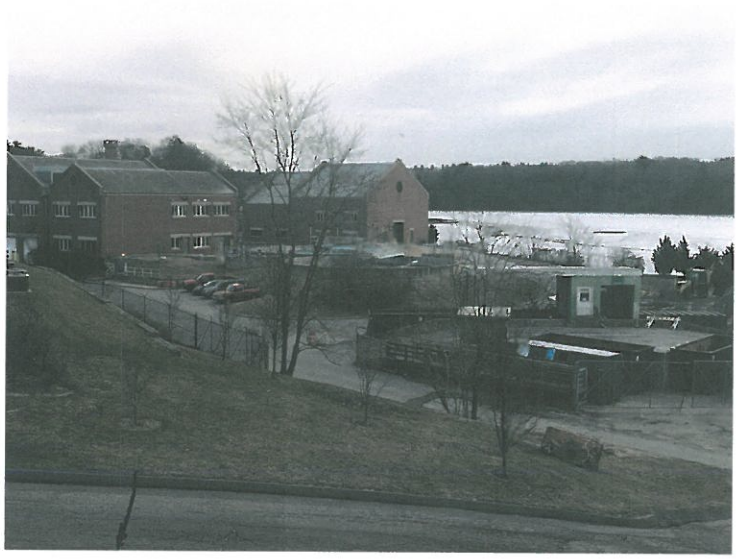
JGA 18-009

EAST GREENWICH WASTEWATER TREATMENT FACILITY AND COLLECTION SYSTEM

RESILIENCY PLAN



for the

TOWN OF EAST GREENWICH

125 Main Street

East Greenwich, Rhode Island 02818

Prepared by:

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EAST GREENWICH WASTEWATER TREATMENT FACILITY AND COLLECTION SYSTEM

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RESILIENCY PLAN

INTRODUCTION

The East Greenwich Wastewater Treatment Facility is located at 21 Crompton Avenue in East Greenwich, RI (adjacent to Greenwich Cove). The plant was designed for an average daily flow of 1.7 MGD and a peak hourly flow of 3.0 MGD. Primary treatment consists of a mechanical bar rake screen and primary clarification.

Flow from the two primary clarifiers is distributed to Rotating Biological Contactor (RBC) basins. The two trains of four RBCs provide treatment of organic BOD and ammonia removal. Each train consists of two standard density media RBCs, one medium density media RBC, and one high density media RBC.

Effluent from the RBC process enters a distribution chamber where polymer solution is added before entering the secondary clarifiers. After flocculation and sedimentation has occurred in the secondary clarifiers, the effluent enters the nitrogen removal facility. The nitrogen facility consists of three biological aerated filters (BAF) and three denitrification filters. Effluent from this process enters the disinfection via ultraviolet and then discharges to Greenwich Cove.

The solids process involves pumping the primary and secondary sludges to the mixed sludge well before being pumped to the gravity thickeners. Currently, the thickened sludge is hauled off for incineration. The plant, however, has the option to dewater the thickened sludge through its belt filter press where the dewatered sludge is lime stabilized before being hauled to RI Resource Recover for disposal.

The East Greenwich Wastewater Treatment Facility was initially constructed in 1985 to achieve secondary treatment. In 2004 the plant was upgraded to achieve nutrient removal. During that period of time, the TR-16 Guides for Design of Wastewater Treatment Works required that "*treatment plants and pump stations upgraded prior to issue of this document should have been designed to (1) provide for uninterrupted operation of all units during conditions of a 25-year (4% annual chance) flood and (2) be placed above or protected against the structural, process, and electrical equipment damage that might occur in a 100-year (1% annual chance) flood elevation.*"

The flood elevations are based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map issued at the time of design. Since the flood events of 2010 and the corresponding concerns in the frequencies of these storm events, TR-16 Guides for Design of Wastewater Treatment Works (2011 Edition as revised in 2016) has recommended changes to the flood elevation. TR-16 is now recommending that existing pump stations or treatment facilities that are planned for upgrades or expansion should consider extending the maximum flood protection criteria.

The new criteria requires:

> *"New pump stations, new facilities within a treatment plant and new wastewater treatment plants should (1) provide for uninterrupted operation of all units during conditions of a 100-year (1% annual chance) flood and (2) be placed above, or protected against, the structural, process, and electrical equipment damage that might occur in an event that results in a water elevation above the 100-year (1% annual chance) flood. The level of protection depends on how critical a component of the facility is to operation of the facility. Specifically, critical equipment of these facilities should be protected against damage up to a water surface elevation that is 3 feet above the 100-year flood elevation. Non-critical equipment should be protected against damage up to a water surface elevation that is 2 feet above the 100-year flood elevation."*

TR-16 has defined Critical Equipment as follows:

> *"critical equipment, which includes conveyance and treatment system components identified for protection including, but not limited to, all electrical, mechanical, and control systems associated with pump stations and treatment facilities that are responsible for conveyance of wastewater to and through the treatment facility to maintain primary treatment and disinfection during the flood event. Other equipment that, if damaged by flood conditions, will prevent the facility from returning to pre=event operation after cessation of flood conditions is also critical equipment."*

In Rhode Island, as elsewhere, increasing storm intensities have damaged wastewater treatment plants and pump stations. Due to the location of many wastewater facilities and associated pump stations, the treatment works are at risk of inundation since their designs utilize low elevations, which are often riverine or coastal floodplains.

