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Rehoboth Beach Wastewater Treatment Plant

City of Rehoboth Beach

Force Main Alignment Study

December 2011

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

This Force Main Alignment Study *("Report"):*

1. *has been prepared by GHD Inc. ("GHD") for City of Rehoboth Beach, Delaware;*
2. *may only be used and relied on by City of Rehoboth Beach, Delaware;*
3. *must not be copied to, used by, or relied on by any person other than City of Rehoboth Beach, Delaware without the prior written consent of GHD;*
4. *may only be used for the purpose outlined.*

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Executive Summary

Two (2) alternative alignments were evaluated for constructing a force main pipeline from the Rehoboth Beach Wastewater Treatment Plant (WWTP) to the Deauville Beach parking area. From the Deauville Beach parking area the force main will connect to an ocean outfall, which will be evaluated in a separate document. The two (2) alternatives are as follows: (See Figure 1 in Appendix A)

- Alternative A: Force main from the WWTP, north along the Lewes – Rehoboth canal, crossing Rehoboth Avenue into Grove Park, turning northeast in the Henlopen Avenue right-of-way to Deauville Beach
- Alternative B: Force main from the WWTP, north along the Lewes – Rehoboth canal, turning northeast within the State Road right-of-way, crossing Rehoboth Avenue at Fifth Street, turning northeast in the Columbia Avenue right-of-way, crossing Surf Avenue to Deauville Beach

A preliminary opinion of capital costs was prepared for each alternative evaluated. Additional costs associated with annual operation and maintenance (O&M) for each alternative were also developed. Twenty-year present worth cost estimates were also developed for the alternatives. Capital and 20-year present worth costs are summarized in Table ES-1.

Table ES-1 Opinion of 20-Year Present Worth Cost Comparison

Description	**Alternative A: Force main via Canal Street to Henlopen Avenue 2012 ($)**	**Alternative B: Force main via State Road to Columbia Avenue 2012 ($)**
Capital Costs	$5,160,000	$5,320,000
20-year Present Worth and Operations and Maintenance Costs	$10,000	$10,000
Total	**$5,170,000**	**$5,330,000**

.

The advantages and disadvantages of each alternative are summarized below:

Alternative A

Advantages	Disadvantages
1. More cost effective to design and construct due to less existing utility congestion	1. Longer pipeline distance – 100’
2. Wider right-of-way in Henlopen Avenue for traffic control and minimal traffic on Canal Road	2. Additional historic evaluation
3. No commercial property along alignment to be impacted by construction activity	

Alternative B

Advantages	Disadvantages
1. Shorter pipeline distance – 100’	1. Design and construction of pipeline in the proximity of numerous existing utilities
	2. Columbia Avenue has a narrow right-of-way and is constructed of historic concrete that should not be demolished requiring additional Horizontal Directional Drilling (HDD)
	3. Commercial properties along alignment may be impacted with construction activity

The total project cost for the conveyance of treated effluent from the Rehoboth Beach WWTP to the connection point with the ocean outfall to be located in the parking area in Deauville Beach ranges from $4.5 to $5.6 million for the two alternatives.

Based on the advantages and disadvantages of each alternative and the opinion of probable cost for the project, Alternative A is recommended.

1. Introduction

1.1 Background

The City of Rehoboth Beach owns and operates the Rehoboth Beach Wastewater Treatment Plant (WWTP) located within the city limits on Bay Road. The facility treats wastewater from the City and surrounding areas of Henlopen Acres, Dewey Beach and North Shores and discharges the treated effluent to the Lewes - Rehoboth Canal. In 1993, the Delaware Department of Natural Resources and Environment Control (DNREC) issued a new National Pollutant Discharge Elimination System (NPDES) permit requiring Biological Nutrient Removal (BNR) at the WWTP. These upgrades were completed in two phases, in 1994 and 1997, to reduce the nitrogen and phosphorus discharge as required by the permit.

In 1998, a Total Maximum Daily Load (TMDL) was issued for the Indian River and the Rehoboth Bay requiring “all point source discharges which are currently discharging into the Indian River, Indian River Bay, and Rehoboth Bay and their tributaries shall be eliminated systematically.”

In 2005, the terms of a consent order, which addressed the TMDL were finalized and a revised discharge permit for the WWTP was issued. The consent order establishes a firm date of December 31, 2014 for the discharge to be eliminated from the Lewes-Rehoboth Canal and the new disposal method to be fully operational.

A study was completed in 2005, which evaluated four alternatives for the disposal of treated effluent:

- Land application
- Rapid infiltration beds
- Groundwater injection
- Ocean Outfall

Land application was eliminated after an extensive two year land search could not locate sufficient property to be used for the spray sites within a reasonable distance from the WWTP.

Rapid Infiltration Beds were eliminated due to potential problems with groundwater mounding and nitrogen migration to the Inland Bays.

Groundwater injection was eliminated due to regulator issues, cost and high level of risk associated with these technologies.

The Ocean Outfall was identified as the most cost-effective and technically feasible alternative.

A series of public meetings were held in 2007 to explain the results of the study and to solicit feedback. During this time several private utility companies contacted the City and expressed an interest in providing wastewater treatment and disposal service using land application. After completing a Request for Proposal (RFP) process, one proposal was received. This proposal was eliminated due to several issues, the most significant being:

- Uncertainty regarding future total cost.

- Only conceptual cost estimates for expansion of land application site.
- A user fee based on a guaranteed 2.0 million gallons per day (mgd).
- Unknown cost sharing terms and conditions.

Thus the Ocean Outfall method of disposal remained as the most feasible solution to removing the point source discharge from the Lewes-Rehoboth Canal. Additional details regarding this study can be found in the 2009 Rehoboth Beach Wastewater Treatment Plant Alternative Discharge Cost Evaluation.

1.2 Objectives

This report focuses on the evaluation of alternative alignments for constructing a force main from the WWTP to the Deauville Beach parking area. From this point, the force main will connect to the ocean portion of the outfall, which will flow to a diffuser approximately 6,000' offshore. The main objectives of this study are as follows:

1. Description of the alternate alignments to access the Deauville Beach parking area.
2. Determine cost to construct the alignments.
3. Present a planning level capital cost estimate, Operations and Maintenance (O&M) cost estimate and a Twenty-year present worth cost analysis for the above options.

2. Discussion of Alternatives

2.1 Introduction

Two alternatives (Alternatives A and B) to convey effluent from the Rehoboth Beach WWTP to Deauville Beach parking area property were investigated. Each alternative involves a pumping station and force main. The pumping station will be located at the site of the existing Rehoboth Beach WWTP. The pump station is not part of this report and will be evaluated in a separate facility plan.

Both alternatives will be constructed north approximately 3,640' from the WWTP, along Bay Road, running parallel to the Lewes – Rehoboth Canal. See Figure 1. The force main will proceed under the Highway One overpass to the intersection at State Road.

At this point, **Alternative A** will continue north approximately 860', passing to the west of the Park Place on the Canal property within an approximately 20' wide section of land at the top of the canal bank, within the Army Corps of Engineers jurisdiction. On the north side of the Park Place property, the pipeline will continue north approximately 700' within the Canal Street right-of-way to the Rehoboth Avenue intersection. The alignment will continue under Rehoboth Avenue, west of the Rehoboth Beach Museum into Grove Park turning northeast into Henlopen Avenue near the Grove Road intersection approximately 800'. The alignment will then remain within the Henlopen Avenue right-of-way for approximately 5,400' to the connection point with the ocean outfall section of the pipeline within the Deauville Beach parking area. Alternative A is approximately 11,400'.

Starting at the intersection of Bay Road and State Road, **Alternative B** will continue northeast along State Road approximately 2,260' to the intersection with Fifth Street. Turning north on Fifth Street approximately 800' under Rehoboth Avenue, the alignment will then turn northeast into Columbia Avenue. The alignment will proceed approximately 3,900' within the Columbia Avenue right-of-way to the intersection Surf Avenue. The alignment will continue north approximately 700' to the connection point with the ocean outfall section of the pipeline within the Deauville Beach parking area. Alternative B is approximately 11,300'.

2.2 Pump Station at Rehoboth Beach WWTP Site

The pumping station at the Rehoboth Beach WWTP will be designed to convey treated effluent to the diffuser point approximately 6,000' offshore of the Deauville Beach parking area, making the force main approximately 17,400'. Recently collected field data and preliminary modeling of the effluent plume indicate that a Y-type diffuser may not provide the most effective mixing of the effluent with ocean water. Because of the predominately linear, north/south current flows at the location of the diffuser, a Y-type configuration presents the potential for the two independent plumes to combine and thereby decrease the dilution. The diffuser design is being optimized as part of the modeling effort to characterize the near-field and far-field dilution. Several alternative designs are being considered, but it is anticipated that a straight line linear diffuser will provide the most effective mixing.

The water depth at the diffuser location is approximately 40'.

Photo 1 Fenceline West of WAS Holding Tanks

It is proposed to install the effluent pumps in the existing post aeration tanks of the WWTP (See Figure 2). The pumps will be vertical turbine pumps, and sized to pump from the minimum to the peak flow with the largest pump out of service. Design of the pump station will take place concurrently with the force main design.

2.3 Common Alignment between Alternatives A and B

The Rehoboth Beach WWTP was constructed on a former landfill. Due to the potential for settling of the soil on the WWTP site, all structures and yard piping must be installed on piles. To avoid the congested area of yard piping that exists in the access road on site, the alignment will be constructed along the fence line to the west of the Waste Activated Sludge (WAS) holding tanks and Diversion Tanks (See Figure 2). There is currently one (1) tree that has grown between the fence and the tanks that will be removed, Photo 1. Upon exiting the WWTP, piles to support the pipe are not anticipated to be required. Geotechnical testing along the alignment will be performed to determine the loading capacity of the soils. The alignment will be located within the pavement of Bay Road running north, parallel to the four existing force mains that flow into the WWTP. The alignment will remain in Bay Road right-of-way(R-O-W), under the Highway One overpass, Photo 2, to the intersection with State Road. This entire section is anticipated to be open cut construction.

Photo 2 Bay Road R-O-W Under Highway 1 Overpass

2.4 Alternative A: Force Main Routed along the Lewes – Rehoboth Canal and within the Henlopen Avenue Right-of-Way

Alternative A will continue running parallel to the Lewes – Rehoboth Canal within the Army Corps of Engineers right-of-way in the 20' wide area between the top of the canal bank and the Park Place on the Canal property.

Photo 3 Park Place on the Canal

As shown in Photo 3, small diameter evergreen trees are planted along the property line. In an effort to reduce the construction impact to the Park Place residents, HDD construction is anticipated in this section.

Photo 4 North of Park Place on the Canal Property

North of the Park Place property, Photo 4, the alignment will either return to the road right-of-way of Canal Street or remain in the Corps right-of-way, depending on the congestion of existing utilities.

The proposed force main will run parallel to the existing utilities and avoid any impacts to the existing trees along the road, Photo 5. The method of construction in this area will depend on the location of the existing utilities and trees.

Photo 5 Canal Street

To avoid traffic delays on Rehoboth Avenue, Photo 6, and potential damage to trees in Grove Park, it is anticipated that this section of the alignment would be installed by Horizontal Directional Drilling (HDD). This portion of the alignment is also in the Army Corps of Engineers right-of-way, running parallel to the Henlopen Acres force main just to the west of the Rehoboth Beach Museum. Upon entering Grove Park, Photo 7, the alignment turns northeast to continue to Henlopen Avenue. The HDD section from the north side of Grove Park to the south side of Park Place on the Canal is approximately 2,400'.

Photo 6 Canal Street - Rehoboth Avenue Intersection

Returning to open cut construction and staying within the Henlopen Avenue right-of-way, Photo 8, the alignment will run approximately 5,400' to the connection point with the ocean outfall section of the pipeline within the Deauville Beach parking area.

Photo 7 North of Rehoboth Beach Museum, Entering Grove Park

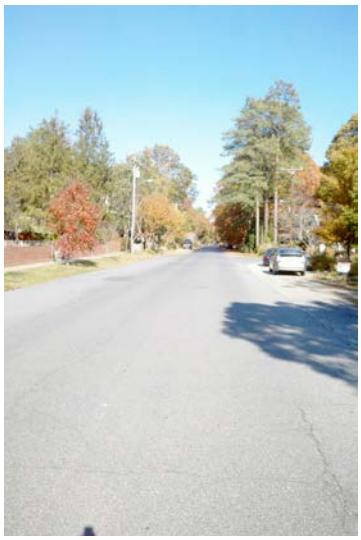

Photo 8 Henlopen Avenue Looking Northeast

Alternative A has multiple construction benefits, including:

- Less congestion with existing underground utilities
- Less bends in the alignment
- Henlopen Avenue is a wider right-of-way
- Less traffic on Canal Street and Henlopen Avenue

See Chapter 3 for detailed opinion of construction cost.

2.5 Alternative B: Force Main routed along State Road to Fifth Street to Columbia Avenue

Alternative B turns northeast staying within the State Road right-of-way and avoiding the numerous existing utilities, photo 9.

Photo 9 State Road Looking Northeast

Photo 10 Rehoboth Avenue / Fifth Street Intersection

This alignment will then turn north and will be installed by HDD under Rehoboth Avenue within the Fifth Street right-of-way, photo 10. The alignment will resume open cut construction and continue north to the intersection of Fifth Street and Columbia Avenue.

At the intersection, the alignment will turn northeast within the Columbia Avenue right-of-way. Columbia Avenue is constructed of historic concrete pavement. Because the roadway itself is likely to be eligible for listing to the National Register, it is anticipated that 3,900' of pipe construction would be installed by HDD.

Photo 11 Columbia Ave Looking Northeast

At the intersection with Surf Avenue, the alignment will continue north approximately 700' to the connection point with the ocean outfall section of the pipeline within the Deauville Beach parking area.

Alternative B has multiple disadvantages, including:

- Numerous existing underground utilities to avoid
- Additional bends in the alignment creating additional minor losses
- Historic concrete in Columbia Avenue disturbance
- Columbia Avenue is a narrow right-of-way
- Construction impact on the commercial zone possibly creating an negative economic impact
- Higher traffic on Columbia Avenue causing additional traffic delays
- Longer section of HDD required thereby increasing construction cost

See Chapter 3 for detailed opinion of construction cost.

2.6 Force Main Design Criteria

The determination of the force main size is primarily a function of the flow rate. The WWTP is designed for a maximum daily flow rate of 7.2 mgd. The proposed force main will be approximately 3.2 miles long and constructed with Polyvinyl chloride (PVC) and Fusible Polyvinyl chloride (FPVC). The PVC will be installed in the open cut construction areas and the FPVC for the HDD. PVC and FPVC have an estimated life span of 100 years. The force main has been sized to 24" nominal diameter for this study. During final design a more detailed analysis of the pipe size will be completed.

2.7 Historic Preservation Considerations

A desktop review and site visit has been performed by DNREC's Division of Parks and Recreation, Cultural Heritage Section. If Alternative A is selected, a limited archaeological survey is required along open cut portions of the alignment in the following areas:

- Behind Park Place on the Canal (approximately 600')
- Along Canal Street (approximately 600')
- In Grove Park (approximately 100')

The results of the limited archaeological survey, will allow DNREC to determine if further archaeological study is necessary. Soils testing will be required in the vicinity of the proposed drill pit located at Deauville Beach for either alternative to confirm that there are no intact Holocene period landscapes between the beach and the Pre-Holocene escarpment at the end of Surf Drive.

Due to the historic concrete pavement in Columbia Avenue, pipeline installation for Alternative B has been recommended by the Cultural Heritage Section to utilize HDD as a way of minimizing disturbance to this pavement.

Archaeological consulting firms have been contacted for proposals to conduct the background assessment of the soils and review the existing site information.

See Appendix B for Historic Preservation correspondence.

2.8 Environmental Considerations

A desktop review has been requested and performed by DNREC's Division of Fish and Wildlife and Division of Water Resources Wetlands Division. The Division of Fish and Wildlife has "no records of state-rare or federally listed plants, animals or natural communities within this portion of the alignment that would be impacted by this project."

The Division of Water Resources has no state regulated wetlands along the alignments but awaits confirmation from a field evaluation. The U.S. Army Corps of Engineers has requested the alignment be reviewed by an environmental consultant to confirm that the alignment does not cross any State-regulated subaqueous lands. An environmental consultant has evaluated the recommended alignment and found no Federal 404 wetlands along the proposed route.

