# Western New York Science & Technology Advanced Manufacturing Park (STAMP)

# Stormwater Management Preliminary Report

## Prepared for:

**Genesee County Economic Development Center**
**99 Medtech Drive, Batavia, NY 14020**

**March 2011**

Clark Patterson Lee
DESIGN PROFESSIONALS

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APPENDICES

## Executive Summary

The Science and Technology Advanced Manufacturing Park (STAMP) project in the Town of Alabama, in western Genesee County, New York is being planned. The project site consists of approximately 1,300 acres and is located along New York State Highway Route 77, approximately 5 miles north of the New York State Thruway. The purpose of the project is to develop a high technology manufacturing center, with a focus on renewable energy and to provide economic development opportunities within the region.

The purpose of the Stormwater Management Preliminary Report is to evaluate the necessary improvements required to manage and mitigate stormwater runoff throughout the developed STAMP project site.

Currently, the majority of the STAMP project site consists of agricultural land and some residential homes. The site can be characterized as having gentle to moderate slopes with intermittent streams. State and Federal delineated wetlands are located on the site. The site does not lie within the FEMA 100 Year Flood Plain.

Under existing conditions, the site has been divided into four distinct drainage catchment areas with associated design points. There are three streams that are within the STAMP site, two of which are unnamed (unnamed stream #1 and unnamed stream #2) and the third is Whitney Creek. Both the existing drainage catchments and the streams are shown in Appendix A.

This evaluation will consider the STAMP project at full build-out and the impact that the development will have on the existing site. At Full Build-Out, approximately 6,130,000 square feet of building development will be required and approximately 9,330 employees are projected to occupy the site. This translates to an increase in impervious area of approximately 490 acres compared to existing conditions when considering the associated buildings, roads and parking lots.

Similar to existing conditions, under developed conditions the site has been divided into four distinct drainage catchment areas with associated design points (see Appendix B). Under developed conditions, the existing flow path of unnamed stream #1 will be disrupted due to the placement of the proposed buildings, parking lots and associated roadways. Therefore, the stream has been re-routed to discharge into unnamed stream #2 traveling through proposed drainage catchment area #2. This will allow both streams to continue to contribute to the offsite wetlands.

New development within the developed drainage catchment areas will require new stormwater runoff mitigation, including both quality and quantity practices. For this analysis, it is assumed that the primary stormwater mitigation measure will be pond-type facilities. The ponds will have a forebay and permanent pool to treat water quality and additional storage volume to treat water quantity.

By comparing peak flows generated from existing conditions and developed conditions, required pond volumes can be calculated using the PondPack software. The calculation is based on an estimation of the amount of storage required to mitigate developed stormwater flows to existing flow rates or lower. For this report, the worst case scenario of the peak flow generated by the 100 year storm event is used for drainage catchment areas 1, 2 and 4. Due to the reduction of drainage area for catchment area 3 from existing to developed conditions, no pond storage estimates have been completed.

The following is a summary of existing and developed flows for each drainage area for the 1, 10 and 100 year storm events.

**RUNOFF - EXISTING CONDITIONS**

| WATERSHED/ SUBAREA | DRAINAGE AREA | 1-YEAR STORM EVENT | 10-YEAR STORM EVENT | 100-YEAR STORM EVENT |
|---|---|---|---|---|
| DA-1 | 706 acres | 233.05 cfs | 653.33 cfs | 1,024.76 cfs |
| DA-2 | 437 acres | 104.40 cfs | 318.25 cfs | 512.57 cfs |
| DA-3 | 103 acres | 30.06 cfs | 103.11 cfs | 172.09 cfs |
| DA-4 | 126 acres | 40.96 cfs | 141.85 cfs | 236.25 cfs |

**RUNOFF - DEVELOPED CONDITIONS**

| WATERSHED/ SUBAREA | DRAINAGE AREA | 1-YEAR STORM EVENT | 10-YEAR STORM EVENT | 100-YEAR STORM EVENT |
|---|---|---|---|---|
| DA-1 | 725 acres | 809.38 cfs | 1909.57 cfs | 2826.11 cfs |
| DA-2 | 465 acres | 421.37 cfs | 1094.23 cfs | 1672.73 cfs |
| DA-3 | 78 acres | 17.90 cfs | 65.85 cfs | 111.59 cfs |
| DA-4 | 128 acres | 45.20 cfs | 188.05 cfs | 328.18 cfs |

The following table summarizes the storage requirements for the stormwater management facilities for drainage catchment areas 1, 2 and 4. The calculations used are based on the flow rates for the 100 year storm event.

**STORMWATER MANAGEMENT FACILITY STORAGE REQUIREMENTS**

| WATERSHED/ SUBAREA | STORAGE REQUIREMENT |
|---|---|
| DA-1 | 77.09 acre-feet |
| DA-2 | 47.58 acre-feet |
| DA-4 | 5.19 acre-feet |

In addition to the main stormwater pond facilities in each catchment area, point source treatment practices will be implemented as required in the pending New York State Department of Environmental Conservation New York Stormwater Management Design Manual. The point source treatment practices include rain gardens for roof drainage, bio-retention swales or infiltration trenches for parking areas, and a variety of other practices. Buffers for these treatment practices have been incorporated into the overall conceptual plan for the project. As development occurs, additional stormwater studies and calculations will be required to determine compliance and adequate sizing of associated treatment methods.

For this analysis, worst case pond sizes were calculated for developed conditions. The point source treatment requirements improve infiltration and decrease runoff generated from development. Therefore, the size of the ponds will generally decrease as more of these practices are implemented.

The point source treatment practices include rain gardens for roof drainage, bio-retention swales or infiltration trenches for parking areas, and a variety of other practices. Buffers for these treatment practices have been incorporated into the overall conceptual plan for the project. As development occurs and more design details are available, additional stormwater studies and calculations will be required to determine more exact locations and sizing of associated treatment methods.

The final design and layout of the treatment practices will also assist in supplying water to the existing wetlands and streams on the STAMP site. By discharging treated stormwater from these practices into the streams and wetland systems, the integrity of the systems will be maintained and even enhanced.

