

DOCUMENT 00 90 10

ADDENDUM No. 4

PART 1 GENERAL

1.0 DOCUMENT INCLUDES

- A. Changes to Bid Documents
- B. Changes to Specifications
- C. Changes to Plan Set
- D. Clarifications and Responses to Questions

1.1 CONSTRUCTION CONTRACT

- A. The Construction Contract is known as: *Mountain Green BNR Wastewater Treatment Plant*
- B. Date of this Addendum: 2/10/2023.
- C. All other provisions in the contract to remain in full force and effect.

PART 2 CHANGES TO BID DOCUMENTS

- 2.0** C-410 Schedule of Values
- i. Addition of item #105 Flo-dar

PART 3 CHANGES TO SPECIFICATIONS

- 3.0** Addition of Electrical Specifications
- 1) 16010 – Electrical General Requirements
 - 16150 – Electrical Control Devices
 - 16400 – Service and Distribution Systems
 - 16410 – Fuses.

PART 4 CHANGES TO PLAN SET

- 4.0** Electrical Drawings
- 1) E-201, E-202, E-203, E-307, E-307, E-308, E-403, E-406.

PART 5 ITEMS OF DISCUSSION

The following is a response to questions received from contractors and suppliers.

5.0 Clarifications and Response to Comments

2) Question:

1. We could not find some needed details on the drawings. Could you please provide the following:
 - a. Distance from invert top of the wall (or can we assume that this is the length called out in the gate schedule?).

Response: Correct, this is the length called out in the schedule.

- b. Head (or can we assume this same length is equal to the head?).

Response: 14' Head maximum.

- c. Any other details that pertain to the gates would be helpful

2. Please confirm that all gates are to have a self-contained guide and no pedestals.

Response: Confirmed.

3. The schedule calls for 316, 317 & 318 stainless steel, we do not have Gates that are made in 317 or 318 SS. Please verify we are to provide 316 stainless steel only.

Response: Material should be 316 SS, (317 and 318 were drafting errors).

4. Please confirm that the 30" slide gates cover a pipe and so they are 30x30 and head is unknown.

Response: Both slide gates will be covering a 20" pipe. Head is unknown.

5. Please confirm that the weir gate height is equal to the distance from the invert to the top of the wall = 36".

Response: Confirmed.

3) Question:

1. Permit fees – Will the GC be paying for permit fee or will they be a paid or reimbursed by the County/City? Typically, permit fees are waved or directly reimbursed or there is any allowance for permit fees (this prevents the General Contractor from adding OH&P to the estimated permit fees. Also, it is difficult to obtain an accurate cost for permits base on the following reasons: (1) The municipality not sure what they want to charge themselves. (2) Obtaining the fee schedules and calculating a project base on a cost which we are unlikely to know until the last moment. (3) Is difficult to get the information from the right person inside the municipality in a timely manner. I would suggest waiving the fees or making the fees directly reimbursable (except discharge fees), or providing a general allowance so it is an even paying fee between the General Contractors.

Response: Permit fees will be directly reimbursed.

2. Sales and Use Taxes – In addendum 2 Article 21 – Sales and Use Tax, it states that the job is tax exempt. I believe this is highly unlikely and may only apply to the equipment that was purchased by the District. I haven't bid a tax exempt job in Utah in the last 5 years. Please clarify.

Response: Not Tax Exempt for purpose of bidding, response from District to follow.

3. Backfill – Will the native backfill be allowed to be used to backfill up against the structures (digester, clarifiers, headworks, plant operation building). Typically, we can filter out the either 3" – 6" cobble within a certain distance from the structure. This would make huge difference in identifying the risk associated with important granular backfill. There will be a lot of dirt excavated especially for the aerobic digester and the clarifier. If the dirt that is removed can be used as backfill, this would remove and

enormous amount of risk. Now, we know that for area for asphalt paving will require the preparation shown on sheet CD-100 detail D. Please clarify.

Response: If the native material meets the requirements of backfill material as defined in Table 2 of the geotechnical report, the native material can then be used for backfill. However, if the native material does not meet the requirements for fill material as described in Table 2 of the geotechnical report, the native material cannot be used for fill.

4. Dewater – It was mentioned that Whitaker Construction was dewatering a project near the project. Could you provide the size of the hole they are dewatering including the depth with the GPM that they are pumping out?

Response: The Canyon View Lift Station is 25 feet deep. Please contact Whitaker Construction for information on dewatering GPM.

5. Owner Purchase Equipment Lead Times – Please provide the lead times for the owner purchased equipment.

6. Equipment Storage – Will the equipment be stored by the district or will the General Contractor be responsible for the storage of the equipment (until installed) or will the supplier store the equipment until the equipment can be directly installed by the General Contractor?

Response: Yes, contractor will be responsible for storage on site.

7. Liner – The plans Sheet BB-102 call out for 12 oz Non-Woven Geotextile and a 60 mil HDPE Liner while the specification 02951SP calls out for a 40 mil liner on a 10 oz Geotextile. Please clarify.

Response: Follow specification 02951SP, revised drawing to follow.

8. Sludge – Please provide the amount of sludge that will need to be removed out of Basin #2. Also, if an allowance for sludge removal could be provide, it would significantly reduce the unforeseen risk associated with sludge removal. If the sludge would be removed by other under a separate contract by the owner, it would reduce the risk/cost of the sludge removal.

Response: Sludge will be removed by District. See response in Addendum #3.

9. Transfer Switch – Will the transfer switch be provide with the owner provide generator. Usually, in my experience, transfer switch typically are provided and ordered at the same time by the generator manufacturer.

Response: Transfer switch and generator will be contractor supplied. See response in Addendum #3.

4) Question:

1. Do the temporary utilities need to be removed once they are no longer needed or can they be abandoned in place?

Response: They can be abandoned in place.

2. Do Dewatering wells need to be abandoned or can they be kept in place with a MH ring & Cover? If they do need abandoned are we able to leave the casing and fill with gravel?

Response: Dewatering wells may be abandoned in place, leave the casing and fill with gravel.

3. Do the clarifiers & Digester need damp proofing on their exterior walls or is that only for the building foundation walls?

Response: Damp proofing is not required for the clarifiers and digester exterior walls because Xypex is required in the mix design.

4. What is the current depth of Pond #2 (what is the capacity of the pond?)

Response: The current depth is approximately 9 feet.

5. We are required to dewater pond #2 at a rate not to exceed 150 GPM. What should be done if 150 GPM is not enough to dewater effectively due to infiltration from neighboring ponds & groundwater?

Response: For purpose of bidding, assume 150 GPM will suffice.

6. It was mentioned at the pre-bid that the ponds are currently unlined. Is it to be expected that we will need to deal with infiltration from the ponds during our excavation & utility installation?

Response: Assume no infiltration from neighboring ponds for purpose of bidding.

5) Question:

On Sheet BB-100, I see the grade lines for the new BNR. What is the elevation of the bottom of Cell Basin #2 and what is the elevation of the top of the berm. Also, I am assuming that the new contour line are 1' each. Is that correct?

Response: Sheet CS-100 shows the "Top of Embankment" as 4842.5'. That is correct, the grade lines on BB-100 are each 1'. The existing floor Cell No. 2 is estimated to be at 4830.27', also noted on CS-100.

6) Question:

We have a little bit of a concern with the current route of line 15 (BNR.O to CL). Right now the line is going on the berm between ponds 2&3. This berm is only 15' wide at the top and the line is 10'+ deep through here. The temporary bypass between ponds 1&3 will be located in the center of this berm as well during install. Our concern is that this will be a very difficult installation without affecting the ponds or the bypass line. Would the attached re-route be an option? We could adjust to an open shoring option on both ends to accommodate install of line #15 as well as change the bypass route the existing pond #3 outlet line.

Response: We agree with this concern and will change the plans to show line 15 going around the cells, rather than between them. Revised civil sheets to follow.

7) Question:

On Sheet CU-500, what is the size of the NP line?

Response: The NP line is 3" pipe diameter.

8) Question:

On sheet CU-201, there is shown 6' x 6' precast box. The bid item #34 says there is a Slide Gate, but I don't see a detail for this precast box that shows the size of the Slide Gate. Also, are there 2 slide gates? Also, are these gates/gate to have electric operators. Please clarify.

Response: The slide gates for this precast box are listed in the Gate Schedule shown on CU-001.

9) Question:

On the Schedule of Values #36 & #48 show Flo-Dars, however, the electrical plans show another Flo-Dar on Sheet E-304 #8. Are you planning on adding this to the Schedule of Valves? If so, please add at the end, like #105.

Response: That is correct, there should be three Flo-Dars. Please see the attached revised schedule of values with item #105.

10) Question:

The profile for the 24" line CU-203 does not match with profile and plan view. I think the Match Sheet was not taken account of. Please clarify.

Response: Profile on CU-203 is the right profile, it just has an extra 50 ft (29+50 – 30+00). These sheets will be updated with the new piping route.

11) Question:

In regard to addendum 3 – question 13, I did visit the adjacent site. At the time of my visit, there were 5 pumps running and (7) generators on site. I think a better answer to the question is the amount of gpm that is being dewatered. "The Pump being used" makes it sound like there is only one pump running. Please see the attached picture. Maybe, the reference is for a different project. Please clarify.

Response: There are multiple locations at that site requiring dewatering. Please contact Whitaker Construction directly for details on dewatering.

12) Question:

On Sheet CD-100, there are 2 details for trench Backfill (B) and (A). Detail B (top of detail) has a note for CS-407 Asphalt Restoration Detail. Also, Detail B is labeled Wet Trenching. Are we to assume (Sewer lines) that are wet trenching (below the water table) will be backfilled with Gravel above the waterline. Please clarify.

Response: Yes, any piping that is below the water table will use the wet trenching detail. That detail is accurate that the trench will be backfilled with gravel above the water table. This detail will probably be used for all the wet piping since it will be below the water table.

13) Question:

As for chainlink fence, the only chainlink fence that is new is shown on CU-307 is at the Northeast corner of the Headwork Building. Is this correct? The fencing that wraps the site is already existing. Please clarify.

Response: It is assumed that the existing chainlink fence on the north side of the plant will need to be removed for construction operations and replaced at the end of the project.

14) Question:

1) Concerning drawing(s) OP-AE-101 verses E-407. These drawings show panels(s) HPO and LPO in contradicting locations. Where is the actual location to be?

Response: Electrical Panels HPO and LPO should be located in the electrical room as shown on Sheet E407. (This should also be reviewed by Royal Engineering)

2) Concerning drawing HW-AE-101 verses E-403. These drawings show panel LHB in contradicting locations.

Where is the actual location to be?

Response: Electrical Panel exact location is flexible, but should be located in Electrical room as shown on both Sheets. Preferred location is near the transformer as shown on Sheet E403.

3) Concerning schedule of values for bid form on page 20 of the specifications, item # 8 calls to remove and

dispose of power pole. The info that I find on the drawings is on E-304, keyed note # 3 calling to coordinate

with the utility to remove the existing overhead transformer. Can the power pole removal be clarified?

Response: Work on power pole needs to be coordinated with Rocky Mountain Power. It is assumed that RMP will remove the existing transformers and install a riser for new transformer feeder.

4) Concerning schedule of values, item # 11, remove and dispose of conduit. Does this pertain to the re-location of grinder controls conduits and interception and re-routing of the existing conduits as shown on drawing E-304? It's assumed that the existing conduits need to be intercepted, the old conductors removed, and new conductors re-installed in the existing underground conduits. Is this correct?

Response: The assumption is correct for the existing grinder controls. The existing conduits should be intercepted and rerouted as possible for use with new conductors to equipment as shown in drawings.

15) Question:

1) Concerning drawing(s) HW-AE-101 and OP-AE-101. For the receptacles, manual starter switches, and t-stats. Are these to be surface mounted on the CMU or blocked out? If surface mounted are they to be in an FS/FD malleable iron or aluminum box with W/P covers or will a standard surface mounted 4 square box be acceptable with raised industrial covers?

Response: The use of surface mount is acceptable in the headworks building and plant operations buildings except in the office, breakroom, lab, locker room, and bathroom. For surface mounting provide a standard surface mounted 4 square boxes with raised industrial covers. In the headworks building provide boxes and covers that are class 1 div 2 rated in the central section.

2) With the Generator being provided by the 'Owner' per specifications, does the E.C have the responsibility to provide a crane and concrete generator pad for setting this? If so, are there any minimum specifications that are required for the generator pad? Also, is it the E.C.'s responsibility to fill the generator with fuel and top it off after testing, assuming it's diesel. Is this Diesel or Natural Gas?

Response: Generator is to be supplied by Contractor per Specification 16817SP. Key Note #5 on Drawing E201 had been corrected. Generator pad details to follow.

16) Question:

1) Concerning drawing E305, keyed note 2, extend fiber optics and spare conduit(s) to highway. What is the approximate distance to reach the location at the highway from the north (top) of E305 to the highway location? Also, where is the location located? Is it to the north of the park, or north of the park, parking lot? From what I see, it's approximately 1,000-1200 ft north of the top of the E305 drawing? Would this portion of the conduit installation require directional boring or saw cutting, trenching and patching?

Response: The exact location for the connection to the telcomm provider has not been determined. It is assumed that the conduit would need to be run to the road right-of-way for bidding purposes. The estimated distance is 775 ft from the point indicated by Key Note #2 on Drawing E305. Asphalt to be restored after fiber installation.

2) Concerning drawing(s) E304 and CS103. E304 keyed notes 1, 2, & 3 say that the pole is to stay, the pole mounted transformers are to be removed and we are to install our 6" primary to the pole with the transformer on it. CS103 keyed note 2 calls to remove the pole with the transformer on it and remove the intermediate pole holding up the power lines during phase 1 and provide a temporary electrical service. Which drawing reflects what needs to be provided? If the CS103 option is to be used, is there a method on how the temporary power would be obtained?

Response: It is anticipated that the existing utility pole will remain in place and that the transformers will be removed by Rocky Mountain Power.

3) Concerning existing 'P' and 'C' conduits shown on drawing(s) E206, E208 and E304. Are the existing conduits to remain and be re-routed for new equipment locations and the wire to be pulled out and replaced? Or do the existing conduits and existing wire remain and be spliced as necessary during re-routing?

Response: Reuse existing conduit and conductor where possible per Key Notes #4, #5, #6 and #7.

4) During the site meeting on Monday January 30th, some concern was raised on de-watering. Would the de-watering pumps be diesel driven or are they electric and will need temporary power installed to operate. If they need electric power to operate, what would the amps, volts and horsepower be? And will the current power availability be sufficient to operate these should they be electric. If they are electric, it is assumed that the motor control panel(s) would be provided by the de-watering contractor, is this correct?

Response: Please see the previous Addendum #3 with details on the pump(s), also see question 10 response regarding dewatering. The means and methods for this are up to the contractor, however temporary power should be available for electric pumps. This is to be coordinated with Rocky Mountain Power. Correct, it is assumed that the dewatering contractor would provide any equipment necessary to operate to the pump(s).

17) Question:

1) Concerning drawing(s) E201 one line and E303 site plan. For the 1,000-kW 'Owner' provided generator. It is assumed that the E.C. is responsible for the generator pad installation. Is there a detail or specification on the construction of this pad? Also, is

it the E.C.'s responsibility to provide a crane for off-loading, setting, and anchoring or the generator? It is also assumed that the commissioning and start-up testing for this generator would be provided by the 'Owner' along with the filling and top off of the diesel fuel, is this correct?

Response: Generator is to be provided by Contractor. Contractor will be responsible for off-loading, setting and anchoring the generator and for filling generator with fuel.

- 2) Concerning drawing(s) E304 and E303 (site plans) and lighting plans OP-AE102 and HW-AE102 (building lighting plans). I see no site pole lights along the roadway between the headworks building and the operations building. Just checking on if this is something that may be required or if the wall packs on the headworks and operations building will provide sufficient lighting. This was just an observation and doesn't have anything to do with what is on the drawings.

Response: No lighting specified for roadway at this time.

18) Question:

- 1) Drawings E-307, E-308, E-403, E-406, have an incorrect scale. Please correct and reissue.

Response:

Per addendum #3, drawing scale for E307 should be 1" = 60" (5'), not 60'.

Drawing E308 has been modified to show 1" = 1'

Drawings E403 and E406 have been corrected to show 3/8" = 1'

- 3) Can you please give us the KAIC rating for the following panels and switch boards; SB-001, SB-002, MCC-HB, Panels LHB, LPO and HPO. The panel schedule refers to a "Fault Current Table" Where is this?

