N90845.AR.001066
NWIRP BETHPAGE
5090.3a

FINAL BASIS OF DESIGN FOR WELLHEAD TREATMENT OF TRICHLOROETHENE CONTAMINATION AT AQUA NEW YORK SEAMANS NECK ROAD WATER PLANT NWIRP BETHPAGE NY

12/1/2010

TETRA TECH

Basis of Design Report

For

Wellhead Treatment for Trichloroethene Contamination at Aqua New York Seamans Neck Road Water Plant

Naval Weapons Industrial Reserve Plant
Bethpage, New York

Naval Facilities Engineering Command
Mid-Atlantic

Contract Number N62470-08-D-1001

Contract Task Order WE25

December 2010

BASIS OF DESIGN REPORT FOR WELLHEAD TREATMENT FOR TRICHLOROETHENE CONTAMINATION AT AQUA NEW YORK SEAMANS NECK ROAD WATER PLANT

NAVAL FACILITIES ENGINEERING COMMAND MID-ATLANTIC

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command
Mid-Atlantic
9742 Maryland Avenue
Norfolk, Virginia 23511-3095

Prepared and Submitted by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406-1433

Contract No. N62470-08-D-1001
Contract Task Order WE25

December 2010

APPROVED FOR SUBMISSION BY:

JOHN J. TREPANOWSKI
PROGRAM MANAGER
TETRA TECH
KING OF PRUSSIA, PENNSYLVANIA

PREPARED UNDER THE DIRECTION OF:

DAVE BRAYACK, P.E.
NY LN 080336
PROJECT MANAGER
TETRA TECH
NORFOLK, VIRGINIA

STATE OF NEW YORK
DAVID DANIEL BRAYACK
080336
LICENSED PROFESSIONAL ENGINEER

Table of Contents

This basis of design submission is presented in the format provided in Part 1 “Submission of Plans” of the *Recommended Standards for Water Works, 2007 Edition*.

1. Engineer's Report
2. Summary of the Design Criteria
3. Operation Requirements, where applicable
4. General Layout
5. Detailed Plans
6. Specifications
7. Cost Estimates
8. Water Purchase Contracts between Water Supplies (Not applicable)
9. Other Information as Required by Reviewing Authority

1.0 INTRODUCTION

This Basis of Design Report (BODR) has been prepared by Tetra Tech NUS, Inc. (Tetra Tech) for the Mid-Atlantic Division of the Naval Facilities Engineering Command (NAVFAC) under Contract Task Order (CTO) WE25 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract number N62470-08-D-1001. The BODR presents the design basis for implementing a well-head treatment remedy for Aqua New York (ANY) water supply wells N-8480 (Well No. 3) and N-9338 (Well No. 4) located at the Seaman's Neck Road Facility. Implementation of the design and construction of the remedy is authorized under the Navy's Record of Design (ROD), dated January 2003. The ROD addresses historic releases from Navy and Northrop Grumman property located generally north and hydraulically upgradient of the Seaman's Neck Road Facility.

Trichloroethene (TCE) has been detected in the water supply wells at concentrations up to approximately 2.1 micrograms per liter (µg/L) and has generally been trending upward since first detected in 2006, especially during peak water usage in the summer of each year. Monitoring wells directly upgradient of the well field did not exhibit detectable concentrations of TCE in groundwater. In addition, a groundwater investigation conducted in 2009, indicates that the primary flow path of contaminated groundwater in this area is east of the well field and/or at a depth below the well field extraction wells. Additional investigation of contaminated groundwater is continuing. The New York State Department of Health (NYSDOH) maximum contaminant level (MCL) for TCE is 5 µg/L. A summary of TCE data trends is presented in Appendix A. This BODR is presented in the format provided in the *Recommended Standards for Water Works, 2007 Edition*.

1.1 GENERAL INFORMATION

a. Description of the existing water works and sewage facilities:

Aqua New York's Nassau County service territory currently operates eight (8) individual plant sites. The water supply is obtained from the Magothy formation and Upper Glacial Aquifer through eighteen (18) source wells. All eighteen (18) wells provide a combined available capacity of 52.13 million gallons per day (MGD).

This report focuses on the Seaman's Neck Road facility, which is located at:

670 Seaman's Neck Road
Levittown, NY 11783

At the Seaman's Neck Road Facility, there are two operating wells (N-8480 and N-9339) and one inactive well (N-3893) (Table 1.1). The site's authorized capacity is 6.05 MGD. The rated capacity of the two pumping wells is 4,200 gallons per minutes (gpm) or 2,100 gpm per well. Raw water treatment at the Seaman's Neck Road Facility consists of pH adjustment, disinfection, and iron removal for the active wells. Sodium hydroxide is currently being used for pH adjustment. Sodium hypochlorite is used for disinfection and iron oxidation. An iron filtration system was installed in 2002 to remove naturally occurring iron from the raw water. A long chained polyphosphate product (Calciquest) is used for corrosion control in the un-lined portion of the distribution system.

Table 1.1: Summery of Existing Supply Wells (Seaman's Neck Road Facility)

ANY Well	NYSDEC	Year Placed in Service	Well Depth (feet)	Approved Capacity	Comment
No. 2	N-3893	1952	151	2.016	Inactive
No. 3	N-8480	1969	655	3.024	Active
No. 4	N-9339	1979	649	3.024	Active

NYSDEC: New York State Department of Environmental Conservation

Sewerage services are provided by Nassau County's Department of Public Works (NCDPW).

b. Identification of the municipality or area served:

Aqua New York's Nassau County service territory presently supplies potable water to an estimated population of 173,000 through approximately 44,380 metered service connections. Geographically, the water supply service area covers approximately 26 square miles within the southeastern portion of Nassau County in the Towns of Hempstead and Oyster Bay.

Adjacent water purveyors to Aqua New York ("Aqua NY" or "ANY") include the Town of Hempstead, and East Meadow Water District to the north, the Long Island Water Corporation, and Freeport Village to the west, South Farmingdale and Massapequa Water District to the east and the Suffolk County Water Authority to the far east.

c. Name and mailing address of the owner or official custodian:

This construction project is a joint effort between NAVFAC and ANY, a private water service utility. The construction project will be funded by the Navy's Environmental Restoration (ER) Program. Upon completion of construction and proveout, the facilities will be conveyed to Aqua New York.

The Navy's Point of Contact for this project is:

Ms. Lora Fly
Remedial Program Manager
NAVFAC Mid-Atlantic, Northeast IPT
9742 Maryland Avenue, Building *Z*-144
Norfolk, VA 23511-3095
Phone: 757-341-2012

The parcel of land and water supply facility is owned by Aqua New York.

Aqua New York
Joseph Trotta, Director, Laboratory
60 Brooklyn Avenue
Merrick, NY 11566
(516)378-3922

d. Imprint of professional engineer's seal or conformance with engineering registration requirements of the individual state or province:

Certification is provided on the Title Page of this BODR.

1.2 EXTENT OF WATER WORKS SYSTEM

a. ***Description of the nature and extent of the area to be served:***

Aqua New York's Nassau County service territory presently supplies potable water to an estimated population of 173,000 through approximately 44,380 metered service connections. Geographically, the water supply service area covers approximately 26 square miles within the southeastern portion of Nassau County in the Towns of Hempstead and Oyster Bay. Based on the existing water supply system, the Seaman's Neck Road Facility provides water predominately to the northeastern portion of the service territory.

b. Provisions for extending the water works system to include additional areas:

This BODR provides no provisions for extending or expanding the water works system.

c. Appraisal of the future requirements for service, including existing and potential industrial, commercial, institutional, and other water supply needs:

Additional water supply needs in the area are not anticipated. In the event that additional water is to be obtained from this area, the quality of groundwater would be reviewed and the need to provide additional treatment, if any, would be evaluated at that time.

1.3 JUSTIFICATION OF PROJECT

a. Where two or more solutions exist for providing public water supply facilities, each of which is feasible and practicable, discuss the alternatives. Give reasons for selecting the one recommended, including financial considerations, operational requirements, operator qualifications, reliability, and water quality considerations:

TCE has been detected in the Seaman's Neck Road facility's source water at a maximum concentration of 2.1 µg/L in September 2009. Some seasonal variation appears to be occurring with the TCE concentration, but there appears to be a general trend of increasing concentrations (Appendix A). The maximum anticipated VOC concentration at the Seamans Neck Road Facility, as well as the duration of impact, is uncertain. Based on evaluation of existing groundwater data in the area, the maximum influent TCE concentration has been estimated to be 10 to 50 µg/L. Higher concentrations of TCE have been detected in groundwater samples collected from below the depth of the Seaman's Neck Road Facility supply wells and in monitoring wells to the east of the Facility. In addition, other non-Navy-related VOCs (tetrachloroethene [PCE]) have been detected in shallower monitoring wells north of the Seaman's Neck Road Facility.

The New York State Department of Health (NYSDOH) drinking water standard for TCE is 5 µg/L in potable water supply systems. Notification, additional monitoring, and treatment are required at lower concentrations. The objective of this BODR is to reduce TCE concentrations in the plant effluent to 0.5 µg/L or less.

Two "Best Available Technologies" for the treatment of TCE were evaluated. One technology is packed tower aeration (PTA), also known as air stripping. The other technology is liquid phase granular activated carbon (GAC). Typically, GAC is the preferred method when dealing with low concentrations of VOCs that can effectively be adsorbed on GAC, and PTAs are used when higher concentrations are anticipated or poorly adsorbed VOCs are present.

An evaluation of air stripping and GAC treatment options were developed and evaluated. This evaluation is detailed in Appendix B, and evaluated four options, as follows:

Option A – Liquid phase GAC before the iron removal plant;

Option B – Liquid phase GAC after the iron removal plant;

Option C – Air stripping after the iron removal plant, assuming the maximum TCE concentration entering the well field would remain less than 50 µg/L; and

Option D – Air stripping after then iron removal plant, assuming the maximum TCE concentration entering the well field would exceed 50 µg/L.

Based on this evaluation, the Navy in consultation with Aqua New York identified Option B – liquid phase GAC after the iron removal plant, as the preferred option for addressing TCE in these water supply wells. Since there is a potential that higher concentrations of VOCs can enter the system in the future, the Navy is installing additional monitoring wells in the area to better evaluate the type, concentration, and duration of VOCs that may be entering the well field in the future. In addition, space is being reserving at the facility to install an air stripping pre-treatment system to address the potential for higher concentrations of VOCs (e.g., TCE at a concentration greater than 50 µg/L for an extended period of time) or the significant presence of poorly adsorbed VOCs (e.g., cis-1,2-dichloroethane).

1.4 SOIL, GROUNDWATER CONDITIONS, AND FOUNDATION PROBLEMS

a. The character of the soil through which water mains are to be laid:

A soil investigation was conducted at the facility in February 2010. The Geotechnical Report is presented in Appendix C. The soils at the Seaman's Neck Road Facility to a depth of 30 feet below ground surface are classified as tan-brown, fine to coarse sand, with some fine gravel and a trace of silt (USCS: SW, gravelly sand).

b. Foundation conditions prevailing at sites of proposed structures:

A soil investigation was conducted at the facility in February 2010. The Geotechnical Report is presented in Appendix C. The soils at the Seaman's Neck Road Facility to a depth of 30 feet below ground surface are classified as tan-brown, fine to coarse sand, with some fine gravel and a trace of silt (USCS: SW, gravelly sand).

c. ***The approximate elevation of ground water in relation to subsurface structures:***

A soil investigation was conducted at the facility in February 2010. The Geotechnical Report is presented in Appendix C. Groundwater was encountered at approximately 23 feet below ground surface.

1.5 WATER USE DATA

a. A description of the population trends as indicated by available records, and the estimated population which will be served by the proposed water supply system or expanded system 20 years in the future in five year intervals or over the useful life of critical structures/equipment

Additional water supply needs in the area are not anticipated. The design is based on the current authorized capacity. In the event that additional water is to be obtained from this area, the quality of groundwater would need to be evaluated and the need to provide additional treatment would be evaluated at that time.

b. Present water consumption and the projected average and maximum daily demands, including fire flow demand:

Water supply well pump No. 3 is rated for 1,800 gpm, while water supply well pump No. 4 is rated for 2,100 gpm. Each well has a state authorized capacity of 2,100 gpm or a total capacity of 4,200 gpm (6.05 MGD). Based on recent plant records, on an annual basis, the plant operates at approximately 34 percent of maximum capacity (1,428 gpm average or 3,000 hours per year at maximum capacity). Typical operation is for one of the wells to operate the majority of the time year round, and the second well operates on a more regular basis only during the summer months. During peak summer use, both wells run continuously for an extended period of time.

c. Present and/or estimated yield of the sources of supply:

Since the facility has been operating for an extending period of time without issue, the existing yield of the groundwater aquifer is assumed to be adequate for current and potential future water uses.

d. Unusual occurrences:

Other than the presence of TCE and potentially other VOCs in the groundwater, unusual occurrences have not been identified.

1.6 Flow requirements

a. Hydraulic analyses based on flow demands and pressure requirements:

Since the existing well field has been operating for an extended period of time without incident, the existing well field is believed to be adequate for current and potential future water uses. Because the planned treatment system will result in additional pressure loss (up to 15 pounds per square inch), the capacity of the existing pumps and motors will be upgraded to maintain the current flow and pressure in the system.

b. Fire flows, when fire protection is provided, meeting the recommendations of the Insurance Services Office or other similar agency for the service area involved.

The existing well field is believed to be adequate for current and potential future water uses. Because the planned treatment system will result in additional pressure loss (up to 15 pounds per square inch), the capacity of the existing pumps will be upgraded to maintain the current flow and pressure in the system.

1.7 Sources of water supply:

a. Source Selection:

The existing water supply wells will continue to be used. This project does not consider the closure or relocation of the Seaman's Neck Road facility or the new development or modification of a source well.

1.7.1 <u>Surface water sources (selection criteria):</u>

Surface water is not being considered as a water supply source.

1.7.2 <u>Groundwater sources (selection criteria):</u>

The existing groundwater source will continue to be used.

1.8 PROPOSED TREATMENT PROCESSESS

Summarize and establish the adequacy of proposed processes and unit parameters for the treatment of the specific water under consideration. Alternative methods of water treatment and chemical use should be considered as a means of reducing waste handling and disposal

problems. Bench scale test, pilot studies, or demonstrations may be required to establish adequacy for some water quality standards.

The existing treatment systems consisting of pH control, chlorination disinfection, and iron removal will remain and continue in its current configuration. The existing phosphate feed system will be located to the effluent from the new GAC system.

Primary elements of the proposed treatment system are as follows:

- The pumps and motors in the existing water supply wells will be upgraded to address additional pressure loss in the new GAC system.
- Six carbon steel, liquid phase GAC adsorption system will operate in parallel. Each vessel is 10 feet in diameter and 18 feet high (23 feet high from grade), and contains 20,000 pounds of GAC.
- A new sodium hypochlorite post-GAC chlorination system will be used to provide residual chlorine in the plant effluent.
- The GAC system will be designed to allow for periodic backwashing (or fluffing) of the filters. This operation will be mostly manual with limited automation to prevent overflow of a planned backwash holding tank. A new centrifugal pump will be provided for the backwash (fluffing) operation. This pump will pull water from the existing water storage tank currently used for backwashing the iron filtration system. The waste backwash water will be sent to a new backwash tank located inside the new building. Waste water from the backwash tank will flow by gravity (50 to 200 gpm) to the existing sanitary sewer main.
- Pressure, flowrate, and water level instrumentation will be provided for operation.

1.9 Sewerage system available

Describe the existing sewerage system and sewage treatment works, with special reference to their relationship to existing or proposed water works structures which may affect the operation of the water supply system, or which may affect the quality of the supply:

Community sanitary sewerage is by NCDPW. There are sewer mains that run along Seaman’s Neck Road and along Red Oak Drive. Although sanitary sewer mains are within 100’ to 150’ feet of the wellheads, the source wells are considered “deep”, so cross contamination between source water and sewer water has not been identified as a concern at this time.

In addition, the water lines pass over the sanitary sewer lines at the crossings on Seaman’s Neck Road and Red Oak Drive.

1.10 Waste disposal

Discuss the various wastes from the water treatment plant, their volume, proposed treatment and points of discharge. If discharging to a sanitary sewerage system, verify that the system,

including any lift stations, is capable of handling the flow to the sewage treatment works and that the treatment works is capable and will accept the additional loading:

The primary waste stream from the proposed treatment system is spent GAC. A total of 120,000 pounds of spent GAC will be taken off site for disposal every two to five years.

Community sanitary sewerage is by NPDPW. Aqua New York discharges to the sewer system through an existing tie-in on Seaman's Neck Road. Currently, wastewater from the backwash of the iron filtration plant is discharged to the sewer. The proposed plant will generate additional wastewater that is to be discharged to the sanitary sewer system. The wastewaters will consist of the following:

- Water sample ports for monitoring: less than 1,000 gallons per day;
- Miscellaneous water from tank condensation, eye wash and shower testing: less than 1,000 gallons per day;
- Compliance testing waters generated during GAC changeouts, and if necessary rinse waters from sodium hydroxide-based disinfection of media: 100,000 gallons of water per unit, every two to five years; and
- If required, carbon backwashing water: 60,000 gallons every 6 to 24 months.

The existing sewer connection for the facility is rated 200 gpm (288,000 gallon per day). Flow rate and pH will be equalized as needed prior to discharge. This discharge and these operations are not anticipated to have a significant impact on the existing sewage system.

Extended high rate water discharges during system proveout and GAC changeout flushing water will also be discharged to a surface water recharge basin located on Red Oak Drive.

1.11 Automation

Provide supporting data justifying automatic equipment, including the servicing and operator training to be provided. Manual override must be provided for any automatic controls. Highly sophisticated automation may put proper maintenance beyond the capability of the plant operator, leading to equipment breakdowns or expensive servicing. Adequate funding must be assured for maintenance of automatic equipment:

The planned GAC treatment system will have minimal automation and generally operate as a flow through system. The existing pump and chemical feed systems will be replaced in kind and consist of start-stop operation of the water supply pumps with interlocks to sodium hypochlorite and sodium hydroxide feed pumps.

Pressure and flow switch alarms will be provided to notify operators of potential clogging of the GAC units. Carbon changeout and backwashing, if required, will be conducted by a qualified third-party vendor (e.g., carbon supplier).

Existing automatic equipment practices will be extended to the new treatment system, including the following:

- Interlocking of two dedicated sodium hypochlorite feed systems for each well pump (one existing pre-iron removal plant and one new post-GAC treatment);
- Interlocking of one dedicated phosphate feed system for each well pump;
- Redundant flow confirmation systems (flow switch and orifice plate) for chemical feed systems; and

Timer and high-level switch to be used during backwashing of GAC units to prevent overflow of the Backwash Holding Tank.

A flow meter will be placed on each GAC unit to confirm uniform flow distribution between the GAC units.

High level alarms will be provided on new sodium hypochlorite storage tanks.

1.12 Project sites

a. Discussion of the various sites considered and advantages of the recommended ones:

Alternative water supply sites were not considered as part of this project.

b. The proximity of residences, industries, and other establishments:

This Seaman's Neck Road Facility is surrounded by a large residential area known as the Levittown Planned Residential District (LPRD). The Facility is less than one acre and directly abuts three residential parcels and two suburban streets, so noise and aesthetic concerns need to be addressed during the design. There are also several local establishments; mostly commercial services such as convenience stores, restaurants, and gas stations, as well as other typical public resources such as schools, fire stations, and churches in the general area.

c. Any potential sources of pollution that may influence the quality of the supply or interfere with effective operation of the water works system, such as sewage absorption systems, septic tanks, privies, cesspools, sink holes, sanitary landfills, refuse and garbage dumps, etc.:

There are one or more potential sources of groundwater contamination upgradient of the existing water supply wells. Existing groundwater data has only identified VOCs, such as TCE as being present in the groundwater. The planned treatment system specifically addresses TCE contamination.

1.13 FINANCING (See "Part 7: Cost Estimate" for detailed cost breakdown)

a. Estimated cost of integral parts of the system:

The capital costs for planned treatment system address the following elements:

- Process System (GAC, Chemical Feeds, Piping);

- Electrical System, Motor Control Center, Backup Power;
- Metal Building and Foundation;
- Building Amenities (HVAC, Fire Protection, Analyzer Bench);
- Site Work (Excavation, Utility Trenching, Stormwater);
- Existing Treatment Train Upgrades (Well Pumps); and
- Construction Costs

Anticipated Capital Cost: $4,100,000.00

b. Detailed estimated annual cost of operation:

Annual Operation and Maintenance (O&M) costs for GAC treatment system are as follows:

- Labor and monitoring
- Carbon replacement and handling fees
- Building and equipment maintenance
- Utility costs (electric, gas, and communications)

Anticipated O&M Cost: $200,000.00 per year, over 30 years

c. Proposed methods to finance both capital charges and operating expenses:

Capital funding for this project will be provided by the federal government entity "United States Navy". O&M funding and O&M terms of service are currently being arranged between Aqua New York and the United States Navy.

1.14 Future extensions

Summarize planning for future needs and services:

An area has been set aside at the Seaman's Neck Road Facility to be used in the event that air stripping as a pretreatment system for supplemental VOC removal is required. A design of this system indicates that two 30-foot tall stripping towers and a clear well would be required. The need for this system would be based on higher concentrations of VOCs for a sustained period that would effectively reduce the capacity of the Facility to provide water because of excessive downtime or cost. In addition, in the event that VOCs are detected that are not effectively removed by GAC are encountered, air stripping would be considered.

Expansion or increase of service (increase in flow or the addition of new source wells) is not part of the scope of this project. If additional water supply is required in the future, additional treatment would be addressed based on the water supply capacity and current and future quality of extracted groundwater.

2.0 SUMMARY OF DESIGN CRITERIA

This section provides the criteria used to design a liquid phase GAC system for the Seaman's Neck Road Facility.

2.1 GENERAL

The proposed improvement is to add a liquid-phase GAC system and related equipment to an existing treatment plant to remove TCE and other similar VOCs.

The design of the addition of the GAC system is based upon providing the plant's current authorized capacity and well pumping capacity, which is 6.05 MGD or 4,200 gpm. For design parameters that are based on long-term operational considerations (e.g. GAC, power, and chemical usage), the annual average flow rate of 2.06 MGD or 1,430 gpm is used. The design assumes no change in level of service, and assumes that these flows meet Aqua's existing and future average day, peak day, and emergency flow (fire flow) requirements as well as Aqua's long-term (20 year) planning needs.

a. Long-term dependable yield of the source of supply

The Long Island aquifer is extensive with a large capacity and long-term sustainable yield. The planned treatment system will not affect the dependability of the source of supply.

b. Reservoir surface area, volume, and a volume-versus-depth curve, if applicable

A reservoir is not used by Aqua New York and therefore this criterion is not applicable.

c. Area of watershed, if applicable

The Long Island aquifer is extensive with a large capacity and long-term sustainable yield. The planned treatment system will not affect the area of watershed required.

d. Estimated average and maximum day water demands for the design period

The estimated average and maximum day water demands will remain unchanged for the planned treatment system. Currently, the Seaman's Neck Road Facility provides an annual average of 2.06 MGD and a daily maximum of 6.05 MGD.

e. Number of proposed services:

The number of proposed services will remain unchanged for the planned treatment system.

f. Fire fighting requirements:

The proposed treatment system will include fire protection services for the treatment building, but will not significantly affect the requirements for water use at the system.

g. Flash mix, flocculation and settling basin capacities:

Flash mix, flocculation, and settling basin units are not part of the planned treatment system.

h. Retention times:

Not applicable, no retention within this system

i. Unit Loadings

Each of the six GAC units is sized to treat 10 to 50 µg/L of TCE at a flow rate of 700 gpm.

Increased Loading: As stated in the "justification of project", the GAC units can address source water with higher concentrations of TCE. An influent TCE concentration of 50 µg/L is the estimated concentration when O&M requirements and costs may no longer be manageable at this site. The duration at which the higher concentrations would be encountered would also be addressed. Existing and planned monitoring wells would be used to project potential influent TCE concentrations with up to 5 years advance notice.

Increased Influent Rate: While the units can hydraulically handle more than 700 gpm, higher flow rates would reduce adsorption contact time, thus potentially increasing the design outlet TCE of 0.5 µg/L.

j. Adsorber area and the adsorption rate/capacity

Each vessel is made of carbon steel with vinyl ester lining and is suitable for 125 pounds per square inch (psi) pressure. Each vessel contains 20,000 pounds of GAC. Inside each adsorption vessel, the source water will flow downward through a bed of GAC that will be approximately 10 feet in diameter and 8 feet deep.

In the proposed application, there are 6 vessels treating a combined 4,200 gpm of water. Each adsorber vessel will treat a maximum of 700 gpm with 7.5 minutes of empty bed contact time (EBCT). The maximum pressure drop across the units will be approximately 15 psi. Normally, all six GAC units will be in use. During one pump operation, which occurs during approximately 2/3 of the time, the EBCT will be approximately 15 minutes and the pressure drop across the units will be less.

To estimate a design carbon usage rate, a standard carbon isotherm chart developed from laboratory measurements was used, see Figure 2.1. The Freundlich equation is also a standard method using empirical K and $^{1/n}$ values per the relationship between carbon and the adsorbate. Carbon usage rates for TCE at concentrations of 10, 50, and 500 µg/L are highlighted in Figure 2.1 and are summarized as follows.

To convert adsorptive capacity to carbon usage as shown, the below equation is used. This estimate assumes a 25% efficiency rate to account for contact time, TCE breakthrough curves, and a low background concentration of other organics/adsorbates.

$$\frac{50 \times 10^{-6} grams\ (g) - TCE}{Liter\ (L)} \times \frac{100\ g\ GAC}{2.2\ g - TCE} \times \frac{3.785\ L}{1\ gal} \times \frac{1\ lb}{454 g} \times \frac{1{,}000{,}000\ gal}{1\ MG} \times \frac{1}{25\%} = 76 \frac{lb\ GAC}{MG}$$

Calculated carbon usage rates for TCE influent concentrations of 10, 50, and 500 µg/L are summarized as follows.

Influent TCE Concentration (µg /L)	Adsorption Capacity (gram of TCE/100 grams of carbon)	Carbon Usage (pounds of carbon/million gallon of water treated)
10	1.2	28
50	2.2	76
500	5.0	336

Based on the average annual flow rate of 2.06 MGD, the carbon usage rate is converted to the anticipated carbon usage in pounds of carbon per day. For six GAC vessels, each with 20,000 pounds of carbon, there are 120,000 pounds of carbon at the facility. To estimate breakthrough time, the total amount of carbon present at the facility is divided by the average amount of carbon used each day, as follows.

Influent TCE Concentration (µg/L)	Effluent TCE Concentration (µg/L)	Anticipated Carbon Usage (pounds/day)	Anticipated Breakthrough (years)
10	0.5	60	5.5
50	0.5	160	2
500	0.5	720	0.5

k. Backwash Rate

Each carbon adsorber will require an initial backwash during startup and periodic backwashes to fluff the media during operation. The need for backwash "media fluffing" will be required if there is a differential pressure drop of approximately 15 PSI across the bed. Because of the filtration system preceding the GAC units, backwashing of the filter is not anticipated. Long-term buildup of solids in the GAC units will be removed during the carbon changeouts. However, since this condition cannot be assured, a provision for backwashing the filters is provided.

The backwash pump is sized to deliver 1,000 gpm at 66 feet of head for the duration of the backwash. Each carbon adsorber is backwashed for approximately 10 minutes to attain the required bed expansion (approximately 20%). Backwash water generated from the fluffing operation is approximately 10,000 gallons for each adsorber (60,000 gallons total). The water will be obtained from the existing backwash storage tanks.

The fluffing operation will be staggered per vessel to:

i. Keep the other vessels in operation;
ii. Keep the backwash waste tank from overflowing (the tank is sized at 15,000 gallons to accommodate one vessel backwash cycle (10,000 gallons) plus additional capacity;

iii. Allow the waste holding tank contents to discharge into the sewer system at a rate that is acceptable to NCDPW, including planning to avoid backwashing the GAC units while backwash from the the iron filtration units are draining to sewer.

The proposed discharge rate into NCDPW sewer system will be 50 to 200 gpm, based on the capacity of the existing discharge structure. Two to four vessels would be backwashed per day based on the availability of manpower and to avoid conflict with discharge from the existing iron filtration plant wastewater discharge.

l. Feeder capacities and ranges

There are no new chemicals for this project. Existing sodium hypochlorite, sodium hydroxide, and phosphate pumps will continue to operate as before. The power supply for these pumps will be routed to and interlocked with the new motor starters for the upgraded well supply pumps. Two new post-GAC unit sodium hypochlorite feed pumps will be provided. These pumps will be identical to the existing pumps, and the power supply will be similarly interlocked with the new motor starters. Two existing chemical feeds are modified per this project: sodium hypochlorite and phosphate. Four new 150-gallon double walled tanks will be used to supply the sodium hypochlorite.

Table 2.1 New Feeder Capacity and Range Specification:

Chemical	Location	Capacity (gph)	Range (turndown)	Accuracy
Sodium Hypochlorite	Existing, Post-GAC Unit for Well No. 3	2.5	10 to 1	+/- 2%
Sodium Hypochlorite	Existing, Post-GAC Unit for Well No. 4	2.5	10 to 1	+/- 2%

m. Minimum and maximum chemical application rates

Table 2.2 Feeder Application Rate Specification (New Sodium Hypochlorite Pumps only)

Chemical	Location	Maximum Design Pump Rate (gph)[1.]	Average Design Pump Rate (gal/wk)[2.]	Design Residual Chlorine Concentration (ppm)
Sodium Hypochlorite	Post-GAC Unit for Well No. 3	1.6	90	1.5
Sodium Hypochlorite	Post-GAC Unit for Well No. 4	1.6	90	1.5

1. Maximum pump rate is based on each pump operating at 2,100 gpm, a 12 percent chlorine equivalent concentration, and a dosage of 1.5 ppm of chlorine residual.
2. Average pump rate is based on each 2,100 gpm pump operating 34 percent of the time, a 12 percent chlorine equivalent concentration, and a dosage of 1.5 ppm of chlorine residual.

2.2 PLANT LAYOUT

The site layout of the proposed facilities is based on the following constraints:

a. Set the building location and elevation relative to the existing well houses, chemical building, the iron filtration building, and two large aboveground tanks
b. Consideration of water main tie-in and other site utility tie-ins and crossings
c. Consideration of major building appurtenances such as a power transformer and back-up generator
d. Addresses transportation needs such as general access, large deliveries, chemical deliveries, maintenance, security, and safety while minimizing new paving
e. Considers grading and stormwater on a relatively flat site
f. Meets the spirit of the local zoning code
g. Considers residents in terms of noise, light, and landscaping
h. Sets aside an expansion area in case additional equipment is required

Approximately four different site layouts were developed, and the current plan best addresses all of the above needs (see Appendix B). The site plan is subject to comment by the Town of Hempstead.

2.3 BUILDING LAYOUT

The proposed structure is a rectangular plan that is 86 feet long by 36 feet wide (3,024 square feet), with 25-foot high exterior walls and a gabled roof with a 3 in 12 slope. The building will be approximately 30 feet tall and will have perimeter bents which span the entire width of the building, thus creating an open floor plan with no interior columns. It is a one-story, pre-engineered metal frame building that will act as an unoccupied water treatment facility. The major components of the building are:

a. 6 GAC vessels
b. Backwash Pump
c. Backwash Wastewater Storage Tank
d. Analyzer Bench
e. Hypochlorite Room with tank and metering pumps
f. Phosphate system with tank and metering pumps
g. Electrical Room
h. Water piping and electrical conduit
i. Safety Showers / Eyewash
j. Fire protection equipment
k. Heating, ventilation, and air conditioning system
l. Interior drainage (floor drain and sump pump)
m. Structural and architectural components
n. Man doors and overhead door

The size of the building is constrained by the site restrictions, therefore interior space is limited. There is limited post-construction flexibility due to the size and weight of the GAC vessels, and there is no room for additional equipment or storage. Any new equipment would require building expansion into the site's set-aside expansion area. The roofs of the chemical and electrical rooms are rated to handle storage, but the area is not advertised as storage space and will be discouraged. Body (head and arm) clearance and maintenance access (wrench turning) of the major components was considered in building layout.

A building code study was performed on the building regarding egress, fire wall ratings, sprinkler requirements, and ventilation for chemical storage rooms, etc. This study will be included in the final report. This building is subject to approval of the Town of Hempstead.

2.4 LOCATION OF STRUCTURES

This site is not in a flood hazard area.

2.5 ELECTRICAL CONTROLS

The facility's present incoming line electrical service is not adequate for the proposed modifications and will be upgraded in size and appropriately redistributed. New distribution equipment will be installed to accommodate the proposed modifications.

An existing transformer will be replaced with a larger transformer and relocated to the east of the new Treatment Facility.

Starters for the new pump motors will be located in the new Electrical Room in the Treatment Facility. These starters will also be interlocked with existing and new chemical feed pumps. The existing iron filtration plant will continue to operate under current conditions. Additional detail will be provided in the final design package.

2.6 STANDBY POWER

An existing gas emergency generator currently powers one well pump and associated chemical feed systems. Because the new GAC plant will require the size of the well pump motors to be increased, the existing emergency generator is not adequate and will be replaced with a larger gas-powered generator. The new generator will be sized to provide the same level of service as currently exists.

2.7 SHOP SPACE AND STORAGE

The new treatment facility is not an occupied building. Though storage and shop space are generally discouraged at this location, there will be a small storage cabinet as part of the analyzer bench.

GAC maintenance is to be performed by a third-party vendor, therefore special tool storage is not required. Chemicals will be delivered in liquid form and directly connected to their dispense containers (no interim chemical storage).

2.8 LABORATORY FACILITIES

Onsite laboratory/testing facilities are not part of the new treatment system.

2.9 MONITORING EQUIPMENT

The existing water quality monitoring and recording procedures will be maintained at the facility. Chlorine residual monitoring will continue to be performed at the same frequency as current operation. However, the chlorine residual and pH monitoring points for compliance will be relocated to the water supply after the GAC units in the new Treatment Building.

2.10 SAMPLE TAPS

Sample taps will be provided to continue to monitor the performance of the iron filtration plant and new sample taps will be provided in the new Treatment Facility to monitor finished water.

2.11 FACILITY WATER SUPPLY

A facility water supply service line for the new Treatment Facility will be obtained from the existing finished water line.

2.12 WALL CASTING

No extra wall castings are anticipated to be required as part of this upgrade. In the event that an air stripping pretreatment system is required in the future, tie-ins to that system would be conducted in exterior underground piping.

2.13 METERS

For the water supply system, the existing flow meters will remain and continue to operate under current conditions. New meters for the facility upgrade will consist of flow meters on each GAC unit and on the backwash pump.

2.14 PIPING COLOR CODE

Standard piping color codes and notes are provided on the general legend of the construction drawing set.

2.15 DISINFECTION

All wells, pipes, tanks, and equipment which can convey or store potable water will be disinfected in accordance with current American Water Works Association (AWWA) procedures. Final plans and specifications will outline the procedure and include the disinfectant dosage, contact time, and method of testing the results of the procedure.

Granular activated carbon brought to the site will be transported and maintained in a sterile environment. During initial startup and during GAC changeout, testing will be conducted to confirm that the GAC unit discharge water is free of bacteria. If necessary, the carbon can be sterilized in the GAC units using sodium hydroxide. Rinse water will be neutralized and resulting wastewater will be processed in the backwash holding tank.

2.16 OPERATION AND MAINTANANCE MANUAL

An operation and maintenance manual including a parts list and parts order form, operator safety procedures and an operational trouble-shooting section will be supplied to ANY as part of the proveout reporting.

2.17 OPERATOR INSTRUCTION

Operators will be trained during plant commissioning and startup. Operation of the new treatment facility is similar to the existing facility operation. Monitoring of flow through each unit (to evaluate potential plugging of individual units) and pressure drop across the combined GAC units will be the only new monitoring requirements.

2.18 SAFETY

Safety features are being included in the design, including the Uniform Building Code, Uniform Fire Code, National Fire Protection Association Standards, and state and federal Occupational Safety and Health Administration standards.

Specific practices will be provided in the final design package. These practices will include noise protection, protective equipment and clothing for chemical areas, safety showers and eye washes, handrails and guards, warning signs, smoke detectors, toxic gas detectors and fire extinguishers.

2.19 SECURITY

Security measures will be installed and operated in accordance with current practices at the facility. These features include exterior area cameras and interior motion detectors. These systems will be connected to the existing security system for the facility. In addition, exterior doorways will be locked, and two entrances are currently present at the facility.

2.20 FLOOD PROTECTION

The planned treatment facility is above the 100 year flood plain.

2.21 CHEMICAL AND WATER CONTACT MATERIALS

Chemical and water contact materials will be detailed in the final design package.

2.22 OTHER CONSIDERATIONS

Additional considerations may be identified during the design process and will be incorporated into the final design.

2.23 APPLICABILITY OF POLICY STATEMENTS, INTERIM STANDARDS,, AND RECOMMENDED STANDARDS (PARTS 3 THROGH 9)

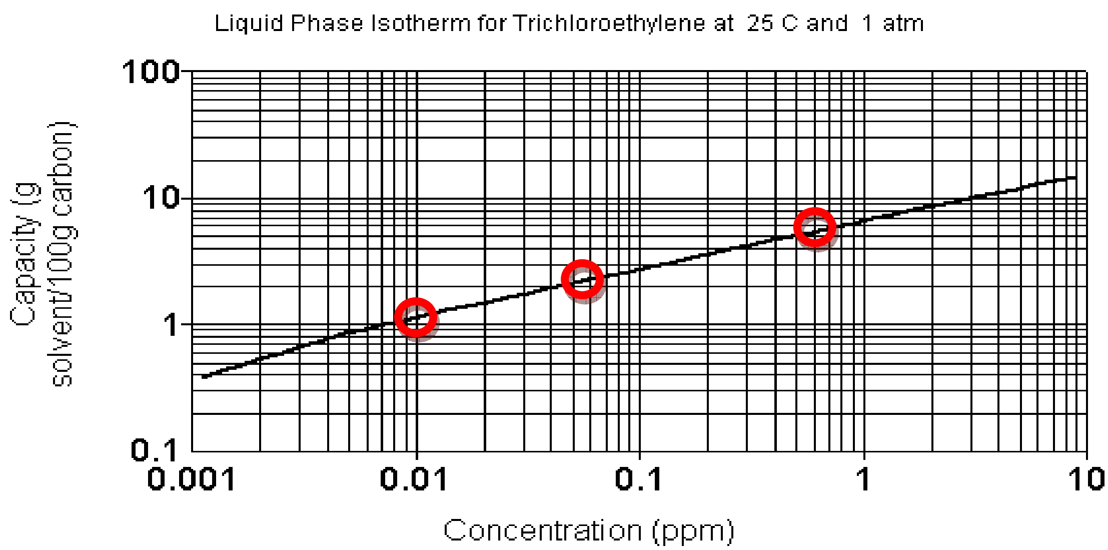
Policy Statements	Applicable?	Sections/Comment
Pre-Engineered Water Treatment Plants	No	None
Automated/Unattended Operation Of Surface Water Treatment Plants	No	None
Bag And Cartridge Filters For Public Water Supplies	No	None
Ultra Violet Light For Treatment Of Public Water Supplies	No	None
Infrastructure Security For Public Water Supplies	Yes	Addressed under 2.19, additional detail to be provided in the final design
Arsenic Removal	No	None

Interim Standards	Applicable?	Sections/Comment
Nitrate Removal Using Sulfate Selective Anion Exchange Resin	No	None
Use Of Chloramine Disinfectant For Public Water Supplies	No	None
Membrane Technologies For Pubic Water Supplies	No	None

Recommended Standards	Applicable?	Comment
Part 3 - Source Development	No	Existing source supply.
Part 4 – Treatment		
4.1 Clarification	No	None
4.2 Filtration	Yes	Existing filtration system will continue to be used.
4.3 Disinfection	Yes	Existing disinfection systems to be used, additional disinfection system to be added to GAC Unit effluent.
4.4 Softening	No	None
4.5 Aeration	No	None
4.6 Iron And Manganese Control	No	Existing filtration system will continue to be used.

