MAP, PLAN & REPORT

Formation of Town of East Hampton Sewer District No. 1 for Montauk Hamlet

H2M Project No.
EHPT 21-01

Draft #2

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Prepared for:

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EXECUTIVE SUMMARY

This Map, Plan and Report has been prepared in accordance with the engineering requirements contained in Article 12-A, Section 209-C of New York State Town Law to establish an improvement district within the Town of East Hampton (Town) to provide sanitary sewer service in Montauk Hamlet.

The proposed sanitary sewer improvement district was initially contemplated to provide service to four (4) non-contiguous areas within Montauk Hamlet. The four (4) areas contemplated were identified by the Town and prioritized based on existing sanitary flow density. Following an initial evaluation, it was decided by the Town, to form the sanitary sewer improvement district based on servicing only one of the four (4) areas. The area selected as the basis of the boundary was the area that yielded the highest sanitary flow density and is referred to as Downtown Montauk, hereinafter Town of East Hampton Sewer District No. 1 (district).

The proposed district boundary will encompass two hundred and twenty-two (222) tax lots, which will be provided with centralized sanitary wastewater collection, conveyance, and treatment infrastructure. The properties within the district service area are generally located along Montauk Highway bounded by Fort Pond to the north, S. Eton Street to the west, S. Essex Street to the east and the Atlantic Ocean to the south. The existing onsite wastewater disposal systems within this District are impacted by shallow groundwater and are identified as a concentrated source of nitrogen to groundwater within the Town. Tax lots located along the northern boundary of the district have been directly linked as a contributing source of nitrogen into Fort Pond as recently confirmed by a report titled *Quantifying Nitrogen Loading to the Fort Pond Contributing Area and Impacts from Sewering the Downtown Montauk Area* that was prepared by Timothy J. Hazlett, Ph.D. Hydrogeology + Water Resources Modeling Practice Leader at H2M architects + engineers, dated November 2021.

Establishing the district will provide the infrastructure required to collect and convey sanitary wastewater generated within Montauk Hamlet to a new treatment facility proposed to be constructed on approximately 14 acres of land acquired by the Town from Suffolk County. The 14 acres of land acquired is intended to not only support treatment of the proposed flows from the district, but also allow for future expansion to accommodate growth within the district as well as sewer service extensions into other unsewered areas within the Town. Providing enhanced treatment for sanitary wastewater will help reduce the effects of excessive nitrogen loading to groundwater and contribute to the improvement of water quality with the Fort Pond contributing area and other contributing areas to surface waters within the Town. Future expansion into other unsewered areas within the Town as well as installation of Innovative and Alternative Onsite Wastewater Treatment Systems (I/A OWTS) in areas not feasible to provide centralized sanitary wastewater collection, conveyance, and treatment infrastructure are also recommended as part of the Town's long-term water quality improvement initiatives.

The main objective of establishing the district is to protect public health and improve environmental conditions by decreasing the nitrogen loading rate attributed to existing onsite wastewater disposal systems from continuing to negatively impact groundwater and surface water bodies within and surrounding the Town. Other benefits that can be realized include improved social conditions and opportunity for economic growth without increasing the net nitrogen load into the environment. Storm water runoff, fertilizer usage, waterfowl and sediment flux are other factors that contribute to the degradation of both groundwater and surface water within and surrounding the Town that must also be acted upon as part of an overall program to improve water quality to fully realize the benefits associated with nitrogen load reduction.

This Map, Plan and Report presents the service area boundaries, sanitary flow projections, preliminary engineering analyses and investigations, cost opinions, and associated tax implications for the stakeholders within the district boundary to construct, operate, and maintain the proposed sanitary wastewater infrastructure. The preliminary analyses and plans presented herein represent the initial build-out for the district, which will be refined during future detailed design phases of the project. Future district expansion considerations are also identified hereinafter, the implementation of which will require subsequent Map, Plan and Reports to be prepared.

Sanitary flow projections and analyses are prepared in accordance with the *Recommended Standards for Wastewater Facilities 2004 Edition* (*Ten States Standards*) and Suffolk County Department of Health Services (SCDHS) Standards. The probable project cost opinion is prepared based on the proposed district infrastructure requirements and adjusted to reflect inflation and escalation to the anticipated mid-point of construction. The probable project cost opinion also includes a 25% contingency, which is typical and representative of the conceptual design phase of a project.

This report must be approved by the Town Board, the New York State Commissioner of Health, New York State Comptroller, and Suffolk County Department of Health Services (SCDHS) to establish the official boundaries and identify the financial burden to benefitted properties (i.e. stakeholders).

The process to form the Town of East Hampton Sewer District No. 1 is a legal process and this Map, Plan and Report is just one step in the formation procedure. It is incumbent upon the Town Board to authorize legal counsel to seek NYS approval in accordance with NYS Law and to follow the procedure required by law.

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1.0 BACKGROUND

Montauk hamlet is in the Town of East Hampton on the East End of Long Island located on the South Shore between Napeague, New York to the easternmost extent of Long Island (refer to **Figure 1** for an overview map of the hamlet). In total Montauk hamlet is around 20 sq. miles. The hamlet borders the Atlantic Ocean and Block Island Sound and has a deeply rooted sense of being connected with the water. In addition, the core areas of business are near Fort Pond and Lake Montauk. The entire Town of East Hampton is economically reliant on the local water bodies for tourism, mariculture, and agriculture. Several nearby water bodies have been deemed impaired by New York State Department of Environmental Conservation (NYSDEC). From several recent studies, the impairment is due in part to high nutrient loading from antiquated septic systems serving the area via groundwater flow.

The Suffolk County Comprehensive Water Resources Management Plan (Plan), prepared in 2015, acknowledged continued use of conventional onsite sanitary wastewater disposal systems and fertilizer application as significant contributors of nitrogen loading to groundwater within Suffolk County.[1] Other contaminants such as pathogens, volatile organic compounds (VOCs), phosphates, pharmaceuticals, and personal care products were also identified as constituents of concern from conventional onsite sanitary disposal systems. The Plan concluded that proper management of all water resources will be necessary to improve groundwater quality, surface water quality, potable supply, and coastal resiliency. The Plan also indicated that successful implementation of protective measures for the County's water resources would heavily rely on the involvement of all stakeholders. For this reason, the Town of East Hampton has taken the lead in addressing the protection of water resources on a local level by commissioning this Map, Plan and Report.

As a sub-task to the Map, Plan and Report the Town commissioned Timothy J. Hazlett, PhD (Hazlett), Hydrogeology and Water Resources Modeling Practice Leader at H2M architects + engineers, to conduct a study to identify and quantify sources of nutrient loading specific to Fort Pond. Hazlett's findings confirmed that sanitary wastewater generated within Montauk hamlet is the largest source of nitrogen to the Fort Pond contributing area by contributing 84% of the total load. The study further elaborated that "nitrogen reduction via the addition of sewers…seems a relatively straightforward and valuable approach in terms of improving water quality of Fort Pond…The replacement of septic and cesspool systems with sewers, nearest to Fort Pond and within the identified groundwater contributing area, should be a priority if the pond's water quality is the focus." The Fort Pond groundwater contributing area was identified to encompass the residential build-out on the west and east sides of the pond as well as the northern portion of the downtown Montauk business area (i.e. Downtown Montauk). The findings of Hazlett's study are documented in a report titled, *Quantifying Nitrogen Loading to the Fort Pond Contributing Area and Impacts from Sewering the Downtown Montauk Area*[2]. A copy of this report is included as **Appendix A**.

This Map, Plan and Report was commissioned by the Town to establish a Town sewer district as the first step toward mitigating nitrogen contamination attributed to the continued use of conventional onsite sanitary wastewater disposal systems within Montauk hamlet. The Town initially contemplated four (4) non-contiguous areas within Montauk hamlet for sewer infrastructure, namely the Downtown Montauk Area, Railroad Area, Dock Area, and Ditch Plains Area (refer to **Figure 2** for an overview map of the four (4) areas). Each area was identified by the Town as an area of concern with regards to the nitrogen loading to groundwater from existing onsite sanitary wastewater disposal systems.

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[1] The Suffolk County Comprehensive Water Resources Management Plan, 2015, was prepared as a joint effort between Suffolk County Department of Health Services, Suffolk County Department of Public Works, Suffolk County Department of Economic Development and Planning, Suffolk County Water Authority and CDM-Smith to develop one document that identified the current impairments to all water resources within the County and recommend corrective actions that must be taken to prevent further degradation.

[2] Timothy J. Hazlett, PhD. *Quantifying Nitrogen Loading to the Fort Pond Contributing Area and Impacts from Sewering the Downtown Montauk Area*. November 2021. Prepared for the Town of East Hampton and Town Board Members.

Following a review of prior studies prepared on behalf of the Town[3] to evaluate the economic growth, environmental protection, and potential sewering of Montauk Hamlet in conjunction with input received from the Montauk Wastewater Committee[4] and a preliminary sanitary wastewater flow density analysis of the four (4) areas, it was determined that the Town focus the initial district formation on providing sewer service to the Downtown Montauk Area. The Downtown Montauk Area was selected as the basis for the district formation based on yielding the highest existing sanitary wastewater flow density of all four (4) areas, equal to 2,154 gallons per day per acre (gpd/ac). The comparable flow densities for the Railroad Area, Dock Area, and Ditch Plains Area were projected to be 1,497 gpd/ac (119,306 gpd ÷ 79.70 ac), 838 gpd/ac (136,321 gpd ÷ 162.76 ac), and 626 gpd/ac (100,350 gpd ÷ 160.34 ac), respectively. Focusing the initial district formation on the Downtown Montauk Area would enable the Town to remove some of the highest density sanitary wastewater nutrient loading from continuing to impact groundwater, while also providing initial sewer service to properties closest to the selected wastewater treatment plant site, thereby reducing the capital costs associated with the connection pipe between the service area and treatment plant.

In addition to the four (4) areas of concern, the Town also identified three (3) alternative locations for siting a sanitary wastewater treatment plant (WWTP). The three (3) alternative sites were based on locations identified in the *Downtown Montauk Wastewater Management Strategic Plan*, dated December 14, 2017, prepared by Lombardo Associates, Inc. The sites were identified based on location and labeled as Option 1: Landfill/Cell Tower Property, Option 2: Dock/Star Island Area, and Option 3: Montauk Manor/SCWA Property. Applicability of each site was evaluated with consideration to proximity to public drinking water supply wells, groundwater contours and direction of flow, Special Groundwater Protection Area(s), Town of East Hampton Water Recharge Overlay District boundaries, Freshwater Wetlands and Check Zones, NYS Tidal Wetlands, USA Wetlands, FEMA flood zones, special site conditions, and distance to proposed district sanitary sewer service area. Following an initial evaluation of the three (3) alternative sites, each site was deemed not feasible for various reasons which were summarized in a memorandum prepared by H2M. A copy of the memorandum has been included as **Appendix B**.

In response to the three (3) sites being deemed not feasible, H2M, along with representatives from the Town, collaborated on additional siting options and determined a ~13.4-acre area located on Suffolk County-owned land adjacent to the eastern boundary of the Option 1: Landfill/Cell Tower Property as the preferred location to site a sanitary wastewater treatment plant. A preliminary analysis of this land area identified it to be suitable for the following reasons: 1) site is large enough to accommodate construction of a treatment facility including space for sub-surface effluent disposal and future expansion, 2) site meets buffer requirement between residential parcels and other areas of substantial human use, and 3) site can be accessed through the existing Town landfill property and not require a new roadway access off public right-of-way, thereby mitigating introduction of commercial traffic in areas not previously impacted.

The proposed infrastructure, identified herein, is conceptual and focused on improving the local environmental conditions as well as promoting smart growth, where permitted, in accordance with local zoning. Implementation of this plan is contingent upon the Town's ability to finance the build-out of sanitary infrastructure, which can be highly dependent on grant subsidy. As such, this Map, Plan and Report defines the Town of East Hampton Sewer District No. 1 boundary and identifies the sanitary wastewater collection, conveyance, and treatment requirements for the proposed service area.

The proposed Town of East Hampton Sewer District No. 1 boundary will encompass properties located in the Downtown Montauk area that contribute high-density sanitary wastewater nutrient load to

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[3] Prior studies include the *Wastewater Needs Analysis Report* (2014), *Comprehensive Town-wide Wastewater Management Plan* (2015), *Lake Montauk Watershed Protection Plan* (2014), and the *Downtown Montauk Wastewater Management Strategic Plan* (2017)

[4] Committee established with thirteen (13) community representatives and six (6) ex-officio members from the Town of East Hampton, presided over by the Town Supervisor to discuss and coordinate actions moving forward to improve wastewater management within Montauk Hamlet.

groundwater, some of which correlates to the groundwater contributing area to Fort Pond. Operation and maintenance considerations, overall project cost and tax implications, legal requirements and an overview of the environmental review process are also identified. By providing the proposed sanitary wastewater infrastructure, the Town will reduce the overall nitrogen load to the environment and create infrastructure that could be expanded upon in the future to remove additional nitrogen sources from onsite wastewater disposal that continues to impact the environment within the Town, including but not limited to the Railroad Area, Dock Area, and Ditch Plains Area.

1.1 Purpose of Forming the Sewer District

Montauk Hamlet is one of the most popular destinations in the Hamptons. It hosts wet and dry businesses, tourism, recreation, and commerce on the east end of Long Island. Located in the Town of East Hampton, the Montauk area is home to some of the most beautiful landscapes, golf courses, and beaches in Suffolk County. While historically the population has been seasonal, the area has transformed into more of a year-round community. To continue to support and grow, the sanitary system must be robust enough to handle the increase in year-round uses.

The properties in the Downtown Montauk Area were all originally constructed with conventional onsite sanitary wastewater disposal systems consisting of cesspools, septic tanks, and leaching pools fitted to each individual property. The existing onsite sanitary wastewater disposal systems, coupled with relatively shallow depth to ground water throughout parts of the area, result in excessive nitrogen loading to many of the coastal waters through subsurface groundwater transport. The Downtown Montauk Area is surrounded by surface waters including Fort Pond, Fort Pond Bay, and Lake Montauk, all of which have been identified as partially impaired water bodies on the Priority Water Bodies list prepared by the New York State Department of Environmental Conservation (NYDEC).

Excessive delivery of nitrogen can lead to environmental problems such as, algal blooms, hypoxic zones, habitat loss, and acidification. Studies have determined that the primary source of nitrogen to these regions is from wastewater, specifically septic tanks, and cesspools. Therefore, nitrogen loading mitigation strategies are necessary for the Downtown Montauk Area and other surrounding areas within the hamlet.

Business development and revitalization also hinge upon functioning sanitary systems. Every building, whether residential or commercial, designed for any specific use, has a certain amount of wastewater flow that its sanitary system is engineered to handle. In Suffolk County, the areas where failing on-site sanitary systems exist as the predominant method of wastewater disposal are losing value as they cannot be used to their fullest extent. This is seen in the Downtown Montauk Area where many buildings cannot accommodate mixed-use, cannot have a wet license, and are not able to increase their maximum occupancy ratings.

To minimize the discharge of contaminants to the environment, Suffolk County Department of Health Services (SCDHS) enacted Article 4, Article 6, Article 7, and Article 12 of the Suffolk County Sanitary Code to form the rules and regulations on which to protect groundwater and public health in Suffolk County. Article 6 of Suffolk County Sanitary Code was enacted in 1980 to limit development density based on location relative to water resources. Any development initiated after 1980 that would exceed the density limitations specified in Article 6 would be required to install onsite sanitary wastewater treatment system(s) or connect to a centralized treatment system to ensure compliance with local regulatory requirements. It is for these reasons that the development of centralized sanitary infrastructure would be beneficial to the social, economic, and environmental sectors of the Downtown Montauk Area.

Centralized sanitary wastewater collection, conveyance and treatment infrastructure will provide the property owners within the Downtown Montauk Area with the opportunity to expand their existing businesses in compliance with local zoning ordinance, as well as improve public perception associated with the reduction of nuisance odor emissions and potential back-ups that require pump-out activities of existing onsite sanitary wastewater disposal systems. Improvements to the Downtown Montauk Area will provide additional employment opportunities and may result in increased property valuations. The increase in property valuation within the Downtown Montauk Area and surrounding properties will provide additional property tax revenues to the Town while increased business activity will provide additional sales tax and income tax revenue, thus increasing the overall valuation of Montauk hamlet and to the overall Town.

For these reasons, the Town has commissioned this Map, Plan and Report to establish the framework on which to provide sanitary sewer service to properties located within the Downtown Montauk Area. The expansion of this service area would require preparation of additional Map, Plan and Report documents in the future at a schedule to be determined by the Town Board.

1.2 Current Regulatory Statutes

Article 6 of the Suffolk County Sanitary Code limits wastewater generation in un-sewered areas of Suffolk County based on tax lot location relative to eight (8) groundwater management zones (GMZ). Each GMZ was created to separate the Suffolk County watershed based on differences in hydrogeology and groundwater quality. The flow limitations for each GMZ are based on maintaining a maximum total nitrogen concentration in groundwater of 10 mg/L. The 10 mg/L limit is based on the current SCDHS maximum allowable concentration for nitrogen in groundwater.

The Downtown Montauk area is located within GMZ IV. GMZ IV is the zone that comprises the southeastern portion of the south fork of the County not included in GMZ V, which has more agricultural activities. The sanitary flow limitation associated with GMZ IV is 600 GPD/acre, which is equivalent to limiting zoning to a 20,000-square foot (0.5 acre) lot for each single-family residence. Since most of the development within the Downtown Montauk Area occurred prior to existing Suffolk County Sanitary Code regulations, the existing build-out within Downtown Montauk exceeds the current density limitations in many areas.

1.3 Sewer Service Area

The proposed district boundary encompasses the Downtown Montauk area, which is depicted in **Figure 3**. The district boundary includes two hundred and twenty-two (222) Suffolk County tax parcels across approximately 81 acres of surface area. The properties within the district are primarily comprised of commercial lots, with some residential and vacant parcels. The commercial properties consist mainly of restaurants, hotels, and store fronts, representative of a typical main street type business corridor in Suffolk County.

Flow generated by parcels within the district will be collected and conveyed to a single treatment facility. The proposed treatment facility and collection and conveyance infrastructure, would be owned, operated, and maintained by the Town of East Hampton. The initial sanitary wastewater infrastructure would be designed with capacity to accommodate growth within the district as well as potential future expansion of sanitary sewer service to properties located outside the initial district boundary. Incorporating additional capacity within the initial build-out plan will provide the Town with flexibility to accommodate a range of growth and/or expansion opportunities in the future while minimizing the need for costly capital investment that would otherwise be required if the initial infrastructure was design based off the sanitary wastewater flow projected for the existing build-out within the district.

2.0 SANITARY FLOW PROJECTIONS

2.1 Introduction

Sanitary wastewater flow must be identified to determine the appropriate size and type of infrastructure necessary to provide wastewater collection, conveyance, and treatment. There are several different methods that can be used to estimate wastewater flow for a given area. As cited in an industry textbook -

"Commercial wastewater flow rates are generally expressed in gal/acre/day and are based on existing water use records for developed properties or estimated flows for future development based on anticipated zoning. Comparative data from similar areas could also be used to estimate hydraulic loadings."[5] In areas that are already developed, where significant changes of use are not expected, land use, density loading rates and design sewage flow rates in accordance with local regulatory design standards are typically used to project wastewater flows. Since existing build-out is known, wastewater generation rates have been based on design sewage flow rates specified by Suffolk County Department of Health Services for the existing uses.

