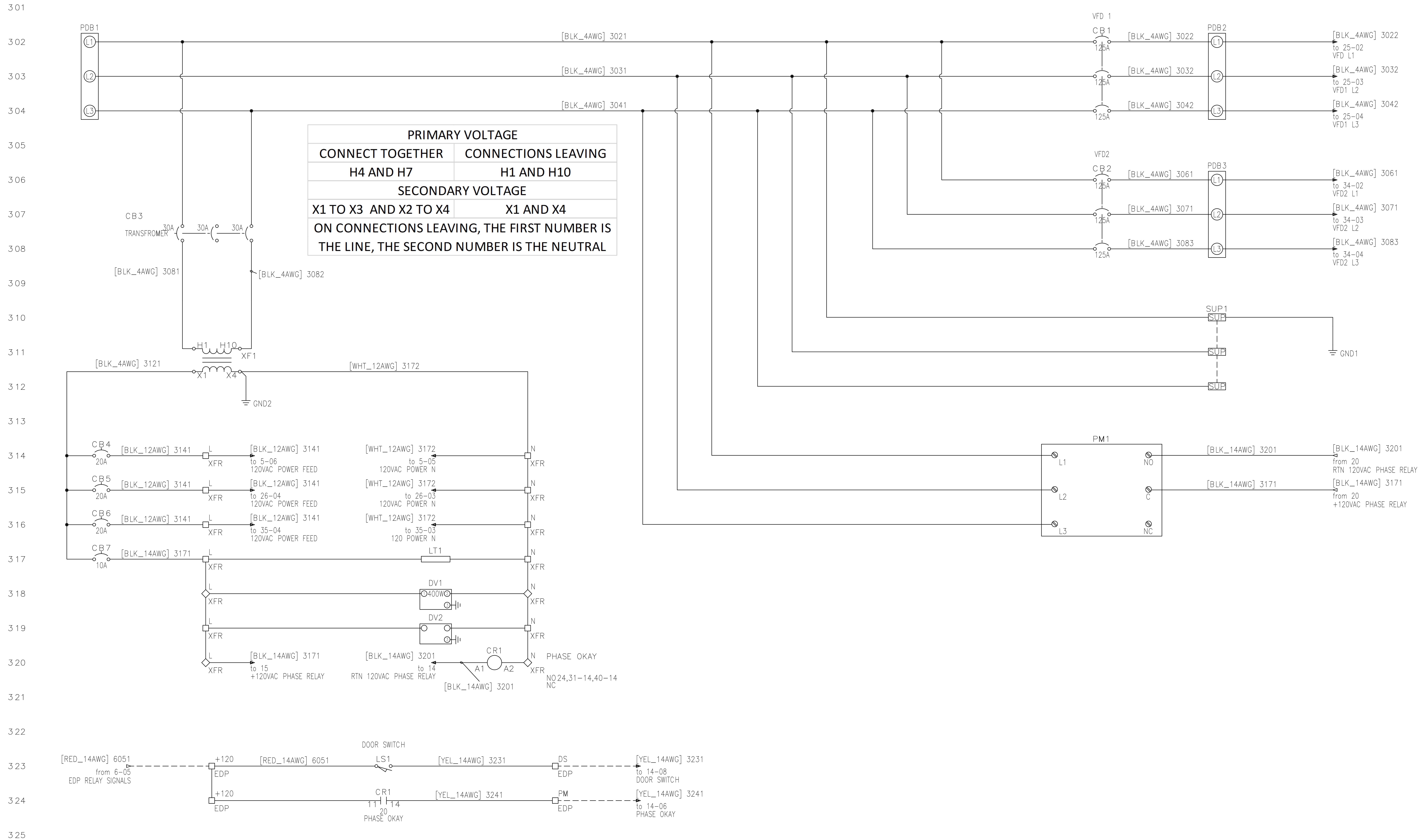
TITLE: PANEL ASSEMBLY

DATE: 10/29/24

DRAWING #: DISTRIBUTION PANEL-2

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



PRIMARY VOLTAGE	
CONNECT TOGETHER	CONNECTIONS LEAVING
H4 AND H7	H1 AND H10
SECONDARY VOLTAGE	
X1 TO X3 AND X2 TO X4	X1 AND X4
ON CONNECTIONS LEAVING, THE FIRST NUMBER IS THE LINE, THE SECOND NUMBER IS THE NEUTRAL	

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NOTES:
- ALL AC SIGNALS POWERED FROM OUTSIDE OF THE PANEL MUST BE WIRED INTERNALLY WITH YELLOW WIRE
- ALL DC SIGNALS POWERED FROM OUTSIDE OF THE PANEL MUST BE WIRED INTERNALLY WITH ORANGE WIRE
- BLUE AND RED DESIGNATION ON THIS PAGE SHOW WHAT WIRE COLOR THE ASSOCIATED WIRE IS WITHIN THE PLC PANEL

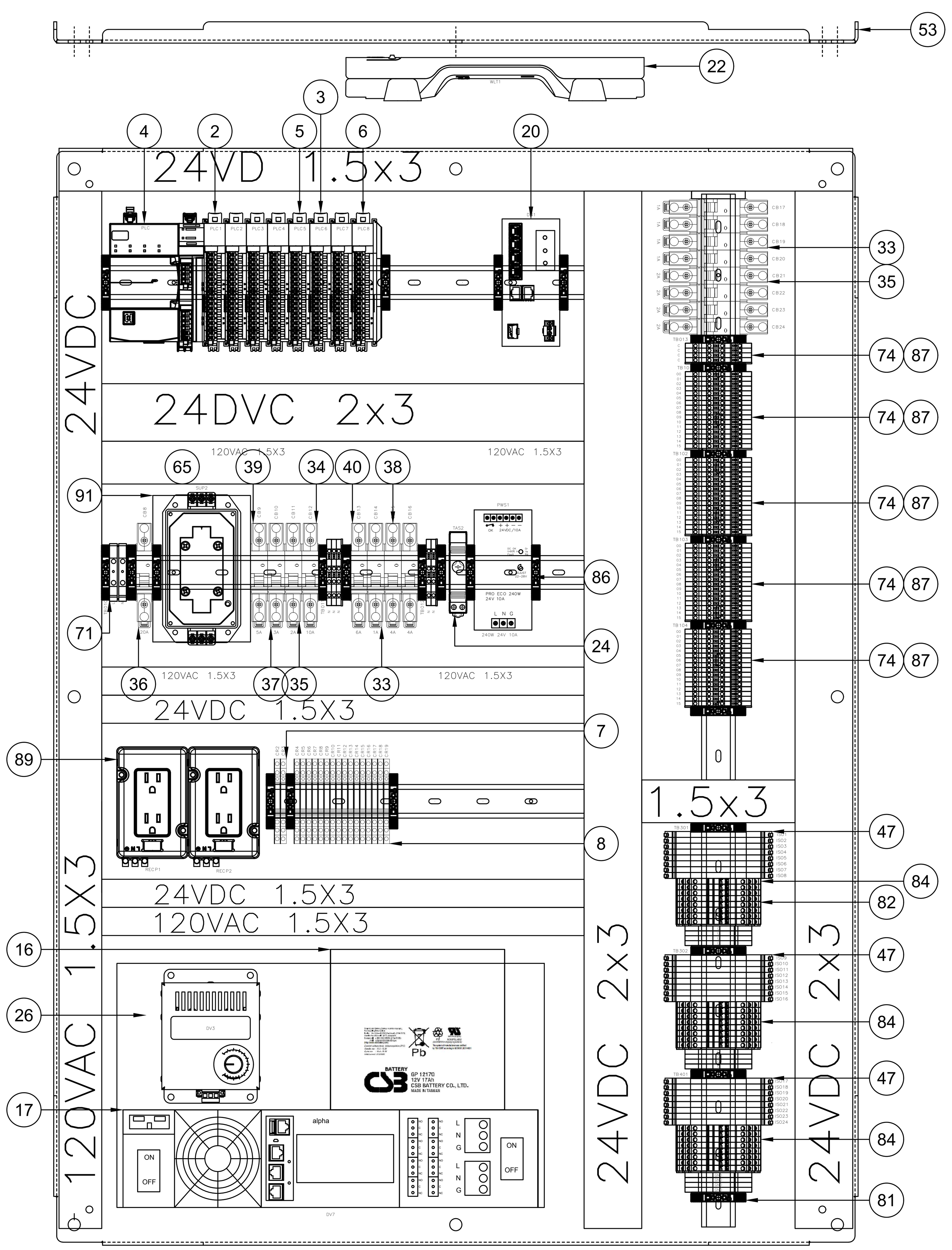
TITLE: POWER CIRCUIT

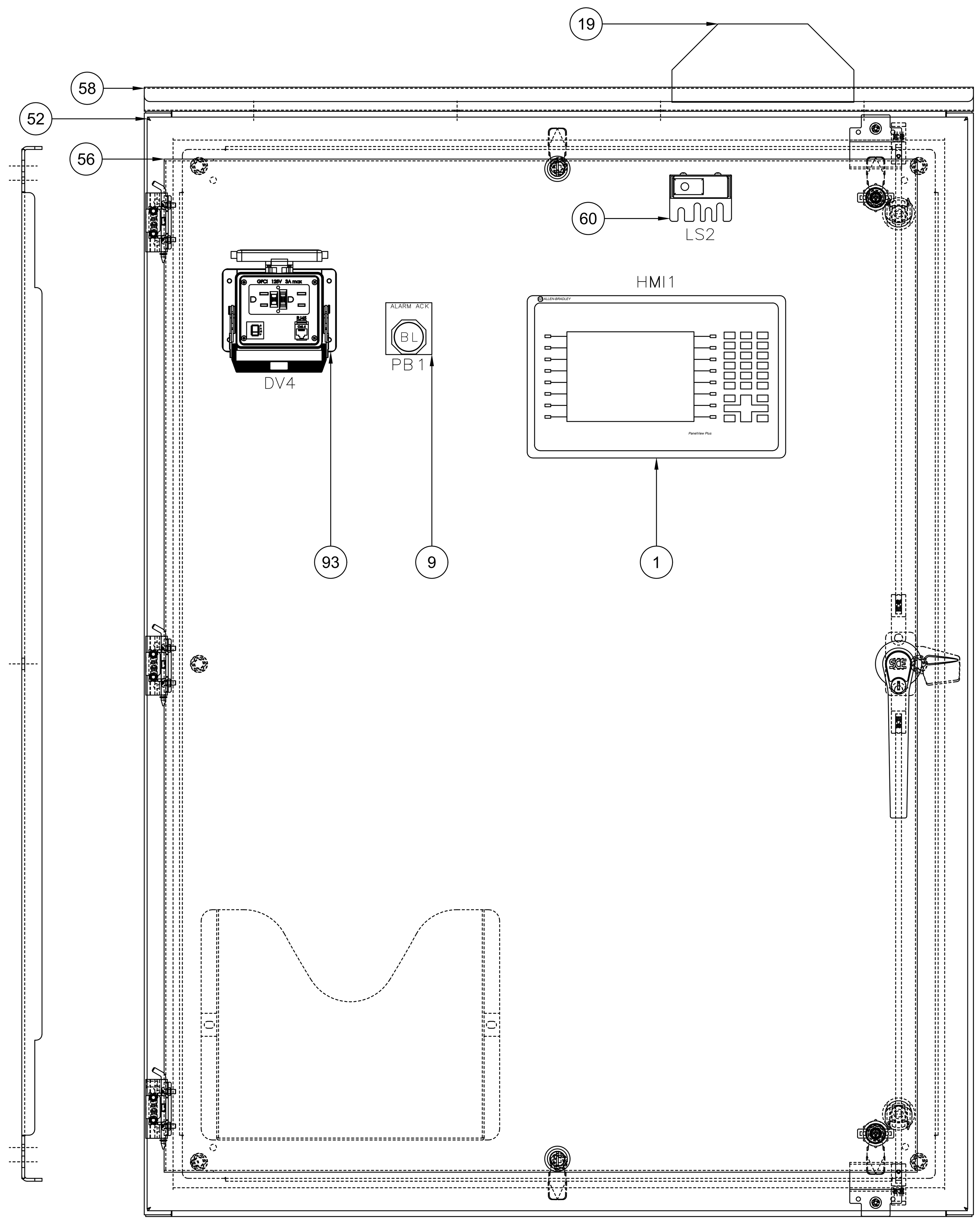
DATE: 10/29/24

DRAWING #: DISTRIBUTION PANEL-3

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD





TYPICAL BILL OF MATERIALS

ITEM	TAGS	QTY	SUB	CATALOG	ASSYCODE	MFG	DESC
1	HMI1	1	1	2711P-B7C22D9P		AB	PANELVIEW PLUS 7 GRAPHIC TERMINAL
2	PLC1,PLC2,PLC3,PLC4	4	1	5069-IB16	5069-RTB18-SCREW	AB	16CH COMPACT I/O INPUT 24V DC SINK
3	PLC6,PLC7	2	1	5069-IF8	5069-RTB18-SCREW	AB	COMPACT 5000 8 CHANNEL ANALOG INPUT
4	PLC	1	1	5069-L306ER	5069-RTB64-SCREW	AB	COMPACTLOGIX 600KB ETHERNET CONTROLLER
5	PLC5	1	1	5069-OB16	5069-RTB18-SCREW	AB	COMPACT I/O 16 CHANNEL 24VDC SOURCE OUTPUT MODULE
6	PLC8	1	1	5069-OF8	5069-RTB18-SCREW	AB	COMPACT 5000 8 CHANNEL ANALOG OUTPUT MODULE
7	CR2,CR3	2	1	700-HLT1U1		AB	HL TYPE TERMINAL BLOCK RELAY
8	CR4,CR5,CR6,CR7,CR8,CR9,CR10,CR11,CR12,CR13,CR14,CR15,CR16,CR17,CR18,CR19	16	1	700-HLT1Z24		AB	HL TYPE TERMINAL BLOCK RELAY
9	PB1	1	1	800H-AR2A		AB	PUSH BUTTON - MOMENTARY, NEMA 4/4X
16		1	1	181-025-10		ALPHA	BATTERY, 12V, 17Ah, STANDAR LIFE GENERAL PURPOSE VRLA AGM
17	DV7	1	1	FXM-650		ALPHA	UPS, POWER MODULE ONLY
17	DV7		1	740-767-22		ALPHA	BATTERY CABLE KIT, FXM650, 24VDC
19		1	1	ANT-2-4G2-0		CISCO	CELLUAR DOME ANTENNA
20	DN1	1	1	IR1101		CISCO	RUGGED SERIES ROUTER
22	WLT1	1	1	7L4302302100		FINDER	PANEL LIGHT, 600 LUMENS, 6W, 110/240VAC/DC MOTION SWITCH WITH PUSH IN TERMINALS
24	TAS2	1	1	7T8100002402		FINDER	THERMOSTAT, SPST-NC 10A, -20 C TO +60 C
26	DV3	1	1	DAH2001A		HOFFMAN	200W ELECTRIC HEATER, 120V
33	CB14,CB17,CB18,CB19,CB20	5	1	B1N1C1		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
34	CB12	1	1	B1N1C10		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
35	CB11,CB21,CB22,CB23,CB24	5	1	B1N1C2		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
36	CB8	1	1	B1N1C20		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
37	CB10	1	1	B1N1C3		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
38	CB15,CB16	2	1	B1N1C4		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
39	CB9	1	1	B1N1C5		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
40	CB13	1	1	B1N1C6		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
47	ISO1,ISO2,ISO3,ISO4,ISO5,ISO6,ISO7,ISO8,ISO9,ISO10,ISO11,ISO12,ISO13,ISO14,ISO15,ISO16,ISO17,ISO18,ISO19,ISO20,ISO21,ISO22,ISO23,ISO24	24	1	3104		PR	Isolation and conversion of standard DC signals
52		1	1	SCE-48EL3612SSLPPL		SCE	S.S. LPPL Enclosure
53		1	1	SCE-48P36		SCE	BACK PANEL THAT FITS 48X36 ENCLOSURE
56		1	1	SCE-DF48EL36LP		SCE	DEAD FRONT PANEL
58		1	1	SCE-DS36SS		SCE	SHIELD, SS DRIP
60	LS2	1	1	SCE-LSA		SCE	ASSEMBLY, LIGHT SWITCH
65	SUP2	1	1	USPT1P1-64		SSI	CONTROL PANEL INLINE SURGE
71	TB010	2	1	1020200000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 6
73	TB301,TB302,TB401	12	1	1036300000		WEIDMULLER	STANDARD DESIGN PROTECTIVE CONDUCTOR TERMINAL - WDK 2.5 PE
74	TB011,TB012,TB013,TB101,TB102,TB103,TB104	73	1	1041100000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDK 2.5 (W/ ZQV JUMPERS)
75	TB010	1	1	1050000000		WEIDMULLER	END PLATE/PARTITION - WAP 2.5-10
76	TB010	1	1	1050100000		WEIDMULLER	END PLATE/PARTITION - WAP 16-35
79	TB011,TB012,TB013,TB101,TB102,TB103,TB104	7	1	1059100000		WEIDMULLER	END PLATE/PARTITION - WAP
80	TB301,TB302,TB401	3	1	1059140000		WEIDMULLER	END PLATE FOR STANDARD DESIGN - WAP WDK 2.5 GN
81	TB010,TB011,TB012,TB013,TB102,TB103,TB104,TB301,TB302,TB401	27	1	1061200000		WEIDMULLER	END BRACKET - WEW 35/2
82	TB301,TB302,TB401	3	1	1063110000		WEIDMULLER	VSSC, End plate
84	TB301,TB302,TB401	24	1	1064170000		WEIDMULLER	Surge protection for measurement and control, UP(L/N-PE) 900 V
87	PWS1	1	1	1469490000		WEIDMULLER	Weidmuller Single Phase Power Supply, Switch Mode Power Supply Unit PRO ECO 240W 24V 10A
87	TB011,TB012,TB013,TB101,TB102,TB103,TB104	7	1	1527690000		WEIDMULLER	PUSH IN JUMPER (10)
88	TB103,TB104	2	1	1527690000		WEIDMULLER	PUSH IN JUMPER (10)
89	TB010,TB011,TB012,TB013,TB101,TB102,TB103,TB104,TB301,TB302,TB401	11	1	2593450000		WEIDMULLER	
90	RECP1,RECP2	2	1	6720005421		WEIDMULLER	15A, 120V DUAL OUTLET, DIN RAIL MOUNT, DRAC DP 15
92		1	1	DINP01-4060A		WINFORD	DIN RAIL MOUNT PLATE 4X6"
94	DV4	1	1	ZP-PGA-32-201		ZIPport	PANEL INTERFACE CONNECTOR

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NOTES:

- UPS MUST BE MOUNTED IN CUSTOM BUILT SHELF TO ALLOW FOR EASY ACCESS TO DISPLAY SCREEN AND BE LARGE ENOUGH AND STURDY ENOUGH FOR BATTERIES TO BE PLACED ON TOP OF IT.

TITLE: PANEL ASSEMBLY

DATE: 10/29/24

DRAWING #: PLC PANEL-4

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

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NOTES:

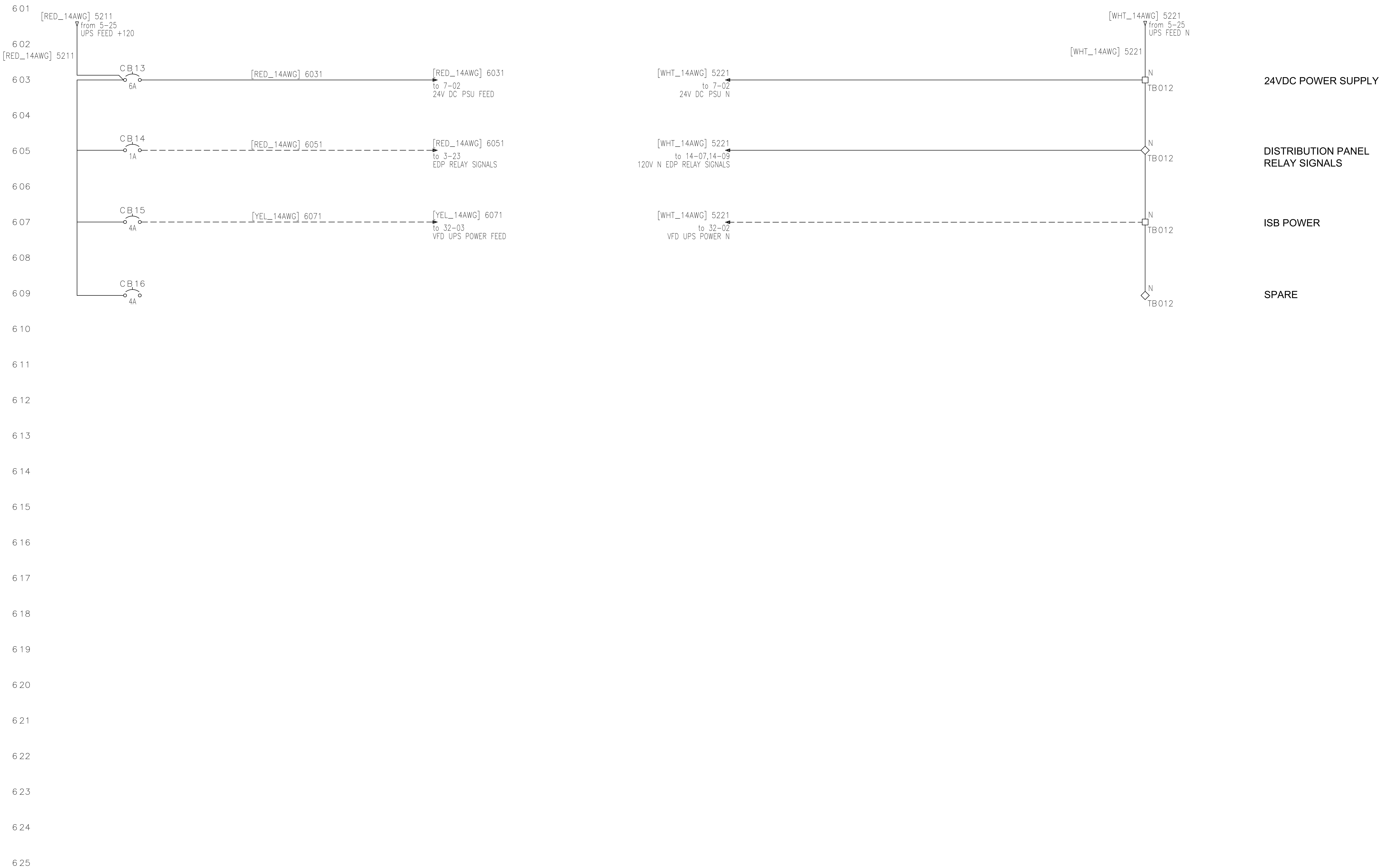
TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: PLC PANEL-5

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



citizens energy group™

NOTES:

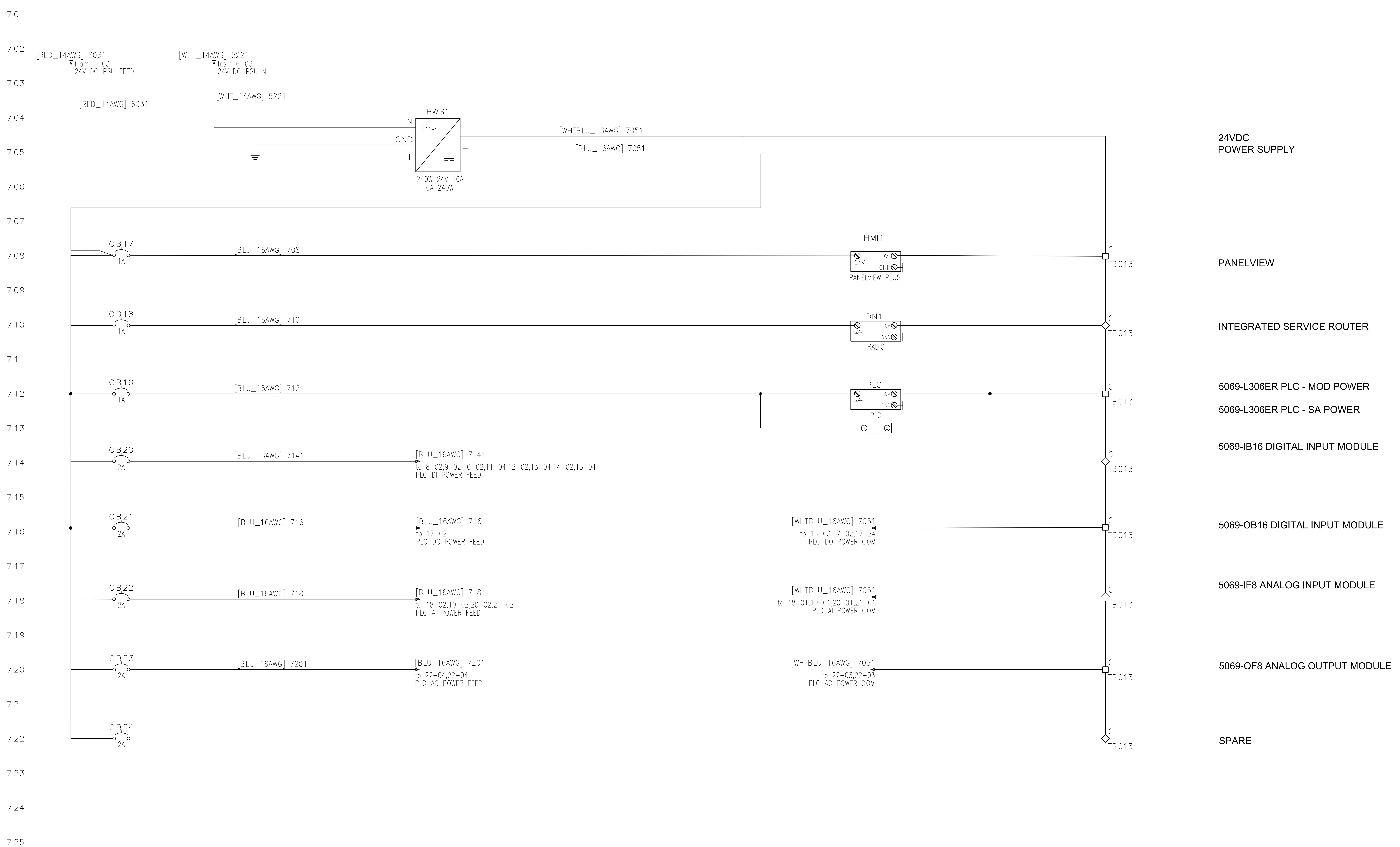
TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: PLC PANEL-6

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



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NOTES:

TITLE: POWER CIRCUIT 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-7

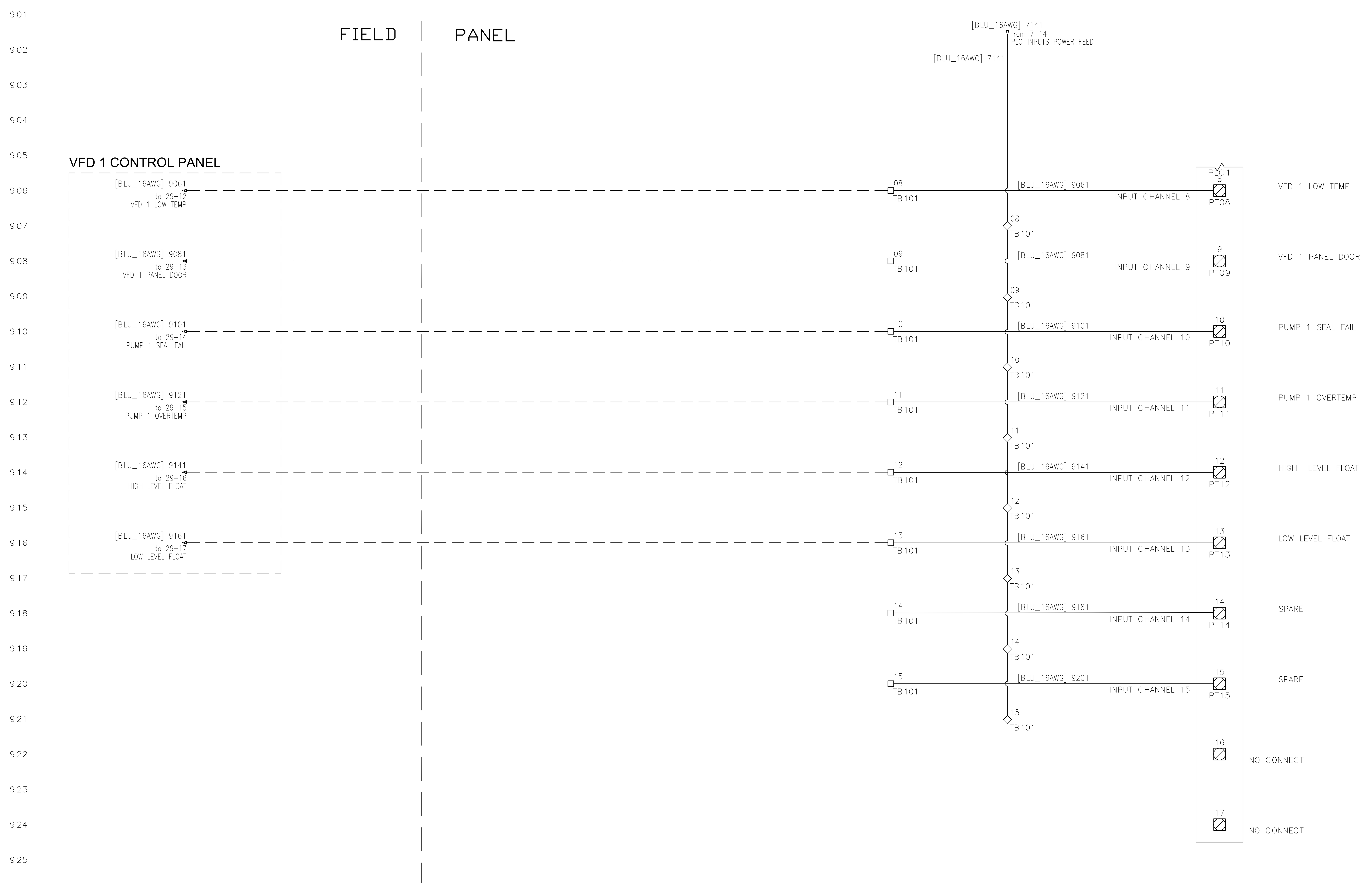
VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:1:I.

TITLE: DIGITAL INPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-8	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:1:I.

TITLE: DIGITAL INPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-9	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:2:I.

TITLE: DIGITAL INPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-10	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	

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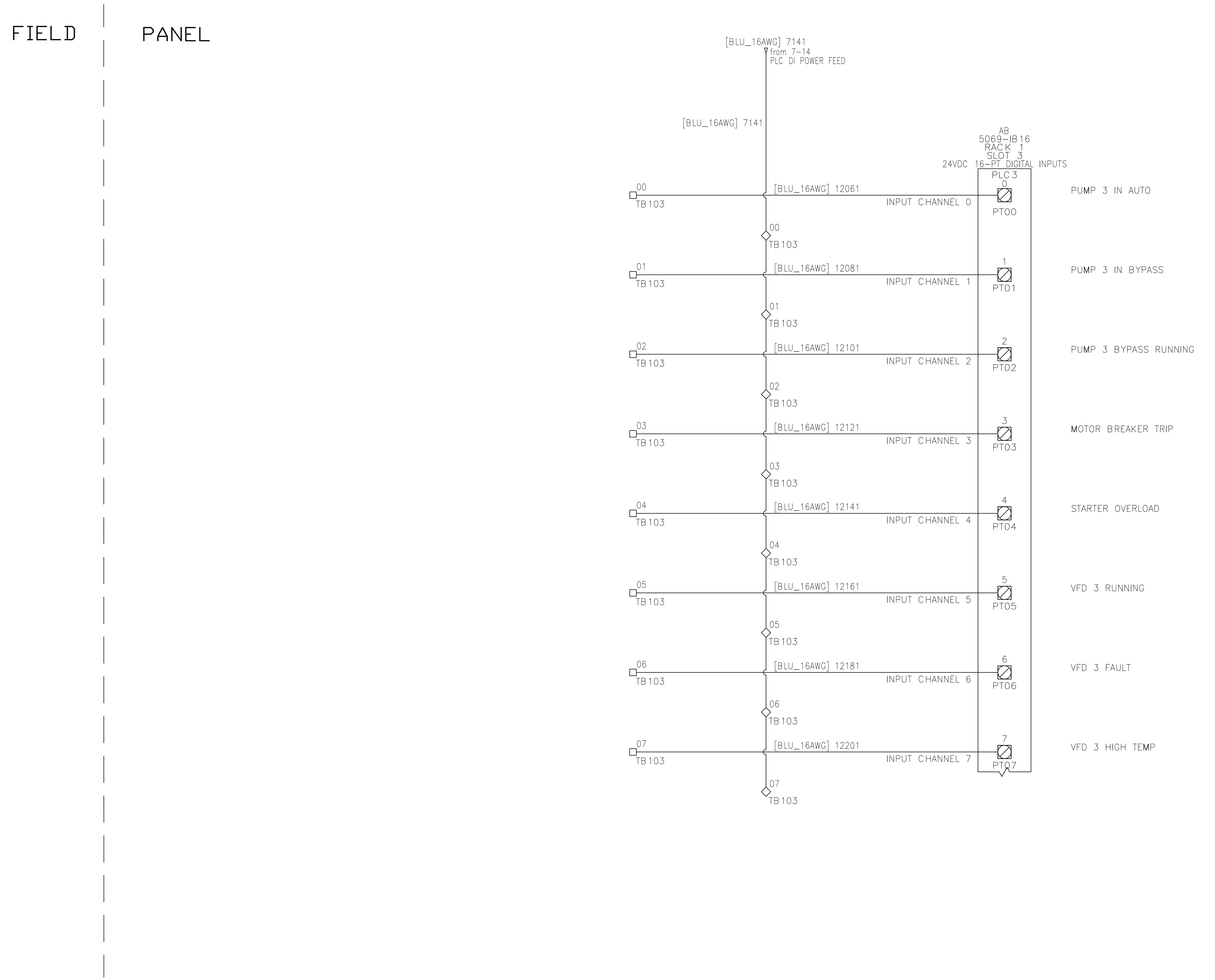
NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:2:I.

TITLE: DIGITAL INPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-11	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:3:I.

TITLE: DIGITAL INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-12

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:3:I.

TITLE: DIGITAL INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-13

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:4:I.

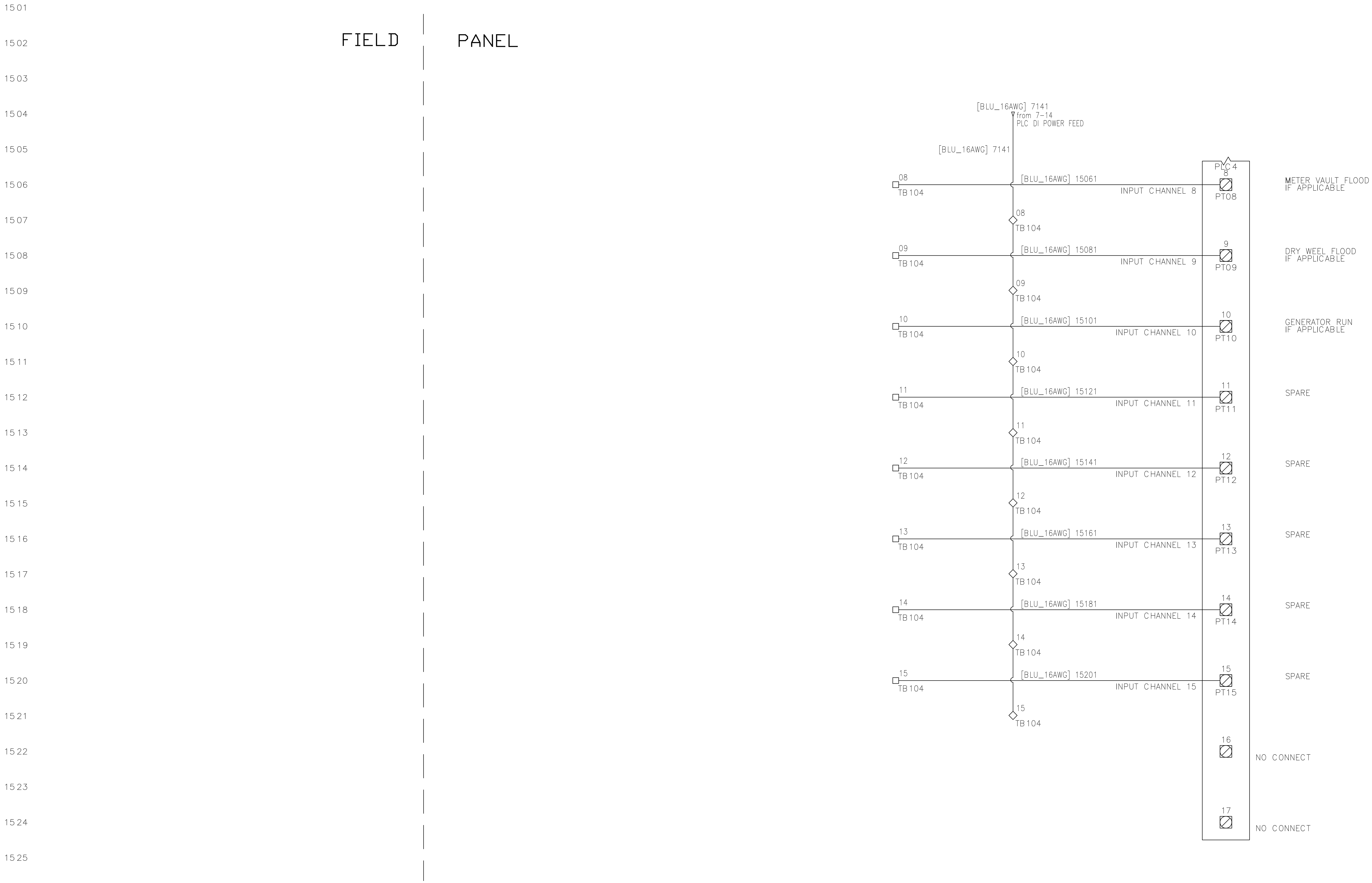
TITLE: DIGITAL INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-14

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:4:I.

TITLE: DIGITAL INPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-15	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:5:O.

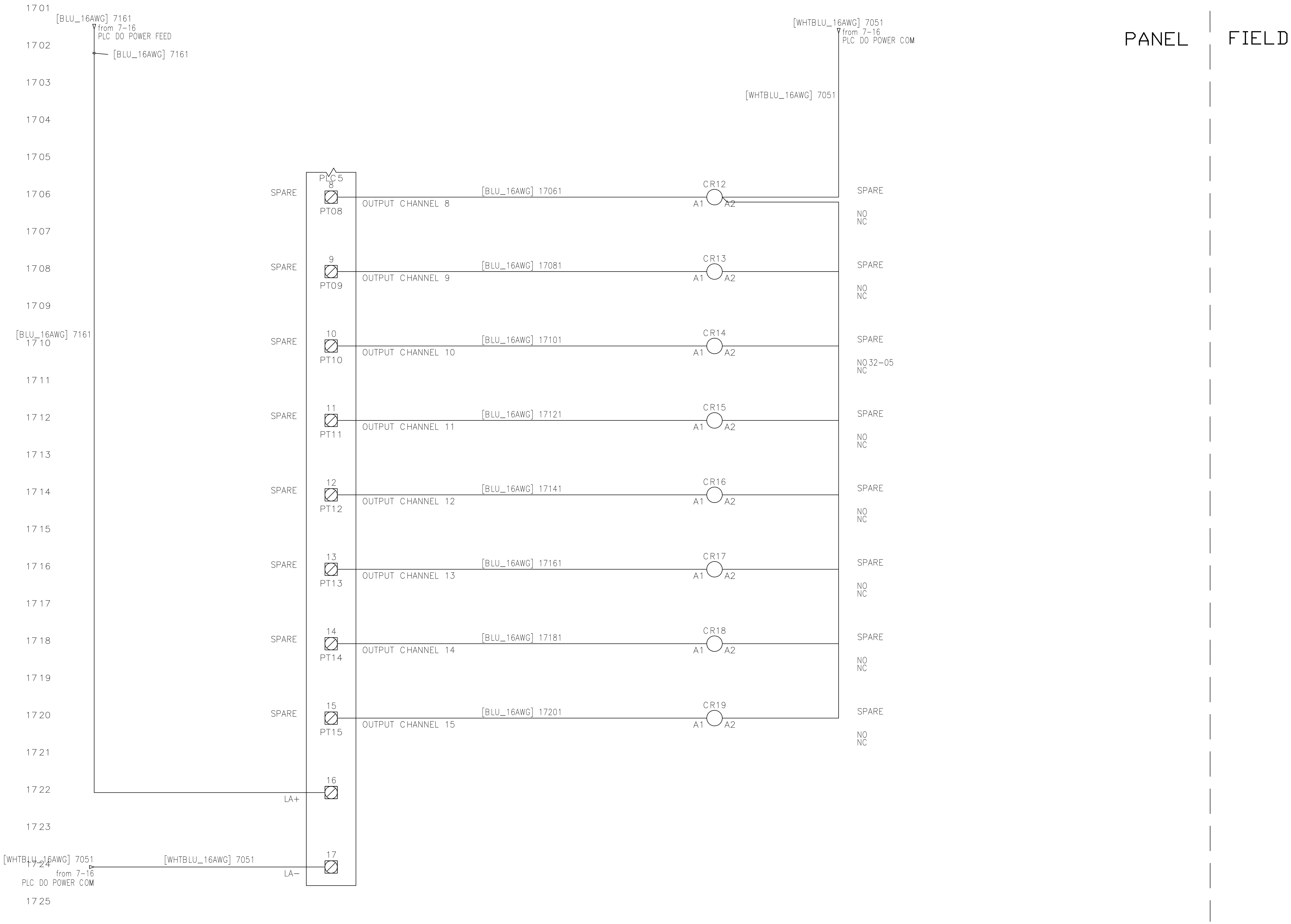
TITLE: DIGITAL OUTPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-16

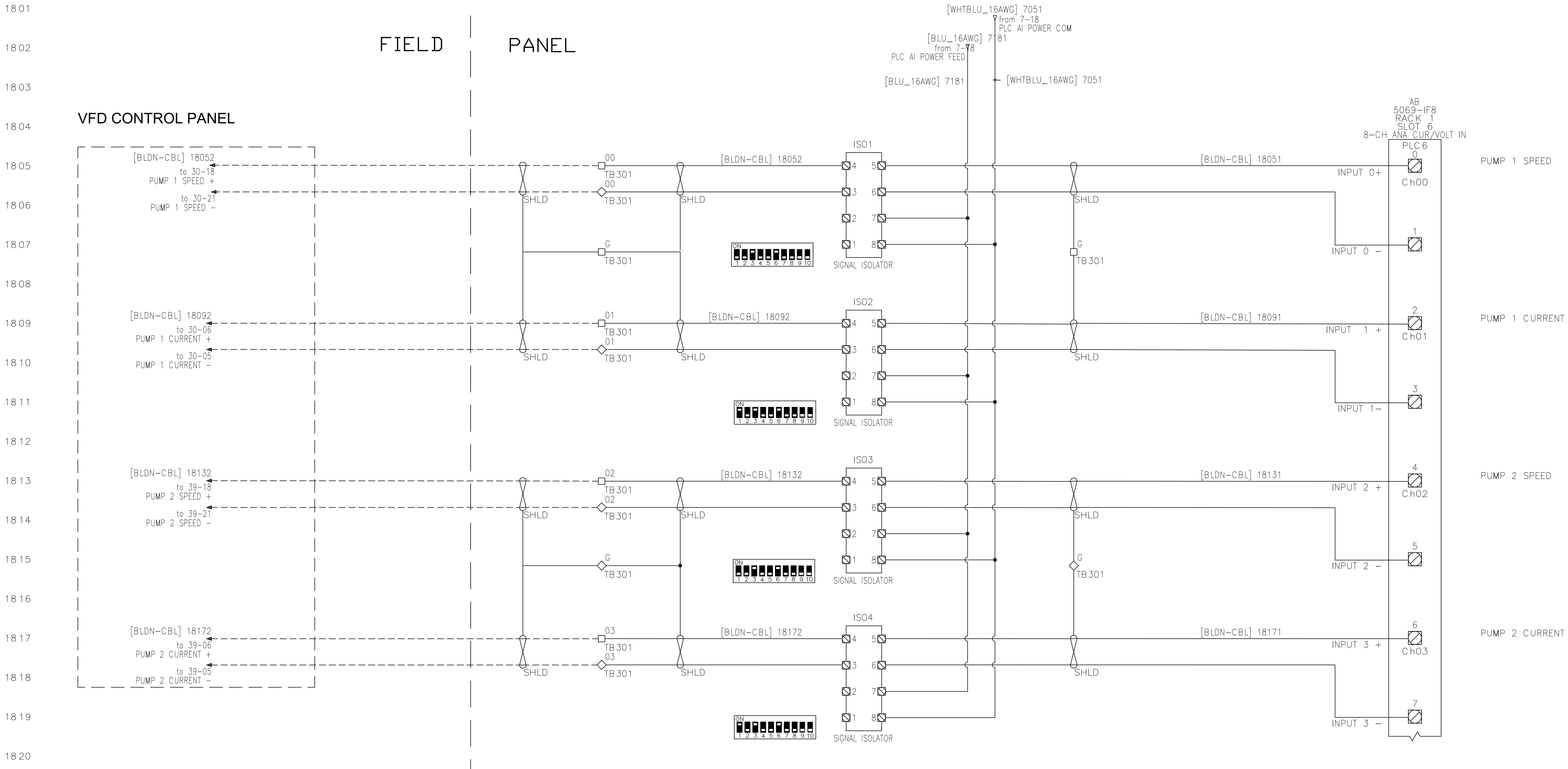
VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



NOTES:
EACH PLC ADDRESS BEGINS WITH LOCAL:5:O.