Recommended Standards	Applicable?	Comment
4.7 Fluoridation	No	None
4.8 Stabilization	No	None
4.9 Taste And Odor Control	No	None
4.10 Microscreening	No	None
Part 5 - Chemical Application	Yes	Existing sodium hydroxide and sodium hypochlorite feed systems will continue to be used. The existing phosphate feed system will be relocated to feed chemical after the GAC units. A new sodium hypochlorite feed system will be added to provide disinfection after the GAC unit.
Part 6 - Pumping Facilities	No	Existing pumping facilities will be used. The pump and motors will be upgraded to provide additional pressure to accommodate the pressure drop across the GAC units.
Part 7 - Finished Water Storage	No	None
Part 8 - Distribution System Piping And Appurtenances	Yes	Tie-ins to existing system will be conducted.
Part 9 - Waste Residuals	Yes	During GAC replacement, flush water will be discharged to the NPDPW and a local recharge basin. If required for GAC disinfection, neutralized sodium hydroxide water will be discharged to NCDPW. If required, filter backwash water will be discharged to NCDPW.

FIGURE 2.1
CARBON ISOTHERM FOR TCE
SEAMAN'S NECK ROAD FACILITY, LONG ISLAND, NEW YORK



3.0 OPERATION REQUIREMENTS

Upon successful proveout of the new treatment facilities, day-to-day operation and maintenance of the treatment facility will be conducted by ANY. Normal operation of new GAC system will include the following activities.

- Filling of sodium hyphochlorite storage tanks (by chemical supplier)
- Replacement of phosphate drums (by chemical supplier)
- Switching of sodium hypochlorite feed pump suction between storage tanks
- Monitoring of chemical tank levels
- Monitoring of chlorine residual and adjustment of feed pump dosage rates
- Monitoring of flowrates through individual GAC units and pressure drop across combined GAC units

GAC changeout and, if required, backwashing of the GAC units will be will be conducted by an approved third-party vendor.

The estimated carbon replacement frequency is shown below. The replacement frequency is based on the breakthrough design values as calculated under Part 2: Summary of Design Criteria. There is a potential that carbon life may be extended as long as the carbon does not decompose, clog, collect microbial growth, or show signs of contaminant breakthrough (TCE or otherwise).

Inlet TCE (µg/L)	Design Carbon Replacement Frequency (years)
10	5.5
50	2
500	0.5

Carbon will be replaced at the first sign of breakthrough. In addition, sample ports located at several depths in the GAC bed will be used to predict break through.

Major Stewardship Items related to the GAC system:

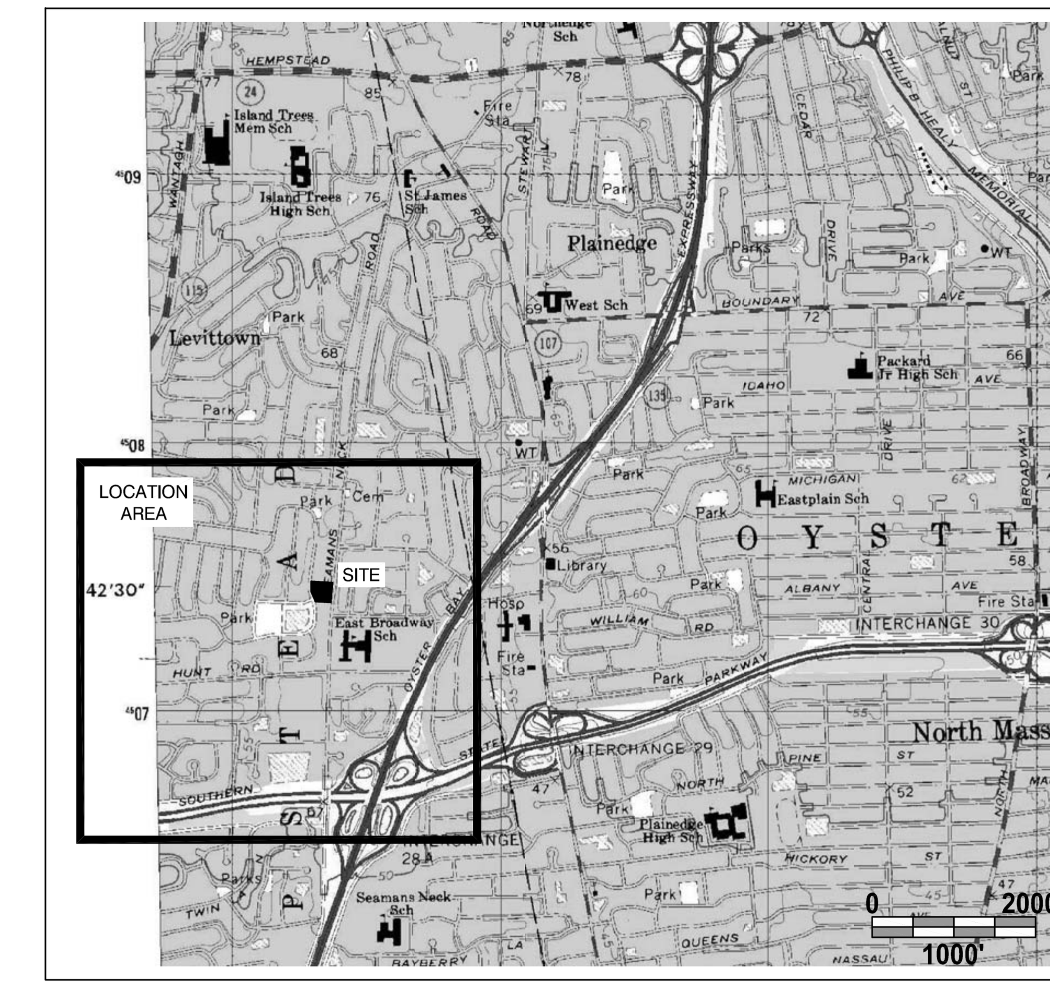
a. GAC vessels – 30 years
b. GAC building roof replacement – 30 years

4.0 GENERAL LAYOUT

The following general layout drawings are presented in attached figures:

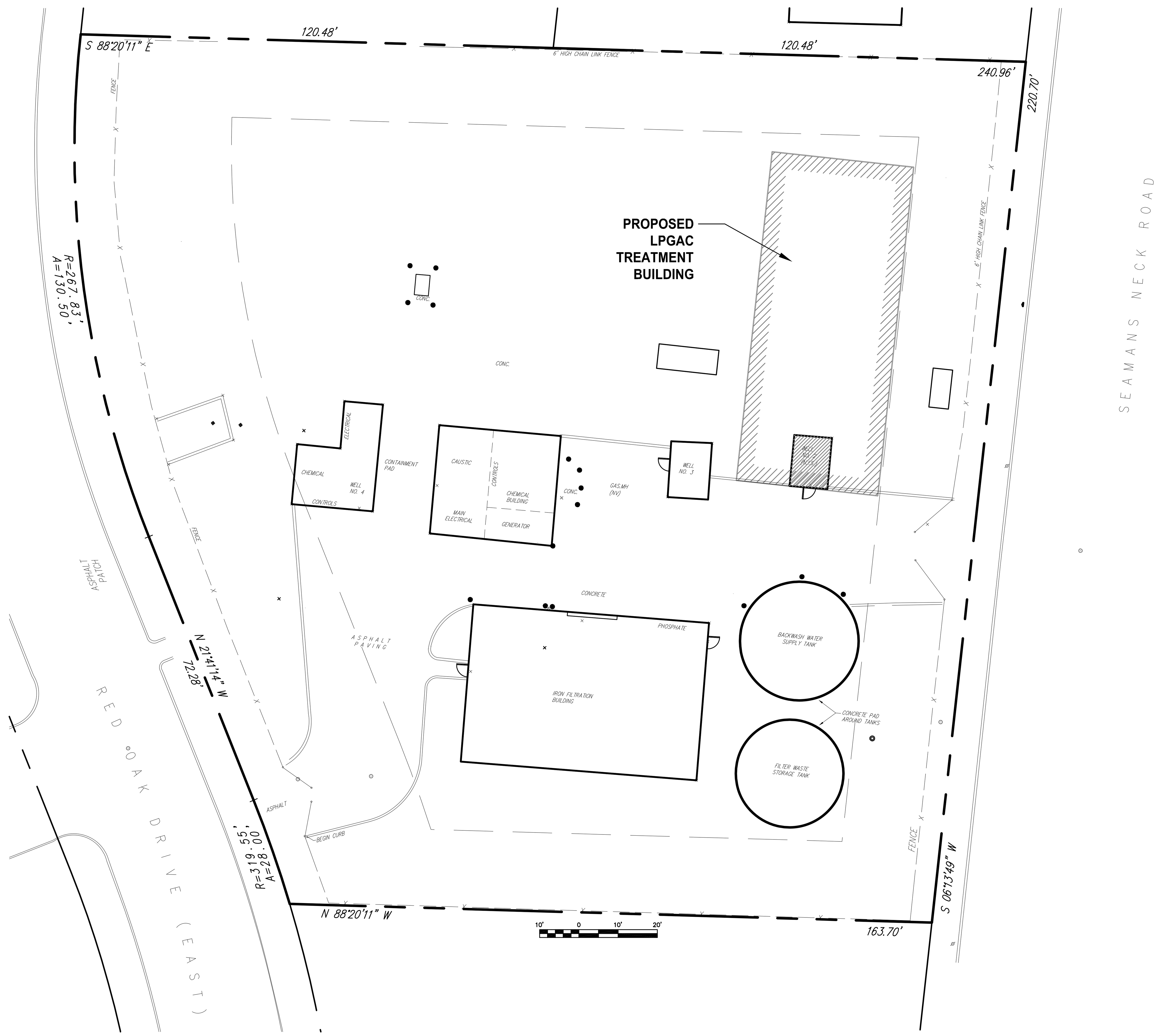
- G-1 – Cover
- C-1 – Site Layout Plan
- C-2 – Site Utility Plan
- C-3 – Site Grading Plan
- A-1 – Floor Plan
- A-2 – Roof Plan and Building Elevations
- L-1 – Site Landscape Plan

MODIFICATIONS TO AQUA NEW YORK, INC. WATER TREATMENT FACILITY SEAMANS NECK ROAD NASSAU COUNTY, NEW YORK



GENERAL VICINITY MAP - 1"=2000'

SOURCE: USGS - AMITYVILLE, NY - 7.5 MINUTE QUADRANGLE - 1994



PROPERTY PLAN - 1"=20'

DRAWING LIST

GENERAL
G-1 COVER SHEET
G-2 LEGEND & ABBREVIATIONS
G-3 LEGEND

CIVIL
C-0 EXISTING & DEMOLITION SITE PLAN
C-1 SITE LAYOUT PLAN
C-2 SITE UTILITY PLAN
C-2A SITE UTILITY PLAN TIE-IN
C-3 SITE GRADING PLAN
C-4 EROSION & SEDIMENT CONTROL PLAN
C-5 SITE DETAILS
C-6 SITE DETAILS
C-7 E&S CONTROL DETAILS
C-8 BACKWASH WASTE SEWER PROFILE
L-1 LANDSCAPE PLAN
L-2 LANDSCAPE DETAILS

ARCHITECTURAL
CP-1 CODE PLAN
A-1 FLOOR PLAN
A-2 ROOF PLAN AND BUILDING ELEVATIONS
A-3 BUILDING SECTIONS
A-4 SCHEDULES AND DETAILS

STRUCTURAL
S-1 FOUNDATION PLAN
S-2 FOUNDATION DETAILS
S-3 FOUNDATION DETAILS
S-4 STRUCTURAL DETAILS
S-5 GENERAL NOTES, SCHEDULES & DETAILS

PROCESS & MECHANICAL
PFD-1 PROCESS FLOW DIAGRAM
PID-1 P&ID-EXISTING SYSTEM TIE-IN
PID-2 P&ID-NEW BUILDING
PID-3 P&ID-LPGAC 100/200
PID-4 P&ID-LPGAC 300/400
PID-5 P&ID-LPGAC 500/600
M-1 LPGAC BUILDING EQUIPMENT LAYOUT
M-2 LPGAC PIPING LAYOUT
M-3 LPGAC SECTIONS
M-4 LPGAC SECTIONS

ELECTRICAL
E-1 LEGEND & GENERAL NOTES
E-2 SINGLE LINE DIAGRAM - SHEET 1
E-3 SINGLE LINE DIAGRAM - SHEET 2
E-4 ELEMENTARY DIAGRAMS - SHEET 1
E-5 ELEMENTARY DIAGRAMS - SHEET 2
E-6 ELEMENTARY DIAGRAMS - SHEET 3
E-7 POWER & CONTROL CONDUIT PLAN
E-8 SITE CONDUIT PLAN
E-9 CONDUIT DETAILS & SECTIONS
E-10 CONDUIT TEMPLATES
E-11 PANEL RISER DIAGRAMS
E-12 ELECTRICAL LIGHTING & MISC. PLAN
E-13 LIGHTING SCHEDULE & DETAILS
E-14 GROUNDING PLAN
E-15 GROUNDING NOTES & DETAILS
E-16 MCP-LPGAC ELEMENTARY DIAGRAM - SHT. 1
E-17 MCP-LPGAC ELEMENTARY DIAGRAM - SHT. 2
E-18 MCP-LPGAC ELEMENTARY DIAGRAM - SHT. 3
E-19 INSTRUMENTS & MISC. POWER

PLUMBING
P-1 UNDERSLAB FLOOR PLAN
P-2 FLOOR PLAN
P-3 DETAILS

FIRE PROTECTION AND EQUIPMENT
FA-1 FIRE ALARM / SECURITY EQUIPMENT
FX-1 FIRE SUPPRESSION

HVAC
H-1 NATURAL GAS PIPING
H-2 HVAC LAYOUT

SITE DATA:

1.	PREPARED FOR:	UNITED STATES NAVY
2.	OWNER:	AQUA AMERICA - NEW YORK
3.	PROPERTY ADDRESS:	670 SEAMANS NECK ROAD LEVITTOWN, N.Y. 11783 TOWN OF HEMPSTEAD, NASSAU COUNTY, NEW YORK
4.	TAX PARCEL NUMBER:	BLOCK 403, SECTION 51, LOT 27 (FORMERLY LOT 8. SUBDIVIDED INTO LOTS 25 & 27. LOT 25 WAS TAKEN FOR ROAD WIDENING)
5.	SCHOOL DISTRICT:	LEVITTOWN SCHOOL DISTRICT
6.	SOURCE OF TITLE:	DEED BOOK 4725, PAGES 33-36
7.	PARCEL AREA:	1.0705± ACRES (CALCULATED PER DEED)
8.	ZONING:	LEVITTOWN PLANNED RESIDENCE DISTRICT (LPRD).
9.	SETBACKS:	FRONT YARD: AVERAGE FRONT YARD DEPTH SIDE YARD: 20 FEET (OTHER THAN SINGLE FAMILY RESIDENCE) REAR YARD: 25 FEET
10.	TOPOGRAPHY:	TOPOGRAPHY IS BASED ON A FIELD SURVEY PERFORMED BY TETRA TECH ON SEPTEMBER 26-27, 2009, AN.
11.	DATUM:	HORIZONTAL=DEED REFERENCE, VERTICAL=NASSAU COUNTY.
12.	BENCHMARK:	SANITARY MANHOLE AT RED OAK DRIVE, RIM = 55.36.
13.	BOUNDARY:	BOUNDARY LINES SHOWN HEREIN ARE BASED ON PHYSICAL FIELD EVIDENCE, AERIAL PHOTOGRAPHS, RECORD DEED 4725, PAGE 33, AND AVAILABLE PLANS AND WAS BEST FIT TO THE EXISTING CONDITIONS. NO PINS OR MONUMENTS WERE FOUND DURING THE FIELD SURVEY.
13.	SANITARY SEWER:	NASSAU COUNTY SEWAGE DISPOSAL DISTRICT NO. 3.
14.	UTILITIES:	UTILITIES ARE SHOWN ACCORDING TO FIELD SURVEYED FOUND SURFACE EVIDENCE AND BEST AVAILABLE PLANS. ALL UTILITIES ARE APPROXIMATE AND MUST BE VERIFIED PRIOR TO COMMENCING EXCAVATION OPERATIONS.
15.	FEMA	THIS SITE IN LOCATED ON THE FEMA FIRM PANEL 36059C0253-G. THE PANEL IS LISTED AS "PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS" ON FEMA FIRM INDEX MAP NUMBER 36059CIND1-B.
16.	REFERENCE PLANS:	"MAP SHOWING REAL PROPERTY TO BE ACQUIRED FOR THE ALTERATION OF ALIGNMENT OF SEAMANS NECK ROAD", SHEET 5 OF 9, PREPARED BY BRUIN & KING, DATED AUGUST 1962.

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

90% SUBMISSION REVIEW 12/17/2010

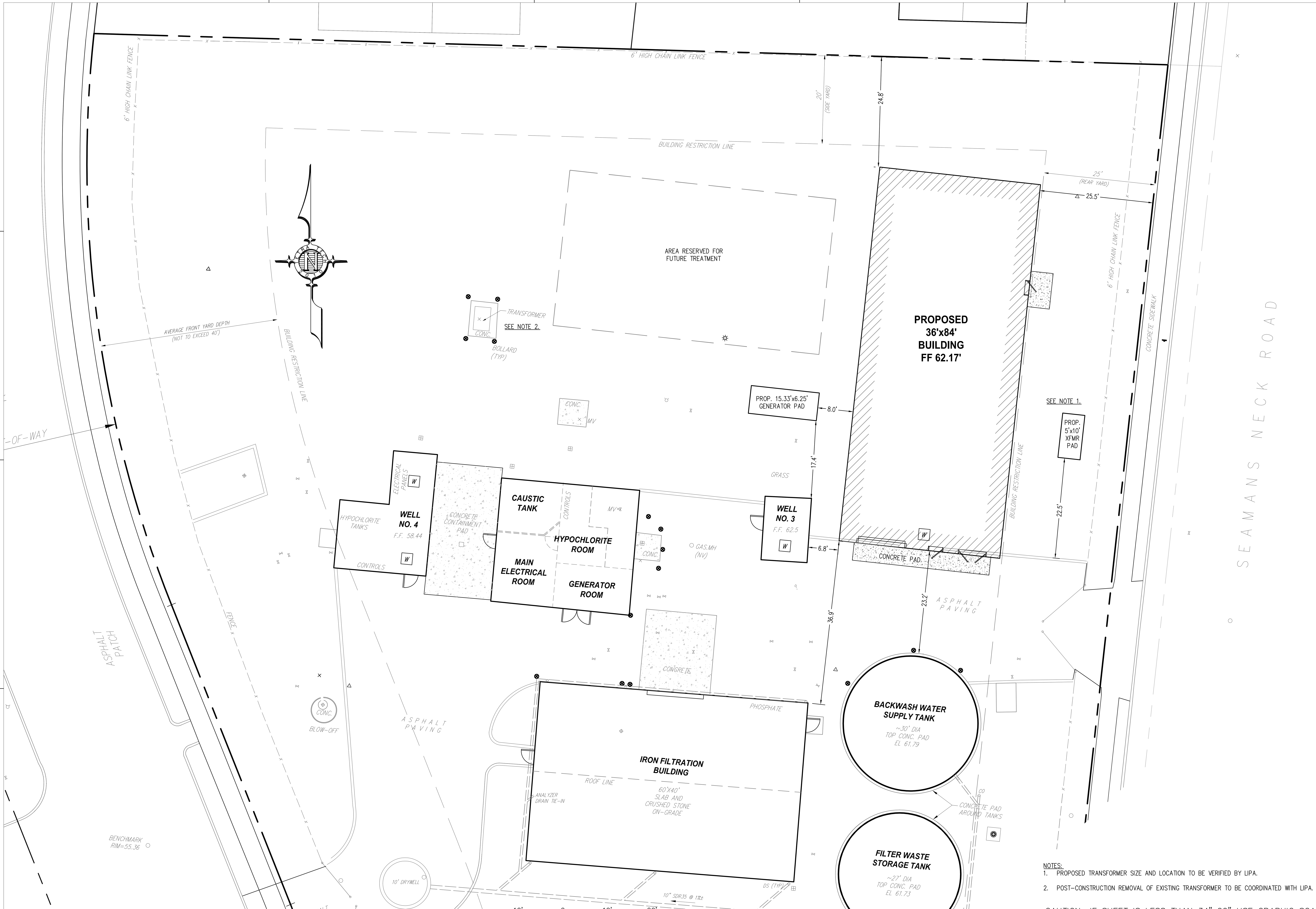
DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT — NAVAL STATION - NORFOLK, VIRGINIA
AQUA NY — NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

COVER SHEET

CODE ID. NO. 80091	SIZE D
SCALE:	SEE INSET
MAXIMO NO. N62470-08-D-1001	
JOB ORDER NO. WE-25	
SPEC. NO.	
CONSTR. CONTR. NO. 112G02223	
NAVFAC DRAWING NO.	
SHEET OF --	

G-1



NOTES:
1. PROPOSED TRANSFORMER SIZE AND LOCATION TO BE VERIFIED BY LIPA.
2. POST-CONSTRUCTION REMOVAL OF EXISTING TRANSFORMER TO BE COORDINATED WITH LIPA.

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

30%	60% - INTERIM DESIGN	4/14/10	N/A	
SYM	DESCRIPTION		DATE	APPR

NAVFAC

90% SUBMISSION REVIEW 12/17/2010

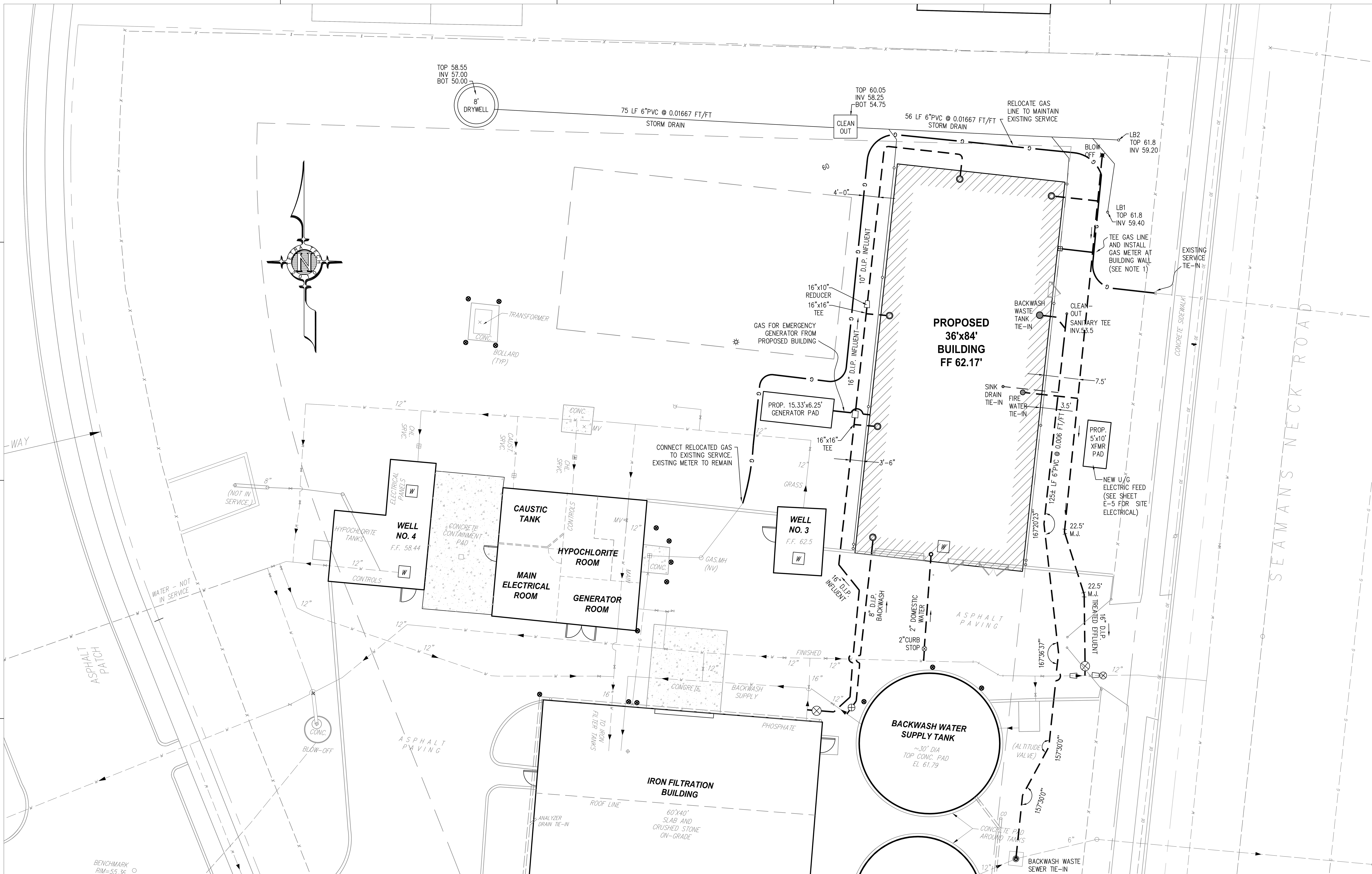
DES	HKM	DR	SNL
REVIEWED BY	HKM		
PM/DM	HKM		
CHIEF ENG/ARCH	HKM		

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT NAVAL STATION – NORFOLK, VIRGINIA
AQUA NY NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

SITE LAYOUT PLAN

CODE ID. NO. 80091	SIZE D
SCALE:	1"=10'-0"
MAXIMO NO. N62470-08-D-1001	
JOB ORDER NO. WE-25	
SPEC. NO.	
CONSTR. CONTR. NO.	112G02223
NAVFAC DRAWING NO.	
SHEET OF	--
	C-1

K:\112G02223 – Aqua Bethpage–Navy Project – H. Mital\Drawings\Civil\02223_Layout.dwg 12/17/2010 11:27



NOTES:
1. EXISTING AND PROPOSED BUILDINGS TO HAVE SEPARATE GAS SERVICE & METER.
2. SEE C-9 FOR NOTES REGARDING PIPE CROSSINGS AND DEPTHS.
3. SEE ELECTRICAL PLANS FOR ELECTRICAL SITE WORK.
4. PLACE CLEANOUTS AT THE ENDS OF THE TWO ROOF DRAIN LEADERS.

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90% SUBMISSION REVIEW 12/17/2010

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT — NAVAL STATION - NORFOLK, VIRGINIA
AQUA NY — NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

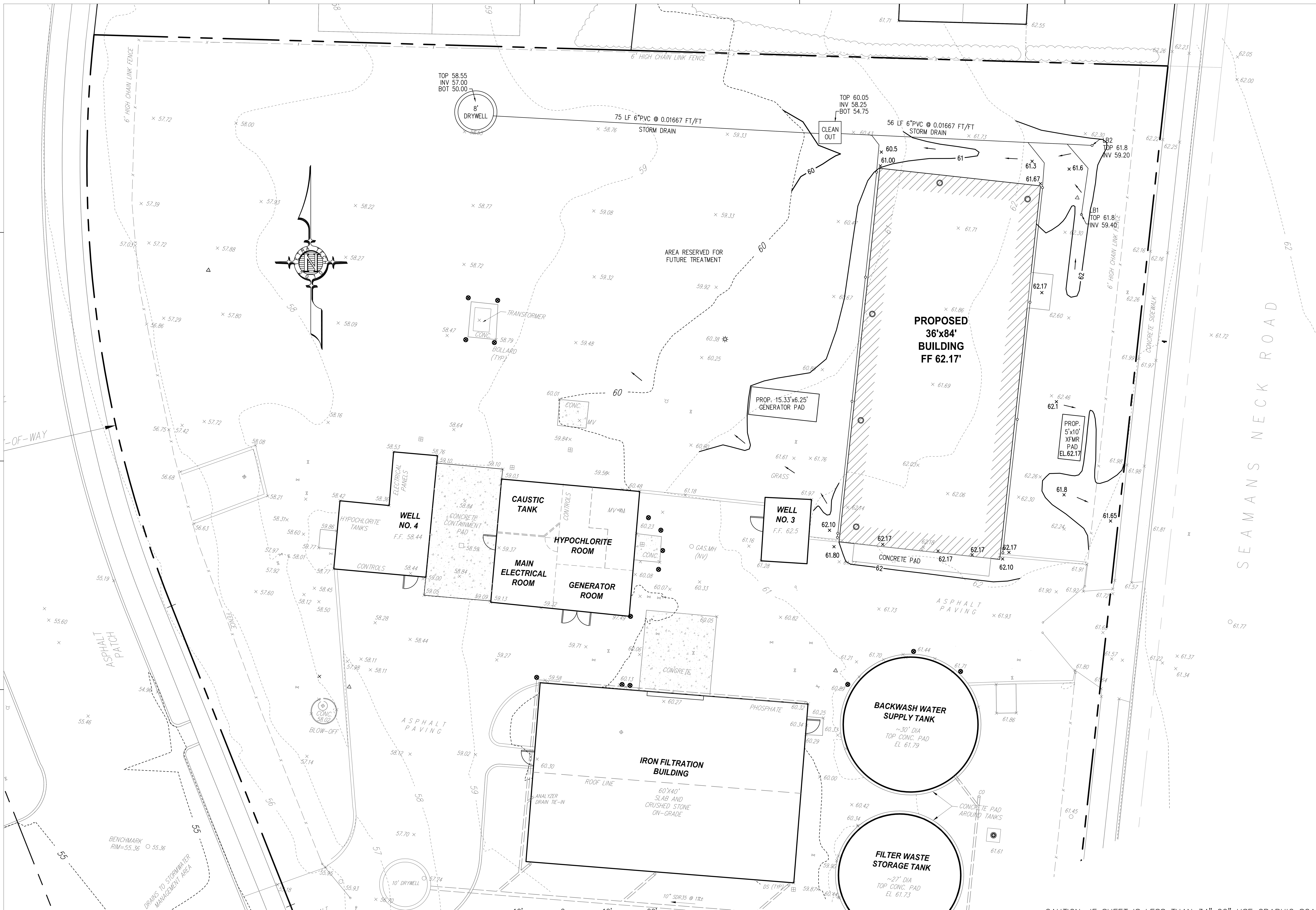
SITE UTILITY PLAN

CODE ID. NO. 80091	SIZE D
SCALE:	1"=10'-0"
MAXIMO NO. N62470-08-D-1001	
JOB ORDER NO. WE-25	
SPEC. NO.	
CONSTR. CONTR. NO. 112G02223	
NAVFAC DRAWING NO.	
SHEET OF —	

C-2

NAVFAC

K:\112G02223 - Aqua Bethpage-Navy Project - H. Mild\Drawings\Civil\02223_Utility.dwg 12/17/2010 12:59



CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90% SUBMISSION REVIEW 12/17/2010

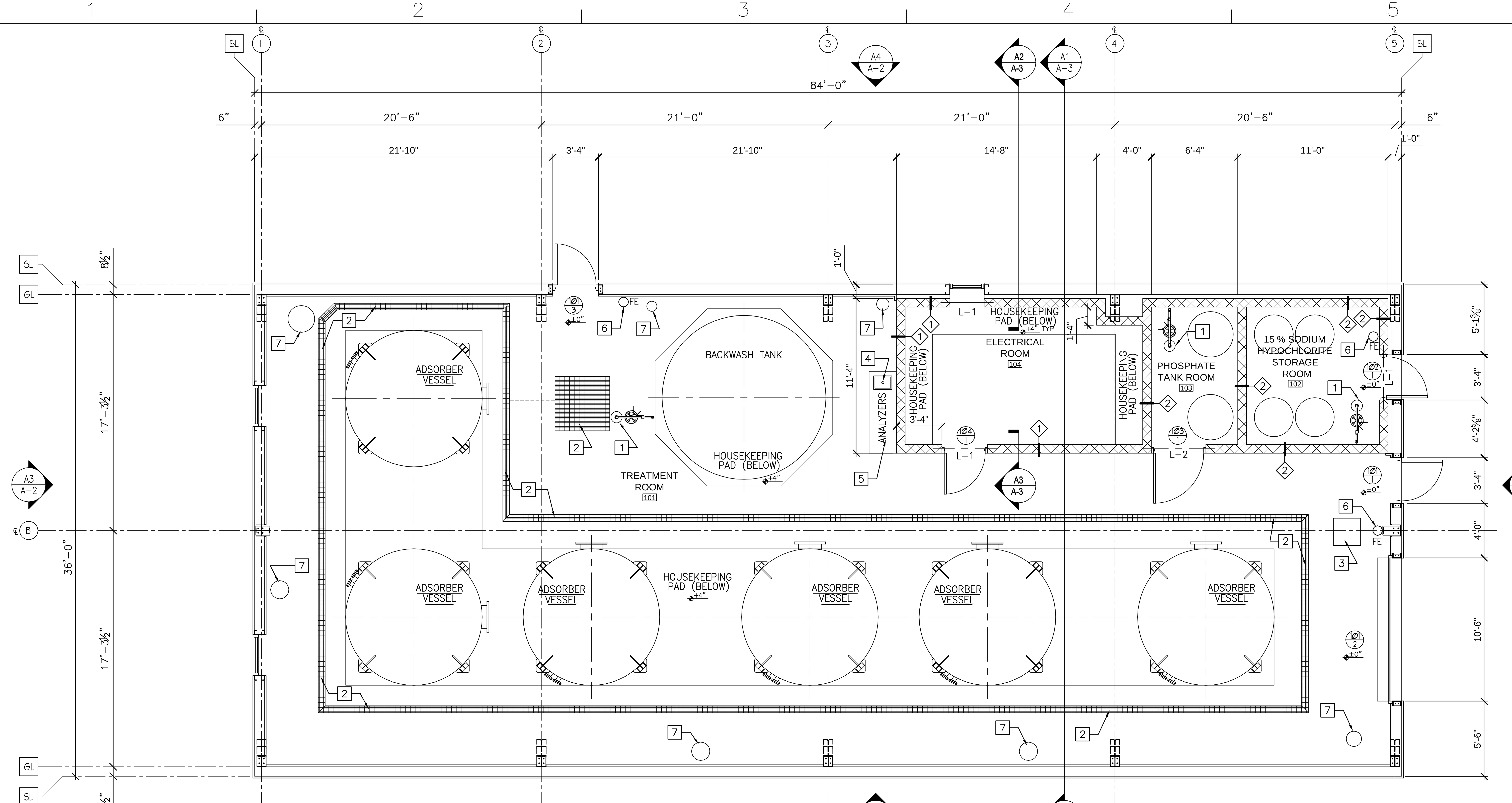
DES	HKM	DR	SNL
REVIEWED BY	HKM		
PM/DM	HKM		
CHIEF ENG/ARCH	HKM		

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION – NORFOLK, VIRGINIA
AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

SITE GRADING PLAN

CODE ID. NO. 80091 | SIZE D
SCALE: 1"=10'-0"
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF ––

C-3



FLOOR PLAN

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

PLAN NORTH

GENERAL NOTES:

1. MAINTAIN MINIMUM ADA PUSH/PULL REQUIRED CLEARANCES TO OBSTRUCTIONS (IE. WALLS, COLUMN WRAPS, ETC.). MAINTAIN THE FOLLOWING MINIMUM CLEARANCES FOR ALL SWING DOORS:
   - LATCH JAMB ON PULL SIDE OF DOOR = 1'-6"
   - LATCH JAMB ON PUSH SIDE OF DOOR = 1'-0" MIN.
2. SEE STRUCTURAL DRAWINGS FOR GROUTING & REINFORCING REQUIREMENTS.
3. VERIFY ALL EXG CONDITIONS AND DIMENSIONS IN THE FIELD, INCLUDING THOSE MARKED AS "+/-" AND "VIF". IMMEDIATELY NOTIFY THE ARCHITECT OF ANY DISCREPANCIES PRIOR TO COMMENCING ANY WORK IN AFFECTED AREA(S).
4. DO NOT SCALE DWGS TO OBTAIN DIMENSIONS. REFER TO STRU AND ARCH DWGS FOR DIMENSIONS REQUIRED. CRITICAL DIMENSIONS NOT FOUND SHOULD BE FIELD VERIFIED OR OBTAINED FROM THE ARCHITECT. IMMEDIATELY NOTIFY THE ARCHITECT OF ANY DISCREPANCIES BETWEEN THE STRU AND ARCH DWGS.
5. NOTES ON ONE DWG OR DETAIL APPLY TO ALL SIM DWGS OR DETAILS.
6. DIMENSIONS ARE ACTUAL TAKEN FROM STRUCTURAL COMPONENTS. IE: FACE OF MASONRY, FACE OF METAL STUDS, ETC. TYP UNO. MASONRY DIMENSIONS ARE ACTUAL.
7. SEE STRU DWGS FOR SLAB, HOUSEKEEPING PADS, FOUNDATION, SUBSURFACE DRAINAGE INFORMATION AND DETAILS.
8. TOP OF SLAB ELEVATION 0'-0" ON ARCH DWGS CORRESPONDS TO DATUM ELEVATION 62.17' ON CIVIL DWGS.
9. APPLY CONTINUOUS JOINT SEALANT WHERE INDICATED ON DWGS AND AT ALL JOINTS BETWEEN DISSIMILAR MATERIALS.
10. ALL WORK IS TO BE IN STRICT COMPLIANCE WITH ALL FEDERAL, STATE AND LOCAL LAWS AND CODES WHICH APPLY TO THIS USE AND TO GENERALLY ACCEPTED CONSTRUCTION TRADE PRACTICES.
11. PAINT ALL EXPOSED PIPING, CONDUIT AND MECHANICAL EQUIPMENT IN AREAS NOTED TO BE PAINTED.
12. PROVIDE FIRE EXTINGUISHERS (FE) AS LOCATED ON FLOOR PLAN AND AS REQUIRED BY AUTHORITIES HAVING JURISDICTION.
13. SEE FLOOR PLAN ON THIS SHEET FOR MASONRY LINTEL LOCATIONS, NOTED AS L-#. SEE STRUCTURAL DRAWINGS FOR LINTEL SCHEDULE AND ADDITIONAL INFORMATION.
14. SEE PLUMBING DRAWINGS FOR ADDITIONAL FLOOR DRAIN LOCATIONS AND INFORMATION.
15. SEE MECHANICAL AND STRUCTURAL DRAWINGS FOR ADDITIONAL INFORMATION ON HOUSEKEEPING PADS.
16. NOT ALL LOUVERS ARE SHOWN ON FLOOR PLAN DUE TO HEIGHT DIFFERENCES. SEE HVAC DWGS FOR FINAL QUANITITY, LOCATIONS, AND SIZES. SEE STRUCTURAL DWGS FOR LINTEL SCHEDULE.

