# West Brook Stormwater Mitigation Project


# Final Report

Warren County Soil and Water Conservation District

51 Elm Street, Warrensburg, NY 12885

Dave Wick, CPESC, District Manager

February 3, 2004

# Final Report to NYS DEC

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| Project: | West Brook Stormwater Mitigation Project |
| Project Sponsor: | Warren County Soil and Water Conservation District (SWCD)<br>51 Elm Street, Warrensburg, NY 12885<br>(518) 623-3119. |
| Contact: | Dave Wick, District Manager, Warren County SWCD<br>(518) 623-3119 district@nycap.rr.com |
| Report numbers: | Final |
| Reporting Dates: | June 1, 1997 – December 31, 2003 |
| Date Report Submitted: | February 3, 2004 |
| Contract #: | C003608 |
| Grant Amount: | $219,000 |
| Local Match Provided: | $219,866 (50% of project cost) |

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## Project History and Summary:

The West Brook Stormwater Mitigation Project arose out of the defunct Fort George Constructed Stormwater Wetland Project, which never went to construction due to land use issues at the DEC owned Battlefield Park in Lake George. When the proposed wetland project failed to materialize, Don Lake was commissioned by the NYS DEC to work with the Warren County SWCD in generating a report and alternatives to the stormwater wetland project. This effort was completed in December of 2001. The report contained pollutant removal efficiency numbers for the original wetland project, which then became the base for outlining the alternative stormwater mitigation measures for the watershed. The report concluded that by retrofitting the major developed properties and roadways in the watershed, the pollutant removal goals of the original wetland project could be reached and even surpassed.

With this new information, the original $186,800 DEC grant to the Warren County SWCD was re-contracted and reauthorized so that the District could begin work to retrofit properties and roadways within the watershed. An additional $32,200 was allocated to the project by DEC, bringing the total grant to the Warren County SWCD up to $219,000. This grant was a dollar-for-dollar matching grant (50/50), and the local match committed was $219,000 bringing the total project cost to $438,000. These funds were to address and retrofit five to seven major developed properties within the watershed (as defined in Project Scope of Work), and a Town of Lake George road (Birch Ave). NYS Route 9 itself was not a part of this contract, as the NYSDOT was charged with moving forward with this effort on its own behalf and with its own funding.

The goal of this West Brook Stormwater Mitigation Project was to assess, quantify, and ultimately mitigate the stormwater runoff coming from large developed properties and town roads within the West Brook/NYS Route 9 corridor in the Town of Lake George. I am very pleased to report that the number and scale of stormwater retrofit projects undertaken and completed in this project exceeds what was outlined in the DEC approved Scope of Work. Dozens of stormwater collection, conveyance, and infiltration structures have been installed on large developed properties and town roads, and are functioning properly. As such, it also stands that the

stormwater runoff issue from private properties and town roads within this watershed has successfully been addressed. As stated in Don Lake's report "West Brook Stormwater Mitigation Project" (page 19), *"Implementation should be phased with the parcels with the highest TSS (total suspended solids) targeted for remediation first. This would include in priority order:*

1. *Routes 9 and 9N* *10,256 lbs*
2. *Bowling Alley* *2,128 lbs*
3. *Holiday Inn* *2,039 lbs*
4. *Northland (Super 8) Motel* *1,372 lbs*
5. *Birch Avenue* *1,276 lbs*

*These five parcels total 17,071 pounds, or approximately 81% of all the TSS load."*

The District's charge was to address the large privately owned developed properties noted above, plus the town road (Birch Ave). We have completed this charge, and completed the retrofit of three additional properties in the watershed.

At the conclusion of this project, the following properties were retrofitted with stormwater collection, conveyance, and infiltration systems:

1. Lake George Bowling Alley
2. Holiday Inn
3. Super 8 Motel
4. Mobil Station/Nice n Easy
5. Holly Tree Motel
6. Harry's Restaurant
7. Birch Avenue

As all of the retrofit projects conducted under this project are infiltration systems, tss, phosphorus, nitrogen, and all other pollutants have been removed from the stormwater network on the affected properties (not just tss). Excellent cooperation was given from local landowners within the scope of this effort, and the Town of Lake George highway department was very generous with their time and efforts spent retrofitting Birch Ave at their own expense. There were no significant problems encountered with the planning and undertaking of the stormwater projects completed in this effort.

By retrofitting these properties and installing stormwater collection and infiltration systems on them, the pollutants in the stormwater runoff from these properties were eliminated from the Route 9 stormwater network which outlets directly to West Brook just above its confluence with Lake George. The goal of this program was achieved, and actually exceeded, with the work accomplished to date under this project. This report contains a summary of each stormwater retrofit project, what was installed, and its current status.

It must be noted that NYS Route 9 itself, which is by far the largest paved parcel in the watershed, has yet to be retrofitted by the NYS DOT with stormwater improvements. This issue is currently being worked on by the DOT, with assistance from the DEC and the Warren County SWCD. As of this printing, no plans have been forthcoming to fund stormwater improvements to Route 9.

