STORMWATER MS4
OPERATIONS & MAINTENANCE PLAN

Town of Hanover

June 2020
Revised September 2020

ENVIRONMENTAL PARTNERS

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SECTION 1 INTRODUCTION

This Stormwater Operation & Maintenance (O&M) Plan has been prepared for the Town of Hanover to address stormwater infrastructure O&M requirements (Part 2.3.7.a.iii) of the Environmental Protection Agency's (EPA's) 2016 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts, hereafter referred to as the "2016 Massachusetts MS4 Permit" or "MS4 Permit."

This O&M Plan addresses Minimum Control Measure 6, Good Housekeeping and Pollution Prevention for Permittee Owned Operations, by describing the activities and procedures the Town of Hanover will implement so that the MS4 infrastructure is maintained in a timely manner to reduce the discharge of pollutants from the MS4. The O&M Plan outlines inspection and maintenance procedures for catch basins, municipally-owned streets, facilities, and parking lots, and stormwater Best Management Practices.

The O&M Plan for the Town of Hanover also establishes procedures to address the proper use, storage and disposal of pesticides, herbicides and fertilizers. It includes recommendations for proper lawn maintenance and disposal of grass clippings and other vegetative waste at Open Spaces and Parks maintained by the Town of Hanover. The Plan includes a description of structural and non-structural BMP's under municipal control as well as recommended maintenance schedules and operations for all municipal stormwater structures.

Inspection form templates are included to record observations and corrective actions taken for specific BMP's. The completed inspection forms should be kept on file for a minimum of 3 years and the information used to update the O&M Plan as necessary. For example, if a particular catch basin is scheduled for annual inspection / cleaning and is consistently found to contain accumulated sediments to within one (1) foot of the outlet, the inspection frequency should be revised accordingly. Information obtained from prior maintenance activities, inspection reports, citizen complaints as well as reports provided by the Town of Hanover departments such as the Conservation Commission among others, will be used to determine the appropriate priority level.

The O&M Plan reflects the current processes for Town operations, and its use is applied throughout the Department, as listed below:

Department	Supervisor
Public Works	Victor J. Diniak Kurt Kelley
Parks and Recreation	Lauren Rodday
Facilities	Robert Murray, PE
Conservation	Sandra MacFarlane

SECTION 2 PERMIT REQUIREMENT ELEMENTS

The Permit details the requirements of an O&M Plan for stormwater infrastructure and includes the elements listed in Section 2.3.7.a.ii.1 and Sections 2.3.7.a.iii through 2.4.7.a.v of the Permit, as detailed below. Town-owned facilities typically include parks and open space, buildings and facilities, and vehicles and equipment. The requirements of the Permit as itemized below detail individual elements associated with each facility that can either affect stormwater quality or specifically treat stormwater generated by these facilities. EPA Maps and corresponding TMDL Data are attached to this report as Appendix A.

- **Fertilizer Use, Storage, and Disposal** – Establish procedures to address the proper use, storage, and disposal of pesticides, herbicides, and fertilizers including minimizing the use of these products and using only in accordance manufacturer's instruction.
- **Lawn and Landscaping Maintenance** – Evaluate lawn maintenance and landscaping activities to ensure practices are protective of water quality. Protective practices include reduced mowing frequencies, proper disposal of lawn clippings, and use of alternative landscaping materials (e.g. drought resistant planting).
- **Public Trash Receptacles and Pet Waste Storage** – Establish pet waste handling collection and disposal locations at all parks and open space where pets are permitted, including the placing of proper signage concerning the proper collection and disposal of pet waste… Establish procedures for management of trash containers at parks and open space (scheduled cleanings; sufficient number).
- **Catch Basin Cleaning Program** – Optimize routine inspections, cleaning and maintenance of catch basins such that the following conditions are met:
    - Prioritize inspection and maintenance for catch basins near construction activities.
    - Establish a schedule with a goal that the frequency of routine cleaning will ensure that no catch basin at any time will be more than 50 percent full.
    - If a catch basin sump is more than 50 percent full during two consecutive routine inspections/cleaning events, document that finding, investigate the contributing drainage area for sources of excessive sediment loading, and abate contributing sources.
    - Consider an excessive sediment or debris loading to a catch basin as a sump more than 50 percent full.
    - Document in the SWMP and in the first annual report the plan for optimizing catch basin cleaning, inspection plans, or its schedule for gathering information to develop the optimization plan.
    - Report in each annual report the total number of catch basins, number inspected, number cleaned, and the total volume or mass of material removed from all catch basins.
- **Street Sweeping Program** – Establish and implement procedures for sweeping and/or cleaning streets, and permittee-owned parking lots. The procedures shall include more frequent sweeping of targeted areas determined by the permittee on the basis of pollutant load reduction potential, based on inspections, pollutant loads, catch basin cleaning or inspection results, land use, water quality limited or TMDL waters or other relevant factors as

determined by the permittee. Report in each annual report the number of miles cleaned and the volume or mass of material removed.

- **BMP Maintenance & Inspection Procedures** –Establish and implement inspection and maintenance frequencies and procedures for all stormwater treatment structures such as water quality swales, retention/detention basins, infiltration structures, proprietary treatment devices or other similar structures. All Town-owned stormwater treatment structures (excluding catch basins) shall be inspected annually at a minimum.
- **Storage of Catch Basin Cleanings & Street Sweepings** – Ensure proper storage of catch basin cleanings and street sweepings prior to disposal or reuse such that they do not discharge to receiving waters.
- **Winter Road Maintenance** – Establish and implement procedures for winter road maintenance including the use and storage of salt and sand; minimizing the use of sodium chloride and other salts and evaluating opportunities for use of alternative materials; and ensure that snow disposal activities do not result in disposal of snow into waters of the United States.
- **Vehicles and Equipment** – Establish procedures for the storage of Town owned vehicles and establish procedures to ensure that vehicle wash waters are not discharged to the municipal storm sewer system or to surface waters.
- **Reporting** – Report in the annual report on the status of the inventory required by this part and any subsequent updates; the status of the O&M programs and the maintenance activities associated with each and keep a written record of all required activities but not limited to maintenance activities, inspections and training.

The following sections present the Town of Hanover O&M procedures associated with each of these requirements.

SECTION 3 FERTILIZER USE, STORAGE, AND DISPOSAL

The Town of Hanover maintains its public spaces and parks utilizing subcontractors to periodically fertilize town-owned land. The list of public facilities currently maintained by the DPW or other departments include:

Fire Department Headquarters	Pond Street Water Treatment Facility	Ellis Field
Town Hall	Broadway Well Building #1	Ceurvels Field
John Curtis Free Library	Broadway Well Building #2	Salmond School
Council on Aging	Philip C. Beal Well Building #1	Sylvester School
Fire Station #1	Philip C. Beal Well Building #2	Veterans Memorial Park
Fire Station #2	Hanover Street Well Building #1	B.E. Hall Field/Playground Facility
Forge Pond Park	Hanover Street Well Building #2	Luddams Ford Site
DPW Garage	Pond Street Well Building #1	Hanover Center Cemetery
DPW Maintenance Garage	Pond Street Well Building #2	Union Cemetery
DPW Storage Yard	Pond Street Well Building #3	Darling Cemetery
Facility Garage	Hanover Street Well Backup Generator	Hanover Senior Center
Transfer Station	Center School	Briggs Field
Police Station	Hanover Middle School	Gallant Field
Broadway Water Treatment Facility	Hanover High School	
Philip C. Beal Water Treatment Facility	Cedar School	

The location of these facilities are shown on attached Figure 1.

3.1 CURRENT FERTILIZER USE

The Town's subcontractor currently uses fertilizers on all open spaces and at public parks. They do not use pesticides. The subcontractor only uses Lesco Granular Fertilizer and typically purchases it and sprays it the day of purchase. The fertilizer is applied by the subcontractors. The Town also uses Tri-Power Selective Herbicide and Barricade 4FL Herbicides, applied by subcontractors.

The Town is consistently reviewing its operation and usage of these chemicals, looking for ways to reduce the use, and to ensure that it is always applied in accordance with the manufacturer's instructions.

All fertilizer applications should conform to the requirements outlined in 330 CMR 31.00 Plant Nutrient Application Requirements for Agricultural Land and Non-Agricultural Turf and Lawns. The purpose of this regulation is to ensure that municipalities limit non-point source pollutants from entering the surface and groundwater resources of the Commonwealth as well as minimizing the impacts of nutrients on water resources to protect human health and safety. This Regulation also references the

University of Massachusetts Amherst Extension Service guidelines for fertilizer applications. With regard to fertilizer applications, 330 CMR 31.00 includes the following requirements:

- Apply fertilizers and nutrients consistent with University of Massachusetts Extension Service guidelines for turf
- Do not apply fertilizers or nutrients to surface waters, saturated soils, flooded soils, or frozen soils
- Do not apply fertilizers within 100 feet of surface waters used for public water supplies
- Do not apply fertilizers within a Zone I of a public Water Supply Well
- Apply fertilizers using a broadcast method outside of 20 feet of Surface Waters not used for public water supplies
- Apply fertilizers using a drop spreader or rotary spreader with a deflector or targeted spray within ten feet of Surface Waters not used for public water supplies
- Do not apply fertilizers to impervious areas
- Do not apply fertilizers for de-icing purposes
- Do not apply fertilizers to drought dormant, cold dormant, inactive, or brown turf
- Do not apply fertilizers containing Phosphorus unless
    - A soil test was taken within the last three years that indicates additional phosphorus is needed for growth
    - Phosphorous containing fertilizer is used to establish a new lawn
- Records shall be kept for all applications of Plant Nutrients or Phosphorus Containing Fertilizer to Non-agricultural Turf and Lawns consistent with 330 CMR 31.07

3.2 FERTILIZER STORAGE

All fertilizers are applied by a subcontractor; therefore, the Town does not store fertilizers. Should the Town decide to purchase and apply fertilizer themselves, the following guidelines would apply.

Fertilizer storage and handling should be performed consistent with UMass Extension Service regarding Fertilizer storage and handling. Guidance can be found here:

https://ag.umass.edu/greenhouse-floriculture/greenhouse-best-management-practices-bmp-manual/fertilizer-storage-handling

Specifically, fertilizers should be stored as follows:

- Store fertilizers separate from other chemicals in dry conditions
- Provide extra care to concentrate stock solutions. Secondary containment should be used for stock solutions.
- Provide pallets to keep large drums or bags off the floor. Shelves for smaller containers should have a lip to keep the containers from sliding off easily. Steel shelves are easier to clean than wood if a spill occurs.
- For storage in large bulk tanks, provide a containment area large enough to confine 125 percent of the contents of the largest bulk container.

- Keep the storage area locked and clearly labeled as a fertilizer storage area. Preventing unauthorized use of fertilizers reduces the chance of accidental spills or theft. Labels on the windows and doors of the building give firefighters information about fertilizers and other products present during an emergency response to a fire or a spill.
- Provide adequate road access for deliveries and use, and in making the storage area secure. Also make it accessible, to allow getting fertilizers and other chemicals out in a hurry.
- Never store fertilizers inside a well house or a facility containing an abandoned well..
- Reseal open containers and return to storage.
- Replace and/or repair damaged containers.
- Insure there are no floor drains within fertilizer containment areas.
- Insure fire detection and alarm systems are present. Oxidizers and flammable materials should be stored separately. Fire extinguishers should be immediately available. Fire Department should be notified annually of fertilizer inventories.
- Inventories should be actively maintained.
- Lighting should be provided.
- Inspections should occur monthly for 1) signs of container corrosion or other damage (leaking or damaged containers should be repackaged as appropriate) 3) faulty ventilation, electrical, and fire suppression systems (problems should be reported and corrected).
- Storage areas should be locked.
- Signs should be posted.
- Active mechanical temperature control should be provided with no direct sources of heat.
- Mechanical ventilation should be working and used.
- Fertilizer stock tanks should be labeled with fertilizer formulation and concentration; records should be kept of fertilizer formulation, concentration, date, and location of application; records should be kept of media nutrient analyses.
- Concentrated stock should be stored near the injector in high density polyethylene or polypropylene containers with extra heavy duty walls; secondary containment should be provided.
- Sufficient planning should be made to eliminate the need for disposal; empty fertilizer containers should be discarded based on latest advice from environmental protection authorities.
- Fertilizer systems should be cleaned. Solids and rinse solution should be composted.
- Secondary containment should be used for fertilizer stock tanks routinely; spill clean-up materials should be used for liquids (e.g., absorbent materials) and solids (e.g., shovel, dust pan, broom and empty and/or buckets) should be available within the general area.
- Any fertigation equipment should be checked monthly for accuracy; containment tanks, back flow preventers and any equipment that holds fertilizer in the dry or liquid form should be inspected; stock tanks should be inspected weekly for deterioration and cracks; the manufacturer recommendations should be followed when calibrating or working on fertilizer injector equipment; stock solution tanks and the areas surrounding fertilizer injectors and concentrated solutions should be kept clean and free of debris.

3.3 FERTILIZER DISPOSAL

All fertilizers are applied by a subcontractor; therefore, the Town does not need to dispose of fertilizers. Should the Town decide to purchase and apply fertilizer themselves, the following guidelines would apply.

Consistent with the UMass Extension Service's guidance on fertilizer management, sufficient planning would be made to eliminate the need for disposal. Empty fertilizer containers would be discarded based on latest advice from environmental authorities.

SECTION 4 LAWN & LANDSCAPING MAINTENANCE

The Town DPW maintains its public spaces and parks. The list of public spaces currently maintained by the Town include:

Fire Department Headquarters	Pond Street Water Treatment Facility	Ellis Field
Town Hall	Broadway Well Building #1	Ceurvels Field
John Curtis Free Library	Broadway Well Building #2	Salmond School
Council on Aging	Philip C. Beal Well Building #1	Sylvester School
Fire Station #1	Philip C. Beal Well Building #2	Veterans Memorial Park
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Police Station	Hanover Middle School	Gallant Field
Broadway Water Treatment Facility	Hanover High School	
Philip C. Beal Water Treatment Facility	Cedar School	

The location of these facilities are shown on attached Figure 1.

4.1 CURRENT LAWN & LANDSCAPING PRACTICES

The Town currently maintains a mowing and landscaping schedule through the DPW. In addition to the application of fertilizers described in Section 3.0, lawn and landscaping maintaining activities include: mowing, tree-trimming and landscaping. The Town performs these services, and mows bi-weekly April through November. The Town is currently reviewing its operation schedule, looking for ways to reduce the mowing frequency. Lawn mowing should be performed consistent with UMass Extension Service recommendations as follows:

https://ag.umass.edu/home-lawn-garden/fact-sheets/lawn-mowing

4.2 DISPOSAL OF LAWN CLIPPINGS

The Town mulches any lawn clippings generated by the mowed areas and they remain onsite..

The UMass Extension Service recommends that lawn clippings should generally remain left on the lawn unless there is an excessive amount of lawn clippings due to infrequent mowing. Lawn clippings

are a valuable source of nutrients and can reduce the need for fertilization. In the event that lawns are mowed when grass is wet, they may clump together and need to be removed. Lawn clippings should be managed consistent with the UMass Extension Service recommendations as follows:

https://ag.umass.edu/home-lawn-garden/fact-sheets/lawn-mowing

4.3 ALTERNATIVE LANDSCAPING MATERIALS

The Town does not currently use alternative landscaping materials, but will look into the possibility of using them in future planting events. Any alternative landscape materials or practices should be coordinated with applicable guidance documents and regulations including, but not limited to:

- Massachusetts Regulations
- UMass Extension Service Guidance
- Applicable Federal Laws and Regulations
- Environmental Protection Agency Policies and Guidance documents.

SECTION 5 TRASH RECEPTACLES & PET WASTE

5.1 PUBLIC TRASH OPERATIONS

The Town currently maintains the trash receptacles in public spaces. The trash is collected and disposed of by subcontractors.

The Town is currently reviewing its operation schedule, looking for ways to increase the efficiency of trash removal.

5.2 PET WASTE

The Town has Pet Waste informational signs installed along walkways in Forge Pond Park. The Town will work with other Town Departments (Conservation, Highway Division, and Planning) to discuss potential other locations where Pet Waste information should be installed.

Efforts will be made to increase the number of signs installed to alert pet owners regarding the removal and disposal of pet wastes. All pet wastes should be collected by pet owners and disposed of in trash receptacles. Any signs posted would include wording that discourages pet owners from disposing of pet waste in catch basins.

SECTION 6 CATCH BASIN CLEANING PROGRAM

Traditional municipal storm drain systems were designed to quickly collect, treat, detain, infiltrate and convey stormwater runoff to receiving waters. The purpose of catch basin, inlet and storm drain cleanings is to remove accumulated sediment which prevents blockages, flooding and reduce the release of downstream pollutants.

Fine particles and pollutants generated by stormwater run-off, atmospheric deposition, vehicle emissions, breakup of street surface materials, littering, and sanding accumulate along the curbs of roads in between rainfall events. This results in the accumulation of trash and sediment. Pollutants attach to trash and sediment including nutrients, metals, hydrocarbons, bacteria, pesticides, and toxic chemicals. Storm drain maintenance is often the first opportunity to provide pre-treatment and remove pollutants before they are conveyed through the storm drain system. Because they effectively trap these pollutants, catch basins need to be cleaned out periodically to prevent those materials from being transported by high stormwater flows into downstream stormwater best management practices and Hanover's waterways and water resources.

The catch basin maintenance schedule should begin annually after the last spring snowfall. Inspection should include the condition of the inlet structure grate, brick or concrete risers, oil hoods and inlet and outlet pipes. As applicable, each stormwater inlet should include a public awareness message (e.g. "drains to pond" or "only rain in this drain") stenciled or otherwise marked near the drain. Catch basins with illegible or missing labels should be noted on the inspection report and be re-labeled before the next scheduled inspection. Damage or deterioration threatening the structural integrity of any component, conveyance or facility should be repaired as soon as possible but no longer than before the next scheduled inspection. The Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards recommend cleaning catch basins four times per year, including at the end of the snow removal and foliage removal seasons.

6.1 EXISTING CATCH BASIN CLEANING PROGRAM

The Town's subcontractors currently run their catch basin cleaning program once per year, visiting all of their catch basins annually, typically in early spring. The subcontractors perform the catch basin cleanings using a clamshell truck. Hanover has had no flooding issues and has not allowed sediment to build up in their catch basins beyond 50% full. This is primarily due to the Town's mandate that all catch basins are cleaned regularly. Also, the Town no longer uses sand as part of the winter roadway maintenance.

6.2 CATCH BASIN MAPPING AND INSPECTIONS

There are 2,831 catch basins throughout Hanover that have been previously mapped in the MS4 area, as defined by the 2000 and 2010 Census. All catch basins are located in Geographic Information System (GIS) format using historic aerial flyover data, handheld GPS units, and employee knowledge. A Town-wide mapbook has been prepared showing unique catch basin identifiers (e.g. CB-1001) to aid in accurately recording and cataloging data from field inspections. The mapbook is included with this report as Attachment 1 (stand-alone 11x17 set of maps).

In the event Town personnel identify additional catch basin structures in the field that have not been mapped, the field crew will sketch in the approximate location, and label with a temporary ID for future entry into the system. This will allow the field crew to generate a historic record in the logging system for the new structures characteristics. The locations of the new catch basin structures will be captured in the future using a hand-held GPS unit.

The Town subcontracts the annual catch basin cleaning. During the catch basin cleaning program, the field crew will utilize the mapbook and a field inspection form in order to create a historic log for each structure. Items to be noted will include: condition of the grate cover, volume of sediment accumulated in the structure, date inspected/cleaned, marking paint condition, etc. The inspection form template for the catch basins is attached as Appendix B.

6.3 CATCH BASIN STRUCTURE PRIORITY RANKING

This section of the O&M Plan is to be used to focus on areas that typically found to generate high levels of sediment or if the Town decides, to reduce the scope of their annual catch basin cleaning program (i.e., not cleaning every catch basin every year).

In the event that catch basin cleaning's are prioritized, using the data collected during the field inspection program, the Town's stormwater catch basins will be assigned a priority maintenance schedule according to the following criteria:

- Priority A – Catch basins that are designated as consistently generating the highest volumes of trash, sediment and/or debris. These catch basins are typically located near construction activities. Any catch basins that are more than 50 percent full during two consecutive inspections and cleanings should receive top priority. Catch basins that are located in a high priority watershed or watershed discharging to an impaired water or water that has an established Total Maximum Daily Load should also be inspected more often.

- Priority B – Catch basins that are designated as consistently generating moderate volumes of trash, sediment and/or debris. These catch basins will consistently show sediment loads in the catch basin sumps but the depths of sediment may not reach 50 percent of the sump depth.

- Priority C – Catch basins that are designated as generating low volumes of trash, sediment and/or debris. These catch basins may not include any sediment on a consistent basis.

The future inspection/cleaning schedule assignments would be as follows:

BMP	Activity	Frequency
Catch Basin	Inspection / Cleaning)	Priority A – Inspect four times/year. Clean when sediment reaches 50% of sump depth. Priority B – Inspect minimum of one time per year. Clean when sediment reaches 50% of sump depth. Priority C – Inspect minimum of one time/year

The MassDEP Stormwater Management Standards recommend that catch basins be inspected four times per year or whenever the depths of sediment within the catch basin sump equals ½ the depth from the bottom of the sump to the catch basin invert. Newer catch basins that were installed consistent with MassDEP Stormwater Management Standards have typically included a four foot deep sump. Catch basins that were installed prior to the promulgation of these Standards, or did not meet the standards, may have been installed with a smaller sump depth, or possibly no sump at all. The Town has noted that, since the catch basins have been cleaned annually, the depths of sediment have consistently been less than ½ the depth of the bottom sump to the catch basin invert.

Catch basin are to be cleaned when accumulated sediments and debris either by mechanical methods when its depth is equal to or greater than 1/2 the depth from the bottom of the basin to the invert of the outlet pipe. If a hydrocarbon sheen is noted on the surface of the water in the basin it shall be removed using absorbent pads; these pads will be allowed to dry prior to disposal in a solid waste dumpster pursuant to MassDEP's "1-drip" policy.

The materials removed from the catch basin shall not re-enter the stormwater system. Non-hazardous sediments are to be disposed of at an approved solid waste landfill or used as landfill daily cover in accordance with MassDEP policy and regulations. In cases where an inspection reveals sediments with abnormal, non-natural discoloration or detects strong petroleum and/or chemical odors, the crew performing the catch basin cleanings should notify the Hanover Fire Department for proper handling of hazardous materials. Also, a Licensed Site Professional (LSP) registered in the State of Massachusetts pursuant to MGL c.21A, §§ 19 through 19J shall be responsible for managing the disposal of such material in accordance with 310 CMR 40.0000 the Massachusetts Contingency Plan. Refer to Section 7.0 for proper catch basin cleaning material storage protocol.

The MS4 permit requires that logs be kept documenting the number of catch basins cleaned and inspected each year. The number of catch basins inspected, cleaned, and the total mass of material removed from each catch basin shall be reported each year.

SECTION 7 STREET SWEEPING PROGRAM

Street and parking lot sweeping is a practice that municipalities may have traditionally conducted for aesthetic purposes. However, the water quality benefits are widely recognized and street and parking lot sweeping is identified in the MassDEP Stormwater Management Standards as a pretreatment strategy for removing solids, as well as the pollutants that become attached to sediment.

A number of factors impact the effectiveness of a street sweeping program. The first factor is the type of equipment used. When standard mechanical sweeping equipment needs to be replaced, high-performance sweepers are purchased preferentially. Street sweeping has traditionally been more effective at removing large-sized particles, but new equipment has been developed to remove smaller, fine-grained particles. Mechanical sweepers (broom-type) are usually the least expensive and are better suited to pick up large-grained sediment. Vacuum and regenerative air sweepers are better at removing fine-grained articles, but they are more expensive. Removal efficiency can be improved through tandem sweeping (i.e. two sweepers sweeping the same route, with one following the other to pick up missed material), or if the street sweeper makes multiple passes on a street. Vacuum sweepers are also best suited for cleaning pervious pavements.

The second factor influencing street sweeping effectiveness is the way in which the equipment is operated. The equipment must be operated according to the manufacturers' operating instructions by operators who have been properly trained to sweep in order to protect water quality.

The third determining factor is the degree to which parked cars or similar blockages can impede a sweeper's access to the curb.

The frequency of street sweeping is also a significant factor in removing sediments and other pollutants from municipal streets. The MS4 permit requires streets to be swept once per year in the spring following winter activities.

7.1 EXISTING STREET SWEEPING PROGRAM

The Town currently runs their street sweeping program once per year, sweeping 90 miles of roads annually in early spring. The department currently utilizes GIS tracking to track the date, number of loads taken, start/end times, names of streets swept, etc.

7.2 STREET SWEEPING PRIORITY RANKING

In accordance with the MS4 permit, the Town will sweep and/or clean streets, and Town-owned parking lots a minimum of once per year. All streets with the exception of high speed limited access highways will be swept and/or cleaned a minimum of once per year, preferably in the spring (following winter activities). More frequent sweeping shall occur in targeted areas including streets and parking lots that consistently experience higher pollutant loads based on catch basin inspections and cleanings, proximity to constructions sites, and areas that discharge to water bodies with impairments or have a Total Maximum Daily Load. The procedures shall also include more frequent sweeping of targets areas (See Appendix A and Figure 2) determined by the Town on the

basis of following factors: (a) pollutant load reduction potential, (b) pollutant loads, (c) catch basin cleaning or inspection results, (d) land use, or (e) proximity to impaired/TMDL waters or other relevant factors as determined by the Town. These targeted areas are shown in Figure 2, and also on Attachment 1 – Town of Hanover Mapbook. The Town shall report in each annual report the number of miles cleaned and the volume or mass of material removed.

For uncurbed, limited access highways, the Town shall either meet the minimum frequencies above, or develop and implement an inspection, documentation and targeted sweeping plan.

This schedule applies only to streets and municipal parking lots with curb/gutter construction. Other municipal roadways and parking lots will be prioritized according to the previous schedule and will include trash and litter control as well as hand sweeping and collection. Sweepings collected during sweeping activities are currently stockpiled at the DPW Garage located at 219 Ames Way and will either be disposed or reused in accordance with the MassDEP policy entitled "Reuse and Disposal of Street Sweepings, Department of Environmental Protection Policy # BAW-18-001," dated 5/14/18. Figure 2 is a Street Sweeping Prioritization Map showing the designated priority zones to aid the Town in prioritizing street sweeping and planning for future activities. As shown on Figure 2, Winter Street is the only prioritized street in the Hanover MS4 area. Refer to Section 9.1 for street sweeping material storage protocol.

SECTION 8 BMP MAINTENANCE

An essential component of an effective municipal stormwater system is the ongoing operation and maintenance of the various components of the stormwater drainage and conveyance systems. Failure to provide effective maintenance of stormwater management systems can reduce the hydraulic capacity, the pollutant removal efficiency, and infiltration capacity of stormwater practices. Stormwater management system Operation and Maintenance Programs should address operation and maintenance concerns proactively instead of reacting to problems that occur such as flooding or water quality degradation associated with erosion, clogging or outright failure of one or more of the system components. Proactively inspecting facilities and addressing concerns provides some consistency in workflow and helps to avoid emergency situations.

There are two key components to adequately maintaining stormwater management infrastructure:

- Regularly scheduled inspections, and
- Regular maintenance.

Following is a description of some of the most common Stormwater Best Management Practices (BMPs) in municipalities and the recommended or required inspection and maintenance schedule.

8.1 STORMWATER BASINS

Stormwater basins are designed differently depending on site conditions and each project's approach to stormwater management. The more common stormwater basins designed and constructed, include:

- Extended Detention basins
- Infiltration Basins
- Wet Basins
- Bioretention Basins/Rain Gardens
- Sediment Forebays

Each specific type of basin has distinct operations and maintenance requirements as outlined in the Operations and Maintenance plan that was developed as part of each project's design and approval process. Below are operation and maintenance requirements that are specific to each type of stormwater basin as described in the Massachusetts Stormwater Management Standards.

Extended Dry Detention Basins

- Inspect complete structure biannually
- Inspect outlet control structure for clogging, etc., twice per year
- Check for erosion, twice per year
- Check for sedimentation, annually
- Mow basin bottom, side slopes, spillway, twice per year
- Remove trash, twice per year

Infiltration Basins

- Inspection and perform preventive maintenance, minimum twice per year
- Inspect pretreatment BMP, as required by each BMP and after major storm events for first six months
- Inspect after major storms for first six months, check drawdown times
- Address ponding immediately
- Inspect twice per year for
    - Differential settlement
    - Cracking
    - Erosion
    - Leakage in embankments
    - Tree growth on embankments
    - Condition of rip-rap
    - Sediment accumulation (when bottom is dry)
    - Health of turf
- Mow side slopes and basin bottom, twice per year
- Remove trash and debris, twice per year
- When removing sediment, wait until bottom is dry, till remaining soil, revegetate
- Inspect and clean pretreatment devices minimum twice per year or more

Wet Basins

- Inspect annually
- Inspect outlet control structure for clogging, etc., twice per year
- Check for erosion, tree growth, etc., twice per year
- Mow dry/upper stages, twice per year
- Remove trash, sediment, twice per year

Bioretention Basins/Rain Gardens

- Inspect for soil erosion, monthly
- Inspect and remove trash monthly
- Inspect for invasive species/weeds, monthly
- Replace mulch, annually in the spring
- Remove dead vegetation, annually in either the fall or spring
- Replace dead vegetation, annually in either the fall or spring
- Prune, annually in either the fall or spring
- Replace soil media and all vegetation, as needed

Sediment Forebays

- Inspect monthly
- Clean minimum of four times per year
- Mow twice per year or when grass exceeds 6 inches in height
- Replace rip-rap pads, when necessary

8.2 WATER QUALITY SWALES

Water Quality Swales under operational control by the Town should be maintained consistent with the Massachusetts Stormwater Management Standards or the Operations and Maintenance manual as approved as part of the projects design and approval.

The maintenance objective for water quality swales includes preserving the hydraulic and removal efficiency of the channel and maintaining a dense, healthy vegetative cover to encourage sediment removal and – where appropriate – stormwater infiltration. The following operations and maintenance activities are recommended for Water Quality Swales consistent with the Massachusetts Stormwater Management Standards:

- Inspect twice per year
- Mow annually, or if vegetation exceeds 6 inches
- Remove Sediment/Trash, Minimum once per year
- Reseed eroded areas, as needed

Every five years, scraping of the channel bottom and removal of sediment to restore original cross section and infiltration rate, and seeding to restore ground cover is recommended.

Dry swales should be inspected on an annual basis and after storms of greater than or equal to the 1-year precipitation event. Both the structural and vegetative components should be inspected and repaired if needed. Trash and debris should be removed and properly disposed of.

Wet swales should be inspected annually and after storms of greater than or equal to the 1-year precipitation event. During inspection, the structural components of the system, including trash racks, valves, pipes, and spillway structures should be checked for proper function. Any clogged openings should be cleaned out and repairs should be made where necessary. Sediment should be removed from the bottom of the swale.

8.3 DRY WELLS

Dry wells are structures that collect stormwater generated by either roof tops or paved surfaces and infiltrate stormwater into the ground. Drywells vary in size and depth, but are typically either four, six or eight feet in diameter and have varying depths depending on ground water elevations. Dry wells typically have open bottoms and include perforations in concrete that allows water to leach out of the bottom and sides of the structures. The structures are typically surrounded by one to two feet of 3/4 to 1-1/2 inch stone around the sides and bottom of the dry well. When these facilities collect and infiltrate stormwater from surface runoff, pretreatment of stormwater is critical to insure that sediments are removed prior to discharge to the structure.

Maintenance of dry wells should include the following consistent with the Massachusetts Stormwater Management Standards:

- Inspect annually to insure that there has been no sediment build-up that could impact the functionality of the dry well.

- Remove sediment in the dry well when it reaches 50% capacity.
- Replace the structure and or stone when the system fails to infiltrate effectively.

8.4 PROPRIETY SUBSURFACE SEPERATORS

Proprietary Subsurface Separators have a greater ability to trap and contain stormwater-borne pollutants than standard catch basins. They are fitted with baffles and chambers that create a hydrodynamic separation of floatable and non-floatable particles. The Town does not know of any subsurface separators within its MS4 System at this time, but will adhere to the inspection process detailed within if a subsurface separator is to be installed in the future.

Proprietary Subsurface Separators under operational control of the Town will be maintained consistent with manufacturers operations and maintenance guidelines. Typically, these units need to be inspected a minimum of once per year. For units that are installed in high sediment areas, these units may need to be inspected more frequently.

Inspection of proprietary subsurface separators will include inspecting the operational condition of any baffles and filters contained within the structure. The depth of sediment collected in the separator will also be measured. All floatable trash will be removed from the separator during each inspection. If a hydrocarbon sheen is noted on the surface of the water in the separator it shall be removed using absorbent pads; these pads will be allowed to dry prior to disposal in a solid waste dumpster pursuant to MassDEP's "1-drip" policy. If the accumulated sediment is within 18 inches of the outlet elevation, it will be removed by vacuum or mechanical means. Disposal of all collected sediments will conform to the procedures described herein for disposal of sediments collected from municipal catch basins.

8.5 OTHER STORMWATER BEST MANAGEMENT PRACTICES

The Stormwater BMPs described above are typically designed and constructed for projects where it is intended that the local municipality will assume Operations and Maintenance activities. There are numerous other stormwater BMPs that are described within the Massachusetts Stormwater Standards. Operations and Maintenance activities related to these additional BMPs should be conducted as outlined in the Standards, as well as in the Operations and Maintenance Plans developed and approved by local regulatory boards for each approved BMP. Additional stormwater BMPs that could be Operated and Maintained by municipalities include:

- Gravel Wetlands
- Constructed Wetlands
- Vegetated Filter Strips
- Sand and Organic Filters
- Infiltration Trenches
- Leaching Fields
- Porous Pavements
- Rain Barrels and Cisterns

SECTION 9 STREET SWEEPING & CATCH BASIN CLEANINGS

This section describes the disposal requirements of the Town's Street Sweeping and Catch Basin Cleanings materials. The Town has traditionally stockpiled catch basin cleanings and street sweepings at a Town–owned yard located at the DPW Garage, 219 Ames Way (see Figure 3). The procedures required for properly managing these materials are further described below and in the SOP's attached as Appendix D.

9.1 STREET SWEEPINGS

The Town's street sweeping operations are mainly conducted once per year in the spring, although prioritized areas are swept two times per year, once in the spring and once in the fall. The street sweepings are subsequently brought back to the Town-owned yard at 219 Ames Way to the designated street sweeping stockpile area (Figure 3) and are currently being stored there for up to one year. The annual amount generated is approximately 20 cubic yards.

Street sweepings need to be disposed of consistent with the MassDEP policy entitled "Reuse and Disposal of Street Sweepings, MassDEP Policy # BAW-18-001," dated 5/14/18. They must also be managed under MassDEP Policy #COMM-97-001 "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills."

Street sweepings can be stored prior to use under the following conditions:

- Storage must at a site where the sweepings are generated,
- Storage must be at a location, such as a Department of Public Works yard, that is under control of the government entity doing the sweeping.
- Must be protected from wind and rain to prevent dust, erosion and off-site migration.
- Cannot be stored within 100 feet of a wetland or within a wetlands resource area or riverfront area,
- Cannot be stored within 500 feet of a ground or drinking water supply,
- Cannot result in a public nuisance
- Must be temporary and will be used within one year of collection.

Street sweepings are considered "solid waste" and are therefore subject to the Massachusetts solid waste regulations. Street sweepings have been preapproved for the following uses, without Prior Approval from MassDEP:

- Daily cover at permitted lined solid waste landfills provided they meet the daily cover materials specified at 310 19.130(15).
- Use as Fill in Public or Private Ways and Parking Lots with some restrictions and conditions.
- Use as an Additive to Restricted Use Compost with some restrictions and conditions.
- Reuse as Anti-Skid Material with some restrictions and conditions.

- Reuse at Landfills Regulated under MassDEP Policy #COMM-97-001 with some restrictions and conditions.
- Use at Reclamation Soil Facilities Regulated Under MassDEP Policy #COMM-15-01.
- Street sweepings may also be used as a bulking agent for wastewater sludge or septage disposal, with prior approval from MassDEP.

9.2 CATCH BASIN CLEANINGS

The Municipality's catch basin cleaning operations are conducted once per year in the Spring. The cleanings are subsequently brought back to the Town-owned DPW yard at the catch basin cleanings stockpile area, as shown on Figure 3. The annual amount generated is approximately 500 cubic yards.

Figure 3 also shows the location of the storage area and the proximity to localized wetlands and waterbodies surrounding the storage area; Torrey Brook and Drinkwater River are adjacent to the storage area. The Town is in the process of redesigning and moving their salt shed, at which time the catch basin cleanings will be stored on pavement, in the current location of the salt shed.

Catch basin cleanings collected by the Town's subcontractors need to be disposed of consistent with the MassDEP policies regarding "Management of Catch Basin Cleanings." Materials removed from catch basins are typically defined as solid waste by the MassDEP. Any catch basin cleanings that have been contaminated by a spill, or are suspected of contamination need to be disposed of in accordance with the 310 CMR 30.000 Hazardous Waste Regulations. Any materials that contain liquids are prohibited from being disposed of at landfills. Dry materials can be disposed of at landfills, and may be approved for use as grading and shaping materials at landfills.

SECTION 10 WINTER ROAD MAINTENANCE

Winter Road Maintenance includes the management of equipment and facilities needed to maintain roads for safe travel as well as the application of anti-icing and de-icing materials. Municipalities are required to insure roads are as safe as possible. Because of this, the tendency to think "more sand/salt is better" can be difficult to overcome. Several studies have shown that by using new techniques, equipment, and chemicals, roads can actually be safer with less salt use. MassDOT typically treats road using both anti-icing and de-icing strategies. Anti-icing involve applying a liquid solution to roads before a storm that prevents snow and ice from binding to the pavement. De-icing is performed during and after storms to remove ice and snow through plowing and applying additional materials to the surface of the roads. MassDOT typically uses 5 different materials to treat roads for snow and ice as follows:

- Rock salt
- Liquid Magnesium Chloride
- Liquid Brine
- Sand
- Pre-mix (rock salt and calcium chloride)

Winter maintenance teams can benefit from the following practices:

1. Use the Right Material. Stop using sand, except for low-speed intersections, curves and hills. Use a chemical that is effective at current road surface temperatures. Consider using alternate chemicals on bridges and in source water protection areas.
2. Use the Right Amount. The number one factor in applying salt is the surface temperature. Warmer roads need less salt. Consider purchasing inexpensive infrared thermometers for spreading trucks.
3. Apply at the Right Place. Put salt down where it will do most good. Hills, curves/corners, shaded sections of road, bridges, etc., need special attention. A section of road with surface temp below 10°F will not benefit from rock salt. Use another chemical instead. Designate sensitive areas as low or no salt zones.
4. Apply at the Right Time. Apply as early as possible! Obtain and use the most up-to-date weather forecasts. Do not wait until snow is falling to get started. It takes much more salt to melt accumulated snow than it does to prevent accumulation. Factor in expected traffic, approaching day/night change in temperatures, etc. Brine can be applied very early, forming a bond with the road that can be effective for days in the right conditions.

10.1 SAND USE

The Town does not use sand for winter road maintenance. Municipalities should avoid using sand to the greatest extent practicable as it can clog storm drains and other stormwater management systems elements. In the event the stormwater management system is not maintained properly and unable to capture sand, sand could possibly be discharges to water and wetland resources.

10.2 DEICING CHEMICAL USE

The Town uses a salt and magnesium chloride wetting agent. As described above, de-icing and anti-icing strategies should be used, when appropriate.

10.3 STORAGE OF DEICING CHEMICALS

The deicing material is stored in a covered shed at the DPW Garage.

Improper storage techniques can cause some of the most severe environmental damage from winter maintenance materials because they can result in highly concentrated runoff. Salt can cause serious environmental issues. Sand is typically mixed with salt, sand piles should also be included in a proper storage program.

Deicing chemicals (i.e. salt, calcium chloride, etc.) shall be stored in storage sheds or tanks in a manner that minimizes the potential for runoff. All deicing chemicals shall be covered when not in use. Sand piles shall be bermed to minimize runoff. During handling, sand and salt which fall outside of the storage areas will be swept back to the storage areas within 48 hours of the activity, to minimize runoff.

A properly stored salt/sand pile is:

- Located on a flat site
- Located away from source water protection areas, floodplains and wetlands
- Sited on an impermeable (paved) pad, with a drain that directs runoff to proper treatment
- Covered with a roof and walls on at least 3 sides

During regular inspections, the salt and deicing chemical storage areas shall be inspected by the Deputy Superintendent of Public Works to ensure that runoff is minimized. All findings during an inspection shall be sent to the Director of Public Works.

Figure 4 shows the location of the salt and de-icing storage areas and the proximity to localized wetlands and streams surrounding the storage area.

MassDEP Guideline DWSG97-1 pertaining to storage of road salt and other chemical deicing agents became effective December 19, 1997. Uncovered storage of salt is forbidden by Massachusetts General Law Chapter 85, section 7A in areas that would threaten water supplies. 310 CMR 22.21(2)(b) restricts deicing chemical storage within wellhead protection areas, such as Zone I and Zone II, for public water supply wells, unless storage is within a structure designed to prevent the leaching or runoff of salt. 310 CMR 22.20C prohibits uncovered or uncontained storage of road or parking lot de-icing and sanding materials within Zone A at reservoirs.

10.4 SNOW DISPOSAL ACTIVITIES

The Town does not use a centralized snow storage or dumping area.

The MassDEP Bureau of Water Resources Snow Disposal Guidance, effective December 23, 2019 provides guidance on snow disposal activities. These guidelines provide the following criteria for selection of snow disposal sites including:

- Locating them adjacent to or on pervious surfaces in upland areas
- Locating sites away from water resources and drinking water wells
- Avoid storage of disposal of snow and ice containing deicing chemicals in Zone A And Zone II of a drinking water supply
- Avoid storage and disposal of snow or ice within an Interim Wellhead Protection Area (IWPA) of public water supply wells and within 75 feet of private wells
- Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or Wetlands.
- Avoid dumping snow on MassDEP designated high and medium yield aquifers
- Avoid dumping snow in sanitary landfills and gravel pits.
- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales, or ditches.

With regard to Site Preparation and Maintenance, MassDEP provides the following standards for snow disposal sites:

- Install a silt fence or barrier on the down gradient side of snow disposal sites
- Maintain a minimum 50 foot vegetated buffer between the disposal site and adjacent waterbodies
- Clear debris from the site prior to using the sit for snow removal
- Clear debris from the site and properly dispose of it at the end of snow season, and no later than May 15

With regard to snow disposal site approvals, MassDEP provides the following guidance:

- No review needed for previously used and mapped upland and pervious snow disposal locations.
- In cases where there is no snow disposal capacity, local Conservation Commissions may provide Emergency Certification under the Wetlands Protection Act to authorize snow disposal in buffer zones to wetlands, open water areas, and resource areas. Emergency authorizations should utilize the following guidelines:
    - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
    - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern. •
    - Do not dispose of snow where trucks may cause shoreline damage or erosion.
    - Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

SECTION 11 VEHICLES AND EQUIPMENT

Regular maintenance of both municipal and contracted vehicles and heavy equipment prolongs the life of municipal assets and helps reduce the potential for leaking of fluids associated with normal wear and tear. Leakage of fluids from vehicles can drain towards stormwater management facilities and ultimately towards water bodies and wetland resources. Therefore, it is important from both an operational and stormwater management perspective that municipalities maintain their vehicles and equipment properly. With regards to the maintenance of vehicles and equipment, municipalities should conduct the following activities to insure their vehicles and other equipment are maintained in good working order.

