1.8 Noise

Methodology

To evaluate the potential cumulative noise impact resulting from the Belleayre Mountain Ski Center UMP and the Modified Belleayre Resort at Catskill Park, the predicted noise levels, as estimated from modeling conducted for the BMSC UMP DEIS and the Modified Belleayre Resort at Catskill Park SDEIS, were added. Potential impacts were for the construction and operation of each project at the nearest noise receptor locations. These levels were then compared with the local regulations for compliance with the town code for Shandaken. The Town of Shandaken has limits that apply to the receiving land use in Table 1.8-1, measured at or within the property boundary of the receiving land.

Table 1.8-1 Town of Shandaken Maximum Permissible Continuous Sound Levels at Specified Times

Receiving Property	Time	Sound Level Limits (dBA)
Residential zones (R5, R3, R1.5, HR)	7:00 a.m. to 7:00 p.m.	57
	7:00 p.m. to 7:00 a.m.	53
Commercial zones (HC, HB, and CLI)	7:00 a.m. to 9:00 p.m.	64
	9:00 p.m. to 7:00 a.m.	60

Source: Town of Shandaken 1992

In addition, the combined noise levels were compared with the measured existing noise levels in the area to determine the potential increase in noise above the existing noise level. Under NYSDEC policy, noise level increases of more than 6 dBA over baseline conditions may require a closer analysis of impact potential, depending on existing sound pressure levels and the character of surrounding land use and receptors. In most cases, an increase of 10 dBA would mean that avoidance and mitigation measures should be considered. For operational noise which, unlike noise from temporary construction, has potential for a long-term noise impact, it is appropriate to use the NYSDEC 6 dBA incremental increase guideline as a criterion to identify a significant impact.

1.8.1 Construction Noise

To assess the cumulative effect of construction activities from both projects, the noise levels at the nearest receptors were combined for the construction sites from each project that would occur during the same construction year (up to and including Year 3, when the BMSC is complete). For example, the construction sites for the receptor identified as W-11, which include the north parking lot, the east parking lot, the new reservoir, and the Deer Run Trail for the ski center, were each individually combined with the Highmount golf course construction site projected noise levels.

Table 1.8-2 presents:

1. The construction noise levels estimated for these sites and the combined level,
2. The distance from the construction site to the receptor,
3. The noise level increase over existing levels if both sites would be active at the maximum estimated levels during the same time period, and
4. The increase over existing levels with mitigation measures employed.

These assumptions represent a worst case analysis.

The sound pressure level (SPL) that humans experience typically varies from moment to moment. Therefore, various descriptors are used to evaluate sound levels over time. One descriptor commonly used is the Leq. The Leq is the continuous equivalent sound level. The sound energy from the fluctuating SPLs is averaged over time to create a single number to describe the mean energy, or intensity, level. The Leq has an advantage over other descriptors because Leq values from various sound sources can be combined to determine cumulative sound levels.

Table 1.8-2 Cumulative Construction Noise Levels

Receptor	Const. Years	Project	Construction Activity	Approximate Distance to construction (feet)	Project Sound Level Plus Ambient Leq (dBA)	Daytime Ambient Sound Level Leq (dBA)	Sound Level Change (dBA)	Mititgated Sound Level Change (dBA)
W-1	1 - 2	Resort	Highmount Hotel	620	63	50		
	1 - 2	Resort	Rock Crushing- Highmount Hotel	500	75	50		
	1 - 5	Resort	Highmount Lodge	330	69	50		
	2	Belleayre Ski Center	West Trail Clearing	4500	53	50		
				Combined Sound Level	**76**	50	**26**	**14**
W-2	1	Resort	Conference Clubhouse	600	47	50		
	1	Belleayre Ski Center	Discovery Lodge Expansion	9500	44	50		
				Combined Sound Level	**49**	50	**-1**	**0**
W-3	1	Resort	Wilderness Activities Center	475	48	50		
	1	Belleayre Ski Center	Discovery Lodge Expansion	7500	46	50		
				Combined Sound Level	**50**	50	**0**	**0**
W-4	1	Resort	Wilderness Activities Center	240	54	50		
	1	Belleayre Ski Center	Discovery Lodge Expansion	7000	47	50		
				Combined Sound Level	**55**	50	**5**	**5**
W-5	1	Resort	Wilderness Activities Center	650	45	50		
	1	Belleayre Ski Center	Discovery Lodge Expansion	6680	47	50		
				Combined Sound Level	**49**	50	**-1**	**0**
W-7	1 - 2	Resort	Wildacres Hotel & Facilities	1280	53	50		
	1 - 2	Resort	Rock Crushing- Wildacres/Golf	3500	59	50		
	1 - 2	Resort	Clubhouse	920	53	50		
	2	Belleayre Ski Center	West Trail Clearing	2500	56	50		
	2	Belleayre Ski Center	Upper Parking Lot	2500	58	50		
				Combined Sound Level	**63**	50	**13**	**4**

Receptor	Const. Years	Project	Construction Activity	Approximate Distance to construction (feet)	Project Sound Level Plus Ambient Leq (dBA)	Daytime Ambient Sound Level Leq (dBA)	Sound Level Change (dBA)	Mititgated Sound Level Change (dBA)
W-11	1 - 2	Resort	Highmont Golf Club - nearest hole	200	74	50		
	2	Belleayre Ski Center	North Parking Lot Clearing	335	70	50		
	2	Belleayre Ski Center	East Parking Lot Clearing	3124	69	50		
	2	Belleayre Ski Center	New Reservoir Clearing	977	65	50		
				Combined Sound Level	**77**	50	**27**	**4**
W-11	3	Resort	Front-9 (East) Village - 84 Units	200	76	50		
	3	Belleayre Ski Center	Deer Run Trail	2788	55	50		
				Combined Sound Level	**76**	50	**26**	**15**

Ld = daytime ambient noise level

As indicated in Table 1.8-2, combining the sound levels for the construction of the resort and the BMSC projects with mitigation measures employed, would result in an increase in the sound level at the receptors ranging from no increase to a 15 decibel increase over the existing sound level.

During the construction of the Front-9 Village, mitigation resulting in 5 dBA lower construction sound levels can be accomplished by minimizing on-site equipment. This is predicted to reduce typical construction levels to below significance. Noise during construction of the nearest units, especially those closest to receptor W-11 may result in brief noise impacts typical of residential construction. During such construction at the nearest set of housing units, therefore, temporary barriers or shielding would be used as-needed to further control noise.

A noise increase of up to 14 dBA over the existing background noise level may be experienced by receptor W-1 if the Highmont Hotel construction, rock crushing for the Highmont Hotel, Highmount Lodge construction and clearing for the West Trail are all occurring at the same time. The Highmount Lodge building is scheduled to be constructed in Years 4 and 5 (Phase 3). Though a few lodging units are planned for the first three construction years, most will be constructed as needed over construction Years 4 through 8.

Mitigation measures planned for these construction projects would reduce the noise contribution at the nearest receptors. As stated in the BMSC DEIS and the Modified Belleayre Resort at Catskill Park SDEIS, the following measures would be employed to reduce the noise levels during construction:

- Stationary equipment such as compressors and generators would be located away from noise-sensitive receptors.
- Construction activities would be phased such that not all of the equipment is operating simultaneously.
- Maximum-sized intake and exhaust mufflers will be used on internal combustion engines.
- Idling equipment would be turned off when not in use.
- To the extent possible, construction sites should be laid out in a manner that reduces the need for backing up construction equipment in order to reduce the noise from backup alarms.

- Noise-reduction blankets that would reduce the noise level by 5dB to 10 dB would be installed on perimeter site fencing at some locations, as necessary.

- On-site equipment use would be minimized when within 500 feet of residences in order to reduce the noise of moving equipment on and off-site.

- A sound barrier would be put in place when construction activities would be within 500 feet of a residence.

With the implementation of these measures, the cumulative noise impact of constructing both projects would not be significant.

1.8.2 Facility Operation

To assess the potential cumulative noise impact resulting from the operation of the BMSC and the Modified Belleayre Resort at Catskill Park, the operating noise levels projected by the environmental impact study for each project were combined for the nearest representative receptor locations (See Figure 1.8-1 for receptor locations). Table 1.8-3 presents the representative receptors and the distance from the nearest operating project noise sources.

Table 1.8-3 Approximate Operation to Receptor Distance

Receptor Location	Nearest Ski Center Snowmaking Operation Phase/Distance (Feet)*					Nearest Highmount Snow Gun	Nearest Hotel, Conference Building, or Clubhouse HVAC/Distance
	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	(Feet)	(Feet)
W-1	3076	6966	5555	2687	1555	492	Highmount Hotel/328
W-2	4556	8419	6651	3553	2362	1476	Clubhouse/656
W-3	2641	6129	4397	1352	345	984	Wilderness Activities Center/ 951
W-4	2745	5709	4075	1309	423	1476	Wilderness Activities Center/525
W-5	2854	5299	3954	1558	751	1969	Wilderness Activities Center/492

* Distance to nearest operating snowgun

For both studies, the operating noise levels were estimated using CadnaA noise prediction software for stationary noise sources and the Federal Highway Administration Traffic Noise Model (TNM) for traffic. To evaluate the cumulative noise, the operating noise levels illustrated in Figures 4.10-2 through 4.10-6 (E & E 2012) and Table 5-3, Project Operation Noise Assessment and Mitigation – Nighttime, Continuous and Non-continuous Sources (Obrien & Gere

0 2,000 Feet

Belleayre Mountain Ski Center
Catskill State Park
Project Area, Aerial Photography

Cumulative Operation and Construction Noise Receptor Locations
State Highway
Local Road
Town Boundary

Figure 1.8-1 Belleayre Mountain Ski Center Cumulative Operations and Construction Noise Receptor Locations

Sheet No. 1

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Source: Bing, 2010
Date: February 13, 2013

2011), were reviewed and combined. The combined noise sources include; operations for the BMSC (including each of five snowmaking phases), snowmaking on the Highmount ski slopes, the operation of the Wildacres hotels, conference buildings and clubhouses and project traffic noise. Table 1.8-4 presents the operational noise levels, the cumulative sound level, and the predicted increases above the ambient sound level.

Table 1.8-4 Cumulative Operating Noise Levels for the BMSC and the Modified Belleayre Resort at Catskill Park

Receptor Location	Noise Level Ski Center[1] Leq (dBA)	Noise Level Wildacres Ski Slopes[2] Leq(dBA)	Hotels Conference Buildings and Clubhouses[3] Leq (dBA)	2015 Build Noise Level Ski Center Traffic[4] Leq (dBA)	2015 Build Noise Level Resort Traffic Leq (dBA)	Daytime Ambient Sound Level Leq (dBA)	Cumulative Sound Level Contribution Projects Plus Ambient Leq (dBA)	Cumulative Increase (dBA)
Phase 1 Ski Center Snowmaking								
W-1	33	41	29	31	37	50	51	1
W-2	26	31	20	31	35	50	50	0
W-3	41	28	24	43	47	50	53	3
W-4	44	33	24	36	44	50	52	2
W-5	46	31	26	32	38	50	52	2
W-7	28	28	21	33	34	50	50	0
W-11	43	20	27	56	54*	54**	60	6
Phase 2 Ski Center Snowmaking								
W-1	28	41	29	31	37	50	51	1
W-2	26	31	20	31	35	50	50	0
W-3	29	28	24	43	47	50	52	2
W-4	30	33	24	36	44	50	51	1
W-5	41	31	26	32	38	50	51	1
W-7	36	28	21	33	30	50	50	0
W-11	49	20	27	56	54*	54**	61	7
Phase 3 Ski Center Snowmaking								
W-1	30	41	29	31	37	50	51	1
W-2	27	31	20	31	35	50	50	0
W-3	30	28	24	43	47	50	52	2
W-4	32	33	24	36	44	50	51	1
W-5	45	31	26	32	38	50	52	2
W-7	42	28	21	33	30	50	51	1

W-11	47	20	27	56	54*	54**	60	6
Phase 4 Ski Center Snowmaking								
W-1	25	41	29	31	37	50	51	1
W-2	24	31	20	31	35	50	50	0
W-3	35	28	24	43	47	50	52	2
W-4	37	33	24	36	44	50	51	1
W-5	41	31	26	32	38	50	51	1
W-7	32	28	21	33	30	50	50	0
W-11	49	20	27	56	54*	54**	60	6
Phase 5 Ski Center Snowmaking								
W-1	21	41	29	31	37	50	51	1
W-2	17	31	20	31	35	50	50	0
W-3	47	28	24	43	47	50	53	3
W-4	47	33	24	36	44	50	53	3
W-5	44	31	26	32	38	50	51	1
W-7	27	28	21	33	30	50	50	0
W-11	38	20	27	56	54*	54**	60	6

[1] Snowmaking Operation 4 pm to 10 pm

[2] With reduced night operations (10:00 p.m. to 7:00 a.m.)

[3] Estimated sound levels assume HVAC with mitigation

[4] Traffic 6 pm to 7 pm when snowmaking phase is fully operational and traffic is 35% of Saturday pm Peak

* Modeled with 35 % of Saturday pm peak hour Resort traffic

** Modeled with 35 % of existing Ski Center Saturday pm peak hour traffic noise level

As the tables disclose, there would be an increase over the ambient noise level at each of the receptor locations as a result of the expanded ski center and the resort project operating at the same time. By employing the mitigation measures: restricting the snowmaking operations for Phases 1through 5 to the hours from 4 p.m. to 10 p.m., restricting the snowmaking operation for the sixth northernmost snowmakers along the west slope (west and northwest of Highmount Lodge to the hours of 7 a.m. to 10 p.m., and using lower noise HVAC units with shielding, it is expected that the cumulative noise levels due to the operation of both projects would result in a noise increase of less than 5 dBA at all of the receptors with the exception of W-11 which is impacted by the increase in project traffic.

With these mitigation measures, it is estimated that the combined operation of both projects would result in a cumulative noise level at receptors W-1 through W-5, and W-7 ranging from 50 to 53 dBA, which falls within the Town of Shandaken noise limit of 53 dBA for a receiving property in a residential zone during the evening and an increase in noise level of less than 4 dBA over the existing noise level, but below the NYSDEC threshold level of 6 dBA. Receptor W-11 exceeds the Shandaken noise limit of 53 dBA under current operations due to traffic noise. Although the NYSDEC guidance suggests that an incremental increase of 6 dBA at the receptor may produce complaints, traffic noise condition would occur during the winter ski season, in the daytime, when residential windows are normally closed, resulting in a 25 to 30 dB noise reduction in the home (New York State Department of Transportation 1998). People are normally engaged in daytime activities that are not as sensitive to noise at this time.

1.8.3 Traffic Noise

To assess the cumulative impact of traffic noise resulting from the operation of the Belleayre Ski Center and the resort projects, the worst-case traffic noise levels (Saturday evening peak hour) projected in the SDEIS for each project were combined. For both studies, the traffic noise levels were generated using the Federal Highway Administration Traffic Noise Model (TNM) noise prediction software. The predicted sound levels for both projects were combined for the winter Saturday PM peak traffic hour (See Table 1.8-5). The initial traffic study for this project used an operational year of 2015, but project delays suggest that 2018 is a more realistic start date. A change in background traffic could impact the noise analysis, but this region is not experiencing significant changes in traffic volumes, so this potential change is not expected to have a detectable change in background noise,

The combined traffic noise increase over the existing noise level would range from 3.9 to 5.7 dBA for receptors 1 through 11 located along Galli Curci Road

(see Figure 1.8-2). The operation of both projects would result in an increase in traffic noise of approaching 6 dBA. Although the NYSDEC guidance suggests that an incremental increase of 6 dBA at the receptor may produce complaints, this peak traffic volume would occur during the winter ski season, in the daytime, when residential windows are normally closed, resulting in a 25 to 30 dB noise reduction in the home (New York State Department of Transportation 1998). People are normally engaged in daytime activities that are not as sensitive to noise at this time.

Table 1.8-5 Traffic Noise Levels

Receptor	Existing Noise Level Ski Center Traffic Leq (dBA)	2015 Build Noise Level Ski Center Traffic Leq (dBA)	2015 Build Noise Level Resort Traffic Leq (dBA)	Cumulative Sound Level Leq (dBA)	Cumulative Increase in Sound Level (dBA)
1	35.6	35.9	37.0	39.5	3.9
2	33.4	35.3	35.0	38.2	4.8
3	44.4	47.4	46.5	50.0	5.6
4	40.3	40.2	44.2	45.7	5.3
5	35.0	36.7	37.9	40.4	5.4
6	38.3	41.1	40.3	43.7	5.5
7	54.3	57.9	55.5	59.9	5.5
8	55.6	53.8	60.1	61.0	5.4
9	59.0	60.5	62.7	64.7	5.7
10	60.1	62.8	62.1	65.5	5.4
11	57.8	60.9	58.9	63.0	5.3

A supplemental traffic noise study was conducted to evaluate the summer conditions at the project site (Creighton Manning 2012). Noise measurements were obtained at the three locations that were included in the initial noise impact assessment. The noise measurements obtained at the three locations during August had some results that were consistent with measurements that were taken in November 2007 and some results that reflected higher ambient noise levels due to active environmental conditions (insects, birds) that were absent in the November measurements. The results obtained at each receptor in August were compared to the modeling results presented in the initial noise impact assessment and verified that the results presented in the report show the worst case impacts would occur during the winter.

Traffic levels would be expected to be less during the summer months since the peak operations at the proposed resort would occur during the winter when the Belleayre Ski Center is operational. Since music concerts have been ongoing at the Belleayre Ski Center in the summer, the concert and traffic noise are considered as existing conditions and no additional noise would be expected from

the Belleayre Mountain Ski Center UMP operation in the summer. The cumulative noise resulting from both projects would include only additional traffic noise associated with the resort operation, which would be less than the winter traffic noise.

Belleayre Mountain Ski Center
Catskill State Park

Project Area, Aerial Photography

- Traffic Noise Receptor Locations
- State Highway
- Local Road
- Town Boundary

Figure 1.8-2 Belleayre Mountain Ski Center
Traffic Noise Receptor Locations

Sheet No. 1

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Source: Bing, 2010
Date: February 13, 2013

References:

Creighton Manning Engineering, LLP. August 2012. *Response to Comments Belleayre Resort at Catskill Park, Towns of Shandaken and Middletown, Ulster and Delaware Counties, NY; CME Project No. 111-164.*

Ecology and Environment, Inc. May 2012. *Belleayre Mountain Ski Center Unit Management Plan & Draft Environmental Impact Statement*. Appendix AG - Noise Technical Report & Data.

O'Brien & Gere. April 2011. *Supplemental Draft Environmental Impact Statement for the Modified Belleayre Resort at Catskill Park*. Appendix 20. Construction and Operations Noise Study.

1.9 Socioeconomics

1.9.1 Economy, Employment, and Income

Construction Impacts

The cumulative socioeconomic impacts of the construction and operation of the expanded BMSC and the Modified Crossroads Resort at Catskill Park development project would have a positive socioeconomic impact on the local (e.g. the Towns of Middletown, Shandaken, and Olive) and regional economy (e.g. Delaware, Ulster, and Greene Counties) . In total, the projects are expected to cost approximately $438.9 million. Presumably, a substantial portion of these funds would be used to purchase goods and services from the regional economy. Table 1.9-1 provides a detailed analysis of the construction costs associated with the two projects. As shown on the table, the expansion of the BMSC would cost approximately $74 million to complete while the Modified Crossroads Resort at Catskill Park development project would cost approximately $365 million to complete. The ski center expansion is expected to take approximately five years to construct while construction activities are expected to continue for 10 years at the Crossroads project.

Table 1.9-1: Combined Construction Costs of the Belleayre Mountain Ski Center Expansion Project and the Modified Crossroads Resort at Catskill Park Project

Construction Element	Total Construction Costs ($million)
Belleayre Mountain Ski Center Expansion Project	
Trails and Ski Lift Improvements	$21.6
Utility and Parking Improvements	$27.0
Building Improvements	$18.9
Contingency	$6.7
Belleayre Mountain Ski Center Expansion Total	**$74.2**
Crossroads Development Project	
Highmount Spa and Resort	
Residential Construction	$93.5
Non-Residential Building Construction	$56.8
Non-Building and Other Construction (Golf, Parking, etc.)	$31.9
Sub-Total	$182.2
Wildacres Resort	
Residential Construction	$54.7
Non-Residential Building Construction	$68.4
Non-Building and Other Construction (Golf, Parking, etc.)	$59.4
Sub-Total	$182.5

Crossroads Development Project Total	**$364.7**
Total Construction Costs	**$438.9**

Source: Part A - Section 4.11; Part B – Appendix 3: Socioeconomic and Fiscal Conditions and Effects.

As a result of the proposed construction activities, approximately 230 annual full-time equivalent construction jobs would be created during this phase of the projects. For the sake of the economic analysis, weekly and hourly estimates of the total number of construction workers employed on-site were converted to year-round full-time equivalents (FTE). One full-time equivalent worker is equal to one worker working a total of 2,080 person-hours in a year or several workers working a total of 2,080 person-hours over a shorter duration. These FTE workers are used only to identify and assess the economic impact of this new construction employment. The actual number of workers at the sites would fluctuate depending on the work load. At peak times, the total number of workers on-site could be substantially greater than the average levels indicated on the table.

As shown on Table 1.9-2 the vast majority of the 230 to 234 direct construction jobs would be generated by the Modified Crossroads Resort at Catskill Park, with the expansion of the BMSC accounting for only 12 to 16 FTE construction jobs for the five years duration of construction. In contrast, the Modified Crossroads Resort at Catskill Park project is expected to generate an estimated 218 FTE jobs for the entire 10-year construction period.

Table 1.9-2: Annual Direct Construction Employment Resulting from the Belleayre Mountain Ski Center Expansion Project and the Crossroads Development Project

Construction Element	**Annual Number of Construction Jobs**
Belleayre Mountain Ski Center Expansion Project	12 to 16
Crossroads Development Project	
Highmount Spa and Resort	109
Wildacres Resorts	109
Total Crossroads	218
Total Annual Construction Jobs Generated by Both Projects	**230 to 234**

Source: Part A - Section 4.11; Part B – Appendix 3: Socioeconomic and Fiscal Conditions and Effects.

In an effort to quantify the direct and indirect economic impacts associated with the proposed construction, an economic model developed by the U.S. Bureau of Economic Analysis, the Regional Input-Output Modeling System (RIMS II)

economic model was utilized. Separate modeling efforts were conducted for both the proposed BMSC expansion project and the Modified Crossroads Resort at Catskill Park. Both projects would have a significant indirect impact on the communities located around the proposed construction sites. During the construction phase, the expansion of BMSC would directly and indirectly generate $14.3 million in regional output; increase employee earnings by $4.2 million, and directly and indirectly support 89 jobs each year for the five years that construction is expected to occur (see Table 1.9-3).

Table 1.9-3: Direct and Indirect Impacts Resulting from Construction Expenditures Associated with the Expansion of the Belleayre Mountain Ski Center[1]

Economic Indicator	Expected Annual Change
Annual Change in Regional Output	$14,300,000
Annual Change in Employee Earnings	$4,200,000
Annual Change in Employment (Jobs)	89

[1]Indirect economic impacts resulting from the Belleayre Mountain Ski Center expansion are estimated for Delaware, Greene, and Ulster Counties.

Source: Part A - Section 4.11.

As shown on Table 1.9-4, construction activities at the Modified Crossroads Resort at Catskill Park are anticipated to increase regional output by nearly $80 million a year for the duration of the construction phase. In addition, approximately $21 million in direct and indirect employee earnings and approximately 449 direct and indirect jobs would be generated annually in New York State as a result of the construction phase of the Modified Crossroads Resort at Catskill Park.

Table 1.9-4: Direct and Indirect Impacts Resulting from Construction Expenditures Associated with the Crossroads Development Project[1]

	Expected Annual Change		
Economic Indicator	**Highmount Spa and Resort**	**Wildacres Resorts**	**Total**
Annual Change in Regional Output	$35,120,000	$43,980,000	$79,100,000
Annual Change in Employee Earnings	$9,500,000	$12,040,000	$21,540,000
Annual Change in Employment (Jobs)	199	250	449

[1]Indirect impacts resulting from the Crossroads Development project are estimated for all of New York State.

Source: Part B – Appendix 3: Socioeconomic and Fiscal Conditions and Effects.

The cumulative economic impacts associated with both the expansion of the Belleayre Mountain Ski Center and the Crossroads Development Project were

estimated. Regional output, employee earnings, and total employment would experience substantial increases as a result of construction of these two projects. The increase in construction spending would directly impact the regional and state economy by increasing employment and earnings in the construction industry. As the new construction workers spend a portion of their payroll in the local area and construction companies purchase a portion of the materials from local suppliers, the overall demand for local goods and services would increase. As these local merchants respond to this increase in demand, they may in turn increase employment at their operations and/or purchase more goods and services from their providers. These new workers may then spend a portion of their income in the area, thus "multiplying" the positive economic impacts of the original injection of funds.

However, these impacts result from a one-time injection of funds associated with the construction activities and therefore are short-term. Once the construction is complete and the original funds have left the regional economy through either taxes, savings, or through goods and services purchased from outside the area, these positive economic impacts would cease.

Operational Impacts

Operation of the expanded BMSC and the Modified Crossroads Resort at Catskill Park projects would have a long-term positive impact on the local and regional economies. Local employment opportunities, employee earnings, and local expenditures would increase as a result of both projects. The BMSC expansion project is expected to nearly double the annual attendance at the Belleayre Mountain Ski Center; as a result, total employment at the ski center is expected to increase by approximately 275 additional employees. Likewise, an estimated 541 full-time jobs and 230 part-time/seasonal jobs would be required to operate and maintain the Modified Crossroads Resort at Catskill Park project once it became operational. In total the two projects would create nearly 1,050 new jobs, with approximately 575 of these jobs permanent full-time positions. The remaining 525 jobs would be part-time and/or seasonal in nature (see Table 1.9-5).

Table 1.9-5: Annual Employment at the Belleayre Mountain Ski Center Expansion Project and the Crossroads Development Project during Operation

Type of Job	Belleayre Ski Center Expansion	Crossroads Development Project	Total Employment
Full – Time[1]	32	541	573
Part- Time/Seasonal	200	230	430
Concessionaire	40 to 45	-	40 to 45
Total	272 to 277	771	1,043 to 1,048

[1] Full-time employment includes both salaried and hourly personnel.

Source: Part A - Section 4.11; Part B – Appendix 3: Socioeconomic and Fiscal Conditions and Effects.

Approximately 100 of these full-time positions would be salaried and require some managerial or professional expertise. The remaining positions would be paid hourly and would cover a range of more entry-level hospitality, recreation, clerical and building maintenance jobs. Additional full-time positions at the BMSC are expected to pay between approximately $26,000 and $40,500 (expressed in 2008 dollars) (see Part A- Table 4.11-38). Seasonal part-time workers are expected to earn an average of $7,500 (expressed in 2008 dollars) per year (see Part A-Table 4.11-37). More than 80% of the operational employees at the Crossroads Development project are expected to be hourly. Pay rates for the majority of the hourly employees are expected to range between $12.00 an hour and $30.00 an hour. Salaried managers' remuneration is expected to range between $30,000 and $130,000 depending on the position and level of experience (see Part B- Appendix 3 Table 3.2-18). See Part A - Section 4.11.3.1 and Part B – Appendix 3 Subsection "Employment Expected to be Generated by the Proposed Project" for a more detailed discussion of the types of positions and salaries expected to be generated by the operation of the two projects.

Cumulatively, the expansion of the BMSC and the Modified Crossroads Resort at Catskill Park projects are expected to directly inject a total of approximately $29.1 million into the regional economy each year through payroll and wage and salary payments. Direct employee earnings are expected to increase by approximately $4.2 million at the BMSC as a result of the expansion project and the Modified Crossroads Resort at Catskill Park project is expected to generate an additional $24.9 million employee earnings once its facilities become operational.

Similar to the economic impacts of construction, these additional jobs and employee earnings would further stimulate the local and regional economy and have a positive indirect economic impact on the region. As the new employees from the two projects spend a portion of their payroll in the regional economy, the demand for local goods and services would expand. Revenues at local retail establishments and service providers would increase. As these local merchants respond to this increase in demand, they may in turn increase employment at their operations and/or purchase more goods and services from their providers thus multiplying the original injection of funds.

These secondary or indirect impacts have been calculated for the three-county region for both projects using the RIMS II economic model. As shown on Table 1.9-6, an estimated additional 280 indirect jobs or a total of approximately 1,320

jobs would be created directly and indirectly as a result of these projects. Similarly, the $29.1 million increase in employee earnings would result in an indirect increase of $13.8 million of employee earnings in the region. Therefore, the operation of the BMSC and the Modified Crossroads Resort at Catskill Park project are expected to directly and indirectly increase employee earnings in the three-county area by approximately $42.9 million each year.

