RHC

Shumaker
Oxford/Tibbetts
Stormwater Study

PRELIMINARY DESIGN REPORT
OXFORD ROAD
DRAINAGE IMPROVEMENTS

Prepared for

Town of New Hartford
111 New Hartford Street
New Hartford, NY 13413

SCE Project No. 00549.01

By

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1.0 INTRODUCTION

Shumaker Consulting Engineering & Land Surveying, P.C. (SCE) was retained by the Town of New Hartford (New Hartford) to prepare a preliminary design for stormwater management infrastructure in an area of town that is prone to periodic flooding caused by excessive stormwater runoff. The area of town affected by the periodic flooding is in the vicinity of the intersection of Oxford Road and Kellogg Road, and the runoff is primarily generated by a watershed subarea located along the north and south sides of Tibbitts Road. See Figure 1 for a plan of the study area.

In the report, entitled *Oxford Road/Kellogg Road Regional Stormwater Drainage Assessment*, dated November 11, 2005, (Regional Stormwater Report) SCE presented the findings of a full hydrologic assessment of the subject drainage way. Identified in the report as Reach B and Reach C, these areas are prone to overflow conditions and subsequent flooding during storms as low as the 5-year periodicity storm. According to the report, the flooding conditions were caused by existing drainage infrastructure identified as "inefficient hydraulic sections and undersized driveway culverts."

This document presents a preliminary engineering design for improvements to the subject drainage channels. It identifies basic engineering criteria to adequately address the calculated stormwater flow conditions, and presents preliminary plans for each identified corrective measure. Included as part of this report are three engineering scenarios that address the identified flooding conditions; the first scenario consists of re-furbished roadside ditches and channels, the second scenario includes the construction of a new underground storm sewer system, and the third scenario details a proposed detention basin in Jubilee Estates and re-furbished roadside ditches and channels.

2.0 BACKGROUND

A detailed hydraulic analysis of the drainage channel between the outlet of Jubilee Estates and the watershed outlet was conducted as part of the Regional Stormwater Report. Identified as Reach B and Reach C, the drainage pathway receives stormwater from an upgradient ditch on Oxford Road, and three drainage subareas identified as Jubilee Estates (residential development), Janet Terrace (residential development), and Oxfordtown (residential development). Table 1 presents a summary of the peak flows calculated for the drainage channel(s) evaluated in the report.

TABLE 1
PEAK FLOW SUMMARY TABLE
PRELIMINARY DESIGN, OXFORD ROAD – OXFORDTOWN STORMWATER DRAINAGE

Storm Periodicity	24-Hour Design Storm (in.)	Jubilee Outlet (CFS)	Janet Terrace Outlet (CFS)	Oxfordtown Outlet (CFS)	Oxford Rd. Ditch (CFS) (Reach B)	Oxfordtown Swale (CFS) (Reach C)
1-Year	2.3	11.15	12.14	24.05	11.13	22.78
2-Year	2.5	16.93	14.89	28.59	16.91	30.42
5-Year	3.2	42.38	25.51	45.2	43.6	66.54
10-Year	3.8	68.93	35.51	60.2	72.34	103.86
25-Year	4.5	103.88	47.72	78.56	111.19	153.71
50-Year	4.8	119.91	53.18	86.46	129.23	176.52
100-Year	5.4	153.54	64.16	102.61	167.02	223.38

Notes

1. Peak flows at subarea outlets represent hydrograph peaks and cannot be summarized by straight-line addition.
2. Oxford Rd. Ditch = Reach B; Oxfordtown Swale = Reach C as identified in SCE's Regional Stormwater Report, dated November 11, 2005.
3. Oxford Rd. Ditch flows into Oxfordtown Swale, hence the calculated flow in Oxfordtown Swale represents the cumulative quantity of stormwater from all upgradient sources.

