Belleayre Mountain Ski Center UMP-DEIS

Appendix E
SWPPP – Stormwater Pollution Prevention Plan

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Belleayre Mountain Ski Center

Unit Management Plan

DRAFT

Appendix E

Stormwater Pollution Prevention Plan (SWPPP)

SWPPP Binder 1 - Table of Contents & Permanent Measures

prepared by

NYSDEC Bureau of Design & Construction

DRAFT

Draft Belleayre Mountain Ski Center
Stormwater Pollution Prevention Plan
March 2011

New York State
Department of Environmental Conservation
Division of Operations
Bureau of Design and Construction

625 Broadway
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Belleayre Mountain Ski Center
Stormwater Pollution Prevention Plan
2011

VOLUME I

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I. BACKGROUND INFORMATION (Part III.B.1.a.)

1. OVERALL PROJECT DESCRIPTION

1.1. Belleayre Mountain General Description

Belleayre Mountain Ski Center is a State owned recreation facility, located in the Town of Shandaken, Ulster County, NY. Operated by the New York State Department of Environmental Conservation, it provides year-round recreation opportunity. The facility is predominately on Forest Preserve land which has been classified as an Intensive Use Area in the Catskill Park State Land Master Plan. The Belleayre Mountain Intensive Use Area (excluding day use area) is located on 2,165.28 acres of state lands acquired as Forest Preserve (2,107.25 acres), special use (15.03 acres), and approximately 43 acres of Non-Forest Preserve. A Legal Description of the property boundary is included in the References section of this SWPPP: (Intended to meet DOP SWPPP Appendix A-3 Checklist item A.5)

For the Purposes of this SWPPP the Owner/Operator name, legal address and phone number are as follows: NYSDEC, 625 Broadway, Albany NY 12233, 518-###-#### (Intended to meet DOP SWPPP Appendix A-3 Checklist item A.1.)

Figure G4, titled "Overall Project Master Plan" is a Vicinity map showing the overall project boundaries.

SHPO documentation "that the project has no effect on property on or eligible historic registers" can be found in the UMP/DEIS Document "(Intended to meet DOP SWPPP Appendix A-3 Checklist item B.14)

1.2. Project Features General Description

As part of this project, a land easement area of approximately 30 acres, comprising the former Highmount ski resort is being considered as added to Belleayre. Plans for the construction of ski lifts, ski trails and their supporting infrastructure in this area, in addition to the traditional facility area are included within the scope of this project. The individual Belleayre Ski Center "Site areas" are encompassed within the boundaries of the overall property as described above.

The numerous Site Areas, which are being considered and discussed in this SWPPP, where <u>construction with</u> various associated levels of <u>site disturbance</u> is proposed, include:

- parking lot areas and access drives,
- ski trails, ski lifts, terminals, and snowmaking equipment
- snowmaking water pond with associated infrastructure, including pumping and water transmission lines,
- skier bridge crossing Overlook Road at Tomahawk,

- seasonal amphitheatre style seating area, and
- An enclosed parking area deicing materials storage facility.

For consistency, the areas where construction will occur will be referred to as follows:

Proposed Upper Discovery (UD) Parking Area
Existing Discovery Bus Parking
Existing Lower Discovery Parking Lots
Proposed North Parking
Proposed East Parking
Proposed Snowmaking Pond Area
Proposed Skier Bridge Area
Tomahawk Reception Lodge

2. PURPOSE AND SCOPE

2.1. DEC and DEP State Permitting

This UMP/EIS SWPPP has been prepared as part of permit application documentation for construction under individual SPDES permit coverage. Individual permit coverage is required instead of General permit coverage based on site conditions and determination by the department. These permit documents were initially prepared following along the provisions in NYSDEC GP-0-08-001 and the adopted February 2008, SEIS stormwater protocol. These were current and in effect at the time when the design commenced. Following the 2010 changes to the New York City stormwater regulations and the updated NYSSMDM, the stormwater management system designs for the Discovery Lodge Improvements and UD Parking Area were updated in an effort to show compliance with the new requirements. The stormwater systems for other site areas included in this SWPPP will be updated when design plans are completed, at the time of planned construction. This will allow for the designs to include up-to-date design features. The potential for stormwater regulations to change during the the ten year lifecycle of the UMP implementation is anticipated as is the ability to lessen the impact of the development.

The information provided herein is intended to be of sufficient detail and thoroughness to demonstrate compliance with the DEC and NYCDEP requirements as is typically required to receive permit coverage. As with similar highly specialized technical reports, engineering experience, education and a thorough understanding of stormwater hydrology and hydraulics, commonly utilized by a professional engineer should be applied to any judicious technical review of the data.

2.2. MS4 Permitting

The project is not located within the boundaries of a Municipal Separate Storm Sewer System as shown on the DEC interactive Stormwater Map at the time or this document preparation.

3. SWPPP MULTI-DOCUMENT FORMAT

The SWPPP is divided into a multi-volume set which includes the following:

- VOL I. SWPPP Permanent Measures Design Report

  Supporting documentation for design approach and for Permanent Measures for Stormwater Quality Treatment and Quantity Control including:
  - Hydrologic evaluation comparing pre to post-construction runoff
  - Design calculations as required for stormwater treatment practices
  - Post construction maintenance plan components

- VOL II. Construction Phase Erosion & Sediment Control Plan

Contains plans and procedures for documenting and controlling site disturbance
- Phasing of construction to control disturbed area size
- Construction Sequencing
- Location Plans and details of construction phase erosion control measures
- Owners Inspector Site Log
- Inspection forms for Temporary and Permanent Measures
- Draft NOIs, Draft NOTs

- CPE&SCP for Snowmaking Pond – included in VOL II Appendix

- UMP Drawings Under Separate Cover

- SWPPP for proposed Discovery Lodge Expansion Project. – included in Appendix I

4. SWPPP RESPONSIBILITY

This SWPPP has been prepared by the NYSDEC DOP Bureau of Design and Construction under the leadership of the SWPPP Engineer. The SWPPP provides stormwater management system design data for permit coverage at the time of UMP/DEIS preparation. The data include representative design details for both temporary erosion and sedimentation controls and permanent stormwater quality and quantity treatment systems.

Implementing the SWPPP will be made the responsibility of the Contractors retained by the Owner through contract documents. Some aspects of the construction work may be performed by department staff, such as trail clearing and establishing vegetation.

Inspection during construction of the stormwater treatment system, on the Owners behalf, will be the responsibility of the Construction Phase Owners Professional Engineer or Certified Professional in Erosion and Sediment Control. Some tools to be utilized are included herein such as the construction phase "Log Book" found in the Construction Phase E&SCP. Inspection of the construction of permanent Qlty&Qnty systems and Erosion and Sediment Controls will be conducted.

Inspection during construction, on the Contractor(s) behalf, will be required per contract documents.

II. EXISTING SITE CHARACTERIZATION

1. GENERAL SITE DESCRIPTION

The site is located a short distance from the intersection of State Route 28 and County Route 49a in the Town of Shandaken, Ulster County, New York. Proposed construction will occur in several distinct areas on the larger overall state property comprising the Ski Center Facility. The areas of proposed construction can separated into areas of intense construction and areas of what could be considered lesser scale in terms of site disturbance and impervious areas constructed.

2. SITE CONDITIONS (Part III.B.1.b.)

3. GROUND COVERS

The Overall Mountain is a combination of woodlands, grass covered ski trails, grassed lift areas and some impervious areas. Undeveloped forest area and the former Highmount ski resort. The elevation on the mountain varies from approximately 2,000 to 3,429 feet. The predominant forest cover on the Belleayre property is the northern hardwood type, typical for much of the Catskill Mountain region (reference).

The existing impervious areas cover a relatively small percentage of the overall mountain and include:

- Asphalt paved and crusher run gravel covered vehicle parking areas.
- Roofs on facility buildings, their exterior decks and slabs.
- Service roads to the lodges and parking lots.

3.1. TOPOGRAPHY

Current topographic mapping of the Mountain was developed from aerial photographs taken in May of 2008. The elevation of proposed construction areas range from approximately 1890-ft at the proposed Information Building near route 28 up to approximately 3375 ft along the mountain ridge in the southeast corner of the property.

SCS defines their "E" soils as 25-35% and "F" soil slopes as greater than 35%. These slopes are found in the upper elevations of the mountain.

Updated topographic mapping for the mountain was prepared as part of this project. The following paragraph discusses that data.

> Reference: May 24, 2008 topographic mapping prepared James W. Sewall Company from 1"=1200' Scale, Black and White Aerial Photographs dated April 17, 2008, using photogrammetric methods. Ground control supplied to Sewell by NYSDEC R3 Land Surveyor in New York State Plane NAD83 and Vertically NAVD88. Map indicates it meets the National Map Accuracy Standards for 1"=200' maps with 5' contours.

Further discussion on existing site topography can be found in UMP Section 4.2, included in Appendix F.

3.2. CULVERT INVENTORY

Existing culvert data are tabulated on Figure EX16. Replacement of culverts was occurring during 2008 along County Route 49a, after the department data were collected. The culvert inventory data along County Route 49a, from Culvert 1.2H west was reconciled with adjacent area data obtained by the LA Group, subsequent to the roadwork, and shown in the culvert table on EX16.

3.3. RECEIVING WATERS - STREAMS

3.3.1. Watershed

The Ski Center site is located in both the Pepacton and Ashokan reservoir watersheds. The divide between the watersheds of the Pepacton Reservoir to the West and the Ashokan Reservoir to the East, passes nearly through the middle of the site and the 8-Digit Hydrologic Units are the East Branch Delaware River and the Mid-Hudson River respectively (see E&E Figure 3-2, in section #). Neither the Pepacton or Ashokan Reservoirs are in Phosphorous or Coliform restricted Watersheds. NRCS HUC-11 mapping shows the site within the Upper Esopus and Pepacton reservoir watersheds where they are identified as AA&AA-S Watersheds. The site is at the upper end of the overall Upper Esopus watershed, which is relevant to "big picture" stormwater peak flow timing. The DEC Interactive map shows the entire site within an AA-AAS watershed.

The Ashokan Reservoir is on the NYSDEC's May 17, 2007 303(d) list under the category "Silt /Sediment" with the source listed as "stream bank erosion".

3.3.2. Stream System

General

The criteria in GP-08 Part I..D.7.b are met by the on-site streams listed below. They range in Classification from class B to C, with none as AA or AA-S in the MHDB Water Quality Classifications Coverage and they do not appear to be shown on the HUC-11 Map as AA or AA-S streams.

With regard to proposed flow attenuation, the streams originating on-site can be considered as first order streams, where they are located on-site.

Streams in the Ashokan Watershed
The proposed Upper Discovery Parking, North Parking, Skier Bridge Area, and the Snowmaking Pond Area are in the Crystal Brook watershed. Crystal Brook flows to Birch Creek which flows to the Esopus near Big Indian, then to the Ashokan Reservoir. Streams on the East side of the site include the Crystal Brook and the Cathedral Glen. Crystal Brook is shown on the DEC interactive map with a "B(T)" stream classification. Cathedral Glen is shown on the same map with a "C" stream classification. These are also labeled and shown on Figure EX17.

Streams in the Pepacton Watershed

The off-site Emory Brook accepts stream flow from the West portion of Belleayre. Flow from the Vly creek (former lake Switzerland dam location) is added, further downstream the flow enters Dry Brook and then flows to the Pepacton Reservoir. The runoff from the Belleayre site is conveyed north through several culverts that cross under County Route 49A. One "Unnamed" stream is shown on the DEC interactive map with a "B" stream classification. The stream crosses 49A approximately 2000-ft west of the intersection with Overlook Road.

Proposed Ski lift terminals and trails are located in this watershed area. This stream is also shown and labeled on Figure EX17.

3.3.3. Stream Channel Roughness and Geometry

Figure EX17 includes a table listing properties of existing culverts located for stormwater modeling data. The approximate location and properties of culverts located along County Route 49A were field determined beginning on February 7, 2008. Project Plans for the 2003 Overlook Road reconstruction project were used for the approximate location and properties of culverts located along the road. These were subsequently field verified on February 15, 2008. The box culvert at the railroad was observed during a 2008 site visit. Local municipal culvert

replacement work along 49A occurred during the 2008 construction season, revised culvert data were obtained by LA Group along the west extent and provided to DEC.

Field measurements and photographs were taken, documenting the condition of Crystal Brook at the proposed ski trail crossing(s)

3.4. IDENTIFIED WETLANDS

Federal wetland areas labeled W12 and W13 have been identified and reported (E&E 2009a) near the locations of proposed East and North parking areas respectively. The boundaries of these wetlands and Buffer Distances are shown on the Proposed Parking - Grading & Drainage UMP Drawings for each parking area.

3.5. SOILS DESCRIPTION

3.5.1. Soil Conservation Service Characterization

The United States Department of Agriculture (USDA) Soil Conservation Services (SCS) Soil Survey of Ulster County provides surficial soil conditions for the study area. The SCS identifies primarily Arnot, Lackawanna, Oquaga and Wortsboro soils in the areas of proposed intense development. Soil data compiled from the SCS survey, including the HSG's (DEC Part III.B.1.c) are presented in Table 1.

Most of the upper site is shown to have Arnot and Oquaga soils. Both are of moderate permeability, runoff is very rapid. The hazard of erosion is high when vegetation is removed.

The soils located in proposed snowmaking pond and parking areas are LCD, LCF and WLB. Large Stones and Slope are listed in the SCS Surveys Table 11 as issues for LCD and LCF. WLB is listed as favorable for pond reservoir areas and large stones are identified in the SCS Survey Table 11. These soils have permeability rates less than 5 inches per hour. This low permeability doesn't meet the NYSSDM criteria of 2 inches per hour for proposing infiltration stormwater treatment practices.

Soil Conservations Service soils boundaries are shown on the Stormwater Management System Maps for each Intense Development Area and on the Existing Conditions Site Watershed map. Some of the upper mountain area Soils have E and F designations.

For a review and discussion of current and historic soils investigation data, see the NYSDEC UMP section, Geologic and Topographic Resources.

SCS Bedrock Information

SCS characterizes the Catskills Mountain region bedrock geology as "near horizontal bedded Devonian sandstones, siltstones and shales. Bedrock was not encountered in any of test pits excavated, which are discussed below. Bedrock types are shown on the NYSDEC UMP Drawings.

3.5.2. Subsurface Investigations

Subsurface Boring Project

A subsurface boring project was conducted during the preparation of the SWPPP. Pertinent information from the associated report are included in Appendix G. Subsurface Investigation in the Proposed Pond area included three deep test pit excavations, five soil borings, bedrock cores, field and laboratory soil testing.

Historic and modern subsurface investigations have been conducted on the site. The locations of test pit and borings conducted are shown on UMP Drawings EX19 through EX25 for each IDA and historic subsurface investigation area.

DEC Geological investigation

Section 4 of the UMP includes documentation and descriptions of the conditions observed during a site-wide IDA subsurface investigation conducted by a Department geologist for this project. The investigation correlated the boundaries shown on the NRCS soils maps with field conditions observed. Numerous deep test pits were excavated in addition to hand excavations. No evidence of a seasonal high groundwater table was noted in the deep test pits. Logs for the excavations are included in Appendix F.

Infiltration Testing

Field soil infiltration testing was performed at two locations in the Upper Discovery Parking Area. These areas are labeled as PERC 1 and PERC 2 shown on drawings in Appendix G. One location was chosen to determine infiltration within a DSW and another to determine infiltration beneath a SSF. Test results showed that 5/8(0.625)" per hour can be used for design in the LEE soil area of PERC1 and 3.75" per hour can be used design in the WLB soil area of PERC 2. A copy of the test results for these two locations, noted as P-1 and P-2 is included in the Appendix G.

Additional infiltration testing will be performed in areas of Porous Asphalt (PA) pavement and other areas where infiltration practice criteria in NYSSMDM10 require it. This will be done to confirm the existing data when construction plans are prepared, and the SWPPP is updated, prior to construction.

4. EXISTING RUNOFF CHARACTERISTICS (Part III.B.1.b)

4.1. General

The Belleayre site can be separated into four aggregate subcatchment areas based on where drainage flow exits along the property boundaries.

In the Ashokan Drainage Area:
1-Areas where drainage flows through the culvert crossing under the Catskill Mountain Railroad embankment
2-Areas where drainage passes through culverts under Van Loan road
3-Areas where drainage flows to the stream below the Cathedral Brook snowmaking water impoundment.

