

MAY 2015



*ENGINEERING*

*CONSULTING*

*OPERATIONS*



Kidder Township  
Stormwater Concept Plan  
Project No. 10635.13

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**SECTION A**  
**PROJECT NARRATIVE**

# **STORMWATER CONCEPT PLAN FOR KIDDER TOWNSHIP CARBON COUNTY, PENNSYLVANIA**

## **INTRODUCTION**

ARRO Consulting Inc. is currently appointed as the Kidder Township Engineer and has been contracted by the Kidder Township Board of Supervisors to perform a Stormwater Concept Plan of the Township. The intent of the study is to identify existing stormwater problems that are currently affecting the existing roads, culverts, bridges and stormwater conveyance systems as well as identifying areas where erosion and sediment enter the various lakes and streams throughout the Township. The purpose of the plan is to document and map the findings of the entire Township and identify historic and existing problem areas that have been identified and documented by the residents and numerous homeowner groups throughout the Township. This report is a summary of the existing conditions of the stormwater systems in Kidder Township and provides recommendations for the rehabilitation, replacement, or reconstruction of bridges, culverts, swales, storm sewers, and roads. The basis of the plan is summarized below.

1. Review available topographical feature maps of Kidder Township including County and Township provided GIS information.
2. Using the information above, prepare a draft map with existing features, roadways, parcels, and watersheds for the Township.
3. Review previous reports and information, federal, state and local ordinances and regulations.
4. Meet with Township staff, officials, and the EAC (Environmental Advisory Council) to identify historic problem areas and discuss public outreach program.
5. Meet with all identified homeowner associations to identify problem areas.
6. Perform site inspections of the identified problem areas and document existing conditions.

7. Develop a summary report of findings for the identified problem areas and confirm outfalls and culverts.
8. Meetings with Kidder Township to review findings.
9. Provide the Township with the final stormwater concept plan and map.

The plan will serve as a baseline condition of the stormwater management within the Township and provide the Kidder Township Supervisors a general concept of where existing problems have been identified, what type of rehabilitation will be needed, and a preliminary opinion of cost. Within each problem area there may be possible complications associated with each project and additional steps may be needed to execute the recommendations. The plan will not provide a remedy to all past problems or provide in-depth design or construction plans to alleviate identified areas. It will provide the basis for the planning of future projects and the focus for future public outreach and education. One main follow-up step to the plan is the possibility of creating a stormwater management panel where 1 member of each HOA group is selected to represent their organization at meetings, as needed, with the board of supervisors and the engineer.

The plan is not an all-inclusive plan to remediate past stormwater problems and conditions. The plan will focus on controlling and maintaining the current stormwater run-off to efficiently remove it from the roadways, to safely convey it to the receiving stream, and to minimize the erosion and sediment contained in the run-off.

There have been numerous studies performed by various consultants, engineers, and watershed groups with the vast majority of them pertaining to Lake Harmony. This plan will take a look at the stormwater runoff draining to Lake Harmony, its effect and treatment methods using best management practices. It will not, however, focus on the existing chemical or biological condition of the water, water treatment, amount of sediment in the lake and procedures to remove it.

Additionally, the Lake Harmony Watershed Group had an independent study of the Lake Harmony watershed and provided supplemental information regarding the effects of the run-off entering the Lake and potential rehabilitation measures. In conjunction with the watershed group's plan and this plan, the Township will have the appropriate information available to make

sound and concise decisions on what areas of concern to address for stormwater issues Township wide.

## **BACKGROUND**

Kidder Township covers 72-square miles of beautifully wooded terrain in the northern tip of Carbon County. It is primarily a heavily wooded area which encircles Hickory Run State Park and has thousands of acres of Pennsylvania State Game Lands, contains (2) ski slopes, golf courses, resorts, lakes and streams. There are 40.77 miles of roadway in Kidder Township with only 5.19 miles owned by Kidder Township. The Pennsylvania Turnpike northeast extension runs North and South, Interstate 80 runs east to west, with state routes 940, 534 and 903 traversing the township.

The natural boundaries of the Township are defined by (3) large stream networks - the Lehigh River from the northern tip down along the western edge, the Mud Run along the south and the Tobyhanna and Tunkhannock Creeks along the east flowing north into the Lehigh River at the northern most part of the Township. The stormwater concept plan will break the Township into these three main watershed areas and investigate localized areas and the effect runoff has to these existing streams.

The Lehigh River will contain the areas just west of Jack Frost Ski Resort down through Hickory Run State Park with a majority of the developed areas in the Leonardsville, Pocono Mountain Lake and the areas that drain to the Black Creek.

The Mud Run watershed will focus on the areas surrounding the Albrightsville area and Holiday Pocono with contributing areas from Hawk Run, Laurel Run, and Swamp Run.

Tobyhanna watershed will contain the areas of Lake Harmony, Big Boulder Lake, Split Rock and up to the Jack Frost Ski Resort.

## **SUMMARY AND RECOMMENDATIONS**

Prior to constructing any improvements it is highly recommended to visit the site to determine if the problem areas have expanded or worsened due to further deterioration. More detailed design, and possibly construction plans, will need to be prepared to better define the rehabilitation measures and to refine quantities and costs at the time for construction and bidding, if required. The cost shown in the report is a total cost needed to implement the recommended repair by all the entities impacted and not a cost that is the sole responsibility of the Township. Ownership of available lands to implement improvements will need to be considered and easements/right-of-way acquisition will need to be determined. The cost analysis has a column to indicate the locations where improvements are in public right-of-way, Township or PennDOT, all other locations are located on private property or some other homeowner association's property.

Throughout the Township routine maintenance of shoulder/swale grading and vegetation/ leaf removal along the majority of the private, Township and state roads will not only greatly increase the removal of stormwater from the roadways but will increase the life span of the paving from accelerated deterioration. Receiving inlets, pipes, and channels should be maintained with vegetation and leaf removal more rigorously for the systems to work efficiently. Roadway anti-skid material, although necessary to transport vehicular traffic through the Township in winter conditions creates a great deal of maintenance issues. Incorporating devices around or near streams and water bodies to help capture this material for removal prior to entering the waterways is imperative to the water quality of our receiving streams. As well as implementing additional street sweeping procedures to remove the anti-ski after the winter season.

Implementation of post construction BMP products such as oil and debris separating snouts in inlets, interlocking concrete block and vegetation channel lining for heavy flow channels, soil stabilizing driveways, check dams consisting of filter socks in swales, and vegetative filter sock infiltration berms, rain gardens, and basins can be utilized as newer greener solutions to conventional applications to decrease sediment, debris and improve water quality. See Section F for more information.

Lake shore housing developments provide homeowners and recreational homeowners a fabulous opportunity to live next to beautiful bodies of water, however all the benefits that make these amenities attractive comes with a price. Closely developed housing on steep slopes accelerates runoff, creates sediment and pollutants the water entering the lakes. Without proper water quality devices treating water before entering the lakes or planned stormwater management facilities in the further reaches of the watershed to hold back and detain runoff, the current issues of constant sediment laden runoff will continue to enter the lakes. This runoff in addition to the amount of sediment and debris that enters the lakes through replenishment of stone, gravel, and sand parking/dock/ beach areas as well as the eroding unprotected shorelines has all played a part in the current condition of the lakes.



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**Client:**  
**Project:**  
**Project No.:**  
**Prepared By:**  
**Date:**

Kidder Township  
 Stormwater Management Plan  
 10635.13  
 DFW  
 5/18/2015

### Summary of Construction Cost Opinions

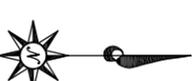
| # | Drainage Area  | Ownership | Cost           |
|---|--|-----------|----------------|
| 1 | North Lake Drive Improvements within this current concept plan     | Township  | \$56,370.00    |
|   | Tobyhanna Area without the below Lake Harmony Estates Improvements | Various   | \$688,737.47   |
|   | Lake Harmony Estates Improvements above South Lake Drive           | Private   | \$1,395,000.00 |
|   | Total Tobyhanna Area Watershed                                     | Various   | \$2,083,737.47 |
|   |  |           |                |
|   | Future North Lake Improvements                                     | Township  | \$225,240.00   |
|   |  |           |                |
| 2 | Total Lehigh Area Watershed  | Various   | \$293,070.00   |
|   | Lehigh Area Watershed within Township ROW                          | Township  | \$226,770.00   |
|   |  |           |                |
| 3 | Total Mud Run Watershed  | Various   | \$495,180.00   |
|   | Mud Run Watershed In Township ROW                                  | Township  | \$255,180.00   |
|   |  |           |                |

**Total Cost**                    **\$2,871,987.47**  
**Costs within the Township ROW**                    **\$538,320.00**

SECTION B  
WATERSHED MAP

WATERSHED AREA MAP  
FOR  
STORMWATER MANAGEMENT PLAN

KIDDER TOWNSHIP  
CARBON COUNTY, PENNSYLVANIA

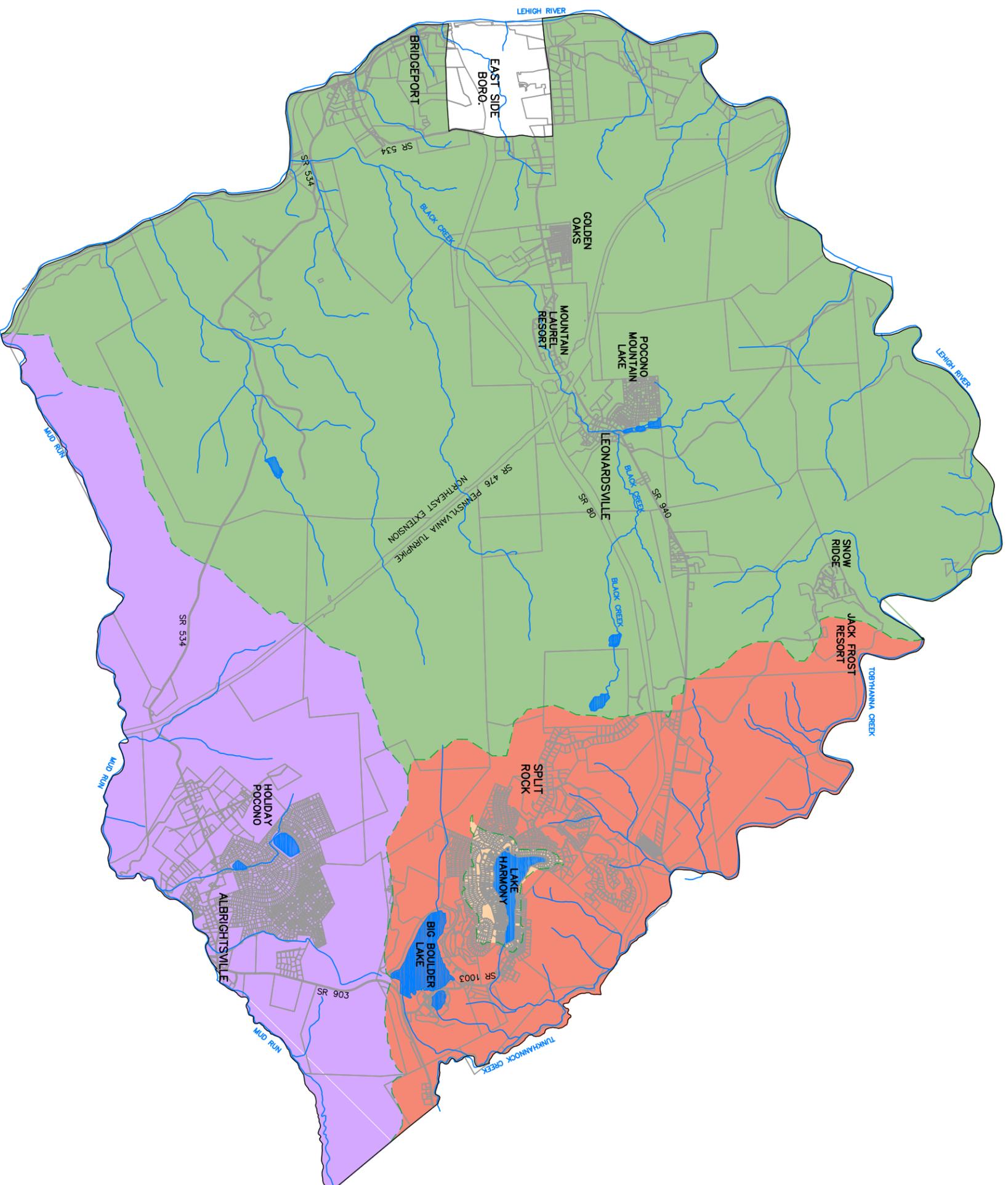


PREPARED BY:

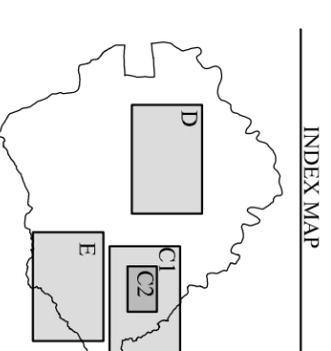


ENGINEERING & ENVIRONMENTAL CONSULTANTS

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- LEGEND**
- EXISTING BRIDGE/CULVERT
  - DRAINAGE AREA BOUNDARY
  - LEHIGH RIVER DRAINAGE AREA
  - TOBIHANNA DRAINAGE AREA
  - MUD RUN DRAINAGE AREA
  - LAKE HARMONY DRAINAGE AREA

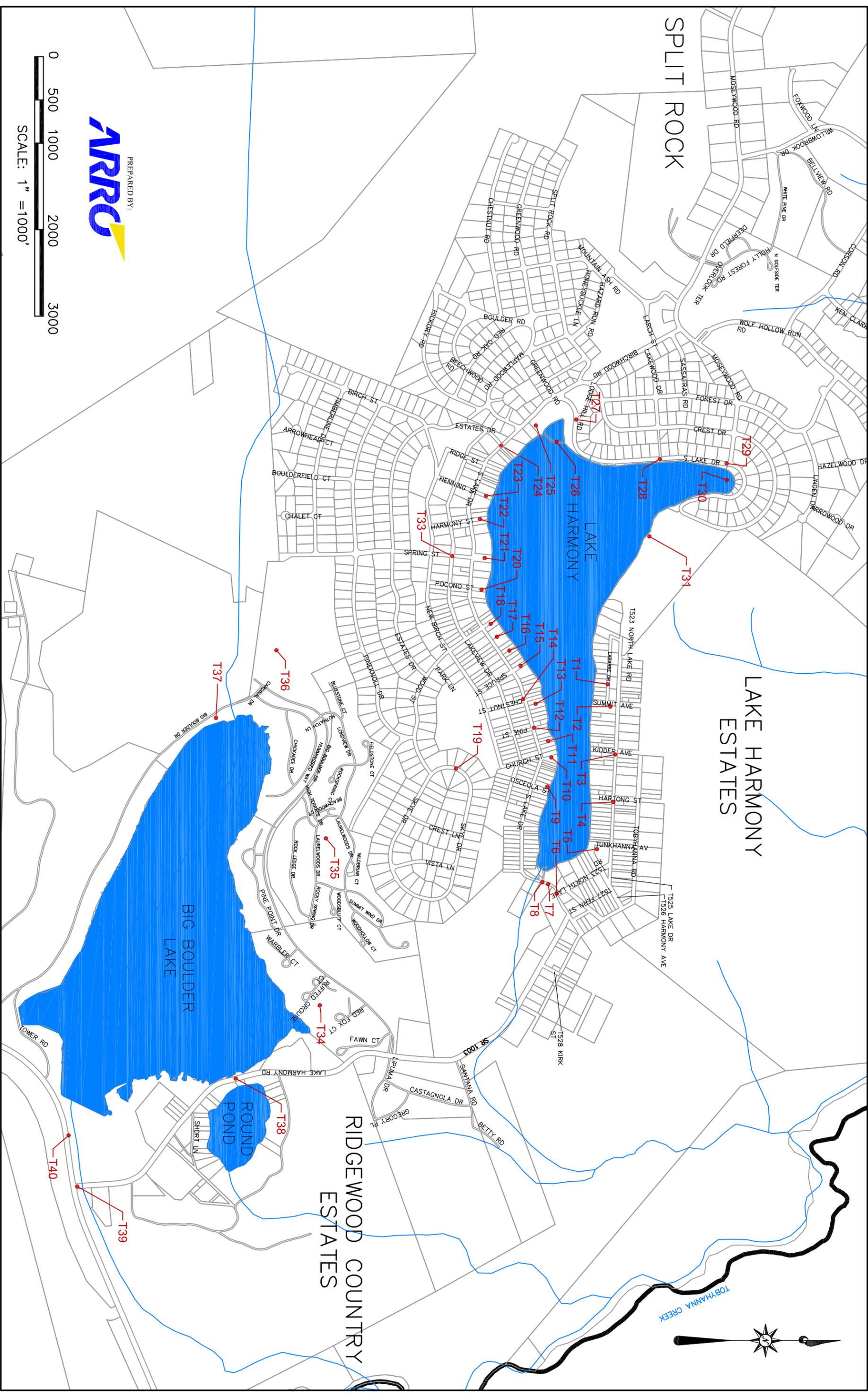


SECTION C  
TOBYHANNA WATERSHED

SPLIT ROCK

LAKE HARMONY  
ESTATES

RIDGEWOOD COUNTRY  
ESTATES



PREPARED BY:





## **Tobyhanna Watershed**

The Tobyhanna watershed will focus on the areas surrounding Big Boulder, Lake Harmony and Split Rock.

