

Halfway Brook Watershed Stormwater Assessment and Management Plan



Prepared by the Warren County Soil and Water Conservation District
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Executive Summary

In 1997, the Warren and Washington County Soil and Water Conservation Districts (SWCD), with support of the local communities, applied for grant funding from the EPA for a watershed wide study of Halfway Brook. Historically Halfway Brook had been a successful trout fishery in the area, but with land use changes, water quality of the brook has declined. In an effort to determine the cause of the decline and suggest recommendations for improvement, the EPA awarded the Warren and Washington SWCD's funding for a study on the watershed. Assessment and evaluation of stormwater inputs into Halfway Brook was a key component of the plan.

The intent of this plan is to provide a list of priority areas of stormwater concern in the developed areas of the watershed to the local municipalities, and provide recommendations for stormwater improvement. This will allow the municipalities within the watershed to use this plan as a justification for funding of water quality projects.

Examination of stormwater required extensive time spent to determine which areas were the most affected. Investigations to find stormwater outlets into the brook and the areas drained required map work, aerial photos and many meetings with officials from the Town of Queensbury and the Village of Fort Ann. Once the drainage patterns were determined walking the areas to determine the land use and to decide what recommendations could be initiated to improve the stormwater was completed.

After examination of the areas impacted by stormwater it was determined that there were twelve major areas of concern; eight in the Town of Queensbury, two in the City of Glens Falls and two in the Village of Fort Ann. Parameters used to determine the priority list included the drainage area of the outlet, amount of developed land within the area and road maintenance and usage.

Primary areas of concern in the developed sections of the watershed were: the Route 9 corridor, Quaker Road corridor, Aviation Road corridor, North Glens Falls and the Route 4/149 corridor in the Village of Fort Ann. Specific recommendations of stormwater improvement are included in this plan to provide a basis for water quality remediation.

Acknowledgments

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1. Introduction

1.1 Overview

As land gets developed, road networks built, and open space diminished, the hydrology of that land area also changes. With increased development, we see increases in the runoff to streams and lakes, as more land area becomes impervious to water that once infiltrated. In addition to this extra volume of water, we see the quality of this runoff generally decline. Rainwater that once landed on forests and fields now lands on parking lots and roads. This water from a rainstorm (stormwater) will fall onto these areas and pick up whatever materials happen to be on this impervious area, and eventually outlet into the nearest waterbody. If there happened to be any gas or oil which leaked from a car in a parking lot, or excess sand from winter sanding operations, this material also gets transported into the stream or lake. As a result, the quality of water in these waterbodies declines and the aquatic ecosystem which at one time was pristine now has become impaired. Fisheries habitat in some cases becomes non-existent, and the water quality impaired to such a state that it is not safe for contact recreation. This is a concern for local residents and municipalities who utilize these waterbodies, and it is largely up to the local populace to initiate a program to remediate this situation.

Halfway Brook and its tributaries flow through the developed areas of Glens Falls, Queensbury, and Fort Ann before outleting into the Champlain Canal. This brook has been listed by the NYS Department of Environmental Conservation as being impaired by stormwater runoff, to the point where fish spawning in certain areas is impossible due to silting of the spawning beds. The fisheries habitat is also noted as being impacted by this runoff, due to higher temperature runoff from roads following a storm event and sand from winter road de-icing operations. The focus of this study was to determine where the most significant impacts to Halfway Brook and its tributaries are, and to provide recommendations to alleviate some of these impacts.

1.2 Purpose of Stormwater Plan

The purpose of the study was to locate and identify areas of stormwater runoff within the Halfway Brook watershed, examine their impacts on water quality and the aquatic ecosystem, and then develop viable solutions to the areas that are impacted by this runoff. This study is one component of an overall watershed management plan that is currently being developed for the Halfway Brook watershed. What this stormwater plan sets forth is an assessment of the drainage patterns and stormwater concerns within the Halfway Brook watershed, and specific recommendations to improve these situations. The top ten to fifteen stormwater concerns in the watershed have been determined and potential retrofitting of these drainage sites has been preliminarily developed. Each recommendation has a probable cost attached to it, and also a list of what issues may arise with actually constructing the recommendation. The intent of these recommendations is to outline the various concerns for stormwater runoff that is impacting Halfway Brook, and to provide a good starting point to address these concerns.

Each project listed in the recommendations will need site specific planning and engineering to have it undertaken. In addition, many of the recommendations for improvement are relatively costly as they cover relatively large drainage areas. Funding from State and Federal agencies is available to offset the costs of undertaking these improvements, and the local resources are available to assist with developing grants to obtain this money. Many new technologies have been developed to remove pollutants from stormwater runoff, and utilization of these technologies and more traditional solutions could improve the quality of Halfway Brook and its tributaries.

1.3 Location of the Study and Watershed Characteristics

The Halfway Brook watershed is located in Warren County, New York and Washington County, New York. The origin of Halfway Brook is the Wilkie Reservoir located in the Luzerne Mountains on the western edge of the Town of Queensbury. The outlet is in the Champlain Canal, within the Village of Fort Ann located in the Town of Fort Ann. The total watershed area of Halfway Brook is approximately 56,000 acres. The municipalities involved in this stormwater study are Towns of Queensbury and Fort Ann, Village of Fort Ann and the city of Glens Falls. Appendix A is a map, which shows the location of the watershed and Appendix B, indicates the land use within the watershed. Much more detail on the Halfway Brook watershed including soils, hydrology, land use, and other characteristics will be included in the Watershed Management Plan, and are not included herein.

2. Methodology

In order to create a comprehensive stormwater plan for the Halfway Brook watershed, it was necessary to understand the stormwater drainage system in areas which impacted Halfway Brook. This was done using extensive fieldwork and research of state, county and town drainage plans. Upon location and identification of storm sewer systems, it was necessary to map this information in order to be more readily usable. All maps included in this plan were generated using the data collected and transcribing it onto Geographical Information System (GIS) software. GIS enables its user to edit maps using aerial photos and planimetric quadrangle map images as the base of the maps, then adding stormwater, watershed and other pertinent information onto the map image. Areas in need of improvements in stormwater control were then pinpointed. Recommendations were then formed and mapped, creating the stormwater management plan.

The format and content of this study is set forth in the Halfway Brook Watershed Management Planning Program grant. Objective six of this grant was to undertake a stormwater assessment and recommendation study for the watershed, as set forth through six specific tasks as follows:

- Task A: Delineate storm sewer systems and drainages in the developed areas of the watershed.
- Task B: Identify areas where sediment is entering the stream through stormwater drainage.
- Task C: Identify idle land where stormwater improvement structures could potentially be installed.
- Task D: Identify existing stormwater quality improvement structures in the watershed.
- Task E: Develop specific stormwater improvement practices including costs.
- Task F: Identify and map locations of SPDES permits in the watershed.

The structure and content of this plan is reflective of these tasks, and work undertaken in this project was to satisfy these specific objectives.

Task A

Delineate on a map major storm sewer systems and stormwater drainage ditches in the urbanized/developing areas of the watershed.

Major stormwater sewer systems were found by research and fieldwork. Maps of state roads important to the Halfway Brook watershed were obtained from the New York State Department of transportation for Route 9 and 9L. County roads principal to the watershed are Bay Road, Quaker Road, Ridge Road, Aviation Road and Glenwood Avenue. Warren County Department of Public Works provided maps for these roads. Developed areas, commercial and residential also contain major storm sewer systems. The

planning department at the Queensbury Town Hall provided maps for many of these areas. These maps were primarily drainage plans and profiles. However some maps were outdated, or not available for certain developed locations. For these areas it was necessary to go into the field to complete the storm system information. Fieldwork consisted of going to the area of concern, locating, mapping and identifying the type of storm sewer structure. This information was then compiled to generate maps of major storm sewer systems and drainage ditches within the watershed.

Task B

If it is a problem, identify on a map the areas in the watershed where sediment is entering the stream system following winter road sanding operations.

Road sand material buildup was found to be a problem in some areas of the watershed, notably in highly developed areas. Inspection of culvert inlets of stormwater sewer systems and drainage ditches pinpointed sedimentation of roadside origin. Stream walking was also used as a method of locating areas of sediment buildup caused by road traction materials. Areas of sediment concern corresponded to the locations noted in Task A. Recommendations for sediment control are included in Task E, and correspond to the listed areas of stormwater concern.

Task C

Identify on a map the idle land areas in the watershed which might potentially be reserved for stormwater management facilities for future development, or set aside for retrofitting for existing development.

The location of open lands available for potential stormwater use was conducted along with the fieldwork associated with mapping of stormwater sewer systems. While walking along developed roads, areas of open space were noted and mapped. These areas were then researched to determine whether the land was available and appropriate for our uses.

Task D

Identify the location of stormwater management facilities constructed within the last five years in the watershed and provide an appraisal (i.e. red flags) as to whether or not the facilities are providing water quality or flood control benefits.

The stormwater management facilities within the Halfway Brook watershed consist of eight different types. These consist of detention basins, infiltration basins, oil/water separators, rock-lined trenches, infiltration trenches, level lip spreaders, and infiltrators. Throughout the previous spring and summer, when stormwater research of this type was taking place, the area has generally experienced a drought, therefore the observation of these facilities during a storm event has been limited. However, from the observations made when possible of a storm event's impact of these facilities, these areas of stormwater management are not a concern and seem to be functioning properly. Appendix C is a map of stormwater management facilities within the watershed.

Task E

Identify specific stormwater control practices where they may be needed, and provide an estimate of the cost for implementing those practices.

In the process of gathering information on stormwater control within the watershed through research and fieldwork, it became apparent that certain areas had no stormwater control system in place, or possessed

a failing system. These areas of concern were then viewed during and after storm events to better understand the stormwater practices of a problem area. Further testing was done on water outflow from culverts and drainage ditches in regions where stormwater control was needed or failing. These results indicated the type of pollutant and aided in identifying the type of stormwater control practice that would be needed. A list of the top ten areas needing stormwater control practices was created from this information, which includes those areas in need of sediment inflow control due to winter road sanding operations.

Task F

Identify and map locations of permitted point sources of pollution in the watershed, and describe the pollutants being controlled by the SPDES permit. Determine if there are opportunities for reducing pollutants of concern.

State Pollution Discharge Elimination System (SPDES) permits are issued from the NYSDEC. In order to identify sites on a GIS map, a list of permits were obtained from the NYSDEC in Albany, NY. Warren County SWCD staff met with the Town of Queensbury Wastewater officials to locate the areas of permits. A map of the permit sites within the watershed and a list of facility names and permit names are included in this report (Appendices D & E).

3. Current Stormwater Situation

3.1 Roadside Drainage into Halfway Brook and Tributaries (Very High Impact- Very Low)

A. Town of Queensbury

(See Appendix F for map)

1. Route 9. Drains substantial area of the Route 9 corridor from the Aviation/Route 9 intersection down to the city limits. Very developed property within this corridor with extensive paved areas. (Very High Impact)
2. Quaker Road. Halfway Brook crosses under Quaker Road by the intersection of Quaker Road and Glenwood Avenue. Quaker Road is a main thoroughfare with commercial development. One 24" corrugated metal pipe (cmp) culvert leads into the brook at the confluence of Cemetery Brook and Halfway Brook (across from Key Bank). Stormwater from the commercial stores is drained towards Halfway Brook and first enters a wetland area from the outlet of the stores, however heavy flows have cut channels that transport flow quickly to the brook. (High Impact)
3. Bay Road. Recent development by a large retail store has reduced stormwater runoff in the area. Bay Road itself is a well traveled road that has some residential development, a community college, a golf course, open space and commercial development. North of the Quaker Road intersection, a retail store was replaced by Lowe's Home Improvement center and their stormwater plan improved to lessen the effects of stormwater on the brook. A number of drop inlets are found which flow into the ACC tributary or Halfway Brook itself. South of the intersection of Quaker Road, residential and a concrete manufacturing plant is found. Stormwater from the area roads empties into the Crandall Park tributary, which flows into Halfway Brook by Cronin Road. (High Impact)
4. Willow Road. Willow Road is located off of Pine Lane from West Mountain Road. A development community with relatively heavy buffers of woody materials around the stream. Stormwater impacts are apparent with six (6) drop inlets discharging from the road directly into the brook. (Moderate Impact)