The Rhode Island Department of Environmental Management (RIDEM) recognized the need to begin integrating climate change considerations into wastewater system planning and design. The most recent study conducted by RIDEM "Implication of Climate Change for RI Wastewater Collection & Treatment Infrastructure" prepared by Woodard & Curran, focused on the municipal treatment plants and the major pump stations that help bring flow to those treatment plants.

The report targeted two levels for future upgrades:

> *"1) Improvements that would provide for continuous operation up to a specified flood elevation and 2) Improvements that would consider survivability of the structure and electrical components of the facilities up to a higher specified flood elevation."*

To ensure that these factors are considered at each of the nineteen treatment plants with the issuance of each new RIPDES permit, the RIDEM is requiring the Town to develop a Resiliency Plan to determine short and long term action plans that will be undertaken to

maintain and protect collection and treatment system assets during re-occurring flooding and the potential sea level rises.

The East Greenwich plan has been prepared in accordance with RIDEM's "Guidance for the Consideration of Climate Change Impacts in the Planning and Design of Municipal Wastewater Collection and Treatment Infrastructure" and includes findings of the 2017 RIDEM report "Implications of Climate Change for Rhode Island Wastewater Collection and Treatment Infrastructure."

The Resiliency Plan includes:

- An assessment of current and projected impacts from natural hazards on critical components within the collection and treatment systems, as well as on the systems themselves;
- A plan to adapt and protect vulnerable components and systems; and
- An analysis that provides justification for selected adaptation methods.

The analysis considers component and system design life and sea level rise projections. The critical components that were considered are those that are necessary to ensure forward flow of the wastewater and treatment of wastewater in accordance with the limits set forth by RIDEM.

Base Flood Elevation (BFE)

In establishing the Base Flood Elevation, RIDEM has allowed the communities to choose which base flood elevation to use. Traditionally, the FEMA Insurance Mapping has been used to establish the BFE (100-year flood elevation). The second, more conservative BFE is generated by STORMTOOLS, which takes into account coastal hazards and sea level rise, and local assessments of shoreline changes and wave hazards in the vicinity of vulnerable wastewater treatment facilities.

1. Based on the FEMA Insurance Mapping, the 100-year bases flood elevation is Elevation 11.0. Therefore, non-critical components will require an additional two feet over the BFE (Elevation 13.0). The critical components will require an additional three feet over the BFE (Elevation 14.0).

2. Based on STORMTOOLS, the 100-year storm coastal flooding elevation is Elevation 16.8. This would translate to Elevation 18.6 for non-critical components and Elevation 19.8 for critical components.

At this time, the Town has elected to utilize the FEMA 100-year flood elevation as the BFE. At each subsequent permit renewal, the Town will re-evaluate the BFE to determine further protective actions that may be required. As part of the flood protection evaluation, design consideration will be given to the potential change in BFE in the future. Figure 1 depicts the critical components of the East Greenwich Wastewater Treatment Facility that will be affected as a result of the changes in flood elevation. An assessment of the Treatment Plant site finds that the areas shaded in "yellow" will need to be addressed.

LEGEND

100 YEAR FLOOD ELEVATION PLUS 3' CRITICAL COMPONENT

AREA REQUIRING ADDITIONAL FLOOD PROTECTION

(E) ELECTRIC MANHOLE
(M) SCUM MANHOLE
(S) SEWER MANHOLE
(T) TELEPHONE MANHOLE

UV/DISINFECTION CHAMBER
T.O.C. 12.27

GREENWICH COVE

METHANOL TANK

METHANOL PUMP BUILDING
DAY TANK

EDGE OF PAVE

RETAINING WALL

TOP OF SLOPE

CHOPPER PUMP VAULT

EL. 15.18'

NITROGEN REMOVAL BUILDING
F.F. 15.18

PARSHALL FLUME
T.O.C. 14.68'

GAS STATION
T.O.C. 14.50'

WATER ST PUMP STATION
F.F. EL. 13.68'

EDGE OF PAVE

EDGE OF PAVE

DETENTION BASIN

SPECIAL SMH NO.1
T.O.C. 18.68'

SECONDARY CLARIFIER NO.1
T.O.C. 18.68'

PRIMARY CLARIFIER NO.1
T.O.C. 28.18'

HEADWORKS
T.O.C. 26.00'

PUMP CHAMBER NO.1

PROCESS BUILDING
F.F. EL. 15.18'

DIVERSION STRUCTURE
T.O.C. 18.68'

PUMP CHAMBER NO.2
T.O.C. 17.88'

SECONDARY CLARIFIER NO.2
T.O.C. 18.68'

F.F. GARAGE EL. 11.18'

PRIMARY CLARIFIER NO.2
T.O.C. 28.18'

GRASSY AREA

GRASSY SLOPE

GRASSY SLOPE

EDGE OF PAVE

TRANSFER STATION

CROMPTON AVE

DPW GARAGE

0 20 40 50 100
PLAN SCALE: 1"=40'