## ***Final Financial Summary For This Project***

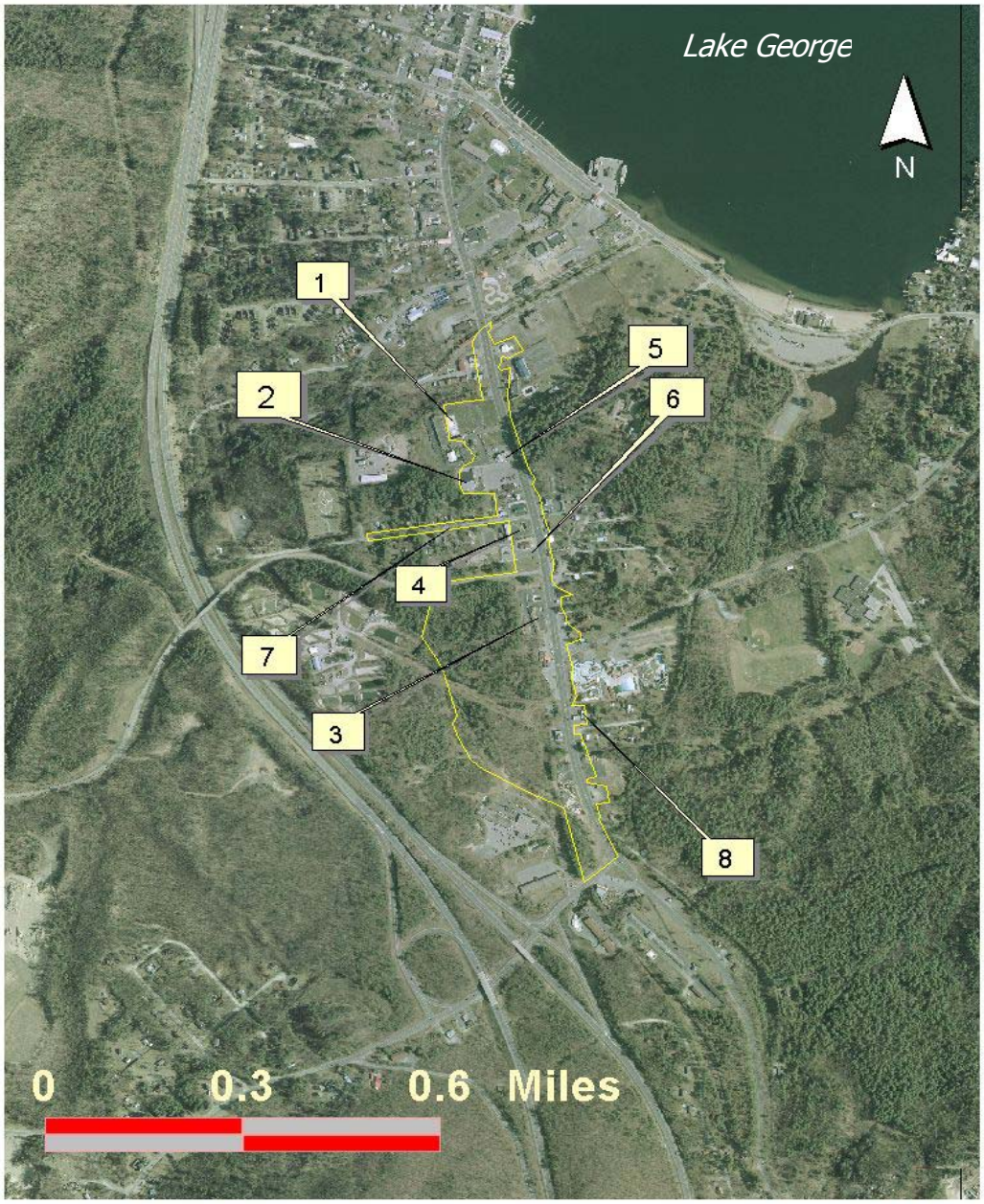
Final Budget Summary:

| *Item* | *State Assistance Budgeted* | *Local Match Budgeted* | *Total Project Costs Budgeted* | *Total Project Costs incurred to date* |
|---|---|---|---|---|
| Personal Services | 27,500.00 | 130,000.00 | 157,500.00 | 172,847.14 |
| Travel | 0.00 | 12,000.00 | 12,000.00 | 6,238.47 |
| Equipment | 4,000.00 | 45,000.00 | 49,000.00 | 49,706.99 |
| Supplies and Materials | 14,500.00 | 17,000.00 | 31,500.00 | 25,863.68 |

| | | | | |
|---|---|---|---|---|
| Construction Contracts | 173,000.00 | 15,000.00 | 188,000.00 | 123,430.49 |
| Engineering Contracts* | 0.00 | 0.00 | 0.00 | 24,849.60 |
| Legal and Miscellaneous Contracts** | 0.00 | 0.00 | 0.00 | 35,930.00 |
| Totals | 219,000.00 | 219,000.00 | 438,000.00 | 438,866.37 |

* Most of the engineering contract costs were from the original stormwater wetland project, and these costs were not considered a part of the new budget, which was an error. The original wetland project budget reflected these costs, and they should have been reflected in the revised budget.

** This item is reported from the original wetland contract, whereby considerable legal and contracted planning expenses were incurred by the Lake George Association in moving forward with the use through permanent easement or purchase of lands owned by the Charles Wood Foundation.




*Aerial photo of the southern tip of Lake George. The numbers identify the locations of the properties retrofitted in this project. The yellow line delineates the subwatershed which drains north into West Brook from NYS Route 9.*

# ***Stormwater Retrofit Projects Completed in this Contract***

## **Project #1: Holiday Inn Lake George (Completed Summer 2002)**

This property maintains the second largest impervious area in the watershed. It has four distinct drainages which exit the property. All four drainages were retrofitted with conveyance and infiltration structures, as noted below.


*Site A (Entrance Driveway)*

Site summary: A trench drain was installed across the driveway, directing water into two subsurface dry wells 4' high by 8' diameter, infiltrating the first three quarters of an inch of runoff from a storm event.

