Belleayre Mountain Ski Center UMP-DEIS

Appendix C
Wastewater Engineers Report

December, 2009

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Engineering Report

Belleayre Mountain Ski Center
Wastewater Collection/Treatment Analysis

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EXECUTIVE SUMMARY

New York State Department of Environmental Conservation (NYSDEC), Division of Water engineering staff evaluated whether the existing wastewater collection system at Belleayre Mountain Ski Center (BMSC) is adequate to handle the proposed ski center expansion as outlined in the BMSC Unit Management Plan Draft Environmental Impact Statement (UMP/DEIS). Presently, the ski center's sewage collection system accommodates approximately 4,500 skiers per day, with peak attendance of 6,000 skiers per day. The proposed expansion would accommodate 9,000 skiers per day, with projected peak attendance of potentially 10,500 skiers per day.

This engineering evaluation of the BMSC collection system:

A. Describes the existing wastewater collection system (See Appendix A).

B. Computes maximum daily flow to be approximately 60,000 gpd for the expanded facility.

C. Evaluates and verifies that the capacity of the existing collection system is adequate to handle the proposed maximum daily flow.

D. Recommends maintenance repairs to the existing system to address inflow, infiltration, and flow measurement issues:
   - Substantially remove existing water infiltration into the system by re-grading critical areas of direct surface runoff away from the collection system;
   - Repair or replace asbestos cement (AC) collection lines and block constructed manholes from the Overlook Lodge, adjacent buildings, and the Nursery;
   - Divert stormwater runoff away from the existing wastewater holding tank manhole cover.
   - Replace the sewage flow monitoring device that measures flow from BMSC (V-Notch weir) with a Parshall flume, Palmer Bowlus flume, or Flo Dar. This would address the likely inaccurate measurements due to the fouling of the v-notch weir. Modify the existing flow monitoring station to improve access to the weir for maintenance (pumping out of solids and cleaning of the weir).

E. Estimates the cost for a 180,000+/- gallon equalization (EQ) tank to be $560,000 (See Appendix F).

F. Identifies the existing Memorandum of Understanding (MOU) between NYSDEC and NYCDEP 1999, regarding acceptance of sanitary wastewater (effluent) at the Pine Hill Wastewater Treatment Plant (WWTP) (See Appendix H). Determined that the existing maximum daily flow per this MOU is 35,000 gpd, and the MOU will need to be amended to accommodate the proposed increased flow of 60,000 gpd.

1.0 INTRODUCTION

New York State Department of Environmental Conservation (NYSDEC) owns and operates Belleayre Mountain Ski Center (BMSC), on Belleayre Mountain located in Highmount, Ulster County, New York. Belleayre Mountain has a summit elevation of 3,429 feet, and a vertical drop of 1,404 feet. The ski center provides 8 ski lifts that serve 47 ski trails on 171 skiable acres. The ski center currently accommodates a comfortable carrying capacity (CCC) of about 4,500 skiers per day and has seen peak days of approximately 6,000 skiers a difference of 1500 skiers.

In the BMSC UMP/DEIS, NYSDEC proposes to expand BMSC to accommodate a (CCC) of 9,000 skiers per day, with a peak of 10,500 skiers per day. The projected peak attendance at the ski center is calculated to be 1,500 skiers per day above the CCC. The assumption here is that the difference between CCC and peak day would remain the same from existing conditions. This is based on the observation of ski area management that on peak days, after parking facilities are full, guests will continue to park along County Route 49A, and out to Route 28, but at some point, people begin to turn away and leave. On a day where the attendance is at the CCC, the parking lots are full. Overflow parking along the road accommodated the attendance over CCC up to the peak day. The capacity of this overflow parking will remain unchanged in the expanded facility, so it is deduced that the difference from CCC to peak days will remain unchanged as well.

This engineering report evaluates whether the ski center's existing wastewater collection system is adequate to handle the proposed ski center expansion. Currently, Pine Hill WWTP is the recipient of all wastewater from BMSC with the exception of Sunset Lodge, which is on septic and separate from the BMSC wastewater collection system. It is proposed that the Sunset Lodge septic tank effluent would be connected to the wastewater collection system and discharged to the Pine Hill WWTP as well.