Table 1.9-6: Cumulative Annual Direct and Indirect Employment and Employee Earnings Impacts Associated with the Operations of the Belleayre Mountain Ski Center Expansion Project and the Crossroads Development Project

	Belleayre Mountain Ski Center Expansion	Crossroads Resort Project	Total Impacts
Employment Impacts (in jobs)			
Direct Employment Impacts	272 to 277	771	1,043 to 1,048
Indirect Employment Impacts	10 to 20	264	274 to 284
Total Employment Impacts	282 to 297	1,035	1,317 to 1,332
Employee Earnings Impacts (in 2008 $ millions)			
Direct Employee Earnings Impacts	$4.2	$24.9	$29.1
Indirect Employee Earnings Impacts	$0.8	$13.0	$13.8
Total Employee Earnings Impacts	$5.0	$37.9	$42.9

Source: Part A - Section 4.11; Part B – Appendix 3: Socioeconomic and Fiscal Conditions and Effects.

Unlike the construction impacts described above, the economic impacts associated with the operation of these facilities would be long-term. These positive economic effects on local employment and employee earnings would occur each year that the projects are in operation.

The expansion of the BMSC and the Modified Crossroads Resort at Catskill Park projects may also have an effect on existing ski resorts and other hospitality-related facilities in the area. The Hunter Mountain Ski Center and the Plattekill Mountain Ski Center, which are located approximately 20 miles from Belleayre Mountain Ski Center, and the Windham Mountain Ski Center located approximately 30 miles from the BMSC, are the most likely recreational facilities to be impacted by the proposed expansion and development projects, though other area ski centers could be affected.

The improvements in the facilities at the Belleayre Mountain Ski Center are expected to generate additional demand and increase attendance at the resort (see

Part A, Section 4.11.3). While some of this increased attendance may come at the expense of other existing ski centers, much of the additional attendance is anticipated to be new customers who have not previously skied in the Catskill region. Once the new customers come to the Catskill region to ski, it is anticipated that they would also visit other area ski resorts; thereby increasing the demand at these other resorts. The synergy between the Belleayre Mountain Ski Center and other local ski resorts are anticipated to generate additional demand for all resorts when attendance at one of them increases.

While the overall demand at retail outlets, eating and drinking establishment and lodging facilities and recreational facilities are expected to increase as a result of the combined projects, existing businesses would also experience increased competition from the various components of the Belleayre Mountain Ski Center expansion and the Modified Crossroads Resort at Catskill Park. Part B-Appendix 4 Section 7.3 provides a detailed discussion of the potential positive and negative impacts of the project to commercial development in the region.

Work Force Impacts

As described above, the proposed expansion of the BMSC and the Modified Crossroads Resort at Catskill Park are expected to cumulatively create approximately 230 annual FTE jobs during the construction phase and approximately 573 full-time positions and approximately 475 part-time positions during the operational phase. Based on an analysis of existing commuting patterns; a review of the number of unemployed workers in the local workforce; and an analysis of number of individuals collecting unemployment insurance in the three-county region with relevant work experience in the construction and hospitality industries, it is expected that there would be a sufficient number of unemployed or underemployed workers in the existing labor force in the three-county region to handle this increase in demand for construction workers and part-time operational workers, although some more highly skilled construction positions may need to be filled by individuals who temporarily relocate to the region or by individuals who are willing to commute from areas outside the three-county region. In 2007 there were a total of 6,043 unemployed individuals in the three-county region that were actively looking for employment (see Part A-Table 4.11-18). This figure does not include individuals who have stopped looking for work or who have left the labor force for other reasons. As another measure of the available workforce, a total of 26,116 individuals in the three-county region collected unemployment insurance in 2007. Approximately 20.4% of these recipients had experience in the construction industry while an additional 10.4% of these recipients had experience in the accommodation and food service

industry (see Part-B Appendix 3 Table 3.9.2-8). In addition, based on the analysis described above, the majority of the estimated 573 full-time positions that would be created by these two projects would also be filled by existing unemployed or underemployed residents in the three-county region. Approximately 100 of these full-time positions would be salaried and require some managerial or professional expertise. The remaining positions would be paid hourly and would cover a range of more entry-level hospitality, recreation, clerical and building maintenance jobs. See Part A - Section 4.11.3.1 and Part B – Appendix 3: Socioeconomic and Fiscal Conditions and Effects Table 3.9.2-18 for a more detailed discussion of the types of positions expected to be generated by the operation of the two projects.

However, given the relatively small regional labor force, not all of these new positions are expected to be filled by existing residents. When the initial labor force analysis was completed in 2008, it was estimated that up to 250 full-time employees from outside the region would be required to fill these job openings (see Part A-Section 4.11.3 and Part B-Appendix 3 Section 3.9.2). However, unemployment rates in the region have nearly doubled over the past five years and Delaware, Greene, and Ulster counties are currently experiencing some the of the highest unemployment rates in the state. If these employment conditions are still in effect when the proposed projects start operation, more of the newly created full-time positions are expected to be filled by local residents and less in-migration is expected to occur than was originally predicted.

1.9.2 Population and Housing

The proposed expansion of the BMSC and the Modified Crossroads Resort at Catskill Park projects are not expected to have a significant impact on the population or demographic characteristics of Delaware, Ulster, or Greene counties. As described previously the majority of the construction and operation jobs that would be created by these projects are expected to be filled by individuals currently living in the three-county region or by those willing to commute into the region.

Some specialized workers may temporarily relocate to the area during the construction seasons. However, given the transient nature of these jobs it is unlikely that these workers would permanently relocate to the area. Therefore, no significant permanent in-migration into the region is anticipated as a direct result of construction of these projects.

These temporary workers would most likely be housed in existing hotel/motel accommodations, in available rental units or in RV campsites. Currently there are

more than 100 hotel/motels, resorts, country inns, and bed and breakfasts in Delaware, Greene, and Ulster counties (Official Tourism Site of New York's Catskills Region 2012). In addition, according to the 2000 census there were more than 2,550 vacant rental properties available in three-county region (see Part A-Section 4.11.1.1 and Part B-Appendix 3 Section 3.9.1 for more details). Given the relatively small number of construction workers expected to relocate and the relatively large number of possible rental units and hotel/motel rooms, temporary housing is not anticipated to be difficult to obtain and the influx of temporary workers are not expected to influence the overall supply of temporary housing during the construction phase.

However, a portion of the full-time operational jobs would likely have to be filled by individuals who currently reside outside of the three-county region. As described above, some of these positions would be filled by current residents or individuals who would be willing to commute; however, up to 250 workers and their households may relocate to the three-county region as a result of their employment at these projects. Assuming an average household size of 2.38 persons, an estimated 595 persons may move into the region as a result of the increased employment opportunities. This figure represents only 0.2% of the region's total population.

Each of these new households would require housing, although all could be housed in the currently vacant units in the three-county region if they so choose. The existing supply of single-family homes for sale and rental units is larger than the estimated number of relocating workers. In 2000 there were a total of 28,137 vacant housing units in the three-county region compared with the expected 250 relocating workers. The existing stock of vacant housing units should be more than sufficient to accommodate any in-migration caused by the projects.

Enough affordable housing is expected to be available in Delaware, Ulster and Greene counties to accommodate the projected influx of 250 families. In 2000, the median gross contract rent in the three counties ranged from $451 in Delaware County to $626 in Ulster County. Gross contract rent is the rent price plus any added utility costs a resident must pay (See Part A- Section 4.11.1.1). In addition, median mortgage and selected monthly owner costs (e.g. utilities and taxes) in 2000 ranged from $825 Delaware County to $1,149 in Ulster County (U.S. Bureau of the Census 2013). Using the U.S. Department of Housing and Urban Development's definition, housing is affordable if mortgage or rental payments and utilities and property taxes do not exceed 30% of total household income. Using this definition, an individual would have to earn $13,530 in Delaware County to afford half of the rental properties in the county and would have to earn $24,750 to afford to purchase half of the owner-occupied housing in the county.

Likewise an annual income of $18,780 would be required to afford rental of half of the housing units in Ulster County and an annual income of $34,470 would be required to afford half of the owner-occupied housing units in Ulster County. Given the relatively small number of workers expected to move to the region as a result of these two projects, and the fact that those relocating are likely to be filling the higher paying jobs, housing affordability is not anticipated to be greatly affected.

1.9.3 Taxes and Revenues

The proposed expansion of the BMSC and the proposed Modified Crossroads Resort at Catskill Park projects are expected to have a positive impact on local sales tax, property tax, and hotel occupancy tax receipts. During the construction and operation phases local sales tax receipts would expand as the amount of economic activity in the region expands. As the new workers spend a portion of their income in the local area and as Belleayre and Crossroad suppliers purchase materials in the local area, sales tax receipts in the region would increase. Local sales tax generation would be further enhanced by the increase in attendance at the BMSC as the facility expands and completion of the Modified Crossroads Resort at Catskill Park would further increase tax receipts. Retail activities at the two projects are expected to generate, in total, approximately $2.8 million a year in local sales taxes and an additional $2.8 million in statewide sales taxes. In addition, once operational, the Modified Crossroads Resort at Catskill Park project is anticipated to generate nearly $710,000 in hotel occupancy taxes each year.

Property taxes are also expected to experience a significant increase as a result of the Modified Crossroads Resort at Catskill Park; the expansion of the Belleayre Mountain Ski Center, which is located on state land, is exempted from local property taxes. The first year after the Modified Crossroads Resort at Catskill Park project is completed (Year 11), local property tax receipts from all taxing districts in Ulster County are expected to increase by approximately $3.3 million. In the same year local property tax receipts from all taxing districts in Delaware County are expected to increase by approximately $311,000. See Part B-Appendix 3 Section 3.9.3 for a more detailed discussion of the property tax implications for the Crossroads Development project on a municipal level.

1.9.4 Community Services and Facilities

Development of both projects would result in an increase in visitor expenditures in the area, some new business growth, and generation of minor amounts of new wastewater flows. However, existing businesses would be able to accommodate retail demands, and this business growth is expected to have an insignificant impact on existing land uses or associated public services (potential demand for water and wastewater treatment is reviewed in Sections 1.3 and 1.4).

The BMSC UMP DEIS concludes that a significant population increase is not expected. Because there would be no new in-migration to the study area, existing public services are assumed to be adequate. The Modified Crossroads Resort at Catskill Park SDEIS identifies anticipated service providers for the project. These include emergency services (police, fire, medical, and ambulance), wastewater treatment, schools, waste management, electricity, and telephone providers. All providers indicated the ability and capacity to service the needs of the project. Municipal or outside water supply providers would not be used for either project so no impacts on the water supply are anticipated.

1.9.5 Environmental Justice

According to NYSDEC Commissioner Policy 29, Environmental Justice and Permitting (New York State Department of Environmental Conservation March 2003) a potential environmental justice (EJ) area is defined as a minority or low-income community that bears a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the federal, state, local, and tribal programs and policies (New York State Department of Environmental Conservation 2003). The policy expands upon Executive Order (EO) 12898, issued by President Clinton on February 11, 1994, which requires that impacts on minority or low-income populations be accounted for when preparing environmental and socioeconomic analyses of projects or programs that are proposed, funded, or licensed by federal agencies.

The policy states that a NYSDEC permit applicant must conduct a preliminary screening to identify whether the proposed action is located in a potential EJ area. If the preliminary screening identifies a potential EJ area, the applicant must submit a written public participation plan as part of the complete application for a permit. At a minimum, the plan must demonstrate that the applicant will 1) identify stakeholders in the proposed action; 2) distribute and post written information on the proposed action and permit review process; 3) hold public information meetings to keep the public informed about the proposed action and

permit review status; and 4) establish easily accessible document repositories in or near the potential environmental justice area and on the internet to make available pertinent project information.

According to the policy, a minority population is a group of individuals identified or recognized as African-American, Asian American/Islander, American Indian, or Hispanic. Hispanic refers to ethnicity and language, not race. In rural areas, a minority community is defined as having a minority population equal to or greater than 33.8%. A low-income population is defined as a group of individuals having an annual income that is less than the poverty threshold established by the U.S. Census Bureau. This poverty threshold varies based on family size. A low-income community is an area having a low-income population equal to or greater than 23.59% of the total population.

Policy 29 also requires potential adverse environmental impacts within the affected area to be identified. If an area does not meet the NYSDEC thresholds for a potential EJ area, the permit review process may continue independent of the elements of the policy. If an area does meet the NYSDEC thresholds that could indicate it might be an EJ area, the remainder of these policy requirements shall be incorporated into the review process. The proposed socioeconomic study area does not meet EJ thresholds; therefore, no significant EJ issues are expected to occur.

Since the socioeconomic study area identified for these projects do not qualify as an environmental justice community for race, ethnicity, or income reasons, the permit review process may continue independently of the elements of the NYSDEC Commissioner Policy 29, Environmental Justice and Permitting.

1.10 Community Character

The community character and land use study area for each project comprises the two project sites and the communities along the Route 28 corridor between Boiceville and Margaretville.

The power to define the community character is a unique prerogative of municipalities acting in their governmental capacity (*Matter of Vil. Of Chestnut Ridge v. Town of Ramapo*, 45 A.D.3d 74, 94). Community character is defined by municipalities, through their comprehensive plans, which document their existing community character, set out their vision for the future, and configure a road map for achieving that by guiding land use patterns and development. Ideally, comprehensive plan goals are implemented through land use regulations and other municipal actions.

Municipalities commonly define existing character by the synergy of their natural and build environments. The natural environment may include such things as a community's visual and scenic qualities, river corridors, open lands, farmlands, wetlands, woodlands, mountains, critical habitats, air quality, water quality and noise levels.

The build environment may include historic buildings, particular development patterns, and the visual character of the built landscape. Social and cultural environments and the economic environment are also part of the built environment. The social and cultural environment of a community includes such things as the crime rate, property maintenance, school quality, property values, and historic and cultural resources. The economic environment of a community includes types of jobs, their quantity and quality, commuting patterns, and the integrity of a downtown area.

Key characteristics can also include the amount of noise in a community, traffic patterns/volume, and air quality. This section describes the cumulative impacts of the Belleayre and Crossroads projects on the following as they pertain to community character:

- Key elements of community character such as land use, cultural amenities, noise, traffic and air quality;
- Future development in the Catskills;
- The Catskill State Park and Forest Preserve.

1.10.1 Key Elements of Community Character

The general pattern of development within the study area is described in both the BMSC UMP DEIS and the Modified Belleayre Resort at Catskill Park SDEIS as low-density development within a mountainous region. The surrounding lands are primarily undeveloped state-owned lands. Development is concentrated in the valleys and in the hamlets along the Route 28 corridor and is regulated by local zoning and guided by the goals of several local planning documents. A mix of land uses associated with historical uses in the Catskills region— agriculture, forestry, tourist-related uses, including large scale resorts and residential uses—is a central feature of the study area.

Section 3.8 of the Modified Belleayre Resort at Catskill Park SDEIS describes the comprehensive planning efforts in the study area communities. Both projects are described as generally consistent with the applicable local planning and development goals. See section "3.8.2 Land Use, Planning and Zoning, A. Comprehensive Plans and Land Use Plans." In addition, the proposed project is permissible under the Town of Middletown's and the Town of Shandaken's zoning regulations as special permit uses. A special use permit is a use allowed by zoning subject to requirements imposed by zoning to assure that the proposed use is in harmony with zoning and will not adversely affect the neighborhood. Special uses are presumed compatible with the existing land use. The Town of Shandaken has the provision in the Zoning Ordinance which allows resorts, by special permit, in any zone in Shandaken.

The projects integrate with each other (resort and ski area) and are a familiar use in the Catskills, and as stated in Section 3.8, are consistent with the goal of promoting tourism that is embraced by communities in the study area. The projects allow for the conservation of a substantial amount of acreage for public ownership and use, including the acquisition of 1,200 acres known as the "Big Indian" parcel; adaptively reuse and provide for the protection of historic structures; and provide recreational and/or open space within their Project areas.

As indicated in Section 1 of the BMSC UMP DEIS, all of the Project facilities proposed for the Belleayre Mountain Ski Center (BMSC) were carefully planned to support the existing ski center, and there would be no changes in existing land use. The project would not preclude existing or planned uses in the vicinity of the study area. As indicated in the Modified Belleayre Resort at Catskill Park DEIS and SDEIS, permanent land use impacts of the Modified Belleayre Resort at Catskill Park would be restricted to the project site. Approximately 29% of this site would be developed.

As stated in Section 4.7 of the BMSC UMP DEIS, the majority of the proposed new facilities at the BMSC would not be visible from historic/cultural resources. These resources would be screened from ski center facilities either by terrain or by the extensive existing vegetation at the ski center. The proposed new ski slopes

could be viewed from some historic structures; however, ski slopes are an existing part of the resort and would not introduce a discordant element into the landscape.

As described in Section 1.8 of the BMCS UMP DEIS, the cumulative impacts of both projects on noise are anticipated to be temporary, and restricted to on-site activities (i.e., during construction). Construction would occur over a period of time and not together all at once, which serves to avoid or reduce construction related noise impacts.

Section 1.11 and Section 1.12 of this cumulative impact assessment describe the potential cumulative impacts of both projects on air quality and Climate Change. Air quality impacts resulting from construction of both projects would be temporary, and sources (i.e., small equipment and trucks) would be distributed throughout the BMSC and the Modified Belleayre Resort at Catskill Park because they are primarily mobile equipment. There would be a short-term cumulative adverse impact on air quality during the mix of construction and operation activities, and the minor cumulative impacts on air quality would cease upon completion of construction.

During operations, minor cumulative impacts are anticipated as a result of traffic-related emissions or pollutants emitted from sources associated with the Belleayre Resort at Catskill Park. For emissions of NOx (a pollutant that factors into regional ozone issues), the reduction at the BMSC from the elimination of existing diesel equipment would likely offset any increase in NOx associated with operation of the Belleayre Resort at Catskill Park. Also, as described in Section 4.8 of the BMSC UMP DEIS and Section 1.11 of this cumulative impact assessment, GHG emissions would exceed the guideline of 25,000 tons per year direct CO_2e during a three-year period associated with construction activities and operation of facilities at the BMSC and the Belleayre Resort at Catskill Park. This short-term cumulative impact would end when construction is completed at the BMSC. In subsequent years, direct cumulative GHG emissions are expected to be less than the guideline of 25,000 tons per year direct CO_2e.

While there would be some short-term adverse impacts from construction on some of the key attributes described above, the cumulative impacts of both projects on these resources would not be expected to alter the community's sense of character.

1.10.2 Future Development

The scope called for a discussion of the impact on future developments in the Catskills in terms of the precedent set by construction of the projects. The projects, however, are so unique that they are unlikely to set any precedent. There is only one publicly owned ski area in the Catskills, However, the other elements regarding future development patterns are set out below.

In the study area communities, commercial and economic activity has been historically focused in the existing hamlets and villages. While limited commercial development exists along Route 28, the concentration of commercial development is limited to the areas immediately adjacent to Boiceville and Margaretville. This pattern of development is likely to continue because of existing local and New York City development patterns, regulations on new development, and existing environmental constraints. As stated in Section 4.1.6.1 of the BMSC UMP DEIS, significant residential, commercial or industrial development is not planned for the area at this time, although the proposed projects would not preclude other development activities. This is also consistent with the comprehensive plans.

The cumulative impacts of the combined projects are not expected to have adverse effects on local water supply. According to the Modified Belleayre Resort at Catskill Park SDEIS, pumping and water quality tests demonstrate that two new wells would provide sufficient potable water for the resort. As stated in Section 3.2 of the Modified Belleayre Resort at Catskill Park SDEIS, no outside service provider, municipal or otherwise, is involved; thus, the Village of Fleischmann's water supply would not be compromised as a result of the project. As described in Appendix B of the BSMC UMP DEIS (Snowmaking Engineer's Report), the expansion project would require a seasonal volume of 203 mg (million gallons) of water for the snowmaking system. The initial opening of the ski area would require 10.5 mg, and a total of 64 mg would be required for the Christmas Holiday Operation. The existing usable storage volume at Pine Hill Lake is 25 mg, and Cathedral Glen is 2 mg. With simple upgrades to the diversion structure weir, the recharge volume over the base conservation flow of 8 cfs is greater than 600 mg, which is more than adequate to supply a typical ski season snowmaking supply.

Wastewater from both projects would be collected and conveyed to the Pine Hill WWTP for treatment. As described in Section 3.1 of the Belleayre Resort at Catskill Park SDEIS, the Pine Hill WWTP has more than sufficient capacity to accept and treat the wastewater generated by the project. The Pine Hill WWTP has a design flow of 500,000 gallons per day (gpd) and it provides advanced wastewater treatment including microfiltration of the final effluent per NYCDEP standards. The average daily flows for the Pine Hill WWTP are reported at 130,000 gpd based on current operational reports. Expected wastewater flows from the project are projected to be 160,000 gpd at full project build out and under a 100% occupancy scenario. Because the loadings from the project are similar to conventional residential
wastewater, the project would neither adversely affect the treatment capacity of the WWTP, nor the ability of the WWTP to meet its SPDES discharge permit limits.

As indicated in Appendix B of the BMSC UMP DEIS, with the appropriate maintenance repairs, the existing BMSC wastewater collection system is adequate

to accommodate the proposed expansion. The expansion would result in a maximum daily sewage flow of approximately 60,000 gpd at peak attendance. Thus, the existing Pine Hill WWTP capacity of 500,000 gpd would adequately accommodate the operation of both projects while allowing capacity for future development projects.

As described in Section 3.6 of the Modified Belleayre Resort at Catskill Park SDEIS, none of ten representative locations within a 5-mile viewshed of the project would experience a significant change in visual resources, and the project would not be visible from any Forest Preserve lands classified as Wilderness. While glow from outdoor project lighting is expected, these levels are lower than the recommended limit for most rural locations. Additionally, views were evaluated from 22 locations from mountain peaks, hiking trails and/or overlooks outside of the 5-mile radius. The majority of these did not have views of the project, while 3 of these locations had potential views toward the project. As described in Section 4.7 of the BMSC UMP DEIS, the new ski slopes may be visible from specific visual resources within the study area, but these views are typical of the existing ski area and would not introduce a discordant visual element into the viewshed.

The scope called for an analysis of the visual impact of any proposed development over 2,500 feet. Since the scope was written, the Modified Belleayre Resort at Catskill Park has been changed to eliminate resort development over 2,500 feet in elevation.

1.10.3 Catskill Forest Preserve

As noted in the Section 4.1.6.1 of the BMSC UMP DEIS, the character of the Catskill Forest Preserve is comprised of a rich history, wild and undeveloped surroundings, natural resources, recreational opportunities and regional economic importance. Belleayre Mountain Ski Center is classified in the Catskill Park State Land Master Plan as an intensive use area, which supports development of the area for public recreation. In accordance with the Master Plan, intensive use areas provide facilities designed to accommodate significant numbers of visitors, such as campgrounds, ski centers, and visitor information centers.

The BMSC expansion project is neither designed nor intended to increase access to adjacent forest preserve lands except for any proposed passive recreational uses of portions of the Big Indian lands. Although the project would result in a significant increase in skier attendance at the BMSC and could foster a greater interest in the surrounding area, the project is expected to have negligible impacts on Forest Preserve lands. As described in section 4.13 of the BMSC UMP DEIS, this determination was based on a review of visitor use data from trail registers throughout the Forest Preserve during periods of previous Belleayre Ski Center expansions. The review included registers for the Wilderness Areas adjacent to

the Ski Center for a five year period prior to and after the 1999 expansion at Belleayre. Although the 1999 addition of new trails and lifts resulted in a significant increase in skier attendance, no significant change in use was observed in the surrounding Forest Preserve lands.

As described in Section 3.14 of the Modified Belleayre Resort at Catskill Park SDEIS, the proposed project does not abut any designated Wilderness area or Wild Forest area, nor are there any proposed direct connections between the resort and the Wilderness or Wild Forest areas. Section 3.14 of the Modified Belleayre Resort at Catskill Park SDEIS indicates that State documentation and studies were reviewed to estimate the potential number of additional hikers that would result from project implementation. Although the New York State Comprehensive Outdoor Recreation Plan reports that hiking is predicted to be fairly level between 2005 and 2025, at full build-out (up to 11 years after initiation of construction), approximately 200 additional people per day could be engaged in hiking at local or regional trails including those at the Catskill Forest Preserve However, many of these 200 people may participate in other activities provided by the resort or off-site; thus the SDEIS makes a reasonable estimate that approximately 105 additional people may hike on local and regional trails when the resort would be at average occupancy. Some, but not all of these 105 people would be expected to use Forest Preserve trails in the vicinity of the combined project area.

At average resort occupancy and in the years following BMSC expansion, it is reasonable to expect that the additional number of Forest Preserve visitors would not exceed 105 people per day. While studies have not been conducted to date to determine the park's capacity to accommodate this increase in visitor use, the Modified Belleayre Resort at Catskill Park SDEIS indicates that the project Applicant will assist in data collection efforts that could be used to update future UMPs. The SDEIS indicates that to mitigate adverse impacts that could result from an increase in Forest Preserve use, the applicant would implement a program to educate and guide resort guests in the use of Forest Preserve trails. Trails that may be at risk of overuse would be identified in order to redirect guests to less intensively used trails. Information on guest usage would be submitted to NYSDEC monthly, and a report on trail conditions and guest usage will be submitted to the NYSDEC annually.

1.10.4 Conclusion

The proposed expansion of the Belleayre Mountain Ski Center as set forth in the UMP/DEIS is consistent with existing on-site uses; and the Modified Crossroads project would re-introduce resort development uses into an area that historically supported this type of development. Nonetheless, it is consistent with the comprehensive plans and zoning of the two towns that would be home to the resort. Because the combined projects would not result in a change to the community character of the study area, no significant cumulative impacts on community character are expected.

1.10.5 Mitigation

No mitigation measures for potential impacts to community character are specifically proposed, beyond mitigation for individual resource areas such as impacts on the Catskill Forest Preserve (Crossroads Resort), visual resources (signs and building materials), traffic, and air quality (dust control measures during construction, reduction of air pollutant emissions through the use of green technology, green design, and the use of shuttle buses or ski-in/ski-out options). These mitigation measures are discussed in each resource chapter.

1.11 Air Quality

The improvements proposed in the BMSC UMP DEIS for the BMSC and the proposed Modified Belleayre Resort at Catskills Park were evaluated for their potential cumulative impacts on air quality sources of greenhouse gases (GHG). The potential for impacts from the GHG emissions are further evaluated in Section 1.12.. This evaluation addresses emission of criteria pollutants and greenhouse gases from the construction and operational phases of the projects. Background air quality, as discussed in Section 4.8.1.2 of the BMSC UMP DEIS, is better than the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants although the project location in New York State places it in the Northeast Ozone Transport Region (NOTR). No ambient air quality standards are applicable to greenhouse gases.

Criteria Air Pollutants

Construction

Construction of each project would occur over multiple years. The BMSC expansion would occur over a five-year period; the construction of the Modified Belleayre Resort at Catskills Park would occur in three phases over a period of eleven years. The duration of both projects and the level of activity in each year would vary, depending on a number of factors including but not limited to availability of funding and economic conditions which may affect the pace of development (construction). However, it is possible that construction activities would overlap in one or more years and it is feasible that operation of the expanded Belleayre ski center would overlap with a combination of construction and operational activities at the Crossroads project site. Since it is not feasible to predict which construction activities on each project would occur at a specific time, and the specific activities occurring during the potential overlap period, the cumulative assessment for construction air pollutant emissions is based on a worst-case scenario—peak construction year emissions for each project with the assumption they occur during the same year. Table 1-11.1 summarizes potential construction emissions.

Only construction PM10 emissions associated with material handling were calculated for the original Crossroads Resort project and were disclosed in the 2004 DEIS. These emissions represent a worst-case condition of operation of one portable concrete batch plant and two portable rock crushing plants during 3,800 hours in each of two years. The 2004 Crossroads Resort DEIS stated that the concrete batch plant and rock crushers would be governed by “mobile source” air permits. The Modified Belleayre Resort at Catskills Park SDEIS does not re-evaluate these emission sources or indicate they would not be used, therefore it is assumed the Modified Belleayre Resort at Catskills Park project would still require their use. Typical portable concrete batch plant and rock crushers utilize diesel engines for on-site power. Construction emissions outside of those two

years were not determined; they are assumed to be minor, being produced by small equipment and trucks typically used for building construction. A commitment to implement dust control measures as needed was included in the SDEIS. It is reasonable to expect that PM10 emissions for the Modified Belleayre Resort at Catskills Park project would be lower than the original Belleayre Crossroads estimate due to the reduced size and scope of the Modified Belleayre Resort at Catskills Park project. Therefore, the original construction emission estimate is considered conservative for purposes of this cumulative assessment.

Construction emissions for the BMSC would be primarily from mobile sources. These would include bulldozers, excavators, soil compactors, delivery trucks, worker commute vehicles and dump trucks. This equipment would be used during construction of the Discovery Lodge and equipment buildings, clearing new trails and parking areas, and adding snowmaking water storage and adding/replacing ski lifts. Construction would occur during the summer months with year two of the construction period anticipated to be the most active.

Table 1.11-1 Worst-Year Combined Construction Phase Emissions

Source	Emission (tpy)					
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Belleayre Mountain Ski Center	**8.8**	**27**	**42**	**0.7**	**2.4**	**2.3**
Crossroads Resort	**NA**	**NA**	**NA**	**NA**	**3.3**	**NA**
Total	**8.8**	**27**	**42**	**0.7**	**5.7**	**2.3**

Key:

CO = Carbon monoxide.
NO_x = Nitrogen oxides.
$PM_{2.5}$ = Particulate matter less than 2.5 microns in diameter.
PM_{10} = Particulate matter less than 10 microns in diameter.
SO_2 = Sulfur dioxide.
tpy = Tons per year.
VOCs = Volatile organic compounds.
NA = No estimate available.

