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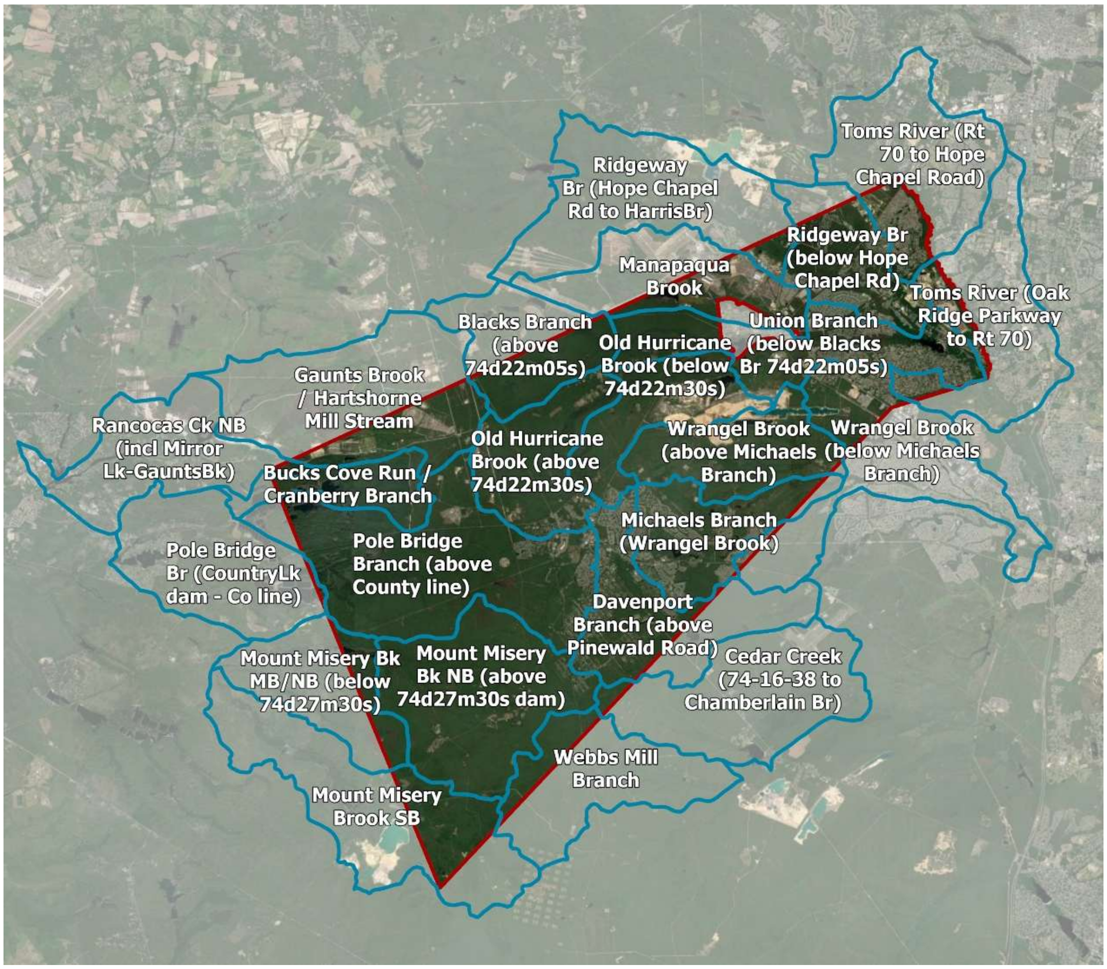

Manchester Township (Ocean County)
Watershed Inventory Report

Developed by the Rutgers Cooperative Extension Water Resources Program
Funded by New Jersey Department of Environmental Protection
July 8, 2026

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Acknowledgements

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Introduction

Located in Ocean County in central New Jersey, Manchester Township covers over 82 square miles. With a population of 45,115 (2020 United States Census), Manchester Township's demographic is 85.2% white, 4.3% black or African American, 0.2% American Indian and Alaska Native, 2.3% Asian, and 8.1% other. The Hispanic population also includes 7.8% of the demographic. Manchester Township is dominated by natural (forests, wetlands, water) land uses. These natural land uses compose 79.1% of the municipality. The urban land use is 18.6% and the agricultural land use is 0.4%. The urban land use is predominantly residential uses at 64.6% with the majority being high density residential or multiple dwellings at 29.8% (NJDEP Open Data). The New Jersey Department of Environmental Protection (NJDEP) defines multiple dwelling and high-density residential development as single-unit residential areas with more than five dwellings per acre; neighborhoods of two- or three-family homes, row houses, and garden apartments up to three stories; and larger complexes such as condominiums, apartment buildings, and towers of four stories or more (Anderson et al., 1976).

Manchester Township contains portions of 23 subwatersheds which can be seen in Table 1 and in Figure 1. The total area of the subwatershed and the portion that is within Manchester Township are included in the table. There are approximately 160 miles of rivers and streams within the municipality; these include all or portions of Blacks Branch, Cedar Creek, Cranberry Branch, Davenport Branch, Deer Park Branch, Forked Brook, Gaunts Brook, Goodwater Branch, Green Branch, Little Hurricane Branch, Manapaqua Brook, Michaels Branch, Middle Ruckels Branch, North Branch Mount Misery Brook, North Branch Rancocas Creek, North Ruckels Branch, Old Hurricane Brook, Pole Bridge Branch, Ridgeway Branch, South Branch Mount Misery Brook, South Hurricane Brook, South Ruckels Branch, Sunken Branch, Tice Van Morn Branch, Toms River, Union Branch, Webbs Mill Branch, and Wrangle Brook. Manchester Township is within the New Jersey Department of Environmental Protection (NJDEP) Watershed Management Area (WMA) 13 (Barnegat Bay) and WMA 19 (Rancocas).

Table 1: Manchester Township subwatershed areas

HUC 14	Subwatershed Name	Municipality Area (acres)	Total Area (acres)
02040202020010	Gaunts Brook / Hartshorne Mill Stream	2,042	7,325
02040202020030	Rancocas Ck NB (incl Mirror Lk-Gaunts Bk)	116	4,636
02040202030010	Pole Bridge Br (above County line)	8,399	8,771
02040202030020	Mount Misery Bk NB (above 74d27m30s dam)	6,490	6,490
02040202030030	Mount Misery Bk MB/NB (below 74d27m30s)	867	3,698
02040202030040	Mount Misery Bk SB	1,573	7,233
02040202030050	Bucks Cove Run / Cranberry Branch	1,604	1,895
02040202030060	Pole Bridge Br (Country Lk dam - Co line)	54	5,108
02040301060070	Toms River (Rt 70 to Hope Chapel Road)	1,030	5,785
02040301060080	Toms River (Oak Ridge Parkway to Rt 70)	888	5,247
02040301070030	Ridgeway Br (Hope Chapel Rd to Harris Br)	358	6,430
02040301070040	Ridgeway Br (below Hope Chapel Rd)	2,686	3,210
02040301070050	Blacks Branch (above 74d22m05s)	1,737	3,601
02040301070060	Old Hurricane Brook (above 74d22m30s)	3,555	3,555
02040301070070	Old Hurricane Brook (below 74d22m30s)	3,205	3,209
02040301070080	Manapaqua Brook	1,659	4,236
02040301070090	Union Branch (below Blacks Br 74d22m05s)	4,200	4,562
02040301080010	Wrangel Brook (above Michaels Branch)	3,463	3,499
02040301080020	Michaels Branch (Wrangel Brook)	3,303	3,489
02040301080030	Davenport Branch (above Pinewald Road)	2,883	4,764
02040301080050	Wrangel Brook (below Michaels Branch)	1,597	5,933
02040301090010	Webbs Mill Branch	884	4,631
02040301090030	Cedar Creek (74-16-38 to Chamberlain Br)	162	5,836
TOTAL		**52,755**	**113,143**

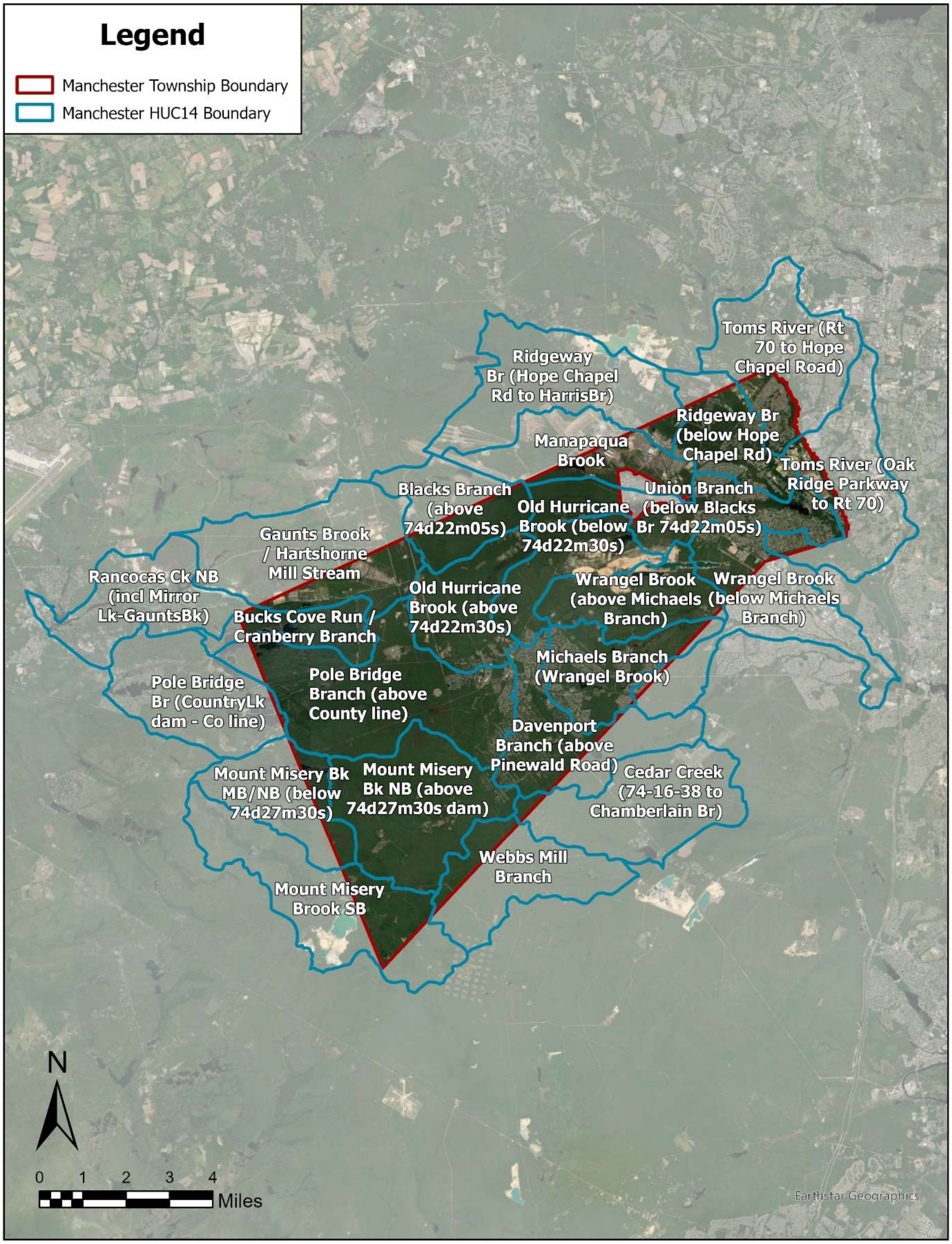

Figure 1: Manchester Township subwatersheds (HUC14s)

The purpose of this watershed inventory report is to provide a comprehensive understanding of key, defining features within the watersheds throughout Manchester Township. This involves gathering, organizing, and presenting information about existing conditions and infrastructure within each watershed. It aims to serve as a tool for informed decision-making, planning, and implementation of sustainable watershed management strategies aimed to protect and enhance the health of the watershed, its associated ecosystems, and the surrounding communities. This will allow existing water quality issues (TMDLs and water quality impairments) to be addressed. Known flooding areas can also be addressed through this process.