SCE was tasked by New Hartford to identify and prepare preliminary engineering documents for improvements to the Oxford Road Ditch (Reach B) and Oxfordtown Swale (Reach C) drainage features. The goal of the design is to improve the overall hydraulic conditions in

order to accommodate a larger design rainfall, and to minimize the risk of periodic flooding during small storm events. Another goal of the preliminary design is to identify options that would minimize the need to construct stormwater detention structure(s) in the Jubilee Estates residential area, although this was also considered during the preliminary design process. All three options presented in this report have considered the downstream impacts of their associated improvements. In all cases, the net result of these impacts is within the calculated capacity of the outlet swales.

This report will serve to advance the design for the solution to the localized flooding problem as far as practicable at this time. Additional information must be obtained in order to continue with the design process beyond that which is presented herein. Most notably, additional topographic survey and mapping is necessary to finalize the design and cost estimate presented in this report.

3.0 PRELIMINARY DESIGN METHODOLOGY

Many resources were consulted in the designs presented in this report. Figures were generated based on the figures presented in the Regional Stormwater Report. These figures were overlain on aerial photographic mapping obtained from the New York State GIS Clearinghouse. All hydrologic flow data were compiled from the Regional Stormwater Report.

Existing and proposed culvert and ditch section capacities were evaluated using the Federal Highway Administration's Urban Drainage Design Program, HY-22 and FEMA's Quick-2 program. Two proprietary programs were utilized to evaluate the effectiveness of ditch linings under given hydraulic conditions. This software calculates the shear stress which will be present in the ditch section and compares that value with the allowable shear stress of various materials. These programs are Macra-1 from Maccaferri (a manufacturer of gabion baskets) and ErosionWorks from American Excelsior (a manufacturer of natural and synthetic erosion control products).

Also utilized for design guidance was Hydraulic Engineering Circular No. 22, Second Edition Urban Drainage Design Manual from FHWA and a culvert design manual from the U.S. Army Corps of Engineers.

4.0 SCENARIO ONE: DITCH IMPROVEMENTS AND NEW CULVERTS

The first scenario consists of improvements to the hydraulic section and several driveway culverts within the ditch at Oxford Road to allow the complete passage of peak runoff associated with the 25-year rainfall event. The elements of this preliminary design included the following:

- Modify the outfall at Jubilee Estates to allow a more controlled inlet to the Oxford Road stormwater management ditch system.
- Increase the size and slope of up to three downstream driveway culverts to convey the 25-year peak flow along Oxford Road. In addition, the pipe construction would be changed from Reinforced Concrete Pipe (RCP) or Corrugated Metal Pipe (CMP) to High Density Polyethylene (HDPE) for improved hydraulic characteristics.
- Modify the existing ditch system to a more uniform trapezoidal channel to maximize flow. Provide a liner or protect the new ditch to lower hydraulic head loss, and to increase the capacity of the ditch system.
- Modify the outfall at Janet Terrace to allow a more controlled inlet to the Oxford Road stormwater management ditch system.
- Modify the entrance to the 48-inch diameter RCP storm sewer system that conveys stormwater under Oxford Road, and then discharges to a surface swale near Gateshead Road.
- Replace two CMP culverts with two new HDPE culverts along the alignment of a surface swale that passes through the Oxfordtown Apartment Complex.
- Replace an existing 48-inch CMP culvert under Harrogate Road with a new 5-foot wide x 4-foot high concrete box culvert.
- Provide stream channel bank protection in locations, as required, to minimize erosion or damage caused by periodic high stream velocities.

Figures 2, 3, 4, and 5 present preliminary design plans for Scenario One. Figures 2, 3, and 4 are plan view representations of the proposed improvements at Oxford Road, Gateshead and the Pedestrian Walkway, and Harrogate Road, respectively. Figure 5 is a profile of the proposed improvements at Oxford Road.