Response:

Estimated max available fault current based on utility 1500 kVA transformer and 3% impedance is 60,140 Amps. Equipment AIC rating for bidding:

SB-001	65,000 AIC
HPO	65,000 AIC
LPO	22,000 AIC
SB-002	35,000 AIC
MCC-HB	35,000 AIC
LHB	22,000 AIC

Enclosure:

- 1) C-410 Schedule of Values Sheet
- 2) Electrical Specifications
- 3) Electrical Sheet Revisions
- 4) SKM Scope

BNR BASIN		
93	01000 SP	Install Owner Supplied BNR Equipment (piping, valves, chains, etc.)
94		Furnish & Install BNR Baffle Wall Equipment
95	02204 SP	Furnish & Install BNR Basin Liner
96		Furnish & Install 12" FRP Hobas Air Piping
CLARIFIERS		
97	01000 SP	Install Owner Supplied Clarifier Equipment & Appurtenances
98	03110 SP	Construct Clarifier Structure
99	02224 15321 SP	Furnish & Install Clarifier Piping, Valves, Fittings, Fasteners, etc.
100	02226	Furnish & Install Ring Drain System (piping, manholes, fittings, etc.)
AEROBIC DIGESTER		
101	01000 SP	Install Owner Supplied Digester Equipment & Appurtenances
102	03110 SP	Construct Digester Structure
103	02224 15321 SP	Furnish & Install Digester Piping, Valves, Fittings, Fasteners, etc.
104	15240 SP	Furnish & Install Floating Decanter Assembly
ADDITIONAL ITEMS		
105		Furnish & Install Flo-Dar Meter Assembly (Existing eastern influent line. Shown on CU-100).

2. ~~Lump Sum Price (Base Bid and Alternates)~~

Lump Sum Bid Price for Base Bid	\$
Alternate A [Add] [Deduct]	\$
Alternate B [Add] [Deduct]	\$

3. ~~Lump Sum Price (Sectional Lump Sum Bids)~~

Lump Sum Bid Price for Section I only	\$
Lump Sum Bid Price for Section II only	\$
Lump Sum Bid Price for Section I and II	\$

B. ~~All specified cash allowance(s) are included in the price(s) set forth below, and have been computed in accordance with Paragraph 13.02 of the General Conditions.~~

Lump Sum for Cash Allowance 1	\$
Lump Sum for Cash Allowance 2	\$
Lump Sum for Cash Allowance 3	\$

16010.1 DESCRIPTION

The General Conditions, Supplementary General Conditions, Alternates and Addenda, applicable drawings and the Technical Specifications herein shall apply to the providing and construction of a complete electrical system under the requirements of this Division 16.

16010.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01300 - Submittals
Section 02200 - Trench Excavation and Backfill
Section 16150 - Electrical Control Devices
Section 16400 - Service and Distribution System

16010.1.2 SCOPE

- A. The Work required under this Section consists of the Electrical General Requirements and related items necessary to complete the Work indicated within the Contract Documents.
- B. This Section describes procedures and incidental items of Work relating to Electrical Division 16.
- C. The drawings are diagrammatic, intended to indicate the general scope and location of the Work to be installed and are not to be considered as complete in every detail. The Contractor shall install all Work indicated and/or specified herein, complete in every way to perform the function (s) intended without additional cost.
- D. Plans and Specifications are complementary; whatever is called for in either shall be as called for in both. In the event Work is called for in more than one place and is of conflicting requirements, the right shall be reserved to require the installation of the larger or the more expensive.

16010.1.3 CONTRACT DOCUMENTS

- A. Contract documents consist of drawings, specifications, and other documents issued by the Engineer. Each is complementary and requirements shown, written or reasonably inferable therefrom on one is considered as written, shown and implied in all.
- B. Electrical drawings are diagrammatic, but shall be followed as closely as actual construction and Work of other Contractors will permit. Runs to panels from outlets referred to as "home runs" are indicated, by pointing in the general direction of panels. Contractor shall continue such circuits to the panels as though the routes were completely indicated.
- C. Deviations from the Drawings required to make Work of this Contract conform to Building as constructed, or as to Work of other contractors or subcontractors, shall be made by the Contractor at his expense. The Engineer reserves the right to make minor changes in the location of equipment and outlets without additional charges.
- D. The Contractor shall familiarize himself with the architectural and mechanical plans. The Contractor shall perform all Work and provide all material required by the electrical Contractor shown under these and all other sections of the plans and specifications.

16010.1.4 SUBMITTALS

All submittals shall meet the requirements of Section 01300 of these Specifications.

16010.1.4.1 SHOP DRAWINGS – Submittal of shop drawings shall be as follows:

- A. Submittal of shop drawings shall meet the requirements of Section 01300 of these Specifications.
- B. Shop drawings shall be submitted within fifteen (15) days after the award of contract.
- C. Shop drawing shall include functional and descriptive literature of the particular item furnished complete with dimensional drawings, rough-in and installation instructions, knock-out locations, hangers or mounting devices, etc., as required for the proper checking and installation of the equipment. Catalog sheets without any reference made to the particular item will not be acceptable. All special features called for in the Contract Documents shall be noted. Where performance test results of a product design are called for in the technical sections of these specifications, test data sheets shall be provided with the shop drawing submittal.
- D. Shop drawings shall be submitted for all switch gear, motor control centers, motor starters, control panels, telemonitoring panels, alarms, electrical controls, electrical instrumentation, communication devices and circuitry, lighting fixtures, and equipment anchors and supports for seismically supported components.
- E. In connection with seismic restraint requirements, shop drawings are required for all equipment anchors, supports, and seismic restraints. Submittals shall include weights, dimensions, load/deflection data, centers of gravity, standard connections, manufacturer's recommendations, and behavior problems (vibration, thermal, expansion, etc.) associated with equipment so that the final design can be properly reviewed.
- F. Three preliminary sets shall be submitted to the Architect/Engineer for their review. Following review, two sets will be returned to the Contractor for correction. After corrections have been made, the formal six sets of the corrected shop drawings shall be submitted for final review and distribution.
- G. Each shop drawing required under this or other sections of Division 16 shall be bound together in sets in one hard back three ring binder per set, properly indexed for the formal submittal. Binders shall be properly sized to adequately contain all of the materials to be placed therein and shall be labeled to identify the Owner, the name of the job, the name of the Contractor and/or any sub-contractor (s), and any other pertinent information.

16010.1.4.2 MATERIALS LIST - A materials list including manufacturer, type, size, model number and other properties shall be submitted for all raceway, conduit, fittings, support materials, wire, cable, junction boxes, and wiring devices, including boxes for weather proof devices.

16010.1.4.3 EQUIPMENT/INSTRUMENT LIST - Equipment/Instrument list(s) including manufacturer, type, size, model number and other properties shall be submitted for all equipment and instruments.

16010.1.4.4 OPERATION AND MAINTENANCE MANUAL – The Contractor, or electrical subcontractor, shall assemble and deliver to the Owner an operation and maintenance (O&M) manual for the electrical systems furnished and installed in connection with the Work. O&M manuals shall be as follows:

- A. Number of copies shall be as specified in Section 01300 or as required in the Special

Provisions or by the Engineer or the Owner. The O&M manual shall be reviewed and approved prior to the final inspection.

- B. Each copy of the O&M manual shall be bound in a hard-backed binder. The front of each binder shall have the following information printed on it by silk screen process:

OPERATION AND MAINTENANCE MANUAL
FOR
(PROJECT NAME)
(SPECIFIC SYSTEM NAME AND/OR LOCATION, as appropriate)
(OWNER'S NAME)

- C. Each copy shall contain a master index at the beginning of the manual showing all items included.
- D. A separate section for each different type of item of equipment or information furnished shall be provided. Use plastic tab indexes for all sections of the book.
- E. The first section of the manual shall consist of the names, addresses and telephone numbers of the Mechanical Engineer, Electrical Engineer, General Contractor, Electrical Contractor.
- F. Descriptive literature (manufacturer's catalog cuts and other data) of each manufactured item shall be included. Literature shall show capacities and size of equipment used and shall be marked indicating each specific item with all applicable data underlined.
- G. Operating instructions shall, at a minimum, include:
1. General description of the electrical system.
 2. Where applicable, a step-by-step procedure to follow in putting each piece of electrical equipment in operation.
 3. Provide diagram for the electrical control system showing the wiring of all related electrical control items, such as fuses, interlocks, electrical switches and relays.
 4. Test results of all items requiring testing as called for in the technical section of specifications.
- H. Maintenance instructions shall, at a minimum, include:
1. Manufacturer's maintenance instructions for each piece of electrical equipment installed in the project. Instructions should include installation instructions, parts numbers and lists, operation instructions of equipment, name of vendor, and maintenance and lubrication instructions.
 2. A summary list of each piece of electrical equipment requiring lubrication, showing the name of the equipment, location, type and frequency of lubrication.
 3. A complete list of all electrical equipment used indicating name, model, serial number and nameplate data of each item, together with number and name of each system with which the item is associated.
- I. An approved copy of the manual shall be used during final inspection and shall be left with the Owner for its use and disposition.

16010.1.4.5 OTHER INFORMATION - Other information shall be provided as required by the Engineer.
16010.2 MATERIALS

All equipment and materials shall be as specified, new, of the best quality and free from defects. Each type of equipment or material shall be the same make and quality.

16010.2.1 UNDERWRITERS LABORATORIES

All equipment, materials, and devices shall be approved by Underwriters Laboratories, Inc. (UL). Custom designed items shall be fabricated using UL approved materials. All custom panels shall bear the UL label certifying UL-508 standards.

16010.2.2 MATERIALS AND EQUIPMENT TO BE SUPPLIED

The Contractor or electrical Subcontractor shall provide all materials, equipment, and any other fittings or devices required for a complete and finished installation. Materials and equipment shall be as shown on the Drawings and/or as called for in these Specifications, including the Special Provisions if any, unless otherwise approved, in writing, by the Engineer.

16010.2.3 APPROVAL OF SUBSTITUTIONS

Equipment and materials are designated by one or more manufacturer's name brands or numbers. It is not the intent of the Specifications to exclude other equipment or materials that equal the standard of those specified. If the Bidder, in its bid, desires to use equipment or materials other than those specified, the Bidder must obtain written approval from the Engineer in this regard at least seven (7) calendar days prior to bidding. Submit complete data, including detailed specifications and drawings with written request in duplicate. Samples may be requested if deemed necessary. Certificates of compliance with specifications or a list of all exceptions to the specifications shall be included with request.

16010.2.4 STORAGE OF EQUIPMENT AND MATERIALS

- A. The Contractor shall be responsible for the proper transportation, unloading, storage, and holding of all electrical systems, materials, and equipment until they are installed in the Work, and accepted by the Owner. This shall include responsibility for damage, loss, theft, and pilferage.
- B. Materials and equipment shall be handled and stored in accordance with the manufacturer's and/or supplier's instructions. Packaged items shall be stored in original, undamaged condition with manufacturer's seals and labels intact. Materials and equipment shall be stored in a neat and orderly condition at all times and allowing for easy access for inspection.

16010.2.5 RACEWAYS AND FITTINGS

The manufacturer shall be Republic Steel, Triangle, National, Carlon, Allied or approved equal. All conduits shall be in accordance with the requirements of the National Electric Code (NEC) and applicable local codes. Steel conduit shall be in accordance with recommendations of the latest edition of American Iron and Steel Institute "Design Manual on Steel Electric Raceways."

A. RIGID GALVANIZED STEEL CONDUIT (RGS)

- 1. Shall be USAS C80.1, zinc-coated by hot-dip galvanizing or sheradizing with additional enamel or lacquer coating.
- 2. Fittings shall be threaded type and of the same material as the conduit.
- 3. Unless otherwise noted, rigid metallic conduit shall be used for underground runs, under slab runs, and where runs are placed in concrete. It shall also be used

for exposed runs in mechanical rooms and for other exposed runs where the conduit is exposed to moisture, weather or mechanical injury.

4. Where rigid metallic conduit is used for underground installations, including elbows required to make sweeps in PVC conduit runs, the conduit shall be wrapped with 3m-50 10 mil pipe wrap or approved equal.

B. INTERMEDIATE METAL CONDUIT (IMC)

1. Shall be UL Standard 1242, hot-dip galvanized steel.
2. Fittings shall be threaded type and of the same material as the conduit.
3. It can be used for exposed runs in mechanical rooms and for other exposed runs where the conduit is exposed to moisture, weather or mechanical injury.
4. **This conduit shall not be used in hazardous areas.**

C. ELECTRICAL METALLIC TUBING (EMT)

1. Shall be in accordance with UL “Standard for Electrical Metallic Tubing” No. 797, galvanized mild steel with interior coat of enamel.
2. Fittings shall be steel compression type.
3. **Cast type, indenter, or set-screw type fittings shall not be used.**
4. EMT shall be used for exposed and concealed runs to lighting fixtures above 10 feet or above ceilings.
5. **Not approved for any exposed conduit runs or drops.**

D. NON-METALLIC CONDUIT (PVC)

1. Shall be PVC Schedule 40 heavy wall suitable for direct burial.
2. Fittings shall be threaded or solvent welded type of the same material as the conduit.
3. **Shall not be used above grade or embedded in concrete, except as noted specified for runs above 600 volts. PVC shall not be used where exposed or concealed in walls or floors.**
4. PVC may be used for all underground runs, except for bends exceeding 22 degrees where jacketed or wrapped rigid galvanized steel is required, and runs under concrete slabs. Runs under concrete slabs shall be embedded in earth a minimum of 4 inches below the bottom of the slab. Risers through concrete slabs shall be rigid steel or intermediate metal conduit.
5. Provide PVC to steel adapters as required.

E. FLEXIBLE LIQUID-TIGHT CONDUIT

1. Shall be galvanized steel, liquid-tight, with moisture and oil- proof extruded PVC cover.
2. Fittings shall be liquid-tight, compression type.
3. Approved for flexible connections to equipment, items or instruments subject to vibration such as motors, fans, pumps, dry transformers, etc.
4. **Flexible Liquid-tight conduit shall not be less than 18 inches in length and not more than 3 feet in length.**

F. FLEXIBLE STEEL CONDUIT

1. Shall be galvanized steel.
2. Fittings shall be compression type of the same material as the conduit.
3. Shall be used for lighting fixture runs above drop ceiling grid systems or other devices required or approved by NEC or as requested or approved by the Engineer. (Install ground conductor per NEC in runs over 6 feet in length.)

G. PVC COATED CONDUIT

1. Rigid Steel conduit coated with a minimum of 40 mil of PVC coating shall be used in all corrosive areas or where required by NEC or the Engineer.
2. **All fittings, boxes, support materials, clamps, etc., used with PVC coated conduit shall be PVC coated in a like manner.**
3. Wiring devices shall be corrosion resistant UL rated in corrosive areas requiring PVC coated conduit.

H. WALL AND FLOOR SLEEVES

Shall be galvanized sheet steel or pipe.

I. CLAMPS

1. Shall be galvanized malleable iron one-hole straps, beam clamps or other approved device with necessary bolts and expansion shields.
2. **Perforated metal straps shall not be used.**

J. CONDUIT SIZES

1. Shall be as indicated on the drawings.
2. **Shall not be smaller than $\frac{3}{4}$ inch exposed or 1 inch buried conduit unless otherwise specifically approved by the Engineer.**

K. CONDUIT BUSHINGS

1. For conduit 1-1/4 inch and larger use OZ type BLG or SBLG with Lay-in-Lug.
2. Use Lay-in-Lug bushings on multiple conduit entrances to enclosures or gutters.
3. Bonding bushings shall be used on conduits containing service entrance conductors.

L. ENTRANCE SEALS

Provide and install OZ entrance seals on all conduits entering building below grade.

M. RACKS AND SUPPORTS

1. Conduit support racks, Unistrut supports and fittings, etc., shall be hot-dipped galvanized, except in corrosive areas where the supports and fittings must be PVC coated.
2. **Painted metal supports are not allowed.**

N. PULL BOXES

1. Pull boxes, which are required for proper conduit installation, shall be sized according to the requirements of Article 314 of the NEC.
2. Conduit bodies shall be cast type with threaded hubs.
3. Outdoor, buried pull boxes shall be Oldcastle H-Series or equal.
 - a) Pull boxes shall be sized per NEC 314.28 but shall not be smaller than 24" x 24" x 24".
 - b) If fully enclosed pull boxes are used, they shall be coated with coal tar epoxy per specification 9900.3.2.4.

O. OUTLET/JUNCTION BOXES

1. Boxes shall be provided in the wiring or raceway systems wherever required for routing/pulling of wires, making connections and mounting of devices or fixtures.
2. Boxes in exposed conduit runs shall be cast metal condulets with threaded hubs installed exposed. **Non-metallic boxes are not allowed.**
3. Each box shall be metal and shall have the volume required by the National Electrical Code for the number of conductors enclosed in the box. Boxes for mounting lighting fixtures shall not be less than 4 inch octagonal or 4 inch square except that smaller boxes may be installed as required by fixture configuration, as approved. Boxes in the raceway system shall not be less than 1-1/2 inches deep, except where shallower boxes required by structural conditions are approved.
4. Boxes for other than lighting fixture outlets shall not be less than 4 inches square.
5. Boxes in concealed conduit runs shall be equipped with tile extension rings, device mounting straps and accessories required for the purpose of the outlet.