TITLE: DIGITAL OUTPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-17	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



1821
1822
1823
1824
1825

3104

Input setup					Output setup						
	1	2	3	4		5	6	7	8	9	10
0...20 mA	OFF	OFF	OFF	OFF	0...20 mA	OFF	OFF	OFF	NA	NA	NA
4...20 mA	OFF	OFF	ON	OFF	4...20 mA	OFF	ON	OFF	NA	NA	NA
0...10 V	OFF	ON	OFF	OFF	0...10 V	ON	OFF	OFF	NA	NA	NA
2...10 V	OFF	ON	ON	OFF	2...10 V	ON	ON	OFF	NA	NA	NA
0...5 V	OFF	ON	OFF	ON	0...5 V	ON	OFF	ON	NA	NA	NA
1...5 V	OFF	ON	ON	ON	1...5 V	ON	ON	ON	NA	NA	NA
0...20 mA Tx	ON	OFF	OFF	OFF							
4...20 mA Tx	ON	OFF	ON	OFF							

Remember to cycle power for power rail / terminals to reload DIP-switch values at power up.

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:6:I.

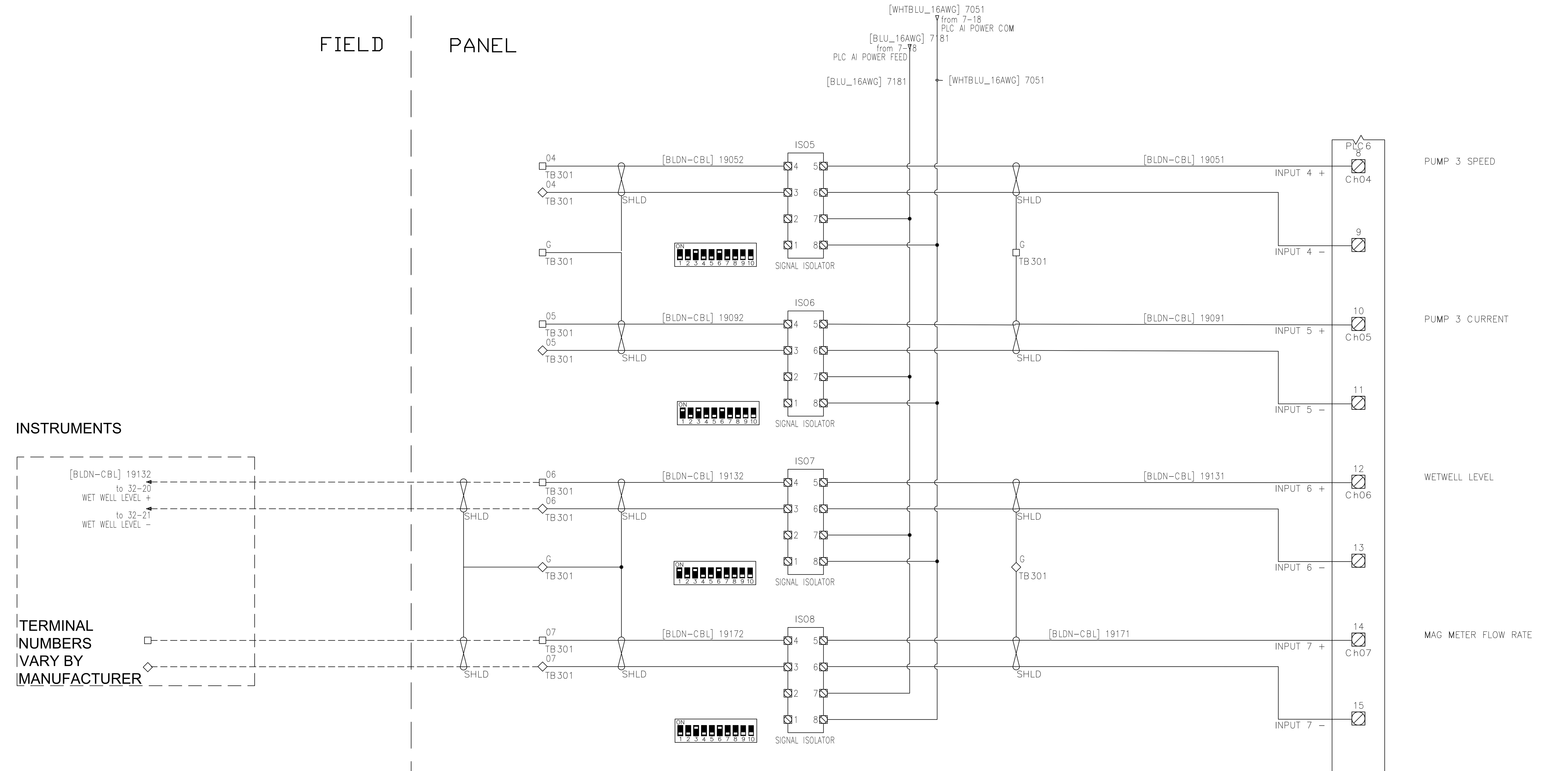
TITLE: ANALOG INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-18

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



3104

Input setup					Output setup						
	1	2	3	4		5	6	7	8	9	10
0...20 mA	OFF	OFF	OFF	OFF	0...20 mA	OFF	OFF	OFF	NA	NA	NA
4...20 mA	OFF	OFF	ON	OFF	4...20 mA	OFF	ON	OFF	NA	NA	NA
0...10 V	OFF	ON	OFF	OFF	0...10 V	ON	OFF	OFF	NA	NA	NA
2...10 V	OFF	ON	ON	OFF	2...10 V	ON	ON	OFF	NA	NA	NA
0...5 V	OFF	ON	OFF	ON	0...5 V	ON	OFF	ON	NA	NA	NA
1...5 V	OFF	ON	ON	ON	1...5 V	ON	ON	ON	NA	NA	NA
0...20 mA Tx	ON	OFF	OFF	OFF							
4...20 mA Tx	ON	OFF	ON	OFF							

Remember to cycle power for power rail / terminals to reload DIP-switch values at power up.

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:6:I.

TITLE: ANALOG INPUTS 24VDC

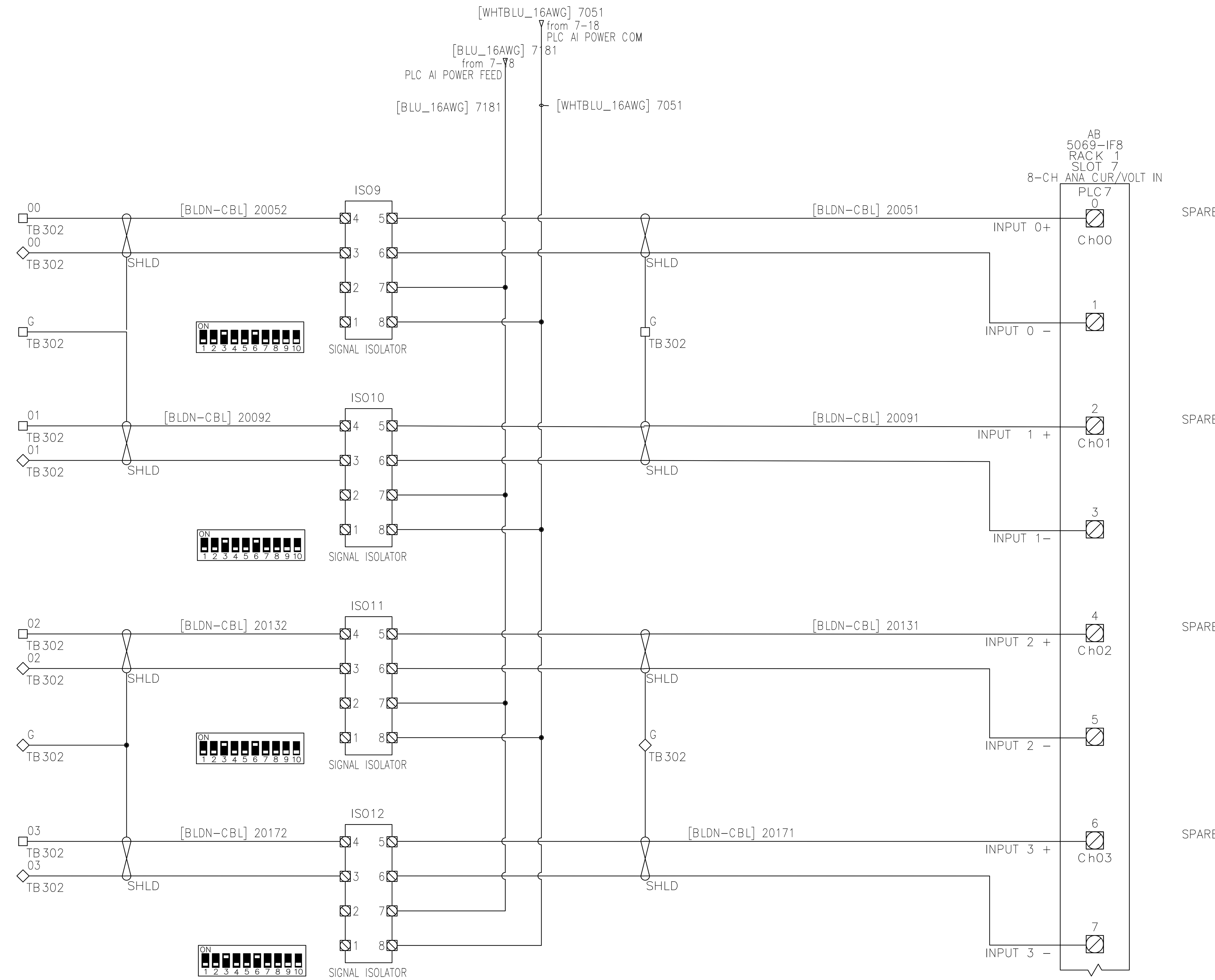
DATE: 10/29/24

DRAWING #: PLC PANEL-19

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

FIELD PANEL



3104

	Input setup				Output setup						
	1	2	3	4		5	6	7	8	9	10
0...20 mA	OFF	OFF	OFF	OFF	0...20 mA	OFF	OFF	OFF	NA	NA	NA
4...20 mA	OFF	OFF	ON	OFF	4...20 mA	OFF	ON	OFF	NA	NA	NA
0...10 V	OFF	ON	OFF	OFF	0...10 V	ON	OFF	OFF	NA	NA	NA
2...10 V	OFF	ON	ON	OFF	2...10 V	ON	ON	OFF	NA	NA	NA
0...5 V	OFF	ON	OFF	ON	0...5 V	ON	OFF	ON	NA	NA	NA
1...5 V	OFF	ON	ON	ON	1...5 V	ON	ON	ON	NA	NA	NA
0...20 mA Tx	ON	OFF	OFF	OFF							
4...20 mA Tx	ON	OFF	ON	OFF							

Remember to cycle power for power rail / terminals to reload DIP-switch values at power up.

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:7:I.

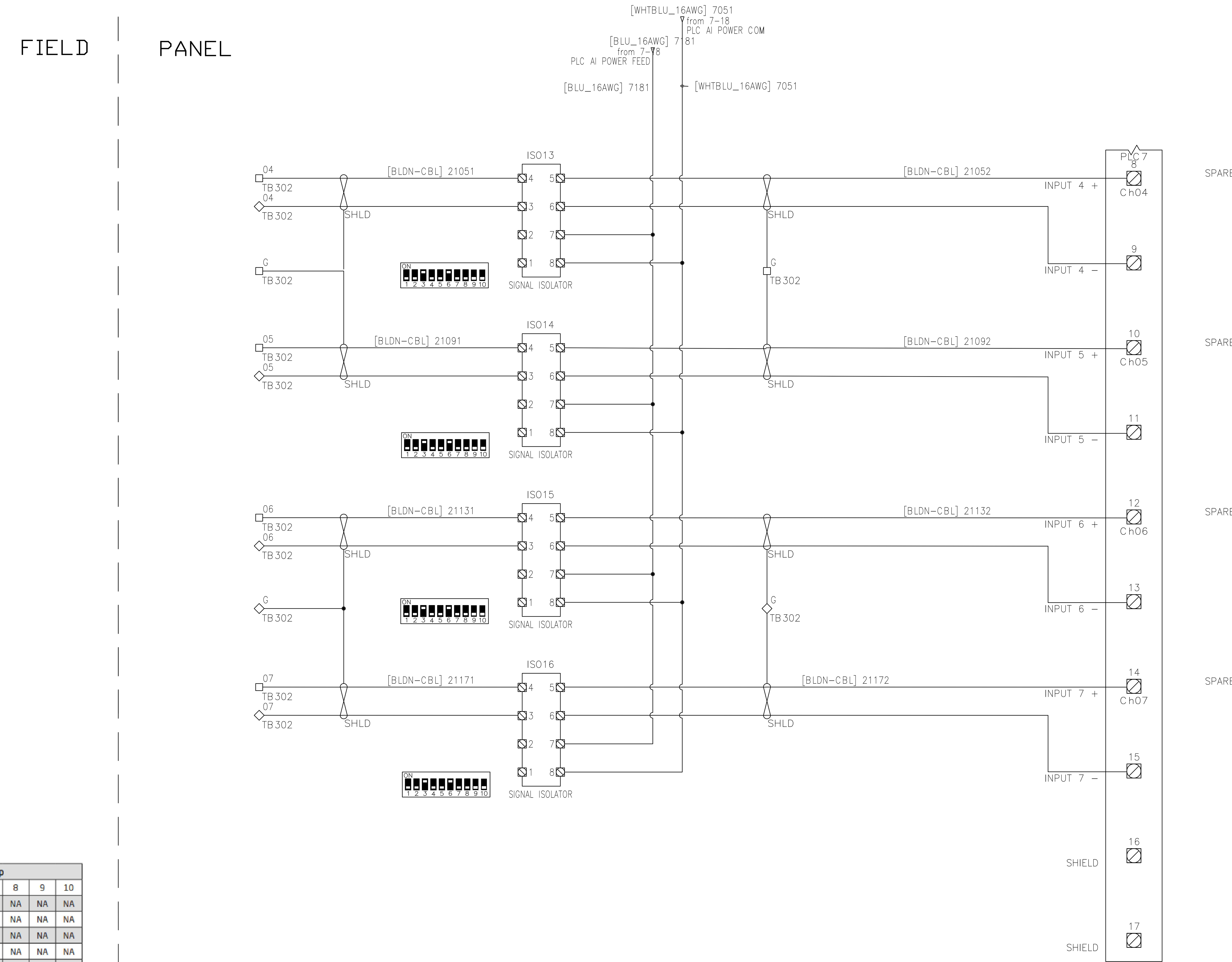
TITLE: ANALOG INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-20

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



3104

Input setup					Output setup						
	1	2	3	4		5	6	7	8	9	10
0...20 mA	OFF	OFF	OFF	OFF	0...20 mA	OFF	OFF	OFF	NA	NA	NA
4...20 mA	OFF	OFF	ON	OFF	4...20 mA	OFF	ON	OFF	NA	NA	NA
0...10 V	OFF	ON	OFF	OFF	0...10 V	ON	OFF	OFF	NA	NA	NA
2...10 V	OFF	ON	ON	OFF	2...10 V	ON	ON	OFF	NA	NA	NA
0...5 V	OFF	ON	OFF	ON	0...5 V	ON	OFF	ON	NA	NA	NA
1...5 V	OFF	ON	ON	ON	1...5 V	ON	ON	ON	NA	NA	NA
0...20 mA Tx	ON	OFF	OFF	OFF							
4...20 mA Tx	ON	OFF	ON	OFF							

Remember to cycle power for power rail / terminals to reload DIP-switch values at power up.

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:7:I.

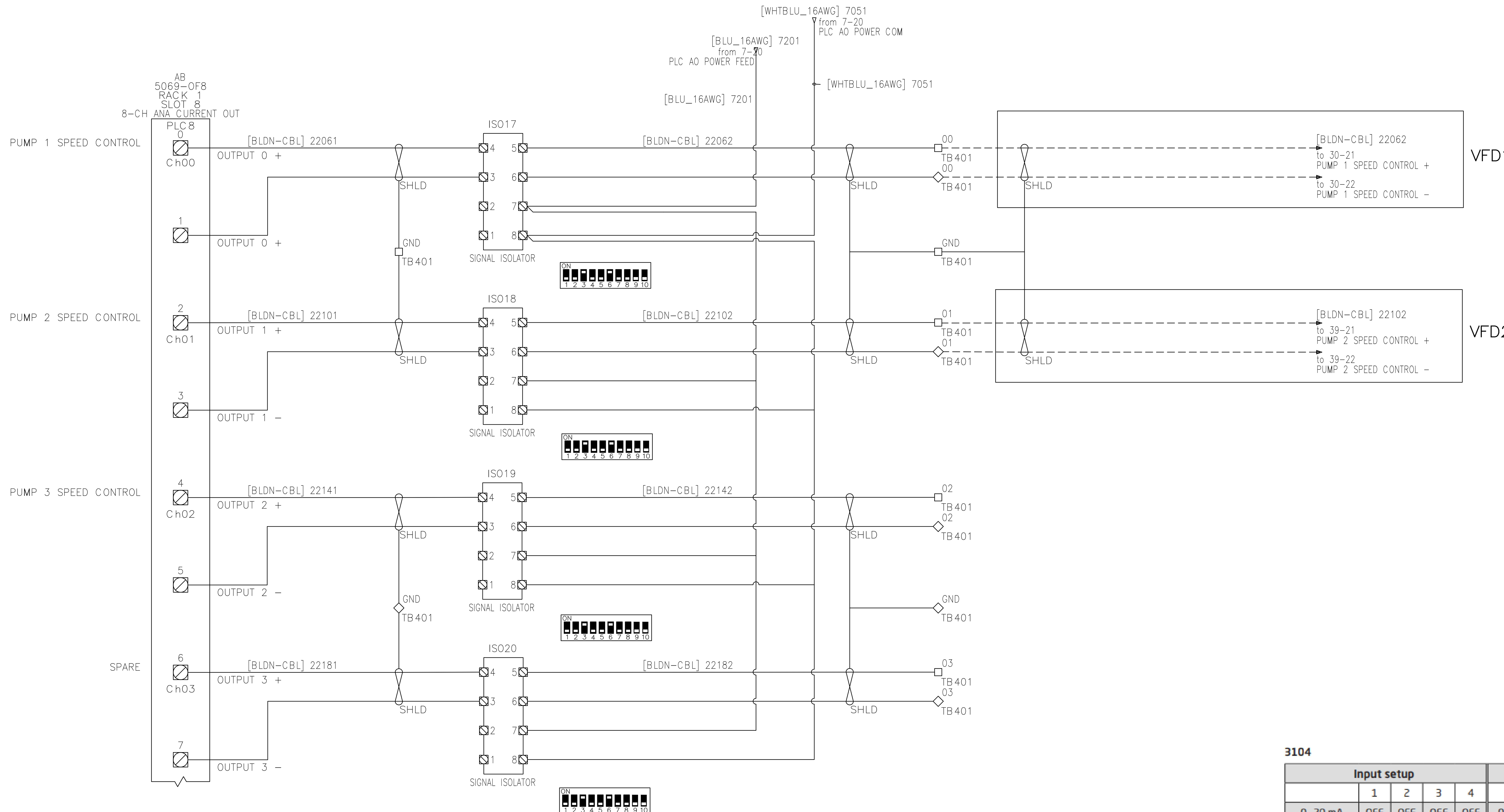
TITLE: ANALOG INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-21

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



3104

	Input setup				Output setup						
	1	2	3	4		5	6	7	8	9	10
0...20 mA	OFF	OFF	OFF	OFF	0...20 mA	OFF	OFF	OFF	NA	NA	NA
4...20 mA	OFF	OFF	ON	OFF	4...20 mA	OFF	ON	OFF	NA	NA	NA
0...10 V	OFF	ON	OFF	OFF	0...10 V	ON	OFF	OFF	NA	NA	NA
2...10 V	OFF	ON	ON	OFF	2...10 V	ON	ON	OFF	NA	NA	NA
0...5 V	OFF	ON	OFF	ON	0...5 V	ON	OFF	ON	NA	NA	NA
1...5 V	OFF	ON	ON	ON	1...5 V	ON	ON	ON	NA	NA	NA
0...20 mA Tx	ON	OFF	OFF	OFF							
4...20 mA Tx	ON	OFF	ON	OFF							

Remember to cycle power for power rail / terminals to reload DIP-switch values at power up.

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NOTES:
EACH PLC ADDRESS BEGINS WITH LOCAL:8:O.

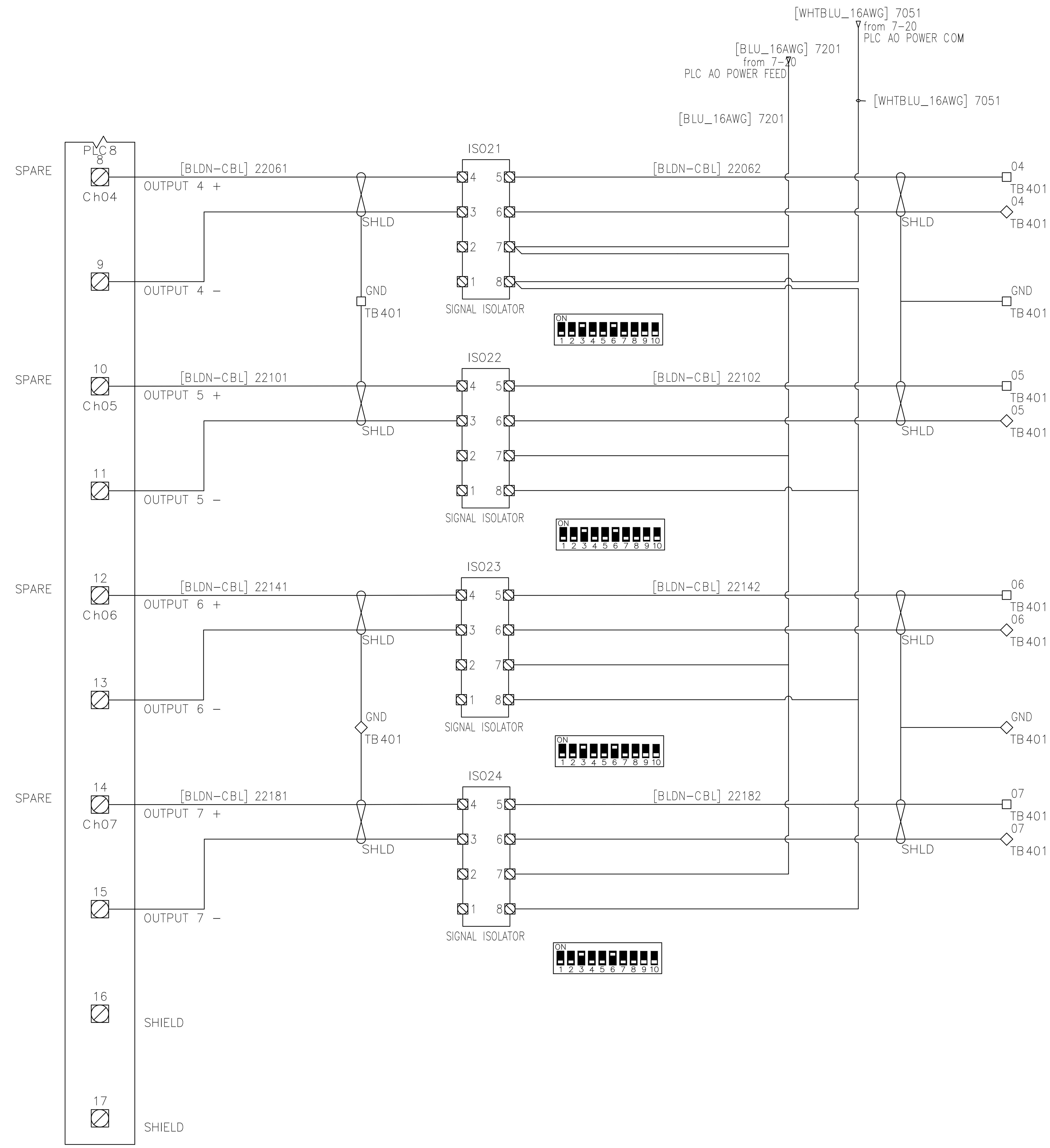
TITLE: ANALOG OUTPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-22

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



3104

Input setup					Output setup						
	1	2	3	4		5	6	7	8	9	10
0...20 mA	OFF	OFF	OFF	OFF	0...20 mA	OFF	OFF	OFF	NA	NA	NA
4...20 mA	OFF	OFF	ON	OFF	4...20 mA	OFF	ON	OFF	NA	NA	NA
0...10 V	OFF	ON	OFF	OFF	0...10 V	ON	OFF	OFF	NA	NA	NA
2...10 V	OFF	ON	ON	OFF	2...10 V	ON	ON	OFF	NA	NA	NA
0...5 V	OFF	ON	OFF	ON	0...5 V	ON	OFF	ON	NA	NA	NA
1...5 V	OFF	ON	ON	ON	1...5 V	ON	ON	ON	NA	NA	NA
0...20 mA Tx	ON	OFF	OFF	OFF							
4...20 mA Tx	ON	OFF	ON	OFF							

Remember to cycle power for power rail / terminals to reload DIP-switch values at power up.

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:8:O.

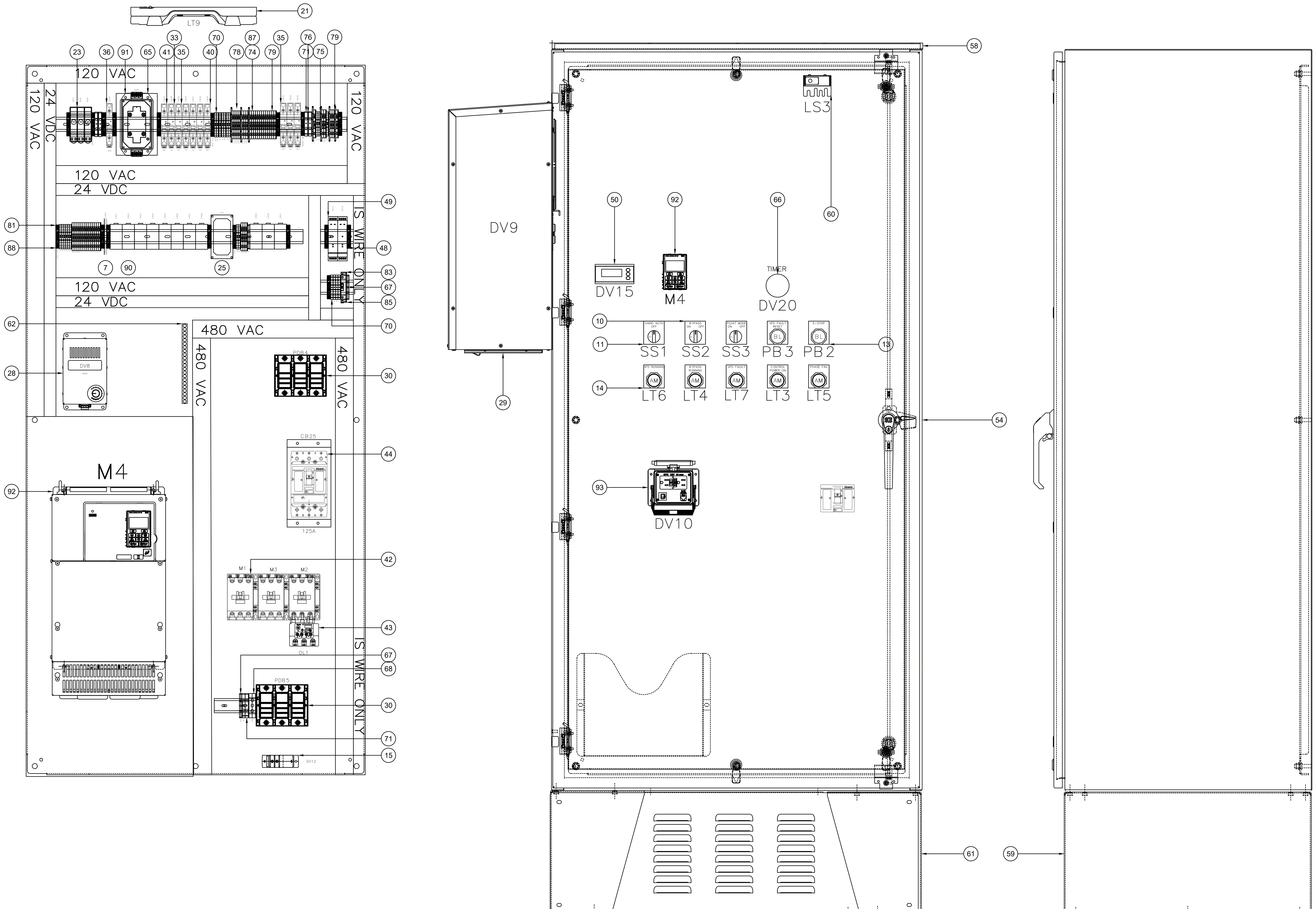
TITLE: ANALOG OUTPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-23

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



TYPICAL BILL OF MATERIALS

ITEM	TAGS	QTY	SUB	CATALOG	ASSYCODE	MFG	DESC
7	CR20	1	1	700-HLT1U1		AB	HL TYPE TERMINAL BLOCK RELAY
10	SS2,SS3	2	1	800H-HR2B		AB	2 NC 2 NO, 30MM SELECTOR SWITCH 2 POSITION, MAINTAINED
11	SS1	1	1	800H-JR2B		AB	2 NC, 2 NO - 30MM SELECTOR SWITCH, 3 POSITION, MAINTAINED
12	PB3	1	1	800H-R2D1		AB	PUSH BUTTON - MOMENTARY, NEMA 4/4X
13	PB2	1	1	800H-TFRXJT6D2		AB	30MM TRIGGER ACTION E-STOP, TWO POSITION MAINTAINED, TWIST RELEASE, 60MM PLASTIC HEAD, RED
14	LT3,LT4,LT5,LT6,LT7	5	1	800T-PT16A		AB	AMBER PILOT LIGHT - PRESS TO TEST, NEMA 4/13
15	DV12	1	1	ACT200-42L-S		ACUAMP	AcuAMP AC current transducer, 1-phase, split core, 0-200A sensing range, 4-20mA output.
21	LT9	1	1	7L4302301100		FINDER	PANEL LIGHT, 600 LUMENS, 6W, 110/240VAC/DC ON/OFF SWITCH WITH PUSH IN TERMINALS
23	TAS3,TAS4	2	1	7T8100002302		FINDER	THERMOSTAT, SPST-NO 10A, -20 C TO +60 C
24	TAS5	1	1	7T8100002402		FINDER	THERMOSTAT, SPST-NC 10A, -20 C TO +60 C
25	1P1	1	1	MINICAS120		FLYGT	SEAL FAIL RELAY
28	DV8	1	1	DAH8001B		HOFFMAN	
29	DV9	1	1	IQ550BFF		ICE CUBE	
30	PDB4,PDB5	2	1	LFD35523Z	LPBC33	LITTELFUSE	1 LINE 4 LOAD POWER DISTRIBUTION BLOCK
33	CB28,CB30,CB31	3	1	B1N1C1		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
35	CB29,CB32,CB34,CB35,CB36	5	1	B1N1C2		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
36	CB26	1	1	B1N1C20		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
40	CB33	1	1	B1N1C6		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
41	CB27	1	1	B1N1C8		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
42	M1,M2,M3	3	1	EX9C8011G7	AX4222UL	NOARK	NOARK Electric, Ex9C Standard Contactor, 120 VAC Control Voltage, Pole - 3 N/O, 1 N/O & 1 N/C Aux Contact, Rated Current 80 Amp
43	OL1	1	1	EX9R100B65A		NOARK	NOARK Electric, Thermal Overload Relay, Compatible with Ex9C/Ex9CR/Ex9CS/Ex9CSR series, Frame Size - 100A, Setting Amperage - 48 - 65 Amps
44	CB25	1	1	M1N125T3L		NOARK	M1N SERIES MCCB, UL489, 3 POLE, LUG-LINE/LOAD CONNECTION
44	CB25		1	AL21N		NOARK	ALARM CONTACT FOR USE WITH ANY M1-M6 MCCB, 1NO/1NC
44	CB25		1	LK21NCA		NOARK	3-HOLE M1 TERMINAL LUG KIT
48	DV16	1	1	5104BB2A		PR	EX REPEATER POWER SUPPLY
49	DV13	1	1	5202B2		PR	PULSE ISOLATOR
50	DV15	1	1	5714D		PR	PROGRAMMABLE LED INDICATOR WITH ANALOG OUTPUT AND 2 RELAYS
54		1	1	SCE-72EL3624SSLPPL		SCE	72X36X24 SS 3PT LATCH
55		1	1	SCE-72P36GALV		SCE	SUBPANEL, BENT GALAVANIZED
57		1	1	SCE-DF72EL36LP		SCE	DEAD FRONT, WALL MOUNT PANEL
58		1	1	SCE-DS36SS		SCE	SHIELD, SS DRIP
59		1	1	SCE-FK1224SS		SCE	KIT, SS FLOOR
60	LS3	1	1	SCE-LSA		SCE	ASSEMBLY, LIGHT SWITCH
61		1	1	SCE-SKL123644SS		SCE	SKIRT, SS LOUVERED
62		1	1	ECGB20		SIEMENS	GROUND BUS BAR
65	SUP5	1	1	USPT1P1-64		SSI	CONTROL PANEL INLINE SURGE
66	DV20	1	1	722-0003	5003-011	TRUMETER	HOURMETER 90-264VAC 50/60Hz FL RD
67	P1.1,TBIS-,VFD1	3	1	1010100000		WEIDMULLER	STANDARD DESIGN PROTECTIVE CONDUCTOR TERMINAL - WPE 4
68	P1.1	1	1	1010500000		WEIDMULLER	STANDARD DESIGN PROTECTIVE CONDUCTOR TERMINAL - WPE 35
69	TBVFD ISB,VFD1,VFD1-120,VFD1-PLC	18	1	1020000000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 2.5
70	TBIS-	4	1	1020180000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 4
71	P1.1,TBVFD ISB,VFD1 PF	6	1	1020200000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 6
74	TBVFD ISB,VFD1,VFD1-120,VFD1-PLC	43	1	1041100000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDK 2.5 (W/ ZQV JUMPERS)
75	P1.1,TBIS-,TBVFD ISB,VFD1,VFD1 PF,VFD1-120	8	1	1050000000		WEIDMULLER	END PLATE/PARTITION - WAP 2.5-10
76	TBVFD ISB,VFD1 PF,VFD1-120,VFD1-PLC	6	1	1050100000		WEIDMULLER	END PLATE/PARTITION - WAP 16-35
78	TBVFD ISB,VFD1-120	7	1	1058800000		WEIDMULLER	END PLATE/PARTITION - WTW
79	TBVFD ISB,VFD1,VFD1-120,VFD1-PLC	9	1	1059100000		WEIDMULLER	END PLATE/PARTITION - WAP
81	TBIS-,TBVFD ISB,VFD1,VFD1 PF,VFD1-120,VFD1-PLC	18	1	1061200000		WEIDMULLER	END BRACKET - WEW 35/2
83	TBIS-	1	1	1063810000		WEIDMULLER	Surge Protection for Instrumentation and Control, Surge Protection for Measurement and Control, UP(L/N-PE) = 2000 V
85	TBIS-	1	1	1067240000		WEIDMULLER	VSSC, End plate
88	TBVFD ISB,VFD1,VFD1-120,VFD1-PLC	16	1	1527690000		WEIDMULLER	PUSH IN JUMPER (10)
89	P1.1,VFD1,VFD1 PF,VFD1-120,VFD1-PLC	5	1	2593450000		WEIDMULLER	SCHT, Terminal marker, 39.3 x 8 mm, Pitch in mm (P): 7.00 beige
91	CR21,CR22,CR23,CR24,CR25,CR26,CR27,CR28,CR29,CR30,CR31	11	1	8921050000		WEIDMULLER	RIDERSERIES RCM, Relay module, Number of contacts: 4, CO contact AgNi, Rated control voltage: 115 V AC, Continuous current: 6 A, Screw connection
92		1	1	DINP01-4060A		WINFORD	DIN RAIL MOUNT PLATE 4X6"
93	M4	2	1	CIMR-PU4A0072FAA		YASKAWA	50HP, 3PHASE, 380-480V, NEMA 1 ENCLOSURE
94	DV10	1	1	ZP-PGA-32-201		ZIPport	PANEL INTERFACE CONNECTOR

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NOTES:

MUST INCLUDE TIE DOWN POINTS FOR FIELD WIRING GOING UP LEFT SIDE OF VFD. MUST BE SECURED BY SCREW, NO STICKY BACKS ALLOWED.

MUST INCLUDE CIRCUIT BREAKERS BROUGHT UP TO SWING BY MEANS OF CUSTOM FABRICATED SHELF/RISER.

TITLE: PANEL ASSEMBLY

DATE: 10/29/24

DRAWING #: VFD 1-24

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

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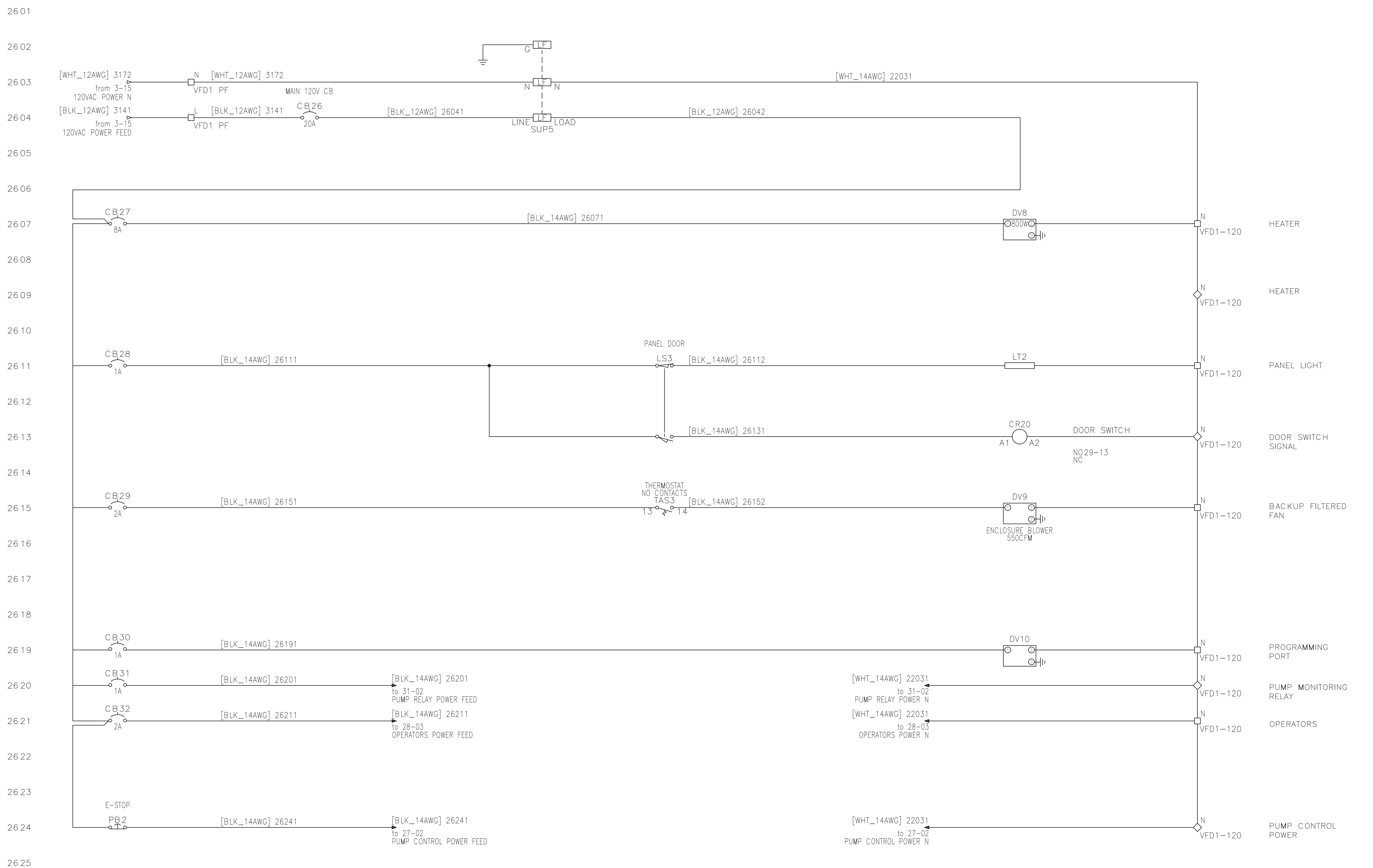
NOTES:

TITLE: POWER CIRCUIT 3 PHASE	DATE: 10/29/24
DRAWING #: VFD 1-25	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



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NOTES:

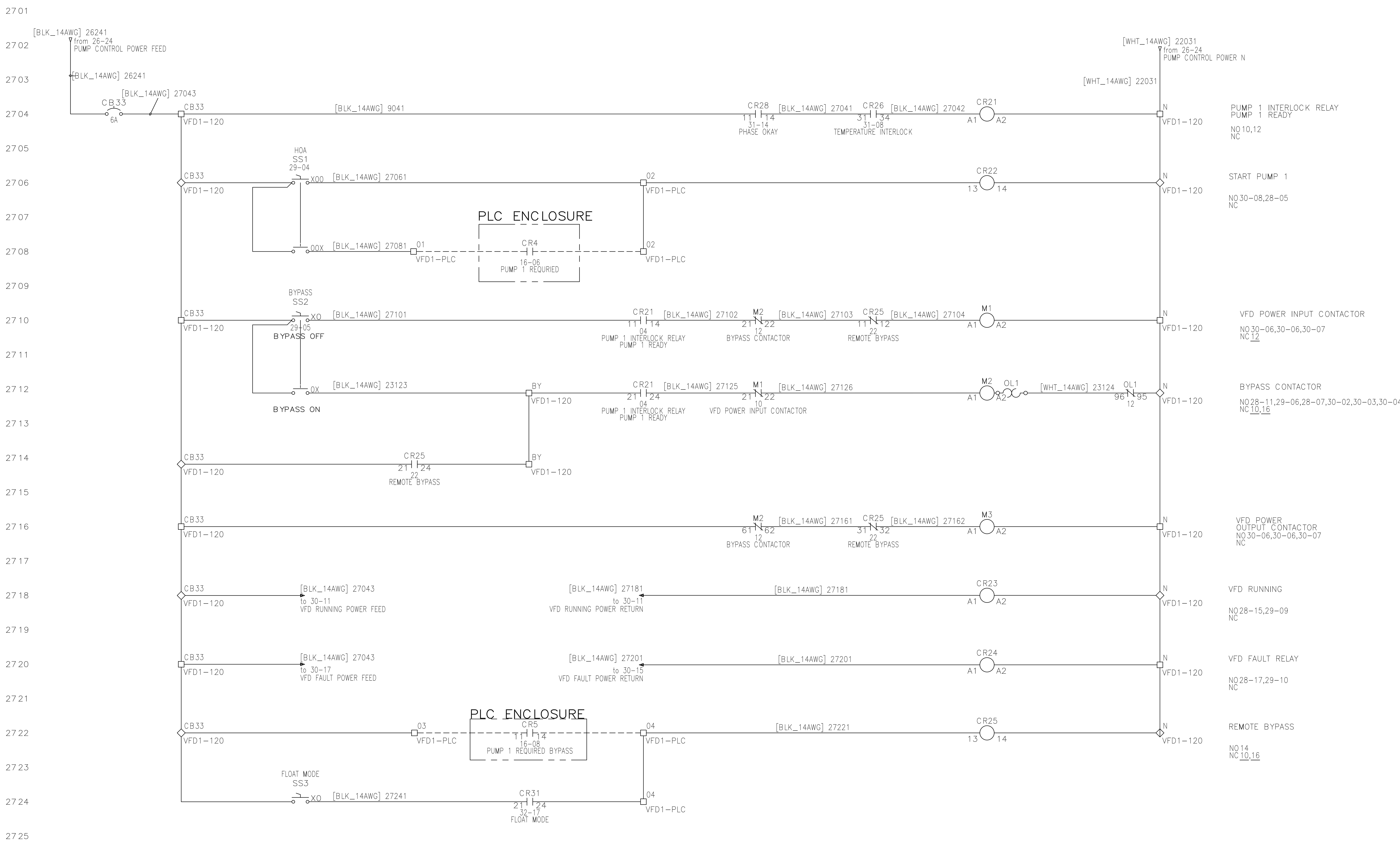
TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: VFD 1-26

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



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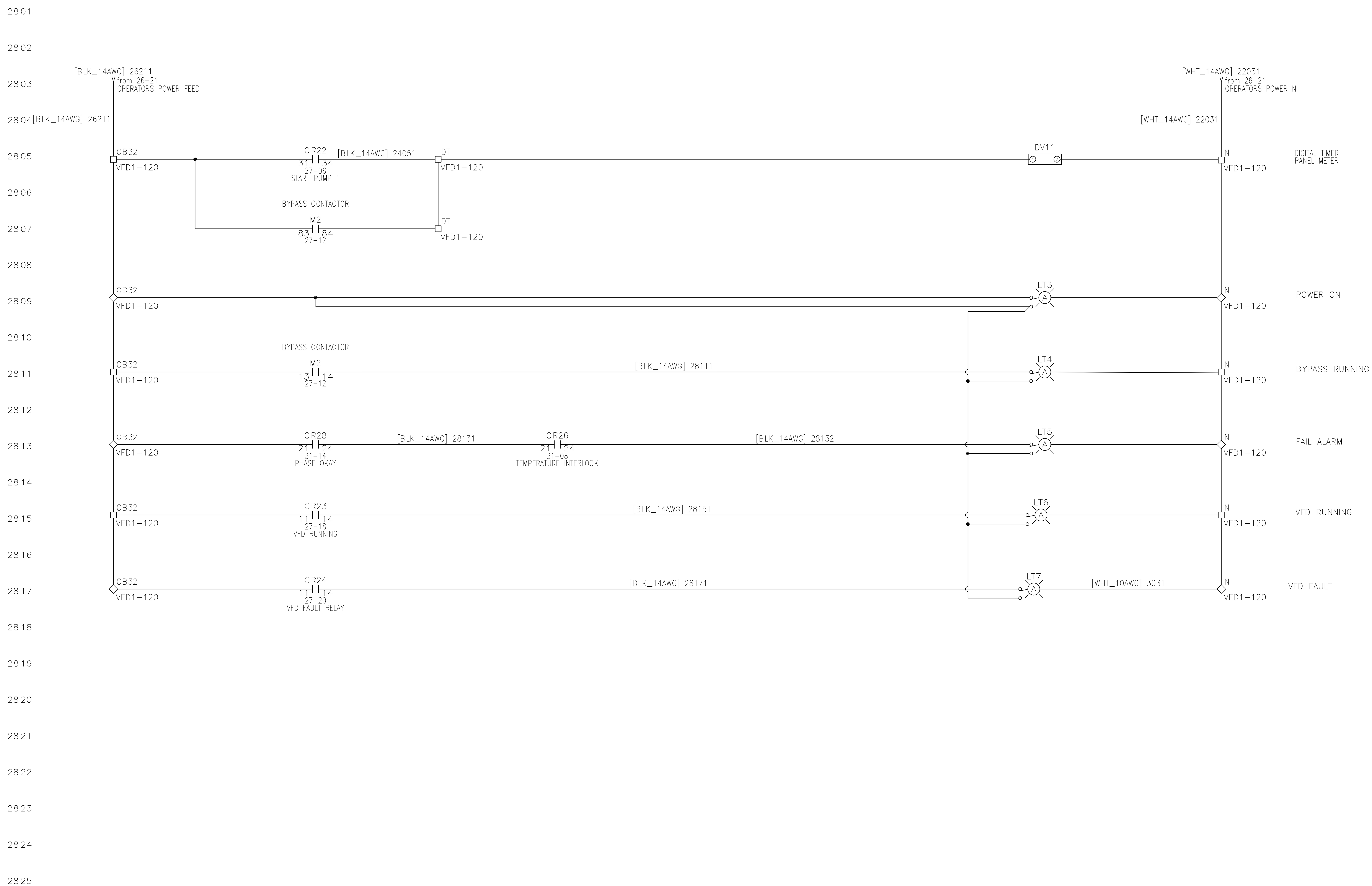
NOTES:

TITLE: POWER CIRCUIT 120VAC	DATE: 10/29/24
DRAWING #: VFD 1-27	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



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NOTES:

TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: VFD 1-28

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

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NOTES:

- ALL AC SIGNALS POWERED FROM OUTSIDE OF THE PANEL MUST BE WIRED INTERNALLY WITH YELLOW WIRE
- ALL DC SIGNALS POWERED FROM OUTSIDE OF THE PANEL MUST BE WIRED INTERNALLY WITH ORANGE WIRE
- BLUE AND RED DESIGNATION ON THIS PAGE SHOW WHAT WIRE COLOR THE ASSOCIATED WIRE IS WITHIN THE PLC PANEL

TITLE: VFD PANEL INTERCONNECTIONS

DATE: 10/29/24

DRAWING #: VFD 1-29

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

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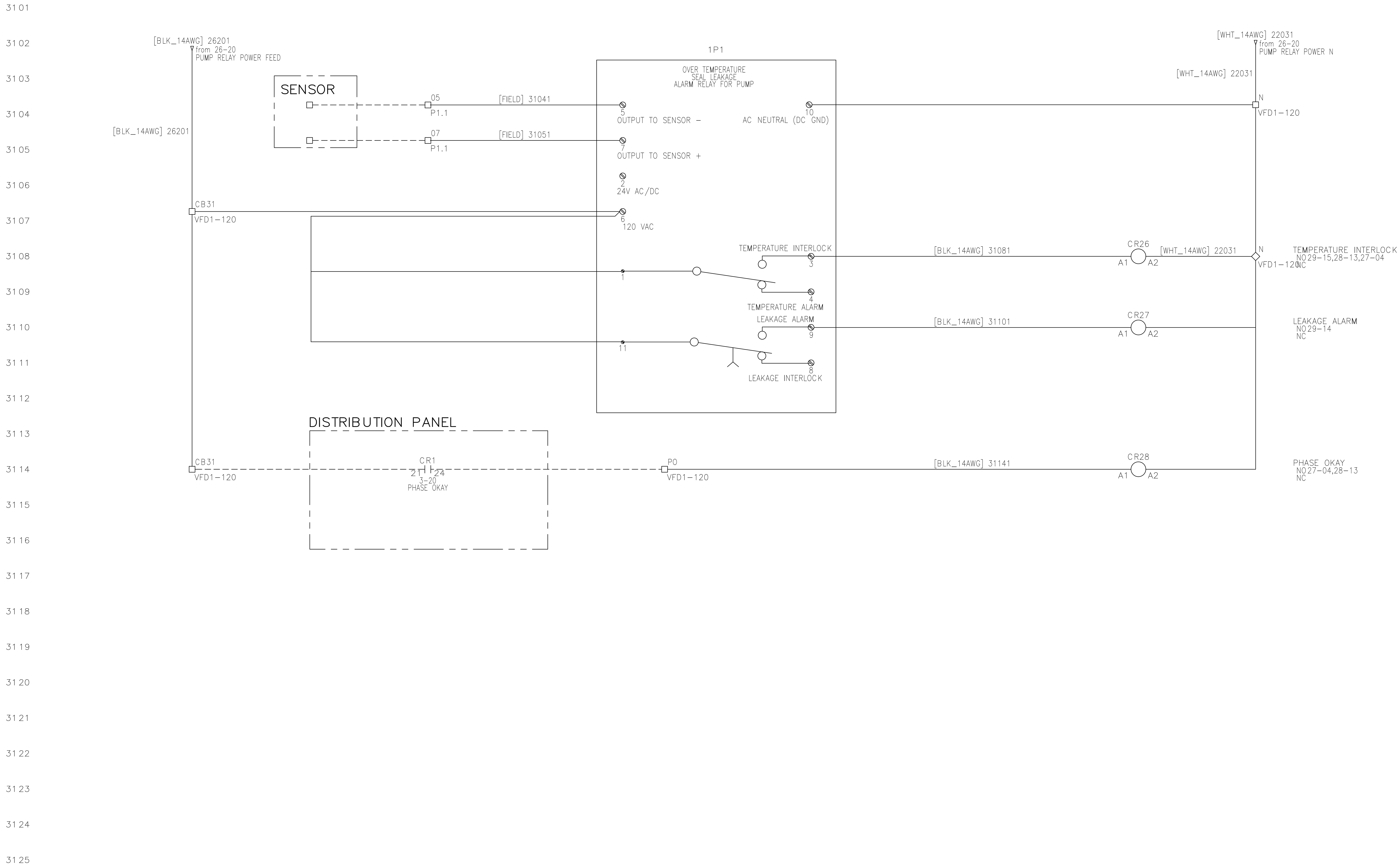
NOTES:

- THIS VFD CIRCUIT SHOWS A TYPICAL YASKAWA VFD. IT IS UP TO INTEGRATOR TO PROPERLY SIZE VFD AND USE APPROPRIATE VFD BLOCK FOR THEIR CHOSEN VFD.