4.1 INCREASED CAPACITY DRIVEWAY CULVERTS

The three existing driveways (Jubilee Estates maintenance road and two private residences) are furnished with 30-inch diameter culverts of either RCP or CMP material. Surveyed inverts indicate that the existing pipe slopes and cover over the pipes also vary. In designing new culvert pipes, a straight line slope was chosen for the proposed culverts and the hydraulically improved ditch, using the existing Oxford Road slope of .035 ft/ft. It should be noted that the slope of Oxford Road was obtained from surveyed culvert inverts and photographic evidence of the estimated amount of cover over top of the existing culvert pipes. Utilizing the HY-22 software, it was shown that a 42-inch HDPE smooth-lined culvert will pass the 25-year storm under partial flow conditions, with approximately 2.1 feet of water in the pipe. Velocity in the pipe is calculated at 18.3 feet per second (fps). The profile of this alignment shows increased cover over the pipes at all three driveway locations.

4.2 INCREASED CAPACITY ROADSIDE DITCH

An improvement in the hydraulic capacity of the driveway culverts will result in the need to similarly improve the roadside ditch. The same HY-22 software and ditch slope was used as for the culvert design. Using a bottom width of 2 feet and ditch side slopes of 1 to 1, two different types of ditch linings were investigated for flow capacity. These linings generally are classified as vegetated, and asphalt or concrete lined.

The vegetated ditch passes the 25-year storm with a depth of water of 2.6 feet and a velocity of 10 fps. Hydraulic modeling revealed that grass alone would not resist the velocity and shear stress, and vegetation reinforced with a rolled geo-synthetic turf reinforcing product may withstand these forces.

The asphalt or concrete lined ditch will pass the 25-year storm with a water depth of 2.0 feet and a velocity of 14 fps. Based on hydraulic modeling, it was determined that an asphalt or concrete lining will resist shear stress and erosion for this high velocity flow.

An investigation of the profile of the driveway culverts and improved ditch reveals that the depth of the ditch in relation to the Oxford Road shoulder would be approximately 5 feet. Ditch geometry consisting of 1 to 1 side slopes, 5-foot depth and 2-foot bottom width will result in the back of the ditch line 12 feet from the edge of the Oxford Road shoulder.

4.3 MODIFICATIONS AT ENDS OF NEW DITCH SECTION

The configuration of the existing ditch at the entrance to the culvert under the Jubilee Estates maintenance driveway requires the flow from the Jubilee Estates drainage swale to make an abrupt, ninety degree turn to continue down the ditch. This hydraulically inefficient geometry contributes to the ditch overflow at this location, and has apparently caused significant shoulder erosion in the past, as evidenced by the presence of gabion baskets reinforcing the shoulder. A concrete structure at this location must be designed which will receive flow from the south in the Oxford Road ditch and also redirect flow from the Jubilee Estates swale and convey this combined flow into the 42-inch HDPE culvert under the driveway. Some re-grading of the Jubilee swale may be necessary to reduce the slope of the swale as it approaches the proposed structure.

Preliminary research into the design of this structure has shown that when a flow of this volume and velocity is redirected around a bend, some superelevation of the water surface occurs at the outside of the bend. A large radius of curvature may be required to accomplish an acceptable height of superelevation based on the stormwater flow rates calculated at this outfall.

The existing concrete structure at the entrance to the 48-inch RCP system under Oxford Road will be modified so that flow from the proposed ditch section can enter the 48-inch pipe. As currently constructed, ditch flow must pass over the top of a weir configuration to drop into the 48-inch pipe and this weir must be lowered to the elevation of the proposed ditch line.

4.4 CULVERT REPLACEMENT IN OXFORDTOWN APARTMENTS

Two existing 48-inch CMP culverts within the Oxfordtown complex, one under Gateshead Road and the other under a pedestrian walkway just downstream from the first must be replaced with 48-inch HDPE smooth-lined culverts to improve capacity to a conveyance in excess of the 25-year storm. As currently constructed, capacity is 121 and 108 cfs for the 48-inch culverts at Gateshead Road and the pedestrian walk, respectively. Changing the material of these two culverts and maintaining the existing slope will increase the capacity at those locations to 200 and 180 cfs, respectively.