A review of the municipality's repetitive flooding areas and drainage concerns shows that most issues are isolated ponding events at individual properties. These typically involve water collecting on driveways, lawns, or low-lying areas adjacent to roadways. Contributing factors include flat roadway grades, low elevations, and clogged or undersized drainage structures. Many of these concerns are resolved through routine maintenance or minor adjustments, such as pipe cleaning or shoulder grading.

Several locations exhibit recurring drainage concerns over multiple years. Ridgeway Road, near Torrey Road, has experienced persistent roadway flooding with repeated follow-ups from residents. The New York Avenue corridor, including areas near 1921 and 1981 New York Avenue, has ongoing complaints of driveway and frontage ponding as well as requests for additional drainage infrastructure. The Chilvers area, including portions of Coolidge and Delaware Avenue, has low points and clogged drains that result in runoff affecting adjacent properties. Tuckerton Avenue and specific locations along Delaware Avenue, such as 1820 Delaware Avenue, also show repeated issues, often associated with low-lying properties or nearby development. Overall, the repetitive flooding and documented drainage complaints reflect a mix of maintenance-related concerns and areas where drainage deficiencies may contribute to recurring water accumulation.

A geographic information system (GIS) was used to visualize data pertaining to the existing stormwater infrastructure, land cover, watershed delineation, and water quality classification and impairments within separate layers. Datasets from the New Jersey Department of Environmental Protection's (NJDEP's) GIS database was used to populate the watershed inventory map, from which the relevant data were isolated. Datasets representing Manchester Township's existing stormwater infrastructure were provided by the municipality and were manipulated, if necessary, for the specific purposes of this report. All data layers can be viewed in greater detail at the following webmap: https://arcg.is/1ije1j2. The map utilizes public "view layers," which mirror the live source layers for outfalls, inlets, and other MS4 infrastructure.

Stormwater Outfalls

Manchester Township owns and operates 27 stormwater outfalls that drain directly into waterways as of February 2026. Figure 2 depicts the outfalls that are owned and operated by Manchester Township per the MS4 permit from the NJDEP.

All outfalls that are "owned and operated" by Manchester Township are required to be inspected once every five years per the MS4 permit from the NJDEP for erosion and illicit discharges. Condition assessments are conducted on a yearly basis, addressing approximately 20% of the outfalls each year for five years. Additional information about the observed outfall conditions and illicit discharge investigations are reported in the Stormwater Pollution Prevention Plan which is available on Manchester Township's website: https://manchestertwp.com/stormwater-management-information/.

Receiving Surface Waters

Table 2 shows how many outfalls are in each receiving surface water based on the "Surface Water Quality Classification of New Jersey" layer and the "Waterbody 2020 in New Jersey" based on the National Hydrography Dataset (NHD) accessed in February 2026. Figure 2 indicates the receiving waterbodies of the Manchester Township owned and operated outfalls.

Table 2: Manchester Township outfalls discharging to receiving surface waters

Receiving Surface Water	Outfall Number	Percent
Davenport Branch	1	3.7%
Davenport Branch Tributary	6	22.2%
Michaels Branch	1	3.7%
Pine Lake	2	7.4%
Pole Bridge Branch Tributary	1	3.7%
Tice Van Morn Branch Tributary	1	3.7%
Toms River	2	7.4%
Toms River Tributary	3	11.1%
Union Branch	10	37.0%

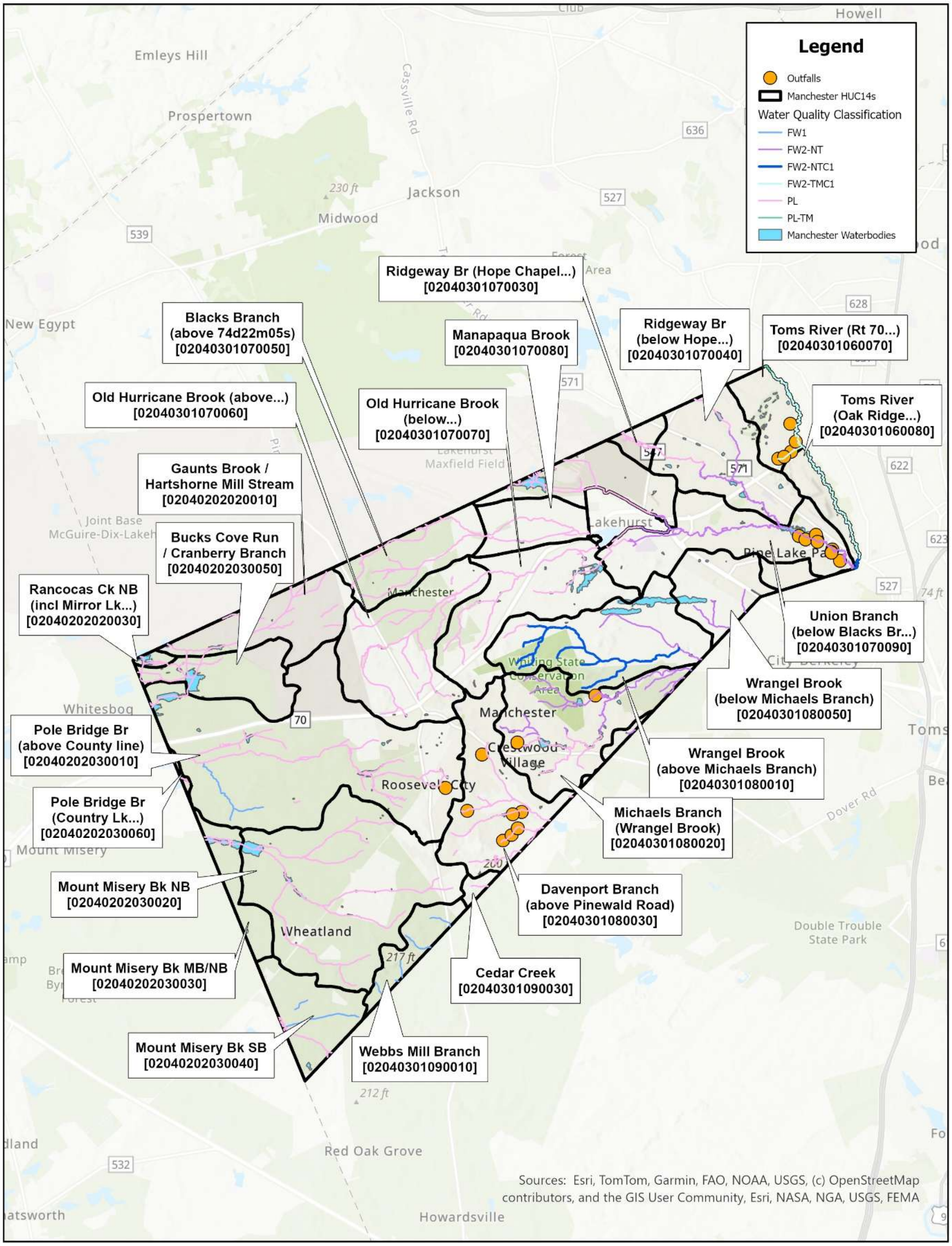

Figure 2: Manchester Township owned and operated stormwater outfalls

Water Quality Classification

The majority of streams in Manchester Township are classified as FW2-NT based on the "Surface Water Quality Classification of New Jersey" layer accessed in February 2026. A fraction of the waters in Manchester Township are category one waters (C1) which are protected from any measurable change to existing water quality because of their exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources. This includes designations FW2-NTC1 and FW2-TMC1. About 29 miles, or over 18%, of streams in Manchester Township are considered FW2-NT. About 8 miles, or just 5%, of streams are classified as FW2-NTC1, and about 7 miles, or just 4.4% of streams are classified as FW2-TMC1. The remaining waterways, about 116 miles or 72.5%, are classified as PL or PL-TM. The number of outfalls discharging to each surface water quality designation can be seen in Table 3. No outfalls discharge to FW2-NTC1 or PL-TM stream segments.

Figure 2 also depicts the water quality classification of surface waters throughout Manchester Township.

Table 3 : Manchester Township receiving surface water quality and outfall percentage

Receiving Surface Water Quality	Outfall Number	Percent
FW2-NT	13	48.1%
FW2-TMC1	5	18.5%
PL	9	33.3%

Stormwater Interconnections

Manchester Township contains parts of other MS4 systems including county owned (Ocean County) systems. There is also a small portion of Jackson Township that drains into Manchester's MS4 systems. The locations of these stormwater interconnections have been delineated as a series of point locations that mark where one system enters or leaves from another. Every effort was made to correctly represent interconnection with available data of roads and parcels along with the stormwater piping network. Due to the complexity of the stormwater piping system, there are many instances where water moves back and forth between systems, and it is often unclear exactly which portions are owned or maintained by which entity. There are two interconnections delineated with the involved parties being Ocean County and Jackson Township. Of those, one interconnection is flowing from Manchester Township into the Ocean County system, and the other is flowing from Jackson Township into Manchester Township. Figure 3 illustrates the distribution of these interconnections.

