PROJECT DESIGN AND SAMPLING PLAN

Per- and Polyfluoroalkyl Substances (PFAS) in Groundwater from Monitoring Wells at Wastewater Treatment and Disposal Facilities

Department of Natural Resources and Environmental Control

Division of Water

89 Kings Highway
Dover, DE 19901

November 2025

Table of Contents

1.0 INTRODUCTION

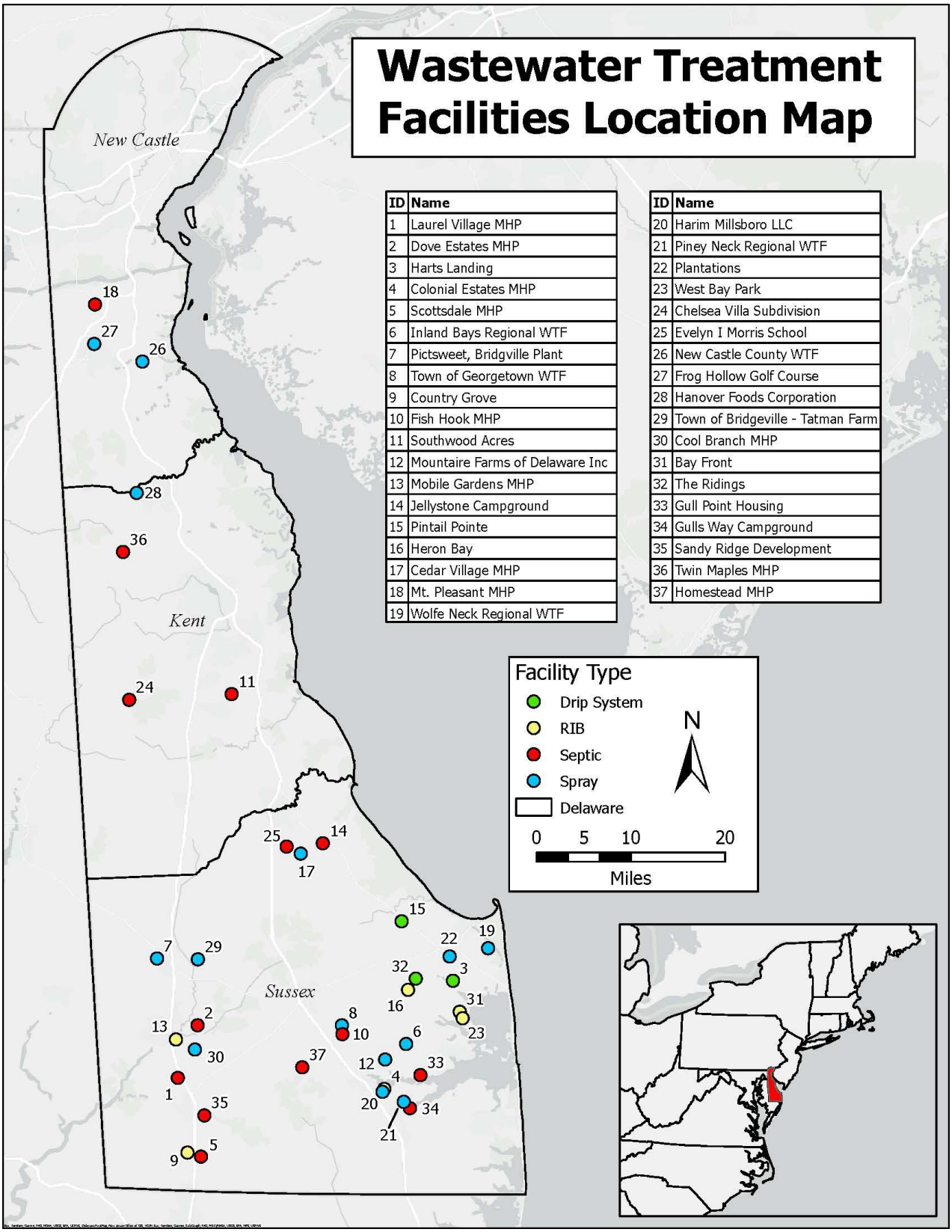
In July 2023, the Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Water (DW) launched a screening study of Per- and Polyfluoroalkyl Substances (PFAS) in wastewater (aka Phase I Wastewater PFAS) which included sampling of influent and effluent at select wastewater treatment facilities, as well as soils, groundwater and adjacent surface water from spray application fields and rapid infiltration basins (RIBs). Fourteen wastewater treatment facilities and disposal sites across the State of Delaware were selected for the study. Sampling was completed in July 2024, and a data summary report was prepared and posted on de.gov/PFAS in March 2025 (DNREC, 2023; DNREC, 2025). Based on the results from Phase I, DNREC is expanding its study to sample groundwater for PFAS from selected monitoring wells installed at all wastewater disposal facilities throughout the state that discharge more than 10,000 gallons per day (GPD) of treated wastewater to groundwater for disposal (groundwater discharge facilities). The scope of work for this study, named Phase II Wastewater PFAS, is presented in this document.

Discharges from wastewater treatment facilities can be categorized in two ways, either by the receiving media or the source of the wastewater. Receiving media can be surface water bodies (rivers, bay, or ocean) and are classified as "Surface Water Discharges", or wastewater applications to the land surface and subsurface which ultimately reaches the groundwater or "Groundwater Discharges". There are three classifications of wastewater sources, municipal, industrial, or residential. Industrial wastewater discharges are from industrial and commercial sources which may contain pollutants at levels that could affect the quality of receiving waters or interfere with publicly owned treatment works that receive those discharges. Municipal wastewater may be a combination of residential, businesses and industrial sources. Residential or domestic wastewater originates from activities such as restroom usage, bathing, food preparation and laundry.

For this study, groundwater sampling for PFAS analysis will be performed from selected upgradient and downgradient monitoring well installed at qualified groundwater discharge facilities. **Section 2.0** presents descriptions of selected groundwater discharge facilities; **Section 3.0** presents the sampling plan for each facility; **Section 4.0** discusses quality assurance and quality control; **Section 5.0** shows the tentative project schedule, and **Section 6.0** summarizes the proposed activities.

2.0 FACILITY DESCRIPTION

Four types of groundwater discharge facilities are included in this study: spray irrigation (treated wastewater applied over crops/grass fields/forested areas), rapid infiltration basins (RIBs) (discharged directly into the artificially constructed soil basins), large septic systems, and drip systems. Thirty-seven groundwater discharge facilities across the state met the study criteria of a discharge rate > 10,000 GPD and monitoring wells installed, which includes fourteen spray irrigation, six RIBs, fourteen large septic systems, and three drip systems ***(Figure 1)***. A location map for each facility was created using DNREC NavMap (DNREC NavMap) and the download date is provided in the map. A summary of these facilities is shown in ***Table 1***.



ID	Name
1	Laurel Village MHP
2	Dove Estates MHP
3	Harts Landing
4	Colonial Estates MHP
5	Scottsdale MHP
6	Inland Bays Regional WTF
7	Pictsweet, Bridgville Plant
8	Town of Georgetown WTF
9	Country Grove
10	Fish Hook MHP
11	Southwood Acres
12	Mountaire Farms of Delaware Inc
13	Mobile Gardens MHP
14	Jellystone Campground
15	Pintail Pointe
16	Heron Bay
17	Cedar Village MHP
18	Mt. Pleasant MHP
19	Wolfe Neck Regional WTF

ID	Name
20	Harim Millsboro LLC
21	Piney Neck Regional WTF
22	Plantations
23	West Bay Park
24	Chelsea Villa Subdivision
25	Evelyn I Morris School
26	New Castle County WTF
27	Frog Hollow Golf Course
28	Hanover Foods Corporation
29	Town of Bridgeville - Tatman Farm
30	Cool Branch MHP
31	Bay Front
32	The Ridings
33	Gull Point Housing
34	Gulls Way Campground
35	Sandy Ridge Development
36	Twin Maples MHP
37	Homestead MHP

Figure 1 Locations of facilities for Phase II Wastewater PFAS.

Facility Name	Site Type	Wastewater Source	Discharge Rate* (GPD)
Laurel Village MHP	Septic	Residential	40,200
Dove Estate MHP	Septic	Residential	11,100
Harts Landing	Drip System	Residential	39,150
Colonial Estates MHP	RIB	Residential	11,000
Scottsdale MHP	Septic	Residential	22,200
Inland Bays Regional WTF	Spray	Municipal	2,650,000
Pictsweet, Bridgeville Plant	Spray	Industrial	1,930,000
Town of Georgetown WTF	Spray	Municipal	1,900,000
Country Grove	RIB	Residential	54,000
Fish Hook MHP	Septic	Residential	11,700
Southwood Acres	Septic	Residential	51,194
Mountaire Farms of Delaware Inc	Spray	Industrial	2,600,000
Mobile Gardens MHP	RIB	Residential	60,000
Jellystone Campground	Septic	Residential	19,900
Pintail Pointe	Drip System	Residential	11,700
Heron Bay	RIB	Residential	97,506
Cedar Village MHP	Spray	Residential	60,000
Mt Pleasant MHP	Septic	Residential	11,700
Wolfe Neck Regional WTF	Spray	Municipal	4,000,000
Harim Millsboro LLC	Spray	Residential	280,000
Piney Neck Regional WTF	Spray	Municipal	200,000
Plantations	Spray	Residential	57,269
West Bay Park	RIB	Residential	92,520
Chelesa Villa Subdivision	Septic	Residential	22,200
Evelyn I Morris School	Septic	Residential	10,230
New Castle County WTF	Spray	Municipal	2,500,000

Frog Hollow-The Legends Golf Course Community	Spray	Municipal	250,000
Hanover Foods Corporation	Spray	Industrial	940,000
Town of Bridgeville - Tatman Farm	Spray	Municipal	345,279
Cool Branch MHP	Spray	Residential	63,000
Bay Front	RIB	Residential	540,000
The Ridings	Drip System	Residential	70,000
Gull Point Housing	Septic	Residential	42,020
Gulls Way Campground	Septic	Residential	30,150
Sandy Ridge Development	Septic	Residential	17,700
Twin Maples MHP	Septic	Residential	15,201
Homestead MHP	Septic	Residential	11,100

* Design flow rate; GPD = gallons per day, MHP = mobile home park, WTF = wastewater treatment facility, RIB = rapid infiltration basin

Table 1 Groundwater discharge facilities selected for PFAS study.

2.1. Laurel Village Mobile Home Park (Septic)

- Permit Number: 359167-02
- Permittee: Laurel Village MHP, LLC
- Operator: Licensed Operator
- Operational History: Portions of the community in place before 1991. Community system expanded in 1991.
- Facility Location: 10159 Palmetto Street, Laurel, DE 19956
- Design Flow Rate: 40,200 GPD (system one – 21,000 GPD and system two – 19,200 GPD)
- Facility Description: The Laurel Village On-site Wastewater Treatment and Disposal System (OWTDS) is authorized to receive and treat domestic wastewater from 134 lots located at the Laurel Village MHP. The site consists of two systems. System 1 serves 70 lots and System 2 serves 64 lots. System 1 consists of two 1,000 gallon (G) septic tanks, twenty-seven 1,500 G septic tanks, and two 2,800 G septic tanks that are equipped with pumps. Once treated, the wastewater flows to sixteen seepage beds for disposal. System 2 consists of twenty-five 1,500 G septic tanks, and one

8’ diameter dosing tank that is equipped with two pumps. Once treated, the wastewater flows to sixteen capping fill beds for disposal.

- Location Map:

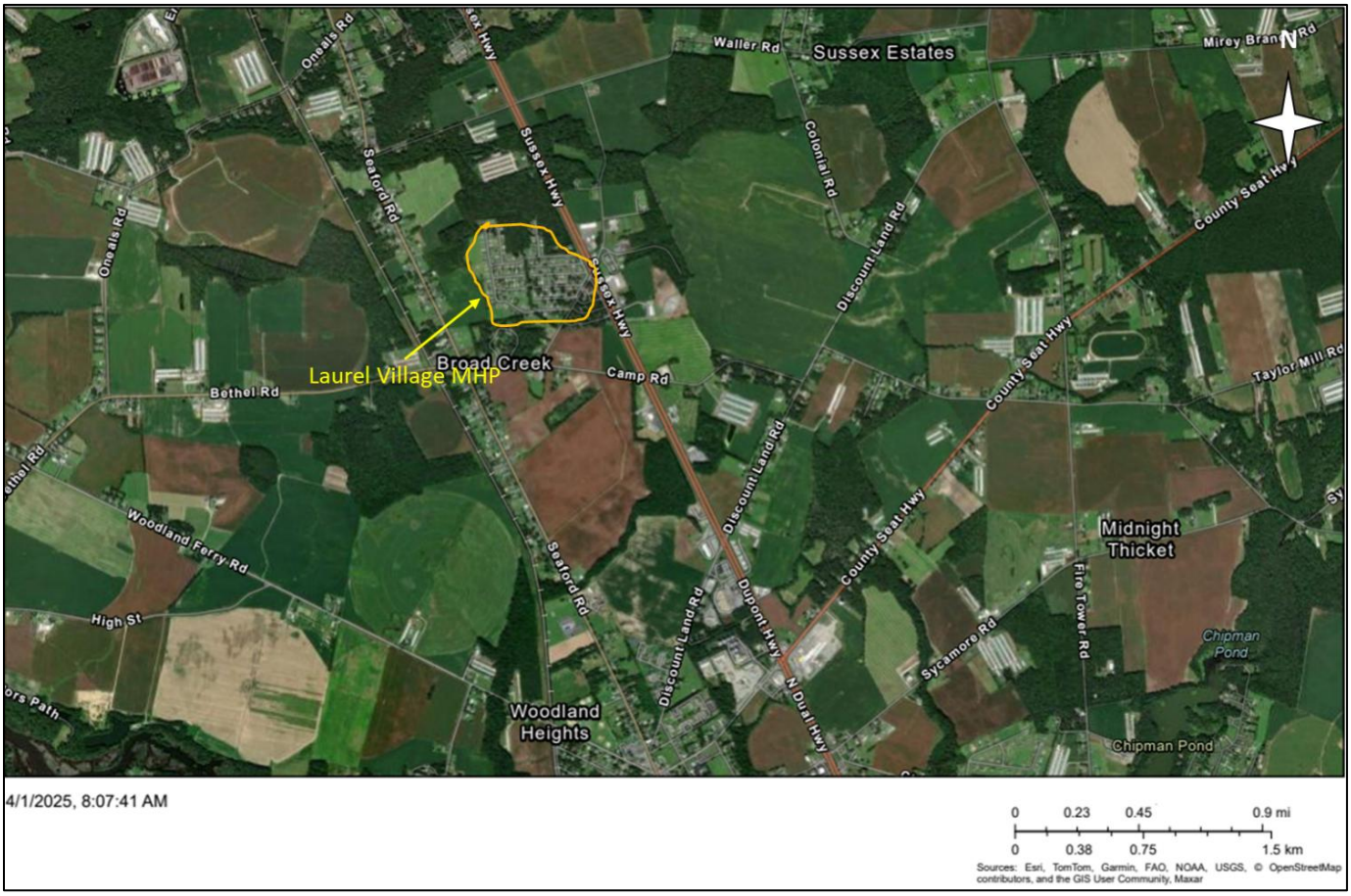


Figure 2 Location map of the Laurel Village MHP OWTDS.

2.2 Dove Estate Mobile Home Park (Septic)

- Permit Number: 359069-03
- Permittee: Dove Estates LLC
- Operator: Licensed Operator
- Operational History: Constructed in 1986
- Facility Location: 11427 Clover Drive, Seaford, DE 19973
- Design Flow Rate: 11,100 GPD

- Facility Description: The Dove Estates OWTDS is authorized to receive and treat domestic wastewater generated by 37 mobile homes located at the Dove Estates MHP. The effluent is treated by 17 septic tanks and sent through the collection system to the disposal area. Following treatment, the effluent is disposed of into one of four pressure dosed beds.
- Location Map:

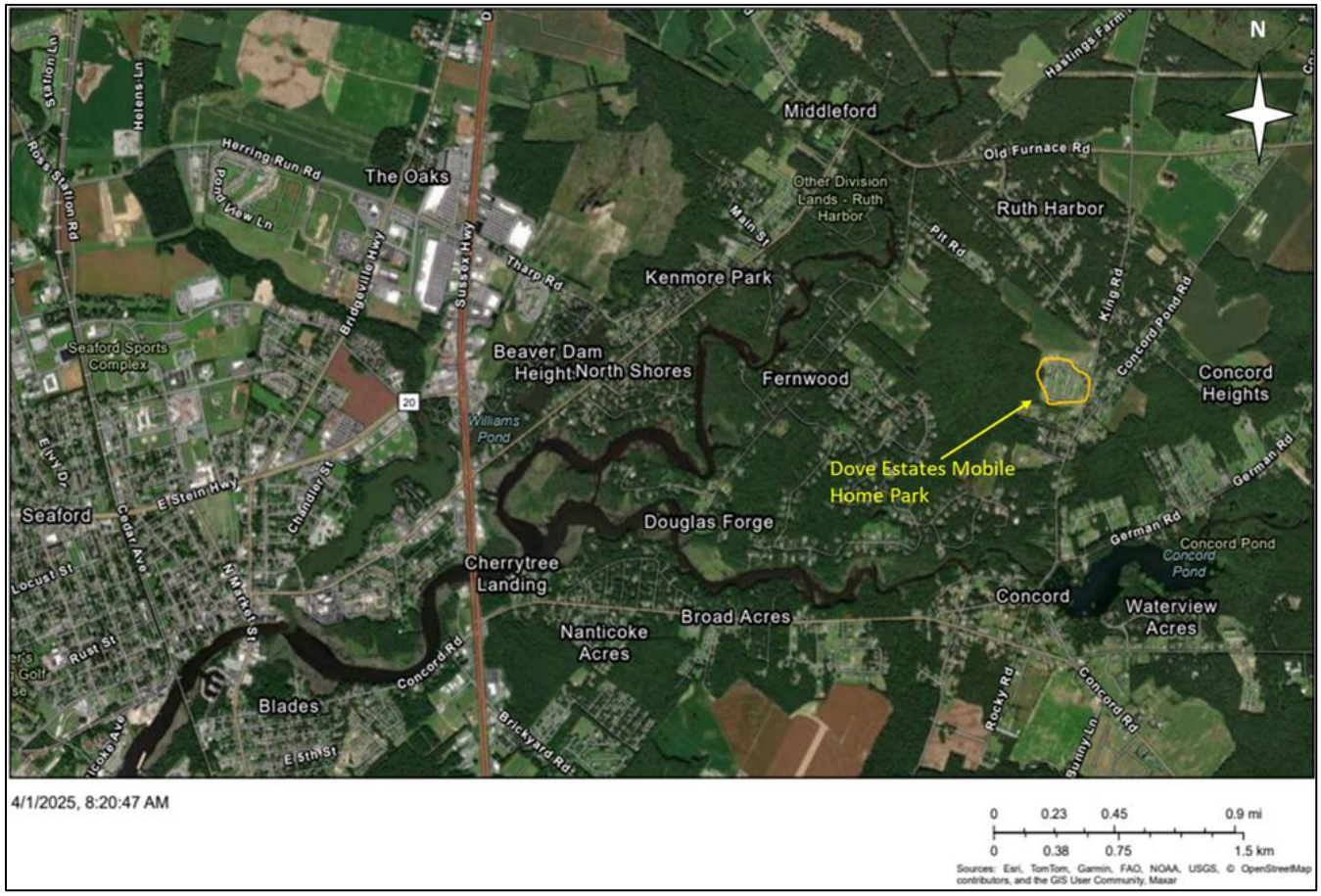


Figure 3 Location map of the Dove Estate MHP OWTDS.

2.3 Harts Landing (Drip System)

- Permit Number: 359119-03
- Permittee: Artesian Wastewater Management Inc.
- Operator: Licensed Operator
- Operational History: Operated since 2007
- Facility Location: 20729 Annondell Drive, Lewes, DE 19958

- Design Flow Rate: 39,150 GPD
- Facility Description: The Harts Landing OWTDS is authorized to receive and treat domestic wastewater from 145 dwellings and a community center located at the Hart's Landing Subdivision. The sanitary wastewater is treated by a Single Train Activated Sludge Process with Membrane Filtration and discharged to twelve drip dispersal zones. Treated effluent is sent to two separate zones for disposal.
- Location Map:

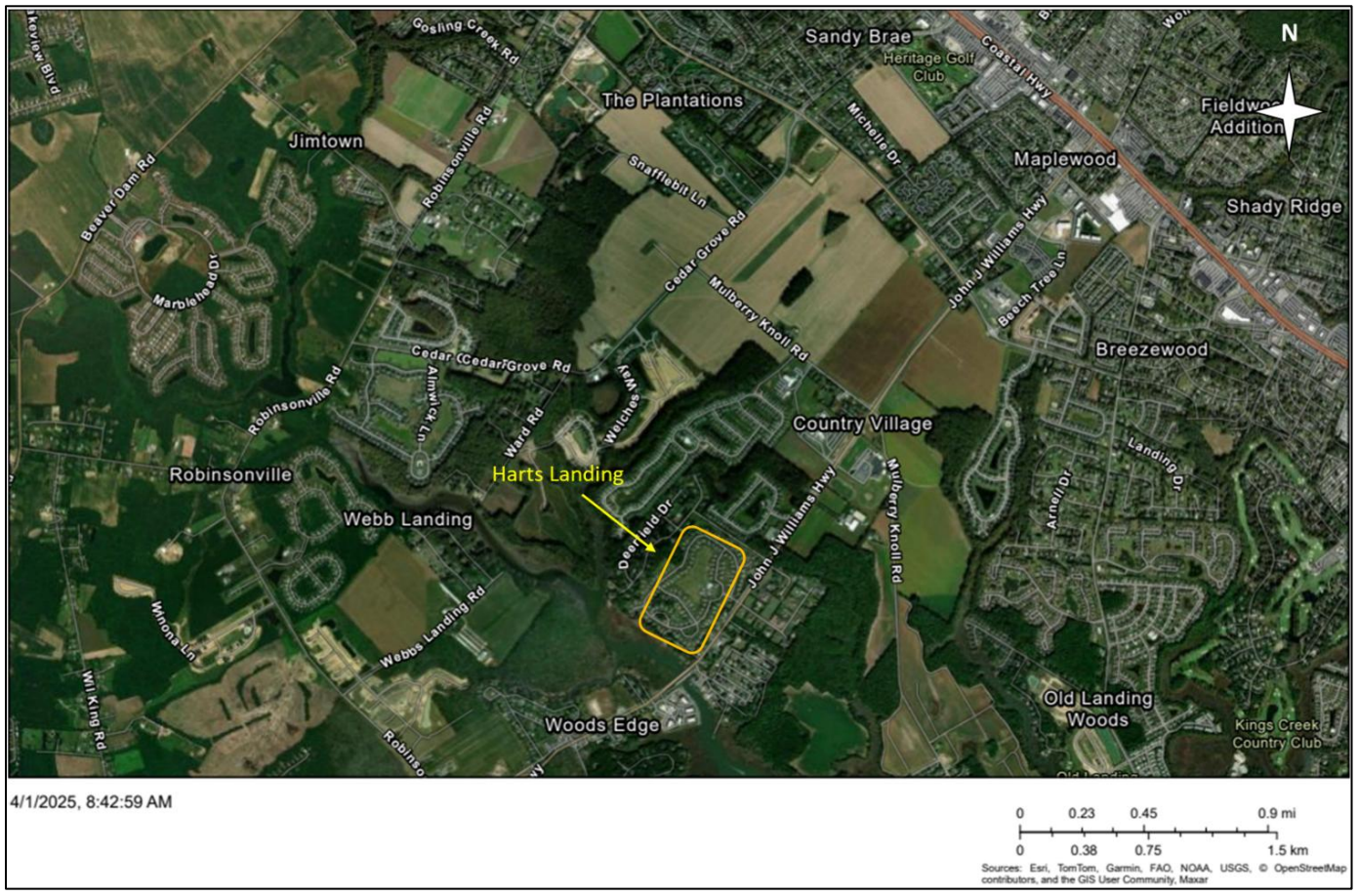


Figure 4 Location map of the Harts Landing OWTDS.