The last downstream improvement under Scenario 1 consists of replacing the existing 48-inch CMP culvert under Harrogate Road with a 5-foot wide by 4-foot high concrete box culvert. This culvert has also been designed to convey the 25-year storm. It is unknown if the existing Drainage Easement in this location is adequate to allow this improvement.

4.5 ESTIMATED COSTS FOR SCENARIO ONE

The following table presents estimated construction costs for Scenario One.

TABLE 2
ESTIMATED CONSTRUCTION COST, SCENARIO ONE

Item	Estimated Cost
Maintenance and Protection of Traffic	$ 2,000
90 lf of 42-inch HDPE, installed	$ 5,400
Five 42-inch galvanized end sections	$ 4,000
80 lf of 48-inch HDPE, installed	$ 5,600
Four 48-inch galvanized end sections	$ 3,600
150 lf of 5 foot x 4 foot concrete box culvert	$ 97,500
New inflow structure at Jubilee Estates	$ 10,000
Modify existing structure at 48-inch RCP	$ 5,000
Ditch lining (geo-synthetic)	$ 1,200
Trench excavation and backfill	$ 7,000
Select granular fill for pipe bedding	$ 5,400
Pavement restoration	$ 7,500
Grass area restoration	$ 1,300
Subtotal	**$155,500**
15% Engineering/Survey	$ 23,325
30% Contingency	$ 46,650
Total	**$225,475**

5.0 SCENARIO TWO: SUBSURFACE STORM SEWER SYSTEM ALONG OXFORD ROAD

The required size, depth, and calculated water velocity associated with the improved roadside ditch system along Oxford Road warranted additional evaluations of an engineering solution to the documented flooding problem. Scenario Two has been developed to include the construction of a subsurface storm sewer system from the Jubilee Estates Outfall to the entrance of the 48-inch RCP culvert that conveys water under Oxford Road.

The preliminary design criteria utilized for this scenario was based on conveying the 100-year storm along the same general path as the existing stormwater management ditch. Specific project elements will consist of the following:

- Install an improved structure at the terminus of the Jubilee Estates Outfall to convey surface water into the subsurface storm sewer system.
- Install approximately 300-linear feet of 42-inch smooth-lined HDPE corrugated storm sewer pipe along the western shoulder of Oxford Road.
- Repair at least 3 driveway entrances along Oxford Road.
- Install an improved structure at the terminus of the Janet Terrace Outfall to convey surface water into the subsurface storm sewer system.
- Construct a stormwater structure to provide a transition from the 42-inch HDPE pipe to the 48-inch RCP culvert under Oxford Road.
- Construct a new 5-foot x 5-foot catch basin with frame and grate at the location where 15-inch CMP will intercept new 42-inch HDPE.
- Construct a new 5-foot x 5-foot catch basin between the Jubilee Estates maintenance driveway and the next driveway to the north, to intercept surface flow which will be present in the roadside swale.
- Replace two CMP culverts with two new HDPE culverts along the alignment of a surface swale that passes through the Oxfordtown Apartment Complex.
- Replace an existing 48-inch CMP culvert under Harrogate Road with a new 6-foot wide x 5-foot high concrete box culvert.
- Provide stream channel bank protection in locations, as required, to minimize erosion or damage caused by periodic high stream velocities.

Refer to Figures 6, 7, 8, and 9 for the improvements detailed in this Scenario. Figures 6, 7, and 8 are plan views and Figure 9 is a profile of the proposed improvements at Oxford Road.

