VHB PIONEER
Environmental | Transportation | Land Development Services

October 15, 2008

Ref: 57017

Mr. Padraic Monks
Section Chief - Stormwater Section
Vermont Department of Environmental Conservation
Water Quality Division
103 South Main Street, Building 10 North
Waterbury, VT 05671-0408

Re: Summit Ventures NE, LLC./Sugarbush Resort
Warren, Vermont
Water Quality Remediation Plan for Clay Brook and Rice Brook

Dear Padraic:

In accordance with the criteria of the 2006 EPA listing guidance, VHB Pioneer has prepared the enclosed Water Quality Remediation Plan (WQRP) for Sugarbush Resort to address known impairments and for water quality remediation of Rice Brook and Clay Brook. As you know, much work has already been completed by Sugarbush Resort to enable improvements in water quality in these watersheds. The enclosed WQRP documents these prior actions and resulting water quality results. The analysis provides necessary technical information for a Vermont Department of Environmental Conservation (DEC) determination that attainment of Vermont Water Quality Standards will occur within a reasonable timeframe, as well as a monitoring component and commitment to revise the Plan if needed in the future.

We look forward to the Department's review of the Plan, and determination that it satisfies the applicable criteria to designate Clay Brook and Rice Brook as "Category 4b" waters.

Please contact me with any questions or comments.

Very truly yours,
VANASSE HANGEN BRUSTLIN, INC.

Jeffrey A. Nelson
Director, Environmental Services

JAN/pwe
Enclosure

cc: Win Smith
Jason Lisai

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SUMMIT VENTURES NE, LLC
SUGARBUSH RESORT
Warren, Vermont

WATER QUALITY REMEDIATION PLAN
CLAY BROOK AND RICE BROOK WATERSHEDS

October 15, 2008

VHB PIONEER

SUMMIT VENTURES NE, LLC
SUGARBUSH RESORT
WATER QUALITY REMEDIATION PLAN
CLAY BROOK AND RICE BROOK WATERSHEDS

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October 15, 2008

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SUMMIT VENTURES NE, LLC
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WATER QUALITY REMEDIATION PLAN
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October 2008

EXECUTIVE SUMMARY

To address existing water quality impairments, VHB Pioneer (VHBP) has prepared a Water Quality Remediation Plan (WQRP) for the Clay Brook and Rice Brook watersheds in Warren, Vermont. Both of these streams are listed by Vermont Department of Environmental Conservation (VT DEC) on the 2006 Section 303(d) as not meeting Vermont Water Quality Standards (VWQS) due to aquatic life support, which has been documented through macroinvertebrate surveys in the subject streams conducted over many years. The designated cause of the impairment is principally stormwater runoff. This WQRP is structured to meet the required elements for Category 4(b) waters, as presented in the 2006 U.S. Environmental Protection Agency (EPA) integrated listing guidance.

The specific elements of this WQRP are:

1. Quantification of historic stormwater pollutant impacts to Clay Brook and Rice Brook
2. Identification and quantification of water quality improvements resulting from the measures implemented since 2003 pursuant to existing permits and authorizations
3. Determination of additional measures that may be warranted now and in the future, to assure attainment of VWQS in these watersheds.

The analyses presented herein are based on sediment washoff loading, and utilize the concept of an attainment watershed as the basis for the determination that standards will be achieved. The loading analyses have demonstrated that <u>overall</u> watershed

sediment washoff loads have been reduced by four (4) percent in the Clay Brook watershed and 45 percent in the Rice Brook watershed, due to previously completed improvements, with as much as an 80 percent reduction on the subwatershed scale. Substantial reductions in both sediment washoff and peak runoff rates from existing developed areas on parcels owned by Sugarbush have been achieved.

Beginning in 2003, Sugarbush Resort and its partners, including the Town of Warren and the Mad River Valley Planning District (MRVPD), have implemented a series of water quality improvement measures within these watersheds. These have included small and large scale efforts to improve stormwater treatment practices, better management of nonpoint source runoff, control peak runoff rates, restore steam channels and riparian zones, and prevent and/or treat iron seeps.

Since the initiation of implementation measures, considerable improvement in aquatic biota composition has occurred in both streams. Significant improvements have been seen at several biomonitoring sites in Rice Brook, since 2004, following the initial implementation of water quality restoration measures. At this time, Rice Brook, in particular, has displayed a steady trend of improvement such that the most recent monitoring results from 2007 indicate that much of the stream is no longer impaired for Aquatic Life Support (ALS), which has been the basis for the 303(d) listing.

SUMMIT VENTURES NE, LLC
SUGARBUSH RESORT
WATER QUALITY REMEDIATION PLAN
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October 2008

1.0 INTRODUCTION

1.1 Background

Clay Brook and Rice Brook are listed on the 2006 State of Vermont list of impaired waters pursuant to Section 303(d) of the Clean Water Act as not meeting standards for Class B Vermont waters. Monitoring of aquatic biota indicates that Aquatic Life Support (ALS), a designated use pursuant to Section 3-04(A) of the Vermont Water Quality Standards (VWQS), has historically not been attained in these waters. The impairment has generally been attributed to stormwater runoff from earlier land development at Sugarbush, in Clay Brook and Rice Brook watersheds as well as the disturbance of iron-rich soils within Clay Brook watershed.

The Water Quality Remediation Plan (WQRP) for the Clay Brook and Rice Brook watersheds at Sugarbush Resort in the Town of Warren, Vermont has been prepared based on consideration of these waters as "Category 4(b) waters"

pursuant to the 2006 U.S. Environmental Protection Agency (EPA) integrated listing guidance. The Vermont Department of Environmental Conservation (DEC) and VHB Pioneer (VHBP) have determined that this WQRP is an appropriate planning tool for design of water quality improvement measures for these waters, given that "available data and/or information indicate[s] that at least one designated use is not being supported or is threatened, but a [Total Maximum Daily Load] TMDL is not needed" (EPA 2006). A WQRP is appropriate for Clay Brook and Rice Brook, as category 4(b) waters because "…other pollution control requirements (e.g., best management practices) required by local, State or Federal authority are stringent enough to implement applicable water quality standards within a reasonable period of time" (ibid., p. 54). Specifically for these watersheds, operational phase stormwater management controls implemented pursuant to 10 V.S.A. Section 1264, including pollutant offsets, as well as non-point source control measures implemented within the Rice Brook watershed, pursuant to a 319 Grant.

1.2 Water Quality Remediation Plan Overview

The WQRP updates and expands on information that had previously been collected and presented with respect to hydrologic, pollutant loading, and biomonitoring assessments that have been ongoing at Sugarbush Resort over the years. Past observations have indicated that water quality impacts within Clay Brook and Rice Brook watersheds resulted from historic practices associated with land conversion and development. These historic activities resulted in increased sediment loading to the mainstems and their tributaries, and modified hydrology within the contributing drainage areas. Subsequent recent improvements have

resulted in reductions in these historic impacts. Therefore, specific elements of WQRP preparation have involved:

- Assessing modifications that have occurred to watershed hydrology over time, including an assessment of prior and existing development, and associated stormwater management systems
- Determining a sediment load target
- Identifying and ranking potential ongoing sources of sediment loading to the streams
- Re-assessing the strategy to reduce calculated present and future sediment loads
- Continuing to implement the biomonitoring plan to evaluate further progress towards achieving sediment load targets
- Re-assessing and revising the action plan and corresponding schedule for implementation of necessary Best Management Practices (BMPs) and other remediation measures

To address these aforementioned elements, the main objectives of the WQRP have included the following specific tasks:

- Delineate watersheds and subwatersheds for Clay Brook, Rice Brook, and the attainment watershed (Chase Brook)
- Revise previously prepared land cover and land use maps with existing areas of development, including recently constructed stormwater management systems
- Conduct a washoff sediment load analysis for updated impervious surfaces within each watershed

- Revise watershed hydrologic models for both streams, including pre-development, existing, and future land-use conditions
- Assimilate existing Phase 2 Stream Geomorphic Assessment (SGA) data for Clay Brook and Rice Brook
- Analyze the current geomorphic stream stability and identify areas of geomorphic instability
- Complete updated hydrologic analyses

1.2.1 Watershed Delineation

Field mapping has been conducted within Clay Brook, Rice Brook, and Chase Brook watersheds to further verify watershed and subwatershed boundaries, incorporating natural divides and constructed drainage features, such as culverts, swales, and outfalls of stormwater management systems. This information has been used to update a previously prepared comprehensive watershed geographic information system (GIS) data layer. All data have been incorporated into an ARC/INFO® format to enhance the utility of the information and allow for additional data layers to continue to be incorporated into GIS for further analysis.

Stormwater management systems and locations of stormwater discharge points to receiving waters – both in pre-interim and interim (existing) conditions – have been determined based on a review of existing stormwater discharge permits (see Section 2.3) and field inspections to confirm stormwater facility as-built information.

1.2.2 Wash-off Sediment Load Analysis

Sediment washoff loads from impervious areas within the Clay Brook, Rice Brook, and Chase Brook watersheds were calculated utilizing the Simple Method to assess specific areas that may have been (or may be) contributing to surface water impairment (see Section 4.2). Sediment loads have been determined for three scenarios, reflecting pre-interim (i.e., 2003), interim (existing), and post-interim (future Lincoln Peak Phase I Development) conditions. Results from these analyses have been used to determine feasible locations within each watershed where a further reduction in sediment loading may be achieved, if necessary.

1.2.3 Hydrologic Modeling

Watershed-wide hydrologic models for Clay Brook, Rice Brook, and Chase Brook have been developed using HydroCAD®, which implements the Natural Resources Conservation Service (NRCS) unit hydrograph method, to evaluate existing hydrologic conditions in the watershed, and to assess impacts to watershed hydrology resulting from changes in land use and land cover. Surface areas for all land use types have been determined from GIS software to accurately represent land use conditions in the hydrologic model. The model includes subwatersheds that have been designated within the three watersheds based on existing land use, drainage, slope, soil type, and other factors, which enable computation of composite runoff hydrographs for select design storms in select locations. The overall hydrologic productivity of the watershed, as well as impacts of proposed changes to land cover and drainage, has been evaluated.

Clay Brook, Rice Brook, and Chase Brook watersheds have been modeled for interim (existing) conditions and for Clay Brook and Rice Brook for known post-interim (future) conditions. This approach has allowed for a comprehensive evaluation of in-stream hydrologic changes associated with specific actions, including proposed new development and potential supplemental remediation measures. The modeling work has provided the basis for a Channel Protection volume (CPv) assessment of the percentage of impervious area with stormwater runoff that is sufficiently detained to meet the CPv standard of the Vermont Stormwater Management Manual (VSMM, 2002) within Clay Brook and Rice Brook watersheds, as compared to the amount of detention that is provided in the attainment watershed, Chase Brook. These analyses have been conducted for existing (interim) and post-interim conditions, as discussed in more detail in Section 5.2.

1.2.4 Instream Survey and Reconnaissance

In 2006, the Friends of Mad River conducted a Phase 2 Stream Geomorphic Assessment (SGA) of Clay Brook and Rice Brook. The purpose of this assessment was to evaluate stream characteristics, including geomorphic processes and sensitivity, bank stability, habitat conditions, stream evolution stages, and the impacts of culvert and bridges. In 2008, VHBP assessed Clay Brook and Rice Brook (and their tributaries) for in-stream channel processes, geomorphic stability and water quality concerns (erosion, sediment deposition and iron seeps). The results of these efforts have been incorporated into future remediation efforts and are presented herein.

1.3 Water Quality Remediation Plan Components

Beginning in 2003, Sugarbush Resort and its partners have implemented and will continue to maintain Best Management Practices (BMPs) in a manner that have resulted in positive responses with respect to aquatic biota, and which are expected to bring Clay Brook and Rice Brook into attainment of the VWQS. This WQRP details existing conditions, recent remediation measures, monitoring plans and results, and future actions that are expected to lead to attainment of the VWQS within a reasonable period of time. This WQRP provides scientific data and discusses how it will meet the standards for use, as part of the 4(b) "off-ramping" process under the Clean Water Act, which includes the following requirements:

1. Statement of the problem causing the impairment (Section 6.0)
2. Description of the proposed implementation strategy and supporting pollution controls (Section 7.0)
3. Estimate or projection of the time when water quality standards will be met (Section 8.0)
4. Reasonable schedule for implementing the necessary pollution controls (Section 8.0)
5. Description of, and schedule for, monitoring milestones for tracking and reporting progress to EPA on the implementation of the pollution controls (Sections 8.0)

6. Commitment to revise as necessary the implementation strategy and corresponding pollution controls if progress towards meeting water quality standards is not being shown (Section 8.0)

2.0 CLAY BROOK AND RICE BROOK WATERSHEDS

2.1 Regional Setting

The watersheds of Clay Brook and Rice Brook are located on the east-facing slopes of the Green Mountains in the Town of Warren, Washington County, Vermont. Clay Brook and Rice Brook converge south of the rear property boundary of The Bridges Resort on the Sugarbush Access Road. From the confluence point, Clay Brook merges with several other tributaries before it flows under VT Route 100 and enters the northward flowing Mad River. The entire Clay Brook watershed, including subwatersheds (e.g., Rice Brook and "Hotel Brook"), from headwaters to confluence with the Mad River, is located within the Town of Warren. Land ownership within the Clay, Rice, and Chase Brook watershed consists of both private (Sugarbush Resort) and public (United States Forest Service/Green Mountain National Forest).

2.2 Land Use / Land Cover

The watersheds of Clay Brook and Rice Brook are mountainside and principally forested watersheds. While the upper reaches of each watershed are largely forested, interspersed with alpine ski trails, maintenance roads and structures, and ski lifts, the lower portion of each watershed flows through the ski area's base facilities and related residential developments, including a golf course and

substantial areas of parking lots and roadways. As Clay Brook and Rice Brook flow downhill towards their confluence, each crosses through several subwatershed areas that contain a high percentage of impervious and developed surface areas, where both the channels and floodplains have been modified substantially over time. The entire area of the parking lots for the base area, along with extensive developed facilities such as the base facilities, wastewater treatment plant, Sugarbush Village, and other commercial uses, are concentrated within the Clay Brook and Rice Brook subwatersheds. A permitted water withdrawal facility is located on Clay Brook for public water supply purposes.

Within Clay Brook watershed, the upper subwatersheds (totaling approximately 1,000 acres) extend from elevation 1,600 feet to nearly 4,000 feet (see Clay and Rice Brook watersheds map in the map pocket). Below these subwatersheds, several smaller subwatersheds drain areas with a mix of development that was largely constructed prior to current stormwater treatment practices and regulatory framework, thereby resulting in a high degree of impact to the stream's geomorphology and water chemistry.

Overall, Clay Brook watershed is primarily composed of forested area (80 percent), with 18 percent of open area and the remaining two (2) percent as gravel/impervious area (see Table 1).

Table 1: Existing Land Cover in Clay Brook Watershed

Land Cover	Total Area (acres)	Total Area (square miles)	Percent of Watershed
Forested	1,119	1.75	80%
Gravel	16	0.03	1.1%
Impervious	14	0.02	1.0%
Open	253	0.40	18%
Total	**1,402**	**2.19**	**100%**

Rice Brook watershed is similar to Clay Brook watershed, with a few higher-elevation subwatersheds featuring a mix of ski trails and structures, residential development and roadways, and small portions of the ski area base facilities at the bottom of each subwatershed. Together these upper subwatersheds total approximately 300 acres, and extend from the Sugarbush Village road at elevation 1,500 feet up to a knob at elevation 3,300 feet (see map pocket). The Rice Brook watershed, by contrast to Clay Brook watershed, includes a greater area of more diffuse land development and disturbance. Rice Brook watershed is primarily comprised of forested area (72 percent), with 21 percent open area and the remaining seven (7) percent as gravel/impervious (see Table 2).

Table 2: Existing Land Cover in Rice Brook Watershed

Land Cover	Total Area (acres)	Total Area (square miles)	Percent of Watershed
Forested	399	0.62	72%
Gravel	15.9	0.02	2.9%
Impervious	23	0.04	4.1%
Open	114	0.18	21%
Total	**554**	**0.86**	**100%**

Stormwater discharges from developed land tend to flow over swales, roads or other features prior to discharging into Rice Brook. However, portions of Rice Brook (e.g., Hotel Brook) were culverted in the early stages of resort development in order to provide for the development of Sugarbush Resort's base area facilities and parking lots.

2.3 Existing Environmental Permits

The lands in the Clay Brook and Rice Brook watershed, and adjoining areas, are subject to a number of Federal, State and local permits relating to water quality. There are three principal sets of permits:

1. The over-arching federal permits to use the U.S. Forest Service (USFS) land to operate a ski area and ancillary facilities
2. A series of stormwater and State of Vermont permits for various developments in and around the base area
3. Permits to operate a public water supply and centralized wastewater treatment system and disposal field.

2.3.1 Umbrella Federal Permits

The principal permit for Sugarbush Resort's use of USFS land is the Special Use Permit [#161], which is valid through September 28, 2041. This was granted in conjunction with the Record of Decision on the 1998 Environmental Impact Statement (DEIS). The DEIS discussed the impact of ski trails on both sedimentation and iron seeps, and the long-term sedimentation impacts from gravel roadways and parking lots in the lower watersheds, which had led to degradation of Clay Brook and Rice Brook. The DEIS noted that measures were being taken with respect to both issues, and that additional measures would be implemented with the Preferred Alternative.

2.3.2 Existing Stormwater and Stream Restoration Activities

Several restoration activities and remediation/ improvement projects have been installed in the past fifteen years pursuant to Vermont stormwater

and other DEC permits. Notably, an in-stream pond on the Golf Course was removed from Clay Brook, and the stream channel and associated floodplain were restored; a segment of the Hotel Brook tributary of Rice Brook was "daylighted" and restored, along with its associated floodplain; and substantial improvements were made to stormwater management in Rice Brook and Clay Brook, including construction of stormwater basins and infiltration areas, in conjunction with construction of Clay Brook building and associated base area improvements. These stormwater measures involved the construction of seven stormwater treatment/control facilities pursuant to DEC operational phase stormwater discharge permit 1-1581; basins 1 and 7 are located in the Clay Brook watershed, and basins 3, 4, 5, 6, and 8 are located in the Rice Brook watershed. The Clay Brook Residences and reconstructed Gate House base lodge represent Phase Ia of an approved Master Plan for the Lincoln Peak base area; subsequent phases will include other surface water remediation measures that are detailed in this report.

2.3.3 Water Supply and Wastewater Disposal System

Sanitary sewage from the Sugarbush Lincoln Peak base area facilities and surrounding developments is conveyed to two wastewater treatment facilities, both of which are indirect discharge (soil-based) wastewater disposal systems. The Mountain Wastewater Treatment (MWT) system is within the Rice Brook watershed, and is permitted to discharge 81,300 gallons per day in winter, 225,400 gallons per day in spring, and does not currently discharge from June to October. The Lincoln Peak wastewater treatment system is within the Clay Brook watershed, and is permitted to discharge 66,600 gallons per day.

The MWT system collects wastewater generated from the condominiums and resort development at the Lincoln Peak area. This wastewater system is permitted by Indirect Discharge Permit (IDP) #9-0013. The wastewater treatment system and leachfields are located at Sports Center Drive at Sugarbush's Lincoln Peak Base Area. The facility consists of super-aerated lagoons, clarification, sand filtration, aerated effluent storage, and dechlorination prior to indirect discharge in subsurface leachfields. The treatment facility produces a tertiary level of treatment. This system has been in operation for decades, and presently averages 60,000 gallons per day on a year-round basis. Groundwater from the leaching field drains south, towards Rice Brook, and provides discharge to the base flow of Rice Brook.

The Lincoln Peak system collects wastewater generated from the new construction at the Lincoln Peak base area. The wastewater treatment system and leachfields are located at the Sugarbush Lincoln Peak Base Area's "22-Acre Site" on a land parcel east of Inferno Road in the Town of Warren. IDP #9-0260 authorizes the indirect discharge of tertiary treated effluent from the 66,600 gallons per day (gpd) wastewater treatment plant serving the Lincoln Peak Base Area. The facility consists of Sequencing Batch Reactors (SBR) with filtration and ultraviolet disinfection. These reactors are designed to achieve nitrification, denitrification, and biological phosphorus removal. Treated effluent is discharged to the dual alternating sets of leachfields. This system was activated in January of 2007, and presently averages 5,700 gpd of wastewater flow on a year-round basis. Peak daily flows have been 21,000 gallons or less. Groundwater from the leaching field drains northeast, towards Clay

Brook, and provides a minor component of discharge to the base flow of Clay Brook.

The Mountain Water Company (MWC) Public Community Water System (PCWS) is permitted as WSID #5281, and serves the Sugarbush resort community. The water system consists of eleven bedrock wells and a surface water intake on Clay Brook upstream from Inferno Road, a total of 238,000 gallons of finished water storage in six tanks, and a distribution system. The water system supplies approximately 650 connections. Based on the most recent meter data, potable water consumption is approximately 54,000 gpd during the off-season (April through November) and 89,000 gpd during ski season (December through March). Peak demand is approximately 164,000 gpd. Currently, the eleven wells produce approximately 27,400 gpd on average, and the balance of the water for the system is produced by Clay Brook. In the future, it is anticipated that use of the Clay Brook intake will decrease, and greater amounts of groundwater would be used.

3.0 ATTAINMENT WATERSHED

3.1 Regional Setting

The Chase Brook watershed is located in the Town of Fayston, Vermont, on the east-facing slope of the Green Mountain central ridge. The watershed encompasses nearly 1,300 acres in an approximate triangle between the peaks of Mount Ellen and Stark Mountain, and the confluence with Slide Brook at the Fayston School on German Flats Road. From this lower point of the triangle,

Slide Brook continues under VT Route 17 and joins Mill Brook before entering the Mad River.

3.2 Land Use / Land Cover

As with Rice Brook and Clay Brook, the Chase Brook watershed is characterized by steep slopes and largely forested cover. While the Mount Ellen portion of Sugarbush Resort is located almost entirely within the Chase Brook watershed, the presence of ski trails and base facility development is limited to the southern half of the watershed. These land uses occupy a significantly smaller proportion of the total Chase Brook area than that of Rice Brook and Clay Brook. From the top of 4,050-foot Mount Ellen to a pond at 1,500 feet, the largest (609 acres) subwatershed of Chase Brook flows through a combination of forest, ski trails, access roads and chairlift facilities. Two other large subwatersheds with a total area of 476 acres occupy the northern sections of the watershed near Stark Mountain, and are almost entirely forested, with only minor land use disturbance associated with ski trails. Two smaller subwatersheds encompass the lower reaches of the watershed, including the Mount Ellen base lodge and parking areas, access roads and minor residential developments. Chase Brook watershed is primarily composed of forested area (87 percent), with 12 percent open area and the remaining one (1) percent as gravel/impervious (see Table 3). Hydrology and drainage patterns in these lower elevation areas have been altered more significantly than those above with a network of swales and stormwater culverts.

Table 3: Existing Land Cover in Chase Brook Watershed			
Land Cover	**Total Area (acres)**	**Total Area (square miles)**	**Percent of Watershed**
Forested	1,130	1.77	87%
Gravel	5.9	0.01	0.5%
Impervious	6.6	0.01	0.5%
Open	153	0.24	12%
Total	**1,296**	**2.03**	**100%**

3.3 Existing Environmental Permits

In addition to the USFS special use permit mentioned above (which applies to portions of the Chase Brook watershed in addition to the Rice and Clay Brook watersheds), Permit No. 1-0226 to discharge stormwater was issued in 1977 for the Fiddlehead Condominium development just north of the Glen Ellen base lodge.

4.0 SEDIMENT LOADING ANALYSIS

4.1 Sediment Loading Analysis Information

The Simple Method Model, of Schueler 1987, was used to estimate washoff-based sediment loading at the subwatershed scale. This method is a widely used and accepted approach for the estimation of pollutant loads within watersheds associated with stormwater runoff, and is comparable to VTANR/EPA benchmarks. The method provides a straightforward approach for the comparison of annual pollutant loads associated with alternative land uses, combined with treatment and management options. This empirical method is

intended to provide reasonable estimates of annual pollutant loads, from which decisions can be made regarding the appropriate nonpoint calculations of pollutant loads in the designated watersheds.

The Simple Method formula is:

$$L = 0.226 \times P \times Pj \times C \times A \times Rv \times T$$

Where:

L = Annual load (lbs/year)

0.226 = Simple Method Coefficient for unit conversion

P = Annual Precipitation (inches)

Pj = Fraction of rainfall events producing runoff

C = Flow weighted mean concentration for pollutant (mg/l)

A = Area of contributing subwatershed (acres)

Rv = 0.05 + 0.009 x (site imperviousness) or accepted value

T = Treatment Removal Rate (1-%Treatment)

For Clay Brook and Rice Brook at Sugarbush, the following values have been assigned for the Simple Method analysis of washoff sediment loading:

P = 51.0 inches (PRISM climatological data, downloaded from VCGI)

Pj = 0.9 (based on assumption that 10 percent of storms do not produce significant runoff)

C = Dependent on land use conditions, see Table 4

Table 4: Sediment Concentration Values

Land Use	TSS (mg/L)	Sources
Commercial	77	NYS DEC Draft Manual (2001)
Commercial Lodging	97	NYS DEC Draft Manual (2001)
Forest	51	NYS DEC Draft Manual (2001)
Meadow/Open	51	NYS DEC Draft Manual (2001)
Residential	70	NYS DEC Draft Manual (2001)
Ski Trail	100	VHBP Judgment (2006)
Transportation Gravel	374	Clinton & Vose - WQ Report (2003)
Transportation Paved	142	NYS SMDM (2001)
Water	0	n/a

Site Imperviousness:

Site imperviousness for the runoff coefficient value (Rv) was calculated with the use of a GIS land cover layer. By overlaying the land use (e.g., commercial, residential, transportation gravel) with the land cover (e.g., building, parking, forest, open) layer, impervious percentages for each type of land could be calculated and were further broken down by subwatershed. The Rv varies between different land-use categories because it is directly related to the impervious cover of the specified area.

Contributing Subwatershed Area:

Subwatershed areas were delineated using a combination of the Vermont Agency of Natural Resources "Impaired Watersheds" layer and routing of stormwater through existing draining systems.

Treatments:

Existing treatment conditions were identified through review of existing stormwater discharge permits issued by Vermont DEC. Credited treatment types in this analysis consisted of dry/wet stormwater retention ponds and swale

designs. Percent removal was estimated based on the STP implemented and the age of the permit.

4.2 Sediment Loading Analysis Results

Sediment loading results for Clay Brook, Rice Brook, and Chase Brook Watersheds for the three site conditions analyzed (pre-interim, interim, post-interim) have been summarized in a table on page 3 of Appendix 1, with individual tables for each scenario provided on pages 4 through 10 of Appendix 1. The unitized sediment loads for Clay Brook and Rice Brook watersheds have been compared using unitized loads from similar/comparable streams: Chase Brook, as described further in Section 3.0, Cold Brook located in Bennington County. The sediment loading results for Chase Brook are described in Section 4.2.3; previously conducted Simple method analyses by VHB Pioneer for Cold Brook determined sediment loading of approximately 100 pounds/acre/year (lbs/ac/yr) for this attainment watershed.

4.2.1 Clay Brook Watershed

The Clay Brook watershed sediment loading results indicate a reduction in annual sediment loading from pre-interim conditions (99,190 lbs/yr) to interim conditions (95,889 lbs/yr). Post-interim conditions reflect an insignificant decrease in sediment loading from interim conditions, as the drainage area to Clay Brook increases by 0.6 acres (95,728 lbs/yr). The unitized loads for the three conditions decrease from pre-interim conditions (71 lbs/ac/yr) to interim (69 lbs/ac/yr), and increase slightly from interim to post-interim conditions (68 lbs/ac/yr). While these unitized sediment loads are greater than Chase Brook (49 lbs/ac/yr) (see

Section 4.2.3), they are less than the unitized load for Cold Brook. Additionally, although the overall watershed decrease in unitized load from pre-interim to interim conditions is relatively small, the reductions for subwatersheds in the Lincoln Peak base area are much greater, and the recent aquatic biota sampling indicate improvements occurring in Clay Brook (see Sections 6.4 and 6.5).

The reduction between pre-interim and interim conditions is largely due to Wet Ponds 1 and 7 providing 80 percent removal treatment to Sugarbush Lincoln Peak parking (Clay Brook subwatershed CB04) and to Sugarbush Lincoln Peak Base Area "22-Acre-Site" (Clay Brook subwatershed CB10_a). The slight change in sediment loads between interim and post-interim conditions is due to more area being drained to wet pond 1, which was once within the Rice Brook watershed (see Appendix 1, pages 4 through 6). Wet Pond 1 has an available storage volume of 50,734 cubic feet (see Appendix 2). Wet pond 7 has an available storage volume of 20,125 cubic feet (Appendix 2).

4.2.2 Rice Brook Watershed

The Rice Brook watershed sediment loading results indicate a reduction in annual sediment loading from pre-interim conditions (92,050 lbs/yr) to interim conditions (50,500 lbs/yr). Post-interim conditions (49,500 lbs/yr) reflect a less significant decrease in sediment loading from interim conditions. The unitized loads for the three conditions decrease from pre-interim conditions (165 lbs/ac/yr) to interim (91 lbs/ac/yr) and post-interim conditions (90 lbs/ac/yr). While these unitized sediment loads are greater than Chase Brook (49 lbs/ac/yr), interim and post-interim conditions have

been reduced to under the unitized load for Cold Brook. Additionally, the annual aquatic life support (ALS) measurements performed in stream indicate improvements occurring in Rice Brook (See Sections 6.4 and 6.5).

The sediment loading reduction between pre-interim and interim conditions is due to 80 percent removal treatment to Upper Sugarbush Village Road (Rice subwatersheds RB08 through RB17), and wet ponds 3,4,5,6, and 8. Wet Pond 3 provides 50,704 cubic feet of available storage volume for Rice Brook subwatershed RB03. Wet Pond 4 provides 40,032 cubic feet of available storage volume for Rice Brook subwatershed RB25. Wet Pond 5 provides 10,019 cubic feet of available storage volume for Rice Brook subwatershed RB07. Wet Pond 6 provides 31,465 cubic feet of available storage volume for Rice Brook subwatershed RB01_a. Wet Pond 8 provides 6,989 cubic feet of available storage volume for Rice Brook subwatershed RB24. These volumes can be found in Appendix 2. The reduction in sediment loads between interim and post-interim conditions is due to changes of drainage areas in Rice Brook subwatersheds RB03 and RB01_a.

4.2.3 Chase Brook Watershed

The Chase Brook watershed sediment loading results indicate a watershed-wide unitized load of 49 lbs/ac/yr. The low unitized load reflects the low percent impervious in the watershed, of approximately one percent. The supplemental attainment watershed, Cold Brook, has a unitized washoff sediment load of approximately 100 lbs/ac/yr. As described above, sediment loading analyses for Clay Brook resulted in unitized values of 74 lbs/ac/yr in pre-interim conditions to 67 lbs/ac/yr in

interim and post-interim conditions, with 123 lbs/ac/yr in pre-interim, 93 lbs/ac/yr in interim, and 91 lbs/ac/yr in post-interim conditions in Rice Brook watershed. Given that the unitized sediment loading is 49 lbs/ac/yr for Chase Brook and 100 lbs/ac/yr for Cold Brook, the range of sediment loading associated with the attainment watersheds has been determined to be between 50 and 100 lbs/ac/yr. These values represent the target that should be met for Clay and Rice Brooks with respect to washoff sediment loads.

5.0 HYDROLOGIC MODELING ANALYSIS

5.1 Hydrologic Modeling Information

Hydrologic modeling simulations were performed for the Clay Brook, Rice Brook, and Chase Brook watersheds for the purpose of assessing impacts associated with changes in land use and land cover. The stormwater runoff model, built using HydroCAD® hydrologic modeling software, is designed to estimate runoff volume and rates based on user inputs for rainfall as well as surface conditions. The model incorporates land cover characteristics, soil hydrologic properties (represented by weighted curve numbers), runoff flow paths (represented as times of concentration) and stormwater management infrastructure to compute peak flow rates and runoff volumes. Specific model input variables include simulated storms, and nodes for subwatersheds, stream reach routing, and infrastructure of stormwater piping networks and detention basins.

The soils comprising each watershed include various hydrologic soil groups (HSGs). HSG labels are assigned to NRCS mapped soil units based on soil infiltration rate and water retention capability. According to the NRCS hydrogroup classification scheme, "A" rated soils – such as sands and gravels – retain water longer and contribute less water volume to runoff than "B" rated soils (silts and loams), with "C" soils (sandy clay loams) then "D" soils (clays) contributing the greater volume to runoff respectively. Soil cover and related HSGs for the project area were obtained from soils layers created by NRCS in 2006 for Washington and Addison Counties. This information, combined with land cover data in a Geographic Information System (GIS), produce modified runoff curve numbers (CNs).

Time of concentration (Tc) was determined for each subwatershed. The Tc HydroCAD® input is defined as the time required for stormwater runoff to travel from the most hydrologically remote point in the subwatershed to the outlet. The time of concentration for each subwatershed was calculated using available site plans, topography, land cover, stream, and subwatershed data. Slopes were calculated by estimating the elevation drop over the distance of travel. Sheet flow lengths of up to 150 feet were used to approximate the initial flow from the hydrologically most remote point in the subwatershed. Undisturbed areas generally were assigned longer sheet flow lengths than disturbed and developed areas. Shallow concentrated flow through forests, ski trails, and ditches was approximated prior to streams. Trapezoidal channel flow was then used to approximate travel time in streams. In developed areas, sheet flows and shallow concentrated flows over gravel or paved surfaces were measured. Ditch and culvert drainage networks, and culverts draining under roadways were considered in the measurements. Reach features that represent the travel of

stormwater through waterways in the form of trapezoidal channels within HydroCAD® were used to approximate the stream channel where field data are unavailable. Trapezoidal channel sizes increase as drainage areas to the channels increase.

5.1.1 Channel Protection Volume (CPv) Standard

Channel Protection volume (CPv) standards implemented through Vermont Stormwater Management Manual (VSMM) are achieved by providing 12 or 24 hours of extended detention (ED) storage for the one-year, 24-hour storm. The 12 hour ED time is applicable to the Clay and Rice Brook stormwater basins because these facilities discharge to cold-water fish habitat. Chase Brook has been identified as the target scenario, although it is difficult to compare Clay Brook and Rice Brook with Chase Brook, because there is no detention time provided for flow off impervious surfaces in the Chase Brook watershed.

5.2 Hydrologic Modeling Results

The CPv standard was determined to be met for 26 percent of Clay Brook and 25 percent of Rice Brook watershed impervious areas, and for 25.7 percent of the combined watershed impervious area, for the interim condition. Detention time was provided through wet ponds 1, 3, 4, 5, 6, 7, and 8, which were designed to meet the CPv standard. Detention time was only provided for stormwater detention systems associated with the Lincoln Peak Base Area Redevelopment, as other treatment systems only provide water quality treatment. Post-Interim conditions results do not change significantly. A HydroCAD® routing diagram for interim conditions is provided on page 1 of Appendix 2. Channel protection

volume analysis summary sheets for Interim and Post-Interim Conditions are provided in Appendix 2 (pages 66 and 67).

6.0 IDENTIFIED IMPACT AREAS

Field reconnaissance of ongoing contributors to water quality impacts within the subject streams has been assessed as part of on-going monitoring of Clay Brook and Rice Brook. Particular attention has been given to on-mountain activities, construction activities, and stormwater management. Assessment of probable impacts that are causing impairment has resulted in the following preliminary conclusions.

6.1 Existing Land Uses and Erosion

As described in Section 2.2, approximately 2.0 percent of the Clay Brook watershed and 7.0 percent of the Rice Brook watershed is composed of developed (impervious) area, including gravel surfaces. To address potential impacts to receiving waters that are associated with these surfaces, Sugarbush Resort has undertaken numerous efforts since 2003 to implement stormwater management systems (e.g., stormwater basins) in accordance with operational phase stormwater discharge permit #1-1581 issued by DEC. Since implementation, there has been a marked improvement in water quality within Clay Brook and Rice Brook, as evident from biomonitoring results of recent years (see Section 6.5). To continue water quality improvements, Sugarbush Resort intends on implementing additional stormwater runoff controls, as described further in the Section 7.0 – Strategies to Remediate.

Included in the ongoing initiatives to minimize the potential for sediment loading to Clay Brook and Rice Brook, significant effort has gone into assessing construction practices and the potential need for improved erosion prevention and sediment control (EPSC). To that end, Sugarbush Resort has recently engaged outside consultants to conduct EPSC training for operations and maintenance staff, as a means of educating individuals responsible for on-mountain activities in the importance of installing measures that will ultimately reduce further impacts to these receiving waters. As with improved operational phase stormwater management, it is anticipated that a more rigorous EPSC measure implementation will result in further improvements in water quality within Clay Brook and Rice Brook.

6.1.1 Clay Brook

As part of the Clay Brook watershed assessment, areas of potential sediment washoff were identified, as reported herein. In particular, it was identified that the vehicle maintenance yard that is located upslope of Super Bravo chair lift (see map pocket) is a potential contributor of sediment laden runoff to Clay Brook. The maintenance yard is generally characterized as an open area with partial stabilization although the majority of the area is open ground (see Photograph 1 on page 1 of Appendix 3). Two occurrences that may be contributing to sediment wash-off involve: (1) run-on of sheetflow from upslope areas that are directed through the maintenance yard, and (2) sheetflow of stormwater runoff from impervious and exposed surfaces within the maintenance yard to adjacent drainage swales and culverts.

Erosion from drainage swales was also observed within the Lincoln Peak lodge area (see Photograph 2 on page 1 of Appendix 3), along Inferno Road (see Photograph 3 on page 2 of Appendix 3) and within adjacent condominium development areas that are not owned/operated by Sugarbush Resort (see Photographs 4 through 7 on pages 2 through 4 of Appendix 3). Although these areas may not have an impact on an individual basis; collectively, they may be considered more significant.

6.1.2 Rice Brook

Potential contribution of sediment washoff to Rice Brook and its tributaries was largely limited to one eroded roadside swale along the driveway to Sugarbush Health and Racket Club (see Photograph 8 on page 4 Appendix 3). Although largely insignificant, this swale conveys unmanaged stormwater runoff from the driveway to Hotel Brook and is therefore considered to be a potential source of sediment.

6.2 Sources of Iron

As evidenced by ongoing monitoring of Clay Brook and Rice Brook, there is significant iron found within the parent material in the watersheds. In particular, it has been observed that areas of disturbance (e.g., Lincoln Peak base area, townhouse developments) result in discharge of iron seeps to drainage swales, roadside swales, and ultimately to the receiving waters. The following sections provide a summary of these observed occurrences.

6.2.1 Clay Brook

As part of watershed monitoring and reconnaissance, iron sources within the Clay Brook watershed were assessed within the reach that extends from monitoring station BIO 2.0 to the Lower Organ Grinder trail crossing (see map pocket). Within this reach of Clay Brook, four iron seeps were observed, as summarized below. Additionally, reconnaissance of the surrounding development areas was conducted, with no observation of iron seeps in these areas. The following is a summary of these observed iron seeps with labels that correspond to the Sugarbush Resort – Clay and Rice Brook Watersheds map.

Iron Seep #01 (IS-01)

Iron seep #01 is a moderately heavy iron seep associated with a tributary on the right bank just upstream from station BIO 2.0 (see Photograph 9 on page 5 of Appendix 3). This seep is likely a result of soil disturbances associated with the Wastewater Treatment Facility and Disposal Site.

Iron Seep #02 (IS-02)

Iron seep #02 is a severe iron seep on the left bank just below the outlet of the 72-inch culvert under the Lincoln Peak base area (see Photograph 10 on page 5 of Appendix 3). This iron seep is likely due to disturbance of parent material, as well as groundwater flow through the fill material that was used in the construction of the Lincoln Peak base area. This iron seep was originally identified and treated in 2005, with a buried limestone trench running parallel to the stream although it continues to contribute iron directly to Clay Brook.

Iron Seep #03 (IS-03)

On the right bank, just upstream of the Lower Organ Grinder trail, iron seep #03 originates from a trail ditch then flows into Clay Brook (see Photograph 11 on page 6 of Appendix 3).