PLAN KEY NOTES:

1. SAFETY SHOWER AND EYE WASH-SEE MECH/PLUMB DWGS.
2. TRENCH DRAIN AND SUMP – SEE MECH/PLUMB AND STRU DWGS FOR FINAL SIZE, LOCATION AND ADDITIONAL INFORMATION.
3. EXISTING WELL NUMBER 2 ENCLOSURE – SEE STRUCTURAL DWGS. SEE MECH/PLUMB AND CIVIL DWGS FOR ACTUAL LOCATION AND ADD'L INFORMATION.
4. SERVICE SINK – SEE MECH/PLUMB DWGS.
5. ANALIZERS AREA – SEE MECH DWGS. FOR ADDITIONAL INFORMATION.
6. FIRE EXTINGUISHERS (FE) SEE CODE PLAN CP-1.
7. PIPE DOWN THRU SLAB – SEE STRU AND MECH DWGS.

PARTITION TYPES

1. 8" CMU – HEIGHT OF WALL SHALL BE 12'-0" ABOVE FINISH FLOOR. PROVIDE HORIZONTAL JOINT REINFORCING IN FIRST COURSE AND THEN AT 16" O.C. VERTICALLY. SEE STRUCTURAL DWGS FOR ADDITIONAL INFORMATION. CMU WALL THICKNESS: 7 ⅝".
2. 8" CMU – CLASS D-2 HOLLOW CORE. HEIGHT OF WALL SHALL BE 12'-0" ABOVE FINISH FLOOR. PROVIDE HORIZONTAL JOINT REINFORCING IN FIRST COURSE AND THEN AT 16" O.C. VERTICALLY. SEE STRUCTURAL DWGS FOR ADDITIONAL INFORMATION. CMU WALL THICKNESS: 7 ⅝". 2-HOUR RATED UL DESIGN NO. U905

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

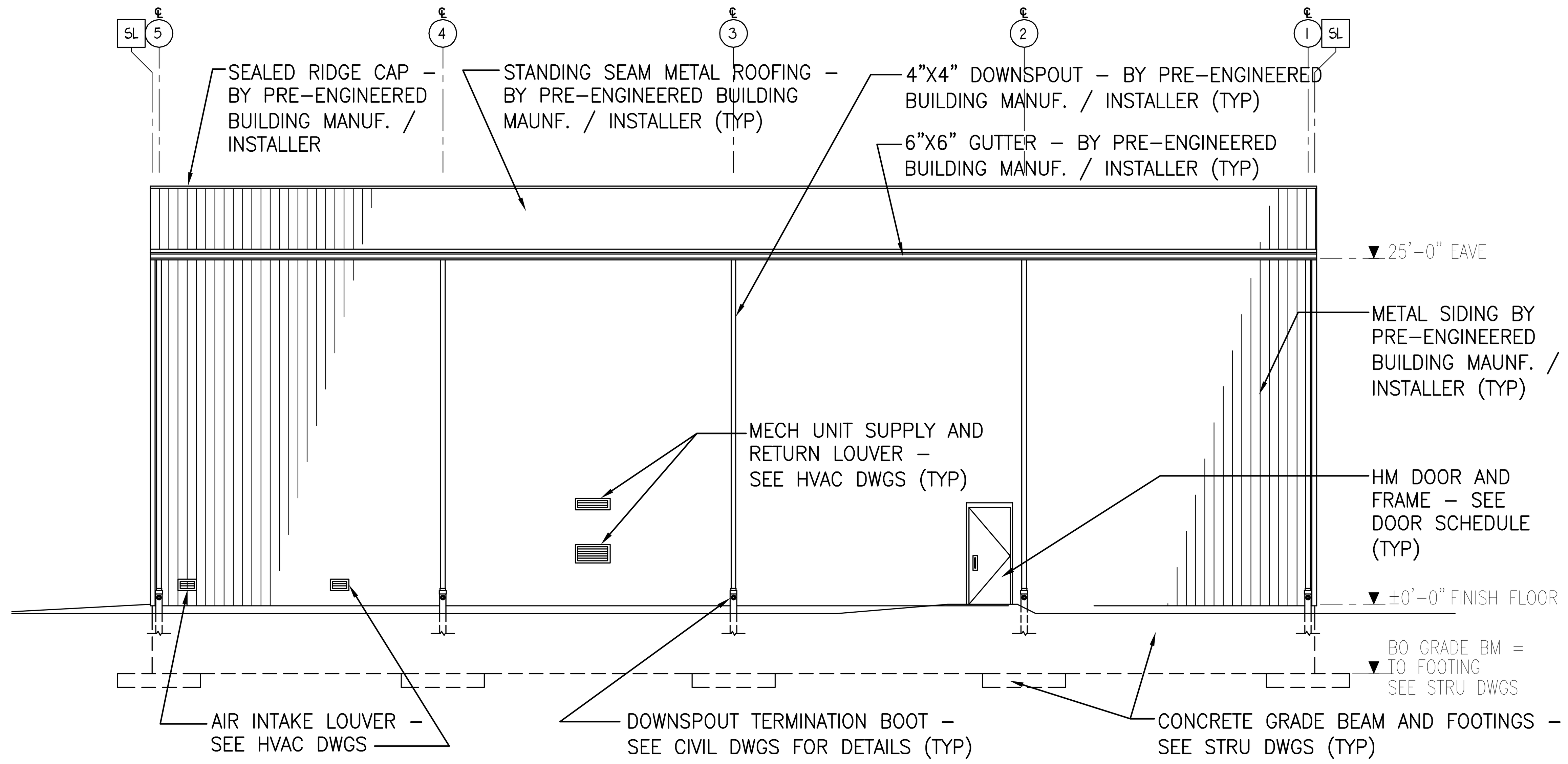
90% SUBMISSION REVIEW 12/17/2010

DES HKM | DR MTR
REVIEWED BY HKM
PM/DM HKM
CHIEF ENG/ARCH HKM

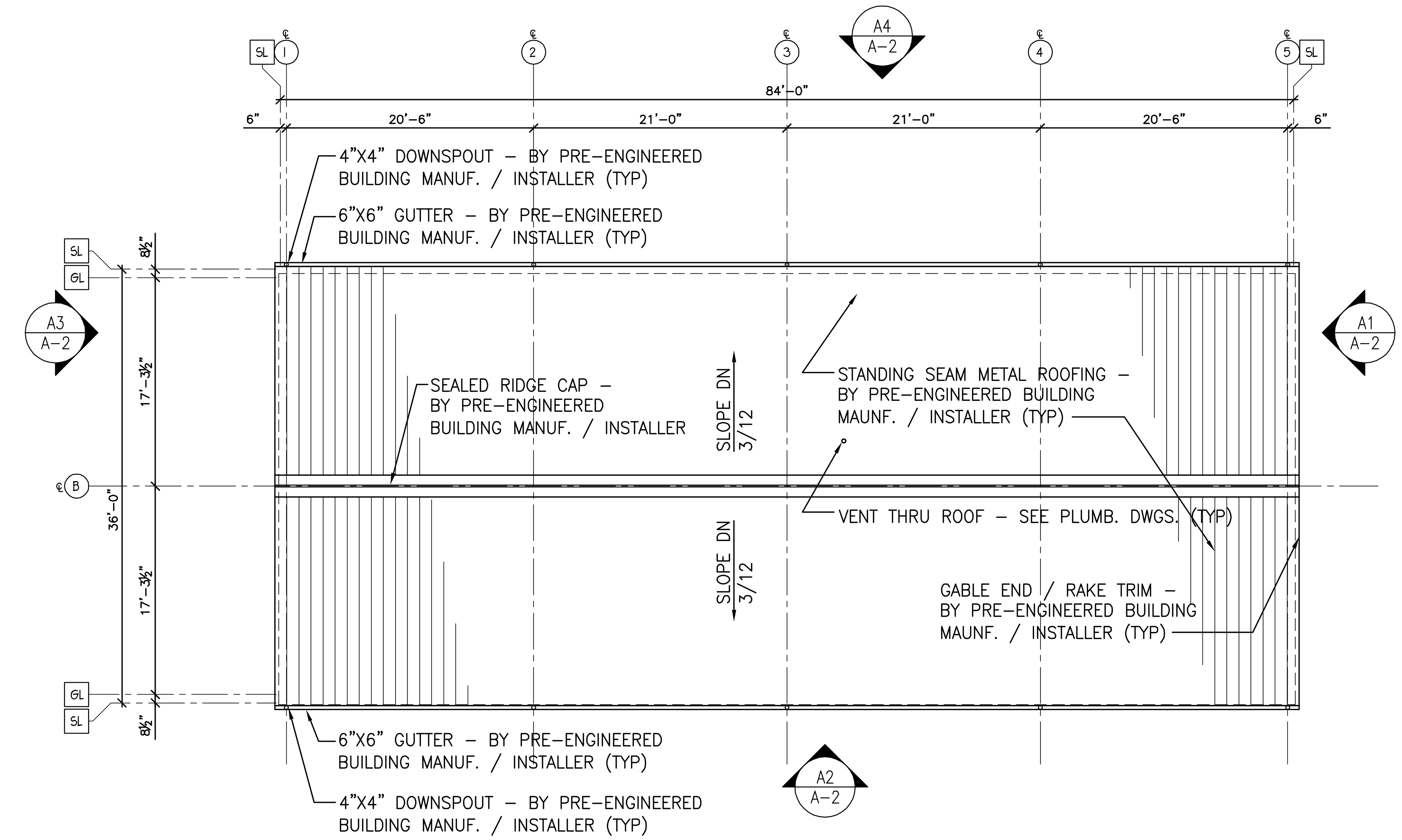
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NAVAL STATION – NORFOLK, VIRGINIA
NORTHEAST IPT
AQUA NY NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY
FLOOR PLAN

CODE ID. NO. 80091 | SIZE D
SCALE: 1/4"=1'-0"
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF ––

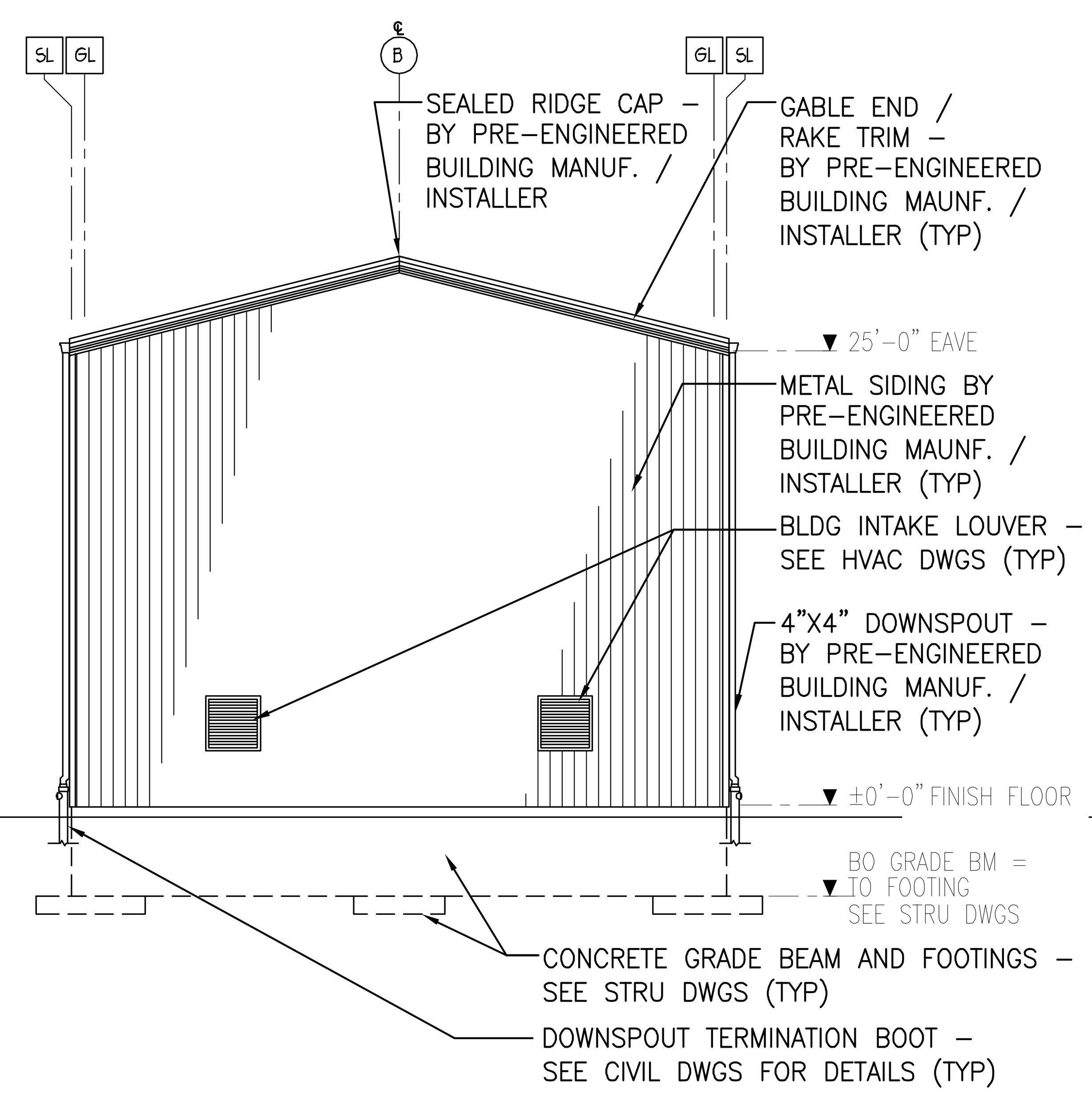
A-1



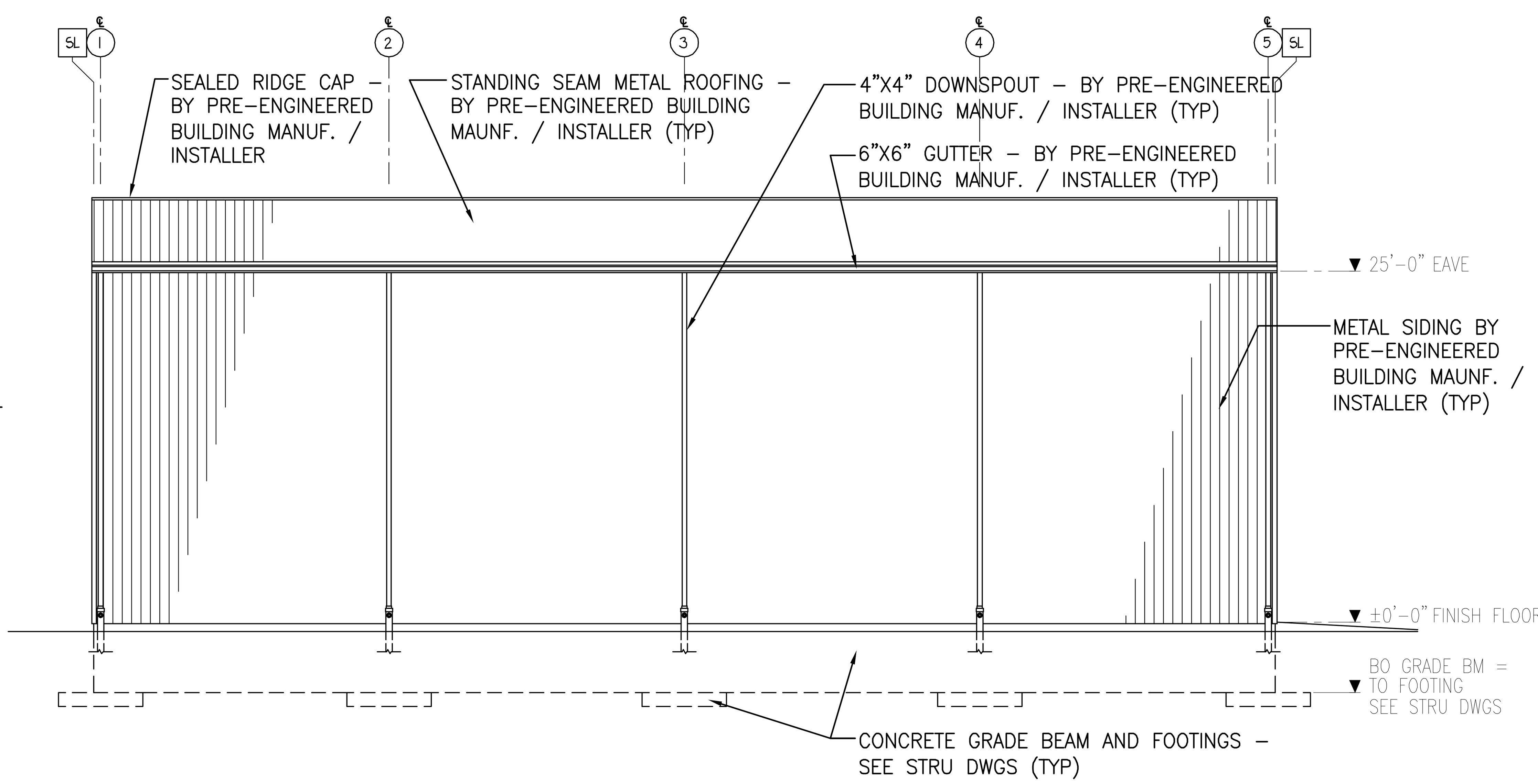
EAST ELEVATION A4
SCALE: 1/8" = 1'-0" A-1, A-2



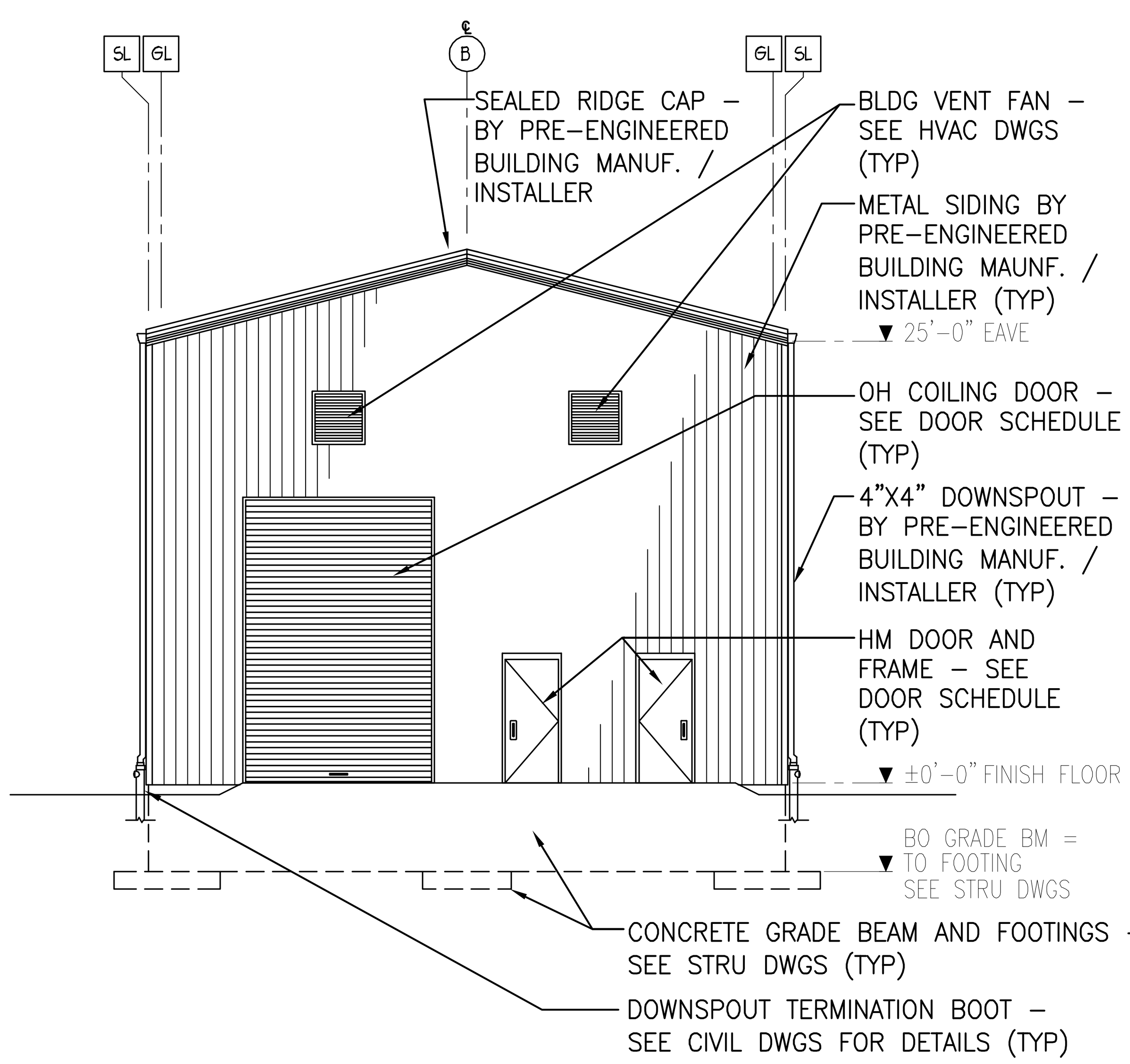
ROOF PLAN A5
SCALE: 1/8" = 1'-0" A-2
PLAN NORTH



NORTH ELEVATION A3
SCALE: 1/8" = 1'-0" A-1, A-2



WEST ELEVATION A2
SCALE: 1/8" = 1'-0" A-1, A-2



SOUTH ELEVATION A1
SCALE: 1/8" = 1'-0" A-1, A-2

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90% SUBMISSION REVIEW 12/17/2010

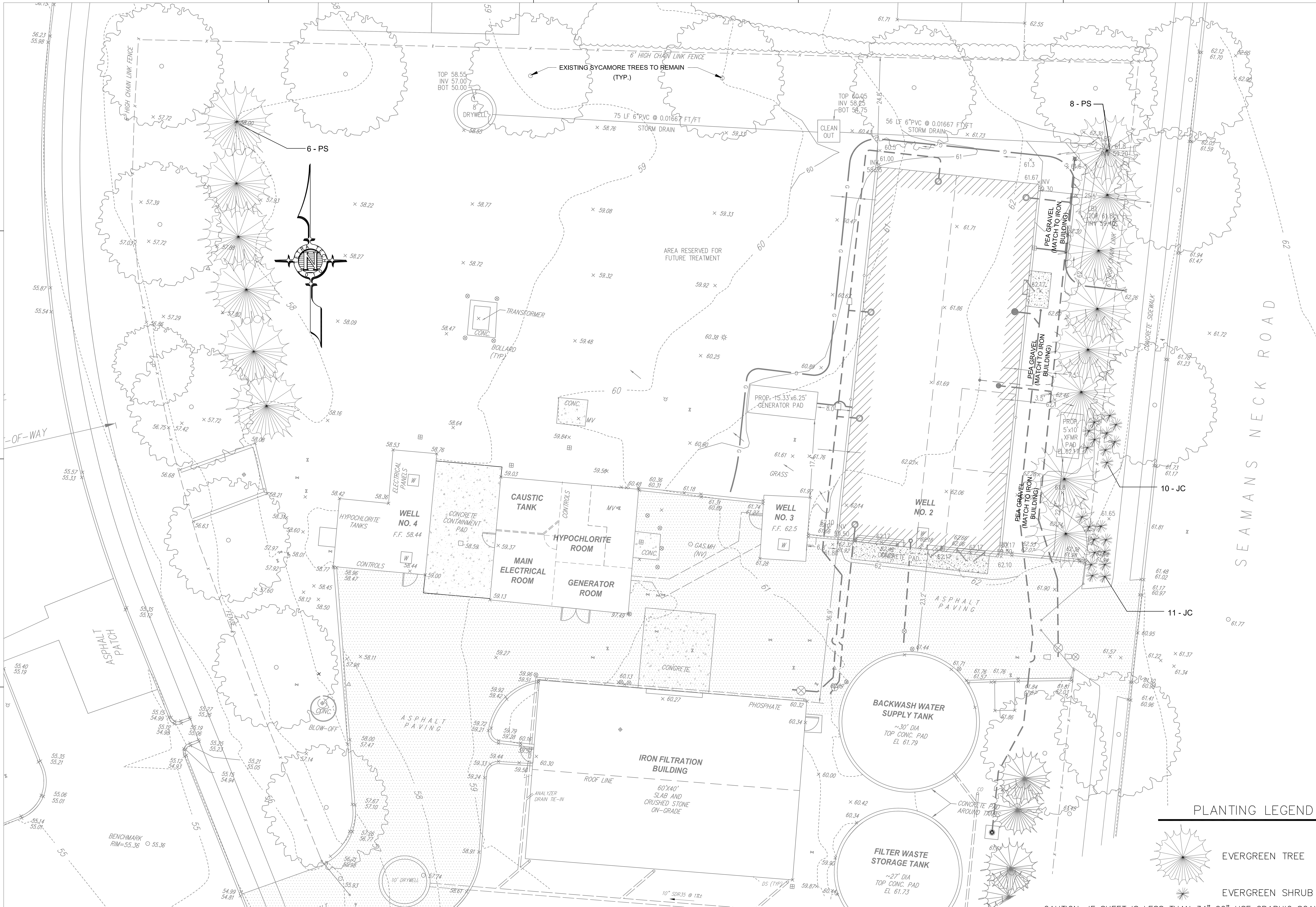
DES HKM | DR SNL
REVIEWED BY HKM
PM/DM HKM
CHIEF ENG/ARCH HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NORTHEAST IPT
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NAVAL STATION – NORFOLK, VIRGINIA

AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

ROOF PLAN AND BUILDING ELEVATIONS

CODE ID. NO. 80091 | SIZE D
SCALE: 1/4"=1'-0"
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF ——
A-2



CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

90% SUBMISSION REVIEW 12/17/2010

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION – NORFOLK, VIRGINIA
AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

SITE LANDSCAPE PLAN

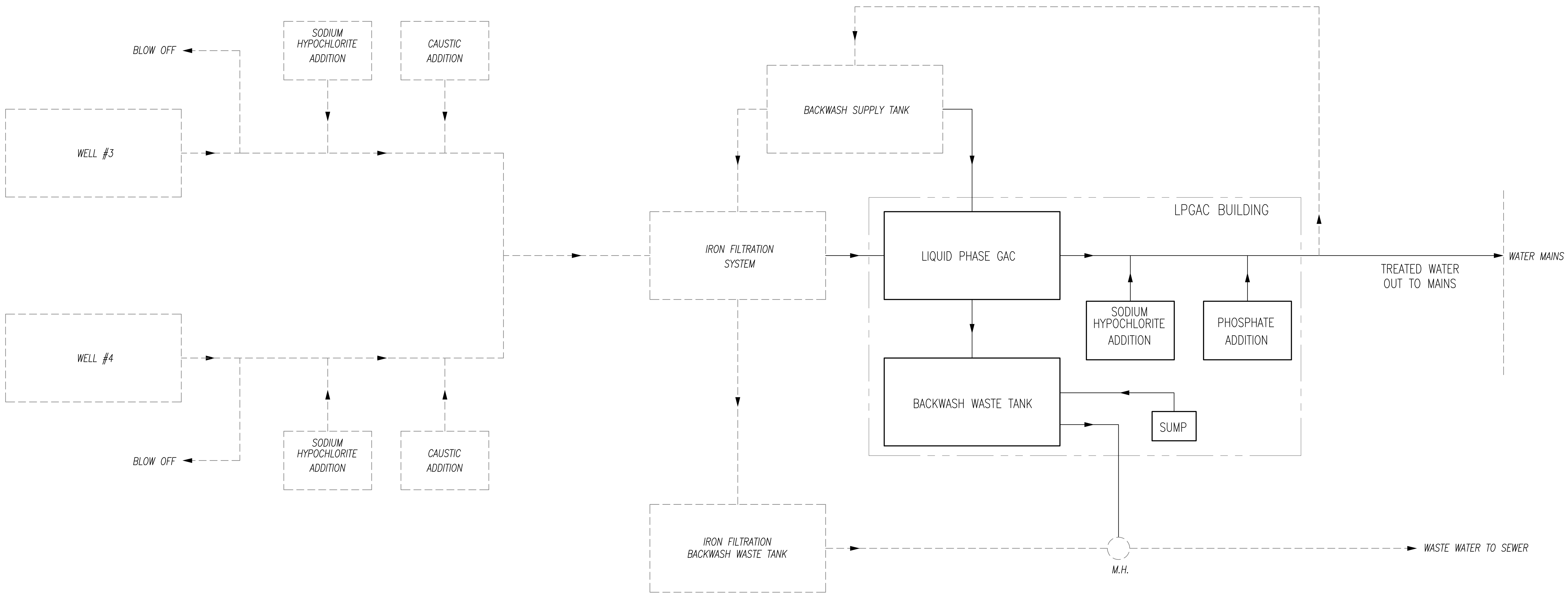
CODE ID. NO. 80091	SIZE D
SCALE:	1"=10'-0"
MAXIMO NO. N62470-08-D-1001	
JOB ORDER NO. WE-25	bbb
SPEC. NO.	
CONSTR. CONTR. NO. 112G02223	
NAVFAC DRAWING NO.	
SHEET OF --	

L-1

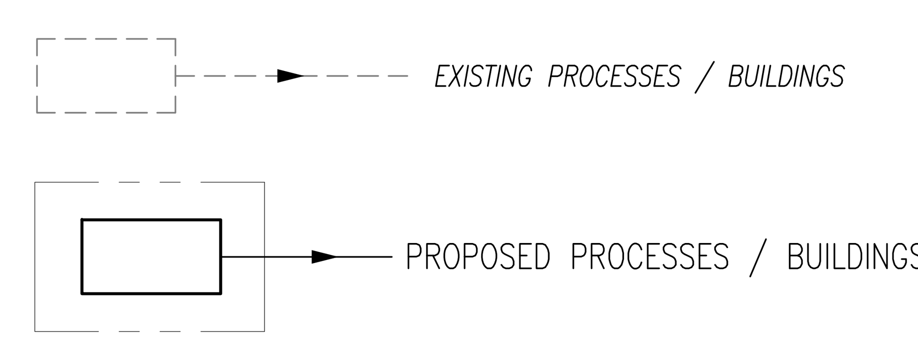
5.0 DETAILED PLANS

The process flow, piping and instrumentation diagram, and mechanical plans are provided herein as:

- PFD-1 – Process Flow Diagram
- PID-1 - P&ID – Existing System Tie-in
- PID-2 – P&ID
- PID-3 – P&ID – LPGAC 100/200
- PID-4 – P&ID – LPGAC 300/400
- PID-5 – P&ID – LPGAC 500/600
- M-1 – Proposed LPGAC Building Equipment Layout
- M-2 – Proposed LPGAC Piping Layout
- M-3 – Building Sections
- M-4 – Building Sections



BLOCK PROCESS FLOW DIAGRAM



CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90% SUBMISSION REVIEW 12/17/2010

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

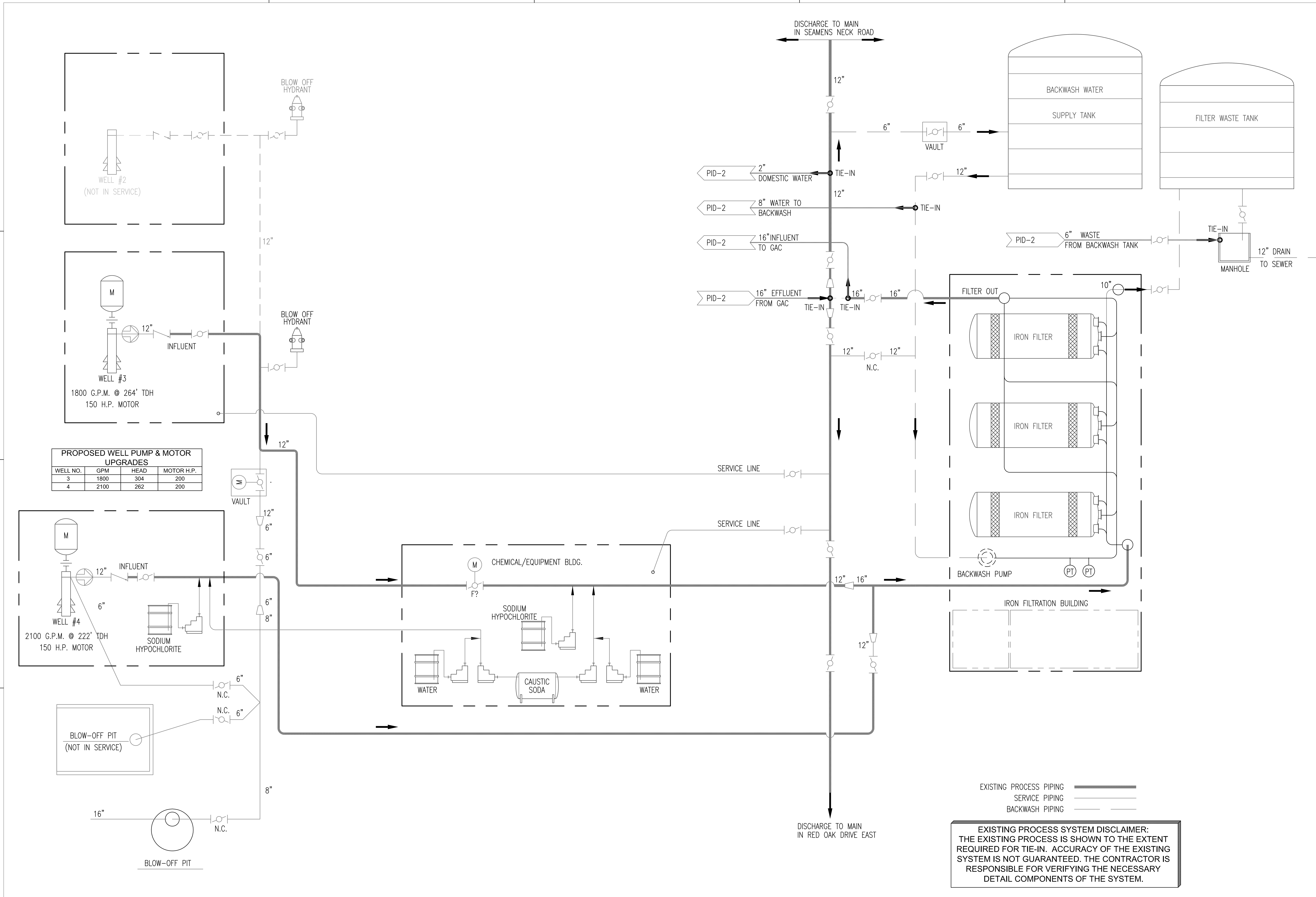
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT — NAVAL STATION – NORFOLK, VIRGINIA

AQUA NY — NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

PROCESS FLOW DIAGRAM

CODE ID. NO. 80091	SIZE D
SCALE:	NTS
MAXIMO NO. N62470-08-D-1001	
JOB ORDER NO. WE-25	
SPEC. NO.	
CONSTR. CONTR. NO. 112G02223	
NAVFAC DRAWING NO.	
SHEET	OF --

PFD-1



PROPOSED WELL PUMP & MOTOR UPGRADES			
WELL NO.	GPM	HEAD	MOTOR H.P.
3	1800	304	200
4	2100	262	200

EXISTING PROCESS SYSTEM DISCLAIMER:
THE EXISTING PROCESS IS SHOWN TO THE EXTENT REQUIRED FOR TIE-IN. ACCURACY OF THE EXISTING SYSTEM IS NOT GUARANTEED. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE NECESSARY DETAIL COMPONENTS OF THE SYSTEM.

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90% SUBMISSION REVIEW 12/17/2010

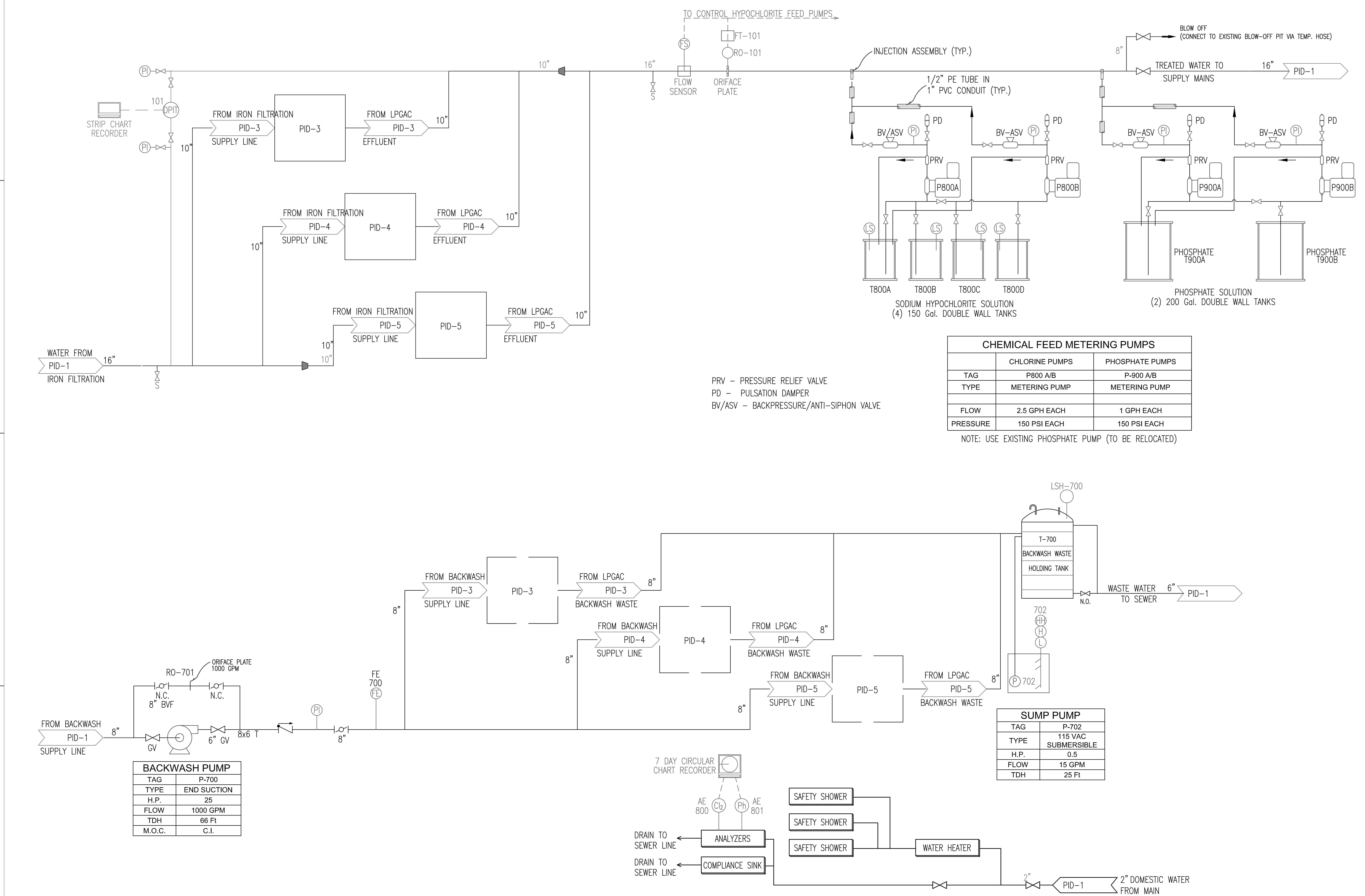
DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION - NORFOLK, VIRGINIA
AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

P&ID - EXISTING SYSTEM TIE-IN

CODE ID. NO. 80091 SIZE D
SCALE: NTS
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF --

PID-1



PRV – PRESSURE RELIEF VALVE
PD – PULSATION DAMPER
BV/ASV – BACKPRESSURE/ANTI-SIPHON VALVE

CHEMICAL FEED METERING PUMPS

	CHLORINE PUMPS	PHOSPHATE PUMPS
TAG	P800 A/B	P-900 A/B
TYPE	METERING PUMP	METERING PUMP
FLOW	2.5 GPH EACH	1 GPH EACH
PRESSURE	150 PSI EACH	150 PSI EACH

NOTE: USE EXISTING PHOSPHATE PUMP (TO BE RELOCATED)

SUMP PUMP

TAG	P-702
TYPE	115 VAC SUBMERSIBLE
H.P.	0.5
FLOW	15 GPM
TDH	25 Ft

BACKWASH PUMP

TAG	P-700
TYPE	END SUCTION
H.P.	25
FLOW	1000 GPM
TDH	66 Ft
M.O.C.	C.I.