11.1 VEHICLE AND EQUIPMENT MAINTENANCE

The Town DPW currently conducts vehicle maintenance at their Ames Way Highway Garage facility. All vehicle and equipment maintenance should be performed consistent with the Guidelines below.

- Create an inventory of all vehicles and equipment that are used on a regular basis.
- Maintain and update the inventory of vehicles and equipment.
- Monitor vehicles and equipment for leaks.
- In instances where machinery have leaks, repair machinery as soon as possible.
- Dispose of and/or recycle all fluids consistent with state and federal regulations. Do not dump fluids outside or into stormwater management facilities
- Perform regular maintenance consistent with equipment manufacturer's recommendations.
- Perform all repairs and maintenance, including regular maintenance (i.e. oil changes. etc,) and painting, indoors.
- Insure that all drains within indoor facilities are not connected to stormwater management systems.
- Dispose of all waste materials and fluids consistent with local, state, and federal regulations.
- Insure that all fueling areas are covered,
- Insure that fueling areas should drain to an oil/gas separator or preferably fuel containment area.
- Store any waste materials under protection from outdoor elements and include secondary containment.
- Store all fluids in designated storage containers and areas. Insure these containers are located within buildings.
- Store and recycle batteries indoors,
- Insure that storage areas do not have floor drains. In the event that they do have floor drains, insure that they do not discharge to the municipal drain system or to wetland resource areas.
- Insure that all hazardous wastes are labelled and stored according to local, state, and federal regulations.
- Insure that any hazardous wastes are disposed of in accordance with local, state, and federal regulations.

- Perform all cleaning of parts indoors. Insure that all solvents are collected and recycled.

11.2 VEHICLE AND EQUIPMENT WASHING

Vehicle and equipment washing is performed at the Highway Garage on Ames Way. Smaller vehicles are washed inside the maintenance garage, while larger trucks are washed outside the garage on pervious ground surface. All vehicle and equipment washing should be performed consistent with the Guidelines below.

- All vehicles should be washed in a designated area.
- If possible, wash vehicles and equipment indoors. Indoor facilities should not have floor drains that are connected to the municipal stormwater management system or discharge to wetlands or water resources. Floor drains should be connected to either the sanitary sewage system, a recycled water system, or a tight tank.
- All wash water from vehicle washing should be collected by a recycling unit or tight tank.
- Do not discharge vehicle wash water to wetland resource areas or municipal drain systems.
- Use biodegradable or phosphate free detergents.
- Do not discharge any wash water to groundwater resource areas or wellhead protection areas.
- Maintain drip kits in wash areas.
- Provide separate wash and maintenance areas if possible.
- Remove any heavy debris, dirt, mud, etc. from vehicles separate from designated wash areas. Remove heavy debris, dirt, mud, etc. and dispose of properly.
- Wash engines or other motorized parts with a high incidence of fluids indoors. Contain any drips and spills to maximum extent practicable.
- Avoid using solvents and heavy detergents to the maximum extent practicable.

11.3 EMPLOYEE TRAINING

Regular employee training should be provided for all staff performing regular maintenance and/or equipment cleaning. Providing regular training a minimum of one time per year is recommended.

SECTION 12 REPORTING AND RECORDKEEPING

The tracking and documentation of MS4 Maintenance and Operations is a required part of the permit program. All inspection forms will be recorded and stored at the DPW facility at 50 Pond Street, to ensure that the proper documentation is maintained and reported on the annual reports and that the relevant data is added to the Town's management database.

SECTION 13 TRAINING

This component of the O&M Plan establishes the procedures for identifying, planning, delivering and tracking training. The training is provided to operations and maintenance staff as necessary to maintain knowledge and skills that help ensure that they understand their roles and responsibilities and can adequately perform their duties as they relate to supporting the standard operating procedures outlined in this O&M Plan. Training is provided to employees through three basic means: 1) Annual Environmental Awareness Training; 2) Right-to-Know Training; 3) Regulatory Specific Training (e.g., Stage II vapor recovery equipment inspections).

The Deputy Superintendent of Public Works is responsible for identifying the personnel that require training based upon job duties and how those duties relate to environmental compliance. All inspectors of stormwater management facilities should have some knowledge or experience with stormwater systems. If possible, trained stormwater engineers should direct them. Inspections by registered engineers should be performed where routine inspection has revealed a question of structural or hydraulic integrity affecting public safety.

13.1 TRAINING LEAD

For those staff responsible for implementing the O&M program, on the job training will be managed by the Deputy Superintendent of Public Works. He/she will manage and assign training as described below.

The Town of Hanover shall, at a minimum, annually train all public works employees or other employees involved in the implementation of the O&M program about the program. The Town of Hanover shall report on the frequency and type of employee training in the annual report.

13.2 TRAINING PLAN

Training will be assigned to those individuals specifically involved in the O&M procedures. The Town of Hanover may elect to retain consultants for development of the O&M structure database, and associated mapping tasks. Preliminary training activities, a schedule and identification of those to receive training are listed in the following table:

Training Topic	Attendees	Estimated Number of Attendees	Training Type and Frequency	Description
O&M – Program field staff	Temporary and permanent alteration of wetland resource areas.	2	In-field training	This training is for staff that will be responsible for field assessment of structures
O&M/IDDE – General Information		10	Lunch-and-Learn Session	This training will explain the O&M/IDDE program.

SECTION 14 MEASUREMENT OF SUCCESS

The success of the O&M program will be measured by each of the elements outlined in the previous sections. Specifically, the following benchmarks will be used:

- Number of Catch Basins inspected and cleaned annually
- Volume of material removed from catch basins
- Number of street miles of street sweepings conducted annually
- Number of municipally owned parking lots swept annually
- Amount of material removed from streets adjacent to sensitive waters
- Number of stormwater Best Management Practices inspected and maintained
- Number of Outfalls repaired
- Training: Number of Employees trained

SECTION 15 REFERENCES

Environmental Protection Agency, General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts, July 2018.

Massachusetts Department of Environmental Protection, Massachusetts Stormwater Handbook, February 2008.

330 CMR 31.00 Plant Nutrient Application Requirements for Agricultural Land and Non-Agricultural Turf and Lawns.

UMass Extension Service Resources/Websites

https://ag.umass.edu/greenhouse-floriculture/greenhouse-best-management-practices-bmp-manual/fertilizer-storage-handling

https://ag.umass.edu/home-lawn-garden/fact-sheets/lawn-mowing

Massachusetts Department of Environmental Protection policy entitled "Reuse and Disposal of Street Sweepings, Department of Environmental Protection Policy # BAW-18-001," dated 5/14/18.

Massachusetts Department of Environmental Protection Guidelines on Road Salt Storage DWSG97-1, effective December 19, 1997;

The Massachusetts Department of Environmental Protection Bureau of Water Resources Snow Disposal Guidance, effective December 23, 2019.

SECTION 16 O&M PLAN CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Authorized Official

Acting Town Manager
Title

9-23-2020
Date

FIGURE 1

Parks and Open Space Maintenance

HINGHAM
NORWELL
ROCKLAND
HANOVER
HANSON
PEMBROKE
N
Union Cemetery
Gallant Field
Pond Street Water Treatment Facility
Hanover DPW
Hanover Middle School
Cedar School
Hanover High School
Darling Cemetery
Hanover Center Cemetery
Center School
John Curtis Free Library
Veterans Memorial Park
B.E. Hall Field/Playground Facility
Ellis Field
Briggs Field
Fire Department
Sylvester School
Transfer Station
Salmond School
Police Department
Town Hall
Forge Pond Park
Ceurvels Field
Broadway Water Treatment Facility
Luddam's Ford Park
Council on Aging
Phillip C. Beal Water Treatment Facility
DPW Garage
Hanover Senior Center
Miles
0
0.5
1
TOWN OF HANOVER, MASS. INCORPORATED JUNE 14, 1727
Figure 1. Parks & Open Space Maintenance
Hanover, Massachusetts
Spring 2020
ENVIRONMENTAL PARTNERS
I:\Hanover.102\Stormwater\102-1906 FY2020 Stormwater\4. O&M Plan\Figures\MXDs\1 - Parks & Open Space Maintenance.mxd

FIGURE 2

Street Sweeping Prioritization

HINGHAM

NORWELL

ROCKLAND

HANOVER

HANSON

PEMBROKE

WINTER STREET

N

Miles
0 0.5 1

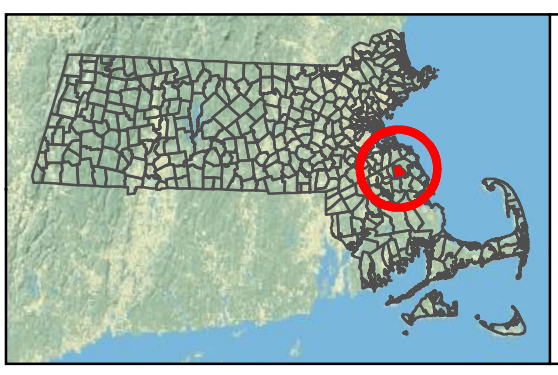

Figure 2. Street Sweepings Prioritization
Hanover, Massachusetts
Spring 2020

ENVIRONMENTAL PARTNERS

I:\Hanover.102\Stormwater\102-1906 FY2020 Stormwater\4. O&M Plan\Figures\MXDs\2 - Street Sweeping Prioritization.mxd

FIGURE 3

Storage Location of Street Sweepings and Catch Basin Cleanings

Street Sweepings &
Catch Basin Cleanings
Stockpile Area

Drinkwater River

Forrey Brook

N

Perennial Stream

Wetland

Town Parcels

Feet

0 100 200

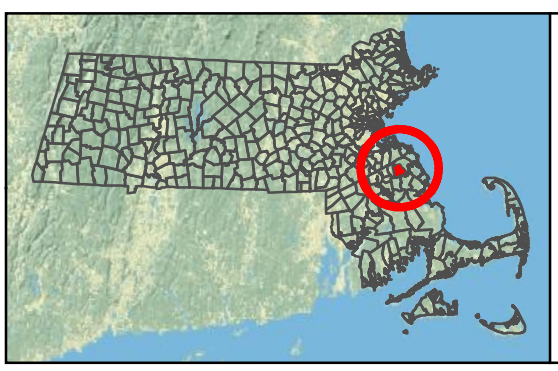

Figure 3. Storage Locations of
Street Sweepings & Catch Basin Cleanings
Hanover, Massachusetts
Spring 2020

ENVIRONMENTAL PARTNERS

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FIGURE 4

Storage Locations of Salt and Sand Supplies

Salt & Sand Supplies
Storage Area

Drinkwater River

Forrey Brook

N

Perennial Stream

Wetland

Town Parcels

Feet

0 100 200

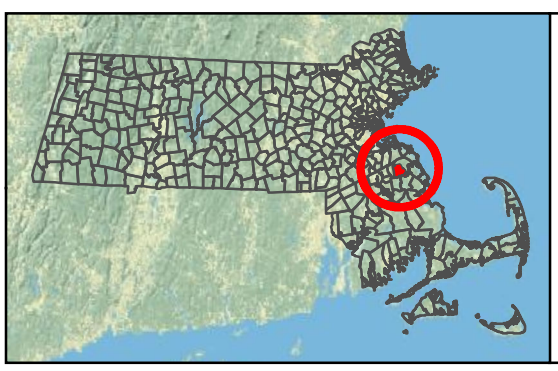


Figure 4. Storage Locations of
Salt and Sand Supplies
Hanover, Massachusetts
Spring 2020

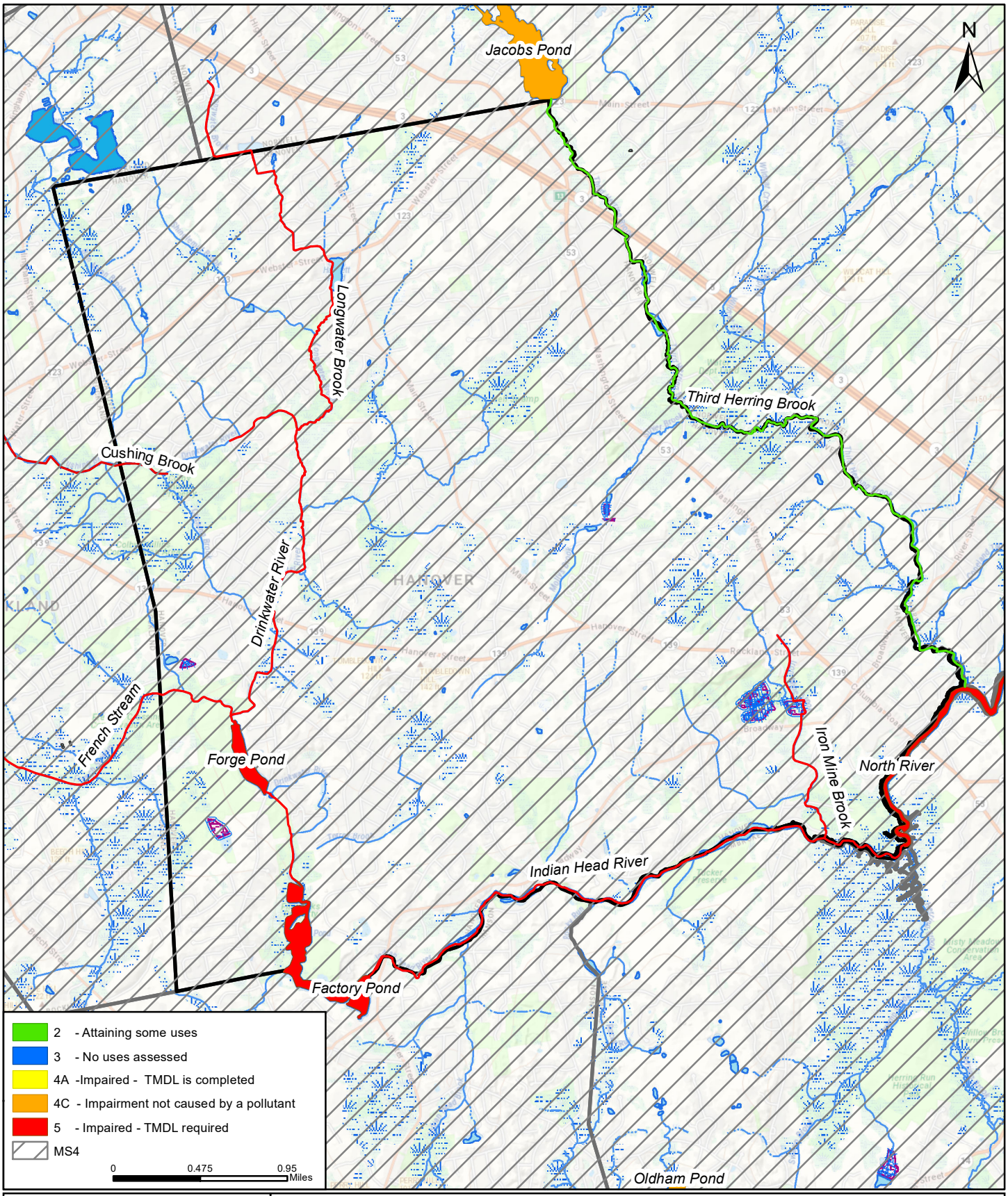
ENVIRONMENTAL PARTNERS

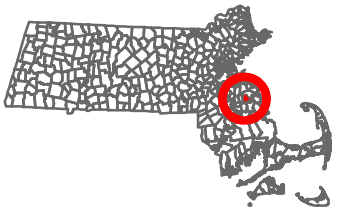
I:\Hanover.102\Stormwater\102-1906 FY2020 Stormwater\4. O&M Plan\Figures\MXDs\4 - Salt & Sand Storage.mxd

APPENDIX A

Town of Hanover Urbanized Area & Impaired Waterbodies Map

Town of Hanover, Massachusetts Year 2016 Integrated List of Waters





Appendix A. Urbanized Area and Impaired Waterbodies Hanover, Massachusetts May 2020

ENVIRONMENTAL PARTNERS

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Town of Hanover, Massachusetts
Massachusetts Year 2016 Integrated List of Waters
Impaired Waters

Category	Name	Segment ID	Description	Size	Units	Impairment Cause
5 - "Water Requiring a TMDL"	**Cushing Brook**	MA94-40	From the headwaters east of Pleasant Street, Rockland to mouth at confluence with Drinkwater River, Hanover.	3.50	MILES	E. Coli
	Drinkwater River	MA94-21	From Whiting Street, Hanover through Forge Pond to the inlet of Factory Pond, Hanover.	3.50	MILES	Debris* Non-Native Aquatic Plants* Trash* Excess Algal Growth Fecal Coliform E. Coli Mercury in Fish Tissue Dissolved Oxygen Dissolved Oxygen Supersaturation Phosphorus (Total) Secchi disk transparency
	Factory Pond	MA94175	Hanson/Hanover	51.00	ACRES	Mercury in Fish Tissue
	French Stream	MA94-03	From the headwaters on the southeast side of the South Weymouth Naval Air Station, Rockland through Studleys Pond to the confluence with Drinkwater River, Hanover.	5.80	MILES	Dissolved Oxygen E. Coli Fecal Coliform Fish Bioassessments Phosphorus (Total) Whole Effluent Toxicity (WET)
	Indian Head River	MA94-04	Outlet of Factory Pond, Hanover/Hanson to Curtis Crossing Dam (also called Ludhams Ford Dam) west of Elm Street, Hanover/Pembroke.	2.80	MILES	Mercury in Fish Tissue Dissolved Oxygen Phosphorus (Total) E. Coli
	Indian Head River	MA94-22	From Curtis Crossing Dam (also called Ludhams Ford Dam) west of Elm Street, Hanover/Pembroke to confluence with Herring Brook, (forming headwaters of North River) Hanover/Pembroke.	0.90	MILES	Mercury in Fish Tissue
	Longwater Brook	MA94-39	Headwaters, south of Route 3, Norwell to mouth at confluence with Drinkwater River, Hanover.	2.80	MILES	E. Coli
	North River	MA94-05	Confluence of Indian Head River and Herring Brook, Hanover/Pembroke to Route 3A (Main Street), Marshfield/Scituate.	0.30	SQUARE MILES	Fecal Coliform Mercury in Fish Tissue

*TMDL not required (Non-pollutant)

APPENDIX B

Catch Basin Inspection Form Template

Job No.: _____ **Town:** **Hanover**

Inspector: _____ **Date:** _____

ENVIRONMENTAL PARTNERS

CATCH BASIN INSPECTION FORM

Catch Basin I.D.	_____	**Final Discharge from Structure?** Yes ☐ No ☐ **If Yes, Discharge to Outfall No:**_____	
Catch Basin Label:	**Stencil** ☐ **Ground Inset** ☐ **Sign** ☐ **None** ☐ **Other**_____		
Basin Material:	Concrete ☐ Corrugated metal ☐ Stone ☐ Brick ☐ Other: _____ ☐	**Catch Basin Condition:**	Good ☐ Poor ☐ Fair ☐ Crumbling ☐
Pipe Material:	Concrete ☐ HDPE ☐ PVC ☐ Clay Tile ☐ Other:_____	**Pipe Measurements:**	Inlet Dia. (in): d= ____ Outlet Dia. (in): D= ____

Required Maintenance/ Problems (check all that apply):

- ☐ Tree Work Required
- ☐ New Grate is Required
- ☐ Pipe is Blocked
- ☐ Frame Maintenance is Required
- ☐ Remove Accumulated Sediment
- ☐ Pipe Maintenance is Required
- ☐ Basin Undermined or Bypassed
- ☐ Cannot Remove Cover
- ☐ Ditch Work
- ☐ Corrosion at Structure
- ☐ Erosion Around Structure
- ☐ Remove Trash & Debris
- ☐ Need Cement Around Grate

Other: _____

Catch Basin Grate Type :	**Sediment Buildup Depth :**	**Description of Flow:**	**Street Name/ Structure Location:**
Bar: ☐ Cascade: ☐ Other:_____ Properly Aligned: Yes ☐ No ☐	0-6 (in): _____ 6-12(in): _____ 12-18 (in): _____ 18-24 (in): _____ 24 + (in): _____	Heavy ☐ Moderate ☐ Slight ☐ Trickling ☐	

***If the outlet is submerged check yes and indicate approximate height of water above the outlet invert.** h above invert (in):___ Yes ☐ No ☐

☐ **Flow**
☐ **Standing Water**
(check one or both)

Observations:

Color:	
Odor:	

Weather Conditions : Dry > 24 hours ☐ Wet ☐

Sample of Screenings Collected for Analysis? Yes ☐ No ☐

Comments:

Circle those present:

Foam	Oil Sheen
Sanitary Waste	Bacterial Sheen
Orange Staining	Floatables
Excessive sediment	Pet Waste
Other:_____	Optical Enhancers

APPENDIX C

Stormwater BMP Inspection Form Template

INSPECTION OF BIORETENTION AREAS / RAIN GARDENS

General Information

BMP Description	Bioretention Area / Rain Garden		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			

Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Inspect for soil erosion and repair	Monthly	Yes ☐ No ☐	
Inspect for invasive species and remove if present	Monthly	Yes ☐ No ☐	
Remove trash	Monthly	Yes ☐ No ☐	
Mulch void areas	Annually	Yes ☐ No ☐	
Remove dead vegetation	Bi-Annually	Yes ☐ No ☐	
Replace dead vegetation	Annually	Yes ☐ No ☐	
Prune	Annually	Yes ☐ No ☐	
Replace all media and vegetation	As Needed	Yes ☐ No ☐	

INSPECTION OF CONSTRUCTED STORMWATER WETLANDS
Years 0-3 of Operation

General Information

BMP Description	Constructed Stormwater Wetland		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			

Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Inspect for invasive species and remove if present	Monthly	Yes ☐ No ☐	
Replace all media and vegetation	As Needed	Yes ☐ No ☐	

In addition, the following information should be recorded and mapped at least once per year:

- Types and distribution of dominant wetland plants
- Presence and distribution of planted wetland species
- Presence and distribution of invasive species
- Indications other species are replacing planted wetland species
- Percent of standing water that is not vegetated
- Replace all media and vegetation
- Stability of original depth zones and micro-topographic features
- Accumulation of sediment in the forebay and micropool and survival rate of plants

INSPECTION OF CONSTRUCTED STORMWATER WETLANDS
Year 4 - Lifetime of Operation

General Information

BMP Description	Constructed Stormwater Wetland		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			

Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Inspect for invasive species and remove if present	Monthly	Yes ☐ No ☐	
Clean forebays	Annually	Yes ☐ No ☐	
Clean sediment in basin/wetland system	Once every 10 years	Yes ☐ No ☐	
Mulch void areas	Annually	Yes ☐ No ☐	
Remove dead vegetation	Bi-Annually	Yes ☐ No ☐	
Replace dead vegetation	Annually	Yes ☐ No ☐	
Prune	Annually	Yes ☐ No ☐	
Replace all media and vegetation	As Needed	Yes ☐ No ☐	

INSPECTION OF EXTENDED DRY DETENTION BASINS

Inspections should be conducted bi-annually, and during and after major storm events.

General Information

BMP Description	Extended Dry Detention Basin		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			

Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Examine outlet structure for clogging or high outflow release velocities	Bi-Annually	Yes ☐ No ☐	
Mow upper stage, side slopes, embankment and emergency spillway	Bi-Annually	Yes ☐ No ☐	
Remove trash and debris	Bi-Annually	Yes ☐ No ☐	
Remove sediment from basin	At least once every 5 years	Yes ☐ No ☐	

INSPECTION OF PROPRIETARY MEDIA FILTERS

General Information

BMP Description	Media Filter		
BMP Location			
Media Type			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			

Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Inspect for standing water, trash, sediment and clogging	Bi-Annually (minimum)	Yes ☐ No ☐	
Remove trash and debris	Each Inspection	Yes ☐ No ☐	
Examine to determine if system drains in 72 hours	Annually	Yes ☐ No ☐	
Inspect filtering media for clogging	Per manufacturer's schedule	Yes ☐ No ☐	

INSPECTION OF SAND AND ORGANIC FILTERS

Inspections should be conducted after every major storm event for the first 3 months following completion, then every 6 months thereafter.

General Information

BMP Description	Sand/Organic Filter		
BMP Location			
Media Type			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			

Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Remove sediment, trash, and debris	Every 6 months	Yes ☐ No ☐	
Rake sand	Every 6 months	Yes ☐ No ☐	

INSPECTION OF DRY WELLS

Regular inspections should be conducted after every major storm event for the first 3 months following completion, then annually thereafter.

General Information

BMP Description	Dry Well		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			
Describe condition of dry well at time of inspection			

After a major storm event, the water depth in the observation well should be measured at 24 and 48 hour intervals and the clearance rate calculated.

INSPECTION OF WET BASINS

Inspections should be conducted after every major storm event for the first 3 months following completion, then biannually thereafter.

General Information

BMP Description	Wet Basin		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			
Describe condition of wet basin at time of inspection			

Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Preventative maintenance	Bi-Annually	Yes ☐ No ☐	
Mow/rake buffer area, side slopes and basin bottom	Bi-Annually	Yes ☐ No ☐	
Remove trash, debris and organic matter	Bi-Annually	Yes ☐ No ☐	
Inspect and clean pretreatment devices	Every other month and after every major storm event	Yes ☐ No ☐	

INSPECTION OF OTHER BMP

General Information

BMP Description			
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular ☐ Pre-Storm Event ☐ During Storm Event ☐ Post-Storm Event ☐			
Describe the weather conditions at time of inspection			

Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
		Yes ☐ No ☐	
		Yes ☐ No ☐	
		Yes ☐ No ☐	
		Yes ☐ No ☐	
		Yes ☐ No ☐	
		Yes ☐ No ☐	
		Yes ☐ No ☐	

OIL/WATER SEPARATOR (OWS)
QUARTERLY INSPECTION CHECKLIST

Facility: _____

OWS Location: _____

Inspected By: _____

Date: _____

Visual Inspection	Are there any signs of spills or leaks in the general area?	**Yes** ☐ **No** ☐
	Is there any evidence of petroleum bypassing the OWS?	**Yes** ☐ **No** ☐
	Are there any unauthorized substances entering the OWS?	**Yes** ☐ **No** ☐
	Does the OWS exhibit any signs of leaks or malfunctions?	**Yes** ☐ **No** ☐

If you answered "Yes" to any of the above questions, further inspection, repair, and/or cleaning may be necessary.

Measurements	A	Distance from rim of access cover to bottom of structure	
	B	Distance from rim of access cover to top of sludge layer	
	C = A - B	Depth of sludge layer	
	D	Distance from rim of access cover to the oil/water interface	
	E	Distance from rim of access cover to the top of the liquid surface	
	F = D - E	Depth of oil layer	

If the values for "C" and/or "F" are greater than those in the manufacturer's recommendations, the OWS must be cleaned by a licensed OWS maintenance company.

APPENDIX D

Inventory of Stormwater Best Management Practices

BMP ID	Location	BMP Category	BMP Type
BMP-1	On the south side along the entrance to 253 King St, off of King St; before the ball fields	Conveyance	Grassed Channel (Biofilter Swale)
BMP-2	On the south side of the entrance road to 253 King St, from King St; start of grassed drainage channel	Structural Pretreatment	Vegetative Filter Strip
BMP-3	Along the east side of the first parking lot on the right (north) leading into 253 King St from King St; before the park starts	Conveyance	Grassed Channel (Biofilter Swale)
BMP-4	In the NE corner of the first parking lot on the right (north) coming into 253 King St (Forge Pond Park) from King St	Structural Pretreatment	Vegetative Filter Strip
BMP-5	On the north (farthest) side of the first parking lot on the right (north) coming into 253 King St (Forge Pond Park) from King St	Treatment	Constructed Stormwater Wetland
BMP-6	On the northeast side of the third baseball field on the Forge Pond Park access road, to the South side of the road	Structural Pretreatment	Sediment Forebay
BMP-7	On the south side of the Forge Pond Park access road (253 King St), after the third baseball field and before a parking lot	Treatment	Constructed Stormwater Wetland
BMP-8	Along the south side of the Forge Pond Park access road (253 King St), after the third baseball field and before a parking lot	Conveyance	Grassed Channel (Biofilter Swale)
BMP-9	Along the north/east side of the Forge Pond Park access road (253 King St) as it curves north toward the furthest baseball fields	Conveyance	Grassed Channel (Biofilter Swale)
BMP-10	On the northern-most land adjacent to the Forge Pond Park access road (253 King St), passed all the baseball fields	Treatment	Constructed Stormwater Wetland
BMP-11	On the Forge Pond Park access road (253 King St), passed all the baseball fields, on the right (east) side of the road, between the road and the furthest parking lot away from King St (not the one along the cul-de-sac)	Conveyance	Grassed Channel (Biofilter Swale)

BMP-12	Along the south corner of the entrance to the 663-733 Center St access road	Conveyance	Grassed Channel (Biofilter Swale)
BMP-13	Along the south side of the 663-733 Center St access road	Conveyance	Drainage Channel
BMP-14	Southwest side of the 663 Center St access road	Treatment	Constructed Stormwater Wetland
BMP-15	Along the north side of the 663-733 Center St access road	Conveyance	Grassed Channel (Biofilter Swale)
BMP-16	Along the south side of the 663-733 access road, near the curve in the road	Structural Pretreatment	Vegetative Filter Strip
BMP-17	Along the south side of the 663-733 Center St access road, near the bend in the road	Treatment	Wet Basin
BMP-18	Along the north side of the 663-733 access road, near the curve in the road	Treatment	Constructed Stormwater Wetland
BMP-19	Near the southeast corner of the parking lot at 663-733 Center Street, along the east side of the access road	Treatment	Bioretention Area / Rain Garden
BMP-20	Along the southern edge of the parking lot at 663-733 Center Street	Structural Pretreatment	Vegetative Filter Strip
BMP-21	Hanover Council on Aging parking lot	Structural Pretreatment	Oil/Grit Separator
BMP-22	Past the southwest corner of the parking lot at 663-733 Center St	Treatment	Bioretention Area / Rain Garden
BMP-23	South of the parking lot at 663-733 Center St	Treatment	Wet Basin
BMP-24	On the southwest corner of the parking lot at 663-733 Center St	Structural Pretreatment	Sediment Forebay
BMP-25	Trees on the vegetated island in the parking lot at 663-733 Center St	Treatment	Sand & Organic Filter
BMP-26	Near the northeast corner of the parking lot at 663-733 Center St	Treatment	Sand & Organic Filter

APPENDIX E

Standard Operating Procedures (SOPs)

ENVIRONMENTAL PARTNERS

STANDARD OPERATING PROCEDURE 1: CATCH BASIN INSPECTION AND CLEANING

Introduction

Catch basins help minimize flooding and protect water quality by removing trash, sediment, decaying debris, solids from stormwater runoff, grease and oil, and pollutants attached to sediment such as phosphorus, nitrogen, bacteria, etc. Sediments are retained in the sump below the invert of the outlet pipe. Catch basin cleaning reduces foul odors, prevents clogs in the storm drain system, and reduces the loading of suspended solids, nutrients, and bacteria to receiving waters.

During regular cleaning and inspection procedures, data can be gathered related to the condition of the physical basin structure and its frame and grate and the quality of stormwater conveyed by the structure. Observations such as the following can indicate sources of pollution within the storm drain system:

- Oil sheen
- Discoloration
- Trash, debris and sediment

Both bacteria and petroleum can create a sheen on the water surface. The source of the sheen can be differentiated by disturbing it, such as with a pole. A sheen caused by oil will remain intact and move in a swirl pattern; a sheen caused by bacteria will separate and appear "blocky". Bacterial sheen is not a pollutant but should be noted.

Observations such as the following can indicate a potential connection of a sanitary sewer to the storm drain system, which is an illicit discharge.

- Indications of sanitary sewage, including fecal matter or sewage odors
- Foaming, such as from detergent
- Optical enhancers, fluorescent dye added to laundry detergent

Each catch basin should be cleaned and inspected at least annually. Catch basins in high-use areas that collect significant amounts of sediment may require more frequent cleaning. The Massachusetts Department of Environmental Protection Stormwater Management Standards recommend that

sediment be removed when it reaches up to 50% of the sump depth. Performing street sweeping on an appropriate schedule will reduce the amount of sediment, debris, and organic matter entering the catch basins, which will in turn reduce the frequency with which structures need to be cleaned.

Cleaning Procedure

Catch basin inspection cleaning procedures should address both the grate opening and the basin's sump. Document any and all observations about the condition of the catch basin structure and water quality on the Catch Basin Inspection Form (attached).

Catch basin inspection and cleaning procedures include the following:

1. Work upstream to downstream.
2. Clean sediment and trash off grate.
3. Visually inspect the outside of the grate.
4. Visually inspect the inside of the catch basin to determine cleaning needs.
5. Inspect catch basin for structural integrity.
6. Determine the most appropriate equipment and method for cleaning each catch basin.
    a. Manually use a shovel to remove accumulated sediments, or
    b. Use a bucket loader to remove accumulated sediments, or
    c. Use a high pressure washer to clean any remaining material out of catch basin while capturing the slurry with a vacuum.
    d. If necessary, after the catch basin is clean, use the rodder of the vacuum truck to clean downstream pipe and pull back sediment that might have entered downstream pipe.
7. If contamination is suspected, chemical analysis will be required to determine if the materials comply with the Massachusetts DEP Hazardous Waste Regulations, 310 CMR 30.000 (https://www.mass.gov/files/documents/2016/08/xl/310cmr30_7883_54357.pdf). Chemical analysis required will depend on suspected contaminants. Note the identification number of the catch basin on the sample label, and note sample collection on the Catch Basin Inspection Form.
8. Properly dispose of collected sediments. See following section for guidance.
9. If fluids collected during catch basin cleaning are not being handled and disposed of by a third party, dispose of these fluids to a sanitary sewer system, with permission of the system operator.
10. If illicit discharges are observed or suspected, notify the appropriate Department.
11. At the end of each day, document location and number of catch basins cleaned, amount of waste collected, and disposal method for all screenings.
12. Report additional maintenance or repair needs to the appropriate Department.

Disposal of Screenings

Catch basin cleanings from storm water-only drainage systems may be disposed at any landfill that is permitted by MassDEP to accept solid waste. MassDEP does not routinely require stormwater-only catch basin cleanings to be tested before disposal, unless there is evidence that they have been contaminated by a spill or some other means.

Screenings may need to be placed in a drying bed to allow water to evaporate before proper disposal. In this case, ensure that the screenings are managed to prevent pollution.

Catch basin cleanings collected by the Town of Hanover need to be disposed of consistent with the Massachusetts Department of Environmental Protection policies regarding “Management of Catch Basin Cleanings.” Materials removed from catch basins are typically defined as solid waste by the Massachusetts Department of Environmental Protection. Any catch basin that have been contaminated by a spill, or are suspected of contamination need to be disposed of in accordance with the 310 CMR 30,000 Hazardous Waste Regulations. Any materials that contain liquids are prohibited from being disposed of at landfills. Dry materials can be disposed of at landfills, and may be approved for use as grading and shaping materials at landfills.

Attachments

Catch Basin Inspection Form

ENVIRONMENTAL PARTNERS

STANDARD OPERATING PROCEDURE 2:

INSPECTING CONSTRUCTED BEST MANAGEMENT PRACTICES

Introduction

Best Management Practices (BMPs) are policies, procedures and structures designed to reduce stormwater pollution, prevent contaminant discharges to natural water bodies, and reduce stormwater facility maintenance costs. Constructed BMPs are permanent site features designed to treat stormwater before infiltrating it to the subsurface or discharging it to a surface water body.

This Standard Operating Procedure provides a general summary of inspection procedures for eight common constructed BMPs, including:

1. Bioretention Areas and Rain Gardens
2. Constructed Stormwater Wetlands
3. Extended Dry Detention Basins
4. Proprietary Media Filters
5. Sand and Organic Filters
6. Wet Basins
7. Dry Wells
8. Infiltration Basins

This SOP is based on the Massachusetts Stormwater Handbook and is not intended to replace that document. This SOP is also not intended to replace the Stormwater BMP Operation and Maintenance (O&M) Plan required by the Massachusetts Wetlands Protection Act, Order of Conditions.

Bioretention Areas and Rain Gardens

Bioretention areas and rain gardens are shallow depressions filled with sandy soil, topped with a thick layer of mulch and planted with dense native vegetation. There are two types of bioretention cells:

1. Filtering bioretention area: Areas that are designed solely as an organic filter; and
2. Exfiltration bioretention area: Areas that are configured to recharge groundwater in addition to acting as a filter

Inspection & Maintenance

Regular inspection and maintenance are important to prevent against premature failure of bioretention areas or rain gardens. Regular inspection and maintenance of pretreatment devices and bioretention cells for sediment buildup, structural damage and standing water can extend the life of the soil media.

MAINTENANCE SCHEDULE: BIORETENTION AREAS AND RAIN GARDENS

Activity	Time of Year	Frequency
Inspect for soil erosion and repair	Year round	Monthly
Inspect for invasive species and remove if present	Year round	Monthly
Remove trash	Year round	Monthly
Mulch Void Areas	Spring	Annually
Remove dead vegetation	Fall and Spring	Bi-Annually
Replace dead vegetation	Spring	Annually
Prune	Spring or Fall	Annually
Replace all media and vegetation	Late Spring/Early Summer	As Needed

When failure is discovered, excavate the bioretention area, scarify the bottom and sides, replace the filter fabric and soil, replant vegetation and mulch the surface.

Never store snow within a bioretention area or rain garden. This would prevent required water quality treatment and the recharge of groundwater.

Constructed Stormwater Wetlands

Constructed stormwater wetlands maximize the pollutant removal from stormwater through the use of wetland vegetation uptake, retention and settling. Constructed storm water wetlands must be used in conjunction with other BMPs, such as sediment forebays.

Inspection & Maintenance

Regular inspection and maintenance are important to prevent against premature failure of bioretention areas or rain gardens. Regular inspection and maintenance of pretreatment devices and bioretention cells for sediment buildup, structural damage and standing water can extend the life of the soil media.

MAINTENANCE SCHEDULE, CONSTRUCTED STORMWATER WETLANDS: YEARS 0-3

Activity	Time of Year	Frequency
Inspect for invasive species and remove if present	Year round	Monthly
Record and Map:	Year round	Annually
Types and distribution of dominant wetland plants	Year round	Bi-Annually
Presence and distribution of planted wetland species	Spring	Annually
Presence and distribution of invasive species	Fall and Spring	Bi-Annually
Indications other species are replacing planted wetland species	Spring	Annually
Percent of standing water that is not vegetated	Spring or Fall	Annually
Replace all media and vegetation	Late Spring/Early Summer	As Needed
Stability of original depth zones and micro-topographic features		
Accumulation of sediment in the forebay and micropool and survival rate of plants		

MAINTENANCE SCHEDULE, CONSTRUCTED STORMWATER WETLANDS: YEARS 4 – LIFETIME

Activity	Time of Year	Frequency
Inspect for invasive species and remove if present	Year round	Monthly
Clean forebays	Year round	Annually
Clean sediment in basin/wetland system	Year round	Once every 10 years
Mulch Void Areas	Spring	Annually
Remove dead vegetation	Fall and Spring	Bi-Annually
Replace dead vegetation	Spring	Annually
Prune	Spring or Fall	Annually
Replace all media and vegetation	Late Spring/Early Summer	As Needed

When failure is discovered, excavate the bioretention area, scarify the bottom and sides, replace the filter fabric and soil, replant vegetation and mulch the surface.

Never store snow within a constructed stormwater wetland. This would prevent required water quality treatment and the recharge of groundwater.

Extended Dry Detention Basins

Extended dry detention basins are designed to control both stormwater quantity and quality. These BMPs are designed to hold stormwater for at least 24 hours, allowing solids to settle and to reduce local and downstream flooding. Pretreatment is required to reduce the potential for overflow clogging. The outflow may be designed as either fixed or adjustable. Additional nutrient removal may be achieved by a micropool or shallow marsh.

Inspection & Maintenance

Annual inspection of extended dry detention basins is required to ensure that the basins are operating properly. Potential problems include: erosion within the basin and banks, tree growth on the embankment, damage to the emergency spillway and sediment accumulation around the outlet. Should any of these problems be encountered, necessary repairs should be made immediately.

MAINTENANCE SCHEDULE: EXTENDED DRY DETENTION BASINS

Activity	Time of Year	Frequency
Inspect basins	Spring and Fall	Bi-Annually, and during and after major storms
Examine outlet structure for clogging or high outflow release velocities	Spring and Fall	Bi-Annually
Mow upper stage, side slopes, embankment and emergency spillway	Spring through Fall	Bi-Annually
Remove trash and debris	Spring	Bi-Annually
Remove sediment from basin	Year round	At least once every 5 years

Proprietary Media Filters

Media Filters are designed to reduce total suspended solids and other target pollutants, such as organics, heavy metals or nutrients, which are sorbed onto the filter media, which is contained in a concrete structure. The substrate used as filter media depends on the target pollutants, and may consist of leaf compost, pleated fabric, activated charcoal, perlite, amended sand in combination with perlite, and zeolite. Two types of Media Filters are manufactured: Dry Media Filters, which are designed to dewater within 72 hours; and Wet Media Filters, which maintain a permanent pool of water as part of the treatment system.

Inspection & Maintenance

Maintenance in accordance with the manufacturer's requirements is necessary to ensure stormwater treatment. Inspection or maintenance of the concrete structure may require OSHA confined space training. Dry Media Filters are required to dewater in 72 hours, thus preventing mosquito and other insect breeding. Proper maintenance is essential to prevent clogging. Wet Media Filters require tight fitting seals to keep mosquitoes and other insects from entering and breeding in the permanent pools. Required maintenance includes routine inspection and treatment.

MAINTENANCE SCHEDULE: EXTENDED DRY DETENTION BASINS

Activity	Time of Year	Frequency
Inspect for standing water, trash, sediment and clogging	Per manufacturer's schedule	Bi-Annually (minimum)
Remove trash and debris	N/A	Each Inspection
Examine to determine if system drains in 72 hours	Spring, after large storm	Annually
Inspect filtering media for clogging	Per manufacturer's schedule	Per manufacturer's schedule

Sand and Organic Filters

Sand and organic filters, also known as filtration basins, are intended for quality control rather than quantity control. These filters improve water quality by removing pollutants through a filtering media and settling pollutants on top of the sand bed and/or in a pretreatment basin. Pretreatment is required to prevent filter media from clogging. Runoff from the filters is typically discharged to another BMP for additional treatment.

MAINTENANCE SCHEDULE: EXTENDED DRY DETENTION BASINS

Activity	Frequency
Inspect filters and remove debris	After every major storm for the first 3 months after construction completion. Every 6 months thereafter.

Wet Basins

Wet basins are intended to treat stormwater quality through the removal of sediments and soluble pollutants. A permanent pool of water allows sediments to settle and removes the soluble pollutants, including some metals and nutrients. Additional dry storage is required to control peak discharges during large storm events, and if properly designed and maintained wet basins can add fire protection, wildlife habitat and aesthetic values to a property.

Inspection & Maintenance

To ensure proper operation, wet basin outfalls should be inspected for evidence of clogging or excessive outfall releases. Potential problems to investigate include erosion within the basin and banks, damage to the emergency spillway, tree growth on the embankment, sediment accumulation around the outlet and the emergence of invasive species. Should any of these problems be encountered, perform repairs immediately. An on-site sediment disposal area will reduce sediment removal costs.