Iron Seep #04 (IS-04)

The heaviest iron seep within the Clay Brook watershed, iron seep #04, was observed just downslope of the maintenance building located within a depression between the maintenance building and the Gondolier ski trail. Within this wet area, there is an iron-rich ground water upwelling (see Photograph 12 on page 6 of Appendix 3). This iron seep flows into a recently installed corrugated culvert at the down-slope point of the un-cut area between the Gondolier Ski trail and the maintenance road. It is presumed that this culvert eventually connects to the 72-inch culvert of Clay Brook, however, there was no noticeable iron staining at the culvert or on the rocks below it.

6.2.2 Rice Brook

As with Clay Brook, monitoring and reconnaissance within Rice Brook involved assessment of potential iron sources. The in-stream assessment was conducted within the reach of Rice Brook that extends from the confluence with Clay Brook up to BU-5, including the Hotel Brook and Poma Brook tributaries (see Interim Conditions map in Appendix 1). The greatest concentration of iron seeps occurred within the Hotel Brook tributary, with three iron seeps. There were no major in-stream iron seeps in the main-stem of Rice Brook or the Poma Brook tributary. Additionally, reconnaissance of the surrounding development areas was conducted,

with observation of one iron seep in these areas. The following is a summary of these with labels that correspond to the Post-Interim Conditions map of Appendix 1.

Iron Seep #05 (IS-05)

Iron seep #05 is the heaviest observed iron seep within Rice Brook watershed, and is located on the right bank at the downstream end of the Hotel Brook restoration area (see Photograph 13 on page 7 of Appendix 3).

Iron Seep #06 (IS-06)

Iron seep #06 is a light iron seep stemming from the stormwater outflow from basin 8 within the Hotel Brook restoration area (see Photograph 14 on page 7 of Appendix 3).

Iron Seep #07 (IS-07)

A second heavy iron seep (#07) was identified in the headwaters of Hotel Brook (see Photograph 15 on page 8 of Appendix 3). This iron seep is located just down-slope from the third tower below the top of the Village Double chair lift.

Iron Seep #08 (IS-08)

Iron seep #08 originates from a small tributary that flows along the downslope side of an un-built lot on Village Road (see Photograph 16 on page 8 of Appendix 3). Flow is conveyed from this tributary to a roadside swale along Village Road, which ultimately discharges to a tributary to Rice Brook.

6.3 Channel Processes

6.3.1 Clay Brook

In 2006, Field Geology Services (FGS) conducted a Phase 2 Stream Geomorphic Assessment (SGA) on Clay Brook from the confluence of Rice Brook upstream through the Sugarbush Resort to the headwaters. FGS prepared a report, *Fluvial Geomorphology Assessment of the Mad River Watershed, Vermont*, for the Friends of the Mad River (FMR), under contract of the DEC. FGS observed Clay Brook to be in channel evolution stage III, with a "fair" geomorphic condition and "very high" stream sensitivity. FGS documented historic degradation and current channel widening as the dominant channel adjustment processes. The habitat stream condition for Clay Brook scored as "good". The report issued by FGS noted the prevalence of mass failures in the Clay Brook watershed. These instabilities could be a result of increased peak discharges associated with the development for Sugarbush, however, the mass failures are likely caused by natural setting; clay-rich glacial sediments blanketing bedrock on extremely steep valley walls (Field Geology Services, 2007).

In a Bridge and Culvert Assessment, FGS identified five culverts acting as a channel and floodprone constrictions. Deposition upstream of the inlets and scour downstream of the outlets were observed at the Inferno Road culvert, the culvert embedded in the concrete weir and CB-C-5 (see Table 5). All five culverts were perched, which inhibits fish passage and can undermine the culvert footings due to scour. Six natural grade controls (i.e., channel spanning bedrock) were documented in Clay Brook, which

likely alleviates the extent of historical incising. For more details on the results from the Phase 2 SGA of Clay Brook, see Appendix 4.

Table 5: Inventory of Clay Brook Stream Structures*

Type	Code	Location/Name	Ownership	Width	Geomorphic Issues
Culvert	CB-C-1	Inferno Rd.	Town of Warren	7.7	undersized, perched, deposition US, scour DS
Culvert	CB-C-2	72 - inch culvert	Sugarbush	8.2	undersized, perched, deposition US
Culvert	CB-C-3	Concrete Weir	Sugarbush	3.9	undersized, perched, deposition US, scour DS
Culvert	CB-C-4	Lower Gondolier Tr.	Sugarbush	9.8	undersized, perched
Culvert	CB-C-5	NA	Sugarbush	5.9	undersized, perched, deposition US, scour DS

* As assessed in a Phase 2 SGA for FMR from the confluence with Rice Brook to the headwaters of Clay Brook. Structures are ordered from downstream to upstream. The locations of structures are on the Interim Conditions map in Appendix 1.

In 2008, fluvial geomorphic processes were re-assessed by VHBP from monitoring station BIO 2.0 to the Lower Organ Grinder trail crossing (see Interim Conditions Map on page 1 of Appendix 1). It was observed that below the Inferno Road crossing, Clay Brook was incised with moderate erosion on outside bends. Two flood chutes both on the left bank of Clay Brook indicated current stream lateral migrations. There were also two large mass failures on the right steep banks, one of which was just below BIO 2.0 and seemed to be a historical instability as it has since re-vegetated. There was also a fresh mass failure located on the right bank just upstream of BIO 2.0 and below Inferno Road (see Photograph 17 on page 9 of Appendix 3). Flood chutes and mass failures indicate planform adjustments. However, the mass failures are likely a cause of the natural

setting as discussed in the Phase 2 SGA report (Field Geology Services, 2007).

The stream section between Inferno Road and the 72-inch culvert at the Lincoln Peak Base Area appeared relatively stable. The culvert under Inferno Road is undersized and its 9.8 ft. vertical perch is a barrier to aquatic organism passage (see Photograph 18 on page 9 of Appendix 3). This perch has also resulted in scour undermining the culvert footings (Field Geology Services, 2007). Just upstream of Inferno Road is the existing streamflow measurement flume, which is a required monitoring device pursuant to the Indirect Discharge Permits for Sugarbush Resort. The flume installation consists of a wood and fiberglass structure, installed in the 1980s that constricts flows, provides temporary grade control, and alleviates the impacts of the undersized Inferno Road culvert just downstream. Both of these constrictors have resulted in upstream gravel deposition.

Upstream of the 72-inch culvert there is another undersized culvert that is embedded in the concrete weir associated with the DEC-permitted surface water withdrawal operated by Mountain Water Company (see Photograph 19 on page 10 of Appendix 3). This structure forms a small water diversion. This constriction results in fine sediment deposition upstream and erosion/scour on the left bank downstream. The Clay Brook section between the embedded culvert and the Lower Organ Grinder trail crossing is geomorphically stable.

6.3.2 Rice Brook

In 2006, FGS also conducted a Phase II SGA on Rice Brook from the confluence of Clay Brook upstream to its' headwaters. From the confluence with Clay Brook upstream to the tennis courts within the Sugarbush development, FGS observed Rice Brook to be in channel evolution stage III, with a "fair" geomorphic condition and "high" stream sensitivity. FGS documented historic degradation and current channel widening as the dominant channel adjustment processes. The habitat stream condition for this reach scored "good", with sediment deposition and embeddedness scoring poorly most likely due to the sediment source in the unnamed tributary. The upper reach of Rice Brook (from tennis courts upstream to headwaters) scored geomorphically higher with "good" for geomorphic condition and "moderate" for stream sensitivity. The habitat stream condition was documented as "good" with much better scores for sediment deposition and embeddedness. FGS did not document any natural gradient controls (i.e., channel spanning bedrock) in Rice Brook. There were two culverts and three bridges documented in Rice Brook and they all were classified as channel and/or floodprone constrictions, however, with little sediment transport issues (see Table 6). In the Phase 2 report, FGS specifically noted deposition upstream of the Village Rd. culvert (RB-C-2) caused by its undersized width (Field Geology Services, 2007). For more details on the results of the Phase 2 SGA in Rice Brook, please see Appendix 4.

Table 6: Inventory of Rice Brook Stream Structures*

Type	Code	Location/Name	Ownership	Width	Geomorphic Issues
Culvert	RB-C-1	Sugarbush Access Rd.	Town of Warren	NA	undersized
Culvert	RB-C-2	Village Rd.	Sugarbush	3.8	undersized, deposition US
Bridge	RB-B-1	Sugarbush Village	Sugarbush	NA	undersized span

Table 6: Inventory of Rice Brook Stream Structures*

Type	Code	Location/Name	Ownership	Width	Geomorphic Issues
Bridge	RB-B-2	Sugarbush Village	Sugarbush	NA	undersized span
Bridge	RB-B-3	Sugarbush Village	Sugarbush	NA	undersized span
Culvert	RB-C-3	NA	Sugarbush	4.85	undersized span

* As assessed in a Phase 2 SGA for FMR from the confluence with Clay Brook to the headwaters of Rice Brook. Structures are ordered from downstream to upstream. The locations of the structures are on Interim Conditions map in Appendix 1.

In 2008, the channel processes in Rice Brook and its tributaries were also observed in an assessment by VHBP from the confluence with Clay Brook up to water quality monitoring site BU-5 (see Interim Conditions map on page 1 of Appendix 1). Rice Brook was determined to be geomorphically less stable than Clay Brook. This instability is most likely historically triggered by increased flow into Rice Brook from the Sugarbush development area. As one progresses downstream, Rice Brook transitions between stage III and stage IV of the Schumm channel evolution model (Schumm, 1977 and 1984). There is evidence of historical vertical channel degradation (Stage II) and active widening (Stage III) in the upper portions of this reach (below the Sugarbush Access Rd) and lateral, planform adjustments (Stage IV) in the lower portions of Rice Brook (near the Clay Brook confluence). Incision and degradation was evident by a recently abandoned floodplain (see Photograph 20 on page 10 of Appendix 3). Evidence of active widening included erosion on both stream banks at riffles, and trees collapsing into the stream from sides of Rice Brook (see Photograph 21 on page 11 of Appendix 3). Erosion on the outside of stream bends and two mass failures indicated lateral planform adjustments in Rice Brook, occurring between station BD-3 and the confluence with Clay Brook.

Deposition of fine sediment was documented between the confluence with Clay Brook and the Access Road. This sandy fine sediment was "soft underfoot" indicating recent accumulation. A majority of this fine sediment appears to be originating from an unnamed tributary draining into Rice Brook just below the Sugarbush Access Road. This unnamed tributary had a significant amount of accumulated sediment (Photograph 22 on page 11 of Appendix 3), with noticeably more sediment in Rice Brook below the confluence with the unnamed tributary then above it.

Upstream of the newly installed and properly sized culvert under the Sugarbush Access Road, there was more adequate floodplain access and less fine sediment deposition in Rice Brook. Upstream of Hotel Brook, the main in-stream stressors in Rice Brook are occasional straightening from riprap and constrictors from bridges. Straightening along the Sugarbush Health and Racket Club access road has resulted in some erosion on the right bank. Constrictions for bridge accesses to the Sugarbush Villages have also resulted in downstream erosion. Tributaries to Rice Brook (Hotel Brook and Poma Brook) are more geomorphically stable then Rice Brook. There was some fine sediment deposition in Poma Brook, but there was also good access to a small floodplain. Upstream of the Hotel Brook restoration site, there were signs of incision in Hotel Brook below an undersized culvert at the In Road trail crossing.

6.4 Water Chemistry

6.4.1 Clay Brook

In compliance with the IDP #9-0260 for operation of the newly constructed Lincoln Peak Wastewater Treatment System, monthly water surface monitoring is conducted in the receiving stream, Clay Brook. The water quality parameters are tested monthly, above and below the Lincoln Peak Wastewater Treatment System, and include; pH, chloride, nitrate, total dissolved phosphorus, biological oxygen demand, *Escherichia coli* (*E. coli*), dissolved oxygen, alkalinity, total iron, and turbidity. The VWQS established by the State of Vermont Natural Resources Board set thresholds for turbidity, dissolved oxygen, Escherichia coli, nitrate and pH for Class B waters (VWQS 2008). Of those parameters, only pH and one single reading for turbidity have exceeded VWQS since 2006. The pH in Clay Brook has occasionally been below the lower threshold in the VWQS of 6.5.

Although the primary purpose of the water quality monitoring is to detect a possible local effect of the Lincoln Peak Wastewater Treatment System, the water quality in Clay Brook appears to be in very good condition.

6.4.2 Rice Brook

In accordance with the requirements of IDP #9-0013, there are monthly surface water quality tests of Rice Brook associated with the MWT at Sugarbush Resort. Water quality samples are analyzed for *E. coli*, chloride, nitrate, total phosphorus, total dissolved phosphorus, pH, turbidity and temperature. One station is located upstream of the disposal field and the other station is located downstream of the disposal field. The VWQS established by the State of Vermont Natural Resources Board set threshold levels for turbidity, dissolved oxygen, *E. coli*, nitrate and pH

for Class B waters (VWQS 2008). The annual mean values for turbidity, dissolved oxygen, *E. coli*, and nitrate in Rice Brook have never exceeded the VWQS thresholds. Occasionally, the annual mean pH has dipped below the lower threshold of 6.5 s.u.

Results from 1989-2007 demonstrate that the MWT facility has not significantly affected the water quality and that the water quality in Rice Brook is in very good condition.

6.5 Aquatic Biota

6.5.1 Clay Brook

There are four biomonitoring stations in Clay Brook and assessments of aquatic biota metrics from 2005-2007 indicate that Clay Brook is not meeting VT DEC Class B aquatic life support criteria (page 1, Appendix 5). There are eight biocriteria parameters calculated from the macroinvertebrate composition and each parameter has to pass a threshold level in order for a station to be in compliance. Two stations upstream of Inferno Road (Clay Iron – Upstream and Clay Iron – Downstream; see Interim Conditions Map on page 1 of Appendix 1) have not met biocriteria standards due to low values in density, richness and EPT index values (pages 17 and 20, Appendix 5). These stations are more likely impacted by iron seeps. Two stations below Inferno Road (BIO 2.1 and 2.0; see Interim Conditions Map on page 1 of Appendix 1) were designed to detect the possible local impacts from the Lincoln Peak Wastewater Treatment System and have not met biocriteria standards due

to low values in density, richness and Pinkham-Pearson Coefficient of Similarity – Functional Groups (PPCS-F) (pages 23 and 26, Appendix 5).

Passing values for the other five metrics demonstrate that water quality is high and the streambed is not impacted by excessive sedimentation. This inference is supported by the water quality testing and a recent stream assessment, which confirmed that excessive fine sediment deposition is not abundant in Clay Brook between BIO 2.0 and the 72-inch culvert. Low density values reflect poor productivity, possibly due to limited food resources and low nutrients, which naturally occur in first-order streams (Bode, et al. 1996). The headwater conditions of Clay Brook might also be responsible for low species richness, which sometimes occurs in these systems naturally (Bode, et al., 1996). This circumstance is supported by data collected at station BU-5 on Rice Brook, which represents background conditions in Rice Brook and has low density and richness values. Iron seeps could also be in part responsible for failing metrics at the Clay Brook biomonitoring stations, especially the EPT index that is only failing at the biomonitoring sites (Clay Iron – Upstream and Clay Iron Downstream) that are in closer proximity to iron seeps in Clay Brook.

6.5.2 Rice Brook

Biomonitoring on Rice Brook has been conducted since the mid-1990s in association with the DEC-permitted indirect discharge system at Sugarbush Resort operated by MWT. This monitoring has involved summer and winter macroinvertebrate sampling, using artificial substrates and kick net sampling. For the purpose of assessing compliance with VT DEC Class B biocriteria, the summer kick net

sampling results provide the most relevant data set. There are five biomonitoring sampling locations on Rice Brook, beginning with the lowermost station, BD-3 (upstream of the Clay Brook confluence) and extending upstream through the Sugarbush Resort area (stations BD-2, BU-1B, BU-1A) to station BU-5, which is above the base area representing background conditions in Rice Brook (see Interim Conditions Map on page 1 of Appendix 1).

Since the implementation of water quality restoration measures in the base area by Sugarbush and the Town of Warren in 2003, there has been a steady improvement in the aquatic biota composition in Rice Brook (page 1, Appendix 5). Prior to these remediation actions, none of the stations on Rice Brook in the vicinity of the resort area met Class B biocriteria for aquatic life support. Since then, there has been full compliance with the Class B biocriteria standards at station BU-1A in 2003-2005; at station BU-1B in 2004, 2006, and 2007; and station BD-2 in 2004, 2005, and 2007 (page 1, Appendix 5). The restoration of 350 feet of Hotel Brook and the construction of numerous stormwater treatment and control measures associated with the Lincoln Peak Lodge development in 2005 and 2006 has improved water quality conditions so that Class B biocriteria are being met more frequently at more biomonitoring stations than previously observed. When the stations adjacent to the Sugarbush base area development have not been in compliance with the Class B biocriteria, density, richness and EPT are the parameters that have failed (pages 5, 8, and 11, Appendix 5).

Biomonitoring station BD-3 is located in a forested area downstream of the resort and the Sugarbush Access Road and has only met aquatic life support criteria in 2004. Since 2000, the richness, EPT index, and/or the Pinkham-Pearson Coefficient of Similarity – Functional Groups (PPCS-F) parameters have failed to meet the biocriteria standards (with the exception of 2004). The lack of compliance at station BD-3 may be due to a lag effect in which the water quality improvements in the resort area have not yet been observed downstream in the macroinvertebrate community associated with station BD-3. Additionally, a stream assessment by VHBP of Rice Brook in 2008 noted an excessive amount of sediment entering Rice Brook below station BD-2, but above station BD-3 from the unnamed tributary (see Photograph 22 on page 11 of Appendix 3). This accumulated sediment was most noticeable in the tributary but was also documented in eddies in the main stem of Rice Brook in the vicinity of station BD-3. This sediment could be in part responsible of the lack of biocriteria compliance at station BD-3. However, the percentage of Oligochaeta is the parameter that is most affected by excessive fine sediments, and this parameter has consistently complied with its biocriteria threshold since 2000 (page 14, Appendix 5).

Biocriteria data from station BU-5 indicate that Rice Brook has natural low levels in density, richness, EPT and the PPCS-FG parameters (page 2, Appendix 5). BU-5 is upstream of the Sugarbush Resort, and therefore represents ambient conditions in Rice Brook. Since 1995, this station has only met Class B biocriteria in 2001 and 2005. Besides the aforementioned two years, the density, richness, EPT and/or PPCS-FG parameters have been the cause of the non-compliance. The watershed setting could be

responsible for low density and richness bio-criteria values in Rice Brook. Headwater systems often naturally have poor macroinvertebrate productivity and richness due to low nutrients and food resources (Bode, et al., 1996).

7.0 REMEDIATION STRATEGIES

Since 2003, numerous actions to address water quality impacts within the Clay Brook and Rice Brook watersheds have been designed and implemented (see Tables 7 and 8). The primary intent of these remediation measures has been to address the two principal sources of impairment of aquatic life use of the streams: (1) to reduce the impacts of sedimentation due to stormwater runoff from roads, ski trails, and other development in both watersheds; and (2) to reduce the impacts of iron seeps from land disturbance that has occurred primarily within the Clay Brook watershed.

In addition to these measures, this WQRP presents additional proposed remediation measures that address both point and non-point sources of pollutants that are affecting the two streams. Furthermore, Sugarbush Resort plans to prepare a Best Management Practice (BMP) document outlining a general strategy for maintaining and improving stormwater facilities, roads and trails on the Resort, and on mountain activities.

7.1 Clay Brook Watershed

7.1.1 Existing

Past implementation of BMPs within the Clay Brook watershed have involved construction of several stormwater management systems, re-

establishment of natural channel processes, and remediation of iron seeps (see Table 7). These remedial measures have resulted in overall improvements to aquatic biota in Clay Brook.

Table 7: Past BMPs and Restoration Measures, Monitoring, and Observations in Clay Brook Watershed

Measure	Improvement	Year of Implementation
Removal of in-stream pond and restoration of stream channel, floodplain	Re-establish natural channel processes	1998 - 2000
Lincoln Peak Base Area Development	Stormwater Management System – Basins 1 and 7	2004 - 2005
Lincoln Peak Base Area Development	Iron Seep Remediation near outfall of 72-inch culvert	2004

7.1.2 Proposed

Although there have been improvements to aquatic biota in Clay Brook, Sugarbush Resort is committed to implementation of supplemental remediation measures, on lands owned or controlled by the Resort, with the anticipation that there will be continued improvement in aquatic habitat and attainment of VWQS. Activities occurring on USFS land will be subject to their concurrence prior to implementation. In particular, proposed remediation measures will involve the following measures: (corresponding locations (e.g., P-1) can be found on the Interim Conditions Map on page 1 of Appendix 1 and photographs are provided in Appendix 3):

1. Redirecting of runoff to divert clean flow around the vehicle maintenance area (P-1 and Photograph 1 on page 1 of Appendix 3)
2. Retrofitting of stone-lined swales and other means of stabilized conveyance of stormwater runoff associated with the vehicle maintenance area (P-2)
3. Stabilizing the eroded drainage swale within the Lincoln Peak Base Area (P- 3 and Photograph 2 on page 1 of Appendix 3)
4. Remediating an iron seep located downslope of the vehicle maintenance area (IS-04 and Photograph 12 on page 6 of Appendix 3)
5. Remediating an iron seep located in Clay Brook immediately upstream of the Lower Organ Grinder trail crossing (IS-03 and Photograph 11 on page 6 of Appendix 3)
6. Stabilizing an undercut section of Clay Brook located immediately downstream of a concrete weir (P-4 and Photograph 19 on page 10 of Appendix 3).

7.1.3 Future

Although it is anticipated that implementation improvements completed to date will result in attainment of VWQS, Sugarbush Resort is committed to the implementation of further measures on lands owned or controlled by the Resort. The specific measures to be implemented will be determined based on project cost, capital availability, and logical sequencing in the context of earth disturbance associated with other projects. In particular, these future improvements may involve additional roadside swale stabilization, iron seep remediation, and streambank stabilization. While not the responsibility of Sugarbush Resort, there are also opportunities for improved stormwater management within

condominium development areas that are located on adjacent properties (e.g., South Village development area, see photographs 4 through 7 on pages 2 through 4 of Appendix 3).

7.2 Rice Brook Watershed

7.2.1 Existing

Past implementation of BMPs within the Rice Brook watershed have been similar to those within Clay Brook watershed, involving implementation of several stormwater management systems, re-establishment of natural channel processes, and remediation of iron seeps (see Table 8). As previously described, these remedial measures have resulted in overall improvements to aquatic biota in Rice Brook.

Table 8: Past BMPs and Restoration Measures, Monitoring, and Observations in Rice Brook Watershed

Measure	Improvement	Year of Implementation
EPA Section 319 Grant/Sugarbush Village	Stormwater Management Retrofits – Phase I	2003
EPA Section 319 Grant/Sugarbush Village	Stormwater Management Retrofits – Phase II	2004/5
Lincoln Peak Base Area Development	Stormwater Management System – Basins 3 and 4	2004/5
Town of Warren	Replacement/upgrade of Sugarbush Access Road culvert	2005
Lincoln Peak Base Area Development	Stormwater Management System – Basins 5, 6, and 8	2006

Table 8: Past BMPs and Restoration Measures, Monitoring, and Observations in Rice Brook Watershed		
Measure	**Improvement**	**Year of Implementation**
Lincoln Peak Base Area Development	Restoration of Hotel Brook upper and lower segments	2006

7.2.2 Proposed

Again, although there have been improvements to aquatic biota in Rice Brook, Sugarbush Resort is committed to implementation of supplemental remediation measures, on lands owned or controlled by the Resort, with the anticipation that there will be continued improvement in aquatic habitat and attainment of VWQS. Activities occurring on USFS land will be subject to their concurrence prior to implementation. In particular, proposed remediation measures will involve the following measures (corresponding locations (e.g., P-5) can be found on the Post-Interim Conditions map on page 2 of Appendix 1 and photographs are provided in Appendix 3):

1. Addressing water quality impacts (iron seeps and sediment) at the base of the Village double chairlift (P-5)
2. Stabilizing the streambank within Rice Brook along the access road to the Sugarbush Health and Racket Club (P-6)
3. Retrofitting the parking lot behind the Sugarbush Health and Racket Club with a sediment forebay (P-7 and Photograph 23 on page 12 of Appendix 3)
4. Stabilizing an eroded roadside swale along the driveway to the Sugarbush Health and Racket Club (P-8 and Photograph 8 on page 4 of Appendix 3)

5. Remediating an iron seep located on the right bank at the downstream end of the Hotel Brook Restoration area (IS-05 and Photograph 13 on page 7 of Appendix 3)
6. Remediating an iron seep located at the headwaters of Hotel Brook, in the vicinity of the third tower of the Village Double chairlift (IS-07 and Photograph 15 on page 8 of Appendix 3)

Since only the lowest monitoring station (WQB-3/ BD-3) within Rice Brook is not currently meeting standards while the remaining areas of the watershed are attaining standards, the focus is being limited to stabilization of roadside swales and iron seep remediation, with continued monitoring to observe the trend that results from these additional improvements.

7.2.3 Future

In addition to the measures described above, Sugarbush Resort is reserving additional potential improvement areas if in the future VWQS do not continue to improve as anticipated. In particular, Sugarbush Resort is committed to investigating potential reductions in sediment washoff associated with the unnamed tributary to Rice Brook that is located within the vicinity of the wastewater treatment plant (see Photograph 22 on page 11 of Appendix 3). Furthermore, Sugarbush Resort will continue to implement stormwater management practices for all new development, re-development, and expansion that are in compliance with the requirements of the VSMM.

8.0 SCHEDULE OF IMPLEMENTATION

8.1 Implementation of Remedial Measures

Sugarbush Resort is committed to timely implementation of additional remedial measures, with the first phase to occur during completion of the Lincoln Peak base area to full build-out. Further implementation of measures (e.g., re-directing drainage in the vehicle maintenance yard) are anticipated to occur during the 2009 and 2010 construction season (May through October). Further measures, as described above, are planned to be implemented in concert with earth disturbance associated with Phases 1b and 1c of the Lincoln Peak base area redevelopment project.

8.2 Proposed Water Quality Targets

Attainment of VWQS will be judged by compliance with Class B aquatic biota criteria for small high gradient streams, for a period of two consecutive years. The specific criteria for each of the eight metrics are provided in Table 9.

Table 9: DEC Class B Biological Criteria

Metric	Value
Density	≥300
Richness	≥27
EPT	≥16
PMA-O	≥45
BI	≤4.5
% Olig	≤12
EPT/EPT+C	≥0.45
PPCS-FG	≥0.40

Within the Rice Brook watershed, compliance with these metrics will be judged at Stations BD-2 and BD-3. For Clay Brook, stations BIO 2.0 and BIO 2.1 will be used. In each case, these stations are located downstream of all resort activities and at the downstream end of the DEC designated impaired reach.

8.3 Water Quality Monitoring Plan

Following VT DEC protocols, aquatic biota sampling has been conducted by VHBP for the last eight years (2000 through 2007) in the Rice Brook watershed and the last three years (2005 through 2007) in the Clay Brook watershed. Aquatic biota sampling has been conducted at Rice Brook stations BU-5, BU-1A, BU-1B, BD-2, and BD-3 as well as Clay Brook stations "Clay Iron-Upstream" and "Clay Iron-Downstream", as shown on Post-Interim Conditions Map on page 2 of Appendix 1. Biomonitoring at stations BIO 2.0 and BIO 2.1, on Clay Brook, was also performed in 2006 and 2007 for the Lincoln Peak Wastewater Indirect Discharge Permit (IDP). Section 8.3.1 provides a summary of water quality monitoring stations.

8.3.1 Water Quality Monitoring Locations and Parameters

Specific locations of the described sites can be found on the Post-Interim Conditions Map on page 2 of Appendix 1. On Clay Brook, station Clay Iron – Upstream is about 100 feet below the large culvert adjacent to the upper parking area adjacent to the Gate House and recently constructed

building A2/A3 (Clay Brook at Lincoln Peak). Clay Iron – Downstream is 100 feet upstream of the Inferno Road culvert. These "iron seep" monitoring stations are also utilized by the DEC as their biomonitoring stations. Station BIO 2.1 is located on Clay Brook at an elevation of approximately 1,500 feet, and it is the upstream monitoring station for the Lincoln Peak IDP. Station BIO 2.0 is located at an elevation of approximately 1,400 feet, and it is the downstream compliance monitoring station for the Lincoln Peak IDP.

On Rice Brook, station BU-5, the most upstream station, is located above the former snowmaking pump station. Station BU-1A is located above the confluence of Rice Brook and Hotel Brook near the parking lot sedimentation basin. Station BU-1B is located below the confluence of Rice Brook and Hotel Brook, but above the MWT leachfield. Station BD-2 is located on Rice Brook below the MWT leachfield and the Sugarbush Access Road culvert. Station BD-3 is located above the confluence of Rice Brook and Clay Brook, at a location approximately 1,000 feet downstream of Sugarbush's land holdings.

There are eight biocriteria parameters calculated from the macroinvertebrate composition for Class B aquatic life support. Parameters measured include; density, richness, EPT index, Percent Model Affinity of Orders (PMA-O), Hilsenhoff Biotic Index, percent of Oligochaeta, EPT and Chironomidae, and Pinkham-Pearson Coefficient of Similarity.

8.3.2 Water Quality Monitoring Schedule and Reporting

As required by the indirect discharge permits (IDPs) (#9-0013 and #9-0260) there is monthly water chemical sampling in both Rice Brook and Clay Brook. The water quality annual reports are submitted to the VT DEC in September for Clay Brook and in March for Rice Brook. As also required by the IDPs, there is annual biomonitoring in both Rice and Clay Brook occurring in August or September and the annual reports for each stream are submitted in March. There is additional supplemental biomonitoring in Rice Brook conducted during the winter months.

8.3.3 Meeting Water Quality Targets

With the recent improvements to in-stream conditions and stormwater management in Rice Brook and Clay Brook, it is very likely that water quality and biomonitoring results will continue to improve. VHBP expects the water quality targets to be met within a two to four year period, which represents a reasonable time frame.

8.3.4 Water Quality Remediation Plan Revisions

Sugarbush is committed to revising their WQRP as necessary if the current implementation strategy for improving quality standards proves to be unsuccessful. Additional and/or revised monitoring activities may be proposed for implementation, based on future observations. For example, it might be advantageous to add a fifth biomonitoring site to Clay Brook. Currently, there is no monitoring site upstream of the development area and iron seeps, thus, there are no biomonitoring results that represent background conditions in Clay Brook. This potential site could act similarly to that of BU-5, which indicates ambient macroinvertebrate conditions in Rice Brook.

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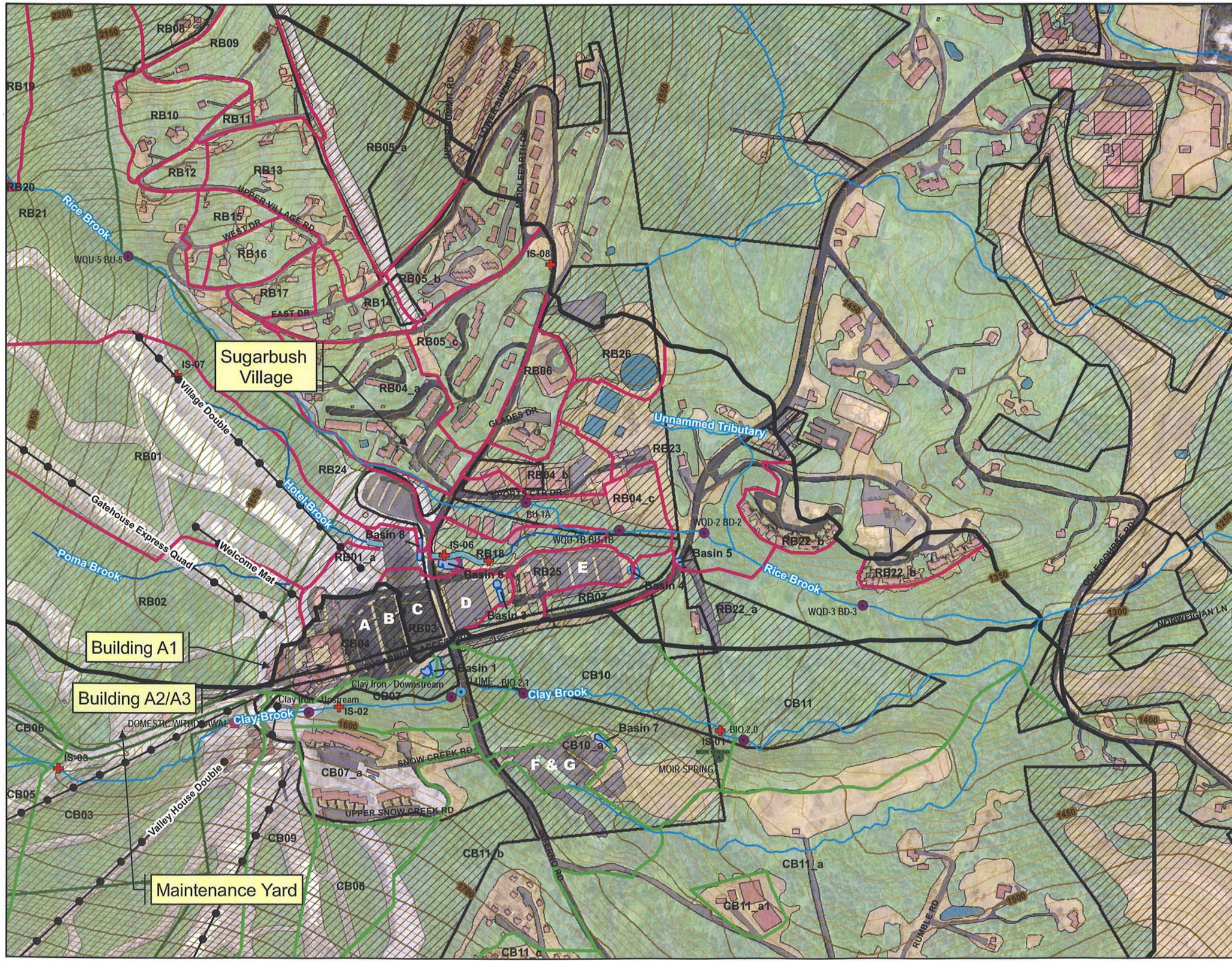
APPENDIX 1

Sugarbush Resort
Warren, VT
Interim Conditions Map

October 10, 2008



Legend

- Iron Seeps
- Biomonitoring Stations
- Drinking Water Withdrawal
- Flume Flow Monitoring Station
- Moir Spring Monitoring Station
- Hotel Brook Restoration Reach
- Streams
- Watershed Boundary
- Clay Brook Subwatershed
- Rice Brook Subwatershed
- Stormwater Basins
- Sugarbush Property
- USFS Property
- Structure
- Forest
- Gravel Road
- Open
- Paved Road
- Ski Trail
- Water
- Ski Lift
- 10 ft. Contour
- 50 ft. Contour

Sources: Monitoring Stations, stormwater discharge locations, stormwater basins, watershed boundaries and MWT leachfield provided by VHB PEA/PEA (2006, 2007, 2008); Streams from VT Hydrography dataset, VCGI (2005); Roads from e911 roads and VCGI (2005); Infrastructure and lincoln peak leachfield digitized by PEA from CAD (2006); Contours digitized by PEA (2005); Orthophotograph provided by NAIP (2006).

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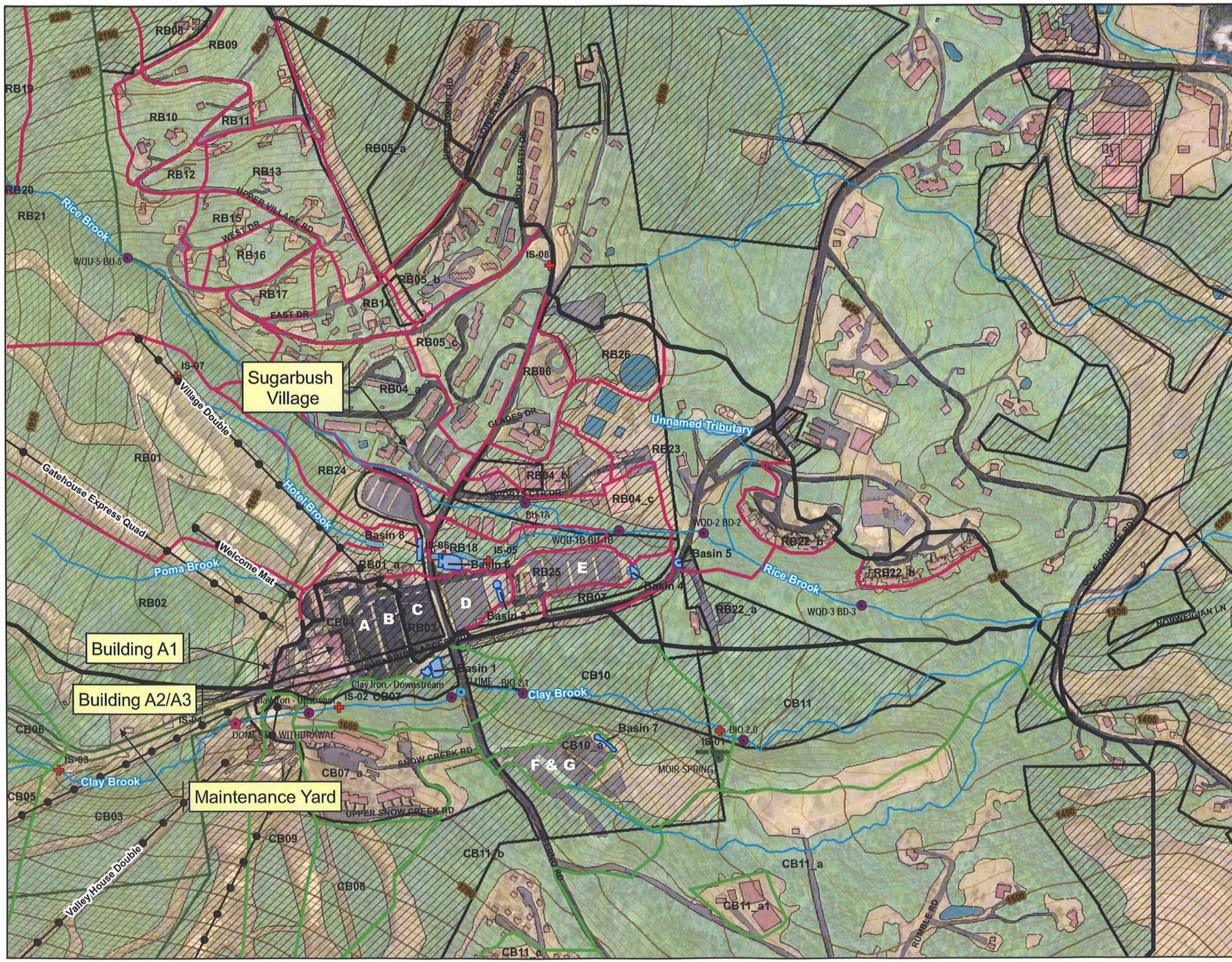
Prepared by: JLS

Sugarbush Resort
Warren, VT
Post-Interim Conditions Map

October 10, 2008



Legend

- Iron Seeps
- Biomonitoring Stations
- Drinking Water Withdrawal
- Flume Flow Monitoring Station
- Moir Spring Monitoring Station
- Hotel Brook Restoration Reach
- Stormwater Basins
- Streams
- Watershed Boundary
- Clay Brook Subwatershed
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- Sugarbush Property
- USFS Property
- Structure
- Forest
- Gravel Road
- Open
- Paved Road
- Ski Trail
- Water
- Ski Lift
- 10 ft. Contour
- 50 ft. Contour

N

500 250 0 500 Feet

Sources: Monitoring Stations, stormwater discharge locations, stormwater basins, watershed boundaries and MWT leachfield provided by VHB PEA/PEA (2006, 2007, 2008); Streams from VT Hydrography dataset, VCGI (2005); Roads from e911 roads and VCGI (2005); Infrastructure and lincoln peak leachfield digitized by PEA from CAD (2006); Contours digitized by PEA (2005); Orthophotograph provided by NAIP (2006).