The following is a description of the problem areas identified, the deficiencies noted, recommendations, color photographs, and an estimated cost to repair. A priority indicator of (L) =Low, (M) = Medium and (H) = High has been included next to the cost to indicate a priority level of each area. An indicator of (T) for Township and (P) for PennDOT has been included after location below and on the cost summary for items that include work in the indicated public right-of-ways

## **Lake Harmony**

Lake Harmony is a glacial lake with no surface stream flowing into the lake and the primary sources of water are precipitation, surface runoff, and groundwater. The lake is approximately 120 acres and the receiving watershed approximately 415 acres. The majority of the watershed is developed and surrounded by steep slopes. Due to the relatively small size of the watershed compared to the lake size there are no overflow or quantity issues currently with the lake or its outlet structure. The main concern is the amount and type of sediment that is entering the lake and how it is affecting the water quality and depth of the water.

The watershed will be broken up into (3) drainage areas for the purposes of this report. North Lake Drive, South Lake Drive, and Split Rock. Split Rock includes South Lake Drive from the entrance of the development to around the cove. Between the cove and North Lake Drive there is a private single family residence that owns approximately 1300ft along the shore between these two locations.

### **Location: North Lake Drive**

**Existing Deficiency:** North Lake Drive is a Township-owned, paved road. The street has no curbs or well defined roadside swales and has several inlets/headwalls and cross pipes located at a majority of the intersections. The drainage area upstream of the road is small and consists of (1) row of single family wooded lots. Runoff along the roadway is relatively sediment free with the exception of runoff that drains from steep, unpaved driveways and the water that

crosses stone driveways, transporting sediment and causing erosion to these driveways on the north side of the road. The water on the north side of the road enters the existing storm system and is conveyed under the road and outlets a variety of different ways most notably into rock gardens/basins, as noted in the isolated areas below, prior to entering the Lake. Generally the inlets and headwalls contained heavy sediment and leaves.

On the south side of the road runoff sheet flows off the edge of the roadway onto adjoining properties, down driveways and intersecting roadways toward the lake. The lots on the south side of the road are very steep and heavily developed and typically consist of large homes with stone and paved driveways, stone and sand beaches, and large docks.

Recent home construction and associated stormwater soil testing by the Township SEO has indicated that the depth to limiting zone in the areas around the Lake are not conducive to deep basins or rains gardens for infiltration.

Recommendation: It is recommended that the steep roads and driveways connecting to the road be paved. While stone driveway areas are generally considered to be more environmentally friendly for filtration and infiltration, these areas are not significantly performing these functions. Over time, the stone compacts forming a tight, nearly-impervious surface, which is not significantly less pervious than asphalt. Bare patches of dirt were visible in some of the stone driveways and roads. Furthermore, the steep slopes in the area do not allow sufficient time for the runoff to infiltrate, diminishing the effectiveness of the stone areas. In addition driveways that receive additional upstream runoff cannot handle the quantity of water and therefore continuous erosion and transport of sediment occurs. At a minimum gutters that convey channelized runoff along the roadway across these driveways on the north side should be paved, and areas downstream of driveways on the south side should include ample vegetated filter areas.

The inlets and headwalls need to constantly be maintained to remove sediment and anti-skid material as well as for the removal of leaves. New inlets should be

installed with snouts or water quality inserts to help separate and remove sediment and debris from leaving the inlets.

The biggest question for North Lake Drive is where the water that leaves the roadway system goes prior to entering the lake. Adequately designed vegetated swales and filter areas that can reduce the sediment and temperature of runoff and promote infiltration is ultimately the goal. Existing rock gardens used to try to accomplish this goal are currently undersized, drained by a pipe at the bottom of the basin, and not constructed of vegetation in accordance to Township ordinance or DEP guidelines. Also as noted above due to the shallow limiting zones at grade, water quality bmp's would be the most effective means to treat water below North Lake Drive.

Additional improvements that should be included in future planning when North Lake is scheduled to be repaved and are in addition to the items that are not specified in the identified areas below include; re-paving the roadway with bituminous curbing along the south side of the roadway to keep runoff from entering and eroding residential property and driveways and new inlets at Kidder Avenue and Hartung Street to help direct water to specific discharge locations with designed filtration.

New inlets and pipes should be installed in the low spot in North Lake Drive above the low spot in Labarre with a pipe connecting to the Labarre Inlets or draining to a vegetated swale to keep surface runoff from running across the steep wooded lot down to Labarre. New Inlets should be installed at the Summit Street intersection.

At Kidder Avenue the outlet pipe of the pipe across North Lake drive has been blocked by a parking area and Kidder Avenue has been recently stoned and expanded to service several houses, a new alternative way to route water into the lake should be explored since the roadway drainage has been blocked in this area. A new discharge location between Kidder Avenue and Hartung Street can be considered if the downstream property would be available. New inlets and cross pipe leading to a vegetated filtration system in the location of House

Number 172 can be further explored. A parallel pipe rerouting water from the Kidder Avenue inlets to this location will not only reduce the runoff down Kidder Avenue it will also reduce the drainage area to the Hartung Street inlets.

The following is a description of the specific problem areas identified, the deficiencies noted, recommendations, and color photographs.

### **Area T1**

Location: Labarre Drive

Existing Deficiency: Labarre Drive is a private gravel road with a paved portion at the low point of the road. Located at the low point are two inlets that collect runoff from the road and the upstream areas between Lebarre Drive and North Lake Drive. The inlets discharge directly to the lake. A concrete-lined overflow swale routes the remaining runoff, which bypasses the inlets, to the lake. Currently the inlets and overflow swale have no filters. Erosion was noted along the north shoulder of the road.

Recommendation: The stone portions of the roadway should be paved with a rolled curb gutter on the north shoulder to alleviate erosion or vegetated swales with check dams should be installed along the road to direct water to the inlets and overflow swale. Inlets should be replaced at a lower elevation to capture the runoff and a sump should be provided in the inlets for the installation of snouts. The installation of the snouts and vegetated swale would provide filtering for the runoff, alleviating organic and soil pollution to the lake.

Cost: \$100,800.00 (H)

### **Area T2**

Location: North Lake Road and Summit Avenue (T)

Existing Deficiency: Summit Avenue is a private steep stone and dirt road that intersects North Lake Drive and runs south toward the lake and dead-ends at a residential driveway. Runoff flows from a portion of North Lake Road down

Summit and is eroding a swale on the east side of the road toward the lake. The remaining runoff that does not continue down Summit Avenue follows the road west to the existing inlets previously noted on Labarre Drive.

Recommendation: Summit Drive should be paved and graded to divert water to a proposed swale, which would also help alleviate runoff on Labarre Drive. A vegetated swale with check dams should be installed along the east side of Summit Drive to divert water to the lake. A cross pipe from west to east may also be considered.

Cost: \$21,280.00 (M)

### **Area T3**

Location: North Lake Drive and Kidder Avenue (T)

Existing Deficiency: Kidder Avenue is a private, steep, red stone road on Lake Harmony Estates property. An existing headwall and cross pipe are installed in North Lake Drive and it would assume used to discharge across the road down Kidder Avenue. In the location where the outlet of this pipe should be is a built-up residential parking area. It is assumed water that flows across the road is entering the stone subbase of the road. A new retaining wall at the end of the parking area with a trench grate system was recently installed at the bottom of the roadway and discharges to a rock rain garden. The rock rain garden is drained by a discharge pipe from the bottom directly to the lake. The rock rain garden is not adequately filtering the stormwater runoff as evident by the photos taken during heavy rain events.

Recommendation: The existing rock rain garden should be considered to be retrofitting with a vegetated rain garden with adequate freeboard and discharge pipe elevation designed to allow adequate filtering of pollutants. A more detailed analysis of the rain garden size should be performed to ensure that it is adequately sized to handle the amount runoff and that the PADEP recommended loading ratio is not significantly exceeded or if the size complies with the rain garden sizing chart in the small application for stormwater management adopted by the Township.

The driveway/road should be considered to be paved to prevent additional stone and debris from washing into the trench gate and basin. Also the amount of surface sheet flow from North Lake Drive running down the roadway should be decreased if possible. Future roadway work along North Lake Drive should include curbing with a new inlet before this roadway/driveway. The existing headwall and cross pipe should be replaced with a new inlet with a snout, cross pipe and vegetated apron and the stormwater captured should be routed to a new filtration system, namely a vegetated swale or rain garden, rather than through the driveway subbase.

Cost: \$47,200.00 (L)

#### **Area T4**

Location: North Lake Drive and Hartung Street (T)

Existing Deficiency: Hartung Street is a private stone road with two stone swales running alongside the road down to North Lake Drive. A roadside infiltration trench runs on the west side of North Lake Drive. The infiltration trench does appear to be collecting and infiltrating small storms. However, during heavy rainfall runoff leaves the trench drain then crosses Hartung on the North Side, and it erodes the gutter area and transports sediment to the storm system. A headwall and storm pipe transports runoff across the street to a swale that extends halfway down Hartung Street on the south side. The swale appears to come to a dead end at an existing driveway, requiring stormwater to run through the driveway stone to a rock garden near the lake. It was observed that the rock garden is not adequately filtering runoff from large storms. An outlet pipe at the bottom of the basin is discharging to the lake.

Recommendation: The existing headwall and cross pipe should be replaced with a new inlet, snout, pipe, and stilling basin/vegetated apron. Hartung Street should be paved to eliminate runoff from the stone surfaces. The swales on both sides of the street should be regraded and vegetated with check dams to promote infiltration, filtration, and detention of the runoff. The swale on the south side

should be regraded to provide check dams and extended further downslope through the existing driveway with a pipe, and piped or swaled to the rock garden. The existing rock garden should be reconstructed to a vegetated rain garden of sufficient size to handle the runoff draining to it. Also an elevated discharge location should be provided to allow the runoff time to settle prior to reaching the outlet. If the size of the rock garden is not adequate to handle the North Lake Runoff then it should be enlarged or discharged to a new rain garden, vegetated buffer, or swale.

Cost: \$60,220.00 (L)

#### **Area T5**

Location: North Lake Drive at the Marina (T)

Existing Deficiency: Drainage to the Marina is divided into two sections prior to converging into a discharge pipe into the marina. A storm sewer system at the intersection of North Lake Road and Harmony Avenue collects water through two inlets which then discharge to a swale. The piping system appears new and is in good condition. The water drains down an eroded swale to a junction pipe to the marina.

A headwall on Tunkhanna Drive collects runoff from the street and discharges to an eroded swale. The swale then discharges to the junction pipe to the marina.

Recommendation: The existing swales should be modified, widened, and reconstructed as vegetated swales with check dams. Additionally a swale, inlet, and rolled curb to direct runoff to the storm system should be considered in future planning for when the roadway is to be re-paved.

Cost: \$23,430.00 (L)

#### **Area T6**

Location: Intersection of North Lake Drive and South Lake Drive (T) (P)

Existing Deficiency: The existing inlets along South Lake Drive are severely clogged with sediment and leaves. The inlet and cross pipe at the entrance to the Piggy are clogged and not visible due to heavy stone debris. These inlets continue to an existing inlet/junction box on the Inn's property, then outlet along North Lake Drive.

Recommendation: New sumped inlets, snouts and the associated piping should be installed to the existing clogged inlets on South Lake Drive. This should include the inlet at the entrance to the Piggy. The Piggy entrance should be repaired with an asphalt or concrete entrance apron to keep red river stone from continually spilling into the street and into the inlet. A new inlet at the North Lake Drive intersection should be installed with an outlet pipe to South North Lake Drive and adequately conveyed to the receiving stream.

Cost: \$24,300.00 (H)

## **Area T7**

Location: South Lake Drive from the intersection of North Lake Drive towards Nick's (P)

Existing Deficiency: Downstream of the South Lake and North Lake Drive intersection mentioned above runoff that either enters the conveyance system or flows through the intersection down the north edge of North Lake Drive is eroding the side of the road and severely damaging the bituminous pavement. In addition the construction of the parking area for the dry hydrant redirects runoff flowing along the north gutter line across South Lake Drive.

Recommendation: The improvements noted for area T6, if constructed, will remove a majority of the water from affecting this area and will help with future erosion problems. However, if run-off is left to run along the north side of North Lake drive and conveyed directly to the receiving stream, a paved gutter or swale to a pipe cross culvert outletting to the receiving stream should be installed or a new swale around the dry hydrant to the concrete spillway.

Cost: \$8,940.00 (H)

### **Area T8**

Location: Lake Harmony Overflow (Nick's Lake House)

Existing Deficiency: A 30 inch culvert crosses South Lake Drive and is the overflow for Lake Harmony. The upstream concrete swale is generally in good condition with surface spalling. The downstream swale is vegetated with erosion alongside the road shoulder and at the discharge.

Recommendation: The downstream swale and erosion should be repaired with riprap to stabilize the shoulder and swale banks.

Cost: \$7,020.00 (L)

### **Location: South Lake Drive**

Existing Deficiency: South Lake Drive is a paved PennDOT road. The street has no substantial curbs or roadside swales and has inlets/headwalls and cross pipes located at a majority of the intersections. The roadway was recently oil and chipped and a large amount of stone from that process and anti-skid material is present in the inlets and the downstream channels.

The drainage area upstream of South Lake Drive consists of a much larger area than North Lake which contains Lake Harmony Estates. The development consists of single family lots with some paved intersecting roads running north toward the lake and South Lake Drive, but the majority of the parallel streets remain un-paved. The development and existing homes do not include any stormwater management and only newly constructed homes are being included with approved BMP's in accordance with the Township's Stormwater Management Ordinance. This heavy development upstream is the main reason for the numerous issues documented in this section for failing and undersized pipes, swales and rain gardens downstream.

Large driveways, docks, and beaches adjacent to the lake comprised of sand and stone are not contained and are contributing to the amount of sediment into the lake. The inlets, pipes and infrastructure experience locations of deterioration and do not appear to be collecting all of the roadway runoff. Discharge from the roadway collection system varies and the majority of areas need to be addressed to become more efficient.

Recommendation: As discussed previously adequately designed vegetated swales and filter areas that can reduce the sediment and temperature of runoff and promote infiltration should be provided. Due to the limiting zones around the lake, shallow water quality bmp's between South Lake Drive and the Lake should be utilized while infiltration basins and rain gardens for infiltration should be utilized upslope of South lake Drive.

Large sand and stone driveways should include ample vegetated filters downstream or converted to an alternative surface.

Routine and additional maintenance of the roadway by PennDOT including sweeping and vacuuming is and should continue to be provided. Encouraging discussions with Tom Rogal of PennDOT District 5-0 Carbon County have been made and partnerships with PennDOT to install and/or rehabilitate the existing infrastructure with new and/or additional inlets, pipes, etc. will continue.

Comprehensive planning of stormwater through the Lake Harmony Estates development consisting of crowned paved roads draining to receiving swales and infiltration or detention basins to help control run-off is the ultimate solution to decrease the transportation of sediment from upstream areas and controlling velocities that are eroding the downstream areas.

## **Area T9**

Location: South Lake Drive and Osceola Street (P)

Existing Deficiency: Runoff is collected at the inlets on South Lake Drive and discharges to a stone swale. The swale extends to the lake, and discharges

directly to the lake. The stormwater runoff is not significantly filtered or the velocity adequately reduced by the swale.

Recommendation: The existing swale should be replaced with a combination of stormsewer and vegetated swale with check dams. The storm sewer should be extended past the steep slopes to an inlet with a snout, and discharge to the proposed vegetated swale.

Cost: \$11,700.00 (L)

### **Area T10**

Location: South Lake Drive and Church Street (P)

Existing Deficiency: An inlet on South Lake Drive collects runoff from the street and discharges overland to an existing rock garden. The storm pipe was inaccessible as the outlet is covered by a steel plate and stone. The rock garden discharges directly to the lake via a short rock swale. Runoff to the rock garden is polluted with sediment. The elevation of the discharge pipe is set at the bottom of the rain garden, which does not allow sufficient ability for the rock garden to filter the water.

Recommendation: The rock garden should be considered to be retrofitted or replaced with a vegetated rain garden. The vegetation will provide additional filtration of the stormwater runoff. Raising the elevation of the discharge will also allow for additional settlement of the sediment in the runoff further reducing the sediment loads on the lake. Upstream drainage from stone and unpaved areas, mainly Lakeview Drive, to the South Lake Drive Inlets should be addressed by stabilizing upstream roads.