5. Adirondack Northway. The Adirondack Northway crosses above Halfway Brook south of Exit 19. A large culvert with an asphalt apron diverts water from I-87 and into the area known as Cole's Woods, where the stream is located. It appears that much of the flow does not directly enter the brook and instead travels into the woods. During periods of snowmelt, however the inputs may be large, since snow and ice build up may prevent drainage into the woods. (Moderate Impact)
6. Cole's Woods. Bordering the City of Glens Falls, Cole's Woods is a heavily forested recreational area. Hiking trails cross the stream through the property and are used for mountain biking and also as cross country ski trails. There is also a very good amount of ground cover in the understory and bordering Halfway Brook. Much of the riparian zone along the south side of Halfway Brook is marshy. There are two major culverts that divert stormwater from the Dixon Road area and the developed area known as Broadacres. Dixon is a heavily traveled road and may contribute moderate amounts of stormwater to the brook. (Moderate impact)
7. Hovey's Park. Located between Lafayette Street and Glenwood Ave., a culvert that enters the park from the west opens into a heavily vegetated ditch approx. 150 yards from the confluence of Halfway Brook and the ditch. The drainage begins west of Lafayette Street, from a wetland on Bank Street. (Moderate Impact)
8. Dixon Road. 150 feet north of the intersection of Dixon Road and Peggy Ann Road, Halfway Brook flows out of the Halfway Brook Reservoir property and under Dixon Road. Dixon Road is a heavily traveled road and can impact the brook. There are 2 road surface drains that have an apron tie into the curb. Any stormwater is directed downslope into a heavily wet, vegetated area alongside of the brook. (Moderate Impact).
9. Potter Road. Potter Road runs between West Mountain Road and Dixon Road. Heavily vegetated around the stream and no direct roadside drainage system suggests minimal stormwater impacts at this site. (Low Impact)
10. Glenwood Ave. Glenwood Ave. borders Halfway Brook along Hovey's Park Pond and the attached wetland to the south. (Low Impact)
11. Cronin Road. Cronin Road is a connector between Bay and Ridge Roads. Bay Meadows Golf Course is the major landowner at this location. Some development at the intersection of Bay and Cronin Roads can be found. A roadside ditch runs to the brook from the west and enters into a rock-lined section, before entering the brook. A few houses are found here as well. This area is heavily vegetated. (Low Impact)
12. Meadowbrook Road. Surface drainage around the Meadowbrook road area, with most of the road drainage sheeting off of the road and outleting into yards and such. (Low Impact)
13. Haviland Road. Haviland Road does not cross Halfway brook, but is near enough and had several small drainages that may transport pollutants to Halfway Brook. Recent land use changes from agriculture to a golf course and residential property, has likely increased traffic on this road. There is not much buffering area for stormwater to filter through near Ridge Road. (Low Impact)
14. Ridge Road. The last road intersection in Warren County. A heavily traveled road with mainly residential properties, Ridge Road is well forested near the brook and has a large floodplain with wetland species. A culvert of 18" reinforced concrete pipe (rcp) enters the brook from the north side of the bridge intersection. Stormwater from the grade break on Ridge Road north of the bridge, travels in a grassed lined ditch to the culvert. There are numerous wetlands in the area, which may provide for detention and treatment. A small portion of Haviland Road connects to the stormwater drain at the intersection of Haviland and Ridge Roads, but the road portion is short and again has many wetlands. (Low Impact)
15. Thunderbird Road. As Halfway Brook leaves the city watershed property for the first time it crosses Thunderbird Road. A development of 4-5 houses located above Halfway Brook has stormwater conveyed from part of the development, on the unimproved road, via a roadside ditch. (Low Impact)
16. West Mountain Road. Halfway Brook crosses West Mountain Road south of the Aviation Road-West Mountain Road intersection. A residential area that is partially owned by the City of Glens Falls, this crossing has a low rate of stormwater influence except during ground freeze. There are no defined roadside ditches or culverts that convey stormwater to the brook. (Very Low Impact)

B. City of Glens Falls

(See Appendix G for map)

1. Bowman Ave outlet 1. Starting in the southern end of the watershed in the city of Glens Falls stormwater from the Notre Dame Street area flows Northeast towards Route 9. It crosses Route 9 and flows northwest to Bowman Ave., where it outlets to a small tributary of the Crandall Park trib. (High Impact)
2. Webster Ave outlet. Stormwater from the Horicon Avenue and parts of Coolidge Avenue flows east to Route 9 then northwest to Bowman Avenue. Stormwater from Crandall Park and Route 9, from Webster Ave. to Bowman Ave. flows south along Route 9 to Bowman Ave, where it heads east and empties into the small tributary that accepts the Notre Dame Avenue stormwater. From the city line on Route 9 to Webster Ave., stormwater is carried to the Crandall Park tributary, located on Webster Ave. (High Impact)
3. Bowman Ave outlet 2. East of the Crandall Park tributary, stormwater is collected from the Bay Road, Sanford Street and Ridge Street areas. The areas located between the Bay Road-Sanford Street intersection and the Sanford Street-Bay Road intersection drains north to the intersection of Bay Road and Webster Ave. At this point the water flows west down Webster Ave. to the Crandall Park tributary. (High Impact)

C. Town of Kingsbury

1. Washington County Route 35. Located at the change of Warren to Washington Counties there are residential and commercial properties. Roadside ditches allow stormwater runoff from Pattens Mills road to Halfway Brook. On the West side of the brook, stormwater is sheeted into wooded areas or vegetated areas before entering Halfway Brook. (Moderate Impact)
2. Pattens Mills Road. Pattens Mills Road crosses Halfway Brook and has a stormwater culvert that empties into it at the Pattens Mills Road bridge. Residential properties with large areas of undeveloped land are the main land uses around this intersection. (Moderate Impact)

D. Town of Fort Ann

1. State Route 149. Route 149 crosses above Halfway Brook about 30 feet. A heavily traveled road between the Village of Lake George, Queensbury and the Village of Fort Ann, Rt. 149 has residential, commercial, agricultural and industrial areas. Only a short section of road is affecting Halfway Brook however. Open space and a few houses are along the section of 149 that has stormwater runoff from the road. A concrete and soil ditch, of approximately 102 linear yards, drains directly above Halfway Brook. (Low/Moderate Impact)
2. Tripoli Road. Tripoli Road is a steeply graded road that has some drainage towards Halfway Brook, but there is a good amount of vegetation that filters the water before it reaches the brook. The steepness of this drainage area however may contribute direct stormwater inputs during higher intensity storm events. (Low Impact)
3. Farley Road. Farley Road has light residential development, agriculture and open spaces in the drainage area. Farley Road has 2 stream crossings on Halfway Brook. With the lack of development reducing the amount of traffic on the road, high amount of vegetation and no direct ditches or culverts entering the brook, the amount of stormwater inputs are low. (Low Impact)
4. Mattison Road. Also known as Bentley Road, Mattison Road is surrounded by agricultural land with a few residential dwellings. The bridge on Mattison road drains directly into the brook via 4 – 6 inch drop inlets directly above the brook. Some stormwater is also able to reach the stream by a roadside ditch on the Northeast side of the Mattison Road bridge. (Low Impact)

5. Goodman Road. Agriculture is the main land use on Goodman Road. Heavy vegetation around the brook reduces the impact of stormwater. On the east side of the brook a wetland is located and appears to accept much stormwater from that side. (Low Impact)
6. South Bay Road. Above the geographic feature known as Kane Falls, land use is mainly agricultural. Low slopes and open spaces are commonly seen in this area of Washington County that is still farmed. Heavy vegetation around the bridge reduces the amount of stormwater impacts from the road. The bridge is slightly crowned and any runoff drops from the bridge to the brook below. A major drainage from the Northwest side of South Bay Road crosses under the road, and empties into a field just north of Halfway Brook. A ditch still exists from the edge of the field, and may at sometime conduct stormwater into the brook instead of the field. (Low Impact)

E. Village of Fort Ann

(See Appendix H for map)

Route 149 is the dividing line for stormwater drainage in the village. Stormwater south of 149 empties into the Fort Ann tributary or the Champlain Canal. North of Route 149 stormwater empties into Halfway Brook, the Fort Ann tributary and the old Champlain canal.

1. Elizabeth Street/Catherine Street/149. Drainage from the intersection of Elizabeth Street and Catherine Street flows north to the intersection of Catherine Street and Route 149. This is a main tie in for stormwater in the village. A line running from the intersection of Route 149 and Route 4 connects to this tie in as does the north side of the Catherine Street/ Route 149 intersection. Continuing west on 149 the stormwater drain collects the runoff from the north side of Route 149 up to Queen Anne Drive. A tie in into the Fort Ann tributary box culvert was located (18" rcp). (High Impact)
2. Route 4. North of the cross connection, stormwater enters several drop inlets located on both sides of Route 4. The stormwater is then outleted into Halfway Brook on either side of the Route 4 bridge by 2-24" cmp's. (Moderate/High Impact)
3. Fort Ann School area. From the intersection of Victoria Street and Catherine Street, stormwater flows north and west. A line running in front of the Fort Ann school travels in a northwesterly direction across the ballfield and converges with two lines running from the block between Victoria and Elizabeth Streets. The 12" black plastic pipe continues behind the bus garage and is outleted into a ditch in a heavily vegetated area between the school and the Fort Ann tributary. (Low Impact)
4. Route 4/Victoria Street. Stormwater at the intersection of Victoria Street and Route 4 travels north on Route 4 past Elizabeth Street. The drainage is cross-connected at approximately 100 yards south of the Route 149 and Route 4 intersection, and flows west to east. Surface run-off from the grade break in front of the Cumberland Farms flows south to the drop inlets, which are cross-connected. A 12" cmp line runs to the Champlain Canal, out of the watershed. (Low Impact)
5. Mountainview Lane. The western most stormwater runoff from development within the village is off Mountainview Lane. Drop inlets are located within this development on Haviland Rd., Sunset Rd. and Mountainview Lane. The drop inlets on Haviland Rd. head north then turn east onto Sunset Rd. Mountainview's drop inlets head north and merge with the line from Haviland/Sunset area. After the tie in from these 3 roads, stormwater is outleted into an undeveloped vegetated area. (Low Impact)
6. South Bay Road. A 12" cmp culvert on the northeast side of the bridge on the Fort Ann tributary drains South Bay Rd. from the firehouse. It includes the road from the firehouse to the drop inlet, east of the bridge. (Low Impact)
7. South Bay Road/Catherine Street. Drains area north of the Route 149/Catherine Street intersection. Flows north to South Bay Road and outlets into the Fort Ann tributary from a 12"cmp. (Low Impact)
8. Route 4. The drop inlets on Route 4, located north of the intersection of Route 4 and Route 149 flow north. A cross-connecting culvert, located in front of St. Ann's Catholic Church, empties stormwater into the old canal. (Low Impact)

3.2 Location and description of stormwater culverts emptying directly into Halfway Brook and Tributaries

To determine the water quality impacts to the Brook from the stormwater drainage system in the developed areas, it was necessary to locate the culvert outlets into the Brook and its tributaries. Once the culvert outlets were found, the upland drainage system was then determined. Sub-watersheds for each drainage system were developed and then assessed for the degree of impervious versus pervious surfaces, and their potential impact on water quality was concluded. Appendix I is a map of the culvert locations. The location and size of the culverts emptying into Halfway Brook are as follows:

1. Willow Road. 18" cmp.
2. Dixon Road (Halfway Brook Reservoir station). 18"cmp from station area.
3. Dixon Road (Halfway Brook Reservoir station). 12"cmp from station area.
4. Dixon Road (Halfway Brook Reservoir station). 12"High Density Polyethylene (HDPE) pipe from station area.
5. I-87. 12"cmp to wooded area near brook.
6. I-87. 30" cmp to wooded area near brook.
7. Cole's Woods. In the park, at the end of Northrup Rd, 30" cmp. At the end of Parkview Avenue in the woods, 36" cmp.
8. Northway Plaza. Cemetery Brook tributary, 48"cmp.
9. Quaker Road. 36" cmp to ditch along Quaker Road (tributary of Cemetery Brook).
10. Quaker Road. 18" cmp to ditch along Quaker Road (tributary of Cemetery Brook).
11. Route 9/ Glen Street. Northwest corner at bridge crossing, 12" rcp.
12. Route 9. Northeast corner at bridge crossing, 48" cmp.
13. Route 9. Southwest corner at bridge crossing, 18" rcp.
14. Route 9. Southeast corner at bridge crossing, 18" rcp.
15. Glenwood Avenue. From Glenwood Ave. to brook, 14" cmp.
16. Hovey's Pond. Behind memorial Bank and herb gardens, 24" cmp.
17. Bank Street pond. 2-30" cmp's from Queensbury Plaza area.
18. Bank Street pond. 1-30"cmp from pond to Hovey Park.
19. Quaker Road. By confluence of Cemetery Brook and Halfway Brook, 24" cmp.
20. Bay Road. 24"cmp, northeast side of bridge intersection of Halfway Brook.
21. Bay Road. 30" cmp, southeast side of bridge intersection of Halfway Brook.
22. Bay Road. 24"cmp, southwest side of bridge intersection of Halfway Brook.
23. Bay Road. 30" cmp, northwest side of bridge intersection of Halfway Brook.
24. Bay Road, First tributary north of mainstem on Bay Road. 2-32" cmp's.
25. Bay Road, Second tributary north of mainstem on Bay Road. 2-24" cmp's.
26. Ridge Road. Northeast side of bridge crossing, 18" rcp.
27. Pattens Mills Road. Southeast corner of bridge, 18" cmp.
28. Fort Ann School. Flows towards Fort Ann tributary, 18"cmp.
29. Route 149. Fort Ann tributary, 18" rcp.
30. Route 4. South of intersection of Rt. 149 and Route 4, 12"rcp.
31. Route 4. North of intersection of Route 149 and Route 4, 12" rcp.
32. South Bay Road. Fort Ann tributary, north side of South Bay Road, 12" cmp.
33. South Bay Road. Fort Ann tributary, south side of South Bay Road, 12" cmp.
34. Mountainview Lane. Fort Ann tributary, 18" cmp.
35. Route 4. Southwest side of bridge crossing, 24" cmp.
36. Route 4. Southeast side of bridge crossing, 24" cmp.