In the Pepacton Drainage Area:
1-Areas where drainage crosses CR49A

4.2. Subcatchment areas affected by IDA construction

Drainage Area #1 above: Approximately 340 acres, flows through box culverts under the Catskill Mountain Railroad to the north of the Cathedral Glen reservoir discharge.
Drainage Area #2 above: Approximately 15 acres, flows through three culverts under Van Loan Road, to the adjacent wetland area.

5. EXISTING STORMWATER MANAGEMENT PRACTICES IN USE

There are currently systems located at the Maintenance Building and at the service drive to the existing Tomahawk parking lots. The available hydraulic design data for the Tomahawk SSF were input for an upland subcatchment associated with the proposed upper discovery parking area.

6. PRE-DEVELOPMENT STORMWATER MODEL DEVELOPMENT - HYDROLOGIC AND HYDRAULIC ANALYSIS (Part III.B.2.e)

General discussion of model development is provided in this section; detailed discussion of design points is in Section III.

A commercially available computer program was used to compare pre-to-post development conditions. The particular model used was selected based on stipulations in the SEIS. The SCS Unit hydrograph method with Aspects of both TR-20 and TR-55 are utilized by the program. The program produces detailed printouts of data input and output to facilitate documentation of the modeling. Printouts representing the Computer Analysis Performed are included in

Appendix A. The first in the series of model results printouts has been labeled to assist engineers interpreting the data.

III. PLANNED SITE CONSTRUCTION

1. SITE AREAS CONSIDERED IN THIS SWPPP

This section presents general discussion of the footprints of each area where stormwater Qlty/Qnty treatment methods are proposed. The general locations of these areas are shown on the Overall Project Master Plan, Figure G4.

1.1. LIFT AND TRAIL CONSTRUCTION

1.1.1. Ski Trail and Appurtenance Construction

These Trails will have Construction Phase Erosion and Sediment Controls. This project will involve the cutting of trees within the limits shown on the plans and will include the complete grubbing of all stumps within the clearing limits. Permanent erosion control measures will include establishing a permanent stand of grass in all new trail areas, as well as construction of water bars or similar stone lined channels to divert runoff into the woods at intervals. This construction is described in the CPE&SCP.

1.1.2. Lift Line Corridor Construction

Construction of the lift line corridors will involve cutting trees to provide a 60' wide area with sufficient clearance. The proposed lift lines will have tree stumps cut as close as possible to the ground, while not actually grubbing them out. The trees will be chipped on-site as close as possible to their original location to minimize disturbance to the ground cover. The chips will be spread over the lift corridor area to control erosion in areas disturbed by construction equipment. This construction is described in the CPE&SCP.

1.1.3. Lift Terminal and Skier Staging area Construction

This construction is described in the CPE&SCP.

1.1.4. Skier Bridge Area

This construction is described in the CPE&SCP.

1.1.5. Ski Trail Stream Crossings

Two crossings are proposed. This construction is described in the CPE&SCP.

1.2. PARKING LOT AREAS

1.2.1. Upper Discovery Parking

This area includes four tiers of proposed parking and associated service drives, located west of the Discovery Lodge Entrance and Discovery Lodge Bus Parking Lot. Access to the parking area is off of CR 49A. Proposed parking is shown on UMP Drawing PK1 for 336 stalls, distributed over the four terraced lots.

1.2.2. North Parking

This area includes two tiers of proposed parking and an associated service drive, located east of the Discovery Lodge Entrance and west of the two existing Discovery Lodge lower parking Lots. Access to the parking area is off of CR 49A. Proposed parking is shown on UMP Drawing PK5 for 186 stalls, distributed over the two terraced lots.

1.2.3. East Parking and adjacent Information Building Parking

This area includes three tiers of proposed parking and associated service drives, located immediately south of the intersection of CR49A and Van Loan Road, and a lower elevation (information building) parking area on the opposite side of Van Loan Road, near the same intersection. Proposed parking is shown on UMP Drawing PK7 for 164 stalls in the terraced area and 21 stalls in the lower lot.

1.2.4. Parking adjacent to Skier Bridge

Construction of the Skier Bridge in the existing Tomahawk parking lot area will reduce the existing parking capacity by approximately [ ] stalls. The current potential parking of [ ] stalls will be reduced to [ ] stalls in the configuration as shown on UMP Drawing [ ]. Runoff from this area is and will continue to be collected and conveyed to the nearby existing SSF for treatment.

1.2.5. Parking adjacent to Compressor Building

Construction of the Compressor building within the footprint of the uppermost existing Tomahawk parking lot area will reduce the existing potential parking capacity by approximately [ ] stalls. Runoff from this area is and will continue to be collected and conveyed to the nearby existing SSF for treatment+.

1.3. BUILDINGS

1.3.1. Discovery Lodge and vicinity Site Improvements

SWPPP Documents prepared for site improvements in the vicinity of the Discovery Lodge are under separate cover in Appendix I.

1.3.2. Amphitheatre Area

1.3.3. Summit Lodge Expansion

1.3.4. Tomahawk Base Area Lodge

The proposed building will have perimeter gravel drainage system to collect roof runoff and a foundation drainage system that convey flow by gravity through an underground piped system to daylight and ultimately to the nearby existing SSF system for quality treatment.

1.3.5. Compressor Building

The proposed building will have perimeter gravel drainage system to collect roof runoff and a foundation drainage system that convey flow by gravity through an underground piped system to daylight and ultimately to the nearby existing SSF system for quality treatment.

1.3.6. Proposed Information Building/Booth

1.4. SNOWMAKING POND

1.5. UNDERGROUND UTILITIES

2. AREAS FOR CONSTRUCTION PHASE EROSION CONTROLS AND AREAS WITH PERMANENT STORMWATER TREATMENT SYSTEMS IN ADDITION

This section reviews each individual site area and the proposed approach, CPE&SCP only or full SWPPP applying GP-08 criteria.

The design of stormwater management features for the site is based on applying current NYS and NYC stormwater management criteria. These include NYSDEC GP-08-01 permit (NYSDEC, 2008) and pertinent NYCDEP (reference to NYCDEP Section 18-39.) regulations.

NYSDEC GP-0-08-001, Appendix B, Tables 1 and 2 differentiate between some construction project types that require the preparation of a SWPPP that only includes CPE&SCPs and those that require a full SWPPP, including post-construction stormwater management practices. A similar approach was applied to this project to categorize some of the proposed construction features. Table 4 and 5 show the proposed project features in a side-by-side comparison with Construction Activities from Tables 1 and 2 respectively. As an example: Where proposed buried utilities, such as snowmaking pond water lines will require trenching, backfilling and re-vegetation, yet create no additional impervious area, CPE&SCP treatments are proposed.

2.1. CPE&SCP Coverage Areas

Site areas where grading and re-vegetation will occur are included in this category as are areas where small isolated impervious areas will be created. Some components of site construction will occur in numerous non-contiguous areas. Each area will have individual design attention

given to construction phase erosion and sediment controls. Areas that will have a change in the type of vegetative cover where no impervious area is created are also included in this category.

- Some of the areas of proposed construction will have no increase in impervious surfaces, such as where underground utilities are going to be installed by trenching, backfilling and re-vegetating.

- Some areas where existing trees will be removed in order to construct and provide clearance for skier lifts will not undergo overall grading and revegetated with grass, but will be allowed to naturally fill in with brushy type growth. This growth can then be maintained as a dense cover with equipment suitable for trimming brush and woody vegetation. The change in cover types causes a potential change in hydrology from pre to post constructions to be considered. Areas disturbed by vehicular access will be stabilized.

- New grassed ski trails will create formerly wooded areas replaced with grassed areas. Although there is no additional impervious surface area, the change in cover types causes a potential change in hydrology from pre to post constructions to be considered.

- Some areas will have additional "small scale" impervious surfaces created. These include the lift terminal roofs, service slabs, tower footings if exposed at the surface. Design will include features to diffuse the localized runoff and not create concentrated erosive flows. Areas disturbed by vehicular access will be stabilized.

- Two Stream Crossing bridges are proposed, one for the Deer Run Extension Trail and a second for the trail to the base of the proposed Belleayre West Lift. These both cross

- The Proposed Snowmaking Pond area will be revegetated with the exception of areas where water is impounded.

2.2. Full SWPPP Areas

The need for, and design of post-construction stormwater management practices was determined for the individual areas of proposed construction disturbance on the site. The following areas have proposed permanent stormwater treatment systems constructed.

- The three proposed parking areas will have stormwater Qlty/Qnty treatment systems.

- The Discovery Lodge expansion will have addition building roof area and service driveway areas. The proposed impervious areas associated with the expansion are treated in an adjacent stormwater treatment system. The system specific design report is included in Appendix I.

2.3. Full SWPPP Green Infrastructure Area

The Proposed Upper Discovery Parking area was designed applying 2010 changes in the NYSSMDM and 2010 NYC regulatory changes.

2.4. Reconstructed Areas

Some areas will have Retrofitted stormwater pretreatment systems installed, with no associated increase in impervious area. The two existing lower discovery parking lots lend themselves to installing centrifugal separation type pretreatment units to treat the runoff from this area before if flows to Crystal Brook.

Some of the project areas will involve redevelopment of existing facilities and use of existing stormwater treatment systems.

- The Skier Bridge Area will have some existing impervious pavement area removed and replaced with vegetation.
- The Tomahawk Reception Lodge roof will drain to adjacent gravel areas. Sidewalks will drain to an underground system.
- The Uppermost Tomahawk Parking area will have a building for snowmaking air compressors constructed within its footprint.

An additional area where impervious surface will be constructed is the proposed Amphitheatre seating area.

- The Overlook Lodge Expansion will have additional Roof area and a slab area installed to service the portable amphitheatre.

3. DESIGN RAINFALL EVENTS AND RUNOFF

3.1. NYSDEC EVENTS

3.1.1.1. NYSSMDM 2008

The NYSSMDM, TP-40, based storm events used to design of the stormwater management facilities, and prepare the Erosion and Sediment Control Plan, were identified during scoping, and are listed in (NYSDEC 2008) The events are summarized in Table 2 below. Soil Conservation Service (SCS) Type II synthetic rainfall distributions were used for the site. These were applied to site locations except as described below.

3.1.1.2. NYSSMDM 2010

The 2010 changes to the NYSSMDM include calculation of a RRv based on the WQv associated with the 90% storm. These were applied to the to the UD Parking Area and Discovery Lodge area.

RRv Treatment Requirement
For this UMP SWPPP, treating the 90% storm based rainfall WQv and RRv event are considered sufficient to meet the DEC requirement for water quality and runoff reduction in this west of hudson, non-phosphorous-restricted location.

RRv Credit for Exceeding Treatment Required

The 1-year 24-hr storm event is treated in order to meet the DEP requirements for water quality volume treatment identified below. The percentages of partial RRv credit for SMPs are applied to the runoff volume from the WQv 1yr storm where SMPs are designed to treat the 1-year storm. The DEC promotes infiltration of the 1 year storm where practicable, stating in NYSSMDM10:

> " Reduction of water quality treatment volume is a requirement and reduction of water "quantity" volumes associated with channel protection (Cp_v) is encouraged, where soil conditions allow. (pg 4-6)" and,
>
> "Reduction of runoff for meeting stream channel protection objectives, where site conditions allow, is encouraged and the volume reduction achieved through green infrastructure can be deducted from CPv"

NYSSMDM10 pg 4-7, states that the Cpv requirement does not apply in certain conditions, including the following:

> "• Reduction of the entire Cpv volume is achieved at a site through green infrastructure or infiltration systems."

RRv credits based on percentages of the WQv were applied using the 1-year 24-hour storm where it is used for the calculated WQv to a particular treatment practice. As a result, applying the 20% DSW, in C soils, credit to the 1 year storm, generally results in a greater volume than the 90% storm and RRv credit is increased.

3.2. NYCDEP EVENTS

NYSDEC 2008 Includes considering the 25 year NYCDEP event. NYCDEP refers to the 25-year event in (NYCDEP 18-39) where Section 18-36 "Wastewater Treatment Plants" (f)(5)(ii) states:

> "All vital plant structures, mechanical and electrical equipment of new or existing wastewater treatment plants located or designed within the 100-year flood plain shall be protected from damage from a 100-year flood that may affect or disrupt its function or

general performance. Such structures and equipment shall remain fully operational in a 25-year flood."

NYC also refers to the 25-year storm in (NYC, 1998) where Section 128-3.9 "Stormwater pollution prevention plans and impervious surfaces" (c)(4) states:

> "All stormwater pollution prevention plans prepared pursuant to this section shall include an analysis of the 25-year storm."

3.2.1.1. NYCDEP 2010 STORMWATER REGULATION CHANGES

The NYC Stormwater regulations of 2010 that affected the design of the UD Parking Area are cited below. Design modifications applied to address the regulations are in italics.

NYCDEP's §18-39 (c)(3) Stormwater Treatment Volume. All stormwater pollution prevention plans prepared pursuant to this section shall include measures to capture and treat the greater of the volume of runoff generated by the 1-year, 24-hour storm or the Water Quality Volume (WQ_v). Stormwater management practices which provide treatment shall be designed to accommodate the quantity of runoff flowing to the stormwater management practice, including runoff from off-site areas.

The UD Parking Area water quality treatment practices have been sized to treat the 1-year storm based WQv. The Storage Volumes needed are calculated using NYSSMDM10 Appendix B methods. . Design calculations Table UD-2# shows the data.

NYCDEP's §18-39 (c)(6) states" If an activity requiring a stormwater pollution prevention plan will result in impervious surfaces covering twenty percent (20%) or more of the drainage area for which a stormwater management practice is designed, the stormwater pollution prevention plan shall provide for stormwater runoff from that drainage area to be treated by two different types of stormwater management practices in series, except that only one stormwater management practice is required if either:"

> (i) the stormwater management practice provided is a stormwater infiltration practice; or
>
> (ii) the activity requiring a stormwater pollution prevention plan is in the West of Hudson watershed within a village, hamlet, village extension, or area zoned for commercial or industrial uses or in the East of Hudson watershed within a Designated Main Street Area.

The use of porous asphalt pavement infiltration practices in the UD Parking Area reduces the impervious surfaces such that they are <20% in the individual subcatchments to the water quality treatment practices. Design calculations Table UD-2B shows the data.

3.3. RUNOFF COEFFICIENTS

For existing and proposed forested areas, Manning's numbers associated with dense underbrush were used in sheet flow calculations. References such as the State of Indiana Design Manual, Chapter 29, suggests that in selecting n for "Woods: Dense Underbrush", "consider cover to a height of about 12 in. This is the only part of the plant cover that will obstruct sheet flow." The existing cover and duff layer in the woods should support the application of this n. In areas where additional light will be available in the understory area, vegetative cover should increase. A representative area was observed during a June 5, 2008 site visit, when grass conditions near the toe of the steeper Peekamoose trail section and the adjacent forested area were observed. The following Photographs were taken:

Photograph 1 - Forest area adjacent to Peekamoose 1 of 2.

Photograph 2 - Forested area adjacent to Peekamoose 2 of 2.

Photograph 3 - Peekamoose Grass Cover in Trail Area.

For weighing CN coefficients the following values were generally used.

70 Grassed areas

74 Wooded areas
98 Impervious areas
100 Large water body

For calculating Tc values, the following cover types and N values were generally used.

SHT Flow across parking/pavement: Smooth Surfaces N=0.011
SHT Flow in grassed areas: Grass: Dense N=0.24
SHT Flow in forested areas: Woods Dense Underbrush N=0.8

SCF in Grassed areas: Short Grass Pasture, Vf=7.0
SCF in Forest/Wooded areas: Forest w/Heavy Liter, Vf=2.5 FPS could be Woodland Vf=5

OCF along existing Overlook Road drainage ditch, 49A : Earth Clean and Winding N=0.025
OCF Reach along existing 49A : Earth, cobble bottom, clean sides N=0.04

OCF in Crystal Brook Above UD Parking Area: Mountain Stream N=0.040

OCF in Tomahawk Parking constructed swales, light stone, N=0.035
OCF in Closed SICPP Pipe: N=0.013
OCF in Parking Areas conveyance swales to DSW "earth, grassed & winding: N=0.030
OCF in Upper Discovery Parking Upland Diversion Swale, "earth, grassed & winding: N=0.030
OCF in East Parking side slope conveyance channel: N=0.
OCF in East Parking swale to DV1 diversion to SSF Forebay 1, N=0.

