FINAL

Prepared for New York City Department of Environmental Protection

Hunts Point Wastewater Treatment Plant New Anaerobic Digester Facilities

Geotechnical Interpretive Report

DECEMBER 2018 | Contract: HP-238-DES | PIN: 82614WP01294

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December 21, 2018

Mr. Nat Federici
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New York City Department of Environmental Protection
96-05 Horace Harding Expressway, 4th Floor
Corona, New York 11368 BC Project No. 148526

Subject: Task 3.9.a.4 Geotechnical Interpretive Report – Final
HP-238 Hunts Point WWTP New Anaerobic Digester Facilities
HP-238-DES, PIN 82614WP01294

Dear Mr. Federici:

The final Geotechnical Interpretive Report – Draft for Hunts Point WWTP New Anaerobic Digester Facilities project (HP-238) is complete and posted to e-Builder. The final report provides soil and rock design parameters, design groundwater levels, seismic site class and recommendations for foundation design and construction.

Please do not hesitate to contact me at (646) 367-0583 if you have any questions or require additional information.

Very truly yours,

Brown and Caldwell Associates

Jean-Pierre Hourani, P.E.,
Project Manager

JPH:tb

GEOTECHNICAL INTERPRETIVE REPORT
BEDC HP-238 HUNTS POINT WWTP
NEW ANAEROBIC DIGESTER FACILITIES
Bronx, New York

December 20, 2018

Brown and Caldwell
1350 Broadway, Suite 2000
New York, New York

MRCE
built on firm foundations

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MRCE
built on firm foundations

December 20, 2018

Brown and Caldwell
1350 Broadway, Suite 2000
New York, NY 10018

Attn: Mr. Jean-Pierre Hourani, PE, BCEE

Re: Geotechnical Interpretive Report
HP-238 Hunts Point WWTP
New Anaerobic Digester Facilities
Bronx, New York
MRCE File # 12591

Dear Mr. Hourani:

Mueser Rutledge Consulting Engineers (MRCE) has completed a subsurface geotechnical investigation for the HP-238 Hunts Point Wastewater Treatment Plant (WWTP) New Anaerobic Digester Facilities project. The results of the investigation are presented in our Draft Geotechnical Data Report dated August 7, 2018. This Geotechnical Interpretive Report provides soil and rock design parameters, design groundwater levels, seismic site class and recommendations for foundation design and construction.

1.0 EXHIBITS

The following exhibits are attached to illustrate our report:

Exhibit	Description
Figure 1	Site Location Plan
Table No. 1	Soil and Rock Design Parameters
Drawing B-1	Boring Location Plan – MRCE 2018 Investigation
Drawing B-2	Available Borings near Overhead Gas Piping Alignment
Drawing C-1	Elevation Contours of Top of Stratum T–Glacial Till
Drawing C-2	Elevation Contours of Top of Rock
Appendix A	Overhead Digester Gas Piping Drawings Digester Feed Pump Station & Feed Wells Dwgs.

2.0 DATUM

Elevations in this report refer to the North American Vertical Datum of 1988 (NAVD88), where Elev. 0 is 1.508 feet below the Bronx Datum and 1.1 feet above Mean Sea Level at Sandy Hook, New Jersey in 1929 (National Geodetic Vertical

Datum, NAVD29).

3.0 SITE DESCRIPTION

The New York City Department of Environmental Protection (NYCDEP) is making improvements to the Hunts Point WWTP in the Hunts Point area of the Bronx, New York. As part of these improvements, NYCDEP is proposing to construct new Anaerobic Digester Facilities in a vacant lot immediately northwest of the WWTP. The lot is between Viele Avenue and Ryawa Avenue to the north and south and Manida Street and Barretto Street to the east and west as shown on Figure 1. The site is owned by the City of New York and is part of the larger Barretto Point Site.

Ground surface at the site slopes downward gradually from north to south from about Elev. +34 to Elev. +23 before dropping steeply from Elev. + 23 to Elev. +11 along the southwest property line.

4.0 PROJECT DESCRIPTION

NYCDEP is proposing to construct new anaerobic sludge digestion and support facilities to provide stable, reliable digestion of solids and achieve DEP's goals of generating Class B quality biosolids and providing additional reliability for all equipment. The new digester facilities are anticipated to consist of the following structures at locations shown on Drawing B-1:

- Four (4) – 86 ft diameter sludge digesters (Nos. 1 through 4) with top at Elev. +121 ft and supported on a concrete mat foundation bearing at about Elev. +9.
- A below ground equipment gallery measuring roughly 215 ft by 175 ft that will house supporting equipment and connect the digesters underground on a mat foundation bearing at about Elev. +9. Each digester will be supported on an independent mat foundation which will be separated from the gallery mat foundation by an expansion joint.
- Two stairway towers to access the top of the digesters from the floor of the equipment gallery at Elev. +12 and top of digesters at Elev. +118 feet. The top of the stairway towers is Elev. +122.4.
- One single-story gas room, with an approximate footprint of 58 ft by 73 ft, supported on the gallery roof between Digesters 1 and 3, along the east side of the digester facility. The roof of the gas room is Elev. +57.
- A single-story control building with an approximate footprint measuring 58 ft by 77 ft supported on the gallery roof between Digesters 2 and 4 on the west side of the digester facility. The roof of the control building is Elev. +51.
- One digester feed pump station just south of Ryawa Avenue.
- Four 30-foot-tall waste gas burners on the west side of Barretto Street southwest of the digesters.
- A buried pipe chase beneath Ryawa Avenue to connect various utilities between the existing Plant and digester equipment gallery.
- Overhead digester gas piping, starting from the southern end of the new sludge digesters, extending past the existing sludge thickeners, and terminating to the east at the Main Building and to the west at the digester waste gas burners.
- Three condensate removal rooms along the digester gas piping alignment.

- One guard house at the plant entrance on Ryawa Avenue.

- Site grades will be raised around the proposed Digester Facilities to bring them a minimum of one foot above the design flood elevation (DFE = El. +22). This increase in site grades will require up to approximately 10 feet of new fill placement.

- Extension of existing exhaust concrete chamber walls above ground to match the raise in grades, southeast of the digester feed pump station.

5.0 SITE HISTORY AND GEOLOGY

We refer to our 2018 Geotechnical Data Report for a discussion of the site history and geology.

6.0 SUBSURFACE INVESTIGATIONS

Subsurface geotechnical information from the following prior subsurface investigation programs is available:

1. Site Investigation Report – Barretto Point Site, Bronx New York, prepared by Dvirka and Bartilucci Consulting Engineers, dated September 2000.
2. Engineering Evaluation and Foundation Recommendations Phases II & III Draft Report, prepared by URS, dated April 30, 2002.
3. Hunts Point Water Pollution Control Project Upgrading and Expansion Report, prepared by Praeger Kavanagh and Waterbury, dated December 1968.
4. Hunts Point Pollution Control Project Extension Boring Location Plan and Geologic Sections, Drawing GS-1, prepared by Moran, Proctor, Mueser and Rutledge Consulting Engineers, dated March 18, 1960.
5. 9. Hunts Point Sewage Treatment Works Plant Site Record of Borings Drawings, Sheet Nos. 1 through 8, prepared by City of New York Department of Public Works, dated March 27, 1944.

MRCE performed a recent geotechnical investigation between June 11 and July 2, 2018 to evaluate subsurface conditions in the area of the proposed digester facilities. In order to satisfy NYC Code requirements, a total of 18 borings are required for the Digester Facilities. Considering previous borings, we determined that 16 new borings were required to satisfy the Code. One boring was added at the intersection of Barretto Street and Ryawa Avenue where significant raise in grades is proposed to determine if any soft compressible soils were present. The investigation thus consisted of seventeen (17) new borings penetrating into rock and four (4) piezometers for groundwater monitoring at locations shown on Drawing B-1.

Logs of the historic borings and a summary of the results of the recent MRCE investigation are provided in the 2018 MRCE Geotechnical Data Report.

7.0 SUBSURFACE SOIL, ROCK AND GROUNDWATER CONDITIONS

7.1 Subsurface Stratigraphy and Groundwater Levels

The general subsurface profile at the site consists of a surficial fill layer underlain by natural strata consisting of glacial till, decomposed to weathered rock, and bedrock.

Groundwater levels were observed in piezometers during the subsurface investigation. The monitoring data indicates that site groundwater levels north of Ryawa Avenue range from Elev. +20.4 to Elev. +18.9, and groundwater levels south of Ryawa Avenue range from Elev. +5.9 to Elev. +7.4. The groundwater level generally slopes downward from north to south, or toward the East River. Area groundwater levels may fluctuate due to seasonal variations, changing tides in the nearby East River, recent precipitation, surface run-off, nearby groundwater pumping and leakage into / from underground utilities. As such, groundwater levels at the time of construction may be different than observed during our investigation.

We refer to our 2018 Geotechnical Data Report for a detailed description of subsurface conditions.

8.0 RECOMMENDED DESIGN PARAMETERS

8.1 Soil and Rock Design Parameters

Recommended soil and rock design parameters based on the MRCE subsurface investigation program are provided in Table No. 1, for use in the design of foundations and temporary construction works such as excavation support systems.

8.2 Design Groundwater Levels

The piezometer monitoring data indicates that site groundwater levels north of Ryawa Avenue range from Elev. +20.4 to Elev. +18.9, while water levels south of Ryawa Avenue range from Elev. +5.9 to Elev. +7.4. Accordingly, we recommend a design groundwater level at El. +21 north of Ryawa Avenue and at El. +9 south of Ryawa Avenue. The design groundwater level for each proposed below-grade structure is as follows:

- Digesters 1 through 4 El. +21
- Digester Gallery El. +21
- Pipe Chase El. +9
- Exhaust Chamber Walls El. +9

8.3 Flood Levels

Based on the Hunts Point WWTP New Anaerobic Digester Facilities "Climate Resiliency and Adaptation Plan" (CRAAP) Report by Brown & Caldwell dated June 2018, the project team has established a Design Flood Elevation (DFE) of El. +22 for the project.

8.4 Soil and Rock Permeability

Based on laboratory gradation tests and soil sample descriptions on the boring logs, we recommend using the following permeability / hydraulic conductivity (k) values for site strata for dewatering estimates and groundwater modelling:

Stratum F – Fill, k = 1 x 10^{-2} cm/sec to 1 x 10^{-3} cm/sec
Stratum T – Glacial Till, k = 1 x 10^{-3} cm/sec to 1 x 10^{-4} cm/sec
Stratum DR – Decomposed Rock, k = 1 x 10^{-3} cm/sec to 1 x 10^{-4} cm/sec

For Stratum WR – Weathered Rock, k = 1 x 10^{-5} cm/sec may be used and for Stratum R – Bedrock, k = 1 x 10^{-6} cm/sec may be used.

MRCE performed in-situ permeability testing (rising head tests) in four piezometers (three screened in soil and one in bedrock). The permeability tests correspond to a limited zone around the piezometer screen and may or may not be reflective of a broader area. The values recommended above are higher than the measured value of k in the piezometers for the relevant strata.

The recommended k values are considered applicable to the bulk behavior of the soil mass. Local areas of higher and lower permeability are expected within each stratum. For dewatering purposes, we recommend the low end of the k range be used to design well spacing and the high end of the range be used to assess pumping quantities.

9.0 SEISMIC EVALUATION

Structural design of the proposed HP-238 Hunts Point New Anaerobic Digester facilities must comply with the 2014 New York City Building Code (Code). The Code requires an assessment of the potential hazard of soil liquefaction under the seismic event specified by the Code and an evaluation of the seismic Site Class to determine the seismic design parameters.

9.1 Liquefaction Evaluation

Typically, loose granular soils and low-plasticity cohesive soils below the groundwater level are susceptible to liquefaction during earthquake shaking. Groundwater observations during the subsurface investigation indicate that the depth to groundwater at the site ranges from approximately 8 to 11 feet below existing grades. The proposed depth of excavations will generally range from 3 to 24 feet below existing grades.

Liquefaction susceptibility was evaluated using the Code's Liquefaction Assessment Diagram (NYCBC Figure 1813.1), which compares the SPT N60 Values measured in the borings with specified liquefaction "screening lines". In our evaluation, we further screened out soils that are above the groundwater table (unsaturated) or have a high fines content and therefore not susceptible to liquefaction, and soils that will be removed during excavation. Our evaluation indicated that the site soils are unlikely to liquefy during the design earthquake event.

9.2 Site Class

Based on the MRCE geotechnical investigation results, seismic Site Class D (for a Stiff Soil Profile) is recommended in accordance with Table 1613.5.2 of the Code. Accordingly, the Site Class D design parameters of S_{DS} = 0.294g and S_{D1} = 0.117g should be used for structural design.

10.0 FOUNDATION DESIGN RECOMMENDATIONS

10.1 Digester Tanks, Digester Gallery and Pipe Chase

The bearing level of the Digester Tanks, Digester Gallery and Pipe Chase structures will range from El. +9 to El. +10.5. At these elevations, a majority of the structure footprint will bear in Stratum T (Glacial Till) or Stratum DR (Decomposed Rock). These soil strata are suitable for structure support on shallow mat foundations at an allowable bearing pressure of 6 tons / square foot (tsf).

In the southwest portion of the Digester Complex (below a portion of Digester No. 2 and the Pipe Chase), Stratum F extends below the base of the proposed mat elevation. Stratum F is unsuitable for heavy structure foundation support. The surface of underlying suitable Stratum T is as low as El. +4 (Boring MR-10) based on the borings. In such areas, the Stratum F soils should be locally over-excavated to the top of Stratum T and replaced with lean concrete (with a compressive strength of 1000 pounds per square inch) to the bottom of mat elevation.

The structural design of a mat foundation can be performed using Winkler springs to represent the load-deformation response of subgrade soils. Such springs are characterized by coefficient of subgrade reaction or subgrade modulus. A unit subgrade modulus (k_{v1}) for a 1 foot x 1 foot plate can be taken as 250 tons / cubic foot (tcf) for mat foundation design for the Digester Tanks, Digester Gallery and Pipe Chase. This unit subgrade modulus (k_{v1}) needs to be modified for the mat structural analysis by taking into account the size and shape of the mat foundation, applied load distribution, rigidity of the mat foundation and location of any expansion joints. As an example, the modified subgrade modulus value for the digester tank taking into account the size of the digester would be about 65 tcf. Mat design should be performed in accordance with ACI 336.2R, with adjustments in subgrade modulus made using an iterative analysis between the structural and geotechnical engineer until computed mat deflections are reasonably compatible with predicted settlements.

The mat foundation elevation will extend below the normal groundwater elevation and DFE. We understand that the mat foundation will be designed as a monolithic pressure slab to resist uplift from groundwater pressure, using the gravity loads of the slab and structure above. We recommend using a factor of safety of at least 1.2 in evaluating uplift resistance under the normal design water level. Uplift resistance should be calculated using only the dead weight of the structure in place. Live load within the structure should not be taken as a resisting force to counter uplift pressures. If the dead weight of the structure is not sufficient or the slab design cannot accommodate the full uplift pressure, positive measures such as tiedown anchors must be provided to resist the excess uplift pressures.

10.2 Digester Waste Gas Burners

The Digester Waste Gas Burners will be constructed at grade level over a new slab in the southwest portion of the site after raising existing grades from approximately El. +18 to El. +22. We understand that the maximum bearing pressures under the proposed slab are small (approximately 660 psf due to Dead Load + Live Load + Snow Load). An additional 220 psf maximum bearing pressure will be applied as Wind Load. No net uplift loading will be present. The subsurface conditions in this area consist of medium compact to compact granular fill underlain by decomposed rock. Based on the relatively low design bearing pressures under the new slab, we recommend supporting the slab on new fill after raising grades. Select granular fill should be used to raise grades within the slab footprint at finished grade and extending out on a 1H:2V slope down to existing grade level. Recommendations for site preparation, proof-rolling of the existing fill subgrade and placement of new fill are provided in Section 11.2 of this Report.

The Digester Waste Gas Burner footprint has been relocated after the MRCE Field Investigation Program and the MRCE Boring MR-17D is outside the footprint of the new location. Accordingly, we recommend that a geotechnical boring be made within the new footprint prior to construction of the Burner foundation to confirm that the subsurface soil conditions are appropriate for shallow slab support on new fill.