2.4 Colonial Estates Mobile Home Park (RIB)

- Permit Number: 359048-05
- Permittee: Southern Delaware Communities, Inc.
- Operator: Licensed Operator

- Operational History: Operated since 2001
- Facility Location: Colonial Estates Avenue, Millsboro, DE 19966
- Design Flow Rate: 11,000 GPD
- Facility Description: The Colonial Estates OWTDS is authorized to receive and treat domestic wastewater generated by 56 mobile homes located in the Colonial Estates MHP. The effluent is treated by an Integrated Surge Anoxic Mixing Sequencing Batch Reactor Package Plant and is disposed of into six RIBs.
- Location Map:

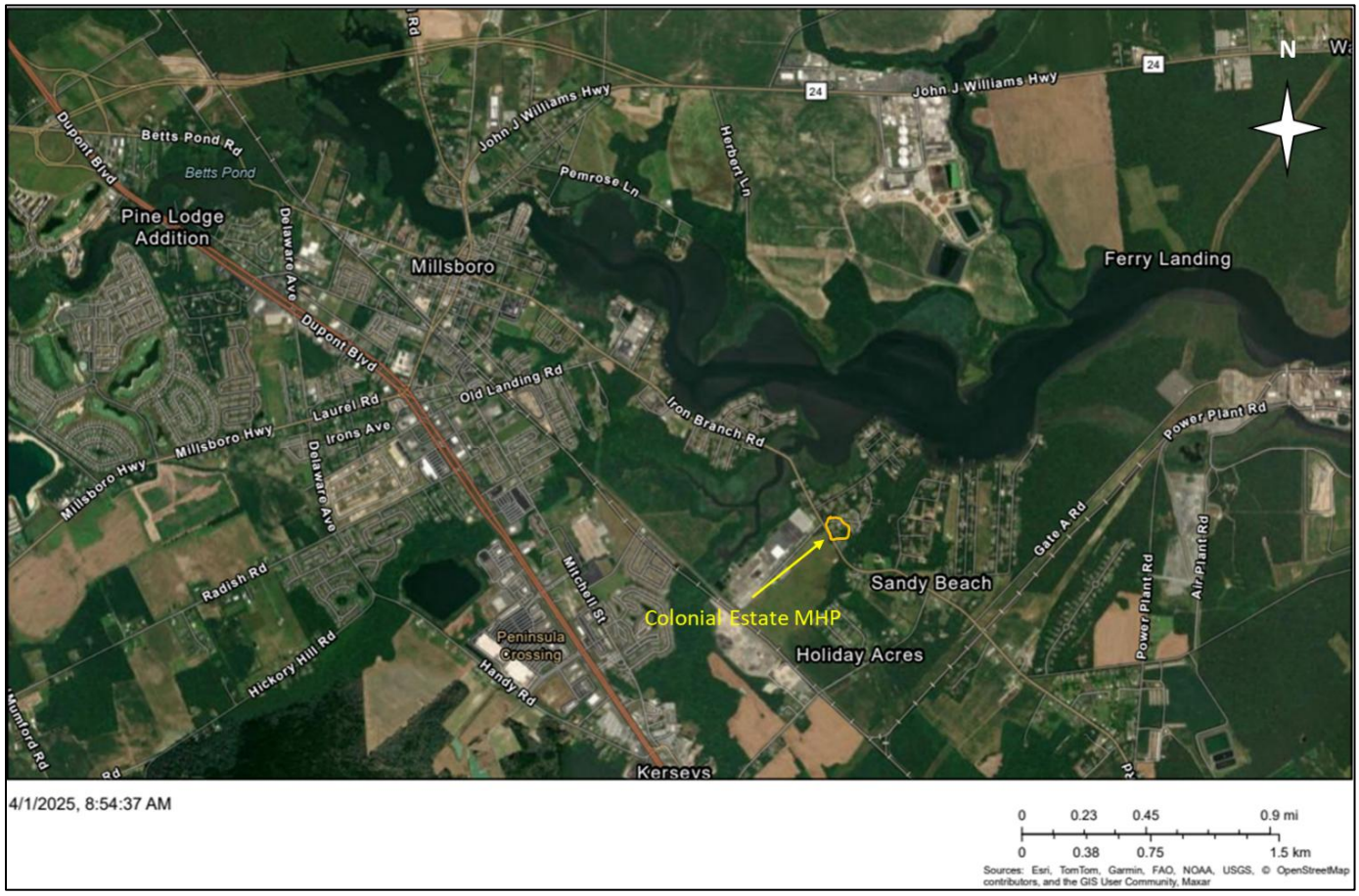


Figure 5 Location map of the Colonial Estates MHP OWTDS.

2.5 Scottsdale Mobile Home Park (Septic)

- Permit Number: 359255-02
- Permittee: Scottsdale MHP, LLC

- Operator: Licensed Operator
- Operational History: Operated since 1988
- Facility Location: 35531 Scottsdale Circle, Laurel, DE 19973
- Design Flow Rate: 22,200 GPD
- Facility Description: The Scottsdale OWTDS is authorized to receive and treat domestic wastewater generated by 100 mobile homes located within the Scottsdale MHP. Shared septic tanks are utilized to provide primary treatment of wastewater. Once the effluent leaves the septic tank it utilizes small diameter gravity sewer to collect at lift stations where it is lifted to the appropriate dosing chamber. The dosing chambers are utilized to dose corresponding elevated sand mounds.
- Location Map:

Figure 6 Location map of the Scottsdale MHP OWTDS.

2.6 Inland Bays Regional Wastewater Treatment Facility (Spray)

- Permit Number: 359141-08
- Permittee: Sussex County Council
- Operator: Licensed Operator
- Operational History: Prior to 1995
- Facility Location: 2945 Inland Bay Road, Millsboro, DE 19966
- Design Flow Rate: 2,650,000 GPD
- Facility Description: The Inland Bays Regional WTF is currently authorized to receive and treat up to 2,650,000 GPD of wastewater from Sussex County's wastewater service territories (Phase 1 Operations). The current system consists of influent headworks for screening and grit removal, two Biolac aeration lagoons for biological nutrient removal, two secondary clarifiers, one chlorine contact tank for disinfection, and two treated wastewater (effluent) storage lagoons. The facility's biosolids handling system includes three waste solids holding lagoons (one of which also serves as an overflow lagoon) a belt filter press for sludge dewatering, and a sludge dryer system. Treated wastewater (effluent) is currently stored in one 39 million gallon (MG) lagoon and one 32 MG lagoon prior to being discharged to 432.5 acres of County-owned agricultural fields via eight center pivot spray irrigation systems.
- Location Map:

Figure 7 Location map of the Inland Bay Regional WTF..

2.7 Pictsweet, Bridgeville Plant (Spray)

- Permit Number: 359222-06
- Permittee: The Pictsweet Company
- Operator: Licensed Operator
- Operational History: Prior to 1990
- Facility Location: 18215 Wesley Church Road, Bridgeville, DE 19933
- Design Flow Rate: 1,930,000 GPD
- Facility Description: The Pictsweet Company's Bridgeville Plant is a vegetable processing facility that handles peas, lima beans, and green beans. Wastewater generated in association with vegetable processing is screened and land applied through spray irrigation. The facility is currently authorized to treat wastewater generated in association with vegetable processing and spray

irrigate up to 1,930,000 GPD on permitted spray irrigation fields. The wastewater spray irrigation system at the facility includes two static screens, a 2.1 MG aerated storage lagoon, irrigation pumps, and three spray sites with grass or other vegetable crops. The Pictsweet irrigation site consists of 70.7 acres and includes five center pivot irrigation systems. The John Ray Farm irrigation site consists of 22.0 acres and includes one center pivot system. The Pictsweet Field #7 irrigation site consists of 40.5 acres and includes one center pivot system. The total irrigated area is 133.2 acres.

- Location Map:

Figure 8 Location map of the Pictsweet Bridgeville Plant WTF.

2.8 Town of Georgetown Wastewater Treatment Facility (Spray)

- Permit Number: 359297-09
- Permittee: Town of Georgetown
- Operator: Licensed Operator

- Operational History: Prior to 1992
- Facility Location: 24021 Cedar Lane, Georgetown, DE 19947
- Design Flow Rate: 1,900,000 GPD
- Facility Description: The Town of Georgetown is authorized to operate and maintain the WTF to treat domestic wastewater from the Town of Georgetown and to spray irrigate the treated effluent onto permitted agricultural spray fields located in Sussex County, Delaware as listed in Part I.A of their permit. The Town of Georgetown's wastewater collection, transmission, and treatment system consists of a network of gravity sewer mains, a system of pump stations, a grit removal and flow equalization facility, and a wastewater treatment and effluent spray irrigation facility.
- Location Map:

Figure 9 Location map of the Town of Georgetown Regional WTF.

2.9 Country Grove (RIB)

- Permit Number: 359054-02

- Permittee: Artesian Wastewater Management Inc.
- Operator: Licensed Operator
- Operational History: Operated since 2007
- Facility Location: 10242 Bacons Road, Delmar, DE 19940
- Design Flow Rate: 54,000 GPD
- Facility Description: The Country Grove OWTDS is authorized to receive and treat domestic wastewater generated by 180 dwellings located within the Country Grove and residual discharged from the Country Grove Water Treatment Plan. The effluent is treated by dual Fluidyne ISAM 30 Wastewater Treatment Plant. Once treated the effluent is sent to six RIBs.
- Location Map:

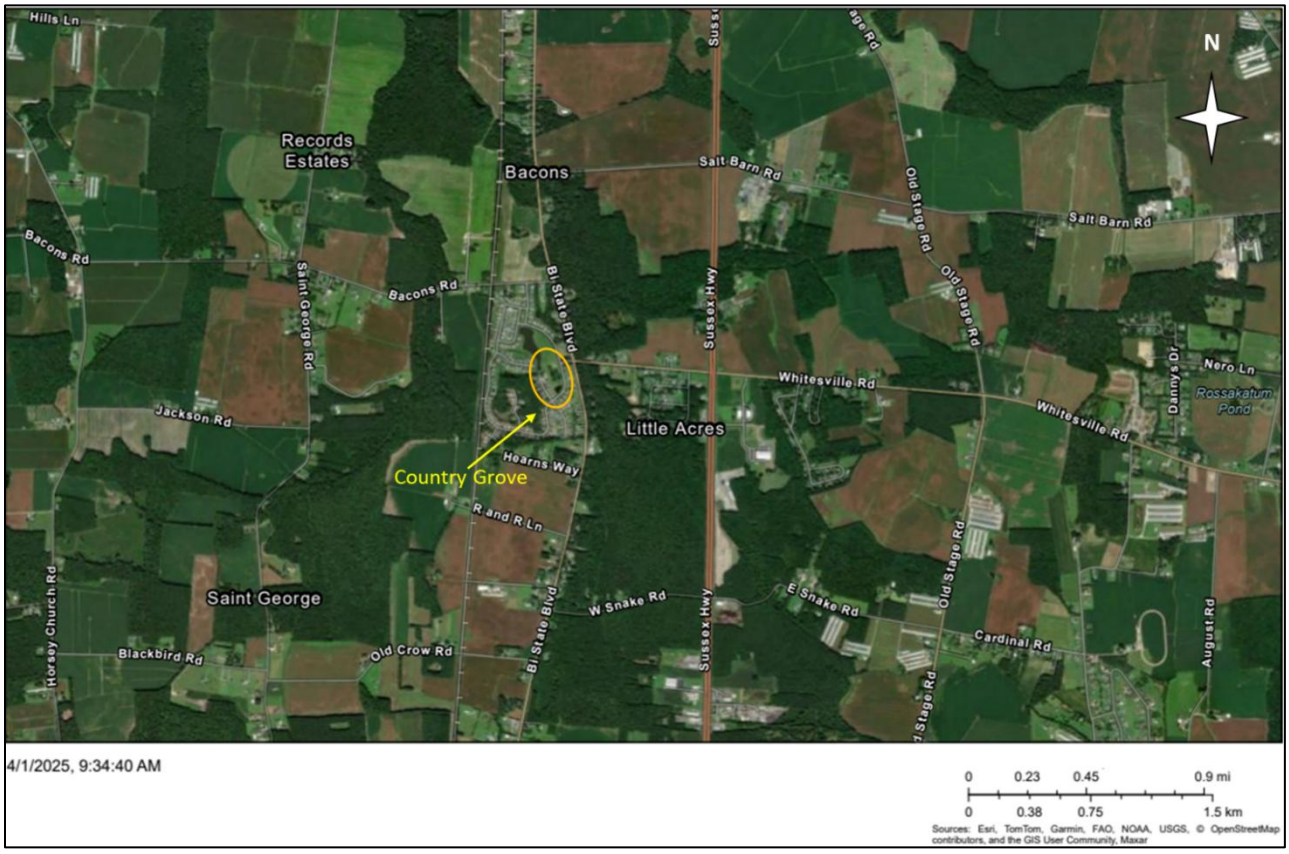


Figure 10 Location map of the Country Grove OWTDS.

2.10 Fish Hook Mobile Home Park (Septic)

- Permit Number: 359091-03
- Permittee: Fish Hook MHP, LLC
- Operator: Licensed Operator

- Operational History: Operated since 1999
- Facility Location: Corner of Zoar Road, Cedar Lane, Georgetown, DE 19947
- Design Flow Rate: 11,700 GPD
- Facility Description: The Fish Hook OWTDS is authorized to receive and treat sanitary wastewater generated by 39 mobile homes located in the Fish Hook MHP. The system with five pressure dosed disposal beds (System A) services 14 mobile homes at a daily maximum flow of 4,200 GPD. The system with ten pressure dosed disposal beds (System B) services 25 mobile homes at a daily maximum flow of 7,500 GPD. Primary treatment occurs through the utilization of septic tanks. Once treated the effluent gravity flows to a dosing chamber equipped with pumps to dose the pressure dose systems. Each bed is dosed three times a day.
- Location Map:

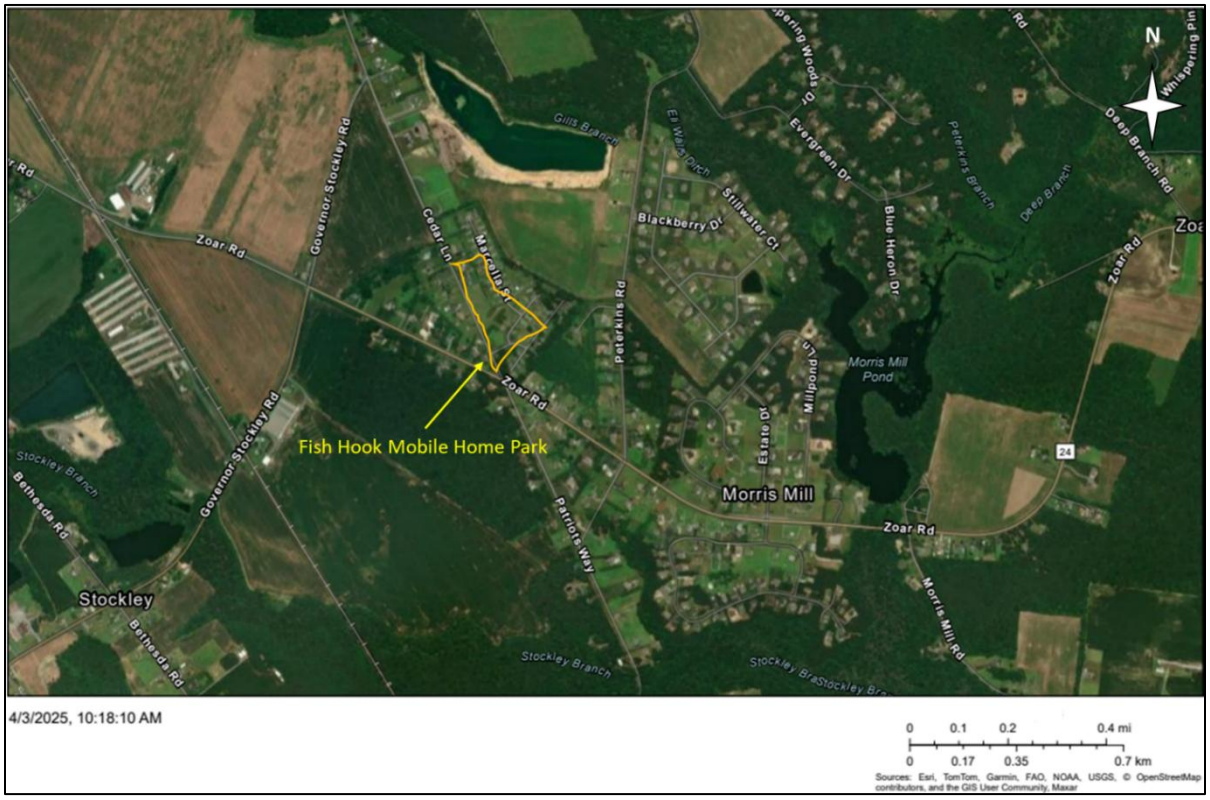


Figure 11 Location map of the Fish Hook MHP OWTDS.

2.11 Southwood Acres (Septic)

- Permit Number: 359264-04

- Permittee: Investors Realty, Inc.
- Operator: Licensed Operator
- Operational History: Operated since 2006
- Facility Location: Bluebell Drive, Magnolia, DE 19962
- Design Flow Rate: 51,194 GPD
- Facility Description: The Southwood Acres OWTDS is authorized to receive and treat sanitary wastewater from 206 mobile homes located in the Southwood Acres MHP. The sanitary wastewater is treated by a dual Geoform Rotating Biological Contactor wastewater treatment system, filtered by a DynaSand DSF07 filter and then the treated wastewater is discharged to six RIBs for final disposal.
- Location Map:

Figure 12 Location map of the Southwood Acres MHP OWTDS.

2.12 Mountaire Farms of Delaware Inc (Spray)

- Permit Number: 359191-06

- Permittee: Mountaire Farms of Delaware, Inc.
- Operator: Licensed Operator
- Operational History: Prior to 1988
- Facility Location: 29106 John J. Williams Highway, Millsboro, DE 19966
- Design Flow Rate: 2,600,000 GPD
- Facility Description: The Mountaire Farms of Delaware Inc WTF is designed to receive and treat poultry processing wastewater, stormwater, and sanitary wastewater. The current treatment process includes the following elements: primary and secondary screening, equalization tank, dissolved air flotation, anaerobic lagoon biological treatment/equalization (two lagoons), activated sludge biological treatment with biological nutrient reduction capability–Modified Ludzack-Ettinger, post-anaerobic DAF, secondary clarification (two units), sludge digestion and thickening, disinfection (chlorination) and a post-treatment spray irrigation storage lagoon. The effluent is spray irrigated onto approximately 893 acres. Seven center pivot spray irrigation systems are located north of State Route #24. In addition, six center pivot spray irrigation systems are located south of Route #24.
- Location Map:

Figure 13 Location map of the Mountaire Farms of Delaware Inc. WTF.

2.13 Mobile Gardens Mobile Home Park (RIB)

- Permit Number: 359189-03
- Permittee: Mobile Gardens MHP, LLC
- Operator: Licensed Operator
- Operational History: Operated since 2008
- Facility Location: 25713 South Parkway Road, Seaford, DE 19973
- Design Flow Rate: 60,000 GPD
- Facility Description: The Mobile Gardens OWTDS is authorized to receive and treat sanitary wastewater generated from 277 dwellings from the Mobile Gardens and Hollyview MHP plus an additional 48 units from Brickyard Apartments upon written authorization from the Department. Wastewater is sent from the collection system to an existing 5’ diameter pre-cast concrete wet well.

Wastewater is then pumped from the wet well to the wastewater treatment plant. The sanitary wastewater is treated by a Biologically Engineered Single Sludge Treatment wastewater treatment plant. Once treated, the wastewater is disinfected prior to disposal. The effluent is disposed of into one of five RIBs. The RIB area has been designed to receive a maximum flow of 76,450 GPD adjusted seasonally due to limits on high groundwater and mounding influences.

- Location Map:

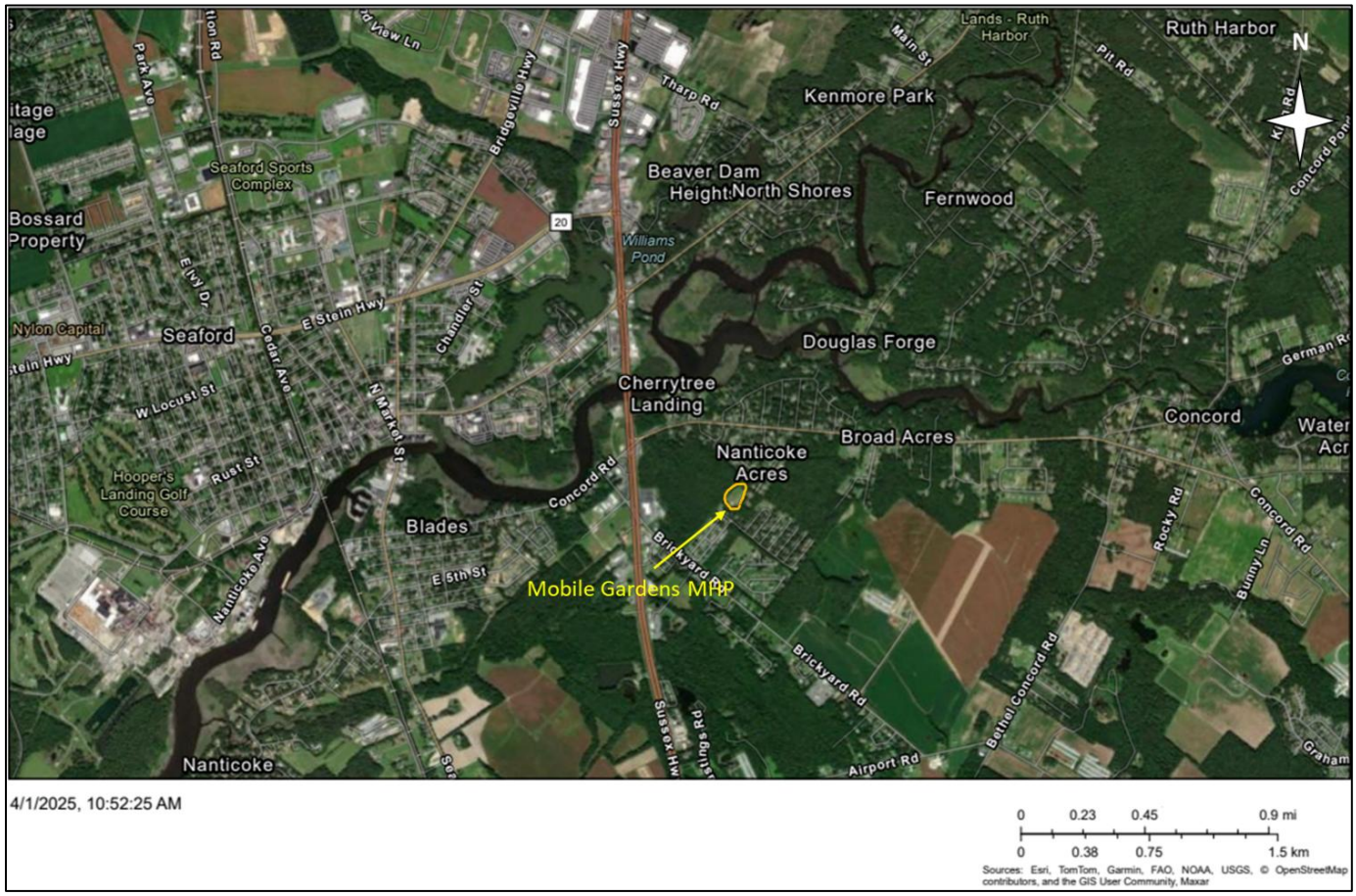


Figure 14 Location map of the Mobile Gardens MHP OWTDS.

2.14 Jellystone Campground (Septic)

- Permit Number: 359002-03
- Permittee: Bluewater Development
- Operator: Licensed Operator
- Operational History: Operated since 2006

- Facility Location: 8295 Brick Granary Road, Lincoln, DE 19960
- Design Flow Rate: 19,900 GPD
- Facility Description: The Jellystone Campground OWTDS is authorized to receive and treat sanitary wastewater generated by 266 campsites and an office/convenience store with two employees. The wastewater gravity flows to septic tanks that are equipped with effluent filters and flows to a dosing chamber. A separate pressure dosed disposal bed is utilized for the pool backwash wastewater.
- Location Map:

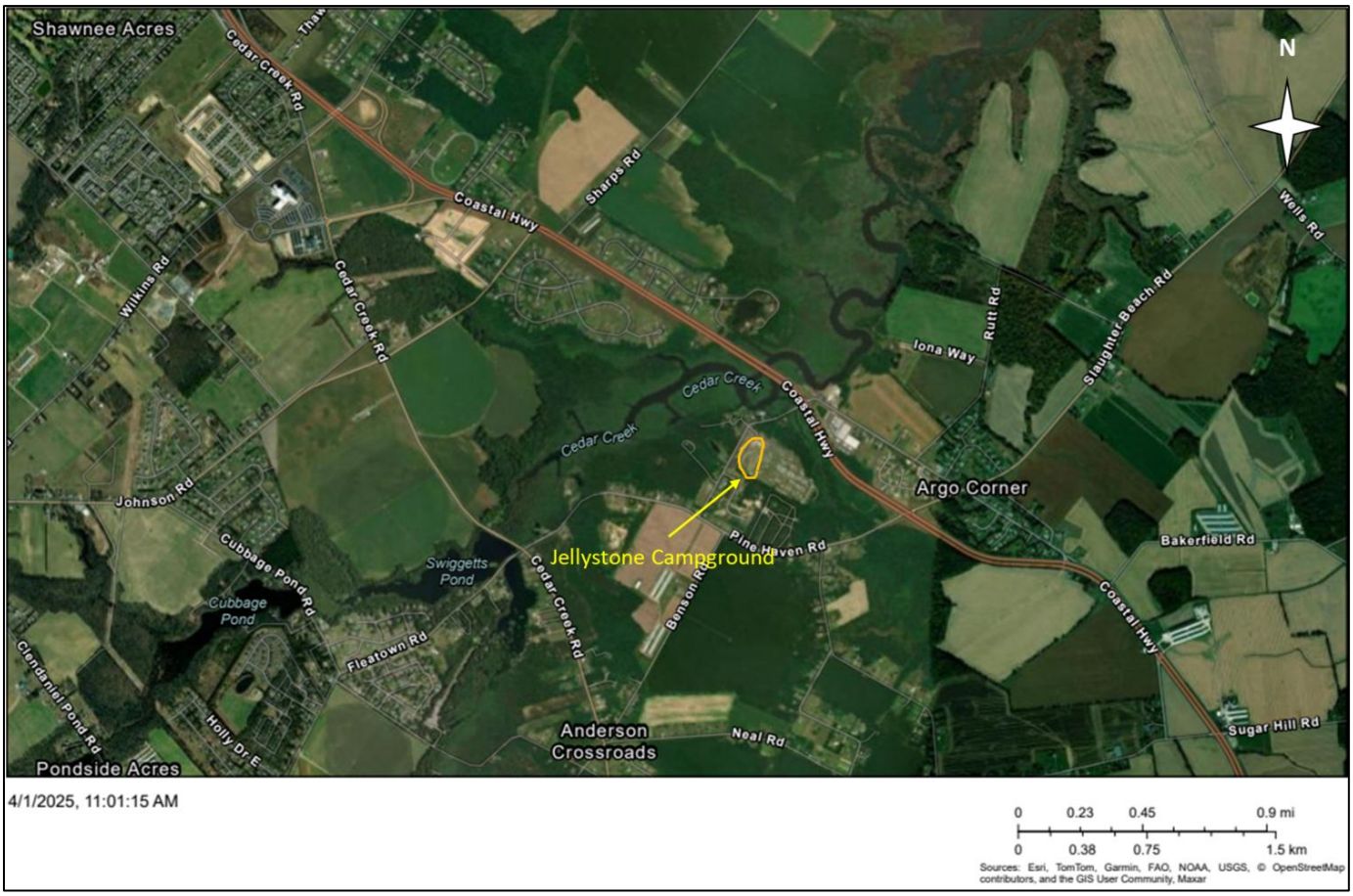


Figure 15 Location map of the Jellystone Campground OWTDS.