2.0 SCOPE OF REPORT

This report provides a description of the existing BMSC wastewater collection system followed by the methodology of data collection and an analysis of the data. Next is a discussion of the capacity of the wastewater collection system based upon a review of design and revision drawings or "as-builts" and existing flow data into the collection system. A follow-up system inspection further explains data results. The potable water system is then described. Next is an evaluation of the capacity of the collection system based upon the proposed expansion, details on the specifications and a cost estimate of a proposed equalization tank (Appendix H, AIP, Exhibit H, page 4.). Finally, the report provides recommendations of changes, upgrades and/ or repairs to the system.

3.0 DESCRIPTION OF THE BELLEAYRE MOUNTAIN SKI CENTER WASTEWATER COLLECTION/ TREATMENT SYSTEM

3.1 History

The initial BMSC wastewater system was constructed in the 1950s using asbestos cement (AC) pipes that routed wastewater from the Upper Lodge (Overlook Lodge) to on-site septic tank and sand filter treatment system. The Lower Lodge (Discovery Lodge) and its wastewater treatment system was constructed in the early 1960's. The Lower Lodge system was also an on-site septic tank and sand filter system. The sand filter systems discharged their treated effluent into a nearby stream. In 1999, due to operational difficulties with the sand filters and the availability of the newly constructed Pine Hill WWTP, a project was undertaken to collect all of the on-site septic tank effluent and transmit it to the Pine Hill WWTP for treatment and disposal. The Sunset Lodge which is located at the summit of the mountain is served by a septic tank and absorption bed system that is not currently connected to the wastewater collection system.

3.2 Existing Collection System

The current collection system consists of 11 manholes, 4 septic tanks, 8345 feet of gravity sewer line, and 3015 feet of force mains (See BMSC UMP/ DEIS Appendix A, EX4 - Existing Sanitary Sewer System Overall; EX5 - Existing Sanitary Sewer System Upper Area; and EX6 - Existing Sanitary Sewer System Lower Area).

Overlook Lodge wastewater flows by gravity to manhole #1 then travels 205 feet by pipe to manhole #2 and on to manhole #4. Wastewater from Longhouse Lodge flows by gravity 65 feet by PVC pipe to manhole #2. The combined wastewater lines from Overlook Lodge and Longhouse Lodge continue 125 feet through AC pipe to manhole #3, emptying to a septic tank. Wastewater discharge from the upper pumphouse flows by gravity to a septic tank then travels 890 feet through a 4" HDPE pipe to manhole #4. From the septic tank, the wastewater line travels through 90 feet of AC pipe, joining with the line from the upper pumphouse at manhole #4. This line empties to 6" HDPE pipe and travels another 610 ft to manhole #6.

The Nursery wastewater flows by gravity to a septic, then to manhole #5 before continuing through 6"HDPE pipe for 515 feet to manhole #6, where it empties to the wastewater line from the upper pumphouse, Overlook Lodge and Longhouse Lodge. The line continues for another 330 feet to manhole #10, then to a septic tank and then through 120 feet of 6" HDPE pipe to manhole # 9.

The carpenter shop discharge flows by gravity to manhole #8, combining with wastewater from manhole #7 and continuing by gravity flow 360 feet to manhole #9 where it would have combined with the old garage wastewater, however the old garage is scheduled for demolition and services have been disconnected. The gravity flow continues 130 feet through 6" HDPE pipe to manhole #10. From manhole #10, 6" HDPE pipe transports by gravity the wastewater from these buildings for 1415 feet to manhole #11.

Wastewater discharge from the Discovery Lodge flows by gravity for 170 feet to a holding tank. The discharge from the maintenance center is directed by force main up through 4" HDPE pipe for 1,985 feet to the same holding tank that also captures the Discovery Lodge discharge. The combined discharge from the holding tank is pumped by an effluent lift station 1,030 feet through a 4" HDPE force main to manhole #11. Wastewater Flows from the upper mountain and lower mountain combine in manhole #11.

