Appendix A
Nine Minimum Controls

Nine Minimum Controls – Requirements and Compliance Measures

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Greater New Haven Water Pollution Control Authority

November 14, 2022

Nine Minimum Controls – Requirements and Compliance Measures

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Acronyms and Abbreviations

Authority	Greater New Haven Water Pollution Control Authority
AGRU	automatic grease recovery unit
CCTV	closed-circuit television
CM	corrective maintenance
CMMS	computerized maintenance management system
CMOM	capacity, management, operations, and maintenance
COSS	Cost of Service Study
CP	cathodic protection
CSL	CSL Services, Inc.
CSO	combined sewer overflow
CSS	combined sewer system
CT DEEP	Connecticut Department of Energy and Environmental Protection
DWO	dry weather overflow
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
ESWPAF	East Shore Water Pollution Abatement Facility
FOG	fat, oil, and grease
FY	fiscal year
GIS	Geographic Information System
GNHWPCA	Greater New Haven Water Pollution Control Authority
GPS	global positioning system
HDPE	high density polyethylene
HP	horsepower
I/I	infiltration and inflow
ID	identification
IPP	Industrial Pretreatment Department
ITCP	Intermediate-Term Control Plan
kW	kilowatt(s)
LACP	Lateral Assessment Certification Program

LTCP	long-term control plan
MACP	Manhole Assessment Certification Program
MG	million gallon(s)
mgd	million gallon(s) per day
MIU	Miscellaneous Industrial User
MS4	municipal separated storm sewer system
NMC	Nine Minimum Controls
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PACP	Pipeline Assessment Certification Program
PM	preventive maintenance
POTW	publicly owned treatment works
QA	quality assurance
QC	quality control
REG	Regulator
RWA	Regional Water Authority
SCADA	Supervisory Control and Data Acquisition
SIU	Significant Industrial User
SOP	standard operating procedure
SSES	sewer system evaluation survey
SSO	sanitary sewer overflow
STCP	Short-Term Control Plan

1. Introduction

Combined sewer systems (CSSs) carry a mixture of sanitary sewage and stormwater to a treatment facility via a single pipe. During wet weather, wastewater flows can exceed the capacity of the CSS and/or treatment facilities. In such an event, sewers are designed to overflow directly to surface water bodies, such as lakes, rivers, estuaries, or coastal waters. These overflows, called combined sewer overflows (CSOs), can be a source of water pollution.

As an effort to combat CSOs, the U.S. Environmental Protection Agency (EPA) issued the CSO Control Policy on April 11, 1994. One aspect of the policy is the Nine Minimum Controls (NMCs), which are CSO-reducing measures that do not require significant engineering studies or major construction.

The NMCs are:

1. Proper operation and regular maintenance programs for the sewer system and CSO outfalls.
2. Maximum use of the collection system for storage.
3. Review and modification of pretreatment requirements to ensure that CSO impacts are minimized.
4. Maximization of flow to the publicly owned treatment works (POTW) for treatment.
5. Elimination of CSOs during dry weather.
6. Control of solid and floatable materials in CSOs.
7. Pollution prevention programs to reduce contaminants in CSOs.
8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts.
9. Monitoring to effectively characterize CSO impacts and the efficacy of CSO controls.

Jacobs has completed an update to the NMC Implementation Assessment originally included in the City of New Haven's 2001 CSO Long-Term Control Plan (LTCP). This updated assessment of the Greater New Haven Water Pollution Control Authority's (GNHWPCA's, Authority's) implementation of the NMC measures follows EPA's May 1995 Guidance Document for Nine Minimum Controls.

For each of the NMCs, the status of the control measures implemented and any deficiencies that would require future corrective action by the GNHWPCA are summarized. Based on the assessment, the GNHWPCA is in full compliance with the implementation of the NMCs and that no corrective action is required at this time.

The GNHWPCA should continue to assess and update their programs to support implementation of the NMCs, many of which are as follows:

- CSO Flow Monitoring Program
- Monthly CSO Regulators, CSO Outfalls and Duckbill Inspection Program
- Hydraulic Modeling Program/Updates
- Emergency Response Plan (ERP)
- Regulator Improvement Program
- Capacity, Management, Operating and Maintenance (CMOM) Plan

- Large Diameter Sewer Cleaning Program
- Wet Weather Operational Plan (East Shore Water Pollution Abatement Facility [ESWPAF])
- CSO Reporting Using Connecticut Department of Energy and Environmental Protection (CT DEEP) Website.

The GNHWPCA should also continue to work closely with the City of New Haven regarding pollution prevention measures such as catch basin cleaning and street sweeping.

2. NMC 1 – Proper Operation and Regular Maintenance Programs

The objective of NMC 1 is to create a program that establishes operation, maintenance, and inspection procedures to ensure that a CSS and treatment facility will maximize combined sewage treatment. The following section summarizes the requirements of NMC 1 and GNHWPCA's ongoing implementation of these requirements.

2.1 Organizations and Individuals Responsible for Operations and Maintenance

The first requirement of NMC 1 is a delineation and description of the organizations and individuals responsible for operations and maintenance (O&M).

The GNHWPCA owns, operates, and maintains their collection and treatment system; and coordinates CSO activities with the City of New Haven. The City of New Haven owns, operates, and maintains the separated storm sewer system in the City of New Haven including the catch basins that feed into the GNHWPCA's CSS. The GNHWPCA and City of New Haven coordinate activities on a regular basis.

GNHWPCA maintains an up-to-date organizational chart that is published annually as part of their Cost of Service Study (COSS). A copy of the COSS is provided to the City of New Haven to assist in coordinating CSO activities. A copy of the GNHWPCA's fiscal year (FY) 2023 organization chart identifying GNHWPCA staff roles and reporting responsibility is shown on **Figure 2-1**.

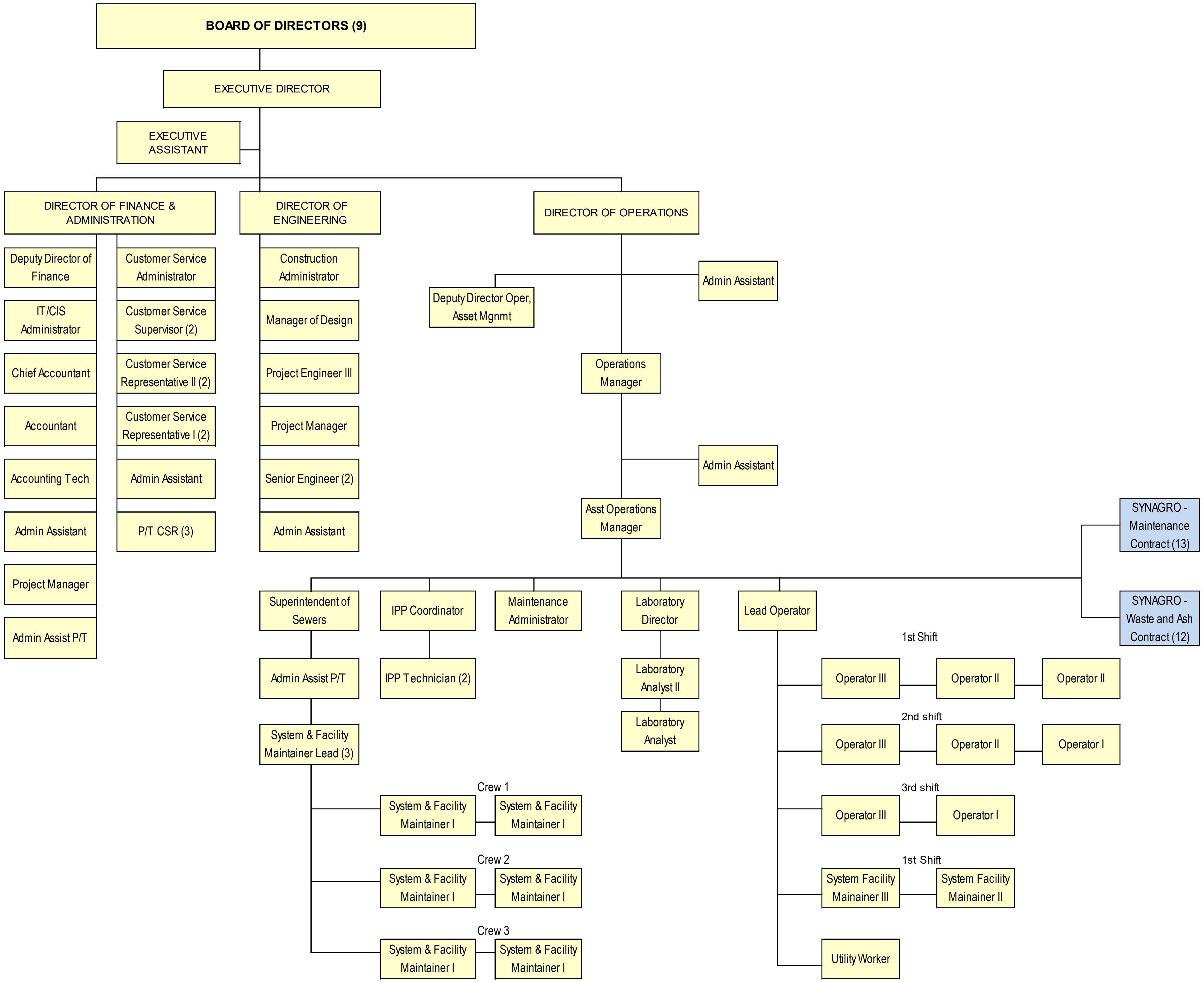

Figure 2-1. GNHWPCA Organization Chart

Table 2-1 contains the names and positions of GNHWPCA's Directors.

Table 2-1. GNHWPCA Directors

Name	Position	Contact Number
Sidney J. Holbrook	Executive Director	(203) 446 – 5280
Gabriel Varca	Director of Finance and Administration	(203) 466 – 5280
Thomas Sgroi	Director of Engineering	(203) 466 – 5185
Gary Zrelak	Director of Operations	(203) 466 – 5285

Table 2-2 contains the names and positions of key individuals at the City of New Haven that are responsible for the day-to-day management and operation of the City's separated storm system.

Table 2-2. City of New Haven

Name	Position	Contact Number
Giovanni Zinn	City Engineer	(203) 946-8101
Jeff Pescosolido	Director of Public Works	(203) 946-7700

2.2 Planning and Budgeting Procedures

NMC 1 requires planning and budgeting procedures for CSS and treatment facility O&M. This should include making resources available for O&M and the procedures for preparing and approving the annual budget. The EPA also recommends that the individuals responsible for day-to-day O&M should be encouraged to participate in budgeting. This is beneficial because these individuals can provide current field-based accounts of what is needed and not needed to carry out their daily responsibilities.

GNHWPCA's sewer collection system O&M budgeting is based on historical expense levels, review of capital requirements, and projection of future requirements to meet the level of service goals of the GNHWPCA. Budget preparation workshops that include the Directors and department supervisors are used to develop the draft annual O&M and capital budgets as the two go hand in hand. In addition, the City of New Haven is consulted as they share 40 percent of the cost of the CSO capital program.

Rate studies are performed regularly to confirm the adequacy of rates developed and include the commissioning of the annual COSS. The COSS includes a projection of the cost of service for the next 4 years and presents the recommended schedule of user rates and charges for the upcoming fiscal year. The budgeting process starts months before the final budget is approved by the GNHWPCA Board of Directors. Through this process, the GNHWPCA continues to successfully deliver required services while maintaining sound cost control. The GNHWPCA also strives to maintain an operating reserve equal to 6 months of annual O&M expense in case of emergencies.

Table 2-3 summarizes the historic and projected annual O&M and total annual budgeted costs for the GNHWPCA.

Table 2-3. Summary of Historical Revenue and Expenses

Description	FY2014	FY2015	FY2016 (Approved)
Revenues			
Billing Revenues[a]	$34,176,430	$34,965,518	$36,236,798
Other Revenue[b]	5,220,563	4,204,000	4,176,000
Total Revenue	**$39,396,993**	**$39,169,518**	**$40,412,798**
Expenses			
O&M	27,454,762	27,454,762	28,051,441
Debt Service [c]	10,823,816	11,164,277	10,715,614
Total Expenses	**$38,278,578**	**$38,619,039**	**$38,767,055**

[a] Represents actual billing revenues received (that is, net of receivables management costs).

[b] Includes City of New Haven CSO cost share.

[c] Excludes depreciation expense.

2.2.1 Cost of Service Study

The Executive Director, in accordance with the GNHWPCA sewer ordinance, will ensure that a COSS is performed at least annually. The objective of the COSS is to produce a schedule of recommended user rates and charges for the customers of the GNHWPCA's system, which will be sufficient to meet the anticipated costs of operating the sanitary sewer system for the upcoming fiscal year. The COSS shall include:

- A review and evaluation of the proposed expense budget for the upcoming fiscal year, and preparation of cost estimates for the succeeding four fiscal years based on the Executive Director's cost estimates.
- A review and evaluation of the proposed revenue budget for the upcoming fiscal year, and preparation of cost estimates for the succeeding four fiscal years based on the Executive Director's revenue estimates.
- Determination of the projected revenue requirement from user rates for the upcoming fiscal year and the succeeding four fiscal years.
- Development of a schedule of recommended rates and charges sufficient to support the estimated annual revenue requirements from user rates for the upcoming fiscal year and the succeeding four fiscal years.
- Analyzing the GNHWPCA's historical collection rate, including the current fiscal year and the Executive Director's estimate of the collection rate for the upcoming fiscal year.
- Preparation of a report documenting recommendations, assumptions, and methodology.
- Other information as required by the Executive Director from time to time.
- The Executive Director shall review the results and submit the COSS to the GNWHPCA Board of Directors on or before the third Monday in April.
- The Executive Director shall submit one copy of the adopted "Annual Budget" of the GNHWPCA to the State of Connecticut Office of Policy and Management by the July 1st of each year or within 30 calendar days after the adoption of the budget, whichever is later pursuant to the act.

2.3 List of Critical GNHWPCA Facilities

The following facilities, including collection system piping and related structures, are critical to CSS performance:

- **Critical Facilities:**
  - ESWPAF to Treat Dry and Wet Weather Flows
  - Pump Stations. GNHWPCA owns and operates 30 pump stations, 3 of which are critical to CSS performance including the East Street, Union, and Boulevard Pump Stations.
- **Critical Combined Sewers and Related Structures:**
  - Gravity Sewers
  - Force Mains
  - Regulator Structures (see **Table 2-4**)
  - Diversion Structures
  - 5 million gallon (MG) Truman CSO Storage Tank
  - Large Diameter Combined Sewers Prone to Sedimentation
  - CSO Outfalls (see **Table 2-4**)
  - Tidal Check Valves on CSO Outfalls
  - Siphons. GNHWPCA owns and operates 6 siphons, with the James Street Siphon located in the CSS area being the most critical to CSS performance.

The GNHWPCA's Computerized Maintenance and Management System (CMMS) maintains and monitors performance of the critical facilities. The GNHWPCA's Geographic Information System (GIS) maintains information on the sewer collection system piping and related CSS control structures. GNHWPCA staff have remote access to the GIS information to readily facilitate O&M or emergency response when in the field.

The GNHWPCA's CSO Flow Monitoring Program (initiated in 2012) measures, on a continuous basis, the flows to the CSO regulators and at the CSO outfalls. This flow monitoring program provides GNHWPCA with data to measure and further evaluate performance of these critical facilities.

GNHWPCA's CMMS, GIS, and flow monitoring program have proven highly effective at monitoring and maintaining the GNHWPCA's critical facilities. These systems also assist in managing customer service requests, data capture, and work crew observations of collection system conditions, timely reporting, and documentation of all required bypass notifications. These systems are an integral tool to conduct preventive maintenance and coordination of rehabilitation and replacement projects.

Table 2-4. List of CSO Outfalls and Regulators

NPDES CSO #[a]	NPDES Regulator Location [a]	NPDES CSO Receiving Water [a]	NPDES CSO Status [a]	CSO #[b]	CSO Status [b]	Reg # [b]	Reg Status [b]
#003	E.T. Grasso Boulevard at Orange Avenue	West River	Active	#003	Active	#003	Weir raised 16 inches in 2020
#004	E.T. Grasso Boulevard at Legion Avenue	West River	Active	#004	Active	#004	Weir raised 24 inches in 2020
#005	E.T. Grasso Boulevard at Derby Avenue	West River	Active	#005	Active	#005	Weir raised 1.45 feet in 2014
#005 (A)	University Place	West River	Active	None	Closed prior to 2008	None	Closed prior to 2008
#005 (B)	Elm/University Place	West River	Active	None	Closed prior to 2008	None	Closed prior to 2008
#006	Whalley Avenue at Fitch Street	West River	Active	#006	Active	#006	Weir raised 42 inches in 2020
#008	Munson Street at Orchard Street	Mill River	Active	#008	Closed in 2014	#008	Closed in 2014
#009	Grande Avenue at James Street	Mill River	Active	#009	Active	#009	Weir raised 8 inches in 2015 and an additional 6 inches in 2022
#010	East Street at I-91 (2 Weirs/2 Regulators)	Mill River	Active	#010	Closed in 2014	#010	Closed in 2014
#010 (A)	East Street at I-91 (2 Weirs/2 Regulators)	Mill River	Active	#011	Active	#010 (A)	Closed in 2020
#011	Humphrey Street at I-91	Mill River	Active	#011	Active	#011	Active
#012	Mitchell Drive east of Nicoll Street	Mill River	Active	#012	Closed in 2018	#012	Closed in 2018
#013	Everitt Street at East Rock Road	Mill River	Active	#013	Closed in 2014	#013	Closed in 2014
#013 (A)	East Rock Road at Everitt Street	Mill River	Active	None	Closed prior to 2008	None	Closed prior to 2008
#014	Trumbull Street at Orange Street	Mill River	Active	#011	Active	#014	Closed in 2014
#015	James Street Siphon	Quinnipiac River	Active	#015	Active	#015	Weir raised 18 inches in 2022
#016	Poplar Street at River Street	Quinnipiac River	Active	#016	Active	#016	Weir repaired in 2014 and raised 6 inches in 2022
#019	Pine Street at North Front Street	Quinnipiac River	Active	#019	Closed in 2015	#019	Closed in 2015
#020	Quinnipiac Avenue at Clifton Street	Quinnipiac River	Active	#020	Closed in 2019	#020	Closed in 2019
#021	East Street Pump Station	New Haven Harbor	Active	#021	Active	#021	Active

Table 2-4. List of CSO Outfalls and Regulators

NPDES CSO #[a]	NPDES Regulator Location[a]	NPDES CSO Receiving Water[a]	NPDES CSO Status[a]	CSO #[b]	CSO Status[b]	Reg #[b]	Reg Status[b]
#021 (A)	Chapel/Hamilton	New Haven Harbor	Active	None	Closed prior to 2008	None	Closed prior to 2008
#024	Boulevard Pump Station (Sea Street)	New Haven Harbor	Active	#024	Active	#024	Weir raised 1.5 feet in 2017
#025	Union Pump Station (Union and State Street)	New Haven Harbor	Active	#025	Active	#025	Weir raised 9.15 feet in 2019
#025 (A)	Elm/University Place	New Haven Harbor	Active	None	Closed prior to 2008	None	Closed prior to 2008
#025 (B)	Grove/Whitney	New Haven Harbor	Active	None	Closed prior to 2008	None	Closed prior to 2008
#026	Humphrey Pump Station	Mill River	Active	#011	Active	#026	Closed in 2019
#027	East/Ives	Mill River	Active	None	Closed prior to 2008	None	Closed prior to 2008
#028	Mitchell Pump Station	Mill River	Active	#012	Closed in 2018	#028	Closed in 2018
#031	S. Frontage/Davenport	New Haven Harbor	Active	None	Closed in 2013	None	Closed in 2013
#032	Port Sea/Liberty	New Haven Harbor	Active	#025	Active	#032	Closed in 2014
#033	Carlisle/Liberty	New Haven Harbor	Active	None	Closed prior to 2008	None	Closed prior to 2008
#034	George/Temple	New Haven Harbor	Active	#025	Active	#034	Closed in 2019
	Greene Street	New Haven Harbor	Active	Greene	Closed in 2014	Greene	Closed in 2014
	Middletown/Front	Quinnipiac River	Active	None	Closed prior to 2008	None	Closed prior to 2008
				11	Active CSOs	11	Active Regulators

[a] NPDES Permit # CT 0100366 dated February 9, 2016.

[b] Ongoing CSO Flow Monitoring Program initiated in June 2012.

2.4 Written Procedures and Schedules for Routine, Periodic Maintenance of Major Equipment, and CSO Diversion Facilities

NMC 1 also requires written procedures and schedules for routine, periodic maintenance of major equipment and CSO diversion facilities, with a focus on preventive maintenance (PM). The GNHWPCA's CMMS documents procedures, schedules, and status of performed and required maintenance with a focus on PM for all the GNHWPCA's facilities. In addition, the GNHWPCA's 2011 *Capacity, Management, Operations, and Maintenance (CMOM) Plan* provides goals and programs for collection system inspections and maintenance.

The GNHWPCA's CMOM Plan was updated in 2017 to reflect the findings of the GNHWPCA's comprehensive CMOM Program Assessment (completed in February 2016) as documented in its CMOM Corrective Action Plan (completed in April 2016). The updated CMOM Program Manual was submitted to EPA and CT DEEP in April 2017. The implemented programs include a more proactive hydrogen sulfide monitoring and control program; a fat, oil, and grease (FOG) education program targeted toward residential establishments; a siphon and pressure sewer cleaning and inspection program; and a forcemain performance monitoring program.

2.4.1 Preventive Maintenance

The Authority's Collections Lead will create CMMS work orders for Subsewer Sheds and provide identifying mapping for Stick Camera or Closed Circuit Television (CCTV) Assessment to be performed as part of the PM Program. PM actions are as follows:

- Ensure that field crews are provided with all necessary emergency equipment.
- The Collections Facility Maintainers Crew are assigned CMMS work orders from their Collections System Leads, accompanied by mapping of subsewer sheds to perform Stick Camera Inspections.
- The Collections Crew will identify these Stick Camera Inspections by asset Identification (ID) and load this information into one of the Authority's field computers. The Collections Crew records information identifying issues based on NASSCO Manhole Assessment Certification Program (MACP)/Lateral Assessment Certification Program (LACP) ratings along with data required within the Field Identification Form.
- This information is uploaded and integrated in the field to the Authority's GIS program which contains the age, condition, materials, and the last date of inspection of each element of the collection system.
- The Facility Maintainer performing the Stick Camera Inspection may identify issues that may need immediate attention and are required to notify the Collections Lead who will use the CMMS work order system to create a follow-up work order to address these issues (that is, Blockages, Surcharged System, Compromised Pipe, or Structures).
- Stick Camera Assignments will also determine areas where the Authority's manhole structures are buried or damaged, and in need of repair or replacement.
- The ongoing Manhole Raising Program adjusts approximately 200 manhole structures per year that need raising or replacement due to routine paving, projects or age.
- Manholes to be raised or replaced are assigned to the Authority's contractor through the CMMS work order system and accompanied by a map identifying the asset ID.
- The manhole structures identified as buried and failed during the Stick Camera Inspections will automatically generate a new follow-up work order. These follow-up work orders are accessed once the Authority's contractor has raised the structure and access is available.

- The Facility Maintainer, upon completion of the requested Stick Camera work order, will close out this work order and turn over the information to the Authority's Engineering Department for evaluation.
- The Engineering Department works collaboratively with, and provides technical assistance to, the Collections Department to determine which Stick Camera information may require follow-up CMMS work orders (that is, manhole raising, closed-circuit television [CCTV] inspections, map errors, cleaning, repair, or replacement).

The following sections summarize GNHWPCA's maintenance procedures for specific components of the overall system.

2.4.2 Collection System Maintenance

The Collections Crew, the Engineering Department, or an Authority's Consultant identifies areas within the Collections System which may require a follow up CMMS work order for rehabilitating or replacing sewers to address operational problems, such as blockages, or structural problems and reports back to the Collections Department Leads. Sewers experiencing operational or structural problems can be identified through SSO Evaluations, Stick Camera Inspections, Infiltration and Inflow (I/I) Studies, Sewer System Evaluation Surveys (SSESs), Root Intrusion Treatments, Heavy Grease Removal, CCTV Inspection, Follow-up Cleaning and Visual Inspections.

The Authority has completed Cleaning and CCTV inspection of over 59,000 feet of large diameter sewers (between 44 inches and 82 inches nominal diameter) since 2014 throughout the collection system. An additional 110,000 feet of sewers smaller than 44 inches in nominal diameter were cleaned and CCTV inspected during the same timeframe. The program has resulted in the removal of over 3,000 cubic yards of debris from within the collection system.

The Collections Leads create a follow up CMMS work order that defines deficiencies within the system. The Collections Leads and the Collections Crew meet with the Collections System Superintendent to identify sewers that may need rehabilitation and/or replacement. The Collections System Superintendent or the Collections System Leads identify these deficiencies and submit a report within the CMMS based off the NASSCO Pipeline Assessment Certification Program (PACP)/MACP/LACP ratings and turn over these reports to the Authority's Engineering Department. The Collections System Superintendent reviews the CMMS rehabilitation work orders and identifies the emergency replacement CMMS work orders. The Collections System Superintendent addresses emergency replacement CMMS work orders by creating a failure of that asset that will create a new work order in the CMMS system that will be assigned to the Authority's Engineering Construction Manager. The Engineering Department then procures a Contractor to rehabilitate or replace the sewers experiencing operational or structural problems. This program has proven effective at identifying, rehabilitating, and replacing sewers with operational or structural problems.

2.4.3 Pump Stations

The Authority uses a CMMS to ensure routine inspections and maintenance is performed consistently. PM Schedules have been systematically developed for each of the pump stations. These PMs automatically generate work orders on predetermined schedules to be completed by the Authority's Personnel and Maintenance Contractor. The work orders include checklists for the maintenance staff and operators to complete. A record of all results is maintained in the CMMS. A corrective maintenance (CM) work order is generated for any items that required follow-up or repair.

Comprehensive Condition Assessments are generally performed on 5-year intervals by an independent outside engineering firm. The most recent Comprehensive Condition Assessment was performed in 2017. Condition Assessments are used to assist in preparation of the 5-year Capital Plan. Weekly and monthly inspections help identify capital projects to maintain reliability. Major maintenance repairs and capital replacement are executed through onsite maintenance contractors with approval by the Authority.

All pump stations are inspected at least every week by a staff dedicated to pump station operation and inspections. Larger pump stations are inspected more frequently (up to three times a week). Checklists and PM work orders are completed and work order requests are promptly submitted for any items requiring attention.

The Authority has Emergency Generators available at all its large and mid-sized pump stations (above 10 horsepower [HP]) except for the Union Pump station. Emergency power can be supplied to the Union Pump Station via one or more of the Authority's four trailer mounted portable generators whose capacities range from 150 kW to 1.5 mW. There are seven small pump stations (10 HP or less) that do not have permanently installed generators. These pump stations may be maintained during a power outage by the Authority's 35-kW portable generator, Vac-truck, one of the four Authority-owned portable diesel pumps or vacuum-truck contractors.

The Authority has a well-defined hierarchy of incident command and control during emergencies. There are positions that are defined to dispatch resources to suit the conditions of the emergency.

All the Authority's pump stations contain at least one installed redundant pump and can maintain station pump capacity with one pump out of service. The Truman CSO Storage Tank does not have an installed redundant pump but has a spare pump that can be readily swapped with the installed pump if it fails.

Any issues are addressed by assigning a corrective work order. Management reviews the equipment status of all pump stations monthly to ensure issues are being addressed on a timely basis and the proper resources are assigned. The Grit Collectors located at the East Street and Boulevard Pump Stations have proven difficult to maintain. The Authority has been replacing the bucket and chain system grit collectors with a Screw Conveyor type system.

2.4.4 Siphons

Inspection of the James Street Siphon is performed on an annual basis. Cleaning and CCTV inspection of the James Street Siphon was completed in 2016.

The GNHWPCA Collections Department completed cleaning the other seven of the Authority's siphons in 2016, to establish a starting point for the Siphon PM Program in 2017.

The Siphon PM Program includes:

- Self-generating work orders within the CMMS system to clean the Short Beach Road siphon in East Haven every 6 months.
- Self-generating work orders within the CMMS system to clean the Whitneyville siphon in Hamden every year.
- Self-generating work orders within the CMMS system for semi-annual Stick Camera Inspections for the other five siphons (followed by cleaning if required).
- Self-generating work orders within the CMMS system for annual siphon cleaning for the other five siphons.

2.4.5 Force Mains

2.4.5.1 Force Main Performance Assessment

The Authority uses pump station flow monitoring and pressure data from the Supervisory control and data acquisition (SCADA) system as well as amp readings recorded during routine pump station inspections to assess the performance of the 30 force mains. A reduction in pump station pumping capacity, increase in pressure, or an out-of-range amp reading will trigger a work order in the CMMS to investigate and correct the cause of the problem.

2.4.5.2 Air Release Valves

The Authority has replaced the force main air/vacuum relief valves throughout the system. Procedures have been developed to inspect, flush, and maintain the eight air release valves on an annual basis. These PMs will reside and be tracked in the CMMS system.

2.4.5.3 Inline Valves

The Authority has a program to inspect and maintain the five in-line valves that are over 24 inches in diameter on an annual basis. These activities are tracked in the CMMS system.

2.4.5.4 Force Main Structural Condition Assessment

The Authority has evaluated several force main inspection technologies. The Authority has undertaken a targeted approach to inspections of the force mains throughout the system. When construction activity is adjacent to a force main, the exposed pipe is inspected visually. In the case of major force mains, the pipe receives an ultrasonic scan to document the wall thickness. The force main pressures are monitored and recorded during pump station inspections to detect potential blockages or leakage. Concrete force mains that may be subject to hydrogen sulfide degradation at the outlet are inspected using stick camera, CCTV, or manned entry inspection while the pump station is taken offline for the inspection.

As a result of routine scheduled inspections, the Morris Cove force main discharge was drained and inspected. As a result, the discharge pipe was then scheduled for a coating to prevent hydrogen sulfide corrosion from affecting the integrity of the force main.

During rehabilitation and Resiliency Improvements of the Far View Pump Station, the force main was replaced to provide safe operating conditions into the future.

2.4.5.5 Cathodic Protection

The 3-mile-long ductile iron force main from the Boulevard and East Street Pumping Stations to the ESWPAF is equipped with a cathodic protection (CP) system. CP is the application of direct current to polarize or shift the electrochemical voltage of a metallic surface to a point where the driving force for the corrosion reaction is eliminated. The 36-inch diameter ductile iron force main from the Boulevard Pump Station to East Street Pump Station is 6,806 feet long and was constructed in 1985. The 42-inch-diameter and 48-inch-diameter ductile iron force mains from the East Street Pump Station to the Harbor Crossing are 3,536 feet long and were constructed in 1983. The twin barrel 42-inch-diameter ductile iron and high density polyethylene (HDPE) force mains under New Haven Harbor were replaced in 2008. The ductile iron portion of each barrel under New Haven Harbor is approximately 340 feet long and is protected by the CP system. The HDPE portion of each barrel is approximately 1,785 feet long and is not protected by the CP system. The 48-inch diameter ductile iron force main from the Harbor Crossing to the ESWPAF is 5,497 feet long and was constructed in 1983.

The CP system consists of five impressed current cathodic protection system rectifiers located at Boulevard Pump Station, East Street Pump Station, one at each end of the Harbor Crossing, and at the ESWPAF. There are test stations that allow for monitoring the effectiveness of the CP system. The Authority hires a consultant annually to conduct an inspection of the condition of the CP system and make recommendations for improvements to the CP system. Implementation of large capital improvements are typically scheduled for a subsequent fiscal year. In 2022, the improvements included the addition of permanent test coupons and detailed inspections of isolation flanges to confirm separation of cathodic protection systems from one another.

2.4.6 Regulators and Tide Gates

The Authority owns and maintains six tidal check valves that prevent extreme tides from entering the system through five CSO Outfalls. The tidal check valves were installed between 2010 and 2014 to replace aging metal flap tide gates. The tidal check valves are located at CSO Outfalls 009, 015, 016, 021 and 024. There are two tidal check valves on CSO Outfall 024.

Each of the five tidal check valves is inspected on a monthly basis. Any deficiencies noted will trigger a work order in the CMMS to investigate and correct the cause of the problem.

2.5 Written Procedures for Emergency Response

The ERP was developed by the GNHWPCA to strengthen the Authority's ability to effectively respond to and rapidly recover from a range of emergencies. The ERP expands upon emergency response material previously developed for the GNHWPCA, incorporating significant new elements specifically tailored for the GNHWPCA. The ERP is intended to be a consolidated response reference for the full range of potential emergency conditions the GNHWPCA faces. It also is meant to be a living document, regularly updated as new incidents generate "lessons learned" that should inform changes.

2.5.1 Purpose of the ERP

The purpose of ERP is to provide a set of guidelines to GNHWPCA staff to aid in executing a rapid, effective response to and rapid recovery from emergency conditions. Toward that objective, this ERP provides specific guidance in three core aspects of emergency response tailored to the GNHWPCA system:

1. Identifies the GNHWPCA person responsible for coordinating the emergency.
2. Provides response procedures for various asset types.
3. Describes an internal and external communications process.

The ERP is premised on the well-established principle that effective emergency response requires a commitment to preparation. Accordingly, the ERP provides recommendations for measures to be implemented before an emergency to better facilitate the GNHWPCA response when emergency conditions arise. These recommendations are provided for both long-range planning and training purposes.

No ERP can be a substitute for sound judgment and the need to often improvise during times of crisis. At its best, it should serve as a highly-regarded resource, consulted during each step of an emergency to reduce the risk that key aspects of the response have been overlooked.

2.6 Policies and Procedures for Training O&M Personnel

An O&M program includes policies and procedures for training new O&M personnel. GNHWPCA provides technical training to the O&M staff on an annual basis. Collection system certifications are documented and reported annually. Contractors are required to provide, to maintain, and to track appropriate training for their employees for any contracted work, and to comply with GNHWPCA's health and safety and training policies. GNHWPCA's training and safety program has proven effective at providing proper training and safety equipment for all the GNHWPCA staff involved with CSS O&M. The following section provides an overview of the GNHWPCA's training and safety program.

2.6.1 Training and Safety Programs

GNHWPCA uses outside contractors and online certification programs to implement the following training and safety programs:

- Water Environment Association Certification
- Fork Lift Operators Permit
- Confined Space Entry
- Occupational Safety and Health Administration 10-hour Certification
- NASSCO PACP/MACP/LACP
- Flagger Training

- Smith Driving Course, Forward, Backup, and Distracted
- Sanitary Sewer Overflow (SSO) Estimating and Reporting Training
- Weekly Tailgates
- Hazard Communications Material Safety Data Sheet
- Lockout/Tag-out
- Excavation/Trenching
- Bloodborne Pathogens
- CPR and First Aid

2.6.2 Safety Equipment

GNHWPCA's Safety Committee reviews all standard operating procedures (SOPs) and field procedures, and provides recommendations for improvement through an after-action analysis. This program has proven effective at providing proper training and safety equipment for all GNHWPCA's staff involved in collection system O&M. The following equipment is required and used in daily operations of GNHWPCA's collections crew:

- Personal protective equipment
  - gloves
  - boots
  - hard hats
  - safety glasses
- Safety cones
- Road signs
- Strobe lights
- Retrieval Tripod and Harness
- Fall protection equipment
- Hazardous atmosphere gas meters
- Manhole ventilator and tubing
- Flashlights
- Two-way radios
- CDL vehicle backup cameras

2.7 O&M Program Review and Revision

The GNHWPCA's CMMS documents procedures, schedules, and status of performed and required maintenance with a focus on PM for all the GNHWPCA's facilities. In addition, the GNHWPCA's 2016 *Capacity, Management, Operations, and Maintenance (CMOM) Plan* provides goals and programs for collection system inspections and maintenance.

The GNHWPCA's CMOM Plan include implementing a more proactive hydrogen sulfide monitoring and control program, FOG education program targeted toward residential establishments, siphon and pressure sewer cleaning and inspection program, and force-main performance monitoring.

The GNHWPCA's CMMS maintains and monitors performance of the critical facilities. The GNHWPCA's GIS maintains information on the sewer collection system piping and related CSS control structures. GNHWPCA staff have remote GPS access to the GIS information to readily facilitate O&M or emergency response when in the field.

The GNHWPCA's CSO Flow Monitoring Program (initiated in 2012) measures, on a continuous basis, the flows to the CSO regulators and at the CSO outfalls. This flow monitoring program provides GNHWPCA with data to measure and further evaluate performance of these critical facilities.

GNHWPCA's CMMS, GIS and flow monitoring program have proven highly effective at monitoring and maintaining the GNHWPCA's critical facilities as well as assisting in managing customer service requests, incorporating work crew observations into collection system conditions reports and bypass reports, timely performance, and documentation of all required bypass notifications, conduct of PM and coordination of rehabilitation and replacement projects. These tools are updated continuously to reflect the most current information.

3. NMC 2 – Maximization of Storage in the Collection System

The objective of NMC 2 is to enact simple CSS modifications to improve wet weather flow storage such that excess flow is retained in the system until downstream sewers and treatment facilities are ready to convey and treat the flows. Implementing this NMC involves identifying possible locations where minor modifications can be made and subsequently analyzing each potential modification to ensure that it will not cause problems and only benefit the collection system. Possible modifications include removing accumulations of debris or sediment; replacing undersized sections of pipe; identifying and repairing malfunctioning regulators or broken weirs; inspecting, maintaining, and repairing tidal check valves; adjusting regulator settings; upgrading and adjusting pump operations at interceptor lift stations; and removing other flow obstructions.

The GNHWPCA uses data from the CSO Flow Monitoring Program, CSO regulator, outfall, and tidal check valves inspection program; collection system hydraulic model (updated in 2015); large diameter sewer cleaning program, and SSO bypass reports to evaluate and maximize the capacity of the collection system and cost effectively implement its LTCP. This program has proven effective at reducing CSO volumes by more than 66 percent (from 126 MG in 1997 to 43.3 MG in 2015 during the Typical Year [as defined in the 2001 LTCP]). Further reduction in CSOs took place from the Short-Term Control Plan (STCP) Improvements to achieve approximate 20 MG during the typical year. The proposed Intermediate-Term Control Plan (ITCP) projects (as defined in the 2016 LTCP Update) are expect to reduce CSO volumes by an additional 7 MG to 12.8 MG.

GNHWPCA also has an ongoing program to fund and implement I/I studies, sewer system evaluation surveys, and sewer rehabilitation projects. The purpose of these projects is to reduce extraneous flows into the sanitary sewer collection system and ultimately to the ESWPAF to further maximize conveyance and treatment capacity at the ESWPAF.

3.1 Minor Combined Sewer System Modifications

The initial inception of CSOs (more than a century ago) was to eliminate basement and street flooding during high intensity rainfall events while degradation of receiving water quality was not a concern. For this reason, modern day operation parameters inherited from original design is still reminiscent of the original design concept even after alteration of the sewer system in recent day. Coupled with modern analytic techniques (such as modeling, investigation, and sensing), evaluation of sewer system performances can be extended to an unprecedented level of details to aid the decision maker in achieving the cost-effective abatement objects for CSO reduction. Primarily, regulators designed in the late 1800s and early 1900s can now be modified and closed to achieve the maximum potential in-system storage while not putting basements or streets at risk. The Authority uses data from the CSO Flow Monitoring Program and the 2014 hydraulic model of the CSS to make decisions about minor CSS modifications.

GNHWPCA has successfully inactivated thirteen CSO outfalls, by the closing of 13 regulators. The overflow weirs at nine regulators were raised since 2005 as shown in **Table 3-1**. The remaining 11 active regulators continue to be inspected and monitored on a regular basis. Further evaluations continue of the regulators to determine what additional improvements, if any, can be made to further reduce CSOs.

Table 3-1. CSO Improvements (2018 – 2022)

CSO No. and Type			Discharge Location	Improvement
#003		REG	West River	Weir raised 16 inches in 2020
#004		REG	West River	Weir raised 24 inches in 2020
#006		REG	West River	Weir raised 42 inches in 2020
#009		REG	Mill River	Weir raised 8 inches in 2015 and by 6 inches in 2022
#010 (A)		REG	Mill River	Closed in 2020
#012	CSO		Mill River	Closed in 2018
#015		REG	Quinnipiac River	Weir raised 18 inches in 2022
#016		REG	Quinnipiac River	Weir repaired in 2014 and raised 6 inches in 2022
#020	CSO		Quinnipiac River	Closed in 2019
#024		REG	New Haven Harbor	Weir raised 1.5 feet in 2017
#025		REG	New Haven Harbor	Weir raised 9.15 feet in 2019
#026	CSO		Mill River	Closed in 2019
#028	CSO		Mill River	Closed in 2018
#034	CSO		New Haven Harbor	Closed in 2019

CSO outfall closures and regulator improvements made before this update to the LTCP are listed as follows for reference:

- Closed CSO 002
- Raised the weir at REG 004 by 8 inches
- Raised the weir at REG 005 by 1.45 feet
- Closed REGs 005A and 005B
- Closed CSO 008
- Raised the weir at REG 009 by 8 inches
- Closed CSO 010
- Raised the weir at REG 012 by 6 inches
- Closed CSO 013
- Closed REG 013A
- Closed REG 014
- Closed CSO 019
- Closed REG 021A
- Raised the weir at REG 024 by 1.56 feet
- Closed REGs 025A and 025B
- Closed CSO 027
- Closed REG 031
- Closed REG 032
- Closed REG 033
- Raised the weir at REG 034 by 2 feet
- Closed CSO Greene
- Closed REG Middletown/Front

3.2 Wet Weather Pumping Capacity Upgrades

Increasing the wet weather pumping capacity at the East Street, Union, and Boulevard pump stations and increasing the wet weather treatment capacity at the ESWPAF are integral components of the approved CSO LTCP. The $60M Construction of Phase 1 improvements at the ESWPAF were completed in 2017. The Wet Weather Capacity Improvements at the East Street Pump Station are under design. They will increase capacity from 30 million gallons per day (mgd) to 45 mgd on an interim basis with capabilities to reach 65 mgd in the Long Term Improvements. Wet weather capacity improvements will increase the Union Pump Station from 15 mgd to 35 mgd, and the Boulevard Pump Station from 30 mgd to 45 mgd. These Intermediate-Term improvements are underway. These pump stations will be held at their current capacities until the Phase II and Phase III Wet Weather Capacity Upgrades at the ESWPAF have been completed.

3.3 Storm Drain System Capacity Upgrades

Also as part of the LTCP, the City of New Haven has hired a consultant to develop a long-term plan to increase the capacity of the storm drain system around REG 025, which will eliminate stormwater inflow at REG 025 and REG 034, and provide CSO capacity for storms between a 2-year and 10-year return frequency.

GNHWPCA has also developed a short-term improvements project to close REG 034 and raise REG 025 by 9.15 feet, to eliminate stormwater inflow into the CSS. These closures are complete.

The City of New Haven has also began introducing green infrastructure projects throughout the City in both separated and combined sewershed to further decrease the stormwater inflow to both systems.

GNHWPCA constructed 75 bioswales along City streets during the STCP in the West River sewer shed during 2018 and 2019.

GNHWPCA, in conjunction with the City of New Haven, has an aggressive green redevelopment program that requires all new development (such as commercial, institutional, and multihousing) in a combined sewer area to be able to capture and retain the 2-year, 6-hour design storm on their property. This reduces the stormwater entering the CSS. Technologies employed to detain the 2-year, 6-hour design storm includes infiltrators and drywells, rain water storage tanks, bioswales and tree wells, and water features. Since 2008, the GNHWPCA has approved 80 green redevelopment projects that have effectively separated 205 acres of combined sewer area. These green redevelopment projects have reduced CSO events by seven per year and CSO volume by 5.6 MG per year. The green redevelopment program is being implemented at no cost to GNHWPCA rate payers.