Cost: \$17,400.00 (M)

### **Area T11**

Location: South Lake Drive (adjacent to House #184)

Existing Deficiency: An inlet on South Lake Drive discharges across the road to a swale. The discharge is diverted by a stone berm onto the paved driveway and travels across a lawn area prior to reaching the lake. Some of the stone from the swale had washed down the driveway.

Recommendation: While the lawn appears to provide adequate filtration for the runoff, the swale should be replaced with a vegetated swale with check dams to prevent erosion of the swale and enhance runoff filtering.

Cost: \$4,800.00 (L)

### **Area T12**

Location: South Lake Drive and Pine Street

Existing Deficiency: A rock garden on the south side of South Lake Drive discharges to the stormsewer system on the road. Then the stormsewer system drains to a rock garden, which discharges directly to the lake.

Recommendation: The rock rain garden should be converted to a vegetated rain garden to provide greater filtration.

Cost: \$24,000.00 (L)

### **Area T13**

Location: South Lake Drive (adjacent to home 208)

Existing Deficiency: A stone swale on private property along the house collects runoff from the road and driveway and discharges into the lake. Erosion was noted around the upstream end of the swale.

Recommendation: Establish vegetation in the eroded portions upstream of the swale. The swale should be converted to a vegetated swale with check dams to slow the water and provide more time for settlement of the suspended solids.

Cost: \$4,320 (L)

#### **Area T14**

Location: Chestnut Street

Existing Deficiency: A rock garden has been installed alongside Chestnut Street. This rock garden drains overland and across South Lake Drive.

Recommendation: As previously noted, the rock gardens do not effectively filter the runoff, unless they are constructed properly. It is recommended that the rock garden be converted to a vegetated rain garden with an elevated outlet. This conversion will allow for increased filtration of the runoff.

Cost: \$12,000.00 (L)

#### **Area T15**

Location: Spruce Street

Existing Deficiency: Spruce Street between the lake and South Lake Drive is an undeveloped wooded area. This area provides a natural buffer for the runoff.

Recommendation: To maximize the efficiency of the woodland buffer, a compost filter sock with vegetated media should be installed in the wooded area. These filter socks provide a filter for runoff, and can be installed without removal of the existing trees.

Cost: \$1,200.00 (L)

#### **Area T16**

Location: South Lake Drive Between homes 246 and 248

Existing Deficiency: An inlet in the shoulder of South Lake Drive collects runoff and discharges to a swale. The storm pipe is CMP and appears in adequate condition with some corrosion observed at the flow line. The swale the pipe discharges to is located outside of the right-of-way and on private property. The

swale begins as concrete but shortly changes to an eroded swale, which meanders to small sand beach and then into the lake. Stone debris was noted in the upstream portion of the swale, and appears to be from the street.

Recommendation: The swale should be converted to a vegetated swale to allow for greater filtration of the stormwater. The beach discharge point should be converted to a vegetated filter strip to eliminate the sand and other debris washing into the lake.

Cost: \$6,480.00 (L)

### **Area T17**

Location: South Lake Drive and Wood Street (around the beach) (P)

Existing Deficiency: An inlet on the east side of the beach area on the south side of South Lake Drive discharges overland to the lake. The discharge location was not visible as the area was covered with leaves, branches, and debris. There was no visible erosion. On the south side of the beach, an inlet with pipes to the east and west is visible, but there were no visible discharge locations.

On the west side of the beach, a headwall from a roadside swale alongside South Lake Drive collects stormwater from the upstream areas. The storm pipe from the headwall begins as a 15" RCP, but it changes to an 18" HDPE pipe at a downstream deflection. The 18" pipe appears to have been slipped over the 15" pipe to allow the junction in place of a structure. The 18" HDPE is filled with debris. The storm sewer from South Lake Drive discharges to a short swale, which flows into a headwall for the stormsewer system alongside the western side of the beach. This beach stormsewer system collects runoff from the road and beach, and discharges to a small rain garden located in the wooded area. The rain garden discharges to the lake.

The beach area is not contained and constant wave action is currently pulling a large portion of the beach along the shoreline to the adjoining properties.

Recommendation: Stormwater piping across South Lake Drive should be replaced to eliminate the pipe deflection, which is a cause of blockages and reduced capacity. At a minimum, debris should be removed from the pipes to increase runoff capacity. Or a water debris separator installed on the existing pipe system to clean runoff from entering into the lake. The rain garden should be retrofitted to provide more settling volume and vegetation for pollutant reduction. The sand from the beach should be contained and the removal of the existing sand outside the limit of the beach should be performed.

Cost: \$40,433.33 (H)

### **Area T18**

Location: South Lake Drive and Wood Street (boat loading area) (P)

Existing Deficiency: The parking area is stone with exposed areas of dirt, and receives a large portion of water from the upstream areas of Wood Street across South Lake. An inlet is located at the intersection of Wood Street and South Lake Drive, which discharges to the lake. The corrugated metal piping deflects and has minimal cover, and it is exposed in portions.

Recommendation: An inlet should be placed on the southeast side of Wood Street to collect upstream runoff that currently ponds at the intersection and overflows down the driveway. Roadside swales should be installed to divert the water to the inlets. Approximately 75 feet of the existing CMP piping that is discharging to the lake should be removed, and a stilling basin and vegetated swale with check dams should be constructed to direct runoff to the lake.

The stone parking area and driveway should be paved to help eliminate sediment pollution to the lake. A vegetated filter strip, bioretention area, or vegetated filter sock berm should be constructed downstream of the parking area to filter the runoff prior to entering the lake. The drainage area to this intersection is very large and planned stormwater controls in the Estates in conjunction with Area T33 should also be considered and will minimize the impacts in this location.

Cost: \$93,900.00 (H)

### **Area T19**

Location: Skye Drive

Existing Deficiency: Skye Drive has two eroded roadside swales on the east side of the street. Each swale collects water in a sumped area to pipes which discharge on the west side of Skye Drive to eroded swales on a private residential property. The sumped areas were clogged with leaves and debris. These eroded swales channel the water to the rear of house 305, which appear to collect in a natural conveyance channel through the woods and down to Chestnut Street.

Recommendation: The eroded channels on the east side of the street should be regraded to provide a larger swale that will not be as susceptible to debris. Stone rip-rap should be placed in the downstream channels to prevent further erosion of the banks. However, these channels pass through significant wooded areas, which serve as a natural filter for the runoff before it gets to the lake. Therefore, no additional filtration measures appear to be required. However this area does have the potential for a large infiltration/detention basin to reduce the rate and volume of the upgradient development run-off that is ultimately draining to South Lake Drive. Large filter sock basins within the wooded areas to preserve trees and to detain and infiltrate runoff should be considered.

Cost: \$40,200.00 (M)

### **Area T20**

Location: South Lake and Pocono Street

Existing Deficiency: Pocono Street between the lake and South Lake Drive is an undeveloped wooded area. This area provides a natural buffer for the runoff.

Recommendation: To maximize the efficiency of the woodland buffer, a compost filter sock with vegetated media should be installed in the wooded area. These

filter socks provide a filter for runoff, and can be installed without removal of the existing trees.

Cost: \$1,200.00 (L)

### **Area T21**

Location: South Lake and Spring Street

Existing Deficiency: Spring Street has a natural stone shoulder, with an undeveloped wooded area between the shoulder and the lake. The wooded area provides a natural buffer for the runoff. However, the slope is steep with a sharp drop off beyond the shoulder of the road.

Recommendation: To maximize the efficiency of the woodland buffer, a compost filter sock with vegetated media should be installed in the wooded area. These filter socks provide a filter for runoff as well as a reduction in velocity, and can be installed without removal of the existing trees.

Cost: \$1,200.00 (L)

### **Area T22**

Location: South Lake and Harmony Street

Existing Deficiency: Harmony Street between the lake and South Lake Drive is an undeveloped wooded area. South Lake Drive has a large grass shoulder on the lake side at this intersection. This grass shoulder and wooded area provides a natural buffer for the runoff. However, the wooded area has steep slopes.

Recommendation: To maximize the efficiency of the woodland buffer, a compost filter sock with vegetated media should be installed in the wooded area. These filter socks provide a filter for runoff as well as a reduction in velocity, and can be installed without removal of the existing trees.

Cost: \$1,200.00 (L)

## **Area T23**

Location: South Lake and Henning Street

Existing Deficiency: An inlet on South Lake Drive collects stormwater and discharges to a series of swales and pipes prior to discharging to a rain garden/settling area. Water overflows the settling area and discharges over the lawn area to the lake.

East of Henning Street on South Lake Drive, water flows down the hill on the north side of the street along the curblineline. Water appears to flow over the rolled curb or flow past the end of the curb to an eroded swale to the lake. Where the runoff would cross the curb, riprap has been installed to prevent erosion. The road is in poor condition in this area and in need of repair. A portion of the swale appears to have been lined with riprap, but stone along the bottom has washed away as only debris from the road remains in the bottom of the swale.

Recommendation: East of Henning Street the following repairs should be considered. The road should be patched for approximately 4'x12' section to repair the gutter flow to the swale at the end of the curb. The swale should be reinforced with larger riprap to prevent washouts or interlocking concrete lined vegetated swale with check dams should be provided.

Cost: \$7,733.33 (L)

## **Area T24**

Location: South Lake and Estates Drive (P)

Existing Deficiency: Insufficient inlets along South Lake contributing to large areas of ponding water on roadway and surface runoff into downstream driveways and homes.

Recommendation: Investigate adding new inlets pipe and outlet swale with associated curbing to direct water to inlets.

Cost: \$30,880.80 (H)

## **Area T25**

Location: Split Rock Parking Lot

Existing Deficiency: Improvements to the access road and parking lot have eliminated a lot of the previous problems at this location. However there is a large accumulation of sediment debris and garbage captured in the system and outlet to a series of outlet pipes.

Recommendation: More rigorous maintenance of collecting debris from the pipe outlets should be performed to remove the possibility of heavy rain washing debris into the lake. Larger stilling basins and/or swales with check dams or rain gardens should be appropriately designed and installed to contain and remove sediment. In addition water and debris separator on the last inlet can also be installed to contain sediment trash and debris from leaving the system.

Cost: \$16,800.00 (L)

## **Area T26**

Location: Split Rock Lagoon

Existing Deficiency: Sand from beach and lagoon enters the lake. Each year Split Rock drains and dredges the lagoon to resurface the beach. However they also add additional sand as needed. The area outside the walkway of the lagoon has a large area of heavy sand deposits. The adjacent area of the lake in this location has a large influx of lily pad formation.

Recommendation: The lagoon and area outside the walkway should be dredged of sand during the lagoon dredging procedures and returned to the beach. A confinement system to keep sand within the confines of the lagoon and around the walkway should be explored and installed.

Cost: N/A (H)

### **Area T27**

Location: South Lake Drive behind Split Rock Lodge

Existing Deficiency: There is a large double inlet that captures roadway runoff and is filled with sediment and antiskid material. The outlet of this inlet is unknown and appears to cross under the bathrooms at the beach and enters the lake.

Recommendation: A new inlet with a water debris separating system with a vegetated filter area or swale downstream of the discharge pipe should be installed. Routine maintenance to remove sediment should be proposed.

Cost: \$10,800.00 (M)

### **Area T28**

Location: South Lake Drive to the Cove

Existing Deficiency: The area between South lake Drive and the Lake is relatively steep and short. Therefore there is not much area for runoff that leaves the road to be filtered. There are locations of isolated ponding on the roadway.

Recommendation: Compost filter socks should be placed in areas where runoff leaves the roadway to contain and slow runoff and remove sediment prior to entering the Lake. Inlets in low spots should be considered.

Cost: \$28,500.00 (L)

### **Area T29**

Location: South Lake Drive and Mosseywood Road intersection

Existing Deficiency: A large amount of runoff from the houses in this area of Split Rock flows down Mosseywood Road to the intersection of South Lake Drive. The runoff creates a ponding situation in the parking area then overflows across the roadway to an existing pathway down to the Lake.

Recommendation: A more in-depth investigation of the upstream drainage area should be conducted to identify areas where infiltrating BMP's can be installed to help minimize runoff to this location. At the location of the frequent ponding a rain garden if possible should be installed with an outlet structure and pipe across South Lake Drive to drain water to a vegetated area prior to entering the lake.

Cost: \$14,400.00 (M)

### **Area T30**

Location: Cove

Existing Deficiency: Due to narrow width of the lake and heavy leaves and other organic material entering the lake; the lake in this location is shallow and has a heavy formation of Lily Pads. Shallow warmer water and heavy nutrients is very conducive to lily pad growth.

Recommendation: Adding shoreline protection to eroding shorelines and containing stone dock areas should be incorporated to reduce the amount of sediment in this area. Isolated dredging to remove stone, sediment and organic debris should be explored. This removal of material to make the lake deeper to achieve cooler temperatures and reduce nutrients in addition to a possible aerator or fountain in this location may increase water flow which will all help in trying to contain the formation of the lily pads.

Cost: N/A (M)

### **Area T31**

Location: Undeveloped Lake Front area between the Cove and North Lake Drive

Existing Deficiency: Due to heavy wave action of the Lake and the unprotected shore line the edge of the lake is being eroded away around trees and vegetation.

Recommendation: Shoreline protection along this section of the shore should be installed.

Cost: N/A (H)

### **Area T32**

Location: Various locations around the lake.

Existing Deficiency: Stone and sand beach and docks. Rigid bulk heads.

Recommendation: Individual audit of homeowner properties and/or public outreach should be conducted to minimize locations where stone and sand is entering the Lake from individual property owners. Removal or retrofit steel bulkheads to alternative materials, mainly rock or hardy vegetation, can be used to lessen the effects of wave action.

Cost: N/A (H)

### **Area T33**

Location: Lake Harmony Estates

Existing Deficiency: As discussed in the summary above for South Lake Drive, a large amount of the runoff draining to South Lake Drive is due to the heavy development of this area with no planned stormwater controls or filtration devices. In addition the unpaved roads and eroded swales that transport the runoff to South Lake Drive contribute to the sediment in the water entering the inlets along South Lake Drive.

Recommendation: Upstream roads within the estates should be paved and drained to vegetated swales and inlets / piping conveyance system to adequately convey filtered runoff to South Lake Drive proposed. In addition appropriately planned stormwater infiltrating BMP's at the upstream intersections within the Estates can help alleviate the amount of water draining to the lake and therefore minimizing the amount of sediment transported along the way.

Cost: \$1,485,000.00 (H)

#### **Area T34**

Location: Blue Heron Development

Existing Deficiency: Townhouse development along Big Boulder Lake previously designed and constructed without current SALDO and stormwater regulations.

Recommendation: Although runoff is not detained, infiltrated or reduced with any stormwater control devices, the owner has installed several post development water quality BMP's. Stilling basins at pipe discharges and vegetated swales with check dams have been installed in a few locations. These types of facilities should be included along all drainage pathways to the Lake.

Cost: N/A (L)

#### **Area T35**

Location: Laurel Woods Development

Existing Deficiency: New townhouse and housing developed on steep slopes.

Recommendation: Relatively new development with planned stormwater management controls to promote infiltration should minimize impacts to the Lake, Blue Heron, & Mid Lake development. Continue to provide routine maintenance on swales, pipes and roadways.

Cost: N/A (L)

#### **Area T36**

Location: Big Boulder Parking Lot Rain Garden.

Existing Deficiency: Large dirt and gravel parking lot downstream of ski slope. Heavy vehicle usages and pollution generator, with an existing rock swale and rain garden facility at the bottom that outlets to the lake.

Recommendation: Conduct a study to investigate upstream drainage area and re-size rain garden to handle anticipated flows. Perform routine maintenance to remove sediment and install additional vegetation in the basin to filter runoff. Continuing repair of bare dirt spots with stone or consider paving main drive aisles to drain to infiltration beds or other means to promote infiltration and to reduce sediment runoff from stone driveways.

Cost: \$20,400.00 (L)

### **Area T37**

Location: Big Boulder Employee parking Lot.

Existing Deficiency: Un-paved dirt and gravel parking lot with short vegetated buffer to Lake. It is recommended that the owner consider stabilization of the parking area.

Recommendation: Install vegetated buffers along edge of parking lot or compost filter socks in wooded area to contain dirt and gravel runoff and help slow and filter sediment laden runoff from entering the Lake.

Cost: \$6,000.00 (L)

### **Area T38**

Location: Big Boulder and Round Pond pipe culvert. (P)

Existing Deficiency: Pipe culvert between water bodies and outlet structures experiencing deterioration. Heavy roadway anti-skid and oil and chip material entering lake and pond.

Recommendation: Request additional street sweeping and vacuum procedures along this area to remove and minimize roadway material from entering the Lake. Install vegetative berms or filter strips to provide large areas of vegetation to capture sediment and filter water before entering into the bodies of water.