From manhole #11, the wastewater flows by gravity for 3240 feet through 6" HDPE to a velocity reduction manhole. It then connects to a 20-foot-long section of 12" PVC pipe to the sewer flow monitoring station. Finally, the system runs through 8" PVC for approximately 76 feet to the DEP manhole on Bonnieview Rd.

4.0 EVALUATION OF EXISTING SYSTEM

4.1 COLLECTION OF DATA

This section includes the methodology of data collection, analysis, follow up system inspection, and discussion.

Design drawings and "as-builts" of the existing BMSC wastewater collection system from NYSDEC Division of Operations were reviewed. Existing data on the following three variables was collected from operational records and reviewed for ski seasons 2007 and 2008:

- Recorded potable water recorded flow data from Upper and Lower water meters
- Daily skier attendance

- Recorded Wastewater Flow Monitoring Station flow data at the meter to Pine Hill WWTP from BMSC collection system (combination of Discovery Lodge, Overlook Lodge, Longhouse Lodge, the Nursery, and maintenance center).

It would be expected that wastewater flow, potable water use, and skier attendance would be closely correlated. However there were unexplained variations in certain data. In Table 1 and Graph 1 below, while it does appear that the potable water use and skier attendance are well correlated, there are instances when flow to the WWTP appears unrelated to the number of skiers and amount of water use. For example, comparing December 23, 2007 and February 18, 2008 shows that even though attendance and potable water usage on February 18, 2008 were more than twice the amounts for December 23, 2007, flow to the WWTP on December 23, 2007 was lower than February 18, 2008. Similarly, March 4, 2008, 86 skiers used 1148 gpd potable water. The WWTP flow meter registered 22,200 gpd. Then March 5, 2008, only 33 skiers used 702 gpd of potable water. The WWTP flow meter recording on March 5, 2008 is 38,550 gpd.

TABLE 1 Comparison of flow to Pine Hill WWTP, potable water and attendance

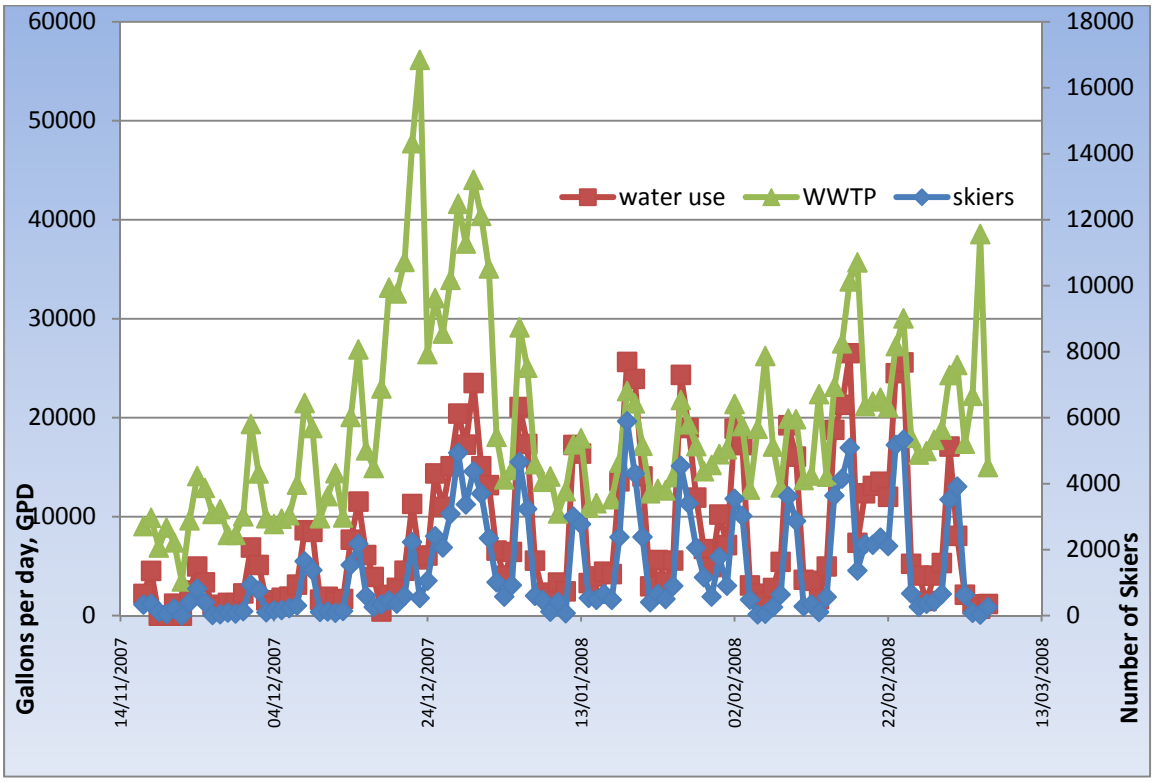
Date	Flow to WWTP	Potable H20	# of Skiers
12/23/07	56,153	3128	536
02/6/08	26,230	1362	60
02/18/08	35,682	7362	1367
03/4/08	22,200	1148	86
03/5/08	38,550	702	33