OCF – REACH Node, for reaches through woods use wide shallow rectangular channel 50'x1', N=0.040

4. STORMWATER MANAGEMENT PRACTICES SELECTION

This section considers the types of treatment systems available, benefits of each and other criteria that need to be considered during design

4.1. EXISTING CONDITIONS THAT PRESENT TREATMENT CONSTRAINTS

4.1.1. Soil Permeability

Infiltration tests were performed at two locations in the proposed UD Parking Area. One location was selected to represent the conditions below the UD dry swales and UD pervious pavement areas. A second location was selected to represent the conditions below the proposed UD surface sand filter. The NYSSMDM10 Appendix D protocol was followed by the engineering firm performing the test and test location and results infor area included in Appendix

G. The testing results show infiltration rates greater than 0.5” per hour in both locations. It is recognized that additional confirmation testing be needed before the construction plans are completed and the SWPPP finalized. Field percolation tests in the 12 or so additional locations required by Appendix D will be performed.

4.1.2. Post Development Thermal Impacts

The proximity of the site to Trout streams and potential for thermal impacts are considerations in the handling of runoff. The Channel Protection criteria require center-of-mass 24 hour extended detention of the post-development 1-yr 24-hour storm event (3.5" Rainfall). On (NYSSMDM page 4-5), the Department indicates that Trout waters may be exempt from the 24-hour Extended Detention requirement with only 12 hours of ED provided to meet the criteria.

The (NYSSMDM page 6-9) suggests that the use of stormwater ponds (with the exception of Micropool Extended Detention Ponds) on trout waters is strongly discouraged; as available evidence suggests that these practices can increase stream temperatures.

Design guidance (NYSSMDM page 6-27) states that the use of stormwater wetlands on trout waters is strongly discourage as available evidence suggests that these practices can increase stream temperatures.

4.1.3. Potential Future Phosphorus Removal Criteria

GP-08 Part III.B.3. specifies projects where Enhanced Phosphorous Removal design criteria apply. Based on the criteria presented, the site does not require post construction management practices for Phosphorus removal. Proposed DSW, SSF and BTS systems may be adaptable to meet future enhanced treatment requirements.

4.1.4. Wetland and Stream Buffers

The NYCDEP required 100 ft setback to stream/wetland (NYCDEP, 18-39.) applies to the parking areas and is met for all but the proposed Information Building Parking Area. See setback lines on Figures PK5 and PK7 for W12, W13 and Crystal Brook setbacks.

4.1.5. Other Treatment Criteria

The mountain site is not in a Coliform Restricted Watershed. Per a Departmental meeting with DEP representatives held on July 18, 2008, the streams on site do not cause DEP Reservoir Stem Criteria to apply.

4.2. TREATMENT PRACTICE AND DESIGN CRITERIA

This section discusses treatment practices and methods which were selected for the specific IDAs on the site. Section 6 goes into into design detail.

Screening of Treatment Practices

The Stormwater Screening factors in NYSSMDM Chapter 7 were used to determine that Dry Swales, Surface Sand Filters and Bioretention Filter Systems are suitable practices to implement for the proposed parking areas. The Table 7.1 to Table 7.5 review did not indicate any factors that would preclude their use.

4.2.1. DEC Better Site Design

4.2.2. CWP Better Site Design

The document CWP 1998 pg 144 provides recommendations to reduce clearing and grading of forested areas and native vegetation. Steeper engineered slopes are suggested (e.g., 2:1 versus 3:1) in order to preserve more trees. On site grading does not exceed 2:1 and generally is 2.5:1 or flatter in areas to be mowed. This is excepting the ski slopes.

4.2.3. Leeds

See the proposed Discovery Lodge site design in Appendix I for Leeds crediting.

4.2.4. Green Infrastructure UD Parking Area Evaluation

Green Infrastructure Practices (GIPs) were evaluated for the U D Parking Area. The NYSSMDM Chapter 5 sections were reviewed for each of these GIPs. These included the Feasibility / Limitations, Required Elements, Sizing and Design Criteria. Where criteria were identified that were not favorable to using the particular practices, they were noted in the summaries below.

4.2.4.1. Five Step Process

Following through the 5-Step process outlined in NYSSMDM Chapter 3:

Step 1 (NYSSMDM pg 3-14)

The Evaluation Process includes developing maps that identify natural resource areas and drainage patterns. The table below, derived from (NYSSMDM Pg 3-14, Section 3.6) summarizes the availability of the information

Information	On Drawings
Wetlands (jurisdictional, wetland of special concern)	X

Waterways (major, perennial, intermittent, springs)	X
Buffers (stream, wetland, forest, etc.)	X
Floodplains	N/A
Forest, vegetative cover	X
Critical areas	X
Topography (contour lines, existing flow	X
Soil (hydrologic soil groups, highly erodible soils, etc.)	X
Bedrock, significant geology features	X

The evaluation process also includes devising strategies for protection and enhancement of natural resources. The table below, derived from (NYSSMDM Pg 3-14, Section 3.6) summarizes the data for the required evaluation measures.

Strategy	Approach
Prior to site layout, preserve natural features (site fingerprinting)	Mapping was developed to show existing forested areas, wetlands, and stream systems
Utilize natural features to preserve the natural hydrology	Pertinent existing stream system subcatchment areas were identified.
Maintain natural drainage design points	To the extent practicable, the existing drainage points were used to prevent "jumping watersheds"
Maximize retention of forest cover and undisturbed soils	The proposed linear parking modules and adjacent and connected flow-to stormwater treatment systems reduced the overall footprint of disturbance
Avoid erodible soils on steep slopes and limit mass grading	Relatively flat areas at lower elevations at the facility were chosen for the proposed parking area(s)

The evaluation process includes consideration of reducing the impacts of development by reducing impervious surfaces. For the proposed UD Parking Area terraces, the amount of impervious area is greatly reduced by using Porous Asphalt (pervious) pavement for the parking surfaces

The evaluation process includes demonstrating that reasonable opportunities for preserving natural conditions of the site are used to minimize runoff and in an effort to maintain the pre-construction hydrology.

Step 2

The Water Quality Volume was determined for the site. These are tabulated for subcatchments associated with the treatment systems the WQv flow is sent to.

Step 3

Each of the Green Infrastructure techniques listed in Table 3.2 (NYSSMSM10 pg 3-6) were evaluated with results presented in sections below. The Step 3 discussion on NYSSMDM10 pg 3-17 requires the designer to evaluate and identify on of site limitations that make the "application of the technique(s) infeasible" Site specific limitations are identified and listed where they are needed to support the decision to not to pursue use of a particular echniques.

The treatment practices resulting in a reduction of contributing area were considered. They are listed in NYSSMDM Table 3.2 (pg 3-6):

The treatment practices resulting in a reduction of contributing volume are listed in table 5.7 NYSSMDM pg 5-46

Discussion of RRv

Standard SMPs with RRv capacity were considered. The Runoff Reduction Capacity for the Standard SMPs proposed for the UD Parking Area are summarized as follows

SMP	RRv Capacity	Soils on-site	Application
Infiltration practices by source control	90% of WQv	C	
Dry Swale (DSW)	20% of WQv	C	

The DSW practices are localized systems, adjacent to the parking and vehicular travel areas throughout the site. The DSWs accept some flow conveyed from nearby upgrade areas, to the pretreatment forebay, through a diversion structure and pipe system where needed.

Runoff must be reduced using green infrastructure. The objective is to reduce the runoff to the pre-construction condition. This results when the 90% rainfall event volume is removed from the stormwater discharging from the site. The minimum reduction takes the HSG of the exisiting soils into account, using the HSG Group Specific Reduction Factor (S) defined in (NYSSMSM Section 4.3, Pg 4-5). For this proposed location, the HSG C factor of S=0.30 applies. The calculated minimum RRv for each subcatchment is listed in the design spreadsheet.table.

Step 4

Standard Practices are applied to address the remaining water quality volume. For this site, where NYC regulations also apply, the 1-yr, 24-hr event is used to determine the flow treated for WQv quality. The overall list is in NYSSMDM Table 3.3. For the UD Parking Area, DSW and SSF practices were selected.

Step 5

Volume and Peak Rate Control Practices were used for Q2, Q10 and Q100 attenuation from the UD Parking Area.

4.2.4.2. Conservation of Natural Areas (pg 5-47)

Existing forested lands that are located uphill, alongside and downhill of the proposed parking area are retained where possible. Regraded areas within the limits of site disturbance needed to create stable sideslopes can be reforested in some instances and landscaped to promote stormwater uptake.

Feasibility / Limitations

Nothing noted that renders technique technically infeasible

Sizing and Design Criteria

Nothing noted that renders technique technically infeasible

Required Elements

• All conservation areas:

Shall have a minimum contiguous area requirement of 10,000 ft2

The spacing between successive terraced parking areas makes conserving areas greater than the minimum 10,000 sf impractical within the overall limits of site disturbance.

o Shall be located within an acceptable conservation easement instrument that ensures perpetual protection of the proposed area. The easement must clearly specify how the natural area vegetation shall be managed and boundaries will be marked [Note: managed turf (e.g., playgrounds, regularly maintained open areas) is not an acceptable form of vegetation management]

The parking areas location within a state forest area, combined with signs showing the adjacent boundary of the conservation area will provides equivelant protection. The NYSSMDM 2010 "Conservation of Natural Areas" requirement for a "conservation easement instrument" will be met through an internal memorandum of understanding (MOU) within DEC to provide similar long term protection of the areas. This will be accomplished prior to site disturbance, when the protected areas will be surveyed and delineated on-site, with perimeter protection such as markers and signs, installed.

• Conservation areas that drain to any design point can be subtracted from the contributing area for WQv calculation.

This criteria can be applied to several of the subcatchment areas that are upland and alongside the porposed parking area.

4.2.4.3. Sheetflow to Riparian Buffers or Filter Strips (Pg 5-51)

Riparian buffers and Grass Filter strips require a maximum slope of 6% and 8% respectively. The UD parking area is generally too steep to effectively implement these practices, however the construction of impervious surfaces is distant to the existing streams due to current NYCDEP stream buffer regulations.

Feasibility / Limitations

The Feasibility and Limitations section of NYSSMSM include "permanent protection of natural areas, and enforcement for buffer area protections to be effective." This will be accomplished through MOU as described above.

Nothing noted that renders technique technically infeasible

Required Elements

• Runoff shall enter the buffer as overland sheet flow; a flow spreader can be supplied to ensure this, if average contributing slope criteria cannot be met (Note: a level spreader shall be used between buffer slopes ranging between 3% and 15%; for buffer slopes beyond 15% this practice cannot be applied)

This criteria restricts area available for use, the on-site are where existing slopes <15% is extremely limited.

Sizing and Design Criteria

Nothing noted that renders technique technically infeasible

4.2.4.4. Vegetated Open Swale (Pg 5-58)

Dry Swales are used for conventional water quality treatment in the site locations that lend themselves to swale construction. The DSWs are used for a combination of 100% water quality volume treatment and up to 20% RRV credit.

Feasibility / Limitations

Nothing noted that renders technique technically infeasible

Sizing and Design Criteria

Nothing noted that renders technique technically infeasible

Required Elements

Nothing noted that renders technique technically infeasible

• Have a slope between 0.5% and 4% (between 1.5- 2.5 percent recommended)

These slopes are not achievable in many of the drainage conveyance areas. The proposed dry swales have a slope <= 2% paralleling the contours.

4.2.4.5. Tree Planting / Tree Pit (Pg 5-64)

Tree Plantings and Tree Pits are not applicable to the proposed Upper Discovery Parking Area. The 5% slope maximum limits tree planting as a viable alternative in proposed areas

Per the NYSSMDM 2010:

"For new trees, the average slope for the contributing area, including the area under the canopy must not be greater than 5%. The maximum slope can be increased where existing trees are being preserved. Slope specifications for filter strips and buffers should be followed as guidelines."

Required Elements

Nothing noted that renders technique technically infeasible

Feasibility / Limitations

Nothing noted that renders technique technically infeasible

Sizing and Design Criteria

"For new trees, the average slope for the contributing area, including the area under the canopy must not be greater than 5%. The maximum slope can be increased where existing trees are being preserved. Slope specifications for filter strips and buffers should be followed as guidelines."

Tree Plantings and Tree Pits are not applicable to the proposed Upper Discovery Parking Area. The 5% slope maximum limits tree planting as a viable alternative in proposed areas. ^The site areas where existing trees will be preserved are generally not "directly connected" to the proposed impervious areas.

Required Elements

Nothing noted that renders technique technically infeasible

4.2.4.6. Disconnection of Rooftop Runoff (Pg 5-69)

Rooftops are not applicable to the proposed Upper Discovery Parking Area

4.2.4.7. Stream Daylighting (Pg 5-73)

Stream Daylighting is not applicable to the proposed Upper Discovery Parking Area

4.2.4.8. Rain Gardens (Pg 5-76)

Rain Gardens are not applicable to the proposed Upper Discovery Parking Area.

Per the NYSSMDM 2010:

"Rain gardens cannot be used to treat parking lot or roadway runoff. Treatment of these areas and other areas of increased pollutant loading should incorporate the design elements of a Bioretention practice."

4.2.4.9. Green Roofs (Pg 5-86)

Green Roofs are not applicable to the proposed Upper Discovery Parking Area.

4.2.4.10. Stormwater Planters (Pg 5-97)

Stormwater Planters are not applicable to the proposed Upper Discovery Parking Area.

Per the NYSSMDM 2010:

"• The infiltration rate of the native soil should be a minimum of 2 inches per hour."

4.2.4.11. Rain Barrels and Cisterns (Pg 5-106)

Rain Barrels and Cisterns are not applicable to the proposed Upper Discovery Parking Area.

4.2.4.12. Porous Pavement (Pg 5-114)

Porous Pavement can be used in the proposed parking areas.

When designed in accordance with the design elements in section 5.3.11, the WQv for the contributing drainage area is applied towards the runoff reduction.

Required Elements: Drainage

Filter Strip and Riparian Buffers to stream and wetland:

• Maximum contributing length shall be 150 feet for pervious and 75 feet for impervious surfaces

Feasibility / Limitations

Cold Climate Considerations: The UNHSC specification for 65% frost depth from the top of pavement to the native ground results in a 32" minimum section.

Nothing noted that renders technique technically infeasible

Sizing and Design Criteria

Nothing noted that renders technique technically infeasible

Required Elements

Treatment: Applications that are intended for infiltration shall be designed as infiltration practices using the design methods for infiltration trenches outlined in Chapter 6 of this Manual (NYSSMDM10). The Chapter 6 required infiltration practice surface and bottom area calculation methods were followed

4.2.5. Use and Implementation of Stormwater Credits

The DEC Publication "Use and Implementation of Stormwater Credits" includes the following credits which were reviewed for applicability. For each potential credit, there is a minimum set of criteria and requirements which identify the conditions or circumstances under which the credit may be applied.

Credit 1: Natural Area Conservation –
Credit 2: Stream and Wetland Buffers
Credit 3: Vegetated Open Channels
Credit 4: Overland Flow Filtration to Groundwater Recharge Zones - Class C and D soils of low K all but rule this out.
Credit 5: Environmentally Sensitive Rural Development
Credit 6: Riparian Reforestation

Chapter 5 of Maryland's "Stormwater Credits for Innovative Site Design" document includes examples of progressive site design practices that minimize the creation of impervious cover. The following were considered for applicability to the proposed construction:

- Narrower residential road sections
- Shorter road lengths
- Smaller turnarounds and cul-de-sac radii
- Permeable spill-over parking areas
- Smaller parking demand ratios
- Smaller parking stalls
- Angled one way parking
- Shared parking and driveways
- Narrower sidewalks

4.2.6. Permanent Upland Diversion Swales

The flow from existing upgrade areas will be diverted around some of the proposed stormwater management practices using diversion swales as allowed by DEC and explained in the Departments FAQ Guidance (NYSDEC, 2004a) as follows:

Question 12: How should a design manage off-site drainage?
Answer: Off-site drainage is handled slightly differently for each of the required management volumes as follows:

> For water quality, a designer is required to treat off-site drainage in its present condition only for the quantity of off-site drainage that actually flows to the practice. So, for example, if you design a stormwater pond for a 10-acre site at 50% impervious cover, and the pond also receives drainage from 5 additional acres at 20% impervious cover, you would treat all 15 acres, with the following impervious cover: o (50%*(10 Acres)+(20%*5 Acres))/15 acres= 40% impervious cover

A designer may alternatively divert off-site flow around a practice or site, and then not be required to treat this volume. Flow splitters and off-line treatment may be utilized in such designs.