## Introduction

The Science and Technology Advanced Manufacturing Park (STAMP) project in the Town of Alabama, in western Genesee County, New York is being planned. The project site consists of approximately 1,300 acres and is located along New York State Highway Route 77, approximately 5 miles north of the New York State Thruway. The purpose of the project is to develop a high technology manufacturing center, with a focus on renewable energy and to provide economic development opportunities within the region.

The purpose of the Stormwater Management Preliminary Report is to evaluate the necessary improvements required to manage and mitigate stormwater runoff throughout the developed STAMP project site.

## Existing Conditions

Currently, the majority of the STAMP project site consists of agricultural land and some residential homes. The site can be characterized as having gentle to moderate slopes with intermittent streams. State and Federal delineated wetlands are located on the site. The site does not lie within the FEMA 100 Year Flood Plain.

The STAMP site is comprised of many different soils with different Hydrologic Soil Group classifications. The site contains mostly Type C & D soils as defined by the National Cooperative Soil Survey, which generally describes the site as moderate to poorly drained. An existing soils map has been included in Appendix A-1.

Under existing conditions, the site has been divided into four distinct drainage catchment areas with associated design points as follows (see Appendix A-2):

- DA-1 – This subarea consists of approximately 706 acres of agricultural land, residences and roadways. The subarea contains approximately 46 acres of wetlands, 52 acres of wooded area and 5.50 acres of impervious area. The main drainage feature of this subarea is a small stream and a series of culverts which generally drain from NYS Route 77 towards the northwest portion of the site. Design Point 1 (DP1) for this analysis is located in the northwest corner of the STAMP project site.

- DA-2 – This subarea consists of approximately 437 acres of agricultural land, residences and roadways. The subarea contains approximately 66 acres of wetlands, 108 acres of wooded area and 5.60 acres of impervious area. The main drainage feature of this subarea is a series of swales and culverts which drain from NYS Route 77 to the northwest, to the point along the western property line of the STAMP project site. Design Point 2 (DP2) for this analysis is located at the west side of the STAMP site.

- DA-3 – This subarea consists of approximately 103 acres of agricultural land, residences and roadways. The subarea contains approximately 8 acres of wetlands, 4

acres of wooded areas and 2.11 acres of impervious area. The main drainage feature is Whitney Creek which drains to the southwest portion of the site. Design Point 3 (DP3) for this analysis is located at the southwest property line of the STAMP site.

- DA-4 – This subarea consists of approximately 126 acres of agricultural land, residences and roadways. The subarea contains approximately 1.2 acres of wetlands, 2.6 acres of wooded area and 4.71 acres of impervious area. The drainage for this subarea is primarily sheet flow to a swale that drains to the northeast portion of the site. Design Point 4 (DP4) for this analysis is located at the northeast portion of the STAMP site.

**Existing Streams**

There are three streams that are within the STAMP site, two of which are unnamed and the third is Whitney Creek.

- Unnamed stream #1 is the northern most stream on the STAMP site and travels through drainage catchment area #1. The stream begins as a headwater stream for the wetlands located on the northwestern portion of the site and is the main drainage feature of the catchment area. The stream leaves the site along the western boundary line of the property and continues north approximately 5,890 feet and discharges to the southern portion of Oak Orchard Swamp. The onsite drainage area contributing to the stream is approximately 700 acres. The flows calculated for DA-1 for the 1, 10 and 100 year storm events are provided in Table 2.

- Unnamed stream #2 begins at an existing pond located on the southeastern portion of the STAMP site and acts as the main drainage feature of drainage catchment area #2. The stream leaves the site along the western boundary of the STAMP site and continues northward approximately 4,300 feet where it combines with unnamed stream #1. The onsite drainage area contributing to the stream is approximately 440 acres. The flows calculated for DA-2 for the 1, 10 and 100 year storm events are provided in Table 2.

- Whitney Creek enters the site at the south portion of the property near Crosby Road and leaves the site at a point along the southwestern boundary. The creek continues to flow northward where it eventually discharges into a tributary of Oak Orchard Creek and then Oak Orchard Swamp, approximately 20,700 feet away from the discharge point. The onsite drainage area contributing to the creek is approximately 100 acres. The flows calculated for DA-3 for the 1, 10 and 100 year storm events are provided in Table 2 below.

**Hydrologic Analysis Methodology**

The quantity of stormwater runoff generated from a watershed is affected by land development and site improvement projects. Construction activities that change the surface vegetation and grades, along with new impervious areas, typically decrease the groundwater

infiltration. This reduction in infiltration will result in an increase in overland stormwater runoff rates. As a result, a hydrologic analysis is required to evaluate the net effect the proposed site improvements will have on the existing site.

The USDA Soil Conservation Services TR-55 hydrologic models were used to calculate the peak runoff rates for each drainage catchment area. The TR-55 Model uses an empirical method to express storm events as unit hydrographs. The unit hydrographs are developed for each subarea and are hydrologically added to develop peak discharge rates for each storm event. This method has been incorporated into a computer analysis software program, "PondPack", developed by Haestad Methods, Inc. This program was used to generate the peak stormwater runoff rates for the subareas (see Appendices A and B).

The guidelines outlined by USDA Soil Conservation Services TR-55 hydrologic models were followed while calculating the runoff curve number and time of concentration for each subarea. The runoff curve number (CN) is based on a weighted average of ground cover and soil type. Topographic maps, soils surveys and site visits were used to determine ground cover and underlying soils.

Time of concentration (Tc) represents the time it takes for surface runoff to travel from the hydraulically most distant point within the catchment area to the design point. Surface slope, roughness, channel slope and shape, flow patterns and runoff velocities are factors that directly affect the time of concentration. Runoff velocities are based on ground characteristics and flow type. Stormwater runoff flows through drainage areas as sheet flow, shallow concentrated flow, open channel flow or flow in storm sewers. Runoff begins as sheet flow in the upper limits of the subarea and can be characterized as flow over a broad surface area such as short stretches of grass and/or pavement. Sheet flow then gradually develops into shallow concentrated flow. Open channel flow or concentrated flow occurs when shallow concentrated flow converges into well defined ditches or storm sewers. The sum of each travel time over the individual surfaces within the subarea determines the time of concentration.