3.4 Large Diameter Sewer Cleaning and Television Inspection

To increase conveyance and storage in the interceptors and trunk sewers, as well as reduce CSOs, GNHWPCA regularly solicits outside contractors to assist staff with the routine cleaning and CCTV inspections of sewers and manholes. The most recent multi-year contract, entered into in 2021, includes over 180,000 lineal feet of cleaning and CCTV.

The Authority has completed Cleaning and CCTV inspection of over 59,000 feet of large diameter sewers (between 44 inches and 82 inches nominal diameter) since 2014 throughout the collection system. An additional 110,000 feet of sewers smaller than 44 inches in nominal diameter were cleaned and CCTV inspected during the same timeframe. The program has resulted in the removal of over 3,000 cubic yards of debris from within the collection system.

4. NMC 3 – Review and Modification of Pretreatment Requirements

The objective of NMC 3 is to locate and minimize the contributions of nondomestic (industrial and commercial) discharges to CSOs by modifying inspection, reporting, and oversight procedures within the approved pretreatment program. Implementing NMC 3 involves the following three steps:

1. Inventory the flow volume, pollutant types, and discharge concentrations of nondomestic discharges to the CSS.

2. Assess the impact of each nondomestic discharge on CSOs.

3. Evaluate feasible modifications for eliminating the nondomestic discharge.

To implement this NMC, GNHWPCA has implemented a two-phased approach to inspecting and regulating industrial and commercial discharges as follows:

1. Inventory and permitting of all food service establishments.
2. Permitting and inspection of all commercial and industrial discharges to the ESWPAF.

The GNHWPCA has three full-time Industrial Pretreatment Program (IPP) employees dedicated to enforcing the FOG and Industrial Discharge Permit program. All Class 2, 3 and 4 restaurants are required to be in compliance with the CT DEEP General Permit for the Discharge of Wastewater Associated with Food Service Establishments, and must receive a sign-off by the IPP Department Coordinator indicating compliance, before the applicable health department granting a food service license. All restaurants are inspected three to four times a year to enforce best management practices and to ensure proper maintenance of grease interceptors and automatic grease recovery units (AGRUs). To ensure these regulations are reinforced, after an inspection, posters are hung in all kitchens reminding employees not to pour FOG down the drain. Currently, over 98 percent of the restaurants in the region are compliant.

The Authority requires producers of industrial discharges to apply for coverage under either the Miscellaneous Industrial User (MIU) or the Significant Industrial User (SIU) General Permits. The pretreatment program staff visits each permitted facility annually to inspect the facility, discuss problems or initiatives to ensure that program requirements are being followed, and to take samples, as appropriate. In 2022, the GNHWPCA has approximately 184 industrial accounts, of which approximately 92 are located within the City of New Haven.

Commercial and industrial dischargers are required to monitor and sample discharges on a predetermined frequency and report those analytical results to both CT DEEP and GNHWPCA.

4.1 Food Service Establishments

Discharges from food service establishments have historically caused sanitary sewer disruptions and contributed to CSOs due to the discharges of FOG from normal daily operations. These establishments must comply with the CT DEEP's General Permit for the Discharge of Wastewater Associated with Food Preparation Establishments. This regulation requires either the installation of outdoor, in-ground grease traps/interceptors, Super Capacity Grease Interceptors (SCGI), or the use of an AGRU. This program has proven effective relative to controlling FOG from restaurants in the service area. GNHWPCA requirements for FOG control and discharge are described in subsequent sections.

4.1.1 Pre-installation Requirements for Grease Traps

GNHWPCA requires that engineering drawings (site plans and/or utility plans showing the connection to the sewer and the location of the grease trap/interceptor) prepared and signed by the food preparation establishment's Connecticut-licensed professional engineer be submitted to the GNHWPCA Engineering Department for review and approval. The Owner, or designated Engineer, is also required to submit sizing calculations demonstrating that the unit chosen is adequate for the food service establishments use based on facility size.

A GNHWPCA permit is required for the installation of an in-ground grease trap/interceptor.

The GNHWPCA also requires the installation of a backwater valve and a cleanout downstream from the grease/trap interceptor. The grease trap/interceptor shall be installed on 8 inches of bedding material, Item 305, per GNHWPCA Sewer Standards.

4.1.2 Automatic Grease Recovery Units

The food service establishment is required to submit sizing calculations for review by the GNHWPCA's IPP coordinator. The sizing calculations must be consistent with the Fixture-Based Method found in the Connecticut Department of Environmental Protection's Sizing Criteria, and may be prepared by the AGRU's distributor. The IPP coordinator may require additional documentation such as a floor plan or other facility details as may be appropriate to ascertain the suitability of the installation.

The installation must include a sampling port located after the AGRU so that a GNHWPCA IPP inspector can take representative samples of the wastewater flow from the AGRU. It is recommended that arrangements be made for the plumber who will install the AGRU to meet with one of the GNHWPCA IPP inspectors to discuss the requirements before the work starts.

4.2 Residential FOG Program

While it is easier to monitor and control the grease coming from restaurants, residential neighborhoods pose different challenges. Education is more effective than inspection. To address problem areas and blockages in residential neighborhoods, GNHWPCA developed a residential FOG education program that includes:

- Identifying target areas through CCTV evaluations.
- Distributing door hangers on all home upstream of identified hot spots. The GNHWPCA has developed an informational door hanger and has purchased can lid tops that are hung in tandem with the door hangers as a tool to aid in proper grease disposal.
- Notifying and educating residents via issuance of an information letter from the GNHWPCA's IPP coordinator to all customers upstream of any grease blockage that may have caused a SSO.
- Including, on a periodic basis, FOG education materials as inserts with billing statements or within newsletters.

4.3 FOG Disposal

FOG cannot be discharged into the GNHWPCA's collection system; however, FOG collected from grease traps and AGRUs can be disposed of at the GNHWPCA's FOG receiving area located at the ESWPAF, where it is separately processed and then used to offset fuel costs at the GNHWPCA's Multiple Hearth combustor located at the ESWPAF.

The GNHWPCA currently processes approximately 4 million gallon a year in FOG from within the service area and other area sources. The FOG replaces about 200,000 hundred cubic feet of Natural Gas consumption for the Multiple Hearth combustor.

4.4 Commercial and Industrial Discharges

Commercial and Industrial facilities whose discharges are covered under the CT DEEP MIU or SIU General Permits must submit a registration for coverage under the correct permit. Discharge is not authorized until GNHWPCA reviews and approves the registration. Each registration requires the following components:

1. File a discharge registration, which must include but not be limited to, nature of process, volume, rates of flow, production quantities, or any other information that is deemed relevant by the Executive Director to the generation of waste, including substances and concentrations in the wastewater discharge.

2. Submit a plan showing location and size of onsite sewers, sampling point, pretreatment facilities, public sewers and any other information required by the Executive Director.

3. Describe activities, facilities, and plant processes on the premises discharging or proposing to discharge industrial wastewater including all materials, processes, and types of materials that are or proposed to be discharged.

4. List each product produced by type, amount, and rate of production.

5. Provide the chemical components and quantity of liquid or gaseous material bulk stored onsite, even though they may not normally be discharged into the sanitary sewer system.

6. Provide additional information or reports as may be required by the Executive Director.

An annual report shall be submitted by each permittee certifying that there have been no changes in operational procedures, or if there have been such changes, furnishing information thereon in such detail as may be required by the GNHWPCA. Failure to submit such a report shall constitute cause for the suspension or revocation of the industrial waste discharge permit. In the event a permit is canceled for any reason under the provisions hereof, a fee, as revised from time to time, shall be charged for a subsequent initial permit issued to such applicant on completion by the applicant on forms provided by the GNHWPCA, and approval of such application by the Executive Director.

Pretreatment at the discharger's facility may be required when GNHWPCA determines that discharge of the waste will cause an upset at the ESWPAF resulting in loss of treatment capacity or exceedance of the ESWPAF permit for discharge. Pretreatment via the permitting process may also be required of industrial dischargers when modifications occur within the GNHWPCA's discharge permit where the individual discharger's constituents reasonably could cause an exceedance of the GNHWPCA's discharge permit.

5. NMC 4 – Maximization of Flow to the Publicly-Owned Treatment Works (POTW) for Treatment

The objective of NMC 4 is to implement simple modifications to the CSS and treatment plant to enable as much wet weather flow as possible to reach the treatment plant.

The Authority uses data from the CSO Flow Monitoring Program; CSO regulator, outfall, and duckbill inspection program; collection system hydraulic model (updated in 2014); and SSO bypass reports to evaluate the capacity of critical elements of the collection system. This program has proven effective in confirming that the Authority has no unauthorized bypasses from the collection system during wet weather events.

As part of maximizing the wet weather storage and treatment, GNHWPCA is in the process of implementing the New Haven LTCP, which is being updated every 5 years. The 2011 LTCP update detailed the ESWPAF expansion to maximize wet weather treatment. The 2016 LTCP update includes plans for CSO regulator modifications and upgrades at the East, Union, and Boulevard Pump Stations to maximize wet weather capture, conveyance, and treatment.

All the pump stations existing capacities are shown in **Table 5-1**. GNHWPCA is continuing to provide maximum capacities at these pump stations through routine O&M activities. The Authority uses a CMMS to ensure routine inspections and maintenance is performed consistently. Preventive Maintenance Schedules (PMs) have been systematically developed for each of the Pump Stations. These PMs automatically generate work orders on pre-determined schedules to be completed by the Authority's personnel and Maintenance Contractor. The work orders include checklists for the maintenance staff and operators to complete. A record of all results is maintained in the CMMS. A CM work order is generated for any items that required follow-up or repair.

Table 5-1. Active Pump Station Capacities

Pump Station	Address	Existing Total # Pumps	Existing (Future) Capacity (mgd)	VFD
East Street	1 East Street Extension	4	30 (65.0)	
Boulevard	17 Sea Street	4	30 (45.0)	Y
Morris Cove	1217 Dean Street	5	18.0	Y
Union	1 State Street	4	15 (35).0	
Quinnipiac	1040 Quinnipiac Avenue	4	6.6	Y
Barnes Avenue	345 Middletown Avenue	2	4.0	Y
Long Wharf	17 Sea Street	2	1.7	Y
Old Grand Avenue	441 Grand Avenue	2	1.0	
Mitchell Drive	125 Mitchell Drive	2	1. 2	
Fort Hale	25 Woodward Avenue	2	0.4	
Market Street	135 Market Street	2	0.3	
Stone Street	19 Stone Street	2	0.8	
West Rock	355 West Rock Avenue	2	0.3	
Humphrey Street	145 Humphrey Street	2	0.3	
New Grand Avenue	535 Grand Avenue	2	0.1	
Welton Street	151 Welton Street	1	0.4	
State Street	2139 State Street	3	2.0	
Truman Dewater	Storage Facility	1	5.0	
ESWPAF Influent	ESWPAF	1	50.0	Y

GNHWPCA implemented its flow monitoring program in 2012, and has since installed continuous flow monitoring devices at CSO regulators for all active CSO outfalls. CSO flow metering services are provided under contract with CSL Services, Inc. (CSL).

GNHWPCA monitors the daily, monthly, and annual CSO volumes at each CSO and reports them to CT DEEP. The ESWPAF also has an influent meter and an effluent meter. GNHWPCA reviews and analyzes the flow meter data to update the hydraulic model, develop projected flows at the pump stations, and maximize flows to the ESWPAF.

6. NMC 5 – Elimination of CSOs during Dry Weather

The objective of NMC 5 is to eliminate dry weather overflows (DWOs).

6.1 Dry Weather Overflows in GNHWPCA's Jurisdiction

The Authority initiated the CSO Flow Monitoring Program. CSL collects data from 29 depth and velocity meters and three rain gauges owned by GNHWPCA. The meters are deployed to continuously monitor the 11 active CSO Regulators and 11 active CSO Outfalls. Engineering monitors the data, which is posted on CSL's website, in real time. If a CSO DWO did occur, the Authority would be able to respond to the situation immediately.

Each month, CSL submits a report to Engineering that details rainfall events and CSO volumes and durations at each CSO Outfall. Engineering reviews the monthly report to provide quality assurance (QA) and quality control (QC). Engineering then prepares a summary report for the month, which is submitted to CT DEEP each June 30th as a part of the Annual Report which is required under the Consent Decree.

A summary of the current meter locations are provided herein.

- **OF-003 Sewer and Overflow**
  - Meter OF-003 Sewer was installed in the 72 inch wide by 67 inch high Boulevard Trunk Sewer downstream of Regulator 003 in June 2012 at an invert elevation of 1.34 feet. The new overflow depth in the sewer is 67 inches when the new overflow weir is set at the maximum overflow elevation of 6.51 feet.
  - Meter OF-003 Overflow was installed in the 54 inch overflow pipe in June 2012 at an invert elevation of 1.70 feet. This meter was removed in August 2019 during construction of the new regulator as a part of project CWF 2016 -03. The new Meter OF-003 Regulator was installed in the new Regulator 003 structure in January 2020 to measure depth on the sewer side of the new overflow weir (and potentially depth and velocity on the drain side of the new overflow weir in the future). Regulator weir height is 66 inches.
  - The old regulator consisted of a 5 foot long transverse weir in the 72 inch wide by 67 inch high Boulevard Trunk Sewer at elevation 5.15 feet. The old regulator weir was removed to an elevation of 3.95 feet to accommodate peak CSO design flows. The new structure was constructed over the 54 inch CSO Outfall 003 and consists of three concrete weirs at the approximate elevation of the old weir (5.18 feet) equipped with guide rails to add up to four 4 inch stop logs each. The new overflow weir has a total length of 12 feet three inches (13.92 feet per CSL) and a maximum overflow elevation of 6.51 feet. The bottom of the roof slab is at elevation 7.26 feet leaving a 9 inch clear opening over the stop logs.
  - CSO start and stop times are based on depths on the sewer side of the overflow weir greater than the overflow weir elevation of 66 inches as measured at the new Meter OF-003 Regulator.
  - CSO volumes are calculated using the Weir Formula for depths over the weir of up to 9 inches and the Orifice Equation for depths over the weir greater than 9 inches.
  - Check the SCADA data to confirm that the Boulevard Pump Station is pumping at maximum flow of 27 to 33 MGD and that the Truman CSO Storage Tank was in service during any CSO events.

- **OF-004 Sewer and Overflow**
  - Meter OF-004 Sewer was installed in the 72 inch wide by 64 inch high Boulevard Trunk Sewer downstream of Regulator 004 in June 2012 at an invert elevation of 3.00 feet. The new overflow depth in the sewer is 73 inches when the new overflow weir is set at the maximum overflow elevation of 8.71 feet.
  - Meter OF-004 Overflow was installed in the 5 foot wide by 3 foot high box culvert overflow in June 2012 at an invert elevation of 3.01 feet. This meter was removed in August 2019 during construction of the new regulator as a part of project CWF 2016 -03. The new Meter OF-004 Regulator was installed in the new Regulator 004 structure in January 2020 to measure depth on the sewer side of the new overflow weir (and potentially depth and velocity on the drain side of the new overflow weir in the future). Regulator weir height is 101 inches.
  - The old regulator consisted of three weirs; each two feet wide at an elevation of 5.92 feet. The weirs were raised 8 inches in July 2014 to elevation 6.59 feet. The old regulator weir was removed to an elevation of 5.92 feet to accommodate peak CSO design flows. The new regulator structure was constructed over the 5 foot wide by 3 foot high box culvert CSO 004 Outfall and consists of a concrete weir at the approximate elevation of the old weir (6.71 feet) equipped with guide rails to add up to four 6 inch stop logs. The new overflow weir has a total length of 4 feet (between elevations 6.71 feet and 8.71 feet). Above the maximum overflow elevation of 8.71 feet the total weir length is 8.88 feet. The bottom of the roof slab is at elevation 11.21 feet leaving a 30 inch clear opening over the stop logs.
  - CSO start and stop times are based on depths on the sewer side of the overflow weir greater than the overflow weir elevation of 101 inches as measured at the new Meter OF-004 Regulator.
  - CSO volumes are calculated using the Weir Formula for depths over the weir of up to 30 inches and the Orifice Equation for depths over the weir greater than 30 inches.
  - Check the SCADA data to confirm that the Boulevard Pump Station is pumping at maximum flow of 27 to 33 MGD and that the Truman CSO Storage Tank was in service during any CSO events.
- **OF-005 Sewer and Overflow**
  - Meter OF-005 Sewer was installed in the 60 inch wide by 57 inch high Boulevard Trunk Sewer at Regulator 005 in June 2012 at an elevation of 3.85 feet. Overflow depth is 82 inches.
  - Meter OF-005 Overflow was installed in the 48 inch overflow pipe in June 2012 at an invert elevation of 7.35 feet (downstream of the 36 inch drain connection).
  - Meter OF-005 Overflow was reinstalled in the 48 inch overflow pipe in November 2013 at an invert elevation of 7.35 feet (upstream of the 36 inch drain connection).
  - A new brick overflow weir was constructed in the 48 inch overflow pipe upstream of Meter OF-005 Overflow in July 2014 at an elevation of 10.25 feet.
  - CSO start and stop times are based on a depth greater than 82 inches at Meter OF-005 Sewer and positive velocities at Meter OF-005 Overflow.
  - CSO volumes are calculated based on depths and velocities at Meter OF-005 Overflow, the hydraulic elements chart and the Continuity Equation.
  - Check the SCADA data to confirm that the Boulevard Pump Station is pumping at maximum flow of 27 to 33 MGD and that the Truman CSO Storage Tank was in service during any CSO events.

- **OF-006 Sewer, Overflow AA And Overflow BB**
  - Meter OF-006 Sewer was installed in the 36 inch sewer upstream of the 60 inch wide by 57 inch high Boulevard Trunk Sewer and the two overflow pipes in June 2012 at an invert elevation of 7.20 feet. The new overflow depth in the sewer is 72 inches when the new overflow weir is set at the maximum overflow elevation of 13.02 feet.
  - Meters OF-006 Overflows AA and BB were installed in the twin 24 inch overflow pipes in July 2012 at an invert elevation of 9.49 feet, which is equal to the overflow elevation. These meters were removed in August 2019 during construction of the new regulator as a part of project CWF 2016 -03. The new Meter OF-006 Regulator was installed in the new Regulator 006 structure in January 2020 to measure depth on the sewer side of the new overflow weir (and potentially depth and velocity on the drain side of the new overflow weir in the future). Regulator weir height is 42 inches.
  - The new Regulator 006 structure was constructed downstream of the two 24 inch overflow pipes and consists of a concrete weir at the approximate elevation of the old weir (9.52 feet) equipped with guide rails to add up to seven 6 inch stop logs. The new overflow weir has a total length of 4 feet (between elevations 9.52 feet and 13.02 feet). Above the maximum overflow elevation of 13.02 feet the total weir length is 5.96 feet. The bottom of the roof slab is at elevation 14.52 feet leaving an 18 inch clear opening over the stop logs.
  - CSO start and stop times are based on depths on the sewer side of the overflow weir greater than the overflow weir elevation of 42 inches as measured at the new Meter OF-006 Regulator.
  - CSO volumes are calculated using the Weir Formula for depths over the weir of up to 18 inches and the Orifice Equation for depths over the weir greater than 18 inches.
  - Check the SCADA data to confirm that the Boulevard Pump Station is pumping at maximum flow of 27 to 33 MGD and that the Truman CSO Storage Tank was in service during any CSO events.
- **OF-009 Sewer and Overflow**
  - Meter OF-009 Overflow was installed in the 30 inch wide by 45 inch high overflow pipe in October 2012 at an invert elevation of 2.65 feet.
  - The regulator consists of a 5.5 foot long weir at an elevation of 4.65 feet. The weir was rebuilt in January 2013. The overflow was raised 8 inches to elevation 5.32 feet in June 2015. The overflow weir was raised an additional 6 inches to elevation 5.82 feet in April 2022. Regulator weir height is now 38 inches.
  - Meter OF-009 Sewer was installed in the 35 inch wide by 52 inch high James Street sewer one manhole upstream of Regulator 009 in July 2015 at an invert elevation of 2.81 feet. The overflow depth is 30 inches.
  - CSO start and stop times are based on a depth greater than 30 inches at Meter OF-009 Sewer and positive velocities at Meter OF-009 Overflow.
  - CSO volumes are calculated based on depths and velocities at Meter OF-009 Overflow, the hydraulic elements chart and the Continuity Equation.
  - There is significant tidal influence at Meter OF-009 Overflow. A new check valve was installed in CSO Outfall 009 in July 2020.
  - Check the meter data at Meter OF-015 DS to confirm that the James Street siphon is operating at maximum flow of 24 MGD during any CSO events.

- **OF-010 Sewer**
  - Meter OF-010 Sewer was installed in the 54 inch East Street sewer at Regulator 010A in September 2012 at an invert elevation of 7.42 feet. The overflow depth to CSO Outfall 011 was 62 inches.
  - The regulator was a 114 inch wide weir at elevation 12.62 feet.
  - Regulator 010A was closed in March 2020.
  - Meter OF-010 Sewer was left in place to measure flows in the East Street sewer upstream of the East Street Pump Station.
- **REG 011 (Meters 0F-011-997, 609, 631 and 819) (CSO 011)**
  - Four meters were installed in December 2012 to estimate CSOs at Regulator 011.
  - Meter OF-011-997 was installed in the 30 inch sewer on State Street upstream of Regulator 011**.** This meter was removed in September 2013. Metered flows were very consistent and relatively small.
  - Meter OF-011-609 was installed in the 25 inch wide by 37 inch high sewer on Humphrey Street upstream of Regulator 011. This meter was removed in September 2013. Metered flows were very consistent and relatively small.
  - Meter OF-011-631 was installed in the 66 inch sewer on State Street upstream of Regulator 011.
  - Meter OF-011-819 was installed in the 42 inch discharge pipe in Humphrey Street downstream of Regulator 011. The capacity of the 42 inch sewer is approximately 18 to 20 MGD.
  - CSO start and stop times at Regulator 011 are estimated by subtracting the flows from the downstream meter (Meter OF-011-819) from the one upstream meter (Meter OF-011-631). Anytime the resultant flow is greater than zero a CSO is occurring.
  - CSO volumes from Regulator 011 are estimated using the resultant flows as calculated above.
- **REG 026 at Humphrey Street Pump Station**
  - Regulator 026 was a 10 inch overflow pipe from the Humphrey Street Pump Station wetwell to CSO Outfall 011.
  - CSO Regulator 026 was closed in September 2019 as a part of the Humphrey Street Pump Station upgrade project.
- **OF-012 Sewer**
  - Meters OF-012 Overflows A and B were installed in the twin 18 inch overflow pipes in October 2012 at an invert elevation of 13.05 feet. These meters were removed in September 2014.
  - New 6 inch high weirs were installed in each 18 inch overflow pipes in May 2013 at an elevation of 13.65 feet.
  - Meter OF-012 Sewer was installed in the 36 inch wide by 55 inch high sewer in Mitchell Drive, three manholes downstream of Regulator 012, at an invert elevation of 9.89 feet. The overflow depth was 36 inches.
  - CSO Regulator 012 and CSO Outfall 012 were closed in October 2018 as a part of project CWF 2016-02.

- **REG 028 at Mitchell Drive Pump Station**
  - Regulator 028 was a 15 inch overflow pipe from the Mitchell Drive Pump Station wetwell to CSO Outfall 012.
  - CSO Regulator 028 was closed in October 2018 as a part of the Mitchell Drive Pump Station upgrade project.
- **OF-015 US and DS Sewers**
  - Meter OF-015 US was installed in the 45 inch James Street sewer upstream of Regulator 015 in October 2012 at an invert elevation of -1.21 feet.
  - Meter OF-015 DS was installed in the 48 inch sewer to the James Street siphon inlet works building downstream of Regulator 015 in October 2012 at an invert elevation of -2.15 feet.
  - The James Street siphon was designed with a capacity of 24 MGD.
  - The regulator consists of a 7 foot long concrete weir at elevation 1.22 feet. The overflow elevation was raised 18 inches to elevation 2.72 feet by installing two sets of three 6 inch stop logs in April 2022. The overflow depth is now 58.5 inches.
  - CSO start and stop times are based on depths greater than 58.5 inches at Meter OF-015 DS.
  - CSO volumes are calculated by subtracting the Meter 015 DS flows from the Meter 015 US flows.
  - A new check valve was installed in the chamber just upstream of CSO Outfall 015 in July 2020 to replace the defective duckbill.
  - Check the meter data at Meter OF-015 DS to confirm that the James Street siphon is operating at maximum flow of 24 MGD during any CSO events.
- **OF-016 Overflow and OF-016 Sewer**
  - Meter OF-016 Overflow was installed in the 48 inch wide by 60 inch high overflow pipe in Poplar Street in August 2012 at an invert elevation of -0.43 feet. A redundant depth and velocity meter (Meter OF-016 Overflow DS) was installed in the overflow pipe one manhole downstream from Meter OF-016 Overflow in October 2019 at an invert elevation of -0.57 feet. The data from Meter OF-016 Overflow DS confirmed that the depth and velocity measurements at Meter OF-016 Overflow were being influenced by local hydraulic conditions. Meter OF-016 Overflow was removed in January 2020.
  - The regulator consists of a 3.8 foot long brick weir at an elevation of 2.35 feet. The overflow weir was raised 6 inches to elevation 2.85 feet in April 2022. Regulator weir height is now 41 inches.
  - Meter OF-016 Sewer was installed in the 54 inch sewer two manholes downstream of Regulator 016 in River Street in July 2017 at an invert elevation of -0.03 feet. The overflow depth is now 34.5 inches.
  - CSO start and stop times are based on depths greater than 34.5 inches at Meter OF-016 Sewer and positive velocities at Meter OF-016 Overflow DS.
  - CSO volumes are calculated based on depths and velocities at Meter OF-016 Overflow DS, the hydraulic elements chart and the Continuity Equation.
  - A new check valve was installed in the chamber just upstream of CSO Outfall 016 in 2018 to replace the defective duckbill.
  - Check the meter data at Meter OF-015 DS to confirm that the James Street siphon is operating at maximum flow of 24 MGD during any CSO events.

- **OF-020 Sewer and Overflow**
  - Meter OF-020 Overflow (depth sensor) was installed in the 15 inch overflow pipe in Clifton Street at Regulator 020 in March 2013 at an invert elevation of 12.90 feet.
  - Meter OF-020 Sewer was installed in the 24 inch sewer in Quinnipiac Avenue at Regulator 020 in March 2013 at an invert elevation of 10.45 feet. The overflow depth was 30 inches.
  - The regulator was a 15 inch pipe.
  - CSO Regulator 020 and CSO Outfall 020 were closed in July 2019 as a part of project CWF 2016-02.
- **REG 021-OF and OF-021 US Sewer (E St Pump Station Sewer)**
  - Meter E St Pump Station Sewer was installed in the 62 inch wide by 67 inch high East Street sewer upstream of Regulator 021 in September 2012 at an invert elevation of -0.95 feet. The overflow elevation is 90 inches. To convert the Level (in) measurements to NAVD88 divide by 12 to convert to feet and add -0.95 feet.
  - Meter OF-021 was installed in Regulator 021 at the East Street Pump Station in November 2012 at an invert elevation of -2.21 feet. The meter records the depths on the sewer side over the overflow weir. To convert the Weir Level (in) measurements to NAVD88 divide by 12 to convert to feet and add 5.29 feet.
  - The regulator is twin 84 inch wide steel plate weirs at elevation 5.29 feet.
  - There is a duckbill on the overflow pipe in a chamber just upstream of CSO Outfall 021 that was installed in 2015.
  - CSO start and stop times are based on a depth above the overflow weir elevation of 32.5 inches at Regulator 021 as measured by Meter OF-021.
  - CSO volumes are calculated based on depths over the twin 84 inch weirs at Regulator 021 using the Weir Formula.
  - Check the SCADA data to confirm that the East Street Pump Station is pumping at maximum flow of 40 to 45 MGD during any CSO events.
  - Check the SCADA data to confirm that the Union Pump Station is pumping at maximum flow of 20 to 22 MGD during any CSO events.
- **OF-024 US and DS Sewer and REG 024 Weir**
  - Meter OF-024 US was installed in the 84 inch wide by 69 inch high Boulevard Trunk Sewer upstream of Regulator 024 in July 2012 at an invert elevation of -2.06 feet. The overflow depth is 85 inches. To convert the Level (in) measurements to NAVD88 divide by 12 to convert to feet and add -2.06 feet.
  - Meter OF-024 DS was installed in the 48 inch sewer to the Boulevard Pump Station downstream of Regulator 024 in July 2012 at an invert elevation of -3.19 feet. The overflow depth is 88 inches. To convert the Level (in) measurements to NAVD88 divide by 12 to convert to feet and add -3.19 feet.
  - The regulator consists of three weirs each 4.5 feet wide at an elevation of 2.99 feet. The weir elevation was raised 18 inches to elevation 4.49 feet in July 2017.
  - Meter OF-024 Weir Wall was installed in Regulator 024 in October 2012 to measure the depth on the sewer side of the weir at Regulator 024. Regulator weir height is 41.5 inches. To convert the Level - Weir (in) measurements to NAVD88 divide by 12 to convert to feet and add 4.49 feet.

- CSO start and stop times are based on depths above the overflow weir elevation of 12 inches as measured at Meter 024 Weir Wall.
- CSO volumes are calculated by subtracting the Meter OF-024 DS flows from the Meter OF-024 US flows.
- A new influent gate was installed at the Boulevard Pump Station in March 2019 to prevent the level in the wetwell from reaching the walkways. When wetwell levels exceed 180 inches the gate starts to close to maintain wetwell levels at 180 inches.
- Check the SCADA data to confirm that the Boulevard Pump Station is pumping at maximum flow of 27 to 33 MGD and that the Truman CSO Storage Tank was in service during any CSO events.

▪ **REG 025 (Meters State, Frontage, Columbus, and Weir) (CSO 025)**

- Meter OF-025 State was installed in the 48 inch wide by 60 inch high sewer on State Street upstream of Regulator 025 in September 2013 at an invert of 3.87 feet. The rim elevation is 15.35 feet. The distance from the rim to the invert is 138 inches.
- Meter OF-025 Frontage was installed in the 30 inch sewer on North Frontage Road upstream of Regulator 025 in September 2013 at an invert of 1.95 feet. The rim elevation is 16.45 feet. The distance from the rim to the invert is 174 inches.
- Meter OF-025 Columbus was installed in the 30 inch sewer on Columbus Avenue upstream of Regulator 025 in November 2013 at an invert of -1.78 feet. The rim elevation is 9.95 feet. The distance from the rim to the invert is 141 inches.
- Meter OF-025 Weir was installed in Regulator 025 in November 2013. This meter was removed in December 2018 during construction of the new regulator as a part of project CWF 2016-05. The new Meter OF-025 Regulator was installed in the new Regulator 025 structure in July 2019 to measure depths on the sewer side and the storm side of the new overflow weir.
- The old regulator was a 45 inch long overflow weir made up of stainless steel plates at an overflow elevation of 5.35 feet. The old regulator weir was removed. The new regulator structure was constructed above the old regulator structure and consists of a concrete weir at 11.91 feet equipped with guide rails to add up to five 6 inch stop logs. The new overflow weir has a total length of 9 feet and a maximum overflow elevation of 14.41 feet. Regulator weir height is 48 inches. The bottom of the roof slab is at elevation 16.66 feet leaving a 27 inch clear opening over the stop logs. To convert the Level – Sewer Side (in) measurements to NAVD88 divide by 12 to convert to feet and add 10.41 feet.
- CSO start and stop times are based on depths on the sewer side of the overflow weir greater than the overflow weir elevation of 48 inches as measured at the new Meter OF-025 Regulator.
- CSO volumes are calculated using the Weir Formula for depths over the weir of up to 27 inches and the Orifice Equation for depths over the weir greater than 27 inches.
- Check the SCADA data to confirm that the Union Pump Station is pumping at maximum flow of 20 to 22 MGD during any CSO events.
- Check the SCADA data to confirm that the East Street Pump Station is pumping at maximum flow of 40 to 45 MGD during any CSO events.

- **REG 034 (METERS Temple, George, and Weir) (CSO 025)**
  - Meter Regulator 034 - George was installed in the 36 inch wide by 48 inch high sewer on George Street upstream of Regulator 034 in September 2013 at an invert of 11.89 feet. The rim elevation is 20.45 feet. The distance from the rim to the invert is 103 inches. Meter Regulator 034-George was left in place to measure flows in the George Street Sewer upstream of Regulator 025 and the Union Pump Station.
  - Meter Regulator 034 - Temple was installed in the 25 inch wide by 37 inch high sewer on Temple Street upstream of Regulator 034 in September 2013 at an invert of 12.52 feet. The rim elevation is 20.95 feet. The distance from the rim to the invert is 102 inches. Meter Regulator 034 – Temple was removed in October 2019.
  - Meter Regulator 034 - Weir was installed in Regulator 034 in November 2013. Sensors were metering the depths on each side of the overflow weir. Meter Regulator 034 - Weir was removed in January 2019.
  - The overflow weir consisted of wood stop logs, 6.6 feet long, at an overflow elevation of 11.65 feet. The overflow elevation was raised two feet by adding stop logs to elevation 13.65 feet in August 2014.
  - CSO Regulator 034 was closed in January 2019 as a part of project CWF 2016-05.
- **GNH1 Sewer at Truman CSO Storage Tank**
  - Meter GNH1 was installed in the 72 inch wide by 64 inch high Boulevard Trunk Sewer downstream of the Truman Tank Diversion Chamber in June 2012 at an invert elevation of 0.25 feet. The overflow depth is 36 inches.
  - The regulator is a 10 foot long bending weir at elevation 3.28 feet.
  - The SCADA system measures depths in each cell of the 5 MG tank.
  - Truman Tank activation start and stop times are based on a depth greater than 36 inches at Meter GNH1 and SCADA depths in the Truman Tank.
  - CSO storage volumes are calculated based on SCADA depths in the Truman Tank. Each foot of depth in each cell equates to 122,500 gallons.

7. NMC 6 – Control of Solid and Floatable Materials in CSOs

The objective of NMC 6 is to remove coarse solids and floatables from combined sewage. The City of New Haven's pollution prevention practices as discussed further under NMC 7, coupled with the GNHWPCA's O&M programs have proven effective at keeping solids and floatables from discharging into receiving waters.

7.1 Techniques for Removal and Prevention of Solid and Floatable Materials

GNHWPCA and City of New Haven O&M practices have been proven successful at solids and floatables control. Since 2014, GNHWPCA has used CSL to monitor each of the 11 active CSO Outfalls every month for the presence of floatables. These inspections confirm that GNHWPCA does not have a problem with floatables at any of its 11 active CSO outfalls. CSL continues to monitor each of the CSO locations for floatables.

7.2 GNHWPCA's Current FOG Control Procedures

As discussed as part of the third minimum control measure (Pretreatment Requirements), GNHWPCA has three full-time IPP employees dedicated to enforcing the FOG program. All Class 3 and 4 restaurants are required to follow the CT DEEP General Permit for the Discharge of Wastewater Associated with Food Service Establishments, and must receive a sign-off by the IPP coordinator indicating compliance, before the applicable health department granting a food service license. All restaurants are inspected annually.

7.3 New Haven Stormwater Management Plan

The City of New Haven, as part of its stormwater management program and in compliance with its municipal separated storm sewer system (MS4) permit also conducts public education, street cleaning and catch basin cleaning within the CSS service area. GNHWPCA and City of New Haven's practices and coordination of services have been successful at controlling floatables in the service area.

8. NMC 7 – Pollution Prevention Programs to Reduce Contaminants in CSOs

The objective of NMC 7 is to prevent contaminants from entering the CSS.

8.1 Pollution Control Measures

Just like with NMC 6, the best way to reduce contaminants in CSOs is to prevent contaminants from entering the CSS in the first place. The following are several simple yet effective control measures that the GNHWPCA and the City of New Haven implement to address the contaminants issue:

- Street Cleaning. The City of New Haven Department of Public Works begins its annual street sweeping program in April. The program is designed to remove the heavy accumulation of salt, sand and litter that has collected over the winter months and to help keep New Haven's 234 miles of streets clean. The City has 14 sweeping routes which are scheduled twice per month or as needed.
- Catch Basin Cleaning. The City of New Haven contracts with a private contractor(s) to clean and maintain catch basins. The City typically cleans more than 3,000 catch basins per year, which represents more than a third of the total number of catch basins located in the City.
- Bulk Trash Removal. The City of New Haven provides bulk trash removal to customers on an as-requested basis.
- Leaf Pickup. The City of New Haven seasonally collects leaves placed at the curb during the late fall/early winter.
- Construction Debris Disposal. A privately owned and operated transfer station in the City of New Haven accepts construction and demolition debris and other materials that cannot be disposed locally within the state, where it is rail-hauled outside of the state for disposal.
- Household Hazardous Waste. On behalf of the City of New Haven, the South Central Regional Water Authority (RWA) has safe and free disposal of household hazardous waste at their Regional Collection Site located in the City of New Haven.
- Erosion Control. The City of New Haven maintains construction specifications and regulations which require erosion control and which is enforced as part of the permitting process.
- Public Education Programs and Antilitter Campaigns. Education methods include but are not limited to:
  - Public service announcements
  - Advertising
  - Stenciling of street drain inlets
  - Distribution of information with water or sewer bills
- Solid Waste Collection and Recycling. The City of New Haven provides curbside collection of garbage and single stream recyclables to residents and maintains and collects garbage and recyclables from a network of public trash cans along City streets. Collected material is delivered to the City of New Haven Solid Waste Authority Transfer Station for processing and disposal. This facility also accepts solid waste and recyclables from commercial establishments.
- Water conservation. The GNHWPCA works with the RWA to assist in promoting water conservation measures. These include RWA water metering, RWA provision of water saving kits and as requested assistance, as well as public education programs.

- Control illegal dumping into waterways, storm drain inlets, catch basins, or the ground. City of New Haven has public education programs, notices in locations commonly used for dumping, and illegal dumping law enforcement program to mitigate this issue

In addition to this list, the City of New Haven also complies with the requirements of its MS4 permit that it implements City-wide.

9. NMC 8 – Public Notification

The objective of NMC 8 is to inform the public of the location of CSO outfalls, the actual occurrences of CSOs, the possible health and environmental effects of CSOs, and the recreational or commercial activities (such as swimming) that CSOs jeopardize.

The Authority initiated the CSO Flow Monitoring Program in 2012. CSL collects data from 29 depth and velocity meters and three rain gauges owned by GNHWPCA to continuously monitor our 11 active CSO Regulators and 11 active CSO Outfalls. CSL maintains a secure, and limited access web site that is used by Engineering to monitor the data. If a CSO event occurs, the Authority uses the data to estimate the CSO volume and duration.

Each month, CSL submits a report to Engineering that details rainfall events and CSO volumes and durations at each CSO Outfall. Engineering reviews the monthly report to provide QA/QC. Engineering then prepares a summary report for the month which is submitted to the Connecticut DEEP each June 30th as a part of the Annual Report which is required under the Consent Decree.

In accordance with Section 9 of GNHWPCA's National Pollutant Discharge Elimination System (NPDES) Permit, GNHWPCA has installed new signs at each of the 11 active CSO Outfalls. The signs contain the number of the CSO outfall and telephone numbers at both the Authority and CT DEEP, where people can call to report a CSO.

The GNHWPCA also reports potential and actual CSO events using CT DEEP's Right-to-Know Online Bypass Reporting System. The July 2012, Public Act No. 12-11, "An Act Concerning the Public's Right to Know of a Sewage Spill", has been updated over the years. In 2021, Public Act 21-42, "An Act Concerning Revisions to the Sewage Spill Right-To-Know Statute" which requires "…*not later than two hours after becoming aware of any sewage spill or permitted sewage bypass that reaches a water body or may come in contact with the general public, the operator of a sewage treatment plant or collection system shall notify the chief elected official, or such official's designee, and the local public health official of the municipality where the sewage spill or permitted sewage bypass occurred and the chief elected official, or such official's designee, and the local public health official of any municipality that may be potentially impacted downstream by such spill or sewage bypass. As soon as practicable, but not later than two hours after receipt of any such notice pursuant to this subdivision, each such chief elected official, in conjunction with the local public health official, shall inform the public of any sewage spill or permitted sewage bypass that has the potential to impact public health, safety or the environment. Any such information provided to the public may be provided through the use of social media and shall be provided in each predominant language spoken by the residents of such municipality*."

In addition to reporting to the chief elected officials, and in accordance with GNHWPCA's NPDES Permit, within 2 hours of learning of a potential or actual untreated CSO, the Authority must report the event using the CT DEEP website. Within 5 days the Authority must file a follow-up report that contains an estimate of CSO volume to each of the 4 receiving waters in New Haven using the CT DEEP website.

10. NMC 9 – Monitoring to Characterize CSO Impacts and the Efficacy of CSO Controls

The objective of NMC 9 is to use visual inspections and other simple monitoring methods to determine the occurrence and impact of CSOs.

The Authority initiated the CSO Flow Monitoring Program in 2012. CSL collects data from 29 depth and velocity meters and one rain gauge owned by GNHWPCA. The meters are deployed to continuously monitor the 11 active CSO Regulators and 11 active CSO Outfalls. Engineering monitors the data, which is posted on CSL's website, in real time.

Each month, CSL submits a report to Engineering which details rainfall events and CSO volumes and durations at each CSO Outfall. Engineering reviews the monthly report to provide QA/QC. Engineering then prepares a summary report for the month which is submitted to the Connecticut DEEP each June 30th as a part of the Annual Report which is required under the Consent Decree.

Since 2014, GNHWPCA has used CSL to perform a condition assessment of each of the 11 active CSO regulators, 11 active CSO Outfalls, and six tidal check valves every month.

The GNHWPCA uses data from the CSO Flow Monitoring Program, CSO regulator, outfall, and tidal check valve inspection program; collection system hydraulic model (updated in 2015); large diameter sewer cleaning program, and SSO bypass reports to effectively characterize CSO impacts and the efficacy of CSO controls. These tools also allow the Authority to evaluate and maximize the capacity of the collection system and cost effectively implement its LTCP. This program has proven to be effective at reducing CSO volumes by more than 66 percent (from 125.93 MG in 1997 to 43.3 MG in 2015 during the Typical Year [as defined in the 2001 LTCP]). The proposed STCP projects reduced overflows in a typical year to 30 MG. The ITCP projects (as defined in the 2016 LTCP Update) are expected to further reduce annual CSO volumes to 12.8 MG.

11. References

US Environmental Protection Agency, 1995. *Combined Sewer Overflows - Guidance Document for Nine Minimum Controls (EPA 832-B95-003)*, May.

CH2M HILL, Inc. (CH2M). 2001. *City of New Haven Long-Term Combined Sewer Overflow Control Plan.* Final report. April.Greater New Haven Water Pollution Control Authority, Able Engineers, Inc.. 2011. *Capacity, Management, Operations, and Maintenance (CMOM) Plan*. March.

CMOM Corrective Action Plan (completed in April 2016

CH2M HILL, Inc. (CH2M). 2011. *Combined Sewer Overflow Long-Term Control Plan*. Final report.

Appendix B
Wastewater Flows and Loads

Appendix B. Wastewater Flows and Loads

B.1 East Shore Water Pollution Abatement Facility Description

Raw influent wastewater flow enters the plant through a gravity sewer and two force mains. The East Shore Water Pollution Abatement Facility (ESWPAF) design flow is 40 million gallons per day (mgd). The gravity sewer enters the existing headworks building where it is coarse screened and flows by gravity to the existing pump station in the main building. The existing main building pump station pumps the gravity flow received at the plant to the preliminary treatment building. The two force mains are pumped, via collection system pump stations, directly to the preliminary treatment building. Once the flow is lifted to the inlet channel of the preliminary treatment building, it flows by gravity through the remaining treatment processes including primary treatment, secondary treatment, and disinfection. The raw wastewater flow combines with several return streams from the plant site as well as the delivery of septage prior to discharging to primary treatment. Therefore, the primary influent sample location is influenced by the following influent waste and recycle streams:

B.1.1 Influent Waste Streams

- **Raw Wastewater Influent –** The raw wastewater from the ESWPAF service the population estimated to be approximately 233,150 people in the year 2022, resulting in an average raw wastewater flow of approximately 32.2 mgd.
- **Septage Receiving –** Septic haulers discharge their contents to the raw wastewater influent during typical business hours. A rolling average of approximately 102,000 gallons per month (approximately 5,000 gallons per weekday) are accepted by the plant.
- **Decant from Fats, Oils, and Grease (FOG) Receiving –** FOG haulers discharge their contents to a decant tank that separates floating and sinking material from water. Decanted water is discharged to the treatment process, while the settleable and floatable materials are sent directly to the incinerator. The plant accepts approximately 395,000 gallons of FOG materials per month.