> The above is true for channel protection. The designer is required to treat off-site drainage in its current condition, unless the flow is routed around the site.
>
> For both 10- year and 100-year flood control, the designer needs to calculate both pre- and post- development flows assuming that the off-site drainage remains in its current condition. Including off-site drainage in these calculations does not significantly alter the required storage volume since the area and condition remain the same for both pre- and post- development scenarios.
>
> For safe passage of the Spillway Design Flood, as identified in "Guidelines for the Design of Dams," the most conservative design option is to design the practice assuming that the off-site drainage is built out, according to current zoning (i.e., ultimate conditions).

4.2.7. Dry Swale for Parking Area Stormwater Quality Treatment

Dry Swales (DSWs) were selected as a proposed method to provide water quality treatment adjacent to the linear parking tiers.

The FHWA Publication "Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring, May 2002" (FHWA 2002) evaluates treatment approaches in areas of the country where space for stormwater BMP implementation is limited. The included fact sheet on Dry Swales states:

> Dry and wet swales are appropriate for use in narrow areas along roads and medians where sufficient space exists to accommodate the additional storage depth and width. These swales are relatively inexpensive BMPs, and the total cost is principally related to earth moving construction costs. Because drainage/grassed channels are commonly installed in roadway right-of-way areas to provide essential drainage, implementing a more complex dry or wet swale design usually results in a relatively small additional cost and provides significantly better water quality management. Where sufficient space is available in ultra-urban areas, either dry or wet swales may be appropriate BMPs. The design requirements of swales are relatively flexible; the gradient, size, and shape are typically based on local regulations that ensure adequate conveyance of the stormwater. In most applications, swales are placed parallel to roadways and care must be taken to ensure they do not impose an unacceptable safety hazard to any vehicles that might leave the roadway. Swales are practically vandal-proof and add an aesthetic value to roadside areas as long as they are maintained and litter and debris are regularly removed."

In addition to the attributes listed in the NYSSMDM, some of the general benefits of using dry swales to treat stormwater quality are as follows.

- The dry swales promote infiltration of initial runoff through the soil media (porous soil) and into the underground perforated pipe collection system. The subsurface soil temperature may then lower the water temperature.
- The dry swales are "linear" and lend themselves well to the elongated and narrow parking lots and service drives.
- The proximity to the parking areas will allow the dry swales to be used to store and treat snow from adjacent plowing operations.
- Any subsurface isolated groundwater seepage intercepted by the dry swale can potentially be conveyed and maintained in the underground collection piping system.
- Summertime mowing can be combined with debris removal from the dry swales, to collect floatable and other debris.

- Forebay areas at the upper end of each swale can be used to pre-treat and reduce the velocity of water conveyed by grassed swales and culverts from nearby areas and service drives.
- Shoulder areas along the parking areas can used for pretreatment of the sheet flow runoff before it enters the DSWs.
- Mowing equipment currently used by the mountain staff can be used to maintain the grass lined swales with sideslopes generally 2:5H to 1V or less. In some areas, the sideslopes are slightly steeper to accommodate a wider (8-ft) floor and maintain the overall 25-ft width at the the top of the 4-ft deep DSWs.
- Dry swales can utilize interval check dams to contain and treat the WQv to design depths. Wooden logs can be considered for use as an alternative to using gravel for the check dams.

Dry swales can also utilize available storage capacity to temporarily store and convey flow associated with the CSV and Q10 events. Use of an engineered outlet riser/orifice combination can provide extended detention release of the CSV event flow from the dry swale. The reduced ED of CSV goal of 12-hours was used in the design of dry swale treatment systems for the Upper Discovery, North and East parking areas. A DSW is proposed for an area along the Upper Discovery Parking service drive, west of the entrance stub intersection, to treat runoff from the drive. This is the only proposed DSW area that is adjacent to a service drive alone and not parking area.

4.2.8. Surface Sand Filter for Stormwater Quality Treatment

For some areas of the proposed parking lots and service drives, the grade elevation limits the ability to convey stormwater to the DSWs. In two of these areas SSF systems are proposed.

Off-line SSF systems are proposed in the East Parking Area and the Upper Discovery Parking Area. The proposed grading along the northeast extent of the proposed East Parking Area, and the north extent of the proposed Upper Discovery Parking Area, is such that the stormwater conveyance system is at a lower elevation than the nearby parking lot dry swales. In these areas, offline Surface Sand filters coupled with Dry Detention Basins are proposed to treat the stormwater quality and quantity respectively.

4.2.9. Biofilters for Stormwater Quality Treatment

Two proposed BRFs area located adjacent to the Proposed Information Building Parking Area. One filter treats stormwater conveyed from a subcatchment on the opposite side of the Town Road. A second filter treats stormwater that flows directly from the Proposed Information Building Parking Area surface.

4.2.10. Porous Pavement

The Proposed Information Building Parking Area is partially within the 100-ft buffer distance required by (NYCDEP, 18-39.) for impervious surfaces relative to wetlands. Using porous pavement in this location can be part of an approach to meeting these criteria. The low permeability of the existing site soils makes them unsuitable as a subbase material alone.

4.2.11. Dry Detention Basin for Stormwater Quantity Attenuation

Stormwater Dry Detention Basins (DDBs) are used to temporarily store runoff and attenuate post-development peak flows in combination with separate stormwater quality treated systems. Controlled release from the basins is accomplished using an outlet control structure. As opposed to retention basins which may be constantly wet, dry detention basins, with appropriate floor configurations, are normally dry and can support easy to maintain vegetative cover. Dry detention basins are proposed in the Upper Discovery, North and East Parking areas to attenuate flows. In areas where no or minimal additional impervious surface is created, but the CN value is increased significantly, this type of detention storage can be used to prevent a pre to post development increase in runoff.

4.2.12. Road Salting & Sanding Alternatives

Methods to reduce the impact of winter de-icing measures can work hand-in-hand with the sanding and salting

Since the BMSC facility is within the NYC West of Hudson watershed boundary, the NYCDEP regulates de-icing activities. The NYCDEPs Best Management Practices for de-icing activities, which they adopt by reference to NYSDOT, in sections described below.

Information on de-icing planning is readily available from the following agencies and sources:

- (NYC 18-45) New York City Watershed Rules and Regulations, Chapter 18, Subchapter C, Section 18-45
- (NYSDOT) New York State Department of Transportation "Environmental Handbook for Transportation Operators"
- (AASHTO), The AASHTO Center for Environmental Excellence publication, "Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance, Chapter 8 Winter Operations in Salt, Sand and Chemical Management.
- FHA,
- Cornell Local Roads Program, and
- USEPA (Filtration avoidance criteria).
- (NEIWPCC 2009) Special Report "SPECIAL REPORT: CLEAR ROADS, CLEAR ISSUES" 2009 New England Interstate Water Pollution Control Commission; Connecticut, Maine, Massachusetts,

This section provides a general discussion of the proposed flow patterns for runoff to the design points. Treatment Systems are discussed.

4.3. General

The NYSDEC, 2008 SEIS defines which areas of proposed construction are considered as IDAs site Subcatchment area

4.4. Upper Discovery Parking

The stormwater runoff from this proposed parking area is infiltrated and conveyed to nearby Crystal Brook. For analysis, the proposed site has been divided into subcatchment areas, with boundaries shown on UMP Drawing PK-2, that convey runoff to treatment and attenuation locations. The flow paths used for Tc calculations are also shown on UMP Drawing PK-2 using labeled linetypes for flow regimes including SHT, SCF and OCS. Flow patterns were determined based on the topography and drainage structures shown. Arrows labeled using F#'s are used to clarify where flows associated with the WQv are conveyed for treatment. Information from UMP Drawing PK-2 forms the underlying base drawing for the associated stormwater model node diagram in Appendix B. The stormwater model provides detailed engineering information that supplements the UMP Drawings in defining the configuration of the stormwater management system.

An upland diversion swale conveys runoff to Crystal Brook, intercepting it before it reaches the uppermost parking tier stormwater collection system. Both treated and attenuated stormwater collected from the proposed impervious surfaces flow to a proposed conveyance channel, flowing downgrade to the bus lot channel before entering Crystal Brook. The location of the parking area is on the Ashokan side of the nearby watershed divide.

4.5. North Parking

Stormwater runoff from this proposed parking area is conveyed to nearby Crystal Brook. For analysis, the proposed site has been divided into numerous subcatchment areas, with boundaries shown on UMP Drawing PK-7, that convey runoff to treatment and attenuation locations. The flow paths used for Tc calculations are also shown on UMP Drawing PK-7 using labeled linetypes for flow regimes including SHT, SCF and OCS. Flow patterns can be determined based on the topography and drainage structures shown. Arrows labeled using F#'s are used to show where flows associated with the WQv are conveyed for treatment. Information from UMP Drawing PK-7 forms the underlying base drawing for the associated stormwater model node diagram in Appendix B . The stormwater model provides detailed engineering information that supplements the UMP Drawings in defining the configuration of the stormwater management system.

Upgradient runoff from the northwest portion of the site is diverted to Crystal Brook at a location north of the proposed snowmaking pond diversion structure.

Treated and attenuated stormwater flows from a piped system into the conveyance channel for the snowmaking ponds auxiliary spillway, then into Crystal Brook.

4.6. East Parking

Stormwater runoff from this proposed parking area is conveyed to a nearby wetland, located between the site and County Route 28, which is tributary to Birch Creek. For analysis, the proposed site has been divided into numerous subcatchment areas, with boundaries shown on UMP Drawing PK-11, that convey runoff to treatment and attenuation locations. The flow paths used for Tc calculations are also shown on UMP Drawing PK-11 using labeled linetypes for flow regimes including SHT, SCF and OCS. Flow patterns can be determined based on the topography and drainage structures shown. Arrows labeled using F#'s are used to show where flows associated with the WQv are conveyed for treatment. Information from UMP Drawing PK-11 forms the underlying base drawing for the associated stormwater model node diagram in Appendix B . The stormwater model provides detailed engineering information that supplements the UMP Drawings in defining the configuration of the stormwater management system.

Existing roadside drainage systems convey site runoff to culverts crossing off-site near the extreme north corner of the triangular area and at two locations along the adjacent Town Road (Van Loan Road). These locations are utilized in addition to four BRF treated water outlets to convey flow to the existing wetland. The existing wetland drainage flows through a culvert under CR28 towards Birch Creek.

5. DESIGN POINTS SELECTED FOR IDA PRE-TO-POST COMPARISONS

This section describes the logic behind selecting design points for each area

5.1. General

Table 5 lists reference numbered design points for pre-development to post-development comparison for each IDA.

These points are are also shown on predevelopment UMP Drawing EX17 and on the stormwater model stormwater model node diagrams in Appendix B.

Table 6 lists the "Stormwater Management System" UMP Drawings that show subcatchment areas associated with the design points. Existing (pre development) and Proposed (post development) flow path lines used to calculate Tc's are also shown on the UMP Drawings.

Existing Conditions UMP Drawing EX17 also includes a design points table and shows the locations of the predevelopment design points.

5.2. Upper Discovery Parking

The pre to post development design point is at the confluence of the flow from the existing conveyance channel on the west side of the Discovery Bus Parking Lot and Crystal Brook. The location of design point 212 is shown as Link DP-212 in the stormwater model.

5.3. North Parking

The pre to post development design point for this parking area is located along Crystal Brook at a point downstream of the parking area. The location of design point was selected as the nearest point that takes into account the surface area affected by the proposed construction. The location of design point 291 is shown as Link "DP-291" in the stormwater model.

5.4. East Parking

The pre to post development design points for the east parking area were selected based on the three site outlets flowing north to the adjacent wetland. The existing site runoff characteristics divide flow through three culverts located in two locations that cross under the Town Road, one culvert is west and two culverts are east of the relative high point along the Town Road. These are represented by design points 280 for the west and 270 for the combined east culverts. These are shown on UMP Drawing EX16 and in the predevelopment condition stormwater model by Links "2.8 EX" and "2.8.1EX" for the west and "2.7AB EX" for the east outlets respectively. The Discharge points toward the northwest end of the wetland are represented by Links 2.8.1, 2.8.2 and 2.8.3. Flow outlet locations further east include the two existing twelve inch culverts crossing the Town Road, represented by Link 2.7

5.5. Tomahawk –Skier Bridge Area

The design point for this area, which includes parking lot modifications up above, should be in the area of the Existing Box Culvert and Sand filter outlet crossings of Overlook road to

6. TREATMENT PRACTICE DESIGN CRITERIA SUMMARY (Part III.B.2.f.)

This section discusses area-by-area engineering details for each area's proposed stormwater management system.

6.1. General

Appendix A includes a stormwater model "H&H Model Data Key" to facilitate interpreting the stormwater model diagrams and tabulated model data included in the SWPPP.

Post-development subcatchment areas and stormwater management components are labeled on the stormwater model node diagrams included in Appendix B for each representative calculation set for each Intense Development Area. Data demonstrating design parameters and resulting runs for the 10-year-24 hour rainfall event are included. These are labeled as the "Type II 24-hr Q10 Rainfall=6.00" event.

For each subcatchment, Tc data are tabulated in the individual "Summary for Subcatchment" sections of the stormwater model data tables. The segment lengths and slopes for each flow path line used in the Tc calculations are listed. The associated flow paths are shown on the "Stormwater Management System" UMP Drawing for each development area listed in Table 6. The segments of the flow path are labeled as SHT, SCF and OCF as the flow progresses from sheet to shallow concentrated to open channel flow respectively.

Subcatchment boundaries associated with each Tc are shown on the "Stormwater Management System" UMP Drawing for each development area.

For each subcatchment, tabulated CN weighing calculation data are presented in the individual "Summary for Subcatchment" sections of the Stormwater Model printouts. The Area, CN and Descriptions are listed.

Table 5.1 lists the "Center-of-Mass detention time" for the extended detention of the CPv (1-year) rainfall event in the treatment facilities.

6.2. IDENTIFICATION OF POST-CONSTRUCTION STORMWATER CONTROL PRACTICES (Part III.B.2.a.)

This section discusses area-by-area engineering details for each area's proposed stormwater management system.

6.2.1. Upper Discovery Parking (Revised for GI)

6.2.1.1. General

Design Calculations are included in Appendices B and C.
The Hydrocad Model in Appendix B shows results for the 10-year storm event, which is used as driving head for the practices where water is conveyed from offline areas to treatment.

A walkthrough of the calculations in Appendix C Upper Discovery Tables is as follows:

- Table UD-1:
    - Sizing calculation for the Surface Sand Filter, designed to treat the volume of runoff associated with the 1-year 24-hour event.
- Table UD-2:
    - Calculations for the WQv associated with the 90% storm (WQv 90%)
- Table UD-2A:
    - Calculation of RRv Gross based on 90% storm.
    - Calculation of RRv Minimum using S factor.
    - Check that RRv Gross or RRv Min. are met.
- Table UD-2B:
    - Calculation of RRv Credit for Porous Asphalt Paving infiltration system in parking area.
    - Check that Impervious area in Subcat is <20% for DEP criteria
- Table UD-2C:
    - Calculation of PA parking areas
    - Calculation of reqd DSW pretreatment volume.
    - Calculation of reqd DSW floor length and width to treat WQv 90%. The DSWs are adequate for such and meet the DEC sizing. Additional volumes, such as storage available in the subsurface media, are considered for handling the WQv 1-yr, such as is done in other states.
- Table UD-2D:
    - Calculation of DSW and SSF Vol reqd for 1 yr treatment.
    - Calculation of DSW underdrain drawdown capability over 12 hours.
    - Check that DSW provides storage volume for 1 yr treatment, widening floor where necessary.
- Table UD-2E:
    - Calculation of DSW exfiltration volume into grassed wetted sideslope area using average water depth of 6" over a 12 hour period.
    - Calculation of DSW floor drawdown volume over a 12 hour period.
    - Calculation of DSW underdrain flow if considered
    - Calculation of RRV credit for std practice DSW.
- Table UD-2F:
    - Calculation of WQv associated flow, Qp, for diversion volumes to treatment.

6.2.1.2. Upland Diversion Swale

An Upland Diversion Swale meeting design characteristics similar to a Vegetated channel used for stormwater credit (2-3% slope, 1:3 sideslopes) is planned upgrade of the proposed parking area to convey surface runoff east to Crystal Brook. Tree cover will be preserved where possible to provide shade and to reduce thermal impacts. The swale has capacity to convey up to the Q100 event. This water is diverted to keep it out of the stormwater quality treatment system located downhill of the diversion swale. This reduces the size of treatment practices needed.