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RESILIENCY PLAN

EAST GREENWICH WASTEWATER TREATMENT FACILITY AND COLLECTION SYSTEM

100 YEAR BASE FLOOD ELEVATION (EL 11.0)
PLUS 3' CRITICAL COMPONENT (EL 14.0)

FIG 1

TREATMENT PLANT

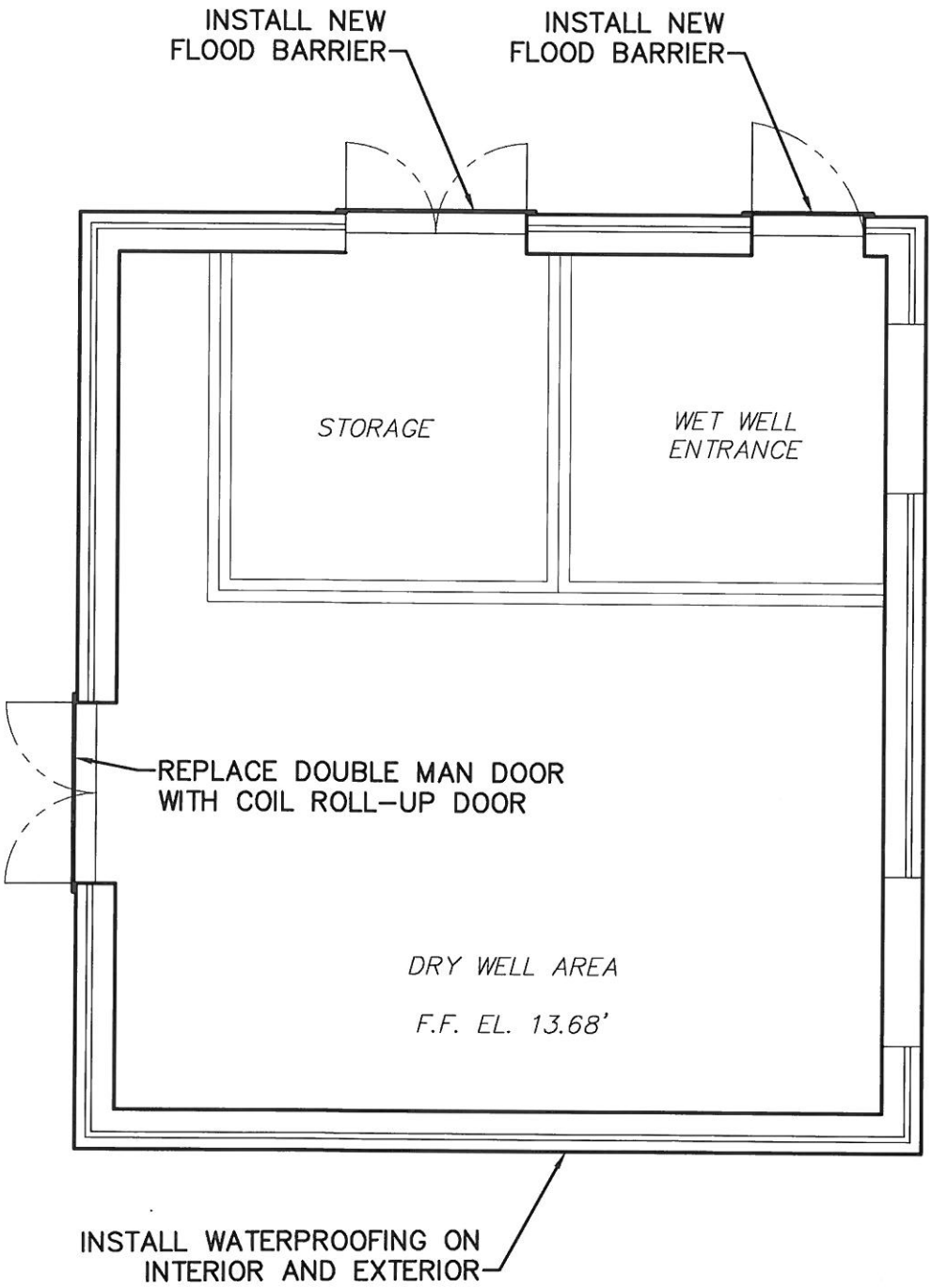
Water Street Pump Station (Critical Component)

The Water Street Pump Station was designed to operate during a 25 and 100 year storm event which was achieved by setting the finish floor elevation at 13.68 feet (2.68 feet above the 100-year flood elevation of 11.0 feet). Under the new standards for critical components, the station must be protected to Elevation 14.0 (the 100-year flood elevation plus 3 feet). The vulnerable areas of this station are the three doors and the exterior wall construction. The flood protection for this facility (Figure 2) would require retrofitting the building with stackable flood barriers at each of the entrances (Figures 3 and 4). The stackable barriers are located in front of the doors using jamb brackets mounted on the face of the building. The jamb brackets will have mounting holes for concrete anchors and bolts. These brackets will be permanently affixed to the building. Aluminum logs (6-inches in height) can be inserted into the jambs. A compression gasket that runs along the length of the entire log will prevent water from entering the pump station. The interlocking design of these aluminum logs causes the water pressure against the barrier to tighten the logs by transferring horizontal water pressure into downward pressure on the compression seals located across the bottom of each log. During a pending storm event, the staff can place the aluminum logs at each of the entrances, which will prevent floodwater from entering the pump station. The existing double man-doors will be converted to an overhead coil door which will be electrically operated to allow for the placement of the stop logs. This will provide access to the drywell area when the flood barrier is in place.

To prevent the flood waters from penetrating the block and brick walls of the pump station, a waterproofing block sealer will be applied to both the interior and exterior walls of the pump station to a minimum of Elevation 14.0. The cost to protect the Water Street Pump Station is estimated to be $71,700.00. Table 1 presents a breakdown of these costs.