10.3 Overhead Digester Gas Piping and Condensate Removal Rooms

Installation of overhead digester gas piping is proposed along a route originating at the southern end of the new Sludge Digesters, extending south past the existing Sludge Thickeners, and terminating to the east at the Main Building and to the west at the Digester Waste Gas Burners. The overhead piping will be carried by steel framing supported on concrete piers typically at the ground surface at spacings ranging from approximately 45 feet to 135 feet along the piping alignment. A total of 12 pier supports are proposed as shown on the drawings provided by the structural engineer in Appendix A. Existing grades generally vary between El. +15 to El. +19 at the pier locations. At Pier locations 1, 2, 3, 11 and 12, the existing grades will be raised above the DFE, by approximately 5 to 9 feet of new fill. Pier 10 will be supported at the base slab level in the basement of the Main Building extension.

Logs of previous geotechnical borings are available in the vicinity of the proposed piers and are provided in the 2018 MRCE Geotechnical Data Report. A location plan of the previous borings in the vicinity of the proposed gas piping alignment is shown on Drawing B-2. The available borings indicate that the subsurface soil and rock strata are very similar to those present at the proposed Digester Facilities. Depth to top of bedrock generally varies from approximately 14 to 30 feet below existing grades (approximately El. +3 to El. -11).

Based on the relatively high uplift loads provided by the structural engineer and the expected subsurface stratigraphy consisting of deep fill in some areas, shallow foundations are not be suitable for support of the piers. Driven pile foundations are not recommended due to the following two concerns:

i. Lengths of driven piles will be limited due to potential obstructions and hard driving conditions in the glacial till soils and hence would not generate adequate uplift resistance.
ii. Pile driving can cause potentially damaging vibrations at existing subsurface utilities and structures supported on shallow foundations in the vicinity of the piers.

Drilled minipiles socketed in rock (defined as caisson piles in NYC Code) are a suitable type of pile foundation since their installation procedure generates low vibrations and they can derive the necessary uplift and compressive resistance by drilling into rock. The typical drilling rigs used to install minipiles are capable of drilling through potential obstructions in the glacial till, and to the required depths into weathered rock / bedrock.

Based on the axial and lateral loads provided by the structural engineer, we recommend the use of approximately 13 inch diameter minipiles socketed in rock. Each minipile would be comprised of a permanent 0.5 inch thick steel casing to the top of rock, a full length threaded center reinforcing bar and cement grout. We estimate that a minipile socketed at least 5 feet into rock of NYC Class 1c of better can achieve an allowable axial design load of approximately 200 kips and an allowable lateral design load of approximately 25 kips. We are in the process of performing the minipile design and will provide a table with pile details for each pier based on the loading requirements along with a typical pile detail for inclusion in the contract drawings. Minimum casing lengths required to top of rock socket and socket lengths based on the compressive, uplift and lateral load requirements will be provided.

Minimum pile spacing should be 3 times the pile diameter (D). For lateral loading, pile group effects must be considered at pile spacings less than 6D.

We recommend performing two lateral load tests on test minipiles to verify design requirements prior to production pile installation. The minimum test load should be equal to twice the design load. Load tests can be performed on production piles, provided that the test pile meets all Code specified acceptance criteria. For axial capacity verification of rock-socketed minipiles (caisson piles), axial load tests will not be required if the quality of rock in each minipile rock socket is observed and approved by video inspection in accordance with Code.

At Pier 10 in the basement of the Main Building extension, the minipiles would be installed from the ground level, positioned on top of the existing roof slab. The roof slab capacity should be verified to support a typical minipile rig. Timber matting should be provided below the rig if required, to distribute the loading on the roof slab to an acceptable value. Groundwater level lowering with a temporary construction dewatering system will likely be required during construction at Pier 10 since the pier support is at the existing basement level. Design normal groundwater level should be considered to be at El. +9.

Three condensate removal rooms (CCR) are proposed along the gas piping alignment. Their locations (CCR-1, CCR-2 and CCR-3) are shown on Drawing B-2. Each room will be 9 feet x 6.25 feet inside plan dimensions and 9.5 feet tall. Each room will be constructed over a new slab at grade level. We understand that the maximum bearing pressures under the proposed slab are small (approximately 800 psf). CCR-1 will be located adjacent to gas piping Pier 11 after raising existing grades from approximately El. +17 to El. +22. CCR-2 will be located adjacent to gas piping Pier 5 and CCR-3 will be adjacent to Pier 8. No raise in grade is proposed at CCR-2 and CCR-3.

We recommend supporting the slab for CCR-1 on new fill after raising grades. Select granular fill should be used to raise grades within the slab footprint at finished grade and extending out on a 1H:2V slope down to existing grade level. Recommendations for site preparation, proof-rolling of the existing fill subgrade and placement of new fill are provided in Section 11.2 of this Report. We recommend supporting the slab for CCR-2 and CCR-3 on existing fill. Recommendations for site preparation and proof-rolling of the existing fill subgrade are provided in Section 11.2 of this Report. We also recommend that a geotechnical boring be made at each CCR location prior to construction of the foundation slab to confirm that the subsurface soil conditions are appropriate for shallow slab support. These borings will also help in determining pile lengths for the adjacent piers.

An allowable bearing pressure of 1 tsf is recommended for the slab / mat design of the condensate removal rooms. For structural design of the mat foundation using Winkler springs, a unit subgrade modulus (k_{v1}) for a 1 foot x 1 foot plate can be taken as 30 tcf. This unit subgrade modulus (k_{v1}) needs to be modified for the mat structural analysis by taking into account the size and shape of the mat foundation, applied load distribution and rigidity of the mat foundation. Mat design should be performed in accordance with ACI 336.2R, with adjustments in subgrade modulus made using an iterative analysis between the structural and geotechnical engineer until computed mat deflections are reasonably compatible with predicted settlements.

10.4 Digester Feed Pump Station and Feed Wells

A Digester Feed Pump Station and Feed Wells is proposed south of the new Digesters. Preliminary drawings and loading information for the proposed structure were provided by the structural engineer. The drawings are included in Appendix A. Existing grades vary between approximately El. +16 to El. +18. Fill will be placed to raise grades to approximately El. +23 to El. +24. The Pump Station structure will consist of a one-story concrete structure with a slab on grade and columns spaced typically on a 30 ft x 17 ft grid. The two Feed Wells (each 16 ft x 16 ft in footprint) will be constructed at the south end of the pump station with a height of 26 feet above the base slab at finished grade level.

Borings made within or near the Pump Station indicate a fill layer is present to a depth of 6 to 8 feet below existing ground surface. The fill is unsuitable for support of the Feed Well structure and columns of the Pump Station due to the potential for excessive settlement.

We evaluated a scenario of excavating the existing fill, replacing it with compacted select fill and supporting all the structural elements on shallow foundations bearing on the new fill. We also evaluated supporting the Pump Station columns and the Feed Well structure on minipiles socketed in rock. We find that there is no significant cost benefit to the shallow foundation support scheme. The minipile support scheme would be a technically superior scheme due to lower design settlement. Based on the loading provided by the structural engineer, we recommend minipiles socketed into rock for support of the Pump Station columns and the Feed Well structure. The minipiles would be similar to those for the Digester Gas piping, except that the pile diameter can be smaller (on the order of 9 to 11 inches) due to lower design loading. We are in the process of performing the minipile design and will provide a table with pile details based on the loading requirements along with a typical pile detail for inclusion in the contract drawings. Minimum casing lengths required to top of rock socket and socket lengths based on the loading requirements will be provided.

We recommend that the columns of the Pump Station be supported on minipiles and the columns pile caps be structurally connected with grade beams if necessary. The slab-on-grade at the Pump Station can be supported on new fill after raising grades and should not be connected with the grade beams or columns. All new fill required to raise grades above existing grades should be compacted select fill. The select fill should be used within the slab footprint at finished grade and extending out on a 1H:2V slope down to existing grade level. Recommendations for site preparation, proof-rolling of the existing fill subgrade and placement of new fill are provided in Section 11.2 of this Report.

For the Feed Wells structure, the slab and walls should be supported on minipiles. We are in the process of performing the minipile design and will provide a table with pile details based on the loading requirements along with a typical pile detail for inclusion in the contract drawings.

Minimum pile spacing should be 3 times the pile diameter (D). For lateral loading, pile group effects must be considered at pile spacings less than 6D.

For axial capacity verification of rock-socketed minipiles (caisson piles), axial load tests will not be required if the quality of rock in each minipile rock socket is observed and approved by video inspection in accordance with Code. Lateral load tests would not be required on the minipiles. The results of successful lateral load tests performed for the Digester Gas Piping minipiles can be used to verify the design soil parameters used for the minipile design at the Digester Feed Pump Station and Feed Wells.

10.5 Guard House

A new guard house is proposed at the Ryawa Avenue plant entrance as shown on Drawing B-2. It will have a footprint of approximately 7 feet x 5 feet and will be constructed over a new slab at grade level. We understand that the maximum bearing pressures under the proposed slab are small (less than 800 psf). No significant change in grade is proposed at this location. We recommend supporting the slab for the guard house on existing fill. Recommendations for site preparation and proof-rolling of the existing fill subgrade are provided in Section 11.2 of this Report.

An allowable bearing pressure of 1 tsf is recommended for the slab / mat design. For structural design of the mat foundation using Winkler springs, a unit subgrade modulus (k_{v1}) for a 1 foot x 1 foot plate can be taken as 30 tcf. This unit subgrade modulus (k_{v1}) needs to be modified for the mat structural analysis by taking into account the size and shape of the mat foundation, applied load distribution and rigidity of the mat foundation. Mat design should be performed in accordance with ACI 336.2R, with adjustments in subgrade modulus made using an iterative analysis between the structural and geotechnical engineer until computed mat deflections are reasonably compatible with predicted settlements.

10.6 Settlement

Total settlement during the service condition at the Digester Tanks, Gallery and Chase is estimated to be less than one inch. For design, the total settlement should be taken to be one inch with a differential settlement of 0.5 inch over 75 feet.

Total settlement at the Digester Waste Gas Burners slab, Digester Feed Well Pump Station slab-on-grade, Condensate Removal Rooms and the Guard House is also estimated to be less than one inch.

Settlements at the Digester Gas Piping Piers, Digester Feed Pump Station and Feed Wells which are supported on minipiles are expected to be on the order of 0.5 inch or less and occur primarily due to pile elastic shortening.

10.7 Gallery Cellar and Other Below-Grade Walls

Basement walls and retaining walls that are restrained from movement will be subject to lateral at-rest earth pressure under service load conditions. The pressures can be calculated using an equivalent fluid pressure of 60 pounds per square foot per foot of depth (pcf) above the design groundwater level, and 90 pcf for the combined soil/water loading below the design groundwater level. Retaining walls that are not restrained from lateral movement will be subject to lateral active earth pressure. The pressures can be calculated using an equivalent fluid pressure of 40 pounds per square foot per foot of depth (pcf) above the design groundwater level, and 82 pcf for the combined soil/water loading below the design groundwater level.

Below-grade walls must also accommodate temporary increases in lateral pressure such as may occur from stockpiling materials, equipment or vehicles adjacent to the structure, or a rise in groundwater levels to the design flood elevation. The lateral pressure exerted by surcharge can be computed using an at-rest earth pressure coefficient of 0.5. Seismic lateral earth pressure, added to static earth (active or at-rest), water, and surcharge pressures, can be calculated using a dynamic earth pressure coefficient, ΔKae, of 0.15.The use of elevated stress levels is appropriate in the design of below-grade walls under temporary loading conditions.

10.8 Frost Depth

Shallow foundations, pile caps and other permanent supports of structures should extend a minimum of 4 feet below the lowest adjacent permanent exposed grade for frost protection. Grade beams should be embedded a minimum of 18 inches below the lowest adjacent permanent exposed grade.

10.9 Waterproofing

The bottom of base mats, slabs and all exterior below grade walls should be waterproofed to at least 2 feet above the DFE and damp-proofed above that elevation. Since the DFE at the site is close to finished grades, the waterproofing can be applied up to ground level. We recommend using a membrane waterproofing system such as Grace Bituthene-Preprufe. For double formed walls, an applied membrane such as Bithuthene 3000 or 4000 should be used. Where excavation support systems are employed as an exterior form, blind side waterproofing will be required.

A hydrophilic (expansive) waterstop such as DeNeef Swellseal should be used for all wall and slab construction joints below grade. The contractor should provide details for sealing penetrations from form ties and excavation support system elements. All waterproofing and vapor barriers should be installed in accordance with manufacturer recommendations to provide a continuous water seal below the floor and outside the walls. Floor waterproofing must be continuously joined with wall waterproofing to provide a complete tie-in. Protection board should be placed along forms or adjacent to backfill to protect waterproofing. Sealing will be required at all below grade wall and slab utility and piping penetrations and at any base slab pile penetrations and should be made in accordance with the waterproofing manufacturer's recommendations. Construction inspection is vital to provide proper quality control.

11.0 CONSTRUCTION CONSIDERATIONS

11.1 Support of Excavation (SOE)

Where open cut excavation is feasible without potential damage to existing structures, utilities or pavements, the excavation sides can be sloped up to 1V:1.5H provided that any groundwater is properly controlled in advance of excavation and surface runoff is properly handled. Temporary support of excavation (SOE) systems will be required where excavation depths are in excess of 5 feet and/or it is not feasible to make open cut excavations (i.e. near adjacent existing utilities).

Based on site grade elevations, excavation depths required at the Digester Complex structures will range from approximately 24 feet at the north end to about 3 feet at the south end. Groundwater lowering of up to about 15 feet below normal groundwater levels will be required at the northern end of the site to achieve water levels 2 feet below final excavation subgrade. Groundwater elevations at the south end of the site are below the bottom of the excavation by approximately 2 feet and would not require dewatering.

Construction dewatering for the overall excavation for the Digester Complex without a groundwater barrier system as part of the SOE system, could require pumping rates on the order of 200-300 gallons / per minute (gpm). Such pumping rates will likely create a zone of influence that extends beyond the site perimeter, redirecting groundwater flow from surrounding properties toward the excavation. Brown and Caldwell (BC) indicated that it is impossible to accurately calculate the lateral extent of this zone of influence without considering groundwater infiltration into buried utility bedding and sewer pipes outside the site perimeter. With the exception of Barretto Point Park located immediately west of the proposed site, the neighboring areas are largely industrial going back in excess of 100 years. BC has recommended that given the uncertainty of accurately calculating the lateral extent of the zone of influence created as a result of the construction dewatering due to excavation and the potential for contaminated groundwater in the surrounding neighborhood, a groundwater cutoff wall should be provided to minimize the dewatering flows into the excavation and limit the potential for offsite contaminant migration towards the site.

A groundwater cut-off type SOE wall can consist of an interlocked steel sheeting with a hydrophilic sealant placed in the interlocks, a slurry trench with inserted sheeting, a tangent pile wall or a secant pile wall.

An interlocked steel sheeting system is not suitable due to the very compact soils and obstructions (boulders) in Stratum T and hard driving conditions in Stratum DR and consequent potential for jumped interlocks, inadequate penetration and openings (windows) in the cut-off wall. A tangent pile wall system is also not suitable since there is high likelihood that the tangent piles may deviate from tangent due to the same characteristics of the strata noted above, thus potentially compromising the required groundwater cut-off. Slurry trench excavation equipment would be able to excavate a continuous trench down to the required wall tip elevations. However, there is some risk that the slurry trench excavation along Barretto Street may relieve lateral stresses in the soils below the adjacent electric duct banks and potentially cause excessive settlement of the duct banks. A secant pile wall system would carry a lower risk of such settlement of the adjacent electric duct banks since only one secant pile is installed at a time compared to the larger excavation length of slurry trench open at any given time. Equipment used in secant pile construction can also drill through dense soils and obstructions and penetrate into rock. For these reasons, a secant pile wall system is the most suitable groundwater cut-off SOE system and is recommended for the project site conditions.