**Hydrologic Storm Events**

The USDA Soil Conservation Services TR-55 hydrologic model uses synthetic storm events when calculating runoff hydrographs. These synthetic storm events are based on statistical analysis of actual storm events for different durations over a broad geographical area. The Soil Conservation Services categorizes rainfall by distribution type associated to a geographical area, and by the total number of inches of precipitation that is assumed to occur over 24-hour duration.

The proposed project lies within the geographical boundary of Type II rainfall distribution area. The following table lists the rainfall depth for each particular design storm event to be analyzed.

**TABLE 1**
**RAINFALL DEPTH – DESIGN STORM EVENTS**
**GENESEE COUNTY (TYPE II DISTRIBUTION)**

| Design Storm Event | Total Rainfall Depth (Inches) |
|---|---|
| 1-Year | 2.1 |
| 10-Year | 3.6 |
| 100-Year | 4.8 |

**Hydrologic Analysis Results**

The following table summarizes the peak flows generated from the drainage catchment areas for the existing site for the various storm events (see Appendix A for computer calculations and results) in cubic feet per second (cfs).

**TABLE 2**
**RUNOFF - EXISTING CONDITIONS**

| WATERSHED/ SUBAREA | DRAINAGE AREA | 1-YEAR STORM EVENT | 10-YEAR STORM EVENT | 100-YEAR STORM EVENT |
|---|---|---|---|---|
| DA-1 | 706 acres | 233.05 cfs | 653.33 cfs | 1,024.76 cfs |
| DA-2 | 437 acres | 104.40 cfs | 318.25 cfs | 512.57 cfs |
| DA-3 | 103 acres | 30.06 cfs | 103.11 cfs | 172.09 cfs |
| DA-4 | 126 acres | 40.96 cfs | 141.85 cfs | 236.25 cfs |

## Developed Conditions

This evaluation will consider the STAMP project at full build-out and the impact that the development will have on the existing site. At Full Build-Out, approximately 6,130,000 square feet of building development will be required and approximately 9,330 employees are projected to occupy the site. This translates to an increase in impervious area of approximately 490 acres compared to existing conditions when considering the associated buildings, roads and parking lots.

Similar to existing conditions, under developed conditions the site has been divided into four distinct drainage catchment areas with associated design points as follows (see Appendix B-1).

- DA-1 - This subarea consists of 725 acres comprised of new buildings, parking lots and roadways. The subarea contains approximately 33 acres of existing wetlands, 127 acres of wooded area and approximately 347 acres of impervious area. The discharge from this subarea will be directed towards new stormwater management facilities by sheet flow and a new storm sewer system. The discharge outlets at the property line in the northwestern portion of the project site to Design Point 1 (DP1).

- DA-2 - This subarea consists of 465 acres comprised of new buildings, parking lots and roadways. The subarea contains approximately 66 acres of existing wetlands, 102 acres of wooded area and approximately 156 acres of impervious area. The discharge from this subarea will be directed towards a new stormwater management facility by sheet flow and a new storm sewer system. The discharge outlets at the western property line of the STAMP site at Design Point 2 (DP2).

- DA-3 - This subarea consists of 78 acres of agricultural land, residences and roadways. The subarea contains approximately 8 acres of wetlands, 4 acres of wooded areas and approximately 2.11 acres of impervious area. This drainage catchment area would remain mostly undisturbed from existing conditions. The discharge from this subarea is naturally directed towards the southwestern portion of the STAMP site by sheet flow to a swale and outlets at Design Point 3 (DP3).

- DA-4 - This subarea consists of 128 acres of agricultural land, existing residences, new buildings, parking lots and associated roadways. The subarea contains approximately 1.2 acres of wetlands, 20 acres of wooded area and approximately 32 acres of impervious area. The runoff from this subarea will be directed towards a new stormwater management facility by sheet flow and a new storm sewer system. The discharge outlets at the northeastern portion of the site near Lewiston Road at Design Point 4 (DP4).

**Stream Alterations**

Originally, unnamed streams #1 and #2 on the STAMP site joined at the wetlands located along the western boundary of the site. Under developed conditions, the existing flow path of the unnamed stream #1 will be disrupted due to the placement of the proposed buildings, parking lots and associated roadways. Therefore, the stream has been re-routed to discharge into unnamed stream #2 traveling through proposed drainage catchment area #2. This will allow both streams to continue to contribute to the offsite wetlands. All developed runoff within proposed drainage catchment area #1 is to be directed towards stormwater management facilities which will discharge into the existing wetlands located along the northwestern portion of the site. With the stormwater management facility discharge and the combined streams discharge, there should be no adverse impact on the existing wetlands that are located along the western boundary of the site.

**Evaluation Assumptions**

Due to the possibility of future alterations to the conceptual plan, the following assumptions have been used in the hydrology calculations used in this analysis:

- The time of concentration component used in PondPack to calculate drainage flow has been assumed to be 15 minutes (0.25 hours) for developed drainage catchment areas 1, 2 and 4. This is due to the large scale of the drainage areas and the lack of detailed information regarding proposed topography.
- Developed drainage catchment areas 1, 2 and 4 will all drain via runoff or new storm sewer systems to the new pond footprints. As the conceptual plan becomes more refined, the drainage areas may be altered and pond footprints may change in size and location.
- For developed conditions, all open green space will be considered maintained lawn area except for wetland areas, existing wooded areas, or proposed wooded areas.

**Hydrologic Analysis Results**

The following table summarizes the peak flows generated from the developed drainage catchment areas for the various storm events (see Appendix B-2 for computer calculations and results) in cubic feet per second (cfs).