High flows to the WWTP relative to low potable water use and skier attendance do not coincide with the expectations. These findings call for further investigation. Therefore, the following factors and data (See Table 2 below) were then included in order to overlay the information with temperature, snowpack and precipitation events to determine if any correlation exists between the reported high flows and high runoff/precipitation events.

- Average Daily Temperature (ADT)
- Precipitation (Rainfall)
- Snowfall

The following graph shows potable water and wastewater flows relative to skier use over time.

GRAPH 1 Comparison of years 2007- 2008 potable water use, wastewater flows, and attendance



Clearly the potable water use and skier attendance coincide with each other but not with wastewater flows. Detailed graphs illustrating 2007-2008 Flow Trend Analysis from BMSC to the Pine Hill Wastewater Treatment Facility are in Appendix A.

The following table shows flow to Pine Hill WWT, potable water and meteorological data.

TABLE 2 Comparison of flow to Pine Hill WWTP, potable water and meteorological data

Date	Flow to WWTP	Potable H20	# of Skiers	ADT	Precipitation (Rainfall)	Snowfall	Snow Depth
12/23/07	56,153	5686	536	36	Trace	0	4
2/6/08	26,230	1362	60	43	.98	0	0
2/18/08	35,682	7362	1367	39	0.83	***	Trace
3/4/08	22,200	1148	86	40	1.97	0	Trace
3/5/08	38,550	702	33	32	0.31	0	Trace

Average daily temperature (ADT), precipitation (rainfall), and snowfall data provides a more comprehensive picture of the BMSC wastewater collection system. Potable water, number of skiers, rainfall, or snowfall seems to have little impact on the WWTP flow meter readings.

To eliminate variables of potable water, number of skiers, rain, snowfall and snow depth, the engineer team considered a dry, warm and off season period from May 19, 2007 to May 31, 2007 (See Table 3 below.)

TABLE 3 Comparison of Flow to Pine Hill WWTP, potable water during dry, warm weather

Date	Flow to WWTP	Potable H20	ADT	Rainfall
5/19/07	736	0	46	0
5/20/07	2063	0	47	.38
5/21/07	3022	657	55	0.06
5/22/07	4363	976	47	0
5/23/07	2026	1148	54	0
5/24/07	2003	915	64	0
5/25/07	3170	1833	68	0
5/26/07	4216	0	70	0
5/27/07	9764	0	64	Trace
5/28/07	2926	0	68	0.3
5/29/07	3459	610	57	0
5/30/07	3206	494	57	0
5/31/07	4245	780	64	0

The expected correlation between potable water flows and wastewater flows does not appear to be present. Wastewater flow data is concluded to be unreliable.

The engineer team then considered a wet, warm off-season period from June 1, 2007 to June 5, 2007 when there are no skiers (See Table 4 below).

TABLE 4 Comparison of flow to Pine Hill WWTP, potable water during wet weather

Date	Flow to WWTP	Potable H20	ADT	Rainfall
6/1/07	5775	1916	71	.08
6/2/07	8626	0	72	.25
6/3/07	5355	0	73	.7
6/4/07	14118	540	67	.26
6/5/07	8763	496	55	.25
6/19/07	3213	1187	70	1.36
7/20/09	5841	3619	73	.99
8/10/07	14912	3516	70	1.39
9/8/07	6085	0	76	1.28
9/11/07	6779	481	59	2.25
9/27/07	3928	482	69	1.46
11/14/07	7030	553	41	.93

Further comparison of potable water, WWTP flow meter readings and rainfall event data shows wastewater flows are unrelated to the water use on the same day.