16010.2.6

A. CONDUCTORS

1. Shall be of the type, size, and locations as shown on the Drawings and meet the requirements of the latest addition of the National Electric Code (NEC).
2. Shall be soft-annealed coated copper in accordance with ASTM B33 or B189.
3. Conductors No. 10 and smaller shall be solid copper for lighting circuits only, all other circuits shall be stranded copper.
4. All conductors shall be THHN/THWN copper rated at 600 volts, unless otherwise noted.
5. **Aluminum conductors will not be allowed.**

B. GROUNDING CABLE

Shall be as called out on the drawings and per NEC. (Grounding lugs shall be the clamp type made of high conductivity copper alloy and shall be provided for all equipment to be grounded.)

C. VFD CABLE

Conductor size shall be as shown in Plans and shall meet the requirements of the latest addition of the National Electric Code (NEC). Cable shall meet the requirements below:

6. Cable shall be designed for VFD applications and shall be rated 600V/2kV, NEC Type TC with a 90°C rating.
7. Three Copper circuit conductors with XLPE insulation.

8. Three symmetrical copper ground wires.
9. Spiral copper tape shield with 100% coverage.
10. Outer PVC jacket.
11. Suitable for Indoor, Outdoor, Burial and Oil Resistance

Acceptable manufacturers:

1. Belden
2. Southwire
3. Approved Equal

16010.2.7 SPLICES, TAPS AND TERMINATIONS

- A. Splices, taps and terminations made in interior damp or wet locations, corrosive atmosphere locations or exterior boxes above or below grade shall be covered with 3M heat shrinkable ITCSN series sleeves or end caps or Raychem equal as approved by the Engineer.
- B. All splices shall require approval by the Engineer.

16010.2.8 SAFETY SWITCH DISCONNECTS

- A. Provide disconnect switches where shown and required by NEC as specified herein.
- B. Type: Heavy duty, manual, single throw, fusible or non-fusible as indicated.
- C. Rating: 600 volt, ampere size as noted or as required for load served.
- D. Enclosure: Nema 4, Gasketed stainless steel or as called out in equipment schedule on drawings. Stainless steel 316 shall be used in hazardous/corrosive areas. Stainless steel 304 shall be used in all other locations.
- E. Fuses: Switches shall be equipped with Type "R" fuse clips factory installed. Fuses shall be dual element type RK5 of size as noted.
- F. Non-Fusible Switches: For equipment 2 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

16010.2.9 JUNCTION BOXES

- A. Junction or pull boxes, which are required but not shown, shall be sized according to requirement of Articles 370 and 373 of NEC.
- B. Shall be cast type condulets with threaded hubs.

16010.2.10 WIRE DEVICES

- A. Switches: 20 ampere, 120/277 volt, toggle type. Single pole used as designation for entire series - double pole, 3-way, 4-way or lock type. Hubbell #1221, Bryant #1221, Leviton #1221. Switch and pilot shall be Hubbell #1221-PL or Leviton #1221-PL. Double pole toggle switch shall be Hubbell #1222-2.
- B. Ground Fault Interrupter Receptacles: 20 ampere, 125 volt, NEMA 5-20R, gray color. Leviton #6398.

- C. Receptacles: 20 ampere, 125 volt, NEMA 5-20R, gray color for locations where indicated. Hubbell #5352, Bryant #5352, or Leviton #5352.
- D. All devices shall be gray in color.
- E. Special receptacles other than those listed above shall be as designated on the drawings.
- F. Device Plates:
 - 1. For surface mounted boxes plates shall be stainless steel suitable for use on cast metal device boxes, conduit FS and FD types. Shall be complete with gaskets and approved for wet locations.
 - 2. For flush boxes in finished areas, plates shall be stainless steel. Gang plates shall be one-piece.

16010.3 CONSTRUCTION REQUIREMENTS

Unless notified otherwise, the Contractor responsible for the electrical Work shall perform all electrical work in accordance with the Drawings and with these Specifications.

16010.3.1 CODES, PERMITS, LICENSES AND STANDARDS

- A. PERMITS AND LICENSES – The Contractor shall secure all permits and licenses required in connection with this work.
- B. CODES AND STANDARDS - All work, labor, and equipment shall conform to applicable State and Local Codes and Standards and the applicable sections of the latest revisions of the following:
 - American Society for Testing and Materials (ASTM)
 - National Fire Protection Association, National Electrical Code (NEC)
 - Insulated Power Cable Engineers Association (IPCEA)
 - Underwriters Laboratories Inc. (UL)
 - American Steel and Iron Institute, “Design Manual on Steel Electrical Raceways”
 - National Electrical Manufacturer’s Association (NEMA)
 - American National Standards Institute (ANSI)
 - Institute of Electrical and Electronic Engineers (IEEE)
 - Uniform Building Code (UBC)
 - Uniform Fire Code (UFC)
 - Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

Conflicts between any of the above referenced codes and standards and between any of them and these Specifications and/or the Project Drawings shall be resolved by complying with the more stringent requirements.

16010.3.2 SAFETY

- A. REGULATIONS - The Contractor’s work shall conform to the Associated General Contractors of America, Inc. *Manual of Accident Prevention in Construction* and shall comply with all current regulations of the Occupational Safety and Health Act (OSHA) as required for work identified on the Drawings or in these Specifications.

- B. SAFETY GUARDS - All equipment, which the Contractor furnishes and installs, shall be provided with appropriate safety guards for prevention of accidents. The Contractor shall provide and maintain any other necessary construction required to secure safety of life or property, including the maintenance of sufficient lights to secure such protection.

16010.3.3 DIAGRAMMATIC DRAWINGS

- A. The electrical drawings are diagrammatic, intended to indicate the general scope and locations of the work to be installed and are not to be considered as complete in every detail. The Contractor shall install all work indicated and/or specified herein, complete to perform the function intended without additional cost.
- B. The electrical drawings are diagrammatic, however, they shall be followed as closely as actual construction and work of other contractors will permit. Runs to panels from outlets, referred to as "home runs", are indicated on the drawings by arrows pointing in the general direction of panels. Contractor shall continue such circuits to the panels as though the routes were completely indicated. Deviations from drawings required to make the work of this Contract conform to building as constructed, or as to work of other contractors, shall be made at the Contractor's expense. The Engineer reserves the right to make minor changes in the location of equipment and outlets without additional charges.

16010.3.4 SITE EXAMINATION

Examination of the site shall be made by the Contractor, who shall compare it with the drawings and specifications and satisfy himself as to the conditions under which the work is to be performed. The Contractor shall, at such time, ascertain and check all conditions which may affect its work. No allowance shall subsequently be made in the Contractor's behalf for any extra expenses to which the Contractor may be put due to failure or neglect on its part to make such examination and determination of the condition.

16010.3.5 SUPERVISION

- A. A competent foreman or superintendent, approved by the Owner's Representative, shall be at the site at all times to receive instructions and shall have the proper authority to act on behalf of the Contractor. The Contractor shall verify dimensions given on the electrical drawings and report any errors or inconsistencies to the Engineer before commencing the work. The Engineer or its representative will interpret the meaning of the Drawings and Specifications where questions arise.
- B. Contractor shall assign persons to be in direct charge of work who are thoroughly experienced in the types of construction work specified herein. All labor shall be performed in a workmanlike manner by skilled workmen under the supervision of competent foremen.

16010.3.6 WORKMANSHIP

Workmanship shall be in accordance with the best present-day construction methods and shall be neat and orderly throughout the project.

16010.3.7 COORDINATION OF CONSTRUCTION

- A. The Contractor shall coordinate work with other contractors, subcontractors, the Owner, and the Engineer to assure orderly and expeditious progress of work. The Contractor shall select order/sequence of work and establish schedule of working hours for

construction, all subject to review and direction by the Owner.

- B. This Contractor shall be held solely responsible for the proper installation of its work. The Contractor shall arrange with the proper contractors for the installation of anchors and other embedded devices, and for the leaving of required chases, openings, etc., and shall do all cutting and patching made necessary by its failure or neglect to make such arrangements with others. Any cutting or patching done by this Contractor shall be subject to the directions of the Engineer and shall not be started until approval has been obtained.
- C. All cutting, welding or drilling of concrete or structural members shall be properly reinforced and patched to match as nearly as possible the surrounding work. Before cutting, welding or drilling any concrete or structural member, the Contractor shall secure the approval of the Engineer. Where deemed appropriate by the Engineer, in the case of gross negligence pertaining to this issue, the Engineer reserves the right to back-charge the Contractor for the Engineers associated costs.

16010.3.8**INSTALLATION****RACEWAY AND FITTINGS****A. STANDARDS**

- 1. All conduit to be installed in accordance with the requirements of the National Electrical Code, latest addition.
- 2. Steel conduit to be installed in accordance with recommendations of American Iron and Steel Institute "Design Manual on Steel Electrical Raceways", latest addition.
- 3. PVC coated conduit installed in accordance with manufacturer instructions.

B. ELECTRICAL CONTINUITY

All metallic conduit systems shall be electrically continuous throughout.

C. MOISTURE

- 1. All conduit raceway systems shall be essentially moisture tight.
- 2. Conduit drainage shall be accomplished by sloping conduits towards manholes or boxes.
- 3. Where pockets cannot be avoided in exposed conduits, provide drainage fittings or weep holes. Weep holes drilled through the walls of any conduit or fitting shall not produce burrs on the inside or outside surface.

D. ALIGNMENT OF EXPOSED CONDUIT

Install conduit runs parallel or at right angles to lines of structure.

E. FIELD CUTS AND THREADS

- 1. Field cuts shall be made square, threads clean and sharp.
- 2. Remove burrs, sharp or rough edges by reaming.
- 3. Before couplings or fittings are attached, apply a coat of red lead or zinc chromate to male threads of RGS or IMC conduit, also apply these coatings or other special compound recommended by the manufacturer of the conduit where the conduit protective coating is damaged.

4. PVC coated conduit system requires male threads on conduit, elbows and nipples and all female threads on fittings or conduit couplings to be protected by application of a urethane coating.
5. **Care must be taken to assure that concrete surfaces are protected from cutting oil, any/all damage will be the responsibility of the Contractor.**

F. BENDS

1. Uniform, whether job-fabricated or made with standard fittings or boxes.
2. Do not dent or flatten conduit
3. Conduit installation should be installed symmetrically insofar as practicable.
4. Unless approved otherwise, bends larger than 1-1/4 inch shall be factory made.
5. Bends in exposed conduit shall be symmetrical insofar as practicable.
6. Do not expose bends at floor or ceiling.

G. LOCATION

1. Conduit routing is generally shown in schematic fashion, unless dimensioned or noted to the contrary.
2. Contractor is responsible to route conduits as required to connect equipment or devices.
3. Vertical risers, equipment and device locations are approximately as indicated on the drawings. Contractor shall coordinate installation of conduit with structure and equipment.
4. Contractor is responsible to coordinate conduit installation with other contractors installations, in the event of conflict, field routed conduit shall be moved at the Contractors expense.
5. Conduit shall be located a minimum 6 inches away from steam, hot water, or other hot surface. Protect from heat, as Engineer approved, if the 6 inch separation is impracticable.
6. Diagonal installation is not permitted.

H. BURIED/EMBEDDED CONDUIT

1. RGS conduit installed underground, or used in PVC runs for sweeps larger than 22 degrees, must be wrapped with 3M-50 10 mil pipe wrap, approved asphalt compound or approved equal.
2. Mid-run weep holes and gravel drainage pockets will not be permitted.
3. Conduits embedded in concrete or masonry shall be securely held in place during concrete placement and construction operations.
4. In concrete floors, conduit shall be set before pouring of concrete begins. Conduit shall be routed in a direct line, with bends as long as possible, with 2 inches minimum from conduit to bottom of slab and maximum conduit size of 2 inch, unless otherwise approved.
5. Non-metallic conduits above 600 Volts shall be encased in red concrete covered by a minimum of 2 inches on all sides.
6. Buried conduit shall be placed 18" below grade, then filled to grade with flowable fill concrete.
7. If minimum of 18" cannot be reached, 3000 psi concrete shall fill the trench to grade .

I. WALL PENETRATIONS

1. Penetrations through exterior building walls to be by core drilling and providing appropriate conduit entrance seals.

2. Openings through existing partitions shall be provided at Contractor's expense. Holes through masonry construction shall be drilled with suitable core drilling machine.
3. All work is to be performed neatly.
4. Patches shall match original material in composition and appearance.
5. Provide fire seals as detailed or required by NEC where a fire rated wall or partition is penetrated.
6. A template shall be provided by the Contractor to hold conduit groups terminating together or passing through fire walls or floors.
7. In walls and partitions, conduit shall be installed vertically. If vertical installation is impracticable, the Engineer shall approve horizontal installation for each location.

J. EXPANSION FITTINGS

Install expansion fittings in all conduit runs crossing structural expansion joints and in all straight conduit runs exceeding 75 feet in length.

K. CONDUIT ENDS

1. Insulating bushings shall be installed at open conduit ends, terminating in panels, control centers, consoles or other similar locations.
2. Plug space around cables with oakum and/or an approved sealing compound where conduits enter switchboards, cabinets or similar locations.
3. Cap or plug all spare conduit ends to prevent the entrance of foreign material.

L. CONDUIT CONNECTIONS

1. At cabinets and boxes use double locknuts and insulating bushings for rigid conduit.
2. At cable tray securely clamp conduit to tray and install insulating bushings.
3. Install insulated grounding bushings with lay-in ground lugs where metallic conduit terminates in non-metallic manholes or pullboxes.
4. Flexible conduit for connection to movable/vibrating equipment shall be liquid-tight, Sealtite as manufactured by Anaconda Metal Hose Company, or approved equal, utilizing approved liquid-tight fittings.

M. SUPPORTS

1. Hangers and supports shall be galvanized or PVC coated.
2. Hangars generally are not detailed, but must be adequate to support combined weight of conduit. Rigid fastenings are to be spaced at a maximum of 6 feet.
3. Clamps will be galvanized malleable iron one-hole straps, beam clamps or other approved device with necessary bolts, washers and expansion shields.
4. **Perforated metal straps shall not be used.**
5. Adjustable hangers shall be used to support horizontal runs only, use trapeze hangers for parallel runs of conduit. Install u-bolts or other approved clamping device at each end and at each elbow. Install clamp every third intermediate hanger for each conduit.

N. CONDUIT CLEANING

Contractor is to clean and swab the inside of conduits, by mechanical means, to remove foreign materials and moisture before conductors are installed.

O. SPARE CONDUITS

1. Spare conduits shall have a nylon pulling line installed for future installation of cables.
2. Recessed panels shall have three 1 inch spare conduits in the wall space stubbed-out above ceiling and three 1 inch spare conduits stubbed under the floor.
3. Spare conduits shall be capped.

CONDUCTOR INSTALLATION**A. BENDING RADII**

Not to be less than permitted by ICEA and/or NEC.

B. SUPPORTS IN VERTICAL RUNS

To be in accordance with NEC requirements.

C. SPLICING

1. Will be permitted only with Engineers approval, and will be held to an absolute minimum.
2. Permitted only in junction boxes or similar accessible locations.
3. Cover with heat shrinkable sleeves to make moisture proof and corrosive resistant.
4. No splicing of instrument or control wiring shall be allowed without specific approval, by the Engineer.

D. CONNECTORS

1. Solderless compression or mechanical type will be utilized where screw does not bear directly on the wire.
2. Apparatus lugs, conductor, and coat shall be thoroughly cleaned with suitable oxidation inhibiting compound prior to connection.
3. Retaining cup washers shall be used where solid wire is used at terminal blocks.
4. Compression type connectors shall be installed using ratchet type crimping tools that will not release until full compression has been achieved.
5. Dies for the crimping tools shall be matched to the connector and approved for use by the Engineer and the connector manufacturer.
6. Twist on type, Scotch-lok or approved equal, connectors shall be restricted to the connection of lighting fixture wires only.

E. POWER CABLES

All power cables will be installed in strict accordance with the manufacturers instruction, and in conformance with NEC.

F. CONNECTIONS

All apparatus lugs shall be tandem single or multi-barrel lugs as detailed/required.

G. CONDUCTOR PULLING

1. Use pulling grips or eyes.

2. Firmly mount pulling reels on portable stand and secure against displacement
3. Use an approved by the Engineer commercial pulling compound for lubrication.
4. Monitor and do not exceed cable-pulling tension as specified by the cable manufacturer.

H. COLOR CODING

1. Single phase service - use white for neutral conductor, and black for ungrounded conductors.
2. Three phase service - feeder and branch conductors shall be color coded as follows:

	<u>120/208 Volt</u>	<u>277/480 Volt</u>
a.	Phase A – Black	Brown
b.	Phase B – Red	Orange
c.	Phase C – Blue	Yellow
d.	Neutral – White	Grey
e.	Ground – Green or Bare	Green or Bare

3. Coding shall be by insulation color or minimum 1 inch band of colored tape.
4. Green covering of conductors shall be solely for grounding.