**TABLE 3**
**RUNOFF - DEVELOPED CONDITIONS**

| WATERSHED/ SUBAREA | DRAINAGE AREA | 1-YEAR STORM EVENT | 10-YEAR STORM EVENT | 100-YEAR STORM EVENT |
|---|---|---|---|---|
| DA-1 | 725 acres | 809.38 cfs | 1909.57 cfs | 2826.11 cfs |
| DA-2 | 465 acres | 421.37 cfs | 1094.23 cfs | 1672.73 cfs |
| DA-3 | 78 acres | 17.90 cfs | 65.85 cfs | 111.59 cfs |
| DA-4 | 128 acres | 45.20 cfs | 188.05 cfs | 328.18 cfs |

**Stormwater Management Results and Requirements**

New development within the developed drainage catchment areas will require new stormwater runoff mitigation, including both quality and quantity practices. For this analysis, it is assumed that the primary stormwater mitigation measure will be pond-type facilities. The ponds will have a forebay and permanent pool to treat water quality and additional storage volume to treat water quantity.

By comparing peak flows generated from existing conditions and developed conditions, required pond volumes can be calculated using the PondPack software. The calculation is based on an estimation of the amount of storage required to mitigate developed stormwater flows to existing flow rates or lower. For this report, the worst case scenario of the peak flow

generated by the 100 year storm event is used for drainage catchment areas 1, 2 and 4. Due to the reduction of drainage area for catchment area 3 from existing to developed conditions, no pond storage estimates have been completed.

Table 4 summarizes the storage requirements for the stormwater management facilities for drainage catchment areas 1, 2 and 4. The calculations used are based on the flow rates given in Table 2 and Table 3 for the 100 year storm event. These results are shown in Appendix B-3 and the approximate pond footprints have been shown in Appendix B-1.

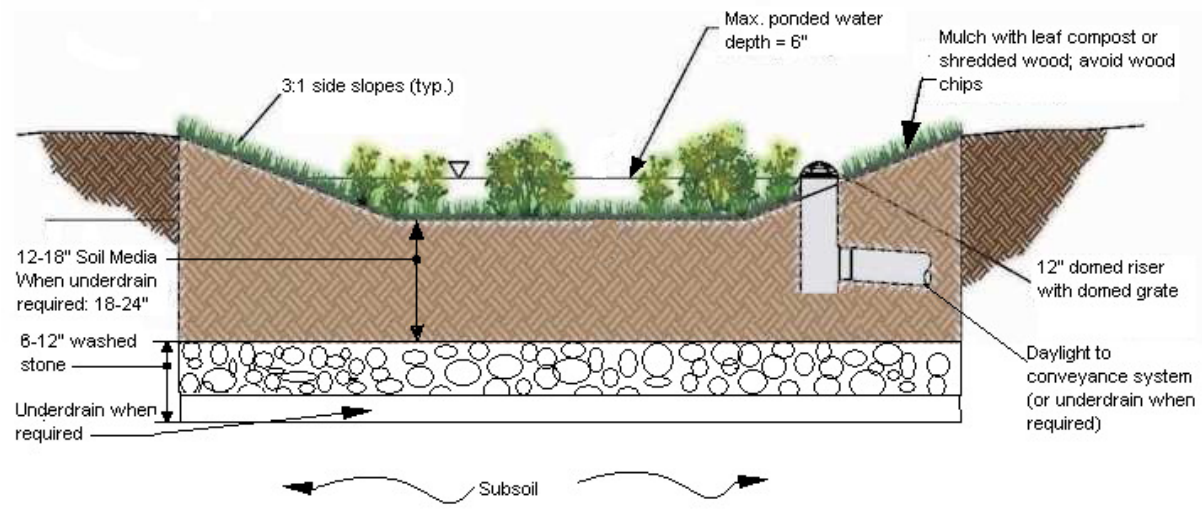
**TABLE 4**
**STORMWATER MANAGEMENT FACILITY STORAGE REQUIREMENTS**

| WATERSHED/ SUBAREA | STORAGE REQUIREMENT |
|---|---|
| DA-1 | 77.09 acre-feet |
| DA-2 | 47.58 acre-feet |
| DA-4 | 5.19 acre-feet |

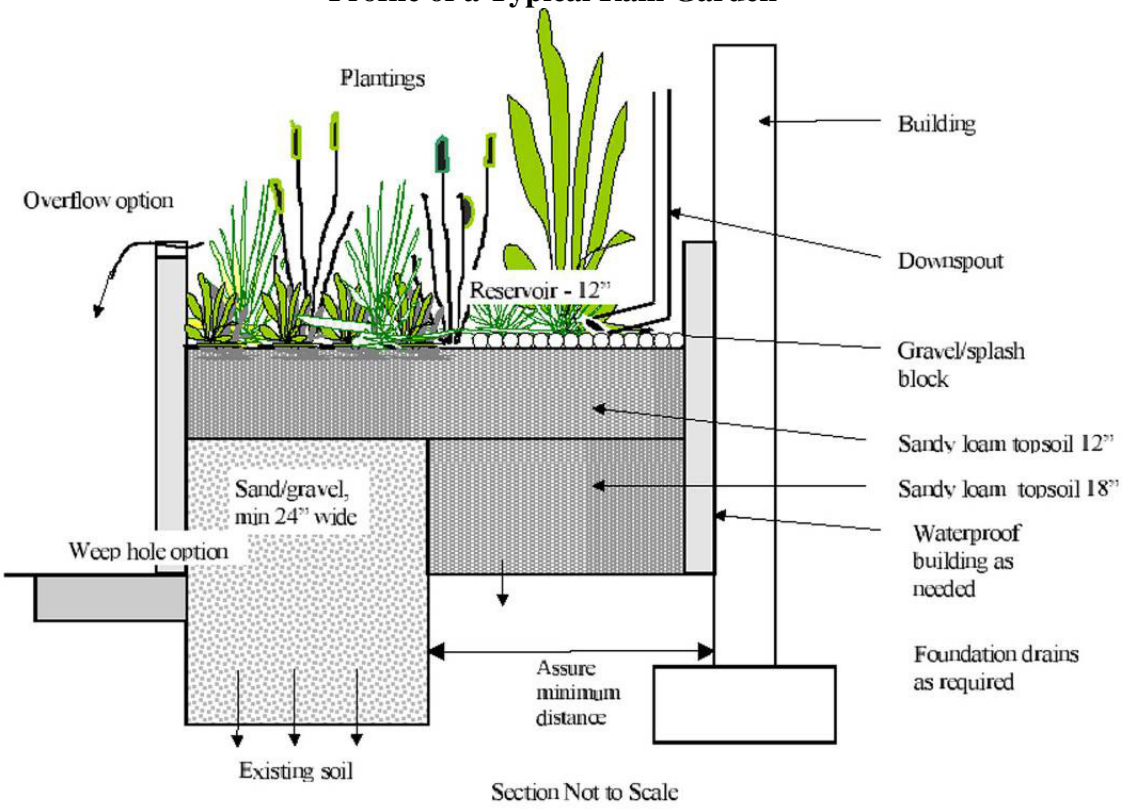
In addition to the primary stormwater pond facilities in each catchment area, point source treatment practices will also be implemented as required in the pending New York State Department of Environmental Conservation New York Stormwater Management Design Manual. Point source practices include rain gardens, stormwater planters and vegetated open swales.