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F:\57017 Sugarbush WQRP Update\GIS\11x17_Sugarbush_WQRP_Map1.mxd

Prepared by: JLS

Sugarbush WQRP
Simple Method Sediment Loading Results Summary
VHB Pioneer
October 13, 2008

Watershed	Condition	Unitized TSS Load (lbs/yr/ac)	Δ (lbs/yr/ac)	Δ (%)
Chase Brook	*Existing*	*49*	*n/a*	
Clay Brook	Pre-Interim	71		
	Interim (Existing)	68	3	4
	Post-Interim	68		
Rice Brook	Pre-Interim	165		
	Interim (Existing)	91	74	45
	Post-Interim	90		

Clay Brook Simple Method Sediment Loading Results Pre-Interim Condition
Sugarbush WQRP
VHB Pioneer
October 13, 2008

Sub-watershed	Development / Treatment	Impervious Area (acres)	Area (acres)	% Impervious	% Treatment	Loads (lbs/year)	Untized Loads (lbs/acre/year)
CB01		0.14	412	0.0%	0%	12,813	31
CB02		0.03	381	0.0%	0%	10,973	29
CB03		0.51	86.2	0.6%	0%	3,512	41
CB03_c	Lower LP Parking	1.2	1.54	75.7%	10%	2,835	1,841
CB05		0.01	54.3	0.0%	0%	1,803	33
CB06		0.00	134	0.0%	0%	4,349	32
CB07		0.40	9.03	4.5%	0%	798	88
CB07_a	Snowcreek	3.3	9.27	35.5%	10%	6,705	724
CB08		0.00	9.28	0.0%	0%	346	37
CB09		0.55	14.0	3.9%	0%	1,212	86
CB10		2.9	24.7	11.6%	0%	10,593	429
CB11		0.23	28.0	0.8%	0%	1,019	36
CB11_a		8.1	127	6.4%	0%	22,156	174
CB11_a1	South-Vill Sports	0.93	2.54	36.7%	10%	797	314
CB11_b		2.3	58.0	3.9%	0%	7,462	129
CB11_c	South-Vill	2.5	17.9	14.0%	10%	7,116	398
CB11_d	South-Vill	1.4	8.23	17.3%	10%	4,108	499
CB11_e		0.11	19.2	0.6%	0%	590	31
TOTAL		**24.6**	**1,397**	**1.8%**		**99,189**	**71**

Subwatershed Receiving Treatment

Annual Load = P * Pj * C * A * Rv * 0.226

Annual Runoff Calculated By:
R = P * Pj * Rv
where: Rv = 0.05 + 0.009Ia
R= Annual Runoff
P= Annual Precip.
Pj= Fraction of rainfall events that produce runoff (0.9)
Rv= Runoff Coefficient
Ia= % Impervious Cover

Precipitation value from PRISM data set (51 inches)

Clay Brook Simple Method Sediment Loading Results Interim (Existing) Condition
Sugarbush WQRP
VHB Pioneer
October 13, 2008

Sub-watershed	Development / Treatment	Impervious Area (acres)	Area (acres)	% Impervious	% Treatment	Loads (lbs/year)	Untized Loads (lbs/acre/year)
CB01		0.14	412	0.03%	0%	12,813	31
CB02		0.03	381	0.01%	0%	10,973	29
CB03		0.85	86.2	1.0%	0%	4,935	57
CB04	Lower LP Parking, Wet Pond 1	5.7	7.76	74%	80%	2,069	267
CB05		0.01	54.3	0.03%	0%	1,803	33
CB06		0.00	134	0.00%	0%	4,349	32
CB07		0.45	7.82	5.7%	0%	863	110
CB07_a	Snowcreek	3.3	9.27	35%	10%	6,705	724
CB08		0.00	9.28	0.00%	0%	346	37
CB09		0.53	14.1	3.8%	0%	2,177	155
CB10		1.1	22.8	4.8%	0%	3,249	142
CB10_a	22 acre site/Wet Pond 7	2.1	3.08	69%	80%	1,542	501
CB11		0.23	28.0	0.82%	0%	1,019	36
CB11_a		8.1	127	6.4%	0%	22,156	174
CB11_a1	South-Vill Sports	0.93	2.54	37%	10%	797	314
CB11_b		2.5	57.1	4.4%	0%	8,277	145
CB11_c	South-Vill	2.5	17.9	14%	10%	7,116	398
CB11_d	South-Vill	1.4	8.23	17%	10%	4,108	499
CB11_e		0.11	19.2	0.59%	0%	590	31
TOTAL		**30.0**	**1,402.3**	**2.1%**		**95,889**	**68**

Subwatershed Receiving Treatment

Annual Load = P * Pj * C * A * Rv * 0.226

Annual Runoff Calculated By:
R = P * Pj * Rv
where: Rv = 0.05 + 0.009Ia
R= Annual Runoff
P= Annual Precip.
Pj= Fraction of rainfall events that produce runoff (0.9)
Rv= Runoff Coefficient
Ia= % Impervious Cover

Precipitation value from PRISM data set (51 inches)

Clay Brook Simple Method Sediment Loading Results Post-Interim Condition
Sugarbush WQRP
VHB Pioneer
October 13, 2008

Sub-watershed	Development / Treatment	Impervious Area (acres)	Area (acres)	% Impervious	% Treatment	Loads (lbs/year)	Untized Loads (lbs/acre/year)
CB01		0.14	412	0.03%	0%	12,813	31
CB02		0.03	381	0.01%	0%	10,973	29
CB03		0.88	86.2	1.0%	0%	5,067	59
CB04	Lower LP Parking, Wet Pond 1	6.1	8.34	73%	80%	1,772	212
CB05		0.01	54.3	0.03%	0%	1,803	33
CB06		0.00	134	0.00%	0%	4,349	32
CB07		0.45	7.82	5.7%	0%	863	110
CB07_a	Snowcreek	3.3	9.27	35%	10%	6,705	724
CB08		0.00	9.28	0.00%	0%	346	37
CB09		0.53	14.1	3.8%	0%	2,184	155
CB10		1.1	22.8	4.8%	0%	3,249	142
CB10_a	22 acre site/Wet Pond 7	2.1	3.08	69%	80%	1,540	501
CB11		0.23	28.0	0.82%	0%	1,019	36
CB11_a		8.1	127	6.4%	0%	22,156	174
CB11_a1	South-Vill Sports	0.93	2.54	37%	10%	797	314
CB11_b		2.5	57.1	4.4%	0%	8,277	145
CB11_c	South-Vill	2.5	17.9	14%	10%	7,116	398
CB11_d	South-Vill	1.4	8.23	17%	10%	4,108	499
CB11_e		0.11	19.2	0.59%	0%	590	31
TOTAL		**30.4**	**1,402.9**	**2.2%**		**95,728**	**68**

Subwatersheds with changes from Interim to Post-Interim conditions

Subwatershed Receiving Treatment

Annual Load = P * Pj * C * A * Rv * 0.226

Annual Runoff Calculated By:
R = P * Pj * Rv
where: Rv = 0.05 + 0.009Ia
R= Annual Runoff
P= Annual Precip.
Pj= Fraction of rainfall events that produce runoff (0.9)
Rv= Runoff Coefficient
Ia= % Impervious Cover

Precipitation value from PRISM data set (51 inches)

Rice Brook Simple Method Sediment Loading Results Pre-Interim Condition
Sugarbush WQRP
VHB Pioneer
October 13, 2008

Sub-watershed	Development	Impervious Area (acres)	Area (acres)	% Impervious	% Treatment	Loads (lbs/year)	Unitized Loads (lbs/acre/year)
RB01		0.03	50.9	0.06%	0%	2,072	41
RB02		0.03	40.7	0.08%	0%	1,384	34
RB03_a	Main LP Parking	12	14.0	86%	25%	31,333	2,243
RB03_b	Gate House	0.59	1.33	44%	10%	522	392
RB04_a	SB Vill 01	4.4	13.2	34%	10%	6,769	513
RB04_b		1.7	4.31	39%	0%	1,759	408
RB04_c		2.4	9.70	25%	0%	3,659	377
RB05_a		0.41	15.6	2.6%	0%	1,141	73
RB05_b	Upper Vill 06	2.5	7.66	33%	10%	2,166	283
RB05_c	SB Vill 06	2.9	11.2	26%	10%	3,591	320
RB06	SB Vill 03	1.5	4.41	35%	10%	3,033	688
RB07	Access Road	0.55	2.63	21%	0%	824	313
RB08	Upper Sugarbush Village Road	0.37	11.3	3.3%	0%	1,348	119
RB09		0.83	7.35	11%	0%	2,061	280
RB10		0.57	5.67	10%	0%	1,318	232
RB11		0.26	0.88	30%	0%	879	998
RB12		0.36	1.58	23%	0%	1,103	700
RB13		0.98	8.98	11%	0%	2,271	253
RB14		1.1	4.45	25%	0%	2,521	566
RB15		0.37	2.98	13%	0%	1,073	360
RB16		0.48	3.36	14%	0%	1,342	399
RB17		0.54	2.44	22%	0%	1,563	640
RB18		0.36	3.73	9.6%	0%	684	184
RB19		0.00	62.9	0.00%	0%	1,693	27
RB20		0.05	140	0.03%	0%	4,456	32
RB21		0.66	68.0	0.97%	0%	3,629	53
RB22_a		1.0	20.1	5.07%	0%	1,270	63
RB22_b	Bridges	2.4	6.03	40.0%	10%	2,346	389
RB23		2.5	19.5	12.9%	0%	3,214	165
RB24	Village Parking	0.00	5.08	0.0%	0%	140	28
RB25	LP Lower Parking	0.05	3.28	1.5%	0%	245	75
RB26		0.35	5.10	6.8%	0%	636	125
TOTAL		**42**	**559**	**7.6%**		**92,045**	**165**

Subwatersheds Receiving Treatment
MRVPD 319 Grant Subwatersheds

Annual Load = P * Pj * C * A * Rv * 0.226

Precipitation value from PRISM data set (51 inches)

Annual Runoff Calculated By:
R = P * Pj * Rv
where: Rv = 0.05 + 0.009Ia
R= Annual Runoff

P= Annual Precip.
Pj= Fraction of rainfall events that produce runoff (0.9)
Rv= Runoff Coefficient
Ia= % Impervious Cover

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Rice Brook Simple Method Sediment Loading Results Interim (Existing) Condition
Sugarbush WQRP
VHB Pioneer
October 13, 2008

Sub-watershed	Development	Impervious Area (acres)	Area (acres)	% Impervious	% Treatment	Loads (lbs/year)	Unitized Loads (lbs/acre/year)
RB01		0.01	49.0	0.02%	0%	1,932	39
RB01_a	Interim Village, parking lot, Wet Pond 6	1.5	4.10	37%	80%	979	239
RB02		0.2	41.1	0.54%	0%	1,627	40
RB03	LP Parking, Wet Pond 3	3.7	4.86	77%	80%	1,742	358
RB04_a	SB Vill 01	4.4	13.2	34%	10%	6,769	513
RB04_b		1.7	4.31	39%	0%	1,759	408
RB04_c		1.9	9.04	21%	0%	2,007	222
RB05_a		0.4	15.6	2.6%	0%	1,141	73
RB05_b	Upper Vill 06	2.5	7.66	33%	10%	2,166	283
RB05_c	SB Vill 02	2.9	11.2	26%	10%	3,591	320
RB06	SB Vill 03	1.5	4.41	35%	10%	3,033	688
RB07	Access road, Wet Pond 5	0.8	2.63	31%	80%	332	126
RB08	Upper Sugarbush Village Road, Grass Channels	0.4	11.3	3.3%	80%	270	24
RB09		0.8	7.35	11%	80%	412	56
RB10		0.6	5.67	10%	80%	264	46
RB11		0.3	0.88	30%	80%	176	200
RB12		0.4	1.58	23%	80%	221	140
RB13		1.0	8.98	11%	80%	454	51
RB14		1.1	4.45	25%	80%	504	113
RB15		0.4	2.98	13%	80%	215	72
RB16		0.5	3.36	14%	80%	268	80
RB17		0.5	2.44	22%	80%	313	128
RB18		0.5	3.69	13%	0%	663	180
RB19		0.0	62.9	0.00%	0%	1,686	27
RB20		0.0	140	0.03%	0%	4,393	31
RB21		0.7	68.0	1.0%	0%	3,629	53
RB22_a		1.1	20.1	5.5%	0%	1,381	69
RB22_b	Bridges	2.4	6.03	40%	10%	2,346	389
RB23		2.5	19.5	13%	0%	3,219	165
RB24	Village Parking, Wet Pond 8	1.3	7.24	18%	80%	847	117
RB25	LP Lower Parking, Wet Pond 4	2.5	4.31	58%	80%	1,553	360
RB26		0.35	5.10	6.8%	0%	636	125
TOTAL		**38.9**	**553.6**	**7.0%**		**50,527**	**91**

Subwatersheds Receiving Treatment
MRVPD 319 Grant Subwatersheds

Annual Load = P * Pj * C * A * Rv * 0.226

Precipitation value from PRISM data set (51 inches)

Annual Runoff Calculated By:
R = P * Pj * Rv
where: Rv = 0.05 + 0.009Ia
R= Annual Runoff

P= Annual Precip.
Pj= Fraction of rainfall events that produce runoff (0.9)
Rv= Runoff Coefficient
Ia= % Impervious Cover

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Rice Brook Simple Method Sediment Loading Results Post-Interim Condition
Sugarbush WQRP
VHB Pioneer
October 13, 2008

Sub-watershed	Development	Impervious Area (acres)	Area (acres)	% Impervious	% Treatment	Loads (lbs/year)	Unitized Loads (lbs/acre/year)
RB01		0.05	49.0	0.43%	0%	1,984	41
RB01_a	Interim Village, parking lot, Wet Pond 6	0.91	3.63	25%	80%	213	59
RB02		0.21	41.1	0.51%	0%	1,608	39
RB03	LP Parking, Wet Pond 3	3.5	4.74	74%	80%	1,491	314
RB04_a	SB Vill 01	4.4	13.2	34%	10%	6,769	513
RB04_b		1.7	4.31	39%	0%	1,759	408
RB04_c		1.9	9.05	21%	0%	2,008	222
RB05_a		0.41	15.6	2.6%	0%	1,141	73
RB05_b	Upper Vill 06	2.5	7.66	33%	10%	2,166	283
RB05_c	SB Vill 02	2.9	11.2	26%	10%	3,591	320
RB06	SB Vill 03	1.5	4.41	35%	10%	3,033	688
RB07	Access road, Wet Pond 5	0.81	2.63	31%	80%	332	126
RB08	Upper Sugarbush Village Road, Grass Channels	0.37	11.3	3.3%	80%	270	24
RB09		0.83	7.35	11%	80%	412	56
RB10		0.57	5.67	10%	80%	264	46
RB11		0.26	0.88	30%	80%	176	200
RB12		0.36	1.58	23%	80%	221	140
RB13		0.98	8.98	11%	80%	454	51
RB14		1.1	4.45	25%	80%	504	113
RB15		0.37	2.98	13%	80%	215	72
RB16		0.48	3.36	14%	80%	268	80
RB17		0.54	2.44	22%	80%	313	128
RB18		0.46	3.67	12%	0%	651	178
RB19		0.00	62.9	0.00%	0%	1,686	27
RB20		0.05	140	0.03%	0%	4,393	31
RB21		0.66	68.0	0.97%	0%	3,629	53
RB22_a		1.1	20.1	5.5%	0%	1,381	69
RB22_b	Bridges	2.4	6.03	40%	10%	2,346	389
RB23		2.5	19.5	13%	0%	3,219	165
RB24	Village Parking, Wet Pond 8	1.3	7.23	18%	80%	846	117
RB25	LP Lower Parking, Wet Pond 4	2.5	4.31	58%	80%	1,553	360
RB26		0.35	5.10	6.8%	0%	636	125
TOTAL		**38.1**	**552.9**	**6.9%**		**49,531**	**90**

Subwatersheds Receiving Treatment
MRVPD 319 Grant Subwatersheds

Annual Load = P * Pj * C * A * Rv * 0.226

Precipitation value from PRISM data set (51 inches)

Annual Runoff Calculated By:
R = P * Pj * Rv
where: Rv = 0.05 + 0.009Ia
R= Annual Runoff

P= Annual Precip.
Pj= Fraction of rainfall events that produce runoff (0.9)
Rv= Runoff Coefficient
Ia= % Impervious Cover

Chase Brook Simple Method Sediment Loading Results Existing Conditions
Sugarbush WQRP
VHB Pioneer
September 8, 2008

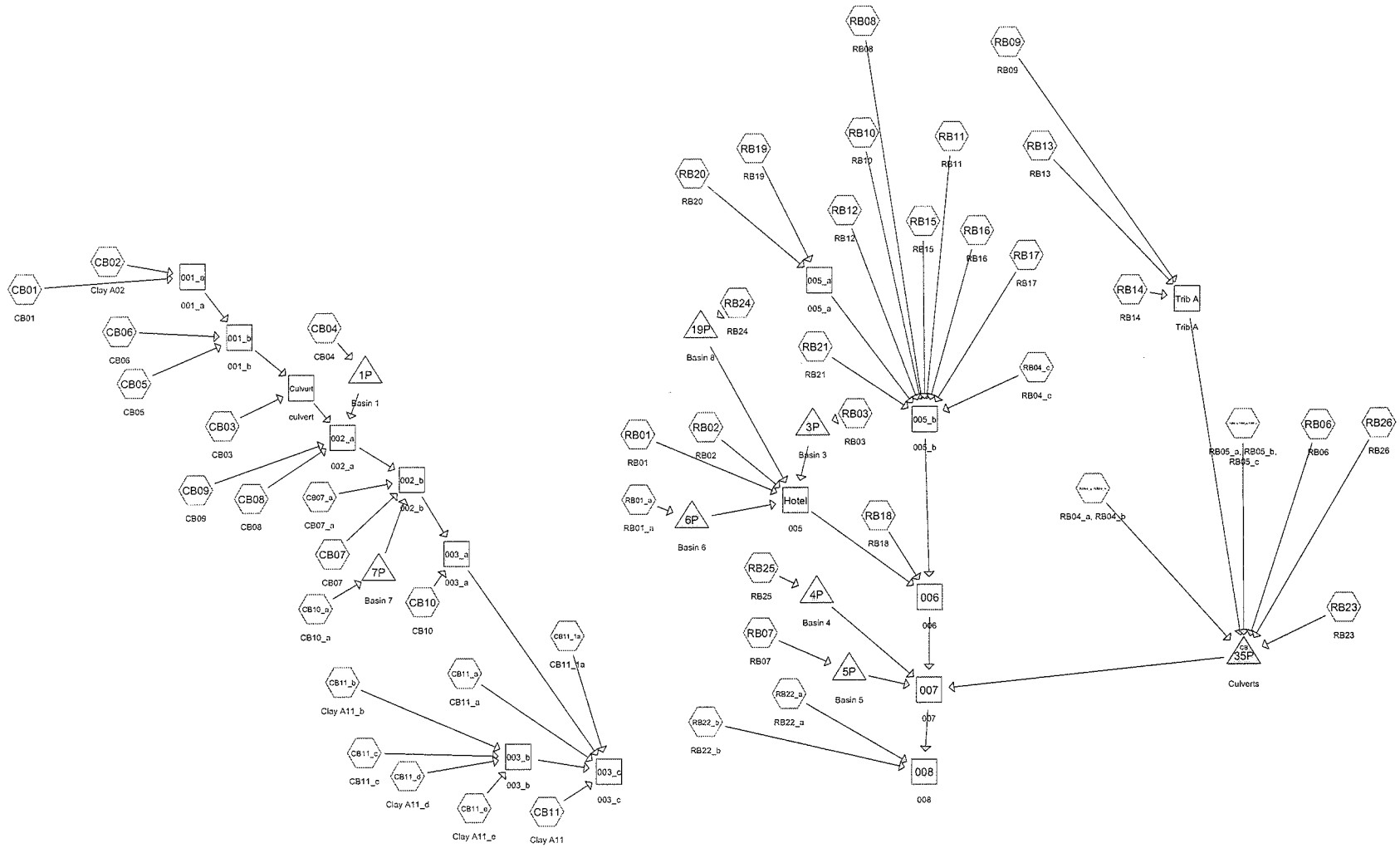
Subwatershed	Impervious Area (acres)	Area (acres)	% Impervious	% Treatment	TSS Load (lbs/yr)	Unitized Load (lbs/acre/yr)
A	*1.22*	*127.7*	0.96%	*0*	5,753	45
B	*0.03*	*354.2*	0.01%	*0*	9,618	27
C	*0.37*	*608.1*	0.06%	*0*	19,511	32
D	*1.02*	*23.1*	4.41%	*0*	2,034	88
E	*1.32*	*32.3*	4.08%	*0*	2,459	76
F	*0.27*	*93.2*	0.28%	*0*	2,836	30
G	*5.84*	*21.6*	27.0%	*0*	18,306	848
H	*2.40*	36.2	6.63%	0	3,611	100
TOTAL	**12.5**	**1296.2**	**0.96%**	**0**	**64,128**	**49**

Annual Load = P * Pj * C * A * Rv * 0.226

Annual Runoff Calculated By:
R = P * Pj * Rv,
where: Rv = 0.05 + 0.009*Ia
R= Annual Runoff
P= Annual Precip.
Pj= Fraction of rainfall events that produce runoff (0.9)
Rv= Runoff Coefficient
Ia= % Impervious Cover

Precipitation value from Prism (51 inches).

APPENDIX 1



Drainage Diagram for SUGARBUSH LP INTERIM CONDITION (existing 2008)

Prepared by {enter your company name here}, Printed 10/15/2008

HydroCAD® 8.50 s/n 001038 © 2007 HydroCAD Software Solutions LLC

Summary for Subcatchment CB01: CB01

Runoff = 134.52 cfs @ 12.50 hrs, Volume= 20.367 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
17.064	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
4.245	69	50-75% Grass cover, Fair, HSG B
101.676	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
27.562	79	50-75% Grass cover, Fair, HSG C
222.105	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
39.375	84	50-75% Grass cover, Fair, HSG D
0.139	98	Paved parking & roofs
412.166	75	Weighted Average
412.027		Pervious Area
0.139		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.1	150	0.5280	0.16		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
14.7	1,600	0.5280	1.82		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
12.3	979	0.2830	1.33		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	1,830	0.2830	27.54	743.49	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
0.1	137	0.1950	22.86	617.16	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
0.6	904	0.2250	24.55	662.93	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
0.4	641	0.2550	26.14	705.75	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
45.3	6,241	Total			

Summary for Subcatchment CB02: Clay A02

Runoff = 114.91 cfs @ 12.41 hrs, Volume= 16.340 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
38.871	55	Woods, Good, HSG B
4.679	69	50-75% Grass cover, Fair, HSG B
120.672	70	Woods, Good, HSG C
12.342	79	50-75% Grass cover, Fair, HSG C
187.429	77	Woods, Good, HSG D
17.188	84	50-75% Grass cover, Fair, HSG D
0.027	98	Paved parking & roofs
381.208	73	Weighted Average
381.181		Pervious Area
0.027		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	150	0.4189	0.14		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
17.7	1,715	0.4190	1.62		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	1,594	0.4189	33.50	904.55	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040 Mountain streams
2.1	3,070	0.2190	24.22	654.04	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
38.3	6,529	Total			

Summary for Subcatchment CB03: CB03

Runoff = 26.34 cfs @ 12.47 hrs, Volume= 3.971 af, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
4.583	30	Woods, Good, HSG A
2.947	49	50-75% Grass cover, Fair, HSG A
1.135	55	Woods, Good, HSG B
0.009	69	50-75% Grass cover, Fair, HSG B
15.326	70	Woods, Good, HSG C
11.493	79	50-75% Grass cover, Fair, HSG C
33.123	77	Woods, Good, HSG D
16.716	84	50-75% Grass cover, Fair, HSG D
0.425	98	Paved parking & roofs
0.333	76	Gravel roads, HSG A
0.092	89	Gravel roads, HSG C
86.182	74	Weighted Average
85.757		Pervious Area
0.425		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	66	0.2270	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
10.7	84	0.4580	0.13		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
16.2	1,646	0.4580	1.69		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	72	0.3970	4.41		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.4	684	0.2950	1.36		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	61	0.2935	3.79		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.7	310	0.3160	1.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	413	0.3160	25.40	457.26	**Trap/Vee/Rect Channel Flow,** Bot.W=0.00' D=3.00' Z= 2.0 '/' Top.W=12.00' n= 0.040
0.2	324	0.3100	28.82	778.14	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
43.2	3,660	Total			

Summary for Subcatchment CB04: CB04

Runoff = 11.39 cfs @ 11.91 hrs, Volume= 0.564 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	0.025	30	Woods, Good, HSG A
	1.597	39	>75% Grass cover, Good, HSG A
	0.114	49	50-75% Grass cover, Fair, HSG A
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.015	70	Woods, Good, HSG C
	0.091	74	>75% Grass cover, Good, HSG C
	0.149	84	50-75% Grass cover, Fair, HSG D
	0.000	80	>75% Grass cover, Good, HSG D
	4.470	98	Paved parking & roofs
*	0.026	100	water
	1.056	76	Gravel roads, HSG A
	0.214	89	Gravel roads, HSG C
	7.757	81	Weighted Average
	3.261		Pervious Area
	4.496		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	6	0.1600	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
0.2	25	0.1200	1.85		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
0.5	219	0.1500	7.86		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.4	1,045	0.1550	12.17	21.50	**Circular Channel (pipe),** Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.025 Corrugated metal
2.6	1,295	Total			

Summary for Subcatchment CB05: CB05

Runoff = 24.47 cfs @ 12.37 hrs, Volume= 3.070 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
9.687	70	Woods, Good, HSG C
5.848	79	50-75% Grass cover, Fair, HSG C
30.564	77	Woods, Good, HSG D
8.182	84	50-75% Grass cover, Fair, HSG D
0.014	98	Paved parking & roofs
54.295	77	Weighted Average
54.281		Pervious Area
0.014		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	70	0.1700	0.32		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
11.2	80	0.3700	0.12		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
0.7	60	0.3700	1.52		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.6	184	0.5500	5.19		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.3	1,700	0.4860	1.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	47	0.1600	2.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	69	0.2500	1.25		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	131	0.3490	4.14		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	150	0.2900	3.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	124	0.1600	1.00		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	169	0.1600	20.71	559.04	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
37.0	2,784	Total			

Summary for Subcatchment CB06: CB06

Runoff = 23.15 cfs @ 12.77 hrs, Volume= 4.952 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.006	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
21.557	55	Woods, Good, HSG B
2.673	69	50-75% Grass cover, Fair, HSG B
54.520	70	Woods, Good, HSG C
19.335	79	50-75% Grass cover, Fair, HSG C
27.025	77	Woods, Good, HSG D
9.265	84	50-75% Grass cover, Fair, HSG D
0.000	98	Paved parking & roofs
134.381	71	Weighted Average
134.381		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	150	0.1980	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
1.4	95	0.1980	1.11		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	94	0.3500	4.14		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	202	0.4817	1.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	28	0.4660	4.78		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.8	935	0.5040	1.77		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	111	0.4300	4.59		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.4	244	0.4760	1.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	80	0.4900	4.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	35	0.4810	1.73		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	41	0.4200	5.83		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
6.3	593	0.3898	1.56		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	63	0.1400	2.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
14.7	983	0.2000	1.12		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	197	0.2000	23.15	625.02	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
61.5	3,851	Total			

Summary for Subcatchment CB07: CB07

Runoff = 0.29 cfs @ 12.48 hrs, Volume= 0.096 af, Depth= 0.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	2.295	30	Woods, Good, HSG A
	0.161	39	>75% Grass cover, Good, HSG A
	0.000	49	50-75% Grass cover, Fair, HSG A
	0.000	55	Woods, Good, HSG B
	0.000	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	4.314	70	Woods, Good, HSG C
	0.215	74	>75% Grass cover, Good, HSG C
	0.395	79	50-75% Grass cover, Fair, HSG C
	0.000	77	Woods, Good, HSG D
	0.000	80	>75% Grass cover, Good, HSG D
	0.000	84	50-75% Grass cover, Fair, HSG D
	0.433	98	Paved parking & roofs
*	0.002	100	water
	0.000	89	Gravel roads, HSG C
	7.815	60	Weighted Average
	7.380		Pervious Area
	0.435		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.8	150	0.1800	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
0.8	50	0.1800	1.06		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	300	0.1400	19.37	522.93	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
0.2	110	0.0500	8.37	26.30	**Circular Channel (pipe),** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
3.5	223	0.1800	1.06		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
29.6	833	Total			

Summary for Subcatchment CB07_a: CB07_a

Runoff = 14.62 cfs @ 11.97 hrs, Volume= 0.758 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	0.505	70	Woods, Good, HSG C
	1.614	89	Gravel roads, HSG C
	2.256	74	>75% Grass cover, Good, HSG C
	3.180	79	50-75% Grass cover, Fair, HSG C
	0.022	84	50-75% Grass cover, Fair, HSG D
	1.678	98	Paved parking & roofs
*	0.017	100	water
	9.272	83	Weighted Average
	7.577		Pervious Area
	1.695		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	100	0.1800	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
0.3	439	0.1800	25.22	316.90	**Circular Channel (pipe),** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.025 Corrugated metal
5.0	539	Total			

Summary for Subcatchment CB08: CB08

Runoff = 5.84 cfs @ 12.25 hrs, Volume= 0.596 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.121	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.402	69	50-75% Grass cover, Fair, HSG B
0.312	70	Woods, Good, HSG C
0.021	74	>75% Grass cover, Good, HSG C
0.037	79	50-75% Grass cover, Fair, HSG C
4.874	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
3.512	84	50-75% Grass cover, Fair, HSG D
0.000	98	Paved parking & roofs
9.279	79	Weighted Average
9.279		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.4	110	0.3200	0.12		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
0.6	137	0.3299	4.02		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	77	0.3400	1.46		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.9	224	0.2700	1.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	126	0.2600	1.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	68	0.2900	3.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.5	263	0.2500	1.25		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	127	0.1700	2.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.8	182	0.1900	1.09		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
28.7	1,314	Total			

Summary for Subcatchment CB09: CB09

Runoff = 7.46 cfs @ 12.36 hrs, Volume= 0.904 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.331	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
3.797	79	50-75% Grass cover, Fair, HSG C
6.635	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
2.774	84	50-75% Grass cover, Fair, HSG D
0.100	98	Paved parking & roofs
0.428	89	Gravel roads, HSG C
14.065	79	Weighted Average
13.965		Pervious Area
0.100		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.8	150	0.3600	0.13		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
1.1	100	0.3600	1.50		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	35	0.3370	4.06		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.1	177	0.3290	1.43		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	25	0.3440	4.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	280	0.3400	1.46		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	85	0.3400	4.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	133	0.3400	1.46		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	42	0.3400	4.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.1	475	0.2712	1.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.4	483	0.2280	3.34		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	60	0.2700	10.55		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.0	200	0.2200	3.28		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
37.0	2,245	Total			

Summary for Subcatchment CB10: CB10

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
16.990	30	Woods, Good, HSG A
4.127	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.593	70	Woods, Good, HSG C
0.023	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.000	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
0.000	84	50-75% Grass cover, Fair, HSG D
0.580	98	Paved parking & roofs
0.397	76	Gravel roads, HSG A
0.109	85	Gravel roads, HSG B
22.819	36	Weighted Average
22.239		Pervious Area
0.580		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	10	0.1010	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
0.3	33	0.1300	2.02		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
0.3	107	0.1700	6.64		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.2	506	0.1700	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	974	0.1700	21.34	576.24	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
13.2	1,630	Total			

Summary for Subcatchment CB10_a: CB10_a

Runoff = 2.38 cfs @ 11.99 hrs, Volume= 0.132 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	0.107	30	Woods, Good, HSG A
	0.361	39	>75% Grass cover, Good, HSG A
	0.000	49	50-75% Grass cover, Fair, HSG A
	0.000	55	Woods, Good, HSG B
	0.000	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.364	70	Woods, Good, HSG C
	0.091	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	0.000	77	Woods, Good, HSG D
	0.000	80	>75% Grass cover, Good, HSG D
	0.000	84	50-75% Grass cover, Fair, HSG D
	0.060	98	Paved parking & roofs
	1.327	76	Gravel roads, HSG A
	0.735	89	Gravel roads, HSG C
*	0.031	100	water
	3.076	73	Weighted Average
	2.985		Pervious Area
	0.091		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	11	0.1000	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
0.3	37	0.1200	2.00		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
0.5	52	0.0700	1.73		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
0.7	185	0.0700	4.26		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.9	353	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.3	638	Total			

Summary for Subcatchment CB11: Clay A11

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
25.810	30	Woods, Good, HSG A
1.940	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.005	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.000	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
0.000	84	50-75% Grass cover, Fair, HSG D
0.204	98	Paved parking & roofs
0.026	76	Gravel roads, HSG A
27.985	31	Weighted Average
27.781		Pervious Area
0.204		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.8	150	0.0770	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
28.1	1,170	0.0770	0.69		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.4	1,170	0.0770	14.36	387.82	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
64.3	2,490	Total			

Summary for Subcatchment CB11_1a: CB11_1a

Runoff = 3.07 cfs @ 11.96 hrs, Volume= 0.163 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.625	61	>75% Grass cover, Good, HSG B
0.056	70	Woods, Good, HSG C
0.232	89	Gravel roads, HSG C
0.926	74	>75% Grass cover, Good, HSG C
0.701	98	Paved roads w/curbs & sewers
2.540	79	Weighted Average
1.839		Pervious Area
0.701		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	56	0.2000	0.33		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
0.2	26	0.1900	2.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
1.3	213	0.1600	2.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.3	295	Total			

Summary for Subcatchment CB11_a: CB11_a

Runoff = 7.90 cfs @ 12.65 hrs, Volume= 2.221 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	11.054	30	Woods, Good, HSG A
	5.404	39	>75% Grass cover, Good, HSG A
	0.000	49	50-75% Grass cover, Fair, HSG A
	40.003	55	Woods, Good, HSG B
	6.201	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	30.647	70	Woods, Good, HSG C
	7.295	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	13.281	77	Woods, Good, HSG D
	4.726	80	>75% Grass cover, Good, HSG D
	0.000	84	50-75% Grass cover, Fair, HSG D
	3.160	98	Paved parking & roofs
*	0.299	100	water
	0.006	76	Gravel roads, HSG A
	2.870	85	Gravel roads, HSG B
	0.626	89	Gravel roads, HSG C
	0.429	91	Gravel roads, HSG D
	126.001	63	Weighted Average
	122.542		Pervious Area
	3.459		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	41	0.1700	2.35		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
6.9	110	0.2170	0.27		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.40"
0.2	41	0.2170	3.26		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	40	0.1700	6.64		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	69	0.1590	2.79		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	47	0.1760	6.75		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	98	0.2700	3.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	53	0.2790	3.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	226	0.2230	1.18		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	140	0.1500	6.24		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.5	122	0.2800	1.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	63	0.2580	1.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	41	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.1	71	0.1700	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	36	0.2000	7.20		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.7	198	0.2360	1.21		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	42	0.2000	3.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.4	288	0.1260	0.89		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	33	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	38	0.1200	2.42		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	197	0.1670	1.02		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	39	0.1400	0.94		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
16.0	794	0.1100	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	1,126	0.1100	17.17	463.53	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
45.5	3,953	Total			

Summary for Subcatchment CB11_b: Clay A11_b

Runoff = 12.77 cfs @ 12.59 hrs, Volume= 2.271 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.766	30	Woods, Good, HSG A
0.033	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
1.633	55	Woods, Good, HSG B
0.986	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
39.470	70	Woods, Good, HSG C
2.096	74	>75% Grass cover, Good, HSG C
9.279	79	50-75% Grass cover, Fair, HSG C
0.000	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
0.000	84	50-75% Grass cover, Fair, HSG D
1.081	98	Paved parking & roofs
0.363	85	Gravel roads, HSG B
1.372	89	Gravel roads, HSG C
57.079	72	Weighted Average
55.998		Pervious Area
1.081		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	150	0.2400	0.43		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
0.8	165	0.2400	3.43		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.3	270	0.3000	1.37		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.4	214	0.3600	1.50		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	32	0.3400	4.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.1	366	0.3470	1.47		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.9	215	0.3460	4.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.9	251	0.3400	1.46		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.3	465	0.2300	3.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.5	885	0.1900	1.09		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	60	0.1700	8.37		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.7	228	0.1700	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	111	0.0790	4.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.4	241	0.0290	0.43		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	110	0.0729	13.98	377.35	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
49.8	3,763	Total			

Summary for Subcatchment CB11_c: CB11_c

Runoff = 5.98 cfs @ 12.41 hrs, Volume= 0.823 af, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
1.365	55	Woods, Good, HSG B
3.334	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.000	70	Woods, Good, HSG C
2.048	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
8.613	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
0.000	84	50-75% Grass cover, Fair, HSG D
0.596	98	Paved parking & roofs
0.617	85	Gravel roads, HSG B
1.291	89	Gravel roads, HSG C
17.864	74	Weighted Average
17.268		Pervious Area
0.596		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.5	150	0.3300	0.13		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
10.8	930	0.3300	1.44		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.5	98	0.1800	1.06		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	27	0.2100	7.38		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.4	106	0.2600	1.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	35	0.3000	8.82		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	72	0.2800	3.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	38	0.2500	8.05		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	207	0.2600	3.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	32	0.3000	8.82		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	97	0.2200	3.28		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.8	168	0.1600	1.00		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
38.2	1,960	Total			

Summary for Subcatchment CB11_d: Clay A11_d

Runoff = 1.79 cfs @ 12.34 hrs, Volume= 0.258 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
1.703	55	Woods, Good, HSG B
1.541	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
2.533	70	Woods, Good, HSG C
1.027	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.000	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
0.000	84	50-75% Grass cover, Fair, HSG D
0.296	98	Paved parking & roofs
0.702	85	Gravel roads, HSG B
0.425	89	Gravel roads, HSG C
8.227	69	Weighted Average
7.931		Pervious Area
0.296		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.1	150	0.2700	0.12		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
5.3	414	0.2700	1.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	19	0.2300	3.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	55	0.2600	3.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	23	0.2900	8.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	137	0.2200	3.28		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	49	0.2000	7.20		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.6	319	0.2200	3.28		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	42	0.3600	1.50		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	30	0.3500	1.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	28	0.3100	8.96		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	109	0.2400	3.43		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	28	0.1400	0.94		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
31.1	1,403	Total			

Summary for Subcatchment CB11_e: Clay A11_e

Runoff = 0.56 cfs @ 12.93 hrs, Volume= 0.236 af, Depth= 0.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
13.289	55	Woods, Good, HSG B
0.386	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
5.340	70	Woods, Good, HSG C
0.089	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.000	77	Woods, Good, HSG D
0.000	80	>75% Grass cover, Good, HSG D
0.000	84	50-75% Grass cover, Fair, HSG D
0.115	98	Paved parking & roofs
19.219	60	Weighted Average
19.104		Pervious Area
0.115		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.8	150	0.1800	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
29.4	1,870	0.1800	1.06		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
54.2	2,020	Total			

Summary for Subcatchment RB01: RB01

Runoff = 3.12 cfs @ 12.64 hrs, Volume= 0.864 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
5.835	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
10.144	49	50-75% Grass cover, Fair, HSG A
3.305	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
1.492	69	50-75% Grass cover, Fair, HSG B
10.854	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
10.298	79	50-75% Grass cover, Fair, HSG C
0.010	98	Paved parking & roofs
4.232	77	Woods, Good, HSG D
2.823	80	>75% Grass cover, Good, HSG D
48.993	63	Weighted Average
48.983		Pervious Area
0.010		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	104	0.1900	0.37		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
8.0	46	0.2900	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
11.9	964	0.2900	1.35		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	140	0.2500	1.25		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.3	534	0.3100	3.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.4	440	0.3000	1.37		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	90	0.1700	2.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.9	317	0.1300	0.90		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.7	577	0.1400	2.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	403	0.1400	19.37	522.93	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
44.6	3,615	Total			

Summary for Subcatchment RB01_a: RB01_a

Runoff = 0.45 cfs @ 12.12 hrs, Volume= 0.064 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	0.023	30	Woods, Good, HSG A
	0.087	39	>75% Grass cover, Good, HSG A
	2.325	49	50-75% Grass cover, Fair, HSG A
	0.000	55	Woods, Good, HSG B
	0.000	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.000	70	Woods, Good, HSG C
	0.000	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	0.327	98	Paved parking & roofs
*	0.141	100	water
	1.196	76	Gravel roads, HSG A
	4.099	62	Weighted Average
	3.631		Pervious Area
	0.468		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	150	0.0911	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
2.2	285	0.0911	2.11		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	182	0.0900	4.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	120	0.0500	10.97	77.55	**Circular Channel (pipe),** Diam= 36.0" Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.025 Corrugated metal
11.5	737	Total			