This swale will also be of sufficient depth to intercept runoff moving along the top of the fragipan layer a few feet below the existing ground surface.

6.2.1.3. Linear Parking Lots

This area has four tiered parking lots in a terraced arrangement. The lots are relatively parallel to the existing surface contours. Each lot is narrow and elongated with angled parking stalls on both sides of a center aisle. This "module" is used throughout the proposed parking lots with an access aisle serving a 45 degree row of parking on each side. A partial module is used in areas where Dry Detention Basins are located adjacent to the lots, omitting one row of stalls.

The surface of each parking lot pitches toward the middle and toward the uphill "upgrade" side of each lot. A 2% cross "transverse" slope and longitudinal slopes of 2% or less promote positive drainage if any plugging of the PA occurs. Control of grading elevation during construction of the parking surface will promote uniformly distributed sheet flow to the adjacent edge of the dry swale. Plowing snow to the uphill side will also promote stormwater quality treatment of snowmelt.

The details illustrating the above description are found on Figure PK10.

Noteworthy positive aspects:

- Localized treatment of stormwater.

6.2.1.4. Dry Swale Stormwater Quality Treatment

Dry Swales are adjacent to the parking areas, at a 1% to 2% pitch that matches that of the adjacent parking lot. A typical Dry Swale cross section is shown on Figure PK11, showing the soil media and perforated treated water collection system. Interval check dams are constructed along the swale to meet the NYSSMDM requirement for WQv storage depths. The WQv storage cross-section for the DWS, needed to meet the NYSSMDM Section 6.5.4 Design Guidance, uses an average depth of 12 inches. This considers an 18 inch maximum depth and 6 inch minimum depth between 18 inch high check dams. The average WQv storage volume available for a 5 ft wide DSW pretreatment area is then 7.5 cf per linear ft of DSW based on the cross section geometry. The storage capacity increases for proposed floor widths of 6.5 ft and 8 ft to 8.83 and 10.125 cf per linear ft respectively.

6.2.1.5. DSW pretreatment

Each DSW has a Pretreatment Forebay area on the up gradient end, which in some instances, accepts surface runoff or flow conveyed through culverts from upper areas such as access drives. Pretreatment Filter Strips (PFS) are used to treat the runoff before it enters the lowermost DSW. The sheet flow from the drive area there can be entirely pretreated in the diaphragm, prior to entering the DSW.. A typical PFS detail is shown in Detail 12/PK11. NYSSMDM Section 6.5.3

indicates that pea gravel diaphragms along the tops of sideslopes can be used for stormwater pretreatment. NYSSMDM Appendix C Specifications for the pea gravel diaphragms call for 12" wide by 24" minimum depth. The proposed 2-ft wide grassed shoulder at 8% sideslope and <2% lateral slope provides a suitable location. A perforated-pipe manifold, within the diaphragm, can be used to daylight in the DSW at intervals. This approach facilitates maintenance as small "deltas" will form as fines from winter road sanding operations are deposited at the outletting locations in concentrated areas. Spring cleaning can remove the fines for re-use and any vegetative cover loss can be re-established.

Lower-end check dams are constructed in each dry swale to control release of the Q100 and Q10 flow into the DDB where ED release of the CPV event is though the slotted riser outlet control structure.

6.2.1.6. Central Dry Detention Basin flanked by Dry Swales

Each terraced parking lot includes a DDB located on the uphill side of the lot, somewhat central to the parking area. A DSW is located on each side of the DDB in the longitudinal direction. The floor of each DDB has protective fill to convey the flows from the DSWs and a perforated underdrain system to promote maintenance of the grassed area. The detail illustrating the above description is found on Figure PK11. Flow from each DDB passes through the control orifices of a precast OCS, to a culvert. Each DDB has provisions for excess flow to weir over the adjacent low point of the parking lot. Each lot has a 60-ft longitudinal vee shaped weirover parking surface area at 2% cross and longitudinal slope, centered about the DDB for greater than the 100 year storm.

6.2.1.7. Sequential Outlets

Typically, flow from the outlet control structure in each DDB is conveyed to the DDB of the immediately downhill terrace. Flow over the "weirover" area of each parking area, if ever realized, would also flow down to the next terrace. For the lowermost terrace in the UD parking area, a DDB located upland of the service drive. The DDB labeled"DDPE" receives the flow. This is discussed in the lower elevation treatments section below.

6.2.1.8. Service Drive Runoff Treatment

Service drives have narrow asphalt paved surface widths of 12-ft for one way traffic and 22-ft for two way traffic. The drives have a 2% cross slope to promote surface drainage to the shoulder area where stormwater is conveyed to treatment practices through vegetated swales and lined swales. Plowing snow to this side will also promote treatment stormwater quality treatment of snowmelt. Where practicable the swales are routed to the upper end of the nearby downgradient DSW. Where needed, Inlet structures are proposed in areas along the swales to intercept and convey flow to the Pretreatment Forebay areas of the downgradient dry swales. The intent is to divert small flows, at least up to those associated with the WQv event, to the dry swales for quality treatment.

6.2.1.9. Lower Elevation Stormwater Treatment

The proposed UD parking area has impervious surfaces downgradient of the lowermost terrace DSW and DDB systems. A DWS is used to treat SW quality from a length of the service drive and an offline SSF is used to treat the stormwater quality for runoff from remaining service drive areas and the area of the entrance onto CR 49A. Diversion structures are used to convey the WQv based flow to the treatment area and allow greater flows to pass continue through.

6.2.1.10. Surface Sand Filter

The offline treatment system includes a pretreatment forebay and surface sand filter area. A perforated pipe, vertical outlet structure is used to convey flow from the single forebay to the sand filter basin. These perforated riser structure is based on the (NYSSMDM Appendix K) design example. The sand filters underground collection system conveys treated stormwater northeast to a daylighted outlet point. Any potential overflows from, the forebay area or the sand filter basin will enter the adjacent channel through an overflow spillway area.

6.2.2. North Parking

6.2.2.1. Linear Parking Lots

This area has two tiered parking lots in a terraced arrangement. The lots are oriented relatively parallel to the existing surface contours. Each lot is narrow and elongated with angled parking stalls on both sides of a center aisle. This "module" is used throughout the proposed parking lots with an access aisle serving a 45 degree row of parking on each side. A partial module is used in areas where Dry Detention Basins are located adjacent to the lots, omitting one row of stalls. The surface pitch of each parking lot directs runoff toward the middle and toward the uphill "upgrade" side of each lot. A 2% cross "transverse" slope and longitudinal slopes of 2% or less promotes positive drainage. The hydraulic path for runoff is relatively short across the approximately 60-ft wide parking module, toward the grassed shoulder forming the edge of the dry detention basin. Control of grading elevation during construction of the parking surface will promote uniformly distributed sheet flow to the adjacent edge of the dry swale. Plowing snow to this side will also promote stormwater quality treatment of snowmelt. The details illustrating the above description are found on Figure PK10, however PA and the underlying materials are not designated for conventional asphalt pavement.

Noteworthy positive aspects:

- Shortened travel time across light colored gravel surfaces should reduce thermal impact. Consistent with…

- Gravel parking lot surfaces.
- Localized treatment of stormwater.

6.2.2.2. Dry Swale Stormwater Quality Treatment

Dry Swales are adjacent to the parking areas, at a 1% to 2% pitch that matches that of the adjacent parking lot. A typical Dry Swale cross section is shown on Figure PK11, showing the soil media and perforated treated water collection system. Interval check dams are constructed along the swale to meet the NYSSMDM requirement for WQv storage depths. Each swale has a Pretreatment Forebay area on the upper end, which in some instances, accepts surface runoff or flow conveyed from upper areas such as access drives. Interval cleanouts provide access to the treated water collection pipe network. Lower-end rock dams are constructed in each dry swale to control release of the Q100 and Q10 flow through the spillway control section, and ED release of the CPV event though the slotted riser outlet control structure.

6.2.2.3. Central Dry Detention Basin flanked by Dry Swales

Each terraced parking lot includes a DDB located on the uphill side of the lot, somewhat central to the parking area. A DSW is located on each side of the DDB in the longitudinal direction. The floor of each DDB has protective fill to convey the flows from the DSWs and a perforated underdrain system to promote maintenance of the grassed area. The detail illustrating the above description is found on Figure PK11. Flow from each DDB passes through the control orifices of a precast OCS, to a culvert. Each DDB has provisions for excess flow to weir over the adjacent low point of the parking lot. Each lot has a 60-ft longitudinal vee shaped weirover parking surface area at 2% cross and longitudinal slope, centered about the DDB.

6.2.2.4. Sequential Outlets

Typically, the outlet control structure in each DDB conveys flow to the DDB of the immediately downhill terrace. Weirover flow, if ever realized, would also flow down to the next terrace.

6.2.2.5. Service Drive Runoff Treatment

Service drives have narrow asphalt paved surface widths of 12-ft for one way traffic and 22-ft for two way traffic. The drives have a 2% cross slope to promote surface drainage to the shoulder area where stormwater is conveyed to treatment practices through vegetated swales and lined swales. Plowing snow to this side will also promote treatment stormwater quality treatment of snowmelt. Where practicable the swales are routed to the upper end of the nearby downgradient DSWs. Where needed, Inlet structures are proposed in areas along the swales to intercept and convey flow to the Pretreatment Forebay areas of the downgradient dry swales. The intent is to

divert small flows, at least up to those associated with the WQv event, to the dry swales for quality treatment.

6.2.3. East Parking

6.2.3.1. Linear Parking Lots

This area has three tiered parking lots in a terraced arrangement. The lots are relatively parallel to the existing surface contours. Each lot is narrow and elongated with angled parking stalls on both sides of a center aisle. This "module" is used throughout the proposed parking lots with an access aisle serving a 45 degree row of parking on each side. A partial module is used in areas where Dry Detention Basins are located adjacent to the lots, omitting one row of stalls. The surface pitch of each parking lot directs runoff toward the middle and toward the uphill "upgrade" side of each lot. A 2% cross "transverse" slope and longitudinal slopes of 2% or less promote positive drainage. The hydraulic path for runoff is relatively short across the approximately 60-ft wide parking module, toward the grassed shoulder forming the edge of the dry detention basin. Control of grading elevation during construction of the parking surface will promote uniformly distributed sheet flow to the adjacent edge of the dry swale. Plowing snow to this side will also promote stormwater quality treatment of snowmelt.

The details illustrating the above description are found on Figure PK10, however PA and the underlying materials are not designated for conventional asphalt pavement.

Noteworthy positive aspects:

- Shortened travel time across light colored gravel surfaces should reduce thermal impact. Consistent with…
- Gravel parking lot surfaces.
- Localized treatment of stormwater.

6.2.3.2. Dry Swale Stormwater Quality Treatment

Dry Swales are adjacent to the parking areas, at a 1% to 2% pitch that matches that of the adjacent parking lot. A typical Dry Swale cross section is shown on Figure PK11, showing the soil media and perforated treated water collection system. Interval check dams are constructed along the swale to meet the NYSSMDM requirement for WQv storage depths. Each swale has a Pretreatment Forebay area on the upper end, which in some instances, accepts surface runoff or flow conveyed from upper areas such as access drives. Interval cleanouts provide access to the treated water collection pipe network. Lower-end rock dams are constructed in each dry swale to control release of the Q100 and Q10 flow through the spillway control section, and ED release of the CPV event though the slotted riser outlet control structure.

6.2.3.3. Central Dry Detention Basin flanked by Dry Swales

Each terraced parking lot includes a DDB located on the uphill side of the lot, somewhat central to the parking area. A DSW is located on each side of the DDB in the longitudinal direction. The floor of each DDB has protective fill to convey the flows from the DSWs and a perforated underdrain system to promote maintenance of the grassed area. The detail illustrating the above description is found on Figure PK11. Flow is from each DDB passes through the control orifices of a precast OCS, to a discharge culvert. Each DDB has provisions for excess flow to weir over the adjacent low point of the parking lot. Each lot has a 60-ft longitudinal vee shaped weirover parking surface area at 2% cross and longitudinal slope, centered about the DDB.

6.2.3.4. Sequential Outlets

Typically, flow from the outlet control structure in each DDB is conveyed to the DDB of the immediately downhill terrace. Weirover flow, if ever realized, would also flow down to the next terrace. For the lowermost terrace in the UD parking area, a DDB upgrade of the service drive (DDB#) receives the flow. This is discussed in the lower elevation treatments section below.

6.2.3.5. Service Drive Runoff Treatment

Service drives have narrow asphalt paved surface widths of 12-ft for one way traffic and 22-ft for two way traffic. The drives have a 2% cross slope to promote surface drainage to the shoulder area where stormwater is conveyed to treatment practices through vegetated swales and lined swales. Plowing snow to this side will also promote treatment stormwater quality treatment of snowmelt. Where practicable the swales are routed to the upper end of the nearby downgradient DSW. Where needed, Inlet structures are proposed in areas along the swales to intercept and convey flow to the Pretreatment Forebay areas of the downgradient dry swales. The intent is to convey flows associated with the WQv event to the dry swales for quality treatment where practicable.

6.2.3.6. Lower Elevation Stormwater Treatment

The proposed East parking area has impervious surfaces downgradient of the lowermost terrace DSW and DDB systems. An offline SSF is used to treat the stormwater quality for runoff from service drive areas. Two BTSs are proposed on the North side of Van Loan Road, one to treat runoff from the proposed parking area there (BIORET2 on PK8) and a second to treat runoff from the intersection of the service drive and Van Loan Road (BIORET1 on PK8). Diversion structures are used to convey the WQv associated flow to BIORET1 and allow greater flows to pass by to the DDB (DRYDET1).

6.2.3.7. Dry Detention Basin

Several Sources of runoff are combined and attenuated in this DDB. Flow passes through the OCS to the proposed sideslope conveyance channel.

6.2.3.8. Surface Sand Filter

Specialized diversion catch basins are used alongside the service drives on the east end of the parking area to divert WQv associated stormwater to an offline SSF for treatment. Larger flows bypass and continue to the Dry Detention Basin. The treatment train begins in either of two pretreatment forebays used in combination with the single SSF basin. A perforated pipe, vertical outlet structure is used in each forebay to convey flow to the SSF basin. These perforated structures are based on the (NYSSMDM Appendix K) design example. The sand filters underground collection system conveys treated stormwater northeast to a daylighting outlet point. Any potential overflows from, the forebay areas or the sand filter basin area would enter the DDB. The treated water from the SSF flows to the proposed sideslope conveyance channel.

6.2.3.9. Lower Parking Lot Bioretention Filters

Runoff from a section of the service drive, from Val Loan Road up to the first crest, is conveyed to BIORET1 for treatment. A closed pipe system is proposed to convey the flow under the road to an OCS that will divert WQv associated flow to the BRF. A grass channel is used for pretreatment, of size determined by the guidelines in NYSSMDM Table 6.2. The treated water flows to the adjacent wetland.

Runoff from the Parking Area EP-D flows directly to BIORET2 for treatment. A grass filter strip provides pretreatment. A stone diaphragm is located above the grass filter strip.
The treated water flows to the adjacent wetland.

6.3. SIZING CALCULATIONS

6.3.1. Representative Calculations

For each of the proposed stormwater treatment practices, WQv and other practice specific capacity requirements are calculated in addition to the stormwater model calculations. The calculations are organized by Parking Area in the Appendix C, “Facility Sizing Calculations” tables. The sequential calculation spreadsheets are provided in the Appendix C Facility Sizing Calculations in an effort to demonstrate compliance with required design elements where engineering calculations are required. These include:

Upper Discovery Parking
UD-1 SSF sizing calculations.
UD-2 CN Weighing and WQv 90%volume calculation,

UD-2A RRv Gross, Minimum and Total Achieved
UD-2B Area PA Pavement, RRV Credit for PA, DEP 20% Impervious check.
UD-2C DSW Sizing Calculations
UD-2D WQv 1-yr, DSW Underdrain, DSW available Storage
UD-2E DSW Exfiltration, DSW Floor Drawdown, DSW/SSF RRv credit
UD-2F Qp for Offline Flow Diversion Structures

North Parking
N-1 WQv volume calculation, DSW pretreatment volume needed, DSW treatment volume needed for WQv storage, WQv calculated flow for offline treatment. Trial "Ballpark" orifice sizes for offline treatment.