2.2 Sanitary Flow Analysis

As previously stated in Section 1.3, the proposed district boundary is comprised of two hundred and twenty-two (222) Suffolk County tax parcels. The existing build-out of the parcels within the district boundary have been tabulated based on criteria obtained from online available real estate data, building dimensions estimated from New York State ortho-imagery, and field reconnaissance. Specific attributes for each parcel were correlated to the corresponding SCDHS design flow criteria and tabulated in a spreadsheet to calculate the average daily flow (ADF). The ADF for each parcel was summed and equaled to a total ADF for the existing build-out within the district of approximately 174,000 gallons per day (gpd). Refer to **Table 1** for the summary of the existing build-out flow.

Table 1 – Town of East Hampton Sewer District No. 1 Existing Build-out Flow Projection

NYS Land Use Code	Description	Area (ac)	Parcel Count	Flow (gpd)	Flow Density (gpd/acre) *
100	Agricultural	0.00	0	0	0
200	Residential	4.97	45	11,850	2,384
300	Vacant Land	14.92	56	0	0
400	Commercial	28.08	92	142,860	5,088
500	Recreation & Ent.	11.89	12	15,883	1,336
600	Comm. Services	10.31	27	222	22
700	Industrial	0.48	1	173	360
800	Public Services	0.00	0	0	0
900	Wild, Forested, Conservation Lands & Parks	10.01	9	2,732	273
	Total . . .	**80.66**	**222**	**173,720**	**2,154**

*Total represents actual flow density of total flow projection divided by total area (ac).

The sanitary flow density for the district is 2,154 gpd/acre (i.e. 173,720 gpd ÷ 80.66 ac.). This existing flow density exceeds Suffolk County Sanitary Code limitations for Groundwater Management Zone IV by 1,554 GPD/ac (i.e. 2,154 gpd/ac. – 600 gpd/ac.). To comply with current sanitary code, the Town would need to either reduce density in the district or provide sanitary wastewater treatment infrastructure. Since the Town desires to improve water quality and allow for potential growth based on existing zoning within the proposed district service area, and a reduction of density is not feasible, the Town's only option is to provide sanitary wastewater collection, conveyance, and treatment infrastructure.

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[5] Metcalf & Eddy, third edition, Wastewater Engineering, pg. 26

[7] Suffolk County Department of Health Services Division of Environmental Quality: Standards for Approval Plans and Construction for Sewage Disposal Systems for other than Single-Family Residence

To account for potential in-district growth and future expansion of the district service area that can occur following the availability of sanitary wastewater infrastructure, the proposed sanitary wastewater infrastructure will be sized to maximize capacity to the greatest extent feasible to ensure operational compliance is maintained during initial low flow conditions, while providing built-in capacity to readily support future flow increases. Selecting the right balance between additional built-in capacity and capital expenditure is always a critical step in the process to provide an effective plan that meets the needs of the stakeholders. Specific attention must be given when determining the initial design capacity for the treatment infrastructure as the capital costs to construct treatment infrastructure are impacted as capacity increases.

Since future in-district growth and expansion of the district service area are not clear, and a detailed zoning/future build-out analysis has not been prepared by the Town, the initial treatment infrastructure capacity will be sized to accommodate an ADF equal to 300,000 gpd. The 300,000 gpd design flow is based on ~57% (i.e. 300,000 gpd ÷ 529,697 gpd) of the existing build-out flow projection for the four (4) priority areas identified by the Town, which provides capacity to support a 42% (i.e. 1 – [173,720 gpd ÷ 300,000 gpd]) flow increase over the existing build-out flow projection for the Downtown Montauk Area. Refer to Table 2 for a summary of the existing build-out flow projections for the four (4) priority areas.

Table 2 – Existing Build-out Flow Projection for Montauk Hamlet Priority Areas

Priority Area	Area Description	Area (ac)	Parcel Count	Flow (gpd)	Flow Density (gpd/ac)
1	Downtown Montauk	80.66	222	173,720	2,154
2	Railroad	79.70	30	119,306	1,497
3	Dock	162.76	105	136,321	838
4	Ditch Plains	160.34	422	100,350	626
	Total . . .	**483.46**	**779**	**529,697**	**1,096***

*Total represents actual flow density of total flow projection divided by total area (ac).

3.0 TECHNICAL INFORMATION

3.1 Collection & Conveyance System Overview

Sanitary wastewater collection systems are used to collect wastewater generated from individual parcels and provide conveyance to either an intermediate pump station or directly to a centralized wastewater treatment facility. The layout and design of collection systems in Suffolk County are done in accordance with Ten States Standards, and the regulatory requirements of SCDHS and NYSDEC.

Several different collection system options were evaluated to identify the appropriate alternative for the Town of East Hampton Sewer District No. 1. The main drivers for the type of system to be used are local topography and cost. Construction costs and operation and maintenance requirements are also considerations that need to be evaluated. The minimization of construction disturbance is also of concern to the Town. The collection system must be designed to handle both the average daily flow and peak hourly flow that will be generated by properties within the district service area.

The three (3) different types of collection systems considered for the district are:

- **Option 1: Gravity Sewers**
- **Option 2: Vacuum Sewers**
- **Option 3: Low Pressure Sewers**

Each of these collection system options has a range of applicability as discussed below.

3.1.1 Option 1: Gravity Sewers

Gravity sewers are designed to use gravity to convey sanitary wastewater from its source to a treatment facility. Gravity sewers are typically configured with one main sewer line running the length of a street with branch laterals connecting each abutting property to the main line. Gravity sewers are appropriate for areas where the sewer pipe installation can follow the natural inclines of the terrain so that wastewater can flow to a treatment facility or intermediate pump station strategically located at a low point in the landscape. The gravity sewer main is situated such that wastewater flow follows the pitch of the pipe all the way to the treatment facility and/or intermediate pump station; the major advantage of this collection system option is its autonomous operation – once in place, the system does not require pumping or other energy inputs to operate. The slope of the gravity sewer must be steep enough to maintain a "self-cleansing velocity" to prevent clogging and decay of untreated wastewater within the sewer pipe. Periodic cleaning and pipe inspections are the only routine maintenance activities necessary.

Gravity sewers can also be installed in areas with varying terrain. This is accomplished by locating pump stations at intermediate low points to convey the collected wastewater to another gravity-flow segment of the collection system or directly to a treatment facility via pump station and force main. These pump stations are powered by electricity and therefore provisions must be made so that continuous operation can be maintained during periods of utility power outage, which requires installation of stand-by power generation facilities.

Installing gravity sewers in areas with varying terrain increases the capital and operational costs of the system, both due to the deep excavations that are required as well as the cost of constructing and operating intermediate pump stations. Another major disadvantage of gravity sewers is the need to open-cut the entire length of roads where the pipe installation is to occur which can result in increased excavation, dewatering, and site restoration costs. Additionally, gravity sewers do not have any integrated flow control built-in to the drainage piping, which results in the piping to be oversized to accommodate the peak flow contributions associated with the diurnal water-use cycle. This characteristic of gravity sewers also impacts the size of the intermediate pump stations to ensure peak flow conditions are met. An inherent benefit of this "over" sizing requirement, makes gravity sewers appealing in applications where future growth and/or expansion of the system is unknown, thereby reducing the chance of needing to upsize collection system components in the future.

3.1.2 Option 2: Vacuum Sewers

Vacuum sewers are a second option for the district to collect sanitary wastewater. As of present date, no vacuum sewers are currently used in Suffolk County. Vacuum sewers rely on a pressure differential to convey wastewater from individual properties to the collection station. This pressure differential is created by vacuum pumps located at a centralized pump station. The vacuum pumps are connected to an enclosed wet-well (collection tank), which is directly connected to the collection system piping, thereby inducing the negative pressure necessary to convey wastewater flow from all properties. Vacuum sewers have been successfully implemented in other parts of the country and the world; they can be cost effective in areas with a high-water table or where the terrain is relatively flat.

The wastewater generated from each property within the collection system flows by gravity into an individual onsite storage tank. Once a certain fill level is reached within each individual storage tank, a pneumatic valve opens, and the vacuum suction induced within the collection system empties the tank and conveys the wastewater through the collection system piping to the enclosed wet well (collection tank). Wastewater collected in the enclosed wet well is then conveyed to a treatment facility via dry-pit sewage pump(s) and force main(s).

Because vacuum sewers do not rely on gravity, they can be installed at shallow depths and do not need to follow the natural grade of the terrain. Directional drilling can be used to install vacuum sewers, which is advantageous in developed areas because of the reduced road excavation and restoration efforts.

Vacuum sewer collection systems require the installation of at least one 'vacuum station' to sustain the required negative pressure on the sewer line. More than one station may be required depending on size and topography of the collection area, which can become difficult to site in locations with limited available space. These vacuum stations are powered by electricity and therefore provisions must be made so that continuous operation can be maintained during periods of power outage.

Since wastewater is temporarily stored at the site where it is generated, the peak flows typical of gravity collection systems are not prevalent in a vacuum sewer system. Peak flows associated with diurnal water use tend to be dampened through flow equalization that occurs within each property's storage tank.

Vacuum sewer systems typically incur relatively high capital costs and high operation and maintenance costs. The high capital costs are associated with the vacuum pumps, associated piping, and system controls as well as the need for an enclosed wet-well (collection tank). The high operation and maintenance costs are attributed to the vacuum equipment necessary to operate the collection system as well as the issues associated with grease build-up inside of the individual onsite storage tanks. Grease build-up is a common issue with wastewater generated by food service users in high-density commercial areas; grease can impede the proper operation of the pneumatic valves causing potential vacuum leaks. These vacuum leaks can directly result in failure of the collection system to convey wastewater to the central vacuum station.

3.1.3 Option 3: Low Pressure Sewers

Low pressure sewer systems are another collection system option that is applicable in relatively flat areas or where the groundwater table is high. The Village of Patchogue currently utilizes low pressure sewer systems in areas where both the groundwater table is shallow, and topography does not lend itself to the use of gravity sewers. Low pressure sewer collection systems require each property within the collection area to operate and maintain an on-site grinder pump station. All grinder pump stations are connected to a pressurized sewer main, which conveys wastewater generated within the collection area to either a treatment facility directly, a gravity sewer or to an intermediate centralized pump station.

The wastewater generated from each property flows by gravity into an onsite storage tank. The onsite storage tank is fitted with level sensing equipment and a submersible grinder pump. The grinder pumps are typically positive displacement type to achieve near constant flows at a wide range of head conditions that are prevalent in low pressure sewer collection systems. Some applications allow the use of submersible centrifugal pumps for high flow users.

The grinder pumps are turned on when a pre-set fill level is sensed in the storage tank and turned off after the storage tank is drained to a low-level condition. The pump cycles are controlled by the capacity of the onsite wet well, the real-time pressure within the common sewer main and the daily wastewater generation rate of the property.

The sewer mains used in a low-pressure collection system are sized based on flow and head requirements and to maintain a "self-cleansing velocity." Typical low-pressure sewer main sizes range from 2-inch diameter to 4-inch diameter piping. Pipe materials used in these applications are typically fabricated from high density polyethylene (HDPE) resin; polyvinylchloride (PVC) pipe material is also used. Like vacuum sewers, low pressure sewers can be installed at shallow depths and do not need to follow the natural grade of the terrain.

Directional drilling can be used to install low pressure sewers, which is advantageous in developed areas and locations with shallow depths to groundwater to minimize road excavation, restoration, and dewatering. Like vacuum sewers, peak flow conditions typical of gravity collection systems are not prevalent in a low-pressure sewer network. Flow equalization of the diurnal water use pattern occurs within the low-pressure grinder station on each property; the maximum flow from a low-pressure sewer system is a function of head loss within the system, which limits the number of pumps that can simultaneously operate.

Typical low-pressure sewer collection systems require the installation of at least one centralized pump station. More than one station may be required depending on size and topography of the collection area. The function of this pump station is like that used in a gravity collection system. However, some low-pressure collection systems can be piped directly to a treatment facility without the need for an intermediate pump station if the system head and flow conditions remain within the operating range of the onsite grinder stations.

Low pressure sewer systems typically become less and less cost effective in sewer districts that convey large volumes of flow, and/or in districts where unknown growth and expansion are expected as this circumstance can impact the size requirements for the low-pressure sewer mains. When this circumstance is anticipated it can result in the need to install numerous parallel low-pressure sewer mains to meet the head and scouring requirements of the system; intermediate pump stations also become required in these instances, all of which contribute to additional capital and operation and maintenance costs. Low pressure sewers, like vacuum sewers, are typically used in hybrid configurations with gravity sewers when the service areas become large scale, requiring numerous intermediate pump stations.

3.1.4 Selected Collection System Option

Topographical information and groundwater data obtained from the United States Geological Survey (USGS) was used to evaluate the physical characteristics of the service area to recommend a collection system option. USGS topography maps show grade within the proposed service area to generally slope from north to south and east to west towards S. Eton Street. Depth-to-groundwater information obtained from the USGS indicates that groundwater levels are less than 11 feet below grade for the area generally located along Montauk Highway between S. Eton Street and S. Emery Street. The remaining properties located in the surrounding areas within the district have typical groundwater depths that range between 11-24 feet below grade.

Based on a preliminary evaluation of the USGS datasets in conjunction with the average daily design flow for existing build-out (i.e. 173,720 gallons per day ≈ 121 gallons per minute); the selection of a gravity sewer system with a low-pressure sewer extension routed south along S. Emerson Avenue to service the high-density parcels abutting the Atlantic Ocean frontage and one central pump station is the recommended option for wastewater collection in the district. To simplify the operation and maintenance of the proposed sewer systems, it has been determined that gravity sewers be used to the maximum extent possible. Vacuum sewers were eliminated from consideration due to the relatively high operation and maintenance costs, and complexity associated with these systems, as well as lack of local operator experience. A purely gravity sewer system was rejected, because of the relatively shallow groundwater conditions that would be encountered to connect the high-density properties within the southern part of the service area. The proposed collection system will be designed in accordance with Ten States Standards.

3.1.5 Preliminary Collection System Design

A gravity sewer drainage network with a low-pressure sewer extension along S. Emerson Avenue will be required to collect the full flow from the district service area. The low-pressure sewer extension will discharge to the gravity sewer drainage network at a manhole located on S. Eagle Street. The sanitary wastewater flow collected within the sewers will discharge to a pump station located within an easement dedicated to the district from Town of East Hampton on Suffolk County Tax Map (SCTM) #: 0300-047.00-02.00-007.001. The final area of the easement will be verified during the preparation of detailed design plans for the pump station. For purposes of this Map, Plan and Report, it is assumed that the pump station will require a 40-foot by 60-foot easement area enclosed within a perimeter fence with paved access road off S. Eagle Street. The pump station will convey all flow generated within Town of East

Hampton Sewer District No. 1 to a wastewater treatment site located west of the service area. Refer to **Figure 4** for an overview of the conceptual collection system layout.

This plan considers ownership of all sewers, pump stations, force mains and associated utility easements will be transferred to the district as required. Since the district would be new to the Town, it is recommended that the Town create a new division within the department of public works that would be responsible for the oversight and management of district operations. At a minimum the district would require a full-time Superintendent with experience managing municipal sanitary wastewater systems. The need for additional supporting staff would be contingent upon whether the district elects to self-perform or contract out the operations and maintenance of the infrastructure.

The proposed gravity sewer network concept will consist of approximately 11,000 linear feet of various size sewer main ranging from 8-inch diameter PVC DR-18 pipe to 12-inch diameter PVC DR-18 pipe and approximately forty (40) pre-cast concrete sanitary manholes. The gravity sewer interceptors will mainly run east-west within various public rights-of-ways. Final sewer main sizing, routing and manhole quantities will be confirmed during detailed design. Each property serviced by a gravity sewer will be connected to the sewer main by a minimum 6-inch diameter PVC building connection. Gravity sewer mains will be designed at depths coordinated to minimize the requirement for ejector pumps at individual parcels. Purchase, installation and operation and maintenance of the gravity service lateral piping from building to sewer main, including all onsite grease traps and ejector pumps (if applicable), will be the responsibility of the private property owner.

The low-pressure sewer extension will consist of approximately 3,700 linear feet of various size main ranging from 4-inch to 6-inch diameter DR-11 HDPE piping. Final pipe sizing and locations/quantity of air release valves and clean out access will be confirmed during detailed design to ensure pipes are sized at the largest diameter to provide sufficient capacity for the design flow while maintaining the necessary minimum scouring velocity of 2.0 feet/second and providing adequate provisions for operation and maintenance as required. The low-pressure pump stations will be installed on each private property connected to the low-pressure sewer extension. Purchase, installation and operation and maintenance of the onsite pump stations and service lateral piping from the building to pump station and pump station to low pressure sewer main will be the responsibility of the private property owner.

One (1) centrally located pump station will be constructed in accordance with SCDHS standards and will include a wet well, separate valve pit with flow meter, control building and standby emergency power generator. Refer to **Figure 5** for an overview of the conceptual pump station layout.

The sanitary infrastructure will be installed within rights-of-way and municipally owned properties to the greatest extent possible. Areas where infrastructure cannot be installed within a right-of-way and municipally owned properties will require temporary construction and permanent maintenance easements. The final locations of all sewer mains, service laterals, manholes, and pump stations will be determined during the detailed design phase of this project so that they can be coordinated with existing utility locations and site conditions to avoid potential conflicts. Easements will be outlined in the Engineering Design Report (EDR) to be prepared during the detailed design phase of the project.

3.2 Wastewater Treatment Overview

Three (3) potential siting alternatives for a wastewater treatment facility were initially identified by the Town and labeled as Option 1: Landfill/Cell Tower Property, Option 2: Dock/Star Island Area, and Option 3: Montauk Manor/SCWA Property. Following a preliminary evaluation each was dismissed as a feasible alternative for various reasons, which are summarized in Section 1.0 of this report, the details of which were summarized in a memorandum provided as **Appendix B**. Use of innovative/alternative onsite wastewater treatment systems (I/A OWTS) was not considered for the Downtown Montauk Area since these systems are not intended to allow for any increase in sanitary flow density above what is currently limited under Article 6 of the Suffolk County Sanitary Code.

In collaboration with Town officials and district stakeholders, a ~14.0-acre site located adjacent to the east boundary of the Option 1: Landfill/Cell Tower Property was identified as the preferred site for a wastewater treatment facility for the district. This site offers enough space to construct a treatment facility that can treat and dispose of approximately 550,000 gpd, which will accommodate all flow contemplated from the district as well as modest (i.e. 20,000 gpd) in-district growth and potential expansion of the district in the future. The site is currently located on SCTM #: 0300-048.00-03.00-008.009, which is comprised of undeveloped wooded lands owned by Suffolk County. Preliminary discussions between the Town and the Suffolk County Executive's office have confirmed that a land transfer between Suffolk County and the Town would be required. Formation of the district will be contingent upon the legal proceedings required to finalize the land transfer between both entities.