Summary for Subcatchment RB02: RB02

Runoff = 0.04 cfs @ 24.11 hrs, Volume= 0.017 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
19.246	30	Woods, Good, HSG A
0.010	39	>75% Grass cover, Good, HSG A
7.317	49	50-75% Grass cover, Fair, HSG A
0.763	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.107	69	50-75% Grass cover, Fair, HSG B
8.582	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
3.511	79	50-75% Grass cover, Fair, HSG C
0.191	98	Paved parking & roofs
0.030	76	Gravel roads, HSG A
0.383	80	>75% Grass cover, Good, HSG D
0.950	77	Woods, Good, HSG D
41.090	48	Weighted Average
40.899		Pervious Area
0.191		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	46	0.3800	0.41		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
16.0	104	0.2600	0.11		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
8.7	668	0.2600	1.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	107	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.8	139	0.2700	1.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	388	0.2700	3.64		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.7	381	0.2000	1.12		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	134	0.2200	3.28		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	752	0.1120	0.84		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	713	0.1200	17.93	484.14	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
52.8	3,432	Total			

Summary for Subcatchment RB03: RB03

Runoff = 5.52 cfs @ 11.99 hrs, Volume= 0.293 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	0.028	30	Woods, Good, HSG A
	0.937	39	>75% Grass cover, Good, HSG A
	0.094	49	50-75% Grass cover, Fair, HSG A
	0.000	55	Woods, Good, HSG B
	0.000	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.000	70	Woods, Good, HSG C
	0.000	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	2.188	98	Paved parking & roofs
	1.535	76	Gravel roads, HSG A
*	0.083	100	water
	4.865	78	Weighted Average
	2.594		Pervious Area
	2.271		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	52	0.0950	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
1.4	184	0.0700	2.22		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
1.0	58	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	64	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.9	305	0.1200	5.58		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.1	663	Total			

Summary for Subcatchment RB04_a, RB04_b: RB04_a, RB04_b

Runoff = 4.12 cfs @ 12.01 hrs, Volume= 0.344 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	2.755	30	Woods, Good, HSG A
	1.749	39	>75% Grass cover, Good, HSG A
	0.272	49	50-75% Grass cover, Fair, HSG A
	5.766	55	Woods, Good, HSG B
	0.800	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.000	70	Woods, Good, HSG C
	0.000	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	4.922	98	Paved parking & roofs
	0.485	76	Gravel roads, HSG A
	0.712	85	Gravel roads, HSG B
	0.000	89	Gravel roads, HSG C
*	0.043	100	water
	17.504	64	Weighted Average
	12.539		Pervious Area
	4.965		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	27	0.4800	3.27		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
2.5	183	0.2400	1.22		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.0	31	0.1400	22.24	279.48	**Circular Channel (pipe),** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.025 Corrugated metal
1.4	79	0.1500	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	353	0.1500	15.99	223.93	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=2.00' Z= 2.0 '/' Top.W=11.00' n= 0.040
0.3	407	0.1400	22.24	279.48	**Circular Channel (pipe),** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.025 Corrugated metal
0.1	75	0.1800	17.52	245.30	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=2.00' Z= 2.0 '/' Top.W=11.00' n= 0.040
0.0	40	0.0700	15.73	197.62	**Circular Channel (pipe),** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.025 Corrugated metal
1.0	759	0.0900	12.39	173.46	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=2.00' Z= 2.0 '/' Top.W=11.00' n= 0.040
5.8	1,954	Total			

Summary for Subcatchment RB04_c: RB04_c

Runoff = 0.01 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
4.318	30	Woods, Good, HSG A
0.145	76	Gravel roads, HSG A
2.426	39	>75% Grass cover, Good, HSG A
0.426	49	50-75% Grass cover, Fair, HSG A
1.729	98	Paved parking & roofs
9.044	47	Weighted Average
7.315		Pervious Area
1.729		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	72	0.1100	0.27		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
0.6	61	0.1200	1.73		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	40	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	28	0.1400	6.02		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	43	0.1100	1.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	1,271	0.1100	13.70	191.76	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=2.00' Z= 2.0 '/' Top.W=11.00' n= 0.040
7.1	1,515	Total			

Summary for Subcatchment RB05_a, RB05_b, RB05_c: RB05_a, RB05_b, RB05_c

Runoff = 2.72 cfs @ 12.39 hrs, Volume= 0.608 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
22.912	55	Woods, Good, HSG B
2.698	61	>75% Grass cover, Good, HSG B
3.116	69	50-75% Grass cover, Fair, HSG B
0.000	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
4.542	98	Paved parking & roofs
1.244	85	Gravel roads, HSG B
0.000	89	Gravel roads, HSG C
34.512	63	Weighted Average
29.970		Pervious Area
4.542		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	48	0.1900	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
4.2	92	0.2000	0.36		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
12.1	871	0.2300	1.20		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	39	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.4	108	0.2500	1.25		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	61	0.2300	7.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	67	0.2000	3.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	80	0.0500	8.37	26.30	**Circular Channel (pipe),** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
0.5	424	0.0900	13.54	162.52	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
0.3	304	0.1900	16.32	51.28	**Circular Channel (pipe),** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
0.0	40	0.1000	14.28	171.31	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
0.1	60	0.1600	14.98	47.05	**Circular Channel (pipe),** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
0.0	40	0.1000	14.28	171.31	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
0.2	152	0.1900	16.32	51.28	**Circular Channel (pipe),** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
0.2	185	0.1100	14.97	179.68	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035
0.1	50	0.1900	16.32	51.28	**Circular Channel (pipe),** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
0.2	208	0.1100	14.97	179.68	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035
0.0	35	0.1900	16.32	51.28	**Circular Channel (pipe),** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
0.2	170	0.1100	14.97	179.68	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035
30.2	3,034	Total			

Summary for Subcatchment RB06: RB06

Runoff = 2.16 cfs @ 11.97 hrs, Volume= 0.138 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.159	30	Woods, Good, HSG A
0.098	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
1.285	55	Woods, Good, HSG B
1.341	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.000	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.941	98	Paved parking & roofs
0.030	76	Gravel roads, HSG A
0.552	85	Gravel roads, HSG B
4.406	69	Weighted Average
3.465		Pervious Area
0.941		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	22	0.1600	2.02		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
2.5	46	0.1900	0.31		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
0.1	26	0.2000	7.20		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	63	0.2200	3.28		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	34	0.2200	2.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.0	30	0.0500	10.97	77.55	**Circular Channel (pipe),** Diam= 36.0" Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.025 Corrugated metal
0.0	21	0.1700	18.61	223.37	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
3.3	242	Total			

Summary for Subcatchment RB07: RB07

Runoff = 0.01 cfs @ 24.01 hrs, Volume= 0.003 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
1.520	30	Woods, Good, HSG A
0.304	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.000	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.596	98	Paved parking & roofs
0.212	76	Gravel roads, HSG A
2.632	50	Weighted Average
2.036		Pervious Area
0.596		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.1000	1.43		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
19.3	73	0.0800	0.06		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
5.1	68	0.0690	0.22		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
3.9	10	0.0800	0.04		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
0.2	24	0.0800	1.98		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.4	335	0.0900	0.75		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
36.0	520	Total			

Summary for Subcatchment RB08: RB08

Runoff = 0.16 cfs @ 12.99 hrs, Volume= 0.089 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.475	69	50-75% Grass cover, Fair, HSG B
10.046	55	Woods, Good, HSG B
0.381	61	>75% Grass cover, Good, HSG B
0.010	79	50-75% Grass cover, Fair, HSG C
0.082	98	Paved parking & roofs
0.290	85	Gravel roads, HSG B
0.042	70	Woods, Good, HSG C
11.326	57	Weighted Average
11.244		Pervious Area
0.082		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	150	0.3000	0.12		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
6.5	533	0.3000	1.37		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	39	0.4100	4.48		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.7	534	0.2800	1.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.9	68	0.2700	1.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	335	0.0700	5.23	62.71	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.080 Earth, long dense weeds
35.5	1,659	Total			

Summary for Subcatchment RB09: RB09

Runoff = 3.14 cfs @ 12.21 hrs, Volume= 0.315 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
6.138	70	Woods, Good, HSG C
0.328	74	>75% Grass cover, Good, HSG C
0.050	79	50-75% Grass cover, Fair, HSG C
0.199	98	Paved parking & roofs
0.634	89	Gravel roads, HSG C
7.349	73	Weighted Average
7.150		Pervious Area
0.199		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	150	0.3000	0.12		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
1.9	160	0.3000	1.37		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	853	0.0800	12.77	153.23	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
23.2	1,163	Total			

Summary for Subcatchment RB10: RB10

Runoff = 0.30 cfs @ 12.33 hrs, Volume= 0.079 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
3.961	55	Woods, Good, HSG B
0.223	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.607	70	Woods, Good, HSG C
0.314	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.236	98	Paved parking & roofs
0.027	89	Gravel roads, HSG C
0.307	85	Gravel roads, HSG B
5.675	61	Weighted Average
5.439		Pervious Area
0.236		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.8	150	0.3600	0.13		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
5.3	410	0.2700	1.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	209	0.0900	13.54	162.52	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035
24.4	769	Total			

Summary for Subcatchment RB11: RB11

Runoff = 0.70 cfs @ 12.04 hrs, Volume= 0.047 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.564	70	Woods, Good, HSG C
0.051	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.000	98	Paved parking & roofs
0.265	89	Gravel roads, HSG C
0.880	76	Weighted Average
0.880		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	64	0.3600	0.11		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
1.4	95	0.2000	1.12		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	281	0.0800	12.77	153.23	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
11.3	440	Total			

Summary for Subcatchment RB12: RB12

Runoff = 0.77 cfs @ 12.18 hrs, Volume= 0.073 af, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
1.169	70	Woods, Good, HSG C
0.050	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.013	98	Paved parking & roofs
0.342	89	Gravel roads, HSG C
1.574	74	Weighted Average
1.561		Pervious Area
0.013		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	150	0.2800	0.12		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
0.8	62	0.2800	1.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
21.6	212	Total			

Summary for Subcatchment RB13: RB13

Runoff = 3.14 cfs @ 12.31 hrs, Volume= 0.385 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
6.351	70	Woods, Good, HSG C
1.645	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.309	98	Paved parking & roofs
0.672	89	Gravel roads, HSG C
8.977	73	Weighted Average
8.668		Pervious Area
0.309		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.4	150	0.2600	0.12		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
1.0	78	0.2600	1.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	29	0.1300	0.90		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	57	0.1400	2.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.4	195	0.1500	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	27	0.1300	2.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.3	67	0.1100	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.6	111	0.1700	2.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.9	159	0.3000	1.37		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	79	0.2800	3.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
31.1	952	Total			

Summary for Subcatchment RB14: RB14

Runoff = 3.34 cfs @ 12.11 hrs, Volume= 0.252 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
2.254	70	Woods, Good, HSG C
0.790	74	>75% Grass cover, Good, HSG C
0.278	79	50-75% Grass cover, Fair, HSG C
0.457	98	Paved parking & roofs
0.674	89	Gravel roads, HSG C
4.453	77	Weighted Average
3.996		Pervious Area
0.457		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	43	0.3500	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
0.1	11	0.4200	2.59		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
0.1	30	0.3300	4.02		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.4	175	0.2400	1.22		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	29	0.1800	6.83		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	14	0.1400	0.94		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.0	162	0.1300	0.90		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.6	83	0.1100	2.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.9	156	0.1300	0.90		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	76	0.1300	2.52		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.9	779	Total			

Summary for Subcatchment RB15: RB15

Runoff = 0.21 cfs @ 12.31 hrs, Volume= 0.047 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
2.014	55	Woods, Good, HSG B
0.234	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.264	70	Woods, Good, HSG C
0.095	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.068	98	Paved parking & roofs
0.070	89	Gravel roads, HSG C
0.235	85	Gravel roads, HSG B
2.980	62	Weighted Average
2.912		Pervious Area
0.068		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.4	150	0.2600	0.12		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
2.2	168	0.2680	1.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	27	0.2200	7.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	251	0.2400	22.12	265.40	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
23.9	596	Total			

Summary for Subcatchment RB16: RB16

Runoff = 0.16 cfs @ 12.46 hrs, Volume= 0.047 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
2.312	55	Woods, Good, HSG B
0.479	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.087	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.102	98	Paved parking & roofs
0.035	89	Gravel roads, HSG C
0.345	82	Dirt roads, HSG B
3.360	61	Weighted Average
3.258		Pervious Area
0.102		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.7	150	0.1500	0.09		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
4.3	250	0.1500	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	181	0.2000	17.63	141.01	**Trap/Vee/Rect Channel Flow,** Bot.W=0.00' D=2.00' Z= 2.0 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
31.2	581	Total			

Summary for Subcatchment RB17: RB17

Runoff = 0.23 cfs @ 12.25 hrs, Volume= 0.043 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
1.581	55	Woods, Good, HSG B
0.317	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.000	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.088	98	Paved parking & roofs
0.054	89	Gravel roads, HSG C
0.401	85	Gravel roads, HSG B
2.441	63	Weighted Average
2.353		Pervious Area
0.088		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	150	0.3200	0.13		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
2.0	166	0.3200	1.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	280	0.0700	11.94	143.33	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
22.1	596	Total			

Summary for Subcatchment RB18: RB18

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	2.317	30	Woods, Good, HSG A
	0.855	39	>75% Grass cover, Good, HSG A
	0.000	49	50-75% Grass cover, Fair, HSG A
	0.000	55	Woods, Good, HSG B
	0.000	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.000	70	Woods, Good, HSG C
	0.000	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	0.430	98	Paved parking & roofs
*	0.058	100	water
	0.035	76	Gravel roads, HSG A
	3.695	42	Weighted Average
	3.207		Pervious Area
	0.488		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	24	0.1200	1.83		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.40"
2.1	36	0.1800	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
9.2	432	0.0990	0.79		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.6	558	0.0900	15.53	419.28	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
12.1	1,050	Total			

Summary for Subcatchment RB19: RB19

Runoff = 11.47 cfs @ 12.69 hrs, Volume= 2.319 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
8.085	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
26.815	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.830	79	50-75% Grass cover, Fair, HSG C
0.000	98	Paved parking & roofs
26.893	77	Woods, Good, HSG D
0.299	80	>75% Grass cover, Good, HSG D
62.922	71	Weighted Average
62.922		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.3	150	0.1900	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
1.2	76	0.1900	1.09		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.3	49	0.1800	2.97		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.3	2,190	0.3600	1.50		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	35	0.3500	4.14		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.8	461	0.2800	1.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	859	0.2700	26.90	726.21	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
56.5	3,820	Total			

Summary for Subcatchment RB20: RB20

Runoff = 39.76 cfs @ 12.41 hrs, Volume= 5.613 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
0.000	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
2.965	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
4.875	69	50-75% Grass cover, Fair, HSG B
69.558	70	Woods, Good, HSG C
1.495	74	>75% Grass cover, Good, HSG C
11.947	79	50-75% Grass cover, Fair, HSG C
0.046	98	Paved parking & roofs
40.060	77	Woods, Good, HSG D
130.946	73	Weighted Average
130.900		Pervious Area
0.046		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.8	150	0.4100	0.14		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
18.7	1,797	0.4100	1.60		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.4	2,216	0.2500	25.88	698.79	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
37.9	4,163	Total			

Summary for Subcatchment RB21: RB21

Runoff = 12.88 cfs @ 12.19 hrs, Volume= 1.631 af, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
2.446	30	Woods, Good, HSG A
0.000	39	>75% Grass cover, Good, HSG A
0.221	49	50-75% Grass cover, Fair, HSG A
17.306	55	Woods, Good, HSG B
0.079	61	>75% Grass cover, Good, HSG B
4.220	69	50-75% Grass cover, Fair, HSG B
32.093	70	Woods, Good, HSG C
1.149	74	>75% Grass cover, Good, HSG C
3.919	79	50-75% Grass cover, Fair, HSG C
0.161	98	Paved parking & roofs
0.000	76	Gravel roads, HSG A
0.088	85	Gravel roads, HSG B
0.411	89	Gravel roads, HSG C
4.387	77	Woods, Good, HSG D
1.542	84	50-75% Grass cover, Fair, HSG D
68.022	66	Weighted Average
67.861		Pervious Area
0.161		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	150	0.2600	3.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	64	0.2600	3.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.6	456	0.2900	1.35		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	32	0.3600	4.20		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	102	0.3500	1.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.9	241	0.3800	4.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.5	116	0.2500	1.25		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	178	0.2500	3.50		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.9	590	0.2500	1.25		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
18.9	1,929	Total			

Summary for Subcatchment RB22_a: RB22_a

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
18.573	30	Woods, Good, HSG A
0.438	39	>75% Grass cover, Good, HSG A
0.000	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.000	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.281	98	Paved parking & roofs
0.819	76	Gravel roads, HSG A
20.111	33	Weighted Average
19.830		Pervious Area
0.281		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.3	150	0.0800	0.07		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
4.7	204	0.0835	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	35	0.0600	3.94		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
23.2	1,014	0.0850	0.73		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.0	866	0.0850	15.09	407.46	**Trap/Vee/Rect Channel Flow,** Bot.W=3.00' D=3.00' Z= 2.0 '/' Top.W=15.00' n= 0.040
63.3	2,269	Total			

Summary for Subcatchment RB22_b: RB22_b

Runoff = 1.06 cfs @ 12.09 hrs, Volume= 0.118 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
1.312	30	Woods, Good, HSG A
0.134	76	Gravel roads, HSG A
2.301	49	50-75% Grass cover, Fair, HSG A
2.278	98	Paved roads w/curbs & sewers
6.025	64	Weighted Average
3.747		Pervious Area
2.278		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	93	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
1.4	130	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	52	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	16	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	6	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.1	77	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.3	374	Total			

Summary for Subcatchment RB23: RB23

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	10.569	30	Woods, Good, HSG A
	5.799	39	>75% Grass cover, Good, HSG A
	0.000	49	50-75% Grass cover, Fair, HSG A
	0.047	55	Woods, Good, HSG B
	0.001	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.000	70	Woods, Good, HSG C
	0.000	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	1.750	98	Paved parking & roofs
	0.770	76	Gravel roads, HSG A
*	0.584	100	water
	19.520	43	Weighted Average
	17.186		Pervious Area
	2.334		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.4	120	0.1200	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
3.0	54	0.1600	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
3.3	220	0.2000	1.12		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.5	49	0.0500	0.56		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.0	62	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.2	505	Total			

Summary for Subcatchment RB24: RB24

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

Area (ac)	CN	Description
3.746	30	Woods, Good, HSG A
0.161	39	>75% Grass cover, Good, HSG A
2.025	49	50-75% Grass cover, Fair, HSG A
0.000	55	Woods, Good, HSG B
0.000	61	>75% Grass cover, Good, HSG B
0.000	69	50-75% Grass cover, Fair, HSG B
0.000	70	Woods, Good, HSG C
0.000	74	>75% Grass cover, Good, HSG C
0.000	79	50-75% Grass cover, Fair, HSG C
0.339	98	Paved parking & roofs
0.966	76	Gravel roads, HSG A
7.237	45	Weighted Average
6.898		Pervious Area
0.339		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0	150	0.1600	0.10		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
11.1	666	0.1600	1.00		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.2	196	0.1500	2.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	215	0.1100	5.34		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.9	277	0.1200	2.42		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
40.9	1,504	Total			

Summary for Subcatchment RB25: RB25

Runoff = 0.30 cfs @ 12.51 hrs, Volume= 0.076 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	0.415	30	Woods, Good, HSG A
	1.367	39	>75% Grass cover, Good, HSG A
	0.000	49	50-75% Grass cover, Fair, HSG A
	0.000	55	Woods, Good, HSG B
	0.000	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.000	70	Woods, Good, HSG C
	0.000	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	0.615	98	Paved parking & roofs
*	0.021	100	water
	1.889	76	Gravel roads, HSG A
	4.307	63	Weighted Average
	3.671		Pervious Area
	0.636		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.4	150	0.1000	0.08		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 2.40"
3.1	145	0.1000	0.79		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	43	0.1000	6.42		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	82	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	530	0.0650	5.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
37.0	950	Total			

Summary for Subcatchment RB26: RB26

Runoff = 0.01 cfs @ 24.00 hrs, Volume= 0.004 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Type II 24-hr 1yearTypeII Rainfall=2.40"

	Area (ac)	CN	Description
	1.409	30	Woods, Good, HSG A
	2.424	39	>75% Grass cover, Good, HSG A
	0.000	49	50-75% Grass cover, Fair, HSG A
	0.111	55	Woods, Good, HSG B
	0.077	61	>75% Grass cover, Good, HSG B
	0.000	69	50-75% Grass cover, Fair, HSG B
	0.000	70	Woods, Good, HSG C
	0.000	74	>75% Grass cover, Good, HSG C
	0.000	79	50-75% Grass cover, Fair, HSG C
	0.075	98	Paved parking & roofs
*	0.735	100	water
	0.244	76	Gravel roads, HSG A
	0.030	85	Gravel roads, HSG B
	5.105	49	Weighted Average
	4.295		Pervious Area
	0.810		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	300	0.1400	0.40		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.40"
0.2	25	0.1400	2.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.3	220	0.1600	2.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	121	0.0500	10.97	77.55	**Circular Channel (pipe),** Diam= 36.0" Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.025 Corrugated metal
14.2	666	Total			

Summary for Reach 001_a: 001_a

Inflow Area = 793.374 ac, 0.02% Impervious, Inflow Depth > 0.58" for 1yearTypeII event
Inflow = 246.22 cfs @ 12.45 hrs, Volume= 38.361 af, Incl. 0.10 cfs Base Flow
Outflow = 244.49 cfs @ 12.49 hrs, Volume= 38.361 af, Atten= 1%, Lag= 2.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 10.48 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 5.72 fps, Avg. Travel Time= 2.1 min

Peak Storage= 17,321 cf @ 12.47 hrs, Average Depth at Peak Storage= 1.98'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,338.55 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 737.0' Slope= 0.1018 '/'
Inlet Invert= 1,830.00', Outlet Invert= 1,755.00'

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	3.5	2,580	19.90
1.00	8.8	6,486	65.46
1.50	14.5	10,687	119.85
2.00	23.9	17,614	252.13
2.50	36.5	26,901	480.73
3.00	48.6	35,818	734.41
4.00	73.8	54,391	1,338.55

Summary for Reach 001_b: 001_b

Inflow Area = 982.050 ac, 0.02% Impervious, Inflow Depth > 0.59" for 1yearTypeII event
Inflow = 284.84 cfs @ 12.50 hrs, Volume= 48.036 af, Incl. 0.10 cfs Base Flow
Outflow = 283.62 cfs @ 12.52 hrs, Volume= 48.035 af, Atten= 0%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 11.09 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 5.74 fps, Avg. Travel Time= 1.5 min

Peak Storage= 13,589 cf @ 12.50 hrs, Average Depth at Peak Storage= 2.07'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,338.55 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 528.0' Slope= 0.1894 '/'
Inlet Invert= 1,710.00', Outlet Invert= 1,610.00'

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	3.5	1,848	19.90
1.00	8.8	4,646	65.46
1.50	14.5	7,656	119.85
2.00	23.9	12,619	252.13
2.50	36.5	19,272	480.73
3.00	48.6	25,661	734.41
4.00	73.8	38,966	1,338.55

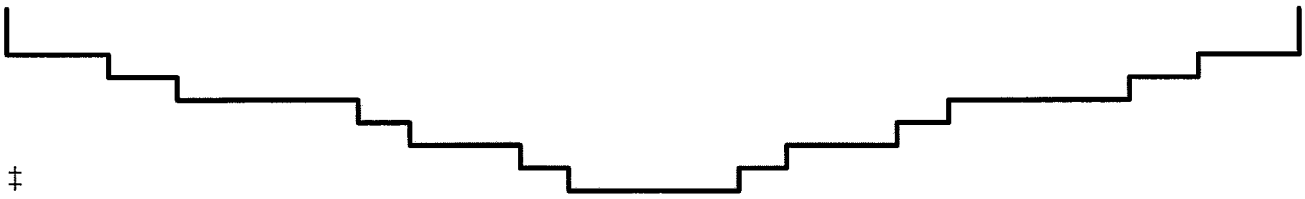
Summary for Reach 002_a: 002_a

Inflow Area = 1,099.333 ac, 0.47% Impervious, Inflow Depth > 0.63" for 1yearTypeII event
Inflow = 179.65 cfs @ 12.40 hrs, Volume= 57.375 af, Incl. 0.10 cfs Base Flow
Outflow = 179.47 cfs @ 12.52 hrs, Volume= 57.371 af, Atten= 0%, Lag= 7.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 8.84 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 7.11 fps, Avg. Travel Time= 3.2 min

Peak Storage= 27,702 cf @ 12.44 hrs, Average Depth at Peak Storage= 1.91'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,319.56 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 1,350.0' Slope= 0.0500 '/'
Inlet Invert= 1,515.00', Outlet Invert= 1,447.50'



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Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.5	3,375	17.76
1.00	6.4	8,640	42.08
1.50	13.5	18,225	107.00
2.00	22.1	29,835	198.43
2.50	36.0	48,600	382.32
3.00	51.9	70,065	631.84
4.00	89.6	120,960	1,319.56

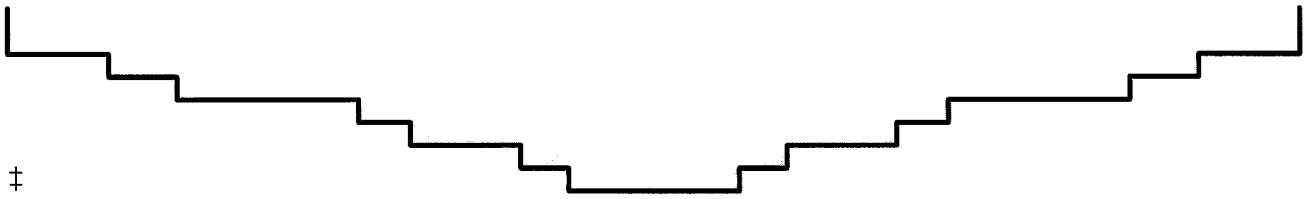
Summary for Reach 002_b: 002_b

Inflow Area = 1,119.496 ac, 0.66% Impervious, Inflow Depth > 0.64" for 1yearTypeII event
Inflow = 181.32 cfs @ 12.51 hrs, Volume= 60.010 af, Incl. 0.10 cfs Base Flow
Outflow = 180.68 cfs @ 12.62 hrs, Volume= 60.005 af, Atten= 0%, Lag= 6.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 8.85 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 7.11 fps, Avg. Travel Time= 3.2 min

Peak Storage= 28,419 cf @ 12.54 hrs, Average Depth at Peak Storage= 1.91'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,319.56 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 1,380.0' Slope= 0.0652 '/'
Inlet Invert= 1,505.00', Outlet Invert= 1,415.00'



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Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.5	3,450	17.76
1.00	6.4	8,832	42.08
1.50	13.5	18,630	107.00
2.00	22.1	30,498	198.43
2.50	36.0	49,680	382.32
3.00	51.9	71,622	631.84
4.00	89.6	123,648	1,319.56

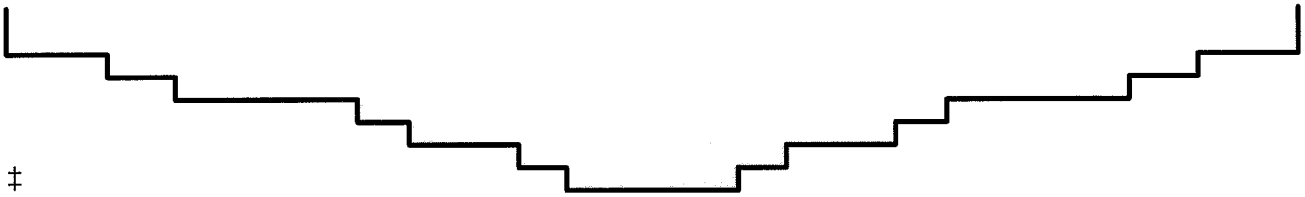
Summary for Reach 003_a: 003_a

Inflow Area = 1,142.315 ac, 0.70% Impervious, Inflow Depth > 0.65" for 1yearTypeII event
Inflow = 180.78 cfs @ 12.62 hrs, Volume= 61.659 af, Incl. 0.10 cfs Base Flow
Outflow = 179.04 cfs @ 12.79 hrs, Volume= 61.651 af, Atten= 1%, Lag= 9.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 8.83 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 7.11 fps, Avg. Travel Time= 4.9 min

Peak Storage= 42,690 cf @ 12.71 hrs, Average Depth at Peak Storage= 1.90'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,319.56 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 2,100.0' Slope= 0.0500 '/'
Inlet Invert= 1,415.00', Outlet Invert= 1,310.00'



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Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.5	5,250	17.76
1.00	6.4	13,440	42.08
1.50	13.5	28,350	107.00
2.00	22.1	46,410	198.43
2.50	36.0	75,600	382.32
3.00	51.9	108,990	631.84
4.00	89.6	188,160	1,319.56

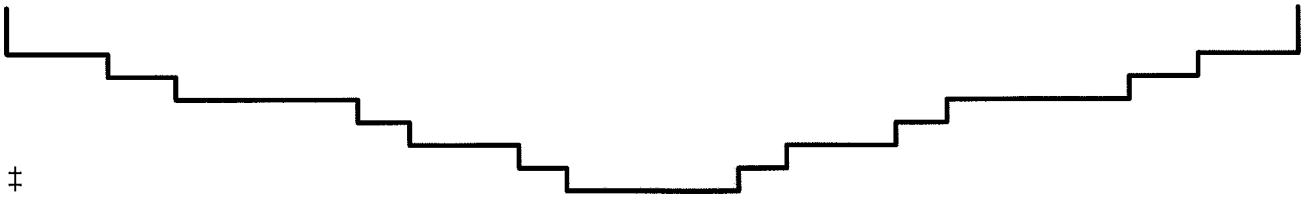
Summary for Reach 003_b: 003_b

Inflow Area = 102.389 ac, 2.04% Impervious, Inflow Depth > 0.61" for 1yearTypeII event
Inflow = 19.93 cfs @ 12.51 hrs, Volume= 5.242 af, Incl. 0.10 cfs Base Flow
Outflow = 18.86 cfs @ 12.74 hrs, Volume= 5.239 af, Atten= 5%, Lag= 14.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 7.10 fps, Min. Travel Time= 6.5 min
Avg. Velocity = 7.10 fps, Avg. Travel Time= 6.5 min

Peak Storage= 7,422 cf @ 12.63 hrs, Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,319.56 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 2,767.0' Slope= 0.0813 '/'
Inlet Invert= 1,535.00', Outlet Invert= 1,310.00'



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Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.5	6,918	17.76
1.00	6.4	17,709	42.08
1.50	13.5	37,355	107.00
2.00	22.1	61,151	198.43
2.50	36.0	99,612	382.32
3.00	51.9	143,607	631.84
4.00	89.6	247,923	1,319.56

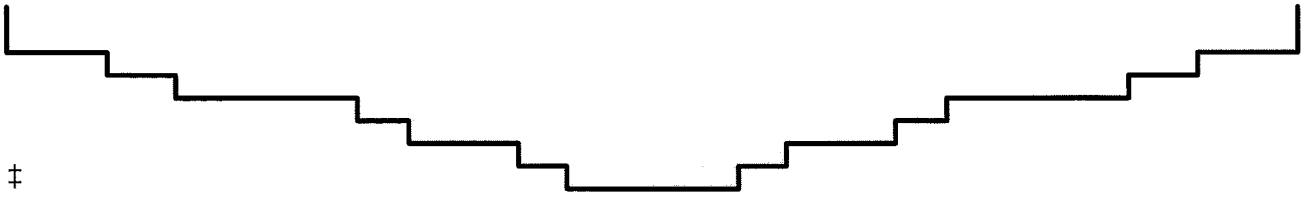
Summary for Reach 003_c: 003_c

Inflow Area = 1,401.230 ac, 1.03% Impervious, Inflow Depth > 0.61" for 1yearTypeII event
Inflow = 205.63 cfs @ 12.76 hrs, Volume= 70.929 af, Incl. 0.10 cfs Base Flow
Outflow = 205.45 cfs @ 12.79 hrs, Volume= 70.927 af, Atten= 0%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 9.08 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 7.11 fps, Avg. Travel Time= 0.6 min

Peak Storage= 6,228 cf @ 12.77 hrs, Average Depth at Peak Storage= 2.02'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,319.56 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 275.0' Slope= 0.0364 '/'
Inlet Invert= 1,310.00', Outlet Invert= 1,300.00'



‡

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.5	688	17.76
1.00	6.4	1,760	42.08
1.50	13.5	3,713	107.00
2.00	22.1	6,078	198.43
2.50	36.0	9,900	382.32
3.00	51.9	14,273	631.84
4.00	89.6	24,640	1,319.56

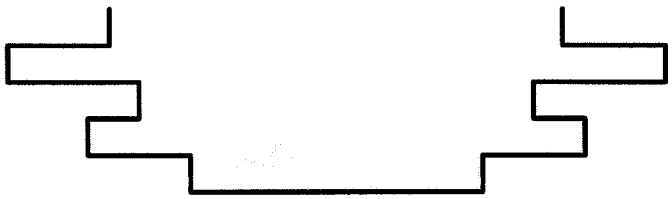
Summary for Reach 005_a: 005_a

Inflow Area = 193.868 ac, 0.02% Impervious, Inflow Depth > 0.59" for 1yearTypeII event
Inflow = 48.60 cfs @ 12.44 hrs, Volume= 9.585 af, Incl. 0.10 cfs Base Flow
Outflow = 48.03 cfs @ 12.46 hrs, Volume= 9.585 af, Atten= 1%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 8.89 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 6.34 fps, Avg. Travel Time= 0.9 min

Peak Storage= 1,860 cf @ 12.45 hrs, Average Depth at Peak Storage= 1.01'
Bank-Full Depth= 2.50', Capacity at Bank-Full= 190.18 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 340.0' Slope= 0.2206 '/'
Inlet Invert= 1,970.00', Outlet Invert= 1,895.00'



Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.0	680	12.65
1.00	5.4	1,836	48.00
1.50	8.1	2,754	82.98
2.00	12.6	4,284	156.48
2.50	15.7	5,338	190.18

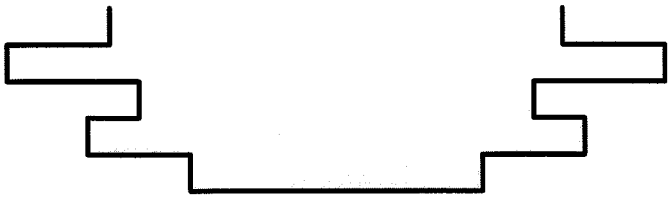
Summary for Reach 005_b: 005_b

Inflow Area = 299.170 ac, 0.84% Impervious, Inflow Depth > 0.53" for 1yearTypeII event
Inflow = 56.55 cfs @ 12.43 hrs, Volume= 13.294 af, Incl. 0.10 cfs Base Flow
Outflow = 54.77 cfs @ 12.63 hrs, Volume= 13.290 af, Atten= 3%, Lag= 11.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 9.24 fps, Min. Travel Time= 6.2 min
Avg. Velocity = 6.34 fps, Avg. Travel Time= 9.1 min

Peak Storage= 20,485 cf @ 12.53 hrs, Average Depth at Peak Storage= 1.10'
Bank-Full Depth= 2.50', Capacity at Bank-Full= 190.18 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 3,454.0' Slope= 0.1202 '/'
Inlet Invert= 1,895.00', Outlet Invert= 1,480.00'



Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.0	6,908	12.65
1.00	5.4	18,652	48.00
1.50	8.1	27,977	82.98
2.00	12.6	43,520	156.48
2.50	15.7	54,228	190.18

Summary for Reach 006: 006

Inflow Area = 409.149 ac, 1.54% Impervious, Inflow Depth > 0.52" for 1yearTypeII event
Inflow = 57.96 cfs @ 12.63 hrs, Volume= 17.834 af, Incl. 0.10 cfs Base Flow
Outflow = 57.08 cfs @ 12.70 hrs, Volume= 17.831 af, Atten= 2%, Lag= 4.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 8.53 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 5.76 fps, Avg. Travel Time= 2.8 min

Peak Storage= 6,543 cf @ 12.66 hrs, Average Depth at Peak Storage= 0.87'
Bank-Full Depth= 2.50', Capacity at Bank-Full= 607.78 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 970.0' Slope= 0.0567 '/'
Inlet Invert= 1,480.00', Outlet Invert= 1,425.00'

‡

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.5	2,425	14.36
1.00	8.2	7,954	72.36
1.50	16.1	15,617	176.28
2.00	26.7	25,899	347.19
2.50	38.8	37,636	607.78

Summary for Reach 007: 007

Inflow Area = 517.914 ac, 4.26% Impervious, Inflow Depth > 0.54" for 1yearTypeII event
Inflow = 64.28 cfs @ 12.68 hrs, Volume= 23.260 af, Incl. 0.10 cfs Base Flow
Outflow = 63.21 cfs @ 12.77 hrs, Volume= 23.253 af, Atten= 2%, Lag= 5.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 8.65 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 5.54 fps, Avg. Travel Time= 4.8 min

Peak Storage= 11,753 cf @ 12.72 hrs, Average Depth at Peak Storage= 0.93'
Bank-Full Depth= 2.50', Capacity at Bank-Full= 607.78 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 1,592.0' Slope= 0.0660 '/'
Inlet Invert= 1,425.00', Outlet Invert= 1,320.00'

‡

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.6	4,139	14.36
1.00	8.2	13,054	72.36
1.50	16.1	25,631	176.28
2.00	26.7	42,506	347.19
2.50	38.8	61,770	607.78

Summary for Reach 008: 008

Inflow Area = 544.050 ac, 4.53% Impervious, Inflow Depth > 0.52" for 1yearTypeII event
Inflow = 63.45 cfs @ 12.77 hrs, Volume= 23.371 af
Outflow = 63.45 cfs @ 12.77 hrs, Volume= 23.371 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs

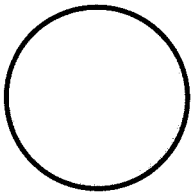
Summary for Reach Culvert: culvert

Inflow Area = 1,068.232 ac, 0.06% Impervious, Inflow Depth > 0.60" for 1yearTypeII event
Inflow = 309.84 cfs @ 12.52 hrs, Volume= 53.659 af, Incl. 0.10 cfs Base Flow
Outflow = 167.02 cfs @ 12.40 hrs, Volume= 53.657 af, Atten= 46%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 14.76 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.04 fps, Avg. Travel Time= 2.3 min

Peak Storage= 5,177 cf @ 12.30 hrs, Average Depth at Peak Storage= 4.00'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 167.02 cfs

48.0" Diameter Pipe, n= 0.025 Corrugated metal
Length= 412.0' Slope= 0.0500 '/'
Inlet Invert= 1,610.00', Outlet Invert= 1,589.40'



Summary for Reach Hotel: 005

Inflow Area = 106.284 ac, 3.09% Impervious, Inflow Depth > 0.33" for 1yearTypeII event
Inflow = 3.26 cfs @ 12.64 hrs, Volume= 2.892 af, Incl. 0.10 cfs Base Flow
Outflow = 3.21 cfs @ 12.73 hrs, Volume= 2.891 af, Atten= 2%, Lag= 5.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 6.33 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 6.33 fps, Avg. Travel Time= 2.8 min

Peak Storage= 536 cf @ 12.69 hrs, Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 2.50', Capacity at Bank-Full= 190.18 cfs

Custom stage-discharge table
Intermediate values determined by Linear interpolation
Length= 1,050.0' Slope= 0.0286 '/'
Inlet Invert= 1,510.00', Outlet Invert= 1,480.00'

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
0.50	2.0	2,100	12.65
1.00	5.4	5,670	48.00
1.50	8.1	8,505	82.98
2.00	12.6	13,230	156.48
2.50	15.7	16,485	190.18

Summary for Reach Trib A: Trib A

Inflow Area = 20.779 ac, 4.64% Impervious, Inflow Depth > 1.50" for 1yearTypeII event
Inflow = 8.65 cfs @ 12.20 hrs, Volume= 2.605 af, Incl. 0.10 cfs Base Flow
Outflow = 8.25 cfs @ 12.33 hrs, Volume= 2.602 af, Atten= 5%, Lag= 7.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Max. Velocity= 5.29 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 1.16 fps, Avg. Travel Time= 17.9 min

Peak Storage= 1,985 cf @ 12.25 hrs, Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 3.00', Capacity at Bank-Full= 423.80 cfs

