Heavenly LAKE TAHOE

January 18, 2022

Mr. Rob Tucker
Senior Water Resource Control Engineer
Lahontan Regional Water Quality Control Board
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

Re: Heavenly Mountain Resort 2017 through 2021 Environmental Monitoring Program Five Year Comprehensive Report

Dear Mr. Tucker:

Enclosed, please find for your review the Five Year Comprehensive Environmental Monitoring Program Report for the Water Years 2017-2021. This report is submitted in fulfillment of the monitoring and reporting requirements set forth in the California Regional Water Quality Control Board Lahontan Region Monitoring and Reporting Program No. 2015-0021 for Heavenly Ski Resort. This report also fulfills both the fourth quarter sampling and reporting, covering the months of July, August, and September, as well as the 2021 Annual Report. The annual report requirements and their location in the report are listed below:

- Water Quality Monitoring Results (Appendix A)
- Storm Vault Water Quality Monitoring Results (Appendix D)
- Facilities Maintenance Monitoring 4th Quarter of 2021 Water Year (Appendix E)
- Snow Conditioning and Snowmaking Monitoring (Appendix E)
- Deicer and Abrasives Application and Recovery (Appendix E)
- Facilities/Watershed Awareness Training (Appendix E)
- USFS Road Monitoring (Appendix F)

Pursuant to the Monitoring and Reporting Program No. 2015-0021, all BMP monitoring reports are submitted as an appendix to the Mitigation and Monitoring Annual Report in the spring of the following water year (May 1st, 2022). However, a comprehensive review of the past five water years with regards to the BMP program is included in this report as Chapter 4 for completeness. Additional trend analysis and project recommendations are also included in this report.

Should you require additional information or have questions regarding this report and its contents, please contact Chris Donley of Cardno at 208-272-9178.

Sincerely,

DocuSigned by:
Tom Fortune
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Tom Fortune
Vice President & General Manager

Cc: Nicole Bringolf, USDA Forest Service LTBMU
Julie Roll, Tahoe Regional Planning Agency
Anthony D’Angelo, Western Regional Compliance Sr. Manager at Vail Resorts
Blair Davidson, Senior Administrative Assistant at Heavenly

Date: January 18, 2022

California Regional Water Quality Control Board
Lahontan Region
2501 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150

Facility Name: Heavenly Mountain Resort

Address: Post Office Box 2180
Stateline, Nevada 89449

Contact Person: Tom Fortune

Job Title: Vice President & General Manager

Phone: (775) 586-2311

Email: tfortune@vailresorts.com

WDR/NPDES Order Number: R6T-2015-0021

WDID Number: 6A090033000

Type of Report (circle one)**:** Monthly Quarterly Semi-Annual **Annual** **Other**

Month(s) (circle applicable month(s)*:

JAN	FEB	MAR	APR	MAY	JUN
JUL	AUG	SEP	**OCT**	NOV	DEC

***Annual Reports** (circle the first month of the reporting period)

Year: Water Year 2022

Violation(s)? **NO** _______ **YES*** ___X___
(Please check one)
***If YES is marked complete a-g (Attach Additional information as necessary)**

a) Brief Description of Violation:

1. Heavenly Valley Creek station 43HVC-1A, Sky Meadows site, has an annual average value exceedance of the Lahontan standards for: Total Phosphorus and Chloride.
2. Heavenly Valley Creek station 43HVC-2, Patsy's site, has an annual average value exceedance of the Lahontan standards for: Total Phosphorus and Chloride.
3. Heavenly Valley Creek station 43HVC-3, Property Line site, has an annual average value exceedance of the Lahontan standards for: Total Phosphorus and Chloride.
4. Bijou Park Creek station 43HVC-4, CA Parking Lot site, has annual average exceedances of the Lahontan standards for: Total Nitrogen, Total Phosphorus, and Chloride.
5. Bijou Park Creek station 43HVC-4, CA Parking Lot site, has 90th percentile annual average exceedances of the Lahontan standards for: Suspended

Sediment.

6. Bijou Park Creek station 43HVC-4, CA Parking Lot site, had six daily exceedances of the Lahontan standards for: Turbidity.

7. California Parking Lot Filter Vault Effluent Point station 43HVP-2, exceeded not to exceed limits of the Lahontan standards in Water Year 2021 during all three storm sampling events. Turbidity and Total Nitrogen standards were exceeded 11/18/20. Turbidity, Total Phosphorus and Total Nitrogen were exceeded on 5/16/21, and Turbidity, Total Phosphorus, Total Nitrogen and Oil and Grease were exceeded on 6/24/21.

b) Section(s) of WDRs/ NPDES Permit Violated: Board Order No. R6T-2015-0021, WDID NO. 6A090033000

c) Reported Value(s) or Volume:

43HVC-1A: (Annual Average)
Total Phosphorus: 0.031 mg/L
Chloride: 0.769 mg/L

43HVC-2: (Annual Average)
Total Phosphorus: 0.028 mg/L
Chloride: 1.48 mg/L

43HVC-3: (Annual Average)
Total Phosphorus: 0.027 mg/L
Chloride: 1.12 mg/L

43BPC-4: (Annual Average)
90th Percentile Suspended Sediment: 81.7 mg/L
Total Nitrogen: 0.572 mg/L
Total Phosphorus: 0.178 mg/L
Chloride: 51.7 mg/L

43BPC-4: (*Turbidity Daily Exceedances > 20.0 NTU*)
Turbidity (11/19/20): 123.02 NTU
Turbidity (1/13/21): 86.9NTU
Turbidity (2/17/21): 21.1 NTU
Turbidity (4/20/21): 24.0 NTU
Turbidity (5/4/21): 174.0 NTU
Turbidity (9/20/21): 21.6 NTU

43HVP-2: (Results from November 18, 2020)
Turbidity: 150 NTU
Total Nitrogen: 1.0 mg/L

43HVP-2: (Results from May 16, 2021)
Turbidity: 760 NTU
Total Phosphorus: 0.63 mg/L
Total Nitrogen: 3.2 mg/L

43HVP-2: (Results from June 24, 2021)
Turbidity: 150 NTU
Total Phosphorus: 0.27 mg/L
Total Nitrogen: 5.8 mg/L
Oil and Grease: 3.7 mg/L

d) WDRs/NPDES Limit/Condition:

Maximum concentrations not to exceed for discharge to surface waters in the Lake Tahoe Hydrologic Unit (Applies to the Effluent Storm Filter Site 43HVP-2):

Turbidity: 20.0 NTU
Total Nitrogen: 0.5 mg/L
Total Phosphorus: 0.10 mg/L
Oil and Grease: 2.0 mg/L

Effluent limits for surface water runoff in the Lake Tahoe Hydrologic Unit and Additional Receiving Water Limits for Lake Tahoe (Applies to the Bijou Park Creek Site 43BPC-4):

Turbidity: 20 NTU [1]
Total Nitrogen: 0.15 mg/L
Total Phosphorus: 0.008 mg/L
Chloride: 3.0 mg/L
Total Suspended Solids: 60 mg/L [2]

Maximum receiving water concentrations for discharge in the Heavenly Valley Creek watershed to Trout Creek (Applies to 43HVC-1A, 43HVC-2, 43HVC-3 and the reference site 43HDVC-5):

Total Nitrogen: 0.19 mg/L
Total Phosphorus: 0.015 mg/L
Chloride: 0.15 mg/L
Total Suspended Solids: 60 mg/L [2]

[1] The turbidity maximum surface water runoff effluent value is based on the average daily samples collected from a single discharge point for the Lake Tahoe Hydrologic Unit.

[2] Total Suspended Solids (TSS) value based on Lake Tahoe Basin 90th percentile value.

e) Date(s) and Duration of Violation(s):

Water Year 2021 (October 1, 2020 – September 30, 2021)

f) Explanation of Cause(s):

Heavenly Valley Creek – Annual average values for total phosphorus and chloride were exceeded at each of the three sampling locations along Heavenly Valley Creek (43HVC-1A, 43HVC-2, and 43HVC-3). The annual average for total phosphorus and chloride were also exceeded at the reference reach sampling location (43HDVC-5) and it should be noted that no water quality samples were collected beyond July at the reference reach due to the Caldor fire. These reference site annual averages are truly undeveloped watershed conditions. The reference reach annual average for total phosphorus was slightly lower (0.022 mg/L) than the annual averages collected along the Heavenly Valley Creek locations. Similarly, the chloride annual average was exceeded at the reference reach for Water Year 2021 (0.37 mg/L). However, the Hidden Reference site (43HDVC-5) chloride annual average value was a fraction of the chloride exceedances along Heavenly Valley Creek locations. Since the reference reach site exceeded these state annual average standards, Heavenly Mountain Resort operations are not solely responsible for water quality exceedances reported.

Bijou Park Creek – Annual averages for total nitrogen, total phosphorus and chloride exceeded the state standard for the below California Parking Lot sampling site along Bijou Park Creek (43BPC-4). In addition, the 90th percentile suspended sediment annual value was also exceeded. As stated above, total phosphorus and chloride values were also exceeded at the reference site along Hidden Valley Creek (43HDVC-5); however, the annual averages for Bijou Park Creek (43BPC-4) are well above the reference reach exceedance values. For the second time in the past five years, the 90th percentile suspended sediment was exceeded for Water Year 2021. This also occurred during Water Year 2019. Lastly, six of the sixteen collected daily water samples at Bijou Park Creek exceeded the daily turbidity standard for 20 NTU. This site is located adjacent to Wildwood Avenue and downstream of Heavenly Mountain Resort's California Base Parking Lot and typically experiences the highest loading of all the creek sites.

California Parking Lot Filter Vault Effluent Sampling Location (43HVP-2) - Turbidity and total nitrogen exceeded the state standards for all three storm samples collected during Water Year 2021. These parameters were in exceedance of the standard at the two inlet locations (43HVP-1A and 43HVP-1B) for all three events as well. The storm runoff into the samples while filtered still did not meet state standards. Total Phosphorus was exceeded for both the May and June storm samples, but not the November sample. Since the November sample occurred at the beginning of the water year shortly after the filters had been replaced (typically in late summer), the new filters did their job; however, after a full winter season and filtration loading, they tend to become inoculated and are less effective at capturing and removing phosphorus. The June sampling event also reported an exceedance for oil and grease at the compliance outlet location. The northern inlet had an oil and grease detection as well, however, the outlet result is higher suggesting that oil and grease is accumulating in the system or that an oil and grease boom placed within the system had failed and released additional sheen. Another possible cause for the oil and grease exceedance could be the fact that there were parking lot pavement/asphalt improvements done over the course of the summer. As rain accumulates and starts to sheet flow across the new pavement, residual oils associated with asphalt would be transported into and through the filter system. Filter and oil boom maintenance and replacement was performed in July 2021 prior to the Caldor Fire and stationing of equipment, supplies, and firefighters during the months of August and September. Samples collected in Water Year 2022 hope to show that fire operations in the parking lot did not adversely affect the filtration system.

g) Corrective Action(s): (Specify actions taken and a schedule for actions to be taken)

For Water Year 2021, Heavenly applied 300 gallons of liquid brine prior to storms in lieu of abrasives. This effort is slightly less than the past season, but brine application is storm dependent and may also be associated with the pandemic (COVID) requiring guest reservations to ski/visit the resort. Since 2017, Heavenly has committed to the application of brine to the parking lot and main entrance roadways accessing the California Lodge/Parking Lot. Continued sampling should show a decrease in water quality constituent loading associated with cinder/salt application as the resort emphasizes the application of liquid brine.

Heavenly continues to inspect, maintain, and implement annual filter replacement as needed for the vault system. At a minimum, all sacrificial filters (14) are replaced annually, and additional filter replacement is determined based on filter media inspections. Filter and vault inspections occurred on July 15th and additional vault clean out occurred on July 30th of Water Year 2021. The filter maintenance logs are included in Appendix E. Additional parking lot improvements included the removal and replacement of 11,600 ft^2 of degraded and replacement of asphalt in the Upper California Parking Lot and 13,000 ft^2 in the Lower Parking Lot. Two drop inlets were repaired and the French drain at the toe of slope between the Upper and Lower lots was improved (July CA Maintenance Log – Appendix E).

Unfortunately, mother nature and the Caldor Fire began in August and forced the evacuation of South Lake Tahoe. Fire operations were moved to the California Parking Lot. This included the command center, sleeping quarters, restrooms, and kitchen facilities to shelter and feed the numerous firefighters. The control center and associated management brought unprecedented traffic and travel to and through the parking lot. Time and future water quality sampling events will tell what toll the additional usage took upon both the parking lot and filtration system.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision following a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my knowledge of the person(s) who manage the system or those directly responsible for data gathering, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

If you have any questions or require additional information, please contact Tom Fortune at the number provided above.