MAINTENANCE SCHEDULE: WET BASINS

Activity	Time of Year	Frequency
Inspect wet basins	Spring and/or Fall	Annually (Minimum)
Mow upper stage, side slopes, embankment and emergency spillway	Spring through Fall	Bi-Annually (Minimum)
Remove sediment, trash and debris	Spring through Fall	Bi-Annually (Minimum)
Remove sediment from basin	Year round	As required, but at least once every 10 years

Dry Wells

Dry wells are used to infiltrate uncontaminated runoff. These BMPs should never be used to infiltrate stormwater or runoff that has the potential to be contaminated with sediment and other pollutants. Dry wells provide groundwater recharge and can reduce the size and cost required of

downstream BMPs or storm drains. However, they are only applicable in drainage areas of less than one acre and may experience high failure rates due to clogging.

Inspection & Maintenance

Proper dry well function depends on regular inspection. Clogging has the potential to cause high failure rates. The water depth in the observation well should be measured at 24 and 48 hour intervals after a storm and the clearance rate calculated. The clearance rate is calculated by dividing the drop in water level (inches) by the time elapsed (hours).

MAINTENANCE SCHEDULE: DRY WELLS

Activity	Frequency
Inspect dry wells	After every major storm for the first 3 months after construction completion. Annually thereafter.

Infiltration Basins

Infiltration basins are designed to contain stormwater quantity and provide groundwater recharge. Pollution prevention and pretreatment are required to ensure that contaminated stormwater is not infiltrated. Infiltration basins reduce local flooding and preserve the natural water balance of the site, however high failure rates often occur due to improper siting, inadequate pretreatment, poor design and lack of maintenance.

Inspection & Maintenance

Regular maintenance is required to prevent clogging, which results in infiltration basin failure. Clogging may be due to upland sediment erosion, excessive soil compaction or low spots. Inspections should include signs of differential settlement, cracking, erosion, leakage in the embankments, tree growth on the embankments, riprap condition, sediment accumulation and turf health.

MAINTENANCE SCHEDULE: INFILTRATION BASINS

Activity	Time of Year	Frequency
Preventative maintenance	Spring and Fall	Bi-Annually
Inspection	Spring and Fall	After every major storm for the first 3 months after construction completion. Bi-annually thereafter and discharges through the high outlet orifice.
Mow/rake buffer area, side slopes and basin bottom	Spring and Fall	Bi-Annually
Remove trash, debris and organic matter	Spring and Fall	Bi-Annually

Attachments

Inspection of Bioretention Areas/Rain Gardens

ENVIRONMENTAL PARTNERS

STANDARD OPERATING PROCEDURE 3:

OIL/WATER SEPARATOR (OWS) MAINTENANCE

Oil/water separators (OWS), also known as gas/oil separators, are structural devices intended to provide pretreatment of floor drain water from industrial and garage facilities. An OWS allows oils (and substances lighter than water) to be intercepted and be removed for disposal before entering the sanitary sewer system. Substances heavier than water settle into sludge at the bottom of the unit. The remaining water passes through the unit into the sanitary sewer system.

General OWS Maintenance Requirements

OWS units are generally required where petroleum-based products, wastes containing petroleum, or oily and/or flammable materials are used, produced, or stored. OWS units should not be used to manage stormwater or flow from vehicle washing facilities. High flow rates through an OWS will reduce the structure's ability to separate materials. Detergents and solvents can emulsify oil and grease, allowing the particles to enter the sewer, so these should not be disposed of in drains entering the OWS.

1. Each OWS at a facility may receive different materials in different quantities, so the cleanout schedule may not be the same for every OWS at a facility.
2. Employees performing inspections of an OWS must be properly trained and be familiar with the maintenance of that specific structure, since function can vary based on design. Third-party firms may be utilized to perform quarterly inspections.
3. Do not drain petroleum, oil, or lubricants directly to an OWS. The structures are designed to manage these materials at low and medium concentrations in sanitary sewage, not as slug loads.
4. Do not drain antifreeze, degreasers, detergents, fuels, alcohols, solvents, coolant, or paint to the OWS.
5. Separator compartment covers should be tightly sealed to ensure floor drainage only enters the first compartment of the OWS.
6. Drains should be kept free of debris and sediment to the maximum extent practicable.

7. Spill cleanup materials should be maintained in the area served by the OWS. For more information on spill cleanup and response materials, refer to SOP 4, "Spill Response and Cleanup Procedures".

OWS Inspection Procedures

Daily inspection of an OWS should include a visual examination of the area served by the OWS for evidence of spills or leaks.

Weekly inspections of an OWS should include the following:
Catch basin inspection and cleaning procedures include the following:

1. Visually examine the area served by the OWS for evidence of spills or leaks.
2. Inspect the point of discharge (i.e., sewer manhole) for evidence of petroleum bypassing the OWS.
3. Inspect drains for any signs of unauthorized substances entering the OWS.
4. Examine the OWS for signs of leaks or any malfunction.

Quarterly inspections of an OWS should include the following:

1. Complete tasks noted as appropriate for daily and weekly inspection.
2. Complete the Quarterly OWS Inspection Checklist, attached, during the inspection.
3. Take the following measurements to benchmark function of the OWS:
    A. Distance from rim of access cover to bottom of structure
    B. Distance from rim of access cover to top of sludge layer
    C. Depth of sludge layer (C = A – B)
    D. Distance from rim of access cover to the oil/water interface
    E. Distance from rim of access cover to the top of the liquid surface
    F. Depth of oil layer (F = D – E)

OWS Cleaning Procedures

Cleaning of the OWS is required when there has been a spill to the OWS that exceeds ten gallons of oil, one gallon of detergent or solvent, or any material prohibited by the owner of the sanitary sewer. Cleaning is also required when the levels of accumulated sludge and/or oil meet the manufacturer's recommended levels for cleaning. This will vary based on the manufacturer of the OWS. If the manufacturer's recommendations are unknown, the following guidelines are appropriate for determining when to clean:

1. When sludge accumulates to 25% of the wetted height of the separator compartment; or
2. When oil accumulates to 5% of the wetted height of the separator compartment; or
3. When 75% of the retention capacity of the OWS is filled.

Cleaning should be performed a minimum of once per year. When cleaning is required, it shall be performed by licensed OWS maintenance companies. Materials removed from the OWS must be disposed of in accordance with Massachusetts Hazardous Waste Regulations, 310 CMR 30.00.

Documentation of Cleaning and Service

The operator of the premises where the OWS is located shall maintain a log describing the date and type of all inspections, service and maintenance performed in connection with the Separator. Documentation shall include the identity of the inspector (or the identity of the person or entity that performed the service and/or maintenance). Records shall also document the amount of residue removed from the OWS each time it was cleaned, and how removed materials were disposed. This documentation shall be maintained for a minimum of six years.

Attachments

Quarterly OWS Inspection Checklist

ENVIRONMENTAL PARTNERS

STANDARD OPERATING PROCEDURE 4:

MANAGEMENT OF SAND AND DEICING CHEMICALS AT DPW FACILITIES

Purpose

To ensure that sand and deicing chemicals are managed consistent with environmental regulations.

Responsibility

It is the responsibility of the Highway Division General Foreman to report leaks in sheds/tanks and other problems to the Director of Operations. It is the Highway Division's General Foreman's responsibility to ensure that spilled deicing chemicals are cleaned up and put back to the storage area within 48 hours.

The Director of Operations is responsible for ensuring regular inspections of the sand and deicing chemical storage areas during regular inspections.

Policy

Deicing chemicals (i.e. salt, calcium chloride, etc.) shall be stored in storage sheds or tanks in a manner that minimizes the potential for runoff. All deicing chemicals shall be covered when not in use. Sand piles shall be bermed to minimize runoff. During handling, sand and salt which fall outside of the storage areas will be swept back to the storage areas within 48 hours of the activity, to minimize runoff.

During regular inspections, the sand and deicing chemical storage areas shall be inspected by the DPW Highway Division General Foreman or designee to ensure that runoff is minimized. All findings during an inspection shall be sent to the DPW Director of Operations.

STANDARD OPERATING PROCEDURE 5:

THE HANDLING AND STORAGE OF STREET SWEEPINGS

Purpose

To provide guidance on the handling and storage of street sweepings.

Street sweepings are defined as sand and soil generated during the routine cleaning of roadways. Street sweepings may also contain leaves and other miscellaneous solid waste. Street sweepings do not include the material swept from the road surface that has resulted from hazardous materials spills or material cleaned from other roadway structures such as catch basins or other drainage structures.

This policy does cover sweepings collected by DPW contractors. DPW contractors are fully responsible for the reuse and/or disposal of sweepings according to Department of Environmental Protection (DEP) policy. Under no circumstances are private contractors allowed to store sweepings on DPW property.

Responsibility

It is responsibility of the DPW Highway Division General Foreman and his designee (DPW Loader Operator) to ensure that sweepings are handled in compliance with this policy and other applicable state and federal regulations.

Policy

This policy is based upon the DEP Policy #94.092 “Reuse and Disposal of Street Sweepings.” The DEP policy is attached and must be followed as part of this policy.

Street Sweepings are to be stored in a labeled accumulation area at the DPW Yard that ensures the prevention of dust, erosion, and off-site migration. This is generally accomplished by marking the perimeter of the stockpile of Sweepings with signage and linked jersey barriers/berms, and locating the stockpile in an area where the grades do not allow for the off-site migration of stormwater from the stockpile.

The sweepings must not be stored within the 100-foot Buffer Zone of a Wetland, within a Wetland Resource Area or within the 200 foot Riverfront Area.

Sweepings collected from urbanized areas (non-residential areas) should be stockpiled separately from sweepings collected from other areas. These two types of street sweepings should be stored in separate accumulation areas so that non-urbanized sweepings can be more easily reused. Storage of street sweepings is temporary. Street sweepings should not be stored for longer than one year.

Street Sweeping Reuse and Disposal

As indicated in the DEP policy, there are options for reuse that require no analytical testing or DEP oversight. Options for reuse (construction fill, compost additive, reapplication, etc.) will be evaluated on a case by case basis by the DPW Director of Operations

Disposal of street sweepings as solid waste or as cover material is allowed at permitted solid waste landfills.

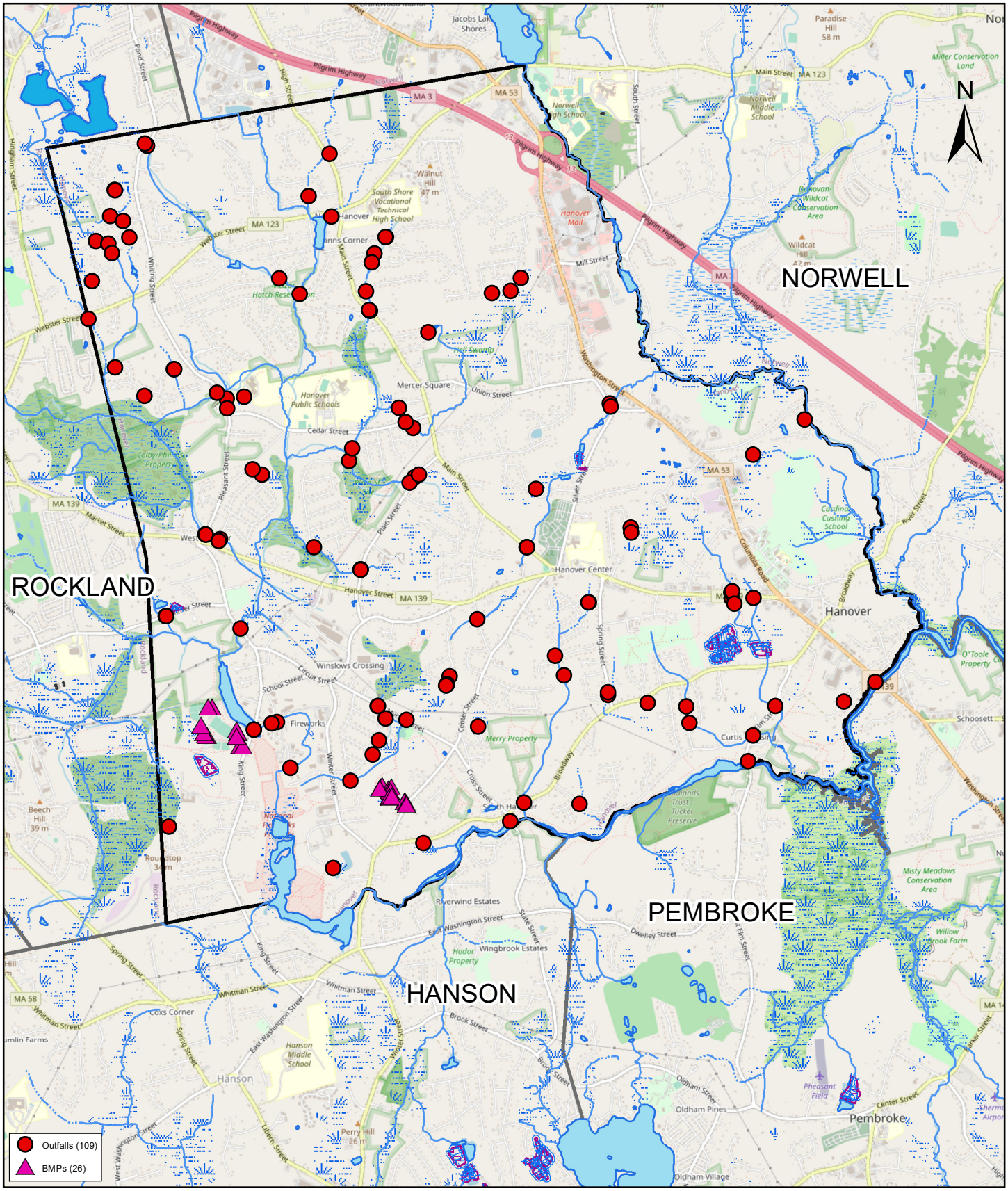
Street sweepings collected from urban areas must have analytical testing conducted before reuse. If testing is required for disposal or reuse, each stockpile of sweepings must be tested (1 sample/1000 cubic yards).

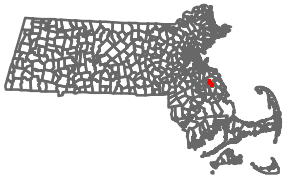
Attachments

DEP Policy #94.092 “Reuse and Disposal of Street Sweepings”

APPENDIX F

Stormwater Infrastructure Map





Appendix F. Stormwater System
Hanover, Massachusetts

ENVIRONMENTAL PARTNERS

APPENDIX G

Street and Parking Lot Sweeping Map

ENVIRONMENTAL PARTNERS

Street Sweeping Log

Date_____ Precipitation in the last three days? Yes ☐ No ☐

Weather Today: _____ Temperature:_____

Supervisor/Crew Leader: _____

Street Swept (Name)	Miles	Potential Sources of Pollution	Comments
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	
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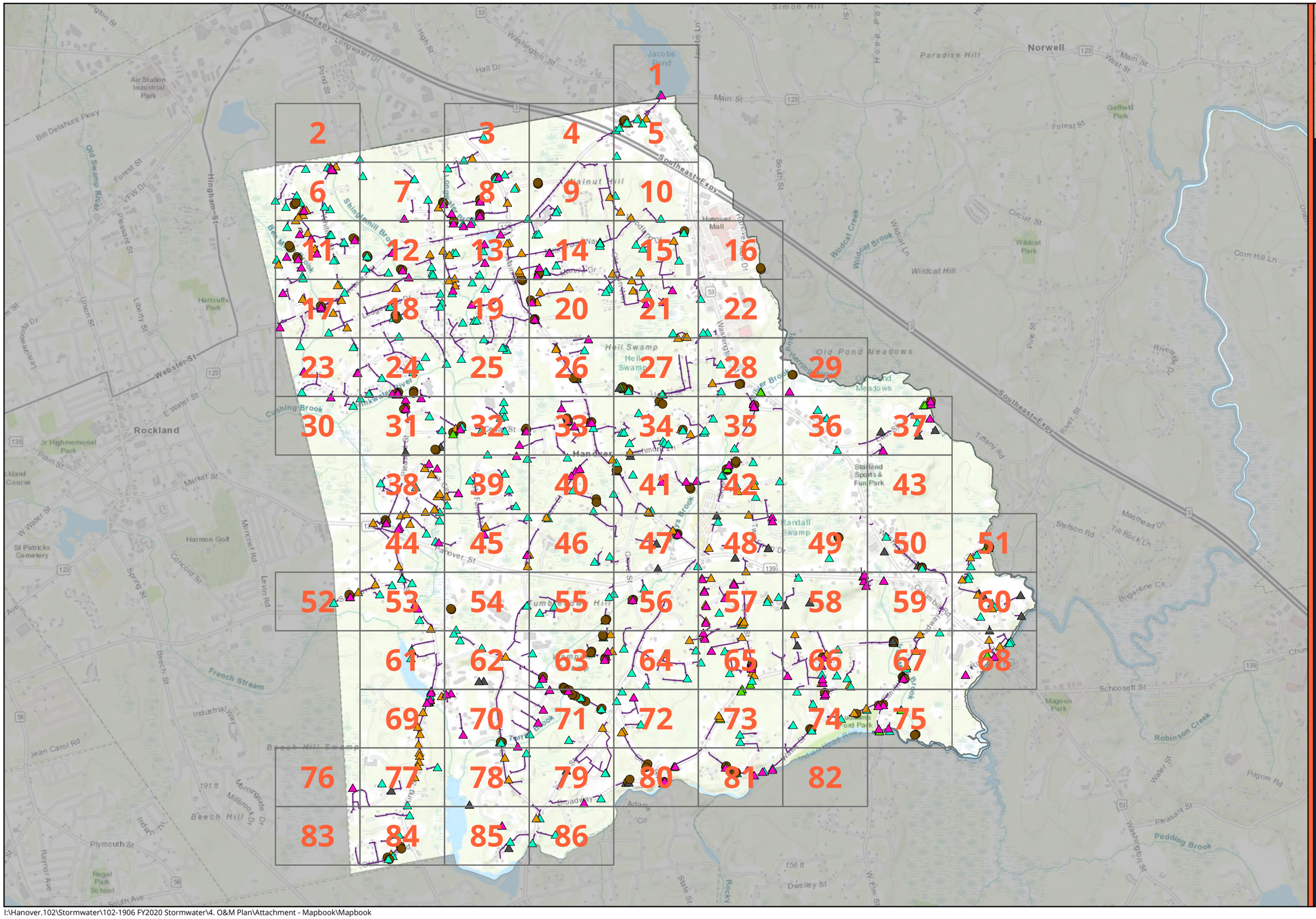
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____ Other	
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	
		____None ____Material Storage ____Construction Activity ____Equipment Storage ____Erosion ____Other	

Total Sediment Accumulated from Route (estimated based on truck loads)_____cubic yards

Total Sediment Accumulated from Route (if weighed) _____tons

ATTATCHMENT 1

Town of Hanover Mapbook



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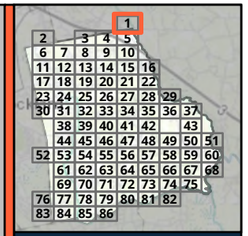


Stormwater System

Hanover, Massachusetts

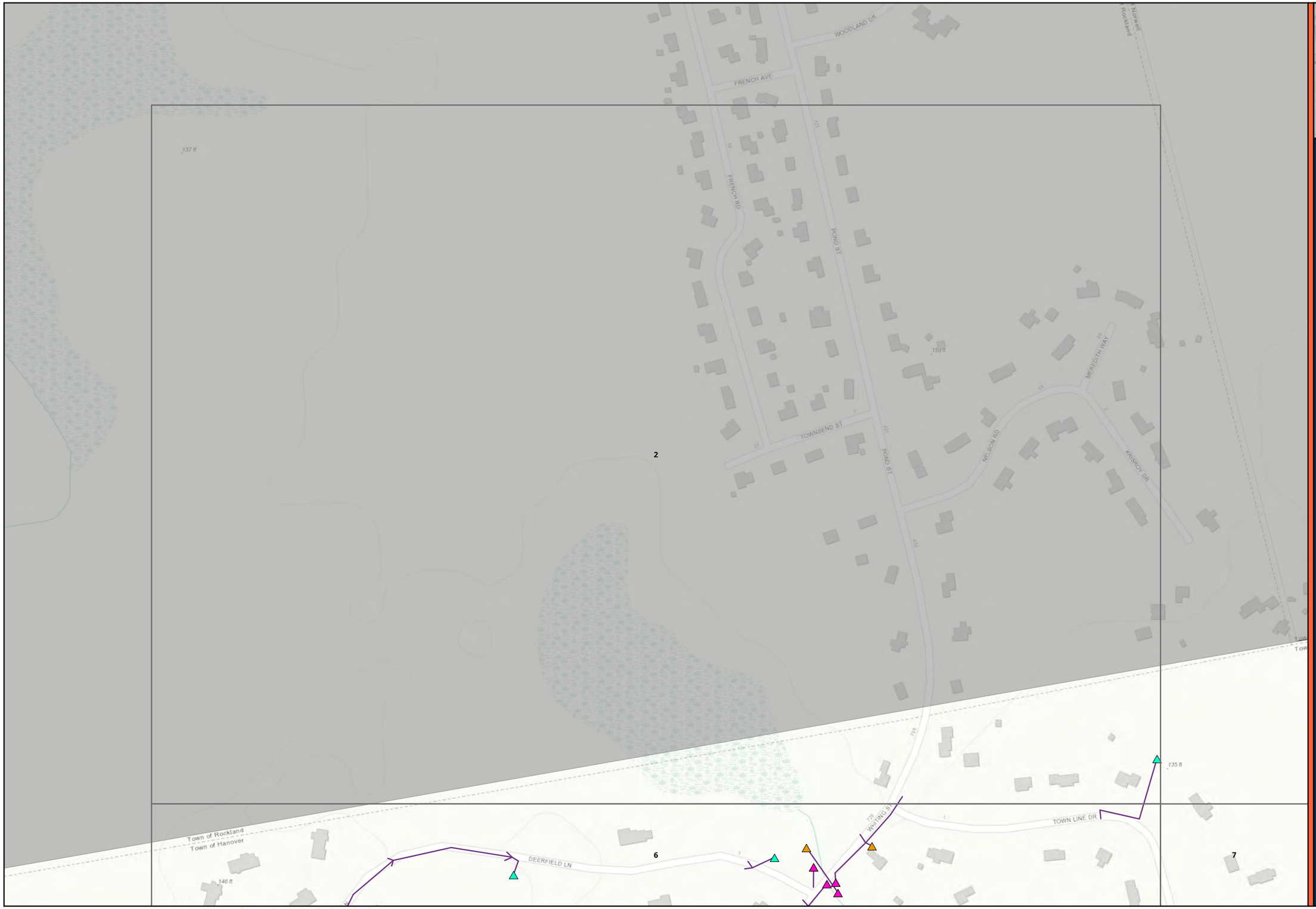
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

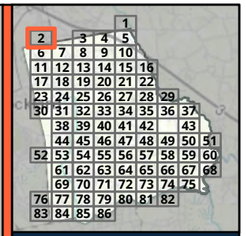
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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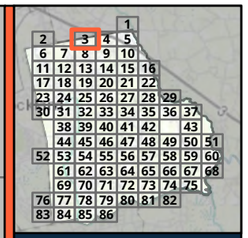

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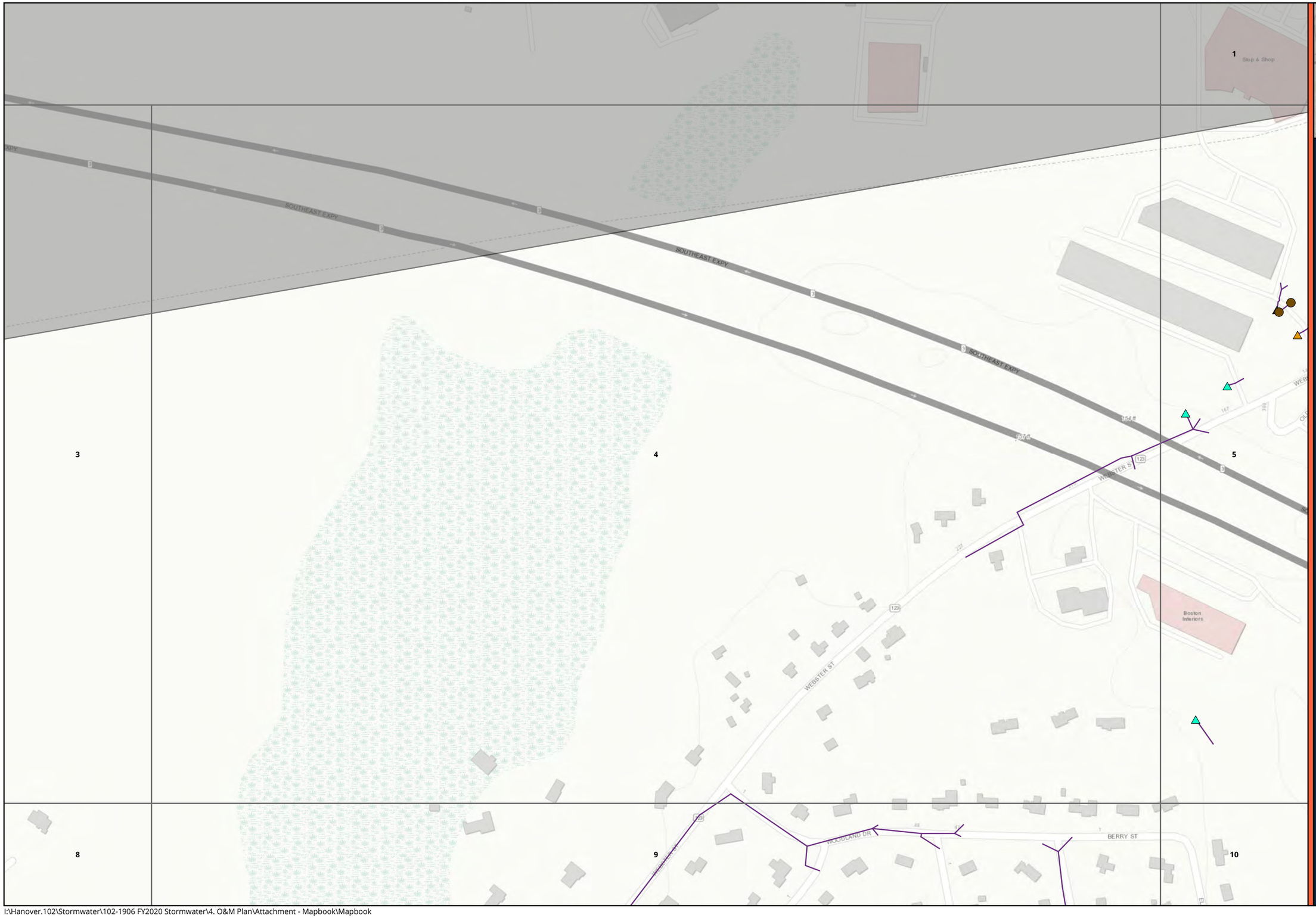

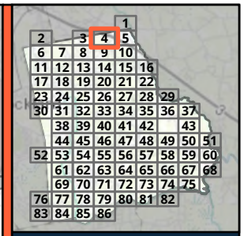

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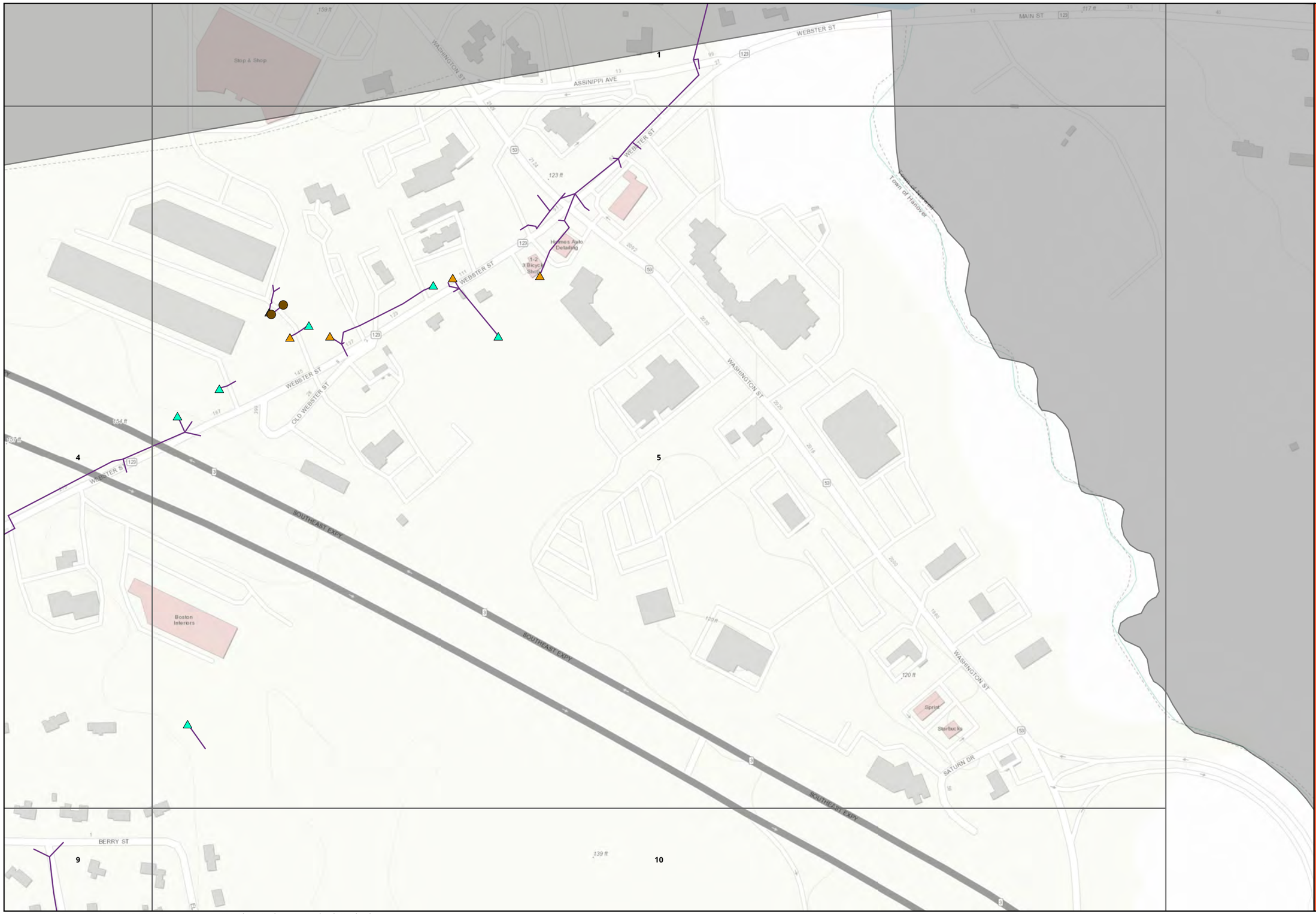
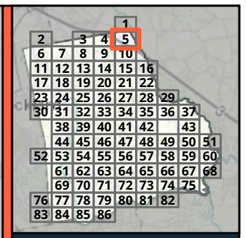
ENVIRONMENTAL PARTNERS





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ENVIRONMENTAL PARTNERS

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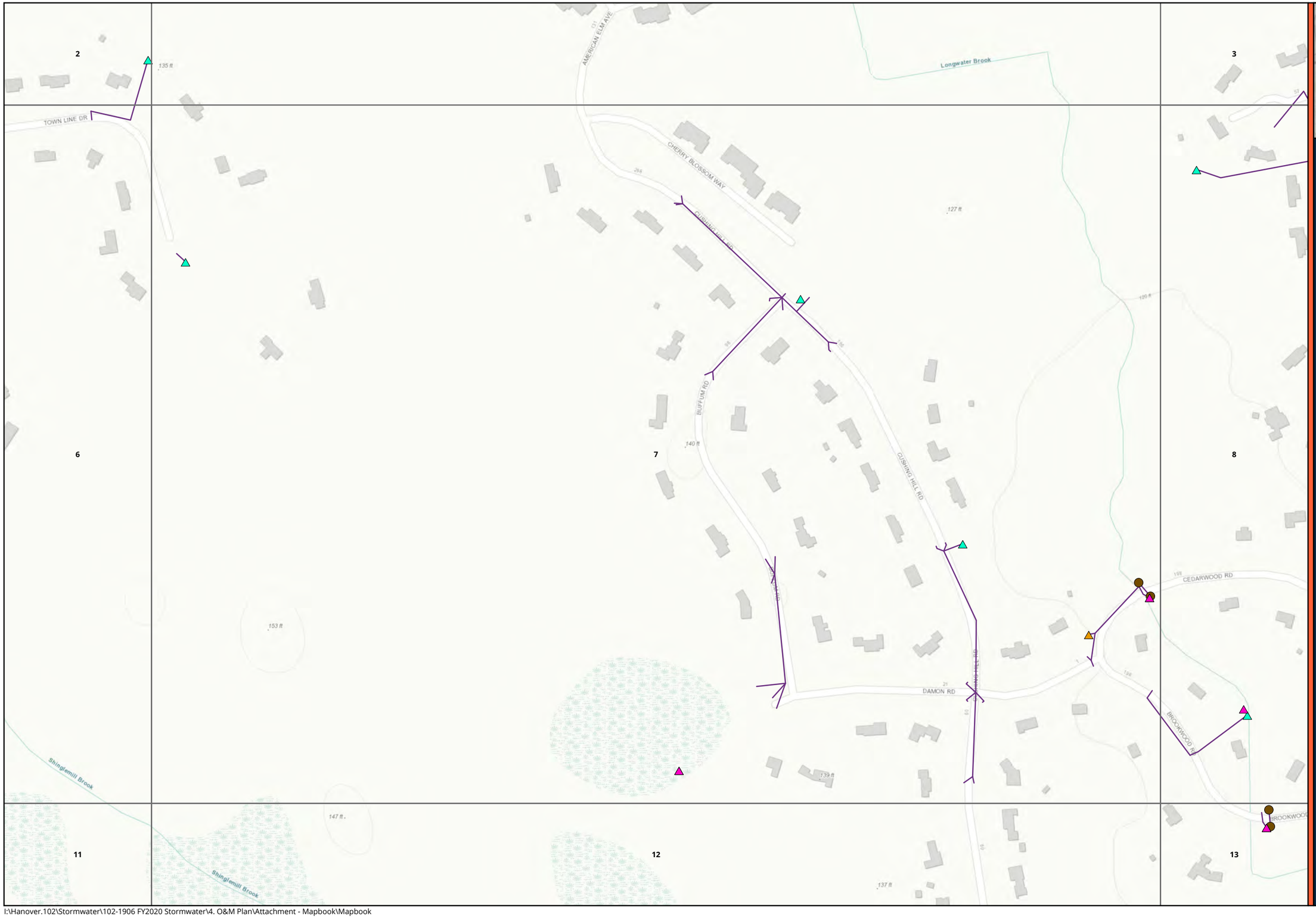

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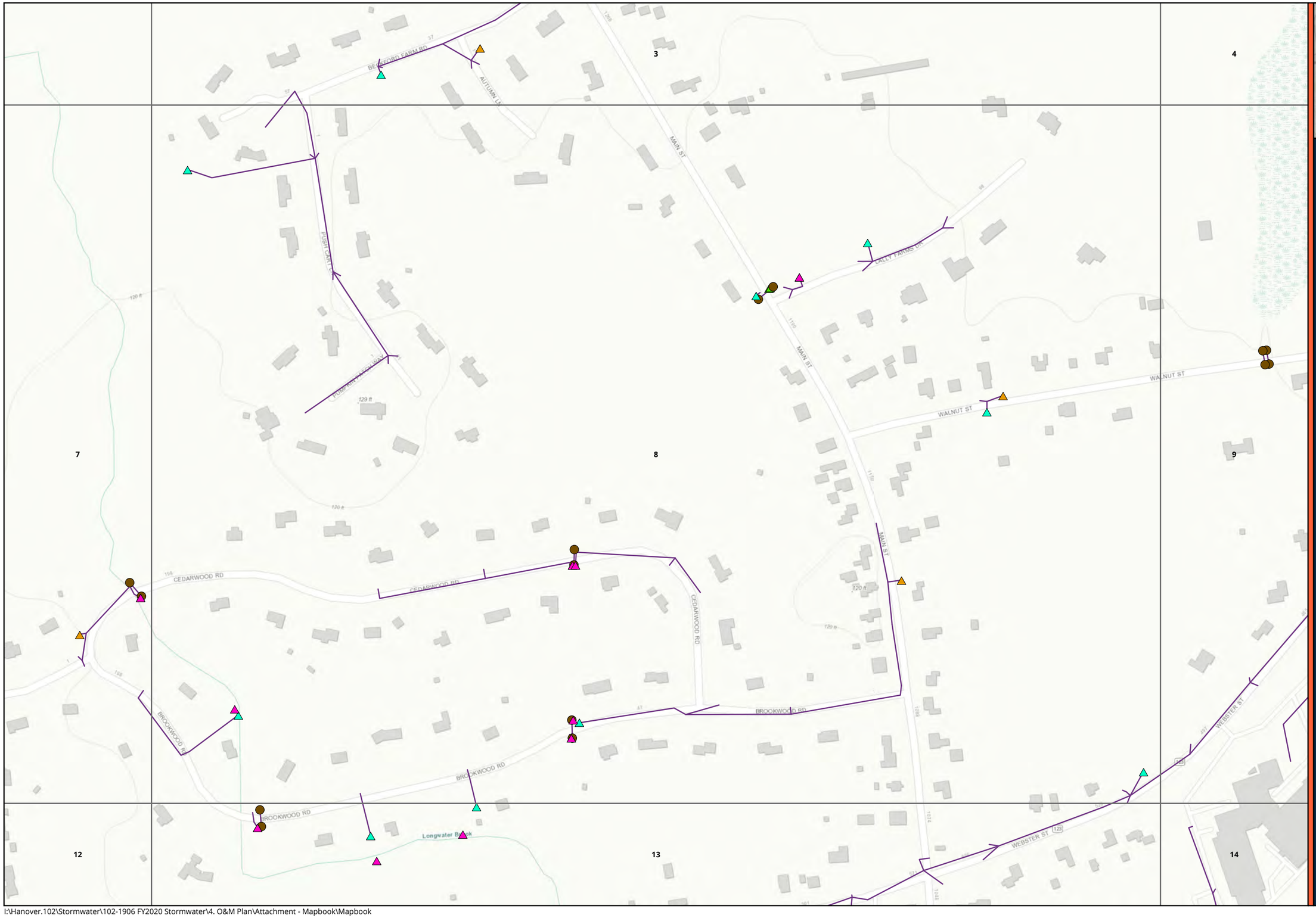

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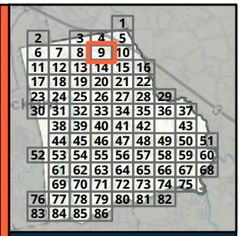

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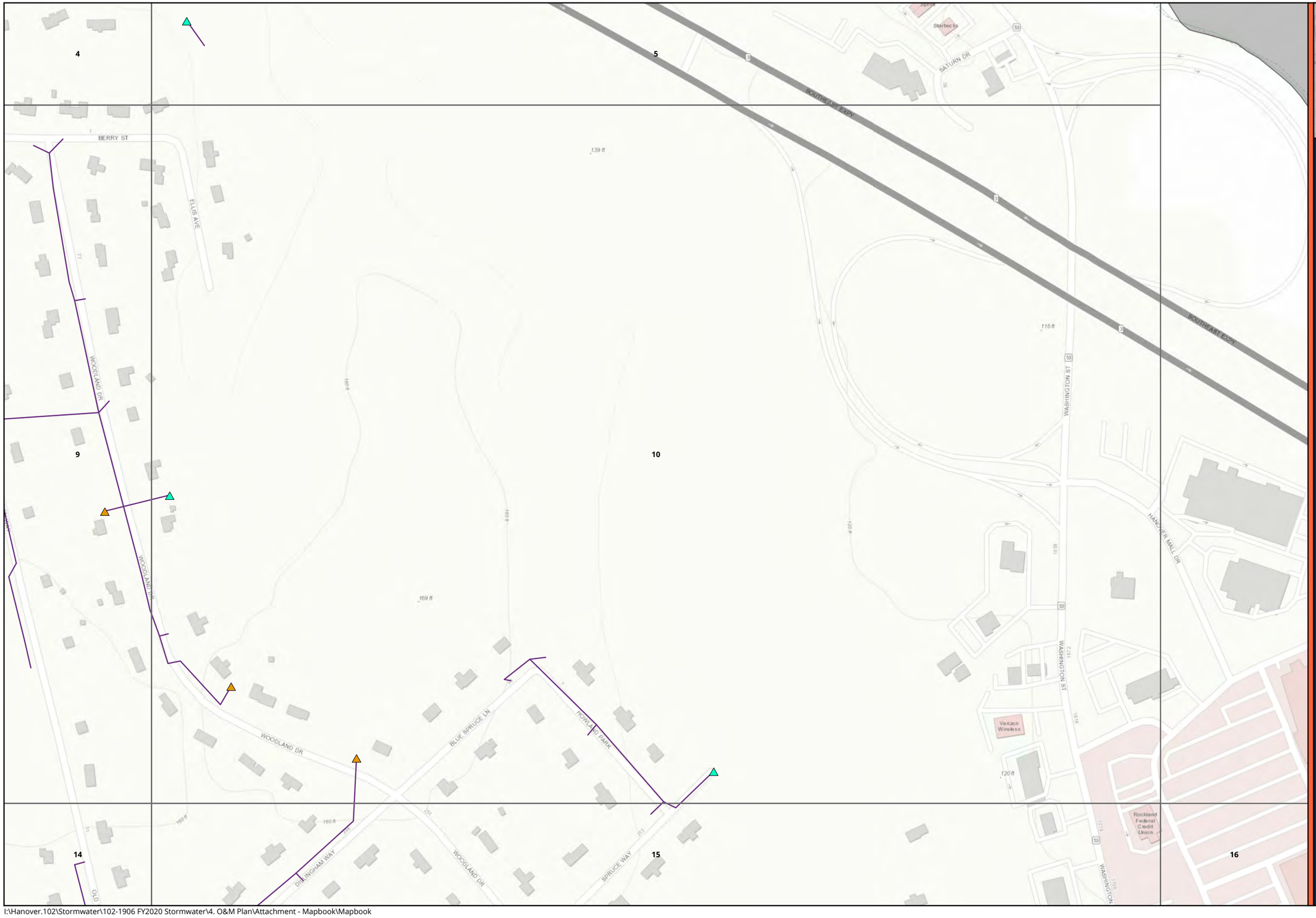