3.00' x 3.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 2.0 '/' Top Width= 15.00'
Length= 1,250.0' Slope= 0.0704 '/'
Inlet Invert= 1,540.00', Outlet Invert= 1,452.00'

Summary for Pond 1P: Basin 1

Inflow Area = 7.757 ac, 57.96% Impervious, Inflow Depth = 0.87" for 1yearTypeII event
Inflow = 11.39 cfs @ 11.91 hrs, Volume= 0.564 af
Outflow = 0.72 cfs @ 13.00 hrs, Volume= 0.563 af, Atten= 94%, Lag= 65.0 min
Primary = 0.72 cfs @ 13.00 hrs, Volume= 0.563 af

Routing by Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Starting Elev= 1,559.00' Surf.Area= 6,768 sf Storage= 19,980 cf
Peak Elev= 1,560.63' @ 13.00 hrs Surf.Area= 8,577 sf Storage= 32,492 cf (12,512 cf above start)

Plug-Flow detention time= 2,359.3 min calculated for 0.105 af (19% of inflow)
Center-of-Mass det. time= 714.9 min (1,563.4 - 848.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,554.00'	50,734 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,554.00	1,872	0	0
1,554.50	2,223	1,024	1,024
1,555.00	2,574	1,199	2,223
1,555.50	2,961	1,384	3,607
1,556.00	3,348	1,577	5,184
1,556.50	3,785	1,783	6,967
1,557.00	4,221	2,002	8,969
1,557.50	4,869	2,273	11,241
1,558.00	5,517	2,597	13,838
1,558.50	6,142	2,915	16,753
1,559.00	6,768	3,228	19,980
1,559.50	7,312	3,520	23,500
1,560.00	7,857	3,792	27,292
1,560.50	8,429	4,072	31,364
1,561.00	9,000	4,357	35,721
1,561.50	9,675	4,669	40,390
1,562.00	10,350	5,006	45,396
1,562.50	11,000	5,338	50,734

Device	Routing	Invert	Outlet Devices
#1	Primary	1,559.00'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#2	Primary	1,559.50'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Primary	1,560.00'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#4	Primary	1,560.50'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#5	Primary	1,561.00'	**143.0 deg x 2.0' long Sharp-Crested Vee/Trap Weir** C= 2.47

Primary OutFlow Max=0.72 cfs @ 13.00 hrs HW=1,560.63' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.10 cfs @ 6.07 fps)
- **2=Orifice/Grate** (Orifice Controls 0.08 cfs @ 5.02 fps)
- **3=Orifice/Grate** (Orifice Controls 0.06 cfs @ 3.69 fps)
- **4=Orifice/Grate** (Weir Controls 0.48 cfs @ 1.18 fps)
- **5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Basin 3

Inflow Area =	4.865 ac,	46.68% Impervious,	Inflow Depth =	0.72"	for 1yearTypeII event
Inflow =	5.52 cfs @	11.99 hrs,	Volume=	0.293 af	
Outflow =	0.09 cfs @	21.76 hrs,	Volume=	0.293 af,	Atten= 98%, Lag= 586.2 min
Primary =	0.09 cfs @	21.76 hrs,	Volume=	0.293 af	

Routing by Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Starting Elev= 1,529.75' Surf.Area= 0 sf Storage= 12,807 cf
Peak Elev= 1,531.51' @ 21.76 hrs Surf.Area= 0 sf Storage= 22,210 cf (9,403 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 2,224.9 min (3,089.1 - 864.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,524.00'	50,704 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,524.00	0
1,525.00	261
1,526.00	1,089
1,527.00	2,831
1,528.00	5,314
1,529.00	9,365
1,529.50	11,718
1,530.00	13,896
1,530.50	16,379
1,531.00	19,166
1,531.50	22,172
1,532.00	25,265
1,532.50	28,575
1,533.00	32,147
1,533.50	36,111
1,534.00	40,554
1,534.50	45,520
1,535.00	50,704

Device	Routing	Invert	Outlet Devices
#1	Primary	1,529.75'	**1.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,531.00'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Primary	1,531.50'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#4	Primary	1,532.00'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#5	Primary	1,532.50'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#6	Primary	1,533.00'	**143.0 deg x 4.0' long Sharp-Crested Vee/Trap Weir** C= 2.47

Primary OutFlow Max=0.09 cfs @ 21.76 hrs HW=1,531.51' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.03 cfs @ 6.30 fps)
- **2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 3.28 fps)
- **3=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.27 fps)
- **4=Orifice/Grate** (Controls 0.00 cfs)
- **5=Orifice/Grate** (Controls 0.00 cfs)
- **6=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 4P: Basin 4

Inflow Area =	4.307 ac,	14.77% Impervious,	Inflow Depth =	0.21"	for 1yearTypeII event
Inflow =	0.30 cfs @	12.51 hrs, Volume=	0.076 af		
Outflow =	0.03 cfs @	24.34 hrs, Volume=	0.076 af,	Atten= 90%,	Lag= 709.7 min
Primary =	0.03 cfs @	24.34 hrs, Volume=	0.076 af		

Routing by Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Starting Elev= 1,485.80' Surf.Area= 0 sf Storage= 8,102 cf
Peak Elev= 1,486.49' @ 24.34 hrs Surf.Area= 0 sf Storage= 10,343 cf (2,241 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)

Center-of-Mass det. time= 1,191.4 min (2,167.3 - 975.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,481.00'	40,032 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,481.00	0
1,482.00	479
1,483.00	1,742
1,484.00	3,485
1,485.00	5,750
1,485.80	8,102
1,486.00	8,756
1,486.50	10,367
1,487.00	11,848
1,487.50	13,678
1,488.00	16,117
1,488.50	18,992
1,489.00	22,259
1,489.50	26,092
1,490.00	30,318
1,490.50	34,979
1,491.00	40,032

Device	Routing	Invert	Outlet Devices
#1	Primary	1,485.80'	**Special & User-Defined** Head (feet) 0.00 0.20 0.70 1.20 1.70 2.20 2.70 3.20 3.70 4.20 4.70 5.20 Disch. (cfs) 0.000 0.010 0.030 0.030 0.300 3.090 4.280 5.210 14.740 36.380 70.960 119.760

Primary OutFlow Max=0.03 cfs @ 24.34 hrs HW=1,486.49' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 0.03 cfs)

Summary for Pond 5P: Basin 5

Inflow Area = 2.632 ac, 22.64% Impervious, Inflow Depth = 0.02" for 1yearTypeII event
Inflow = 0.01 cfs @ 24.01 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 24.48 hrs, Volume= 0.003 af, Atten= 45%, Lag= 28.3 min
Primary = 0.00 cfs @ 24.48 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Starting Elev= 1,458.60' Surf.Area= 0 sf Storage= 2,744 cf
Peak Elev= 1,458.66' @ 24.48 hrs Surf.Area= 0 sf Storage= 2,839 cf (94 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 544.5 min (1,766.2 - 1,221.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,454.50'	10,019 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,454.50	0
1,455.00	44
1,456.00	261
1,457.00	784
1,458.00	1,830
1,458.60	2,744
1,459.00	3,398
1,459.50	4,356
1,460.00	5,489
1,460.50	6,839
1,461.00	8,320
1,461.50	10,019

Device	Routing	Invert	Outlet Devices
#1	Primary	1,458.60'	**Special & User-Defined** Head (feet) 0.00 0.40 0.90 1.40 1.90 2.40 2.90 Disch. (cfs) 0.000 0.020 2.700 12.570 34.370 69.050 118.030

Primary OutFlow Max=0.00 cfs @ 24.48 hrs HW=1,458.66' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 0.00 cfs)

Summary for Pond 6P: Basin 6

Inflow Area = 4.099 ac, 11.42% Impervious, Inflow Depth = 0.19" for 1yearTypeII event
Inflow = 0.45 cfs @ 12.12 hrs, Volume= 0.064 af
Outflow = 0.02 cfs @ 24.11 hrs, Volume= 0.064 af, Atten= 95%, Lag= 719.6 min
Primary = 0.02 cfs @ 24.11 hrs, Volume= 0.064 af

Routing by Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Starting Elev= 1,543.50' Surf.Area= 3,347 sf Storage= 8,027 cf
Peak Elev= 1,544.07' @ 24.11 hrs Surf.Area= 3,878 sf Storage= 10,083 cf (2,056 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 1,395.6 min (2,356.9 - 961.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,540.00'	31,465 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,540.00	1,547	0	0
1,540.50	1,709	814	814
1,541.00	1,883	898	1,712
1,541.50	2,132	1,004	2,716
1,542.00	2,403	1,134	3,850
1,542.50	2,627	1,258	5,107
1,543.00	2,853	1,370	6,477
1,543.50	3,347	1,550	8,027
1,544.00	3,843	1,798	9,825
1,544.50	4,113	1,989	11,814
1,545.00	4,383	2,124	13,938
1,545.50	4,954	2,334	16,272
1,546.00	5,526	2,620	18,892
1,546.50	5,846	2,843	21,735
1,547.00	6,165	3,003	24,738
1,547.50	6,728	3,223	27,961
1,548.00	7,290	3,505	31,465

Device	Routing	Invert	Outlet Devices
#1	Primary	1,543.50'	**1.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,544.00'	**1.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	1,544.50'	**12.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	1,546.00'	**143.0 deg x 4.0' long Sharp-Crested Vee/Trap Weir** C= 2.47

Primary OutFlow Max=0.02 cfs @ 24.11 hrs HW=1,544.07' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 0.02 cfs @ 3.48 fps)
- **2=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.87 fps)
- **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond 7P: Basin 7

Inflow Area =	3.076 ac,	2.96% Impervious,	Inflow Depth =	0.51"	for 1yearTypeII event
Inflow =	2.38 cfs @	11.99 hrs, Volume=	0.132 af		
Outflow =	0.03 cfs @	24.05 hrs, Volume=	0.131 af,	Atten= 99%,	Lag= 723.7 min
Primary =	0.03 cfs @	24.05 hrs, Volume=	0.131 af		

Routing by Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Starting Elev= 1,545.00' Surf.Area= 0 sf Storage= 6,839 cf
Peak Elev= 1,545.98' @ 24.05 hrs Surf.Area= 0 sf Storage= 11,409 cf (4,570 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 2,084.7 min (2,969.4 - 884.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,542.00'	20,125 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1,542.00	0
1,542.50	218
1,543.00	1,045
1,543.50	2,091
1,544.00	3,398
1,544.50	4,966
1,545.00	6,839
1,545.50	9,017
1,546.00	11,500
1,546.50	14,244
1,547.00	17,119
1,547.50	20,125

Device	Routing	Invert	Outlet Devices
#1	Primary	1,545.00'	**Special & User-Defined** Head (feet) 0.00 0.50 1.00 1.50 2.00 2.50 Disch. (cfs) 0.000 0.020 0.030 2.710 10.240 27.780

Primary OutFlow Max=0.03 cfs @ 24.05 hrs HW=1,545.98' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 0.03 cfs)

Summary for Pond 19P: Basin 8

Inflow Area = 7.237 ac, 4.68% Impervious, Inflow Depth = 0.00" for 1yearTypeII event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Starting Elev= 1,553.50' Surf.Area= 2,201 sf Storage= 4,470 cf
Peak Elev= 1,553.50' @ 0.00 hrs Surf.Area= 2,201 sf Storage= 4,470 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,550.00'	6,989 cf	**10.00'W x 50.00'L x 4.50'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	1,553.50'	**1.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1,553.75'	**8.0" Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#3	Primary	1,554.25'	**5.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,553.50' (Free Discharge)
├─**1=Orifice/Grate** (Controls 0.00 cfs)
├─**2=Orifice/Grate** (Controls 0.00 cfs)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 35P: Culverts

Inflow Area = 101.826 ac, 14.30% Impervious, Inflow Depth > 0.44" for 1yearTypeII event
Inflow = 12.38 cfs @ 12.33 hrs, Volume= 3.696 af
Outflow = 12.38 cfs @ 12.33 hrs, Volume= 3.696 af, Atten= 0%, Lag= 0.0 min
Primary = 12.38 cfs @ 12.33 hrs, Volume= 3.696 af

Routing by Stor-Ind method, Time Span= 0.00-200.00 hrs, dt= 0.10 hrs
Peak Elev= 1,453.27' @ 12.33 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	1,468.00'	**36.0" x 72.0' long Culvert** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,467.00' S= 0.0139 '/' Cc= 0.900 n= 0.025 Corrugated metal
#2	Primary	1,467.00'	**3.00' W x 3.00' H x 108.0' long stream** Ke= 0.050 Outlet Invert= 1,465.00' S= 0.0185 '/' Cc= 0.900 n= 0.035
#3	Primary	1,465.00'	**36.0" x 63.0' long Culvert** CMP, square edge headwall, Ke= 0.500 Outlet Invert= 1,465.00' S= 0.0000 '/' Cc= 0.900 n= 0.025
#4	Primary	1,465.00'	**3.00' W x 3.00' H x 256.0' long stream** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,464.30' S= 0.0027 '/' Cc= 0.900 n= 0.035
#5	Primary	1,464.30'	**36.0" x 45.0' long Culvert** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,464.29' S= 0.0002 '/' Cc= 0.900 n= 0.025 Corrugated metal
#6	Primary	1,464.29'	**3.00' W x 3.00' H x 104.0' long Stream** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,451.40' S= 0.1239 '/' Cc= 0.900 n= 0.035
#7	Primary	1,451.40'	**36.0" x 27.0' long Culvert** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,451.39' S= 0.0004 '/' Cc= 0.900 n= 0.025
#8	Primary	1,551.39'	**3.00' W x 3.00' H x 1,250.0' long Culvert** CMP, end-section conforming to fill, Ke= 0.500 Outlet Invert= 1,425.00' S= 0.1011 '/' Cc= 0.900 n= 0.035

Primary OutFlow Max=11.64 cfs @ 12.33 hrs HW=1,453.25' (Free Discharge)
- **1=Culvert** (Controls 0.00 cfs)
- **2=stream** (Controls 0.00 cfs)
- **3=Culvert** (Controls 0.00 cfs)
- **4=stream** (Controls 0.00 cfs)
- **5=Culvert** (Controls 0.00 cfs)
- **6=Stream** (Controls 0.00 cfs)
- **7=Culvert** (Barrel Controls 11.64 cfs @ 3.65 fps)
- **8=Culvert** (Controls 0.00 cfs)

Channel Protection Volume Analysis - Interim Condition
Sugarbush WQRP
VHB Pioneer
October 15, 2008

Watershed	Subwatershed	Stormwater Treatment Practice	Impervious Area (acres)	Detention Time Provided (hours)	CPv Met
Clay Brook	CB04	Wet Pond 1	5.74	11.9	Yes (99% of 12 hours)
	CB10_a	Wet Pond 7	2.12	34.8	Yes
	Subtotal Treated Impervious Area		7.86		
	Total Impervious Area		30.04		
	Percent of Impervious Area receiving CPv treatment		26%		
Rice	RB01_a	Wet Pond 6	1.52	23.3	Yes
	RB03	Wet Pond 3	3.72	37.1	Yes
	RB07	Wet Pond 5	0.81	9.1*	Yes
	RB24	Wet Pond 8	1.31	**	Yes
	RB25	Wet Pond 4	2.50	19.9	Yes
	Subtotal Treated Impervious Area		9.86		
	Total Impervious Area		38.90		
	Percent of Impervious Area receiving CPv treatment		25%		

*Maximum detention time provided by minimum recommended orifice size (1 inch)
** No inflow for 1 year Type II storm, channel protection volume requirement met

Channel Protection Volume Analysis - Post-Interim Condition
Sugarbush WQRP
VHB Pioneer
October 15, 2008

Watershed	Subwatershed	Stormwater Treatment Practice	Impervious Area (acres)	Detention Time Provided (hours)	CPv Met
Clay Brook	CB04	Wet Pond 1	6.07	12**	Yes
	CB10_a	Wet Pond 7	2.12	34.7	Yes
	Subtotal Treated Impervious Area		8.19		
	Total Impervious Area		30.40		
	Percent of Impervious Area receiving CPv treatment		27%		
Rice	RB01_a	Wet Pond 6	0.91	12**	Yes
	RB03	Wet Pond 3	3.52	12**	Yes
	RB07	Wet Pond 5	0.81	9.1*	Yes
	RB24	Wet Pond 8	1.30	***	Yes
	RB25	Wet Pond 4	2.50	19.9	Yes
	Subtotal Treated Impervious Area		9.04		
	Total Impervious Area		38.10		
	Percent of Impervious Area receiving CPv treatment		24%		

*Maximum detention time provided by minimum recommended orifice size (1 inch)
**Post-Interim Condition detention time design not finalized, to provide 12-hours or more detention
*** No inflow for 1 year Type II storm, channel protection volume requirement met

APPENDIX 3

Photograph 1: Vehicle maintenance yard with largely unmanaged drainage of runoff through areas of exposed soil (P-1).

Photograph 2: Minor erosion of roadside swale within Lincoln Peak Base Lodge area, with recent application of stone to stabilize (P-3).

Photographs taken by Krista Reinhart of VHB Pioneer on August 14, 2008.

Photograph 3: Eroding roadside swale along Inferno Road.

Photograph 4: Eroding drainage swale located
within South Village development area.

Photographs taken by Krista Reinhart of VHB Pioneer on August 14, 2008.

Photograph 5: Eroded roadside swale along South Village access road.

Photograph 6: Severely eroded drainage swale draining runoff from impervious surfaces within South Village development area.

Photographs taken by Krista Reinhart of VHB Pioneer on August 14, 2008.

Photograph 7: Eroded swale with staked hay bale to retain sediment transport within South Village development area.

Photograph 8: Eroded roadside swale conveying stormwater runoff from access road to Sugarbush Health and Racket Club to Rice Brook (P-8).

Photographs taken by Krista Reinhart of VHB Pioneer on August 14, 2008.

Photograph 9: Moderately heavy iron seep (IS-01) in Clay Brook just upstream from monitoring station BIO 2.0.

Photograph 10: Severe iron seep (IS-02) at the outflow of the 72-inch culvert in Clay Brook.

Photographs taken by Jacob Riley of VHB Pioneer on August 14, 2008.

Photograph 11: Iron seep (IS-03) upstream of the Lower Organ Grinder crossing of Clay Brook.

Photograph 12: Iron seep (IS-04) below maintenance facility in the Clay Brook watershed.

Photographs taken by Jacob Riley of VHB Pioneer on August 14, 2008.

Photograph 13: Iron seep (IS-05) at the downstream end of the Hotel Brook Restoration area.

Photograph 14. Iron seep (IS-06) from the stormwater outflow from basin 8 within the Hotel Brook restoration area.

Photographs taken by Jacob Riley of VHB Pioneer on August 14, 2008.

Photograph 15: Heavy iron seep (IS-07) in the headwaters of Hotel Brook, down-slope of Village Double chairlift.

Photograph 16: An iron seep (IS-08) in the tributary that flows on the down-slope side on the un-built lot along Village Road.

Photographs taken by Krista Reinhart and Jacob Riley of VHB Pioneer on August 14, 2008.

Photograph 17: The recent mass failure in Clay Brook downstream of Inferno Road.

Photograph 18. Undersized and perched culvert under Inferno Road in Clay Brook.

Photographs taken by Jacob Riley of VHB Pioneer on August 14, 2008.

Photograph 19: Undersized culvert in Clay Brook embedded in the concrete weir projects water at the left bank and has caused an eroded undercut bank (P-4).

Photograph 20: This recently abandon floodplain in Rice Brook is an indicator of historic incision.

Photographs taken by Jacob Riley of VHB Pioneer on August 14, 2008.

Photograph 21: Channel widening adjustment process in Rice Brook, as illustrated by the eroding banks and collapsing trees in a riffle.

Photograph 22: Accumulated sediment spanning the channel of the unnamed tributary. Photograph taken just upstream of the confluence with Rice Brook.

Photographs taken by Jacob Riley of VHB Pioneer on August 14, 2008.

Photograph 23: Parking lot behind Sugarbush Health and Racket Club, with stormwater runoff that is conveyed via a catch basin and underground culvert network directly to an unnamed tributary to Rice Brook (P-7).

Photograph taken by Krista Reinhart of VHB Pioneer on August 14, 2008.

APPENDIX 4

Phase 2 Segment Summary

October 6, 2008 SGAT Version: 4.56

Project: **Mad River**
Stream: **Clay Brook**
Reach # **T9.04**
Segment: **0**
Completion Date: **September 21, 2006**
Organization: **Friends of the Mad River**
Observers: **N. Miller, R. Hill**
Why Not assessed:
Rain: **Yes**
Segment Length (ft): **7,409**
Segment Location: **Extending from the confluence with Rice Brook upstream into the Sugar Bush ski resort to**

QC Status - Staff: Passed **Consultant: Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **None**
1.2 Alluvial Fan **None**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	676	316
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	109	73

1.4 Adjacent Side	Left	Right
Hillside Slope	Very Steep	Extremely
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Mixed	Bedrock

1.5 Valley Features
Valley Width (ft) **40**
Width Determination **Estimated**
Confinement Type **Semi-confined**
Rock Gorge? **No**
Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **23**
2.2 Max Depth (ft) **1.23**
2.3 Mean Depth (ft) **0.73**
2.4 Floodprone Width (ft) **27**

Notes:

Step 2. (Contued)

2.5 Aband. Floodpln **4.18** ft.
Human Elev Floodpln **0.00** ft.
2.6 Width/Depth Ratio **31.51**
2.7 Entrenchment Ratio **1.17**
2.8 Incision Ratio **3.40**
Human Elevated Inc Rat **0.00**
2.9 Sinuosity **Low**
2.10 Riffles Type **Complete**
2.11 Riffle/Step Spacing (ft) **30**
2.12 Substrate Composition

Bedrock	0%
Boulder	23%
Cobble	33%
Coarse Gravel	26%
Fine Gravel	14%
Sand	4%
Silt and smaller	0%

Silt/Clay Present? **Yes**
Detritus **1** %
Large Woody **187**
2.13 Average Largest Particle on

Bed	647.0	mm
Bar	410.0	mm

2.14 Stream Type
Stream Type: **F**
Bed Material: **Cobble**
Subclass Slope: **a**
Bed Form: **Step-Pool**
Field Measured Slope:
2.15 Reference Stream Type
(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	Multiple	40.40
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Mix	Mix
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	1,980	1,344
Erosion Height (ft)	3.83	4.74
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	106	69

Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Coniferous	Coniferous

Bank Canopy	Left	Right
Canopy %	76-100	76-100

Mid-Channel Canopy **Closed**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	0-25
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	None	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Commercial	Commercial
Mass Failures	0	0
Height	40	40
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**
4.2 Adjacent Wetlands **None**
4.3 Flow Status **Low**
4.4 # of Debris Jams **3**
4.5 Flow Regulation Type **None**
Flow Regulation Use
Impoundments **Small**
Impoundmt. Location **In Reach**
4.6 Up/Down strm flow reg **None**
(old) Upstrm Flow Reg **None**
4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	4	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**
Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
18	14	30
Diagonal	**Delta**	**Island**
0	4	8

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
18	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**
5.5 Straightening **None**
Straightening Length: **0**
5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Clay Brook** | Reach # **T9.04** | Segment: **0** | Completion Date: **September 21,**

Organization: **Friends of the Mad River** | Observers: **N. Miller, R. Hill** | Rain: **Yes**

Segment Length (ft): **7,409** | Segment Location: **Extending from the confluence with Rice Brook upstream into the Sugar Bush ski resort to**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**3.00**	**1.00**		
Dam	**Mid-segment**	**5.00**	**5.00**		
Ledge	**Mid-segment**	**10.00**	**10.00**		
Ledge	**Mid-segment**	**3.00**	**2.00**		
Weir	**Mid-segment**	**7.00**	**5.00**		
Ledge	**Mid-segment**	**5.00**	**3.00**		
Ledge	**Mid-segment**	**0.00**	**0.00**		
Ledge	**Mid-segment**	**5.00**	**4.00**		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Culvert	**7.70**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above,Scour Below**				
Culvert	**8.20**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above**				
Culvert	**3.90**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above,Scour Below**				
Culvert	**9.80**	**Yes**	**No**	**Yes**	**Yes**
Problem	**None**				
Culvert	**5.90**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bedrock	**15.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**None**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**Other**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**5**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**33**		
Geomorphic Rating	**0.4125**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**III**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**Very High**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	**18**
6.2 Embeddedness	**13**
6.3 Velocity/Depth Patterns	**18**
6.4 Sediment Deposition	**14**
6.5 Channel Flow Status	**13**
6.6 Channel Alteration	**18**
6.7 Frequency of Riffles/Steps	**18**
6.8 Bank Stability	**Left: 6 Right: 6**
6.9 Bank Vegetation Protection	**Left: 9 Right: 9**
6.10 Riparian Vegetation Zone Width	**Left: 9 Right: 9**
Total Score	**160**
Habitat Rating	**0.8**
Habitat Stream Condition	**Good**

Narrative:

Phase 2 Segment Summary

October 6, 2008 SGAT Version: 4.56

Project: **Mad River**
Stream: **Rice Brook**
Reach # **T9.3-S2.01**
Segment: **A**
Completion Date: **May 24, 2006**
Organization: **Friends of the Mad River**
Observers: **R Hill, N Miller**
Why Not assessed:
Rain: **Yes**
Segment Length (ft): **2,840**
Segment Location: **From confluence with Clay Brook upstream to sewage weir near tennis courts**

QC Status - Staff: Provisional Consultant: Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Other Reason**
1.2 Alluvial Fan **Yes**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	47	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	207	0

1.4 Adjacent Side

	Left	Right
Hillside Slope	Extremely	Extremely
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Mixed	Mixed

1.5 Valley Features
Valley Width (ft) **70**
Width Determination **Measured**
Confinement Type **Broad**
Rock Gorge? **No**
Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **35**
2.2 Max Depth (ft) **1.66**
2.3 Mean Depth (ft) **0.94**
2.4 Floodprone Width (ft) **55**

Notes:
Logging along left bank has added a lot of large woody debris to stream.

Step 2. (Contued)

2.5 Aband. Floodpln **3.32** ft.
Human Elev Floodpln **0.00** ft.
2.6 Width/Depth Ratio **37.66**
2.7 Entrenchment Ratio **1.55**
2.8 Incision Ratio **2.00**
Human Elevated Inc Rat **0.00**
2.9 Sinuosity **Low**
2.10 Riffles Type **Complete**
2.11 Riffle/Step Spacing (ft) **30**
2.12 Substrate Composition

Bedrock	0%
Boulder	6%
Cobble	31%
Coarse Gravel	23%
Fine Gravel	21%
Sand	19%
Silt and smaller	0%

Silt/Clay Present? **Yes**
Detritus **11** %
Large Woody **19**
2.13 Average Largest Particle on

Bed	27.0	mm
Bar	19.0	mm

2.14 Stream Type
Stream Type: **B**
Bed Material: **Gravel**
Subclass Slope: **a**
Bed Form: **Step-Pool**
Field Measured Slope:
2.15 Reference Stream Type
(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	Multiple	50.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Mix	Mix
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	365	654
Erosion Height (ft)	2.00	2.47
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	30	34

Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Coniferous	Coniferous

Bank Canopy	Left	Right
Canopy %	51-75	51-75

Mid-Channel Canopy **Closed**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	26-50	26-50
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	None	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Residential	Residential
Mass Failures	0	0
Height	50	50
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**
4.2 Adjacent Wetlands **None**
4.3 Flow Status **Moderate**
4.4 # of Debris Jams **2**
4.5 Flow Regulation Type **None**
Flow Regulation Use
Impoundments **None**
Impoundmt. Location
4.6 Up/Down strm flow reg
(old) Upstrm Flow Reg **None**
4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**
Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	0	2
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**
5.5 Straightening **None**
Straightening Length: **0**
5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Project: **Mad River**
Stream: **Rice Brook** Reach # **T9.3-S2.01** Segment: **A** Completion Date: **May 24, 2006**
Organization: **Friends of the Mad River** Observers: **R Hill, N Miller** Rain: **Yes**
Segment Length (ft): **2,840** Segment Location: **From confluence with Clay Brook upstream to sewage weir near tennis courts**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Culvert	**0.00**	**Yes**	**No**	**Yes**	**Yes**
Problem	**None**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**Other**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**5**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**34**		
Geomorphic Rating	**0.425**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**III**		
Geomorphic Condition	**Fair**		
Stream Sensitivity	**High**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	**16**
6.2 Embeddedness	**11**
6.3 Velocity/Depth Patterns	**18**
6.4 Sediment Deposition	**7**
6.5 Channel Flow Status	**9**
6.6 Channel Alteration	**18**
6.7 Frequency of Riffles/Steps	**18**
6.8 Bank Stability	**Left: 7 Right: 7**
6.9 Bank Vegetation Protection	**Left: 8 Right: 8**
6.10 Riparian Vegetation Zone Width	**Left: 7 Right: 9**
Total Score	**143**
Habitat Rating	**0.715**
Habitat Stream Condition	**Good**

Narrative:

Phase 2 Segment Summary

October 6, 2008 SGAT Version: 4.56

Project: **Mad River**
Stream: **Rice Brook**
Reach # **T9.3-S2.01**
Segment: **B**
Completion Date: **May 24, 2006**
Organization: **Friends of the Mad River**
Observers: **R Hill, N Miller**
Why Not assessed:
Rain: **Yes**
Segment Length (ft): **3,620**
Segment Location: **Sewage pipe weir near tennis courts upstream to headwaters**

QC Status - Staff: Provisional Consultant: Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Planform and Scope**
1.2 Alluvial Fan **Yes**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	230	0
height	0	0
Roads	822	203
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	875	367

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Extremely
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Mixed	Mixed

1.5 Valley Features
Valley Width (ft) **27**
Width Determination **Measured**
Confinement Type **Semi-confined**
Rock Gorge? **No**
Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **17**
2.2 Max Depth (ft) **2.94**
2.3 Mean Depth (ft) **1.90**
2.4 Floodprone Width (ft) **34**

Notes:
Dredging above first culvert

Step 2. (Contued)

2.5 Aband. Floodpln **4.58** ft.
Human Elev Floodpln **0.00** ft.
2.6 Width/Depth Ratio **8.68**
2.7 Entrenchment Ratio **2.06**
2.8 Incision Ratio **1.56**
Human Elevated Inc Rat **0.00**
2.9 Sinuosity **Low**
2.10 Riffles Type **Complete**
2.11 Riffle/Step Spacing (ft) **15**
2.12 Substrate Composition

Bedrock	0%
Boulder	28%
Cobble	27%
Coarse Gravel	20%
Fine Gravel	18%
Sand	7%
Silt and smaller	0%

Silt/Clay Present? **Yes**
Detritus **2** %
Large Woody **20**
2.13 Average Largest Particle on

Bed	780.0	mm
Bar	290.0	mm

2.14 Stream Type
Stream Type: **B**
Bed Material: **Cobble**
Subclass Slope: **a**
Bed Form: **Step-Pool**
Field Measured Slope:
2.15 Reference Stream Type
(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	None	0.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks
Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Mix	Mix
Consistency	Cohesive	Cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	77	273
Erosion Height (ft)	3.00	3.50
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	164

Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Coniferous	Coniferous

Bank Canopy	Left	Right
Canopy %	51-75	51-75

Mid-Channel Canopy **Closed**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	26-50	26-50
W less than 25	0	0

Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Residential	Residential
Mass Failures	0	0
Height	0	0
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**
4.2 Adjacent Wetlands **None**
4.3 Flow Status **Moderate**
4.4 # of Debris Jams **1**
4.5 Flow Regulation Type **None**
Flow Regulation Use
Impoundments **None**
Impoundmt. Location
4.6 Up/Down strm flow reg
(old) Upstrm Flow Reg **None**
4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	0

4.9 # of Beaver Dams **0**
Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	0	50
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
3	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
0	0	No

5.4 Stream Ford or Animal **No**
5.5 Straightening **None**
Straightening Length: **0**
5.5 Dredging **None**

Note: Step 1.6 - Grade Controls and Step 4.8 - Channel Constrictions are on The second page of this report - with Steps 6 through 7.

Stream: **Rice Brook** | Reach # **T9.3-S2.01** | Segment: **B** | Completion Date: **May 24, 2006**

Organization: **Friends of the Mad River** | Observers: **R Hill, N Miller** | Rain: **Yes**

Segment Length (ft): **3,620** | Segment Location: **Sewage pipe weir near tennis courts upstream to headwaters**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Weir	**Mid-segment**	**0.00**	**0.00**		

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Culvert	**3.80**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above**				
Bridge	**0.00**	**Yes**	**No**	**Yes**	**Yes**
Problem	**None**				
Bridge	**0.00**	**Yes**	**No**	**Yes**	**Yes**
Problem	**None**				
Bridge	**0.00**	**Yes**	**No**	**No**	**Yes**
Problem	**None**				
Culvert	**4.85**	**Yes**	**No**	**Yes**	**Yes**
Problem	**None**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**15**	**None**	**No**
7.2 Channel Aggradation	**15**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**16**		**No**
Total Score	**59**		
Geomorphic Rating	**0.7375**		
Channel Evolution Model	**F**		
Channel Evolution Stage	**I**		
Geomorphic Condition	**Good**		
Stream Sensitivity	**Moderate**		

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type **High**

	Score
6.1 Epifaunal Substrate - Available Cover	**16**
6.2 Embeddedness	**16**
6.3 Velocity/Depth Patterns	**18**
6.4 Sediment Deposition	**14**
6.5 Channel Flow Status	**13**
6.6 Channel Alteration	**18**
6.7 Frequency of Riffles/Steps	**20**
6.8 Bank Stability	**Left: 9 Right: 9**
6.9 Bank Vegetation Protection	**Left: 9 Right: 9**
6.10 Riparian Vegetation Zone Width	**Left: 8 Right: 8**
Total Score	**167**
Habitat Rating	**0.835**
Habitat Stream Condition	**Good**

Narrative:

APPENDIX 5

Sugarbush Resort
Vermont Water Quality Standards
Biomonitoring Data
October 6, 2008

Biomonitoring Summary Table - Kicknet Monitoring Results Compliance with Class B2-3 Bio Criteria													
Watershed	Station	1995	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Rice Brook	BU-5	F	F	--	--	F	P	F	I	I	P	I	F
	BU-1A	F	F	--	--	F	I	F	P	P	P	F	F
	BU-1B	F	F	F	F	F	F	F	F	P	F	P	P
	BD-2	F	F	F	F	F	I	F	F	P	P	F	P
	BD-3	F	F	F	F	F	F	F	I	P	I	F	I
Clay Brook	Iron - Upstream	--	--	--	--	--	--	--	--	--	F	F	F
	Iron - Downstream	--	--	--	--	--	--	--	--	--	F	F	F
	BIO 2.1	--	--	--	--	--	--	--	--	--	--	I	F
	BIO 2.0	--	--	--	--	--	--	--	--	--	--	I	F

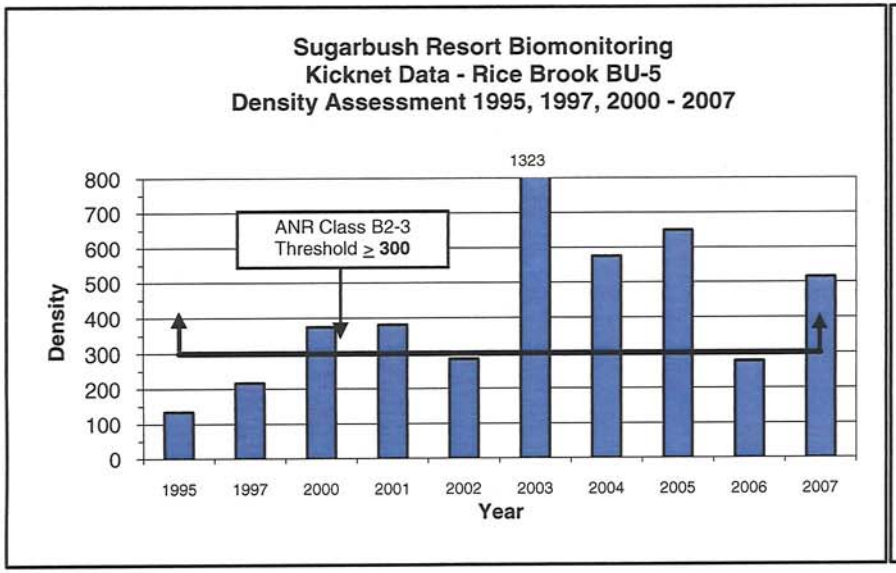
P = Pass (met full suport requirement for class B2-3)
I = Indeterminate
F = Fail (non-support)

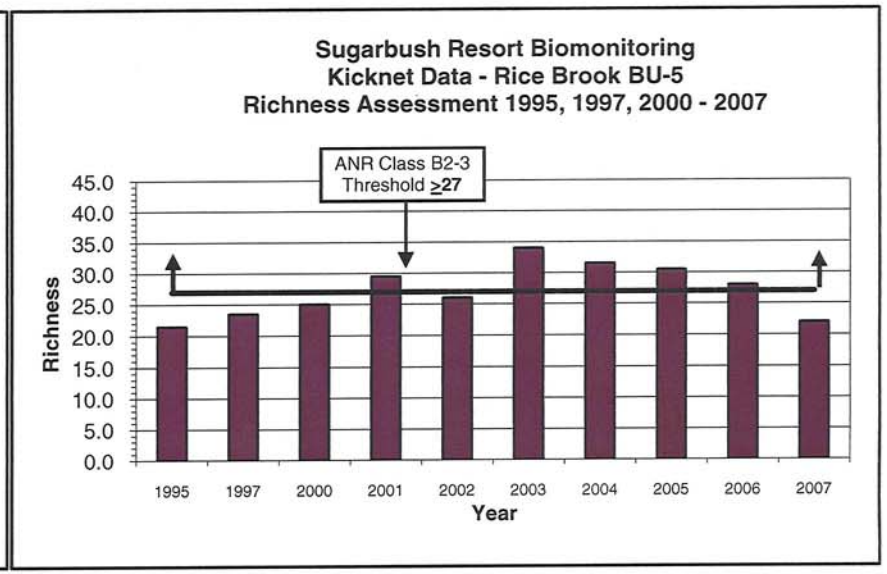
Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-5
Class B

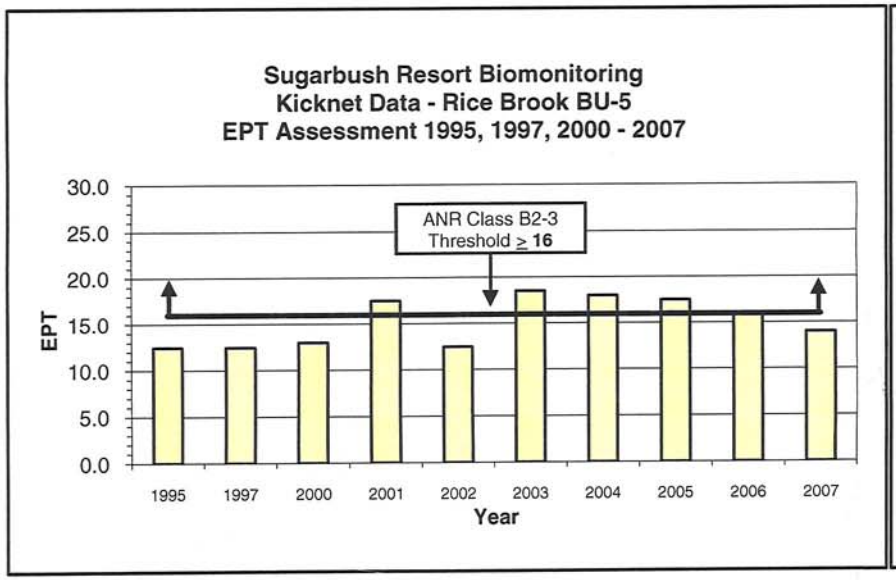
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT+C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	≥300	≥27	≥16	≥45	≤4.50	≤12	≥0.45	≥0.40	
1995	**135**	**21.5**	**12.5**	59.0	1.6	0.0	0.79	**0.3**	Not Supported
1997	**217**	**23.5**	**12.5**	72	1.31	0.5	0.82	0.42	Not Supported
2000	375	**25.0**	**13.0**	63	1.67	1	0.80	0.42	Not Supported
2001	382	29.5	17.5	55	1.74	1	0.68	0.40	Supported
2002	**284**	**26.0**	**12.5**	57	2.22	1	0.64	**0.37**	Not Supported
2003	1323	34.0	18.5	61	2.00	3	0.86	**0.37**	Indeterminate
2004	575	31.5	18.0	63	1.83	2	0.80	**0.38**	Indeterminate
2005	650	30.5	17.5	62	1.69	3	0.79	0.41	Supported
2006	**277**	28.0	16.0	63	2.13	2	0.69	0.41	Indeterminate
2007	515	**22.0**	**14.0**	68	1.31	2	0.95	0.52	Not Supported