To site and construct a new wastewater treatment facility, adequate land area must be available to accommodate treatment process structures and equipment, effluent disposal facilities, future expansion area, required buffer distance from property lines and setbacks from environmentally sensitive receptors. Determination of land area requirements is dependent upon the capacity and discharge requirements for the treatment facility. For purposes of the Map, Plan and Report, it has been assumed that the treatment facility process tanks and equipment will be located inside of a building and be designed to discharge effluent nitrogen concentrations less than 10 mg/L of filtered effluent via subsurface leaching structures. The treatment capacity used to determine the ~14.0-acre land area requirement is based on the 300,000 gpd ADF defined in Section 2.0 of this report, with consideration for future expansion to accommodate treatment capacity of up to 550,000 gpd.

The conceptual treatment process design assumes standard SCDHS influent wastewater strength. The selected process technology is a Sequencing Batch Reactor (SBR). This process technology was selected based on its extensive use throughout Suffolk County and proven ability to meet the assumed process performance requirements. The extensive use of this technology in Suffolk County will benefit the district when it comes to retaining qualified personnel to operate and maintain the equipment, whether that be by Town-employees directly or via contract. A copy of the preliminary SBR process design is included as **Appendix C**. The final details of design, including selection of treatment process equipment and detailed design layouts will be confirmed during the detailed design phase of this project and finalized in the Engineering Design Report, which will be submitted for regulatory approval prior to preparing construction documents (i.e. plans and specifications) to publicly bid the work. A copy of the conceptual wastewater treatment facility site overview is provided as **Figure 6**.

4.0 LEGAL CONSIDERATIONS AND MAP, PLAN & REPORT

4.1 Formation Requirements

The Town must follow the legal procedures outlined by New York State (NYS) Town Law to establish the Town of East Hampton Sewer District No. 1. The formation of the district is contingent upon the Town Board accepting this Map, Plan and Report in accordance with Article 12-A, Section 209-C of New York State Town Law. This section of NYS Law requires the Town Board to determine by resolution that all property and property owners within the improvement district are benefitted; the establishment of the district is in the best interest of the public; and to identify the apportionment of costs of facilities. This Map, Plan and Report must also be approved by the state commissioner of health.

Permission of the state comptroller may be required depending on the total cost to the typical property within the district relative to the average cost threshold for properties within the district and/or as a result of a petition submitted to the Town by the district stakeholders in accordance with NYS Town Law. A "typical property", as defined in NYS Town Law, is a benefitted property having an assessed value that approximates the assessed value of the mode of the benefitted properties situated in the district that will be required to finance the cost of the proposed improvements.

Table 3 provides a listing of the Parcel IDs for properties proposed to be within the district. These properties are required to be reported to the New York State Comptroller's office. The State may require a metes and bounds description of the district boundary in addition to the parcel listing should the boundary include non-contiguous areas and/or bisect parcels.

Table 3 – SCTM Properties within the Town of East Hampton Sewer District No. 1

DISTRICT	SECTION	BLOCK	LOT
0300	04900	0100	013004
0300	04900	0100	040000
0300	04900	0100	012000
0300	04900	0100	016000
0300	04900	0100	011000
0300	04900	0100	013003
0300	04900	0100	036000
0300	04900	0100	004000
0300	04900	0100	027000
0300	04900	0100	024000
0300	04900	0100	028000
0300	04900	0100	023000
0300	05000	0100	005000
0300	05000	0100	003000
0300	04700	0300	001000
0300	05000	0100	029000
0300	04700	0300	002000
0300	05000	0100	017000
0300	05000	0100	010000
0300	05000	0100	016000
0300	04700	0300	003000
0300	04800	0300	046000
0300	05000	0100	025001
0300	05000	0100	004000
0300	04800	0300	047000
0300	04700	0300	004000
0300	04800	0300	041000
0300	05000	0100	031000
0300	05000	0100	023005
0300	05000	0100	019000
0300	04700	0300	005000
0300	04700	0300	006000
0300	05000	0100	020000
0300	04700	0300	007000
0300	04700	0200	007001

0300	04800	0300	038000
0300	04800	0300	044000
0300	05000	0100	018000
0300	05000	0100	007001
0300	05000	0100	002000
0300	05000	0100	028000
0300	04700	0300	008000
0300	05000	0100	030000
0300	04700	0300	009000
0300	04700	0300	010000
0300	05000	0100	027001
0300	04700	0200	010001
0300	05000	0100	001000
0300	04800	0300	045000
0300	04700	0200	011000
0300	05000	0100	009001
0300	04800	0300	031000
0300	05000	0100	013001
0300	04700	0300	011001
0300	05000	0100	014000
0300	05000	0100	015000
0300	05000	0100	011000
0300	05000	0200	003000
0300	04700	0300	011002
0300	04800	0300	043000
0300	05000	0200	016000
0300	05000	0200	009000
0300	05000	0200	027000
0300	04700	0300	012000
0300	05000	0200	004000
0300	05000	0200	028000
0300	04800	0300	042000
0300	05000	0200	007001
0300	04700	0200	012000
0300	04800	0300	037000
0300	05000	0200	022000
0300	04700	0200	013000
0300	04700	0200	014000
0300	04800	0300	048000
0300	04700	0200	015000
0300	04700	0200	016000
0300	05000	0200	029000

0300	04900	0100	008000
0300	04900	0100	038000
0300	04900	0100	022000
0300	04900	0100	039000
0300	04900	0100	009000
0300	04900	0100	005000
0300	04900	0100	020000
0300	04900	0100	030000
0300	04900	0100	019000
0300	04900	0100	029000
0300	04900	0100	003000
0300	04900	0100	015000
0300	04900	0100	021000
0300	04900	0100	025000
0300	04900	0100	026000
0300	04900	0100	006000
0300	04900	0100	002000
0300	04900	0100	007000
0300	04900	0100	032000
0300	04900	0100	031000
0300	04900	0100	034000
0300	04900	0100	018000
0300	04900	0100	017000
0300	04900	0100	033002
0300	04900	0100	033001
0300	04900	0100	035000
0300	04900	0100	014000
0300	04900	0100	013002
0300	04900	0100	037000
0300	04900	0100	001000
0300	04900	0100	010000
0300	04900	0300	042000
0300	04900	0300	023000
0300	04900	0300	043000
0300	04900	0300	007001
0300	04900	0300	008000
0300	04900	0300	020000
0300	04900	0300	037001
0300	04900	0300	028000
0300	04900	0300	010000
0300	04900	0300	029000
0300	04900	0300	044000

0300	04900	0300	009000
0300	04900	0300	001002
0300	04900	0300	045000
0300	04900	0300	041000
0300	04900	0300	003000
0300	04900	0300	035000
0300	04900	0300	034002
0300	04900	0300	039001
0300	04900	0300	019000
0300	04900	0300	007002
0300	04900	0300	038000
0300	04900	0300	005001
0300	04900	0300	001001
0300	04900	0300	013000
0300	04900	0300	014000
0300	04900	0300	016000
0300	04900	0300	017000
0300	04900	0300	046000
0300	04900	0300	040000
0300	04900	0300	015001
0300	04900	0300	015002
0300	04900	0300	034003
0300	04900	0300	027001
0300	04900	0300	022000
0300	04900	0300	030000
0300	04900	0300	021000
0300	04900	0300	025000
0300	04900	0300	024003
0300	04900	0300	031000
0300	04900	0300	032000
0300	04900	0400	035000
0300	04900	0400	051000
0300	04900	0400	052004
0300	04900	0400	010000
0300	04900	0400	014002
0300	05000	0200	026001
0300	04900	0400	016001
0300	04900	0400	012002
0300	04900	0400	008000
0300	04900	0400	047000
0300	04900	0400	053000
0300	05000	0200	024001

0300	05000	0200	002001
0300	05000	0200	008000
0300	04900	0400	048000
0300	04900	0400	009000
0300	04900	0400	007000
0300	04900	0400	049000
0300	04900	0400	038000
0300	04900	0400	045000
0300	04900	0400	003000
0300	04900	0400	014003
0300	04900	0400	036000
0300	04900	0400	004000
0300	04900	0400	011000
0300	04900	0400	037000
0300	04900	0400	012001
0300	04900	0400	002000
0300	04900	0400	039000
0300	04900	0400	050000
0300	04900	0400	006000
0300	04900	0400	005000
0300	04900	0400	040000
0300	04900	0400	021000
0300	04900	0400	020000
0300	04900	0400	025002
0300	04900	0400	019000
0300	04900	0400	044000
0300	04900	0400	023000
0300	04900	0400	022000
0300	04900	0400	001000
0300	04900	0400	028000
0300	04900	0400	029000
0300	04900	0400	052005
0300	04900	0400	025001
0300	04900	0400	025003
0300	04900	0400	052007
0300	04900	0400	027000
0300	04900	0400	041000
0300	04900	0400	034001
0300	04900	0400	031000
0300	04900	0400	030000
0300	04900	0400	042001
0300	04900	0600	016000

0300	04900	0600	014001
0300	04900	0600	028000
0300	04900	0600	013001
0300	04900	0600	007000
0300	04900	0600	010001
0300	04900	0600	026000
0300	04900	0600	002000
0300	04900	0600	004000
0300	04900	0600	006000
0300	04900	0600	005000
0300	05000	0200	021000
0300	04900	0600	015000
0300	04900	0600	003000
0300	04900	0600	021000
0300	04900	0600	001000
0300	04900	0600	019001
0300	04900	0600	020013
0300	04900	0600	017000
0300	04900	0600	027000

4.2 Regulatory Requirements

The following bulleted items identify the regulatory requirements that must be considered during the creation of a Town district.

- State Environmental Quality Review Act (SEQRA) compliance
- State Historic Preservation Office (SHPO) Compliance
- State Pollutant Discharge Elimination System (SPDES) Permitting
- Other project-related permits

4.3 SEQRA & SHPO Compliance (pending Town acceptance of draft report)

SEQRA is required by the NYSDEC to consider environmental factors early in the planning stages for projects undertaken by local, regional, and state agencies. The SEQRA process is intended to identify potential impacts to the environment that would result from proceeding with the project as planned. The Town has initiated the SEQRA process. An expanded environmental assessment has been completed and the Town has started the proceedings to declare themselves lead agency and conduct coordinated review to issue a determination of significance for the project to ensure full compliance with SEQRA. Refer to **Appendix D** for a copy of the expanded environmental assessment.

Submission of the plan to the State Historic Preservation Office (SHPO) is a significant part of the initial SEQRA process to identify areas where sites of historical significance could potentially be affected by the implementation of the proposed plan. Like SEQRA, the Town has already submitted information to SHPO and received a final determination stating, “no adverse impact.” Refer to **Appendix E** for a copy of the SHPO letter.

Should the SEQRA review result in a negative determination, the project plan and associated environmental review process will need to be re-evaluated and additional environmental impact studies and reporting may be required.

4.4 SPDES Permitting (pending Town acceptance of draft report)

A State Pollutant Discharge Elimination System (SPDES) permit is required to regulate all point source storm water and wastewater discharges to both groundwater and surface waters under New York State law. A SPDES application will be prepared as part of the detailed design phased of this project and be filed with the New York State Department of Environmental Conservation as part of the Engineering Design Report for the new wastewater treatment facility.

4.5 Other Project-Related Permits

Based on the locations where the proposed sanitary infrastructure will be constructed, it is anticipated that road opening permits may be required from Suffolk County Department of Public Works Division of Highways and Town of East Hampton. Permitting from the New York State Department of Environmental Conservation (NYSDEC) may also be necessary in areas where infrastructure may encroach on classified wetlands and or require significant dewatering. Storm Water Pollution Prevention Plans (SWPPP) will also be required.

Additional permitting requirements may become necessary following the SEQRA compliance portion of this project.

5.0 ANTICIPATED PROJECT SCHEDULE

A preliminary project schedule for implementation of the project is provided in **Table 3**.

Table 4 – Preliminary & Aggressive Project Schedule

Milestone	2022	2023	2024	2025	2026	2027	2028	2029	2030
Map, Plan & Report Finalized	▨▨▨▨								
SEQRA and SHPO completed (Assumes EIS not required)	☐☐▨▨	▨☐☐☐							
Public Hearings/Referendum to Establish the Town Sewer District (May Be Required)		☐▨▨☐							
Engineering Design Report Preparation (Includes State Approval) *		☐☐▨▨	▨▨▨☐						

New York State Comptroller Approval Process (Sewer District Formed)							▨	▨	▨	▨	▨																									
Project Funding, Grants and Loan Process							▨	▨	▨	▨	▨	▨	▨	▨	▨	▨																				
Plans & Specifications Prepared for Construction												▨	▨	▨	▨	▨	▨	▨	▨	▨	▨															
Suffolk County & NYSDEC Review of Construction Documents																		▨	▨	▨	▨															
Project Advertisement, Bidding, Award & Contract Execution																						▨	▨	▨												
Construction																									▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	

* Assumes design engineer retained without RFP and seamless progression of project without work stoppage and restart between milestones and/or future revisions to the proposed plan.

The schedule represents an aggressive timeline and assumes the Town can finalize their financing plans by the time the project is advertised for bids. Additional assumptions have also been integrated into this schedule such as the time allocated for review and approvals by regulatory state agencies, as well as stoppage of construction during the peak summer season. Should these assumptions prove accurate and the Town acts to keep the project moving forward, then it is expected that the system will be on-line in the fourth quarter of 2030.

6.0 TOTAL PROJECT CAPITAL COST OPINION

6.1 Introduction- Capital Construction and Soft Costs

Capital costs associated with the project are shown in **Table 4**. The capital cost opinion is based on the preliminary conceptual plan for the sanitary sewer infrastructure presented in Section 3 of this report and includes the following:

- Budgeted Construction and Engineering design costs for the proposed sanitary infrastructure.

  Budgeted Engineering design services during construction, and construction management budgets for the new facilities.

- Soft costs including utility mark-out & survey mapping, topographic and boundary survey, soil borings & geo-technical analysis, operations and maintenance manuals, Project Labor Agreement (PLA), Sewer Use Code, land & easement acquisition, bond counsel, permitting and funding assistance.

The capital cost opinion presented in this document is based on assumptions relating to the final scope of design, unknown subsurface conditions, and unknown subsurface utility locations. Unknown locations of existing subsurface utilities and groundwater can also significantly impact overall project cost and anticipated schedule. Market conditions, as they pertain to inflation, interest rates, public bidding environment, and delays in the project schedule related to project funding, are other potential concerns when projecting project costs.

The capital cost opinion includes the construction, engineering, and soft costs for the construction of the proposed sanitary wastewater collection, conveyance, and treatment infrastructure. Estimated costs for restoration do not account for any special restoration that may be required by the governing municipality and assume only areas disturbed by work are restored. Trench restoration is assumed, not curb-to-curb paving.

The project soft costs include survey, archeological investigations (if applicable), soil borings and geo-technical analysis, preparation of operation and maintenance manuals for the infrastructure, development, and negotiation of a project labor agreement (PLA), assistance with creating a Sewer Use Code, legal fees associated with land and easement acquisition and bond counsel and permitting and grant assistance budgets. The costs associated with the abandonment of on-site septic tanks, installation of onsite low-pressure sewer pump stations and sewer hook-up are not included in the scope of construction work to be administered under Town contract. The total capital cost opinion for the sewer district also does not include remediation of contaminated soils encountered during work. The costs associated with the previously stated items not included in the total project cost opinion would be borne by each property where this work would be required.

Table 5 summarizes the project capital cost opinion based on providing sanitary infrastructure to the properties within the district service area. The cost opinion assumes a Town PLA will be in place to allow for the treatment facility and collection and conveyance construction to be let under two separate single prime contracts.

The line-item costs presented in **Table 5** depict present-day value and escalation to second half of construction in 2030, based on the project schedule presented in **Table 4**. The escalation factor is calculated based on the 10-year compounded interest rate referenced from the 20 Cities Construction Cost Index (CCI) that is published by Engineering News-Record (ENR). The average annual compounded rate at which the CCI increased over the last 10 years is 4.00%.

Table 5 – Total Project Capital Cost Opinion (Present Day – 2022 & Escalation – 2030)

Item	Cost $ (2022)	Cost $ (2030) *(Rounded to $10,000)*
Wastewater Treatment Facility (WWTP)	$20,100,000	$27,510,000
Collection & Conveyance System (Sewers, Pump Station & Force Main to WWTP site)	$16,300,000	$22,310,000
Total Estimated Construction Cost:	**$36,400,000**	**$49,820,000**
Budget for Engineering Design and Engineering Design During Construction Services (FEMA ASCE Curve A)		$2,890,000*
Budget for Construction Management (based on 10% of construction cost)		$4,990,000
Total Soft Costs[6]		$1,195,000
	Total Estimated Project Cost:	**$58,895,000**
	25% Project Contingency (SAY:	**$14,730,000**
	Total Estimated Project Cost (SAY):	**$73,625,000**

*Budget for Engineering Design and Engineering Design During Construction services is escalated assuming an annual rate increase of 4% for the effort projected to prepare the Engineering Design Report, Detailed Plans and Specifications and Engineering Design During Construction Services based on the project timeline outlined in **Table 3**.

6.2 Estimated Operation and Maintenance Costs (Sewer Rent)

It is recommended that operation and maintenance of the sewer district be managed by a new division of the Town's department of public works (DPW). The new division of DPW will require, at a minimum, a full-time Superintendent to perform managerial functions required to oversee the sewer district. In addition, it is also recommended that two (2) full-time employees be hired by the Town and dedicated to the district to perform general maintenance activities within the collection, conveyance, and treatment systems primarily consisting of equipment repairs as needed. These employees must possess a valid NYS commercial driver's license (CDL) and be mechanically inclined and experienced in general maintenance of equipment and construction activities. Equipment, such as a vacuum (Vactor) truck, two off-road capable support vehicles and a maintenance building/shop with office, tools, work bench and spare parts, specific to the sewer district, is recommended to be located at the WWTP site and serve as the home base for this division of DPW. Operations of the pump station and WWTP is recommended to initially be outsourced to a licensed contract operator with the long-term plan to hire a licensed WWTP operator and two WWTP operator helpers as employees of the sewer district.

Preliminary operation and maintenance budgets were estimated to account for administrative effort, labor, equipment, materials (including consumable chemicals), and contract operations services that would be necessary to operate and maintain the infrastructure of the size and complexity proposed for the district. Additional budget line items were also included to account for sludge disposal, utility usage expenses, engineer of record retainer, a sinking fund, and an expense line item for miscellaneous consumables. These expenses were based on the conceptual infrastructure design and current disposal and utility rates as well as an arbitrary budget to be used as needed for on-call engineering support. The sinking fund line item was included to ensure surplus revenue is collected in anticipation of major repairs that may be

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[6] Includes costs for Topographic, Boundary & Sub-surface Existing Utility Survey = $600,000, Phase 1A & Phase 1B Archeological Surveys (if applicable) = $75,000, Soil Borings, Existing Pavement Cores, Piezometers & Geo-technical Analysis = $120,000, Operations & Maintenance Manuals = $120,000, Project Labor Agreement = $100,000, Sewer Use Code (legal budget only) = $30,000, Land & Easement Acquisition (legal budget only) = $50,000, Permitting Assistance = $25,000, and Grant Assistance = $25,000.

needed in the future. The sinking fund line item, like all line items associated with the proposed operation and maintenance budgets are estimated and will need to be reassessed as the detailed design phase of this project progresses. **Table 6** provides a summary of the estimated annual operation and maintenance budget for the Town of East Hampton Sewer District No. 1

Table 6 – Annual Operation and Maintenance (O&M) Cost Summary

Description	Annual Budget ($)
Superintendent & Staff (total comp)	$400,000
Contract Operator	$600,000
Sludge Hauling and Tipping Expense	$400,000
Utilities Expense	$800,000
Engineer of Record (EOR) Retainer Expense	$50,000
Sinking Fund Expense	$300,000
Consumable Expense (Vehicles, Tools, Fuel, etc.)	$300,000
Total Annual O&M Cost . . .	**$2,850,000**

The total annual O&M budget would be assessed to users based on their allocated sanitary design flow in accordance with SCDHS design criteria at time of connection to the district infrastructure. Reassessment of the user charge would need to occur following changes of use and/or future district extensions to ensure a fair and equitable distribution of the costs to all benefitted properties. Since the initial district existing build-out flow is equal to 173,720 gpd, the annual user charge rate would be $16.41 per gallon per day of allocated design flow (i.e. $2,850,000 ÷ 173,720 gpd). The annual user charge would be reassessed on an annual basis to adjust for flow increases within the 300,000 gpd initial district design capacity resulting from in-district changes of use and/or future district boundary extensions, as well as to account for price increases on various expenses. Rate adjustments would be performed in accordance with the limitations stipulated under Town municipal law.