Hydrology:
Site area = 10,268 square feet
Needed to accommodate 0.5 inches (minimum) of rainfall over this area
Volume of the half inch storm = 428 cubic feet of water

Stormwater Improvements:
Installed a trench drain across driveway to collect and direct water to installed dry wells that act as infiltration structures for stormwater.
System sizing: 8 foot diameter, 4 foot high well = 200 cubic feet of water capacity
Therefore, 2 – 4'x8' drywells were needed to accommodate flow.
Stone pad under dry well (10' wide x10' wide x2' deep), plus the stone to backfill the hole around the drywell, @ 40% porosity (#3 stone) accommodates 240 additional cubic feet of water, bringing the total storage up to 740 cubic feet of volume.

| ***Items Installed*** | ***Quantity*** |
|---|---|
| Dry well (4'x8') | 2 |
| Traffic Cover | 2 |
| Grate and frame for Drywell | 2 |
| Open Top Slotted Drain Pipe | 40 feet |
| Concrete for Trench | 3 yards |
| Filter Fabric | 1 roll |
| #3 Stone | 22 yards |
| Topsoil | 5 yards |
| Grass seed | 2 pounds |
| Straw mulch | 2 bales |

*Site B (Main Parking Area in Front of Motel)*

Site summary: Stormwater flows into a new dry well (8' deep by 8' diameter) that acts as pre-treatment and infiltration. Outflow from this well goes into an infiltrator chamber bed system for infiltration and final treatment of the first three quarters of an inch of runoff from a storm event.
Hydrology:
Site area = 29,510 square feet
Needed to accommodate 0.5 inches (minimum) of rainfall over this area
Volume of the half inch storm = 1,230 cubic feet of water

Stormwater Improvements:
Existing drainage patterns bring all stormwater to one point in the parking lot, which flows directly into a concrete bowl shaped area which drains through a grate into the new dry wells below.

Dry wells were installed to act as a pre-treatment system, reducing the volume of particulates (sand and silt) which would enter final treatment system (infiltrator chambers). The dry wells will also act as infiltration structures for stormwater. Pre-treatment is two 4 foot high by 8 foot diameter dry wells stacked on top of each other, with a grate inlet and an 8" outlet pipe. The outlet pipe leads to four six-inch pipes which feed the infiltration chambers for final treatment. The stone pad under the dry well (10' wide x10' wide x2' deep), plus the stone needed to backfill the hole around the wells, @ 40% porosity (#3 stone) accommodates 240 additional cubic feet of water, adding additional storage and infiltration capacity to system. The majority of stormwater infiltration will be through the installed Stormtech® infiltrator chambers, sized as follows:
Volume needed to address = 1,230 cubic feet. Therefore, based upon Stormtech® system, chamber number and sizing was designed according to this need. Bed size is 20 feet wide by 30 feet long, totaling 600 square feet of surface area. Adding the drywell capacity, plus the infiltration bed capacity, brings the total storage of stormwater up to 1,830 cubic feet. This system can accommodate approximately 0.75" of rainfall in capacity alone. When adding the infiltration component to this system, the actual volume of stormwater the system is addressing is much higher.

| ***Item*** | ***Quantity*** |
|---|---|
| Dry well (4' high x 8' diameter) | 2 |
| Traffic Cover | 1 |
| Grate and frame for Drywell | 1 |
| Concrete for sluiceway and bowl above dry wells | 3 yards |
| Filter Fabric | 1 roll |
| #3 Stone (for well) | 22 yards |
| 8" PVC Pipe | 20 feet |
| 6" PVC Pipe | 16 feet |
| Stormtech© Infiltration chambers | 16 |
| #2 Stone (for chamber bed) | 60 yards |
| Topsoil | 5 yards |
| Grass Seed | 5 pounds |
| Straw mulch | 4 bales |

*Site C (Driveway North of Pool)*

Site summary: Stormwater flows into a dry well (8' deep by 8' diameter), which infiltrates the first half to three quarters of an inch of runoff from a storm event.

Hydrology:
Site area = 5,050 square feet
Needed to accommodate 0.5 inches (minimum) of rainfall over this area
Volume of the half inch storm = 210 cubic feet of water

Stormwater Improvements:
Existing drainage pattern brought all stormwater to one point, which was modified with infiltration improvements. Installation of dry wells acts to infiltrate the stormwater at this site. No outlet pipe was installed, and overflow acts in the same way as it previously did.

Stormwater structures are 2 – 4'x8' stacked dry wells. The stone pad under the dry well (10' wide x10' wide x2' deep), plus the stone to backfill the hole around the drywells, @ 40% porosity (#3 stone) accommodates 240 additional cubic feet of water, adding additional storage and infiltration capacity to system.

| Item | Quantity |
|---|---|
| Dry well (4' high x 8' diameter) | 2 |
| Traffic Cover | 1 |
| Grate and frame for Drywell | 1 |
| Filter Fabric | 1 roll |
| #3 Stone | 22 yards |
| Asphalt | 2 yards |

*Site D (Northeast Lower Parking Area)*

Site summary: Stormwater flows into a series of two dry wells (8' deep by 8' diameter), which infiltrates the first half to three quarters of an inch of runoff from a storm event.

Hydrology:
Site area = 21,345 square feet
Needed to accommodate 0.5 inches (minimum) of rainfall over this area
Volume of the half inch storm = 890 cubic feet of water

Stormwater Improvements:
Existing drainage pattern brings all stormwater largely to one point, which was modified with infiltration improvements. Installed dry wells will act to infiltrate the stormwater at this site. No outlet pipe was installed, and overflow will act in the same way as it previously did.