Cost: \$2,400.00 (M)

### **Area T39**

Location: Lake Harmony Road culvert. (P)

Existing Deficiency: Large accumulation of anti-skid and oil and chip stone material along edge of road and culvert headwall.

Recommendation: Perform additional street sweeping and vacuuming of roadway surface. Install compost filter and/or rock filter berms at each corner of the wingwalls to provide locations for roadway debris to accumulate; ensuring removal can be easily performed.

Cost: \$1,200.00 (H)

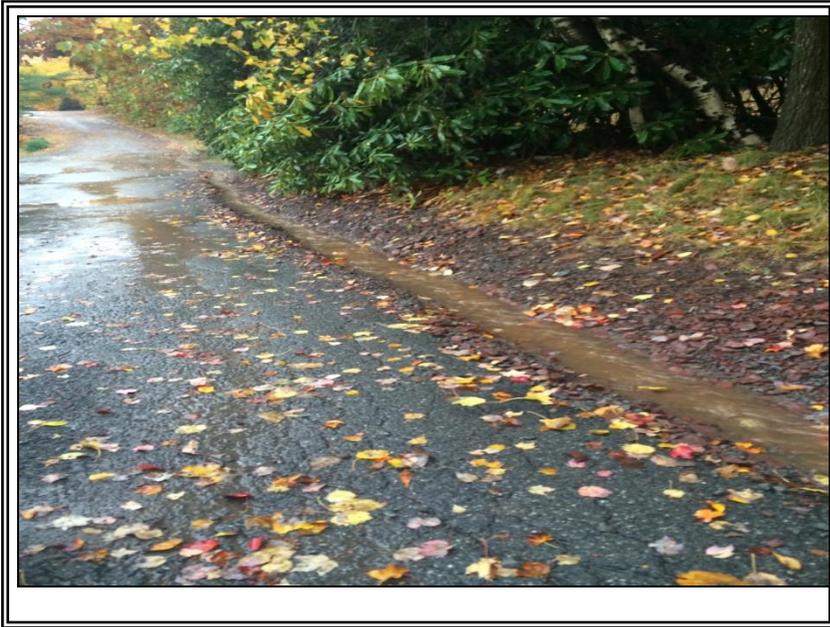
### **Area T40**

Location: SR 903 and Big Boulder Lake Outlet Structure. (P)

Existing Deficiency: Large accumulation of anti-skid, roadway debris, and trash blocking the existing inlet on south side of SR 903. Large accumulation of sediment and trash at outlet pipe location and down along the bank towards the outlet of Big Boulder Lake and stream.

Recommendation: Clean and remove debris and sediment from inlet and outlet location. Property owner has installed several check dams downstream of outlet pipe that is collecting sediment and filtering water. Maintenance and removal of sediment behind check dams should be performed and additional dams installed as needed.

Cost: \$5,400.00 (M)



**T1-Labarre Drive**  
Roadway run-off upstream of inlets



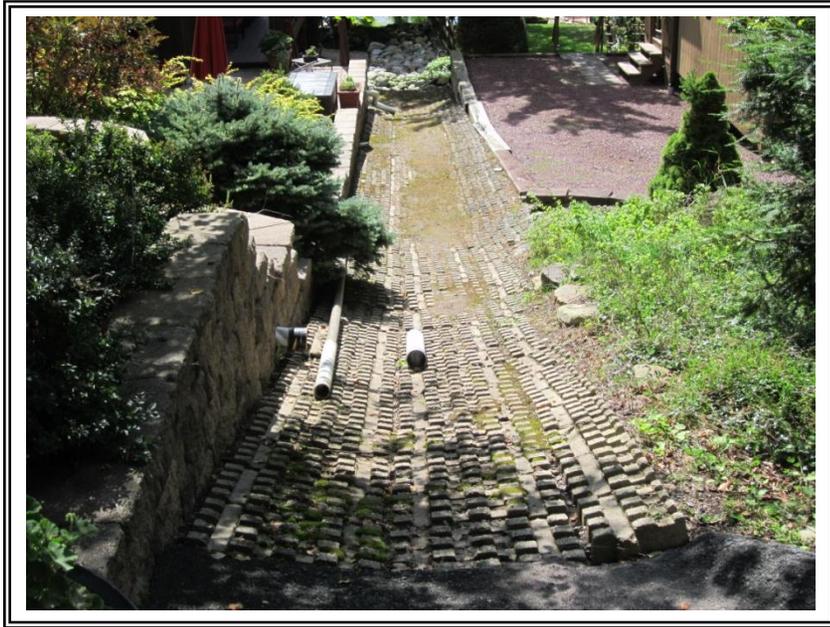
**T1-Labarre Drive**  
Inlet on north side of road



**T1-Labarre Drive**  
Inlet on south side of road and  
overflow channel to lake



**T1-Labarre Drive**  
Lake downstream of overflow channel



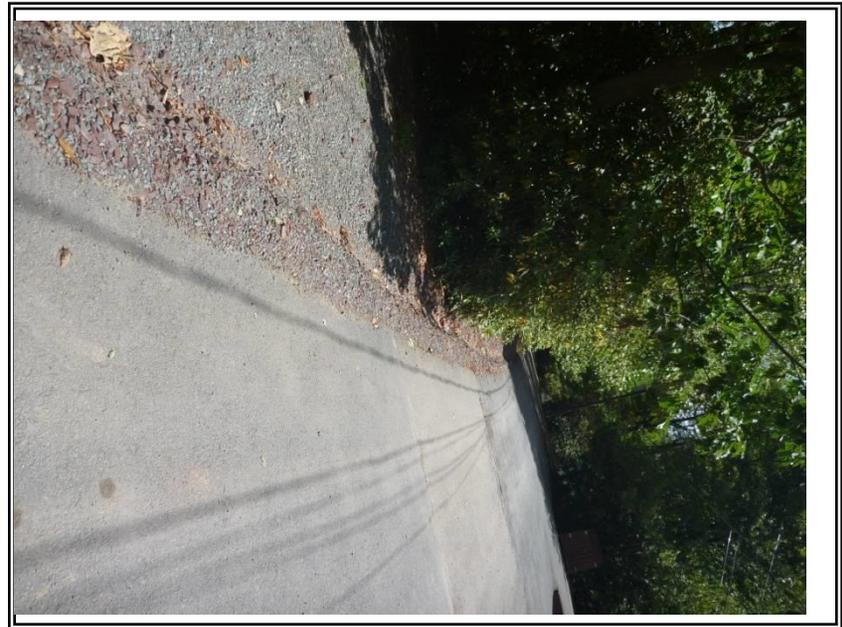
**T1-Labarre Drive**  
Overflow swale to Lake



**T1-Labarre Drive**  
Unpaved road condition



**T1-Labarre Drive**  
Discharge from inlets



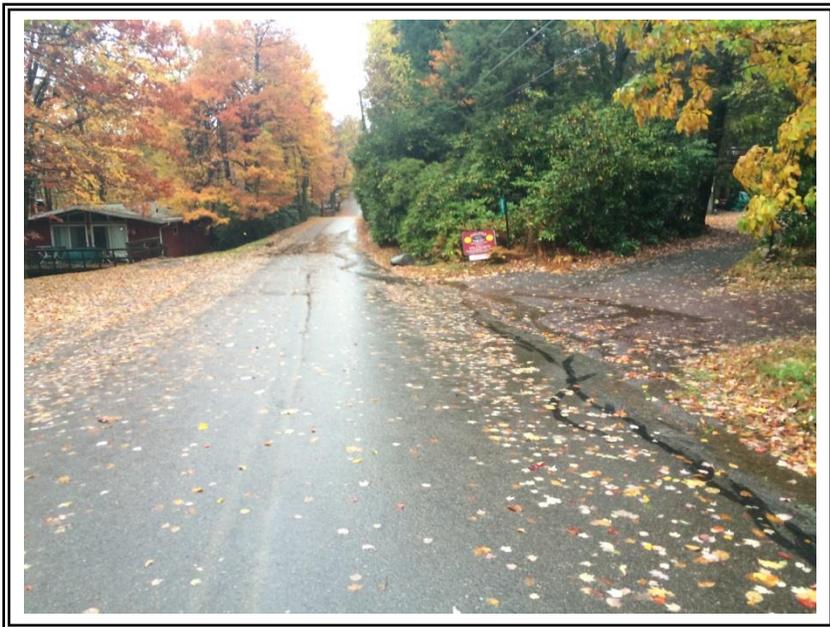
**T1-Labarre Drive**  
Roadside erosion



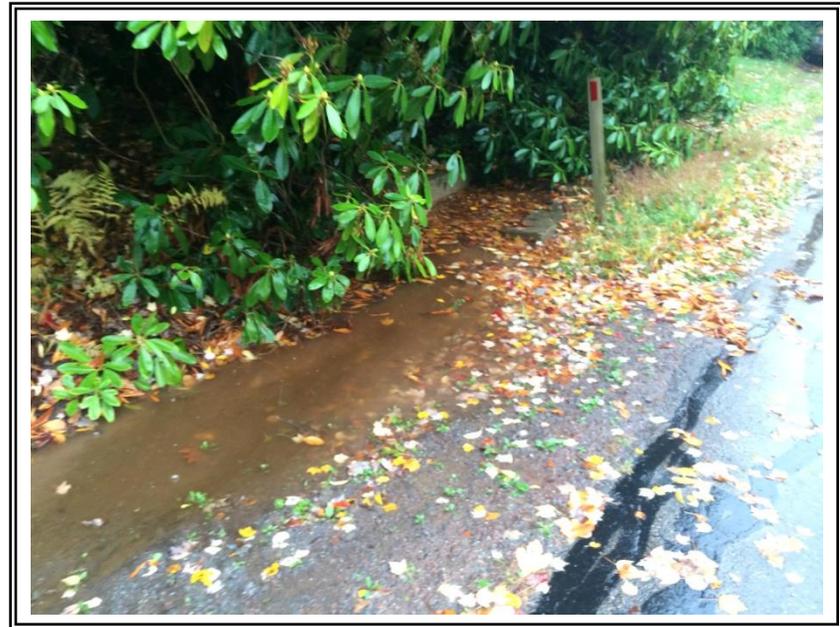
**T2 – Summit Avenue**  
Intersection with North Lake Drive



**T2 – Summit Avenue**  
Drainage path to Lake



**T3 – Kidder Avenue**  
Roadway Drainage Toward Kidder  
Avenue



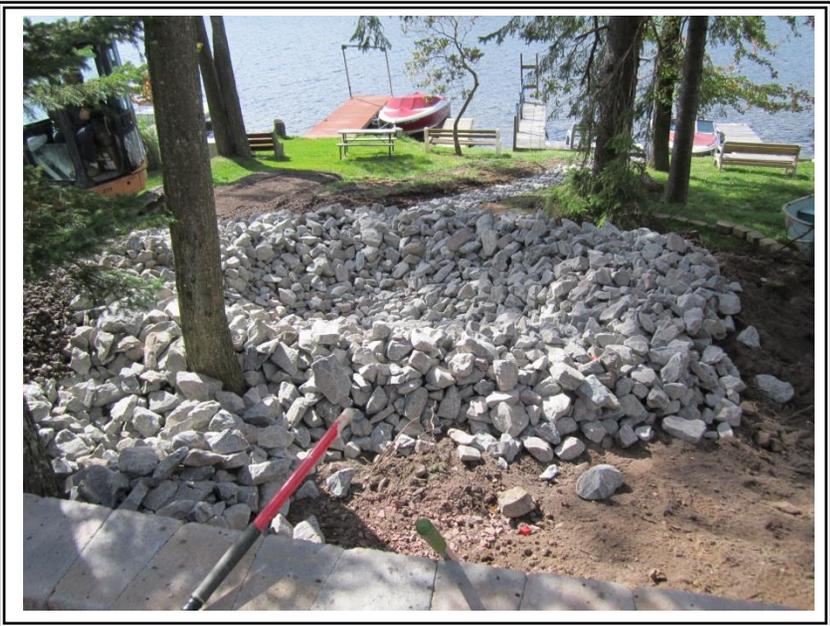
**T3 – Kidder Avenue**  
Headwall at Kidder Avenue



**T3-Kidder Avenue**  
Parking area across from headwall  
in outlet location



**T3-Kidder Avenue**  
Trench drain to rain garden



**T3-Kidder Avenue**  
Stone rain garden



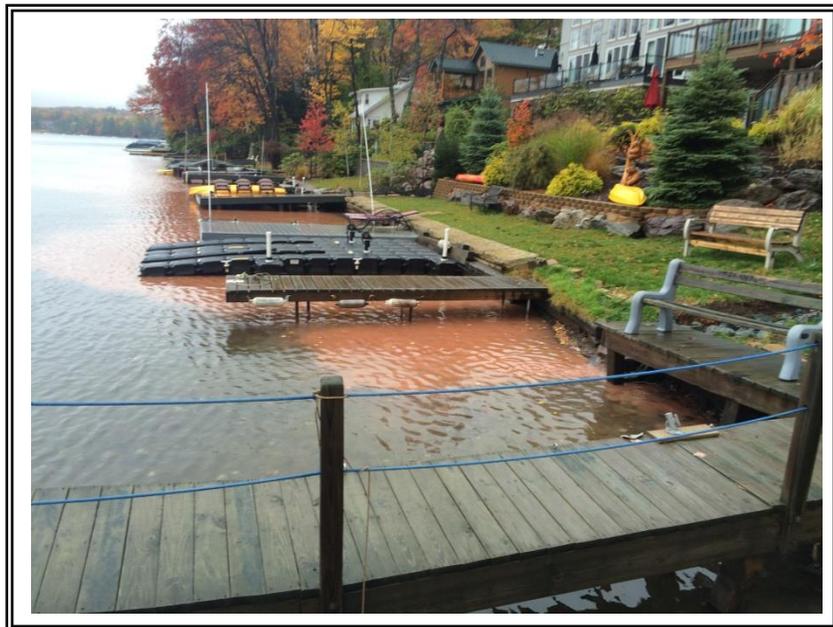
**T3-Kidder Avenue**  
Stone swale to lake



**T3-Kidder Avenue**  
Trench Drain during Heavy Rain



**T3-Kidder Avenue**  
Discharge pipe to the lake



**T3-Kidder Avenue**  
Lake looking west after heavy rain



**T3-Kidder Avenue**  
Damaged Bulkhead



**T4-Hartung Avenue**  
Unpaved portion of road



**T4-Hartung Avenue**  
Infiltration trench



**T4-Hartung Avenue**  
Swale discharge



**T4-Hartung Avenue**  
Stone rain garden



**T4-Hartung Avenue**  
Gutter spread through driveway



**T4-Hartung Avenue**  
Headwall



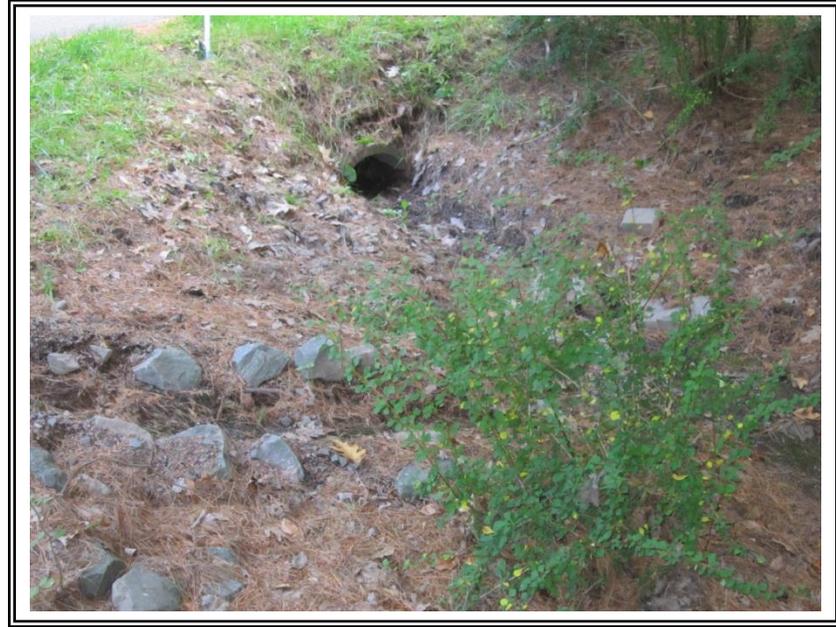
**T4-Hartung Avenue**  
Rock Garden during heavy rain