TITLE: VFD CIRCUIT	DATE: 10/29/24
DRAWING #: VFD 1-30	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



NOTES:
THIS PAGE CONTAINS A TYPICAL COMBINED SEAL FAIL RELAY USED WITH FLYGT AND GRUNDFOS PUMPS. IT IS UP TO THE INTEGRATOR TO CORRECTLY IDENTIFY AND USE THE APPROPRIATE PUMP MONITORING RELAY(S).

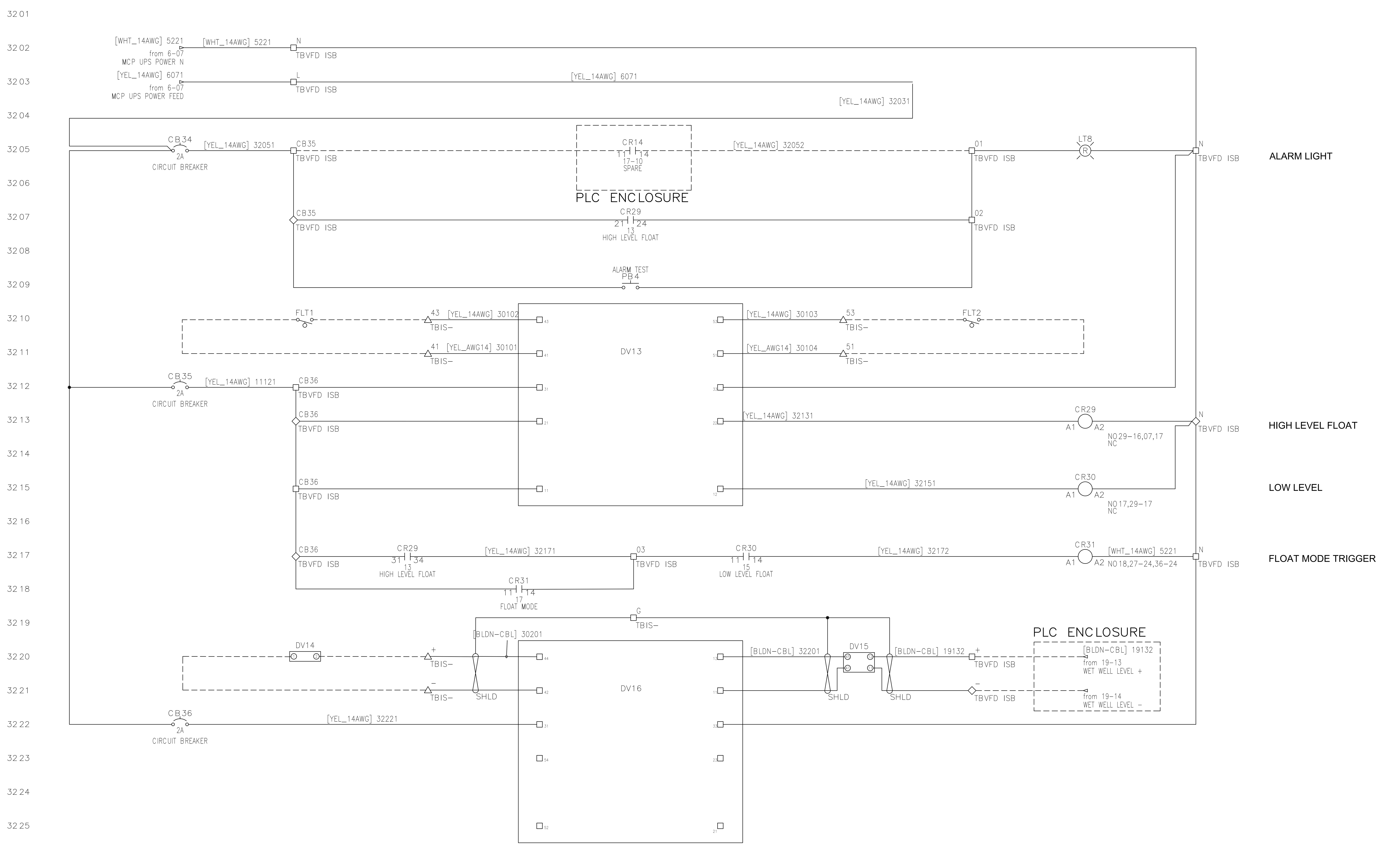
TITLE: PUMP PROTECTION RELAY

DATE: 10/29/24

DRAWING #: VFD 1-31

VERSION: 2025

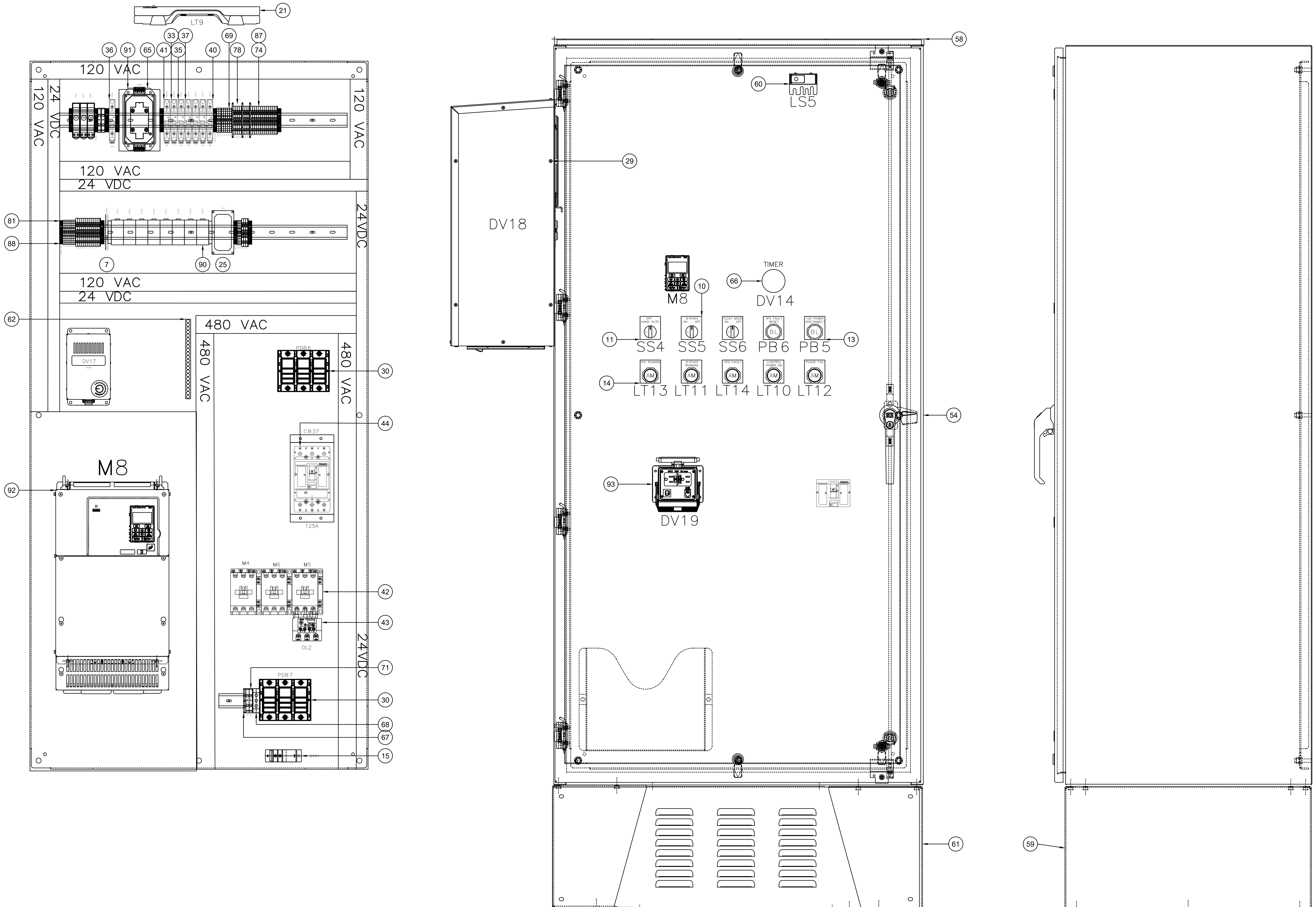
CEG LEVEL 2 LIFT STATION STANDARD



NOTES:

ANYTHING IN TBIS MUST BE RATED FOR INTRINSICALLY WIRE. IF RATING IS NOT APPLICABLE, LIKE TERMINALS, THE PART IN QUESTION SHOULD BE A BLUE/LIGHT BLUE COLOR.

TITLE: VFD FROM UPS 120V	DATE: 10/29/24
DRAWING #: VFD 1-32	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



TYPICAL BILL OF MATERIALS

ITEM	TAGS	QTY	SUB	CATALOG	ASSYCODE	MFG	DESC
7	CR32	1	1	700-HLT1U1		AB	HL TYPE TERMINAL BLOCK RELAY
10	SS5,SS6	2	1	800H-HR2B		AB	2 NC 2 NO, 30MM SELECTOR SWITCH 2 POSITION, MAINTAINED
11	SS4	1	1	800H-JR2B		AB	2 NC, 2 NO - 30MM SELECTOR SWITCH, 3 POSITION, MAINTAINED
12	PB6	1	1	800H-R2D1		AB	PUSH BUTTON - MOMENTARY, NEMA 4/4X
13	PB5	1	1	800H-TFRXJT6D2		AB	30MM TRIGGER ACTION E-STOP, TWO POSITION MAINTAINED, TWIST RELEASE, 60MM PLASTIC HEAD, RED
14	LT10,LT11,LT12,LT13,LT14	5	1	800T-PT16A		AB	AMBER PILOT LIGHT - PRESS TO TEST, NEMA 4/13
15	DV21	1	1	ACT200-42L-S		ACUAMP	AcuAMP AC current transducer, 1-phase, split core, 0-200A sensing range, 4-20mA output.
21	LT9	1	1	7L4302301100		FINDER	PANEL LIGHT, 600 LUMENS, 6W, 110/240VAC/DC ON/OFF SWITCH WITH PUSH IN TERMINALS
23	TAS6,TAS8	2	1	7T8100002302		FINDER	THERMOSTAT, SPST-NO 10A, -20 C TO +60 C
24	TAS7	1	1	7T8100002402		FINDER	THERMOSTAT, SPST-NC 10A, -20 C TO +60 C
25	1P2	1	1	MINICAS120		FLYGT	SEAL FAIL RELAY
28	DV17	1	1	DAH8001B		HOFFMAN	
29	DV18	1	1	IQ550BFF		ICE CUBE	
30	PDB6,PDB7	2	1	LFD35523Z	LPBC33	LITTELFUSE	1 LINE 4 LOAD POWER DISTRIBUTION BLOCK
33	CB40,CB43	2	1	B1N1C1		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
35	CB41,CB44	2	1	B1N1C2		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
36	CB38	1	1	B1N1C20		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
37	CB42	1	1	B1N1C3		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
40	CB45	1	1	B1N1C6		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
41	CB39	1	1	B1N1C8		NOARK	MINIATURE CIRCUIT BREAKER UL 489 240VAC, 10kA BOX LUGS
42	M4,M5,M6	3	1	Ex9C8011G7	AX4222UL	NOARK	NOARK Electric, Ex9C Standard Contactor, 120 VAC Control Voltage, Pole - 3 N/O, 1 N/O & 1 N/C Aux Contact, Rated Current 80 Amp
43	OL2	1	1	Ex9R100B65A		NOARK	NOARK Electric, Thermal Overload Relay, Compatible with Ex9C/Ex9CR/Ex9CS/Ex9CSR series, Frame Size - 100A, Setting Amperage - 48 - 65 Amps
44	CB37	1	1	M1N125T3L		NOARK	M1N SERIES MCCB, UL489, 3 POLE, LUG-LINE/LOAD CONNECTION
44	CB37		1	AL21N		NOARK	ALARM CONTACT FOR USE WITH ANY M1-M6 MCCB, 1NO/1NC
44	CB37		1	LK21NCA		NOARK	3-HOLE M1 TERMINAL LUG KIT
54		1	1	SCE-72EL3624SSLPPL		SCE	72X36X24 SS 3PT LATCH
55		1	1	SCE-72P36GALV		SCE	SUBPANEL, BENT GALAVANIZED
57		1	1	SCE-DF72EL36LP		SCE	DEAD FRONT, WALL MOUNT PANEL
58		1	1	SCE-DS36SS		SCE	SHIELD, SS DRIP
59		1	1	SCE-FK1224SS		SCE	KIT, SS FLOOR
60	LS5	1	1	SCE-LSA		SCE	ASSEMBLY, LIGHT SWITCH
61		1	1	SCE-SKL123644SS		SCE	SKIRT, SS LOUVERED
62		1	1	ECGB20		SIEMENS	GROUND BUS BAR
65	SUP8	1	1	USPT1P1-64		SSI	CONTROL PANEL INLINE SURGE
66	DV14	1	1	722-0003	5003-011	TRUMETER	HOURMETER 90-264VAC 50/60Hz FL RD
67	P2.1	1	1	1010100000		WEIDMULLER	STANDARD DESIGN PROTECTIVE CONDUCTOR TERMINAL - WPE 4
68	P2.1	1	1	1010500000		WEIDMULLER	STANDARD DESIGN PROTECTIVE CONDUCTOR TERMINAL - WPE 35
69	VFD2,VFD2-120,VFD2-PLC	15	1	1020000000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 2.5
71	P2.1,VFD2 PF	4	1	1020200000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 6
74	VFD2,VFD2-120,VFD2-PLC	35	1	1041100000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDK 2.5 (W/ ZQV JUMPERS)
75	P2.1,VFD2,VFD2 PF,VFD2-120,VFD2-PLC	5	1	1050000000		WEIDMULLER	END PLATE/PARTITION - WAP 2.5-10
76	VFD2 PF,VFD2-120	2	1	1050100000		WEIDMULLER	END PLATE/PARTITION - WAP 16-35
78	VFD2-120	3	1	1058800000		WEIDMULLER	END PLATE/PARTITION - WTW
79	VFD2,VFD2-120,VFD2-PLC	5	1	1059100000		WEIDMULLER	END PLATE/PARTITION - WAP
81	P2,VFD2,VFD2 PF,VFD2-120,VFD2-PLC	13	1	1061200000		WEIDMULLER	END BRACKET - WEW 35/2
88	VFD2,VFD2-120,VFD2-PLC	8	1	1527690000		WEIDMULLER	PUSH IN JUMPER (10)
89	P2.1,VFD2,VFD2 PF,VFD2-120,VFD2-PLC	5	1	2593450000		WEIDMULLER	SCHT, Terminal marker, 39.3 x 8 mm, Pitch in mm (P): 7.00 beige
91	CR33,CR34,CR35,CR36,CR37,CR38,CR39,CR40	8	1	8921050000		WEIDMULLER	RIDERSERIES RCM, Relay module, Number of contacts: 4, CO contact AgNi, Rated control voltage: 115 V AC, Continuous current: 6 A, Screw connection
92		1	1	DINP01-4060A		WINFORD	DIN RAIL MOUNT PLATE 4X6"
93	M8	2	1	CIMR-PU4A0072FAA		YASKAWA	50HP, 3PHASE, 380-480V, NEMA 1 ENCLOSURE
94	DV19	1	1	ZP-PGA-32-201		ZIPport	PANEL INTERFACE CONNECTOR

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NOTES:

MUST INCLUDE TIE DOWN POINTS FOR FIELD WIRING GOING UP LEFT SIDE OF VFD. MUST BE SECURED BY SCREW, NO STICKY BACKS ALLOWED.

MUST INCLUDE CIRCUIT BREAKERS BROUGHT UP TO SWING BY MEANS OF CUSTOM FABRICATED SHELF/RISER.

TITLE: PANEL ASSEMBLY

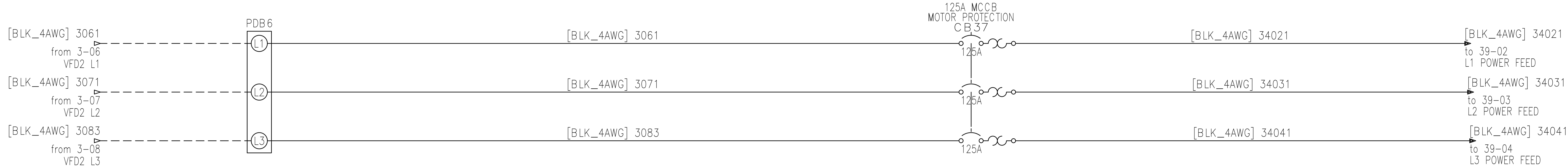
DATE: 10/29/24

DRAWING #: VFD 2-33

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

3401



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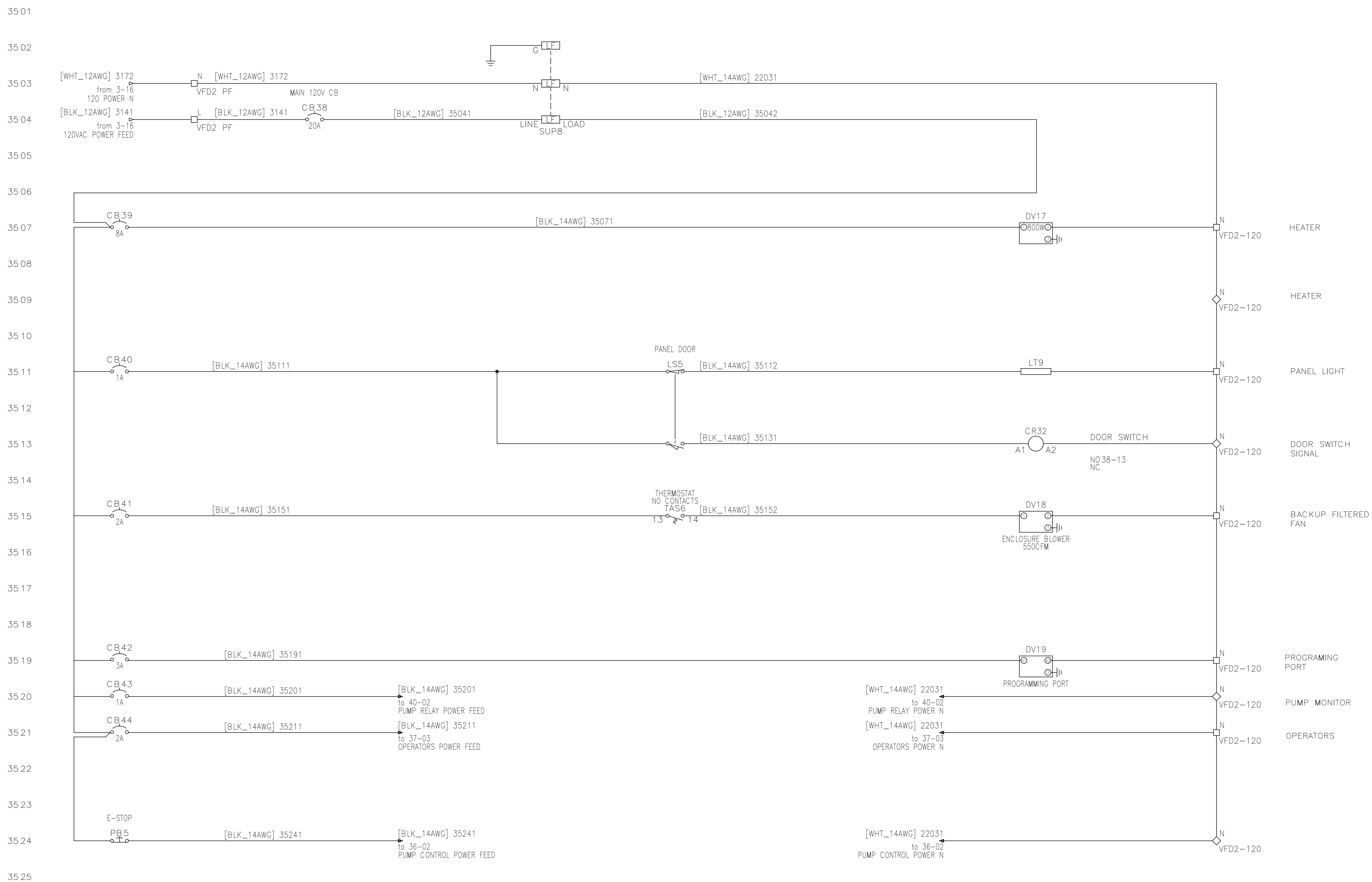
NOTES:

TITLE: POWER CIRCUIT 3 PHASE	DATE: 10/29/24
DRAWING #: VFD 2-34	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



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NOTES:

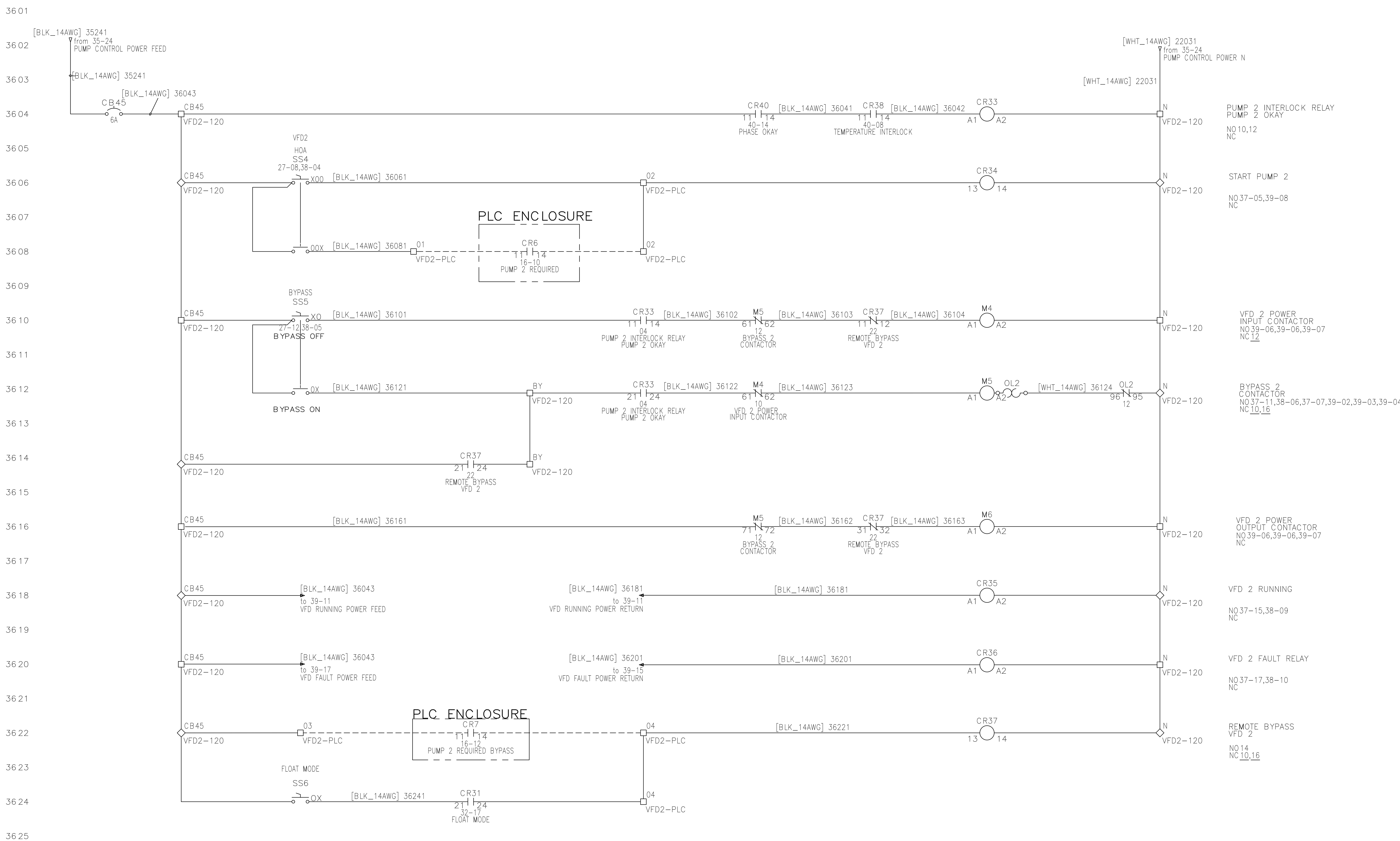
TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: VFD 2-35

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD



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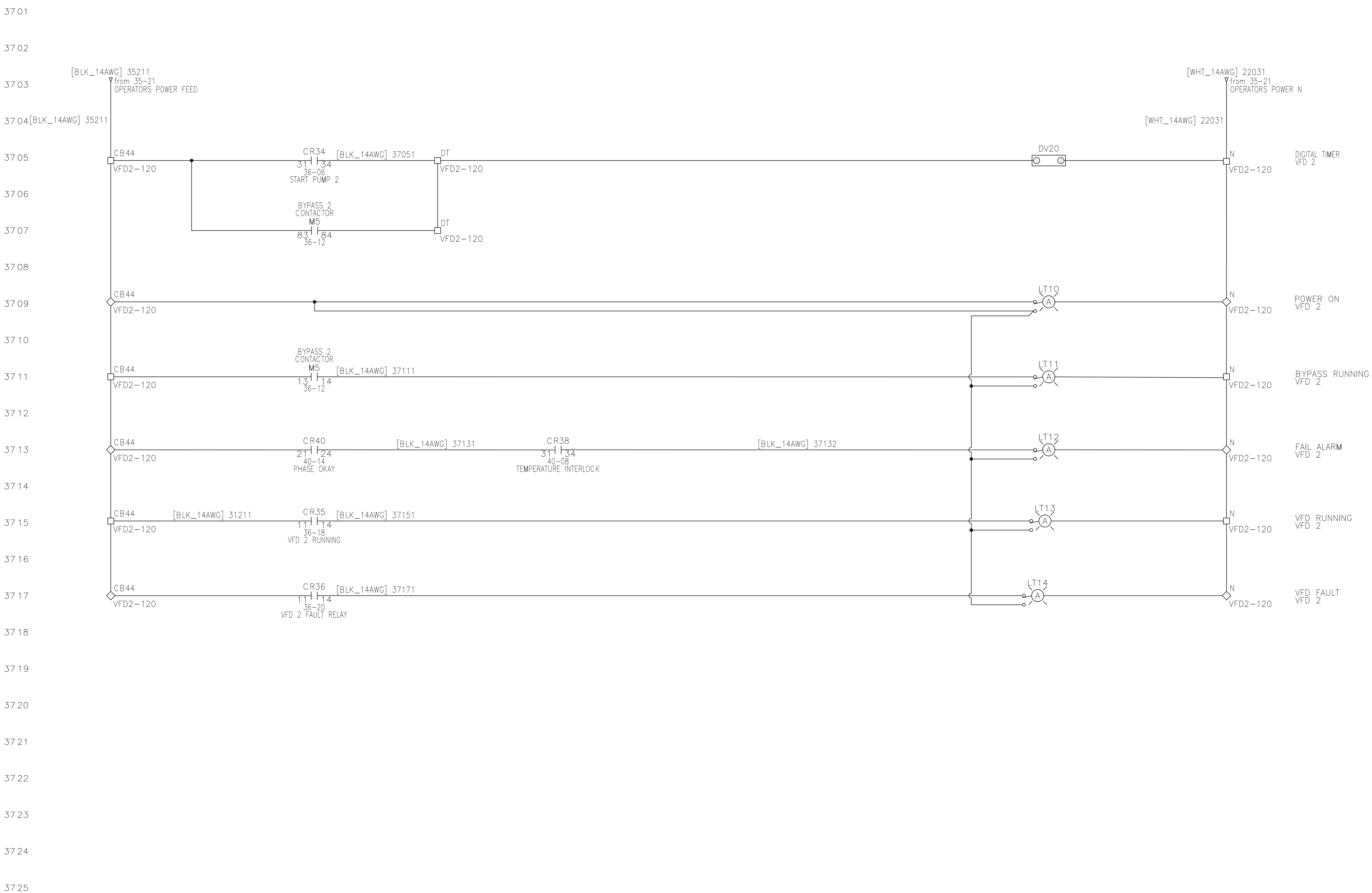
NOTES:

TITLE: POWER CIRCUIT 120VAC	DATE: 10/29/24
DRAWING #: VFD 2-36	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



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NOTES:

TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: VFD 2-37

VERSION: 2025

CEG LEVEL 2 LIFT STATION STANDARD

NOTES:

- ALL AC SIGNALS POWERED FROM OUTSIDE OF THE PANEL MUST BE WIRED INTERNALLY WITH YELLOW WIRE
- ALL DC SIGNALS POWERED FROM OUTSIDE OF THE PANEL MUST BE WIRED INTERNALLY WITH ORANGE WIRE
- BLUE AND RED DESIGNATION ON THIS PAGE SHOW WHAT WIRE COLOR THE ASSOCIATED WIRE IS WITHIN THE PLC PANEL

TITLE: VFD PANEL INTERCONNECTIONS	DATE: 10/29/24
DRAWING #: VFD 2-38	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	

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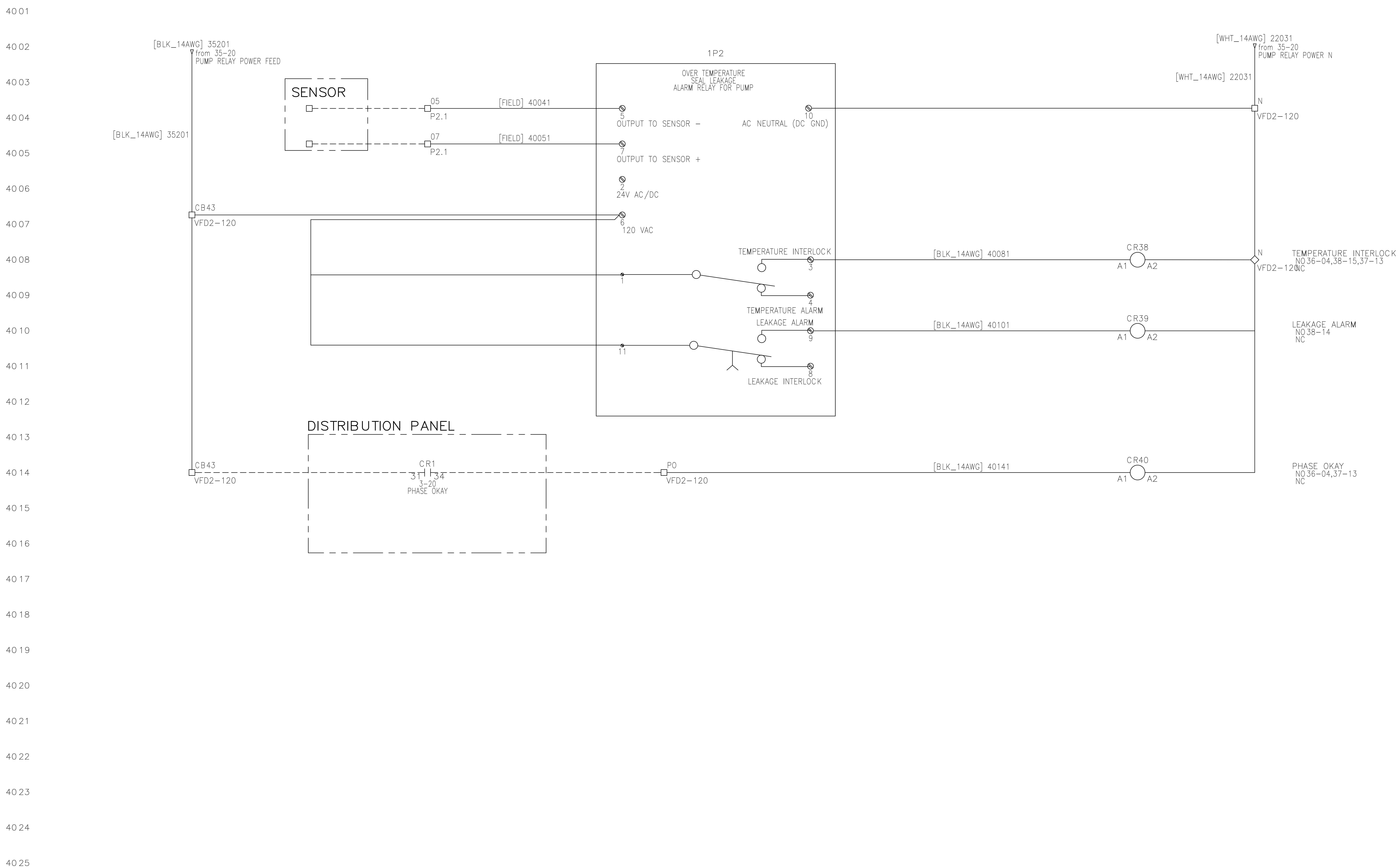
NOTES:

- THIS VFD CIRCUIT SHOWS A TYPICAL YASKAWA VFD. IT IS UP TO INTEGRATOR TO PROPERLY SIZE VFD AND USE APPROPRIATE VFD BLOCK FOR THEIR CHOSEN VFD.

TITLE: VFD CIRCUIT	DATE: 10/29/24
DRAWING #: VFD 2-39	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



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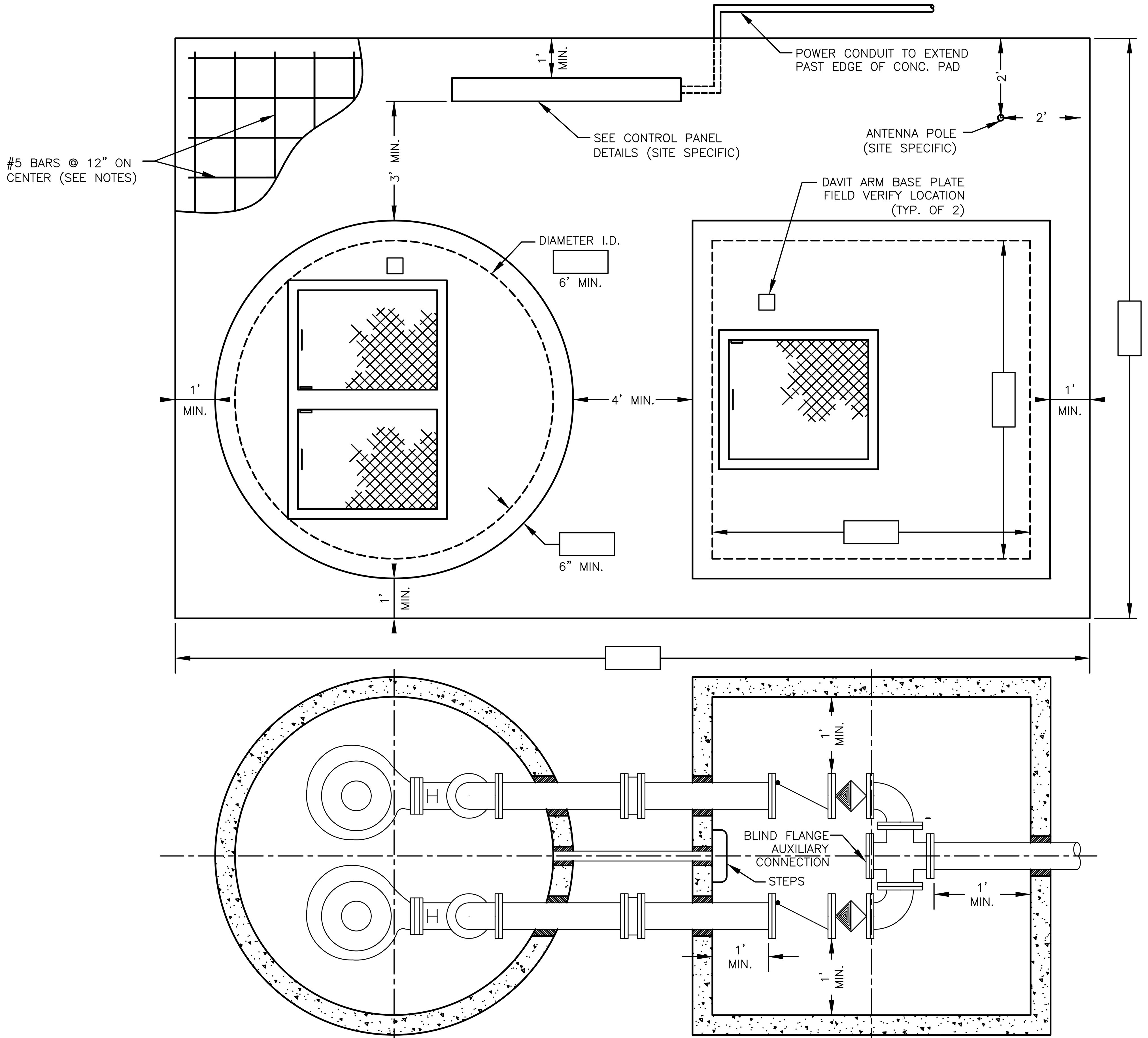
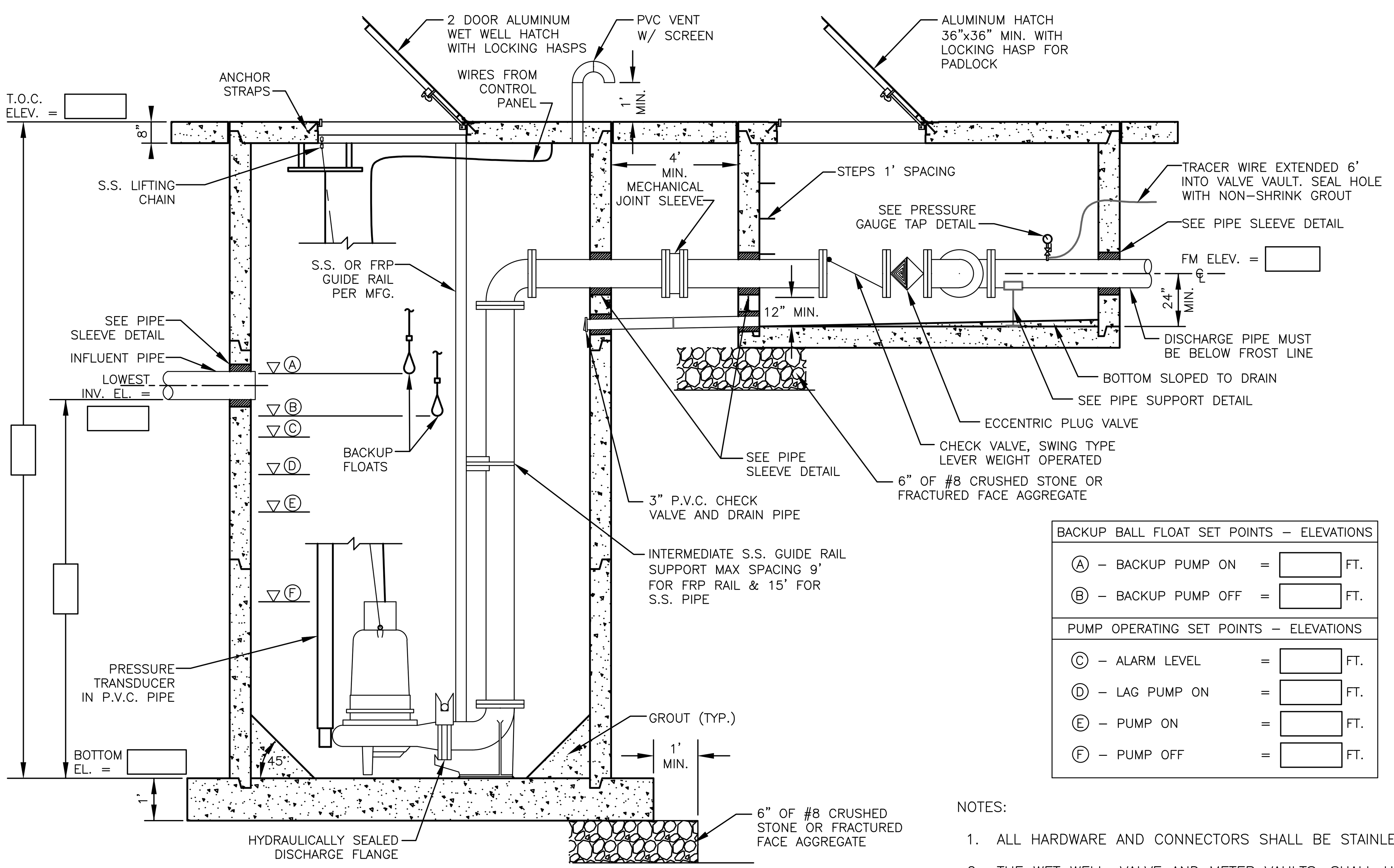
NOTES:

THIS PAGE CONTAINS A TYPICAL COMBINED SEAL FAIL RELAY USED WITH FLYGT AND GRUNDFOS PUMPS. IT IS UP TO THE INTEGRATOR TO CORRECTLY IDENTIFY AND USE THE APPROPRIATE PUMP MONITORING RELAY(S).