2.15 Pintail Pointe (Drip System)

- Permit Number: 208427-OP
- Permittee: Pintail Pointe Homeowners Association

- Operator: Licensed Operator
- Operational History: Operated since 2007. This facility is currently closed and connected to the Sussex County WTF in December 2023.
- Facility Location: Finch Lane, Milton, DE 19968
- Design Flow Rate: 11,700 GPD
- Facility Description: The Pintail Pointe OWTDS was authorized to receive and treat sanitary wastewater generated from thirty-nine dwellings located within the Pintail Pointe Subdivision. The influent flows from the dwellings did not exceed a daily monthly average of 11,700 GPD. The wastewater was treated by a Water Incorporated Aeration Package Treatment Plant with filtration and disposed of into nine full depth pressure dosed disposal beds. The disposal beds were dosed three times a day for a cumulative flow of 1,300 GPD/bed.
- Location Map:

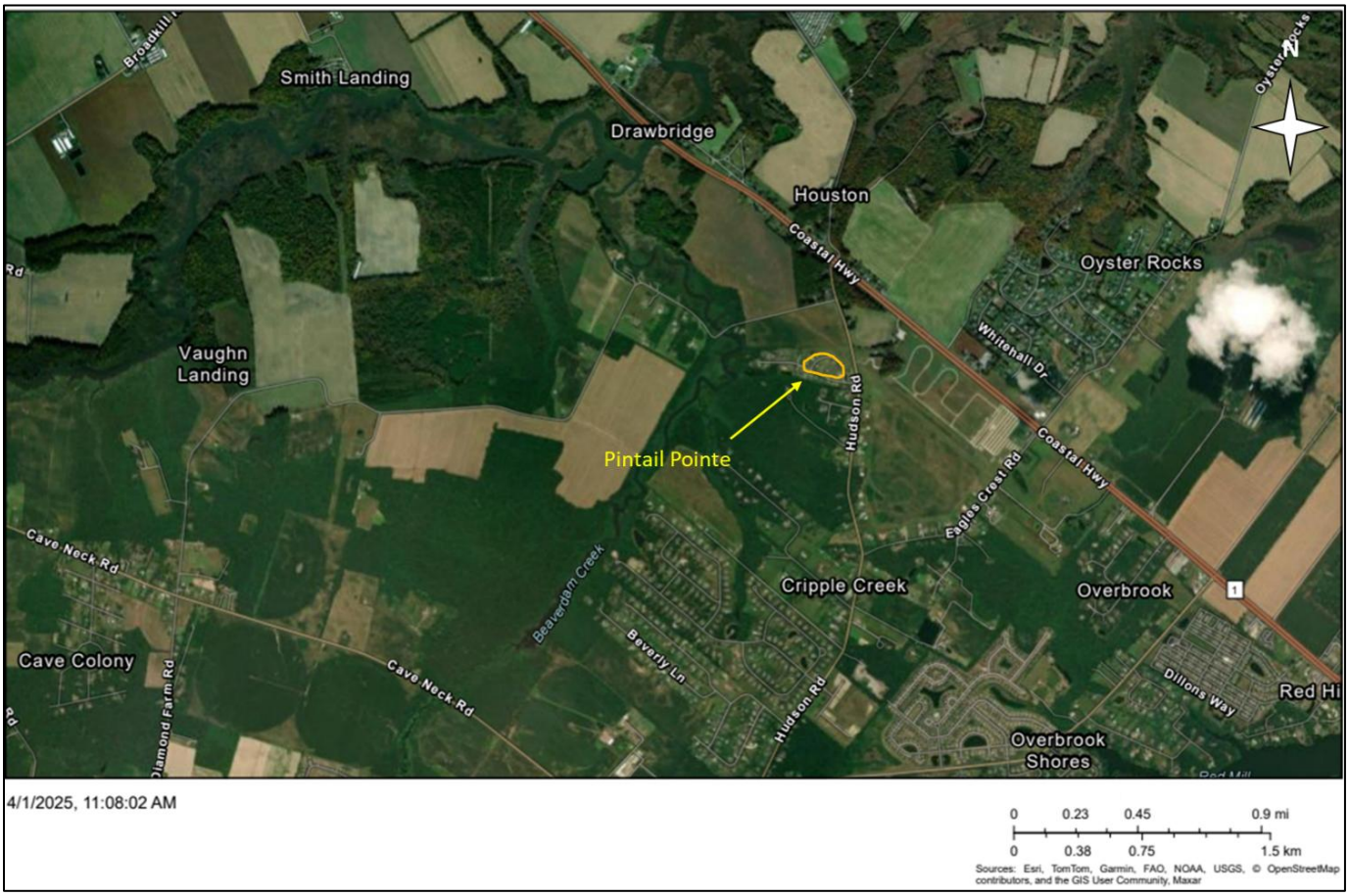


Figure 16 Location map of the Pintail Pointe OWTDS.

2.16 Heron Bay (RIB)

- Permit Number: 359124-03
- Permittee: Artesian Wastewater Management, Inc.
- Operator: Licensed Operator
- Operational History: Operated since 2007 but temporarily closed since 2023
- Facility Location: 29988 W Barrier Reef Blvd, Lewes, DE 19958
- Design Flow Rate: 97,506 GPD
- Facility Description: The Heron Bay OWTDS is authorized to receive and treat sanitary wastewater generated from 856 dwellings and a community center from developments located in the area as identified in the Conditional Use approval from Sussex County. The influent flows from the dwellings and center may not exceed a daily monthly average of 97,506 GPD. The effluent is treated by two Fluidyne ISAM-50 wastewater treatment plants and disposed of into six RIBS.
- Location Map:

Figure 17 Location map of the Heron Bay OWTDS.

2.17 Cedar Village Mobile Home Park (Spray)

- OWTDS-Spray Permit Number: 359042-02
- Permittee: Cedar Village, LLC
- Operator: Licensed Operator
- Operational History: Prior 1994
- Facility Location: 132 Amelia Dr, Lincoln, DE 19960
- Design Flow Rate: 60,000 GPD
- Facility Description: The wastewater treatment facility treats domestic wastewater collected from the Cedar Village MHP. The treatment facility consists of two partially mixed aerated lagoons; one 3.8 MG facultative polishing/storage lagoon; and one 5,000 G chlorine contact chamber. The treated effluent is discharged to a 7.61 acre spray irrigation field via a solid set spray irrigation system.
- Location Map:

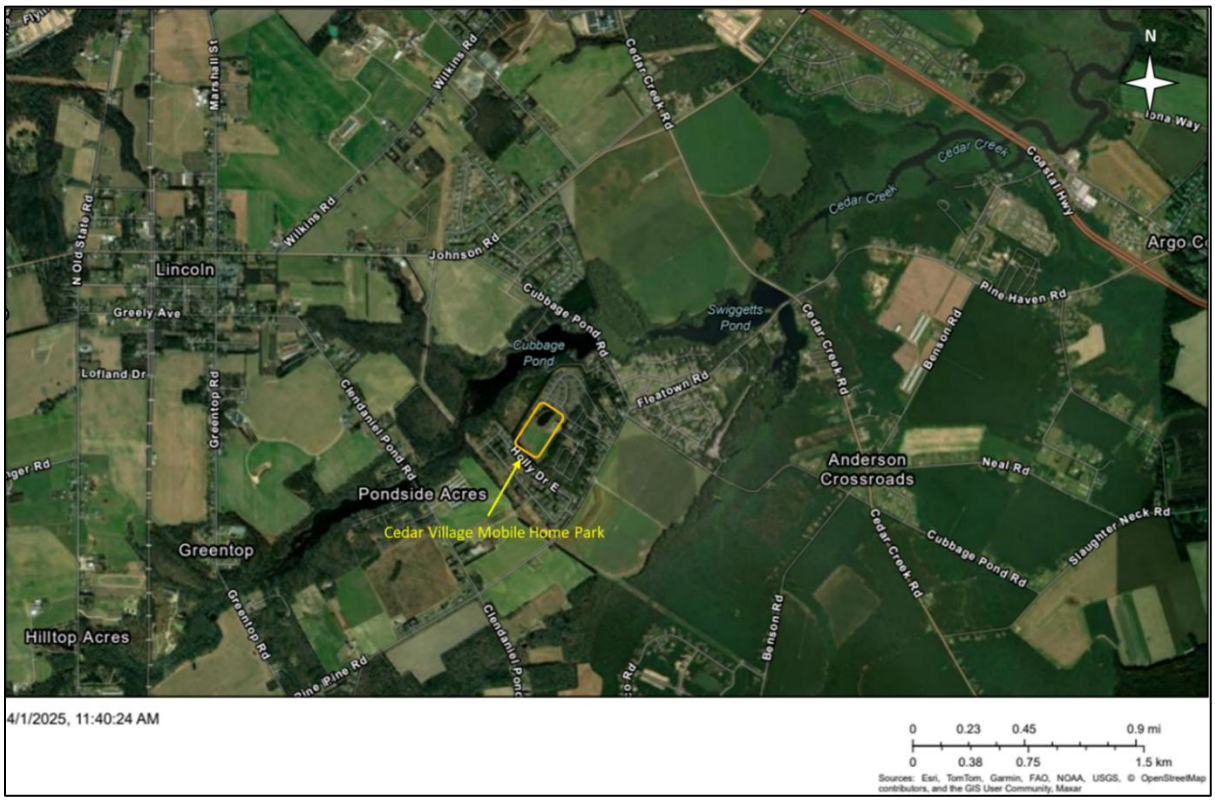


Figure 18 Location map of the Cedar Village MHP WTF.

2.18 Mt. Pleasant Mobile Home Park (Septic)

- Permit Number: 359193-04
- Permittee: Mt. Pleasant MHP, LLC
- Operator: Licensed Operator
- Operational History: Operated since 2001
- Facility Location: 4401 Summit Bridge Road, Middletown, DE 19709
- Design Flow Rate: 11,700 GPD
- Facility Description: The Mt. Pleasant MHP OWTDS is authorized to receive and treat sanitary wastewater generated from 39 mobile homes located within the Mt. Pleasant Mobile Home Community. The sanitary wastewater is pre-treated by one septic tank. The effluent is treated by five 1,000 G and sixteen 1,500 G septic tanks, one 1,000 G dosing tank and three lift tanks. The wastewater is pumped to twelve pressure dosed bed systems for disposal.
- Location Map:

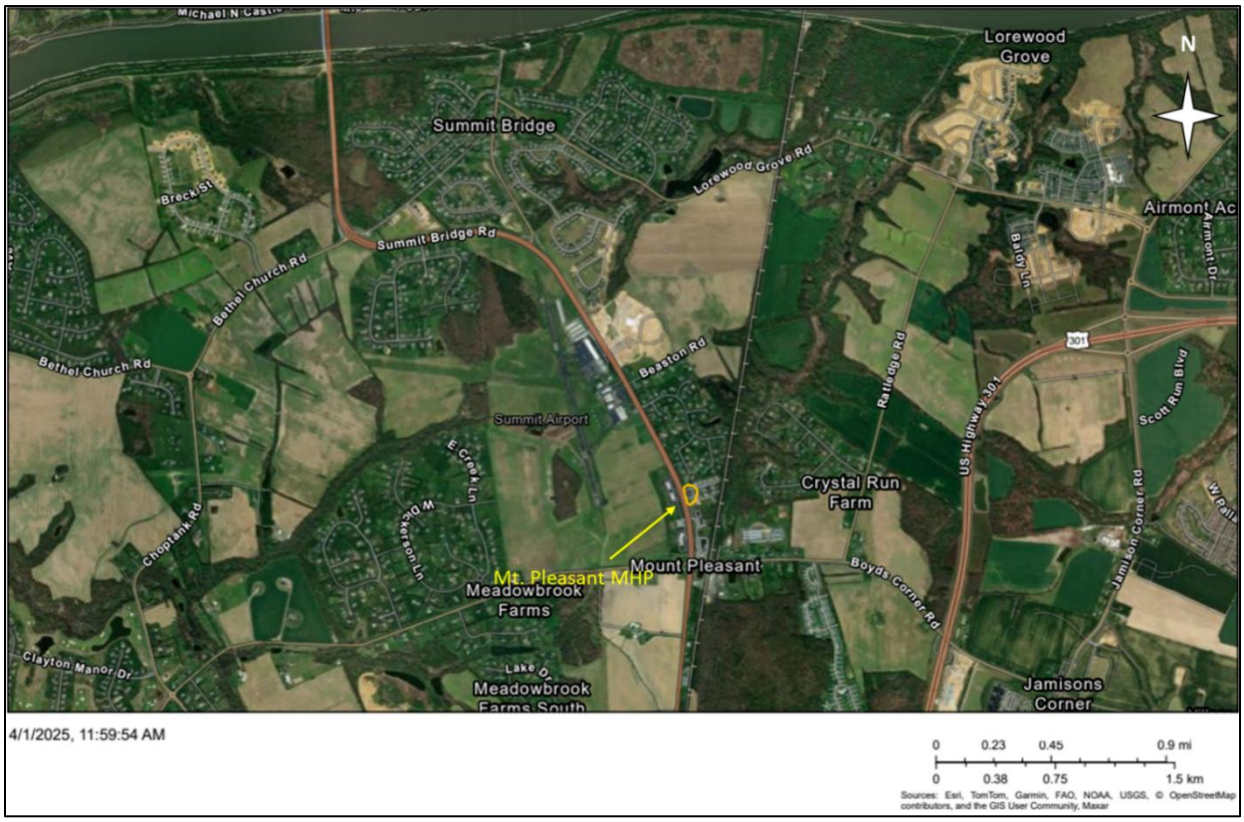


Figure 19 Location map of the Mt. Pleasant MHP WTF.

2.19 Wolfe Neck Regional Wastewater Treatment Facility (Spray)

- Permit Number: LTS 5005-95-12
- Permittee: Sussex County Council
- Operator: Licensed Operator
- Operational History: Prior to 1996
- Facility Location: 36160 Wolfe Neck Road, Rehoboth Beach, DE 19971
- Design Flow Rate: 4,000,000 GPD
- Facility Description: Wolfe Neck Regional WTF treats domestic wastewater from the West Rehoboth expansion of the Dewey Beach Sanitary Sewer District and spray irrigates the treated effluent onto the spray fields. The wastewater treatment facility consists of a mechanically cleaned bar screen; three 23.8 MG partially mixed aerated lagoons, one 68.9 MG storage lagoon, a chlorine building with chlorination equipment, two 45,000 G chlorine contact pipes, an operation building, an irrigation pumping station with four 2,200 G per minute pumps, and 319 acres five center pivot irrigation systems.
- Location Map:

Figure 20 Location map of the Wolfe Neck Regional WTF.

2.20 Harim Millsboro LLC (Spray)

- Permit Number: LTS 5017-92-11
- Permittee: Harim Millsboro LLC
- Operator: Licensed Operator
- Operational History: Prior to 1992
- Facility Location: 29984 Pinnacle Way, Millsboro, DE 19966
- Design Flow Rate: 280,000 GPD
- Facility Description: The Harim Millsboro LLC discharges processing water from the plant pasteurizers. The discharged processing water is pumped onto 29 acres of spray irrigation field. The discharge is applied to the spray irrigation field in a uniform manner by means of a center

pivot spray irrigation system. The system is designed to spray irrigate 280,000 G of effluent per day. The spray irrigation field is maintained with a mixture of reed canary and orchard grass.

- Location Map:

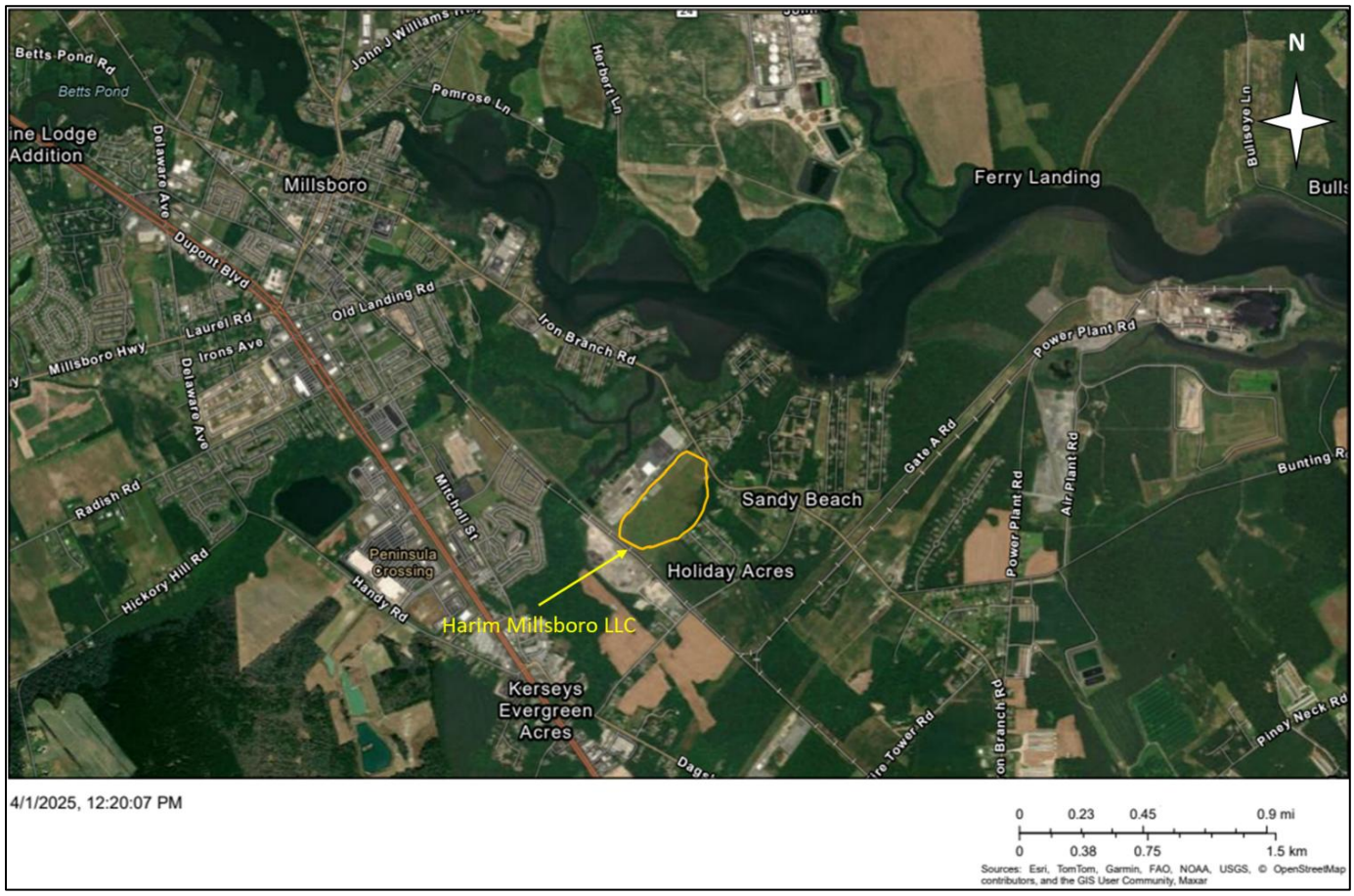


Figure 21 Location map of the Harim Millsboro LLC WTF.

2.21 Piney Neck Regional Wastewater Treatment Facility (Spray)

- Permit Number: 359224-03
- Permittee: Sussex County Council
- Operator: Licensed Operator
- Operational History: Prior 1993
- Facility Location: 29535 Piney Neck Road, Dagsboro, DE 19939
- Design Flow Rate: 200,000 GPD

- Facility Description: The Piney Neck Regional WTF treats domestic wastewater from the towns of Dagsboro and Frankford, Sussex County, Delaware, and spray irrigate the treated effluent onto 38.01 acres of spray fields and 19.12 acres of loblolly pine plantation. The pretreatment facility consists of a mechanically cleaned bar screen, a split flow chamber, two 3.1 MG aerated lagoons, one 12.5 MG storage lagoon, one 9,460 G chlorine contact chamber, chlorination building and equipment, and one irrigation pump station with two 1,000 G per minute pumps.
- Location Map:

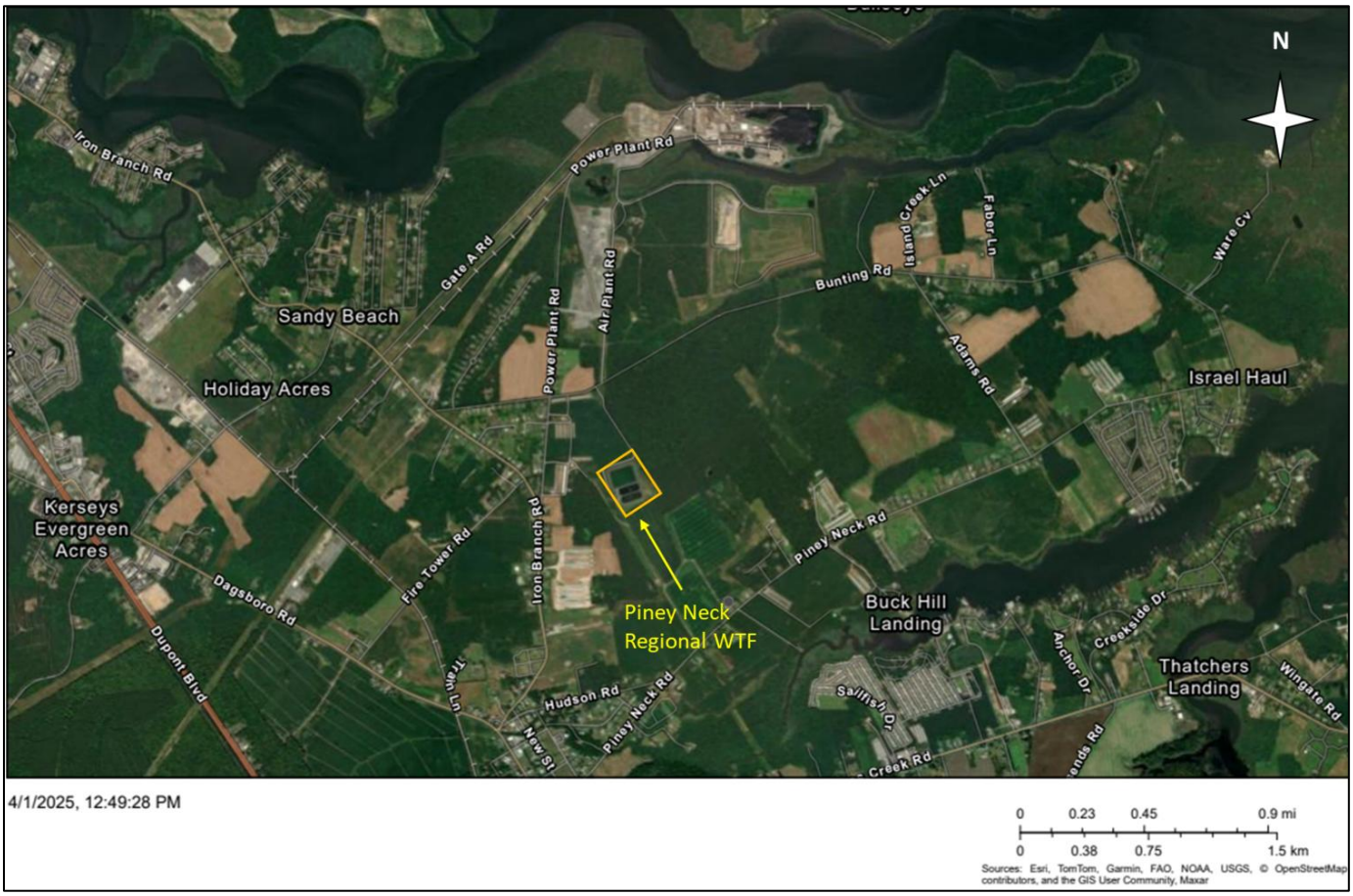


Figure 22 Location map of the Piney Neck Regional WTF.