Vegetated open swales are natural drainage paths which can be used instead of constructing underground closed storm sewers to increase the time of concentration, reduce the peak discharge, and provide infiltration. Rain gardens manage and treat small volumes of stormwater runoff using a conditioned planting soil bed and planting materials to filter runoff stored within a shallow depression. Stormwater planters are defined as small landscaped stormwater treatment devices that can be designed as infiltration or filtering practices. Stormwater planters use soil infiltration and biogeochemical processes to decrease stormwater quantity and improve water quality. Bioretention areas are defined as shallow stormwater basins or landscaped areas which utilizes engineered soils and vegetation to capture and treat runoff. The practice is often used at parking lots where stormwater can sheet flow into the swale.

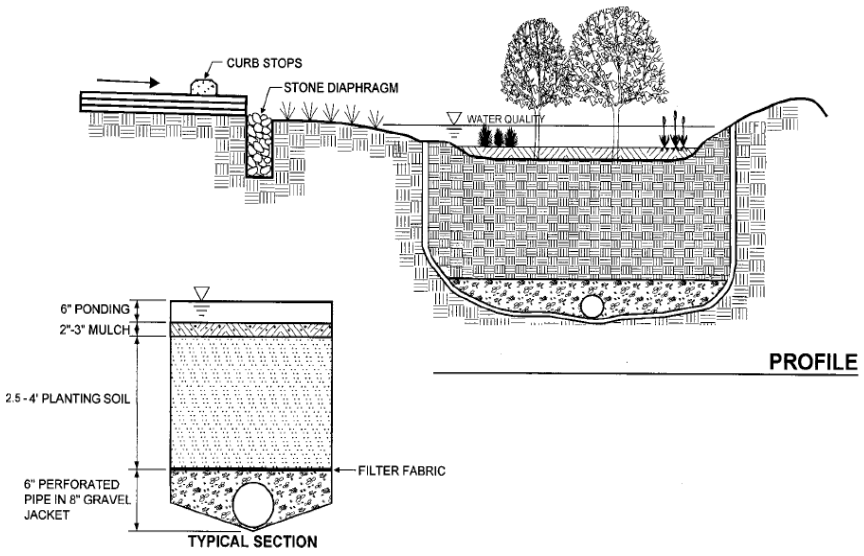
As the exact layout of the development is unknown at this time, the design and layout of the point source treatment practices cannot be clearly defined. However, buffer areas for these features have been reserved on the concept plan for future planning purposes. The following sketches from the New York Stormwater Management Design Manual show a typical rain garden profile, an infiltration stormwater planter and a bioretention swale for reference.




**Profile of a Typical Rain Garden**




**Typical Infiltration Stormwater Planter**




**Profile of Typical Bioretention Swale**

## Conclusions

The purpose of this Stormwater Management Preliminary Report is to evaluate the necessary improvements required to provide stormwater management for the STAMP project site. The project site consists of approximately 1,300 acres and is located along New York State Highway Route 77, approximately 5 miles north of the New York State Thruway. The project requires new stormwater management facilities to mitigate runoff created from the increase in impervious surfaces in development.

Under proposed conditions, drainage catchment areas 1, 2 and 4 will require stormwater ponds to mitigate the majority of the required water quality and quantity volumes. Catchment area 3 will remain essentially undisturbed. In addition, several point source treatments will be incorporated to improve water quality throughout the developed STAMP site.

For this analysis, worst case pond sizes were calculated for developed conditions. The point source treatment requirements improve infiltration and decrease runoff generated from development. Therefore, the size of the ponds will generally decrease as more of these practices are implemented.

The point source treatment practices include rain gardens for roof drainage, bio-retention swales or infiltration trenches for parking areas, and a variety of other practices. Buffers for these treatment practices have been incorporated into the overall conceptual plan for the project. As development occurs and more design details are available, additional stormwater studies and calculations will be required to determine more exact locations and sizing of associated treatment methods.

The final design and layout of the treatment practices will also assist in supplying water to the existing wetlands and streams on the STAMP site. By discharging treated stormwater from

these practices into the streams and wetland systems, the integrity of the systems will be maintained and even enhanced.

# APPENDIX A – 1:
# EXISTING SOILS MAP

Drawing Name: G:\OFFICE\CAD STANDARDS\ACAD\PROPOSED BORDERS\CIVIL\BOTTOM\CPA22X34.DWG Date: 04/27/01 Time: 10:28 am

Referenced Drawings: None

LEWISTON ROAD

PATTERSON ROAD (ABANDONED)

CROSBY ROAD

HAM ROAD

ALLEGANY ROAD

JUDGE ROAD

TONAWANDA INDIAN RESERVATION

1 INCH = 500 FEET

| REVISIONS | | | | |
|---|---|---|---|---|
| NO | DATE | BY | CHKED | DESCRIPTION |

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GENESEE COUNTY
ECONOMIC DEVELOPMENT CENTER

TOWN OF ALABAMA GENESEE COUNTY NEW YORK

DATE: 02/02/10
DRAWN: ARK
DESIGNED: ARK
CHECKED: TAC
SCALE: 1"=500'