TITLE: PUMP PROTECTION RELAY	DATE: 10/29/24
DRAWING #: VFD 2-40	VERSION: 2025
CEG LEVEL 2 LIFT STATION STANDARD	



PLAN VIEW
NOT TO SCALE



BACKUP BALL FLOAT SET POINTS – ELEVATIONS		
A – BACKUP PUMP ON	=	FT.
B – BACKUP PUMP OFF	=	FT.
PUMP OPERATING SET POINTS – ELEVATIONS		
C – ALARM LEVEL	=	FT.
D – LAG PUMP ON	=	FT.
E – PUMP ON	=	FT.
F – PUMP OFF	=	FT.

SECTION VIEW
NOT TO SCALE

NOTES:

1. ALL HARDWARE AND CONNECTORS SHALL BE STAINLESS STEEL.
2. THE WET WELL, VALVE AND METER VAULTS, SHALL HAVE REBAR DOWEL MATERIAL PENETRATED AT GRADE LEVEL TO CONNECT TO SURROUNDING REINFORCED CONCRETE PAD.

INFORMATION

COUNTY: ______ TOWNSHIP: ______

SECTION: ______ TWP: ______ RANGE: ______

PROJECT: ______

LOCATION: ______

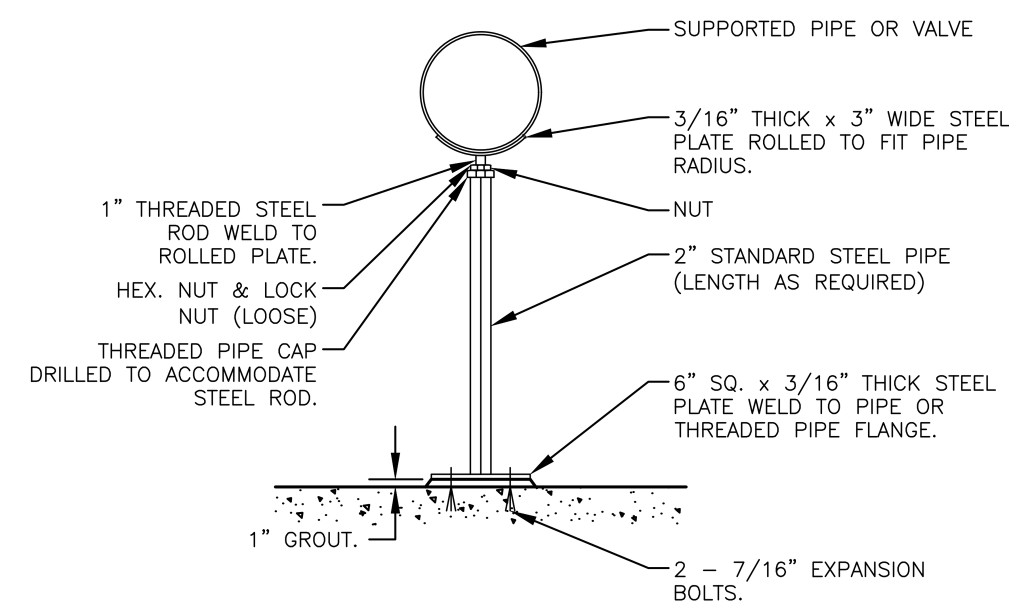
STATION PIPE SIZE, INCHES: ______ FORCE MAIN TYPE: ______

FORCE MAIN SIZE, INCHES: ______ LIFT STATION I.D.: ______

FORCE MAIN LENGTH, FEET: ______

PUMP DATA

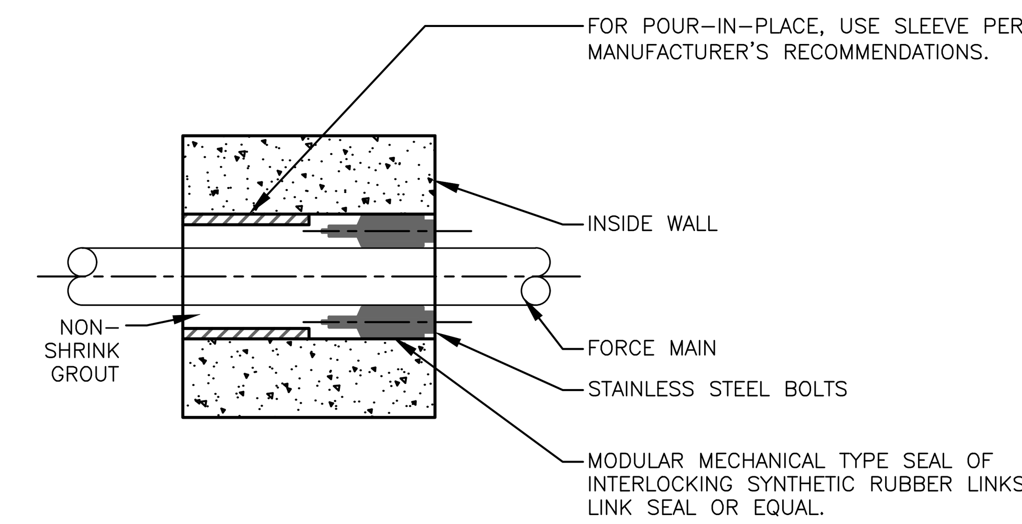
	INITIAL	ULTIMATE
DISCHARGE SIZE:		
GPM:		
TDH:		
HP:		
RPM:		
VOLTAGE:		
PHASE:		
MANUFACTURER:		
MODEL:		
IMPELLER SIZE:		



NOTES:

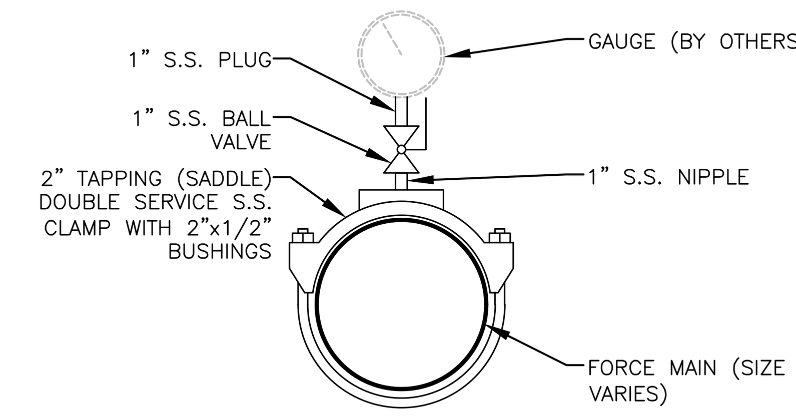
1. PIPE SUPPORTS SHALL BE SPACED NOT MORE THAN 12'-0" ON CENTER. PIPE TO BE SUPPORTED NEAR EACH SIDE OF VALVES, FLOW METERS, AND COUPLINGS.

ADJUSTABLE PIPE SUPPORT DETAIL
NOT TO SCALE



WALLS SHALL BE CORE DRILLED

PIPE SLEEVE DETAIL
FOR ALL WALL PENETRATIONS
NOT TO SCALE



PRESSURE GAUGE TAP DETAIL (TYP.)
NOT TO SCALE

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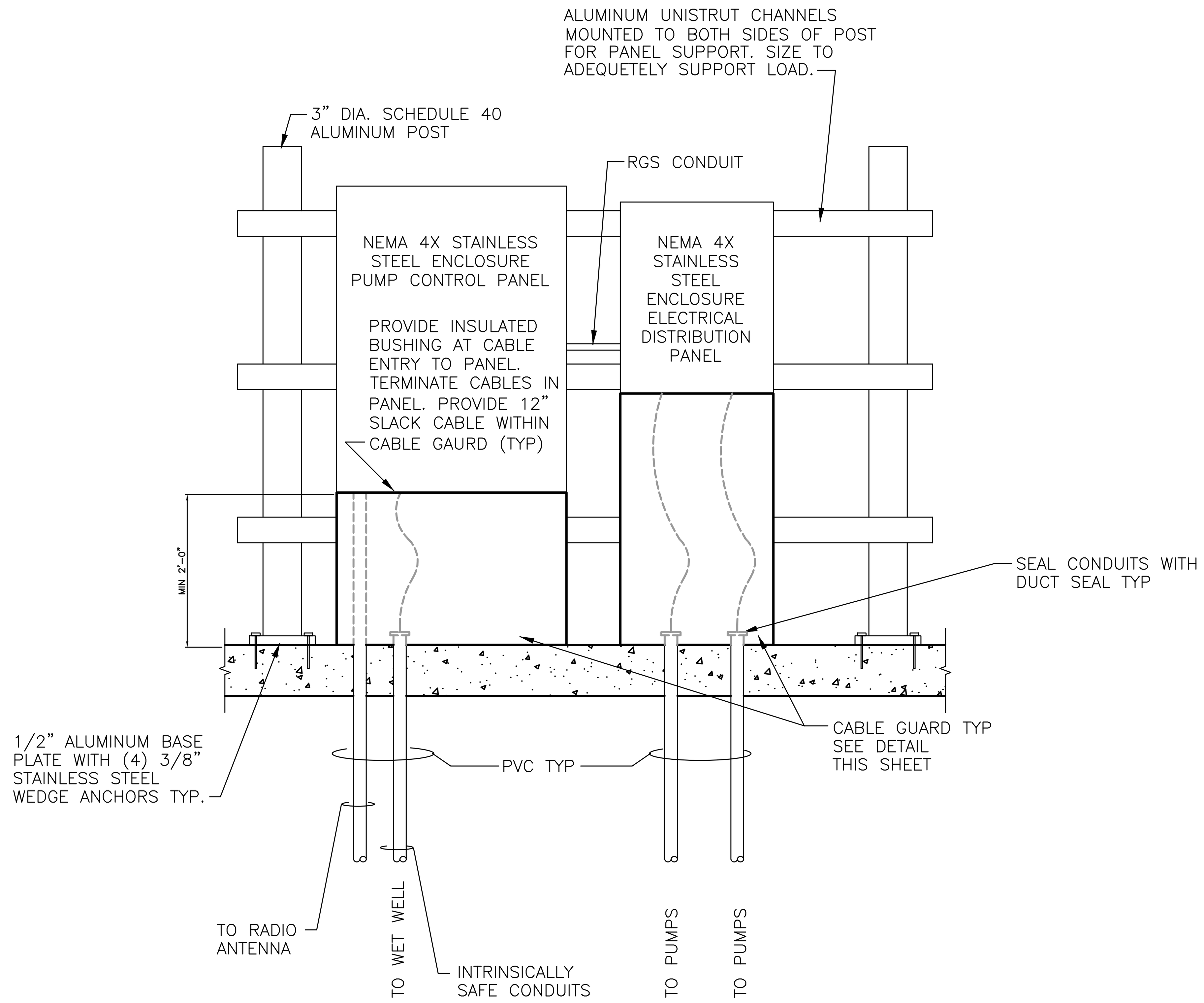
Revision Number	Revision Description	Drawn By	Checked By	Date

Filename
Project No.
Project Date

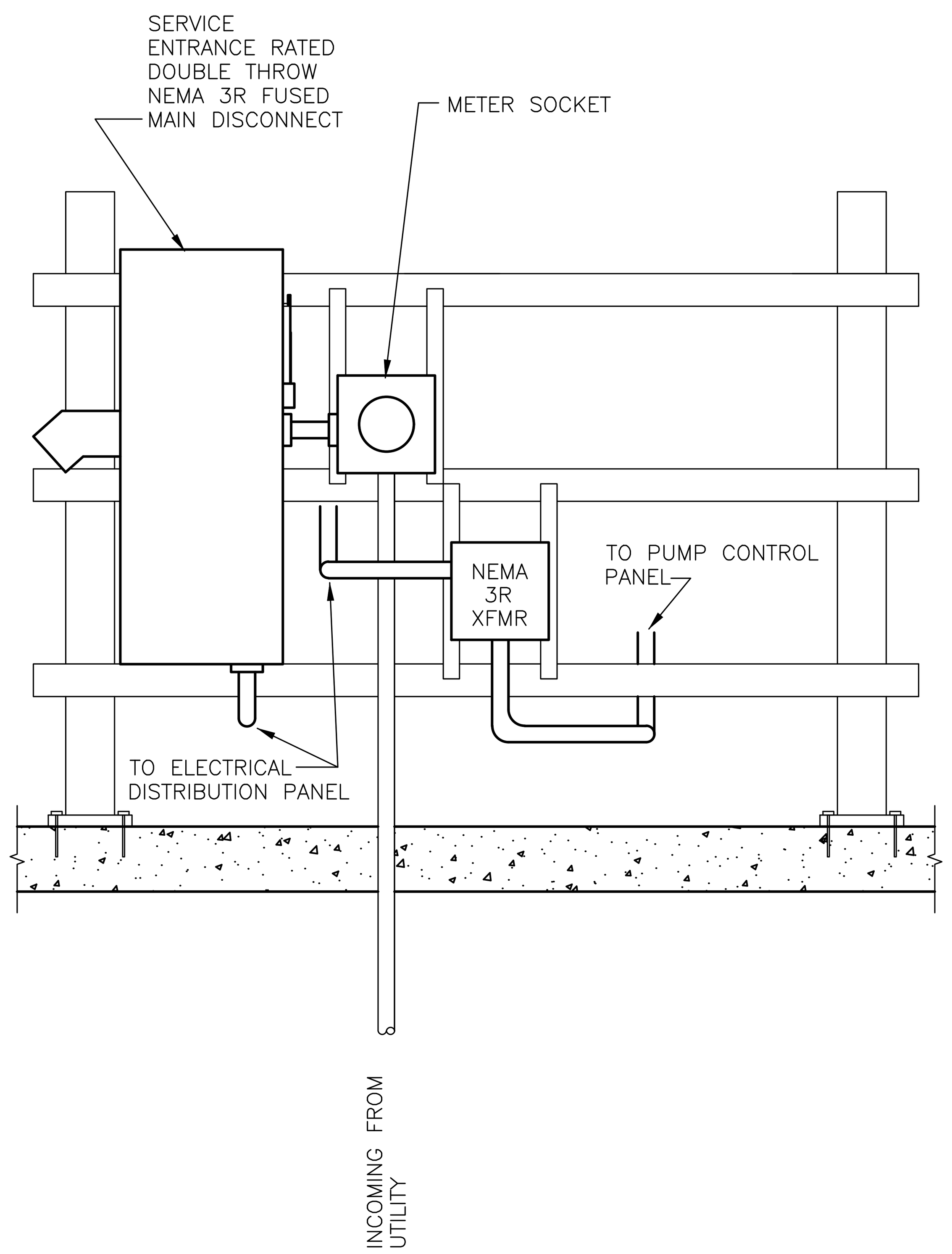
CITIZENS ENERGY GROUP
LEVEL 3 SUBMERSIBLE LIFT STATION
STANDARD DETAILS

FIGURE NO.
500.014



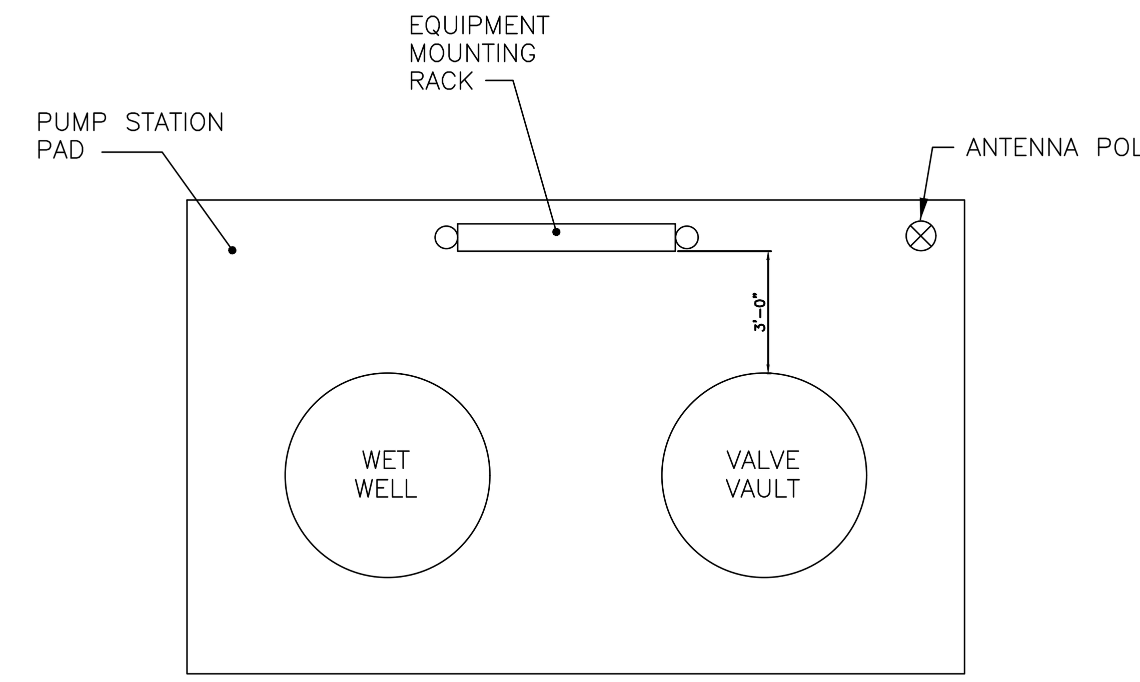
EQUIPMENT MOUNTING DETAIL (FRONT)

NTS



EQUIPMENT MOUNTING DETAIL (REAR)

NTS



TYPICAL PLAN VIEW

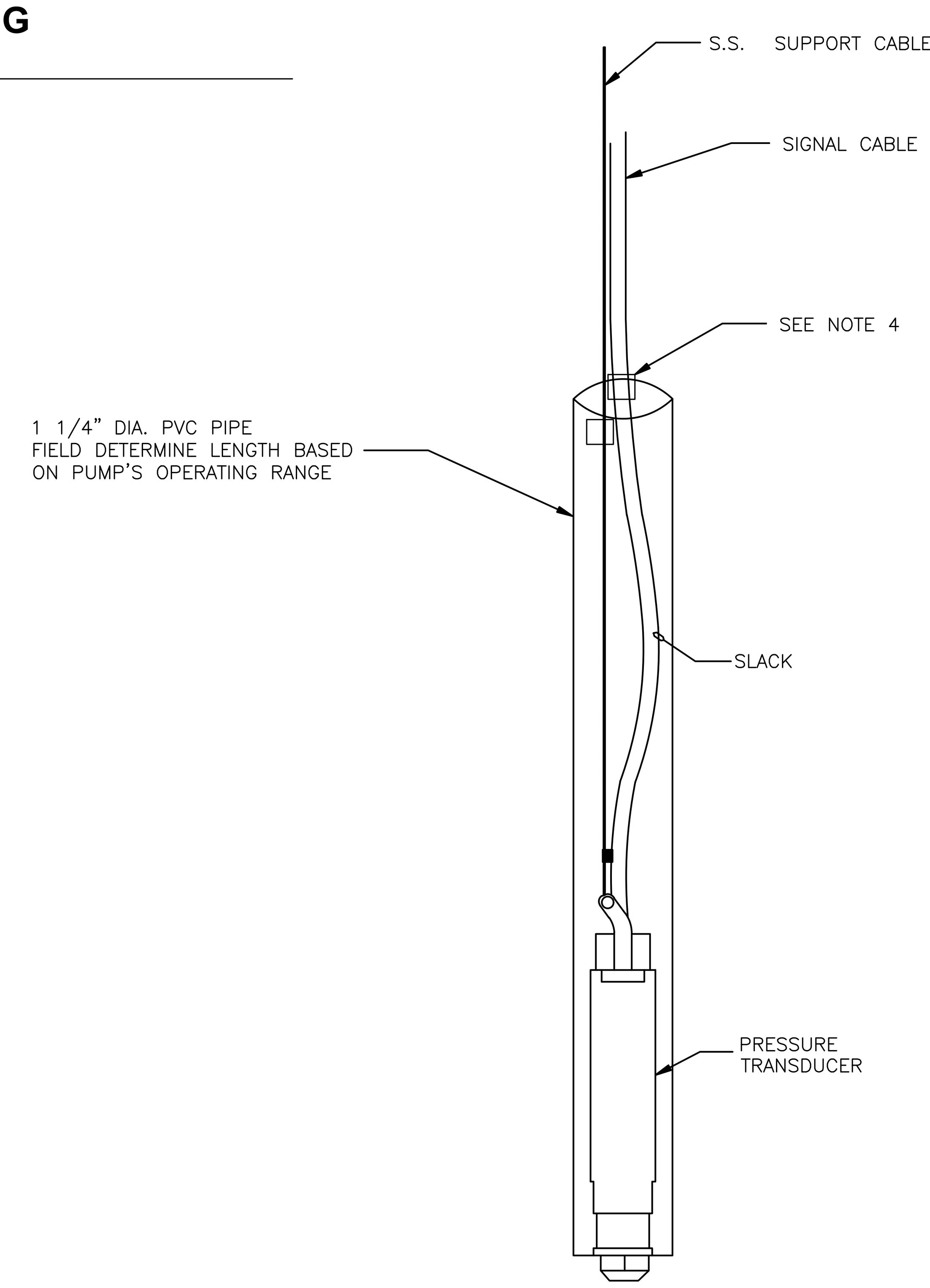
NTS

NOTES:

1. SECURE GUARD TO EQUIPMENT ENCLOSURE WITH 1/4" S.S. BOLTS AND TO CONCRETE WITH 1/4" S.S. WEDGE ANCHORS.
2. PROVIDE VENT ON EACH SIDE.
3. FIELD DETERMINE GUARD DIMENSIONS BASED ON EQUIPMENT PANEL SIZE AND LOCATION.
4. CONSTRUCT GUARD WITH NON-FERROUS MATERIAL SUCH AS FIBERGLASS COMPOSITE, STAINLESS STEEL OR ALUMINUM BASED ON EQUIPMENT PANEL SIZE AND LOCATION.

CABLE GUARD DETAIL

NTS



PRESSURE TRANSDUCER DETAIL

NTS

BEFORE INSTALLATION

1. DO NOT DISASSEMBLE THE TRANSDUCER OR LOOSEN THE COMPRESSION NUT AT THE SIGNAL CABLE ENTRY. THIS WILL VOID WARRANTY.
2. DO NOT NICK OR CUT THE SIGNAL CABLE JACKET TO PREVENT LEAKAGE THAT WILL VOID WARRANTY. AVOID ROLLING THE CABLE SPOOL OVER ROCKS, STONES, OR OTHER SHARP OBJECTS.
3. CONFIRM THE CONNECTION BETWEEN THE TRANSDUCER SIGNAL CABLE LEADS AND THE METER OR TRANSMITTER TERMINALS TO ENSURE PROPER OPERATION. REFER TO OPERATOR'S MANUAL. IF NEEDED, DISCONNECT THE SIGNAL CABLE LEADS FROM THE METER OR TRANSMITTER BEFORE INSTALLATION. DO NOT CONNECT THE SIGNAL CABLE LEADS TO ANY OTHER POWER SOURCE.

INSTALLATION

4. DRILL HOLE NEAR TOP OF PVC PIPE (TYP. 2). LOOSELY SECURE THE FREE ENDS OF THE SIGNAL CABLE AND SUPPORT CABLE, IF APPLICABLE, WITH ZIP TIES BEFORE LOWERING INTO THE WET WELL. PROPER INSTALLATION WILL ALLOW RETRIEVAL OF TRANSDUCER FOR MAINTENANCE.
5. HANDLE THE SIGNAL CABLE AND TRANSDUCER WITH CARE DURING INSTALLATION.
6. FOR DEPTHS OVER 300 FEET, USE A SUPPORT CABLE TO CARRY THE WEIGHT OF THE TRANSDUCER. PROVIDE SLACK IN THE SIGNAL CABLE TO PREVENT THE TRANSDUCER'S WEIGHT FROM PULLING ON THE SIGNAL CABLE (SEE DETAIL. ALSO REFER TO THE OPERATOR'S MANUAL).
7. DO NOT ROUTE THE SIGNAL CABLE NEXT TO HIGH VOLTAGE POWER LINES.
8. PROVIDE MEANS TO REMOVE THE TRANSDUCER IF NEEDED IN THE FUTURE.

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Revision Number	Revision Description	Drawn By	Checked By	Date

Revision Date 10/31/2018

CITIZENS ENERGY GROUP

LEVEL 3 SUBMERSIBLE LIFT STATION

ELECTRICAL DETAILS

FIGURE NO.

500.015

CITIZENS ENERGY GROUP
CLSXXX
LEVEL 3 STANDARD
LIFT STATION CONTROL PANEL

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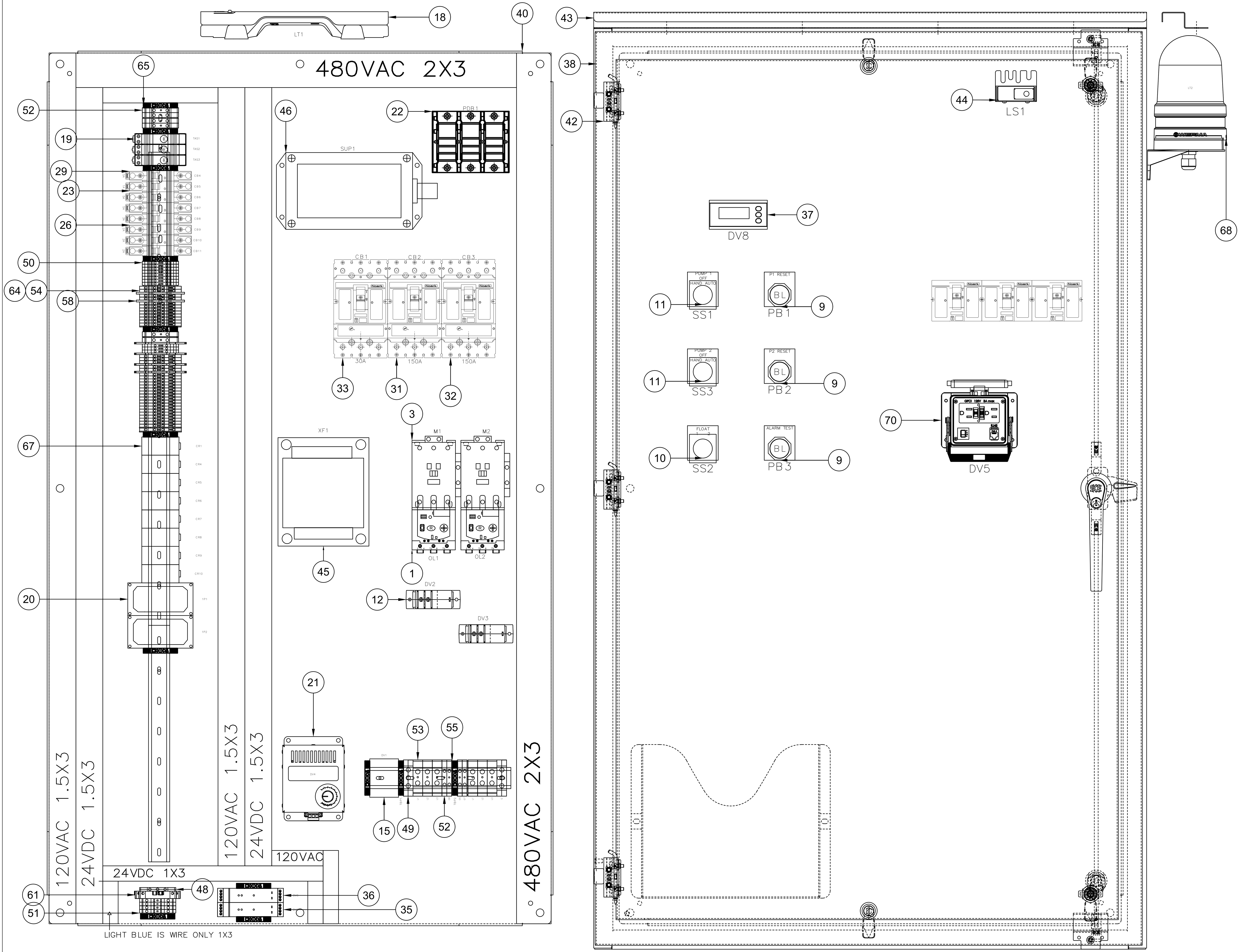
NOTES:

TITLE: TABLE OF CONTENTS	DATE: 10/29/24
DRAWING #: MOTOR CONTROL PANEL-1	VERSION: 2025
FIGURE 500.016 CEG LEVEL 3 LIFT STATION STANDARD	



TYPICAL BILL OF MATERIALS

SOME PARTS DO NOT HAVE ANY ACCEPTABLE SUBSTITUES. PLEASE REFER TO LISTS BELOW FOR PARTS THAT MUST BE INCLUDED.

ITEM	TAGS	QTY	SUB	CATALOG	ASSYCODE	MFG	DESC
1	OL1,OL2	2	1	193-1EFGJ		AB	Thermal Overload
3	M1,M2	2	1	300-DOD930		AB	CONTACTOR AC COMPACT SZ3 120VAC COIL
3	M1,M2	2	1	193-1EMRD		AB	E100 ELEC RESET IND DISPLAY
9	PB1,PB2,PB3	3	1	800H-AR2A		AB	PUSH BUTTON - MOMENTARY, NEMA 4/4X
10	SS2	1	1	800H-HR2A		AB	NON-ILLUMINATED SELECTOR SWITCH, NEMA 4/4X/13
11	SS1,SS3	2	1	800H-JR2A		AB	NON-ILLUMINATED SELECTOR SWITCH, NEMA 4/4X/13
12	DV2,DV3	2	1	ACT200-42L-S		AcuAMP	AcuAMP AC current transducer, 1-phase, split core, 0-200A sensing range, 4-20mA output.
15	DV1	1	1	SLA-230-ALA		ATC	PHASE MONITOR/RELAY
15	DV1		1	700-HN125		AB	SCREW TERMINAL TUBE BASE SOCKET, OPEN STYLE CONSTRUCTION
18	LT1	1	1	7L4302302100		FINDER	PANEL LIGHT, 600 LUMENS, 6W, 110/240VAC/DC MOTION SWITCH WITH PUSH IN TERMINALS
19	TAS1,TAS2,TAS3	3	1	7T8100002402		FINDER	THERMOSTAT, SPST-NC 10A, -20 C TO +60 C
20	1P1,1P2	2	1	MINICAS120		FLYGT	SEAL FAIL RELAY
21	DV4	1	1	DAH2001A		HOFFMAN	200W ELECTRIC HEATER, 120V
22	PDB1	1	1	LFD35533Z	LPBC33	LITTELFUSE	1LINE 6 LOAD POWER DISTRIBUTION BLOCK
23	CB5	1	1	B1N1C1		NOARK	
26	CB9,CB10,CB11	3	1	B1N1C2		NOARK	
27	CB8	1	1	B1N1C3		NOARK	
29	CB4,CB6,CB7	3	1	B1N1C5		NOARK	
31	CB2	1	1	M1N125T3L		NOARK	M1N SERIES MCCB, UL489, 3 POLE, LUG-LINE/LOAD CONNECTION
31	CB2		1	AL21N		NOARK	ALARM CONTACT FOR USE WITH ANY M1-M6 MCCB, 1NO/1NC
32	CB3	1	1	M1N125T3L		NOARK	M1N SERIES MCCB, UL489, 3 POLE, LUG-LINE/LOAD CONNECTION
33	CB1	1	1	M1N30T3L		NOARK	M1N SERIES MCCB, UL489, 3 POLE, LUG-LINE/LOAD CONNECTION
35	DV9	1	1	5104BB2A		PR	EX REPEATER POWER SUPPLY
36	DV6	1	1	5202B2		PR	PULSE ISOLATOR
37	DV8	1	1	5714D		PR	PROGRAMMABLE LED INDICATOR WITH ANALOG OUTPUT AND 2 RELAYS
38		1	1	SCE-48EL3612SSLPPL		SCE	S.S. LPPL Enclosure
40		1	1	SCE-60P36		SCE	FITS 60X36 ENCLOSURE
42		1	1	SCE-DF60EL36LP		SCE	DEAD FRONT FOR 60X36 ENCLOSURE
43		1	1	SCE-DS36SS		SCE	SHIELD, SS DRIP
44	LS1	1	1	SCE-LSA		SCE	
45	XF1	1	1	CE2000TH		SolaHD	
46	SUP1	1	1	STMB9-3N4-64		SSI	STMx9 SERIES 90kA PER PHASE, TYPE 2 SPD, Ln =20kA
48		1	1	1010100000		WEIDMULLER	STANDARD DESIGN PROTECTIVE CONDUCTOR TERMINAL - WPE 4
49	TBP1.1,TBP2.1	2	1	1010500000		WEIDMULLER	STANDARD DESIGN PROTECTIVE CONDUCTOR TERMINAL - WPE 35
50	TB120,TBP2M	11	1	1020000000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 2.5
51	TBIS	4	1	1020180000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 4
52	TBP1.1,TBP2.1,TBP2	10	1	1020200000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 6
53	TBP1.1,TBP2.1	6	1	1020500000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 35
54	TB120,TBP2M	36	1	1041100000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDK 2.5 (W/ ZQV JUMPERS)
55	TB120,TBP1.1,TBP2.	4	1	1050000000		WEIDMULLER	END PLATE/PARTITION - WAP 2.5-10
56	TBP1	1	1	1050080000		WEIDMULLER	END PLATE/PARTITION - WAP 2.5-10
57	TBP2M,TBXFR	2	1	1050100000		WEIDMULLER	END PLATE/PARTITION - WAP 16-35
58	TB120,TBP2M	6	1	1058800000		WEIDMULLER	END PLATE/PARTITION - WTW
59	TB120,TBP2M	3	1	1059100000		WEIDMULLER	END PLATE/PARTITION - WAP
60	TBP2M	13	1	1061200000		WEIDMULLER	END BRACKET - WEW 35/2
61	TBIS	1	1	1063810000		WEIDMULLER	
64	TB120,TBP1.1,TBP2I	8	1	1527690000		WEIDMULLER	PUSH IN JUMPER (10)
65	TB120,TBP2M,TBXFI	3	1	2593450000		WEIDMULLER	
67	CR1,CR4,CR5,CR6,CI	8	1	8921050000		WEIDMULLER	RIDERSERIES RCM, Relay module, Number of contacts: 4, CO contact AgNi, Rated control voltage: 115 V AC, Continuous current: 6 A, Screw connection
68	LT2	1	1	26211060	26270006	WERMA	WERMA EvoSIGNAL Maxi TwinLIGHT series LED industrial signal beacon, 120mm, red, permanent or blinking (1 Hz ON for 480ms),
70	DV5	1	1	ZP-PGA-32-201		ZIPport	PANEL INTERFACE CONNECTOR

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NOTES:
- MUST PROVIDE A 3" SS BARRIER TO ISOLATE INTRINSICALLY SAFE COMPONENTS, AT LEAST 20 GAUGE, MECHANICALLY FASTENED.
- MUST PROVIDE A LIGHT BLUE WIREWAY FOR IS WIRES TO MOVE THROUGH
- ALL OPERATORS ARE SHOWN ON SWINGOUT. PANEL MUST HAVE A DEADFRONT.
- BILL OF MATERIALS SHOWS POSSIBLE PART NUBMERS, IT IS UP TO THE INTEGRATOR TO PROPERLY SIZE AND SELECT COMPONENTS

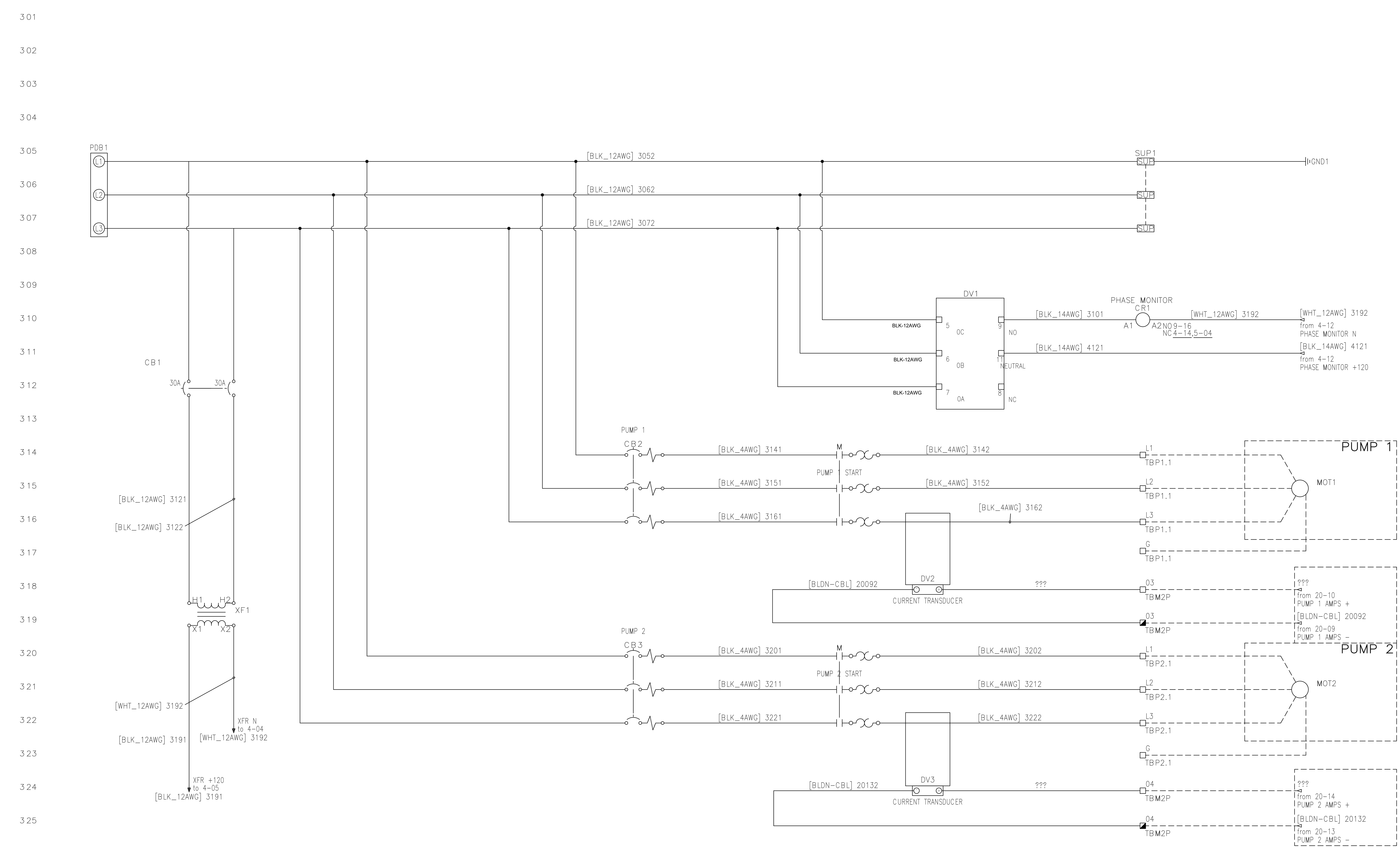
TITLE: PANEL ASSEMBLY

DATE: 10/29/24

DRAWING #: MOTOR CONTROL PANEL-2

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD



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NOTES:

TITLE: POWER CIRCUIT 3 PHASE

DATE: 10/29/24

DRAWING #: MOTOR CONTROL PANEL-3

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD

NOTES:

TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: MOTOR CONTROL PANEL-4

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD

NOTES:

TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: MOTOR CONTROL PANEL-5

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD

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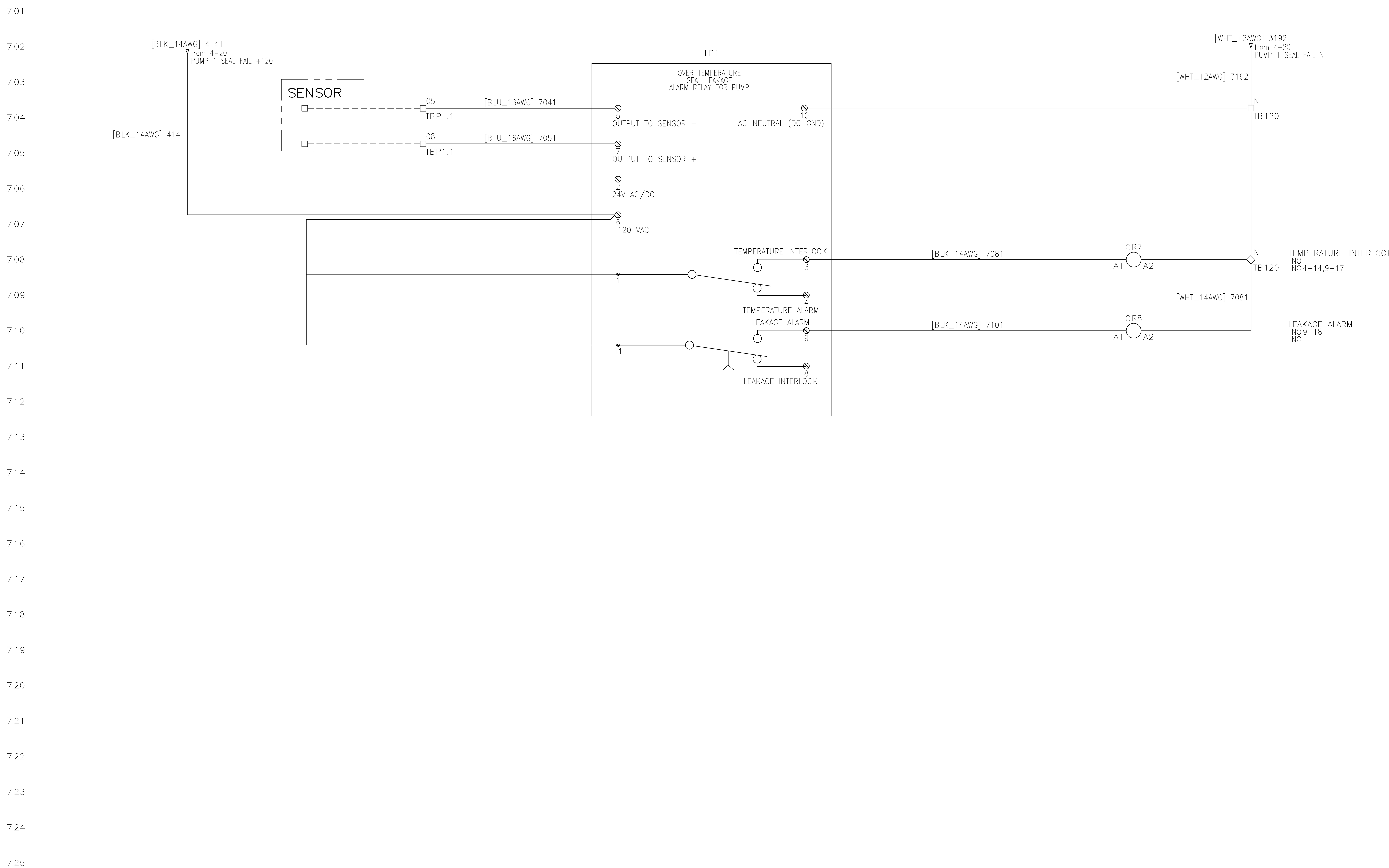
NOTES:

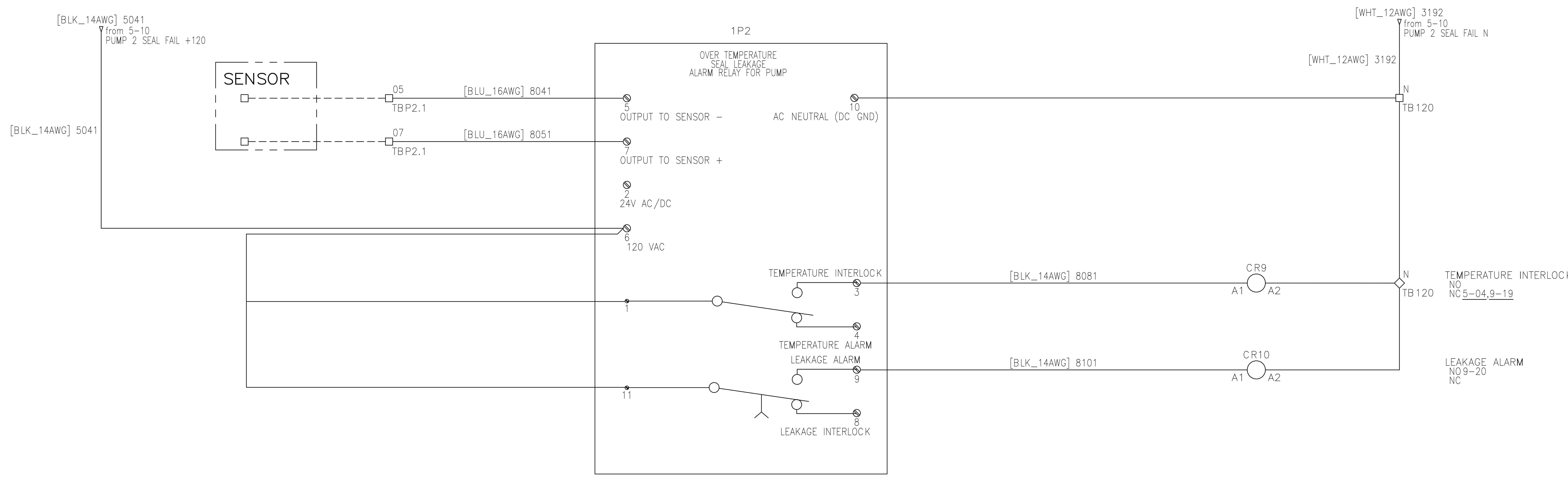
ANYTHING IN TBIS MUST BE RATED FOR INTRINSICALLY WIRE. IF RATING IS NOT APPLICABLE, LIKE TERMINALS, THE PART IN QUESTION SHOULD BE A BLUE/LIGHT BLUE COLOR.