TABLE 1
ENGINEERING ESTIMATE
FLOOD BARRIERS FOR WATER STREET PUMP STATION

	Unit	Unit Cost	Cost
Furnish & Install Flood Barriers (Single Door)	1 ea.	$5,900.00	$ 5,900.00
Furnish & Install Flood Barriers (Double Door)	2 ea.	$6,500.00	13,000.00
Furnish & Install Coil Door	1 ea.	$15.500.00	15,500.00
Waterproof Paint	415 s.f.	$45.00	18,700.00
Sub-Total			$ 53,100.00
Engineering (15%)			8,000.00
Contingencies (20%)			10,600.00
TOTAL			**$ 71,700.00**



WATER STREET PUMP STATION – PLAN

SCALE: 3/16"=1'-0"

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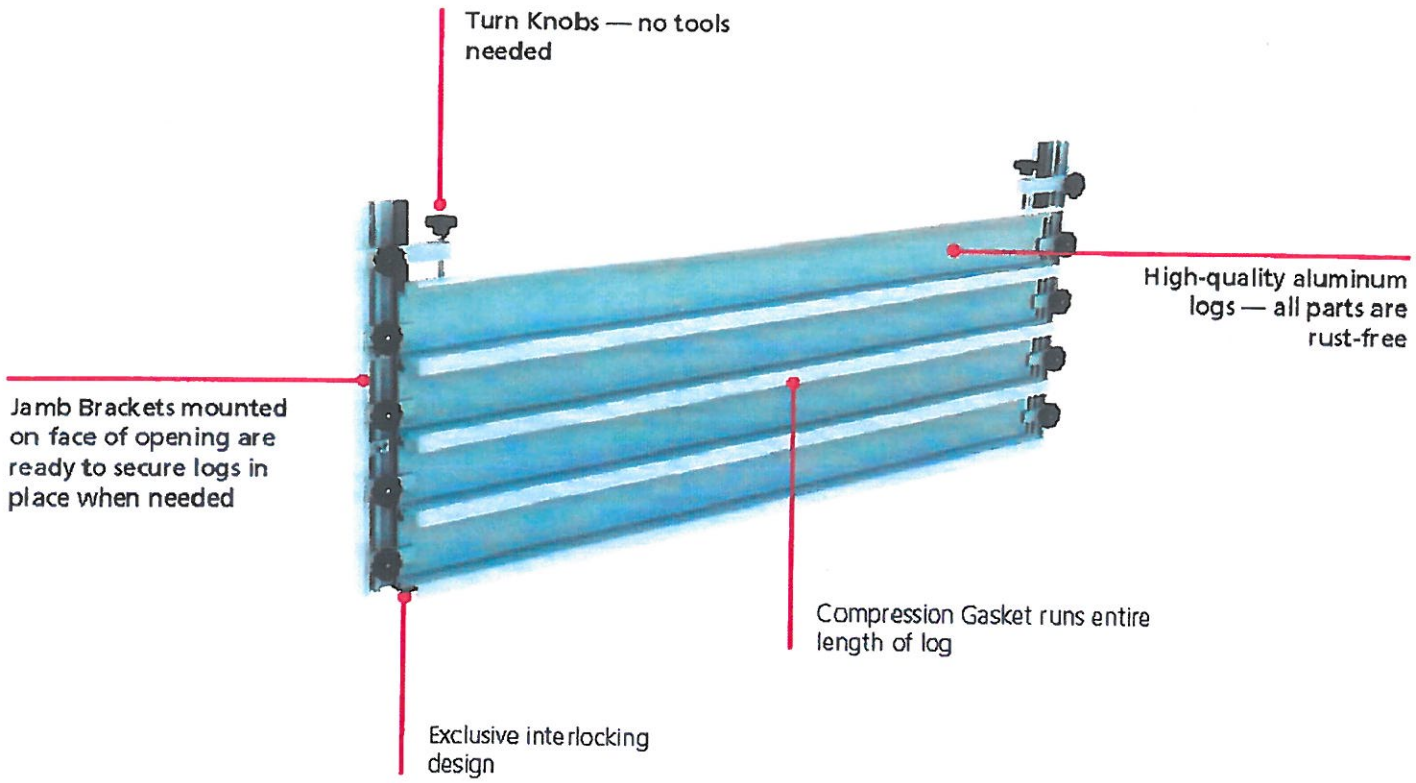
EAST GREENWICH WASTEWATER TREATMENT FACILITY AND COLLECTION SYSTEM
RESILIENCY PLAN
WATER STREET PUMP STATION