2.22 Plantations (Spray)

- Permit Number: 359229-05
- Permittee: Artesian Wastewater Management, Inc.
- Operator: Licensed Operator

- Operational History: Prior to 1997
- Facility Location: 33789 Walnut Grove Road, Lewes, DE 19958
- Design Flow Rate: 57,269 GPD
- Facility Description: The Plantations WTF treats domestic wastewater from the Plantations Development. The treatment system consists of an influent flow meter, one aerated treatment lagoon, two storage lagoons, a chlorination system, an irrigation pumping station, and an effluent flow meter. The chlorinated effluent is spray irrigated onto 10.1 acres of perennial grass using 40 solid set sprinklers arranged in 5 zones.
- Location Map:

Figure 23 Location map of the Plantations WTF.

2.23 West Bay Park (RIB)

- Permit Number: 359322-03

- Permittee: Rehoboth Bay Conservancy, LLC
- Operator: Licensed Operator
- Operational History: Operated since 2006. Connected to center sewer line on September 2, 2025.
- Facility Location: 23719 Bayview Drive, Lewes, DE 19958
- Design Flow Rate: 92,520 GPD
- Facility Description: The West Bay Park OWTDS is authorized to receive and treat domestic waste that is generated by 360 dwellings from the West Bay Community Development. The effluent is treated by a dual Biowheel wastewater treatment plant. Once treated, the effluent is sent to six RIBs. A total of twelve basins and their associated controls have been constructed (6 active, and 6 spare).
- Location Map:

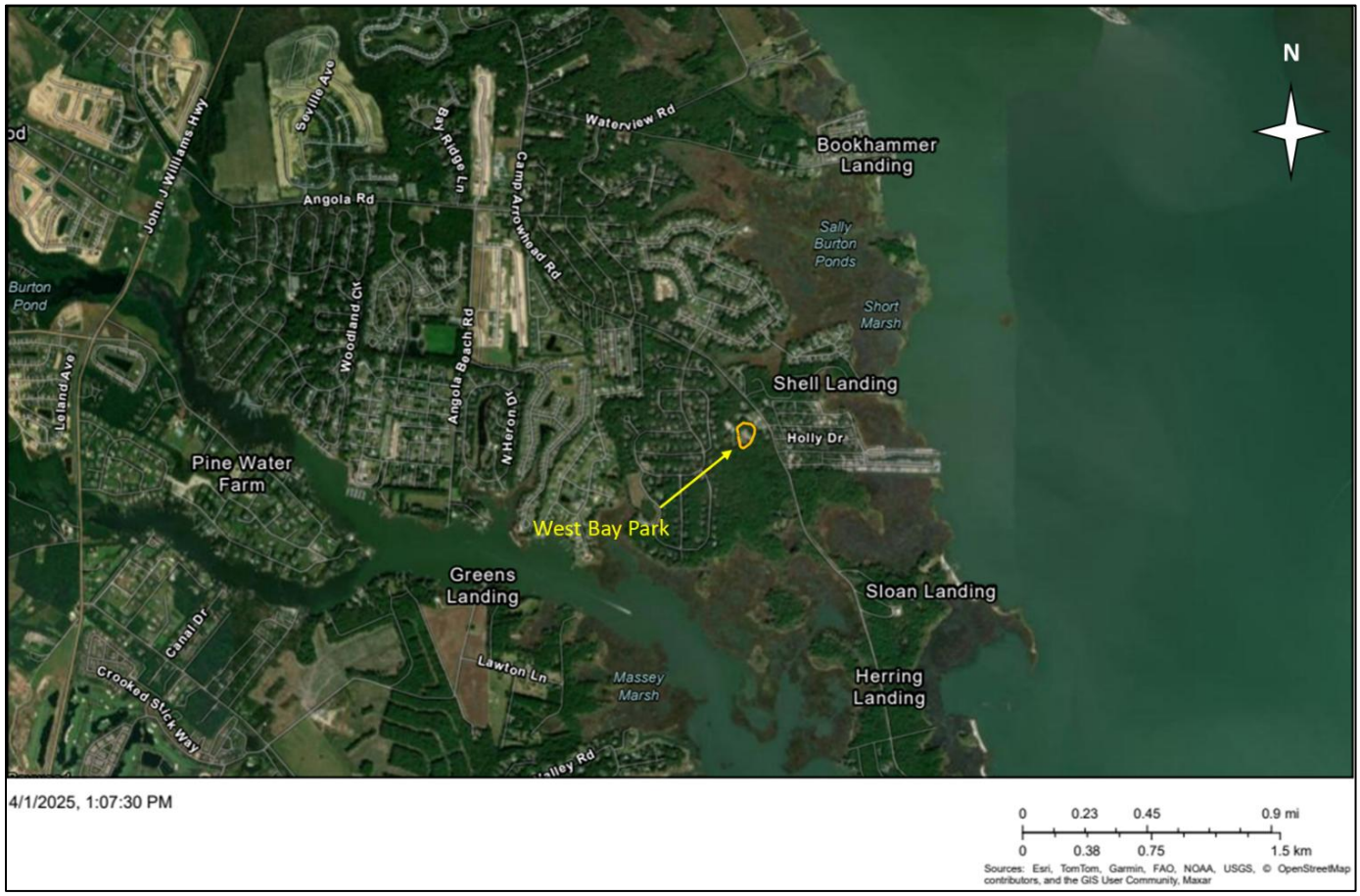


Figure 24 Location and layout of the West Bay Park OWTDS.

2.24 Chelesa Villa Subdivision (Septic)

- Permit Number: 359045-03
- Permittee: Canterbury Homes, Inc.
- Operator: Licensed Operator
- Operational History: Operated since 2008
- Facility Location: Willow Grove Road & Kali Drive, Felton, DE 19934
- Design Flow Rate: 22,200 GPD
- Facility Description: The Chelesa Villa Subdivision OWTDS is authorized to receive and treat domestic wastewater generated by the Chelesa Villa Subdivision. The site is served by two systems which were installed under separate construction permits. One system service 3,600 GPD of domestic wastewater generated by 13 dwellings (lots 41,42,46,70-75, and 77-80). Individual and shared septic tanks are utilized to provide primary treatment of the wastewater. Once the effluent leaves the tank it flows by gravity to a 4,400 g dosing chamber where it is disposed of in drip dispersal zones. Other system service 16,800 GPD of domestic wastewater generated by 56 dwellings. Individual and shared septic tanks are utilized to provide primary treatment of the wastewater. Once the effluent leaves the tank it flows by gravity to a 4’ diameter lift station. The lift station pumps two equalization tanks which gravity feed into a 4’ diameter dosing station. The dosing station utilizes alternating dual pumps which send effluent through time dosing to one of nine drip dispersal zones.
- Location Map:

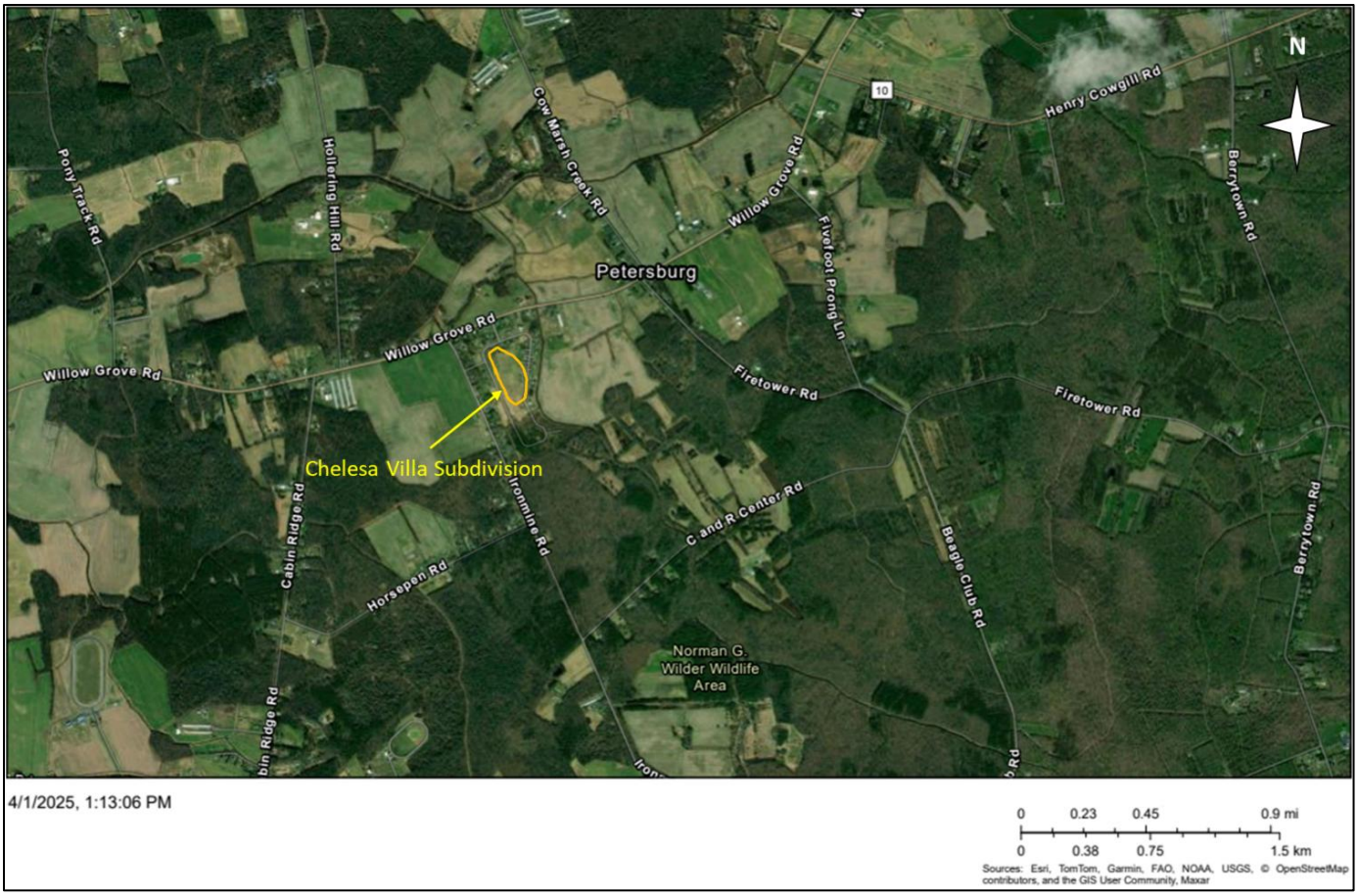


Figure 25 Location map of the Chelesa Villa Subdivision OWTDS.

2.25 Evelyn I. Morris School (Septic)

- Permit Number: 359084-02
- Permittee: Milford School District
- Operator: Licensed Operator
- Operational History: Operated since 1992
- Facility Location: 8609 Third Street, Lincoln, DE 19960
- Design Flow Rate: 10,230 GPD
- Facility Description: The Evelyn I. Morris School OWTDS is authorized to receive and treat residential wastewater generated by the Evelyn I. Morris School. The influent flows may not exceed a daily maximum of 10,230 GPD. The wastewater is treated by one 2,800 G grease trap,

three 2,800 G and one 4,400 G septic tanks. The effluent leaves the septic tanks and is sent to ten pressure dosed beds for disposal.

- Location Map:

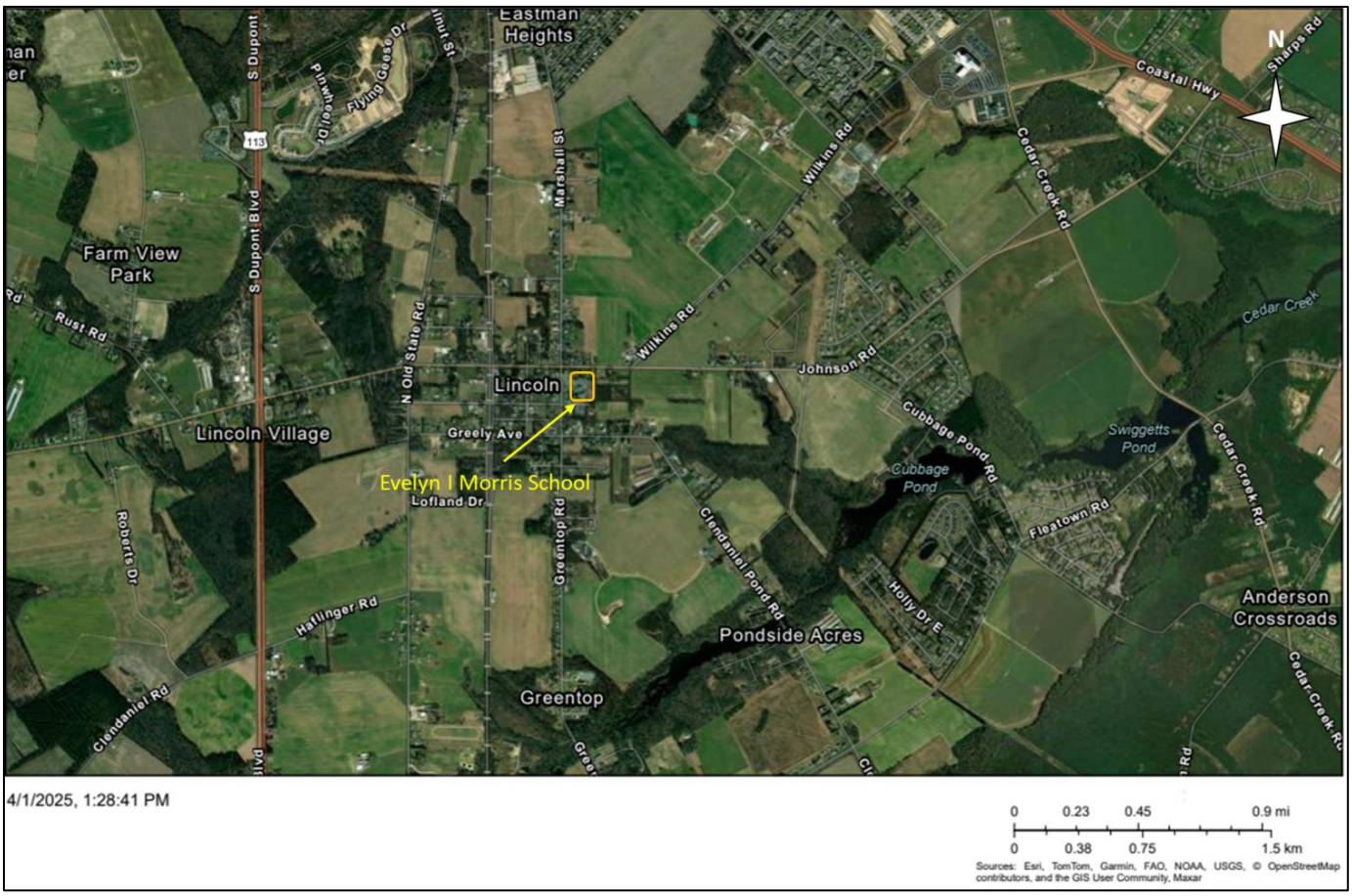


Figure 26 Location map of the Evelyn I. Morris School OWTDS.

2.26 New Castle County Wastewater Treatment Facility – Water Farm 1 (Spray)

- OWTDS-Spray Permit Number: 359199-03
- Permittee: New Castle County Department of Special Services
- Operator: Licensed Operator
- Operational History: Prior to 1996
- Facility Location: 810 Old Corbit Road, Middletown, DE 19730
- Design Flow Rate: 1,330,000 GPD

- Facility Description: The New Castle County Water Farm #1 WTF is located between Delaware Route 9 and County Road 299, South of County Road 424, New Castle County, Delaware. Domestic wastewater is treated and spray irrigated onto spray fields. Treatment consists of an influent screen, influent flow meters, two sequencing batch reactors, aerobic digester, post equalization basin, cloth disk filtration, UV disinfection, effluent flow meters designed to treat 2.5 MG of wastewater daily. All effluent undergoes flocculation, filtration, and disinfection. Spray irrigation discharges to five center pivot irrigation systems (155.3 acres) and five solid set irrigation systems (11.4 acres) all planted in reed canary grass.
- Location Map:

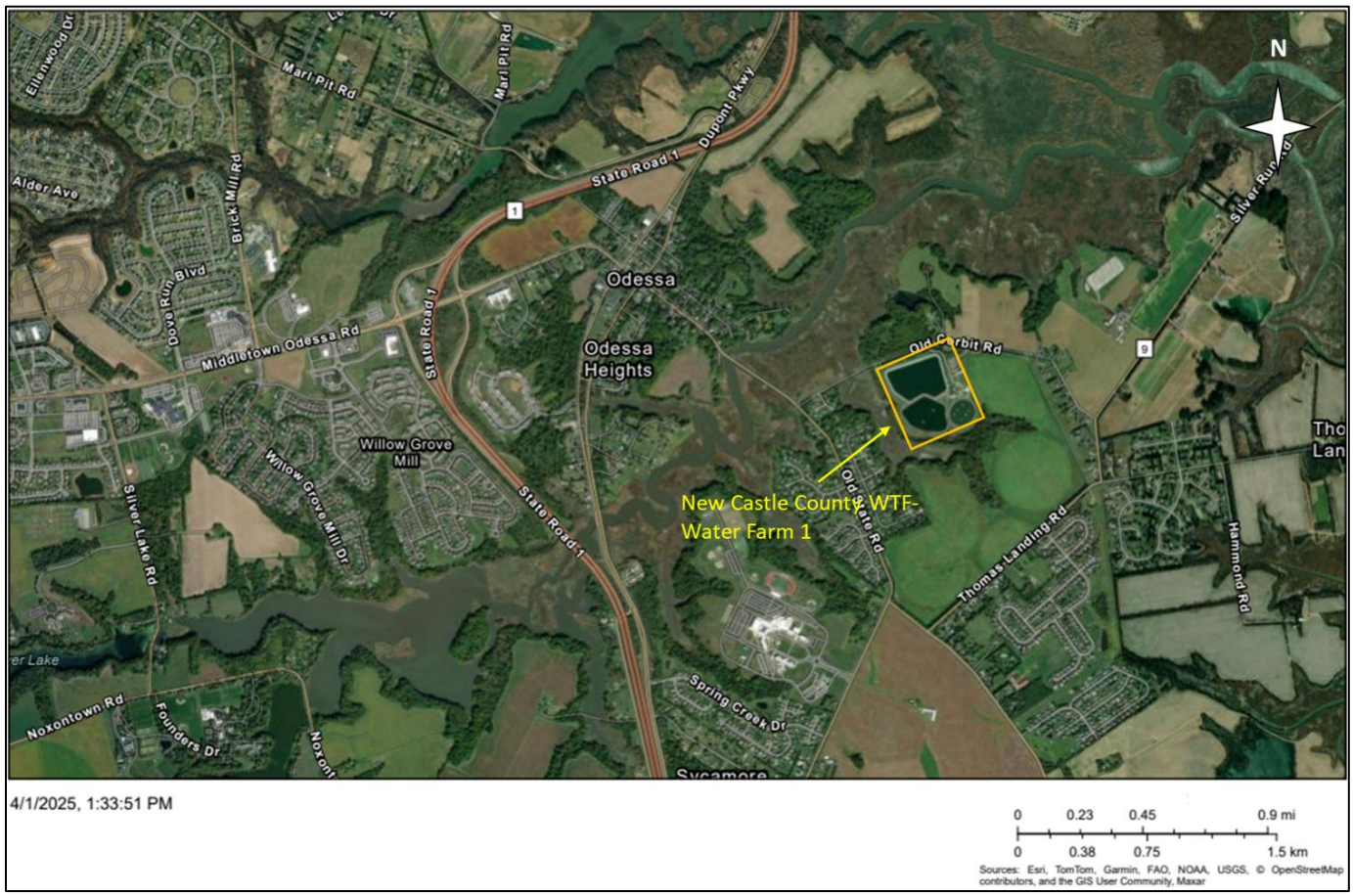


Figure 27 Location map of the New Castle County WTF – Water Farm 1 WTF.

2.27 Frog Hollow – The Legends Golf Course Community (Spray)

- OWTDS-Spray Permit Number: 359099-04

- Permittee: Town of Middletown
- Operator: Licensed Operator
- Operational History: Prior to 1999
- Facility Location: 30 Snead Circle, Middletown, DE 19709
- Design Flow Rate: 250,000 GPD
- Facility Description: The Frog Hallow – The Legends Golf Course Community WTF is designed to provide tertiary treatment of domestic wastewater collected from the town of Middletown and Frog Hollow/The Legends Golf Course Communities. The effluent is spray irrigated to 139.97 acres of roughs, greens, trees, and fairways planted in bentgrass, ryegrass, and bluegrass mixtures. It consists of an influent pumping station, influent flow meter, influent screen, sewage grinder, a 5.5 MG aerated lagoon, a 10.8 MG polishing/storage lagoon, filter feed pumps, flocculation facilities, two sand filters, and disinfection facilities, and a 7.2 MG storage lagoon.
- Location Map:

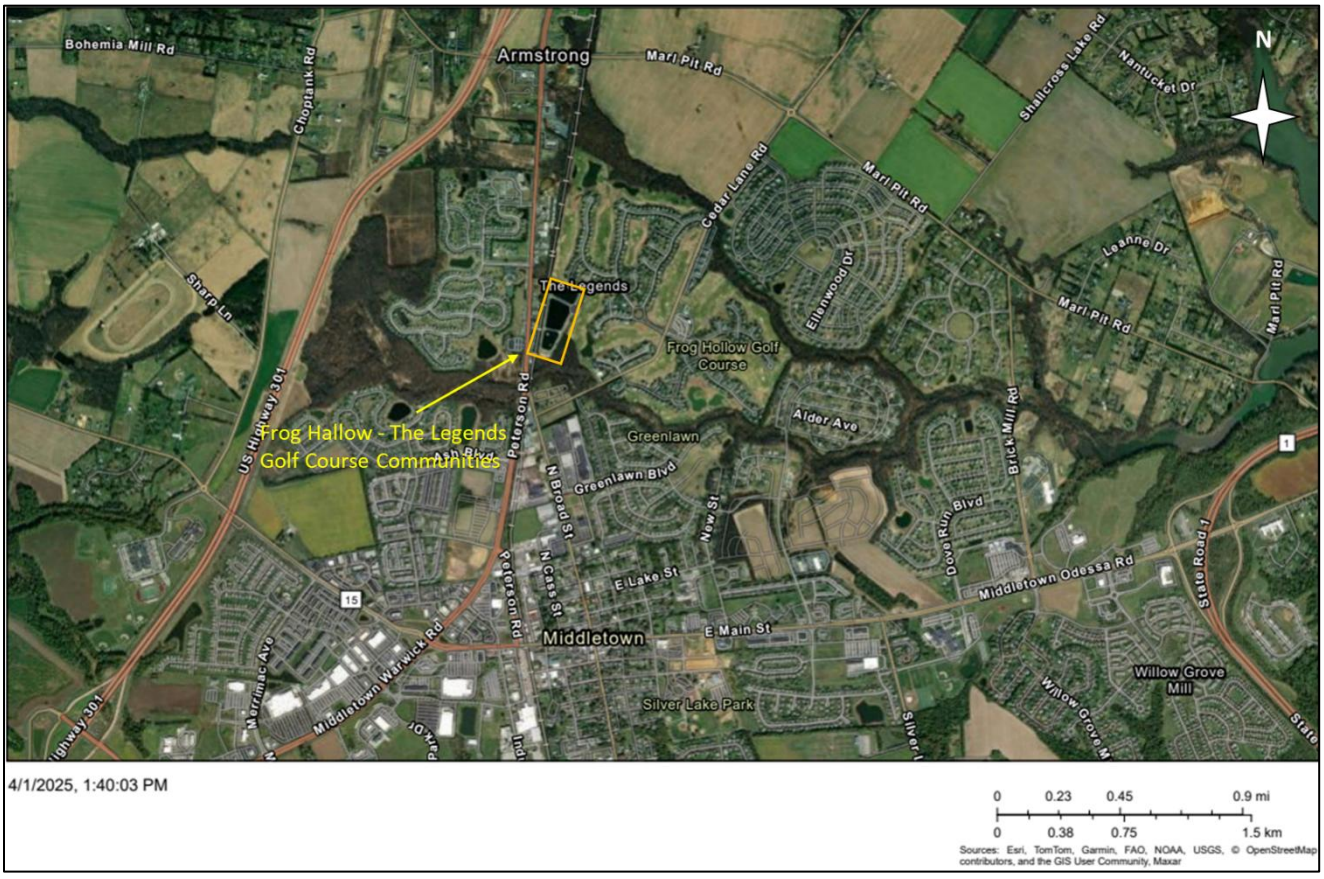


Figure 28 Location map of the Frog Hallow – The Legends Golf Course WTF.

2.28 Hanover Foods Corporation (Spray)

- OWTDS-Spray Permit Number: 359118-02
- Permittee: Hanover Foods Corporation
- Operator: Licensed Operator
- Operational History: Prior to 1996
- Facility Location: 7000 Millington Road, Clayton, DE 19938
- Design Flow Rate: 940,000 GPD
- Facility Description: Hanover's Clayton facility serves as a bulk freezer plant which processes and freezes vegetables seasonally and poultry products year around. The facility currently manages wastewater from the vegetable processing operations and discharges wastewater to spray fields located to the west and south of the facility, and to the northwest of the facility across Providence Creek. Prior to spray irrigation, wastewater is collected, passed through a grease separator, is screened through rotary screens, flows to a 35,000 G surge tank, and is pumped to five pivots (pivot #1 through pivot #5). A 400,000 G storage tank is also utilized for additional equalization and storage capacity.
- Location Map:

Figure 29 Location map of the Hanover Foods Corporation WTF.