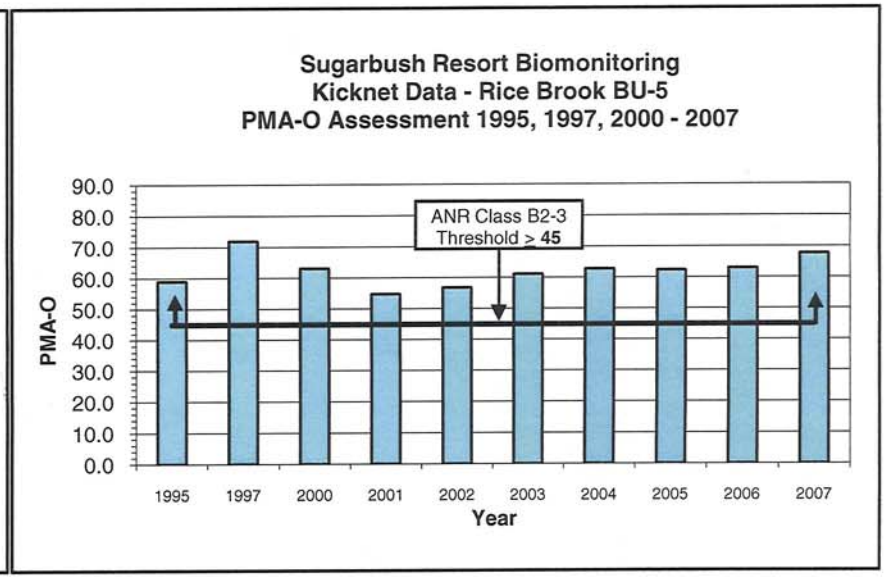
Bold/shade denotes metric did not meet Class B2-3 biocriteria threshold

Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-5
Summary Metric Charts

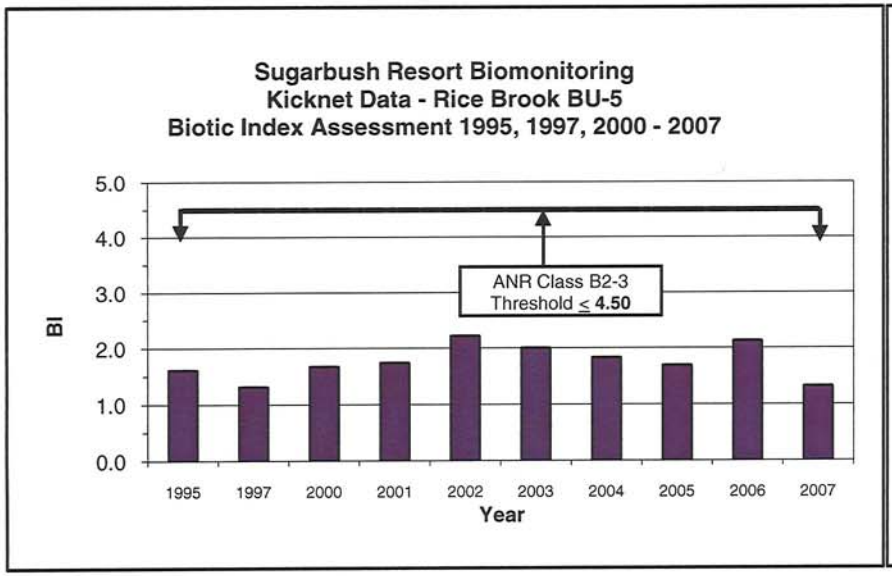


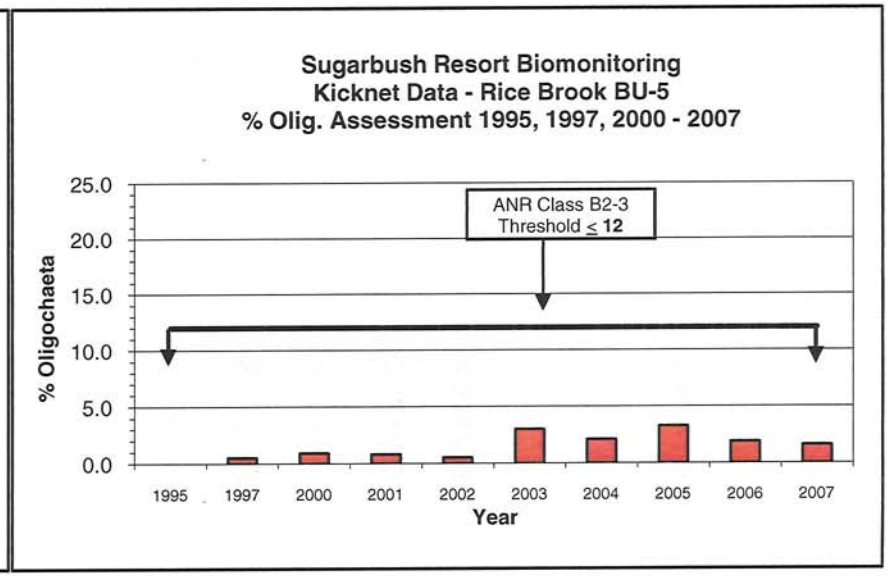


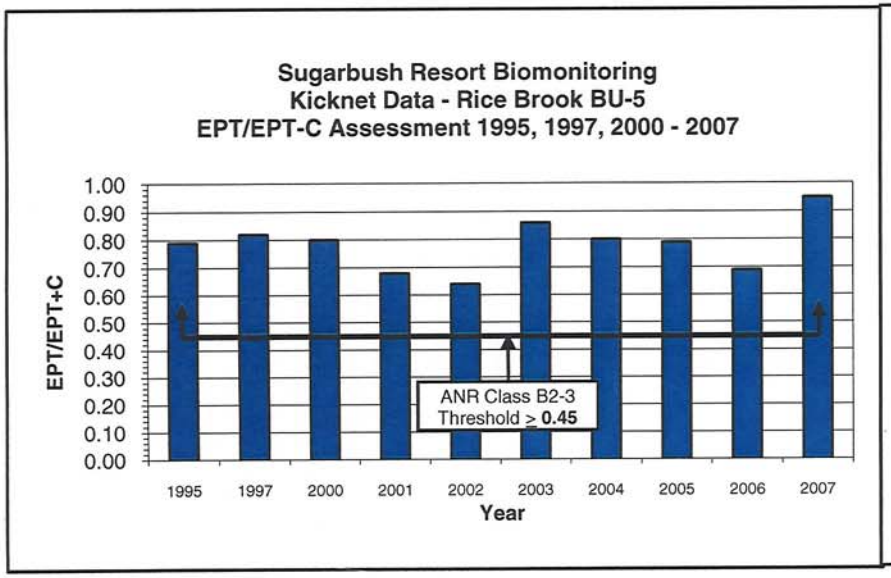


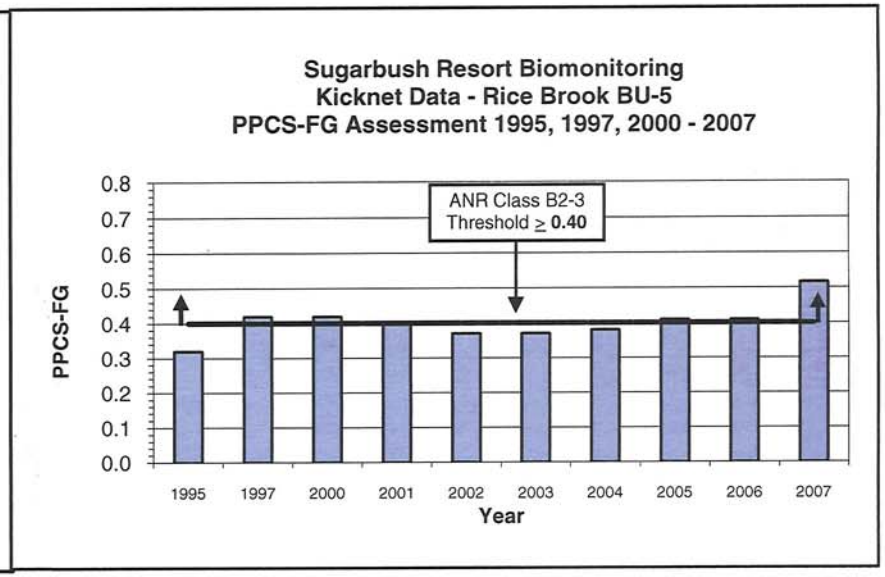


Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-5
Summary Metric Charts







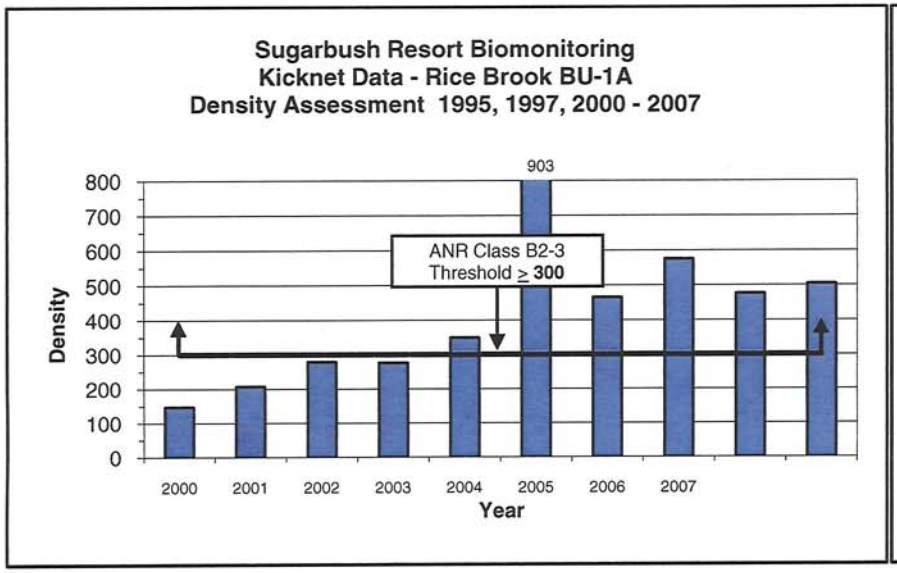


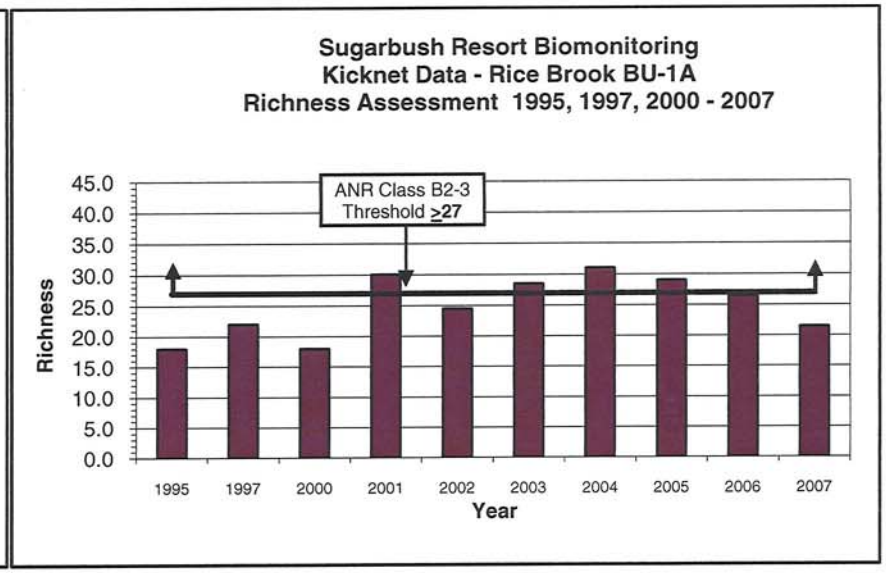
Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-1A
Class B

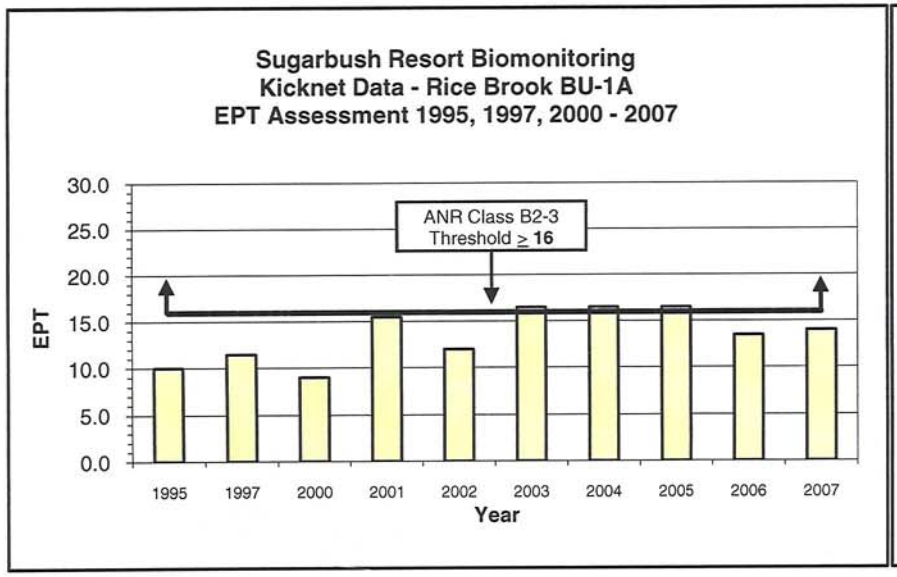
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT +C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	≥300	≥27	≥16	≥45	≤4.50	≤12	≥0.45	≥0.40	
1995	**148**	**18.0**	**10.0**	64	1.82	0	0.86	0.44	Not Supported
1997	**207**	**22.0**	**11.5**	75	1.61	2	0.88	**0.37**	Not Supported
2000	**279**	**18.0**	**9.0**	49	1.21	2	0.94	**0.31**	Not Supported
2001	**276**	30.0	**15.5**	71	1.96	3	0.77	0.46	Indeterminate
2002	349	**24.5**	**12.0**	57	2.49	1	0.54	0.46	Not Supported
2003	903	28.5	16.5	73	1.98	1	0.82	0.46	Supported
2004	466	31.0	16.5	76	2.44	4	0.81	0.45	Supported
2005	576	29.0	16.5	66	2.16	3	0.68	0.46	Supported
2006	477	**26.5**	**13.5**	79	2.74	1	0.75	0.43	Not Supported
2007	505	**21.5**	**14.0**	76	1.47	1	0.90	0.45	Not Supported

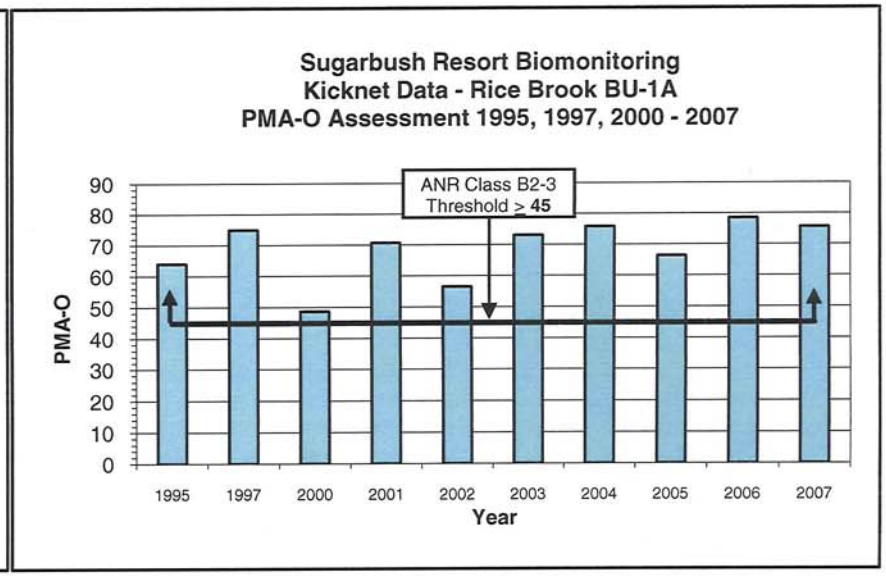
Bold/shade denotes metric did not meet Class B2-3 biocriteria threshold

Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-1A
Summary Metric Charts

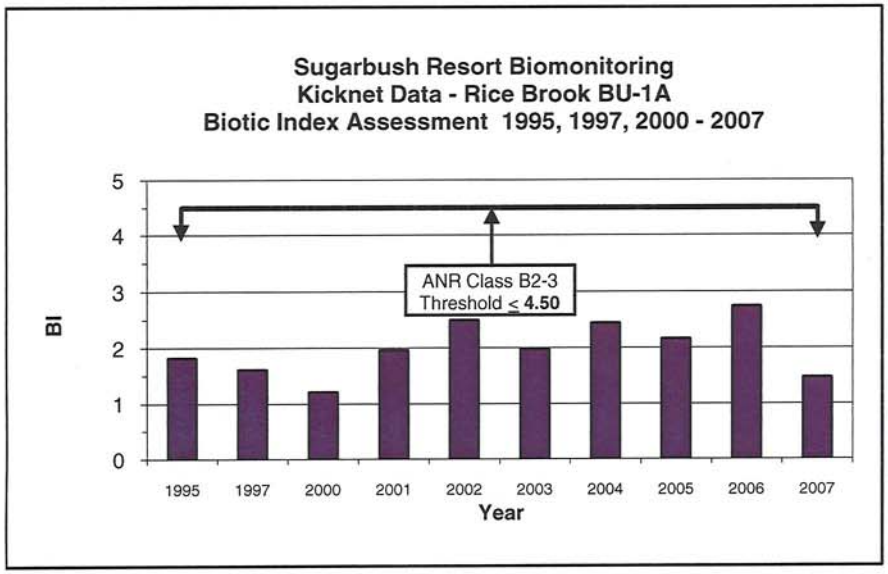


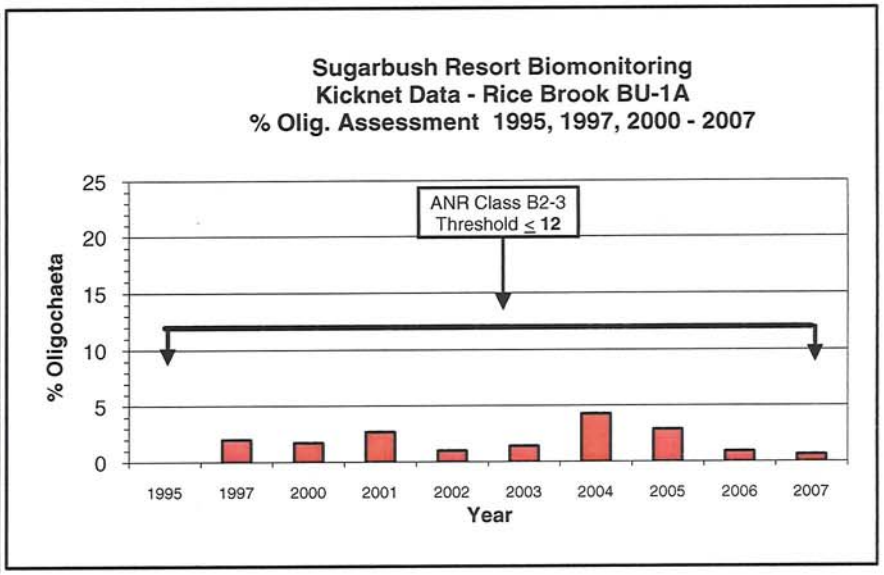


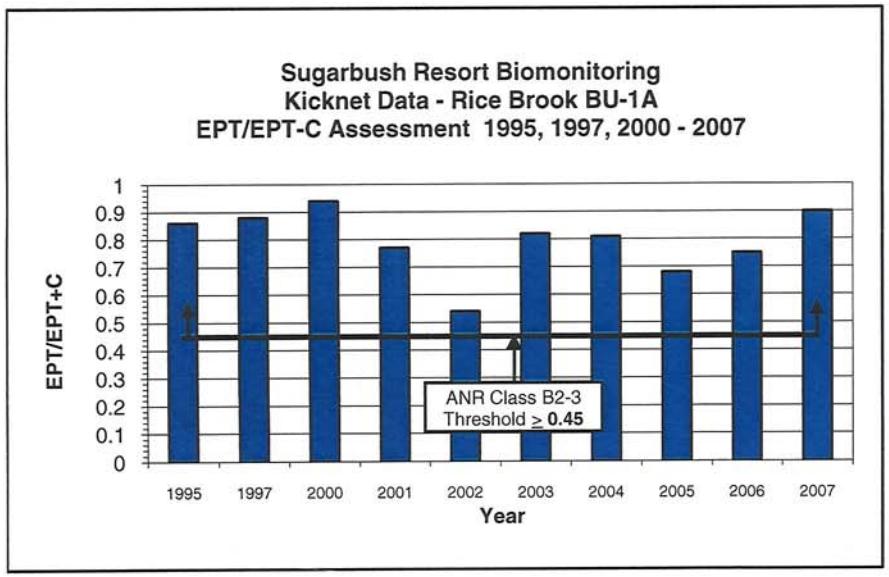


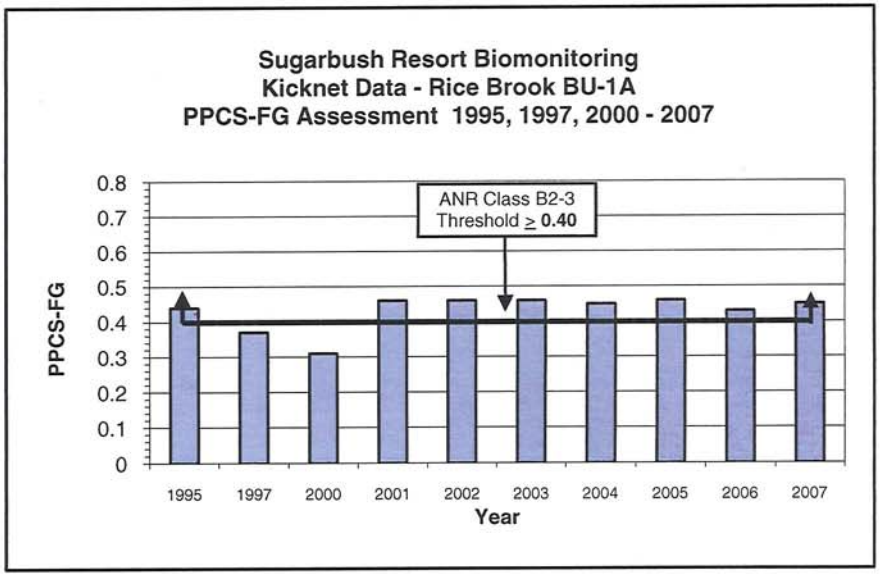


Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-1A
Summary Metric Charts







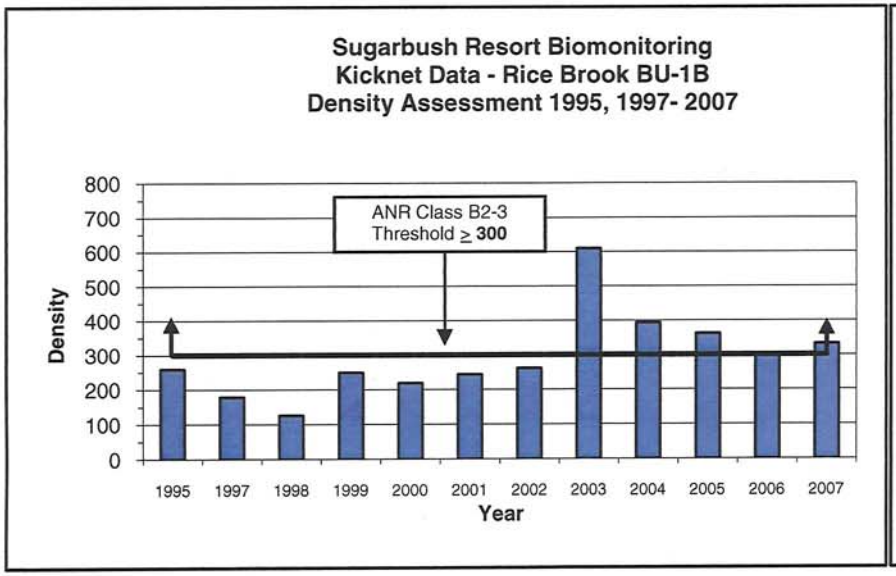


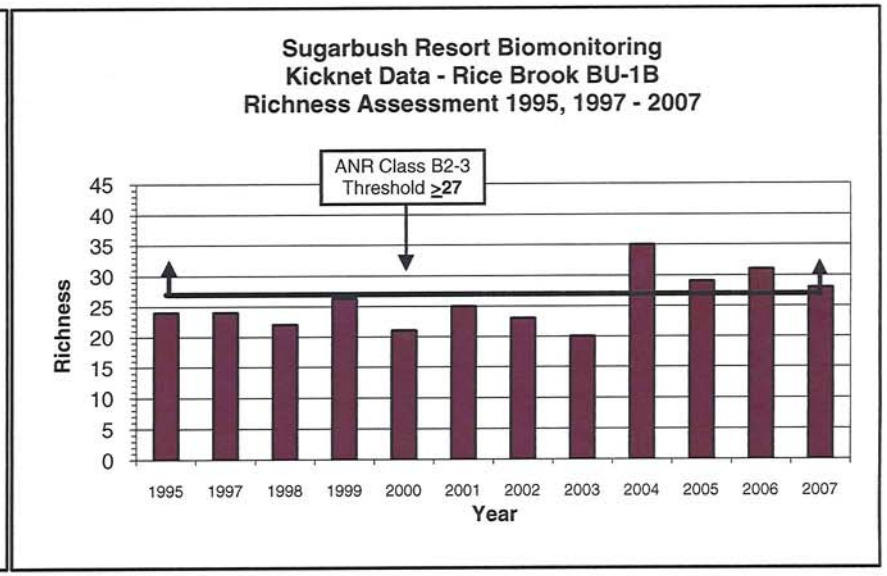
Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-1B
Class B

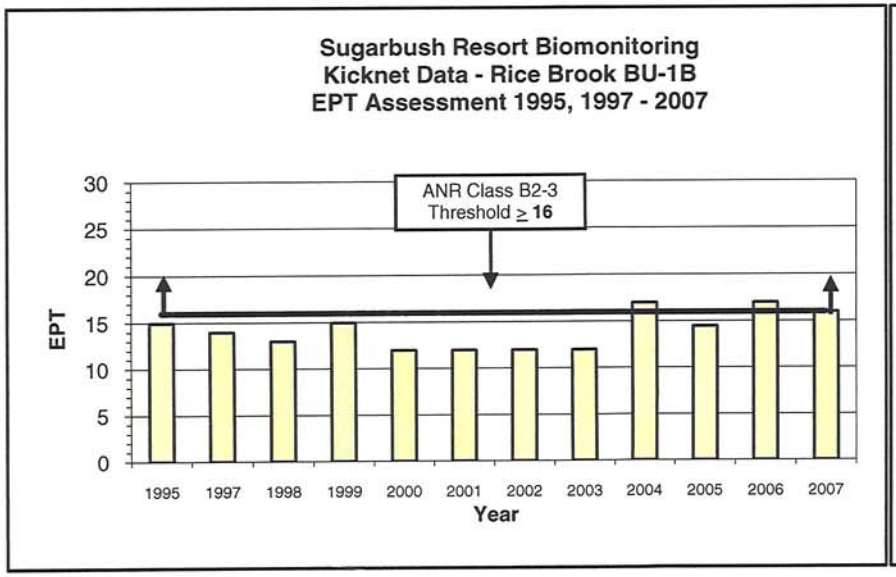
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT +C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	≥300	≥27	≥16	≥45	≤4.50	≤12	≥0.45	≥0.40	
1995	**259**	**24**	**15**	68	2.21	1.5	0.69	0.57	Not Supported
1997	**178**	**24**	**14**	86	1.71	2.8	0.87	0.48	Not Supported
1998	**125**	**22**	**13**	68	3.19	8.8	0.58	**0.37**	Not Supported
1999	**249**	**26.3**	**15**	60	2.12	3.3	0.73	0.55	Not Supported
2000	**218**	**21.0**	**12.0**	50	0.90	2	0.90	**0.37**	Not Supported
2001	**243**	**25.0**	**12.0**	63	2.25	0	0.61	0.54	Not Supported
2002	**261**	**23.0**	**12.0**	58	2.81	0	0.50	0.52	Not Supported
2003	609	**20.0**	**12.0**	65	1.09	2	0.89	0.45	Not Supported
2004	393	35.0	17.0	79	2.22	6	0.75	0.53	Supported
2005	362	29.0	**14.5**	61	2.51	1	0.64	0.48	Not Supported
2006	302	31.0	17.0	74	2.20	1	0.77	0.47	Supported
2007	332	28.0	16.0	84	2.37	1	0.86	0.57	Supported

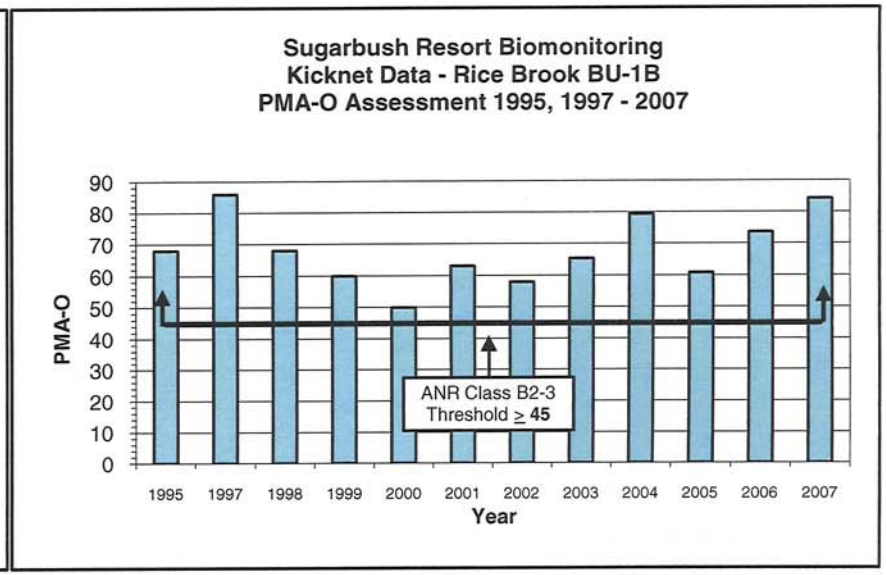
Bold/shade denotes metric did not meet Class B2-3 biocriteria threshold

Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-1B
Summary Metric Charts

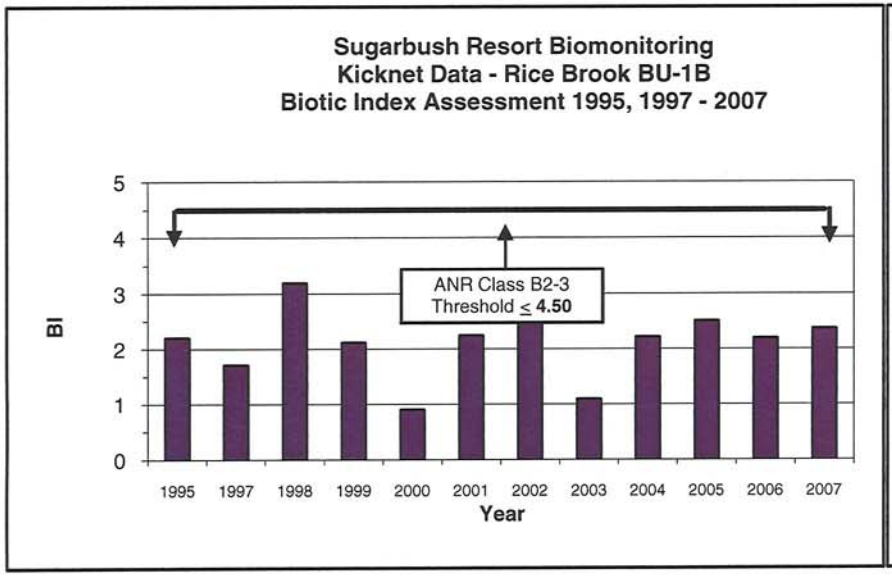


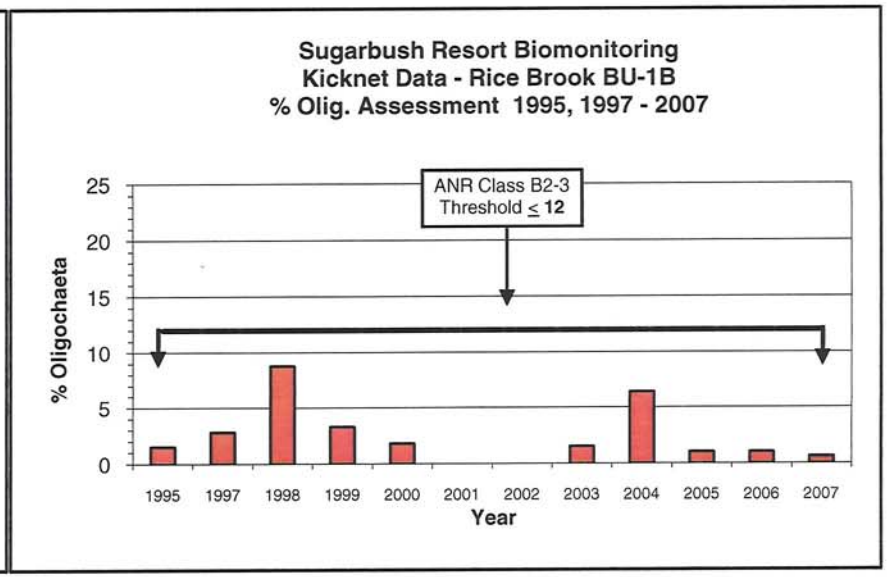


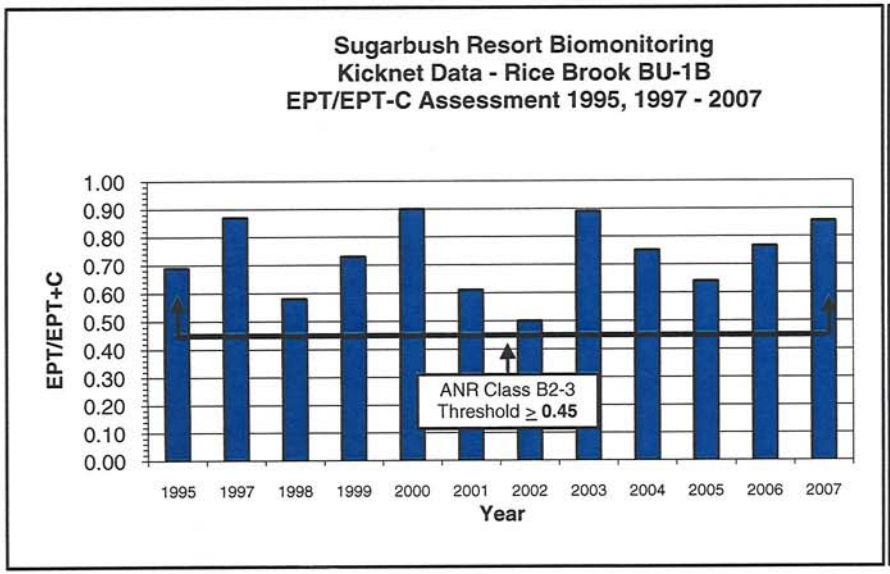


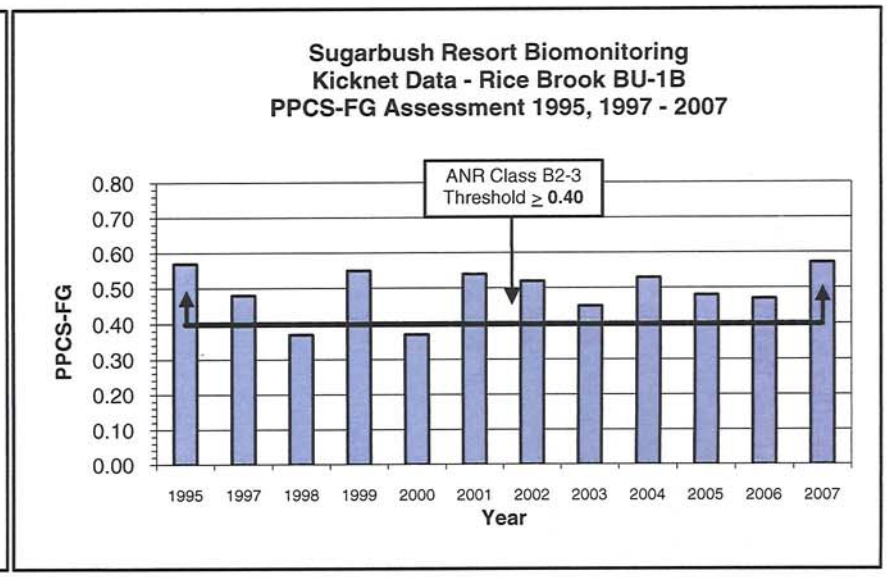


Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BU-1B
Summary Metric Charts







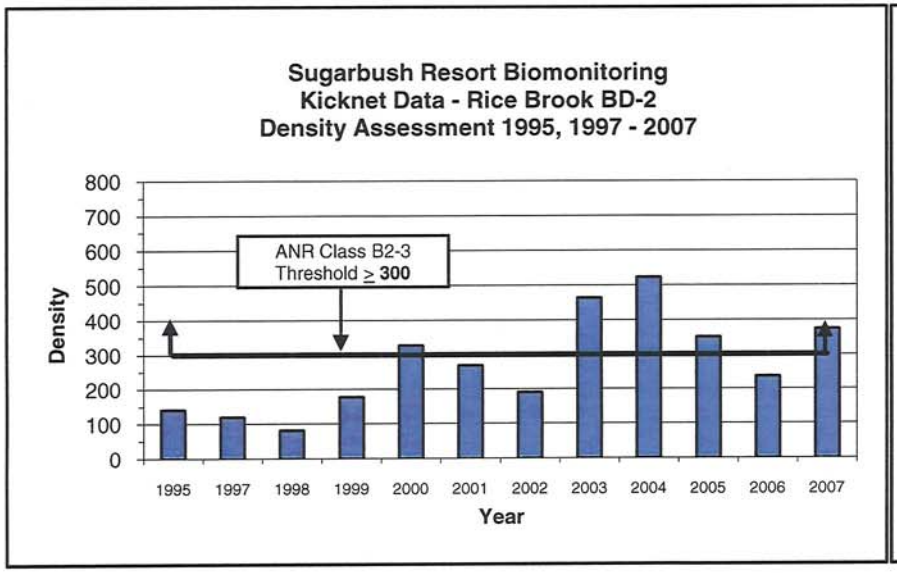


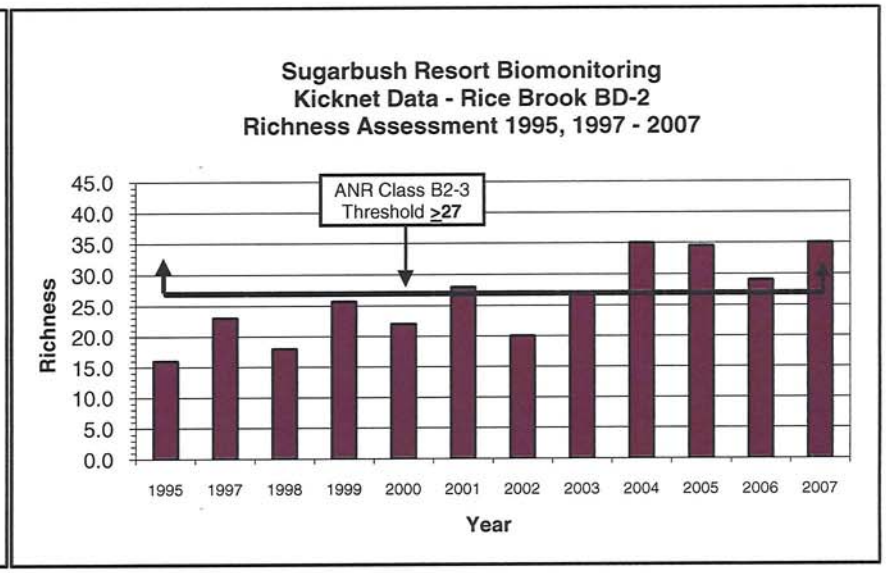
Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BD-2
Class B