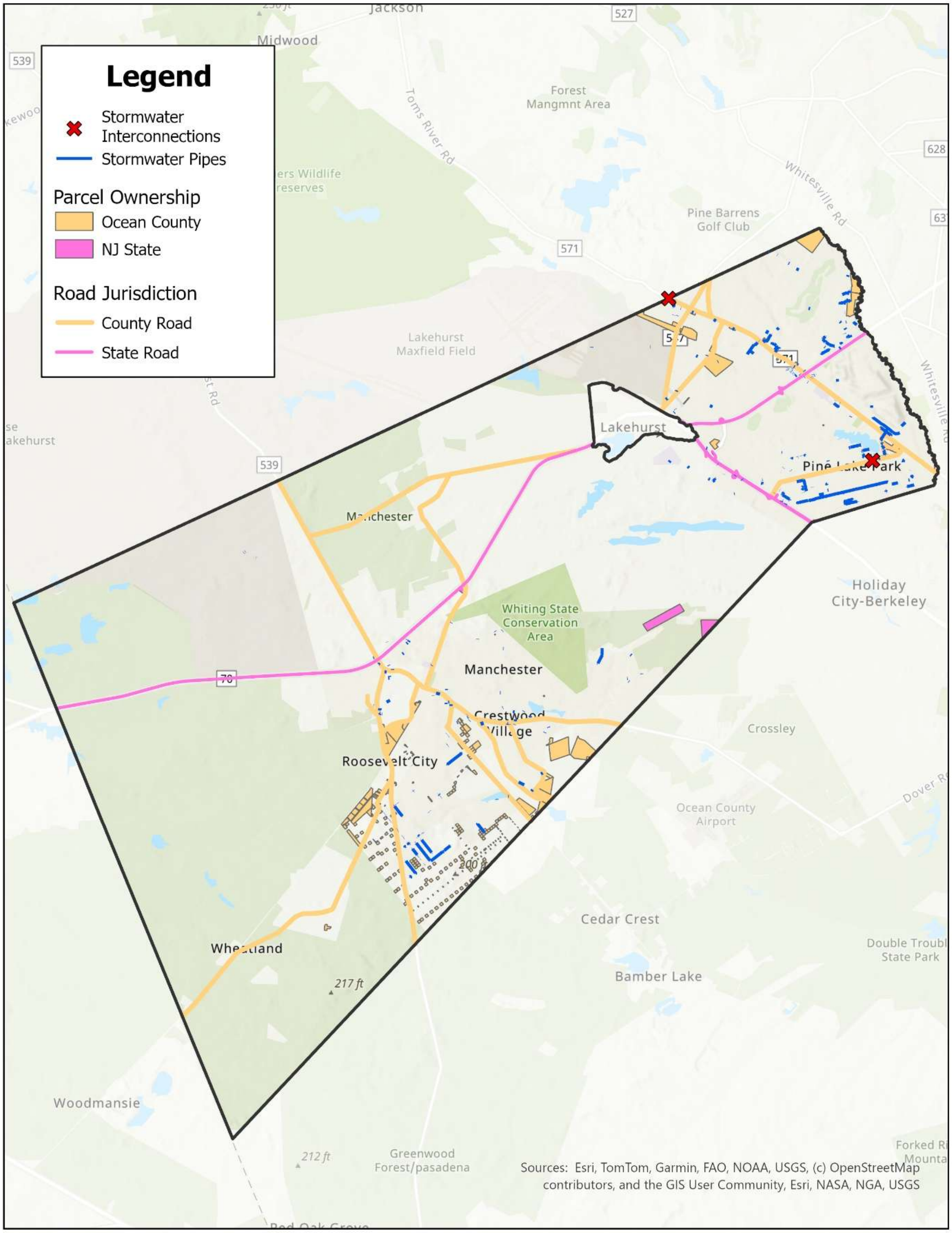

Figure 3: Manchester Township stormwater interconnections

Drainage Area Delineations

The Watershed Inventory Report includes a delineation of the drainage areas that are flowing to outfalls as well as upstream of interconnection points that flow from Manchester Township's MS4 system and into another MS4 system. These delineations can identify potential sources for illicit discharges from outfalls or aid in identifying other issues in the stormwater piping network.

General Methodology

The procedure used to delineate drainage areas for the outfalls and interconnection points considered the municipality's topography, the stream network, and the pipe network using toolsets in ArcGIS Pro and ArcHydro. This stormwater representation combines surface drainage and connectivity defined by the stormwater infrastructure which redirects the surface drainage. The outfalls and interconnection points represent drainage points for drainage area delineation purposes. Since the datasets mapping the pipe network and these drainage points may have been established independently of one another, it was important to establish connectivity within the network. Thus, the closest point along a pipe to these drainage points was found. For the interconnections, these points were adjusted where needed to ensure they were placed along the stormwater pipe network. In the case of the outfalls, these points were connected via new lines representing the connection from the stormwater pipe network to the outfalls. The same procedure was then used to establish connectivity between the outfalls and the nearest stream or waterbody.

Once connectivity was established, these networks were used to alter the existing topography by reconditioning the digital elevation model (DEM) to represent this network as an artificial low point in the elevations. The purpose of this is to direct surface flow to the stormwater pipe network and into the streams. Further processing must be employed to generate a hydraulically correct DEM by filling local low points that would otherwise disrupt further hydraulic analysis.

Using this modified DEM, analysis tools constructed rasterized flow direction and flow accumulation data. Ideally, the flow accumulation would coincide with the pipe and stream network. However, the necessary measures for DEM preprocessing and reconditioning introduce some error to the analysis, so these layers are not entirely in agreement. As the drainage points must be located along the flow accumulation network, the closest point along the flow accumulation line was found for each of the outfalls and the interconnections. Then, a watershed delineation tool was used, which took the flow direction into account along with each of the drainage points to delineate each respective drainage area.

Visual analysis was performed to ensure that the delineated drainage areas were adequate representations of the surface flow into the pipe network that fed into each drainage area. Delineations that were insufficient representations for their associated outfall or interconnection were adjusted and corrected where possible to ensure accurate representation of the drainage area based on the available datasets.

The delineation procedure is not entirely accurate due to assumptions and analysis issues and is ineffective if there is not a well-established pipe network, but it does provide a rough understanding of what the drainage area sources are for outfalls and interconnections. Future procedures can be refined to improve the delineation process by incorporating networks and catch basins into the analysis. This effort should be combined with auditing and refining the stormwater pipe network to fill in gaps.

Outfalls

The delineated watersheds representing the drainage area of the outfalls are referred to as "outfallsheds" moving forward. The watershed delineation tool generated a total of 27 outfallsheds, meaning that delineation successfully delineated a drainage area for each outfall. Thus, the 27 unique outfallsheds displayed in Figure 4 were deemed to be an appropriate representation of the surface runoff that drained to the pipe network associated with each of these outfalls. The outfall ID field corresponds to the unique symbology of the outfallshed. To look at these drainage delineations in more detail, please refer to the webmap: https://arcg.is/1ije1j2.

Interconnections

The watershed delineation tool generated a drainage area for each of the two (2) stormwater interconnections. Visual analysis found these drainage areas accurate, leaving the two (2) unique drainage areas displayed in Figure 5 representing the surface runoff that drains to the pipe network associated with the drainage point at each interconnection. The interconnection ID field corresponds to the unique ID of the drainage area.