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90% SUBMISSION REVIEW 12/17/2010

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

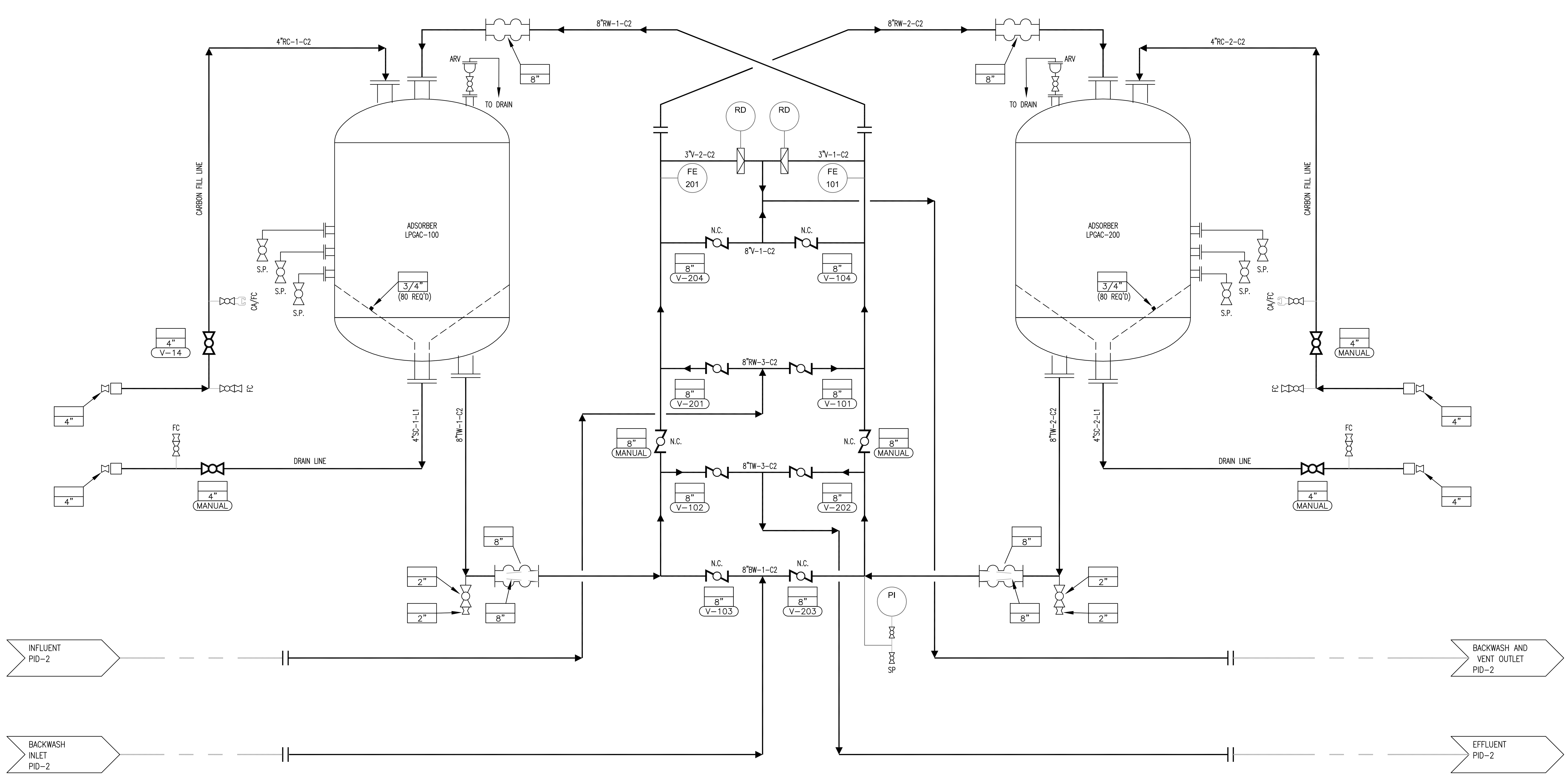
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION – NORFOLK, VIRGINIA
AQUA NY
NASSAU COUNTY, NEW YORK

MODIFICATIONS TO WATER TREATMENT FACILITY

P&ID

CODE ID. NO. 80091 SIZE D
SCALE: NTS
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF ––

PID-2



MEDIA

MEDIA: GAC
QUANTITY PER VESSEL: 20,000 LBS.
SERVICE: POTABLE

INSTRUMENTATION

PI 217
PSE 577 FOR 125 psig MAX. OPER. PRESS.
PDS 294

DESIGN CONDITIONS

FLOW RATE – 700 GPM
INFLUENT PRESSURE – 125 PSIG MAX.
INFLUENT TEMP. – 120°F MAX.
BACKWASH RATE – 1000 GPM MAX.
ELECTRIC POWER – 120 V, 60~ SINGLE PHASE, 15 AMP

LEGEND

BW – BACKWASH WATER
FC – FLUSH CONNECTION
RC – REACT.(OR VIRGIN) CARBON
RW – RAW WATER
SC – SPENT CARBON SLURRY
SP – SAMPLE PORT
TW – TREATED WATER
V – VENT
NC – NORMALLY CLOSED

ADSORBERS

10'-0" O.D. x 12'-0" S.S.
ASME 2:1 ELLIPTICAL TOP AND BOTTOM HEADS.
CARBON STEEL CONSTRUCTION.
ASME SECT. VIII, DIV. 1
W/ PLASITE 4110 LINING
125 PSIG @ 140°F DESIGN.

UTILITY REQUIREMENTS

AIR, CARBON TRANSFER –
100 SCFM @ 30 PSIG MIN.
PLANT WATER –
100 GPM @ 30 PSIG MIN. WIRING –
MIN. AWG #16 TO PDS 294

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

90% SUBMISSION REVIEW 12/17/2010

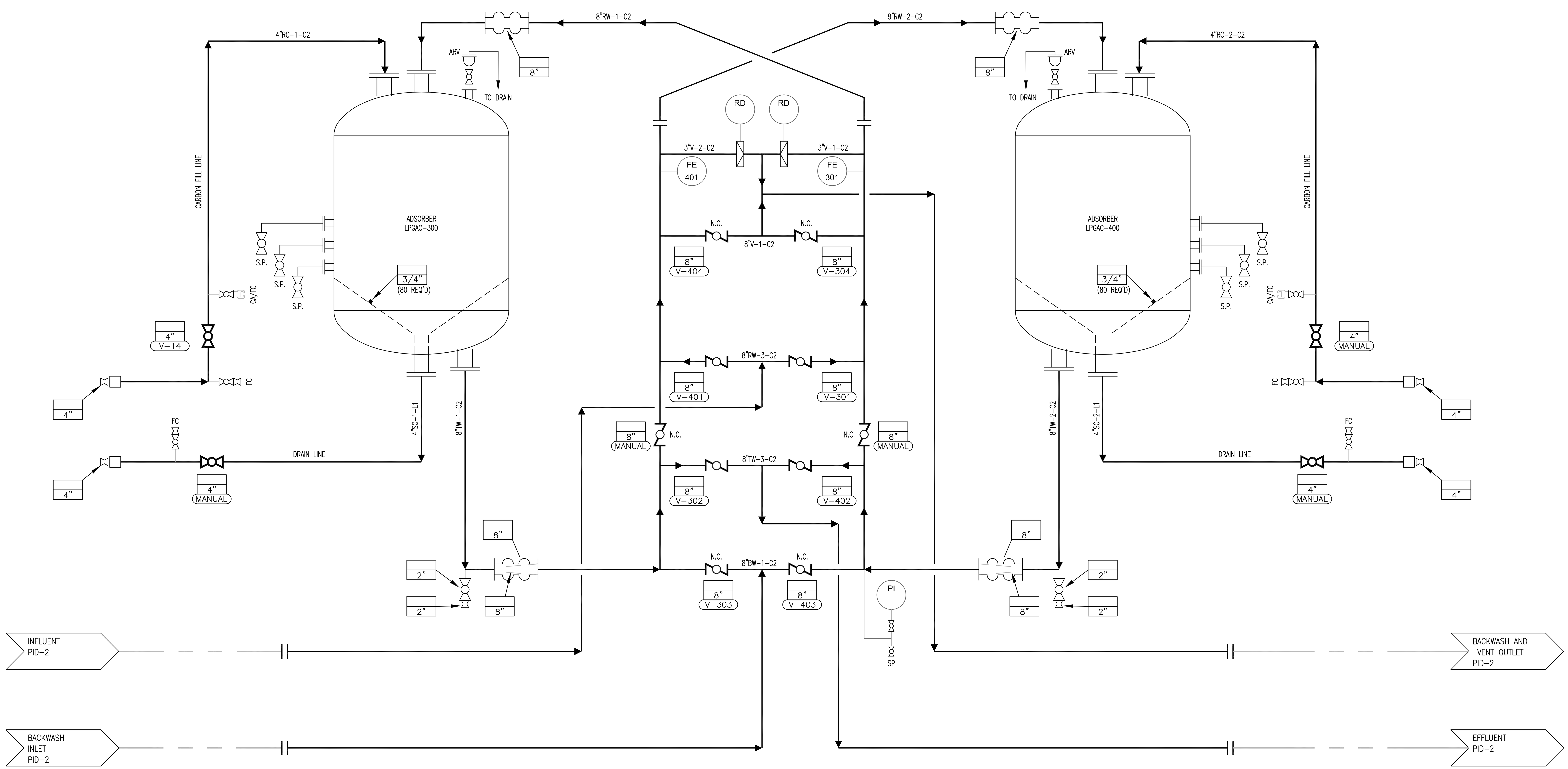
DES HKM DR SNL
REVIEWED BY HKM
PM/DM HKM
CHIEF ENG/ARCH HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION – NORFOLK, VIRGINIA
AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

P&ID - LPGAC 100/200

CODE ID. NO. 80091 SIZE D
SCALE: NTS
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF ––

PID-3



MEDIA

MEDIA: GAC
QUANTITY PER VESSEL: 20,000 LBS.
SERVICE: POTABLE

INSTRUMENTATION

PI 217
PSE 577 FOR 125 psig MAX. OPER. PRESS.
PDS 294

DESIGN CONDITIONS

FLOW RATE – 700 GPM
INFLUENT PRESSURE – 125 PSIG MAX.
INFLUENT TEMP. – 120°F MAX.
BACKWASH RATE – 1000 GPM MAX.
ELECTRIC POWER – 120 V, 60~ SINGLE PHASE, 15 AMP

LEGEND

BW – BACKWASH WATER
FC – FLUSH CONNECTION
RC – REACT.(OR VIRGIN) CARBON
RW – RAW WATER
SC – SPENT CARBON SLURRY
SP – SAMPLE PORT
TW – TREATED WATER
V – VENT
NC – NORMALLY CLOSED

ADSORBERS

10'-0" O.D. x 12'-0" S.S.
ASME 2:1 ELLIPTICAL TOP AND BOTTOM HEADS.
CARBON STEEL CONSTRUCTION.
ASME SECT. VIII, DIV. 1
W/ PLASITE 4110 LINING
125 PSIG @ 140°F DESIGN.

UTILITY REQUIREMENTS

AIR, CARBON TRANSFER –
100 SCFM @ 30 PSIG MIN.
PLANT WATER –
100 GPM @ 30 PSIG MIN. WIRING –
MIN. AWG #16 TO PDS 294

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90%
SUBMISSION
REVIEW
12/17/2010

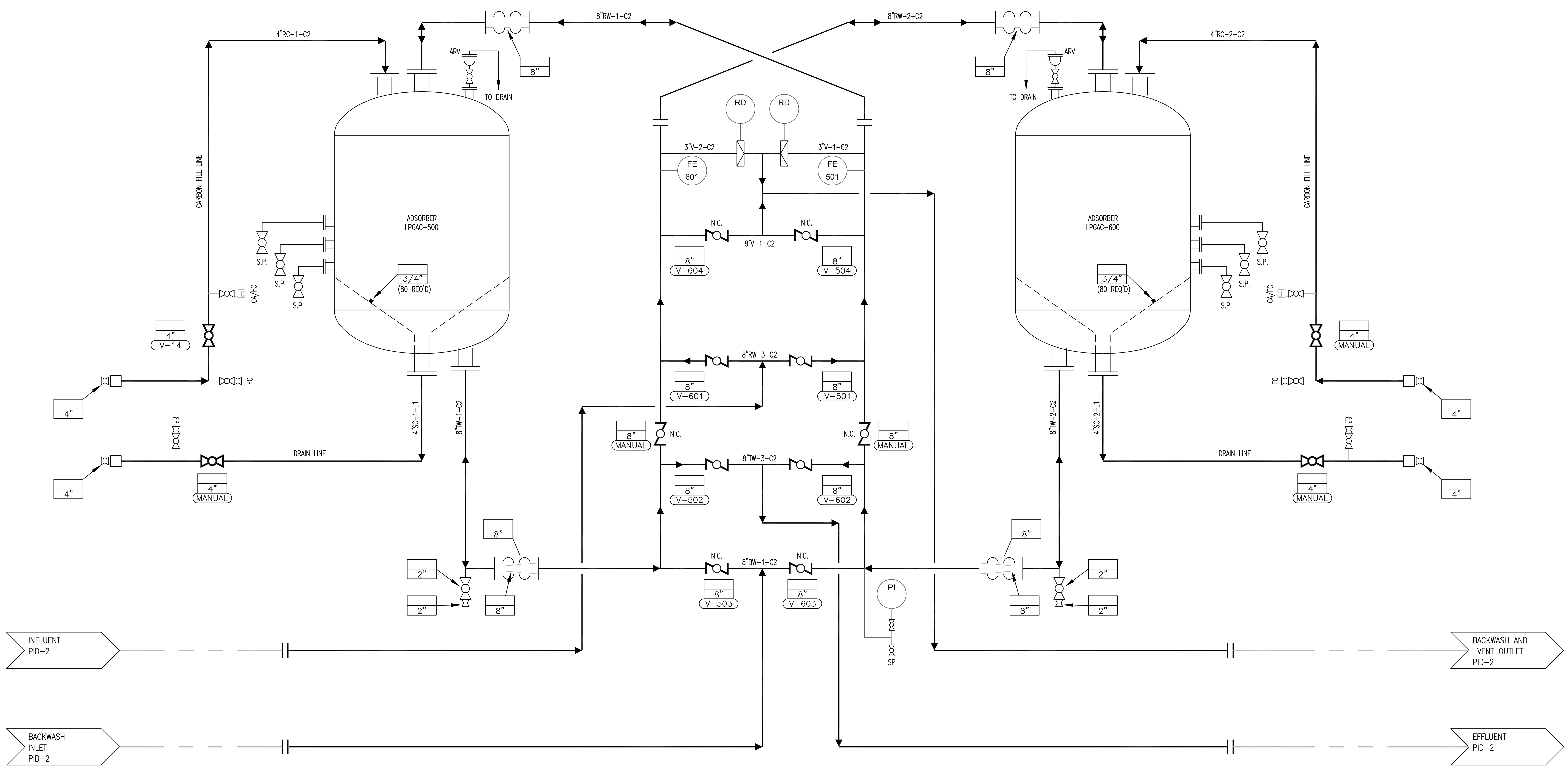
DES HKM DR SNL
REVIEWED BY HKM
PM/DM HKM
CHIEF ENG/ARCH HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NAVAL STATION – NORFOLK, VIRGINIA
NORTHEAST IPT
AQUA NY NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

P&ID 300/400

CODE ID. NO. 80091 SIZE D
SCALE: NTS
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF

PID-4



MEDIA

MEDIA: GAC
QUANTITY PER VESSEL: 20,000 LBS.
SERVICE: POTABLE

INSTRUMENTATION

PI 217
PSE 577 FOR 125 psig MAX. OPER. PRESS.
PDS 294

DESIGN CONDITIONS

FLOW RATE – 700 GPM
INFLUENT PRESSURE – 125 PSIG MAX.
INFLUENT TEMP. – 120°F MAX.
BACKWASH RATE – 1000 GPM MAX.
ELECTRIC POWER – 120 V, 60~ SINGLE PHASE, 15 AMP

LEGEND

BW – BACKWASH WATER
FC – FLUSH CONNECTION
RC – REACT.(OR VIRGIN) CARBON
RW – RAW WATER
SC – SPENT CARBON SLURRY
SP – SAMPLE PORT
TW – TREATED WATER
V – VENT
NC – NORMALLY CLOSED

ADSORBERS

10'-0" O.D. x 12'-0" S.S.
ASME 2:1 ELLIPTICAL TOP AND BOTTOM HEADS.
CARBON STEEL CONSTRUCTION.
ASME SECT. VIII, DIV. 1
W/ PLASITE 4110 LINING
125 PSIG @ 140°F DESIGN.

UTILITY REQUIREMENTS

AIR, CARBON TRANSFER –
100 SCFM @ 30 PSIG MIN.
PLANT WATER –
100 GPM @ 30 PSIG MIN. WIRING –
MIN. AWG #16 TO PDS 294

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90% SUBMISSION REVIEW 12/17/2010

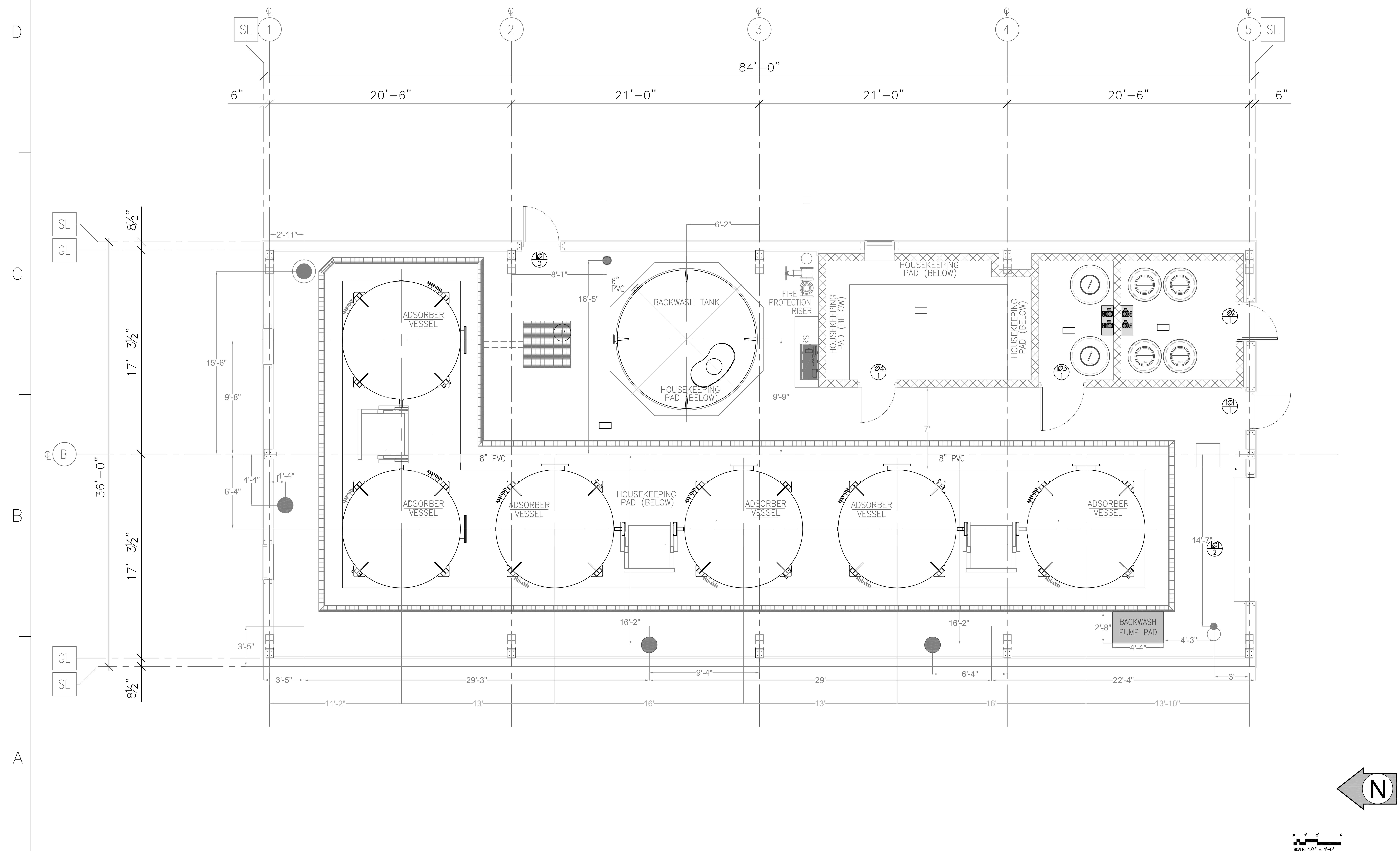
DES HKM	DR SNL
REVIEWED BY HKM	
PM/DM HKM	
CHIEF ENG/ARCH HKM	

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT NAVAL STATION – NORFOLK, VIRGINIA
AQUA NY NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

P&ID - LPGAC 500/600

CODE ID. NO. 80091 SIZE D
SCALE: NTS
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF ––

PID-5



CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

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

90% SUBMISSION REVIEW 12/17/2010

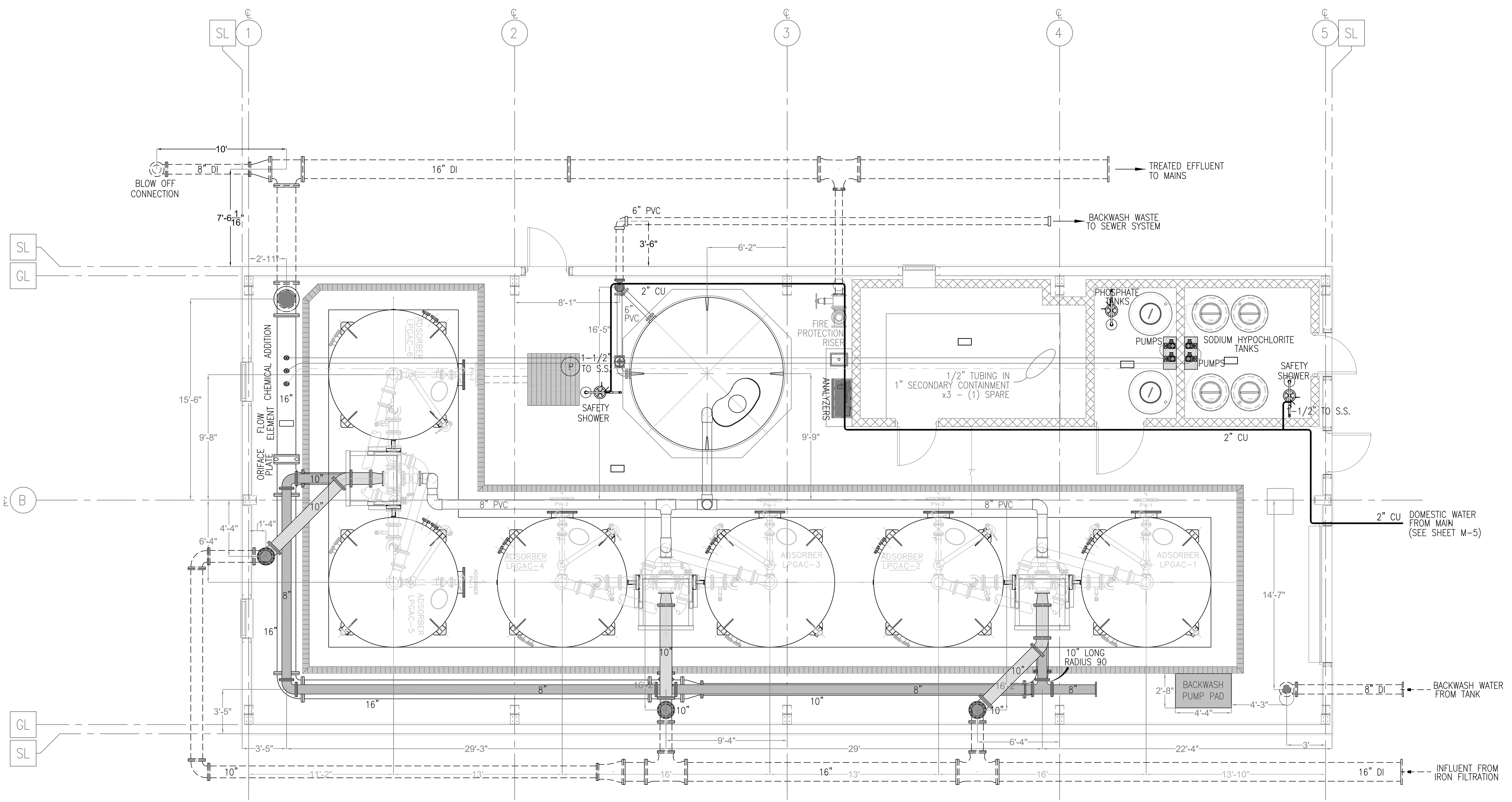
DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION - NORFOLK, VIRGINIA
AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

PROPOSED LPGAC BUILDING EQUIPMENT LAYOUT

CODE ID. NO. 80091	SIZE D
SCALE:	1/4"=1'-0"
MAXIMO NO. N62470-08-D-1001	
JOB ORDER NO. WE-25	
SPEC. NO.	
CONSTR. CONTR. NO. 112G02223	
NAVFAC DRAWING NO.	
SHEET	OF --
M-1	

K:\112G02223 - Aqua Bethpage-NAvy Project - H. Mital\Drawings\Mechanical\02223_M1.dwg 12/17/2010 13:30



PIPING NOTES:

UNDERGROUND PIPING SHALL BE MECHANICAL JOINT, RETAINED GLAND TYPE
PROVIDE THREADED ROD TIES IN PIPING WATER LINES (TYP.)
INTERIOR PIPING SHALL BE FLANGED, CLASS 52 CEMENT LINED.
BACKWASH WASTE PIPING SHALL BE SCH. 80, FLANGED AT FITTINGS.
ALL LINES SHALL HAVE 3/4" BALL VALVE HIGH POINT VENTS AND LOW POINT DRAINS.

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

90% SUBMISSION REVIEW 12/17/2010

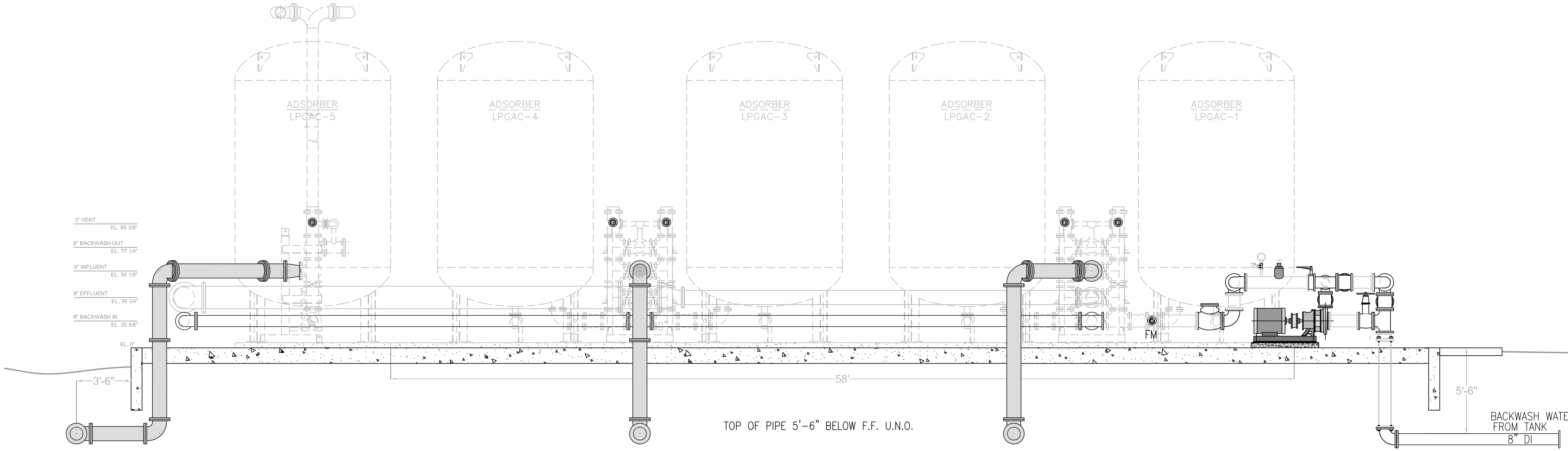
DES HKM	DR SNL
REVIEWED BY HKM	
PM/DM HKM	
CHIEF ENG/ARCH HKM	

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION - NORFOLK, VIRGINIA
AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

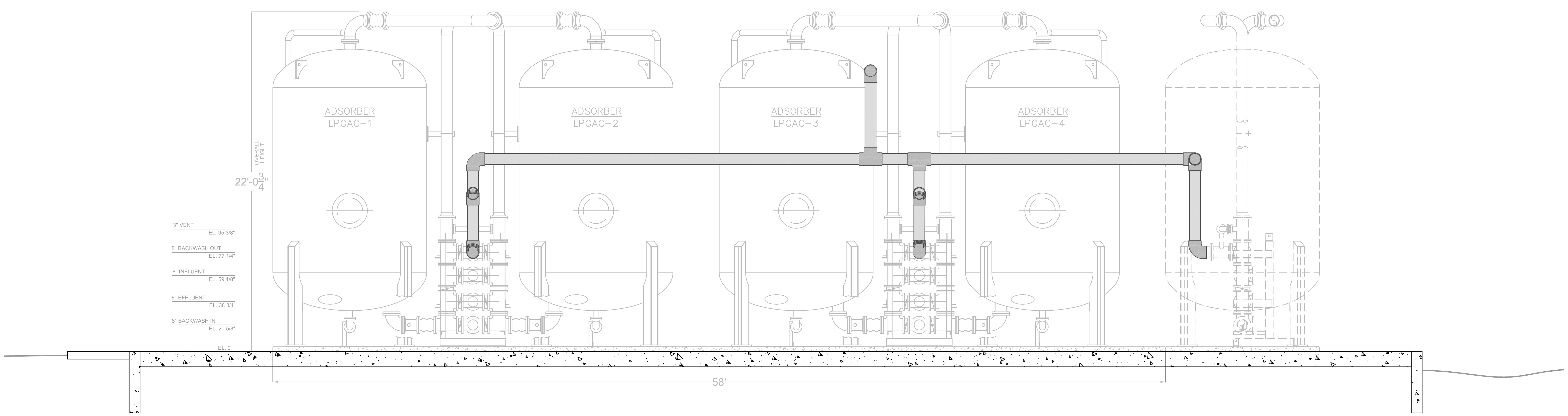
PROPOSED LPGAC PIPING LAYOUT

CODE ID. NO. 80091	SIZE D
SCALE: 1/4"=1'-0"	
MAXIMO NO. N62470-08-D-1001	
JOB ORDER NO. WE-25	
SPEC. NO.	
CONSTR. CONTR. NO. 112G02223	
NAVFAC DRAWING NO.	
SHEET OF --	

M-2



2 / M-3 SECTION: VESSEL PIPING - REAR (TYP.)
SCALE: 1/4" =1'-0"



1 / M-3 SECTION: VESSEL PIPING - FRONT (TYP.)
SCALE: 1/4" =1'-0"

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

90% SUBMISSION REVIEW 12/17/2010

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

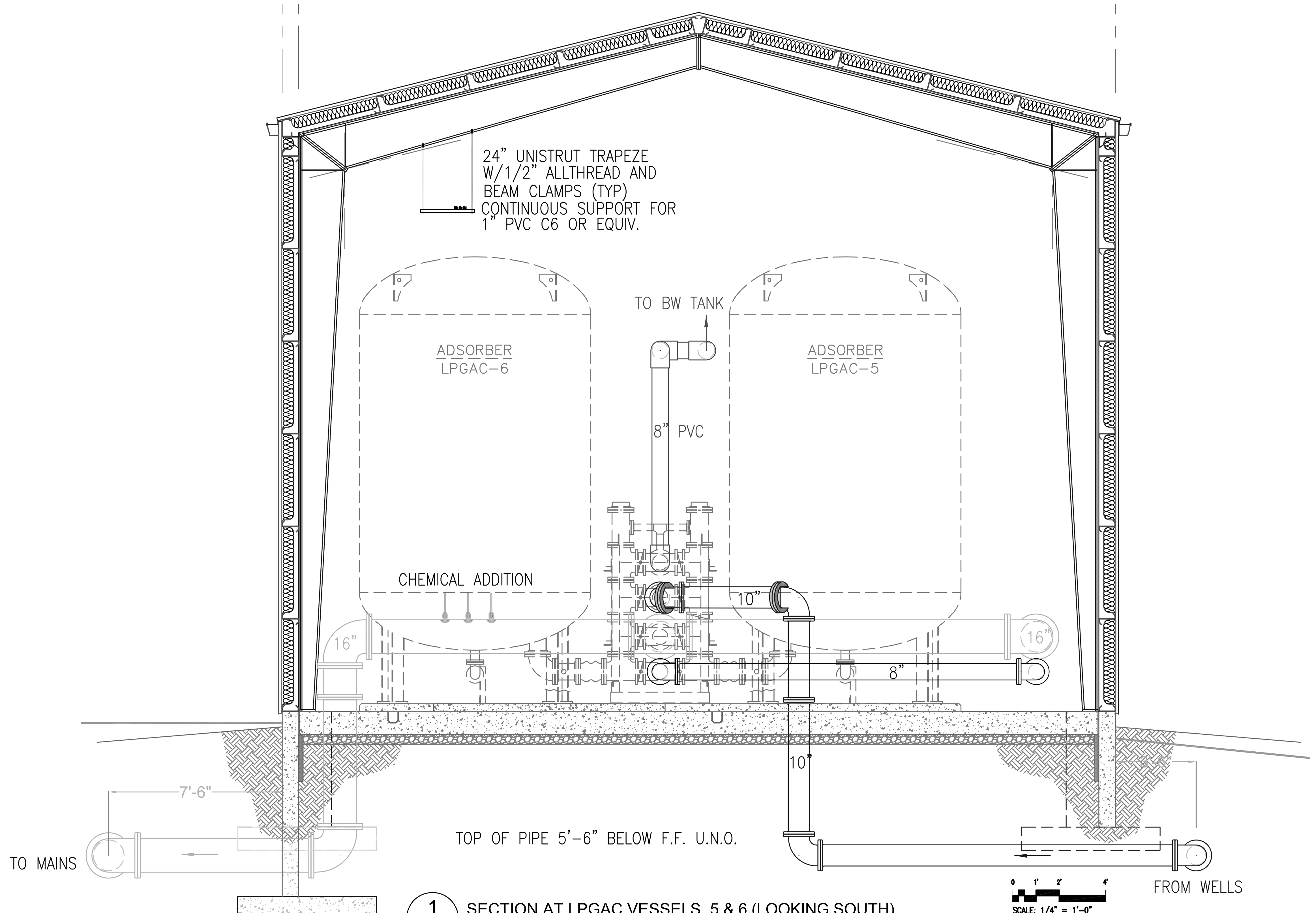
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION - NORFOLK, VIRGINIA

AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

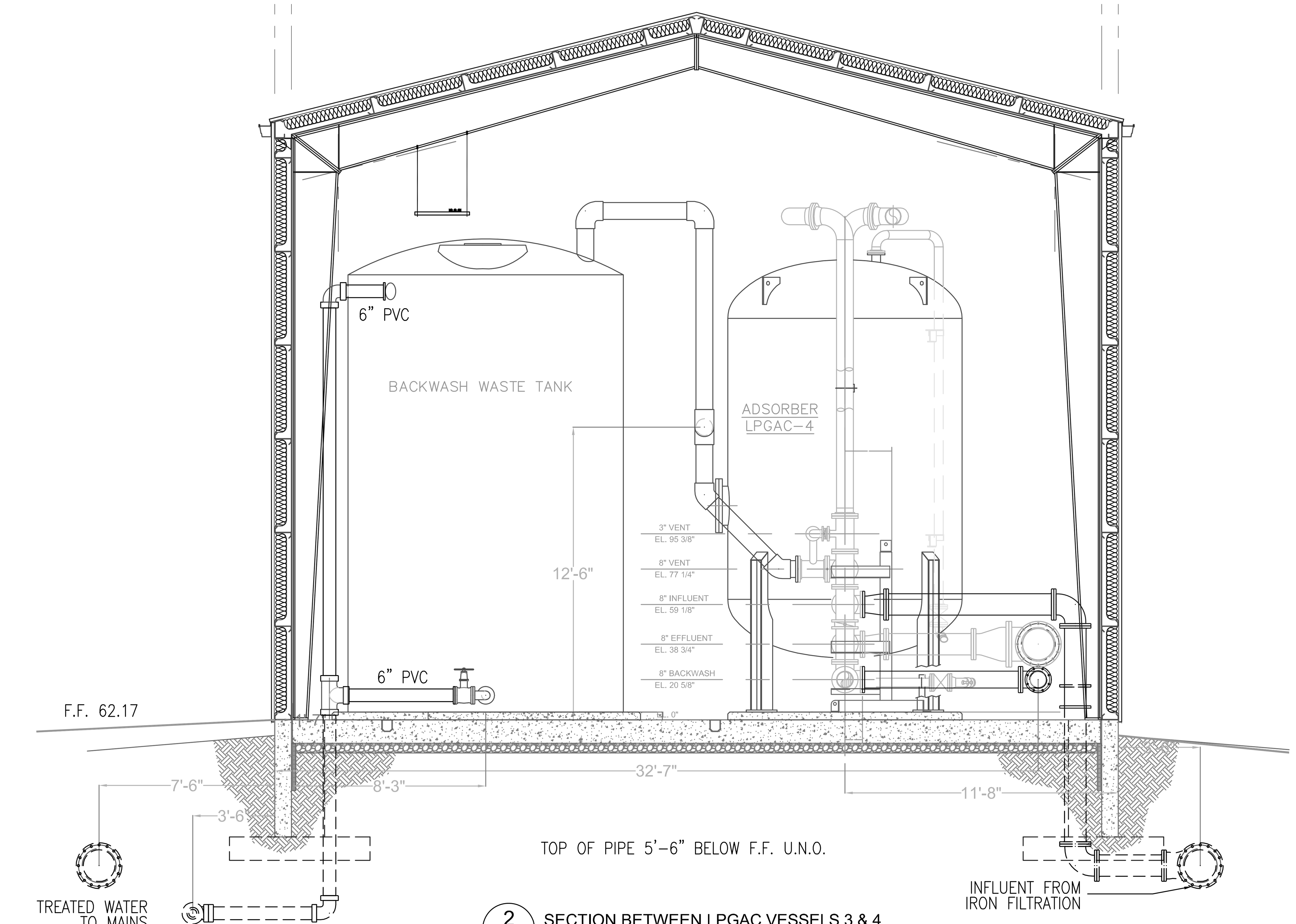
BUILDING SECTIONS

CODE ID. NO. 80091	SIZE D
SCALE:	1/4"=1'-0"
MAXIMO NO. N62470-08-D-1001	
JOB ORDER NO. WE-25	
SPEC. NO.	
CONSTR. CONTR. NO. 112G02223	
NAVFAC DRAWING NO.	
SHEET	OF --

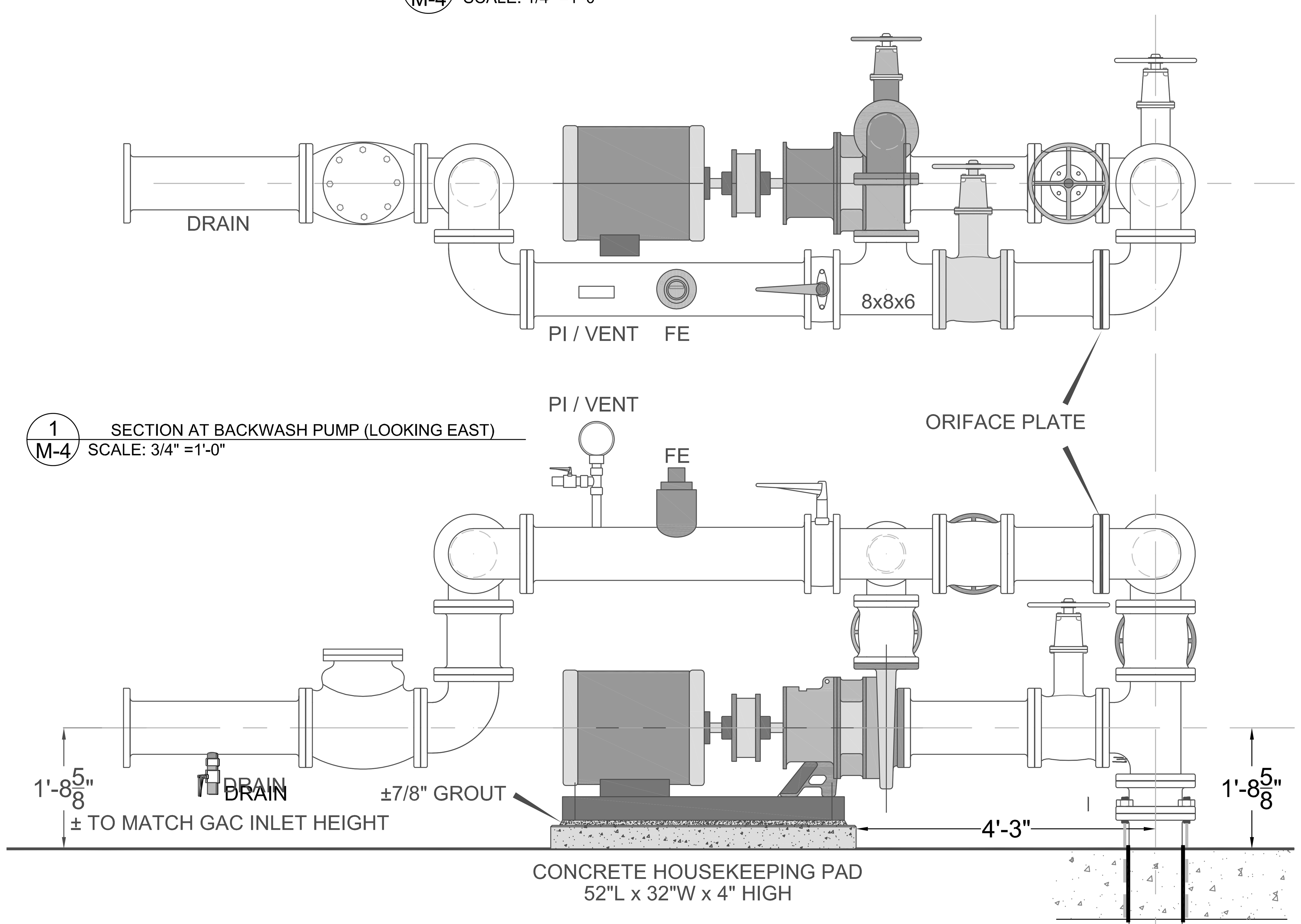
M-3



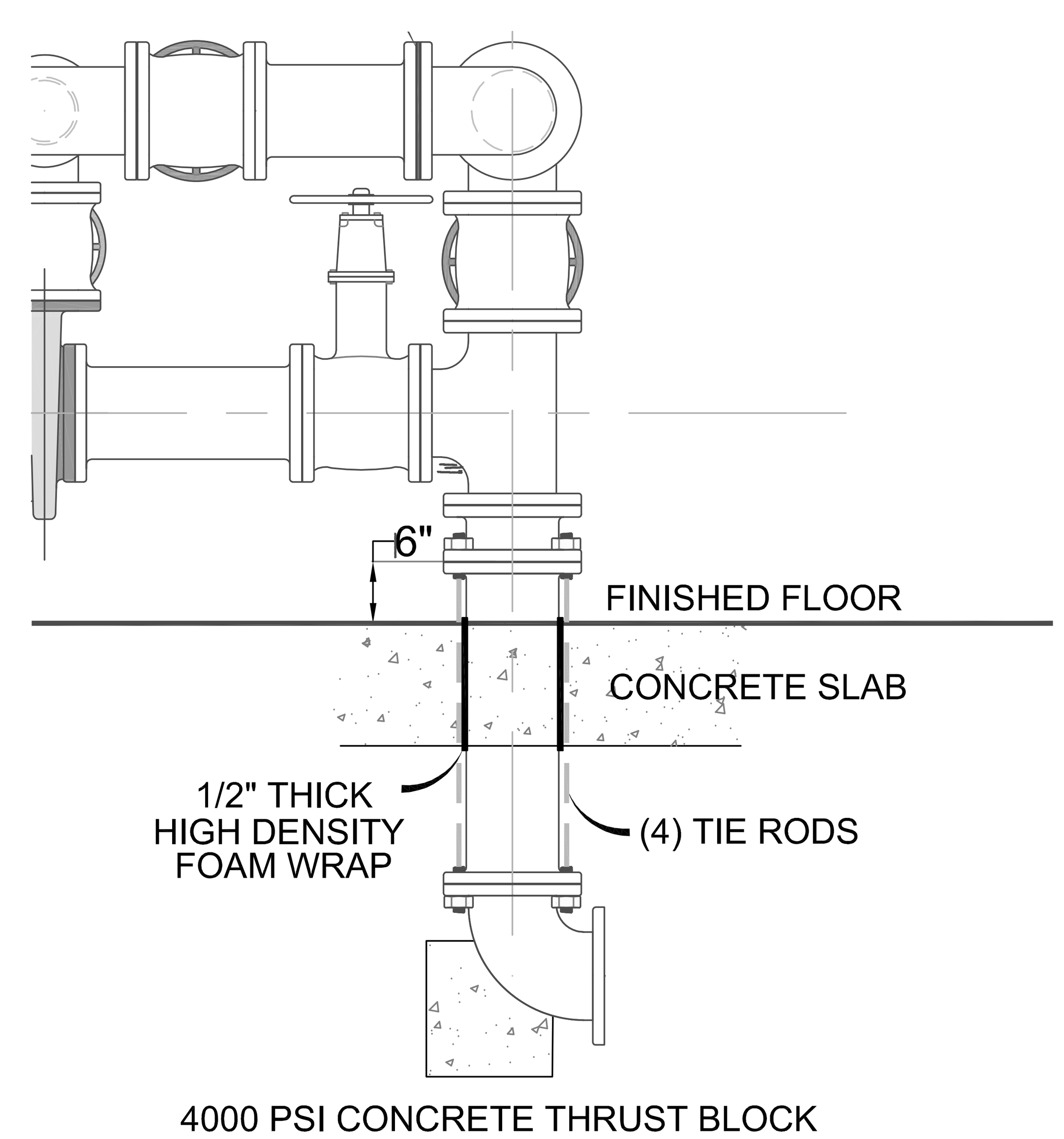
1 M-4 SECTION AT LPGAC VESSELS 5 & 6 (LOOKING SOUTH)
SCALE: 1/4" =1'-0"



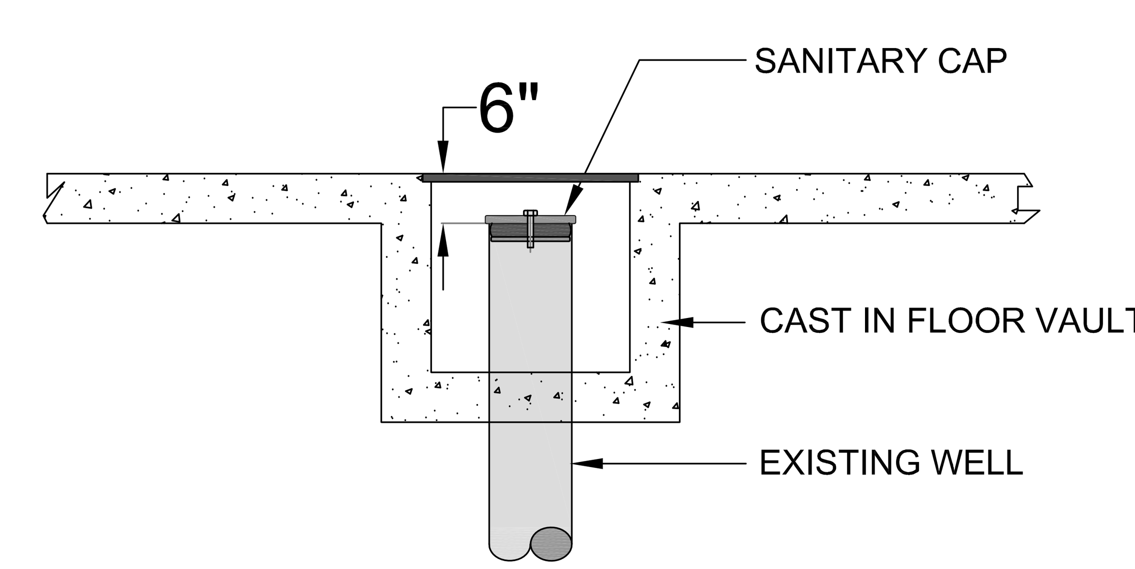
2 M-4 SECTION BETWEEN LPGAC VESSELS 3 & 4
SCALE: 1/4" =1'-0"



1 M-4 SECTION AT BACKWASH PUMP (LOOKING EAST)
SCALE: 3/4" =1'-0"



5 M-4 PIPE PENETRATION THROUGH FLOOR (TYP.)
SCALE: NTS



4 M-4 WELL#2 SANITARY CAP DETAIL
SCALE: NTS

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

90% SUBMISSION REVIEW 12/17/2010

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
NORTHEAST IPT
NAVAL STATION – NORFOLK, VIRGINIA
AQUA NY NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY

BUILDING SECTIONS

CODE ID. NO. 80091 SIZE D
SCALE: 1/4"=1'-0"
MAXIMO NO. N62470-08-D-1001
JOB ORDER NO. WE-25
SPEC. NO.
CONSTR. CONTR. NO. 112G02223
NAVFAC DRAWING NO.
SHEET OF ——

M-4

K:\112G02223 – Aqua Bethpage-NAvy Project – H. Mital\Drawings\Mechanical\02223_M4.dwg 12/17/2010 13:32

6.0 SPECIFICATIONS

Technical specifications will be provided in the final report. An equipment list (Table 6.1), instrument list (Table 6.2), system control list (Table 6.3) and the anticipated specification table of contents (Table 6.4) are provided at this time.

Table 6.1 Equipment List

ID Number	Equipment	Quantity	Dimensions/Capacity	Remarks
No. 3	Existing Well Pump	1	1,800 gpm @ 304’ TDH, 200 HP	Retrofit with additional bowl and new motor to maintain flowrate with an additional 15 psi.
No. 4	Existing Well Pump	1	2,100 gpm, @ 262’ TDH, 200 HP	Retrofit with additional bowl and new motor to maintain flowrate with an additional 15 psi.
LPGAC-100 to -600	GAC Adsorbers	6	10’ diameter x 18‘ high, 20,000 pounds	700 gpm each unit, 125 psig design pressure
T-700	Backwash Holding Tank	1	12’ diameter x 19.5’ high (15,000 gallon capacity)	Capacity for 1.5 backwashes.
P-700	Backwash Pump	1	1,000 gpm at 66’ TDH	End suction, centrifugal type
T-800	Hypochlorite Storage Tanks	4	150 gallons	Double wall tank
P-800 A&B	Hypochlorite Feed Pumps	2	2.5 gph, 150 psi	Positive displacement
T-900 A&B	Phosphate Storage Tanks	2	200 gallons	Double wall tank
P-900 A&B	Phosphate Feed Pumps	2	Existing pumps to be relocated	Positive displacement
P-702	Sump Pump	1	15 gpm @ 25’ TDH, 0.5 HP	Building sump
	Backup Generator	1	260 KW, 325 KVA	Gas powered.

Table 6.2 Instrument List

INSTRUMENTATION	ID	LOCATION	QTY	Comments
Flow sensor/transmitter	FE 101/FT 101	GAC 101- inlet flow	1	local display only
Flow sensor/transmitter	FE 201/FT 201	GAC 201- inlet flow	1	local display only
Flow sensor/transmitter	FE 301/FT 301	GAC 301- inlet flow	1	local display only
Flow sensor/transmitter	FE 401/FT 401	GAC 401- inlet flow	1	local display only
Flow sensor/transmitter	FE 501/FT 501	GAC 501- inlet flow	1	local display only
Flow sensor/transmitter	FE 601/FT 601	GAC 601- inlet flow	1	local display only
Flow sensor/transmitter	FE 700/FT 700	Backwash Pump discharge line	1	local display only
Level switch-High	LSH 700	BW tank T-700	1	controls BW pump's operation
Level switches- High	LSH 800 A thru D	Hypochlorite Tanks T800 A thru D	4	to audible alarm
Differential Pressure Transmitter	DPIT 100	Carbon Filter Inlet/Outlet header	1	local display only
Strip chart recorder		Treatment Building	1	for DPIT 100
Chlorine Analyzer	CL/PH 100	Treated water header	2	signals to local recorders
and pH analyzer				
Circular chart- 7-day		Treatment Building	2	for pH and chlorine analyzers
Float Switches		Sump pump	3	controls sump pump locally
Orifice plate	RO-101	plant effluent line	1	detects plant effluent flow (redundent signal)
flow transmitter	FT-101	plant effluent line	1	signal from RO-101
Flow switch	FS-101	plant effluent line	1	detects plant effluent signal
Orifice plate	RO-701	Backwash Pump bypass line	1	regulate flow from plant effluent in bypass mode
pressure relief valves	PRV 800A thru D	Hypochlorite Feed Pump discharge	2	supplied by chemical pump vendor
back pressure/anti-siphon valve	BP 800A thru D	Hypochlorite Feed Pump discharge	2	supplied by chemical pump vendor
pulsation dampener	PD 800A thru D	Hypochlorite Feed Pump discharge	2	supplied by chemical pump vendor
pressure relief valves	PRV 900A thru B	Phosphate Feed Pump discharge	2	supplied by chemical pump vendor
back pressure/anti-siphon valve	BP 900A thru B	Phosphate Feed Pump discharge	2	supplied by chemical pump vendor
pulsation dampener	PD 900A thru B	Phosphate Feed Pump discharge	2	supplied by chemical pump vendor
Pressure Gauge	Various	pump discharge and all GACs		local reading only
Rupture Disks	RD -101 thru 601	GAC inlet line	6	supplied by LPGAC vendor

Table 6.3
System Control List

System	Number	Function	Remarks
Well	WP-03	Well Pump No. 3 operation, Hand-Off-Auto Switch	New motor starter to be located in Electrical Room, starter is interlocked to operation of two hypochlorite pumps (existing and P-800A) and phosphate pump (P-900A)
Well	WP-04	Well Pump No. 4 operation, Hand-Off-Auto Switch	New motor starter to be located in Electrical Room, starter is interlocked to operation of two hypochlorite pumps (existing and P-800B) and phosphate pump (P-900B)
GAC	DP101 FQ-100 to FQ-600	Monitor for high pressure drop across GAC units and individual unit flow totals.	Monitor and record increase in pressure differential across GAC unit. Local flow meter on each filter effluent to evaluate uniform flow through GAC units
Backwash Pump System	P-700 FI-700 LS-700	Backwash Pump (P-700) operation, Hand-Off-Auto Switch.	New motor starter to be located in Electrical Room. Starter is interlocked to high level switch on Backwash Tank. High level will disable pump. Local flow meter to monitor/confirm flow rate during backwash. Timer to allow pump to operate for 10 minutes.
Sodium Hypochlorite Feed System	P-800A and -800B LA-800A to -800D	Sodium Hypochlorite feed system, Hand-Off-Auto Switch	Pumps are interlocked with WP-3 and WP-04 operation. Pump operation requires redundant confirmation of flow (flow switch-FS101 and orifice plate – RO101). Feed rate is manually adjusted via stroke control on pump. Check valve prevents backflow of water. Local audible alarms for high level in tanks T-800A to -800D during filling operation.
Phosphate Feed System	P-900A and -900B	Phosphate feed system, Hand-Off-Auto Switch	Pumps are interlocked into WP-3 and WP-04 operation. Pump operation requires redundant confirmation of flow ((flow switch-FS101 and orifice plate – RO101). Feed rate is manually adjusted via stroke control on pump. Check valve prevents backflow of water.
Effluent Monitoring of pH and Chlorine	AE-800 and -801	Continuous chlorine and pH monitors with strip chart recorders.	Compliance monitoring, new equipment identical to existing system.

Table 6.4

Preliminary Specification Table of Contents

DIVISION 03 - CONCRETE

03 30 00 CAST-IN-PLACE CONCRETE

DIVISION 04 - MASONRY

04 20 00 MASONRY

DIVISION 05 - METALS

05 05 23 WELDING, STRUCTURAL

05 30 00 STEEL DECKS

05 40 00 COLD-FORMED METAL FRAMING

05 50 13 MISCELLANEOUS METAL FABRICATIONS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 21 13 BOARD AND BLOCK INSULATION

07 84 00 FIRESTOPPING

07 92 00 JOINT SEALANTS

DIVISION 08 - OPENINGS

08 11 13 STEEL DOORS AND FRAMES

08 33 23 OVERHEAD COILING DOORS

08 71 00 DOOR HARDWARE

08 91 00 METAL WALL AND DOOR LOUVERS

DIVISION 09 - FINISHES

09 29 00 GYPSUM BOARD

09 90 00 PAINTS AND COATINGS

DIVISION 10 - SPECIALTIES

10 14 01 EXTERIOR SIGNAGE

10 14 02 INTERIOR SIGNAGE

10 44 16 FIRE EXTINGUISHERS

DIVISION 13 - SPECIAL CONSTRUCTION

13 34 19 METAL BUILDING SYSTEMS

DIVISION 22 - PLUMBING

22 00 00 PLUMBING, GENERAL PURPOSE

22 07 19 PLUMBING PIPING INSULATION

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

23 11 25 FACILITY GAS PIPING

23 82 23 UNIT VENTILATORS

DIVISION 26 - ELECTRICAL

26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS

26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL

26 05 19.00 10 INSULATED WIRE AND CABLE

26 05 71.00 40 LOW VOLTAGE OVERCURRENT PROTECTIVE DEVICES

26 08 00 APPARATUS INSPECTION AND TESTING

26 12 19.10 THREE-PHASE PAD-MOUNTED TRANSFORMERS

26 20 00 INTERIOR DISTRIBUTION SYSTEM

26 24 16.00 40 PANELBOARDS

26 24 19.00 40 MOTOR CONTROL CENTERS

26 27 13.10 30 ELECTRIC METERS

26 28 21.00 40 AUTOMATIC TRANSFER SWITCHES

26 29 01.00 10 ELECTRIC MOTORS, 3-PHASE VERTICAL INDUCTION TYPE

26 32 14.00 10 DIESEL-GENERATOR SET, STATIONARY 15-300 KW, STANDBY APPLICATIONS

26 41 00.00 20 LIGHTNING PROTECTION SYSTEM

26 51 00.00 40 INTERIOR LIGHTING

26 52 00.00 40 EMERGENCY LIGHTING

26 53 00.00 40 EXIT SIGNS

26 56 23.00 40 AREA LIGHTING

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 05 26.00 40 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

DIVISION 31 - EARTHWORK

31 00 00 EARTHWORK

31 05 19 GEOTEXTILE

31 11 00 CLEARING AND GRUBBING

31 32 11 SOIL SURFACE EROSION CONTROL

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 05 33 LANDSCAPE ESTABLISHMENT

32 11 23 AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE

32 12 17 HOT MIX BITUMINOUS PAVEMENT

32 13 73 COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS

32 16 13 CONCRETE SIDEWALKS AND CURBS AND GUTTERS

32 31 13 CHAIN LINK FENCES AND GATES

32 92 19 SEEDING

32 92 23 SODDING

32 93 00 EXTERIOR PLANTS

DIVISION 33 - UTILITIES

33 11 00 WATER DISTRIBUTION

33 40 00 STORM DRAINAGE UTILITIES

DIVISION 40 - PROCESS INTEGRATION

40 05 13 PIPELINES, LIQUID PROCESS PIPING

40 17 26.00 20 WELDING PRESSURE PIPING

40 17 30.00 40 WELDING GENERAL PIPING

40 95 00 PROCESS CONTROL

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT

43 21 13 PUMPS: WATER, CENTRIFUGAL

43 21 29 FLOW MEASURING EQUIPMENT - POTABLE WATER

43 21 39 PUMPS: WATER, VERTICAL TURBINE

43 31 13.14 DOWNFLOW LIQUID ACTIVATED CARBON ADSORPTION UNITS

43 32 69 CHEMICAL FEED SYSTEMS

-- End of Project Table of Contents --

7.0 COST ESTIMATES

Capital (Table 7.1) and Operation and Maintenance (Table 7.2) costs estimates are presented in this section.

Table 7.1 Capital Cost Estimate

Description	Quantity	Unit Price	Unit	Cost	Comment
Vessels+ frontal piping	6	$120,000	EA	$720,000	20,000 lbs carbon ea.
Existing equipment upgrades	1	$150,000	LS	$150,000	Wells 3 and 4 pump & motor
Hypochlorite system new	1	$75,000	LS	$75,000	
Relocate phosphate system	1	$20,000	LS	$20,000	
Backwash tank and pump	1	$40,000	EA	$40,000	15,000 gallon HDPE
Aboveground piping and valves	1	$100,000	LS	$100,000	
Underground piping+ valves	1	$150,000	LS	$150,000	
Equipment/Piping installation	1	$375,000	LS	$375,000	30% of equip cost
Buildings	3,024	$400	SF	$1,209,600	
Fire Suppession system	1	$30,000	EA	$30,000	
HVAC	1	$75,000	EA	$75,000	
Electrical material and installation	1	$250,000	LS	$250,000	
Instrumentation and installation	1	$80,000	LS	$80,000	
Construction Cost				**$3,274,600**	
Project /Construction Management	10%	Const. Cost	LS	$327,460	
Contingency	15%	Const. Cost	LS	$491,190	
Overhead Cost				**$818,650**	
Total Capital Cost				**$4,093,250**	

Table 7.2 Annual O&M Cost Estimate

Activity	Quantity	Unit	Unit Rate ($/ea)	Subtotal ($)	Notes
Carbon Replacement Costs	21,900	lbs	3.85	84,315	60 lb/day, tranportation, testing, virgin GAC, and disposal.
Labor	365	hours	80	29,200	2 hours per day
Sampling and Analytical	56	sample	150	8,400	Monthly sampling of Influent and effluent, and quarterly sampling within one unit.
Power (No. 3 and 4 pumps)	180,000	kwhr	0.17	30,600	Incremental power, 60 KW, 3000 hr/year
Power (Misc)	40,000	kwhr	0.17	6,800	Lighting, instruments, and misc.
Sodium Hyypochlorite	9,882	lbs	1.20	11,859	1.5 ppm, 4,200 gpm, 34%
Building Heat	6	month	2,500	15,000	Four full months and four half months.
Filter Backwash	2	Each	6,000	12,000	Two backwashs per year
Total				198,174	Say $200,000 per year.

8.0 WATER PURCHASE CONTRACTS BETWEEN WATER SUPPLIES

This water works improvement does not include modification to water purchase contracts.

9.0 OTHER INFORMATION AS REQUIRED BY REVIEWING ATHORITY

To be determined.

APPENDIX A
GROUNDWATER DATA

Appendix A-1: Groundwater Data

A-1, Table 1: Groundwater TCE Concentration Data:

Well No. 3 (N-8480)			Well No. 4 (N-9338)		
Date	TCE µg/L	LAB	Date	TCE µg/L	LAB
09.11.06	0.6	ECOTEST	09.21.06	ND	ECOTEST
10.02.06	0.5	ECOTEST	02.02.07	ND	ECOTEST
Out of service			03.27.07	ND	ECOTEST
04.10.07	0.4	ECOTEST			
04.25.07	0.5	H2M	04.25.07	ND	H2M
05.14.07	0.6	ECOTEST	05.14.07	ND	ECOTEST
06.05.07	0.6	ECOTEST	06.05.07	ND	ECOTEST
07.19.07	0.8	ECOTEST	07.19.07	ND	ECOTEST
08.07.07	0.6	ECOTEST	08.07.07	ND	ECOTEST
09.07.07	0.8	ECOTEST	09.07.07	ND	ECOTEST
10.04.07	0.8	ECOTEST	10.04.07	ND	ECOTEST
11.02.07	0.6	ECOTEST	11.02.07	ND	ECOTEST
12.10.07	0.5	ECOTEST	12.05.07	ND	ECOTEST
01.09.08	0.7	ECOTEST	01.07.08	ND	ECOTEST
02.04.08	0.5	ECOTEST	02.04.08	ND	ECOTEST
03.06.08	0.6	ECOTEST	03.06.08	0.5	ECOTEST
			03.14.08	0.5	ECOTEST
			03.19.08	0.5	ECOTEST
			03.24.08	<0.5	ECOTEST
04.02.08	<0.5	ECOTEST	04.02.08	<0.5	ECOTEST
05.01.08	0.6	ECOTEST	05.15.08	<0.5	ECOTEST
06.16.08	1.0	ECOTEST	06.05.08	<0.5	ECOTEST
07.15.08	1.2	ECOTEST	07.15.08	<0.5	ECOTEST
08.15.08	1.1	ECOTEST	08.15.08	<0.5	ECOTEST
09.03.08	1.4	ECOTEST	09.03.08	<0.5	ECOTEST
10.06.08	0.9	ECOTEST	10.07.08	<0.5	ECOTEST
11.07.08	0.7	ECOTEST	11.10.08	<0.5	ECOTEST
12.02.08	0.8	ECOTEST	12.02.08	<0.5	ECOTEST
01.07.09	0.8	ECOTEST	01.06.09	0.5	ECOTEST
02.13.09	0.8	ECOTEST	02.13.09	<0.5	ECOTEST
03.04.09	0.9	ECOTEST	03.04.09	<0.5	ECOTEST
04.20.09	0.9	ECOTEST	04.06.09	<0.5	ECOTEST
05.13.09	0.9	ECOTEST	05.13.09	0.5	ECOTEST
07.16.09	1.2	ECOTEST	07.14.09	<0.5	ECOTEST
08.11.09	1.2	ECOTEST	08.11.09	<0.5	ECOTEST
09.11.09	1.6	ECOTEST	09.11.09	<0.5	ECOTEST
10.08.09	0.9	ECOTEST	10.08.09	<0.5	ECOTEST
			12.08.09	0.6	ECOTEST
01.28.10	1.1	ECOTEST			
03.09.10	1.4	ECOTEST	03.08.10	0.7	ECOTEST
06.02.10	1.9	ECOTEST	06.08.10	<0.5	ECOTEST
07.28.10	2.0	ECOTEST	07.28.10	<0.5	ECOTEST
10.05.10	2.1	ECOTEST	10.05.10	<0.5	ECOTEST

A-1, Table 2: Groundwater Analysis Data (Year 2008):

Parameter (s)	NY Limit	LEVITTOWN	
Well No		N-8480	N-9338
Date Sampled		5/19/08	6/25/08
Antimony	6.0 µg/L	<5.0	<5.0
Arsenic	50.0 µg/L	<5.0	<5.0
Barium	2.0 mg/L	0.006	0.006
Beryllium	4.0 µg/L	<1.0	<1.0
Cadmium	5.0 µg/L	<1.0	<1.0
Chromium	100.0 µg/L	<5.0	<5.0
Copper	1.3[A] mg/L	0.03	0.05
Iron	0.3[B] mg/L	1.4	1.7
Lead	15.0[A] µg/L	<1	2.3
Mercury	2.0 µg/L	<0.25	<0.25
Nickel	100 µg/L	<10.0	<10.0
Selenium	50 µg/L	<2.0	<2.0
Silver	100 µg/L	<1.0	<1.0
Thallium	2.0 µg/L	<2.0	<2.0
Sodium	mg/L	10	9
Manganese	0.3[B] mg/L	0.03	0.02
Zinc	5.0 mg/L	0.4	0.03
Total Hardness	mg/L	17	14
Calcium Hardness	mg/L	10	8.4
Ammonia (NH3)	mg/L	<0.05	<0.05
Free Cyanide	200.0 µg/L	<20.0	<20.0
Fluoride	2.2 mg/L	<0.2	<0.2
Chloride	250 mg/L	16	13
Sulfate	250 mg/L	22	18
Nitrite (as N)	100 µg/L	<2.0	<2.0
Detergents (MBAs)	mg/L	<0.1	<0.1
pH	S.U.	4.9	4.8
Total Alkalinity	mg/L	<2	<2
TDS	mg/L	70	70
Nitrate (as N)	10.0 mg/L	<0.05	<0.05
Turbidity	5.0 UNITS	2.5	<1
Color	15 0 units	<5	<5
Odor	3.0 units	<1.0	<1.0
LSI	mg/L	-6	-6
Perchlorate	µg/L	<0.5	<0.5

APPENDIX B
PREDESIGN INVESTIGATION

APPENDIX B – PREDESIGN INVESTIGATION
SEAMAN'S NECK ROAD WATER TREATMENT PLANT UPGRADE

1.0 Design Basis and Background

This pre-design evaluation addresses treatment requirements for two existing potable water supply wells (Wells 3 and 4) located at the Seaman's Neck Road Plant of Aqua New York (Aqua). The purpose of this evaluation is to investigate potential remedial options for addressing volatile organic compound (VOC) contamination in the well field. Since 2007, Trichloroethene (TCE) has been detected consistently in the water supply wells at a concentration up to approximately 1.6 micrograms per liter (µg/L). In addition, the TCE concentration has been generally increasing over the past three years.

The source of the TCE has been linked to a groundwater plume originating near the Northrop Grumman Complex. Near this source (8,300 feet upgradient of the Aqua well field), TCE has been detected at a concentration up to 840 µg/L in a permanent monitoring well, see Figure 1. Near the Aqua well field, (approximately 1,100 feet upgradient of the Aqua well field), there are outpost monitoring wells screened at the depth of the Aqua supply well screens. These outpost monitoring wells do not contain detectable concentrations of VOCs. During the 2009 vertical profile boring, VOCs (TCE and tetrachloroethene [PCE}) were detected at concentrations greater than 100 µg/L at depths above and below the Aqua supply well screens. Based on the presence of VOC-contaminated groundwater upgradient of the Aqua well field, the maximum VOC concentration anticipated at the Seaman's Neck Road Plant, as well as the duration of impact, is uncertain.

Aqua water supply well No. 3 pump is rated for 1,800 gallons per minutes (gpm), while Aqua water supply well No. 4 pump is rated for 2,100 gpm. Each well has a state-authorized capacity of 2,100 gpm or a total capacity of 4,200 gpm (6 million gallons per day [MGD]). Based on recent plant records, the plant operates at an average of 34 percent of the maximum pump capacity (1,428 gpm average or 3,000 hr/year at capacity) on an annual basis. Typical operation is for one of the wells to operate the majority of the time year round, and the second well operates on a more regular basis only during the summer months.

Because of uncertainty with the magnitude of the upgradient groundwater contamination, this report describes design schemes to treat influent TCE concentrations of 10 µg/L, 100 µg/L and 500 µg/L to 0.5 µg/L in the effluent. TCE is the primary organic constituent of concern. Dissolved iron is also present, and the facility has in place an iron removal plant.

Two general treatment technologies are being evaluated under four options.

- Option A - Liquid phase granular activated carbon (LPGAC), before the iron removal plant.
- Option B – LPGAC, after the iron removal plant.

- Option C - Air stripping tower (AST), after the iron removal plant, less than 50 µg/L TCE.
- Option D - Air stripping tower (AST), after the iron removal plant, greater than 50 µg/L TCE.

Option A - Liquid phase granular activated carbon (LPGAC), before the iron removal plant

1. Raw well water from each well (pre-chlorination and pH adjustment) will be diverted to a separate LPGAC treatment system. Following LPGAC treatment, the water will be diverted back to the existing chlorinated and pH facilities.
2. Two existing well pumps and motors will be modified or replaced to address additional head loss in pre-filters, LPGAC and associated piping (expected <50'). New motors will be 200 HP instead of the current 150 HP. Pumps will be modified to develop more pressure.
3. Each treatment system will consist of four 10' diameter vessels and contain 20,000 lbs of virgin carbon (total eight vessels).
4. The vessels will be running in parallel, with each vessel will be treating a maximum flow of 525 gpm (10 minute of EBCT).
5. The Well No. 3 discharge line after LPGAC will be rerouted back to existing chemical treatment room (near pump). The Well No. 4 discharge line after LPGAC will be diverted parallel to Well No. 3 line, but will be reconnected outside the existing chemical room. A new (small) building will be required for this tie-in and chemical addition. Existing chemical feed system from Well No. 4 will be relocated. This way each well will have their separate chemical feed system and maximum reuse of the existing chemical feed systems.
6. LPGAC treated water from Well Nos. 3 and 4 will be joined just prior to iron removal system.
7. Each filter will require initial backwash during startup and periodic backwash to fluff the media. The need for backwash will be based on pressure drop (e.g., 10 psi) and is expected to occur every 4 to 8 weeks. Backwash will require 1,000 gpm of water for 10 minutes per vessel. This water will be taken from the treated water header. During backwash, the associated water supply well will be taken off line. The backwash wastewater will be sent to a new 12,000 gallon tank. This water will then be transferred to existing wastewater tank at 50 gpm.
8. A duplex pre-filter will be added before LPGAC to remove any fine suspended solids from the well.
9. Carbon replacement will depend on TCE concentrations. At 4,200 gpm and the annual average flow, carbon usage and TCE break-thru will be as follows:

Inlet TCE (µg/L)	Outlet TCE (µg/L)	Carbon Usage (pounds/day)[1]	Break-through (days)[1]
10	0.5	15 to 60	2,700 to 10,700
100	0.5	60 to 240	650 to 2,600
500	0.5	170 to 640	240 to 950

(1) The range is carbon usage is based on assumptions regarding the sharpness of the breakthrough curve and competition of carbon adsorption sites with other naturally occurring organics.

Option B - Liquid phase granular activated carbon, after iron removal plant

1. Combined Well water from the iron removal system will be discharged to the LPGAC treatment system. Following LPGAC treatment, new chemical feed facilities will be used to treat the water prior to distribution.
2. Two existing well pumps and motors will be modified or replaced to address additional head loss in pre-filters, LPGAC and associated piping (expected less than 50 feet). New motors will be 200 HP instead of the current 150 HP. Pumps will be modified to develop more pressure.
3. The LPGAC system will consist of six 10' diameter vessels each containing 20,000 lbs of virgin carbon.
4. These vessels will be running in parallel, thus each vessel will be treating a maximum flow of 700 gpm (7.5 minute of EBCT).
5. Each filter will require initial backwash during startup and periodic backwash to fluff the media. The need for backwash will be based on pressure drop (e.g., 10 pounds per square inch) and is expected to occur every 6 to 12 months. Backwash will require 1,000 gpm of water for 10 minutes per vessel. This water will be taken from the treated water header. During backwash, the one raw water well will also be taken off line. The backwash wastewater will be sent to a new 12,000 gal tank. This water will then be transferred to existing wastewater tank at 50 gpm.
6. There is no need of a duplex pre-filter before the LPGAC as the IR plant will remove bulk of the iron and turbidity as well.
7. A new post-LPGAC chlorination system will be used to provide residual chlorine.
8. Existing phosphate feed system will be relocated in the new building.
9. Carbon replacement will depend on TCE concentrations. At 4,200 gpm and the annual average flow, carbon usage and TCE Carbon Usage will be the same as Option A. Breakthrough will occur sooner than Option A, because there are only 6 vessels instead of 8 vessels.

Evaluation of Options A and B

Option A

- Maintains a separate treatment system for each well, to the iron removal system.
- LPGAC may be prone to increased fouling because of dissolved iron adsorption and require more frequent backwashing.
- Low pH inhibits bacterial growth.
- Carbon vessels may need to be coated internally for low pH (4 to 5 S.U.).