**T4-Hartung Avenue**  
Lake below discharge pipe



**T5 - Marina**  
Debris at headwall



**T5 - Marina**  
Crosspipe discharge



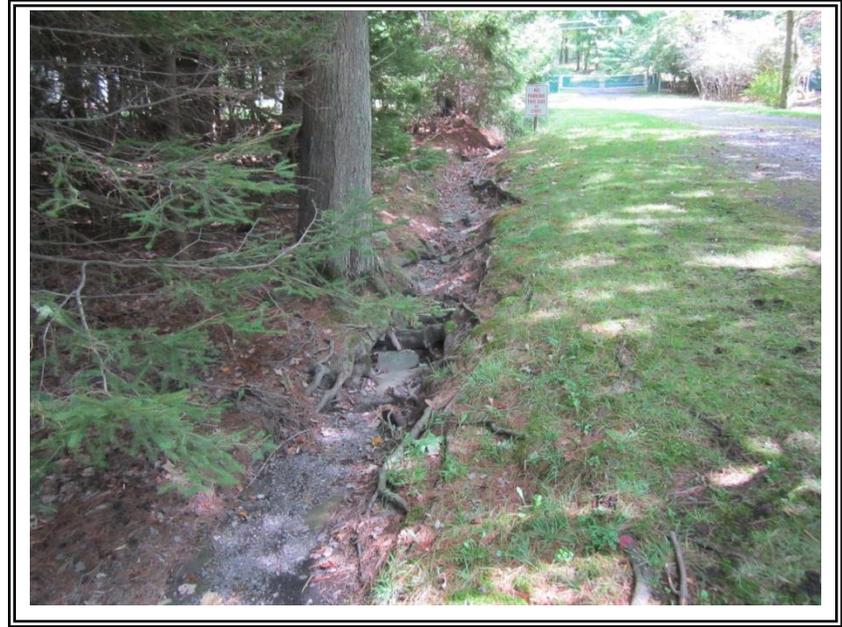
**T5 - Marina**  
Swale to marina



**T5 - Marina**  
Swale to upstream marina discharge



**T5 - Marina**  
Swale during heavy rain



**T5 - Marina**  
Eroded swale east of marina



**T5 - Marina**  
Stormsewer system east of marina



**T5 - Marina**  
Marina discharge



**T6 – South Lake Drive**  
Clogged Inlet



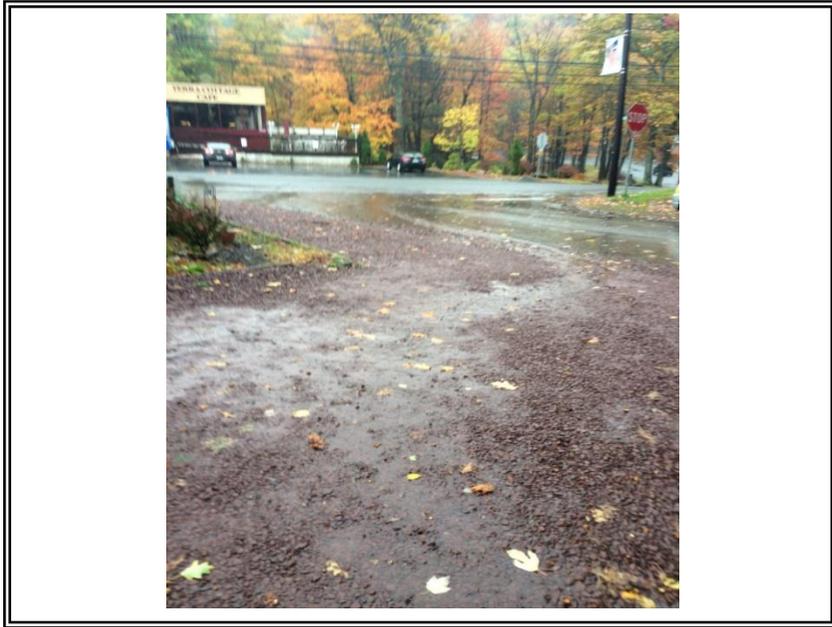
**T6 – Piggy Driveway**  
Blocked Inlet



**T6 – S. & N. Lake Drive Intersection**  
Piggy Driveway



**T6 – S. & N. Lake Dr. Intersection**  
Inlet on motel property



**T6 – Piggy Driveway**  
Runoff during heavy rain



**T7 – North Lake Drive**  
Looking South



**T7 – North Lake Drive**  
Looking North



**T7 – North Lake Drive**  
Sheet flow across roadway



**T8-Discharge at Nicks**  
Discharge channel from Lake



**T8-Discharge at Nicks**  
Headwall



**T8-Discharge at Nicks**  
Downstream channel



**T8-Discharge at Nicks**  
Downstream bank erosion



**T9-Osceola Street**  
Inlet on south side of street



**T9-Osceola Street**  
Inlet on north side of road



**T9-Osceola Street**  
Inlet discharge



**T9-Osceola Street**  
Stone swale to lake



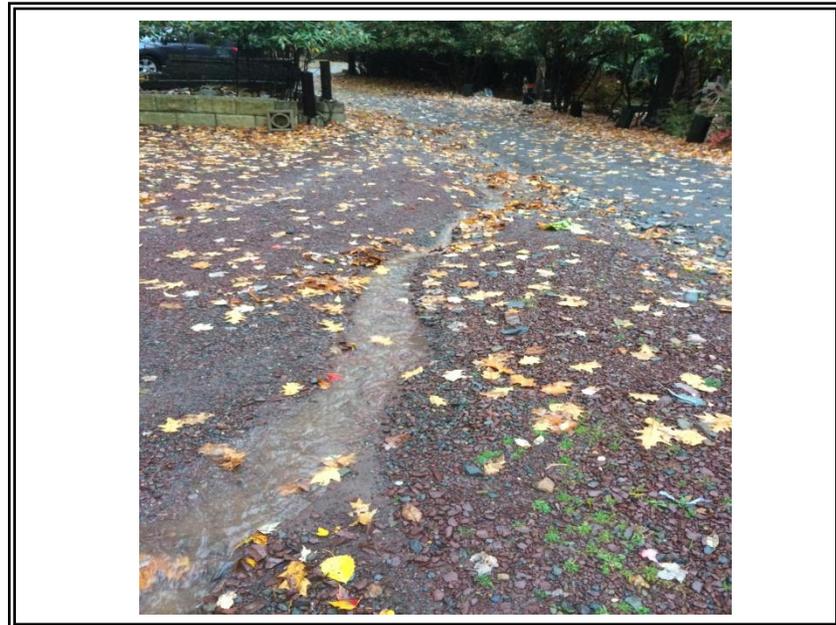
**T10-Church Street**  
Steel plate covering discharge



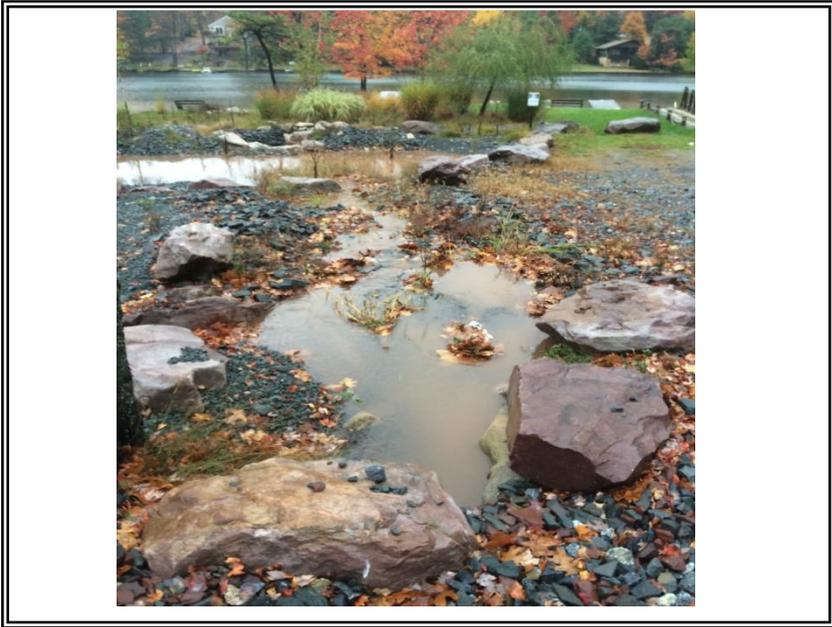
**T10-Church Street**  
Rock rain garden



**T10-Church Street**  
Unpaved roads from L.H. Estates uphill of  
Church Street intersection with South Lake



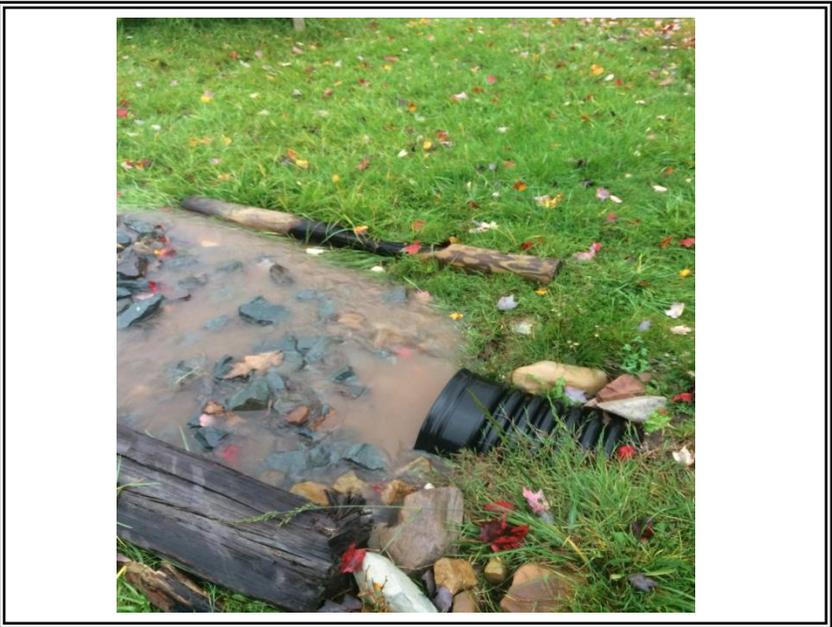
**T10-Church Street**  
Upstream Runoff from the L.H.  
Estates



**T10-Church Street**  
Rock rain garden during heavy rain



**T10-Church Street**  
Rock rain garden during heavy rain



**T10-Church Street**  
Rain garden discharge



**T10-Church Street**  
Lake below rock rain garden during heavy rain



**T11-South Lake Drive**  
Upstream inlet



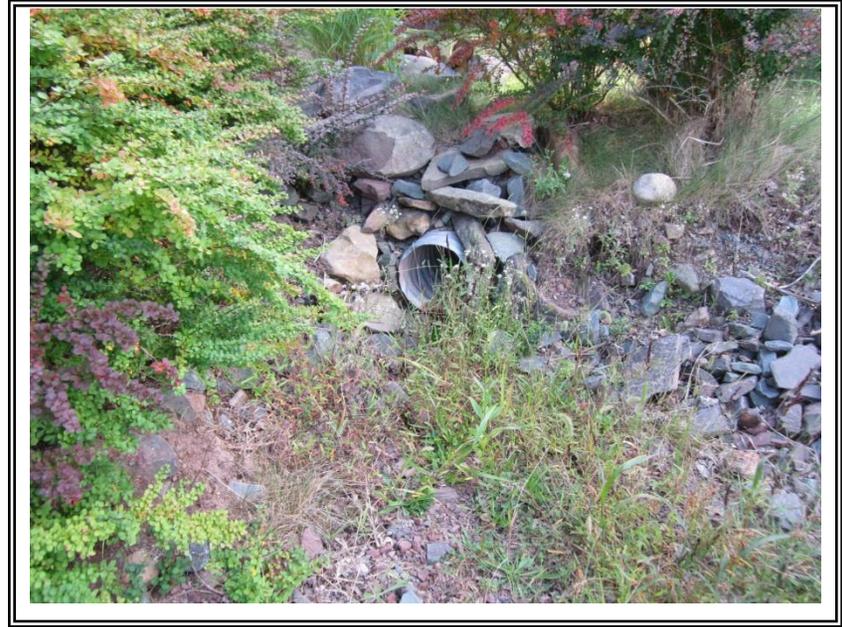
**T11-South Lake Drive**  
Swale discharge



**T11-South Lake Drive**  
Overland flow path to lake



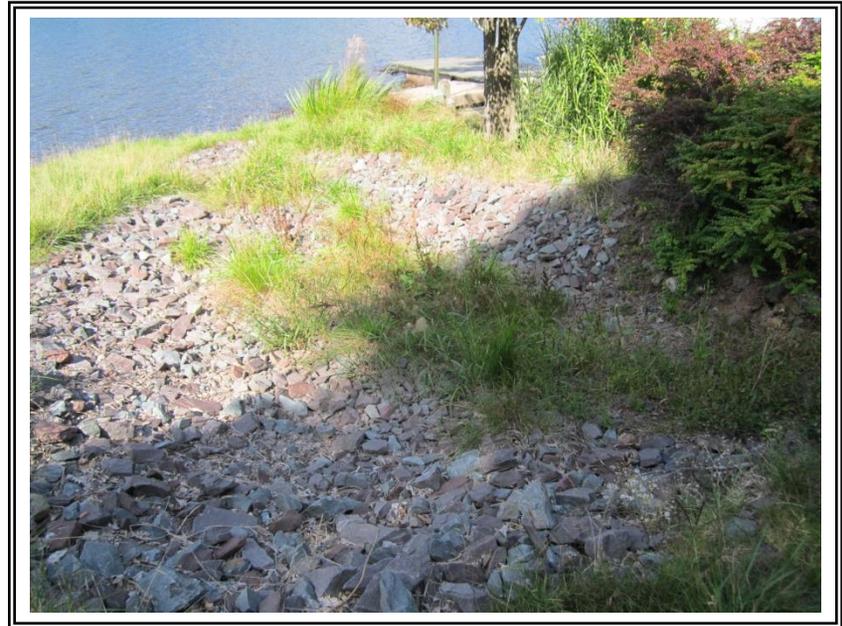
**T12-Pine Street**  
Inlet on South Lake Drive