A secant pile wall is constructed by first installing primary piles filled with concrete followed by the installation of secondary piles between the primary piles. The secondary piles are installed by overlapping with the primary piles and are filled with concrete to create a continuous groundwater barrier. Steel core beams are installed in the secondary piles before concrete placement or in wet concrete after concrete placement, to provide the required bending strength and stiffness to the wall. The secant piles would be drilled and seated into bedrock to achieve the groundwater cut-off and also to obtain fixity at the wall toe. In order to provide a groundwater cutoff, an equivalent permeability of the secant pile wall should be specified to be no greater than 1×10^{-6} cm/sec. Such an effective secant pile wall keyed into bedrock would provide a cutoff with very little groundwater inflow entering the excavation. Allowing for some leakage through the bathtub, groundwater inflow may be estimated to be on the order of 10 to 50 gpm.

The secant pile wall would be required on the north, east and west sides of the Digester Complex in order to provide the groundwater cut-off. It would not be required on the south side since the excavation subgrade elevation is higher than the normal groundwater level. In order to reduce the need for lateral bracing for the SOE wall and reduce the depth of the wall, pre-excavation can be performed on the north side where the existing grades are the highest and adequate space is available for pre-excavation.

For excavation support on the south side of the proposed digesters at Ryawa Avenue, where excavation subgrades will not extend below the normal groundwater level, soldier piles and timber lagging are suitable for excavation support. Similarly, soldier piles and timber lagging are also suitable for the small replacement manhole excavations required for rehabilitation of the 42-inch sewer beneath Barretto Street. Drilled-in soldier piles are recommended to enable the soldier piles to extend past obstructions in the glacial till, hard zones in the decomposed / weathered rock and penetrate into bedrock where needed. Additionally, drilled-in soldier piles will also avoid pile driving and consequent potential for damage to nearby buried utilities.

Recommended parameters for design of SOE systems are included in Table No. 1. Appropriate surface surcharge pressures per NYC Building Code should be considered such as from adjacent roadways and sidewalks, and potential temporary construction loads. The excavation support systems must be designed by a Professional Engineer licensed in the State of New York with the design submitted for review and approval of the NYC Department of Buildings (NYC DOB) as part of the foundation permitting process.

11.2 Excavation and Subgrade Preparation

Foundations on Natural soils: Foundations bearing on natural soils of Stratum T or Stratum DR require support on undisturbed subgrade. Final subgrade exposure must be made using a smooth edged excavating tool, such as a backhoe bucket with the teeth shielded, and operating by reach of equipment at least two feet above subgrade. This should be followed by proof rolling of exposed subgrade with at least two passes of a 10 ton static drum roller to determine if any disturbed soils exist below subgrade, Proof rolling should be performed after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade. If any disturbed zones are found, they should be removed down to competent undisturbed subgrade and backfilled with controlled structural fill or controlled low strength material (CLSM). Foundation construction should either proceed immediately after subgrade approval or subgrade promptly covered with a lean concrete mud mat to protect subgrade materials from subsequent deterioration from weather, surface water infiltration and construction traffic in the interim period until foundation construction.

Foundations, Slabs-on-grade, Slabs and Pavements on Fill: Subgrade preparation for foundations, slabs-on-grade, slabs, roadway and parking lot pavements and sidewalks supported on existing fill should include clearing and grubbing, then stripping topsoil, vegetation, existing foundations, and any other deleterious materials. Subgrade should then be visually inspected and proof rolled with at least two passes of a 10 ton static drum roller to verify its integrity. Proof rolling should be performed after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade. Hard points, such as boulders or construction debris, should be removed a minimum of one foot below subgrade. If soft, spongy, loose, or otherwise unsatisfactory material is encountered, that material should be removed and replaced with controlled select fill or CLSM. Where the foundations, slabs-on-grade, slabs, roadway and parking lot pavements and sidewalks will be supported on new select fill to be placed over existing fill, similar procedures should be followed to prepare the existing fill subgrade prior to placement of new select fill.

All subgrades must be free of water, frozen material, or otherwise deleterious materials and inspected and approved for construction by a qualified geotechnical engineer. Subgrades should be protected from subsequent deterioration from weather, surface water infiltration, and construction traffic until construction proceeds. Contractor practices and work designs should prevent surface water runoff and flood waters from entering excavation and backfill areas using perimeter berms and dikes. Slopes, crowns, and ditches on backfill surfaces should be maintained to ensure proper surface drainage and prevent surface water from ponding or softening soil subgrades and backfill surfaces.

11.3 Minipile Installation and Verification Testing

Minipile installation should be performed by experienced specialty subcontractors and carefully monitored by a qualified geotechnical engineer to assure the integrity of the pile. The borings indicate the presence of obstructions in the fill and cobbles and boulders in the glacial till (Stratum T) which should be factored in the selection of pile installation methods and equipment. We recommend the use of duplex drilling methods with internal flush in advancing the minipiles through overburden soils to reduce the risk of ground loss and impacts to adjacent structures and utilities. The use of drilling methods involving external flush or forced air in soil should not be permitted. Down-the-hole (D-T-H) hammer use may be permitted in soil only to advance through obstructions. D-T-H use can be permitted in advancing through weathered rock and bedrock. The drill bit or D-T-H should not be permitted to advance beyond the tip of the pile casing. A positive head of drilling fluid should be maintained continuously within the casing when drilling below the groundwater table.

Pile lateral load testing to verify design loads must occur prior to installation of production piles. Lateral load tests should occur from an elevation at or close to final pile cutoff and should be performed in accordance with applicable ASTM standards and requirements of the NYC Code.

11.4 Groundwater Control

Groundwater will need to be lowered to a minimum of 2 feet below excavation subgrade ahead of excavations below the groundwater table, as demonstrated by piezometers, in order to maintain dry, stable subgrades. Excessive groundwater drawdown outside the groundwater cutoff SOE system may cause transport of contaminants from their source areas to uncontaminated third-party properties. It is recommended that project specifications require the contractor to limit the groundwater level drawdown outside the groundwater cutoff SOE system to a maximum of 3 feet below the normal groundwater levels. The groundwater levels should be monitored by piezometers during construction. The project specifications should require the contractor to perform remedial measures at water leaks in the groundwater cutoff SOE system to stop the leaks promptly and mitigate any excessive groundwater drawdown outside the groundwater cutoff SOE system.

We understand that a groundwater cutoff system will not be required for sewer manhole replacement excavations due to the limited excavation size. Excavations and dewatering for the sewer manhole replacements below the groundwater level should be performed for one manhole at a time with work completed at a manhole prior to beginning the work at another manhole.

Construction dewatering systems can include wellpoints, deep wells, sump pits with sump pumps, trench drains, etc. The design and operation of the construction dewatering systems should be the responsibility of the contractor. Design calculations and details of the dewatering systems should be submitted by the contractor prior to execution, and all as-built records submitted promptly after installation.

11.5 Backfill

Controlled (select or structural) fill is recommended where existing grades will be raised beneath new structures, slabs-on-grade, slabs, roadways, pavements, and as backfill adjacent to below grade walls. Controlled fill should conform to NYC Building Code requirements for controlled fill. Controlled fill should consist of a well graded sand, gravel, crushed rock, recycled concrete aggregate, or a mixture of these containing no organic matter, wood, brick or other deleterious materials or equivalent materials with a maximum particle size of 3 inches and a maximum of 10 percent passing the No. 200 sieve. Controlled fill should be placed in loose lifts not exceeding 12 inches (six inches where hand operated equipment is used), at its optimum moisture content plus or minus 2 percent, and compacted to a minimum of 95% of the Modified Proctor maximum dry density (ASTM D 1557). Excavated site soils may not be suitable for use as controlled fill without significant segregation and processing and it may be assumed that offsite material will be required for controlled fill.

Common fill may be used to raise grades beneath landscaped and other unloaded areas. Common fill should consist of granular soils (SP, SP-SM, SM, SC) with no more than 35 percent fines and a maximum liquid limit of 25 and plasticity index of 6. Common fill should be placed in loose lifts not exceeding 8 inches and compacted to a minimum of 90% of the Modified Proctor maximum dry density (ASTM D 1557). Lift thicknesses in confined areas where small compaction equipment must be used, such as utility trenches should be limited to six inches. Granular soils excavated on site from within the footprint of the remediated area at the former Paint and Varnish facility may be suitable for use as common fill provided that they meet the above gradation requirements. Some processing may be needed including sieving and moisture conditioning. Otherwise, granular material can be imported for fill. We understand that excavated soils from other on-site areas are considered environmentally unsuitable for re-use as fill. On-site soils and sources of off-site borrow should be subjected to laboratory testing including grain size and control density tests prior to use to determine if they meet the specified backfill requirements.

11.6 Pre-Construction Condition Surveys, Construction Monitoring and Protection of Adjacent Structures

Pile installation, SOE installation, foundation excavation and dewatering for the proposed facilities may affect nearby structures, utilities and properties that must be maintained during and after construction. Cracking and settlement may result from ground vibrations and lateral and vertical movements due to excavation. A program of monitoring vibrations and movements of nearby structures is recommended.

The monitoring program should include the following:

a) A pre-construction and post-construction condition survey of all buildings, structures and utilities within 100 feet of construction. Condition surveys should include photographing existing conditions and installing crack gages at existing cracks on the inside and outside of the structures and exposed utility infrastructure.
b) Movement monitoring of buildings and utility infrastructure within 50 feet of pile installation and SOE installation and within 25 feet of excavations, during excavation and while the excavations remain open.
c) Vibration monitoring at all buildings and utilities within 25 feet of pile installation and SOE installation.
d) Lateral deflection monitoring of the SOE system.
e) Groundwater level monitoring inside excavations and outside the groundwater cut-off SOE walls.
f) Noise monitoring.

The monitoring program should identify threshold and limiting values for vibrations and displacements based on the condition of the adjacent buildings and utility infrastructure observed during pre-construction inspections and provide notification procedures in the event the established threshold values are exceeded. The plan should include actions to be taken, such as modifying construction methods or conducting additional condition surveys, should the predetermined threshold values be reached during construction. Monitoring criteria should be reviewed periodically during construction and modified as necessary based on field observations. A minimum of two weeks of baseline monitoring data should be obtained prior to start of intrusive construction activity.

11.7 NYC DOB Special Inspection Requirements

The New York City Department of Buildings (DOB) requires the following geotechnical construction items to be inspected by a Professional Engineer licensed in the state of New York employed by a DOB certified Special Inspection Agency:

1. Excavation, soil subgrade, sheeting, shoring and bracing.
2. Deep foundation elements, including pile installation and load testing.

The following Technical Report (TR) Forms will be required to be submitted for the above construction inspection items:

- TR-1 Statement of Responsibility
- TR-5 Pile Driving

In addition, TR-1 and TR-4 will also need to be submitted for the Soil Investigation Report.

12.0 GEOTECHNICAL REVIEW OF FOUNDATION DESIGN AND CONSTRUCTION

The borings disclose a subsurface profile with variations in depth to the foundation bearing strata and bedrock across the site. Structure loads and foundation types will vary across the site given the variety of structure types. Interaction between the geotechnical and structural engineer is therefore essential as foundation design progresses to design the structure foundations and provide adequate structural performance under the range of service load conditions. Geotechnical review and assistance in preparation of foundation plans and specifications for below grade work is also critical so that foundation and construction recommendations provided herein are properly interpreted and implemented in the design.

Recommendations for foundation design and construction in this report are based on the information available at the time this report was prepared, information obtained from the borings, and associated field and laboratory testing. However, conditions on the site may vary between discrete boring locations and from those observed at the time of our subsurface exploration. The nature and extent of variations between borings may not become fully evident until exposed in construction. Geotechnical observations of foundation construction and testing is recommended to provide an opportunity to observe soil conditions and behavior as exposed during construction, evaluate the applicability of the recommendations provided in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein. We recommend that all foundation construction be observed by a qualified engineer in accordance with the requirements of the NYC Building Code.

Please do not hesitate to contact us, if there are any questions regarding our Geotechnical Interpretive Report.

Very truly yours,
MUESER RUTLEDGE CONSULTING ENGINEERS

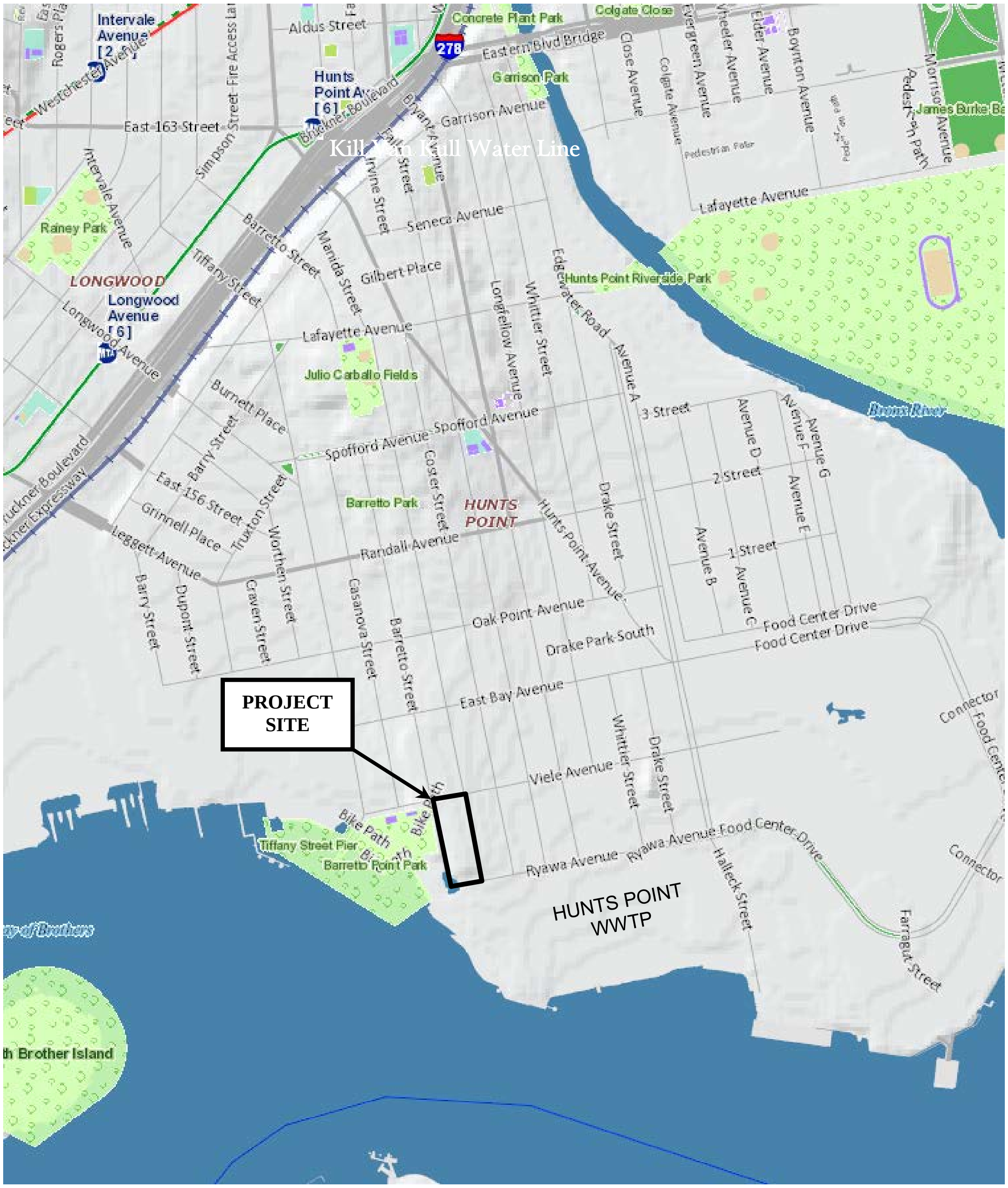
Hiren J. Shah, PE

Walter E. Kaeck, PE

SMR:HJS:WEK:F:\125\12591\Geotechnical Reports\Geotech Interpretive Report\HP-238 MRCE Geotechnical Interpretive Report.docx