See Appendix C for Environmental Review correspondence.

2.9 Floodplain Considerations

The Flood Insurance Rate Map (FIRM) 10005C0355J for Sussex County Delaware dated January 6, 2005 depicts approximately 2,000' of the proposed force main to be constructed in a Zone 'X' floodplain in the area of the WWTP and Bay Road accessing the facility on the southern end of the alignment. Zone X represents area that is outside of the 100-year flood but within the 500-year flood.

On the same FIRM, the northern end of the alignment in the area of the Deauville parking area, the proposed alignment is shown within Zone AE. This area is within the 100-year flood.

For both alternatives, the proposed construction of the underground pipline, all excess spoils will be trucked off-site to an approved spoils site located outside of the 100-year floodplain and will therefore not impact the floodplain.

See Appendix D for Flood Insurance Rate Maps.

2.10 Noise Considerations

After construction, there will not be any noise associated with the pipeline, regardless of which alignment is selected. During construction, there will be typical construction noises associated with trucks and excavation equipment. To mitigate these disturbances, construction activity is scheduled to take place during non-peak season times of the year and then only during normal business hours.

3. Engineer's Opinion of Costs

3.1 Introduction and Assumptions

Preliminary cost estimates were developed for the two alternatives alignments evaluated for the design and construction of the force main from the Rehoboth Beach WWTP to Deauville Beach parking area. Capital cost estimates, operations and maintenance (O&M) cost estimates and 20-year present worth analyses were developed for both alternatives. Capital cost estimates are shown in Section 3.2, operations and maintenance cost estimates are shown in Section 3.3 and 20-year present worth analyses are shown in Section 3.4.

For preparation of capital cost estimates the following criteria were used:

- For Alternatives A & B, a 30 percent contingency was included with all construction costs.
- All costs are presented in 2011 US dollars. The construction cost estimate will be updated prior to bidding to reflect the impact of inflation and observation of bid prices on similar size projects in the area.
- Contractor general conditions were assumed to be 10 percent of the construction subtotal.
- Contractor overhead costs were assumed to be 10 percent of the construction subtotal.
- Contractor profit was assumed to be 10 percent of the construction subtotal.
- Project costs associated with administration, legal, engineering and construction management services was accounted for in a 25 percent adder to the total construction cost.
- Cost for dewatering during construction due to high groundwater was not included for any cost alternative.
- Contingency of 30% added to capital cost.

Table 1 summarizes the unit prices that were used for determining the capital cost estimates from calculated material quantities. Table 2 summarizes the installed force main unit costs used for Alternatives A and B.

Table 1 Construction Unit Price Estimates

Element	Unit Cost
Trench Excavation	$ 6.75/CY
Backfill & Compacting	$ 55/CY
Hauling	$ 4/CY
Bedding	$ 26.75/CY

Table 2 Force Main Unit Costs, Alternatives A and B

Element	Unit Cost
24-in PVC, Open cut, No Pavement	$125/LF
24-in PVC, Open cut, Pavement	$150/LF
24-in FPVC, Horz. Directional Drill	$300/LF
Air Release Valves & Vaults	$30,000/Each
Traffic Control	$1,500/Day
Daily Production, Open cut	200'/Day
Daily Production, Directional Drill	100'/Day

For preparation of the present worth costs the following criteria were used:

- All equipment was assumed to be online and operating by 2012 for both Alternatives.
- The duration of the present worth analysis used is 20 years, which equates to an end year of 2032.
- The interest rate for present worth calculations was assumed to be 3 percent and the discount rate was assumed to be 6 percent.

3.2 Capital Costs

Opinion of capital costs for both alternatives is summarized on Table 3.

Table 3 Opinion of Capital Costs

Description	Alternative A: Force main via Canal Street to Henlopen Avenue 2012 ($)	Alternative B: Force main via State Road to Columbia Avenue 2012 ($)
Open Cut 24" Force main from WWTP to State Road Intersection	$1,100,000	$1,100,000
Combination Open Cut & Horz. Directional Drill 24" Force main from State Road Intersection to Deauville Beach	$2,230,000	$2,330,000
Subtotal	**$3,330,000**	**$3,430,000**
Contingency (30%)	$1,000,000	$1,030,000
Legal, Administration, Planning and Engineering (25%)	$830,000	$860,000
Estimated Project Cost	**$5,160,000**	**$5,320,000**

See Appendix E for Engineer's Opinion of Probable Construction Cost.

3.3 Operations and Maintenance Opinion of Costs

Operations and maintenance opinion of costs for both alternatives are summarized in Table 4.

Table 4 Opinion of Operations and Maintenance Costs

Description	Alternative A: Force main via Canal Street to Henlopen Ave 2012 ($)[1]	Alternative B: Force main via State Road to Columbia Ave 2012 ($)[1]
Annual Operations Cost [2]	$ -	$ -
Annual Maintenance Cost	$500	$500
Total	**$500**	**$500**

Notes:
1. The Maintenance Cost is based on the quarterly inspection of the force main by public works.
2. Operating costs are associated with the pump station that is not included in this analysis.

3.4 Twenty-year Present Worth Life Cycle Cost Estimates

20-year present worth costs for both alternatives are summarized in Table 5.

Table 5 Opinion of 20-year Present Worth Costs

Description	Alternative A: Force main via Canal Street to Henlopen Ave 2012 ($)	Alternative B: Force main via State Road to Columbia Ave 2012 ($)
Capital Costs	$5,160,000	$5,320,000
20-year PW O&M Costs	$10,000	$10,000
Total	**$5,170,000**	**$5,330,000**

3.5 Summary of Opinion of Costs

Alternative A, is the more economical of the two options.

4. Conclusions

The conclusions for the Rehoboth Beach WWTP force main evaluation are based on the force main alternatives discussed in Chapter 2.

4.1 Alternatives A and B: Force Main from WWTP to Deauville Beach

Two (2) routing alternatives were presented for the force main. Both alternatives will follow the same alignment for the first 3,640' from the WWTP, to the intersection of State Road and Bay Road.

Alternative A, continues to run parallel to the Lewes – Rehoboth Canal, crosses Rehoboth Avenue into Grove Park and follows Henlopen Avenue to the Deauville Beach parking area.

Alternative B will proceed northeast in State Road, cross Rehoboth Avenue and go north on Fifth Street, turn northeast on Columbia Avenue, cross Surf Avenue to the Deauville Beach parking area.

4.2 Conclusion

The advantages and disadvantages of each alternative are summarized below:

Alternative A

Advantages	**Disadvantages**
1. More cost effective to design and construct due to less existing utility congestion	1. Longer pipeline distance – 100'
2. Wider right-of-way in Henlopen Avenue for traffic control and minimal traffic on Canal Road	2. Additional historic evaluation
3. No commercial property along alignment to impact	

Alternative B

Advantages	**Disadvantages**
1. Shorter pipeline distance – 100'	1. Design and construction of pipeline in the proximity of numerous existing utilities
	2. Columbia Avenue has a narrow right-of-way and is constructed of historic concrete that should not be demolished requiring additional HDD
	3. Many commercial properties to impact with construction

Based on the advantages and disadvantages of each alternative and the opinion of probable cost for the project, Alternative A is recommended.

Appendix A

Force Main Alignment Figures 1 & 2

Legend

Outfall Pipe — Force Main Alternative A — Force Main Alternative B

Paper Size ANSI B

0 230 460 920 1,380 1,840

Feet

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Delaware FIPS 0700 Feet

N

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City of Rehoboth Beach
Ocean Outfall Project

Forcemain Alignment Alternatives

Job Number	86-14327
Revision	D
Date	September 27, 2011

Figure 1

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16701 Melford Blvd Ste 330 Bowie MD 20715 USA **T** 240 206 6810 **F** 240 206 6811 **E** bowmail@ghd.com **W** www.ghd.com

Legend

Force Main

Paper Size ANSI A

0 0.0035 0.007 0.014 0.021 0.028

Miles

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Delaware FIPS 0700 Feet

N

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City of Rehoboth Beach
Ocean Outfall Project

Job Number 86-14327
Revision A
Date August 2, 2011

Proposed Pump Station Location

Figure 2

16701 Melford Blvd Ste 330 Bowie MD 20715 USA T 240 206 6810 F 240 206 6811 E bowmail@ghd.com W www.ghd.com

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Appendix B

Historic Preservation Correspondence

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May 9, 2011

DNREC, Division of Parks and Recreation
Cultural Heritage Section
152 S. State Street
Dover, DE 19901

Attn: Ms. Cherie Clark

Re: Forcemain Alignment Study
Rehoboth Beach Wastewater Treatment
Ocean Outfall
GHD No. 8614327.5

Dear Ms. Clark:

In reviewing the minutes from the July 22, 2010 JPPM Meeting, this project which consists of the pump station located at the Rehoboth Beach Wastewater Treatment Plant (RBWWTP), the force main leading from the RBWWTP to the beach, and the ocean outfall which runs from the beach to approximately 6,000' offshore will be funded through the DNREC Revolving Fund.

Per our phone conversation today, please find attached the proposed force main alignment leading from the existing Rehoboth Beach Wastewater Treatment Plant to the ocean outfall at Deauville Beach. There is also an aerial photo of the Deauville Beach Park that you requested. I have highlighted in orange the alignment that is currently favoured. This alignment would cross over Rehoboth Avenue at Canal Street and pass between the Rehoboth Beach Museum and edge of the canal via directional drilling. The force main would then proceed through the park and northeast within the right-of-way of Henlopen Avenue to Deauville Beach Park.

The second alignment alternative would cross Rehoboth Avenue at 5th Street and proceed northeast on Columbia Avenue. This alternative is currently less favoured due to the higher congestion of traffic and utilities as well as the narrower right-of-way of Columbia Avenue.

I look forward to meeting with you on May 20, 2011 at the Deauville Beach parking lot at 10:00 a.m. to discuss this project. Please feel free to contact me on my cell phone at (410) 310-2173.

Sincerely,

GHD INC.

Lee W. Mayer, P.E.
Project Engineer

LWM/kab

Attachments

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May 9, 2011

DHCA, Historical Preservation
21 The Green
Dover, DE 19901

Attn: Mr. Craig Lukezic

Re: Forcemain Alignment Study
Rehoboth Beach Wastewater Treatment Plant
Ocean Outfall
GHD No. 8614327.6

Dear Mr. Lukezic:

Per our phone conversation today, please find attached the proposed force main alignment leading from the existing Rehoboth Beach Wastewater Treatment Plant to the ocean outfall at Deauville Beach. I have highlighted in orange the alignment that is currently favoured. This alignment would cross over Rehoboth Avenue at Canal Street and pass between the Rehoboth Beach Museum and edge of the canal via directional drilling. The force main would then proceed through the park and northeast within the right-of-way of Henlopen Avenue to Deauville Beach Park.

The second alignment alternative would cross Rehoboth Avenue at 5th Street and proceed northeast on Columbia Avenue. This alternative is currently less favoured due to the higher congestion of traffic and utilities as well as the narrower right-of-way of Columbia Avenue.

I look forward to meeting with you on May 20, 2011 at the Deauville Beach parking lot at 10:00 a.m. to discuss this project. Please feel free to contact me on my cell phone at (410) 310-2173.

Sincerely,

GHD INC.

Lee W. Mayer, P.E.
Project Engineer

LWM/kab

Attachments

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State of Delaware
Department of Natural Resources and Environmental Control
Delaware Division of Parks and Recreation
89 Kings Highway
Dover, Delaware 19901

November 4, 2011

RE: City of Rehoboth Beach Wastewater Treatment Plant Ocean Outfall Project
(Draft EIS)

Greg Pope
Project Engineer
DNREC Office of the Secretary
5 East Reed, Suite 200
Dover DE 19901

Dear Mr. Pope:

I have reviewed the Rehoboth Beach Ocean Outfall Project Draft Environmental Impact Statement under the provisions of Section 106 of the National Historic Preservation Act (amended 1966) and in coordination with the Delaware State Historic Preservation Office. It is my conclusion that the Ocean Outfall project is an undertaking for Section 106 review that has the potential to affect historic properties in limited areas of force main construction on land and offshore.

The City of Rehoboth Beach developed from a farm to a resort community in the late 19th century in a setting that has been occupied over time by Native American, Afro-American and European settlers. Though historic buildings will not be affected by this project, Columbia Avenue is an historic concrete road which may be a contributing element to the 1937 modern subdivision of Henlopen Acres. Therefore, additional evaluation and measures to avoid open cut construction in Columbia Avenue are recommended for this force main option.

In addition, the Lewes and Rehoboth Canal is an historic structure which was completed through Rehoboth by the mid-1920's. Thus, there is a potential that spoil from construction may overlie the banks of the canal and protect a buried historic landscape in this vicinity. Potential archaeological sites may include both historic and Native American sites. It is expected that limited archaeological survey will be necessary in areas of open cut force main construction, including the area at Deauville Beach, that are outside of the street layout. For open cut construction within the street layout on Henlopen Avenue no archaeological survey is recommended because buried utilities from storm water, sewer and lateral connections have

widely disturbed the underlying soil stratigraphy. Thus, Alternative A, the force Main Route along the Lewes Rehoboth Canal and within Henlopen Avenue is the preferred alternative.

Provisions for underwater survey offshore from Rehoboth Beach were addressed in the EIS (Appendix K). An archaeological remote sensing survey of the two proposed pipeline routes was conducted by Tidewater Atlantic Research. One target area with potentially significant cultural resources was identified near the end of the alignment trending SSE. This anomaly would require additional underwater survey to conclude that it is historic. No significant anomalies were associated with the alignment trending due east from Rehoboth Beach. It is my conclusion therefore, that the EAST trending route will have the least impact on cultural resources.

Please contact me at (302) 739-9184 or Cherie.Clark@state.de.us if there are any questions about this review.

Sincerely,

Cherie Clark

Cherie Clark
Cultural Preservation Specialist

CC: Maureen Wingate, Project Engineer, GHD
Jeff Riling, Engineer, GHD
Craig Lukezic, Delaware State Historic Preservation Office

Appendix C

Environmental Review Correspondence

CLIENTS | PEOPLE | PERFORMANCE

May 10, 2011

Environmental Review/Information Request
Delaware Natural Heritage Program
Division of Fish and Wildlife
4876 Hay Point Landing Road
Smyrna, DE 19977

Re: Forcemain Alignment Study
Rehoboth Beach Wastewater Treatment
Ocean Outfall
GHD No. 8614327.5

Dear Sir:

Please find attached the proposed force main alignment leading from the existing Rehoboth Beach Wastewater Treatment Plant to the ocean outfall at Deauville Beach. The proposed 24" diameter force main is anticipated to be constructed using a combination of open cut and directional drilling construction. I have highlighted in orange the alignment that is currently favoured. This alignment would cross over Rehoboth Avenue at Canal Street and pass between the Rehoboth Beach Museum and edge of the canal via directional drilling. The force main would then proceed through the park and northeast within the right-of-way of Henlopen Avenue to Deauville Beach Park.

The second alignment alternative would cross Rehoboth Avenue at 5th Street and proceed northeast on Columbia Avenue. This alternative is currently less favoured due to the higher congestion of traffic and utilities as well as the narrower right-of-way of Columbia Avenue.

I would appreciate it if you could review the alignments and notify me of any areas that will impact the project. Please feel free to contact me if you have any questions. My direct phone number is: 240-206-6833.

Sincerely,

GHD INC.

Lee W. Mayer, P.E.
Project Engineer

LWM/kab

Attachments

G:\86\14327\Task 7 - Force Main Alignment Study\WP\Letters\2011.5.10 ltr to Endangered Species.docx

GHD Inc.
16701 Melford Boulevard Suite 330 Bowie MD 20715 USA
T 1 240 206 6810 F 1 240 206 6811 E bowmail@ghd.com W www.ghd.com

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
& ENVIRONMENTAL CONTROL
DIVISION OF FISH & WILDLIFE
NATURAL HERITAGE AND ENDANGERED SPECIES PROGRAM
4876 Hay Point Landing Road
Smyrna, Delaware 19977
Phone: 302-735-8651

May 23, 2011
(Request received May 13, 2011)

Lee W. Mayer
GHD
16701 Melford Blvd, Suite 330
Bowie, MD 20715

RE: Force main alignment from existing Rehoboth Beach Wastewater Treatment Plant to proposed ocean outfall at Deauville Beach, Rehoboth Beach, DE

Dear Mr. Mayer:

Thank you for contacting the Natural Heritage and Endangered Species program about information on rare, threatened and endangered species, unique natural communities, and other significant natural resources as they relate to the above referenced project.