Sincerely,

DocuSigned by:

Signature: Tom Fortune

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Name: Tom Fortune

Title: Vice President & General Manager

Environmental Monitoring Program Comprehensive Report

Heavenly Mountain Resort Water Years 2017–2021

WDID: 6A090033000

January 2022

Photo courtesy of Heavenly Mountain Resort

Cardno®

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Document Information

Prepared for	Heavenly Mountain Resort 224 Kingsbury Grade P.O. Box 2180, State Route 27 – Suite 202 Stateline, NV 89449 and Lahontan Regional Water Control Board & Lake Tahoe Basin Management Unit (USFS)
Project Name	Environmental Monitoring Program Comprehensive Report
File Reference	Environmental Monitoring Program Comprehensive Report_ie.docx
Job Reference	E321403000
Date	January 2022

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Acronyms

BMI	Benthic Macroinvertebrate
BMPs	Best Management Practices
CalTrans	California Department of Transportation
CEDEN	California Environmental Data Exchange Network
CERP	Construction Erosion Reduction Program
cfs	cubic feet per second
CSCI	California Stream Condition Inventory
CSLT	City of South Lake Tahoe
CWE	Cumulative Watershed Effects
cm	centimeter
EIR/EIS	Environmental Impact Report / Environmental Impact Statement
EIR/EIS	Environmental Impact Report / Environmental Impact Statement / Environmental Impact Statement
EMP	Environmental Monitoring Program
GPS	global positioning system
Heavenly	Heavenly Mountain Resort
IBI	Index of Biological Integrity
Lahontan	Lahontan Regional Water Quality Control Board (of the state of California)
LTBMU	Lake Tahoe Basin Management Unit (USDA Forest Service)
LWD	large woody debris
m	meter
mg/L	milligrams/lite
rmm	millimeter

MMP	Mitigation and Monitoring Plan
MRP	Monitoring and Reporting Program
ND	Non Detect
NTU	Nephelometric Turbidity Units
RCI	Resource Concepts, Inc.
RIVPACS	River Invertebrate Prediction and Classification System
SCI	Stream Condition Inventory
SEZ	Stream Environment Zones
SNOTEL	Snow Telemetry
SWAMP	Surface Water Ambient Monitoring Program
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TRPA	Tahoe Regional Planning Agency
TSS	Total Suspended Sediment
USFS	United States Forest Service
WDID	Waste Discharger Identification
WDR	Waste Discharge Requirement
WET Lab	Western Environmental Testing Laboratory
WMPR	Watershed Maintenance and Restoration Program
WY	Water Year

1 Executive Summary

This report is organized into three levels of detail enabling the reader to choose between a broad summary and specific areas of focus. The executive summary is a first tier, providing an overview of Heavenly Mountain Resort's (Heavenly's) watershed rating over a 5-year period (2017–2021). This tier consists of Tables 1-1 and 1-2, which provide a quick overview and summary of the rating criteria established in the Waste Discharge Requirements (WDRs) for Heavenly. The summary tables also provide a roadmap to the more detailed discussion in the report.

The second tier is the body of the Environmental Monitoring Program (EMP) Comprehensive Report (2017–2021), which contains a moderate level of detail in describing the watershed conditions and trend analysis for water quality, stream condition, and best management practice (BMP) effectiveness and the Watershed Maintenance and Restoration Program (WMRP). Additional trend analysis is discussed as are conclusions and recommendations moving forward. The body of the report also directs readers to the appendices, where the greatest level of detail is provided.

The third tier, the most detailed tier, includes the appendices at the end of the comprehensive report. The appendices contain monitoring data, graphs, statistics, as well as other annual report requirements outlined in the WDR Monitoring and Reporting Program (MRP). Discussion in the report builds upon the data supplied in the appendices.

The following tables (1-1 and 1-2) summarize the overall ratings and findings detailed in the body of this report for both Watershed CA-1 (Heavenly Valley Creek) and Watershed CA-6A (Bijou Park Creek). These tables and additional discussion can be found in Chapter 6 of this report.

Table 1-1 Watershed CA-1 Rating Criteria Summary

Watershed CA-1	Watershed Condition	Rating Criteria
Heavenly Valley Creek	Water Quality	*Fair* for Heavenly Valley Creek
Heavenly Valley Creek	Stream Condition	*Good* for 2 of the 3 reaches along Heavenly Valley Creek
Watershed CA-1	BMP Effectiveness	*Excellent* for the entire resort including Watershed CA-1
Watershed CA-1	Watershed Maintenance & Restoration Program	*Excellent* – most master plan projects are located in Watershed CA-1
Overall Rating		*Stable* – conditions have not improved substantially but have not deteriorated either.

Table 1-2 Watershed CA-6A Rating Criteria Summary

Reaches within Watershed CA-6A	Watershed Condition	Rating Criteria
Bijou Park Creek and Storm Vault Effluent monitoring site	Water Quality	*Fair* for Bijou Park Creek and vault storm samples
Bijou Park Creek and California Base Parking Lot	Stream Condition	"N/A" – Stream Condition Inventory monitoring not required along Bijou Park Creek at this time
Watershed CA-6A	BMP Effectiveness	*Excellent* for the entire resort including Watershed CA-6A
Watershed CA-6A	Watershed Maintenance & Restoration Program	"N/A" – no master plan projects are located in Watershed CA-6 (mostly maintenance-related projects)
Overall Rating		*Stable* – not all metrics are measured in this watershed

The overall rating for the Heavenly Valley Creek Watershed CA-1 is considered *stable*, seeing as how water quality and stream condition results have shown neither improvement nor degradation over the past years. Likewise, the rating for the Bijou Park Creek Watershed CA-6A is considered *stable*; however, not all metrics are measured or scored in this watershed. Water quality is the driver for Bijou Park Creek, and water quality concentrations for some parameters are decreasing.

Recommendations regarding improvements to the MRP as well as the WDR are detailed within the body of the report. For simplicity these recommendations are summarized below:

1. Although the Hidden Valley Creek reference reach site (43HDVC-5) was affected by the Caldor Fire, we recommend retaining this sampling location and note its recovery to proper functioning condition post-fire.

2. Water quality monitoring results continue to be formatted and uploaded to the California Environmental Data Exchange Network (CEDEN) database so that future decisions regarding impaired waterbodies under Section 303(d) of the Clean Water Act can be informed by these data. When completed, water quality data will span from water year 2010, providing 12 years' worth of results.

3. Heavenly has consistently met the rolling 5-year average for total suspended sediment (TSS) Total Maximum Daily Load (TMDL) at the Property Line monitoring site (43HVC-3) since 2005. The Lahontan Regional Water Quality Control Board (Lahontan) should consider delisting this constituent from the 303(d) list for this waterbody.

4. Additional recommendations for improving the StormFilter treatment vault and thus effluent water quality results were outlined in the *Bijou Park Creek Evaluation Report* (Tormey 2017, Appendix J of this report) and are summarized in Chapter 3.6.5. Heavenly should work with Lahontan to establish a new sampling station along Bijou Park Creek that would act as a reference and provide background data for water quality results. Additional vault improvements are detailed as well, in hopes of further aiding in filtration and improved water quality.

5. We recommend continuing adaptive management practices with regard to stream condition monitoring, water quality monitoring, and BMP effectiveness and WMRP monitoring and reporting. Proactive solutions for each of these monitoring matrix items improve data collection and therefore reporting. For example, as technology advances, finding applicable means and incorporating them improves data collection, saving time and money in terms of labor, compilation, and reporting.

2 Introduction and Background

2.1 Introduction

This comprehensive report presents and interprets 5 years of environmental monitoring data at Heavenly Mountain Resort (Heavenly) from 2017 through 2021. The US Forest Service (USFS) Lake Tahoe Basin Management Unit (LTBMU) prepared a comprehensive report covering data from 1991 to 2003; Cardno (formerly ENTRIX, Inc. and Cardno ENTRIX) prepared the 2001 to 2005 comprehensive report in 2006, the 2006 to 2011 comprehensive report in 2012, and the 2012 to 2016 comprehensive report in 2017. The purpose of the comprehensive report is to evaluate long-term trends and make recommendations for modifications to the monitoring program as indicated by the review. This report is composed of five trend analysis chapters: water quality monitoring, Watershed Maintenance and Restoration Program (WMRP) implementation, best management practices (BMPs) effectiveness monitoring, riparian condition monitoring, and overall watershed health. Additional chapters in this report cover annual Lahontan Regional Water Quality Control Board (Lahontan) reporting requirements for water year (WY) 2021.

2.2 Purpose

The primary purpose of this report is to present trend analysis, with respect to watershed health, as measured through data collected in WYs 2017 through 2021 at Heavenly and as defined by the Lahontan Board Order Waste Discharge Requirements (WDRs). If indicated by the trend analysis or by observations and measurements during this 5-year period, make recommendations to improve the effectiveness of the monitoring to meet the monitoring objectives.

2.3 Scope

Heavenly's first comprehensive report in 2003 covered a time period of 13 years (1991 through 2003). In accordance with the 2003 Lahontan Board Order, future comprehensive reports encompass 5 years of data to tie to the Lahontan Board's NPDES review cycle more closely. The 2006 comprehensive report covered WYs 2001 through 2005; the analyzed data overlapped the 2003 report. No new information was gathered on effective soil cover or riparian condition during this time interval, and the focus was limited to water quality, taking into consideration results dating back to 1991, which included the first 9 years of implementation of the monitoring program under the EIS and subsequent master plan. Pursuant to the amended monitoring and reporting program, the following comprehensive report covered the time frame of 2006 to 2011, covering a 6-year span due to the timing of the amended monitoring and reporting program. The most recent comprehensive report, submitted in 2017, covered WYs 2012 to 2016 and adhered to the Lahontan Board Order WDRs (Board Order R6T-2015-0021, Waste Discharge Identification [WDID] 6A090033000) signed in May 2015. Comprehensive reports are now submitted on a 5-year cycle.

The monitoring program was originally developed and implemented by the USFS as part of the Heavenly Ski Resort Master Plan Environmental Impact Statement (Parsons Harland Bartholomew and Associates, Inc. 1996) and later incorporated into the Heavenly Ski Resort Master Plan as Chapter 7 (Parsons Harland Bartholomew and Associates, Inc. 1996). In 2003, the Lahontan issued a Revised Board Order and a revised monitoring plan. In 2005, monitoring and reporting duties were transferred to ENTRIX, Inc. by Heavenly. The 2007 amendment to the Heavenly Ski Resort Master Plan, approved by the Tahoe Regional Planning Agency (TRPA) on April 25, 2007, went into effect and was implemented by Heavenly in collaboration with Lahontan, the USFS, and TRPA. Modifications resulting from the master plan amendment included incorporating data from all mitigation monitoring into a single report that is to be submitted annually in May to the TRPA, USFS, and Lahontan. The mitigation monitoring report schedule and submittal are ongoing and occur annually.

Due to proposed on-mountain expansion plans, a joint Environmental Impact Report/Environmental Impact Statement/Environmental Impact Statement (Final EIR [CEQA] and EIS [TRPA/NEPA]) was developed and approved in the spring of 2015 (Hauge Brueck Associates 2015). This document followed the formats of the Heavenly Ski Resort Master Plan EIR/EIS/EIS (Parsons Harland Bartholomew and Associates, Inc. 1996) and 2007 Heavenly Mountain Resort Master Plan Amendment (Parsons Harland Bartholomew and Associates, Inc. 2007), and where appropriate the new master plan was updated and refined.

The requirements of the annual and comprehensive water quality and BMPs monitoring reports remained the same following approval of the master plan amendment. As the California Environmental Quality Act lead agency, Lahontan is responsible for ensuring all mitigation measures are implemented in accordance with the monitoring program; additionally, “the Water Board recognizes that another agency (USFS or TRPA) has responsibilities for ensuring implementation” for monitoring mitigation measures outside of Lahontan’s authority (Lahontan 2015a:16–17). The annual BMP monitoring report is submitted with the annual mitigation and monitoring report due on May 1 of the following year; however, the 5-year comprehensive review of BMP effectiveness is included in this report.

The master plan represents a comprehensive 20-year development plan for Heavenly. Master plan and master plan amendment implementation objectives of Heavenly, TRPA, and the USFS regarding protection of the environment include (Parsons Harland Bartholomew and Associates, Inc. 2007):

- Making optimal use of the natural attributes of the site without creating a substantial impact on the environment (Heavenly);
- Restoring the health of sub-watersheds and other natural resource values disturbed by past activities (Heavenly);
- Protecting the environmental quality of the area (USFS);
- Providing a quality ski experience within the resort with ski runs and other disturbed areas stabilized to reduce the potential for soil erosion (USFS);
- Improving the visual quality of the area (USFS); and
- Providing for long-term preservation and restoration of stream environment zones (SEZs) (TRPA).

Implementation of the Collection/Monitoring Agreement between Heavenly and the USFS under the monitoring program will provide data sufficient to determine compliance with agency water quality standards and validate the efficiency of BMPs in protecting against adverse cumulative watershed effects.

2.4 Location

Heavenly lies in the southeastern corner of the Lake Tahoe Basin, on the east slope of the central Sierra Nevada in the Carson Range. Encompassing about 10,530 acres (4,800 skiable acres) in California and Nevada, the resort is one of the largest in the area operated on USFS lands. For the 2022 ski season, Heavenly has 28 ski lifts (including gondola and tram) and 122 ski trails. As of 2021, this equated to approximately 720 acres of named trails, 650 lift acres, a number of on-mountain lodge facilities, and approximately 30 miles of summer maintenance roads within the resort boundary (Figure 1-1).