Construction emissions would be temporary and emission sources would be distributed throughout the Belleayre Ski Center and Modified Belleayre Resort at Catskills Park areas because they are primarily mobile. Construction emissions would cease when construction is completed. The minor cumulative impacts on air quality would cease upon completion of construction. The dispersed nature and short-term impacts would not represent a significant cumulative adverse impact.

Operation

Operation of the two facilities is expected to ultimately produce only small cumulative air quality impacts. Several features of both projects are designed to reduce air pollutant emissions:

- New snowmaking equipment that uses electric motors to turn fans instead of diesel compressors and pumps
- Green building design at the BMSC,
- Incorporation of energy saving designs into the Modified Belleayre Resort at Catskills Park project;
- Minimizing vehicle traffic between the Modified Belleayre Resort at Catskills Park project and BMSC through use of shuttle buses or ski-in/ski-out options.

The multi-year construction period for both projects and phased construction/operation of the Modified Belleayre Resort at Catskills Park project would result in a multi-year period of a mix of construction and operation. After completion of construction at the BMSC, the Modified Belleayre Resort at Catskills Park project would continue with a mix of construction and operation as additional Modified Belleayre Resort at Catskills Park facilities are built. Thus, there would be a short-term cumulative effect during the overlapping period of construction and operation activities. The long-term cumulative effect would be operation of the two facilities after completing full build-out of the Modified Belleayre Resort at Catskills Park project.

During operation, the enhancements to the BMSC and the availability of lodging and activities at the Modified Belleayre Resort at Catskills Park resort would increase traffic along roads leading to the site and at the ski center and nearby Crossroads site. Visitor traffic would peak at the ski center and the Crossroads project at different times because the ski center is a day use facility and the Crossroads resort is a longer use facility. The peak traffic hour for the BMSC would be Saturday late-afternoon, shortly after closing, as skiers leave. Traffic to and from the Modified Belleayre Resort at Catskills Park resort would vary depending on arrival and departure times for guests with multiple day stays at the Crossroads. The Modified Belleayre Resort at Catskills Park resort traffic would not have a well-defined "peak hour" at the same time as the BMSC; however the Modified Belleayre Resort at Catskills Park resort traffic study for the 2015 build year shows the resort would add traffic to the Saturday PM peak hour (Crossroad SDEIS Appendix 11). Most visitors at the Modified Belleayre Resort at Catskills Park resort and the BMSC would be expected to use the Crossroads' shuttle service or ski-in/ski-out alternatives rather than individual vehicles, thus providing some degree of mitigation of vehicle trips during the Saturday late afternoon peak travel hour for BMSC. Traffic and associated emissions from the Modified Belleayre Resort at Catskills Park would not be expected to coincide with peak traffic air pollutant emissions associated with the BMSC. Therefore,

the potential cumulative impact of traffic-related emissions is expected to be small.

The emission analysis for the BMSC shows that a decrease in on-site NOx emissions is anticipated when full operation would begin after completion of construction (see Table 1.11-2). NOx is singled out here for additional analysis because of its contribution to the production of low-level ozone. The predicted decrease in on-site NOx emissions would be primarily due to the proposed replacement of diesel engine-powered snowmaking equipment with electric motor-driven equipment.

Emission sources at the Modified Belleayre Resort at Catskills Park would consist of propane heating units, eight diesel-fueled emergency generators, cooking stoves and fireplaces, on-site skier/visitor shuttle vehicles, and personal vehicles. The heating units would be small enough to be below the threshold requiring a NYSDEC air permit and would be distributed throughout the Modified Belleayre Resort at Catskills Park. To quality for emergency use status, the diesel engine emergency generators would be limited to less than 500 hours operation per year for each unit; the Modified Belleayre Resort at Catskills Park anticipates an average annual actual operation of about 38 hours per year for each emergency generator.

Table 1.11-2 shows a summary of cumulative emissions. Based on the net change in emissions at BMSC and the potential actual emissions from operation of the Modified Belleayre Resort at Catskills Park, a modest increase in all pollutants would be expected with the largest increases occurring for CO and NOx.

For emissions of NOx (a pollutant that factors into the NOTR regional ozone issue), it is expected that the reduction at the BMSC would offset a portion of the increase in NOx associated with operation of the Modified Belleayre Resort at Catskills Park, cumulatively resulting in an increase of 7 tons per year of NOx (see Table 1.11-2). The cumulative increase in NOx could potentially be as high as 45 tons per year if emergency generator use is based on a full 500 hours per year for each emergency generator. It is unreasonable to expect each generator to operate at its full potential for a year. Therefore, based on expected actual emissions the cumulative increase in NOx emissions of the two projects would not represent a significant adverse cumulative impact.

Table 1.11-2. Potential Cumulative Impacts During Operations, BMSC plus Modified Belleayre Resort at Catskills Park

Emission Source	Proposed Emissions (tons per year)					
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Total Existing (Belleayre Mountain Ski Center Equipment and Staff/Visitor Traffic)	7.4	66	41	0.3	1.4	1.3
Total Proposed (Belleayre Mountain Ski Center Equipment and Staff/Visitor Traffic)	7.7	80	12	0.5	0.5	0.3
Net Change at BMSC	+0.3	+14	-29	+0.2	-0.9	-1
Total Proposed Modified Belleayre Resort stationary sources[Note 1]	1.4	5	36	3.7	1.2	1.2
Cumulative Net Change	+1.7	+19	+7	+3.9	+0.3	+0.2

Note 1: Emissions shown include anticipated actual annual emergency generator emissions based on 38 hours per year operation each. Potential annual operation of the generators could be permitted for up to 500 hours per year resulting in higher cumulative emissions.

1.12 Climate Change

The improvements proposed in the UMP for the BMSC and the proposed Modified Crossroads Resort at Catskill Park were evaluated for their potential cumulative impacts on greenhouse gas (GHG) emissions and climate change. The effect of climate change on the combined projects was also evaluated.

Greenhouse gas annual reporting thresholds (25,000 tons per year) and major source permit greenhouse gas thresholds (100,000 tons per year) have been established by the EPA for stationary emission sources. These thresholds imply levels of significance for stationary sources that require the reporting of emissions and for evaluating mitigation options. There are no specific thresholds established for determining the significance of cumulative greenhouse gas emissions in New York State, but New York has established a protocol for estimating potential emissions.

Federal NEPA GHG guidance suggests 25,000 metric tons per year of carbon dioxide equivalent (CO_2e) as a quantity of direct emissions that may indicate that a GHG assessment would be useful to the public and decision-makers when evaluating a proposed action. New York SEQR and federal NEPA GHG guidance also suggest that mitigation measures should also be discussed when evaluating GHG emissions to provide an indication of intent to reduce GHG emissions, to the extent feasible. For this GHG cumulative assessment, the federal NEPA GHG value of 25,000 tons per year of direct CO_2e is used as a benchmark.

Construction at the BMSC would take place over a five-year period. In each year of construction, direct GHG emissions would be produced from construction equipment exhaust at the rate of approximately 10,000 metric tons of CO_2e per year. Construction at the ski center would also result in the loss of forest when land is cleared for ski lifts and trails. The CO_2e released from the forest and woody material is estimated at 44,000 tons (see Section 4.9.3 in the BMSC UMP DEIS. This release of GHG would likely occur over the period of construction as the woody material decays. It is anticipated the woody material would be chipped and used primarily as ground cover (mulch).

As discussed in Section 4.9.2.3 of the BMSC UMP DEIS and shown in Table 1.12-1, direct GHG emissions during ski center operations would be lower compared with existing direct GHG emissions; conversely, indirect GHG emissions would be higher.. Indirect emissions from the removal of trees for the ski lifts and trails would result in a loss of carbon sequestration estimated at approximately 30 tons of CO_2e per year. Mitigation measures affecting direct emissions of GHGs during operations at the MMSC include the incorporation of green building principles in the new construction at the Discovery Lodge and subsequent reduction of energy consumption and use of electricity-driven snowmaking machines.

Construction at the Modified Crossroads Resort at Catskill Park may initially coincide with construction at the ski center. Since construction at the Crossroads resort would take place over an 11-year period, the overlap of construction GHG emissions at the two sites would potentially cease after a five-year period when construction is completed at the BMSC. In the initial years, the ski center would be emitting GHG from construction and also still using the diesel snowmaking equipment. In this worst-case analysis it is assumed that the replacement of the diesel pumps and compressors would not occur until the end of construction. This is a conservative assumption. Also, the snowmaking would not occur during the same months as the construction, but GHG emissions are assessed on an annual basis so no credit is accepted for the lack of overlap between construction and snowmaking.

Table 1.12-1. Potential for Cumulative Impacts of Greenhouse Gases during Construction and Operations of the BMSC and the Modified Crossroads Resort at Catskill Park (Crossroads)

Year	Cumulative Activity			CO_2e Direct and Indirect Emissions (metric tons per year)			
				Facility		Cumulative	
				Direct	Indirect	Direct	Indirect
Existing				3,651	4,280	3,651	4,280
				0	0		
	Facility	Construction	Operation				
1	Ski Center	✓	✓	13,149	4,280	19,855	4,280
	Crossroads	✓		6,706	0		
2	Ski Center	✓	✓	13,149	4,280	16,981	4,280
	Crossroads	✓		3,832	0		
3	Ski Center	✓	✓	13,149	4,280	28,619	7,850
	Crossroads	✓	✓	15,488	3,570		
4	Ski Center	✓	✓	13,149	4,280	29,214	8,185
	Crossroads	✓	✓	16,065	3,905		
5	Ski Center	✓	✓	13,149	4,280	30,351	8,594
	Crossroads	✓	✓	17,202	4,314		
6	Ski Center		✓	661	7,029	18,734	11,677
	Crossroads	✓	✓	18,073	4,648		
7	Ski Center		✓	661	7,029	19,709	12,086
	Crossroads	✓	✓	19,048	5,057		
8	Ski Center		✓	661	7,029	19,401	12,235
	Crossroads	✓	✓	18,740	5,206		
9	Ski Center		✓	661	7,029	19,499	12,421
	Crossroads	✓	✓	18,838	5,392		
10	Ski Center		✓	661	7,029	20,418	12,644
	Crossroads	✓	✓	19,757	5,615		
11+	Ski Center		✓	661	7,029	20,099	12,644
	Crossroads		✓	19,438	5,615		

Note: In years 3 through 10, Crossroads resort will operate at less than full build out. In year 11 and thereafter, Crossroads Resort operates in full build out mode.

In subsequent years, operation of the BMSC would coincide with operation of completed Modified Crossroads Resort at Catskill Park facilities.. Table 1.12-1 shows a likely time profile of GHG emissions from activities at the Modified Crossroads Resort at Catskill Park during the 11-year period and beyond. Sources of direct GHG emissions at the Modified Crossroads Resort at Catskill Park include emissions from on-site fossil fuel combustion (propane and/or natural gas), primarily in heating systems and kitchen equipment. Off-site direct GHG emissions would be produced by resort staff as they commute to/from work (estimated at approximately 3,700 metric tons per year CO_2e). Fugitive emissions of GHGs from heating, ventilation, and air conditioning (HVAC) and kitchen refrigeration systems are very small compared with the overall project and were not considered significant for the cumulative impact assessment. Indirect GHG emissions would be produced by the Modified Crossroads Resort at Catskill Park‘s use of purchased electricity; the quantity of indirect emissions associated with electricity use would increase as new facilities are opened. When the resort is fully built, approximately 5,600 metric tons per year indirect CO_2e would be associated with electricity use.

Using 25,000 tons per year direct CO_2e as a guideline value, Table 1.12-1 shows a three-year period when cumulative GHG emissions would exceed 25,000 tons per year direct of CO_2e. This period coincides with construction activities and operation of facilities at the two project sites. This short-term effect would end when construction is completed at the ski center. In subsequent years, direct cumulative GHG emissions are expected to be less than 25,000 tons per year direct CO_2e.

Mitigation designed to reduce the direct and indirect emission of GHGs from the BMSC and Modified Crossroads Resort at Catskill Park are focused on efficient use of energy, materials and resources. With these measures implemented, the ski center and Crossroads resort would minimize GHG emissions to the extent practicable.

Mitigation measures that will aide in minimizing emissions of GHGs from the ski center are summarized below:

- Using green building principles in new construction at the Discovery Lodge to lower energy consumption and thus reduce direct and indirect GHG emissions;
- Replace the diesel engine air compressor station with a substantially larger electric air compressor station to mitigate direct GHG emissions associated with snowmaking;
- Testing and repairing leaks in the compressed air system to maintain efficiency;
- Strategic placement of the new water reservoir to take advantage of gravity and use of new higher efficiency pumps;

- Groundwater reclamation to reroute surface water run-off directly to the upper and new reservoirs instead of allowing it to flow to Pine Hill Lake;
- Establish automated procedures and install automated equipment to control energy use; and
- Mitigating a reduced ability to sequester carbon by keeping forest clearing to a minimum, using wood from the cleared areas in on-site building construction if feasible, using the cleared wood as firewood and establishing a forest by planting trees in areas that are currently not forested.

Transportation and other mobile source/equipment GHG emission mitigation measures at the ski center would include:

- Construction emissions mitigation using best management practices aimed to maximize fuel efficiency such as using fuel-efficient vehicles, ensuring that all equipment is properly maintained and minimizing idling of construction vehicles;
- Using existing power sources (e.g., grid electric power) or clean fuel electric generators rather than diesel-powered electric generators;
- Mitigation measures to reduce the impact from staff and visitor traffic such as increasing the number of passengers per vehicle and thereby reduce the number of vehicles travelling to Belleayre Mountain Ski Center. Other key mitigation measures include preferential parking areas for high occupancy vehicles and other incentives for carpooling such as rewards of food, beverages, free/reduced price lift tickets or equipment tuning; and increasing use of mass transit and/or shuttle buses by providing additional parking for buses.

The Modified Crossroads Resort at Catskill Park‘s design goal is to achieve Leadership in Energy and Environmental Design (LEED) Silver status. The project would also incorporate mitigation measures outlined in NYSDEC’s “Policy on Assessing Energy Use and Greenhouse Gas Emissions in Environmental Impact Statements.” These mitigation measures would result in overall lower energy consumption and associated GHG emissions.

The impact of the proposed project on the ability of the site to sequester carbon would be mitigated, if feasible. Clearing forested areas would be kept to the minimum required for a successful project. In so doing, trees and other woody plants remaining on-site would continue to provide carbon sequestration. In addition, as part of landscaping around the resort areas, replacement trees would be planted wherever feasible.

Effects of Climate Change on the Projects

A study of the impacts of climate change on the U.S. Northeast is summarized in the Northeast Climate Impacts Assessment (NEICA) Synthesis Report (Frumhoff et al, 2007, http://www.northeastclimateimpacts.org/). This report states that regional temperature data over the past 30 years (1970 to 2000) show that the average daily temperature in the U.S. Northeast has warmed at a rate of about 0.5 degrees Fahrenheit (°F) per decade. Winter daily average temperatures have warmed at a rate of 1.3°F per decade during this period. The NECIA climate projections found that over the next several decades, due to GHG emissions in the recent past, average daily temperatures across the Northeast will rise 2.5°F to 4°F per decade in winter and 1.5°F to 3.5°F per decade in summer even if actions are taken to reduce emissions. The NECIA study suggests that the climate of the project area by mid-century (i.e. in 50 years) could be similar to current conditions in Maryland/Northern Virginia or more similar to Southern Virginia/Northern North Carolina depending on the amount of warming that ultimately occurs. Some current research suggests that while global warming as a long-term trend will continue, there may be periods of a slowed warming rate or even a pause in the rise of average temperatures over the next 10 to 30 years. The effects of this phenomenon, if realized, could be a delay in the decline in the snow season suggested in the NECIA study.

Another important report is the "ClimAid Report" (Rosenzweig, 2011) that was prepared by a group of scientists for the New York State Energy Research Development Authority. This report extends predictions to 2080 and provides predictions of impacts to specific economic sectors. It states that "…the negative impact on the state's winter recreation industry will adversely affect the Catskill and Adirondack regions."

Major winter recreation areas such as the BMSC may face operational challenges during the 21st Century if average global temperatures continue to rise. The primary effect of increasing global temperatures will likely be a shortening of the ski season, reduction in annual snowfall and hours with air temperatures suitable for snowmaking, and a general lessening of the snow quality as more mixed precipitation or rain falls during the winter months. However, the increase in reliance on snowmaking to maintain a reliable snowpack would help to mitigate or adapt to these potential changing conditions, as long as snowmaking capacity is sufficient to take advantage of available snowmaking hours. In addition, the existing layout of the ski center, i.e., the northward facing slopes, will help retain snow during warmer temperatures since sunlight on sunny days will not be as direct as it would be on south facing slopes.

Water resources utilized by the projects would also be affected by climate change. Rain events during the winter could be more prevalent and of higher intensity, thus increasing runoff and high stream flow conditions. With an earlier end to the snow season, the peak spring runoff could be as much as 2 weeks earlier than current conditions. During the summer months, there could be extended periods

of hot, dry weather, interspersed with periods of strong summer thunderstorms and associated heavy, short duration rain events. For the BMSC, increased maintenance of land areas may be required to manage runoff to minimize erosion. For the Modified Crossroads Resort at Catskill Park, drought conditions would require an increase in the use of irrigation to maintain landscape appearance and golf course amenities. Water conservation techniques such as using water-saving fixtures that exceed building code requirements, re-use of gray water and/or collecting and re-using rainwater and design water efficient landscaping could be used to mitigate low rainfall periods.

The NECIA Synthesis report also addresses the effect of the lower and higher emission scenarios on plant and animal species. For the lower emission scenario, there could be a 350 mile northward shift in plant species by the end of the century. Many existing hardwood forest and plant species could adapt to these climate conditions and remain viable in the region. Under the higher emission scenario, the NECIA Synthesis report suggests the northward shift could be as much as 500. This degree of climate shift could reduce the productivity of spruce/fir forests through a reduction of habitat capable of supporting these forests. Hemlock forests may also be more susceptible to the northward migration of pests as winter temperatures continue to warm.

Climate change challenges to construction of the projects, if the projects are built in the next 10 to 20 years, are expected to be minimal, especially if the Northeast US experiences a slowed warming rate or pause in warming over the next 10 to 30 years as suggested by some researchers. It is anticipated that the effects from climate change over the next 10 years on both projects would be small and that local soil and water conditions, which could impact operation of construction equipment, would not change significantly from current conditions.

Conversely, the potential for the combined projects to have a contribution toward accelerating global climate change was also considered. The USEPA considers 25,000 tpy of Co_2e, to be a threshold below which project impacts on global climate are *de minimus* and not reportable. This threshold would not be reached except for a few years during the worst case projections of construction and operations at both project sites overlapping with the extended use of diesel compressors. The mitigation efforts described above would lower emissions below the reportable threshold.

1.13 Cultural Resources

Separate cultural resources analyses were conducted for the BMSC UMP DEIS and the Modified Crossroads Resort at Catskill Park SDEIS. These analyses considered prehistoric archaeological resources, historic archaeological resources, historic structures and changes to the viewshed that could impact the setting of historic resources.

1.13.1 Impacts

Prehistoric Archaeological Sites

As indicated in Section 4.12 of the BMSC UMP DEIS, there is no evidence of known prehistoric archaeological resources within a 1-mile radius of the BMSC. As indicated in Section 3.13 of the Modified Crossroads Resort at Catskill Park SDEIS, no prehistoric materials were recovered within the area of potential area of effect (APE) for the Modified Crossroads Resort at Catskill Park. Thus, there is no potential for cumulative impacts on prehistoric archaeological sites resulting from the construction and operation of both projects.

Historic Archaeological Sites

Fourteen historic archaeological sites were identified within a 1-mile radius of the BMSC. The Phase 1 archaeological survey determined that most of the land that would be used for the proposed construction has either sustained a severe prior disturbance or was unsuitable for human habitation because of the extreme slope. With only once exception—the early 20th century Whispell House in Area F—all discovered modern/historical remains are not eligible for State or National Register of Historic Places (S/NRHP) listing or were avoided making further evaluation unnecessary. To avoid potential impacts on the Whispell House property, the parking lot was re-designed following consultation with the NYS Office of Parks Recreation and Historic Preservation (OPRHP). Consequently, the proposed construction activities for the BMSC UMP project will have no effect on historic archaeological sites.

The Phase 1A analysis conducted for the Modified Crossroads Resort at Catskill Park site identified 12 historic archaeological sites within one mile of the Modified Crossroads Resort at Catskill Park project area, many of which are the same sites identified within 1-mile of the BMSC. Five of these sites are listed on the NRHP. A Phase 1B field examination and Supplemental Phase 1B Cultural Resources Report submitted in February, 2010 by Birchwood Archaeological Services for the Modified Crossroads Resort at Catskill Park project did not identify any historic archaeological sites in the additional areas proposed for development. Three historic sites identified in the 2003 Crossroads Development

DEIS will be adaptively reused for the Crossroads resort. To mitigate potential impacts on these structures, the NYS OPRHP will review proposed interior and exterior work. Thus, the proposed construction activities for the Modified Crossroads Resort at Catskill Park project are not expected to have an effect on historic archaeological sites.

Because neither the BMSC UMP project nor the Modified Crossroads Resort at Catskill Park project would have an adverse effect on historic archaeological sites, cumulative impacts on these resources are not anticipated.

Visual Impacts on Historic Resources

As described in Section 4.12.5.3 of the Belleayre UMP SDEIS, 88 historic properties (primarily standing structures) were surveyed and recorded. Of these, three properties were listed on the State or National Register of Historic Places (S/NRHP) and six properties were determined to be eligible, five of them in a response to a survey conducted for the Modified Crossroads Resort at Catskill Park project. Additionally, an historic district in the Village of Fleishmanns is an eligible resource. As indicated in Section 4.12.5.5, of the BMSC UMP DEIS, the majority of the proposed new facilities at the Belleayre Ski Center would not be visible from these historic properties. The resources would be screened from ski center facilities either by terrain or by the extensive existing vegetation at the ski center. Some of the historic structures would be in the visual zone of influence of some of the proposed new ski slopes. However, ski slopes are an existing part of the resort and would not introduce a discordant element into the landscape. Thus, the proposed BMSC expansion is not expected to have adverse visual impacts on historic properties.

While five S/NRHP-listed properties are within a mile of the proposed Modified Crossroads Resort at Catskill Park, all of these structures are located in the Village of Fleishmanns and Pine Hill and are not readily visible from the boundaries of the BMSC or the Modified Crossroads Resort at Catskill Park. The proposed project is visually consistent with previous land uses on the property: the abandoned ski lifts of the former Highmount ski area are still visible in one portion of the APE. Thus, the Modified Crossroads Resort at Catskill Park project is not expected to have adverse visual impacts on historic properties. See Section 1.7 of this cumulative impact analysis for additional information about potential visual impacts from both projects.

Since neither project will have adverse visual impacts on historic properties, cumulative impacts are not expected.

1.13.2 Mitigation

Construction and operation of the BMSC and the Modified Crossroads Resort at Catskill Park are not expected to result in adverse cumulative impacts on cultural resources; thus, no mitigation measures are proposed beyond agency consultation for the adaptive reuse of historic buildings for the Modified Crossroads Resort at Catskill Park and avoidance of the historic Whispell House at BMSC.

Water Budget Analysis

Belleayre Mountain Ski Area
Modified Belleayre Resort at Catskill Park

Highmount, New York

CHA Project Number: 18882

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1.0 INTRODUCTION

This report provides the findings and conclusions of a water budget analysis (Water Budget) that has been completed for the Belleayre Mountain Ski Area (Study Area) and the Belleayre Resort (Wildacres Resort and Highmount Spa Resort). The work has been completed by CHA Consulting, Inc. (CHA) for the New York State Office of General Services (NYSOGS) as a supplement to the Unit Management Plan (UMP) Draft Environmental Impact Statement (DEIS), April 2011. The Budget is an assessment of potential changes in runoff, evapotranspiration and infiltration associated with the construction and development activities planned for Belleayre identified in the UMP. The Water Budget identifies the potential effects to the local watershed due to alterations to the land surface, storm water management structures, irrigation and snow-making capabilities. The Water Budget specifically addresses the conditions and alterations as described in the UMP DEIS and the "Scoping Outline for the Modified Belleayre Resort at Catskill Park Supplemental Draft Environmental Impact Statement" utilizing the information presented to determine the appropriate input parameters to validate existing conditions and predict post-development conditions. The Water Budget was based on the Thornthwaite Model software Version 1.1.0 published by the United States Geological Survey (USGS).

The Study Area encompasses 2480 acres, encompassing the expansion of the ski area and the adjacent resort construction. The study area includes the study areas described in both previous water budget reports for the two separate but adjacent projects, (Alpha Geoscience March 2011, and CHA February 2012). Two outlying parcels of the Belleayre Resort were not included in the study area because development is not occurring on those parcels, the K well field and the abandoned quarry. The two parcels are the location of the primary and back up water supply wells. A planned land acquisition of the former Highmount Ski Area by the NYSDEC was included in the study areas of each report, which totals approximately 100 acres. The combined study area accounts for this overlap by reducing the area study in the Alpha Geoscience report as the area and soil types were included in the previous CHA report.

The planned development will include additional parking, improvements to access roads/walks, clearing of additional trails, construction of a golf course, additions to existing buildings, new conference center/hotel, new multiunit dwellings and additional stormwater management structures and an additional snowmaking reservoir that will be used for expanded snowmaking capabilities. The existing buildings of the former Highmount Ski Area were planned for differing usage as part of each project, but for the purpose of the water balance, the critical factor is that the buildings will remain in their current footprint. The purpose of the Water Budget is to identify the potential changes in runoff and infiltration in the post-development condition, compared to existing condition of the Study Area.

2.0 EXISTING AND POST-DEVELOPMENT CONDITIONS

2.1 EXISTING SITE CONDITIONS

The Belleayre Mountain Ski Area facility currently consists of two lodge buildings, a number of outlying buildings for infrastructure and equipment, parking lots, access roads, cleared trails and lift equipment, stormwater detention ponds and a snowmaking reservoir. The Highmount property is of a similar nature to the Belleayre facility including several small buildings and associated ski- related infrastructure and trail systems. Of note, the Highmount property has not been used since 1994 and the trails have become brush covered due to a lack of clearing and maintenance. The proposed Belleayre Resort is planned to be constructed in an area that is wooded, with some limited areas of non-wooded previously developed property.

The Study Area is located in the vicinity of Shandaken, Ulster County New York, (and extends into Delaware County), which is on the northern slopes of the Catskill Mountains, within the Catskill Forest Preserve. The location of the facility is presented on Figure 1. The Study Area is located within two watersheds as defined by the USGS Hydrologic Unit Codes (HUC); the Middle Hudson Watershed (HUC #02020006), and the East Branch Delaware River Watershed (HUC #2040102).

Four (4) perennial streams that drain into the Middle Hudson Watershed have been identified within the Budget area. The streams are tributaries of the Birch Creek, which eventually discharges into the Middle Hudson Watershed.

No perennial streams that drain into the East Branch Delaware Watershed have been identified in the project area. One (1) ephemeral stream has been mapped along and just beyond the west side of the Water Budget area. The stream has been assigned Class B according to the New York State Department of Environmental Conservation (NYSDEC) indicating that it is appropriate for contact recreation, not for drinking water. The stream drains from the Water Budget area into Emory Brook continuing on to drain into Vly Creek, Bush Kill and eventually into the East Branch of the Delaware River.

Wetlands in the Budget study area cover approximately 3.5 acres. The United States Army Corps of Engineers maintains jurisdiction over 3.375 acres of the total. The wetlands identified within the Study Area are not within any planned disturbance and the mandatory setbacks are honored within the planned development activities.

The majority of the watercourses in the area are designated as protected under the NYSDEC classification system, by either being mapped with a designation of Class C(T), or more valuable, or by having no mapped classification, but having a downstream connection to a watercourse that is protected. Crystal Spring Brook is the only stream within the Budget area classified as B(T) requiring a high level of protection due to its identified support of a Trout population.

The potable water supply system for the Belleayre Ski Area consists of a series of four (4) main groundwater supply wells, and a fifth well that is dedicated to supplying the Sunset Lodge. The wells have been installed and maintained by the facility. The well field will continue to be utilized for the post-development water supply with modification to the number of wells and distribution from those wells as part of the planned development. The UMP/DEIS process required an analysis of the current potable water supply system and the likely changes to the demand that will be a result of the development. The groundwater withdrawal is expected to increase marginally based on the planned increase in visitation.

One of the four main wells in the current water supply system is planned to be abandoned due to unresolvable turbidity issues. The fifth well which supplies the Sunset lodge and is not considered a part of the main groundwater supply system is to be abandoned. The Sunset lodge water supply is planned to be replaced by a 50,000 gallon storage tank that is fed by a booster pump installed in the groundwater supply system.