Option B

- Iron removal prior to LPGAC reduces concerns with iron fouling of media from raw water.
- Problems with iron removal system operation could discharge suspended solids to LPGAC and increase backwashing frequency.
- Water to LPGAC will have some chlorine residual that will increase carbon use and require slightly higher overall chlorine use.

Option C - Air stripping tower (AST)

This system would be added after the existing iron removal system to minimize iron precipitation in the air stripping towers. For the air stripper design, packed vertical tower was considered. Depending on TCE concentrations, tower height will vary as illustrated in below:

Inlet TCE (µg/L)	Outlet TCE (µg/L)	Number of towers/ Tower height (feet)
10	0.5	Two/ 33
100	0.5	Two/48
500	0.5	Two/60
500	0.5	Four/36'

Since the site is located in a residential neighborhood, the height of the building is limited to 35 feet. Thus to meet 0.5 µg/L TCE in plant effluent, a single stage AST can treat a maximum of 50 µg/L of influent TCE. TCE concentrations greater than 50 µg/L will require two stage AST treatment systems (Option D).

Option C: Single Stage AST for TCE less than 50 µg/L

Single stage air stripping can treat water to obtain effluent quality of 0.5 µg/L as long as the influent concentration is below or equal to 50 µg/L. Under this system:

1. Treated water from iron removal plant will be diverted to AST. Existing well pump operation will be modified to reflect lower discharge pressure. Post AST chlorination will be required.
2. There will be two packed towers running in parallel. Each tower will treat 2,100 gpm of groundwater.
3. Based on a flow rate of 2100 gpm per well, a 10-foot diameter is the recommended diameter required for each tower. With packing height of 20 feet total AST height will be about 32 feet.
4. Effluent from AST will discharge into an underground clear well. Based on 25 minute storage at 4,200 gpm, approximately 100,000 gallon sump will be provided in this stage.
5. There will be three booster pumps at this clear well each rated at 2,100 gpm to discharge treated water to the water main.

6. Building to house the system will be approximately 2000 square feet with 600 square feet having a height of 35 feet to accommodate the towers and the balance having a height of 25 feet.
7. Post chlorination system will be provided to maintain residual chlorine.
8. Existing phosphate feed system will be relocated in the new building.
9. No changes will be made to caustic systems

Table below illustrates the tower sizes and performance of this arrangement. Design is slightly conservative to take care of low temperature impact on performance.

TCE Influent (µg/L)	TCE Effluent (µg/L)	Removal Efficiency (%)	Tower Height (feet)	Air flow CFM	TCE in air (mg/l)
10-50	0.5	99%	32	15,500	<0.5

Option D: Two-Stage AST for TCE greater than 50 µg/L:

For influent concentrations greater than 50 µg/l and to achieve a target concentration of 0.5 µg/l and maintain the AST within reasonable height (below 35 feet), two stage air stripping will be required, consisting of a primary stage where a bulk of the load will be removed followed by a secondary stage where the water will be polished. Under this system:

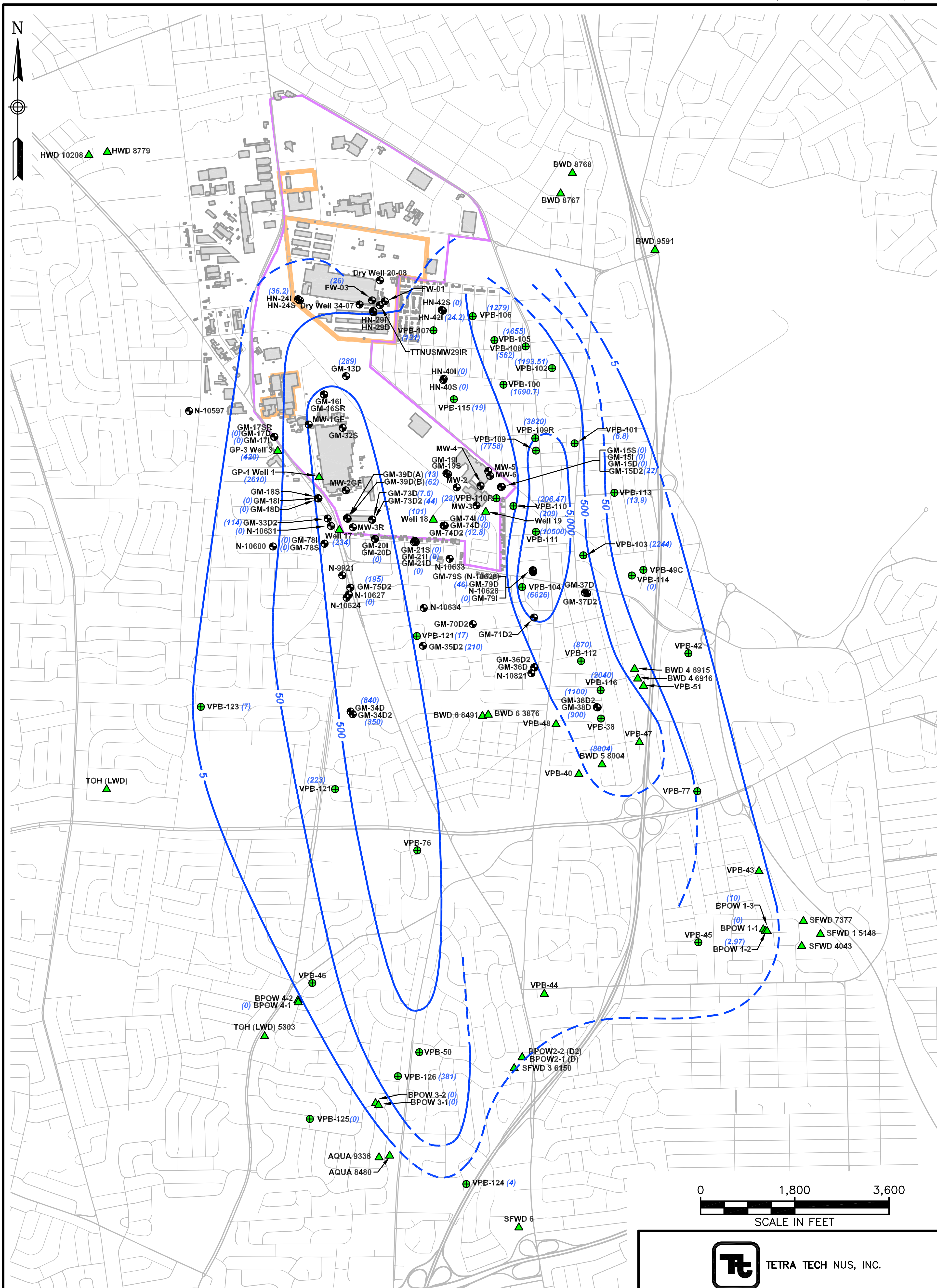
1. Treated water from iron removal plant will be diverted to AST. Existing well pump operation will be modified to reflect lower discharge pressure. Post AST chlorination will be required.
2. There will be two towers in each stage. The first set of two towers will be a primary stage and a similar set will form the secondary stage.
3. The plant will be designed such that 2100 gallons per minute (gpm) of groundwater will be treated through one tower. Hence two towers will be required to treat the total flow of 4200 gpm in each stage.
4. A 10 feet diameter is the recommend diameter required for the tower design irrespective of the stage.
5. Effluent from first stage will discharge into an underground clear well.
6. There will be three transfer pumps at this clear well each rated at 2,100 gpm to discharge treated water to the second stage air stripping columns.
7. Effluent from the second stage will discharge into an underground clear well.
8. From the second sump, treated water will be pumped to the water main for distribution.
9. Building to house the system will be approximately 3700 square feet with 1700 square feet having a height of 35 feet to accommodate the towers and the balance having a height of 25 feet.
10. Chemical systems will be same as Option C above.

Table below illustrates the sizes and performance of the twin stage arrangement.

TCE Influent (µg/L)	TCE Effluent (µg/L)	Removal Efficiency (%)	Tower Height (Feet)	Air flow CFM	TCE in air (mg/L)
500	15	97	32	12,500	3.5
15	0.5	97	32	12,500	< 0.5

Evaluation of Options C and D

- As long as the iron removal plant precedes the air stripping plant (either one stage or two stages) there is a low chance of iron fouling and consequently the need for acid washing etc.
- In case of dual stage system, the equipment cost does not come down even if influent TCE is low as diameter is governed by flow and minimal height of packing has to be maintained.
- If high concentrations of VOCs occur for an extended period of time, the operating costs of AST are lower than LPGAC.



TETRA TECH NUS, INC.

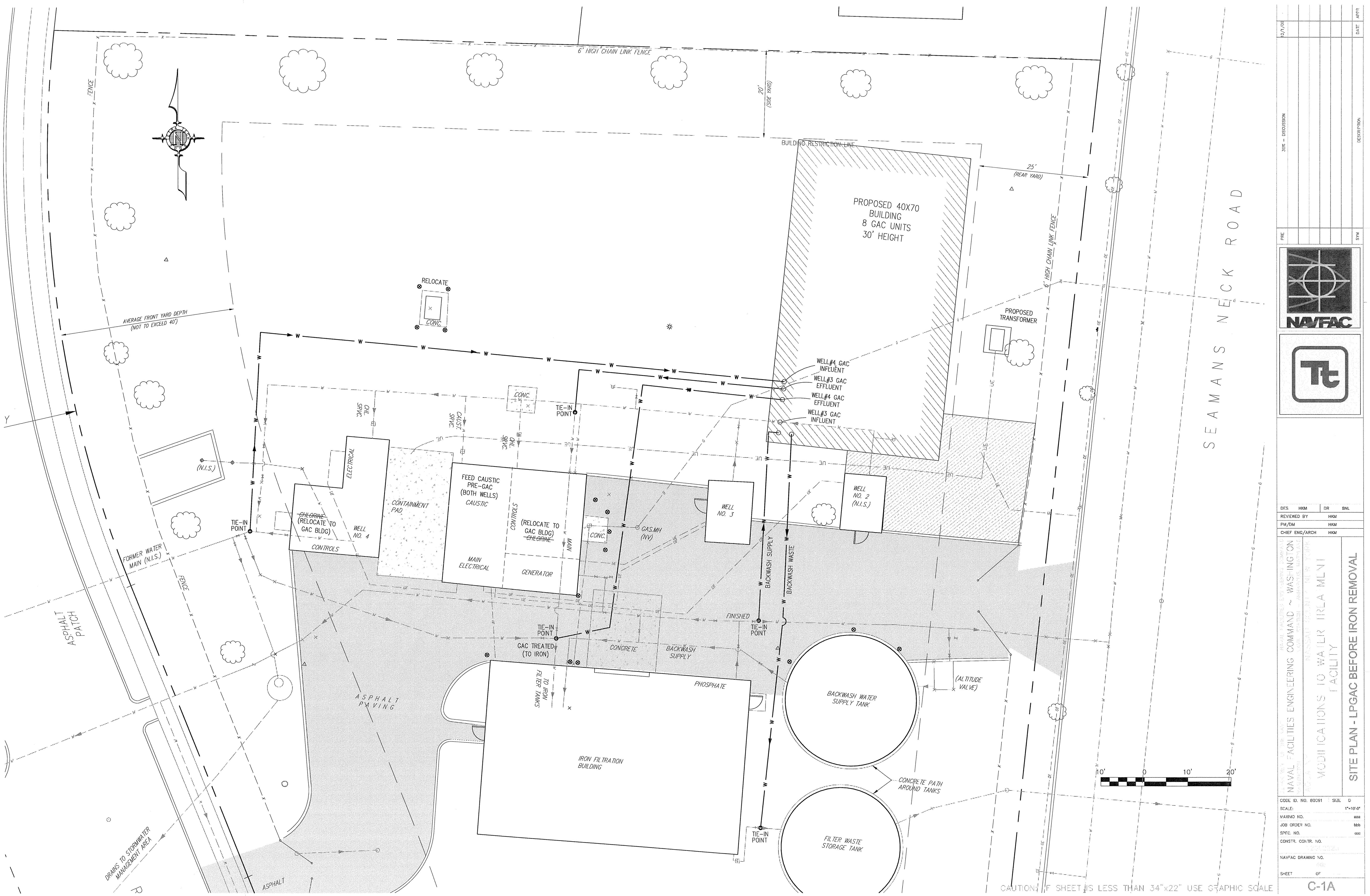
LEGEND

- GROUNDWATER SAMPLING LOCATION
- VERTICAL PROFILE BORING
- WATER SUPPLY WELL
- (840) TVOC CONCENTRATION IN ug/L
- ISOCONCENTRATION CONTOUR (DASHED WHERE INFERRED, IN ug/L)
- 1997 NORTHROP-GRUMMAN BETHPAGE BOUNDARY
- 1997 NWIRP BETHPAGE BOUNDARY
- BUILDING
- HIGHWAY
- MAJOR LOCAL ROAD
- MINOR LOCAL ROAD

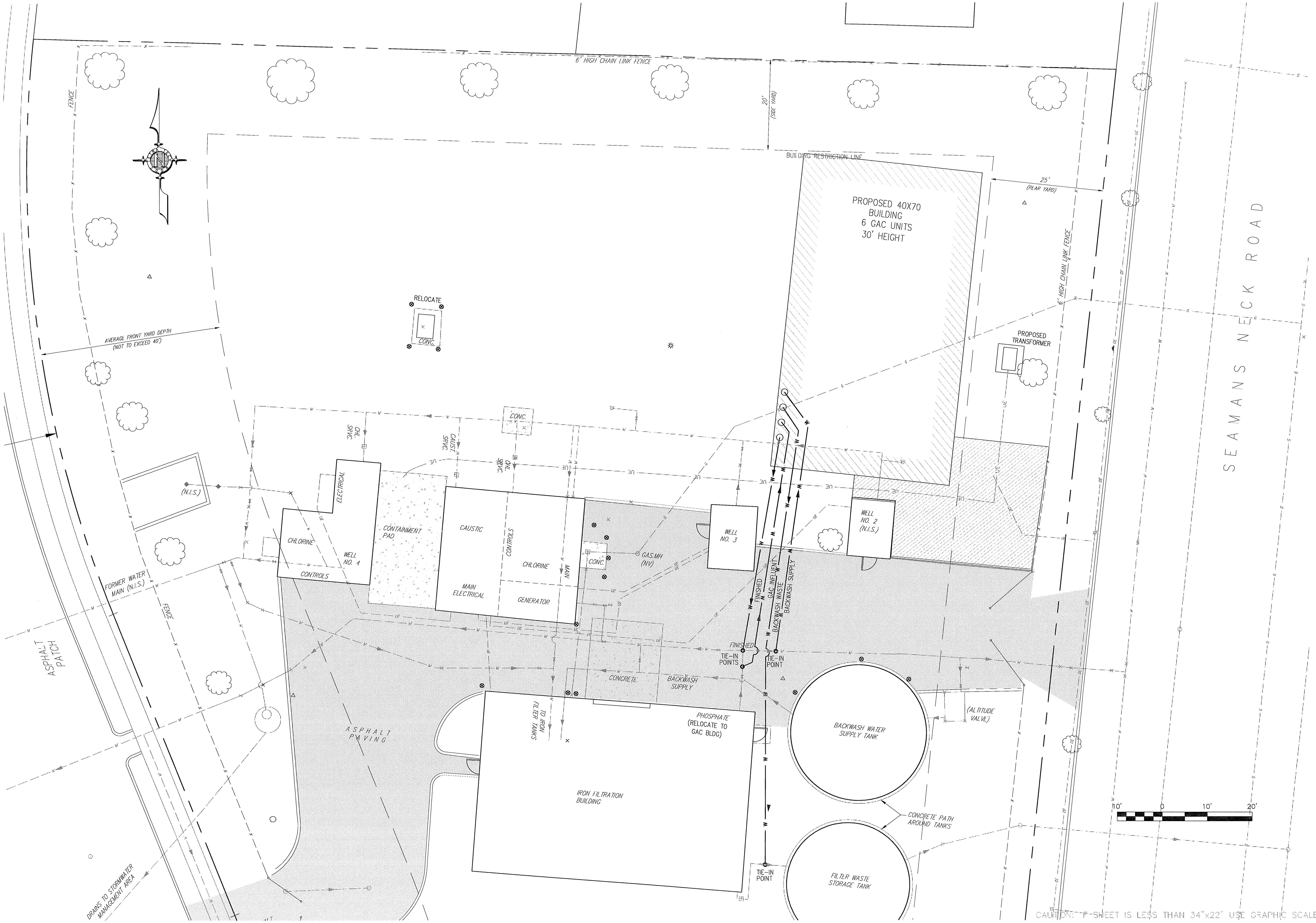
OPERABLE UNIT 2 (SITE 1) GROUNDWATER TOTAL VOLATILE ORGANIC COMPOUND NAVAL WEAPONS INDUSTRIAL RESERVE PLANT BETHPAGE, NEW YORK

FILE	SCALE
112G00622GM03.dwg	AS NOTED

FIGURE NUMBER	REV	DATE
FIGURE 1	0	10/05/09



6' HIGH CHAIN LINK FENCE
FENCE
20' (SIDE YARD)
BUILDING RESTRICTION LINE
25' (REAR YARD)
PROPOSED 40X70 BUILDING 8 GAC UNITS 30' HEIGHT
6' HIGH CHAIN LINK FENCE
SEAMANS NECK ROAD
RELOCATE
CONC.
AVERAGE FRONT YARD DEPTH (NOT TO EXCEED 40')
PROPOSED TRANSFORMER
WELL#4 GAC INFLUENT
WELL#3 GAC EFFLUENT
WELL#4 GAC EFFLUENT
WELL#3 GAC INFLUENT
TIE-IN POINT
CHL SPVC.
CAUST SPVC.
CHL SPVC.
ELECTRICAL
(N.I.S.)
CONTAINMENT PAD
FEED CAUSTIC PRE-GAC (BOTH WELLS)
CAUSTIC
CONTROLS
(RELOCATE TO GAC BLDG)
CHLORINE
MAIN ELECTRICAL
GENERATOR
MAIN
CHLORINE (RELOCATE TO GAC BLDG)
WELL NO. 4
CONTROLS
GAS MH (NV)
WELL NO. 3
WELL NO. 2 (N.I.S.)
BACKWASH SUPPLY
BACKWASH WASTE
FORMER WATER MAIN (N.I.S.)
ASPHALT PATCH
FINISHED
GAC TREATED (TO IRON)
CONCRETE
BACKWASH SUPPLY
TO IRON FILTER TANKS
PHOSPHATE
ASPHALT PAVING
IRON FILTRATION BUILDING
BACKWASH WATER SUPPLY TANK
(ALTITUDE VALVE)
CONCRETE PATH AROUND TANKS
FILTER WASTE STORAGE TANK
DRAINS TO STORMWATER MANAGEMENT AREA
ASPHALT
10' 0 10' 20'
CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE
NAVFAC
DES HKM
DR SNL
REVIEWED BY HKM
PM/DM HKM
CHIEF ENG/ARCH HKM
NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON
MODIFICATIONS TO WATER TREATMENT FACILITY
SITE PLAN - LPGAC BEFORE IRON REMOVAL
CODE ID. NO. 80091
SIZE D
SCALE: 1"=10'-0"
NAVFAC DRAWING NO.
SHEET OF
C-1A
10/06/2009 09:57



CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

DATE | APPR
DESCRIPTION
SYM

NAVFAC

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

MODIFICATIONS TO WATER TREATMENT FACILITY

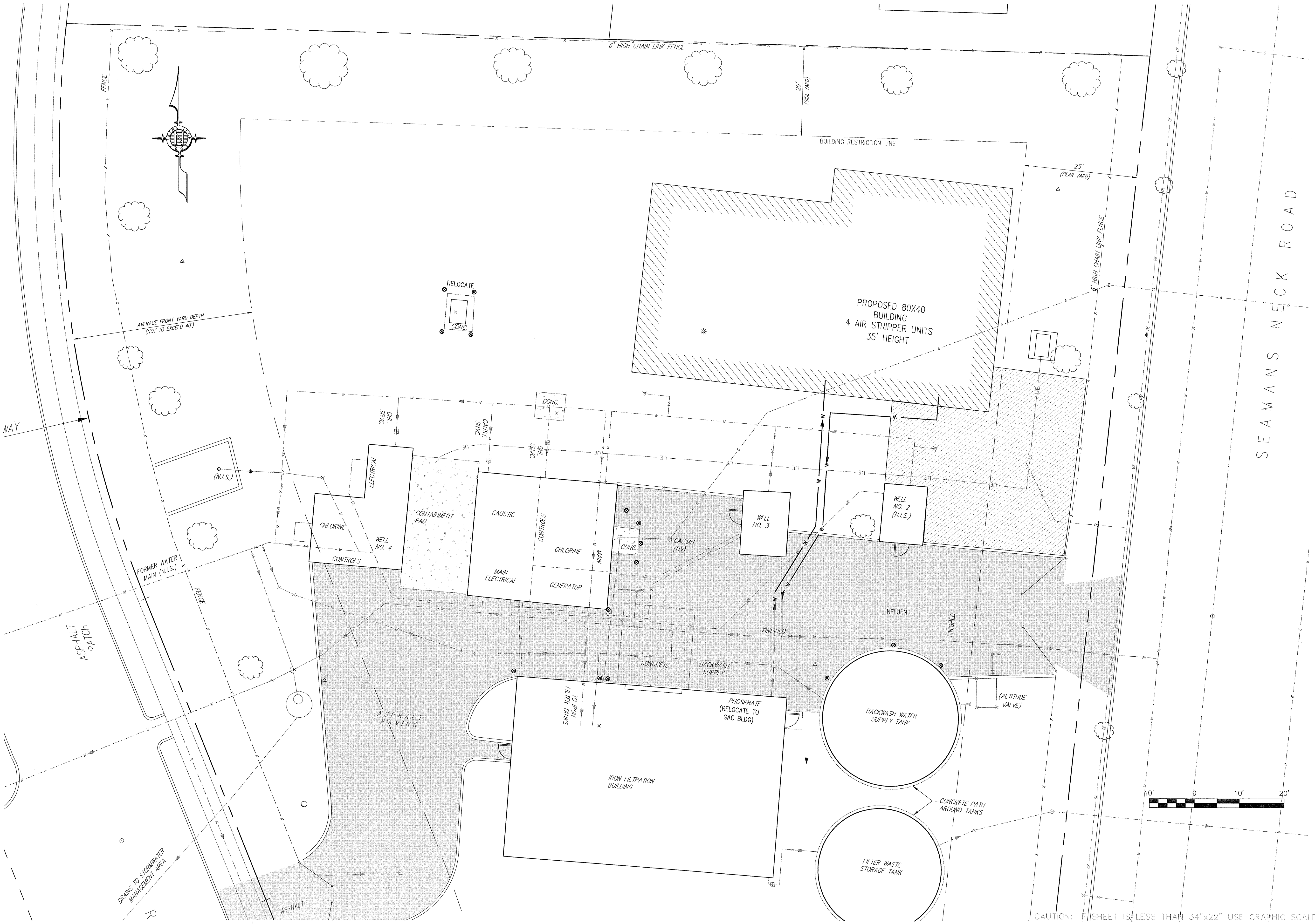
SITE PLAN - LPGAC AFTER IRON REMOVAL

CODE ID. NO. 80091	SIZE D
SCALE:	1"=10'-0"
MAXIMO NO.	aaa
JOB ORDER NO.	bbb
SPEC. NO.	ccc
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	OF

C-1B

K:\112G02223 - Aqua Bethpage-NAvy Project - H. Mita\Drawings\Civil\02223_Layout.dwg 10/06/2009 09:57


6' HIGH CHAIN LINK FENCE
FENCE
20' (SIDE YARD)
BUILDING RESTRICTION LINE
25' (REAR YARD)
PROPOSED 50X40 BUILDING 2 AIR STRIPPER UNITS 35' HEIGHT
6' HIGH CHAIN LINK FENCE
SEAMANS NECK ROAD
RELOCATE
CONC.
AVERAGE FRONT YARD DEPTH (NOT TO EXCEED 40')
(N.I.S.)
CHL SRVC.
CAUST SRVC.
CHL SRVC.
ELECTRICAL
CHLORINE
WELL NO. 4
CONTROLS
CONTAINMENT PAD
CAUSTIC
CONTROLS
CHLORINE
MAIN ELECTRICAL
GENERATOR
MAIN
CONC.
GAS.MH (NV)
WELL NO. 3
WELL NO. 2 (N.I.S.)
FORMER WATER MAIN (N.I.S.)
ASPHALT PATCH
INFLUENT
FINISHED
FINISHED
CONCRETE
BACKWASH SUPPLY
TO IRON FILTER TANKS
PHOSPHATE (RELOCATE TO GAC BLDG)
(ALTITUDE VALVE)
BACKWASH WATER SUPPLY TANK
ASPHALT PAVING
IRON FILTRATION BUILDING
CONCRETE PATH AROUND TANKS
FILTER WASTE STORAGE TANK
DRAINS TO STORMWATER MANAGEMENT AREA
ASPHALT
CURB
10' 0 10' 20'
CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE
DATE
APPR
DESCRIPTION
NAVFAC
DES HKM
DR SNL
REVIEWED BY HKM
PM/DM HKM
CHIEF ENG/ARCH HKM
NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON
SITE PLAN - SINGLE STAGE AIR STRIPPER
CODE ID. NO. 80091 SIZE D
SCALE: 1"=10'-0"
MAXIMO NO. aaa
JOB ORDER NO. bbb
SPEC. NO. ccc
CONSTR. CONTR. NO.
NAVFAC DRAWING NO.
SHEET OF
C-1C
Aqua Bethpage-NAvy Project - H. Mito\Drawings\Civil\02223_Layout.dwg 10/06/2009 09:57



DES HKM | DR SNL
REVIEWED BY HKM
PM/DM HKM
CHIEF ENG/ARCH HKM

NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

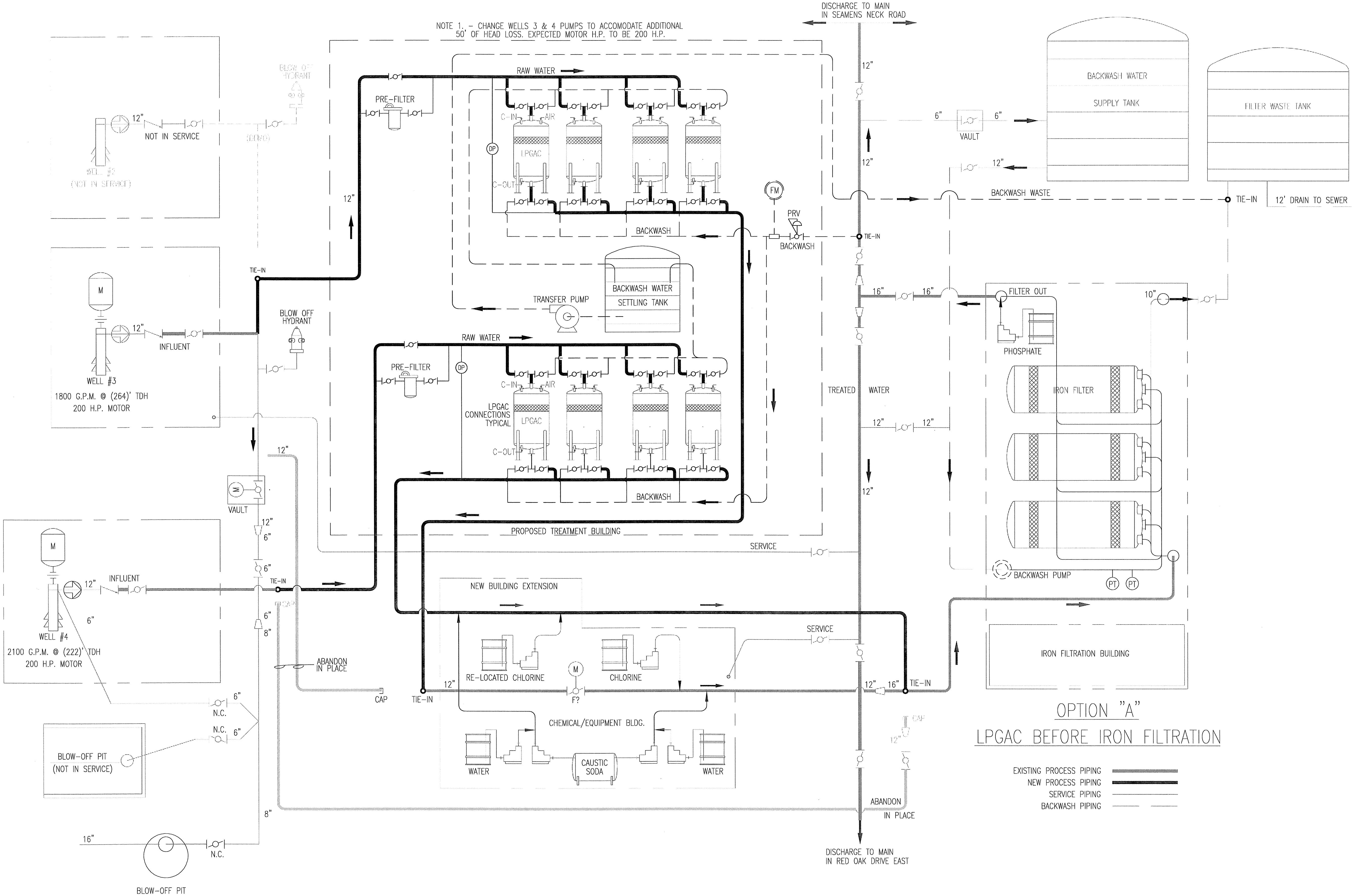
MODIFICATIONS TO WATER TREATMENT FACILITY

SITE PLAN - 2 STAGE AIR STRIPPER ALONE

CODE ID. NO. 80091 SIZE D
SCALE: 1"=10'-0"
MAXIMO NO. aaa
JOB ORDER NO. bbb
SPEC. NO. ccc
CONSTR. CONTR. NO.
NAVFAC DRAWING NO.
SHEET OF

C-1D

K:\112G02223 - Aqua Bethpage-NAvy Project - H. Mito\Drawings\Civil\02223_Layout.dwg 10/06/2009 09:55



OPTION "A"

LPGAC BEFORE IRON FILTRATION

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

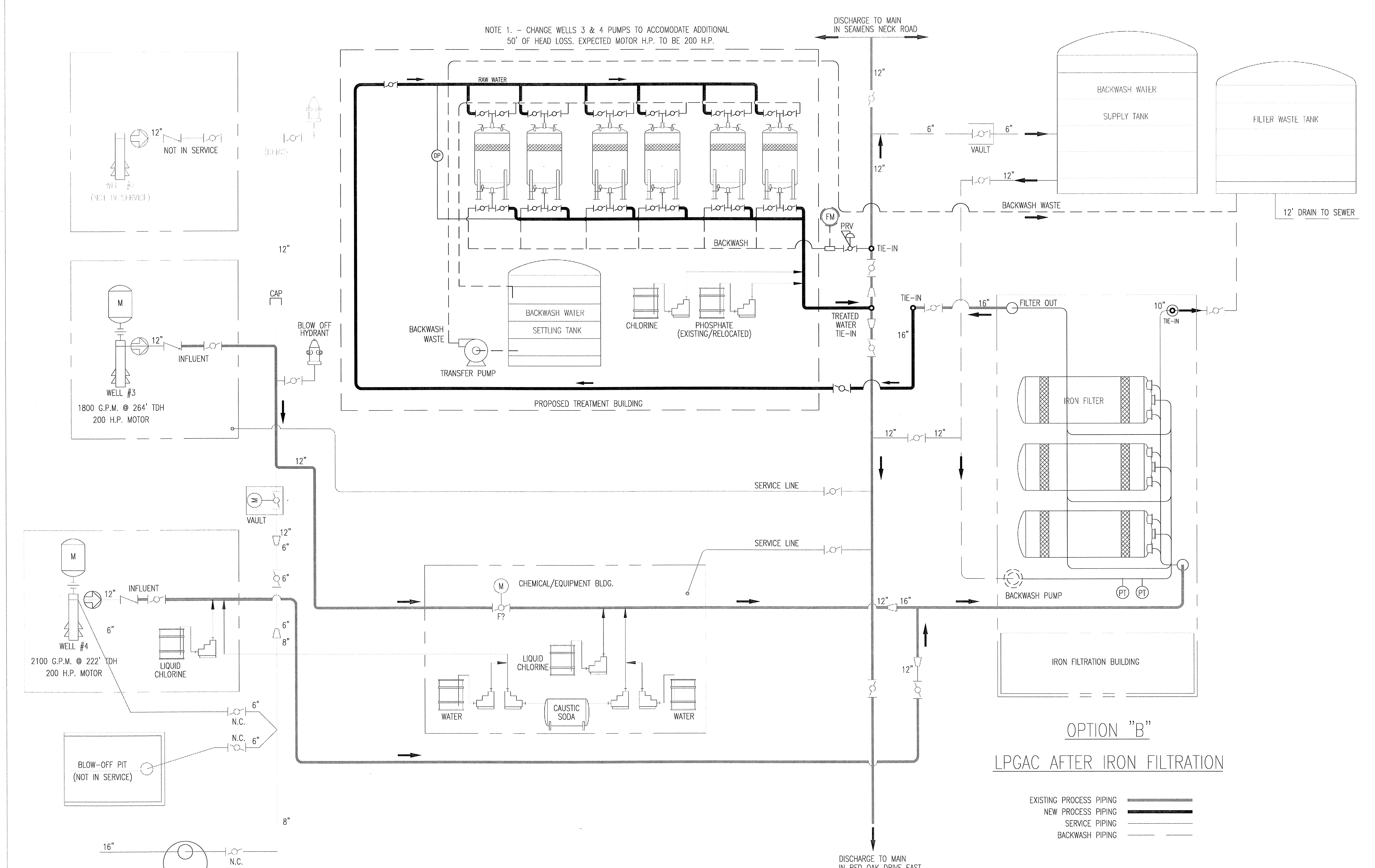
MODIFICATIONS TO WATER TREATMENT FACILITY

P&ID - LPGAC - IRON REMOVAL

CODE ID. NO. 80091	SIZE D
SCALE:	NTS
MAXIMO NO.	AAA
JOB ORDER NO.	BBB
SPEC. NO.	CCC
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	OF

PID_A

K:\112G02223 – Aqua Bethpage–NAvy Project – H. Mital\Drawings\Mechanical\PWTR–0002–MAXIMO–MS.dwg 10/01/2009 15:25



OPTION "B"

LPGAC AFTER IRON FILTRATION

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

DES	HKM	DR	SNL
REVIEWED BY	HKM		
PM/DM	HKM		
CHIEF ENG/ARCH	HKM		

NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

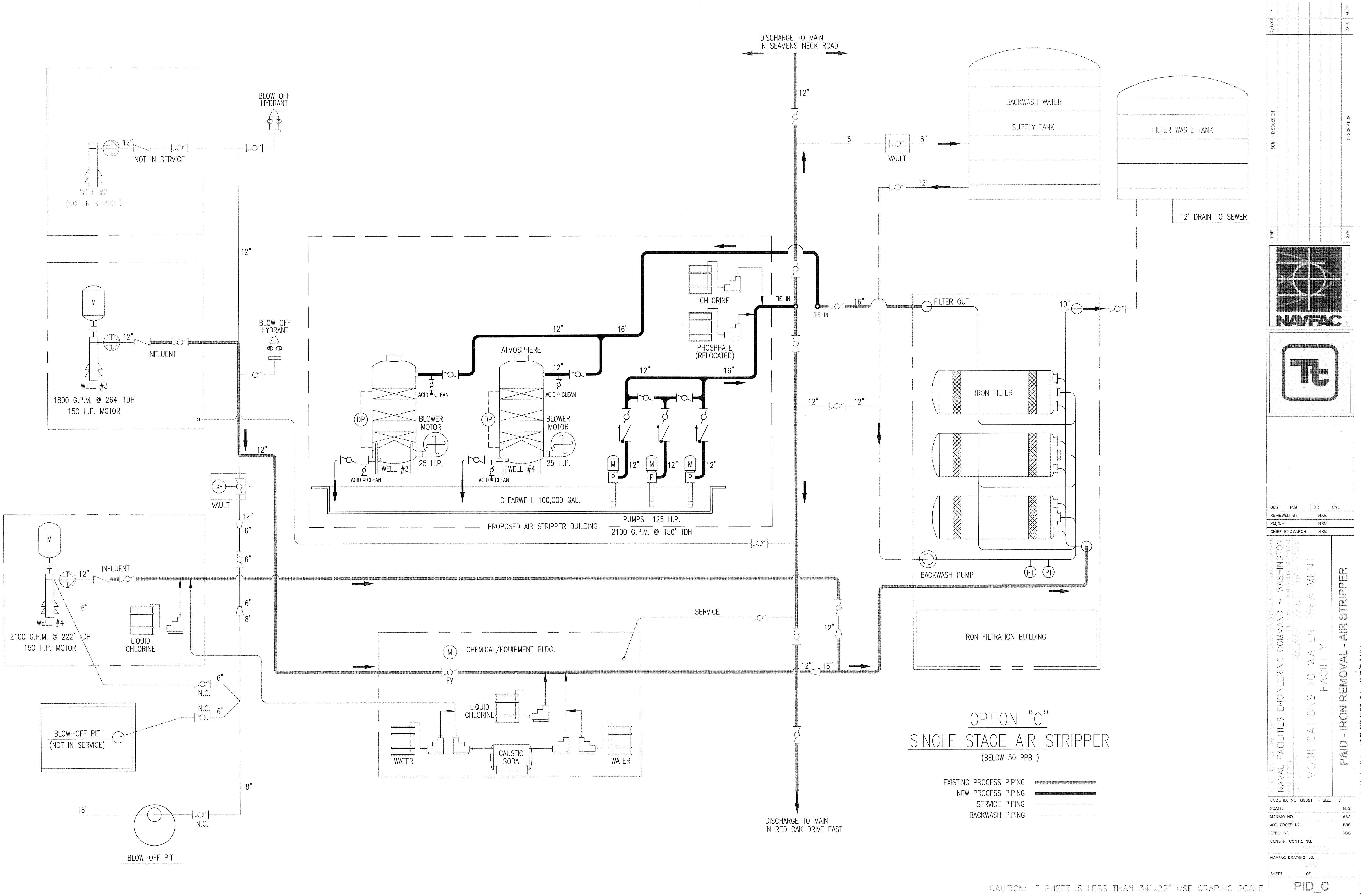
MODIFICATIONS TO WATER TREATMENT FACILITY