3.3 SPDES Permit Locations within the Halfway Brook Watershed

A task as set forth in the Plan of Work for this project was to determine the location of State Pollution Discharge Elimination System permits which have been issued by the NYS DEC primarily for commercial groundwater discharges. Appendix D shows the approximate location of these permits, and Appendix E has the facility name and the permit recipient.

Within the Halfway Brook watershed, there are a total of 27 SPDES permits issued by the NYS DEC. Twenty-six of these permits are for groundwater discharges, and one is for a surface discharge. The lone surface discharge is the Village of Fort Ann wastewater treatment facility. The parameters that are being controlled at the Fort Ann facility are: Biological Oxygen demand, Total Suspended Solids, Total Settleable Solids, pH and Temperature.

At this time according to the NYS DEC, there are no reported problems with the permitted sites.

If the Village of Fort Ann upgrades the size and capacity of its plant in the future, phosphorus will likely be a parameter that the DEC regulates for in the SPDES permit.

4. Water Sampling Program

The sampling program for Halfway Brook was undertaken in order to find the condition of the its waters, whether they are polluted, how much, and what from. The sampling sites were chosen to give a representation of the brook, as it ranges from wilderness stream to urban to agricultural waterway, through its length. The sampling sites were then selected based on their location, and the stormwater inputs in their area. This is also true of the stormwater sampling program, however stormwater samples must be taken of the first ½ inch of runoff, to get an accurate reading of what types of pollutants the stormwater is contributing to the brook. Accordingly the stormwater sampling sites were chosen because of their direct stormwater input during a storm, the samples taken at these sites, if done quickly, would give accurate reading of the stormwater pollutants. In addition to the biological and chemical samples that are being examined, we are currently monitoring streamflow in Halfway Brook with two automatic stream level recorders and a Stevens Recorder. Readings are taken every 15 minutes with the automatic recorders and daily with the Stevens Recorder. The water chemistry coupled with the flow data will allow us to characterize the hydrology of Halfway Brook, and provide a solid background of information relating to impacts from development and agricultural operations within the watershed. Appendix J shows the sampling site locations.

4.1 Location of Sampling Sites

There are eight sampling sites located within the Halfway Brook watershed area. Fecal coliform (Fc), nitrate (N), molybdate reactive phosphorus (Mrp), total phosphorus (Tp) and total suspended solids (Tss), are monitored on a monthly basis and during storm events. A listing of the sites and their locations follow and a detailed description of the baseline site and stormwater sites are found below.

- a. Wilkie Intake Reservoir: Located off Butler Pond Rd in the Town of Queensbury, in the Luzerne Mountains (Baseline Sampling Site).
- b. Route 9: Intersection of Route 9 and Halfway Brook in the Town of Queensbury, just North of the City of Glen Falls (Stormwater Sampling Site).
- c. Meadowbrook Road: Intersection of Meadowbrook Road and Halfway Brook. Crossing found south of Haviland Road and north of Cronin Road in the town of Queensbury (Stormwater Sampling Site).

- d. County Line: Halfway Brook enters Washington County and intersects Washington County Route 35, east of the Town of Queensbury/ Warren county line from Sunnyside East Road.
- e. Mattison/Bentley Road: Intersection of Halfway Brook and Mattison/Bentley Road, in the Town of Fort Ann.
- f. Kane Falls: Washington County Route 16 crosses Halfway Brook, North of the Village of Fort Ann in the Town of Fort Ann.
- g. Fort Ann Tributary: Confluence of Fort Ann Tributary and Halfway Brook on Washington County Route 16, within the Village of Fort Ann.
- h. Canal: Fort Ann Wastewater Treatment center property, located at the end of Canal Street in the Village of Fort Ann.

The Route 9 and Meadowbrook road sites are areas that have been set up for the examination of stormwater.

4.2 Description of drainage area at baseline sampling site

The Wilkie Reservoir Intake site is located within the City of Glens Falls watershed property and the city currently draws water from several reservoirs within the property. This site was chosen as the baseline site due to the surrounding land use. Heavily forested sloping lands with the lack of any improved roads make this the least impacted sampling site on the brook. Used primarily for watershed protection, there is no development within the city's watershed property where this sampling site is located. The predominate soil found in this area is a Bice (BdC), very bouldery fine sandy loam with a 3 to 15 percent slope. It is a deep, well drained acidic soil commonly found in Warren County. The property is currently posted against trespassing by the city, keeping it in a relatively pristine state. There is not any stormwater entering above the sampling site from the roads, which makes it very useful for comparison against the developed areas.

4.3 Description of drainage area at Stormwater Sampling Sites

A. Route 9 Sampling Site

Route 9, also known as Glen Street, is a heavily traveled road located in the most developed area of the Town of Queensbury. Stormwater is a major concern in the area due to the high amount of impervious surface. With the high amount of impervious surface found here and lack of open space, most water reaching the ground does not infiltrate, but instead runs off to the brook untreated. With the amount of development in the Glen Street area, soil descriptions for the non-impervious areas cannot be accurately obtained from the soil survey map. There are some areas of herbaceous vegetation and tree plantings, but their presence is limited. Channel flows change rapidly during storm events due to the amount of water that is outleted into the brook from the stormwater drainage system. North of Halfway brook, stormwater from the west side of Glen Street from Sweet Road joins with stormwater from Aviation Road. Continuing south it accepts the remaining drainage on Glen Street, south of the Quaker Road-Glen Street intersection. Two stormwater culverts enter the brook from the north. There are also two culverts that drain from the south side of the brook, mostly a residential area with a few auto shops.

B. The Meadowbrook Road sampling site

The Meadowbrook Road site is found in a residential area of the Town of Queensbury. It is an area of mixed forest and open yards, and has the Queensbury Girl Scout Camp on both sides of the brook on the west side of Meadowbrook Road. Heavily forested within the camp, a permanent tributary enters the brook with a supply of spring water. This tributary originates on Blind Rock Road and assumes two other

drainages as it flows south along Bay Road. Eventually this tributary heads east across the Bay Meadows Golf Course, and empties into Halfway Brook.

There is a flooding issue at this site, with residential structures on the east side of Meadowbrook Road located in the floodplain. After snowmelt in the spring, many structures are affected and owners are concerned with the amount of water that travels into their properties. Some of the stormwater on Meadowbrook Road proper drains into the property owners' yards, where due to loamy sandy soils (Wareham), they are infiltrated into the ground. This site is located below the major developed areas of the Town of Queensbury.

4.4 Stormwater Sample Analyses: Low Flow and Storm Event

Low Flow Testing: Since August 1998 there have been thirteen samples taken at the Wilkie Intake Reservoir site (baseline site), sixteen at the Route 9 site and eleven at the Meadowbrook Road site (both in developed areas). During baseline sampling at the sites (during low flow times), the baseline site had the lowest concentrations of all of the aforementioned parameters of N, P, Fecal Coliform, and TSS. All water samples were tested by trained staff at the Darrin/RPI Freshwater Institute in Bolton Landing.

Low Flow Result: On average, concentrations of the examined parameters are two to three times as high at the stormwater sites versus the baseline site.

Storm Event Testing: There have been only two storm events sampled this year due to the lack of precipitation however, the stormwater-sampling program is ongoing and will continue until the summer of 2000. At that time a more thorough examination of the sampling results will be undertaken. However, the two storm sample days have provided at least a cursory glance at the increases in pollutants into the Brook as a result of stormwater impacts.

Storm Event Result: All of the parameters tested during a storm condition came out significantly higher at the developed sample locations versus the undeveloped location. Phosphorus was approximately three times higher at the developed site than at the pristine site. Total Suspended Solids (TSS) was found to be approximately ten to fifteen times the number found at the pristine site. Fecal Coliform was found to be over 6,000 colonies per liter at the Meadowbrook site, while at the Wilkie site the count was only 23 colonies per liter; which merits a concern in the bacteriological component of the water quality.

We must note that these samples represent only two storm events and are not conclusive in their characterization of the pollutant loading to the Brook. They do however give a broad idea to the impact that developed areas can have on a waterbody.

5. Open Space within Developed Areas of the Watershed

One key objective of this Assessment Plan was to locate suitable areas which could be utilized for stormwater improvement structures or facilities. Given the fact that any space in these developed areas within the watershed are largely premium property, it was difficult to locate a large number of suitable sites which were adjacent to various key drainage structures. Extensive mapping and fieldwork was undertaken for this objective, primarily focusing on lands owned publicly. Priority was given to subparcels of land which had the following characteristics associated with them:

1. Proximity to major drainage lines
2. Municipal ownership
3. Size enough for installation of a structure
4. Minimal underground or overhead utilities

The following list of properties is an outline of the most prominent potential sites for stormwater retrofitting structures in the Towns of Queensbury and Fort Ann, and the City of Glens Falls within the Halfway Brook watershed. Appendix K and L are maps with the location of each of these sites denoted on it for spatial reference, Appendix M shows all vacant land within the watershed.

- a. Northwest corner of Bay and Quaker Roads.
- b. Aviation Road, between Burger King and Mobil Oil.
- c. Route 9, south of Walmart.
- d. Northeast corner of intersection of Route 9 and Quaker Road.
- e. NIMO right of way on Bank Street.
- f. Bay Road (1) east of Bay Road and 3 parcels south of Cronin Road.
- g. Bay Road (2) west of Bay Road, 1 parcel south of Cronin Road.
- h. Lafayette Street (West side, intersecting with Bank Street).
- i. Glenwood Avenue, next to County Court Building.
- j. Quaker Road by Mark Plaza.
- k. Queensbury Cemetery/Northway Plaza, behind plaza outlet.
- l. Quaker Road – Lafayette Street. East side of Lafayette, behind plaza on Quaker Road, borders Hovey's Pond.
- m. Hovey's Park.
- n. Cronin Road – Freihoffers Bakery Outlet area.
- o. Cronin Road – Bay Meadows Golf Course, by mainstem of Halfway Brook.
- p. Aviation Road
- q. Bowman Ave, Glens Falls
- r. Webster Ave, Glens Falls
- s. Webster Ave, Glens Falls
- t. Webster Ave, Glens Falls
- u. Bay Road, below intersection of Webster
- w. Bay Road, northwest parcel on Halfway Brook
- x. Bay Road, southeast parcel on Halfway Brook
- y. Bay Road, northeast parcel on Halfway Brook
- z. Route 149 – located between cemetery and Fort Ann tributary.
- aa. Route 4 - Village of Fort Ann. Open property located in front of bank at Route 4 and Halfway Brook intersection.
- bb. South Bay Road. Open area on corner of Fort Ann tributary and Catherine Street.
- cc. Fort Ann school property.

Many of these sites have been incorporated into recommendations for stormwater retrofitting of existing drainage lines (Chapter 6). Other sites listed above which have not been included in these priority recommendations are still potentially available for other projects which would still have a positive impact on water quality.

6. Water Quality Improvement Recommendations

The following recommendations are set forth as a guide to improve the quality of stormwater flowing into Halfway Brook, largely from developed areas. Inherent in this task is the issue of the limited space that is available for permanent remediation structures due to the high market value of properties in these developed areas. These recommendations are primarily based on the availability of land to install these improvement structures, coupled with the viability and cost effectiveness of undertaking the work. Each of the following recommended practices is located on a map (Appendices F, G, H) included in this

document, showing approximate location and drainage area to be routed into these new water quality improvement structures. The projects listed below are ranked “moderate impact” or higher in the “Roadside Drainages” section of Chapter 3. Other, lower priority/lower cost projects with a ranking of “moderate” will still have a positive impact on the Brook, although not specifically listed here.

Note: All cost estimates include survey, design, and construction costs if the project was fully conducted by consulting firms and private contractors. Many of the costs could likely be reduced with the use of municipal equipment and town forces.

Note: To offset the local cost of implementing these recommendations, there are many state and federal water quality improvement grant opportunities available such as the Clean Water/Clean Air Bond Act, the NYS Environmental Protection Fund, Section 319 of the Clean Water Act, and others. The County Soil and Water Conservation Districts in Warren and Washington counties are available to work with municipalities on grant proposals to fund such projects.

6.1 Queensbury Stormwater Improvement Project Recommendations

(Appendix F)

1. Aviation Road/Lower Route 9 Corridor

Overview: The most significant problem found with stormwater impacts to Halfway Brook comes from the route 9 corridor in Queensbury. Stormwater from the Aviation Mall area on Aviation Road flows down to the intersection of Aviation Road and Route 9, entering the Route 9 drainage line. From this intersection, stormwater flows south along Route 9 to the northeast culvert at the intersection of Halfway Brook and Route 9 across the street from Price Chopper. This entire area has been developed primarily with commercial properties, and open space is extremely limited. The stormwater drainage area from the following two combined drainages is over 170 acres, all of which outlets into Halfway Brook through a 48” culvert. To improve the stormwater in this area, the drainage area should be divided into two parts: Aviation Road and Lower Route 9. This division is necessitated by the lack of available area for stormwater improvement structures on the lower Route 9 corridor.

Recommendation - Aviation Road: Stormwater flows down Aviation Road and outlets into the Route 9 drainage line at the intersection of Aviation and Route 9. To improve the water quality coming from this Aviation line, the undeveloped space between Burger King and Mobil Gas on the southern side of Aviation Road could be used as a treatment area. There is approximately 120 feet by 40 feet of grass area that is undeveloped, potentially available for the installation of one or more underground structures in series (i.e. Vortech or similar structure). This would capture approximately 80 % of the stormwater on Aviation Road and treat it. Although these type of underground stormwater improvement structures do little to remove dissolved pollutants, a large amount of road sand, trash, and debris will be removed from the stormwater.