The calculated groundwater demand for the entire facility following development is anticipated to be 60,000 gallons per day. The total sustainable yield of the three wells that will remain in service is 102 gallons per minute (~147,000 gallons per day). The available supply remaining after the planned well abandonment far exceeds the anticipated demand. One of the supply wells yields the majority of the water supply capacity; 60 gallons per minute, the remaining wells are capable of providing for the necessary supply should the high yield well be offline. The current potable water supply system is capable of delivering the anticipated required demand without requiring additional withdrawals from the aquifer.

Crossroads Ventures LLC. proposes to build a four season use resort/vacation area that is adjacent to the Belleayre Mountain Ski Area on a previously undeveloped parcel of land. The proposed development will offer direct access between the two facilities, and provide a destination with lodging and conference center that is not currently available in the area. The development property is property is roughly 740 acres of wooded area in the lower portion of the valley and extending up the mountain somewhat from New York State Route 28. The resort is proposed to be constructed in two separate parcels, one the Wildacres Resort consisting mainly

of a hotel, golf course and practice facility with a clubhouse and the Highmount Spa Resort consisting mainly of a lodge/hotel, and conference center with multi-unit dwellings and ski in ski out access to the Bellayre Mountain Ski Area. The disturbance to construct the proposed facility will be significantly less than the 740 acre property, developing roughly 230 acres. The proposed development has also obtained two small properties that are solely used for water supply well systems, and are not considered part of the study area due to their limited size and small disturbance.

2.2 POST-DEVELOPMENT CONDITIONS

The total area of the Budget study area that is planned to be altered in a manner that potentially affects the water budget is approximately 353 acres out of the total Study Area of 2480 acres. The areas to be developed include: 1) Discovery Lodge improvements, 2) Parking area construction/expansion, 3) Discovery snowmaking reservoir, 4) Ski trails and lift alignments clearing, 5) Golf course development, 6) Irrigation pond construction, 7) Construction of dwellings, 8) Construction of the Highmount Spa, and 9) Construction of the Wildacres Resort.

The major impacts consist mainly of clearing of trees for parking, trails landscaping and construction of buildings. The total disturbance to the Study Area represents roughly 14 percent of the total with the majority of the disturbance to be created on the Belleayre Resort portion of the Study Area. The development-related clearing will occur over non-contiguous portions of the study area which creates a less significant impact than if all of the development was to occur on a contiguous portion of the Budget study area.

Discovery Lodge Improvements

The Discovery Lodge improvements include the addition to the building, construction to the driveway and approach, stormwater infiltration structures, dry swales and stormwater diversion features. The Discovery Lodge improvements will disturb an area of approximately 3.25 acres within an area of 7.5 acres. The disturbance will cause a net change to the Budget that includes creation of additional impervious surface area from the current 0.97 acres to 1.63 acres following the development. The Discovery Lodge area is a small parcel within the study area, the area is discussed as its own parcel because the construction has a separate plan that documents the areas and their development.

The development planned for the Discovery Lodge was designed in a manner that controls stormwater runoff and promotes infiltration of precipitation through features designed to intercept and recover precipitation that falls on the existing and expanded impervious surfaces. The runoff that will be generated by the development is estimated to be less than the current

runoff generated by the Discovery Lodge as the storm water is detained in a series of basins and controlled by a diversion structure constructed on the uphill side of the lodge. The diversion structure causes runoff to be directed around the lodge and into a wooded area eliminating a portion of the storm water that would contribute to the runoff downstream of the lodge. The calculations provided in the Discovery Lodge SWPPP indicate that the peak runoff from the development will be reduced by an average of 50%, with the amount of reduction dependent on the significance of the rainfall event. The range of reduction values is between 42% and 59% with the greatest reduction in peak runoff associated with the most significant rainfall events.

Parking Area Expansion

The development planned for the facility is conceived with the expectation that the attendance will increase throughout the year, and will be significantly higher during peak attendance events. Currently the parking available is able to handle the average daily attendance but is significantly lacking during peak attendance events such as holiday weekends. The development of additional parking capacity will provide for more convenient access to the facility, and a safer condition by reducing the number of vehicles parked along shoulders of access roads and public roads surrounding the facility. The disturbance associated with the parking area expansion is 42 acres.

The initial effect of additional parking to the Budget analysis will be an increase in impermeable surface and reduction in vegetated area, creating a situation of runoff without infiltration. The parking areas are designed in a location that has low slopes compared with the majority of the site, reducing the significance of the impact to the surroundings during construction and limiting the significance of the run on by maintaining to the extent possible the current slopes and drainage. The Upper Discovery Parking Lot will be constructed of permeable asphalt allowing storm water to percolate into the soil beneath the parking lot rather than leaving the site as runoff. The permeable asphalt which allows the water to pass through to the underlying soil means that the area will be modeled as the underlying soil for the purpose of the water budget.

The storm water management features associated with the parking lots planned to be developed will be treated as if they do not contribute to infiltration despite the fact that they are unlined. The storm water management features are designed to take the entire volume of runoff generated from the parking lot surface and store it temporarily in a series of detention features that progressively spill over into a centralized detention basin, then on into Crystal Brook. Some amount of infiltration will certainly occur through the unlined channels as runoff is temporarily stored while passing through the system, the infiltration will initially be equivalent to the undisturbed condition, and will progressively become less as the suspended fine particles, (silt and clay) settle from the water and deposit into the bottom of the detention structures, essentially

creating a lining. Disregarding the infiltration that will occur as runoff passes through the stormwater management system and will provide a conservative estimate of the infiltration, by treating the entire area developed for stormwater management feature as impervious.

Discovery Snowmaking Reservoir

The addition of the snowmaking reservoir adjacent to the Discovery lodge will provide additional capacity for creating snow and extending the ski season while providing the facility a reduction in energy consumption, and providing some additional infiltration of runoff within the Budget study area. The disturbance associated with the snowmaking reservoir is 25 acres.

Currently the snowmaking reservoir is at a lower elevation and requires pumping over a greater distance and during peak energy usage hours, moving a portion of the storage to a higher elevation allows the water to be nearer where it will be applied and the transfer of the water from the Pine Lake reservoir can be done during off peak hours, reducing the energy cost, and system demand. The effect of additional infiltration from this feature will not be included in the Budget analysis in order to provide a conservative approach. The stored water comes from the Pine Lake reservoir which is a diversion of surface water that is captured from the Birch Creek which is the primary drainage feature exiting the valley. The reservoir is designed to collect runoff from the upland areas to the south and west of the reservoir. The additional runoff that will be captured before leaving the Budget area will allow for a reduced amount of water being utilized from the Pine Hill Lake, and the effect is that diversion at the downstream location will only occur when the flow rate is eight (8) cubic feet per second or higher, rather than the current value of five (5) cubic feet per second.

The snowmaking activities recapture a significant volume of runoff that has left the upland portions of the ski area and flowed along the Crystal Brook Stream to the Pine Hill Lake., and apply it back to the upland portions during the ski season, in order to increase the length of the season. The snowmaking is irrigation, which is the unnatural application of water to the land surface, the effects of irrigation are the same as increasing precipitation, in this case the precipitation is in the winter which delays the release of the liquid phase until the spring melt. The snowmaking water is being withdrawn from diverted runoff from the downstream reaches of the Budget study area and applied back to the upland portions of the Budget study area. This is a return of that runoff back to where it had runoff from, but reapplied at a different season than when it had runoff, allowing it to be stored throughout the winter until it begins to melt and contribute to infiltration and runoff in the spring. The snowmaking process has been occurring at this site for many years and over those years has been expanded to include larger volumes and additional areas. In the current analysis, only the impacts from the planned development and the expansion of the snowmaking capabilities are considered. **Ski Trail and Lift Alignment Clearing**

The clearing of ski trails and lift alignments creates a limited linear disturbance within much larger overall area that remains undisturbed. The majority of the Clearing planned for the former Highmount Ski Area will reestablish trails that had been cleared, but have become overgrown following the closure of the facility. The overall disturbance is 49.75 acres. The soil properties and slopes that make up the study area have very low rates of infiltration and thus very high rates of runoff. The rate of runoff from these areas is not particularly sensitive to alteration of the cover material. The runoff generated from the cleared areas is to be managed through diversion structures that direct the runoff into the large areas that remain tree covered. The maintenance of smooth trails without gullies or channelized flow forming is critical to limiting the maintenance effort required to operate the facility. The flow diversion strategy transports the water from the open sloped areas where it is likely to form channels and gullies to the tree covered areas where the velocity of the flow will be disrupted and damage requiring maintenance is far less likely.

The clearing of ski trails and clearing of areas surrounding parking and improvements does not alter the soil properties, but does cause an alteration to the vegetation and will affect the runoff volume and type.

Golf Course and Irrigation Pond Construction

The construction of an 18 hole championship golf course and driving range practice facility creates the largest disturbance to the study area for a specific purpose. The golf course construction will disturb approximately 44 acres, and will alter the soil type within its footprint. The course will be constructed in two separate areas, both generally north of the Belleayre Ski Area. The construction of the golf course requires the import of soil of the appropriate characteristics to support the specialized vegetation and create the necessary playing surface. The soil that will be used as fill to construct the golf course has characteristics that will provide for less runoff, greater evapotranspiration and greater percolation when compared to the native soil. The area of the golf course that is constructed of imported soil is accounted for as a cut and fill soil type with appropriate hydrologic properties applied for the proposed soil type.

The golf course will also require irrigation to maintain the vegetation during the summer months when evapotranspiration rates are the highest and precipitation is low. The irrigation water will be provided from a 1.2 acre pond that will be constructed to collect and store the necessary water from by diverting runoff from the surrounding upland creating a subcatchment basin. The subcatchment basin including the irrigation pond will become an area of zero runoff as the water from that area will be fully contained within the irrigation pond. The irrigation pond will be

constructed with an impervious liner so that there will be no loss of water needed for irrigation to the underlying soils making it an area of zero percolation. The irrigation pond area is accounted for as an impervious surface due to the lined construction with zero percolation and zero runoff from the area.

Additional irrigation water is available from three wells located on the Wildacres portion of the site. The irrigation is planned to come from the water contained within the irrigation pond as described, but in the event that insufficient refill of the pond from stormwater occurs, groundwater will be used to supplement the imbalance. Tests performed on the three wells proposed for irrigation are capable of sustaining an average total pumping rate of approximately 37 gpm for the entirety of the typical irrigation season without adverse effect on existing groundwater supplies or surface water.

Highmount and Wildacres Resort Development

The Highmount Resort development will be constructed in an area to the west of the Former Highmount Ski area. The Wildacres Resort area will be constructed north of the Belleayre Ski Area. Each of the developments include a number of dwellings, a hotel and conference center, the roadways necessary to access the structures, landscaping, and stormwater control structures. The Wildacres Resort will contain a hotel and conference center, a parking garage, 12 octoplex dwellings, and 11 quadplex, dwellings, a clubhouse and golf course maintenance facilities. The Highmount Resort includes a hotel and spa, a lodge building, 8 duplex dwellings and a clubhouse/conference building. The existing Marlowe Mansion will remain undisturbed in the Wildacres Resort area. The Highmount Ski Area does include existing buildings that are planned to be reused as a Wilderness Activity Center as part of the proposed resort development; therefore only the proposed new buildings have been considered in the water budget.
The stormwater features designed to manage runoff from the upland portion of the development will temporarily store runoff before allowing it to pass through to natural drainage features. The water budget analysis assumes that no percolation to groundwater will occur beneath these features, and that all of the water that is collected into these features passes through as runoff. The main disturbance will be to the vegetative cover as the property is developed from wooded to non-wooded. Limited regrading will be conducted to complete building construction and completion of driveways and access roads.

Table 1 below summarizes the total disturbances associated with the post-development condition.

Table 1
Summary of Disturbance Impacts by Development Type

Development Type	Disturbance (ac)	Impact	Net Difference (ac)
Lodge Improvements	3.25	change to impervious surface	0.66
Parking Area Expansion	42	change to impervious surface	21.25
Discovery Snowmaking Reservoir	25	no change	0
Ski Trail and Lift Alignment Clearing	49.75	no change	0
Golf Course Construction	43.25	change to cut and fill soil	43.25
Golf Course Irrigation Pond	1.2	change to impervious surface	1.2
Highmount/Wildacres Resort Development	187.62	change to impervious surface	35.82
Total	**352.07**		**102.18**

3.0 METHODS OF ANALYSIS

A water budget analysis was completed to evaluate the potential changes to surface runoff and infiltration (aquifer recharge) on an annualized basis. The Thornthwaite monthly water balance program, version 1.1.0, published by the USGS, was utilized to perform the Budget computations. The program takes into account seven inputs, Runoff Factor, Direct Runoff Factor, Soil Moisture Storage Capacity, Latitude, Snow Temperature Threshold, Rain Temperature Threshold, and Maximum Snow Melt Rate, to account for the site-specific characteristics. The inputs are carefully chosen and adjusted to best reflect the site characteristics. The data entered into the model is limited to mean monthly temperature and mean monthly precipitation, this data along with the values chosen for the seven inputs allow the model to generate results. The combination of these limited inputs has been developed through empirical validation to provide an accurate estimation of the Budget.

The output from the Water Budget provides a mechanism for estimating percolation into the soil and underlying aquifer, taking into account climatological factors, soil characteristics, site conditions (slope, impervious surfaces, drainage features), and vegetation. The analysis does not predict the available water quantity or water quality. The water budget relies on the assumption commonly used by the USGS that changes in groundwater storage are negligible over an annual basis.

Modifications to the landscape within the project area will have an effect to the Budget with decreased runoff, or increased infiltration considered a positive effect. The environmental impact of proposed site modifications is measured against a baseline determination of existing conditions contrasted with predicted post-development conditions. To run the model, CHA identified two primary site characteristics that will be altered during the course of site development: one is a decrease in the acreage of a specific soil type (with limited infiltration capacity) with a corresponding increase in the acreage of impervious surface; the second is expanded snow-making output. It is important to note that only the final post-development condition was considered for the Belleayre Ski Area despite the fact that the development is anticipated to be constructed in multiple phases. Interim post-development conditions at various stages of construction were not evaluated in the Water Budget.

3.1 MODEL INPUTS AND VARIABLES

As described above, there are a number of inputs and variables to the Thornthwaite Model. This section describes the data used in the model.

Climate Data

Climate data applied to the model has been generated from the available measurements collected by the NYSDEC's Bureau of Air Quality Surveillance at the Belleayre Mt. Air Monitoring Station (Location 5565-03). Alpha Geoscience provided a data set of temperature and precipitation values compiled from the available data collected over the period of 1991-2010 by compiling the daily measurements into monthly averages, then compiling the monthly averages into a single monthly average for the entire period. The data compiled by Alpha is published in the Water Budget Analysis completed for the Modified Belleayre Resort at Catskill Park (Alpha Geoscience, (March 2011) published as an appendix to the Supplemental Draft Environmental Impact Statement (April 2011).

Typically, climate data, specifically precipitation, does not change from the existing condition to the post-development condition. For this project, because the planned development will add enhanced snowmaking in certain areas of the Study Area, the model was also run to evaluate the effect of additional precipitation (in the form of snow). Snowmaking is utilized to extend the ski season and was treated in essence as irrigation being applied to the specific spaces within the Study Area. Similarly the irrigation that is planned for the golf course has been incorporated into the modeling as additional precipitation. The total volume of planned irrigation was divided equally between the months of June, July and August and applied to the area of cut and fill soil representing the golf course, 44.16 acres. The total volume of additional precipitation created from irrigation to the golf course and to the ski slopes is equivalent to approximately 48 million gallons of water. The effect of additional precipitation has been determined by applying the additional volume of precipitation to the affected soil types, and accounting for the changes in percolation and runoff that result.

Soil Types

Various soil types are important in the model because each has different soil moisture storage characteristics and infiltration rates. The Water Budget study area is presented in the UMP DEIS showing areas affected by planned development, and maps identifying soil types include Figure 4.5-1 and Figure 4.5-3. The soils have been mapped using the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil classification guidelines.

The Water Budget study areas consists of approximately 28 different soil types, but most share similar properties, and represent approximately 95% of the Study Area. The model is not

sensitive to small variations in soil properties and as a result, infiltration and runoff values are similar for a majority of the Study Area.

For the Water Budget, an analysis was prepared for three different soil types. The planned development will affect approximately fourteen (14) percent of the total study area, and will cause only minor disturbances to many of the soil types that are too small to evaluate. The soil type that will be most affected is the WLB or Wellsboro and Wurtsboro very bouldery soils that are gently sloping. Generally the soil types that are present within the Study area are of Hydrologic Group "C" indicating that the soil has a very slow infiltration rate. The relatively small contribution from the balance of soils with somewhat different properties is overwhelmingly offset by the majority soils rendering the results for the total area to be insensitive to the minority fractions contribution. Table 2 below identifies the net effect of development to each soil type.

Table 2
Summary of Disturbance Impacts by Soil Type

Soil Type	Infiltration Rating	Existing (ac)	Post-Development (ac)	Net Difference (ac)
ARF	Most Limited	882.75	881.5	-1.25
ORD	Most Limited	449.25	432.75	-16.5
LCF	Most Limited	218.25	218.25	0
WLB	Most Limited	156.75	136.25	-20.50
LCD	Most Limited	145.5	143.25	-2.25
ORC	Most Limited	114	97.5	-16.5
CF	Not Rated	46	89.25	43.25
LEE	Most Limited	31	25.5	-5.5
WOB	Most Limited	23	23	0
RXF	Not Rated	15	15	0
VAB	Somewhat Limited	9	9	0
VAD	Most Limited	11.5	11.5	0
MTB	Most Limited	14	13.5	-0.5
HCC	Most Limited	5.5	5.5	0
HCE	Most Limited	33.25	14.5	-18.75
HCF	Most Limited	42.5	42.5	0
LHD	Most Limited	11.25	11.25	0
LHE	Most Limited	4.25	4.25	0
LKE	Most Limited	146	146	0
MNC	Most Limited	14.5	14	-0.5
MND	Most Limited	17.5	16.25	-1.25

Soil Type	Infiltration Rating	Existing (ac)	Post-Development (ac)	Net Difference (ac)
RRE	Most Limited	51.5	33.25	-18.25
RRF	Most Limited	1.25	1.25	0
WMB	Most Limited	2.5	2.5	0
WMC	Most Limited	7	7	0
ARD	Most Limited	0.5	0.5	0
OIC	Most Limited	4	3.5	-0.5
Impervious	Not Rated	22.5	81.5	59
Total		**2480**	**2480**	**0**

Runoff Factors

The selection of runoff factors for each soil type is based on published data from Landphair and Motloch (1985). Values chosen are based on judgment in the application of typical values determined for a small set of generalized soil types. The factors considered in determination of a value to be applied to a specific soil include, vegetative cover, soil composition and slope. The runoff factor is applied evenly to each monthly average precipitation value. The application of the runoff factor determines the amount of precipitation that will be shed from the soil type, and therefore not available for percolation or evapo-transpiration.

The local climate causes seasonal fluctuations in runoff due to the winter precipitation being bound as snow and ice that will remain stored in place until average temperatures exceed the freezing point. The determination of an average annualized runoff value disregards the seasonal variation in runoff due to seasonal climate variation and accounts for the total runoff as if it occurs evenly throughout the year. Moreover, the model does not predict runoff or infiltration at a specific time or condition, but is used a mechanism for measuring the potential overall effect on the conditions caused by the planned development.

Soil Moisture Capacity

Soil moisture capacity was determined from data provided by the USDA NRCS soil survey database for the Budget study area. The USDA NRCS publishes maps identifying the distribution of soil types and the significant characteristics and properties that are associated with the various soil types identified. The soil moisture storage capacity for soils identified in the Budget study area that will be developed ranges from 2.0 to 3.8 inches, with a mean value of 2.7 inches. The soil types present in the Budget study area were verified to be consistent with those

presented in the UMP SDEIS, the tables included in the SWPPP were amended to include the additional information required for input into the Thornthwaite Model. The percent rock at the surface which presents a generally impervious surface is potentially significant in two instances; the Lackawanna and Swartswood soils identified as LEE, 9%, and the Oquaga-Arnot soils identified as ORC/ORD, 15%. The impervious surface present within these areas represent a 100% runoff condition. However, the occurrence of the bedrock outcrops is distributed throughout the area. Precipitation that lands on the bedrock outcrops will runoff onto adjacent pervious portions of the soil and the overall effect of the impervious content is therefore considered negligible for the purposes of the model.

Site Clearing and Vegetative Cover

The existing vegetative cover on most of the development area is cleared or non-wooded, but there is a mix of wooded and previously cleared areas that are covered with brush that will be affected by the development. The existing vegetative cover is depicted on Figure 4.5-4. The primary areas to be affected by the development include three parking areas, and a snowmaking reservoir planned to be constructed along Route 49A. The remainder of the significant clearing activities will be completed to expand existing cleared trails, and reestablish cleared trails on the former Highmount Ski Area. The expansion of existing trails is along the margin of existing trails, which is a limited disturbance spread over large areas. The clearing of trails located on the former Highmount Ski Area is a restoration to conditions that were established when the ski area opened originally. The trails began to become overgrown when maintenance ceased in 1994.

The development of the Belleayre Resort will clear an area of previously undisturbed land. The clearing of the land for construction of access roads, parking, building sites, and golf course construction changes both the vegetative cover and the soil types, or infiltration properties of the surface. The creation of additional impervious surfaces for buildings roads and parking is planned in a way that minimizes their impact by directing runoff to designed stormwater control features and allowing a portion of the runoff to make its way onto grassy slopes and infiltrate into the soils. The construction of the golf course will require a change to the underlying soil type and slopes through import of soil with properties that will support the unique vegetation that creates the playing surfaces. The soil that will be imported has significantly greater rates of infiltration and evapotranspiration. The majority of the development area will alter the vegetative cover that is present, but will not have an effect on the soil properties.

The clearing for the post-development condition will be performed in such a way that the overall effect to the Budget study area is relatively insignificant. Small areas are cleared within larger portions of undisturbed areas, and the soil properties remain the same, with only the vegetative cover changing from forested to cleared grassy areas. Because these alterations do not have a

significant effect by clearing of large contiguous areas, the values chosen for direct runoff incorporated into the model inputs represent a combined area of grassy slopes and forested slopes. The results calculated by the model are not particularly sensitive to changes in the direct runoff input and as such the differences between the vegetative cover is not significant.

4.0 RESULTS

4.1 EXISTING CONDITIONS

Prior to running the model to consider post-development conditions, the model was run based on existing conditions. Initially, the model was run to predict monthly runoff, evapotranspiration and infiltration amounts based on long term precipitation data for the three main types of soil relative to their infiltration capacities (see Tables A1-A3 in Appendix A).

Additionally, because some snow-making does already occur within specific portions of the Study Area, the model was again run to predict monthly runoff, evapotranspiration and infiltration amounts based on additional precipitation in the form of snow for two soil types (see Tables A4 and A5 in Appendix A).

This analysis was then repeated for the various soil types on an annualized basis. The results for the study area existing conditions are tabulated in Tables A6 and A7.

To validate model results, the total runoff for the Study Area under the last model run was then compared to the stream discharges for the area. The Giggle Brook which drains the Belleayre Mountain is a measuring point maintained by the New York City Department of Environmental Protection, and has very high calculated runoff rate of 20.7 inches annually. Using these calculated runoff rates and the area of the watershed that is captured by the Giggle Brook yields a runoff coefficient of 0.54. The results of the Water Budget analysis performed for this study area are similar to and therefore support the measurements collected at the NYCDEP gauging stations.

The runoff coefficient calculated for the study area, which discharges to the Giggle Brook, is 0.50 under initial conditions. The correlation of these measurements indicates that the high runoff rates are valid, and that because of its topographic relief, Belleayre Mountain produces significant runoff with precipitation from the upland area being removed quickly by surface drainage features and recharge to the aquifer. The similarity of the site specific measurements of stream discharge to the results of the Thornthwaite model lend strong credibility to the parameters chosen for the model input. The small difference between the runoff coefficients may be attributed to two factors, one is the assumption that the discharge measured in the brook is solely attributable to runoff, and two, the study area and the watershed that discharge to the brook are not the same.

The Budget analysis performed using the existing conditions indicate that rate of percolation for the study area is approximately 164 gpm, which is equivalent to 0.07 gpm per acre or approximately 97 million gallons per year for the entire study area of 2480 acres. This rate is based on the natural precipitation that has been recorded at the facilities weather station, this value does not account for the significant amount of precipitation that is generated in the form of snowmaking throughout the ski season. Snowmaking for the purpose of the Budget will be converted to an estimated precipitation equivalent by using the current snowmaking area of 160 acres and the water flow rate of 3600 gpm, together with the estimated duration of snowmaking from the UMP/DEIS. Calculations that include the precipitation in the form of snowmaking activities based on the snowmaking plan included in the UMP/DEIS for the facility generate a significantly different and more accurate estimation of the runoff and percolation for the facility. The Budget analysis performed using the snowmaking precipitation in the current state indicates that the rate of percolation for the study area is approximately 244 gpm, which is equivalent to 0.10 gpm per acre, or 51,712 gallons per year per acre. The addition of a large volume of precipitation in the form of snowmaking generates an increase in the rate of percolation that is 1.49 times the natural precipitation rate of percolation, or an additional 16,593 gallons per year per acre.

The runoff rate for the study area is approximately 2,899 gpm, which is equivalent to 1.17 gpm per acre, or 614,952 gallons per year per acre. Similar to the rate of percolation the addition of precipitation in the form of snowmaking introduces a significant change to the rate of runoff. The Budget analysis performed using the snowmaking precipitation in the current state indicates that the rate of runoff for the study area is approximately 3,159 gpm, which is equivalent to 1.27 gpm per acre, or 667,512 gallons per year per acre. The addition of a large volume of precipitation generates an increased rate of runoff that is 1.09 times the rate of runoff generated by natural precipitation alone, or an additional 52,560 gallons per year.

4.2 POST-DEVELOPMENT CONDITIONS

Following the process described above for the existing conditions on the site, the model was run for the relevant soil types and with expanded snow-making, and irrigation for the post-development condition. The annual percolation and runoff rates for each soil type or group of soil types with similar characteristics were tabulated with the area of each soil group, and converted to an annualized rate in gallons per minute. The annualized percolation to groundwater under post-development conditions by soil group is presented in Tables B1 and B2 in Appendix B. The results for the undeveloped soil groups are as they were under existing conditions, except the areas and model input parameters have been changed to reflect the changes to impervious surfaces associated with the Discovery Lodge expansion, the Parking Lot expansion, and the Snowmaking Reservoir. As discussed above, the clearing for trails does not result in significant

changes to the model output because soil type and slopes do not change, and therefore, the amount of runoff is not significantly changed.

The model results for each of three relevant soil groups are included as Tables B3 through B6 in Appendix B. The areas to change in the post-development condition including the Discovery Lodge improvements, the Parking Lot expansion, Golf course, Irrigation pond and the snowmaking reservoir, are tracked separately according to the area of each.

Moreover, snowmaking produces a high moisture content snow that is significantly denser than natural snow. Manmade snow can be controlled to create desirable ski conditions, with the base snow being high water content, and the upper surface of lower water content to create a more powdery surface. Snowmaking for the purpose of the Budget will be converted to an estimated precipitation equivalent by using the expanded area of 203 acres (43 additional acres) and the water flow rate of 5,200 gpm (1,600 gpm additional), together with the estimated duration of snowmaking from the UMP/DEIS. The estimated additional precipitation from snowmaking will be applied to the Highmount area that currently does not receive any manmade snow. A portion of this additional snowmaking may be applied to the areas that currently receive manmade snow, but the expansion of the capabilities will predominantly be used within the Highmount area. The amount of precipitation estimated through the snowmaking season was input into the model as precipitation and is tracked separately from the natural precipitation in the corresponding tables for reference. These values were added to the precipitation data collected at the Belleayre weather station to take into account all precipitation that is applied at the site, both natural and irrigation (snowmaking).

The Budget for the post-development conditions indicates that the annualized percolation rate for the study area will be approximately 210 gpm, which is equivalent to 0.08 gpm per acre, or 42,048 gallons per year per acre. This represents a 34 gpm decrease from the existing conditions aquifer recharge rate of 244 gpm in the Budget study area, or 7,206 gallons per year per acre. This change in percolation rate is small when compared to the seasonal and annual climate fluctuations. Construction of additional impervious surfaces and alteration of the vegetative cover lead to the decrease in percolation. This rate is based on the natural precipitation that has been recorded at the facilities weather station.

When considering snowmaking, calculations that add to the existing precipitation in the form of snowmaking activities based on the snowmaking plan included in the UMP/DEIS for the facility generate a significantly different estimation of the runoff and percolation for the facility. The Budget analysis performed using the snowmaking/irrigation precipitation in the current state indicates that the rate of percolation for the study area is approximately 286 gpm, which is equivalent to 0.12 gpm per acre, or 63,072 gallons per year per acre. The addition of a large

volume of precipitation in the form of snowmaking/irrigation generates an increase in the rate of percolation that is 1.5 times the natural precipitation rate of percolation.