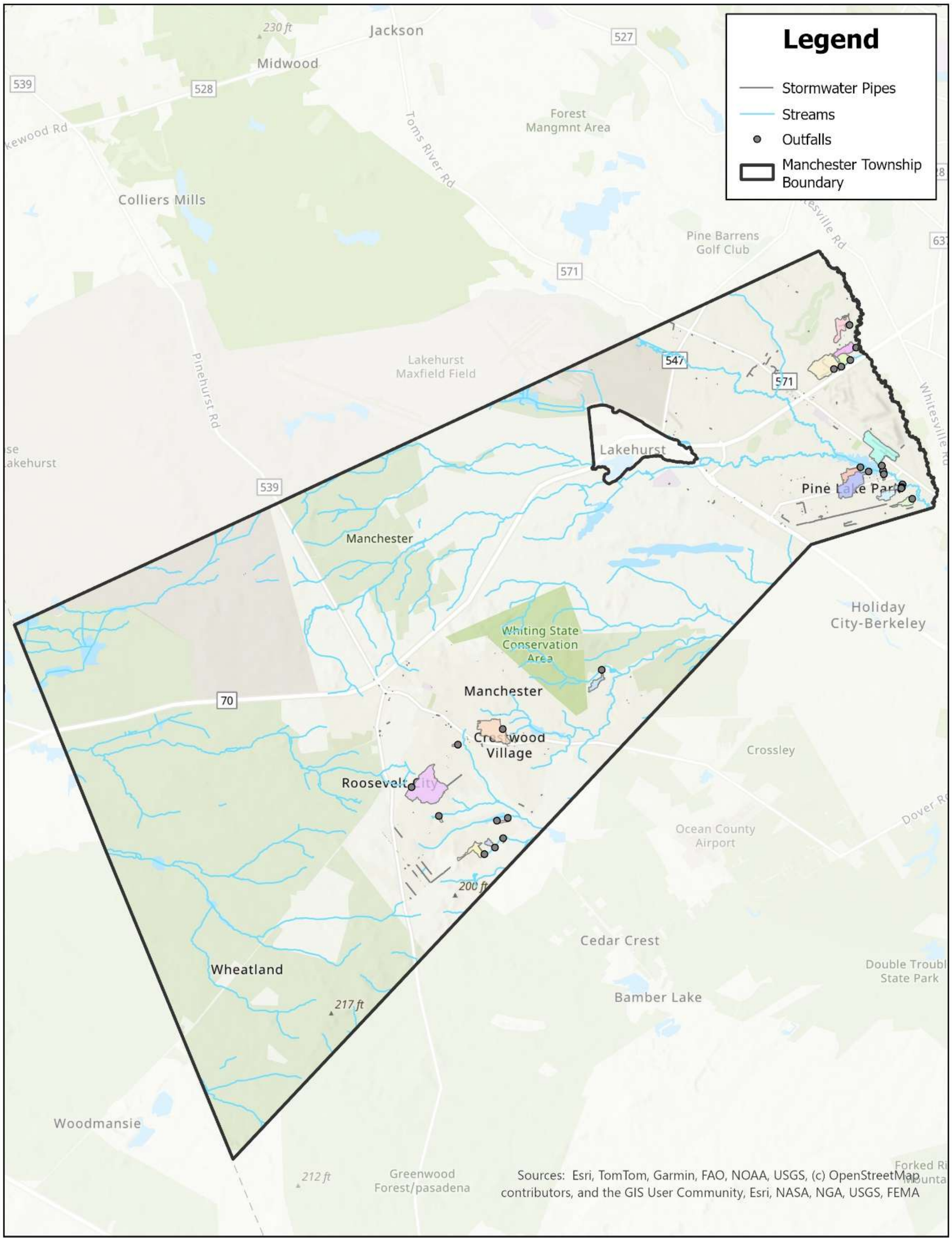

Figure 4: Manchester Township outfall watershed delineations

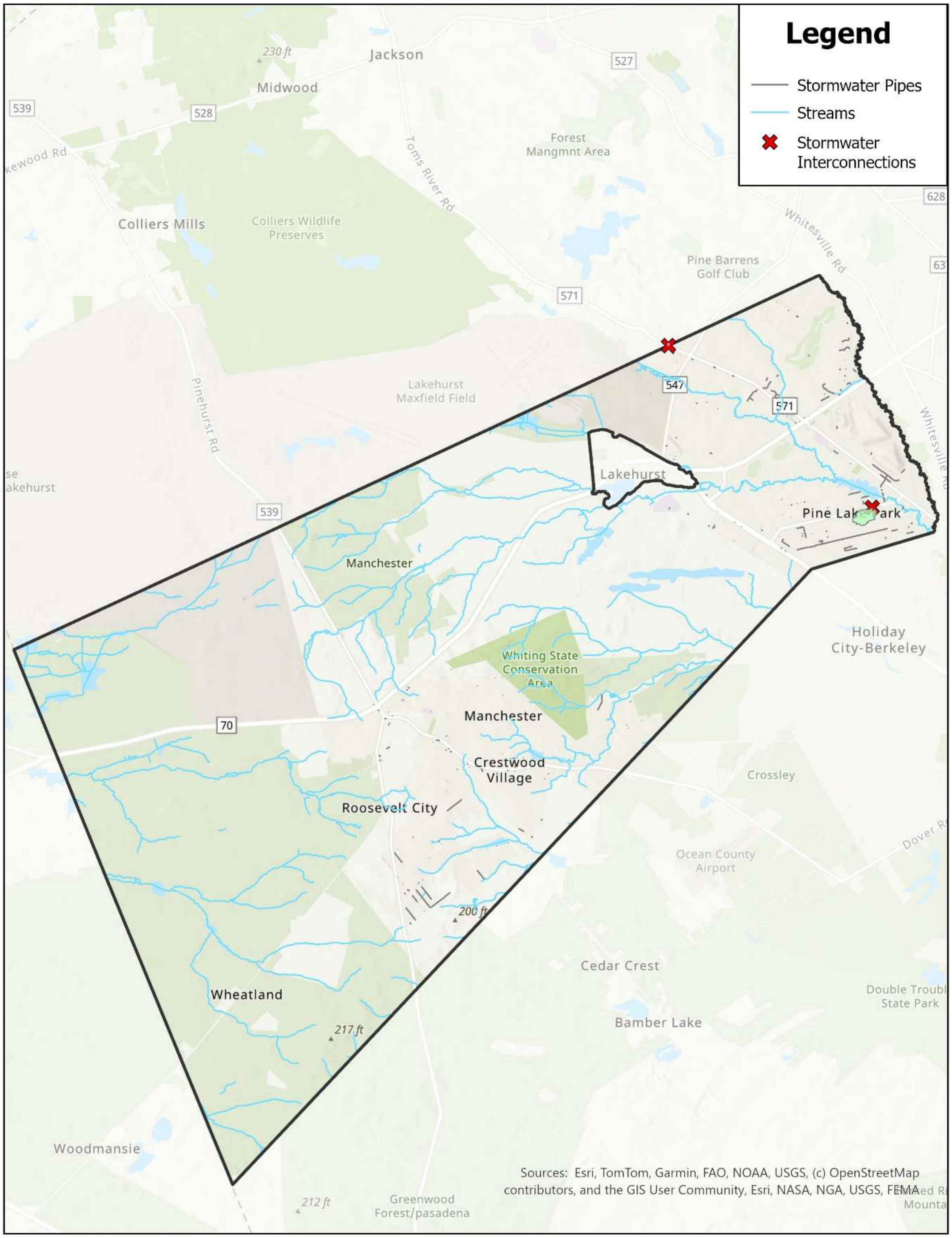

Figure 5: Manchester Township stormwater interconnection watersheds

TMDLs and Water Quality Impairments

Section 303(d) of the Clean Water Act requires states to identify and list waters that do not meet water quality standards after the implementation of technology-based controls. These waters are impaired, meaning they do not meet water quality standards designed to protect public health and the environment. If a water body is found to be impaired, it is included in the 303(d) list, and a total maximum daily load (TMDL) may be developed for that impairment. In accordance with Section 305(b) and 303(d) of the Federal Clean Water Act, New Jersey is required to assess the overall water quality of the state's waters and identify those waterbodies with a water quality impairment for which TMDLs may be necessary. NJDEP fulfills its assessment obligation under the Clean Water Act through the Integrated Water Quality Monitoring and Assessment Report, which includes the Integrated List of Waterbodies, issued biennially. A TMDL represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint sources of pollutants of concern, the natural background, and surface water withdrawals. A TMDL can be thought of as a "budget" for the total amount of a pollutant that can enter a waterbody while still maintaining surface water quality standards. TMDLs have been developed for various pollutants in various waterbodies throughout the state. Tier A MS4 discharges are considered point sources under the Clean Water Act. For MS4 discharges, best management practices (BMPs) are generally considered the most appropriate form of effluent limitation when designed to satisfy technology-based requirements and to protect water quality.

The NJDEP has created a TMDL Look-Up Tool to find applicable TMDLs for each municipality. This tool can be found at https://www.nj.gov/dep/dwq/msrp-tmdl-rh.htm. Only TMDLs related to stormwater as a source are included based on NJ-WET's (New Jersey Watershed Evaluation Tool) inclusions, and the data is up to date as of October 1, 2025. This tool will be reviewed every year to determine if new TMDLs have been approved and adopted so they can be incorporated into the Stormwater Pollution Prevention Plan (SPPP). Table 4 below shows the approved TMDLs for the waterbodies in Manchester Township along with impairments identified by the 303(d) list published in 2020. Figure 6 and Figure 7 depict the region to which each TMDL applies, and Figure 8 depicts the areas to which each of these impairments apply, and the sections are formatted by the year the impairment was first listed in the 303(d) list.

Table 4: TMDLs and impairments for subwatersheds within or bordering Manchester Township, Ocean County, NJ

HUC 14	Subwatershed Name	TMDL(s)	Impairment(s)
02040202020010	Gaunts Brook / Hartshorne Mill Stream	Streamsheds PCBs VOCs Lakesheds Fecal Coliform	Copper Lead
02040202020030	Rancocas Ck NB (incl Mirror Lk-Gaunts Bk)	Streamsheds PCBs VOCs Lakesheds Fecal Coliform	PCBs in Fish Tissue Lead Copper pH
02040202030010	Pole Bridge Br (above County line)	Streamsheds PCBs VOCs Lakesheds Fecal Coliform Shellfish Total Coliform	-
02040202030020	Mount Misery Bk NB (above 74d27m30s dam)	Streamsheds PCBs VOCs Lakesheds Fecal Coliform	-
02040202030030	Mount Misery Bk MB/NB (below 74d27m30s)	Streamsheds PCBs VOCs	-
02040202030040	Mount Misery Bk SB	Streamsheds PCBs VOCs Lakesheds Fecal Coliform	-
02040202030050	Bucks Cove Run / Cranberry Branch	Streamsheds PCBs VOCs Lakesheds Fecal Coliform	-
02040202030060	Pole Bridge Br (Country Lk dam - Co line)	Streamsheds PCBs VOCs	Total Phosphorus Dissolved Oxygen pH
02040301060070	Toms River (Rt 70 to Hope Chapel Road)	Streamsheds Pre-2008 Fecal Coliform Lakesheds	*E. coli*

		Fecal Coliform Shellfish Total Coliform	
02040301060080	Toms River (Oak Ridge Parkway to Rt 70)	Streamsheds Pre-2008 Fecal Coliform Lakesheds Fecal Coliform Shellfish Total Coliform	-
02040301070030	Ridgeway Br (Hope Chapel Rd to Harris Br)	Lakesheds Fecal Coliform Shellfish Total Coliform	-
02040301070040	Ridgeway Br (below Hope Chapel Rd)	Streamsheds Pre-2008 Fecal Coliform Lakesheds Fecal Coliform Shellfish Total Coliform	pH
02040301070050	Blacks Branch (above 74d22m05s)	Lakesheds Fecal Coliform Shellfish Total Coliform	-
02040301070060	Old Hurricane Brook (above 74d22m30s)	Streamsheds PCBs VOCs Lakesheds Fecal Coliform Shellfish Total Coliform	-
02040301070070	Old Hurricane Brook (below 74d22m30s)	Lakesheds Fecal Coliform Shellfish Total Coliform	-
02040301070080	Manapaqua Brook	Lakesheds Fecal Coliform Shellfish Total Coliform	-
02040301070090	Union Branch (below Blacks Br 74d22m05s)	Streamsheds Pre-2008 Fecal Coliform Lakesheds Fecal Coliform Shellfish Total Coliform	PCBs in Fish Tissue
02040301080010	Wrangel Brook (above Michaels Branch)	Lakesheds Fecal Coliform	-

		Shellfish Total Coliform	
02040301080020	Michaels Branch (Wrangel Brook)	Lakesheds Fecal Coliform Shellfish Total Coliform	pH
02040301080030	Davenport Branch (above Pinewald Road)	Lakesheds Fecal Coliform Shellfish Total Coliform	E. *coli*
02040301080050	Wrangel Brook (below Michaels Branch)	Lakesheds Fecal Coliform Shellfish Total Coliform	Dissolved Oxygen
02040301090010	Webbs Mill Branch	Lakesheds Fecal Coliform Shellfish Total Coliform	Dissolved Oxygen
02040301090030	Cedar Creek (74-16-38 to Chamberlain Br)	Lakesheds Fecal Coliform Shellfish Total Coliform	pH

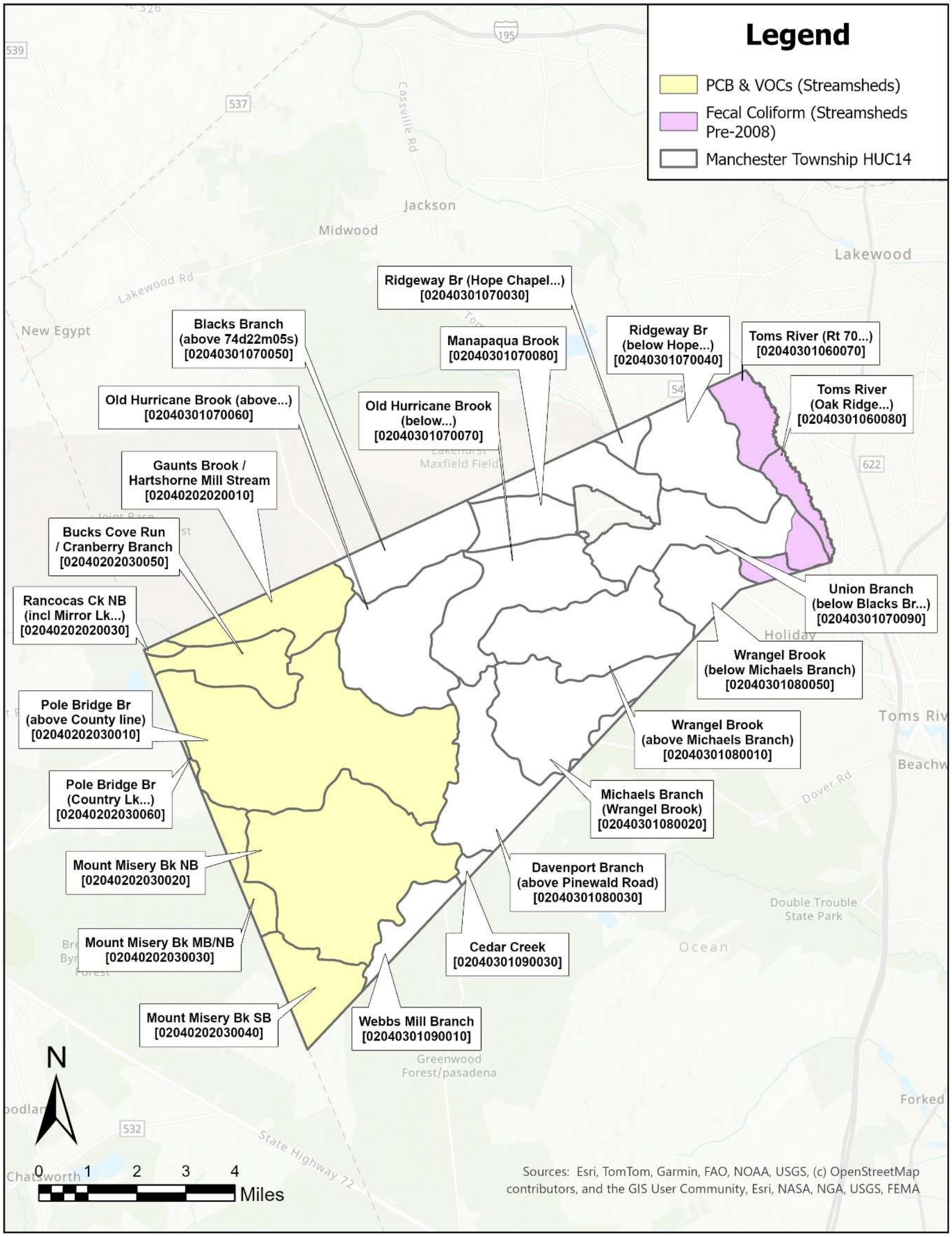

Figure 6: Manchester Township HUC14s with TMDLs (PCBs, VOCs, and fecal coliform)