There are currently no records of state-rare or federally listed plants, animals or natural communities within this portion of the alignment that would be impacted by this project. The majority of the alignment occurs along existing roadways. There are no plans to cross the canal for this segment of the project and construction in close proximity to the canal will be via directional drill. Because the directional drilling will be conducted at the edge of the canal, we recommend a frac-out contingency plan be in place prior to the start of project activities. The contingency plan should include the following:

1) A provision to contain materials released,
2) A clean-up protocol, and
3) Arrangements for an experienced representative (drilling crew or consultant) to watch the site at all times so that the operation can be shut down immediately in the event a frac-out occurs.

We are continually updating records on Delaware's rare, threatened and endangered species, unique natural communities and other significant natural resources. If the start of the project is delayed more than a year past the date of this letter, please contact us again for the latest information. If you have any questions, please contact me at (302) 735-8654 or Edna.Stetzar@state.de.us.

Sincerely,
Edna J. Stetzar
Edna J. Stetzar
Environmental Scientist III

Delaware's good nature depends on you!

GHD 2011 Rehoboth Outfall-force main from facilities to beach

CLIENTS|PEOPLE|PERFORMANCE

May 10, 2011

DNREC, Division of Water Resources
Wetlands Section
89 Kings Highway
Dover, DE 19901

Attn: Ms. Laura Herr

Re: Forcemain Alignment Study
Rehoboth Beach Wastewater Treatment
Ocean Outfall
GHD No. 8614327.5

Dear Ms. Herr:

Per our phone conversation today, please find attached the proposed force main alignment leading from the existing Rehoboth Beach Wastewater Treatment Plant to the ocean outfall at Deauville Beach. I have highlighted in orange the alignment that is currently favoured. This alignment would cross over Rehoboth Avenue at Canal Street and pass between the Rehoboth Beach Museum and edge of the canal via directional drilling. The force main would then proceed through the park and northeast within the right-of-way of Henlopen Avenue to Deauville Beach Park.

The second alignment alternative would cross Rehoboth Avenue at 5th Street and proceed northeast on Columbia Avenue. This alternative is currently less favoured due to the higher congestion of traffic and utilities as well as the narrower right-of-way of Columbia Avenue.

I would appreciate it if you could review the alignments and notify me of any areas that will impact the project. Please feel free to contact me if you have any questions. My direct phone number is: 240-206-6833.

Sincerely,

GHD INC.

Lee W. Mayer, P.E.
Project Engineer

LWM/kab

Attachments

G:\86\14327\Task 7 - Force Main Alignment Study\WP\Letters\2011.5.10 ltr to Laura Herr.docx

GHD Inc.
16701 Melford Boulevard Suite 330 Bowie MD 20715 USA
T 1 240 206 6810 F 1 240 206 6811 E bowmail@ghd.com W www.ghd.com

RE: Rehoboth Beach Force Main Alignment for Ocean Outfall at Deauville Beach
Herr Laura M. (DNREC)
to:
'Lee.Mayer@ghd.com'
06/21/2011 08:26 AM
Show Details

Repository: 861432706 "Rehoboth Beach: Force Main Alignment Study TO7"

There were no State-regulated wetlands along the alignment.

However, we await the Corps JD to determine whether there may be State-regulated subaqueous lands - i.e. any crossing of tidal or non-tidal streams, ditches or other waterways - in the path of the alignment.

From: Lee.Mayer@ghd.com [mailto:Lee.Mayer@ghd.com]
Sent: Tuesday, June 21, 2011 8:18 AM
To: Herr Laura M. (DNREC)
Subject: Rehoboth Beach Force Main Alignment for Ocean Outfall at Deauville Beach

Dear Ms. Herr:
During the JPPM meeting last Thursday, I believe you mentioned that you did not find any wetlands impacting the proposed alignments from your desktop review. I would appreciate it if you could send me a letter with your findings that I can attach in my Alignment Study. Attached is a revised exhibit that I drafted after the meeting dated June 16, 2011 for your reference.

I have contacted two private environmental consultants to get a competitive bid for a field review of the alignment per the request from Mr. John Brundage. I will let you know when we are planning on meeting in the field if you wish to attend.

Regards,

Lee W. Mayer, P.E.
Project Engineer

GHD
T: 1 240 206 6833 | V: 866833 | F: 240 206 6811 | E: lee.mayer@ghd.com
16701 Melford Boulevard Suite 330 Bowie Maryland 20715 USA | www.ghd.com

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

This e-mail has been scanned for viruses by MessageLabs.

COASTAL & ESTUARINE RESEARCH, INC.
Marine Studies Complex
P.O. Box 674
Lewes, Delaware 19958
302-645-9610

October 20, 2011

John Brundage
U.S. Army Corps of Engineers
1203 College Park Drive, Suite 103
Dover, DE 19904

RE: Rehoboth Beach Ocean Outfall Project Force Main Alignment, Rehoboth Beach, Sussex County, Delaware

Dear John:

Enclosed for your review and verification is a Federal 404 Wetland Jurisdictional Determination Report submitted on behalf of the City of Rehoboth Beach (applicant) for the proposed Rehoboth Beach Ocean Outfall Project Force Main Alignment, Rehoboth Beach, Sussex County, Delaware. Also enclosed is the Preliminary Jurisdictional Determination Form.

The proposed force main alignment extends from the Rehoboth Beach Wastewater Treatment Plant (adjacent to the Lewes and Rehoboth Canal) northward along Roosevelt Street, State Road, Canal Street, and Henlopen Avenue, to Deauville Beach (Atlantic Ocean), a distance of 10,850± linear feet (see Figure 3 in the report for location). The project site consists primarily of developed, residential lands, and will involve installation of a 24" diameter force main, to be installed by open-cut trench excavation (6' width x 6' depth) and backfill, and directional boring. It is my understanding that Lee Mayer, P.E., GHD has already discussed the proposed project with you.

Based on qualitative observations along the entire proposed project alignment and detailed investigations of vegetation, soils, and hydrology at four sampling sites, there are no Federal 404 wetlands along the proposed route of the Rehoboth Beach force main alignment. This is supported by the National Wetlands Inventory Map, which shows that there are no wetlands present along the alignment.

I would like to request written verification of the determination. Please feel free to contact me if you have any questions, if you require additional information, or if you would like to schedule a site inspection.

Sincerely,

Evelyn M. Maurmeyer, Ph. D.

Enclosures

cc: Lee W. Mayer, P.E., GHD

COASTAL & ESTUARINE RESEARCH, INC.
Marine Studies Complex
P.O. Box 674
Lewes, Delaware 19958
302-645-9610

October 20, 2011

Laura Herr
Wetlands and Subaqueous Lands Section, DNREC
89 Kings Highway
Dover, DE 19901

RE: Rehoboth Beach Ocean Outfall Project Force Main Alignment, Rehoboth Beach, Sussex County, Delaware

Dear Laura:

Enclosed for your files is a copy of the Federal 404 Wetland Jurisdictional Determination Report for the proposed Rehoboth Beach Ocean Outfall Project Force Main Alignment, Rehoboth Beach, Sussex County, Delaware, which I have submitted to John Brundage, US Army Corps of Engineers, for review and written verification.

The proposed force main alignment extends from the Rehoboth Beach Wastewater Treatment Plant (adjacent to the Lewes and Rehoboth Canal) northward along Roosevelt Street, State Road, Canal Street, and Henlopen Avenue, to Deauville Beach (Atlantic Ocean), a distance of 10,850± linear feet (see Figure 3 in the report for location). The project site consists primarily of developed, residential lands, and will involve installation of a 24" diameter force main, to be installed by open-cut trench excavation (6' width x 6' depth) and backfill, and directional boring. Based on qualitative observations along the entire proposed project alignment and detailed investigations of vegetation, soils, and hydrology at four sampling sites, there are no Federal 404 wetlands along the proposed route. This is supported by the National Wetlands Inventory Map, which shows that there are no wetlands present along the proposed route.

It is my understanding that Lee W. Mayer, P.E., GHD, Inc. has already discussed the proposed project with you, and that you have confirmed to him that there are no DNREC-regulated wetlands along the alignment.

Sincerely,

Evelyn M. Maurmeyer, Ph. D.

Enclosure

cc: Lee W. Mayer, P.E., GHD, Inc.

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): ____

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:

____ Evelyn Maurmeyer, CER, Inc., PO Box 674, Lewes DE 19958 (agent)

____ Applicant: City of Rehoboth Beach, PO BOX 1163, 229 Rehoboth Ave. Rehoboth Beach DE 19971

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: CENAP-OP-R-____

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: ____
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: DE County: Sussex City: Rehoboth Beach

Center coordinates of site (lat/long in degree decimal format):

Lat. ____° N, Long. ____° W

Universal Transverse Mercator: — m Easting (x) — m Northing (y)

Name of nearest waterbody: Lewes and Rehoboth Canal; Atlantic Ocean.

Identify (estimate) amount of waters in the review area:

Non-wetland waters: 0 linear feet: — width (ft) and/or — acres.

Cowardin Class: —

Stream Flow: —

Wetlands: 0 acres.

Cowardin Class: —

Name of any water bodies on the site that have been identified as Section 10 waters:

Tidal: N/A

Non-Tidal: "

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination. Date: ____

☐ Field Determination. Date(s): ____

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.
This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA: **Data reviewed for preliminary JD** (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

- [x] Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: _____
- [x] Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - [ ] Office concurs with data sheets/delineation report. _____
  - [ ] Office does not concur with data sheets/delineation report.
- [ ] Data sheets prepared by the Corps: _____.
- [ ] Corps navigable waters' study: _____.
- [ ] U.S. Geological Survey Hydrologic Atlas: _____.
  - [ ] USGS NHD data.
  - [x] USGS 8 and 12 digit HUC maps.
- [x] U.S. Geological Survey map(s). Cite scale & quad name: Rehoboth Beach, DE
- [x] USDA Natural Resources Conservation Service Soil Survey. Citation: Web Soil Survey
- [x] National wetlands inventory map(s). Cite name: Rehoboth Beach DE
- [ ] State/Local wetland inventory map(s): _____.
- [ ] FEMA/FIRM maps: _____.
- [ ] 100-year Floodplain Elevation is: _____(National Geodetic Vertical Datum of 1929)
- [x] Photographs:
  - [x] Aerial (Name & Date): 2011. (figure 3)
  - [x] Other (Name & Date): Ground level, Oct. 2011
- [ ] Previous determination(s). File no. and date of response letter: _____.
- [ ] Other information (please specify): _____.

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

_____
Signature and date of
Regulatory Project Manager
(REQUIRED)

Todd Mammoser 10/13/11
Signature and date of
person requesting preliminary JD
(REQUIRED, unless obtaining the signature
is impracticable)

COASTAL & ESTUARINE RESEARCH, INC.
Marine Studies Complex
P.O. Box 674
Lewes, Delaware 19958
302-645-9610

FEDERAL 404 WETLAND JURISDICTIONAL DETERMINATION REPORT

Applicant

City of Rehoboth Beach
PO Box 1163
229 Rehoboth Avenue
Rehoboth Beach, DE 19971

Project Site

Rehoboth Beach Ocean Outfall Project Force Main Alignment
Rehoboth Beach Wastewater Treatment Plant to
Deauville Beach (Atlantic Ocean), 10,850± linear feet
Rehoboth Beach, Sussex County, Delaware

October, 2011

COASTAL & ESTUARINE RESEARCH, INC.
Marine Studies Complex
P.O. Box 674
Lewes. Delaware 19958
302-645-9610

October, 2011

FEDERAL 404 WETLAND JURISDICTIONAL DETERMINATION: REHOBOTH BEACH OCEAN OUTFALL FORCE MAIN ALIGNMENT STUDY, REHOBOTH BEACH, SUSSEX COUNTY, DELAWARE

Applicant

City of Rehoboth Beach
PO Box 1163
229 Rehoboth Avenue
Rehoboth Beach, DE 19971

Site Location and Project Description

1. The project site is the Rehoboth Beach Ocean Outfall Project Force Main Alignment, located in Rehoboth Beach, Sussex County, Delaware (see Figures 1 and 2 for location maps).

2. The proposed project will extend from the Rehoboth Beach Wastewater Treatment Plant (adjacent to the Lewes and Rehoboth Canal), northward along Roosevelt Street, Canal Street, State Road, and Henlopen Avenue, to Deauville Beach (Atlantic Ocean), a distance of 10,850± linear feet. See Figure 2 for USGS topographic map, Rehoboth Beach, Delaware quadrangle; and Figure 3 for aerial photograph showing location of proposed alignment.

3. The project site consists primarily of developed, residential lands. See Figures 4a to 4j for representative ground-level photographs.

4. The proposed project will involve installation of a 24" diameter force main, to be installed by open-cut trench excavation (6' width x 6' depth) and backfill, and directional boring.

National Wetlands Inventory Map

The National Wetlands Inventory Map (GoogleEarth® aerial photograph overlay) of the project site and vicinity is shown in Figure 5. There are no Federal 404 wetlands mapped along the proposed force main alignment.

Soils

The USDA Web Soil Survey of site and vicinity is shown in Figure 6, with a listing of map unit names on Table 1. Soils mapped in the proposed force main alignment (from south to north) are UfB (Udorthdents, refuse substratum, 0 to 35 percent slopes); BuA (Brockatonorton-Urban land complex, 0 to 2 percent slopes); GuB (Greenwich-Urban land complex, 0 to 5 percent slopes); AsA (Askecksy loamy sand, 0 to 2 percent slopes); and AbC (Acquango-Beaches complex, 0 to 10 percent slopes).

Hydrology

Delaware Environmental Observing System (DEOS) precipitation data for Rehoboth Beach, Delaware for the month of September, 2011 (the month preceding this investigation) was 1.78" (see Table 2). Delaware Geological Survey Sussex County Hydrologic Conditions for September, 2011 are presented in Table 3. Precipitation in Rehoboth Beach for the 6-month period (April-September, 2011) was 4.87" below normal, and 3.39" below normal for the 5-month period (May-September, 2011) preceding this investigation. Thus, hydrologic conditions were drier than normal at the time of this study.

Field Investigations

1. Methodology. The entire length of the proposed force main alignment was examined on October 3, 2011 for a qualitative assessment of presence or absence of Federal 404 wetlands. Detailed investigations of vegetation, soil, and hydrology were conducted at four sampling sites (marked on site with orange flagging ribbon labeled BH-1 to BH-4), following methodology outlined in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0), November, 2010.

2. Vegetation. Vegetational inventories were conducted at each sampling site. Species in each of five strata (trees, saplings, shrubs, herbs, and vines) were identified, and visual estimates of percent cover of each species in each stratum were made. See Figures 7a through 7d for photographs; Figure 5 for locations; and Appendix for Wetland Determination Data Forms. Vegetation at the sampling sites includes, but is not limited to:

Common Name	Genus/species	Indicator Status
Trees		
Red oak	*Quercus rubra*	FACU
Cherry	*Prunus serotina*	FACU
Mulberry	*Morus rubra*	FACU
Sweet gum	*Liquidambar styraciflua*	FAC
Willow oak	*Quercus phellos*	FAC
Japanese black pine	*Pinus thunbergii*	NL
Saplings		
Red oak	*Quercus rubra*	FACU
White oak	*Q. alba*	FACU
Cherry	*Prunus serotina*	FACU
Sassafras	*Sassafras albidum*	FACU
Red cedar	*Juniperus virginiana*	FACU
Tree of Heaven	*Ailanthus altissima*	NI
Blackjack oak	*Q. marilandica*	NL
Shrubs		
Multiflora rose	*Rosa multiflora*	FACU
Pokeweed	*Phytolacca americana*	FACU
Winged sumac	*Rhus copallinum*	NI
Yucca	*Yucca filamentosa*	NL
Herbs		
Fescue	*Festuca arundinacea*	FACU
Wild onion	*Allium canadense*	FACU
Plantains	*Plantago major*	FACU
Maiden grass	*Miscanthus sinesis*	FACU
Panic grass	*Panicum* spp.	FAC (?)
Prickly pear cactus	*Opuntia compressa*	NL
Vines		
Virginia creeper	*Parthenocissus quinquefolia*	FACU
Greenbriers	*Smilax rotundifolia*	FAC
Japanese honeysuckle	*Lonicera japonica*	FAC

3. Hydrology. Each sampling site was examined for field evidence of primary and secondary indicators of wetland hydrology. No wetland hydrology indicators were noted at any of the sampling sites (see Appendix for Wetland Determination Data Forms).