4.2 DATA ANALYSIS

As noted earlier, it would be expected that sewage flows would be greater when more skiers are at the BMSC. Initial examination of the BMSC data shows that the flow measurement at the WWTP meter does not follow potable water use data or ski attendance data.
One plausible reason may be that the WWTP readings in Table 1 are inaccurate due to possible build-up of solids on the flow measurement device itself (weir).

Another reasonable explanation for the variation at the WWTP meter based upon the comparison of water use with wastewater meter flows (Tables 2, 3, and 4) during rain events may be the result of inflow and infiltration (I&I) into the system. Inflow refers to water that enters the sewers from gaps in manholes, and infiltration refers to water that seeps into sewer pipes through cracks, separated joints, and other flaws in the underground pipe system.

An exhaustive examination of the various data suggests unreliable meter readings however nothing conclusive was found. It is critical to have reliable flow measurements in order to evaluate the system capacity. These results called for an on-site system inspection.

5.0 SYSTEM INSPECTION

On March 17, 2009 a field inspection of the wastewater collection system was conducted. There were clear skies, warm temperatures ranging in the 50s, and observable melting snow. The inspection started at the Upper Lodge.

The engineering team removed covers from manholes not covered by ice or snow to inspect for infiltration. The team found several potential sources of I&I related to connections and manholes original to Overlook Lodge, Longhouse Lodge and adjacent buildings. The facility manager indicated these manholes and lines are scheduled to be replaced. Replacement will eliminate possible infiltration from these sources.

Inspection continued at the Discovery Lodge area. Four covers of the septic tank were removed, revealing an overload of scum in the tank. Further examination exposed a scum layer that was higher than the baffles. The team confirmed that this scum was a carry-over of solids and grease from the Discovery Lodge. The team consulted the facility maintenance operator and found that the tanks are pumped once a year. This further supports the theory that build-up of solids and grease could be interfering with the WWTP meter readings.
The engineering team then conducted an inspection of the flow measurement device leading to the WWTP. This inspection confirmed that the meter readings reflected meter inaccuracies due to the build-up of solids (See Appendix B for pictures).

Subsequent inspections of the system were conducted during heavy rain events. For example, on April 3, 2009, a significant amount of water was observed flowing into the manhole cover servicing the holding tank and pump chamber located at the Children's Learning Area below the Discovery Lodge. To address this issue, a temporary swale was constructed to divert stormwater runoff away from the pump chamber below the Discovery Lodge. (Appendix B contains pictures taken during the site inspections).

In conclusion, the follow-up inspection

- Identified probable infiltration issues
- Identified possible improper functioning of Overlook Lodge septic tank outlet baffle
- Identified significant inflow (stormwater runoff) into the wastewater collection system at the pump chamber manhole located below the Discovery Lodge in the Children's Learning Area.
- Revealed an overload of scum in the Discovery Lodge septic tank and confirmed that this scum was a carry-over of solids and grease from the Discovery Lodge
- Identified possible improper functioning of Discovery Lodge septic tank outlet baffle.

- Pine Hill WWTP meter readings are suspected to be inaccurate as a result of the build-up of solids and grease at the flow meter (v-notch weir) meter.

Recommendations for maintenance repairs to the wastewater collection system based on the findings of the field inspections are included at the end of this report.

6.0 POTABLE WATER SUPPLY SYSTEM

Projecting future system capacity to the Pine Hill WWTP meter requires reliable sewage flow data, which, as noted earlier, is not available. Potable water, and ski attendance data is available, reliable and a reasonable source from which to calculate current sewage flow for the proposed BMSC expansion. What follows is a description of the potable water supply system at BMSC. This report then provides an analysis of the historical data, an explanation of the calculations leading to projecting future system capacity, and flow rate data and analysis.