FIG 2



FLOOD BARRIER – DETAIL

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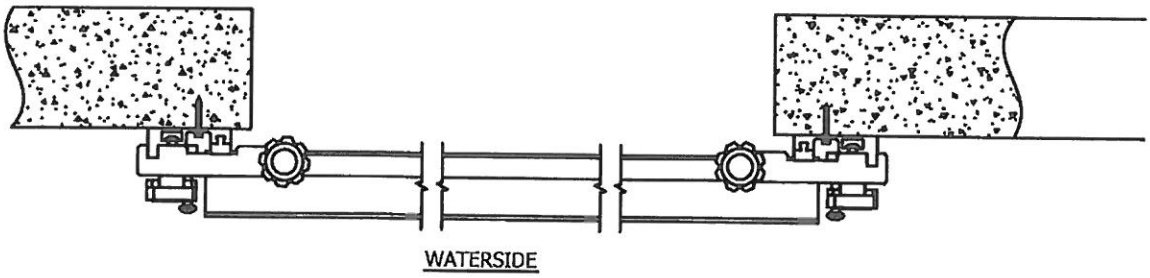
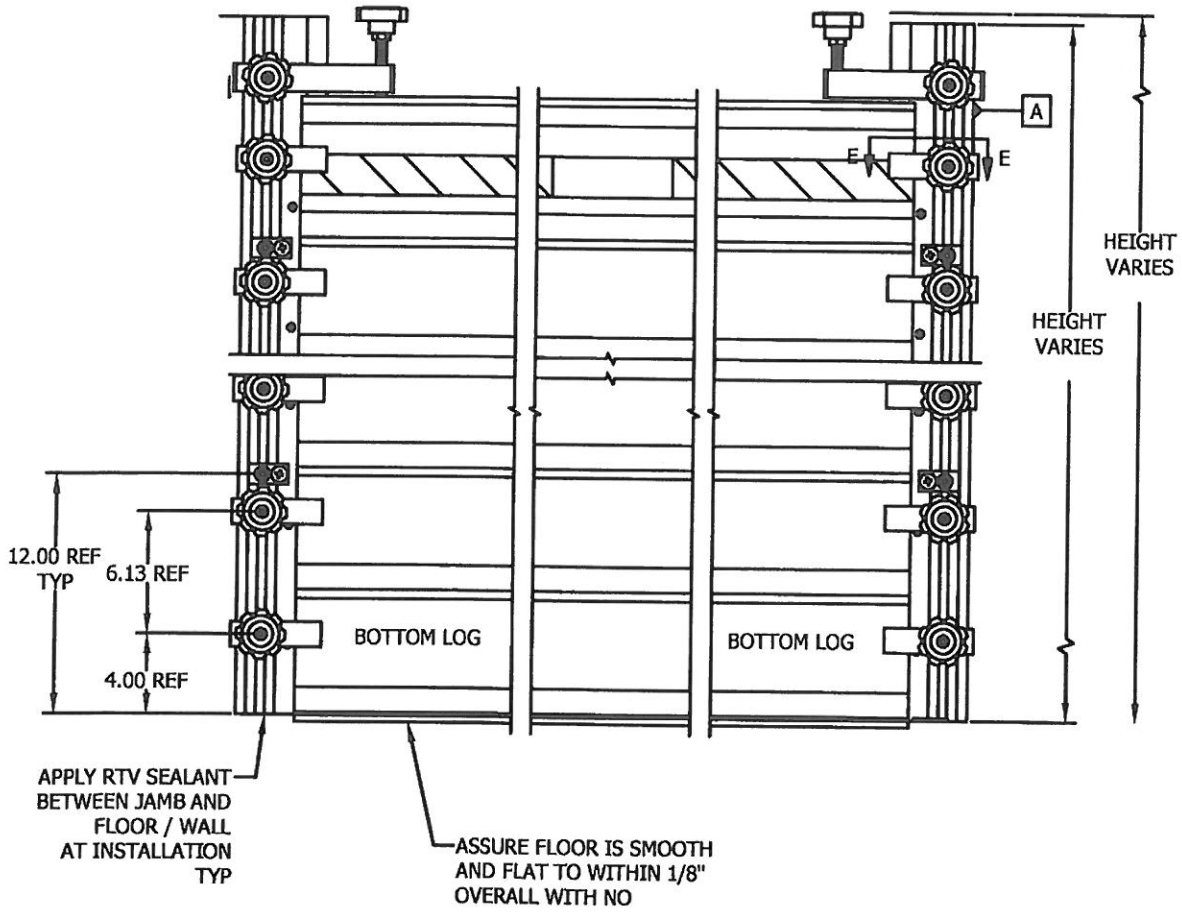
EAST GREENWICH WASTEWATER TREATMENT FACILITY AND COLLECTION SYSTEM
RESILIENCY PLAN
FLOOD BARRIER

FIG 3



FLOOD BARRIER – SECTION



FLOOD BARRIER – PLAN

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EAST GREENWICH WASTEWATER TREATMENT FACILITY AND COLLECTION SYSTEM
RESILIENCY PLAN
FLOOD BARRIER

FIG 4

Ultra-Violet Disinfection Chamber (Critical Component)

The disinfection tanks were initially designed as chlorine contact tanks. However, in 2005, one of the tanks was converted for ultraviolet disinfection process. The existing tanks walls are set at Elevation 13.09. The new regulations require this process to be protected to Elevation 14.0. The protection of this process can be achieved by constructing a containment wall around the entire process, which is depicted in Figure 5. The existing tanks walls will be drilled and dowelled for the placement of reinforcing steel to secure the additional 1.0 feet of concrete wall. A waterstop will be placed between the new and existing concrete to prevent leakage between the concrete. Once the concrete is cured, waterproof paint will be applied to the exterior wall. The UV hydraulic unit will need to be relocated within the containment wall and set at an elevation above 14.0. Access to the UV unit will be achieved by the placement of a new stair and platform.