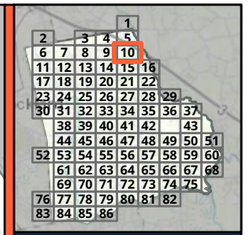

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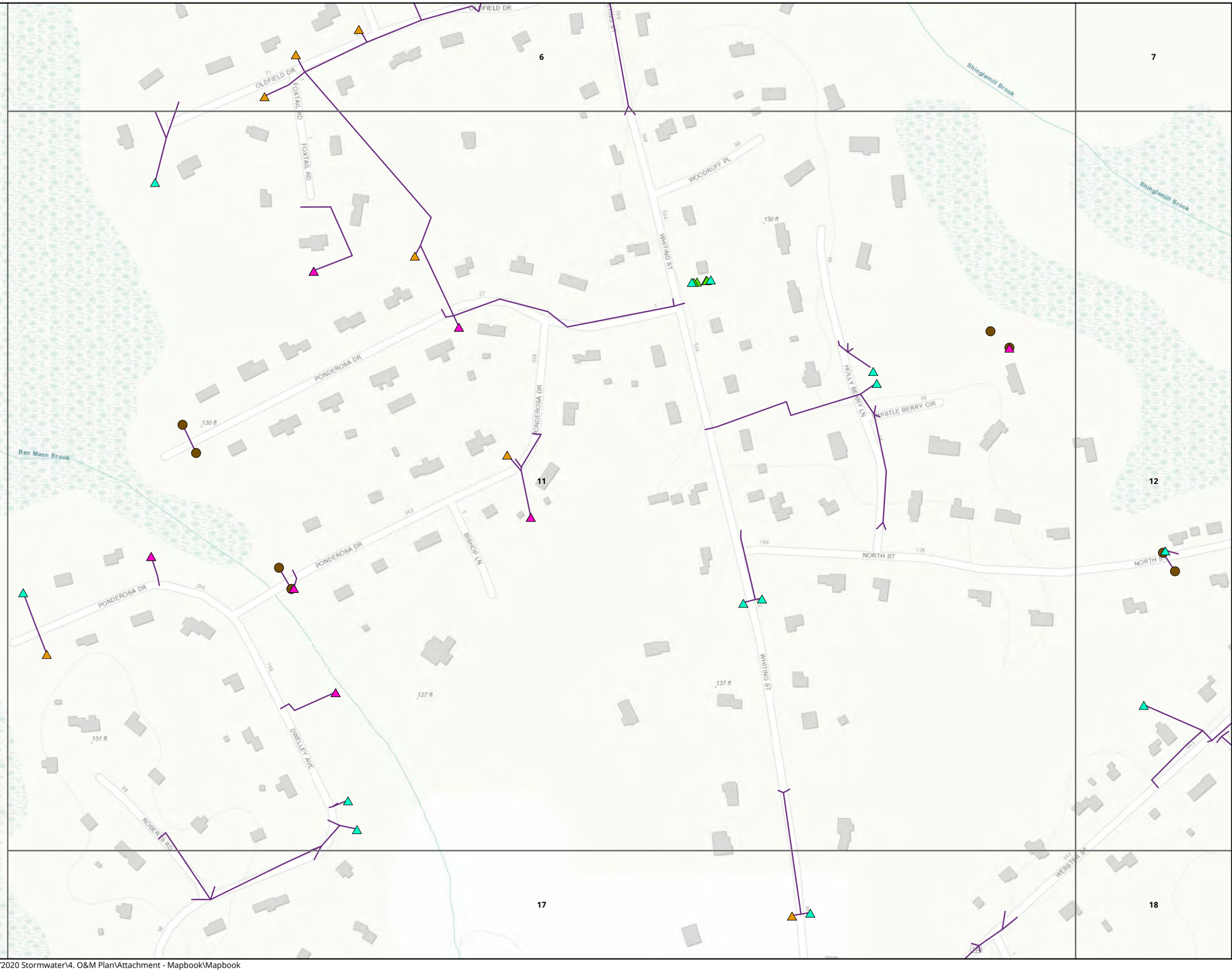

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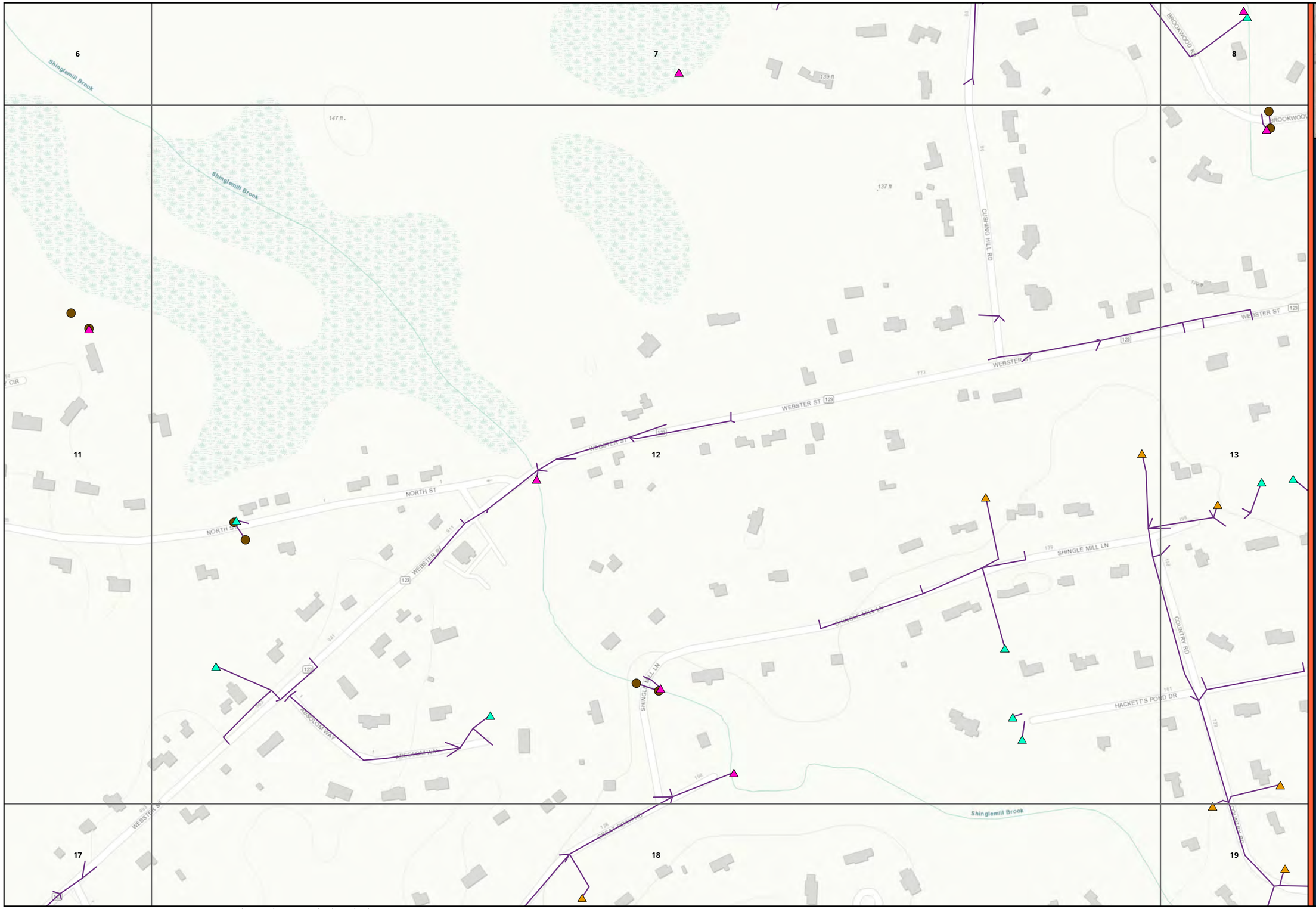

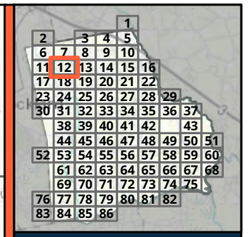

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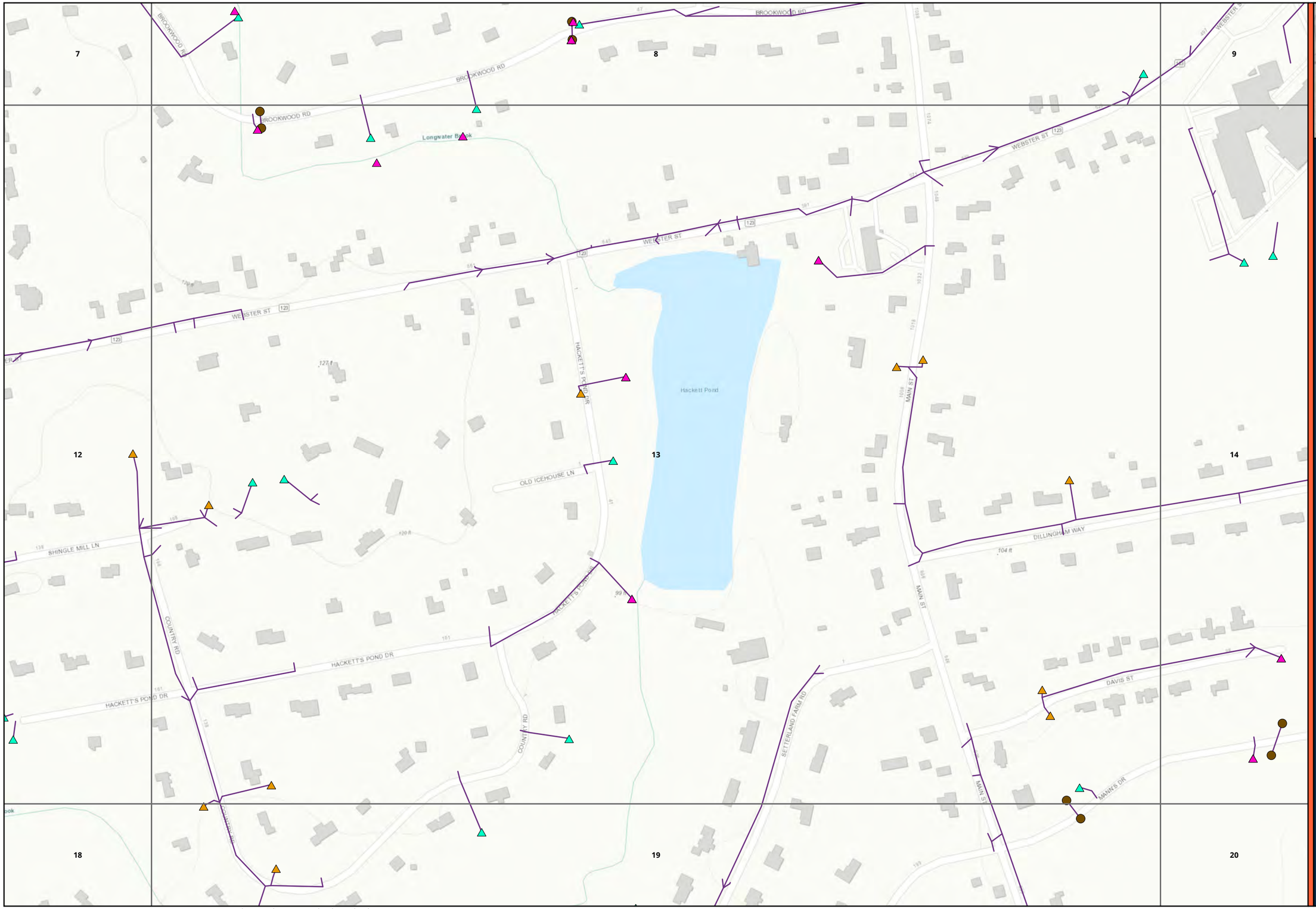

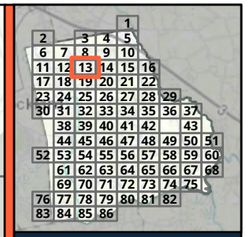

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ENVIRONMENTAL PARTNERS

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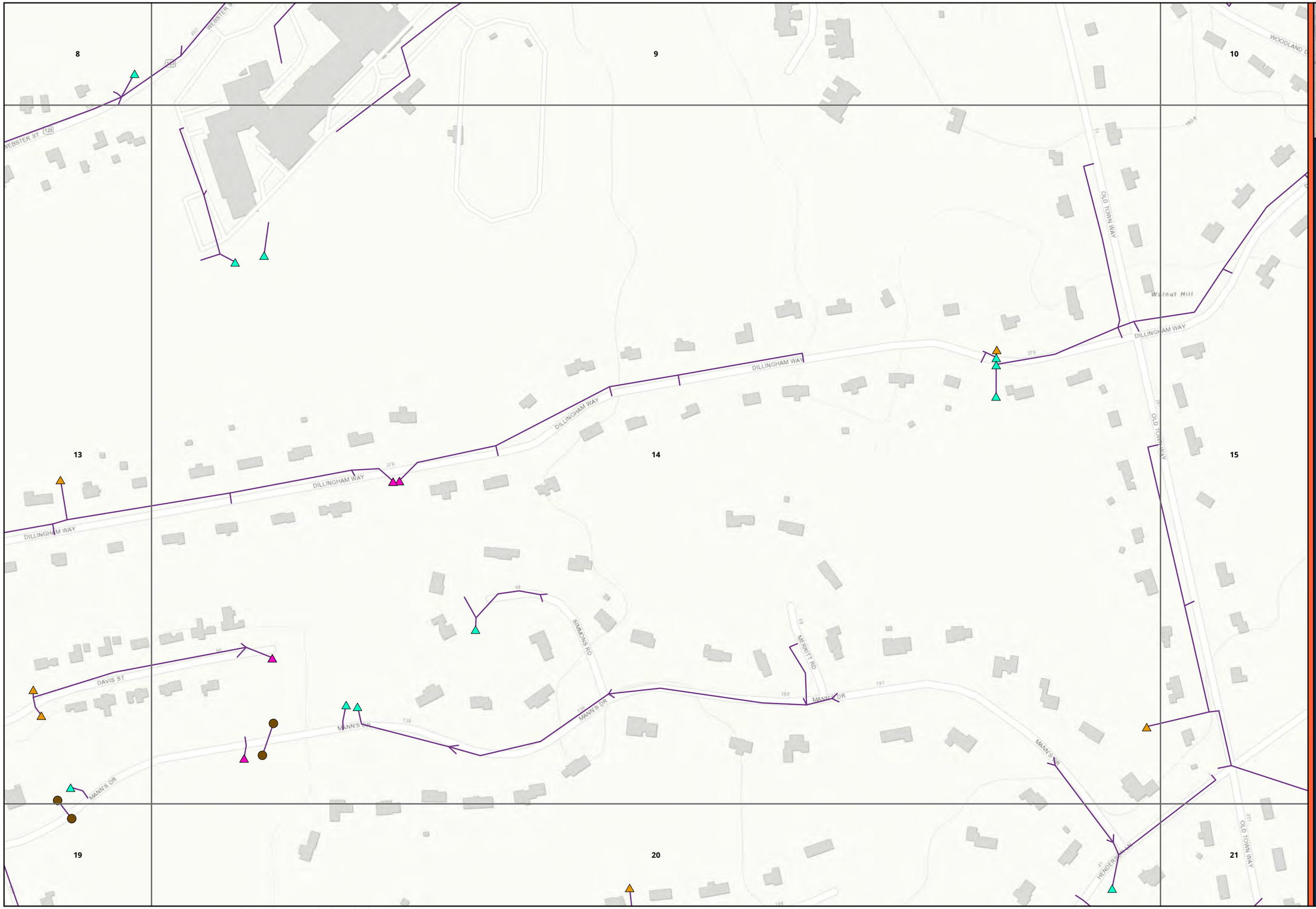

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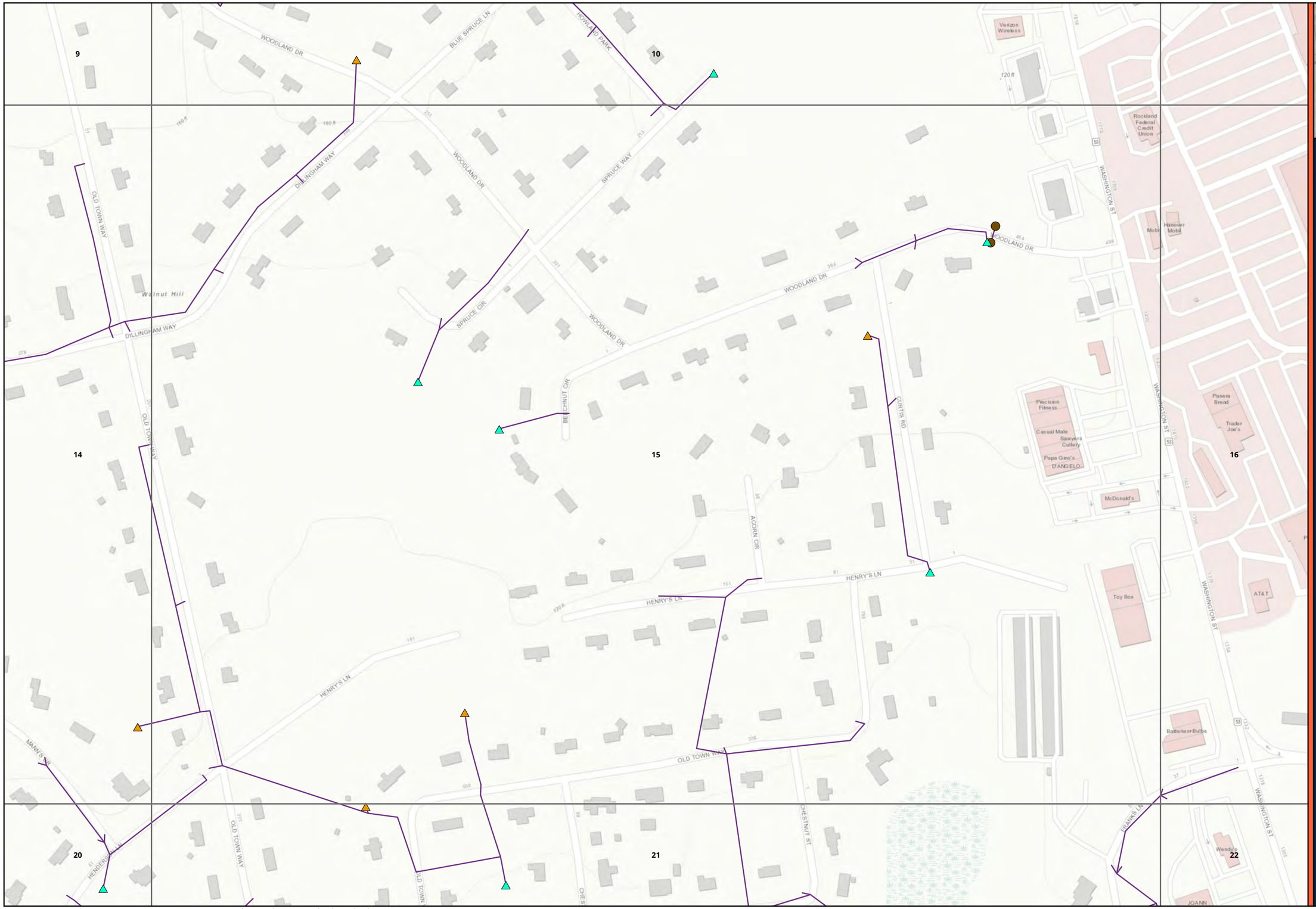
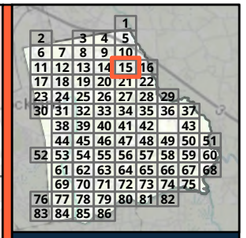
ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

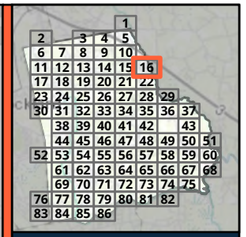
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS



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Stormwater System

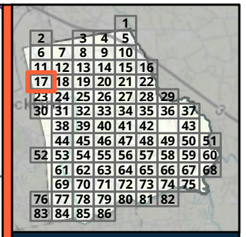
Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250
Feet

ENVIRONMENTAL PARTNERS



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Stormwater System

Hanover, Massachusetts

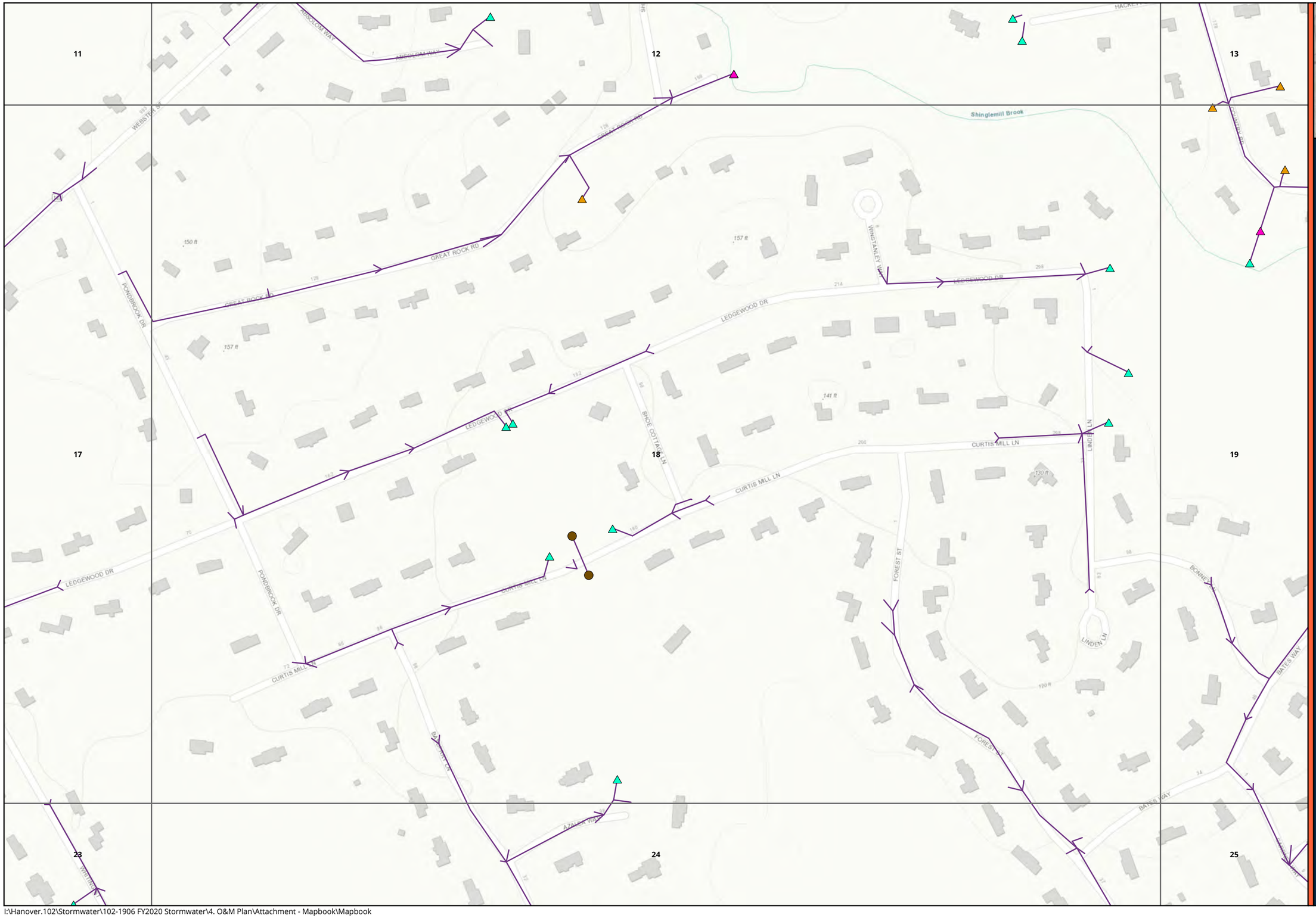
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

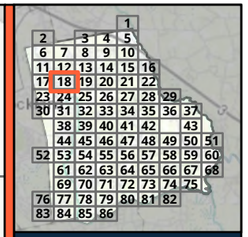
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
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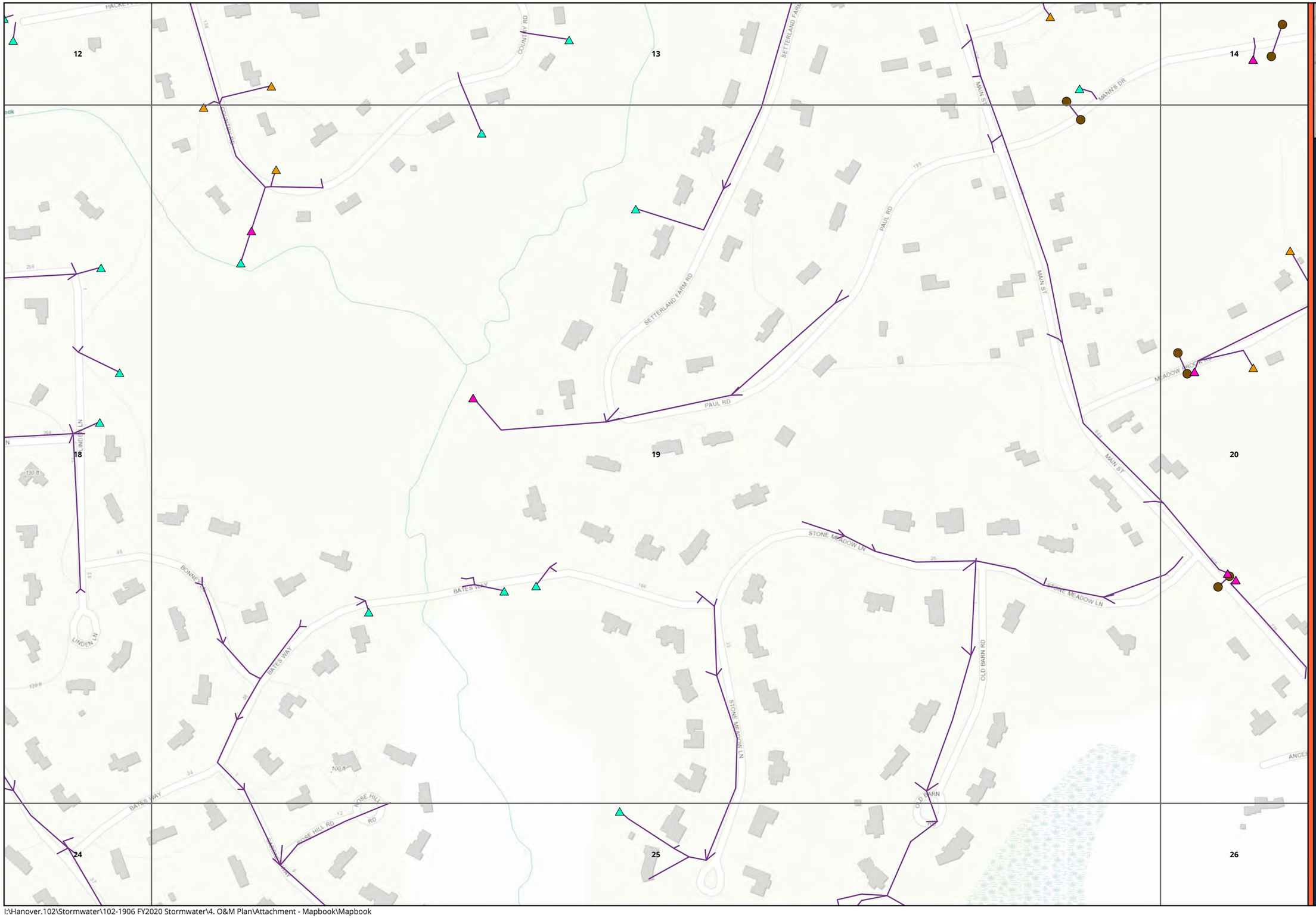
- Drain Pipe

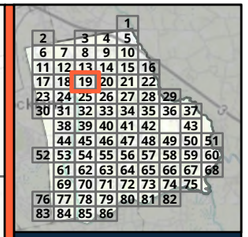
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

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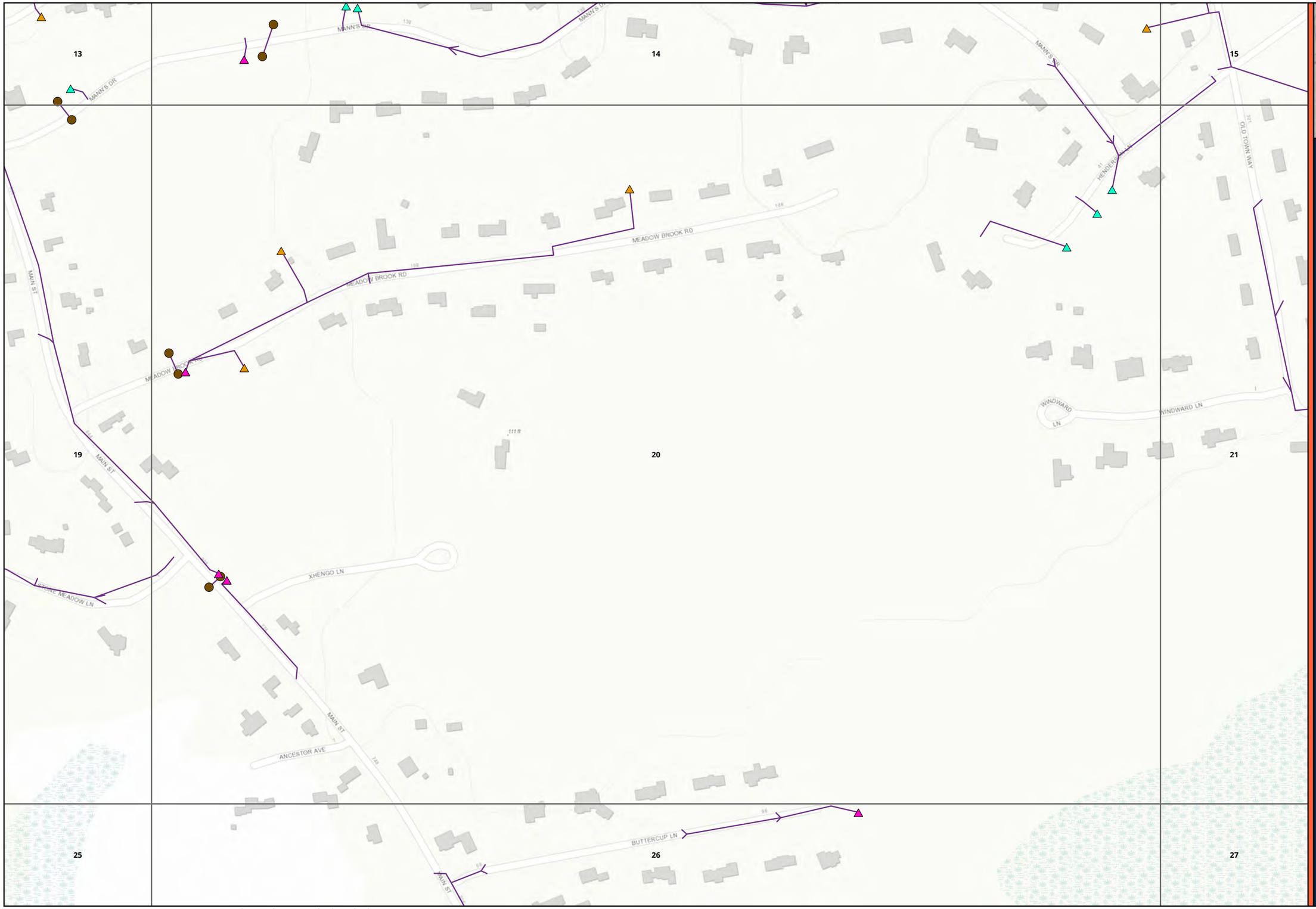
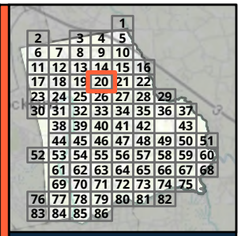
Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

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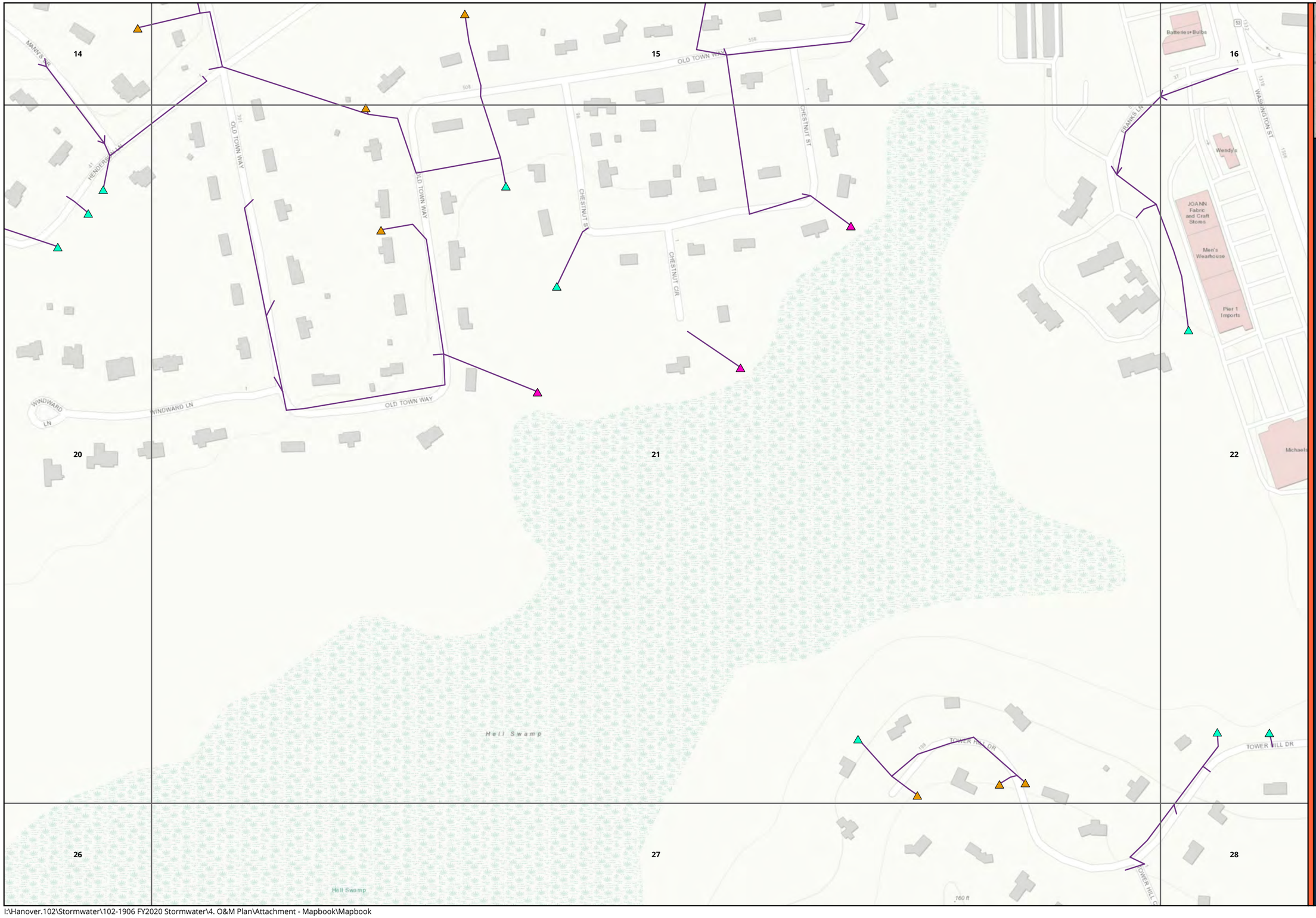
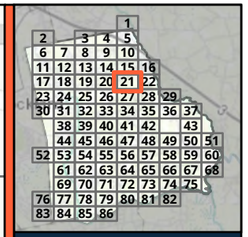
N

0 125 250 Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

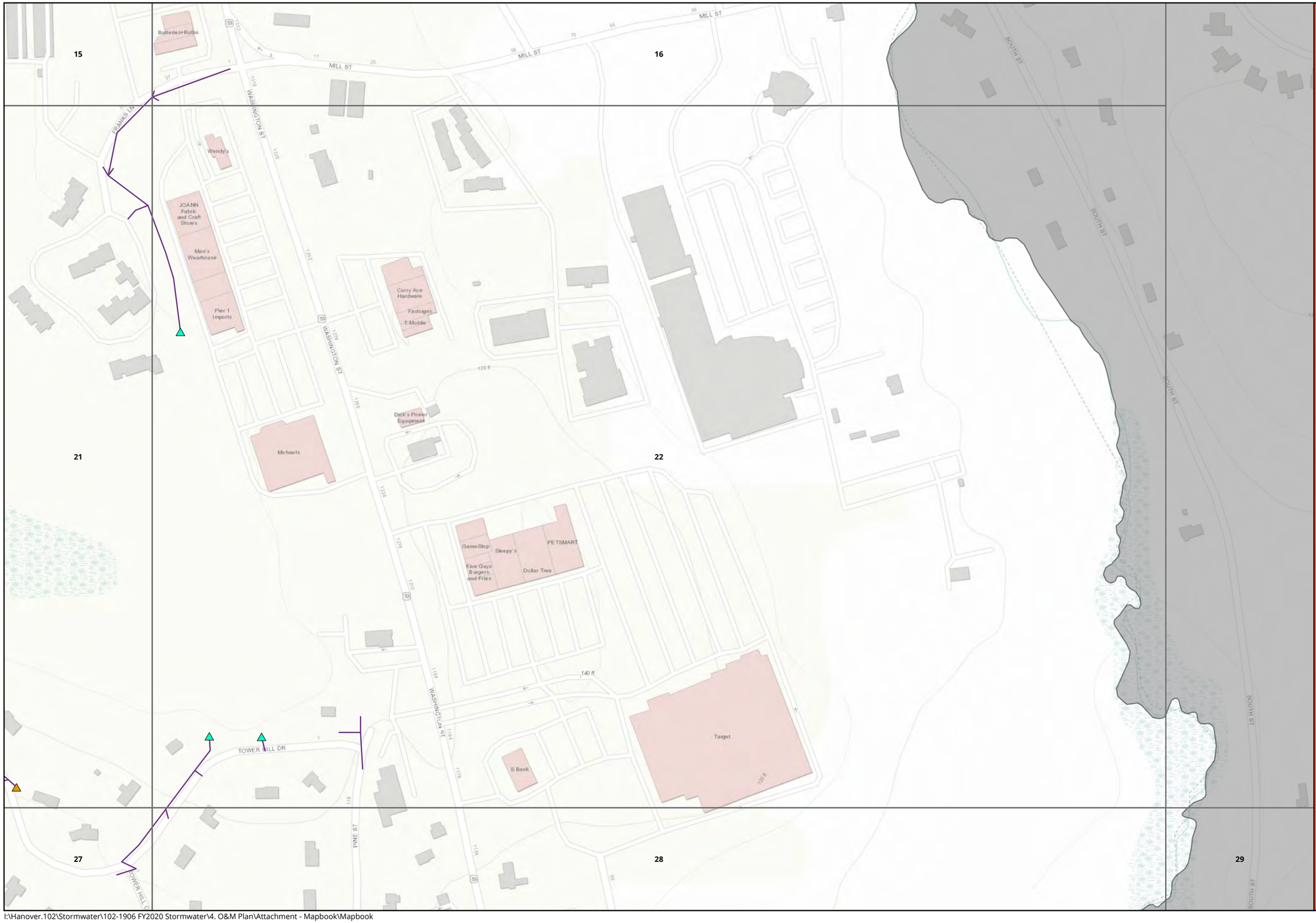
Hanover, Massachusetts

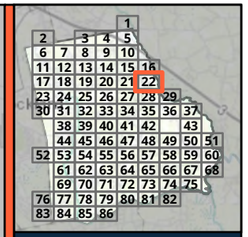
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250
Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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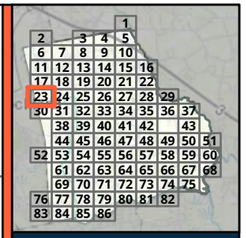

Stormwater System

Hanover, Massachusetts

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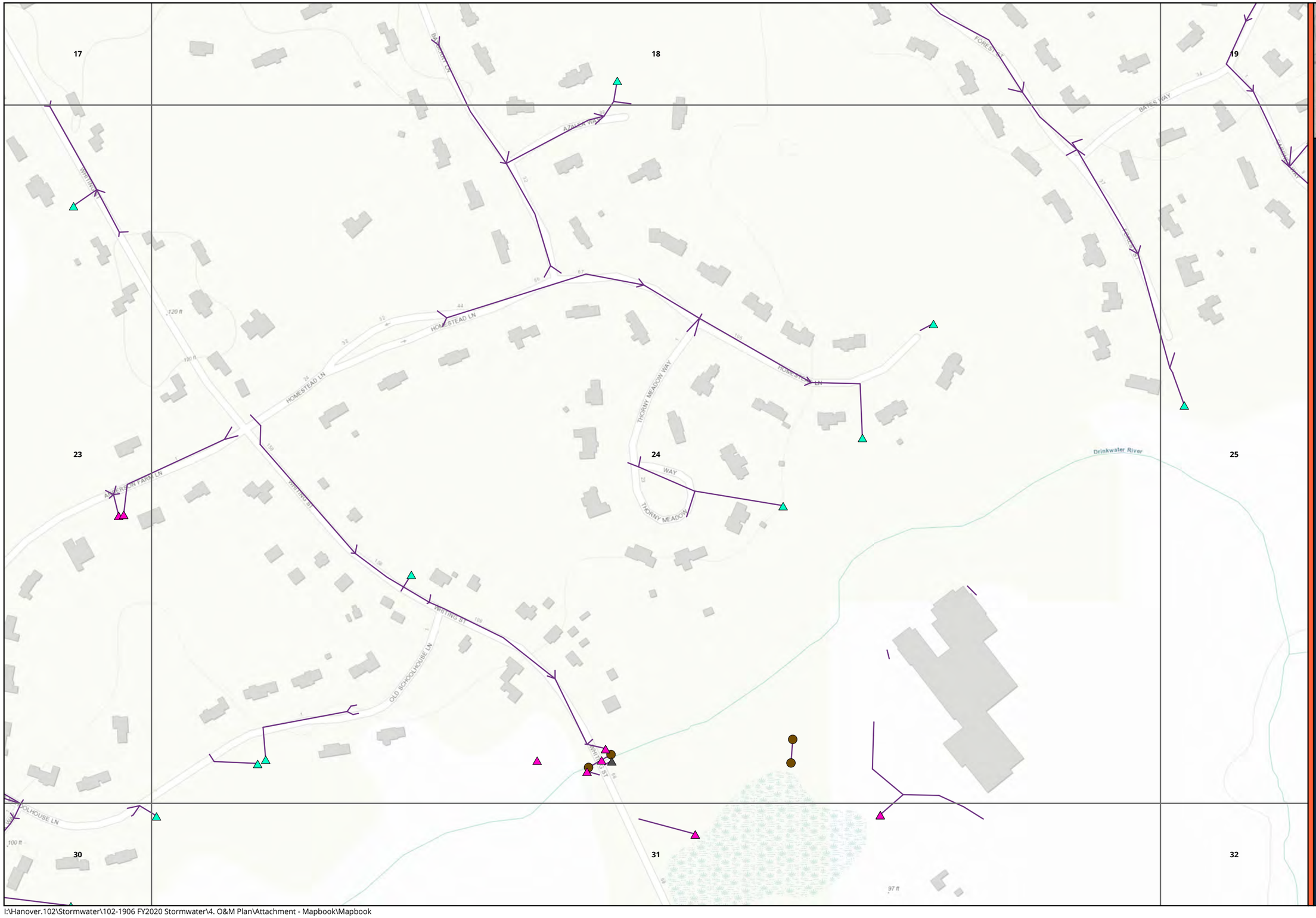
- Drain Pipe