7.0 FINANCIAL IMPACT TO THE TOWN OF EAST HAMPTON

7.1 Total Project Cost Debt Service

Article 12-A, Section 209-C of NYS Law gives the Town Board the authority to apportion the annual capital debt service incurred by the sewer district (service area) across the benefitted properties.

7.2 Apportionment of Costs for the Town of East Hampton Sewer District No. 1

NYS Law requires the Map, Plan and Report to identify the actual apportionment of debt service for a sewer improvement district. The Map, Plan and Report must identify the area of local assessment and the apportionment based on the benefit received by each property within the benefitted service area. The recommended apportionment method for the costs of the sewer system is based on “ad valorem.” Ad valorem-based debt service distributes the project costs across the assessed value of benefitted properties using the assessed property values as the proportion across which the debt will be serviced.

The multiplier used to determine the annual debt service is referred to as the capital recovery factor (CRF). The CRF is calculated using the following formula:

$$CRF = \frac{i(1+i)^n}{(1+i)^n-1}$$

- i = interest rate
- n = payback period

The CRF is dependent upon the interest rate and payback period associated with the bond used to fund the capital cost of the district.

Funding for this project is based on financing using a New York State Environmental Facilities (NYS EFC) loan to determine the anticipated annual debt service for the Town of East Hampton Sewer District No. 1. The presumed NYS EFC loan financing is based on a 2.5% interest rate over a 30-year term, with an initial loan origination charge equal to 1.84% of the total finance amount. The CRF associated with these assumed loan terms is equal to 0.0478.

The total annual debt service is determined by multiplying the bond amount by the CRF. This is termed the amortized cost. The bond amount is based on the 2030 project costs summarized in **Table 5**. The assessment rate for the district is calculated by dividing the annual debt service by the total assessed value of taxable properties within the benefitted area. **Table 7** provides a summary of the tax rates for property owners within the service area.

Table 7 – Sewer District Assessment (Tax) Summary

Bond Amount	Debt Service for Sewer System	Total Assessed Value (A.V.)[7]	Annual Sewer District Assessment (Per $1,000 A.V.)
$74,979,700*	$3,587,981	$1,416,036	$2,530/$1,000 A.V.

*Includes the assumed 1.84% loan origination charge.

The debt service analysis was evaluated based on the Town receiving no grant subsidy to illustrate a conservative depiction of the overall sewer district tax assessment. However, to improve affordability, the Town intends to vigorously pursue various grant opportunities to further offset the cost of the sewer system. Any amount of grant supplement will lower the annual debt service rate depicted in **Table 7**.

Table 8 depicts total annual sewer system costs for a "typical" property within the district to provide a representative range of annual costs that could be expected by stakeholders under this plan.

Table 8 – Annual Charges for Typical Property in Town of East Hampton Sewer District No. 1

Typical Property 2022 A.V.	2022 Market Value[8]	Flow Allocation (gpd)	Annual Sewer Assessment (Tax)	Annual User Charge (Rent)	Total Annual Cost ($) (Tax + Rent)
$800	$177,776	587*	$2,023.88	$9,632.67	$11,656.55

*Based on highest flow allocation for a property in the district with an A.V. = $800.

---

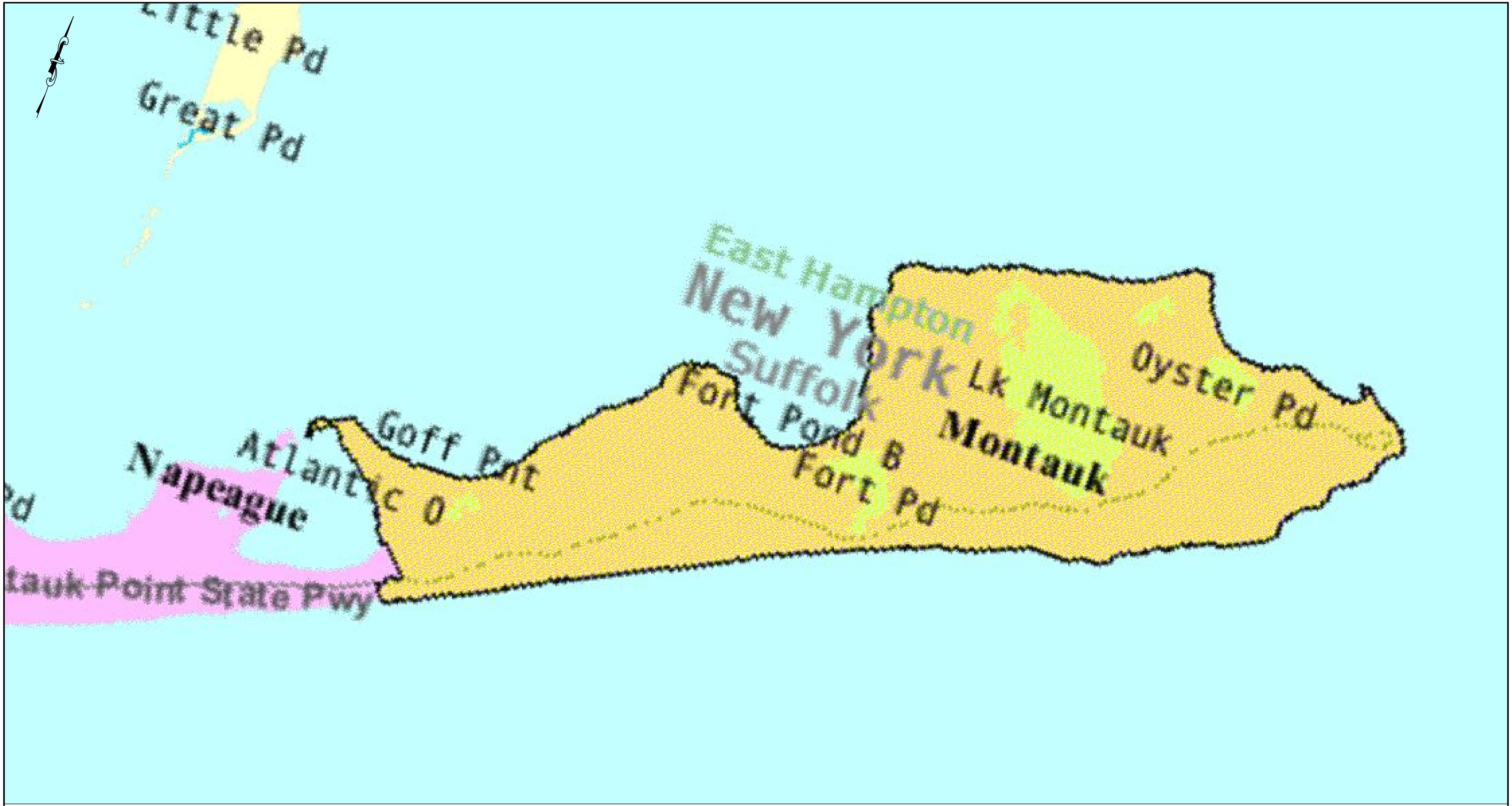
[7] Total market value of parcels within the district is based on the Town of East Hampton 2022 tentative tax assessment roll.

[8] 2022 Tentative Tax Assessment Roll data is representative estimates based on full market values identified from information provided by the Town Assessor's office and represent the arithmetic average values for the property types listed.

FIGURE 1

Montauk Hamlet Overview Map

FIGURE 1



NOTES:

1. BACKGROUND IMAGERY OBTAINED FROM UNITED STATES CENSUS BUREAU VIA https://en.wikipedia.org/wiki/Montauk,_New_York.

Montauk Hamlet Overview Map

Project # EHPT 2101

DATE: JUNE 2022

H2M architects + engineers

www.h2m.com

FIGURE 2

Montauk Priority Area Overview Map

FIGURE 2

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

N

1 inch = 2,600 feet

Montauk Priority Area Overview Map

H2M architects + engineers

Document Path: X:\EHPT (Town of East Hampton)_EHPT NONPROJECT\GIS Maps and Data\EHPT2101 - Downtown Montauk Sanitary Map and Plan\EPHT2101_KAJ.mxd

FIGURE 3

Town of East Hampton Sewer District No. 1
Conceptual Service Area Overview Map

FIGURE 3

PROPOSED TOWN OF EAST HAMPTON SEWER DISTRICT NO. 1 WWTP SITE

- 13.36 ACRES (EASEMENT AND/OR LAND TRANSFER FROM SUFFOLK COUNTY TO TOWN)
- SCTM #: 0300-048.0003.00-008.007

TOWN OF EAST HAMPTON PROPOSED SEWER DISTRICT NO. 1 SERVICE AREA BOUNDARY

- 222 TAX LOTS
- 80.66 ACRES
- 173,720 GPD EXISTING FLOW PROJECTION

NOTES:

1. SUFFOLK COUNTY TAX MAP #'S AND LOT LINES OBTAINED FROM SUFFOLK COUNTY GIS DATABASE. ACTUAL TAX MAP LOT LINES MAY DIFFER AND MUST BE CONFIRMED BY SURVEY DURING DETAILED DESIGN PHASE.
2. GROUND ELEVATION RANGES BETWEEN ~9' ABOVE MEAN SEA LEVEL TO ~40' ABOVE MSL.

Town of East Hampton SD#1 Conceptual Service Area Overview

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FIGURE 4

Town of East Hampton Sewer District No. 1
Conceptual Collection System Overview

FIGURE 4

TOWN OF EAST HAMPTON PROPOSED DOWNTOWN MONTAUK SEWER SERVICE AREA BOUNDARY
- 222 TAX LOTS
- 80.66 ACRES
- 173,720 GPD EXISTING FLOW PROJECTION

PROPOSED PUMP STATION LOCATION:
- ~40' X 60' PERIMETER FENCE AREA
- EASEMENT ON SCTM #: 0300-047.00-02.00-007.001

AREA SERVICED BY GRAVITY SEWERS
- 191 TAX LOTS (86% OF LOT COUNT)
- 66.66 ACRES (82.6% OF AREA)
- 95,986 GPD (55.3 % OF FLOW)

AREA SERVICE BY LPS
- 31 TAX LOTS (14% OF LOT COUNT)
- 14.00 ACRES (17.4% OF AREA)
- 77,734 GPD (44.7% OF FLOW)

PROPOSED GRAVITY SEWER MAIN
- 11,000 LF
- 40 MANHOLES
- DIAMETER VARIES (8-INCH Ø MIN.)

PROPOSED LOW PRESSURE SEWER (LPS) MAIN
- 3,700 LF
- 20 CLEANOUTS
- 4-INCH & 6-INCH DIAMETER

NOTES:

1. AERIAL BACKGROUND ORTHOIMAGERY OBTAINED FROM NYS GIS CLEARINGHOUSE. http://gis.ny.gov/gateway/mg/index.html
2. SUFFOLK COUNTY TAX MAP #'S AND LOT LINES OBTAINED FROM SUFFOLK COUNTY GIS DATABASE. ACTUAL TAX MAP LOT LINES MAY DIFFER AND MUST BE CONFIRMED BY SURVEY DURING DETAILED DESIGN PHASE.
3. GROUND ELEVATION RANGES BETWEEN ~9' ABOVE MEAN SEA LEVEL TO ~40' ABOVE MSL.

Town of East Hampton SD#1 Conceptual Collection System Overview

Project #
EHPT 2101

DATE:
JUNE 2022

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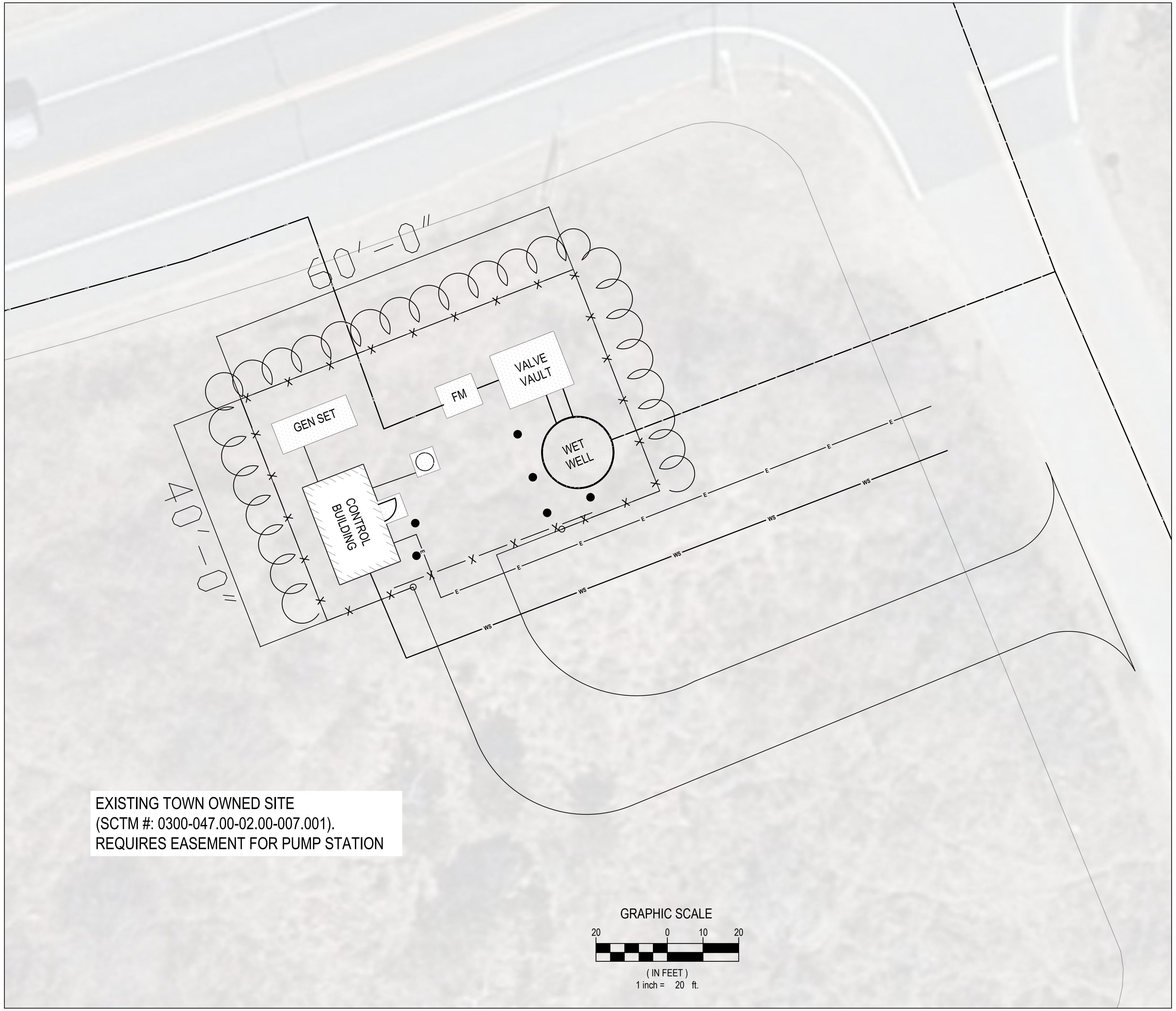
FIGURE 5

Town of East Hampton Sewer District No. 1
Conceptual Pump Station Overview

FIGURE 5



EXISTING TOWN OWNED SITE
(SCTM #: 0300-047.00-02.00-007.001).
REQUIRES EASEMENT FOR PUMP STATION

LEGEND:

———————	PAVEMENT LIMITS
——— LPS ———	LOW PRESSURE SEWER
——— S ———	GRAVITY SEWER
—FM— —FM— —FM—	FORCE MAIN
— G — G — G — G —	GAS CONNECTION
——— E ——— E ———	UNDERGROUND ELECTRIC
——— WS ——— WS ———	WATER SERVICE
◡◡◡◡◡◡◡◡	LANDSCAPING

NOTES:

1. AERIAL BACKGROUND ORTHOIMAGERY OBTAINED FROM NYS GIS CLEARINGHOUSE. http://gis.ny.gov/gateway/mg/index.html
2. SUFFOLK COUNTY TAX MAP #'S AND LOT LINES OBTAINED FROM SUFFOLK COUNTY GIS DATABASE. ACTUAL TAX MAP LOT LINES MAY DIFFER AND MUST BE CONFIRMED BY SURVEY DURING DETAILED DESIGN PHASE.