B.1.2 Recycle Waste Streams

- **Incinerator Scrubber Return –** Nonpotable service water from the ESWPAF chlorine contact basin is used to scrub the incinerator exhaust of particulate solids. The discharge from the scrubber is recycled back to the ESWPAF and enters upstream of the primary influent sample location.
- **Gravity Thickener Overflow –** The thin sludge overflow pumped from the primary clarifiers is thickened in gravity thickeners. The overflow from the gravity thickeners is recycled to the ESWPAF and enters upstream of the primary influent sample locations.
- **Gravity Belt Thickener Filtrate –** The filtrate from thickening of waste-activated sludge (WAS) from the ESWPAF is recycled to the front end of the plant and enters upstream of the primary influent sample location.
- **Belt Filter Press –** Thickened primary sludge and WAS from the ESWPAF is dewatered, as well as a mixture of primary sludge and WAS from the Norwalk, Ansonia, Bridgeport, Branford, New Canaan, West Haven, and East Windsor wastewater treatment facilities. The filtrate from the press is recycled to the front end of the plant and enters upstream of the primary influent sample location.

B.2 Process Flow Diagram

The process flow diagram shown on **Figure B-1** illustrates the current wastewater treatment processes.

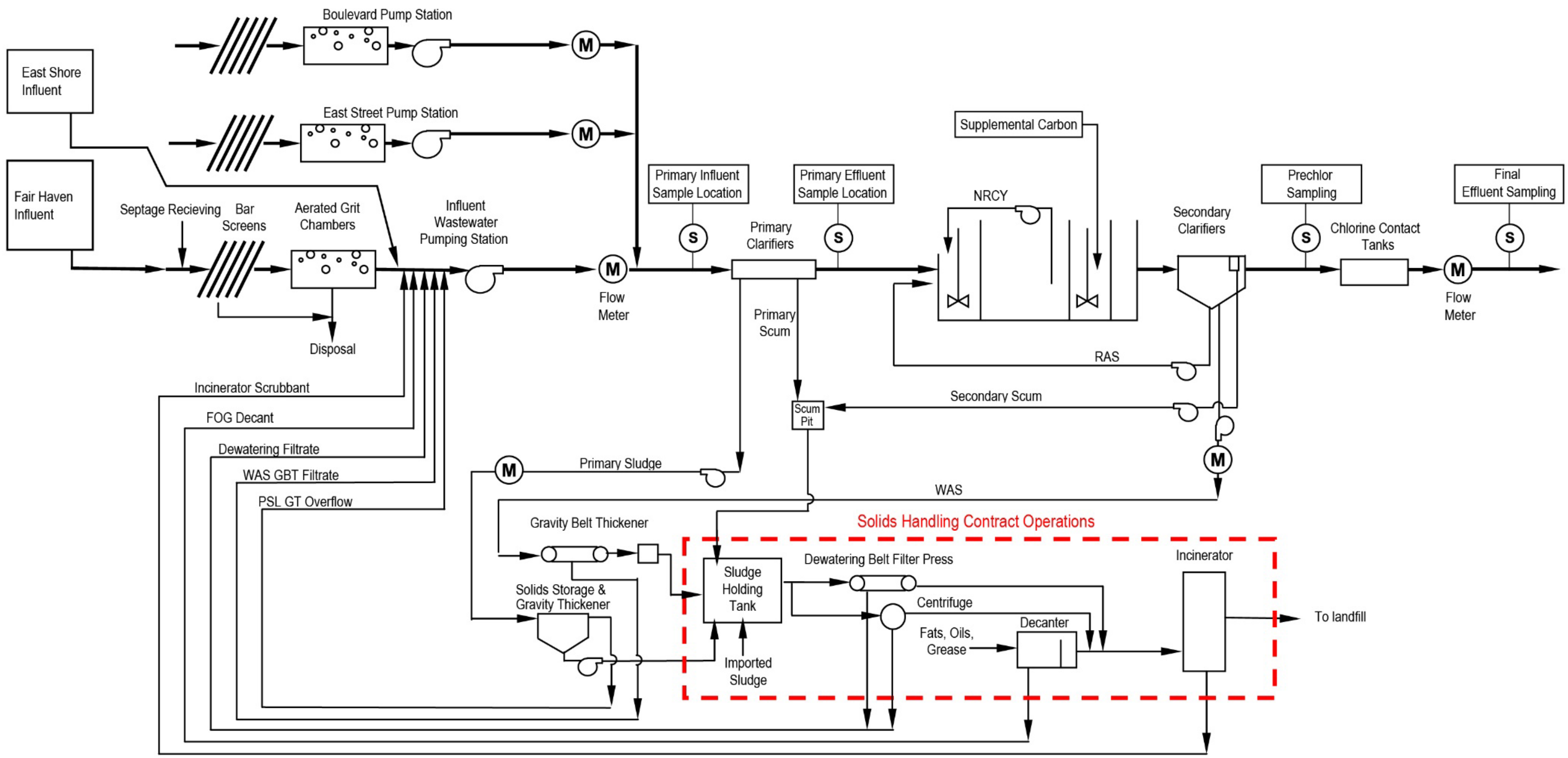

Figure B-1. ESWPAF Process Flow Diagram

B.3 Flows and Loads

B.3.1 Current Flows and Loads

Historical operator and laboratory data for the ESWPAF were obtained from plant staff and spanned a period from January 1, 2017 to December 31, 2021. An analysis was performed on data collected at the primary influent sample collection point, which includes plant recycles as well as raw wastewater influent. Therefore, the current flows and loads analysis is based on primary influent.

B.3.1.1 Statistical Analysis and Data Quality Check Summary

The plant data were consolidated and analyzed statistically to identify average and peak conditions. This dataset was segregated into winter (November 1 through April 30) and summer (May 1 through October 31) seasons. Both 7-day and 30-day moving averages were calculated to identify peak week and maximum month (MM) peaking factors (P.F.).

To identify and remove anomalies, the historical data were scrubbed. Data scrubbing used the lognormal interquartile range (IQR) method, which compares the natural logarithm of the loading values to a calculated valid minimum value and valid maximum value for each data range. The lognormal distribution is used for environmental statistics as values are generally positively skewed. Any number greater than the valid maximum or lower than the valid minimum is then identified as a suspected outlier and removed from the data used for flow and load projection calculations. The IQR is calculated as the difference between the 25th and 75th percentile of the historical data, which statistically represents 50 percent of the values. The valid minimum and maximum (or "fences") were calculated by taking 2.5 times the IQR, which is then either added to the 75th percentile to develop the valid max or subtracted from the 25th percentile for the valid minimum. This IQR range statistically represents greater than 90 percent of the distribution.

The data were analyzed according to the following conditions:

- **Annual Average (AA) -** This is the average of all daily data for the entire period. A 12-month rolling average is used for ESWPAF as the basis of the 40-mgd design flow rate in the facility's National Pollutant Discharge Elimination System permit.
- **Maximum Month (MM) -** This is the maximum 30-day moving average during the analysis period and is the key sustained-flow design criteria. The MM value has been calculated for flow and loadings independently.
- **Maximum Weekly (MW)** - This is the maximum 7-day moving average during the analysis period. The MW value has been calculated for flow and loadings independently.
- **Maximum Daily (MD) -** This is the maximum for flow and loadings that occurred in a single day during the analysis period.
- **Peak Hour (PH) -** This is only determined for flow and is an important hydraulic capacity criterion for the total influent flow to the ESWPAF.

Table B-1 summarizes the primary influent flows and loads for the analysis period.

Table B-1. Summary of Historical Primary Influent Flows and Loads

Parameter	Flow (mgd)	Summer Flow (mgd)	Winter Flow (mgd)	TSS (PPD)	BOD-5 (PPD)	TN (PPD)	NH3-N (PPD)	TP (PPD)	ORTHO-P (PPD)
AA	29.6	27.9	31.3	84,300	93,950	8,846	5,308	3,033	1,704
MM	40.7	40.7	40.3	138,550	138,450	13,036	7,821	4,469	2,512
MW	47.8	45.2	47.8	176,050	161,500	15,206	9,124	5,214	2,930
MD	81.0	77.6	81.0	267,000	232,150	21,858	13,115	7,494	4,211
PH	110.6	110.6	105.8	-	-	-	-		-

Notes:

Flow and loading data ranges from 2017 to 2021.

- = not applicable

BOD-5 = 5-day biochemical oxygen demand

NH3-N = ammonia

ORTHO-P = orthophosphate

PPD = pounds per day

TN = total nitrogen

TP = total phosphorus

B.3.1.2 TSS = Total Suspended Solids – Historical Population

Historical population data were obtained from the US Census Bureau for the 2010 and 2020 United States Census'. A summation of the populations for the towns of New Haven, East Haven, Woodbridge, and Hamden was used as these towns contribute flows to the ESWPAF. Using the total populations from 2010 and 2020, a growth rate of 1.5 percent per decade, or 0.15 percent per year, was calculated and used to estimate total historical population for 2017, 2018, 2019, and 2021. **Table B-2** shows historical and estimated total populations from 2017 to 2021. It was assumed that the total population for each year was serviced by the sanitary sewer collection system and not utilizing onsite wastewater treatment systems (for example, residential septic tanks).

Table B-2. Historical Population

Year	2020 Census	Calculated	Population Used for Analysis
2017	-	231,401	231,401
2018	-	231,748	231,748
2019	-	232,096	232,096
2020	232,202	232,444	232,202
2021	-	232,793	232,793

Notes:

2010 and 2020 populations sourced from 2010 and 2020 US Census'.

2017, 2018, 2019, and 2021 populations were estimated using the population growth rate from 2010 to 2020 (that is., 0.15 percent per year).

B.3.1.3 Historical Flow Analysis

B.3.1.3.1 Key Features of Statistical Flow Analysis

To incorporate Inflow and Infiltration (I/I) reduction because of collection system rehabilitation and improvements, a base flow was developed. Base flows were assumed to occur from July 1 through September 30, which tend to be the driest months of the year, and only on days when there was zero rainfall accumulation, resulting in minimal I/I contribution.

AA flow is the true average over the entire year, whereas seasonal average flow is the average flow over the seasons (for example, summer vs. winter). P.F. were developed by dividing the flow condition (such as AA and seasonal MM) by the historical base flow. MM is typically how treatment facilities are designed since it aligns with monthly average compliance requirements. Peak week and MD are used for sludge production and aeration needs.

Because of a lack of influent flow data, effluent flows were assumed to be equivalent to influent flows and effluent flow data were used for historical flow analysis. The historical influent daily average flow, winter months, and the 30-day moving average are shown on **Figure B-2**. As can be seen on the figure, it is evident that historical peak flows tended to occur during the winter months. Winter months were classified as months that fall within the range of January 1 through April 30, and November 1 through December 31 of that year. The correlation between increased peak flows and winter months is likely because of an increase in I/I into the collection system from increased precipitation during these months.

Historical flow and P.F. are presented in **Table B-3** for summer and **Table B-4** for winter conditions. The annual baseflow, which roughly estimates the true population influenced flow with minimal influence from I/I was assumed to occur from July 1 through September 30, and only on days when there was zero rainfall accumulation. The AA is the true average over the entire year. Flow P.F. were developed by dividing the flow condition (such as AA and seasonal MM) by the historical base flow. Multiple summary conditions are outlined in each table.

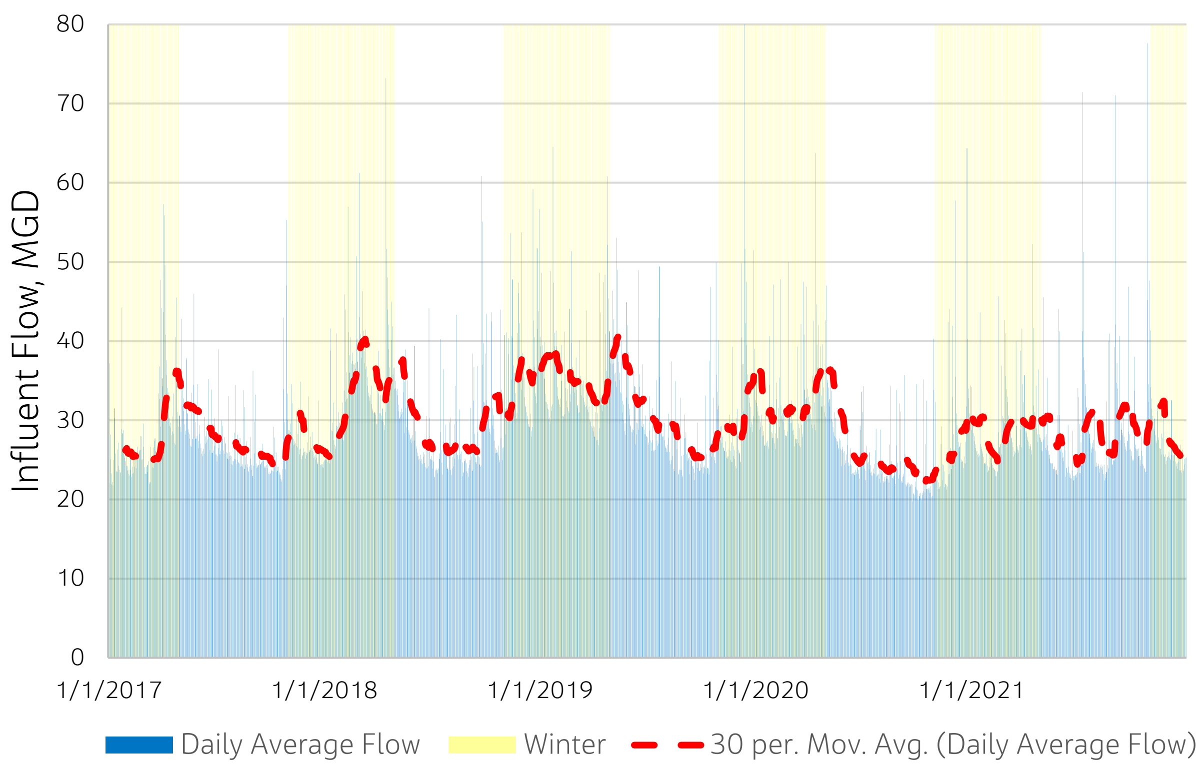

Figure B-2. Historical Daily Average and 30-day Moving Average Flows (2017 to 2021)

Table B-3. Historical Flows and Peaking Factors for Average Annual and Summer Conditions

Year	Base Flow	All Year		Summer (May 1 - Oct 31)							
		AA		Seasonal Average		MM		MW		MD	
		Flow	P.F.	Flow	P.F.	Flow	P.F.	Flow	P.F.	Flow	P.F.
2017	25.0	27.7	1.11	27.4	1.10	35.1	1.40	36.9	1.48	55.3	2.21
2018	25.3	32.0	1.26	28.6	1.13	37.7	1.49	41.0	1.62	60.9	2.41
2019	26.1	32.0	1.23	29.8	1.14	40.7	1.56	45.2	1.73	53.1	2.04
2020	23.0	27.9	1.21	25.1	1.09	36.4	1.58	36.9	1.60	47.0	2.04
2021	27.5	28.3	1.03	28.6	1.04	32.1	1.17	44.0	1.60	77.6	2.83
Average	25.4	29.6	1.17	27.9	1.10	36.4	1.44	40.8	1.61	58.8	2.31
Maximum	27.5	32.0	1.26	29.8	1.14	40.7	1.58	45.2	1.73	77.6	2.83

Notes:

Flow units are mgd.

Data were provided for January 1, 2017 through December 31, 2021.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the base flow for that year.

Table B-4. Historical Flows and Peaking Factors for Average Annual and Winter Conditions

Year	Base Flow	All Year		Summer (May 1 - Oct 31)							
		AA		Seasonal Average		MM		MW		MD	
		Flow	P.F.	Flow	P.F.	Flow	P.F.	Flow	P.F.	Flow	P.F.
2017	25.0	27.7	1.11	27.9	1.12	36.3	1.45	45.8	1.83	57.3	2.29
2018	25.3	32.0	1.26	35.4	1.40	40.3	1.59	47.8	1.89	73.2	2.90
2019	26.1	32.0	1.23	34.2	1.31	38.8	1.49	47.8	1.84	81.0	3.11
2020	23.0	27.9	1.21	30.8	1.34	37.5	1.63	42.3	1.84	64.4	2.80
2021	27.5	28.3	1.03	28.0	1.02	32.4	1.18	44.7	1.63	52.3	1.90
Average	25.4	29.6	1.17	31.3	1.24	37.1	1.47	45.7	1.80	65.6	2.60
Maximum	27.5	32.0	1.26	35.4	1.40	40.3	1.63	47.8	1.89	81.0	3.11

Notes:

Flow units are mgd.

Data were provided for January 1, 2017 through December 31, 2021.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the base flow for that year.

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B.3.1.3.2 Peaking Factors and Precipitation

The historical AA flows were compared to annual total precipitation to show the relation between the two. **Figure B-3** shows total precipitation in comparison with the AA flows from 2017 to 2021.

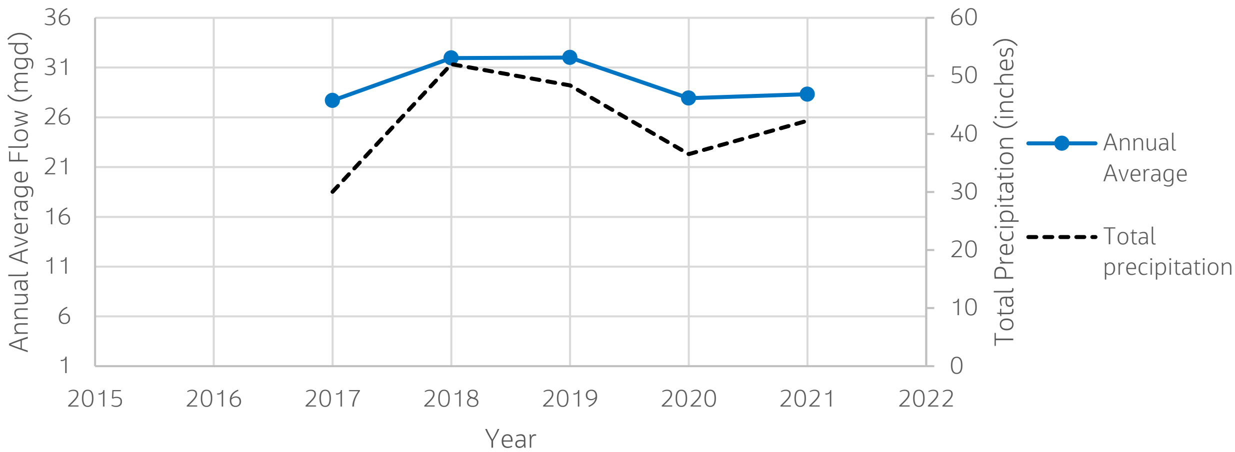


Figure B-3. Annual Average Flow and Total Annual Precipitation

Precipitation data were sourced from the National Oceanic and Atmospheric Administration. From **Figure B-3**, it appears that there was a reduction in the AA flows due to I/I improvements that were implemented. The data for 2020 and 2021 shows a significant drop in the flows during high total precipitation. This shows that I/I improvements were impactful in lessening the amount of I/I into the system.

B.3.1.4 Historical Load Analysis

Historical loads were evaluated to determine the loading P.F. to be applied for future load projections. The loading analysis was performed independently from the peak flow assessment described previously. AA load is the true average over the entire year whereas seasonal average load is the average over the season (for example, summer vs. winter). Historical loads were obtained using the following procedure:

1. The influent load analysis was performed using historical data on TSS, BOD-5, TN, NH3-N, TP, and ORTHO-P provided by the Town.
2. Historical mass loading rates were calculated from the flows and concentrations and the annual average loads, annual MM loads, and design loading conditions (summer and winter MM, MW, and MD) were extracted.
3. The historical P.F. were developed using the AA load.
4. Loading data ranging from 2017 to 2021 was used for the loading analysis.
5. The average P.F. from 2017 to 2021 was selected for the annual average loading. The maximum P.F. from 2017 to 2021 was selected for the MM annual loadings and for the summer and winter weather MM, maximum week, and maximum day loadings.
6. The AA loading from 2017 to 2021 was calculated for each constituent.
7. The average historical loading per capita was calculated by taking the average of each year's per capita loading from 2017 to 2021.
8. Sewer serviced population projections were used to project future AA loading rates of TSS, BOD-5, TN, NH3-N, TP, and ORTHO-P.
9. The P.F. were then applied to the future AA loading rates to generate future loads for the various design conditions.

Historical data were used to develop mass load P.F. for all annual and seasonal conditions from 2017 to 2021. The annual averages were used to calculate the load P.F.. The peak loads and P.F. developed for each constituent are described in the following subsections.

B.3.1.4.1 TSS Peaking Factors

The historical daily influent TSS loading, winter months, and the 30-day moving average are shown on **Figure B-4.**

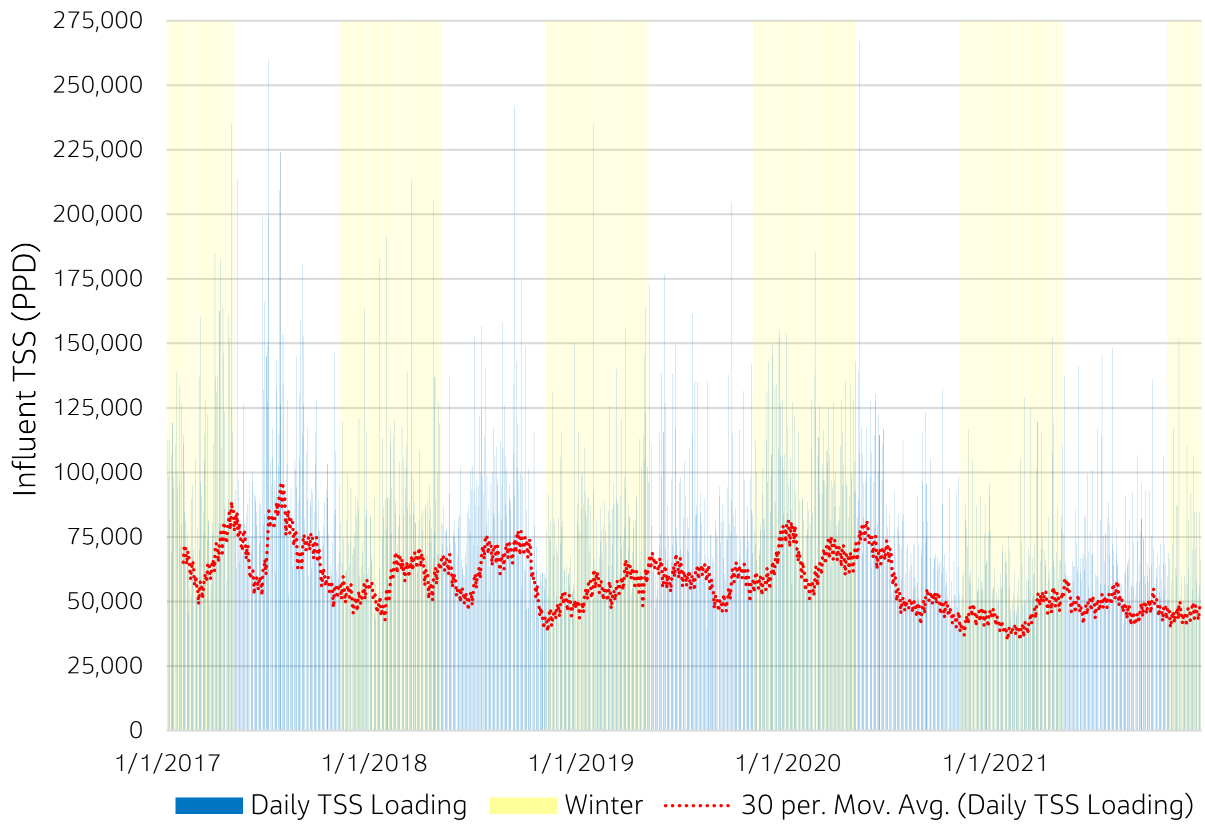


Figure B-4. Historical Influent TSS Loading

The historical TSS loading, and the calculated P.F. are presented in **Table B-5** for summer conditions and **Table B-6** for winter conditions. The P.F. were calculated over the AA load.

The average P.F. between 2017 to 2021 was selected for the annual average loads. The maximum P.F. between 2017 to 2021 were selected for MM annual load and the MM summer, MW summer, MD summer, MM winter, MW winter, and MD winter loads.

Table B-5. Historical TSS Loading and Peaking Factors for Average Annual and Summer Conditions

Year	Annual Average Load	Annual		Summer (May 1 - Oct 31)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	96,161	138,560	1.44	138,560	1.44	176,038	1.83	260,122	2.71
2018	85,933	110,456	1.29	110,456	1.29	143,693	1.67	242,090	2.82
2019	88,089	119,608	1.36	99,255	1.13	139,468	1.58	204,992	2.33
2020	82,607	116,252	1.41	111,307	1.35	144,200	1.75	267,001	3.23
2021	68,698	81,619	1.19	81,619	1.19	99,588	1.45	148,226	2.16
Average	84,298	113,299	1.34	108,239	1.28	140,597	1.66	224,486	2.65
Maximum	96,161	138,560	1.44	138,560	1.44	176,038	1.83	267,001	3.23

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

Table B-6. Historical TSS Loading and Peaking Factors for Average Annual and Winter Conditions

Year	Annual Average Load	Annual		Winter (Jan 1st-Apr 30th & Nov 1st-Dec 31st)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	96,161	138,560	1.44	126,639	1.32	145,164	1.51	235,229	2.45
2018	85,933	110,456	1.29	100,551	1.17	116,710	1.36	213,780	2.49
2019	88,089	119,608	1.36	119,608	1.36	135,467	1.54	235,308	2.67
2020	82,607	116,252	1.41	116,252	1.41	149,218	1.81	185,503	2.25
2021	68,698	81,619	1.19	79,197	1.15	101,668	1.48	152,333	2.22
Average	84,298	113,299	1.34	108,449	1.28	129,645	1.54	204,431	2.41
Maximum	96,161	138,560	1.44	126,639	1.41	149,218	1.81	235,308	2.67

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

B.3.1.4.2 BOD-5 Peaking Factors

The historical influent BOD-5 loading, winter months, and the 30-day moving average are shown on **Figure B-5.**

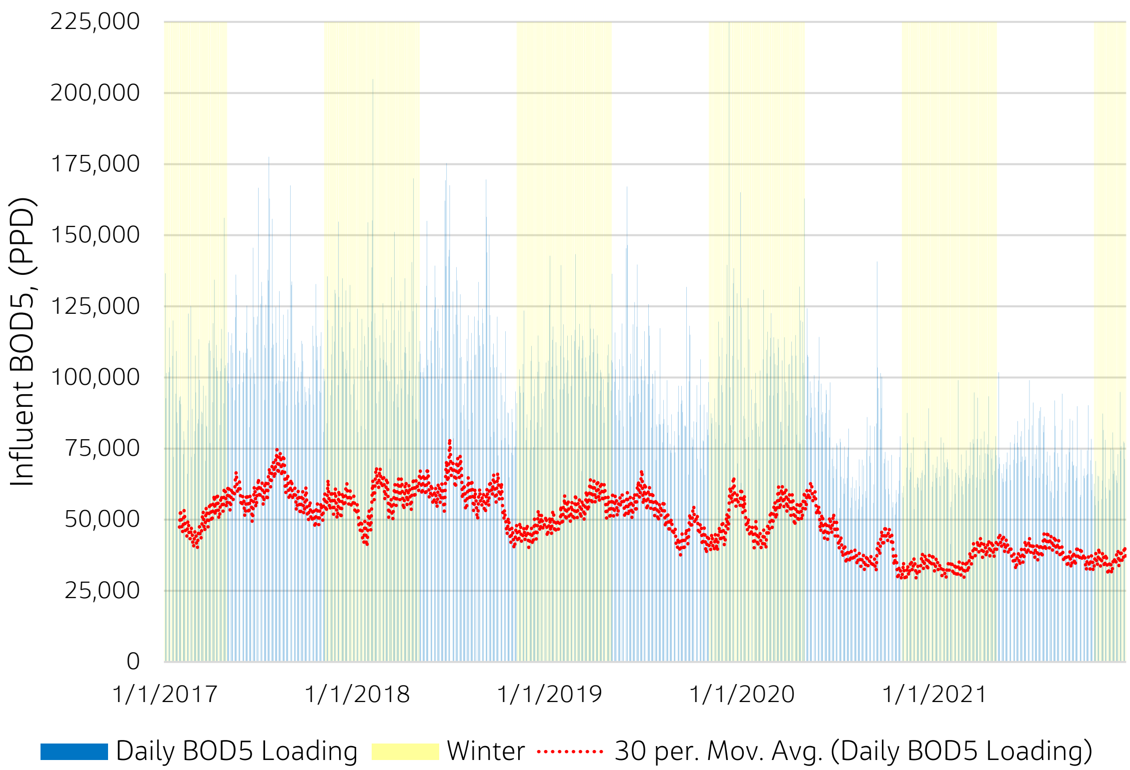


Figure B-5. Historical Influent BOD-5 Loading

The historical BOD-5 loading, and the calculated P.F. are presented in **Table B-7** for summer conditions and **Table B-8** for winter conditions. The P.F. were calculated over the AA load. Data were readily available and recorded for time period 2017 to 2021.

The average P.F. between 2017 to 2021 was selected for the annual average load. The maximum P.F. between 2017 and 2021 were selected for the MM annual load and the MM summer, MW summer, MD summer, MM winter, MW winter, and MD winter loads.

Table B-7. Historical BOD-5 Loading and Peaking Factors for Average Annual and Summer Conditions

Year	Annual Average Load	Annual		Summer (May 1 - Oct 31)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	107,035	132,086	1.23	132,086	1.23	153,123	1.43	177,579	1.66
2018	108,385	138,468	1.28	138,468	1.28	161,488	1.49	175,325	1.62
2019	100,585	120,529	1.20	115,190	1.15	153,048	1.52	167,148	1.66
2020	82,553	122,184	1.48	107,181	1.30	122,129	1.48	140,755	1.71
2021	71,271	79,637	1.12	79,637	1.12	87,977	1.23	101,831	1.43
Average	93,966	118,581	1.26	114,512	1.21	135,553	1.43	152,528	1.61
Maximum	108,385	138,468	1.48	138,468	1.30	161,488	1.52	177,579	1.71

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

Table B-8. Historical BOD-5 Loading and Peaking Factors for Average Annual and Winter Conditions

Year	Annual Average Load	Annual		Winter (Jan 1st-Apr 30th & Nov 1st-Dec 31st)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	107,035	132,086	1.23	120,308	1.12	133,573	1.25	156,143	1.46
2018	108,385	138,468	1.28	123,259	1.14	155,348	1.43	204,930	1.89
2019	100,585	120,529	1.20	120,529	1.20	150,394	1.50	232,172	2.31
2020	82,553	122,184	1.48	122,184	1.48	122,129	1.48	162,945	1.97
2021	71,271	79,637	1.12	75,611	1.06	81,630	1.15	99,048	1.39
Average	93,966	118,581	1.26	112,378	1.20	128,615	1.36	171,048	1.80
Maximum	108,385	138,468	1.48	123,259	1.48	155,348	1.50	232,172	2.31

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

During the project kickoff meeting held on February 10, 2022, Greater New Haven Water Pollution Control Authority noted that a customer was improperly discharging glycerin into the sewer collection system that caused a spike in BOD-5 at the ESWPAF. The data review showed that BOD-5 loading ranged from approximately 38,000 PPD to approximately 165,000 PPD depending on year and season, with the exception of two outliers. On February 1, 2018 and December 9, 2019, BOD-5 loadings of approximately 191,000 PPD and 225,000 PPD were observed.

An assessment was performed to determine the impact of keeping the two outliers in the BOD-5 data analysis. Since the outliers occurred in winter months, the only impact was to the MD Winter data. This resulted in an annual average projection of 17,388 PPD more than if left out. Jacobs recommends using the outliers in the flows and loads analysis as there is potential for BOD-5 spikes because of similar events in the future and the data points were valid and passed the lognormal IQR data scrubbing. The analysis of historical BOD-5 loading includes these outliers.

B.3.1.4.3 TN Peaking Factors

The historical influent TN loading, winter months, and the 30-day moving average are shown on **Figure B-6.**

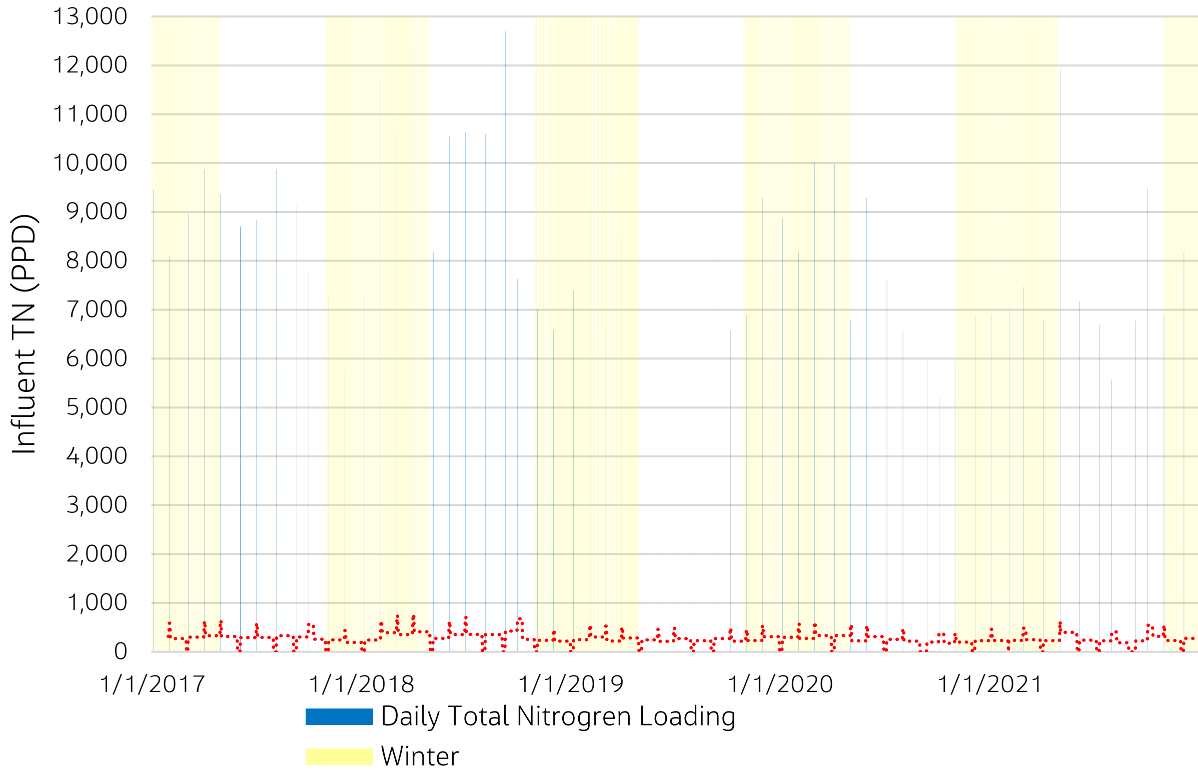


Figure B-6. Historical Influent TN Loading

The dataset for TN loading was limited. Historical data from 2017 to 2021 showed datapoints for TN were collected once per month. Because of a lack of datapoints, the methodology used to calculate MD, MW, and MM was not accurate as it relies on multiple datapoints within the duration of a month, otherwise the P.F. for MD, MW, and MM will be identical. historical TN loading, and the calculated P.F. are presented in **Table B-9** for summer conditions and **Table B-10** for winter conditions. The P.F. were calculated over the AA load. Data were readily available and recorded for time period 2017 to 2021.

The average P.F. between 2017 to 2021 was selected for the annual average load. The maximum P.F. between 2017 and 2021 were selected for the MM annual load and the MM summer, MW summer, MD summer, MM winter, MW winter, and MD winter loads.

Table B-9. Historical TN Loading and Peaking Factors for Average Annual and Summer Conditions

Year	Annual Average Load	Annual		Summer (May 1 - Oct 31)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	8,600	9,874	1.15	9,874	1.15	9,874	1.15	9,874	1.15
2018	9,657	12,697	1.31	12,697	1.31	12,697	1.31	12,697	1.31
2019	7,610	9,289	1.22	8,160	1.07	8,160	1.07	8,160	1.07
2020	7,615	10,013	1.32	9,297	1.22	9,297	1.22	9,297	1.22
2021	7,580	11,931	1.57	11,931	1.57	11,931	1.57	11,931	1.57
Average	8,212	10,761	1.31	10,392	1.27	10,392	1.27	10,392	1.27
Maximum	9,657	12,697	1.57	12,697	1.57	12,697	1.57	12,697	1.57

Notes:
Load units are PPD.
To determine MM and MW flows, running 30-day and 7-day averages were used.
P.F. are calculated for each calendar year using the AA load for that year.

Table B-10. Historical TN Loading and Peaking Factors for Average Annual and Winter Conditions

Year	Annual Average Load	Annual		Winter (Jan 1st-Apr 30th & Nov 1st-Dec 31st)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	8,600	9,874	1.15	9,868	1.15	9,868	1.15	9,868	1.15
2018	9,657	12,697	1.31	12,357	1.28	12,357	1.28	12,357	1.28
2019	7,610	9,289	1.22	9,289	1.22	9,289	1.22	9,289	1.22
2020	7,615	10,013	1.32	10,013	1.32	10,013	1.32	10,013	1.32
2021	7,580	11,931	1.57	8,194	1.08	8,177	1.08	8,177	1.08
Average	8,212	10,761	1.31	9,944	1.21	9,941	1.21	9,941	1.21
Maximum	9,657	12,697	1.57	12,357	1.32	12,357	1.32	12,357	1.32

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

B.3.1.4.4 NH3-N Peaking Factors

The historical influent NH3-N loading, winter months, and the 30-day moving average are shown on **Figure B-7.**

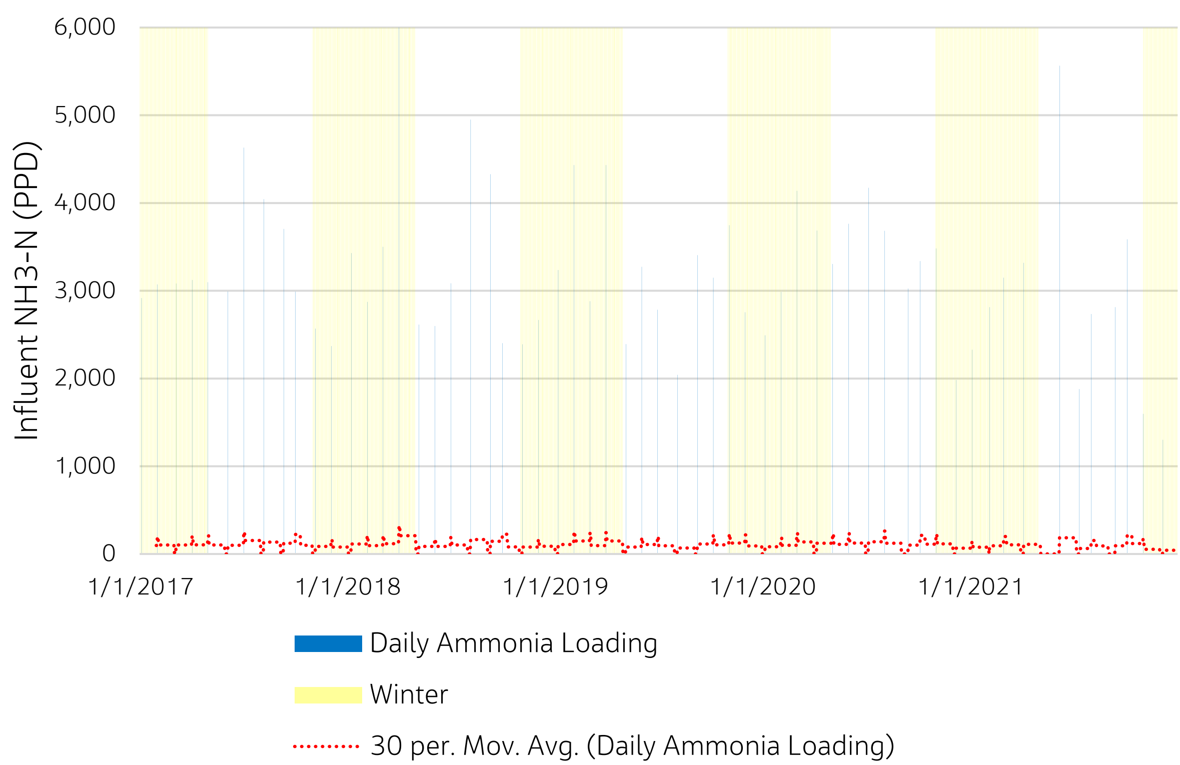


Figure B-7. Historical Influent NH3-N Loading

The historical NH3-N loading, and the calculated P.F. are presented in **Table B-11** for summer conditions and **Table B-12** for winter conditions. The P.F. were calculated over the AA load. Data were readily available and recorded for time period 2017 to 2021.

The average P.F. between 2017 to 2021 was selected for the AA load. The maximum P.F. between 2017 and 2021 were selected for the MM annual load and the MM summer, MW summer, MD summer, MM winter, MW winter, and MD winter loads.

Table B-11. Historical NH3-N Loading and Peaking Factors for Average Annual and Summer Conditions

Year	Annual Average Load	Annual		Summer (May 1 - Oct 31)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	3,216	4,631	1.44	4,631	1.44	4,631	1.44	4,631	1.44
2018	3,424	6,251	1.83	4,950	1.45	4,950	1.45	4,950	1.45
2019	3,211	4,433	1.38	3,405	1.06	3,405	1.06	3,405	1.06
2020	3,338	4,174	1.25	4,174	1.25	4,174	1.25	4,174	1.25
2021	2,826	5,566	1.97	5,566	1.97	5,566	1.97	5,566	1.97
Average	3,203	5,011	1.57	4,545	1.43	4,545	1.43	4,545	1.43
Maximum	3,424	6,251	1.97	5,566	1.97	5,566	1.97	5,566	1.97

Notes:
Load units are PPD.
To determine MM and MW flows, running 30-day and 7-day averages were used.
P.F. are calculated for each calendar year using the AA load for that year.