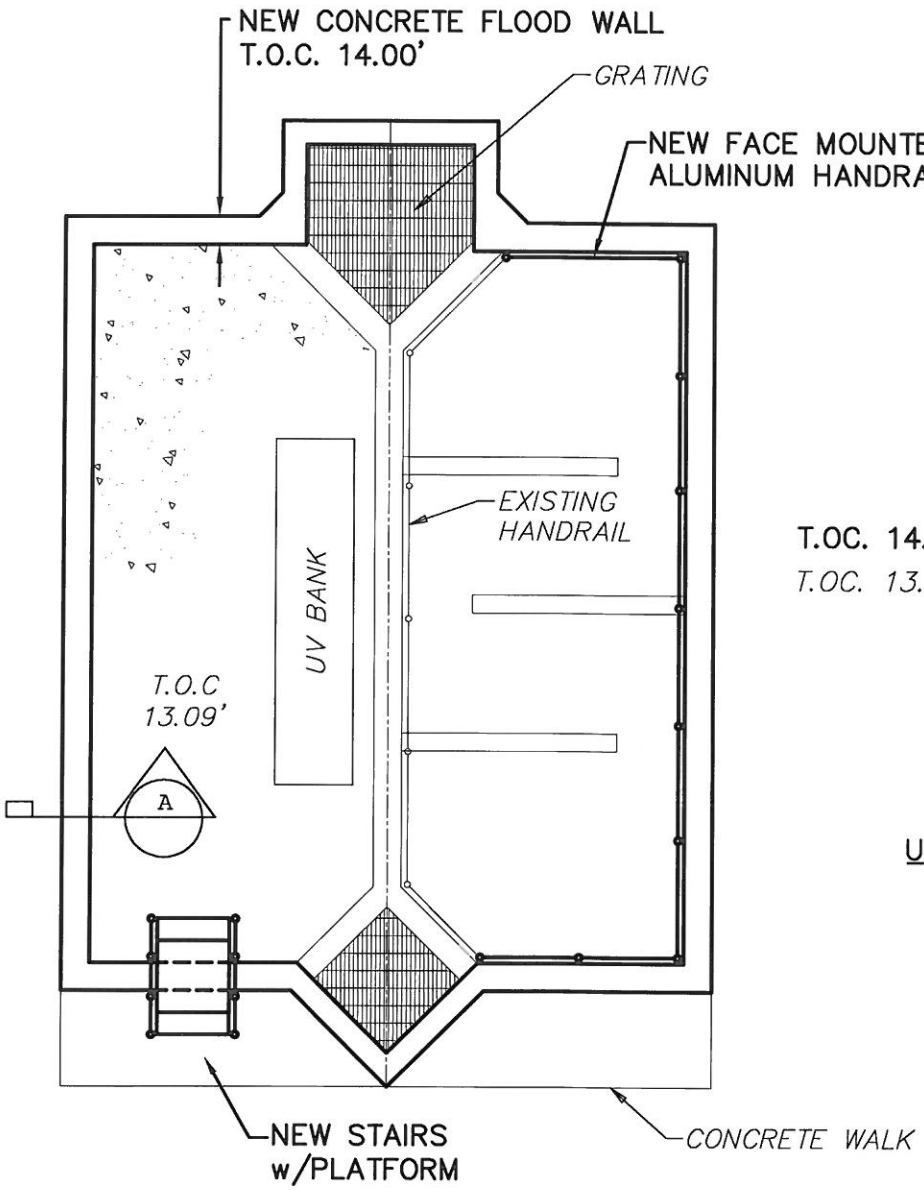
The estimated cost for this work is approximately $133,600.00. Table 2 provides a breakdown of these costs.

TABLE 2
ENGINEERING ESTIMATE
FLOOD BARRIERS FOR ULTRA-VIOLET DISINFECTION CHAMBER

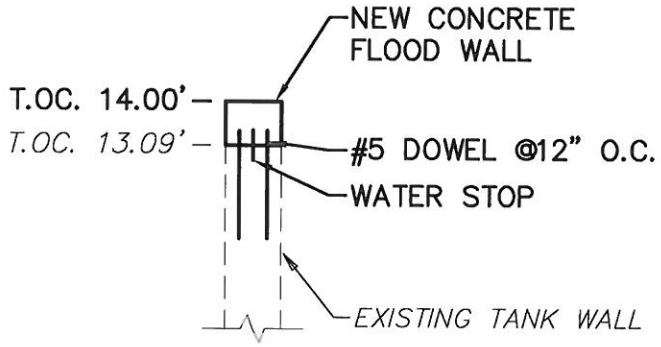
	Unit	Unit Cost	Cost
Form & Pour Floodwall	L.S.		$ 42,000.00
Aluminum Stairs & Platform	L.S.		15,000.00
Waterproof Floodwall	600 s.f.	$45.00	27,000.00
Relocation of the Hydraulic Controls	L.S.		15,000.00
Sub-Total			$ 99,000.00
Engineering (15%)			14,800.00
Contingencies (20%)			19,800.00
TOTAL			**$ 133,600.00**

Garages at the Process Building (Critical Component)

As in the case of the Water Street Pump Station, the finish floor of the garage at the Process Building is set at Elevation 11.18. This building has been classified as critical as the flooding of this area will introduce flood waters into the Water Street Pump station through the floor drains. The solution to the flooding of the garages is the same as described for the Water Street Pump Station. The installation of assembled aluminum stop logs will prevent the garage from flooding. The estimated cost for this is $52,600.00.



UV CHAMBER – PLAN
SCALE: 1/8"=1'–0"



UV CHAMBER – SECTION A
SCALE: 1/4"=1'–0"

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EAST GREENWICH WASTEWATER TREATMENT FACILITY AND COLLECTION SYSTEM
RESILIENCY PLAN
UV CHAMBER

FIG 5

Chopper Pump Vault (Critical Component)

As part of the 2004 Advanced Wastewater Treatment Upgrade, a below grade vault was installed to house a pair of chopper pumps and related controls. The vault is located adjacent to the Ultraviolet Disinfection Chamber. Access to the belowground vault is through a hatch located at grade (Elevation 12.45). The projected flood elevation for this area is Elevation 14.00.

The existing hatch is to be replaced with a heavy-duty watertight hatch that meets or exceeds the FEMA and NFIP Floodproofing Certification Standards. The hatch is to be designed with handles that are evenly spaced to distribute the load equally. The handle shall be provided with an O-ring seal to ensure a watertight closure. Figure 6 provides a typical detail for the hatch installation. The costs associated with the installation of a 30" x 30" watertight hatch is estimated to be $57,300.00.