The annualized post-development runoff rates estimated for the Budget study area are summarized in Tables B4 and B5 in Appendix B. The Budget analysis for post- development conditions indicates almost no change in the surface water runoff from the study area. The annualized surface water rate of discharge to the natural drainage features is approximately 3,239 gpm, which is equivalent to 1.31 gpm per acre, or 688,536 gallons per year per acre. The post-development rate represents an increase from the existing conditions rate of 2,899 gpm to 3,239 gpm, which is equivalent to an increase of approximately 0.14 gpm per acre, or an additional 73,584 gallons per year per acre.

5.0 DISCUSSION OF RESULTS

A Water Budget analysis completed for the study area accounts for the alteration due to development with regard to alteration in amount or rate of runoff, groundwater withdrawal, and percolation into the soil (groundwater recharge). The analysis attempts to take into account as many of the potential effects of alteration, though some of the potentialities are difficult to quantify, however the analysis even if somewhat limited provides a baseline for recognition of significant issues in the form of drastic alteration of natural conditions.

The development identified in the plan for the expansion of the Belleayre ski facility is mainly in the form of clearing for additional ski trails, expansion of parking lots, expansion of the snowmaking reservoir, and some improvements and expansion to Discovery Lodge. The sum of these disturbances is 120 acres.

A large portion of the disturbance will occur associated with clearing of trails for additional ski area. For these areas, the existing slopes and soil types will not change and therefore runoff predominates both in the existing condition and post-development condition.

The remainder of the development will cause an alteration to the surface creating additional impervious surface. However, the additional impervious surface created during development is approximately 59 acres of the total 2480 acre Study Area, which represents 1.2% of the total area. The creation of impervious surface has the greatest effect on runoff and infiltration presenting nearly 100% runoff and 0 percent for percolation. . The runoff rates from the study area are very high due to the site topography, overall relief, and existing soil type. The combination of mountain slopes and soils that have very low rates of infiltration allows the water to move quickly to the valley floor through established drainage features of streams and brooks.

The development identified in the plan for creation of the Belleayre Resort is mainly in the form of clearing for landscaping, and golf course construction. The alteration of the development area from the existing wooded vegetation to a non-wooded condition does not alter the soil type, and therefore the infiltration rates. The development of the golf course will significantly alter the soil type as well as the vegetative cover; the golf course requires a far more permeable soil that is necessary to support the specialized vegetation that is used to create the golf course playing surface.

The runoff and percolation rate estimates generated through this Budget analysis are annualized averages. The calculated differences between current and developed conditions are general estimates of the potential impact the planned development will have on the site and affected

surrounding area. The development as planned appears to present an increase in the rate of runoff, and an increase in the rate of percolation over the Budget study area. The additional application of surface water increases the amount of both percolation and runoff within the study area. Collection of the stormwater to be utilized for golf course irrigation eliminates some of the additional runoff that is created by the planned construction, but is insufficient to fully offset the additional runoff generated. The reapplication of stormwater collected both onsite and from site runoff lower in the valley will significantly increase the percolation, yielding a greater increase in the amount of percolation than runoff.

The increases in both runoff and percolation with a slight decrease in the amount of evapotranspiration are attributed to the increase in the amount of precipitation created by expanded snowmaking and applied irrigation for the golf course. Typically, a comprehensive water balance for any project site should net out between pre- and post-development conditions (for example an increase in post-development run-off will be balanced by a decrease in percolation) and a direct comparison can be made with pre-development conditions because precipitation values almost always remain the same. The fixed volume of water entering the study area in the form of precipitation creates the situation that allows the disturbance to be directly measured in the change in the water balance of the study area. For this project, the post development condition includes a significant increase in precipitation in the form of golf course irrigation and expanded snowmaking and these increase total precipitation values (compared to existing conditions) and significantly impacts water balance.

The additional precipitation applied to the golf course is collected from stormwater that is collected in a lined irrigation pond which reduces runoff from a portion of the site in the post development condition. The water is then reapplied onto an area of the development that has been altered to a more permeable condition allowing for an increase in percolation. The area that is being irrigated is larger than the area that the irrigation water is collected from as a result a portion of that water will runoff from the portion of the area outside the irrigation pond catchment, yielding an increase in runoff.

Snowmaking presents a similar situation, surface water that has left the site as runoff, is reapplied to a portion of the site as precipitation. The portion of the site that receives the additional precipitation as snowmaking is not planned to be altered with regard to soil type. The additional precipitation in this area creates an increase in both percolation and runoff, and a decrease in evapotranspiration as the snowpack will be last longer into the spring and provide a saturated condition into the season where a soil moisture deficit typically leads to losses in the form of evapotranspiration. The creation of additional impervious surfaces in the form of parking, roads and buildings causes an increase in runoff and a decrease in percolation.

The post development condition shows that there is a greater increase in percolation, than runoff, and a slight decrease in evapotranspiration. The water utilized to provide the increase in precipitation that creates this condition comes from runoff that would leave the study area in the natural drainage features. The reapplication of a portion of that water to the study area increases both the percolation and runoff from the study area, indicating that there is no net detraction from runoff after collecting a portion of that water, and a net increase to percolation which will be available to recharge groundwater, these changes are partially at the expense of evapotranspiration due to the study area remaining saturated, or snow-covered for a greater period of the year,

Table 3 below is a summary of the water budget parameters in the pre-development and post development conditions.

Table 3
Summary of Water Budget Parameters in Pre and Post-development Conditions

Development State	Runoff (gpm)	Net Difference	Evapotranspiration (gpm)	Net Difference	Percolation (gpm)	Net Difference
Pre-Development*	2899		2739		244	
Post-Development	3230	+11.75%	2708	-1.2%	286	+17.21%

*****_Natural precipitation plus existing snowmaking_

The calculated differences may be mitigated in ways not easily modeled and include the following:

- Some percolation will occur within the unlined stormwater management features, which will slightly increase the percolation rate, and reduce the rate of runoff.

- Evaporation of storm water in temporary storage features will also occur resulting in a slight decrease in the rate of runoff from those areas.

- A portion of the runoff from buildings and approaches will run onto grassy areas where a portion of it will percolate through the soil.

- The Upper Discovery Parking Lot will be constructed of permeable asphalt allowing some storm water to percolate into the soil beneath the feature rather than leaving the

site as runoff. This lot is being constructed as a demonstration test, and if successful, permeable asphalt may be used in other areas which would expand the benefit.

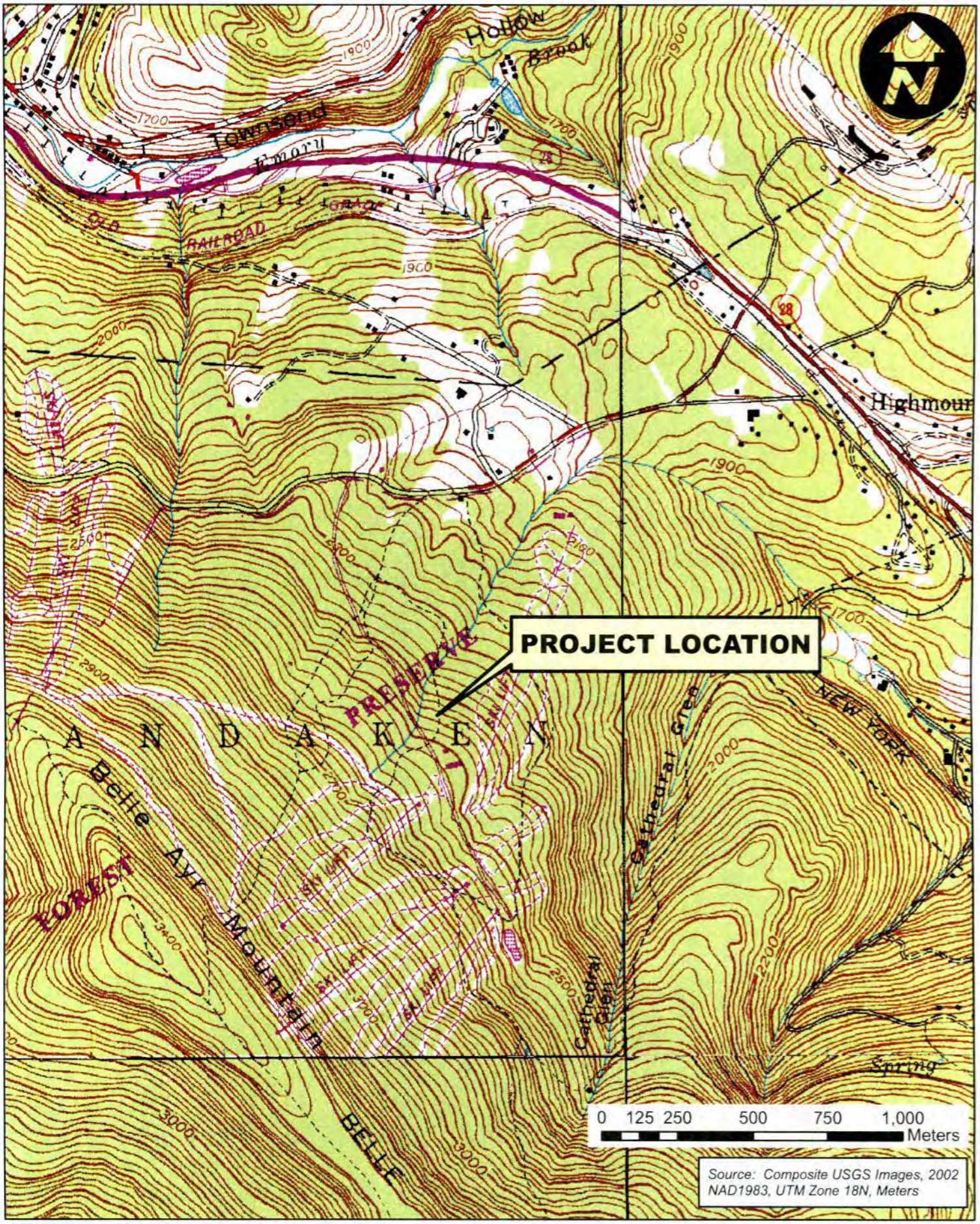
- The Highmount Lodge and the Highmount Spa are planned to be constructed with vegetated roofs which will eliminate a portion of the runoff included in the current calculations by allowing that stormwater to be utilized by the plantings that cover the otherwise impervious surface.

- The Golf Course development includes regrading of the surface contours in order to create the playing surface design. The golf course is being developed along the lower portion of the valley and will receive some run on from the steeper slopes above creating an area that will allow percolation that in this study will be accounted for as runoff.

- There is a slight increase in planned in groundwater withdrawals therefore possibly decreasing the amount of groundwater in storage temporarily.

In summary, the potential changes in the Water Budget for the post-development condition are relatively minor given the small areas of disturbance compared to the overall size of the Study Area. Additionally, some of the measured impacts of additional runoff in the post-development condition may be further mitigated by best management practices for storm water.

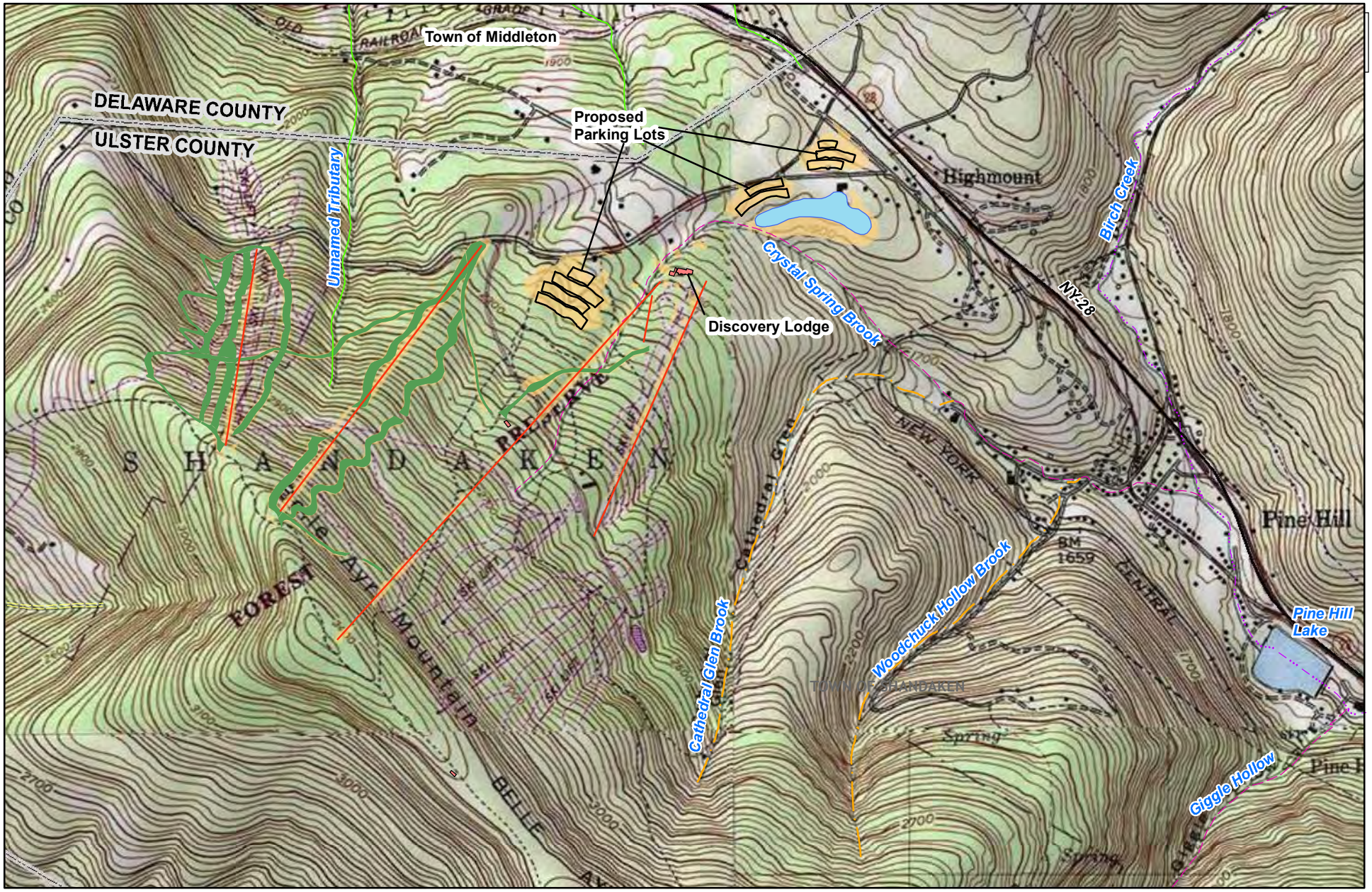
FIGURES



SHUMAKER
Consulting Engineering & Land Surveying, P.C.

Belleayre Ski Lodge Restoration Project
Culvert Installation Location Map

Figure 1 - Site Location



0 1,000 Feet

Belleayre Mountain Ski Center
Catskill State Park

Project Area, USGS Topographic Imagery

- Proposed Ski Lift Centerline (July, 2009)
- Proposed Tree Cutting Area
- Proposed Trail Clearing (July, 2009)
- Parking Lot
- Proposed Snow Making Pond (July 2009)

NYSDEC Stream Class
- B
- B(T)
- B(TS)
- C
- C(T)

Figure 4.5-1: Ski Center Project Facilities

Sheet No. 1

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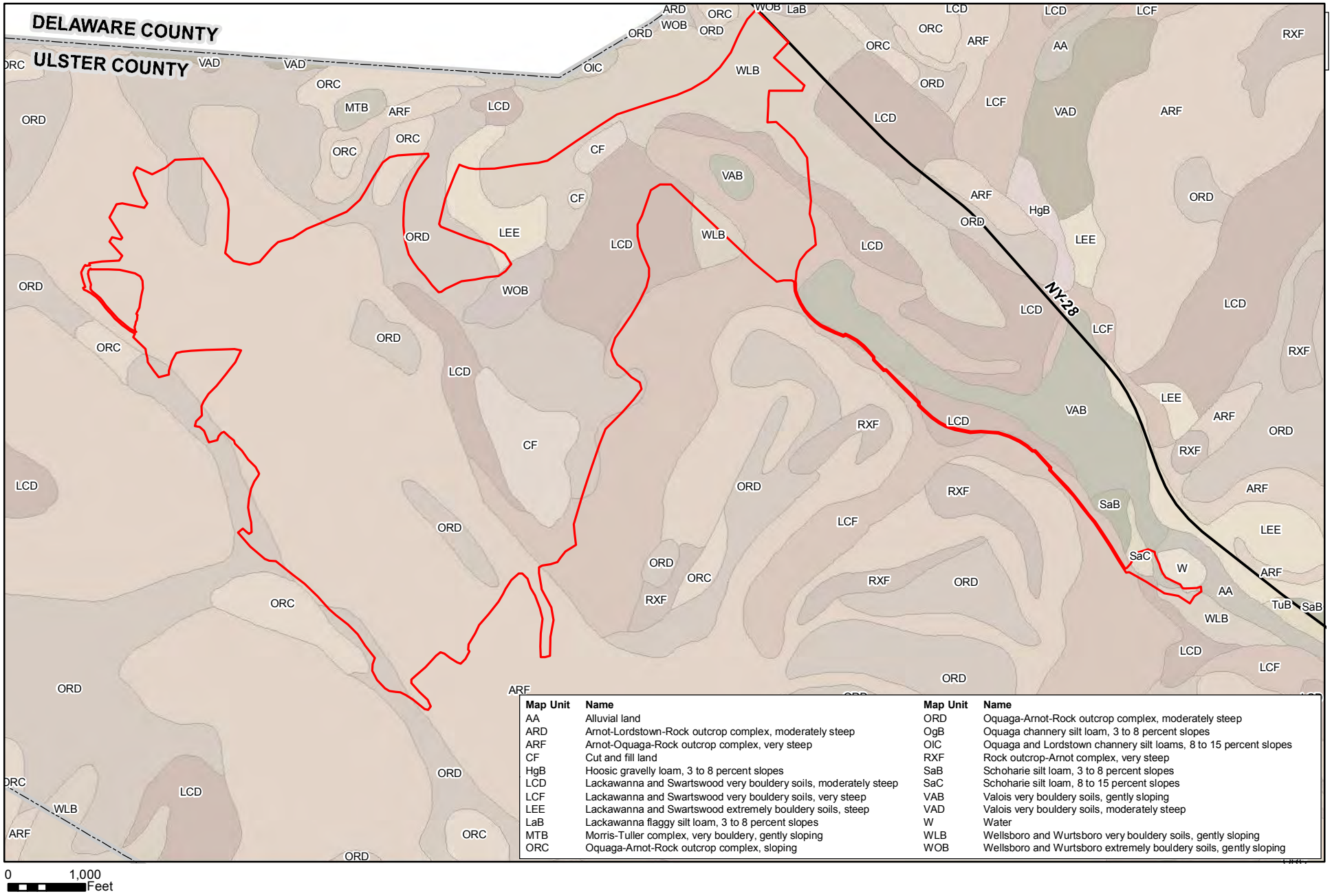
Date: December 16, 2010



Map Unit	Name	Map Unit	Name
AA	Alluvial land	ORD	Oquaga-Arnot-Rock outcrop complex, moderately steep
ARD	Arnot-Lordstown-Rock outcrop complex, moderately steep	OgB	Oquaga channery silt loam, 3 to 8 percent slopes
ARF	Arnot-Oquaga-Rock outcrop complex, very steep	OIC	Oquaga and Lordstown channery silt loams, 8 to 15 percent slopes
CF	Cut and fill land	RXF	Rock outcrop-Arnot complex, very steep
HgB	Hoosic gravelly loam, 3 to 8 percent slopes	SaB	Schoharie silt loam, 3 to 8 percent slopes
LCD	Lackawanna and Swartswood very bouldery soils, moderately steep	SaC	Schoharie silt loam, 8 to 15 percent slopes
LCF	Lackawanna and Swartswood very bouldery soils, very steep	VAB	Valois very bouldery soils, gently sloping
LEE	Lackawanna and Swartswood extremely bouldery soils, steep	VAD	Valois very bouldery soils, moderately steep
LaB	Lackawanna flaggy silt loam, 3 to 8 percent slopes	W	Water
MTB	Morris-Tuller complex, very bouldery, gently sloping	WLB	Wellsboro and Wurtsboro very bouldery soils, gently sloping
ORC	Oquaga-Arnot-Rock outcrop complex, sloping	WOB	Wellsboro and Wurtsboro extremely bouldery soils, gently sloping

Belleayre Mountain Ski Center
Catskill State Park

Project Area, USDA SSURGO Soils

Study Boundary (October, 2009)

Sheet No. 1

Figure 4.5-3: Belleayre Mountain Ski Center Ulster County Soil Map

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Date: December 16, 2010

0 1,000 Feet

Belleayre Mountain Ski Center
Catskill State Park

Project Area, NYS Orthoimagery, 2004

Study Boundary (October, 2009)

Ecological Communities

- Brushy Cleared Land
- Developed
- Hemlock - Northern Hardwood Forest
- Maintained Ski Slope and Attendant Features
- Mowed Lawn
- Railroad
- Red Maple - Hardwood Swamp
- Shallow Emergent Marsh
- Successional Northern Hardwoods

Sheet No. 1

Figure 4.5-4: Belleayre Mountain Ski Center Ecological Communities

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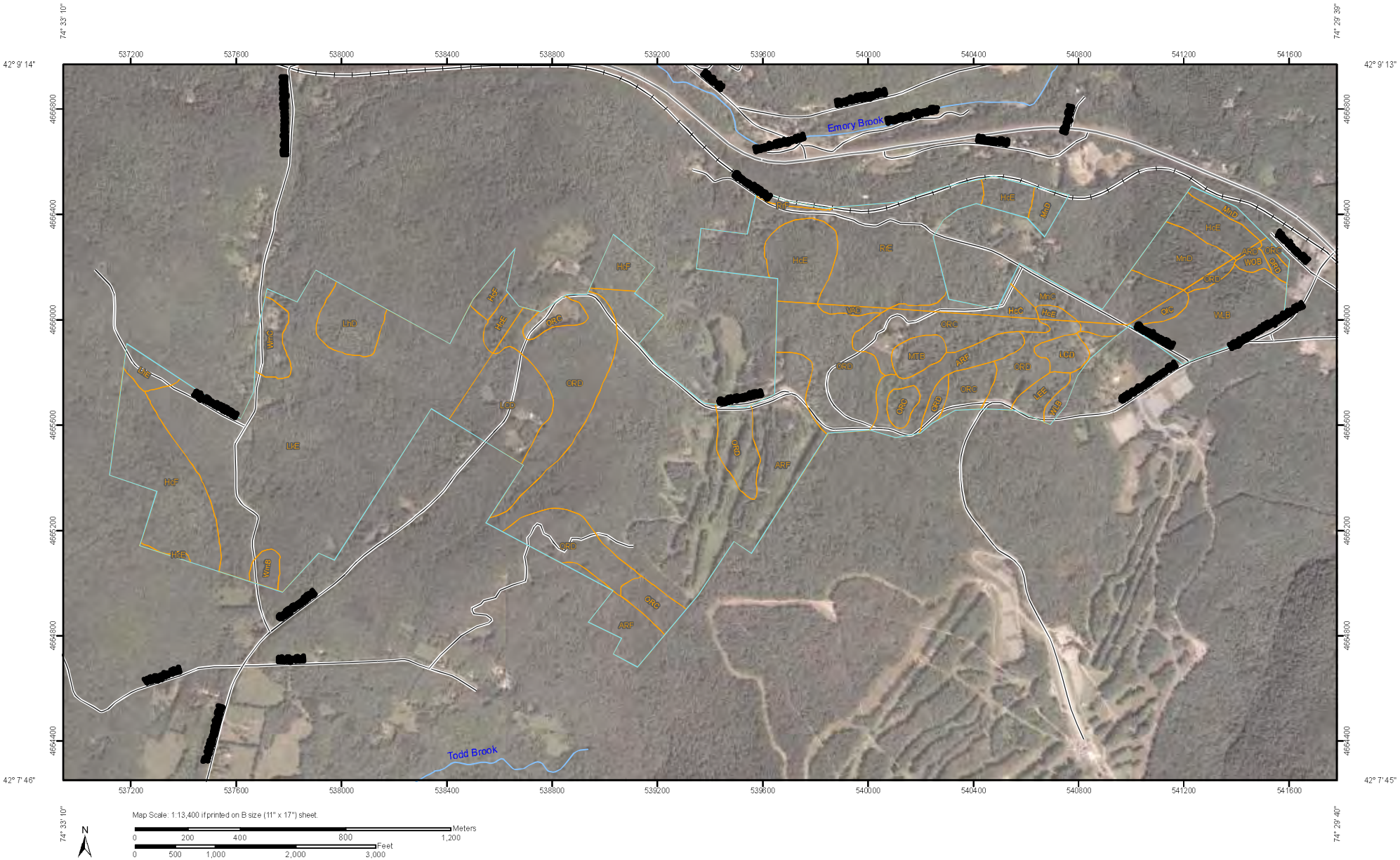
Date: December 16, 2010

Soil Map—Delaware County, New York, and Ulster County, New York



APPENDIX A
Tables – Existing Conditions

New York State Office of General Services
Belleayre Mountain Ski Center

CHA

Natural Precipitation
Most Limited Soils

Month	Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation
January	75.50	6.40	20.10	129.90	49.00
February	52.71	5.90	13.10	125.50	33.71
March	98.55	58.50	20.40	70.00	19.65
April	94.07	72.70	37.40	70.00	-16.03
May	106.51	72.80	64.80	70.00	-31.09
June	113.26	63.20	95.20	70.00	-45.14
July	103.56	52.00	106.60	46.60	-55.04
August	88.75	41.80	81.60	37.10	-34.65
September	114.02	43.40	51.80	70.00	18.82
October	122.48	57.50	29.10	70.00	35.88
November	95.64	58.10	15.70	70.00	21.84
December	89.47	39.50	10.20	70.00	39.77
Total Annualized					
Millimeters	1154.52	571.80	546.00		36.72
Inches	**45.45**	**22.51**	**21.50**		**1.45**

WATER BUDGET ANALYSIS

TABLE A1

New York State Office of General Services
Belleayre Mountain Ski Center

CHA

Natural Precipitation
Somewhat Limited Soil

Month	Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation
January	75.50	6.4	15.8	134.20	53.30
February	52.71	5.7	12	131.30	35.01
March	98.55	52.3	20.4	89.00	25.85
April	94.07	67.3	37.4	89.00	-10.63
May	106.51	68.3	64.8	89.00	-26.59
June	113.26	59.5	95.2	89.00	-41.44
July	103.56	48.4	105	76.00	-49.84
August	88.75	38.5	79.6	71.40	-29.35
September	114.02	41.7	51.8	89.00	20.52
October	122.48	55.9	29.1	89.00	37.48
November	95.64	57.9	15.7	89.00	22.04
December	89.47	41.7	10.2	89.00	37.57
Total Annualized					
Millimeters	1154.52	543.60	537.00		73.92
Inches	**45.45**	**21.40**	**21.14**		**2.91**

WATER BUDGET ANALYSIS

TABLE A2

New York State Office of General Services
Belleayre Mountain Ski Center

CHA

Natural Precipitation
Cut and Fill (CF) Soil

Month	Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation
January	75.50	6.4	15.8	134.20	53.30
February	52.71	5.4	12	131.30	35.31
March	98.55	49.6	20.4	89.00	28.55
April	94.07	64.6	37.4	89.00	-7.93
May	106.51	65.8	64.8	89.00	-24.09
June	113.26	57.4	95.2	89.00	-39.34
July	103.56	45.8	105	76.00	-47.24
August	88.75	36	79.6	71.40	-26.85
September	114.02	41	51.8	89.00	21.22
October	122.48	55.1	29.1	89.00	38.28
November	95.64	58.3	15.7	89.00	21.64
December	89.47	44.4	10.2	89.00	34.87
Total Annualized					
Millimeters	1154.52	529.80	537.00		87.72
Inches	**45.45**	**20.86**	**21.14**		**3.45**

WATER BUDGET ANALYSIS

TABLE A3

New York State Office of General Services
Belleayre Mountain Ski Center

CHA

Natural Precipitation and Snowmaking
Most Limited Soils

Month	Total Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation	Snowmaking Precipitation	Natural Precipitation
January	449.07	10.20	17.80	132.20	421.07	373.57	75.50
February	312.00	50.00	12.60	79.00	249.40	259.29	52.71
March	156.08	195.20	20.40	79.00	-59.52	57.53	98.55
April	94.07	228.20	37.40	79.00	-171.53		94.07
May	106.51	201.50	64.80	79.00	-159.79		106.51
June	113.26	152.20	95.20	79.00	-134.14		113.26
July	103.56	100.20	106.60	55.60	-103.24		103.56
August	88.75	66.80	82.10	45.60	-60.15		88.75
September	114.02	69.40	51.80	79.00	-7.18		114.02
October	122.48	83.20	29.10	79.00	10.18		122.48
November	139.80	102.10	15.70	79.00	22.00	44.16	95.64
December	399.90	132.20	10.20	79.00	257.50	310.43	89.47
Total Annualized							
Millimeters	2199.50	1391.20	543.70		264.60		
Inches	**86.59**	**54.77**	**21.41**		**10.42**		