4. Soils. Soil borings were taken at each of the sampling sites to determine soil characteristics and to confirm Web Soil Survey mapped soils. Soil profiles generally confirmed typical profiles for each soil series, with evidence of (surficial) fill material at some sites.

Federal 404 Wetland Determination

Federal 404 wetlands are characterized by dominance (>50%) of hydrophytic vegetation; presence of hydric soil; and field evidence of at least one primary and/or two secondary indicators of wetland hydrology. All three parameters must be present for an area to be a Federal 404 wetland. On the basis of the National Wetlands Inventory Map (Figure 6); qualitative observations along the entire proposed project alignment; and detailed investigations of vegetation, soils, and hydrology at four sampling sites, **there are no Federal 404 wetlands along the proposed route of the Rehoboth Beach force main alignment.** This is based on the following criteria:

1. **Vegetation.** Vegetation is dominated by non-hydrophytic species. Dominance Test values for the four sampling sites ranged from 0-25% hydrophytic species.

2. **Hydrology.** There was no field evidence of wetland hydrology indicators present along the proposed project.

3. **Soils.** Soils on site do not exhibit field evidence of hydric soil indicators.

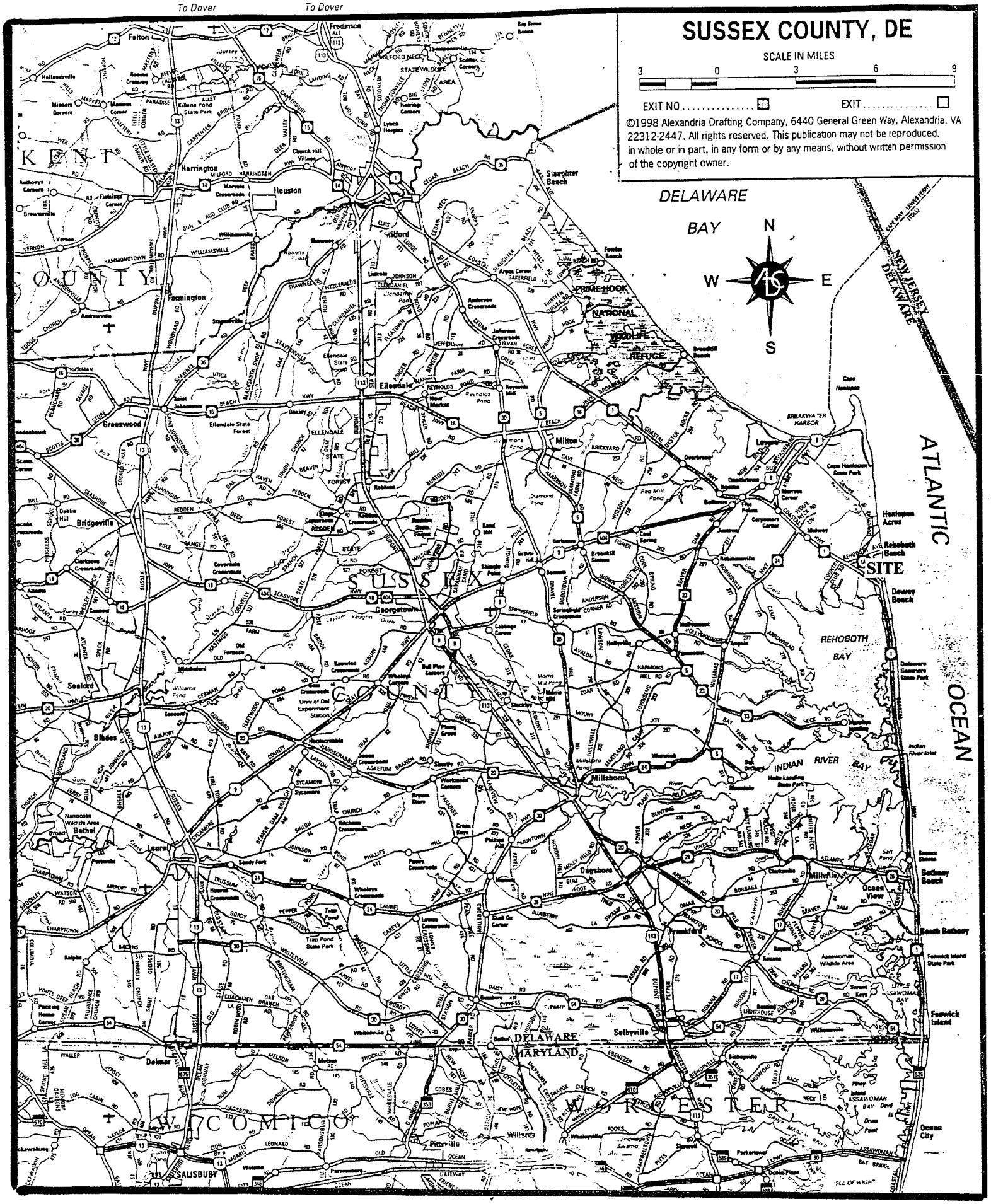


Figure 1. Map of Sussex County, Delaware showing site location, Rehoboth Beach. Scale as shown.

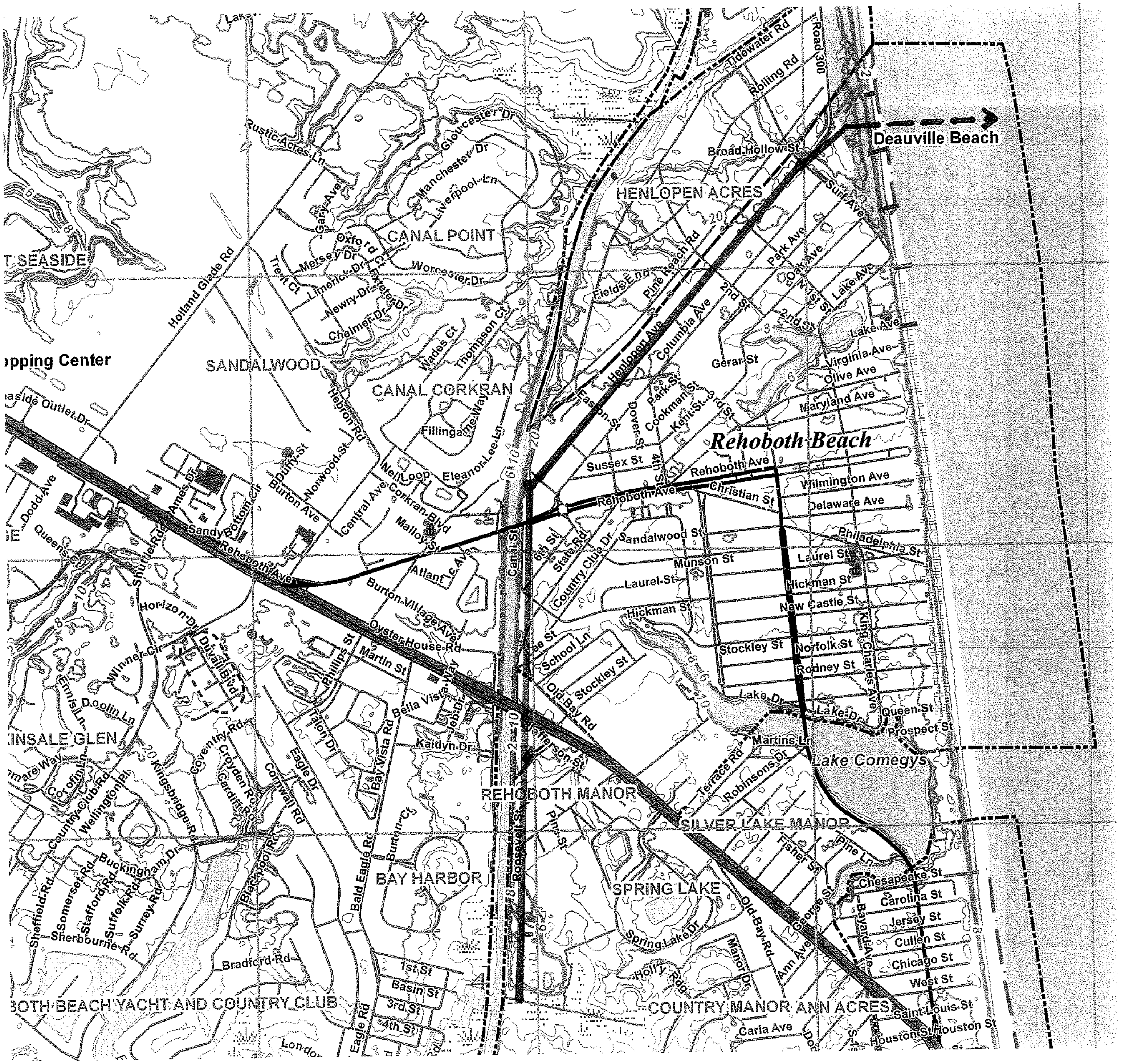


Figure 2. USGS topographic map, Rehoboth Beach, Delaware quadrangle. Proposed Rehoboth Beach Ocean Outfall Force Main Alignment will extend from Rehoboth Beach Wastewater Treatment Plant, Roosevelt Street (east of the Lewes and Rehoboth Canal) to Deauville Beach (Atlantic Ocean). Also see Figure 3 for alignment.

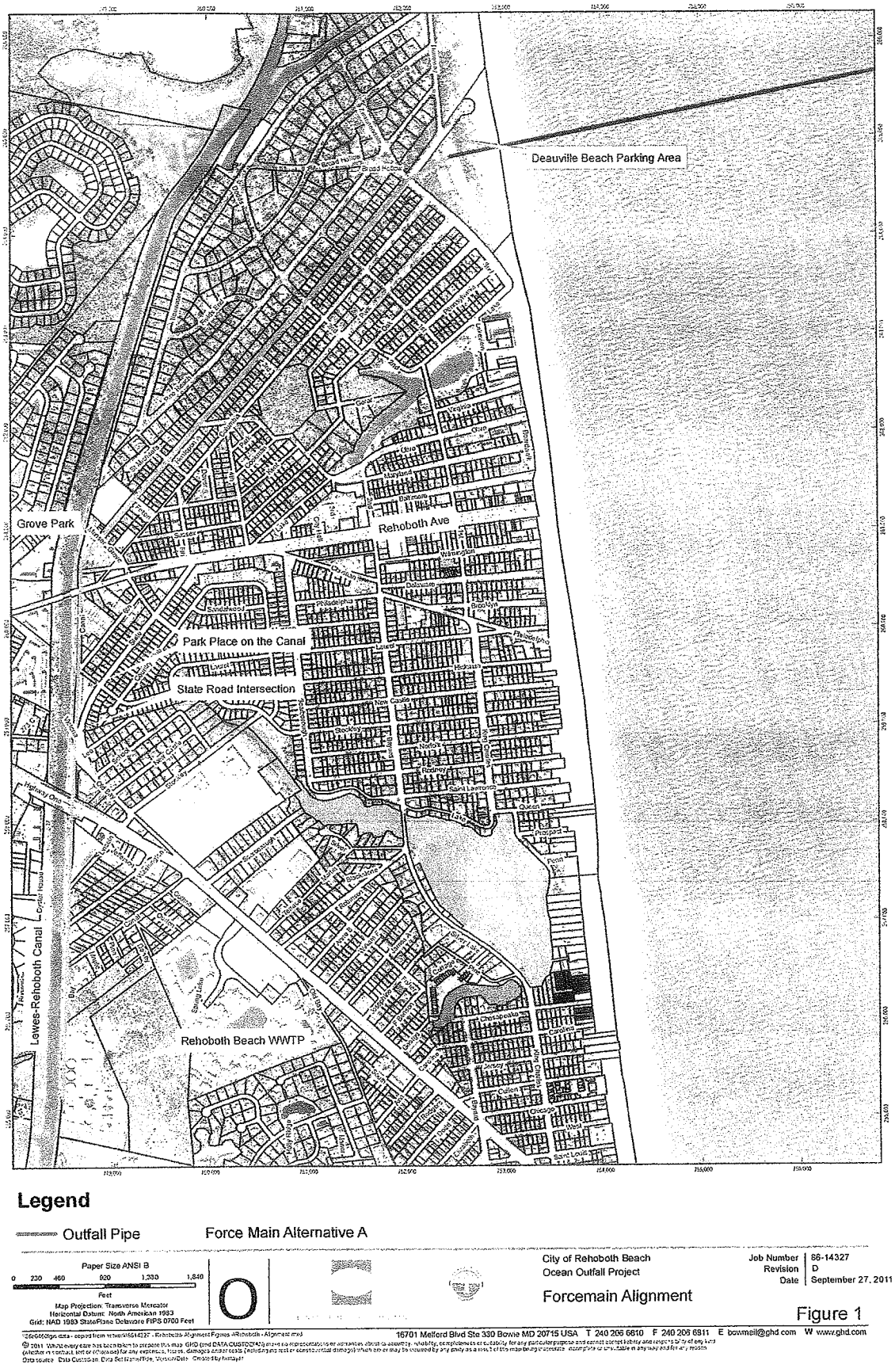


Figure 3. Aerial photograph of Rehoboth Beach, Sussex County, Delaware, showing proposed Rehoboth Beach Ocean Outfall Force Main alignment. Project will extend from Rehoboth Beach Wastewater Treatment Plant northward along Roosevelt Street, State Road, Canal Street, and Henlopen Avenue, to Deauville Beach.

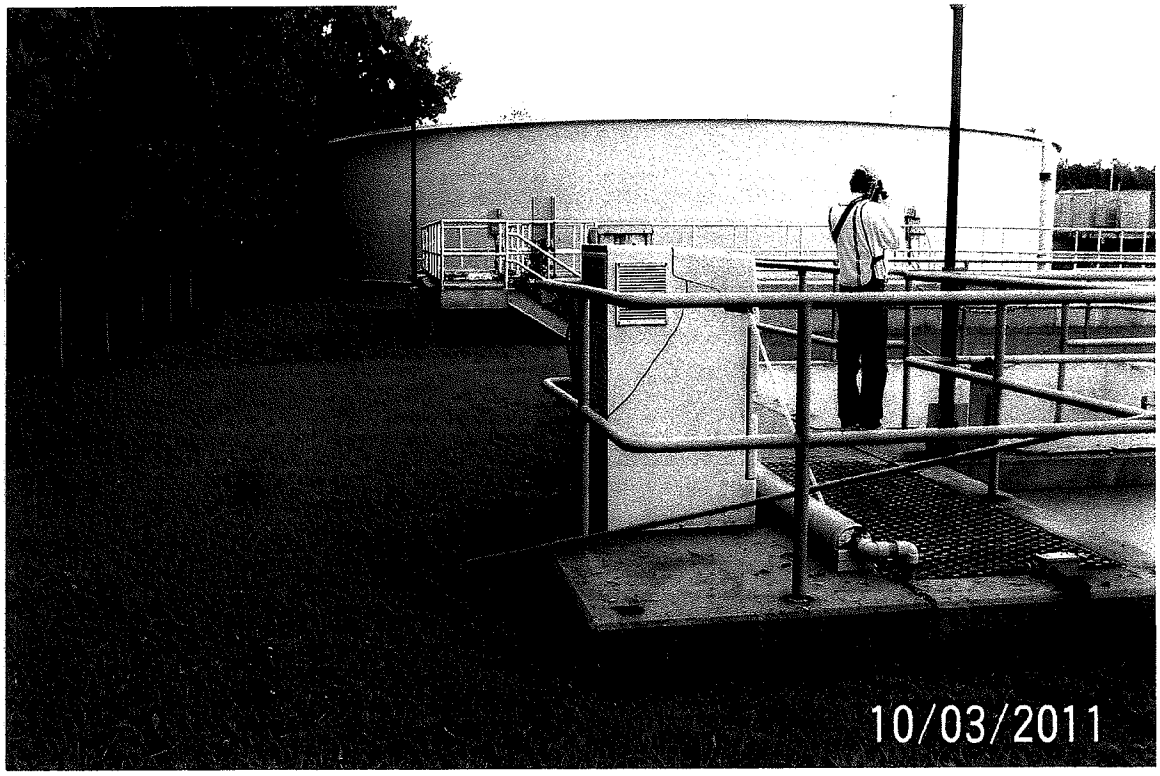


Figure 4a. Photograph of Rehoboth Beach Wastewater Treatment Plant, Roosevelt Street, Rehoboth Beach, Sussex County, Delaware.