Town of East Hampton SD#1
Conceptual Pump Station Overview

Project #
EHPT 2101

DATE:
JUNE 2022

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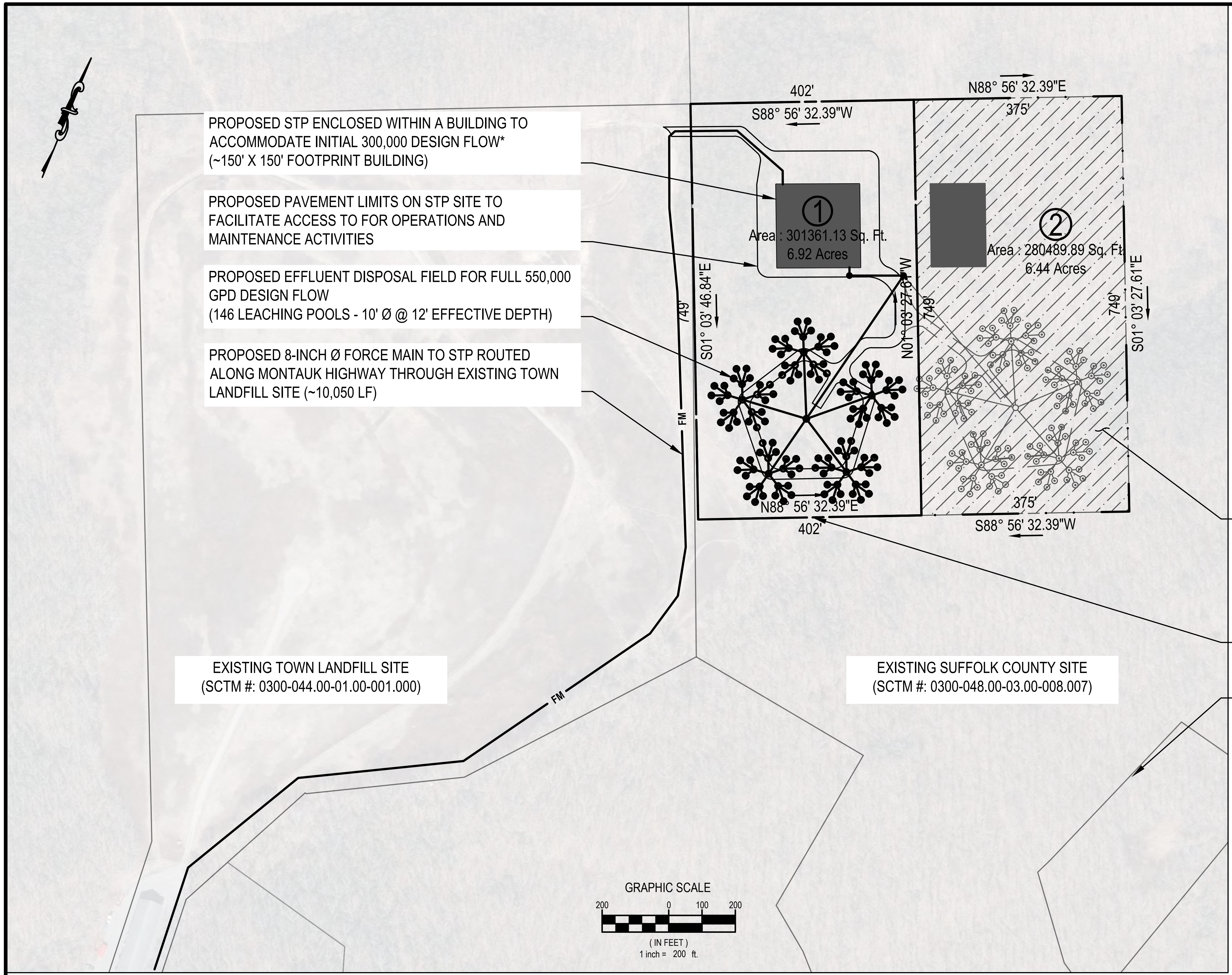
FIGURE 6

Town of East Hampton Sewer District No. 1
Conceptual Wastewater Treatment Facility
Overview

FIGURE 6



PROPOSED STP ENCLOSED WITHIN A BUILDING TO ACCOMMODATE INITIAL 300,000 DESIGN FLOW*
(~150' X 150' FOOTPRINT BUILDING)

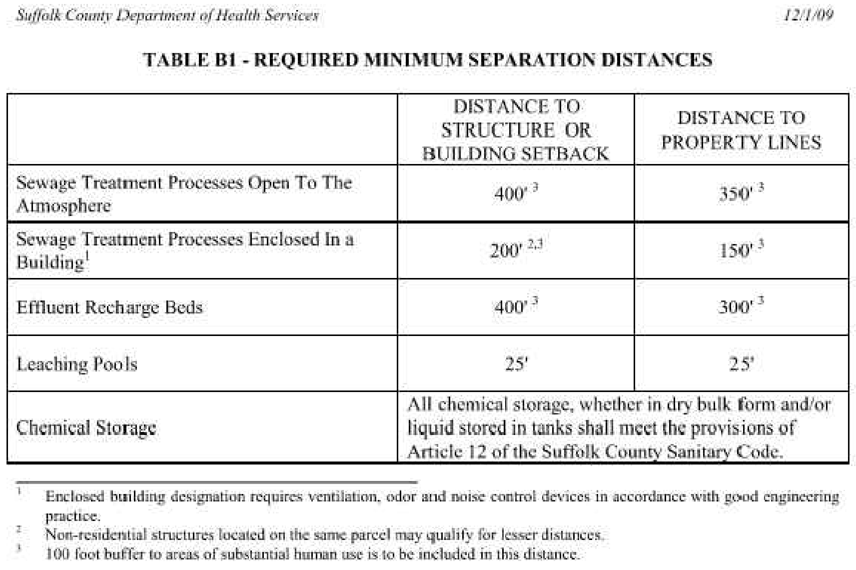
PROPOSED PAVEMENT LIMITS ON STP SITE TO FACILITATE ACCESS TO FOR OPERATIONS AND MAINTENANCE ACTIVITIES

PROPOSED EFFLUENT DISPOSAL FIELD FOR FULL 550,000 GPD DESIGN FLOW
(146 LEACHING POOLS - 10' Ø @ 12' EFFECTIVE DEPTH)

PROPOSED 8-INCH Ø FORCE MAIN TO STP ROUTED ALONG MONTAUK HIGHWAY THROUGH EXISTING TOWN LANDFILL SITE (~10,050 LF)

EXISTING TOWN LANDFILL SITE
(SCTM #: 0300-044.00-01.00-001.000)

EXISTING SUFFOLK COUNTY SITE
(SCTM #: 0300-048.00-03.00-008.007)



Suffolk County Department of Health Services *12/1/09*

TABLE B1 - REQUIRED MINIMUM SEPARATION DISTANCES

	DISTANCE TO STRUCTURE OR BUILDING SETBACK	DISTANCE TO PROPERTY LINES
Sewage Treatment Processes Open To The Atmosphere	400'[3]	350'[3]
Sewage Treatment Processes Enclosed In a Building[1]	200'[2,3]	150'[3]
Effluent Recharge Beds	400'[3]	300'[3]
Leaching Pools	25'	25'
Chemical Storage	All chemical storage, whether in dry bulk form and/or liquid stored in tanks shall meet the provisions of Article 12 of the Suffolk County Sanitary Code.	

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[1] Enclosed building designation requires ventilation, odor and noise control devices in accordance with good engineering practice.
[2] Non-residential structures located on the same parcel may qualify for lesser distances.
[3] 100 foot buffer to areas of substantial human use is to be included in this distance.

FUTURE EXPANSION AREA FOR FULL 550,000 GPD DESIGN FLOW TO ACCOMMODATE ADDITIONAL EFFLUENT DISPOSAL AND NEW HEADWORKS, EQUALIZATION AND SLUDGE HOLDING INFRASTRUCTURE
(~6.44 ACRES)

PROPOSED STP SITE
(~6.92 ACRES)

SCTM LOT LINE (TYP.)

NOTES:

1. AERIAL BACKGROUND ORTHOIMAGERY OBTAINED FROM NYS GIS CLEARINGHOUSE. http://gis.ny.gov/gateway/mg/index.html
2. SUFFOLK COUNTY TAX MAP #'S AND LOT LINES OBTAINED FROM SUFFOLK COUNTY GIS DATABASE. ACTUAL TAX MAP LOT LINES MAY DIFFER AND MUST BE CONFIRMED BY SURVEY DURING DETAILED DESIGN PHASE.
3. PROPOSED LAYOUT IS CONCEPTUAL, ACTUAL LAYOUT MAY DIFFER DURING DETAILED DESIGN PHASE.

Town of East Hampton Conceptual WWTP Overview

Project #	EHPT 2101
DATE:	JUNE 2022

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APPENDIX A

Quantifying Nitrogen Loading to the Fort Pond Contributing Area and Impacts from Sewering the Downtown Montauk Area, prepared by Timothy J. Hazlett, PhD

FORT POND WATERSHED ASSESSMENT REPORT

Quantifying Nitrogen Loading to the Fort Pond Contributing Area and Impacts from Sewering the Downtown Montauk Area

H2M Project No. EHPT2101

NOVEMBER 2021

Prepared for:

Supervisor Peter Van Scoyoc and Town Board Members
Town of East Hampton
159 Pantigo Road
East Hampton, New York 11937

Prepared by:

H2M architects + engineers
538 Broad Hollow Road, 4th Floor
Melville, New York 11747

H2M architects + engineers

TABLE OF CONTENTS

APPENDICES

1.0 BACKGROUND & OBJECTIVES

Fort Pond is located north and west of downtown Montauk, a hamlet that is part of the Town of East Hampton. The location is on the easternmost tip of the southern fork of Long Island. Montauk Hamlet is separated from areas west by some low hills and surface water bodies, including Fort Pond.

The relative water quality of Fort Pond is of interest as a part of a larger project, which is planning to provide municipal sanitary wastewater collection, conveyance, and treatment infrastructure within downtown Montauk. The addition of this infrastructure will eliminate existing onsite wastewater disposal systems' (septic/cesspool) discharge to groundwater, where the flow will be diverted to a treatment plant. The goal of the nutrient loading analysis is to estimate the current nitrate loading to Fort Pond and then compare that to a post-sewering scenario to evaluate any reduction in nitrogen loading (via groundwater) to Fort Pond. Please refer to Gobler C. J., 2017 and Lloyd, S., 2014 for example applications of the approach employed here.

1.1 Geologic Setting

Fort Pond is situated on top of what is variously described in the literature as a Till Moraine (Caldwell, D.H., et. al., 1986). Long Island's two forks are remnants of its glacial past and it is thought that the south fork, where the site is located, is a feature near where the glacial ice sheets terminated some 10,000 years ago or more (Ronkonkoma Terminal Moraine).

The terrain formed by the till consists of several low rolling hills within the study area. The hills are comprised of unsorted deposits of boulders, gravels, sands, silts, and clays (Nemickas, B. and Koszalka, E., 1982). Fort Pond is situated in a topographic low, probably underlain by glacial materials that are relatively less permeable than sands or gravels, considering the perched (water table) nature of the pond. Fort Pond stretches nearly from the north (Fort Pond Bay) to south shore (Atlantic Ocean) and is 72 hectares (~178 acres) in area.

1.2 Groundwater Flow to Fort Pond

The study relies on groundwater flow as the mechanism for transporting nitrate from a source to a point of discharge, which in this case is Fort Pond. Groundwater flow direction and rates are not explicitly accounted for in the model spreadsheet. Instead, a catchment area is first designated for the receiving water body. H2M defined the Fort Pond catchment by subtracting depth-to-water[1] from the publicly available GIS-based LiDAR defined surface topography to define the groundwater (water table) elevation. The boundaries of the groundwater catchment to Fort Pond were calculated using GIS. The area of the groundwater catchment is calculated as 243 ha (~600 acres). Refer to Appendix A for an overview map of the modeled Fort Pond groundwater catchment area.

2.0 NUTRIENT LOADING MODEL (NLM)

The nutrient loading of the Fort Pond groundwater catchment is based on the use of a spreadsheet model known as the NLM (Nitrogen Loading Model), developed by researchers at the Marine Biological Laboratory in Woods Hole, MA. NLM has been used widely along the Northeast coast, in part because it can quantify sources of nitrogen with relative ease and accuracy and tie into land use and population. The NLM is for use in groundwater-driven systems and has been used on projects across Long Island. Inputs to the NLM specified by the user mostly include area values for different land uses, as these may reflect conditions of runoff versus infiltration to groundwater and potentially varying nutrient loading rates.

---

[1] Depth-to-water data based on web-based publicly available information obtained from United States Geologic Survey (USGS). https://ny.water.usgs.gov/maps/li-dtw/

2.1 Major Components

There are three primary nutrient source categories considered in the NLM: atmospheric deposition, wastewater, and fertilizer. Given the area of study (defined by water table elevations as the groundwater area contributing to Fort Pond), and in most instances each of the primary categories applied in the model are comprised of sub-categories.

The Wastewater category contains loading input from cesspools and septic systems. In this specific case, it also contains documented discharges to groundwater from two sites with their own onsite wastewater treatment facility and effluent leach fields (i.e. Rough Riders Landing and Montauk Manor). The Atmospheric deposition category applies nitrogen loading distributed over the area on a weighted basis per land use type. Grassed land, for example, is assigned a higher atmospheric deposition rate than paved impervious areas, where runoff is dominant. Fertilizer is the remaining major loading category. It consists of an estimated loading rate of nitrate on park lands, sports fields, and lawns expressed in terms of mass (kg) per area (ha) per time (yr).

2.2 Limitations

The NLM is a so-called “lumped parameter” model that combines external inputs along with internal constants to generate output solutions. There are many assumptions inherent to the model, which in some cases will result in over- or underestimated nutrient loads. Limitations of the model for the reader to consider include:

- water table groundwater levels vary
    - with time,
    - from nearby pumping or injection,
    - from seasonal variations in rainfall or water use / wastewater infiltration,
    - atmospheric pressure (storms),
    - with sea level changes (tides – when near the shore), and
    - with spatially variable precipitation.

As a result, the groundwater contributing area will tend to change over time as well. The NLM area therefore is representing a moment in time that is likely close to average water table conditions but may not cover the full range of behavior of the groundwater system.

- loading rates (+/-)
    - may be known precisely in some areas but may have to be estimated or assigned textbook values elsewhere and
    - nitrogen fixing or other forms of affective removal from the system are all estimated and difficult to measure.
- areas over which some loads are distributed are inexact and based on GIS (or best available data) where possible

The NLM for Fort Pond should be viewed as a broad-brush tool to evaluate the relative nitrogen loading within the contributing area. As more or better data is available in the future, it could be used to replace current data in the model and refine the results of the model, decreasing uncertainty.

2.3 Fort Pond NLM Model

The three dominant nitrogen loading inputs used in the NLM are land area-weighted Wastewater, Atmospheric, and Fertilizer sources. The area-weighting means that all else being equal in each scenario, identical loading rates on different sized land areas will produce larger inputs to groundwater on the smaller parcel (higher concentration). Wastewater comprised the largest estimated loading component to Fort Pond, followed by Atmospheric Deposition, and Fertilizer (total).

2.3.1 Wastewater

For the septic and cesspool components of wastewater nitrogen loading, the mass is estimated by a combination of proximity to Fort Pond and (<200m vs >200m) the parcels are weighted equally between cesspool and septic systems. Denitrification is included in the wastewater calculation more than 200m from Fort Pond, as the inferred groundwater flow path and contact time for the nitrogen is longer.

Where specific data of nitrogen discharge was available, it was used in the model. Discharge permit data for maximum yearly loading rates to groundwater were used for the Rough Riders Landing and Montauk Manor properties (approximately 30,000 gpd at 10mg/L). This was a conservatively high estimate, given the season fluctuation of use and occupancy. At times during the year the loading may be at the highest rate, while at other times it may be negligible. The variation in source concentration over time will lag the arrival at the pond due to the groundwater travel time. The estimated wastewater nitrogen loading to Fort Pond is 6301 kg/yr, prior to sewering, and is reduced to 5342 kg/yr after the planned sewer installation (refer to **Figure 1, Figure 2 and Figure 3**). The model predicts an overall nitrogen budget reduction of about 2% of the current discharge to Fort Pond due to wastewater alone (~1000 kg/yr).

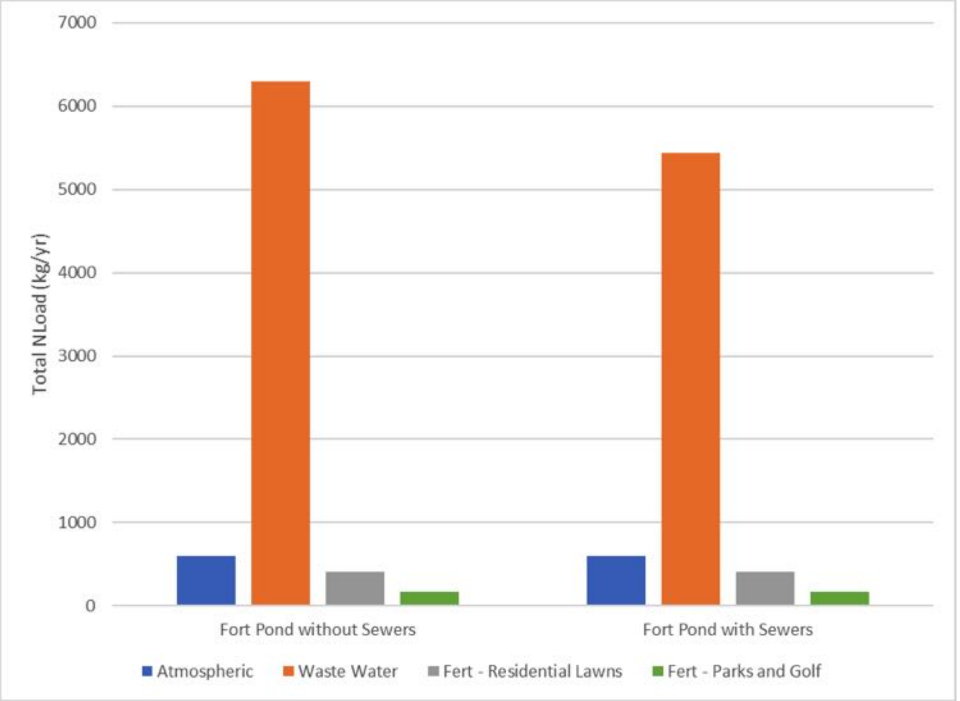


Figure 1 – Estimated Nitrogen Loading to Fort Pond Prior to and After Sewering

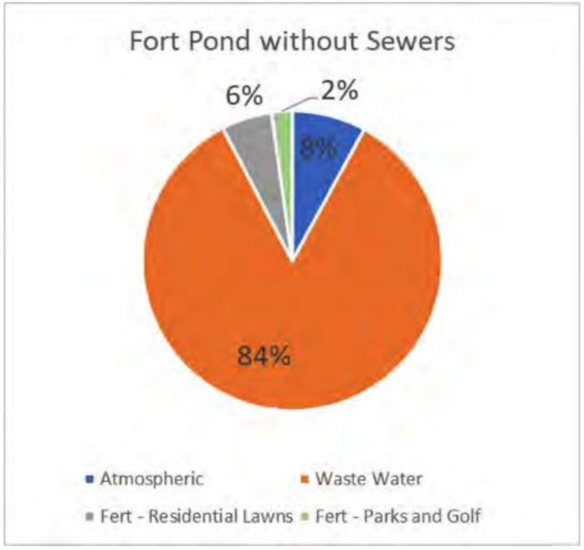


Figure 2 - Components of Nitrogen Budget Prior to Sewers

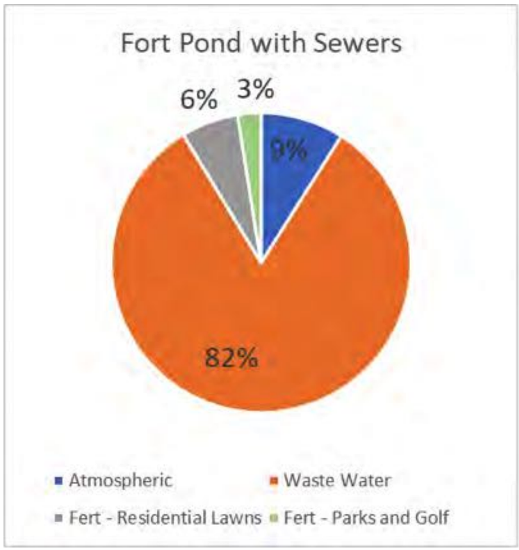
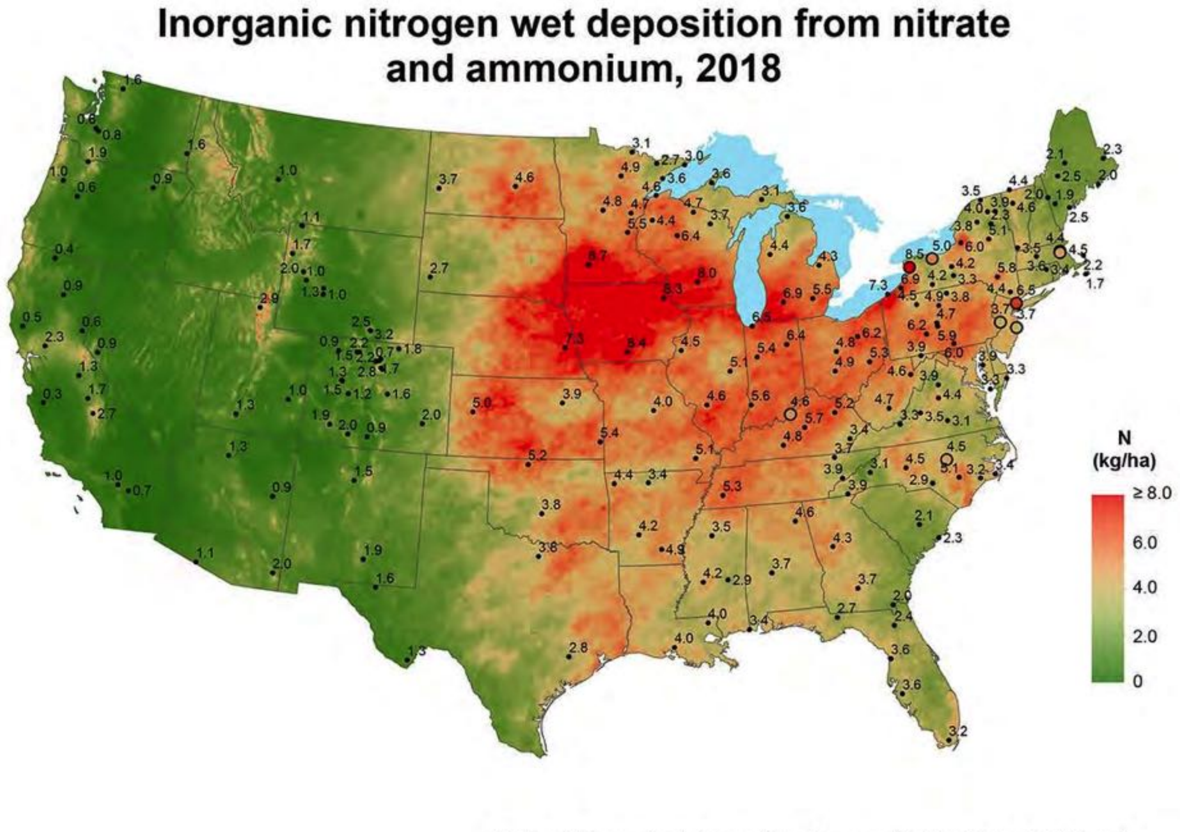