Potential Problems: There are underground utilities and overhead lines in the undeveloped area. Secondly a cross-connecting culvert would be needed to take stormwater from the north side of Aviation Road and divert it towards the treatment area. The land is privately owned and an easement would need to be obtained.

Probable Cost: Depending on easement cost, the design and construction of such a solution would likely be approximately \$100,000 or so. However, if work was conducted in the Lower Route 9 corridor, this project may become unnecessary as it would be covered under that one.

Recommendation - Lower Route 9 Corridor (Aviation Road down to Halfway Brook): Field work and mapping have shown that there is very limited area to undertake stormwater improvements in this area due to the high level of development and high market value of the land. There are two options for stormwater improvement in this area.

1. **Option 1: Niagara Mohawk Power Line right-of-way.** This area, located between the Red Lobster and the Valvoline Oil Change would be a potential site to construct a stormwater improvement wetland, which would be able to receive water from both Aviation Road and lower Route 9. This solution would provide water quality improvement in terms of both sediment removal and nutrient removal.

Potential Problems: NiMo has a general policy of not granting easements to receive stormwater on their right of ways due to maintenance issues. Further conversations with higher level NiMo representatives will need to take place for this solution to happen. Also, the new fiber optic line has just been installed in close proximity to the area that would become the wetland, causing issues with construction.

Probable Cost: Expensive. If approval to construct this wetland was granted, design and construction costs would likely be in the range of \$200,000 - \$300,000.

2. **Option 2: Open space/grass area - Price Chopper.** There is an open grass area located between the Price Chopper parking lot and Halfway Brook that is approximately 60 feet by 30 feet in dimension. This area could be utilized for a large underground retention structure which would slow the stormwater and allow it to settle out any solids and debris. More innovative stormwater improvement structures could be installed which would remove these components and possibly some of the nutrients and organics. This structure (or structures) would accept all of the stormwater from the large drainage area above and treat it before it was outleted into Halfway Brook, alleviating the most significant stormwater problem in the watershed.

Potential Problems: The landowner (Price Chopper) would need to provide a permanent easement on that section of property, and the DOT would need to reroute the largest stormwater drain on the highway over to the other side of the road. Technical problems relating to sizing and spacing of the new drainage line and the new structure would also need to be overcome.

Probable Cost: Design and construction costs associated with this effort would likely be in the \$100,000 - \$200,000 range. If DOT assumed the costs of rerouting their drainage line, it would save approximately \$25,000 or so.

3. **Option 3: Roadside catchments at drop inlet locations.** By installing roadside catch basins (sediment traps) where the drop inlets are located, a large amount of sediment can be removed before it enters the brook. At various locations to be determined along Route 9, these structures could be installed at approximately every other drop inlet location which would provide for pollutant removal from stormwater runoff before it reaches the brook. This solution would only remove heavy solids and trash, and would not address lighter solids and dissolved nutrients.

Problems: Obtaining approval from the NYS DOT for major roadside structural improvements would take time, and maintenance of these structures would be relatively high if they were to work properly.

Probable Cost: Varying, depending upon the number of catch basins installed. The cost of each basin would be approximately \$10,000 - \$15,000 each.

2. Upper Route 9 Corridor (Sweet Road to Quaker Road)

Overview: Route 9 stormwater from the upper boundary of Sweet Road to the lower boundary of Aviation Road flows south along this $\frac{3}{4}$ mile section, then turns east at the Quaker/Aviation intersection and enters the roadside ditch on Quaker Road. This ditch outlets into Cemetery Brook which outlets into Halfway Brook shortly after. Within this Route 9 section there is a Walmart and an Ames department store with large impervious parking areas, as well as many other smaller commercial businesses.

Recommendation - Option 1: Using the grass covered state property located in front of Monroe Muffler, a series of underground structures may be installed to control stormwater quality and quantity from this subsurface culvert. Available space in this area is approximately 40 feet wide by 200 feet long, which would be sufficient to control for stormwater quality using the proper structures.

Problems: Obtaining easement rights from New York State DOT for use of the property.

Probable Cost: Design and construction of in-line subsurface structures such as Vortechinics® would likely be \$100,000 - \$200,000.

Recommendation - Option 2: Utilizing the front of the Queensbury Cemetery property, a vegetated stormwater detention basin could be constructed to accept the stormwater from this same section of Route 9. This basin could be vegetated with selected species of plants to allow for improved nutrient uptake, which would improve upon the subsurface structure recommendation above. However, the winter and spring dormant plant season will not be able to provide this benefit.

Potential Problems: The Queensbury sewer system is in the vicinity, and engineering will be a concern. Also, as a surface structure, the cemetery board may have concern over aesthetics of the property resulting from this project.

Probable Cost: Design and construction of this structure would be in the \$50,000 - \$80,000 range, depending upon possible relocation of existing utilities and easement costs.

3. Northway Plaza stormwater drainage

Overview: The Northway Plaza, a large strip-type mall in the Town of Queensbury has a very large parking area associated with it which currently has no stormwater improvement system incorporated into its facilities. The drainage area associated with this development is approximately 17 acres, with the strong majority of it being impervious. Currently, all of the stormwater from this development ties into one major drainage line which outlets into a low quality wetland area in the back of the plaza. This wetland drains directly into Cemetery Brook, a major tributary to Halfway Brook.

Recommendation: Create a high quality stormwater wetland at the site of the current outlet, and build enough capacity in this wetland to allow it to have water quality improvement qualities. A berm/riser system could be built at the exit of this wetland to provide for larger capacity and retention time, allowing for nutrient uptake and sediment removal.

Potential Problems: Accessibility to this site may be difficult as it is down a steep incline on the backside of the plaza. Landowner issues and easements would need to be taken care of, and maintenance of this wetland would need to be accounted for.

Probable Cost: Much of this cost is tied to excavation of the wetland and plantings of new species, which are more suited to nutrient uptake. Design and construction of this solution would likely range from \$50,000 - \$100,000.

4. **Bay Road (North of Quaker Road)**

Overview: Approximately ½ mile of Bay Road north of Quaker Road drains directly into Halfway Brook just north of the intersection of these roads. In this stormwater drainage area (13 acres) there is a substantial amount of development and impervious area. There are two stormwater drainage pipes emptying into the Brook at this location; one on the west side of Bay Road and one on the east side. A solution is recommended which will eliminate this direct drainage and allow for pollutant and debris removal before it outlets into Halfway Brook.

Recommendation: There is a fairly extensive floodplain for Halfway Brook in front of the Lowe's Warehouse, which could be utilized as a filter for stormwater. The two drainage pipes could be rerouted to outlet into this floodplain, where the stormwater would spread out across this vegetated area and infiltrate into the soil. Building a low berm before the stormwater flow reached the bank of Halfway Brook would allow for a longer retention and infiltration time. This solution would be a relatively simple means to address this issue at this location.

Potential Problems: The drainage line on the western side of Bay Road would have to be cross connected to the eastern side, and the Warren County DPW would need to approve this work. Also, a drainage easement would need to be obtained from the landowner of the floodplain lands, and a temporary construction easement for work on the floodplain would need to be obtained. There is a new fiber optic line very close to this site which would have to be located and avoided.

Probable Cost: The cost of this recommendation is largely dependent upon the willingness of the Warren County DPW to do the drainage modifications. If they were not, and the work was contracted out privately, it likely would cost about \$20,000 - \$40,000.

5. **Bay Road (South of Quaker Road)**

Overview: Approximately ¾ mile of Bay Road south of Quaker Road drains directly into Halfway Brook at the intersection of these roads. Much of this stormwater drainage area (11 acres) is roadway, which is heavily traveled and sanded in the winter. There are two drainage pipes which outlet into Halfway Brook, one on the east side of Bay Road and one on the west.

Recommendation: There is a fairly extensive floodplain for Halfway Brook in front of the Lowe's Warehouse, which could be utilized as a filter for stormwater (much like item 6 above). The two drainage pipes could be rerouted to outlet into this floodplain, where the stormwater would spread

out across this vegetated area and infiltrate into the soil. Building a low berm before the stormwater flow reached the bank of Halfway Brook would allow for a longer retention and infiltration time. This solution would be a relatively simple means to address this issue at this location. This section of Bay Road drains somewhat of a smaller area than the northern section, and the development is less intensive. To undertake one of these two projects, we would recommend undertaking the northern section (item 6 above).

Potential Problems: The drainage line on the western side of Bay Road would have to be cross connected to the eastern side, and the Warren County DPW would need to approve this work. Also, a drainage easement would need to be obtained from the landowner of the floodplain lands, and a temporary construction easement for work on the floodplain would need to be obtained.

Probable Cost: The cost of this recommendation is largely dependent upon the willingness of the Warren County DPW to do the drainage modifications. If they were not, and the work was contracted out privately, it likely would cost about \$20,000 - \$40,000.

6. Quaker Road (Route 9 to Halfway Brook)

Overview: Drainage from this section of Quaker Road primarily flows off the road and into grassed swales and ditches. There are only a few drainage lines running along this section, which makes it somewhat difficult to determine a solution as there is no specific outlet to the stormwater. This sheeting of stormwater into grassed swales and ditches in many cases is a positive situation in that it allows for increased infiltration into the ground as well as decent sediment removal as the flow filters through the grass. However, there are still areas of concern which merit a closer look and some improvements to improve the quality of runoff into Halfway Brook. On the negative side, many of the commercial developments in this area do not have stormwater control structures in place on their properties, and it is not likely that these developments will retrofit their existing drainage systems to install these structures.

Recommendations:

1. Hannaford Plaza – the stormwater detention area which was created for control of stormwater coming off of this development could be easily improved at a minimal cost. The outlet culverts are at approximately the same elevation as the inlet culverts, providing for very little capacity in this basin. By installing a simple riser structure at the outlet, the retention time of this basin and its infiltration capabilities would be significantly improved.
2. CVS property – the same problem with the Hannaford Plaza detention basin exists with the CVS detention basin. With a riser structure installed, this basin would have much more capacity and provide for water quality improvement of the stormwater coming off of this development. Very easy to install and minimal cost.
3. Increase road sweeping operations – much of the concern from the Quaker Road corridor is related to winter road sanding operations. Spring runoff carries this sand into the drainage channels and ultimately into the Brook. Warren County DPW should make this $\frac{3}{4}$ mile section of Quaker Road a priority for road sweeping when the time is suitable for this activity.
4. Retrofit roadside drop inlets to convert them to sediment traps – Most of the drop inlets which take the stormwater off of Quaker Road have no storage capacity and simply convey the stormwater to an outlet. By converting these structures to sediment traps, each of the smaller drainages can be controlled for in terms of sedimentation. Site specific selection of these drop inlets would need to be made based on the scope of the funds available.

7. Route 9 between Crandall Park and Halfway Brook

Overview: This section of Route 9 drains north from approximately the location of the YMCA up where it outlets into Halfway Brook near the Price Chopper. It is approximately 1/8 mile long and this road section drains land which includes both commercial and residential properties as well as the section of Route 9 totaling approximately 3 acres. Concerns for stormwater in this section include primarily road sanding, but also potential runoff contaminants from a gas station and an auto repair center.

Recommendation: The flow from this drainage goes under the Sunoco station adjacent to Halfway Brook. Installing a subsurface stormwater improvement structure at this location (either on the Sunoco lot or in the DOT right of way) would control for almost all of the flow from this three-acre section. With the potential for petroleum-laden runoff from the gas station and auto repair center, a solution which can improve water quality relating to these contaminants (such as Aquashield™) would be recommended.

Potential Problems: Obtaining permission from the Sunoco property owner to install this structure below their pavement would be a potential issue if it was located on their property. Working around the existing subsurface facilities in this location might also provide a challenge.

Probable Cost: Design and installation of a stormwater improvement structure which controls for petrochemical laden runoff would likely cost in the range of \$40,000-\$80,000.

8. Interstate 87 (Northway) drainage into Halfway Brook

Overview: There is a section of the Northway approximately ½ mile long which drains off this highway and out through a culvert which outlets approximately 30 feet from the main stem of Halfway Brook. Winter road sanding operations on the Northway produce large amounts of excess sand, which flow off the road and into the Brook through this culvert.

Recommendation: At the outlet of the culvert which drains the Northway, a berm could be constructed which would route the stormwater and any sediment away from the Brook and into the surrounding woods. There is plenty of area to have this stormwater dissipate into these woods whereby essentially no stormwater would enter the Brook from the Northway. This would be a very simple and quick fix to a primary stormwater input into the Brook.

Potential Problems: As this is a NYS DOT right-of-way, it would just take some effort to get them to include this project in their project schedule. Otherwise, no problems are anticipated with this simple project.

Probable Cost: If the NYS DOT decides to undertake the project, there would be no local cost associated with it. Essentially this project would just entail some time on a backhoe or excavator, with minimal materials cost.

6.2 Glens Falls Stormwater Improvement Project Recommendations

(Appendix G)

1. Bowman Avenue stormwater outlet

Overview: Outletting at the end of Bowman Avenue, this drainage of approximately 130 acres of the City of Glens Falls empties into the Crandall Park tributary. Much of the land use in this area is city residential, with an extensive road network. This stormwater drainage has been identified as the most significant impact on Halfway Brook water quality coming from the city of Glens Falls.