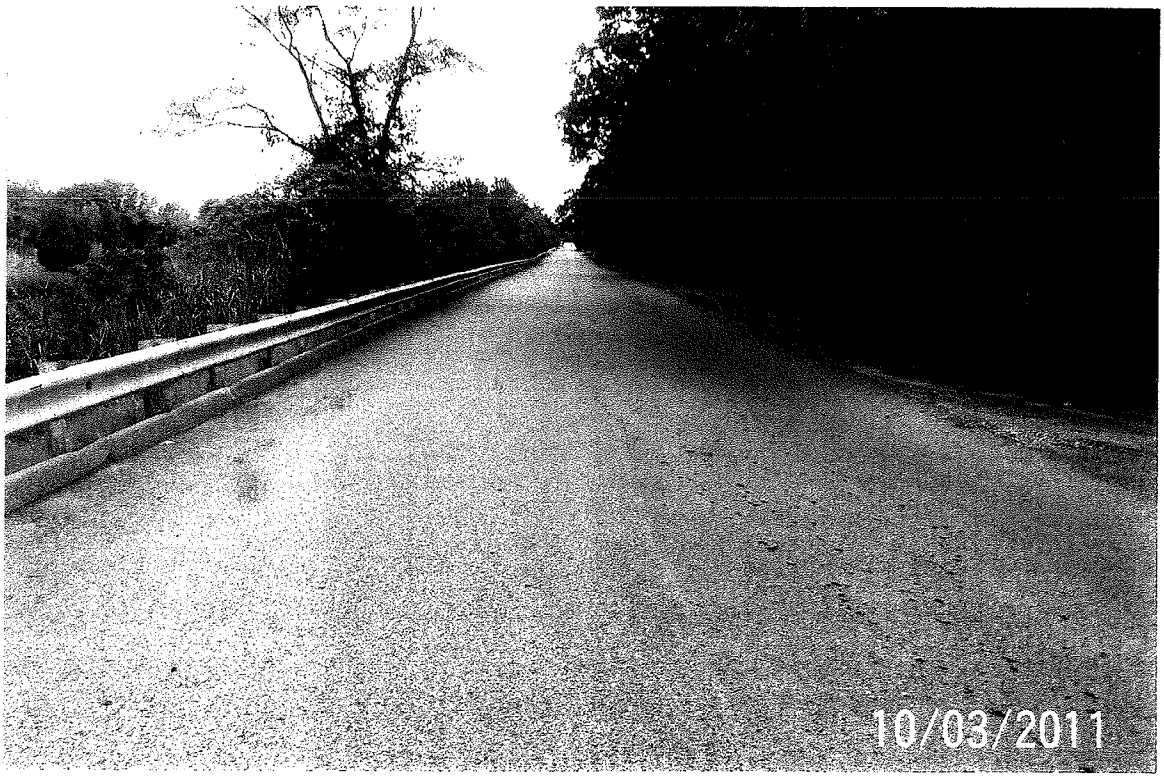


Figure 4b. Photograph of Roosevelt Street, Rehoboth Beach, Sussex County, Delaware. Force Main Alignment will be located on left (west) side of road; installation by trenching. (Lewes and Rehoboth Canal on left, downslope).

Figure 4c. Photograph of State Road, Rehoboth Beach, Sussex County, Delaware. Force Main Alignment will be located on left (west) side of road; installation by trenching. (Lewes and Rehoboth Canal on left, downslope).

Figure 4d. Photograph of Park Place Townhouses, State Road, Rehoboth Beach, Sussex County, Delaware. Force Main Alignment will be located on left (west) side of buildings (at top of bank, Lewes and Rehoboth Canal); installation by trenching.

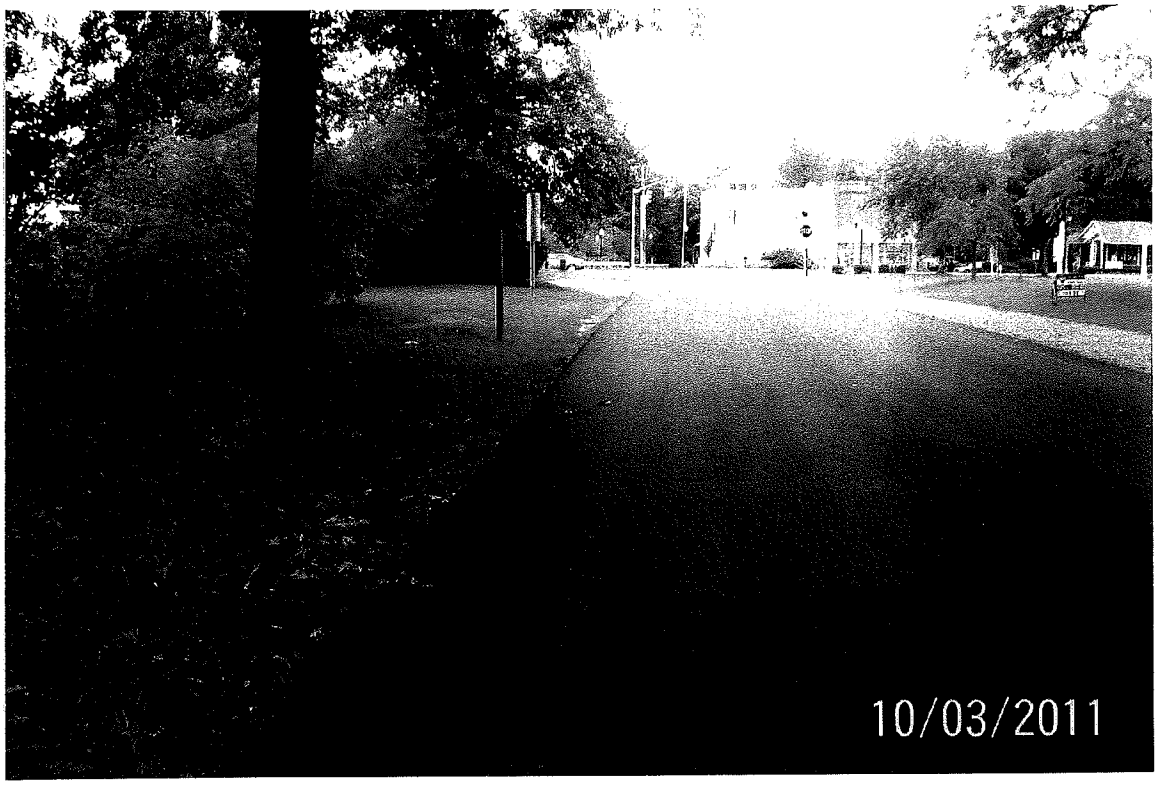


Figure 4e. Photograph of Canal Street, Rehoboth Beach, Sussex County, Delaware; Rehoboth Avenue in background. Force Main Alignment will be located on left (west) side of road (at top of bank, Lewes and Rehoboth Canal). Installation by trenching, with directional boring beneath Rehoboth Avenue.

Figure 4f. Photograph of Grove Park, Rehoboth Beach, Sussex County, Delaware; Rehoboth Avenue. Force Main Alignment will be installed by directional boring beneath the park.

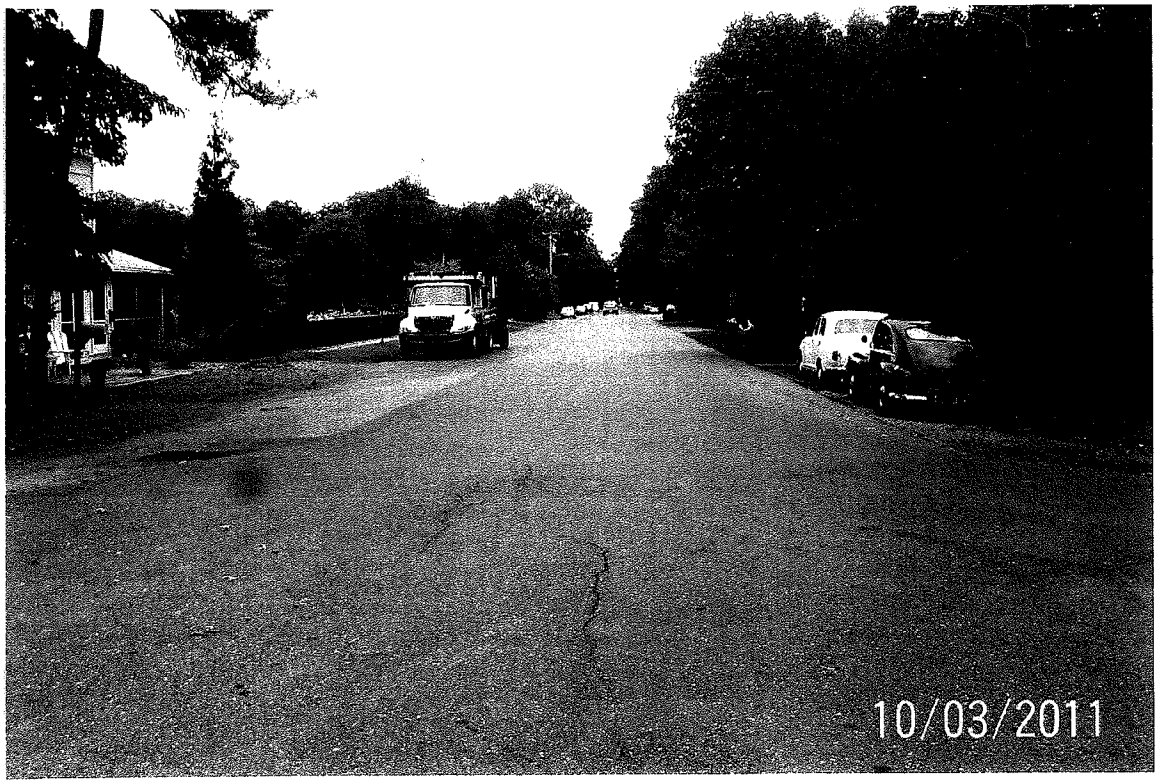


Figure 4g. Photograph of Henlopen Avenue, Rehoboth Beach, Sussex County, Delaware. Force Main Alignment will be located on left (west) side of road; installation by trenching.

Figure 4h. Photograph of Henlopen Avenue and Surf Avenue, Rehoboth Beach, Sussex County, Delaware. Force Main Alignment will be located on right (south) side of road, through grassy/wooded area; installation by trenching.

Figure 4i. Photograph of Deauville Beach parking lot, Henlopen Avenue and Surf Avenue, Rehoboth Beach, Sussex County, Delaware. Force Main Alignment will be installed under parking area by directional boring.

Figure 4j. Photograph of Atlantic Ocean at Deauville Beach, Henlopen Avenue and Surf Avenue, Rehoboth Beach, Sussex County, Delaware, terminus of proposed Rehoboth Beach Ocean Outfall.

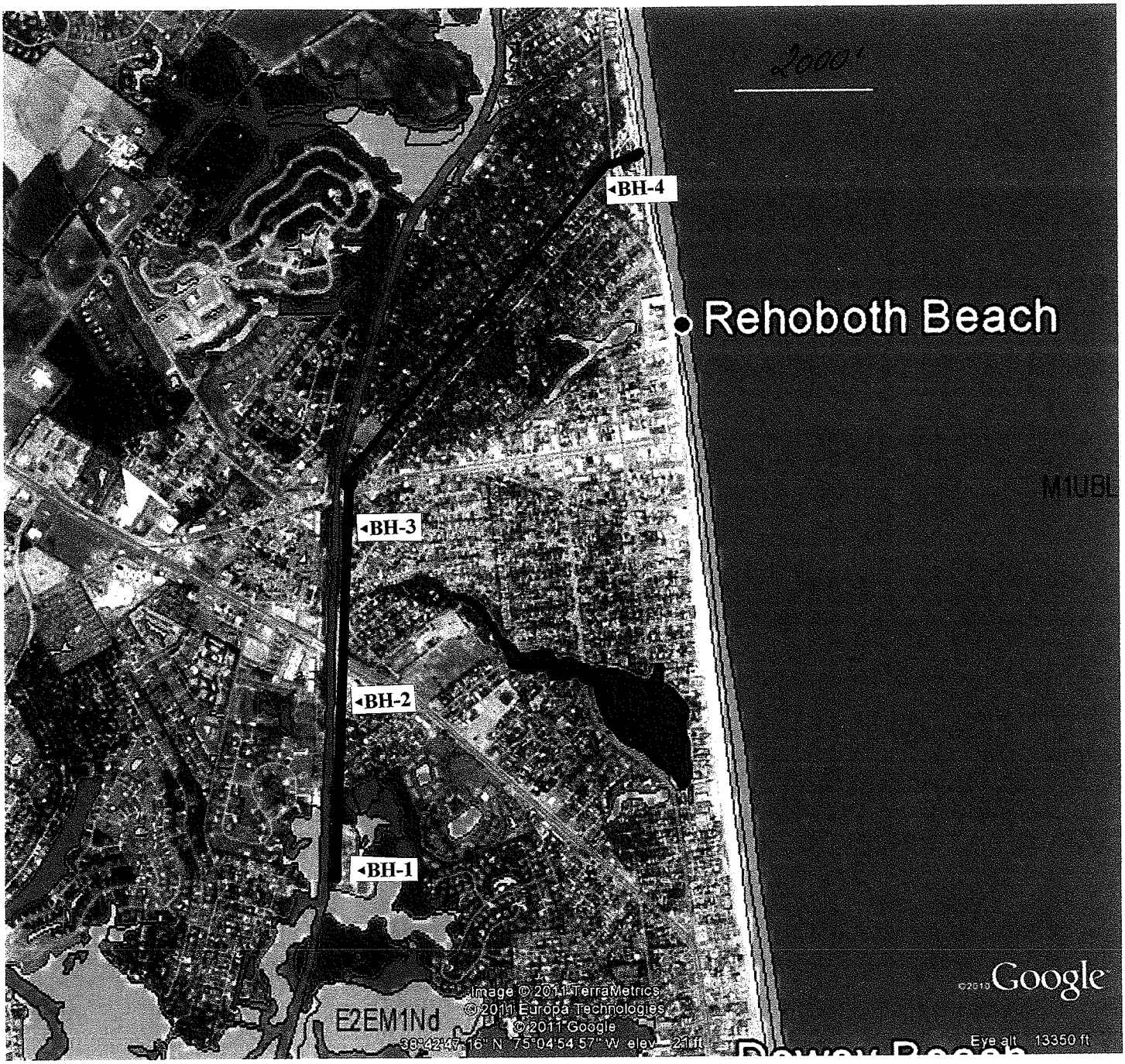


Figure 5. National Wetlands Inventory Map (GoogleEarth® aerial photograph overlay) of the project site and vicinity. There are no Federal 404 wetlands mapped along the proposed force main alignment. Sampling sites BH-1 through BH-4 also depicted; see Figures 7a to 7d for photographs, and Appendix for Wetland Determination Data Forms.