Table B-12. Historical NH3-N Loading and Peaking Factors for Average Annual and Winter Conditions

Year	Annual Average Load	Annual		Winter (Jan 1st-Apr 30th & Nov 1st-Dec 31st)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	3,216	4,631	1.44	3,123	0.97	3,123	0.97	3,123	0.97
2018	3,424	6,251	1.83	6,251	1.83	6,251	1.83	6,251	1.83
2019	3,211	4,433	1.38	4,433	1.38	4,433	1.38	4,433	1.38
2020	3,338	4,174	1.25	4,139	1.24	4,139	1.24	4,139	1.24
2021	2,826	5,566	1.97	3,318	1.17	3,318	1.17	3,318	1.17
Average	3,203	5,011	1.57	4,253	1.32	4,253	1.32	4,253	1.32
Max	3,424	6,251	1.97	6,251	1.83	6,251	1.83	6,251	1.83

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

B.3.1.4.5 TP Peaking Factors

The historical influent TP loading, winter months, and the 30-day moving average are shown on **Figure B-8.**

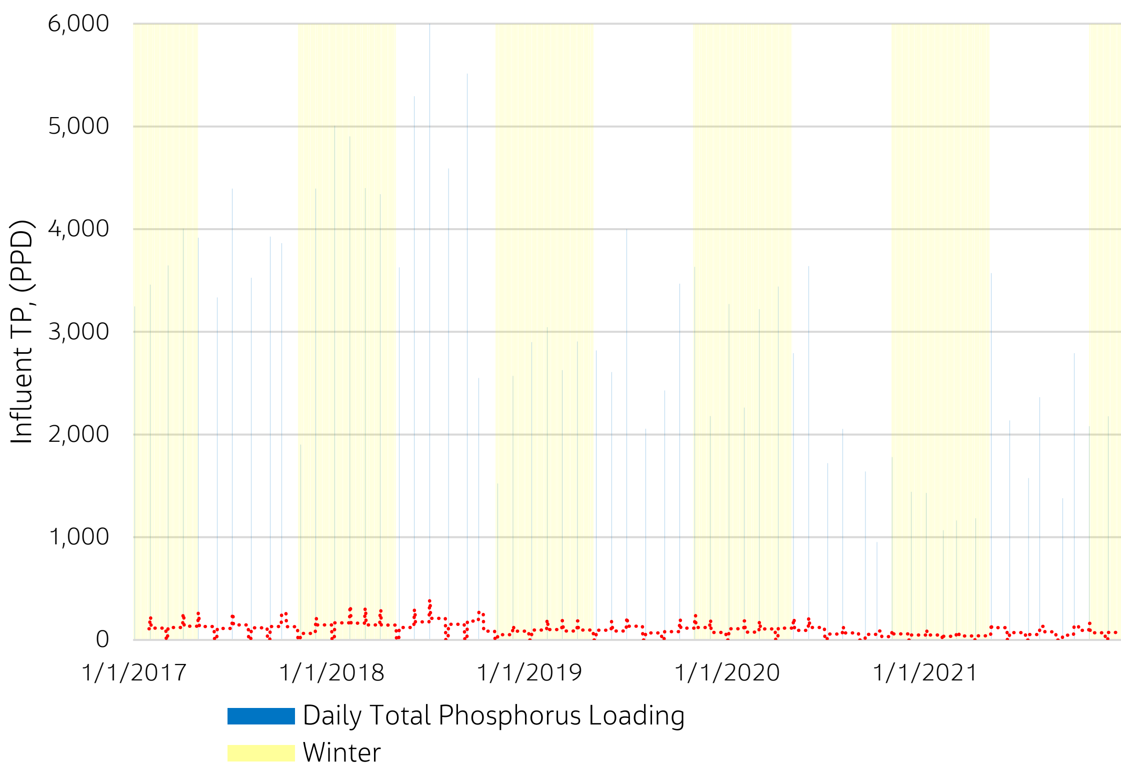


Figure B-8. Historical Influent TP Loading

The historical TP loading, and the calculated P.F. are presented in **Table B-13** for summer conditions and **Table B-14** for winter conditions. The P.F. were calculated over the AA load. Data were readily available and recorded for time period 2017 to 2021.

The average P.F. between 2017 to 2021 was selected for the AA load. The maximum P.F. between 2017 and 2021 were selected for the MM annual load and the MM summer, MW summer, MD summer, MM winter, MW winter, and MD winter loads.

Table B-13. Historical TP Loading and Peaking Factors for Average Annual and Summer Conditions

Year	Annual Average Load	Annual		Summer (May 1 - Oct 31)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	3,635	4,396	1.21	4,395	1.21	4,395	1.21	4,395	1.21
2018	4,220	6,319	1.50	6,319	1.50	6,319	1.50	6,319	1.50
2019	2,890	4,001	1.38	4,001	1.38	4,001	1.38	4,001	1.38
2020	2,352	3,641	1.55	3,641	1.55	3,641	1.55	3,641	1.55
2021	1,911	3,572	1.87	3,572	1.87	3,572	1.87	3,572	1.87
Average	3,002	4,386	1.50	4,386	1.50	4,386	1.50	4,386	1.50
Maximum	4,220	6,319	1.87	6,319	1.87	6,319	1.87	6,319	1.87

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

Table B-14. Historical TP Loading and Peaking Factors for Average Annual and Winter Conditions

Year	Annual Average Load	Annual		Winter (Jan 1st-Apr 30th & Nov 1st-Dec 31st)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	3,635	4,396	1.21	4,396	1.21	4,396	1.21	4,396	1.21
2018	4,220	6,319	1.50	5,008	1.19	5,008	1.19	5,008	1.19
2019	2,890	4,001	1.38	3,633	1.26	3,633	1.26	3,633	1.26
2020	2,352	3,641	1.55	3,442	1.46	3,442	1.46	3,442	1.46
2021	1,911	3,572	1.87	2,179	1.14	2,179	1.14	2,179	1.14
Average	3,002	4,386	1.50	3,731	1.25	3,731	1.25	3,731	1.25
Maximum	4,220	6,319	1.87	5,008	1.46	5,008	1.46	5,008	1.46

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

B.3.1.4.6 ORTHO-P Peaking Factors

The historical influent ORTHO-P loading, winter months, and the 30-day moving average are shown on **Figure B-9.**

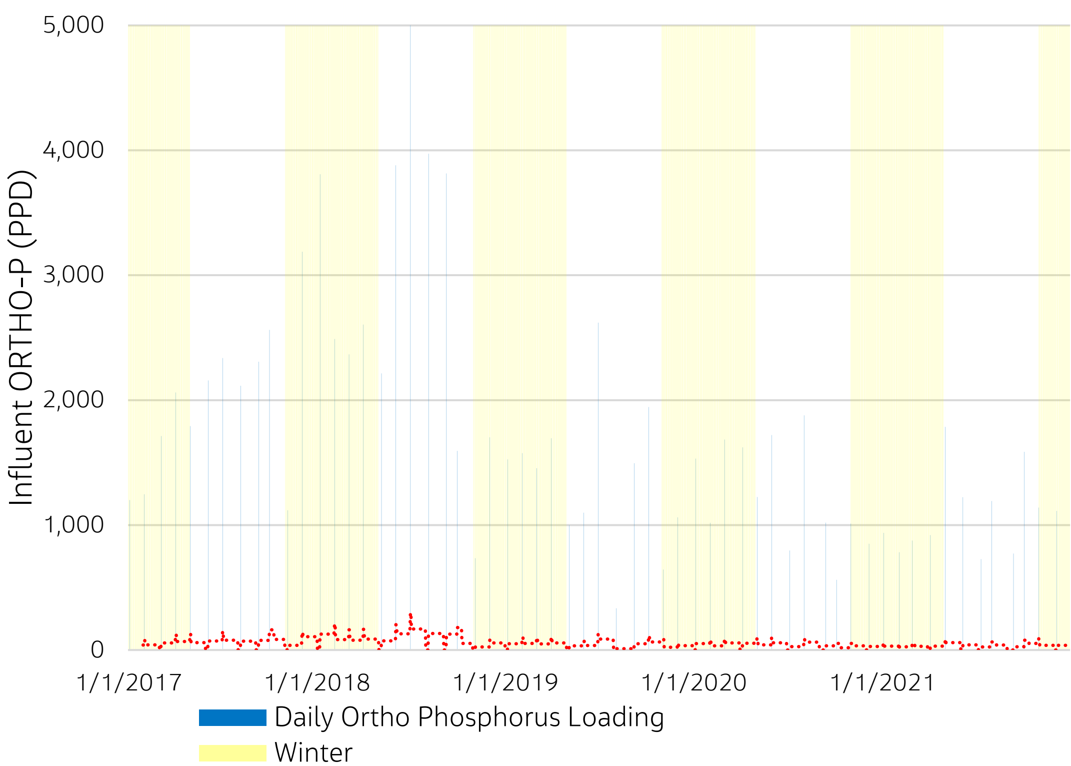


Figure B-9. Historical Influent ORTHO-P Loading

The historical ORTHO-P loading, and the calculated P.F. are presented in **Table B-15** for summer conditions and **Table B-16** for winter conditions. The P.F. were calculated over the AA load. Data were readily available and recorded for time period 2017 to 2021.

The average P.F. between 2017 to 2021 was selected for the AA load. The maximum P.F. between 2017 and 2021 were selected for the MM annual load and the MM summer, MW summer, MD summer, MM winter, MW winter, and MD winter loads.

Table B-15. Historical ORTHO-P Loading and Peaking Factors for Average Annual and Summer Conditions

Year	Annual Average Load	Annual		Summer (May 1 - Oct 31)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	1,983	3,189	1.61	2,563	1.29	2,563	1.29	2,563	1.29
2018	2,852	5,042	1.77	5,042	1.77	5,042	1.77	5,042	1.77
2019	1,371	2,621	1.91	2,621	1.91	2,621	1.91	2,621	1.91
2020	1,244	1,878	1.51	1,878	1.51	1,878	1.51	1,878	1.51
2021	1,088	1,786	1.64	1,786	1.64	1,786	1.64	1,786	1.64
Average	1,708	2,903	1.69	2,778	1.62	2,778	1.62	2,778	1.62
Maximum	2,852	5,042	1.91	5,042	1.91	5,042	1.91	5,042	1.91

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

Table B-16. Historical ORTHO-P Loading and Peaking Factors for Average Annual and Winter Conditions

Year	Annual Average Load	Annual		Winter (Jan 1st-Apr 30th & Nov 1st-Dec 31st)					
		MM		MM		MW		MD	
		Load	P.F.	Load	P.F.	Load	P.F.	Load	P.F.
2017	1,983	3,189	1.61	3,189	1.61	3,189	1.61	3,189	1.61
2018	2,852	5,042	1.77	3,809	1.34	3,809	1.34	3,809	1.34
2019	1,371	2,621	1.91	1,696	1.24	1,696	1.24	1,696	1.24
2020	1,244	1,878	1.51	1,685	1.36	1,685	1.36	1,685	1.36
2021	1,088	1,786	1.64	1,140	1.05	1,140	1.05	1,140	1.05
Average	1,708	2,903	1.69	2,304	1.32	2,304	1.32	2,304	1.32
Max	2,852	5,042	1.91	3,809	1.61	3,809	1.61	3,809	1.61

Notes:

Load units are PPD.

To determine MM and MW flows, running 30-day and 7-day averages were used.

P.F. are calculated for each calendar year using the AA load for that year.

B.3.1.4.7 Loading Peaking Factors Summary

A summary of the selected P.F. from historical loading data is presented in **Table B-17.**

Table B-17. Summary of Applied Peaking Factors for all Load Constituent's Projections

	TSS	BOD-5	TN	NH3-N	TP	ORTHO-P
MM Annual	1.64	1.47	1.55	1.95	2.11	2.95
MM Summer	1.64	1.47	1.55	1.74	2.11	2.95
MW Summer	2.09	1.72	1.55	1.74	2.11	2.95
MD Summer	3.17	1.89	1.55	1.74	2.11	2.95
MM Winter	1.50	1.31	1.50	1.95	1.67	2.23
MW Winter	1.77	1.65	1.50	1.95	1.67	2.23
MD Winter	2.79	2.47	1.50	1.95	1.67	2.23

B.3.1.5 Historical Per Capita Flow and Load Estimates

B.3.1.5.1 Per Capita Flow

Historical sewer serviced populations determined for 2017 to 2020 were used in conjunction with the previously determined AA flows to estimate the flow per capita that is presented in **Table B-18**. Per capita flows were calculated by dividing the annual base flow by that year's sewer serviced population.

Table B-18. Historical per Capita Flows

Year	Sewer Serviced Population (capita)	Base Flow (mgd)	Flow per Capita (gal/d/capita)
2017	231,401	25.0	108.2
2018	231,748	25.3	109.0
2019	232,096	26.1	112.2
2020	232,202	23.0	99.1
2021	232,793	27.5	118.0
Average	232,048	25.4	109.3

Notes:

Base flow units are mgd.

Flow per capita units are in gallons per day per capita (gal/d/capita).

2020 sewer serviced population taken from 2020 US Census.

2017, 2018, 2019, and 2021 sewer serviced population calculated using a growth rate of 0.15 percent per year.

Growth rate determined using 2010 and 2020 US Census data.

B.3.1.5.2 Per Capita Loading

Historical sewer serviced populations determined for 2017 to 2021 were used in conjunction with the previously determined AA loads to estimate the loading per capita for TSS, BOD-5, TN, NH3-N, TP, and ORTHO-P. Annual per capita loading is shown in that is presented in **Table B-19** and **Table B-20**. Per capita loads were calculated by dividing the AA load by that year's population.

Table B-19. Historical Average Annual Load and Per Capita Loading for TSS, BOD-5, and TN

Year	Sewer Serviced Population (capita)	TSS Loading		BOD-5 Loading		TN Loading	
		AA Load (PPD)	Per Capita Loading (PPD/capita)	AA Load (PPD)	Per Capita Loading (PPD/capita)	AA Load (PPD)	Per Capita Loading (PPD/capita)
2017	231,401	96,161	0.416	107,035	0.463	8,600	0.037
2018	231,748	85,933	0.371	108,385	0.468	9,657	0.042
2019	232,096	88,089	0.380	100,585	0.433	7,610	0.033
2020	232,202	82,607	0.356	82,553	0.356	7,615	0.033
2021	232,793	68,698	0.295	71,271	0.306	7,580	0.033
Average	232,048	84,298	0.363	93,966	0.405	8,212	0.035

Note:

Load units are PPD.

Table B-20. Historical Average Annual Load and Per Capita Loading for NH3-N, TP, and ORTHO-P

Year	Sewer Serviced Population (capita)	NH3-N Loading		TP Loading		Ortho P Loading	
		AA Load (PPD)	Per Capita Loading (PPD/capita)	AA Load (PPD)	Per Capita Loading (PPD/capita)	AA Load (PPD)	Per Capita Loading (PPD/capita)
2017	231,401	3,216	0.014	3,635	0.016	1,983	0.009
2018	231,748	3,424	0.015	4,220	0.018	2,852	0.012
2019	232,096	3,211	0.014	2,890	0.012	1,371	0.006
2020	232,202	3,338	0.014	2,352	0.010	1,244	0.005
2021	232,793	2,826	0.012	1,911	0.008	1,088	0.005
Average	232,048	3,203	0.014	3,002	0.013	1,708	0.007

Note:

Load units are PPD.

B.3.2 2045 Flows and Loads

B.3.2.1 Population Projections

Future sewer serviced populations were calculated from 2022 through 2045 using the historical annual growth factor of 0.15 percent per year. As previously discussed, using the 2010 and 2020 US Census data, it was determined that a growth factor of 1.5 percent capita occurred from 2010 to 2020, or 0.15 percent annually from 2010 to 2020. **Table B-21** summarizes population projections every 5 years from 2025 through 2045.

Table B-21. 2025-2045 Population Projections

Year	Population Projection (capita)
2025	234,193
2030	235,954
2035	237,729
2040	239,518
2045	241,319

Note:

Population projections were determined using 2010 to 2020 annual population growth rate of 0.15 percent.

B.3.2.2 Flow and Load Projections

B.3.2.2.1 Flow Projections – Scenario Based Peaking Factors

Flow projections were divided into two scenarios for P.F. selection basis. The first scenario uses a P.F. selection basis of average applied P.F. for calculating projected flows. The second scenario uses maximum applied P.F. The average P.F. are smaller than the maximum P.F.; thus, the projected flows in the first scenario will be smaller than those in the second scenario. This was done to provide two separate scenarios for wastewater treatment facility upgrade design purposes. **Table B-22** shows the applied P.F. for flow previously determined in **Table B-3** and **Table B-4**.

Table B-22. Scenario Based Applied Peaking Factors

		Applied Peaking Factor for Flow (to Base Flow)						
Scenario	Selection Base	AA	Summer MM	Summer MW	Summer MD	Winter MM	Winter MW	Winter MD
Scenario 1	Average	1.17	1.44	1.61	2.31	1.24	1.80	2.60
Scenario 2	Maximum	1.26	1.58	1.73	2.83	1.63	1.89	3.11

Using the population projection for 2045, base flows were projected by dividing the average flow per capita by the projected sewer serviced population for that year. The remaining flow parameters were projected by multiplying the selected P.F. by the projected base flows. The base flows and projected flows for the first scenario using average applied P.F. are summarized in **Table B-23** and **Figure B-10**. The base flows and projected flows for the second scenario using maximum applied P.F. are summarized in **Table B-24** and **Figure B-11**.

Table B-23. Scenario 1 Flow Projections (Average Applied Peaking Factors)

Flow Projections (mgd)									
				Summer			Winter		
Year	Sewer Serviced Population	Baseflow	AA	MM	MW	MD	MM	MW	MD
2045	241,319	26.4	30.8	38.0	49.6	60.8	38.7	47.6	68.6

Note:

Flow units are mgd.

Table B-24. Scenario 2 Flow Projections (Maximum Applied Peaking Factors)

Flow Projections (mgd)									
				Summer			Winter		
Year	Sewer Serviced Population	Baseflow	AA	MM	MW	MD	MM	MW	MD
2045	241,319	26.4	33.4	41.7	45.8	74.5	43.0	49.9	82.0

Note:

Flow units are mgd.

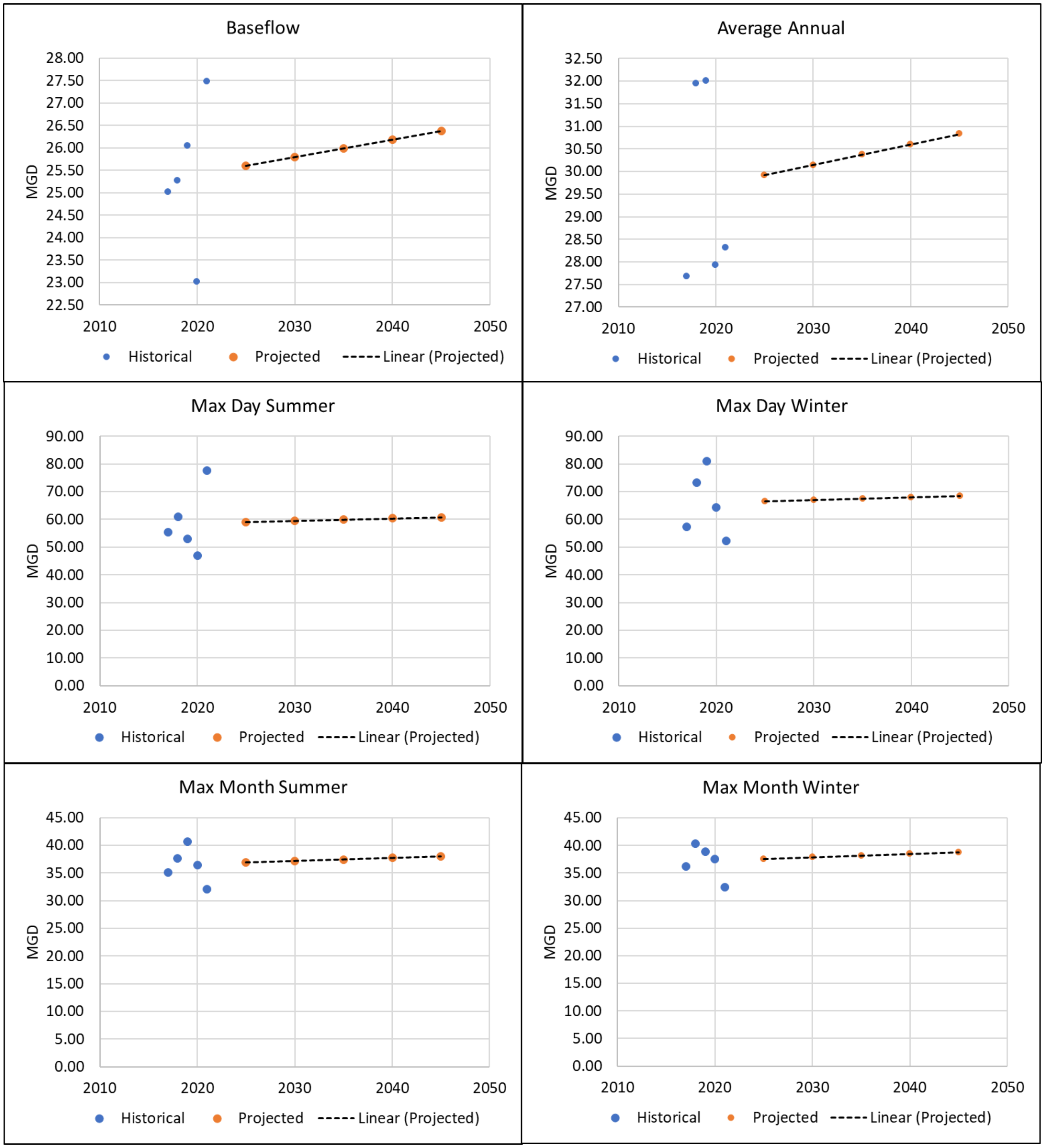


Figure B-10. Scenario 1 (Average Applied Peaking Factor Basis) Base Flow, Average Annual, Max Month Summer and Winter Flow Projections and Historical Flows

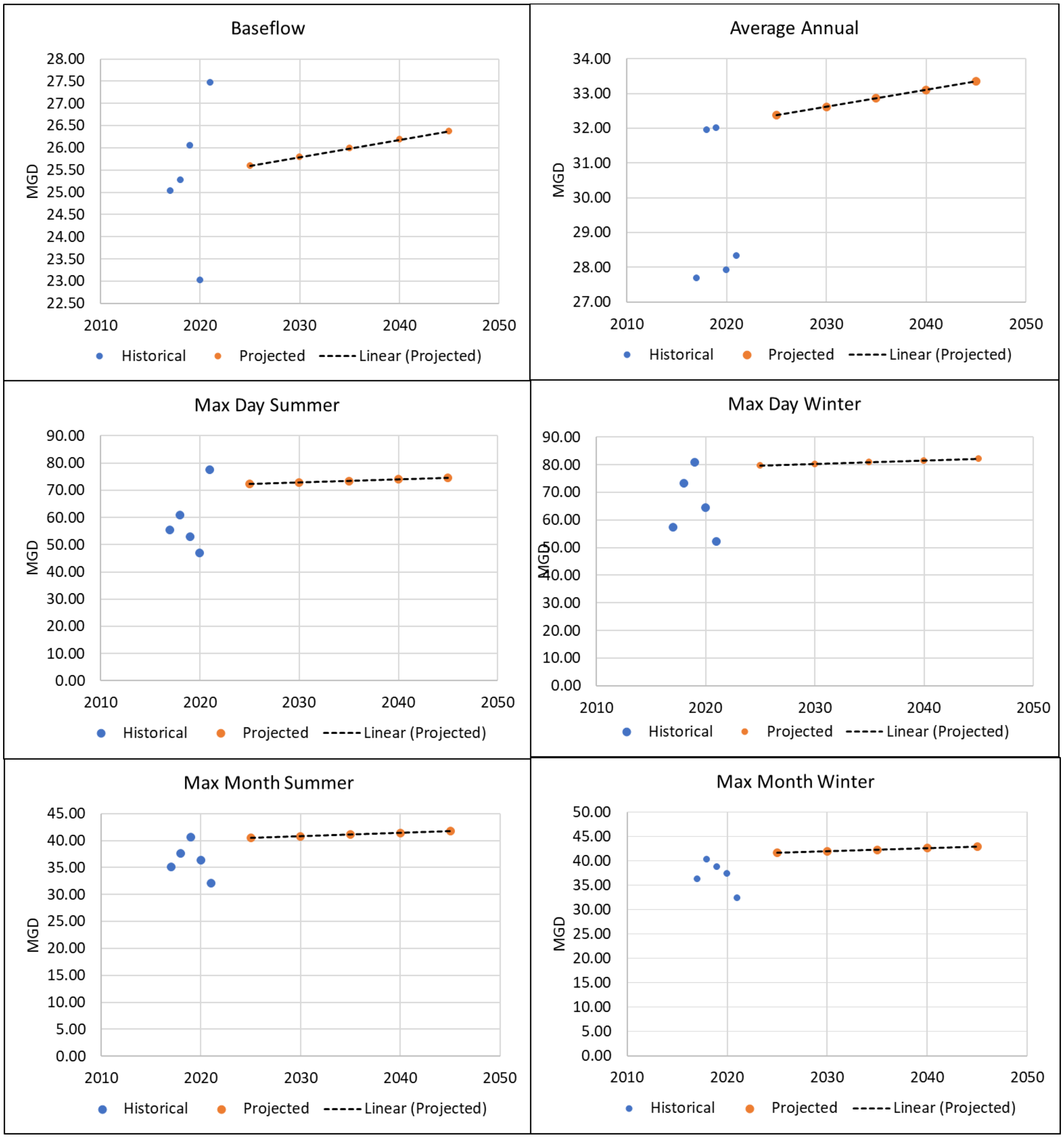


Figure B-11. Scenario 2 (Maximum Applied Peaking Factor Basis) Base Flow, Average Annual, Max Month Summer and Winter Flow Projections and Historical Flows

B.3.2.2.2 Loading Projections

The AA residential loading projections were developed for TSS, BOD-5, TN, NH3-N, TP, and ORTHO-P using the calculated load per capita and the projected populations. The loading P.F. previously selected were applied to the AA loading to generate the future peak loading conditions presented in **Table B-25**, and **Figure B-12** through **Figure B-16**.

Table B-25. 2045 Loading Projections (PPD)

	Load per Capita	Sewer Serviced Population	AA	MM Annual	MM Summer	MW Summer	MD Summer	MM Winter	MW Winter	MD Winter
TSS	0.363	241,319	87,650	144,100	144,100	183,050	277,650	131,700	155,200	244,700
BOD-5	0.405	241,319	97,700	144,000	144,000	167,950	184,650	128,200	161,550	241,450
TN	0.035	241,319	9,200	13,550	13,550	15,800	17,400	12,050	15,200	22,750
NH3-N	0.014	241,319	5,500	8,150	8,150	9,500	10,450	7,250	9,150	13,650
TP	0.013	241,319	3,150	4,650	4,650	5,400	5,950	4,150	5,200	7,800
ORTHO-P	0.007	241,319	1,750	2,600	2,600	3,050	3,350	2,350	2,950	4,400

Note:

Load units are PPD.

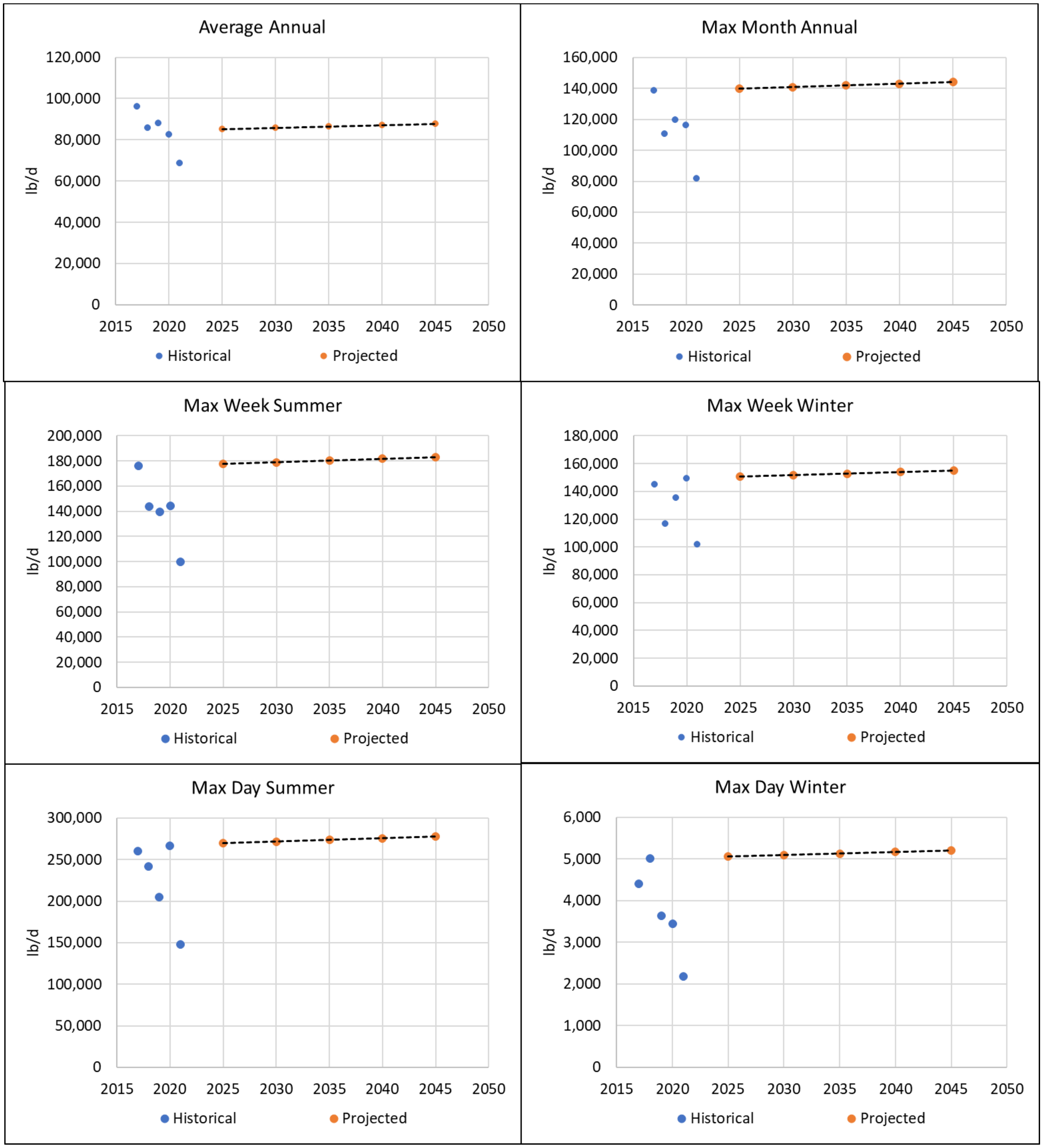


Figure B-12. Historical and Projected TSS Loading

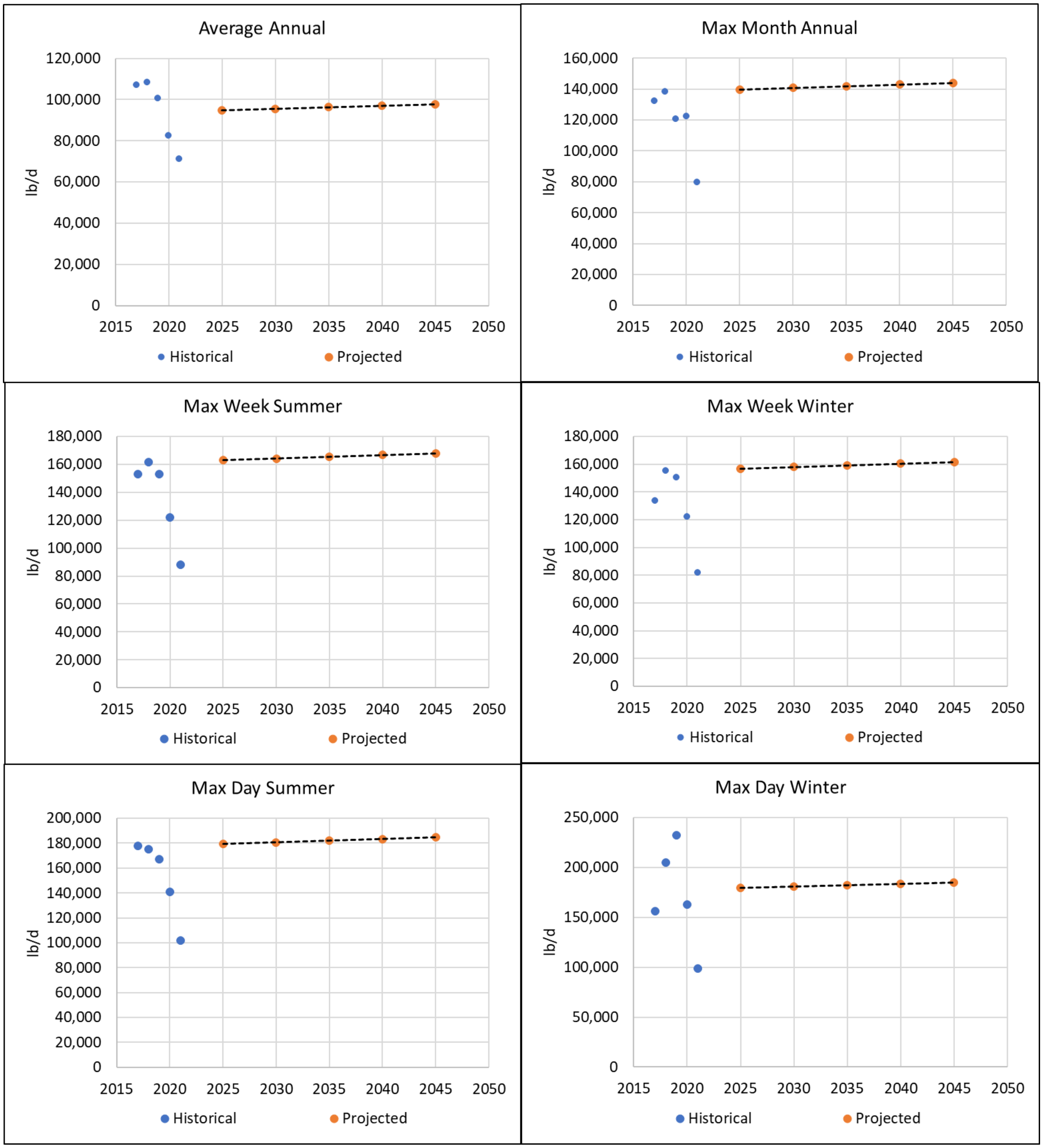


Figure B-13. Historical and Projected BOD-5 Loading

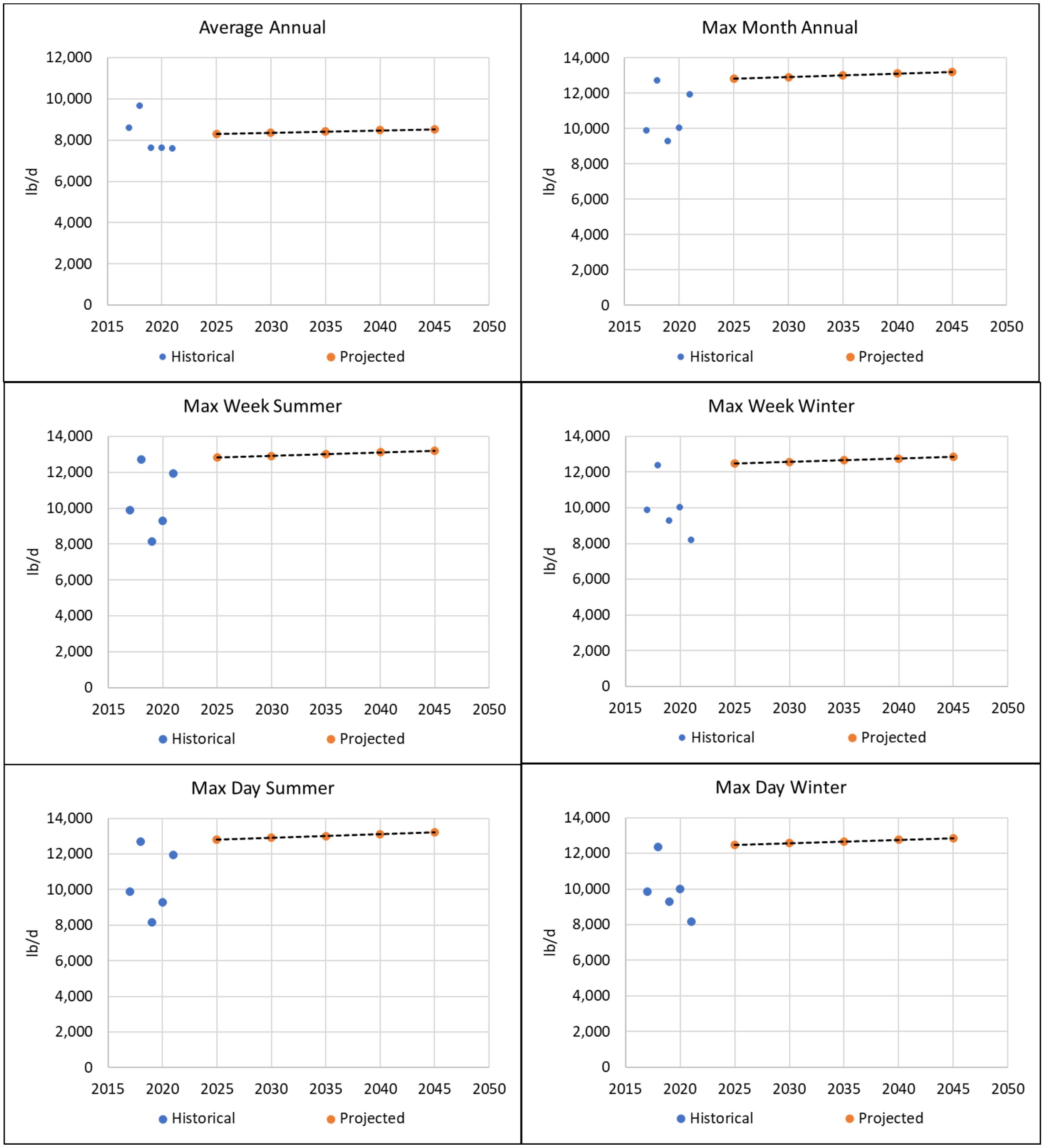


Figure B-14. Historical and Projected TN Loading

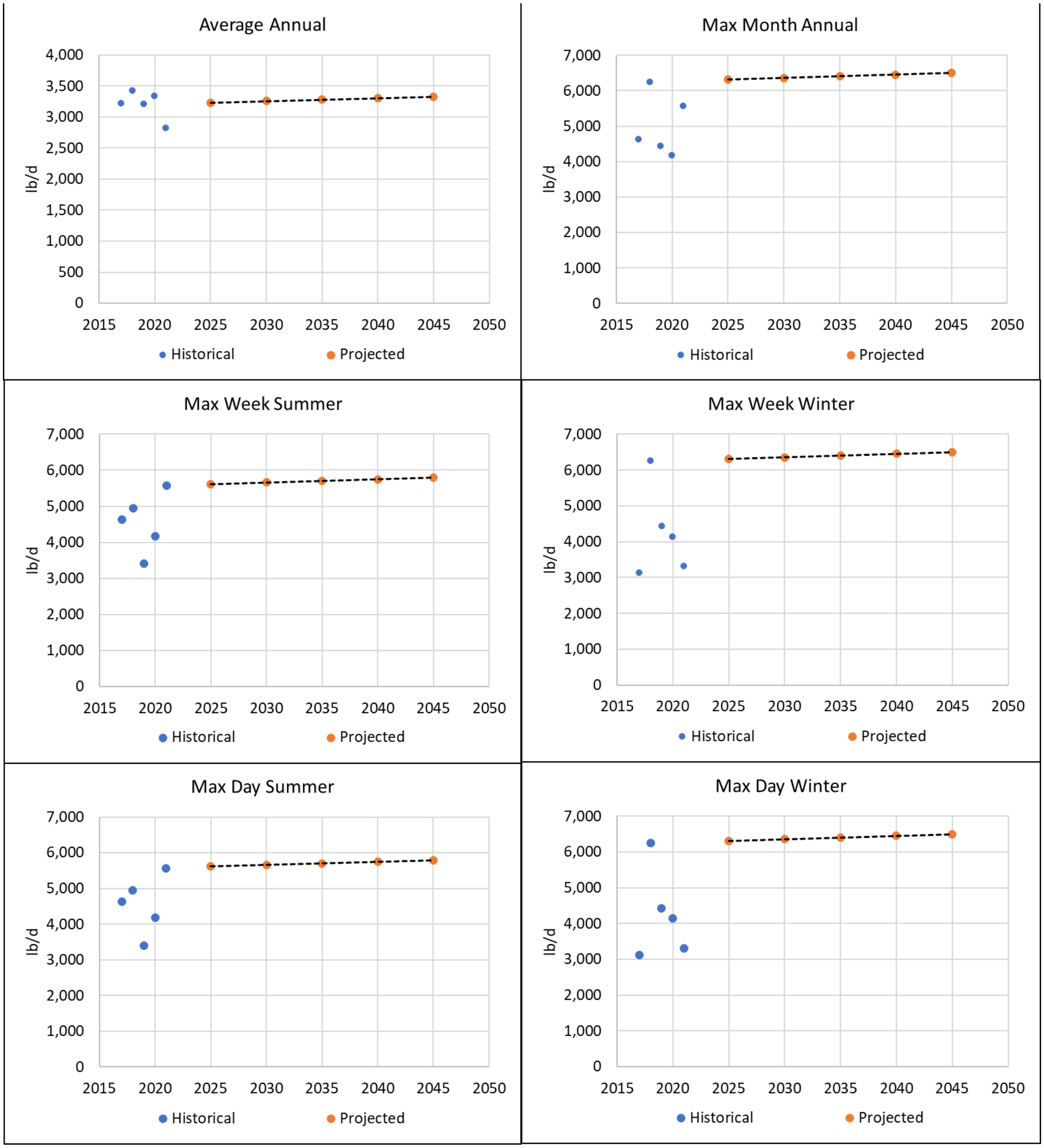


Figure B-15. Historical and Projected NH3-N Loading

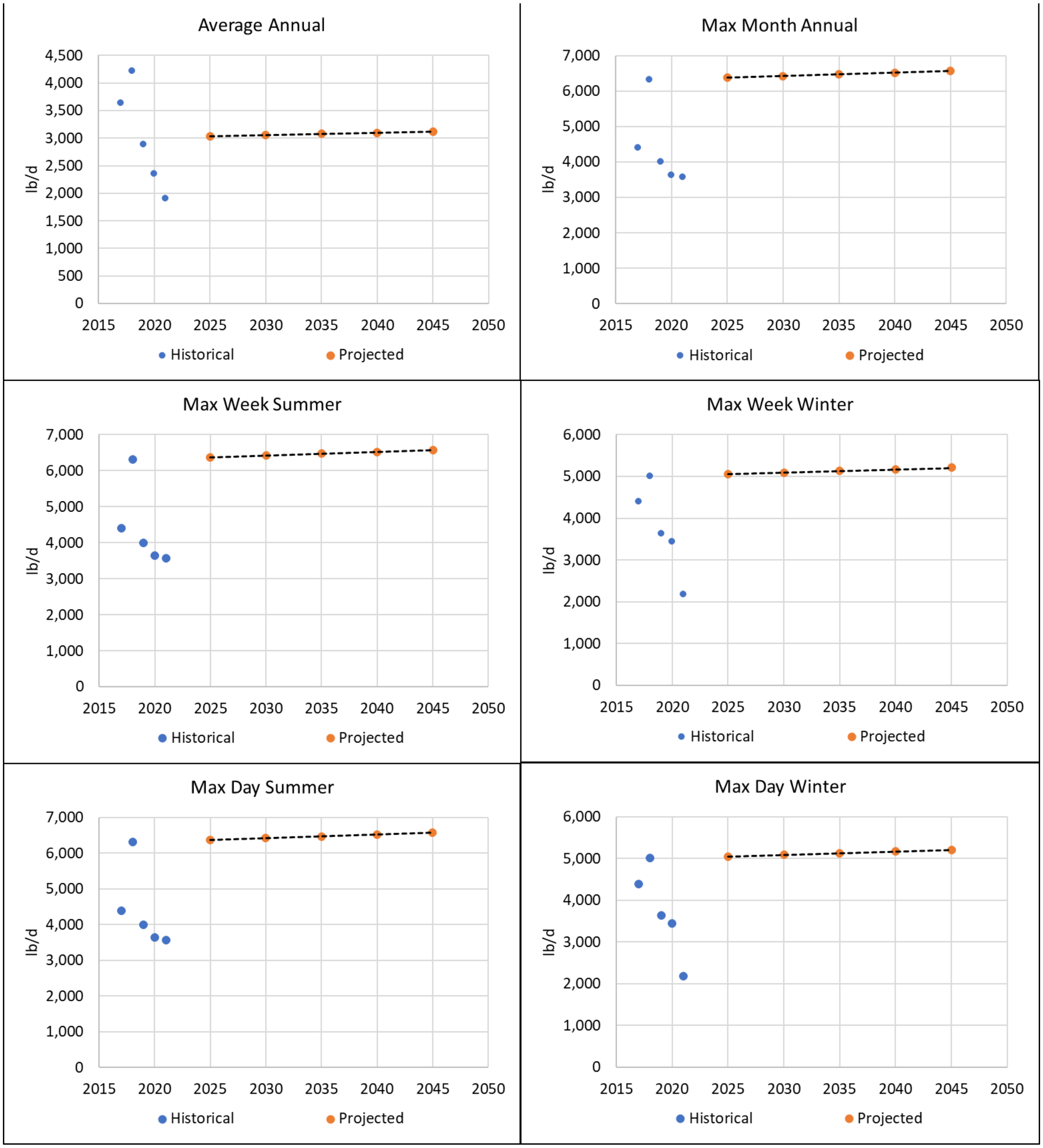


Figure B-16. Historical and Projected TP Loading

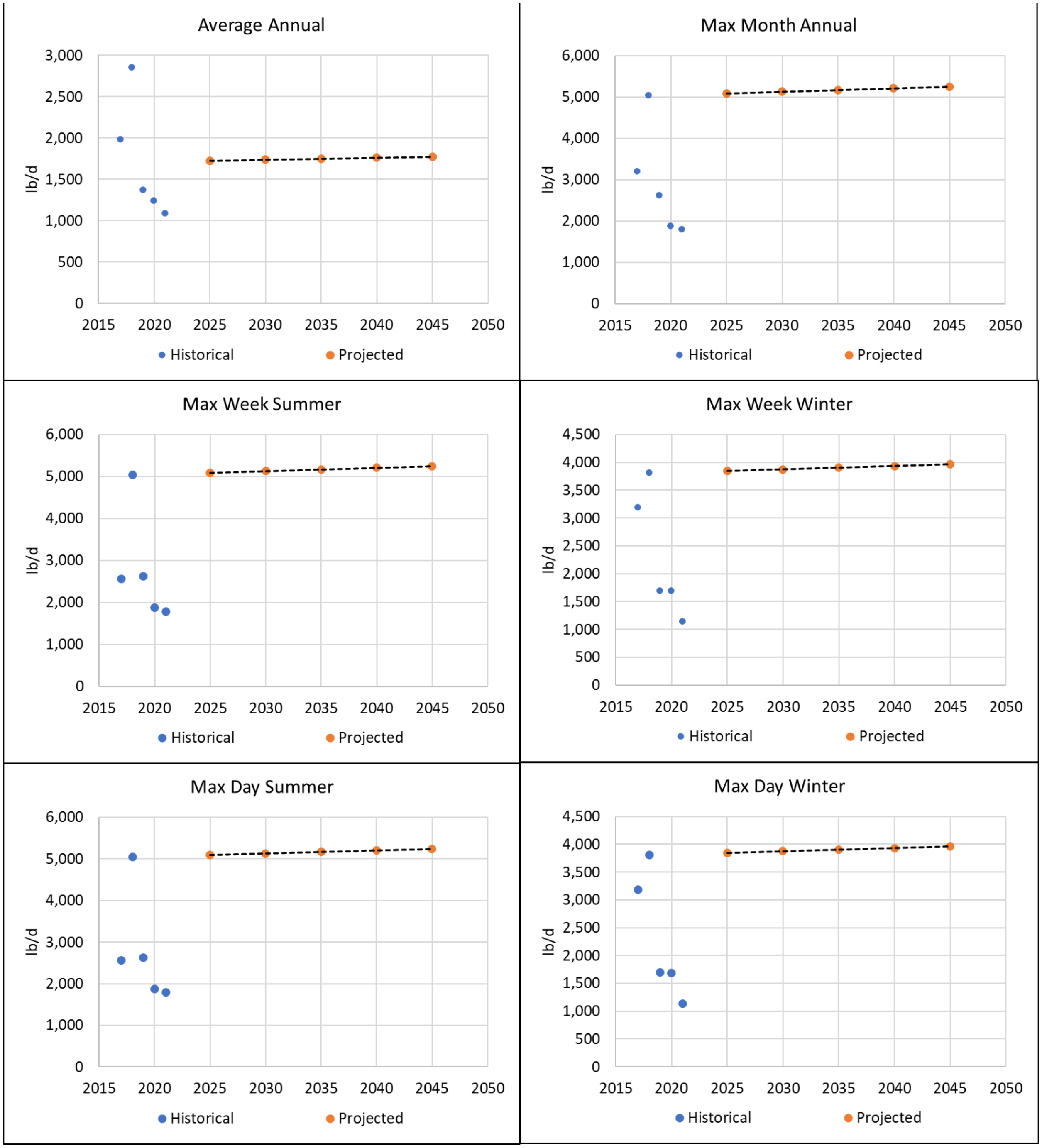


Figure B-17. Historical and Projected ORTHO-P Loading

B.3.2.3 Basis for Design

A summary of the historical flows and loads are presented in **Table B-26**. Flow and loading data were based on all years (2017 to 2022).