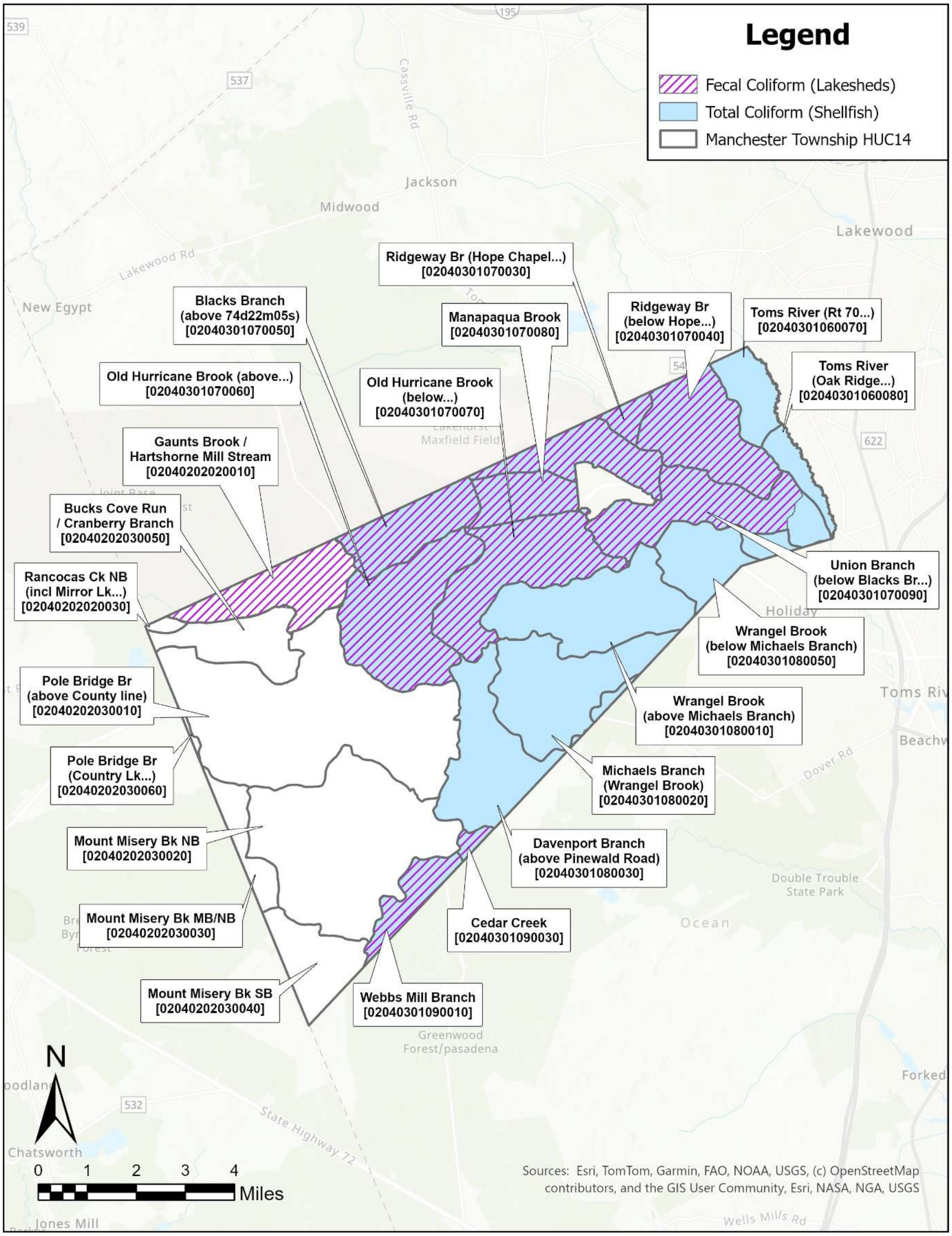

Figure 7: Manchester Township HUC14s with TMDLs (fecal coliform and total coliform)

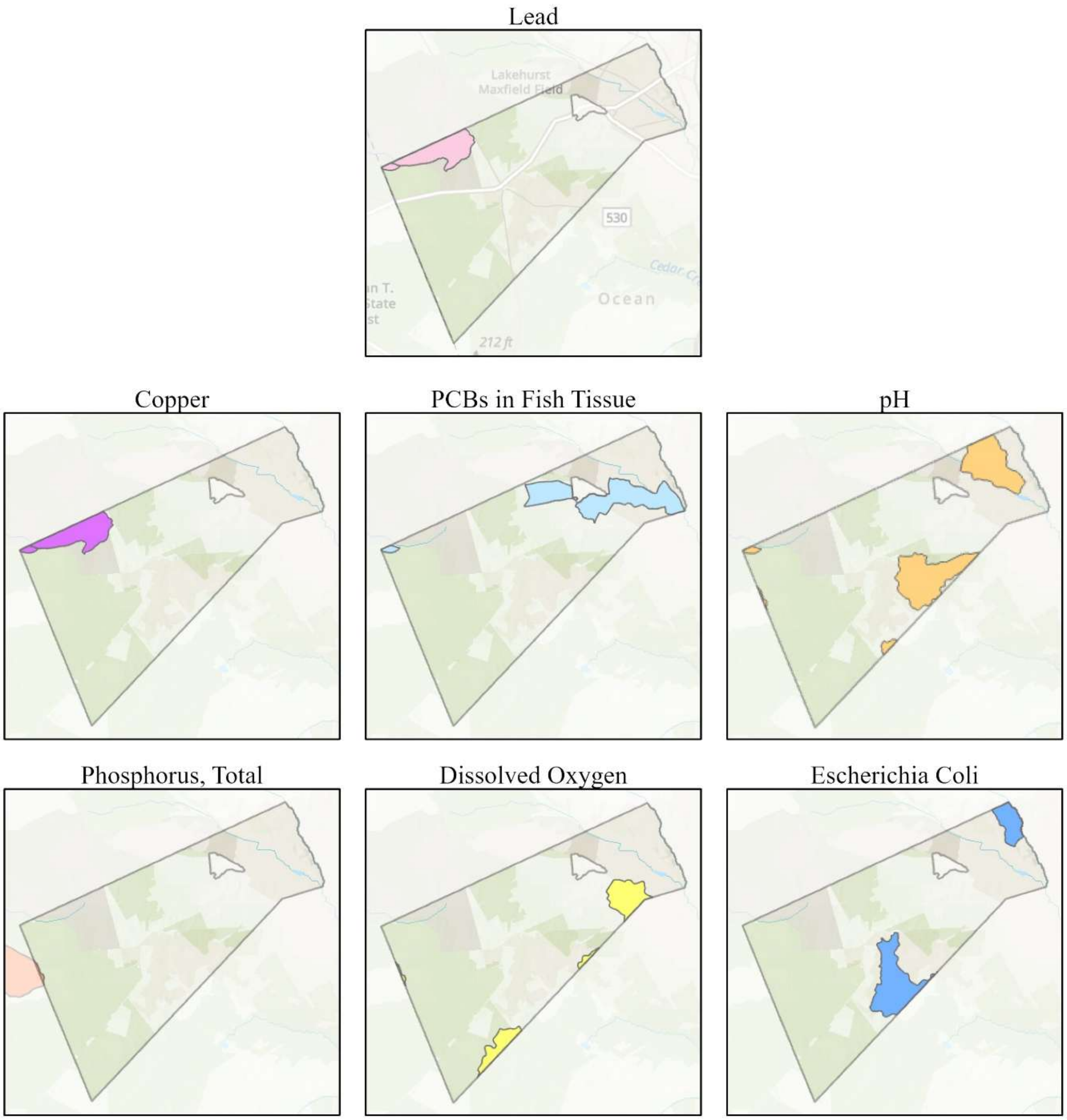

Figure 8: Manchester Township 303(d) impaired waters

Fecal Coliform, Total Coliform & E. coli [TMDL & Impairment]

Prior to October 2006, New Jersey had water quality standards for fecal coliform as an indicator for pathogen impairment. The regulations stated that "Fecal coliform levels shall not exceed a geometric average of 200 CFU/100 ml nor should more than 10 percent of the total sample taken during any 30-day period exceed 400 CFU/100 ml in FW2 waters." TMDLs were developed for fecal coliform to address exceedances. These TMDLs included the load reductions required to achieve instream fecal coliform concentrations. Nonpoint and stormwater point sources are the primary contributors to fecal coliform loads in these streams and can include storm-driven loads transporting fecal coliform from sources such as geese, farms, and domestic pets to the receiving water. Nonpoint sources also include steady inputs from sources such as failing sewage conveyance systems and failing or inappropriately located septic systems. Because the total point source contribution other than stormwater (i.e., publicly-owned treatment works or POTWs) is an insignificant fraction of a percent of the total load, these fecal coliform TMDLs will not impose any change in current practices for POTWs and will not result in changes to existing effluent limits.

Streamsheds Pre-2008 (Fecal Coliform)

A fecal coliform TMDL was developed for Toms River where a portion of Manchester Township contributes drainage area to the river. Manchester contains some tributaries that feed into the river which include Union Branch, Wrangle Brook, and Davenports Branch. The total drainage area of the Toms River is about 124 square miles (79,360 acres), and Manchester contributes approximately 1,918 acres of that which is primarily composed of urban areas. The overall reduction proposed by the TMDL is 72% for all load allocations (LAs) and wasteload allocations (WLAs) (NJDEP, 2003). The report calls out older homes on septic in close proximity to the stream that may apply to Manchester.

Lakesheds (Fecal Coliform)

A fecal coliform TMDL was also developed for Mirror Lake in which Manchester is a part of WMA 19. The drainage area to the lake is 71.38 km^2 (17,638 acres), and Manchester includes about 2,042 acres of that area which is primarily forested land. The overall reduction proposed by the TMDL is 99% for all land uses (NJDEP, 2007a).

Pine Lake is located in Manchester where a fecal coliform TMDL was also developed for this lake and is a part of WMA 13. The drainage area to the lake is 159.6 km^2 (39,438 acres), and Manchester includes about 17,400 acres of that area which is primarily forested areas with portions of urban lands. The overall reduction proposed by the TMDL is 99% for all land uses (NJDEP, 2007b).

Bamber Lake is another lake just outside of Manchester which has a 50.97 km^2 (12,595 acres) total drainage area. Manchester includes about 4.23 km^2 (1,046 acres) of that area which is primarily forested land. A fecal coliform TMDL was developed and there is an overall 93% reduction for all land uses (NJDEP, 2007b).

For each waterway that has a fecal coliform TMDL, there are recommended strategies for achieving the required load reductions. Most of the strategies include complying with the MS4 permit requirements including passing pet waste ordinances, street sweeping, and catch basin cleaning. In watersheds where there are agricultural land uses, the recommended strategies included helping the farmer obtain United States Farm Bill funding to implement agricultural best management practices that will reduce the impact of stormwater runoff from their farm.

<u>Shellfish (Total Coliform)</u>

A total coliform TMDL was developed for the Toms River Estuary and Cedar Creek Estuary in WMA 13, which a portion of Manchester drains. Manchester is designated as a WLA source in the report. The overall reduction proposed by the TMDL is 74% for Toms River Estuary with a 79% reduction for agriculture and urban land in WLA areas. For the Cedar Creek Estuary, an overall reduction of 48% is proposed with a 79% reduction for agricultural and urban lands in WLA areas (NJDEP, 2006).