EXHIBITS

N



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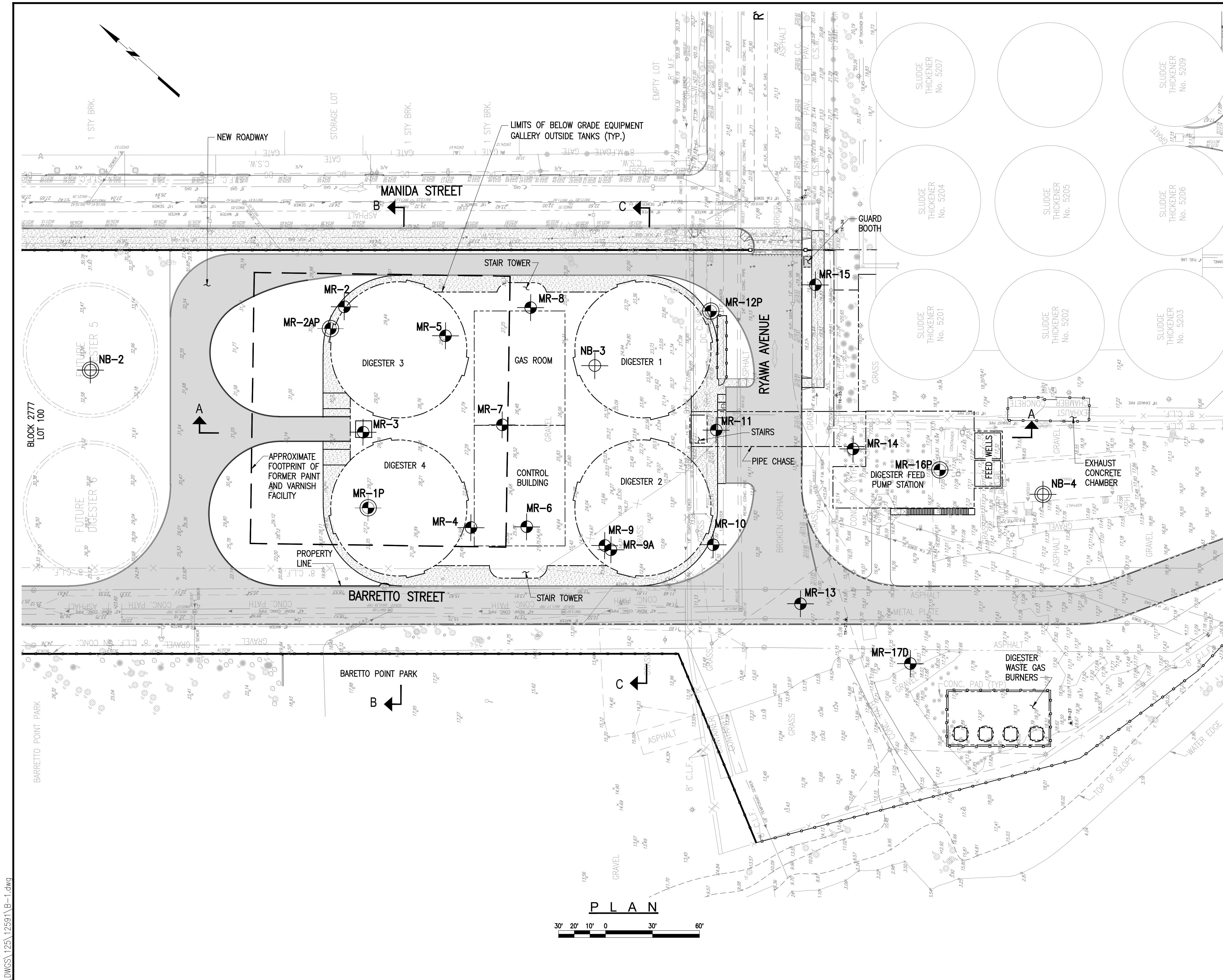
HP-238 HUNTS POINT WWTP			
BRONX			NEW YORK
MUESER RUTLEDGE CONSULTING ENGINEERS 225 WEST 34TH STREET, NEW YORK, NY 10122			
SCALE -	**MADE BY: SMR** **CH'KD BY: HJS**	**DATE: 07-25-2018** **DATE: 08-06-2018**	**FILE NO.** **12591**
SITE LOCATION PLAN			FIGURE NO. **1**

Table No. 1: Soil and Rock Design Parameters

Soil and Rock Parameters	STRATUM			
	F	T	DR/WR	R
Total Unit Weight (pcf)	120	130	135	165
Buoyant or Effective Unit Weight (pcf)	58	68	73	103
Angle of Internal Friction, Φ (degrees)	30	36	36	NA
Earth Pressure Coefficients				
At-rest earth pressure coefficient, K_o (for normally consolidated conditions)	0.5	0.412	0.412	NA
Active earth pressure coefficient, K_a	0.33	0.26	0.26	NA
Passive earth pressure coefficient, K_p	3.0	3.85	3.85	NA
Allowable Bearing Pressure (tsf)	NA	6	6	20
Ultimate Friction Factor, S - soil to formed concrete	0.4	0.4	0.4	0.5
Permeability / Hydraulic Conductivity, (cm/sec)	1×10^{-2} to 1×10^{-3}	1×10^{-3} to 1×10^{-4}	1×10^{-3} to 1×10^{-4} (DR) 1×10^{-5} (WR)	1×10^{-6}

Table No.1 Notes:

1. K-values are lateral earth pressure coefficients for soil strata against the face of a vertical wall with a horizontal ground surface and do not account for pressures due to groundwater or surcharges. Variations from these conditions will result in changes of the K-values. Effective unit weights should be used below the groundwater table and water pressure should be added. Surcharge loads above the ground surface should be included in accordance with NYC Building Code.
2. Allowable net bearing pressures reported represent values in excess of pre-construction stabilized overburden pressure at the same location and are subject to adjustments in accordance with NYC Building Code, Table 1804.1.
3. For evaluation of lateral pressures in bedrock, a total unit weight of 165 pcf should be used with a coefficient of at-rest pressure, Kor = 0.1 assuming that single formed walls are used. If walls are double formed and backfilled, a Kor value of 0.2 should be used assuming controlled select fill is placed against the walls. Below the design groundwater rock pressures should be calculated using submerged unit weights and water pressure must be added.



NOTES:

1. THE PLAN IS BASED ON TOPOGRAPHIC SURVEY BY MUNOZ ENGINEERING, P.C. DATED DECEMBER 9, 2016.
2. PROPOSED DIGESTER FACILITY FOOTPRINT WAS PROVIDED BY BROWN AND CALDWELL ON OCTOBER 16, 2018 AND MAY NOT REPRESENT THE LATEST CONFIGURATION.
3. LIMITS OF FORMER PAINT AND VARNISH MANUFACTURING FACILITY IS BASED ON AREA SHOWN IN ENVIRONMENTAL RESTORATION RECORD OF DECISION REPORT, FIGURE 5, PREPARED BY DEC, DATED DECEMBER 2003.
4. BORING NOS. NB-1 THROUGH NB-3 WERE MADE BY AQUIFER DRILLING AND TESTING, INC. (ADT) IN 2002 UNDER INSPECTION BY URS. BORING LOCATIONS ARE BASED ON BORING LOCATION PLAN, FIGURE 2, PREPRAPED BY URS, FROM ENGINEERING EVALUATION AND FOUNDATION RECOMMENDATIONS PHASES I AND II DRAFT REPORT, DATED APRIL 30, 2002.
5. BORING NOS. MR-1P THROUGH MR-17D WERE MADE BY JERSEY BORING AND DRILLING, INC. BETWEEN JUNE 11 AND JUNE 29, 2018 UNDER CONTINUOUS INSPECTION BY MUESER RUTLEDGE CONSULTING ENGINEERS (MRCE).
6. AS-DRILLED LOCATIONS AND GROUND SURFACE ELEVATIONS WERE SURVEYED BY MEGA CONSTRUCTION MANAGEMENT, INC. ON JUNE 27, 2018.
7. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
8. SEE DRAWING NOS. GS-1 AND GS-2 FOR GEOLOGIC SECTIONS A-A, B-B AND C-C.
9. FOR OVERHEAD DIGESTER GAS PIPING ALIGNMENT AND LOCATION OF CONDENSATE CONTROL ROOMS (CCR), SEE DRAWING NO. B-2 INCLUDED IN APPENDIX F.

LEGEND:

- NB-3 – PREVIOUS BORING (URS 2002)
- NB-2 – PREVIOUS BORING AND MONITORING WELL (URS 2002)
- MR-3 – MRCE 2018 BORING
- MR-12P – MONITORING WELL "P" INDICATES PIEZOMETER

REV.	DATE	BY	DESCRIPTION

HP-238 HUNTS POINT WWTP – NEW ANAEROBIC DIGESTER FACILITIES
BRONX NEW YORK

BROWN AND CALDWELL
NEW YORK NEW YORK

MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE			FILE NUMBER
GRAPHIC	MADE BY: L.R.	DATE: 10-24-2018	12591
	CH'KD BY: S.M.R.	DATE: 10-24-2018	DRAWING NUMBER

BORING LOCATION PLAN
MRCE 2018 INVESTIGATION

B-1

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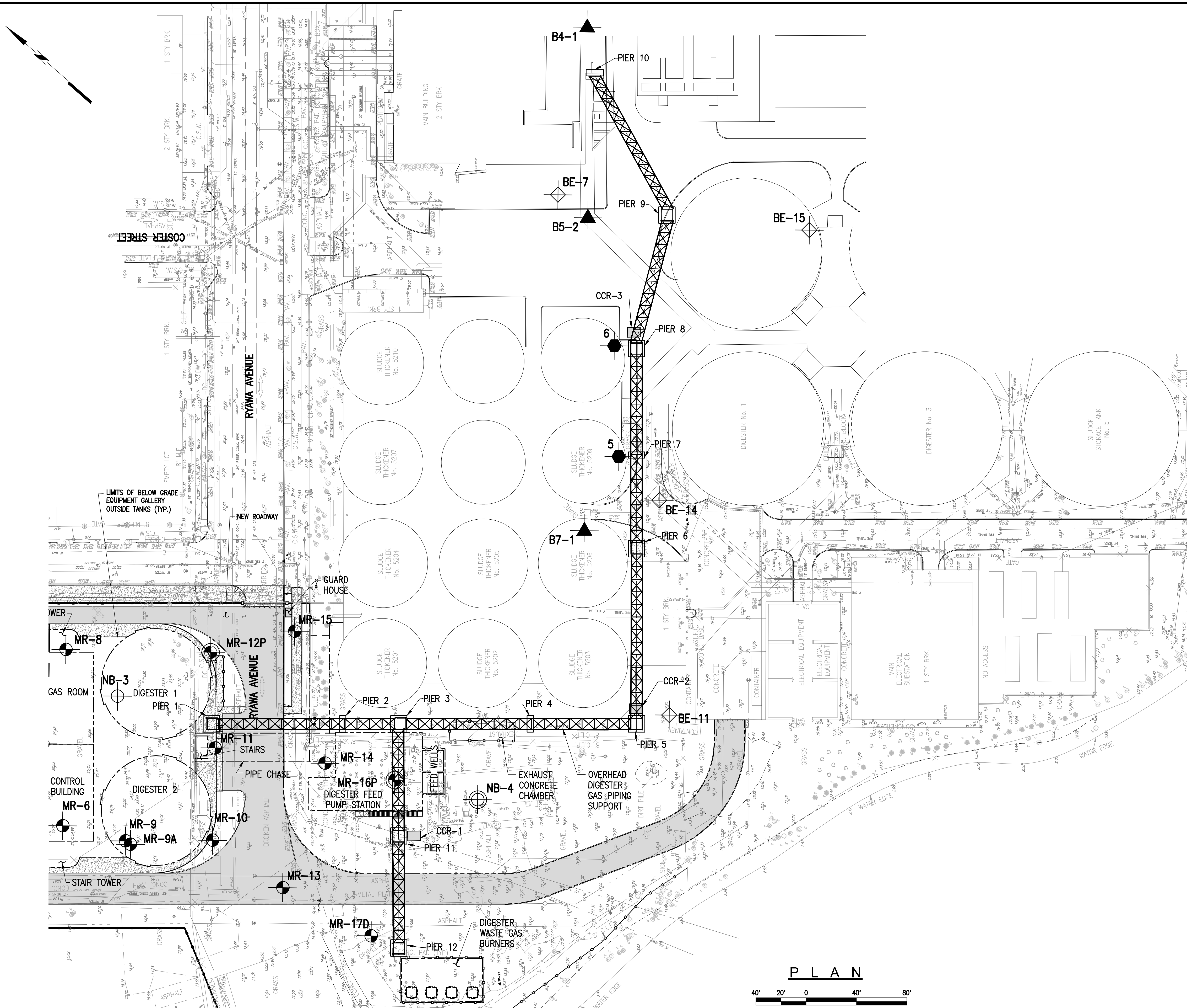

PLAN

NOTES:

1. THE PLAN IS BASED ON TOPOGRAPHIC SURVEY BY MUNOZ ENGINEERING, P.C. DATED DECEMBER 9, 2016.
2. PROPOSED DIGESTER FACILITY FOOTPRINT WAS PROVIDED BY BROWN AND CALDWELL ON OCTOBER 16, 2018 AND MAY NOT REPRESENT THE LATEST CONFIGURATION.
3. BORING NB-SERIES WERE MADE BY AQUIFER DRILLING AND TESTING, INC. (ADT) IN 2002 AND BE-SERIES WERE MADE BY CRAIG TEST BORING CO., INC. IN 1999 UNDER INSPECTION BY URS. BORING LOCATIONS ARE BASED ON BORING LOCATION PLAN, FIGURE 2, PREPRAPED BY URS, FROM ENGINEERING EVALUATION AND FOUNDATION RECOMMENDATIONS PHASES I AND II DRAFT REPORT, DATED APRIL 30, 2002.
4. 1960 BORINGS WERE MADE BY NYC DEPT. OF PUBLIC WORKS (DPW) IN 1959 AND SAMPLES EXAMINED BY MRCE IN 1960.
5. 1944 BORINGS WERE MADE BY NYC DPW.
6. BORING NOS. MR-1P THROUGH MR-17D WERE MADE BY JERSEY BORING AND DRILLING, INC. BETWEEN JUNE 11 AND JUNE 29, 2018 UNDER CONTINUOUS INSPECTION BY MUESER RUTLEDGE CONSULTING ENGINEERS (MRCE).
7. OVERHEAD DIGESTER GAS PIPING ALIGNMENT IS BASED ON DIGESTER GAS PIPING SUPPORT – OVERALL PLAN, DRAWING NO. S-574 PROVIDED TO MRCE ON AUGUST 24, 2018.