WATER BUDGET ANALYSIS
TABLE A4

New York State Office of General Services
Belleayre Mountain Ski Center

CHA

Natural Precipitation and Snowmaking
Cut and Fill (CF) Soil

Month	Total Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation	Snowmaking Precipitation	Natural Precipitation
January	449.07	6.4	16.7	132.20	425.97	373.57	75.50
February	312.00	31.7	11	79.00	269.30	259.29	52.71
March	156.08	128.8	20.4	79.00	6.88	57.53	98.55
April	94.07	165.6	37.4	79.00	-108.93		94.07
May	106.51	164.8	64.8	79.00	-123.09		106.51
June	113.26	143.3	95.2	79.00	-125.24		113.26
July	103.56	112.8	106.6	55.60	-115.84		103.56
August	88.75	87.1	86.3	45.60	-84.65		88.75
September	114.02	85.6	51.8	79.00	-23.38		114.02
October	122.48	90.3	29.1	79.00	3.08		122.48
November	139.80	100.7	15.7	79.00	23.40	44.16	95.64
December	399.90	119.8	10.2	79.00	269.90	310.43	89.47
Total Annualized							
Millimeters	2199.50	1236.90	545.20		417.40		
Inches	**86.59**	**48.70**	**21.46**		**16.43**		

WATER BUDGET ANALYSIS

TABLE A5

New York State Office of General Services

Belleayre Mountain Ski Center

CHA

Existing Conditions
Natural Precipitation

Soil Type	Infiltration Rating	Budget Acres	Runoff	Runoff Gpm	Percolation	Percolation Gpm
ARF	Most Limited	882.75	22.51	1026.59	1.45	66.13
ORD	Most Limited	449.25	22.51	522.45	1.45	33.65
LCF	Most Limited	218.25	22.51	253.81	1.45	16.35
WLB	Most Limited	156.75	22.51	182.29	1.45	11.74
LCD	Most Limited	145.5	22.51	169.21	1.45	10.90
ORC	Most Limited	114	22.51	132.58	1.45	8.54
CF	Not Rated	46	20.86	49.57	3.45	8.20
LEE	Most Limited	31	22.51	36.05	1.45	2.32
WOB	Most Limited	23	22.51	26.75	1.45	1.72
RXF	Not Rated	15	22.51	17.44	1.45	1.12
VAB	Somewhat Limited	9	21.40	9.95	2.91	1.35
VAD	Most Limited	11.5	22.51	13.37	1.45	0.86
MTB	Most Limited	14	22.51	16.28	1.45	1.05
HCC	Most Limited	5.5	22.51	6.40	1.45	0.41
HCE	Most Limited	33.25	22.51	38.67	1.45	2.49
HCF	Most Limited	42.5	22.51	49.43	1.45	3.18
LHD	Most Limited	11.25	22.51	13.08	1.45	0.84
LHE	Most Limited	4.25	22.51	4.94	1.45	0.32
LKE	Most Limited	146	22.51	169.79	1.45	10.94
MNC	Most Limited	14.5	22.51	16.86	1.45	1.09
MND	Most Limited	17.5	22.51	20.35	1.45	1.31
RRE	Most Limited	51.5	22.51	59.89	1.45	3.86
RRF	Most Limited	1.25	22.51	1.45	1.45	0.09
WMB	Most Limited	2.5	22.51	2.91	1.45	0.19
WMC	Most Limited	7	22.51	8.14	1.45	0.52
ARD	Most Limited	0.5	22.51	0.58	1.45	0.04
OIC	Most Limited	4	22.51	4.65	1.45	0.30
Impervious	Not Rated	22.5	38.95	45.28	0.00	0.00
Total		**2480**		**2898.77**		**163.95**

WATER BUDGET ANALYSIS

TABLE A6

New York State Office of General Services

Belleayre Mountain Ski Center

CHA

Existing Conditions

Natural Precipitation and Snowmaking

Soil Type	Infiltration Rating	Budget Acres	Runoff	Runoff Gpm	Percolation	Percolation Gpm
ARF	Most Limited	782.75	22.51	910.29	1.45	58.64
ARF*	Most Limited	100	54.77	282.96	10.42	53.83
ORD	Most Limited	429.25	22.51	499.19	1.45	32.16
ORD*	Most Limited	20	54.77	56.59	10.42	10.77
LCF	Most Limited	218.25	22.51	253.81	1.45	16.35
WLB	Most Limited	156.75	22.51	182.29	1.45	11.74
LCD	Most Limited	135.5	22.51	157.58	1.45	10.15
LCD*	Most Limited	10	54.77	28.30	10.42	5.38
ORC	Most Limited	114	22.51	132.58	1.45	8.54
CF	Not Rated	16	20.86	17.24	3.45	2.85
CF*	Not Rated	30	48.70	75.48	16.43	25.46
LEE	Most Limited	31	22.51	36.05	1.45	2.32
WOB	Most Limited	23	22.51	26.75	1.45	1.72
RXF	Not Rated	15	22.51	17.44	1.45	1.12
VAB	Somewhat Limited	9	21.40	9.95	2.91	1.35
VAD	Most Limited	11.5	22.51	13.37	1.45	0.86
MTB	Most Limited	14	22.51	16.28	1.45	1.05
HCC	Most Limited	5.5	22.51	6.40	1.45	0.41
HCE	Most Limited	33.25	22.51	38.67	1.45	2.49
HCF	Most Limited	42.5	22.51	49.43	1.45	3.18
LHD	Most Limited	11.25	22.51	13.08	1.45	0.84
LHE	Most Limited	4.25	22.51	4.94	1.45	0.32
LKE	Most Limited	146	22.51	169.79	1.45	10.94
MNC	Most Limited	14.5	22.51	16.86	1.45	1.09
MND	Most Limited	17.5	22.51	20.35	1.45	1.31
RRE	Most Limited	51.5	22.51	59.89	1.45	3.86
RRF	Most Limited	1.25	22.51	1.45	1.45	0.09
WMB	Most Limited	2.5	22.51	2.91	1.45	0.19
WMC	Most Limited	7	22.51	8.14	1.45	0.52
ARD	Most Limited	0.5	22.51	0.58	1.45	0.04
OIC	Most Limited	4	22.51	4.65	1.45	0.30
Impervious	Not Rated	22.5	38.95	45.28	0.00	0.00
Total		**2480**		**3158.59**		**244.31**

WATER BUDGET ANALYSIS

TABLE A7

* Indicates area where snowmaking occurs

APPENDIX B
Tables – Post Development Conditions

New York State Office of General Services

Belleayre Mountain Ski Center

CHA

Developed Conditions
Natural Precipitation

Soil Type	Infiltration Rating	Budget Acres	Runoff	Runoff Gpm	Percolation	Percolation Gpm
ARF	Most Limited	881.5	22.51	1025.13	1.45	66.03
ORD	Most Limited	432.75	22.51	503.26	1.45	32.42
LCF	Most Limited	218.25	22.51	253.81	1.45	16.35
WLB	Most Limited	9.6	0	0.00	1.45	0.72
WLB	Most Limited	126.65	22.51	147.29	1.45	9.49
LCD	Most Limited	3.1	0	0.00	1.45	0.23
LCD	Most Limited	140.15	22.51	162.99	1.45	10.50
ORC	Most Limited	2.1	0	0.00	1.45	0.16
ORC	Most Limited	95.4	22.51	110.94	1.45	7.15
CF	Not Rated	38	16	31.41	13.74	26.97
CF	Not Rated	5.25	0	0.00	13.74	3.73
CF	Not Rated	30	48.7	75.48	16.43	25.46
CF	Not Rated	16	20.86	17.24	3.45	2.85
LEE	Most Limited	1	0	0.00	1.45	0.07
LEE	Most Limited	24.5	22.51	28.49	1.45	1.84
WOB	Most Limited	1	0	0.00	1.45	0.07
WOB	Most Limited	22	22.51	25.58	1.45	1.65
RXF	Not Rated	15	22.51	17.44	1.45	1.12
VAB	Somewhat Limited	9	21.40	9.95	2.91	1.35
VAD	Most Limited	11.5	22.51	13.37	1.45	0.86
MTB	Most Limited	13.5	22.51	15.70	1.45	1.01
HCC	Most Limited	5.5	22.51	6.40	1.45	0.41
HCE	Most Limited	2.5	22.51	0.00	1.45	0.19
HCE	Most Limited	12	22.51	13.96	1.45	0.90
HCF	Most Limited	42.5	22.51	49.43	1.45	3.18
LHD	Most Limited	11.25	22.51	13.08	1.45	0.84
LHE	Most Limited	4.25	22.51	4.94	1.45	0.32
LKE	Most Limited	146	22.51	169.79	1.45	10.94
MNC	Most Limited	14	22.51	16.28	1.45	1.05
MND	Most Limited	4	0	0.00	1.45	0.30
MND	Most Limited	12.25	22.51	14.25	1.45	0.92
RRE	Most Limited	33.25	22.51	38.67	1.45	2.49
RRF	Most Limited	1.25	22.51	1.45	1.45	0.09
WMB	Most Limited	2.5	22.51	2.91	1.45	0.19
WMC	Most Limited	7	22.51	8.14	1.45	0.52
ARD	Most Limited	0.5	0	0.00	1.45	0.04
OIC	Most Limited	3.5	0	0.00	1.45	0.26
Impervious	Not Rated	10.6	0	0.00	0	0.00
Impervious	Not Rated	70.9	38.95	142.67	0.00	0.00
Total		**2480**		**2920.07**		**210.05**

WATER BUDGET ANALYSIS

TABLE B1

New York State Office of General Services

Belleayre Mountain Ski Center

CHA

Developed Conditions

Natural Precipitation and Snowmaking

Soil Type	Infiltration Rating	Budget Acres	Runoff	Runoff Gpm	Percolation	Percolation Gpm
ARF	Most Limited	781.5	22.51	908.84	1.45	58.54
ARF*	Most Limited	100	66.04	341.19	12.2	63.03
ORD	Most Limited	412.75	22.51	480.00	1.45	30.92
ORD*	Most Limited	20	66.04	68.24	12.2	12.61
LCF	Most Limited	218.25	22.51	253.81	1.45	16.35
WLB	Most Limited	9.6	0	0.00	1.45	0.72
WLB	Most Limited	126.65	22.51	147.29	1.45	9.49
LCD	Most Limited	3.1	0	0.00	1.45	0.23
LCD	Most Limited	130.15	22.51	151.36	1.45	9.75
LCD*	Most Limited	10	66.04	34.12	12.2	6.30
ORC	Most Limited	2.1	0	0.00	1.45	0.16
ORC	Most Limited	95.4	22.51	110.94	1.45	7.15
CF	Not Rated	38	16	31.41	13.74	26.97
CF	Not Rated	5.25	0	0.00	13.75	3.73
CF	Not Rated	16	20.86	17.24	3.45	2.85
CF*	Not Rated	30	58.91	91.30	19.27	29.87
LEE	Most Limited	1	0	0.00	1.45	0.07
LEE	Most Limited	24.5	22.51	28.49	1.45	1.84
WOB	Most Limited	1	0	0.00	1.45	0.07
WOB	Most Limited	22	22.51	25.58	1.45	1.65
RXF	Not Rated	15	22.51	17.44	1.45	1.12
VAB	Somewhat Limited	9	21.40	9.95	1.45	0.67
VAD	Most Limited	6.5	22.51	7.56	1.45	0.49
VAD*	Most Limited	5	66.04	17.06	1.45	0.37
MTB	Most Limited	13.5	22.51	15.70	1.45	1.01
HCC	Most Limited	5.5	22.51	6.40	1.45	0.41
HCE	Most Limited	2.5	22.51	0.00	1.45	0.19
HCE	Most Limited	12	22.51	13.96	1.45	0.90
HCF	Most Limited	42.5	22.51	49.43	1.45	3.18
LHD	Most Limited	11.25	22.51	13.08	1.45	0.84
LHE	Most Limited	4.25	22.51	4.94	1.45	0.32
LKE	Most Limited	146	22.51	169.79	1.45	10.94
MNC	Most Limited	14	22.51	16.28	1.45	1.05
MND	Most Limited	4	0	0.00	1.45	0.30
MND	Most Limited	12.25	22.51	14.25	1.45	0.92
RRE	Most Limited	33.25	22.51	38.67	1.45	2.49
RRF	Most Limited	1.25	22.51	1.45	1.45	0.09
WMB	Most Limited	2.5	22.51	2.91	1.45	0.19
WMC	Most Limited	7	22.51	8.14	1.45	0.52
ARD	Most Limited	0.5	0	0.00	1.45	0.04
OIC	Most Limited	3.5	0	0.00	1.45	0.26
Impervious	Not Rated	10.6	0	0.00	0	0.00
Impervious	Not Rated	70.9	38.95	142.67	1.45	5.31
Total		**2480**		**3239.50**		**285.97**

WATER BUDGET ANALYSIS

TABLE B2

* Indicates area where snowmaking occurs

New York State Office of General Services
Belleayre Mountain Ski Center

CHA

Natural Precipitation and Expanded Snowmaking
Most Limited Soils

Month	Total Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation	Snowmaking Precipitation	Natural Precipitation
January	502.24	10.20	17.80	132.20	474.24	426.74	75.50
February	480.12	61.40	12.60	79.00	406.12	427.41	52.71
March	193.37	246.80	20.40	79.00	-73.83	94.82	98.55
April	94.10	280.70	37.40	79.00	-224.00		94.07
May	106.51	245.90	64.80	79.00	-204.19		106.51
June	113.26	185.30	95.20	79.00	-167.24		113.26
July	103.56	123.20	106.60	79.00	-126.24		103.56
August	88.75	80.60	82.10	77.70	-73.95		88.75
September	114.02	80.20	51.80	79.00	-17.98		114.02
October	122.48	90.40	29.10	79.00	2.98		122.48
November	168.43	122.20	15.70	79.00	30.53	72.79	95.64
December	444.12	150.50	10.20	79.00	283.42	354.65	89.47
Total Annualized							
Millimeters	2530.96	1677.40	543.70		309.86		
Inches	**99.64**	**66.04**	**21.41**		**12.20**		

WATER BUDGET ANALYSIS

TABLE B3

New York State Office of General Services

Belleayre Mountain Ski Center

CHA

Natural Precipitation and Expanded Snowmaking
Somewhat limited Soils

Month	Total Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation	Snowmaking Precipitation	Natural Precipitation
January	502.24	6.4	16.7	133.30	479.14	426.74	75.50
February	480.12	39.1	11	84.00	430.02	427.41	52.71
March	193.37	162.5	20.4	84.00	10.47	94.82	98.55
April	94.10	203.8	37.4	84.00	-147.10		94.07
May	106.51	201.5	64.8	84.00	-159.79		106.51
June	113.26	174.8	95.2	84.00	-156.74		113.26
July	103.56	138.5	106.6	84.00	-141.54		103.56
August	88.75	107.4	86.3	84.00	-104.95		88.75
September	114.02	101.3	51.8	84.00	-39.08		114.02
October	122.48	102.5	29.1	84.00	-9.12		122.48
November	168.43	120.3	15.7	84.00	32.43	72.79	95.64
December	444.12	138.2	10.2	84.00	295.72	354.65	89.47
Total Annualized							
Millimeters	2530.96	1496.30	545.20		489.46		
Inches	**99.64**	**58.91**	**21.46**		**19.27**		

WATER BUDGET ANALYSIS

TABLE B4

New York State Office of General Services
Belleayre Mountain Ski Center

CHA

Natural Precipitation
Impervious Surfaces

Month	Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation
January	75.50	1.00	50.20	75.50	24.30
February	52.71	5.40	25.70	118.50	21.61
March	98.55	79.00	20.40	88.40	-0.85
April	94.07	98.50	37.40	44.20	-41.83
May	106.51	110.80	50.10	22.10	-54.39
June	113.26	117.30	11.10	11.10	-15.14
July	103.56	107.50	5.50	5.50	-9.44
August	88.75	92.50	5.50	0.00	-9.25
September	114.02	117.60	0.00	0.00	-3.58
October	122.48	125.90	0.00	0.00	-3.42
November	95.64	99.00	0.00	0.00	-3.36
December	89.47	34.80	10.20	47.70	44.47
Total Annualized					
Millimeters	1154.52	989.30	216.10		0.00
Inches	**45.45**	**38.95**	**8.51**		**0.00**

WATER BUDGET ANALYSIS
TABLE B5

New York State Office of General Services
Belleayre Mountain Ski Center

CHA

Natural Precipitation and Irrigation
Cut and Fill Soil

Month	Total Precipitation	Runoff (Total)	Actual Evapotranspiration	Soil Moisture Storage	Percolation	Irrigation Precipitation	Natural Precipitation
January	75.50	2.50	23.10	126.90	49.9		75.50
February	52.71	2.30	22.90	104.00	27.51		52.71
March	98.55	18.60	20.40	61.00	59.55		98.55
April	94.07	28.60	37.40	61.00	28.07		94.07
May	106.51	33.70	64.80	61.00	8.01		106.51
June	168.10	42.00	95.20	61.00	30.9	54.84	113.26
July	158.40	43.30	106.60	61.00	8.5	54.84	103.56
August	143.60	44.90	86.3	61.00	12.4	54.84	88.75
September	114.02	45.30	51.80	61.00	16.92		114.02
October	122.48	50.50	29.10	61.00	42.88		122.48
November	95.64	52.20	15.70	61.00	27.74		95.64
December	89.47	42.70	10.20	50.80	36.57		89.47
Total Annualized							
Millimeters	1319.10	406.60	563.50		348.95		
Inches	**51.93**	**16.00**	**22.17**		**13.74**		

WATER BUDGET ANALYSIS
TABLE B6

CUMULATIVE IMPACT ANALYSIS FOR:

BELLEAYRE MOUNTAIN SKI CENTER UMP DEIS
AND
BELLEAYRE RESORT AT CATSKILL PARK
SUPPLEMENTAL DEIS

APPENDIX B:
TRANSPORTATION IMPACT STUDY

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December 2012

CHA Project No. 18882

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1.0 INTRODUCTION

1.1 Background

The New York State Department of Environmental Conservation (NYSDEC) prepared a Draft Environmental Impact Statement (DEIS) in May 2012 for the proposed Unit Management Plan (UMP) for the Belleayre Mountain Ski Center (BMSC) in Highmount, New York. The UMP includes trail and ski lift expansions, equipment improvements, and lodge expansions. The Belleayre Resort at Catskill Park is a separate development project proposed by Crossroads Ventures, LLC to be located on property adjacent to the Ski Center. The resort project is proposed to include two hotels, fractional ownership units (a.k.a. timeshares) and an 18-hole golf course. A Supplemental DEIS (SDEIS) was prepared in August 2012 for the Belleayre Resort project to identify the project-specific impacts of that development, including its impacts on the transportation system.

1.2 Project Description

The purpose of this study is to evaluate the cumulative transportation impacts of the combined traffic volumes of the BMSC UMP and the Belleayre Resort. All of the Existing, future No-Build and Build condition evaluations for the study areas for each project are included in the BMSC UMP DEIS (Section 4.6 and Appendix AD) and the Belleayre Resort at Catskill Park SDEIS (Sections 3.5 and 4.7 and Appendix 11).. This study will only discuss the cumulative impacts of the two projects.

2.0 CUMULATIVE TRAFFIC CONDITION

2.1 Cumulative Traffic Volumes

The estimated time of completion (ETC), or year of opening, evaluated for the BMSC UMP and Belleayre Resort is 2015. The BMSC UMP DEIS discusses that the ETC year of the UMP was revised to 2018 subsequent to the completion of the traffic projections and analysis for the future conditions. However, because the background growth was conservatively estimated and the Route 28 corridor has seen little to no growth in the last ten years, the evaluations of the 2015 (ETC) year and subsequent design horizons (ETC+10 and ETC+20) are still applicable for the revised ETC year of 2018. See Section 3.1 of the BMSC UMP DEIS Appendix AD for a more detailed discussion of the study area volume trends.

The site generated trips for both projects were estimated and presented in their respective traffic impact studies. In summary:

- BMSC UMP - Trips were estimated based on traffic data collected at the existing site on a peak operating day, and applied to the planned peak attendance level for the UMP (9,000 patrons).
- Belleayre Resort at Catskill Park - Trips were estimated for the project based on the Institute of Transportation Engineers (ITE) *Trip Generation*, *8th Edition* data for the component land uses, with applicable adjustments to account for the interaction between the Resort and BMSC that are consistent with ITE recommended practice, including considerations of planned shuttle service and ski-in/ski-out amenities.

As identified in the BMSC UMP traffic study, the peak day of activity at the ski center is Saturday during the winter season; traffic data was collected on the Martin Luther King Jr. Birthday holiday weekend to provide a conservative "worst-case" at the study area intersections. The peak hour coincides with patrons leaving at the end of the day, approximately 4-5pm.

The Resort is not expected to have a peak hour during the same timeframe. However, since the ITE trip generation data only provides one peak hour trip rate for Saturday conditions, their peak hour of generator is being used. This is a conservative approach since its peak trip generation would not likely coincide with the peak hour of adjacent street traffic and the ski center.

The new site generated trips for both sites are summarized in Table 1.

Table 1
Combined Site Generated Traffic
Saturday Peak Hour

Project	Vehicle Trips		
	Enter	Exit	Total
BMSC UMP	110	626	736
Belleayre Resort	98	70	168
Total	**208**	**696**	**894**

While the BMSC planned peak attendance day is 9,000 patrons, it is not anticipated to be a regular occurring level of attendance. The TIS for the BMSC UMP cites that historical attendance data available from BMSC shows that the average Saturday attendance is

approximately 57 percent lower than the peak attendance day. This would indicate that the average Saturday attendance with the UMP could be expected to be approximately 3,900 patrons.

The site generated trips summarized in Table 1 were added to the 2015 No-Build background volumes from the BMSC UMP traffic study to develop the 2015 Combined Build traffic volumes, as shown on Figures 1 and 2 in Appendix A.

2.2 Capacity Analyses

The operating conditions of transportation facilities are evaluated based on the relationship of existing or projected traffic volumes to the theoretical capacity of the highway facility. Various factors affect capacity including traffic volume, travel speed, roadway geometry, grade, number and width of travel lanes and intersection control. The operating conditions were evaluated using Highway Capacity Software (HCS+), which uses the methodology in the 2000 *Highway Capacity Manual* (HCM), published by the Transportation Research Board (TRB). The procedures describe operating conditions in terms of Level of Service (LOS). In general, "A" represents the best operating condition and "F" represents the worst. Descriptions of LOS and the associated performance measures set forth in the HCM 2000 are provided in Appendix B.

To determine the cumulative impact of the BMSC UMP and Belleayre Resort on the operations of the adjacent transportation system, traffic operations of the study intersections and roadway segments were analyzed for the Saturday peak hour for the 2015 (ETC) Combined Build Condition.

It is important to note that the conditions analyzed are a “worst-case” peak condition at BMSC since the trip generation was based on the highest attendance (9,000) patrons anticipated. As stated previously, the normal recurring attendance is likely to be much lower. Additionally, the estimated site generated trips for the Belleayre Resort are based on the peak hour of the hotel and fractional units. The peak hours of these uses are not likely to overlap with the peak exiting traffic of the BMSC. Peak entering and exiting traffic at the Resort is more likely to occur earlier in the day, as visitors are checking in and out, rather than during the PM peak hour when ski lifts close and BMSC patrons leave.

The LOS summary of the 2015 No-Build (from the BMSC UMP DEIS Appendix AD) and 2015 Combined Build conditions are provided in Table 2 for the study intersections and Table 3 for the roadway segments. The computation worksheet summaries are provided in Appendix C.

Table 2
Intersection Level of Service Summary
2015 (ETC) Saturday Peak Hour

Intersection & Approach		2015 No-Build Condition		2015 Combined Build Condition	
		LOS	Delay	LOS	Delay
NY Route 28 & NY Route 212					
NY Route 28 (Left)	EB	A	8.5	A	9.0
NY Route 212	SB	C	20.7	F	73.4
NY Route 28 & NY Route 214					
NY Route 28 (Left)	EB	A	8.2	A	8.8
NY Route 28 (Left)	WB	A	8.8	B	10.8
South Street	NB	C	23.2	F	83.2
NY Route 214	SB	D	26.0	F	365.7
NY Route 28 & NY Route 42					
NY Route 28 (Left)	EB	A	7.6	A	8.1
NY Route 42	SB	C	20.1	F	79.7
NY Route 28 & CR 47					
NY Route 28 (Left)	EB	A	7.7	A	8.0
NY Route 28 (Left)	WB	A	9.0	B	11.8
CR 47	NB	C	18.6	F	104.9
CR 47	SB	B	12.1	C	19.0
NY Route 28 & Main Street					
NY Route 28 (Left)	WB	A	9.2	B	12.1
Main Street	NB	C	16.7	E	40.5
NY Route 28 & CR 49A					
NY Route 28 (Left)	EB	A	7.6	A	7.6
NY Route 28 (Left)	WB	A	7.7	A	8.2
CR 49A	NB	F	169.1	F	952.3
Owl Nest Road	SB	E	42.9	F	**
NY Route 28 & CR 38					
NY Route 28 (Left)	EB	A	8.4	A	8.7
CR 38	SB	C	15.2	C	18.0
CR 49A & Van Loan Road					
CR 49A (Left)	EB			A	8.0
CR 49A (Left)	WB	**N/A**		C	15.1
Van Loan	NB			F	368.2
Van Loan	SB			F	**
CR 49A & North Parking					
CR 49A (Left)	WB	**N/A**		B	14.1
North Lot Driveway	NB			F	273.0
CR 49A & Gunnison Road/Lower Driveway					
CR 49A (Left)	EB	A	7.5	A	7.9
CR 49A (Left)	WB	A	9.6	B	12.5
Belleayre Lower Driveway	NB	D	34.2	F	333.2
Gunnison Road	SB	E	39.6	F	**
CR 49A & Discovery Lodge					
CR 49A (Left)	WB	A	8.8	B	11.1
Discovery Lodge Driveway	NB	C	21.6	F	71.8
CR 49A & Upper Discovery Parking					
CR 49A (Left)	WB	**N/A**		B	10.3
Upper Discovery Parking	NB			F	134.8
CR 49A & Overlook Road					
CR 49A (Left)	EB			A	7.5
CR 49A (Left)	WB	A	7.5	A	7.8
Overlook Road	NB	B	13.2	F	53.7
Wildacres Resort	SB			F	588.4

* Delay given in seconds per vehicle.
** Delay value exceeds limits of analysis.

Table 3
Segment Level of Service Summary
2015 (ETC) Saturday Peak Hour

Segment		2015 No-Build Condition	2015 Combined Build Condition
NY Route 28: NY Route 209 to NY Route 375*	EB	A	B
	WB	B	B
NY Route 28: NY Route 375 to NY Route 212		D	E
NY Route 28: NY Route 212 to NY Route 214		C	D
NY Route 28: CR 38 to NY Route 30		C	C
CR 49A: South of Belleayre Access		C	C

* This is a multilane segment, therefore LOS is provided for each direction. All other segments are analyzed as two-lane segments.

The analysis of the cumulative development indicates that the LOS for traffic entering or crossing Route 28 from the intersecting side streets will generally be LOS E or LOS F during the worst case condition of a peak attendance day at the BMSC. While the site generated trips related to the BMSC UMP and the Belleayre Resort increase delay at these study area intersections, many of the unsignalized approaches still operate with an acceptable volume to capacity (v/c), indicating that there is reserve capacity. Particularly, NY Route 212 (v/c = 0.73), NY Route 42 (v/c = 0.70), CR 47 (v/c = 0.75) and Main Street (v/c = 0.18), though they operate at LOS E or F still have reserve capacity based on their v/c ratios. Additionally, the 95th percentile queue lengths are at approximately four vehicles or less. Based on these analyses, no improvements are recommended at these locations for the year of opening.

The intersections of NY Route 28 & NY Route 214 and NY Route 28 & CR 49A are estimated to operate with higher levels of delay and v/c ratios that exceed capacity (greater than 1.0). These intersections, as well as the intersections along CR 49A, are addressed under mitigation improvements.

The segment of NY Route 28 from NY Route 375 to NY Route 212 is estimated to operate at LOS E for the Combined Build condition. However, it still is estimated to operate with reserve capacity with a v/c ratio of 0.74 and no improvements are recommended for this roadway segment.

3.0 MITIGATION IMPROVEMENTS

3.1 NY Route 28 & NY Route 214

At the intersection of NY Route 28 and NY Route 214, the increase in delay on the NY Route 214 approach is related to the additional site trips eastbound on NY Route 28 during the peak hour.

Traffic signal warrant criteria were reviewed and the intersection does meet the peak hour warrant criteria for the Saturday peak hour evaluated. However, since this is just one hour of a peak operating day, and weekdays and the off-peak seasons will not experience the same levels of delay, the installation of a traffic signal is not recommended. This recommendation is also based on a sensitivity analysis that is presented later in Section 3.4. To alleviate the delay for right-turn vehicles from NY Route 214, a right-turn lane could be provided on the approach. This would reduce the overall approach delay to 164 seconds per vehicle, though the left-turn movement would still operate with a v/c ratio of 1.38. The intersection operations with the addition of a southbound right-turn lane are shown in Table 4.