PCB [TMDL & Impairments]

PCBs are classified as a probable human carcinogen by the U.S. Environmental Protection Agency (EPA). They also have been shown to have an adverse impact on human reproductive and immune systems and may act as an endocrine disruptor. Due to their stable properties, PCBs were used in hundreds of industrial and commercial applications, including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; and in pigments, dyes, and carbonless copy paper, among other applications. PCB laden oil is often associated with electrical transformers. More than 1.5 billion pounds of PCBs were manufactured in the United States before their manufacture and general use, with a few small exceptions, was banned by the EPA in the late 1970s. Existing uses in some electrical equipment continue to be allowed. PCBs are hydrophobic and thus tend to bind to organic particles in sediment and soils. Their chemical stability allows them to persist in the environment for years. PCBs accumulate in the tissue of fish and other wildlife, entering the organism through absorption or ingestion. As a result, they may be present in fish and marine mammals at levels many times higher than in the surrounding water and at levels unsuitable for human consumption.

The states of Delaware, New Jersey, and Pennsylvania have identified the Delaware Estuary as being impaired based on their findings of elevated levels of polychlorinated biphenyls (PCBs) in the tissue of fish caught in this portion of the Delaware River. As a result of this finding, the Delaware River Basin Commission (DRBC) prepared a TMDL for polychlorinated biphenyls (PCBs) for water quality management zones 2-5 of the Tidal Delaware River. Manchester Township is in water quality management zone 2.

Since pentachlorobiphenyls (penta-PCBs) were the dominant PCBs in fish tissue monitored in the estuary and ambient data indicated that throughout the estuary penta-PCBs represent approximately 25% of the total PCBs present, the penta-PCBs were selected for the development of the TMDL. TMDLs, WLAs, and LAs for total PCBs were extrapolated using a factor of 4 to 1 from TMDLs, and allocations were developed for penta-PCBs.

The TMDL recognizes the Manchester Township MS4 as a WLA (Appendix Table 5-1, DRBC, 2003). Approximately 2% of the permissible PCB loading is allocated to MS4s. The TMDLs for Zone 2 for total PCB is set at 257.36 mg/day. The WLA portion of the loading is set at 11.03 mg/day for Zone 2. While a percent reduction in PCB loading for Manchester Township is not provided in the PCB TMDL, monitoring data show that the existing PCB load throughout the estuary is roughly two to three orders of magnitude higher than the TMDL (DRBC, 2003).

VOCs [TMDL]

"Volatile Organic Compounds (VOCs) is the name given to a large group of chemical compounds that vaporize into the air and can dissolve into the water from certain solids or liquids at varying rates. VOCs are released or "off-gassed" into the air by many products that are used to build and maintain motor vehicles and houses, such as paints, glues, caulk, solvents, fuels and other vehicle fluids, cleansers and disinfectants, aerosol sprays, pesticides, and wood preservatives. Common examples of VOCs are benzene, ethylene glycol, formaldehyde, methylene chloride, tetrachloroethylene, toluene, xylene, and 1,3- butadiene. While many VOCs can cause adverse effects on aquatic life, there are also several adverse human health risks associated with encountering VOCs, including worsening asthma symptoms, cancer, liver and kidney damage, and central nervous system damage. Stormwater can come in contact with VOCs from vehicle surfaces, roads, parking lots, driveways, and litter or other wastes. Once these improperly disposed materials containing VOCs encounter stormwater runoff, they are discharged to the surface and ground waters of the state which are in turn used for drinking water supplies and the protection and propagation of aquatic life. Surface water quality criteria serve to protect water quality for designated uses such as supporting the survival, growth, and reproduction of aquatic life, protecting the quality of drinking water sources, maintaining good water quality for primary and secondary contact recreational uses, and keeping fish safe for human consumption." (NJDEP Pollutants of Concern, 2025).

A TMDL for VOCs for the Delaware River Estuary was developed in December 1998. The report established wasteload allocations (WLAs) for three volatile organic chemicals (1,2 - Dichloroethane, Tetrachloroethene, and Trichloroethene), chronic toxicity, and acute toxicity. These wasteload allocations refer to point sources within the watershed that are regulated through the National Pollutant Discharge Elimination System (NPDES) permits. Additional LAs from non-point sources may include runoff from urban and agricultural areas as well as indirect sources. There were 37 municipalities included in the WLA of which Manchester Township was excluded. The phase II report that was supposed to address the LAs was indefinitely deferred, so Manchester has no action required to address VOCs. That said, many actions that may target PCBs could also help to address VOCs (DRBC, 2003).

Phosphorus [Impairment]

"Phosphorus is a key nutrient for plant growth and is often the limiting nutrient in a freshwater setting. Total phosphorus is the sum of particulate and dissolved phosphorus which includes the total amount of phosphorus in both organic and inorganic forms. High concentrations of phosphorus in receiving waters may result from stormwater runoff due to poor agricultural practices, urban areas, leaking septic systems, illicit discharges or sanitary sewer overflows (SSOs). Additional stormwater runoff sources of phosphorus include the breakdown of plant and leaf litter (including grass clippings), soil particles, pet and animal waste, fertilizer from lawns, and atmospheric deposition of phosphorus particles. Contribution from runoff from lawns and roads accounts for the greatest loading in many receiving waters. An excess of phosphorus into a water body can have a detrimental effect on designated uses related to both public health and aquatic health. For instance, too much phosphorus in a surface water can cause increased growth of algae and large aquatic plants (a process called eutrophication) causing significant swings in pH and dissolved oxygen, which can in turn result in the violation of surface water quality criteria for these parameters and adversely affect the aquatic community. Additionally, high levels of phosphorus can also lead to HABs, that produce toxins which can be harmful to human and animal health. The presence of excessive plant biomass can also interfere with other designated uses, such as swimming or boating. When algae are present in large amounts, drinking water purveyors must also increase the use of disinfectants and oxidants to treat the algae, which can lead to an increase in disinfection byproducts such as trihalomethanes, listed as likely carcinogens by EPA" (NJDEP Pollutants of Concern, 2025).

Lead [Impairment]

"Lead is a naturally occurring elemental metal that is extremely toxic to humans and animals. Some common uses of lead today are lead acid batteries, including those used in automobiles, bullets and shotgun shot, fishing sinkers, industrial grade and non-domestic paint, boat keels, radiation shielding, and soldering. Lead enters the environment through the manufacture and use of consumer products and by contamination of soils and water. Any lead occurring in soils can be mobilized into waterbodies through stream scouring and erosion. Lead in these forms makes its way into waterbodies, including those used for drinking water sources, through stormwater runoff.

The Tier A MS4 permit prohibits the improper disposal of waste, such as paint, as well as a program to detect and eliminate illicit discharges" (NJDEP Pollutants of Concern, 2025).

Dissolved Oxygen [Impairment]

"Dissolved oxygen (DO) refers to the concentration of oxygen gas incorporated into the water. Oxygen enters the water by direct absorption from the atmosphere and is enhanced by turbulence. Running water, such as that of a swift moving stream, normally contains more dissolved oxygen than the still water of a pond or lake. Water also absorbs oxygen released by aquatic plants during photosynthesis. Sufficient DO is essential to growth and reproduction of aerobic aquatic life (e.g., see Murphy 2006, Giller and Malmqvist 1998, Allan 1995; https://www.epa.gov/caddis-vol2/dissolved-oxygen). Low levels of oxygen (hypoxia) or no oxygen levels (anoxia) can occur when excess organic materials are decomposed by microorganisms. During this decomposition process, the DO in the water is consumed. In some water bodies, DO levels fluctuate periodically, seasonally, and even as part of the natural daily ecology of the aquatic resource. As DO levels drop, some sensitive animals may move away, decline in health, or even die. DO is considered an important measure of water quality as it is a direct indicator of an aquatic resource's ability to support aquatic life. While each organism has its own DO tolerance range, generally, DO levels below 3 milligrams per liter (mg/L) are of concern, and waters with levels below 1 mg/L are considered hypoxic and are usually devoid of life. Stormwater runoff containing nutrients such as nitrate, phosphorus, and organic TSS matter and animal and pet waste cause the levels of dissolved oxygen to decrease in the receiving waters. An increase in these materials transported via stormwater runoff will have a greater impact on receiving waters" (NJDEP Pollutants of Concern, 2025).

pH [Impairment]

"pH (scientifically referred to as the Potential of Hydrogen) measures the concentration of hydrogen ions in a solution and is the indicator of the acidity or alkalinity of a substance, representing its ability to donate or accept hydrogen ions. pH values can range from 0 to 14, with 0 representing the most acidic and 14 representing the most basic. Fluctuations in pH and pH levels outside of the typical levels for a waterbody can negatively impact aquatic life, including reduced biodiversity if those values exceed critical thresholds. These impacts happen when the receiving waters experience even slight changes in pH levels that negatively impact reproduction, growth, and the ability to sustain life for species that live within them. Pure water has a neutral pH equal to 7, but when chemicals or pollutants are mixed with stormwater runoff, the mixture can become either acidic or basic. Such is the case when stormwater comes into contact with ammonia, sulfur, battery acids, lime, cement, wet or fresh concrete, fertilizers, compost, and other pollutants. This mixing can happen on the ground with runoff or can happen in the atmosphere with air pollutants causing "acid rain." When acid rain or pH impacted storm water runoff collect in streams and ponds, the pH of that water body is changed. Microsoft Word - Rain Events Newsletter - June 2010 - CA (wgr-sw.com)" (NJDEP Pollutants of Concern, 2025).

Impervious Cover

NJDEP's Open Data impervious surface GIS data layer based on the 2015 land use layer depicts surfaces throughout Manchester that have been covered with materials that are highly resistant to infiltration by water, rendering them impervious (data collected [October 1, 2025]). These impervious cover values were used to estimate the impervious coverage for Manchester. Based upon the NJDEP impervious surface data, Manchester has impervious cover totaling 9.1%.

The literature suggests a link between impervious cover and stream ecosystem impairment (Schueler, 1994; Arnold and Gibbons, 1996; May et al., 1997). Impervious cover may be linked to the quality of lakes, reservoirs, estuaries, and aquifers (Caraco et al., 1998), and the amount of impervious cover in a watershed can be used to project the current and future quality of streams. Based on the scientific literature, Caraco et al. (1998) classified urbanizing streams into the following three categories: sensitive streams, impacted streams, and non-supporting streams.

Schueler (1994, 2004) developed an impervious cover model that classified "sensitive streams" as typically having a watershed impervious surface cover from 0-10%. "Impacted streams" have a watershed impervious cover ranging from 11-25% and typically show clear signs of degradation from urbanization. "Non-supporting streams" have a watershed impervious cover of greater than 25%; at this high level of impervious cover, streams are simply conduits for stormwater flow and no longer support a diverse stream community. Schueler et al. (2009) reformulated the impervious cover model based upon new research that had been conducted.

This analysis determined that stream degradation was first detected at 2 to 15% impervious cover. The updated impervious cover model recognizes the wide variability of stream degradation at impervious cover below 10%. The updated model also moves away from having a fixed line between stream quality classifications. For example, 5 to 10% impervious cover is included for the transition from sensitive to impacted, 20 to 25% impervious cover for the transition between impacted and non-supporting, and 60 to 70% impervious cover for the transition from non-supporting to urban drainage. Based upon this information, Manchester's impervious cover percentage would suggest that its waterways are likely in the transition between sensitive and impacted streams. The impervious cover broken down by subwatershed can be seen in Table 5. The extent of the impervious cover in Manchester is shown in Figure 9.