The California/Nevada state line divides the USFS special use permit boundary, with approximately 60 percent of the ski area in Nevada and 40 percent in California. Approximately 60 percent of Heavenly lies within the jurisdiction of the TRPA within the Lake Tahoe Basin (Parsons Harland Bartholomew and Associates, Inc. 1996).

Heavenly has been a special-use permittee of the USFS since 1955. In 2002, Heavenly was acquired by Vail Resorts, Inc.

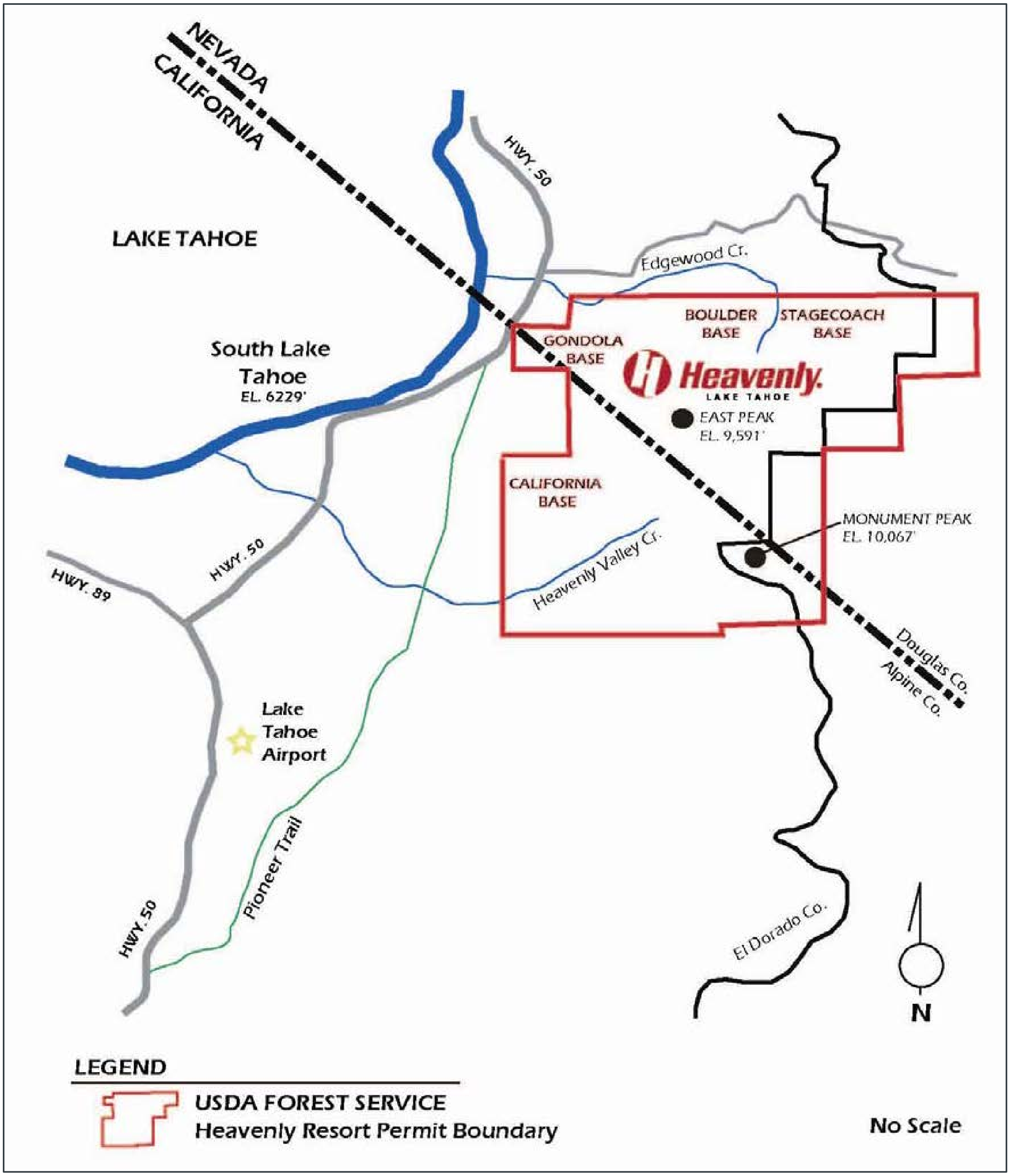

Figure 2-1 Location of Heavenly Mountain Resort (Source: Parsons Harland Bartholomew and Associates, Inc. 2007)

2.5 Site Geology

The section of the Carson Range in which Heavenly is situated is formed from a granitic batholith. Soils are derived from deposits of decomposed granite rock including quartz, monzonite, and granodiorite. The granitic rock at Heavenly ranges from rock outcrops to decomposed granitic grus. Grus is crumbled granite that forms by physical weathering, specifically the hot-and-cold cycling of daily temperatures. Grus typically produces coarse-textured soil. Coarse-textured soils are highly permeable, have surface layers that do not absorb water readily, and are easily eroded. The decomposed materials leave residual soils on slopes and form colluvial soils from eroded materials farther downslope.

Much of the steep terrain has a thin layer of young soils that occur on actively eroding slopes. If these soils are disturbed, runoff is rapid and erosion hazard is high. Rocky outcrop areas have rapid runoff but only a slight erosion hazard. Small areas of recently formed alluvium, adjacent to streams and meadows on level to gently sloping slopes, support riparian vegetation and have a seasonal high-water table at a depth of 12 to 24 inches. Springs are commonly found near the base of steep granitic slopes in locations such as Heavenly's California Base area.

2.6 Site Hydrology

Heavenly Valley Creek is a tributary to Trout Creek, which is a tributary to the Upper Truckee River. The Heavenly Valley Creek watershed is designated as CA-1. Within the USFS permit boundary, the watershed is approximately 64,750 square miles, with approximately 3,450 feet of vertical relief. Many of the upper ski runs, lifts, and facilities on the California side of the ski resort are within the upper watershed of Heavenly Valley Creek. Heavenly Valley Creek is generally a perennial stream with peak flows from May to July. At lower elevations the stream has run dry in drought years.

The highest point in the Heavenly Valley Creek watershed is Monument Peak at 10,053 feet. The watershed contains Sky Meadows, which is approximately 8,600 feet in elevation. Below Sky Meadows, Heavenly Valley Creek flows into a 22 to 28 acre-feet capacity reservoir (Sky Meadow Reservoir) used for snowmaking and irrigation storage. Approximately 1,300 feet below the reservoir dam (California Dam), tributaries join the mainstream. Heavenly Valley Creek flows southwest for approximately 1,200 feet before exiting the developed portion of the ski resort at approximately 7,900 feet in elevation. Heavenly Valley Creek drops another 1,300 feet in the next 1.5 miles before exiting the USFS permit area and Heavenly property line at an approximate 6,600-foot elevation.

Several smaller watersheds are also contained within the California side of Heavenly. The CA-6 watershed is 412 acres and includes steep ski slopes (the Face), the California Base area, Wildwood-Keller Creek, and Bijou Park Creek. Development of the California Base area involved more than 10 acres of cut and fill to create the California Base Lodge, maintenance facilities, and parking lots. Bijou Park Creek surfaces northwest of the California Base area and drains into Lake Tahoe at the Ski Run Marina.

The CA-4 watershed is approximately 136 acres and contains one access road and Bijou Creek. Bijou Creek drains into Lake Tahoe approximately 2,000 feet west of Bijou Park Creek.

The CA-7 watershed, a portion of which is in Nevada, is approximately 284 acres and drains into the area below the gondola. It discharges into the casino core area on the Nevada side of the state line. Nearly all of the 370 acres of California land draining toward the West Fork Carson River in Nevada is in the Mott Canyon watershed (NV-1), while a few acres drain into the South Fork Daggett Creek watershed (NV-2+5).

In order to effectively monitor the entire Heavenly project area, water quality sampling occurs in Heavenly Valley Creek, Bijou Park Creek, and Edgewood Creek.

2.7 Heavenly Water Quality History

Lake Tahoe was designated as an "Outstanding National Resource Water" in the 1980s by the US Environmental Protection Agency. This designation affords strict water quality objectives for the lake and its tributaries, including those originating from Heavenly. Consequently, maintaining water quality at the resort is a high priority and has been the focus of restoration and monitoring programs. Early analysis of water quality data collected at Heavenly Valley Creek indicated total suspended sediment (TSS) and nutrient concentrations were affected by ski resort development; however, specific causes were not identified.

Many older run surfaces were created by the preferred method of bulldozing a swathe down steep hillsides, resulting in removal of all vegetation, rocks, and woody debris and often loss of the shallow topsoil. Roads were built to install lifts, thereby interrupting drainage patterns with bare, compacted surfaces. The loss of soil cover and alteration of the topography caused accelerated erosion throughout the resort, although the relative contribution from individual sources, including those not attributable to the resort, was not identified through water quality monitoring. Similarly, beneficial effects of revegetation and other mitigation projects prior to 1991 could not be detected using the monitoring data of the time.

Heavenly's planning process was guided by a steering committee comprising members from Heavenly, the USFS, the TRPA, El Dorado County (California), the City of South Lake Tahoe (California), and Douglas County (Nevada). The steering committee agreed that quantitative data were needed to numerically judge the ecosystem health at Heavenly. The need for compliance with state standards and the ease of obtaining water samples have been the primary reasons for emphasis on measuring water quality. The USFS was tasked with preparing a watershed monitoring program that would track the progress of past and future restoration and mitigation, as well as that of new development.

2.8 Monitoring Program History

Heavenly has been subject to water quality regulation by Lahontan since 1970. The original monitoring program was developed by the USFS as part of the Heavenly Master Plan Draft Environmental Impact Statement in 1996, prepared pursuant to the TRPA Code of Ordinances. It was later incorporated into the Heavenly Ski Resort Master Plan as Chapter 7 of that document. The master plan allows annual reviews and permits the Collection and Monitoring Agreement to be updated as necessary.

The monitoring program was revised in 2003 in Lahontan Board Order R6T-2003-0032. The 2003 revisions were to acknowledge new facilities, uses, and the Total Maximum Daily Load (TMDL) Program for Heavenly Valley Creek. The master plan amendment was approved on April 25, 2007; the amended master plan built on the original master plan and was updated with future on-mountain improvements proposed by the new owners (Vail Resorts, Inc.).

The monitoring program was revised again in May of 2011 by Lahontan (Program Number 2003-0032A1, WDID number 6A090033000) to incorporate monitoring of the newly installed filter vaults in the California Base Parking Lot. In 2015, a joint EIR/EIS/EIS was completed, addressing environmental concerns with newly proposed on-mountain improvements. This document also updated the 2007 master plan amendment. To be consistent with the revised master plan and EIR/EIS/EIS, Lahontan incorporated these changes into a new WDR permit (Board Order R6T-2015-0021, WDID 6A090033000). The new WDRs govern this report and employ the updated TMDL targets included in Table 2-1.

Table 2-1 Heavenly Valley Creek Total Maximum Daily Load Targets

Parameter	Heavenly Valley Creek TMDL Target
Instream sediment load	Maximum of 58 tons/year as a 5-year rolling average, as measured at the HVC-3 monitoring location
Stream condition index	Rating of *Good* or better
Benthic macroinvertebrate health	Improving trends in community metrics with stable conditions comparable to Hidden Valley Creek (reference reach)
BMP effectiveness	Rating of *Good* or better
Watershed Maintenance and Restoration Program	Rating of *Good* or better

Much of the information collected prior to 1991 provides a generalized baseline for understanding physical, chemical, and biological impacts of ski area development on ecosystem resources, against which future management activities may be measured. The monitoring program combines as many physical, chemical, and biological parameters as feasible to gain a comprehensive view of watershed processes. Soil cover, BMPs, and riparian conditions are three areas impacting water quality at Heavenly that were selected for additional monitoring. Each of these areas affects others; a comprehensive condition and trend analysis in 2003 attempted to tie all of the individual parts together to show interactions and opportunities for adaptive management.

In 2003, the first comprehensive report was completed by the USFS and included data from 1991 through 2003. In general, the 2003 report determined most of Heavenly's watersheds to be in good condition and improved from the before-treatment period. The 2003 report did not provide statistical analysis due to an insufficient number of WYs to represent the after-treatment period. Specifically, the before-treatment period was generally high flow (wet years), while the after-treatment period had generally low flow conditions (dry years). WY 2005 represented the first wet year since many of the watershed treatments and was comparable to conditions in the pre-treatment period. That report focused on a more in-depth analysis of before- and after-treatment WYs.