2.29 Town of Bridgeville – Tatman Farm (Spray)

- OWTDS-Spray Permit Number: 359292-05
- Permittee: Town of Bridgeville
- Operator: Licensed Operator
- Operational History: Prior to 2008 but currently ceased discharged via spray irrigation
- Facility Location: Oak Road, Bridgeville, DE 19933
- Design Flow Rate: 345,279 GPD
- Facility Description: The Town of Bridgeville's WTF currently treats 90% domestic waste and 10% food processing waste from Cannon Cold Storage and RAPA Scrapple. Phase I of the Bridgeville Farm Spray Irrigation Facility is currently designed to dispose 345,278 GPD annual average and consists of a 25 MG storage lagoon and a wastewater spray irrigation system for the land application of the treated domestic and food processing wastewater. The treatment facility consists

of screening, grit removal, Rotating Biological Contactors, flocculating clarifiers, with Ferric Chloride addition, chlorine disinfection, and a tertiary sand filter. A portion of the treated wastewater was spray irrigated via two center pivot irrigation system onto 68.33 acres of 126.67 acres of land known as the Bridgeville Farm. The spray fields were planted in row crops of soyabeans or corn from April through late summer and a rye cover crop from late summer through winter.

- Location Map:

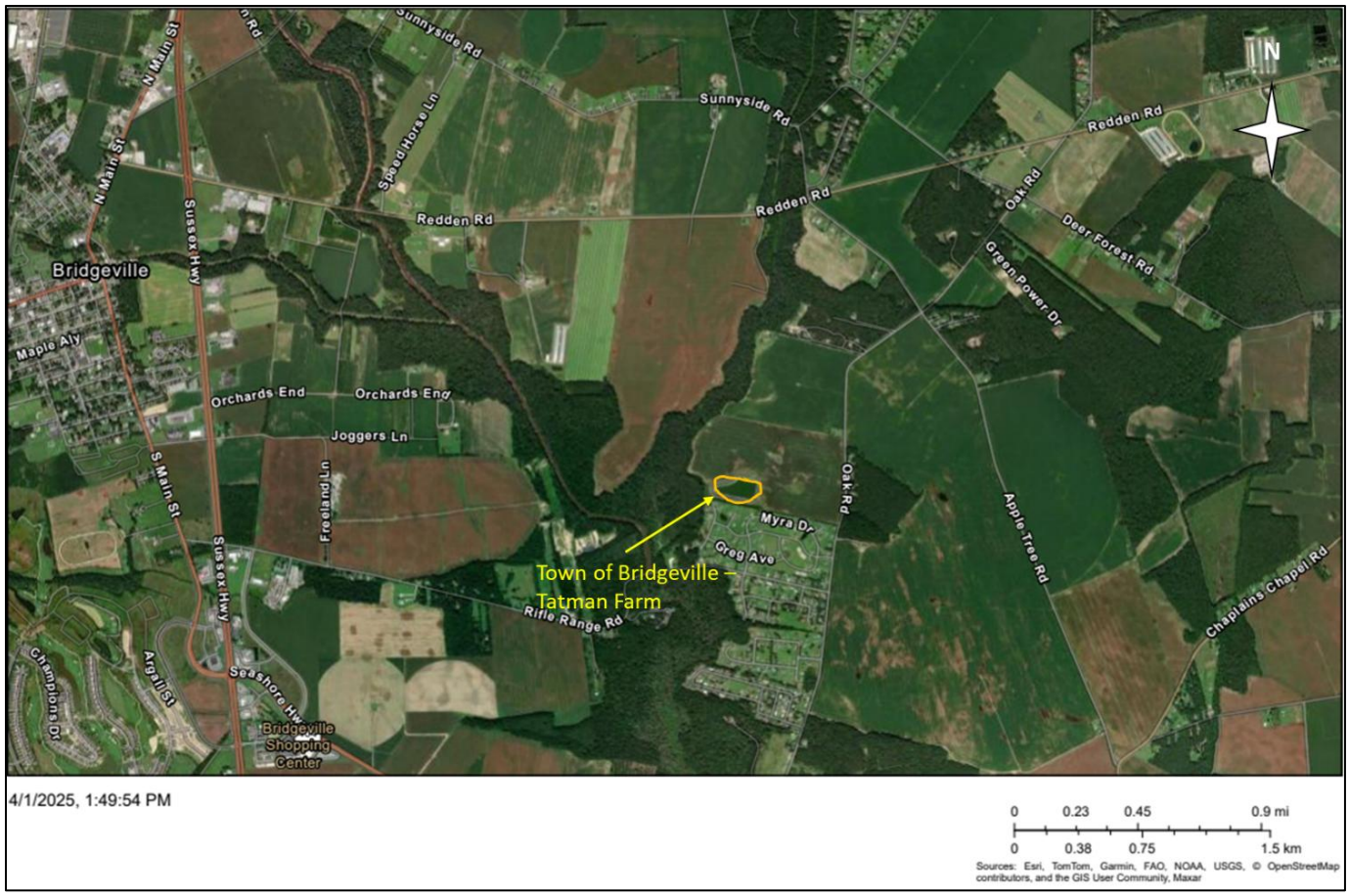


Figure 30 Location map of the Town of Bridgeville - Tatman Farm WTF.

2.30 Cool Branch Mobile Home Park (Spray)

- OWTDS-Spray Permit Number: 35051-03
- Permittee: Hometown Village of Cool Branch, LLC
- Operator: Licensed Operator

- Operational History: Prior to 1997
- Facility Location: 100 Hitch Pond Circle, Seaford, DE 19973
- Design Flow Rate: 63000 GPD
- Facility Description: The facility treats domestic wastewater from the Village of Cool Branch MHP. Phase I is designed to treat up to 63,000 GPD and consists of a comminutor and a manually cleaned bar screen, one 2.41 MG aerated lagoon; one 6.68 MG facultative polishing/storage lagoon; two 5000 G chlorine contact chambers, with chlorination building and equipment; and one irrigation pump station with one 180 G per minute pump and two 120 G per minute pumps.
- Location Map:

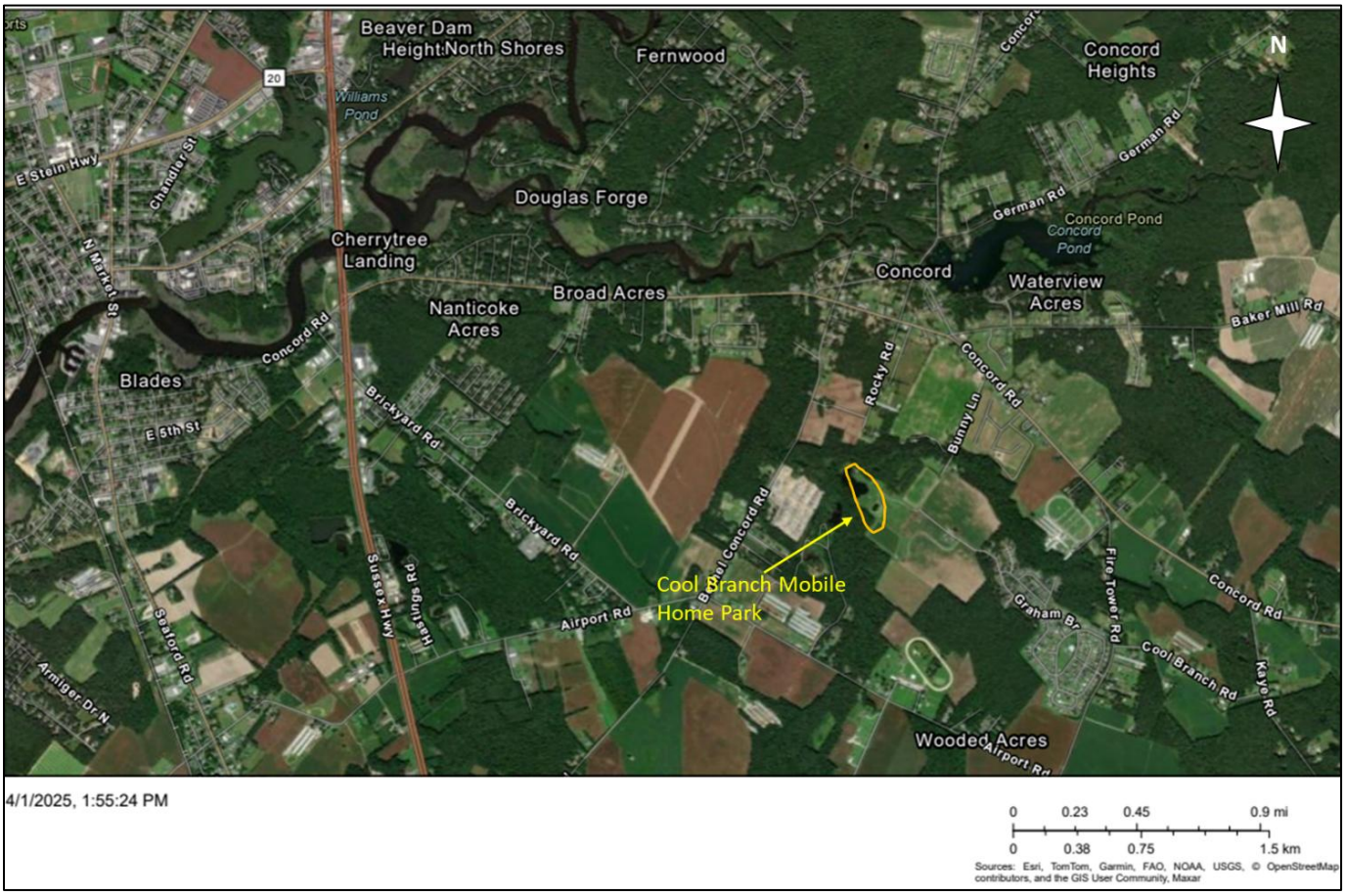


Figure 31 Location map of the Cool Branch MHP WTF.

2.31 Bay Front (RIB)

- Permit Number: 359008-04

- Permittee: Artesian Wastewater Management Inc.
- Operator: Licensed Operator
- Operational History: Started in 2007 but temporally closed since 2024
- Facility Location: 37158 Marsh Island Avenue, Lewes, DE 19958
- Design Flow Rate: 540,000 GPD (Phase 1)
- Facility Description: The Bay Front OWTDS is authorized to receive and treat residential wastewater generated by 360 dwellings and community facilities from Bay Front Development. The effluent is treated by a dual activated sludge wastewater treatment plant with Kubota membrane filtration prior to being discharged to three Rapid Infiltration Basins.
- Location Map:

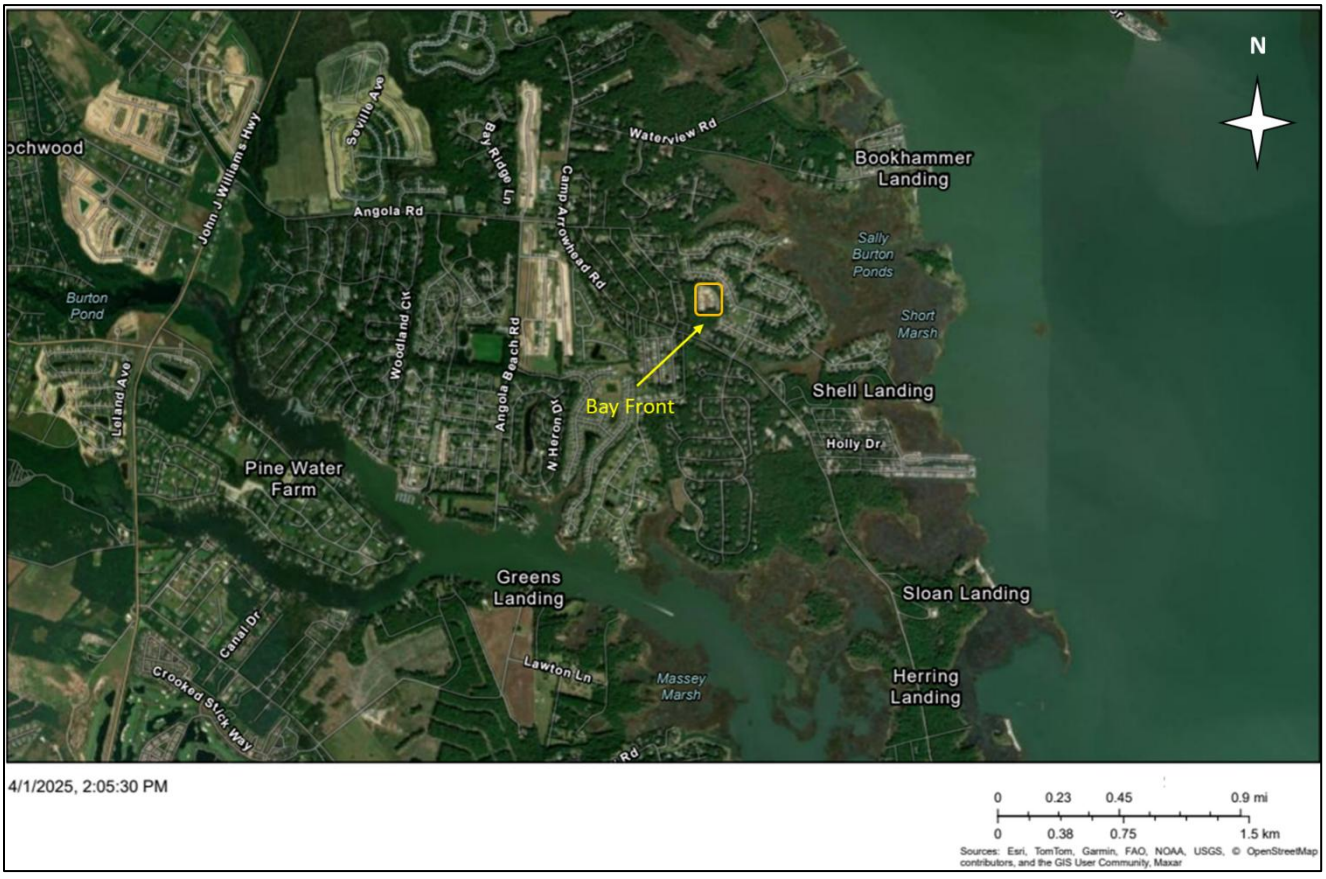


Figure 32 Location map of the Bay Front OWTDS.

2.32 The Ridings (Drip System)

- Permit Number: 359286-05
- Permittee: Artesian Wastewater Management Inc.

- Operator: Licensed Operator
- Operational History: Operated since 2009
- Facility Location: 22615 Ramble Road, Sussex County, DE
- Design Flow Rate: 70,000 GPD
- Facility Description: The Ridings OWTDS is authorized to receive and treat residential wastewater generated by 225 dwellings and a clubhouse located within the Ridings at Rehoboth subdivision and 101 dwellings located within the Ocean Meadows subdivision. The wastewater is treated by a dual Aqua Aerobics Sequencing Batch Reactor Wastewater Treatment Plant. The wastewater is disposed of into nine drip dispersal fields.
- Location Map:

Figure 33 Location map of the Ridings OWTDS.

2.33 Gull Point Housing (Septic)

- Permit Number: C4013-91S
- Permittee: Utility Systems, Inc.

- Operator: Licensed Operator
- Operational History: Operated since 1993
- Facility Location: 31036 Crepe Myrtle Drive, Millsboro, DE 19966
- Design Flow Rate: 42,020 GPD
- Facility Description: Gull Point Housing OWTDS is authorized to receive and treat residential wastewater generated by 150 dwellings from the Gull Point Housing Community. A Sequencing Batch Reactor Plant with 70 standard pressure dosed beds.
- Location Map:

Figure 34 Location map of the Gull Point Housing OWTDS.

2.34 Gulls Way Campground (Septic)

- Permit Number: 359114-03
- Permittee: Gulls Way Campground, LLC
- Operator: Licensed Operator

- Operational History: Operated since 1999
- Facility Location: 31684 Jimmy Lane, Dagsboro, DE 19939
- Design Flow Rate: 30,150 GPD
- Facility Description: The Gulls Way Campground OWTDS is authorized to receive and treat residential wastewater generated by the campsites and pool houses within the Gulls Way Campground. Primary treatment occurs through the utilization of septic tanks. Once treated the effluent is pumped via lift stations to a 1,500 G dosing chamber equipped with dual pumps. The pumps alternate between doses and activate one disposal bed at a time. The eighteen disposal beds alternate between doses.
- Location Map:

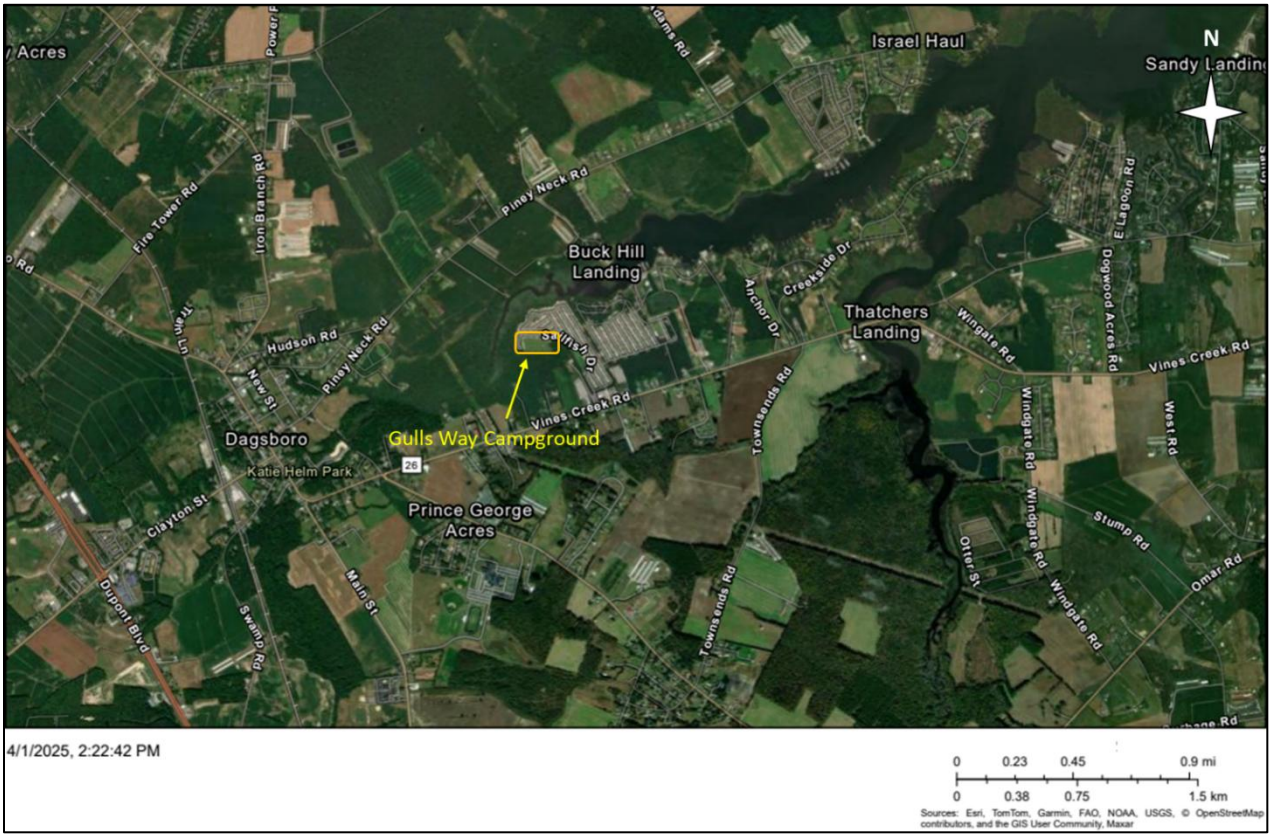


Figure 35 Location map of the Gulls Way Campground OWTDS.

2.35 Sandy Ridge Development (Septic)

- Permit Number: 359252-03
- Permittee: Diamond State Sustainability Corporation
- Operator: Licensed Operator

- Operational History: Operated since 2002
- Facility Location: Sandy Ridge Drive, Laurel, DE 19956
- Design Flow Rate: 17,700 GPD
- Facility Description: The Sandy Ridge Development OWTDS is authorized to receive and treat residential wastewater generated by 59 dwellings located within the Sandy Ridge Development. The wastewater is provided by thirty 1,500 G septic tanks. Each septic tank is shared by two dwellings. The wastewater flows by gravity from the septic tanks through the collection system into four dosing chambers. The treated effluent is then pumped from the dosing tank for disposal to one of 16 capping fill disposal systems.
- Location Map:

Figure 36 Location map of the Sandy Ridge Development OWTDS.

2.36 Twin Maples Mobile Home Parks (Septic)

- Permit Number: 359307-03
- Permittee: WHAG Partnership
- Operator: Licensed Operator

- Operational History: Operated since 2000
- Facility Location: 86 Maple Oaks Lane Clayton, DE 19938
- Design Flow Rate: 15,201 GPD
- Facility Description: The Twin Maples OWTDS is authorized to receive and treat domestic wastewater from 60 mobile homes and one single family house located at the Twin Maples MHP. The site consists of five systems. System 1 consists of one 1,500 G septic tank, and one 1,500 G dosing tank that is equipped with two pumps. Once treated, the wastewater flows to one pressure dosed bed for disposal. System 2 consists of one 1,000 G septic tank, one 1,500 G septic tank, one 2,800 G septic tank, and one 2,800 G dosing tank that is equipped with two pumps. Once treated, the wastewater flows to one sand lined bed for disposal. System 3 consists of one 1,000 G septic tank, three 1,500 G septic tanks, and one 2,800 G dosing tank that is equipped with two pumps. Once treated, the wastewater flows to one pressure dosed bed for disposal. System 4 consists of three 1,500 G septic tanks, and one 2,800 G dosing tank that is equipped with two pumps. Once treated, the wastewater flows to one sand lined bed for disposal. System 5 consists of four 1,000 G septic tanks, seventeen 1,500 G septic tanks, one 6’ diameter dosing tank that is equipped with two pumps. Once treated, the wastewater flows to nine pressure elevated infiltrator beds for disposal. Each bed receives a dose individually.
- Location Map:

Figure 37 Location map of the Twin Maples MHP OWTDS.

2.37 Homestead Mobile Home Park (Septic)

- Permit Number: 359134-04
- Permittee: KDM Development
- Operator: Licensed Operator
- Operational History: Operated since 2002
- Facility Location: 26981 Shortly Road, Georgetown, DE 19947
- Design Flow Rate: 11,100 GPD
- Facility Description: The Homestead MHP OWTDS is authorized to receive and treat sanitary wastewater from 37 mobile homes. The sanitary wastewater is treated by individual and shared septic tanks. Once the effluent leaves the septic tanks, it travels through small diameter gravity sewer to collect at a 4’ diameter lift station. The lift station delivers the effluent to a 6’ diameter dosing chamber which utilizes dual alternating pumps to dose to 8 elevated sand mounds for disposal. Each elevated sand mound system shall be dosed individually at 229 G per dose.

- Location Map:

Figure 38 Location map of the Homestead MHP OWTDS.

3.0 SAMPLING PLAN

Groundwater samples from upgradient and downgradient monitoring wells of spray, RIB, septic, and drip systems will be collected for PFAS analysis. Facilities hydrological reports were reviewed, and groundwater flow directions were considered when selecting groundwater sampling locations. Additionally, downgradient monitoring wells close to the communities with domestic wells were prioritized. Samples will be named as Facility Code + DNREC ID (*round*), where Facility Code is the facility identification; DNREC ID is the unique well permit ID issued by DNREC; and *Round* is the number of the sampling event. For example, **IB-189210-1** will be the groundwater sample collected from the Inland Bays Regional Wastewater Treatment facility from well whose DNREC ID is 189210 during the first round of sampling event.

For this study, groundwater sampling samples will be collected from two rounds of sampling events. The first round of sampling event is planned to be conducted in June and the second round will start a month later after the first round.

3.1 Laurel Village Mobile Home Park (Septic)

The Laurel Village OWTDS utilize septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of in seepage beds. There are three monitoring wells (DNREC ID: 86226, 86227, and 86228) located at the Laurel Village MHP ***(Figure 39)***. The groundwater flow direction is north towards Gum Branch. All three monitoring wells are selected for groundwater sampling. Monitoring well 86226 is an upgradient well whereas 86227 and 86228 are downgradient wells.

Figure 39 Proposed monitoring wells for groundwater sampling at Laurel Village MHP OWTDS.

3.2 Dove Estates Mobile Home Park (Septic)

The Dove Estates OWTDS utilize septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed into pressure dosed beds. There are three monitoring wells (DNREC ID:

178566, 178786, and 178787) located at the Dove Estates MHP wastewater disposal and treatment facility and all of them are selected for the groundwater sampling ***(Figure 40)***. The groundwater flow direction is South towards Deep Creek. The monitoring well 178566 is an upgradient well whereas 178786 and 178787 are downgradient wells.