Stormwater structures are 2 – 8' diameter x8' deep dry wells. The stone pad under the dry well system (25' wide x10' wide x2' deep), plus the stone needed to backfill the hole around the wells, @ 40% porosity (#3 stone) accommodates 680 additional cubic feet of water, adding additional storage and infiltration capacity to system.

| Item | Quantity |
|---|---|
| Dry wells (4' high x 8' diameter) | 4 |
| Traffic Cover | 2 |
| Grate and frame for Drywells | 2 |
| Filter Fabric | 2 rolls |
| Asphalt | 10 yards |
| #3 Stone (for well) | 63 yards |
| Clean Fill (Item 4) | 40 yards |
| Topsoil | 15 yards |
| Grass Seed | 10 pounds |
| Straw Mulch | 6 bales |

*Additional Notes on Holiday Inn Stormwater Project:*

1. Construction was conducted by Patrick Galusha Construction and Excavation. Contractor cost for materials and installation was $38,429.
2. Don Lake Jr., P.E. was the project engineer, stamping the designs and overseeing this project.
3. The District oversaw all phases of construction on a daily basis, certifying installation and as-built designs.
4. Construction of this project took approximately three weeks. Work occurred on a daily basis with minimal interruption.
5. All disturbed areas of lawns were re-graded to match original topography, then seeded with an appropriate seed mix and mulched.
6. All disturbed areas of blacktop surfaces were re-graded with gravel, compacted, and then overlain by new blacktop to match original surface.
7. Mike Hoffman, Holiday Inn owner, very pleased with project

## Project #2: Lake George Bowling Alley (Completed Fall 2002)

**Overall project summary:**

The large asphalt parking lot at this property has been retrofitted with stormwater infiltration structures, which will act to reduce phosphorus and other pollutants by infiltrating them into the ground. Two "stormwater medians" were constructed within the parking area, which intercept the flow on the parking lot and provide for the subsurface storage and infiltration of surface runoff. The medians are underlain by stormwater infiltration chambers to provide a large quantity of storage volume. These medians are nicely landscaped at the surface, and improve not only the water quality aspects of the site, but also the overall aesthetics of the property.

***South Median***

Hydrology:
Site area = 22,080 square feet
Needed to accommodate 0.5 inches (minimum) of rainfall over this area
Volume of the half inch storm = 920 cubic feet of water

Stormwater Improvements constructed:
This site consists of a 164' long x 7' wide stormwater median, underlain with #3 stone and 18 infiltration chambers, to collect and infiltrate stormwater from the south portion of the parking lot.

The top of the median was depressed below the surface of the parking lot so that runoff will flow into and remain in the median. Small berms were constructed within the median to impede surface flow down the center line of the median, allowing for a longer retention time. To facilitate stormwater entry into the subsurface chambers during storm events, six inch diameter pvc riser pipes were installed from the chambers to the surface at specified locations. Upright bar guards were installed at the top of the risers to prevent clogging of the inlets. Marine plywood cutoff walls were installed subsurface within the median at specified locations to hamper lateral subsurface flow, and the chambers were capped with end caps at specified locations for this same reason. The

surface of this median was landscaped with native shrubs and ornamental trees, seeded, and protected with North American Green© SC-75 erosion control blankets.

This system utilizes "Stormtech®" infiltration chambers. A volume of 1268 cubic feet of water is able to be stored in this system. Therefore, this median will infiltrate up to approximately three quarters of an inch of rainfall from the area which drains to it on the site.

As an add-on to this project, the Bowling Alley owners wanted to replace the foundations for their light poles in this median. The District contracted with Jarrett-Martin Engineers, LLP, to design the new bases, and the contractor installed the new bases as an addition to this project. These costs were borne by New England Bowl. The designs for the bases are included in the Bowling Alley Stormwater Project file.

South Median Materials:

| *Item* | *Quantity* |
|---|---|
| Stormtech® Infiltration chambers | 18 |
| #2 Stone | 82 yards |
| Clean Fill (sand) | 60 yards |
| 6" PVC pipe | 40 feet |
| 6" Riser bar guards | 6 |
| Filter Fabric | 1150 sq ft |
| Pre-cast Curbs (6' long) | 40 |
| Marine plywood sheets (4'x8') | 3 |
| Topsoil | 26 yards |
| Shrubs (assorted) | 25 |
| Ornamental Trees (Canadian Red Cherry) | 3 |
| Grass seed | 20 pounds |
| SC-75 Erosion Control Blanket | 2 rolls |

***North Median***

Hydrology:
Site area = 27,378 square feet
Needed to accommodate 0.5 inches (minimum) of rainfall over this area
Volume of the half inch storm = 1141 cubic feet of water

Stormwater Improvements constructed:
Installed a 208' long x 7' wide stormwater median underlain with a bed of #2 stone, along the northern property line to infiltrate stormwater from the northern most portion of the parking lot. The original design included the installation of subsurface stormwater chambers. However, during construction it was noted that this median is underlain by a ductile pipe water line. Although UFPO was contacted four days prior to construction, the Village of Lake George Water Department did not come out to the site to mark the line. To avoid disturbance and possibly breach of this line, the chambers were eliminated in favor of simply backfilling the trench with #2 stone. This stone layer was overlain with a one-foot thick layer of #1 stone, to minimize piping of material through the stone.

The top of the median was depressed below the surface of the parking lot so that runoff will flow into and remain in this area. Eight (6") diameter riser pipes were installed from the stone bed to the surface at specified locations in the median to allow for the conveyance of water directly into the subsurface stone bed under high flow conditions. Upright bar guards were installed at the top of the risers to prevent clogging of the inlets. Small berms were constructed within the median to impede surface flow down the center line of the median, allowing for a longer retention time. The surface of this median was landscaped with native shrubs, seeded, and protected with North American Green® SC-75 erosion control blankets.

North Median Materials:

| *Item* | *Quantity* |
|---|---|
| #2 Stone | 240 yards |
| #1 Stone | 80 yards |
| Clean Fill (sand) | 140 yards |
| Topsoil | 40 yards |
| 6" riser bar guards | 8 |
| Marine plywood sheets (4'x8') | 3 |
| Pre-cast curbs (7' long) | 23 |
| 6" PVC Pipe | 40 feet |
| Assorted shrubs | 17 |
| Grass seed | 20 pounds |
| SC-75 Erosion Control Blanket | 3 rolls |

Upon completion of the stormwater medians, new parking lines were painted on the pavement, and curbing was installed around the median to protect the trench and the light poles.