Recommendations from this comprehensive report resulted in a shift away from ground- and aerial-truthing of vegetation establishment (i.e., effective soil cover); additionally, water quality monitoring results at the Sky Meadows monitoring site (43HVC-1A) showed improvement that resulted in temporarily suspending additional sampling at this location. Benthic macroinvertebrate (BMI) sampling associated with the EIR/EIS/EIS document and revisions to the waste discharge Monitoring and Reporting Program (MRP) No. 2015-0021 reinstated the requirement for water quality monitoring at Sky Meadows. Water quality sampling began in the fourth quarter of WY 2015, after nearly 9 years. Similarly, the 2006 to 2011 and 2012 to 2016 comprehensive reports revisited cumulative watershed health over the next years of data collection. Recommendations from these reports have included monthly monitoring of deicer and on-mountain salt application to help improve data collection and long-term reporting.

This comprehensive report is focused on the period after treatment covering WYs 2017 through 2021. It focuses on water quality monitoring and data reporting, watershed maintenance and restoration, BMP effectiveness, riparian condition, and watershed health as governed by the WDRs. Additionally, deicers and abrasives application/recovery monitoring, snow conditioning and snowmaking enhancement monitoring, USFS roads monitoring, facilities maintenance monitoring, and awareness training are described in this report to meet the requirements of the annual report. Each of these topics is discussed to support adaptive management decisions.

2.9 Significant Projects and Watershed Changes since 2016

Annual reports document master plan projects and completions in detail; however, these projects and natural disasters are summarized below for completeness and to provide context to the 5-year analysis. These specific projects either required Clean Water Act Section 404 permitting (i.e., working within a waterway or SEZ), or in case of the wildfire will likely alter monitoring results moving forward.

- Galaxy Chair Replacement (2017–2018)

  The Galaxy Chair Replacement project required new foundations for chairlift tower supports that were placed within the SEZ and Daggett Creek drainage. While extreme care was taken regarding construction techniques, dewatering, and BMP placement, some changes in stream condition inventory (SCI) monitoring results at XS-1 were observed.

- Upper Edgewood Watershed Prescribed Burn (September 2019)

  A prescribed burn was conducted in a portion of the Upper Edgewood Creek watershed by Tahoe Douglas Fire Protection District in September 2019. The prescribed fire was conducted on lands outside of the Heavenly boundary, but on lands directly above the Upper Edgewood monitoring site (43HVE-1). The prescribed fire is correlated with poor water quality samples collected on September 18, 2019, and exceedances of Nevada Division of Environmental Protection state standards when active burning was observed. For example, TSS spiked from 16 milligrams per liter (mg/L) in August 2019 to 844 mg/L in September 2019 (5,275 percent increase). These single value exceedances were the primary driver for annual average exceedances at the Upper Edgewood monitoring site (43HVE-1) in 2019. It is possible that the prescribed fire continued to affect water quality results following September 2019.

- California Dam Sediment Removal (2020)

  The California Dam and impounded reservoir had lost capacity (acre-feet of water) over the years due to sediment deposition over time. Located directly downstream from the Sky Meadows water quality monitoring site and SCI monitoring reach (43HVC-1A and HVC-1) and upstream of the Patsy's water quality monitoring site and SCI monitoring reach (43HVC-2 and HVC-2), the reservoir was dewatered and dredged in late summer 2020. Construction techniques and BMPs were implemented so that Heavenly Valley Creek was minimally impacted. Sedimentation within the reservoir decreases the reservoir's capacity and could potentially be causing backwatering within the Sky Meadows monitoring reach.

- Caldor Fire (August 2021)

  The Caldor Fire started on August 14, 2021, and burned west of Lake Tahoe. The rapid ascent of the fire along both Highways 50 and 89 caused evacuations in the Lake Tahoe Basin, forest closures, and smoky conditions. The fire reached Echo Summit and entered the Lake Tahoe Basin on August 30, 2021. Ultimately, firefighters were able to stop the fire's progression; however, the fire did burn through the Hidden Valley Creek watershed, including the reference site and reach for water quality monitoring and SCI monitoring (43HDVC-5 and HDVC-2).

  Because of the fire, no water quality samples or monitoring were performed during the month of August 2021. The active fire funneled smoke into the basin, causing unhealthy air quality. Particulate matter (PM2.5), defined as "fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller" (US Environmental Protection Agency 2021), was reflected in an air quality index reading of more than 200 for an extended period leading up to the fire reaching the basin and while the fire was burning in the basin, indicating generally poor air quality and suspended particulate matter throughout the basin. This fine material as well as visible ash fell from the sky. Additionally, samples were not collected at the Property Line monitoring site (43HVC-3) or the reference reach site (43HDVC-5) in September 2021 due to forest closures associated with unsafe conditions post-fire. It should also be noted that the fire boundary encompassed the reference reach site (43HDVC-5) and much of the reach. Firefighting operations were active at/near the stream sampling site. The Upper Hidden Valley Creek SCI monitoring reach (HDVC-1) appears to have been unaffected based on fire extent mapping, but the site has yet to be visually verified due to forest closures in the fall of 2021. Since the fire occurred late in the WY (quarter four) at baseflow conditions, the long-term impacts of the fire and fire suppression operations remain to be seen. The reference reach is likely to exhibit alterations associated with the fire that Heavenly Valley Creek did not experience. In addition, the California Base Parking Lot at Heavenly was used as the operations base (e.g. for logistics, planning, staging, and housing and feeding of fire crews) that increased traffic and usage to the parking lot. Off road vehicles used in fire operations were likely transporting additional fine sediment on-site and it should be noted that the fire and firefighting operations occurred after routine annual maintenance of the filters and vaults.

3 Water Quality Monitoring

3.1 Introduction

The main compounds of concern originate as non-point sources of sediment and dissolved solids, chloride, and nitrogen and phosphorus. Nitrogen and phosphorus compounds are considered nutrients because they promote primary production. Natural sources of these compounds include erosion and breakdown of soils that may contain large quantities of nutrients. Anthropogenic sources include increased erosion from recreation and construction, development, and atmospheric deposition (Sparks 2003). When analyzing nutrient impacts to ground and surface waters, many interactions must be considered, including land use and management practices, geology, topography, soils, climate, and atmospheric inputs.

Several agencies enforce regulations developed to protect the water quality of Lake Tahoe. They include the TRPA, Lahontan, and the Nevada Division of Environmental Protection. The current standards with which water quality must comply are contained in Lahontan Program No. R6T-2015-0021 (updated in 2015), TRPA's 208 Water Quality Management Plan, and *Standards for Truckee Region: Edgewood Creek at Palisades Drive* as listed by the Nevada Division of Environmental Protection. Lahontan has established a TMDL for TSS to protect the clarity of Lake Tahoe. Data are reported to Lahontan on a quarterly and annual basis. Comprehensive analysis is completed on a 5-year cycle (2017–2021 for this report).

3.2 Monitoring Site Locations

Sky Meadows (43HVC-1A), Patsy's (43HVC-2), and Property Line (43HVC-3) water quality monitoring sites are all located at various points along Heavenly Valley Creek in California (CA-1). The Hidden Valley Creek monitoring site (43HDVC-5), which is unaffected by resort operations, serves as the reference reach site for samples collected from Heavenly Valley Creek. The Bijou Park Creek monitoring site (43BPC-4) is located down-gradient from the California Base Parking Lot near an outlet pipe and stream origination. The three vault sampling locations are located near the northwestern corner of the lower parking lot at the California Base Lodge. The northernmost influent site, Storm Vault Influent North (43HVP-1A), collects runoff water from the lower parking lot and tram area. The southernmost influent site, Storm Vault Influent South (43HVP-1B), collects runoff from the upper parking lot (adjacent to the California Base Lodge), while the Storm Vault Effluent monitoring site (43HVP-2) lies west between the two influent sites. Upper Edgewood (43HVE-1) and Lower Edgewood (43HVE-2) are both located on Edgewood Creek. The Edgewood Creek sites are located in Nevada and are not under Lahontan jurisdiction. However, they are included in this report for completeness. The sampling station identification number and sampling rationale are presented in Table 3-1, which includes the required filter vault sampling stations. Figure 3-1 shows the monitoring sites and their respective watershed boundaries.

Table 3-1 Heavenly Mountain Resort Monitoring Program Water Quality Sampling Stations

Sampling Station ID	Sampling Station Description	Sampling Station Name[1]	Rationale
43HVC-1A	Heavenly Valley Creek at Sky Meadows, above Snowmaking Pond	Sky Meadows	Characterized water quality in Heavenly Valley Creek drainage from the developed ski area
43HVC-2	Heavenly Valley Creek below Patsy's and Groove Chairlifts	Patsy's	Characterized water quality in Heavenly Valley Creek drainage from the developed ski area
43HVC-3	Heavenly Valley Creek located at the USFS Property Line	Property Line	Characterized water quality in Heavenly Valley Creek leaving National Forest System land below Heavenly
43BPC-4	Bijou Park Creek located below the California Base Parking Lot	Bijou Park Creek	Characterized water quality in Bijou Park Creek below the California Base Lodge and parking area
43HDVC-5	Hidden Valley Creek baseline/reference station	Hidden Valley Creek	Characterized water quality in stream draining a similar, mostly undeveloped watershed
43HVE-1	Edgewood Creek above Boulder Parking Lot	Upper Edgewood Creek	Characterized water quality in Edgewood Creek above the Boulder Parking Lot and below the ski runs
43HVE-2	Edgewood Creek below Boulder Parking Lot	Lower Edgewood Creek	Characterized water quality in Edgewood Creek below the Boulder Parking Lot
43HVP-1A	North manhole influent pipe into the filter system	Storm Vault Influent North	Characterized water quality inflow from the lower parking lot into the filter system
43HVP-1B	South manhole influent pipe into the filter system	Storm Vault Influent South	Characterized water quality inflow from the upper parking lot into the filter system
43HVP-2	West manhole effluent pipe out of the filter system	Storm Vault Effluent	Characterized water quality exiting the filter system

[1] In the text of the document, these sampling stations are referred to by their abbreviated names.

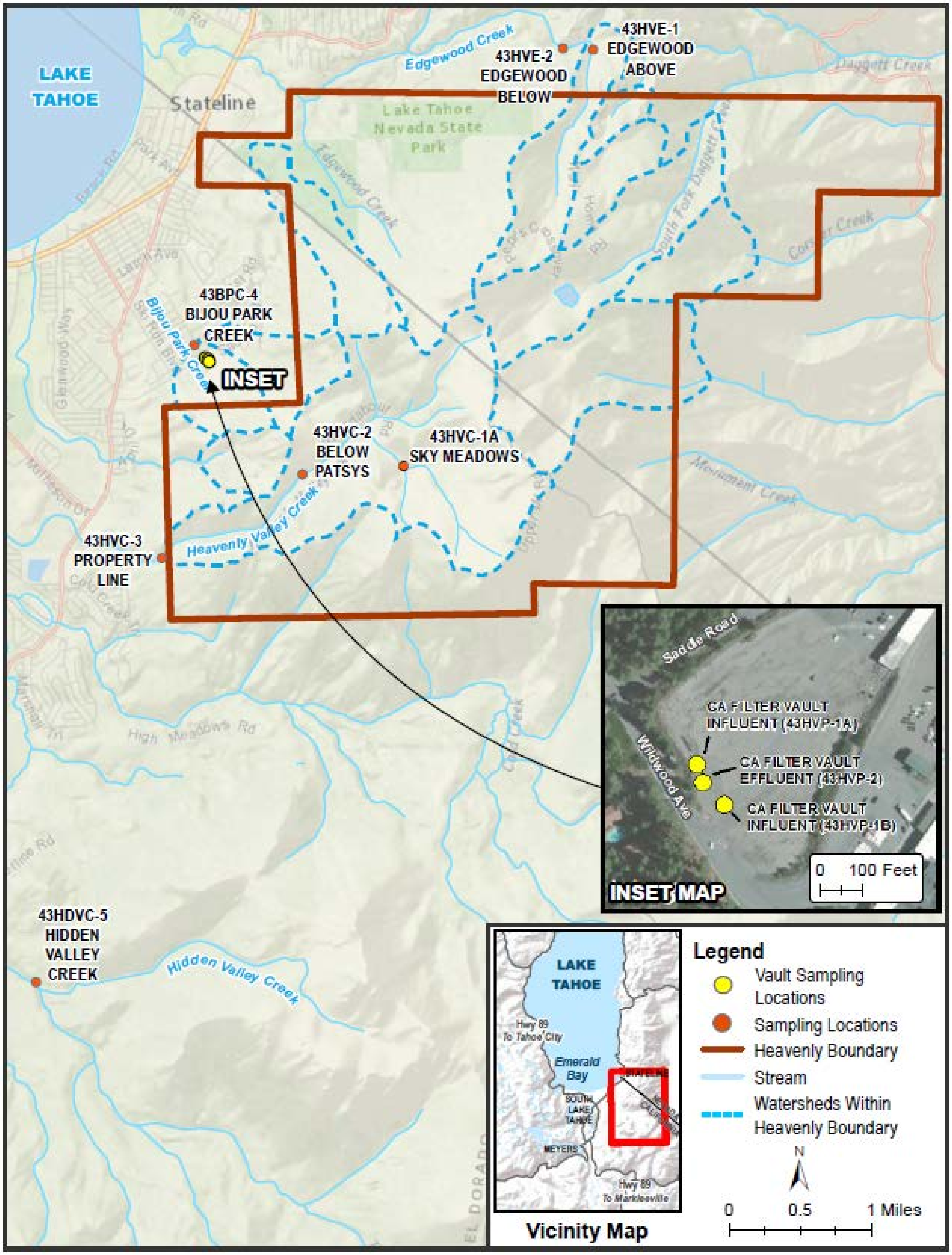

Figure 3-1 Approximate Locations of Water Quality Sampling Sites

3.3 Methods

The USFS monitored water quality at Heavenly Valley Creek from 1980 to 1987. Resource Concepts, Incorporated (RCI) was contracted by Heavenly to perform water quality monitoring from 1987 through 1995. The USFS monitored Heavenly Valley Creek, Hidden Valley Creek, Bijou Park Creek (California Base Parking Lot), and Edgewood Creek from 1995 through mid-2005. Cardno (formerly ENTRIX, Inc. and Cardno ENTRIX) has been contracted to perform monitoring and reporting since May 31, 2005.