Figure 3 - Components of Nitrogen Budget After Sewers

2.3.2 Atmospheric Deposition

Nitrogen gas comprises 78% of Earth's atmosphere while oxygen gas is approximately 21% of the atmosphere at sea level. Both are critical for life on earth. There are two main mechanisms by which atmospheric nitrogen is deposited on the land surface: wet and dry deposition (An excellent primer on nitrogen deposition can be found here - http://nadp.slh.wisc.edu/lib/brochures/nitrogen.pdf).

Dry deposition occurs via the chemical interaction between nitrogen compounds in the air and the surface of the earth. These can be complex and occur over many different time and spatial scales where nitrogen is removed from the atmosphere and chemically attached to water, plants, rocks and minerals, and many other types of materials. Wet deposition occurs primarily through precipitation (rain and snow). Refer to **Figure 4** for an overview of nationwide atmospheric nitrogen deposition variation.



National Atmospheric Deposition Program/National Trends Network

Figure 4 - Atmospheric N Deposition Variation

There are many factors affecting the overall atmospheric deposition of N. Broadly speaking, one can see that the eastern US and upper Midwest have much higher amounts of nitrogen deposited per hectare (ha) than from the Rocky Mountains and west. Agricultural, vehicular emissions, and other contributions to the atmospheric nitrogen load tend to fallout as precipitation in the east. The western half of the country benefits from prevailing westerly winds along with less arable land and lower population density, overall.

Atmospheric deposition of nitrogen over the Fort Pond groundwater catchment is not affected by sewering. The calculated nitrogen load in both cases is 594 kg/yr when denitrification and vadose zone release is included. Without these factors, the loading to Fort Pond is predicted to be 1,647 kg/yr. As a percentage of the calculated nitrogen budgets before and after sewering (refer to **Figures 2 and Figure 3**), atmospheric nitrogen deposition accounts for 8% and 9%, respectively. The percentage of the budget accorded atmospheric deposition increases slightly when the sewers have been installed because the overall nitrogen loading within the catchment is predicted to decrease.

2.3.3 Fertilizer

There are approximately 54 hectares of grassed areas (parks, lawns, golf courses) within the groundwater catchment of Fort Pond. It is assumed in the NLM that each of these categories of grassed land use apply fertilizer to the properties. Three different rates are used in the model, with the golf course rate being the highest at approximately 146 kg/ha/yr.

Fertilizer application overall has the least contribution to Fort Pond's nutrient budget totaling 573 kg/yr with or without the new sewer installed (**Figure 1**). The percentage contribution of fertilizer nitrogen increases from 8% to 9% (**Figures 2 & 3**) when the sewer is added, as the overall nitrogen budget is decreased.

3.0 SUMMARY & RECOMMENDATIONS

The Nutrient Loading Model (NLM) spreadsheet model was originally developed by Woods Hole Oceanographic Institute. It was employed here to evaluate and quantify what, if any, changes to Fort Pond water quality could be anticipated, given the installation of sewers within downtown Montauk. All nitrogen inputs to the model were distributed over the groundwater catchment for Fort Pond and often associated with a land use or cover. The model was populated with input that was known directly from permits and was otherwise derived from GIS datasets.

Three primary sources were categorized in the model: wastewater, atmospheric deposition, and fertilizers. All these categories are contributing nitrogen to the Fort Pond catchment. The wastewater component is by far the dominant one, accounting for more than 80% of both the before and after sewering nitrogen budget. The remainder of both budgets are comprised of nearly equal parts accounted for by atmospheric deposition and fertilizers (parks + golf courses). Even with about 10 parcels being added to the sewer system and removed from cesspools or septic.

It is clear that the definition of the problem as stated and the varying availability of data, there are uncertainties in the predictions made by the model. Fort Pond's nitrogen budget is most heavily influenced by wastewater via combination of leach field discharges, septic systems, and cesspools. Were the problem area of the groundwater catchment for Fort Pond changed in shape or size, it is not likely that either atmospheric deposition or fertilizer would come to dominate the nitrogen budget.

In terms of mitigation value, there is little that can be done locally as far as reducing the atmospheric deposition nitrogen loading to Fort Pond. The occurrence of atmospherically deposited nitrogen is complex and related to precipitation and how or where the nitrogen fixes to land surface materials or moves into groundwater. Wastewater nitrogen reduction via the addition of sewers, however, seems a relatively straightforward and valuable approach in terms of improving the relative water quality of Fort Pond or other points of discharge. The replacement of septic and cesspool systems with sewers, nearest to Fort Pond and within the identified groundwater contributing area, should be a priority if the pond's water quality is the focus.

The current model area does not contain a large area of land designated as fertilized. If Fort Pond water quality improvement is a key community objective, it is suggested that fertilizer plans be considered for properties like golf courses and parks, where fertilizer application is common.

Lastly, the seasonality of wastewater volume and nitrate loading should be considered when considering future actions. The distance within the Fort Pond catchment from a given source to the pond may be known and constant, but the travel time is not. Summer season high nitrogen levels at the pond may in fact reflect a combination of recent local sources and older, more distant sources. Managing nitrogen inputs based on both their source concentrations and locations will provide the best possible outcomes.

4.0 REFERENCES

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NADP, 2018. Inorganic nitrogen wet deposition map, National Atmospheric Deposition Program/National Trends Network, from 1985 and 2018.

Nemickas, B. and Koszalka, E., 1982. Geohydrologic Appraisal of Water Resources of the South Fork, Long Island, New York, Geological Survey Water-Supply Paper 2073.

APPENDIX A: Fort Pond Groundwater Catchment Area Overview Map

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

━ Groundwater Divide
☐ Montauk Waste Water Districts
▨ Fort Pond
🟩 Watershed Boundary

Downtown Montauk Sanitary Map and Plan
Nitrogen Load Map

H2M
architects
+
engineers
Melville, NY
Parsippany, NJ Purchase, NY Suffern, NY
New York, NY Latham, NY Howell, NJ

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APPENDIX B

Memorandum RE: WWTP SITING UPDATE, prepared by Nicholas F. Bono, P.E. issued to Kim Shaw, Town of East Hampton Environmental Protection Director

Memorandum

TO: KIM SHAW, TOWN ENVIRONMENTAL PROTECTION DIRECTOR

FROM: NICHOLAS F. BONO, P.E.

DATE: 9/2/2021

RE: WWTP SITING UPDATE

This memorandum has been prepared to provide an overview of the wastewater treatment plant (WWTP) assessment performed by H2M on the three (3) sites listed below that were identified in our agreed upon scope of services associated with RFP #EH2020-101 – Consulting Engineering Services for the Map & Plan of a Wastewater Collection System for Downtown Montauk.

1) Landfill/cell tower property
2) Montauk Manor/SCWA property
3) Dock/Star Island area

Enclosed are copies of comprehensive overview maps for the entire project area as well as each specific site location listed above. Each map was prepared using GIS data to illustrate site proximity to public drinking water supply wells, groundwater contours and direction of flow, Special Groundwater Protection Area(s), Town of East Hampton Water Recharge Overlay District boundaries, Freshwater Wetlands and Check Zones, NYS Tidal Wetlands, USA Wetlands, FEMA flood zones, special site conditions, and the Town of East Hampton proposed sewer service boundaries (i.e. Downtown Montauk service area, Railroad service area, Docks service area, and Ditch Plains service area).

The specific conditions that negatively impact WWTP siting for each location are summarized below:

1) Landfill/cell tower property

Tax Map #: 0300044000100001000

Parcel Owner: Town of East Hampton

Calculated Acreage: 29.51 acres

Proximity to public supply well: within 1,500 feet (SCDHS requires separate site review)

Groundwater contours and direction of flow: bisected by groundwater divide; 10-foot approximate groundwater elevation; flow potential appears to not impact water in Fort Pond

Town of East Hampton Water Recharge Overlay District boundaries: within recharge overlay boundary

Freshwater Wetlands and Check Zones: not within area of influence

NYS Tidal Wetlands: not within area of influence

USA Wetlands: not within area of influence

FEMA flood zones: not within area of influence

Special site conditions: former landfill site that was capped circa earlier 2000's; approximate cap area assumes 9 acres of site and remaining open area onsite utilized for access road and required storm water storage/recharge. Ongoing landfill closure monitoring is still active. This condition renders the site not feasible for siting WWTP and required effluent recharge infrastructure.

Proposed sewer service area boundary: not within boundary

2) Montauk Manor/SCWA property

Tax Map #: 0300027020100001000

Parcel Owner: Private Unit Owners

Calculated Acreage: 8.96 acres

Proximity to public supply well: within 1,500 feet (SCDHS requires separate site review)

Groundwater contours and direction of flow: 2-foot approximate groundwater elevation; flow potential appears to impact water in Fort Pond

Town of East Hampton Water Recharge Overlay District boundaries: not within recharge overlay boundary

Freshwater Wetlands and Check Zones: within area of influence

NYS Tidal Wetlands: not within area of influence

USA Wetlands: not within area of influence

FEMA flood zones: not within area of influence

Special site conditions: parcel is currently developed and includes an existing wastewater treatment plant operating under NYS SPDES permit NY0195952; existing permitted facility is permitted to treat 30,000 gallons per day; undeveloped area on site is wooded with significant portion of undeveloped area containing slopes greater than 15%; undeveloped area on site appears to be large enough to construct new wastewater treatment infrastructure while maintaining existing treatment works during construction, however, there does not appear to be suitable area to construct effluent recharge facilities, therefore a remote recharge site would be necessary for this site to be evaluated further; proximity to public supply wells will also require separate site review from SCDHS, however, a remote recharge site may simplify that process; the site is also developed and privately owned, which will require negotiations and legal agreements with the owner. These conditions render the site feasible for siting WWTP, but not feasible for siting the required effluent recharge infrastructure.

Proposed sewer service area boundary: within Railroad service area boundary

3) Dock/Star Island area

Tax Map #: 0300006000400020002 & 0300012000100008012

Parcel Owner: BLACK CANYON INVESTMENTS LLC

Calculated Acreage: 5.03 acres & 3.57acres (8.6 acres total)

Proximity to public supply well: not within 1,500 feet

Groundwater contours and direction of flow: 3-foot approximate groundwater elevation; flow potential appears to impact water in Montauk Lake

Town of East Hampton Water Recharge Overlay District boundaries: not within recharge overlay boundary

Freshwater Wetlands and Check Zones: not within area of influence

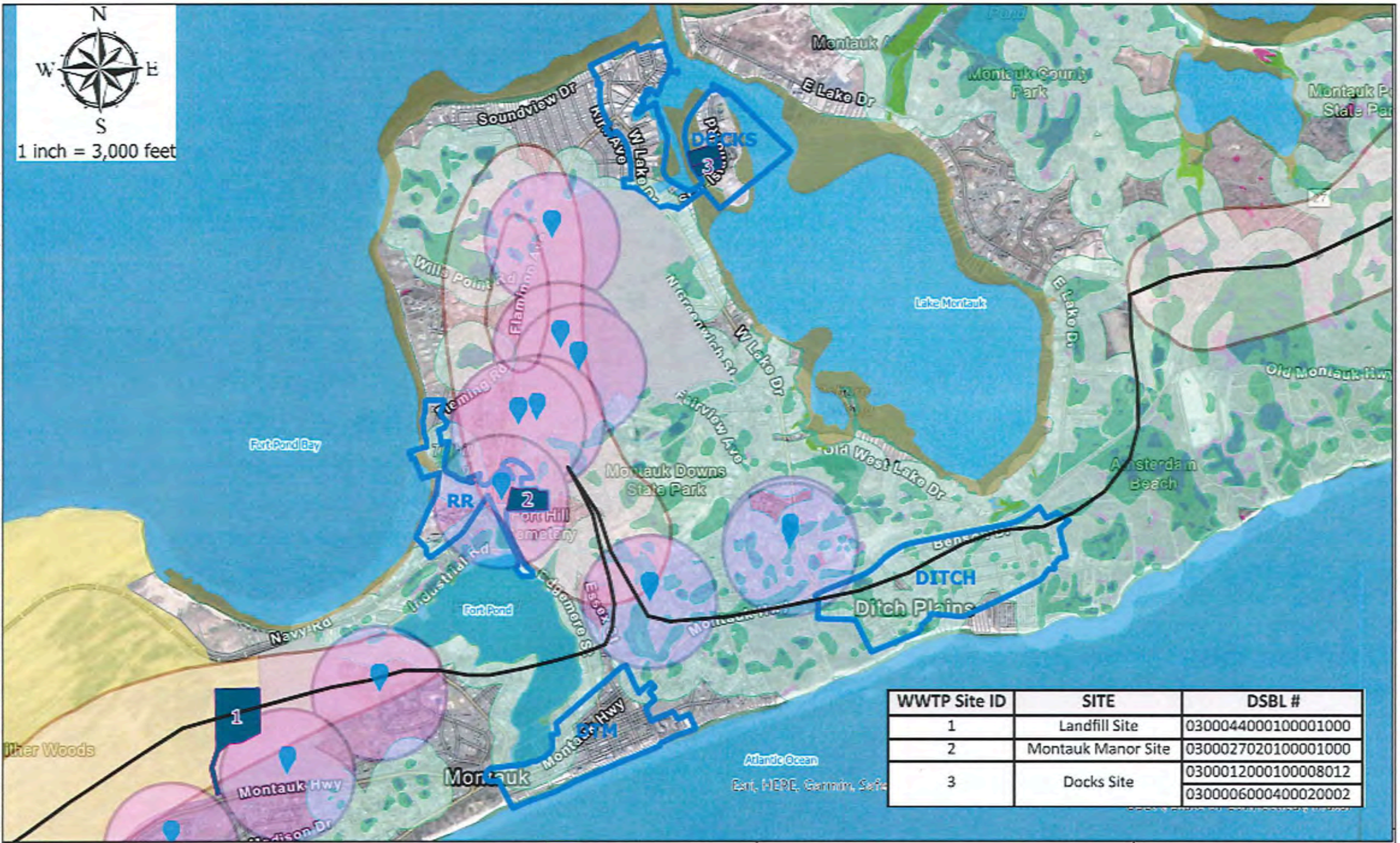
NYS Tidal Wetlands: within area of influence

USA Wetlands: within area of influence

FEMA flood zones: within area of influence

Special site conditions: parcels are low lying with high groundwater and located within wetlands and FEMA food zones. These conditions render the site not feasible for siting WWTP and required effluent recharge infrastructure.