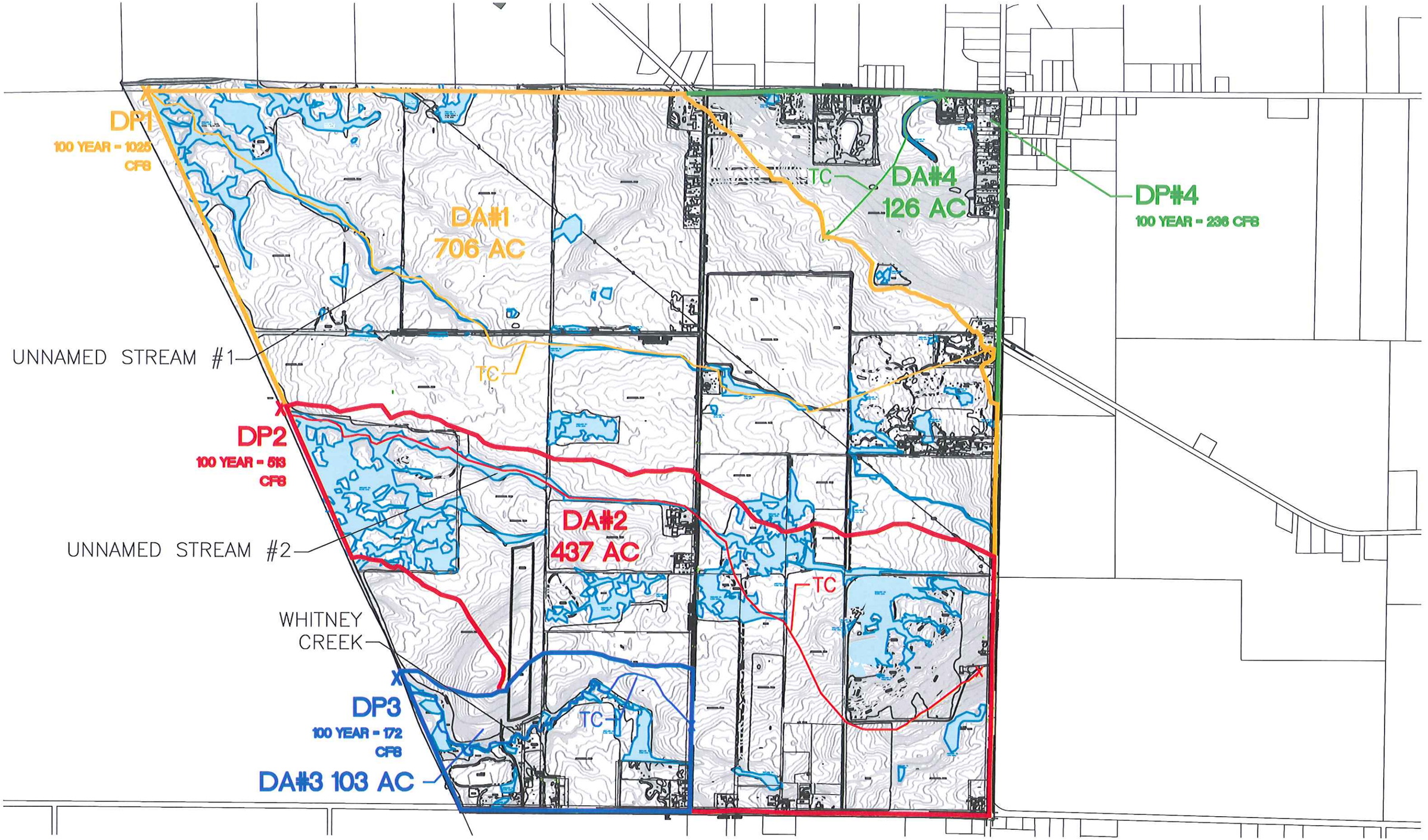
SCIENCE AND TECHNOLOGY
ADVANCE MANUFACTURING PARK (STAMP)

SOILS MAP

PROJECT NUMBER 11790.00

DRAWING NUMBER C-004

# APPENDIX A – 1:
# EXISTING DRAINAGE MAP




Drawing Name: G:\PROJECTS\GCEDC\STAMP\ACAD\CIVIL\STORM\STORM FIGURES.DWG Date: 03/08/11 Time: 08:23 am
Referenced Drawings: Aerial survey base alabama contours Aerial survey base Concept-PV

| REVISIONS | | | | |
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GENESEE COUNTY
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TOWN OF ALABAMA GENESEE COUNTY NEW YORK

DATE: 01/19/10
DRAWN: ARK
DESIGNED: ARK
CHECKED: TAC
SCALE: 1"=1000'

SCIENCE AND TECHNOLOGY
ADVANCED MANUFACTURING PARK (STAMP)

# EXISTING DRAINAGE CATCHMENT AREAS MAP

PROJECT NUMBER
11790.00

DRAWING NUMBER
D-001

# APPENDIX A – 2:
# EXISTING RUNOFF RATES
# FROM PONDPACK

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Genesee County

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Pre 1 | 2.1000 | Synthetic Curve | TypeII 24hr |
| Pre 10 | 3.6000 | Synthetic Curve | TypeII 24hr |
| Pre100 | 4.8000 | Synthetic Curve | TypeII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *DESIGN POINT 1 | JCT | 1 | 42.063 | | 12.5500 | 233.05 | | |
| *DESIGN POINT 1 | JCT | 10 | 109.681 | | 12.5500 | 653.33 | | |
| *DESIGN POINT 1 | JCT | 100 | 170.554 | | 12.5500 | 1024.76 | | |
| EXISTING AREA #1 | AREA | 1 | 42.063 | | 12.5500 | 233.05 | | |
| EXISTING AREA #1 | AREA | 10 | 109.681 | | 12.5500 | 653.33 | | |
| EXISTING AREA #1 | AREA | 100 | 170.554 | | 12.5500 | 1024.76 | | |