Cardno has followed the US Geological Survey protocol to maintain consistency in data collection. Data collection involves using the flume at the Patsy's monitoring site to measure discharge. A Marsh-McBirney meter is used to measure discharge at all other sites. The Sky Meadows monitoring site (43HVC-1A) was previously gaged by the exiting flume; however, the streambanks around the flume have eroded, allowing for partial flows to circumnavigate around the flume. The Marsh-McBirney meter was used to measure discharge upstream of the flume at Sky Meadows, except in the winter, when the cross-section is fully covered with snow. During the winter, the flume is used to determine the approximate flow. Grab samples are taken at every site and sent to certified laboratories for analysis.

Cardno uses High Sierra Water Lab (formerly of Tahoe City, California, and now of Sutherlin, Oregon) to test for low-level constituents. Cardno previously used Western Environmental Testing Laboratory (WET Lab) of Reno, Nevada, to test for chloride during WYs 2017 to 2019. However, in 2019, the US Environmental Protection Agency made changes to definitions and procedures for determining the method detection limit for certified analytical laboratories. The revised method detection limit procedure helped address laboratory blank contamination and better accounted for intra-laboratory variability. As such, WET Lab's reporting limit, which is related to method detection limits, for chloride was raised from 0.10 mg/L to 0.25 mg/L, which is greater than the Lahontan not-to-exceed standard (0.15 mg/L). As a result, any non-detect (ND) results may have been above the state standard, but undetectable according to the new method detection limit procedures for the given analytical equipment utilized. Starting in WY 2020, samples were sent to Excelchem Laboratories, Inc. in Sacramento, California, whose equipment meets a reporting limit of 0.15 mg/L for chloride. WET Lab analyzes all of the stormwater constituents collected from the California filter vault locations due to the hold times and pickup service during storm events. All analysis methods and reporting limits have remained the same and are in accordance with the most current edition of *Standard Methods for the Examination of Water and Wastewater* (Baird and Bridgewater 2017). See the *Draft Heavenly Mountain Resort Standard Operating Procedures / Water Quality Sampling Quality Assurance Project Plan* (Cardno 2021) for additional information regarding standard and protocols for water quality sampling.

Consistency in sampling frequency has improved over the years. The data set from 2001 through 2015 had similar numbers of samples taken during runoff and baseflow periods for Heavenly Valley Creek and Edgewood Creek. However, the new WDR no longer requires weekly runoff sampling and instead focuses on biweekly sampling of the annual runoff hydrograph. Biweekly sampling, with a greater frequency (five additional dates) of sampling during the runoff period, began in WY 2016 and has continued through WY 2021. Frequency variances also occur based on the precipitation accumulations, the amount of snowpack, and duration of runoff. As past annual reports have stated, WY 2017 was a very wet year, with accumulated precipitation and snow water equivalent approximately double the 1991 to 2020 average. WYs 2018 and 2019 were considered approximately average, with 2018 slightly below and 2019 slightly above average. WYs 2020 and 2021 were both well below average and are considered drought years. Refer to Figure B-1 in Appendix B for WY data.

Storm sampling is only required under the new WDR permit for the California filter vault sampling locations and is discussed in further detail in Chapter 3.6.5.

3.4 Data Compilation

Annual master spreadsheets are maintained to facilitate comprehensive reporting. Starting in 2020 Cardno's water quality analysis and field results for stream sampling locations in California have been reported to the California Environmental Data Exchange Network (CEDEN). CEDEN is a central database designed to share information regarding California surface waters using a standardized, integrated data-sharing network. Sampling constituent results are reported using the Chemistry Data Submission Guidance Document and Template, and flow discharge measurements as well as all other field results are reported using the Field Collection and Results Data Submission Guidance Document and Template. Past years' water quality data (2009–2019) are undergoing digitizing, summarizing, and quality assurance/quality control in accordance with the CEDEN template and format and will be uploaded and submitted soon. Where reported laboratory analysis values were less than or equal to a detection limit, half of the numeric value of the detection limit is used for annual calculations, and actual values would therefore be lower than the annual calculated values. However, for CEDEN reporting, all non-detect values are reported as less than the detection limit, with no specific value assigned.

3.5 Monitoring Parameters

The following sections give an overview of each monitoring parameter (constituent), what affects its concentrations, and its relation to Heavenly sampling. Table 3-2 describes the history of the analysis groups as well as the parameters sampled and analyzed from 2006 through 2021.

Table 3-2 Constituent/Parameter Measuring History (2006–2021)

Years	2006–2010	2011–2016	2017–2021
Sampling Group	ENTRIX, Inc.	Cardno, Inc. (formerly ENTRIX, Inc.)	Cardno, Inc.
Analysis Group	ENTRIX, Inc. High Sierra Water Lab WET Lab	Cardno, Inc. High Sierra Water Lab WET Lab	Cardno, Inc. High Sierra Water Lab WET Lab ExcelChem Laboratories, Inc.
Parameters Measured	Discharge Conductivity Turbidity TSS Total nitrite/nitrate Total Kjeldahl nitrogen (TKN) Soluble reactive phosphorus–dissolved orthophosphorus Total phosphorus Chloride Iron Lead (for California Base Parking Lot only) Oil & Grease (for California Base Parking Lot only) TPH (for California Base Parking Lot only) Ammonia (for California Base Parking Lot only)	Discharge Turbidity TSS Total nitrite/nitrate TKN Total nitrogen Total phosphorus Chloride Oil and grease (for California Base Parking Lot Filter Vault locations only) Specific conductivity, soluble reactive phosphorus, and dissolved phosphorus (for Edgewood Creek monitoring sites only)	Same as the 2011–2016 time frame.

As of WY 2021, laboratory analysis by parameter is as noted in Table 3-3.

Table 3-3 Contracted Laboratory Analysis

Laboratory	Contracted Analysis
ExcelChem Laboratories, Inc.	Chloride (associated with stream sampling)
High Sierra Water Lab	Nitrate + nitrite, total phosphorus, TKN, TSS, turbidity, soluble reactive phosphorus, dissolved phosphorus, conductivity (associated with stream sampling)
WET Lab	Nitrate + nitrite, total phosphorus, TKN, total suspended solids, turbidity, chloride, oil and grease (associated with stormwater discharge sampling)

3.5.1 Phosphorus

Phosphorus has a large role in lake eutrophication. The microbiota in Lake Tahoe is phosphorus limited, meaning that more phosphorus added to the lake results in faster algal growth. Phosphorus is firmly held by soils and usually does not leach into a soluble bio-available form measured as soluble reactive phosphorus. Phosphorus leaching can occur in sandy soils with no clay, aluminum oxides, iron oxides, or organic matter (Sparks 2003), which can be found in some of decomposed granite soils at Heavenly. Soluble reactive phosphorus values are no longer required by the WDR at the California stream monitoring and filter vault sites.

3.5.2 Nitrogen

Nitrogen can often be a limiting nutrient to algal growth. Although it is not currently the limiting nutrient in Lake Tahoe, it is still an important measure of water quality as low nitrogen and low phosphorus levels are key to reduced algal growth (Horne and Goldman 1994). Nitrogen is a nutrient and occurs in many forms including ammonia, organic, nitrate, and nitrite. Nitrogen is measured as nitrate/nitrite and total Kjeldahl nitrogen (TKN); both values add up to total nitrogen. Nitrate is usually the most abundant form of nitrogen in lakes. The partially reduced form of nitrate is nitrite, which is usually present in much smaller quantities. Nitrate sources are often fertilizers, animal waste, or sewage, but it can also exist naturally though leaching soils. TKN is the sum of organic nitrogen and ammonia nitrogen in a waterbody. The presence of high concentrations of ammonia in a stream or lake can create a large oxygen demand. This demand is caused by the oxidation of ammonia to nitrate. All monitoring sites at Heavenly are tested for nitrogen. BMP treatment is geared toward nitrogen reduction by plant uptake.

3.5.3 Chloride

The chloride ion is required for essential cell processes and is a benign constituent in water. Chloride is monitored to determine if applications of deicers to parking lots and salts to ski runs and terrain parks have an effect on the chloride concentration in streams in the drainage area.

3.5.4 Turbidity

Turbidity is the measure of how much light can pass through a water sample. It refers to the cloudiness, haziness, or murkiness of a fluid. Turbidity gives a general sense of particle content and color by visually measuring the clarity of the water. It is measured in nephelometric turbidity units (NTUs). The greater the turbidity value, the cloudier the water. In rivers, turbidity can normally be attributed to abiotic substances such as sediment. Lake turbidity is related to biotic and abiotic substances. Turbidity is a concern because it measures clarity or the aesthetic value of the water.

3.5.5 Suspended Sediment

TSS are particles greater than 0.1 micron (μm) in diameter that are suspended in solution. These particles not only aid in the scattering of light, which decreases clarity, but can also be carriers of phosphorus, metals, and other polluting substances. TSS is measured at all stream monitoring sites at Heavenly. Quantities of TSS give a good indication of erosion in a watershed and are therefore important in the trend analysis at Heavenly.

3.5.6 Oil and Grease

Oil and grease are petroleum-based products. Their source is automobiles and other equipment. Oil and grease are contaminants and are metabolized by aquatic microbiota. The latest WDR permit conditions only require oil and grease sampling at the influent and effluent locations at the storm filter vault system at the California Base Parking Lot.

3.5.7 Specific Conductivity

Specific conductivity is a measure of the ability of a substance to conduct electric current. Therefore, specific conductivity correlates with ions in a solution. Studies have shown that specific conductivity has a direct relation to constituents such as total dissolved solids, chloride, and sulfate, and to hardness. Statistical relations can be quantified between these constituents and specific conductivity using several years of correlating data. After a relation is quantified, specific conductivity can be used as a surrogate for these other constituents. Specific conductivity is only measured at the Edgewood Creek monitoring sites located in Nevada.

3.6 Results and Discussion

In the following discussion, results are presented for Heavenly Valley and Hidden Valley Creeks, followed by Bijou Park Creek and Edgewood Creek. Edgewood Creek is located in Nevada and is therefore not under the jurisdiction of Lahontan but is included in this report for completeness. For each stream, compliance with water quality standards is presented first, along with a comparison to the reference reach site that is outside the area affected by Heavenly's operations. Following this presentation, an analysis of water quality trends is presented for each stream. The California Base Parking Lot filter vault information can be found in Chapter 3.6.5.

3.6.1 Heavenly Valley and Hidden Valley Creek

3.6.1.1 Summary of Compliance at the Property Line Monitoring Site

The Property Line monitoring site represents water quality conditions where water leaves Heavenly and is the point for measuring compliance with the TSS TMDL. Graphs showing constituents versus flow for all sites from 2006 through 2021 are included in Appendix C. Annual means and standard deviations for the Heavenly Valley and Hidden Valley Creek sites, WYs 2017 through 2021, are also included in Appendix C. Values that have exceeded the applicable annual average standard (non-compliance) are in bold text. Table 3-4 summarizes annual non-compliance frequency from 2006 to 2021 at the Property Line monitoring site (43HVC-3) versus the Hidden Valley Creek reference reach site (43HDVC-5). The California annual state standards for TSS, total phosphorus, total nitrogen, and chloride are included in Table 3-4. The total number of samples collected over the 16 WYs are reported below. Values that exceed the state standard are in bold. The non-compliance percentages were totaled by dividing by the total number of annual exceedances by the 16-year period of record.