Table B-26. Summary of Historical Primary Influent Flows and Loads

Parameter	Flow (mgd)	Summer Flow (mgd)	Winter Flow (mgd)	TSS (PPD)	BOD-5 (PPD)	TN (PPD)	NH3-N (PPD)	TP (PPD)	ORTHO-P (PPD)
AA	29.6	27.9	31.3	84,300	93,950	8,846	5,308	3,033	1,704
MM	40.7	40.7	40.3	138,550	138,450	13,036	7,821	4,469	2,512
MW	47.8	45.2	47.8	176,050	161,500	15,206	9,124	5,214	2,930
MD	81.0	77.6	81.0	267,000	232,150	21,858	13,115	7,494	4,211
PH	110.6	110.6	105.8	-	-	-	-		-

Note: Flow and loading data ranges from 2017 to 2021.

During the CSO LTCP Update Workshop No. 2 meeting held on March 10, 2022, Jacobs recommended using Scenario 2 for flow design basis. The flow and load projections that are part of the basis of design for the project are summarized in **Table B-27**.

Table B-27. Summary of 2045 Projected Primary Influent Flows and Loads

Condition	2045						
	Flow (mgd)	TSS (PPD)	BOD-5 (PPD)	TN (PPD)	NH3-N (PPD)	TP (PPD)	ORTHO-P (PPD)
Base Flow	26.4	-	-	-	-	-	
AA	33.4	87,650	97,700	9,199	5,519	3,154	1,772
MM Annual	-	144,100	144,000	13,558	8,135	4,649	2,612
MM Summer	41.7	144,100	144,000	13,558	8,135	4,649	2,612
Max Week Summer	45.7	183,050	167,950	15,813	9,488	5,422	3,047
MD Summer	74.5	277,650	184,650	17,386	10,431	5,961	3,350
MM Winter	43.0	131,700	128,200	12,071	7,242	4,139	2,326
MW Winter	49.9	155,200	161,550	15,211	9,126	5,215	2,931
MD Winter	82.0	244,700	241,450	22,734	13,640	7,794	4,380
PH	187.0	-	-	-	-	-	-

Appendix C
Cost Estimates

Project: GNHWPCA 2022 CSO LTCP Update
Estimate Type: Capital Improvements Planning
Prepared By: E. Fleischer/D. Lynch
Date: 10-Nov-22

Process Group	Facility	Total Cost	Comments
Wet Weather Improvements at the ESWPAF			
	Preliminary Treatment	$69,217,620	
	Primary Clarifiers with CEPT	$58,598,611	
	Secondary Treatment - Hydrocyclones	$4,267,913	
	Secondary Treatment - MABR	$50,739,177	
	WW Disinfection	$50,255,439	
	Gravity Thickeners	$5,909,961	
	Disinfection Improvements	$866,629	
	Outfall Repairs	$2,305,111	
	Subtotal	**$242,160,461**	
	Total	**$242,160,461**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Preliminary Treatment
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer/A. Tweneboa-Kodua
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 1 - General Requirements					
Included in percentages below				$0	
Div. 1 Subtotal:				$0	
Division 2 - Site Work					
Demolition					
Existing Garage	3,000	SF	$10	$30,000	Estimators judgement
Existing Maintenance Facility	7,500	SF	$12	$90,000	Estimators judgement
Ecavation					incl backfill
Preliminary Treatment Bldg	6,963	CY	$50	$348,148	basement for grit and septage
Dewatering & Excavation Support					
Sheeting and Shoring	12,000	SF	$50	$600,000	Sheeting
Dewatering & Excavation Support	60	DAYS	$2,500	$150,000	Subcontractors (2022)
Yard Piping					
Twin 72 inch Effluent Pipes	850	FT	$1,913	$1,625,625	2 @ 72 inch dia in same trench
Site Work					
Grading and Drainage	1	ALLOWANCE	$80,753	$80,753	Estimators judgment
Micropiles (10" diameter)	0	FT	$195	$0	Assume piles are not needed for this building.
Roads & paved areas	1,333	SQYDS	$90	$119,970	see attached sketch for area
Div. 2 Subtotal:				**$3,044,496**	
Division 3 - Concrete					
Truck Bay					
Stone Base 6" Thick	157	CY	$50	$7,833	90' x 47' x 0.5' (2)
Base Slab	940	CY	$750	$705,000	90' x 47' SOG 3' Thick (2)
3rd Floor Slab	0	CY	$1,500	$0	65' x 65' Elevated Slab- 1.5' thick
Fine Screening					
Stone Base 6" Thick	133	CY	$50	$6,667	80' x 90' x 0.5'
Base Slab	800	CY	$750	$600,000	80' x 90' SOG- 3' Thick

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Preliminary Treatment
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer/A. Tweneboa-Kodua
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
2nd Floor Slab	870	CY	$1,500	$1,305,000	90 x 174' Elevated Slab 1.5' thick
3rd Floor Slab	35	CY	$1,500	$52,500	10' x 60' Elevated Slab 1.5' thick (walkway)
Elec, Control, and HVAC					
Stone Base 6" Thick	105	CY	$50	$5,250	45' x 42' x 0.5'
Base Slab	210	CY	$750	$157,500	45' x 42' SOG- 3' Thick (3)
2nd Floor Slab	105	CY	$1,500	$157,500	45 x 42' Elevated Slab 1.5' thick (3)
3rd Floor Slab	0	CY	$1,500	$0	65 x 25' Elevated Slab 1.5' thick
Channels					
Screening Influent and Effluent	129	CY	$1,500	$192,889	14x7.5'x14' channel, 248ft, 1ft thick
Fine Screen Channels	632	CY	$1,500	$948,111	14x7.5x14 channel, variable thickness
Grit Removal Channels	330	CY	$1,500	$495,000	9x6x9 channel, 370ft, 1ft thick
Grit Removal					
Stone Base 6" Thick	160	CY	$50	$8,000	100' x 85' x 0.5'
Base Slab	950	CY	$750	$712,500	100' x 85' SOG- 3' Thick
1st Floor Slab	475	CY	$1,500	$712,500	Elevated Slabs 1.5 thick
Pista Grit	1,110	CY	$1,500	$1,665,000	Six: 18' x 18' Box with 12' dia x 9' height Ave. (185 cy per headcell)
Below Grade Wall	360	CY	$1,200	$432,000	Below Grade Walls- L=370', H=13', 2' Thick
Div. 3 Subtotal:	7,271	**CY**		**$8,163,250**	
Division 4 - Masonry					
Included in Div 10				$0	
Div. 4 Subtotal:				$0	
Division 5 - Metals					
Other Metals Included in percentages below					
Div. 5 Subtotal:				$0	
Division 6 - Wood & Plastics					
Included in Div 10				$0	
Div. 6 Subtotal:				$0	
Division 7 - Thermal & Moisture Protection					

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Preliminary Treatment
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer/A. Tweneboa-Kodua
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Included in Div 10				$0	
Div. 7 Subtotal:				$0	
Division 8 - Doors & Windows					
Included in Div 10				$0	
Div. 8 Subtotal:				$0	
Division 9 - Finishes					
Included in percentages below				$0	
Div. 9 Subtotal:				$0	
Division 10 - Specialties					
Truck Bay Superstructure	8,460	SF	$250	$2,115,000	
Fine Screens Superstructure	15,660	SF	$250	$3,915,000	
Elec, Control, HVAC Superstructure	5,670	SF	$250	$1,417,500	
Div. 10 Subtotal:				**$7,447,500**	
Division 11 - Equipment					
Fine Screens					
Fine Screens (Aqua Guard PF. 7.5' (W) x 15	4	EA	$400,000	$1,600,000	**Parkson Aqua Guard PF quote from Joe Nagel (June 29, 2022)**
Screen Presses (Aqua Wash AWP10-5)	4	EA	$100,000	$400,000	**Parkson Aqua Wash quote from Joe Nagel (June 29, 2022)**
Transfer Screws (60' long, 15 deg) - 2022 EN	3	EA	$113,054	$339,162	Vortex Quote 70,000, norm@vulcanindustries.com, 9/21/09
Sluice Gates - 2022 ENR Update	6	EA	$89,474	$536,845	Fontaine quote s/steel
Grit Removal					
Head Cell Grit Removal Units (12' Diameter)	6	EA	$621,333	$3,728,000	**Hydro International (July 8, 2022). Includes all equipment.**
Grit Pumps	12	EA	Included above		**Hydro International (July 8, 2022)**
GritCleanse (Classifier and Concentrator)	6	EA	Included above		**Hydro International (July 8, 2022)**
Sluice Gates - 2022 ENR Update	6	EA	$53,781	$322,688	Fontaine quote s/steel (2011)
Truck Bay					
Leveling Screws - 2002 ENR Update	3	EA	$113,054	$339,162	Vortex Quote 70,000, norm@vulcanindustries.com, 9/21/09

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Preliminary Treatment
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer/A. Tweneboa-Kodua
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Hoppers with Load Cells - 2022 ENR Update	6	EA	$161,506	$969,033	Ned Johnson- Loudoun
Equipment Installation	1	PERCENT	30%	$2,470,467	
Div. 11 Subtotal:				**$10,705,356**	
Division 12 - Furnishings					
Not Used				$0	
Div. 12 Subtotal:				$0	
Division 13 - Special Construction					
Included in Percentages Below				$0	
Div. 13 Subtotal:				$0	
Division 14 - Conveying Systems					
Included in Div 11				$0	
Div. 14 Subtotal:				$0	
Division 15 - Mechanical					
Included in Percentages Below				$0	
Div. 15 Subtotal:				$0	
Division 16 - Electrical					
Included in Percentages Below				$0	
Div. 16 Subtotal:				$0	
Subtototal Division 1 - 11 (72%)				**$29,360,602**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Preliminary Treatment
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer/A. Tweneboa-Kodua
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Percentage of Costs					
Metals	3%		$40,778,614	$1,223,358	**Based on historical data**
Finishes	2%		$40,778,614	$815,572	**For costs not included in superstructure cost (2022)**
Process Mechanical Piping	8%		$40,778,614	$3,262,289	**Based on historical data**
I&C	5%		$40,778,614	$2,038,931	**Based on historical data**
Electrical	10%		$40,778,614	$4,077,861	**Based on historical data**
	28%				
Facility Subtotal:				**$40,778,614**	
General Requirements	15%		$6,116,792		**Based on historical data (2022)**
Overhead	5%		$2,344,770		**Based on historical data (2022)**
Profit	10%		$4,689,541		**Based on historical data (2022)**
Mobilization/Demolization	5%		$2,344,770		**Based on historical data (2022)**
Bond/Insurance	3%		$1,406,862		**Based on historical data (2022)**
Subtotal:				$57,681,350	
Contingency	20%		$11,536,270	$11,536,270	
Total Facility Cost:				**$69,217,620**	

Notes:

1. Concrete quantities recalculated for 2022 layout.
2. Equipment updated per ENR cost indices if new quotes were not obtained.
3. Assumes micropiles are not needed for this facility.
4. Reduced process-mechanical, I&C, electrical allowances for this facility.

Previous Estimates	Construction Cost	2022 Estimate/Previous Estimate
2011 Cost (09/27/2010)	$31,496,558	2.20
2018 Cost (10/14/2016)	$45,330,000	1.53

Division 2 - Site Work	10%
Division 3 - Concrete	28%
Division 10 - Specialties, Superstructures	25%
Division 11 - Equipment	36%
Percentages (Divisions 1 through 11)	100%

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Primary Clarifiers, CEPT, Odor Control
Estimate Type: Order-of-Magnitude
Prepared By: M. Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 1 - General Requirements					
Included in percentages below				$0	
Div. 1 Subtotal:				$0	
Division 2 - Site Work					
Demolition					
Demolition of Primary Influent Channel	148	CY			data from 1975 drawing set
Demolition of Primary Clarifiers Wall and Footing	281	CY			data from 1975 drawing set
Demolition of Primary Clarifier Floor	329	CY			data from 1975 drawing set
Demolition of Primary Sludge Pits (3 exist, 2 older)	121	CY			See Attachment A
Demolition of Primary Effluent Structure, clarifier 3	18	CY			
Demolition I Subtotal:	878	CY	$450	$395,125	
Demolition of Primaries chain and flight collectors	9	EA			245 ft long and 20 ft wide each
Demolition of Primaries scum collectors	9	EA			22 ft long each, 3 of 18", 3 of 14" and 2 of 14" pipe
Demolition of Primaries sludge screw conveyors	3	EA			65 ft long and 24" dia, each
Demolition of Primary Sludge Pumps	6	EA			In basement of Main Bldg
Demolition II Subtotal:	1	ALLOWANCE	$300,000	$300,000	Estimators judgement
Excavation					
Primary Clarifier 4	9,293	CY	$50	$464,667	incl. backfill
Primary Clarifier 4 Gallery	2,292	CY	$50	$114,593	
Gallery Clarifier 1-3	2,095	CY	$50	$104,741	
Dewatering	240	DAY	$2,500	$600,000	Estimators judgement
Yard Piping					
Effluent piping, 84 inch dia	142	FT	$2,500	$355,000	incl trenching and backfill
Piping. 72 inch dia.	249	FT	$1,913	$476,337	
Piping. 48 inch dia	538	FT	$850	$457,300	DIP
Sludge piping	640	FT	$180	$115,200	
Scum piping 18 inch dia	260	FT	$450	$117,000	
Site Work					
Grading and Drainage	1	ALLOWANCE	$80,753	$80,753	Estimators judgement
Micropiles (10" diameter) - Pipe Gallery	5,051	FT	$195	$984,945	J. Parra (08/2022)
Micropiles (10" diameter) - Primary Clarifier	1,237	FT	$195	$241,215	J. Parra (08/2022)
Micropiles (10" diameter) - Piping	3,437	FT	$196	$673,652	J. Parra (08/2022)
Roads (22 ft wide)	489	SQYDS	$90	$44,000	Type I asphalt pavement

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Primary Clarifiers, CEPT, Odor Control
Estimate Type: Order-of-Magnitude
Prepared By: M. Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Div. 2 Subtotal:				**$5,524,527**	
Division 3 - Concrete					
Primary Clarifier 4					
Stone Base 6" thick	310	CY	$50	$15,489	
Effluent Structure Walls	28	CY	$1,200	$33,333	
Effluent Structure Floor	19	CY	$750	$14,000	
Primary Clarifier Walls	628	CY	$1,200	$753,600	
Primary Clarifier Floor	1,859	CY	$750	$1,394,000	
Primary Clarifier Footings	244	CY	$750	$183,167	
Influent Pipe Encasement	1,048	CY	$750	$785,649	
Primary Clarifier Gallery (1-4)					
Stone Base 6" thick	175	CY	$50	$8,750	In ground for 20 ft (El 19.0 to El -1.0)
Gallery Walls	756	CY	$1,200	$907,467	
Gallery Floor	1,042	CY	$750	$781,667	
Gallery Roof	521	CY	$1,500	$781,667	
Gallery Footings	131	CY	$750	$98,583	
Div. 3 Subtotal:				**$5,741,883**	
Division 4 - Masonry					
Not used				$0	
Div. 4 Subtotal:				$0	
Division 5 - Metals					
Primary Tank Covers - 2022 ENR Update	16,728	SF	$81	$1,350,833	Cover entire primary tank. Quote by Temcor (H. Moreno 310-353-5178).
Hand Railing	500	LF	$120	$60,000	walkway down length of tank
Other Metals Included in percentages below					
Div. 5 Subtotal:				**$1,410,833**	
Division 6 - Wood & Plastics					
Not used				$0	
Div. 6 Subtotal:				$0	
Division 7 - Thermal & Moisture Protection					

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Primary Clarifiers, CEPT, Odor Control
Estimate Type: Order-of-Magnitude
Prepared By: M. Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Not used				$0	
Div. 7 Subtotal:				$0	
Division 8 - Doors & Windows					
Not used				$0	
Div. 8 Subtotal:				$0	
Division 9 - Finishes					
Included in percentages below				$0	
Div. 9 Subtotal:				$0	
Division 10 - Specialties					
Gallery Exits -2 (stairwells)	700	SF	$300	$210,000	Incl Gallery HVAC
Div. 10 Subtotal:				**$210,000**	
Division 11 - Equipment					
Primary Clarifier Mechanism	4	EA	$414,900	$1,659,600	**Quote by Polychem (M. Smith 781-421-2600).**
Clarifier influent slide gates - 2022 ENR Update	24	EA	$10,982	$263,577	vender quote
Clarifier chanel isolation gates - 2022 ENR Update	3	EA	$14,212	$42,637	vender quote
Primary Sludge Pumps - 2022 ENR Update	12	EA	$43,607	$523,278	Pumps P-14-1-(12), dry & wet weather same for planning purposes Wemco, S. Roach/Wescor Assoc. (508-384-8921)
Primary Sludge Pump Drives - 2022 ENR Update	12	EA	$16,151	$193,807	AFDs for pumps P-14-1-(12), dry & wet weather same for planning purposes, Wemco, S. Roach/Wescor Assoc. (508-384-8921)
PSD line 6" flow meters - 2022 ENR Update	12	EA	$4,845	$58,142	Estimator's judgment
48" Mag Meter - 2002 ENR Update	4	EA	$62,180	$248,719	500/inch from Stafford Estimate
48" Butterfly Valves 2022 ENR Update	4	EA	$29,071	$116,284	Vender quote
$FeCl_3$ Metering Pumps - 2022 ENR Update	5	EA	$15,343	$76,715	0 to 150 gph. Based on Geiger quote (C. Brown 410-682-2660)
Polymer Metering Pumps - 2022 ENR Update	5	EA	$9,690	$48,452	0 to 30 gph. Based on Geiger quote (C. Brown 410-682-2660)
Polymer Blending Units - 2022 ENR Update	4	EA	$24,226	$96,903	0 to 1800 gph; waiting on quote
$FeCl_3$ Storage Tank - ENR Update	2	EA	$34,724	$69,447	Each; 12 ft dia, 19 ft SWD, 16000 gal work. From Belding Tank Manuf.
Equipment Installation	1	PERCENT	30%	$1,019,268	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Primary Clarifiers, CEPT, Odor Control
Estimate Type: Order-of-Magnitude
Prepared By: M. Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Div. 11 Subtotal:				**$4,416,830**	
Division 12 - Furnishings					
Not used				$0	
Div. 12 Subtotal:				$0	
Division 13 - Special Construction					
Additional Odor Control Scrubber - 2022 ENR Update	1	EA	$367,684	$367,684	
60 inch diameter ductwork	65	LF	$485	$31,494	
72 inch diameter ductwork	125	LF	$485	$60,565	
Ductwork Support Systems	10	EA	$5,000	$50,000	
Equipment Installation	1	PERCENT	30%	$137,923	
Div. 13 Subtotal:				$647,664	
Division 14 - Conveying Systems					
Not used				$0	
Div. 14 Subtotal:				$0	
Division 15 - Mechanical					
Included in percentages below				$0	
Div. 15 Subtotal:				$0	
Division 16 - Electrical					
Included in percentages below				$0	
Div. 16 Subtotal:				$0	
Subtototal Division 1 - 13 (52%)				**$17,951,736**	
Percentage of Costs					

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Primary Clarifiers, CEPT, Odor Control
Estimate Type: Order-of-Magnitude
Prepared By: M. Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Metals	3%		$34,522,570	$1,035,677	**Based on historical data**
Finishes	2%		$34,522,570	$690,451	**Based on historical data**
Process Mechanical Piping	18%		$34,522,570	$6,214,063	**Based on historical data**
I&C	10%		$34,522,570	$3,452,257	**Based on historical data**
Electrical	15%		$34,522,570	$5,178,386	**Based on historical data**
	48%				
Facility Subtotal:				**$34,522,570**	
General Requirements	15%		$5,178,386		**Based on historical data**
Overhead	5%		$1,985,048		**Based on historical data**
Profit	10%		$3,970,096		**Based on historical data**
Mobilization/Demolization	5%		$1,985,048		**Based on historical data**
Bond/Insurance	3%		$1,191,029		**Based on historical data**
Subtotal:				$48,832,176	
Contingency	20%		$9,766,435	$9,766,435	
Total Facility Cost:				**$58,598,611**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: MABR
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer, D. Lynch, N. Johnson
Date: 8/24/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 1 - General Requirements					
Included in percentages below				$0	
Div. 1 Subtotal:				$0	
Division 2 - Site Work					
Not Used				$0	
Div. 2 Subtotal:				$0	
Division 3 - Concrete					
Equipment Pads	500	CY	$500	$250,000	
		CY	$1,000	$0	
Div. 3 Subtotal:				**$250,000**	
Division 4 - Masonry					
Not Used				$0	
Div. 4 Subtotal:				$0	
Division 5 - Metals					
other items included in percentages below				$0	
Div. 5 Subtotal:				$0	
Division 6 - Wood & Plastics					
Not Used				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: MABR
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer, D. Lynch, N. Johnson
Date: 8/24/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Div. 6 Subtotal:				$0	
Division 7 - Thermal & Moisture Protection					
Not Used				$0	
Div. 7 Subtotal:				$0	
Division 8 - Doors & Windows					
Not Used				$0	
Div. 8 Subtotal:				$0	
Division 9 - Finishes					
Included in percentages below				$0	
				$0	
Div. 9 Subtotal:				$0	
Division 10 - Specialties					
Not Used				$0	
Div. 10 Subtotal:				$0	
Division 11 - Equipment					
Suez ZeeLung	1	EA	$22,000,000	$22,000,000	Quote from Suez (June 2022). All equipment included.
Equipment Installation	1	PERCENT	20%	$4,400,000	
Div. 11 Subtotal:				**$26,400,000**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: MABR
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer, D. Lynch, N. Johnson
Date: 8/24/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 12 - Furnishings					
Not Used				$0	
Div. 12 Subtotal:				$0	
Division 13 - Special Construction					
Not Used				$0	
Div. 13 Subtotal:				$0	
Division 14 - Conveying Systems					
Not Used				$0	
Div. 14 Subtotal:				$0	
Division 15 - Mechanical					
Included in percentages below				$0	
Div. 15 Subtotal:				$0	
Division 16 - Electrical					
Included in percentages below				$0	
Div. 16 Subtotal:				$0	
Subtototal Division 1 - 11 (77%)				**$26,650,000**	
Percentage of Costs					
Metals	3%		$34,610,390	$1,038,312	Based on historical data

Project: GNHWPCA 2022 CSO LTCP Update
Facility: MABR
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer, D. Lynch, N. Johnson
Date: 8/24/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Finishes	0%		$34,610,390	$0	Based on historical data
Process Mechanical Piping	5%		$34,610,390	$1,730,519	Based on historical data
I&C	5%		$34,610,390	$1,730,519	Based on historical data
Electrical	10%		$34,610,390	$3,461,039	Based on historical data
	23%				
Facility Subtotal:				$34,610,390	
General Requirements	5%		$1,730,519		
Overhead	8%		$2,907,273		
Profit	5%		$1,817,045		
Mobilization/Demolization	1.5%		$545,114		
Bond/Insurance	2%		$672,307		
Subtotal:				$42,282,648	
Contingency	20%		$8,456,530	$8,456,530	
Total Facility Cost:				**$50,739,177**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Hydrocyclones
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer, D. Lynch
Date: 8/24/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 1 - General Requirements					
Included in percentages below				$0	
Div. 1 Subtotal:				$0	
Division 2 - Site Work					
Not Used				$0	
Div. 2 Subtotal:				$0	
Division 3 - Concrete					
Miscelllaneus Concrete	500	CY	$500	$250,000	
Div. 3 Subtotal:				**$250,000**	
Division 4 - Masonry					
Not Used				$0	
Div. 4 Subtotal:				$0	
Division 5 - Metals					
other items included in percentages below				$0	
Div. 5 Subtotal:				$0	
Division 6 - Wood & Plastics					
Not Used				$0	
Div. 6 Subtotal:				$0	
Division 7 - Thermal & Moisture Protection					
Not Used				$0	
Div. 7 Subtotal:				$0	
Division 8 - Doors & Windows					

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Hydrocyclones
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer, D. Lynch
Date: 8/24/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Not Used				$0	
Div. 8 Subtotal:				$0	
Division 9 - Finishes					
Included in percentages below				$0	
				$0	
Div. 9 Subtotal:				$0	
Division 10 - Specialties					
Not Used				$0	
Div. 10 Subtotal:				$0	
Division 11 - Equipment					
Hydocylone Package	2	EA	$586,960	$1,173,920	Quote from WaterWorld (May 2022)
Hydroclone Feed Pumps (WAS)	3	EA	$40,000	$120,000	
Equipment Installation	1	PERCENT	30%	$352,176	
Div. 11 Subtotal:				**$1,646,096**	
Division 12 - Furnishings					
Not Used				$0	
Div. 12 Subtotal:				$0	
Division 13 - Special Construction					
Pre-Fabricated Structure	800	SF	$250	$200,000	
Div. 13 Subtotal:				$200,000	
Division 14 - Conveying Systems					
Not Used				$0	
Div. 14 Subtotal:				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Hydrocyclones
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer, D. Lynch
Date: 8/24/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 15 - Mechanical					
Included in percentages below				$0	
Div. 15 Subtotal:				$0	
Division 16 - Electrical					
Included in percentages below				$0	
Div. 16 Subtotal:				$0	
Subtototal Division 1 - 11 (72%)				**$2,096,096**	
Percentage of Costs					
Metals	3%		$2,911,244	$87,337	Based on historical data
Finishes	0%		$2,911,244	$0	Based on historical data
Process Mechanical Piping	5%		$2,911,244	$145,562	Based on historical data
I&C	5%		$2,911,244	$145,562	Based on historical data
Electrical	15%		$2,911,244	$436,687	Based on historical data
	28%				
Facility Subtotal:				$2,911,244	
General Requirements	5%		$145,562		
Overhead	8%		$244,545		
Profit	5%		$152,840		
Mobilization/Demolization	1.5%		$45,852		
Bond/Insurance	2%		$56,551		
Subtotal:				$3,556,595	
Contingency	20%		$711,319	$711,319	
Total Facility Cost:				**$4,267,913**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 1 - General Requirements					
Included in percentages below				$0	
Div. 1 Subtotal:				$0	
Division 2 - Site Work					
Demolition					
Existing CCT1 baffle walls	0	CY	$150	$0	
Effluent channel wall to beach gate	0	CY	$150	$0	
Ecavation					incl backfill
Dry/Wet Weather Flow Split	3,693	CY	$50	$184,650	assume 20x40x12 ft deep
Chlorine Contact Tanks	22,630	CY	$50	$1,131,500	
Wet Weather Conduit	10,276	CY	$50	$513,778	
Dewatering					
Dry/Wet Weather Flow Split	90	DAY	$2,500	$225,000	
Chlorine Contact Tanks	180	DAY	$2,500	$450,000	
Wet Weather Conduit	120	DAY	$2,500	$300,000	
Sheeting and Shoring					
Dry/Wet Weather Flow Split	4,920	SF	$50	$246,000	
Chlorine Contact Tanks	14,400	SF	$50	$720,000	
Wet Weather Conduit					
Yard Piping					
NaOCl Pipes, 2" PVC	1,200	FT	$105	$125,974	incl trenching and backfill
Site Work					
Grading and Drainage	1	ALLOWANCE	$100,000	$100,000	
Micropiles (Conduit)	12,151	FT	$195	$2,369,445	
Micropiles (WW CCT)	10,342	FT	$195	$2,016,690	
Roads (22 ft wide)	1,333	SQYDS	$90	$120,000	Assume 1500 ft of new road at 24 ft wide
Div. 2 Subtotal:				**$8,503,037**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 3 - Concrete					
Primary Effluent Conduit					
84 inch dia RCP	0	FT	$335	$0	vender quote, from flow split to secondary
84 inch fittings	0	EA	$5,500	$0	vender quote
Dry/Wet Weather Flow Split					assume 20x40x12 ft deep
Stone Base 6" thick	91	CY	$50	$4,549	Stone base underneath SOG
Base slab	546	CY	$750	$409,417	
Walls	439	CY	$1,200	$526,400	
Concrete Elevated Slab 18" Thick	273	CY	$1,500	$409,417	
Wet Weather Chlorine Contact Tanks					
Stone Base 6" thick	429	CY	$50	$21,467	Stone base underneath SOG
Base slab	2,576	CY	$750	$1,932,000	
Exterior walls 24" Thick	1,058	CY	$1,200	$1,269,333	
Footings	202	CY	$0	$0	
Baffle walls 12" Thick	693	CY	$1,200	$831,333	
Divider walls 24" Thick	244	CY	$1,200	$292,578	
Interior walls 18" Thick	126	CY	$1,200	$150,800	
Concrete Quantity	6,008				
Wet Weather Effluent Conduit					
WW CCT to Plant Effluent Conduit	3,500	FT	$1,913	$6,695,500	vender quote
Effluent Conduit Vaults					
14' x 14' Concrete Vault	2	EA	$350,000	$700,000	
Div. 3 Subtotal:				**$13,242,794**	
Division 4 - Masonry					
				$0	
Not used					
Div. 4 Subtotal:				$0	
Division 5 - Metals					
Chlorine Contact Tank Covers - 2022 ENR Update	22,500	SF	$81	$1,822,500	from primary tank 4 cover quote
Included in percentages below				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Div. 5 Subtotal:				**$1,822,500**	
Division 6 - Wood & Plastics					
Not used				$0	
Div. 6 Subtotal:				$0	
Division 7 - Thermal & Moisture Protection					
Not used				$0	
Div. 7 Subtotal:				$0	
Division 8 - Doors & Windows					
Not used				$0	
Div. 8 Subtotal:				$0	
Division 9 - Finishes					
Not used				$0	
Div. 9 Subtotal:				$0	
Division 10 - Specialties					
		SF	$0	$0	
Div. 10 Subtotal:				$0	
Division 11 - Equipment					
		EA		$0	
		EA		$0	
Slide Gate, 48" w/ operator - 2022 ENR Update	8	EA	$10,982	$87,859	Based on 4/2008 cost estimate (4.5% inflation).

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
42" Butterfly Valves, Flow Split Box - 2022 ENR Update	4	EA	$29,071	$116,284	vender quote
Magmeters - 2022 ENR Update	2	EA	$57,000	$114,000	vender quote
Equipment Installation	1	PERCENT	30%	$95,443	
Div. 11 Subtotal:				**$413,586**	
Division 12 - Furnishings					
Not used				$0	
Div. 12 Subtotal:				$0	
Division 13 - Special Construction					
Included in percentages below				$0	
Div. 13 Subtotal:				$0	
Division 14 - Conveying Systems					
Not used				$0	
Div. 14 Subtotal:				$0	
Division 15 - Mechanical					
Included in percentages below				$0	
Div. 15 Subtotal:				$0	
Division 16 - Electrical					
Included in percentages below				$0	
Div. 16 Subtotal:				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Subtototal Division 1 - 11 (81%)				**$23,981,917**	
Percentage of Costs					
Metals	3%		$29,607,304	$888,219	**Based on historical data**
Finishes	1%		$29,607,304	$296,073	**Based on historical data**
Process Mechanical Piping	5%		$29,607,304	$1,480,365	**Based on historical data**
I&C	3%		$29,607,304	$888,219	**Based on historical data**
Electrical	7%		$29,607,304	$2,072,511	**Based on historical data**
	19%				
Facility Subtotal:				$29,607,304	
General Requirements	15%		$4,441,096		
Overhead	5%		$1,702,420		
Profit	10%		$3,404,840		
Mobilization/Demolization	5%		$1,702,420		
Bond/Insurance	3%		$1,021,452		
Subtotal:				$41,879,532	
Contingency	20%		$8,375,906	$8,375,906	
Total Facility Cost:				**$50,255,439**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 1 - General Requirements					
Included in percentages below				$0	
Div. 1 Subtotal:				$0	
Division 2 - Site Work					
Demolition					
Existing CCT1 baffle walls	0	CY	$150	$0	
Effluent channel wall to beach gate	0	CY	$150	$0	
Ecavation					incl backfill
Dry/Wet Weather Flow Split	3,693	CY	$50	$184,650	assume 20x40x12 ft deep
Chlorine Contact Tanks	22,630	CY	$50	$1,131,500	
Wet Weather Conduit	10,276	CY	$50	$513,778	
Dewatering					
Dry/Wet Weather Flow Split	90	DAY	$2,500	$225,000	
Chlorine Contact Tanks	180	DAY	$2,500	$450,000	
Wet Weather Conduit	120	DAY	$2,500	$300,000	
Sheeting and Shoring					
Dry/Wet Weather Flow Split	4,920	SF	$50	$246,000	
Chlorine Contact Tanks	14,400	SF	$50	$720,000	
Wet Weather Conduit					
Yard Piping					
NaOCl Pipes, 2" PVC	1,200	FT	$105	$125,974	incl trenching and backfill
Site Work					
Grading and Drainage	1	ALLOWANCE	$100,000	$100,000	
Micropiles (Conduit)	12,151	FT	$195	$2,369,445	
Micropiles (WW CCT)	10,342	FT	$195	$2,016,690	
Roads (22 ft wide)	1,333	SQYDS	$90	$120,000	Assume 1500 ft of new road at 24 ft wide
Div. 2 Subtotal:				**$8,503,037**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 3 - Concrete					
Primary Effluent Conduit					
84 inch dia RCP	0	FT	$335	$0	vender quote, from flow split to secondary
84 inch fittings	0	EA	$5,500	$0	vender quote
Dry/Wet Weather Flow Split					assume 20x40x12 ft deep
Stone Base 6" thick	91	CY	$50	$4,549	Stone base underneath SOG
Base slab	546	CY	$750	$409,417	
Walls	439	CY	$1,200	$526,400	
Concrete Elevated Slab 18" Thick	273	CY	$1,500	$409,417	
Wet Weather Chlorine Contact Tanks					
Stone Base 6" thick	429	CY	$50	$21,467	Stone base underneath SOG
Base slab	2,576	CY	$750	$1,932,000	
Exterior walls 24" Thick	1,058	CY	$1,200	$1,269,333	
Footings	202	CY	$0	$0	
Baffle walls 12" Thick	693	CY	$1,200	$831,333	
Divider walls 24" Thick	244	CY	$1,200	$292,578	
Interior walls 18" Thick	126	CY	$1,200	$150,800	
Concrete Quantity	6,008				
Wet Weather Effluent Conduit					
WW CCT to Plant Effluent Conduit	3,500	FT	$1,913	$6,695,500	vender quote
Effluent Conduit Vaults					
14' x 14' Concrete Vault	2	EA	$350,000	$700,000	
Div. 3 Subtotal:				**$13,242,794**	
Division 4 - Masonry					
				$0	
Not used					
Div. 4 Subtotal:				$0	
Division 5 - Metals					
Chlorine Contact Tank Covers - 2022 ENR Update	22,500	SF	$81	$1,822,500	from primary tank 4 cover quote
Included in percentages below				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Div. 5 Subtotal:				**$1,822,500**	
Division 6 - Wood & Plastics					
Not used				$0	
Div. 6 Subtotal:				$0	
Division 7 - Thermal & Moisture Protection					
Not used				$0	
Div. 7 Subtotal:				$0	
Division 8 - Doors & Windows					
Not used				$0	
Div. 8 Subtotal:				$0	
Division 9 - Finishes					
Not used				$0	
Div. 9 Subtotal:				$0	
Division 10 - Specialties					
		SF	$0	$0	
Div. 10 Subtotal:				$0	
Division 11 - Equipment					
		EA		$0	
		EA		$0	
Slide Gate, 48" w/ operator - 2022 ENR Update	8	EA	$10,982	$87,859	Based on 4/2008 cost estimate (4.5% inflation).