TITLE: POWER FROM UPS 120VAC	DATE: 10/29/24
DRAWING #: MOTOR CONTROL PANEL-6	VERSION: 2025
CEG LEVEL 3 LIFT STATION STANDARD	



NOTES:
THIS PAGE CONTAINS A TYPICAL COMBINED SEAL FAIL RELAY USED WITH FLYGT AND GRUNDFOS PUMPS. IT IS UP TO THE INTEGRATOR TO CORRECTLY IDENTIFY AND USE THE APPROPRIATE PUMP MONITORING RELAY(S).

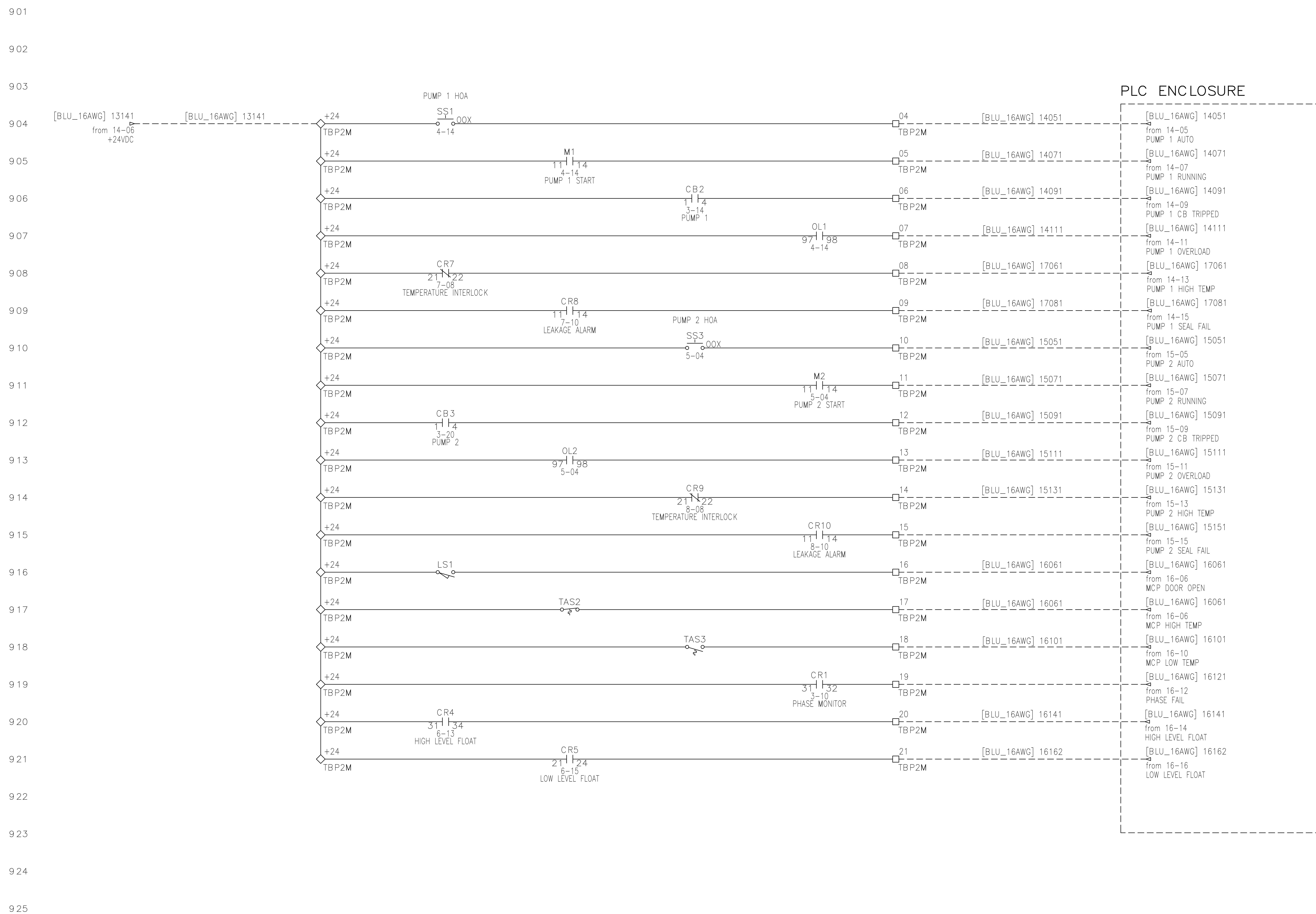
TITLE: PUMP PROTECTION RELAY	DATE: 10/29/24
DRAWING #: MOTOR CONTROL PANEL-7	VERSION: 2025
CEG LEVEL 3 LIFT STATION STANDARD	



NOTES:

THIS PAGE CONTAINS A TYPICAL COMBINED SEAL FAIL RELAY USED WITH FLYGT AND GRUNDFOS PUMPS. IT IS UP TO THE INTEGRATOR TO CORRECTLY IDENTIFY AND USE THE APPROPRIATE PUMP MONITORING RELAY(S).

TITLE: PUMP PROTECTION RELAY	DATE: 10/29/24
DRAWING #: MOTOR CONTROL PANEL-8	VERSION: 2025
CEG LEVEL 3 LIFT STATION STANDARD	



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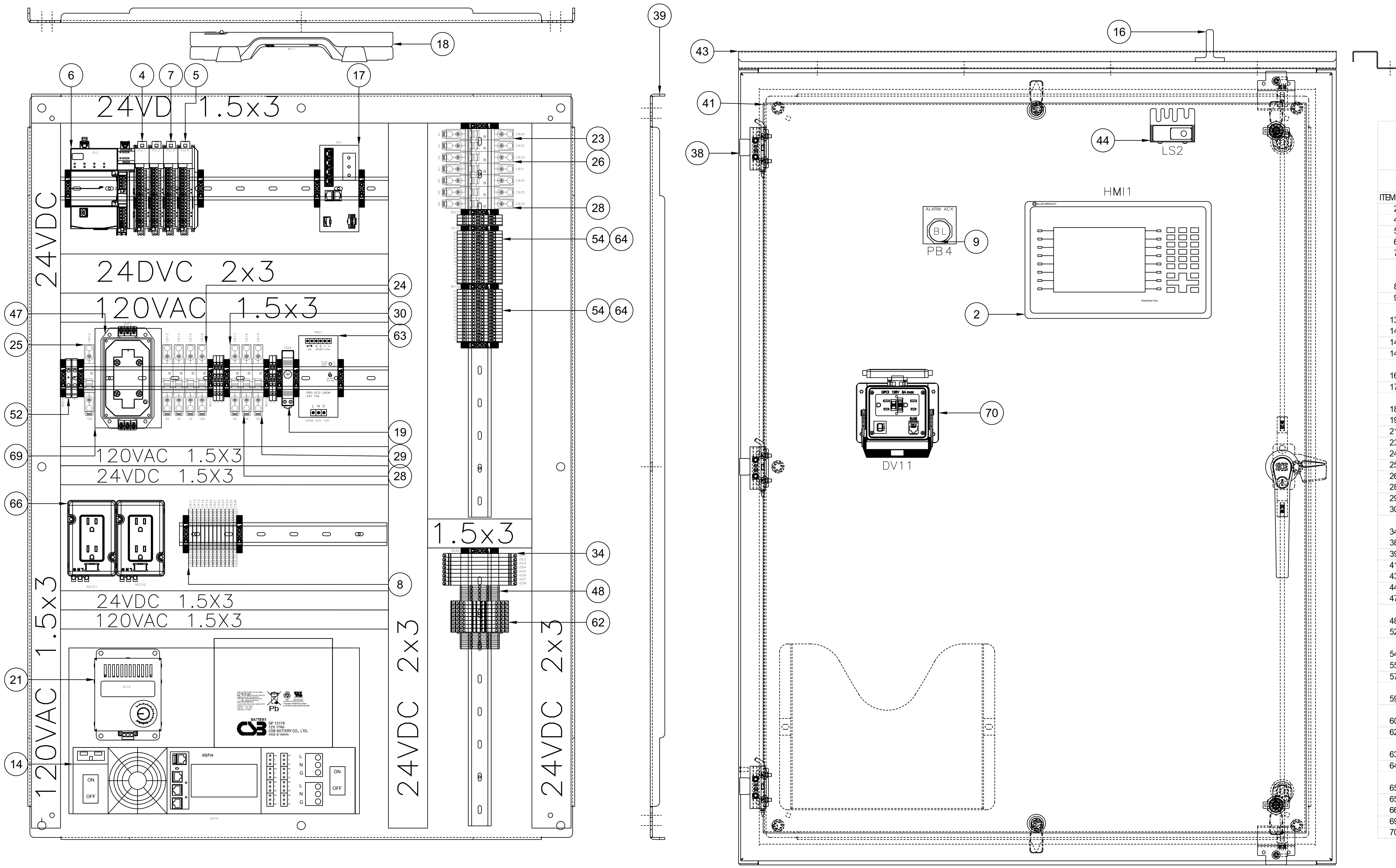
NOTES:
- ALL AC SIGNALS POWERED FROM OUTSIDE OF THE PANEL MUST BE WIRED INTERNALLY WITH YELLOW WIRE
- ALL DC SIGNALS POWERED FROM OUTSIDE OF THE PANEL MUST BE WIRED INTERNALLY WITH ORANGE WIRE
- BLUE AND RED DESIGNATION ON THIS PAGE SHOW WHAT WIRE COLOR THE ASSOCIATED WIRE IS WITHIN THE PLC PANEL

TITLE: PANEL CONNECTIONS	DATE: 10/29/24
DRAWING #: MOTOR CONTROL PANEL-9	VERSION: 2025
CEG LEVEL 3 LIFT STATION STANDARD	



TYPICAL BILL OF MATERIALS

SOME PARTS DON'T HAVE ACCEPTABLE SUBSTITUES, SEE BELOW FOR LIST

ITEM	TAGS	QTY	SUB	CATALOG	ASSYCODE	MFG	DESC
2	HMI1	1	1	2711P-B7C22D9P		AB	PANELVIEW PLUS 7 GRAPHIC TERMINAL
4	PLC1,PLC2	2	1	5069-IB16	5069-RTB18-SCREW	AB	16CH COMPACT I/O INPUT 24V DC SINK
5	PLC4	1	1	5069-IF8	5069-RTB18-SCREW	AB	COMPACT 5000 8 CHANNEL ANALOG INPUT
6	PLC	1	1	5069-L306ER	5069-RTB64-SCREW	AB	COMPACTLOGIX 600KB ETHERNET CONTROLLER
7	PLC3	1	1	5069-OB16	5069-RTB18-SCREW	AB	COMPACT I/O 16 CHANNEL 24VDC SOURCE OUTPUT MODULE
8	CR11,CR13,CR14,CR19,CR20, CR21,CR22,CR23,CR24,CR25, CR26	12	1	700-HLT1Z24		AB	HL TYPE TERMINAL BLOCK RELAY
9	PB4	1	1	800H-AR2A		AB	PUSH BUTTON - MOMENTARY, NEMA 4/4X
13		1	1	181-025-10		ALPHA	BATTERY, 12V, 17Ah, STANDAR LIFE GENERAL PURPOSE VRLA AGM
14	DV14	1	1	FXM-650		ALPHA	UPS, POWER MODULE ONLY
14	DV14		1	740-697-22		ALPHA	RACK MOUNT KIT, BRKT, 2RU, BLK, FXM650
14	DV14		1	740-767-22		ALPHA	BATTERY CABLE KIT, FXM650, 24VDC
16		1	1	LGAM-BC3G-26-3SP		Panorama Antennas	Low Profile MiMo 2G/3G/4G Antenna
17	DN1	1	1	IR1101		CISCO	SEE STANDARD PARTS LIST FOR ALL REQUIRED OPTIONS
18	WLT1	1	1	7L4302302100		FINDER	PANEL LIGHT, 600 LUMENS, 6W, 110/240VAC/DC MOTION SWITCH WITH PUSH IN TERMINALS
19	TAS5	1	1	7T8100002402		FINDER	THERMOSTAT, SPST-NC 10A, -20 C TO +60 C
21	DV10	1	1	DAH2001A		HOFFMAN	200W ELECTRIC HEATER, 120V
23	CB20,CB21,CB22	3	1	B1N1C1		NOARK	MINIATURE CIRCUIT BREAKER UL489 240VAC, 10kA BOX LUGS
24	CB16	1	1	B1N1C10		NOARK	MINIATURE CIRCUIT BREAKER UL489 240VAC, 10kA BOX LUGS
25	CB12	1	1	B1N1C15		NOARK	MINIAUTRE CIRCUIT BREAKER UL489 240VAC, 10kA BOX LUGS
26	CB14,CB15,CB23,CB24,CB25	5	1	B1N1C2		NOARK	MINIATURE CIRCUIT BREAKER UL489 240VAC, 10kA BOX LUGS
28	CB18,CB26	2	1	B1N1C4		NOARK	MINIATURE CIRCUIT BREAKER UL489 240VAC, 10kA BOX LUGS
29	CB13,CB19	2	1	B1N1C5		NOARK	MINIATURE CIRCUIT BREAKER UL489 240VAC, 10kA BOX LUGS
30	CB17	1	1	B1N1C6		NOARK	MINIATURE CIRCUIT BREAKER UL489 240VAC, 10kA BOX LUGS
34	ISO1,ISO2,ISO3,ISO4,ISO5,ISO 6,ISO7,ISO8	8	1	3104		PR	Isolation and conversion of standard DC signals
38		1	1	SCE-48EL3612SSLPPL		SCE	S.S. LPPL Enclosure
39		1	1	SCE-48P36		SCE	BACK PANEL THAT FITS 48X36 ENCLOSURE
41		1	1	SCE-DF48EL36LP		SCE	DEAD FRONT PANEL
43		1	1	SCE-DS36SS		SCE	SHIELD, SS DRIP
44	LS2	1	1	SCE-LSA		SCE	ASSEMBLY, LIGHT SWITCH
47	SUP2	1	1	USPT1P1-64		SSI	CONTROL PANEL INLINE SURGE
48	TB301	8	1	1010100000		WEIDMULLER	STANDARD DESIGN PROTECTIVE CONDUCTOR TERMINAL - WPE 4
52	TB010	2	1	1020200000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDU 6
54	TB011,TB012,TB013,TB101,TB 102	40	1	1041100000		WEIDMULLER	STANDARD DESIGN TERMINAL BLOCK - WDK2.5 (W/ ZQV JUMPERS)
55	TB010	1	1	1050000000		WEIDMULLER	END PLATE/ PARTITION - WAP 2.5-10
57	TB010	1	1	1050100000		WEIDMULLER	END PLATE/ PARTITION - WAP 16-35
59	TB011,TB012,TB013,TB101,TB 102,TB301	6	1	1059100000		WEIDMULLER	END PLATE/ PARTITION - WAP
60	TB010,TB011,TB012,TB101,TB 102	20	1	1061200000		WEIDMULLER	END BRACKET - WEW 35/2
62	TB301	8	1	1064170000		WEIDMULLER	Surge protection for measurement and control, UP(L/N-PE) 900 V
63	PWS1	1	1	1469490000		WEIDMULLER	Weidmuller Single Phase Power Supply, Switch Mode Power Supply Unit PRO ECO 240W 24V 10A
64	TB012,TB013,TB101,TB102	6	1	1527690000		WEIDMULLER	PUSH IN JUMPER (10)
65	TB010,TB011,TB012,TB013,TB 101,TB102,TB301	7	1	2593450000		WEIDMULLER	
65	TB011,TB013,TB101,TB102	6	1	1527690000		WEIDMULLER	PUSH IN JUMPER (10)
66	RECP1,RECP2	2	1	6720005421		WEIDMULLER	15A, 120V DUAL OUTLET, DIN RAIL MOUNT, DRAC DP 15
69		1	1	DINP01-4060A		WINFORD	DIN RAIL MOUNT PLATE 4X6"
70	DV11	1	1	ZP-PGA-32-201		ZIPport	PANEL INTERFACE CONNECTOR

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NOTES:

TITLE: ASSEMBLY

DATE: 10/29/24

DRAWING #: PLC PANEL-10

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD

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NOTES:

TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: PLC PANEL-11

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD

citizens energy group™

NOTES:

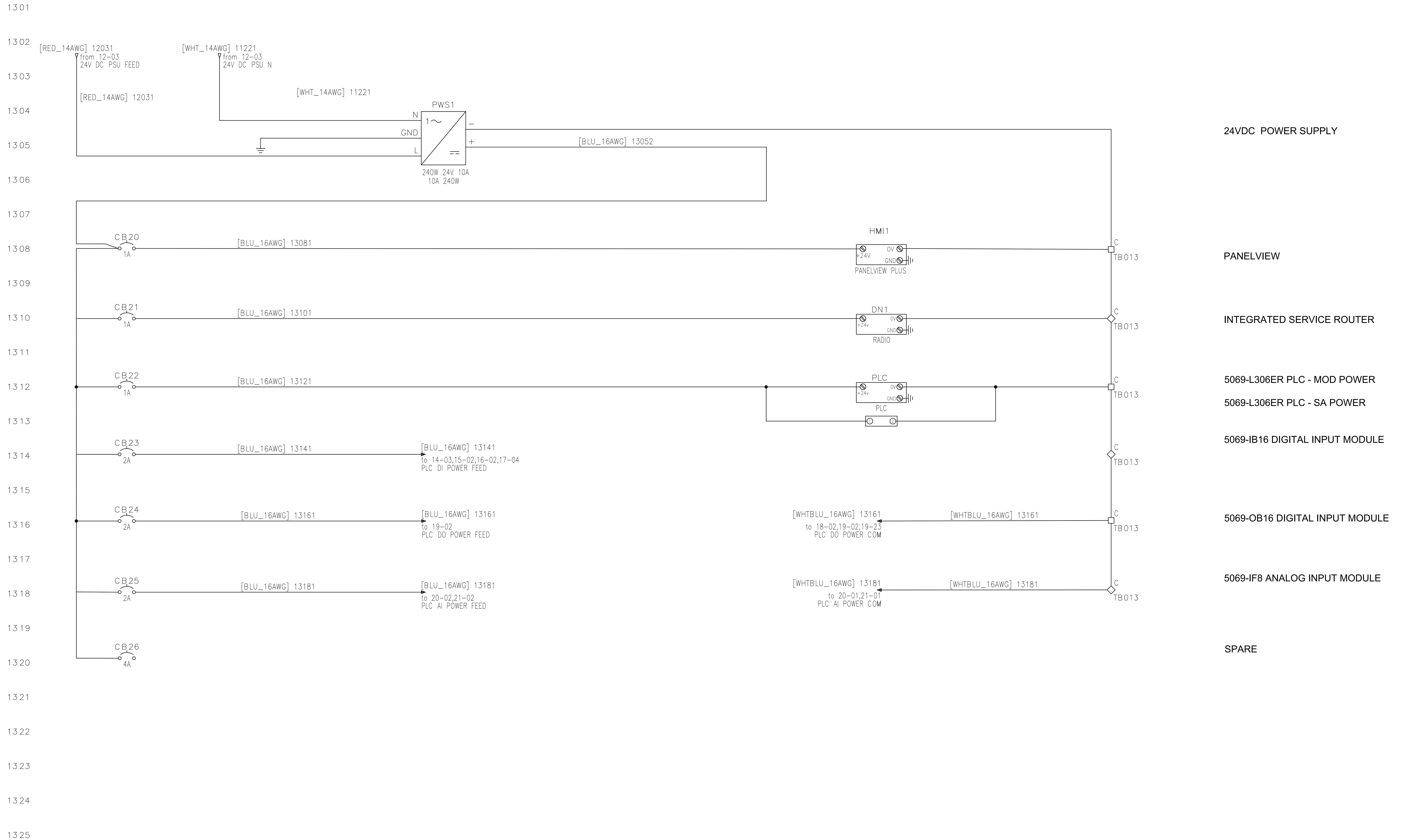
TITLE: POWER CIRCUIT 120VAC

DATE: 10/29/24

DRAWING #: PLC PANEL-12

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD



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NOTES:

TITLE: POWER CIRCUIT 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-13

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:1:I.

TITLE: DIGITAL INPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-14	VERSION: 2025
CEG LEVEL 3 LIFT STATION STANDARD	

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:1:I.

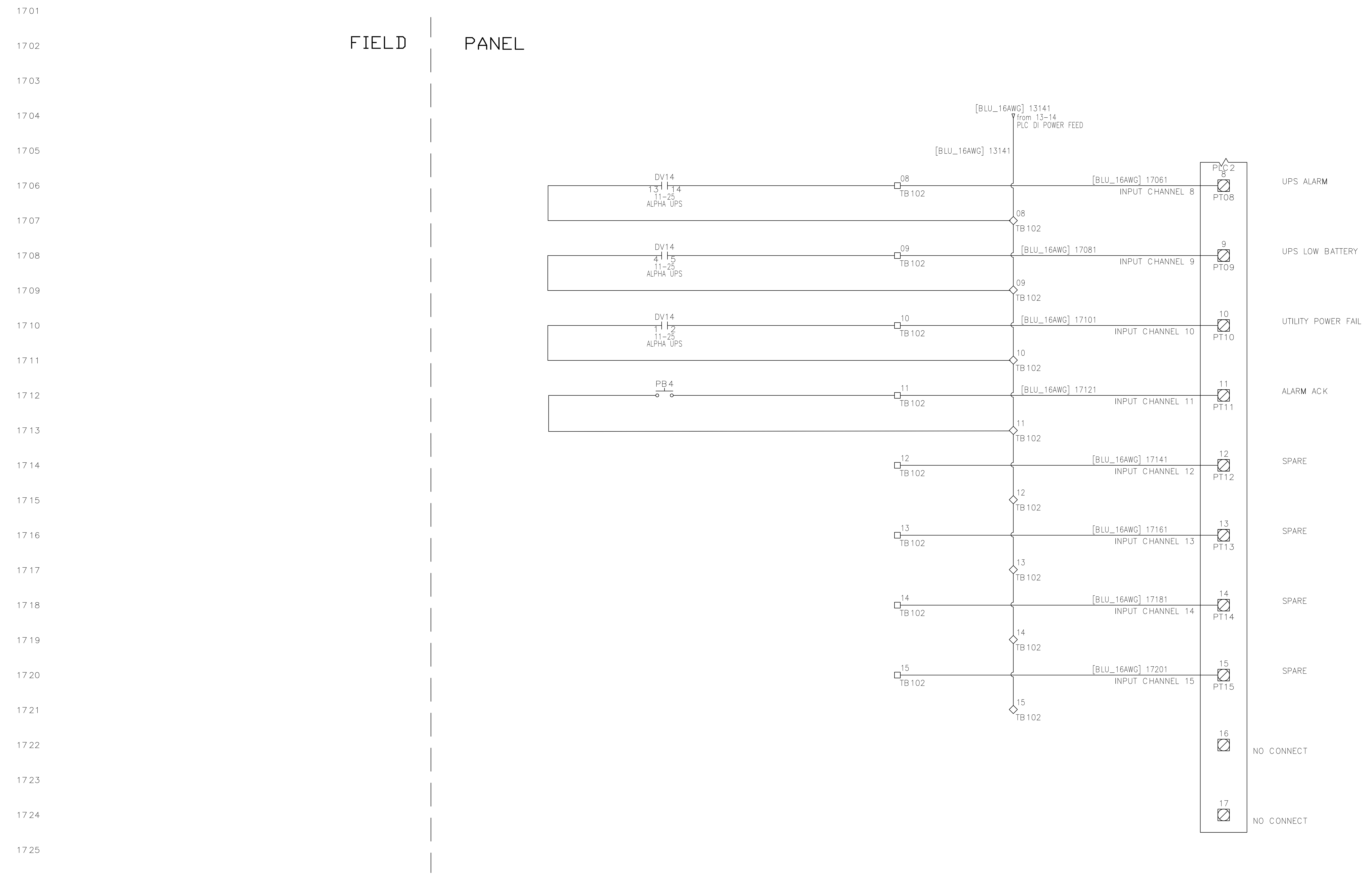
TITLE: DIGITAL INPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-15	VERSION: 2025
CEG LEVEL 3 LIFT STATION STANDARD	

citizens energy group™

NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:2:I.

TITLE: DIGITAL INPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-16	VERSION: 2025
CEG LEVEL 3 LIFT STATION STANDARD	



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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:2:I.

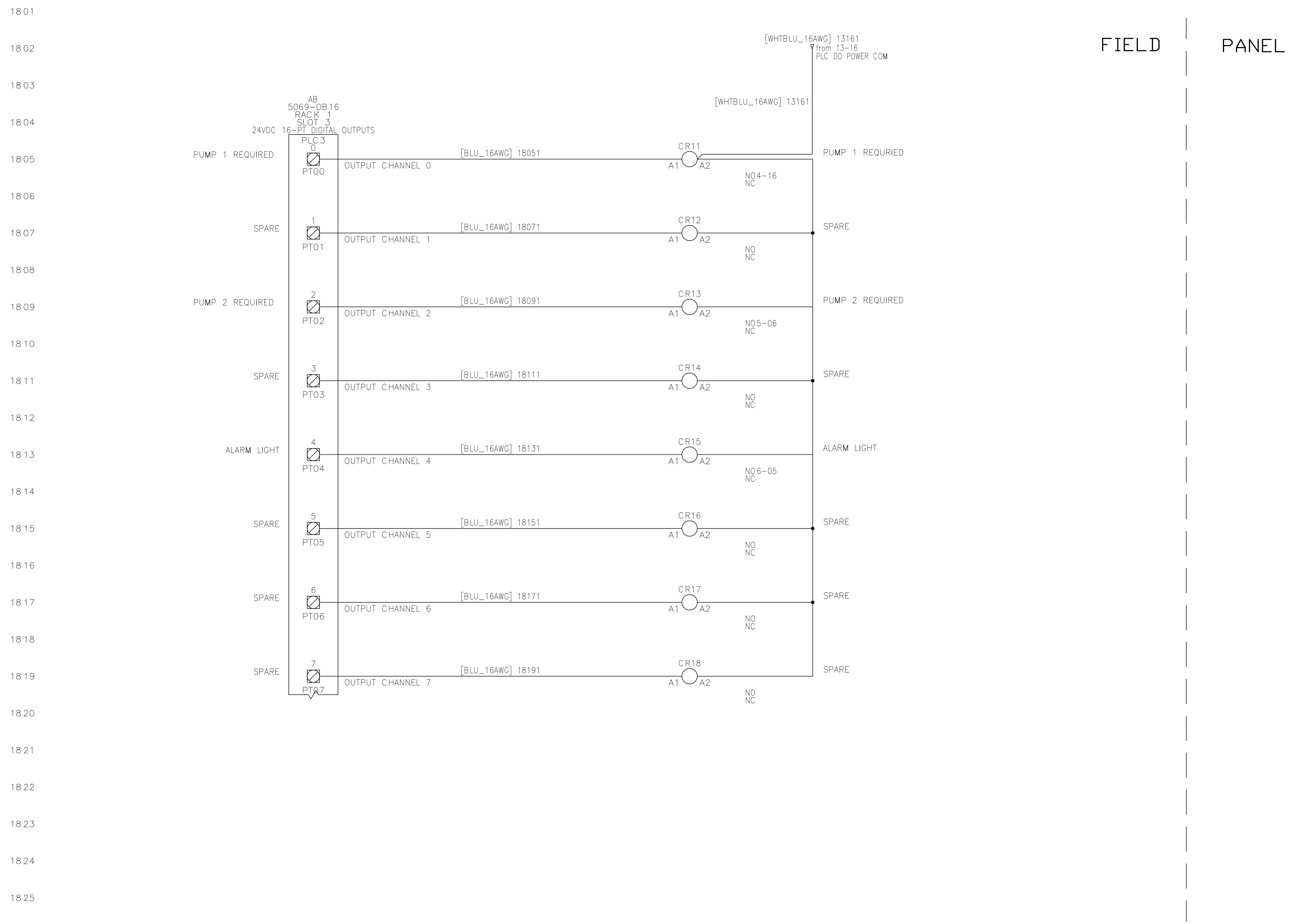
TITLE: DIGITAL INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-17

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD



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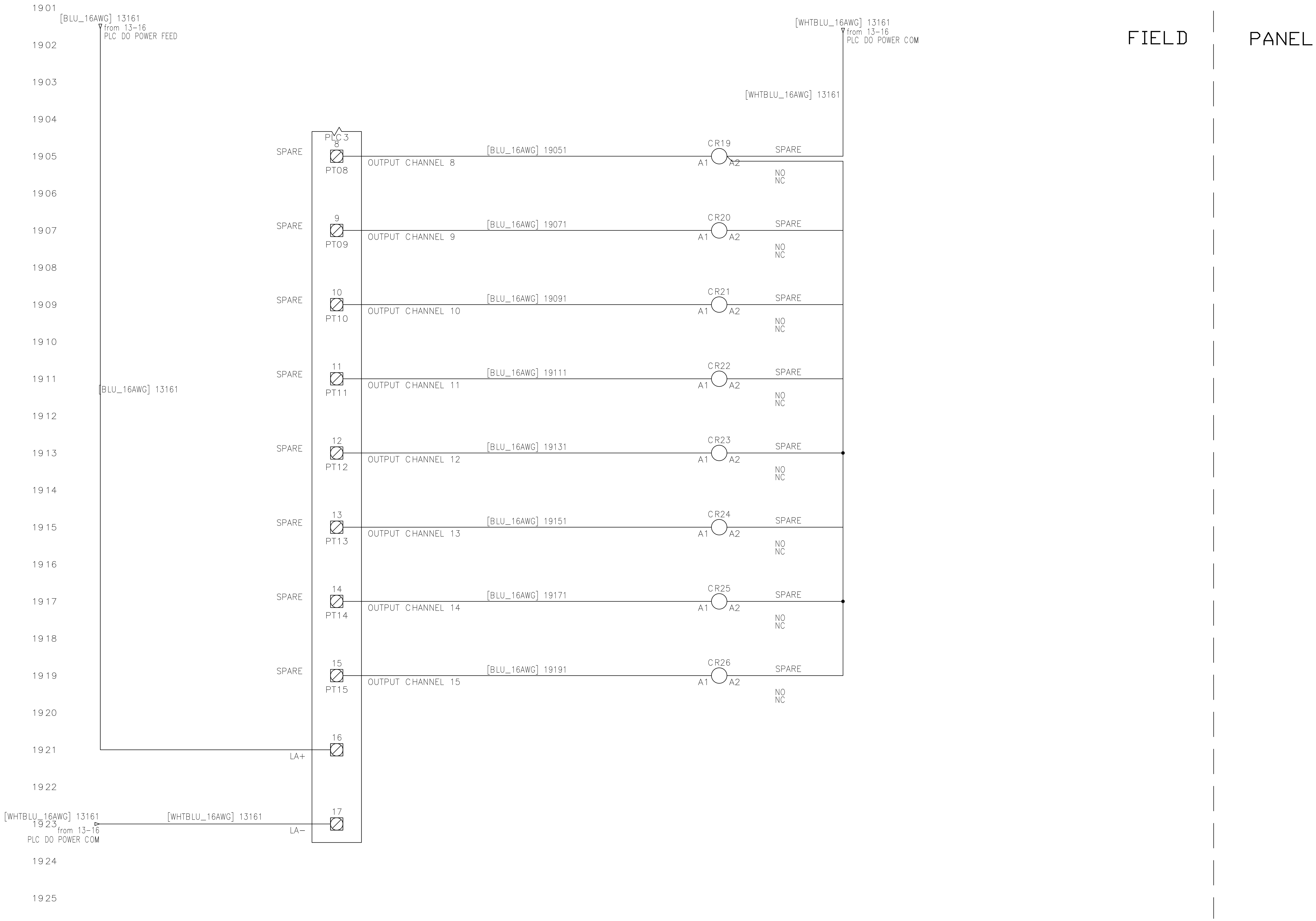
NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:3:O.

TITLE: DIGITAL OUTPUTS 24VDC	DATE: 10/29/24
DRAWING #: PLC PANEL-18	VERSION: 2025
CEG LEVEL 3 LIFT STATION STANDARD	



NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:3:O.

TITLE: DIGITAL OUTPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-19

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD

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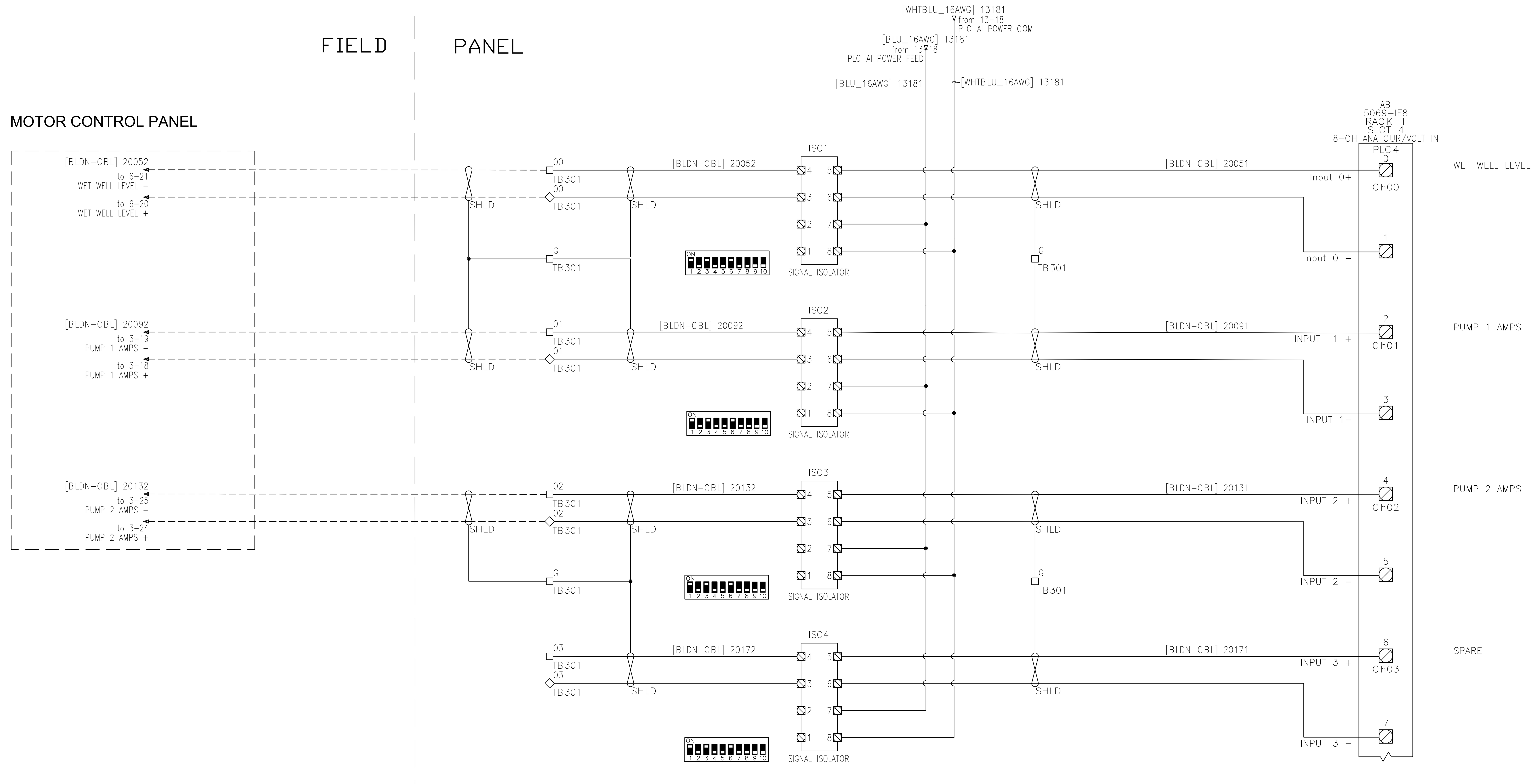

3104

Input setup					Output setup						
	1	2	3	4		5	6	7	8	9	10
0...20 mA	OFF	OFF	OFF	OFF	0...20 mA	OFF	OFF	OFF	NA	NA	NA
4...20 mA	OFF	OFF	ON	OFF	4...20 mA	OFF	ON	OFF	NA	NA	NA
0...10 V	OFF	ON	OFF	OFF	0...10 V	ON	OFF	OFF	NA	NA	NA
2...10 V	OFF	ON	ON	OFF	2...10 V	ON	ON	OFF	NA	NA	NA
0...5 V	OFF	ON	OFF	ON	0...5 V	ON	OFF	ON	NA	NA	NA
1...5 V	OFF	ON	ON	ON	1...5 V	ON	ON	ON	NA	NA	NA
0...20 mA Tx	ON	OFF	OFF	OFF							
4...20 mA Tx	ON	OFF	ON	OFF							

Remember to cycle power for power rail / terminals to reload DIP-switch values at power up.

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:4:I.

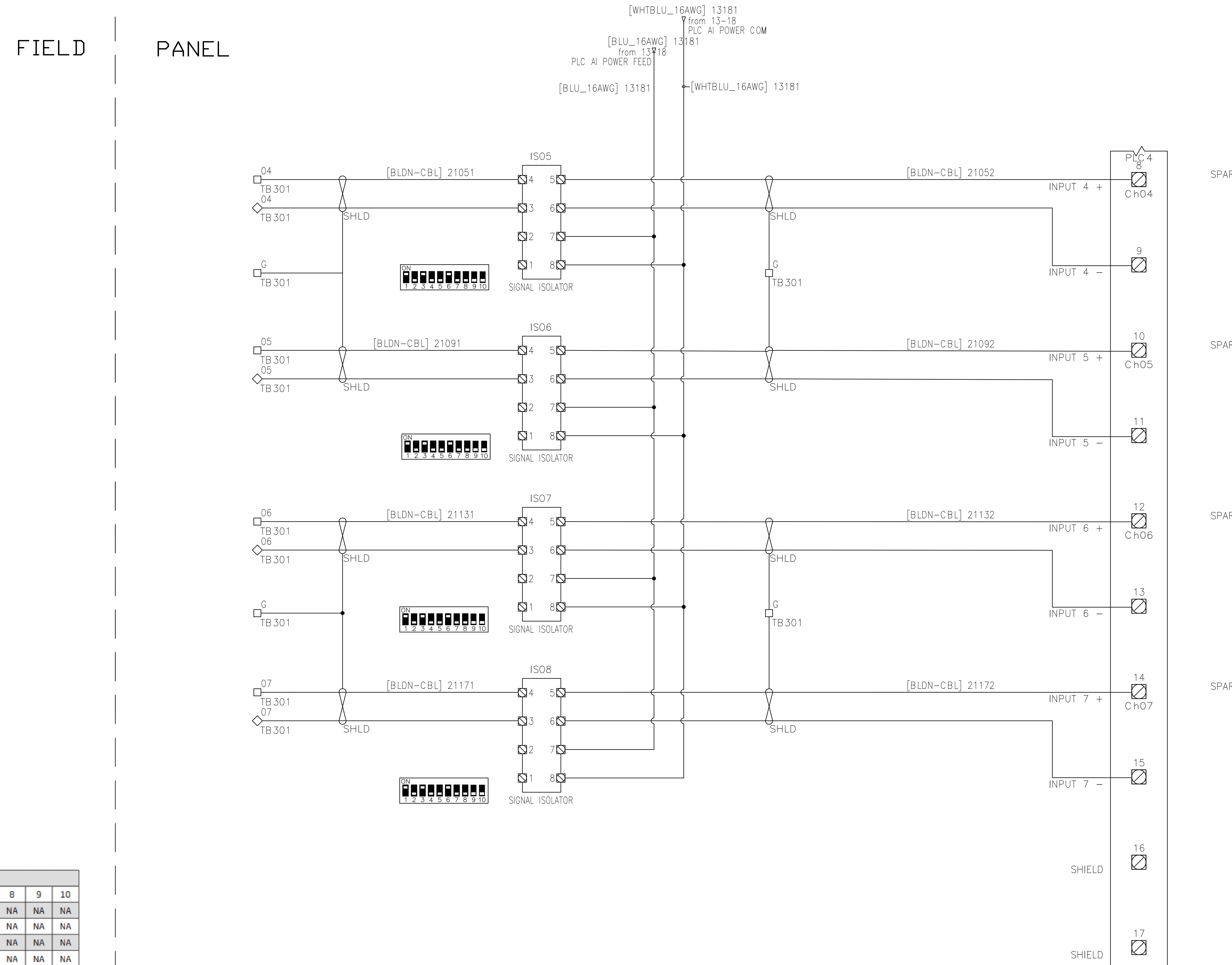
TITLE: ANALOG INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-20

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD



3104

Input setup					Output setup						
	1	2	3	4		5	6	7	8	9	10
0...20 mA	OFF	OFF	OFF	OFF	0...20 mA	OFF	OFF	OFF	NA	NA	NA
4...20 mA	OFF	OFF	ON	OFF	4...20 mA	OFF	ON	OFF	NA	NA	NA
0...10 V	OFF	ON	OFF	OFF	0...10 V	ON	OFF	OFF	NA	NA	NA
2...10 V	OFF	ON	ON	OFF	2...10 V	ON	ON	OFF	NA	NA	NA
0...5 V	OFF	ON	OFF	ON	0...5 V	ON	OFF	ON	NA	NA	NA
1...5 V	OFF	ON	ON	ON	1...5 V	ON	ON	ON	NA	NA	NA
0...20 mA Tx	ON	OFF	OFF	OFF							
4...20 mA Tx	ON	OFF	ON	OFF							

Remember to cycle power for power rail / terminals to reload DIP-switch values at power up.

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NOTES:

EACH PLC ADDRESS BEGINS WITH LOCAL:4:I.