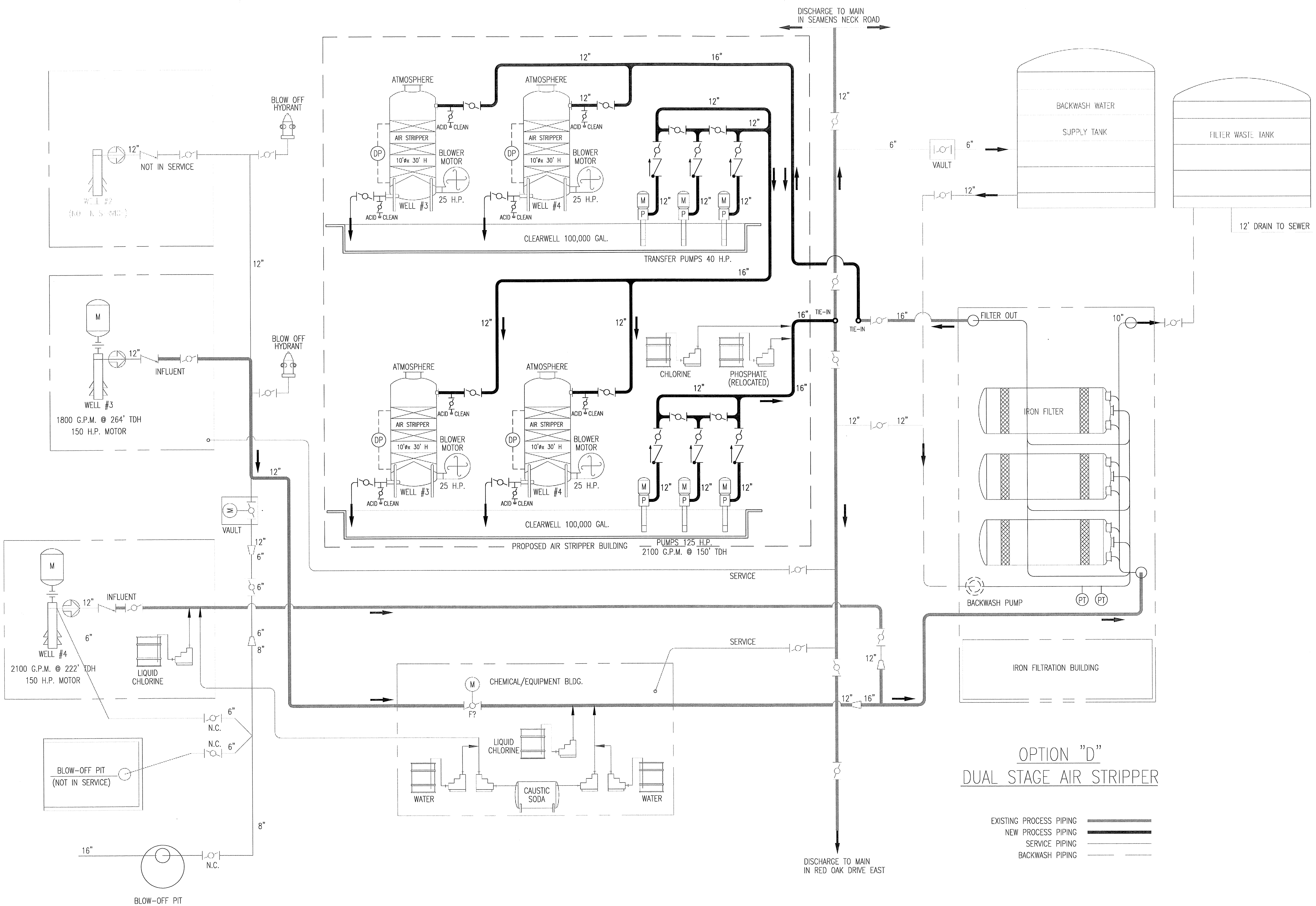
P&ID - IRON REMOVAL - LPGAC

CODE ID. NO. 80091	SIZE D
SCALE:	NTS
MAXIMO NO.	AAA
JOB ORDER NO.	BBB
SPEC. NO.	CCC
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	OF

PID_B

K:\112G02223 - Aqua Bethpage-NAvy Project - H. Mital\Drawings\Mechanical\PWTR-0002-MAXIMO-MS.dwg 10/06/2009 08:19


DISCHARGE TO MAIN
IN SEAMENS NECK ROAD
BLOW OFF
HYDRANT
NOT IN SERVICE
WELL #2
12"
BACKWASH WATER
SUPPLY TANK
FILTER WASTE TANK
VAULT
6"
12' DRAIN TO SEWER
WELL #3
1800 G.P.M. @ 264' TDH
150 H.P. MOTOR
INFLUENT
ATMOSPHERE
CHLORINE
PHOSPHATE
(RELOCATED)
TIE-IN
16"
FILTER OUT
10"
IRON FILTER
ACID
CLEAN
BLOWER
MOTOR
DP
WELL #3
WELL #4
25 H.P.
CLEARWELL 100,000 GAL.
PROPOSED AIR STRIPPER BUILDING
PUMPS 125 H.P.
2100 G.P.M. @ 150' TDH
VAULT
8"
WELL #4
2100 G.P.M. @ 222' TDH
150 H.P. MOTOR
LIQUID
CHLORINE
BACKWASH PUMP
PT
SERVICE
IRON FILTRATION BUILDING
CHEMICAL/EQUIPMENT BLDG.
N.C.
BLOW-OFF PIT
(NOT IN SERVICE)
WATER
CAUSTIC
SODA
OPTION "C"
SINGLE STAGE AIR STRIPPER
(BELOW 50 PPB)
EXISTING PROCESS PIPING
NEW PROCESS PIPING
SERVICE PIPING
BACKWASH PIPING
BLOW-OFF PIT
DISCHARGE TO MAIN
IN RED OAK DRIVE EAST
CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE
NAVFAC
NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON
MODIFICATIONS TO WATER TREATMENT FACILITY
P&ID - IRON REMOVAL - AIR STRIPPER
SCALE: NTS
MAXIMO NO. AAA
JOB ORDER NO. BBB
SPEC. NO. CCC
PID_C



DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

MODIFICATIONS TO WATER TREATMENT FACILITY

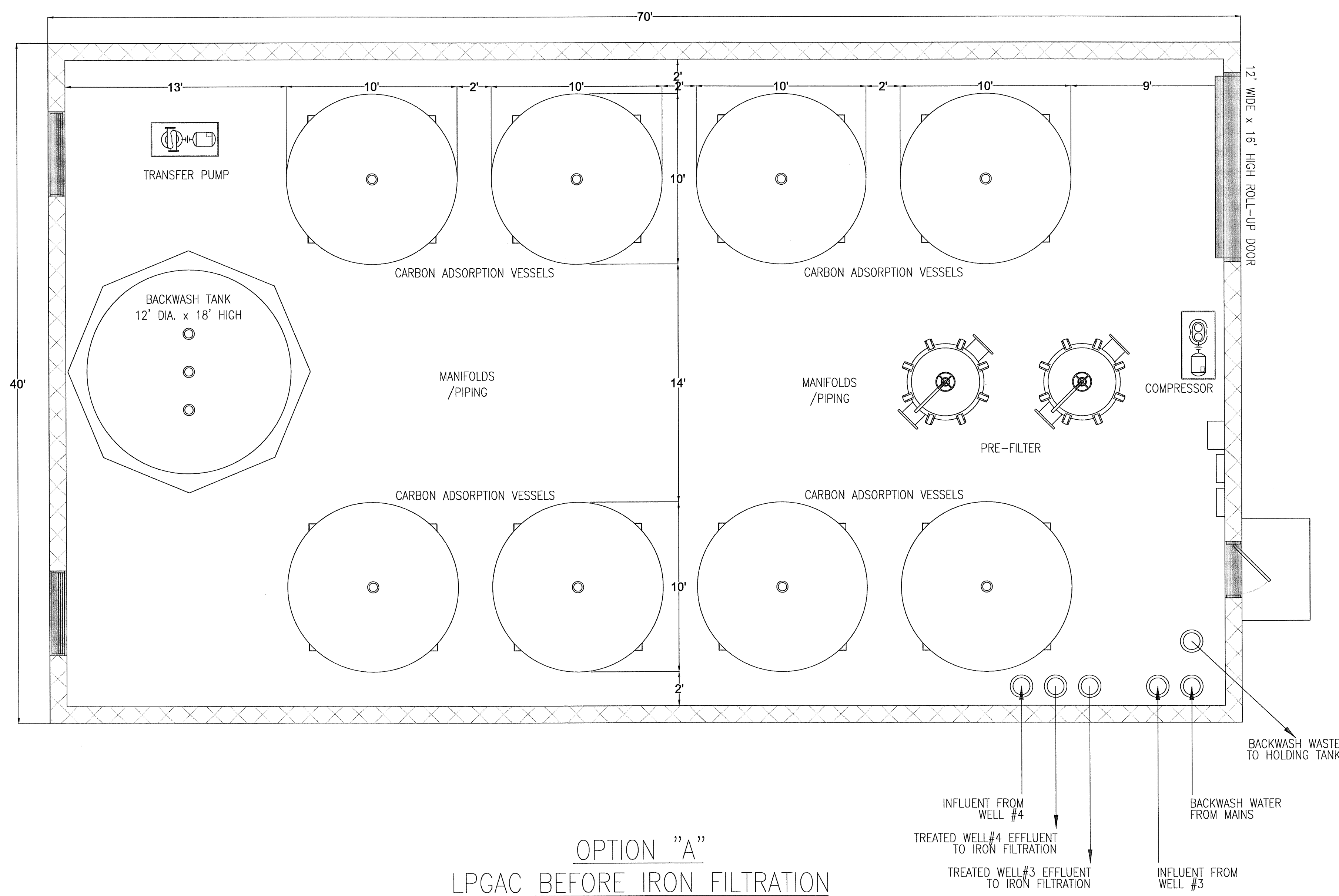
P&ID - IRON REMOVAL - 2 STAGE AIR STRIPPER

CODE ID. NO. 80091	SIZE D
SCALE:	NTS
MAXIMO NO.	AAA
JOB ORDER NO.	BBB
SPEC. NO.	CCC
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	OF

PID_D

K:\112G02223 - Aqua Bethpage-NAvy Project - H. Mital\Drawings\Mechanical\PWTR-0002-MAXIMO-MS.dwg 10/06/2009 15:15

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE



OPTION "A"
LPGAC BEFORE IRON FILTRATION

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

MODIFICATIONS TO WATER TREATMENT FACILITY

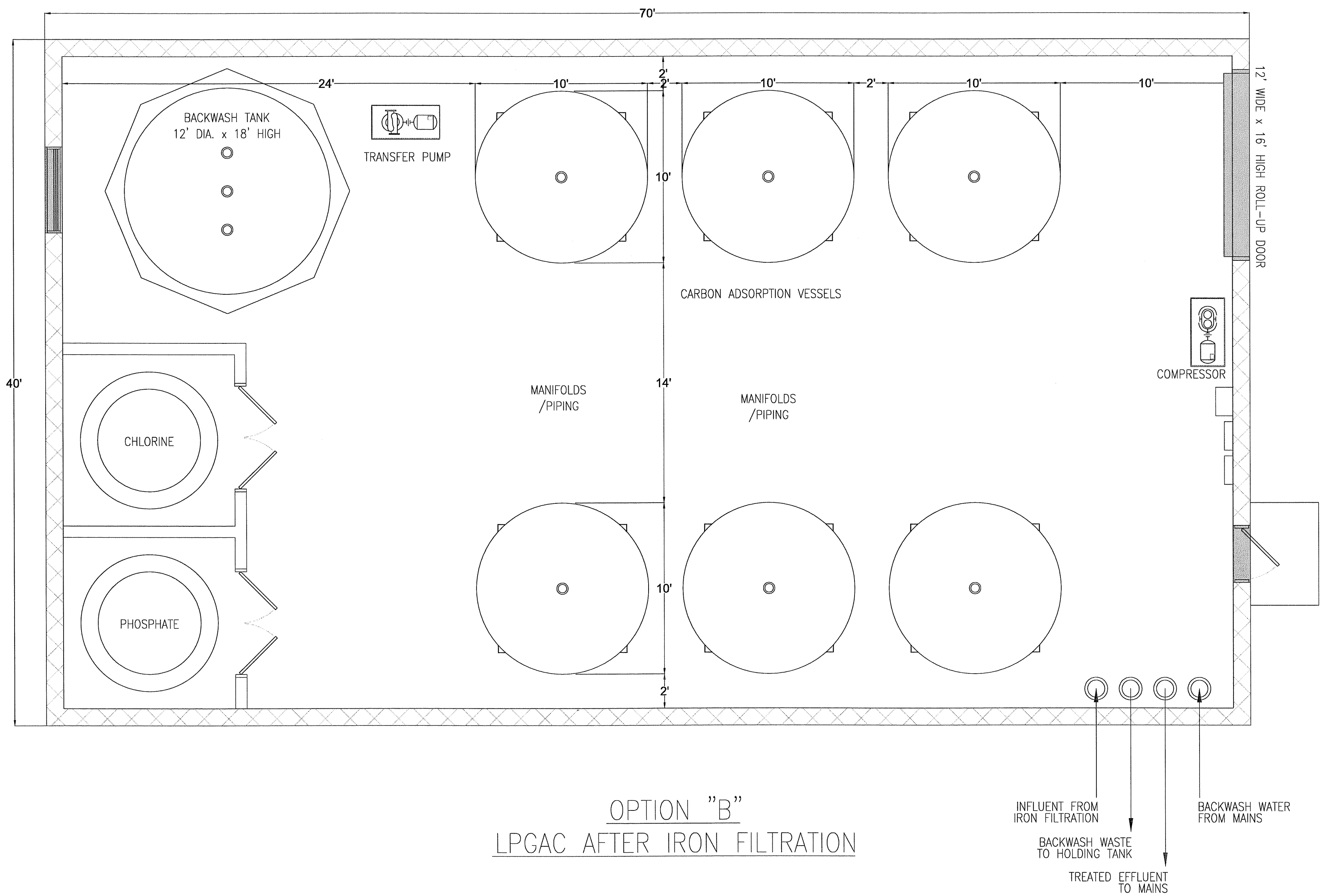
LPGAC BEFORE IRON BUILDING LAYOUT

DES	HKM	DR	SNL
REVIEWED BY		HKM	
PM/DM		HKM	
CHIEF ENG/ARCH		HKM	

CODE ID. NO. 80091 SIZE D
SCALE: 1/4"=1'-0"
MAXIMO NO. AAA
JOB ORDER NO. BBB
SPEC. NO. CCC
CONSTR. CONTR. NO.
NAVFAC DRAWING NO.
SHEET OF

M-1A

10/01/2009 15:27



OPTION "B"
LPGAC AFTER IRON FILTRATION

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

NAVFAC

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

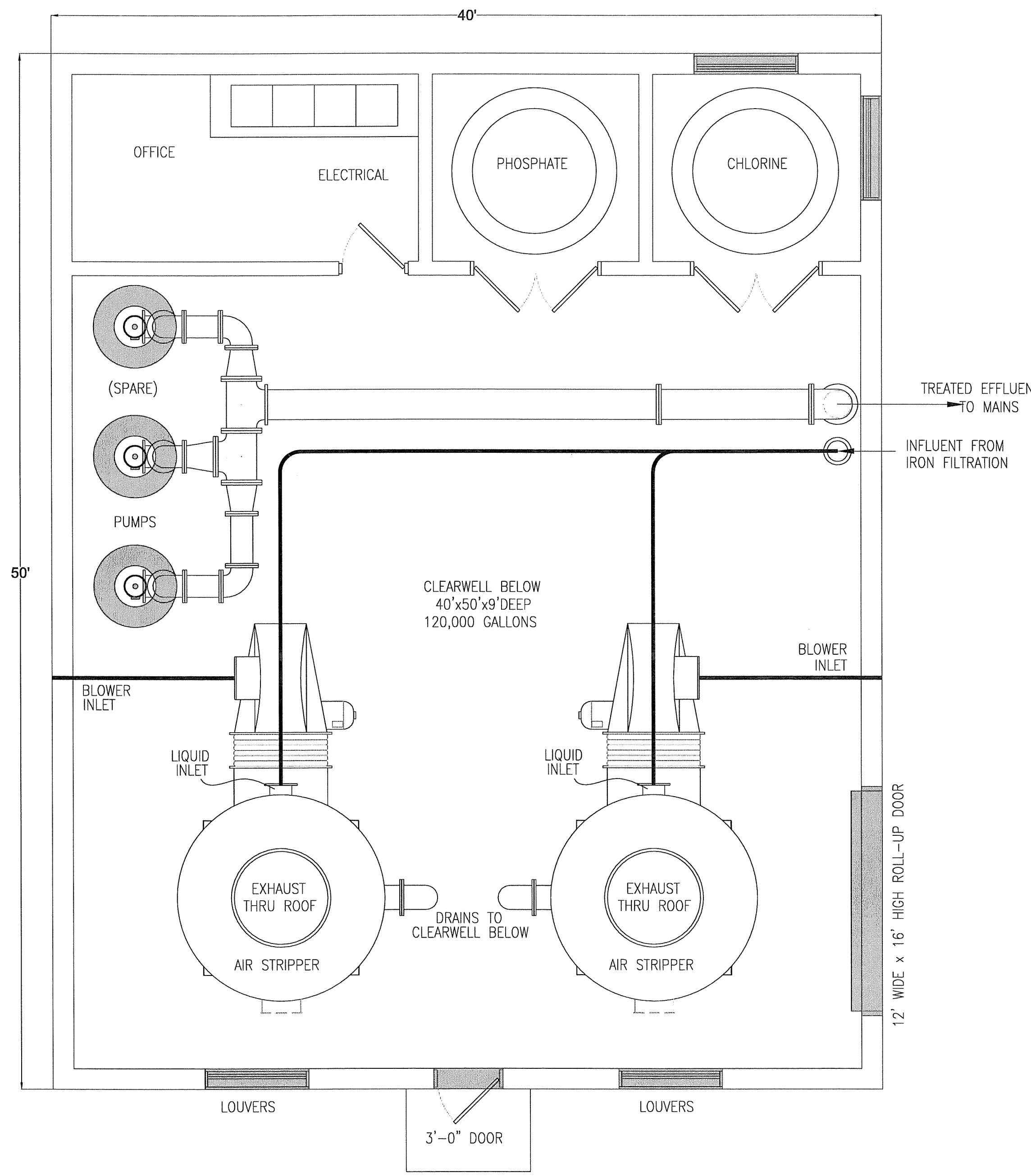
NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

LPGAC AFTER IRON BUILDING LAYOUT

CODE ID. NO. 80091	SIZE D
SCALE:	1/4"=1'-0"
MAXIMO NO.	AAA
JOB ORDER NO.	BBB
SPEC. NO.	CCC
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	OF

M-1B

10/06/2009 08:17



OPTION "C"
SINGLE STAGE AIR STRIPPER TREATMENT

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

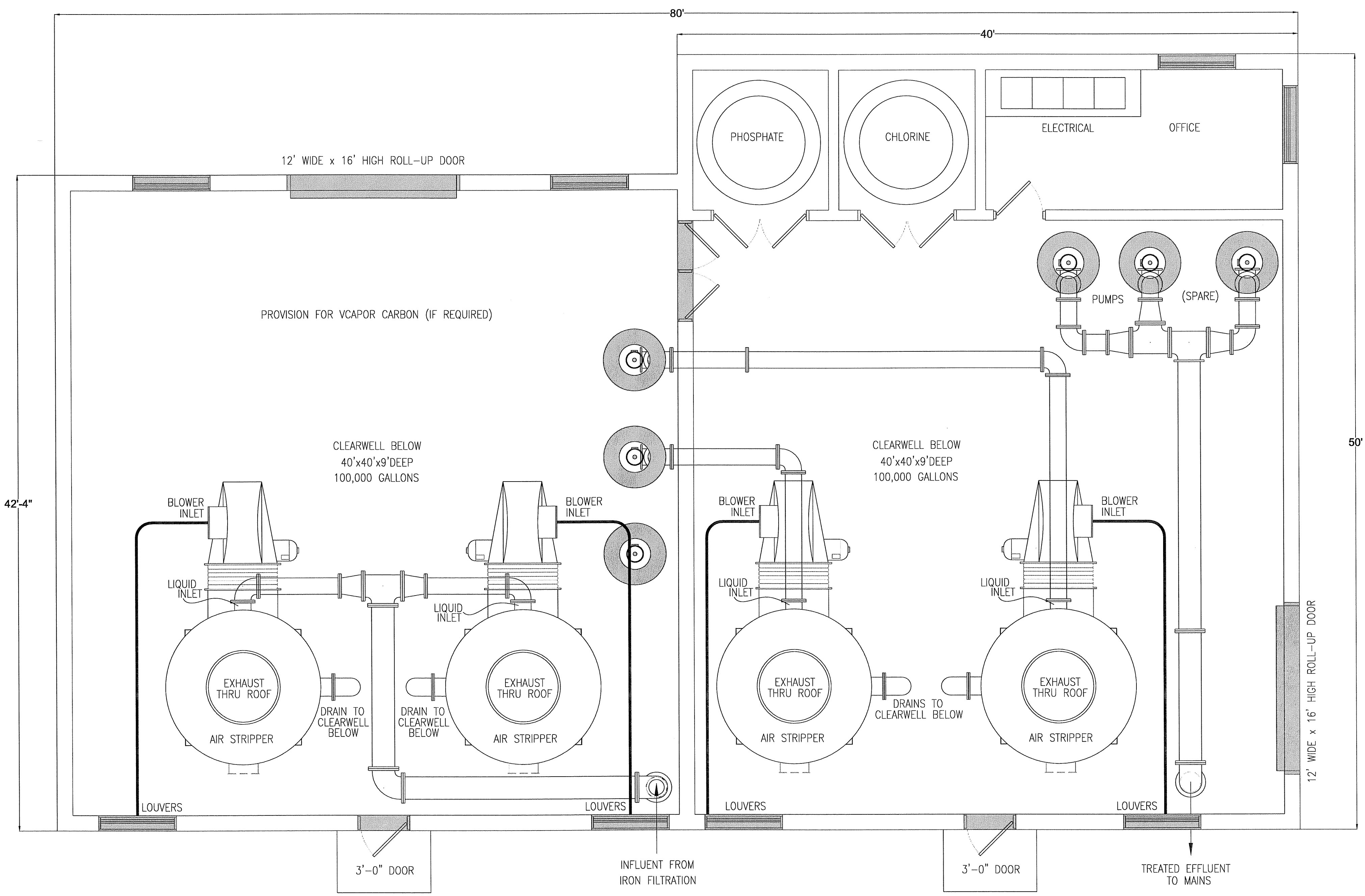
MODIFICATIONS TO WATER TREATMENT
[illegible]ACL[illegible]Y

SINGLE STAGE AIR STRIPPER BUILDING LAYOUT

CODE ID. NO. 80091	SIZE D
SCALE:	NTS
MAXIMO NO.	AAA
JOB ORDER NO.	BBB
SPEC. NO.	CCC
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	OF

M-1C

K:\112G02223 – Aqua Bethpage–NAvy Project – H. Mital\Drawings\Mechanical\PWTR-0001-MAXIMO-ME.dwg 10/06/2009 14:51



OPTION "D"
AIR STRIPPER TREATMENT

CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

DES HKM	DR SNL
REVIEWED BY	HKM
PM/DM	HKM
CHIEF ENG/ARCH	HKM

NAVFAC

NAVAL FACILITIES ENGINEERING COMMAND ~ WASHINGTON

MODIFICATIONS TO WATR TREATMNT FACILITY

DUAL STAGE AIR STRIPPER BUILDING LAYOUT

CODE ID. NO. 80091	SIZE D
SCALE:	NTS
MAXIMO NO.	AAA
JOB ORDER NO.	BBB
SPEC. NO.	CCC
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	OF

M-1D

K:\112G02223 – Aqua Bethpage–NAvy Project – H. Mital\Drawings\Mechanical\PWTR-0001-MAXIMO-ME.dwg 10/06/2009 15:16

APPENDIX C
GEOTECHNICAL SUBSURFACE INVESTIGATION REPORT

GEOTECHNICAL SUBSURFACE INVESTIGATION REPORT

For the proposed

SEAMANS NECK ROAD WATER TREATMENT PLANT AQUA, NEW YORK

NOVEMBER 2010

Prepared by:

Tetra Tech
240 Continental Drive, Suite 200
Newark, DE 19713

112G02223

GEOTECHNICAL SUBSURFACE INVESTIGATION REPORT

FOR THE PROPOSED

SEAMANS NECK ROAD
WATER TREATMENT PLANT
AQUA, NEW YORK

November 2010

Prepared by:

Tetra Tech
240 Continental Drive, Suite 200
Newark, DE 19713

112G02223

Prepared By: ____________________

Ralph H. Boedeker, P.E. (DE, PA, MD, VA)
Manager, Geotechnical Engineering Department

STATE OF NEW YORK
MATTHEW CORBRIDGE McCARTY
No. 079476
LICENSED PROFESSIONAL ENGINEER

Approved By: ____________________

Matthew C. McCarty, P.E.
Senior Structural Engineer

TABLE OF CONTENTS

Section		Page
1.0	**INTRODUCTION**	**1**
2.0	**DESCRIPTIONS, INVESTIGATIONS AND SUBSURFACE CONDITIONS**	**1**
2.1	General Site and Facility Description	1
2.2	Subsurface Investigation Program	2
2.3	Subsurface Conditions	3
3.0	**ANALYSIS AND DESIGN RECOMMENDATIONS**	**4**
3.2	Shallow Foundation Systems – Building and Adsorber Spread Footings	4
3.2	Backwash Tank Mat Foundation	5
3.3	Ground-Supported Floor Slabs	6
3.4	Seismic Design	6
4.0	**CONSTRUCTION RECOMMENDATIONS**	**7**
4.1	Site Preparation in Structural Areas	7
4.2	Compacted Structural Fill	7
4.3	Shallow Foundation Construction	8
4.4	Underground Utilities	8
4.5	Site Work Quality Control and Assurance	9
5.0	**REPRESENTATIONS**	**9**

ATTACHMENTS

Site Plan with Test Boring Locations and Acid Room Layout Plan
Test Boring Logs
Generalized Stratigraphic Profile
Laboratory Testing Results

1.0 INTRODUCTION

This report presents the results of a geotechnical subsurface investigation performed for a new water treatment plant to be located at the Seamans Neck Road Plant of Aqua, New York. The purpose of this study was to investigate subsurface conditions within the project site, formulate foundation design criteria for the proposed treatment plant structure, and provide pertinent geotechnical site recommendations for construction.

This geotechnical study represents an evaluation of subsurface conditions within the project site, and provides recommendations based on an exploration of subsurface soil conditions by means of Standard Penetration Test (SPT) Borings (ASTM D1586). The scope of this investigation included a test boring program, laboratory testing of representative soil samples, engineering analyses of the available data, and preparation of this engineering report.

2.0 DESCRIPTIONS, INVESTIGATIONS AND SUBSURFACE CONDITIONS

2.1 General Site and Facility Description

A site plan depicting the location of the investigation area is attached to this report. The site is relatively flat and grass covered. The proposed treatment plant structure is to consist of an approximately 85-foot long by 35-foot wide pre-engineered building. The structure will be single-story, approximately 25 feet tall, and have perimeter bents that span the entire width of the building, thus creating an open floor plan with no interior columns. The perimeter wall construction will consist of metal siding and girt framing between bents; therefore, the anticipated foundation wall load between girts will be negligible. The finished floor of the treatment plant will be constructed at or near existing grades.

Structural information pertaining to the pre-engineered building, as well as various tanks to be located within the building, is as follows:

- Per the project structural engineer, the maximum building column load (dead load plus live load) is estimated to be 20 kips.

- The treatment plant will contain a series of six carbon adsorption tanks, with an operating weight of approximately 215,000 pounds per tank pair. The tanks are to be supported by structural steel support legs; each leg supporting approximately 27 kips.
- The treatment plant will also contain a large backwash tank, measuring approximately 12 feet in diameter and 18 feet tall. A water fluid height of 18 feet would produce a uniform pressure of approximately 1,125 pounds per square foot (psf) at the base of the 12-foot diameter tank. The treatment plant will contain several other miscellaneous tanks; however, it is assumed that the actual base loading of the tanks will be less than that of the backwash tank.

2.2 Subsurface Investigation Program

Three SPT borings (BP-ANY-SB01 through BP-ANY-SB03) were performed during this investigation, each boring advanced to a final depth of 30 feet. The borings were performed at the locations depicted on the attached site plan. Final boring locations were adjusted to avoid existing underground utilities. A fourth boring was planned; however, could not be performed due to access constraints. The test borings were performed to collect representative soil samples and to determine subsurface soil and groundwater conditions. The borings were performed on February 2, 2010, using a CME 75 drilling rig. SPT split-spoon samples (ASTM D1586) were obtained within each of the borings. In this procedure, a 2-inch O.D. split-barrel sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through the final 12-inch interval is termed the Standard Penetration Resistance (SPR) N-value. After hand auguring boreholes to a depth of 4.0 feet (to avoid damaging potential underground utilities), split-spoon samples were collected continuously from depths of 4 to 10 feet, and thereafter at 5-foot intervals. The performance of the test borings was reviewed by a representative of Tetra Tech NUS. Test boring logs, as prepared by the field representative, are attached. Following completion of the drilling, the boreholes were backfilled with the soil cuttings.

All of the collected soil samples were inspected and described visually during the field exploration program. Select samples were identified for geotechnical laboratory testing. Two Mechanical Sieve Tests (ASTM D422), and 19 Water Content Tests (ASTM D2216) and Percent Finer than a No. 200 Sieve Tests (ASTM D1140) were performed to aid in defining the general site stratigraphy and to measure the amount of silt and clay particulate in the soil samples. Laboratory testing results are attached to this report.

2.3 Subsurface Conditions

Subsurface conditions within the investigation area can generally be described as granular alluvial deposits varying in thickness, gradation and density. Subsurface conditions are described in detail in the test boring logs, and are also depicted on a generalized stratigraphic profile attached to this report as a visual aid in depicting subsurface soil and groundwater conditions. It should be noted that subsurface conditions between boring locations were interpolated and may not be precise.

A generalized description for each of the various subsurface soil strata encountered is presented in the following paragraphs.

- <u>Topsoil/Rootmat</u>
  The thickness of the surficial topsoil/root mat zone varied at boring locations, ranging from negligible to several inches. Contractors bidding on site work for the proposed development should not rely on the limited topsoil data included in this report, but should perform their own investigations to develop their estimate on the quality and availability of topsoil.

- <u>Stratum A - Alluvial Coarse-Grained Soils</u>
  Underlying the surficial layer of topsoil/root mat at the site, Stratum A was encountered at each of the three borings, and can generally be described as a tan-brown, fine to coarse <u>sand</u>, with some fine gravel and a trace to little silt (USCS: SW, gravelly sand). The thickness of Stratum A is approximately 8 feet. SPR values within Stratum A ranged from 33 to 60 blows per final foot of spoon penetration, with an average SPR value of 49 blows (dense). Laboratory and field SPR test data indicate the granular soils of Stratum A to have relatively high shear strength and relatively low compressibility characteristics.

- Stratum B - Alluvial Coarse-Grained Soils
  Underlying Stratum A, Stratum B was encountered at each of the three borings, and can generally be described as a tan-brown, fine to coarse sand, with some fine gravel and a trace silt (USCS: SP, gravelly sand). Each of the borings terminated within Stratum B, with a penetrated thickness of approximately 22 feet. SPR values within Stratum B ranged from 7 to 20 blows per final foot of spoon penetration, with an average SPR value of 15 blows (medium dense). Laboratory and field SPR test data indicate the granular residual soils of Stratum B to have relatively moderate shear strength and relatively low compressibility properties.

Apparent groundwater (unconfined) was encountered at each of the boring locations during the performance of the test borings at an approximate depth of 23 feet below existing ground surfaces. Groundwater elevations will fluctuate throughout a given year depending on actual field porosity and seasonal and annual variations of precipitation.

3.0 ANALYSIS AND DESIGN RECOMMENDATIONS

Tetra Tech evaluated the subsurface conditions at the project site for suitability for the proposed development. It is Tetra Tech's opinion that the site subsurface conditions are suitable for placement of the proposed structure within certain limitations. The design and construction of building foundations and other aspects of the proposed site development that would be influenced by the geotechnical conditions are discussed in the follow sections.

3.1 Shallow Foundation Systems – Building and Adsorber Spread Footings

After all site preparation work has been completed as recommended herein, all shallow foundations should be placed on or within properly placed structural fill material (used to bring the site to design subgrade elevations) and/or the undisturbed soils of Stratum A. Based on field and laboratory testing of soils encountered during this evaluation, as well as estimated maximum column loads, an engineering analysis indicates that shallow spread footings may be designed for a maximum total allowable bearing capacity of 4,000 pounds per square foot (psf).

Based on a total allowable soil bearing load of 4,000 psf, it is estimated that maximum total foundation settlement will be in the order of one-quarter inch (¼") or less. Differential settlements between spread footings are also estimated to be one-quarter inch (¼"), or less. Due to the granular consistency of the Stratum A soils (or placed structural fill), it is estimated that approximately 90% of the building's structural dead-load induced settlement will occur quickly (elastic settlement) and should be built-out during construction. For the adsorption tanks, it is estimated that approximately 90% of the settlement will occur quickly (elastic settlement) as the tanks are filled to their maximum operating capacities.

Interior footings should be placed at least 18 inches below the finished floor grades. Exterior footings exposed to freezing conditions should be placed at least 36 inches below finished exterior grade. Shallow spread footings should have a minimum width of 3.0 feet regardless of bearing pressure.

3.2 Backwash Tank Mat Foundation

After all site preparation work has been completed as recommended herein, a mat foundation for the plant backwash tank should be placed on or within properly placed structural fill material (used to bring the site to design subgrade elevations) and/or the undisturbed soils of Stratum A. Based on field and laboratory testing of soils encountered during this evaluation, as well as the diameter and anticipated loading of the backwash tank, an engineering analysis indicates that tank pad mat foundation may be designed for a maximum total allowable bearing capacity of 4,000 pounds per square foot (psf).

The actual tank load has been estimated to be approximately 1,125 psf spread over a 12-foot diameter area. Based on the anticipated loading of a full tank, it is estimated that maximum total foundation settlement will be in the order of one-quarter inch (¼") or less. Due to the granular consistency of the Stratum A soils (or placed structural fill), it is estimated that approximately 90% of the settlement will occur quickly (elastic settlement) as the tanks are filled to their maximum capacities.

3.3 Ground-Supported Floor Slabs

After all site preparation work has been completed as recommended herein, all ground-supported floor slabs should be placed over properly placed structural fill material (used to bring the site to design subgrade elevations) and/or the undisturbed soils of Stratum A.

All ground-supported floor slabs should be designed as free-floating and not connected to other structural elements. Isolation joints should be utilized in ground-supported floor slabs to accommodate potential differential settlement between the floor slab and adjacent columns. Control joints should also be provided in floor slabs to provide a "preferred" location for possible differential slab settlement. All floor slabs should be structurally reinforced to control cracking, more evenly distribute applied loads, and bridge localized zones of lower density material. A minimum 10-mil polyethylene vapor barrier and free-draining subbase, consisting of at least 6 inches of poorly graded crushed stone aggregate should be provided beneath all floor slabs. For floor slabs installed as recommended herein, a modulus of subgrade reaction (Ks) of 200 pci is estimated for use in concrete slab-on-grade design.

The actual stress distribution and settlement response under the floor slabs will be a function of the structural rigidity of the slab and uniformity of the applied loads. Individual equipment, machinery and tanks should be supported on their own foundations and isolated from the floor slab to avoid localized cracking of the floor slab.

3.4 Seismic Design

Based on the subsurface conditions encountered during the test boring program, it is recommended that a site Class D be utilized for seismic design purposes. The site class definition is as defined by Table 1615.1.1 of the International Building Code.

4.0 CONSTRUCTION RECOMMENDATIONS

4.1 Site Preparation in Structural Areas

At the start of construction all existing vegetation, roots and topsoil should be removed in their entirety from the proposed building area. Following rough grading, and prior to any structural fill/backfill placement, the building area should be proof-rolled in the presence of a qualified soils technician with a minimum 10-ton smooth-wheeled roller, or other approved equipment. The purpose of the proof-rolling is to densify the exposed subgrade areas that have been loosened or disturbed during the stripping/grading operation. In addition, proof-rolling will expose any localized soft areas not encountered during the test boring program. In subgrade areas to receive structural fill, the exposed subgrade areas should be compacted to a visually firm and stable condition. This subgrade compaction effort will enable any structural fill to be placed and compacted at the required densities. Any localized soft and/or excessively wet areas encountered during this program that cannot be adequately stabilized and compacted should be undercut and replaced in accordance with the compacted structural fill recommendations. Subgrade disturbance should be minimized by maintaining positive surface drainage and by limiting construction traffic on the exposed subgrade soils.

4.2 Compacted Structural Fill

All structural load-bearing fill/backfill material required to bring structural building areas to grade, and to backfill utility trenches within slab areas, should be a well-graded granular material containing no organic or other deleterious materials. The granular soils of Stratum A are considered suitable for use as structural fill. Imported structural fill should meet the USCS classification of SW, SP or SM, and should have no more than 25% material passing a No. 200 Sieve (ASTM D1140). AASHTO No. 57 Stone can also be utilized as structural fill at locations approved by the geotechnical engineer, and can be considered for localized, relatively deep fills, such as foundation undercuts and utility trenches.

Structural fill material should be placed in horizontal thin lifts with a compacted thickness no greater than 8 inches. Each thin lift of fill/backfill material placed below structural elements (i.e., foundations and floor slabs) should be compacted to a minimum 95% of its maximum dry density, as determined by the Modified Proctor Test (ASTM D1557). The placement and compaction of structural fill should be monitored on a full-time basis by a qualified technician under the supervision of a geotechnical engineer. Compacted structural fill should be placed at moisture contents to facilitate compaction. Fill lifts for hand tampers should not exceed 4 inches.

4.3 Shallow Foundation Construction

All foundations should be placed on dry, non-frozen, firm soil. When excessively wet or frozen soil is encountered at the footing base, this material should be undercut to suitable bearing materials. The undercut zone may be replaced in accordance with the compacted structural fill recommendations or with lean concrete. During excavation of individual footings, disturbance of the subgrade soils may occur; therefore, compaction of the footing subgrades prior to placement of any reinforcing steel or concrete should be performed.

All footing excavations should be reviewed to verify the quality of the bearing material. Footing excavations should be reviewed by a qualified geotechnical technician working under the supervision of a geotechnical engineer who is familiar with the recommendations of this report. Subgrade review should be performed prior to placement of reinforcing steel or concrete and should verify the presence of suitable bearing soils.

All footing excavations should be protected from ponding water and freezing conditions, and backfilled as soon as practical after the foundation concrete has been placed. Backfilling should follow the compacted structural fill recommendations previously described.

4.4 Underground Utilities

It is recommended that any existing underground utilities within proposed structural areas be relocated outside of the proposed building area. In-place abandonment of existing utilities is not recommended because of the unknown quality and density of previously placed trench backfill material. Therefore, any existing utility trenches within building areas should be backfilled in accordance with the structural fill recommendations after the utility line has been removed.