*Additional Notes:*

1. Construction was conducted by Greenwich Excavation and Construction. Contractor cost for materials and installation was $33,618 (plantings not included).
2. All landscaping of the berms was conducted by District staff.
3. Don Lake Jr., P.E. was the project engineer, stamping the designs and overseeing this project.
4. The District oversaw all phases of construction on a daily basis, certifying installation and as-built designs.
5. Construction of this project took approximately three weeks. Work occurred on a daily basis with minimal interruption. Line painting and curbing took place three weeks following completion of the medians, due to inclement weather for painting.

## Project #3: Super 8 Motel (Completed Summer 2003)

**Overall project summary:**
There are numerous asphalt parking lots at this property. However, three distinct drainage areas can be identified which drain the strong majority of the property, all of which were retrofitted with stormwater infiltration structures. These structures will act to infiltrate stormwater runoff and its pollutants into the ground on-site, removing this water from the Route 9 drainage system which is routed to Lake George via an outfall into West Brook.

The drainage areas have been divided into areas "A", "B", and "C", which are identified on the drainage area map. Space for stormwater improvement structures is limited at this property, so a best attempt was made to accommodate as much stormwater as possible within the defined project locations. A minimum of the first half-inch of runoff from the drainage area is stored in each structure, and in some cases, up to one-inch.

*Site A (South) Summary*

Hydrology:
Site area = 16,160 square feet
Goal is to capture a minimum of 0.5 inches of rainfall over this area and infiltrate it.
Therefore, need to design to accommodate approximately 673 cubic feet of water.

Stormwater Improvements constructed:
24 feet of slotted trench drain pipe (12" diameter) was installed across the asphalt driveway, set into concrete to grade with existing blacktop. The slotted pipe is then connected to a standard 12" diameter corrugated metal pipe which is approximately 4 feet long. This pipe then outlets into a 30" dia. piece of HDPE, mounted vertically on top of the first dry well (6' diameter x 4' high) above the hole in the concrete cap on the well. There is a manhole cleanout at the surface of the blacktop. The well acts as a settling basin. An eight inch diameter schedule 40 pvc pipe was installed from this well into the area of the infiltration chamber bed. Six-inch diameter pvc pipe laterals, branch perpendicularly from the 8" line, at the location of the new infiltration chambers. Two-foot sections of 6" diameter pvc pipe outlet into the end of each chamber. There are four chamber trenches (capped at each end) consisting of four SC-740 StormTech® chambers in each trench, totaling 16 StormTech® chambers. The StormTech® bed was underlain with 6" of #2 stone, which was also used to backfill the chamber bed up to the top of the chambers. The bed was overlain with filter fabric, and then overlain with 24" of clean fill and topsoil to existing grade of drive. The bed was seeded and landscaped as per landowner wishes, and extruded concrete curbing was installed around the entire area.

System sizing:
The volume of the dry well configuration above is approximately 85 cubic feet (6' diameter 3' usable height). 6 StormTech® SC-740 installed equals 450 cubic feet of storage (75 cubic feet per chamber).The stone backfill will be approximately 26 cubic yards, with a porosity of approximately 40%, which adds an additional 280 cubic feet of water storage. This brings the total storage up to 815 cubic feet of water, which is far more than the .5" of runoff designed for.

Site "A" Materials:

| *Item* | *Quantity* |
|---|---|
| Dry Wells (6' diameter x 4' high) | 1 |
| StormTech® SC-740 chambers | 16 |
| Traffic Caps for well | 1 |

| | |
|---|---|
| Manhole cover and frame for Drywell | 1 |
| Open Top Slotted Drain Pipe (12" diameter, 1.75" slot width, 6" slot height) | 24 feet |
| 12" corrugated metal pipe | 4 feet |
| Concrete around slotted pipe | 3 yards |
| #2 Stone | 54 yards |
| 30" HDPE Pipe | 3 feet |
| Filter Fabric | 150 yards |
| Topsoil | 40 yards |
| Grass Seed, Adirondack Mix | 10 pounds |
| Hydromulch | 6 bales |
| Extruded concrete curbing | 270 linear feet |

*Site B (Middle) Summary*

One six-foot-diameter, four-foot-high dry well was installed in the driveway at the location shown on the plans. This dry well acts a settling basin. An 8" diameter schedule 40 pvc pipe then conveys the water to a infiltration bed of 6 StormTech® SC-740 infiltration chambers. The drywell and chambers were underlain with 6" of #2 stone. The side walls of the trench around the drywell were covered with filter fabric to minimize soil piping. The well was covered with an 8" thick concrete traffic cover with an offset grate hole. The hole was overlain with a grate frame and traffic grate. The area surrounding the dry wells and chambers was backfilled with #2 stone up to the top of the well and chambers. This area will was then covered with filter fabric. Blacktop was placed over the drywell area, and shaped like a shallow bowl such that the runoff will be captured and flow into the grate. The area above the infiltration bed was overlain with fill, 12" of topsoil, seeded and mulched.


Hydrology:
Site area = 7,840 square feet
Goal is to capture a minimum of 0.5 inches of rainfall over this area and infiltrate it.
Therefore, need to design to accommodate approximately 326 cubic feet of water.

System Sizing
Six Stormtech® SC-740 chambers installed equal 450 cubic feet of storage (75 cubic feet per chamber). This includes the volume in the surrounding stone. The storage in the dry well equals 85 cubic feet (6' diameter, 3' usable height). This brings the total storage volume to 535 cubic feet. This equals approximately 0.8 inches of runoff that this system will handle, even without infiltration during the storm.