6.1 POTABLE WATER SUPPLY SYSTEM DESCRIPTION

There are two potable water meters, one for Overlook Lodge and surrounding buildings and one for Discovery Lodge. Four drilled wells supply water for the primary potable water supply system. Sunset Lodge has its own well as a water source**.**

The potable water flows from three of the wells flow to a chlorine station. From the chlorine station the supply line runs past the maintenance center to a 100,000 gallon storage tank. From the 100,000 gallon tank, water flows by gravity through a water meter (Discovery Meter) to the Discovery Lodge. Water is also pumped from the 100,000 tank to a 50,000 gallon tank further up the mountain. Water flows by gravity from the 50,000 gallon tank through a water meter (Overlook Meter) and then on to the Overlook Lodge and other buildings. The water to the maintenance center is provided from the main water supply pipeline and is not metered.

6.2 HISTORICAL FLOW AND SKIER DATA

Ski attendance data and potable water supply data from the Overlook meter and Discovery meter for the period December 2007 to April 2008 was analyzed[1].

The following assumptions were made in the development of the calculated numbers. First, potable water use data on days when daily attendance is less than 1000 was excluded because of the variations in flow data. Second, the 95th percentile was applied to flow per skier was chosen as a reasonable method for determining water use per skier per day. The analysis yields 6.12 gpd potable water use per skier on higher attendance days. It also establishes a basis for sewer flow based on number of skiers.

The 6.12 gpd per skier used at the metered buildings was multiplied by the current peak skier attendance of 6,000, yielding a current total metered flow of 36,720 gpd.

In order to account for the unmetered potable water use at Sunset Lodge, a presumptive approach based upon total square footage and potable water use at the metered buildings is used to prorate unmetered potable water use at Sunset Lodge. Projected potable water use becomes 6.33 gpd per skier (See Appendix I for calculations).

[1] USEPA Technical Support Document for Water Quality based Toxic Control

7.0 SKI CENTER EXPANSION

This section discusses the BMSC expansion. The subsequent subsections discuss the projected flow for the proposed expansion, and assessment of the existing the hydraulic capacity of the 6" HDPE gravity sewer line and the pump capacity to handle the increased flow.

The BMSC UMP-DEIS outlines expansion of the ski lift and trail system as well as the associated snowmaking system. Also proposed is expansion of Discovery Lodge and Sunset Lodge, construction of a new Tomahawk Lodge an Information Booth, as well as new parking facilities.

Although the proposed expansion includes changes at the Overlook Lodge, there is no associated square footage increase at Overlook Lodge, Longhouse Lodge or the Nursery (See Appendix C). Registration and rental would be consolidated to one location at the Discovery Lodge. The proposed expansion of Discovery Lodge would increase sitting areas, food preparation areas, the day care facility, restrooms, ticket sales, rental areas, lockers, ski patrol, administration, and storage.

These changes are expected to result in more skiers remaining in these lower buildings. Sunset Lodge would also be expanded and the septic system tied into the current BMSC wastewater collection system.

7.1 FLOW PROJECTION

The projected peak flow is determined by multiplying the prorated water use per skier per day by the projected peak attendance, or 6.33 x 10500 = 66465 gpd. This number may be reduced based on the use of water conserving fixtures.

In accordance with the New York Environmental Conservation Law Section 15-0314, water saving fixtures will be installed in the proposed expansion. A LEED certification (attached in Appendix D) indicates a 20 – 30% water reduction for the proposed water savings fixtures to be installed as part of the Discovery Lodge Expansion. For the purposes of this evaluation, the lower water reduction percentage (20%) is chosen which should result in a more conservative (higher) flow projection.

Since, there is no significant upgrade or change in the Overlook Lodge, Nursery, or Longhouse Lodge proposed ski center expansion, the current water use at these buildings will remain at 20196 gpd (See Appendix I for calculations).

On the other hand, Discovery Lodge and Sunset Lodge would be expanded under the proposed ski center expansion. Currently Discovery Lodge has 28 toilets using 3.5 gallons of water per flush and 6 urinals using 1.5 gallons of water per flush. If expanded, water saving fixtures would be installed in these buildings as well as in the proposed construction of Tomahawk and the Adaptive Building. Thus water use would be reduced an estimated 20% (0.8) and the savings reflected below.