East Parking
E-1 WQv volume calculation, DSW pretreatment volume needed, DSW treatment volume needed for WQv storage, WQv calculated flow for offline treatment. Trial "Ballpark" orifice sizes for offline treatment.
E-2 WQv Calculation for Subcatchments to SSF Forebay FB1
E-3 FB1 Sizing Calculations and Partial SSF sizing
E-4 WQv Calculation for Subcatchments to SSF Forebay FB2
E-5 FB2 Sizing Calculations and Overall SSF sizing
E-6 WQv Calculation for Subcatchments to BRF BIORET1, Grass channel pretreatment sizing, WQv calculated flow for offline treatment. Trial "Ballpark" orifice sizes for offline treatment.
E-7 BIORET1 Pretreatment forebay, treatment surface area and storage volume calculations.
E-8 WQv Calculation for Subcatchments to BRF BIORET2, Grass channel pretreatment sizing, WQv calculated flow for offline treatment. Trial "Ballpark" orifice sizes for offline treatment.
E-9 BIORET2 Pretreatment forebay, treatment surface area and storage volume calculations.

6.4. COLD CLIMATE CONSIDERATIONS

For DSWs
Applying the cold climate design considerations from NYSSMDM 6.5.7 to the DSWs:

To promote snowmelt infiltration into frozen ground: Use a 6 inch diameter underdrain, 12 inch minimum filter bed and SM planting soil
To reduce culvert freezing: The vertical risers at end of each dry swale preclude using 18" culverts. Culverts discharging from DSWs have a 2% minimum slope.
To reduce the impacts of Deicers on Channel Vegetation: This is done primarily through management and maintenance of the DSW, not design features.

The DSW size was not adapted due to NYSSMDM Appendix I calculations. The manuals Appendix I calculations apply to Ponds as referenced in NYSSMDM 6.1.7

For SSFs

Applying the cold climate design considerations from NYSSMDM 6.4.7 to the SSFs:

To prevent pipe freezing an 8 inch diameter underdrain in a 12 inch minimum gravel bed are proposed.
In case of frequent sanding during snow events the proposed pretreatment chambers are upsized to 40 percent of the treatment volume.

For BRFs
Applying the cold climate design considerations from NYSSMDM 6.4.7 to the SSFs:

To prevent pipe freezing an 8 inch diameter underdrain in a 12 inch minimum gravel bed are proposed.

6.5. IDENTIFIED DEVIATIONS FROM STANDARD

This section discusses any noted deviation from the standards for each area.

For each DSW treatment practice, the CPv discharge rates were checked against the 12-hr minimum discussed above for Trout Waters. The extended detention times are listed in Table 5.1 for each area.

7. PRE-DEVELOPMENT STORMWATER MODELING - HYDROLOGIC AND HYDRAULIC ANALYSIS (Part III.B.2.e.)

Appendix A. and Appendix B. include the stormwater model key and model run data respectively. The Appendix B data is ordered by parking area and pre-development followed by post-development for each area. The stormwater model printouts for existing conditions include the 10-year event scenario, which is used for modeling the post development driving head to send WQv associated flow the off-line treatment practices. The results of predevelopment model runs for the additional design storm events are listed in Table 5.

8. POST-DEVELOPMENT STORMWATER MODELING - HYDROLOGIC AND HYDRAULIC ANALYSIS (Part III.B.2.e.)

Appendix B. includes the post development stormwater model run data. The stormwater model printouts include the 10-year event scenario, which is used for the driving head to send WQv associated flow the off-line treatment practices. The results of post development model runs for the additional design storm events listed in Table 5. Table 5.1 lists CPv detention times.

For each DSW treatment practice the CPv discharge rates were checked against the 12-hr minimum discussed above for Trout Waters. The extended detention times are listed in Table 5.1 for each area.

For all Reach and Pond Routings simultaneous routing was used except where noted below. For the East Parking Dynamic Muskingum Cunge Routing was used as the reach routing method for the three channels and Dynamic Storage Indication was used as the pond routing method.

9. PRE-DEVELOPMENT vs. POST-DEVELOPMENT COMPARISON (Part III.B.2.e.)

See Table 5 for the Pre-Development to Post-Development Design Point Comparison. The peak flows for each design rainfall event are compared. Project specific areas are discussed below. The features mentioned can be found on the stormwater model diagrams for each area.

9.1. Upper Discovery

The design point for comparison is DP 212 as shown on the stormwater model (EX and PR 3/3) diagrams.
The flow in Crystal Brook at DP 212 can be attributed to watershed areas that are affected by the proposed UD parking area construction, and upland areas flowing to Crystal Brook that are not changed by this proposed construction. The flow from the upland areas can be considered unchanged when comparing pre to post development conditions. The timing of the peak flow from the parking area is such that it occurs earlier than the peak contribution of the upland areas, therefore the resulting peak flow in the stream at the design point is not increased from pre to post development. Sheets 1 to 4 of 4 in the Appendix B section for UD parking show the hydrographs and diagrams for the overall pre to post 10 year comparison at DP 212.
The parking area discharge from the DDP next to the bus lot is ## at 12.## hours. The upgrade affected areas contributing to the stream result in a peak of 82.07 cfs at 12.26 hours.

9.2. North Parking

The design point for comparison is DP-291 as shown on the stormwater model diagrams (EX## and PR 2of2). The flow in Crystal Brook at DP 291 can be attributed to watershed areas that are affected by the proposed North Parking area construction and upland areas that contribute the same flow before and after the lot is constructed. Upland areas flowing to Crystal Brook that are not changed by this proposed construction are represented in the stormwater model as subcatchment SEC1 and SDP291. These areas represent unchanged existing conditions in the watershed above the existing 60 inch-culvert and the remainder above design point DP-291 respectively.

Treated and attenuated runoff from the parking area is conveyed through an underground piped system system to the location where it flows into the constructed channel for the ponds auxiliary spillway. From there it flows along the lower reach of the channel (OCH1L) to Crystal Brook.

Some upland flow is conveyed to Crystal Brook along the service drive to the west end of lot NP-B.

The Proposed Snowmaking pond will have a spillway surface at elevation 1927. For the stormwater model scenarios the following conditions were considered

- The snowmaking pond water elevation at the start of rainfall events is modeled at 1925 ft so that the spillway does not activate. The pond stores all rainfall landing within its surface area (PND) and the surface runoff from the upgrade subcatchment (SPND1).
- During rainfall events, the Diversion Structure (DIV) does not send additional flow to the pond.

For the modeled rainfall events, the post development peak flow is reduced from the pre-development peak. This is largely due to the storage on the Pond. When flow from the two upland subcatchments (344.6cfs from SDP250) and (162.8cfs from SDP291) are routed during the 10 year event in addition to the proposed developed area, the resulting flow at DP291 is 525cfs @ 12.53 hrs. When the upland subcatchments are subtracted from the total flow at DP291, a flow of 17.82 cfs remains. This is less than the 30.18 cfs flow at DP291 obtained by routing the developed area alone. This is considered to indicate that the combined effect of the proposed parking area and the existing upland flow contributions is a lower peak flow than if considered separately.

Running the same scenario, with the initial pond water surface elevation at 1927, the additional flow results in 39.6 cfs at DP291 and 9cfs flowing over the activated spillway. This relationship holds true for events up to Q100 where all have post development flows less than pre development.

9.3. East Parking

Three culverts convey site runoff north under the existing Town Road (Van Loan Road). The runoff combines in the existing wetland area on the north side of the road. The total existing flow, from the site to the wetland, is shown on the stormwater model diagram using three design points 2.7AB EX, 2.8EX and 2.8.1EX. The total proposed flow is shown at design points 2.7, 2.8.1, 2.8.2, and 2.8.3.

- Design point 2.8.2 flow is from the BIORET2 BRS.
- Design Point 2.8.3 is associated with the BIORET1 treated water, and with bypass flow from larger runoff events. The subcatchment area SCBB1, is conveyed to BIORET1, and

includes the section of service drive from Van Loan Road up to the crest vertical curve in the service drive.

- Design point 2.8.1 includes subcatchment SCV2.8 flow from the existing culvert passing under Van Loan Road from the southeast corner of its intersection with CR 49A. This is pass-through stormwater from the adjacent roadway areas and drainage. Also, pass-through flow from subcatchment SCBB3, is conveyed under the entrance to the proposed EP-D lot to Design point 2.8.1
- Design point 2.7 encompasses two existing road crossing culverts and is the location where treated and bypass flows enter the wetland

IV. GLOSSARY OF TERMS, DEFINITIONS

This section is based on the glossary found in the NYSSMDM, Some project specific additions or modifications have been indicated using a Bold font.

ANTI-SEEP COLLAR - An impermeable diaphragm usually of sheet metal or concrete constructed at intervals within the zone of saturation along the conduit of a principal spillway to increase the seepage length along the conduit and thereby prevent piping or seepage along the conduit.
ANTI-VORTEX DEVICE - A device designed and placed on the top of a riser or at the entrance of a pipe to prevent the formation of a vortex in the water at the entrance.
AQUATIC BENCH -A ten to fifteen foot wide bench which is located around the inside perimeter of a permanent pool and is normally vegetated with aquatic plants; the goal is to provide pollutant removal and enhance safety in areas using stormwater pond SMPs.
AQUIFER - A geological formation which contains and transports groundwater.
"AS-BUILT" - Drawing or certification of conditions as they were actually constructed.
BAFFLES - Guides, grids, grating or similar devices placed in a pond to deflect or regulate flow and create a longer flow path.
BANKFULL FLOW - The condition where stream flow just fills a stream channel up to the top of the bank and at a point where the water begins to overflow onto a floodplain.
BARREL -The closed conduit used to convey water under or through an embankment: part of the principal spillway.
BASE FLOW - The stream discharge from ground water.
BERM - A shelf that breaks the continuity of a slope; a linear embankment or dike.
BIORETENTION - A water quality practice that utilizes landscaping and soils to treat urban stormwater runoff by collecting it in shallow depressions, before filtering through a fabricated planting soil media.
CHANNEL - A natural stream that conveys water; a ditch or channel excavated for the flow of water.
CHANNEL STABILIZATION - Erosion prevention and stabilization of velocity distribution in a channel using jetties, drops, revetments, structural linings, vegetation and other measures.
CHECK DAM - A small dam constructed in a gully or other small watercourse to decrease the stream flow velocity (by reducing the channel gradient), minimize channel scour, and promote

deposition of sediment. CHUTE - A high velocity, open channel for conveying water to a lower level without erosion.
CLAY (SOILS) - 1. A mineral soil separate consisting of particles less than 0.002 millimeter in equivalent diameter. 2. A soil texture class. 3. (Engineering) A fine grained soil (more than 50 percent passing the No. 200 sieve) that has a high plasticity index in relation to the liquid limit. (Unified Soil Classification System)
COCONUT ROLLS - Also known as coir rolls, these are rolls of natural coconut fiber designed to be used for streambank stabilization.
COMPACTION (SOILS) - Any process by which the soil grains are rearranged to decrease void space and bring them in closer contact with one another, thereby increasing the weight of solid material per unit of volume, increasing the shear and bearing strength and reducing permeability.
CONDUIT - Any channel intended for the conveyance of water, whether open or closed.
CORE TRENCH - A trench, filled with relatively impervious material intended to reduce seepage of water through porous strata.
CRADLE - A structure usually of concrete shaped to fit around the bottom and sides of a conduit to support the conduit, increase its strength and in dams, to fill all voids between the underside of the conduit and the soil.
CREST - 1. The top of a dam, dike, spillway or weir, frequently restricted to the overflow portion. 2. The summit of a wave or peak of a flood.
CRUSHED STONE - Aggregate consisting of angular particles produced by mechanically crushing rock.
CURVE NUMBER (CN) - A numerical representation of a given area's hydrologic soil group, plant cover, impervious cover, interception and surface storage derived in accordance with Natural Resources Conservation Service methods. This number is used to convert rainfall volume into runoff volume.
CUT - Portion of land surface or area from which earth has been removed or will be removed by excavation; the depth below original ground surface to excavated surface.
CUT-AND-FILL - Process of earth moving by excavating part of an area and using the excavated material for adjacent embankments or fill areas.
CUTOFF -A wall or other structure, such as a trench, filled with relatively impervious material intended to reduce seepage of water through porous strata.
CZARA -Acronym used for the Coastal Zone Act Reauthorization Amendments of 1990. These amendments sought to address the issue of nonpoint source pollution issue by requiring states to develop Coastal Nonpoint Pollution Control Programs in order to receive federal funds.
DAM - A barrier to confine or raise water for storage or diversion, to create a hydraulic head, to prevent gully erosion, or for retention of soil, sediment or other debris.
DETENTION - The temporary storage of storm runoff in a SMP with the goals of controlling peak discharge rates and providing gravity settling of pollutants.
DETENTION STRUCTURE - A structure constructed for the purpose of temporary storage of stream flow or surface runoff and gradual release of stored water at controlled rates.
DIKE - An embankment to confine or control water, for example, one built along the banks of a river to prevent overflow or lowlands; a levee.

DISTRIBUTED RUNOFF CONTROL (DRC) - A stream channel protection criteria which utilizes a non-uniform distribution of the storage stage-discharge relationship within a SMP to minimize the change in channel erosion potential from predeveloped to developed conditions.
DISTURBED AREA -An area in which the natural vegetative soil cover has been removed or altered and, therefore, is susceptible to erosion.
DIVERSION - A channel with a supporting ridge on the lower side constructed across the slope to divert water from areas where it is in excess to sites where it can be used or disposed of safely. Diversions differ from terraces in that they are individually designed.
DRAINAGE - 1. The removal of excess surface water or ground water from land by means of surface or subsurface drains. 2. Soils characteristics that affect natural drainage.
DRAINAGE AREA (WATERSHED) - All land and water area from which runoff may run to a common (design) point.
DROP STRUCTURE - A structure for dropping water to a lower level and dissipating surplus energy; a fall. The drop may be vertical or inclined.
DRY SWALE - An open drainage channel explicitly designed to detain and promote the filtration of stormwater runoff through an underlying fabricated soil media.
E&SCP – Erosion and Sediment Control Plan
EMERGENCY SPILLWAY -A dam spillway designed and constructed to discharge flow in excess of the principal spillway design discharge.
ENERGY DISSIPATOR - A designed device such as an apron of rip-rap or a concrete structure placed at the end of a water transmitting apparatus such as pipe, paved ditch or paved chute for the purpose of reducing the velocity, energy and turbulence of the discharged water.
EROSION -1. The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. 2. Detachment and movement of soil or rock fragments by water, wind, ice or gravity. The following terms are used to describe different types of water erosion:
Accelerated erosion - Erosion much more rapid than normal, natural or geologic erosion, primarily as a result of the influence of the activities of man or, in some cases, of other animals or natural catastrophes that expose base surfaces, for example, fires.
Gully erosion - The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, ranging from 1 or 2 feet to as much as 75 to 100 feet.
Rill erosion - An erosion process in which numerous small channels only several inches deep are formed. See RILL.
Sheet erosion - The spattering of small soil particles caused by the impact of raindrops on soils. The wet, loosened and spattered particles may or may not subsequently be removed by surface runoff.
EROSIVE VELOCITIES - Velocities of water that are high enough to wear away the land surface. Exposed soil will generally erode faster than stabilized soils. Erosive velocities will vary according to the soil type, slope, structural, or vegetative stabilization used to protect the soil.
EXFILTRATION - The downward movement of water through the soil; the downward flow of runoff from the bottom of an infiltration SMP into the soil.
EXTENDED DETENTION (ED) - A stormwater design feature that provides for the gradual release of a volume of water over a 12 to 48 hour interval in order to increase settling of urban pollutants and protect downstream channels from frequent storm events.