4.5 Site Work Quality Control and Assurance

It is recommended that all site clearing, grading, foundation excavation/construction, and fill/backfill placement be monitored by a qualified technician working under the supervision of a geotechnical engineer who is familiar with the recommendations of this report. The technician should observe and document appropriate site preparation, foundation subgrades, and fill/backfill construction work and make appropriate field tests, as necessary, to verify that acceptable fill materials are being used and construction is being performed in accordance with applicable plans, specifications and acceptable construction practice.

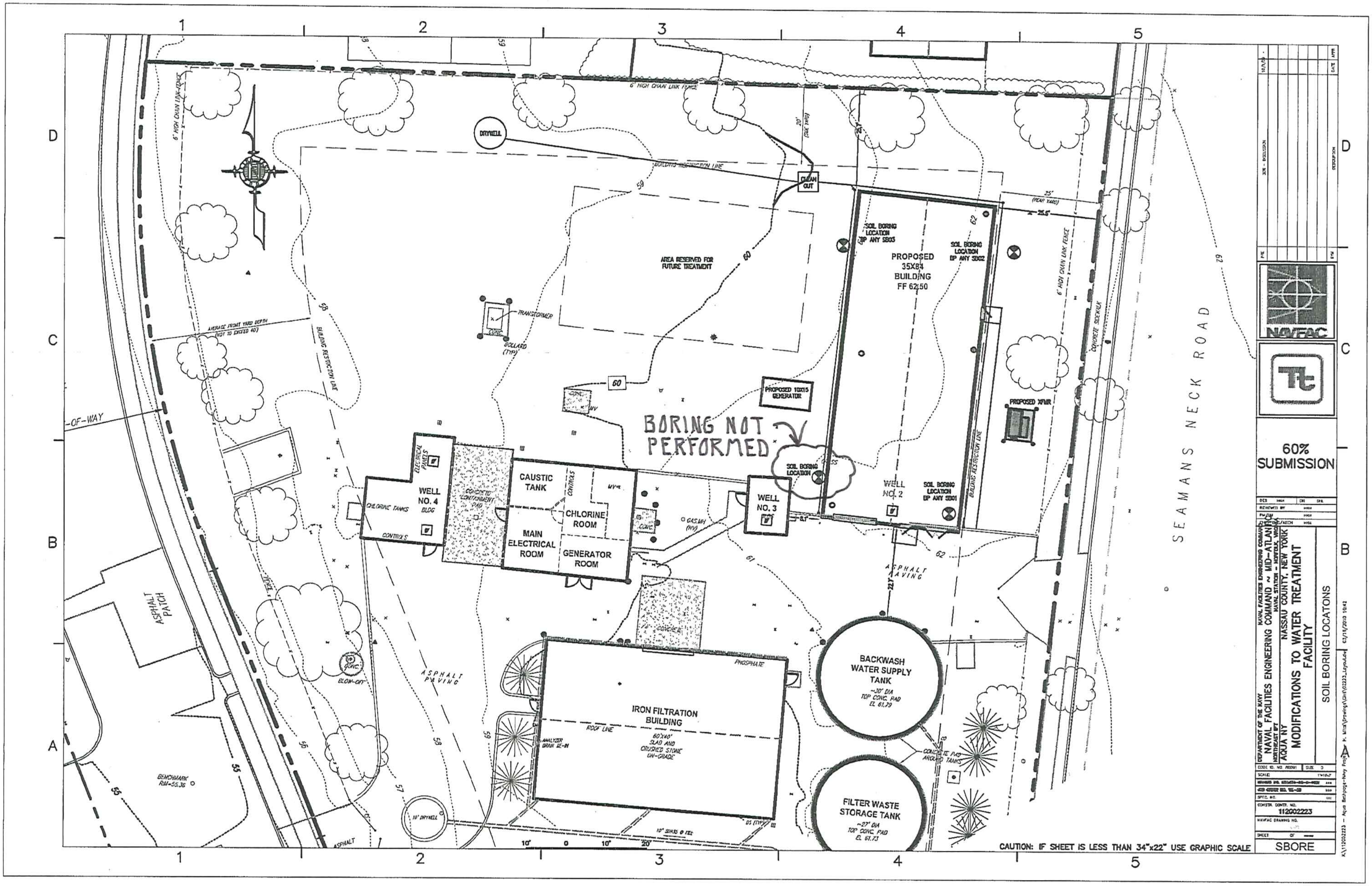
The conclusions and recommendations in this report are based on the premise of competent field engineering and monitoring during construction. All contractors bidding on work involving subsurface conditions should be given full access to this report so that they can develop their own interpretations of the available data.

5.0 REPRESENTATIONS

The above recommendations have been prepared in accordance with generally accepted soil and foundation engineering standards, and are based on soil and groundwater conditions encountered by the test borings. It should be noted that, although soil quality has been inferred from the interpolation of the test boring data, actual subsurface conditions between boring locations are, in fact, unknown. As a result, these recommendations may require modifications based on subsurface conditions encountered during construction. If conditions are encountered during construction that appear to be different than those shown by the test borings, Tetra Tech should be notified, and recommendations in this report may need to be re-evaluated.

ATTACHMENTS

- **Site Plan with Test Boring Locations**
- **Test Boring Logs**
- **Generalized Stratigraphic Profile**
- **Laboratory Testing Results**



BORING NOT PERFORMED
SOIL BORING LOCATION
SOIL BORING LOCATION EP ANY SB01
SOIL BORING LOCATION EP ANY SB02
SOIL BORING LOCATION EP ANY SB03
PROPOSED 35X84 BUILDING FF 62.50
WELL NO. 2
WELL NO. 3
WELL NO. 4 BLDG
PROPOSED 10X15 GENERATOR
PROPOSED XFMR
AREA RESERVED FOR FUTURE TREATMENT
TRANSFORMER
BOLLARD (TYP)
DRYWELL
CLEAN OUT
CAUSTIC TANK
CHLORINE ROOM
MAIN ELECTRICAL ROOM
GENERATOR ROOM
CONTROLS
CHLORINE TANKS
ELECTRICAL PANELS
CONCRETE CONTAINMENT PAD
IRON FILTRATION BUILDING
60'X40' SLAB AND CRUSHED STONE ON-GRADE
ROOF LINE
PHOSPHATE
BACKWASH WATER SUPPLY TANK ~30' DIA TOP CONC. PAD EL 61.79
FILTER WASTE STORAGE TANK ~27' DIA TOP CONC. PAD EL 61.73
ASPHALT PAVING
ASPHALT PATCH
SEAMANS NECK ROAD
6' HIGH CHAIN LINK FENCE
BUILDING RESTRICTION LINE
CONCRETE SIDEWALK
BENCHMARK RM=55.36
10' DRYWELL
-OF-WAY
60% SUBMISSION
NAVFAC
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND ~ MID-ATLANTIC
AQUA NY
NASSAU COUNTY, NEW YORK
MODIFICATIONS TO WATER TREATMENT FACILITY
SOIL BORING LOCATONS
112002223
SBORE
CAUTION: IF SHEET IS LESS THAN 34"x22" USE GRAPHIC SCALE

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NWIRP Bethpage
PROJECT NUMBER:
DRILLING COMPANY: ADT
DRILLING RIG: CME 75

BORING No.: BP-ANY-SB01
DATE: 2/2/2010
GEOLOGIST: Vince Shickora
DRILLER: Joe McGill

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Standard Penetration Resistance (SPR) Number	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						Brn	Silty Sand with fine gravel		Frozen to 12" BGS	-	-	-	-
	2									moist	-	-	-	-
	3						Dk Brn	Silty fine to med. Sand with fine gravel trace silt		moist	-	-	-	-
	4										-	-	-	-
S-1	5	7 / 14				Stiff	Tan Brn	Fine to med. Sand some course sand and fine gravel		moist	-	-	-	-
	6	19 / 27	33	18/24		Very Stiff				collect sample	-	-	-	-
S-2	7	21 / 34				Med-Dense	Tan Brn	FGR to CGR sand with some FGR to MGR Gravel		moist	-	-	-	-
	8	25 / 25	59	20/24		Med-Dense				collect sample	-	-	-	-
S-3	9	7 / 8				Loose	Tan Brn	Same as above		moist	-	-	-	-
	10	12 / 14	20	19/24		Med-Dense				collect sample	-	-	-	-
	11													
	12													
	13													
S-4	14	5 / 6				Loose	Tan Brn	FGR to CGR sand with some FGR to MGR Gravel		moist	-	-	-	-
	15	8 / 9	14	19/24		Loose				collect sample	-	-	-	-
	16													
	17													
	18													
S-5	19	6 / 7				Loose	Tan Brn	FGR to CGR sand with some FGR to MGR gravel		moist	-	-	-	-
	20	7 / 10	14	18/24		Loose				collect sample	-	-	-	-
	21													
	22													
	23				▽					water at ~23' BGS				
S-6	24	4 / 6				Loose	Tan Brn	MGR to CGR sand with some FGR to MGR gravel trace FGR sand		wet saturated	-	-	-	-
	25	8 / 7	14	19/24		Loose				collect sample	-	-	-	-

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2" X 2' stainless split spoon. 3.25" ID Hollow Stem Auger
140 pound auto Hammer

Drilling Area Background (ppm): NA

Converted to Well: Yes ____ No X ____ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NWIRP Bethpage
PROJECT NUMBER:
DRILLING COMPANY: ADT
DRILLING RIG: CME 75
BORING No.: BP-ANY-SB01
DATE: 2/2/2010
GEOLOGIST: Vince Shickora
DRILLER: Joe McGill

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Standard Penetration Resistance (SPR) Number	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	26										-	-	-	-
	27										-	-	-	-
	28										-	-	-	-
S-7	29	5 / 6				Loose	Brn Tan	MGR to CGR sand with FGR to MGR gravel			-	-	-	-
	30	5 / 5	11	17/24		Loose				wet saturated	-	-	-	-
					EOB					collect sample				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2" X 2' stainless split spoon. 3.25" ID Hollow Stem Auger
140 pound auto Hammer

Drilling Area Background (ppm): NA

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NWIRP Bethpage
PROJECT NUMBER:
DRILLING COMPANY: ADT
DRILLING RIG: CME 75

BORING No.: BP-ANY-SB02
DATE: 2/2/2010
GEOLOGIST: Vince Shickora
DRILLER: Joe McGill

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Standard Penetration Resistance (SPR) Number	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	U S C S *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						Dk Brn	Sandy silt with some fine gravel		Frozen to 12" BGS	-	-	-	-
	2									moist	-	-	-	-
	3						Tan Brn	FGR to MGR sand with some CGR sand/FGR to MGR gravel trace silt		moist	-	-	-	-
	4										-	-	-	-
S-1	5	8 / 17				med-Dense	Tan Brn	FGR to MGR sand with some CGR sand/ FGR to MGR gravel		moist	-	-	-	-
	6	25 / 28	42	19/24		Med-Dense				collect sample	-	-	-	-
S-2	7	33 / 29				Dense	Tan Brn	FGR to CGR sand with some FGR to MGR Gravel		moist	-	-	-	-
	8	31 / 26	60	18/24		Med-Dense				collect sample	-	-	-	-
S-3	9	4 / 7				Loose	Tan Brn	Same as above		moist	-	-	-	-
	10	10 / 12	17	20/24		Med-Dense				collect sample	-	-	-	-
	11													
	12													
	13													
S-4	14	4 / 8				Loose	Brn Tan	FGR to CGR sand with some FGR to MGR Gravel		moist	-	-	-	-
	15	10 / 14	18	19/24		Med-Dense				collect sample	-	-	-	-
	16													
	17													
	18													
S-5	19	6 / 7				Loose	Brn Tan	FGR to MGR sand with some CGR sand and FGR to MGR gravel		moist	-	-	-	-
	20	11 / 12	18	20/24		Med-Dense				collect sample	-	-	-	-
	21													
	22													
	23				▽					water at ~23' BGS				
S-6	24	4 / 5				Loose	Brn Tan	FGR to CGR sand and FGR to MGR gravel		wet saturated	-	-	-	-
	25	8 / 9	13	19/24		Loose				collect sample	-	-	-	-

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2" X 2' stainless split spoon. 3.25" ID Hollow Stem Auger
140 pound auto Hammer

Drilling Area Background (ppm): NA

Converted to Well: Yes ____ No X ____ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME:	NWIRP Bethpage	BORING No.:	BP-ANY-SB02
PROJECT NUMBER:		DATE:	2/2/2010
DRILLING COMPANY:	ADT	GEOLOGIST:	Vince Shickora
DRILLING RIG:	CME 75	DRILLER:	Joe McGill

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Standard Penetration Resistance (SPR) Number	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	PID/FID Reading (ppm): Sampler BZ	PID/FID Reading (ppm): Borehole**	PID/FID Reading (ppm): Driller BZ**
	26										-	-	-	-
	27										-	-	-	-
	28										-	-	-	-
S-7	29	8 / 9				Loose	Brn Tan	FGR to CGR sand and FGR to MGR gravel			-	-	-	-
	30	8 / 8	17	1/24		Loose				wet saturated	-	-	-	-
					EOB					small sample no recovery				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2" X 2' stainless split spoon. 3.25" ID Hollow Stem Auger
140 pound auto Hammer

Drilling Area Background (ppm): NA

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME:	NWIRP Bethpage	BORING No.:	BP-ANY-SB03
PROJECT NUMBER:		DATE:	2/2/2010
DRILLING COMPANY:	ADT	GEOLOGIST:	Vince Shickora
DRILLING RIG:	CME 75	DRILLER:	Joe McGill

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Standard Penetration Resistance (SPR) Number	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						Dk Brn	Sandy silt with some fine gravel		Frozen to 12" BGS	-	-	-	-
	2									moist	-	-	-	-
	3						Tan Brn	FGR to MGR sand with some CGR sand and fine gravel trace silt		moist	-	-	-	-
	4										-	-	-	-
S-1	5	11 / 13				med-Dense	Brn Tan	FGR to CGR sand with some FGR to MGR gravel		moist	-	-	-	-
	6	23 / 24	36	20/24		Med-Dense				collect sample	-	-	-	-
S-2	7	15 / 25				Med-Dense	Brn Tan	Same as above		moist	-	-	-	-
	8	28 / 26	53	19/24		Med-Dense				collect sample	-	-	-	-
S-3	9	9 / 9				Loose	Wht Brn Tan	Same as above		moist	-	-	-	-
	10	11 / 13	20	18/24		Med-Dense				collect sample	-	-	-	-
	11													
	12													
	13													
S-4	14	3 / 4				Very Loose	Tan Brn	FGR to CGR sand with some FGR to CGR Gravel trace silt		moist	-	-	-	-
	15	3 / 7	7	3/24		Loose				collect sample	-	-	-	-
	16													
	17													
	18													
S-5	19	6 / 7				Loose	Brn Tan	FGR to CGR sand with some FGR to CGR gravel		moist	-	-	-	-
	20	9 / 10	16	20/24		Loose				collect sample	-	-	-	-
	21													
	22													
	23				▽					water at ~23' BGS				
S-6	24	7 / 8				Loose	Brn Tan	FGR to CGR sand and FGR to MGR gravel		wet saturated	-	-	-	-
	25	11 / 12	19	20/24		Med-Dense				collect sample	-	-	-	-

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: 2" X 2' stainless split spoon. 3.25" ID Hollow Stem Auger
140 pound auto Hammer

Drilling Area Background (ppm): NA

Converted to Well: Yes ______ No X ______ Well I.D. #: ______

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NWIRP Bethpage
BORING No.: BP-ANY-SB03
PROJECT NUMBER:
DATE: 2/2/2010
DRILLING COMPANY: ADT
GEOLOGIST: Vince Shickora
DRILLING RIG: CME 75
DRILLER: Joe McGill

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Standard Penetration Resistance (SPR) Number	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	26										-	-	-	-
	27										-	-	-	-
	28										-	-	-	-
S-7	29	9 / 6				Loose	Brn Tan	FGR to CGR sand and FGR to MGR gravel		wet saturated	-	-	-	-
	30	8 / 8	14	17/24		Loose				collect sample	-	-	-	-
					EOB									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

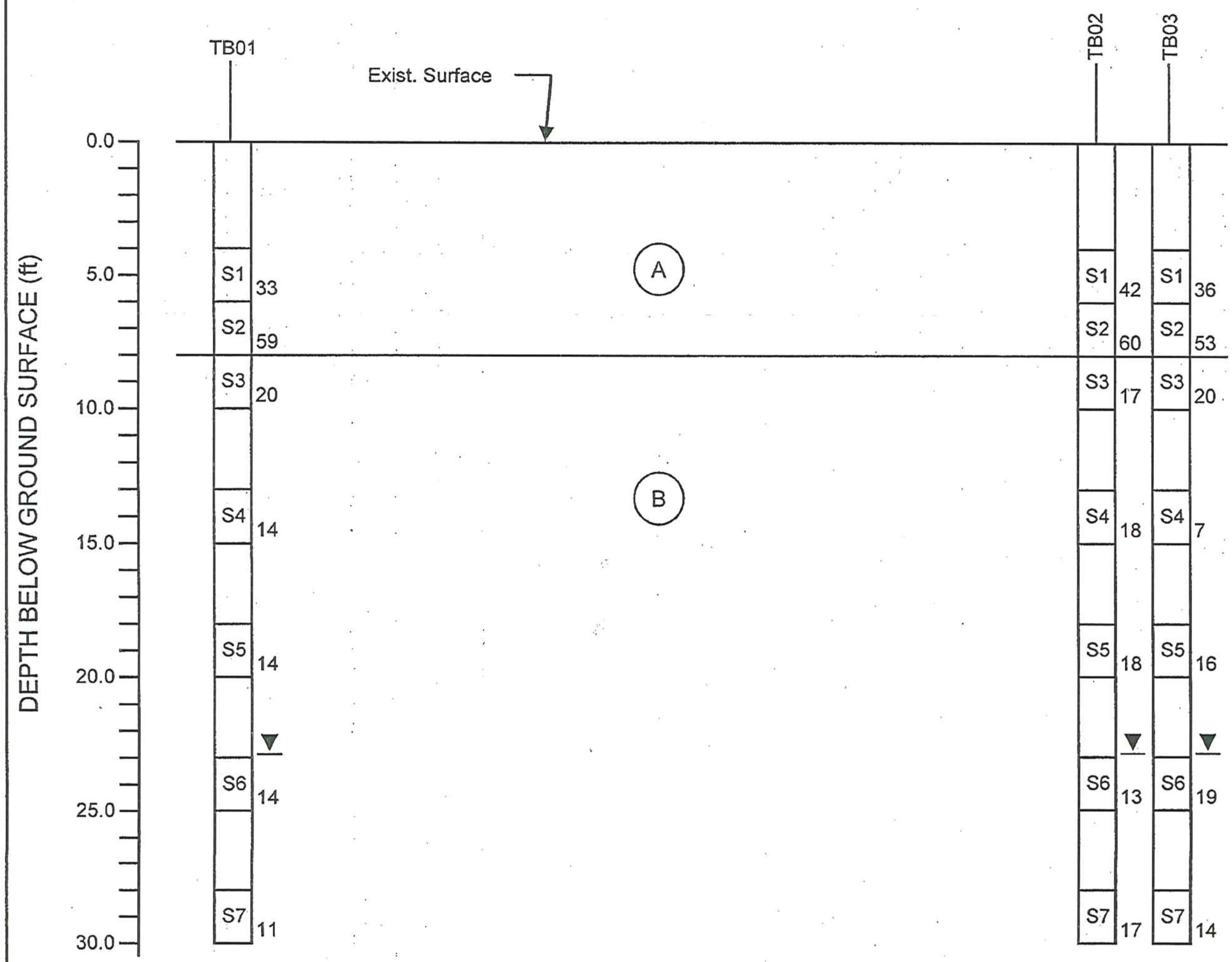
Remarks: 2" X 2' stainless split spoon. 3.25" ID Hollow Stem Auger
140 pound auto Hammer

Drilling Area Background (ppm): NA

Converted to Well: Yes ______ No X ______ Well I.D. #: ______

TETRA TECH

AQUA BETHPAGE NEW YORK - WATER TREATMENT PLANT UPGRADE
GENERALIZED STRATIGRAPHIC PROFILE (TB01, TB02 AND TB03)



GENERALIZED STRATUM DESCRIPTIONS

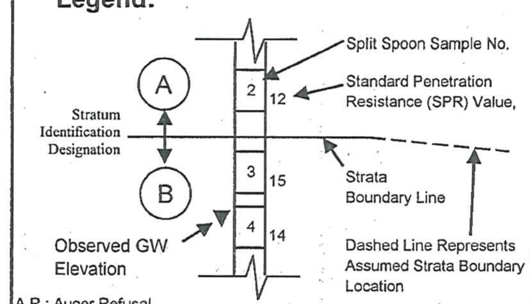
STRATUM A: DENSE, TAN BROWN, FINE TO COARSE SAND WITH SOME FINE GRAVEL AND A TRACE TO LITTLE SILT.

STRATUM B: MEDIUM DENSE, TAN BROWN, FINE TO COARSE SAND WITH SOME FINE GRAVEL AND TRACE SILT.

NOTES:

1) The profiles shown are based on our description of the samples. The test borings represent subsurface conditions encountered at each test boring location, and the profile is based on straight-line interpolation between borings. Conditions between boring location are relatively unknown.

Legend:



FIELD DESCRIPTION AND LOGGING SYSTEM FOR SOIL EXPLORATION

NONCOHESIVE SOILS
(Sand, Gravel & Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Proportions

Description Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Identification

Boulders	- 8 in. diameter or more	
Cobbles	- 3 to 8 in. diameter	
Gravel	- Coarse	-3 in. to 3/4 in. sieve
	- Fine	- 3/4 in. to No. 4 sieve
Sand	- Coarse	- No. 4 to No. 10 sieve (4.75mm - 2.00mm)
	- Medium	- No. 10 to No. 40 sieve (2.00mm - 0.425mm)
	- Fine	- No. 40 to No. 200 sieve (0.425mm - 0.074mm)
Silt/Clay	- Less Than a No. 200 sieve (<0.074mm)	

COHESIVE SOILS
(Silt, Clay & Combinations)

Consistency

Very Soft	- 3 blows/ft. or less
Soft	- 4 to 5 blows/ft.
Medium Stiff	- 6 to 10 blows/ft.
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft.
Hard	- 31 blows/ft. or more

Plasticity

Degree of Plasticity	Plasticity Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	>22

Visual Description on Drillers' Logs are made by drillers visual inspection.

Standard Penetration. Driving a 2.0" O.D., 1-3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6.0 inches of penetration on the drill log (i.e., 6/8/9). The standard penetration test results can be obtained by adding the last two numbers (i.e., 8+9=17 blows/ft.).

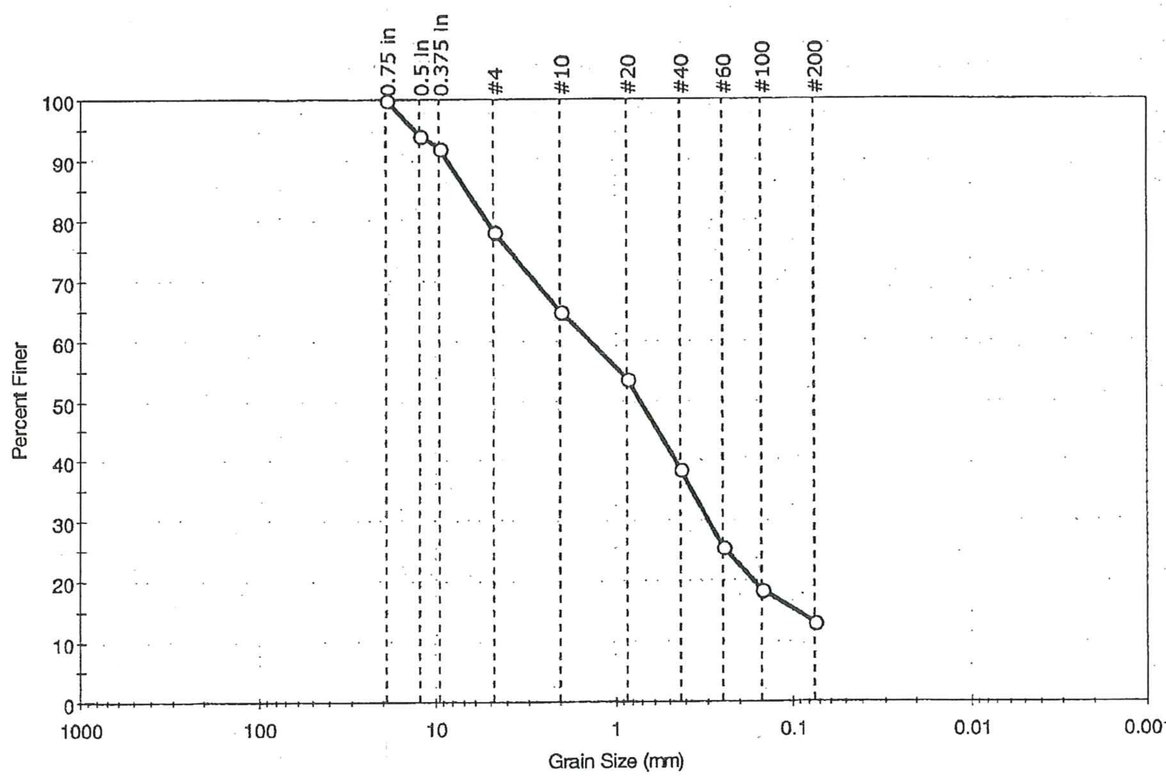
Groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

GeoTesting express
a subsidiary of Geocomp Corporation

Client: Tetra Tech, NUS Inc.			
Project: NWIRP Bethpage CTO WE25			
Location: Bethpage, NY		Project No:	GTX-9643
Boring ID: ---	Sample Type: jar	Tested By:	jbr
Sample ID: BP-ANY-SB02-0608	Test Date: 02/12/10	Checked By:	jdt
Depth : ---	Test Id: 173596		

Test Comment: ---
Sample Description: Moist, yellow silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	22.0	64.8	13.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	94		
0.375 in	9.50	92		
#4	4.75	78		
#10	2.00	65		
#20	0.85	54		
#40	0.42	39		
#60	0.25	26		
#100	0.15	18		
#200	0.075	13		

Coefficients

D_{85} = 6.7062 mm | D_{30} = 0.2994 mm
D_{60} = 1.3769 mm | D_{15} = 0.0949 mm
D_{50} = 0.7178 mm | D_{10} = 0.0488 mm
C_u = N/A | C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

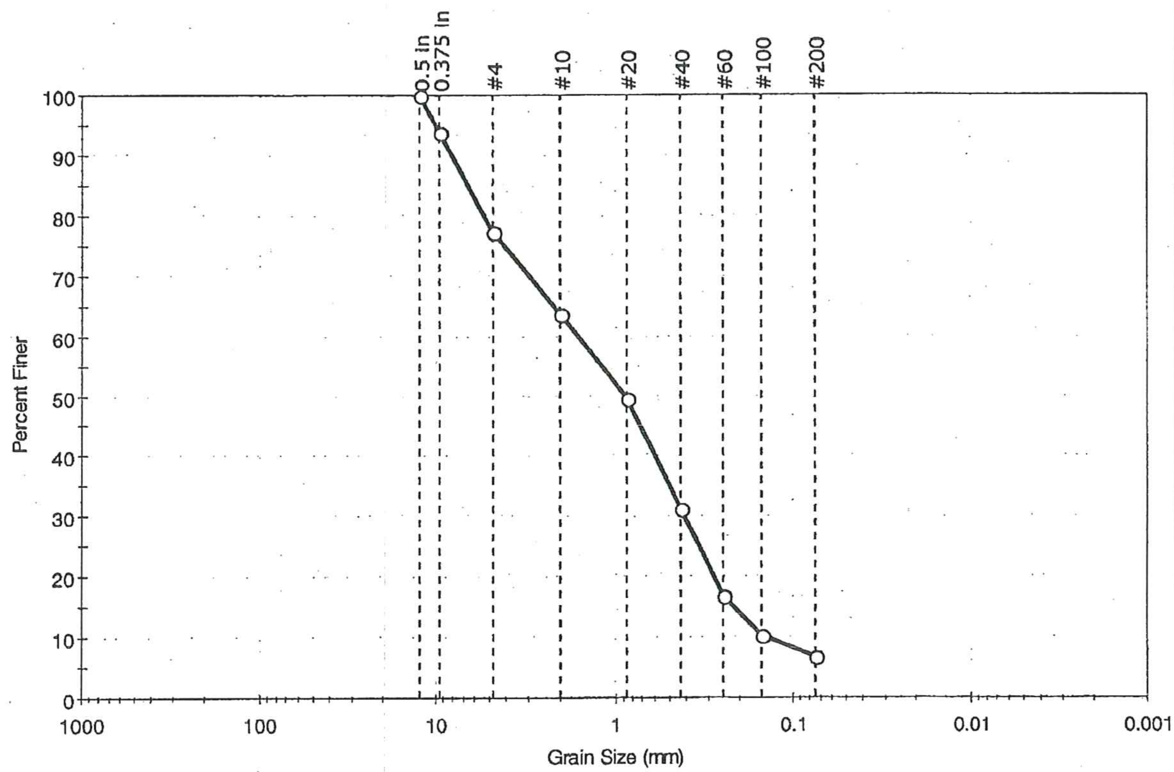
printed 2/22/2010 9:50:01 AM

GeoTesting express
a subsidiary of Geocomp Corporation

Client: Tetra Tech, NUS Inc.			
Project: NWIRP Bethpage CTO WE25			
Location: Bethpage, NY		Project No:	GTX-9643
Boring ID: ---	Sample Type: jar	Tested By:	jbr
Sample ID:BP-ANY-SB02-1315	Test Date: 02/12/10	Checked By:	jdt
Depth : ---	Test Id: 173597		

Test Comment: ---
Sample Description: Moist, yellow sand with silt and gravel
Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	22.7	70.6	6.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	94		
#4	4.75	77		
#10	2.00	64		
#20	0.85	50		
#40	0.42	31		
#60	0.25	17		
#100	0.15	10		
#200	0.075	7		

Coefficients

D_{85} =6.5708 mm
D_{30} =0.4069 mm
D_{60} =1.5970 mm
D_{15} =0.2175 mm
D_{50} =0.8656 mm
D_{10} =0.1393 mm
C_u =11.464
C_c =0.744

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

printed 2/22/2010 9:50:20 AM

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	Tetra Tech, NUS Inc.				
Project:	NWIRP Bethpage CTO WE25				
Location:	Bethpage, NY			Project No:	GTX-9643
Boring ID:	---	Sample Type:	---	Tested By:	mmd
Sample ID:	---	Test Date:	02/22/10	Checked By:	jdt
Depth :	---	Sample Id:	---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	BP-ANY-SB01-0406	---	Moist, yellow sand with silt	2.6
---	BP-ANY-SB01-0608	---	Moist, yellow silty sand	2
---	BP-ANY-SB01-0810	---	Moist, yellowish brown sand with silt	2.7
---	BP-ANY-SB01-1315	---	Moist, yellow sand with silt	2.5
---	BP-ANY-SB01-1820	---	Moist, brownish yellow sand with silt	3.1
---	BP-ANY-SB01-2325	---	Moist, yellow sand with gravel	11.3
---	BP-ANY-SB01-2830	---	Moist, yellow sand with silt and gravel	15.1

Notes: Temperature of Drying : 110° Celsius

GeoTesting express

a subsidiary of Geocomp Corporation

Client: Tetra Tech, NUS Inc.			
Project: NWIRP Bethpage CTO WE25			
Location: Bethpage, NY		Project No:	GTX-9643
Boring ID: ---	Sample Type: ---	Tested By:	mmd
Sample ID:---	Test Date: 02/22/10	Checked By:	jdt
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	BP-ANY-SB02-0406	---	Moist, brownish yellow sand with silt	4.2
---	BP-ANY-SB02-0810	---	Moist, brownish yellow sand with silt	3.5
---	BP-ANY-SB02-1820	---	Moist, yellow sand with silt	2.6
---	BP-ANY-SB02-2325	---	Moist, yellow sand with gravel	11.6
---	BP-ANY-SB02-2830	---	Moist, yellow sand with gravel	11.2

Notes: Temperature of Drying : 110º Celsius

GeoTesting express
a subsidiary of Geocomp Corporation

Client: Tetra Tech, NUS Inc.			
Project: NWIRP Bethpage CTO WE25			
Location: Bethpage, NY		Project No:	GTX-9643
Boring ID: ---	Sample Type: ---	Tested By:	mmd
Sample ID:---	Test Date: 02/22/10	Checked By:	jdt
Depth : ---	Sample Id: ---		

Moisture Content of Soil - ASTM D 2216-05

Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	BP-ANY-SB03-0406	---	Moist, yellow sand with silt	2.1
---	BP-ANY-SB03-0608	---	Moist, yellowish brown silty sand	3.7
---	BP-ANY-SB03-0810	---	Moist, yellow sand with silt	3.7
---	BP-ANY-SB03-1315	---	Moist, brownish yellow sand with silt	4.6
---	BP-ANY-SB03-1820	---	Moist, yellow sand with silt	2.5
---	BP-ANY-SB03-2325	---	Moist, yellow sand with gravel	11.3
---	BP-ANY-SB03-2830	---	Moist, yellow sand with silt and gravel	9.9

Notes: Temperature of Drying : 110° Celsius

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	Tetra Tech, NUS Inc.				
Project:	NWIRP Bethpage CTO WE25				
Location:	Bethpage, NY			Project No:	GTX-9643
Boring ID:	---	Sample Type:	---	Tested By:	mmd
Sample ID:	---	Test Date:	02/12/10	Checked By:	jdt
Depth :	---	Test Id:	173604		

Percent Passing #200 Sieve - ASTM D 1140-00

Boring ID	Sample ID	Depth	Visual Description	Fines, %
---	BP-ANY-SB01-0406	---	Moist, yellow sand with silt	8.5
---	BP-ANY-SB01-0608	---	Moist, yellow silty sand	13.8
---	BP-ANY-SB01-0810	---	Moist, yellowish brown sand with silt	8.1
---	BP-ANY-SB01-1315	---	Moist, yellow sand with silt	5.7
---	BP-ANY-SB01-1820	---	Moist, brownish yellow sand with silt	6.4
---	BP-ANY-SB01-2325	---	Moist, yellow sand with gravel	3.8
---	BP-ANY-SB01-2830	---	Moist, yellow sand with silt and gravel	6.6

printed 2/22/2010 11:33:15 AM

GeoTesting express
a subsidiary of Geocomp Corporation

Client:	Tetra Tech, NUS Inc.				
Project:	NWIRP Bethpage CTO WE25				
Location:	Bethpage, NY			Project No:	GTX-9643
Boring ID:	---	Sample Type:	---	Tested By:	mmd
Sample ID:	---	Test Date:	02/12/10	Checked By:	jdt
Depth :	---	Test Id:	173609		

Percent Passing #200 Sieve - ASTM D 1140-00

Boring ID	Sample ID	Depth	Visual Description	Fines, %
---	BP-ANY-SB02-0406	---	Moist, brownish yellow sand with silt	8.3
---	BP-ANY-SB02-0810	---	Moist, brownish yellow sand with silt	6.3
---	BP-ANY-SB02-1820	---	Moist, yellow sand with silt	6.3
---	BP-ANY-SB02-2325	---	Moist, yellow sand with gravel	2.9
---	BP-ANY-SB02-2830	---	Moist, yellow sand with gravel	2.2

GeoTesting express
a subsidiary of Geocomp Corporation

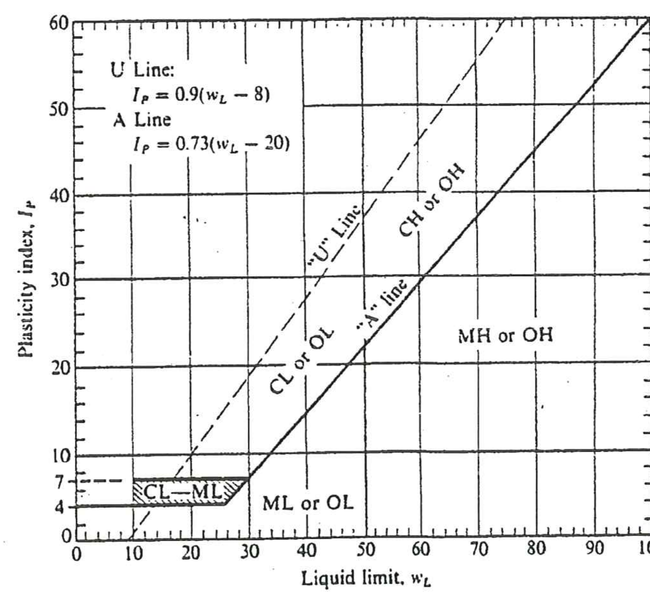
Client: Tetra Tech, NUS Inc.			
Project: NWIRP Bethpage CTO WE25			
Location: Bethpage, NY		Project No:	GTX-9643
Boring ID: ---	Sample Type: ---	Tested By:	mmd
Sample ID:---	Test Date: 02/12/10	Checked By:	jdt
Depth : ---	Test Id: 173616		

Percent Passing #200 Sieve - ASTM D 1140-00

Boring ID	Sample ID	Depth	Visual Description	Fines, %
---	BP-ANY-SB03-0406	---	Moist, yellow sand with silt	9.2
---	BP-ANY-SB03-0608	---	Moist, yellowish brown silty sand	12.2
---	BP-ANY-SB03-0810	---	Moist, yellow sand with silt	7.1
---	BP-ANY-SB03-1315	---	Moist, brownish yellow sand with silt	5.2
---	BP-ANY-SB03-1820	---	Moist, yellow sand with silt	6
---	BP-ANY-SB03-2325	---	Moist, yellow sand with gravel	3.4
---	BP-ANY-SB03-2830	---	Moist, yellow sand with silt and gravel	6.6

Unified soil classification [Casagrande (1948)]

Major divisions			Group symbols	Typical names	Laboratory classification criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent: GW, GP, SW, SP; More than 12 percent: GM, GC, SM, SC; 5 to 12 percent: *Borderline* cases requiring dual symbols‡	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting C_u or C_c requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM† (d, u)	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below A line or I_P less than 4. Limits plotting in hatched zone with I_P between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above A line with I_P greater than 7. Limits plotting in hatched zone with I_P between 4 and 7 are *borderline* cases requiring use of dual symbols
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting C_u or C_c requirements for SW
		Sands with fines (Appreciable amount of fines)	SM† (d, u)	Silty sands, sand-silt mixtures		Atterberg limits below A line or I_P less than 4. Limits plotting in hatched zone with I_P between 4 and 7 are *borderline* cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above A line with I_P greater than 7. Limits plotting in hatched zone with I_P between 4 and 7 are *borderline* cases requiring use of dual symbols
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	For all soils plotting nearly on A line use dual symbols, i.e., $I_P = 29.5$, $w_L = 60$ gives CH-OH or CH-MH. When w_L is near 50 use CL.CH, ML,MH. Take near as ±2 percent.	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
Highly organic soils			Pt	Peat and other highly organic soils		



† Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when w_L is 28 or less and the I_P is 6 or less; suffix u used when w_L is greater than 28.

‡ Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.