I. PHASING

1. Where common neutral is run for two or three circuits, phase conductors shall be connected to breakers in the panel, which are connected to different phase legs.
2. Home runs may be combined at the option of the Contractor, providing not more than three circuits are installed in one conduit, unless otherwise approved by the Engineer.

J. SERVICE SYSTEMS

1. Incoming service systems shall be grounded at two points with the UFER (ground wire tied to the rebar of the footings) and to driven ground rods as indicated on the Standard Detail Drawing.
2. Jumpers shall be provided around water meters and any dielectric sections of pipe.
3. Size shall be as indicated on the Drawings and/or as required by NEC.
4. Connections shall be accessible for inspection.
5. Neutral conductor connection to grounding electrode conductor shall be at the main service enclosure only.
6. Type of equipment and details of installation shall be verified with Power Company representatives.
7. Metering equipment shall be provided as indicated on the Drawings or as required by these Specifications.

16010.3.9 INSTALLATION OF POWER AND CONTROLS TO EQUIPMENT

Contractor shall provide all power and control wiring required for the work of other trades as described on the drawings and in the specifications, except where the furnishing and installing of such wiring is specified elsewhere. Connect cord sets to Owner furnished equipment and make connections to all electric power consuming equipment whether furnished under contract or by Owner.

16010.3.10 TEMPORARY ELECTRIC SERVICE DURING CONSTRUCTION

- A. The Project Contractor is responsible for all project electrical work unless otherwise noted. The Contractor shall be aware, however, that some or all of the project electrical work may be performed by the Owner and/or an independent electrical contractor. The division of work to be performed by others may be indicated on the drawings, or may be as called for by the Engineer. But, the Contractor shall be responsible to review the Drawings and consult with the Engineer, to determine if its scope is less than one hundred percent of all project electrical work. The Contractor shall also be responsible to coordinate and schedule its work with that of the Owner or independent electrical contractor, and to leave its installations ready, with the connecting wires coiled, for the Owner or independent contractor to connect to or to terminate as necessary, thereby ensuring the most efficient completion of the project by all parties.
- B. The Contractor or electrical subcontractor doing the work shall provide temporary power, complete with metering and wiring, for lighting and power outlets for construction tools and equipment. This contractor will make arrangements with the local power company for temporary electrical service connections for construction power.
- C. No attempt shall be made herein to specify construction power requirements for equipment in detail. However, all temporary wiring shall meet NEC, Article 305, requirements. The service shall be provided with a main disconnect, and all power receptacles shall be, or be protected by, appropriately rated GFI single-pole devices.
- D. At completion of the Project, or sooner if directed, the temporary power supply shall be disconnected and removed from the construction site.
- E. During construction, if it becomes necessary to shut down power to a critical item of equipment or process, the Contractor or electrical subcontractor shall provide the necessary wiring and a portable generator or other source of electric power to keep such critical equipment or process in operation.

16010.3.11 SEISMIC RESTRAINT

- A. The appropriate Seismic Zone Classification will be provided on the Drawings or in the Special Provisions. All electrical equipment shall be securely anchored and seismically braced in accordance with the regulations contained in the most recently adopted edition of the UBC and with the *SMACNA Guidelines for Seismic Restraints of Electrical Systems* as they pertain to the Seismic Zone Classification given.
- B. Units mounted and secured directly to structures shall be provided with connectors of sufficient strength to meet the restraining criteria.
- C. All electrical equipment which is to be securely anchored (hard mounted) to the building or structure shall have supports designed to withstand lateral and vertical "G" loadings equal to or greater than UBC requirements and SMACNA guidelines for the given seismic zone.

16010.3.12 LABELING OF J-BOX COVERS

All J-Box covers shall be labeled with information showing the voltage and the circuit number in reference to each home run pulled through that J-Box and a particular run of conduit. The Contractor shall continue such circuits to the panels as though the routes were completely indicated.

16010.3.13 REPAIR OF WORK

- A. The work shall be carefully laid out in advance and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support, or anchorage of the conduit raceways or other electrical work, this work shall be carefully done. Any damage to building, piping or equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Owner.
- B. Penetrations within fire rated wall assemblies shall be appropriately repaired and replaced to full integrity of the designed fire resistance of the wall.

16010.3.14 TESTING

On completion of the work, the installation shall be tested free from all grounds and short circuits. Normal feeders, circuits, and service entrance conductors with wire size #2 and larger shall be tested for leakage phase-to-ground and phase-to-phase prior to energizing the electrical system. The Contractor shall submit a written report to the Engineer showing methods used and readings taken. Voltage applied for testing shall not exceed two times normal operating voltage.

16010.3.15 GUARANTEE/WARRANTY

- A. The following guarantee is a part of the specification and shall be binding on the part of the Contractor:

"The Contractor guarantees that this installation is free from defects. The Contractor agrees to replace or repair, to the satisfaction of the Owner's Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance."
- B. Electrical systems and equipment shall not be considered acceptable for substantial completion until they have performed in service continuously without malfunction for at least ten (10) days.

16010.3.16 DEFECTIVE EQUIPMENT

If equipment fails to conform to the Specifications or to operate satisfactorily, the Owner will have the right to operate said equipment until defects are corrected. The Owner will have the right to operate rejected equipment until it is replaced, without cost for depreciation use or wear. The Contractor shall remove defective equipment from operation for examination, adjustment, alteration, or change only at times approved by Owner.

16010.3.17 CLEAN-UP

- A. As the work progresses, and on a daily basis, the Contractor shall remove from the premises and surrounding streets, alleys, etc., all rubbish and debris resulting from its operations and shall leave all equipment and material furnished by the Contractor absolutely clean and ready for use.
- B. In addition, the Contractor shall periodically remove all debris and waste in order to maintain safe working and operating conditions, and shall dispose of the same in an approved manner. At the completion of work, The Contractor shall remove all its rubbish, tools, scaffolds and surplus materials from and about the site, leaving its work clean and the areas ready for occupancy.

16010.3.18 AS-BUILT DRAWINGS

Blue line white prints of drawings will be furnished by the Engineer, on which the Contractor shall accurately and neatly mark, in colored pencil, all changes or deviations from the drawings as such changes are made in the work. These drawings shall be reviewed with the Engineer on a timely basis, not to exceed at least once each month. Failure to keep as-built drawings up to date shall be cause for withholding monthly or final payment.

16010.3.19 FINAL INSPECTION AND ACCEPTANCE

The Contractor shall notify the Engineer when work is considered to be complete, in full operating condition, and ready for final inspection. The Engineer, after determining that the installation is ready for final inspection, will conduct the final inspection and tests as are deemed necessary to determine that the provisions of the specifications are satisfied. The Owner will not accept work nor make final payment to the Contractor until Engineer has certified that the work of the Contractor is complete and in conformance with the specifications and guarantees.

16010.4 METHOD OF MEASUREMENT

16010.4.1 NO SEPARATE MEASUREMENT

Separate measurement shall NOT be made for furnishing or installing electrical systems, components, materials required to be installed within the pay limits for a building or enclosure identified in the Bid schedule to be furnished by the Contractor.

16010.4.2 SEPARATE MEASUREMENT

- A. NEW BUILDINGS - Separate measurement shall be made for installation of electrical systems, components, and materials, required for a building or enclosure shown on the Drawings and as called for in these Specifications and identified in the Bid Schedule, when such electrical systems, components, and materials are identified and listed in the Bid Schedule.
- B. EXISTING BUILDINGS - Separate measurement will be made for installation of electrical systems, components, and materials, required to be installed or replaced in an existing building or enclosure, as shown on the Drawings and as called for in these Specifications, when such electrical systems, components, and materials are identified and listed in the Bid Schedule.

16010.5 BASIS OF PAYMENT

16010.5.1 No separate payment shall be made for furnishing or installing electrical systems, components, or materials required to be installed within the pay limits for a building or enclosure identified in the BID schedule to be furnished by the Contractor.

PAY ITEM	UNIT
Electrical System (<i>Indicate Building</i>)	Lump Sum
Install Electrical (<i>Describe Component</i>)	Lump Sum
Install Electrical (<i>Describe Component</i>)	Each
Install Electrical (<i>Describe material</i>)	Lump Sum
Install Electrical (<i>Describe material</i>)	Lineal Foot
Replace Electrical (<i>Describe Component</i>)	Lump Sum
Replace Electrical (<i>Describe Component</i>)	Lump Sum
Replace Electrical (<i>Describe material</i>)	Lump Sum
Replace Electrical (<i>Describe material</i>)	Lineal Foot

16150.1 GENERAL**16150.1.1 QUALITY ASSURANCE**

- A. Comply with NFPA 70 requirements for electrical materials and installation.
- B. Provide products and components which have been UL listed and labeled, including UL marks indicating special type usage whenever applicable.

16150.2 PRODUCTS**16150.2.1 MOTOR STARTERS**

- A. Acceptable Manufacturers:
 - 1. Allen-Bradley Co.
 - 2. Eaton Corp/Power Distribution Div.
 - 3. Cutler Hammer
 - 4. General Electric Co. (GE Supply)
 - 5. Square D Co.
- B. Provide factory fabricated starters complying with NEMA Standards Publication ICS 2 with NEMA Type enclosures as specified in Section 16010.
- C. Provide starters with thermal overload protection on each phase utilizing interchangeable melting alloy, Class 20 (trip in 20 seconds or less when carrying a current equal to 600 percent of its current rating) overload heaters, sized in field for full load current rating indicated on each motor nameplate.
- D. Manual Motor Starter: Quick-make, quick-break trip free toggle or pushbutton operating mechanism; provisions for positive padlocking in OFF position.
- E. Magnetic Motor Starter: Non-reversing or reversing, as indicated; manual reset overload relay with reset button on face of enclosure; full voltage starting; control transformer of sufficient capacity to handle operating coil and associated controls, integral with each starter; 120 volts control circuit, fuse protected; equipped with pilot light.

16150.2.2 CONTACTORS

- A. Acceptable Manufacturers:
 - 1. Allen-Bradley Co.
 - 2. Eaton Corp/Power Distribution Div.
 - 3. Culter Hammer
 - 4. General Electric Co. (GE Supply)
 - 5. Square D Co.
- B. Provide contactors complying with NEMA Standards Publication ICS 2 with NEMA Type enclosures as specified in Section 16010, unless otherwise indicated.

16150.2.3 RELAYS

- A. Acceptable Manufacturers:
 - 1. Control Relays:

2. Allen-Bradley Co.
3. IDEC Systems & Controls Corp.
4. Omron Electronics, Inc./Control Components Div.
5. Potter & Brumfield
6. Square D Co.

- B. Provide relays complying with NEMA Standards Publication ICS 2 with NEMA Type enclosures as specified in Section 16010, unless otherwise indicated.

16150.2.4 CONTROL PANELS

- A. Acceptable Manufacturers:

1. Allen-Bradley Co.
2. Eaton Corp/Power Distribution Div.
3. Cutler Hammer
4. Square D Co.

- B. Provide factory fabricated oiltight pushbuttons, selector switches, pilot (indicating) lights, and pushbutton stations complying with NEMA Standards Publication ICS 2, heavy duty, with NEMA Type enclosures as specified in Section 16010.

1. Fabricate pushbutton stations for vertical or horizontal mounting, as indicated, and with button and light arrangements, as indicated on drawings.

- C. Pushbuttons: Momentary or maintained contacts, as indicated; contacts rated 10 amps continuous carrying current, 600 volts AC; quick-make, quick-break, snap action operating mechanism.

- D. Selector Switches: Rotary type; two or three position control, as indicated; legend plate with markings as indicated.

- E. Pilot Lights: Transformer type, 120 volts AC; glass or acrylic plastic prismatic lens, color as indicated; legend plate with markings as indicated.

16150.2.5 CIRCUIT AND MOTOR DISCONNECTS

- A. Acceptable Manufacturers:

1. Cutler Hammer
2. Allen-Bradley Co.
3. Siemens Corp/Electrical Apparatus Div.
4. Square D Co.
5. General Electric Co. (GE Supply)

- B. Provide factory fabricated switches complying with NEMA Standards Publication KS 1 with NEMA Type enclosures as specified in Section 16010.

- C. Safety Switches: 3 pole, heavy-duty, horsepower rated disconnect; rated at 600 volts; quick-make, quick-break operating mechanism; integral operating handle provided with means for positive padlocking in OFF position; current carrying parts constructed of high conductivity copper, with silver-tungsten type switch contacts; fusible or non-fusible as indicated; positive pressure type reinforced fuse clips for fusible switches.

- D. Fuses: Dual element type, with time delay; non-renewable; current limiting where indicated.

16150.2.6 TRANSFER SWITCHES – MANUAL

- A. Acceptable Manufacturers:
 - 1. Cutler Hammer
 - 2. Square D Co.
 - 3. General Electric Co. (GE Supply)
- B. Provide manual transfer switches complying with NEMA Standards Publication KS 1, specifically designed to transfer power from one load to another load, with NEMA Type enclosures as specified in Section 16010.
- C. Manual Transfer Switches: Double throw, 3 pole, heavy-duty, safety switch; rated at appropriate amperes, 600 volts; quick-make, quick-break operating mechanism; blades visible from front of unit for positive indication that switch is OFF; integral three position operating handle provided with means for positive padlocking in OFF position; current carrying parts constructed of high conductivity copper, with silver-tungsten type switch contacts; non-fusible.

16150.3 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

- 16150.3.1 These control devices shall be considered pertinent to the equipment which they are associated with. They will not be measured or paid for separately, but shall be included in other appropriate bid items.

16400.1 GENERAL**16400.1.1 APPLICABLE SECTIONS**

The General Conditions, Supplementary General Conditions, Special Conditions, Alternates and addenda, applicable drawings and the technical specifications herein shall apply to all work under this Division 16.

16400.1.2 SCOPE

Provide all operations, methods, labor and equipment and provide and install all materials and incidentals necessary for the completion of the work as specified herein or included on the drawings.

16400.1.3 WORK INCLUDED

- A. Electrical work required for this work is shown on the drawings and includes, but is not necessarily limited to:
 - 1. Complete new electrical distribution system for power and lighting as shown.
 - 2. Complete system of raceways and outlets for Control and all other auxiliary systems of this Division 16. Unless noted otherwise, the equipment and wiring of these auxiliary systems will be furnished and installed under their respective sections; however, the conduit raceway systems will be furnished and installed under this Section 16400.
 - 3. All excavating, backfilling, compacting, and grading required for the installation of all work covered under this Division 16.
- B. Shall furnish and install all component parts of all the systems required for their safe and proper operation, whether or not specifically mentioned or noted on the drawings, except those items or articles which are specifically noted hereinafter as being supplied otherwise.
- C. Perform all trenching and backfilling required in connection with the work of this section in strict accordance with the provisions of Division 02000 of these specifications.
- D. Provide all required electrical connections and service to items described in all other sections of these specifications. Provide all those services outlined in other divisions of the specifications as being done by the electrical sub-contractor.

16400.1.4 RELATED WORK SPECIFIED ELSEWHERE:

Section 16010 – Electrical General Requirements
Section 16410 – Fuses
Section 16210 – Electrical Fixtures

16400.2 PRODUCTS**16400.2.1 DISTRIBUTION PANELBOARDS**

- A. Distribution panelboards shall be factory assembled dead front, wall mounted as scheduled and braced for the indicated ampere rms symmetrical with equipment, bussing connections, circuit breakers and all similar components indicated on the drawings or required for proper completion. Each breaker shall have an etched micarta nameplate secured by two cadmium plated screws. Nameplates shall indicate equipment served as shown in schedule. Busses shall be copper of a maximum current density of 1000 amperes per inch and shall be equipped with uninsulated equipment ground bus. Three phase, 4-wire panels shall have full capacity neutral bus.
- B. All floor mounted panels shall be mounted on a **4" housekeeping pad** and therefore to comply with NEC, the operating handles of switches and breakers shall be no more than 6'-2" above the bottom of the panel.
- C. Distribution panel boards shall be wall mounted as indicated in schedules. For access to wiring gutters, panel shall be door within door construction. Shall be Square D, I-Line or equal of Siemens I.T.E., Cutler Hammer/Westinghouse or General Electric.

16400.2.2 BRANCH CIRCUIT PANELBOARDS

- A. Branch circuit panelboards shall be Square D for the scheduled voltage, 3 phase, 4 wire operation or equal of Siemens, or General Electric. Shall be equipped with bolt-on breakers. Minimum width shall be 20 inches. Minimum depth shall be 5.75 inches. Panel trims shall be of the door within door construction.
- B. Busses shall be copper.
- C. Branch circuit breakers shall be provided per schedules on drawings. All multi-pole breakers shall be common trip.
- D. Doors shall be complete with corrected circuit schedule on inside. Panels shall be NEMA 3R type construction.

16400.2.3 DRY TYPE TRANSFORMERS

- A. General Purpose Dry-Type Transformers: (Under 600 volts)
 - 1. General: Furnish and install at locations shown on the drawings dry-type two winding power transformers for general power and lighting applications indicated. Transformers shall be UL listed and bear the required Listing Mark.
 - 2. Electrical Rating: Shall be 60 hertz of sizes, phases, high voltage and low voltage as scheduled on the drawings. Each transformer, unless specifically noted otherwise, shall have six (6) 2-1/2% full capacity taps, two above and four below nominal voltage in the high voltage winding. Temperature Classification: Each transformer shall utilize an insulation system that has been properly temperature classified and approved by Underwriters' Laboratories. Unless specifically noted otherwise, the insulation classification shall be 220 C with 150 C winding temperature rise in accordance with Underwriters' Laboratories specification UL506.

3. Load Rating:

- a. Each transformer supplied to this specification shall be capable of operating at 100% of nameplate rating (NPR) continuously while in an ambient temperature not exceeding 40°C and shall be capable of meeting the daily overload requirements of ANSI Standard C57.96 as stated in the following chart:

PERMISSIBLE ONCE DAILY OVERLOADS WITH NORMAL LIFE MAINTAINED			
Peak Load Following and Followed by a Constant Load of			
Peak Load Time (Hours)	90% NPR	70% NPR	50% NPR
1/2	162% NPR	185% NPR	200% NPR
1	138% NPR	148% NPR	152% NPR
2	123% NPR	128% NPR	133% NPR
4	113% NPR	115% NPR	118% NPR
8	106% NPR	107% NPR	108% NPR
NPR = Nameplate Rating			

- b. Transformer loaded in accordance with this paragraph shall be capable of long service life under the thermal conditions specified. There shall be no need for derating.
4. Sound Rating: Each transformer shall have sound levels equal or lower than those established in the latest revision of ANSI Standard C89 as shown in the following chart:

Transformer Rating KVA	Maximum Sound Level Decibels
10-50	45
51-150	50
150-300	55

5. Other Requirements: The following requirements shall be in accordance with Underwriters' Laboratories specification UL506:

- a. Enclosure:
- (i) Ventilation openings
 - (ii) Corrosion resistance
 - (iii) Cable bending space
 - (iv) Grounding provisions
 - (v) Surface temperature rise
 - (vi) Wiring compartment temperature rise
 - (vii) Terminations

6. Test Requirements:
 - a. Each transformer furnished to this specification shall be subjected to the following production tests:
 - (i) Applied potential
 - (ii) Induced potential
 - (iii) No load losses
 - (iv) Voltage ratio
 - (v) Polarity
 - (vi) Continuity
 - b. The manufacturer shall have performed the following additional tests on units identical to the design type being furnished to this specification. Proof of performance of these tests in the form of test data sheets shall be provided as part of the shop drawing submittal.
 - (i) Sound levels
 - (ii) Temperature rise tests
 - (iii) Full-load losses
 - (iv) Regulation
 - (v) Impedance
7. Shop Drawings: Submit shop drawing for review prior to delivery to job site.

16400.3 EXECUTION**16400.3.1 INSTALLATION OF GROUNDING SYSTEM**

- A. The conduit system and neutral conductor of the wiring system shall be grounded to the cold water pipe having a continuous path to earth in compliance with grounding provisions as outlined in the NEC. Point of connection to the water system shall be as near as practicable to the service entrance. Provide bonding jumper same size as system ground to provide ground continuity from customer's side of metallic lines service entrance and street side of metallic mains. The neutral and ground shall be connected together at the main service switch only.
- B. Where the water main is not metallic, delete water pipe ground requirements and provide a concrete encased electrode consisting of a 20-foot length of #3/0 bare copper conductor tied to the steel reinforcing bars and encased within a concrete footing. This footing shall be in direct contact with earth and located near the main panel.
- C. The Contractor shall also install a made electrode ground system consisting of copperclad rods spaced not closer than six feet apart. Grounding conductors and connections to ground rods shall be protected from damage and shall be placed to avoid disconnect by unauthorized personnel. Interconnect with water pipe ground system.
- D. The equipment grounding system shall be such that all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in close proximity with the electrical circuits operate continuously at ground potential and provide a low impedance path for the possible ground fault currents. The system shall comply with the National Electrical Code, modified as indicated on the drawings or specifications and as hereinafter specified to incorporate a maximum 25 ohms ground resistance. Grounding connections shall be accessible for inspection.

- E. The distributions system shall be provided with a separate equipment grounding conductor for each single or three-phase feeder, each branch circuit with a multi-pole protective device and each single phase receptacle and motor circuit as indicated. The required grounding conductor shall be installed in the common raceway with the related phase and/or neutral conductors. Single-phase branch circuits required for lighting, shall consist of phase and neutral conductors installed in common metallic conduit which shall serve as the grounding conductor. Conduit equipment connections utilized in conjunction with the above single-phase branch circuits shall be provided with suitable bonding jumpers connected to approved grounding type bushings. Single-phase branch circuits and all branch circuits installed in flexible conduits shall be provided with a separate grounding conductors as hereinbefore specified for the multi-pole branch circuits.

16400.3.2 INSTALLATION OF PANELS

- A. Installation: Unless otherwise indicated on the drawings, install wall panels with the top of the trim 6'-0" above the finished floor. Panels located in equipment rooms and wire closets shall be surface mounted. Floor mounted panels shall be provided with a 4" concrete housekeeping pad. Floor mounted panels shall be anchored to floor at all four corners and to wall or structural member at top for seismic restraint.
- B. Directories: Mount a typewritten directory behind glass or plastic on the inside of each panel door. On the directory, show the circuit number and complete description of all outlets with specific locations on each circuit. In addition, provide a typewritten label inside door showing source of power to panel both as to feeder switch, panel designation and location within buildings.

16400.3.3 GENERAL PURPOSE DRY TYPE TRANSFORMERS

General purpose dry transformers shall be mounted on floor at locations shown on drawings. Each shall be anchored to floor by means of a minimum of four 1/2" x 6" anchor bolts grouted in existing concrete floor.

16400.3.4 TESTING

- A. General: Upon completion of this portion of the work, test all parts of the electrical system in the presence of the Engineer Owner's Representative.
- B. Test Requirements: All systems shall test free from short circuits and grounds, shall be free from mechanical and electrical defects, and shall show an insulation resistance between phase conductors and ground of not less than that required by the National Electrical Code.

16400.3.5 FINAL INSPECTION

- A. This Division 16 contractor's job foreman shall be present at the final inspection of the work by the Owner.
- B. Electrical job foreman shall have pad and pencil to list all deficient items noted. Corrections and adjustments of deficient items shall be done after the inspection, not during.
- C. See Section 16010 for other requirements for final inspection.

16400.4 METHOD OF MEASUREMENT

- 16400.4.1 SERVICE ENTRANCE. Provide all conduit, sweeps, support members, concrete transformer pads & pad vaults, grounding equipment, breakers, disconnects, enclosures, conductors, and appurtenances as required by the local utility, and as shown on the drawings and as defined in the applicable sections of the specifications required for a complete and fully functioning system.
- 16400.4.2 GROUNDING SYSTEM. Provide all grounding conductors, connections, ground rods, ground wells, and associated appurtenances and as shown on the drawings, and as defined in the applicable sections of the specifications.
- 16400.4.3 POWER PANEL (PP) OR MOTOR CONTROL CENTER (MCC). Provide all conduit, sweeps, pull boxes, power panels, motor starters, motor savers, receiving and installation of motor control center, transient voltage surge suppressor (TVSS), support members, grounding equipment, breakers, disconnects, enclosures, conductors and connections, and appurtenances as shown on the drawings and as defined in the applicable sections of the specifications required for a complete and functioning system.
- 16400.4.4 DRY TYPE TRANSFORMERS. Provide dry type transformer and appurtenances as shown on the drawings and as defined in the applicable sections of the specifications required for a complete and functioning system.
- 16400.4.5 LIGHTING PANEL (LP). Provide all conduit, sweeps, support members, grounding equipment, breakers, disconnects, enclosures, conductors and connections, switches, receptacles, and appurtenances as shown on the drawings and as defined in the applicable sections the specifications required for a complete and functioning system. Where lighting fixtures are not called out in the pay item, they are included in the LIGHTING PANEL (LP).
- 16400.4.6 LIGHTING FIXTURES. Material cost for lighting fixtures and all appurtenances. Note: conduit, wire and switches and included in LIGHTING PANEL (LP) section(s).
- 16400.4.7 HEATING VENTILLATION AIR CONDITIONING (HVAC). Provide all conduit, sweeps, support members, grounding equipment, breakers, disconnects, enclosures, conductors, switches, receptacles, and appurtenances as shown on the drawings and as defined in the applicable sections the specifications required for a complete and functioning system. Note: conduit, wire and switches and included in LIGHTING PANEL (LP) section(s).
- 16400.4.8 CONTROL PANELS. Provide all conduit, signal and power conductors and connections, and appurtenances for all control panels as shown on the drawings and as defined in the applicable sections of the specifications required to provide a complete and functioning system.

16400.5 BASIS OF PAYMENT

- 16400.5.1 No separate payment shall be made for furnishing or installing electrical systems, components, or materials required to be installed within the pay limits for a building or enclosure identified in the BID schedule to be furnished by the Contractor.
- 16400.5.2 When electrical systems, components, or materials are measured for a new building or enclosure as shown on the Bid Schedule, separate payment will be made as listed below.
- 16400.5.3 When initial installation or replacement of electrical systems, components, or materials is made in an existing building as shown on the Bid Schedule, the accepted quantity will be paid for at the contract price listed below:

PAY ITEM	UNIT
Service Entrance	Lump Sum
Grounding System	Lump Sum
Lighting Panel LP1 & Control Panel	Lump Sum
Lighting Fixtures	Lump Sum
HVAC	Lump Sum
Control Panels	Lump Sum

16410.1 GENERAL**16410.1.1 ACCEPTABLE MANUFACTURERS**

- A. Manufacturer: Bussmann.
- B. Other acceptable manufacturer: Gould Shawmut, Littlefuse.
- C. All fuses shall be of one manufacturer. Fuses shall have a 200,000 ampere RMS symmetrical interrupting rating unless noted otherwise.

16410.1.2 FUSE TYPES AND RATINGS

- A. Fuses from 0 to 600 ampere for each circuit serving a single motor shall be UL Class RK5 dual-element Low Peak, LPN-RK (250 volt).
- B. All other fuses in the 0 to 600 ampere range shall be UL Class J, dual-element, time delay, low peak, LPJ-SP (250 volt).
- C. Fuses larger than 600 ampere shall be UL Class L with time delay, Hi Cap, KRP-C.

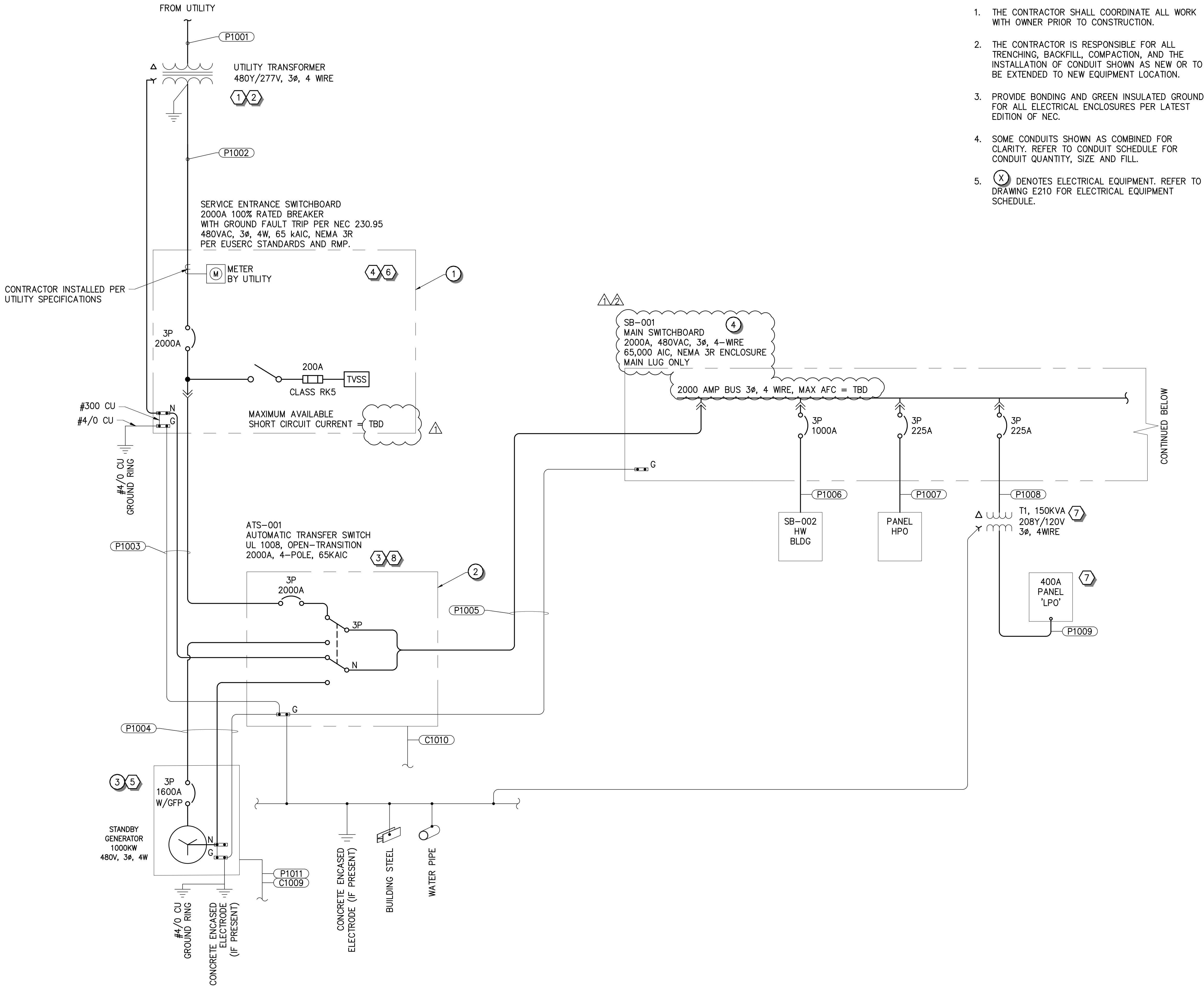
16410.1.3 METHOD OF MEASUREMENT**16410.1.4 NO SEPARATE MEASUREMENT**

Separate measurement shall NOT be made for furnishing or installing electrical systems, components, materials required to be installed within the pay limits for a building or enclosure identified in the Bid schedule to be furnished by the Contractor.

16410.5 BASIS OF PAYMENT

16410.5.1 No separate payment shall be made for furnishing or installing electrical systems, components, or materials required to be installed within the pay limits for a building or enclosure identified in the BID schedule to be furnished by the Contractor.

16410.5.2 When electrical systems, components, or materials are measured for a new building or enclosure as shown on the Bid Schedule, separate payment will be made as listed in specification 16400.