Recommendations: There is a parcel of undeveloped land owned by the city of Glens Falls which is approximately 30 feet by 30 feet in dimension located at the end of Bowman Avenue. This parcel which is adjacent to the outlet of this major stormwater drainage could be utilized for stormwater improvement. Placement of underground water quality improvement structures in this area would increase the detention time and would reduce the stormwater impacts into the Crandall Park tributary to Halfway Brook.

Potential Problems: Restructuring the old stormwater drainage line, and residential concerns during construction may be potential issues. These could be solved relatively easily however. There is also a limited area to have heavy machinery available to work, which may be a concern.

Probable Cost: Design and construction costs would likely be in the \$100,000 - \$200,000 range, based on initial findings of site applicability.

2. Webster Avenue stormwater outlet

Overview: Approximately 74 acres of city property (primarily dense residential and commercial) drains to an outlet on Webster Avenue. This stormwater system outlets into the Crandall Park tributary, which then flows into Halfway Brook approximately ½ mile downstream. This stormwater drainage has been identified as the second most significant impact on Halfway Brook coming from the city of Glens Falls.

Recommendation: Webster Avenue is adjacent to Glens Falls Cemetery and there is a strip of lawn approximately 20 feet wide and 300 feet long which is owned by the city. The stormwater drain line runs parallel to Webster Ave on the southern side of the street directly under this grassed laneway. This drainage line could be cut into and routed into a series of underground detention structures which would remove sand, debris, and trash before the stormwater outlets into the tributary.

Potential Problems: There may be a need for utility relocation if there are any located in this area. Also, there is a long row of white cedar trees between the road and the cemetery fence which would have to be avoided during construction.

Probable Cost: With a series of two to three in-line underground structures, the design and construction costs would likely be in the \$80,000 - \$120,000 range.

6.3 Fort Ann Stormwater Improvement Project Recommendations

(Appendix H)

1. Route 149 drainage (between Route 4 and the Fort Ann tributary)

Overview: The primary concern for stormwater impacts to Halfway Brook in Fort Ann is on Route 149 as it enters the Village from the east. This section of Route 149 is approximately 1/3 of a mile long and is heavily developed with roadways and private residences. Stormwater from this section of roadway flows directly into the Fort Ann tributary, which then outlets into the mainstem of Halfway Brook shortly thereafter.

Recommendation: Road sand and other potential contaminants from stormwater currently flow unabated into the tributary, but the drainage system could be modified to flow into a sediment retention pond in the open field area adjacent to the tributary. This field area has enough space available (~30 feet by 40 feet) to create a settling pond with a riser structure which will allow the stormwater to infiltrate and settle out any silt and debris. The outflow from this settling pond would then be a direct outlet into the tributary.

Potential Problems: Landowner easement issues to construct and maintain the pond.

Probable Cost: Design and construction of this settling pond would be approximately \$10,000 - \$20,000, but with municipal workers this cost could be cut substantially.

2. Route 4 drainage (between Rte 149 and the Halfway Brook bridge)

Overview: This section of Route 4 is approximately ¼ mile long and drains approximately three acres of highway and commercial property. The primary concern here is road sanding operations with the degree of sand required to keep this highway clear. The road drainage on this section drains directly into Halfway Brook at the bridge location through a culvert on both sides of the road.

Recommendation: The two final drop inlets which remove stormwater from Route 4 could be converted to catch basins which would retain any road sand, trash and debris that flows off of this section of highway. Although the installation of a standard catch basin structure would alleviate much of the sedimentation resulting from this section of road, a more effective solution would be a stormwater technology such as Vortech® or a similar device which has a much higher pollutant removal efficiency.

Potential Problems: Obtaining permission from NYS DOT to retrofit their existing drainage structures.

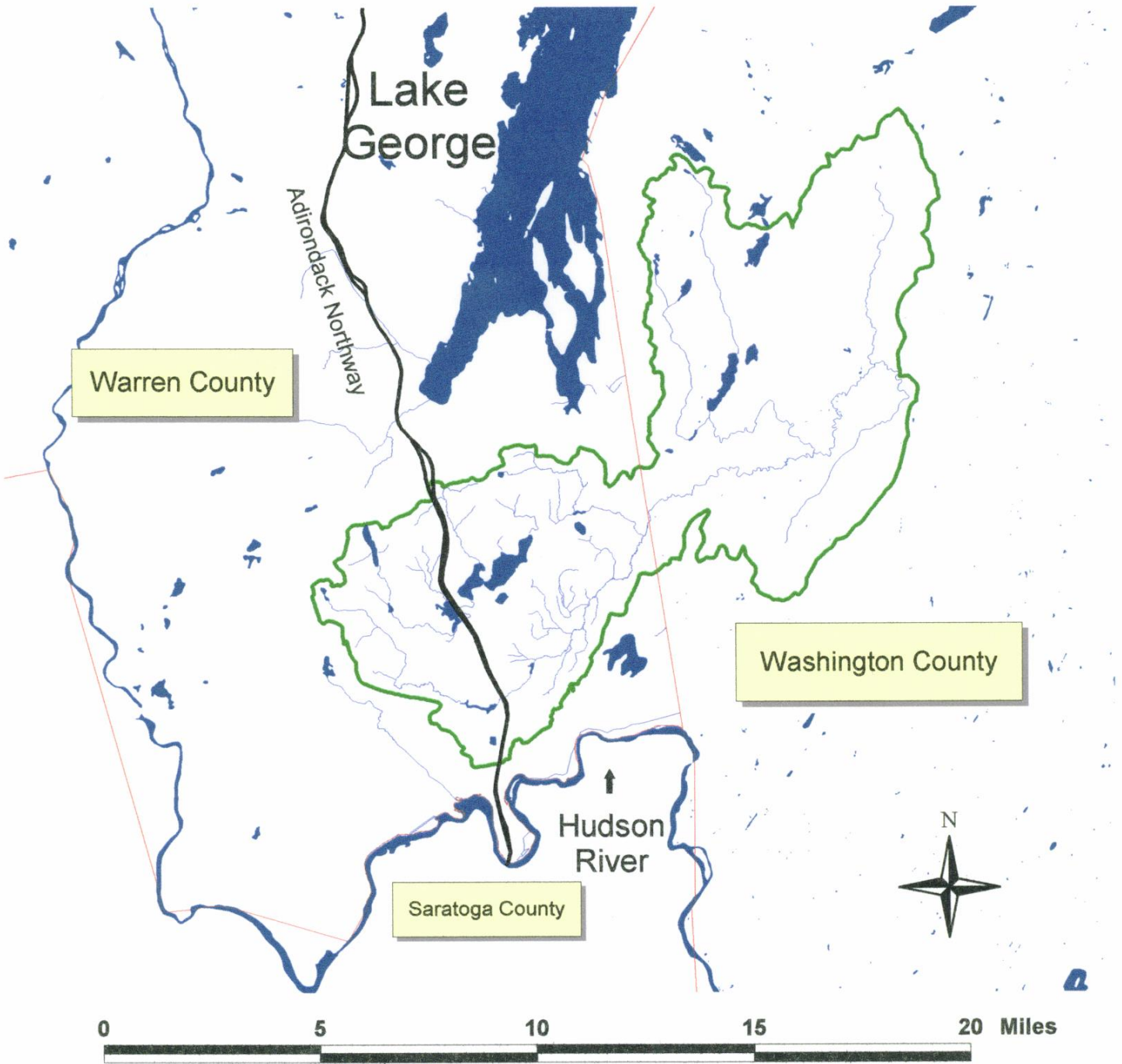
Probable Cost: If NYS DOT could be convinced of the project's merit, they could likely retrofit this section of road under their capital projects or standard maintenance program. If so, there would be no local cost to undertake these improvements. This solution would likely be the standard catch basin solution and not the more efficient stormwater technology. To undertake this better solution, the primary cost would be design time and purchase of the structures, which would likely range from \$30,000 - \$60,000.