TITLE: ANALOG INPUTS 24VDC

DATE: 10/29/24

DRAWING #: PLC PANEL-21

VERSION: 2025

CEG LEVEL 3 LIFT STATION STANDARD

CITIZENS WESTFIELD
CONSTANT SPEED SUBMERSIBLE LIFT STATION STANDARD

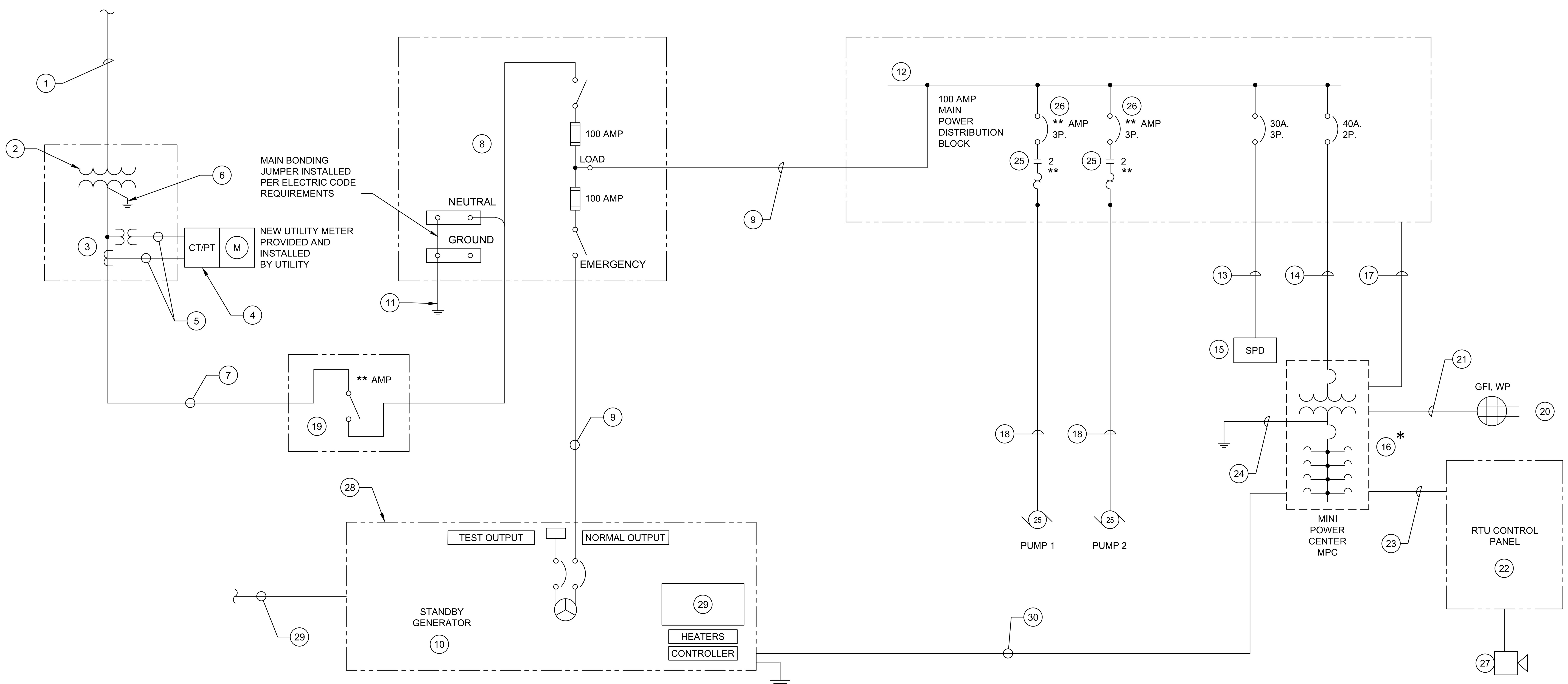
citizens energy group™	NOTES:	TITLE: TABLE OF CONTENTS	DATE: 11/18/24
		DRAWING #: WESTFIELD STANDARD - 1	VERSION: 2025
		CEG WESTFIELD CONSTANT SPEED LIFT STATION STANDARD	

KEYED NOTES:

1. FOR UTILITY TRANSFORMERS INSTALLED WITHIN CONTRACT WORK AREA LIMITS, PROVIDE 4" SCH. 40 PVC CONDUIT OR AS REQUIRED BY ELECTRICAL UTILITY FOR INCOMING PRIMARY SERVICE FEEDERS. CONDUIT SHALL BE INSTALLED AT A MINIMUM DEPTH OF 36" BELOW FINISH GRADE. EXTEND CONDUIT TO A NOMINAL DISTANCE OF 10', OR TO EDGE OF ROW. COORDINATE FINAL LOCATION OF CONDUIT WITH UTILITY PRIOR TO INSTALLATION.
2. FOR UTILITY TRANSFORMERS INSTALLED WITHIN CONTRACT WORK AREA LIMITS, PROVIDE TRANSFORMER PAD PER UTILITY REQUIREMENTS. NEW PAD-MOUNTED UTILITY TRANSFORMER 12470-480Y/277 VOLTS, 3 PHASE.
3. CURRENT AND POTENTIAL TRANSFORMERS PROVIDED BY UTILITY INSIDE CT/PT METERING ENCLOSURE, OR AS PREFERRED BY UTILITY.
4. METER AND CT/PT METERING ENCLOSURE AND METER SOCKET FURNISHED BY UTILITY AND INSTALLED BY CONTRACTOR. METER FURNISHED BY UTILITY. INSTALL ON TRANSFORMER OR EQUIPMENT RACK AS COORDINATED WITH LOCAL UTILITY REPRESENTATIVE.
5. PROVIDE 2" CONDUIT WITH PULL WIRE FOR METERING CONDUCTORS. METERING CONDUCTORS TO BE PROVIDED BY UTILITY.
6. PROVIDE COUNTERPOISE GROUNDING RING AROUND TRANSFORMER PER UTILITY REQUIREMENTS.
7. 2" CONDUIT, 3 #1, 1 #6 NEUTRAL SERVICE CONDUCTORS.
8. SERVICE ENTRANCE RATED AUTOMATIC TRANSFER SWITCH. SWITCH SHALL BE FUSED TYPE, 480 VOLTS, 3 PHASE, 100 AMPS WITH NEUTRAL LUGS. ENCLOSURE SHALL BE STAINLESS STEEL NEMA 4X. SWITCH SHALL HAVE CENTER OFF POSITION. RATED 18,000 A.I.C. MINIMUM.
9. 2" CONDUIT, 4 #1, 1 #6 GROUND SERVICE CONDUCTORS.
10. STANDBY NATURAL GAS GENERATOR. CUMMINS, KOHLER, CATERPILLAR, OR UTILITY APPROVED EQUAL. SEE STANDARDS MANUAL.
11. 1" SCH. 80 PVC CONDUIT WITH A #2 (MINIMUM) GROUNDING ELECTRODE CONDUCTOR EXOTHERMICALLY BONDED TO A #2 BARE TINNED GROUND RING SURROUNDING EQUIPMENT RACK. INSTALL (5) 3/4" x 10' COPPER CLAD STEEL GROUND RODS. ONE AT EACH CORNER AND ONE DIRECTLY BELOW ENCLOSURE WITH MAIN BONDING JUMPER. UNLESS NOTED OTHERWISE, ALL ABOVE GROUND CONNECTIONS BY MECHANICAL KITS, ALL BELOW GRADE CONNECTIONS BY EXOTHERMIC WELDS.
12. PUMP CONTROL PANEL WITH STARTERS, PILOT AND CONTROL DEVICES, AS REQUIRED PER SPECIFICATIONS. (REQUIRED SPARE BREAKERS NOT SHOWN)
13. 1" CONDUIT, 4 #10, 1 #12 GROUND.
14. 1" CONDUIT, 2 #8, 1 #10 GROUND.
15. SURGE PROTECTION DEVICE PER SPECIFICATIONS.
16. MINI-POWER-CENTER, CONSISTING OF A PRIMARY CIRCUIT BREAKER, DRY-TYPE TRANSFORMER, A SECONDARY CIRCUIT BREAKER, AND A SMALL PANELBOARD. REFER TO PANEL SCHEDULES FOR REQUIREMENTS. GROUND THE TRANSFORMER SECONDARY AS A SEPARATELY DERIVED SYSTEM PER NEC REQUIREMENTS.
17. 1" CONDUIT, 4 #12, 1 #12 GROUND (2 CIRCUITS: PUMP CONTROL CIRCUITS AND ENCLOSURE HEATER & LIGHTS).
18. MULTI-CONDUCTOR POWER AND CONTROL SUBMERSIBLE CABLE PROVIDED WITH PUMP.
19. ENERGY REDUCING MAINTENANCE SWITCH. 480V, 3 PHASE, 100A, NEMA 4X.
20. 120 V, 20A DUPLEX GROUND FAULT CIRCUIT INTERRUPTING RECEPTACLE IN A WEATHERPROOF, IN-USE, ALUMINUM HOUSING WITH HASP FOR PAD-LOCKING.
21. RECEPTACLE BRANCH CIRCUIT, SEE SCHEDULES.
22. RTU CONTROL PANEL. SEE SHT IC-2.
23. RTU CONTROL PANEL BRANCH CIRCUIT, SEE SCHEDULES.
24. 1" SCHEDULE 80 PVC WITH 1 #2 BARE TINNED GROUNDING ELECTRODE CONDUCTOR EXOTHERMICALLY WELDED TO GROUND ROD.
25. CONTACTOR THERMAL OVERLOAD RELAY.
26. COORDINATE WITH PUMP VENDOR ON SELECTION OF PUMP OVERCURRENT PROTECTION REQUIREMENTS.
27. ALARM HORN.
28. 50kW 480V, 3 PHASE, 60 HZ. NATURAL GAS STANDBY GENERATOR IN WEATHERPROOF, SOUND ATTENUATED ENCLOSURE. SEE SPECIFICATIONS FOR MORE INFORMATION.
29. NATURAL GAS SUPPLY. COORDINATE GENERATOR INPUT REQUIREMENTS WITH UTILITY. FURNISH AND INSTALL GAS LINE AND METER PER UTILITY REQUIREMENTS BEFORE CONSTRUCTION.
30. THREE CONDUITS WITH BRANCH CIRCUITS FOR GENERATOR CONTROL PANEL, BATTERY, CHARGER, AND HEATERS; SEE SCHEDULES.

ASSUMPTIONS

DETAILS APPLY TO A DUPLEX PUMP STATION, MAXIMUM 25 HP EACH OPERATING AT 460 VOLTS, 3 PHASE WITH A PERMANENTLY INSTALLED GENERATOR, AND NOT SIZED FOR FUTURE EXPANSION. PUMPS OPERATE AT CONSTANT SPEED WITH INTERLOCKS TO PREVENT SIMULTANEOUS STARTING.



ONE-LINE DIAGRAM

SCALE: NTS

MINI-POWER-CENTER SCHEDULE		DESIGNATION:	PANEL "MPC"				MAINS:		60 AMP MAIN CIRCUIT BREAKER			
		LOCATION:	________ LIFT STATION				BUS SIZE:		60 AMP			
		VOLTAGE:	120/240 VOLT				PANEL MOUNTING:		PART OF MINI-POWER-CENTER "MPC"			
		PHASE:	1 PHASE, 3 WIRE				ALL BREAKERS:		10,000 A.I.C. (MINIMUM)			
CKT. NO.	LOAD DESCRIPTION	KVA	CKT. BKR. AMPS	CKT. BKR. POLE	KVA A	KVA B	CKT. BKR. AMPS	CKT. BKR. POLE	KVA	LOAD DESCRIPTION	CKT. NO.
1	MAIN BREAKER		60	2	0.20		20	1	0.20	PUMP CONTROL PANEL CONTROL CIRCUITS	2
3	"		–	–		1.00	20	1	1.00	PUMP CONTROL PANEL HEATER & LIGHT	4
5	GENERATOR CONTROLLER	0.60	20	1	1.10		20	1	0.50	SITE LIGHTING CIRCUIT & ALARM CIRCUIT	6
7	GENERATOR BATTERY CHARGER	0.50	20	1		1.00	20	1	0.50	RTU / TELEMETRY PANEL	8
9	GENERATOR HEATER	0.60	20	1	0.78		20	1	0.18	GFCI DUPLEX RECEPTACLE	10
11	GENERATOR HEATER	0.60	20	1		0.60	20	1		SPARE BREAKER	12
13	GENERATOR HEATER	0.60	20	1	0.60		20	1		SPARE BREAKER	14
15	GENERATOR LIGHTS & RECEPTACLES		20	1		0.00	20	1		BLANK	16
17	SPARE BREAKER		20	1						BLANK	18
19	SPARE BREAKER		20	1	0.00		20			BLANK	20
	TOTAL CONNECTED LOAD:				2.68	2.60	TOTAL =		5.28	KVA	

THIS PANEL IS A PART OF A MINI-POWER-CENTER, CONSISTING OF A 40A PRIMARY BREAKER, A 10 KVA, 1 PHASE, 480-120/240 VOLT TRANSFORMER, A 60A SECONDARY MAIN BREAKER AND A SMALL PANELBOARD WITH COPPER BUS AND BOLT-ON BREAKERS, ALL IN A 316 STAINLESS STEEL NEMA 3R ENCLOSURE.

PROVIDE 22 KAIC RATED BREAKERS FOR THE GENERATOR LOADS

* IT IS PREFERRED THAT ON STATIONS OF 10 HP OR LESS, WITHOUT VFD'S, THAT THE MINI POWER CENTER NOT BE INCLUDED. ALL REQUIRED BREAKERS ARE TO BE INSIDE THE PUMP CONTROL PANEL AND THE TRANSFORMER BE AN EXTERIOR MOUNTED UNIT.

PANELBOARD BRANCH CIRCUIT CONDUIT & CABLE SCHEDULE

#	DESCRIPTION
5 & 7	1" CONDUIT WITH 4 #10 CONDUCTORS AND 1 #12 GROUND CONDUCTOR. RHW
9,11,13	1" CONDUIT WITH 6 #12 CONDUCTORS AND 1 #12 GROUND CONDUCTOR. RHW
15	1' CONDUIT WITH 2 #12 CONDUCTORS AND 1 #12 GROUND CONDUCTOR. RHW
2,4,6	1" CONDUIT WITH 6 #12 CONDUCTORS AND 1 #12 GROUND CONDUCTOR. XHHW
8	3/4" CONDUIT WITH 2 #12 CONDUCTORS AND 1 #12 GROUND CONDUCTOR. XHHW
10	3/4" CONDUIT WITH 2 #12 CONDUCTORS AND 1 #12 GROUND CONDUCTOR. XHHW

Date | Checked By | Drawn By | Revision Description | Revision Number

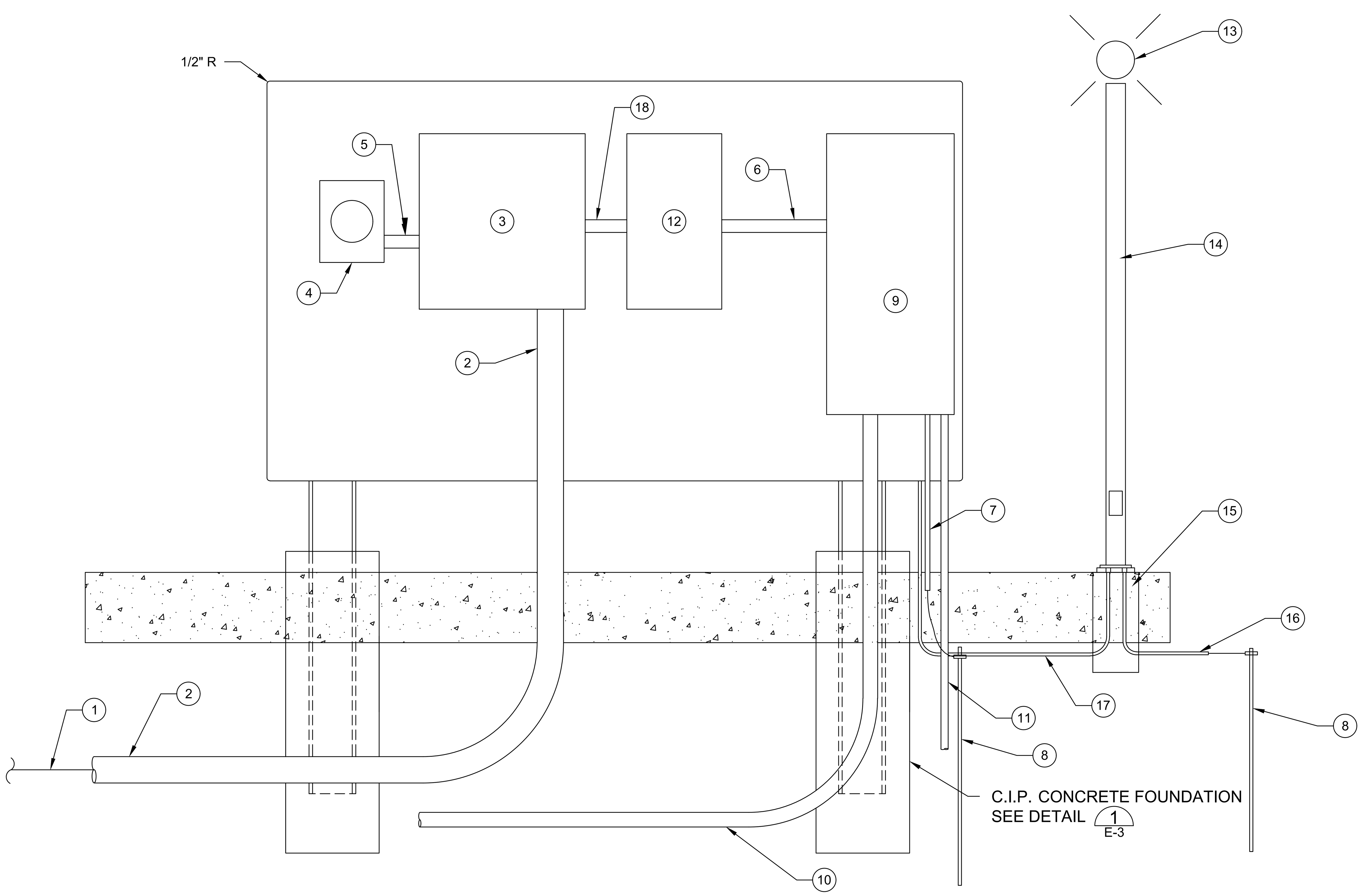
Filename
Project No.
Project Date

CITIZENS WESTFIELD
CONSTANT SPEED SUBMERSIBLE LIFT STATION
STANDARD ELECTRICAL DETAILS – E-1

SHEET NO.
500.017

KEYED NOTES:

1. SERVICE SHALL BE 480/277 VOLTS, 3-PHASE, 4-WIRE, 60HZ.
2. SCH 40 PVC CONDUIT FOR INCOMING PRIMARY SERVICE FEEDERS WITH A TRANSITION TO SCH. 80 PVC OR RMC BEFORE BEING EXPOSED. CONTRACTOR TO COORDINATE WITH UTILITY ON INSTALLATION OF NEW SERVICE ENTRANCE CONDUCTORS AND CONDUIT.
3. CT/PT CABINET FURNISHED BY ELECTRIC UTILITY, INSTALLED BY CONTRACTOR USING STAINLESS STEEL HARDWARE.
4. METER SOCKET FURNISHED BY ELECTRIC UTILITY, INSTALLED BY CONTRACTOR USING STAINLESS STEEL HARDWARE. INSTALL CENTER OF METER AT 5'-0" ABOVE GRADE.
5. PROVIDE EMPTY RIGID STEEL CONDUIT NIPPLE FOR METERING CABLES. CABLES PROVIDED AND INSTALLED BY ELECTRIC UTILITY.
6. RIGID STEEL CONDUIT WITH UTILITY SERVICE CONDUCTORS.
7. PVC CONDUIT WITH GROUNDING ELECTRODE CONDUCTOR.
8. 3/4" X 10' COPPER GROUND ROD (TYPICAL). BOND GROUNDING ELECTRODE CONDUCTOR TO ROD USING EXOTHERMIC WELD.
9. AUTOMATIC TRANSFER SWITCH. INSTALL USING STAINLESS STEEL HARDWARE.
10. RIGID STEEL CONDUIT WITH GENERATOR POWER SUPPLY.
11. RIGID STEEL CONDUIT WITH FEEDER TO PUMP CONTROL PANEL.
12. ENERGY REDUCING MAINTENANCE BYPASS SWITCH; MOUNT WITH AT LEAST 36" CLEARANCE FROM METER SOCKET.
13. SECURITY LIGHTING, SWITCH LOCATED INSIDE PUMP CONTROL PANEL. LUMINAIRE WITH IP 66, CAST ALUMINUM HOUSING UL LISTED FOR WET LOCATIONS; LUMINAIRE OPERATES AT 130 WATTS WITH 120V-277V INPUT; IES TYPE III MEDIUM OPTICS; 4000K; 70 CRI; PHOTOCELL CONTROLLED; PROVIDEMOUNTING ARM FROM LUMINAIRE VENDOR. ARM AND LUMINAIRE TO BE DARK BRONZE.
14. LUMINAIRE INSTALLED ON 14' TALL x 4" DIAMETER x 0.125" THICK ROUND ALUMINUM POLE WITH INTERNAL VIBRATION DAMPER AND TOP CAP SECURED WITH SET SCREWS. PROVIDE CAST ALUMINUM BASE FLANGE WITH BOLT COVERS, FACTORY DRILLED HOLES COORDINATED WITH LUMINARE MOUNTING ARM, AND 2" x 4" HANDHOLE. ANCHOR RODS TO BE FURNISHED BY POLE MANUFACTURER. POLE, CAP, AND BASE SHALL BE FACTORY PAINTED DARK BRONZE.
15. CONCRETE LIGHT POLE FOUNDATION MINIMUM 15" DIAMETER, 24" DEEP; SURROUND WITH 1/4" OF EXPANSION FABRIC TO DEPTH OF WORK PAD; TOP OF FOUNDATION 1" ABOVE WORK PAD WITH 1" CHAMFER AT 45-DEGREES.
16. SCHEDULE 80 PVC WITH GROUNDING ELECTRODE CONDUCTOR.
17. SCHEDULE 80 PVC.
18. RIGID STEEL CONDUIT WITH FEEDER INTO ENERGY REDUCING MAINTENANCE BYPASS SWITCH.



LIFT STATION ELECTRICAL SERVICE PANELS INSTALLATION DETAIL 1
SCALE: NTS

KEYED NOTES:

1. CONCRETE BASE. REFER TO LS-1.
2. ALUMINUM CHANNEL MOUNTED TO CONCRETE BASE. MAXIMUM SEPARATION OF 6' BETWEEN POSTS. INCLUDE BITUMINOUS OR NEOPRENE MATERIAL WHERE ALUMINUM CONTACTS CONCRETE. SEE DETAIL 3 ON E-3.
3. ALUMINUM EQUIPMENT MOUNTING PLATE, SIZED AS REQUIRED TO ACCOMMODATE ALL EQUIPMENT. WELD PLATE TO CHANNELS. ROUND ALL CORNERS TO 0.5 INCH RADIUS. FILE ALL SHARP EDGES. ALUMINUM RACK CONSISTS OF 1/4" THICK VERTICAL SUPPORTS, 1/4" ALUMINUM BACKPLATE, AND 1/8" THICK SLOTTED ALUMINUM CHANNELS.
4. PUMP CONTROL PANEL. SEE EXAMPLE PANEL LAYOUT ON E-3.
5. ELECTRICAL SERVICE CONDUIT FROM ENERGY REDUCING MAINTENANCE BYPASS SWITCH.
6. 2" CONDUIT, 2 #18 TSP CABLES (INCLUDES SPARES).
7. PROVIDE INSULATED BUSHING AT CABLE ENTRY TO PANEL. TERMINATE CABLES IN PANEL, PROVIDE 12" CABLE SLACK WITHIN THE CABLE GUARD (TYPICAL OF ALL CABLES CONNECTING FROM WET WELL).
8. THREE 2" CONDUITS FOR EACH PUMP CABLE ROUTED INTO WET WELL AS INDICATED ON PLAN SHEET.
9. SEAL CONDUITS WITH DUCT SEAL (TYPICAL OF ALL CONDUITS FROM WET WELL)..
10. PROVIDE 2" CONDUIT WITH 24 #16 CONTROL WIRES (INCLUDES SPARES) FOR LIFT STATION CONTROL AND MONITORING FROM RTU PANEL.
11. RTU CONTROL PANEL AS INDICATED ON DETAIL.
12. PROVIDE RED ALARM LIGHT PER SPECIFICATIONS.
13. PROVIDE THREE 2" CONDUITS FROM CONTROL CABINET INTO WET WELL FOR LEVEL SENSOR CABLES AND SPARE.
14. (NOT USED)
15. CABLE GUARD BELOW PANEL SIZED AS REQUIRED. SEE DETAIL.
16. PROVIDE 2" CONDUIT FROM RTU PANEL TO ANTENNA POLE LOCATION. INSTALL CONDUIT WITH WIDE SWEEPS AS PER ANTENNA CABLE MANUFACTURER INSTALLATION REQUIREMENTS.
17. MINI POWER CENTER SEE SHEET E-1.
18. DUPLEX GFI RECEPTACLE WITH METALLIC, IN-USE RAINTIGHT COVER.
19. WET WELL HIGH LEVEL AUDIBLE ALARM.
20. SECURITY AUDIBLE ALARM.
21. SECURITY KEYPAD.

GENERAL NOTES:

A. THE AREA AROUND THE LIFT STATION SHALL BE CLASSIFIED AS A HAZARDOUS LOCATION. ANY SPACE WITHIN 3' (ANY DIRECTION) FROM A VENT IS CLASSIFIED AS CLASS I, DIVISION 1, GROUPS C & D; WITH THE SPACE FROM 3' TO 5' FROM A VENT CLASSIFIED AS CLASS I, DIVISION 2, GROUPS C & D. IN ADDITION, ANY SPACES EXTENDING OUTWARD 3' PAST THE EDGE OF ANY HATCH OPENINGS IN THE TOP OF THE STRUCTURE, TO A HEIGHT OF 18", SHALL BE CLASSIFIED AS CLASS I, DIVISION 2, GROUPS C & D. ALL ELECTRICAL WORK MUST CONFORM WITH THE N.E.C. REQUIREMENTS FOR THESE AREAS.

B. REFER TO ELECTRICAL ONELINE DIAGRAM AND DETAILS ON SHEET E-1 FOR POWER CONDUIT AND CONDUCTORS BETWEEN EQUIPMENT ON EQUIPMENT RACK.

C. MINIMUM CONDUIT DEPTH BELOW BOTTOM OF CONCRETE PAD WHERE THERE IS NO VEHICULAR TRAFFIC IS 4-INCHES. MINIMUM NON-METALIC CONDUIT DEPTH WHERE THERE IS NO CONCRETE PAD AND NO VEHICULAR TRAFFIC IS 18-INCHES; DEPTH INCREASES TO 24-INCHES FOR LOCATIONS THAT MAY BE SUBJECTED TO OCCASIONAL TRAFFIC.

D. PROVIDE LONG RADIUS SWEEP ELBOWS ON PUMP CABLE CONDUITS. 48" MIN.

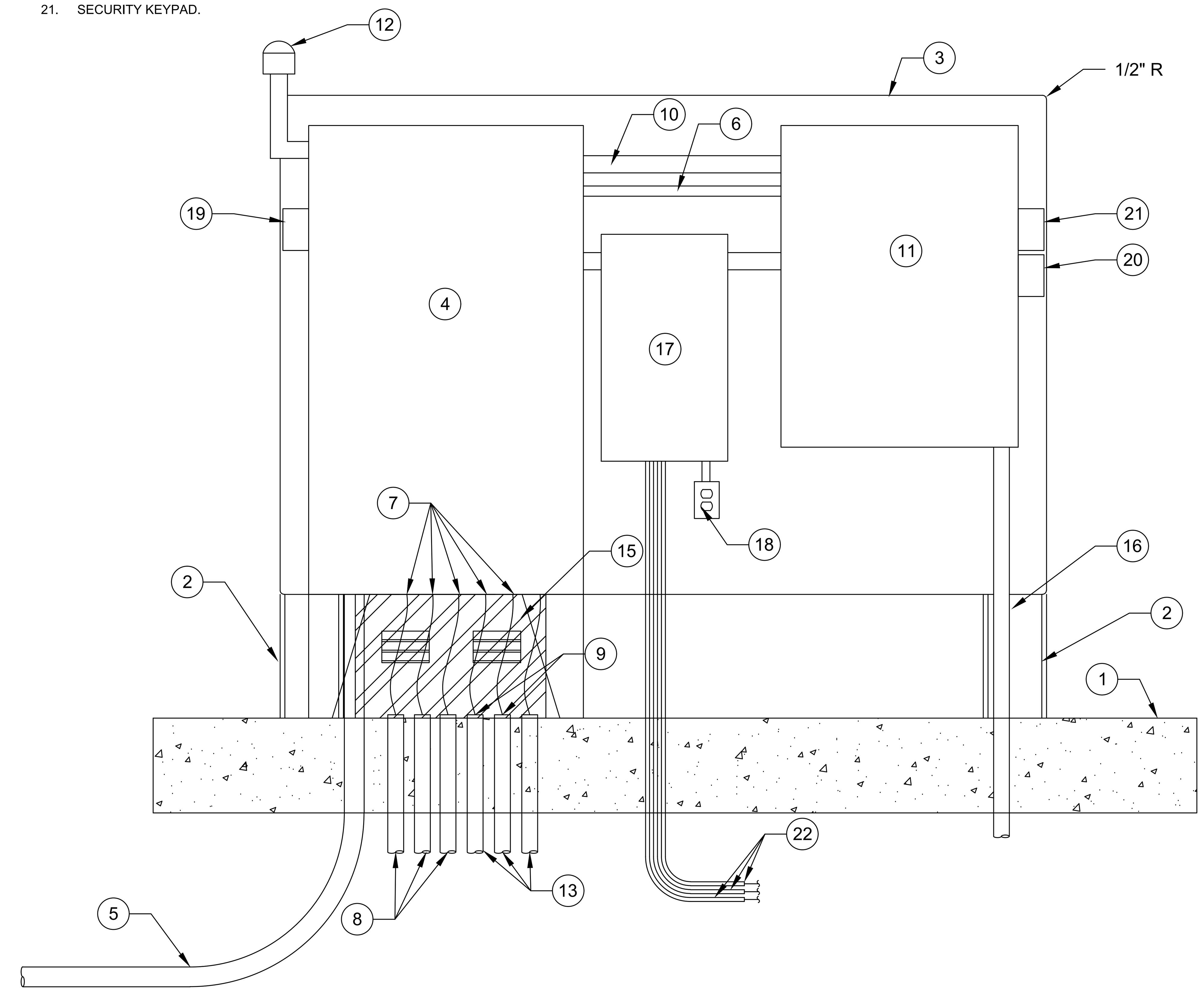
E. ALL METAL CONDUITS END IN GROUNDING BUSHINGS INSIDE ENCLOSURES. ALL GROUNDING BUSHINGS BONDED TO EACH OTHER WITH BARE SOLID #6. ALL METAL ENCLOSURES EQUIPPED WITH GROUND BUS OR GROUND LUG MOUNTED ON SIDE OF ENCLOSURE; GROUND BUS/LUG BONDED TO BUSHINGS WITH BARE SOLID #6.

F. PROVIDE A MINIMUM OF 4" BETWEEN ENCLOSURES; PROVIDE A MINIMUM OF 9" CLEARANCE TO ACTIVATION HANDLES INSTALLED ON SIDE OF CABINET.

G. ALL DISSIMILAR MATERIALS MUST BE SEPARATED BY AN INSULATING MATERIAL DESIGNED FOR THE INTENDED PURPOSE OF KEEPING DISSIMILAR MATERIALS FROM CONTACTING EACH OTHER.

H. 6" MINIMUM CLEARANCE BETWEEN EQUIPMENT ON THE RACK.

I. ARC-FLASH MITIGATION SWITCH SHOULD BE LOCATED OUTSIDE ARC-FLASH BOUNDARY. ABSENT AN ARC-FLASH COORDINATION STUDY PLACE AT 18" FROM TRANSFER SWITCH.



LIFT STATION ELECTRICAL PANELS INSTALLATION DETAIL 2
SCALE: NTS

Revision Number	Revision Description	Drawn By	Checked By	Date

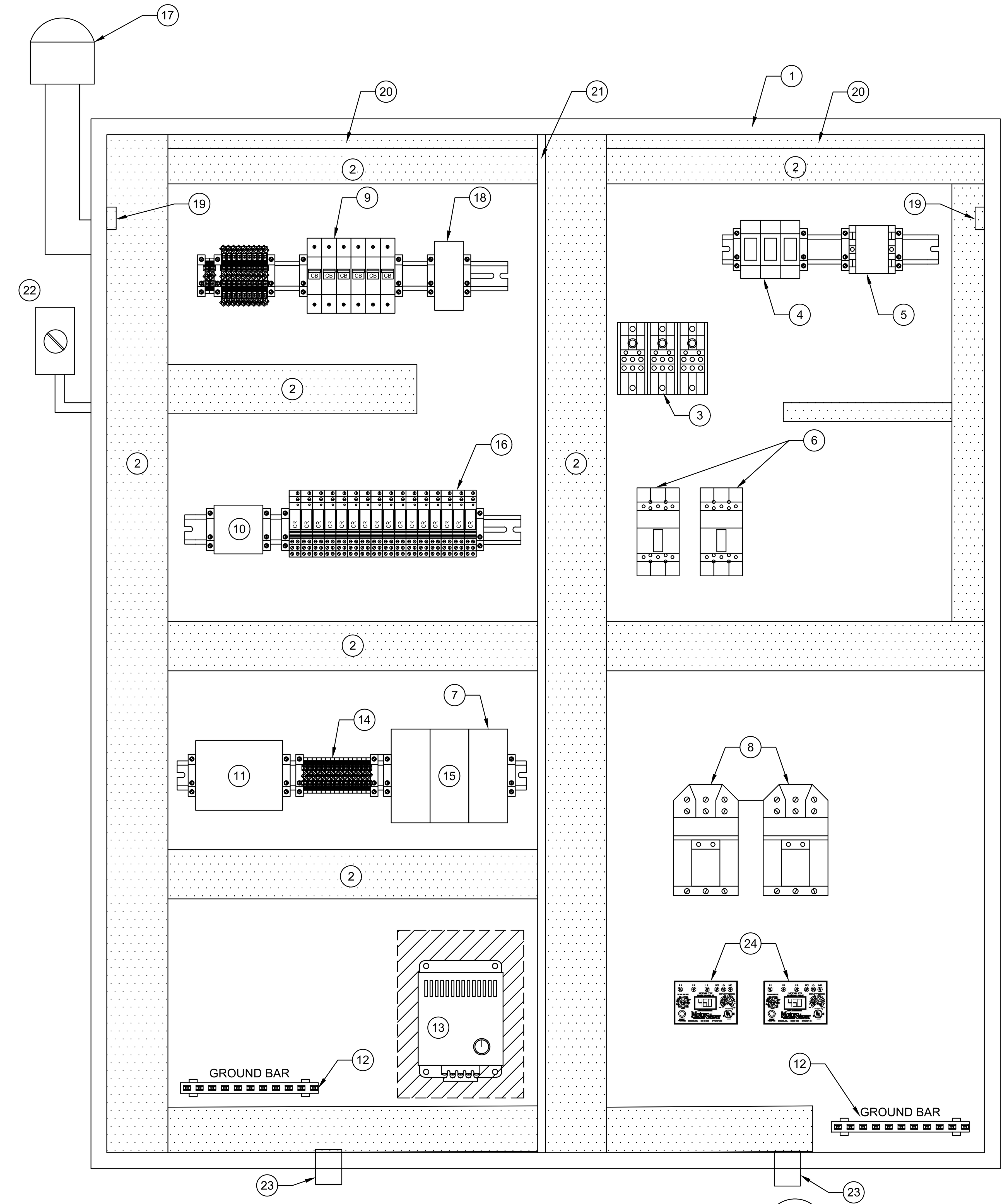
Filename	
Project No.	
Project Date	

CITIZENS WESTFIELD
CONSTANT SPEED SUBMERSIBLE LIFT STATION
STANDARD ELECTRICAL DETAILS – E-2

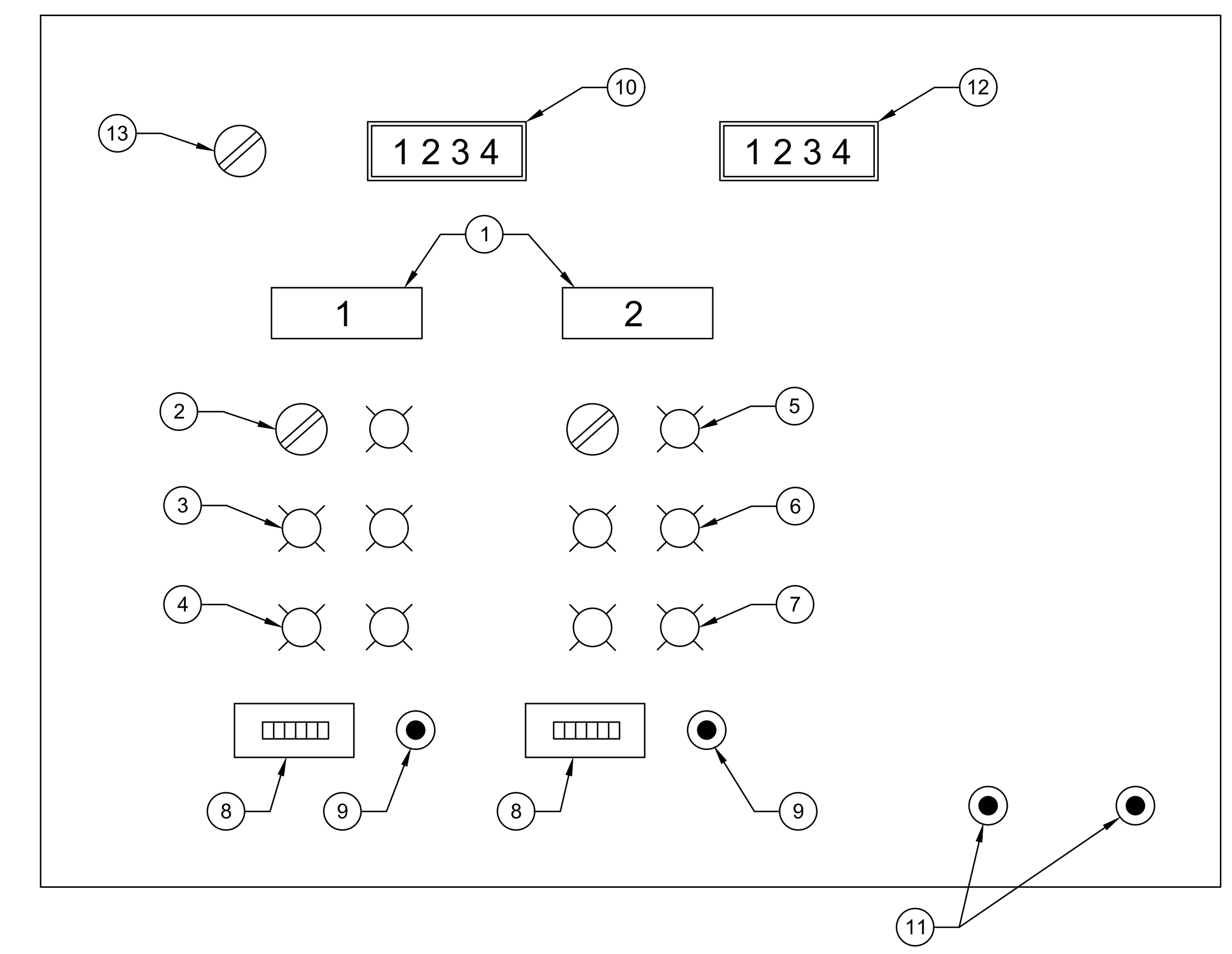
SHEET NO.
500.018

#	DESCRIPTION
1.	NEMA 4X STAINLESS STEEL ENCLOSURE WITH DRIP SHIELD, SIZED AS REQUIRED TO PROVIDE FOR DUAL DOORS AND MOUNTING SPACE. LEAVE SUFFICIENT CLEARANCE ON SIDES AND BOTTOM FOR CONDUITS AND CABLE ENTRIES.
2.	NON-METALLIC SLOTTED WIREWAY SIZED PER SPECIFICATIONS.
3.	POWER DISTRIBUTION BLOCKS, 3 POLE TYPE, SHALL ACCEPT ONE (1) OR TWO (2) CABLES ON THE LINE SIDE FROM #4 TO #250 KCMIL MINIMUM, AND A MINIMUM OF 8 CONDUCTORS ON THE LOAD SIDE FROM #14 TO #4.
4.	480 VOLT 3 PHASE SURGE PROTECTION DEVICES FOR PANEL.
5.	PHASE MONITOR RELAY PER SPECIFICATIONS.
6.	PROVIDE CIRCUIT BREAKER OR MOTOR CIRCUIT PROTECTOR FOR EACH PUMP, SIZED AS REQUIRED.
7.	(NOT USED)
8.	NEMA RATED STARTERS FOR EACH PUMP, WITH MOTOR SAVER SSOLRs AND ALL REQUIRED APPURTENANCES TO CONNECT THE DISPLAY MODULE AND COMMUNICATE VIA SCADA.
9.	120 VOLT CIRCUIT BREAKERS / FUSE BLOCKS AS REQUIRED FOR CONTROL CIRCUITS.
10.	NOMINAL 50 VA OR AS REQUIRED 120 / 24 VOLT CPT FOR INTRINSIC SAFETY CIRCUITS AND PROTECTORS.
11.	INTRINSIC SAFETY RELAYS FOR LEVEL (FLOAT) SWITCHES AS REQUIRED.
12.	PANEL GROUND BUS BAR BONDED TO SUB-PANEL.
13.	CONTROL PANEL HEATER SIZED AS REQUIRED WITH CLEARANCES AROUND UNIT TO PREVENT DAMAGE TO OTHER COMPONENTS AND AT LEAST 3" FROM THE BOTTOM OF THE ENCLOSURE.
14.	TERMINAL BLOCKS AS REQUIRED FOR ALL EXTERNAL WIRING.
15.	PUMP THERMAL / MOISTURE PROTECTION RELAYS. PROVIDE SPACE FOR FUTURE THIRD RELAY.
16.	PROVIDE INTERPOSING RELAYS AS REQUIRED FOR INTERFACING RTU WITH PUMP CONTROL PANEL EQUIPMENT.
17.	ALARM BEACON LIGHT PER SPECIFICATIONS.
18.	DUAL HI/LO THERMOSTAT FOR PANEL TEMPERATURE MONITORING.
19.	ENCLOSURE DOOR SWITCH.
20.	PANEL LIGHT LED 4000K, HARDWIRED TO DOOR ACTIVATION.
21.	SAFETY PARTITION TO LIMIT 480V EXPOSURE.
22.	EXTERIOR PHOTOCELL. 1-3 FT-CD ACTIVATION WITH TIME DELAY.
23.	NEMA 4X VENT/DRAIN.

NOTE:
PUMP CONTROL PANEL SHOWN FOR REFERENCE ONLY, ACTUAL LAYOUT DETERMINED BY SELECTED PANEL ASSEMBLER.

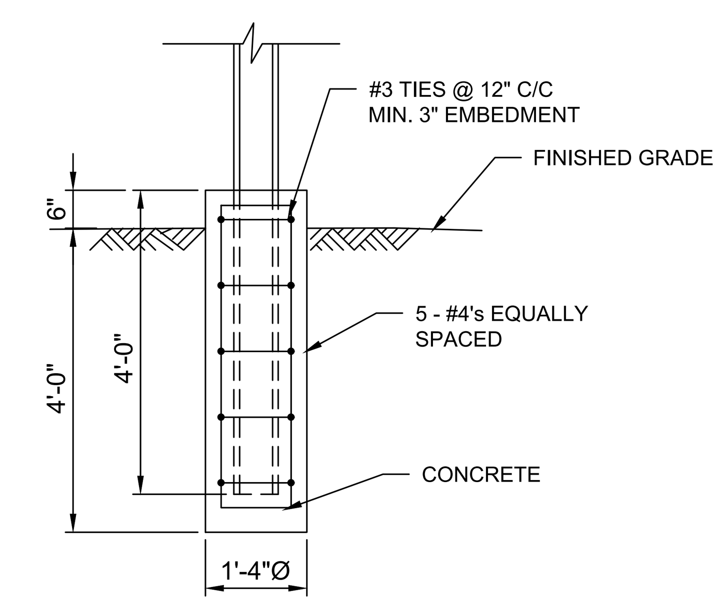


EXAMPLE PUMP CONTROL PANEL LAYOUT 5
SCALE: 3" = 1'-0"



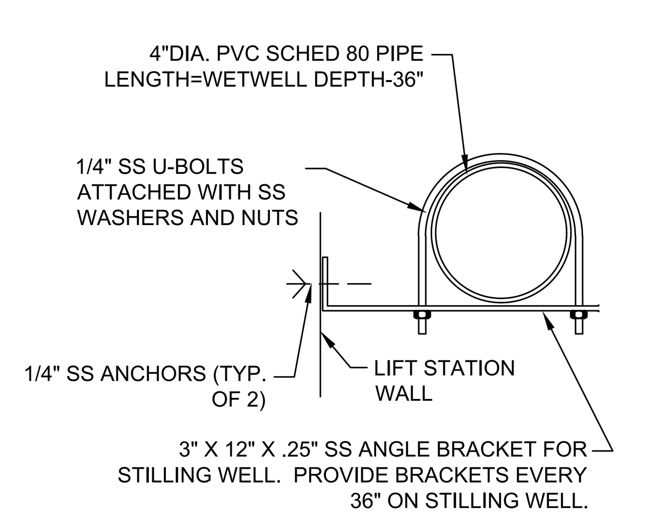
#	DESCRIPTION
1.	NAMEPLATES, 'LIFT 1' AND 'LIFT 2' AS INDICATED
2.	PUMP 'ON-OFF-AUTO' SELECTOR SWITCH
3.	PUMP 'RUNNING' PUSH-TO-TEST PILOT LIGHT
4.	PUMP 'STOPPED' PUSH-TO-TEST PILOT LIGHT
5.	PUMP 'FAIL' PUSH-TO-TEST PILOT LIGHT
6.	PUMP 'TEMP' PUSH-TO-TEST PILOT LIGHT
7.	PUMP 'LEAK' PUSH-TO-TEST PILOT LIGHT
8.	ELAPSED TIME METER
9.	PUMP 'RESET' PUSH BUTTON
10.	LIFT STATION LEVEL METER.
11.	STARTER OVERLOAD RESET BUTTON.
12.	LIFT STATION EFFLUENT FLOW METER.
13.	SELECTOR SWITCH FOR SITE LIGHTING.