Site

There are eight (8) sewer manholes, two (2) electric manholes, and one (1) telephone manhole that would be inundated by the 100-year flood. It is recommended that the existing covers be replaced with watertight covers and the brick risers be waterproofed. The estimated cost for each sewer manhole cover is ($2,700.00 x 8 = $21,600.00) and the cost for each electric manhole and telephone cover is ($4,700.00 x 3 = $14,100.00) for a total estimated cost of $35,700.

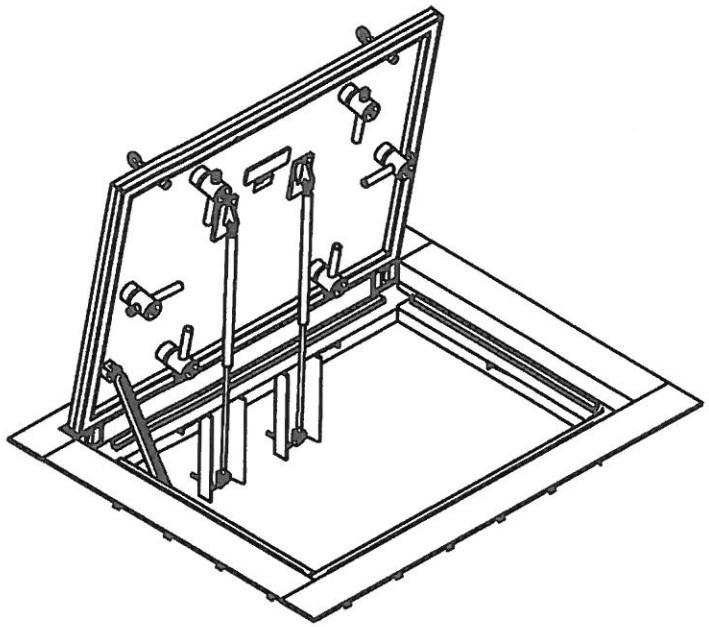
WASTEWATER COLLECTION SYSTEM

The Town of East Greenwich Wastewater Collection System consists of approximately 95,000 feet (17 miles) of sewer lines ranging in size from 6-inch to 30-inches (Figure 7). For the most part, the collection system is comprised of gravity sewers with the exception of the Sun Valley, Pinewood and Cedar Heights Pump Stations.

As part of this plan, we examined each of these stations to determine what impact the change in flood protection would have on the operations of each station. Our investigation found that Sun Valley and Pinewood Pump Stations are not within the 100-year flood zone and, therefore, does not require any corrective action.

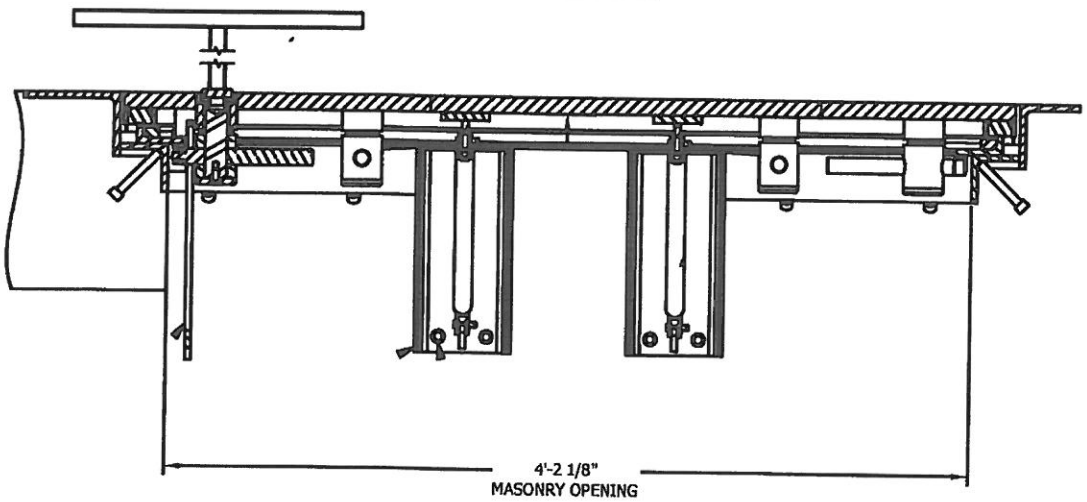
Cedar Heights Pump Station (Critical Component)

The Cedar Heights Pump Station is located on Hemlock Drive in the vicinity of 250 Hemlock Drive. The Maskerchugs Brook is located within the pump station site. The 100-year BFE (based on FEMA) is 62.00 and the critical component elevation is 65.00. The finish floor of the pump chamber is at Elevation 65.18 (0.18 feet above the required flood