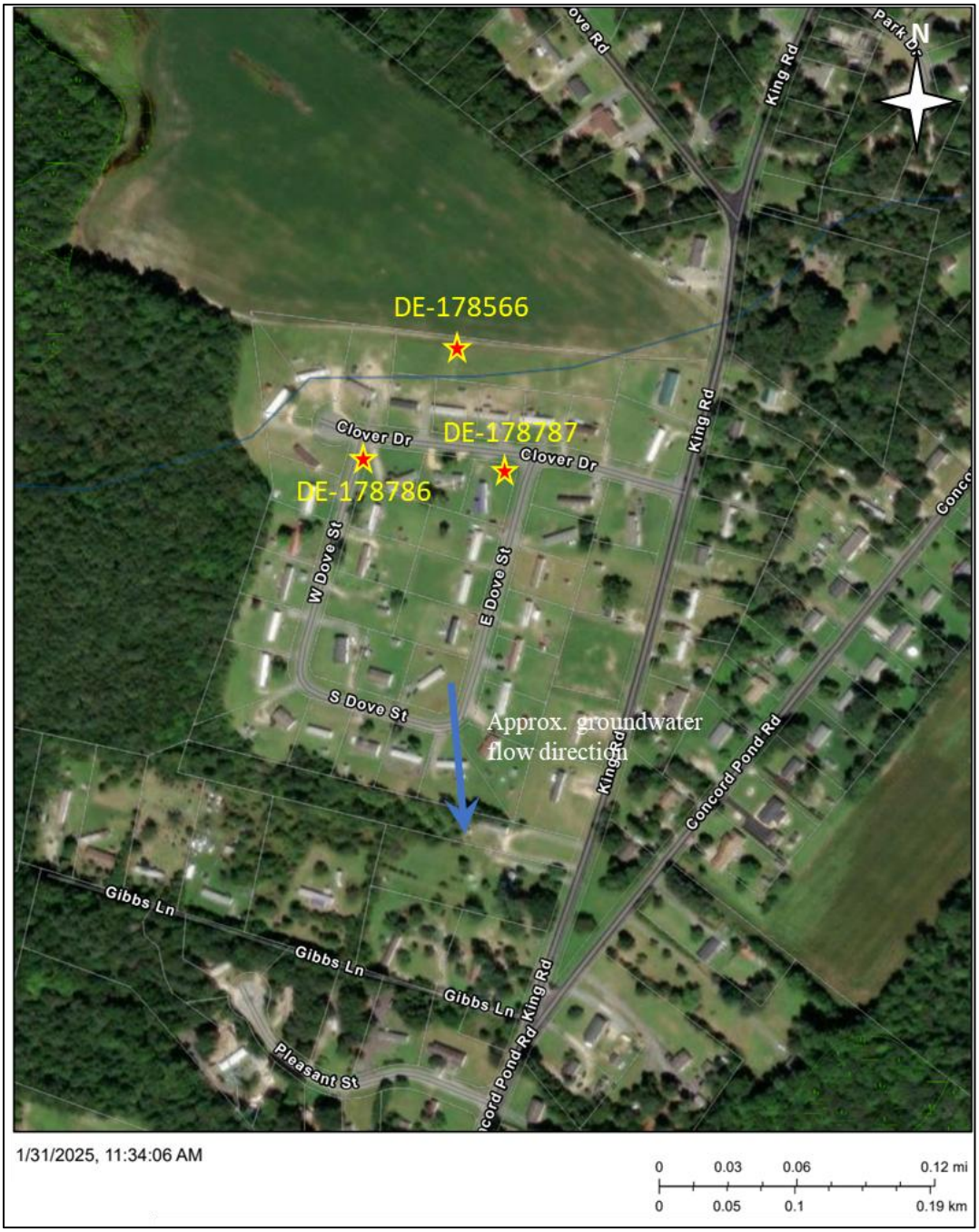


Figure 40 Groundwater sampling sites at Dove Estates MHP OWTDS.

3.3 Harts Landing (Drip System)

Harts Landing wastewater disposal and treatment facility has four monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 203407, 203408, and 203409) ***(Figure 41)***. The groundwater flows west in the northern part of the drainfield and then southeast in the southern part towards Bundicks Branch. The monitoring well 203409 is an upgradient well whereas 203407 and 203408 are downgradient wells.

Figure 41 Groundwater sampling sites at the Harts Landing OWTDS.

3.4 Colonial Estates Mobile Home Park (RIB)

The Colonial Estates MHP OWTDS treats wastewater by an Integrated Surge Anoxic Mixing Sequencing Batch Reactor Package Plant and disposed of into RIBs There are four monitoring wells located at the facility, three of which are selected for groundwater sampling (DNREC ID: 173930, 173926, and 220341) ***(Figure 42)***. The groundwater flow direction is northwest and southeast radial from the RIBs. The monitoring well 173930 is an upgradient well whereas 173926 and 220341 are downgradient wells.

Figure 42 Groundwater sampling sites at the Colonial Estates MHP OWTDS.

3.5 Scottsdale Mobile Home Park (Septic)

The Scottsdale MHP OWTDS utilize septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of into elevated sand mounds. There is a total of six monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 99702, 99703, and 99704) ***(Figure 43)***. The groundwater flow direction is west-northwest towards Nanticoke River and near the elevated sand mounds, it flows south towards the ditch. The monitoring well 99703 is an upgradient well whereas 99702 and 99704 are downgradient and side gradient wells, respectively.

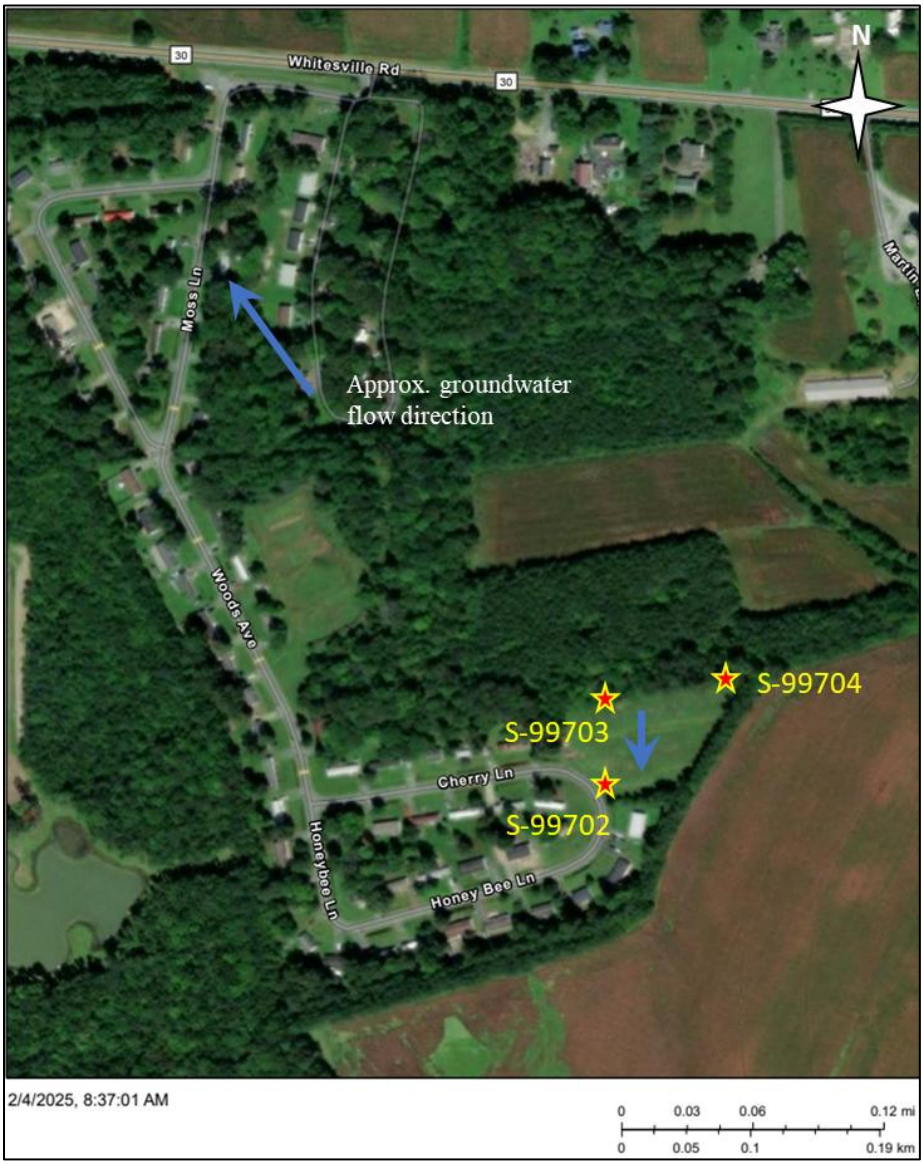


Figure 43 Groundwater sampling sites at the Scottsdale MHP OWTDS.

3.6 Inland Bays Regional Wastewater Treatment Facility (Spray)

For phase 1, The Inland Bays Regional WTF has are eight spray fields associated with the facility: North Field, South Field, North Burton Field, South Burton Field, North Hettie-Lingo Field, South Hettie-Lingo Field, East Hettie-Lingo Field, and West Hettie-Lingo Field. For the existing spray fields, there are twenty-six monitoring wells, four of which are selected for groundwater sampling (DNREC ID: 255717, 283993, 237074, and 237808) ***(Figure 44)***. The groundwater flows east direction towards Inland Bays. The monitoring well 255717 is an upgradient well whereas 283993, 237074, and 237808 are downgradient wells.

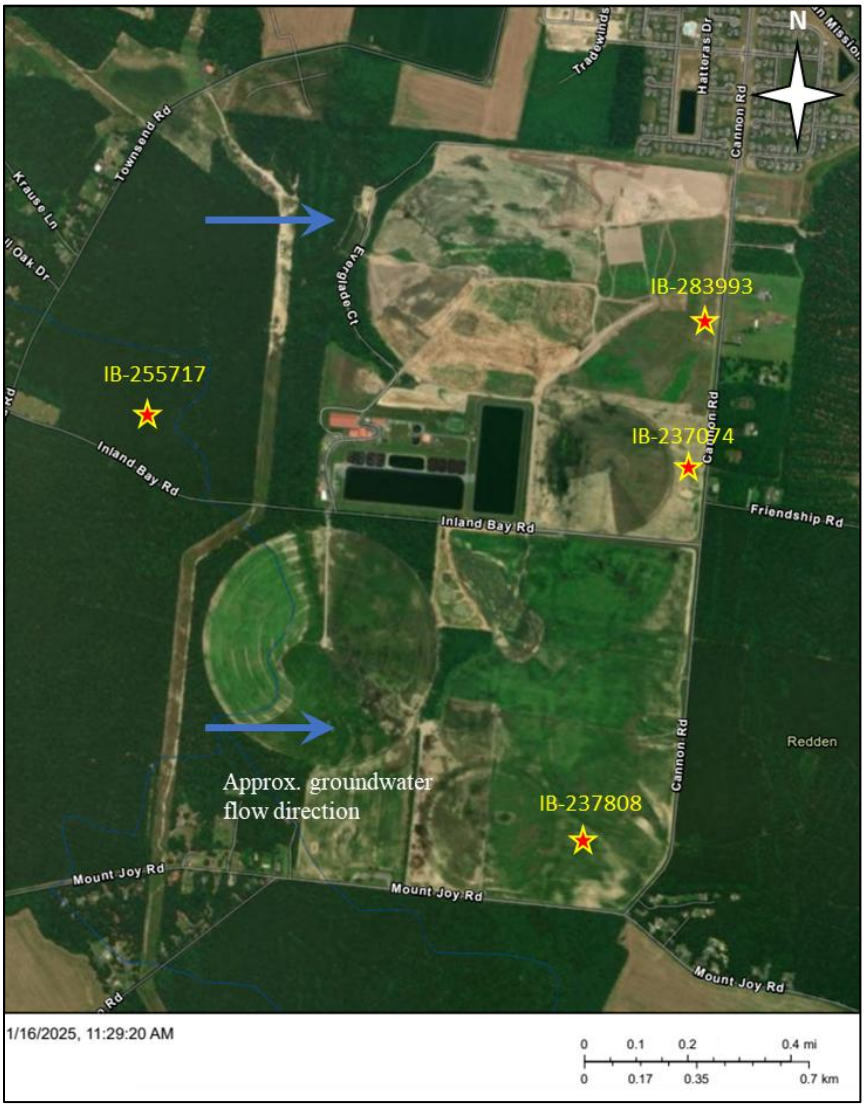


Figure 44 Groundwater sampling sites at the Inland Bays Regional WTF.

3.7 Pictsweet Company - Bridgeville Plant (Spray)

The Pictsweet Company's Bridgeville WTF has three spray irrigation sites associated with the facility: Pictsweet, John Ray Farm, and Pictsweet Field #7. For the existing spray fields, there are twenty monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 73580, 268081, and 73449) ***(Figure 44)***. The groundwater flow direction is northeast towards Bridgeville Branch. The monitoring well 73580 is an upgradient well whereas 268081 and 73449 are downgradient wells.

Figure 45 Groundwater sampling sites at the Pictsweet Company – Bridgeville Plant WTF.

3.8 Town of Georgetown Wastewater Treatment Facility (Spray)

The Town of Georgetown WTF has seven spray irrigation sites associated with the facility: Field 1, Field 2, Field 3, Field 4, Goslee Farm, Prettyman Farm, and Pettyjohn Woods. The Pettyjohn Woods field is an unmanaged natural mixed hardwood site. Some areas of this field are permitted only for seasonal spray application. For the existing spray sites, there are thirty-seven monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 91451, 91455, and 239636) ***(Figure 46)***. The groundwater flow direction is east/southeast to Eli Walls Ditch and under shallow water table conditions the flow direction is towards Gills Branch. The monitoring well 91451 is an upgradient well whereas 91455 and 239636 are downgradient wells. The monitoring wells 91451 and 91455 are in Field 1 and well 239636 is in Pettyjohn Wood field.

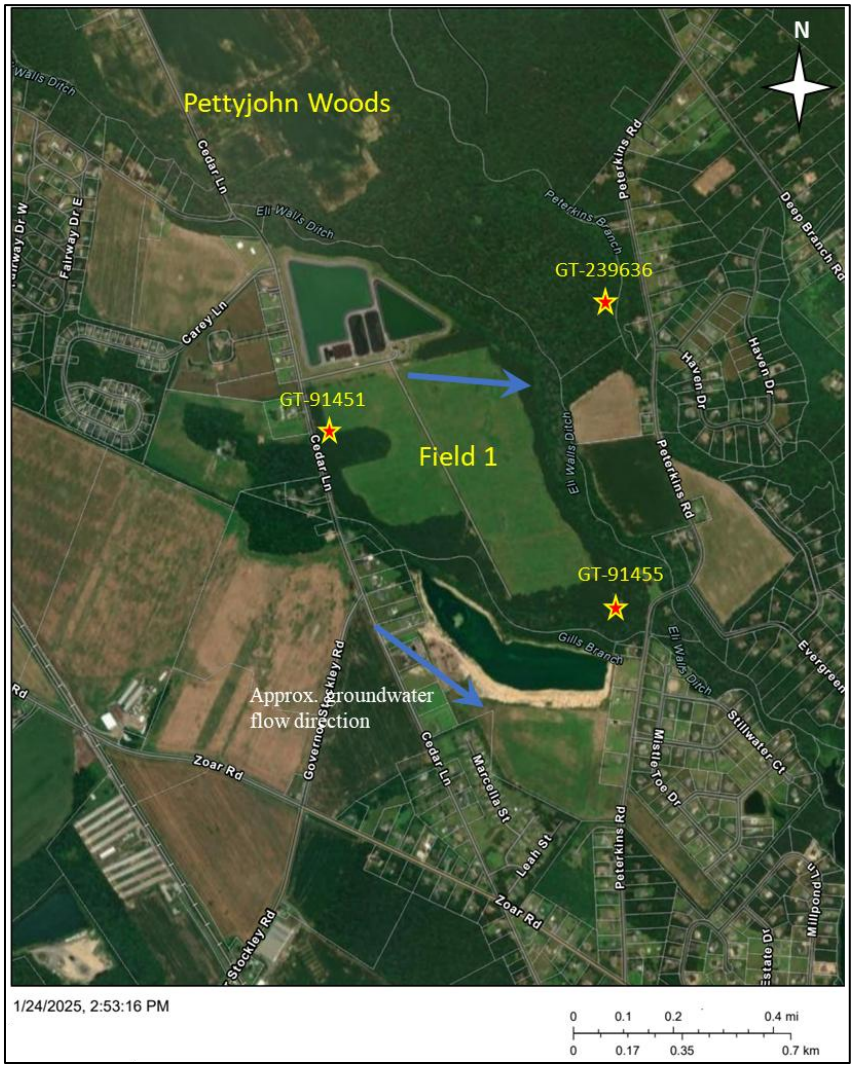


Figure 46 Groundwater sampling sites at the Town of Georgetown WTF.

3.9 Country Grove (RIB)

The Country Grove OWTDS treats wastewater by dual Fluidyne ISAM 30 WWTP and the treated effluent sent to RIBs for disposal. It has five monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 161164, 161166, and 161167) ***(Figure 47)***. The groundwater flow direction is radial from pond, north of RIBS but does not flow west. The monitoring well 161164 is an upgradient well whereas 161166 and 161167 are downgradient wells.

Figure 47 Proposed monitoring wells for groundwater sampling at the Country Grove OWTDS.

3.10 Fish Hook Mobile Home Park (Septic)

The Fish Hook MHP OWTDS utilize septic tanks to provide primary treatment of the wastewater, and the treated effluent gravity flows to a dosing chamber equipped with pumps to dose the pressure dose systems. There are altogether five monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 100308, 100309, and 100310) ***(Figure 48)***. The groundwater flows south to southeast direction towards Morris Mill Pond. The monitoring well 100308 is an upgradient well whereas 100309 and 100310 are downgradient wells.

Figure 48 Groundwater sampling sites at the Fish Hook MHP OWTDS.

3.11 Southwood Acres (Septic)

The Southwood Acres OWTDS treats wastewater by a dual Geoform Rotating Biological Contactor WWTP, filtered by a DynaSand DSF07 and then the effluent is discharged to RIBs for disposal. It has five monitoring wells located at the facility, four of which are selected for groundwater sampling (DNREC ID: 179478, 179472, 192392, and 192904) ***(Figure 49)***. The groundwater flows east towards Double Run Creek. The monitoring well 179478 is an upgradient well whereas 179472, 192392 and 192904 are downgradient wells.

Figure 49 Groundwater sampling sites at the Southwood Acres OWTDS.

3.12 Mountaire Farms of Delaware Inc (Spray)

The Mountaire Farms of Delaware use thirteen fields (i.e., center pivot spray irrigation systems) to spray irrigate the treated wastewater onto approximately 893 acres of land. Seven fields are located north of State Route #24 and are designated as WHBJ Systems Nos. 1, 2, 3, 4, 5, 6, and 7. In addition, six fields are located south of Route #24 and are designated as Center Block Systems Nos. 3, 3A, 3B, 3C, 3DE, and 3DW. For the existing spray fields, there are altogether thirty-three monitoring wells, four of which are selected for groundwater sampling (DNREC ID: 280086, 285177, 70673, and 70677) ***(Figure 50)***. The groundwater flow direction for fields north of John J. Williams Highway flows north and fields south of the road flows southeast towards Indian river. The monitoring well 285177 is an upgradient well whereas 280086, 70673, and 70677 are downgradient wells.

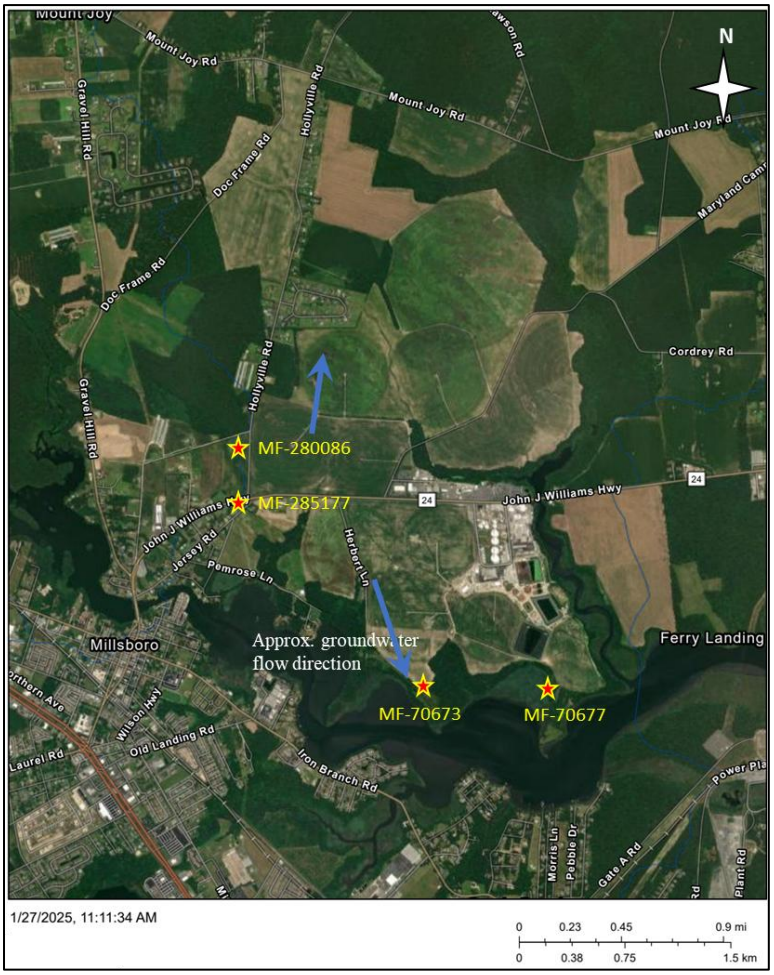


Figure 50 Groundwater sampling at the Mountaire Farms of Delaware Inc.

3.13 Mobile Gardens Mobile Home Park (RIB)

The Mobile Gardens MHP OWTDS treats wastewater by a Biologically Engineered Single Sludge Treatment WWTP, and the effluent is disposed of into RIBs. It has four monitoring wells located in the facility, three of which are selected for groundwater sampling (DNREC ID: 214494, 214496, and 214497) ***(Figure 51)***. The groundwater flows north/northwest towards Nanticoke River. The monitoring well 214496 is an upgradient well whereas 214494 and 214497 are downgradient wells.

Figure 51 Groundwater sampling sites at the Mobile Gardens MHP OWTDS.

3.14 Jellystone Campground (Septic)

The Jellystone Campground wastewater disposal and treatment facility has three monitoring wells located in the disposal beds, and all three wells are selected for groundwater sampling (DNREC ID: 222680, 222681, and 222682) ***(Figure 52)***. The groundwater flow direction is east/northwest/southeast. The monitoring well 222682 is an upgradient well whereas 222680 and 222681 are downgradient wells.

Figure 52 Groundwater sampling sites at the Jellystone Campground OWTDS.

3.15 Pintail Pointe (Drip System)

The Pintail Point OWTDS utilizes septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of at full depth replacement beds. There are five monitoring wells located at the facility, three of which are selected for groundwater sampling (DNREC ID: 220009, 220011, and 220012) ***(Figure 53)***. Based on the monitoring wells site maps and depth to water, the groundwater flows northeast towards wetlands. The monitoring well 220012 is an upgradient well whereas 220009 and 220012 are downgradient wells.

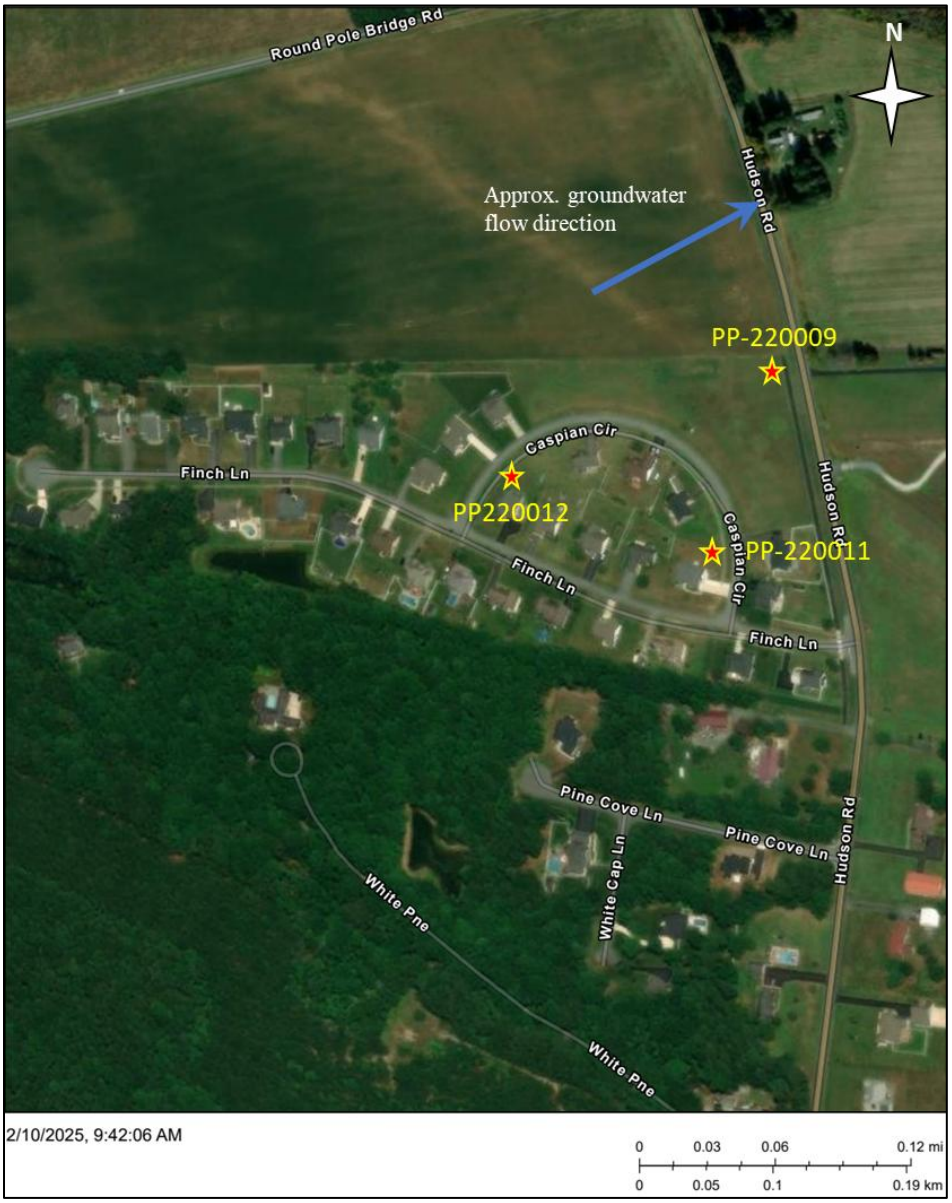


Figure 53 Groundwater sampling sites at Pintail Pointe OWTDS.