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Appendix A

Halfway Brook Watershed

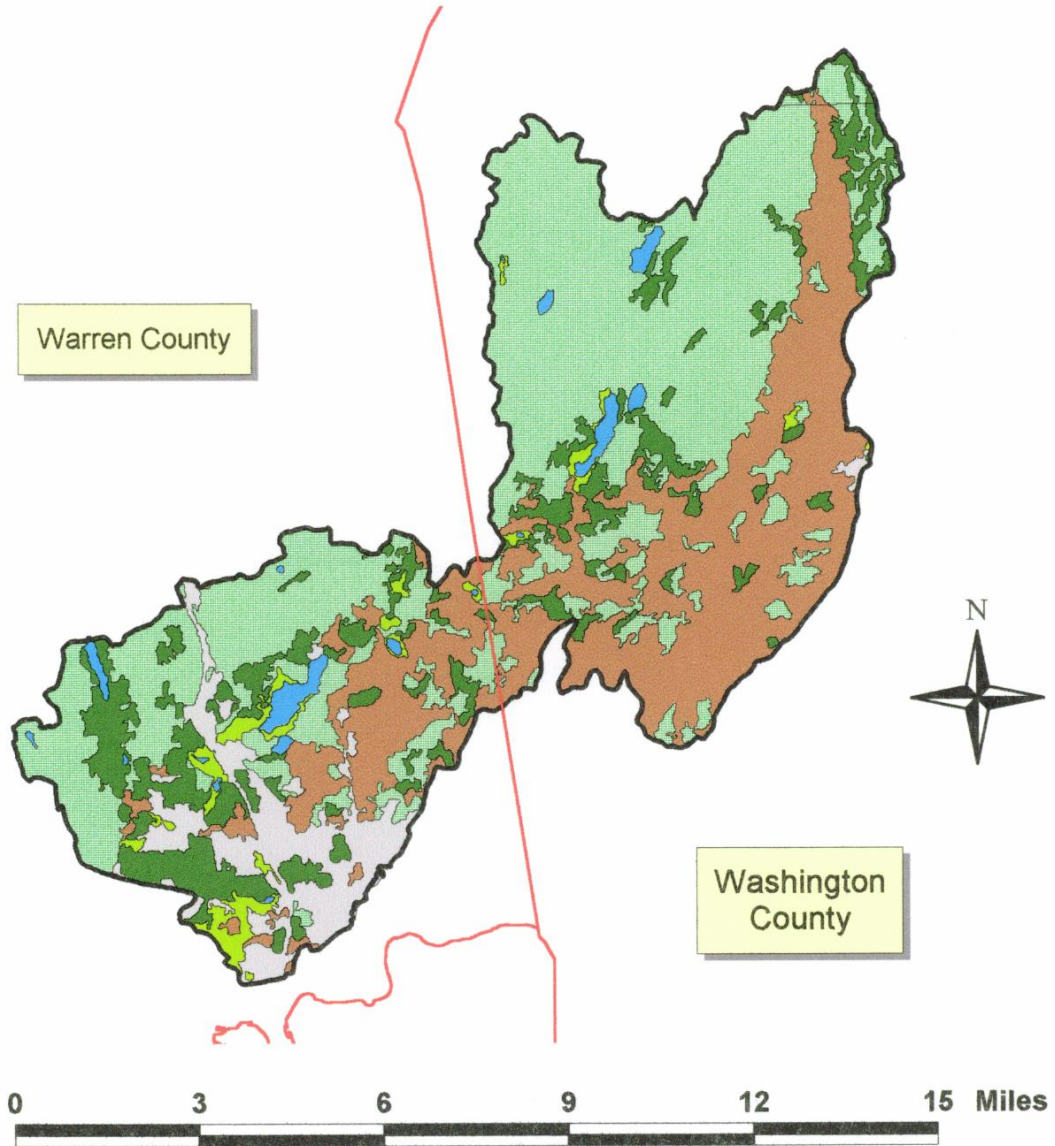


- County boundary
- Streams
- Lakes and ponds
- Halfway Brook watershed

Prepared by the Warren County Soil and Water Conservation District

Appendix B

Land Use within the Halfway Brook Watershed

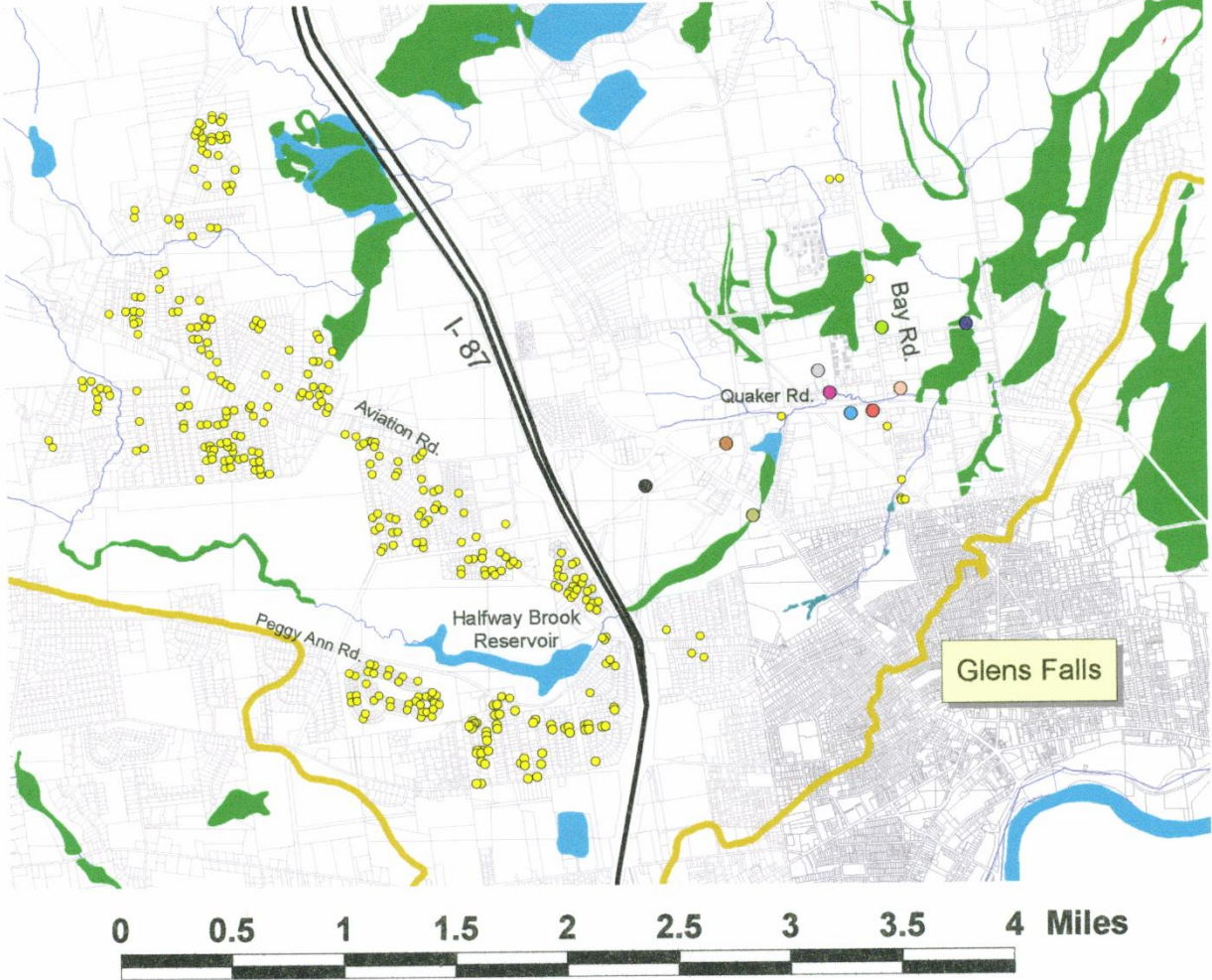


- Land Use**
- Hardwood forest
 - Coniferous forest
 - Wetland
 - Idle / agriculture
 - Water
 - Developed land
- Halfway Brook watershed

Prepared by the Warren County Soil and Water Conservation District

Appendix C

Stormwater Improvement Structures within the Halfway Brook Watershed



Stormwater facility location

- Aviation Mall
- Bay Meadows golf course
- CVS
- Hannaford
- Independent Living Center
- Lowe's
- NIMO
- Price Chopper
- Stewart's Shops
- Wegman Asst. living centre

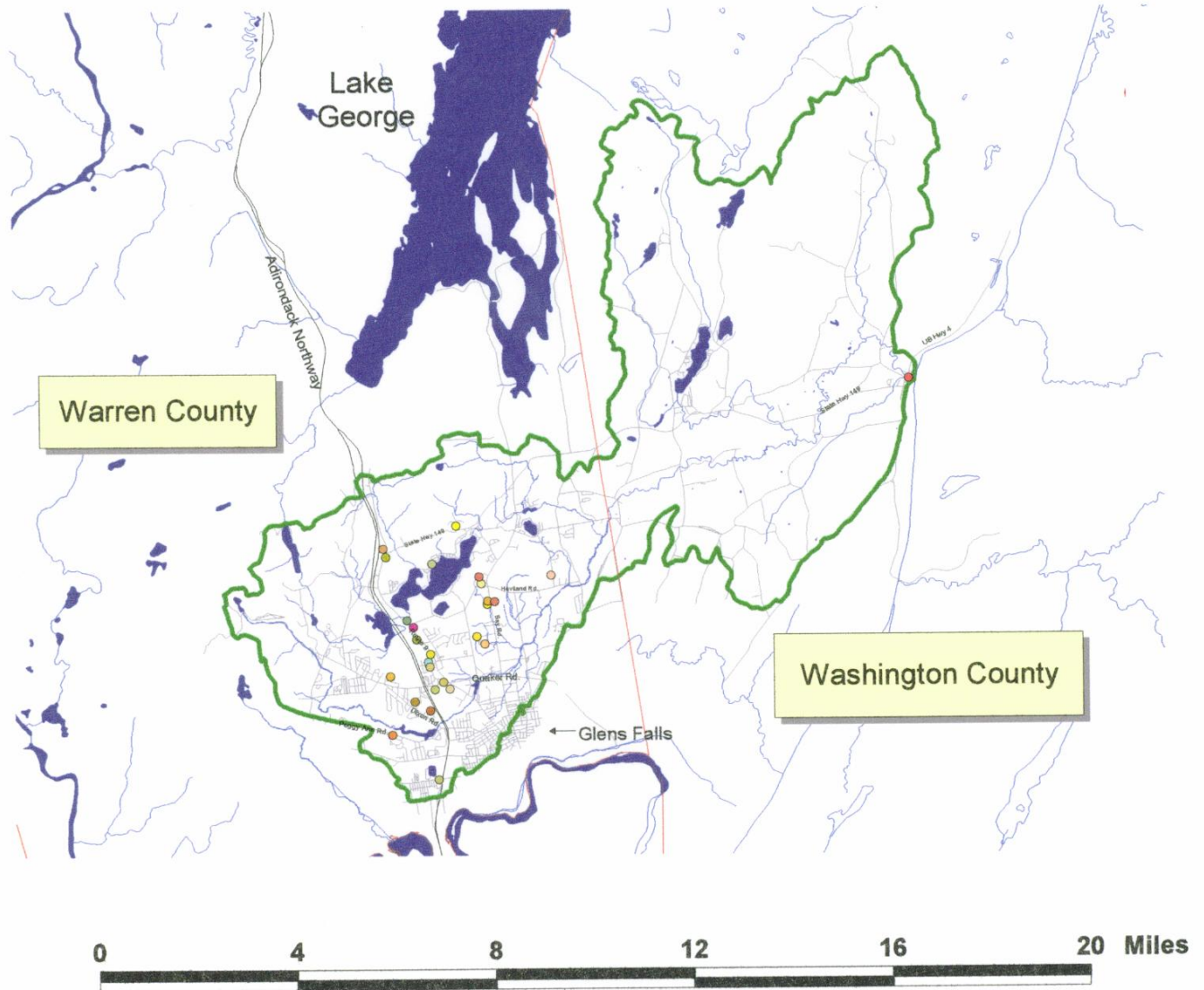
- Halfway Brook watershed
- Wetlands
- Lakes and ponds
- ▬ Streams
- ▭ Town of Queensbury parcels
- ▭ Glens Falls parcels
- Dry well / Infiltrator



Prepared by the Warren County Soil and Water Conservation District

Appendix D

SPDES* Permits Sites within the Halfway Brook Watershed



Permit locations

- A.C.C.
- Adirondack Manor
- Ames
- Aviation Mall
- Bayridge
- Burger King
- College Court Apts.
- Cross Roads Sub-division
- Days Inn
- Dexter Factory Outlet
- Dixon Hghts. Townhomes
- Ft. Ann Sewage Treat. Pla
- Great Escape
- John P. Burke Apts.
- Lake George Plaza
- Ledge View Park
- McDonald's - Queensbury
- Mt. Royal Plaza
- Oral Health Care Asso.
- Overlook
- Queen Victoria Grant
- Queensbury Apts.
- Robert Gardens North
- Rt. 9 Cinemas
- The Dockside Restaurant
- The Woodlyns at Cedar Ct.
- Wilson Apartment Complex

- Roads
- Streams
- Lakes and ponds
- Halfway Brook watershed boundary



* = State Pollution Discharge Elimination System

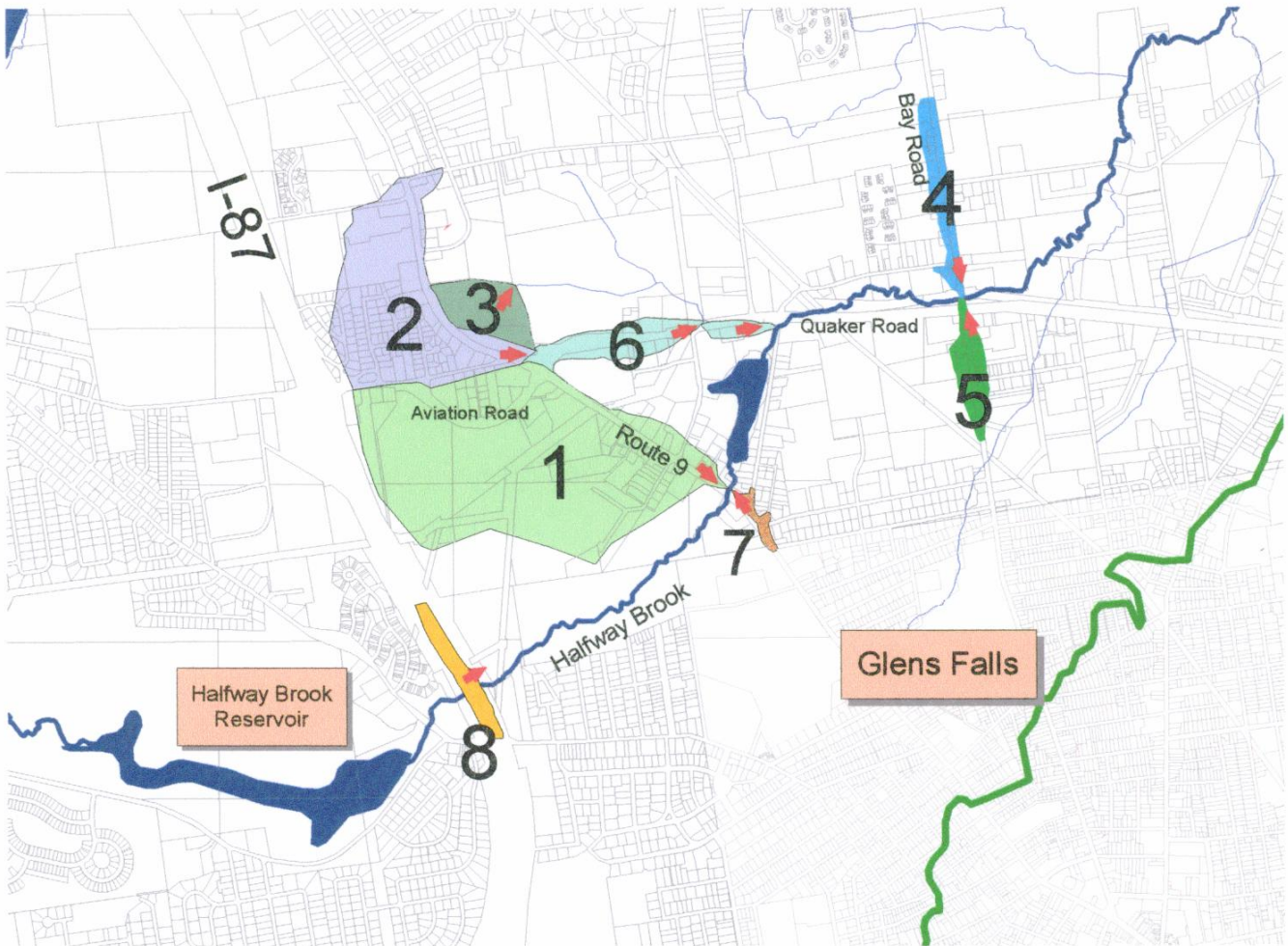
Prepared by the Warren County Soil and Water Conservation District

Appendix E

LOCATION NAME	PERMIT NAME
Dexter Factory Outlet	OSCAP Limited
Overlook	Highland Park Corp.
Cross Roads Sub-division	Richard Schermerhorn
The Woodlyns at Cedar Ct.	Phyllis M. Holtz
Ft. Ann Sewage Trt. Plnt.	Village of Fort Ann
Adirondack Manor	James Keene/ W. Chase
College Court Apts.	Chuck Catalfamo
Ledge View Park	Ledge View Vill. and R.V.
Queen Victoria Grant	Q.V. Homeowners Assn.
The Dockside Restaurant	J.Paul Barton
Aviation Mall	Pyramid Company
John P. Burke Apts.	John P. Burke Apts.
McDonald's - Queensbury	McDonald's Restaurant
Great Escape	Great Escape Theme Park
Burger King	Carrols Corp, Burger King
Robert Gardens North	Robert Gardens North
Mt. Royal Plaza	Guido Passarelli
Rt. 9 Cinemas	Hoytes Route 9 Cinemas
Oral Health Care Asso.	Oral Health Care Asso.
Ames	Gibraltar Mngt. Comp. Inc
A.C.C.	A.C.C.
Dixon Hghts. Townhomes	Dixon Hghts. Homrs. Assn.
Queensbury Apts.	NCR of Queensbury Hsng.
Lake George Plaza	Greenridge Mngmt. Asso.
Days Inn	David Kenny
Bayridge	Qsby. Bayride Homrs. Ass.
Wilson Apartment Complex	Lucas Wilson