Table 3-4 Exceedances of State Effluent Standards at Property Line Monitoring Site (43HVC-3) and Reference Reach Site (43HDVC-5), WYs 2006 through 2021

	Discharge (cfs)	Turbidity (NTU)	Suspended Sediment (mg/L)[1]	Nitrite/ Nitrate (mg/L)	Total Phosphorus (mg/L)	TKN (mg/L)	Total Nitrogen (mg/L)	Chloride (mg/L)
California State Standard		**-**	**60[1]**	**-**	**0.015**	**-**	**0.19**	**0.15**
43HVC-3 Property Line Monitoring Site Annual Averages								
2006	4.30	3.24	27.7	0.012	***0.032***	0.114	0.121	***2.47***
2007	0.760	1.95	3.56	0.005	***0.023***	0.080	0.084	***1.29***
2008	0.550	0.94	2.32	0.005	***0.018***	0.086	0.091	***1.95***
2009	0.460	0.79	3.60	0.003	***0.021***	0.061	0.060	***1.27***
2010	1.31	7.71	11.4	0.013	***0.089***	0.351	***0.387***	***0.97***
2011	5.47	9.14	34.0	0.026	***0.042***	0.129	0.154	***0.66***
2012	1.09	1.16	8.04	0.005	***0.020***	0.085	0.090	***0.94***
2013	0.722	1.37	7.08	0.003	***0.020***	0.103	0.106	***1.08***
2014	0.526	0.83	4.48	0.003	***0.022***	0.128	0.131	***1.06***
2015	0.495	0.70	5.60	0.003	***0.022***	0.099	0.102	***1.25***
2016	3.29	2.40	23.1	0.027	***0.026***	0.117	0.143	***0.81***
2017	7.36	7.52	***74.2***	0.015	***0.053***	0.136	0.151	***0.66***
2018	1.85	1.61	5.50	0.007	***0.020***	0.078	0.085	***0.58***
2019	2.42	2.91	13.4	0.009	***0.027***	0.085	0.095	***0.65***
2020	0.631	1.14	5.70	0.003	***0.021***	0.081	0.080	***1.06***
2021	0.331	1.09	6.50	0.004	***0.027***	0.144	0.148	***1.12***
# Samples	256	258	258	256	258	258	257	183
# Noncompliance	-	-	1	-	16	-	1	16
% Noncompliance	-	-	6.3%	-	100.0%	-	6.3%	100.0%
Maximum Daily	31.6	102	506	0.097	1.05	4.25	4.31	5.90
Minimum Daily	0.002	0.07	0.27	0.001	0.009	0.018	0.019	0.31
Mean Daily	2.15	2.96	7.35[2]	0.009	0.030	0.116	0.125	0.99
Std Error Daily	4.32	9.63	35.2	0.013	0.068	0.268	0.273	0.62
43HDVC-5 Hidden Valley Creek Reference Reach Site Annual Averages								
2006	4.41	1.94	9.44	0.004	***0.032***	0.13	0.134	***0.84***
2007	1.18	1.24	12.5	0.007	***0.026***	0.095	0.102	***0.49***
2008	1.11	1.19	3.84	0.013	***0.025***	0.112	0.126	***0.99***
2009	0.805	1.42	8.80	0.008	***0.029***	0.112	0.12	***0.82***
2010	2.34	2.58	35.1	0.008	***0.043***	0.217	***0.225***	***0.40***
2011	7.05	3.27	32.2	0.004	***0.032***	0.162	0.167	***0.24***
2012	1.67	1.31	5.08	0.009	***0.025***	0.133	0.141	***0.31***
2013	1.42	1.35	5.76	0.009	***0.026***	0.108	0.117	***0.28***
2014	0.974	1.11	4.24	0.011	***0.026***	0.147	0.158	***0.29***
2015	0.659	1.20	5.80	0.008	***0.025***	0.107	0.115	***0.24***
2016	2.96	2.62	19.2	0.018	***0.031***	0.151	0.169	***0.24***
2017	7.44	5.71	21.6	0.004	***0.030***	0.136	0.140	***0.26***
2018	2.49	1.17	2.60	0.007	***0.020***	0.082	0.088	***0.22***
2019	3.53	2.06	5.40	0.006	***0.024***	0.094	0.100	***0.22***
2020	1.22	0.94	4.00	0.004	***0.022***	0.085	0.089	***0.42***
2021	0.751	1.04	3.75	0.005	***0.022***	0.092	0.097	***0.37***
# Samples	289	288	288	288	288	288	288	213
# Noncompliance	-	-	0	-	16	-	1	16
% Noncompliance	-	-	0.0%	-	100.0%	-	6.3%	100.0%
Maximum Daily	31.9	47.2	70.0	0.041	0.200	0.971	0.973	2.40
Minimum Daily	0.09	0.09	0.40	0.001	0.011	0.023	0.031	0.10
Mean Daily	2.55	1.88	3.95[2]	0.008	0.027	0.124	0.132	0.32
Std Error Daily	4.36	3.30	7.59	0.007	0.016	0.100	0.101	0.26

[1] TSS values shown are 90th percentile values. The recalculated values using a weighted average based on the days between sample collection are shown in Table 3-5.

[2] Value shown is the mean daily value.

Total Phosphorus

Every year for the past 16 years, annual average values have exceeded the standard for total phosphorus at the Property Line monitoring site (43HVC-3) along Heavenly Valley Creek. However, the same standards were also exceeded at the reference reach site (43HDVC-5) indicating these conditions are part of the system and not related to Heavenly. Between WYs 2012 and 2016, the annual average exceedance values for total phosphorus at the reference reach site (43HDVC-5) were higher than recorded exceedances at the Property Line monitoring site (43HVC-3). This correlation was not observed between WYs 2017 and 2021; three out of five of the total phosphorus annual exceedance values during the 5-year period (2017–2021) were higher at the Property Line monitoring site (43HVC-3) compared to the reference reach site (43HDVC-5). The annual average values for total phosphorus were the same at both locations in 2018 (0.020 mg/L), while the 2020 annual average was slightly lower at Property Line (43HVC-3) compared to the reference reach site (43HDVC-5). The correlation from WYs 2012 to 2016 was likely due to the fact that WYs 2012 to 2015 were considered drought conditions in which the Property Line monitoring site went dry on occasion. Drought conditions improved from WY 2016 through WY 2019, only for below-average precipitation to return in WYs 2020 and 2021. The correlation could also indicate that prescribed on-mountain treatments are beneficial to the Heavenly Valley Creek watershed as they often meet or exceed total phosphorus results at the reference reach site (43HDVC-5). Therefore, total phosphorus values at the Property Line monitoring site (43HVC-3) should continue to be monitored along with the reference reach (43HDVC-5) as the trend analysis for both of these sites track similar and there is not a significant difference with regards to total phosphorus.

Total Nitrogen

Over the past 16 years (2006–2021), the annual average standard for total nitrogen was exceeded once in 2010 at the Property Line monitoring site (0.387 mg/L). The total nitrogen annual average exceedance value of 0.387 mg/L is 0.197 mg/L above the 0.19 mg/L state standard. The annual average for total nitrogen at the reference reach site (43HDVC-5) in 2010 was 0.225 mg/L—also above the state standard. The total nitrogen annual average for the 5-year period from 2017 to 2021 was not exceeded at either the Property Line monitoring site (43HVC-3) or the reference reach site (43HDVC-5). Total nitrogen values at the Property Line monitoring site (43HVC-3) and reference reach (43HDVC-5) are trending positive with regards to water quality improvement.

Chloride

For the 5-year period (2017–2021), chloride levels are over the annual standard at both the Property Line monitoring site (43HVP-3) and the reference reach site (43HDVC-5), indicating that chloride levels over the standard are a watershed wide condition and not solely due to Heavenly operations. However, chloride annual average exceedance values at Property Line (43HVC-3) were higher than at the reference reach site (43HDVC-5) for each year of the 5-year period from 2017 to 2021. Annual chloride average values at Property Line (43HVC-3) were initially much lower from 2017 to 2019 compared to the 2012 to 2016 years; however, chloride value exceedances during WYs 2020 and 2021 increased to levels comparable to those of 2012 to 2016. A similar trend also occurred at the reference reach site (43HDVC-5), where chloride values in WYs 2020 and 2021 were much higher than in years past. WYs 2017, 2018, and 2019 were all above- or near-average precipitation years, which likely accounts for the lower chloride annual average values reported at Property Line (43HVC-3).

Overall elevated chloride levels in the watershed are likely due to salt usage. During higher precipitation and snowfall years, less salt is needed to keep the snowpack from melting. Huck salt is applied late in the ski season on the terrain park features (ramps and jumps) to lower the freezing point of the top surface. The top layer’s interaction with the snow below causes it to refreeze, which causes the ramp/jump surfaces to harden and last longer. The WY 2018 annual average for chloride at the Property Line monitoring site (43HVC-3) was the lowest value in the past 16 years (0.58 mg/L). This value followed the largest precipitation/snowpack recorded over the 16-year time period as well. While some chloride exceedance values can be linked to the WY and precipitation levels, in recent years Heavenly has been actively tracking and limiting the application of huck salt at the on-mountain terrain park locations. Neglecting precipitation and WY information, the 5-year rolling annual average (2017–2021) for chloride at the Property Line monitoring site (43HVC-3) was 0.814 mg/L. This value is lower than the previous 5-year (2012–2016) rolling average (1.03 mg/L). The fluctuation of chloride results at the reference reach site (43HDVC-5) is not as easily understood. The extreme wet years do not correlate to increased or decreased chloride readings, and nor do drought cycles correlate well with chloride variations. Chloride findings remain high and troublesome in terms of water quality at both the Property Line monitoring site (43HVC-3) and reference reach (43HDVC-5). Chloride constituent monitoring should continue at both sites moving forward to better understand increased background levels as they relate to Heavenly operation and reduction in chloride usage.

TMDL for Suspended Sediment

Prior to the erosion control measures implemented by Heavenly in the 1990s and early 2000s, Heavenly Valley Creek has had historically high sediment loading. In 1999, these values ultimately led Heavenly Valley Creek to be listed on the 303(d) list as impaired for sediment loading and a TMDL being established for TSS. The TMDL for TSS at Heavenly Valley Creek was established in 2000 at 58 tons/year (based on a 5-year rolling average). This value is calculated by weighting the number of days between sample collections and multiplying this value with the discharge value recorded. This new value represents the calculated weighted flow. Laboratory values for TSS are multiplied by the weighted flow numbers and summed. Final unit conversion is applied, and the total is reported in tons per year. This methodology is accepted by Lahontan and has been used in past reports.

Since 2005, Heavenly has consistently had water quality that is better than the TMDL-required levels for TSS. Table 3-5 summarizes TSS loading for the Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5). The 2010 *TMDL Implementation Tracking Status Report* (Lahontan 2010) noted that Heavenly Valley Creek met the TSS target. The measured annual sediment loads for 16 WYs (2006–2021) were all below the TMDL standard, with the exception of WYs 2010, 2011, and 2017, which had annual loading values above the TMDL standard of 58 tons/year (70.5, 118.6, and 161.8 tons/year, respectively). Over the past 5 years, the measured loadings for WYs 2017 to 2021 were all below the TMDL standard, with the exception of WY 2017, which had an all-time high annual loading of 161.8 tons/year. It is important to note that these annual calculation exceedances also correlated with above-average precipitation years and that the rolling 5-year average value of 58 tons/year has not been exceeded in 16 years as shown in Table 3-5. Since the higher precipitation/wet year sediment loading values are averaged with lower precipitation and drought conditions, the total maximum daily load rolling 5-year average has not exceeded the state standard.

Table 3-5 Suspended Sediment Values for Property Line Monitoring Site (43HVC-3) and the Reference Reach Site (43HDVC-5)

Year	Heavenly Valley Creek Property Line (43HVC-3) Suspended Sediment (tons/year)	Rolling 5-year Average Suspended Sediment (tons/year)	Hidden Valley Creek Reference Reach Site (43HDVC-5) Suspended Sediment (tons/year)	Rolling 5-year Average Suspended Sediment (tons/year)
2001	6.60	-	1.41	-
2002	9.10	-	5.06	-
2003	20.4	-	52.4	-
2004	5.20	-	3.66	-
2005	36.9	15.6	27.9	18.1
2006	42.6	22.8	37.2	25.2
2007	1.30	21.3	3.40	24.9
2008	0.60	17.3	1.90	14.8
2009	0.50	16.4	1.90	14.5
2010	70.5	23.1	18.6	12.6
2011	118.6	38.3	60.9	17.3
2012	1.70	38.4	3.40	17.3
2013	1.00	38.5	3.53	17.7
2014	0.24	38.4	1.51	17.6
2015	0.16	24.3	1.44	14.2
2016	6.63	1.95	18.8	5.73
2017	161.8	34.0	50.5	15.2
2018	2.47	34.3	2.50	14.9
2019	12.2	36.7	7.09	16.1
2020	0.94	36.8	2.34	16.2
2021	0.10	35.5	0.83	12.6

Figure 3-2 compares annual weighted sediment loading at the Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5) between 1991 and 2021. Superimposed on the sediment loading data are the total calculated flows per year in cubic meters (divided by 10,000) at each site. Five-year rolling TSS averages for each site and the Lahontan TMDL 5-year rolling standard value of 58 tons/year are also shown on the figure.

Figure 3-2 shows a large TSS increase in 2011 and 2017, consistent with the trends seen in other above-average WYs; as streamflow increases, total sediment loading increases. WYs 2012 to 2015 saw lower TSS values in correlation to lower water flows (drought conditions), while the 2016 average-precipitation year had increased TSS at both the Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5). As the graph clearly shows, TSS is linked to WY and streamflow totals and TSS values at the Property Line monitoring site (43HVC-3) and reference reach (43HDVC-5) are trending positive with regards to water quality improvement.