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Genesee County

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Pre 1 | 2.1000 | Synthetic Curve | TypeII 24hr |
| Pre 10 | 3.6000 | Synthetic Curve | TypeII 24hr |
| Pre100 | 4.8000 | Synthetic Curve | TypeII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| AREA #2 | AREA | 1 | 22.736 | | 12.8500 | 104.40 | | |
| AREA #2 | AREA | 10 | 62.486 | | 12.7000 | 318.25 | | |
| AREA #2 | AREA | 100 | 99.010 | | 12.7000 | 512.57 | | |
| *DESIGN POINT 2 | JCT | 1 | 22.736 | | 12.8500 | 104.40 | | |
| *DESIGN POINT 2 | JCT | 10 | 62.486 | | 12.7000 | 318.25 | | |
| *DESIGN POINT 2 | JCT | 100 | 99.010 | | 12.7000 | 512.57 | | |

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Genesee County

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| 1 | 2.1000 | Synthetic Curve | TypeII 24hr |
| 10 | 3.6000 | Synthetic Curve | TypeII 24hr |
| 100 | 4.8000 | Synthetic Curve | TypeII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *DESIGN POINT 3 | JCT | 1 | 4.307 | | 12.3500 | 30.06 | | |
| *DESIGN POINT 3 | JCT | 10 | 12.889 | | 12.3500 | 103.11 | | |
| *DESIGN POINT 3 | JCT | 100 | 21.036 | | 12.3000 | 172.09 | | |
| EXISTING AREA #3 | AREA | 1 | 4.307 | | 12.3500 | 30.06 | | |
| EXISTING AREA #3 | AREA | 10 | 12.889 | | 12.3500 | 103.11 | | |
| EXISTING AREA #3 | AREA | 100 | 21.036 | | 12.3000 | 172.09 | | |

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Genesee County

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Pre 1 | 2.1000 | Synthetic Curve | TypeII 24hr |
| Pre 10 | 3.6000 | Synthetic Curve | TypeII 24hr |
| Pre100 | 4.8000 | Synthetic Curve | TypeII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *DESIGN POINT 4 | JCT | 1 | 5.296 | | 12.3000 | 40.96 | | |
| *DESIGN POINT 4 | JCT | 10 | 15.850 | | 12.2500 | 141.85 | | |
| *DESIGN POINT 4 | JCT | 100 | 25.869 | | 12.2500 | 236.25 | | |
| EXISTING AREA #4 | AREA | 1 | 5.296 | | 12.3000 | 40.96 | | |
| EXISTING AREA #4 | AREA | 10 | 15.850 | | 12.2500 | 141.85 | | |
| EXISTING AREA #4 | AREA | 100 | 25.869 | | 12.2500 | 236.25 | | |

# APPENDIX B – 1:
# DEVELOPED DRAINAGE MAP

PROPOSED AREA #1
725 ACRES
TONAWANDA INDIAN RESERVATION

POND 1

POND 2

UNNAMED STREAM #2

POND 3

PROPOSED AREA #3
78 ACRES

LEWISTON ROAD

POND 4

NEW BYPASS ROAD

PROPOSED AREA #4
128 ACRES

HAM ROAD

SEWER LINE

RELOCATE UNNAMED STREAM #1 INTO UNNAMED STREAM #2

MAIN SITE ENTRY

RELOCATED STREAM

UNNAMED STREAM #1

PROPOSED AREA #2
465 ACRES

ALLEGANY ROAD - 77

PRESERVE WETLANDS

SECONDARY SITE ENTRY

JUDGE ROAD

JUDGE ROAD

LEGEND

ANTICIPATED POND SIZE FOR NEW CONCEPTUAL PLAN

ANTICIPATED BUFFER/GREEN SPACE

Drawing Name: G:_PROJECTS_GCEDC_STAMP_ACAD_CIVIL_STORM_STORM FIGURES.DWG Date: 03/08/11 Time: 09:44 am
Referenced Drawings: Aerial survey base alabama contours Aerial survey base Concept-PV

| REVISIONS | | | | |
|---|---|---|---|---|
| NO. | DATE | BY | CHKED | DESCRIPTION |


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GENESEE COUNTY
ECONOMIC DEVELOPMENT CENTER

TOWN OF ALABAMA GENESEE COUNTY NEW YORK

DATE: 01/19/10
DRAWN: ARK
DESIGNED: ARK
CHECKED: TAC
SCALE: 1"=1000'

SCIENCE AND TECHNOLOGY ADVANCED MANUFACTURING PARK (STAMP)

# DEVELOPED DRAINAGE CATCHMENT AREAS MAP

PROJECT NUMBER 11790.00

DRAWING NUMBER D-001

# APPENDIX B - 2:
# DEVELOPED RUNOFF RATES FROM PONDPACK

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Genesee County

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Dev 1 | 2.1000 | Synthetic Curve | TypeII 24hr |
| Dev 10 | 3.6000 | Synthetic Curve | TypeII 24hr |
| Dev100 | 4.8000 | Synthetic Curve | TypeII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *DESIGN POINT 1 | JCT | 1 | 55.913 | | 12.0500 | 809.38 | | |
| *DESIGN POINT 1 | JCT | 10 | 132.140 | | 12.0500 | 1909.57 | | |
| *DESIGN POINT 1 | JCT | 100 | 198.218 | | 12.0500 | 2826.11 | | |
| DEV. AREA #1 | AREA | 1 | 55.913 | | 12.0500 | 809.38 | | |
| DEV. AREA #1 | AREA | 10 | 132.140 | | 12.0500 | 1909.57 | | |
| DEV. AREA #1 | AREA | 100 | 198.218 | | 12.0500 | 2826.11 | | |
| POND 10 IN | POND | 1 | 55.913 | | 12.0500 | 809.38 | | |
| POND 10 IN | POND | 10 | 132.140 | | 12.0500 | 1909.57 | | |
| POND 10 IN | POND | 100 | 198.218 | | 12.0500 | 2826.11 | | |
| POND 10 OUT | POND | 1 | 55.913 | | 12.0500 | 809.38 | | |
| POND 10 OUT | POND | 10 | 132.140 | | 12.0500 | 1909.57 | | |
| POND 10 OUT | POND | 100 | 198.218 | | 12.0500 | 2826.11 | | |