3.16 Heron Bay (RIB)

The Heron Bay OWTDS treats wastewater by a Fluidyne ISAM-50 WWTP and disposes it into RIBs. The facility has four monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 217703, 217704, and 217705) ***(Figure 54)***. Based on the monitoring wells site maps, the groundwater flows east to southeast direction towards a wetland. Monitoring well 217703 is an upgradient well whereas 217704 and 217705 are downgradient wells.

Figure 54 Groundwater sampling at the Heron Bay OWTDS.

3.17 Cedar Village Mobile Home Park (Spray)

The Cedar Village Mobile Home Park wastewater disposal and treatment facility spray irrigate the treated effluent onto the spray field located on the northwest corner of the Cedar Village MHP. It has a total of seven monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 86683, 86687, and 86688) ***(Figure 55)***. Based on the monitoring wells site maps, the groundwater flows north to northwest/northeast direction towards Cubbage Pond. The monitoring well 86688 is an upgradient well whereas 86683 and 86687 are downgradient wells.

Figure 55 Groundwater sampling sites at the Cedar Village MHP OWTDS.

3.18 Mt Pleasant Mobile Home Park (Septic)

The Mt. Pleasant Mobile Home Park wastewater disposal and treatment facility disposes of the treated effluent onto the pressure dosed bed system located at Mt. Pleasant MHP. It has total three monitoring wells and all three wells are selected for groundwater sampling (DNREC ID: 177650, 177666, and 177667) ***(Figure 56)***. Based on the monitoring wells site maps, the groundwater flows north to northeast towards the wetland. The monitoring well 177650 is an upgradient well whereas 177666 and 177667 are downgradient wells.

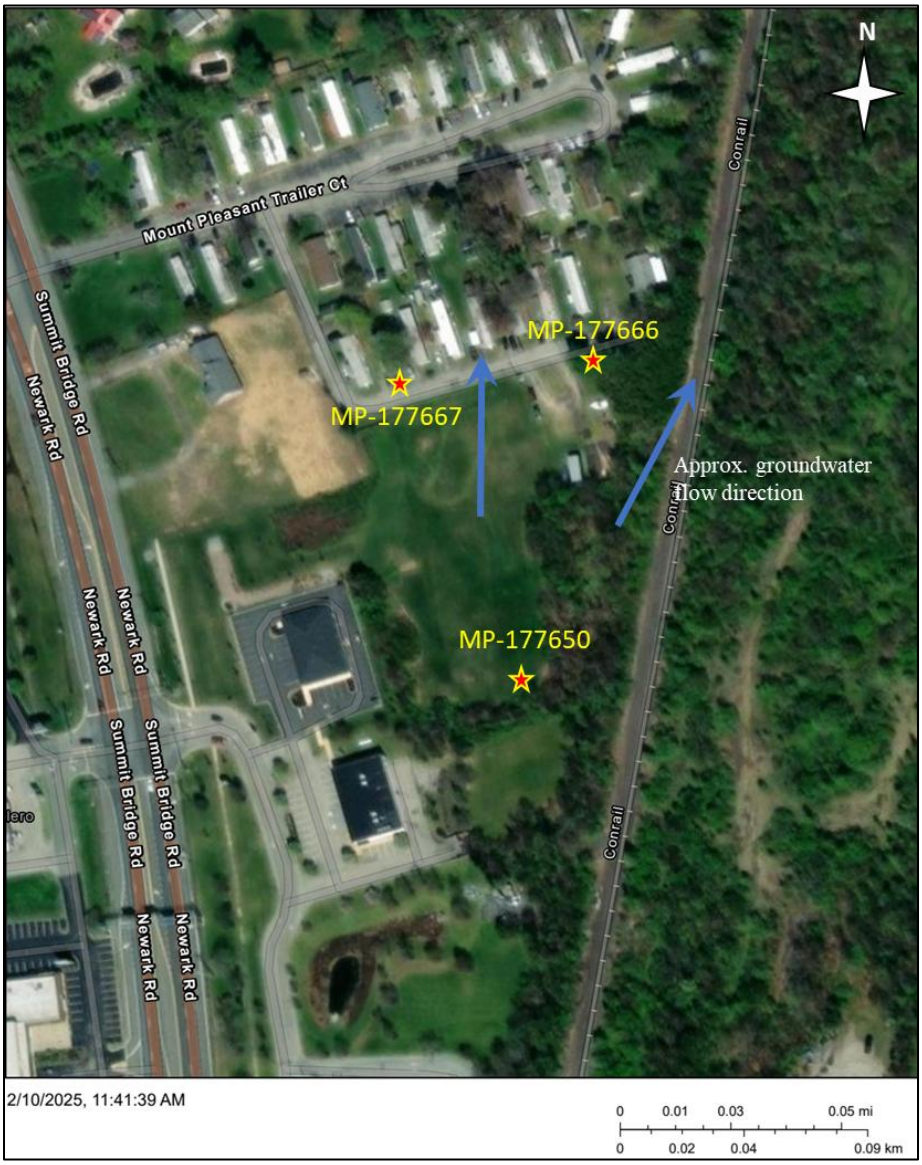


Figure 56 Groundwater sampling sites at Mt Pleasant MHP OWTDS.

3.19 Wolfe Neck Regional Wastewater Treatment Facility (Spray)

The Wolfe Neck Regional wastewater treatment facility spray irrigates the treated domestic wastewater from the West Rehoboth expansion of the Dewey Beach Sanitary Sewer District and spray irrigates the treated effluent onto the spray fields located on the east end of the County Road 270. There are ten monitoring wells located around the spray fields, three of which are selected for groundwater sampling (DNREC ID: 103594, 103595, and 103597) ***(Figure 57)***. Based on the monitoring wells site maps, groundwater in the unconfined aquifer at Wolfe Neck flows from the area centered on the site ridge, northeast towards the Lewes and Rehoboth Canal. It also flows northwest towards Wolfe Glade, and southeast towards Holland Glade. The monitoring well 103594 is an upgradient well whereas 103595 and 103597 are downgradient wells.

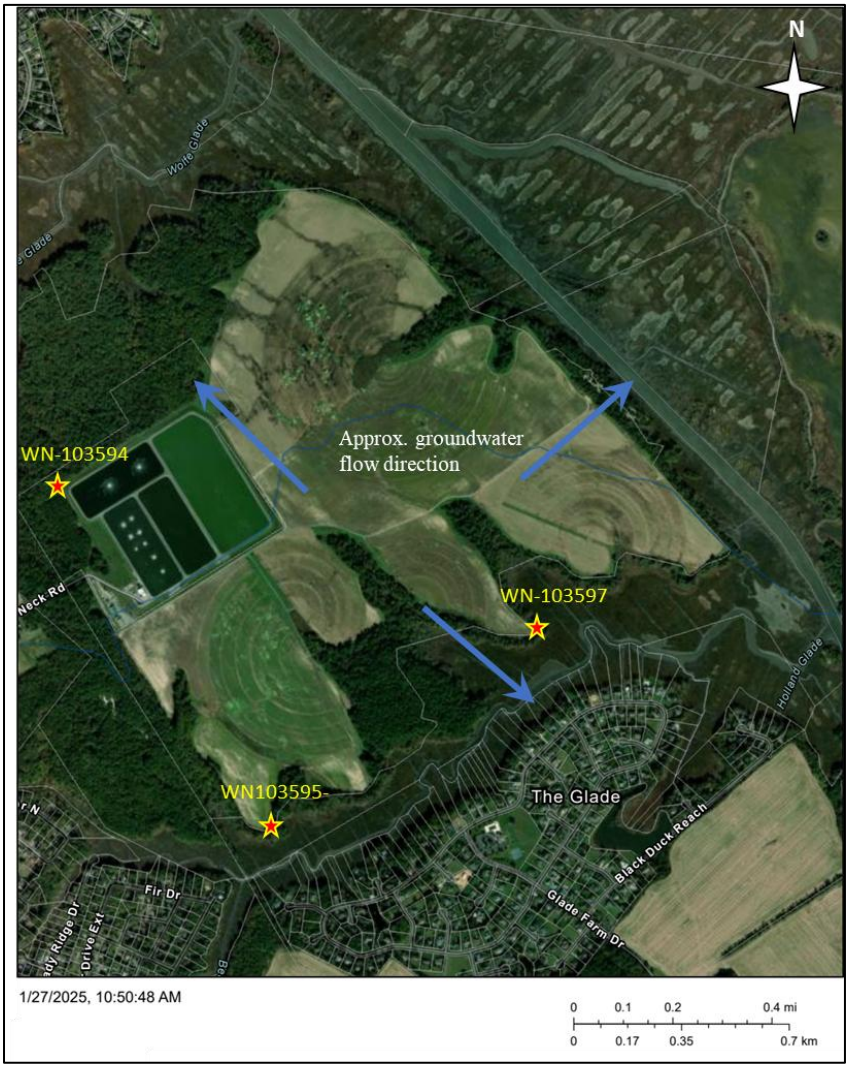


Figure 57 Groundwater sampling sites at the Wolfe Neck Regional WTF.

3.20 Harim Millsboro LLC (Spray)

The Harim Millsboro LLC wastewater treatment facility sprays irrigated processing water from plant pasteurizers onto a spray field located adjacent to Harim Millsboro LLC. There are altogether twelve monitoring wells located around the spray fields, three of which are selected for groundwater sampling (DNREC ID: 244707, 71930, and 95672) ***(Figure 58)***. Based on the monitoring wells site maps, the groundwater flows north to northeast towards Indian River. The monitoring well 244707 is an upgradient well whereas 71928 and 95672 are downgradient wells.

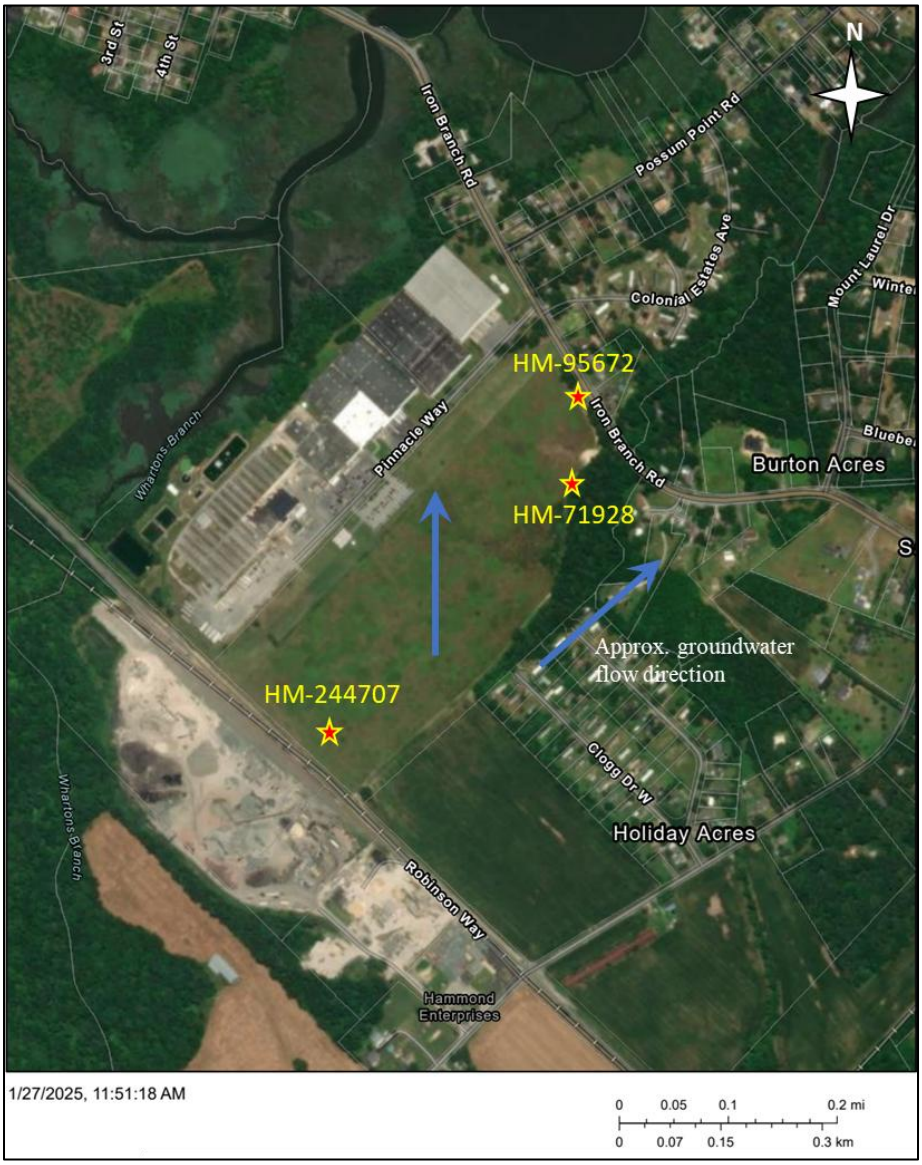


Figure 58 Groundwater sampling at the Harim Millsboro LLC OWTDS.

3.21 Piney Neck Regional Wastewater Treatment Facility (Spray)

The Piney Neck Regional WTF spray irrigate the treated effluent onto 38 acres of spray fields and 19.12 acres of loblolly pine plantation. There are altogether fifteen monitoring wells located around the spray fields, three of which are selected for groundwater sampling (DNREC ID: 222299, 222301, and 22239) ***(Figure 59)***. Based on the monitoring wells site maps, the groundwater flows east to southeast towards Pepper Creek. The monitoring well 22239 is an upgradient well whereas 222299 and 222301 are downgradient wells.

Figure 59 Groundwater sampling sites at the Piney Neck Regional WTF.

3.22 Plantations (Spray)

The Plantations wastewater disposal and treatment facility spray irrigate the treated effluent onto spray fields planted in perennial grass. There are altogether eight monitoring wells located around the spray fields, three of which are selected for groundwater sampling (DNREC ID: 66448, 66454, and 66455) ***(Figure 60)***. Based on the hydrogeological report, the groundwater flows south to southwest direction. The monitoring well 66448 is an upgradient well whereas 66454 and 66455 are downgradient wells.

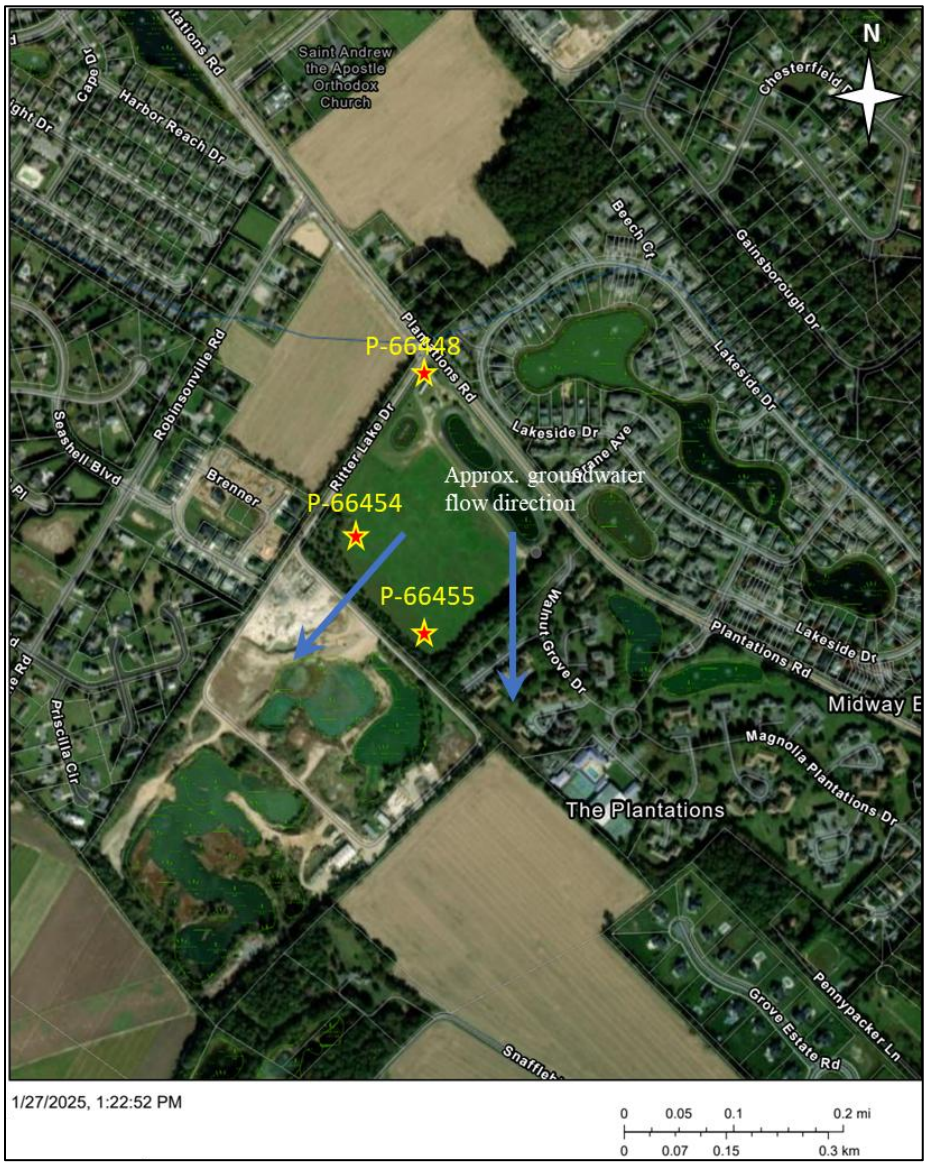


Figure 60 Groundwater sampling sites at the Plantations WTF.

3.23 West Bay Park (RIB)

The West Bay Park OWTDS treats the effluent by a dual Biowheel WTP, and the treated effluent is sent to rapid infiltration basins to dispose. There are altogether four monitoring wells located around the RIBs, three of which are selected for groundwater sampling (DNREC ID: 211376, 211377, and 279523) ***(Figure 61)***. The groundwater radially flows outward from RIBs with a general groundwater flow direction is East. The monitoring well 211376 is an upgradient well whereas 211377 and 279523 are downgradient wells.

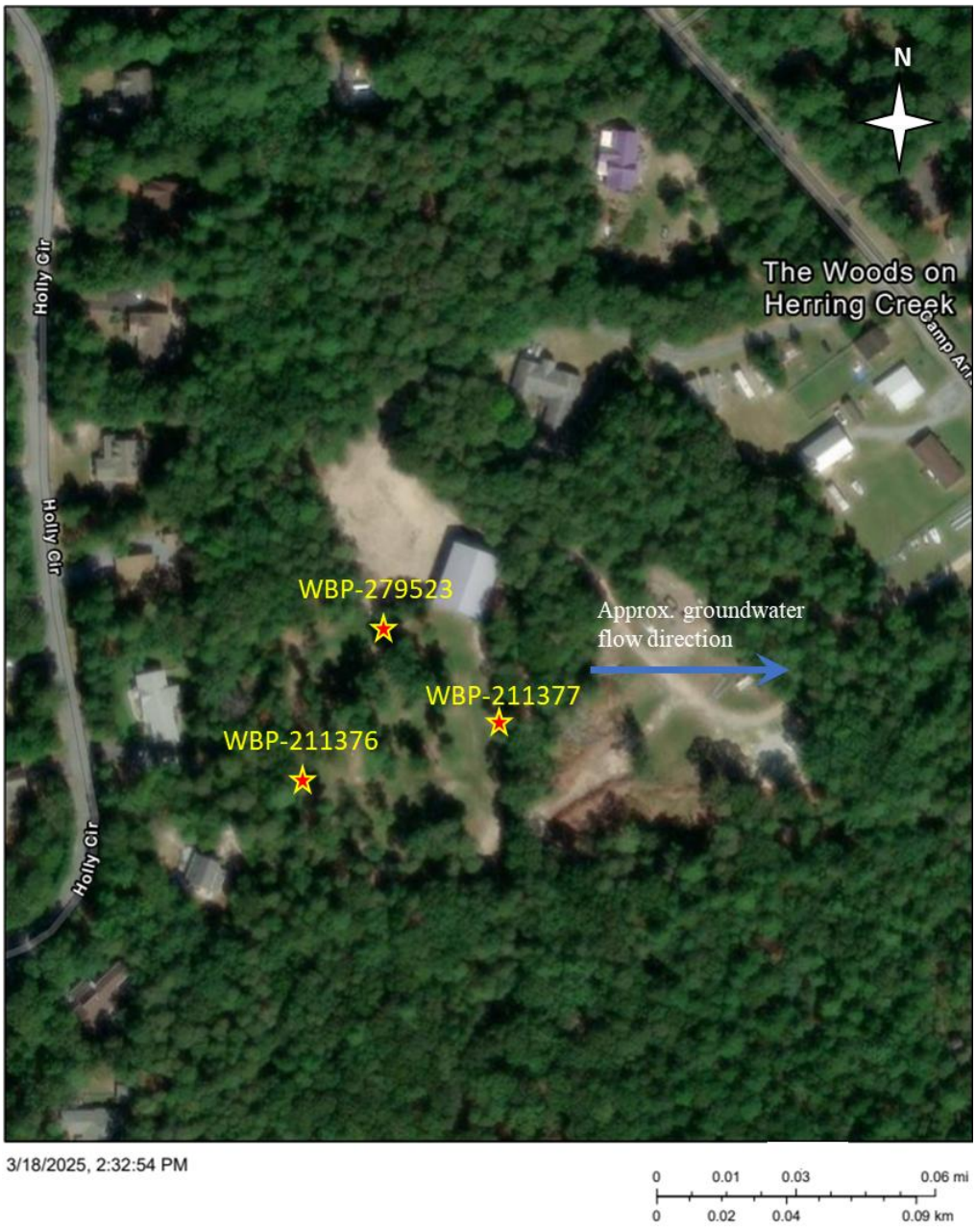


Figure 61 Groundwater sampling sites at the West Bay Park OWTDS.

3.24 Chelesa Villa Subdivision (Septic)

The Chelesa Villa Subdivision OWTDS utilize individual and shared septic tanks to provide primary treatment of wastewater, and the treated effluent is disposed of in drip dispersal zones. There are altogether three monitoring wells and all of them are selected for groundwater sampling (DNREC ID: 191030, 191031, and 191032) ***(Figure 62)***. The groundwater flows east to southeast towards wetlands. The monitoring well 191030 is an upgradient well whereas 191031 and 191032 are downgradient wells.

Figure 62 Groundwater sampling sites at the Chelesa Villa Subdivision OWTDS.

3.25 Evelyn I. Morris School (Septic)

The Evelyn I. Morris School OWTDS utilizes septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of into pressure dosed beds. There are altogether three monitoring wells and all of them are selected for groundwater sampling (DNREC ID: 90682, 90683, and 90684) ***(Figure 64)***. Based on the hydrogeological report, the groundwater flows east towards Cedar creek. The monitoring well 90682 is an upgradient well whereas 90683 and 90684 are downgradient wells.

Figure 63 Groundwater sampling sites at the Evelyn I. Moris School OWTDS.

3.26 New Castle County Wastewater Treatment Facility – Water Farm 1 (Spray)

The New Castle County WTF (Water Farm 1) spray irrigate the treated effluent onto 155.3 acres of spray irrigation fields with five center pivot irrigation system. There are altogether fifteen monitoring wells located around the spray fields, four of which are selected for groundwater sampling (DNREC ID: 90405, 90409, 101189, and 101196) ***(Figure 65)***. The groundwater generally flows northwest towards tributary that feeds into the Appoquinimink River. The monitoring well 90405 is an upgradient well whereas 90409, 101189, and 101196 are downgradient wells.

Figure 64 Groundwater sampling sites at the New Castle County WTF (Water Farm 1).