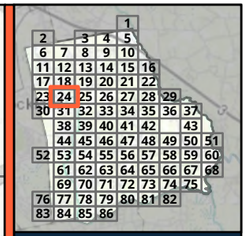
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

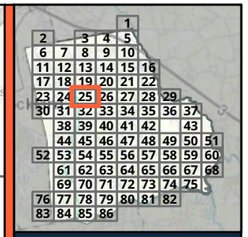
Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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Stormwater System

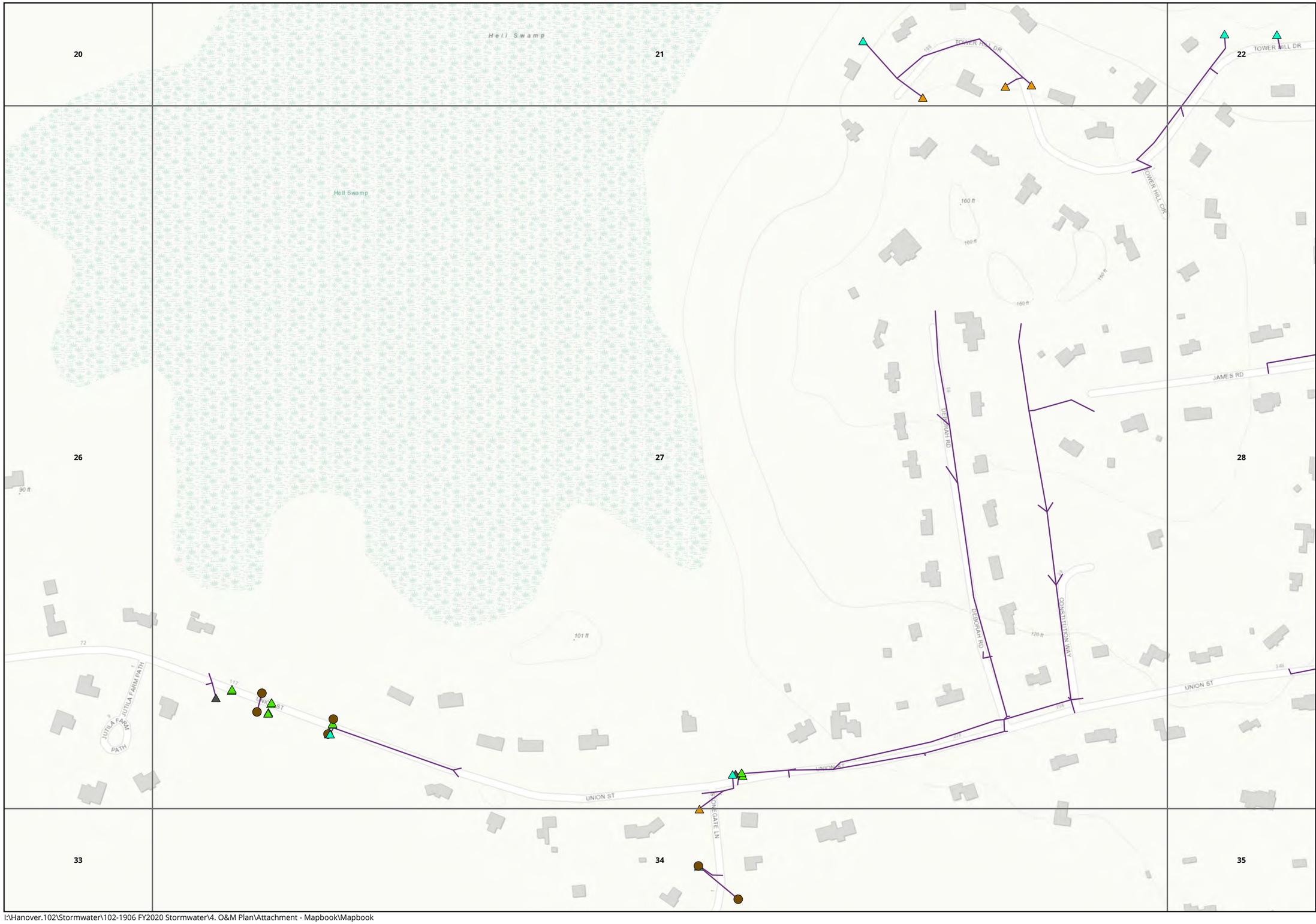
Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



Stormwater System

Hanover, Massachusetts

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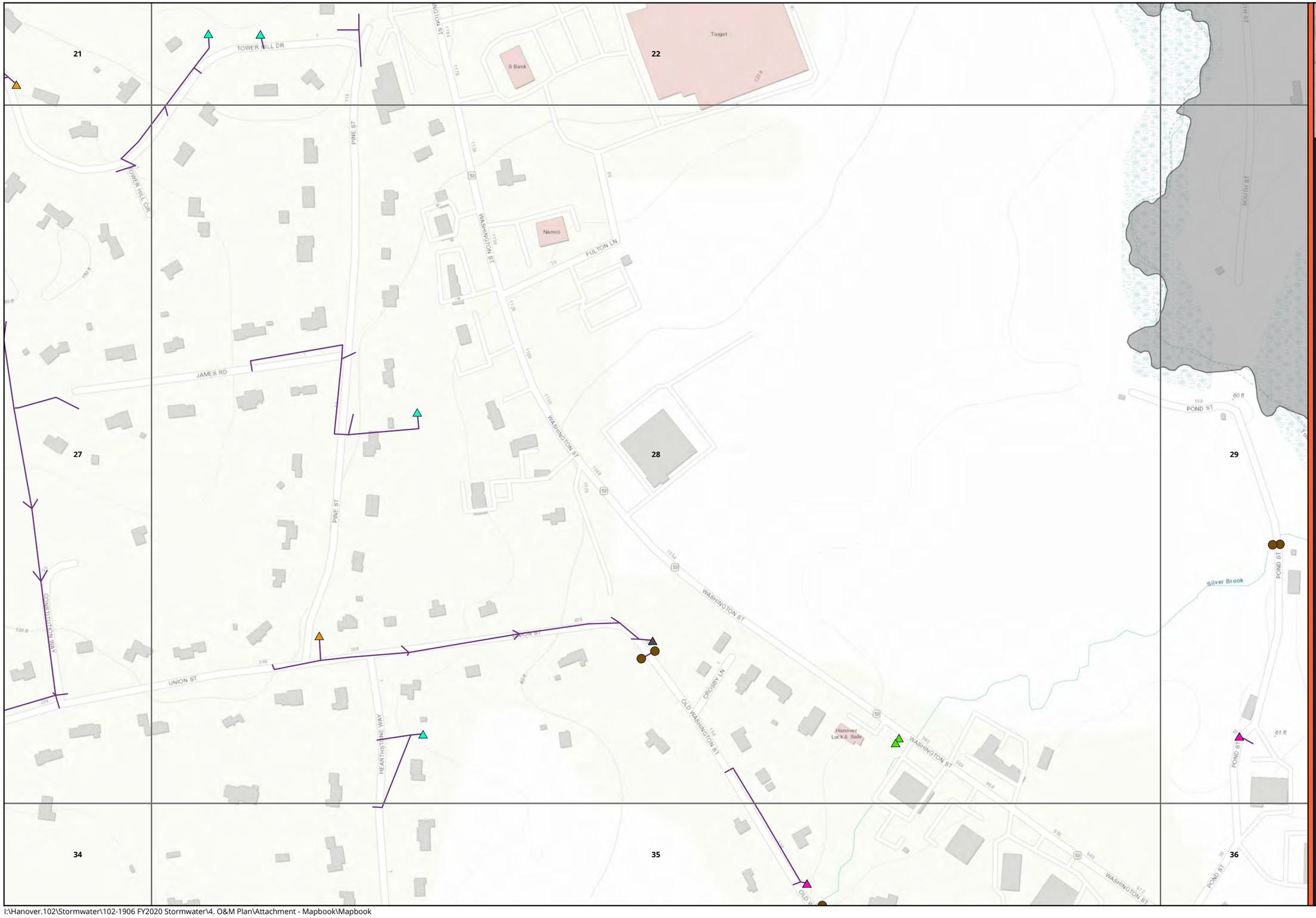
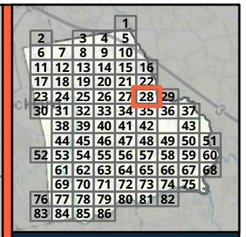
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

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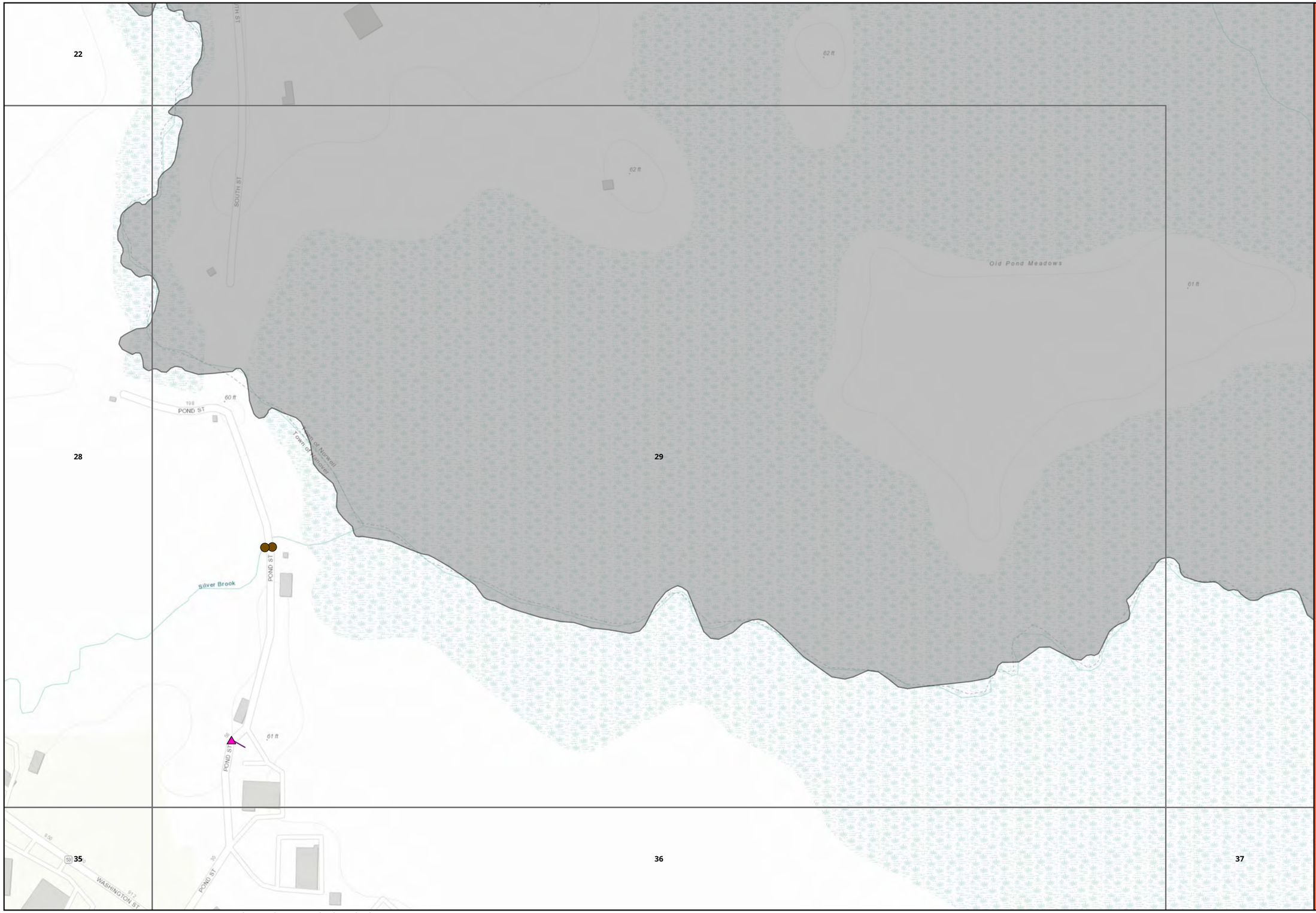
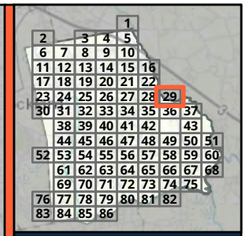
N

0 125 250 Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
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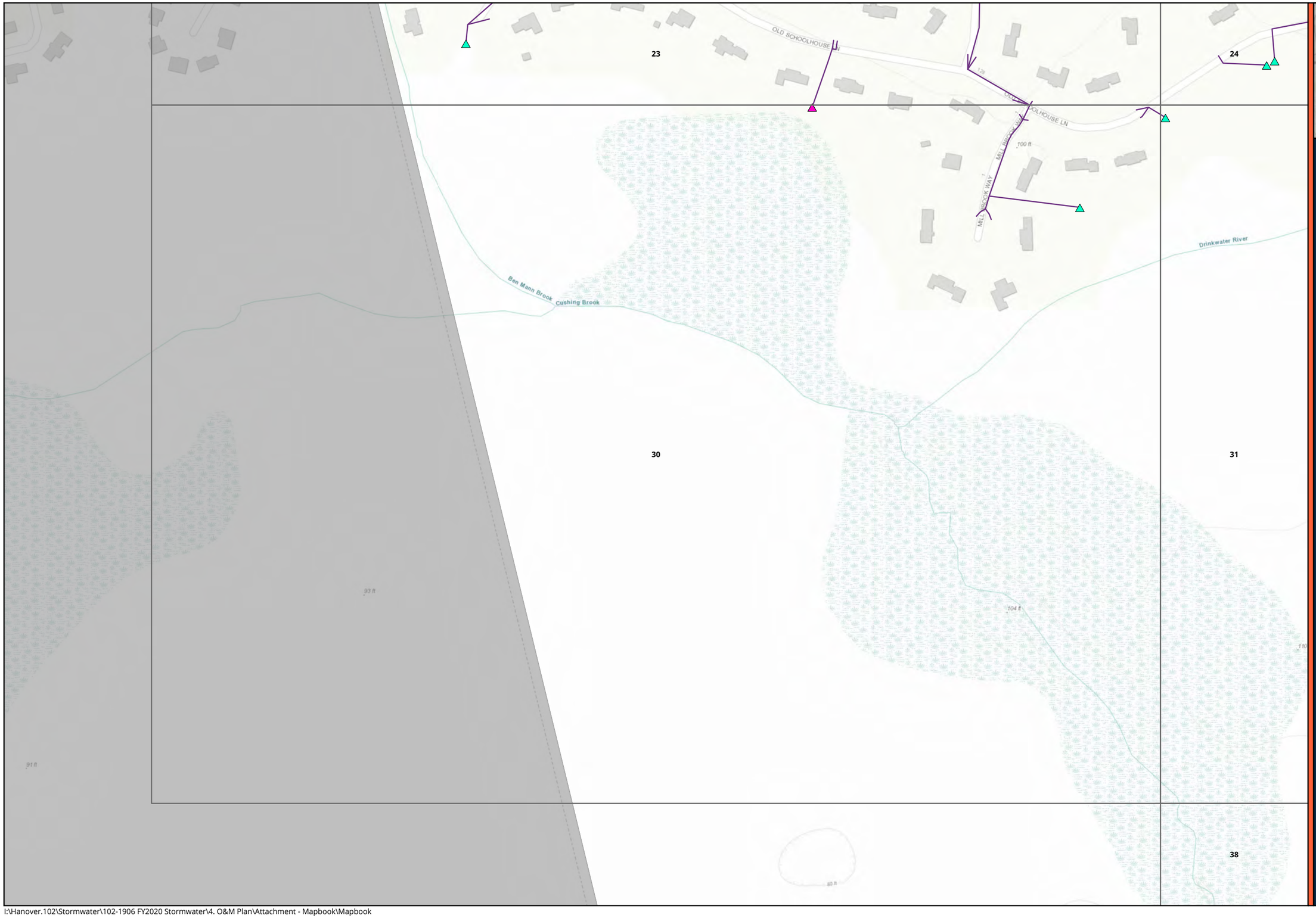
- Drain Pipe

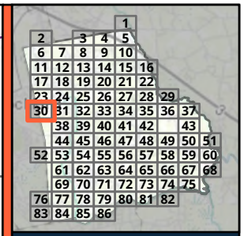
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
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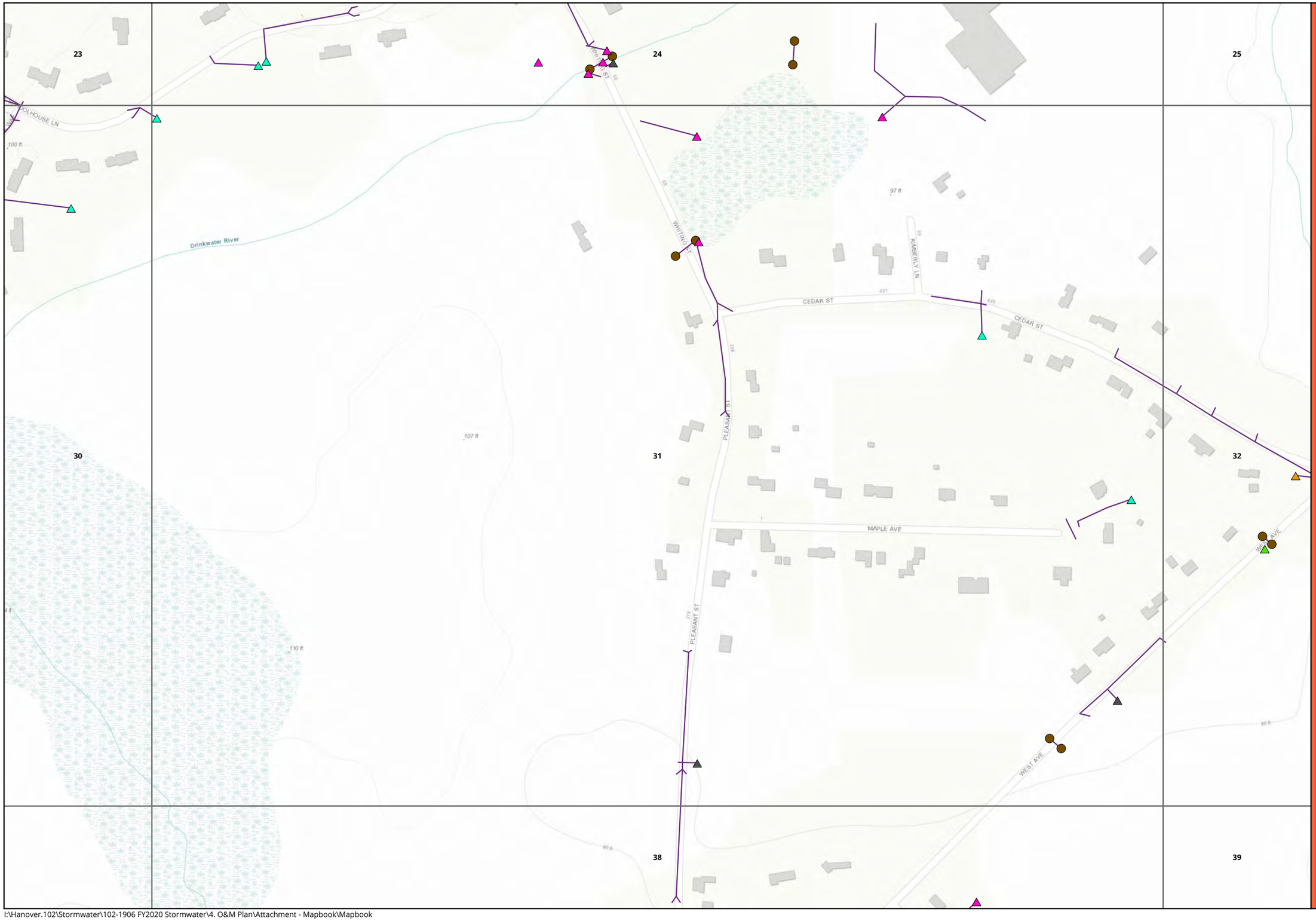
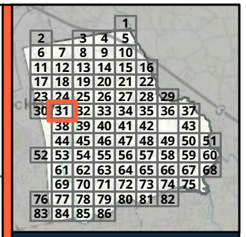
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
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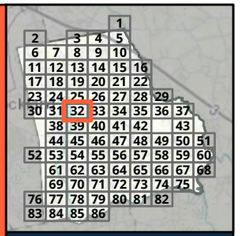
N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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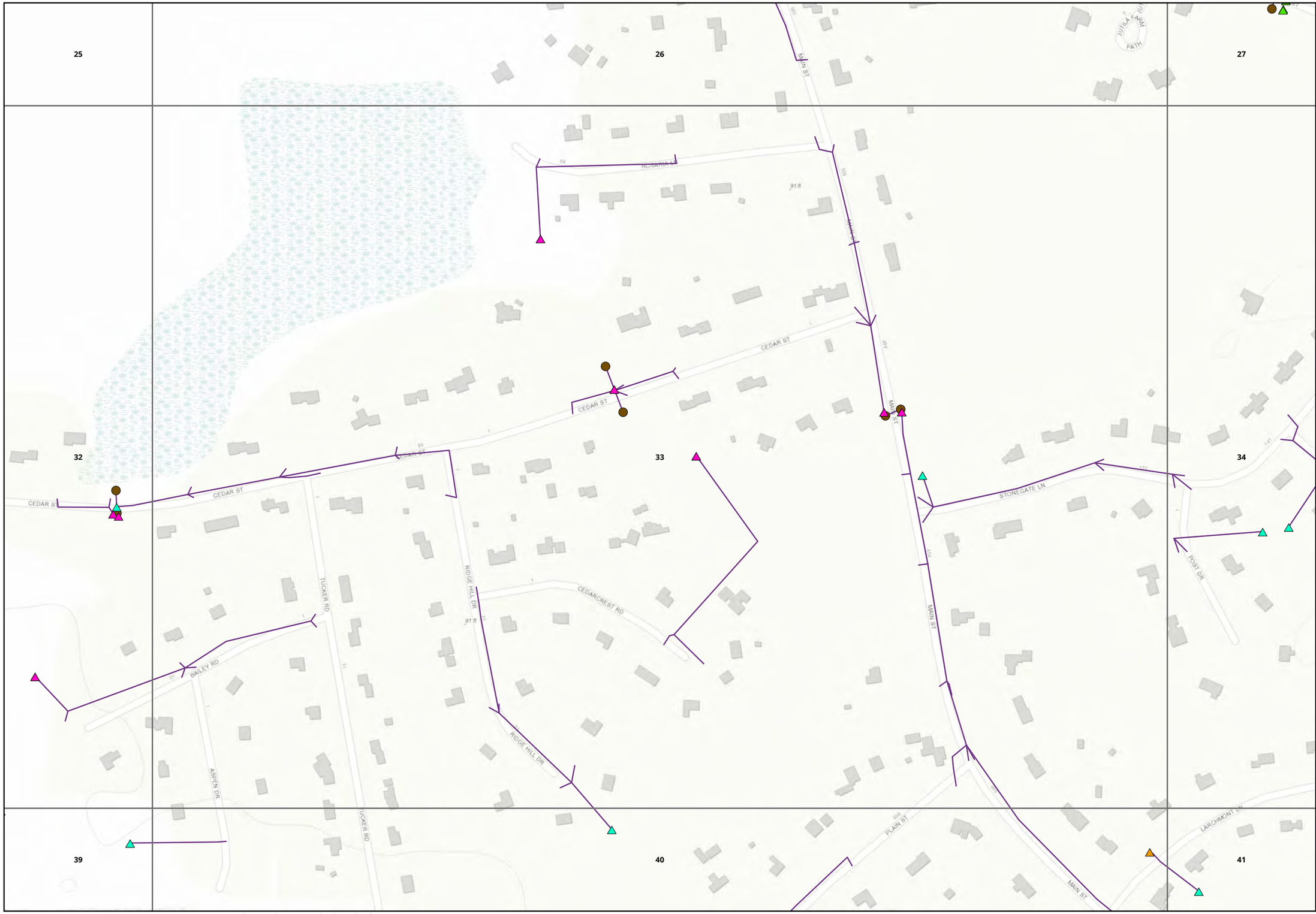

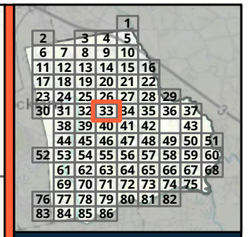

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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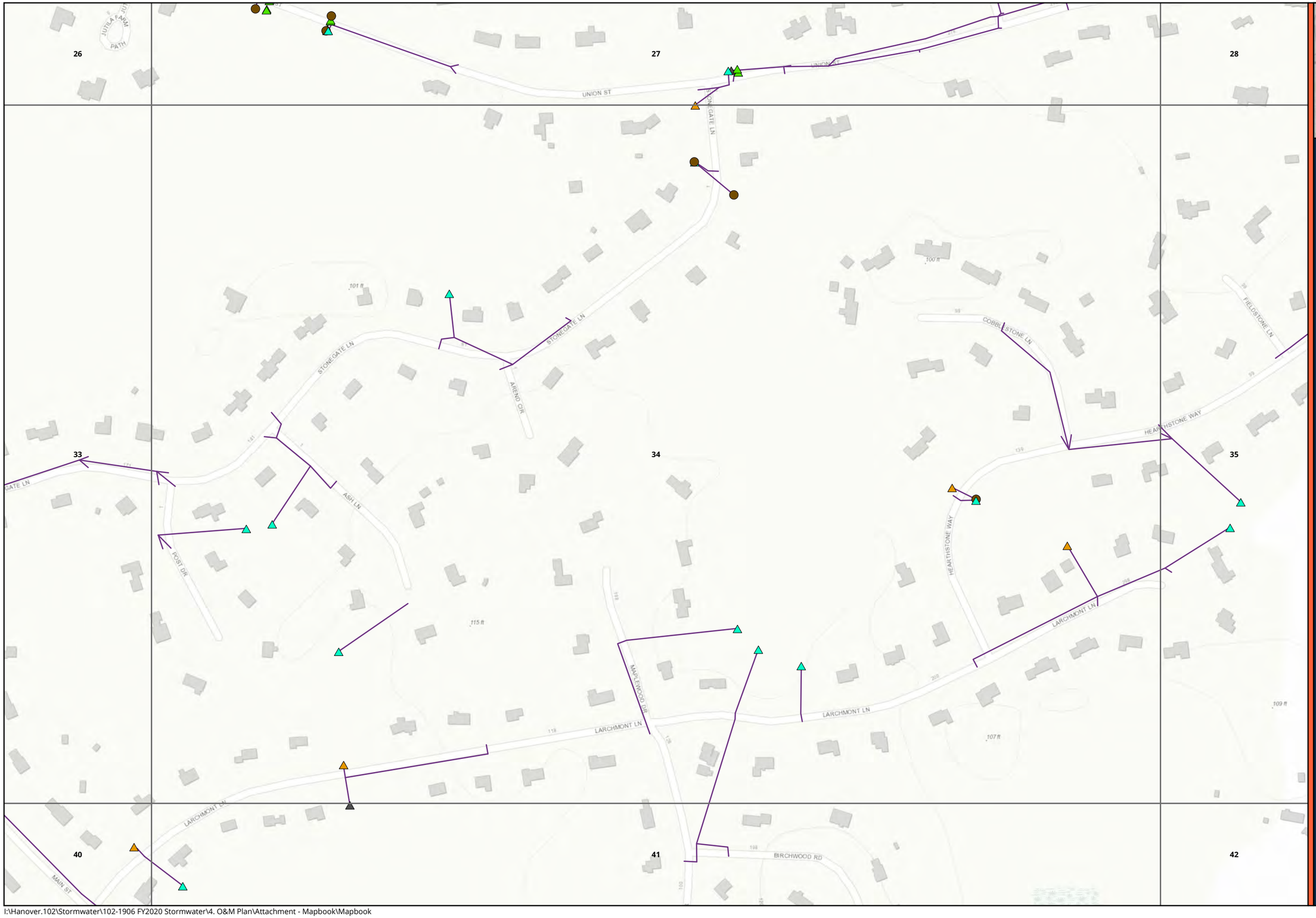

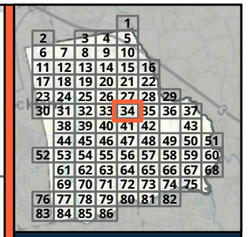

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
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N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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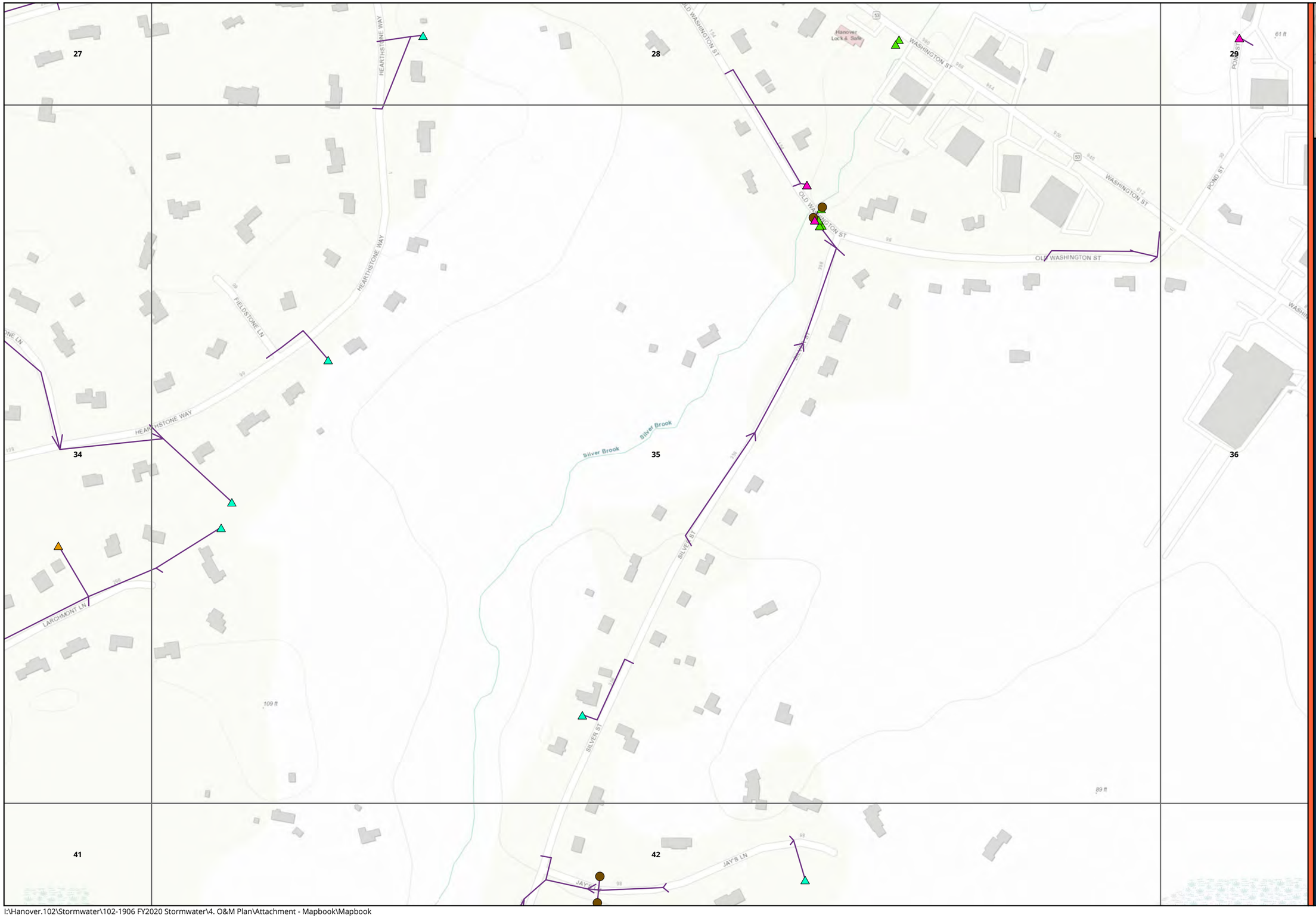

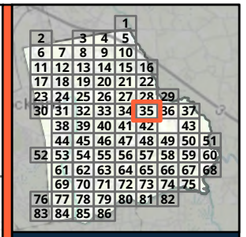

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Stormwater System

Hanover, Massachusetts

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N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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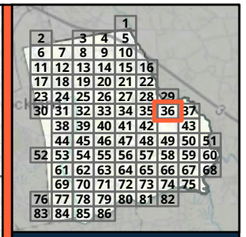

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Stormwater System

Hanover, Massachusetts

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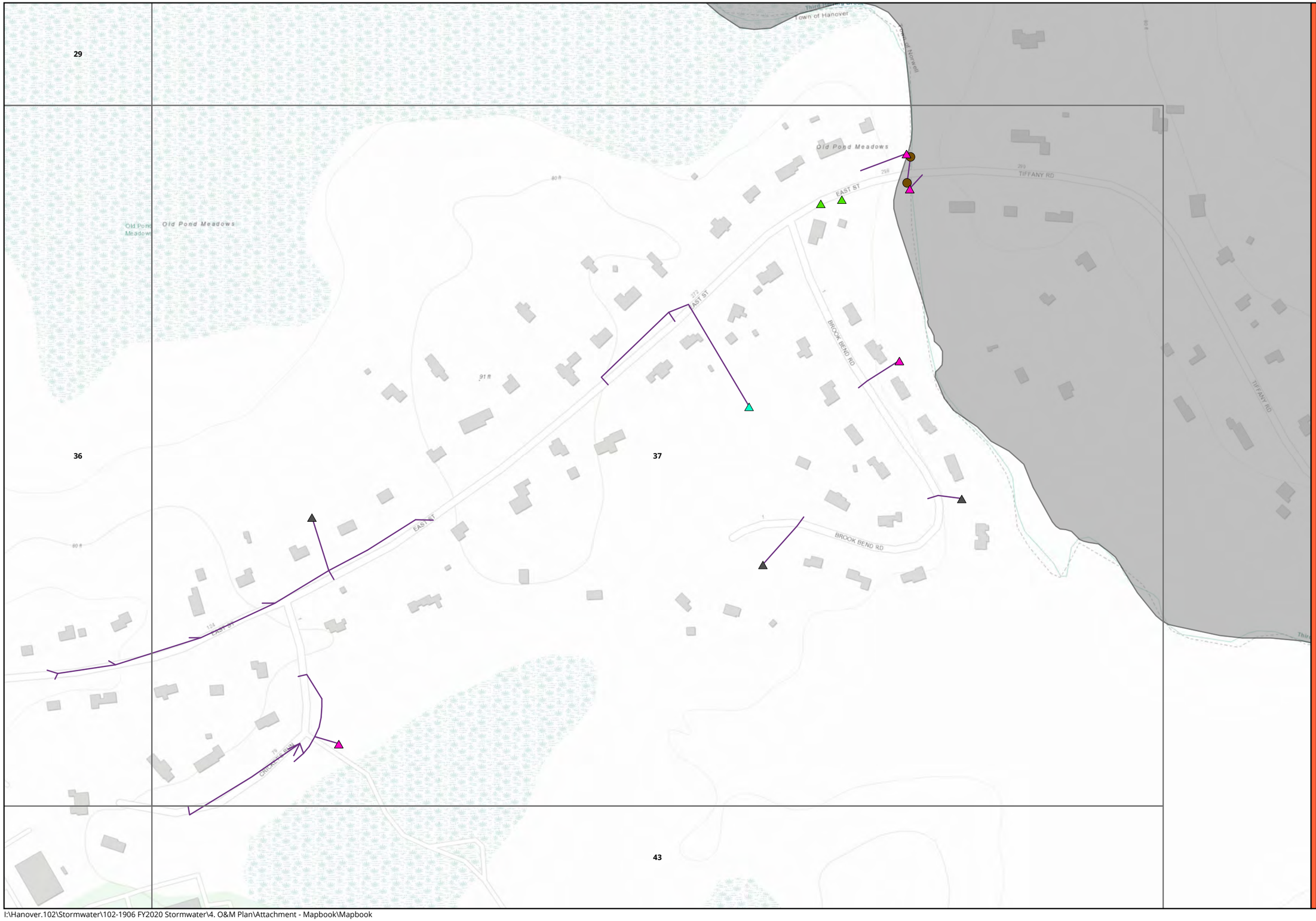
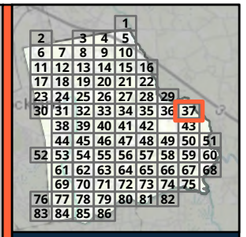
N

0 125 250 Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

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N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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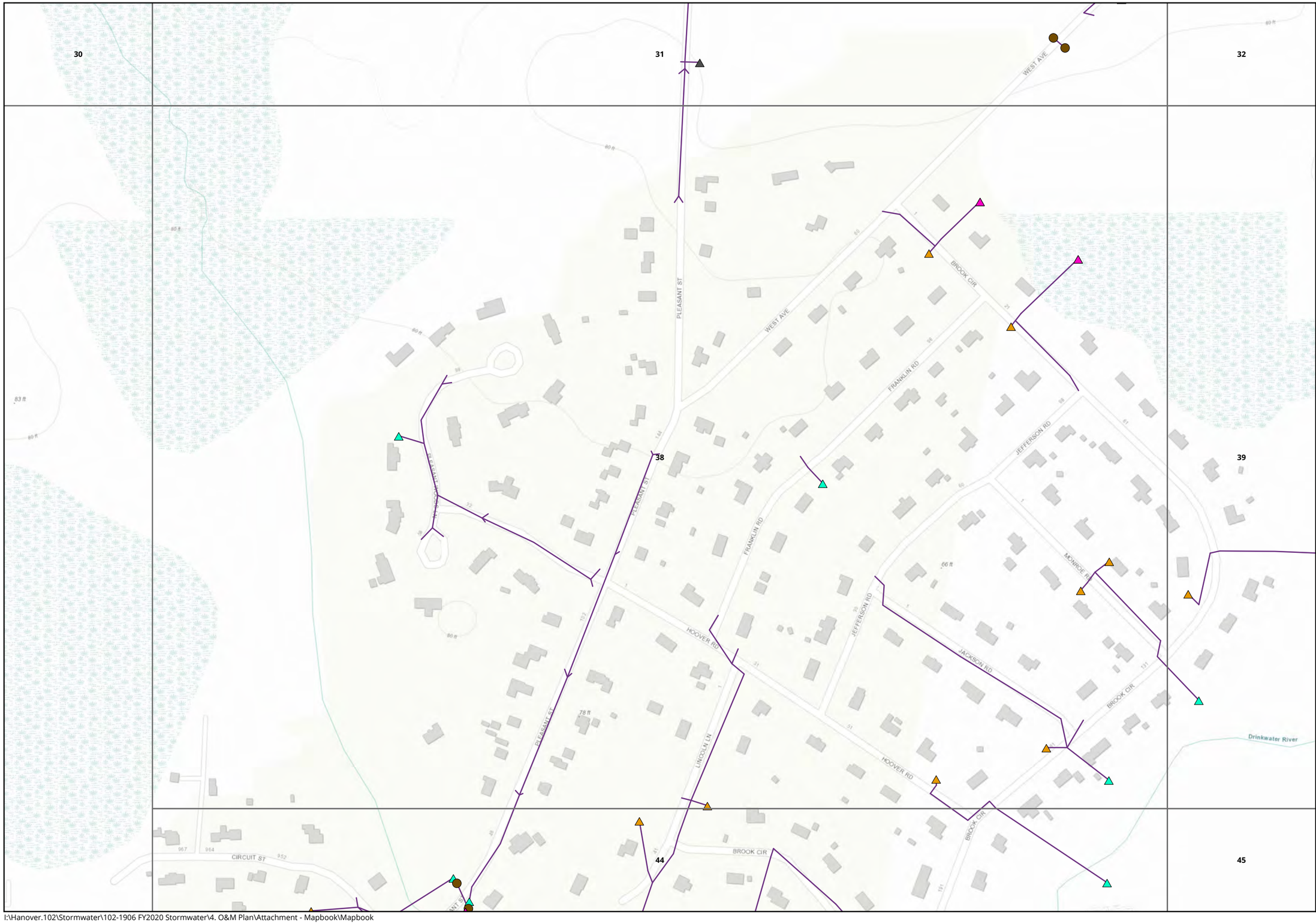

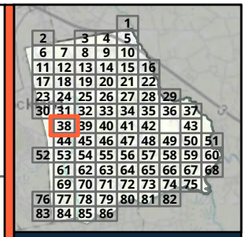

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Stormwater System

Hanover, Massachusetts

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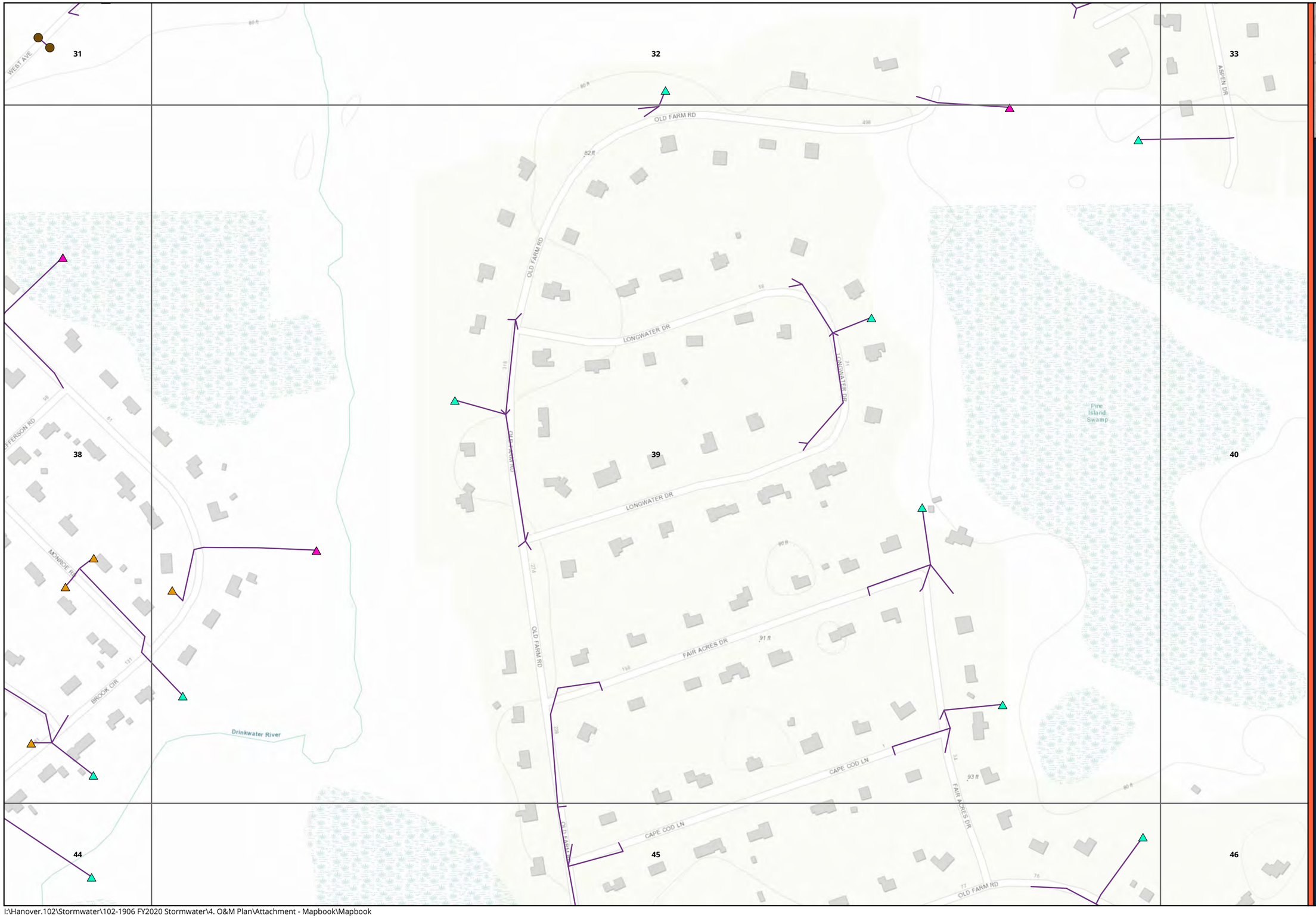
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