Site "B" Materials:

| *Item* | *Quantity* |
|---|---|
| Dry Well (6' wide, 4' high) | 1 |
| Offset Hole Traffic Cap for well | 1 |
| Grate and frame for Drywell | 1 |
| StormTech® SSC-740 chambers | 6 |
| #2 Stone | 26 yards |
| Filter Fabric | 50 yards |
| Asphalt | 3 yards |
| Topsoil | 10 yards |
| Grass Seed/Adirondack Mix | 5 pounds |
| Straw for mulch | 2 bales |

*Site C (North) Summary*


Site area = 36,640 square feet
Goal is to capture a minimum of 0.5 inches of rainfall over this area and infiltrate it. Therefore, need to design to accommodate approximately 1,526 cubic feet of water.

Stormwater Improvements constructed:
Twenty nine feet of slotted trench drain pipe (12" diameter) was installed across the asphalt driveway, set into concrete to grade with existing blacktop. This directs water to the new stormwater infiltration structures (dry well and infiltration chambers). Water flows from the slotted drain pipe into a non-slotted section of 12" diameter pipe as it reaches the grassed area. The pipe outlets into a 30" diameter piece of HDPE, mounted vertically on top of the dry well above the hole in the concrete cap on the well. This well acts as a settling basin. An eight inch diameter schedule 40 pvc pipe was installed from this well into an infiltration bed. Six-inch diameter pvc pipe laterals, branch perpendicularly from the 8" line, at the location of the new infiltration chambers. Two-foot sections of 6" diameter pvc pipe outlet into the end of each chamber. The infiltration bed consists of 12 StormTech® SC-740 chambers underlain with 6 inches of #2 crushed stone, which was also used to back fill the chamber bed up to the top of the chambers. The bed was then overlain with filter fabric, then overlain with 2' of clean fill 12" of topsoil, seeded and mulched.

The 8 foot diameter, 5 foot high dry well, will accommodate 250 cubic feet of water. Twelve StormTech® SC-740 chambers will accommodate 900 cubic feet of water (75 cubic feet per chamber). Fifty yards of #2 stone used to underlay and backfill the chambers and drywell will add additional storage of approximately 540 cubic feet. This brings the total storage up to 1690 cubic feet, which will handle more than 0.5 inches of rainfall on capacity alone.

Site "C" Materials:

| *Item* | *Quantity* |
|---|---|
| Dry Well (8' diameter, 5' high) | 1 |
| Stormtech SC-740 Chambers | 12 |
| 8" hdpe corrugated pipe | 6 feet |
| 6" pvc pipe | 20 feet |
| Traffic Caps for wells | 1 |
| Grate and frame for Drywell | 1 ea |
| Open Top Slotted Drain Pipe (12" diameter, 1.75" slot width, 6" slot height) | 29 feet |
| 12" corrugated metal pipe | 5 feet |
| Concrete around slotted pipe | 4 yards |
| #2 Stone | 50 yards |
| 30" HDPE Pipe | 3 feet |
| Filter Fabric | 140 yards |
| Topsoil | 10 yards |
| Grass Seed, Adirondack Mix | 10 pounds |
| Straw for mulch | 2 bales |

Additional Notes:
1. Construction was conducted by Patrick Galusha Construction and Excavation. Construction and materials cost was $35,883.
2. Don Lake Jr., P.E. was the project engineer, stamping the designs and overseeing this project.
3. The District oversaw all phases of construction on a daily basis, certifying installation and as-built designs.
4. Construction of this project took approximately two weeks. Work occurred daily with minimal interruption
5. All disturbed areas of lawns were re-graded to match original topography, then hydroseeded with an appropriate seed mix and hydromulch.
6. All disturbed areas of blacktop surfaces were re-graded with gravel, compacted, and overlain by new blacktop to match original surface.

**Project # 4: Holly Tree Motel (Completed Fall 2003)**


Overall project summary:
The asphalt driveway at this property was retrofitted with a stormwater infiltration structure, which will act to reduce phosphorus and other pollutants by infiltrating them into the ground. A Slotted Trench Drain was installed in the Canada St. entrance drive of the motel, which will intercept the flow on the parking lot and convey it to a drywell located in the lawn area to the north of the drive, for storage and infiltration.

Hydrology:
Site area = 9400 square feet
Need to accommodate 0.5 inches (minimum) of rainfall over this area
Therefore, volume of the half inch storm = 391 cubic feet of water

Stormwater Improvements Constructed:
20 feet of slotted trench drain pipe (12" diameter) was installed across the asphalt driveway, set into concrete to grade with existing asphalt. This collects and conveys stormwater to a new drywell infiltration structure. Water flows from the slotted drain pipe into a non-slotted section of 12"

diameter pipe when it reaches the grassed area. This pipe then outlets into a 30" diameter piece of HDPE mounted vertically on top of the drywell above the hole in the concrete cap on the drywell. The side walls of the excavation for the drywell were covered with filter fabric to minimize soil piping. One foot of topsoil was then used to bring the site back to existing grade, which was seeded and mulched.

System sizing:

This system is designed using an 8 foot diameter, 5 foot high drywell, plus a 6 inch thick cap. Using this drywell will accommodate a volume of 250 cubic feet of water within the well itself. A two foot thick base of #2 stone under the well, plus the stone needed to fill the remainder of the hole (10' wide by 10' wide by 7' deep following installation of the well on the stone base) equals a total volume of 17 cubic yards of stone required. With a porosity of 40%, the stone will accommodate 180 cubic feet of additional stormwater storage, bringing the total storage up to 430 cubic feet of volume. Therefore, this drywell system stores up to approximately 0.6" of rainfall from the area which drains to it on the site. When adding in the relatively rapid infiltration rate from the underlying sands, the capacity of the system is actually larger than that number.