LEGEND:

B4-1 – PREVIOUS BORING (NYC DPW 1944)

5 – PREVIOUS BORING (MRCE 1960)

BE-7 – PREVIOUS BORING (URS 1999)

NB-3 – PREVIOUS BORING (URS 2002)

NB-4 – PREVIOUS BORING AND MONITORING WELL (URS 2002)

MR-15 – MRCE 2018 BORING

MR-12P – MONITORING WELL "P" INDICATES PIEZOMETER

REV.	DATE	BY	DESCRIPTION

HP-238 HUNTS POINT WWTP –
NEW ANAEROBIC DIGESTER FACILITIES

BRONX — NEW YORK

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MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY: L.R.	DATE: 10-24-2018	FILE NUMBER
GRAPHIC	CH'KD BY: S.M.R.	DATE: 10-24-2018	12591

AVAILABLE BORINGS NEAR OVERHEAD GAS PIPING ALIGNMENT

DRAWING NUMBER
B-2

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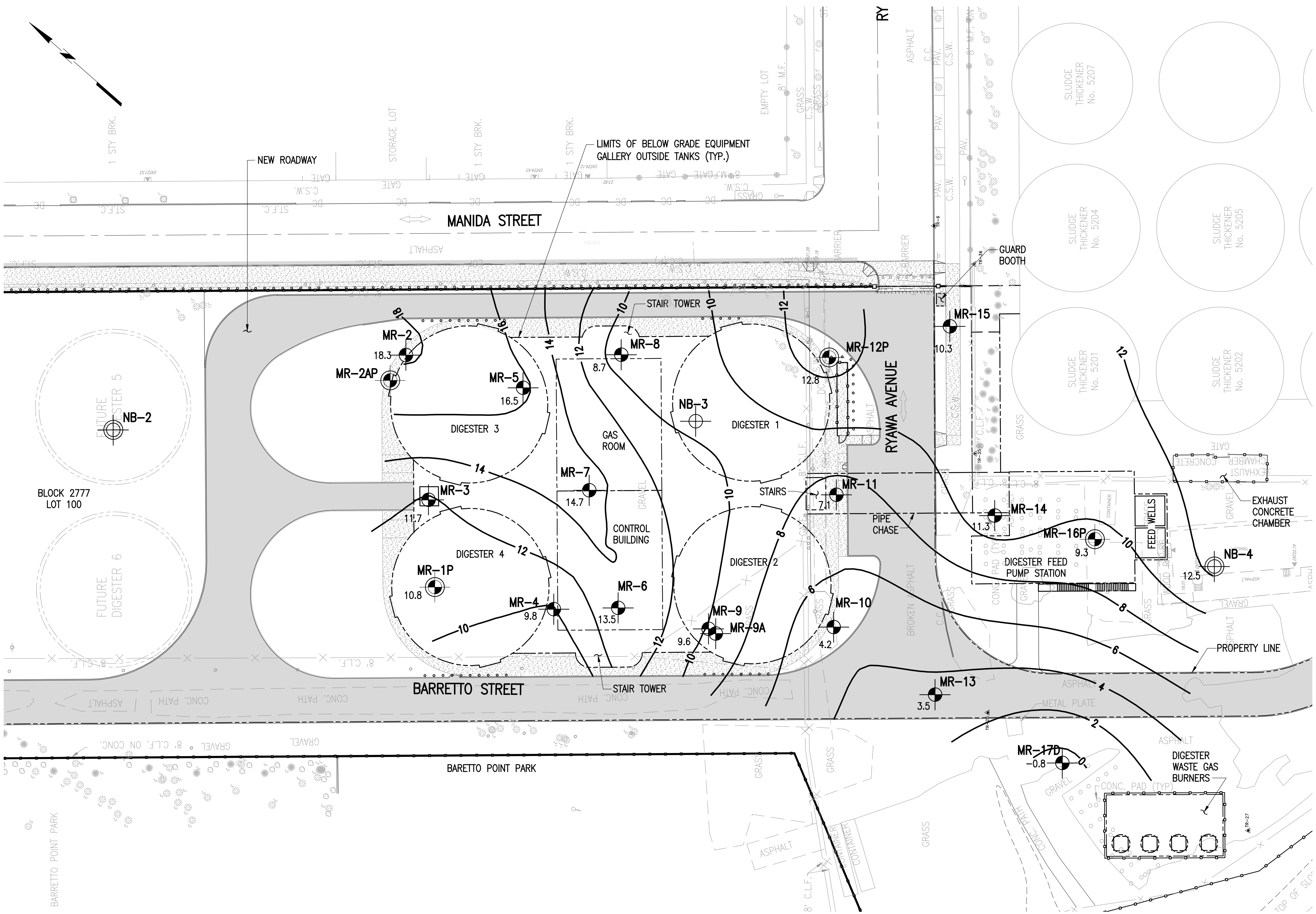

P L A N

30' 20' 10' 0 30' 60'

NOTES:

1. THE PLAN IS BASED ON TOPOGRAPHIC SURVEY BY MUNOZ ENGINEERING, P.C. DATED DECEMBER 9, 2016.
2. FOR GENERAL NOTES, SEE DRAWING NO. B-1.
3. CONTOURS SHOWN ARE SIMPLIFIED INTERPOLATIONS AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.
4. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD 88).

LEGEND:

- NB-3, 5.4 – PREVIOUS BORING (URS 2002) – TOP OF TILL/DR ELEVATION (TYP.)
- NB-2 – PREVIOUS BORING AND MONITORING WELL (URS 2002)
- MR-3 – MRCE 2018 BORING
- MR-12P – MRCE 2018 MONITORING WELL "P" INDICATES PIEZOMETER
- 10 – CONTOURS OF ELEVATION OF TOP OF STRATUM T OR DR, WHICHEVER IS HIGHER

REV.	DATE	BY	DESCRIPTION

HP-238 HUNTS POINT WWTP – NEW ANAEROBIC DIGESTER FACILITIES

BRONX — NEW YORK

BROWN AND CALDWELL

NEW YORK — NEW YORK

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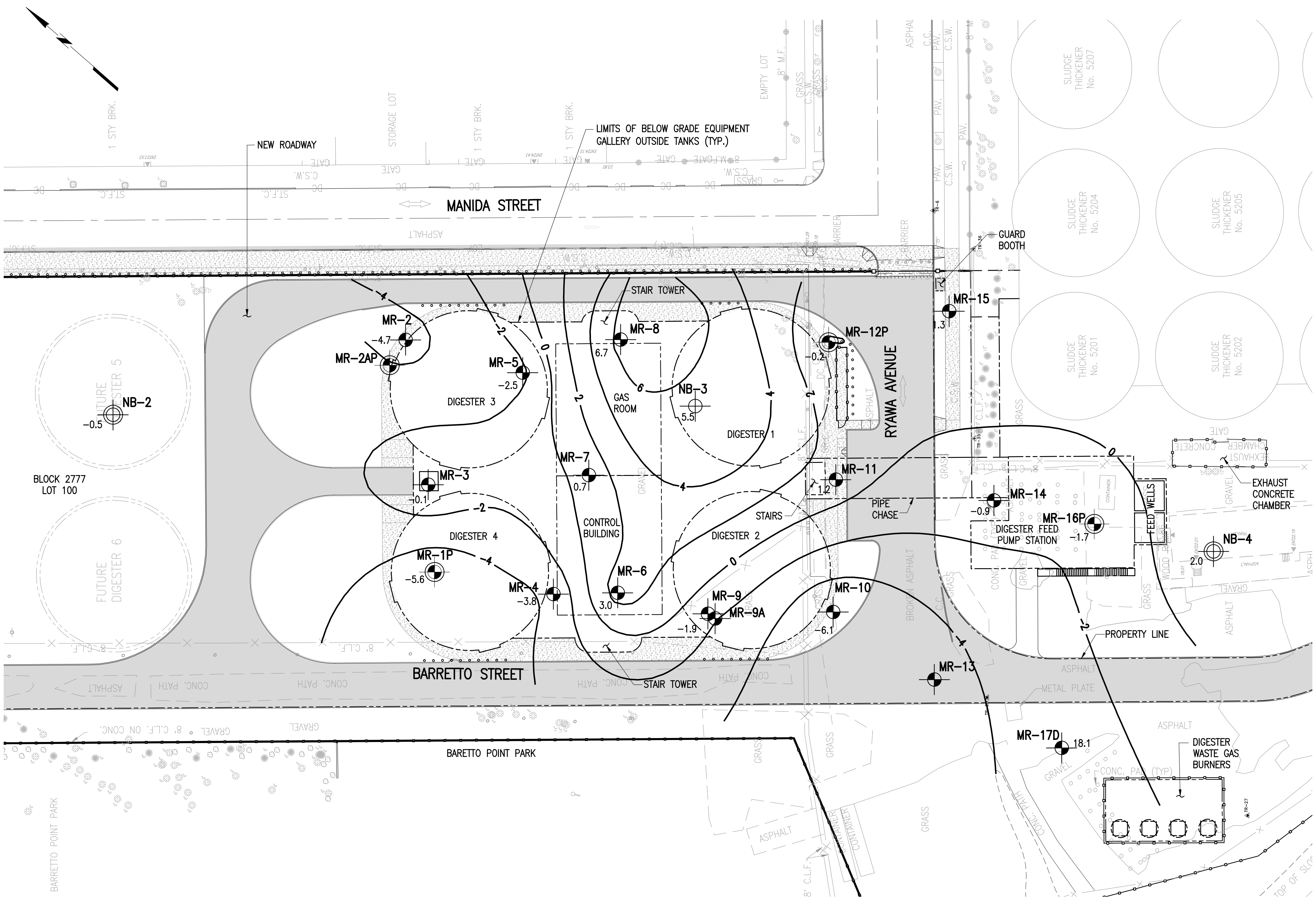
14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE			FILE NUMBER
GRAPHIC	MADE BY: L.R.	DATE: 10-24-2018	12591
	CH'KD BY: S.M.R.	DATE: 10-24-2018	

ELEVATION CONTOURS OF TOP OF STRATUM T – GLACIAL TILL

DRAWING NUMBER: C-1



PLAN

30' 20' 10' 0 30' 60'

NOTES:

1. THE PLAN IS BASED ON TOPOGRAPHIC SURVEY BY MUNOZ ENGINEERING, P.C. DATED DECEMBER 9, 2016.
2. FOR GENERAL NOTES, SEE DRAWING NO. B-1.
3. CONTOURS SHOWN ARE SIMPLIFIED INTERPOLATIONS AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.
4. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD 88).

LEGEND:

- NB-3, 5.5 – PREVIOUS BORING (URS 2002) – TOP OF ROCK/WR ELEVATION (TYP.)
- NB-2 – PREVIOUS BORING AND MONITORING WELL (URS 2002)
- MR-3 – MRCE 2018 BORING
- MR-12P – MRCE 2018 MONITORING WELL "P" INDICATES PIEZOMETER
- -4 – CONTOURS OF ELEVATION OF TOP OF STRATUM R OR STRATUM WR, WHERE PRESENT

REV.	DATE	BY	DESCRIPTION

HP-238 HUNTS POINT WWTP – NEW ANAEROBIC DIGESTER FACILITIES

BRONX NEW YORK

BROWN AND CALDWELL

NEW YORK NEW YORK

MUESER RUTLEDGE CONSULTING ENGINEERS

14 PENN PLAZA – 225 W. 34TH STREET, NY, NY 10122

SCALE	MADE BY: L.R.	DATE: 10-24-2018	FILE NUMBER
GRAPHIC	CH'KD BY: S.M.R.	DATE: 10-24-2018	12591

DRAWING NUMBER

ELEVATION CONTOURS OF TOP OF ROCK

C-2

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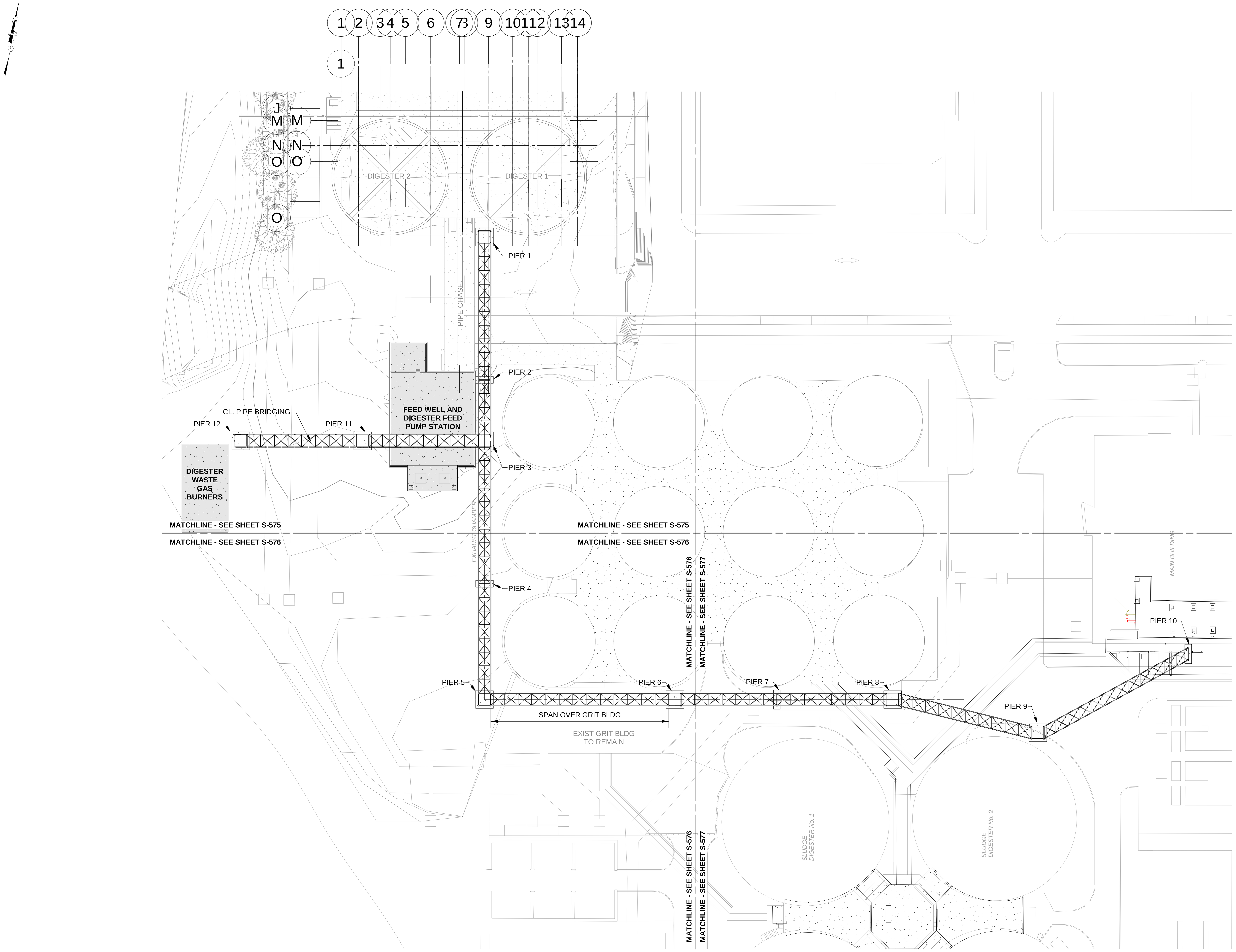
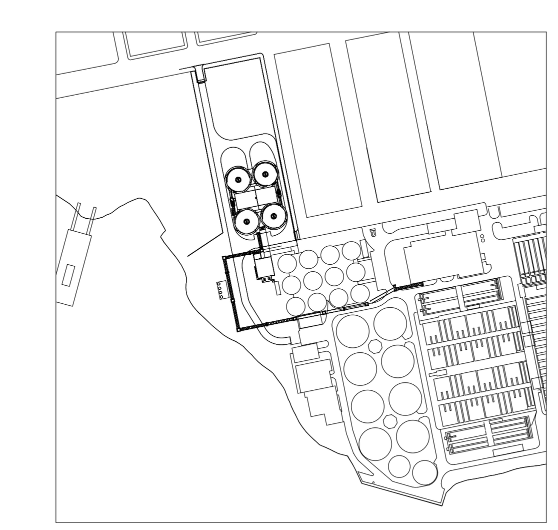
APPENDIX A

OVERHEAD DIGESTER GAS PIPING DRAWINGS
DIGESTER FEED PUMP STATION & FEED WELLS
DWGS

GENERAL NOTES

1. COORD LOCATION AND EL OF PIPE BRIDGING WITH MECH. NOTIFY ENGINEER OF ANY CONFLICTS.
2. FINAL PIPE BRIDGING LAYOUT TO BE DETERMINED. FINALIZED LAYOUT TO BE PROVIDED AT LATER SUBMISSION.
3. LIMITS OF ARCHITECTURAL MESH AND BULLETPROOFING TO BE DETERMINED.





KEY PLAN

0 40 80 FT.
1"=40'

DIGESTER GAS PIPING SUPPORTS - OVERALL PLAN

SCALE: 1" = 40'

60% DESIGN SUBMITTAL

DATE SUBMITTED:
JUNE 13, 2018

GRAPHIC SCALES CHECK BEFORE USE

IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT. SCALE ACCORDINGLY

B THAYER ASSOCIATES

NO.	DATE	REVISIONS/DESCRIPTION	APPR'D.

DESIGNED BY: A. DESANTIS
CHECKED BY: R. LOPEZ
DESIGN LEAD: R. HAMID
SECTION MANAGER: K. PAPASIAN
DRAWN BY: A. DESANTIS

Brown AND Caldwell
BROWN AND CALDWELL ASSOCIATES NEW YORK, NEW YORK

NYC Environmental Protection

ACCOUNTABLE MANAGER: N. FEDERICI, P.E.
PORTFOLIO MANAGER: M. OSIT, P.E.