Proposed sewer service area boundary: within Docks service area boundary



WWTP Site ID	SITE	DSBL #
1	Landfill Site	0300044000100001000
2	Montauk Manor Site	0300027020100001000
3	Docks Site	0300012000100008012 0300006000400020002

Legend

- SCWA Well Sites
- STP Siting Parcels
- 1,500 ft Well Site Buffer
- Proposed Sewer Service Areas
- 4' Glacial Aquifer Contour
- Groundwater Divide Line
- Special Groundwater Protection Area
- Water Recharge Overlay District
- Freshwater Wetlands
- Freshwater Wetland Check Zones

NYS Tidal Wetlands

- IM (Intertidal Marsh)
- HM (High Marsh)
- SM (Shoals, Bars & Mud Flats)
- DS (Dredge Spoil)
- FM (Fresh Marsh)
- LZ (Littoral Zone)

USA Wetlands

- Marine
- Estuarine
- Palustrine
- Riverine
- Lacustrine
- background

Downtown Montauk Sanitary Map & Plan

Environmental Resources Overview Map

H2M architects + engineers

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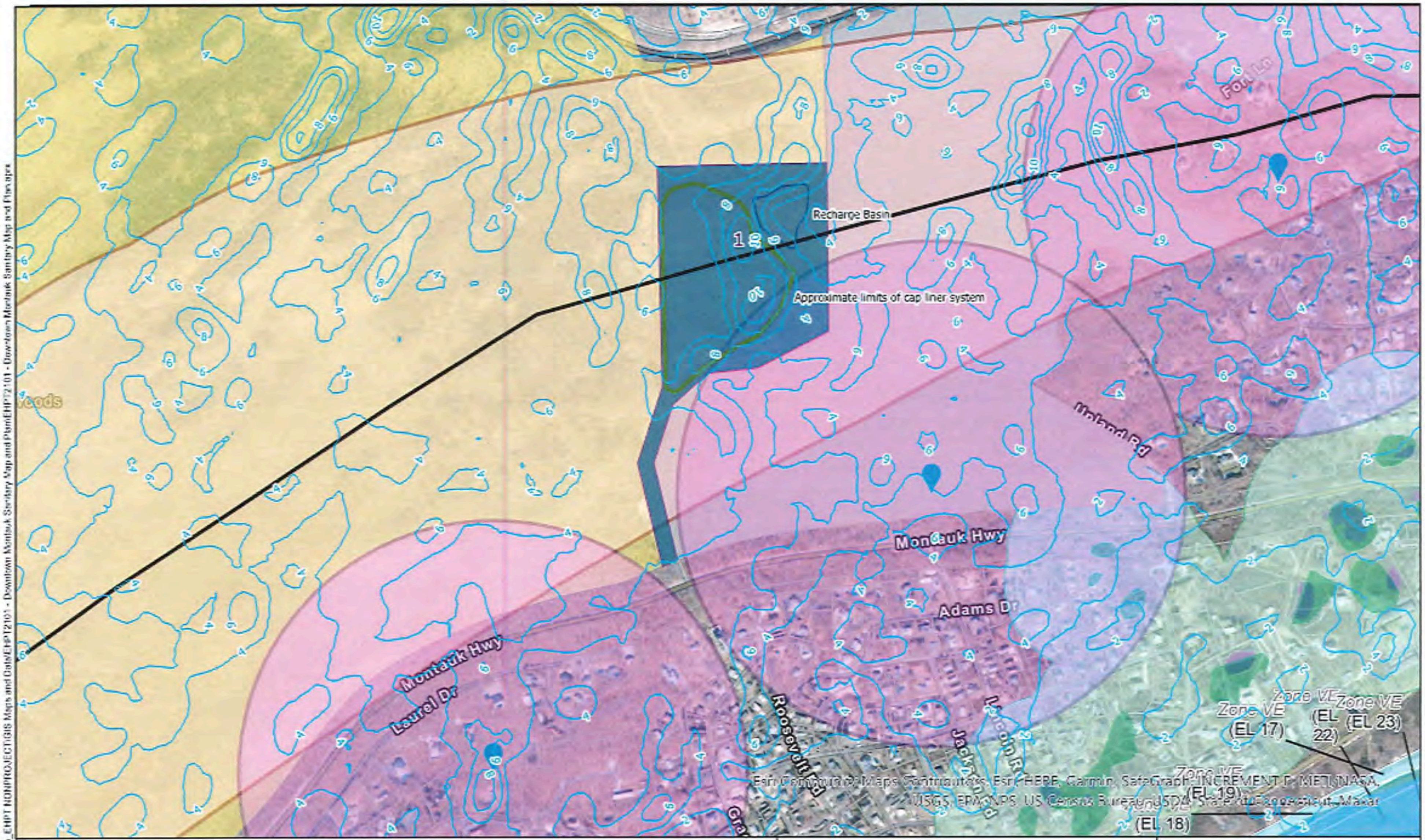

Legend

- SCWA Well Sites
- STP Siting Parcels
- 1,500 ft Well Site Buffer
- Proposed Sewer Service Areas
- 4' Glacial Aquifer Contour
- Groundwater Divide Line
- Special Groundwater Protection Area
- Water Recharge Overlay District
- Freshwater Wetlands
- Freshwater Wetland Check Zones

NYS Tidal Wetlands

- IM (Intertidal Marsh)
- HM (High Marsh)
- SM (Shoals, Bars & Mud Flats)
- DS (Dredge Spoil)
- FM (Fresh Marsh)
- LZ (Littoral Zone)

USA Wetlands

- Marine
- Estuarine
- Palustrine
- Riverine
- Lacustrine
- Ground Water Elevation

Downtown Montauk Sanitary Map & Plan

Environmental Resources Overview Map : Landfill Site

H2M architects + engineers

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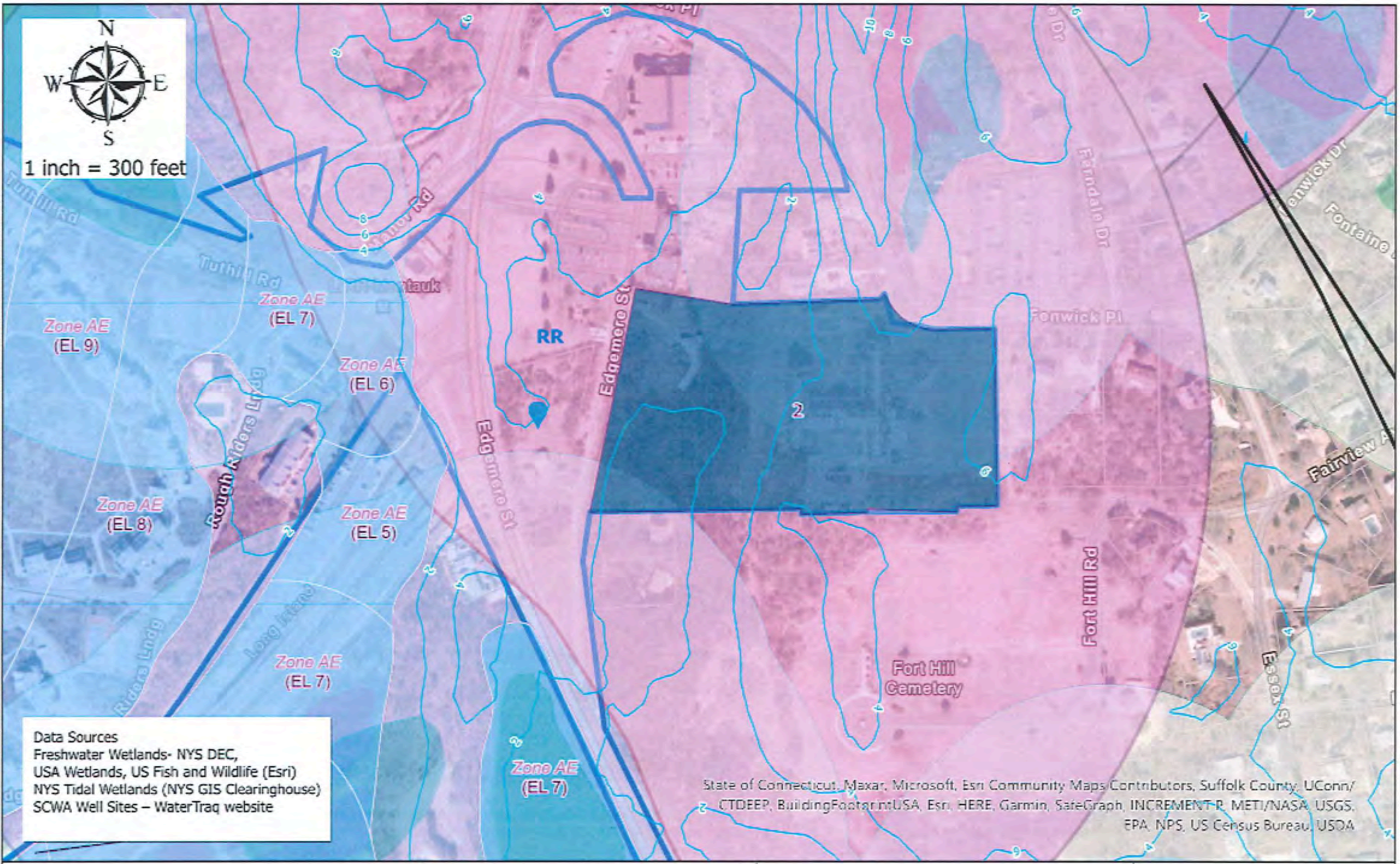

State of Connecticut, Maxar, Microsoft, Esri Community Maps Contributors, Suffolk County, UConn/ CTDEEP, BuildingFootprintUSA, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Data Sources
Freshwater Wetlands- NYS DEC,
USA Wetlands, US Fish and Wildlife (Esri)
NYS Tidal Wetlands (NYS GIS Clearinghouse)
SCWA Well Sites – WaterTraq website

Legend

- ● SCWA Well Sites
- ■ STP Siting Parcels
- ■ 1,500 ft Well Site Buffer
- ▭ Proposed Sewer Service Areas
- ▭ 4' Glacial Aquifer Contour
- — Groundwater Divide Line
- ■ Special Groundwater Protection Area
- ■ Water Recharge Overlay District
- ■ Freshwater Wetlands
- ■ Freshwater Wetland Check Zones

NYS Tidal Wetlands

- ■ IM (Intertidal Marsh)
- ■ HM (High Marsh)
- ■ SM (Shoals, Bars & Mud Flats)
- ■ DS (Dredge Spoil)
- ■ FM (Fresh Marsh)
- ■ LZ (Littoral Zone)

USA Wetlands

- ■ Marine
- ■ Estuarine
- ■ Palustrine
- ■ Riverine
- ■ Lacustrine
- — Ground Water Elevation

Downtown Montauk Sanitary Map & Plan

Environmental Resources Overview Map: Montauk Manor Site

H2M architects + engineers

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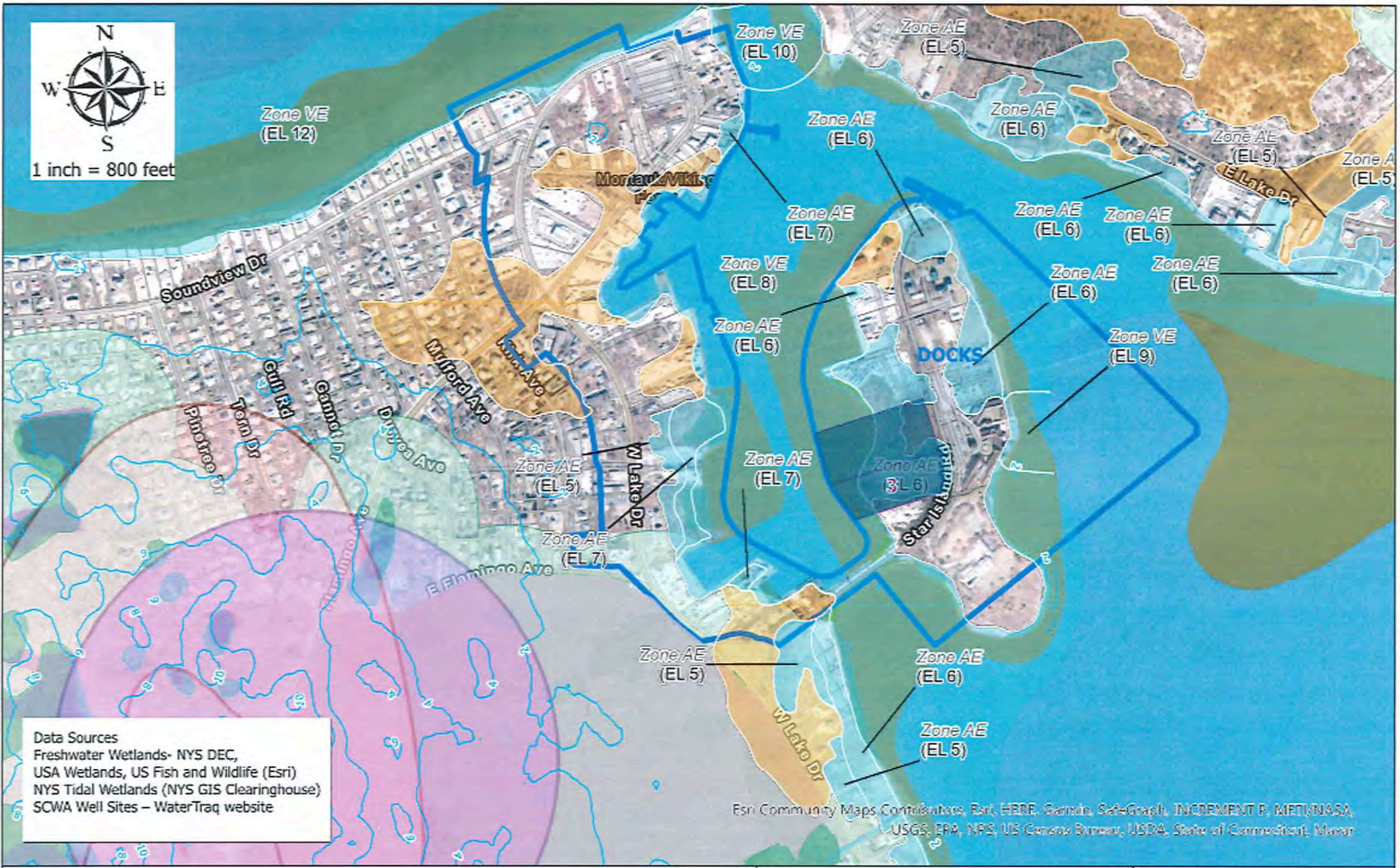


Data Sources
Freshwater Wetlands- NYS DEC,
USA Wetlands, US Fish and Wildlife (Esri)
NYS Tidal Wetlands (NYS GIS Clearinghouse)
SCWA Well Sites – WaterTraq website

Legend

- SCWA Well Sites
- STP Siting Parcels
- 1,500 ft Well Site Buffer
- Proposed Sewer Service Areas
- 4' Glacial Aquifer Contour
- Groundwater Divide Line
- Special Groundwater Protection Area
- Water Recharge Overlay District
- Freshwater Wetlands
- Freshwater Wetland Check Zones

NYS Tidal Wetlands

- IM (Intertidal Marsh)
- HM (High Marsh)
- SM (Shoals, Bars & Mud Flats)
- DS (Dredge Spoil)
- FM (Fresh Marsh)
- LZ (Littoral Zone)

USA Wetlands

- Marine
- Estuarine
- Palustrine
- Riverine
- Lacustrine
- Ground Water Elevation

Downtown Montauk Sanitary Map & Plan

Environmental Resources Overview Map: Dock Site

H2M architects + engineers

APPENDIX C

Preliminary Wastewater Treatment Plant (WWTP) Process Design Summary for Town of East Hampton Sewer District No. 1

DESIGN PROPOSAL

Downtown Montauk Sanitaire #a30912-21

Operating Mode		Startup		Design	
Normal Cycle Flow	MGD	0.175		0.30	
Max Normal Cycle Flow	MGD	0.22		0.45	
Minimum Cycle Flow	MGD	0.30		0.60	
		mg/l	lb/day	mg/l	lb/day
BOD_5 (20°C)		272	397	272	680.544
Suspended Solids		320	467	320	800.64
TKN		65	95	65	162.63
Max Wastewater Temperature	°C	20		20	
Min Wastewater Temperature	°C	10		10	
Ambient Air Temperature	°F	20 - 90		20 - 90	
Site Elevation	ft	100		100	

*** - Maximum 30 day period mass flow**

Table B: SBR EFFLUENT QUALITY (MONTHLY AVERAGE)

		Startup	Design
BOD_5 (20°C)	mg/l	10	10
Suspended Solids	mg/l	10	10
NH_3-N	mg/l	1	1
TN	mg/l	10	10

Table C: SBR PROCESS DESIGN CRITERIA

		Startup	Design
Operating Basins		2	2
Operating Top Water Level	ft	13.53	15.00
F / M	BOD5/DAY/MLSS	0.039	0.039
SVI (after 30 minutes settling)	ml/g	150	150
MLSS at Bottom Water Level	mg/l	2,627	4,569
Waste Sludge Produced (Approx.)	lb/day	319	547
Volume of Sludge Produced (Approx., 0.85% solids)	GPD	4,500	7,720
Max Month Decant Rate	GPM	375	750
Max 4.0hr Cycle Flow Decant Rate	GPM	500	1,000
Hydraulic Retention Time	Days	2.80	1.68
Sludge Age	Days	30.5	30.5

Sufficient Alkalinity must be provided to maintain basin pH of 6.8

Bold, italicized text indicate assumptions made by Sanitaire

Cycle Timing

		Startup		Design	
		Normal	Min	Normal	Min
Air-On	min	120	90	120	90
Air-Off	min	48	36	48	36
Settle	min	60	45	60	45
Decant	min	60	45	60	45
Total	min	288	216	288	216

Table D: KEY SBR DESIGN DETAILS

Top Water Level	ft	13.53
Basin Width (Inside)	ft	29.0
Basin Length (Inside)	ft	85.0
Bottom Water Level	ft	12.56

SBR EQUIPMENT(Base Design)

				Motor HP	No. Req.
Decanter Mechanism	6	' Weir length			2
Decanter Drive Unit				1/4	2
SBR Blower	550	SCFM	6.8 PSIG	60	2
SBR Fine Bubble Aeration System	434	Disc Diffusers/Basin			2
Air Control Valve	6	"			2
Waste Sludge Pump	110	GPM		2.4	2
Submersible Mixer				7.5	4
SBR Controls					1
SBR Influent Valve					2

SBR POWER REQUIREMENTS Max

Max Month		**(At Average Aeration Depth)**			Kwh/Day
Decant Drive Unit	0.2 BHP	2 run	@	5 Hrs/day	1.5
SBR Air Blowers	25.4 BHP	1 run*	@	20 Hrs/day	378.8
Waste Sludge Pump	1.9 BHP	2 run	@	0.3 Hrs/day	1.0
Submersible Mixer	6.0 BHP	4 run	@	4 Hrs/day	71.6
				KWH/DAY	452.9
			AVERAGE	KWH/HR	18.87

* Shared SBR Blowers

SANITAIRE SBR Detailed Design Calculations
BOD Removal, Nitrification, and De-Nitrification Process

SANITAIRE Project #a30912-21
Downtown Montauk

Design Parameters

A. Flow

Max Month	300,000	GPD
Max 4.8hr Cycle Flow	450,000	GPD
Max 4.0hr Cycle Flow	600,000	GPD

B. Treatment

	Influent Quality	Effluent Requirement
BOD_5 (20°C), mg/l	272	10
Suspended Solids, mg/l	320	10
TKN, mg/l	65	
NH_3-N, mg/l		1
TN, mg/l		10

C. Environment

Sufficient Alkalinity must be provided to maintain basin pH of 6.8

Max Wastewater Temperature	20	°C
Min Wastewater Temperature	10	°C
Ambient Air Temperature	20 - 90	°F
Site Elevation	100	ft

D. SBR Process Design Criteria

F / M	0.039	BOD_5 / MLSS / day
SVI (after 30 minutes settling)	150	ml/g
Number of SBR Basins	2	
Top Water Level	15	ft

E. Cycle Timing

		Normal	Storm
Air-On	min	120	90
Air-Off	min	48	36
Settle	min	60	45
Decant	min	60	45
Total	hrs	4.8	3.6

F. Detailed Calculations

Mass of BOD

$$\text{BODL} = \frac{Q \times \text{BODin} \times 8.34}{1{,}000{,}000} = \frac{150{,}000 \times 272 \times 8.34}{1{,}000{,}000} = \mathbf{340\ lb/day/basin}$$

where: BODL = BOD Load (lb/day/basin)
Q = Average Dry Weather Flow per basin (gal/day)
BODin = Influent BOD concentration (mg/l)
1,000,000 = Conversion (l/mg)
8.34 = Conversion (lb/gal)

Mass of Biomass

$$\text{BMOB} = \frac{\text{BOD}_L}{F / M} = \frac{340}{0.0391} = \mathbf{8{,}703\ lb/basin}$$

where: BMOB = Mass of Biomass (lb/day/basin)
F / M = Food to Microorganism ratio (day^{-1})

Volume of Biomass

$$\text{Vbio} = \text{BMOB} \times \text{SVI} = 8{,}703 \times 2.4 = \mathbf{20{,}888\ ft^3/basin}$$

where: Vbio = Volume of Biomass (ft^3/basin)
SVI = Sludge Volume Index (ft^3/lb)

Maximum Volume Above Bottom Water Level

Peak Dry Weather Flow:

$$\boxed{\text{Vbwld} = \frac{\text{PDWF} \times \text{FT}}{24 \times 7.48} = \frac{450{,}000 \times 2.4}{24 \times 7.48} = \mathbf{6{,}016\ ft^3/basin}}$$

where: Vbwld = Maximum Volume Above BWL at Peak Dry Weather Flow (ft^3/basin)
PDWF = Peak Dry Weather Flow (gal/day)
FT = Normal Fill Time (hr/cycle)
7.48 = Conversion (gal/ft^3)

Peak Wet Weather Flow:

$$\boxed{\text{Vbwls} = \frac{\text{PWWF} \times \text{FT}}{24 \times 7.48} = \frac{600{,}000 \times 1.8}{24 \times 7.48} = \mathbf{6{,}016\ ft^3/basin}}$$

where: Vbwls = Maximum Volume Above BWL at Peak Wet Weather (Storm) Flow (ft^3/basin)
PWWF = Peak Wet Weather Flow (gal/day)
SFT = Storm Fill Time (hr/cycle)
#REF! #REF!