Appendix F

Town of Queensbury - Areas of Stormwater Concern



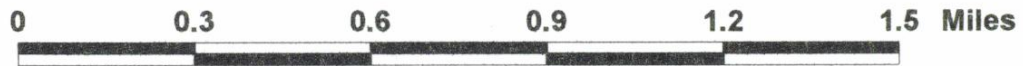
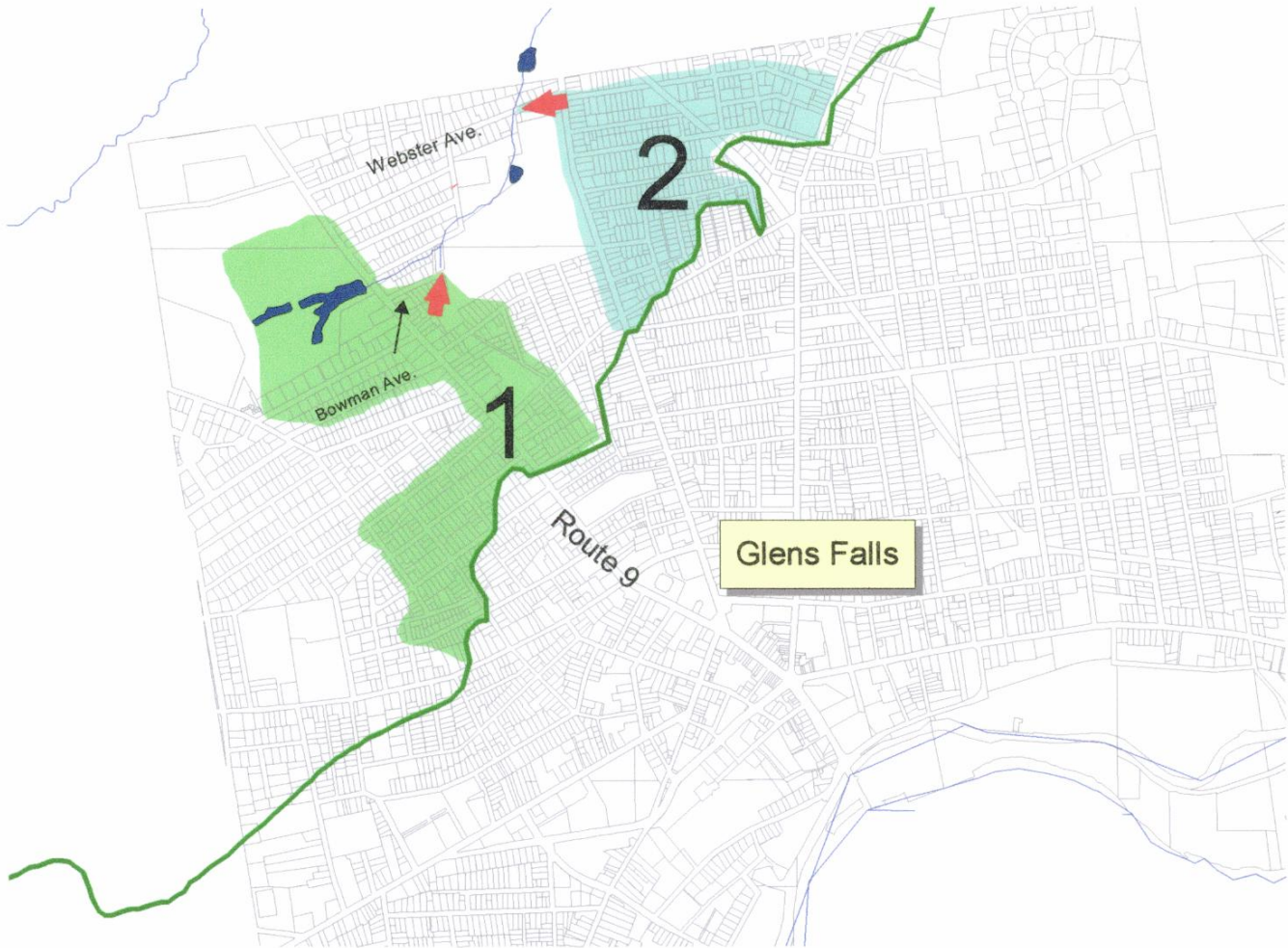
- | | |
|---|----------------------------|
| Quaker Road (Route 9 - Halfway Brook) | Halfway Brook watershed |
| Bay Road (North of Quaker Road) | Town of Queensbury |
| Bay Road (South of Quaker Road) | Glens Falls parcels |
| Route 9 (Crandall Park - Halfway Brook) | Mainstem of Halfway Brook |
| Northway Plaza | Streams |
| Upper Route 9 Corridor | Stormwater drainage outlet |
| Aviation Road/Lower Rt. 9 Corridor | |
| Interstate 87 (Northway) | |
| Lakes and ponds | |



Prepared by the Warren county Soil and Water Conservation District

Appendix G

City of Glens Falls - Areas of Stormwater Concern



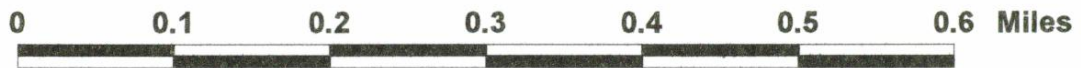
- Streams
- Lakes and ponds
- Halfway Brook watershed
- Glens Falls parcels
- Bowman Ave. drainage
- Webster Ave. drainage
- Stormwater drainage outlet



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Appendix H

Village of Fort Ann - Areas of Stormwater Concern



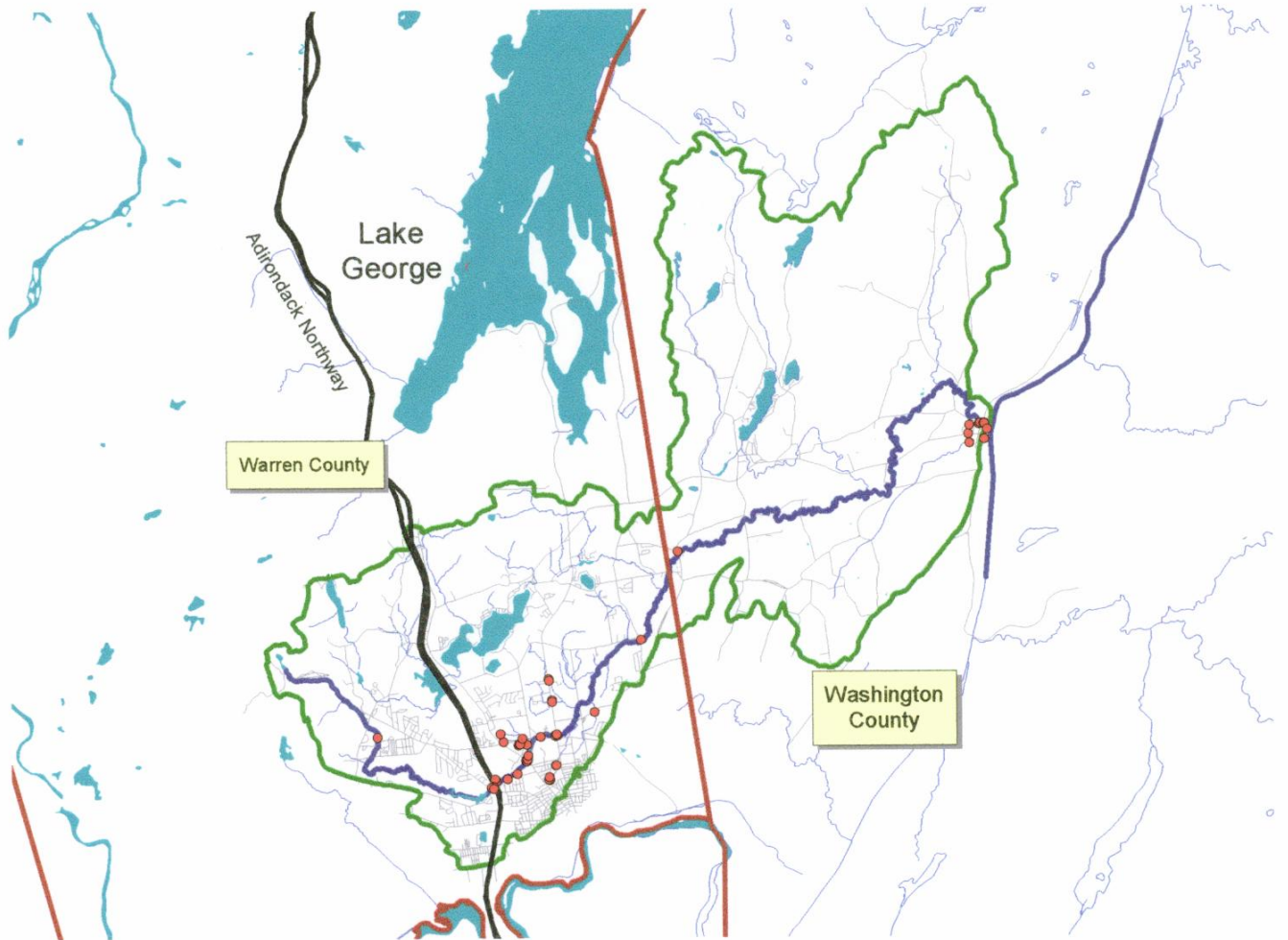
- Village of Fort Ann parcels
- Route 4 drainage
- Rt. 149 drainage
- Fort Ann tributary
- Halfway Brook watershed
- Mainstem of Halfway Brook



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Appendix I

Locations of Stormwater Culverts



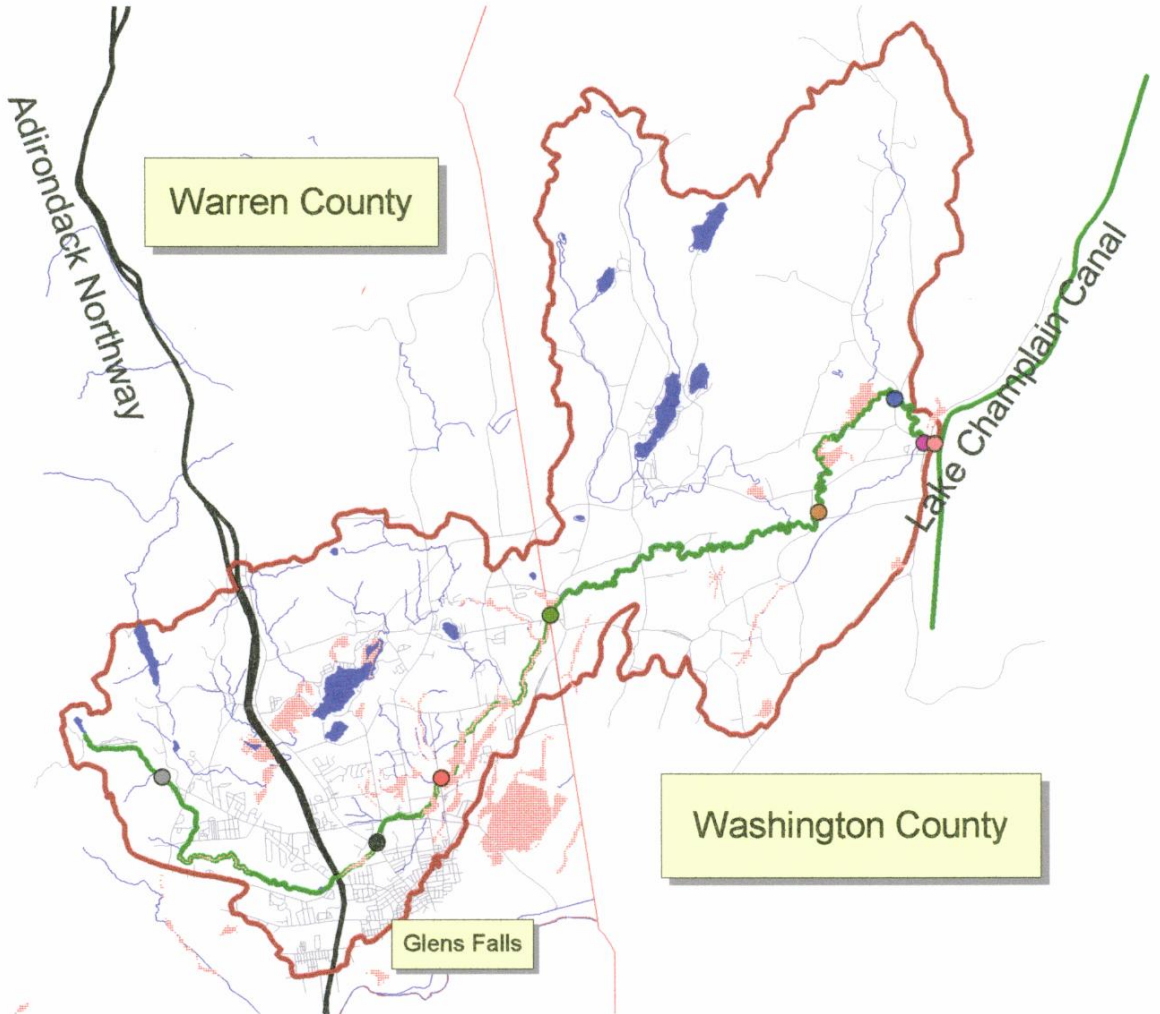
- Culvert
- ▭ Halfway Brook watershed
- ∧ Roads
- Lakes and Ponds
- ∩ Halfway Brook
- ∧ Streams