PARTIAL LAYOUT INNER DOOR
DEVICES PUMP CONTROL PANEL 6
SCALE: NTS

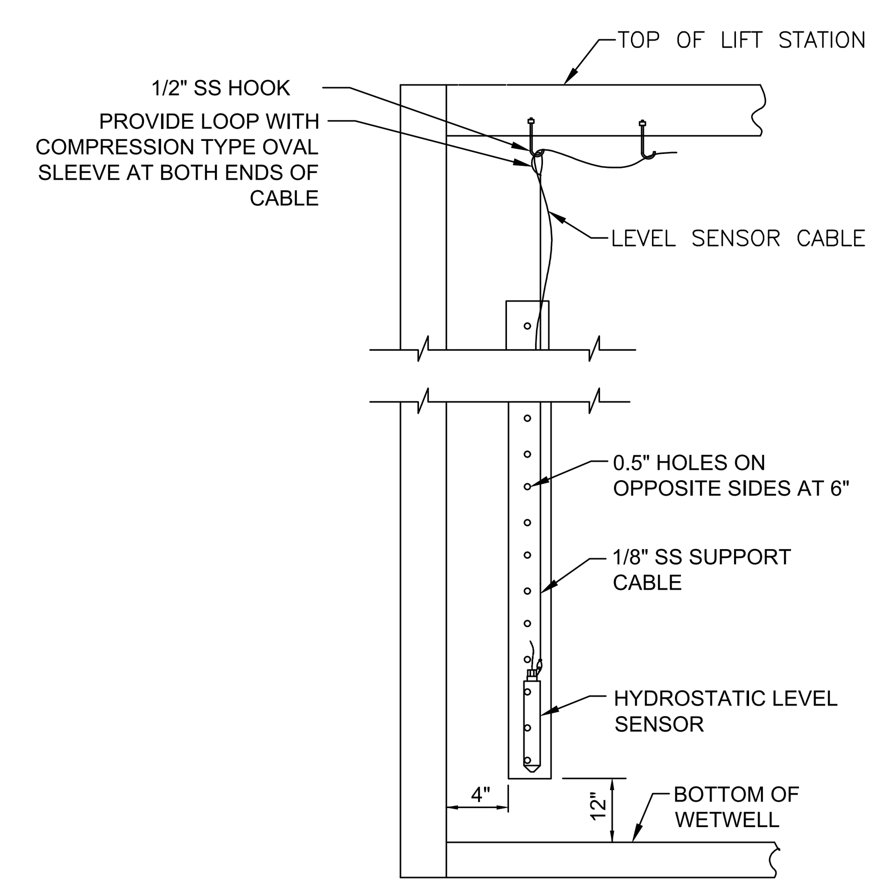


TYPICAL PIER STYLE

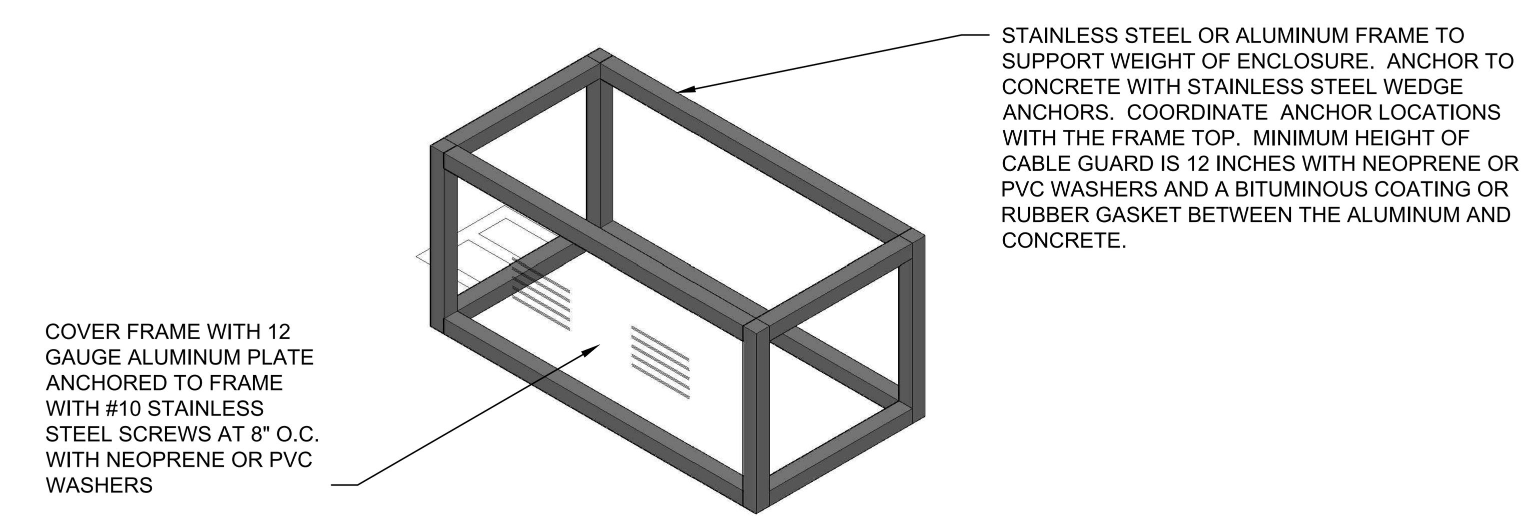
SUPPORT DETAIL 1
SCALE: 1/2" = 1'-0"



STILLING WELL ATTACHMENT DETAIL 2
SCALE: NTS



LEVEL SENSOR MOUNTING DETAIL 3
SCALE: NTS



NOTES:
1. PROVIDE (4) 4"x4" SQUARE HOLES (SOLID PLATES WITH 1 EACH FRONT AND BACK) COVER HOLES WITH HEAVY GAUGE EXPANDED ALUMINUM MESH TACK WELDED TO INSIDE OF ALUMINUM PLATE.
2. DIMENSIONS TO SUIT PANEL SIZE AND LOCATION

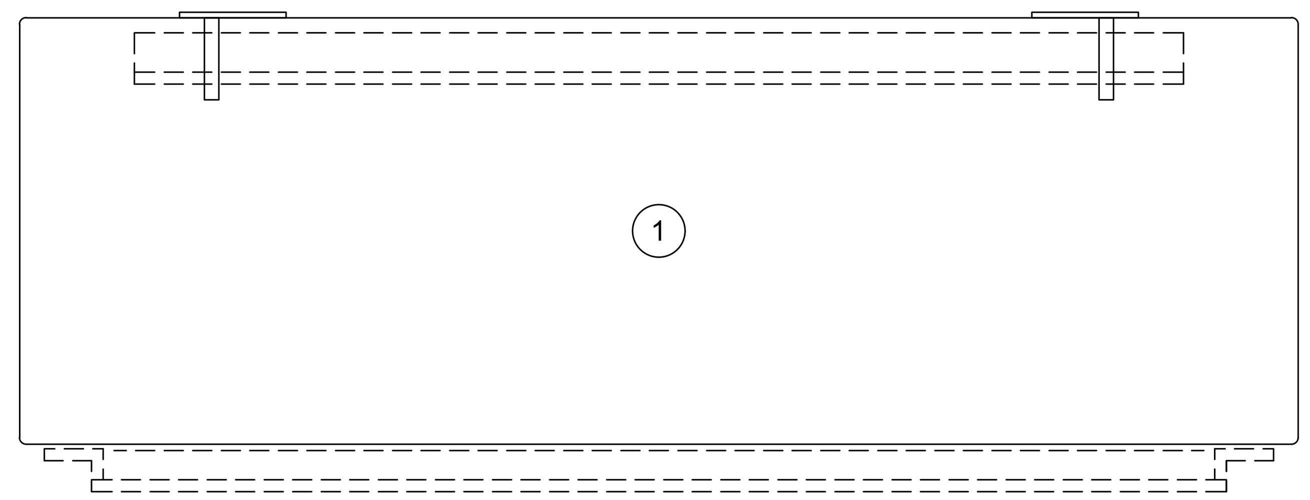
CABLE GUARD DETAIL 4
SCALE: NTS

Revision Number	Revision Description	Drawn By	Checked By	Date

Filename
Project No.
Project Date

CITIZENS WESTFIELD
CONSTANT SPEED SUBMERSIBLE LIFT STATION
STANDARD ELECTRICAL DETAILS – E-3

SHEET NO.
500.019

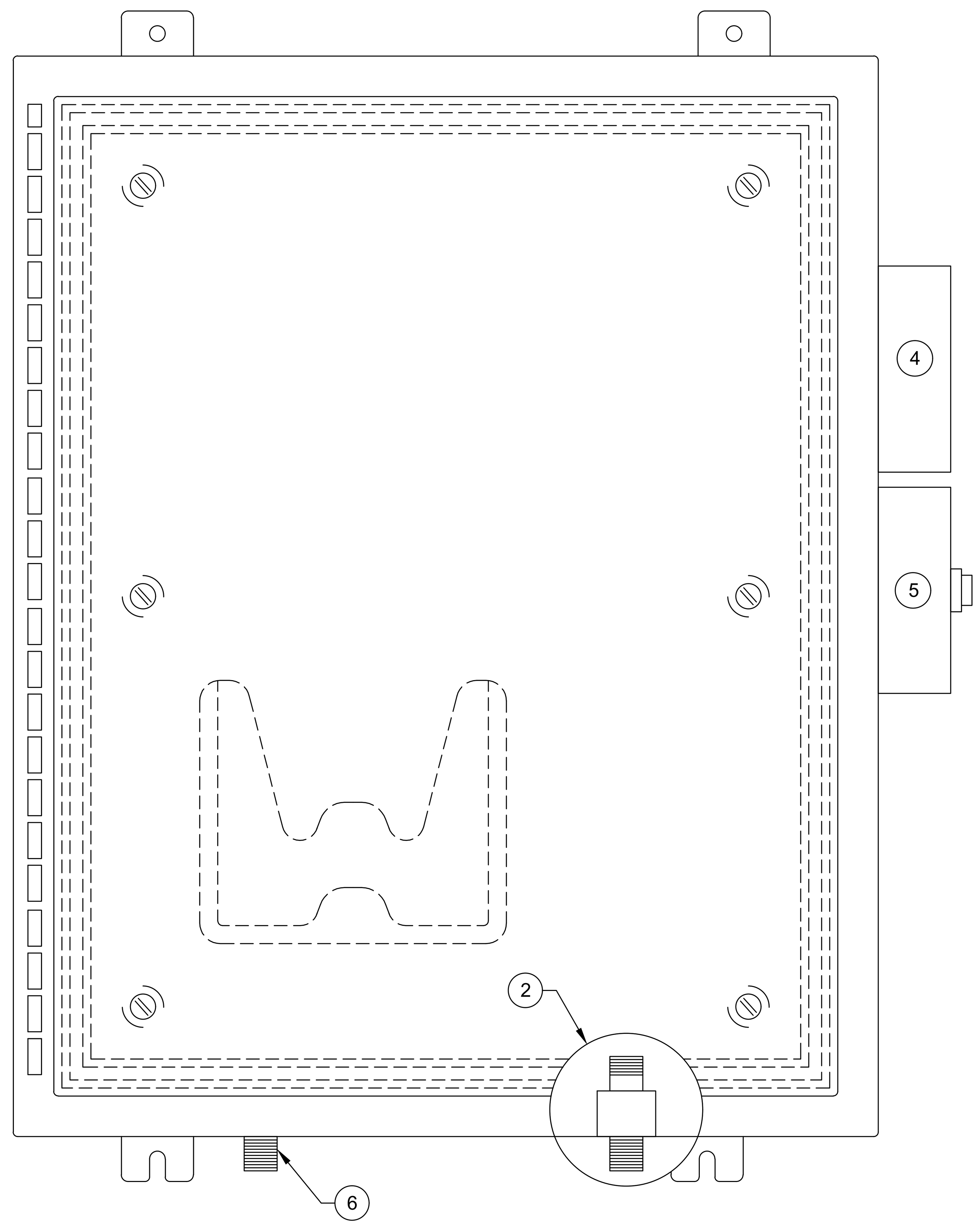


RTU PANEL EXTERIOR TOP DETAIL 1
SCALE: NTS

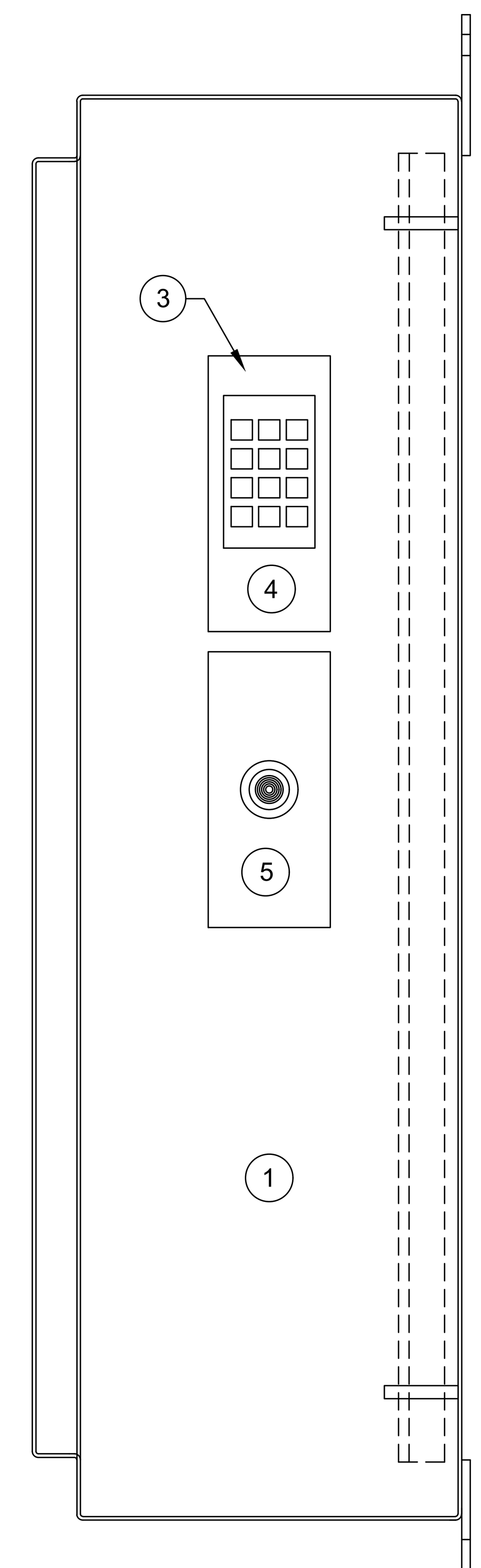
BILL OF MATERIALS

ITEM #	QTY	PART NUMBER *	DESCRIPTION	MANUFACTURER *
1.	1	A48H2312SSLP	STAINLESS 36" x 48" x 12" ENCLOSURE	HOFFMAN
2.	1	AL-NFNFBHP-9	LIGHTNING SURGE PROTECTOR	L-COM
3.	1	479851	RECEPTACLE FACE PLATE	THOMAS BETTS
4.	1	IEI 212W / DBPV1C	SECURITY KEYPAD / RAIN COVER	IEI / ARLINGTON
5.	1	SC628DR	ALARM HORN	MALLORY SONALERT
6.	1	-	NEMA 4X, VENT/DRAIN	-

* MANUFACTURERS AND PART NUMBERS ARE PER INITITAL BASIS OF DESIGN; PANEL ASSEMBLER TO PROVIDE COMPONENTS THAT ARE AN EQUAL OR BETTER CONSTRUCTION BASED ON CURRENTLY AVAILABLE COMPONENTS.



RTU PANEL EXTERIOR FRONT DETAIL 2
SCALE: NTS



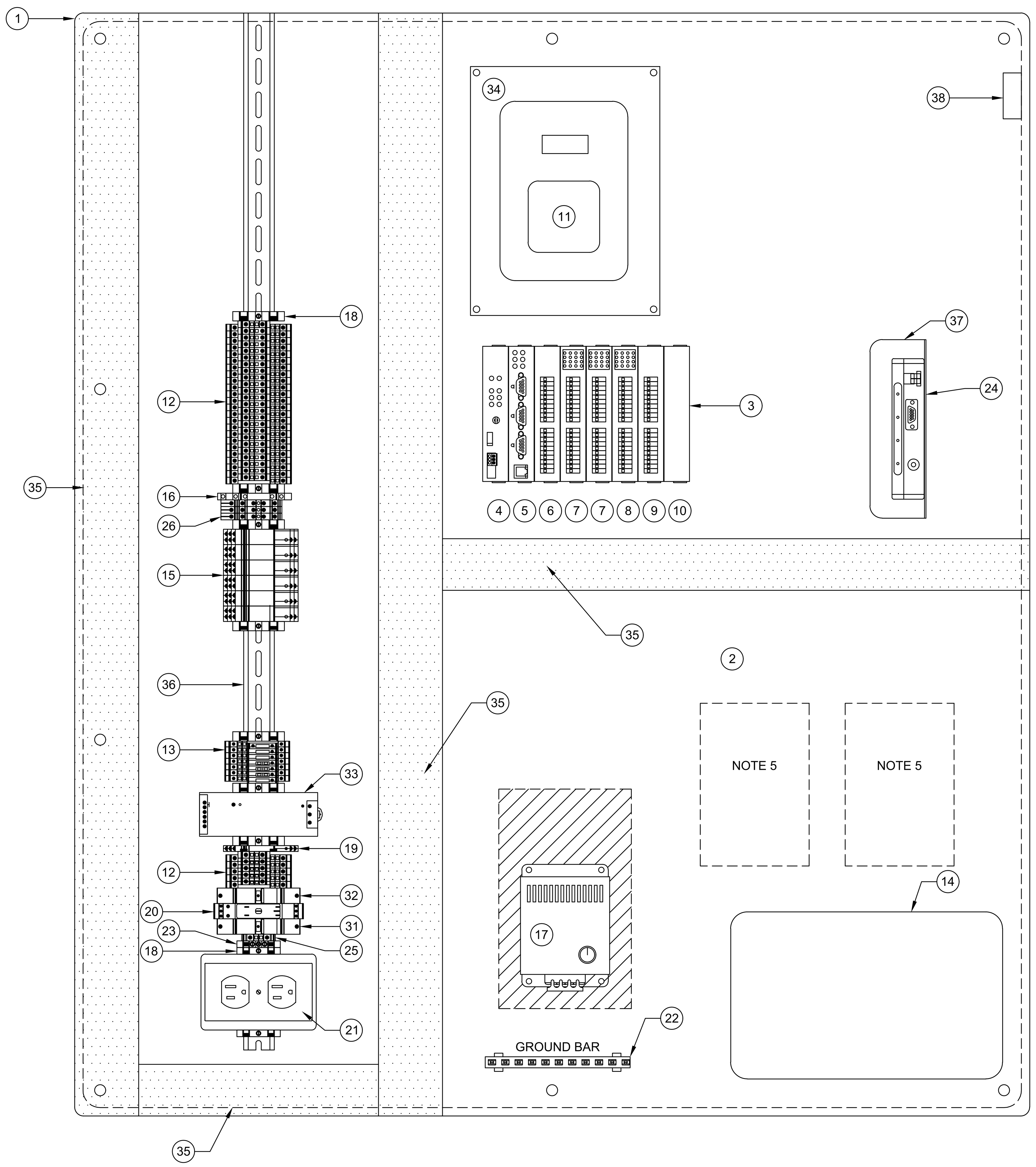
RTU PANEL EXTERIOR SIDE DETAIL 3
SCALE: NTS

Revision Number	Revision Description	Drawn By	Checked By	Date

Filename
Project No.
Project Date

CITIZENS WESTFIELD
CONSTANT SPEED SUBMERSIBLE LIFT STATION
STANDARD INSTRUMENTATION AND CONTROL DETAILS – IC–1

SHEET NO.
500.020



EXAMPLE RTU PANEL INTERIOR LAYOUT (1)

SCALE: NONE

TYPICAL MINIMUM BILL OF MATERIALS

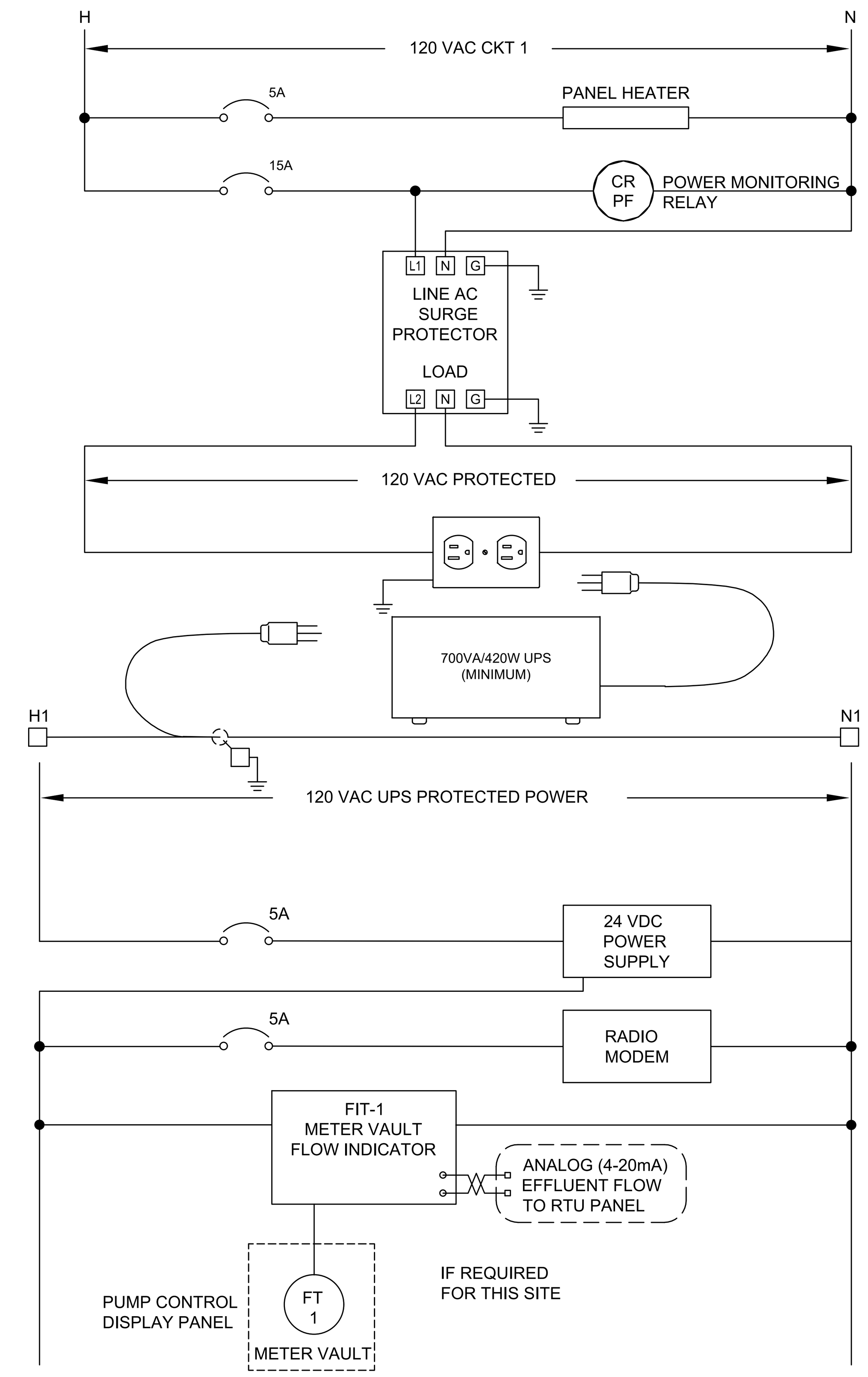
ITEM #	QTY	PART NUMBER *	DESCRIPTION	MANUFACTURER *
1.	1	-	STAINLESS 36" x 48" x 12" ENCLOSURE	-
2.	1	-	ENCLOSURE BACKPLANE	-
3.	1	-	8 SLOT BASE CHASSIS	ALLEN BRADLEY
4.	1	-	24VDC UPS WITH BATTERY	ALLEN BRADLEY
5.	1	5069-L306	CPU MODULE	ALLEN BRADLEY
6.	1	5609-IF8	8 POINT ANALOG INPUT CARD	ALLEN BRADLEY
7.	2	5069-IB16	16 POINT DIGITAL INPUT CARD	ALLEN BRADLEY
8.	1	5069-OB16	16 POINT DIGITAL OUTPUT CARD	ALLEN BRADLEY
9.	2	5609-OF8	8 POINT ANALOG OUTPUT CARD	ALLEN BRADLEY
10.	2	-	BLANK I/O COVER	ALLEN BRADLEY
11.	1	2711P-T4W21D8S	OPERATOR INTERFACE	ALLEN BRADLEY
12.	32	-	DOUBLE LEVEL TERMINAL BLOCK	ALLEN BRADLEY
13.	4	-	FUSED DOUBLE LEVEL TERMINAL BLOCK	-
14.	1	-	BATTERY BACKUP	-
15.	6	-	24VDC DIGITAL OUTPUT RELAY	-
16.	1	-	ANALOG SURGE PROTECTOR	-
17.	1	-	ENCLOSURE HEATER	-
18.	9	-	DIN RAIL END ANCHOR	-
19.	1	-	120 AC POWER MONITORING RELAY	-
20.	1	-	SPD	-
21.	1	-	DUPLEX OUTLET	-
22.	1	-	GROUND BAR	-
23.	1	-	GROUND BLOCK	-
24.	1	EL-805BO	SPREAD SPECTRUM RADIO TRANSNET 900	GE-MDS
25.	1	-	SINGLE LEVEL TERMINAL BLOCK	-
26.	3	-	TRIPLE LEVEL TERMINAL BLOCK	-
27.	3	-	DOUBLE LEVEL TERMINAL BLOCK COVER	-
28.	1	-	SINGLE LEVEL TERMINAL BLOCK COVER	-
29.	1	-	TRIPLE LEVEL TERMINAL BLOCK COVER	-
30.	1	-	ANALOG SURGE PROTECTOR COVER	-
31.	1	-	SINGLE POLE CIRCUIT BREAKER	-
32.	1	-	SINGLE POLE CIRCUIT BREAKER	-
33.	1	-	120 AC / 24 DC POWER SUPPLY	-
34.	1	-	KEYPAD BACKPLANE	-
35.	1	-	2" x 3" WIRE DUCT / COVER	-
36.	1	-	DIN RAIL	-
37.	1	-	RADIO MOUNTING BRACKET	-
38.	1	-	DOOR SWITCH	-

* MANUFACTURERS AND PART NUMBERS ARE PER INITITAL BASIS OF DESIGN; PANEL ASSEMBLER TO PROVIDE COMPONENTS THAT ARE AN EQUAL OR BETTER CONSTRUCTION BASED ON CURRENTLY AVAILABLE COMPONENTS.

NOTES:

1. PROVIDE LATEST MODELS OF THE MATERIALS AS NECESSARY TO MEET ALL FUNCTIONAL REQUIREMENTS AND FEATURES OF THE RTU AS INDICATED IN THE CONTRACT DOCUMENTS.
2. DESIGN INTENT IS TO PROVIDE AN RTU THAT SEAMLESSLY COMMUNICATES WITH THE EXISTING LIFT STATION COMMUNICATION SYSTEM.
3. THE SYSTEM ARCHITECTURE IS MEANT TO BE AS SIMILAR AS POSSIBLE TO THE EXISTING WESTFIELD CEG LIFT STATION RTUS WHILE UTILIZING READILY AVAILABLE PARTS AND EQUIPMENT.
4. CABLING LEAVING RTU ENCLOSURE NOT INCLUDED IN BOM.
5. LEVEL AND FLOW METER TRANSMITTERS INSTALLED INSIDE OR BELOW RTU ENCLOSURE, DEPENDING ON MAKE AND MODEL SELECTED.
6. WHEN REQUESTED BY THE UTILITY, PROVIDE MOTOR CURRENT TRANSDUCER FOR EACH MOTOR TO PRODUCE
7. 4-20 mA DC SIGNAL AND CONTACT CLOSURE SIGNAL TO PLC. PLC TO USE SIGNAL FOR SPEED REFERENCE OR TO GENERATE A MOTOR FAIL TO START ALARM.

NOTE:
RTU PANEL SHOWN FOR REFERENCE ONLY, ACTUAL LAYOUT DETERMINED BY SELECTED PANEL ASSEMBLER.



Name	IO Type	Voltage	Physical IO Point
Pump 1 Running	DI	24VDC	DI 1-1
Pump 2 Running	DI	24VDC	DI 1-2
Float Low	DI	24VDC	DI 1-3
Float High	DI	24VDC	DI 1-4
Power Fail	DI	24VDC	DI 1-5
Control Panel Door Open	DI	24VDC	DI 1-6
RTU Panel Door Open	DI	24VDC	DI 1-7
Pump 1 Fail	DI	24VDC	DI 1-8
Pump 2 Fail	DI	24VDC	DI 1-9
Spare	DI	24VDC	DI 1-10
Pump 1 Overtemp	DI	24VDC	DI 1-11
Pump 1 Seal Fail	DI	24VDC	DI 1-12
Pump 2 Overtemp	DI	24VDC	DI 1-13
Pump 2 Seal Fail	DI	24VDC	DI 1-14
Common Pump Temp or Seal Fail	DI	24VDC	DI 1-15
Control Panel High Temp	DI	24VDC	DI 1-16
Control Panel Low Temp	DI	24VDC	DI 2-1
RTU Panel High Temp	DI	24VDC	DI 2-2
TRU Panel Low Temp	DI	24VDC	DI 2-3
Transducer High	DI	24VDC	DI 2-4
Transducer Low	DI	24VDC	DI 2-5
Spare	DI	24VDC	DI 2-6
Spare	DI	24VDC	DI 2-7
Spare	DI	24VDC	DI 2-8

Name	IO Type	Voltage	Physical IO Point
Pump 1 Run	DO	24VDC	DO 1-1
Pump 1 Force Off	DO	24VDC	DO 1-2
Pump 2 Run	DO	24VDC	DO 1-3
Float Switch on Transducer Fail	DO	24VDC	DO 1-4
Spare	DO	24VDC	DO 1-5
Spare	DO	24VDC	DO 1-6
Spare	DO	24VDC	DO 1-7
Alarm Horn	DO	24VDC	DO 1-8
Wet Well Level	AI	24VDC	AI 1-1
Spare	AI	24VDC	AI 1-2
Spare	AI	24VDC	AI 1-3
Spare	AI	24VDC	AI 1-4

RTU PANEL WIRING DIAGRAM

SCALE: NONE

Revision Number	Revision Description	Drawn By	Checked By	Date

Filename
Project No.
Project Date

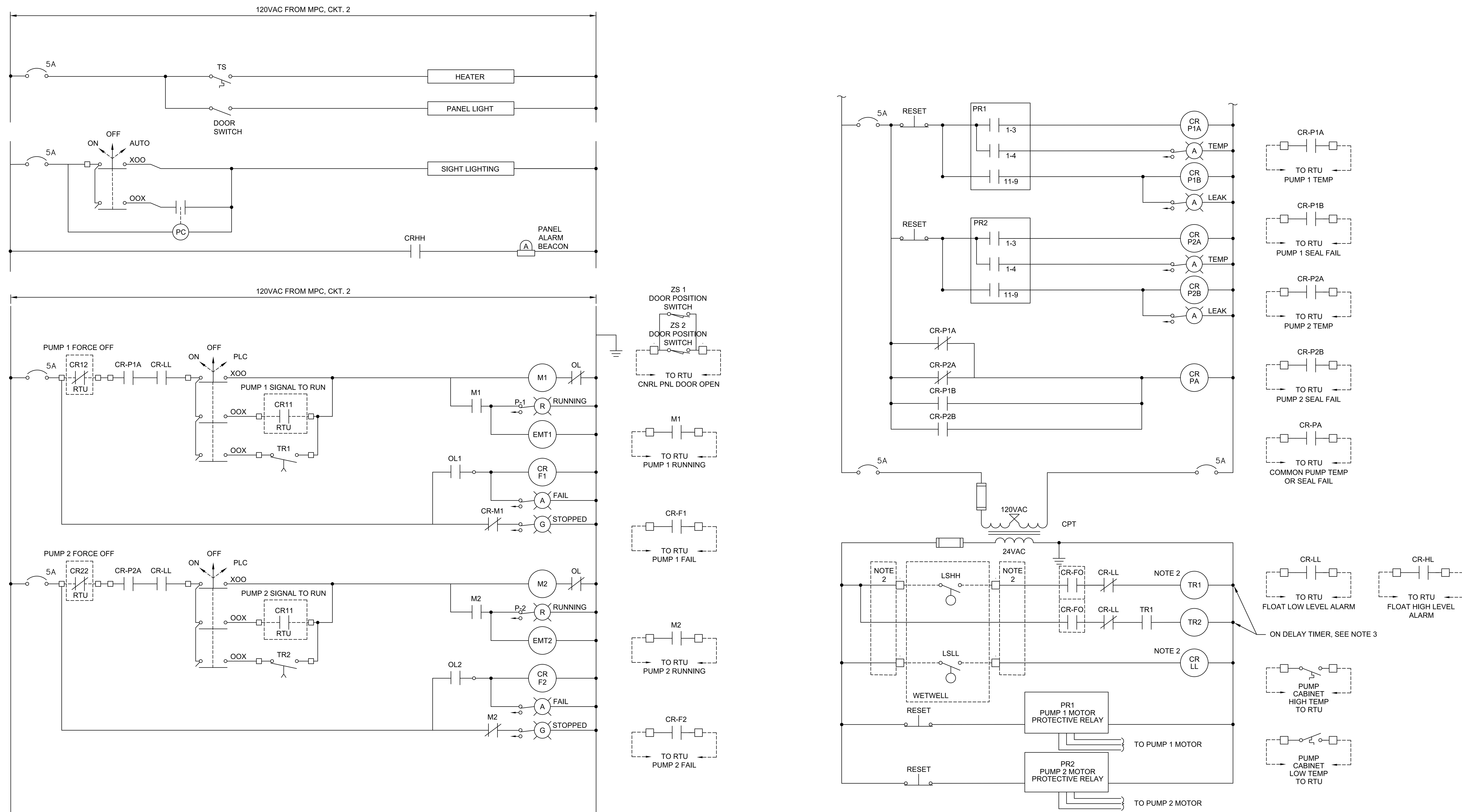
CITIZENS WESTFIELD

CONSTANT SPEED SUBMERSIBLE LIFT STATION

STANDARD INSTRUMENTATION AND CONTROL DETAILS – IC–2

SHEET NO.

500.021



GENERAL NOTES:

1. PR1 AND PR2 ARE PUMP MOTOR TEMPERATURE AND SEAL LEAK DETECTION RELAYS PROVIDED WITH THE PUMPS. PUMP MONITOR RELAYS ARE SHOWN. PROVIDE RELAYS AND ADJUST DIAGRAM AS REQUIRED FOR PUMPS SUPPLIED AT LIFT STATION.
2. PROVIDE INTRINSICALLY SAFE RELAY BARRIERS FOR FLOAT SWITCH WIRES.
3. IF THE LEVEL TRANSDUCER FAILS, THEN THE BACKUP HIGH AND LOW-LOW FLOAT SWITCHES ACT AS PRIME MEANS OF AUTOMATIC LEVEL CONTROL. WHEN THE HIGH FLOAT DETECTS WATER IN THE WET WELL THE LEAD PUMP IS INITIATED. IF THE HIGH FLOAT REMAINS ENGAGED AFTER A USER ADJUSTABLE TIME DELAY OFF THE START OF THE LEAD PUMP OF 0-5 MINUTES, THEN THE LAG PUMP IS INITIATED. BOTH PUMPS ARE AUTOMATICALLY STOPPED ONCE THE LOW-LOW LEVEL IS DETECTED BY THE LOW-LOW FLOAT SWITCH. NOTE - THIS FUNCTIONALITY IS REQUIRED BUT NOT REPRESENTED IN THE PLANS.

CONTROL PANEL WIRING DIAGRAM

SCALE: NTS

Revision Number	Revision Description	Drawn By	Checked By	Date

Filename
Project No.
Project Date

CITIZENS WESTFIELD

CONSTANT SPEED SUBMERSIBLE LIFT STATION

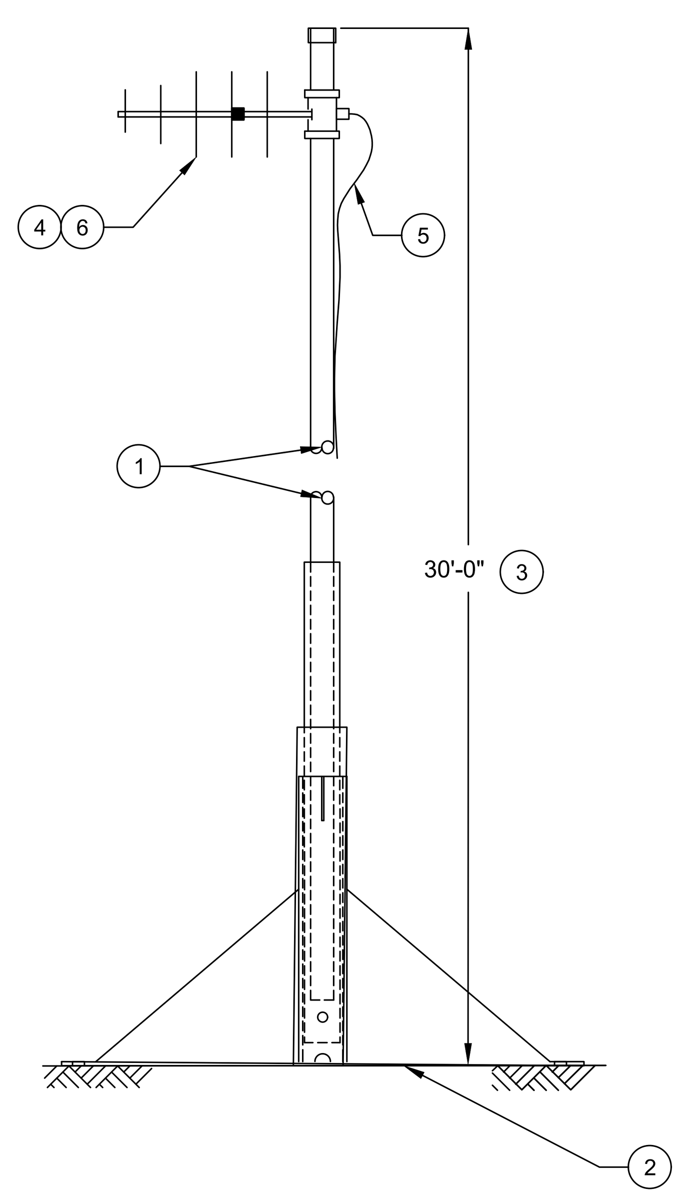
STANDARD INSTRUMENTATION & CONTROL DETAILS – IC–3

SHEET NO.

500.022

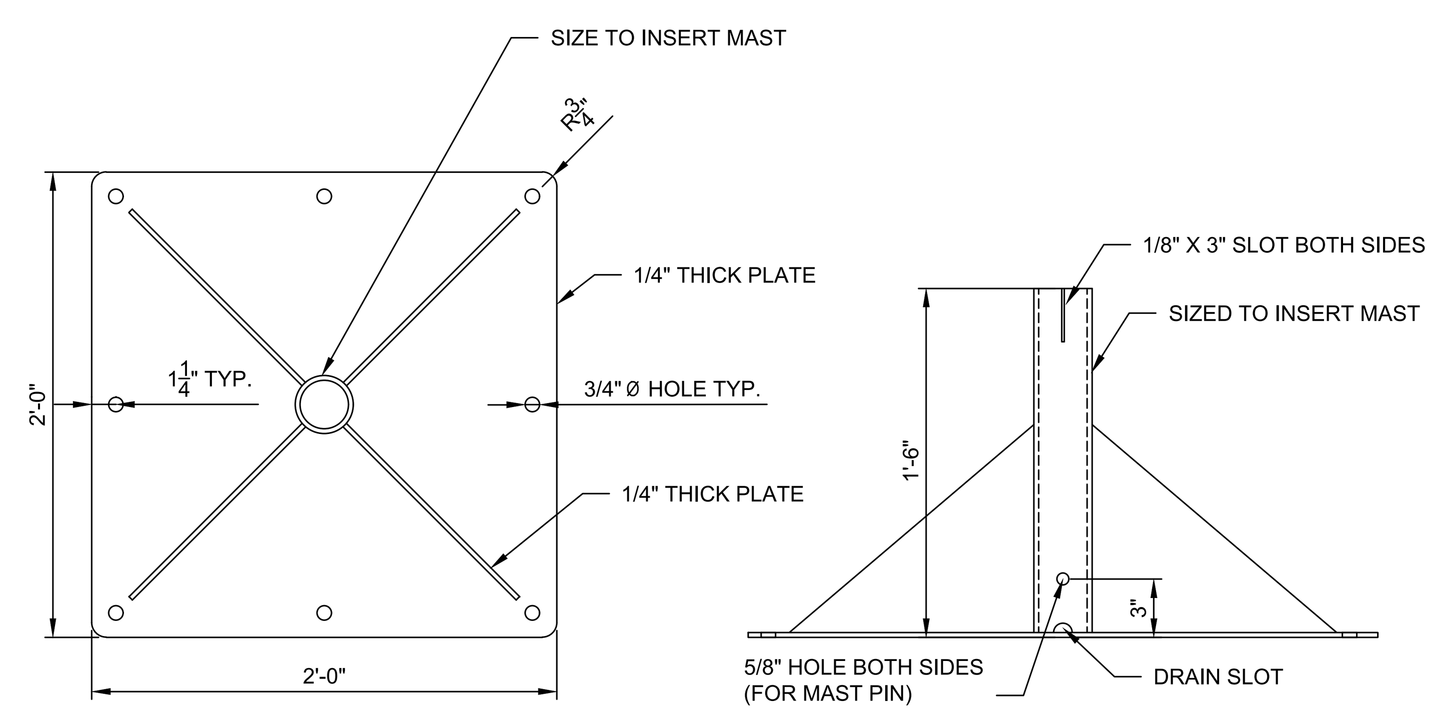
#. KEYED NOTES:

1. INSTALL ALUMINUM TELESCOPIC ANTENNA MAST FOR RADIO ANTENNA MOUNTING IN CONCRETE BASE. COAT BASE MAST SECTION IN CONTACT WITH CONCRETE WITH BITUMINOUS COATING UP TO 4 INCHES ABOVE TOP OF BASE. CAP TOP OF PIPE. (SPIDERBEAM MA180000)
2. SURFACE MOUNT BASE. SEE DETAIL 2 THIS SHEET.
3. CONDUCT FIELD RADIO TESTING IN COORDINATION WITH CITIZENS WESTFIELD OPERATIONS STAFF TO DETERMINE HEIGHT REQUIRED.
4. DIRECTIONAL ANTENNA.
5. COAXIAL CABLE LMR600 TO RTU ENCLOSURE.
6. INSTALL ANTENNA ON THE HORIZONTAL PLANE, NOT ON THE VERTICAL PLANE AS SHOWN IN THE DETAIL.



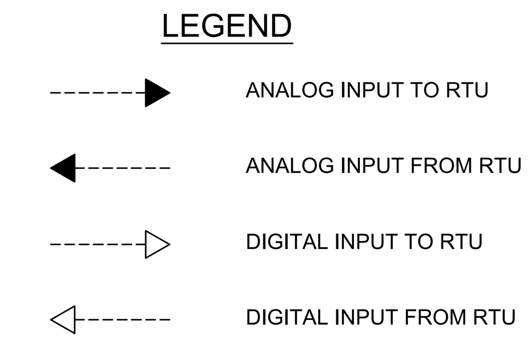
DIRECTIONAL ANTENNA DETAIL 1

SCALE: NONE

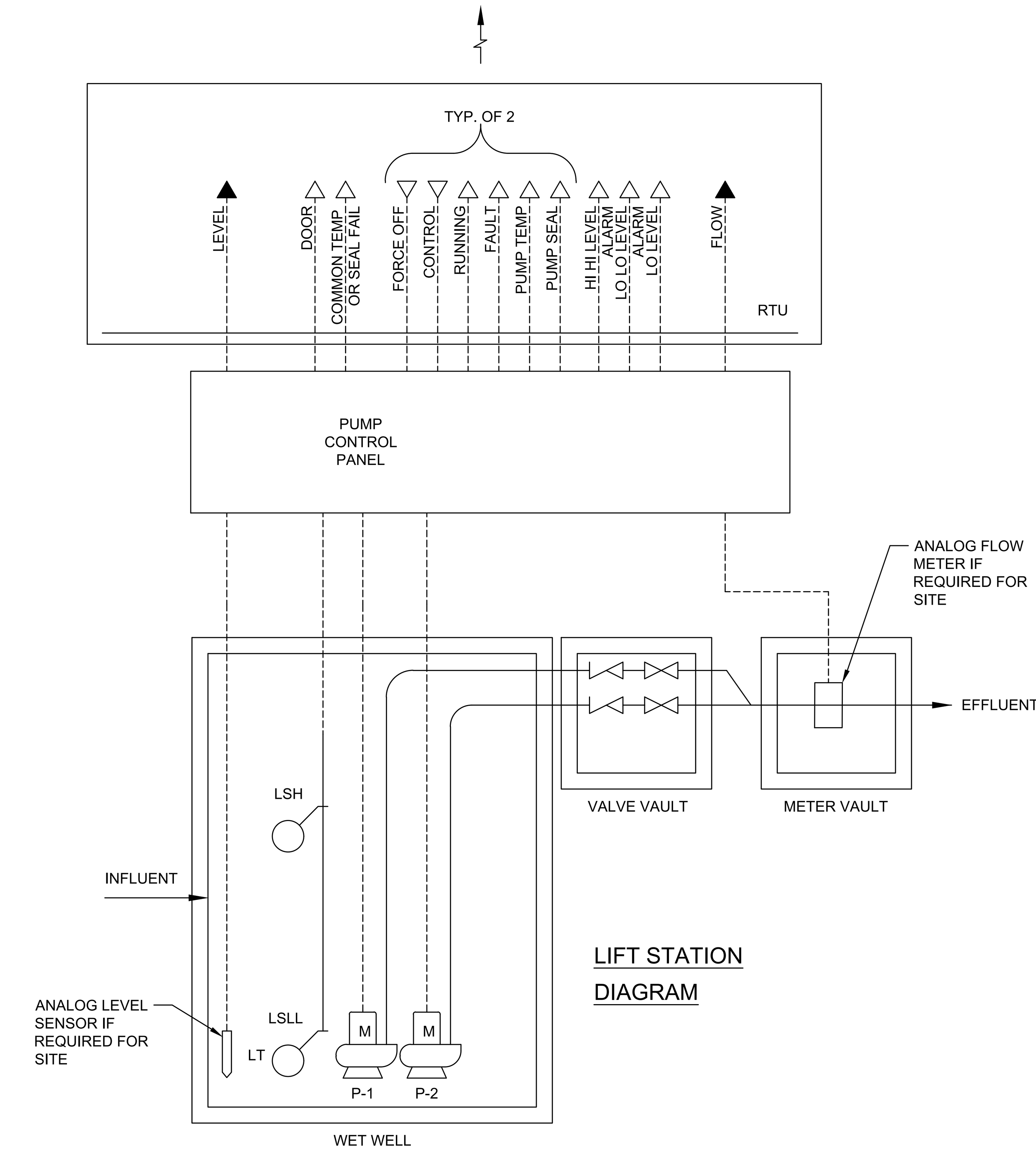


ANTENNA MAST BASE DETAIL 2

SCALE: NONE



COORDINATE WITH CWW ON WHAT ALARMS AND DATA NEEDS TO BE TRANSMITTED; AS A MINIMUM ASSUME A COMMON PUMP WARNING ALARM, A CONTROL PANEL DOOR OPEN ALARM, A COMMON LEVEL ALARM, AND CURRENT WET WELL LEVEL



PROCESS & INSTRUMENTATION DIAGRAM

SCALE: NONE

Revision Number	Revision Description	Drawn By	Checked By	Date

Filename	
Project No.	
Project Date	

CITIZENS WESTFIELD

CONSTANT SPEED SUBMERSIBLE LIFT STATION

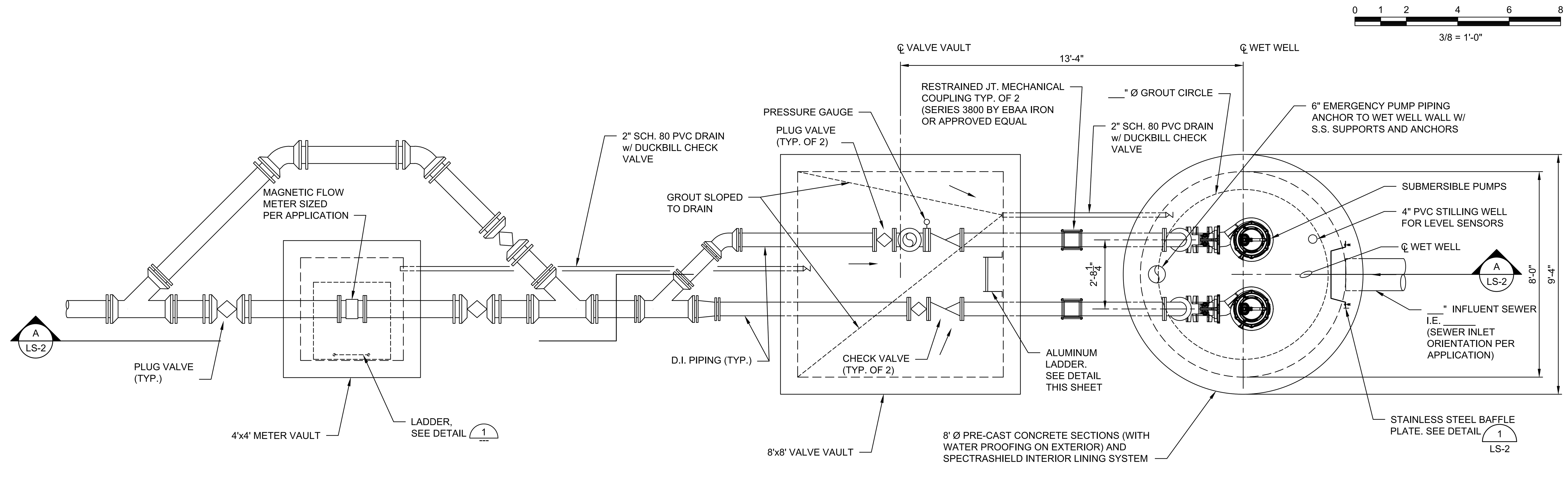
STANDARD INSTRUMENTATION & CONTROL DETAILS – IC-4

SHEET NO.