3.2 NY Route 28 & CR 49A

The intersection of NY Route 28 & CR 49A is estimated to operate with high levels of delay during the Saturday peak hour with the added site traffic related to BMSC UMP and the Belleayre Resort. While it is not anticipated that this delay will be experienced on weekdays or during off-peak times and seasons, to provide the safe and efficient movement of traffic in the area, a greater level of traffic control may be needed. Traffic signal warrant criteria were reviewed and the intersection does meet the peak hour warrant criteria for the Saturday peak hour evaluated.

The addition of a northbound right-turn lane on CR 49A, a westbound left-turn lane on NY Route 28 and the installation of a traffic signal would provide LOS D operations at the intersection. The right-turn movement from CR 49A may still experience excessive delay during the peak hour of exiting traffic, as most traffic exiting both sites are estimated to turn right onto NY Route 28 from CR 49A. The intersection operations with the addition of a northbound right-turn lane, westbound left-turn lane and traffic signal control are shown in Table 4.

To better accommodate traffic during weekdays and/or the off-season, the signal could be set to rest in green on NY Route 28 or switched to flashing operations.

Table 4
Level of Service Summary
With Mitigation Improvements: Peak Event
Saturday Peak Hour

Intersection & Approach		2015 Combined Build Condition	
		LOS	Delay
NY Route 28 & NY Route 214			
NY Route 28 (Left)	EB	A	* 8.8
NY Route 28 (Left)	WB	B	10.8
South Street	NB	F	83.2
NY Route 214	SB	F	164.0
NY Route 28 & CR 49A (signalized)			
NY Route 28	EB	D	46.9
NY Route 28	WB	B	15.5
CR 49A	NB	E	59.8
Owl Nest Road	SB	B	16.0
Overall		*D*	*50.5*

* Delay given in seconds per vehicle.

3.3 CR 49A Intersections

The delay experienced at the roadway and driveway intersections along CR 49A is related to exiting traffic leaving the BMSC and Belleayre Resort parking areas. Since these delays are short-duration and event related, it is not recommended that additional turn lanes or traffic signal control are installed. Additionally, the vehicles experiencing the delay are contained within the sites. Event management traffic control strategies could be implemented to help control and direct traffic during the peak hour. Staffing the driveways on peak attendance days at the BMSC would allow them to stop CR 49A eastbound traffic to allow movements from the parking areas.

3.4 Sensitivity Analysis

Since these analyses are representative of a worst-case condition, with the BMSC UMP operating on a peak day, a sensitivity analysis of the site generated traffic was completed to determine what the operations would be at the NY Route 28 & NY Route 214 and NY Route 28 & CR 49A intersections for a reduced condition.

The TIS for the BMSC UMP included a sensitivity analysis for a reduced attendance of 6,078 patrons. This attendance level was equated to be approximately 32% lower than the peak attendance day, or the same as removing the top-ten highest attendance days. This analysis was

utilized and the site generated traffic for the Belleayre Resort at the intersections of NY Route 28 & NY Route 214 and NY Route 28 & CR 49A was also added to determine the combined operations for this condition.

The LOS summary is provided in Table 5. For this condition, the NY Route 214 approach to NY Route 28 operates with a v/c ratio of 0.68 and geometric improvements at the intersection would not be necessary.

At the intersection of NY Route 28 & CR 49A, unsignalized and signalized controls were tested. With the additional geometry recommended in Section 3.2 (westbound left-turn lane and northbound right-turn lane), the unsignalized intersection is still estimated to operate at LOS F on the CR 49A and Owl Nest Road approaches, with the CR 49A northbound right still operating over capacity (v/c = 1.03). However, with the signalized control, the intersection is estimated to operate at overall LOS B, with all approaches operating at LOS C or better.

Table 5
Level of Service Summary
With Mitigation Improvements – 6,078 patrons at BMSC
Saturday Peak Hour

Intersection & Approach		2015 Build Condition	
		LOS	Delay
NY Route 28 & NY Route 214*			
NY Route 28 (Left)	EB	A	** 8.5
NY Route 28 (Left)	WB	A	9.3
South Street	NB	D	34.5
NY Route 214	SB	F	52.5
NY Route 28 & CR 49A (unsignalized)			
NY Route 28 (Left)	EB	A	7.6
NY Route 28 (Left)	WB	A	7.9
CR 49A	NB	F	58.7
Owl Nest Road	SB	F	***
NY Route 28 & CR 49A (signalized)			
NY Route 28	EB	C	28.7
NY Route 28	WB	B	11.3
CR 49A	NB	B	18.4
Owl Nest Road	SB	B	15.7
Overall		*B*	*18.0*

* The analysis of this intersection represents existing geometric conditions with no improvements.
** Delay given in seconds per vehicle.
*** Delay value exceeds limits of analysis.

Given that only ten ski season days are estimated to experience higher attendance than this condition, it is recommended that the mitigation improvements are considered for this reduced condition rather than the peak attendance day. Installing the turn lanes and signalized control at the intersection of NY Route 28 & CR 49A will provide safe and efficient operations for most operating days at BMSC and Belleayre Resort, and will limit delays and improve safety at the intersection on the peak operating days.

3.5 Traffic Demand Management Strategies

There are some traffic demand management (TDM) strategies are being incorporated into the project proposals that will reduce the vehicular trips between the two sites:

- Local shuttles: The TIS for the Belleayre Resort discusses the use of a shuttle system to transport skiers between the Resort and BMSC. This assumption was used in the trip generation estimates for the Resort and will greatly reduce the number of vehicular trips made between the two sites.

- Ski-in/Ski-out: The documentation for both projects describe ski-in/ski-out accommodations, which allow Resort users to get right onto a ski lift without driving to BMSC. This also was an assumption used in the Resort trip generation estimates.

Overall, the interaction between the two sites is estimated to result in a 51% reduction in trips (175 total trips) to and from the Resort. Additionally, the Resort itself can act like a form of TDM. Currently, most of the patronage at BMSC consists of day trips, resulting in peak surge of exiting traffic. The cumulative effect of these projects is that it provides an opportunity for shared-use trips to the area that can reduce the concentration of peak hour traffic.

Other traffic demand and event management strategies should be implemented to distribute the traffic load on the system.

- Public Transportation: BMSC and Ulster County Area Transit (UCAT) are currently teamed up to provide free round-trip bus service to BMSC from Kingston (and other stops along NY Route 28 between Kingston and BMSC). Expanding this service to provide additional capacity on high-attendance ski days and to serve other key local skier origins within the UCAT service area (Poughkeepsie, New Paltz, Newburgh, Wallkill, Saugerties) can result in greater reductions in vehicular trips to BMSC. Providing bus service to Poughkeepsie would also open the opportunity to provide a connection for Metro-North rail riders.

- Private Bus Companies: Adirondack Trailways currently offers ski packages that include round-trip transportation from New York City and a lift ticket. Multiple day packages with overnight accommodations are also available, with shuttle service to and from the lodging locations. This service could also be expanded to include other regional skier origins besides NYC and to be available more frequently to reduce the number of vehicular trips to BMSC and Belleayre Resort.

- Operations
  - BMSC: Staggering the closing times of different ski lifts rather than closing them all at the same time would spread the departures over a longer period of time. Similarly, keeping other facilities open in the Discovery and Overlook Lodges so that patrons are encouraged to stay at the facility longer after the lifts are closed would also spread the load of departures to other times of the day.
  - Belleayre Resort: The Resort could also help stagger the loading of the transportation by offering different check-in/check-out days for the fractional units (spread out over Friday, Saturday and Sunday rather than all on Saturday) and by offering a variety of weekend packages for the hotel that would include arrivals and departures on off-peak days (Friday and Monday). These strategies would help spread the entering and exiting trips of the Resort so that they do not coincide with the peak exiting traffic of the ski center.

- Driver Information: Providing variable message signs at key locations in the corridor could also communicate to drivers on heavy ski days that traffic delays may be experienced.

3.6 Sight Distance Improvements

The documentation for both the BMSC UMP and the Belleayre Resort included a sight distance evaluation along CR 49A and at the proposed driveway intersections. Both identified improvements to be implemented to improve sight distance for drivers along the CR 49A corridor and drivers exiting driveways from both sites. The improvements identified are summarized below:

- Vegetation clearing and/or embankment grading for the intersections with:
  - Wildacres Front 9 Village driveway
  - Lower Discovery Lodge Parking
  - Highmount Spa Resort driveway
  - Wildacres Upper Access driveway

- Intersection Warning Signs:
    - Wildacres Front 9 Village driveway
    - North Parking
    - Upper Discovery Parking
    - Discovery Lodge

- Wildacres Resort Main Access driveway/BMSC Overlook Road: Realignment of CR 49A to improve vertical and horizontal curves to accommodate pedestrian crossing between the Resort and BMSC.

- Wilderness Activity Center driveway: relocate existing driveway 300 feet to south or restrict movements to right-in/right-out.

A comprehensive corridor signing plan should be developed to ensure that the recommended warning signs do not overlap or conflict with each other.

4.0 GROWTH INDUCING IMPACTS

The construction and operation of the proposed BMSC UMP and Belleayre Resort projects is anticipated to attract local and regional tourists to the area. To support the increase in travelers through the corridor, it can be expected that both projects will induce growth of other supporting uses, such as hotels, restaurants, shops and gas stations, along the NY Route 28 corridor. These developments would be subject to local site plan and zoning approvals, as well as DOT highway access permits.

The impact of the growth of development along the corridor would be the increase of access driveways and traffic volume, which have the potential to introduce operational and safety issues. Higher driveway/roadway densities along a corridor can reduce the overall capacity.

Limiting or consolidating access to future development will help maintain the operational capacity of NY Route 28. It would be beneficial for a corridor access management plan to be completed by NYSDOT or other local agency in anticipation of the induced growth developments that can expected in the area. This would help manage the development requests and provide a basis for site access approvals.

5.0 CONSTRUCTION TRAFFIC

The construction traffic for each project was estimated in their respective studies and is summarized in Table 6. The method of measurement for the construction truck traffic was different for each, with the estimate for BMSC UMP in total number of trucks in use for construction operations and the estimate for Belleayre Resort in number of truck trips per day in and out of the site.

Table 6
Construction Traffic

Resource	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
BMSC UMP: # Trucks in Use	7	12	9	9	8	-	-	-	-
Belleayre Resort: # Truck Trips per Day	53	53	10	10	10	10	10	7	7

As shown, years 1 and 2 will have the highest level of construction related truck activity. In year 2, if it is conservatively assumed that each of the twelve trucks used at BMSC UMP were to make 4 trips per day, it would equal 48 trips per day. Combined with the truck trips for Belleayre Resort and spread over a ten-hour workday, it equates to approximately 10 trips per hour. These trips would be directionally split between entering and exiting the site. The current average daily traffic on NY Route 28 is approximately 3,000 vehicles per day so the construction truck traffic is estimated to increase the daily traffic volumes by approximately three percent. It is not anticipated that construction traffic will affect traffic operations on NY Route 28 or its intersections with local roads.

6.0 CONCLUSION & RECOMMENDATIONS

A DEIS has been completed for the proposed UMP for the BMSC. The UMP is proposed to add trails and lifts, improve equipment and expand their lodges. With these facility improvements, it is anticipated that the peak attendance level would be a maximum of 9,000 patrons a day. A SDEIS has been prepared for the Belleayre Resort at Catskill Park, which includes hotels, fractional units and a golf course.

The purpose of this cumulative transportation impact analysis is to evaluate the effects of the combined traffic of both projects.

The traffic evaluations were conducted for the combined condition, which includes the BMSC maximum peak attendance day and therefore represent a conservative "worst-case" representation of traffic volumes in the area. Trips for the Belleayre Resort were estimated based on the land uses included on-site, and applying credits related to the interaction between the Resort and BMSC (such as shuttle use between the sites and ski-in/ski-out accommodations).

The combined site trips estimated for the BMSC UMP and Belleayre Resort equate to 894 new trips during the peak seasonal condition during the Saturday PM peak hour (208 entering and 696 exiting).

The study area intersections were analyzed for the combined Build conditions to identify the future operating conditions with the ski center expansion and the Resort. The analyses show that many stop-controlled approaches within the study area are estimated to operate at LOS E or F with the combined traffic estimated from both projects. But while traffic crossing or entering NY Route 28 may experience long delays during the peak hour of exiting traffic, the NY Route 28 corridor has sufficient capacity and will operate satisfactorily for through traffic.

For some of the intersections that are estimated to operate at LOS E or F, the v/c ratio and queue lengths indicate that there is still reserve capacity at the intersection and mitigation is not warranted. Additionally, many of the intersections listed that experience LOS E or F are driveways from BMSC or the Resort and the vehicles experiencing the delay are contained within the sites.

The traffic operations on a peak operating day at BMSC is event-like in nature in that it is not a regular occurring condition, and therefore should not be used as a basis for design of transportation facilities. A sensitivity analysis was conducted to test the operations at the intersections of NY Route 28 & NY Route 214 and NY Route 28 & CR 49A during a reduced attendance day at BMSC.

Based on the evaluations and looking at what improvements are necessary for a reduced attendance condition that will serve most of the operating days at the BMSC, physical mitigation improvements are only recommended at the intersection with NY Route 28 & CR 49A. The installation of a northbound right-turn lane, a westbound left-turn lane and a traffic signal will provide safe and efficient operations at the intersection for most operating days at BMSC and will reduce delays and improve safety on the peak operating days.

There are some TDM strategies are being incorporated into the project proposals that will reduce the vehicular trips between the two sites:

- A shuttle system to transport skiers between the Resort and BMSC.
- Ski-in/Ski-out accommodations, which allow Resort users to get right onto a ski lift without driving to BMSC.

Additionally, the Resort itself can act like a form of TDM in that BMSC currently consists of primarily day-trips, but the Resort provides an opportunity for shared-use trips to the area that can reduce the concentration of peak hour traffic.

Other traffic demand and event management strategies should be implemented to distribute the traffic load on the system. These can include:

- Expanding the existing free bus service from Kingston to BMSC to provide additional capacity on peak days and to serve other key local skier origins.
- Expanding packages available from private bus companies to include other regional skier origins besides NYC and to be available more frequently.
- Staggering the closing times of different ski lifts at BMSC rather than closing them all at the same time. Similarly, keeping other facilities open in the Discovery and Overlook Lodges so that patrons are encouraged to stay at the facility longer after the lifts are closed.
- The Resort could offer different check-in/check-out days for the fractional units and offer a variety of weekend packages for the hotel that would include arrivals and departures on off-peak days.
- Providing variable message signs to communicate to drivers on heavy ski days that traffic delays may be experienced.

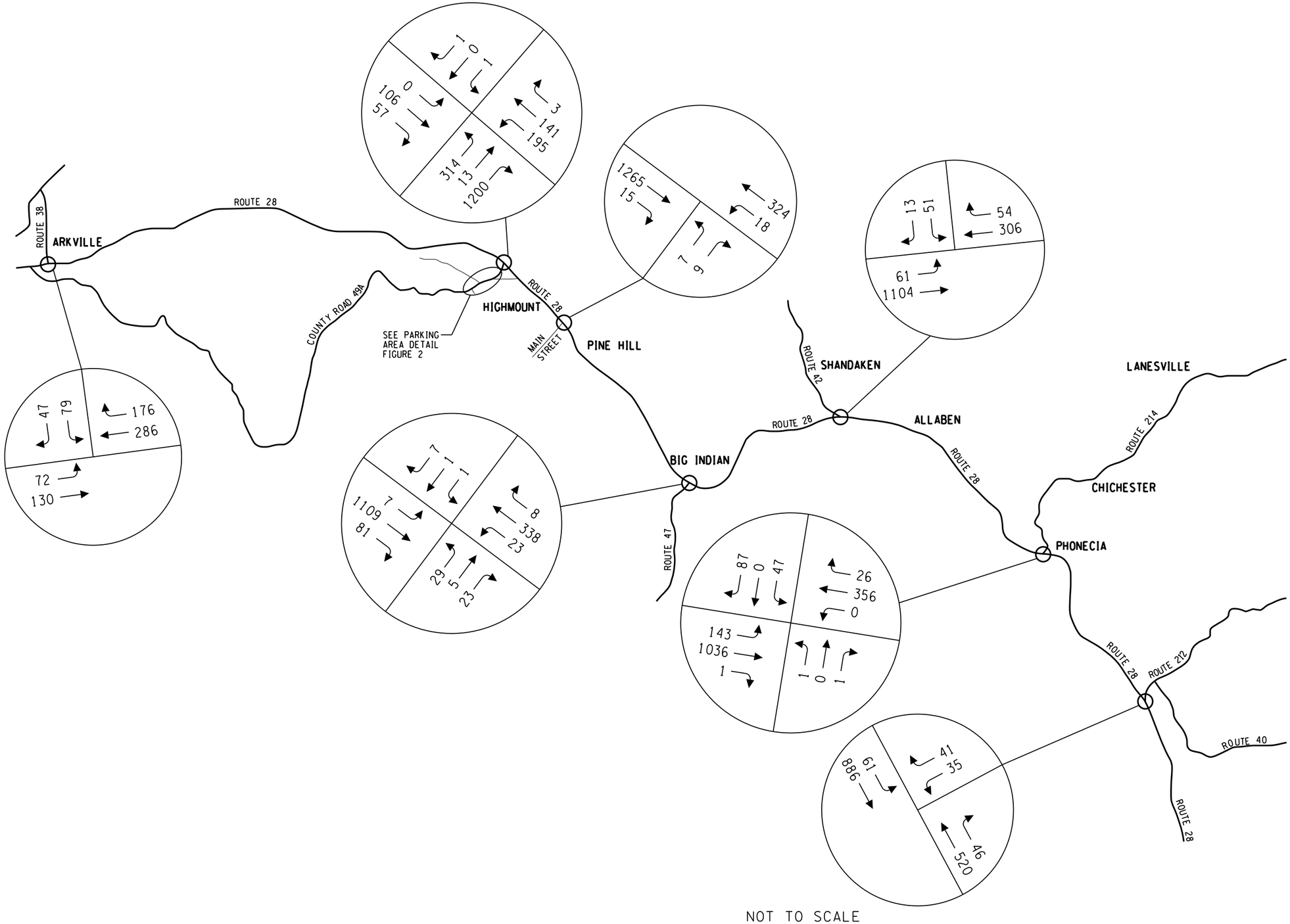
Sight distance evaluations were also conducted for both projects, and resulted in a number of recommendations along CR 49A and at the driveway intersections. Vegetation clearing, embankment grading and/or intersection warning signs are recommended for most of the

driveways. At the intersection of CR 49A & Wildacres Main Access driveway/Overlook Road, a realignment of CR 49A is recommended due to the sight distance limitations and the need to install a pedestrian crossing to accommodate the ski-in/ski-out operations.

The potential for induced growth along the NY Route 28 corridor to support the increased number of travelers and tourists to the area could cause operational and safety issues in the future. A corridor access management plan should be developed by NYSDOT or other local agency to manage access for new development applications so that is does not reduce the capacity of the corridor.

In summary, with the recommendations aforementioned, the cumulative operations of the BMSC UMP and Belleayre Resort at Catskill Park will not have an adverse effect on the operations of the area transportation system.

APPENDIX A
FIGURES



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2015 (ETC) COMBINED BUILD VOLUMES
STUDY AREA INTERSECTIONS
SATURDAY PEAK HOUR

CUMULATIVE IMPACT ANALYSIS
BMSC UMP & BELLEAYRE RESORT

FIGURE
1

DATE: 10/12

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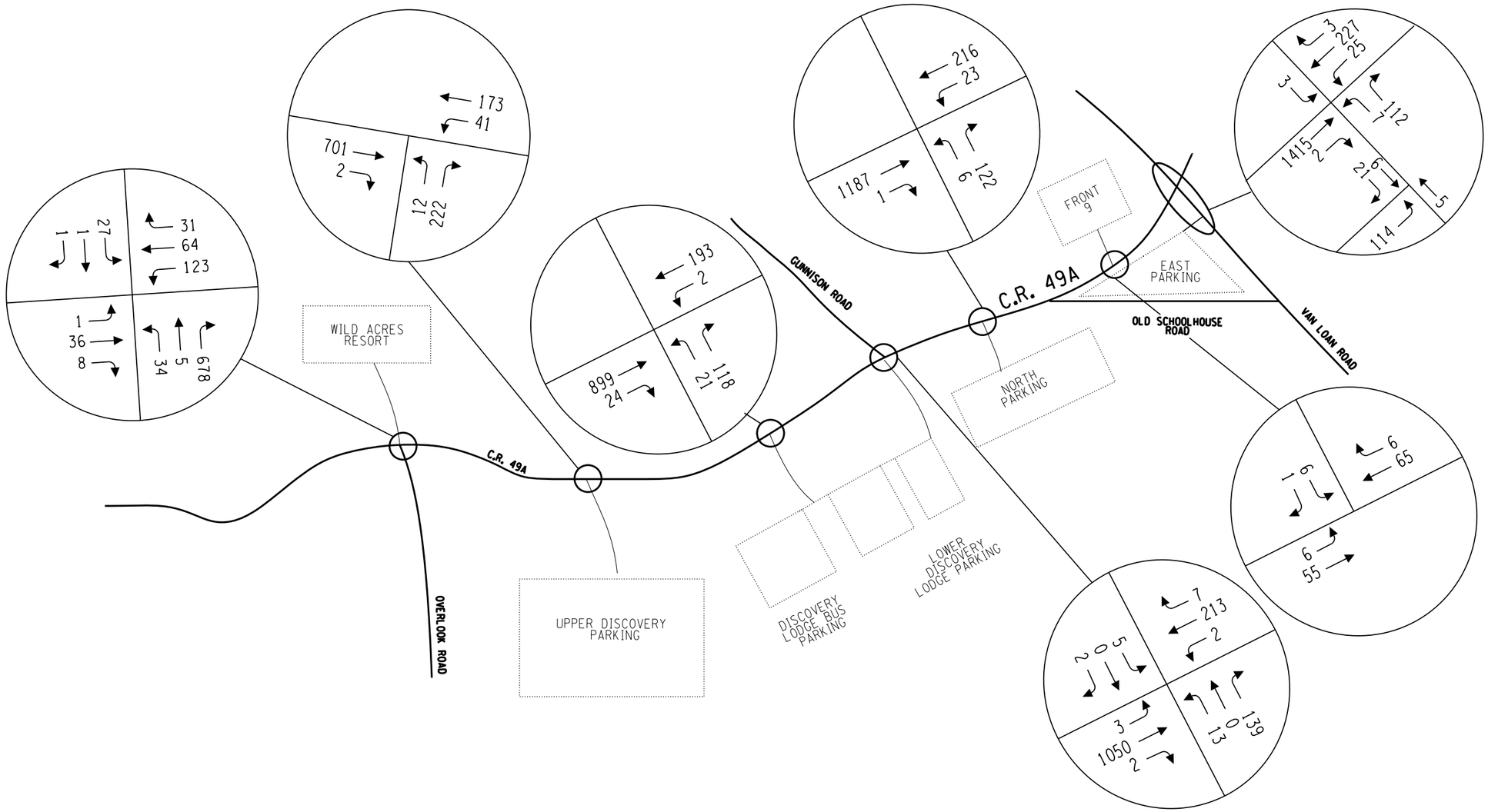

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2015 (ETC) COMBINED BUILD VOLUMES

STUDY AREA INTERSECTIONS
SATURDAY PEAK HOUR

CUMULATIVE IMPACT ANALYSIS
BMSC UMP & BELLEAYRE RESORT

FIGURE
2

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APPENDIX B
LEVEL OF SERVICE CRITERIA

From the *Highway Capacity Manual 2000* published by the Transportation Research Board:

Signalized Intersections

LOS CRITERIA FOR SIGNALIZED INTERSECTIONS

LOS	Control Delay per Vehicle (s/veh)*
A	≤ 10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

Highway Capacity Manual 2000
** s/veh = seconds per vehicle*

LOS A describes operations with low control delay, up to 10 s/veh. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

LOS B describes operations with control delay greater than 10 and up to 20 s/veh. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

LOS C describes operations with control delay greater than 20 and up to 35 s/veh. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a green phase does not serve queued vehicles, and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with control delay greater than 35 and up to 55 s/veh. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity (v/c) ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with control delay greater than 55 and up to 80 s/veh. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

LOS F describes operations with delay in excess of 80.0 s/veh. This level, considered unacceptable to most drivers, often occurs with over-saturation, that is, when arrival flow rates exceed the capacity of lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also be contribute significantly to high delay levels. Often, vehicles do not pass through the intersection in one signal cycle.

Unsignalized Intersections

The level of service criteria for an unsignalized intersection differs from that of a signalized intersection because of the expectation that signalized intersections encounter more traffic and therefore greater delays. The thresholds for the levels of service of unsignalized intersections are as follows:

LOS CRITERIA FOR UNSIGNALIZED INTERSECTIONS

LOS	Control Delay per Vehicle (s/veh)
A	≤ 10
B	> 10-15
C	> 15-25
D	> 25-35
E	> 35-50
F	> 50

Highway Capacity Manual 2000
** s/veh = seconds per vehicle*

APPENDIX C
CAPACITY ANALYSIS WORKSHEETS

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*Rte 28 & Rte 214*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/25/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* | North/South Street: *Rte 214*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*143*	*1036*	*1*	*0*	*356*	*26*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.82*	*0.82*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*155*	*1126*	*1*	*0*	*434*	*31*
Percent Heavy Vehicles	*2*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration	*LTR*			*LT*		*R*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*1*	*0*	*1*	*47*	*0*	*87*
Peak-Hour Factor, PHF	*0.50*	*0.50*	*0.50*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*2*	*0*	*2*	*51*	*0*	*95*
Percent Heavy Vehicles	*0*	*0*	*0*	*3*	*3*	*3*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LT*		*LTR*			*LTR*	
v (veh/h)	*155*	*0*		*4*			*146*	
C (m) (veh/h)	*1096*	*624*		*50*			*95*	
v/c	*0.14*	*0.00*		*0.08*			*1.54*	
95% queue length	*0.49*	*0.00*		*0.25*			*11.24*	
Control Delay (s/veh)	*8.8*	*10.8*		*83.2*			*365.7*	
LOS	*A*	*B*		*F*			*F*	
Approach Delay (s/veh)	--	--	*83.2*			*365.7*		
Approach LOS	--	--	*F*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*Rte 28 & Rte 212*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/25/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* North/South Street: *Rte 212*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*61*	*886*			*520*	*46*
Peak-Hour Factor, PHF	*0.88*	*0.88*	*0.25*	*1.00*	*0.89*	*0.89*
Hourly Flow Rate, HFR (veh/h)	*69*	*1006*	*0*	*0*	*584*	*51*
Percent Heavy Vehicles	*0*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*35*		*41*
Peak-Hour Factor, PHF	*0.25*	*1.00*	*0.25*	*0.65*	*1.00*	*0.65*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*53*	*0*	*63*
Percent Heavy Vehicles	*0*	*0*	*0*	*1*	*0*	*1*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*69*						*116*	
C (m) (veh/h)	*958*						*158*	
v/c	*0.07*						*0.73*	
95% queue length	*0.23*						*4.47*	
Control Delay (s/veh)	*9.0*						*73.4*	
LOS	*A*						*F*	
Approach Delay (s/veh)	--	--	*73.4*					
Approach LOS	--	--	*F*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*Rte 28 & Rte 42*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/25/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* North/South Street: *Rte 42*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*61*	*1104*			*306*	*54*
Peak-Hour Factor, PHF	*0.94*	*0.94*	*0.25*	*1.00*	*0.94*	*0.94*
Hourly Flow Rate, HFR (veh/h)	*64*	*1174*	*0*	*0*	*325*	*57*
Percent Heavy Vehicles	*1*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*1*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*51*		*13*
Peak-Hour Factor, PHF	*0.25*	*1.00*	*0.25*	*0.71*	*1.00*	*0.71*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*71*	*0*	*18*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*					*L*		*R*
v (veh/h)	*64*					*71*		*18*
C (m) (veh/h)	*1240*					*102*		*694*
v/c	*0.05*					*0.70*		*0.03*
95% queue length	*0.16*					*3.57*		*0.08*
Control Delay (s/veh)	*8.1*					*97.3*		*10.3*
LOS	*A*					*F*		*B*
Approach Delay (s/veh)	--	--				*79.7*		
Approach LOS	--	--				*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*Rte 28 & CR 47*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/25/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* North/South Street: *CR 47*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*7*	*1109*	*81*	*23*	*338*	*8*
Peak-Hour Factor, PHF	*0.95*	*0.95*	*0.95*	*0.94*	*0.94*	*0.94*
Hourly Flow Rate, HFR (veh/h)	*7*	*1167*	*85*	*24*	*359*	*8*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*29*	*5*	*23*	*1*	*1*	*7*
Peak-Hour Factor, PHF	*0.71*	*0.71*	*0.71*	*0.75*	*0.75*	*0.75*
Hourly Flow Rate, HFR (veh/h)	*40*	*7*	*32*	*1*	*1*	*9*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*7*	*24*		*79*			*11*	
C (m) (veh/h)	*1192*	*556*		*105*			*268*	
v/c	*0.01*	*0.04*		*0.75*			*0.04*	
95% queue length	*0.02*	*0.14*		*4.06*			*0.13*	
Control Delay (s/veh)	*8.0*	*11.8*		*104.9*			*19.0*	
LOS	*A*	*B*		*F*			*C*	
Approach Delay (s/veh)	--	--	*104.9*			*19.0*		
Approach LOS	--	--	*F*			*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*Rte 28 & Main St.*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/25/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882*