Table 5: Impervious cover by HUC14

HUC14	Subwatershed Name	Area (Acres)	Impervious %
02040202020010	Gaunts Brook / Hartshorne Mill Stream	101.3	5.0%
02040202020030	Rancocas Ck NB (incl Mirror Lk-Gaunts Bk)	2.1	2.2%
02040202030010	Pole Bridge Br (above County line)	441.1	5.3%
02040202030020	Mount Misery Bk NB (above 74d27m30s dam)	138.4	2.2%
02040202030030	Mount Misery Bk MB/NB (below 74d27m30s)	8.3	1.0%
02040202030040	Mount Misery Bk SB	27.2	1.7%
02040202030050	Bucks Cove Run / Cranberry Branch	20.3	1.3%
02040202030060	Pole Bridge Br (Country Lk dam - Co line)	2.2	4.4%
02040301060070	Toms River (Rt 70 to Hope Chapel Road)	281.5	28.1%
02040301060080	Toms River (Oak Ridge Parkway to Rt 70)	206.1	23.5%
02040301070030	Ridgeway Br (Hope Chapel Rd to Harris Br)	70.8	19.9%
02040301070040	Ridgeway Br (below Hope Chapel Rd)	522.4	19.8%
02040301070050	Blacks Branch (above 74d22m05s)	9.5	0.5%
02040301070060	Old Hurricane Brook (above 74d22m30s)	181.1	5.1%
02040301070070	Old Hurricane Brook (below 74d22m30s)	103.6	3.3%
02040301070080	Manapaqua Brook	269.8	16.9%
02040301070090	Union Branch (below Blacks Br 74d22m05s)	801.7	19.4%
02040301080010	Wrangel Brook (above Michaels Branch)	35.6	1.1%
02040301080020	Michaels Branch (Wrangel Brook)	609.9	18.8%
02040301080030	Davenport Branch (above Pinewald Road)	547.9	19.1%
02040301080050	Wrangel Brook (below Michaels Branch)	329.4	21.2%
02040301090010	Webbs Mill Branch	8.1	0.9%
02040301090030	Cedar Creek (74-16-38 to Chamberlain Br)	3.0	1.8%
Total		**4,721.4**	**9.1%**

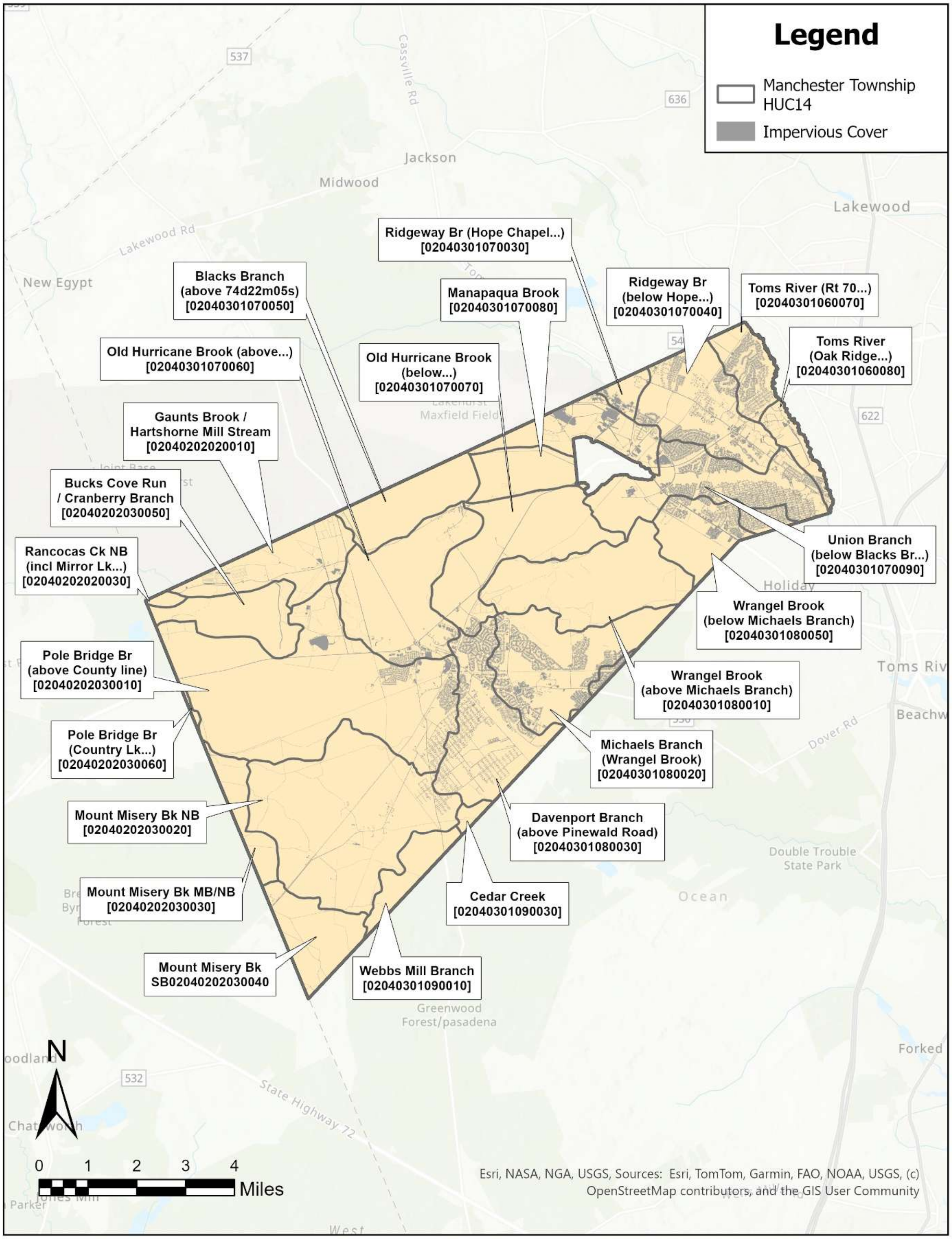

Figure 9: Impervious cover throughout Manchester Township

Overburdened Communities

Overburdened communities are areas with at least 35% low-income households, at least 40% minority race or tribal community, or at least 40% having limited English proficiency. These areas often are close to waterways and floodplain areas, but these communities tend to have limited financial resources and have less capacity to invest in adequate stormwater management systems, increasing the vulnerability of the community to flooding. Flooding in overburdened communities can also lead to public health issues since these communities are already more susceptible to health disparities. Additionally, these communities should have access to clean surface water for recreational activities especially since they may be less aware of potential dangers of swimming or fishing in polluted waterways. This dataset was extracted from NJDEP's GIS Open Data source in October 2025. The sections of Manchester that are considered overburdened communities are depicted in Figure 10. Table 6 shows which subwatersheds contain overburdened communities.

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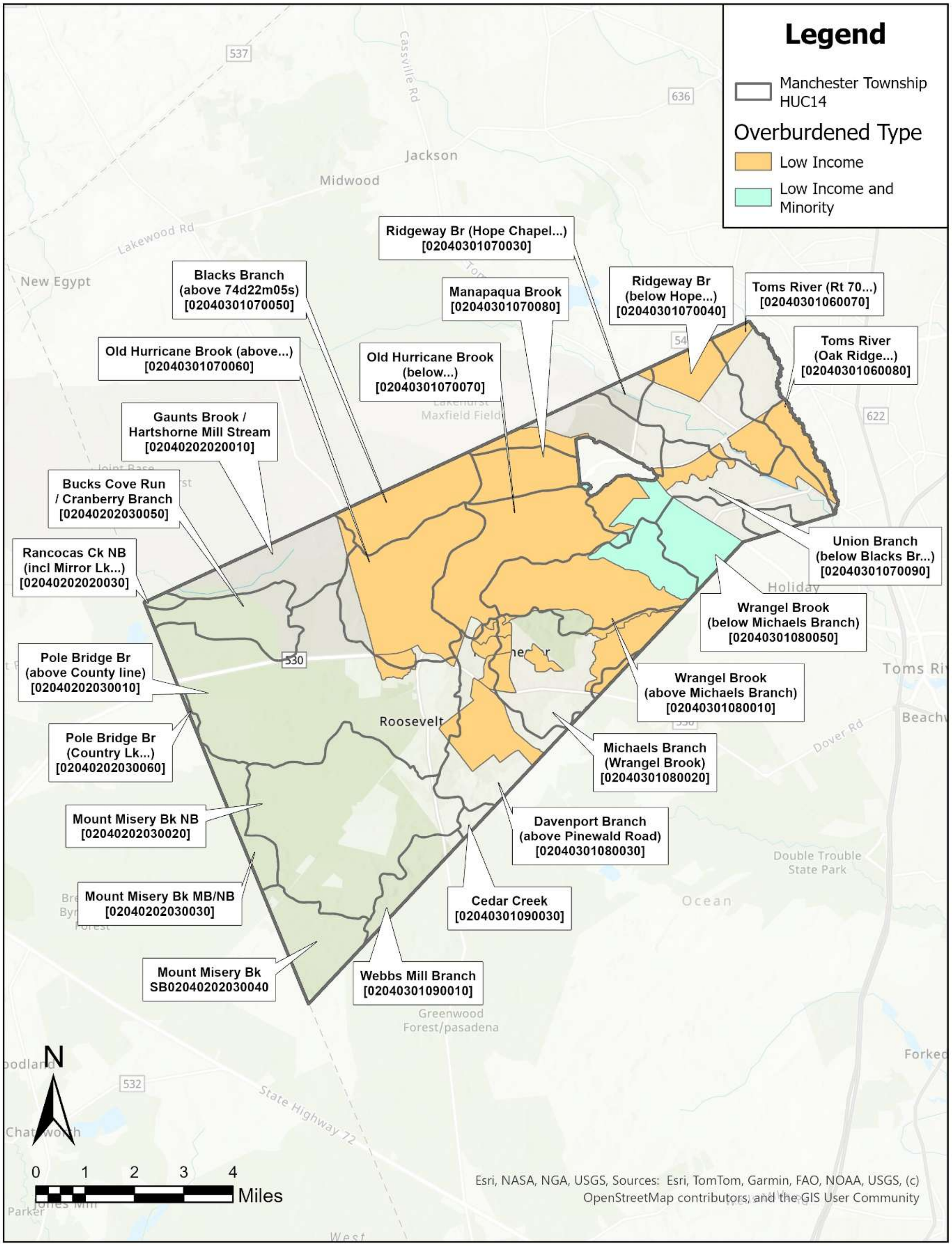