5.1 PROPOSED 42-INCH SUBSURFACE STORM SEWER

For the subsurface storm sewer option, a steeper design slope was utilized, based on the surveyed inverts of the Jubilee Estates driveway pipe and the entrance to the 48-inch RCP system, resulting in a slope of .0389 ft/ft. Under these conditions, a 42-inch HDPE smooth-lined culvert will have sufficient capacity to pass the 100-year storm under partial flow conditions, with approximately 2.8 feet of water in the pipe. Water velocity in the pipe under 100-year storm conditions will be 20.5 fps. The three driveways impacted by the new 42-inch storm sewer would be rebuilt. The profile of the proposed work shows increased depth of cover at the driveway locations. Four drainage structures would need to be constructed or modified for this option, as detailed below.

5.2 INLET STRUCTURE

As discussed in Section 4.3 above, an inlet structure will be designed and constructed to collect and redirect Jubilee Estates flow and receive Oxford Road ditch flow. This structure will also serve as the entrance to the new 42-inch storm sewer.

5.3 CATCH BASINS

A 5-foot x 5-foot catch basin will be constructed at the location where a 15-inch CMP culvert crosses Oxford Road from east to west. This structure will serve to connect this existing cross culvert with the proposed 42-inch storm sewer, and will be furnished with a frame and grate to intercept any surface flow present on the Oxford Road shoulder. An additional 5-foot x 5-foot catch basin, also with a frame and grate will be constructed just south of the southern-most residential driveway to intercept surface flow from Oxford Road.

5.4 MODIFIED STRUCTURE AT 48-INCH RCP

The existing concrete structure at the entrance to the 48-inch RCP storm sewer will be modified to accept the proposed 42-inch storm sewer below grade. The existing Janet Terrace swale will be reshaped and stabilized to direct flow into the modified concrete structure through a grate.

5.5 CULVERT REPLACEMENT IN OXFORDTOWN APARTMENTS

Similar to Section 4.4 above, the existing 48-inch CMP culverts within the Oxfordtown complex must be replaced for increased hydraulic capacity; however, they will be designed to convey the 100-year storm. To effectively manage the 100-year storm, the 48-inch CMP culverts at Gateshead Road and the Pedestrian Walkway must be replaced with 54-inch HDPE. This will increase the conveyance to 276 cfs at Gateshead Road and 247 cfs at the Pedestrian Walkway. The existing 48-inch CMP under Harrogate Road will be replaced by a 6-foot wide by 5-foot high concrete box culvert, also designed to pass the 100-year storm.

6.0 SCENARIO THREE: DETENTION POND AT JUBILEE ESTATES WITH DOWNSTREAM IMPROVEMENTS

The third scenario consists of constructing a detention basin at Jubilee Estates to control the runoff release rate from the development, improvements to the hydraulic section, and several driveway culverts within the ditch at Oxford Road to allow the complete passage of peak runoff associated with the 25-year rainfall event. The elements of this preliminary design included the following:

- Construct a detention basin at Jubilee Estates to allow a more controlled rate of release to the Oxford Road stormwater management ditch system.
- Increase the size and slope of two downstream driveway culverts to convey the 25-year peak flow along Oxford Road. In addition, the pipe construction would be changed from Reinforced Concrete Pipe (RCP) or Corrugated Metal Pipe (CMP) to High Density Polyethylene (HDPE) for improved hydraulic characteristics.
- Modify the existing ditch system to a more uniform trapezoidal channel to maximize flow. Provide a liner or protect the new ditch to lower hydraulic head loss, and to increase the capacity of the ditch system.
- Modify the outfall at Janet Terrace to allow a more controlled inlet to the Oxford Road stormwater management ditch system.
- Modify the entrance to the 48-inch diameter RCP storm sewer system that conveys stormwater under Oxford Road, and then discharges to a surface swale near Gateshead Road.
- Replace an existing 48-inch CMP culvert under Harrogate Road with a new 48-inch HDPE culvert.
- Provide stream channel bank protection in locations, as required, to minimize erosion or damage caused by periodic high stream velocities.