Stormwater System

Hanover, Massachusetts

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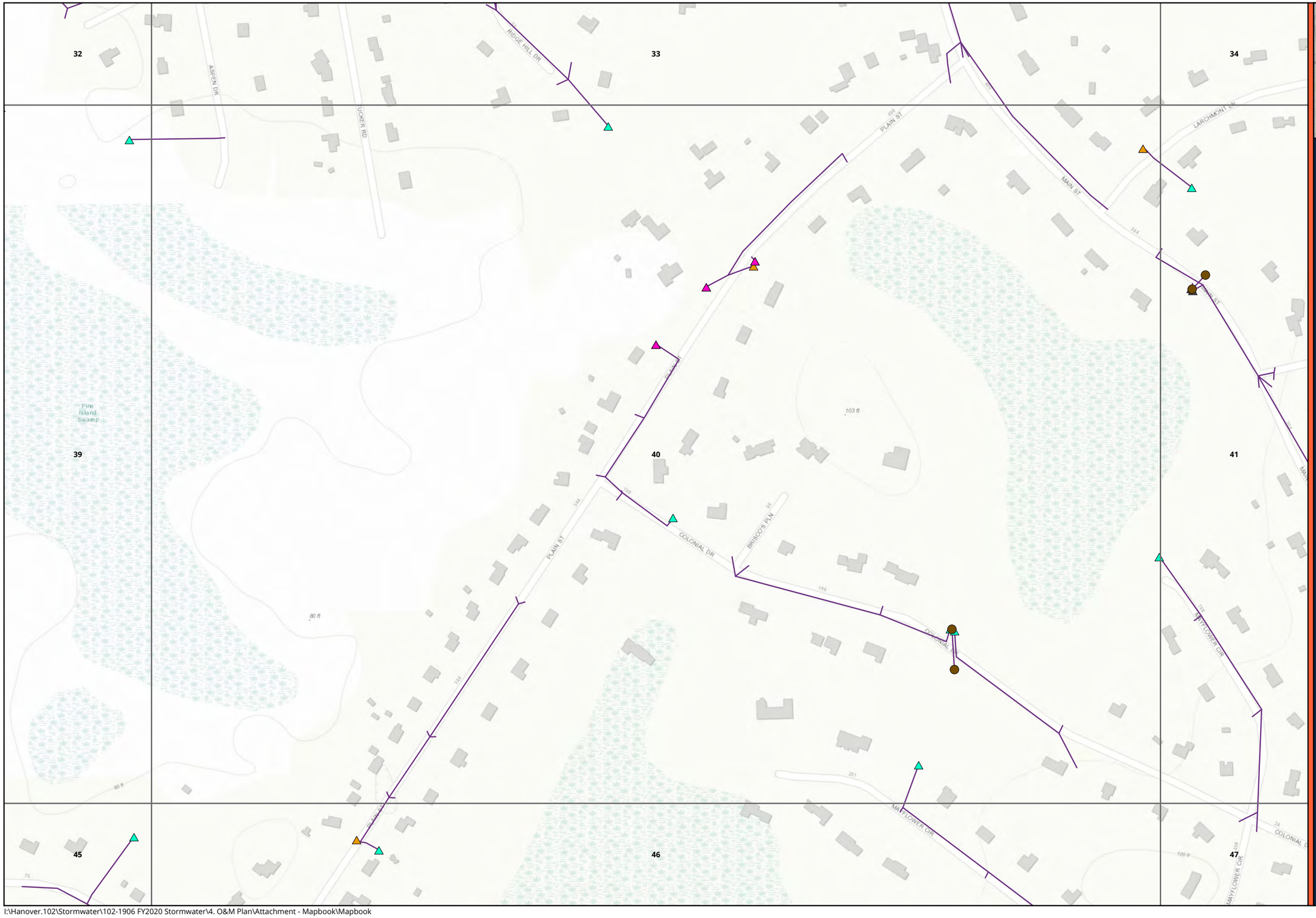
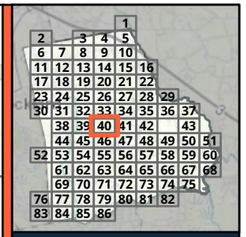
0 125 250 Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

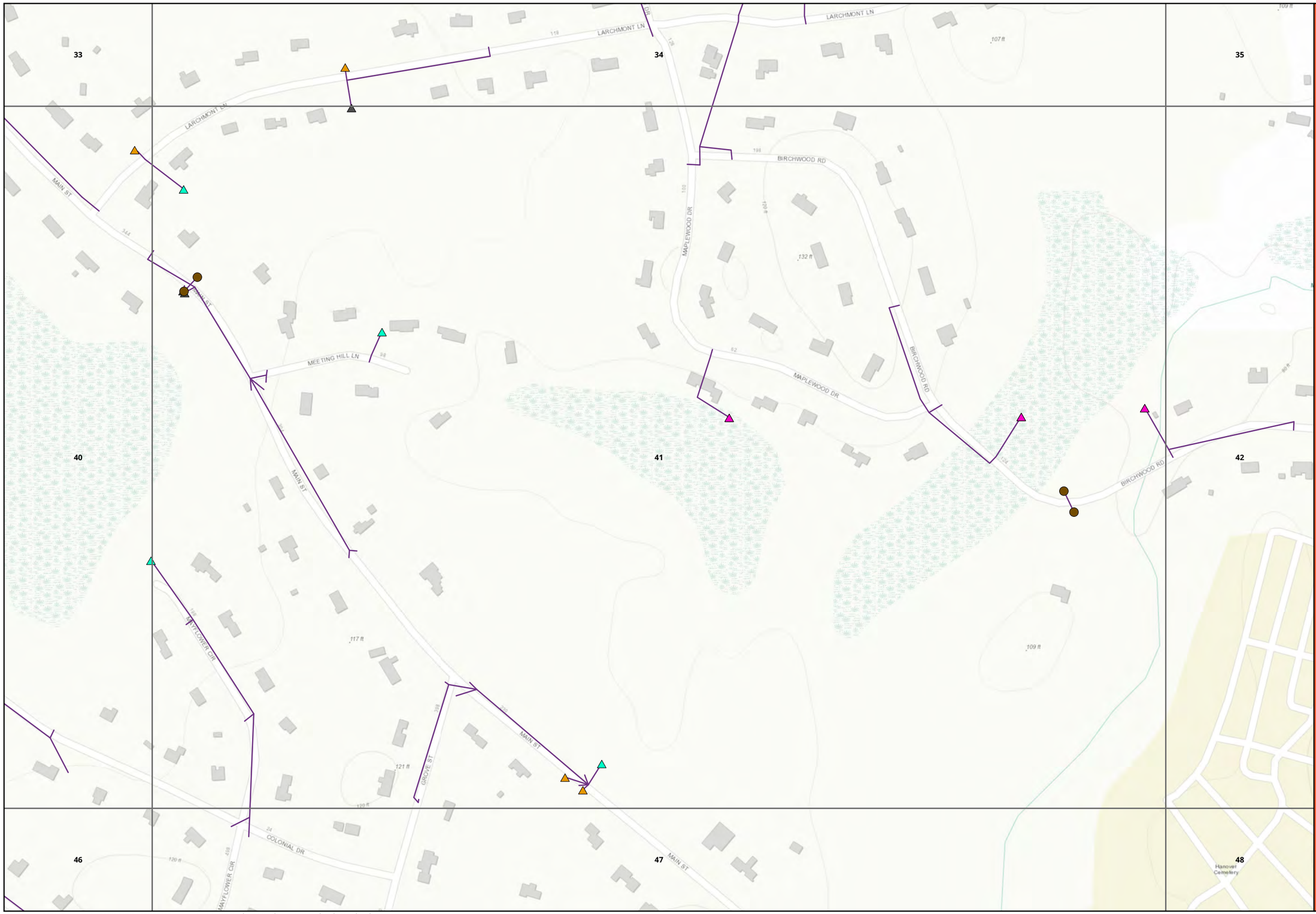
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

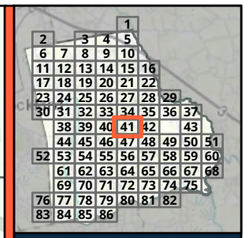
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

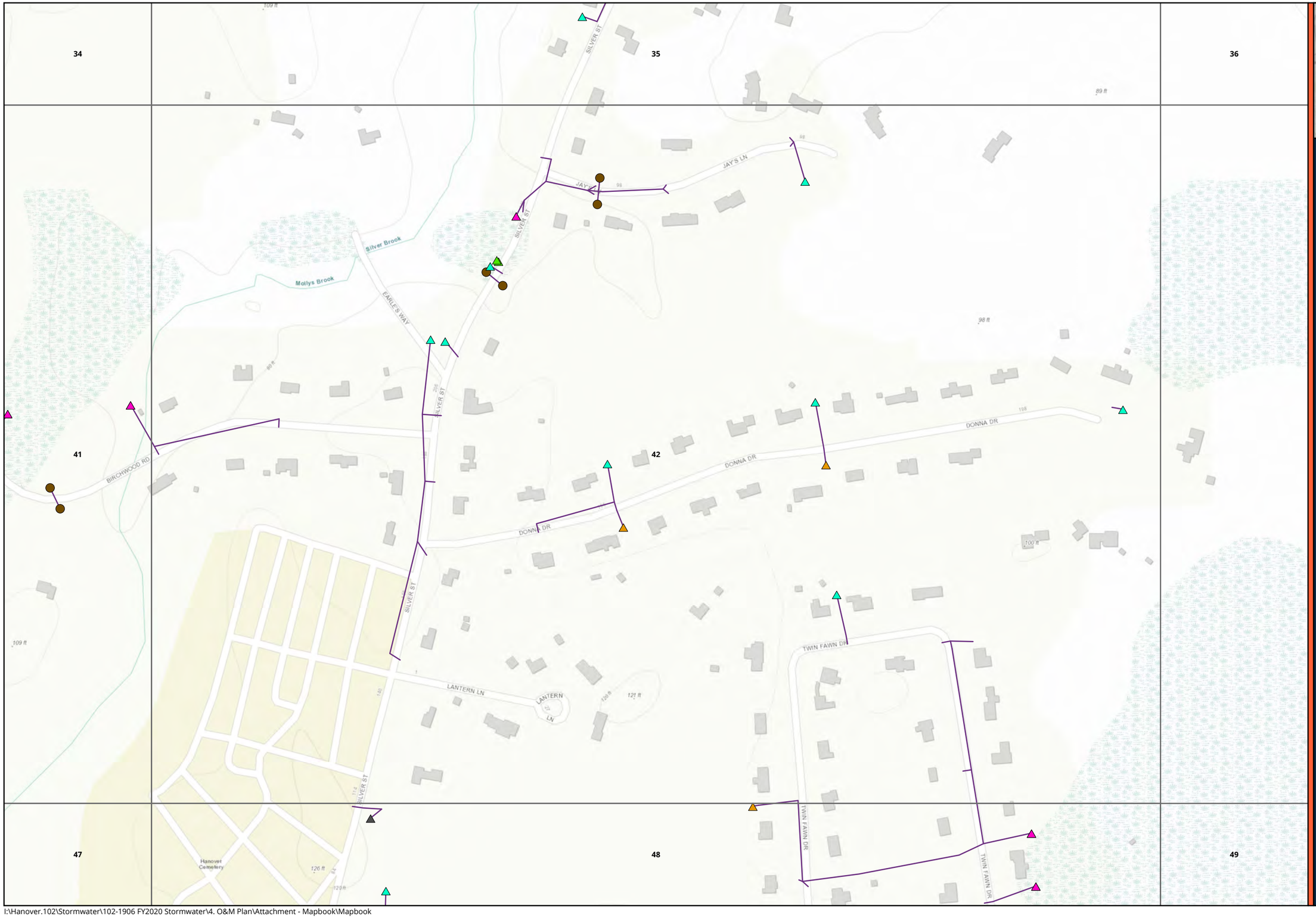
Hanover, Massachusetts

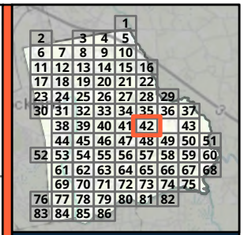
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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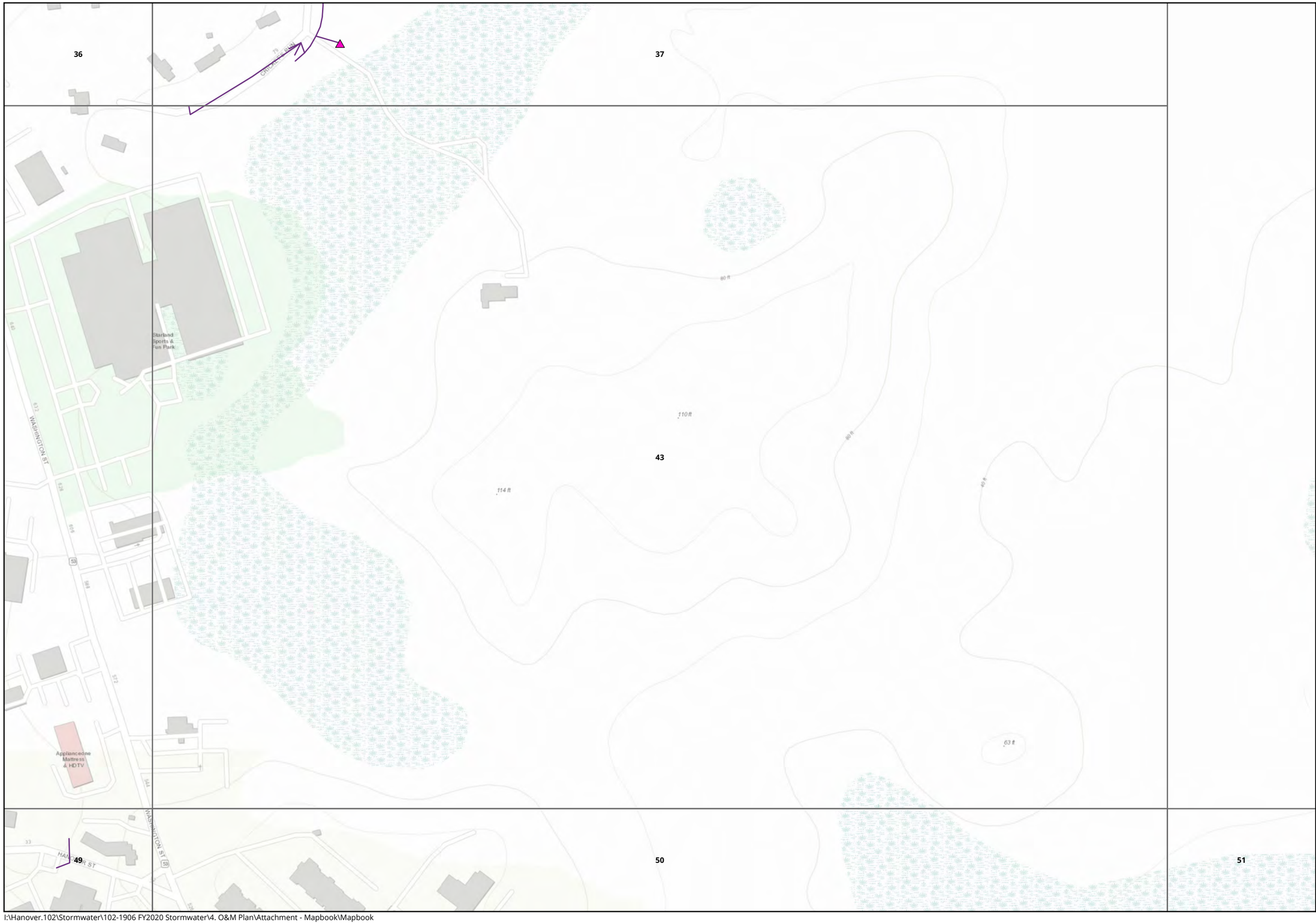

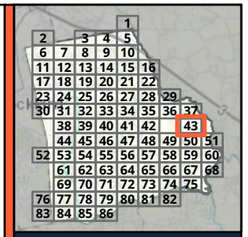

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Stormwater System

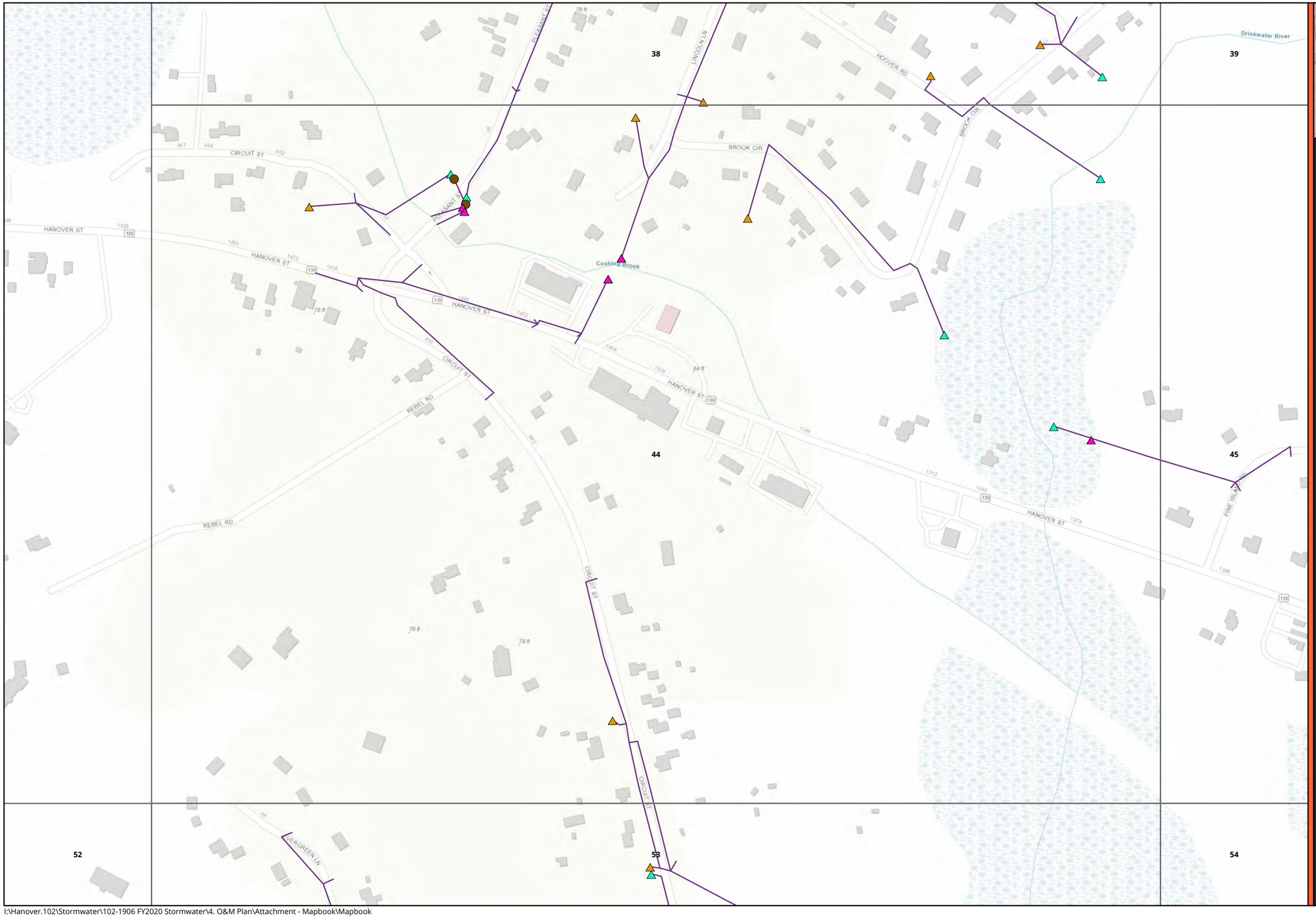
Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



Stormwater System

Hanover, Massachusetts

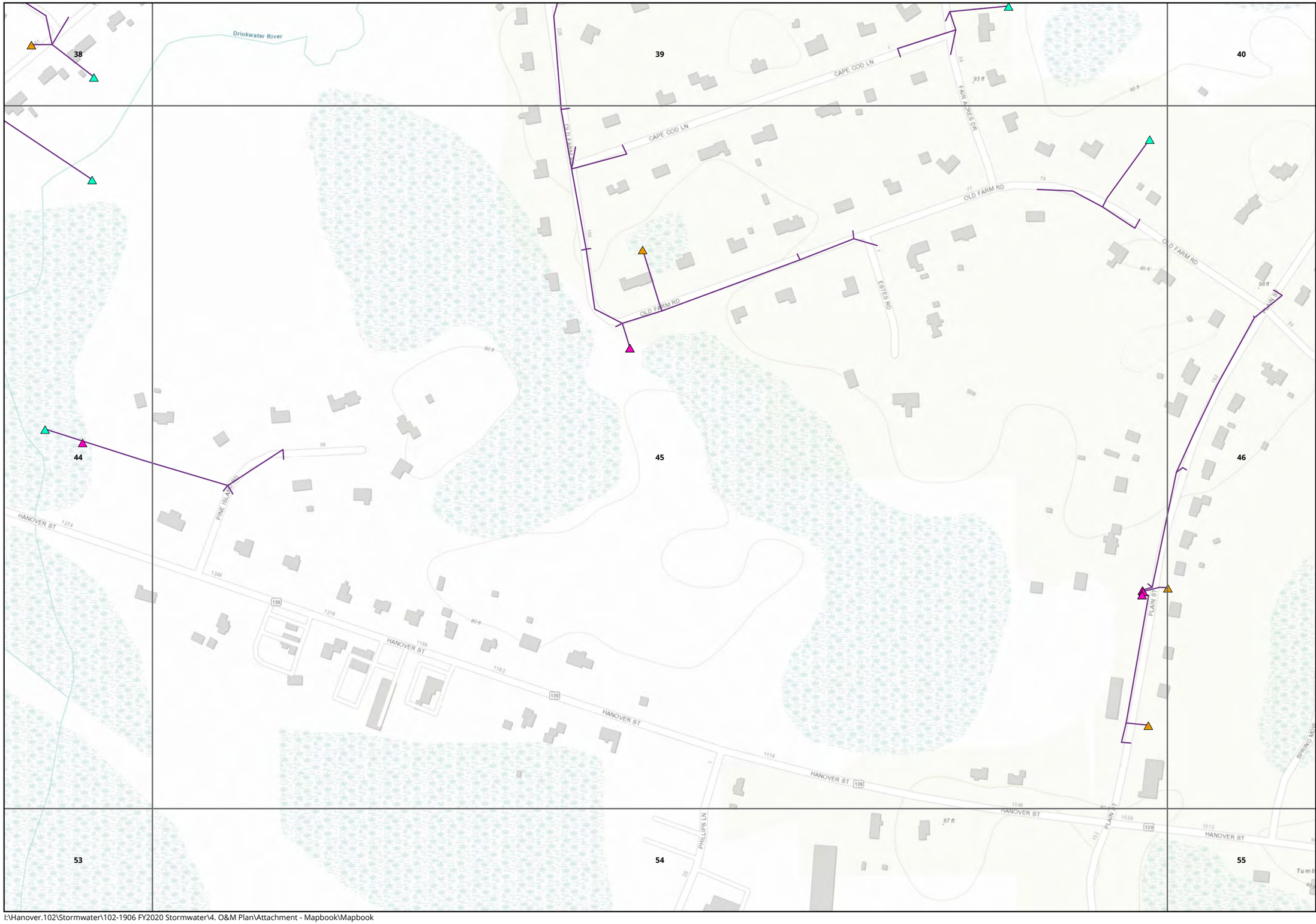
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

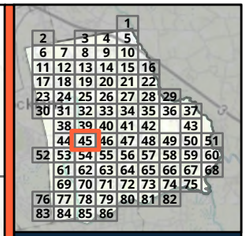
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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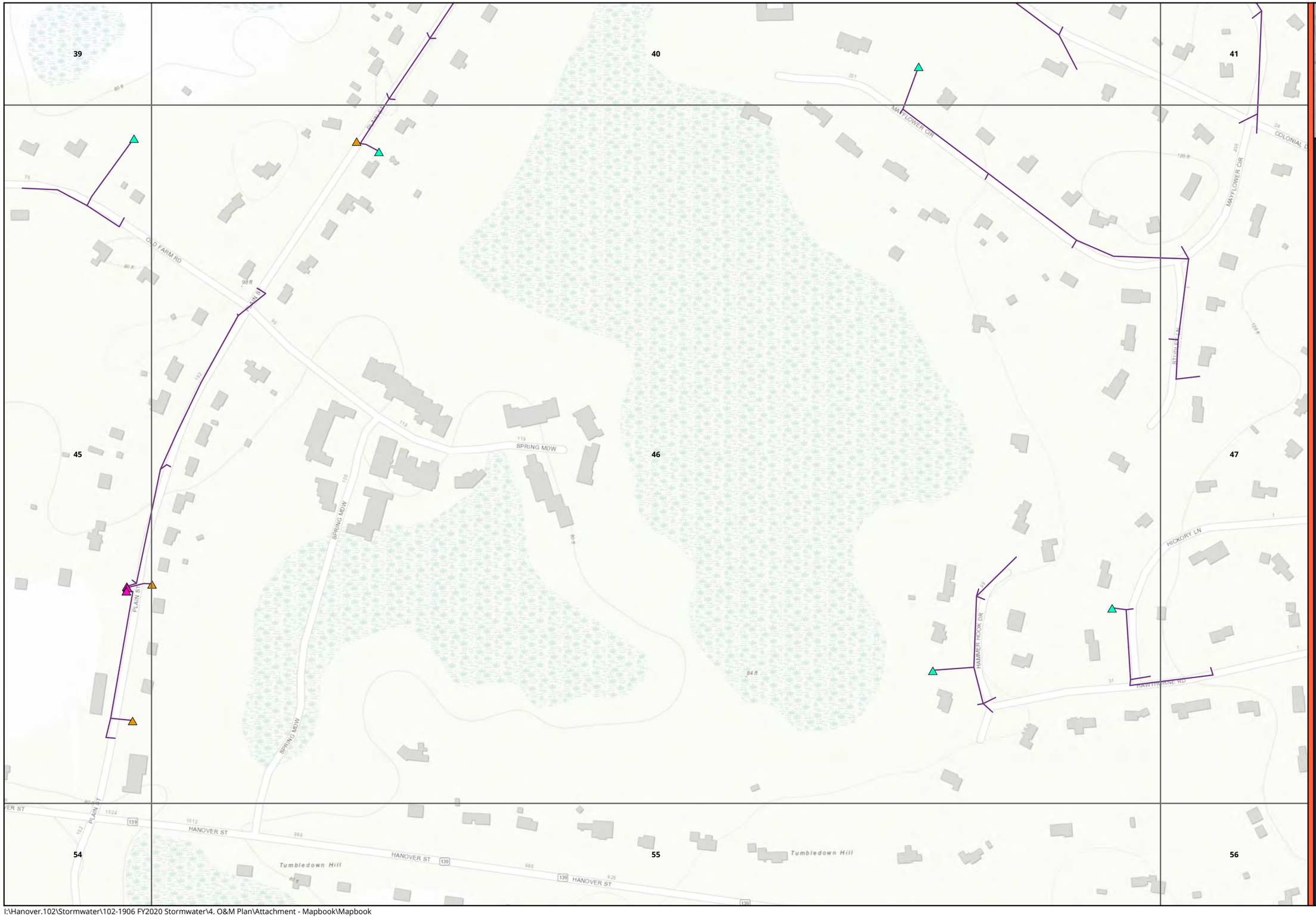


Stormwater System

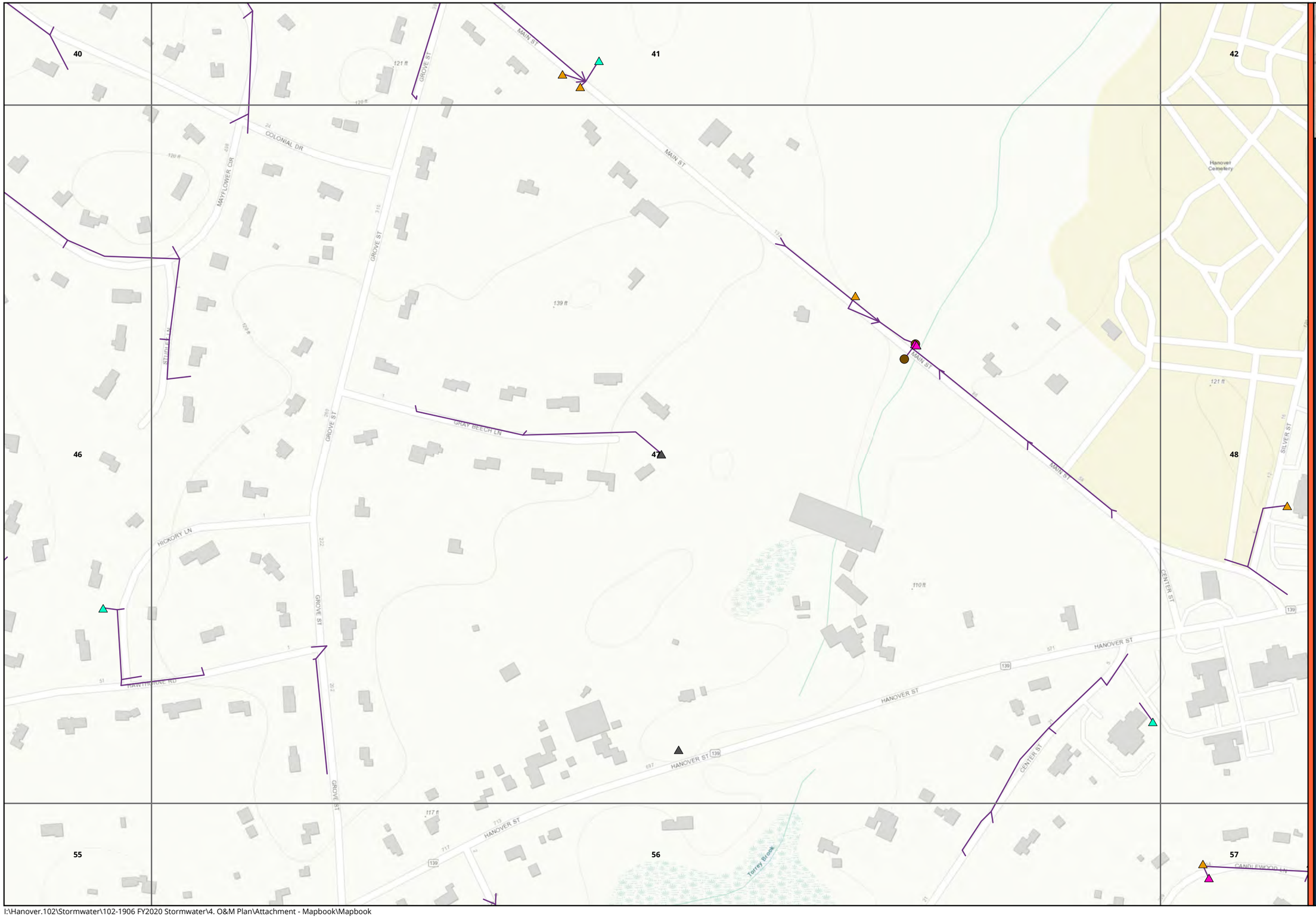
Hanover, Massachusetts

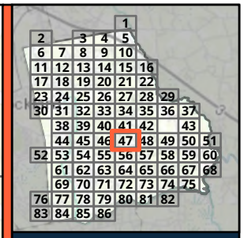
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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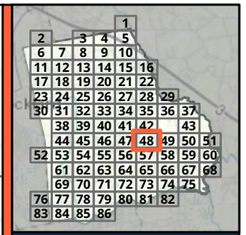

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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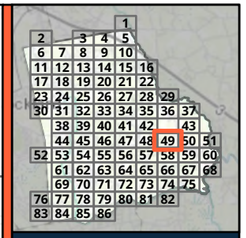

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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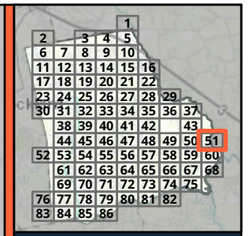

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Stormwater System

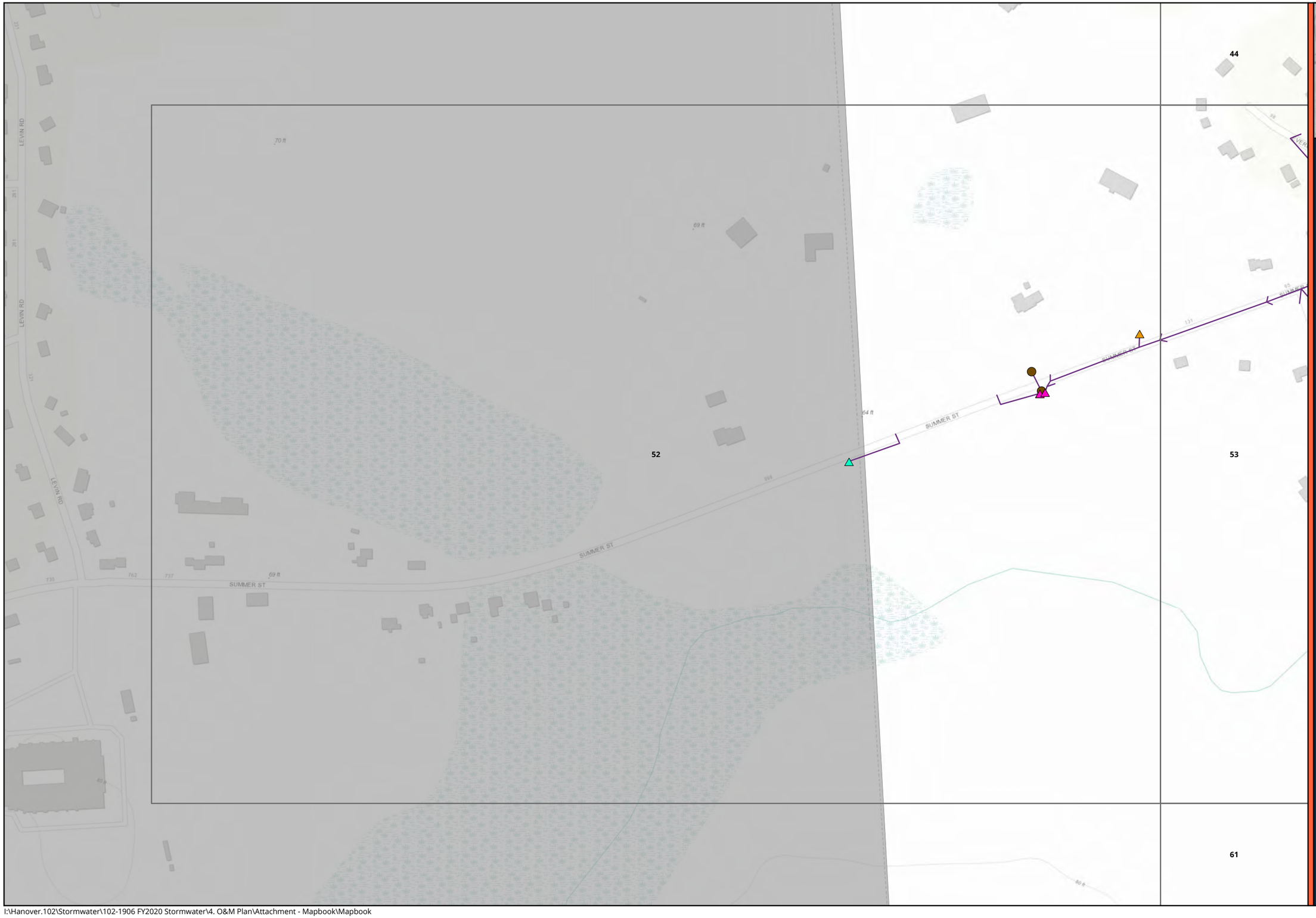
Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



Stormwater System

Hanover, Massachusetts

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- Scupper
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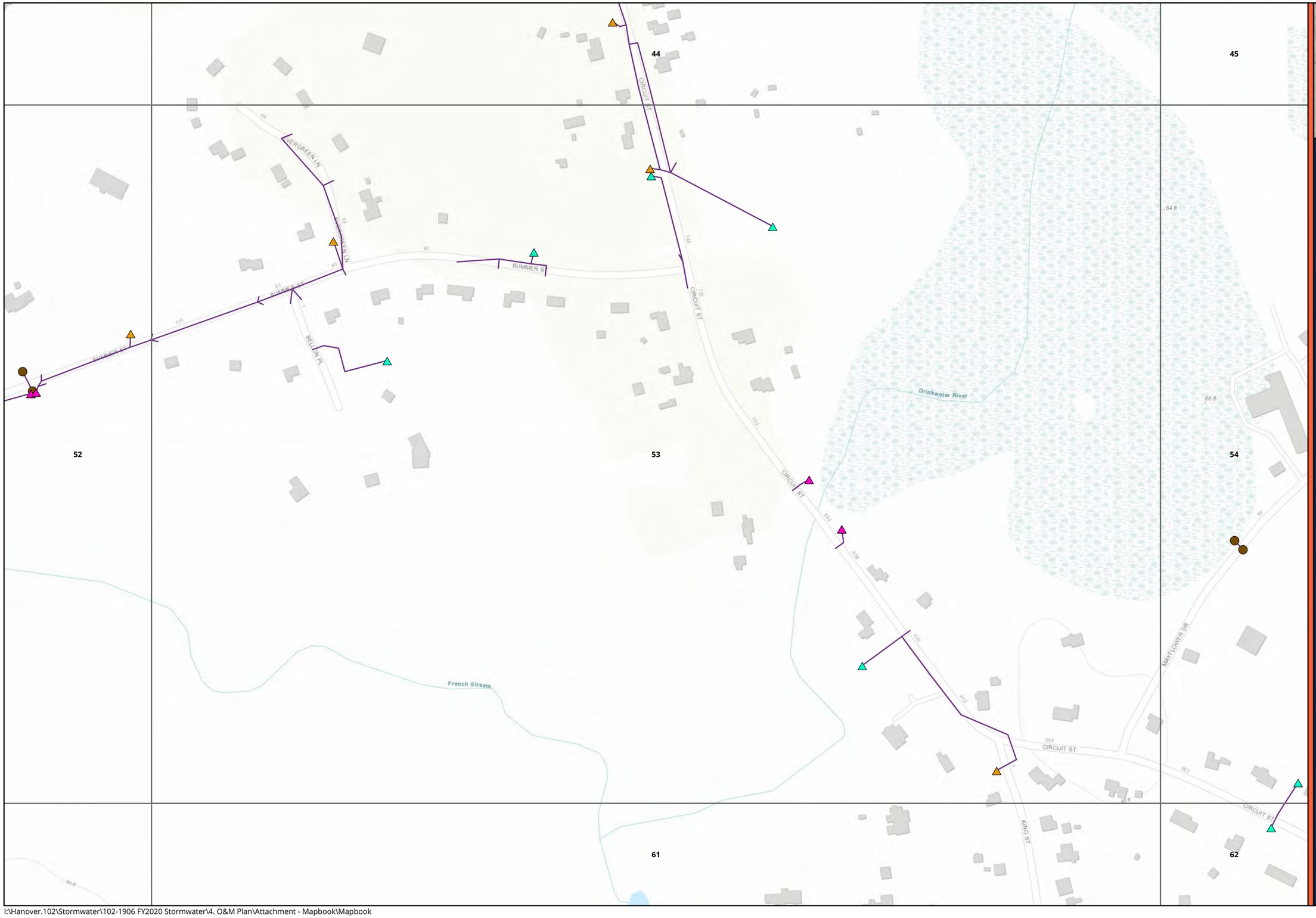
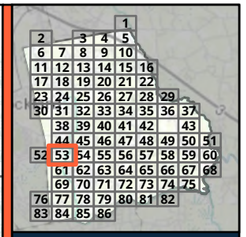
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
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- Inlet
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- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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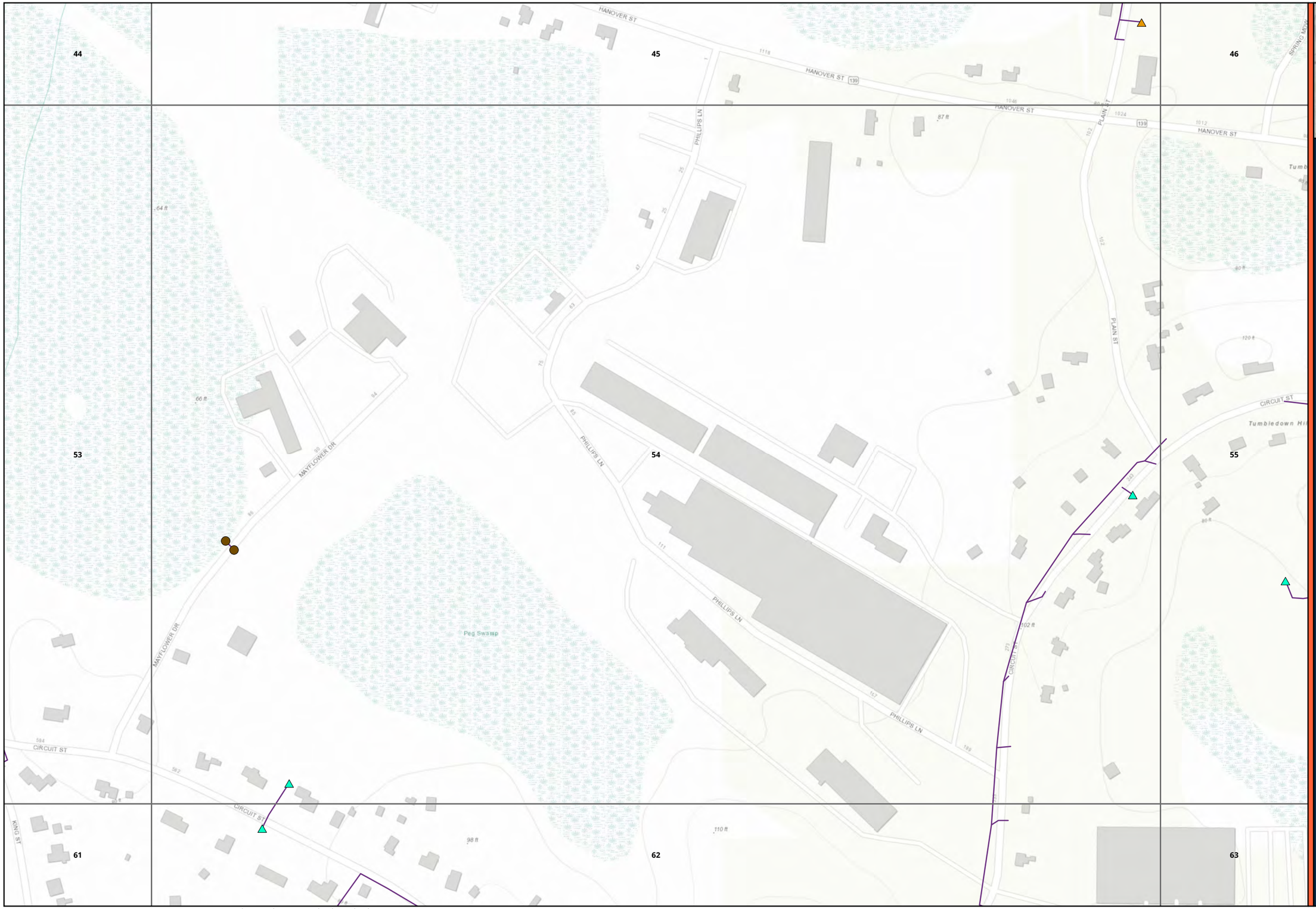