WATERTIGHT HATCH

WATER SIDE



WATERTIGHT HATCH – SECTION

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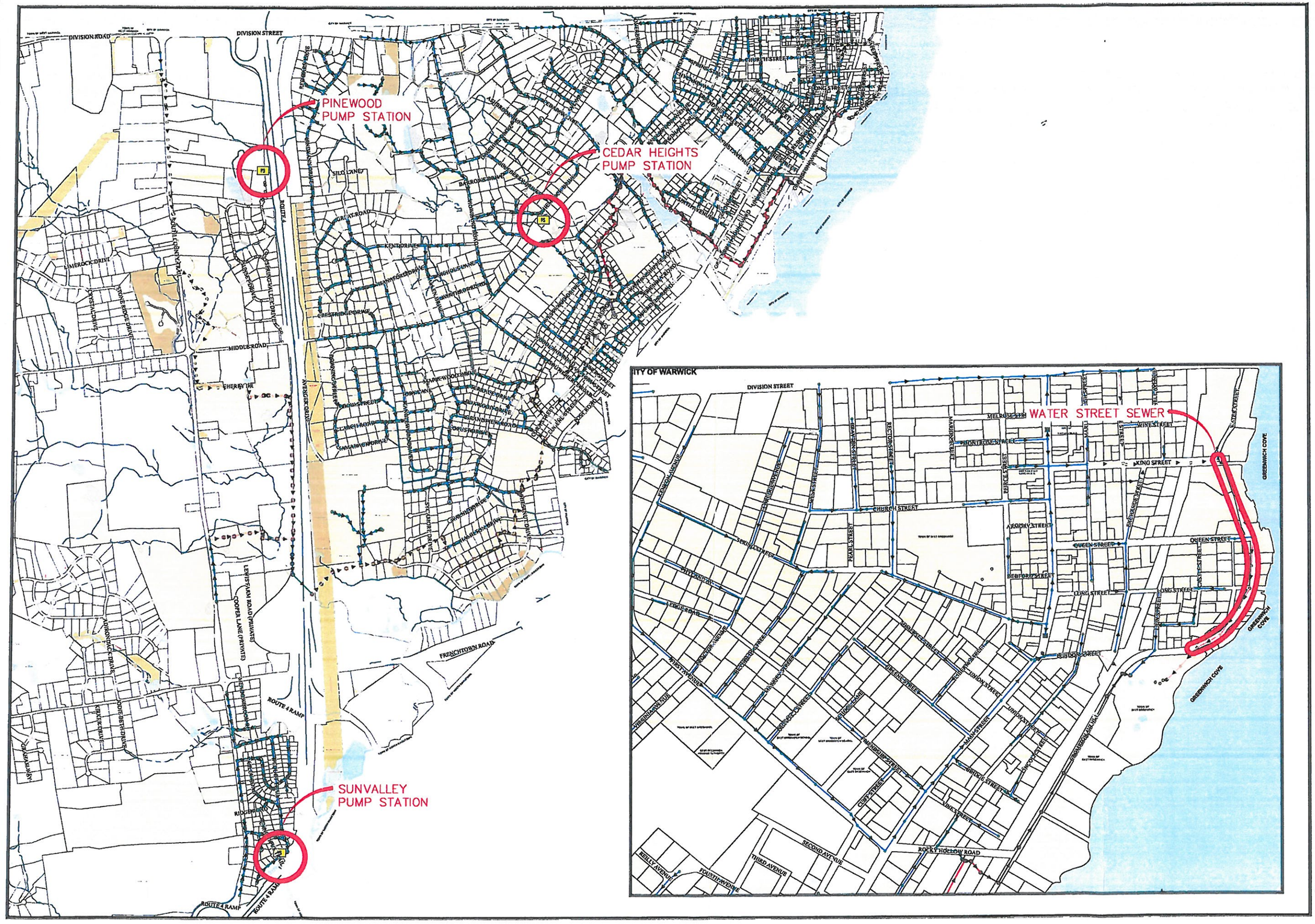
EAST GREENWICH WASTEWATER TREATMENT FACILITY AND COLLECTION SYSTEM
RESILIENCY PLAN
WATERTIGHT HATCHES

FIG 6



TOWN
OF
EAST GREENWICH
SEWER SYSTEM

N
W E
S

Legend

- PS Pump_Station
- **Sewer_Pipes**
  - <all other values>
- **Pipe_Diameter**
  - 16Inch_Pipe
  - 15Inch_Pipe
  - 10Inch_Pipe
  - 12Inch_Pipe
  - 18Inch_Pipe
  - 24Inch_Pipe
  - 27Inch_Pipe
  - 2Inch_Pipe
  - 4Inch_Pipe
  - 6Inch_Pipe
  - 8Inch_Pipe
- **Sewer_Manholes**
  - <all other values>
- **Interceptor**
  - Regular_MH
  - Interceptor_MH
  - Sewered Parcels
  - EasementPolygon

FIGURE 7

0 350 700 1,400
Feet

Print Date: June 1, 2018

These land boundary maps are prepared from deeds but are recorded with the town and other available general information; they are not prepared from actual field surveys. The dimensions shown are measurable records, but do not necessarily illustrate the true boundary locations.

protection elevation). A review of the plans indicates the generator and the electric enclosure are installed on a concrete slab at Elevation 65.18. All of the pump station components are above the critical elevation. The Cedar Heights Pump Station will not be affected by the 100-year flood.

Water Street Sewer Line (Critical Component)

The Water Street sewer line is located on Water Street, adjacent to Greenwich Cove. The 100-year flood elevation (based on FEMA) is 11.0. The critical component elevation is 14.0. In 2012, the existing sewer line was replaced with a new 12-inch sewer line from King St. to the Water Street Pump Station. The manhole covers that were installed on each sewer manhole are the watertight covers. Therefore, there are no additional flood barriers that are recommended for the Water Street sewer line.

SUMMARY

In accordance with this Resiliency Plan, the Town will begin to budget the cost for the corrective actions. The proposed corrective actions at the Wastewater Treatment Facility will cost approximately $350,900.00 (Table 3). As the plant makes improvements in these areas, consideration should be given to implementing these projects.

TABLE 3
SUMMARY OF COST

Water Street Pump Station	$	71,700.00
Ultraviolet Chamber		133,600.00
Garage Door at the Process Building		52,600.00
Chopper Pumps Vault Hatch		57,300.00
Site Improvements		35,700.00
TOTAL	**$**	**350,900.00**