**T12-Pine Street**  
Discharge to rain garden



**T12-Pine Street**  
Upstream of rain garden



**T12-Pine Street**  
Rock rain garden



**T13-South Lake Drive**  
Private swale to lake



**T14-Chestnut Street**  
Rain garden discharge path



**T14-Chestnut Street**  
Eroded stone road



**T14-Chestnut Street**  
Rock rain garden



**T16-South Lake**  
Roadside erosion at inlet



**T16-Between Houses 246 & 248**  
Inlet discharge pipe



**T16-Between houses 246 & 248**  
Eroded swale



**T16-Between Houses 246 & 248**  
Eroded channel to lake



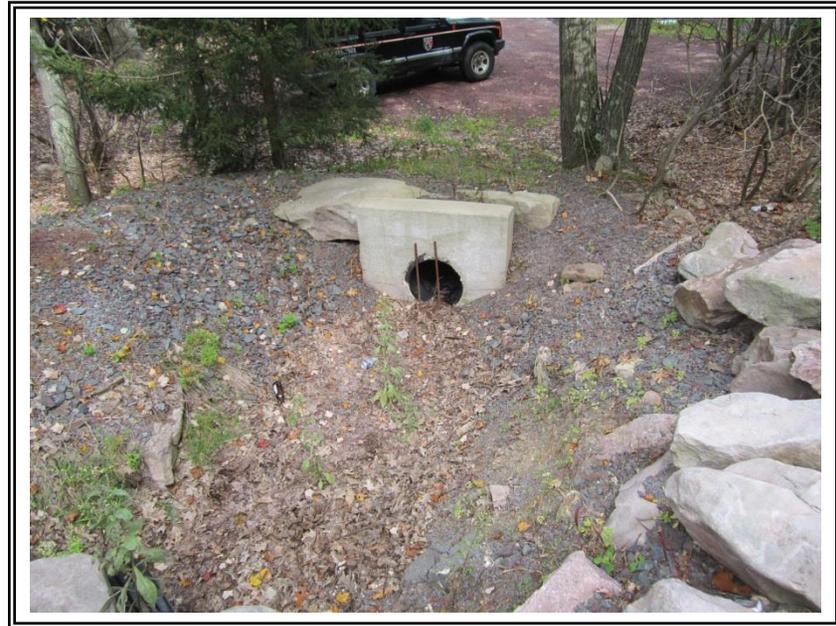
**T17-Beach**  
Upstream headwall



**T17-Beach**  
Crosspipe discharge



**T17-Beach**  
Debris in interior of crosspipe



**T17-Beach**  
Channel to beach storm sewer system



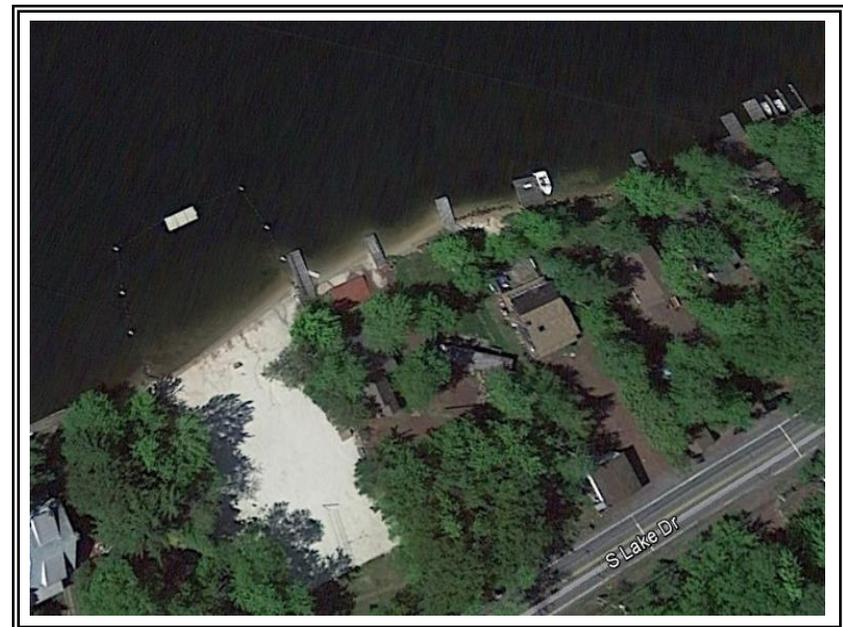
**T17-Beach**  
Beach stormsewer system



**T17-Beach**  
Covered inlet on beach property



**T17-Beach**  
Discharge to settling pond/rain garden



**T17-Beach**  
Aerial Photo of Beach washing to adjoining properties



**T18-Boat Access at Wood**  
Inlet at Wood Street



**T18-Boat Access at Wood**  
Exposed discharge pipe



**T18-Boat Access at Wood**  
Discharge to lake



**T18-Boat Access at Wood**  
Exposed discharge pipe



**T18-Boat Access at Wood**  
Run-off into Lake During heavy rains



**T18-Boat Access at Wood**  
Discharge pipe at Lake



**T18-Boat Access at Wood**  
Discharge to lake



**T18-Boat Access at Wood**  
Looking up towards South Lake  
Drive



**T19-Skye Drive**  
Upstream crosspipe



**T19-Skye Drive**  
Discharge to eroded swale



**T19-Skye Drive**  
Discharge to swale



**T19-Skye Drive**  
Discharge pipe to woods



**T19-Skye Drive**  
Discharge to woods



**T19-Skye Drive**  
Flow path through woods



**T21-Spring Street**  
Looking up Spring Street



**T21-Spring Street**  
Wooded area between lake and S.  
Lake Drive



**T23-Henning Street**  
Deteriorated road condition



**T23-Henning Street**  
Riprap for runoff



**T23-Henning Street**  
Constructed swale to lake



**T23-Henning Street**  
Downstream portion of swale



**T23-Henning Street**  
Stormsewer west of swale



**T23-Henning Street**  
Channel system to lake



**T23-Henning Street**  
Channel system to lake



**T23-Henning Street**  
Channel system to lake



**T23-Henning Street**  
Channel system to lake



**T23-Henning Street**  
Channel system to lake



**T23-Henning Street**  
Discharge to settling pond prior to  
lake discharge



**T23-Henning Street**  
Settling pond



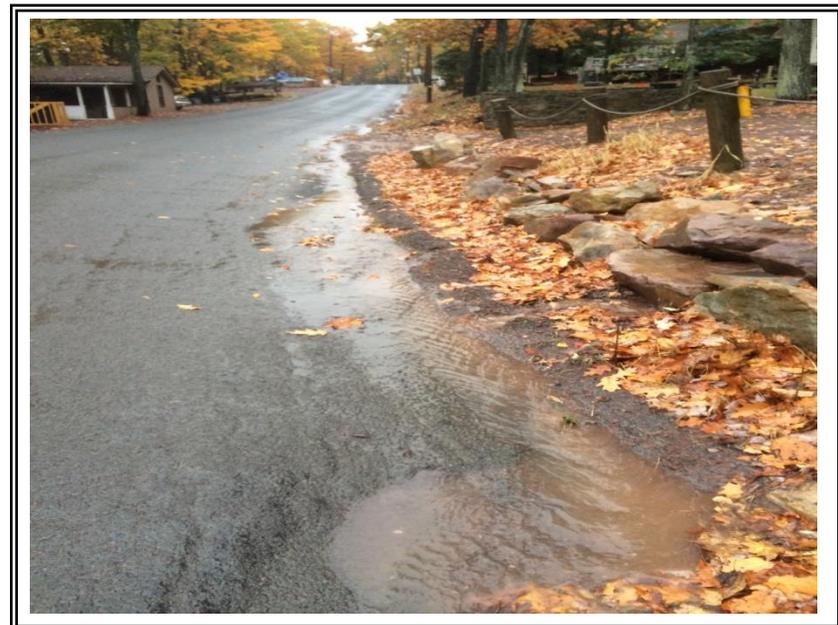
**T24-S.Lake & Estates Drive**  
Upstream run-off north side of road



**T24-S.Lake & Estates Drive**  
Runoff South side of road



**T24-S.Lake & Estates Drive**  
Ponding at Residential Driveway



**T24-S.Lake & Estates Drive**  
East of intersection unpaved  
driveway run-off



**T25-Split Rock Parking Lot**  
Stormsewer discharge



**T25-Split Rock Parking Lot**  
Garbage below parking lot discharge



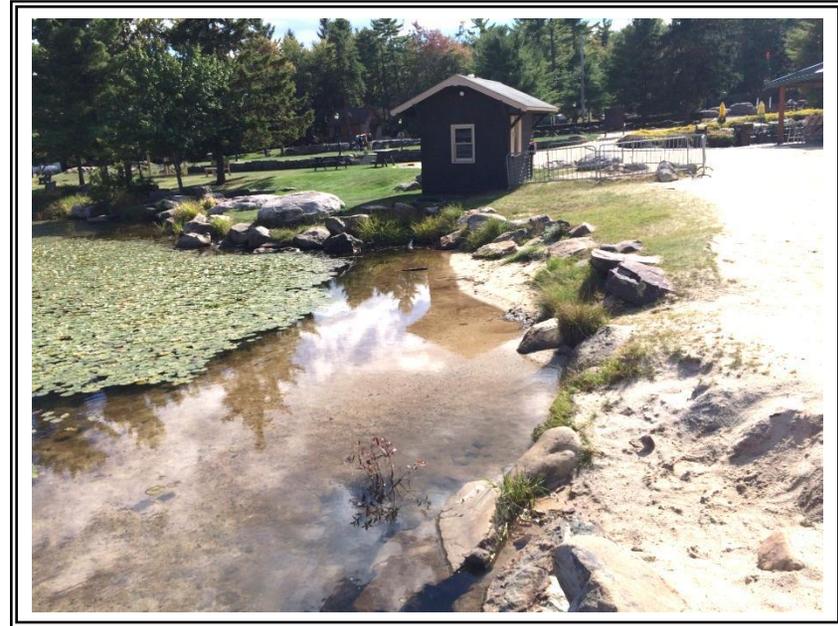
**T26-Split Rock Lagoon**  
Looking towards lodge away from lake



**T26-Split Rock Lagoon**  
Looking towards bathrooms away from lake



**T26-Split Rock Lagoon**  
Berm between lagoon and lake



**T26-Split Rock Lagoon**  
Lake side of berm, heavy sand deposits



**T26-Split Rock Lagoon**  
Heavy sand deposits lake side of lagoon



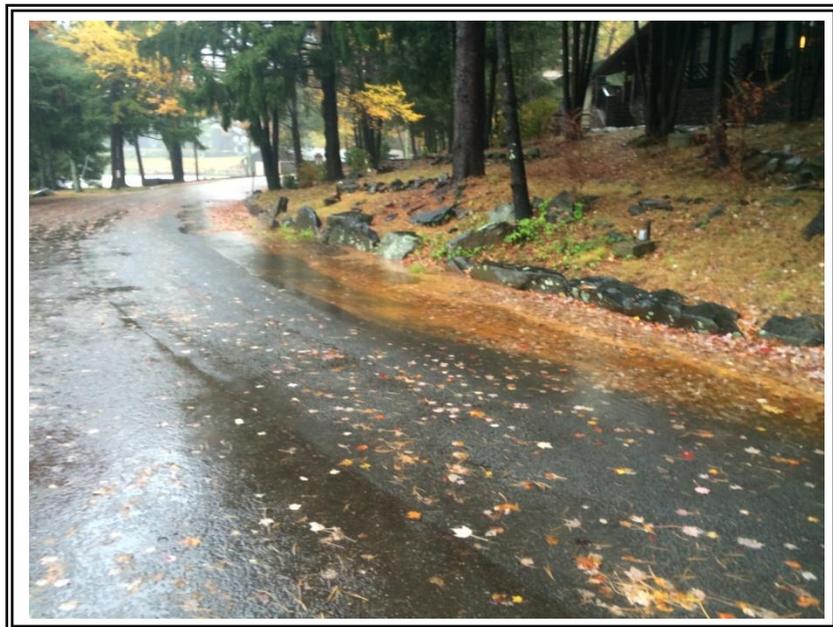
**T26-Split Rock Lagoon**  
Heavy deposits at docks



**T27-S.Lake at Split Rock Lodge**  
Inlet with discharge pipe directly to  
Lake



**T27-S.Lake & Estates Drive**  
Heavy sediment and settling inlet



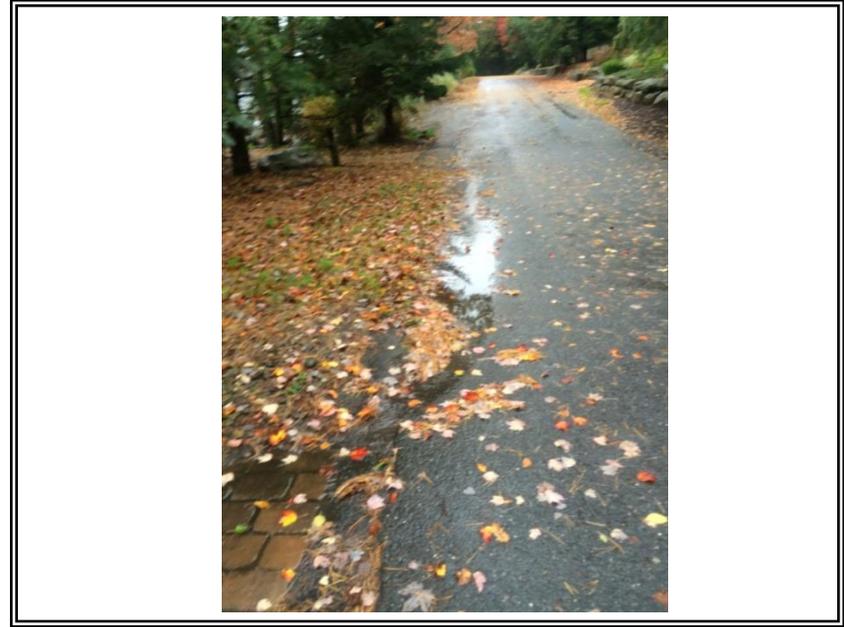
**T28-S.Lake Drive to Cove**  
Ponding along edge of road across  
from Lake



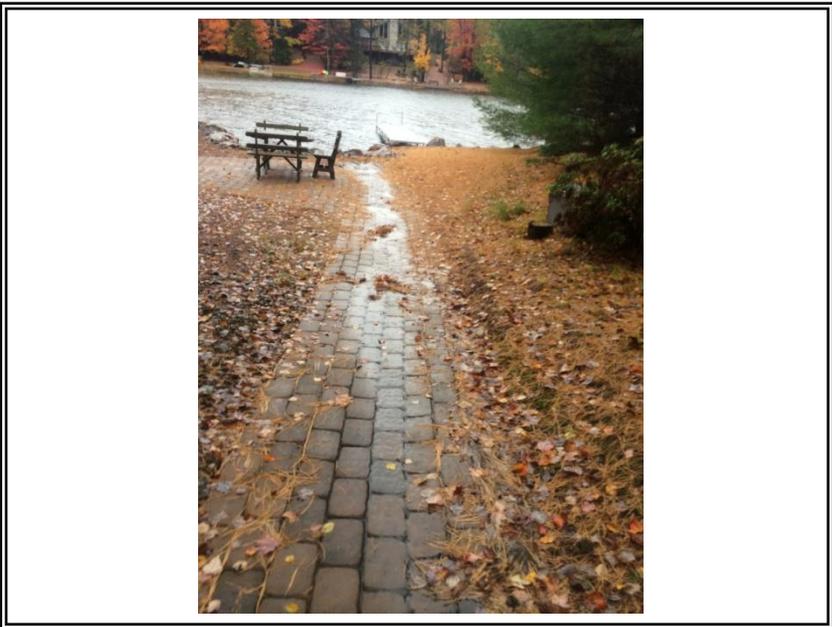
**T28-S.Lake Drive to Cove**  
Short, steep and developed slopes  
between roadway and lake



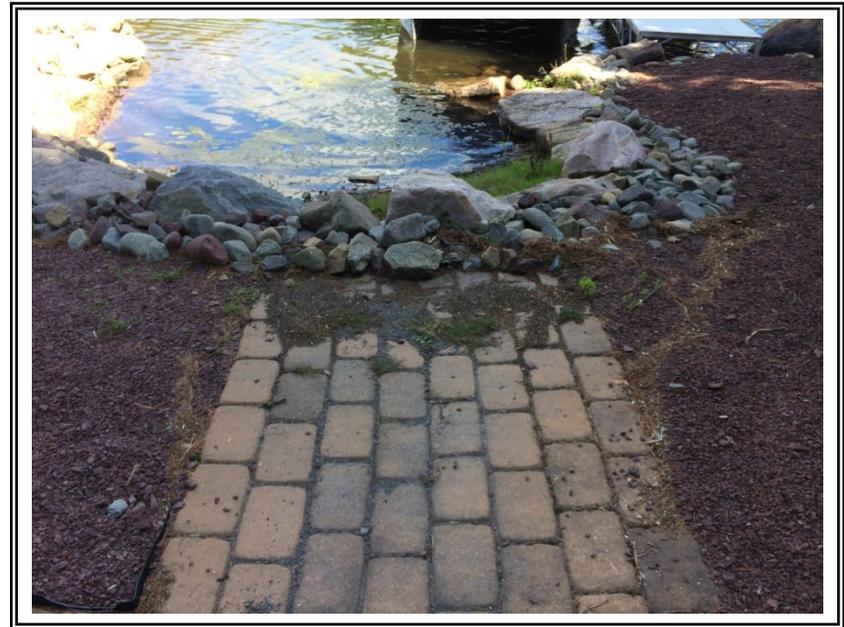
**T29-South Lake and Mosseywood**  
**Intersection**  
Ponding run-off



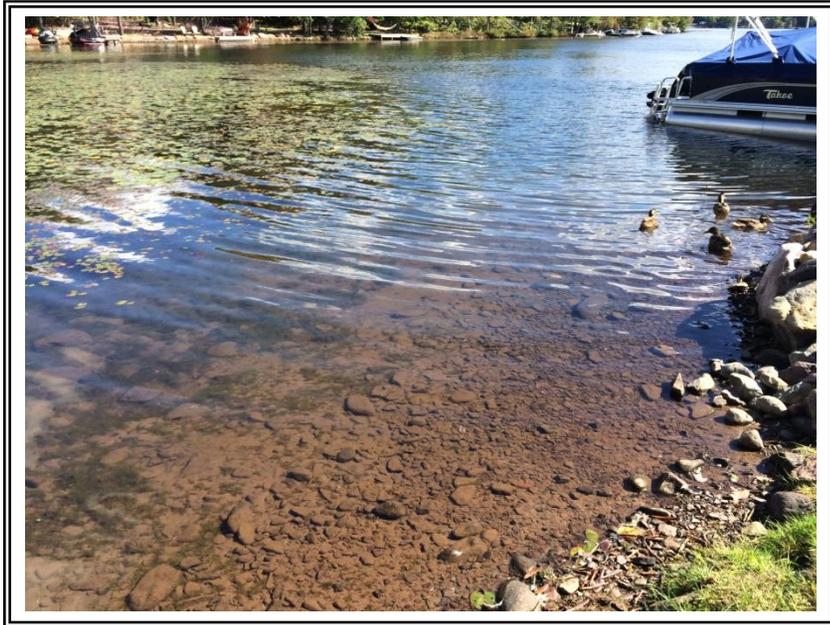
**T29-South Lake and Mosseywood**  
**Intersection**  
Road run-off to walking path