Figure 10: Manchester Township overburdened communities

Table 6: Subwatersheds with overburdened communities

HUC 14	Subwatershed Name	Present
02040202020010	Gaunts Brook / Hartshorne Mill Stream	X
02040202020030	Rancocas Ck NB (incl Mirror Lk-Gaunts Bk)	-
02040202030010	Pole Bridge Br (above County line)	X
02040202030020	Mount Misery Bk NB (above 74d27m30s dam)	-
02040202030030	Mount Misery Bk MB/NB (below 74d27m30s)	-
02040202030040	Mount Misery Bk SB	-
02040202030050	Bucks Cove Run / Cranberry Branch	-
02040202030060	Pole Bridge Br (Country Lk dam - Co line)	-
02040301060070	Toms River (Rt 70 to Hope Chapel Road)	X
02040301060080	Toms River (Oak Ridge Parkway to Rt 70)	X
02040301070030	Ridgeway Br (Hope Chapel Rd to Harris Br)	X
02040301070040	Ridgeway Br (below Hope Chapel Rd)	X
02040301070050	Blacks Branch (above 74d22m05s)	X
02040301070060	Old Hurricane Brook (above 74d22m30s)	X
02040301070070	Old Hurricane Brook (below 74d22m30s)	X
02040301070080	Manapaqua Brook	X
02040301070090	Union Branch (below Blacks Br 74d22m05s)	X
02040301080010	Wrangel Brook (above Michaels Branch)	X
02040301080020	Michaels Branch (Wrangel Brook)	X
02040301080030	Davenport Branch (above Pinewald Road)	X
02040301080050	Wrangel Brook (below Michaels Branch)	X
02040301090010	Webbs Mill Branch	-
02040301090030	Cedar Creek (74-16-38 to Chamberlain Br)	-

Non-Municipally Owned and Operated Stormwater Infrastructure

Manchester Township has collected data for non-municipally owned and operated stormwater infrastructure which primarily consists of stormwater management basins (detention basins, retention basins, infiltration basins) and outfalls from existing records. Additional stormwater facilities were extracted from the New Jersey Hydrologic Modeling Database as of December 2025. The storm drain inlet layer also contains all known storm drain inlets that are not owned or operated by the municipality included in the data fields. The ownership has been assigned to the best of ability regarding parcel information or right of ways, and the municipality is assumed ownership without evidence to the contrary. Of the stormwater facilities, there are 10 owned by Manchester Township and 146 owned by other entities. These other entities include 12 owned by Ocean County, one (1) owned by the state, and 133 owned by private entities. There are three (3) bioretention basins, 19 detention basins, 75 infiltration basins, and 49 retention basins. Of the outfalls, 27 are owned by the municipality and 20 are owned by other entities. These other entities include four (4) owned by Ocean County and 16 owned by private entities.

The subwatersheds that have non-municipally owned or operated stormwater infrastructure (outfalls and/or stormwater facilities) are Gaunts Brook / Hartshorne Mill Stream, Old Hurricane Brook (above 74d22m30s), Pole Bridge Br (above County line), Davenport Branch (above Pinewald Road), Michaels Branch (Wrangel Brook), Wrangel Brook (below Michaels Branch), Union Branch (below Blacks Br 74d22m05s), Toms River (Oak Ridge Parkway to Rt 70), Manapaqua Brook, Ridgeway Br (Hope Chapel Rd to HarrisBr), Ridgeway Br (below Hope Chapel Rd), and Toms River (Rt 70 to Hope Chapel Road).

These stormwater facilities are displayed in Figure 11. The attribute fields of the data contain the respective ownership information, block, and lot information.

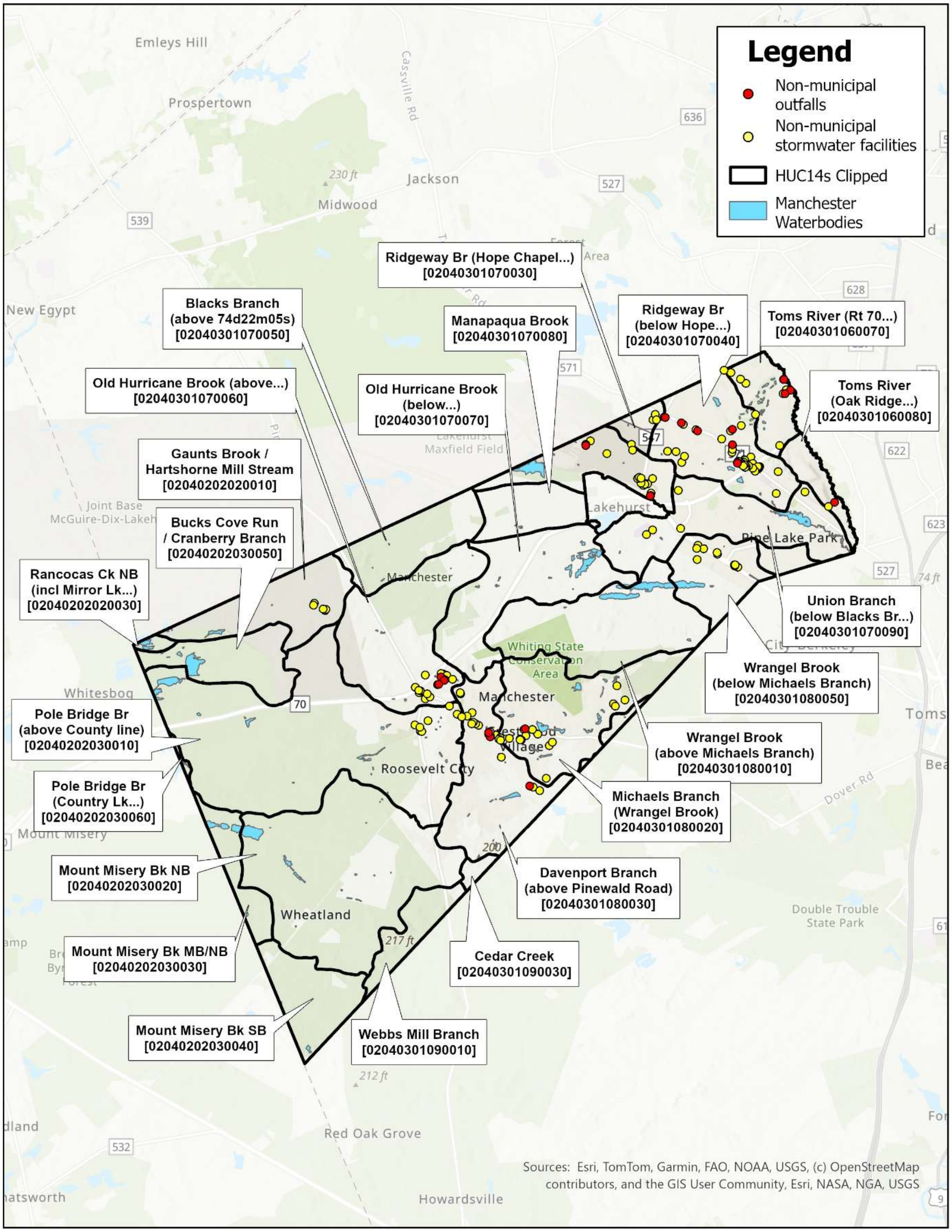

Figure 11: Non-municipally owned or operated stormwater facilities and outfalls

Conclusion

This Watershed Inventory Report shall serve as a record of the known stormwater infrastructure, water quality data, and additional relevant information. All the datasets contained in this report have been compiled into a GIS digital map, https://arcg.is/1ije1j2, that can be utilized to look at the data in far more detail than the static maps included in this Watershed Inventory Report. This report will be followed by a Watershed Assessment Report, which will provide an assessment of potential water quality improvement projects that can be done to address water quality issues that have been identified in this report.

References

Data Sources

2020 Census of Population and Housing. Retrieved on October 1, 2025 from U.S. Department of Commerce, U.S. Census Bureau website: https://data.census.gov/.

New Jersey 2020 Impaired Waters List. Retrieved on October 1, 2025 from U.S. Department of Interior, United States Environmental Protection Agency website: https://www.epa.gov/tmdl/new-jersey-impaired-waters-list.

New Jersey Watershed Evaluation Tool (NJ-WET). Retrieved on October 1, 2025 from Division of Watershed and Land Management, Bureau of NJPDES Stormwater Permitting & Water Quality Management website: https://dep.nj.gov/njpdes-stormwater/municipal-stormwater-regulation-program/watershed-improvementplan-guidance/.

NJDEP Open Data. Retrieved on October 1, 2025 from Division of Information Technology, NJDEP Bureau of GIS website: https://gisdata-njdep.opendata.arcgis.com/.

Total Maximum Daily Load (TMDL) Look-Up Tool. Retrieved on October 1, 2025 from New Jersey Department of Environmental Protection, Bureau of NJPDES Stormwater Permitting and Water Quality Management website: https://dep.nj.gov/njpdes-stormwater/municipal-stormwater-regulation-program/tmdl/.

New Jersey Hydrologic Modeling Database on October 1, 2025 from NJ Soil Conservation Districts and NJ Department of Agriculture website: https://hydro.rutgers.edu/

TMDL Reports

Delaware River Basin Commission (DRBC). 2003. Total Maximum Daily Loads for Polychlorinated Biphenyls (PCBs) for Zone 2-5 of the Delaware River. https://www.nj.gov/drbc/library/documents/TMDL/FinalRptDec2003.pdf

NJDEP. 2006. Fourteen Total Maximum Daily Loads for Total Coliform To Address Shellfish-Impaired Waters in Watershed Management Area 13 Atlantic Coastal Water Region. https://www.nj.gov/dep/wms/bears/docs/Coastal_Pathogen_TMDLs_WMA13.pdf

NJDEP. 2003. Total Maximum Daily Loads for Fecal Coliform To Address 31 Streams in the Atlantic Water Region. https://www.nj.gov/dep/wms/bears/docs/Atlantic%20FC.pdf

NJDEP. 2007a. Total Maximum Daily Loads for Pathogens To Address 17 Lakes in the Lower Delaware Water Region. https://www.nj.gov/dep/wms/bears/docs/adopted_lowerdelaware_fecal_lake.pdf

NJDEP. 2007b. Total Maximum Daily Loads for Pathogens To Address 18 Lakes in the Atlantic Coastal Water Region. https://www.nj.gov/dep/wms/bears/docs/adopted_atlantic_fecal_lake.pdf

Additional References

Anderson, J.R., E. E. Hardy, J. T. Roach, and R. E. Witmer. 1976. A Land Use and Land Cover Classification System for Use with Remote Sensor Data. Geological Survey Professional Paper 964, A revision of the land use classification system as presented in U.S. Geological Survey Circular 671.

Arnold, Jr., C.L. and C.J. Gibbons. 1996. Impervious Surface Coverage The Emergence of a Key Environmental Indicator. Journal of the American Planning Association 62(2): 243-258.

Caraco, D., R. Claytor, P. Hinkle, H. Kwon, T. Schueler, C. Swann, S. Vysotsky, and J. Zielinski. 1998. Rapid Watershed Planning Handbook. A Comprehensive Guide for Managing Urbanizing Watersheds. Prepared by Center For Watershed Protection, Ellicott City, MD. Prepared for U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds and Region V. October 1998.

May, C.W., R.R. Horner, J.R. Karr, B.W. Mar, and E.G. Welch. 1997. Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion. Watershed Protection Techniques 2(4): 483-493.

NJDEP Pollutants of Concern. Retrieved on October 1, 2025 from Bureau of NJPDES Stormwater Permitting website: https://dep.nj.gov/wp-content/uploads/njpdes-stormwater/wip/pollutants-of-concern.pdf

Schueler, T.R. 1994. The Importance of Imperviousness. Watershed Protection Techniques 1(3): 100-111.

Schueler, T.R. 2004. An integrated framework to restore small urban watersheds. Center for Watershed Protection, Ellicott City, MD.

Schuler, T.R., L. Fraley-McNeal, and K. Cappiella. 2009. Is Impervious Cover Still Important? Review of Recent Research. Journal of Hydrologic Engineering 14 (4): 309-315.