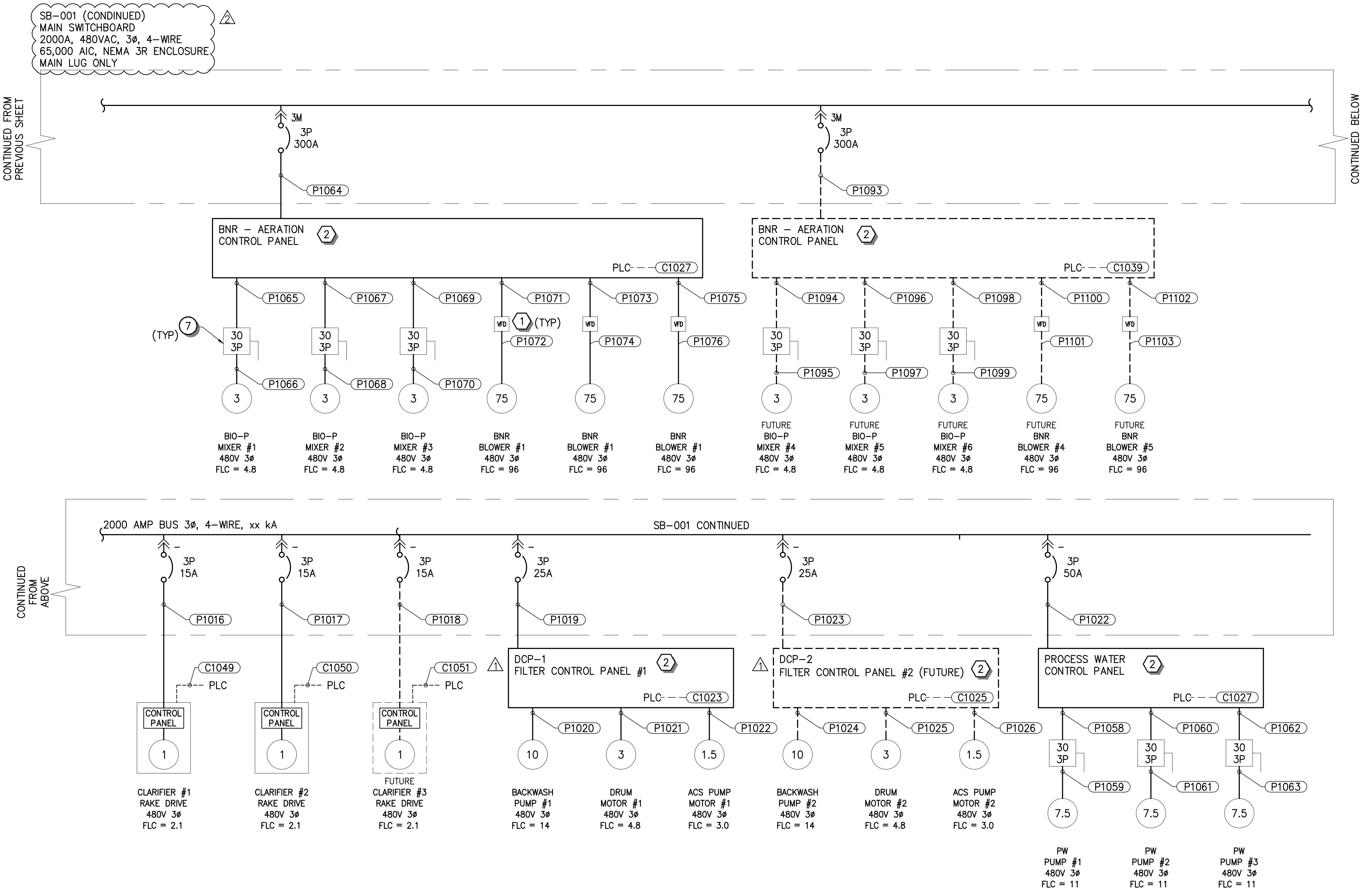
SHEET NOTES:

1. THE CONTRACTOR SHALL COORDINATE ALL WORK WITH OWNER PRIOR TO CONSTRUCTION.
2. THE CONTRACTOR IS RESPONSIBLE FOR ALL TRENCHING, BACKFILL, COMPACTION, AND THE INSTALLATION OF CONDUIT SHOWN AS NEW OR TO BE EXTENDED TO NEW EQUIPMENT LOCATION.
3. PROVIDE BONDING AND GREEN INSULATED GROUND FOR ALL ELECTRICAL ENCLOSURES PER LATEST EDITION OF NEC.
4. SOME CONDUITS SHOWN AS COMBINED FOR CLARITY. REFER TO CONDUIT SCHEDULE FOR CONDUIT QUANTITY, SIZE AND FILL.
5. (X) DENOTES ELECTRICAL EQUIPMENT. REFER TO DRAWING E210 FOR ELECTRICAL EQUIPMENT SCHEDULE.

KEY NOTES

1. ALL SERVICE ENTRANCE WORK SHALL BE COORDIANED WITH OWNER AND ROCKY MOUNTAIN POWER (RMP), PRIOR TO CONSTRUCTION. SERVICE ENTRANCE WORK SHALL BE PER UTILITY REQUIREMENTS.
2. TRANSFORMER BY UTILITY, PAD BY CONTRACTOR PER UTILITY STANDARDS. COORDINATE WITH UTILITY FOR DIMENSIONS AND CONDUIT STUB UP LOCATIONS.
3. PROVIDE AND INSTALL AUTOMATIC TRANSFER SWITCH (ATS). ATS SHALL BE UL 1008 LISTED, OPEN-TRANSITION, AND CONFIGURED AS SHOWN IN DRAWING.
4. PROVIDE SIGN AT METERING SWITCHBOARD INDICATING TYPE AND LOCATION OF STANDBY GENERATOR.
5. GENERATOR PROVIDED AND INSTALLED BY CONTRACTOR. CONTRACTOR TO PROVIDE AND INSTALL CONCRETE PAD PER MANUFACTURER'S RECOMMENDATIONS.
6. PROVIDE LABELS INDICATING ARC FLASH HAZARD PER NEC 110.16, AND AVAILABLE FAULT CURRENT PER NEC 110.24
7. DO NOT BOND NEUTRAL TO GROUND IN THE PANELS. BONDING TO OCCUR AT TRANSFORMER T1.
8. COORDINATE WITH MANUFACTURER TO REMOVE N-G LINK AND SERVICE ENTRANCE LABELLING. PROVIDE PLACARD INDICATING LOCATION OF N-G BOND IS AT THE METERING SWITCHBOARD.

2	ADDENDUM #4	2-7-23
1	ADDENDUM #3	2-3-23
REV. NO.	COMMENT	DATE
REGISTERED PROFESSIONAL ENGINEER 23-Dec-2022 No. 362066 J. RANDALL KNAPP STATE OF UTAH SUNRISE ENGINEERING 6875 SOUTH 900 EAST SALT LAKE CITY, UTAH 84047 TEL 801.523.0100 · FAX 801.523.0990 www.sunrise-eng.com		
MOUNTAIN GREEN SEWER IMPROVEMENT DISTRICT		
BNR WWTP 2022		
ELECTRICAL ONE-LINE DIAGRAM		
SEI NO. S08242	DESIGNED JRK	DRAWN JRK
CHECKED JRK	SHEET NO. 162 of 249	E-201



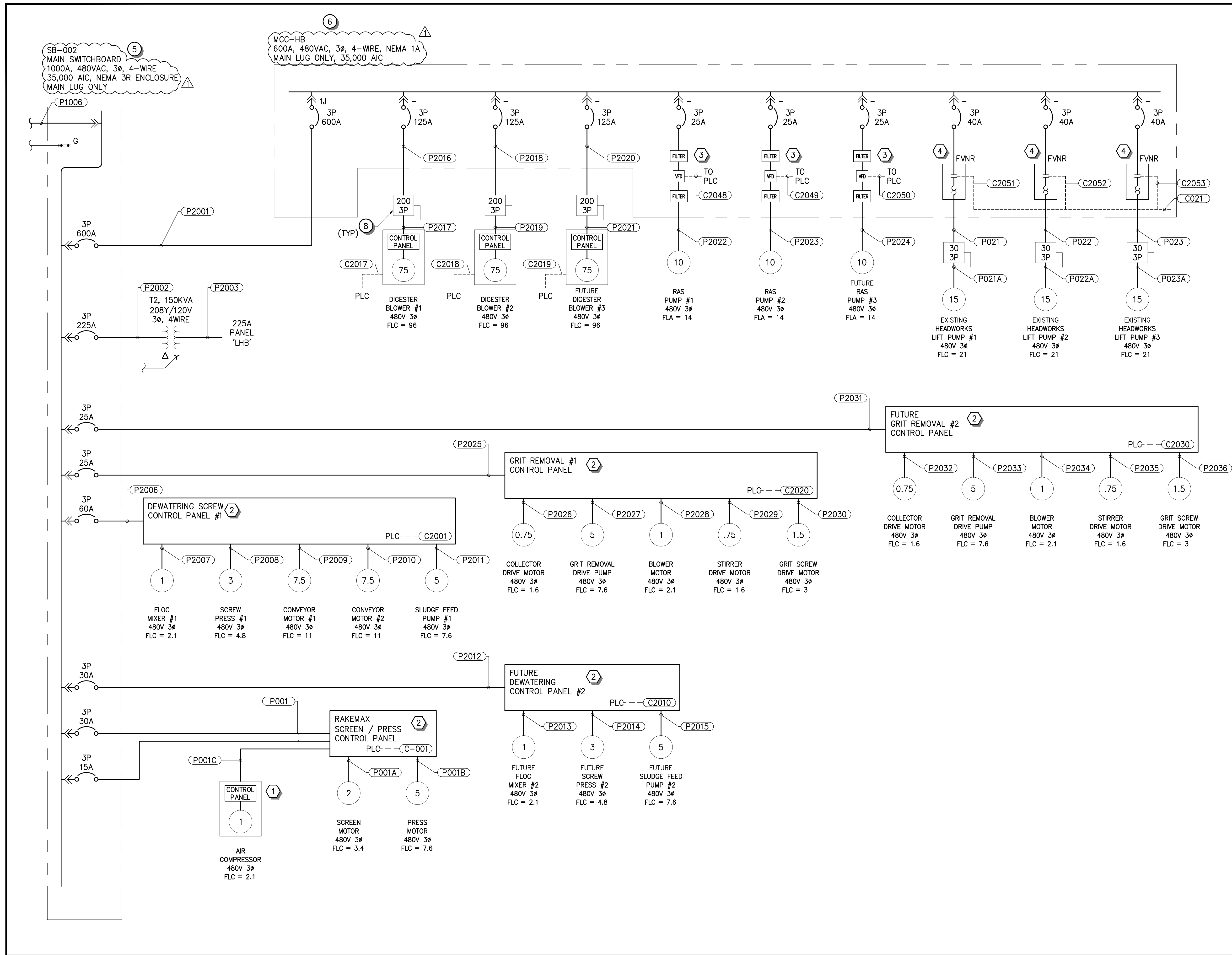
SHEET NOTES:

1. THE CONTRACTOR SHALL COORDINATE ALL WORK WITH OWNER PRIOR TO CONSTRUCTION.
2. THE CONTRACTOR IS RESPONSIBLE FOR ALL TRENCHING, BACKFILL, COMPACTION, AND THE INSTALLATION OF CONDUIT SHOWN AS NEW OR TO BE EXTENDED TO NEW EQUIPMENT LOCATION.
3. PROVIDE BONDING AND GREEN INSULATED GROUND FOR ALL ELECTRICAL ENCLOSURES PER LATEST EDITION OF NEC.
4. SOME CONDUITS SHOWN AS COMBINED FOR CLARITY. REFER TO CONDUIT SCHEDULE FOR CONDUIT QUANTITY, SIZE AND FILL.
5. (X) DENOTES ELECTRICAL EQUIPMENT. REFER TO DRAWING E210 FOR ELECTRICAL EQUIPMENT SCHEDULE.

KEY NOTES

- (1) VFDs BY SUPPLIER, WIRING BY CONTRACTOR. TYPICAL OF BNR BLOWERS. COORDINATE WITH CONDUIT SCHEDULE AND VENDOR DRAWINGS FOR CONNECTION DETAILS.
- (2) CONTROL PANEL BY EQUIPMENT VENDOR, INSTALLED BY CONTRACTOR.

2	ADDENDUM #4	2-7-23
1	ADDENDUM #3	2-3-23
REV NO.	COMMENT	DATE
REGISTERED PROFESSIONAL ENGINEER 23-Dec-2022 No. 362066 J. RANDALL KNAPP STATE OF UTAH SUNRISE ENGINEERING 6875 SOUTH 900 EAST SALT LAKE CITY, UTAH 84047 TEL 801.523.0100 · FAX 801.523.0990 www.sunrise-eng.com		
MOUNTAIN GREEN SEWER IMPROVEMENT DISTRICT		
BNR WWTP 2022		
ELECTRICAL ONE-LINE DIAGRAM		
DESIGNED S08242	DRAWN JRK	CHECKED JRK
SHEET NO. 163 of 249	E-202	



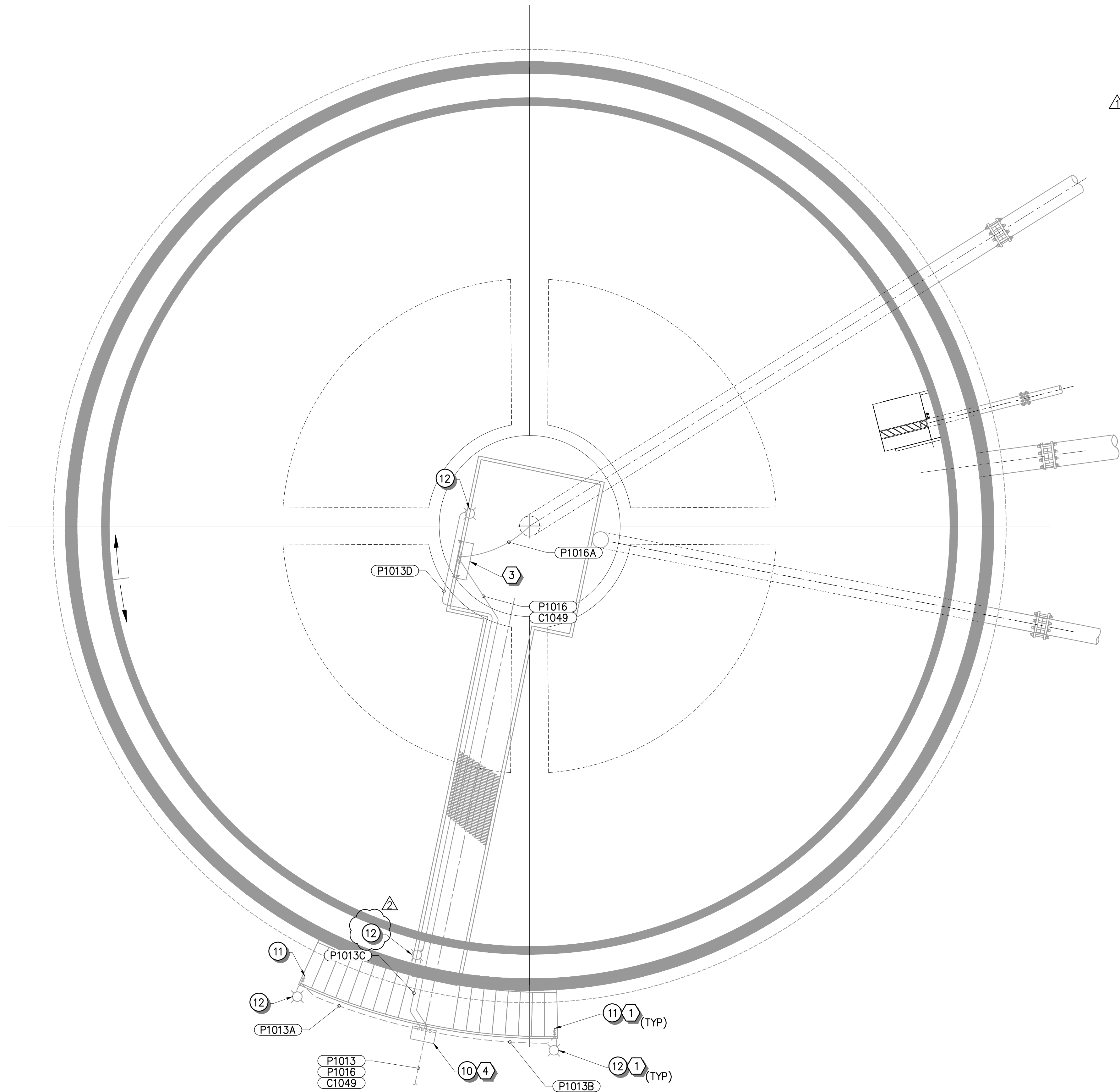
SHEET NOTES:

1. THE CONTRACTOR SHALL COORDINATE ALL WORK WITH OWNER PRIOR TO CONSTRUCTION.
2. THE CONTRACTOR IS RESPONSIBLE FOR ALL TRENCHING, BACKFILL, COMPACTION, AND THE INSTALLATION OF CONDUIT SHOWN AS NEW OR TO BE EXTENDED TO NEW EQUIPMENT LOCATION.
3. PROVIDE BONDING AND GREEN INSULATED GROUND FOR ALL ELECTRICAL ENCLOSURES PER LATEST EDITION OF NEC.
4. SOME CONDUITS SHOWN AS COMBINED FOR CLARITY. REFER TO CONDUIT SCHEDULE FOR CONDUIT QUANTITY, SIZE AND FILL.
5. (X) DENOTES ELECTRICAL EQUIPMENT. REFER TO DRAWING E210 FOR ELECTRICAL EQUIPMENT SCHEDULE.