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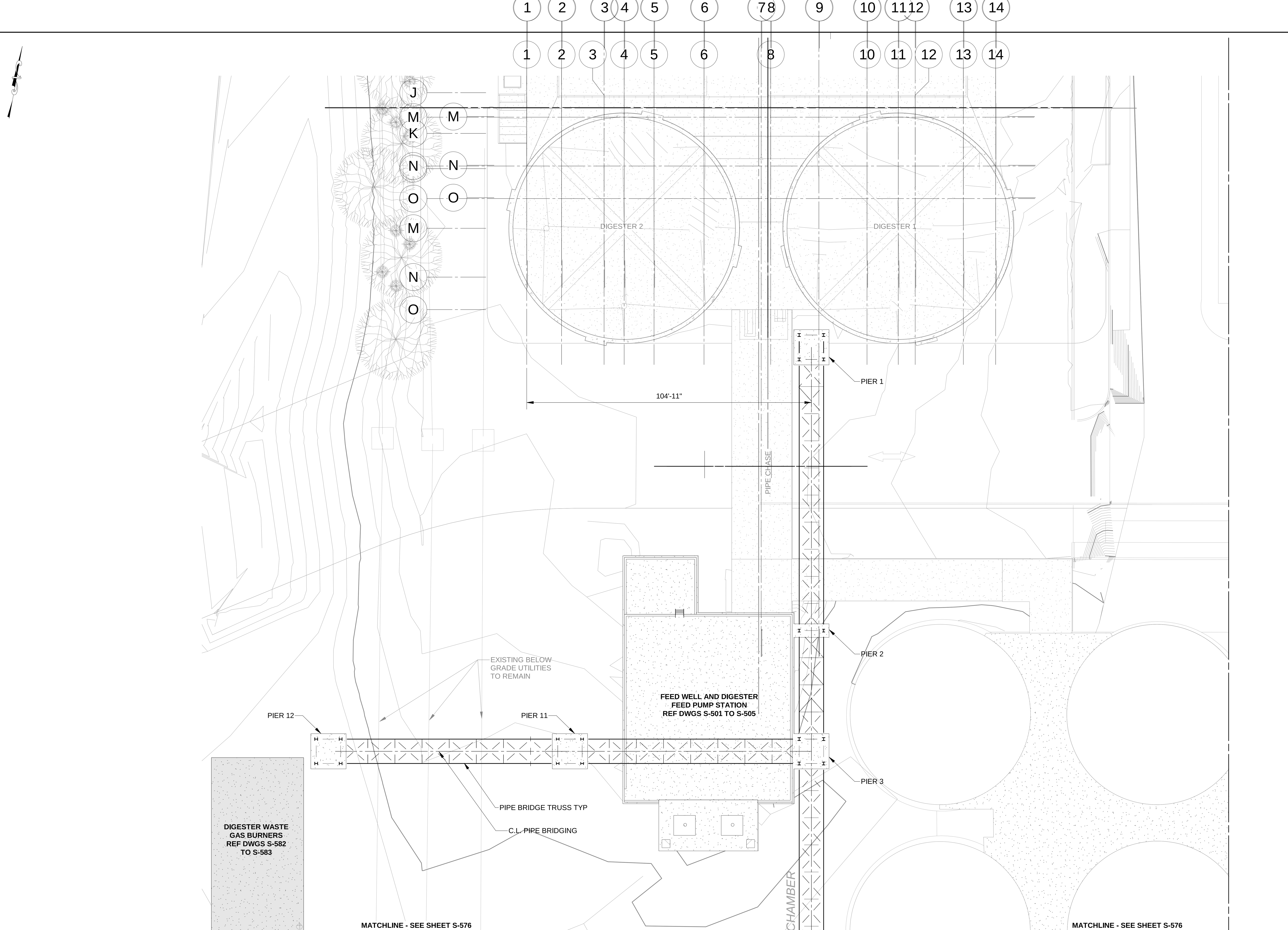
HUNTS POINT WWTP NEW ANAEROBIC DIGESTERS FACILITIES
STRUCTURAL
DIGESTER GAS PIPING SUPPORTS - OVERALL PLAN

DATE: JUNE 13, 2018
SCALE: 1" = 40'-0"
SHEET NO: 192 OF 596
DRAWING NO. S-574

BIM 360://148525 - Hunts Point Anaerobic Digesters/HP-238_S_BTA_V17.rvt
8/24/2018 2:25:06 PM

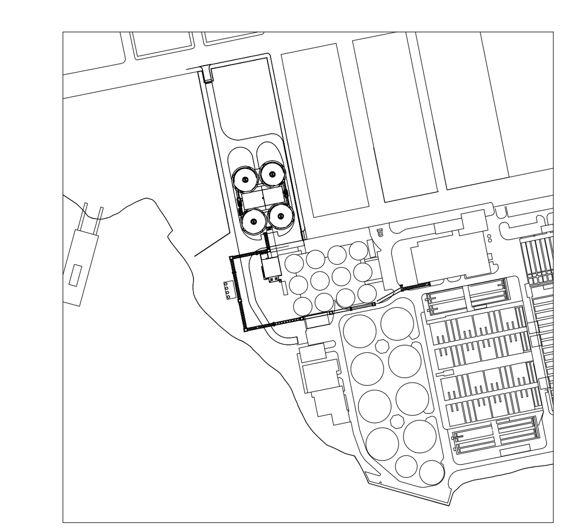
GENERAL NOTES

1. REF S-521 TO S-563 FOR DIGESTER FACILITY AND PIPE CHASE INFO



GAS PIPING SUPPORT - PARTIAL PLAN 1

SCALE: 1" = 20'



KEY PLAN

0 20 40 FT.
1"=20'

60% DESIGN SUBMITTAL

DATE SUBMITTED:
JUNE 13, 2018

GRAPHIC SCALES CHECK BEFORE USE

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B THAYER ASSOCIATES

NO.	DATE	REVISIONS/DESCRIPTION	APPR'D.

DESIGNED BY: A. DESANTIS
CHECKED BY: R. LOPEZ
DESIGN LEAD: R. HAMID
SECTION MANAGER: K. PAPASIAN
DRAWN BY: A. DESANTIS

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HUNTS POINT WWTP NEW ANAEROBIC DIGESTERS FACILITIES
STRUCTURAL
DIGESTER GAS PIPING SUPPORTS - PARTIAL PLAN - 1

DATE: JUNE 13, 2018
SCALE: 1" = 20'-0"
SHEET NO: 193 OF 596
DRAWING NO. S-575

8/24/2018 2:25:30 PM
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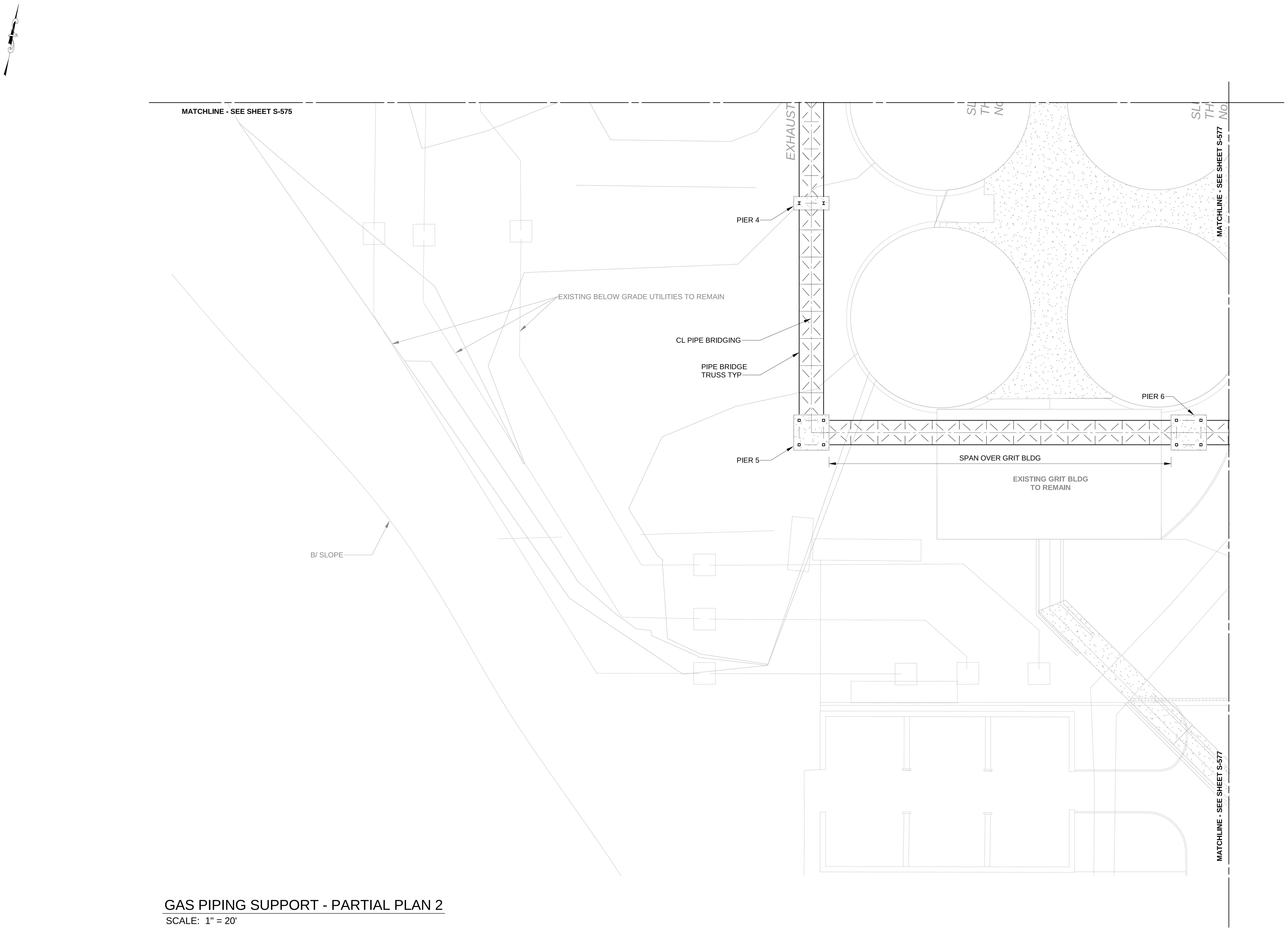
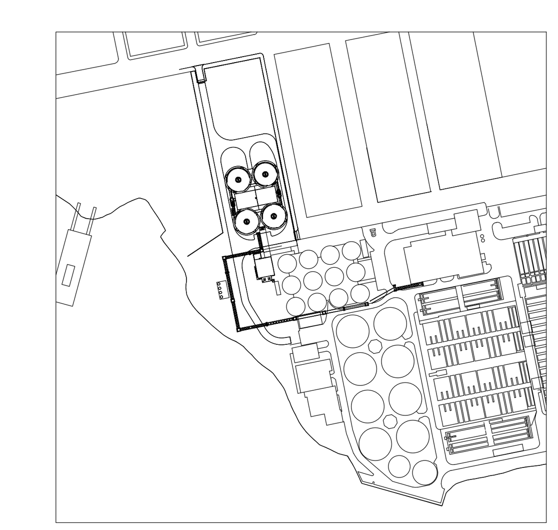


GAS PIPING SUPPORT - PARTIAL PLAN 2

SCALE: 1" = 20'



KEY PLAN

0 20 40 FT.
1"=20'

60% DESIGN SUBMITTAL

DATE SUBMITTED:
JUNE 13, 2018

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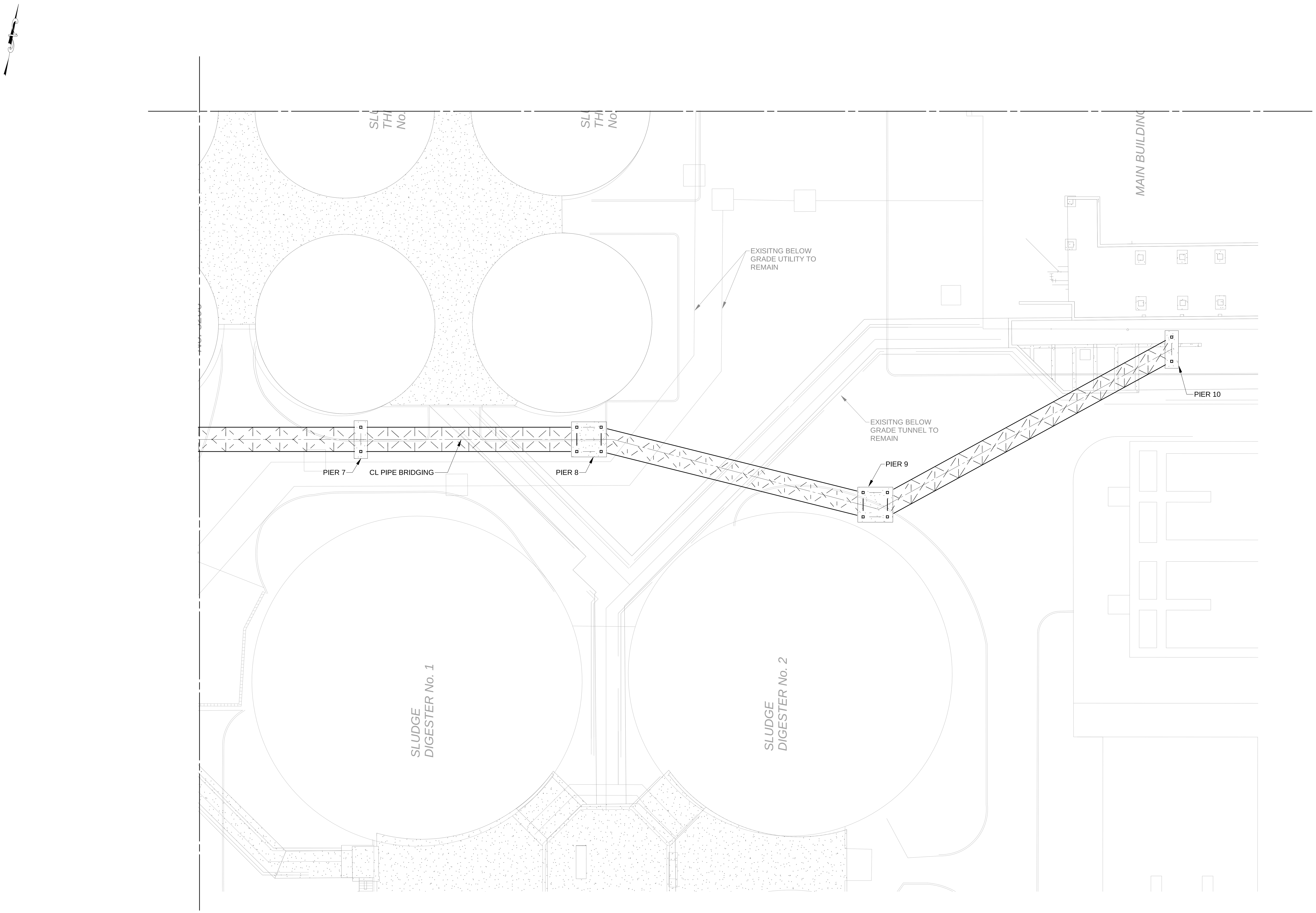
STRUCTURAL
DIGESTER GAS PIPING SUPPORTS - PARTIAL PLAN - 2

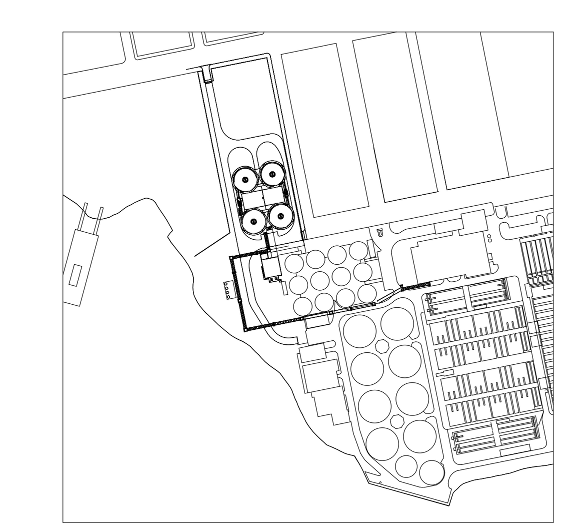
DATE: JUNE 13, 2018
SCALE: 1" = 20'-0"
SHEET NO: 194 OF 596
DRAWING NO. S-576