EXTREME FLOOD (Qf) - The storage volume required to control those infrequent but large storm events in which overbank flows approach the floodplain boundaries of the 100-year flood.
FILTER BED - The section of a constructed filtration device that houses the filter media and the outflow piping.
FILTER FENCE - A geotextile fabric designed to trap sediment and filter runoff.
FILTER STRIP - A strip of permanent vegetation above ponds, diversions and other structures to retard flow of runoff water, causing deposition of transported material, thereby reducing sediment flow.
FINES (SOIL) - Generally refers to the silt and clay size particles in soil.
FLOODPLAIN - The land area that is subject to inundation from a flood that has a one percent chance of being equaled or exceeded in any given year. This is typically thought of as the 100-year flood.
FLOW SPLITTER - An engineered, hydraulic structure designed to divert a percentage of storm flow to a SMP located out of the primary channel, or to direct stormwater to a parallel pipe system, or to bypass a portion of baseflow around a SMP.
FOREBAY - Storage space located near a stormwater SMP inlet that serves to trap incoming coarse sediments before they accumulate in the main treatment area.
FREEBOARD (HYDRAULICS) - The distance between the maximum water surface elevation anticipated in design and the top of retaining banks or structures. Freeboard is provided to prevent overtopping due to unforeseen conditions.
FOURTH ORDER STREAM - Designation of stream size where many water quantity requirements may not be needed. A first order stream is identified by "blue lines" on USGS quad sheets. A second order stream is the confluence of two first order streams, and so on.
FRENCH DRAIN - A type of drain consisting of an excavated trench refilled with pervious material, such as coarse sand, gravel or crushed stone, through whose voids water percolates and flows to an outlet.
GABION -A flexible woven-wire basket composed of two to six rectangular cells filled with small stones. Gabions may be assembled into many types of structures such as revetments, retaining walls, channel liners, drop structures and groins.
GABION MATTRESS -A thin gabion, usually six or nine inches thick, used to line channels for erosion control.
GRADE - 1. The slope of a road, channel or natural ground. 2. The finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; any surface prepared for the support of construction, like paving or laying a conduit. 3. To finish the surface of a canal bed, roadbed, top of embankment or bottom of excavation.
GRASS CHANNEL - A open vegetated channel used to convey runoff and to provide treatment by filtering out pollutants and sediments.
GRAVEL - 1. Aggregate consisting of mixed sizes of 1/4 inch to 3 inch particles which normally occur in or near old streambeds and have been worn smooth by the action of water. 2. A soil having particle sizes, according to the Unified Soil Classification System, ranging from the No. 4 sieve size angular in shape as produced by mechanical crushing.
GRAVEL DIAPHRAGM - A stone trench filled with small, river-run gravel used as pretreatment and inflow regulation in stormwater filtering systems.

GRAVEL FILTER - Washed and graded sand and gravel aggregate placed around a drain or well screen to prevent the movement of fine materials from the aquifer into the drain or well.
GRAVEL TRENCH -A shallow excavated channel backfilled with gravel and designed to provide temporary storage and permit percolation of runoff into the soil substrate.
GROUND COVER - Plants which are low-growing and provide a thick growth which protects the soil as well as providing some beautification of the area occupied.
GULLY - A channel or miniature valley cut by concentrated runoff through which water commonly flows only during and immediately after heavy rains or during the melting of snow. The distinction between gully and rill is one of depth. A gully is sufficiently deep that it would not be obliterated by normal tillage operations, whereas a rill is of lessor depth and would be smoothed by ordinary farm tillage.
HEAD (HYDRAULICS) - 1. The height of water above any plane of reference. 2. The energy, either kinetic or potential, possessed by each unit weight of a liquid expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. Used in various terms such as pressure head, velocity head, and head loss.
HERBACEOUS PERENNIAL (PLANTS) - A plant whose stems die back to the ground each year.
HI MARSH - A pondscaping zone within a stormwater wetland which exists from the surface of the normal pool to a six inch depth and typically contains the greatest density and diversity of emergent wetland plants.
HI MARSH WEDGES - Slices of shallow wetland (less than or equal to 6 inches) dividing a stormwater wetland.
HOT SPOT - Area where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater.
HYDRAULIC GRADIENT - The slope of the hydraulic grade line. The slope of the free surface of water flowing in an open channel.
HYPOXIA - Lack of oxygen in a waterbody resulting from eutrophication.
HYDROGRAPH - A graph showing variation in stage (depth) or discharge of a stream of water over a period of time.
HYDROLOGIC SOIL GROUP (HSG) - A Natural Resource Conservation Service classification system in which soils are categorized into four runoff potential groups. The groups range from A soils, with high permeability and little runoff production, to D soils, which have low permeability rates and produce much more runoff.
HYDROSEED - Seed or other material applied to areas in order to re-vegetate after a disturbance.
IMPERVIOUS COVER (I) - Those surfaces in the urban landscape that cannot effectively infiltrate rainfall consisting of building rooftops, pavement, sidewalks, driveways. Steep slopes and compact soils are not typically included as impervious cover.
INDUSTRIAL STORMWATER PERMIT - An NPDES permit issued to a commercial industry or group of industries which regulates the pollutant levels associated with industrial storm water discharges or specifies on-site pollution control strategies.
INFLOW PROTECTION - A water handling device used to protect the transition area between any water conveyance (dike, swale, or swale dike) and a sediment trapping device.

LEVEL SPREADER - A device for distributing stormwater uniformly over the ground surface as sheet flow to prevent concentrated, erosive flows and promote infiltration.
MANNING'S FORMULA (HYDRAULICS) - A formula used to predict the velocity of water flow in an open channel or pipeline:
Where V is the mean velocity of flow in feet per second; R is the hydraulic radius; S is the slope of the energy gradient or for assumed uniform flow the slope of the channel, in feet per foot; and n is the roughness coefficient or retardance factor of the channel lining.
MICROPOOL - A smaller permanent pool which is incorporated into the design of larger stormwater ponds to avoid resuspension or settling of particles and minimize impacts to adjacent natural features.
MICROTOPOGRAPHY - The complex contours along the bottom of a shallow marsh system, providing greater depth variation which increases the wetland plant diversity and increases the surface area to volume ratio of a stormwater wetland.
MULCH -Covering on surface of soil to protect and enhance certain characteristics, such as water retention qualities.
MUNICIPAL STORMWATER PERMIT - A SPDES permit issued to municipalities to regulate discharges from municipal separate storm sewers for compliance with EPA established water quality standards and/or to specify stormwater control strategies.
NPDES - Acronym for the National Pollutant Discharge Elimination System, which regulates point source and non-point source discharge.
NITROGEN-FIXING (BACTERIA) - Bacteria having the ability to fix atmospheric nitrogen, making it available for use by plants. Inoculation of legume seeds is one way to insure a source of these bacteria for specified legumes.
NORMAL DEPTH - Depth of flow in an open conduit during uniform flow for the given conditions.
OUTFALL - The point where water flows from a conduit, stream, or drain.
OFF-LINE - A stormwater management system designed to manage a storm event by diverting a percentage of stormwater events from a stream or storm drainage system.
ON-LINE - A stormwater management system designed to manage stormwater in its original stream or drainage channel.
ONE YEAR STORM (QP 1) - A stormwater event which statistically has a 100% chance of being equaled or exceeded on average in a given year.
ONE HUNDRED YEAR STORM (QP 100,*Qf*) A extreme flood event which statistically has a one percent chance of being equaled or exceeded in any given year..
OPEN CHANNELS - Also known as swales, grass channels, and biofilters. These systems are used for the conveyance, retention, infiltration and filtration of stormwater runoff.
OUTLET CHANNEL - A waterway constructed or altered primarily to carry water from man-made structures such as terraces, subsurface drains, diversions and impoundments.
PEAK DISCHARGE RATE - The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.
PERMANENT SEEDING - Results in establishing perennial vegetation which may remain on the area for many years.
PERMEABILITY - The rate of water movement through the soil column under saturated conditions

PERMISSIBLE VELOCITY (HYDRAULICS) -The highest average velocity at which water may be carried safely in a channel or other conduit. The highest velocity that can exist through a substantial length of a conduit and not cause scour of the channel. A safe, non-eroding or allowable velocity

pH - A number denoting the common logarithm of the reciprocal of the hydrogen ion concentration. A pH of 7.0 denotes neutrality, higher values indicate alkalinity, and lower values indicate acidity.

PIPING - Removal of soil material through subsurface flow channels or "pipes" developed by seepage water.

PLUGS - Pieces of turf or sod, usually cut with a round tube, which can be used to propagate the turf or sod by vegetative means.

POCKET POND - A stormwater pond designed for treatment of small drainage area (< 5 acres) runoff and which has little or no baseflow available to maintain water elevations and relies on ground water to maintain a permanent pool.

POCKET WETLAND - A stormwater wetland design adapted for the treatment of runoff from small drainage areas (< 5 acres) and which has little or no baseflow available to maintain water elevations and relies on ground water to maintain a permanent pool.

POND BUFFER - The area immediately surrounding a pond which acts as filter to remove pollutants and provide infiltration of stormwater prior to reaching the pond. Provides a separation barrier to adjacent development.

POND DRAIN - A pipe or other structure used to drain a permanent pool within a specified time period.

PONDSCAPING - Landscaping around stormwater ponds which emphasizes native vegetative species to meet specific design intentions. Species are selected for up to six zones in the pond and its surrounding buffer, based on their ability to tolerate inundation and/ or soil saturation.

POROSITY - Ratio of pore volume to total solids volume.

PRETREATMENT - Techniques employed in stormwater SMPs to provide storage or filtering to help trap coarse materials before they enter the system.

PRINCIPAL SPILLWAY - The primary pipe or weir which carries baseflow and storm flow through the embankment.

REDEVELOPMENT - New development activities on previously developed land.

RETENTION - The amount of precipitation on a drainage area that does not escape as runoff. It is the difference between total precipitation and total runoff.

REVERSE-SLOPE PIPE - A pipe which draws from below a permanent pool extending in a reverse angle up to the riser and which determines the water elevation of the permanent pool.

RIP-RAP - Broken rock, cobbles, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection against the action of water (waves); also applies to brush or pole mattresses, or brush and stone, or similar materials used for soil erosion control.

RISER - A vertical pipe or structure extending from the bottom of a pond SMP and houses the control devices (weirs/orifices) to achieve the discharge rates for specified designs.

ROUGHNESS COEFFICIENT (HYDRAULICS) - A factor in velocity and discharge formulas representing the effect of channel roughness on energy losses in flowing water. Manning's "n" is a commonly used roughness coefficient.

RUNOFF COEFFICIENT (RV) - A value derived from a site impervious cover value that is applied to a given rainfall volume to yield a corresponding runoff volume.
SAFE PASSAGE – Safely passing the Spillway Design Flood (SDF) and Service Spillway Design flood (SSDF) as defined in the NYSDEC "Guidelines for Design of Dams."
SAFETY BENCH - A flat area above the permanent pool and surrounding a stormwater pond designed to provide a separation from the pond pool and adjacent slopes.
SAND - 1. (Agronomy) A soil particle between 0.05 and 2.0 millimeters in diameter. 2. A soil textural class. 3. (Engineering) According to the Unified Soil Classification System, a soil particle larger than the No. 200 sieve (0.074mm) and passing the No. 4 sieve (approximately 1/4 inch).
SEDIMENT - Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.
SEEPAGE - 1. Water escaping through or emerging from the ground.2. The process by which water percolates through the soil.
SEEPAGE LENGTH - In sediment basins or ponds, the length along the pipe and around the anti-seep collars that is within the seepage zone through an embankment.
SETBACKS - The minimum distance requirements for location of a structural SMP in relation to roads, wells, septic fields, other structures.
SHEET FLOW - Water, usually storm runoff, flowing in a thin layer over the ground surface.
SIDE SLOPES (ENGINEERING) - The slope of the sides of a channel, dam or embankment. It is customary to name the horizontal distance first, as 1.5 to 1, or frequently, 1 ½: 1, meaning a horizontal distance of 1.5 feet to 1 foot vertical.
SILT - 1. (Agronomy) A soil separate consisting of particles between 0.05 and 0.002 millimeter in equivalent diameter. 2. A soil textural class. 3. (Engineering) According to the Unified Soil Classification System a fine grained soil (more than 50 percent passing the No. 200 sieve) that has a low plasticity index in relation to the liquid limit.
SOIL TEST - Chemical analysis of soil to determine needs for fertilizers or amendments for species of plant being grown.
SPILLWAY - An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, either manually or automatically controlled to regulate the discharge of excess water.
STAGE (HYDRAULICS) - The variable water surface or the water surface elevation above any chosen datum.
STILLING BASIN - An open structure or excavation at the foot of an outfall, conduit, chute, drop, or spillway to reduce the energy of the descending stream of water.
STORMWATER FILTERING - Stormwater treatment methods which utilize an artificial media to filter out
pollutants entrained in urban runoff.
STORMWATER PONDS - A land depression or impoundment created for the detention or retention of stormwater runoff.
STORMWATER WETLANDS - Shallow, constructed pools that capture stormwater and allow for the growth
of characteristic wetland vegetation.

STREAM BUFFERS - Zones of variable width which are located along both sides of a stream and are designed to provided a protective natural area along a stream corridor.
STREAM CHANNEL PROTECTION (CpV) - A design criteria which requires 24 hour detention*, except in Trout Waters,* of the one year post developed, 24 hour storm event for the control of stream channel erosion.
STRUCTURAL SMPs - Devices which are constructed to provide temporary storage and treatment of stormwater runoff.
SUBGRADE - The soil prepared and compacted to support a structure or a pavement system.
TAILWATER - Water, in a river or channel, immediately downstream from a structure.
TECHNICAL RELEASE No. 20 (TR-20) - A Soil Conservation Service (now NRCS) watershed hydrology computer model that is used to compute runoff volumes and route storm events through a stream valley and/or ponds.
TECHNICAL RELEASE No. 55 (TR-55) - A watershed hydrology model developed by the Soil Conservation Service (now NRCS) used to calculate runoff volumes and provide a simplified routing for storm events through ponds.
TEMPORARY SEEDING - A seeding which is made to provide temporary cover for the soil while waiting for further construction or other activity to take place.
TEN YEAR STORM (QP 10*,Q10*) - The peak discharge rate associated with a 24 hour storm event that has a 100% chance of being equaled or exceeded in a given ten year. *Also referred to as Overbank Flood.*
TIME OF CONCENTRATION - Time required for water to flow from the most remote point of a watershed, in a hydraulic sense, to the outlet.
TOE (OF SLOPE) - Where the slope stops or levels out. Bottom of the slope.
TOE WALL - Downstream wall of a structure, usually to prevent flowing water from eroding under the structure.
TOPSOIL - Fertile or desirable soil material used to top dress roadbanks, subsoils, parent material, etc.
TOTAL SUSPENDED SOLIDS - The total amount of soil particulate matter, including both organic and inorganic material, suspended in the water column.
TRASH RACK - Grill, grate or other device at the intake of a channel, pipe, drain or spillway for the purpose of preventing oversized debris from entering the structure.
TROUT WATERS - Waters classified as (T) or (TS) by the New York State DEC.
TWO YEAR STORM (QP 2) - The peak discharge rate associated with a 24 hour storm event that has a 100% chance of being equaled or exceeded in a given two year.
ULTIMATE CONDITION - Full watershed build-out based on existing zoning.
ULTRA-URBAN - Densely developed urban areas in which little pervious surface exists.
VELOCITY HEAD - Head due to the velocity of a moving fluid, equal to the square of the mean velocity divided by twice the acceleration due to gravity (32.16 feet per second per second).
VOLUMETRIC RUNOFF COEFFICIENT (Rv) - The value that is applied to a given rainfall volume to yield a corresponding runoff volume based on the percent impervious cover in a drainage basin.
WATER QUALITY VOLUME (WQv or WQV) - The storage needed to capture and treat 90% of the average annual stormwater runoff volume.

WATER SURFACE PROFILE - The longitudinal profile assumed by the surface of a stream flowing in an open channel; the hydraulic grade line. WEDGES - Design feature in stormwater wetlands which increases flow path length to provide for extended
detention and treatment of runoff.
WET SWALE - An open drainage channel or depression, explicitly designed to retain water or intercept groundwater for water quality treatment.
WETTED PERIMETER - The length of the line of intersection of the plane or the hydraulic cross-section with the wetted surface of the channel.
WING WALL - Side wall extensions of a structure used to prevent sloughing of banks or channels and to direct and confine *overflow*.