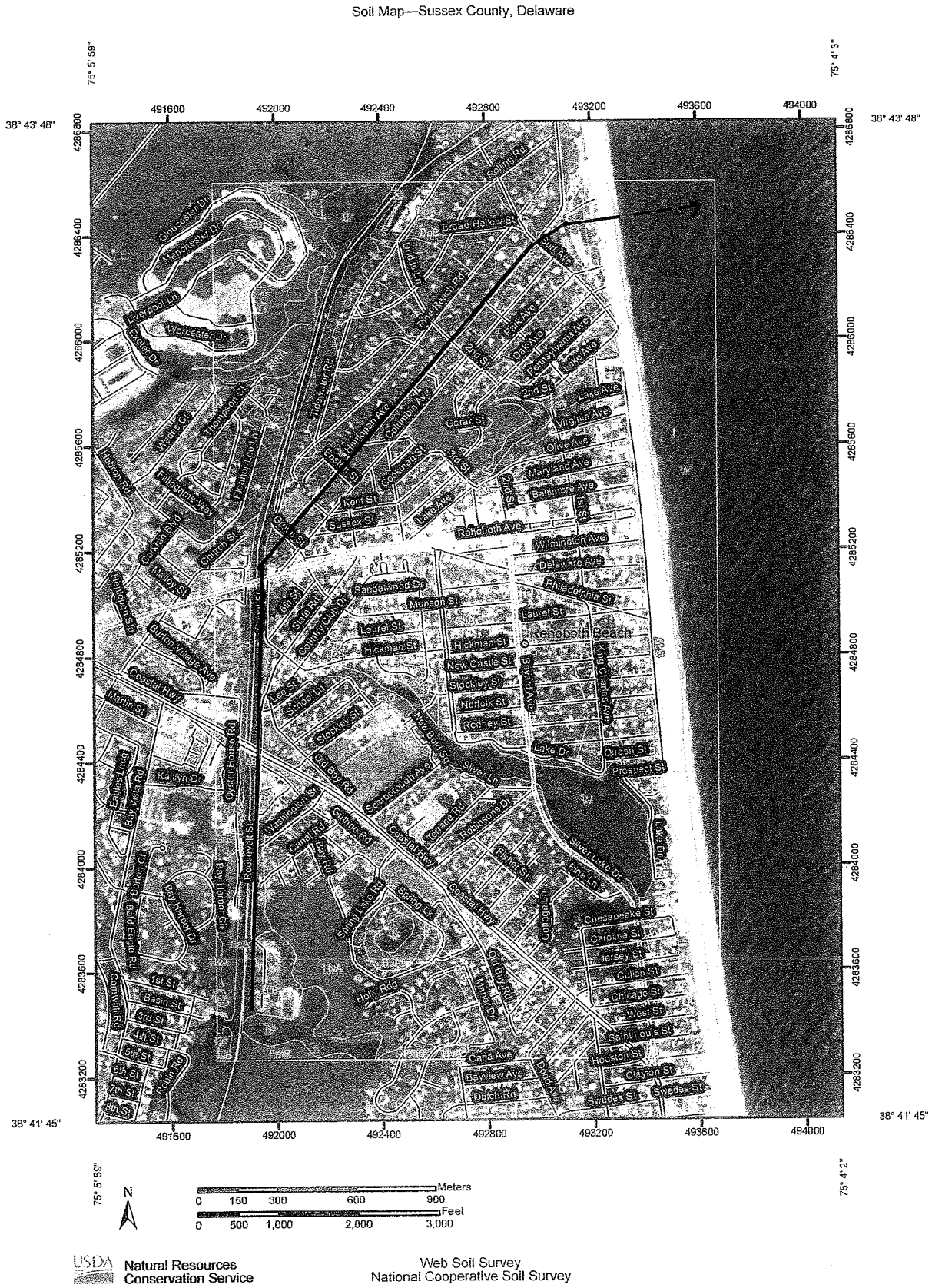


Figure 6. USDA Web Soil Survey of site and vicinity. Soils mapped in the proposed Rehoboth Beach Ocean Outfall Force Main Alignment (from south to north) are UfB (Udorthdents, refuse substratum, 0 to 35 percent slopes); BuA (Brockatonorton-Urban land complex, 0 to 2 percent slopes); GuB (Greenwich-Urban land complex, 0 to 5 percent slopes); AsA (Askecksy loamy sand, 0 to 2 percent slopes); and AbC (Acquango-Beaches complex, 0 to 10 percent slopes). See Table 1 for listing of map unit names.

Map Unit Legend

Sussex County, Delaware (DE005)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AbC	Acquango-Beaches complex, 0 to 10 percent slopes	81.8	5.2%
AsA	Askecksy loamy sand, 0 to 2 percent slopes	7.6	0.5%
AuB	Acquango-Urban land complex, 0 to 5 percent slopes	43.8	2.8%
Br	Broadkill mucky peat, very frequently flooded, tidal	12.9	0.8%
BuA	Brockatonorton-Urban land complex, 0 to 2 percent slopes	60.0	3.8%
DnC	Downer loamy sand, 5 to 10 percent slopes	54.4	3.5%
DoB	Downer sandy loam, 2 to 5 percent slopes	19.6	1.2%
EvB	Evesboro loamy sand, 0 to 5 percent slopes	17.3	1.1%
EvD	Evesboro loamy sand, 5 to 15 percent slopes	6.2	0.4%
FmB	Fort Mott loamy sand, 2 to 5 percent slopes	8.4	0.5%
GrA	Greenwich loam, 0 to 2 percent slopes	27.3	1.7%
GrB	Greenwich loam, 2 to 5 percent slopes	70.0	4.5%
GuB	Greenwich-Urban land complex, 0 to 5 percent slopes	749.6	47.7%
HvA	Hurlock sandy loam, 0 to 2 percent slopes	62.5	4.0%
IeA	Ingleside loamy sand, 0 to 2 percent slopes	0.5	0.0%
IeB	Ingleside loamy sand, 2 to 5 percent slopes	33.8	2.1%
KsA	Klej loamy sand, 0 to 2 percent slopes	9.7	0.6%
LhA	Lenni silt loam, 0 to 2 percent slopes	5.2	0.3%
MmA	Mullica mucky sandy loam, 0 to 2 percent slopes	14.2	0.9%
Pk	Puckum muck, frequently flooded	0.4	0.0%
Pu	Purnell peat, very frequently flooded, tidal	0.6	0.0%
TP	Transquaking and Mispillion soils, very frequently flooded, tidal	18.4	1.2%
UfB	Udorthents, refuse substratum, 0 to 35 percent slopes	14.7	0.9%
UzC	Udorthents, 0 to 10 percent slopes	9.2	0.6%
W	Water	244.1	15.5%
Totals for Area of Interest		**1,572.1**	**100.0%**

Table 1. Listing of soil map units at project site and vicinity (see Figure 6 for soil map).

Rehoboth Beach, DE-Boardwalk Station

ID	DRHB	Network	DEOS
City/State	Rehoboth Beach/DE	Elevation	8 ft.
Latitude	38° 43' N	Longitude	75° 5' W

Daily Station Statistics for September, 2011

Day	Avg Temp (°F)	Max Temp (°F)	Min Temp (°F)	HDD (base 65 °F)	CDD (base 65 °F)	Heat Index (°F)	Wind Chill (°F)	Avg Wind Speed (mph)	Avg Wind Dir (°)	Peak Wind Gust (mph)	Rainfall (in)
1	69.3	75.9 (09:40)	61.3 (05:50)	0.0	4.3	N/A	N/A	4.8	165.1 (SSE)	13.3 (22:59)	0.00
2	69.7	71.7 (13:35)	67.0 (05:00)	0.0	4.7	N/A	N/A	6.6	126.0 (SE)	11.3 (09:28)	0.00
3	71.0	77.1 (10:45)	63.5 (06:55)	0.0	6.0	N/A	N/A	4.9	219.8 (SW)	16.4 (16:46)	0.00
4	74.0	81.8 (11:35)	70.1 (02:15)	0.0	9.0	85.0 (11:35)	N/A	5.4	244.2 (WSW)	17.5 (15:38)	0.00
5	75.0	81.0 (10:10)	73.4 (23:55)	0.0	10.0	84.7 (10:10)	N/A	6.6	213.9 (SW)	18.5 (12:14)	0.00
6	70.2	77.1 (02:55)	67.4 (13:05)	0.0	5.2	N/A	N/A	12.4	49.7 (NE)	25.4 (17:02)	0.26
7	73.5	77.6 (13:35)	70.9 (00:15)	0.0	8.5	N/A	N/A	7.8	160.9 (SSE)	14.6 (22:29)	0.00
8	71.8	74.1 (04:30)	69.9 (14:55)	0.0	6.8	N/A	N/A	8.3	81.2 (E)	24.5 (15:23)	0.06
9	70.8	74.0 (16:15)	68.9 (03:10)	0.0	5.8	N/A	N/A	8.0	104.1 (ESE)	22.3 (01:27)	0.00
10	72.5	77.0 (15:05)	69.0 (06:35)	0.0	7.5	N/A	N/A	3.3	234.0 (SW)	10.8 (17:42)	0.00
11	73.2	75.9 (12:05)	70.7 (06:05)	0.0	8.2	N/A	N/A	6.1	127.2 (SE)	14.3 (16:12)	0.01
12	72.5	77.8 (10:55)	66.1 (06:50)	0.0	7.5	N/A	N/A	3.5	273.3 (W)	10.0 (17:49)	0.00
13	74.7	83.0 (12:05)	67.7 (06:45)	0.0	9.7	86.3 (12:10)	N/A	4.7	248.8 (WSW)	16.8 (15:44)	0.00
14	76.0	84.1 (11:25)	71.9 (06:00)	0.0	11.0	87.4 (11:25)	N/A	5.7	241.5 (WSW)	17.1 (16:00)	0.00
15	71.2	82.9 (10:40)	58.7 (24:00)	0.0	6.2	87.6 (10:40)	N/A	4.8	319.0 (NW)	22.0 (21:58)	0.25
16	58.9	62.0 (16:15)	55.8 (24:00)	6.1	0.0	N/A	N/A	7.4	12.6 (NNE)	25.1 (01:12)	0.00
17	61.1	65.0 (10:50)	54.7 (04:20)	3.9	0.0	N/A	N/A	12.2	81.3 (E)	24.0 (16:57)	0.26
18	64.0	65.0 (12:00)	61.8 (01:55)	1.0	0.0	N/A	N/A	19.5	61.9 (ENE)	28.6 (04:20)	0.00
19	64.3	66.3 (16:00)	62.6 (07:05)	0.7	0.0	N/A	N/A	10.8	87.1 (E)	19.5 (00:06)	0.00
20	68.1	74.7 (13:45)	64.5 (01:45)	0.0	3.1	N/A	N/A	3.2	309.3 (NW)	11.5 (02:09)	0.00
21	68.5	70.9 (15:45)	64.4 (02:50)	0.0	3.5	N/A	N/A	5.2	112.7 (ESE)	14.8 (12:44)	0.00
22	72.3	80.0 (12:05)	69.2 (01:00)	0.0	7.3	83.9 (12:05)	N/A	3.8	234.7 (SW)	14.6 (15:03)	0.16
23	71.3	73.2 (12:35)	70.2 (07:10)	0.0	6.3	N/A	N/A	5.2	171.7 (S)	15.2 (20:10)	0.75
24	70.4	71.5 (13:30)	69.2 (23:40)	0.0	5.4	N/A	N/A	2.3	26.6 (NNE)	8.8 (03:25)	0.00
25	70.0	71.8 (12:10)	68.9 (07:00)	0.0	5.0	N/A	N/A	2.7	54.8 (NE)	9.0 (18:48)	0.00
26	69.6	70.8 (13:55)	68.7 (08:35)	0.0	4.6	N/A	N/A	3.6	127.6 (SE)	11.0 (22:25)	0.00
27	70.3	71.3 (16:20)	68.8 (06:20)	0.0	5.3	N/A	N/A	6.4	152.8 (SSE)	14.6 (15:47)	0.00
28	71.8	74.3 (13:25)	70.1 (04:55)	0.0	6.8	N/A	N/A	6.8	158.0 (SSE)	13.7 (18:01)	0.00
29	72.5	82.5 (14:25)	65.0 (24:00)	0.0	7.5	83.6 (13:05)	N/A	2.9	281.6 (WNW)	16.0 (13:43)	0.02
30	70.4	82.5 (14:10)	58.4 (23:00)	0.0	5.4	82.6 (13:55)	N/A	3.7	270.9 (W)	16.9 (11:14)	0.01

Monthly Station Statistics

Temperature		Precipitation		Miscellaneous	
Avg Temp (°F)	70.3	Total Monthly Rainfall (in)	1.78	Avg Wind Speed (mph)	6.3
Highest Max Temp (°F)	84.1 (14th)	Total Yearly Rainfall (in)	27.79	Avg Wind Dir (°)	137.4 (SE)
Lowest Min Temp (°F)	54.7 (17th)	Max Rainfall (in)	0.75 (23rd)	Peak Wind Gust (mph)	28.6 (18th)
Max Temp ≥ 90°F:	0 Days	Rainfall ≥ 0.01 in:	9 Days	Max Heat Index (°F)	87.6 (15th)
Max Temp ≤ 32°F:	0 Days	Rainfall ≥ 0.25 in:	4 Days	Min Wind Chill (°F)	N/A
Min Temp ≤ 32°F:	0 Days	Rainfall ≥ 1 in:	0 Days	Total Monthly HDD (base 65 °F)	11.8
Min Temp ≤ 0°F:	0 Days			Total Yearly HDD (base 65 °F)	2837.6
				Total Monthly CDD (base 65 °F)	170.5
				Total Yearly CDD (base 65 °F)	1205.7

Note: All observations were obtained from the Delaware Environmental Observing System network

Generated by ODD-DIVAS version 2.1.10-0.

Table 2. Delaware Environmental Observing System (DEOS) precipitation data for Rehoboth Beach, Delaware for the month of September, 2011 (the month preceding this investigation). Total precipitation was 1.78".

Delaware Geological Survey
State of Delaware
University of Delaware • Delaware Geological Survey Building
Newark, Delaware 19716-7501

John H. Talley
Director and State Geologist

Kent County Hydrologic Conditions

PRECIPITATION
Dover – Running surplus/deficit
12-month: 11.64" 6-month: 11.02" 5-month: 9.44"

STREAMFLOW
St. Jones at Dover – 30-day moving average for September 1 to September 30:
61.2 MGD Status: Above Normal

GROUNDWATER
Mc51-01 – September 2011
8.40 ft below land surface Status: Above Normal

Sussex County Hydrologic Conditions

PRECIPITATION
Georgetown - Running surplus/deficit
12- month: -8.62" 6-month: -4.73" 5-month: -3.44"

Lewes – Running surplus/deficit (uses Rehoboth Beach data for January, and April through September)
12- month: -9.96" 6-month: -4.87" 5-month: -3.39"

STREAMFLOW
Nanticoke River at Bridgeville - 30-day moving average for September 1 to September 30:
95.0 MGD Status: Above Normal

GROUNDWATER
Qe44-01 – September 2011
8.80 ft below land surface Status: Normal

Table 3. Delaware Geological Survey Sussex County Hydrologic Conditions for September, 2011. Precipitation in Rehoboth Beach for the 6-month period (April-September, 2011) was 4.87" below normal, and 3.39" below normal for the 5-month period (May-September, 2011) preceding this investigation. Thus, hydrologic conditions were slightly drier than normal.