Figures 10, 11, and 12 show the proposed improvements for this Scenario, with Figures 10 and 11 being plans of Oxford Road and Harrogate Road, respectively. Figure 12 is a profile of the proposed Oxford Road Ditch and Driveway Culvert improvements.

6.1 DETENTION BASIN AT JUBILEE ESTATES

SCE previously prepared a report entitled "Feasibility Assessment Stormwater Management Practices, Jubilee Estates, Tibbitts Road, Town of New Hartford" (January, 2005). In this report, three options were investigated detailing on-site stormwater detention at the Jubilee Estates Subdivision. Using this report and its associated calculations, SCE has further advanced this concept for consideration in this current report.

The goal of this scenario is to detain the stormwater collected on the Jubilee Estates site and release it at a controlled rate, equal to or less than that which will cause significant downstream impacts. In SCE's *Regional Stormwater Report,* it was demonstrated that the vast majority of the stormwater present in the Oxford Road ditch, from the Jubilee Estates outfall to the 48-inch RCP system is direct runoff from Jubilee Estates. Detention and controlled release within the Jubilee Estates drainage area will serve to lessen downstream flooding impacts.

The preliminary design has focused on a single basin constructed on two building lots in Jubilee Estates. Preliminary sizing of the basin is for a bottom area of 29,600 square feet and a 4-foot depth, having a water surface area of 40,000 square feet. This was accomplished with 3 to 1 graded side slopes. As an initial estimate, a 24-inch diameter outlet pipe was chosen to release water from the pond to the Oxford Road ditch system. This data was entered into the TR-55 model previously prepared, with the results of this detention and controlled release shown in Table 4 below.

TABLE 4
Scenario Three
Detention Pond at Jubilee Estates
Preliminary Stormwater Flow Summary

Storm Periodicity	Jubilee Basin Discharge (CFS)[1]	Oxford Road Ditch (Reach B – CFS)	Oxfordtown Swale (Reach C – CFS)
1-Year	4.66	5.17	16.25
2-Year	7.22	8.54	21.6
5-Year	19.73	22.40	46.38
10 Year	30.55	35.91	69.27
25-Year	33.03	38.67	85.63
50-Year	34.09	39.96	92.16
100-Year	35.92	42.14	104.87.

Note 1: Preliminary Design assumes 24-inch diameter discharge pipe from detention structure

The maximum release rate from the proposed Jubilee Estates Basin (under the 100-year storm conditions) is limited to 36 cfs, with the maximum flow in Reach B at 42 cfs. The existing culvert pipes under the three driveways on Oxford Road will not handle this maximum flow and will not handle the 25-year flow of 39 cfs. The limited capacity necessitates some downstream improvements, detailed in the following sections.

6.2 INCREASED CAPACITY DRIVEWAY CULVERTS

Consistent with the objectives of this study, SCE chose the 25-year flow in designing Oxford Road improvements. In order to convey the calculated 39 cfs flow, the culvert pipes at the Jubilee Estates maintenance driveway and the private residence driveway closest to the 48-inch RCP system must be replaced with 30-inch HDPE pipes installed at a slope to match the Oxford Road slope. The existing 30-inch CMP culvert under one residential driveway is capable of passing 40 cfs in its existing configuration, so no action is required at that location.

6.3 INCREASED CAPACITY ROADSIDE DITCH

Concurrent with the culvert replacements listed above, some ditch improvements are necessary. Major reconstruction is not anticipated; however, some cleaning, reshaping, and vegetative relining is necessary to maintain a smooth hydraulic transition of stormwater between the culverts and the ditch. A stability analysis shows that the proposed section lined with grass alone will not withstand the associated shear stress, and requires a lining similar to that proposed in Scenario One.