KEY NOTES

1. AIR COMPRESSOR REQUIREMENTS TO BE DETERMINED. COORDINATE WITH ENGINEER PRIOR TO CONSTRUCTION FOR ADDITIONAL REQUIREMENTS.
2. CONTROL PANEL BY EQUIPMENT VENDOR, INSTALLED BY CONTRACTOR.
3. VFD TO BE INSTALLED IN MCC. MOTOR CONTROLS SHALL INCLUDE: HOA SWITCH, SPEED POT, DISCRETE INPUTS FOR START/STOP, DISCRETE OUTPUTS FOR RUN STATUS, FAILURE ALARM, RUN STATUS, VFD ALARM, VFD FAULT, 4-20mA INPUT FOR SPEED SETTING, 4-20mA OUTPUT FOR SPEED REFERENCE, ETHERNET PORT FOR CONNECTION TO SCADA SYSTEM
4. FVNR STARTER TO BE INSTALLED IN MCC. MOTOR CONTROLS SHALL INCLUDE: HOA SWITCH, DISCRETE INPUTS FOR START/STOP, DISCRETE OUTPUT FOR HAND, RUNNING, OVERLOAD ALARM, HI TEMP, MOISTURE, ETHERNET PORT FOR FUTURE CONNECTION TO SCADA SYSTEM.

1	ADDEMDUM #4	2-7-23
REV. NO.	COMMENT	DATE
REGISTERED PROFESSIONAL ENGINEER 23-Dec-2022 No. 362066 J. RANDALL KNAPP STATE OF UTAH SUNRISE ENGINEERING 6875 SOUTH 900 EAST SALT LAKE CITY, UTAH 84047 TEL 801.523.0100 · FAX 801.523.0990 www.sunrise-eng.com		
MOUNTAIN GREEN SEWER IMPROVEMENT DISTRICT		
BNR WWTP 2022		
ELECTRICAL ONE-LINE DIAGRAM		
SEI NO. S08242	DESIGNED JRK	DRAWN JRK
CHECKED JRK	SHEET NO. 164 of 249	E-203



SCALE
0 5' 10'
HORIZ: 1" = 5'

SHEET NOTES:

1. THE CONTRACTOR WILL BE RESPONSIBLE TO LOCATE ALL EXISTING UNDERGROUND UTILITIES BEFORE ANY EXCAVATION IS PERFORMED. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIRED TO NEW CONDITION OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
2. NOT ALL CONDUITS ARE SHOWN. REFER TO CONDUIT AND CONDUCTOR SCHEDULE FOR INDIVIDUAL CONDUIT FILL REQUIREMENTS. CONDUIT LAYOUT SHOWN IS DIAGRAMMATIC ONLY. CONTRACTOR SHALL FIELD ROUTE AS NECESSARY TO ACCOMMODATE FIELD CONDITIONS AND AVOID OTHER STRUCTURES AS REQUIRED.
3. REFER TO DRAWING E204–E208 FOR CONDUIT IDENTIFICATION.
5. (X) DENOTES ELECTRICAL EQUIPMENT. REFER TO DRAWING E210 FOR ELECTRICAL EQUIPMENT SCHEDULE.

KEY NOTES

- 1 PROVIDE AND INSTALL 3-WAY, WEATHERPROOF SWITCHES FOR CLARIFIER AREA LIGHTING. MOUNT SWITCHES AT EACH END OF STAIRWAY ON HANDRAIL. EACH SWITCH CALL BE CONFIGURED TO SWITCH ALL FIXTURES AT CLARIFIER. FIELD ROUTE CONDUITS P1055A–P1055D BASED ON SITE CONDITIONS.
- 2 LIGHT FIXTURE LOCATION. MOUNT FIXTURE ON 12' ROUND STEEL POLE AND SECURE TO RAILING WITH STAINLESS STEEL PIPE STRAPS. PROVIDE ALL CONDUIT, FITTINGS, MOUNTING HARDWARE AND ALL REQUIRED ACCESSORIES FOR A COMPLETE AND OPERABLE SYSTEM.
- 3 CLARIFIER CONTROL PANEL. CONTROL PANEL PROVIDED BY CLARIFIER EQUIPMENT SUPPLIER AND INSTALLED BY CONTRACTOR. INSTALL PER SUPPLIER RECOMMENDATIONS. COORDINATE EXACT MOUNTING LOCATION AND DETAILS WITH SUPPLIER PRIOR TO INSTALLATION.
- 4 ALL BURIED RIGID CONDUIT SHALL BE TAPE WRAPPED TO 4" ABOVE GRADE WITH 3M–50 10 MIL PIPE WRAP OR APPROVED EQUAL.
- 5 CONDUIT CALLOUTS SHOWN FOR CLARIFIER #1. REFER TO CONDUIT SCHEDULE FOR CONDUITS TO CLARIFIER #2 AND FUTURE CLARIFIER #3.

2	ADDENDUM #4	2–8–23
1	ADDENDUM #3	2–3–23
REV NO.	COMMENT	DATE

SUNRISE ENGINEERING
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MOUNTAIN GREEN SEWER IMPROVEMENT DISTRICT

BNR WWTP 2022

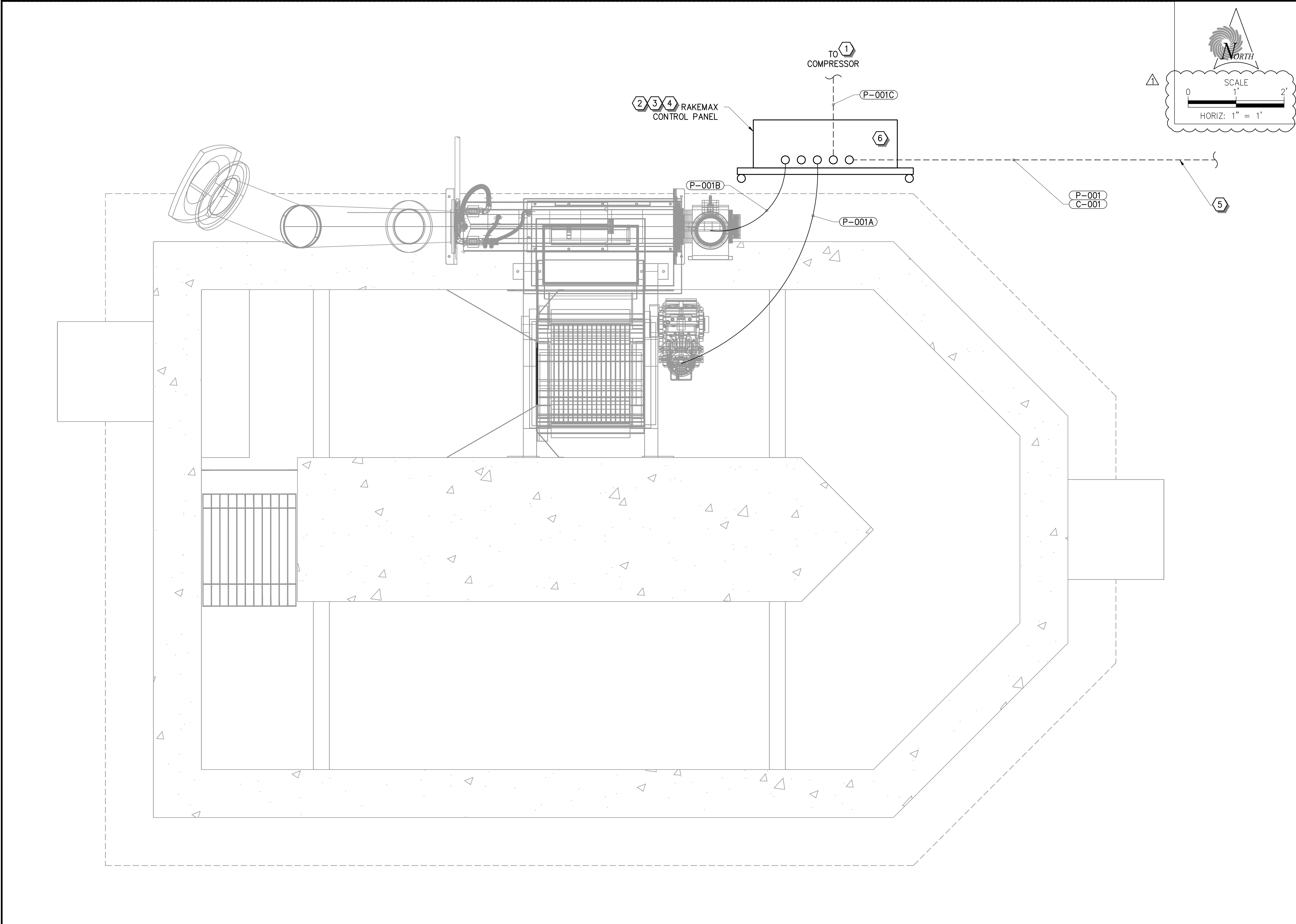
ENLARGED CLARIFIER ELECTRICAL PLAN

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	E-307
S08242	JRK	JRK	JRK	178 of 249	

A
~
1" = 5'

ENLARGED CLARIFIER ELECTRICAL PLAN (TYPICAL) (5)

Warning symbol: a triangle with an exclamation mark inside.



SHEET NOTES:

1. THE CONTRACTOR WILL BE RESPONSIBLE TO LOCATE ALL EXISTING UNDERGROUND UTILITIES BEFORE ANY EXCAVATION IS PERFORMED. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIRED TO NEW CONDITION OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
2. NOT ALL CONDUITS ARE SHOWN. REFER TO CONDUIT AND CONDUCTOR SCHEDULE FOR INDIVIDUAL CONDUIT FILL REQUIREMENTS. CONDUIT LAYOUT SHOWN IS DIAGRAMMATIC ONLY. CONTRACTOR SHALL FIELD ROUTE AS NECESSARY TO ACCOMMODATE FIELD CONDITIONS AND AVOID OTHER STRUCTURES AS REQUIRED.
3. REFER TO DRAWINGS E204-E208 FOR CONDUIT IDENTIFICATION.
5. (X) DENOTES ELECTRICAL EQUIPMENT. REFER TO DRAWING E210 FOR ELECTRICAL EQUIPMENT SCHEDULE.
6. AREA WITHIN A 10 FOOT ENVELOPE AROUND HEADWORKS EQUIPMENT AND OPEN CHANNEL IS A CLASS I DIVISION 2 HAZARDOUS LOCATION. ALL WIRING SHALL COMPLY WITH NEC 500.

KEY NOTES

1. COORDINATE LOCATION OF COMPRESSOR WITH ENGINEER PRIOR TO CONSTRUCTION.
2. RAKEMAX CONTROL PANEL. CONTROL PANEL PROVIDED BY CLARIFIER EQUIPMENT SUPPLIER AND INSTALLED BY CONTRACTOR. INSTALL PER SUPPLIER RECOMMENDATIONS. COORDINATE EXACT MOUNTING LOCATION AND DETAILS WITH SUPPLIER PRIOR TO INSTALLATION.
3. CLARIFIER CONTROL PANEL. CONTROL PANEL PROVIDED BY CLARIFIER EQUIPMENT SUPPLIER AND INSTALLED BY CONTRACTOR. INSTALL PER SUPPLIER RECOMMENDATIONS. COORDINATE EXACT MOUNTING LOCATION AND DETAILS WITH SUPPLIER PRIOR TO INSTALLATION.
4. ALL BURIED RIGID CONDUIT SHALL BE TAPE WRAPPED TO 4" ABOVE GRADE WITH 3M-50 10 MIL PIPE WRAP OR APPROVED EQUAL.
5. LOCATE AND INTERCEPT EXISTING GRINDER CONDUIT P-001 AND EXTEND TO HEADWORKS AREA. INSTALL CONDUCTORS IN EXISTING CONDUIT FOR SCREENING EQUIPMENT AND COMPRESSOR.
6. CONTRACTOR SHALL PROVIDE AND INSTALL CONDUIT AND CONDUCTOR TO FROM RAKEMAX CONTROL PANEL TO SCREEN/PRESS ACCESSORIES AT HEADWORKS LOCATION TO INCLUDE:
 - HEAT TRACE AMBIENT TEMP CONTRACTOR
 - (2) HEAT TRACING CIRCUITS
 - (2) E-STOP SWITCHES
 - (2) MOTOR HI-TEMP SWITCHES
 - (2) WASH SOLENOID VALVES
 - UPSTREAM LEVEL TRANSDUCER
 - DOWNSTREAM LEVEL TRANSDUCER
 - POSITION SWITCH
 - OVERTORQUE SWITCH

COORDINATE WITH EQUIPMENT VENDOR TO DETERMINE LOCATION OF EQUIPMENT.

1	ADDENDUM #4	2-8-23
REV NO.	COMMENT	DATE

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MOUNTAIN GREEN SEWER IMPROVEMENT DISTRICT

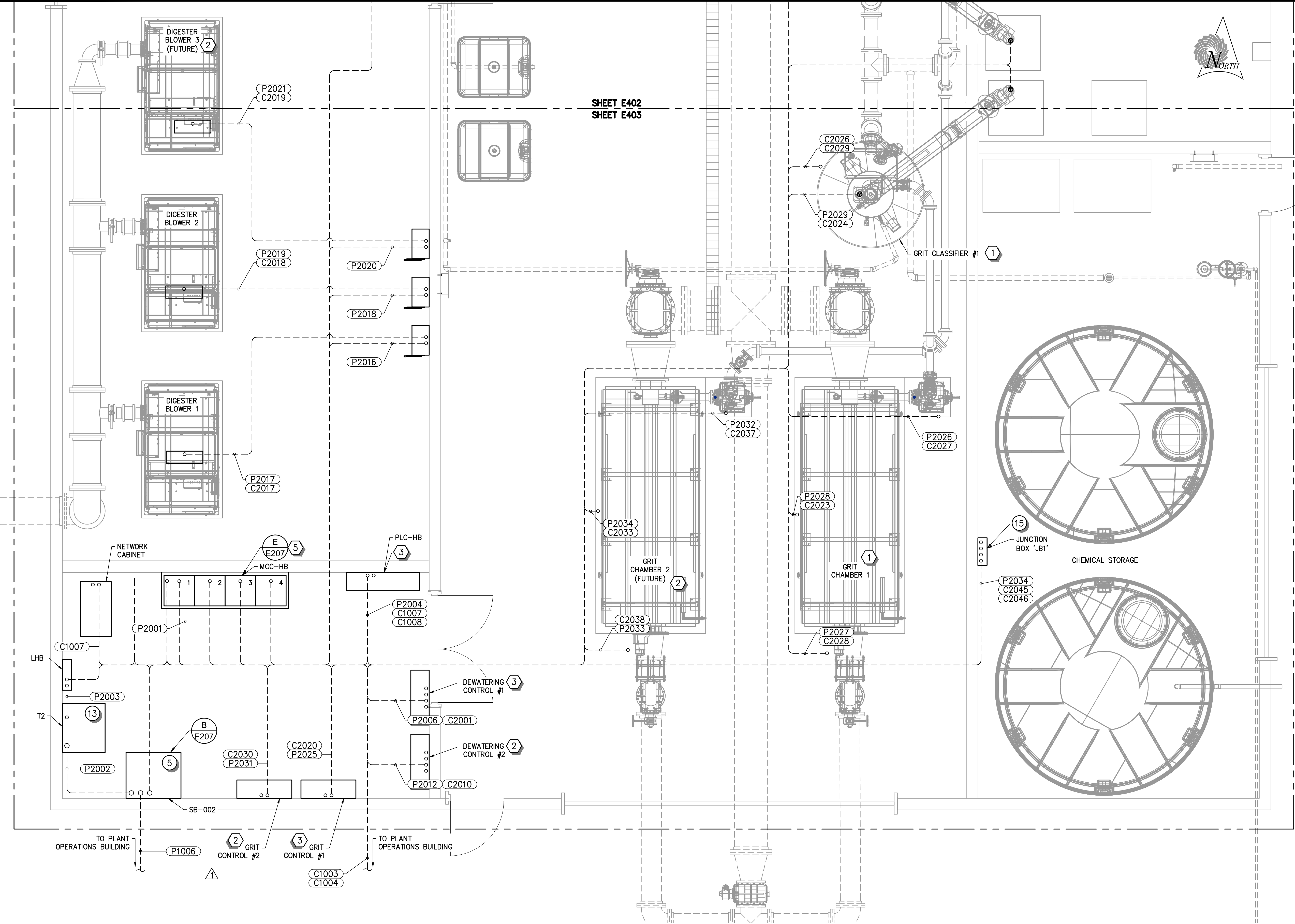
BNR WWTP 2022

ENLARGED HW VAULT PLAN

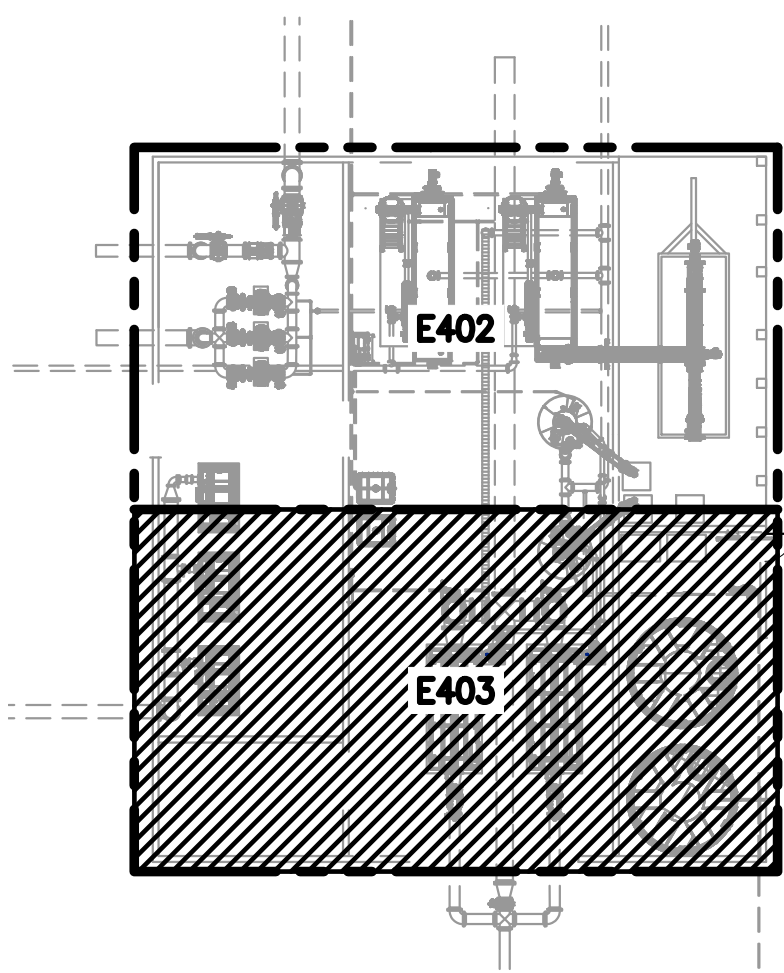
SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	E-308
S08242	JRK	JRK	JRK	179 of 249	