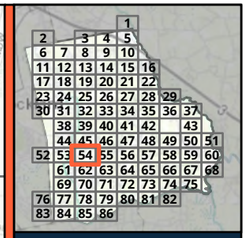

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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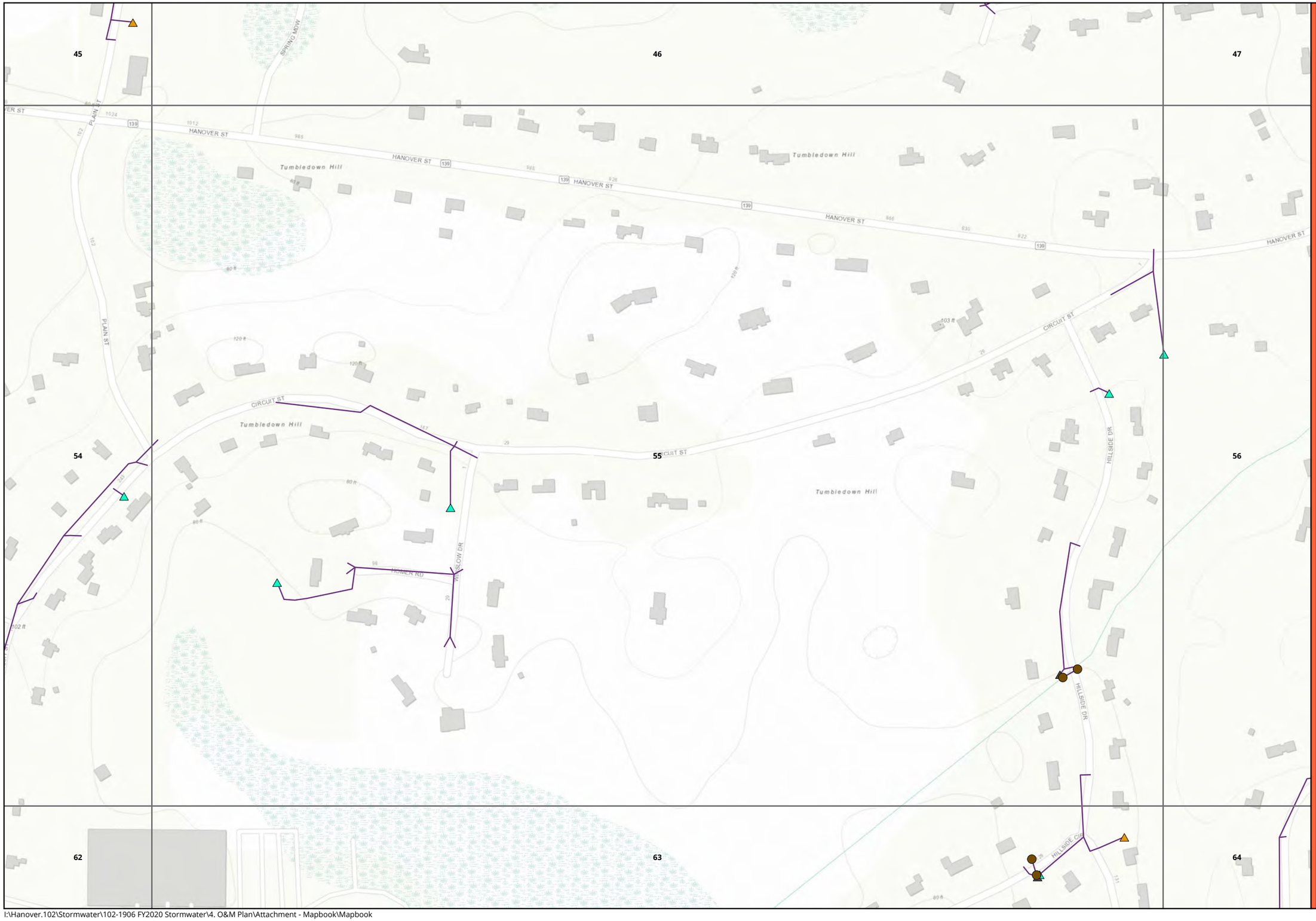
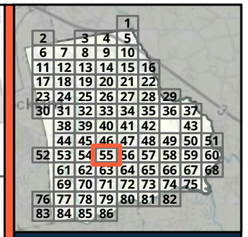




Stormwater System

Hanover, Massachusetts

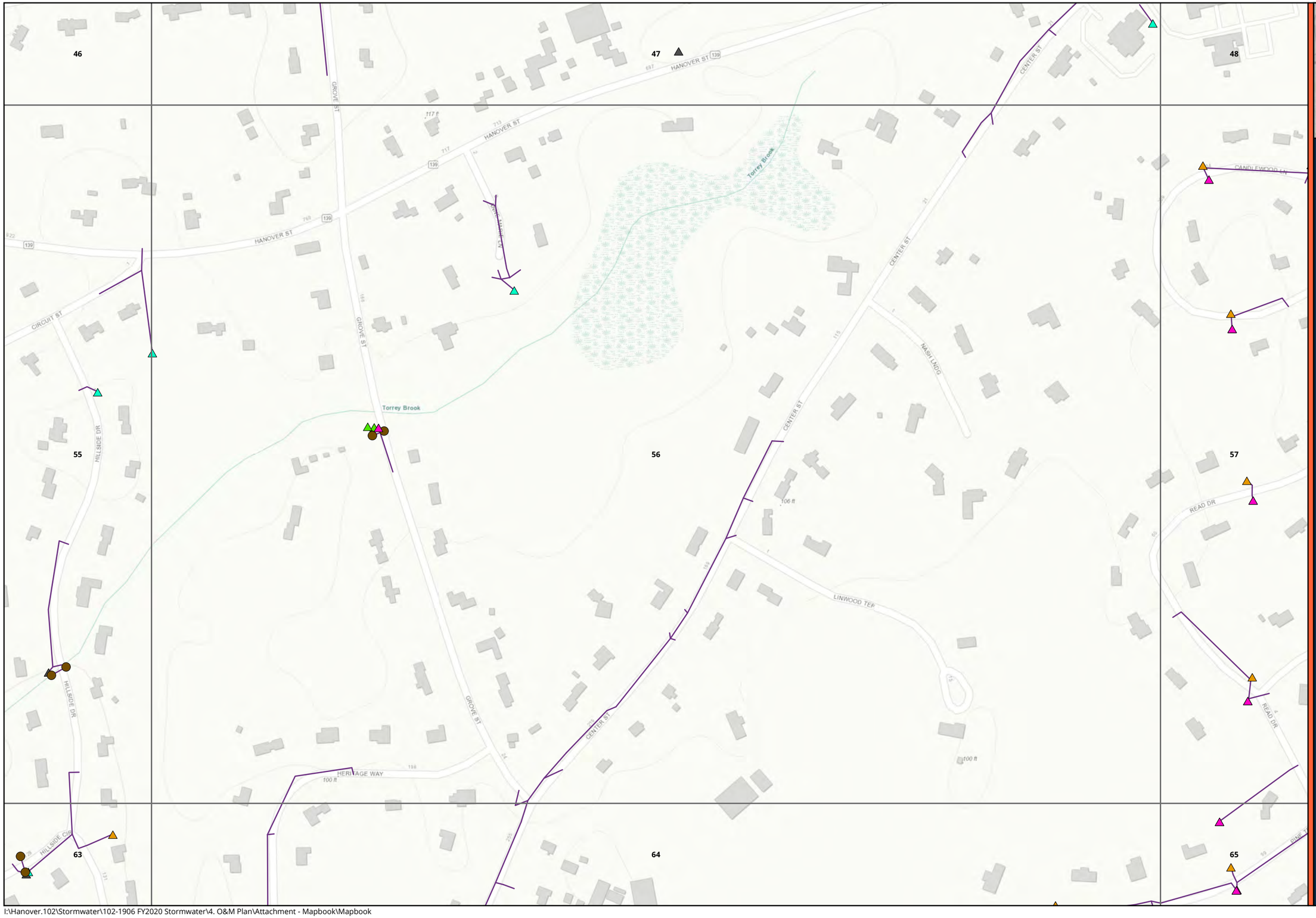
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

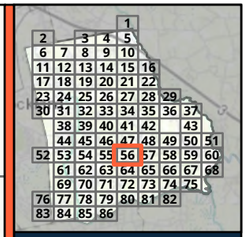
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
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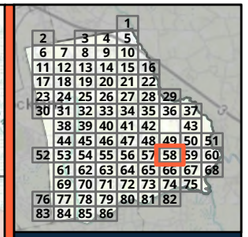
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250
Feet

ENVIRONMENTAL PARTNERS



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Stormwater System

Hanover, Massachusetts

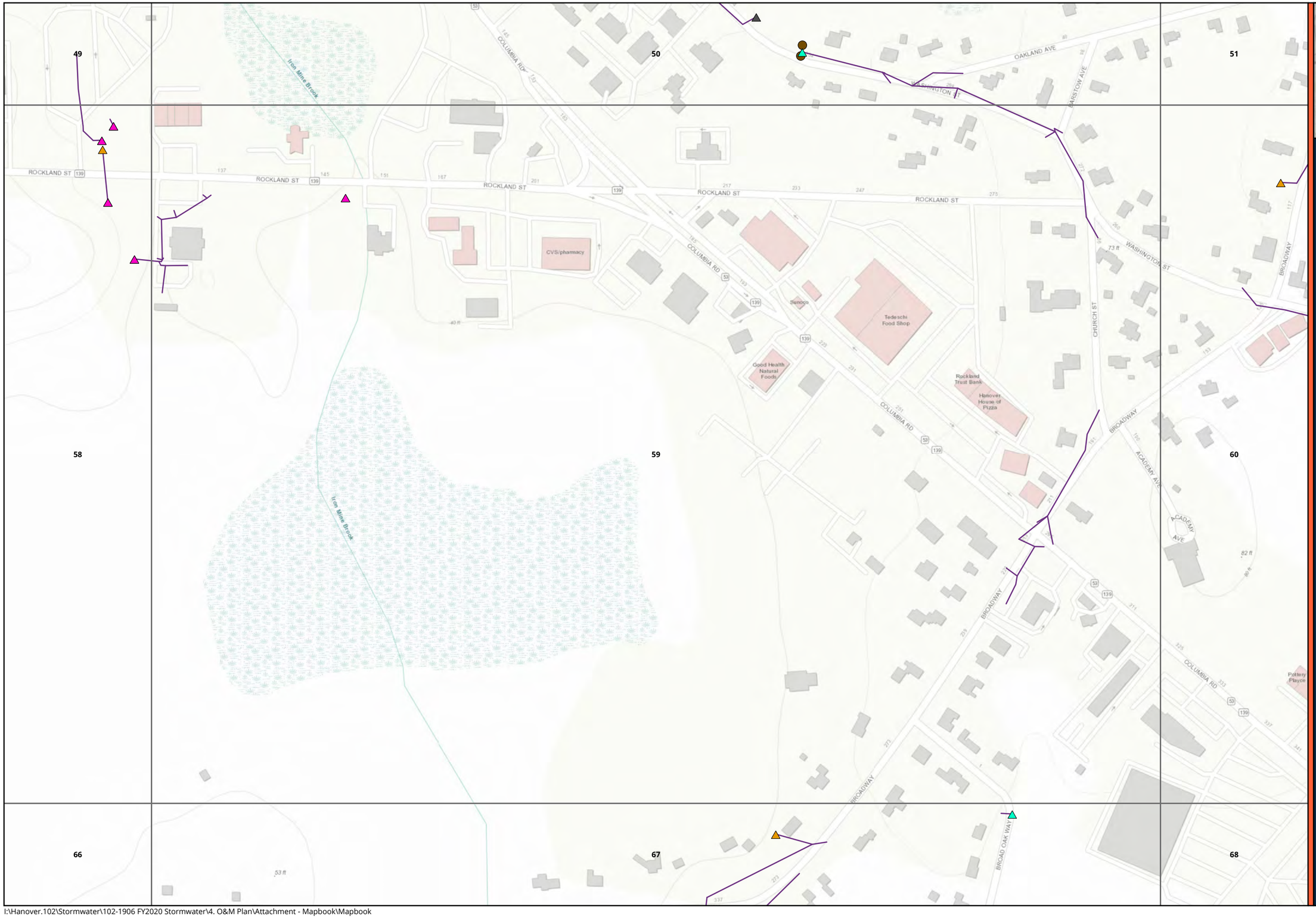
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

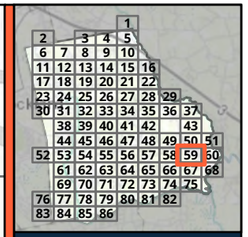
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
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- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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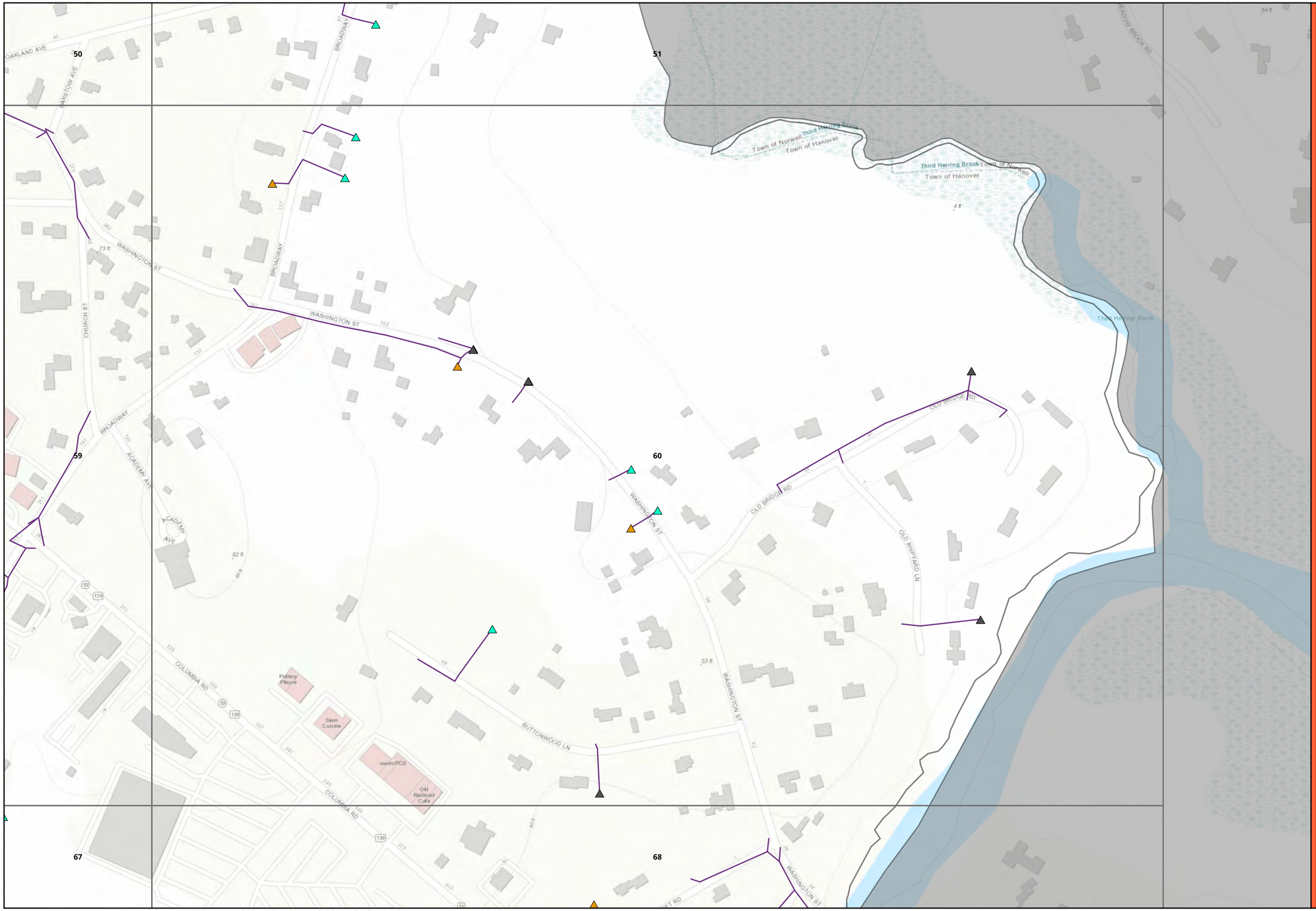

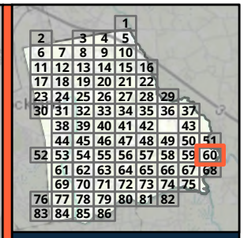

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

Stormwater System

Hanover, Massachusetts

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- Culvert
- Inlet
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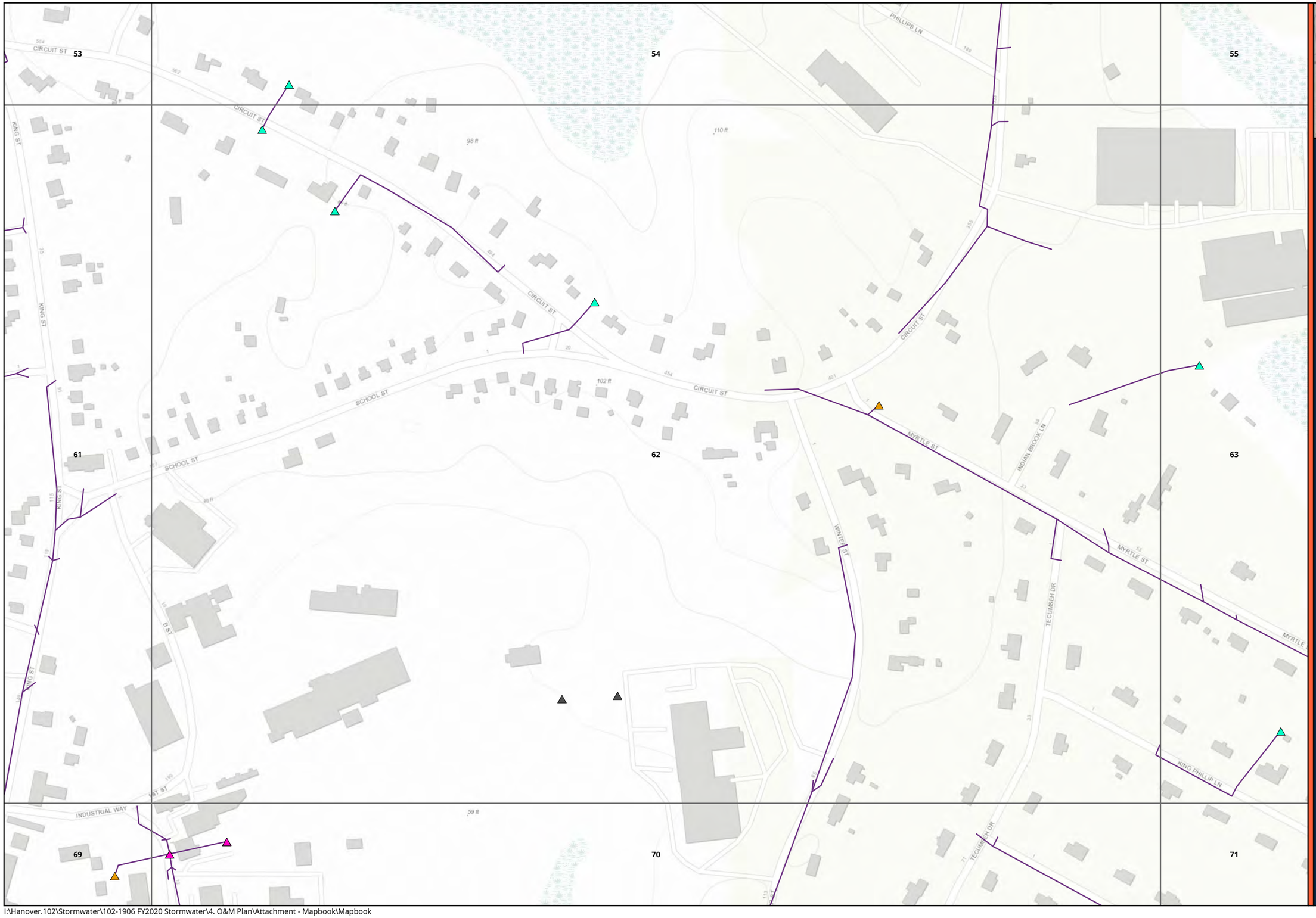
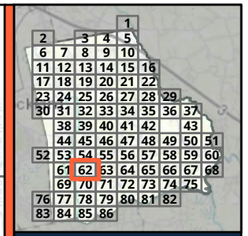
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS





Stormwater System

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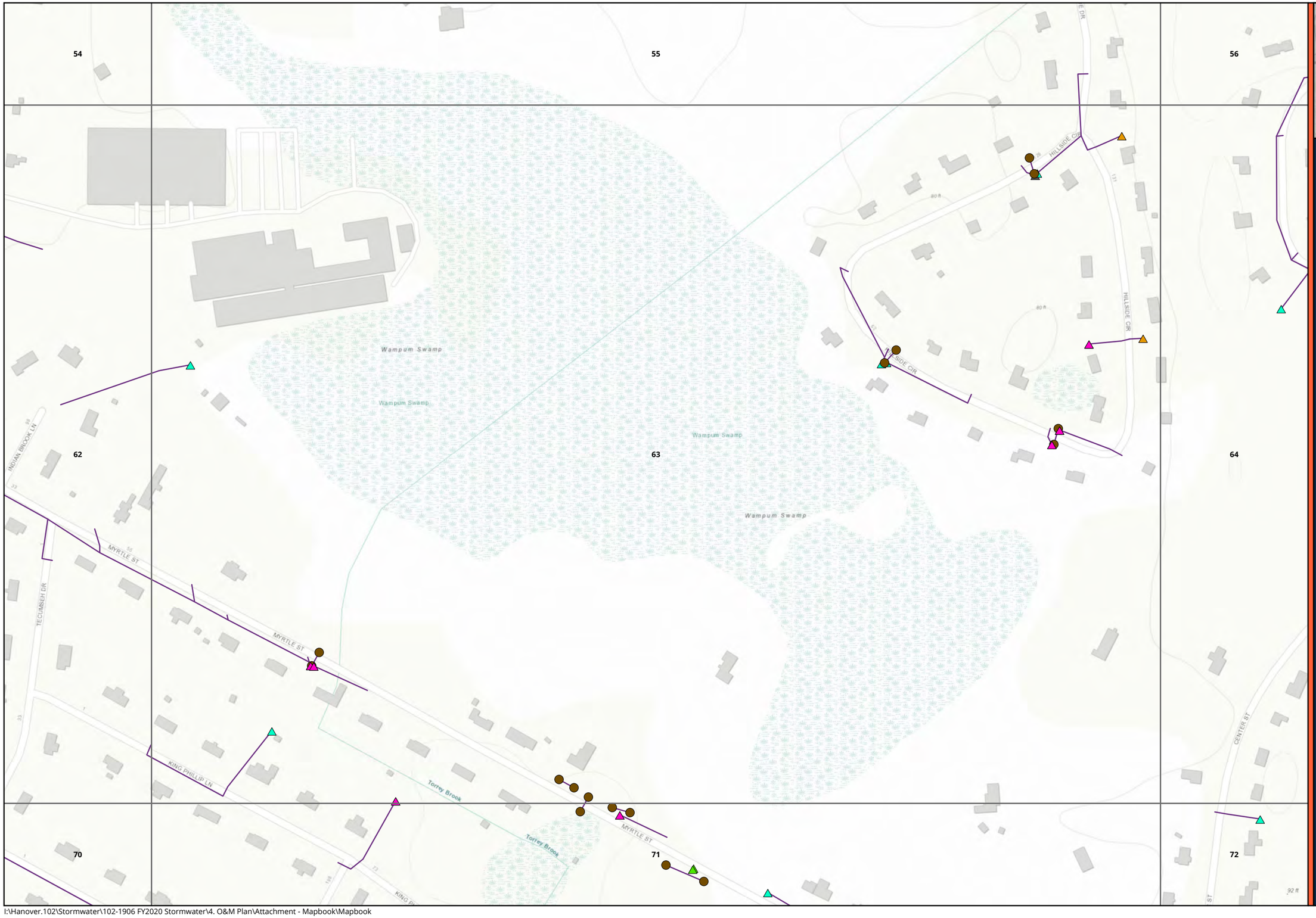
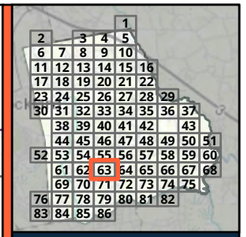
Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
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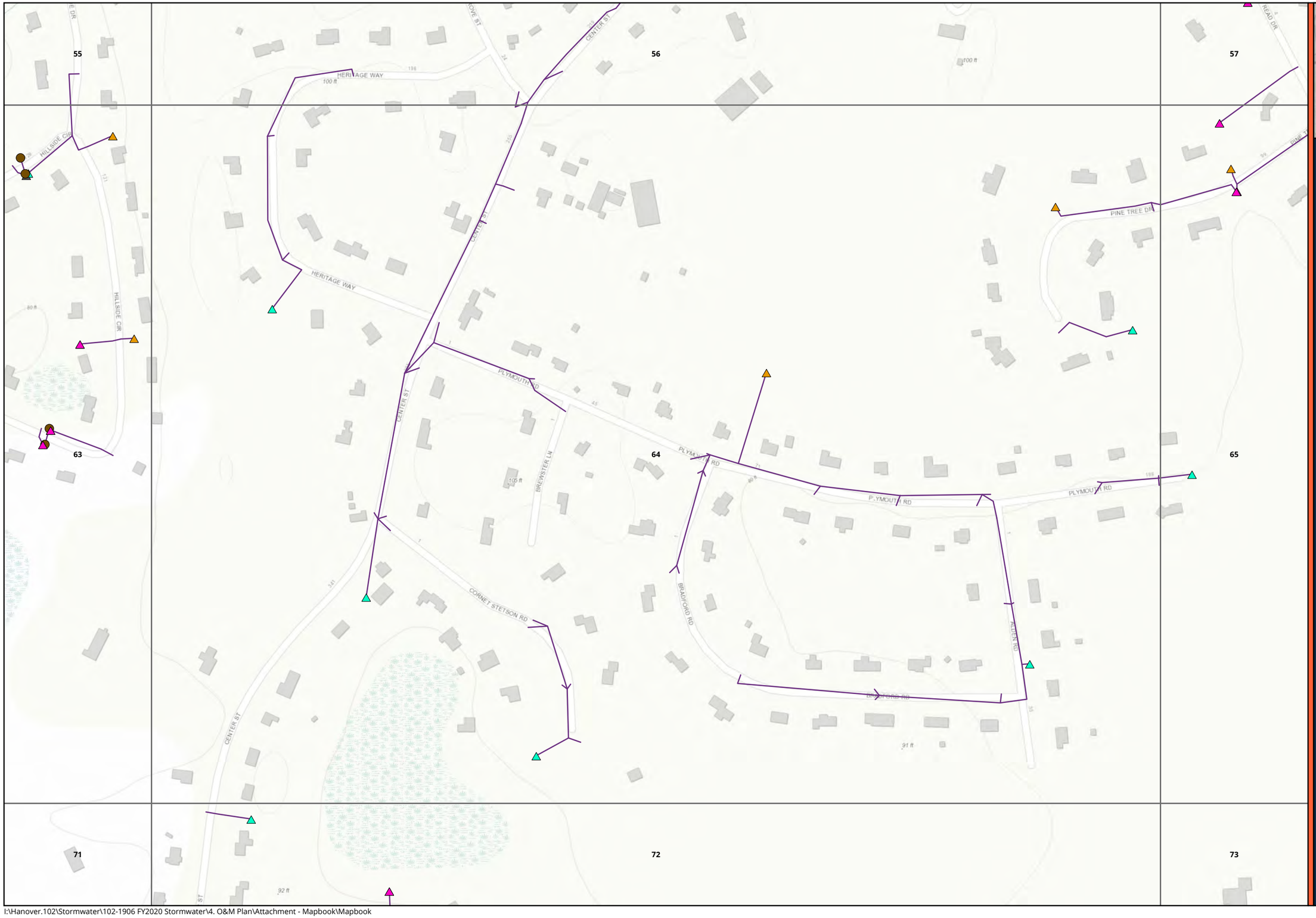
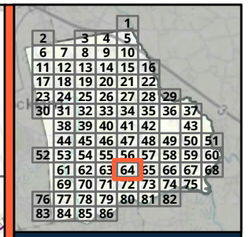
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

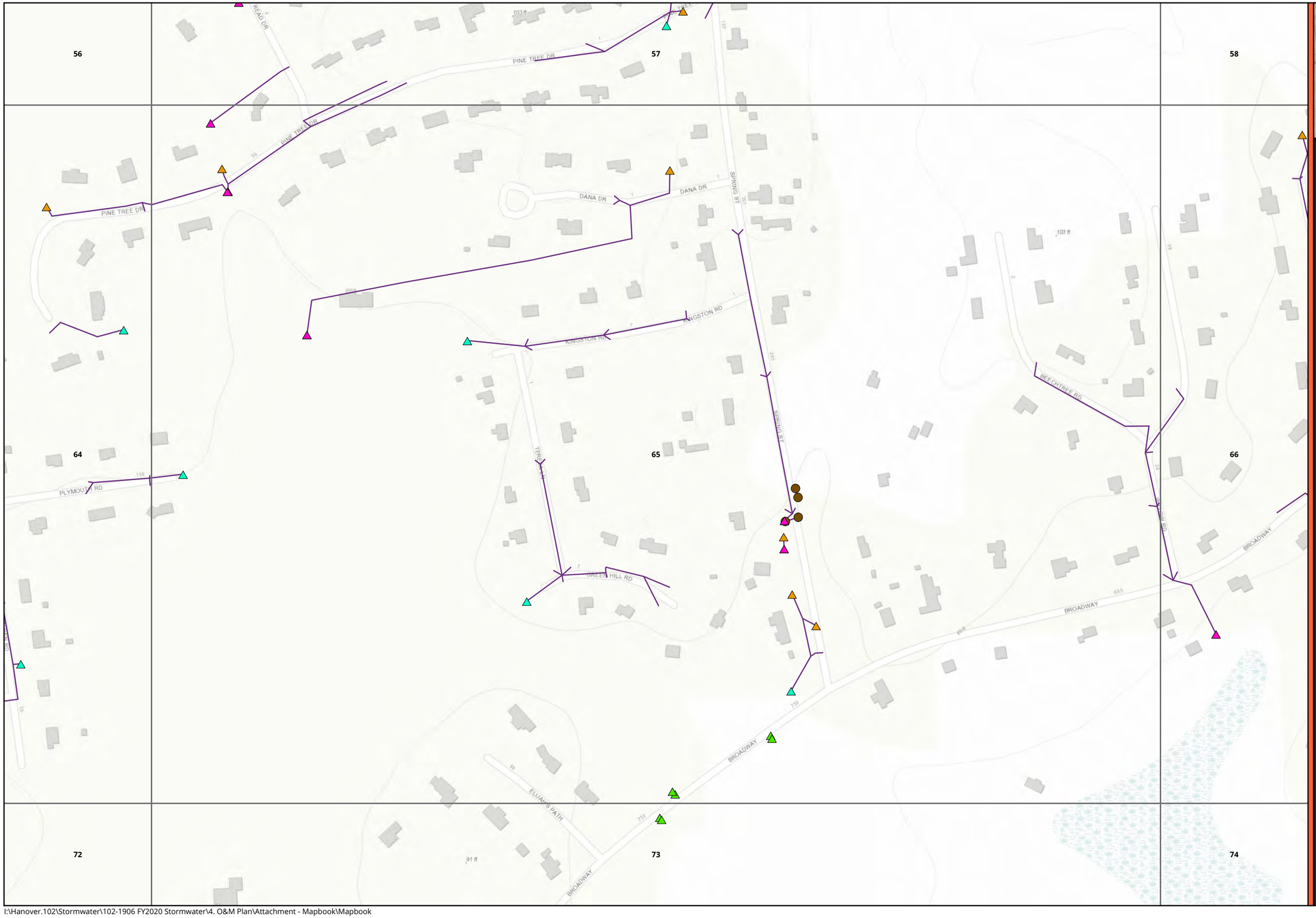
Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250
Feet

ENVIRONMENTAL PARTNERS



Stormwater System

Hanover, Massachusetts

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- Culvert
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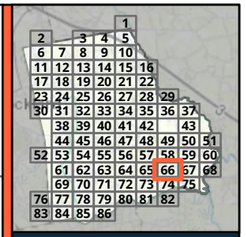
N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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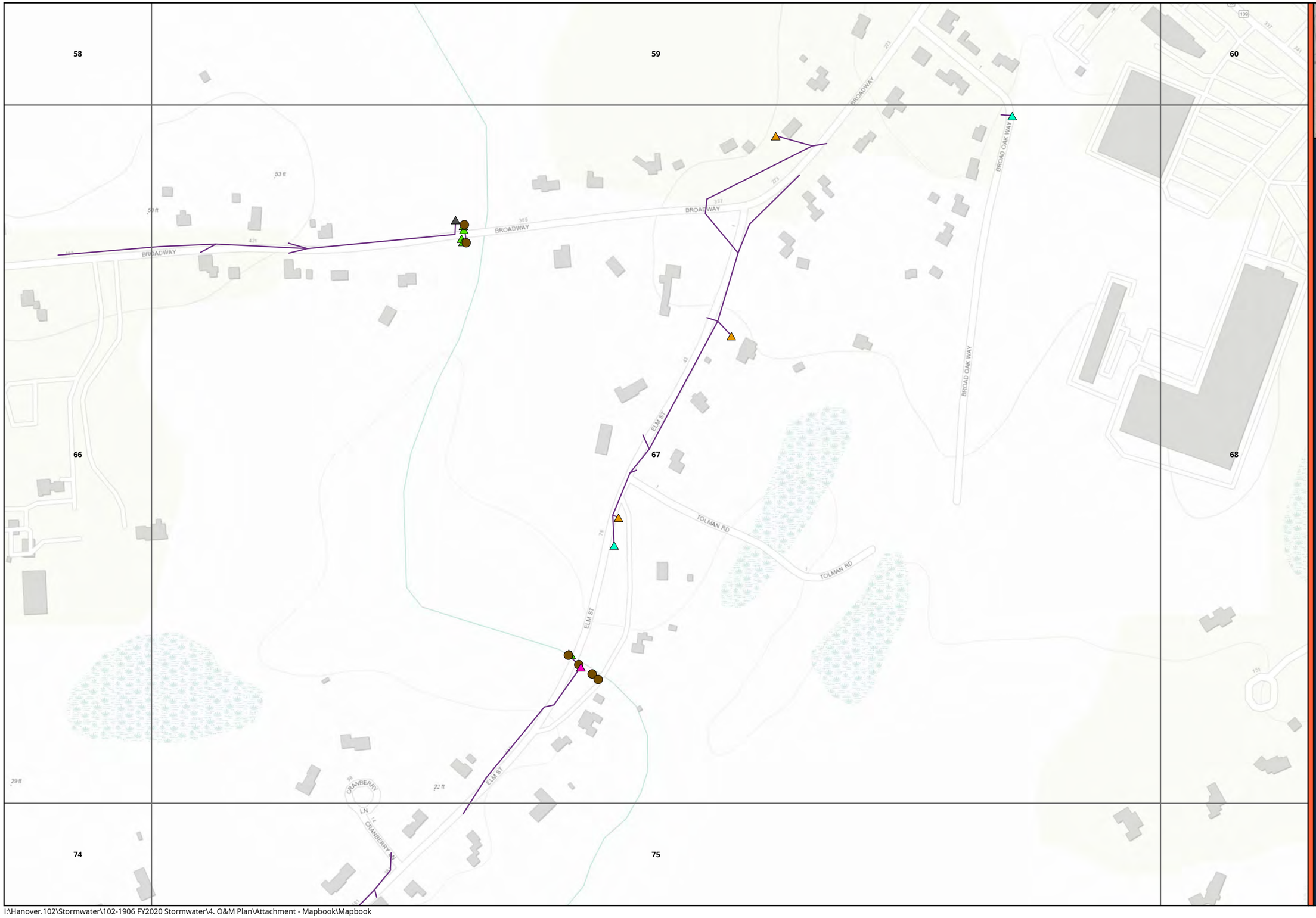
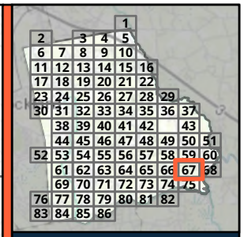




Stormwater System

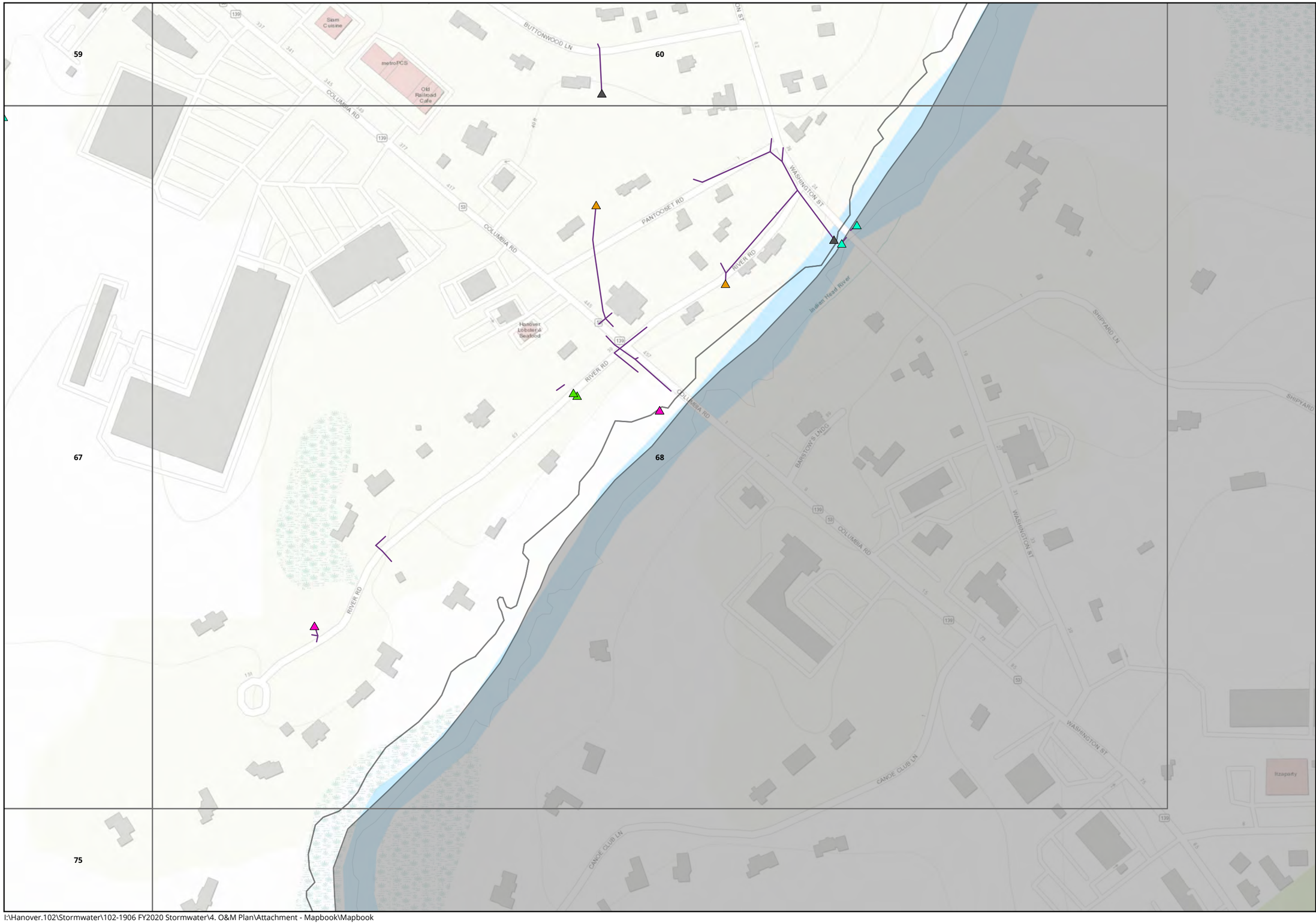
Hanover, Massachusetts

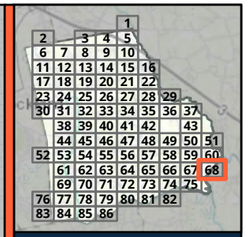
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250
Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

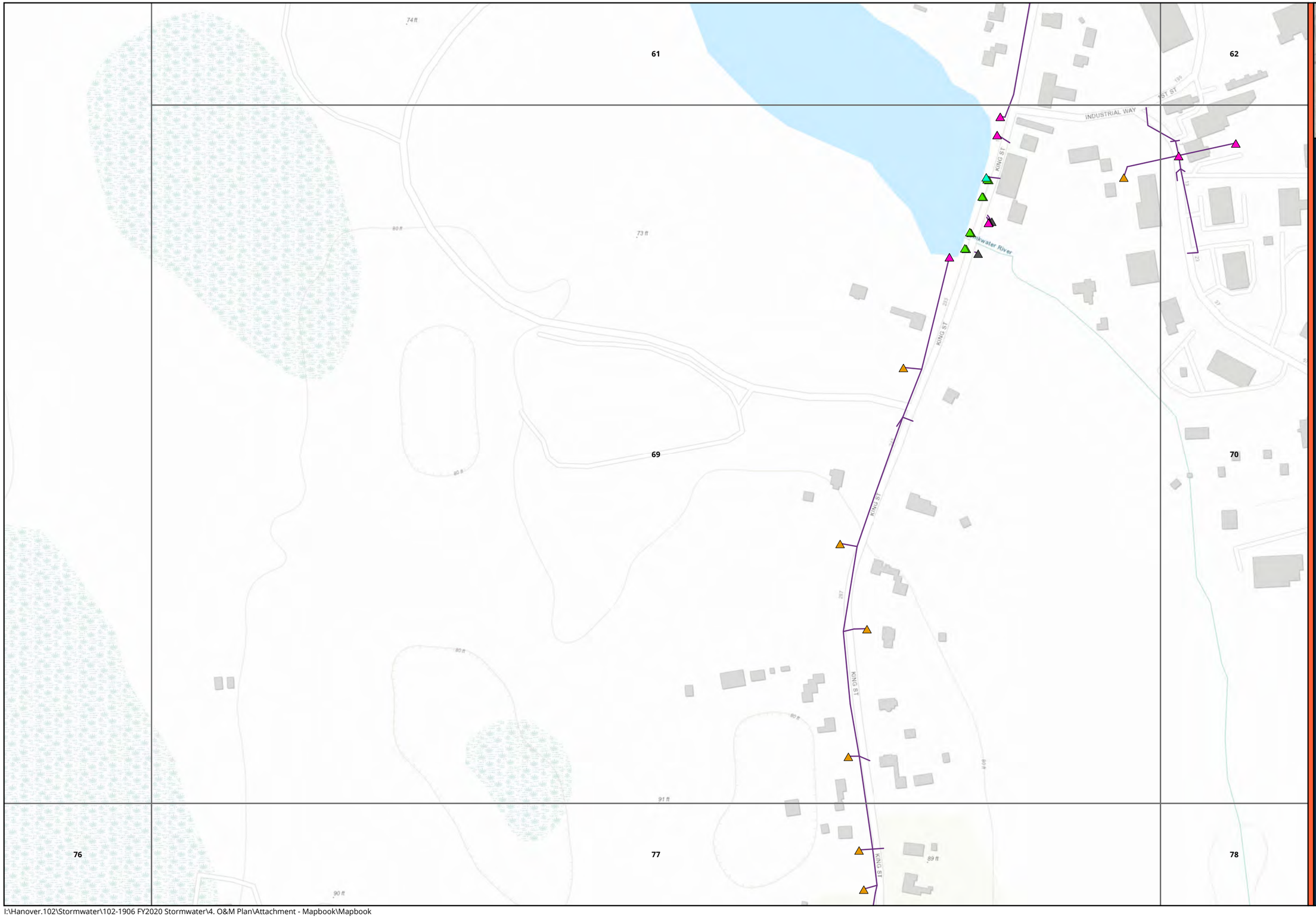
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