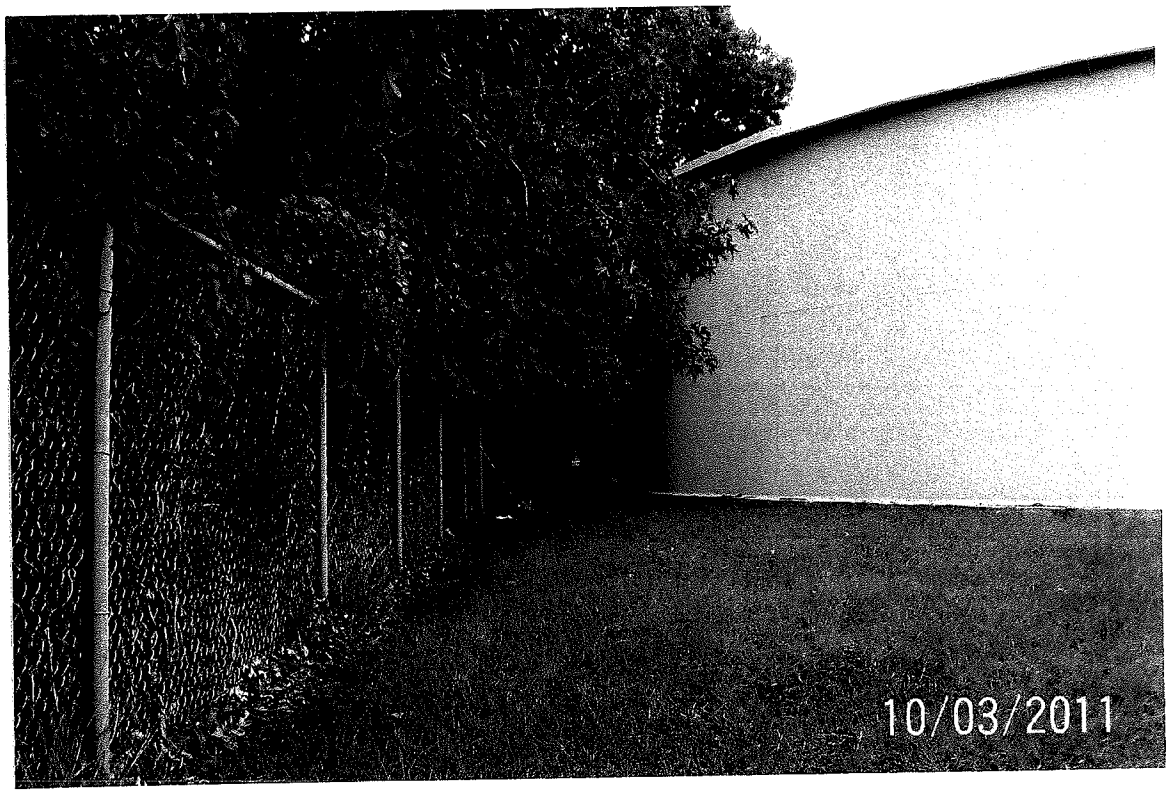


Figure 7a. Photograph of proposed Rehoboth Beach Ocean Outfall Force Main Alignment showing uplands at **BH-1**, Rehoboth Beach Wastewater Treatment Plant, Roosevelt Street. Vegetation includes red oak (*Quercus rubra*, FACU); cherry (*Prunus serotina*, FACU); sweet gum (*Liquidambar styraciflua*, FAC); mulberry (*Morus rubra*, FACU); willow oak (*Q. phellos*, FAC); sassafras (*Sassafras albidum*, FACU); fescue (*Festuca arundinacea*, FACU); and greenbriers (*Smilax rotundifolia*, FAC). Site is not dominated by hydrophytic vegetation (Dominance Test = 25%). Soil is mapped Udorthents, refuse substratum, 0 to 35 percent slopes, with no field evidence hydric soil indicators present, and no field evidence of wetland hydrology indicators present. See Figure 5 for locations of sampling sites, and Appendix for Wetland Determination Data Forms.

Figure 7b. Photograph of proposed Rehoboth Beach Ocean Outfall Force Main Alignment showing uplands at **BH-2**, Roosevelt Street south of Route One overpass (background). Vegetation includes cherry (*Prunus serotina*, FACU); red cedar (*Juniperus virginiana*, FACU); red oak (*Quercus rubra*, FACU); tree-of-heaven (*Ailanthus altissima*, NI); winged sumac (*Rhus copallinum*, NI); multiflora rose (*Rosa multiflora*, FACU); pokeweed (*Phytolacca americana*, FACU); yucca (*Yucca filamentosa*, NL); panic grass (*Panicum* spp., FAC?); Japanese honeysuckle (*Lonicera japonica*, FAC); and Virginia creeper (*Parthenocissus quinquefolia*, FACU). Site is not dominated by hydrophytic vegetation (Dominance Test = 25%). Soil is mapped Brockanorton-Urban land complex, 0 to 2 percent slopes, with no field evidence hydric soil indicators present, and no field evidence of wetland hydrology indicators present. See Figure 5 for locations of sampling sites, and Appendix for Wetland Determination Data Forms.

Figure 7c. Photograph of proposed Rehoboth Beach Ocean Outfall Force Main Alignment showing uplands at **BH-3**, Park Place Townhouses, State Road. Vegetation includes red oak (*Quercus rubra*, FACU); white oak (*Q. alba*, FACU); sassafras (*Sassafras albidum*, FACU); red cedar (*Juniperus virginiana*, FACU); cherry (*Prunus serotina*, FACU); winged sumac (*Rhus copallinum*, NI); fescue (*Festuca arundinacea*, FACU); and (ornamental) maiden grass (*Miscanthus sinesis*, FACU). Site is not dominated by hydrophytic vegetation (Dominance Test = 0%). Soil is mapped Greenwich-Urban land complex, 0 to 5 percent slopes, with no field evidence hydric soil indicators present, and no field evidence of wetland hydrology indicators present. See Figure 5 for locations of sampling sites, and Appendix for Wetland Determination Data Forms.

Figure 7d. Photograph of proposed Rehoboth Beach Ocean Outfall Force Main Alignment showing uplands at **BH-4**, Henlopen Avenue and Surf Avenue. Vegetation includes Japanese black pine (*Pinus thunbergii*, NL); red cedar (*Juniperus virginiana*, FACU); cherry (*Prunus serotina*, FACU); blackjack oak (*Quercus marilandica*, NL); fescue (*Festuca arundinacea*, FACU); wild onion (*Allium canadense*, FACU); plantains (Plantago major, FACU); and prickly pear cactus (*Opuntia compressa*, NL). Site is not dominated by hydrophytic vegetation (Dominance Test = 0%). Soil is mapped Askecksy loamy sand, 0 to 2 percent slopes, with no field evidence hydric soil indicators present, and no field evidence of wetland hydrology indicators present. See Figure 5 for locations of sampling sites, and Appendix for Wetland Determination Data Forms.

COASTAL & ESTUARINE RESEARCH, INC.
Marine Studies Complex
P.O. Box 674
Lewes, Delaware 19958
302-645-9610

APPENDIX:
WETLAND DETERMINATION DATA FORMS

Applicant

City of Rehoboth Beach
PO Box 1163
229 Rehoboth Avenue
Rehoboth Beach, DE 19971

Project Site

Rehoboth Beach Ocean Outfall Project Force Main Alignment
Rehoboth Beach Wastewater Treatment Plant to
Deauville Beach (Atlantic Ocean), 10,850± linear feet
Rehoboth Beach, Sussex County, Delaware

October, 2011

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Rehoboth Beach Ocean outfall Force Main Alignment Study City/County: Rehoboth Beach/Sussex Sampling Date: 10/3/11

Applicant/Owner: City of Rehoboth Beach State: DE Sampling Point: BH-1

Investigator(s): Evelyn Maurmeyer, CERM Section, Township, Range: —

Landform (hillslope, terrace, etc.): Top of bank Local relief (concave, convex, none): level Slope (%): 0%

Subregion (LRR or MLRA): LRR-T Lat: 38° 42' 01.73" Long: 75° 05' 34.84" Datum: —

Soil Map Unit Name: UfB: Udorthents, refuse substratum, 0-3% slopes NWI classification: UPL

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.) * slightly drier

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:
Top of upland bank, Rehoboth Beach Wastewater Treatment Plant, see photograph, Figure 7a.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required: check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) (LRR U)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
DEOS; DGS data (Tables 2, 3)

Remarks:
No field evidence of wetland hydrology indicators present.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: BH - 1

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10' r.)			
1. Quercus rubra	30	Y	FACU
2. Prunus serotina	20	Y	FACU
3. Liquidambar styraciflua	20	Y	FAC
4. Morus rubra	10	N	FACU
5. Q. phellos	10	N	FAC
6.			
	90 = Total Cover		
50% of total cover: 45	20% of total cover: 18		
Sapling Stratum (Plot size: 10' r.)			
1. Q. rubra	20	Y	FACU
2. P. serotina	20	Y	FACU
3. Sassafras albidum	20	Y	FACU
4.			
5.			
6.			
	60 = Total Cover		
50% of total cover: 30	20% of total cover: 12		
Shrub Stratum (Plot size: 10' r.)			
1. non-e			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 10' r.)			
1. Festuca arundinacea	95	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	95 = Total Cover		
50% of total cover: 47.5	20% of total cover: 19		
Woody Vine Stratum (Plot size: 10' r.)			
1. Smilax rotundifolia	10	Y	FAC
2.			
3.			
4.			
5.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ___ No ✓

Remarks: (If observed, list morphological adaptations below).

Site is not dominated by hydrophytic vegetation.

SOIL

Sampling Point: BH - 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-7"	10YR3/3	100	-	-	-	-	LS	loamy sand, pebbly, granular, dry
7-17"	10YR4/4/6	"	-	-	-	-	"	"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A, B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: —

Depth (inches): —

Hydric Soil Present? Yes ____ No ✓

Remarks:

No field evidence of hydric soil indicators present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Rehoboth Beach Ocean outfall Force Main Alignment Study City/County: Rehoboth Beach/Sussex Sampling Date: 10/3/11

Applicant/Owner: City of Rehoboth Beach State: DE Sampling Point: BH-2

Investigator(s): Evelyn Maurmeyer, CEC Inc. Section, Township, Range: —

Landform (hillslope, terrace, etc.): Top of bank Local relief (concave, convex, none): level Slope (%): 0%

Subregion (LRR or MLRA): LRR-T Lat: 38° 42' 29.04" Long: 75° 05' 34.13" Datum: —

Soil Map Unit Name: BuA: Broadkill-Urban land complex NWI classification: UPL

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.) *slightly drier than 30-yr avg

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: Top of bank (Lewes and Rehoboth Canal), Roosevelt Strait south of Route One overpass; see photograph, Figure 7b.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) (LRR U)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

DEOS; DGS data (Tables 2, 3)

Remarks:

No field evidence of wetland hydrology indicators present.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: BH-2

Tree Stratum (Plot size: 10' r.)	Absolute % Cover	Dominant Species?	Indicator Status
1. none			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover: ____	20% of total cover: ____		
Sapling Stratum (Plot size: 10' r.)			
1. Prunus serotina	20	Y	FACU
2. Juniperus virginiana	20	Y	FACU
3. Quercus rubra	20	Y	FACU
4. Ailanthus altissima	20	Y	UPL
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Shrub Stratum (Plot size: 10' r.)			
1. Rhus copallinum	30	Y	UPL
2. Rosa multiflora	10	N	FACU
3. Phytolacca americana	10	N	FACU
4. Yucca filamentosa	5	N	NL
5.			
6.			
	55 = Total Cover		
50% of total cover: 27.5	20% of total cover: 11		
Herb Stratum (Plot size: 10' r.)			
1. Panicum spp.	80	Y	FAC(?)
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Woody Vine Stratum (Plot size: 10' r.)			
1. Lonicera japonica	5	Y	FAC
2. Parthenocissus quinquefolia	5	Y	FACU
3.			
4.			
5.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: (If observed, list morphological adaptations below).

site is not dominated by hydrophytic vegetation.

SOIL

Sampling Point: BH - 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7"	10YR 3/3	100	-	-	-	-	ls	loamy sand (fill?) granular, dry
7-16"	10YR 7/6	100	-	-	-	-	s	sandy (fill?), granular, dry.

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: —

Depth (inches): —

Hydric Soil Present? Yes ___ No ✓

Remarks: No field evidence of hydric soil indicators present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Rehoboth Beach Ocean outfall Force Main Alignment Study City/County: Rehoboth Beach/Sussex Sampling Date: 10/3/11

Applicant/Owner: City of Rehoboth Beach State: DE Sampling Point: BH-3

Investigator(s): Evelyn Maurmeyer, CEP, Inc. Section, Township, Range: —

Landform (hillslope, terrace, etc.): Top of bank Local relief (concave, convex, none): level Slope (%): 0%

Subregion (LRR or MLRA): LRR-T Lat: 38° 42' 39.21" Long: 75° 05' 33.37" Datum: —

Soil Map Unit Name: GuB: Greenwich-Urban land complex, 0-5% slopes NWI classification: UPL

Are climatic / hydrologic conditions on the site typical for this time of year? Yes * ✓ No ____ (If no, explain in Remarks.) * slightly drier

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: Top of bank, (Lewes and Rehoboth canal) at Park Place Townhouses, State Road; see photograph, Figure 7C.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) (LRR U)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

DEOS; DGS data (Tables 2, 3)

Remarks: No field evidence of wetland hydrology indicators present.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: BH -3

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10' r.)			
1. none			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover: ____ 20% of total cover: ____			
Sapling Stratum (Plot size: 10' r.)			
1. Quercus rubra	20	Y	FACU
2. Q. alba	15	Y	FACU
3. Sassafras albidum	15	Y	FACU
4. Juniperus virginiana	15	Y	FACU
5. Prunus serotina	15	Y	FACU
6.			
	____ = Total Cover		
50% of total cover: 40 20% of total cover: 16			
Shrub Stratum (Plot size: 10' r.)			
1. Rhus copallinum	10	Y	NI
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
50% of total cover: 5 20% of total cover: 2			
Herb Stratum (Plot size: 10' r.)			
1. Festuca arundinacea	30	Y	FACU
2. Miscanthus sinensis (?) *	5	N	FACU
3.			
4.			
5.			
6.			
7. * ornamental			
8.			
9.			
10.			
11.			
	35 = Total Cover		
50% of total cover: 17.5 20% of total cover: 7			
Woody Vine Stratum (Plot size: 10' r.)			
1. none			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: ____ 20% of total cover: ____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: (If observed, list morphological adaptations below).

Site is not dominated by hydrophytic vegetation.

Sampling Point: BH-3

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-6"	10YR 4/4	100	-	-	-	-	L	loam, coarse, granular, dry
6-17"	10YR 5/6	"	-	-	-	-	L	loam, coarse granular-blocky, dry.

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: —

Depth (inches): —

Hydric Soil Present? Yes ____ No ✓

Remarks:

No field evidence of hydric soil indicators present.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Rehoboth Beach Ocean outfall Force Main Alignment Study City/County: Rehoboth Beach/Sussex Sampling Date: 10/3/11

Applicant/Owner: City of Rehoboth Beach State: DE Sampling Point: BH-4

Investigator(s): Evelyn Maurmeyer, CER Inc. Section, Township, Range: —

Landform (hillslope, terrace, etc.): Coastal plain Local relief (concave, convex, none): level Slope (%): 0-2%

Subregion (LRR or MLRA): LRR-T Lat: 38° 43' 34.75" Long: 25° 04' 47.40" Datum: —

Soil Map Unit Name: AsA - Askecksy loamy sand, 0-2% slopes NWI classification: UPL

Are climatic / hydrologic conditions on the site typical for this time of year? Yes * ✓ No ____ (If no, explain in Remarks.) * slightly drier

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: Sandy coastal plain environment NW of Henlopen Avenue and surf Avenue; see photograph, Figure 7d.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) (LRR U)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

DEOS; DGS data (Tables 2, 3)

Remarks:

No field evidence of wetland hydrology indicators present.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: BH - 4

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10' r.)			
1. Pinus thunbergii	30	Y	NL
2.			
3.			
4.			
5.			
6.			
	30 = Total Cover		
50% of total cover: 15	20% of total cover: 6		
Sapling Stratum (Plot size: 10' r.)			
1. Juniperus virginiana	20	Y	FACU
2. Prunus serotina	10	Y	FACU
3. Quercus marilandica	10	Y	NL
4.			
5.			
6.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		
Shrub Stratum (Plot size: 10' r.)			
1. none			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 10' r.)			
1. Festuca arundinacea	80	Y	FACU
2. Allium canadense	5	N	FACU
3. Plantago major	5	N	FACU
4. Opuntia compressa	5	N	NL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	95 = Total Cover		
50% of total cover: 47.5	20% of total cover: 19		
Woody Vine Stratum (Plot size: 10' r.)			
1. none			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

__ 1 - Rapid Test for Hydrophytic Vegetation

__ 2 - Dominance Test is >50%

__ 3 - Prevalence Index is ≤3.0[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: (If observed, list morphological adaptations below).

Site is not dominated by hydrophytic vegetation.