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
42" Butterfly Valves, Flow Split Box - 2022 ENR Update	4	EA	$29,071	$116,284	vender quote
Magmeters - 2022 ENR Update	2	EA	$57,000	$114,000	vender quote
Equipment Installation	1	PERCENT	30%	$95,443	
Div. 11 Subtotal:				**$413,586**	
Division 12 - Furnishings					
Not used				$0	
Div. 12 Subtotal:				$0	
Division 13 - Special Construction					
Included in percentages below				$0	
Div. 13 Subtotal:				$0	
Division 14 - Conveying Systems					
Not used				$0	
Div. 14 Subtotal:				$0	
Division 15 - Mechanical					
Included in percentages below				$0	
Div. 15 Subtotal:				$0	
Division 16 - Electrical					
Included in percentages below				$0	
Div. 16 Subtotal:				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Wet Weather Disinfection
Estimate Type: Conceptual
Prepared By: Marialena Hatzigeorgiou/M Moore (rev. E. Fleischer, A. Tweneboa-Kodua)
Date: 8/11/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Subtototal Division 1 - 11 (81%)				**$23,981,917**	
Percentage of Costs					
Metals	3%		$29,607,304	$888,219	**Based on historical data**
Finishes	1%		$29,607,304	$296,073	**Based on historical data**
Process Mechanical Piping	5%		$29,607,304	$1,480,365	**Based on historical data**
I&C	3%		$29,607,304	$888,219	**Based on historical data**
Electrical	7%		$29,607,304	$2,072,511	**Based on historical data**
	19%				
Facility Subtotal:				$29,607,304	
General Requirements	15%		$4,441,096		
Overhead	5%		$1,702,420		
Profit	10%		$3,404,840		
Mobilization/Demolization	5%		$1,702,420		
Bond/Insurance	3%		$1,021,452		
Subtotal:				$41,879,532	
Contingency	20%		$8,375,906	$8,375,906	
Total Facility Cost:				**$50,255,439**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Gravity Thickeners
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 1 - General Requirements					
included in percentages below					
Div. 1 Subtotal:				$0	
Division 2 - Site Work					
Demolition					
GT mechanisms		EA	$15,000	$0	estimators judgement
GT pumps and piping		ALLOWANCE	$25,000	$0	estimators judgement
GT walls		CY	$150	$0	1 tank @35 ft dia
GT Base slab		CY	$150	$0	Top of GT wall elev 16, bottom of GT wall elev 1, pit elev -6
GT Control Bldg. basement		CY	$150	$0	Gallery 10x30 floor elev 1.0 floor elev 12
GT Superstructure		SF	$100	$0	
Demolition Subtotal:				$0	
Excavation					
GT Excavation	1,313	CY	$50	$65,625	for GT-1 estimate 20ft x 20ft beyond existing foot print of 35ft dia GT for GT-2 assume 50ft dia by 15ft deep
Dewatering					
GT Dewatering	45	DAYS	$2,500	$112,500	estimators judgment
Yard Piping					
	1	ALLOWANCE	$100,000	$100,000	estimators judgment
Site Work					
Grading and Drainage	1	ALLOWANCE	$16,151	$16,151	estimators judgment
Micropiles	2,455	LF	$195	$478,725	J. Parra (08/2022)
Roads (22 ft wide)	178	SQYDS	$90	$16,000	Assume 200 ft of new road at 24 ft wide
Div. 2 Subtotal:				$789,001	
Division 3 - Concrete					
Concrete					
Stone Base 6" thick	44	CY	$50	$2,182	
GT base slab	145	CY	$750	$109,028	
GT walls	87	CY	$1,200	$104,667	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Gravity Thickeners
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Control Bldg. base slab		CY	$750	$0	
Control Bldg. walls		CY	$1,200	$0	
Control Bldg elevated slab		CY	$1,500	$0	
Div. 3 Subtotal:				$215,876	
Division 4 - Masonry					
Included in Div 10				$0	
Div. 4 Subtotal:				$0	
Division 5 - Metals					
GT cover	2,826	SF	$120	$339,120	extrapolated form vender quote for 35ft dia GT
Other items included in percentages below					
Div. 5 Subtotal:				$339,120	
Division 6 - Wood & Plastics					
Included in Div 10				$0	
Div. 6 Subtotal:				$0	
Division 7 - Thermal & Moisture Protection					
Included in Div 10				$0	
Div. 7 Subtotal:				$0	
Division 8 - Doors & Windows					
Included in Div 10				$0	
Div. 8 Subtotal:				$0	
Division 9 - Finishes					
Included in percentages below				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Gravity Thickeners
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Div. 9 Subtotal:				$0	
Division 10 - Specialties					
GT Control Bldg super structure		SF	$300	$0	
Div. 10 Subtotal:				$0	
Division 11 - Equipment					
Gravity Thickener Mechanism (60 ft dia) - 2022 ENR Update	1	EA	$232,568	$232,568	vender quote
Sludge pumps - 2022 ENR Update	2	EA	$57,496	$114,992	Vender quote 2001 report inflated at 4.5%/yr
Sump pump - 2002 ENR Update	1	EA	$11,305	$11,305	estimators judgment
Equipment Installation	1	PERCENT	30%	$107,660	
Div. 11 Subtotal:				$466,525	
Division 12 - Furnishings					
Not used				$0	
Div. 12 Subtotal:				$0	
Division 13 - Special Construction					
Not used				$0	
Div. 12 Subtotal:				$0	
Division 14 - Conveying Systems					
Not used				$0	
Div. 14 Subtotal:				$0	
Division 15 - Mechanical					

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Gravity Thickeners
Estimate Type: Order-of-Magnitude
Prepared By: E. Fleischer
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Included in percentages below				$0	
Div. 15 Subtotal:				$0	
Division 16 - Electrical					
Included in percentages below				$0	
Div. 16 Subtotal:				$0	
Subtototal Division 1 - 11 (52%)				$1,810,522	
Percentage of Costs					
Metals	3%		$3,481,773	$104,453	Based on historical data
Finishes	2%		$3,481,773	$69,635	Based on historical data
Process Mechanical Piping	18%		$3,481,773	$626,719	Based on historical data
I&C	10%		$3,481,773	$348,177	Based on historical data
Electrical	15%		$3,481,773	$522,266	Based on historical data
	48%				
Facility Subtotal:				$3,481,773	
General Requirements	15%		$522,266		
Overhead	5%		$200,202		
Profit	10%		$400,404		
Mobilization/Demolization	5%		$200,202		
Bond/Insurance	3%		$120,121		
Subtotal:				$4,924,967	
Contingency	20%		$984,993	$984,993	
Total Facility Cost:				**$5,909,961**	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Disinfection Improvements
Estimate Type: Conceptual
Prepared By: E. Fleischer, D. Lynch
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 1 - General Requirements					
Included in percentages below				$0	
Div. 1 Subtotal:				$0	
Division 2 - Site Work					
Div. 2 Subtotal:				**$0**	
Division 3 - Concrete					
Baffle walls 6" thick (2 tanks, 4 walls each)	23	CY	$1,200	$28,089	
Divider walls 18" Thick	35	CY	$1,200	$42,133	
End walls 18" thick	11	CY	$1,200	$13,333	
Concrete repair	1	ALLOWANCE	$100,000	$100,000	
Div. 3 Subtotal:				**$183,556**	
Division 4 - Masonry					
				$0	
Not used					
Div. 4 Subtotal:				$0	
Division 5 - Metals					

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Disinfection Improvements
Estimate Type: Conceptual
Prepared By: E. Fleischer, D. Lynch
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Stairs, Railings, Walkways.	1	ALLOWNCE	$100,000	$100,000	
Div. 5 Subtotal:				**$100,000**	
Division 6 - Wood & Plastics					
Not used				$0	
Div. 6 Subtotal:				$0	
Division 7 - Thermal & Moisture Protection					
Not used				$0	
Div. 7 Subtotal:				$0	
Division 8 - Doors & Windows					
Not used				$0	
Div. 8 Subtotal:				$0	
Division 9 - Finishes					
Not used				$0	
Div. 9 Subtotal:				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Disinfection Improvements
Estimate Type: Conceptual
Prepared By: E. Fleischer, D. Lynch
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 10 - Specialties					
Not used				$0	
Div. 10 Subtotal:				$0	
Division 11 - Equipment					
Gate repair, extension stems, operators, etc.	1	ALLOWANCE	$100,000	$100,000	
Equipment Installation	1	PERCENT	30%	$30,000	
Div. 11 Subtotal:				**$130,000**	
Division 12 - Furnishings					
Not used				$0	
Div. 12 Subtotal:				$0	
Division 13 - Special Construction					
Included in percentages below				$0	
Div. 13 Subtotal:				$0	

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Disinfection Improvements
Estimate Type: Conceptual
Prepared By: E. Fleischer, D. Lynch
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Division 14 - Conveying Systems					
Not used				$0	
Div. 14 Subtotal:				$0	
Division 15 - Mechanical					
Included in percentages below				$0	
Div. 15 Subtotal:				$0	
Division 16 - Electrical					
Included in percentages below				$0	
Div. 16 Subtotal:				$0	
Subtototal Division 1 - 11 (81%)				**$413,556**	
Percentage of Costs					
Metals	3%		$510,562	$15,317	**Based on historical data**
Finishes	1%		$510,562	$5,106	**Based on historical data**
Process Mechanical Piping	5%		$510,562	$25,528	**Based on historical data**
I&C	3%		$510,562	$15,317	**Based on historical data**
Electrical	7%		$510,562	$35,739	**Based on historical data**
	19%				

Project: GNHWPCA 2022 CSO LTCP Update
Facility: Disinfection Improvements
Estimate Type: Conceptual
Prepared By: E. Fleischer, D. Lynch
Date: 8/25/2022

Item of Work	Qty	Unit	Unit Cost	Total Cost	Comments
Facility Subtotal:				**$510,562**	
General Requirements	15%		$76,584		
Overhead	5%		$29,357		
Profit	10%		$58,715		
Mobilization/Demolization	5%		$29,357		
Bond/Insurance	3%		$17,614		
Subtotal:				$722,191	
Contingency	20%		$144,438	$144,438	
Total Facility Cost:				**$866,629**	

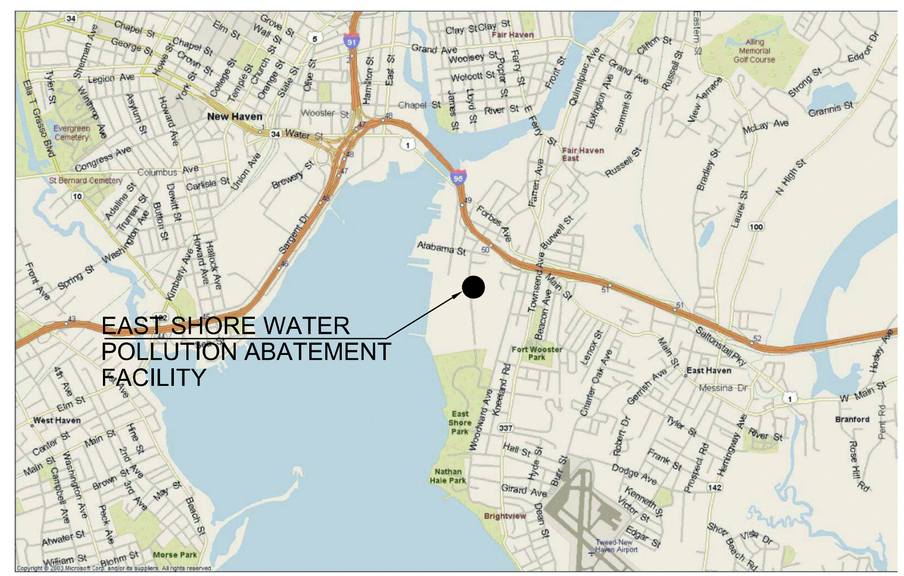
Appendix D
Figures

CITY OF NEW HAVEN
COMBINED SEWER OVERFLOW
LONG-TERM CONTROL PLAN UPDATE
APPENDIX D

Greater New Haven Water Pollution Control Authority
New Haven, Connecticut

FIGURES

NOVEMBER 2022



VICINITY MAP
NTS

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APPENDIX D FIGURES WERE CREATED FOR CAPITAL IMPROVEMENT PLANNING ONLY AND ARE CONCEPTUAL IN NATURE. A REVIEW OF THE DESIGN CONCEPTS SHOWN HERE WILL BE CONDUCTED AS PART OF THE FINAL DESIGN PHASE OF WORK. GEOTECHNICAL AND SITE BOUNDARY SURVEYS ARE ALSO REQUIRED PRIOR TO PROJECT IMPLEMENTATION.

DOCUMENTATION NO. PPS0721221644WDC

Jacobs

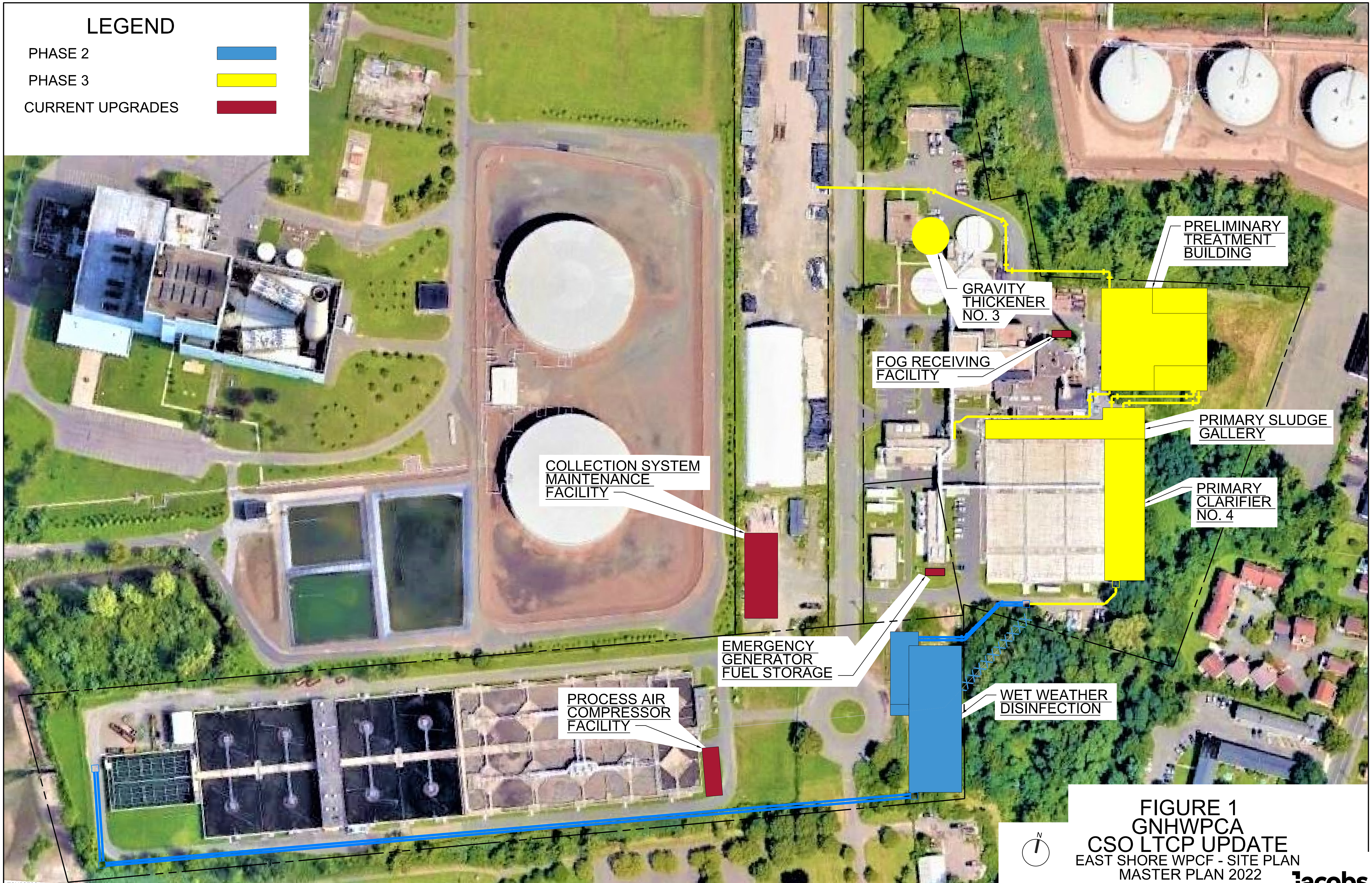

FIGURE 1
GNHWPCA
CSO LTCP UPDATE
EAST SHORE WPCF - SITE PLAN
MASTER PLAN 2022

Jacobs

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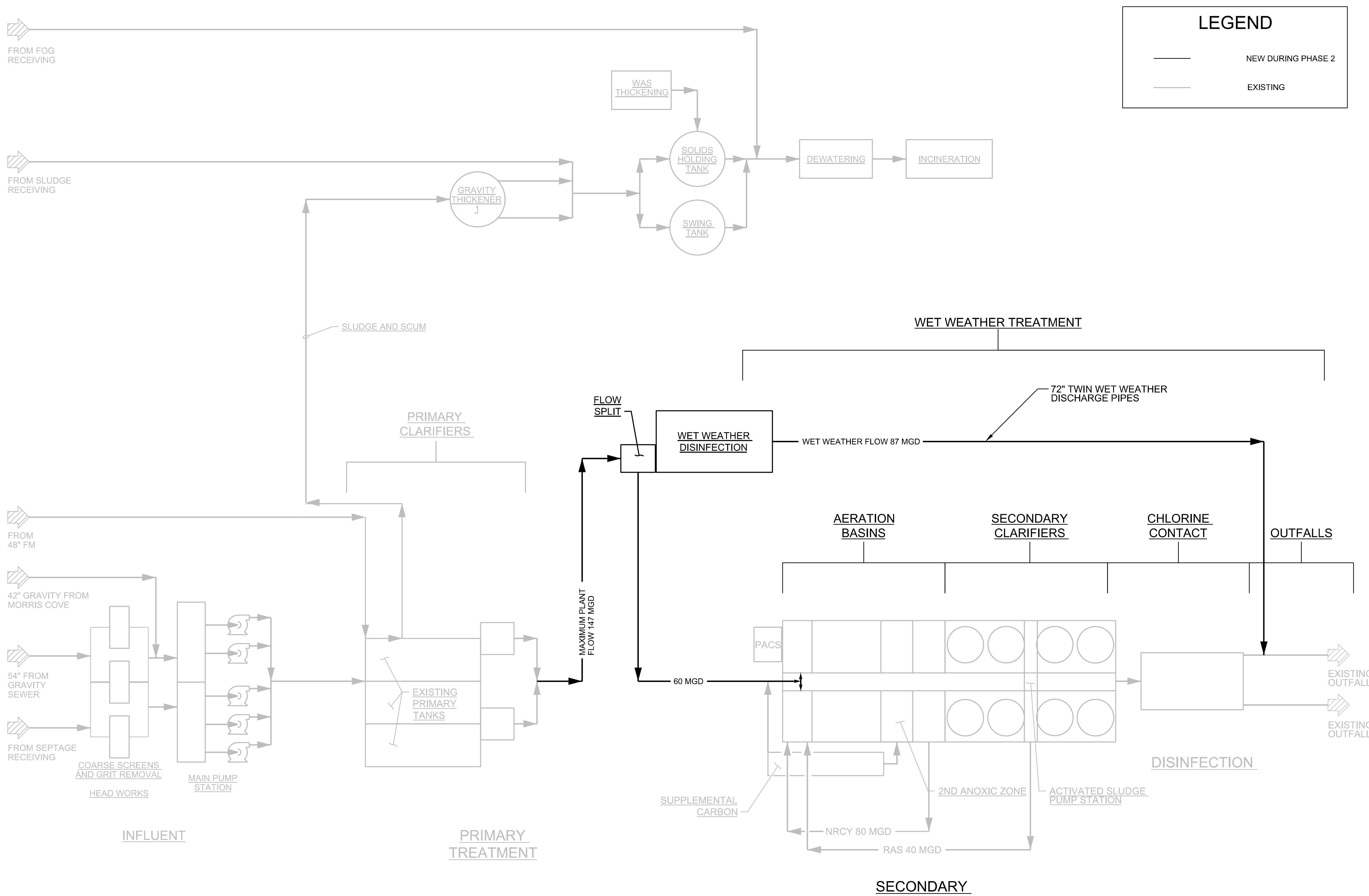


FIGURE 2
GNHWPCA
CSO LTCP UPDATE
PHASE 2 - WET WEATHER PROJECT
PROCESS FLOW DIAGRAM

Jacobs

E2X92700

LEGEND

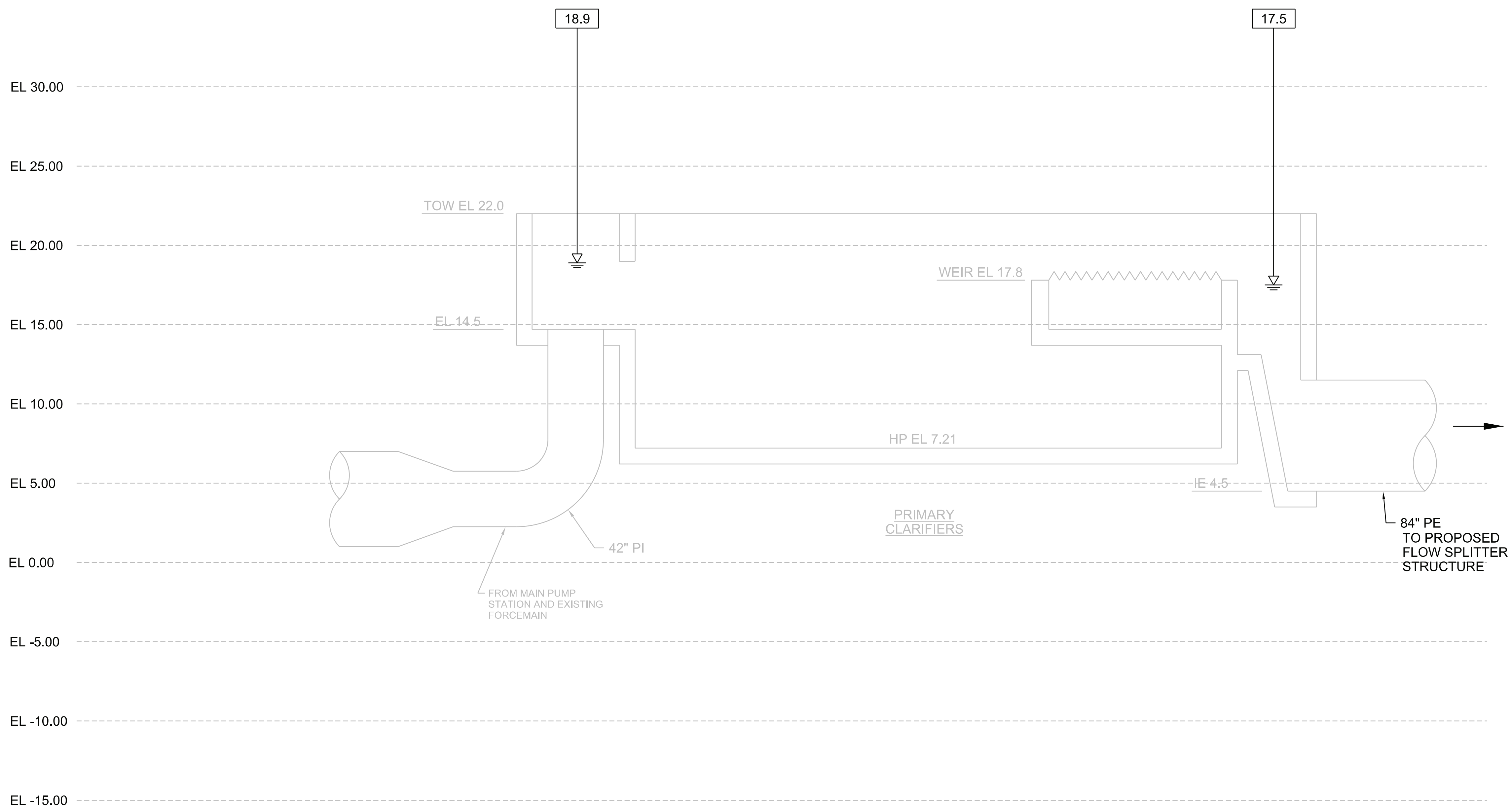
NEW DURING PHASE 2

EXISTING

XX.X — WATER SURFACE ELEVATION AT DESIGN FLOW, SEE NOTES

GENERAL SHEET NOTES

1. DESIGN FLOW (MGD): TOTAL PLANT INFLUENT FLOW THROUGH PRELIMINARY AND PRIMARY TREATMENT = 147 MGD
2. TOTAL PLANT INFLUENT FLOW IS SPLIT DOWNSTREAM OF THE PROPOSED FLOW SPLITTER STRUCTURE. PROFILES OF EACH FLOW SPLIT ARE SHOWN ON FIGURES 4 AND 5
3. ALL PROCESS UNITS ARE IN SERVICE
4. DRAWING NOT TO SCALE ON HORIZONTAL
5. VERTICAL DATUM - NAVD88
6. 8.3 FT WAS USED AS THE NEW HAVEN HARBOR ELEVATION TO REPRESENT THE 25-YR DESIGN FLOOD



HYDRAULIC PROFILE - PRELIMINARY AND PRIMARY TREATMENT

NTS

25 YEAR FLOOD AND PEAK FLOW AT 147 MGD

FIGURE 3
GNHWPCA
CSO LTCP UPDATE
PHASE 2 - WET WEATHER PROJECT
HYDRAULIC PROFILE (1 OF 3)

E2X92700

FILENAME: 001-G-0003_E2X92700.dgn PLOT DATE: 2022\11\09 PLOT TIME: 9:14:27 AM

Jacobs

GENERAL SHEET NOTES

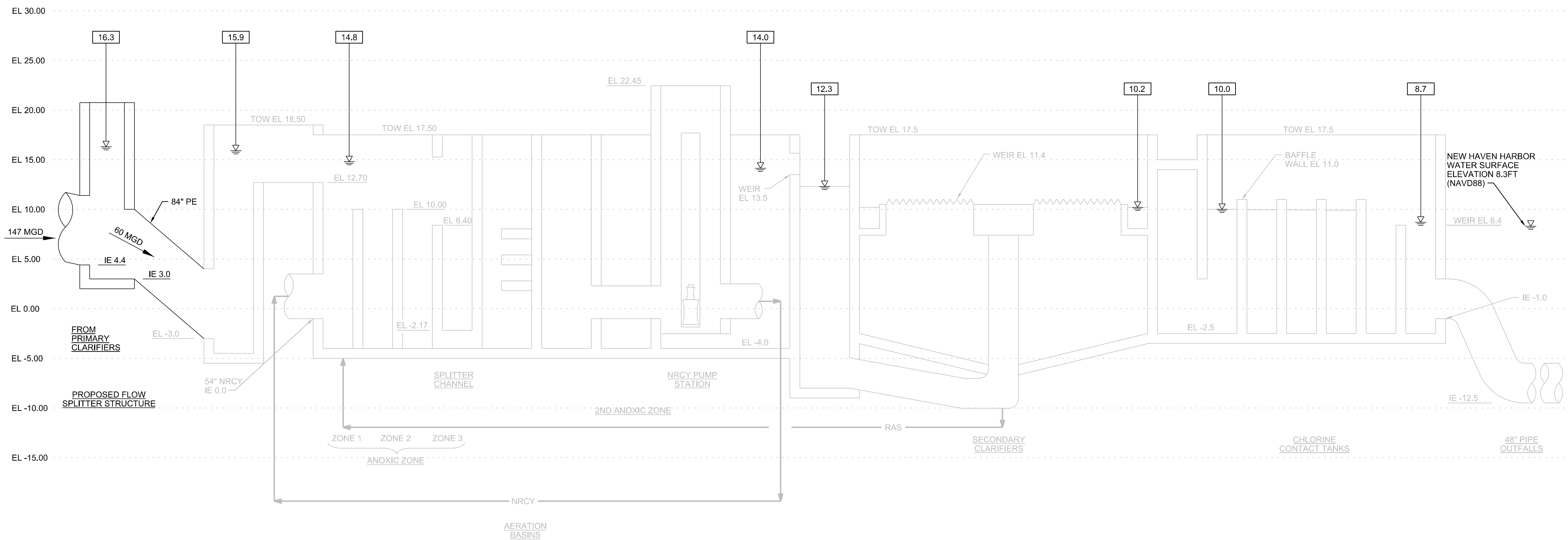
1. DESIGN FLOW (MGD): TOTAL PLANT INFLUENT FLOW THROUGH PRELIMINARY AND PRIMARY TREATMENT = 147 MGD
2. TOTAL PLANT INFLUENT FLOW IS SPLIT DOWNSTREAM OF THE PROPOSED FLOW SPLITTER STRUCTURE. PROFILES OF EACH FLOW SPLIT ARE SHOWN ON FIGURES 3 AND 5
3. ALL PROCESS UNITS ARE IN SERVICE
4. DRAWING NOT TO SCALE ON HORIZONTAL
5. VERTICAL DATUM - NAVD88
6. 8.3 FT WAS USED AS THE NEW HAVEN HARBOR ELEVATION TO REPRESENT THE 25-YR DESIGN FLOOD

LEGEND

NEW DURING PHASE 2

EXISTING

XX.X — WATER SURFACE ELEVATION AT DESIGN FLOW, SEE NOTES



HYDRAULIC PROFILE - SECONDARY TREATMENT

NTS

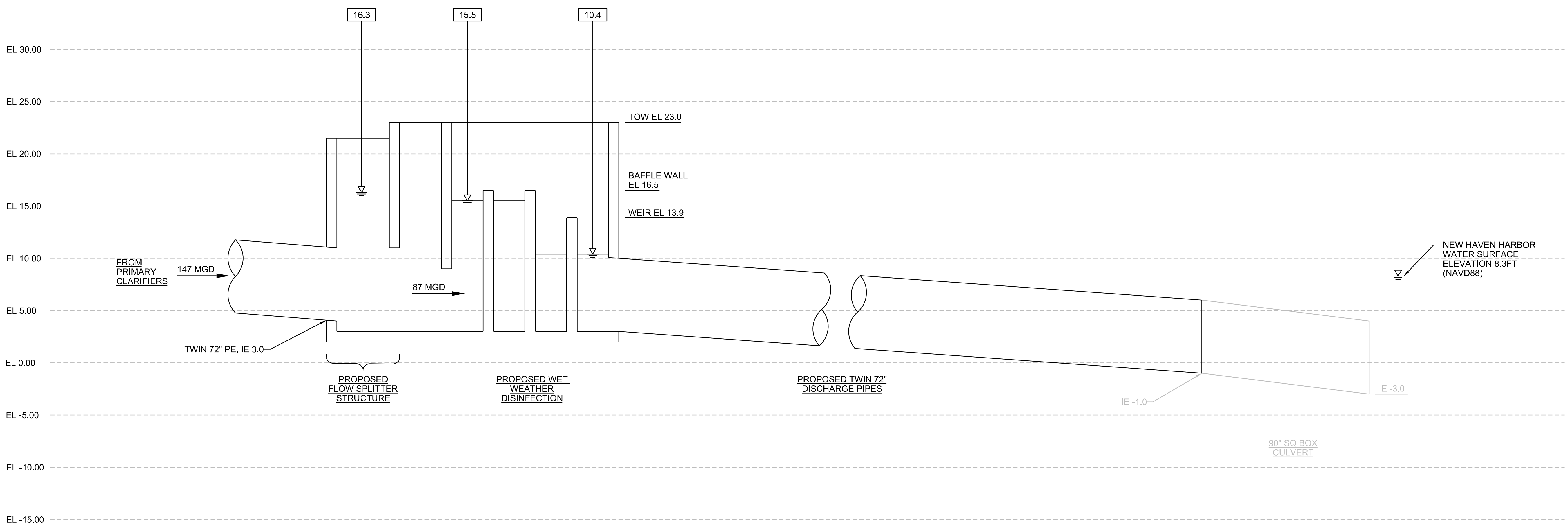
25 YEAR FLOOD AND PEAK FLOW AT 147 MGD

FIGURE 4
GNHWPCA
CSO LTCP UPDATE
PHASE 2 - WET WEATHER PROJECT
HYDRAULIC PROFILE (2 OF 3)

E2X92700

FILENAME: 001-G-0004_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 8:55:48 AM

Jacobs



LEGEND

(solid line)	NEW DURING PHASE 2
(light line)	EXISTING
XX.X	WATER SURFACE ELEVATION AT DESIGN FLOW, SEE NOTES

GENERAL SHEET NOTES

1. DESIGN FLOW (MGD): TOTAL PLANT INFLUENT FLOW THROUGH PRELIMINARY AND PRIMARY TREATMENT = 147 MGD
2. TOTAL PLANT INFLUENT FLOW IS SPLIT DOWNSTREAM OF THE PROPOSED FLOW SPLITTER STRUCTURE. PROFILES OF EACH FLOW SPLIT ARE SHOWN ON FIGURES 3 AND 4
3. ALL PROCESS UNITS ARE IN SERVICE
4. DRAWING NOT TO SCALE ON HORIZONTAL
5. VERTICAL DATUM - NAVD88
6. 8.3 FT WAS USED AS THE NEW HAVEN HARBOR ELEVATION TO REPRESENT THE 25-YR DESIGN FLOOD

HYDRAULIC PROFILE - WET WEATHER TREATMENT

NTS

25 YEAR FLOOD AND PEAK FLOW AT 147 MGD

FIGURE 5
GNHWPCA
CSO LTCP UPDATE
PHASE 2 - WET WEATHER PROJECT
HYDRAULIC PROFILE (3 OF 3)

Jacobs

E2X92700

FILENAME: 001-G-0005_E2X92700.dgn PLOT DATE: 2022\11\09 PLOT TIME: 9:23:52 AM

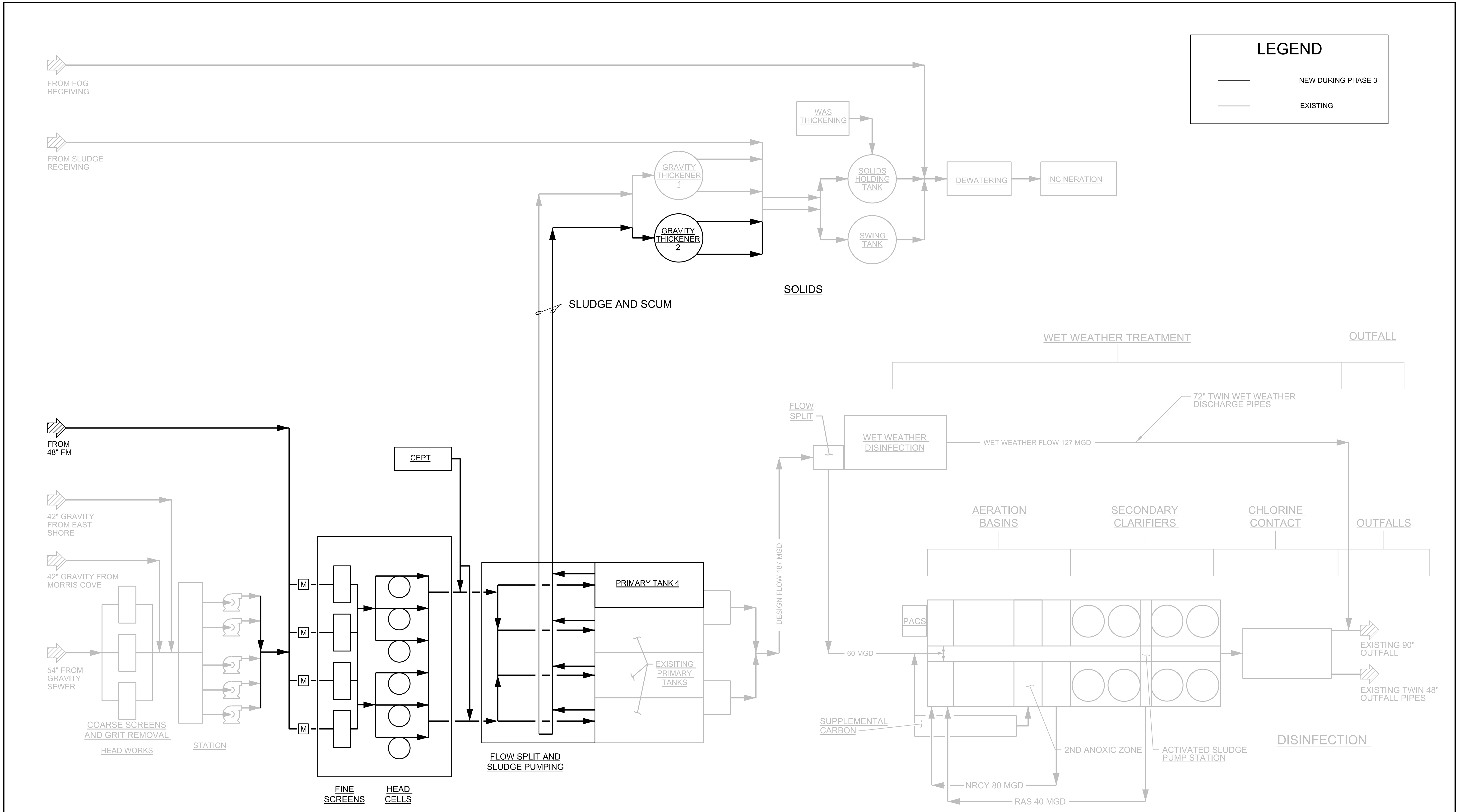


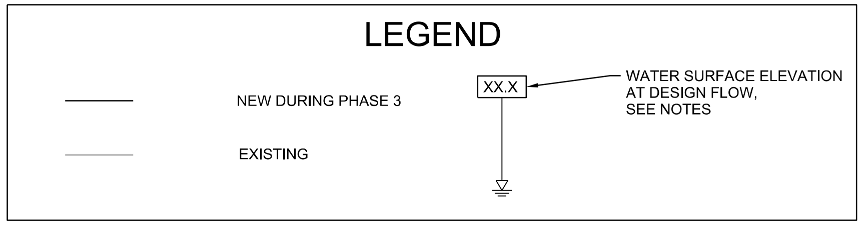
FIGURE 6
GNHWPCA
CSO LTCP UPDATE
PHASE 3 - PRELIMINARY AND PRIMARY TREATMENT UPGRADES WITHOUT NEW OUTFALL - PROCESS FLOW DIAGRAM

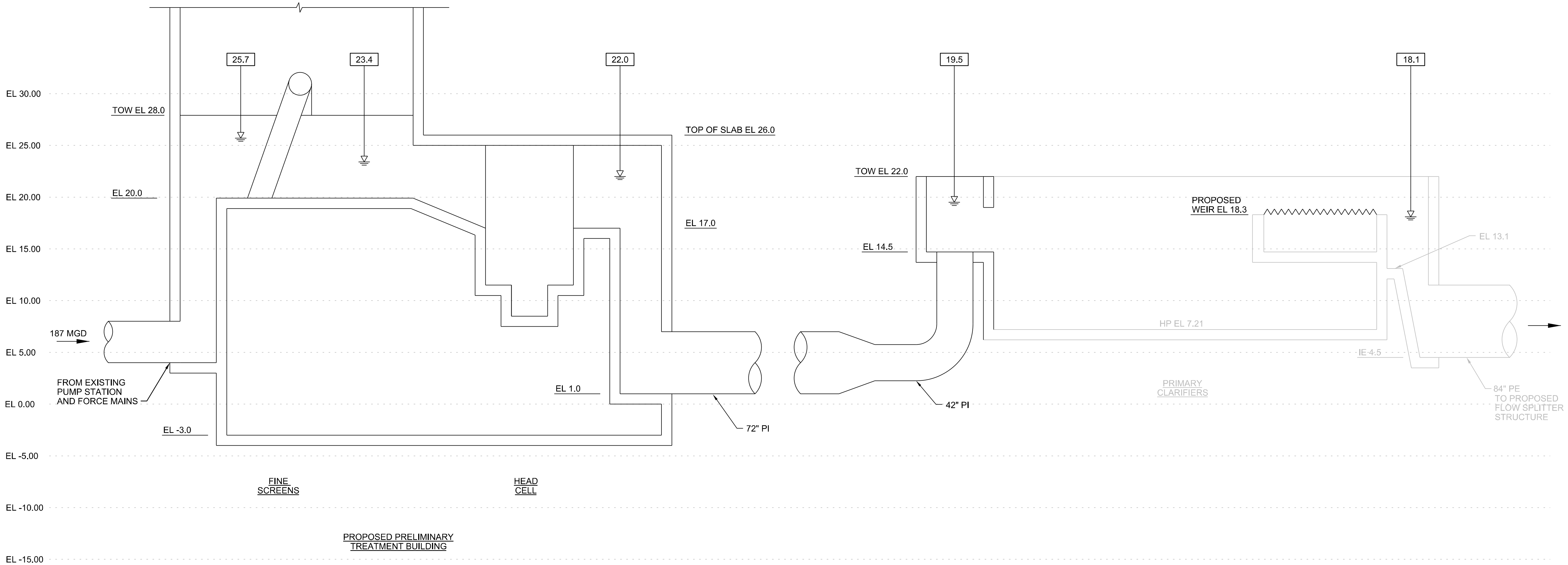
Jacobs

E2X92700

GENERAL SHEET NOTES

1. DESIGN FLOW (MGD): TOTAL PLANT INFLUENT FLOW THROUGH PRELIMINARY AND PRIMARY TREATMENT = 187 MGD
2. TOTAL PLANT INFLUENT FLOW IS SPLIT DOWNSTREAM OF THE PROPOSED FLOW SPLITTER STRUCTURE. PROFILES OF EACH FLOW SPLIT ARE SHOWN ON FIGURES 8 AND 9
3. ALL PROCESS UNITS ARE IN SERVICE
4. DRAWING NOT TO SCALE ON HORIZONTAL
5. VERTICAL DATUM - NAVD88
6. 8.3 FT WAS USED AS THE NEW HAVEN HARBOR ELEVATION TO REPRESENT THE 25-YR DESIGN FLOOD





HYDRAULIC PROFILE - PRELIMINARY AND PRIMARY TREATMENT

NTS

25 YEAR FLOOD AND PEAK FLOW AT 187 MGD

FIGURE 7
GNHWPCA
CSO LTCP UPDATE
PHASE 3 - PRELIMINARY AND PRIMARY TREATMENT UPGRADES WITHOUT NEW OUTFALLS
HYDRAULIC PROFILE (1 OF 3)

E2X92700

Jacobs

FILENAME: 001-G-0007_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 7:14:45 AM

LEGEND

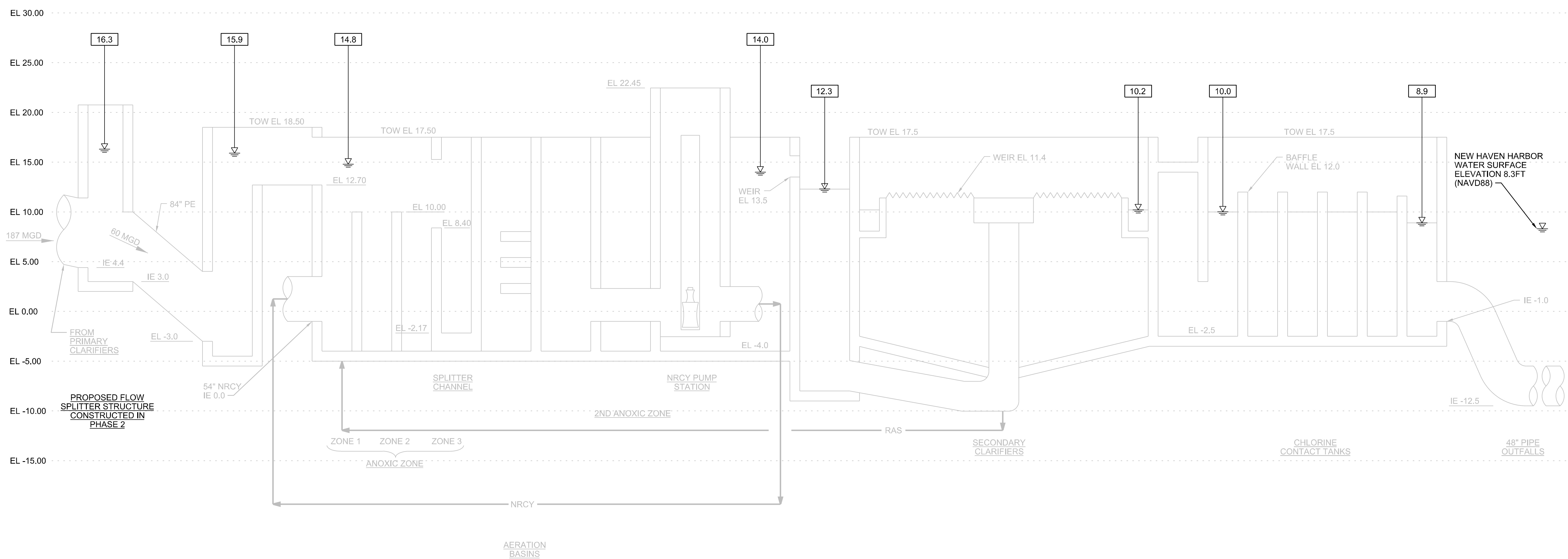
NEW DURING PHASE 3

EXISTING

XX.X — WATER SURFACE ELEVATION AT DESIGN FLOW, SEE NOTES

GENERAL SHEET NOTES

1. DESIGN FLOW (MGD): TOTAL PLANT INFLUENT FLOW THROUGH PRELIMINARY AND PRIMARY TREATMENT = 187 MGD
2. TOTAL PLANT INFLUENT FLOW IS SPLIT DOWNSTREAM OF THE PROPOSED FLOW SPLITTER STRUCTURE. PROFILES OF EACH FLOW SPLIT ARE SHOWN ON FIGURES 7 AND 9
3. ALL PROCESS UNITS ARE IN SERVICE
4. DRAWING NOT TO SCALE ON HORIZONTAL
5. VERTICAL DATUM - NAVD88
6. 8.3 FT WAS USED AS THE NEW HAVEN HARBOR ELEVATION TO REPRESENT THE 25-YR DESIGN FLOOD



PROPOSED FLOW SPLITTER STRUCTURE CONSTRUCTED IN PHASE 2

HYDRALIC PROFILE - SECONDARY TREATMENT

NTS

25 YEAR FLOOD AND PEAK FLOW AT 187 MGD

FIGURE 8
GNHWPCA
CSO LTCP UPDATE
PHASE 3 - PRELIMINARY AND PRIMARY TREATMENT UPGRADES WITHOUT NEW OUTFALLS
HYDRAULIC PROFILE (2 OF 3)