8/24/2018 2:25:32 PM
BIM 360://148525 - Hunts Point Anaerobic Digesters/HP-238_S_BTA_V17.rvt



GAS PIPING SUPPORT - PARTIAL PLAN 3

SCALE: 1" = 20'



KEY PLAN

0 20 40 FT.
1"=20'

60% DESIGN SUBMITTAL

DATE SUBMITTED:
JUNE 13, 2018

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HUNTS POINT WWTP NEW ANAEROBIC DIGESTERS FACILITIES
STRUCTURAL
DIGESTER GAS PIPING SUPPORTS - PARTIAL PLAN - 3

DATE: JUNE 13, 2018
SCALE: 1" = 20'-0"
SHEET NO: 195 OF 596
DRAWING NO. S-577

8/24/2018 2:25:33 PM

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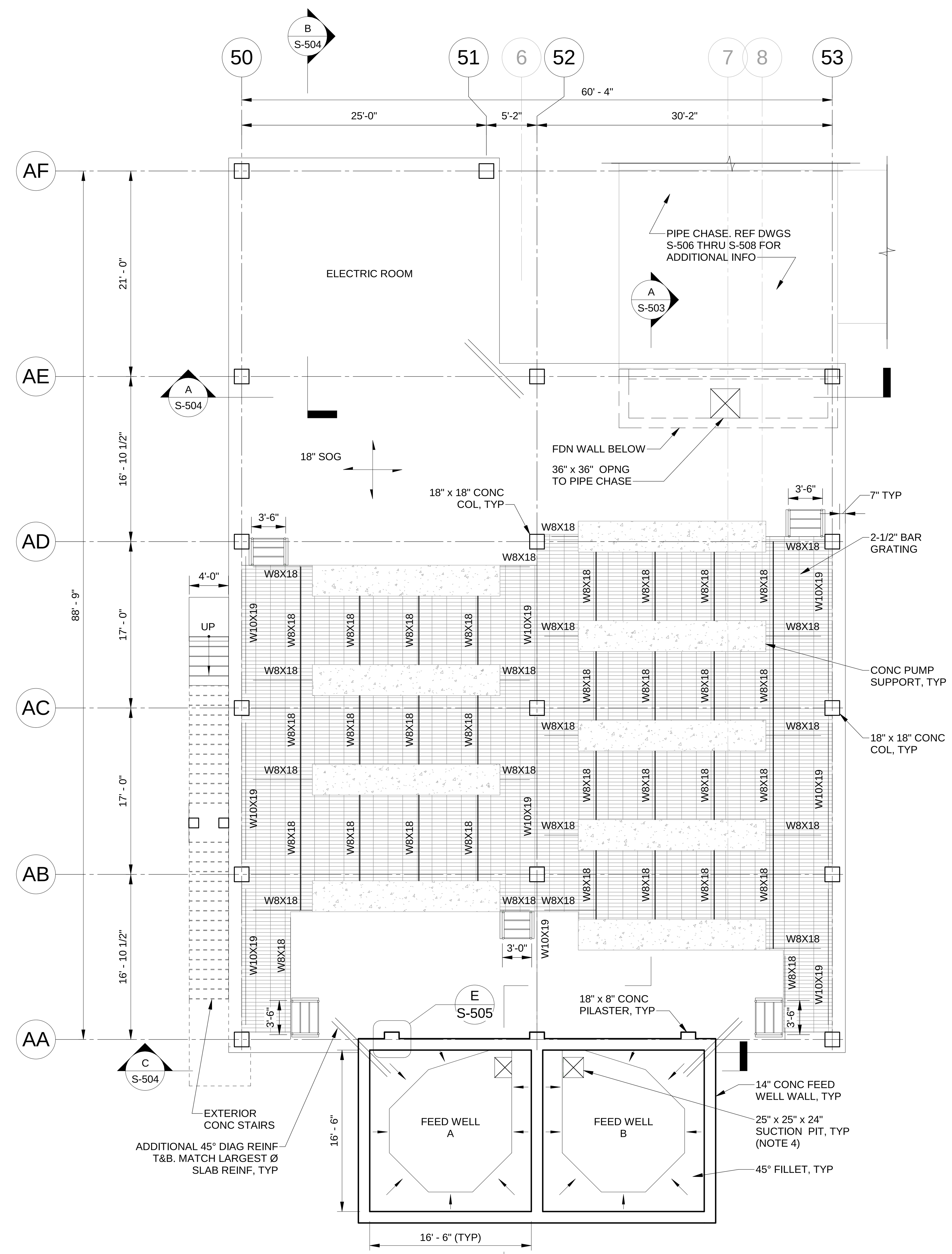
GENERAL NOTES

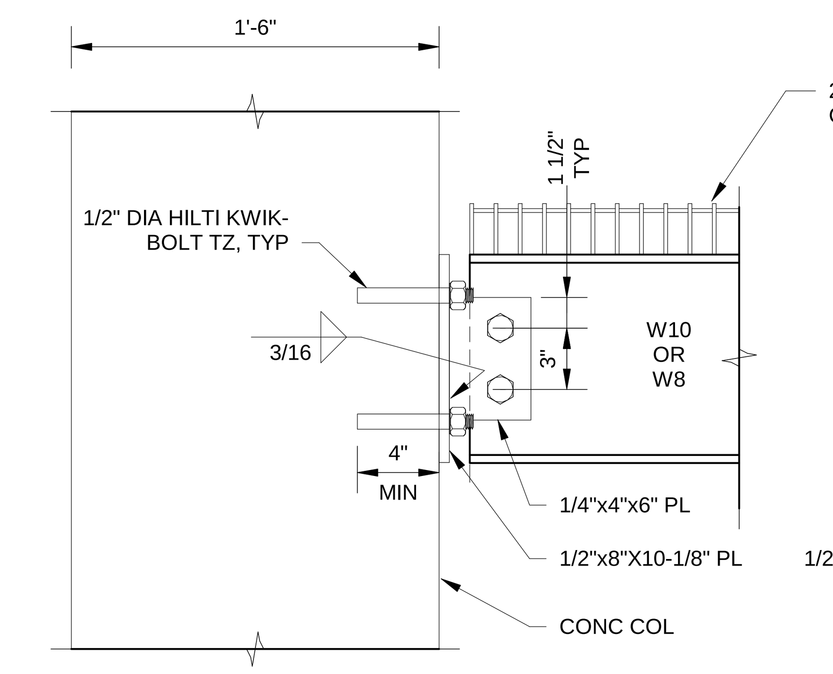
1. REF S-011 FOR BAR GRATING INFORMATION
2. REF S-013 FOR COLUMN SCHEDULE
3. REF S-505 FOR SLAB EDGE AND HAUNCH DETAILS
4. REF ARCH FOR INFILL WALL INFORMATION. REF S-009 FOR MASONRY WALL AND LINTEL INFORMATION.



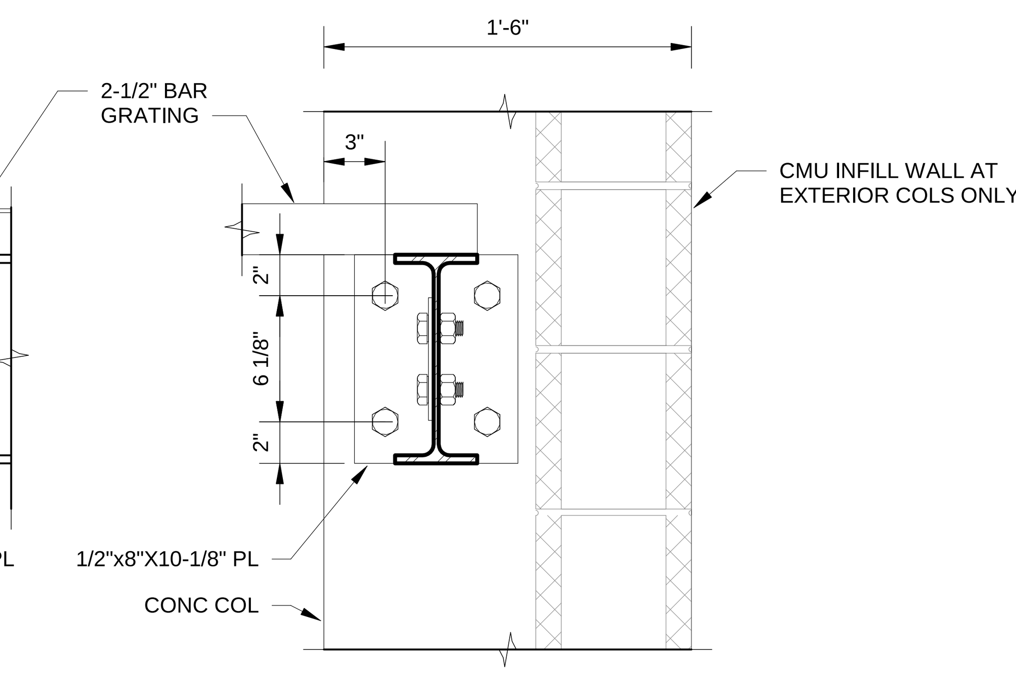
FEED WELL AND DIGESTER FEED PUMP STATION FLOOR PLAN AT EL. 24.00

SCALE: 1/8" = 1'-0"

NOTES:
1. DATUM - FIRST FLOOR FINISH FLOOR EL. 24' - 0"
2. MECHANICAL ACCESS PLATFORM FINISH FLOOR [+2' - 8"]. TOP OF STEEL [+2' - 5 1/2"]
3. PROPOSED APPROXIMATE CJ LOCATION. CONTRACTOR SHALL SUBMIT FINAL CJ LAYOUT TO ENGINEER FOR APPROVAL.
4. REF D/S-505 FOR SUCTION PIT DETAIL.



ELEVATION

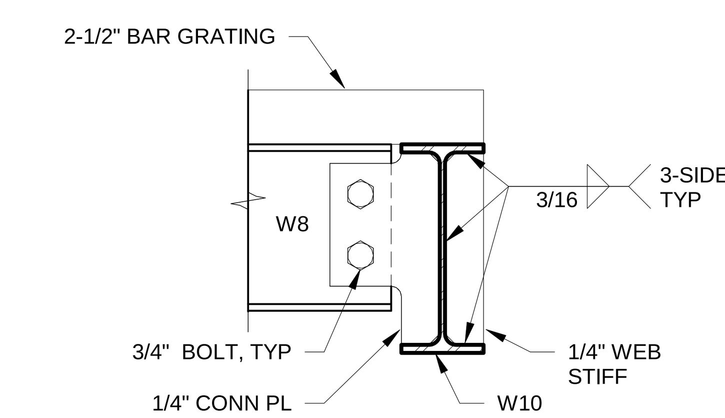


SECTION

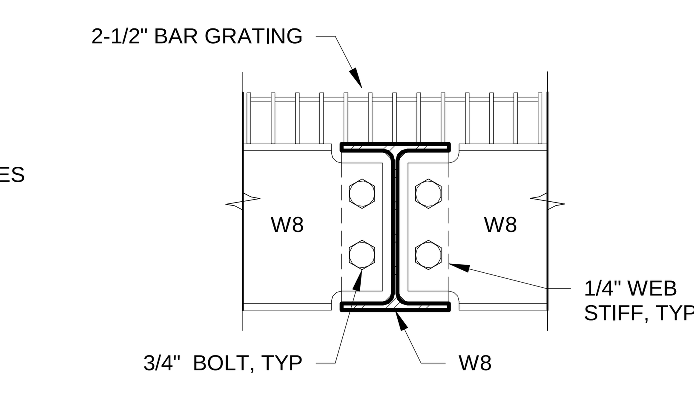
A TYPICAL GRATING FRAMING DETAIL AT COLUMN

SCALE: 1 1/2" = 1'-0"

NOTES:
1. CONFIGURATION SHOWN VALID FOR EXTERIOR COLUMNS. CENTER BEAM AND PLATES AT INTERIOR COLUMNS



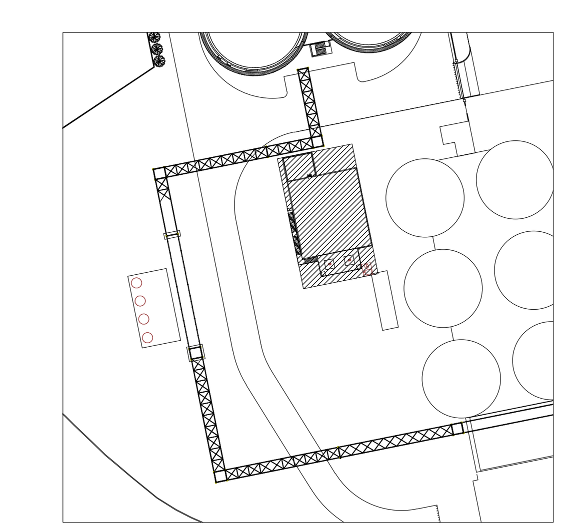
W8 TO W10



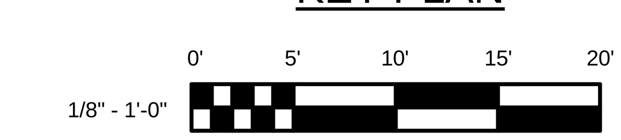
W8 TO W8

B TYPICAL GRATING SUPPORT FRAMING CONNECTIONS

SCALE: 1 1/2" = 1'-0"



KEY PLAN



PROGRESS SUBMISSION
DATE SUBMITTED:
AUGUST 31, 2018

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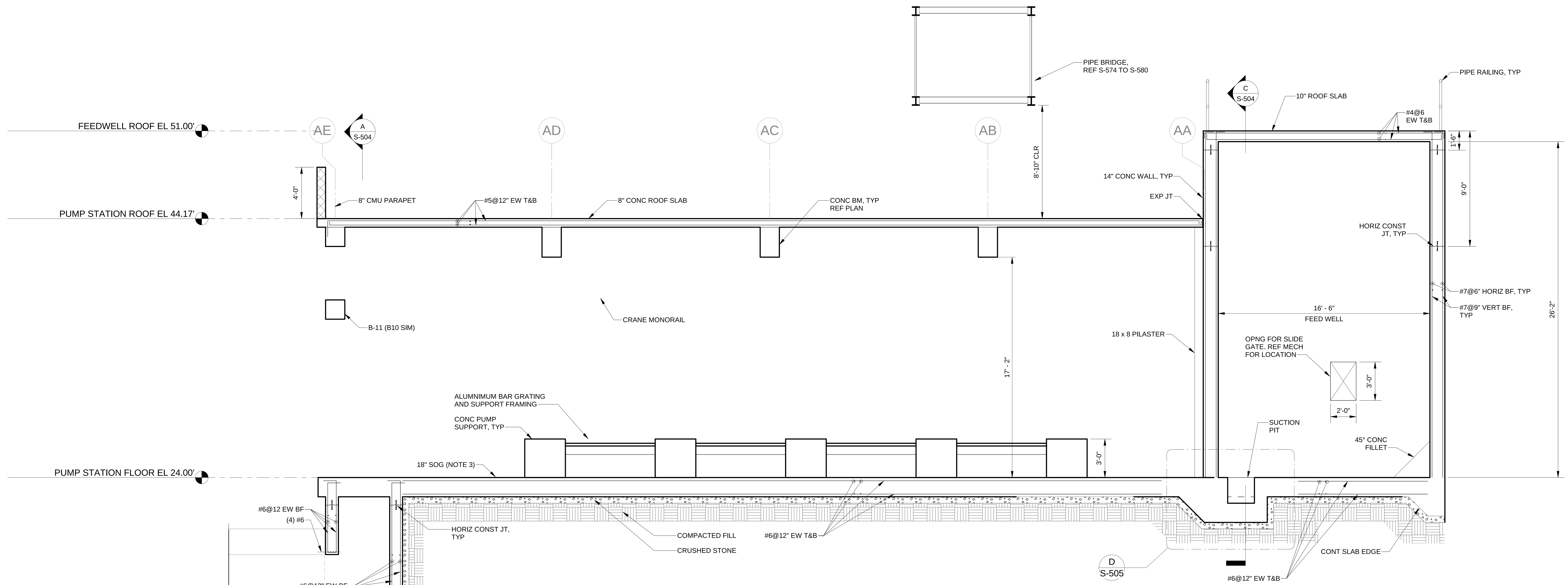
HUNTS POINT WWTP NEW ANAEROBIC DIGESTERS FACILITIES
STRUCTURAL
FEED WELL AND DIGESTER FEED PUMP STATION FLOOR PLAN

DATE: JUNE 13, 2018
SCALE: As indicated
SHEET NO: 130 OF 596
DRAWING NO. S-501

9/13/2018 9:04:49 AM
BIM 360://148525 - Hunts Point Anaerobic Digesters/HP-238_S_BTA_V17.rvt

GENERAL NOTES

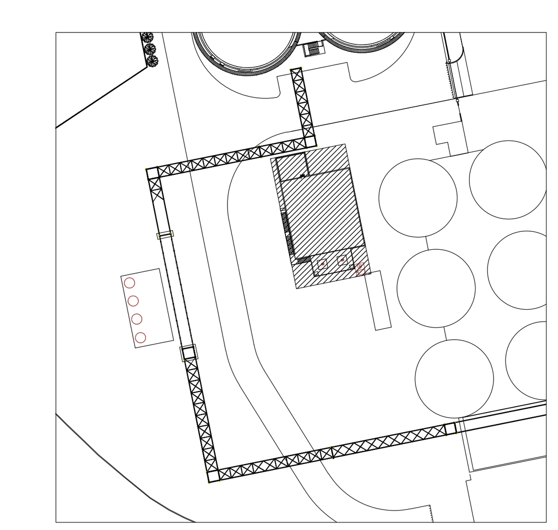
1. REF S-505 FOR TYPICAL SLAB EDGE AND SLAB HAUNCH DETAILS
2. SUGGESTED CONST JT LOCATIONS SHOWN. CONTRACTOR MAY SUBMIT ALTERNATE LOCATIONS TO ENGINEER FOR APPROVAL.
3. SLAB ON GRADE REINF TO BE FINALIZED FOLLOWING SUBMISSION OF FINAL GEOTECHNICAL REPORT.