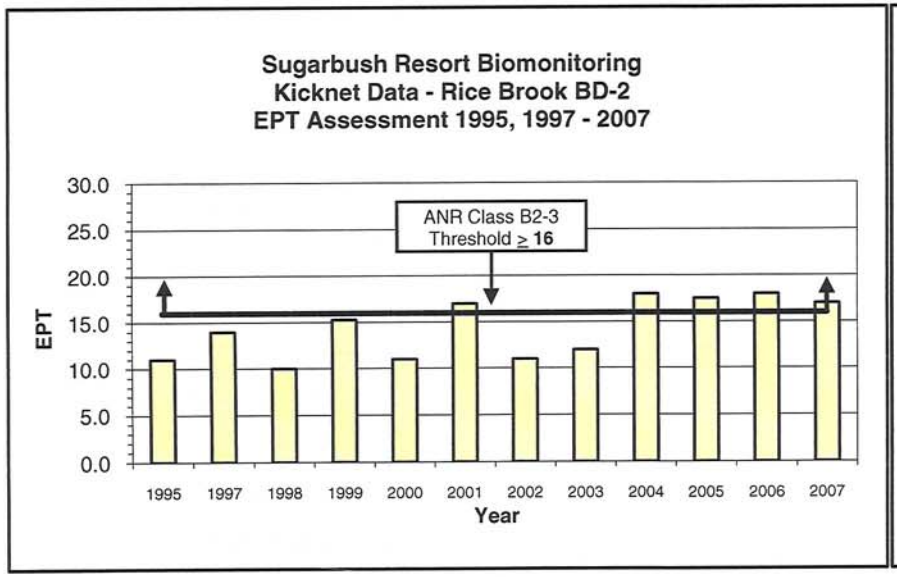
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT +C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	≥300	≥27	≥16	≥45	≤4.50	≤12	≥0.45	≥0.40	
1995	**141**	**16.0**	**11.0**	70	2.05	5	0.81	0.47	Not Supported
1997	**120**	**23.0**	**14.0**	71	1.44	**14**	0.87	51	Not Supported
1998	**82**	**18.0**	**10.0**	63	3.00	3.7	0.58	**34**	Not Supported
1999	**177**	**25.7**	**15.3**	63	2.34	3.4	0.66	51	Not Supported
2000	327	**22.0**	**11.0**	50	0.93	0	0.87	0.46	Not Supported
2001	**269**	28.0	17.0	74	2.22	1	0.68	0.55	Indeterminate
2002	**190**	**20.0**	**11.0**	62	2.21	1	0.62	0.66	Not Supported
2003	465	27.0	**12.0**	55	1.73	1	0.74	0.44	Not Supported
2004	522	35.0	18.0	69	1.55	9	0.84	0.51	Supported
2005	350	34.5	17.5	60	2.78	4	0.60	0.61	Supported
2006	**236**	29.0	18.0	75	2.86	3	0.65	0.43	Not Supported
2007	374	35.0	17.0	66	1.89	2	0.77	0.52	Supported

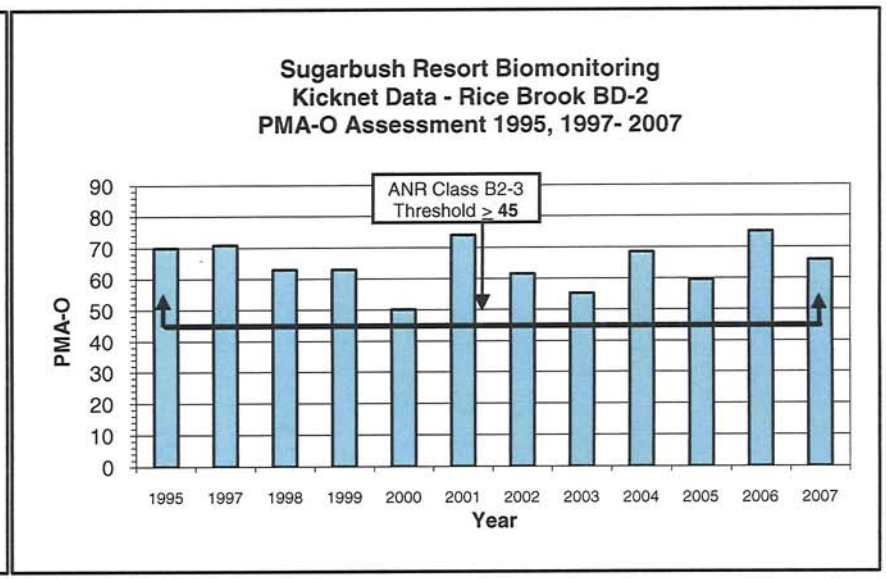
Bold/shade denotes metric did not meet Class B2-3 biocriteria threshold

Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BD-2
Summary Metric Charts

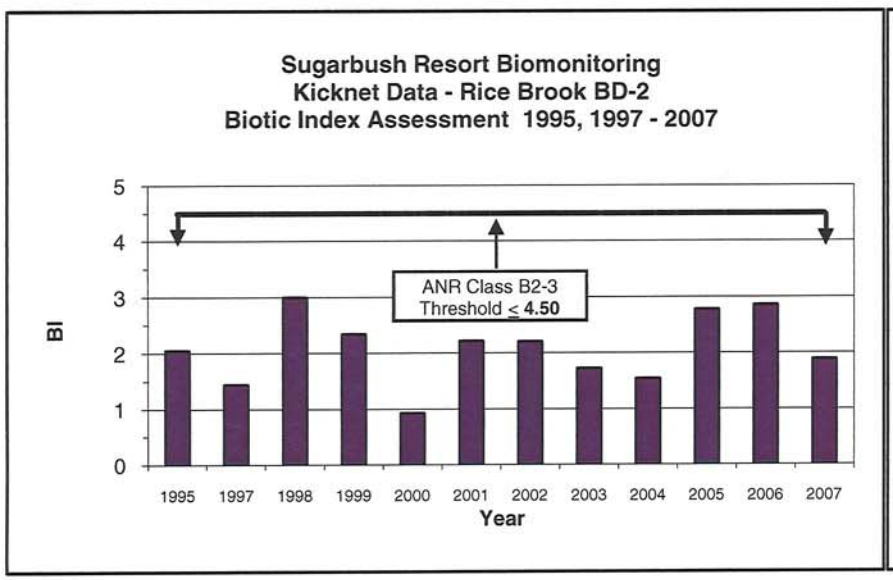


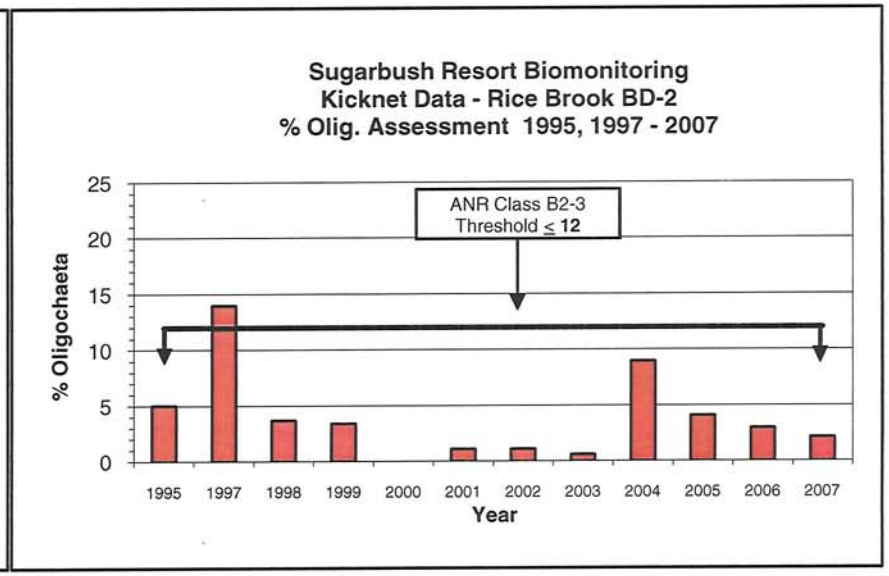


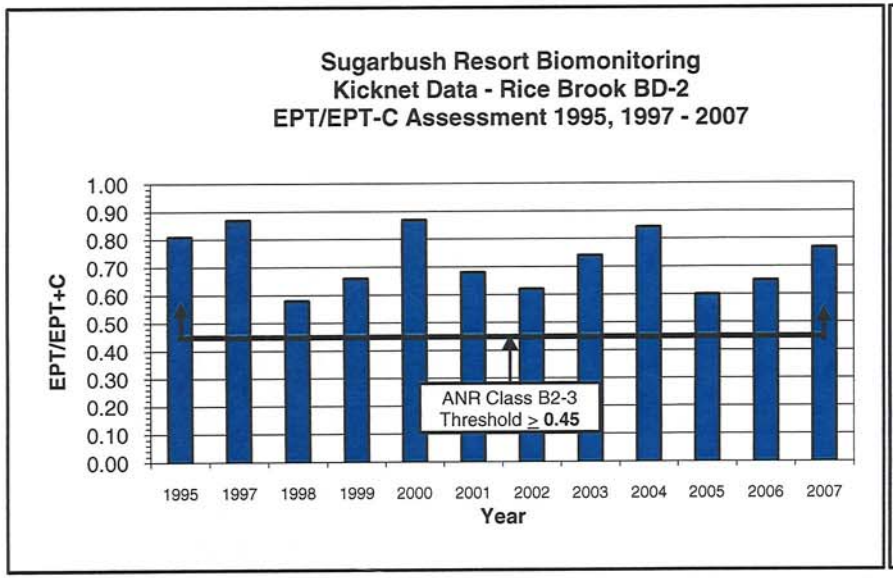


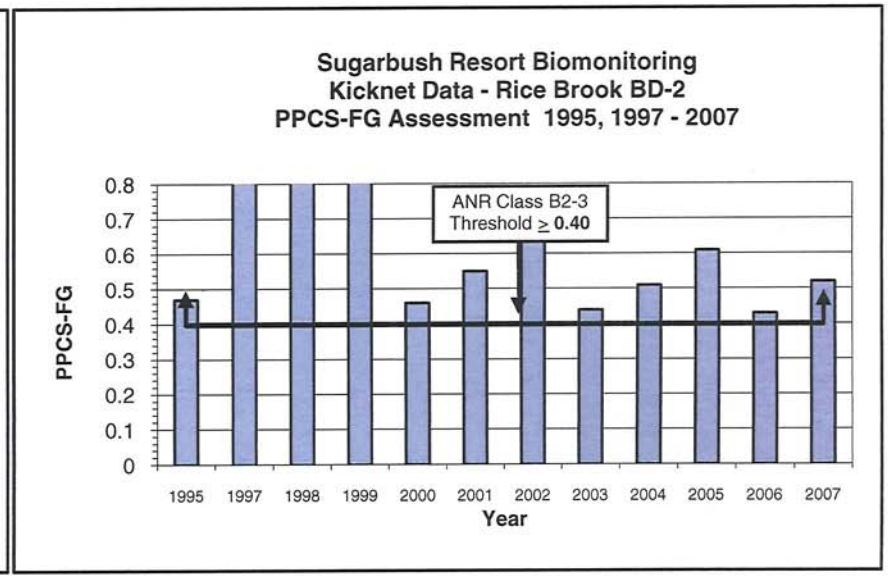


Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BD-2
Summary Metric Charts









Sugarbush Resort Biomonitoring

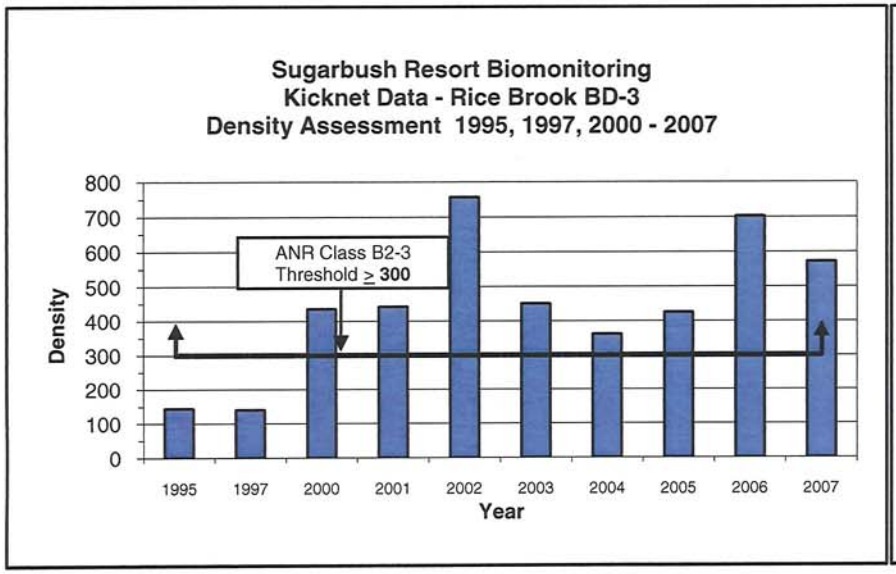
Kicknet Data - Rice Brook BD-3

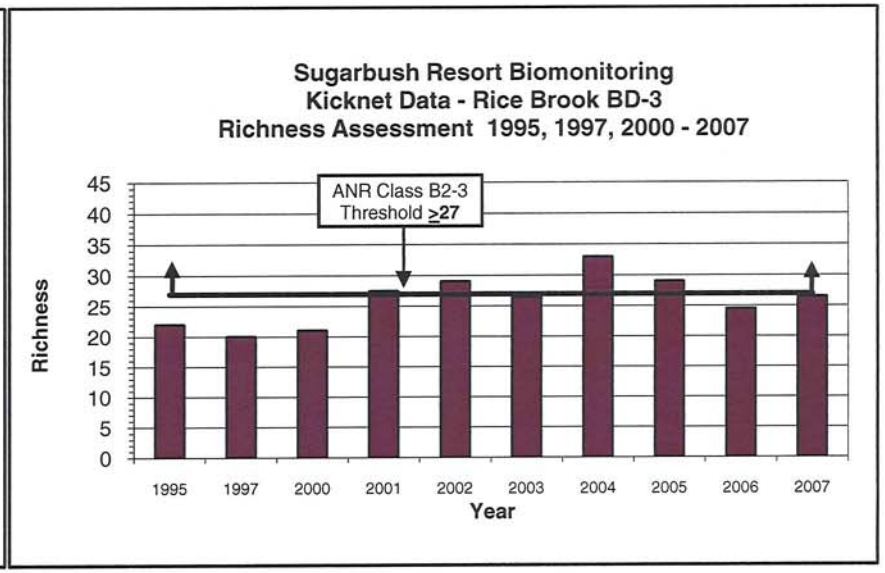
Class B

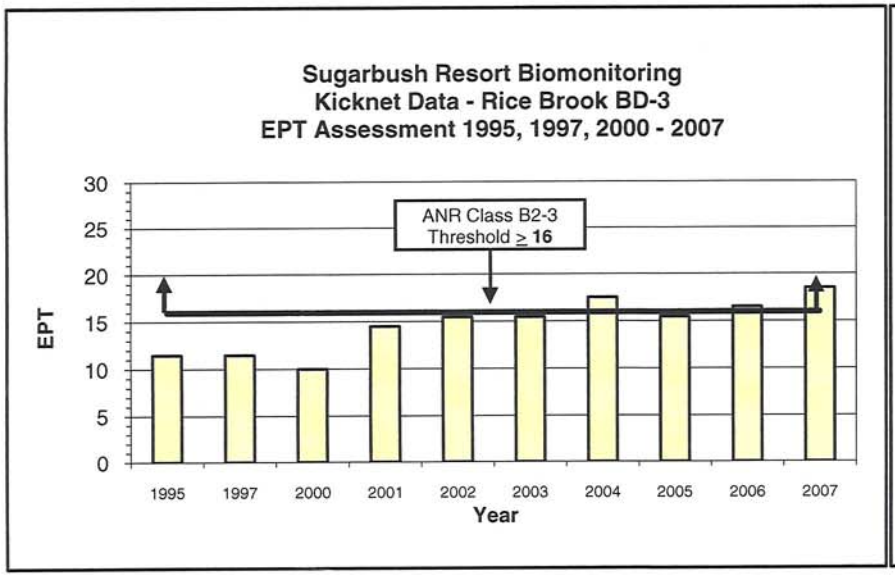
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT +C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	≥300	≥27	≥16	≥45	≤4.50	≤12	≥0.45	≥0.40	
1995	**143.5**	**22**	**11.5**	76	1.46	5.2	0.91	0.48	Not Supported
1997	**140.5**	**20**	**11.5**	79	1.70	**19.5**	0.89	55	Not Supported
2000	435	**21.0**	**10.0**	71	2.31	2	0.82	**0.36**	Not Supported
2001	442	27.5	**14.5**	67	2.78	4	0.87	**0.38**	Not Supported
2002	757	29.0	**15.5**	68	2.73	0	0.67	**0.34**	Not Supported
2003	451	**26.5**	**15.5**	72	1.84	1	0.93	0.41	Indeterminate
2004	362	33.0	17.5	80	2.02	11	0.92	0.43	Supported
2005	425	29.0	**15.5**	76	3.06	4	0.88	0.52	Indeterminate
2006	702	**24.5**	16.5	63	3.67	1	0.95	**0.33**	Not Supported
2007	572	**26.5**	18.5	76	3.03	0	0.94	0.55	Indeterminate

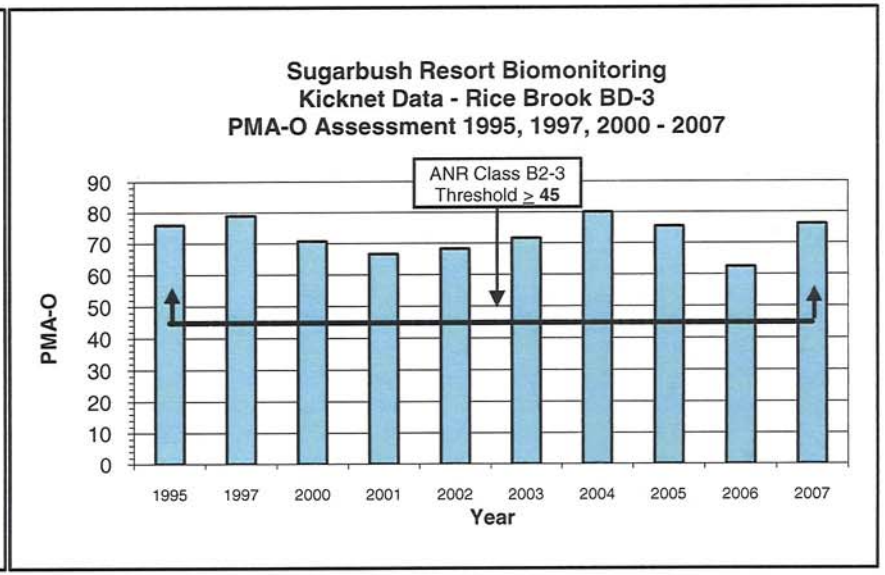
Bold/shade denotes metric did not meet Class B2-3 biocriteria threshold

Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BD-3
Summary Metric Charts

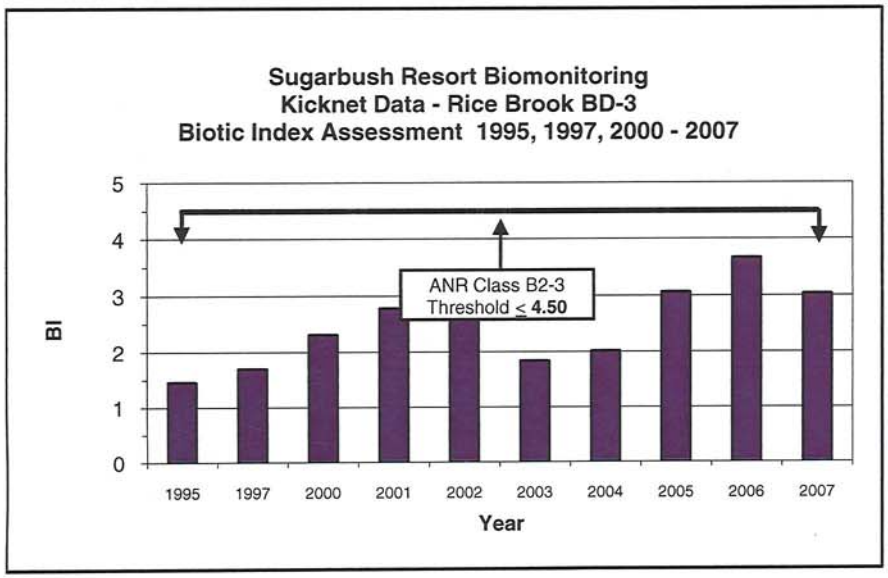


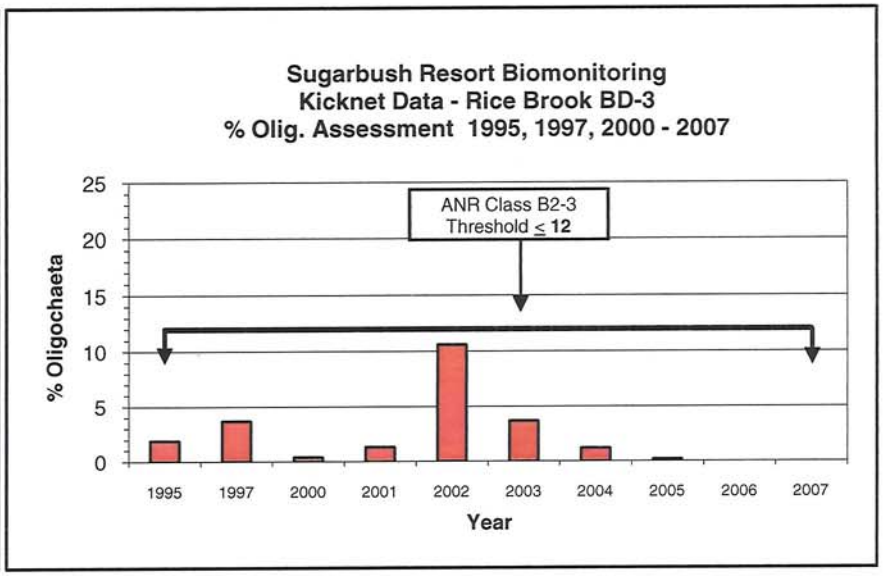


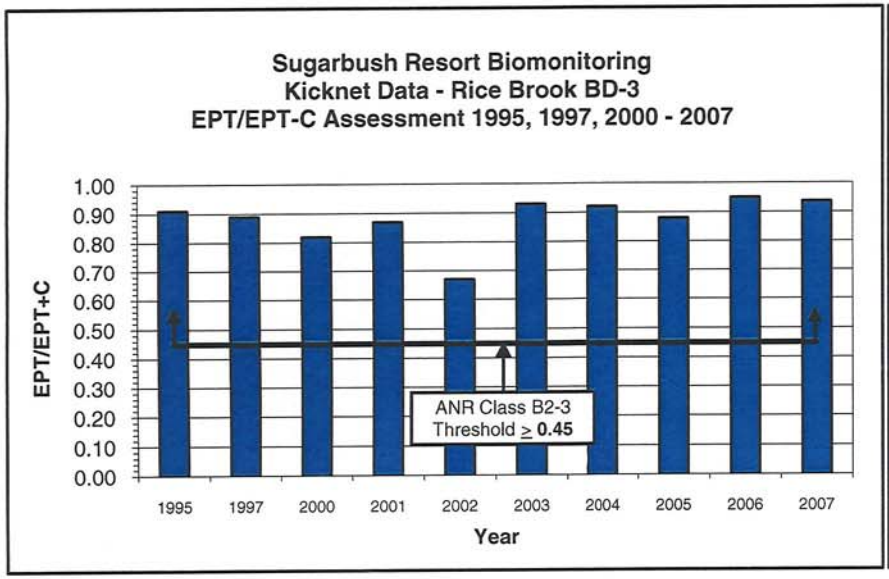


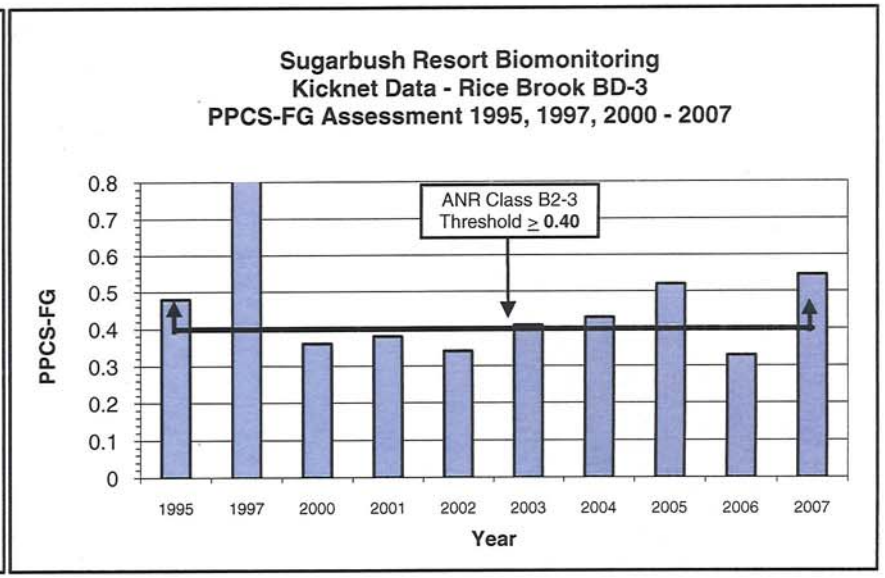


Sugarbush Resort Biomonitoring
Kicknet Data - Rice Brook BD-3
Summary Metric Charts







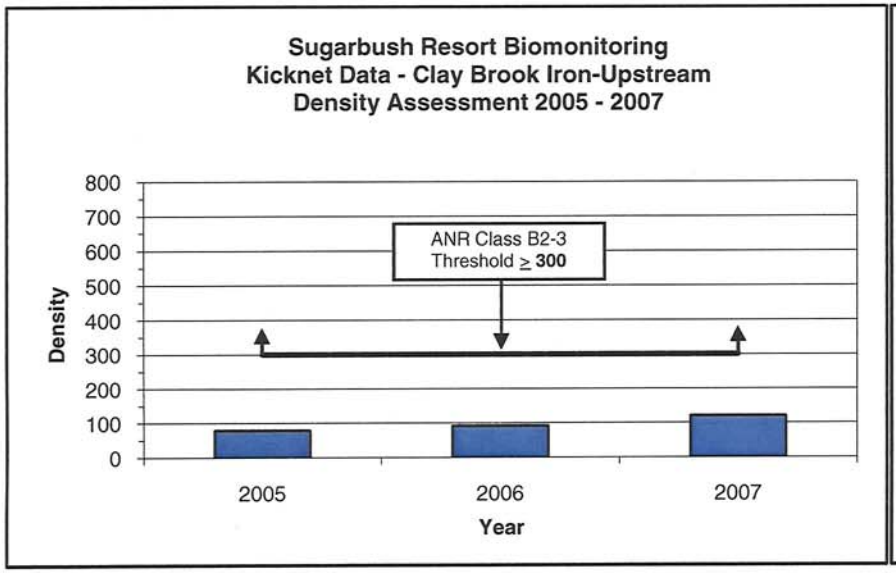


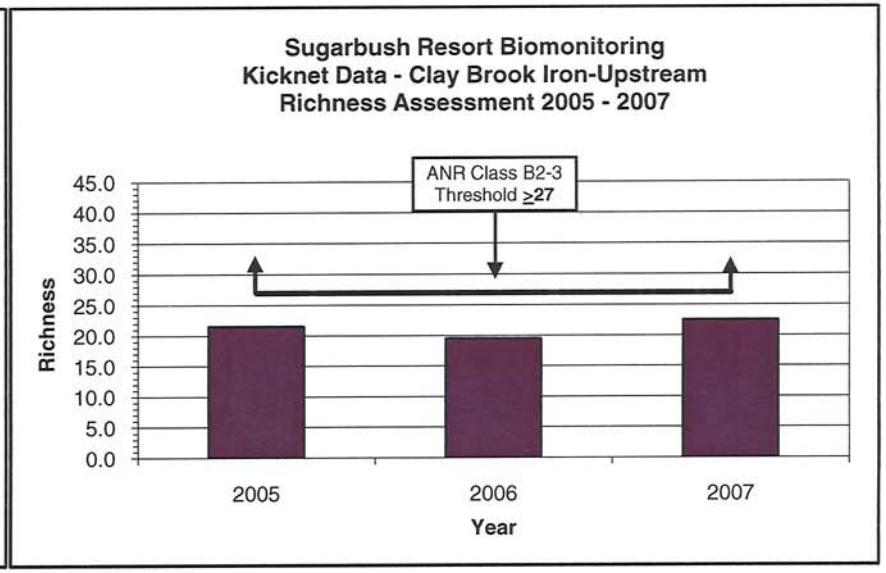
Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook Iron-Upstream
Class B

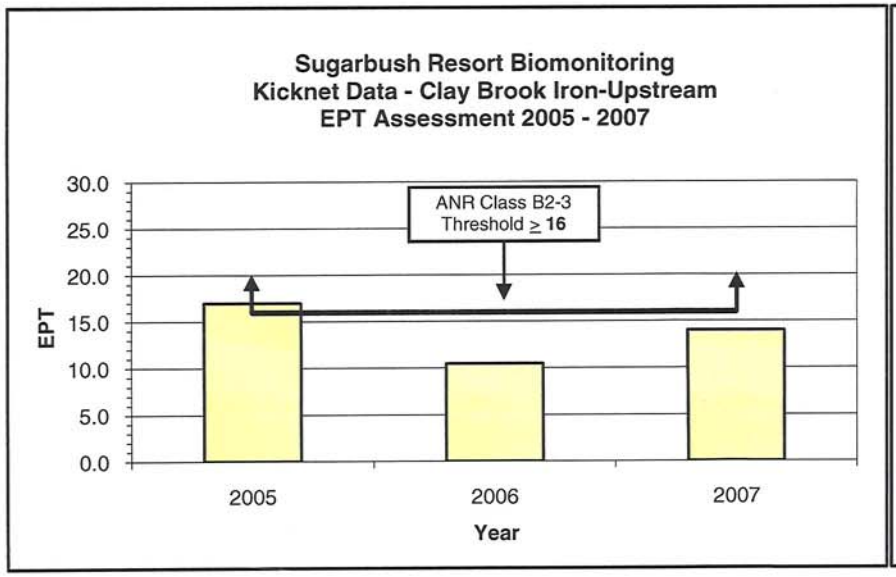
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT +C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	≥300	≥27	≥16	≥45	≤4.50	≤12	≥0.45	≥0.40	
2005	**80**	**21.5**	17.0	72	1.96	2.70	0.93	0.40	Not Supported
2006	**92**	**19.5**	**10.5**	67	2.08	0.57	0.77	0.47	Not Supported
2007	**121**	**22.5**	**14.0**	69	2.02	0.41	0.89	0.45	Not Supported

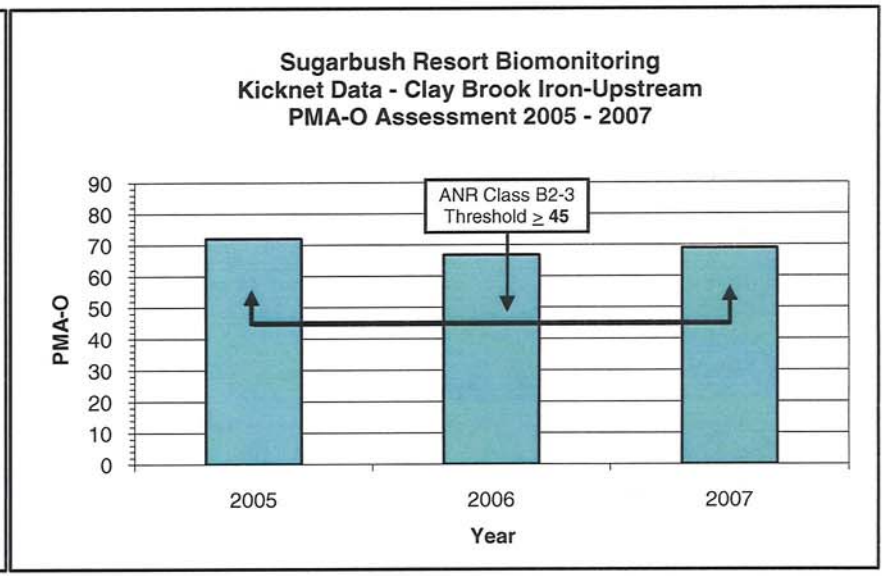
Bold/shade denotes metric did not meet Class B2-3 biocriteria threshold

Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook Iron-Upstream
Summary Metric Charts

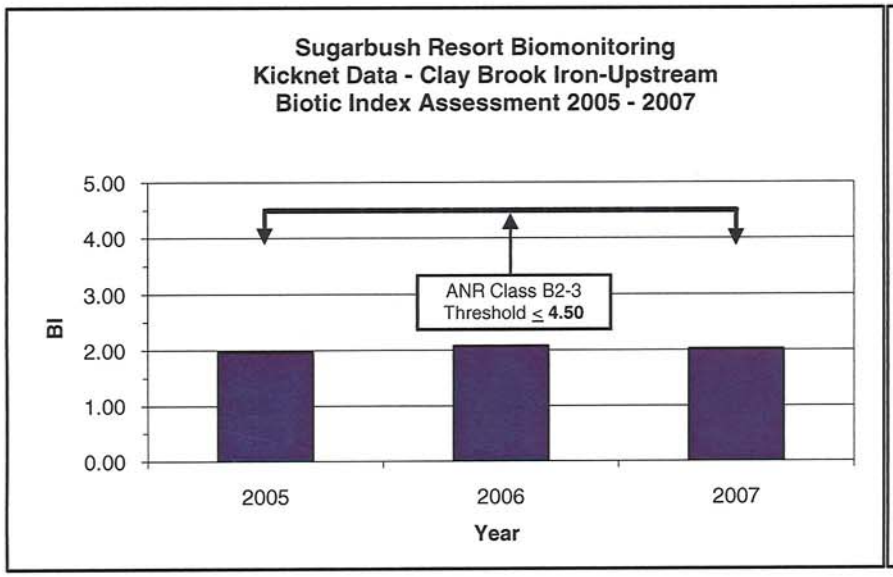


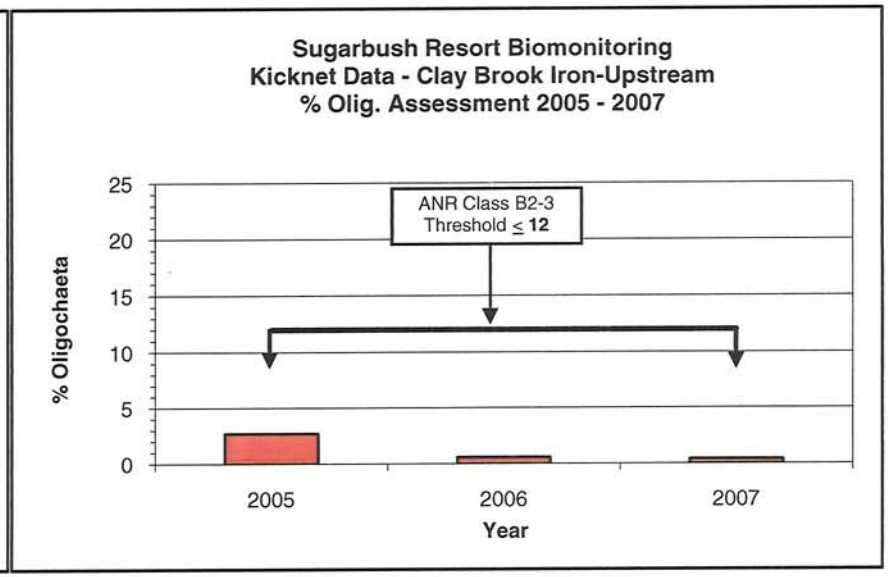


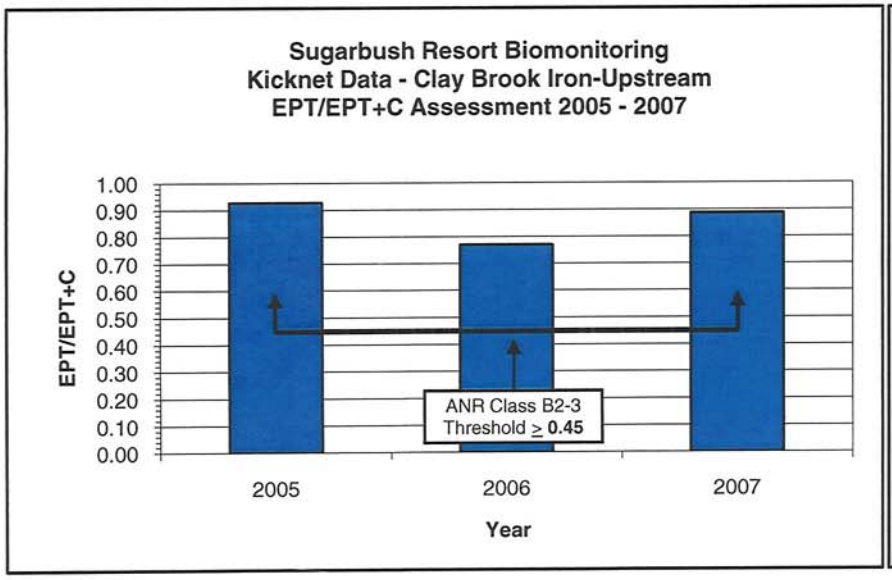


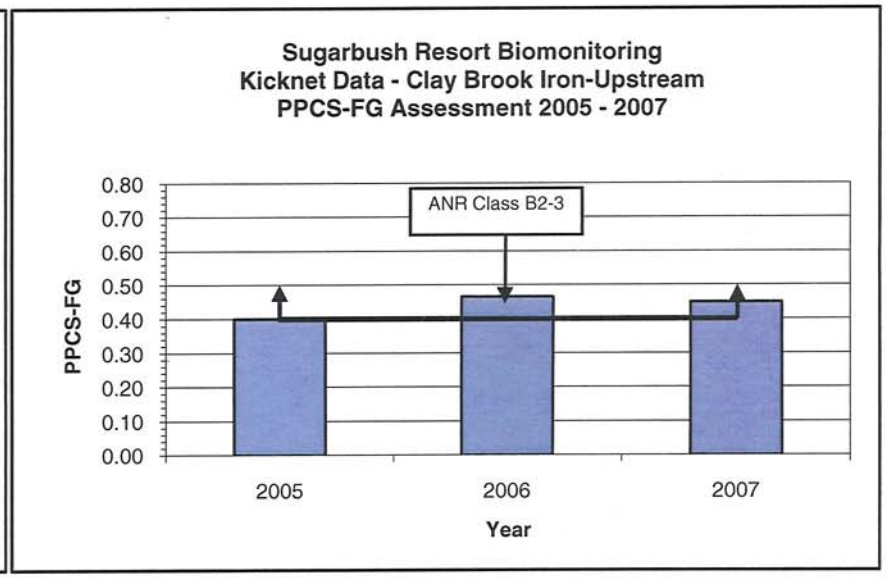


Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook Iron-Upstream
Summary Metric Charts









Sugarbush Resort Biomonitoring

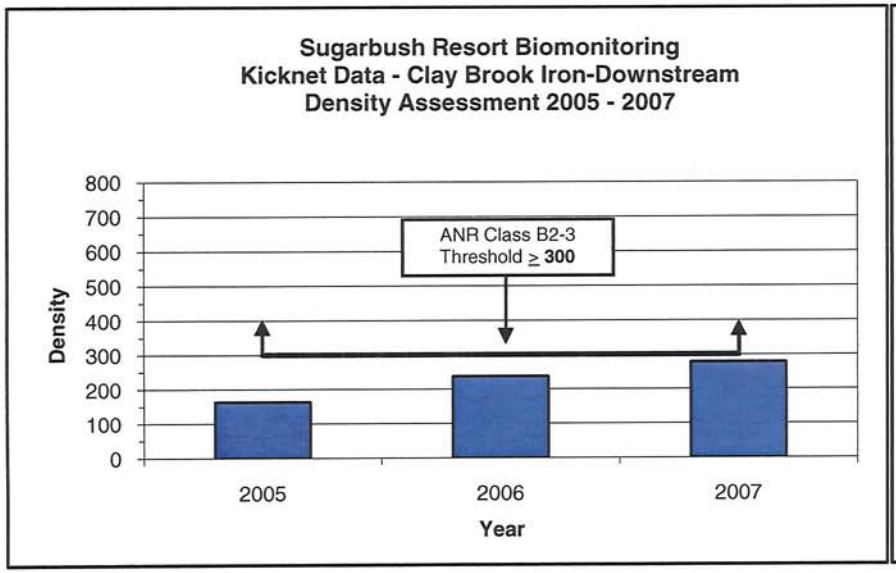
Kicknet Data - Clay Brook Iron-Downstream