1. ADDITIONAL ABBREVIATIONS ACRONYMS AND TERMS

Additional abbreviations and terminology particular to this project and report are as follows:

BLUE BOOK, The most current version of the New York Standards and Specifications for Erosion Control.
BRF, Bioretention Filter (F-5) Stormwater Quality Treatment System
CPE&SCP, construction phase erosion and sediment control plan.
DDB, Dry Detention Basin/Pond
DEC Part #, are references to sections of NYSDEC GP-0-08-001
DSW, Dry Swale (O-1) Stormwater Quality Treatment System
ECSWSSA, Existing Conditions Site Watershed Stormwater Subcatchment Areas
EX, Existing conditions
FSP, Filter Strip Pretreatment System
Full SWPPP, SWPPP that includes both construction phase erosion controls and post construction stormwater management practices.
Intense Development Areas (IDAs), Portions of the property with proposed intensive base area development such as new parking lots, connecting "service" roads, stormwater facilities, and select new building sites, as identified in the SEIS.
NYSSMDM, The New York State Stormwater Management Design Manual.
OCF, Open Channel Flow of runoff for modeling Tc Purposes
OCS, Outlet Control Structure
Overall Mountain, Belleayre Ski Center area generally within the watershed of the proposed site construction.
Qlty&Qnty, Stormwater management systems intended to treat stormwater quality and control stormwater quantity. Also referred to as Long-Term" or Permanent treatment systems.
PA, Porous Asphalt
PR, Proposed conditions
SCF, Shallow concentrated Flow of runoff for modeling Tc Purposes
SHT, Sheet Flow of runoff for modeling Tc Purposes
Site Areas, Areas at the Belleayre Ski Center that include portions of the property where construction is planned.

SMP, Stormwater Management Practice
SSF, Surface Sand Filter (F-1) Stormwater Quality Treatment System
Stormwater Model, For this analysis, Hydrocad® 8.5 © 2007 Hydro CAD Software Solutions LLC computer program was used.
Subcatchment Area, A watershed area, Drainage Basin or part thereof, often associated with a single outlet point
Tc, Time of concentration for modeling Purposes
UMP/EIS SWPPP, SWPPP prepared to demonstrate proposed stormwater management systems meet current permit requirements. Individual project SWPPPs will be generated utilizing the same engineering methodology or additional engineering as needed to comply with any changes in stormwater regulatory requirements by State or Federal agencies having jurisdiction over the life cycle of the UMP. Draft NOIs and other documents needed at the time of construction are included in the accompanying CPE&SCP, with basic information completed.

V. DOCUMENT FIGURES, TABLES AND UMP DRAWINGS

Table 1 through Table 7 are found in this section. Additional supporting information including figures, tables and UMP Drawings, for this SWPPP are provided under separate cover. The lists at the end of this section identify the items which can be inserted in this section, to make it a stand-alone document.

Table 1. Soil Properties						
USDA SCS (NRCS) Soil Survey - Soils within on-site subcatchment areas						
Map Symbol	Description	HSG tbl-16(1)	Unified Classification tbl-14	K(2) tbl-15	T tbl-15	%<200
ARF	Arnot-Oquaga-Rock outcrop complex, very steep. Arnot. Oquaga.	 C/D C	 ML, GM, SM, GM-GC ML, GM	 0.24 0.28	 2-1 3	 15-50 15-55
LCD/LCF	Lackawanna and Swartswood very bouldery soils, moderately steep"D" very steep "F". Lackawanna - Swartwood -	C	 ML, GM, SM, CL ML, GM, SM, GW-GM	 0.28 0.28	 3 3	 20-60 15-65
LEE	Lackawanna and Swartswood extremely bouldery soils, steep. Lackawanna - Swartwood -	C	 ML, GM, SM, CL ML, GM, SM, GW-GM	 0.28 0.28	 3 3	 20-60 15-65
ORC/ ORD	Oquaga-Arnot-Rock outcrop complex, moderately steep. Oquaga. Arnot.	 C C/D	 ML, GM, SM ML, GM, SM, GM-GC	 0.20 0.17	 3 2-1	 15-55 15-50
RXF	Rock outcrop-Arnot complex, very steep. Arnot.	 C/D	 ML, GM	 0.17	 2-1	 30-50
VAB (Lower Site)	Valois very bouldery soils, gently sloping	B	ML, GM, SM, GW-GM	0.28	3	20-60

Table 1. Soil Properties						
USDA SCS (NRCS) Soil Survey - Soils within on-site subcatchment areas						
WLB	Wellsboro and Wurtsboro extremely bouldery soils, gently sloping .					
	Wellsboro	C	ML, GM, SM, CL	0.28	3	15-40
	Wurtsboro (not in site area)	C	ML, GM, SM, SP-SM	0.28	3	10-70

Notes:
(1) For HSGs with a dual hydrologic group (C./D) first letter is for drained areas, second is for undrained areas.
(2) K value is largest below the A Horizon (Lake, 2008)
Permeability is <0.2" per hour for LEE, ORD & WLB Soils
K values <0.35, so not highly erodible per NYSSMDM Appendix L, pg L-1

Table 2. Design Rainfall Event Data Summary			
Event	**Rainfall**	**Used for**	**Reference:**
90% rainfall	1.3-inch	WQv, Water Quality Volume	NYSSMDM Fig. 4.1
1-year 24-hour	3.5-inch	Cpv, Channel Protection Volume	NYSSMDM Fig. 4.4 See Note 2 below
2-year 24-hour	4.0 inch	Conveyance Criteria	NYSSMDM Fig. 4.7
10-year 24-hour	6.0-inch	Q10=Qp, Overbank Flood	NYSSMDM Fig. 4.5
25-year 24-hour	6.5-inch	Q25 "DEP reqd analysis"	NYC Section 18-39 (c.)(4.) ,see Notes 1 below
100-year 24-hour	8.0-inch	Q100= Qf, Extreme Storm	NYSSMDM Fig. 4.6

Notes:
1.) NYCDEP states "All stormwater pollution prevention plans prepared pursuant to this section shall include an analysis of the 25-year storm."
2.) An extended event time span of 72 hours is used to represent the entire outflow volume in comparing center of mass hydrographs.

Table 3. Proposed Site areas where SWPPP only includes Construction-Phase Erosion and Sediment Controls	
These are based in applying criteria from GP-0-08-001, Appendix B, Table 1	
Type of Construction Activity from Table 1	**Project Features Include…**
Linear Utilities	All proposed lifts, underground piping (i.e. Water), air lines, electric
Linear Utilities	Water line routes for Snowmaking
Bike Paths and Trails	Mountain Bike Trails and bridges
Bike Paths and Trails	Hiking/Walking Trails Overlook trail pedestrian bridge
Bike Paths and Trails	Ski Trails, Tomahawk Ski Bridge 1 (Upper Stream Crossing) Tomahawk Ski Bridge 2 (Lower Stream Crossing) Skier Bridge-Crossing Overlook Lodge Road
Land Clearing and Vegetation for Creating open Space	Reservoir Embankment dense grass slopes
Sidewalk Construction not part of a Highway Project	Access walkways from Discovery Bus lot.

Table 4. Proposed site areas where SWPPP includes new Post-Construction Stormwater Management Systems in addition to the Construction-Phase Erosion and Sediment Controls		
These are based in applying criteria from GP-0-08-001, Appendix B, Table 2		
Type of Construction Activity from Table 2	**Proposed Project Feature considered to conform with Table 2 Activity**	**Proposed Treatment Systems include…**
Parking lot construction or reconstruction	Proposed Upper Discovery, North, East and associated Service Drives.	Upland Diversion Swale, Dry Swale and Dry Detention Combination, Sand Filter and Dry Detention Combination, Bioretention
Building and nearby associated impervious areas	Gives overall coverage with exceptions to areas that do not alter pre to post hydrology	Local Stormwater Treatment for Roof, Sidewalk, some with Parking.
“”	Amphitheatre Area (seasonal fabric roof structure) and seating slab	“”Redevelopment
“”	Enclosed Deicing Materials Storage Area and surrounding handling containment area.	“”Redevelopment using exist SW system
“”	Visitors Information Building near Route 28	“”Redevelopment
“”	Discovery Lodge Expansion project	“”Redevelopment
“”	Summit Lodge Expansion (1600 sf addition)	“”Redevelopment
“”	Tomahawk Reception Lodge and Compressor Building.	“”Redevelopment
Retrofit of Existing Parking Area.	Existing Lower Discovery Lots	Retrofit installation of Packaged Pretreatment Structure(s)? Redevelopment?

Table 5 Pre-Development to Post-Development Design Point Comparison					
Location	**Desig Point or Event**	**Design Event**	**Pre-Develop (cfs)**	**Post-Develop (cfs)**	**% Dif**
Upper Discovery Parking					
212					
	1	Convey= 2yr-24hr [Ne or E]		Non Erosive	
	2	Qp=Q10=10yr-24hr	301.44	272.61	
	3	Q25=25yr-24hr	345.84	316.05	
	4	Qf=Q100=100yr 24hr	479.65	472.61	
North Parking					
291					
	1	Convey= 2yr-24hr			
	2	Qp=Q10=10yr-24hr	71.47 @ 12.43	30.18 @ 12.42	
	3	Q25=25yr-24hr	81.92 @ 12.43	35.38 @ 12.45	
	4	Qf=Q100=100yr 24hr	114.26 @ 12.42	50.92 @ 12.42	
SUBCAT SDP250	2	Qp=Q10=10yr-24hr	344.6 @ 12.57	344.6 @ 12.57	
SUBCAT SDP291	2	Qp=Q10=10yr-24hr	12.8 @ 12.44	12.8 @ 12.44	
East Parking Lots					
2.7AB EX compared to proposed 2.7					
	1	Convey= 2yr-24hr		Non Erosive	
	2	Qp=Q10=10yr-24hr	19.64	11.02	
	3	Q25=25yr-24hr	22.43	12.46	
	4	Qf=Q100=100yr 24hr	31.02	22.15	
2.8EX +2.8.1 EX compared to proposed 2.8.1 + 2.8.2 +2.8.3					
	1	Convey= 2yr-24hr		Non Erosive	
	2	Qp=Q10=10yr-24hr	16.89=13.23+3.6	16.19=11.97+1.25+2.9	
	3	Q25=25yr-24hr	19.21=15.09+4.1	18.75=13.54+1.86+3.3	
	4	Qf=Q100=100yr 24hr	26.33=20.80+5.5	26.36=18.36+3.48+4.5	
Table rev: 12/23/09					

Table 5.1 CPv Detention Times – Center of Mass Method		
Lot	**Area**	**Minutes**
UD – Upper Discovery Parking		
	DS-D-E	Appendix B Method for T=12hrs ED Applied
	DS-D-W	Appendix B Method for T=12hrs ED Applied
	DS-C-E	Appendix B Method for T=12hrs ED Applied
	DS-C-W	Appendix B Method for T=12hrs ED Applied
	DS-B-E	Appendix B Method for T=12hrs ED Applied
	DS-B-W	Appendix B Method for T=12hrs ED Applied
	DS-A-E	Appendix B Method for T=12hrs ED Applied
	DS-A-W	Appendix B Method for T=12hrs ED Applied
	DS-S-0	Appendix B Method for T=12hrs ED Applied
Table rev: 12/21/09		
N – North Parking		
	DS-B-E	720
	DS-B-W	866
	DS-A-E	841
	DS-A-W	934
Table rev: 12/21/09		
E – East Parking		
	1P	1212
	2P	1407
	3P	1446
	4P	1323
	5P	528
	6P	841
	SF1	401
	BIORET1	798
	BIORET2	134
Table rev: 12/21/09		
Notes: 72 hour timespan.		

1. UMP DRAWING "SUBSET" INDEX

The supporting UMP Drawings for this document may be on 11x17 sheets bound separately. The following UMP Drawings should be considered as included.

Table 6 UMP Drawing Subset Index

No.	Description	Last Revised/Notes
G4	Overall Project Master Plan	
EX16	Existing Stormwater Subcatchment Areas	
EX17	Proposed Upper Discovery Parking – Subsurface Investigation	
EX18	Proposed North Parking – Subsurface Investigation	
EX19	Proposed East Parking – Subsurface Investigation	
EX20	Proposed Pond Area – Subsurface Investigation	
EX21	Proposed Tomahawk Base Area – Subsurface Investigation	
EX22	Upper Mountain Area – Subsurface Investigation	
EX23	Additional Mountain Areas – Subsurface Investigation	
PK1	Proposed Upper Discovery Parking - Grading & Drainage	
PK2	Proposed Upper Discovery Parking - Stormwater Management System	
PK3	Proposed Upper Discovery Parking - Pre to Post Development Area	
PK4	Proposed North Parking – Grading & Drainage	
PK5	Proposed North Parking - Stormwater Management System	
PK6	Proposed North Parking - Pre to Post Development Area	
PK7	Proposed East Parking - Grading & Drainage	
PK8	Proposed East Parking - Stormwater Management System	
PK9	Proposed East Parking - Pre to Post Development Area	
PK10	Proposed Parking Details I	
PK11	Proposed Parking Details II	
PK12	Proposed Parking Details III	
PK13	Proposed Parking Details IV	

Table 6 UMP Drawing Subset Index		
No.	**Description**	**Last Revised/Notes**
PK14	Proposed Parking Details V	
PK15	Proposed Parking Details VI	
PK16	Proposed Parking Details VII	
BS12	Proposed Tomahawk Base Area – Stormwater Management System.	

2. ADDITIONAL FIGURES UNDER SEPARATE COVER:

Some Figures referenced in this document are found in supporting documents under separate cover. The following Figures and Tables should be considered as included.

Table 7 Additional Figures (AF) Index			
AF No.	**Prepared By**	**Description**	**Last Revised/Notes**
1	E&E	Wetland Map	
2	E&E	Papacton-Ashokan Divide	

REFERENCES

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"NYSSMDM" NYSDEC, 2008. New York State Stormwater Management Design Manual. August 2008. (pdf)

"NYSSMDM10" NYSDEC, 2010. New York State Stormwater Management Design Manual. June 2010. (pdf)

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NYSDEC, 2008c. "Final Scope of the UMP/DEIS"

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NYC, 1998. NYCRR 128-3.9 Effective 07/08/98

MWCG, 1987. "Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs", Metropolitan Washington Council of Governments, (Washington, DC., 1987)

CWP, 1996. "Design of Stormwater Filtering Systems", Center for Watershed Protection (December 1996).

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E&E, 2009a. UMP/DEIS Section, Natural Resources Appendix A BMSC Wetlands and Water Bodies Report, February 2009, prepared by Ecology and Environment, Inc.

VI. POST CONSTRUCTION INSPECTION AND MAINTENANCE PLAN (Part III.B.2.g)

The document, NYSDEC (2008#) "UNIT MANAGEMENT PLAN-DEIS, ATTACHMENT A-1, STORMWATER PROTOCOL" specifies the I&M manual requirements for the permanent stormwater treatment measures included in this SWPPP as follows:

> "The SWPPP shall require the completion of As-Built Drawings and an Operation and Maintenance (O&M) Manual for all of the permanent stormwater pollution prevention measures installed as part of this project. The O&M Manual shall spell out the frequency and scope of routine inspections and maintenance items to be completed to ensure that the measures continue to function as designed."

1. INSPECTION AND MAINTENANCE MANUAL

Sand Filters:
Maintenance will include routine inspection of the functioning of the filter during a storm event to assess the surface infiltration capacity of the filter. Routine mowing and seasonal raking of the filter strip and sand filter area will be required. After several years of operation it may be necessary to strip the grass over the sand filter, along with the top few inches of the filter sand on the filter surface, and replace the surface of the filter sand layer, sandy loam layer, and re-establish turf.

2. LONG TERM OPERATION AND MAINTENANCE RESPONSIBILITY

The Owner is identified herein as the entity that will have responsibly for the long term operation and maintenance of each stormwater management practice

3. INSPECTOR RESPONSIBILITY

The permanent stormwater facilities will be inspected and maintained by the Operations personnel at the mountain as required. In particular the dry swales and sand filter(s) will be inspected during storm events to verify the functioning of the filters and conveyance system. Routine mowing of the grass over the filter will be accomplished by state forces.

4. INSPECTION SCHEDULE

5. MAINTENANCE SCHEDULE FOR POST-CONSTRUCTION STORMWATER CONTROL PRACTICES (Part III.B.2.g.)

This will be added when the Plan is developed

VII. APPENDICES

Appendix A - H&H Model Data Key

Appendix B - Existing and Proposed Conditions H&H Model Data

Node Diagrams for Predevelopment and Post Development models.
Sketches treatment illustrating system components, i.e. OCSs, DDB Sections

Appendix C - Facility Sizing Calculations

Appendix D - Technical Specifications

Appendix E - Reference Documents

Appendix F - Geologic and Topographic Investigation

Appendix G - Soil Boring and Infiltration Testing Reports

Appendix H - Post Construction Maintenance Manual

Appendix I - Shumaker SWPPP for Discovery Lodge Expansion