East/West Street: *Rte 28* | North/South Street: *Main St.*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*1265*	*15*	*18*	*324*	
Peak-Hour Factor, PHF	*0.50*	*0.97*	*0.97*	*0.84*	*0.84*	*0.42*
Hourly Flow Rate, HFR (veh/h)	*0*	*1304*	*15*	*21*	*385*	*0*
Percent Heavy Vehicles	*2*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*7*		*9*			
Peak-Hour Factor, PHF	*0.70*	*1.00*	*0.70*	*0.25*	*0.25*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*10*	*0*	*12*	*0*	*0*	*0*
Percent Heavy Vehicles	*14*	*0*	*0*	*2*	*0*	*3*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*21*		*22*				
C (m) (veh/h)		*531*		*123*				
v/c		*0.04*		*0.18*				
95% queue length		*0.12*		*0.62*				
Control Delay (s/veh)		*12.1*		*40.5*				
LOS		*B*		*E*				
Approach Delay (s/veh)	--	--	*40.5*					
Approach LOS	--	--	*E*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*Rte 28 & CR 49A*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/25/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* North/South Street: *CR 49A*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*0*	*106*	*57*	*195*	*141*	*3*
Peak-Hour Factor, PHF	*0.82*	*0.82*	*0.82*	*0.76*	*0.76*	*0.76*
Hourly Flow Rate, HFR (veh/h)	*0*	*129*	*69*	*256*	*185*	*3*
Percent Heavy Vehicles	*4*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*	*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*314*	*13*	*1200*	*1*	*0*	*1*
Peak-Hour Factor, PHF	*0.86*	*0.86*	*0.86*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*365*	*15*	*1395*	*4*	*0*	*4*
Percent Heavy Vehicles	*1*	*1*	*1*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*0*	*256*		*1775*			*8*	
C (m) (veh/h)	*1374*	*1381*		*578*			*0*	
v/c	*0.00*	*0.19*		*3.07*				
95% queue length	*0.00*	*0.68*		*153.95*				
Control Delay (s/veh)	*7.6*	*8.2*		*952.3*				
LOS	*A*	*A*		*F*			*F*	
Approach Delay (s/veh)	--	--	*952.3*					
Approach LOS	--	--	*F*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*Rte 28 & Rte 38*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/25/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* North/South Street: *Rte 38*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*72*	*130*			*286*	*176*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.25*	*1.00*	*0.89*	*0.89*
Hourly Flow Rate, HFR (veh/h)	*78*	*141*	*0*	*0*	*321*	*197*
Percent Heavy Vehicles	*4*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*79*		*47*
Peak-Hour Factor, PHF	*0.25*	*1.00*	*0.25*	*0.78*	*1.00*	*0.78*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*101*	*0*	*60*
Percent Heavy Vehicles	*0*	*0*	*0*	*1*	*0*	*1*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*78*						*161*	
C (m) (veh/h)	*1038*						*436*	
v/c	*0.08*						*0.37*	
95% queue length	*0.24*						*1.67*	
Control Delay (s/veh)	*8.7*						*18.0*	
LOS	*A*						*C*	
Approach Delay (s/veh)	--	--	*18.0*					
Approach LOS	--	--	*C*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*CR 49A & Van Loan*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/29/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *CR 49A* North/South Street: *Van Loan*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*0*	*1415*	*2*	*25*	*227*	*3*
Peak-Hour Factor, PHF	*0.86*	*0.86*	*0.86*	*0.66*	*0.66*	*0.66*
Hourly Flow Rate, HFR (veh/h)	*0*	*1645*	*2*	*37*	*343*	*4*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*7*	*0*	*112*	*3*	*0*	*0*
Peak-Hour Factor, PHF	*0.70*	*0.70*	*0.70*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*10*	*0*	*160*	*12*	*0*	*0*
Percent Heavy Vehicles	*2*	*0*	*2*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*0*	*37*		*170*			*12*	
C (m) (veh/h)	*1212*	*392*		*108*			*0*	
v/c	*0.00*	*0.09*		*1.57*				
95% queue length	*0.00*	*0.31*		*12.75*				
Control Delay (s/veh)	*8.0*	*15.1*		*368.2*				
LOS	*A*	*C*		*F*			*F*	
Approach Delay (s/veh)	--	--	*368.2*					
Approach LOS	--	--	*F*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*CR 49A & North Parking*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/29/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *CR 49A* North/South Street: *North Parking*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*1187*	*1*	*23*	*216*	
Peak-Hour Factor, PHF	*0.77*	*0.77*	*0.77*	*0.66*	*0.66*	*0.66*
Hourly Flow Rate, HFR (veh/h)	*0*	*1541*	*1*	*34*	*327*	*0*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*		*122*			
Peak-Hour Factor, PHF	*0.70*	*0.60*	*0.70*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*8*	*0*	*174*	*0*	*0*	*0*
Percent Heavy Vehicles	*5*	*0*	*5*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*34*		*182*				
C (m) (veh/h)		*431*		*132*				
v/c		*0.08*		*1.38*				
95% queue length		*0.26*		*11.96*				
Control Delay (s/veh)		*14.1*		*273.0*				
LOS		*B*		*F*				
Approach Delay (s/veh)	--	--	*273.0*					
Approach LOS	--	--	*F*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*CR 49A & Gunnison Rd*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/25/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *CR 49A* | North/South Street: *Gunnison Rd/Belleayre Lower*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*3*	*1050*	*2*	*2*	*213*	*7*
Peak-Hour Factor, PHF	*0.77*	*0.77*	*0.77*	*0.66*	*0.66*	*0.66*
Hourly Flow Rate, HFR (veh/h)	*3*	*1363*	*2*	*3*	*322*	*10*
Percent Heavy Vehicles	*2*	--	--	*8*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*13*	*0*	*139*	*5*	*0*	*2*
Peak-Hour Factor, PHF	*0.60*	*0.60*	*0.60*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*21*	*0*	*231*	*20*	*0*	*8*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*3*	*3*		*252*			*28*	
C (m) (veh/h)	*1227*	*484*		*161*			*0*	
v/c	*0.00*	*0.01*		*1.57*				
95% queue length	*0.01*	*0.02*		*16.95*				
Control Delay (s/veh)	*7.9*	*12.5*		*333.2*				
LOS	*A*	*B*		*F*			*F*	
Approach Delay (s/veh)	--	--	*333.2*					
Approach LOS	--	--	*F*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JMK*	Intersection	*CR 49A & Discovery Lodge*
Agency/Co.	*CHA*	Jurisdiction	*Highmount, NY*
Date Performed	*10/29/2012*	Analysis Year	*2015 Combined Build*
Analysis Time Period	*Saturday Peak*		

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *CR 49A* | North/South Street: *Discovery Lodge*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*899*	*24*	*2*	*193*	
Peak-Hour Factor, PHF	*0.77*	*0.81*	*0.81*	*0.74*	*0.74*	*0.66*
Hourly Flow Rate, HFR (veh/h)	*0*	*1109*	*29*	*2*	*260*	*0*
Percent Heavy Vehicles	*2*	--	--	*7*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*21*		*118*			
Peak-Hour Factor, PHF	*0.74*	*0.60*	*0.74*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*28*	*0*	*159*	*0*	*0*	*0*
Percent Heavy Vehicles	*9*	*0*	*9*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*2*		*187*				
C (m) (veh/h)		*596*		*222*				
v/c		*0.00*		*0.84*				
95% queue length		*0.01*		*6.47*				
Control Delay (s/veh)		*11.1*		*71.8*				
LOS		*B*		*F*				
Approach Delay (s/veh)	--	--	*71.8*					
Approach LOS	--	--	*F*					

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*JMK*
Agency/Co.	*CHA*
Date Performed	*10/29/2012*
Analysis Time Period	*Saturday Peak*

Site Information

Intersection	*CR 49A & Upper Discovery Park*
Jurisdiction	*Highmount, NY*
Analysis Year	*2015 Combined Build*

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *CR 49A* | North/South Street: *Upper Discovery Parking*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*701*	*2*	*41*	*173*	
Peak-Hour Factor, PHF	*0.77*	*0.77*	*0.77*	*0.66*	*0.66*	*0.66*
Hourly Flow Rate, HFR (veh/h)	*0*	*910*	*2*	*62*	*262*	*0*
Percent Heavy Vehicles	*2*	--	--	*3*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*12*		*222*			
Peak-Hour Factor, PHF	*0.65*	*0.60*	*0.65*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*18*	*0*	*341*	*0*	*0*	*0*
Percent Heavy Vehicles	*5*	*0*	*5*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*62*		*359*				
C (m) (veh/h)		*743*		*312*				
v/c		*0.08*		*1.15*				
95% queue length		*0.27*		*14.91*				
Control Delay (s/veh)		*10.3*		*134.8*				
LOS		*B*		*F*				
Approach Delay (s/veh)	--	--	*134.8*					
Approach LOS	--	--	*F*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JMK	Intersection	CR 49A & Upper Driveway
Agency/Co.	CHA	Jurisdiction	Highmount, NY
Date Performed	10/25/2012	Analysis Year	2015 Combined Build
Analysis Time Period	Saturday Peak		

Project Description 18882 - Belleayre Mtn Ski Center

East/West Street: CR 49A | North/South Street: Upper Driveway

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	1	36	8	123	64	31
Peak-Hour Factor, PHF	0.43	0.43	0.43	0.71	0.71	0.71
Hourly Flow Rate, HFR (veh/h)	2	83	18	173	90	43
Percent Heavy Vehicles	2	--	--	4	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	1	1	0
Configuration	L		TR	L		TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	34	5	678	27	1	1
Peak-Hour Factor, PHF	0.79	0.79	0.79	0.80	0.80	0.80
Hourly Flow Rate, HFR (veh/h)	43	6	858	33	1	1
Percent Heavy Vehicles	1	0	1	2	0	3
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	2	173		907			35	
C (m) (veh/h)	1452	1479		899			24	
v/c	0.00	0.12		1.01			1.46	
95% queue length	0.00	0.40		18.95			4.38	
Control Delay (s/veh)	7.5	7.8		53.7			588.4	
LOS	A	A		F			F	
Approach Delay (s/veh)	--	--	53.7			588.4		
Approach LOS	--	--	F			F		

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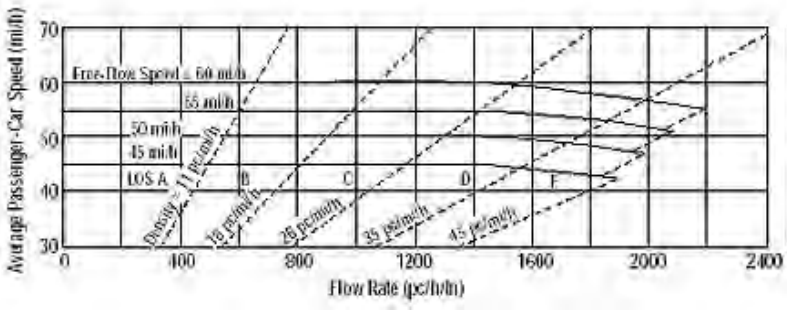
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	JMK
Agency or Company	CHA
Date Performed	10/29/2012
Analysis Time Period	SATURDAY PEAK

Site Information

Highway/Direction to Travel	Rte 28
From/To	Rte 209 / Rte 375
Jurisdiction	
Analysis Year	2015 Combined Build

Project Description Belleayre Ski resort expansion

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1353	Peak-Hour Factor, PHF	0.91
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Rolling
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	2.0
E_T	2.5	f_{HV}	0.971

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	1.6
FFS (mi/h)	58.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	765
Speed, S (mi/h)	58.4
D (pc/mi/ln)	13.1
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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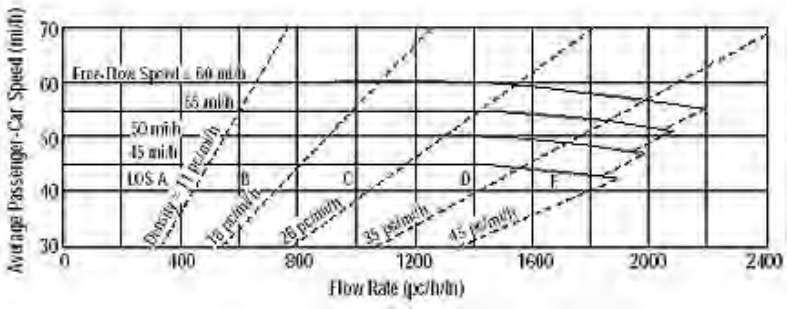
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	JMK
Agency or Company	CHA
Date Performed	10/29/2012
Analysis Time Period	SATURDAY PEAK

Site Information

Highway/Direction to Travel	Rte 28
From/To	Rte 209 / Rte 375
Jurisdiction	
Analysis Year	2015 Combined Build

Project Description Belleayre Ski resort expansion

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1419	Peak-Hour Factor, PHF	0.93
AADT(veh/h)		%Trucks and Buses, P_T	2
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Rolling
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	2.0
E_T	2.5	f_{HV}	0.971

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Undivided
FFS (measured)	
Base Free-Flow Speed, BFFS	60.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	1.6
FFS (mi/h)	58.4

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	785
Speed, S (mi/h)	58.4
D (pc/mi/ln)	13.4
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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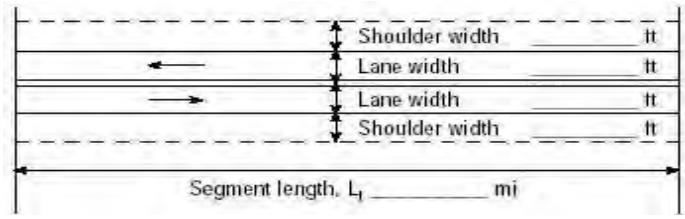
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*JMK*	Highway	*Rte 28*
Agency or Company	*CHA*	From/To	*Rte 375 / Rte 212*
Date Performed	*10/29/2012*	Jurisdiction	
Analysis Time Period	*SATURDAY PEAK*	Analysis Year	*2015 Combined BUILD*

Project Description: *Belleayre Ski resort expansion*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*2012* veh/h
Directional split	*52 / 48*
Peak-hour factor, PHF	*0.87*
No-passing zone	*56*
% Trucks and Buses , P_T	*2 %*
% Recreational vehicles, P_R	*0%*
Access points/ *mi*	*3*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.99*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.990*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*2359*
v_p * highest directional split proportion[2] (pc/h)	*1227*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*60.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.0 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.8 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*59.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*0.8*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*40.2*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*1.000*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*2313*
v_p * highest directional split proportion[2] (pc/h)	*1203*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*86.9*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*2.7*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*89.6*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*E*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.74*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*7400*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*25754*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*184.2*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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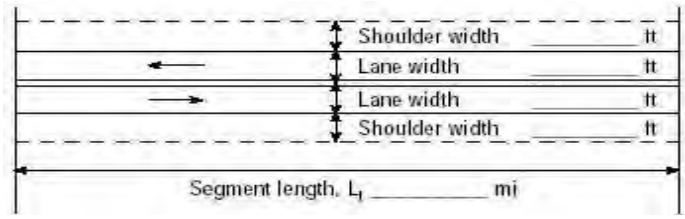
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*JMK*	Highway	*Rte 28*
Agency or Company	*CHA*	From/To	*Rte 212 / Rte 214*
Date Performed	*10/29/2012*	Jurisdiction	
Analysis Time Period	*SATURDAY PEAK*	Analysis Year	*2015 Combined BUILD*

Project Description: *Belleayre Ski resort expansion*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*1324* veh/h
Directional split	*65 / 35*
Peak-hour factor, PHF	*0.87*
No-passing zone	*56*
% Trucks and Buses , P_T	*2 %*
% Recreational vehicles, P_R	*0%*
Access points/ *mi*	*3*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.99*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.990*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1553*
v_p * highest directional split proportion[2] (pc/h)	*1009*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*60.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.0 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.8 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*59.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*1.1*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*46.1*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*1.000*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1522*
v_p * highest directional split proportion[2] (pc/h)	*989*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*73.8*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*6.2*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*80.0*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.49*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*1484*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*5164*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*32.2*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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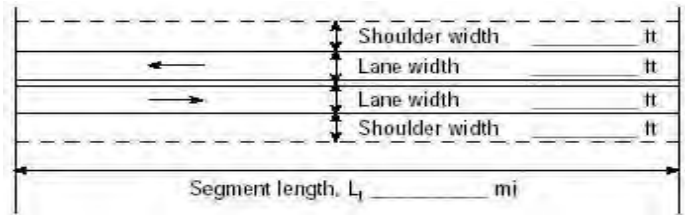
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*JMK*	Highway	*Rte 28*
Agency or Company	*CHA*	From/To	*CR 38 / Rte 30*
Date Performed	*10/29/2012*	Jurisdiction	
Analysis Time Period	*SATURDAY PEAK*	Analysis Year	*2015 Combined Build*

Project Description: *Belleayre Ski resort expansion*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*580* veh/h
Directional split	*52 / 48*
Peak-hour factor, PHF	*0.81*
No-passing zone	*45*
% Trucks and Buses , P_T	*2 %*
% Recreational vehicles, P_R	*0%*
Access points/ *mi*	*3*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.93*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.982*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*784*
v_p * highest directional split proportion[2] (pc/h)	*408*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*60.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.0 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.8 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*59.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*2.1*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*51.1*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.94*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.990*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*769*
v_p * highest directional split proportion[2] (pc/h)	*400*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*49.1*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*13.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*62.2*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.25*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*251*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*812*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*4.9*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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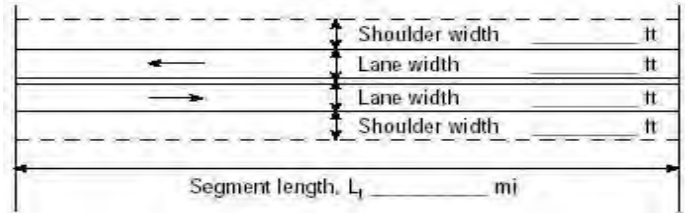
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*JMK*	Highway	*Rte 28*
Agency or Company	*CHA*	From/To	*CR 49A S. of Ski Center*
Date Performed	*10/29/2012*	Jurisdiction	
Analysis Time Period	*SATURDAY PEAK*	Analysis Year	*2015 Combined Build*

Project Description: *Belleayre Ski resort expansion*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☐ Level ☑ Rolling

Two-way hourly volume	*497* veh/h
Directional split	*75 / 25*
Peak-hour factor, PHF	*0.89*
No-passing zone	*100*
% Trucks and Buses , P_T	*2 %*
% Recreational vehicles, P_R	*0%*
Access points/ *mi*	*3*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*0.93*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.1*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*611*
v_p * highest directional split proportion[2] (pc/h)	*458*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*3.7 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.8 mi/h*
		Free-flow speed, FFS ($FSS=BFFS-f_{LS}-f_A$)	*40.5 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*3.9*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*32.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*0.94*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.990*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*600*
v_p * highest directional split proportion[2] (pc/h)	*450*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*41.0*
Adj. for directional distribution and no-passing zone, $f_{d/np}$(%)(Exh. 20-12)	*22.7*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*63.7*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.19*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t$(V/PHF)	*195*

Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*696*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*6.1*
Notes	
1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F. 2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.	

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*CLD*
Agency/Co.	*CHA*
Date Performed	*10/29/12*
Analysis Time Period	*Saturday Peak*

Site Information

Intersection	*Rte 28 & Rte 214*
Jurisdiction	*Highmount, NY*
Analysis Year	*2015 Combine Build Mitigation*

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* | North/South Street: *Rte 214*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*143*	*1036*	*1*	*0*	*356*	*26*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.82*	*0.82*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*155*	*1126*	*1*	*0*	*434*	*31*
Percent Heavy Vehicles	*2*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration	*LTR*			*LT*		*R*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*1*	*0*	*1*	*47*	*0*	*87*
Peak-Hour Factor, PHF	*0.50*	*0.50*	*0.50*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*2*	*0*	*2*	*51*	*0*	*95*
Percent Heavy Vehicles	*0*	*0*	*0*	*3*	*3*	*3*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LT*		*LTR*		*LT*		*R*
v (veh/h)	*155*	*0*		*4*		*51*		*95*
C (m) (veh/h)	*1096*	*624*		*50*		*37*		*618*
v/c	*0.14*	*0.00*		*0.08*		*1.38*		*0.15*
95% queue length	*0.49*	*0.00*		*0.25*		*5.33*		*0.54*
Control Delay (s/veh)	*8.8*	*10.8*		*83.2*		*447.4*		*11.9*
LOS	*A*	*B*		*F*		*F*		*B*
Approach Delay (s/veh)	--	--	*83.2*			*164.0*		
Approach LOS	--	--	*F*			*F*		

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SHORT REPORT

General Information		Site Information	
Analyst	CLD	Intersection	RTE 28 & CR 49A
Agency or Co.	CHA	Area Type	All other areas
Date Performed	10/29/2012	Jurisdiction	HIGHMOUNT, NY
Time Period	SATURDAY PEAK	Analysis Year	2015 COMBINED BUILD MITIGATION

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	0	1	1	1	1	0	0	1	1	0	1	0
Lane Group		LT	R	L	TR			LT	R		LTR	
Volume (vph)	0	106	57	195	141	3	314	13	1200	1	0	1
% Heavy Vehicles	4	4	4	1	1	1	1	1	1	0	0	0
PHF	0.82	0.82	0.82	0.76	0.76	0.76	0.86	0.86	0.86	0.25	0.25	0.25
Pretimed/Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time		2.0	2.0	2.0	2.0			2.0	2.0		2.0	
Extension of Effective Green		2.0	2.0	2.0	2.0			2.0	2.0		2.0	
Arrival Type		3	3	3	3			3	3		3	
Unit Extension		3.0	3.0	3.0	3.0			3.0	3.0		3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0	12.0	12.0			12.0	12.0		12.0	
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/Hour												
Bus Stops/Hour		0	0	0	0			0	0		0	
Minimum Pedestrian Time		3.2			3.2			3.2			3.2	

Phasing	WB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 30.0	G = 10.0	G = 0.0	G = 0.0	G = 40.0	G = 0.0	G = 0.0	G =
	Y = 5	Y = 5	Y = 0	Y = 0	Y = 5	Y = 0	Y = 0	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 95.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		129	70	257	190			380	1395		8	
Lane Group Capacity		192	163	677	888			577	1262		673	
v/c Ratio		0.67	0.43	0.38	0.21			0.66	1.11		0.01	
Green Ratio		0.11	0.11	0.47	0.47			0.42	0.79		0.42	
Uniform Delay d_1		40.9	39.8	15.7	14.6			22.0	10.0		16.0	
Delay Factor k		0.24	0.11	0.11	0.11			0.23	0.50		0.11	
Incremental Delay d_2		8.8	1.8	0.4	0.1			2.8	59.4		0.0	
PF Factor		1.000	1.000	1.000	1.000			1.000	1.000		1.000	
Control Delay		49.8	41.6	16.0	14.8			24.8	69.4		16.0	
Lane Group LOS		D	D	B	B			C	E		B	
Approach Delay	46.9			15.5			59.8			16.0		
Approach LOS	D			B			E			B		
Intersection Delay	50.5			Intersection LOS						D		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*CLD*
Agency/Co.	*CHA*
Date Performed	*10/30/12*
Analysis Time Period	*Saturday Peak*

Site Information

Intersection	*Rte 28 & Rte 214*
Jurisdiction	*Highmount, NY*
Analysis Year	*2015 Comb Build - 6078 attend*

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* | North/South Street: *Rte 214*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*120*	*729*	*1*	*0*	*302*	*26*
Peak-Hour Factor, PHF	*0.92*	*0.92*	*0.92*	*0.82*	*0.82*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*130*	*792*	*1*	*0*	*368*	*31*
Percent Heavy Vehicles	*2*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration	*LTR*			*LT*		*R*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*1*	*0*	*1*	*47*	*0*	*82*
Peak-Hour Factor, PHF	*0.50*	*0.50*	*0.50*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*2*	*0*	*2*	*51*	*0*	*90*
Percent Heavy Vehicles	*0*	*0*	*0*	*3*	*3*	*3*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LT*		*LTR*			*LTR*	
v (veh/h)	*130*	*0*		*4*			*141*	
C (m) (veh/h)	*1160*	*832*		*126*			*208*	
v/c	*0.11*	*0.00*		*0.03*			*0.68*	
95% queue length	*0.38*	*0.00*		*0.10*			*4.20*	
Control Delay (s/veh)	*8.5*	*9.3*		*34.5*			*52.5*	
LOS	*A*	*A*		*D*			*F*	
Approach Delay (s/veh)	--	--	*34.5*			*52.5*		
Approach LOS	--	--	*D*			*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*CLD*
Agency/Co.	*CHA*
Date Performed	*10/30/12*
Analysis Time Period	*Saturday Peak*

Site Information

Intersection	*Rte 28 & CR 49A*
Jurisdiction	*Highmount, NY*
Analysis Year	*2015 Comb Build - 6078 attend*

Project Description *18882 - Belleayre Mtn Ski Center*

East/West Street: *Rte 28* North/South Street: *CR 49A*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*0*	*106*	*44*	*128*	*141*	*3*
Peak-Hour Factor, PHF	*0.82*	*0.82*	*0.82*	*0.76*	*0.76*	*0.76*
Hourly Flow Rate, HFR (veh/h)	*0*	*129*	*53*	*168*	*185*	*3*
Percent Heavy Vehicles	*4*	--	--	*1*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration	*LT*		*R*	*L*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*244*	*13*	*822*	*1*	*0*	*1*
Peak-Hour Factor, PHF	*0.86*	*0.86*	*0.86*	*0.25*	*0.25*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*283*	*15*	*955*	*4*	*0*	*4*
Percent Heavy Vehicles	*1*	*1*	*1*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*		*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*0*	*168*	*298*		*955*		*8*	
C (m) (veh/h)	*1374*	*1399*	*345*		*924*		*0*	
v/c	*0.00*	*0.12*	*0.86*		*1.03*			
95% queue length	*0.00*	*0.41*	*8.03*		*20.96*			
Control Delay (s/veh)	*7.6*	*7.9*	*55.5*		*59.7*			
LOS	*A*	*A*	*F*		*F*		*F*	
Approach Delay (s/veh)	--	--	*58.7*					
Approach LOS	--	--	*F*					

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SHORT REPORT

General Information		Site Information	
Analyst	CLD	Intersection	RTE 28 & CR 49A
Agency or Co.	CHA	Area Type	All other areas
Date Performed	10/29/2012	Jurisdiction	HIGHMOUNT, NY
Time Period	SATURDAY PEAK	Analysis Year	2015 COMB BUILD MIT reduced

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	0	1	1	1	1	0	0	1	1	0	1	0
Lane Group		LT	R	L	TR			LT	R		LTR	
Volume (vph)	0	106	44	128	141	3	244	13	822	1	0	1
% Heavy Vehicles	4	4	4	1	1	1	1	1	1	0	0	0
PHF	0.82	0.82	0.82	0.76	0.76	0.76	0.86	0.86	0.86	0.25	0.25	0.25
Pretimed/Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time		2.0	2.0	2.0	2.0			2.0	2.0		2.0	
Extension of Effective Green		2.0	2.0	2.0	2.0			2.0	2.0		2.0	
Arrival Type		3	3	3	3			3	3		3	
Unit Extension		3.0	3.0	3.0	3.0			3.0	3.0		3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0	12.0	12.0			12.0	12.0		12.0	
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/Hour												
Bus Stops/Hour		0	0	0	0			0	0		0	
Minimum Pedestrian Time		3.2			3.2			3.2			3.2	

Phasing	WB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 20.0	G = 15.0	G = 0.0	G = 0.0	G = 30.0	G = 0.0	G = 0.0	G =
	Y = 5	Y = 5	Y = 0	Y = 0	Y = 5	Y = 0	Y = 0	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 80.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		129	54	168	190			299	956		8	
Lane Group Capacity		343	291	685	938			516	1099		602	
v/c Ratio		0.38	0.19	0.25	0.20			0.58	0.87		0.01	
Green Ratio		0.19	0.19	0.50	0.50			0.38	0.69		0.38	
Uniform Delay d_1		28.4	27.4	11.2	11.1			20.0	9.7		15.7	
Delay Factor k		0.11	0.11	0.11	0.11			0.17	0.40		0.11	
Incremental Delay d_2		0.7	0.3	0.2	0.1			1.6	7.7		0.0	
PF Factor		1.000	1.000	1.000	1.000			1.000	1.000		1.000	
Control Delay		29.1	27.7	11.4	11.2			21.6	17.4		15.7	
Lane Group LOS		C	C	B	B			C	B		B	
Approach Delay	28.7			11.3			18.4			15.7		
Approach LOS	C			B			B			B		
Intersection Delay	18.0			Intersection LOS						B		

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