MVAB (Maximum Volume Above Bottom Water Level) is larger of Peak Dry Weather and Peak Wet Weather Calculation

$$\boxed{\text{MVAB} = \mathbf{6{,}016\ ft^3/basin}}$$

Decant Rates

Peak Dry Weather Flow:

$$\boxed{\text{PDR} = \frac{\text{MVAB} \times 7.48}{\text{NDT}} = \frac{6{,}016 \times 7.48}{60.0} = \mathbf{750\ gal/min}}$$

where: PDR = Normal Decant Rate (gal/min)
NDT = Normal Decant Time (min/cycle)

Peak Wet Weather Flow:

$$\boxed{\text{PWR} = \frac{\text{MVAB} \times 7.48}{\text{SDT}} = \frac{6{,}016 \times 7.48}{45.0} = \mathbf{1{,}000\ gal/min}}$$

where: PWR = Peak Decant Rate (gal/min)
SDT = Storm Decant Time (min/cycle)

Decanter Sizing

Peak Dry Weather Flow:

$$DLa = \frac{PDR}{\text{Weir Loading Rate} \times 7.48} = \frac{750}{20 \times 7.48} = \mathbf{5.01\ ft}$$

where: DLa = Decanter Length for Average Dry Weather Flow (ft)
20 = Weir Loading Rate (ft^3/min/ft of decanter weir)

Peak Wet Weather Flow:

$$DLp = \frac{PWR}{\text{Weir Loading Rate} \times 7.48} = \frac{1{,}000}{25 \times 7.48} = \mathbf{5.35\ ft}$$

where: DLp = Decanter Length for Peak Wet Weather (Storm) Flow (ft)
25 = Weir Loading Rate (ft^3/min/ft of decanter weir)

$$\text{Design Decanter Length} = \mathbf{6.0\ ft}$$

Basin Working Volume

$$BWV = MVAB + Vbio = 6{,}016 + 20{,}888 = \mathbf{26{,}904\ ft^3/basin}$$

where: BWV = Basin Working Volume (ft^3/basin)

Basin Area

$$BA = \frac{BWV}{TWL - BZ} = \frac{26{,}904}{15.0 - 4.1} = \mathbf{2{,}465\ ft^2/basin}$$

where: BA = Basin Area (ft^2)
TWL = Top Water Level (ft)
BZ = Buffer Zone (ft) (Safety Factor)

Sludge Depth

$$SD = \frac{Vbio}{BA} = \frac{20{,}888}{2{,}465} = \mathbf{8.47\ ft}$$

where: SD = Sludge Depth (ft)

Decanter Draw Down

$$DD = \frac{MVAB}{BA} = \frac{6{,}016}{2{,}465} = \mathbf{2.44\ ft}$$

where: DD = Draw Down (ft)

Bottom Water Level

$$BWL = SD + BZ = 8.47 + 4.09 = \mathbf{12.56\ ft}$$

where: BWL = Bottom Water Level (ft)

Top Water Level

$$TWL = BWL + DD = 12.56 + 2.44 = \mathbf{15.00\ ft}$$

where: TWL = Top Water Level (ft)

Hydraulic Retention Time

$$HRT = \frac{BA \times MAFD \times 7.48}{QT}$$

where: HRT = Hydraulic Retention Time (days)
MAFD = Maximum Average Flow Depth (ft)
QT = Fill Rate at Average Dry Weather Flow (gal/day)
FT = Fill Time at Average Dry Weather Flow (mins)

$$MAFD = \frac{QT \times FT}{BA \times 1{,}440 \times 7.48} + BWL = \frac{300{,}000 \times 144}{2{,}465 \times 1{,}440 \times 7.48} + 12.56 = \mathbf{14.19\ ft}$$

$$HRT = \frac{2{,}465 \times 14.19 \times 7.48}{150{,}000} = \mathbf{1.74\ days}$$

MLSS Concentration at Bottom Water Level

$$\text{MLSS} = \frac{\text{Mbio} \times 1{,}000{,}000}{\text{BWL} \times \text{BA} \times 62.42} = \frac{8{,}703 \times 1{,}000{,}000}{12.56 \times 2{,}465 \times 62.42} = \mathbf{4{,}504\ mg/l}$$

where: MLSS = Mixed Liquor Suspended Solids concentration at Bottom Water Level (mg/l)
62.42/1E+06 = Conversion (lb/mg x l/ft³)

Mass of Sludge Produced

$$\Delta M = \left(\frac{Y \times (\text{BOD}_{in} - \text{BOD}_{out})}{1 + (B \times \theta^{(T-20)} \times \text{SRT})} + \text{Zio} + \text{Zno} \right) \times \frac{Q \times 8.34}{1{,}000{,}000} + \text{Csludge}$$

$$\Delta M = \left(\frac{0.6 \times (272 - 10.0)}{1 + (0.07 \times 1.02^{(10-20)} \times 30.5)} + 64.0 + 96.0 \right) \times \frac{1.5\text{E}{+}05 \times 8.34}{1{,}000{,}000} + 0 = \mathbf{273\ lb/day/basin}$$

(Lawrence-McCarty Equation as presented in WEF MOP/8 4th Edition, pg 11-11, Eqn. 11.7)

where: ΔM = Mass of Sludge Produced (lb/day/basin)
Y = Volatile cell yield (VSS/BOD removed)
q = Arrhenius Temperature Correction Factor
B = Decay Rate (day^{-1})
BOD_{out} = Anticipated Effluent BOD (mg/l)
SRT = Solids Retention Time (days)
Zio = Nonvolatile Influent suspended solids (mg/l)
Zno = Volatile Non-Biodegradable solids (mg/l)
T = Minimum Wastewater Temperature (°C)

Volume of Sludge Produced

$$V_{ws} = \frac{\Delta M}{SFws \times 8.34} = \frac{273}{0.0085 \times 8.34} = \textbf{3,858 gal/day/basin}$$

where: Vws = Volume of Waste Sludge (gal/day/basin)
SFws = Solids Fraction in Waste Sludge
8.34 = Density (lb/gal)

Observed Yield Factor

$$Yobs = \frac{\Delta M}{BOD_L} = \frac{273}{340} = \mathbf{0.804} \ \frac{\textbf{MLSS}}{\textbf{BOD}}$$

Observed Yield Factor (lb/day MLSS/lb/day BODremoved)

Mean Cell Residence Time

$$MCRT = \frac{Mbio}{\Delta M + ((Q - Vws) \times TESS \times 8.34 / 1E{+}06)}$$

$$MCRT = \frac{8{,}703}{273 + ((150{,}000 - 3{,}858) \times 10.0 \times 8.34 / 1{,}000{,}000)} = \textbf{30.5 days}$$

where: MCRT = Mean Cell Residence Time (days)
TESS = Anticipated Effluent Total Suspended Solids (mg/l)
8.34E-06 = Conversion (lb/mg x l/gal)

Sludge Age for Nitrification

Refer to Metcalf and Eddy, Edition IV pages 614 and 705

Constants and Temperature Corrections:

Coefficient	Base Value	Theta	Temperature Corrected	Symbol
Maximum Specific Growth Rate of Nitrifying bacteria, g VSS/g VSS.day	0.75	1.07	0.381	$\mu_{nm}(T)$
Half-Velocity constant for nitrifiers	0.74	1.053	0.442	Kn(T)
Nitrifier decay rate	0.08	1.04	0.054	Kdn(T)
Dissolved Oxygen, mg/l	2		2	DO
Half-Velocity Constant for Dissolved Oxygen, mg/l	0.5		0.5	Ko
Minimum Water Temperature, °C	10		10	T
Safety Factor	2.0		2.0	SF

Calculations:

$$\mu_n = \left(\mu_{nm}(T) \times \frac{TENH_3}{TENH_3 + Kn(T)} \times \frac{DO}{DO + Ko} \right) - Kdn(T)$$

$$\mu_n = \left(0.381 \times \frac{1.0}{1.0 + 0.442} \times \frac{2.0}{2.0 + 0.5} \right) - 0.054 = \mathbf{0.158\ days^{-1}}$$

$$SRTmin = \frac{1}{\mu_n} = \frac{1}{0.158} = \mathbf{6.3\ days}$$

$$SRTaerobic = SRTmin \times SF = 6.3 \times 2 = \mathbf{12.7\ days}$$

$$SRToverall = \frac{SRTaerobic \times 24}{TA} = \frac{12.7 \times 24}{10.0} = \mathbf{30.5\ days}$$

Design sludge age adequate for nitrification.

where: µnm(T) = Maximum Temperature Corrected Nitrifier Growth Rate (days^{-1})

μ_n = Specific Nitrifier Growth Rate at Temperature, DO, and Effluent NH_3 (g/g-days)

SRTmin = Minimum Sludge age required for Nitrification (days)

SRTaerobic = Design Aerobic Sludge Age (days)

SF = Safety Factor

SRToverall = Sludge Age accounting for entire SBR cycle (days)

TA = Aeration Time (hrs/day)

$TENH_3$ = Anticipated Effluent Ammonia (mg/l)

Denitrification Capacity

Constants and Temperature Corrections

Coefficient	Base Value	Theta	Temperature Corrected	Symbol
Base Denitrification Rate @ 20°C,NO3/MLVSS/hr	0.0025	1.09	0.0011	μ_{DN}
VSS/TSS	0.71			
Sludge Nitrogen Content	0.12			Ns
Minimum Wastwater Temperature, °C	10			T
Effluent Dissolved Organic Nitrogen, mg/l	1			EDON

Nitrogen Balance

$$N_{Avail} = \text{TKN} - \text{EDON} - \text{TENH}_3 - N_{Assim} - N_{Part} = 65 - 1 - 1.0 - 18.6 - 0.8 = \mathbf{43.6\ mg/l}$$

where: N_{Avail} = Nitrogen available for oxidation and denitrification (mg/l)

TKN = Influent Total Kjeldahl Nitrogen (mg/l)

N_{Assim} = Nitrogen assimilated into VSS in WAS (mg/l)

$$N_{Assim} = \frac{\Delta M \text{ x Ns x VSS/TSS x } 1{,}000{,}000}{Q \text{ x } 8.34} = \frac{273 \text{ x } 0.12 \text{ x } 0.707 \text{ x } 1{,}000{,}000}{150{,}000 \text{ x } 8.34} = \mathbf{18.6\ mg/l}$$

$$N_{Part} = \text{TESS x Ns x VSS/TSS} = 10.0 \text{ x } 0.12 \text{ x } 0.71 = \mathbf{0.8\ mg/l}$$

$$NO_{3(Allow)} = \text{TN} - \text{EDON} - \text{TENH}_3 - N_{Part} = 10 - 1 - 1.0 - 0.8 = \mathbf{7.2\ mg/l}$$

where: $NO_{3(Allow)}$ = Allowable NO3 concentration in effluent (mg/l)

TN = Total Nitrogen in effluent (mg/l)

N_{Part} = Nitrogen bound to VSS portion of effluent TSS (mg/l)

Required Denitrification Capacity

$$\text{Req'd Capacity} = \frac{(N_{Avail} - NO_{3(Allow)}) \text{ x Q x } 8.34}{1{,}000{,}000} = \frac{(43.6 - 7.2) \text{ x } 150{,}000 \text{ x } 8.34}{1{,}000{,}000} = \mathbf{46\ lb/day/basin}$$

Design Denitrification Capacity

$$\text{Design Capacity} = \mu_{DN} \text{ x VSS/TSS x BMOB x ART} = 0.0011 \text{ x } 0.71 \text{ x } 8{,}703 \text{ x } 7.5 = \mathbf{51\ lb/day/basin}$$

where: ART = Anoxic Retention Time (hours/day)

Design denitrification Capacity exceeds required denitrification capacity.

Waste Sludge Pump Capacity

$$\boxed{WSP = \frac{Vws \ \times \ NCT}{24 \ \times \ SPT} = \frac{3{,}858 \ \times \ 4.8}{24 \ \times \ 7.01} = \mathbf{110\ gal/min}}$$

where: WSP = Waste Sludge Pump Capacity(gal/min)
SPT = Sludge Pumping Time (min/cycle)

ICEAS 2-Basin NDN Normal Cycle 288 mins (4.8 hours)

	0	24	48	72	96	120	144	168	228	288
Basin #1	AIR ON (0-24 min)	**AIR OFF (24 min Mix)	AIR ON (0-24 min)	AIR ON (0-24 min)	AIR ON (0-24 min)	AIR OFF (24 min Mix)	AIR ON (0-24 min)	SETTLE (60 min)	DECANT (60 min)	

	168	228	288/0	24	48	72	96	120	144	168
Basin #2	SETTLE (60 min)	DECANT (60 min)	AIR ON (0-24 min)	AIR OFF (24 min Mix)	AIR ON (0-24 min)	AIR ON (0-24 min)	AIR ON (0-24 min)	**AIR OFF (24 min Mix)	AIR ON (0-24 min)	

ICEAS 2-Basin NDN High Flow Mode 216 mins (3.6 hours)

	0	18	36	54	72	90	108	126	171	216
Basin #1	AIR ON (0-18 min)	**AIR OFF (18 min Mix)	AIR ON (0-18 min)	AIR ON (0-18 min)	AIR ON (0-18 min)	AIR OFF (18 min Mix)	AIR ON (0-18 min)	SETTLE (45 min)	DECANT (45 min)	

	126	171	216/ 0	18	36	54	72	90	108	126
Basin #2	SETTLE (45 min)	DECANT (45 min)	AIR ON (0-18 min)	AIR OFF (18 min Mix)	AIR ON (0-18 min)	AIR ON (0-18 min)	AIR ON (0-18 min)	**AIR OFF (18 min Mix)	AIR ON (0-18 min)	

Notes:

Each basin fills continuously over entire cycle. Basins #1 and #2 share blowers.

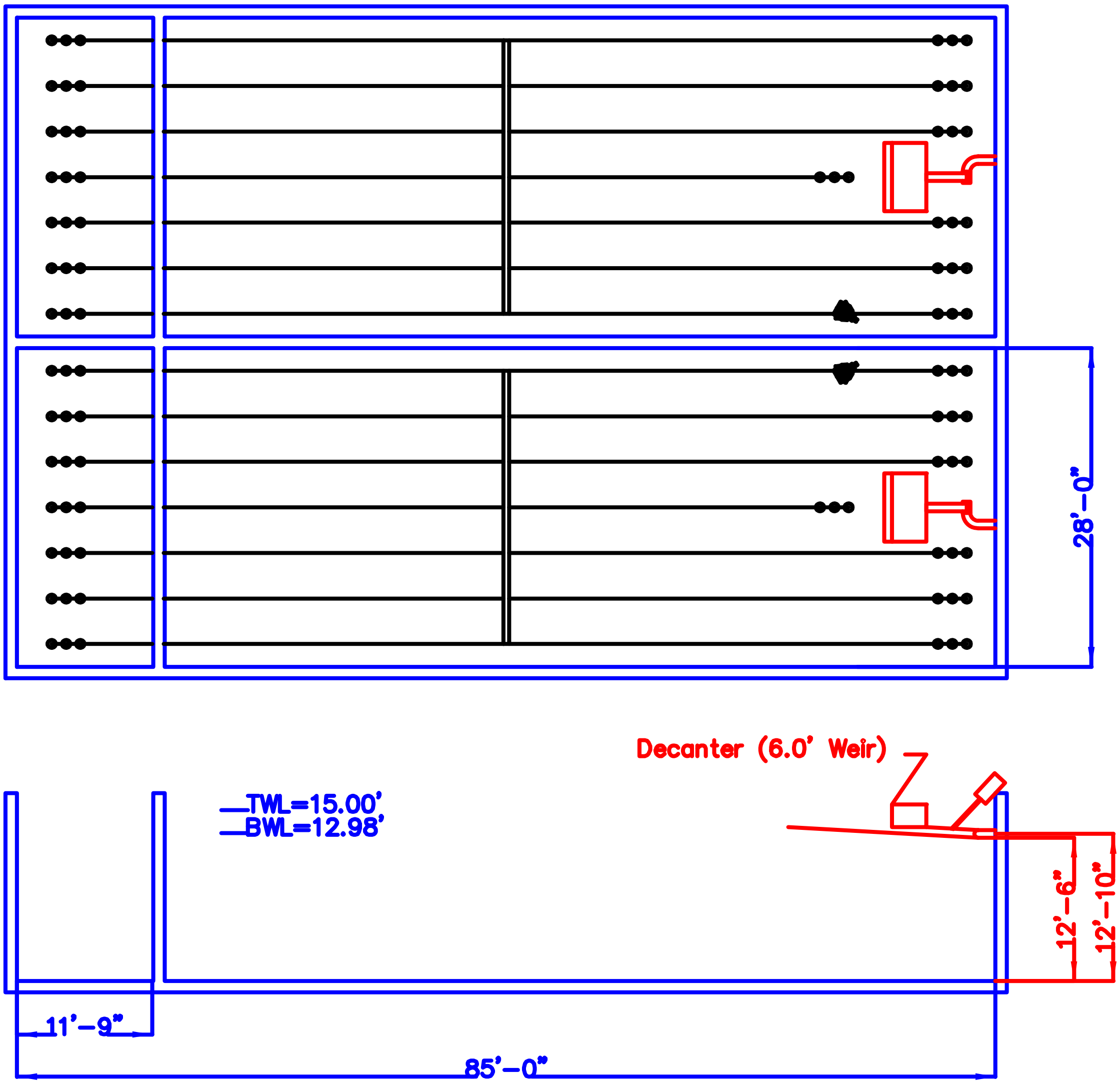
** "Air Off" periods that do not overlap with the other basin can be aerated if needed.

"Air On" periods in the react phase are programmable from 0 to 24 minutes in a normal cycle and 0 to 18 minutes in a storm cycle.

Sludge wasting occurs during the decant phase, pump run time is programmable.

During the storm cycle, the time segments are reduced by 25% to accommodate additional flow.

I:\ABJ\Cycle Charts\ICEAS\NDN\10 Hrs Aeration per Day\60 Min Decant\Single Storm
6/21/2022


28'–0"
Decanter (6.0' Weir)
TWL=15.00'
BWL=12.98'
12'–6"
12'–10"
11'–9"
85'–0"

APPENDIX D

Expanded Environmental Assessment,
prepared by H2M architects + engineers
(pending Town acceptance of draft report)

APPENDIX E

SHPO Letter (pending Town acceptance of draft report)