A
S-501

SECTION THROUGH PUMP STATION

SCALE: 1/4" = 1'-0"



KEY PLAN

PROGRESS SUBMISSION
DATE SUBMITTED:
AUGUST 31, 2018

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NO.	DATE	REVISIONS/DESCRIPTION	APPR'D.

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CHECKED BY: R. LOPEZ
DESIGN LEAD: R. HAMID
SECTION MANAGER: K. PAPASIAN
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HUNTS POINT WWTP NEW ANAEROBIC DIGESTERS FACILITIES
STRUCTURAL
FEED WELL AND DIGESTER FEED PUMP STATION - SECTIONS AND DETAILS - 1

DATE: JUNE 13, 2018
SCALE: 1/4" = 1'-0"
SHEET NO: 132 OF 596
DRAWING NO. S-503

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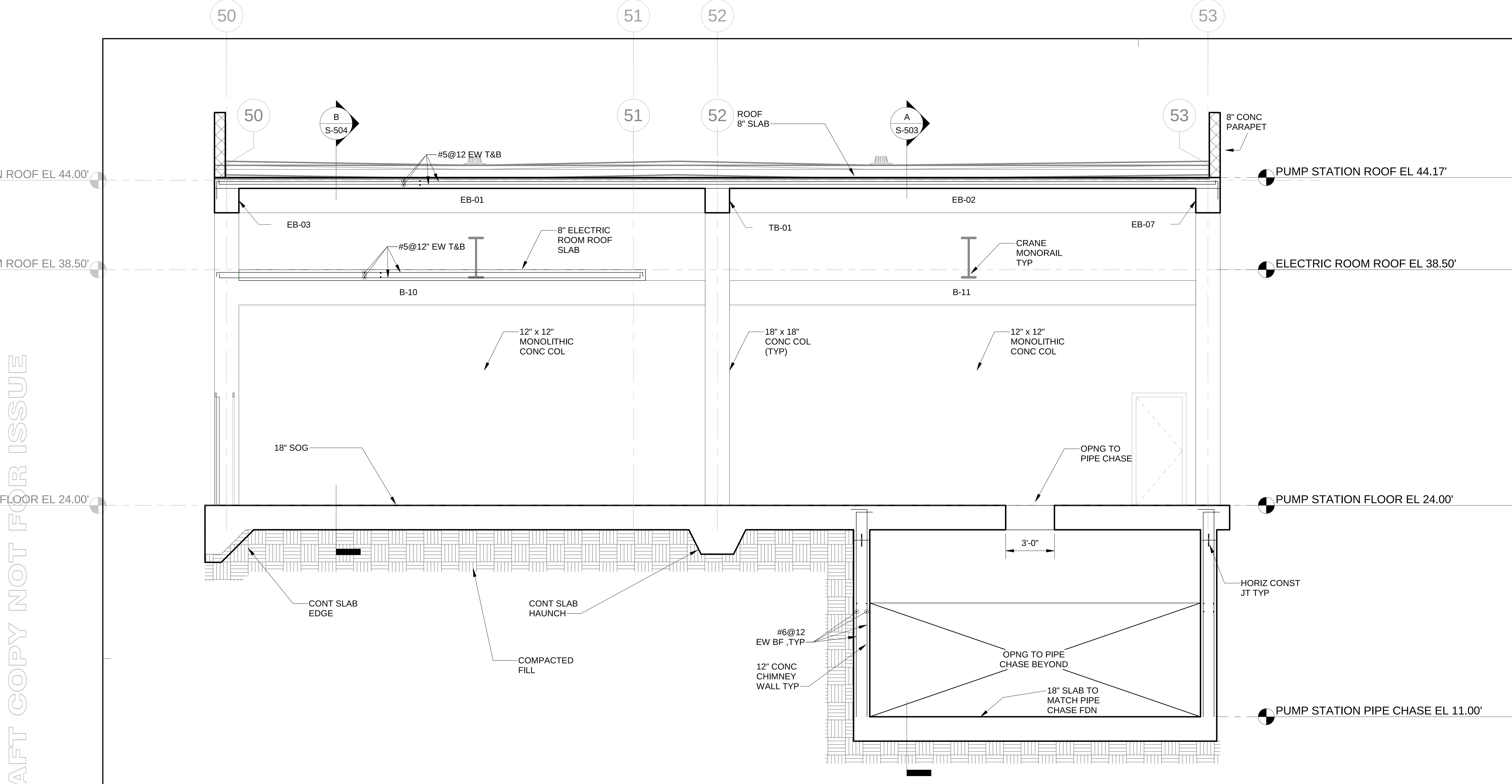
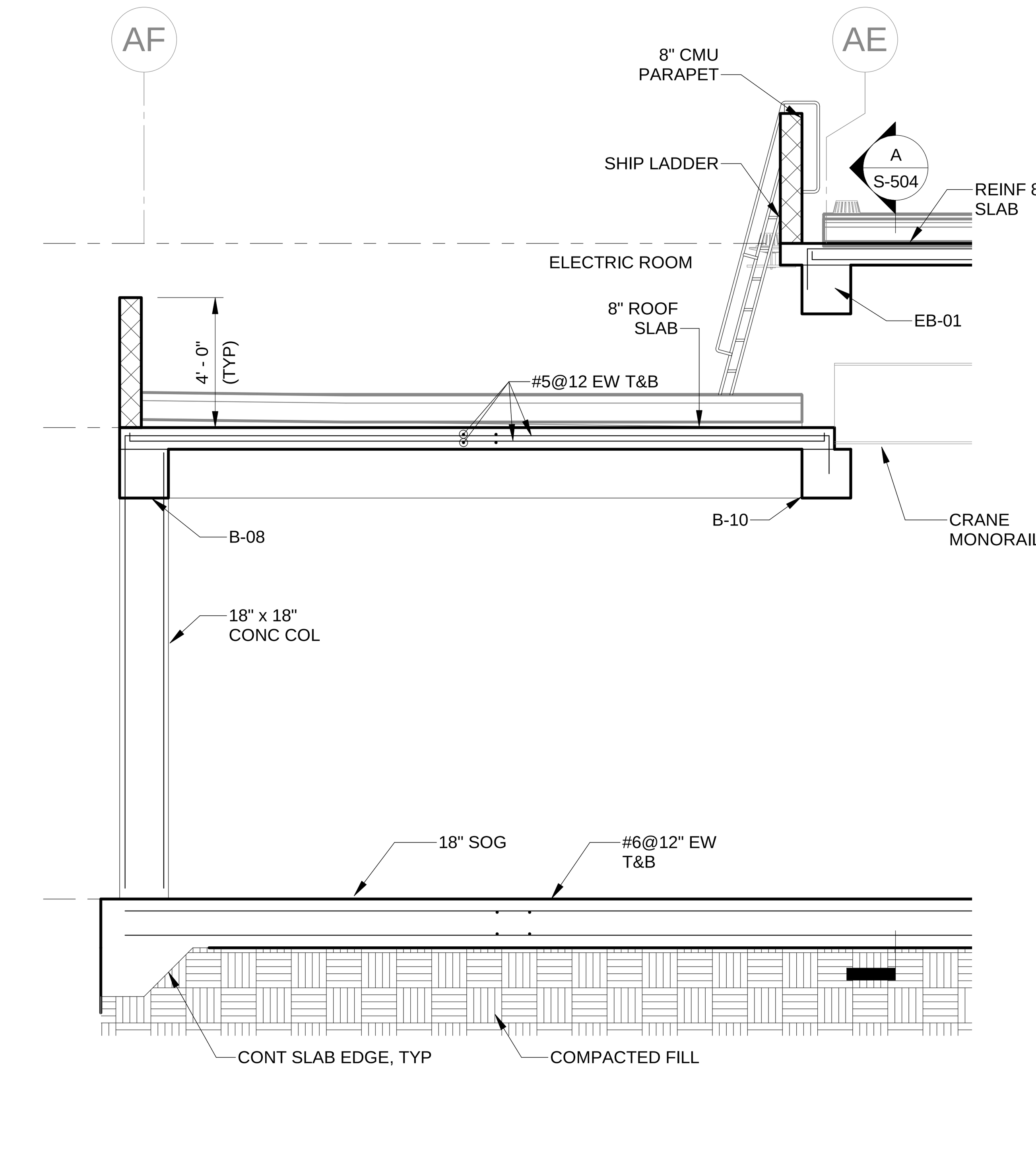
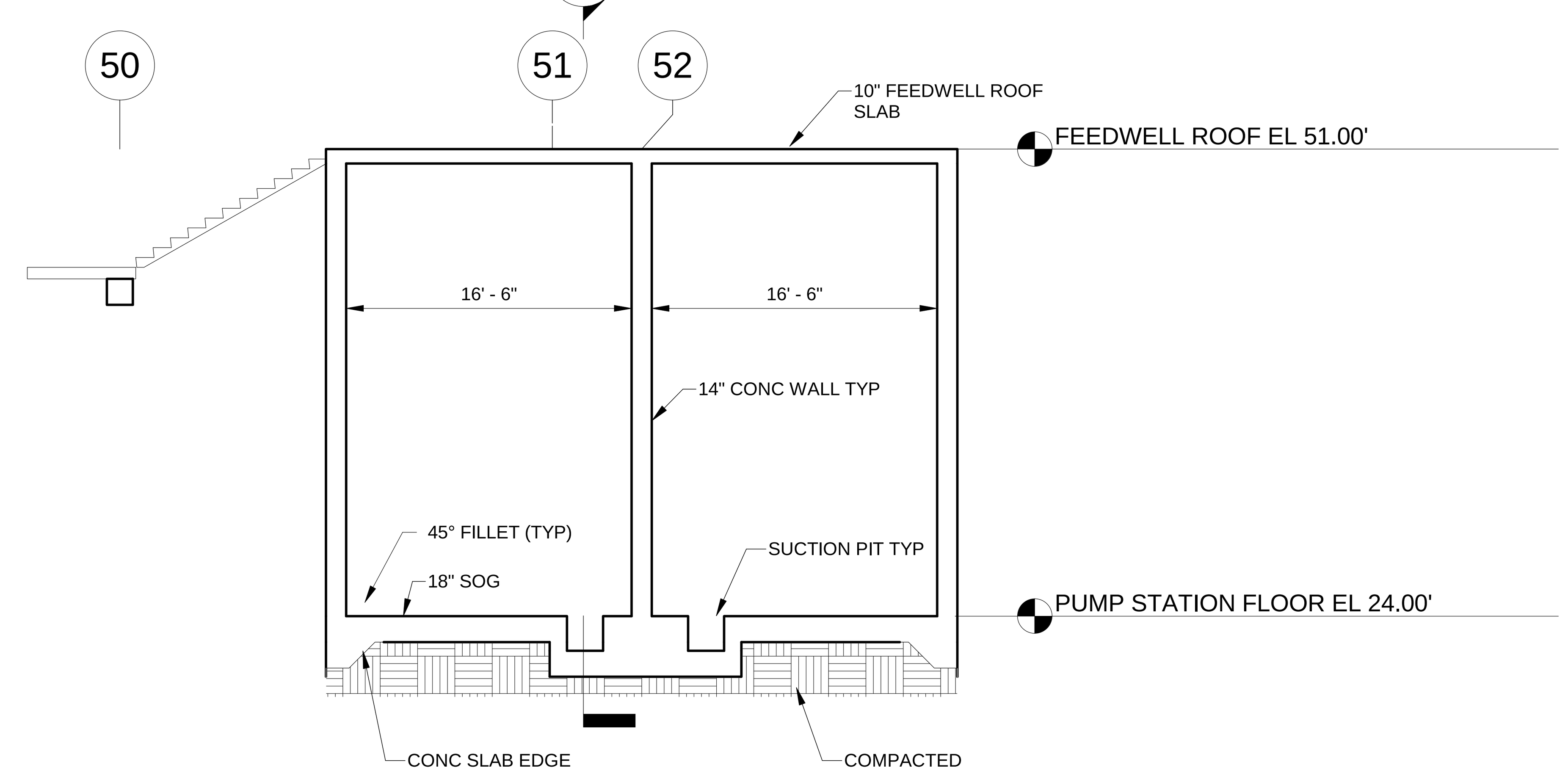


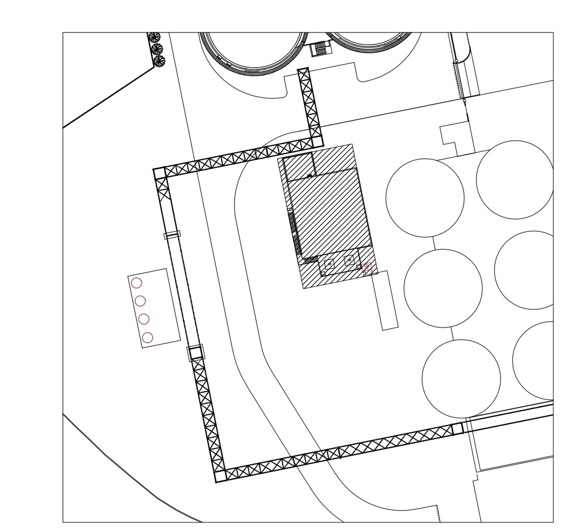
A
S-501
SECTION THROUGH PIPE CHASE CHIMNEY
SCALE: 1/4" = 1'-0"



B
S-501
SECTION THROUGH ELECTRIC ROOM
SCALE: 1/4" = 1'-0"



C
S-501
SECTION THROUGH FEED WELL
SCALE: 1/8" = 1'-0"



KEY PLAN

0' 2' 4' 6' 8'
1/4" - 1'-0"

0' 5' 10' 15' 20'
1/8" - 1'-0"

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DATE SUBMITTED:
AUGUST 31, 2018

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CHECKED BY: R. LOPEZ
DESIGN LEAD: R. HAMID
SECTION MANAGER: K. PAPASIAN
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HUNTS POINT WWTP NEW ANAEROBIC DIGESTERS FACILITIES
STRUCTURAL
FEED WELL AND DIGESTER FEED PUMP STATION - SECTIONS AND DETAILS - 2

DATE: JUNE 13, 2018
SCALE: As indicated
SHEET NO: 133 OF 596
DRAWING NO. S-504

9/13/2018 9:04:59 AM
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Prepared by

Brown and Caldwell Associates
1350 Broadway, Suite 2000
New York City, NY 10018
Tel: 646.367.0631