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Genesee County

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Dev 1 | 2.1000 | Synthetic Curve | TypeII 24hr |
| Dev 10 | 3.6000 | Synthetic Curve | TypeII 24hr |
| Dev100 | 4.8000 | Synthetic Curve | TypeII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *DESIGN POINT 2 | JCT | 1 | 29.618 | | 12.0500 | 421.37 | | |
| *DESIGN POINT 2 | JCT | 10 | 75.293 | | 12.0500 | 1094.23 | | |
| *DESIGN POINT 2 | JCT | 100 | 116.010 | | 12.0500 | 1672.73 | | |
| POND 10 IN | POND | 1 | 29.618 | | 12.0500 | 421.37 | | |
| POND 10 IN | POND | 10 | 75.293 | | 12.0500 | 1094.23 | | |
| POND 10 IN | POND | 100 | 116.010 | | 12.0500 | 1672.73 | | |
| POND 10 OUT | POND | 1 | 29.618 | | 12.0500 | 421.37 | | |
| POND 10 OUT | POND | 10 | 75.293 | | 12.0500 | 1094.23 | | |
| POND 10 OUT | POND | 100 | 116.010 | | 12.0500 | 1672.73 | | |
| PROPOSED AREA #2 | AREA | 1 | 29.618 | | 12.0500 | 421.37 | | |
| PROPOSED AREA #2 | AREA | 10 | 75.293 | | 12.0500 | 1094.23 | | |
| PROPOSED AREA #2 | AREA | 100 | 116.010 | | 12.0500 | 1672.73 | | |

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Genesee County

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| 1 | 2.1000 | Synthetic Curve | TypeII 24hr |
| 10 | 3.6000 | Synthetic Curve | TypeII 24hr |
| 100 | 4.8000 | Synthetic Curve | TypeII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *DESIGN POINT 3 | JCT | 1 | 3.030 | | 12.4500 | 17.90 | | |
| *DESIGN POINT 3 | JCT | 10 | 9.350 | | 12.4000 | 65.85 | | |
| *DESIGN POINT 3 | JCT | 100 | 15.418 | | 12.4000 | 111.59 | | |
| PROPOSED AREA #3 | AREA | 1 | 3.030 | | 12.4500 | 17.90 | | |
| PROPOSED AREA #3 | AREA | 10 | 9.350 | | 12.4000 | 65.85 | | |
| PROPOSED AREA #3 | AREA | 100 | 15.418 | | 12.4000 | 111.59 | | |

MASTER DESIGN STORM SUMMARY

Network Storm Collection: Genesee County

| Return Event | Total Depth in | Rainfall Type | RNF ID |
|---|---|---|---|
| Dev 1 | 2.1000 | Synthetic Curve | TypeII 24hr |
| Dev 10 | 3.6000 | Synthetic Curve | TypeII 24hr |
| Dev100 | 4.8000 | Synthetic Curve | TypeII 24hr |

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

| Node ID | Type | Return Event | HYG Vol ac-ft | Trun | Qpeak hrs | Qpeak cfs | Max WSEL ft | Max Pond Storage ac-ft |
|---|---|---|---|---|---|---|---|---|
| *DESIGN POINT 4 | JCT | 1 | 3.902 | | 12.1000 | 45.20 | | |
| *DESIGN POINT 4 | JCT | 10 | 13.306 | | 12.0500 | 188.05 | | |
| *DESIGN POINT 4 | JCT | 100 | 22.665 | | 12.0500 | 328.18 | | |
| POND 20 IN | POND | 1 | 3.902 | | 12.1000 | 45.20 | | |
| POND 20 IN | POND | 10 | 13.306 | | 12.0500 | 188.05 | | |
| POND 20 IN | POND | 100 | 22.665 | | 12.0500 | 328.18 | | |
| POND 20 OUT | POND | 1 | 3.902 | | 12.1000 | 45.20 | | |
| POND 20 OUT | POND | 10 | 13.306 | | 12.0500 | 188.05 | | |
| POND 20 OUT | POND | 100 | 22.665 | | 12.0500 | 328.18 | | |
| PROPOSED AREA #4 | AREA | 1 | 3.902 | | 12.1000 | 45.20 | | |
| PROPOSED AREA #4 | AREA | 10 | 13.306 | | 12.0500 | 188.05 | | |
| PROPOSED AREA #4 | AREA | 100 | 22.665 | | 12.0500 | 328.18 | | |

# APPENDIX B – 3:
# DEVELOPED STORMWATER MANAGEMENT FACILITY SIZING FROM PONDPACK

## Results from PondMaker Design Wizard

### Drainage Area #1

| Return Event | Pre Development Peak (cfs) | Pre Development Volume (ac-ft) | Post Development Peak (cfs) | Post Development Total Volume (ac-ft) | Estimated Storage (ac-ft) |
|---|---|---|---|---|---|
| 1 | 233.0501 | 42.06333 | 809.3786 | 55.91289 | 22.96575 |
| 10 | 653.3347 | 109.68050 | 1909.5692 | 132.13973 | 52.48437 |
| 100 | 1024.7595 | 170.55349 | 2826.1130 | 198.21754 | 77.09568 |

### Drainage Area #2

| Return Event | Pre Development Peak (cfs) | Pre Development Volume (ac-ft) | Post Development Peak (cfs) | Post Development Total Volume (ac-ft) | Estimated Storage (ac-ft) |
|---|---|---|---|---|---|
| 1 | 104.4026 | 22.73566 | 421.3690 | 29.61770 | 12.42167 |
| 10 | 318.2548 | 62.48639 | 1094.2263 | 75.29288 | 31.19839 |
| 100 | 512.5728 | 99.00979 | 1672.7262 | 116.00961 | 47.58511 |

### Drainage Area #4

| Return Event | Pre Development Peak (cfs) | Pre Development Volume (ac-ft) | Post Development Peak (cfs) | Post Development Total Volume (ac-ft) | Estimated Storage (ac-ft) |
|---|---|---|---|---|---|
| 1 | 40.9574 | 5.29552 | 45.1964 | 3.90183 | 0.34652 |
| 10 | 141.8497 | 15.85024 | 188.0500 | 13.30571 | 2.80270 |
| 100 | 236.2541 | 25.86863 | 328.1760 | 22.66511 | 5.18763 |