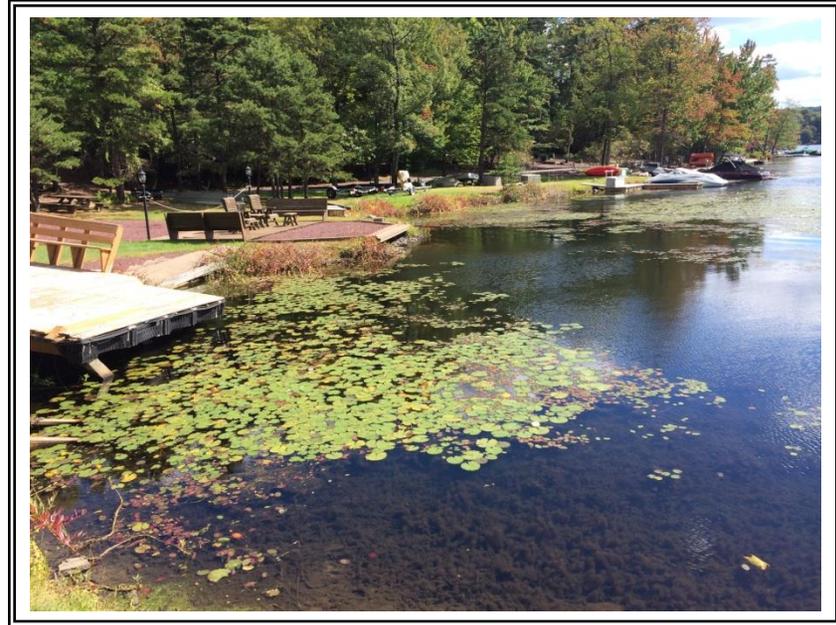
**T29-South Lake and Mosseywood**  
**Intersection**  
Walking Path to Lake



**T29-South Lake and Mosseywood**  
**Intersection**  
Walking Path to Lake



**T30-Split Rock Cove**  
Unprotected shoreline



**T30-Split Rock Cove**  
Heavy vegetation, deposits and Lily Pad formation



**T30-Split Rock Cove**  
Boat Launch



**T31-Shoreline Erosion**



**T32-S. Lake Driveway**  
Stone Driveway



**T32-S. Lake Driveway**  
Driveway during heavy rain



**T32- S.Lake Driveway**  
Stone driveway and sand beach



**T32-S.Lake Driveway**  
Lake during heavy rain



**T32-S. Lake Driveway**  
Residential use of stone and sand



**T32-Bulkhead Weep hole**  
Necessary to relieve water behind wall but drains in sediment



**T32- S.Lake Driveway**  
Boat Launch Areas



**T32-Unprotected Shoreline**



**T33-Lake Harmony Estates**  
Paved roads no crown, roadside  
swales or inlets at South Lake Drive



**T33-Lake Harmony Estates**  
Unpaved Roads Intersecting South Lake Drive



**T33- Lake Harmony Estates**  
Unpaved and uncrowned roads



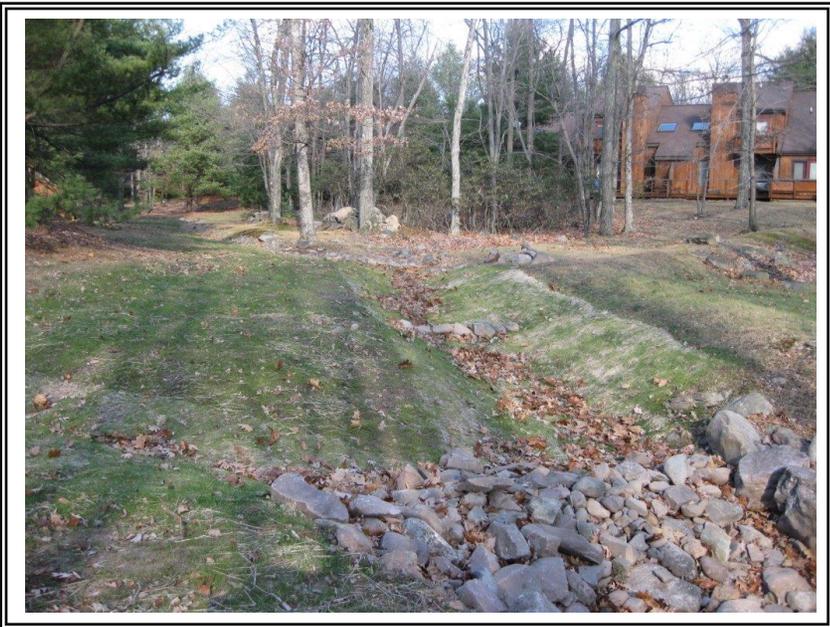
**T33-Lake Harmony Estates**  
Lakeview Drive



**T34-Blue Heron**  
New vegetated swales to convey runoff



**T34-Blue Heron**  
Wetland settling area prior to Lake



**T34- Blue Heron**  
Vegetated Swales with check dams



**T34-Blue Heron**  
Stilling Basin Below Pipe Discharge



**T35-Laurel Woods**  
Crowned roads to rock lined swales



**T35-Laurel Woods**  
Rock lined swale to divert Estates runoff



**T36- Big Boulder**  
Parking Lot



**T36-Big Boulder Parking Lot**  
Rock lined swale and rain garden



**T36-Big Boulder**  
Drainage pipe of Ski resort to lake



**T36-Big Boulder**  
Drainage Pipe discharge



**T37- Big Boulder Employee**  
**Parking Lot**  
Dirt roadway



**T37-Big Boulder Employee Parking Lot**  
Short vegetated area between lot and lake



**T38-Big Boulder & Round Pond Pipe**



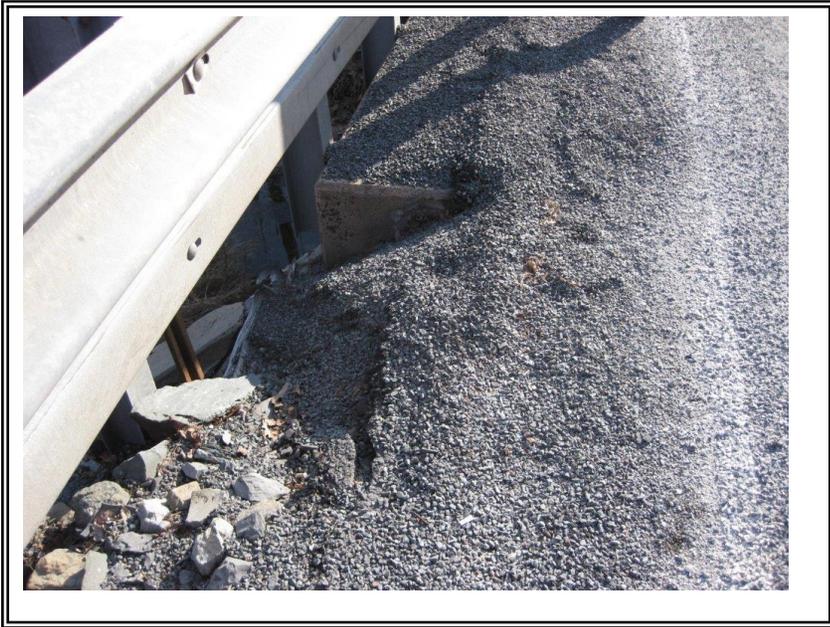
**T38-Swale from Round Pond**  
Note beaver pipe



**T38- Lake Harmony Road**  
Pipe discharge above Big Boulder  
Lake



**T38-Round Pond**  
Heavy vegetation in pond



**T39-Lake Harmony Road Culvert**  
Large accumulation of anti-skid & stone  
wearing surface on headwall



**T39-Lake Harmony Road Culvert**  
Stone and debris on wingwall



**T39- Lake Harmony Road**  
Eroded shoulder and roadway  
material deposits



**T39-Lake Harmony Road Culvert**  
Sediment deposit next to stream below  
roadway



**T40-SR 903**

Large accumulation of anti-skid & stone wearing surface along shoulder



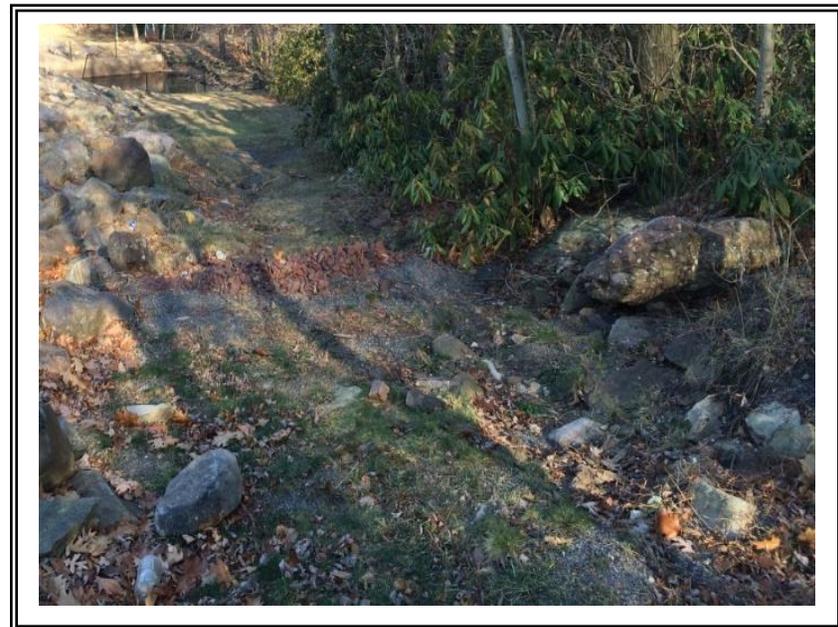
**T40-SR 903**

Blocked Pipe and/or inlet



**T40- SR 903 & Big Boulder Dam**

Large deposit of roadway debris and garbage below clogged Inlet



**T40-Big Boulder Dam**

Check dams to contain roadway sediment before going into stream



1239 Centre Turnpike Orwigsburg, PA 17961  
(T) 570.366.9534 (F) 570.366.9537

**Client:** Kidder Township  
**Project:** Stormwater Management Plan  
**Project No.:** 10635.13  
**Date:** 4/15/2015 **Rev.:** 5/27/2015

\* Priority (L) Low, (M) Medium, (H) High \*\* T = Township & P = PennDOT

| Problem Area | Location                 | ROW** | Item Description  | Quantity | Unit          | Unit Cost    | Price         |
|--------------|--------------------------|-------|---|----------|---------------|--------------|---------------|
|              | North Lake Drive         | T     | Inlet   | 14       | Each          | \$ 3,000.00  | \$ 42,000.00  |
|              |                          | T     | 15" Pipe  | 520      | LF            | \$ 100.00    | \$ 52,000.00  |
|              |                          | T     | Swale   | 125      | LF            | \$ 20.00     | \$ 2,500.00   |
|              |                          | T     | Road Repair ( 1-1/2" Wearing Course with Bituminous curb on south edge of road) | 7600     | SY            | \$ 12.00     | \$ 91,200.00  |
|              |                          |       | Subtotal  |          |               |              | \$ 187,700.00 |
|              |                          |       | Contingencies (20%)   |          |               |              | \$ 37,540.00  |
|              |                          |       | Total   |          |               |              | \$ 225,240.00 |
| T1<br>(H)    | Labarre Street & N. Lake |       | Inlet   | 2        | Each          | \$ 3,000.00  | \$ 6,000.00   |
|              |                          | P     | Swale   | 600      | LF            | \$ 20.00     | \$ 12,000.00  |
|              |                          |       | Road Repair (6" 2A stone, 4" Base Course, 1-1/2" Wearing Course)                | 1200     | SY            | \$ 55.00     | \$ 66,000.00  |
|              |                          |       | Subtotal  |          |               |              | \$ 84,000.00  |
|              |                          |       | Contingencies (20%)   |          |               |              | \$ 16,800.00  |
|              | Total                    |       |   |          | \$ 100,800.00 |              |               |
| T2<br>(M)    | Summit Avenue & N. Lake  |       | Swale   | 300      | LF            | \$ 20.00     | \$ 6,000.00   |
|              |                          |       | Road Repair (6" 2A stone, 4" Base Course, 1-1/2" Wearing Course)                | 213      | SY            | \$ 55.00     | \$ 11,733.33  |
|              |                          |       | Subtotal  |          |               |              | \$ 17,733.33  |
|              |                          |       | Contingencies (20%)   |          |               |              | \$ 3,546.67   |
|              |                          |       | Total   |          |               |              | \$ 21,280.00  |
| T3<br>(L)    | Kidder Avenue & N. Lake  | T     | Inlet & Snout   | 1        | Each          | \$ 3,000.00  | \$ 3,000.00   |
|              |                          | T     | 18" Pipe  | 30       | LF            | \$ 110.00    | \$ 3,300.00   |
|              |                          | T     | Rock Apron  | 1        | LS            | \$ 2,500.00  | \$ 2,500.00   |
|              |                          |       | Rain Garden Retrofit/Bypass Swale system  | 1        | LS            | \$ 10,000.00 | \$ 10,000.00  |
|              |                          |       | Road Repair (6" 2A stone, 4" Base Course, 1-1/2" Wearing Course)                | 373      | SY            | \$ 55.00     | \$ 20,533.33  |
|              |                          |       | Subtotal  |          |               |              | \$ 39,333.33  |
|              |                          |       | Contingencies (20%)   |          |               |              | \$ 7,866.67   |
|              | Total                    |       |   |          | \$ 47,200.00  |              |               |
| T4<br>(L)    | Hartung Street & N. Lake | T     | Inlet & Snout   | 1        | Each          | \$ 3,000.00  | \$ 3,000.00   |
|              |                          | T     | 18" PIPE  | 30       | Each          | \$ 110.00    | \$ 3,300.00   |
|              |                          | T     | Rock Apron  | 1        | LS            | \$ 2,500.00  | \$ 2,500.00   |
|              |                          |       | Swale   | 240      | LF            | \$ 20.00     | \$ 4,800.00   |
|              |                          |       | 18" HDPE pipe   | 110      | LF            | \$ 55.00     | \$ 6,050.00   |
|              |                          |       | Rain Garden Retrofit/Bypass Swale System  | 1        | LS            | \$ 10,000.00 | \$ 10,000.00  |
|              |                          |       | Road Repair (6" 2A stone, 4" Base Course, 1-1/2" Wearing Course)                | 373      | SY            | \$ 55.00     | \$ 20,533.33  |
|              |                          |       | Subtotal  |          |               |              | \$ 50,183.33  |
|              |                          |       | Contingencies (20%)   |          |               |              | \$ 10,036.67  |
|              | Total                    |       |   |          | \$ 60,220.00  |              |               |

| Problem Area | Location                         |   | Item Description     | Quantity | Unit | Unit Cost    | Price        |
|--------------|----------------------------------|---|----------------------|----------|------|--------------|--------------|
| T5<br>(L)    | Marina Access Road & N. Lake     | T | Inlet                | 1        | Each | \$ 3,000.00  | \$ 3,000.00  |
|              |                                  | T | Swale                | 200      | LF   | \$ 20.00     | \$ 4,000.00  |
|              |                                  | T | Driveway Cross Pipe  | 25       | LF   | \$ 85.00     | \$ 2,125.00  |
|              |                                  |   | Swale                | 520      | LF   | \$ 20.00     | \$ 10,400.00 |
|              |                                  |   | Subtotal             |          |      |              | \$ 19,525.00 |
|              |                                  |   | Contingencies (20%)  |          |      |              | \$ 3,905.00  |
|              |                                  |   | Total                |          |      |              | \$ 23,430.00 |
| T6<br>(H)    | N. Lake and S. Lake Intersection | T | Inlets               | 4        | EA   | \$ 3,000.00  | \$ 12,000.00 |
|              |                                  | T | 18" HDPE pipe        | 150      | LF   | \$ 55.00     | \$ 8,250.00  |
|              |                                  | P | Swale                | 250      | LF   | \$ 20.00     | \$ 5,000.00  |
|              |                                  | P | Apron                | 1        | LS   | \$ 2,500.00  | \$ 2,500.00  |
|              |                                  |   | Subtotal             |          |      |              | \$ 20,250.00 |
|              |                                  |   | Contingencies (20%)  |          |      |              | \$ 4,050.00  |
|              |                                  |   | Total                |          |      |              | \$ 24,300.00 |
| T7<br>(M)    | S. Lake towards Nicks            | P | 18" HDPE Pipe        | 50       | LF   | \$ 125.00    | \$ 6,250.00  |
|              |                                  | P | Swale                | 30       | LF   | \$ 40.00     | \$ 1,200.00  |
|              |                                  |   | Subtotal             |          |      |              | \$ 7,450.00  |
|              |                                  |   | Contingencies (20%)  |          |      |              | \$ 1,490.00  |
|              |                                  |   | Total                |          |      |              | \$ 8,940.00  |
| T8<br>(L)    | Lake Harmony Overflow            |   | Swale Repair         | 300      | LF   | \$ 12.00     | \$ 3,600.00  |
|              |                                  |   | Rip-rap              | 75       | CY   | \$ 30.00     | \$ 2,250.00  |
|              |                                  |   | Subtotal             |          |      |              | \$ 5,850.00  |
|              |                                  |   | Contingencies (20%)  |          |      |              | \$ 1,170.00  |
|              |                                  |   | Total                |          |      |              | \$ 7,020.00  |
| T9<br>(L)    | Osceola Street & S. Lake         |   | Swale                | 100      | LF   | \$ 20.00     | \$ 2,000.00  |
|              |                                  |   | 18" HDPE             | 50       | LF   | \$ 55.00     | \$ 2,750.00  |
|              |                                  | P | Inlet                | 1        | EA   | \$ 3,000.00  | \$ 3,000.00  |
|              |                                  | P | Endwall              | 1        | EA   | \$ 2,000.00  | \$ 2,000.00  |
|              |                                  |   | Subtotal             |          |      |              | \$ 9,750.00  |
|              |                                  |   | Contingencies (20%)  |          |      |              | \$ 1,950.00  |
|              |                                  |   | Total                |          |      |              | \$ 11,700.00 |
| T10<br>(M)   | Church Street & S. Lake          |   | Rain Garden Retrofit | 1        | LS   | \$ 10,000.00 | \$ 10,000.00 |
|              |                                  |   | Swale                | 75       | LF   | \$ 20.00     | \$ 1,500.00  |
|              |                                  | P | Inlet                | 1        | EA   | \$ 3,000.00  | \$ 3,000.00  |
|              |                                  |   | Subtotal             |          |      |              | \$ 14,500.00 |
|              |                                  |   | Contingencies (20%)  |          |      |              | \$ 2,900.00  |
|              |                                  |   | Total                |          |      |              | \$ 17,400.00 |
| T11<br>(M)   | House 184 on S. Lake             |   | Swale                | 200      | LF   | \$ 20.00     | \$ 4,000.00  |
|              |                                  |   | Subtotal             |          |      |              | \$ 4,000.00  |
|              |                                  |   | Contingencies (20%)  |          |      |              | \$ 800.00    |
|              |                                  |   | Total                |          |      |              | \$ 4,800.00  |
| T12<br>(L)   | Pine Street & S. Lake            |   | Rain Garden Retrofit | 2        | LS   | \$ 10,000.00 | \$ 20,000.00 |
|              |                                  |   |                      |          |      |              | \$ -         |
|              |                                  |   | Subtotal             |          |      |              | \$ 20,000.00 |
|              |                                  |   | Contingencies (20%)  |          |      |              | \$ 4,000.00  |
|              |                                  |   | Total                |          |      |              | \$ 24,000.00 |