A
~
1" = 1'

ENLARGED HEADWORKS VAULT ELECTRICAL PLAN (TYPICAL)



SHEET E402
SHEET E403



KEY PLAN

SHEET NOTES:

- 1. CONTRACTOR TO COMPLY WITH GENERAL ELECTRICAL REQUIREMENTS ON DRAWING E100.
- 2. ALL CONDUITS ARE NOT SHOWN FOR CLARITY. REFER TO CONDUIT AND CONDUCTOR SCHEDULE FOR ADDITIONAL INFORMATION.
- 3. CONDUITS SHOWN ARE SCHEMATIC ONLY. CONTRACTOR SHALL FIELD ROUTE AS NECESSARY TO AVOID OBSTACLES AND OTHER EQUIPMENT.
- 4. REFER TO DRAWING E204-E208 FOR CONDUIT AND CONDUCTOR SCHEDULE.
- 5. REFER TO DRAWING E210 FOR ELECTRICAL EQUIPMENT SCHEDULE.
- 6. ALL CONDUCTORS SHALL BE ROUTED IN CABLE TRAY, CONDUIT SUSPENDED FROM CEILING, OR BE INSTALLED IN SURFACE MOUNTED CONDUIT. FLEX CONDUIT MAY BE USED TO STUB TO EQUIPMENT AS PERMITTED BY NEC.
- 7. VERIFY LOCATION OF EQUIPMENT SHOWN. COORDINATE WITH EQUIPMENT SUPPLIER FOR STUB UP LOCATIONS.

KEY NOTES

- 1 FOR ALL VENDOR SUPPLIED EQUIPMENT, COORDINATE CONDUIT STUB UP LOCATIONS WITH EQUIPMENT SUPPLIER PRIOR TO INSTALLATION.
- 2 FUTURE EQUIPMENT. STUB AND CAP CONDUIT FLUSH WITH FINISHED FLOOR FOR FUTURE USE AS SHOWN.
- 3 CONTROL PANEL PROVIDED BY EQUIPMENT SUPPLIER AND INSTALLED BY CONTRACTOR. COORDINATE WITH MANUFACTURER FOR ADDITIONAL REQUIREMENTS.
- 4 REFER TO SCADA AND INSTRUMENTATION PLANS FOR RTU EQUIPMENT DETAILS.
- 5 REFER TO CONDUIT SCHEDULE FOR MCC-HB CONDUIT DETAILS.

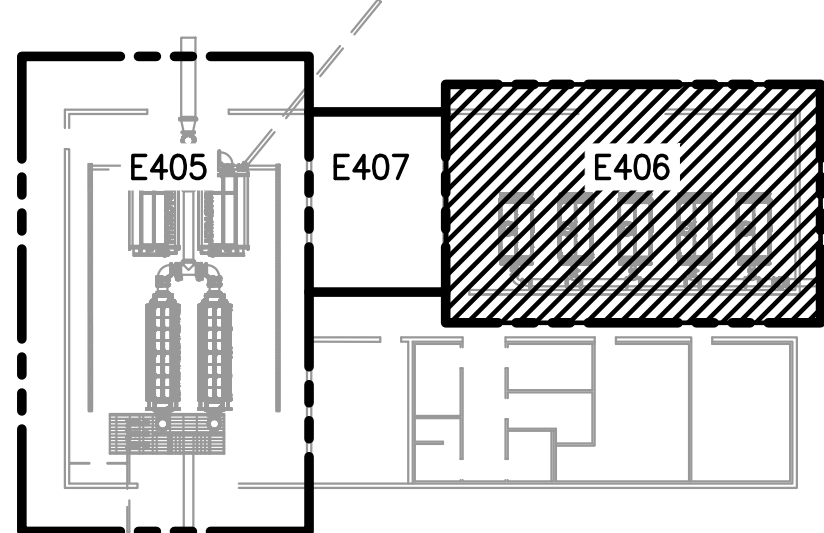
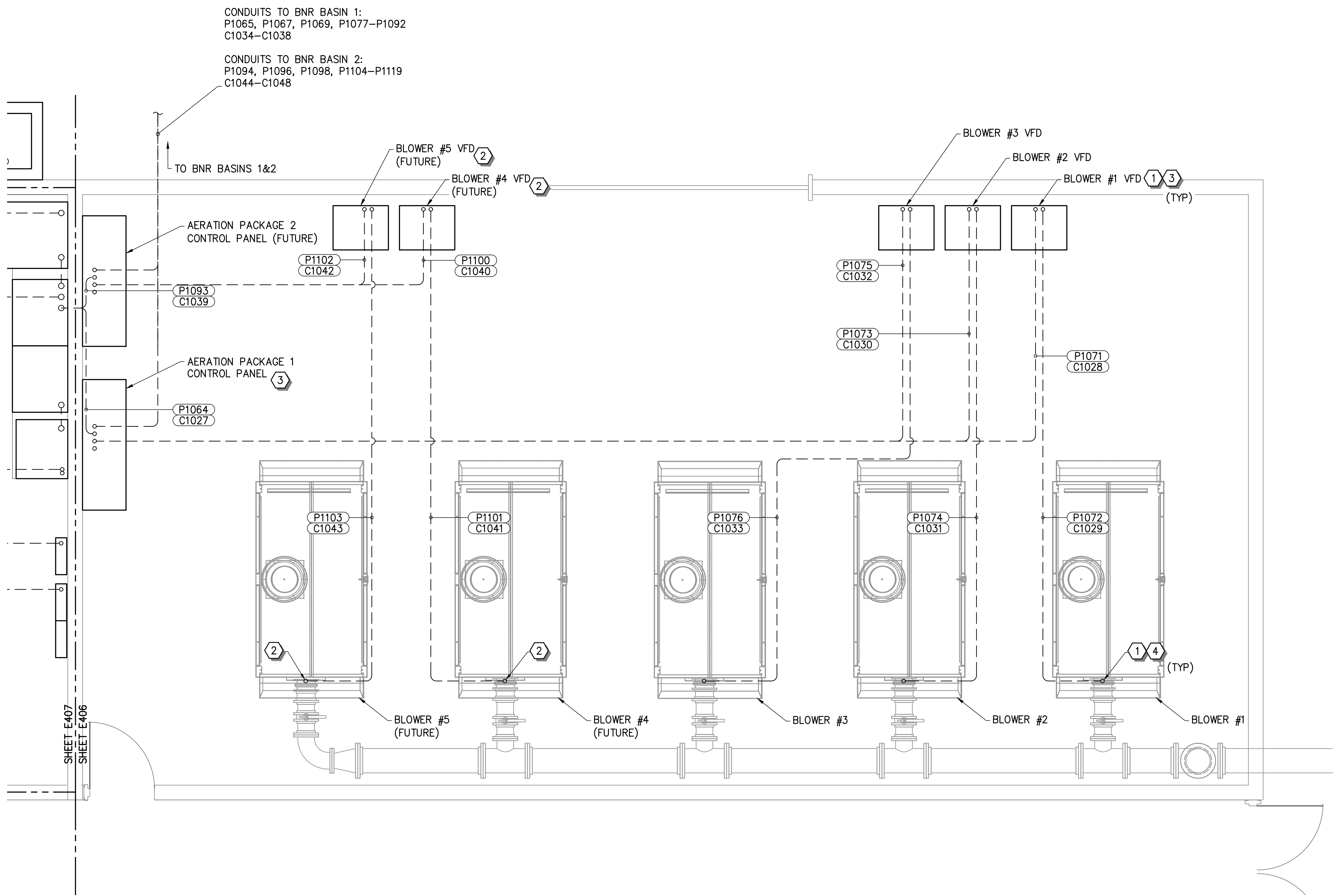
2	ADDENDUM #4	2-7-23
1	ADDENDUM #3	2-3-23
REV NO.	COMMENT	DATE

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MOUNTAIN GREEN SEWER IMPROVEMENT DISTRICT				
BNR WWTP 2022				
HP POWER AND CONTROL PLAN				
SEI NO. S08242	DESIGNED JRK	DRAWN JRK	CHECKED JRK	SHEET NO. 182 of 249
				E-403

B ENLARGED ELECTRICAL PLAN
~ 3/8" = 1' ~

P:\Mountain Green WWTP - Final Design\Electrical\dwg\Electrical HB Power & Control Plan.dwg Feb 09, 2023 2:12pm rknapp



KEY PLAN

SHEET NOTES:

1. CONTRACTOR TO COMPLY WITH GENERAL ELECTRICAL REQUIREMENTS ON DRAWING E100.
2. ALL CONDUITS ARE NOT SHOWN FOR CLARITY. REFER TO CONDUIT AND CONDUCTOR SCHEDULE FOR ADDITIONAL INFORMATION.
3. CONDUITS SHOWN ARE SCHEMATIC ONLY. CONTRACTOR SHALL FIELD ROUTE AS NECESSARY TO AVOID OBSTACLES AND OTHER EQUIPMENT.
4. REFER TO DRAWING E210 FOR ELECTRICAL EQUIPMENT SCHEDULE.
5. REFER TO DRAWING E204-E208 FOR CONDUIT AND CONDUCTOR SCHEDULE.
6. ALL CONDUCTORS SHALL BE ROUTED IN CABLE TRAY, CONDUIT SUSPENDED FROM CEILING, OR BE INSTALLED IN SURFACE MOUNTED CONDUIT. FLEX CONDUIT MAY BE USED TO STUB TO EQUIPMENT AS PERMITTED BY NEC.
7. VERIFY LOCATION OF EQUIPMENT SHOWN. COORDINATE WITH EQUIPMENT SUPPLIER FOR STUB UP LOCATIONS.

KEY NOTES

- 1 COORDINATE CONDUIT STUB UP LOCATIONS WITH EQUIPMENT SUPPLIER PRIOR TO INSTALLATION.
- 2 FUTURE EQUIPMENT. STUB AND CAP CONDUIT FLUSH WITH FINISHED FLOOR FOR FUTURE USE AS SHOWN.
- 3 ELECTRICAL PANEL PROVIDED BY EQUIPMENT SUPPLIER AND INSTALLED BY CONTRACTOR. CONTRACTOR TO PROVIDE ALL CONDUIT, FITTINGS, TERMINATIONS AND MOUNTING HARDWARE.
- 4 FIELD LOCATE BLOWER E-STOP SWITCHES PER MANUFACTURER RECOMMENDATIONS

B ENLARGED ELECTRICAL PLAN
~ 3/8" = 1' A

1	ADDENDUM #4	2-7-23
REV. NO.	COMMENT	DATE
REGISTERED PROFESSIONAL ENGINEER 23-Dec-2022 No. 362066 J. RANDALL KNAPP STATE OF UTAH SUNRISE ENGINEERING 6875 SOUTH 900 EAST SALT LAKE CITY, UTAH 84047 TEL 801.523.0100 • FAX 801.523.0990 www.sunrise-eng.com		
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POB POWER AND CONTROL PLAN		
SEI NO. S08242	DESIGNED JRK	DRAWN JRK
CHECKED JRK	SHEET NO. 185 of 249	E-406



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533 W 2600 S, Suite 25, Bountiful, UT 84010
(801)677-0011 www.skmeng.com

SCOPE OF SERVICES PROPOSAL

TO: Ian Hammond

DATE: November 22, 2022

FROM: Mark Taylor

RE: Mountain Green Sewer Improvement District WWTP Upgrade – System Integration Scope and Fee

We are pleased to present this proposal to provide System Integration Services for the MGSID WWTP Upgrade. This proposal has been broken up into the following sections: 1) Project Assumptions, 2) Proposed Scope of Services, and 3) Cost Breakdown. Please feel free to comment on the information presented as necessary.

1. Project Assumptions

The following assumptions have been made in the development of this proposal:

- HVAC, security (cameras), and fire systems will be provided by others
- For computer hardware, this proposal includes 1 SCADA server, 1 industrial computer (SCADA Client in the headworks building), and 1 workstation with dual monitors for the process building. No other computers are provided as part of this scope. NOTE: option for hot backup SCADA server is provided
- All electrical terminations will be provided by the electrical contractor
- Internet service connection to the plant will be provided by others
- All instrumentation will be provided by others
- SKM is providing two network racks and two PLC control panels. These will be mounted and installed by the contractor
- The proposal includes sales tax on all equipment and software

2. Proposed Scope of Services

Task 1. Project Management

1. Provide overall project management for a successful project including managing SKM staff, project communications, deliverables, and quality control.

Task 2. System Engineering

1. Design Headworks Building Plant PLC Control Panel (PLC-HW)
2. Design Process Control Building Plant PLC Control Panel (PLC-PB)
3. Submit Control Panel Engineering to engineer and client for review

Task 3. System Integration

1. Provide PLC programming for PLC-HW and PLC-PB

2. Provide HMI database programming and development for PLC-HW and PLC-PB, as well as all vendor provided PLCs
3. Provide HMI SCADA screens for PLC-HW and PLC-PB, as well as for all vendor provided PLCs. Develop a cohesive graphical user interface and review/revise with client and operations staff
4. Test HMI/SCADA with operations staff during commissioning
5. Perform initial hardware setup on PLC panels, network switches, SCADA servers and clients. Equipment will be tested at the shop before being delivered to the site

Task 4. Startup and Commissioning

1. Coordinate with vendors regarding data to be displayed on SCADA, and clarify security and control policies. Coordinate PLC to PLC communications where required
2. Coordinate with instrument supplier on scaling, and operational and alarm settings. Assist in troubleshooting when necessary
3. Setup network switches for a fully functional and secure network
4. Perform point to point IO checks on all points wired to PLC-HW and PLC-PB. Perform functional tests on all equipment controlled by PLC-HW and PLC-PB. NOTE: functional and IO tests on vendor provided equipment to be performed by vendor and contractor
5. Provide startup and commissioning services on processes controlled by PLC-HW and PLC-PB. Test and tune processes with operators. Coordinate with vendors, and verify vendor data on SCADA during commissioning phase
6. Install all network/server equipment in server racks, install SCADA clients

Task 5. O&M Manuals

1. Provide a complete O&M Manual. Include As-Built drawings, programming, and basic SCADA user manual

Task 6. Training

1. Train operators on PLC panel troubleshooting and drawings
2. Train operators on SCADA system: Monitoring, Control, Alarming, Notification, Trending, Reporting, and Remote Access. It is anticipated that plant staff will be involved in startup and commissioning- and will get hands on training during that phase. After commissioning, SKM will hold 3 or 4 training sessions using the O&M Manuals and the live SCADA system

Task 7. SCADA Equipment and Software

1. Provide SCADA Equipment and Software as shown in the Cost Breakdown

Task 8. PLC Panel Equipment

1. Provide PLC-PB (Process Building PLC panel). This panel is 36" wide, 72" tall, and 18" deep. NEMA 12, UL Listed. Provided IO:
 - a. 32 Digital Inputs
 - b. 16 Digital Outputs
 - c. 8 Analog Inputs
3. Provide PLC-HW (Headworks Building PLC panel). This panel is 36" wide, 72" tall, and 18" deep. NEMA 12, UL Listed. This panel has an industrial monitor mounted on the front. Provided IO:
 - a. 64 Digital Inputs
 - b. 16 Digital Outputs
 - c. 16 Analog Inputs
 - d. 4 Analog Outputs