To calculate for the water use at the new and upgraded buildings (Discovery, Sunset, and Tomahawk), the water use at the Overlook Lodge and other buildings is subtracted from the projected flow (without water savings).

66465 gpd	Projected flow (without water savings)
-20196 gpd	Overlook lodge meter
46269 gpd	Total water use at upgraded and new buildings without water savings

Applying 20% (0.8) water reduction: 46269 gpd x 0.8 = 37015 gpd.

Therefore, the projected peak water use (ppwu) will be: 20196 gpd + 37015 gpd = 57211 gpd.

Up to this point, the assessment has reflected potable water supply, not wastewater flow. However this report is to evaluate wastewater flow. Potable water supply flow is normally equal to or higher than sewage flow. To be conservative, the engineering team used the potable water flow rate and applied it as the sewage flow, also known as the "hydraulic loading rate."

For the maintenance center, which has 10 employees, the additional hydraulic loading is calculated to be 10 x 15 gpd = 150 gpd (Design Standards for Wastewater Treatment Works, 1988 for an office building design flow rate of 15 gpd per employee).

The Information Booth, which will have 2 employees will have a design hydraulic loading of 2 x 15 gpd = 30 gpd (Design Standards for Wastewater Treatment Works, 1988 for an office building design flow rate of 15 gpd per employee).

The hydraulic loading that could be attributed to infiltration is estimated at 1176 gpd, based on Section 33.94 in Standards for Wastewater Facilities (2004) Ten States Standards. (See Appendix I for calculations)

The total hydraulic loading/ wastewater flow to Pine Hill WWTP is:
57,211gpd (ppwu) + 150 gpd (unmetered maintenance center) +1,176 gpd (infiltration) + 30 gpd (Information Booth) = 58,567 gpd. This number was then rounded up to the projected maximum daily flow of 60,000 gpd for design purposes. Therefore, projected maximum daily flow = 60,000 gpd.

8.0 SYSTEM CAPACITY ASSESSMENT

This section evaluates the capacity of the existing BMSC wastewater collection system to handle the projected increased flows due to the proposed expansion.

8.1 WASTEWATER COLLECTION PIPE

Hydraulic analysis on the 6" HDPE gravity sewer line was performed to determine the flow capacity of the collection system. The engineering team used the length of the 6" HDPE pipe from manhole #4 to the velocity reduction manhole to calculate system capacity.

The distance from manhole #4 to the velocity reduction manhole is approximately 5,595 ft. The elevation at manhole #4 is 2,460 ft. Elevation at the velocity reduction manhole is 1,630 ft. Using Manning roughness value of 0.10 for HDPE pipe, the resulting flow is approximately 1.8 MGD.

The calculated collection system capacity of 1.8 million gallons per day (mgd) is adequate to accommodate the maximum flow of 60,000 gpd.

8.2 PUMP CAPACITY

The existing Discovery Lodge pump is rated at 80 GPM from the manufacturers pump specifications (see Appendix E). The maximum projected flow to the pump station is 37,015 from Discovery Lodge, 150 gpd from the maintenance center, and 30 gpd from the Information Booth resulting in a total flow of 37195 gpd.

The existing lift station is adequate to accommodate maximum daily pumping capacity of 80 gallons per minute (GPM) x 60 minutes per hour (MPH) x 8 hours per day (HPD) = 38,400 GPD + 7500 G Holding Tank Capacity = 45,900 (GPD) Overall Capacity. The lift station will therefore will accommodate the projected peak flow of 37,165 gpd.

9.0 FLOW MEASUREMENT DEVICE ANALYSIS

This Section is an evaluation of flow meters that may be appropriate for the BMSC flow condition. The flow measurement devices evaluated are V-notch weir, Magnetic meter, Parshall flume, Palmer Bowlus, and Flo-Dar Doppler and ultrasonic sewer flow meter.

A V-notch weir is the simplest flow metering device that can be used to measure flow in open channels. It is also considered to be the most accurate discharge measuring device when properly used and maintained. However, it operates with a significant head loss, and its accuracy is greatly affected by solid material that can build up in the weir.