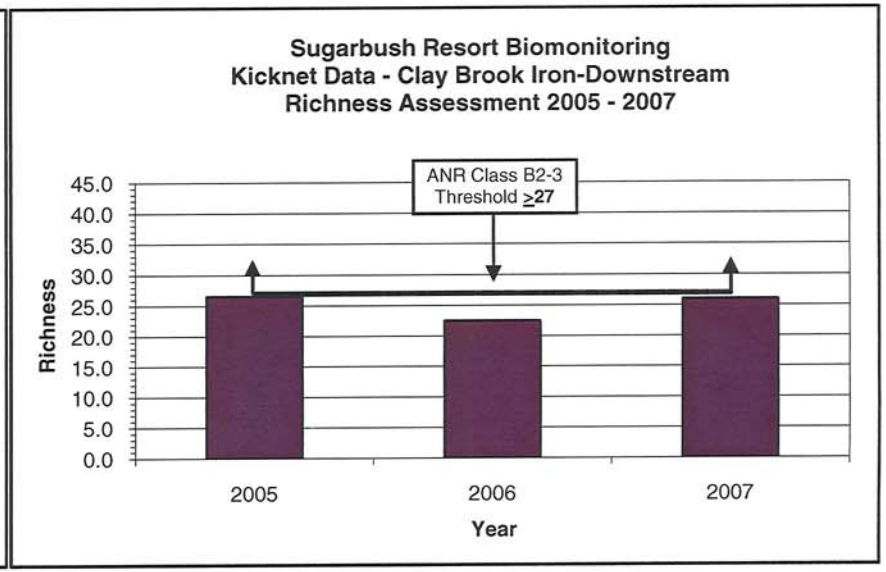
Class B

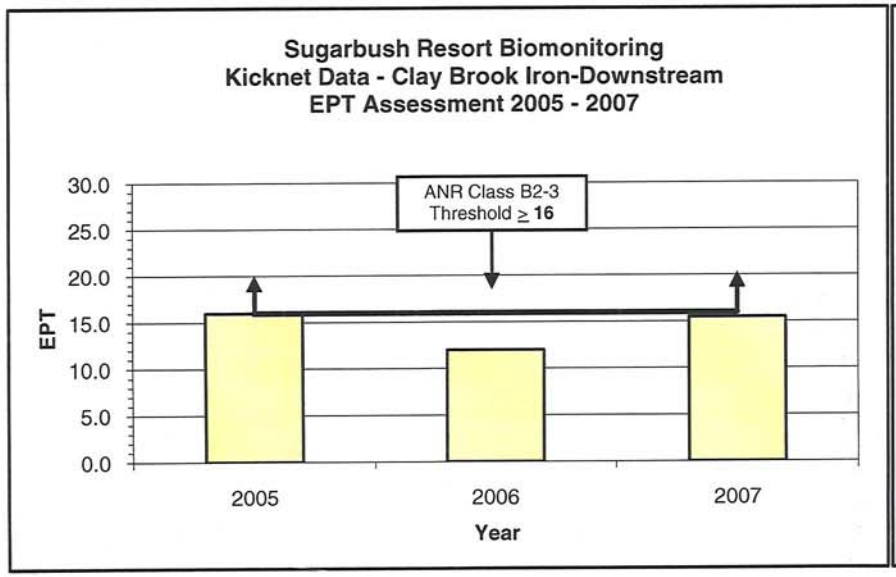
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT+C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	≥300	≥27	≥16	≥45	≤4.50	≤12	≥0.45	≥0.40	
2005	**164**	**26.5**	16.0	71	2.05	3.26	0.95	0.41	Not Supported
2006	**237**	**22.5**	**12.0**	74	2.31	0.68	0.81	0.47	Not Supported
2007	**278**	**26.0**	**15.5**	79	1.70	1.66	0.91	0.63	Not Supported

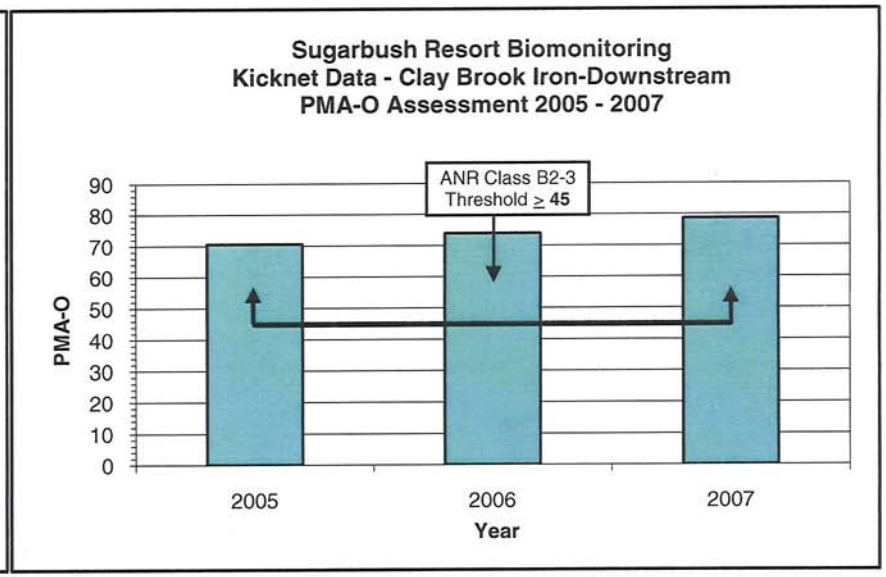
Bold denotes metric did not meet Class B2-3 biocriteria threshold

Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook Iron-Downstream
Summary Metric Charts

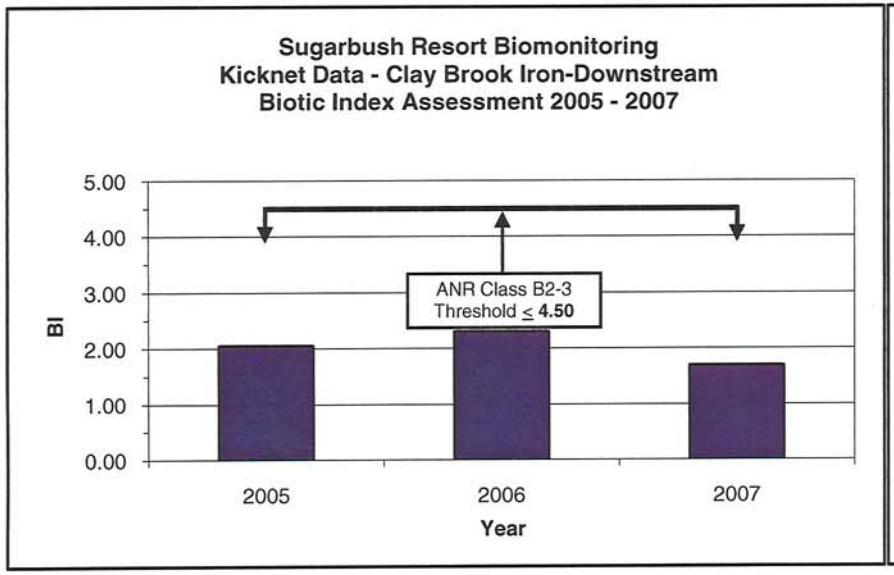


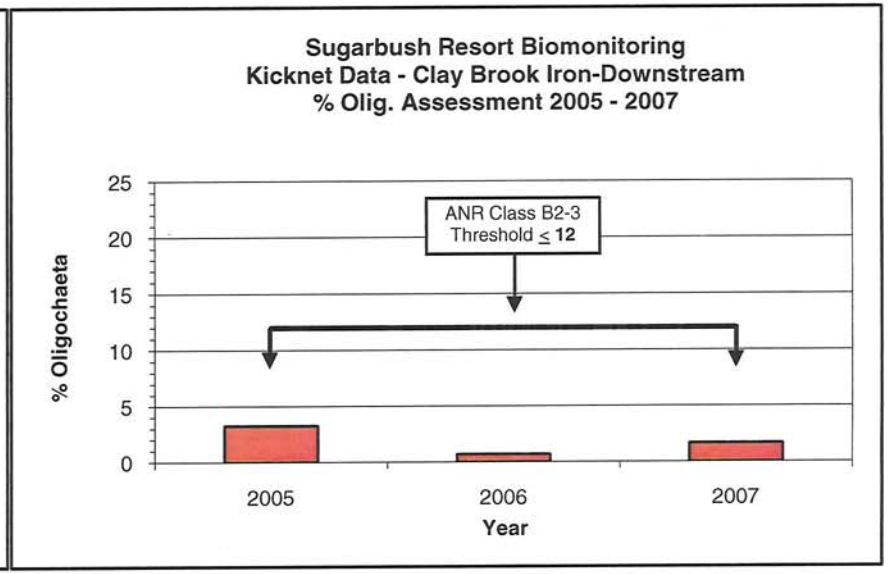


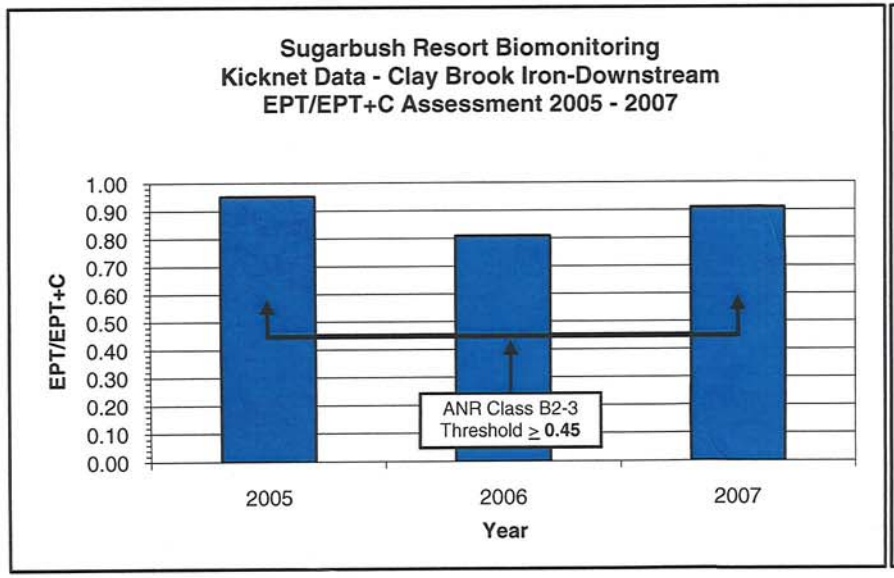


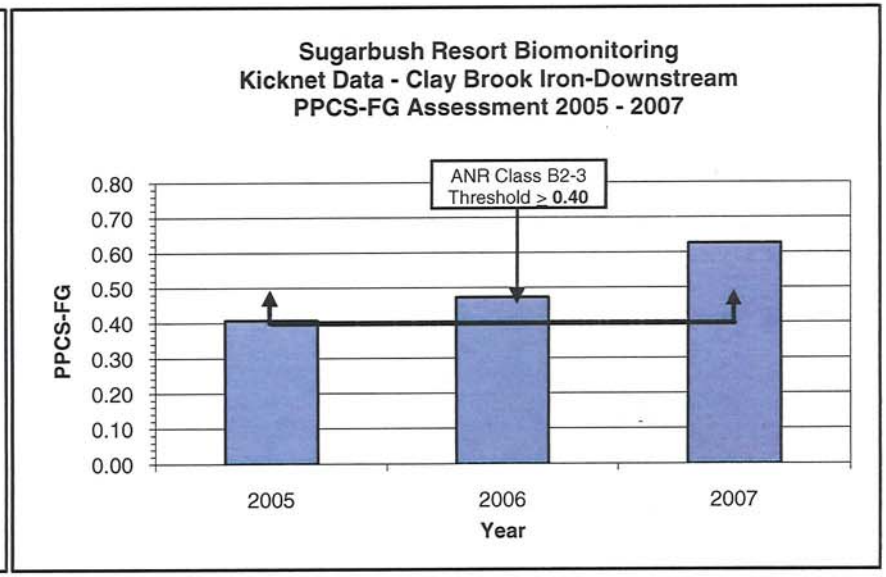


Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook Iron-Downstream
Summary Metric Charts



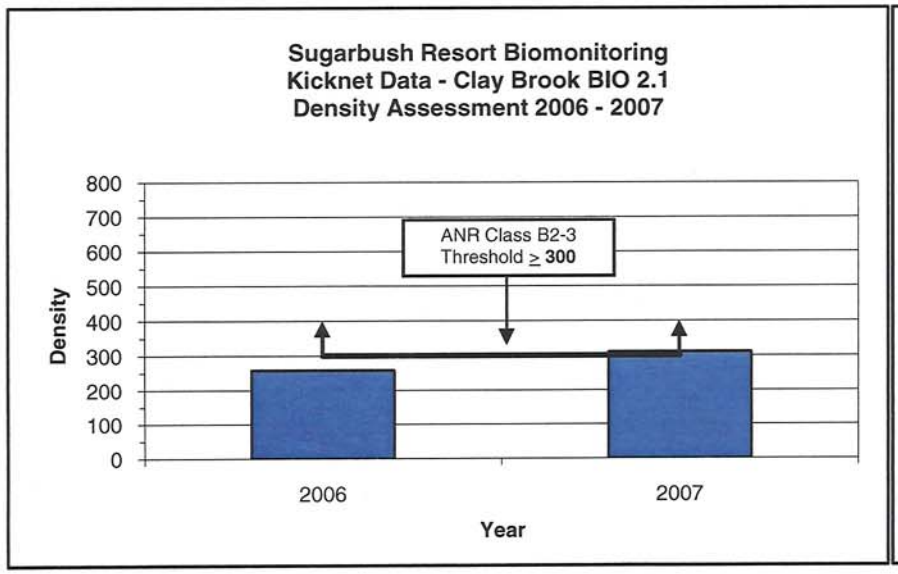


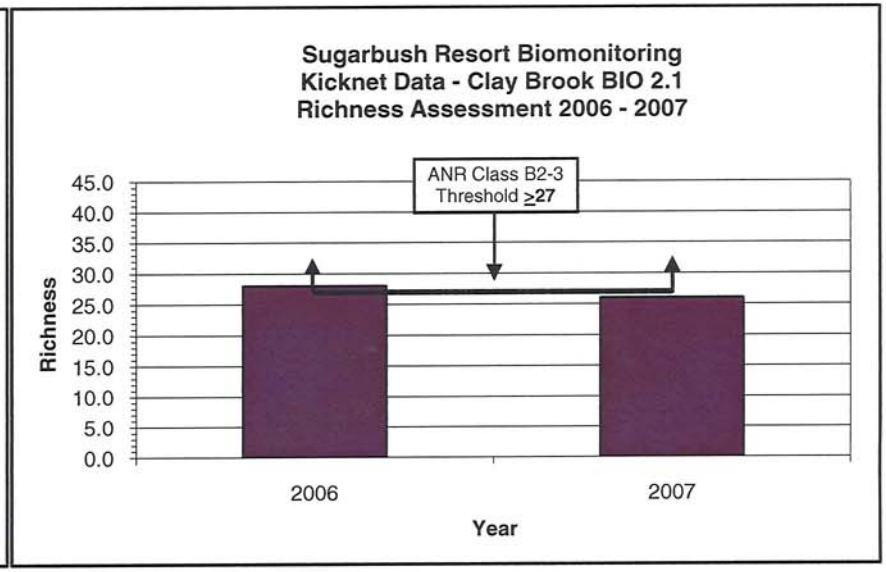


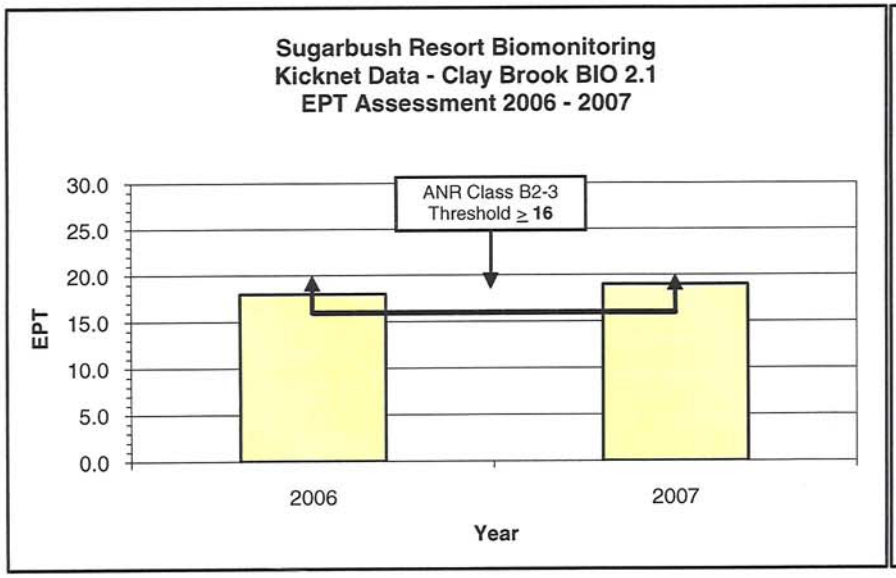


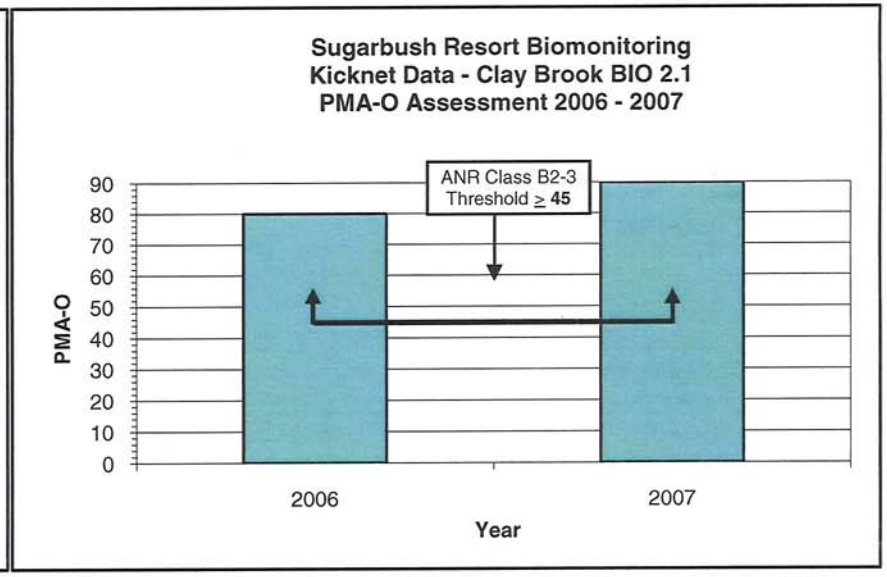
Sugarbush Resort Biomonitoring Kicknet Data - Clay Brook BIO 2.1 (Upstream IDP Station) Class B									
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT+C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	≥300	≥27	≥16	≥45	≤4.50	≤12	≥0.45	≥0.40	
2006	**258**	28.0	18.0	80	1.58	1.16	0.91	0.53	Indeterminate
2007	310	**26.0**	19.0	90	1.55	0.00	0.89	0.70	Not Supported
Bold/shaded denotes metric did not meet Class B2-3 biocriteria threshold									

Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook BIO 2.1
Summary Metric Charts

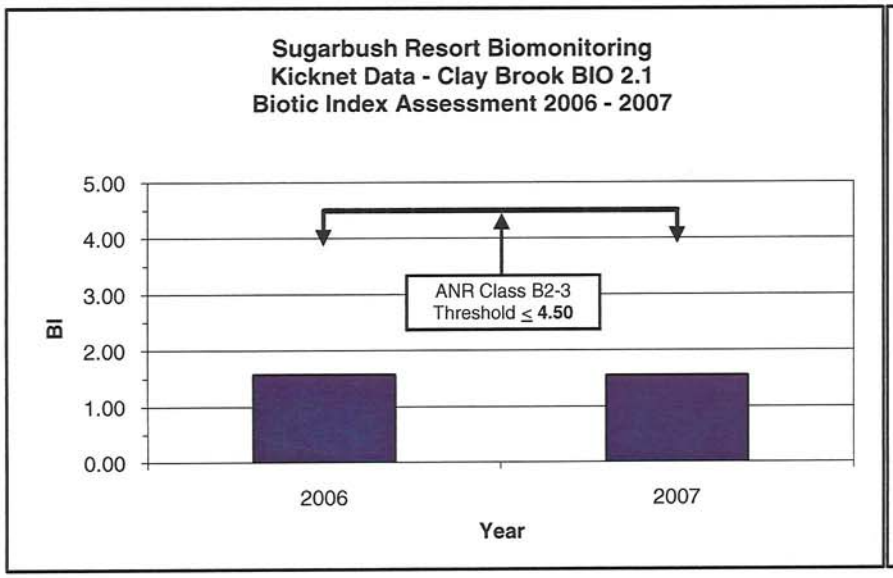


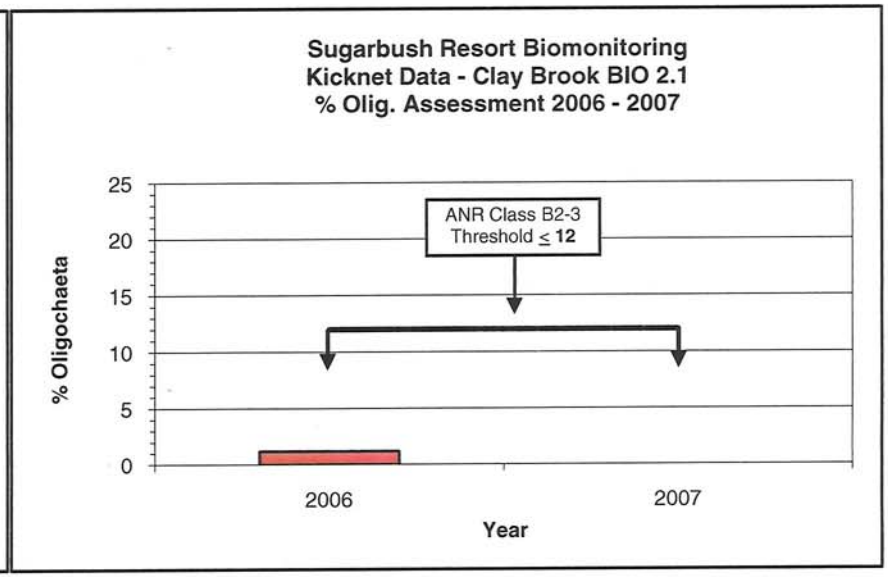


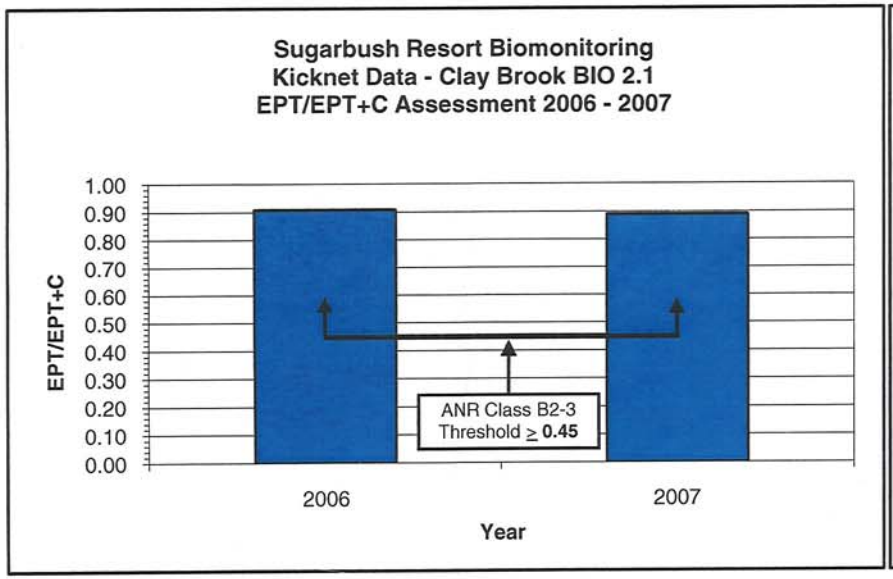


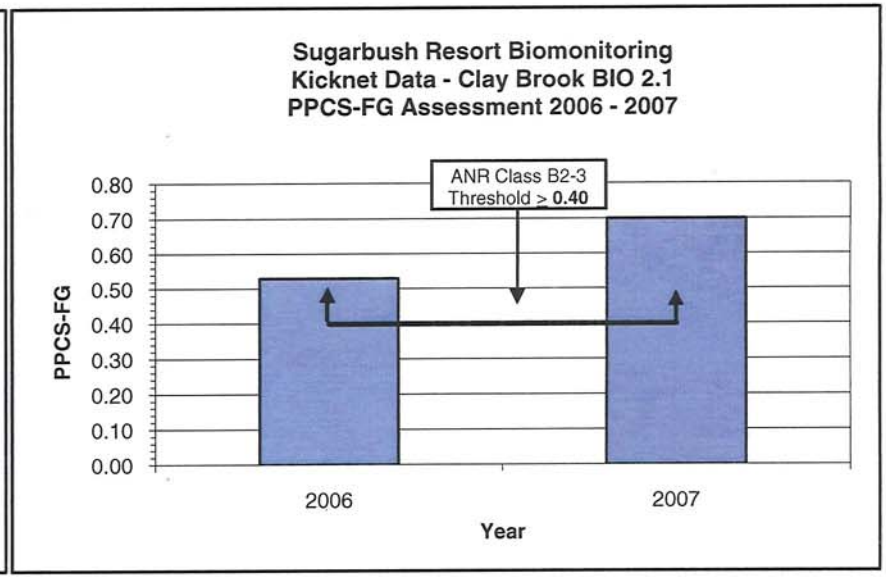


Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook BIO 2.1
Summary Metric Charts









Sugarbush Resort Biomonitoring

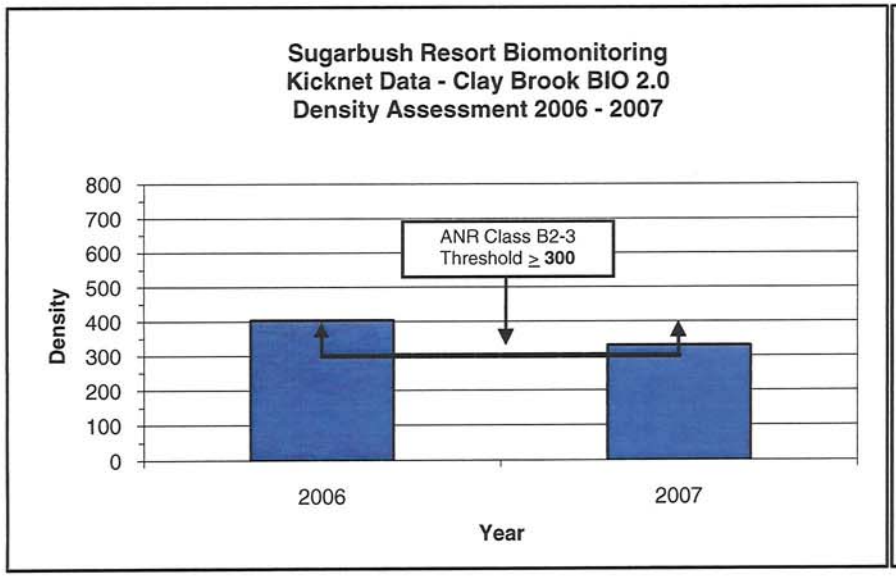
Kicknet Data - Clay Brook BIO 2.0 (Downstream IDP Station)

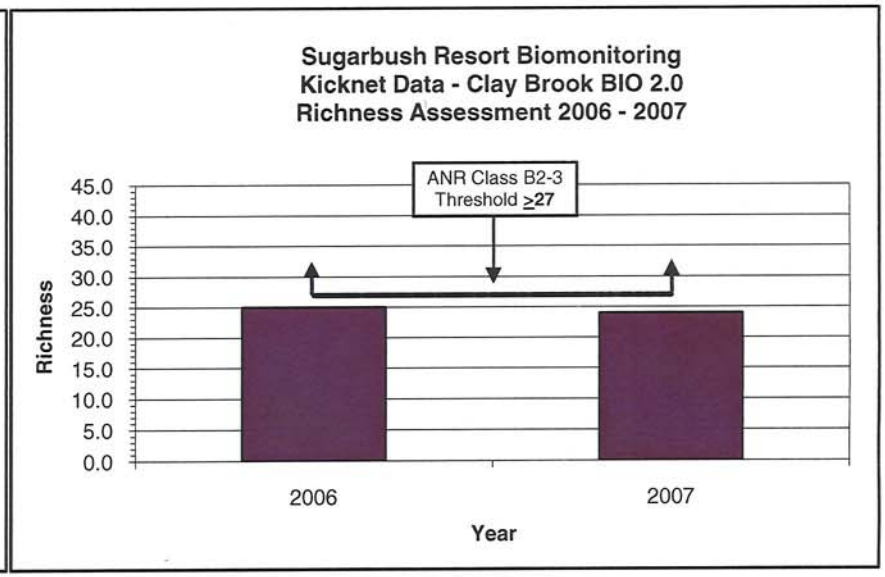
Class B

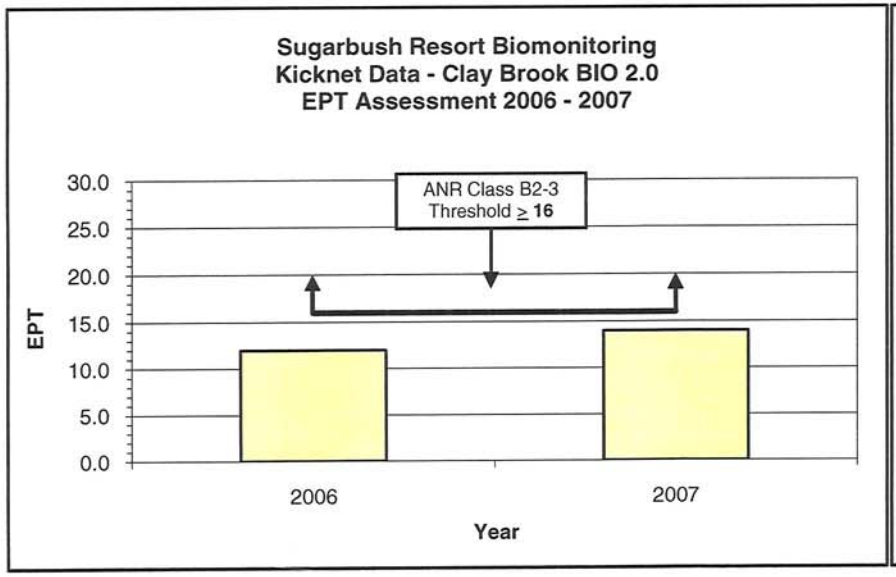
Year	Density	Richness	EPT	PMA-O	BI	% Oligo.	EPT/EPT+C	PPCS-FG	Outcome/ Biological Integrity
Class B2-3	**≥300**	**≥27**	**≥16**	**≥45**	**≤4.50**	**≤12**	**≥0.45**	**≥0.40**	
2006	403	**25.0**	**12.0**	59	2.56	0.25	0.96	0.46	Not Supported
2007	330	**24.0**	**14.0**	46	2.29	1.00	0.98	**0.38**	Not Supported

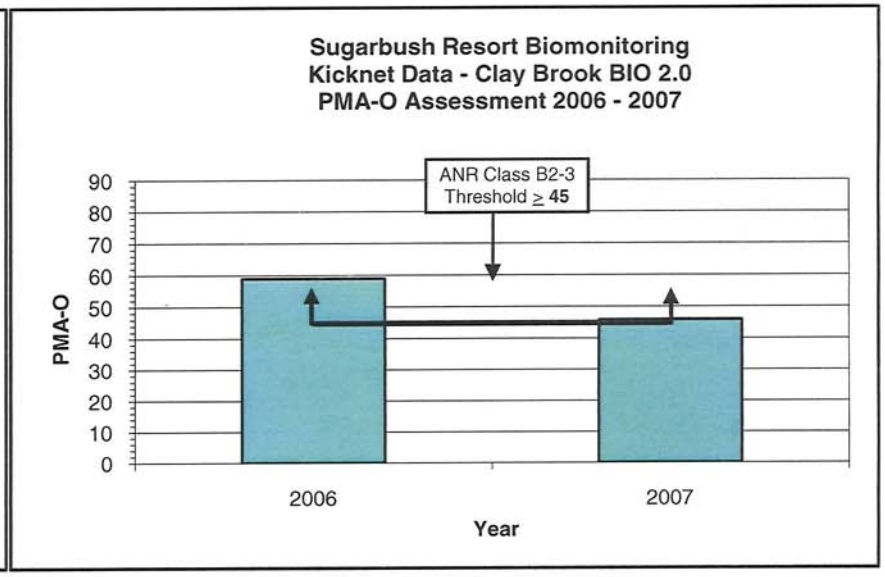
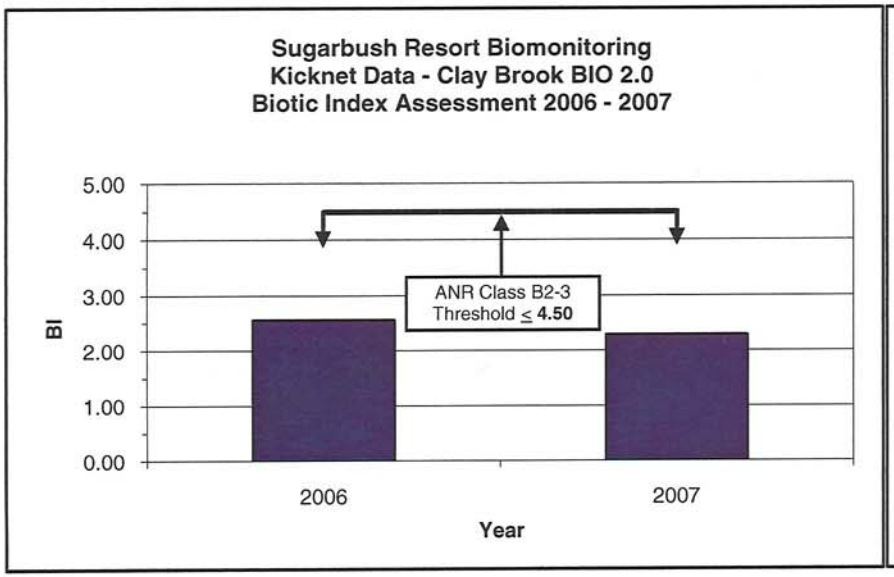
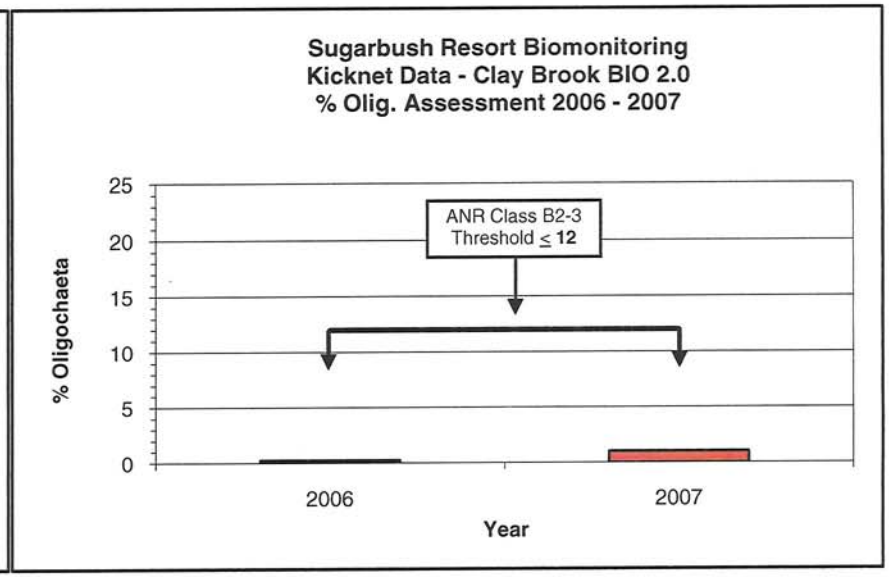
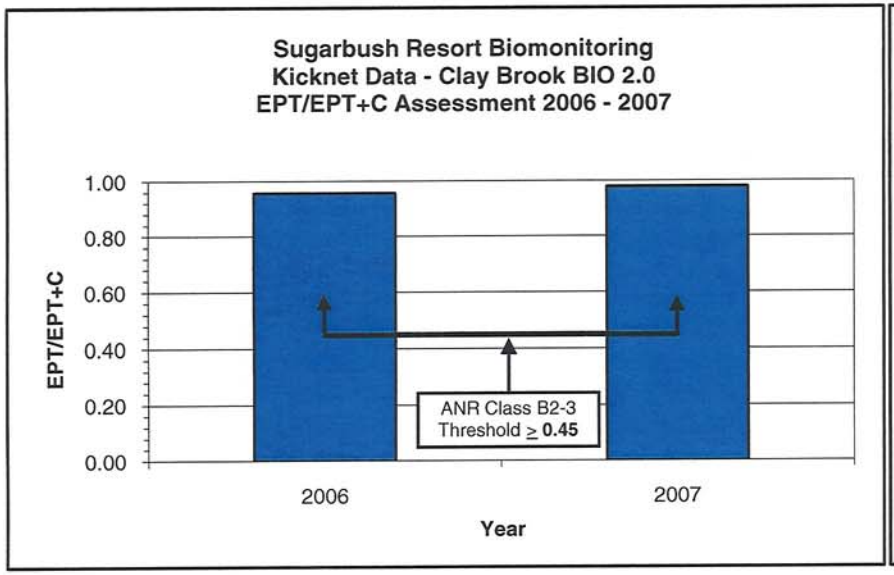
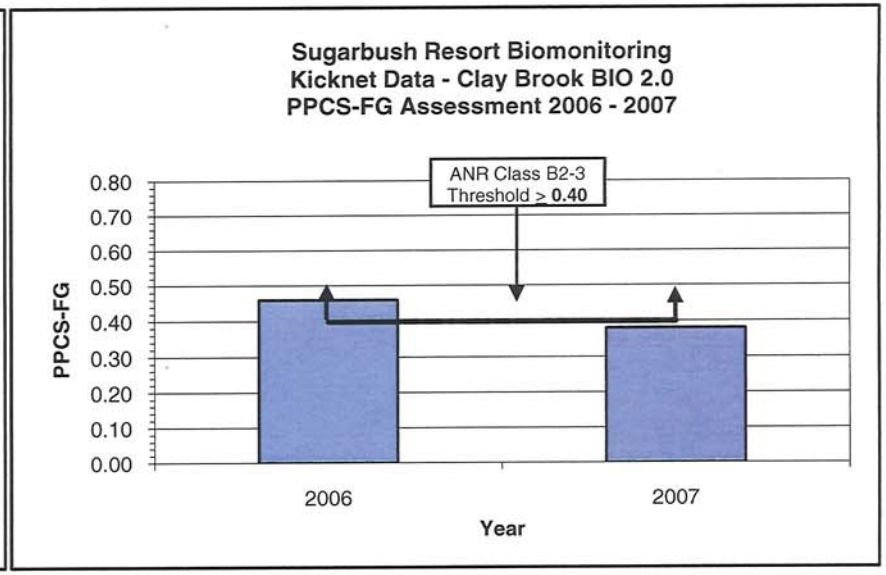
Bold/shaded denotes metric did not meet Class B2-3 biocriteria threshold

Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook BIO 2.0
Summary Metric Charts









Sugarbush Resort Biomonitoring
Kicknet Data - Clay Brook BIO 2.0
Summary Metric Charts