Total Materials and Quantities for Stormwater Improvements

| *Item* | *Quantity* |
|---|---|
| Open Top Slotted Drain Pipe (12" diameter, 1.75" slot width, 6" slot height) | 20' |
| 12" cmp | 12' |
| Dry Well ( 8' diameter, 5' high) | 1 |
| Dry well cover (6" thick) | 1 |
| Grate and Frame for Drywell | 1 ea |
| 30" HDPE pipe for riser | 18" |
| Concrete around slotted pipe | 2 yards |
| #2 Stone | 17 yards |
| Filter Fabric | 45 yards |

Construction Notes:

1. Construction was conducted by Patrick Galusha Construction and Excavation. Contractor cost for materials and installation was $5,800.
2. The District oversaw all phases of construction on a daily basis, certifying installation and as built designs.
3. Construction for this project took approximately two days.
4. All disturbed areas of lawns were re-graded to match original topography, then seeded with an appropriate seed mix and mulched.

## Project # 5: Mobil Station/Nice-n-Easy (Completed Spring 2003):

**Overall project summary:**

This project was a financial collaboration between the District and Riverside Gas and Oil who owns the Mobil Station on Route 9 in Lake George. As this property was re-developed into a new convenience store, they were required to meet a minimum stormwater standard for the new construction by the Town of Lake George. These new stormwater requirements were minimal, and would have done little to curb runoff from the site. As such, the District offered to provide up to $10,000 of matching dollars to undertake a much more comprehensive stormwater retrofit project to address all stormwater for the site. Riverside Gas and Oil agreed, and we set forth on working with their engineer (Jim Hutchins, P.E., from North Creek) on the designs.

Working with Mr. Hutchins, the site was redesigned with a new stormwater collection, conveyance, and infiltration system. As there was insufficient property available to install the infiltration system, an agreement was worked out with the adjacent Holiday Inn property for use of their land for this purpose. Mike Hoffman, owner of the Holiday Inn, deserves recognition for allowing this use on his property at no charge.

Stormwater Improvements Constructed:

To collect the stormwater runoff as it flows across the pavement of the Mobil station, two fifty-foot long sections of 12" diameter Duraslot® open top slotted trench drain were used. Both sections of pipe were installed parallel to Route 9 approximately fifteen feet in from the roadway on the Mobil property. The sections of pipe were separated by a large planter in the center of the parking lot.

The first pipe flows into the second pipe, which then flows to a short section of standard 12" diameter corrugated metal pipe. This pipe outfalls into a riser set upon a large drywell system which is located on the adjacent Holiday Inn Property. The drywell system includes approximately 18" of #2 stone under two dry wells (dimensions 8 foot wide by five foot high). The hole in which the dry wells are placed is lined with filter fabric to minimize piping of soil into the system, and then the hole surrounding the wells was filled with #2 stone. A non-traffic concrete cover was placed on the top of the well, and then a 30" diameter, two foot high section of high density polyethelyne (hdpe) pipe was placed on that. The 12" corrugated metal conveyance pipe carrying the stormwater outlets into a hole in the side of the hdpe pipe, which then falls into the wells for infiltration.

Total Materials and Quantities for Stormwater System

| *Item* | *Quantity* |
|---|---|
| Open Top Slotted Drain Pipe (Duraslot) 12" diameter, 1.75" slot width, 6" slot height) | 100' |
| 12" cmp | 15' |
| Dry Well ( 8' diameter, 5' high) | 2 |
| Dry well cover (6" thick non-traffic) | 1 |

| | |
|---|---|
| Manhole cover and Frame for Drywell | 1 ea |
| 30" HDPE pipe for riser | 24" |
| #2 Stone | 62 yards |
| Filter Fabric | 65 yards |

Construction Notes:

1. Construction of all stormwater improvements was contracted out directly by Riverside Gas and Oil as part of their overall development project. The District simply reimbursed Riverside for 50% of the stormwater improvements, up to $10,000. As the cost of the stormwater improvements was approximately $22,000, the total reimbursement to Riverside out of grant funds was $10,000.
2. Jim Hutchins, P.E., oversaw construction of these stormwater structures.

## Project # 6: Harry's Restaurant (Completed Fall 2003):

**Overall project summary:**

The asphalt driveway at this property was retrofitted with a stormwater infiltration structure, which will act to reduce phosphorus and other pollutants by infiltrating them into the ground. A drywell was installed in the southeast corner of the parking area of the restaurant, which will collect the flow from the parking area, for storage and infiltration.

Hydrology:
Site area = 9600 square feet
Need to accommodate 0.5 inches (minimum) of rainfall over this area.
Therefore, volume of the half inch storm = 400 cubic feet of water.

Stormwater Improvements constructed:
Installed was a 5' high x 8' diameter drywell with a traffic cover, grate and frame. Water flows across asphalt parking area into drywell for storage and infiltration. The side walls of the excavation for the drywell were covered with filter fabric to minimize soil piping. Asphalt was then placed on top of the drywell in such a way as to act as a bowl to collect water and funnel it into the drywell.

System sizing:
This system is designed using an 8 foot diameter, 5 foot high drywell, plus an 8 inch thick traffic cap. Using this drywell will accommodate a volume of 250 cubic feet of water within the well itself. A two foot thick base of #2 stone under the well, plus the stone needed to fill the remainder of the hole (10' wide by 10' wide by 6' deep following installation of the well on the stone base) equals a total volume of 17 cubic yards of stone required. With a porosity of 40%, the stone will accommodate 180 cubic feet of additional stormwater storage, bringing the total storage up to 430 cubic feet of volume. Therefore, this drywell system will store up to approximately

0.6" of rainfall from the area which drains to it on the site. When adding in the relatively rapid infiltration rate from the underlying sands, the capacity of the system will actually be larger than that number.