The second device considered is a Magnetic flowmeter. A magnetic flowmeter is a device that is installed in-line on a pipe. It is a volumetric flow meter with no moving parts and requires low pressure drop. It is also not affected by temperature and pressure. However, the pipe should always be full which is not suitable for BMSC, since a large flow variation is expected into the system.

The third device is a Parshall flume. The main advantage of this device is that it does not significantly restrict flow through the meter device. In other words, it operates at a relatively low head loss. Studies show Parshall flumes operate with much smaller head loss than a weir. Another advantage of the Parshall flume is its self cleaning capacity. In this case, replacement of the V-notch and installation of the flume is more applicable to the BMSC flow conditions. However, installation of a Parshall flume will require extensive reconstruction of the manhole.

The fourth and fifth devices are the Palmer Bowlus flume and the Flo Dar. These devices have all the advantages of the Parshall flume and can be retrofitted into the existing manhole (See Appendix F for details.) The Palmer Bowlus metering flume has been widely used for measuring water and wastewater in open channels or pipelines that are not under any pressure. This flume is normally installed in a "U" shaped channel fed by a pipeline such as a storm drain or sewers. This flume requires little redesign or special modification of circular conduits for installation. The Flo Dar would require minimal modification of the existing manhole. The advantages of these devices are:

- Measurement accuracy
- Low head loss
- Minimum flow restriction
- Ease of installation

10.0 EQUALIZATION TANK

The final scoping document requires the preparation of a budget estimate to construct an 180,000 gallon Equalization Tank (EQ tank). It could potentially be installed at the Pine Hill WWTP to attenuate flow variations coming into the plant. The EQ tank included in this report was used for a similar situation at Hunter Mountain Ski Area, which is located about 20miles+/- from Belleayre Mountain. The EQ tank volume is approximately 200,000 gallons. The EQ tank cost estimate from 2008 was $520,000 for the tank and $40,000 for engineering, yielding a total project cost of $560,000 for the aerated EQ tank. Design specification of the EQ tank is attached at Appendix F.

11.0 CONCLUSION

In conclusion, the existing BMSC wastewater collection system is adequate to accommodate the proposed expansion, with the maintenance repairs included in this report. The BMSC expansion will result in a maximum daily sewage flow of approximately 60,000 gpd, based on a peak attendance of 10,500 skiers.

The on-site inspection found evidence of:

1. A significant build up of grease and solids in the Discovery Lodge septic tank that carries over to the flow meter (v-notch weir) and is believed to be contributing to inaccurate sewage flow measurements from BMSC;

2. Inflow of storm water to the wastewater collection system at the pump chamber located below the Discovery Lodge at the Children's Learning Area.

Recommendations for the BMSC wastewater collection system include:

- Regularly inspect the connections, manholes, and pipes in the original wastewater collection system from Overlook Lodge, Longhouse Lodge and adjacent buildings and identified as potential sources of infiltration.

- Repair and or replace aged and antiquated infrastructure, including septic tanks, manholes, and AC collection pipe as needed to eliminate inflow and infiltration found during inspections.

- Clean, inspect, and maintain the grease trap installed at the Overlook and Discovery Lodges every four months or as needed to address the accumulation of solids.

- A temporary swale, constructed to divert storm water runoff from the Discovery Lodge parking area away from the holding tank manhole and pump chamber, needs to be constructed and maintained until a permanent solution is constructed as part of the Discovery Lodge Expansion project.

- Install water saving fixtures and waterless urinals during the expansion of the BMSC and in all other buildings that have outdated fixtures (Section 15-0314 of the Environmental Conservation Law). The combination of the above recommendations will minimize the flow to the Pine Hill Sewage Treatment Plant .

- Replace the BMSC flow measuring device with a more reliable weir such as a Parshall flume, Palmer Bowlus flume, or Flo Dar. This would address the likely inaccurate measurements due to the fouling of the v-notch weir.

- Modify the existing flow monitoring station to improve access to the weir for maintenance (pumping out of solids& cleaning of the weir).