Sampling Point: BH - 4

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-7"	10YR3/2	100	-	-	-	-	LS	Loamy sand, granular, dry
7-13"	10YR5/2	"	-	-	-	-	S	sand, medium, granular, dry
13-20"	10YR5/3-5/4	"	-	-	-	-	S	"

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: —

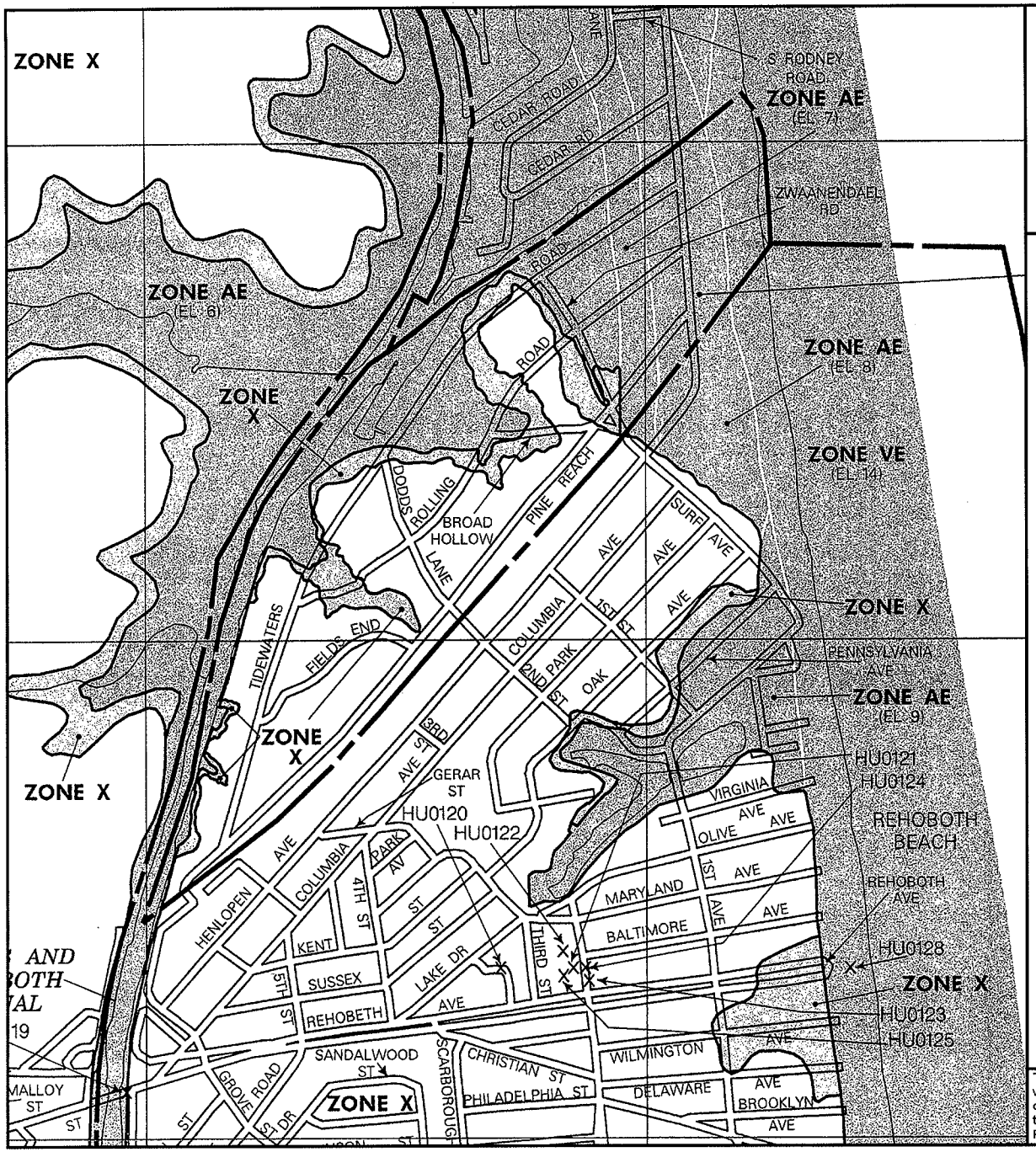
Depth (inches): —

Hydric Soil Present? Yes ____ No ✓

Remarks: No field evidence of hydric soil indicators present.

Appendix D

Flood Insurance Rate Map



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

PANEL 0355J

FIRM

FLOOD INSURANCE RATE MAP

SUSSEX COUNTY,
DELAWARE
AND INCORPORATED AREAS

PANEL 355 OF 660

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DEWEY BEACH, TOWN OF	100056	0355	J
HENLOPEN ACRES, TOWN OF	100053	0355	J
REHOBOTH BEACH, CITY OF	105086	0355	J
SUSSEX COUNTY	100029	0355	J

-NOTE-

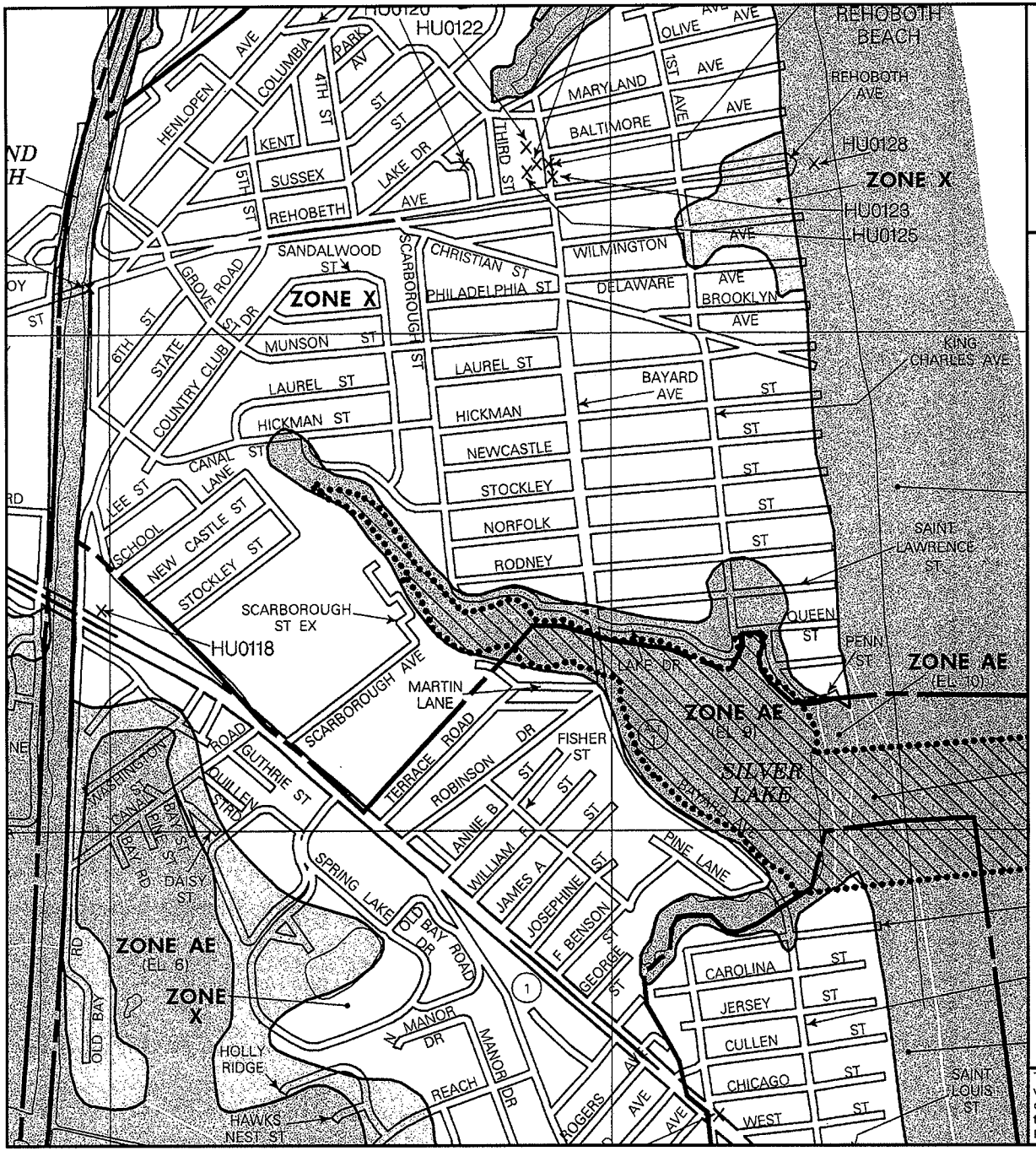
THIS MAP INCORPORATES APPROXIMATE BOUNDARIES OF COASTAL BARRIER RESOURCES SYSTEM UNITS AND/OR OTHERWISE PROTECTED AREAS ESTABLISHED UNDER THE COASTAL BARRIER IMPROVEMENT ACT OF 1990 (PL 101-591).

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
10005C0355J

MAP REVISED
JANUARY 6, 2005

Federal Emergency Management Agency



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

PANEL 0355J

FIRM

FLOOD INSURANCE RATE MAP

SUSSEX COUNTY, DELAWARE

AND INCORPORATED AREAS

PANEL 355 OF 660

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DEWEY BEACH, TOWN OF	100058	0355	J
HENLOPEN ACRES, TOWN OF	100053	0355	J
REHOBOTH BEACH, CITY OF	105086	0355	J
SUSSEX COUNTY	100029	0355	J

–NOTE–

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MAP NUMBER
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MAP REVISED
JANUARY 6, 2005

Federal Emergency Management Agency

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

PANEL 0355J

FIRM
FLOOD INSURANCE RATE MAP
SUSSEX COUNTY, DELAWARE
AND INCORPORATED AREAS

PANEL 355 OF 660

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DEWEY BEACH, TOWN OF	100056	0355	J
HENLOPEN ACRES, TOWN OF	100053	0355	J
REHOBOTH BEACH, CITY OF	105086	0355	J
SUSSEX COUNTY	100029	0355	J

-NOTE-

THIS MAP INCORPORATES APPROXIMATE BOUNDARIES OF COASTAL BARRIER RESOURCES SYSTEM UNITS AND/OR OTHERWISE PROTECTED AREAS ESTABLISHED UNDER THE COASTAL BARRIER IMPROVEMENT ACT OF 1990 (PL 101-591).

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
10005C0355J

MAP REVISED
JANUARY 6, 2005

Federal Emergency Management Agency

Appendix E

Opinion of Probable Construction Cost

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Client: City of Rehoboth Beach | **Computed By:** LWM
Project: Rehoboth Beach WWTP Force Main | **Date:** 11/28/2011
Subjec Alternative A & B from WWTP to State Road Intersection | **Checked By:**
Job Number: 861432706 | **Date:**

Description	Quantity		Material		Equipment		Labor			Total Cost
	No. Units	Basis	Per Unit	Total	Per Unit	Total	Man Hours	$/Man Hour	Total	
Yard Piping - WWTP Site										
Excavation	800	CY	$40.00	$32,000						$32,000
14 Ton Timber Piles	3850	LF	$50.00	$192,500						$192,500
Rebar - In Place	5	TON	$1,480.00	$7,400			19.000	$38.00	$3,610	$11,010
Concrete Pile Caps	170	CY	$147.00	$24,990	$0.56	$95	2.171	$38.00	$14,025	$39,110
24" PVC Pipe	760	LF	$50.00	$38,000						$38,000
Flowable Concrete Fill	250	CY	$200.00	$50,000						$50,000
Compacted Backfill (On-Site Material)	280	CY	incl.		$6.00	$1,680	0.400	$38.00	$4,256	$5,936
Hauling	500	CY	incl.				0.106	$38.00	$2,014	$2,014
24"- 45 Degree Bend	2	EA	$3,650.00	$7,300	$128.00	$256	$ 8.80	$38.00	$669	$8,225
Force Main - WWTP Site to State Rd Intersect										
24" PVC Pipe w/ Pavement Open Cut	2860	LF	$150.00	$429,000	inc.		inc.			$429,000
Traffic Control	15	DAYS					39.000	$38.00	$22,230	$22,230
		Overhead	**10%**	78119	**10%**	$203		**10%**	$4,680	**$83,003**
		Profit	**10%**	$78,119	**10%**	$203		**10%**	$4,680	**$83,003**
		Subtotal		$937,428		$2,437			$56,165	**$996,030**
		General Requirements	**10%**	$93,743	**10%**	$244		**10%**	$5,616	**$99,603**
		Subtotal		$1,031,171		$2,681			$61,781	**$1,095,633**
		Contingency	**30%**	$309,351	**30%**	$804		**30%**	$18,534	**$328,690**
		TOTAL		$1,340,522		$3,486				**$1,424,323**

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Client: City of Rehoboth Beach									**Computed By:**	LWM
Project: Rehoboth Beach WWTP Force Main									**Date:**	11/28/2011
Subject; 24" PVC Alternative A									**Checked By:**	
Job Number: 861432706									**Date:**	
	Quantity		Material		Equipment		Labor			
Description	No. Units	Basis	Per Unit	Total	Per Unit	Total	Man Hours	$/Man Hour	Total	Total Cost
Force Main - State Rd Intersect to Canal Rd										
24" FPVC Pipe HDD	860	LF	$300.00	$258,000						$258,000
Traffic Control	5	DAYS					39.000	$38.00	$7,410	$7,410
Force Main - Canal Road										
24" FPVC Pipe HDD	700	LF	$300.00	$210,000						$210,000
Force Main - Rehoboth Ave to Grove Road										
24" FPVC Pipe HDD	800	LF	$300.00	$240,000	incl.		incl.			$240,000
Force Main - Henlopen Ave to Deauville Beach										
24" PVC Pipe w/ Pavement Open Cut	5400	LF	$150.00	$810,000	incl.		incl.			$810,000
Traffic Control	27	DAYS					39.000	$38.00	$40,014	$40,014
Air Release Valve and Vault	4	EA	$30.000.00	$120,000	incl.		incl.			$120,000
		Overhead	**10%**	163800	**10%**			**10%**	$4,742	**$168,542**
		Profit	**10%**	$163,800	**10%**			**10%**	$4,742	**$168,542**
		Subtotal		$1,965,600					$56,909	**$2,022,509**
		General Requirements	**10%**	$196,560	**10%**			**10%**	$5,691	**$202,251**
		Subtotal		$2,162,160					$62,600	**$2,224,760**
		Contingency	**30%**	$648,648	**30%**			**30%**	$18,780	**$667,428**
		TOTAL		$2,810,808						**$2,892,188**

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Client: City of Rehoboth Beach
Project: Rehoboth Beach WWTP Force Main
Subject: 24" PVC Alternative B
Job Number: 861432706

Computed By: LWM
Date: 11/28/2011
Checked By:
Date:

Description	Quantity		Material		Equipment		Labor			Total Cost
	No. Units	Basis	Per Unit	Total	Per Unit	Total	Man Hours	$/Man Hour	Total	
Force Main - State Rd Intersect to Rehoboth Ave										
24" PVC Pipe w/ Pavement Open Cut	2260	LF	$150.00	$339,000	incl.		incl.			$339,000
24"- 45 Degree Bend	3	EA	$3,650.00	$10,950	$128.00	$384	$ 8.80	$38.00	$1,003	$12,337
Traffic Control	12	DAYS					$ 39.00	$38.00	$17,784	$17,784
Force Main - Rehoboth Ave to Fifth Street										
24" FPVC Pipe HDD	400	LF	$300.00	$120,000	incl.		incl.			$120,000
Traffic Control	5	DAYS					39.000	$38.00	$7,410	$7,410
Force Main - Fifth St to Columbia Ave										
24" PVC Pipe w/ Pavement Open Cut	400	LF	$150.00	$60,000	incl.		incl.			$60,000
Traffic Control	2	DAYS					39.000	$38.00	$2,964	$2,964
Force Main - Columbia Ave to Deauville Beach										
24" FPVC Pipe HDD	2300	LF	$300.00	$690,000	incl.		incl.			$690,000
24" PVC Pipe w/ Pavement Open Cut	1600	LF	$150.00	$240,000	incl.		incl.			$240,000
24" PVC Pipe No Pavement Open Cut	700	LF	$125.00	$87,500	incl.		incl.			$87,500
24"- 45 Degree Bend	3	EA	$3,650.00	$10,950	incl.		incl.			$10,950
Traffic Control	39	DAYS					39.000	$38.00	$57,798	$57,798
Air Release Valve and Vault	4	EA	$30,000.00	$120,000	incl.		incl.			$120,000
		Overhead	**10%**	167840	**10%**	$38		**10%**	$8,696	**$176,574**
		Profit	**10%**	$167,840	**10%**	$38		**10%**	$8,696	**$176,574**
		Subtotal		$2,014,080		$461			$104,351	**$2,118,892**
		General Requirements	**10%**	$201,408	**10%**	$46		**10%**	$10,435	**$211,889**
		Subtotal		$2,215,488		$507			$114,786	**$2,330,781**
		Contingency	**30%**	$664,646	**30%**	$152		**30%**	$34,436	**$699,234**
		TOTAL		$2,880,134		$659				**$3,030,015**

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	L. Mayer	R. Copithorn				
1	L. Mayer	R. Copithorn		R. Copithorn		