| Problem Area | Location                                      |   | Item Description   | Quantity | Unit                | Unit Cost    | Price               |
|--------------|---|---|--|----------|---------------------|--------------|---------------------|
| T13<br>(L)   | S. Lake Drive (lot 208)                       |   | Swale Reconstruction   | 130      | LF                  | \$ 20.00     | \$ 2,600.00         |
|              |   |   | Regrading and Seeding  | 1        | LS                  | \$ 1,000.00  | \$ 1,000.00         |
|              |   |   | Subtotal   |          |                     |              | \$ 3,600.00         |
|              |   |   | Contingencies (20%)  |          |                     |              | \$ 720.00           |
|              |   |   | Total  |          |                     |              | <b>\$ 4,320.00</b>  |
| T14<br>(L)   | Chestnut Street & S. Lake                     |   | Rain Garden Retrofit   | 1        | LS                  | \$ 10,000.00 | \$ 10,000.00        |
|              |   |   | Subtotal   |          |                     |              | \$ 10,000.00        |
|              |   |   | Contingencies (20%)  |          |                     |              | \$ 2,000.00         |
|              |   |   | Total  |          |                     |              | <b>\$ 12,000.00</b> |
| T15<br>(L)   | Spruce Street & S. Lake                       |   | Vegetated Filter Sock  | 100      | LF                  | \$ 10.00     | \$ 1,000.00         |
|              |   |   | Subtotal   |          |                     |              | \$ 1,000.00         |
|              |   |   | Contingencies (20%)  |          |                     |              | \$ 200.00           |
|              |   |   | Total  |          |                     |              | <b>\$ 1,200.00</b>  |
| T16<br>(M)   | South Lake Drive between homes<br>246 and 248 |   | Vegetated Swale  | 200      | LF                  | \$ 20.00     | \$ 4,000.00         |
|              |   |   | Vegetated Filter Strip   | 40       | LF                  | \$ 35.00     | \$ 1,400.00         |
|              |   |   | Subtotal   |          |                     |              | \$ 5,400.00         |
|              |   |   | Contingencies (20%)  |          |                     |              | \$ 1,080.00         |
|              |   |   | Total  |          |                     |              | <b>\$ 6,480.00</b>  |
| T17<br>(H)   | Wood Street & S. Lake (around<br>beach)       |   | Rain Garden Retrofit   | 1        | LS                  | \$ 10,000.00 | \$ 10,000.00        |
|              |   | P | 18" HDPE   | 50       | LF                  | \$ 55.00     | \$ 2,750.00         |
|              |   | P | Inlet  | 1        | EA                  | \$ 3,000.00  | \$ 3,000.00         |
|              |   |   | Sand Removal   | 1        | LS                  | \$ -         | \$ -                |
|              |   |   | Optional water debris separator                                      | 1        | EA                  | \$ 8,000.00  | \$ 8,000.00         |
|              |   |   | Driveway Repair (6" 2A stone, 4" Base Course, 1-1/2" Wearing Course) | 44       | SY                  | \$ 55.00     | \$ 2,444.44         |
|              |   |   | Subtotal   |          |                     |              | \$ 26,194.44        |
|              |   |   | Contingencies (20%)  |          |                     |              | \$ 5,238.89         |
|              | Total   |   |  |          | <b>\$ 31,433.33</b> |              |                     |
| T18<br>(H)   | Wood Street & S. Lake (boat<br>loading area)  |   | Swale  | 75       | LF                  | \$ 20.00     | \$ 1,500.00         |
|              |   |   | Bioretention/Filter Berm   | 75       | LF                  | \$ 30.00     | \$ 2,250.00         |
|              |   |   | Replace existing pipe  | 125      | LF                  | \$ 50.00     | \$ 6,250.00         |
|              |   |   | Stilling Basin   | 1        | LS                  | \$ 2,500.00  | \$ 2,500.00         |
|              |   |   | Demolition of Ex. Storm Sewer  | 75       | LF                  | \$ 10.00     | \$ 750.00           |
|              |   |   | Driveway Repair (4" 2A stone, 3" Base Course, 1-1/2" Wearing Course) | 1250     | SY                  | \$ 40.00     | \$ 50,000.00        |
|              |   | P | Roadside Swale   | 150      | LF                  | \$ 20.00     | \$ 3,000.00         |
|              |   | P | Inlets   | 2        | EA                  | \$ 3,000.00  | \$ 6,000.00         |
|              |   | P | New Storm Pipe in Road   | 60       | LF                  | \$ 100.00    | \$ 6,000.00         |
|              |   |   | Subtotal   |          |                     |              | \$ 78,250.00        |
|              |   |   | Contingencies (20%)  |          |                     |              | \$ 15,650.00        |
|              |   |   | Total  |          |                     |              | <b>\$ 93,900.00</b> |
| T19<br>(M)   | Skye Drive                                    |   | Swale  | 200      | LF                  | \$ 20.00     | \$ 4,000.00         |
|              |   |   | Riprap   | 150      | CY                  | \$ 30.00     | \$ 4,500.00         |
|              |   |   | Infiltration Basin   | 1        | LS                  | \$ 25,000.00 | \$ 25,000.00        |
|              |   |   | Subtotal   |          |                     |              | \$ 33,500.00        |
|              |   |   | Contingencies (20%)  |          |                     |              | \$ 6,700.00         |
|              |   |   | Total  |          |                     |              | <b>\$ 40,200.00</b> |

| Problem Area | Location                           |   | Item Description   | Quantity | Unit         | Unit Cost   | Price        |
|--------------|------------------------------------|---|--|----------|--------------|-------------|--------------|
| T20<br>(L)   | Pocono Street & S. Lake            |   | Vegetated Filter Sock  | 100      | LF           | \$ 10.00    | \$ 1,000.00  |
|              |                                    |   | Subtotal   |          |              |             | \$ 1,000.00  |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ 200.00    |
|              |                                    |   | Total  |          |              |             | \$ 1,200.00  |
| T21<br>(L)   | Spring Street & S. Lake            |   | Vegetated Filter Sock  | 100      | LF           | \$ 10.00    | \$ 1,000.00  |
|              |                                    |   | Subtotal   |          |              |             | \$ 1,000.00  |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ 200.00    |
|              |                                    |   | Total  |          |              |             | \$ 1,200.00  |
| T22<br>(L)   | Harmony Street & S. Lake           |   | Vegetated Filter Sock  | 100      | LF           | \$ 10.00    | \$ 1,000.00  |
|              |                                    |   | Subtotal   |          |              |             | \$ 1,000.00  |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ 200.00    |
|              |                                    |   | Total  |          |              |             | \$ 1,200.00  |
| T23<br>(L)   | Henning Street & S. Lake           |   | Swale  | 200      | LF           | \$ 20.00    | \$ 4,000.00  |
|              |                                    |   | Road Repair (6" 2A stone, 4" Base Course, 1-1/2" Wearing Course) | 44       | SY           | \$ 55.00    | \$ 2,444.44  |
|              |                                    |   | Subtotal   |          |              |             | \$ 6,444.44  |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ 1,288.89  |
|              |                                    |   | Total  |          |              |             | \$ 7,733.33  |
| T24<br>(H)   | Estates Drive & S. Lake            |   | Swale  | 82       | LF           | \$ 12.00    | \$ 984.00    |
|              |                                    | P | 18" HDPE   | 250      | LF           | \$ 55.00    | \$ 13,750.00 |
|              |                                    | P | Inlet  | 3        | EA           | \$ 3,000.00 | \$ 9,000.00  |
|              |                                    |   | Endwall  | 1        | EA           | \$ 2,000.00 | \$ 2,000.00  |
|              |                                    |   | Subtotal   |          |              |             | \$ 25,734.00 |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ 5,146.80  |
|              |                                    |   | Total  |          |              |             | \$ 30,880.80 |
| T25<br>(L)   | Split Rock Parking Lot             |   | Stilling basin/Swale/rain garden                                 | 300      | LF           | \$ 20.00    | \$ 6,000.00  |
|              |                                    |   | Optional water debris separator                                  | 1        | EA           | \$ 8,000.00 | \$ 8,000.00  |
|              |                                    |   | Subtotal   |          |              |             | \$ 14,000.00 |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ 2,800.00  |
|              |                                    |   | Total  |          |              |             | \$ 16,800.00 |
| T26<br>(H)   | Split Rock Lagoon                  |   | Sand confinement system  | 1        | LS           | \$ -        | \$ -         |
|              |                                    |   | Sand Removal in Lake   | 1        | LS           | \$ -        | \$ -         |
|              |                                    |   | Subtotal   |          |              |             | \$ -         |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ -         |
|              |                                    |   | Total  |          |              |             | \$ -         |
| T27<br>(M)   | South Lake Behind Split Rock Lodge |   | Optional water debris separator                                  | 1        | EA           | \$ 8,000.00 | \$ 8,000.00  |
|              |                                    |   | Swale  | 50       | LF           | \$ 20.00    | \$ 1,000.00  |
|              |                                    |   | Subtotal   |          |              |             | \$ 9,000.00  |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ 1,800.00  |
|              | Total                              |   |  |          | \$ 10,800.00 |             |              |
| T28<br>(L)   | South Lake Drive to Cove           |   | Vegetated Filter Sock  | 800      | LF           | \$ 10.00    | \$ 8,000.00  |
|              |                                    |   | 18" HDPE   | 150      | LF           | \$ 55.00    | \$ 8,250.00  |
|              |                                    |   | Inlet  | 5        | EA           | \$ 1,500.00 | \$ 7,500.00  |
|              |                                    |   | Subtotal   |          |              |             | \$ 23,750.00 |
|              |                                    |   | Contingencies (20%)  |          |              |             | \$ 4,750.00  |
|              |                                    |   | Total  |          |              |             | \$ 28,500.00 |

| Problem Area | Location                                    |   | Item Description   | Quantity | Unit | Unit Cost    | Price           |
|--------------|---|---|--|----------|------|--------------|-----------------|
| T29<br>(M)   | South Lake Drive & Mosseywood Road          |   | Rain Garden  | 1        | LS   | \$ 6,000.00  | \$ 6,000.00     |
|              |   |   | Inlet  | 2        | EA   | \$ 3,000.00  | \$ 6,000.00     |
|              |   |   | 18" HDPE   | 50       | LF   | \$ 55.00     | \$ 2,750.00     |
|              |   |   | Swale  | 50       | LF   | \$ 20.00     | \$ 1,000.00     |
|              |   |   | Subtotal   |          |      |              | \$ 12,000.00    |
|              |   |   | Contingencies (20%)  |          |      |              | \$ 2,400.00     |
|              |   |   | Total  |          |      |              | \$ 14,400.00    |
| T30<br>(M)   | Split Rock Cove                             |   | Debris Removal in Lake   | 1        | LS   | \$ -         | NA              |
|              |   |   | Subtotal   |          |      |              | NA              |
|              |   |   | Contingencies (20%)  |          |      |              | NA              |
|              |   |   | Total  |          |      |              | NA              |
| T31<br>(H)   | Unprotected shoreline                       |   | Shoreline Protection   | 1300     | LF   | \$ -         | NA              |
|              |   |   | Subtotal   |          |      |              | NA              |
|              |   |   | Contingencies (20%)  |          |      |              | NA              |
|              |   |   | Total  |          |      |              | NA              |
| T32<br>(H)   | Various                                     |   | Varies   |          | N/A  | \$ -         | NA              |
|              |   |   | Subtotal   |          |      |              | NA              |
|              |   |   | Contingencies (20%)  |          |      |              | NA              |
|              |   |   | Total  |          |      |              | NA              |
| T33<br>(H)   | Lake Harmony Estates                        |   | Road Repair (6" 2A stone, 4" Base Course, 1-1/2" Wearing Course) | 14500    | SY   | \$ 55.00     | \$ 797,500.00   |
|              |   |   | Swale  | 9000     | LF   | \$ 15.00     | \$ 135,000.00   |
|              |   |   | 18" HDPE   | 2000     | LF   | \$ 55.00     | \$ 110,000.00   |
|              |   |   | Basins   | 3        | EA   | \$ 20,000.00 | \$ 60,000.00    |
|              |   |   | Inlets   | 20       | EA   | \$ 3,000.00  | \$ 60,000.00    |
|              |   |   | Subtotal   |          |      |              | \$ 1,162,500.00 |
|              |   |   | Contingencies (20%)  |          |      |              | \$ 232,500.00   |
|              |   |   | Total  |          |      |              | \$ 1,395,000.00 |
| T36<br>(L)   | Big Boulder Parking Lot                     |   | Retrofit Rain Garden   | 1        | LS   | \$ 17,000.00 | \$ 17,000.00    |
|              |   |   | Contingencies (20%)  |          |      |              | \$ 3,400.00     |
|              |   |   | Total  |          |      |              | \$ 20,400.00    |
| T37<br>(L)   | Big Boulder Employee Lot                    |   | Vegetated Filter Sock Berm                                       | 500      | LF   | \$ 10.00     | \$ 5,000.00     |
|              |   |   | Contingencies (20%)  |          |      |              | \$ 1,000.00     |
|              |   |   | Total  |          |      |              | \$ 6,000.00     |
| T38<br>(M)   | Big Boulder and Round Pond Pipe Culvert     | P | Vegetated Filter Sock/berms                                      | 200      | LF   | \$ 10.00     | \$ 2,000.00     |
|              |   |   | Subtotal   |          |      |              | \$ 2,000.00     |
|              |   |   | Contingencies (20%)  |          |      |              | \$ 400.00       |
|              |   |   | Total  |          |      |              | \$ 2,400.00     |
| T39<br>(H)   | Lake Harmony Road Culvert                   | P | Vegetated Filter Sock/Rock berms                                 | 100      | LF   | \$ 10.00     | \$ 1,000.00     |
|              |   |   | Subtotal   |          |      |              | \$ 1,000.00     |
|              |   |   | Contingencies (20%)  |          |      |              | \$ 200.00       |
|              |   |   | Total  |          |      |              | \$ 1,200.00     |
| T40<br>(M)   | SR903 and Big Boulder Lake Outlet Structure |   | Check dams/Rock berms  | 200      | LF   | \$ 10.00     | \$ 2,000.00     |
|              |   | P | Clean inlet and flush pipe                                       | 1        | LS   | \$ 2,500.00  | \$ 2,500.00     |
|              |   |   | Subtotal   |          |      |              | \$ 4,500.00     |
|              |   |   | Contingencies (20%)  |          |      |              | \$ 900.00       |
|              |   |   | Total  |          |      |              | \$ 5,400.00     |