3.27 Frog Hollow – The Legends Golf Course Community (Spray)

The Frog Hollow – The Legends Golf Course Community spray irrigate the treated effluent onto 139.97 acres of roughs, greens, tees, and fairways planted in bentgrass, ryegrass, and bluegrass mixtures. There are altogether ten monitoring wells located around the spray fields, three of which are selected for groundwater sampling (DNREC ID: 163050, 163054, and 203320) ***(Figure 66)***. Based on the hydrogeological report, the groundwater generally flows east to southeast towards Dove Nest Branch. The monitoring well 203320 is an upgradient well whereas 163050 and 163054 are downgradient wells.

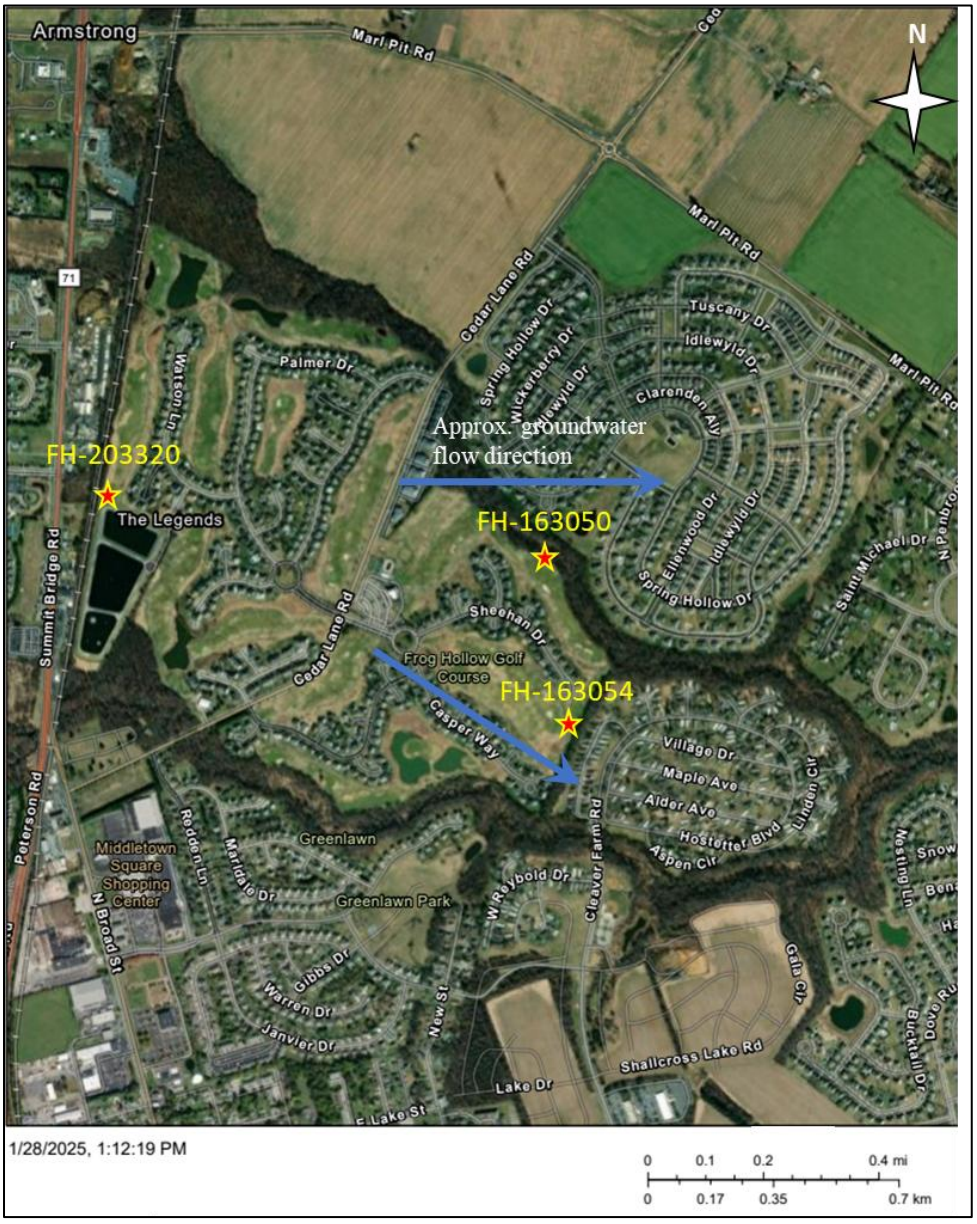


Figure 65 Groundwater sampling sites at the Frog Hollow OWTDS.

3.28 Hanover Foods Corporation (Spray)

The Hanover Foods Corporation spray irrigates the treated effluent onto spray fields located to the west and south of the facility, and also to the northwest of the facility across Providence Creek. There are altogether sixteen monitoring wells located around the spray fields, three of which are selected for groundwater sampling (DNREC ID: 160697, 104490, and 212814) ***(Figure 67)***. The groundwater in the northern spray fields flows east to southeast towards the Providence Creek. In the central spray fields, it flows north to northeast towards the Providence Creek and in the southern spray area, it radially flows northeast which is influenced by Providence Creek and Greens Branch. The monitoring well 160697 is an upgradient well in the southern spray fields whereas 104490 and 212814 are downgradient wells.

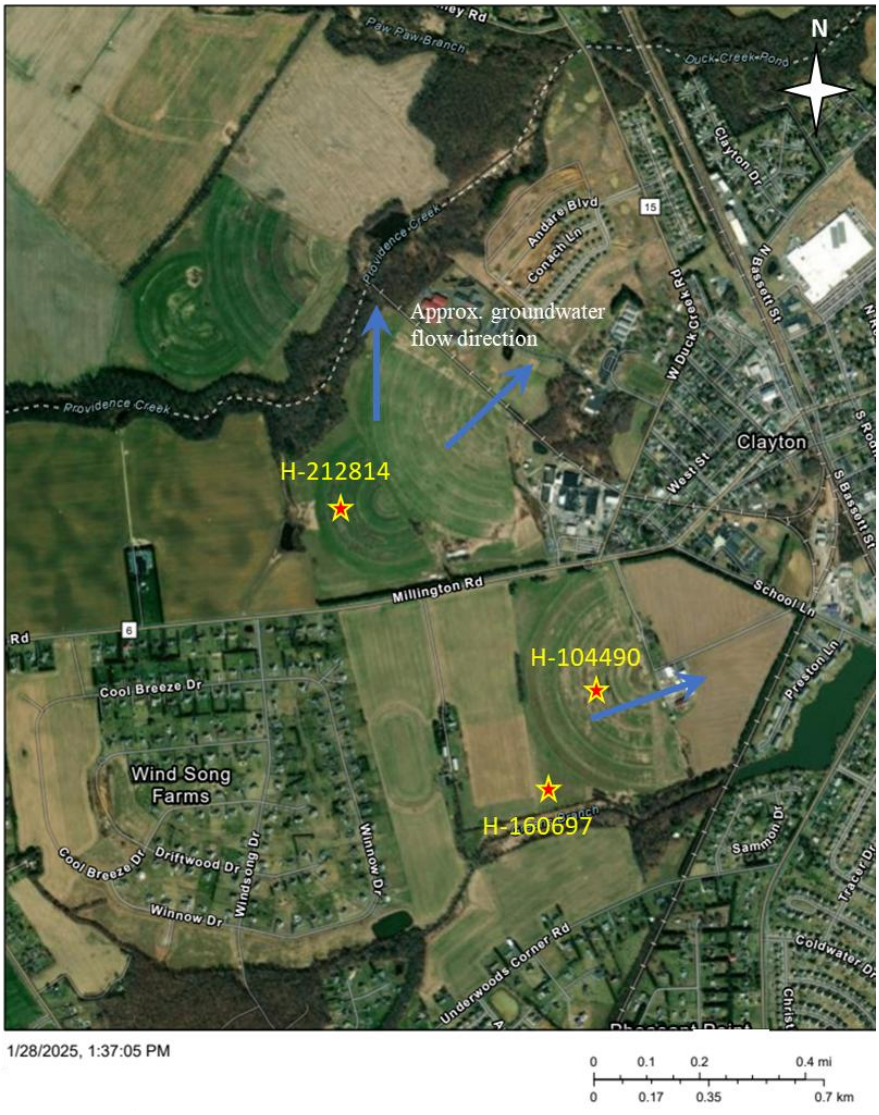


Figure 66 Groundwater sampling at the Hanover Foods Corporation OWTDS.

3.29 Town of Bridgeville – Tatman Farm (Spray)

The Town of Bridgeville- Tatman spray irrigates the treated effluent via a two-center pivot irrigation system onto 68.33 acres of spray fields. There are altogether nine monitoring wells located around the spray fields, four of which are selected for groundwater sampling (DNREC ID: 220976, 220978, and 203898) ***(Figure 68)***. The groundwater flows west across the site towards the Gum Branch. The monitoring well 203898 is an upgradient well in the southern spray fields whereas 220976 is a side gradient well and 220978 is a downgradient well.

Figure 67 Groundwater sampling sites at the Town of Bridgeville WTF.

3.30 Cool Branch Mobile Home Park (Spray)

The Cool Branch MHP spray irrigates the treated effluent onto 30.3 acres of spray fields. There are altogether six monitoring wells located around the spray fields, three of which are selected for groundwater sampling (DNREC ID: 108767, 108769, and 108770) ***(Figure 69)***. The groundwater flows north to northwest towards the Cool Branch. The monitoring well 108767 is an upgradient well in the southern spray fields whereas 108769 and 108770 are downgradient wells.

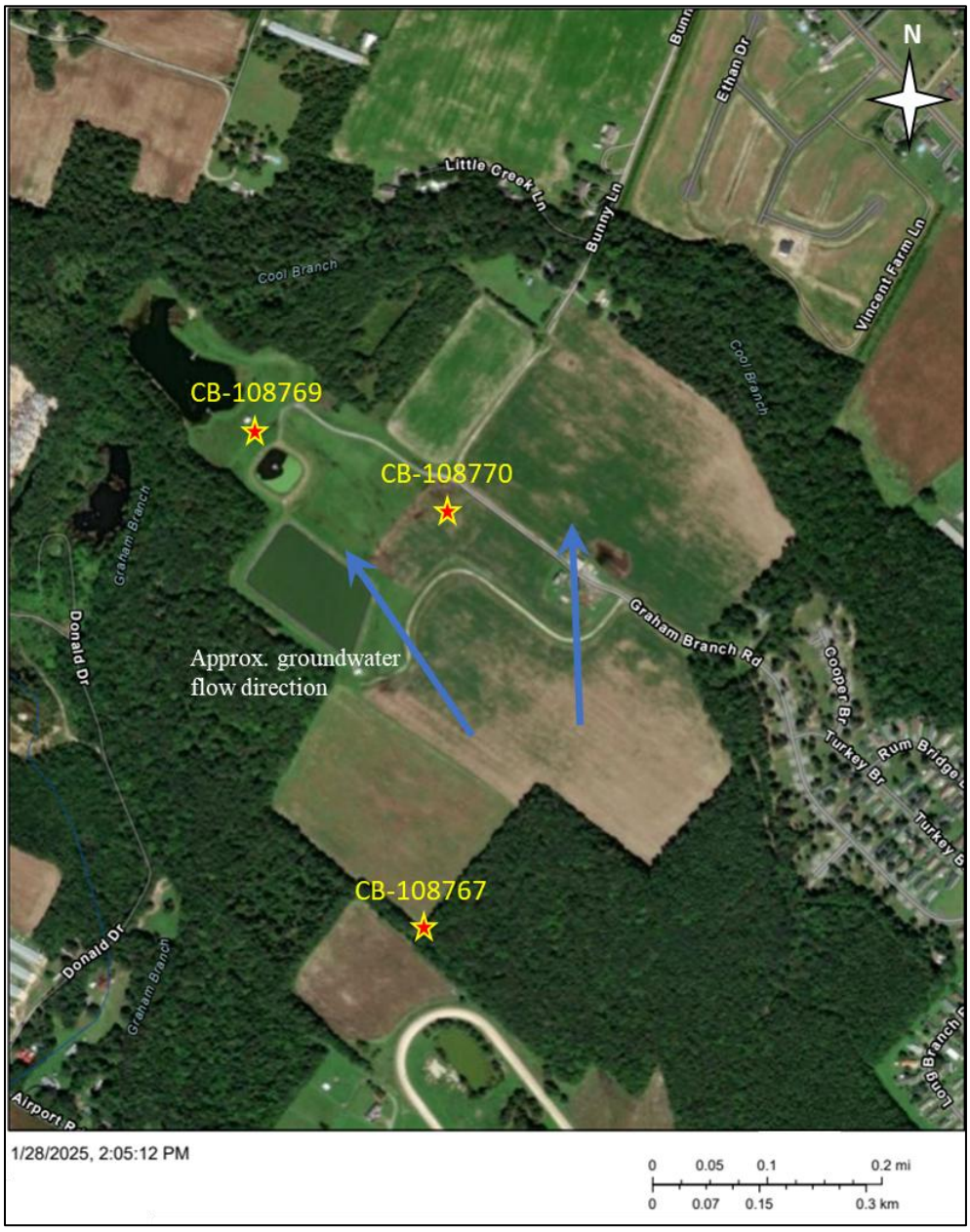


Figure 68 Groundwater sampling sites at the Cool Branch MHP OWTDS.

3.31 Bay Front (RIB)

The Bay Front OWTDS treats the effluent by a dual activated sludge WTP with Kubota membrane filtration, and the treated effluent is sent to rapid infiltration basins to dispose. There are altogether three monitoring wells located around the RIBs, all of them are selected for groundwater sampling (DNREC ID: 210401, 210403, and 227996) ***(Figure 70)***. The groundwater fluctuated during various hydrologic conditions radially outward from RIBs with a general groundwater flow direction is East. The monitoring well 210403 is an upgradient well whereas 210401 and 227996 are downgradient wells.

Figure 69 Groundwater sampling sites at the Bay Front OWTDS.

3.32 The Ridings (Drip System)

The Ridings wastewater disposal and treatment facility treats the effluent by a dual Aqua Aerobics Sequencing Batch Reactor WTP, and the treated effluent is sent to drip dispersal fields to dispose. There are altogether five monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 218990, 218992, and 218993) ***(Figure 71)***. Based on the hydrogeological report, the groundwater flows north to northwest towards Bundicks Branch. The monitoring well 218992 is an upgradient well whereas 218990 and 218993 are downgradient wells.

Figure 70 Groundwater sampling sites at the Ridings OWTDS.

3.33 Gull Point Housing (Septic)

The Gull Point Housing wastewater disposal and treatment facility utilize septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of into pressure dosed beds. There are altogether three monitoring wells and all of them are selected for groundwater sampling (DNREC ID: 100687, 100688, and 100689) ***(Figure 72)***. The groundwater flows south to southeast towards the Inland Bays. The monitoring well 100687 is an upgradient well whereas 100688 and 100689 are downgradient wells.

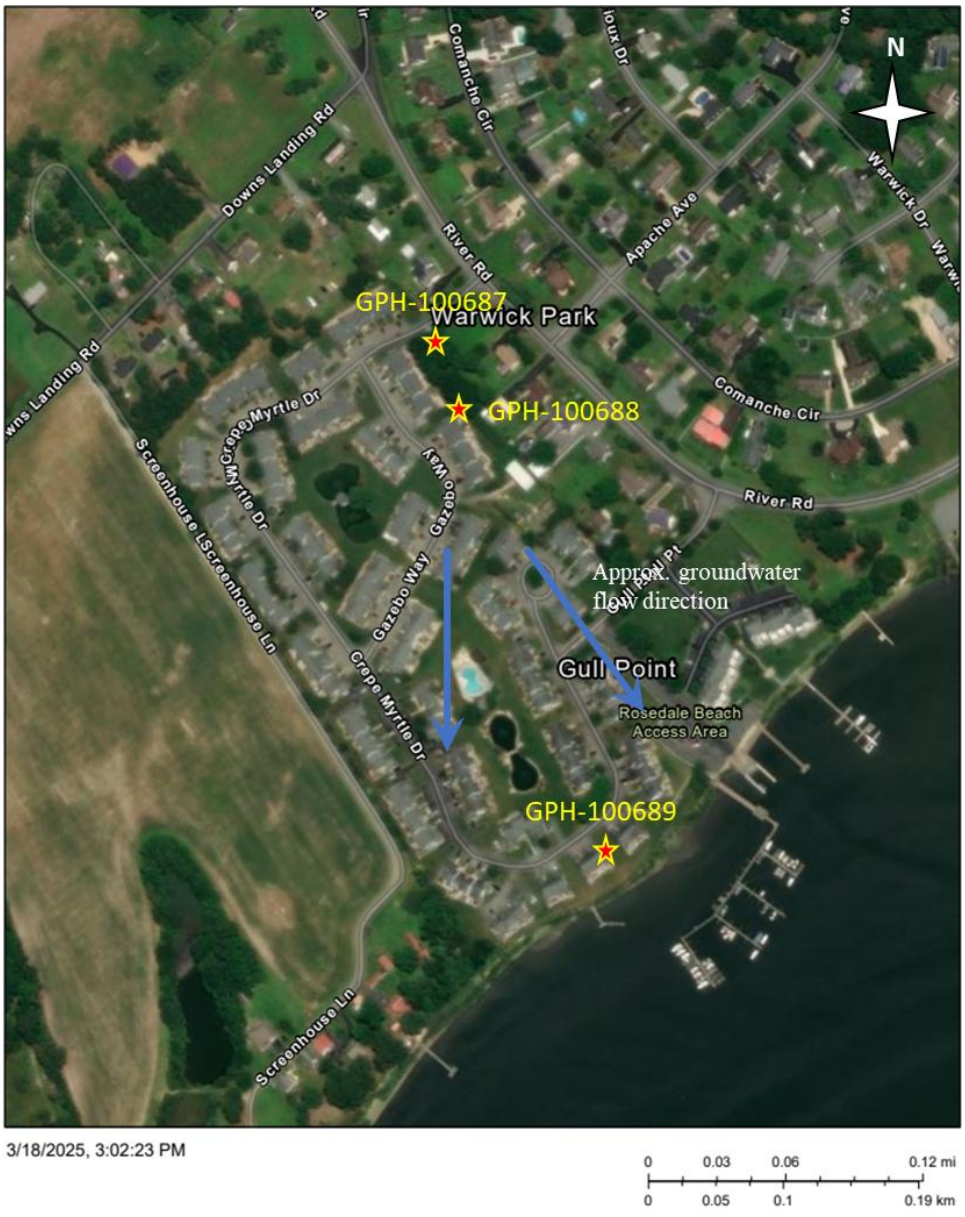


Figure 71 Groundwater sampling sites at Gull Point Housing OWTDS.

3.34 Gulls Way Campground (Septic)

The Gulls Way Campground wastewater disposal and treatment facility utilize septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of into disposal beds. There are altogether three monitoring wells and all of them are selected for groundwater sampling (DNREC ID: 173315, 173317, and 284582) ***(Figure 73)***. The groundwater flows northwest towards Pepper Creek. The monitoring well 173315 is an upgradient well whereas 173317 and 284582 are downgradient wells.

Figure 72 Groundwater sampling sites at the Gull Point Campground OWTDS.

3.35 Sandy Ridge Development (Septic)

The Sandy Ridge Development wastewater disposal and treatment facility utilize septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of into capping fill disposal systems. There are altogether five monitoring wells, three of which are selected for groundwater sampling (DNREC ID: 111091, 111093 and 208609) ***(Figure 74)***. The groundwater flows northwest towards Cooper Branch. The monitoring well 208609 is an upgradient well whereas 111091 and 111093 are downgradient wells.

Figure 73 Groundwater sampling sites at the Sandy Ridge Development OWTDS.

3.36 Twin Maples Mobile Home Park (Septic)

The Twin Maples Mobile Home Park wastewater disposal and treatment facility utilize septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of into pressure dosed disposal beds. There are three monitoring wells, and all of them are selected for groundwater sampling (DNREC ID: 106727, 106729, and 183639) ***(Figure 75)***. The groundwater flows southeast towards Pinks Branch. The monitoring well 183639 is an upgradient well whereas 106727 and 106729 are downgradient wells.

Figure 74 Groundwater sampling sites at the Twin Maples MHP OWTDS.

3.37 Homestead Mobile Home Park (Septic)

The Homestead Mobile Home Park wastewater disposal and treatment facility utilize individual and shared septic tanks to provide primary treatment of the wastewater, and the treated effluent is disposed of into elevated sand mound. There are four monitoring wells, and three of them are selected for groundwater sampling (DNREC ID: 94980, 94981, and 223439) (Figure 76). The groundwater flows east to southeast towards Long Drain ditch. The monitoring well 94981 is an upgradient well whereas 94980 and 223439 are downgradient wells.

Figure 75 Groundwater sampling sites at the Twin Maples MHP OWTDS.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

A Quality Assurance Project Plan (QAPP) will be developed for this study before the start of sampling. DNREC will select qualified contractors and laboratories to perform sample collection and analysis. These contractors will be required to submit Standard Operating Procedures (SOPs) and Quality Assurance and Quality Control Plans (QA/QC) to DNREC for approval prior to contracting. All samples will be analyzed using DNREC modified EPA Method 1633M.

5.0 PROJECT SCHEDULE

This project design and sampling plan will be finalized in November 2025. Sampling team(s) will be selected from State certified-listed contractors in November 2025 when coordination with selected facilities should also be finalized. It is anticipated that first round of sampling would occur in December of 2025.

6.0 SUMMARY

DNREC- Division of Water intends to conduct a study on PFAS in groundwater samples collected from groundwater discharge wastewater treatment facilities. Four types of groundwater discharge facilities (Spray, RIB, septic, and drip system) are selected for this study. Thirty-seven wastewater treatment and groundwater discharge facilities with discharge rates > 10,000 GPD and monitoring wells installed are selected. Excluding QA-QC samples, a total of 230 ($115 \times 2 = 230$) groundwater samples from two rounds of sampling will be collected from wastewater treatment and disposal facilities in this study (Sections 2.0 and 3.0; Table 2). Actual numbers of samples will most likely be less than 230 due to possible dry wells. Field sampling is expected to start in December 2025.

Facility Name	Site Type	Facility Identifier	Selected Wells (DNREC ID)	No of Wells
Laurel Village MHP	Septic	LV	86226, 86227, 86228	3
Dove Estate MHP	Septic	DE	178786, 178787, 178566	3
Harts Landing	Drip System	HL	203407, 203408, 203409	3
Colonial Estates MHP	RIB	CE	173926, 173930, 220341	3
Scottsdale MHP	Septic	S	99702, 99703, 99704	3
Inland Bays Regional WTF	Spray	IB	237074, 237808, 255717, 283993	4
Pictsweet, Bridgeville Plant	Spray	PS	73449, 73580, 268081	3
Town of Georgetown WTF	Spray	GT	91451, 91455, 239636	3
Country Grove	RIB	CG	161164, 161166, 161167	3
Fish Hook MHP	Septic	FH	100308, 100309, 100310	3
Southwood Acres	Septic	SA	179472, 179478, 192392, 192904	4
Mountaire Farms of Delaware Inc	Spray	MF	70677, 272416, 280086, 285177	4
Mobile Gardens MHP	RIB	MG	214494, 214496, 214497	3
Jellystone Campground	Septic	JC	222680, 222681, 222682	3
Pintail Pointe	Drip System	PP	220009, 220011, 220012	3
Heron Bay	RIB	HB	217703, 217704, 217705	3
Cedar Village MHP	Spray	CV	86683, 86687, 86688	3
Mt Pleasant MHP	Septic	MP	177650, 177666, 177667	3
Wolfe Neck Regional WTF	Spray	WN	103594, 103595, 103597	3
Harim Millsboro LLC	Spray	HM	71928, 95672, 244707	3
Piney Neck Regional WTF	Spray	PN	222299, 222301, 222339	3
Plantations	Spray	P	66448, 66454, 66455	3
West Bay Park	RIB	WBP	211376, 211377, 211378	3
Chelesa Villa Subdivision	Septic	CVS	191030, 191031, 191032	3
Evelyn I Morris School	Septic	EIM	90682, 90683, 90684	3
New Castle County WTF–Water	Spray	NCC	90405, 90409, 101189, 101196	4

Frog Hollow-The Legends Golf Course Community	Spray	FH	163050, 163054, 203320	3
Hanover Foods Corporation	Spray	H	104490, 160697, 212814	3
Town of Bridgeville - Tatman Farm	Spray	TB	203898, 220976, 220978	3
Cool Branch MHP	Spray	CB	108767, 108769, 108770	3
Bay Front	RIB	BF	210401, 210403, 227996	3
The Ridings	Drip System	TR	218990, 218992, 218993	3
Gull Point Housing	Septic	GPH	100687, 100688, 100689	3
Gulls Way Campground	Septic	GWC	173315, 173317, 284582	3
Sandy Ridge Development	Septic	SRD	111091, 111093, 208609	3
Twin Maples MHP	Septic	TM	106727, 106729, 183639	3
Homestead MHP	Septic	HS	94980, 94981, 223439	3

* MHP = mobile home park, WTF = wastewater treatment facility

Table 2 List of wastewater treatment facility identifiers and the selected monitoring wells.

REFERENCE

DNREC, 2023. Project Design and Sampling Plan- PFAS in Wastewater: Characterization and Fate. *by* Division of Water, Department of Natural Resources and Environmental Control (DNREC); April 2023.

DNREC, 2025. Wastewater Treatment and Disposal Facilities PFAS Investigation Project: Data Summary Report. *by* Division of Water, Department of Natural Resources and Environmental Control (DNREC); March 2025.

United States Environmental Protection Agency, 2021. Method 1633: Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS.