

Mixed Waste Trenches 31/34 Leachate Tank Replacement Specification

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract 89303320DEM000030



P.O. Box 1464
Richland, Washington 99352

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F. Aguilar
Central Plateau Cleanup Company LLC (CPCCo)

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 **CPCCo**
Central Plateau
Cleanup Company
P.O. Box 1464
Richland, Washington 99352

APPROVED
By Kathryn Meinecke at 7:46 am, Jan 23, 2025

Release Approval

Date

DATE:
Jan 23, 2025



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PART 1 - GENERAL

1.1. DESCRIPTION / BACKGROUND

- A. The Mixed Waste Trenches 31/34 (MWT-31/34) are RCRA/WAC compliant radioactive waste landfills located in the 200W area of the DOE Hanford Site. They are rectangular in shape with an approximate capacity for 21,000 cubic meters of mixed waste each. The floors of both trenches slope at a minimum of 2 percent, each draining to separate recessed areas at the eastern end of the trenches. This is where the leachate collection sumps are located.

Each trench was constructed with a double liner and leachate collection and removal system. Pumps are provided in both the primary and secondary sump areas. There is also a “sewage-style” pump located in an access pit in the primary sump area. Collected leachate is pumped to RCRA/WAC compliant 10,000 gallon above-ground storage tanks with secondary containment. The leachate from these holding tanks is then pumped to tanker trucks for shipment to a treatment facility. These systems are approaching the end of their design life and require replacement.

- B. Design, furnish, install, test, certify, and place into service two replacement leachate temporary storage systems for the radioactive MWT-31/34.
1. Design of two (2) 12,500-gallon plastic leachate tank systems meeting the requirements of WAC 173-303-640 along with new instrumentation and control (I&C) equipment, and freeze protection. This is to include piping from the tanks to the existing crest wall pad, and pumps to transfer from the leachate tanks to the shipping tankers.
 2. Design of two (2) insulated enclosures for the tank systems and co-located I&C equipment.
 3. Design of concrete load-out pad extensions to allow the leachate shipping tankers to be loaded at the new tank location.
 4. Fabrication and procurement of all components necessary for installation of the new systems.
 5. Construction and installation of the new systems, structures, and necessary piping.
 6. Replacement of the existing sump pumps with pumps compatible with the new control systems.
 7. Tie-in of the existing electrical system to the new leachate systems while maintaining functionality at the existing tank systems.
 8. Cold testing and commissioning of the new systems while existing systems remain operational.
 9. Tie-in of the new system piping at the crest wall pad.
 10. Field commissioning of complete systems.
 11. Demolition, removal and disposal of the existing tanks and secondary containment systems.

- C. Install the leachate tank systems in accordance with the codes and standards in Section 2.31, *Applicable Publications*, along with other documents referenced throughout this specification.
- D. Throughout this specification, structures, systems, and components (SSC) may be referred to in the singular, I.E. tank instead of tanks, even though there are two separate leachate collection systems. This is to simplify language, given that the systems are to be identical. The contractor is to assume that whenever an SSC is referred to, the SSC shall be found in both leachate systems. Any questions on whether this applies to a particular SSC shall be referred to the Buyer.

1.2. SCOPE

- A. The scope for this project includes the design, review, procurement, construction, testing and commissioning of two new leachate tank systems (tanks, pumps, controls, enclosures) meeting the requirements of WAC 173-303-640 along with removal of the existing tank systems.

PART 2 - SPECIFIC REQUIREMENTS

2.1. DESIGN AND DRAWINGS

- A. The design process shall be in accordance with CPCC-PRO-EN-40271.
- B. The drawings listed below shall be provided for bid support purposes. The design contractor shall draft and submit new drawings to supersede the existing system drawings. The new drawings shall be drafted in accordance with CPCC-STD-EN-40279. The new drawings shall be submitted to the buyer for approval as part of the design submittals.
- C. The design shall be carried out by an Architect/Engineering firm with Registered Professional Engineers leading each discipline.
- D. The design shall be evaluated by a NACE or API certified corrosion expert for the purpose of verifying corrosion resistance per WAC-173-303-640. This expert may be a direct employee of the design Contractor.
- E. The contractor shall subcontract with an Independent Qualified Registered Professional Engineer (IQRPE) to assess the design, testing, and performance of the system per 173-303-640.

Doc Number	Sheet	Revision	DateEffective	Doc Status	OpsDesignation	SystemID	Baseline	Title
H-2-131585	002	06	1/27/2021 12:00:00 AM	Changing	Essential	BG-01	Yes	LEACHATE COLLECTION TANK & PIPING RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-31)
H-2-131585	001	13	1/19/2021 12:00:00 AM	Changing	Essential	BG-01	Yes	LEACHATE COLLECTION TANK & PIPING RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-31)
H-2-131586	001	06	3/18/1998 12:00:00 AM	Current	Essential	BG-01	Yes	SUMP PUMP INSTALLATION RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-31)
H-2-131586	002	00	3/18/1998 12:00:00 AM	Current	Essential	BG-01	Yes	SUMP PUMP DETAILS RMW LAND DSPL FACIL NON-DRAG-OFF (TR-31)
H-2-131587	002	09	3/6/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	ELECTRICAL - TANK & CONTROL BLDG RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-31)
H-2-131587	003	07	3/6/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	ELECTRICAL SITE PLAN RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-31)
H-2-131587	004	09	3/6/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	ELECTRICAL DETAILS RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-31)
H-2-131587	005	04	3/6/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	ELECTRICAL DETAILS RMW LAND DSPL FACIL NON-DRAG-OFF (TR-31)
H-2-131587	001	05	2/23/1998 12:00:00 AM	Current	None	BG-01E	Yes	ELECTRICAL - CONTROL RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-31)
H-2-818402	001	09	1/19/2021 12:00:00 AM	Changing	Essential	BG-01	Yes	LEACHATE COLLECTION TANK & PIPING RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-34)
H-2-818402	002	04	1/20/2021 12:00:00 AM	Changing	Essential	BG-01	Yes	LEACHATE COLLECTION TANK & PIPING RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-34)
H-2-818403	001	05	11/11/2014 2:52:47 PM	Current	Essential	BG-01	Yes	SUMP PUMP INSTALLATION RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-34)
H-2-818403	002	02	11/11/2014 3:03:27 PM	Current	Essential	BG-01	Yes	SUMP PUMP DETAILS RMW LAND DSPL FACIL NON-DRAG-OFF (TR-34)
H-2-818404	001	03	12/23/1997 12:00:00 AM	Current	Essential	BG-01E	Yes	ELECTRICAL - CONTROL RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-34)
H-2-818404	003	04	3/12/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	ELECTRICAL SITE PLAN RMW LAND DISPOSAL FACILITY NON-DRAG-OFF (TR-34)
H-2-818404	005	06	3/12/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	ELECTRICAL DETAILS RMW LAND DSPL FACIL NON-DRAG-OFF (TR-34)
H-2-818404	002	11	3/7/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	(TR34) ELECTRICAL PLAN - TANK & CONTROL BLDG
H-2-818404	004	11	3/11/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	ELECTRICAL DETAILS / PANEL SCHEDULES RMW LAND DISPOSAL FACILITY NON - DRAG - OFF (TR-34)
H-2-821550	001	04	3/7/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	PUMP CONTROL CIRCUIT ELEMENTARY DIAGRAM (TR-31)
H-2-821550	002	01	2/23/1998 12:00:00 AM	Current	Essential	BG-01E	Yes	PUMP CONTROL CIRCUIT ELEMENTARY DIAGRAM (TR-31)
H-2-821550	001	04	3/7/2024 12:00:00 AM	Current	Essential	BG-01	Yes	PUMP CONTROL CIRCUIT ELEMENTARY DIAGRAM (TR-31)
H-2-821550	002	01	2/23/1998 12:00:00 AM	Current	Essential	BG-01	Yes	PUMP CONTROL CIRCUIT ELEMENTARY DIAGRAM (TR-31)
H-2-821551	001	04	3/12/2024 12:00:00 AM	Current	Essential	BG-01	Yes	PUMP CONTROL PANEL LAYOUT TRENCH 31
H-2-821551	001	04	3/12/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	PUMP CONTROL PANEL LAYOUT TRENCH 31
H-2-821552	001	02	3/7/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	FLEM / CAB LAYOUT TR31-STEP4 MOTOR START CONTROL
H-2-821553	002	04	6/6/2013 12:00:00 AM	Current	Essential	BG-01	Yes	LEACHATE COLLECTION SYSTEM TR-31 P & ID
H-2-821553	001	09	1/19/2021 12:00:00 AM	Changing	Essential	BG-01	Yes	LEACHATE COLLECTION SYSTEM TR-31 P & ID
H-2-821556	001	08	1/20/2021 12:00:00 AM	Changing	Essential	BG-01	Yes	LEACHATE COLLECTION SYSTEM TR-34 P & ID
H-2-821556	002	04	6/6/2013 12:00:00 AM	Current	Essential	BG-01	Yes	LEACHATE COLLECTION SYSTEM TR-34 P & ID
H-2-821559	001	04	3/12/2024 12:00:00 AM	Current	Essential	BG-01	Yes	PUMP CONTROL PANEL ASSEMBLY TRENCH 34
H-2-821559	001	04	3/12/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	PUMP CONTROL PANEL ASSEMBLY TRENCH 34
H-2-821564	001	03	3/12/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	TR34-STEP4 MOTOR START CONTROL ELEM / CAB LAYOUT
H-2-821564	002	03	3/25/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	TRANSFER PUMP MOTOR STARTER CONTROL CABINET
H-2-821565	002	01	9/9/1999 12:00:00 AM	Current	Essential	BG-01E	Yes	PUMP CONTROL CIRCUIT ELEMENTARY DIAGRAM (TR-34)
H-2-821565	001	08	6/13/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	PUMP CONTROL CIRCUIT ELEMENTARY DIAGRAM (TR-34)
H-2-830312	001	04	3/12/2024 12:00:00 AM	Current	Essential	BG-01E	Yes	TEMPERATURE MONITORING PANEL ASSEMBLY TRENCH 34
H-2-830312	001	04	3/12/2024 12:00:00 AM	Current	Essential	BG-01	Yes	TEMPERATURE MONITORING PANEL ASSEMBLY TRENCH 34

2.2. HDPE PIPE

A. HDPE Materials shall comply with the following:

1. Specific Gravity, as determined by ASTM D 792:

0.94 minimum.

2. Carbon Black Content, as determined by ASTM D 1603:

2.0% minimum.

3. Melt Index, as determined by ASTM D 1238:

0.1 to 1.1 g per 10 min

B. HDPE pipe shall be manufactured from first quality polyethylene resin containing no more than 2% clean recycled polymer by weight. The pipe shall meet the requirements for specific gravity, carbon black content, and melt index described above. The pipe shall have uniform wall thickness and shall be free of holes, blisters, bubbles, undispersed raw materials, or any contamination by foreign matter.

C. Any joining or coupling of pipe sections shall be accomplished by extrusion welding or thermal butt fusion per ASTM F2620; no solvent or adhesive welding will be allowed. The pipe shall be bedded in such a way as to maintain grade and avoid crushing from the weight of any anticipated overlying soil, waste, and cover materials. All materials and techniques

shall comply with ASME/BPVC Section IX and ASTM F2620 and be approved by the Engineer prior to installing the HDPE pipe.

- D. All below-grade piping shall be double-walled with leak detection.

2.3. CONCRETE FORMWORK

A. REFERENCES

1. ACI 301 – Concrete Construction.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 347 – Guide to Formwork for Concrete
4. ANSI/ASME A17.1 - Safety Code for Elevators and Escalators
5. PS 1- Structural Plywood

B. PREFABRICATED FORMS

1. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
2. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

C. FORMWORK ACCESSORIES

1. Form Ties: Removable type, galvanized metal, fixed length, with waterproofing washer, free of defects that could leave holes larger than 1 in concrete surface.
2. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
3. Corners: Chamfer, wood strip type; 1x1 inch size; maximum possible lengths.
4. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

D. ERECTION - FORMWORK

1. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

2. Provide bracing to ensure stability of formwork Shore or strengthen formwork subject to over-stressing by construction loads.
3. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
4. Align joints and make watertight. Keep form joints to a minimum.
5. Obtain approval before framing openings in structural members which are not indicated on Drawings.
6. Provide chamfer strips on external corners of all walls and equipment pads.
7. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

E. APPLICATION - FORM RELEASE AGENT

1. Apply form release agent on formwork in accordance with manufacturer's recommendations.
2. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
3. Do not apply form release agent where concrete surfaces will receive protective paint which is affected by agent Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

F. INSERTS, EMBEDDED PARTS, AND OPENINGS

1. Provide formed openings where required for items to be embedded in passing through concrete work. Provide installation plans for embedded items.
2. Locate and set in place items which will be cast directly into concrete.
3. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
4. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
5. Install waterstops continuous without displacing reinforcement Heat seal joints watertight.
6. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

7. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

G. FORM CLEANING

1. Clean forms as erection proceeds, to remove foreign matter within forms.
2. Clean formed cavities of debris prior to placing concrete.
3. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
4. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to dean out forms unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

H. FORMWORK TOLERANCES

1. Construct formwork to maintain tolerances required by ACI 301.

I. FORM REMOVAL

1. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
2. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

2.4. REINFORCING STEEL

A. GENERAL

The cleaning, placing, spacing, bending and splicing of reinforcement shall conform to the applicable provisions of ACI 318 and the CRSI Manual of Standard Practice, unless otherwise shown on the Drawings.

B. REINFORCING BARS

All reinforcing bars shall be new, and shall be deformed bars conforming to ASTM A 615, Grade 60, epoxy coated in accordance with ASTM D3963.

C. WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A185, epoxy coated in accordance with ASTM D3963. Where the size, mesh and weight of the fabric are not indicated or specified otherwise, use 6 by 6 - W19 fabric.

D. FABRICATION AND CLEANING

Before the reinforcement is embedded in concrete, all loose rust, scale, and other objectional material likely to be found on reinforcing bars, such as paint, oil, grease, dried mud, and dried mortar, shall be removed by wire brushing, sand-blasting, wiping with burlap, or other effective means.

Reinforcement shall be accurately formed to the dimensions indicated on the drawings. All bars shall be bent cold. Reinforcement shall not be straightened or rebent. Bars with kinks or bends not shown on the drawings shall not be used. Heating or welding of the reinforcement shall not be permitted; except, bars may be flame cut to length.

E. PLACING

Reinforcement shall be accurately positioned and secured against displacement by using annealed iron wire ties (16 gage or heavier), or suitable clips, at intersections and shall be supported by concrete or metal supports, spacers, or hangers. In all cases, sufficient supports for horizontal reinforcement shall be used so that there will be no sagging of the bars. In slabs-on-grade, reinforcement shall be supported by means of precast mortar blocks. The blocks shall have a horizontal surface approximately 3 inches by 4 inches. The reinforcement in all other slabs and in beams shall be supported by means of metal chairs. Other details of reinforcement placement shall be shown on the Drawings. Rebar placement shall be inspected by qualified inspector prior to concrete placement.

2.5. STRUCTURAL CONCRETE

A. GENERAL

The Contractor shall furnish plant, labor and materials and perform all operations necessary to furnish, place and install concrete and appurtenances thereto necessary for construction of the cast-in-place concrete described in this Specification. In the event that concrete construction fails to conform to the requirements of this Specification, the Contractor may be required to repair or remove and replace said concrete in a manner satisfactory to the Buyer. Such repair or removal and replacement shall be performed by the Contractor at no additional expense to the Owner. When the Engineer rules that such repair or removal and replacement is required, he will notify the Contractor in writing, stating the extent of the repair or replacement to be made.

B. AGGREGATE

All aggregate shall be stone aggregate conforming to ASTM C 33; maximum size shall be 3/4-inch. Blast furnace slag shall not be used or permitted as a coarse aggregate.

C. CEMENT AND WATER

Cement, except as otherwise specified herein, shall be a brand of Portland Cement, approved by the Engineer, conforming to ASTM C 150 and shall be Type I or Type H. Only one brand of cement shall be used throughout the duration of this Contract. Water used for mixing concrete shall conform to ASTM C1602/C1602M-22.

D. ANCHOR BOLTS

Anchor bolts shall be either drilled or cast-in-place as shown on the plans.

1. Drilled anchor bolts shall be either resin adhesive, 316 stainless steel, Hilti Type HIT-HY or Wedge Type expansion anchor, 316 stainless steel, Hilti Type HKB TZ2.
2. Drilled drop-in type female expansion anchors shall be 303 stainless steel, Hilti Type HDI or equal.
3. Adjustable anchors for equipment shall be floating nut type which will allow at least 1/2-inch movement of the fastening stud. The fastening stud shall be 316 stainless steel. Adjustable anchors shall be DECO Manufacturing Co., Decatur, Illinois, Standard Anchor or equal.

E. BATCHING

Concrete shall be transit-mixed, supplied by a reputable local ready-mix company. Concrete shall be proportioned to provide a 28-day compressive strength of at least 3,000 psi. Amount of water used shall be that just required to produce a workable consistency. Slump shall be 4 inches or less. Increase cement content 20 percent if aggregate is batched by volume instead of weight unless calibrated containers are used in a manner to assure the proper weights of aggregates are used.

Concrete mixers may be stationary mixers or truck mixers, of a design acceptable to the Engineer. The mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. Mixing time shall be that necessary to completely and uniformly combine the ingredients to produce concrete without lumps or pockets of ingredients and without segregation of mixed ingredients. In no case shall mixing time be less than 1 minute after all ingredients (cement, aggregates, admixtures and water) have been placed in the mixer.

When stationary mixers are used, the Contractor shall maintain records of the amounts of the various materials entering each batch and the time of batching. When truck mixers are used, the Contractor shall submit a certified delivery ticket with each mixer-load. Said ticket shall

show the quantities of the various ingredients contained in the batch and the time of batching. Ready-mixed concrete, if furnished, shall be batched, mixed, and delivered to point of need in accordance with ASTM C 94, subject to the provisions of this Specification.

F. PLACEMENT

1. PREPARATION - Before placing the concrete, the Contractor shall remove all dirt, sawdust, loose tie wire, debris, ice, snow, and water from forms, trenches, and excavations. Earth surfaces upon which concrete is to be placed shall be clean, damp surfaces, free from frost, ice, and standing or running water. Concrete shall not be placed upon soft mud, dried porous earth, or upon fill that has not been subject to approved rolling and tamping until specified compaction has been obtained.

No concrete shall be placed until the Buyer's Engineer has given approval of the subgrade, forms, clean up, and reinforcing steel in place.

2. CONVEYING AND PLACING - Concrete shall be conveyed from mixer to forms as rapidly as practicable by methods which will prevent segregation or loss of ingredients. No addition of water to the concrete after discharge from the mixer to facilitate conveying, placing, or finishing shall be permitted.

3. CONSOLIDATION - During and immediately after placing, concrete shall be worked into the corners and angles of the forms and around all reinforcement and embedded items without permitting the materials to segregate. The Contractor shall provide a sufficient number of vibrators so that consolidation can be started immediately after the concrete has been deposited in the forms. Concrete shall be deposited as close as possible to its final position in the forms. The depositing of concrete shall be monitored so the concrete may be effectively compacted with a minimum of lateral movement. Concrete shall be consolidated with the aid of mechanical vibrating equipment supplemented by hand spreading and tamping.

Vibrators shall not be used as a means of moving concrete to a desired placement area; this action shall be accomplished by correct initial placement augmented by the use of hand shovels. Vibrating equipment shall be of the high-frequency internal type and shall at all times be adequate to properly consolidate all concrete. Vibration shall be applied at the point of deposit and uniformly throughout the freshly placed concrete.

G. FINISHING

All unformed surfaces shall receive a float finish. Floating shall be accomplished by either wood or metal floats or by a finishing machine. After the concrete has been properly placed, vibrated, and roughly leveled, it shall be screeded off to the proper elevation. All coarse aggregate shall be pushed below the surface. After screeding and tamping of coarse aggregate, the surface shall be made uniform by means of bull floats operated with a horizontal motion. After floating, the surface shall be tested for uniformity by use of a

straightedge. Use of neat cement to absorb excessive surface water is prohibited. No hard trowel or broom finishes will be required. Finished surfaces shall conform to the lines and grades shown on the Buyer-approved design within the following tolerances:

1/8 inch for abrupt irregularities

1/4 inch in any 10 feet

3/8 inch in any 20 feet

3/4 inch in any 40 feet or more

The Contractor shall be held responsible for fully protecting all finished concrete surfaces from any damage which will leave such finished surface in a condition unsuitable for its intended use, as determined by the Engineer.

H. INSPECTIONS AND SUBMITTALS

Concrete reinforcement shall be inspected and approved prior to concrete placement. Concrete shall be tested by ACI-certified technician to have a minimum compressive strength of 4000 PSI at 28 days and results provided as a Submittal. Inspections shall be conducted by ACI-certified Reinforced Concrete Special Inspector. Other documentation shall be submitted as required by MSR and SOW.

2.6. METAL FABRICATION

A. STRUCTURAL STEEL

All structural steel shall conform to ASTM designation A36. All welding of structural steel shall conform to Structural Welding Code D1.1.

B. STAINLESS STEEL

Unless otherwise specified or approved, all miscellaneous metal parts, including anchor bolts, which are labelled stainless steel shall be Type 316 stainless steel.

C. FABRICATION AND INSTALLATION

The Contractor shall fabricate, paint and install all miscellaneous metal work as shown on the Buyer-approved drawing and submittals.

2.7. LEACHATE PUMPS

A. PRIMARY AND SECONDARY LEACHATE COLLECTION SUMP PUMPS

The pumps shall be of the model currently used unless a compelling reason to upgrade is presented to and approved by the Buyer. If approval to upgrade the pumps is given, then the following requirements apply. The submersible pumps for both primary and secondary leachate collection systems shall be identical. The pumps shall be constructed such that virtually all wetted parts are type 316 stainless steel, or other highly corrosion resistant materials. The pump and motor shall have bearings which permit the pump to be operated in continuous or intermittent service in the horizontal position. The external portions of the case shall be free of sharp edges or burrs which would damage the enclosing HDPE pipe, or which might prevent the free sliding of the pump along the enclosing pipe. The motors shall be wired to run on single phase 240-volt (3 wire) service.

B. VERTICAL RISER SUMP PUMP

The larger capacity sump pump to be replaced in the vertical riser is a high head submersible wastewater “sewage-type” pump. The pump shall be of the model currently used unless a compelling reason to upgrade is presented to and approved by the Buyer.

C. TRANSFER PUMP

The transfer pump used to move stored leachate from the leachate temporary storage tank to highway tank trucks shall be a horizontally mounted centrifugal type pump. All the wetted parts of the pump including the interior of the pump case and the impeller shall be epoxy coated to prevent corrosion. Motor shall be TEFC, 3 phase 230/460 Volt, 10 horsepower minimum.

2.8. ENCLOSURE BUILDING

A. DESIGN LOADS

The building must conform to ASCE 7 prescribed snow and wind loads as well as the live loads associated with the leachate tank, piping, pump, interior lighting, and electrical and control equipment, if any.

B. METAL BUILDING

Procure and install a pre-manufactured metal building with dimensions of approximately 24’x24’x30’H or as required to house the leachate tank, transfer pump, instrumentation and control equipment, and piping, while allowing enough space around the perimeter to safely perform maintenance on the equipment. The contractor may instead choose to design the building if this is deemed to be more cost-effective overall by the Buyer.

The building shall have at least one man-door and one roll up door for access. The metal building shall have a leak-free roof and shall be assembled in a neat and workman-like manner to eliminate unsightly gaps and fitment problems. The building shall be insulated,

and weather sealed. Built-in electric space heater(s) (Min 100 kW) shall be procured and installed by the Contractor to allow on-demand heating for personnel comfort.

The building finish shall be corrosion resistant; galvanized steel or aluminum or approved equal.

2.9. LEACHATE TEMPORARY STORAGE TANK

A. GENERAL REQUIREMENTS

1. Design and installation of 12,500-gallon plastic leachate tank system meeting the requirements of WAC 173-303-640 and ASTM D1998-21.
2. Tank and any other above-grade components where liquids may accumulate shall be insulated and provided with freeze protection.
3. Tank shall be double walled for secondary containment purposes.
4. Design drawings shall define the lifting points, anchor bolt locations, level indication, insulation, heat tracing, and other details.
5. Tank shall be provided with leak detection.

B. LEVEL INDICATOR ASSEMBLY

Provide a mechanical corrosion-resistant level indicator assembly.

2.10. PUMP CONTROL EQUIPMENT

A. GENERAL REQUIREMENTS

1. The exact locations and routing of wiring and cables shall be governed by structural conditions and physical interferences and by the location of electrical terminations on equipment.
2. Where job conditions require reasonable changes in approximated locations and arrangements, the Contractor shall make such changes without extra cost to the Buyer.
3. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The Buyer reserves the right to require minor changes in location of equipment prior to roughing in without incurring any additional costs or charges.
4. The Contractor shall review the existing site conditions and examine all design media for the various items of equipment to determine exact routing and final terminations for all wiring and cables.
5. All deviations from the Contract Documents must be approved in writing by the Buyer.

B. FUNCTIONAL OBJECTIVES

Each of the transducer/level sensor systems will have an LCD indicator on the front of the panel indicating the depth of water, in inches. All sump leachate pumps will be equipped with

ON/OFF switches and combination motor starters located in the enclosure building. These pumps will have panel mounted failure and run lights. The transfer pump will have an ON/OFF switch and combination motor starter located at the pump, without automatic shutoff (except thermal). The tank enclosure building will be provided with a rotating beacon on the roof, to be activated by a high tank level. Leachate flow will be monitored by an accumulating turbine meter on the discharge line.

C. REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. The equipment, materials, installation, and other work shall conform to all applicable regulations, standards, specifications, and codes which are current as of the date of the final inspection for this Contract, including, but not limited to, those which are established by the following sources:

1. Instrument Society of America (ISA).
2. American Petroleum Institute (API).
3. National Electrical Manufacturers Association (NEMA).
4. Occupational Safety and Health Administration (OSHA).
5. American National Standards Institute (ANSI).
6. Military Standards (MIL Standards).
7. National Fire Protection Association (NFPA).
8. Scientific Apparatus Makers Association (SAMA).
9. Institute of Electrical and Electronic Engineers (IEEE).
10. National Electrical Code (NEC).
11. Insulated Cables Engineers Associates (ICEA).
12. Local Power and Telephone Companies.
13. Local Authorities Having Jurisdiction (AHJ) over the work.

D. SUBMITTALS

Consistent with Section 2.29, the Contractor shall submit detailed drawings and detailed manufacturers' information describing the proposed control panel and associated devices. The installation shall be consistent with the logic presented on the final Buyer-approved drawings. The Contractor shall coordinate the work specified in these Sections so that a

complete instrumentation and control system for the facility will be provided and will be supported by accurate record drawings. The Contractor, or the Instrumentation Subcontractor, shall prepare and submit through the Contractor, complete and organized installation drawings, as specified herein. Interface between instruments, motor starters, control valves, variable speed drives, flow meters, chemical feeders and other equipment related to the instrumentation and control system shall be included in the drawing submittal.

The contractor shall prepare and submit record drawings, spare parts list, and O&M Manual in accordance with Section 2.29.

E. GENERAL

1. All meters, instruments, and other components shall be the current models marketed by their manufacturers at the time of submittal of the installation drawings unless otherwise approved to interface with existing equipment. Obsolete equipment shall not be used even if new.
2. All panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be of one manufacturer.
3. All instrumentation shall be suitable for operation in the ambient conditions at the equipment installation locations. Heating, cooling, and dehumidifying devices shall be incorporated with the outdoor instrumentation to maintain it within its rated environmental operating ranges. The Contractor shall furnish and install all power wiring for these devices (e.g., heaters, fans, etc.). NEMA rated enclosures suitable for the environment shall be furnished.
4. All instrumentation in hazardous areas shall be intrinsically safe and shall be approved for use, in design review, or prior to installation, in the particular hazardous (classified) location in which it is to be installed.
5. Analog measurements and control signals shall be electrical as indicated herein and shall vary in direct linear proportions to the measured variable, except as noted. Electrical signals outside control panel(s) shall be 4 to 20 milliamperes dc except as noted. Signals within enclosures shall be 1-5 volts dc. Dropping resistors shall be installed at all field side terminations in the control panels to ensure loop integrity.
6. All power supplies shall have an excess rated capacity of 40 percent.
7. The power source or branch supply to each control and analog loop shall be individually fused and disconnectable.

F. GENERAL INSTRUMENTATION ENCLOSURE COMPONENTS

1. Signal Isolators, Converters, and Power Supplier: Signal isolators shall be furnished and installed in each measurement and control loop, wherever required, to ensure adjacent component impedance match, or where feedback paths may be generated, or to ensure system integrity thereby allowing any signal receiving component to be removed without disabling the entire loop. Signal converters shall be included where required to resolve any signal level incompatibilities. Signal power supplies shall be included, as required by the manufacturer's instrument load characteristics, to ensure sufficient power to each loop component.
2. General Purpose Relays: General purpose relays in the Control Board(s) shall be plug-in type with contacts rated 10 amps at 120 volts AC. Quantity and type of contacts shall match the Buyer-approved drawings. Each relay shall be enclosed in a clear plastic heat and shock resistant dust cover with an LED indication of relay actuation. Sockets for relays shall have screw type terminals. Relays shall be ABB type CR-U, IDEC type RH or RR, Potter and Brumfield Type KRP or KUP, Square D Type KP or KU, or approved equivalent.
3. Time Delay Relays: Time delay relays shall be pneumatic on-delay or off-delay type with contacts rated 10-amperes at 120-volts. Units shall include adjustable dial with graduated scale covering the time range in each case. Time delay relays shall be Dayton 1EGC7, IDEC RTE, Agastat SSC, or approved equivalent.
4. Slave Relays: Additional relays (slave relays) shall be installed and wired when the number or type of contacts shown exceed the contact capacity of the specified relays and timers.
5. Selector Switches: Selector switches shall be of the rotary type with the number of positions as shown on the Buyer-approved Drawings. Color, escutcheon engravings, contact configurations and the like shall be as shown. Devices shall be IDEC type AS, Eaton Cutler-Hammer Type 10250T, General Electric Type CR104, or approved equivalent.
6. Pushbuttons and Indicating Lights: Pushbuttons and indicating lights shall be round configuration. Indicating lights shall be push-to-test. Details including colors, engraving, contacts and the like shall be as shown on the submittal. Devices shall be ABB, Square D, IDEC, Eaton Cutler-Hammer, General Electric, or approved equivalent.
7. Circuit Breakers: Circuit breakers shall be single pole, 120-volt, 15 amp rating or as required to protect wires and equipment and mounted inside the panels as shown.
8. Terminal Blocks: Terminal blocks shall be molded plastic with barriers and box clamp terminals and shall be rated for 15 amps at 600 volts. White marking strips fastened securely to the molded sections, shall be provided and wire numbers or circuit identifications shall be marked thereon with permanent marking fluid. Terminal blocks shall be Siemens Type 8WH1000 (screw terminal, through-type terminal), Square D type NSYTRV, or approved equivalent.

9. Signal and Control Circuit Wiring:

- a. Wire type and sizes: Conductor shall be flexible stranded copper machine tool wire; these shall be UL listed Type MTW and shall be rated 600-volts. Wires for instrument signal circuits and alarm input circuit shall be No. 18 AWG. All other wires, including shielded cables, shall be No. 16 AWG minimum.
- b. Wire Insulation Colors: Conductors supplying 120-volts ac power on the line side of a disconnecting switch shall have a black insulation for the ungrounded conductor. Grounded circuit (Neutral) conductors shall have white or gray insulation. Insulation for ungrounded 120-volt ac control circuit conductors shall be red. All wires energized by a voltage source external to the Control Board(s) shall have yellow insulation. Insulation for all dc conductors shall be blue.
- c. Wire Marking: Each signal, control, alarm, and indicating circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal using white numbered wire markers which shall be vinyl cloth, self-adhesive, permanently polyolefin or approved equivalent method.

G. ALARM BEACON

Provide an amber strobe light suitable for outdoor installation.

H. ENCLOSURE

The control panels shall be enclosed in a NEMA TYPE 4X steel cabinet, 14-gauge steel construction: similar to Hoffman A-36H30BLP or approved equal. Sizing of the enclosure to be sufficient to contain all the necessary controls shall be the responsibility of the Contractor.

I. PANEL MOUNTED DEVICES

The lights and switches mounted on the panel front (the door) shall be 1 1/8 inch diameter: IDEC, Telemecanique or approved equal. Each panel mounted device shall have a label permanently affixed to the panel front which describes the device function or meaning. These labels shall be engraved laminated plastic or metal with cushioned adhesive backs.

J. TRANSDUCERS AND METER/CONTROLLERS

The level sensing transducers shall be constructed of 316 stainless steel with maximum diameter of 1.5 inches. The operating range shall be 0 to 6 psi with an accuracy not less than $\pm 0.5\%$ of full scale. The meter/controller shall have outputs from two relays, one adjustable to the "pump start" level and the second adjustable to the "pump stop" level.

Relays shall be adjustable over the full range of current. The meter/controller shall display the water level in inches; the indicator shall be mounted on the face of the control panel. The transducer shall be mounted in an external flush-joint semi-rigid plastic pipe (1" PVC threaded flush joint well pipe or equal) for insertion into the level sensor pipe.

K. FABRICATION AND INSTALLATION

The Contractor shall fabricate the control system as shown on the Buyer-approved drawings. The Contractor shall install the controls and perform all necessary field electrical work to connect the local and remote control devices.

L. CONTROL PANEL SIGNAL AND CONTROL CIRCUIT WIRING

1. Wiring Installation:

- a. All wires shall be run in plastic wireways except field wiring, wiring run between mating blocks in adjacent sections, wiring run from components on a swing-out panel to components on a part of the fixed structure, and wiring run to panel-mounted components. Wiring run from components on a swingout panel to other components on a fixed panel shall be made up in tied bundles. These bundles shall be tied with nylon wire ties and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.
- b. Wiring run to control devices on the front panels shall be tied together at short intervals with nylon wire ties and secured to the inside face of the panel using adhesive mounts.
- c. Wiring to rear terminals on panel-mount instruments shall be run in plastic wireways secured to horizontal brackets nm above or below the instruments in about the same plane as the rear of the instruments.
- d. Conformance to the above wiring installation requirements shall be reflected by details shown on the installation drawings for the Buyer's review.

2.11. PIPING AND PIPE FITTINGS

A. SECTION INCLUDES

All HDPE and stainless steel and other piping included in the leachate collection and removal system.

B. REFERENCES

All pipe materials and methods shall conform to applicable requirements of documents listed hereinafter. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.

ASME A13.1 Identification of Piping and Piping Systems

ASME B1.20.1 Pipe Threads, General Purpose (Inch)

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

ASME B31.1 Power Piping

ASTM A74 Cast Iron Soil Pipe and Fittings

ASTM A53 Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless

ASTM D1784 Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds

ASTM D1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120

ASTM D2241 Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR)

ASTM D2467 Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2564 Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings

ASTM D2683 Socket-Type PE Fittings for Outside Diameter-Controlled PE Pipe and Tubing

ASTM D3034 Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings

ASTM D3261 Butt Heat Fusion PE Plastic Fittings for PE Plastic Pipe and Tubing

ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AWWA C101 Standard for Thickness Design of Cast Iron Pipe

AWWA C104 Standard for Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings

AWWA C110 Standard for Gray Iron and Ductile Iron Fittings

AWWA C111 Standard for Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

AWWA C115 Standard for Flanged Cast Iron and Ductile Iron Pipe with Threaded Flanges

AWWA C151 Standard for Ductile Iron Pipe, Centrifugally cast

AWWA C200 Standard for Steel Water Pipe, Six Inches and Larger

AWWA C203 Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipe

AWWA C206 Standard for Field Welding of Steel Water Pipe

AWWA C207 Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4-inch through 144-inch

AWWA C210 Standard for Liquid Epoxy Coating and Linings for Steel Water Pipe

AWWA C606 Standard for Grooved and Shouldered Joints

AWWA C900 Standard for Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 60-inch

ASTM A888 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Applications

UPC (2024) Uniform Plumbing Code

C. SUBMITTALS

Submit manufacturer's material certification for stainless steel pipe along with any other submittals required per Section 2.29.

D. PART 2: PRODUCTS

1. PIPE

a. HDPE Pipe - See Section 2.2, HDPE Pipe.

b. Stainless Steel Pipe – All pipe identified on the Buyer-approved drawings as stainless steel shall be Schedule 40 Type 316 Stainless Steel, conforming to ASTM A312 and ATSM A403.

1. General

Pipe shall be handled and installed in accordance with AWWA M11. Welded joints shall be in accordance with AWWA C206 and the manufacturer's recommendations. All below-grade metallic piping and fittings shall be double-walled with leak detection and protected from corrosion on the external surface of the outer wall.

2. Pipe Welding

Pipe shall be welded by ASME-certified welders using shielded metal arc, gas shielded arc or submerged arc welding methods. Each welder's certifications shall be approved by the Buyer prior to that welder working on the job. Welds shall be in accordance with the requirements of ASME Boiler Code (Class 1) and API 1104.

E. INSULATION

Conform to Section 2.15 Tank and Piping Insulation.

F. ELECTRICAL HEAT TRACE

Conform to Section 2.27, Electrical Heat Trace.

G. FITTINGS FOR HDPE PIPE

All wetted surfaces of fittings shall be HDPE or Type 316 stainless steel, or other approved corrosion resistant material.

Standard fittings and special fittings shall be manufactured from the same class of material as the pipe is manufactured and fully compatible.

Fittings shall be manufactured in accordance with ASTM D2683 or ASTM D3261. Fabricated fittings shall be pressure rated to match the system piping.

H. FLANGE GASKETS

When connecting flanges requiring gaskets, 1/8" thick neoprene may be used.

I. HDPE COUPLINGS

Mechanical connections of polyethylene pipe to fittings or other materials shall be by means of flanged connections (flanged coupling adapters and ANSI backup rings rated for the same pressure service as the system piping), or flexible couplings designed for joining polyethylene pipe to polyethylene pipe or to another piping material as applicable.

Flanged joints shall use steel bolts. Gaskets shall be required when joining to non-polyethylene materials. In all cases, the bolts shall be evenly torqued using a crossing pattern to gradually tighten lug nuts. Flanged joints are to be retorqued after one hour or more has passed.

J. DISCHARGE FITTING

The discharge end of the transfer pump discharge piping shall be equipped with a quick disconnect fitting.

K. ACCEPTANCE TESTING

1. Pipe Testing: Contractor shall perform all tests specified. Provide all test equipment including test pumps, gauges, volumetric measuring equipment, and other equipment required. Pressure gauges used shall be graduated in increments not greater than 5 psi and shall have range of approximately twice test pressure. Use only gauges and instruments with current calibration. Where testing is specified, completed installation shall comply with designated requirements. Specific pipe test schedule is as follows:

PIPE TEST SCHEDULE

HDPE Sump Discharge Piping from Crest Pad to Tank: 25 psi (design pressure)

Stainless Steel Piping – all: 25 psi (design pressure)

General procedures are as follows:

1. General

Remove from systems, during testing, all equipment which would be damaged by test pressure. Replace removed equipment after testing. Systems may be tested in sections as work progresses; however, any previously tested portion shall become a part of any later test of composite system during final Acceptance Testing. Where new pipe connects to existing piping, the joint between the two pipes shall be leak tested under pressure. Correct leaks by remaking joints with new material; makeshift remedies will not be permitted. Test time will be accrued only while full test pressure is applied to system.

The Contractor shall be responsible for providing all temporary fittings, plugs and thrust blocking for all testing at the specified pressure.

Perform all testing before backfilling, concealing, insulating, or painting.

2. Liquid Systems

Leakage shall be zero for the exposed piping at the specified test pressure throughout the specified duration. Leakage from buried liquid piping systems shall be less than 0.05 gallon per hour per inch diameter per 100 feet of buried piping.

4. Drain Systems

Drain systems other than pumped drain systems shall be tested in accordance with Uniform Plumbing Code, latest edition.

B. Valve testing:

1. Test valve bonnets for tightness. Test operate valves from closed-to-open-closed position while valve is under pressure.

2. Test automatic valves by actuating from fully open to fully closed position.

L. CLEANING

1. Clean equipment and materials. Remove foreign materials including dirt, grease, and other matter.

2. Clean, by flushing, interior of water piping after pressure testing. Upon completion of flushing, completely drain systems at all low points; remove, clean, and replace all strainer baskets and refill systems, if appropriate.

2.12. PIPE AND CONDUIT SUPPORT SYSTEMS

A. DESCRIPTION OF WORK

This section specifies pipe and conduit hangers, brackets, supports. Pipe and conduit supports system shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, structural attachments, and other accessories as shown on the drawings and as specified herein.

B. SUBMITTALS

In accordance with the requirements of Section 2.29, submit the following project data:

- Manufacturer's technical data for all hangers, brackets, supports and documentation of conformance with appropriate standards and these specifications.

C. REFERENCES

All pipe and conduit support materials and methods shall conform to the latest, applicable requirements of documents listed hereafter. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.

ASME A13.1 Identification of Piping Systems

ASME B31.1 Power Piping

ASME Boiler and Pressure Vessel Code

ANSI/MSS SP-58 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

UPC Uniform Plumbing Code

D. GENERAL

The Contractor shall design, provide and install pipe and conduit support systems which include hangers, brackets, supports, anchors, expansion joints, and structural attachments. The support system shall be pipe rack, trapeze pipe hangers or individual pipe clamps, hangers and supports as specified herein and as shown on the drawings. The support system shall be designed in conjunction with the pipe and conduit to be supported.

It shall be the Contractor's responsibility to provide a complete system of pipe and conduit supports.

Where pipe transitions are required from one elevation to another, the Contractor shall field verify and adjust the pipe.

E. PIPE RACKS AND TRAPEZE HANGERS

Pipe and conduit racks and trapeze hangers shall be constructed of galvanized steel channels, rods, posts, post base, dampers, brackets, fittings and accessories for supporting pipes in equipment area. All components for pipe and conduit rack and trapeze shall be Unistrut or approved equal.

F. PIPE CLAMPS AND HANGERS

In area where pipe racks and trapezes are not used, pipe shall be supported with clamp hanger and stanchion saddle support system. The clamps and hangers shall be fastened to threaded rods hanging from structural attachments. Pipe supports shall be selected for the size and type of pipe to which they are applied. Strap hangers will not be acceptable. Threaded rods shall have sufficient threading to permit the maximum adjustment available in the support item. All pipe clamps and hangers shall be hot dip galvanized steel.

Pipe and conduit dampers and hangers shall be as manufactured by ITT Grinnell or equal.

G. STRUCTURAL ATTACHMENTS

Structural attachments shall be concrete insert channels or individual inserts for new concrete, surface mounted channel or individual inserts for existing concrete or where applicable, steel roof plate supported attachments in operations building, complete with all accessories required. All structural attachments including all accessories shall be hot dip galvanized steel and shall be provided by a single manufacturer. Structural attachments shall be, as manufactured by Unistrut Corporation or equal.

H. PROTECTION SADDLES

Protection saddles shall be used for protecting pipe insulation against damage at pipe supports or as shown on the drawings. The nominal thickness of covering shall be the same as that of pipe insulation. The protection saddles shall be curved carbon steel plate and shall be ITT Grinnell or equal.

I. DESIGN

Pipe or conduit support system shall be designed in accordance with applicable reference standards specified. Pipe and conduit supports shall be designed and selected to withstand seismic loads for IBC Site Class D and shall adhere to the following:

1. Weight balance calculations shall be made to determine the required supporting force at each pipe support location and the pipe weight at each equipment location. Design loads for inserts, clamps and other support items shall not exceed the manufacturer's recommended loads.
2. Pipe supports shall be able to support the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment. Allow clearances for pipe expansion and contraction.
3. Wherever possible, pipe attachments for horizontal piping shall be pipe clamps, or as shown on the drawings. Horizontal or vertical pipes should be supported preferably at locations of least vertical movement.
4. All pipe supports shall provide a means of vertical adjustment after erection.
5. Where practical, riser pipe shall be supported independently of the connected horizontal piping. Pipe support attachments to the riser piping shall be riser clamps.

J. INSTALLATION

Pipe support system shall be installed strictly in accordance with standards and codes referenced in Section 2.1.2.C and piping support system manufacturer's and piping manufacturer's recommendations.

In addition, all piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports.

Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper-plated. Those portions of pipe supports which contact other dissimilar metals shall be rubber or vinyl coated.

Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as required to force expansion and contract movement to occur at expansion joints, loops or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellows type expansion joints may be located adjacent to the joint

Pipe supports and expansion joints are not required in buried piping, but concrete thrust blocking or other approved anchorage shall be provided as indicated on the Buyer-approved drawings or specified in other sections.

2.13. VALVES

A. GENERAL

Section includes all valves used for control of water and air, gate valves, manual, electric, hydraulic, and pneumatic operators, epoxy coating, control units, and appurtenant work.

B. SUBMITTALS

Submit detailed manufacturer's information on all valves proposed for use, in accordance with Section 2.29.

C. GATE VALVES

All buried valves shall be of the inside screw type. Valves shall be capable of being repacked under line pressure. Quick opening valves shall have quick opening levers and cams in lieu of handwheel operators. All ferrous surfaces of the valves, 4-inch and larger, which will be in contact with water shall be epoxy-coated.

1. METAL-SEALED GATE VALVES (3-INCH AND LARGER)

a. Double Disc Type: Metal-sealed gate valves for water service shall conform to ANSI/AWWA C 500. Valves shall be of the double-disc type with non-rising stem, opening counter-clockwise, and provided with a 2-inch square operating nut or handwheel, as shown, except where electric, pneumatic, or hydraulic operators are shown. Valves shall have flanged or mechanical joint ends, to match pipe.

b. Solid Wedge Type: Gate valves for other than water service shall be of the iron-body, bronze-mounted, solid wedge type, otherwise conforming to the double-disc type specified in the previous paragraph.

c. Suppliers, or Equal:

- American Cast Iron Pipe Company;
- Clow Valve Company;
- Crane Company;
- Kennedy Valve Co.;
- Milwaukee Valve Company;
- Mueller Company;
- Stockham Valves and Fittings.

2. RESILIENT-SEALED GATE VALVES

a. Resilient-seated gate valves conforming to ANSI/AWWA C509 may be provided, in lieu of metal-seated double disc or solid disc gate valves. Resilient-seated gate valves

shall have cast iron bodies with flanged, bell, or mechanical joint ends, rubber-coated cast iron disc, flanged bonnet, bronze stem, o-ring seals, and operators with handwheel or square nut, unless otherwise shown.

- b. Suppliers, or Equal:
 - American Cast Iron Pipe Company;
 - Clow Valve Company;
 - Kennedy Valve Co.;
 - Mueller Company;
 - Stockham Valves and Fittings.

3. GATE VALVES (SMALLER THAN 3-INCH)

- a. Construction: Gate valves, smaller than 3-inch, for general purpose use shall be heavy duty type for industrial service, with screwed or soldered ends to suit piping. The bodies shall have screwed tops or union bonnets, of bronze conforming to ASTM B-62, with bronze stems, solid wedges, metal handwheels, and Teflon-impregnated or other acceptable packing. Buried valves shall have non-rising stems. Exposed valves (above ground) shall have rising stems. All valves shall have a minimum pressure rating of 125 psi steam, or 200 psi cold water, unless otherwise specified or shown.
- b. Suppliers, or Equal:
 - Powell Valves;
 - Crane Company;
 - Milwaukee Valve Company;
 - Stockham Valves and Fittings.

D. BUTTERFLY VALVES (AWWA)

1. General: Butterfly valves shall conform to ANSI/AWWA C504 subject to the following requirements. Flanged valves shall have 125-lb American Standard flanges, may be either short-bodied or long-bodied. Shaft seals shall be designed for use with standard split-V type packing, or other acceptable seal. The interior passage of butterfly valves shall not deviate from the nominal diameter by more than one inch nor shall it have any obstructions or stops.

2. Coating: All corrosive ferrous surfaces of valves, 4-inch and larger, which will be in contact with water, exclusive of flange faces shall be epoxy-coated.

3. Manual Operators: Operators shall conform to ANSI/AWWA C504, subject to the following requirements. All manually-operated butterfly valves shall be equipped with a handwheel and 2-inch square operating nut and position indicator.

4. Suppliers, or Equivalent:

- a. Rodney Hunt;

- b. De Zurik Corporation;
- c. Henry Pratt Company;
- d. Crane Company

4. Installation: All exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator.

E. VACUUM RELEASE VALVES

Provide vacuum release valves on discharge line of submersible pumps and the transfer pump discharge line at locations shown on the drawings. Connect to HDPE piping using service saddles. Connect to stainless steel pipe by direct tapping or other method approved by the Buyer. Valves to be constructed of corrosion resistant wetted parts.

F. SOLENOID DRAIN VALVE AND PIPING

Furnish and install an electric solenoid operated valve for back-draining of leachate to prevent freezing. Enclosure to be NEMA-4, wetted parts to be stainless or thermoplastic. Orifice size 3/8" minimum, 115VAC coil, use ASCO solenoid valve or approved equal. Tap HDPE pipe using type 101S saddle or approved equal. All connecting piping to be HDPE or type 316 stainless steel; all fittings to be type 316 stainless steel. Drain piping to be insulated but not heat traced.

G. SAMPLE COCKS

Furnish and install 1/2" NPT sample cocks, fabricated of type 316 stainless steel, on tank discharge piping as required by the Buyer-approved design. Sample cocks to be heat traced.

H. CHECK VALVES

Wetted parts shall be type 316 stainless steel, rubber, thermoplastic or other approved corrosion resistant material.

I. VALVE MARKING

Valves shall have stainless steel (SS) indented marker plates marked with the valve number, held in place with SS ties. Characters should be 3/16" in height minimum.

2.14. TURBINE METER

A. GENERAL

Section includes furnishing and installing one turbine meter for monitoring the accumulated leachate discharged to the leachate temporary storage tank.

B. PERFORMANCE

The turbine meter shall be capable of measuring the accumulated flow through the meter with an accuracy of $\pm 1.5\%$ at flow rates from 5 gpm to 160 gpm. A flow rate indicator is not required. End connections shall be flanged. Provide reducers and/or adaptors as necessary to mate with adjacent pipe.

C. MANUFACTURERS

Sensus or approved equal.

D. EXECUTION

Install the turbine meter in accordance with the manufacturers' recommendations.

2.15. TANK AND PIPING INSULATION**A. DESCRIPTION OF WORK**

Contractor to furnish and install insulation on leachate storage tanks, metallic discharge piping and transfer pump.

B. STANDARDS

Unicellular elastomeric thermal insulation shall conform to the requirements of ASTM C 534. Premolded fiberglass insulation shall conform to the requirements of ASTM C335. Calcium silicate insulation shall conform to the requirements of ASTM C533, and MIL-DTL-24244D.

C. SUBMITTALS

In accordance with the requirements of Section 2.29, submit the following project data:

- Manufacturer's product data and technical information
- Evidence or certification of compliance with the above standards

D. GENERAL

Piping insulation shall be tubular and prepared for simple installation. Insulation for vessels and appurtenances shall be in a form suitable for installation directly onto the equipment. Insulation shall include insulating material, protective jackets, flashing and other materials as required for a complete and vaporproof system.

E. INSULATION

A. Pipe Insulation: The pipe insulation shall be premolded fiberglass type in accordance with the required specifications: Minimum thickness shall be 2 inches.

B. Tank Insulation: Premolded fiberglass 3 inches thick, 3# board.

F. PROTECTIVE JACKET

1. General: A protective jacket shall be provided to prevent damage to the vapor barrier. Protective jackets shall be fabricated from aluminum or polyvinyl chloride (PVC) materials as specified.

2. Aluminum Jacket: Aluminum jackets shall be constructed of plain finish aluminum sheet conforming to ASTM B209, alloy 5005, temper H16, with integral vapor barrier.

The jackets shall be designed to provide a positive weatherproof seal along the entire length of the jacket.

Sheet metal screws shall be 6062-T6 aluminum, anodized 2024 aluminum or Type 300 or 400 series stainless steel of adequate strength. For outdoor service, all screws shall be pan-head and furnished with neoprene washers attached.

Strap fasteners for securing jacketing shall be made from aluminum or stainless steel.

3. Polyvinyl Chloride Jacket: The minimum jacket thickness shall be 60 mils. All PVC shall conform to ASTM D1784, Class 12454-B. Joint tape shall be vinyl, 10 mils thick. Fittings, valves, flanges, and other similar items shall be jacketed with 15 mils thick premolded PVC. PVC jacketing and tape shall be spray-coated to match PVC jacket color.

4. Shields: Shields for the protection of insulation at hangers and supports shall be 16-gage aluminum sheet, 9 inches long and formed into a half cylinder.

G. FLASHING

Flashing shall include aluminum caps, sealant and reinforcing as required. Aluminum cap shall be 0.020 inch thick and shall be cut to completely cover the insulation. Sealants insulation shall consist of manufacturer's adhesive.

Reinforcement, if required, shall be wire mesh or as recommended by the insulation manufacturer.

H. INSTALLATION

Installation shall be in accordance with the manufacturer's requirements and the above referenced standards. Insulation shall be applied over clean, dry surfaces with all joints butted firmly together. Aluminum jacket used for pipe exposed to weather shall be completely sealed for leak proof.

Insulation shall be provided with metal shields at each pipe support. Shield inside face shall be coated with insulation adhesives to prevent movement. No strapping will be required.

2.16. BASIC MATERIALS AND METHODS - ELECTRICAL

A. GENERAL

All materials and equipment shall be installed in conformance with the manufacturer's installation instructions and per NEC requirements.

B. PRODUCTS

1. All materials to be new, free from defects and not less than quality herein specified. Materials shall be designed to ensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

2. Each type of materials furnished shall be of the same make, be standard products of manufacturers regularly engaged in production of such materials and be the manufacturer's latest standard design.

3. All materials and equipment installed, including lighting fixtures, shall be listed by UL or other NRTL and shall be so labeled.

C. COMPLETE SYSTEMS

All the systems mentioned shall be complete in every detail and fully operational upon completion of the project unless specifically noted otherwise. Mention of certain materials in these specifications shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide complete and fully operational systems.

D. SUBMITTALS

Per Section 2.29.

1. Submittals are required for:

Raceways

Wire and Cables

Wiring Devices

Motor Controllers (Pump Control Panel, Motor Starters, Disconnect Means)

Motors

Power Service Equipment

Transformers

Panelboards

Lighting Fixtures and Ballasts

Wood Poles

Pushbutton Stations

Pullbox

E. NAMEPLATES

Provide permanently attached nameplates constructed of plastic laminated material engraved through white surface material to black sublayer. Nameplates shall indicate the equipment designation, voltage, number of phases and the name of the piece of equipment that provides the source of power.

Equipment with multiple power sources shall have a permanently attached nameplate constructed of plastic laminated material engraved through red surface material to white sublayer. Nameplate shall indicate "THIS ENCLOSURE CONTAINS X POWER SOURCES" where X refers to the number of power sources.

F. CUTTING CONSTRUCTION:

1. Obtain permission from the Buyer and coordinate with other trades prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.
2. All construction materials damaged or cut into during the installation of this work shall be repaired or replaced by the contractor with materials of like kind and quality as original materials.

G. EXCAVATIONS

1. Excavations shall not disturb or injure walls, footings or other property.
2. Remove all surplus earth not needed for backfilling and dispose of same as directed.

H. CLEAN UP

Contractor shall continually remove debris, cuttings, crates, cartons, etc., created during course of work. Such clean up shall be done daily and at sufficient frequency to eliminate

hazard to other workers, the building or the Buyer's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.

I. WORKMANSHIP AND OBSERVATION

All work and materials shall be subject to observation at any time by representatives of the Buyer.

J. EQUIPMENT CONNECTION

For equipment furnished under this or other Sections of the specifications, or by Buyer; provide and complete all electrical connections necessary to serve such equipment and provide required control connections to all equipment so that the equipment is fully operational upon completion of the project. The Contractor shall provide NRTL-listed disconnect switches and install per NEC.

K. INTERFACE WITH OTHER TRADES

The Contractor shall continually interface and coordinate the electrical work with the work of other trades.

L. WIRE NUMBERING

1. All field wiring, external to pre-manufactured panels and equipment, shall be numbered by the Contractor.

2. The Contractor shall submit a finished wire and conduit number schedule complete with conduit numbers and a functional description of the wires. The wire schedule shall indicate wire run number, number of wires, size of conductors, size of ground conductor, type of conductors, equipment the conductors originated from, the conduits the conductors are routed through, equipment the conductors feed, wire numbers, approximate wire length, and remarks. The conduit number should indicate the conduit number, size of conduit, conduit tubing type, wire run numbers within the conduit, and remarks.

M. EQUIPMENT SUPPORTS

Hangers and supports for raceways and electrical equipment shall be Unistrut with Unistrut conduit clamps or suitable devices. Split, and hinged rings shall be bolted to or interlocked with suspension rod.

N. TESTING DURING INSTALLATION

1. Continuity: Do continuity tests of every wire from instruments or sensing elements to readout or alarm device.

2. Resistance: Measure and record resistance reading between shield and ground for shielded cables in accordance with manufacturer's recommendations. Transfer the resistance reading to record submittals.

2.17. RACEWAYS

A. GENERAL

Provide all raceway systems complete and in conformance with code.

B. RIGID METAL CONDUIT (RMC)

1. Shall be hot dipped galvanized steel. Fittings shall be galvanized malleable iron or noncorrosive alloy threaded fittings compatible with galvanized conduit. Erickson couplings, watertight split couplings, similar to OZ Gedney permitted. Set screw and running thread fittings not permitted.

2. Provide 40 mil. PVC jacket where below grade.

C. LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)

Liquid Tight Flexible Metal Conduit. PVC weatherproof cover over flexible steel conduit.

D. GENERAL INSTALLATION

1. Provide raceways run below grade unless noted otherwise or unless specifically authorized by the Buyer.

2. Supports, bending, reaming, and threading of raceway shall conform with code.

E. RIGID METAL CONDUIT INSTALLATION

All connections shall be watertight.

F. LIQUID-TIGHT FLEXIBLE METAL CONDUIT INSTALLATION

Provide flexible raceway connection for isolation to motors, transformers and to all other equipment subject to vibration, (i.e. control equipment, such as solenoid valves, pressure controls, aquastats, pneumatic electric relays, etc.).

G. RACEWAYS UNDERGROUND

1. Shall be rigid galvanized steel with a 40 mil. PVC jacket. Repair abrasions with PVC base paint.

2. Arrange and slope raceways entering building to drain away from building.
3. Provide marker tape over all underground raceways. Marker tape shall read "Caution - Electric Line Buried Below" as manufactured by Terra Tape or accepted equal. Marker tape shall be installed 1'-0" below grade.
4. Install underground raceways a minimum of 24" below final grade unless otherwise noted or required.
5. Provide backfill around underground raceways. Use clean sand 12" above and below raceways. Backfill above 12" shall be free of debris or rocks greater than 1" in diameter. Raceways shall be spaced with 3" minimum between raceways.

H. RACEWAYS THAT STUB UP THROUGH FLOOR

Install at such depth that the exposed raceway is vertical, and no curved section of the elbow is visible.

I. SEALING OF RACEWAY PENETRATIONS

1. Exterior wall surfaces above grade: Provide watertight seal around all raceways. Use method acceptable to Buyer.
2. Roofs: Provide flashed and hot mopped weatherproof seal, or a pitch pan filled and sealed to be weatherproof where raceway penetrates roof membrane. Provide a weatherhead on all raceway stubups penetrating roof.

J. SEALING OF RACEWAYS

1. Provide watertight seal in the interior of all raceways which pass through building roof. Seal on the end inside the building, using raceway sealing fittings manufactured for the purpose. Seal poured type fittings with a non-hardening compound manufactured for such service.

K. PULL CORDS

In spare raceways, provide a nylon pull cord in those which are greater than 25 feet in length.

L. RACEWAY FILL

Raceways shall be sized per NEC Chapter 9 Tables. Size 1/2-inch minimum.

M. EXPANSION FITTINGS

Raceways crossing expansion joints shall be provided with an expansion fitting with bonding jumper.

N. CONDUIT MARKERS

Conduits shall have stainless steel indented marker plates, Panduit Corporation, catalog no. MMP350-C or approved equivalent, held in place with stainless steel cable ties catalog no. MLT4S-CP or approved equivalent. Characters shall be 3/16-inch high minimum, indented with metal indenting machine catalog no. MIM187 or approved equivalent.

O. CONDUIT CLEANING

Thoroughly swab out conduits to remove foreign material before pulling cables.

2.18. CONDUCTORS AND TERMINATIONS**A. GENERAL**

Provide all conductors, splices and terminations, complete.

B. CONDUCTORS

1. Copper, insulated for 600V. Aluminum or copper clad aluminum conductors not permitted.

2. General: All conductors to be type THHN/THWN-2. Type THWN or XHHW conductors may be utilized at Contractor's discretion, subject to code requirements. Conductors #8 and larger to be stranded. Higher temperature rating wiring for wet conditions shall be utilized per manufacturer's requirements.

3. Conductors shall be brought on site in original containers bearing the NRTL label.

4. Conductors shall be color coded as follows:

Color coding for 240/120-volt, single-phase systems:

- Grounded neutral white
- Grounding conductor green or bare
- Ungrounded conductor black
- Ungrounded conductor red

Color coding for 480Y/277-volt, three-phase systems:

- Grounded neutral gray
- Grounding conductor green or bare
- Phase "A" (ungrounded) conductor brown

- Phase "B" (ungrounded) conductor orange
- Phase "C" (ungrounded) conductor yellow

C. SPLICES

1. Above Grade: Solderless type only. Pre-insulated "twist-on" type (limited to size #10 and smaller). Bolt or compression set type with application of preformed insulated cover, heat shrinkable tubing or plastic insulated tape acceptable for all sizes.
2. Below Grade: Splices below grade shall be in handholes and shall be made watertight with epoxy resin type splicing kits similar to 3M Scotchcast or approved equivalent.

D. TERMINATIONS

1. Compression set, bolted or screw type lug or direct to bolted or screw type terminal.
2. Conductors #12 and smaller shall utilize eye or forked tongue type compression set terminator when termination is to a bolt or screw set type terminal block or terminal cabinet.
3. Terminations shall be suitable for cable size and type employed.

E. PLASTIC CABLE TIES

Nylon or equivalent, locking type.

F. WIRE MARKERS

Wire markers shall be imprinted tubular plastic type.

G. GENERAL INSTALLATION

Install all conductors in raceway unless shown or specifically authorized otherwise.
Install all splices and terminations in enclosures as required or shown.

H. CONDUCTOR SIZE

Number 12 AWG minimum for power and lighting circuits.

I. RACEWAY SIZES SHOWN ON DRAWINGS

Raceways (when shown) are to be sized for copper, type THHN, THWN, THWN-2 unless shown otherwise. Size all raceways per NEC unless specifically justified otherwise.

J. TAPING

If used, shall be half lapped synthetic tape.

K. CONDUCTORS IN PANELS AND SWITCHBOARDS

Conductors in panels and terminal cabinets shall be neatly grouped and formed in a manner to "fan" into terminals with regular spacing.

L. WIRE NUMBERING

Attach wire markers at each termination point within 2 inches of wire termination. Marker nomenclature shall be visible without moving the marker.

M. CABLE LUBRICANTS

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling cables. Cable lubricants shall be soapstone, graphite, or talc. Lubricant shall not be deleterious to the cable.

N. CABLE PULLING

Tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.

O. TERMINATIONS

Make terminations with materials and methods as recommended by the termination manufacturer.

P. FIELD QUALITY CONTROL

Perform general inspection on a minimum of 10% of wire terminations to verify proper lug size, acceptable crimps (per manufacturer's instructions and acceptance criteria), wire identification, wires landed at correct points and equipment, wires not damaged, and wires properly supported in panels.

Perform general inspection of cable pulling to verify correct wire size and type, correct routing, bending radius/pull tension per manufacturer's recommendations. Verify that cable is correctly identified and undamaged.

2.19. OUTLET, JUNCTION AND PULL BOXES

A. GENERAL DESCRIPTION

Provide outlet, junction and pull boxes as required to enclose devices, allow pulling conductors and for wire splices and branches.

B. INTERIOR WIRING

1. General: Outlet and pull boxes shall be pressed steel, zinc coated with plaster ring where applicable. Large junction and pull boxes shall be fabricated sheet steel, zinc coated or baked enamel finish, with return flange and screw retained cover.

2. Concrete and Masonry: Boxes for casting in concrete or mounting in masonry walls shall be specifically designed for that purpose.

C. EXTERIOR WIRING**1. Above Grade:**

Outlet and junction boxes shall be cast or malleable iron or shall be cast of corrosion resistant alloy, complete with conduit hubs, compatible with raceway to which it is connected. Pull boxes shall be fabricated of heavy gauge steel and hot dipped galvanized complete with malleable iron hubs. All boxes shall be labeled for damp or wet locations as applicable.

2. Below Grade:

Where exposed to earth, boxes (handholes) shall be constructed of precast concrete with size, configuration, cover, grates and reinforcing as required by the particular installation.

Manufacturer: Utility Vault, Oldcastle, Renton Concrete Products, or approved equivalent.

D. ANCHORING

All boxes shall be firmly anchored directly or with concealed bracing to building studs or joists. Boxes must be so attached that they will not "rock" or "shift" when devices are operated.

E. ELECTRICAL OUTLETS

1. General: Coordinate the work of this Section with the work of other Sections and trades.

2. Device Outlet Height: Measure from the finished floor to the center line, unless otherwise noted.

Switches: 42-48 inches, set vertically

Receptacles: 18-24 inches, set vertically or as indicated.

Other: As noted or as directed by Buyer or per code.

F. CONNECTION TO EQUIPMENT

For equipment furnished under this or other Divisions of the specifications, or by others; provide outlet boxes of sizes and at locations necessary to serve such equipment and provide final connections to all equipment. Outlet box required if equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring or requires a wire with insulation rating different from circuit wiring used. Study equipment details to assure proper coordination.

G. BLANK COVERS

Provide blank covers or plates over all boxes that do not contain devices or are not covered by equipment.

H. JUNCTION OR PULL BOXES

Pull and junction boxes shall be installed per design, or as necessary to facilitate pulling of wire and to limit the number of bends per NEC requirements. Boxes shall be permanently accessible and shall be placed only at locations approved by the Buyer.

2.20. SWITCHES AND RECEPTACLES

A. GENERAL DESCRIPTION

Provide all wiring devices and plates complete and fully operational.

B. MANUFACTURE

Product of nationally recognized manufacturer regularly engaged in manufacturing such products. Products shall be NRTL listed.

C. COLOR

Material color for switch handles and receptacle faces to be consistent.

D. SWITCHES

Heavy duty type, back and side wired, rated 277/120V, 20 amp. Pass & Seymour 20AC1, Bryant 4901, Hubbell 1221, Leviton 1221, Slater 720- AG, or approved equivalent.

E. RECEPTACLES

Duplex NEMA 5-15R configuration (15 amp, 120V) unless shown otherwise. Back and side wired. Receptacles – Hubbell HBL5262, Leviton CR15-W, or approved equivalent. Ground Fault Receptacles - Hubbell GFTWRST15ALU, Leviton AGTR1-132-HGW, or approved equivalent.

F. DEVICE PLATES:

1. Pressed steel sized to fit box.

2. Exterior: Duplex Receptacles Horizontal Mounting: Perfect Line WGF100-C, Leviton 4998-GY, or approved equivalent. Where horizontal mounting is not possible provide Duplex Receptacles Vertical Mounting: Perfect Line WGF100-CV, Hubbell 88658992, or approved equivalent.

G. MOUNTING

Rigidly fasten (without play) outlet boxes and devices at proper position with wall to bring receptacle flush with plate or switch handle the proper distance through plate. Devices and plates shall be aligned and plumb.

H. ORIENTATION

Set switches with handle operating vertically, up position "ON". Set receptacles vertically unless shown otherwise or construction requires horizontal mounting.

I. DEVICE PLATES

Provide for wiring devices. Plate shall cover cutout for device outlet box.

2.21. MOTOR CONTROLLERS

A. GENERAL DESCRIPTION

1. Work under this Section includes all requirements for motor controllers (starters). Motor controls shall conform to NEMA standards for each specific purpose and be NRTL listed.

2. The Contractor shall furnish and install motor controllers for all motors replaced as part of this design. All motors and motor controllers shall be complete and fully operational upon completion of the project.

B. SUBMITTALS

Verify motor sizes and voltages provided under other sections. Submit detailed information on proposed motor sizes, currents, voltages, motor disconnect means, and motor starter sizes in accordance with Section 2.29.

C. MOTOR STARTERS

1. Magnetic motor starters: Shall conform to or contain items called for below and unless noted otherwise, shall be full voltage non-reversing. No starters smaller than NEMA size 0 and no half size starters are permitted.

2. Overload devices: Shall be melting alloy or bimetallic type. One overload shall be provided for each phase. Provisions shall be made for resetting the overload devices from outside the starter enclosure. Provide ambient compensated overload devices only when the motor is at a constant temperature and the controller is subject to a separate, varying temperature. Automatic reset overload devices are not permitted.

3. Accessories: Each magnetic motor controller shall include phase loss protector, "ON-OFF" selector switch, 120 volt coil (unless noted otherwise), interlock contacts as required, two spare auxiliary interlock contacts and all other accessories required or noted.

4. Enclosures: All motor controllers shall be contained in NEMA 4 enclosures (combination motor starters).

D. MANUFACTURER

Allen Bradley, General Electric, Square D, Westinghouse, Cutler Hammer, Eaton or approved equivalent. Nameplates as per Section 2.16.E.

E. NAMEPLATES

Provide engraved phenolic nameplates. Permanently attach on each controller.

F. WIRING

Wiring shall conform to applicable sections of these specifications. Provide wiring from branch circuit overcurrent device to motor controller to motor terminals, including installation of starter and all connections. Provide raceway and conductors as shown for remote control, or interlock connections. Coordinate other control wiring with other Divisions of the Specifications. Provide overload elements in controllers sized to match motor nameplate full load amperes. Space within controllers shall not be used as a junction box.

G. MOUNTING

Securely mount to equipment, wall or acceptable mounting frame suitable to withstand earthquake forces. Controllers supported only by raceways are not acceptable. Securely mount enclosures to vertical mounting wall as shown on the final Buyer-approved drawings. Motor starter enclosure for transfer pump shall be mounted using Unistrut or other similar mounting hardware. Attach with 4 screws or bolts minimum, each.

2.22. ELECTRIC UTILITIES SERVICE AND POLES

A. GENERAL DESCRIPTION

1. Provide overhead service complete and operational. Existing overhead service is available at pole transformer for tapping into.

B. COORDINATION

1. Utility Poles shown on drawings are in approximate locations. Contact Electric Utilities (EU) of any concerns regarding proper location of poles. Contractor shall ensure utility poles have adequate clearance and do not interfere with existing poles in the area.
2. Contractor shall ensure utility equipment is installed at locations shown on the Buyer-approved Drawings with concurrence from EU.
3. All EU related equipment to be furnished and installed except for the Meter. EU to provide the Meter and make the tie-in to the existing utility transformer.

C. WOOD POLES

1. Poles shall be class 2 or 3. Poles shall be Western Red Cedar or treated Southern Yellow Pine cut from live stock and shall conform to ANSI Standard 5.1, Specifications and Dimensions for Wood Poles. All poles shall be air seasoned and butt treated in accordance with the American Wood Preservers' Association (AWPA) Standard C7. Poles not meeting ANSI 5.1 -2022 will be rejected. Each pole shall be branded or marked as described to meet ANSI 05.1-2022 as follows:

The brand or mark shall be placed squarely on the face of the pole and at least 10 feet from the butt. The face brand shall designate the supplier's code or trademark; plant location and year of treatment; species and preservative code; and class and length of pole.

The pole roof and gain shall be brush coated with pentachlorophenol-petroleum solution conforming to AWPA Standards P8 and P9. The top of each pole shall have a one-way roof cut sloping 30 degrees (120 degrees with pole axis) and the cut surface shall face at right angles to the pole face.

2. The minimum setting depth for poles shall be 10% of pole length plus two feet.
3. Holes for wood poles shall have reasonably straight sides. Holes shall not be grossly oversize, but shall be sufficiently large to permit use of a tamping bar all around the pole.
4. Backfill around poles in sand and gravel areas shall preferably be compacted by flooding the backfill materials as it is placed with copious quantities of water. Where the use of water is impracticable, the backfill shall be placed in six-inch lifts and thoroughly compacted by hand tamping. Surplus excavated material shall be placed around the pole in a cone approximately one foot in height.

D. CROSS ARMS, WOOD

Eight foot long, 3-1/2" X 4-1/2" minimum cross section treated Douglas fir. Provide support bracket for each.

E. POLE LINE HARDWARE

All pole line hardware shall be heavy galvanized steel.

F. OPEN FUSE CUTOUTS - POLE MOUNTED

Unit shall be rated 15 KV, shall be positive latch type, for hook-stick operation. Provide with fuses.

G. SPAN OR DOWN GUYS

Span or down guys shall employ high strength stranded galvanized steel guy wire. An eye bolt shall be used on the pole (angle eye bolt for down guy) and a three bolt clamp. Use 8 foot long galvanized guy guard at lower end of down guy.

H. ANCHORS

Anchors shall be concrete cone type with 5/8" X 8' anchor rod set in line with the angle of the down guy and with the eye at top projecting not over 6" above finished grade. Anchor shall be rated for 15,000 pounds tension in medium dense soil conditions.

I. INSULATORS, POLE MOUNTED

Pin type insulators shall be in accordance with ANSI C29.5 Class 55-4. Shall be wet process brown porcelain or approved equivalent.

J. POLE MOUNTED TRANSFORMERS

The existing pole-mounted transformers should provide sufficient power, but the contractor shall verify. If new transformers are required, the requirements of this paragraph shall apply. Single phase distribution type per ANSI C57.12. Oil filled, non-PCB type. Four taps, (2) 2-1/2% above, (2) 2-1/2% below. 75 KV BIL. Top-mounted primary bushings and side-mounted secondary bushings. Provided with lifting lugs and mounting brackets.

K. SURGE ARRESTERS

Distribution class designed for outdoor pole mounting. Shall be valve type rated for 15 KV. External air gap type not permitted. Provide with mounting bracket.

L. SERVICE DROP

Cable shall be rated for 600 volts, suitable for outdoor aerial installation. Conductors shall be wound symmetrically around messenger cable. Insulation shall be black with one rib for A-phase, two ribs for B-phase, three ribs for C-phase and no ribs for neutral.

M. INSTALLATION

Installation shall be per IEEE C2, National Electrical Safety Code.

N. TRANSFORMER INSTALLATION

Contractor shall be informed that the existing power pole has transformers, a telephone cable and a light fixture in place.

O. METERING

EU shall be contacted for metering design and installation.

P. FIELD QUALITY CONTROL

Verify that transformer installation is in accordance with manufacturer's instructions and drawings and specifications. Verify correct wire identification and type of transformer.

Q. Perform general inspection of surge arrester to verify compliance with drawings and specifications.

2.23. GROUNDING

A. GENERAL DESCRIPTION

Grounding systems shall be provided for service neutral power ground and for equipment grounds and bonding as required by NEC.

B. GROUNDING CONDUCTORS AND CONNECTORS

As required by NEC. Where ground wire is exposed to potential physical damage protect with rigid non-ferrous conduit as permitted by applicable code.

C. GROUND CONDUCTOR

Copper only, sized per NEC. Bare or green insulated in sizes #10 AWG or larger. Green insulated for size #12 AWG. Provide grounding conductor in all conduit runs per NEC or NESC requirements.

D. GROUND RODS

5/8" x 8'-0" copper clad steel. Connect the grounding conductor to each rod.

E. GROUNDING, GENERAL

Provide all grounding for electrical systems and equipment as required by NEC and as specified herein.

F. CONNECTION TO THE GROUNDING AND BONDING SYSTEM

1. Furnish and install connections in accordance with the NEC; including but not limited to:

- a. Raceway system
- b. Panelboards
- c. Service neutral
- d. "Separately derived service" (transformer or emergency power supply)
- e. Electrically operated equipment and devices.
- f. Surge Arrestors

2. No device or equipment shall be connected for electrical service which has a neutral conductor connected to a grounding conductor or to the frame within the device or equipment.

G. METHOD OF CONNECTIONS

Make all ground connections and ground cable splices by thermal welding or copper compression set type connectors with NRTL listing for grounding purposes. Grounding lugs, where provided as standard manufacturer's items on equipment furnished, may be used.

H. EXPANSION FITTINGS

In conduit runs requiring an expansion fitting, a bonding jumper shall be installed around the fitting to maintain continuous ground continuity.

2.24. DRY TYPE TRANSFORMERS

A. GENERAL DESCRIPTION

Provide dry type transformers complete and fully operational. Transformers shall be NRTL-listed and comply with NEMA Standard ST-20.

B. MANUFACTURE

Tierney, Sorgel, Eaton, Westinghouse, General Electric.

C. VENDOR INFORMATION

Provide relevant technical information for transformers, including dimensioned drawings, wiring and connection diagrams.

D. ENCLOSURE

1. Steel panel enclosure over core, coil and terminal chamber with louvered openings for convection cooling.

2. Enclosure required for environment in which located.

E. WINDINGS

Separate primary and secondary. Windings shall have Class H insulation and shall be rated for continuous operation at rated KVA with temperature rise of not over 150 degrees C above a 40 degree C ambient, with a maximum hot spot temperature of 220 degrees C. Windings and core and coil assembly shall be treated and built to resist the effects of dirt and moisture.

F. PRIMARY TAPS

Minimum of two 2-1/2 percent below normal (rated) primary voltage.

G. CAPACITY

Continuous rating not less than size noted.

H. MOUNTING

Mount on wall as noted or as required. Remove all shipping blocks prior to installation.

I. CONNECTIONS

1. 240/120V single phase secondary transformers shall be considered "grounded neutral separately derived systems" and neutral shall be grounded per NEC accordingly.

2. Transformer raceway connections shall be flexible metal conduit as specified in Section 2.17.C.

3. Voltage Tap Connections: Connect all transformers at "normal" tap. After facility is completely energized, measure secondary voltages at all transformers and reconnect taps as subsequently directed.

J. FIELD QUALITY CONTROL

Verify that transformer installation is in accordance with manufacturer's instructions and drawings and specifications. Verify correct wire identification and type of transformer.

2.25. PANELBOARDS

A. GENERAL DESCRIPTION

Provide all panelboard equipment, dead front type complete and fully operational. Conform with UL 67, UL 50, and NEMA PB 1.1 current revisions.

B. MANUFACTURER

Eaton, General Electric, Westinghouse, Square D, IEM, Inc., Cutler Hammer or approved equivalent.

C. SUBMITTALS

Submit vendor information; include front view, dimensions, device sizes and layout, list of nameplates and all other information required to demonstrate conformance with contract documents.

D. PANELBOARD TYPE

1. Panelboards shall be rated at proper voltage and current for intended use with bus bars of copper or aluminum.
2. Busbar to busbar connections to be bolted. Conductor connectors shall be bolted to busbars using Grade 5 bolts, Belleville and flat washers.
3. Panelboards shall have a separate ground bus bonded to panelboard cabinet.
4. Shall have service entrance label when utilized for service entrance equipment.
5. 480Y/277V panelboards shall be rated for all intended loads plus a minimum of 50% load to account for future power considerations, a minimum of 2 spare three-phase 20 breakers to be added to the panelboard.
6. 240/120V panelboards shall be rated for all intended loads plus a minimum of 50% load to account for future power considerations, a minimum of 6 spare single phase 20A breakers to be added to the panelboard.

E. CIRCUIT BREAKERS AND FUSED SWITCHES

1. The following interrupting capacity shall be considered minimum. Other ratings shall be as shown. UL short circuit rating shall be indicated on panelboard.

240/120V Panelboards	minimum 10,000 AIC symmetrical
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480Y/277V Panelboards	minimum 14,000 AIC symmetrical
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2. Circuit breakers: Conform with UL 489, labeled for 75 degrees C conductors. Mount breakers in all panelboards as indicated on the panel schedules. Pre-threaded, bolt on type only. Provide common trip on all multiple pole breakers.

3. Where shown, provide spare breakers or fused switches, complete for future connection of load circuits. Where "Space" is indicated for breakers or fused switches, provide all bussing and mounting hardware in the panelboard required to accept the devices. Provide steel knockouts in dead front metal closure of unused part of panel. If any steel knockouts are

removed, provide breakers in such spaces or approved coverplates. Open spaces not permitted.

F. CABINET AND FRONTS

1. Surface type. Tight closing doors without play, when latched.
2. Finish. Provide factory standard lacquer or enamel finish, gray or blue-gray color, applied over prime coat.

G. SYSTEM OF NUMBERING AND BUS ARRANGEMENT

Shall be as noted on the Panel Schedules.

H. NAMEPLATES

Provide engraved phenolic nameplates per Section 2.16.E and permanently attach to each panelboard front.

I. MOUNTING

Secure in place with top of cabinet at 6'-6" above finished floor, unless otherwise required or shown. Top of cabinet and trim shall be level. Interiors shall not be installed until structure is totally enclosed.

J. WIRING

Shall conform to applicable sections of these specifications and NEC. Conductors and terminations shall conform with Section 2.18.

K. PANEL SCHEDULE (CIRCUIT INDEX) AND LABELS

Provide a typed panel schedule with odd circuits on left and even circuits on right, listing each circuit in the panelboard by number with its proper complete load designation. Mount with a transparent protective cover inside cabinet door. Provide number labels on circuit breakers to match the index.

L. WORK CLEARANCE

Verify space available with equipment sizes and code required working clearances prior to submittal of final design.

M. GROUNDING

Provide per Section 2.23.

2.26. LIGHTING**A. GENERAL DESCRIPTION**

Provide lighting system complete and fully operational. Conform with NEC and NRTL listing requirements.

B. FIXTURE SCHEDULE NUMBERS

These numbers are a design series reference (not a catalog number) and do not necessarily represent the number, size, voltage, wattage, type of lamp, ballast, mounting hardware or special requirements as specified hereinafter or as required by the particular installation(s). Contractor shall verify these requirements and order fixtures as required to give a complete and fully operational installation per the contract documents and per NEC. Provide fixture to correspond with the number of lamps, wattage and/or size shown on the drawings.

C. FIXTURE VOLTAGE

Fixture voltage to match voltage of circuit serving the fixture.

D. SUBMITTALS

Include manufacture's documentation neatly and clearly marked to indicate fixtures and ballasts fully comply with contract documents.

E. METAL PARTS AND HOUSING

1. Interior Fixtures: NRTL listed, steel or aluminum with 300 degrees F., baked enamel finish, brushed aluminum with baked acrylic clear lacquer finish, or stainless steel with a brushed finish, manufacturer's standard color unless specified otherwise.

2. Exterior Fixtures: NRTL listed for wet or damp locations as required. Constructed of corrosion resisting metal, (non-ferrous, aluminum or stainless steel) and in all cases suitable for outdoor service without tarnishing or other damage due to exposure. Gasketed for bug tight operation.

F. LIGHT TRANSMITTING COMPONENTS

Shall not yellow with age. Unless noted otherwise, shall conform to the following:

1. Where the fluorescent fixture requires an acrylic prismatic diffuser, the lens shall be virgin acrylic not less than 0.125 inches overall.

2. Diffusers whether acrylic prismatic, lens, louver, or metal shall be contained in a steel or aluminum frame which is hinged and remains attached to fixture when door is open.

G. SPECIAL PARTS

Provide adapters, plates, brackets and anchors where required to suitably mount lighting fixtures.

H. LAMPS

1. Manufacturer: General Electric, Sylvania, Philips, Venture, Lithonia or approved equivalent.

2. Provide for each fixture in the exact number and type for which the fixture is designed or as noted.

3. Fluorescent Type: Bi-pin, T-12 rapid start; color warm white unless otherwise noted.

4. LED type: 48 inch LED strip light, 120V, 40K color temperature

I. BALLASTS - FLUORESCENT FIXTURES

1. Standard application for all fluorescent fixtures:

a. Suitable for lamp type employed.

b. NRTL and CBM (where applicable) labels, non-PCB, Class P, high power factor type.

c. Rated for operation at minus 20 degrees F.

d. Each ballast individually protected by an in-line GLR fuse in a Bussman type HLR fuseholder.

J. OUTDOOR LIGHTING POLES

Provide wood poles per Section 2.22.C. All poles shall be installed plumb to true vertical.

K. OUTDOOR LIGHTING FIXTURE

Outdoor area lighting shall be Acuity Brands RSX2 277V, 40K, LED Fixture or equivalent. Fixture shall be NRTL listed and suitable for outdoor mounting.

L. INSTALLATION - DIFFUSERS AND ENCLOSURES

Install lighting fixture diffusers only after construction work, painting and clean up are completed. Remove all dirty lamps, reflectors and diffusers; clean and reinstall.

M. ADJUSTMENT OF FIXTURES

Make all final spotlight and adjustable light settings under the direction of the Buyer prior to the completion of the project.

N. CEILING FIXTURE SUPPORT

Where ceiling is of insufficient strength to support weight of lighting fixture(s) installed, provide additional framing to support as required.

2.27. ELECTRICAL HEAT TRACE

A. GENERAL DESCRIPTION OF WORK

Contractor to furnish and install heat tracing on leachate collection tank, discharge piping, any exposed above-ground piping where fluid may settle, and transfer pump.

B. STANDARDS AND CODES

1. All materials and equipment specified herein shall be NRTL listed and labeled as such.
2. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
3. All materials and equipment specified herein, and their installation methods shall conform to the latest published version of the National Electric Code, NEC.
4. Quality Assurance:
 - a. The Heat Trace Cable Manufacturer shall have a complete quality assurance program that includes product qualification testing and routine testing of heater cable against minimum standards of acceptance.
 - b. Manufacturer's qualification testing on representative samples shall include power output, T-rating, jacket insulation resistance, low temperature flexibility, and startup inrush characteristics for a temperature range of -40°F to +150°F.
 - c. Quality Control tests on every foot of heating cable shipped shall include both a visual inspection and a high-frequency sine wave spark test as checks on jacket uniformity. In addition, all braided products shall pass a dry dielectric test. Quality Control tests on representative samples shall include a check of cable dimensions and power output.

C. SUBMITTALS

Submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

D. HEATING CABLE PRODUCTS

1. Heating cables shall be self-regulating, parallel circuit, semiconductive resistance type, with heating element extruded in a continuous strip between parallel copper conductors. Heating cables shall be capable of being overlapped without overheating at overlap places. Cable shall be furnished with tinned copper shield and an outer polyolefin jacket and be capable of being cut to desired length in the field. Constant watt type heating cable will not be acceptable. Raychem BTV Self-Regulating Heating Cable or approved equivalent.
2. Heating cable shall be suitable for operation from 120 volt, single phase power source. Line voltage fluctuations shall not appreciably affect cable heat output.
3. The heater shall not require the use of heat transfer cement or compounds in any form.
4. The heater shall vary its output in response to temperature variations along a pipe, due to heat sinks such as fittings or pipe supports.
5. Provide thermostat to switch heat cable off when ambient air temperature exceeds 50 degrees F.
6. Contractor shall furnish and install, in sufficient quantities, power connection kits, end seals, slice/tee kits, and all other material required for the complete installation and wiring of heat trace cables.

E. GENERAL INSTALLATION

Contractor shall coordinate all heat trace installation work with other ongoing work.

F. HEATING CABLE INSTALLATION

Install heat trace cable per manufacturer's instructions. For leachate temporary storage tank, heat trace system design and installation shall ensure that system does not freeze during any reasonably anticipated weather events during the useful lifespan of the cable. Any discrepancy and/or conflict shall be brought to the attention of the Buyer for final resolution.

G. MAXIMUM LENGTH OF CABLE RUNS

In order to limit the start-up current of branch circuits feeding heater cables, the maximum length of run of individual heater cables shall not exceed 95 percent of the maximum length recommended by the Heater Cable Manufacturer for cable ambient temperature of -40°F.

H. MAXIMUM RATING OF BRANCH OVERCURRENT DEVICE

The rating of branch circuit breakers for any heat trace circuit shall not exceed 40A.

I. TEMPERATURE MONITORING

Zones with installed heat traces shall be supplied with temperature monitoring to ensure that the temperature is maintained at a minimum of 50 degrees F. Surface mount temperature sensors similar to Omega SRTD-1 or approved shall be used. The temperature sensors shall be wired into a NEMA 4 temperature monitoring enclosure with an installed Omega 12 Channel CN600 series temperature scanner or approved equivalent installed on the door to allow operators to view the temperature without opening the enclosure. Components shall be installed per manufacturer's instructions and applicable codes.

J. TESTING

Functionally test each section of heat trace system under load, and according to Manufacturer's recommended test procedures.

K. FIELD QUALITY CONTROL

Perform general inspection to verify proper type, terminations, and splicing per manufacturer's recommendations, drawings, and specifications.

2.28. PROJECT MILESTONES

A. Design Completion

1. Design completion shall be once the final 100% design drawings and calculations have been submitted by the Contractor and approved by the Buyer.

B. Work Package Approval

1. Work package approval is once the work package has been fully approved in the Job Control System.
2. Work package approval typically occurs after work instructions and other supporting documents required for the complete work package have been submitted and all reviewer comments have been dispositioned.
3. Supporting documentation can typically include fire marshal permit, electrical installation permit, engineering change requests, industrial hygiene evaluation, waste planning checklist, and other permits or supporting documents depending on the work plan.

C. Installation Milestone: Enclosure Buildings

1. The enclosure building installation milestone is met once the building structures have been fully erected, including doors.
2. This milestone shall not include installation of the electrical or I&C equipment.
3. This milestone shall not include installation of the mechanical equipment.

D. Installation Milestone: Mechanical Equipment

1. The mechanical equipment installation milestone is met once the new tanks, pumps, piping, valves, and other mechanical equipment are installed.
2. This milestone shall not include installation of the electrical or I&C equipment.

E. Installation Milestone: Electrical Equipment

1. The electrical equipment installation milestone is met once the electrical and I&C equipment has been installed and connected to the new equipment.
2. This milestone shall not include final tie-in of the new equipment to the existing systems.
3. This milestone allows completion of Construction Acceptance Testing (CAT) with the exception of testing the final connections from the existing leachate collection systems to the new tank systems.

F. Installation Milestone: Final Tie-In

1. The final tie-in installation milestone includes the final installations required to complete mechanical and electrical connections of the new equipment to the existing systems.
2. This milestone allows completion of the overall Acceptance Test Plan (ATP).

G. Testing

1. Testing shall be split into parts that test individual sections of the overall system.
2. The Record of Completion (ROC) (Hanford Site Form A-6007-247) shall be completed by the Contractor throughout startup and acceptance testing and provided to the Buyer at the end of the testing.
3. Final drawings shall be submitted prior to starting the final overall Acceptance Test.
4. Any deficiencies identified during the ATP shall be recorded as punchlist items.
5. Punchlist items shall be corrected and resolved within two weeks.
6. An ATP reperformance shall retest all deficiencies and any items affected by the punchlist item resolution.

H. Turnover to Operations

1. Once systems pass all acceptance testing, the system is turned over to Facility Operations.
2. Demo work shall be completed before considering the project fieldwork complete.

2.29. SUBMITTALS

- A. Submittals shall be in accordance with this specification, the Statement of Work (SOW), and the Master Submittal Register (MSR). If a submittal is called for in any one of the documents, the contractor shall assume that the submittal is required and ask for confirmation or clarification from the Buyer if needed.

B. Testing Plans

All testing plans and testing shall be subject to review, approval, and witnessing by the IQRPE unless IQRPE states otherwise. Testing shall satisfy all requirements of WAC 173-303-640.

1. Submit a Factory Acceptance Test (FAT) Plan for major component (tanks, pumps, valves, control equipment) testing that can be performed either at the vendor's shop or by the construction subcontractor prior to installation. Shall be submitted for approval prior to testing and again after satisfactorily completing testing.
2. Submit a CAT plan that tests the functionality of all installed components. Subsystems can be tested separately as installation progresses. CAT plan should not include testing of the final system tie-in. Shall be submitted for approval prior to testing and again after satisfactorily completing testing.
3. Submit an Acceptance Test Plan (ATP) that tests the overall functionality of the system. This test plan shall test all system requirements not accomplished in other test plans and test full integrated system functionality using leachate collected from the trenches. Shall be submitted for approval prior to testing and again after satisfactorily completing testing.

C. Drawings and Calculations:

1. Submit new and revised drawings in accordance with CPCC-STD-EN-40279, "Engineering Drawing Standards".
2. Submit final record drawings prior to construction along with any construction support drawings.
3. Maintain accurate redline copies of record drawings with facility Design Authority concurrence on changes.
4. Submit as-built drawings with redlines incorporated prior to ATP performance.
5. Submit final drawings with any ATP punchlist item changes within 2 weeks of work acceptance.
6. Drawings shall be provided in both PDF and AutoCAD formats.
7. Provide on a drawing sheet a materials and parts list.
8. Submit calculations for concrete slab showing adequacy to support full leachate tank, support equipment, and enclosure.
9. Submit calculations for pipe and pump sizing.

D. Manuals:

Submit companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.

2.30. CONDUCT OF WORK

- A. The work associated with this specification is subject to certain requirements and hazards that may be unique to Hanford and these facilities.

- B. All work shall be according to planned and approved work package instructions. Changes to instructions shall follow the facility work control procedures and approval process.
- C. Construction work and modifications shall be worked only to approved drawings. Redline changes must be approved by the Buyer Design Authority (DA) prior to work. Any as-built redline changes shall include immediate notification to the Buyer Design Authority and the Buyer Project Manager.
- D. Contractor shall inspect work as it is being performed to verify it matches the approved shop drawings and engineering change requests. Discrepancies shall be reported to Buyer Design Authority and Buyer Project Manager for disposition. Discrepancies in-error shall be field-corrected to match approved shop drawings and engineering change requests. Accepted discrepancies shall be recorded as an as-built redline on the drawings with Buyer Design Authority approval.
- E. Work is performed in areas that are posted as radiological areas. The work is likely to be Low Hazard Radiological Work. Radiological Control Technicians shall perform radiological surveys of previously inaccessible surfaces. Wet conditions are expected during breach of existing leachate system. The Radiological Work Permit will address required PPE. The area around the existing leachate system will be posted or controlled as a Contamination Area. The area around the CA will be posted or controlled as a Radiological Buffer Area to accommodate step-off pad activities or partial body entries.
- F. Prior to starting work each day, a prejob meeting shall be held to review the day's scope of work and work hazards.
- G. After turnover to Contractor's construction forces, the work included in the Statement of Work shall be done by the Contractor.
- H. During the ATP, the facility operations personnel should be present to witness the testing.

2.31. APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable. Accepted variations due to these requirements from specific exemptions or equivalencies are specifically identified within this specification by the following notation: "variation".
 1. Instrument Society of America (ISA).
 2. American Petroleum Institute (API).
 3. National Electrical Manufacturers Association (NEMA).

4. Occupational Safety and Health Administration (OSHA).
5. American National Standards Institute (ANSI).
6. Military Standards (MIL Standards).
7. National Fire Protection Association (NFPA).
8. Scientific Apparatus Makers Association (SAMA).
9. Institute of Electrical and Electronic Engineers (IEEE).
10. National Electrical Code (NEC).
11. Insulated Cables Engineers Associates (ICEA).
12. Local Power and Telephone Companies.
13. Local Authorities having jurisdiction over the work.
14. International Building Code (IBC).

2.32. SPARE AND SPECIAL EQUIPMENT

- A. The contractor shall develop a list of recommended spares, including pricing, and submit the list at design completion. The procurement of the spares by the Contractor may be awarded to the Contractor at the Buyer's discretion.
- B. Spare and replacement parts shall be in original packaging and submitted to the BTR.

PART 3 - EXECUTION

3.1. PERMITS

- A. The contractor shall coordinate with the Buyer to obtain the following permits.
 1. Electrical Installation Permit (Site Form A-6005-707) – Provide draft one week after starting construction
 2. Any other permits deemed necessary in SOW or during course of work.