6.4 MODIFIED STRUCTURE AT 48-INCH RCP

The existing concrete structure at the entrance to the 48-inch RCP system under Oxford Road will be modified so that flow from the proposed ditch section can enter the 48-inch pipe. As currently constructed, ditch flow must pass over the top of a weir configuration to drop into the 48-inch pipe and this weir must be lowered to the elevation of the proposed ditch line. Some re-grading and channel stabilization will be required at the location where the swale from Janet Terrace enters the Oxford Road ditch. This re-grading should redirect the flow from Janet Terrace in a more northerly direction and ease the transition into the ditch, towards the structure.

6.5 CULVERT REPLACEMENT IN OXFORDTOWN APARTMENTS

Due to the impact that the detention at Jubilee Estates will have on the downstream watershed, the flow through Reach C (Oxfordtown swale) for the 25-year storm will be limited to 86 cfs. This is well below the capacities of the existing 48-inch CMP culverts under Gateshead Road and the Pedestrian Walkway, and these would not need replacing. The capacity of the 48-inch CMP under Harrogate, however, is approximately 50 cfs which is less than the 25-year flow, and must be replaced. Replacement with an HDPE culvert of

the same size will result in a capacity of approximately 120 to 130 cfs, well in excess of the 25-year flow of 86 cfs.

6.6 ESTIMATED COSTS FOR SCENARIO THREE

The following table presents estimated construction costs for Scenario Three.

TABLE 5
ESTIMATED CONSTRUCTION COST, SCENARIO THREE

Item	Estimated Cost
Maintenance and Protection of Traffic	$ 2,000
Detention Basin Construction (Including Outlet Pipe and Structure)	$ 37,000
60 lf of 30-inch HDPE, installed	$ 3,000
150 lf of 48-inch HDPE, installed	$ 10,500
Four 30-inch galvanized end sections	$ 2,000
Two 48-inch galvanized end sections	$ 1,800
Modify existing structure at 48-inch RCP	$ 5,000
Ditch lining (geo-synthetic)	$ 1,200
Trench excavation and backfill	$ 3,500
Select granular fill for pipe bedding	$ 2,900
Medium Stone Fill (for spillways, etc.)	$ 1,200
Pavement restoration	$ 3,800
Grass area restoration	$ 1,200
Subtotal	**$ 75,100**
15% Engineering/Survey	$ 11,300
30% Contingency	$ 22,600
Land Acquisition	$ 90,000
Present Value of O&M (20 Years)	$ 25,000
Total	**$224,000**

7.0 RECOMMENDATIONS

Two of the three scenarios presented above reveal similar solutions to the identified localized flooding problem. Although the impacted areas of the first two scenarios are roughly the same in size and scope, the end results are distinctly different in their ability to effectively manage stormwater. The third scenario is quite different, in that the approach to mitigate the flooding problem centers on the construction of a detention basin within the Jubilee Estates development. Each scenario has advantages and disadvantages, as discussed below.

7.1 SCENARIO ONE

Scenario one will lead to an excessively deep ditch section creating a potentially dangerous situation for pedestrians and vehicles traveling on Oxford Road. This depth, combined with the high water velocity which will be present in the ditch would also be extremely dangerous for pedestrians and children. Also of concern to the Town is the maintenance requirements associated with a grass-lined or concrete-lined ditch. The grass lining, reinforced with the geo-synthetic erosion control product, will require special care in ditch cleaning operations to avoid damaging the permanent lining. A concrete or asphalt-lined ditch would be subject to frost heave, and continual cracking could be a problem, potentially leading to failure of the lining.

The conveyance capacity of Scenario One is limited to the 25-year storm. As such, all downstream improvements are also limited to the passage of the 25-year storm.

Also of concern is the location of the sanitary sewer system. Field observations indicate the centerline of the existing sanitary sewer is in close proximity to the centerline of the proposed ditch. This may lead to problems with the stability of the existing sanitary sewer manholes and the depth of cover over the sewer main. The sewer manholes will also present a problem in installing and maintaining the ditch lining. The location of the public water

distribution main in this area is reported to be on the opposite (east) side of Oxford Road and should not be in conflict with the proposed work.