500.023

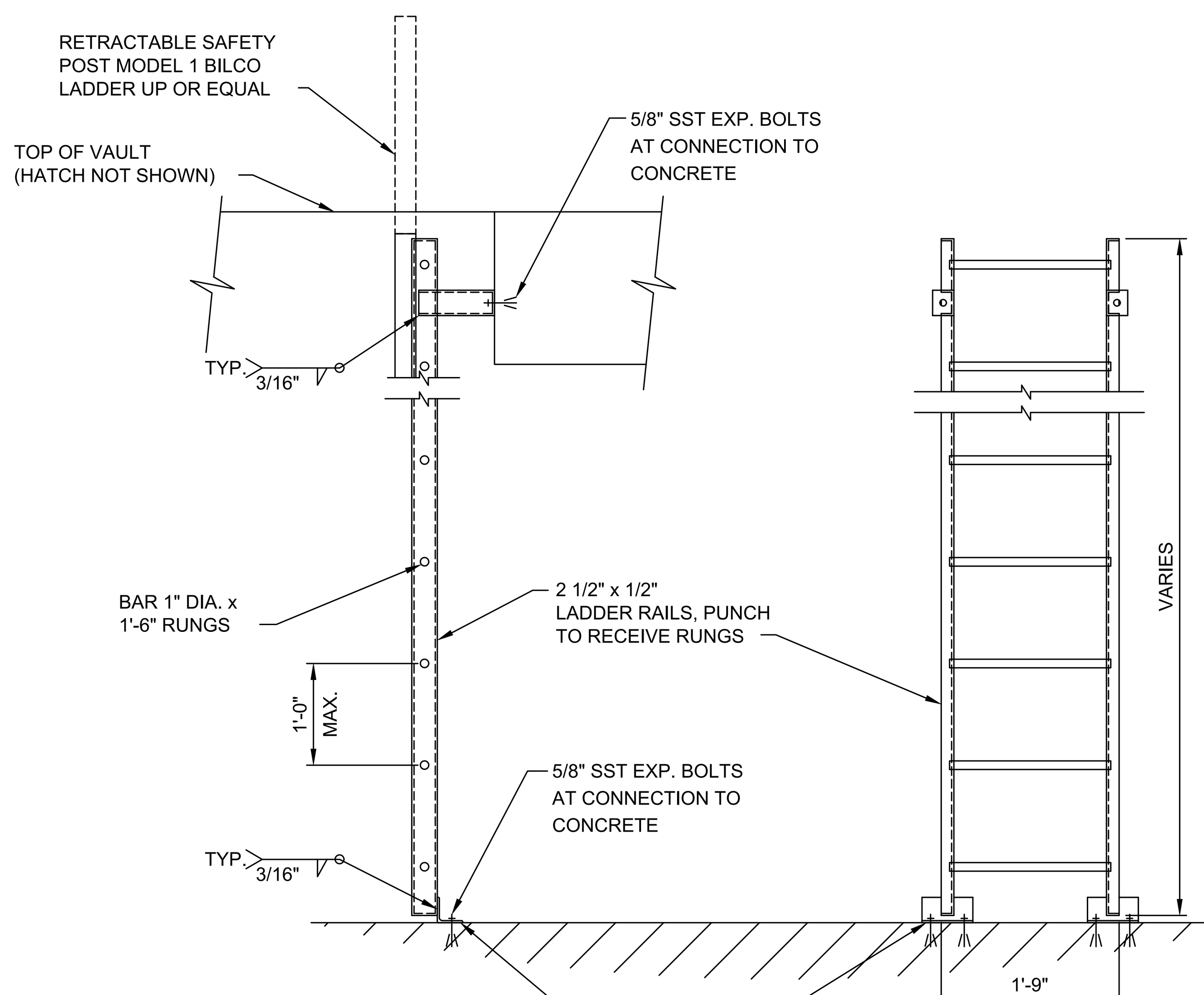
NOTES:

1. LIFT STATION AND VALVE VAULT TO BE CONSTRUCTED ON SPECIAL BACKFILL.
2. INSTALL RETRACTABLE SAFETY POST ON ALUMINUM LADDERS.
3. ALL INTERIOR PIPING SHALL BE COATED. AS REQUIRED WITH TNEMEC 66 HB EPOXY OR EQUAL.
4. INSTALL A "RED VALVE" PRESSURE SENSOR SERIES 40 ON FORCE MAIN. PLACE AN ASHCROFT TYPE NO. 1009 STN. STL. 4 1/2" PRESSURE GAUGE & VALVE ON THE PRESSURE SENSOR. THE GAUGE SHALL HAVE A SHUT OFF VALVE AND A RANGE OF 0-75 PSIG.
5. ALL FASTENERS TO BE 316 S.S.
6. CORE DRILL HOLE AND SEAL ANNULAR OPENING w/ KOR-N-SEAL, OR EQUAL, RESILIENT RUBBER SEAL SEE DETAIL.
7. ALL ANCHOR BOLTS, EXPANSION BOLTS, ETC. SHALL BE 304 STAINLESS STEEL.
8. 2" CHECK VALVE SHALL BE DUCKBILL STYLE BY RED VALVE.
9. ALL D.I.M.J. PIPE JOINTS SHALL BE RESTRAINED.
10. WET WELL AND VALVE VAULT HATCHES SHALL INCLUDE AN INTERIOR FALL PROTECTION SYSTEM PER CITIZENS ENERGY GROUP SANITARY STANDARDS MANUAL.
11. SPECTRASHIELD LINING SYSTEM REQUIRED ON WET WELL INTERIOR.
12. EQUIPMENT, PIPE, FITTINGS, AND EQUIPMENT ARE SHOWN FOR REFERENCE AND MAY NOT BE TO SCALE FOR SPECIFIC PROJECT REQUIREMENTS. CONTRACTOR SHALL VERIFY DIMENSIONS OF REQUIRED EQUIPMENT WITH DESIGN ENGINEER PRIOR TO CONSTRUCTION.



LOWER LEVEL PLAN

SCALE: 3/8"=1'-0"



SECTION

SCALE: NTS

ELEVATION

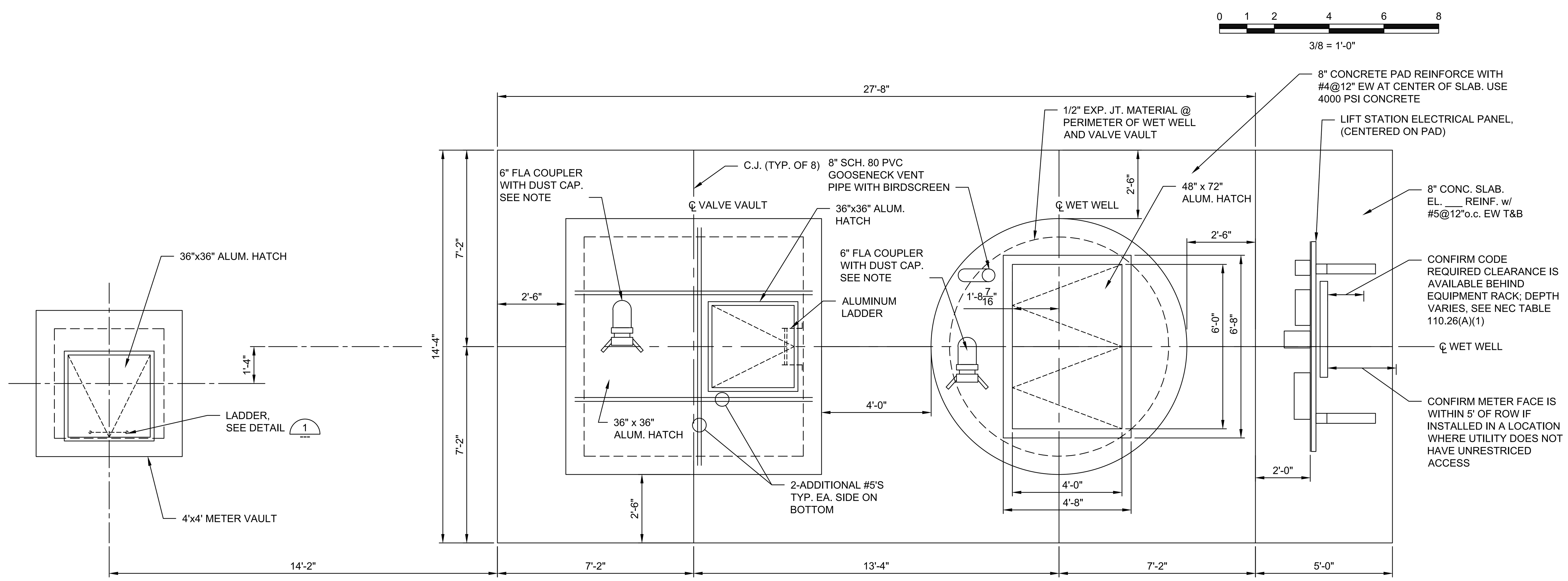
SCALE: NTS

NOTES:

1. MATERIAL SHALL BE ALUMINUM (6061-T6 ALLOY).
2. FINAL DESIGN BY LADDER MANUFACTURER.

LADDER DETAIL 1

N.T.S.



NOTE:
FIELD VERIFY ORIENTATION OF FLA COUPLERS WITH CITIZENS WESTFIELD OPERATIONS STAFF.

TOP PLAN

SCALE: 3/8"=1'-0"

Revision Number	Revision Description	Drawn By	Checked By	Date

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Project No.	
Project Date	

CITIZENS WESTFIELD

CONSTANT SPEED SUBMERSIBLE LIFT STATION

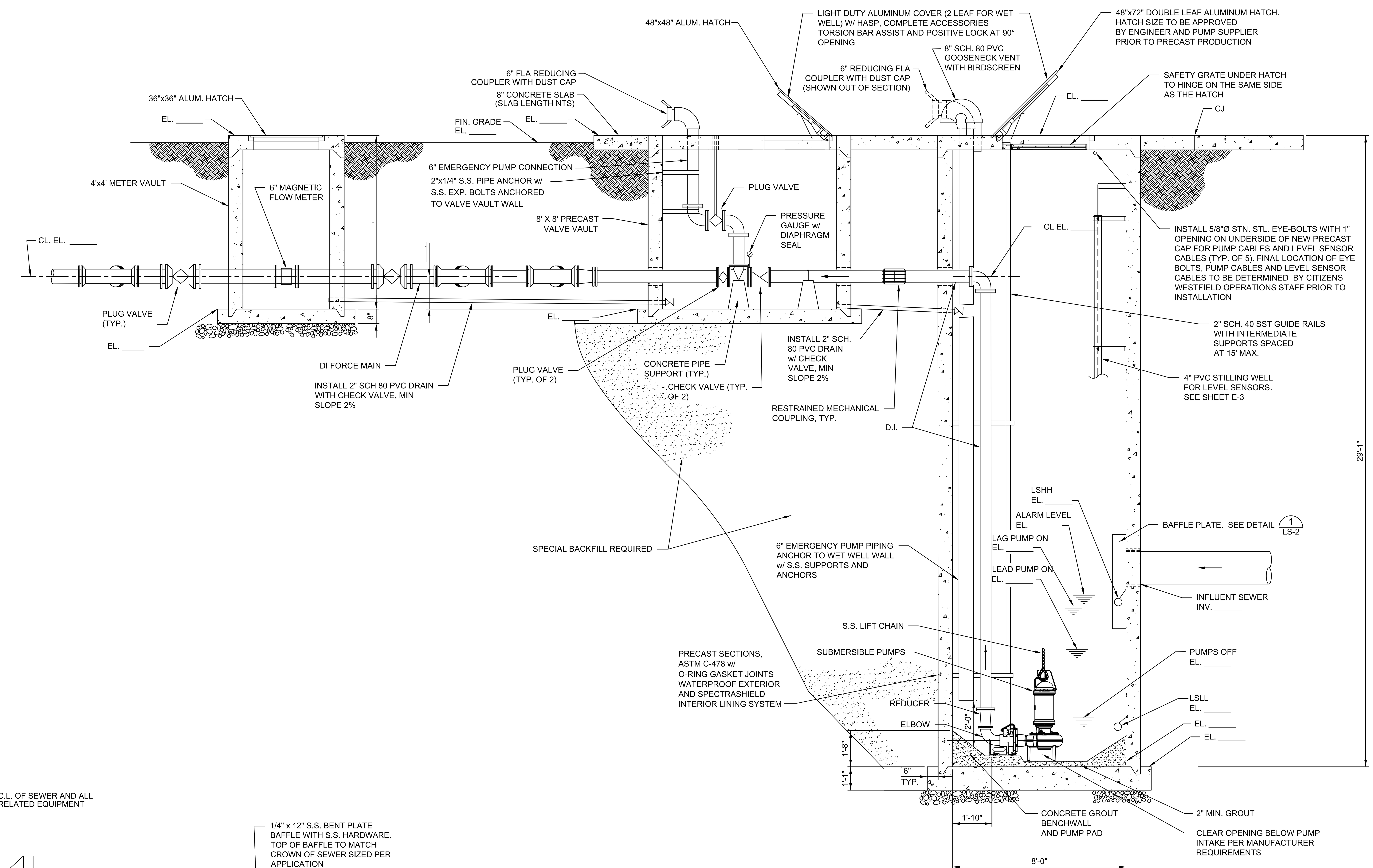
STANDARD DETAILS – LS–1

SHEET NO.

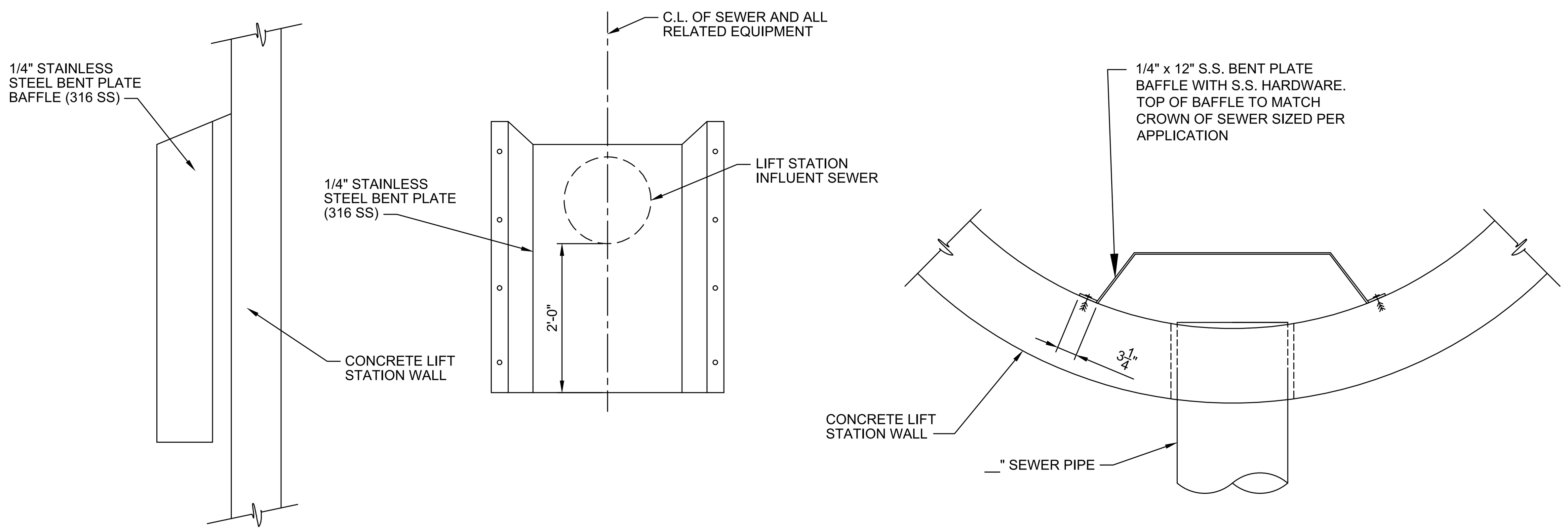
500.024

GENERAL NOTES:

1. PROVIDE NEW CONTINUOUS SUBMERSIBLE LEVEL SENSOR PER CITIZENS STANDARDS. NOMINAL RANGE SHALL BE 0 TO 50 FEET, SCALED 0 TO 40 FEET. AMETEK 575MB001RLS WITH AMETEK CABLE OR ENGINEER APPROVED EQUAL.
2. PROVIDE NEW HIGH AND LOW LEVEL (FLOAT) SWITCHES. SWITCHES SHALL SERVE AS BACKUP IF THE CONTINUOUS LEVEL SENSOR FAILS FOR ANY REASON. VERIFY LEVEL SETTINGS WITH ENGINEER. ANCHOR SCIENTIFIC OR ENGINEER APPROVED EQUAL.
3. DEFAULT OPERATION SHALL BE LEAD PUMP ON/OFF OPERATING BASED ON SPECIFIED WET WELL LEVELS.
4. THE OPERATOR SHALL HAVE THE ABILITY TO SPECIFY THE FOLLOWING POINTS:
   - HL - ALARM
   - HL - LAG PUMP ON
   - HL - LEAD PUMP ON
   - LL - ALL PUMPS OFF
   - LL - ALARM
5. LEAD PUMPS SHALL ALTERNATE BASED ON ACCUMULATED RUN TIME.
6. EQUIPMENT, PIPE, FITTINGS, AND EQUIPMENT ARE SHOWN FOR REFERENCE AND MAY NOT BE TO SCALE FOR SPECIFIC PROJECT REQUIREMENTS. CONTRACTOR SHALL VERIFY DIMENSIONS OF REQUIRED EQUIPMENT WITH DESIGN ENGINEER PRIOR TO CONSTRUCTION.



SECTION A
SCALE: 3/8"=1'-0" LS-1



SEWER BAFFLE DETAIL 1
SCALE: NTS LS-1, LS-2

Revision Number	Revision Description	Drawn By	Checked By	Date

Filename

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Project Date

CITIZENS WESTFIELD

CONSTANT SPEED SUBMERSIBLE LIFT STATION

STANDARD DETAILS – LS-2

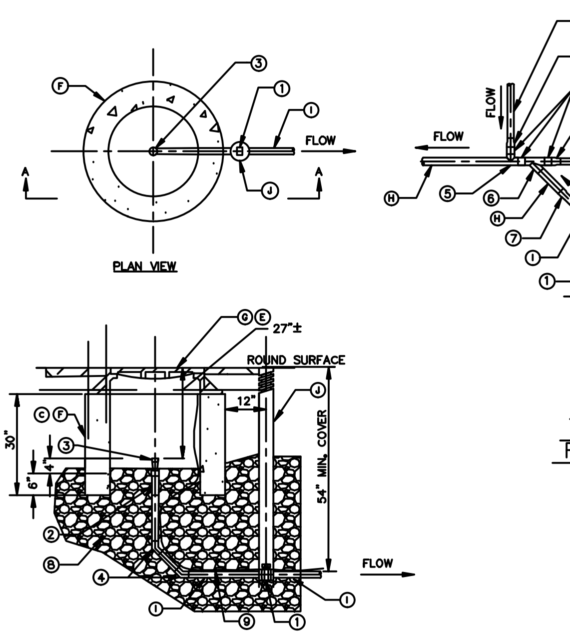
SHEET NO.

500.025

CITIZENS ENERGY GROUP

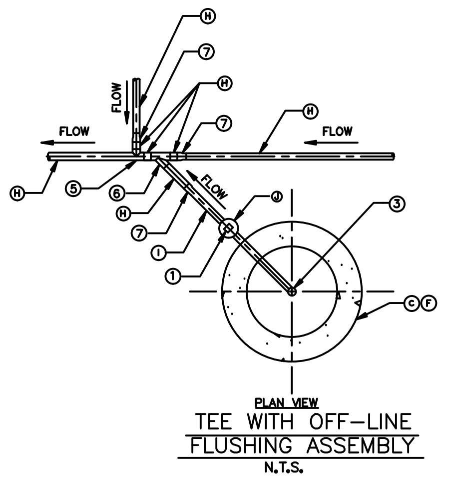
LOW PRESSURE SYSTEM DETAIL

FIGURE 500.02

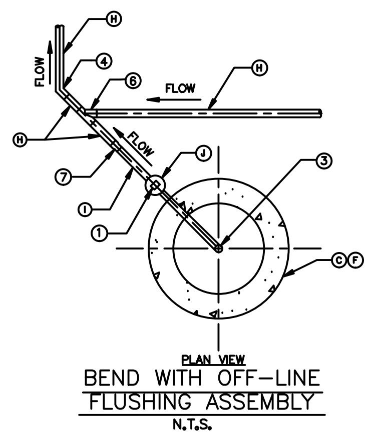


NOTES:
1. STONE TO BE COMPACTED AND BROUGHT UP INSIDE THE PIT TO THE UNDERSIDE OF THE CAM-LOCK SUCH THAT IT DOES NOT INTERFERE WITH OPERATION BUT PROVIDES SUPPORT FOR THE RISER.
2. CENTER THE FLUSHING RISER WITHIN THE PIT.
3. ALL PIPE AND FITTINGS ARE 2" DIA. UNLESS NOTED OTHERWISE.
4. THE EXTERIOR VALVE AND VALVE BOX (AND PIPING TO THE LATERAL WYE FOR OFF-LINE ASSEMBLES) ARE CONSIDERED PART OF THE FLUSHING ASSEMBLY.
5. 24" DIA. HDPE PIPE AND PIT COVER BY STAR PRODUCTS TO BE USED IF LOCATED GREATER THAN 5' OUTSIDE THE ROADWAY OR OTHERWISE APPROVED.

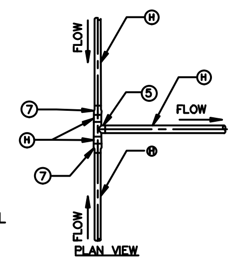
FLUSHING ASSEMBLY
(TERMINAL END OR OFF-LINE)
N.T.S.



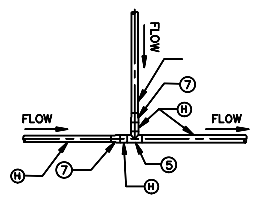
PLAN VIEW
TEE WITH OFF-LINE FLUSHING ASSEMBLY
N.T.S.



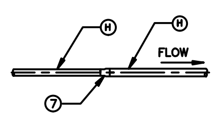
PLAN VIEW
BEND WITH OFF-LINE FLUSHING ASSEMBLY
N.T.S.



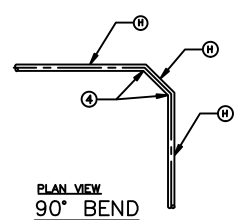
PLAN VIEW
TEE, BRANCH FLOW OUT
N.T.S.



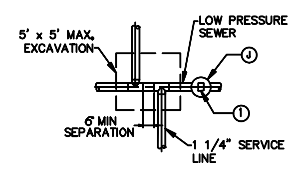
PLAN VIEW
TEE, BRANCH FLOW IN
N.T.S.



PLAN VIEW
REDUCER
N.T.S.



PLAN VIEW
90° BEND
N.T.S.



PLAN VIEW
LOW PRESSURE SEWER SERVICE LINE CONNECTION DETAIL
N.T.S.

MATERIAL NOTES

1. 2" POLYETHYLENE SHUT-OFF BALL VALVE (FULLY PORTED)
2. 2" TRANSITION FITTING FROM HDPE TO STAINLESS STEEL (MALE THREADS)
3. 2" MALE CAM-LOCK W/ CAP (FEMALE THREADS)
4. 45° ELBOW (SIZE VARIES)
5. NON-REDUCING BRANCH TEES (SIZE VARIES)
6. LATERAL WYE (SIZE VARIES)
7. REDUCER, IF APPLICABLE (SIZE VARIES)
8. #8 COMPACTED CRUSHED STONE, MIN. 6" UNDER BOTTOM OF STRUCTURE AND PIPE
9. TRACER WIRE

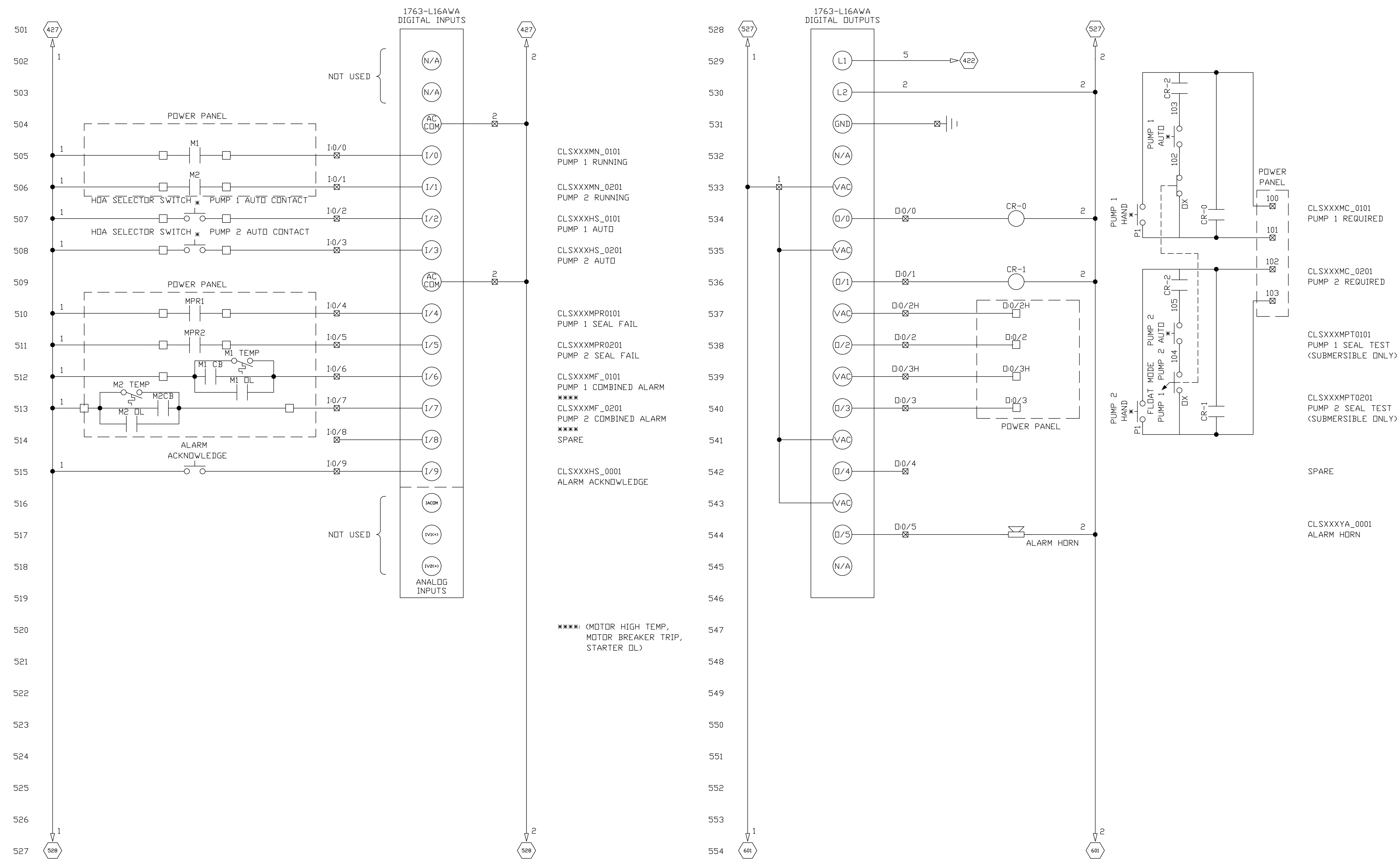
A. ELECTROFUSION PUNCH TEE WITH 1-1/4" BUTT FUSION.
B. 1-1/4" LOW PRESSURE SEWER LATERAL PIPE
C. 24" DIA. HDPE FOR PIT (OPEN BOTTOM)
D. LATERAL ASSEMBLY (PRE-ASSEMBLED, INCLUDES STAINLESS STEEL VALVE CURB STOP AND INTEGRAL CHECK VALVE WITH POLYPROPYLENE COMPRESSION ADAPTOR FITTINGS AT EACH END)
E. PIT COVER (WITH "SEWER" STAMPED INTO SURFACE) BY STAR PRODUCTS #SP-V32026SEWER
F. 24" DIA. PRECAST RCP FOR PIT (OPEN BOTTOM)
G. NEENAH R-1772 FRAME & SOLID LID WITH 2 CONCEALED PICKHOLES AND SELF SEALING GASKET WITH "SANITARY SEWER" STAMPED INTO SURFACE
H. MAINLINE LOW PRESSURE SEWER PIPE (SIZE VARIES)
I. 2" LOW PRESSURE SEWER PIPE
J. 4-1/4" CAST IRON ROADWAY VALVE BOX AND COVER (WITH "SEWER" STAMPED INTO SURFACE) SUITABLE FOR HIGHWAY LOADING

GENERAL NOTES

1. ALL MATERIALS AND INSTALLATION IS TO CONFORM TO THE REQUIREMENTS INCLUDED IN THE TECHNICAL SPECIFICATIONS.
2. ALL PIPE AND FITTINGS ARE TO BE HDPE, MINIMUM DR 11, SIZED IN ACCORDANCE WITH IPS, PRESSURE RATING OF 160 PSI OR GREATER, UNLESS OTHERWISE NOTED.
3. FITTINGS MAY BE FABRICATED OR MOLDED.
4. JOINING OF FITTINGS MAY BE ACCOMPLISHED VIA BUTT FUSION OR ELECTROFUSION EXCEPT WHERE COMPRESSION FITTINGS ARE INDICATED.
5. LIMITED USE OF ELECTROFUSION COUPLINGS IS ALLOWED.
6. 2 TRACER WIRES TO BE INSTALLED ALONG ALL PIPE AND MADE ACCESSIBLE IN ALL FLUSHING ASSEMBLY PITS AND LATERAL ASSEMBLY PITS. WIRE SHOULD BE ACCESSIBLE FOR CONNECTION EVERY 500 FEET OR LESS. IF NOT, A TRACER BOX RATED FOR HIGHWAY LOADING SHALL BE PROVIDED AS NEEDED FOR CONNECTION EVERY 500' OR LESS.
7. ALL BRANCHES OF TEES AND WYES ARE TO MATCH THE LARGEST PIPE SIZE.
8. 54" MINIMUM COVER REQUIRED OVER ALL PIPING.
9. MINIMUM PIPE LENGTH OF 6" BETWEEN ALL FITTINGS.

NOTE

1. MAIN LINE VALVES ARE REQUIRED ON DEAD END LOW PRESSURE MAINS THAT EXTEND 20 FEET PAST THE PROPOSED SERVICE LINE.



Date	Checked By	Drawn By	Revision Description	Revision Number

Filename
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Project Date

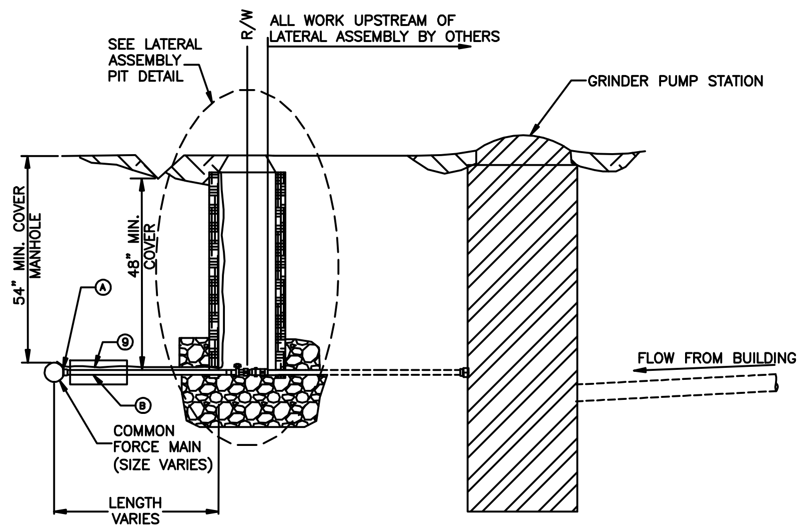
CITIZENS ENERGY GROUP
LEVEL 3 STANDARD 5
MICROLOGIX 1400

SHEET NO.
500.026

CITIZENS ENERGY GROUP

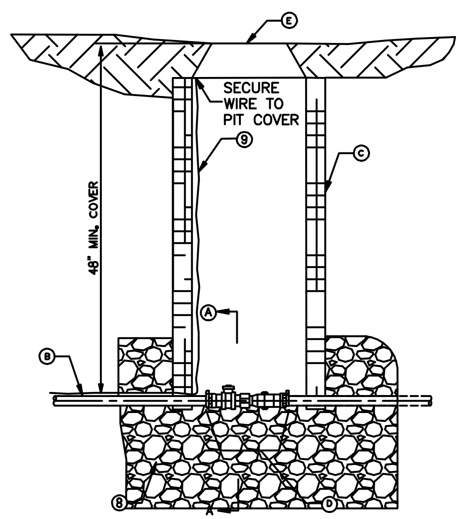
LOW PRESSURE SYSTEM DETAIL

FIGURE 500.03



TYPICAL LATERAL INSTALLATION

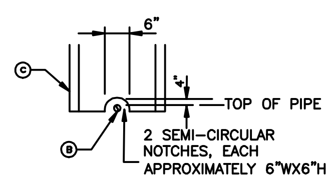
N.T.S.



LATERAL ASSEMBLY PIT DETAIL

N.T.S.

NOTES:
1. CONTRACTOR SHALL TAG EACH CURB STOP WITH ITS CORRESPONDING HOME ADDRESS
2. TAG IS TO BE MADE OF NON-CORROSIVE MATERIAL WITH LARGE STAMPED NUMBERS, AND IS TO BE SECURELY ATTACHED TO THE CURB BOX EITHER DIRECTLY OR USING NON-CORROSIVE TIES IN A LOCATION VISIBLE AND LEGIBLE FROM THE SURFACE BUT NOT WHERE IT WILL INTERFERE WITH OPERATION OF THE VALVE.
3. BED THE ASSEMBLY AND PIPE WITH STONE TO THE SPRINGLINE. DO NOT REST THE PIT ON TOP OF THE LATERAL PIPE.



SECTION A-A

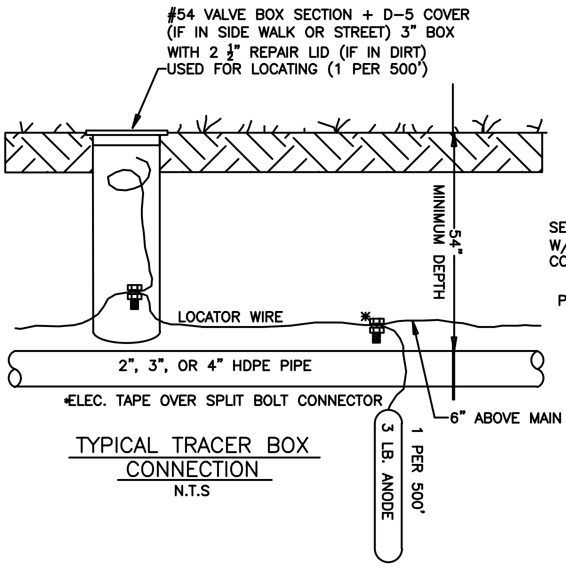
MATERIAL NOTES

1. 2" POLYETHYLENE SHUT-OFF BALL VALVE (FULLY PORTED)
2. 2" TRANSITION FITTING FROM HDPE TO STAINLESS STEEL (MALE THREADS)
3. 2" MALE CAM-LOCK W/ CAP (FEMALE THREADS)
4. 45° ELBOW (SIZE VARIES)
5. NON-REDUCING BRANCH TEES (SIZE VARIES)
6. LATERAL WYE (SIZE VARIES)
7. REDUCER, IF APPLICABLE (SIZE VARIES)
8. #8 COMPACTED CRUSHED STONE, MIN. 6" UNDER BOTTOM OF STRUCTURE AND PIPE
9. TRACER WIRE

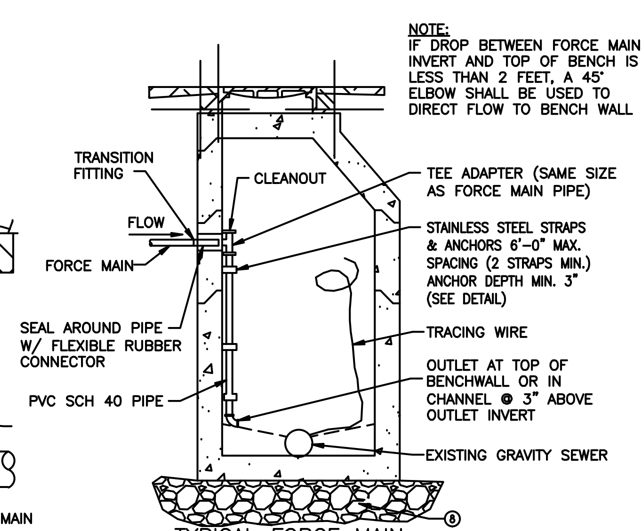
- (A) ELECTROFUSION PUNCH TEE WITH 1-1/4" BUTT FUSION.
- (B) 1-1/4" LOW PRESSURE SEWER LATERAL PIPE
- (C) 24" DIA. HDPE FOR PIT (OPEN BOTTOM)
- (D) LATERAL ASSEMBLY (PRE-ASSEMBLED, ONE-PIECE STAINLESS STEEL, E/ONE UNI-LATERAL OR APPROVED EQUIVALENT)
- (E) PIT COVER (WITH "SEWER" STAMPED INTO SURFACE) BY STAR PRODUCTS #SP-V32026SEWER
- (F) 24" DIA. PRECAST RCP FOR PIT (OPEN BOTTOM)
- (G) NEENAH R-1772 FRAME & SOLID LID WITH 2 CONCEALED PICKHOLES AND SELF SEALING GASKET WITH "SANITARY SEWER" STAMPED INTO SURFACE
- (H) MAINLINE LOW PRESSURE SEWER PIPE (SIZE VARIES)
- (I) 2" LOW PRESSURE SEWER PIPE
- (J) 4-1/4" CAST IRON ROADWAY VALVE BOX AND COVER (WITH "SEWER" STAMPED INTO SURFACE) SUITABLE FOR HIGHWAY LOADING

GENERAL NOTES

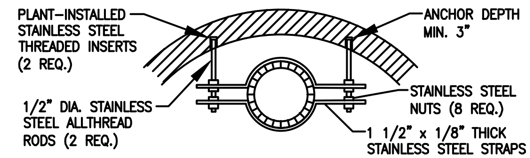
1. ALL MATERIALS AND INSTALLATION IS TO CONFORM TO THE REQUIREMENTS INCLUDED IN THE TECHNICAL SPECIFICATIONS.
2. ALL PIPE AND FITTINGS ARE TO BE HDPE, MINIMUM DR 9, SIZED IN ACCORDANCE WITH IPS, PRESSURE RATING OF 160 PSI OR GREATER, UNLESS OTHERWISE NOTED.
3. FITTINGS MAY BE FABRICATED OR MOLDED.
4. JOINING OF FITTINGS MAY BE ACCOMPLISHED VIA BUTT FUSION OR ELECTROFUSION EXCEPT WHERE COMPRESSION FITTINGS ARE INDICATED.
5. LIMITED USE OF ELECTROFUSION COUPLINGS IS ALLOWED.
6. 2 TRACER WIRES TO BE INSTALLED ALONG ALL PIPE AND MADE ACCESSIBLE IN ALL FLUSHING ASSEMBLY PITS AND LATERAL ASSEMBLY PITS. WIRE SHOULD BE ACCESSIBLE FOR CONNECTION EVERY 500 FEET OR LESS. IF NOT, A TRACER BOX RATED FOR HIGHWAY LOADING SHALL BE PROVIDED AS NEEDED FOR CONNECTION EVERY 500' OR LESS.
7. ALL BRANCHES OF TEES AND WYES ARE TO MATCH THE LARGEST PIPE SIZE.
8. 54" MINIMUM COVER REQUIRED OVER ALL PIPING.
9. MINIMUM PIPE LENGTH OF 6" BETWEEN ALL FITTINGS.



TYPICAL TRACER BOX CONNECTION
N.T.S



TYPICAL FORCE MAIN CONNECTION TO EXISTING MANHOLE
N.T.S

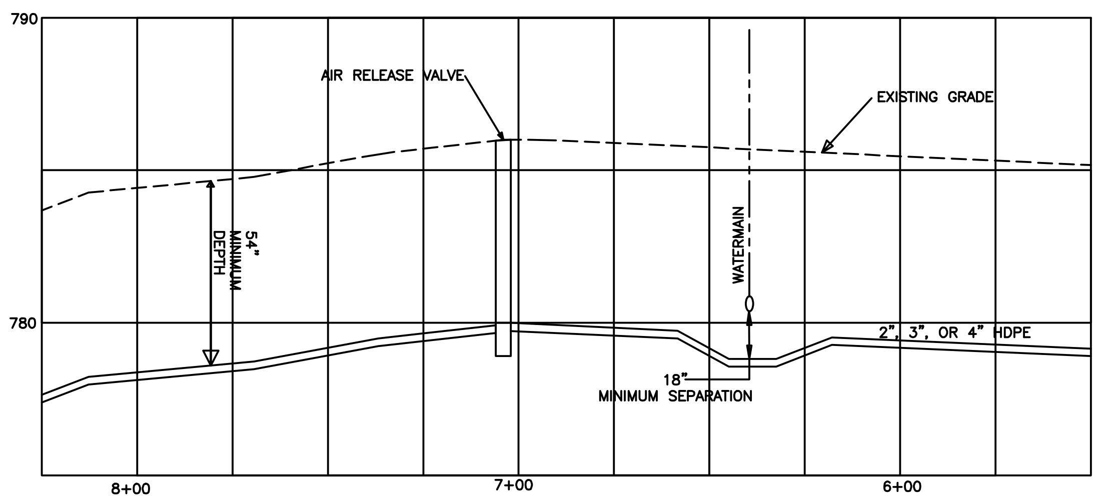


DROP PIPE ANCHOR DETAIL
TOP VIEW

MATERIAL NOTES

① 2" POLYETHYLENE SHUT-OFF BALL VALVE (FULLY PORTED)
② 2" TRANSITION FITTING FROM HDPE TO STAINLESS STEEL (MALE THREADS)
③ 2" MALE CAM-LOCK W/ CAP (FEMALE THREADS)
④ 45° ELBOW (SIZE VARIES)
⑤ NON-REDUCING BRANCH TEES (SIZE VARIES)
⑥ LATERAL WYE (SIZE VARIES)
⑦ REDUCER, IF APPLICABLE (SIZE VARIES)
⑧ #8 COMPACTED CRUSHED STONE, MIN. 6" UNDER BOTTOM OF STRUCTURE AND PIPE
⑨ TRACER WIRE

Ⓐ ELECTROFUSION PUNCH TEE WITH 1-1/4" BUTT FUSION.
Ⓑ 1-1/4" LOW PRESSURE SEWER LATERAL PIPE
Ⓒ 24" DIA. HDPE FOR PIT (OPEN BOTTOM)
Ⓓ LATERAL ASSEMBLY (PRE-ASSEMBLED, INCLUDES STAINLESS STEEL VALVE CURB STOP AND INTEGRAL CHECK VALVE WITH POLYPROPYLENE COMPRESSION ADAPTOR FITTINGS AT EACH END)
Ⓔ PIT COVER (WITH "SEWER" STAMPED INTO SURFACE) BY STAR PRODUCTS #SP-V32026SEWER
Ⓕ 24" DIA. PRECAST RCP FOR PIT (OPEN BOTTOM)
Ⓖ NEENAH R-1772 FRAME & SOLID LID WITH 2 CONCEALED PICKHOLES AND SELF SEALING GASKET WITH "SANITARY SEWER" STAMPED INTO SURFACE
Ⓗ MAINLINE LOW PRESSURE SEWER PIPE (SIZE VARIES)
Ⓘ 2" LOW PRESSURE SEWER PIPE
Ⓙ 4-1/4" CAST IRON ROADWAY VALVE BOX AND COVER (WITH "SEWER" STAMPED INTO SURFACE) SUITABLE FOR HIGHWAY LOADING



TYPICAL LOW PRESSURE SEWER PROFILE
N.T.S.

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8. 54" MINIMUM COVER REQUIRED OVER ALL PIPING.
9. MINIMUM PIPE LENGTH OF 6" BETWEEN ALL FITTINGS.
10. INSTALL AIR RELEASE VALVE AT HIGH POINTS ALONG LOW PRESSURE SEWER ALIGNMENT.

CITIZENS ENERGY GROUP

LOW PRESSURE SYSTEM DETAIL

FIGURE 500.04