Jacobs

E2X92700

FILENAME: 001-G-0008_E2X92700.dgn PLOT DATE: 2022\11\21 PLOT TIME: 4:31:24 PM

GENERAL SHEET NOTES

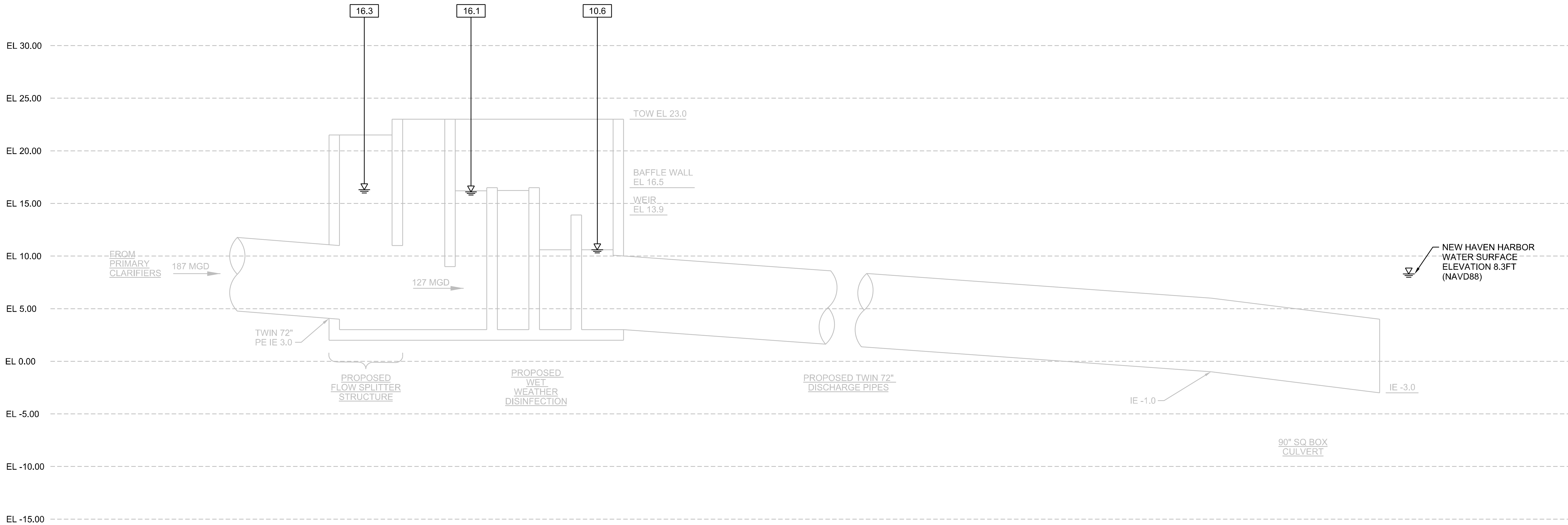
1. DESIGN FLOW (MGD): TOTAL PLANT INFLUENT FLOW THROUGH PRELIMINARY AND PRIMARY TREATMENT = 187 MGD
2. TOTAL PLANT INFLUENT FLOW IS SPLIT DOWNSTREAM OF THE PROPOSED FLOW SPLITTER STRUCTURE. PROFILES OF EACH FLOW SPLIT ARE SHOWN ON FIGURES 7 AND 8
3. ALL PROCESS UNITS ARE IN SERVICE
4. DRAWING NOT TO SCALE ON HORIZONTAL
5. VERTICAL DATUM - NAVD88
6. 8.3 FT WAS USED AS THE NEW HAVEN HARBOR ELEVATION TO REPRESENT THE 25-YR DESIGN FLOOD

LEGEND

NEW DURING PHASE 3

EXISTING

XX.X — WATER SURFACE ELEVATION AT DESIGN FLOW, SEE NOTES



HYDRAULIC PROFILE - WET WEATHER TREATMENT

NTS

25 YEAR FLOOD AND PEAK FLOW AT 187 MGD

FIGURE 9
GNHWPCA
CSO LTCP UPDATE
PHASE 3 - PRELIMINARY AND PRIMARY TREATMENT UPGRADES WITHOUT NEW OUTFALLS

HYDRAULIC PROFILE (3 OF 3)

Jacobs

E2X92700

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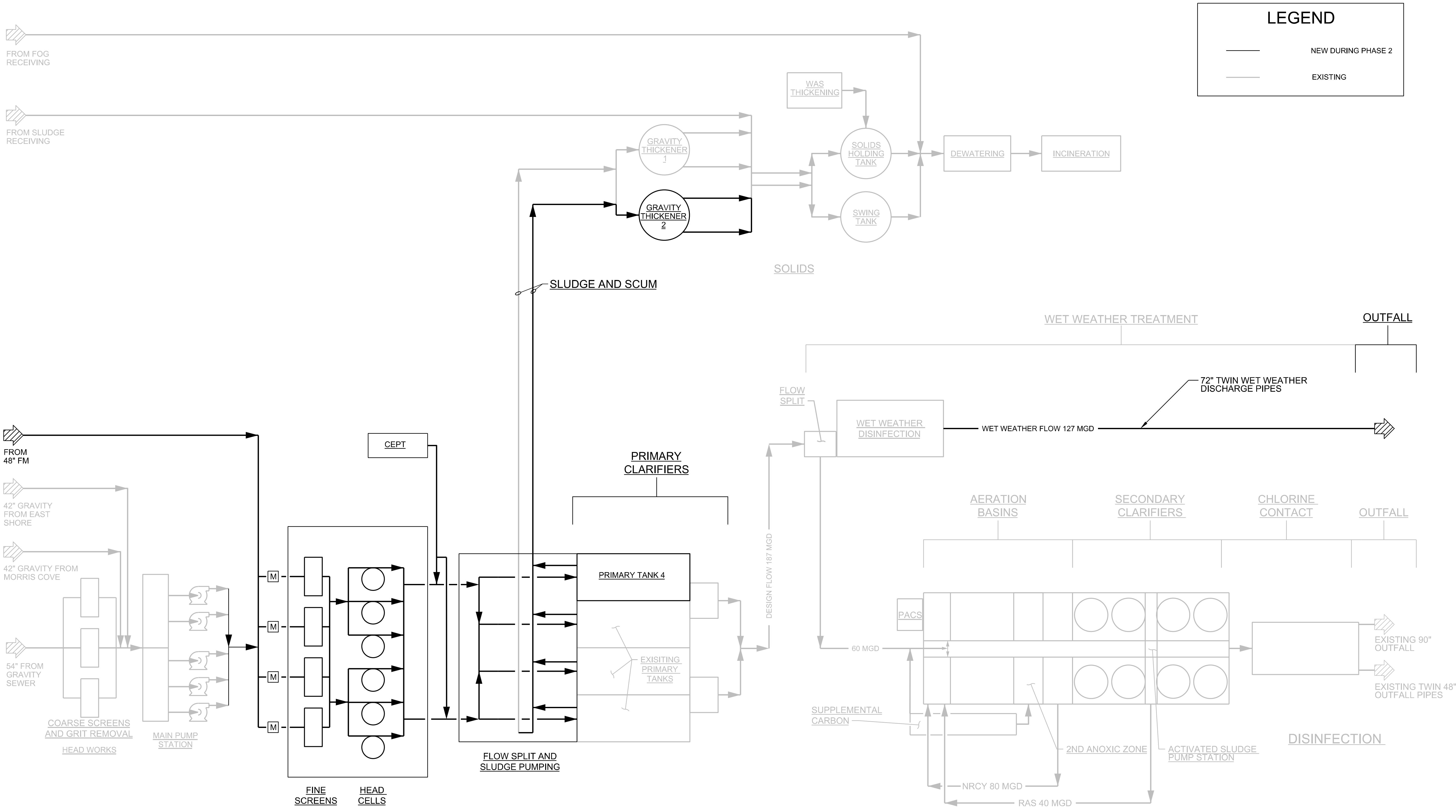


FIGURE 10
GNHWPCA
CSO LTCP UPDATE
PHASE 3 - PRELIMINARY AND PRIMARY TREATMENT UPGRADES WITH NEW OUTFALL - PROCESS FLOW DIAGRAM

Jacobs

E2X92700

FILENAME: 001-G-0010_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 7:22:44 AM

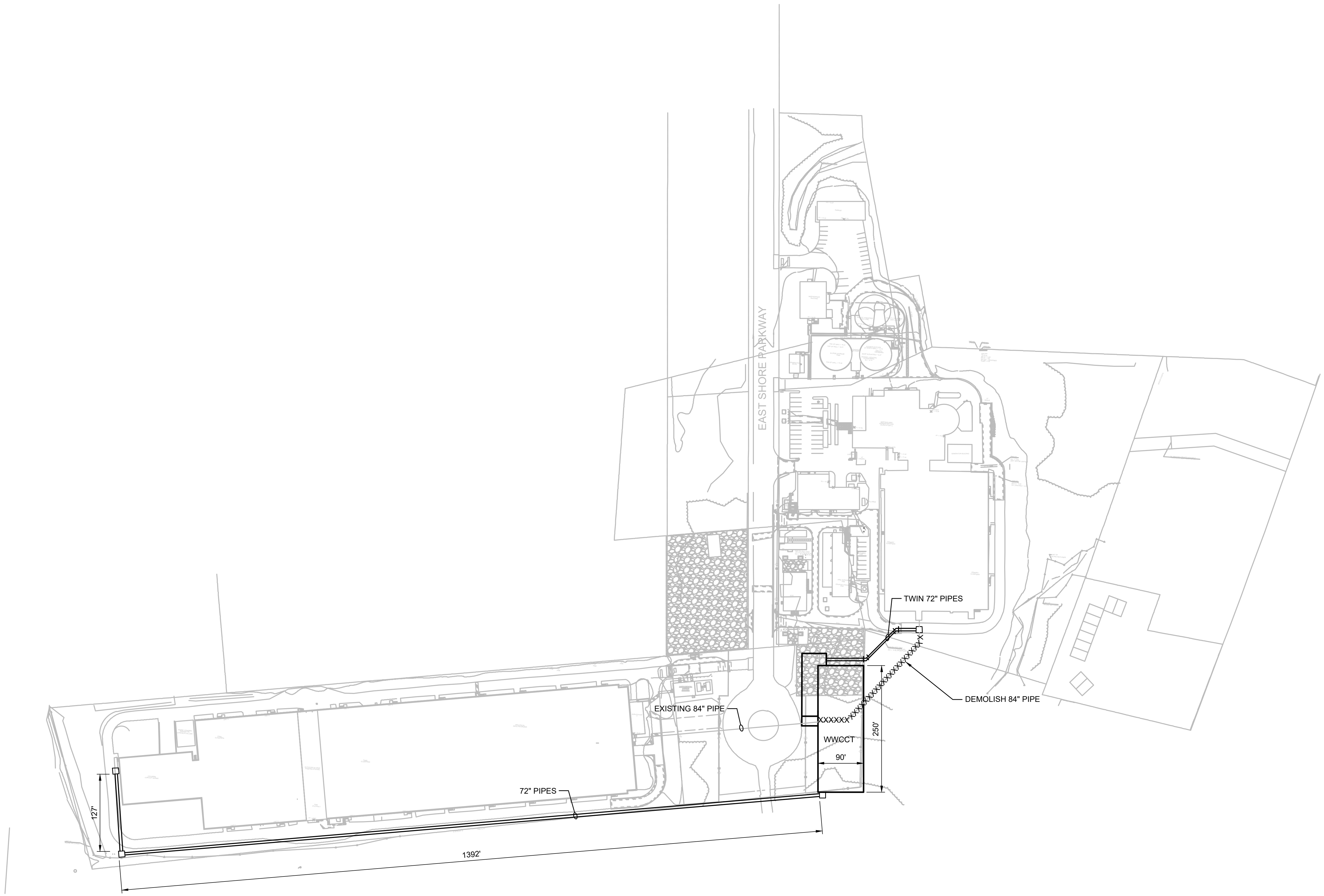


FIGURE 11
GNHWPCA
CSO LTCP UPDATE
YARD PIPING - PHASE 2

Jacobs

664626

FILENAME: 005-C-2001_E2X92700.dwg PLOT DATE: 11/22/2022 PLOT TIME: 12:04:15 PM

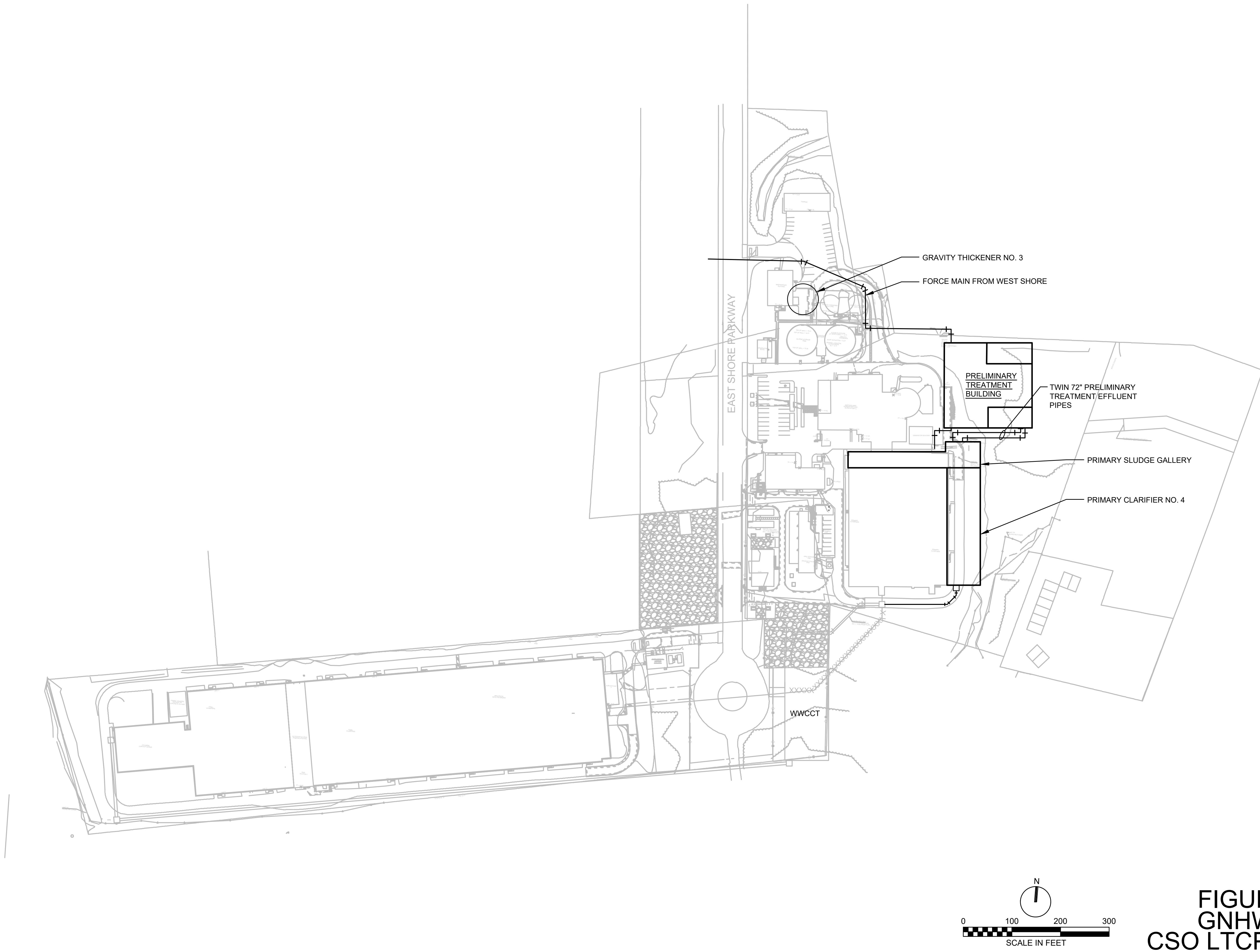


FIGURE 12
GNHWPCA
CSO LTCP UPDATE
YARD PIPING - PHASE 3

Jacobs

664626

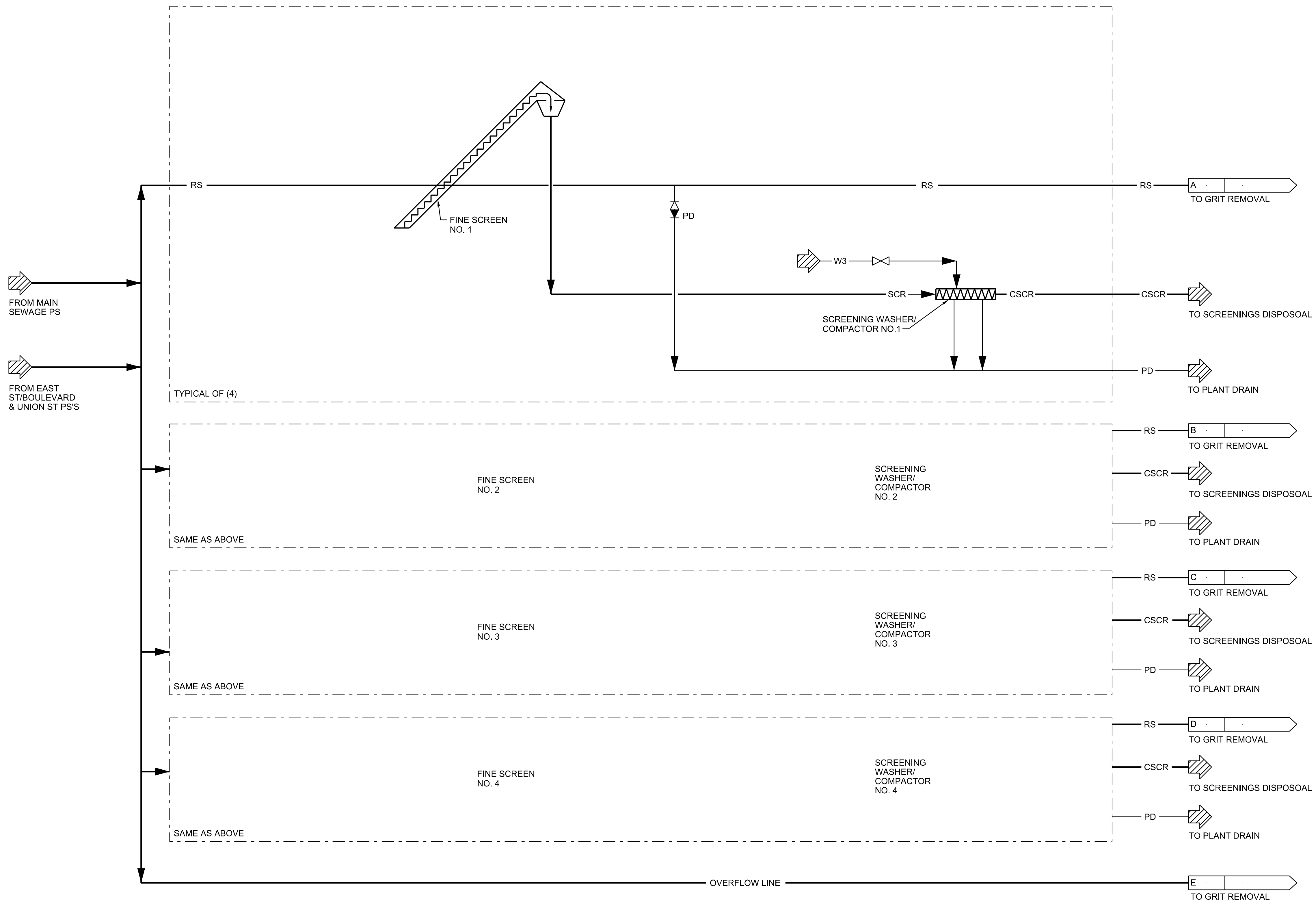


FIGURE 13
GNHWPCA
CSO LTCP UPDATE
PRELIMINARY TREATMENT - FINE SCREENS
PROCESS FLOW DIAGRAM
PLANNING LEVEL FIGURES

Jacobs

E2X92700

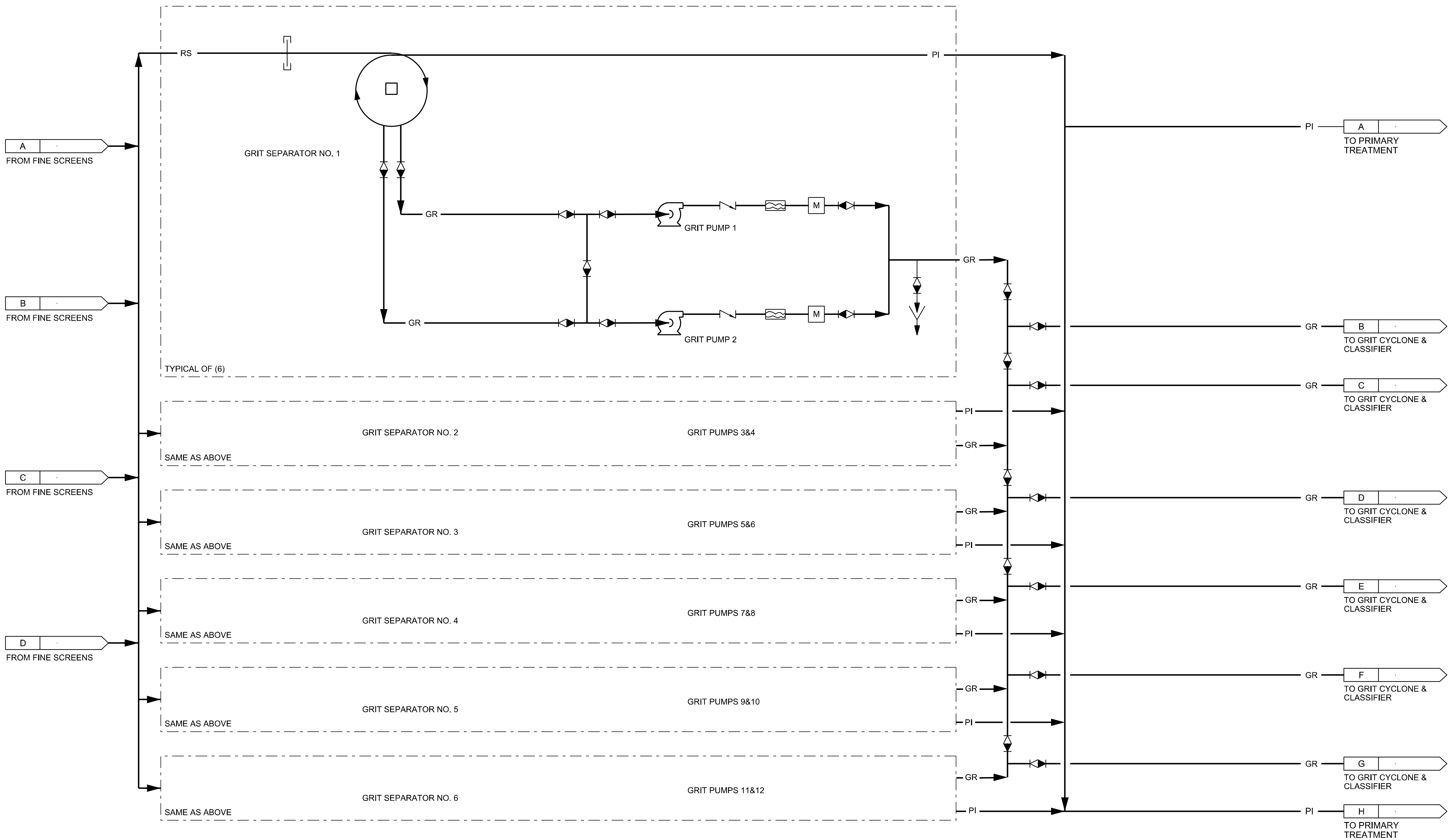


FIGURE 14
GNHWPCA
CSO LTCP UPDATE
PRELIMINARY TREATMENT - GRIT REMOVAL
PROCESS FLOW DIAGRAM
PLANNING LEVEL FIGURES

Jacobs

E2X92700

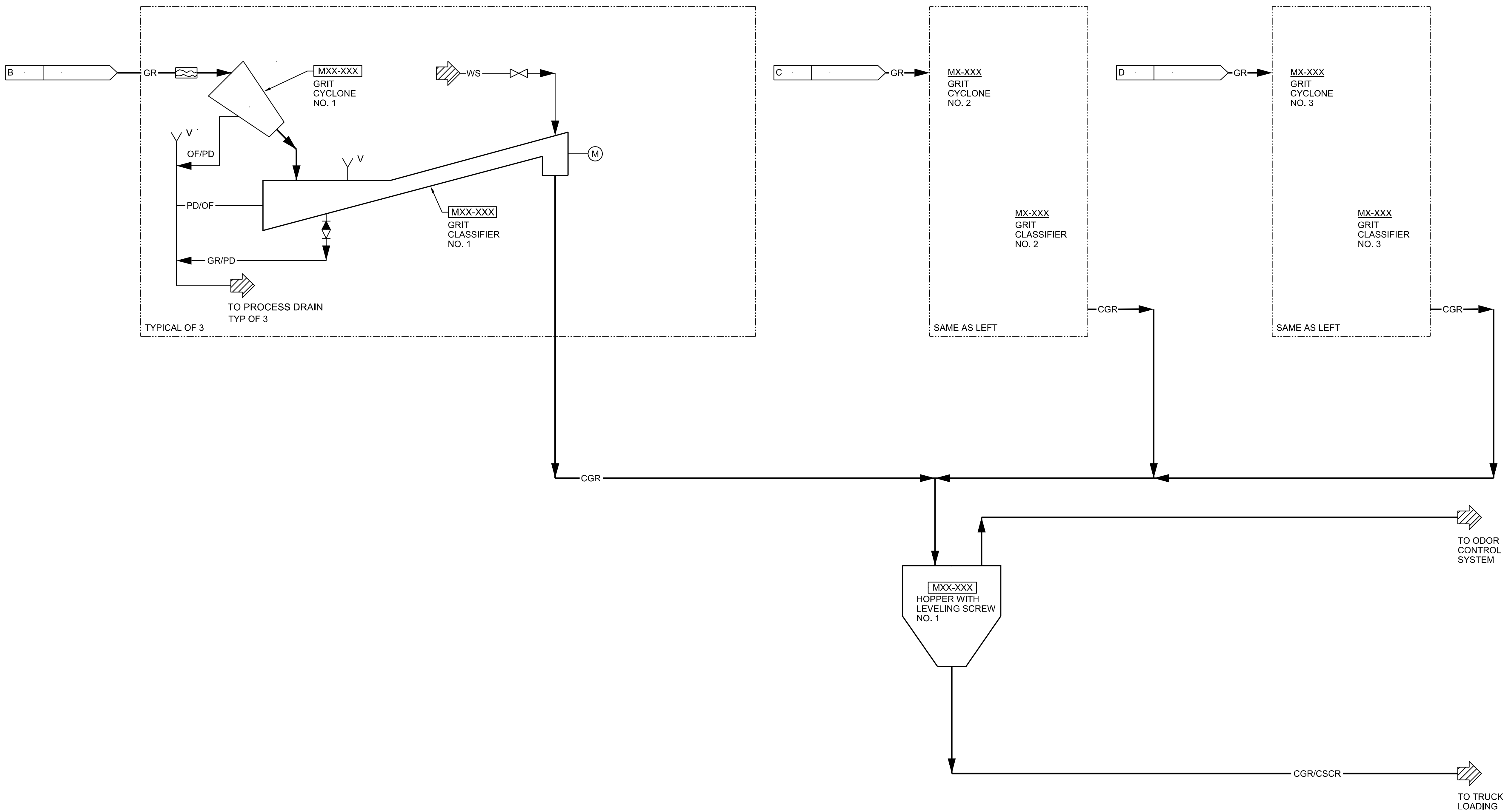


FIGURE 15
GNHWPCA
CSO LTCP UPDATE
GRIT & SCREENINGS HANDLING
PROCESS FLOW DIAGRAM - TRAIN 1
PLANNING LEVEL FIGURES

Jacobs

E2X92700

FILENAME: 200-N-0003_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 7:43:10 AM

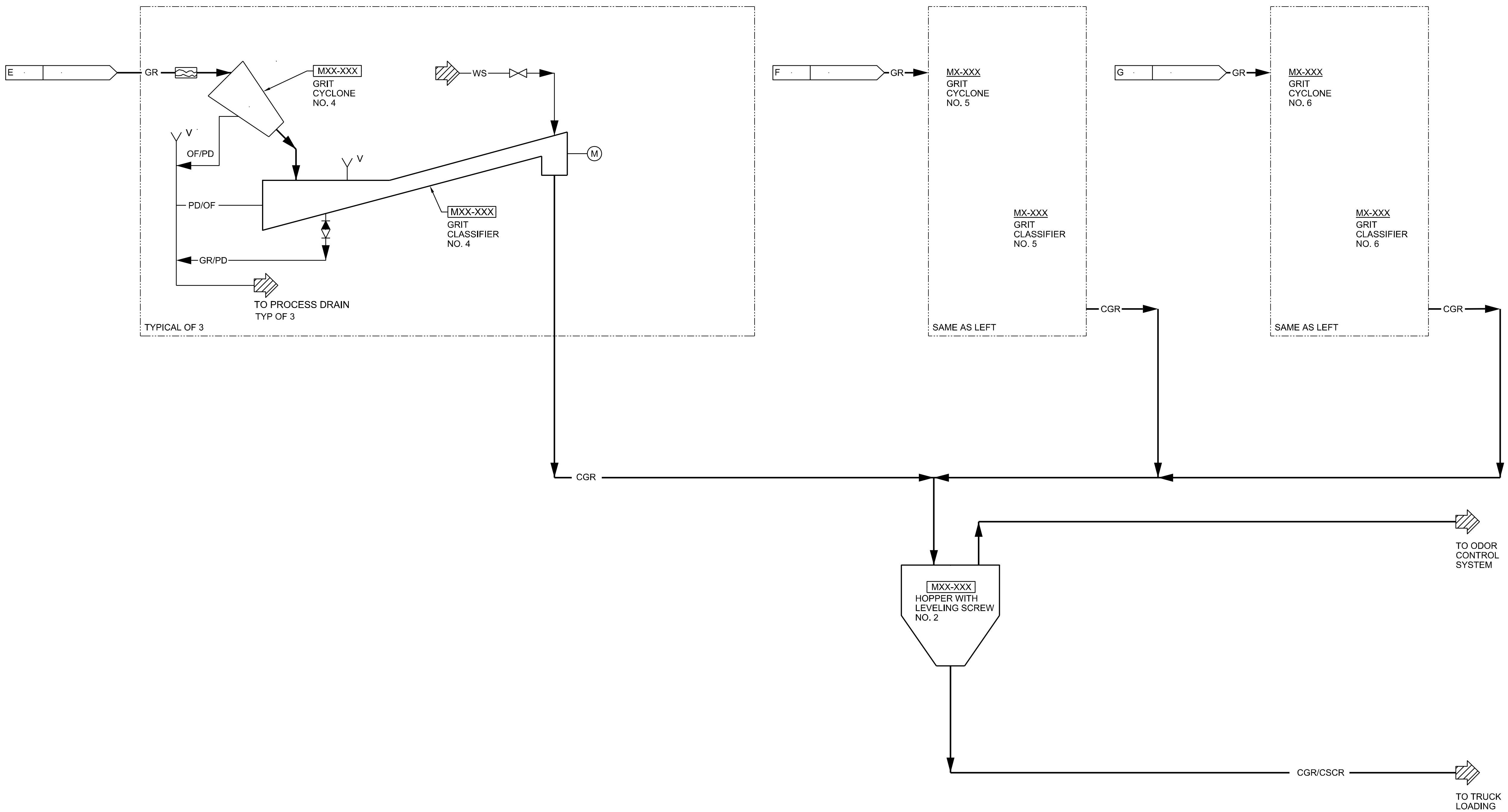
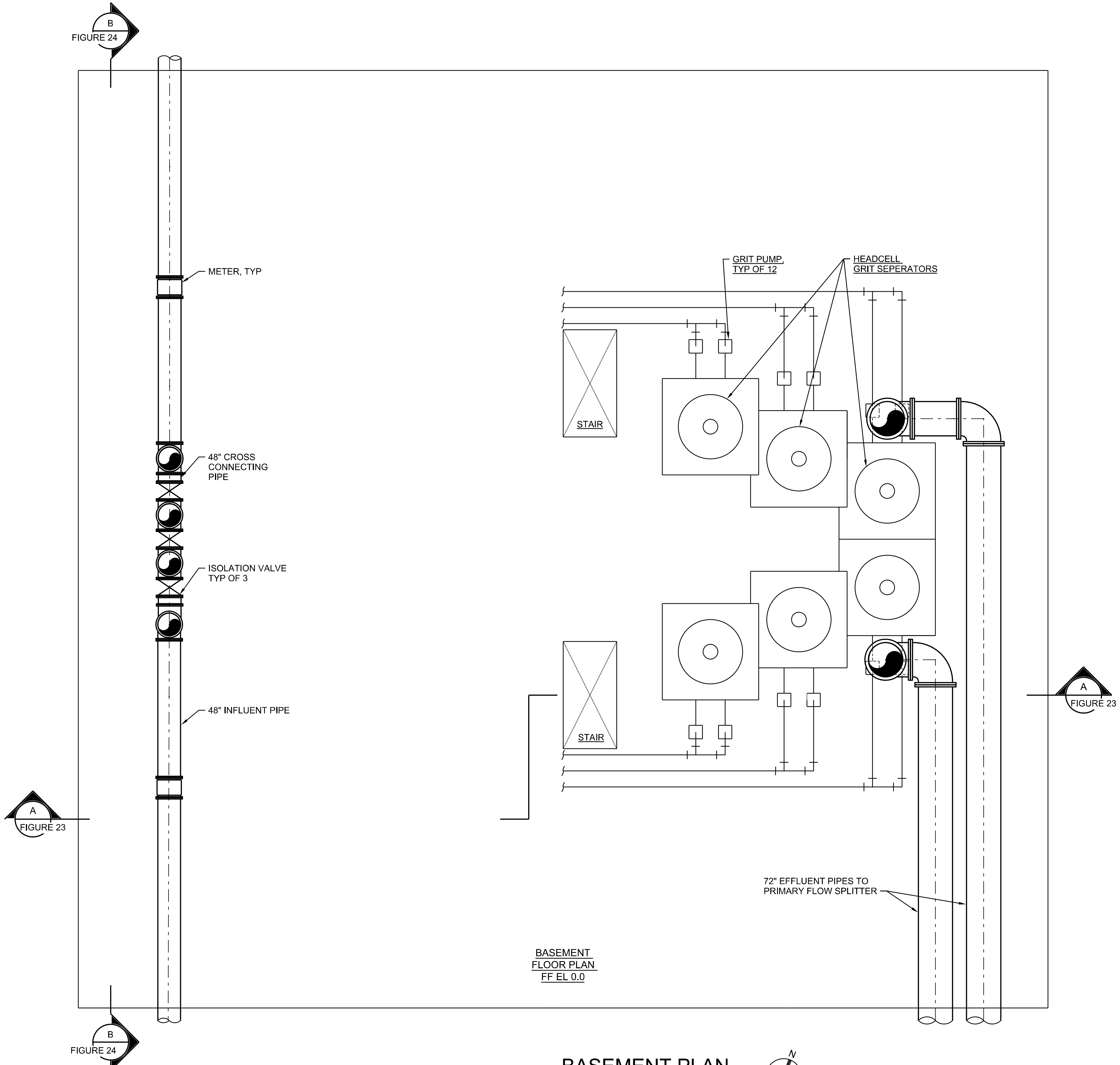


FIGURE 16
GNHWPCA
CSO LTCP UPDATE
GRIT & SCREENINGS HANDLING
PROCESS FLOW DIAGRAM - TRAIN 2
PLANNING LEVEL FIGURES

Jacobs

E2X92700

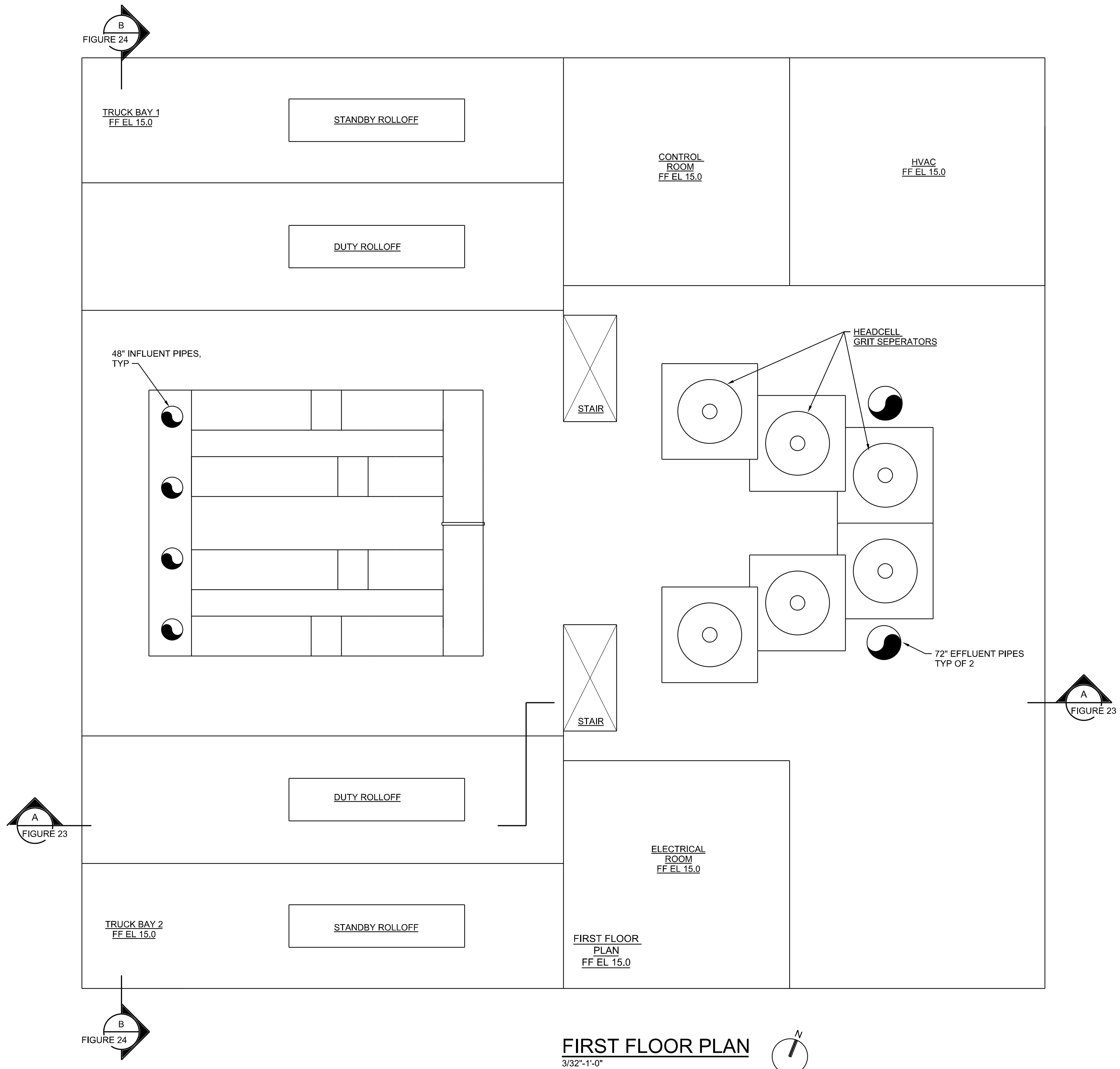


BASEMENT PLAN
3/32"-1'-0"

FIGURE 17
GNHWPCA
CSO LTCP UPDATE
PRELIMINARY TREATMENT BUILDING - BASEMENT PLAN
PLANNING LEVEL FIGURES

Jacobs

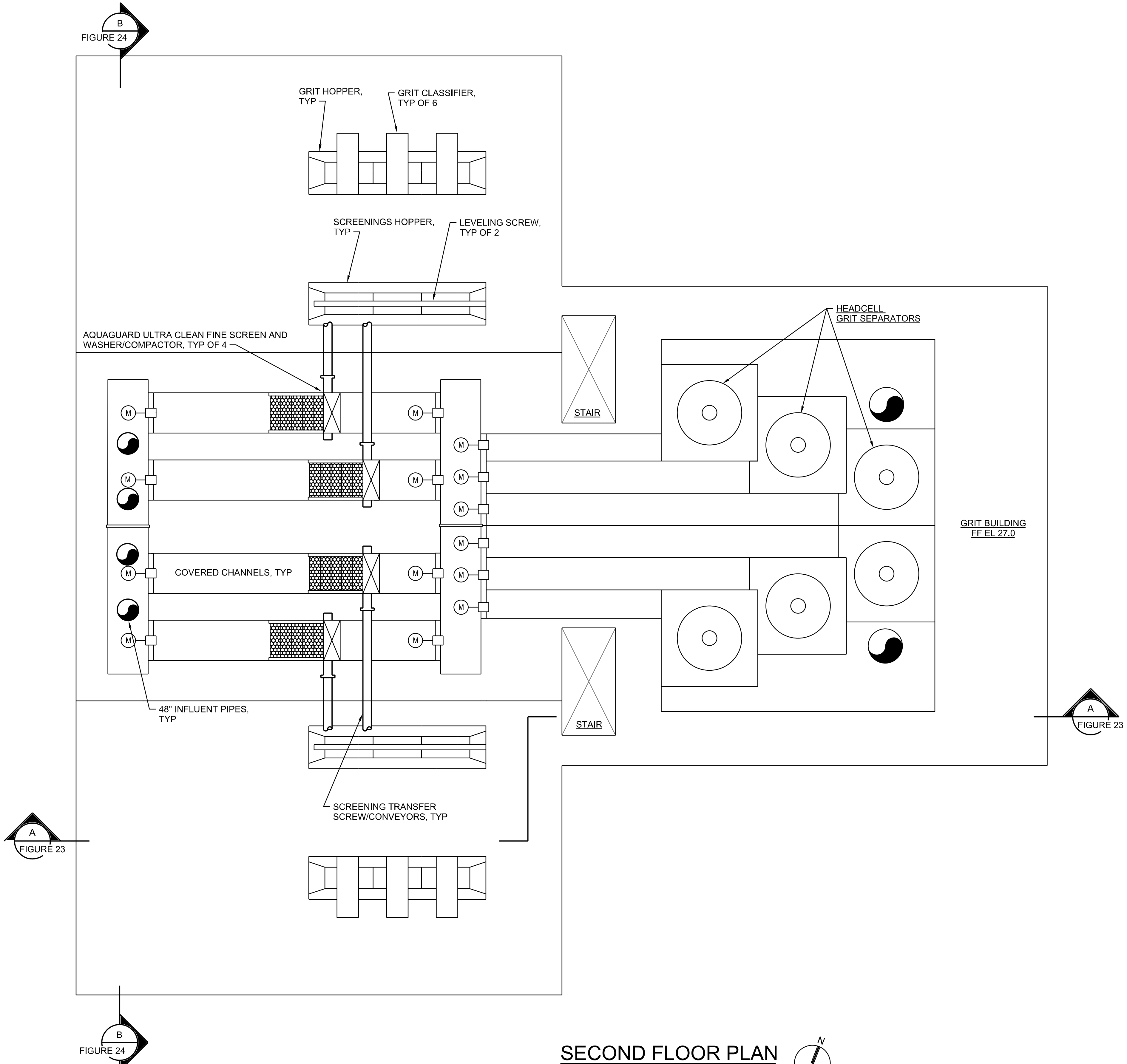
E2X92700



FIRST FLOOR PLAN
3/32"-1'-0"

FIGURE 18
GNHWPCA
CSO LTCP UPDATE
PRELIMINARY TREATMENT BUILDING - FIRST FLOOR PLAN
PLANNING LEVEL FIGURES

Jacobs



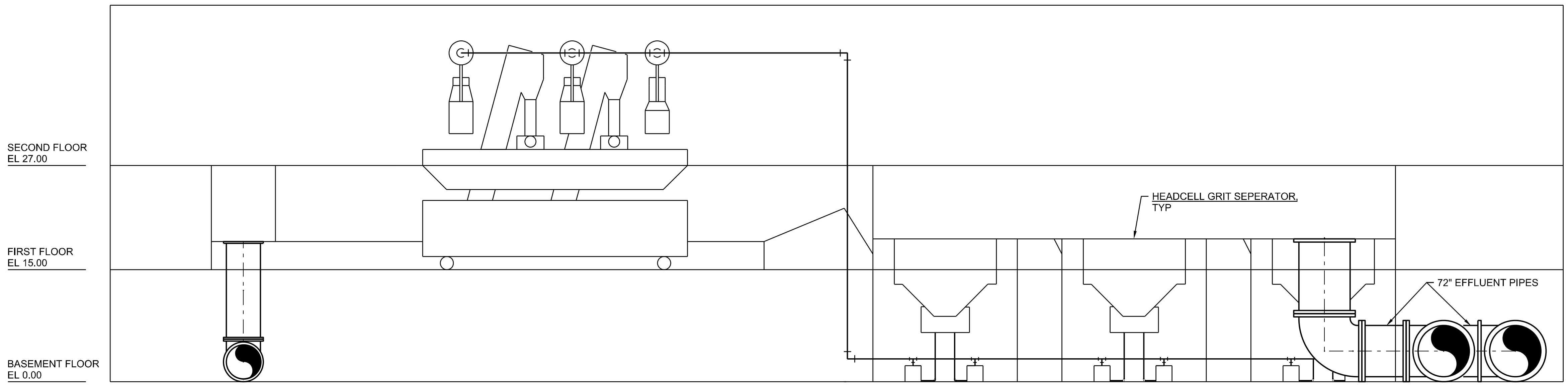
SECOND FLOOR PLAN
3/32"=1'-0"