The installation of the 5-foot x 4-foot box culvert under Harrogate Road may require a new easement and the removal of the line of trees adjacent to the existing 48-inch culvert. These trees appear to have been planted by the property owner, possibly as a privacy hedge.

7.2 SCENARIO TWO

Scenario Two shares several of the issues detailed above for Scenario One, notably the location of the sewer lines, and the tree line at Harrogate Road. Unique to Scenario Two is the additional cost, especially in the larger downstream culverts and box culvert.

7.3 SCENARIO THREE

Scenario Three represents a different view of how to effectively control the identified localized flooding problem. It has been previously demonstrated through hydraulic modeling that the vast majority of stormwater entering the Oxford Road ditch is from Jubilee Estates. By detaining and controlling the release of this water, downstream impacts will be lessened.

The scope of construction which will occur in the Oxford Road right of way is considerably less with this Scenario. The project would include replacing two driveway culverts, reshaping and relining the ditch and installing the outlet pipe for the Jubilee Estates Basin, and may eliminate some permitting issues with the Oneida County Department of Public Works (OCDPW). The need for a specially designed and constructed inlet structure at the Jubilee Estates outfall is negated, due to the fact that nearly all of the stormwater flow in the Jubilee Estates Swale will be redirected to the proposed detention basin.

Unlike Scenario One, which resulted in a deep ditch section with rapidly moving water, this Scenario limits the depth of the ditch to approximately 4 feet, which is similar to existing conditions. The shallower ditch will also lessen the potential impacts to the existing sanitary sewer system. Also, the depth and velocity of water in the ditch is considerably less than with Scenario One.

Due to the detention of stormwater at Jubilee Estates, the concrete box culvert is not necessary at Harrogate, and the existing 48-inch culverts at Gateshead and the pedestrian walkway are adequate. The previously identified tree line will present the same construction and easement difficulties as above.

There are some potential future economic drawbacks associated with Scenario Three which are not present with the other two. The area necessary to construct the proposed basin will likely require the purchase of two building lots in the northeast corner of Jubilee Estates. In addition to the capital cost involved with this initial purchase, the lost revenue from property taxes could be substantial over time. SCE has calculated that this lost revenue may be on the order of $48,000 over a twenty-year period. Also, it is unknown whether the construction of a detention basin will have an adverse effect on the future sale of the remaining lots within Jubilee Estates. This concern may be mitigated through the use of extensive landscaping, to hide the basin from view.

A basin will likely require periodic mowing, brush cutting and cleaning of the basin bottom, outlet structure and outlet pipe, to ensure that it performs as designed. The present value of these operation and maintenance costs has been included as part of this estimate.

Lastly, because the amount of disturbed area will be in excess of one acre of land, it will be necessary to prepare an Erosion and Sediment Control Plan and a Storm Water Pollution Prevention Plan for the construction phase of this scenario. This will likely result in increased engineering fees which may not be adequately reflected in the estimates shown

herein, which use a common percentage of construction cost as the basis for engineering fees.

A review of the three scenarios presented above reveals that all three options achieve the Town's objectives of effectively conveying the 25-year storm from the Jubilee Estates outfall through Oxfordtown Apartments and under Harrogate Road to the ultimate outfall. From a hydraulic standpoint, Scenario Two is superior due to its ability to pass the 100-year storm, but it is also the costliest option. Scenario One and Three will both manage the 25-year storm, and are similar to each other in cost. The feasibility of Scenario Three may be limited by the availability of the two lots necessary to construct the proposed detention basin. Scenario One has questionable value due to the safety and aesthetic concerns of a deep, rapidly flowing ditch in a residential area adjacent to a busy County Road. Scenario Two is considerably more costly than Scenarios One and Three and will require more construction effort in the busy Oxford Road right of way and Oxfordtown development. The Town of New Hartford must consider all of these factors when deciding which scenario will best achieve their objectives.