Total Materials and Quantities

| *Item* | *Quantity* |
|---|---|
| Dry Well ( 8' wide, 5' high) | 1 |
| Dry well cover (8" thick traffic rated) | 1 |
| Grate and Frame for Drywell | 1 ea |
| Asphalt | 2 yards |
| Concrete to secure grate | 0.5 yards |
| #2 Stone | 17 yards |
| Filter Fabric | 45 yards |

Construction Notes:

1. Construction was conducted by Patrick Galusha Construction and Excavation. Construction cost for materials and installation was approximately $2,700.
2. The District oversaw all phases of construction on a daily basis, certifying installation and as built designs.
3. Construction for this project took approximately one day.

## Project # 7: Birch Avenue (Completed Summer 2003):


**Overall project summary:**

The asphalt roadway of this street was retrofitted with several stormwater infiltration structures, which will act to reduce phosphorus and other pollutants by infiltrating them into the ground. Drywells were installed in the asphalt gutters at various locations along the roadway, for storage and infiltration.

Hydrology:
Site area = 54,450 square feet
Need to accommodate 0.5 inches (minimum) of rainfall over this area
Therefore, volume of the half inch storm = 2269 cubic feet of water

Stormwater Improvements constructed:
Installed were 3 stacks of 2, 4' high x 8' diameter drywells, with traffic covers (with offset holes), grates and frames. Water flows along the asphalt gutter and into the drywells for storage and infiltration. The side walls of the excavations for the drywells were covered with filter fabric to minimize

soil piping. Asphalt was then placed on top of the drywell in such a way as to act as a bowl to collect water and funnel it into the drywell. The last stack of 2, 4' x 8' drywells will be installed in April 2004.

System sizing:
This system is designed using 8, 4 foot high, 8 foot diameter drywells (4 stacks of 2 each), including traffic caps. Using this drywell (8x8) will accommodate a volume of 400 cubic feet of water within the well itself. A one foot thick base of #2 stone under the well, plus the stone needed to fill the remainder of the hole, (10' wide by 10' wide by 8' deep following installation of the well on the stone base) equals a total volume of 19 cubic yards of stone required. With a porosity of 40%, the stone will accommodate 200 cubic feet of additional stormwater storage, bringing the total storage up to 600 cubic feet of volume per stack of drywells. Therefore, this drywell system will store up to 2400 cubic feet of stormwater, or approximately 0.6" of rainfall from the area which drains to it on the site. When adding in the relatively rapid infiltration rate from the underlying sands, the capacity of the system will actually be larger than that number.

Total Materials and Quantities

| *Item* | *Quantity* |
|---|---|
| Dry Well ( 8' diameter, 4' high) | 8 |
| Dry well cover (8" thick traffic rated) | 4 |
| Grate and Frame for Drywell | 4 ea |
| Asphalt | 6 yards |
| #2 Stone | 88 yards |
| Filter Fabric | 135 yards |

Construction Notes:
1. Construction was conducted the Town of Lake George Highway Department.
2. Materials costs for this project were approximately $7,000.
3. The District oversaw all phases of construction on a daily basis, certifying installation and as built designs.

## Additional Stormwater Retrofit Initiatives…

The following two efforts are not funded through this grant, but should be noted as being undertaken for the benefit of stormwater in the West Brook watershed.

**Thomson's Garage Stormwater project (Scheduled for construction in May 2004, Funded by NYS Department of State)**

Thomsons Garage property is a key property in the West brook watershed in that it is at the head of the stormwater system and has the potential of adding a number of chemicals and petroleum products to the system. The asphalt driveway at this property will be retrofitted with a stormwater infiltration structure, which will act to reduce phosphorus and other pollutants by infiltrating them into the ground. A Slotted Trench Drain will be installed in the north entrance to Canada St. of the garage, which will intercept the flow on the parking lot and convey it to a drywell located in the lawn area to the north of the drive, for storage and infiltration.

Hydrology:
Site area = 9900 square feet
Need to accommodate 0.5 inches (minimum) of rainfall over this area
Therefore, volume of the half inch storm = 413 cubic feet of water

Stormwater Improvements to be constructed:
45 feet of slotted trench drain pipe (12" diameter) will be installed across the asphalt driveway, set into concrete to grade with existing asphalt. This will collect and convey stormwater to a new drywell infiltration structure. Water will flow from the slotted drain pipe, then outlet into a 30" diameter piece of HDPE mounted vertically on top of the drywell above the hole in the concrete cap on the drywell. The side walls of the excavation for the drywell will be covered with filter fabric to minimize soil piping.

System sizing:
This system is designed using an 8 foot diameter, 5 foot high drywell, plus a 6 inch thick cap. Using this drywell will accommodate a volume of 250 cubic feet of water within the well itself. A two foot thick base of #2 stone under the well, plus the stone needed to fill the remainder of the hole (10' wide by 10' wide by 7' deep following installation of the well on the stone base) equals a total volume of 17 cubic yards of stone required. With a porosity of 40%, the stone will accommodate 180 cubic feet of additional stormwater storage, bringing the total storage up to 430 cubic feet of volume. Therefore, this drywell system will store up to approximately 0.6" of rainfall from the area.

At present the plans for this project are being reviewed and finalized by an Engineer and the project will be constructed in the Spring of 2004.

**Route 9 Highway Retrofit (Planning underway, no construction scheduled or funding secured)**

The Warren County SWCD will continue to work with DOT and DEC to advance stormwater improvements to Route 9 itself, including landowner contacts, easement development, conceptual design, meetings with agencies, construction oversight, and construction follow-up activities. We are currently working with DEC and DOT on these issues, and heading up the landowner and conceptual design end of things. We hope to have landowner approval to install stormwater structures on their properties to address the Route 9 stormwater, but if not, we will have to work directly within the DOT right of way. Until this major roadway is addressed, stormwater runoff in this watershed will continue to be an issue to Lake George.