Prepared by the Warren County Soil and Water Conservation District

Appendix J

Halfway Brook Water Sampling Sites



Current sampling sites

- Canal site
- County Line site
- Ft. Ann tributary
- Kane's Falls/South Bay Rd
- Mattison Rd.
- Meadowbrook Rd.
- Route 9
- Wilkie Intake Reservoir

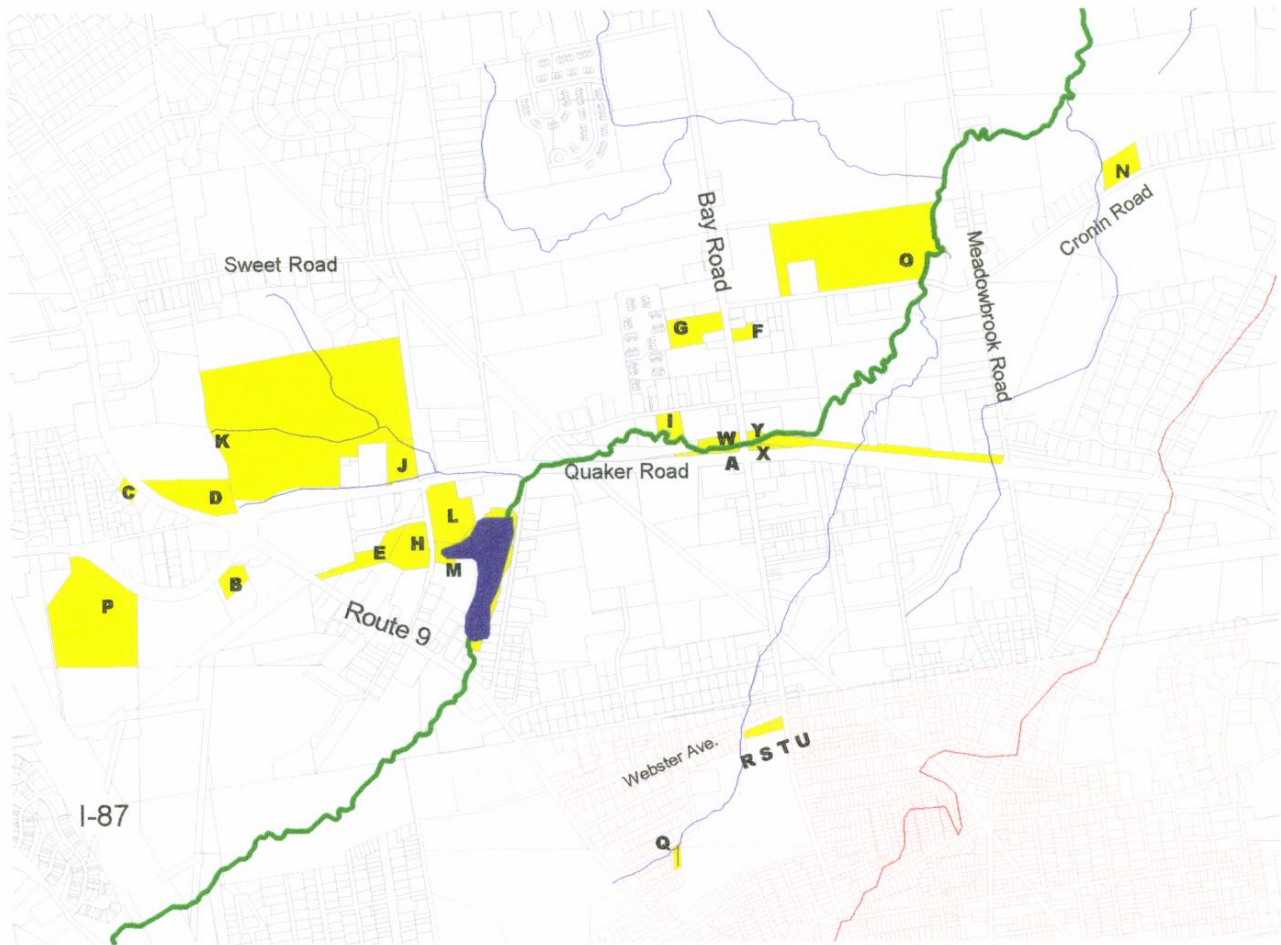
- Wetlands
- Lakes and ponds
- Roads
- Streams
- County boundary
- Watrshed boundary
- Main stem of Halfway Brook



Prepared by the Warren County Soil and Water Conservation District

Appendix K

Location of Potential Stormwater Improvement Sites, Warren County



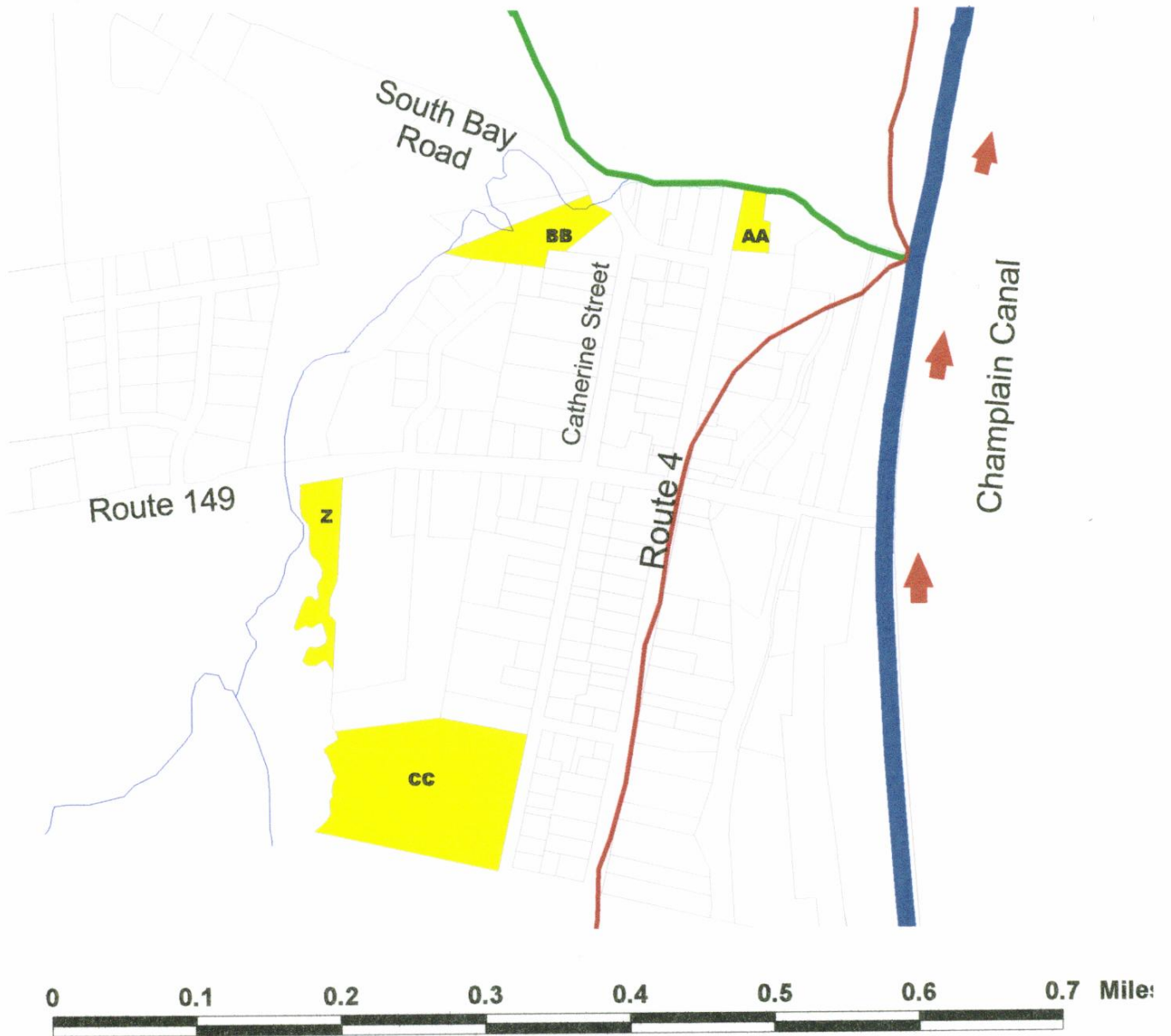
- Location of possible stormwater improvement site
- Halfway Brook watershed
- Lakes and ponds
- Mainstem of Halfway Brook
- Streams
- Queensbury town parcels
- Glens Falls parcels








Prepared by the Warren County Soil and Water Conservation District

Appendix L

Location of Potential Stormwater Improvement Sites, Village of Fort Ann



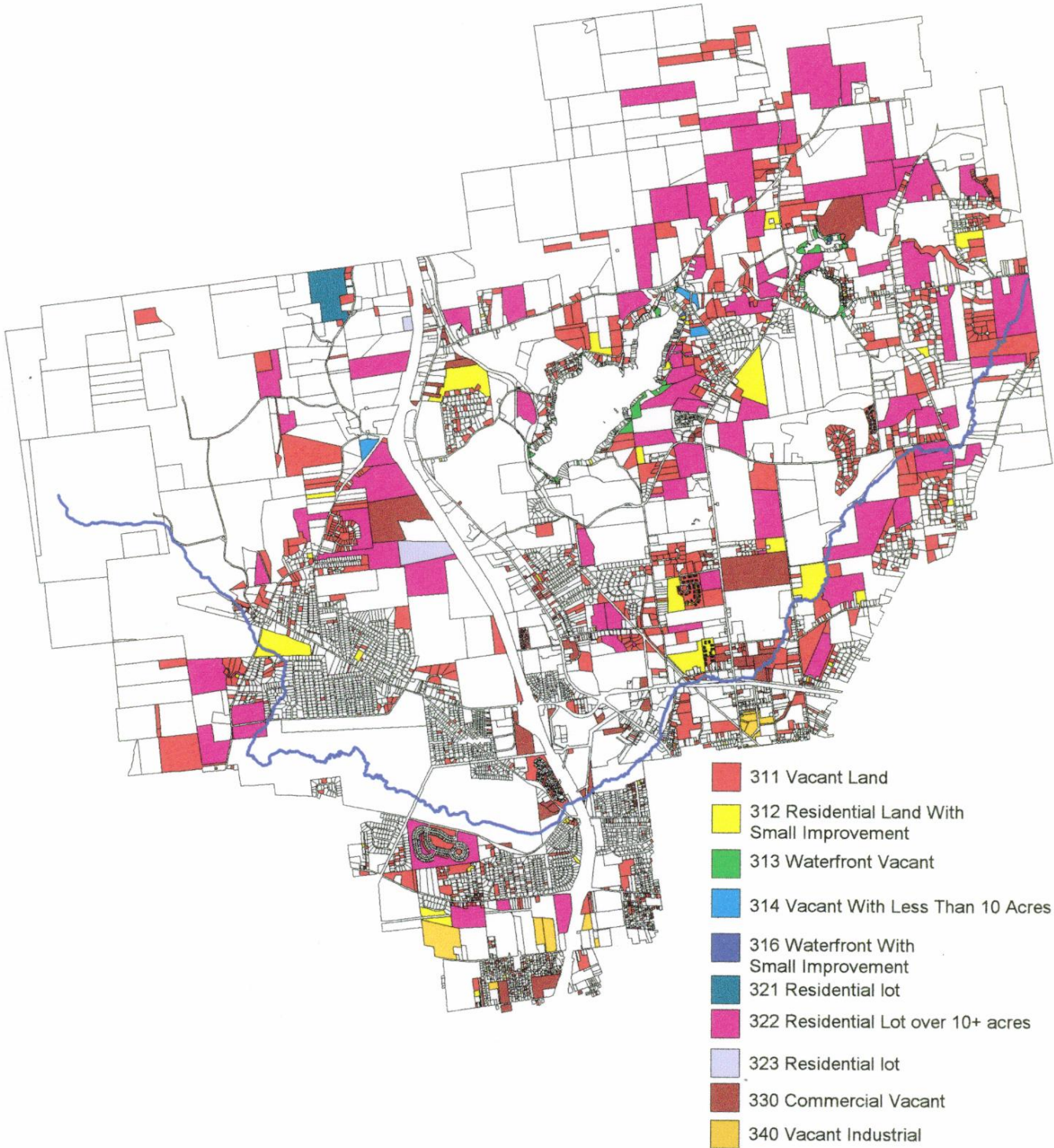
-  Location of possible stormwater improvement site
-  Halfway Brook Watershed
-  Mainstem of Halfway Brook
-  Lakes and ponds
-  Village of Fort Ann parcels



Prepared by the Warren County Soil and Water Conservation District

Appendix M

Halfway Brook Watershed Vacant Land, Town of Queensbury



Produced by the Town of Queensbury, NY, Planning Department
09/17/1999