FIGURE 19
GNHWPCA
CSO LTCP UPDATE
PRELIMINARY TREATMENT BUILDING - SECOND FLOOR PLAN
PLANNING LEVEL FIGURES

Jacobs

E2X92700

FILENAME: 200-SD-2003_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 7:57:22 AM



A SECTION
1/8"=1'-0"
FIGURE 20,21,22

FIGURE 20
GNHWPCA
CSO LTCP UPDATE
PRELIMINARY TREATMENT BUILDING - SECTION
PLANNING LEVEL FIGURES

Jacobs

E2X92700

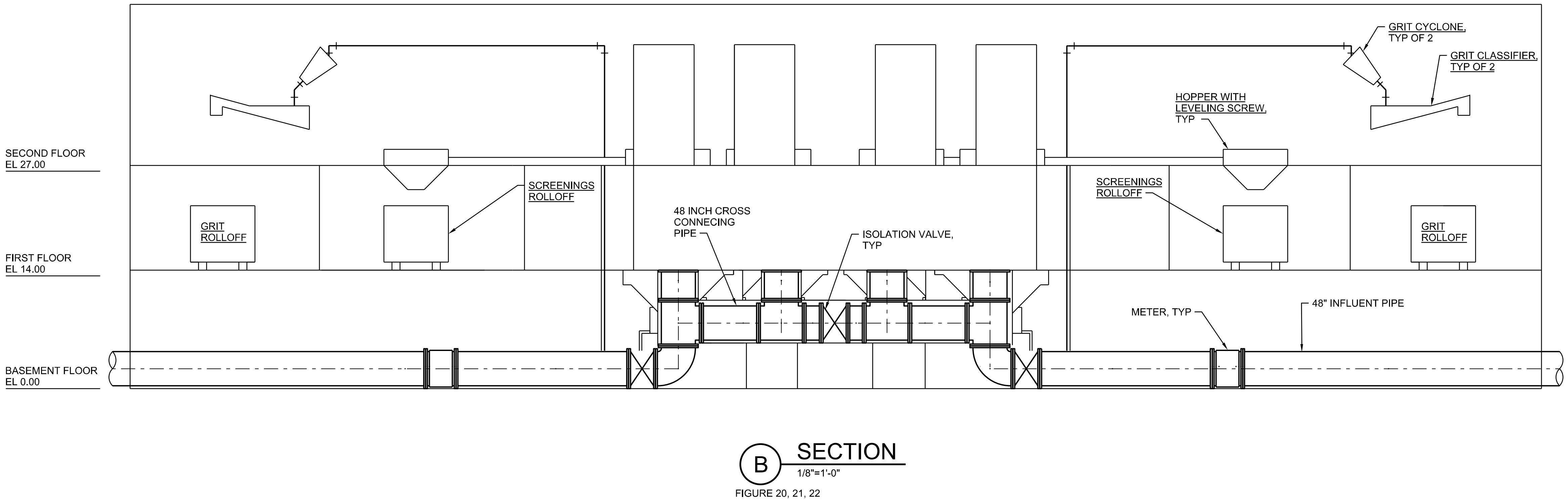


FIGURE 21
GNHWPCA
CSO LTCP UPGRADE
PRELIMINARY TREATMENT BUILDING - SECTION
PLANNING LEVEL FIGURES

Jacobs

E2X92700

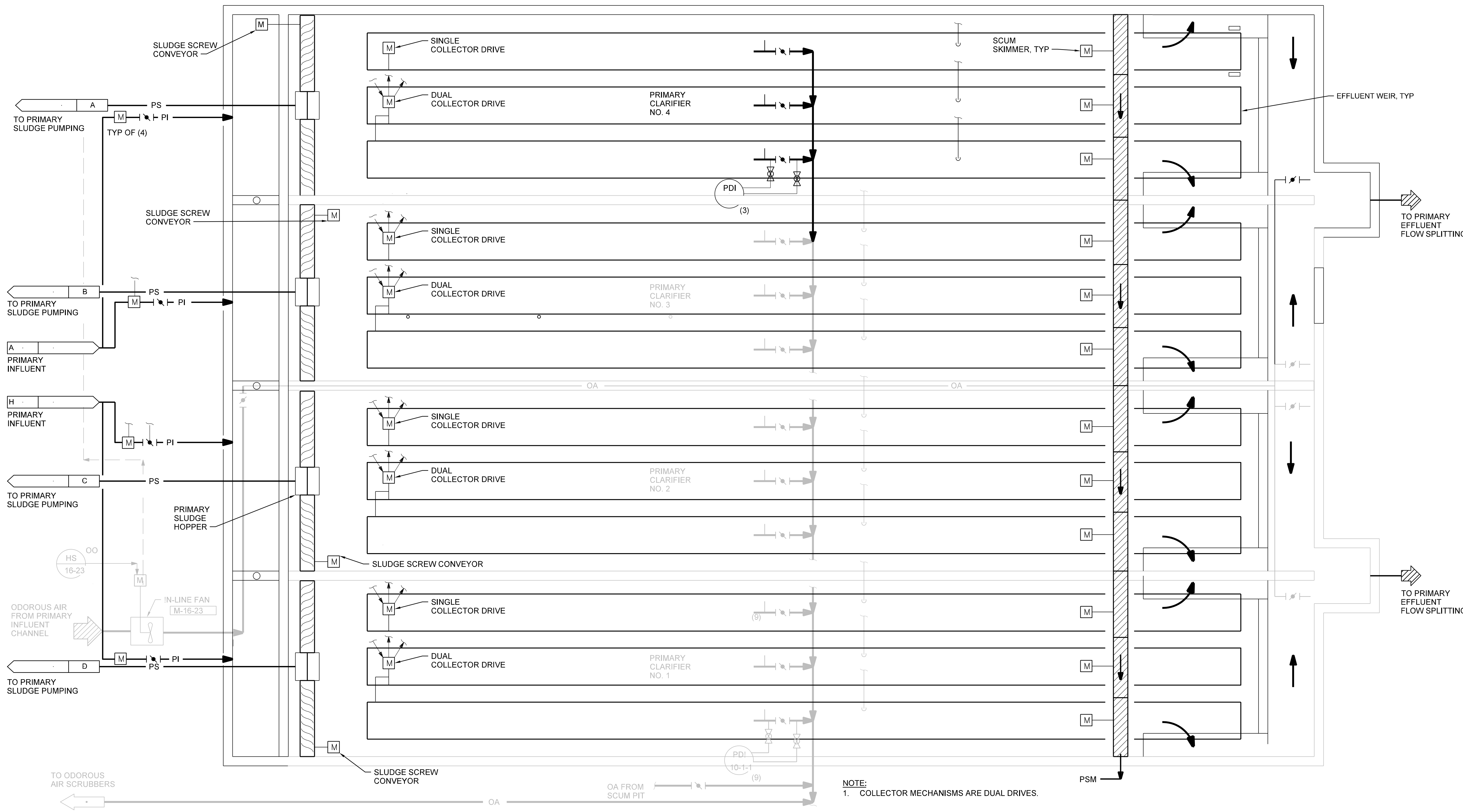


FIGURE 22
GNHWPCA
CSO LTCP UPDATE
PRIMARY CLARIFIERS - PROCESS FLOW DIAGRAM
PLANNING LEVEL FIGURES

Jacobs

E2X92700

FILENAME: 200-N-0005_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 8:06:23 AM

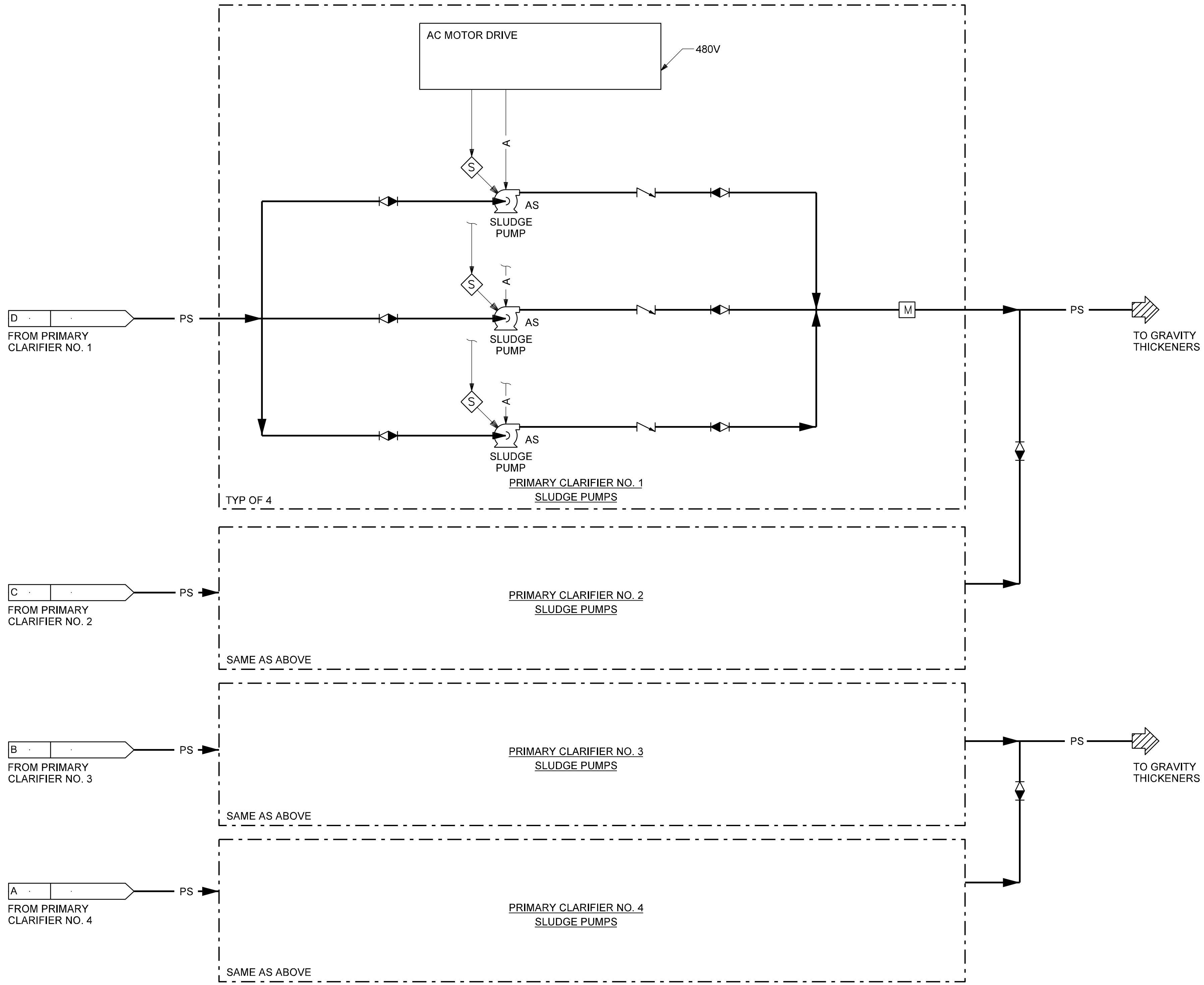
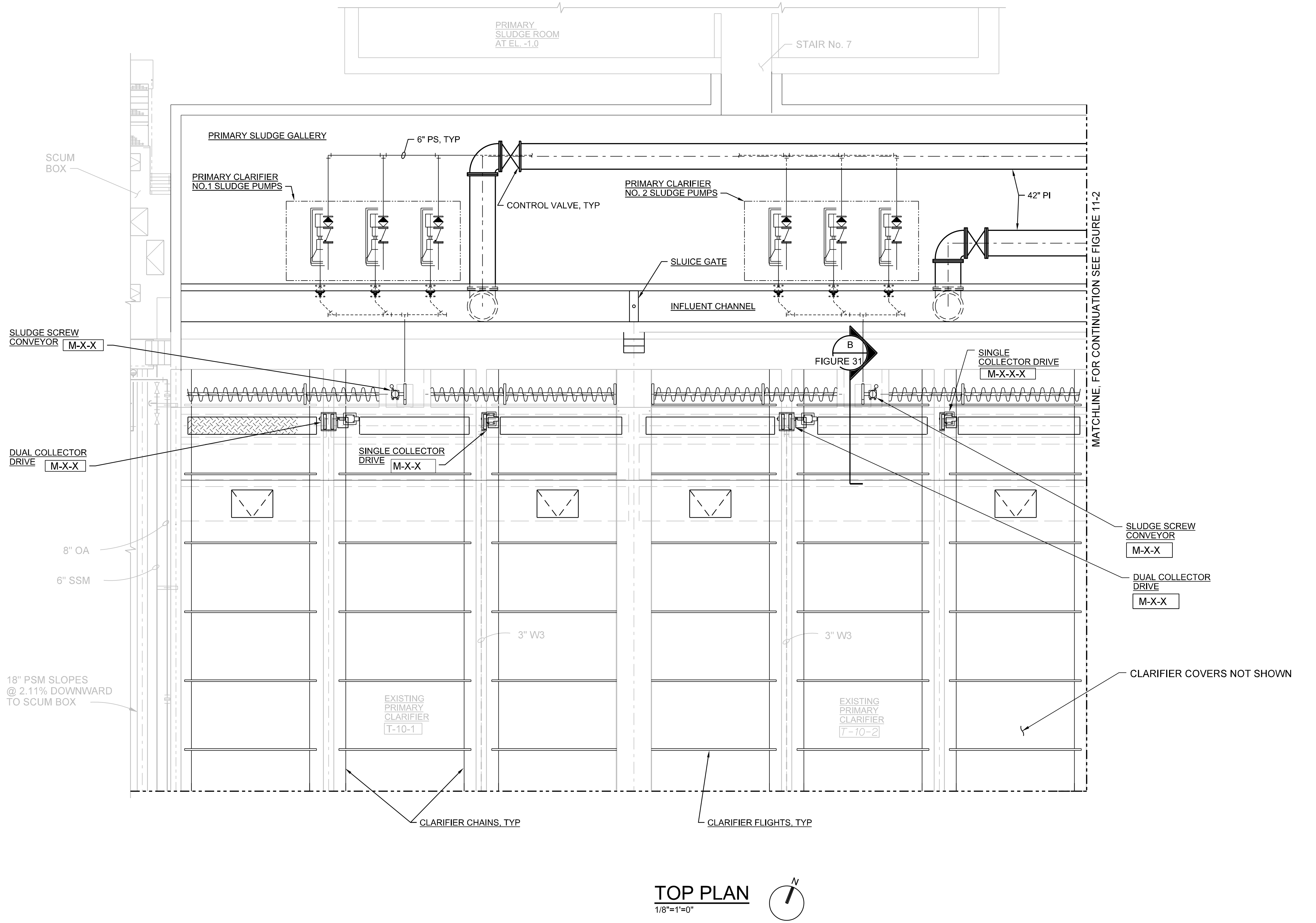
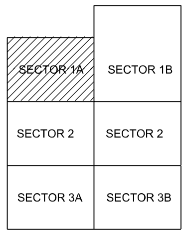


FIGURE 23
GNHWPCA
CSO LTCP UPDATE
PRIMARY SLUDGE - PROCESS FLOW DIAGRAM
PLANNING LEVEL FIGURES

Jacobs

E2X92700





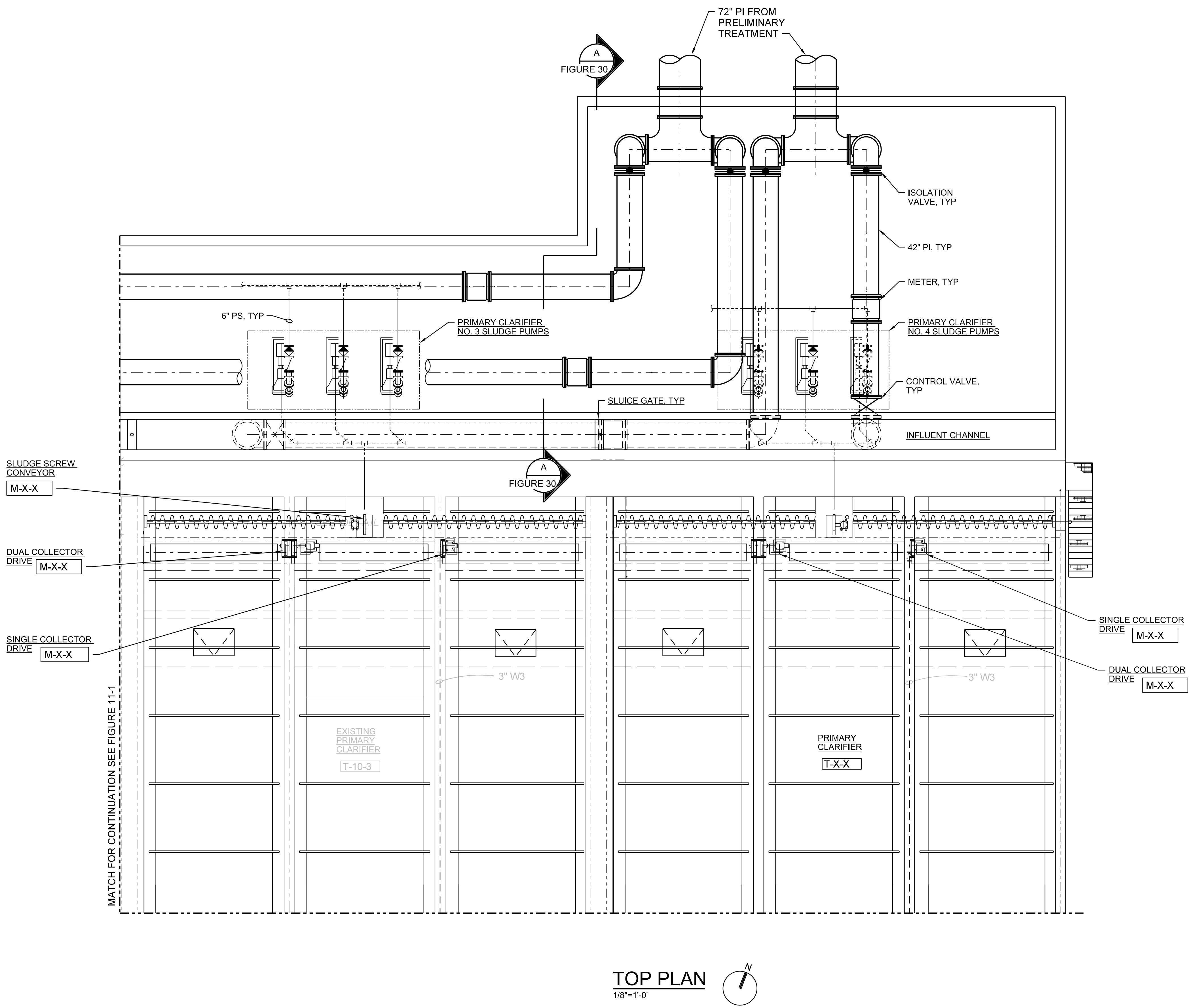
KEY PLAN

FIGURE 24
GNHWPCA
CSO LTCP UPDATE
PRIMARY CLARIFIERS MODIFICATIONS - PLAN SECTOR 1A
PLANNING LEVEL FIGURES

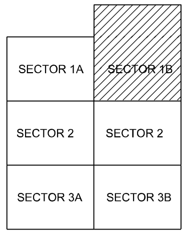
Jacobs

E2X92700

FILENAME: 500-SD-2001_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 8:14:32 AM



TOP PLAN
1/8"=1'-0'



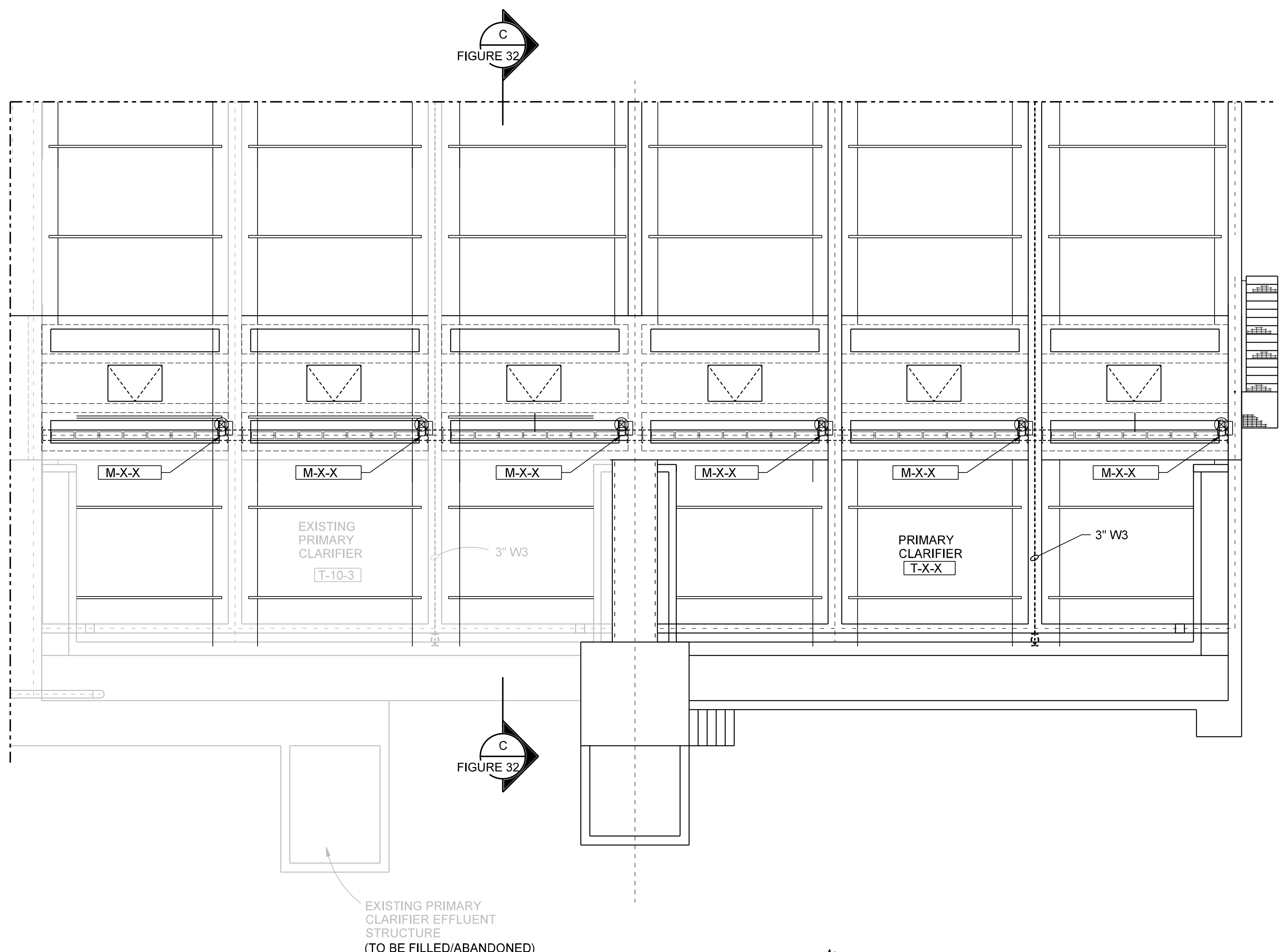
KEY PLAN

FIGURE 25
GNHWPCA
CSO LTCP UPDATE
PRIMARY CLARIFIERS MODIFICATIONS - PLAN SECTOR 1B
PLANNING LEVEL FIGURES

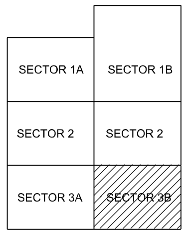
Jacobs

E2X92700

FILENAME: 500-SD-2002_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 8:17:49 AM



TOP PLAN
1/8"=1'-0"



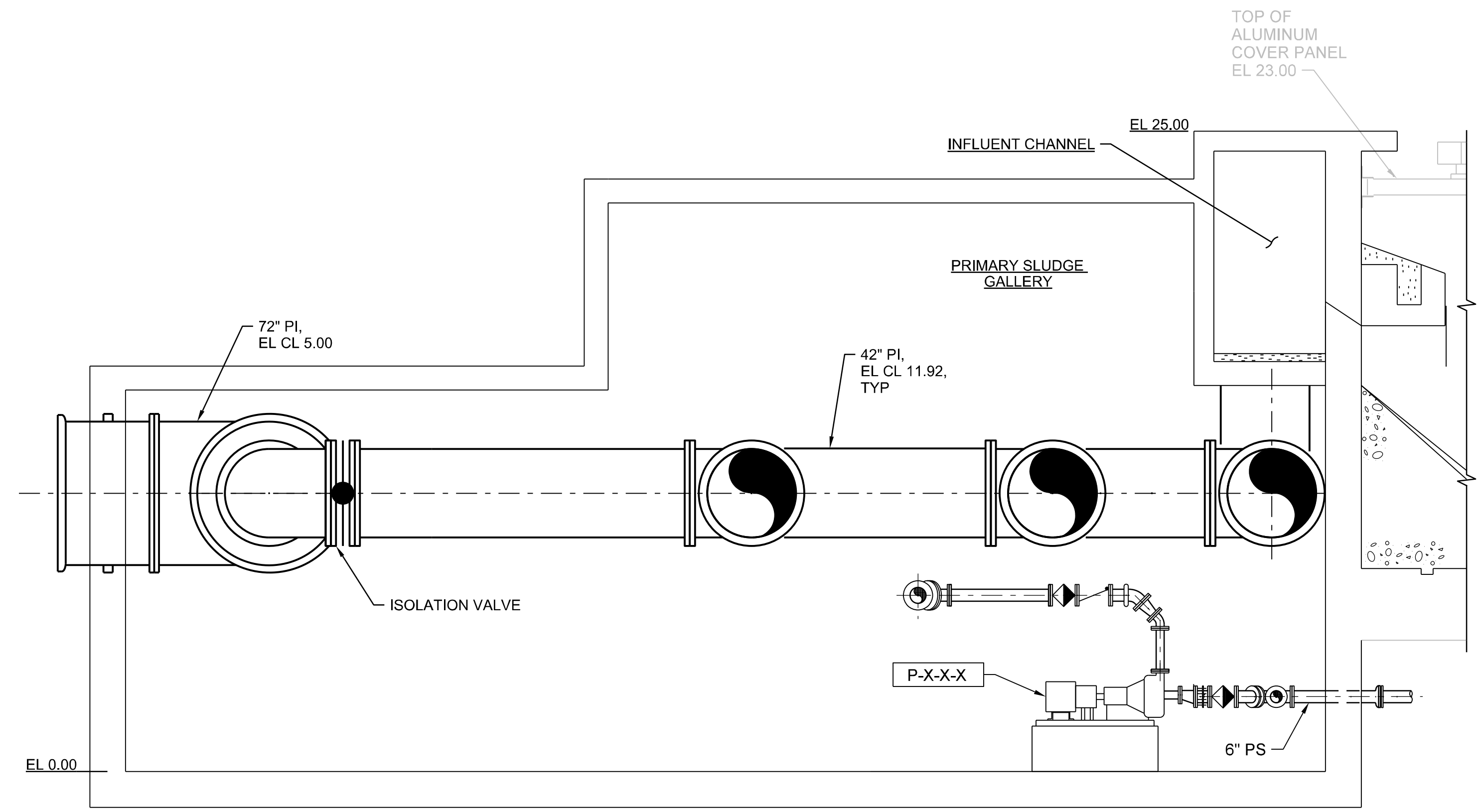
KEY PLAN

FIGURE 26
GNHWPCA
CSO LTCP UPDATE
PRIMARY CLARIFIERS MODIFICATIONS - PLAN SECTOR 3B
PLANNING LEVEL FIGURES

Jacobs

E2X92700

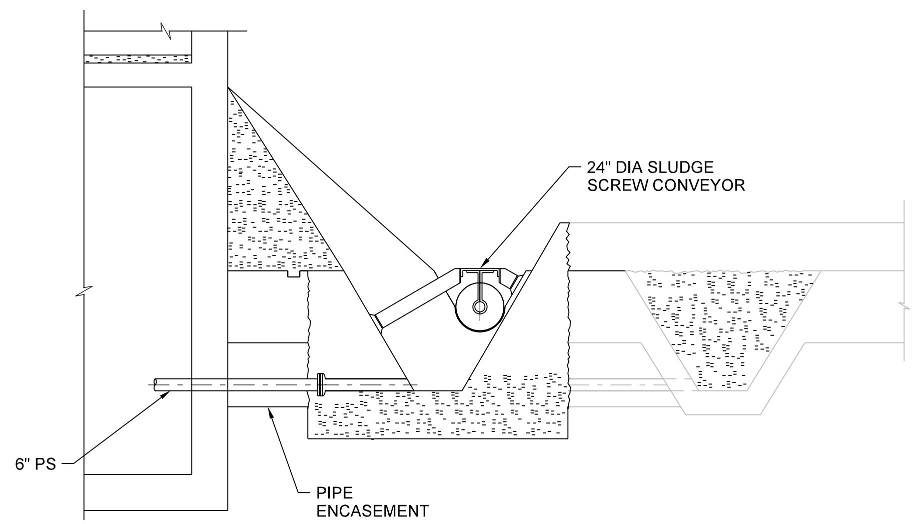
FILENAME: 500-SD-2003_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 8:21:06 AM



A SECTION
1/4"=1'-0"
FIGURE 28

FIGURE 27
GNHWPCA
CSO LTCP UPDATE
PRIMARY CLARIFIERS MODIFICATIONS - SECTION A
PLANNING LEVEL FIGURES

Jacobs

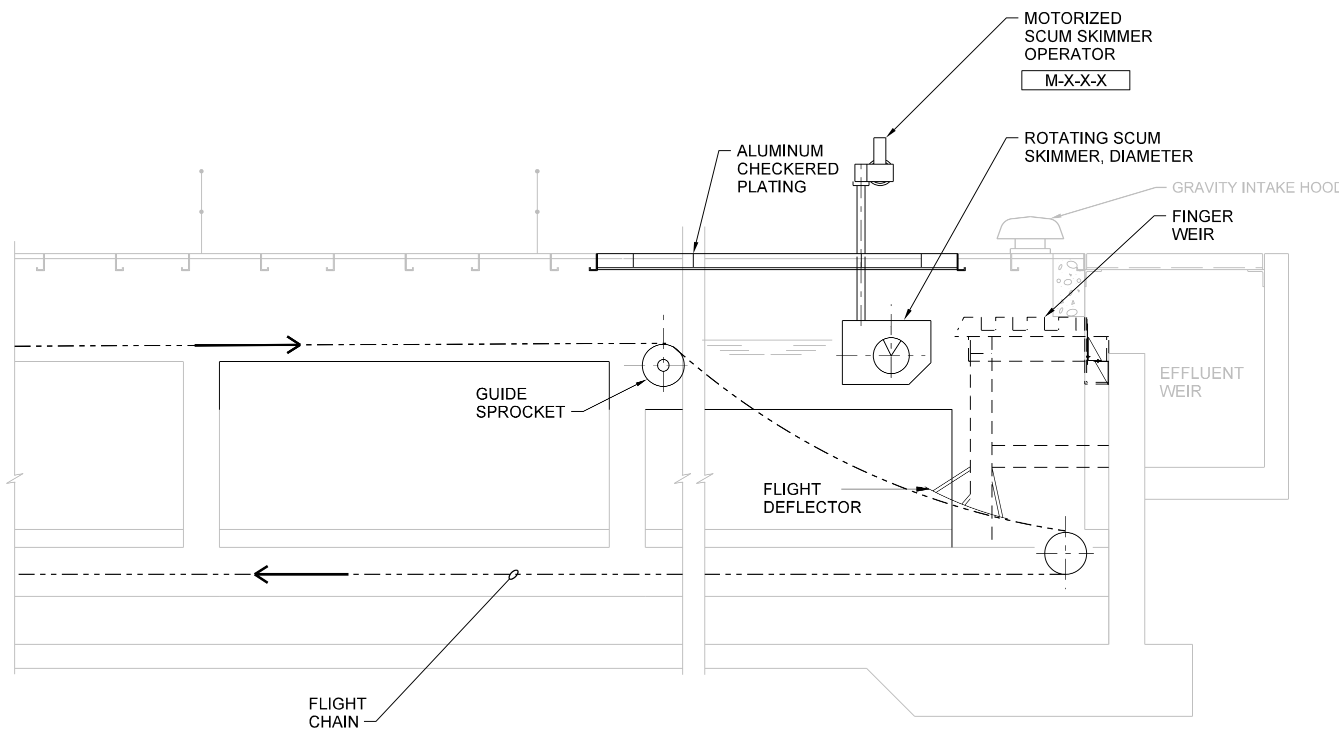


B SECTION
1/4"=1'-0"
FIGURE 27

FIGURE 28
GNHWPCA
CSO LTCP UPDATE
PRIMARY CLARIFIERS MODIFICATIONS - SECTIONS B
PLANNING LEVEL FIGURES

Jacobs

E2X92700



C SECTION
1/4"=1'-0"
FIGURE 29

FIGURE 29
GNHWPCA
CSO LTCP UPDATE
PRIMARY CLARIFIERS MODIFICATIONS - SECTION C
PLANNING LEVEL FIGURES

Jacobs

E2X92700

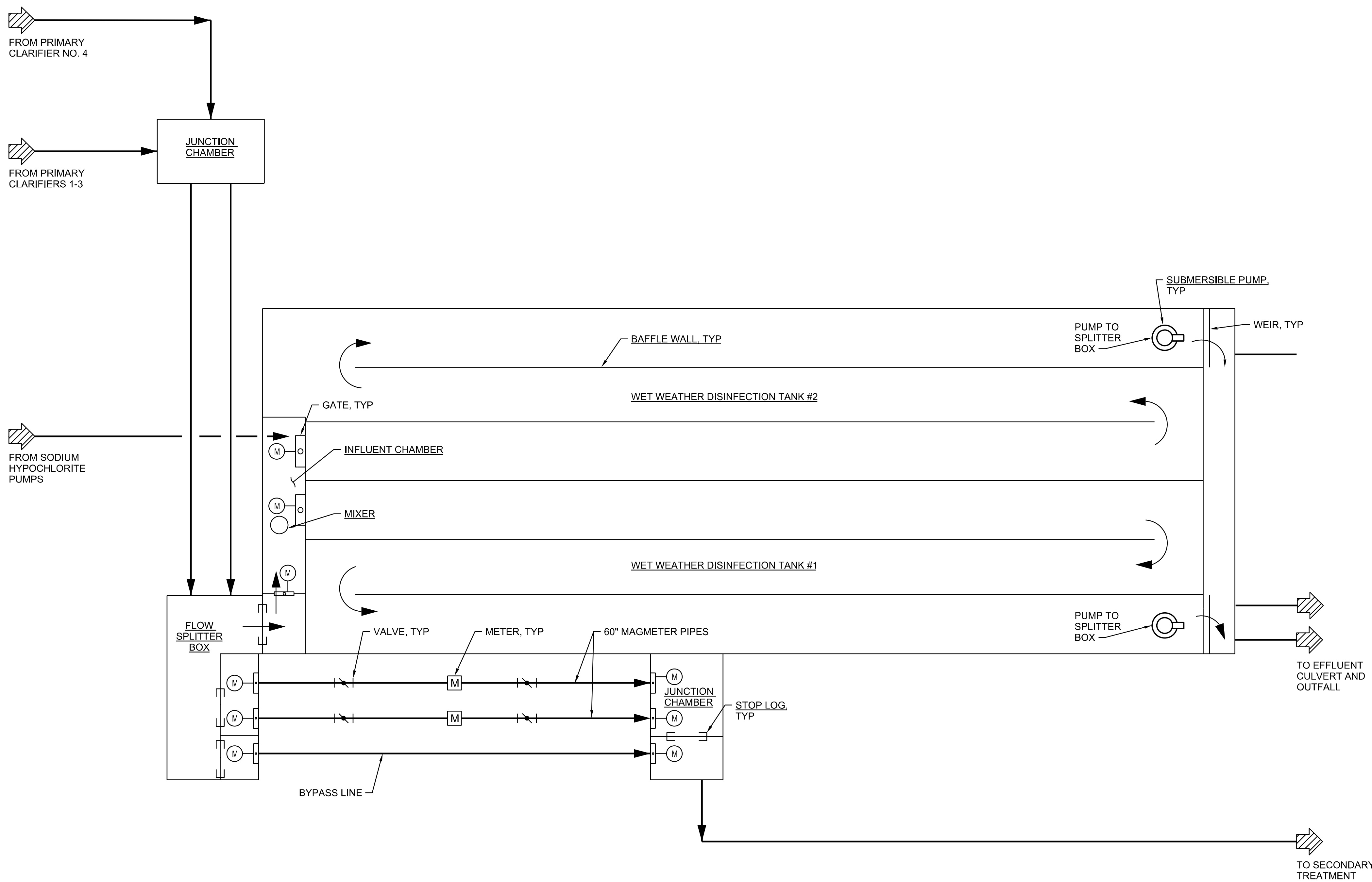


FIGURE 30
GNHWPCA
CSO-LTCP-UPDATE
WET WEATHER FLOW SPLITTING AND DISINFECTION
PROCESS FLOW DIAGRAM
PLANNING LEVEL FIGURES

Jacobs

E2X92700

FILENAME: 400-G-0001_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 8:36:54 AM

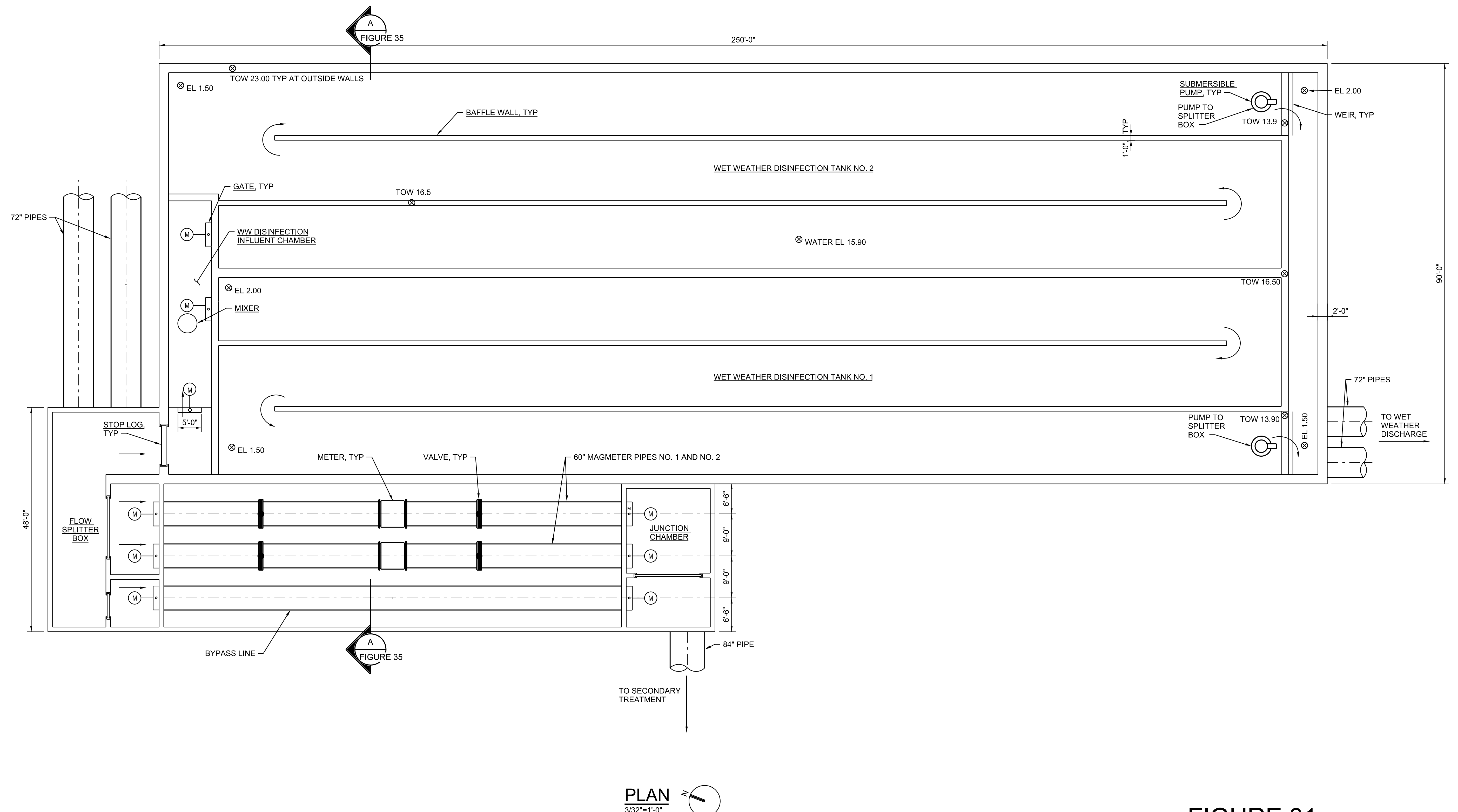
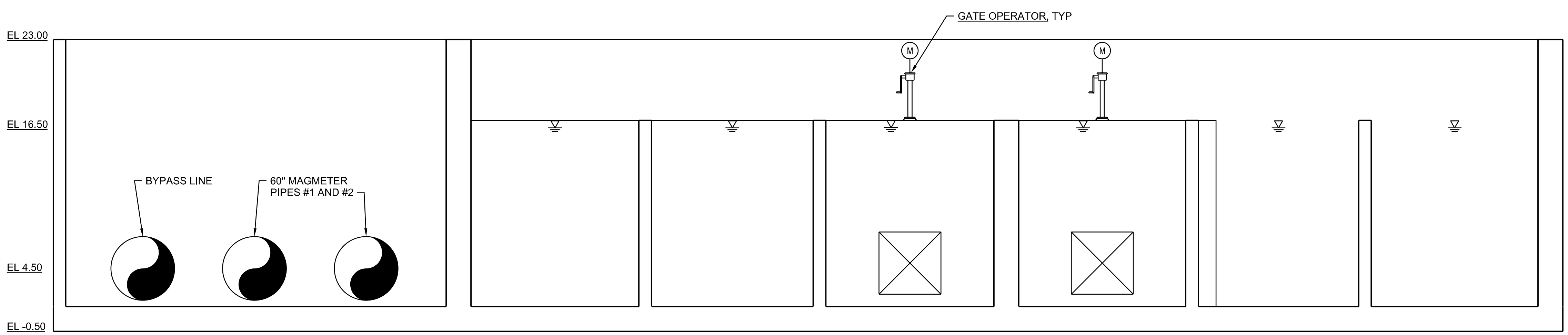


FIGURE 31
GNHWPCA
CSO LTCP UPDATE
WET WEATHER DISINFECTION - PLAN
PLANNING LEVEL FIGURES

Jacobs

E2X92700

FILENAME: 400-G-2001_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 8:41:39 AM



A SECTION
3/16"=1'-0"
FIGURE 34

FIGURE 32
GNHWPCA
CSO LTCP UPDATE
WET WEATHER DISINFECTION - SECTION
PLANNING LEVEL FIGURES

Jacobs

E2X92700

FILENAME: 400-SD-3001_E2X92700.dgn PLOT DATE: 2022\11\22 PLOT TIME: 8:47:14 AM