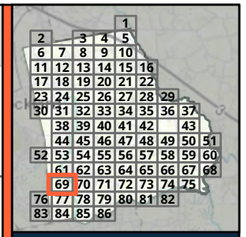
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

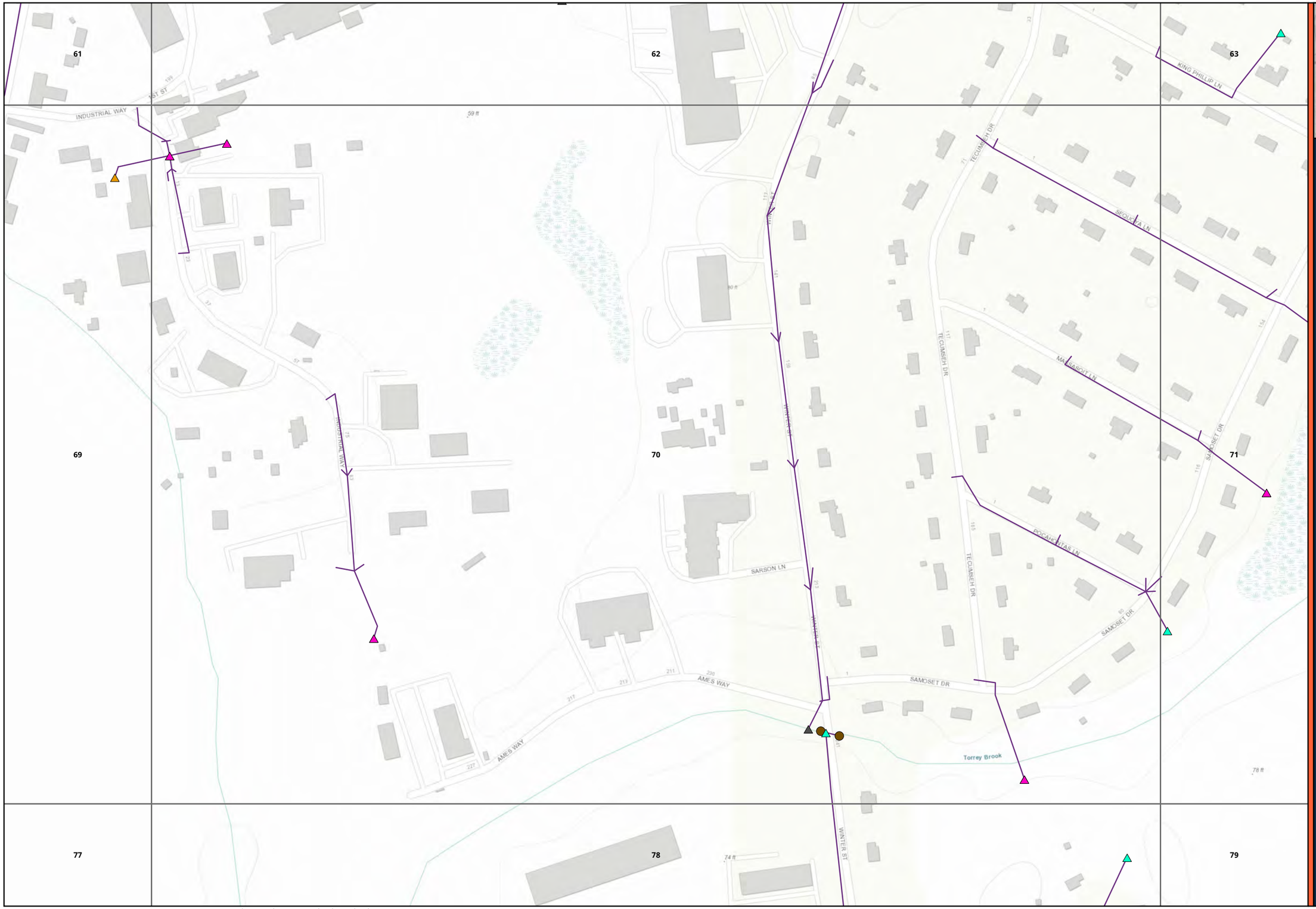
Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



Stormwater System

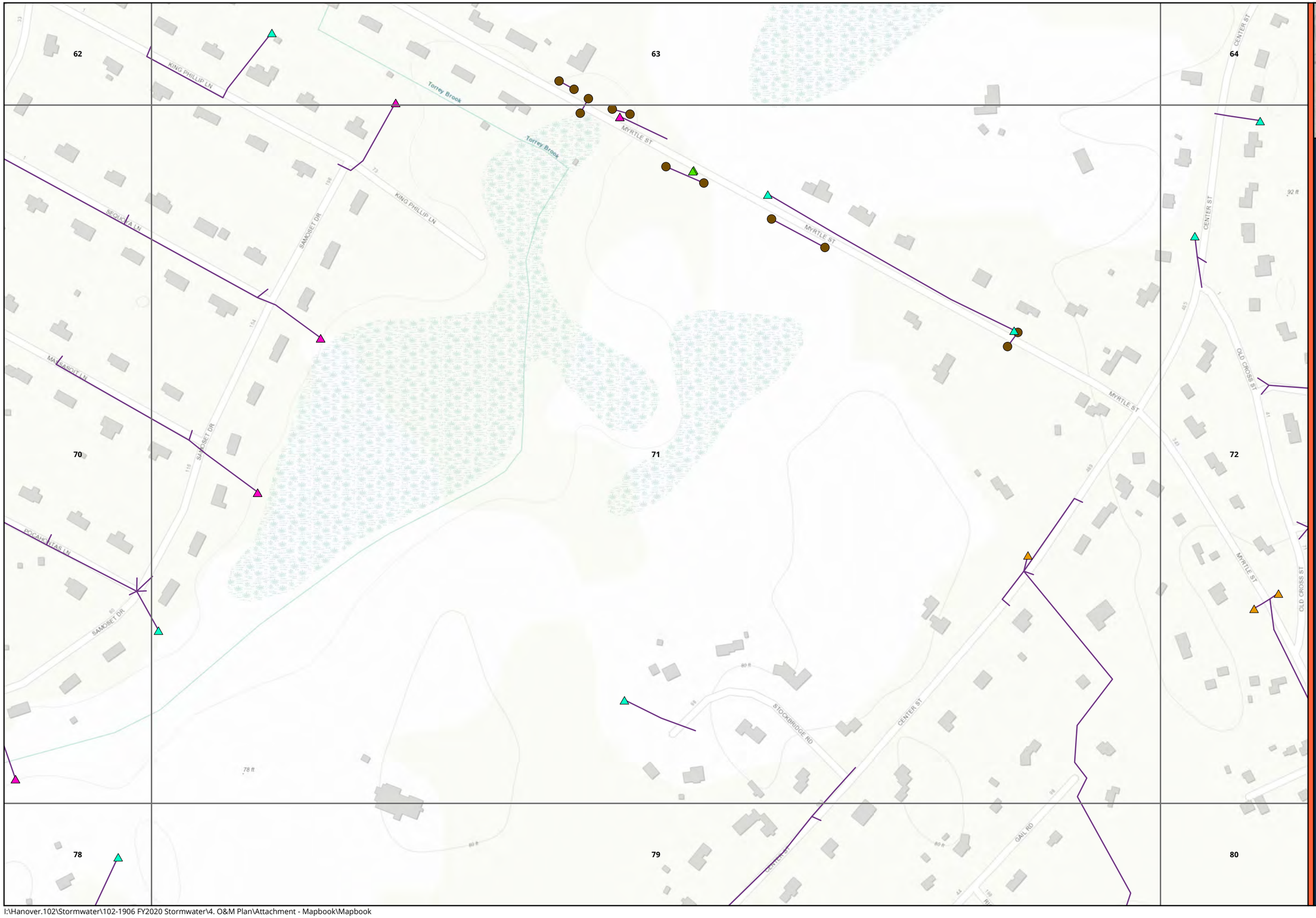
Hanover, Massachusetts

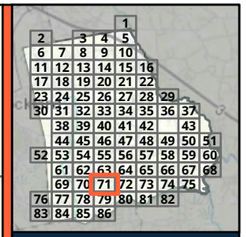
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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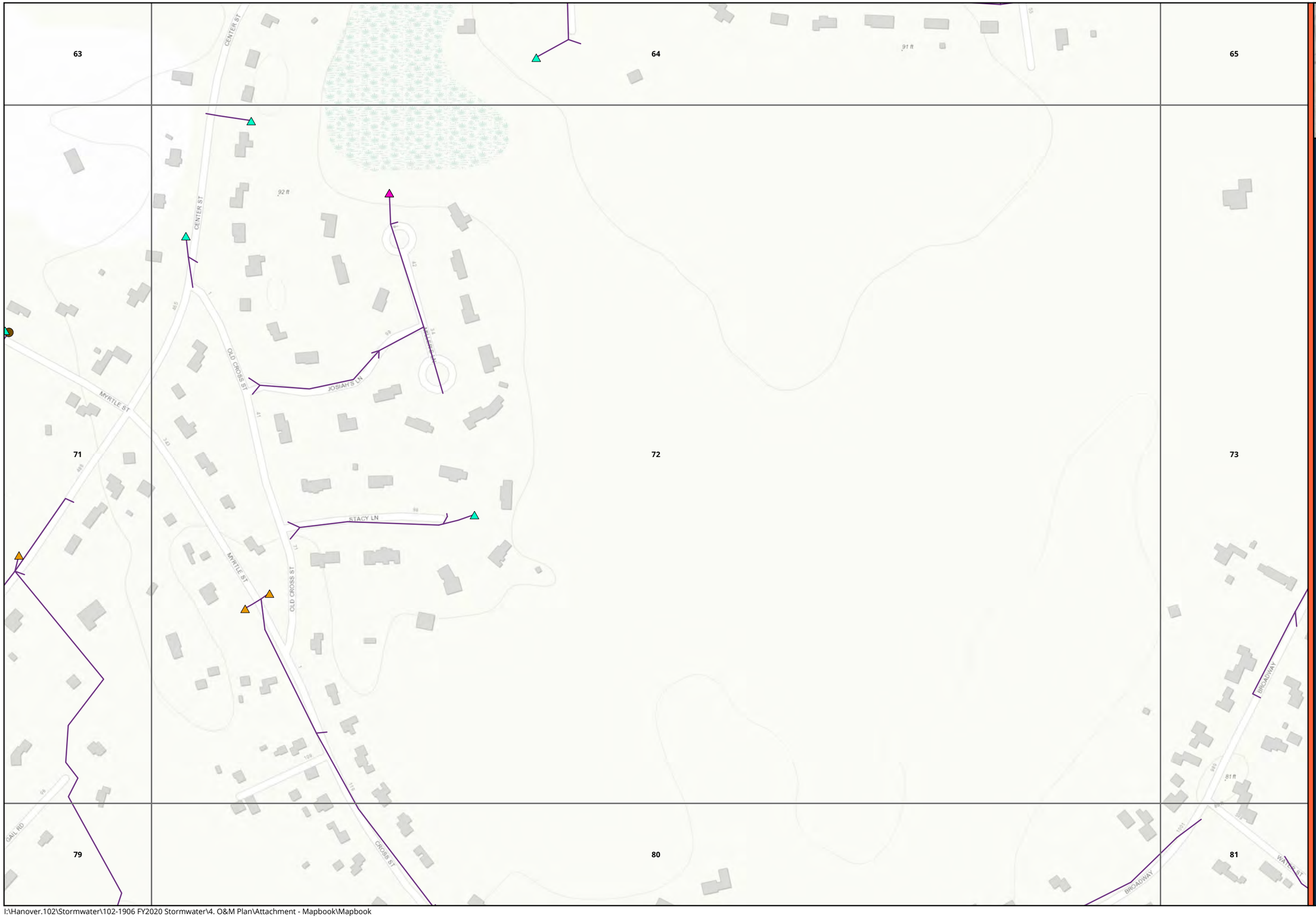

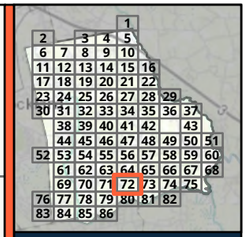

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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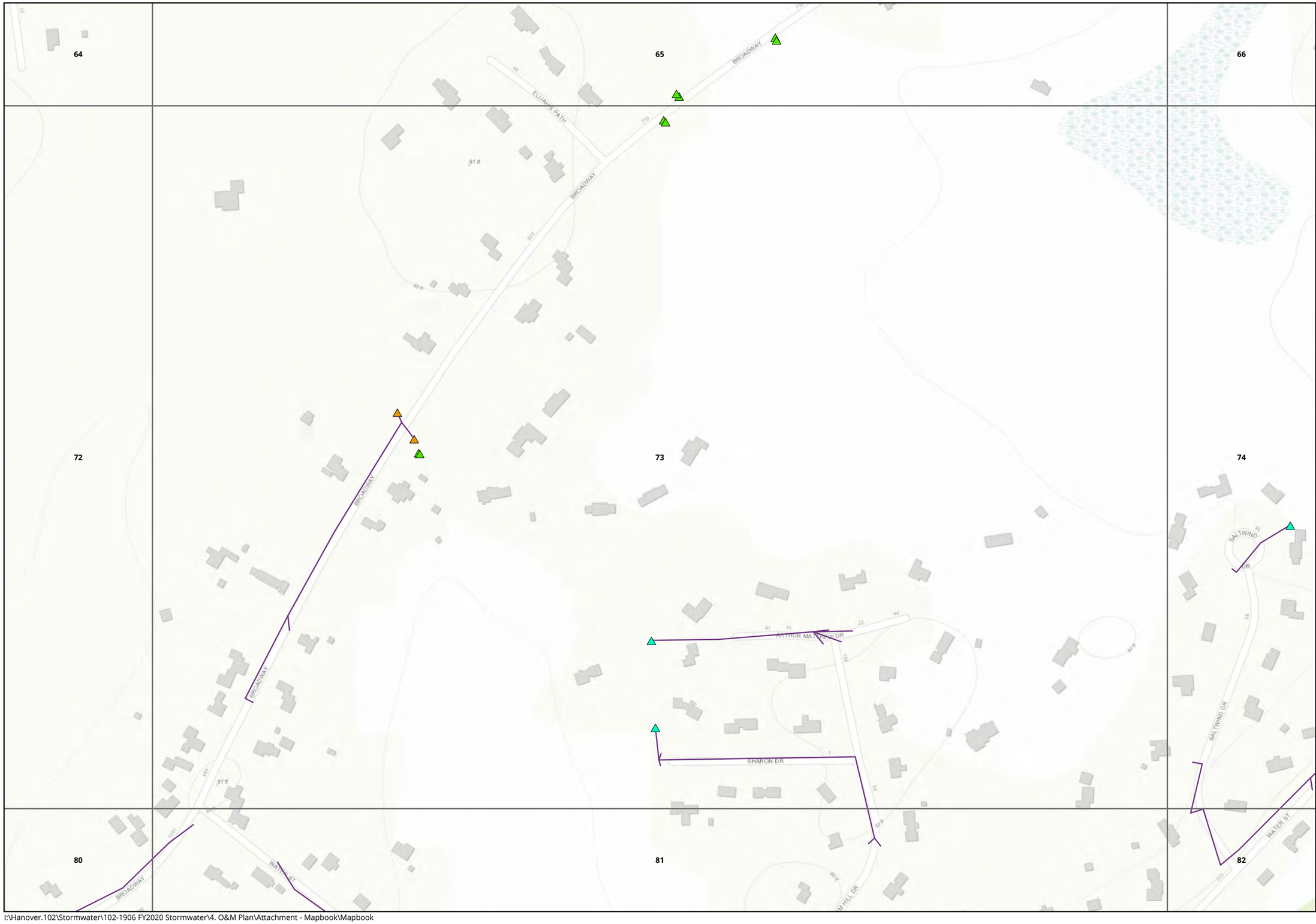

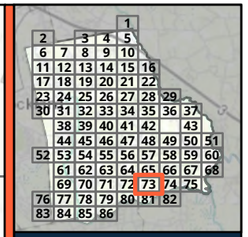

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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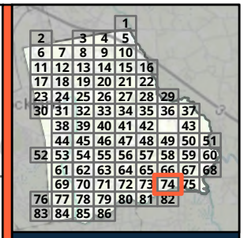

Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
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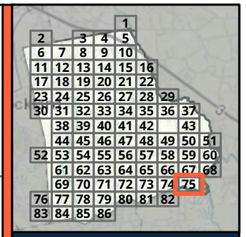
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS



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Hanover, Massachusetts

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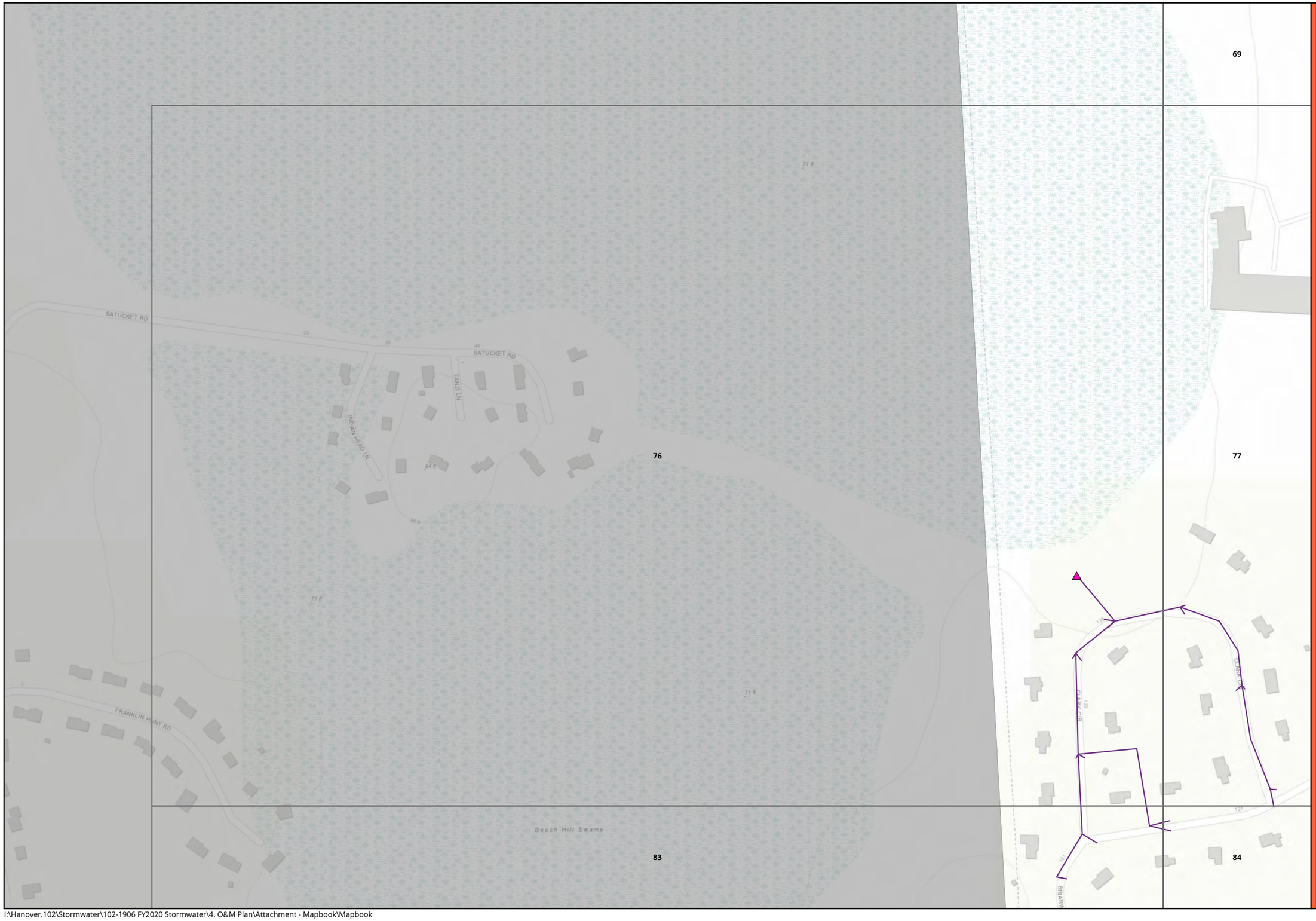
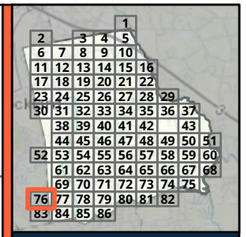
Feet

ENVIRONMENTAL PARTNERS





Stormwater System

Hanover, Massachusetts

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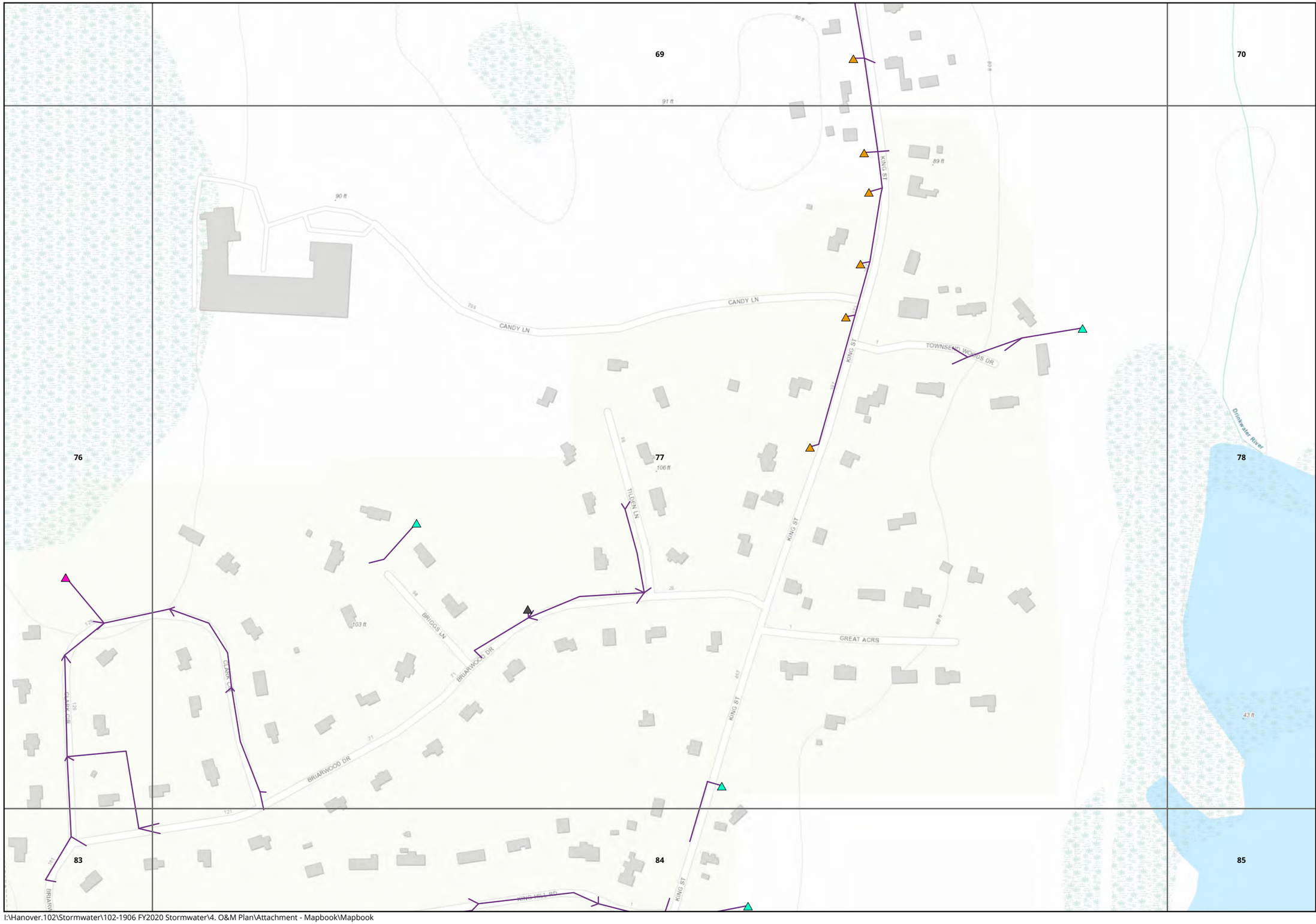
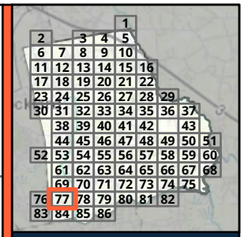
ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
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- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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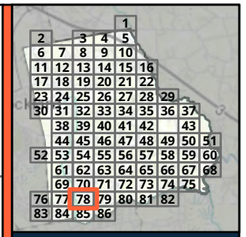

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
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- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS

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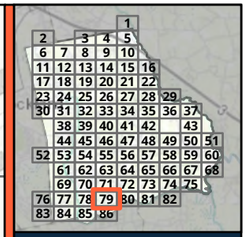

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Stormwater System

Hanover, Massachusetts

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N

0 125 250

Feet

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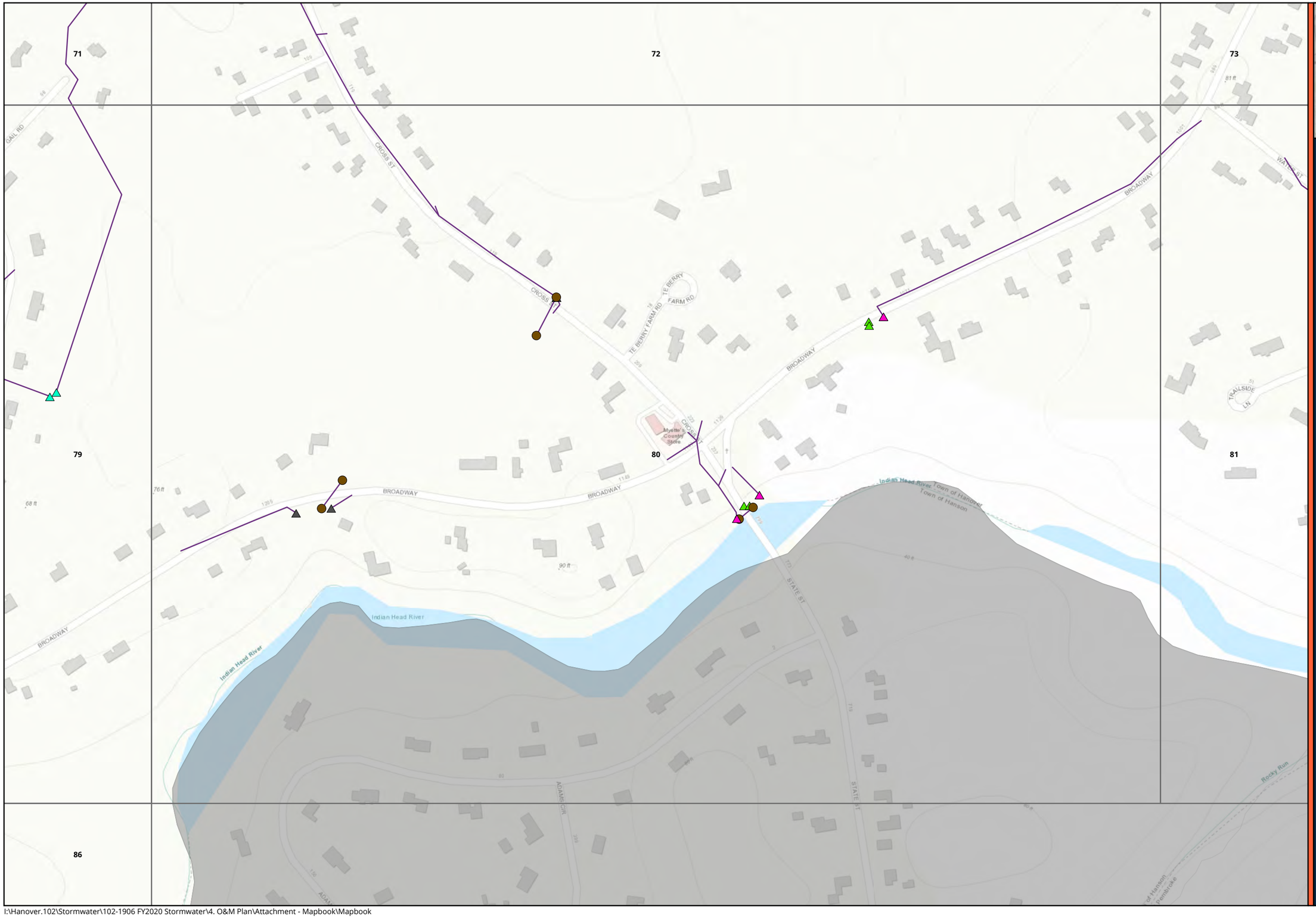

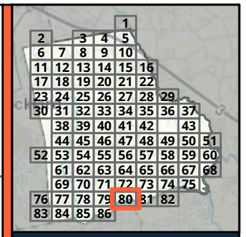

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Stormwater System

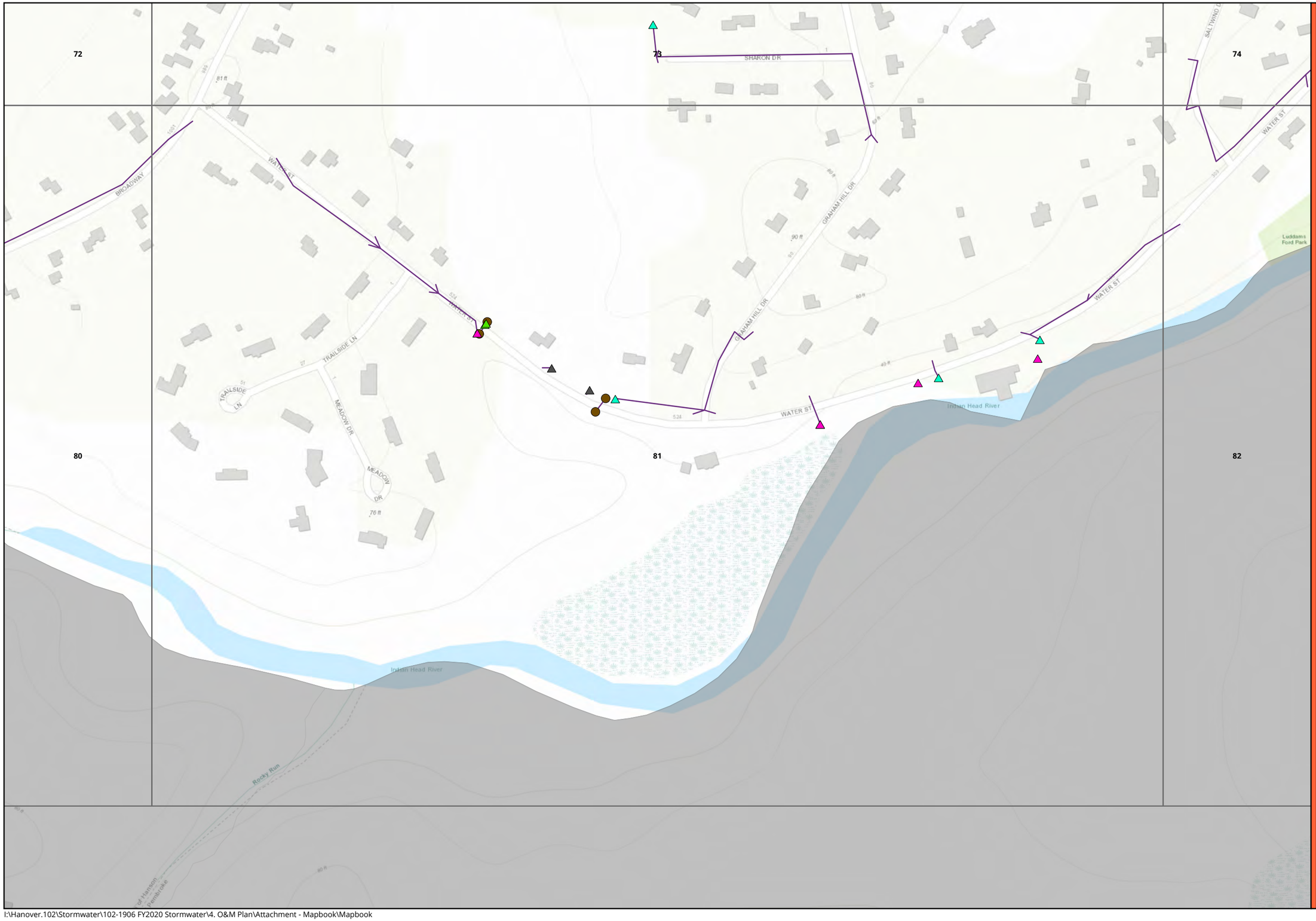
Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250 Feet

ENVIRONMENTAL PARTNERS



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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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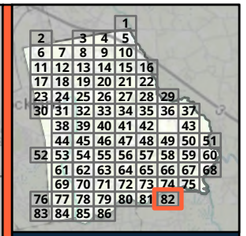

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Stormwater System

Hanover, Massachusetts

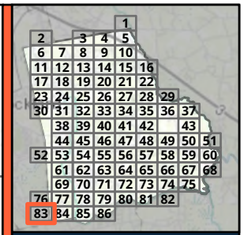
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS



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Stormwater System

Hanover, Massachusetts

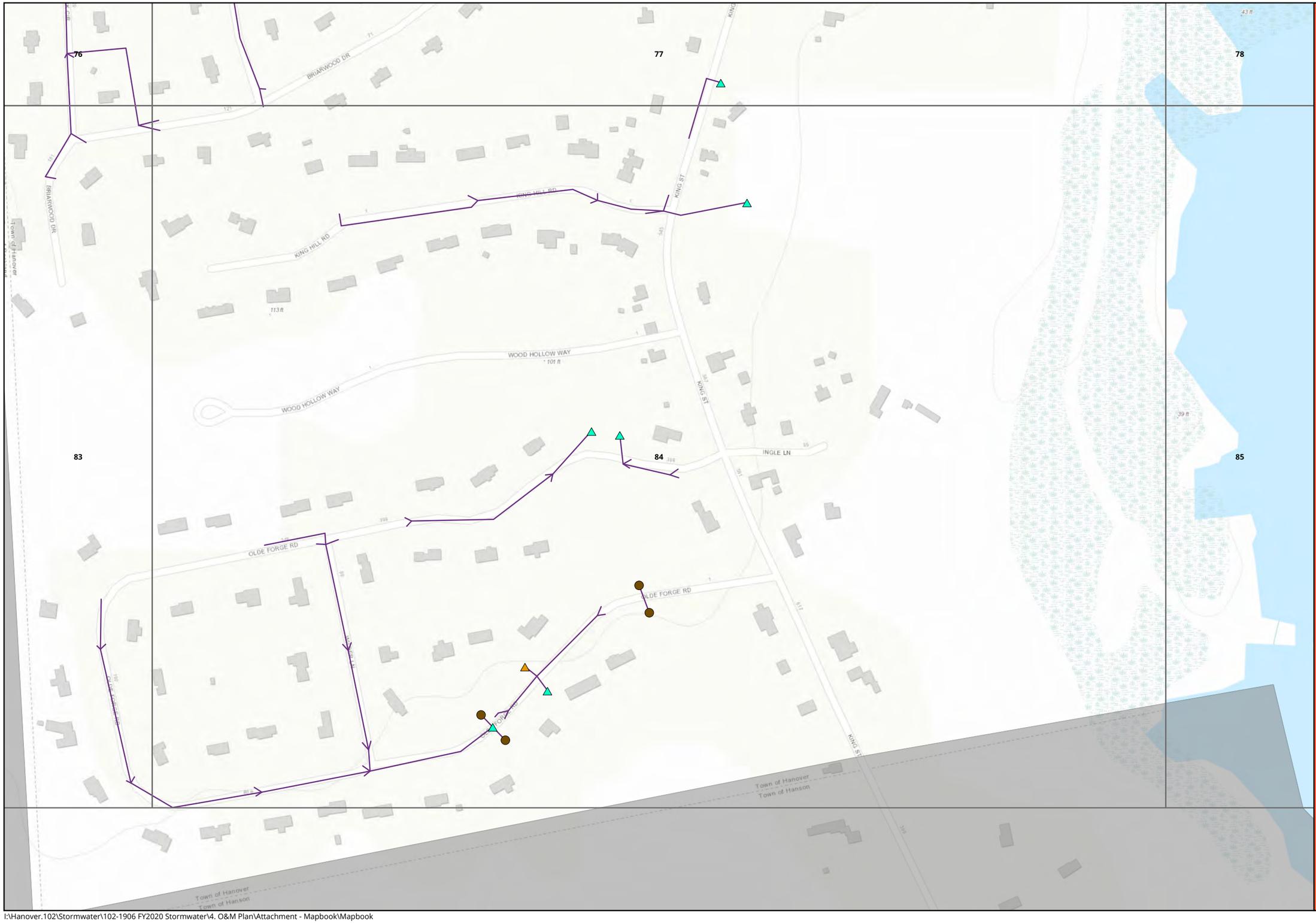
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

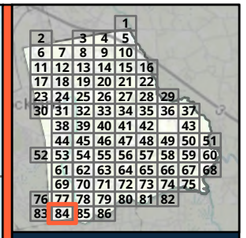
N

0 125 250

Feet

ENVIRONMENTAL PARTNERS





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Stormwater System

Hanover, Massachusetts

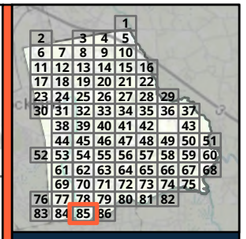
- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS



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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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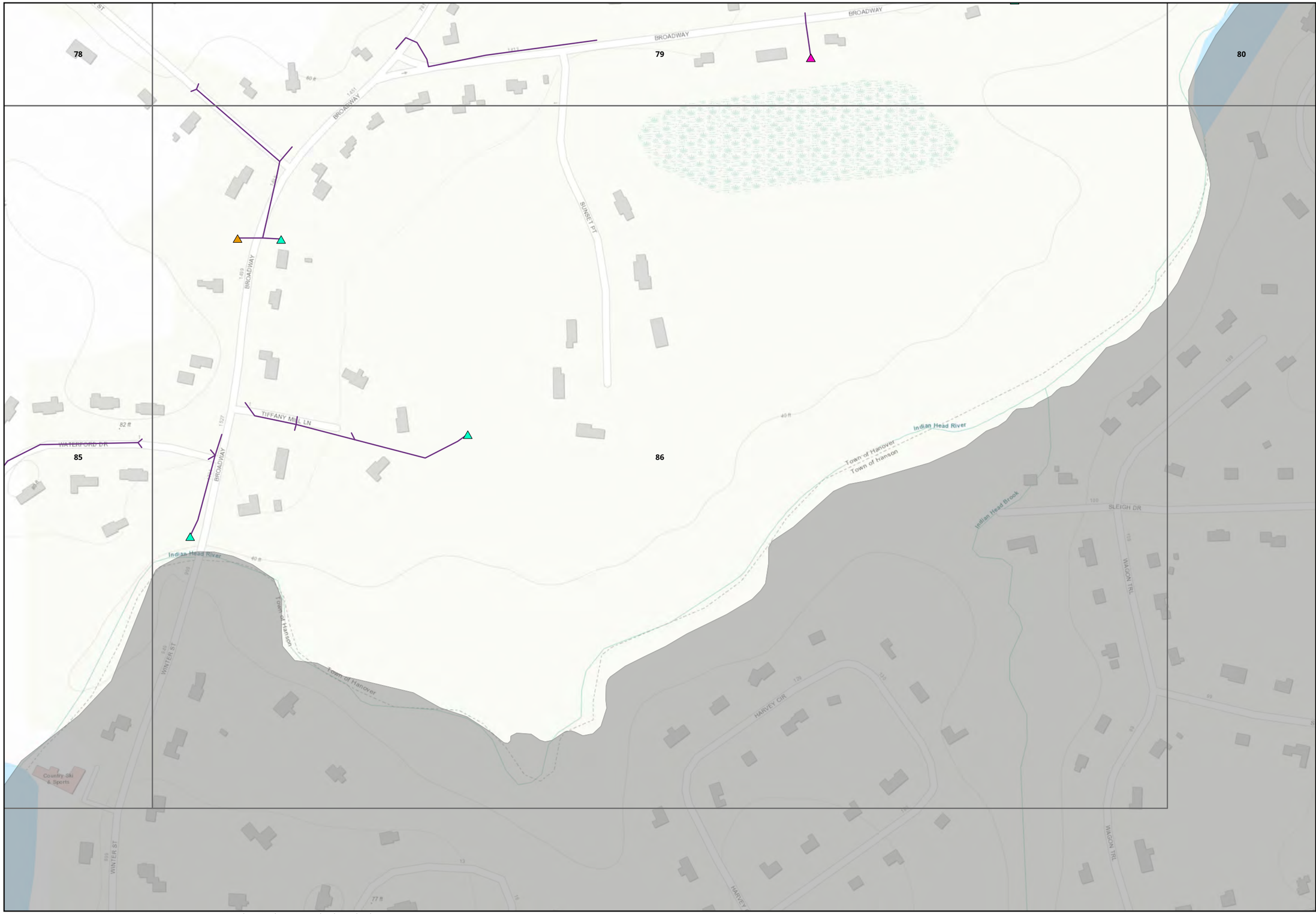

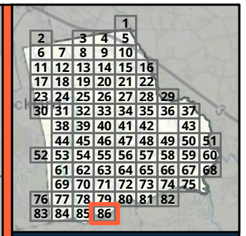

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Stormwater System

Hanover, Massachusetts

- MS4 Outfall (166)
- Culvert
- Inlet
- Non MS4 Outfall
- Outlet
- Scupper
- Drain Pipe

N

0 125 250

Feet

ENVIRONMENTAL PARTNERS

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