3.6.1.2 Graphical Comparison to the Reference Reach Site

Figures B.2-1 and B.2-2 in Appendix B show the straight annual average values for total nitrogen and total phosphorus for both the Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5) since 1991. Total nitrogen values at the Property Line monitoring site (43HVC-3) were lower than at the reference reach site (43HDVC-5) for 3 of the past 5 years (2018–2020). However, the total nitrogen annual average values for 2017 and 2021 were both higher. The higher 2017 annual average for total nitrogen is likely associated with increased precipitation and runoff entering the stream; however, the 2021 result is considerably higher (0.148 mg/L compared to 0.098 mg/L). Only nine samples were collected at the Property Line monitoring site (43HVC-3) during WY 2021. While the site was monitored monthly and biweekly during runoff season, seven of the sixteen sampling events found that the stream was dry, and no measurements or water quality analysis was performed. This resulted in only nine events being used to calculate both the TSS TMDL as well as annual average values. These nine samples occurred primarily during spring runoff, with the capture of a single low-flow condition in July (0.009 cubic feet per second). This phenomenon occurred previously during the drought conditions of WYs 2014, 2015, and 2016, when only 15, 10, and 10 events were sampled (respectively) due to no flow conditions. For the first time since 2014, the rolling 5-year total nitrogen annual average values at the Property Line monitoring site (43HVC-3) exceeded the values at the reference reach site (43HDVC-5). This correlates with the small number of samples collected at the Property Line monitoring site (43HVC-3) due to little or no flow conditions being present. However, during no flow events, total nitrogen is not moving downstream through the tributaries; therefore, the rolling average is an accurate reflection of water quality contributions during these drought years. Total nitrogen values may increase once flows resume, potentially acting as a flush of the system following a period of no flows.

Total phosphorus results over the past 5 years have varied between Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5) as shown in Figure C.10-6 (Appendix C). During drought conditions, total phosphorus values appear higher at the reference reach site (43HDVC-5), as is seen for WYs 2012 through 2015; however, wet years skew this in the other direction as shown in the peaks in both 2011 and 2017 where the Property Line monitoring site (43HVC-3) total phosphorus annual average values exceeded the reference reach sites. Yet since the 2017 wet year and in the preceding 5 years, only the WY 2020 total phosphorus annual average was lower at the Property Line monitoring site (43HVC-3) compared to the reference reach site (43HVDC-5). WY 2020 was considered a drought year, which would correlate to this result; however, WY 2021 was also considered a below-average precipitation year, yet the total phosphorus annual averages were higher at the Property Line monitoring site (43HVC-3) versus the reference reach site (43HDVC-5). As discussed above, the annual average values in 2021 were calculated using only nine mostly runoff sampling events due to low flow. This tends to skew the data toward higher values, as there were no early WY results collected (October through March). These early-season high-elevation results are typically low-flow conditions as water is stored in the snowpack. Due to the collection of runoff samples, the data skew toward higher readings for all constituents. Continual monitoring over both wet and dry conditions is needed to validate this trend.

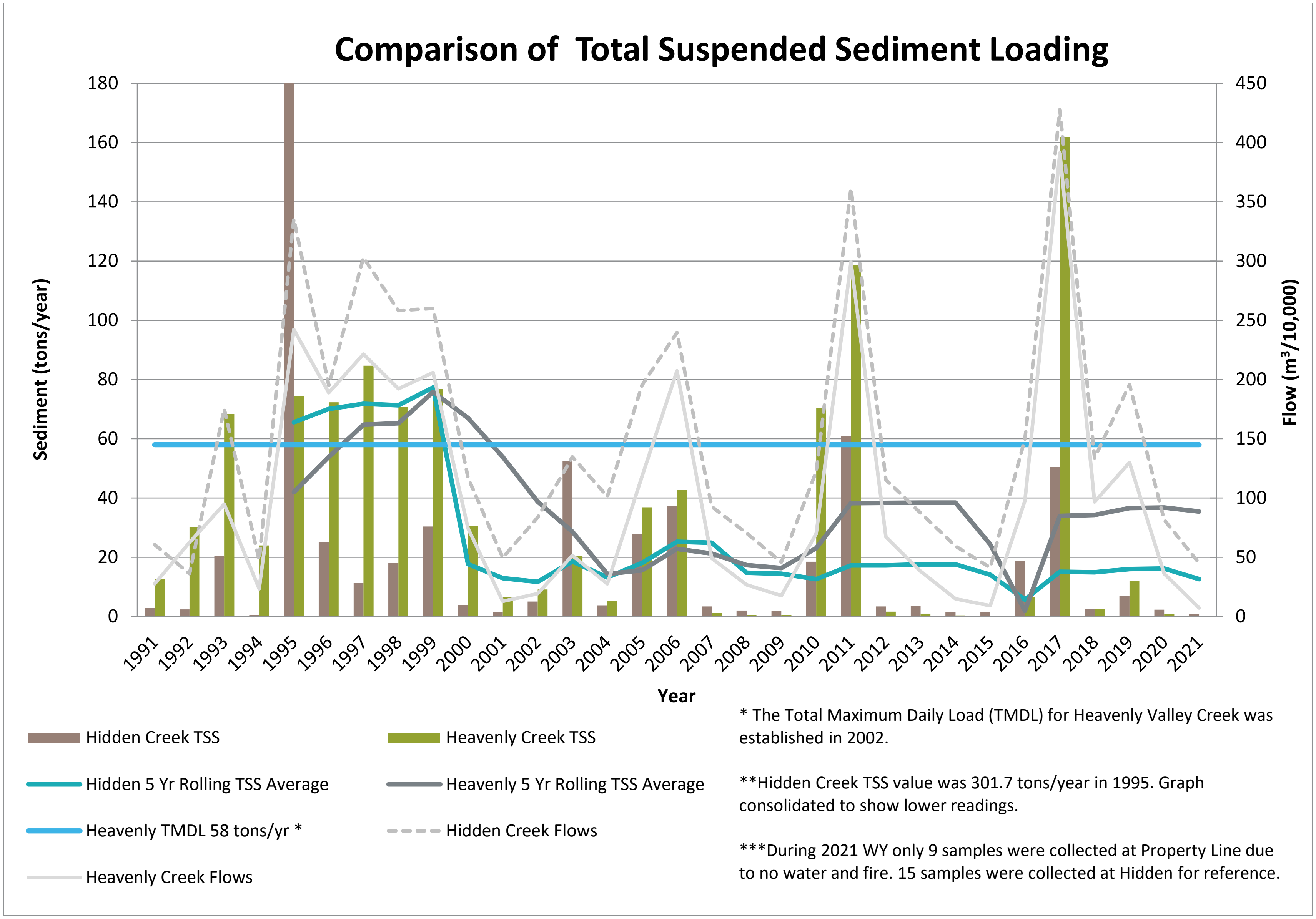

Figure 3-2 Comparison of Sediment Loading (1991 to 2021)

Figure 3-3 illustrates sediment loading at the Property Line monitoring site (43HVC-3) for WYs 1991 through 2021. Again, superimposed on the sediment load is the total calculated flow per year in cubic meters (divided by 10,000) at the Property Line monitoring site. When the whole period of record is considered, the 2011 and 2017 spikes in sediment loading are associated with high streamflows in wet years. In addition, streamflow data from 2007 through 2009 and 2012 to 2015 compare to the drought conditions in 2020 and 2021. During drought conditions, decreased streamflow, depth, and velocity provide minimal sediment loading. Extreme wet years and increased streamflow tend to increase sediment loading; however, average to slightly above-average WYs, such as 2016, 2018, and 2019, only have a slight increase in TSS. Compared to the 1993 and 2005 streamflow data, which are the closest comparisons to the 2016, 2018, and 2019 streamflow values, TSS (tons/year) is considerably lower. Moderate- to average-precipitation WYs and their associated streamflow have increased TSS loading, but this is not nearly as prevalent and high as the 1990s and early 2000s total TSS loading. The minimal increase in sediment loading for an average precipitation year may be attributed to prescribed on-mountain treatment and BMP improvement/maintenance limiting and preventing sediment from entering the streams.

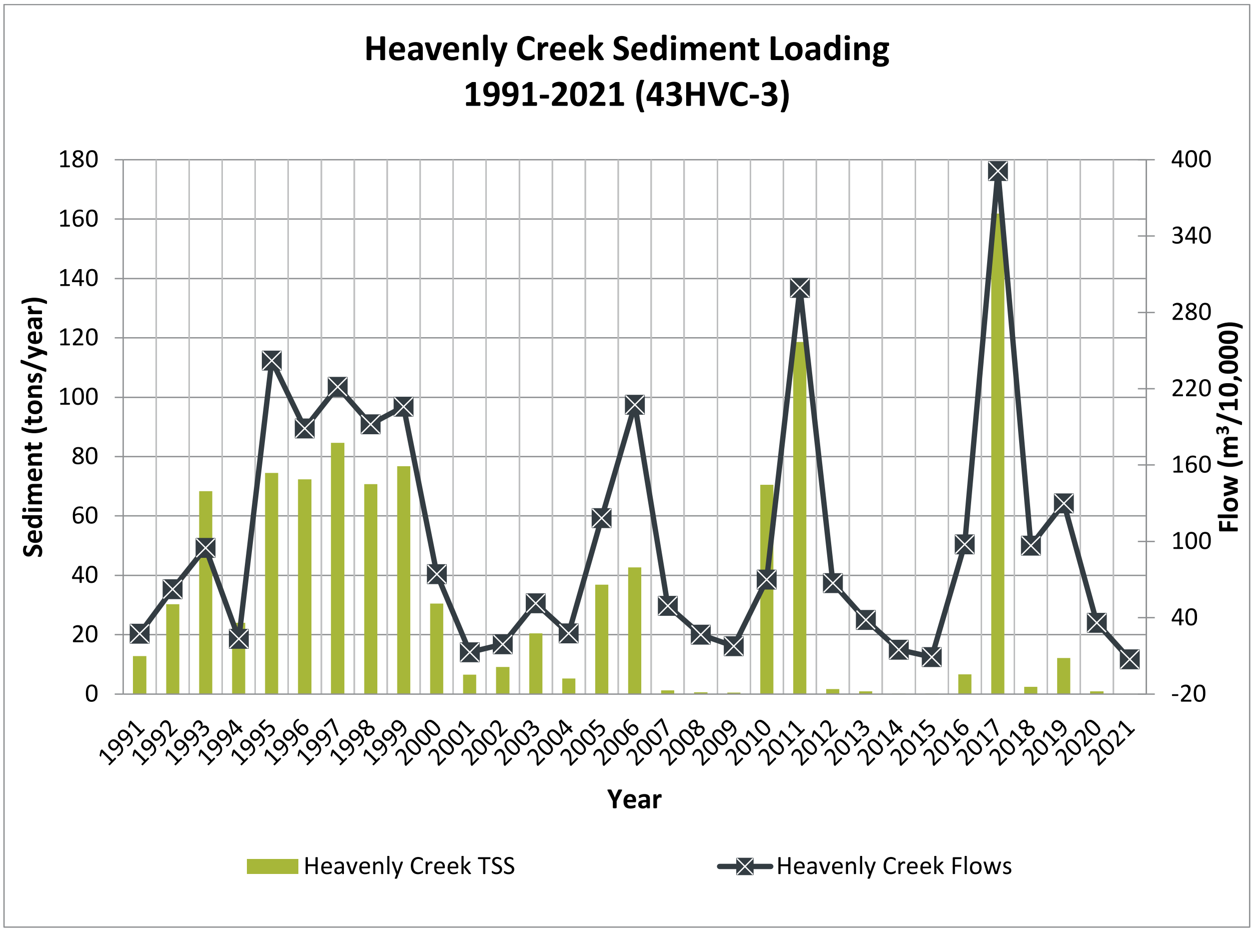

Figure 3-3 Heavenly Creek Sediment Loading at the Property Line Monitoring Site (43HVC-3) from 1991 to 2021

Figures 3-4 through 3-6 are graphical comparisons of annual averages (means) for the Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5) for TSS, total nitrogen, total phosphorus, turbidity, and chloride. Consistent data are available for total phosphorus, total nitrogen, and turbidity since 1993, and for TSS since 1995. Chloride began to be sampled on a quarterly basis in 2006 and was not included in regular monthly sampling until 2012. Quarterly chloride sampling did not provide enough data to show any trends; therefore, only data since 2012 are shown here. This data comparison shows that annual averages of TSS, total phosphorus, total nitrogen, and turbidity at the Property Line monitoring site (43HVC-3) have approximately returned to baseline conditions. Annual averages of chloride at the Property Line monitoring site (43HVC-3) remain problematic, compared to the reference reach site (43HDVC-5).

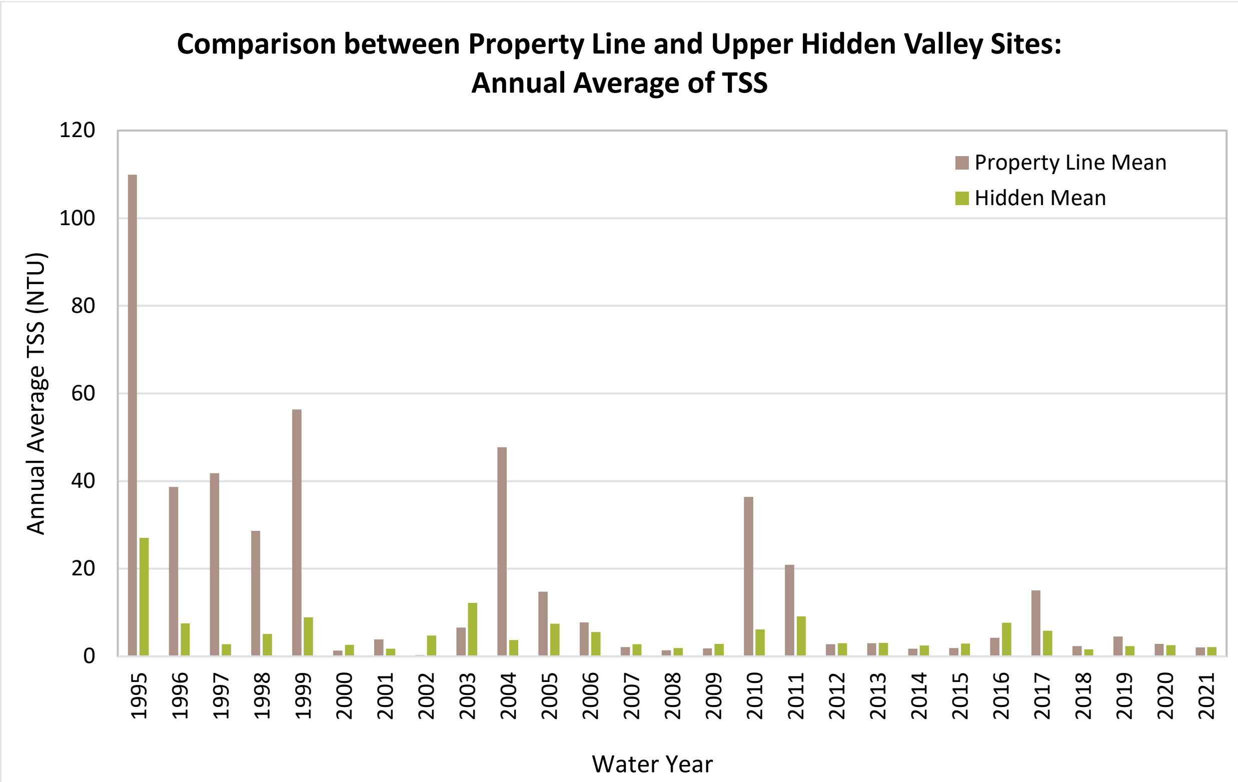

Figure 3-4 Comparison of Annual Averages of TSS between the Property Line Monitoring Site and Reference Reach Site

In several instances, individual observations (such as an TSS observation of 1,032 mg/L on June 16, 2004, at the Property Line monitoring site [43HVC-3]) contribute to very high means despite the remainder of year experiencing low TSS values. In the 5-year reporting period, the Property Line monitoring site (43HVC-3) had substantially greater annual average TSS compared to the reference reach site (43HDVC-5) in 2017 and 2019. These were both above-average precipitation years. During average or below-average precipitation years, TSS at both sites were similar. During the previous 5-year reporting period, there were several years when the reference reach site (43HDVC-5) had higher annual averages compared to the Property Line monitoring site (43HVC-3); these years were either well-below average or average precipitation years. This data comparison shows that the annual average of TSS at the Property Line monitoring site (43HVC-3) have approximately returned to baseline conditions.

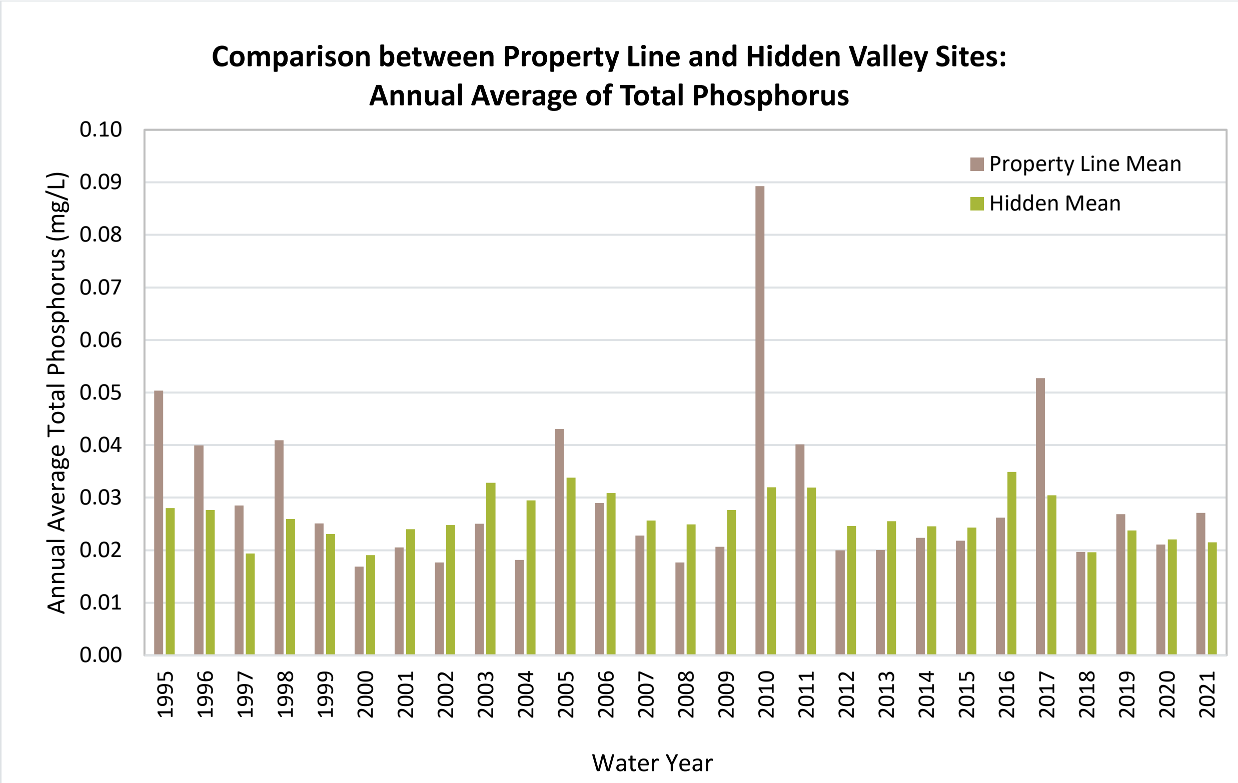

Figure 3-5 Comparison of Annual Averages of Total Phosphorus between the Property Line Monitoring Site and the Reference Reach Site

Comparisons of total phosphorus between the Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5) showed relationships that correlated highly with WY (Figure 3-5). In drought years (2000–2004, 2007–2009, 2012–2015, 2020), annual averages of samples from the reference reach site (43HDVC-5) exceeded those of the Property Line monitoring site (43HVC-3), sometimes significantly so. However, during average precipitation WYs, especially those with precipitation well above average (2011 and 2017), the Property Line monitoring site (43HVC-3) had annual averages of total phosphorus higher than those at the reference reach site (43HDVC-5). Some anomalies are present, such as the 2010 annual average mean at the Property Line monitoring site (43HVC-3), which was nearly double the mean observed over the entire reporting period, despite it being an average-precipitation year. This data comparison shows annual averages of total phosphorus at the Property Line monitoring site (43HVC-3) have approximately returned to baseline conditions.

Similar trends were observed for total nitrogen. In drought years, the reference reach site (43HDVC-5) had more instances of higher annual averages than the Property Line monitoring site (43HVC-3), but in wetter years, the latter's averages for total nitrogen were typically higher (Figure 3-6). Over the 26 years of analyzed data, the annual average of total nitrogen was higher at the reference reach site (43HDVC-5) in 18 years and higher at the Property Line monitoring site (43HVC-3) in 7 years (and equal in one year: 2020). Again, this comparison shows annual averages of total nitrogen at the Property Line monitoring site (43HVC-3) have approximately returned to baseline conditions.

As mentioned above, chloride was first sampled at the sites in 2006, and it was sampled on a quarterly basis between 2006 and 2011. In 2012, sampling began on a monthly basis (and more frequently during the runoff period, on the same sampling schedule as all other constituents). In all years, annual average for chloride at the Property Line monitoring site (43HVC-3) was higher than at the reference reach site (43HDVC-5), although not significantly so until after sampling became more frequent in 2012 (Figure 3-7).

Either small sample sizes or lack of data at valuable times of the year (such as during runoff season) likely contributed to values that were considered not significantly different, more so than actual differences over the course of the year, despite annual averages of chloride being typically smaller at both sites once more regular sampling was initiated. This highlights the importance of sampling on a monthly (or greater) frequency in order to collect representative data. Annual averages of chloride at the Property Line monitoring site (43HVC-3) remain problematic compared to the reference reach site (43HDVC-5), although the reference reach site consistently exceeded state standards as well, as discussed in Chapter 3.6.1.1.

In most years, the Property Line monitoring site (43HVC-3) had higher annual average turbidity compared to the reference reach site, although in several drought years the latter had higher annual averages (2002–2004, 2012–2016; Figure 3-8), similar to the trends observed for total phosphorus and total nitrogen (Figures 3-5 and 3-6). Similarly, in above-average WYs, while both sites experienced higher annual turbidity averages, the Property Line monitoring site (43HVC-3) did so exceedingly. This data comparison shows annual averages of turbidity at the Property Line monitoring site (43HVC-3) have approximately returned to baseline conditions.

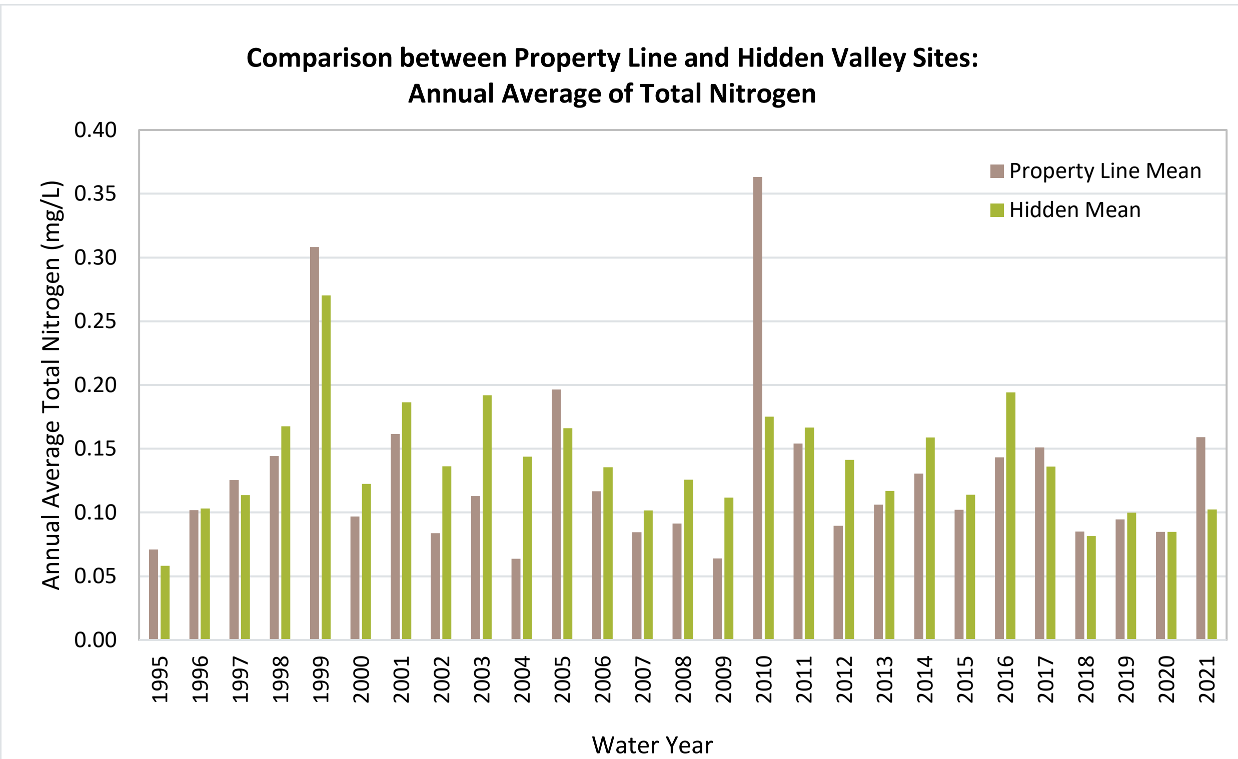

Figure 3-6 Comparison of Annual Averages of Total Nitrogen between the Property Line Monitoring Site and the Reference Reach Site

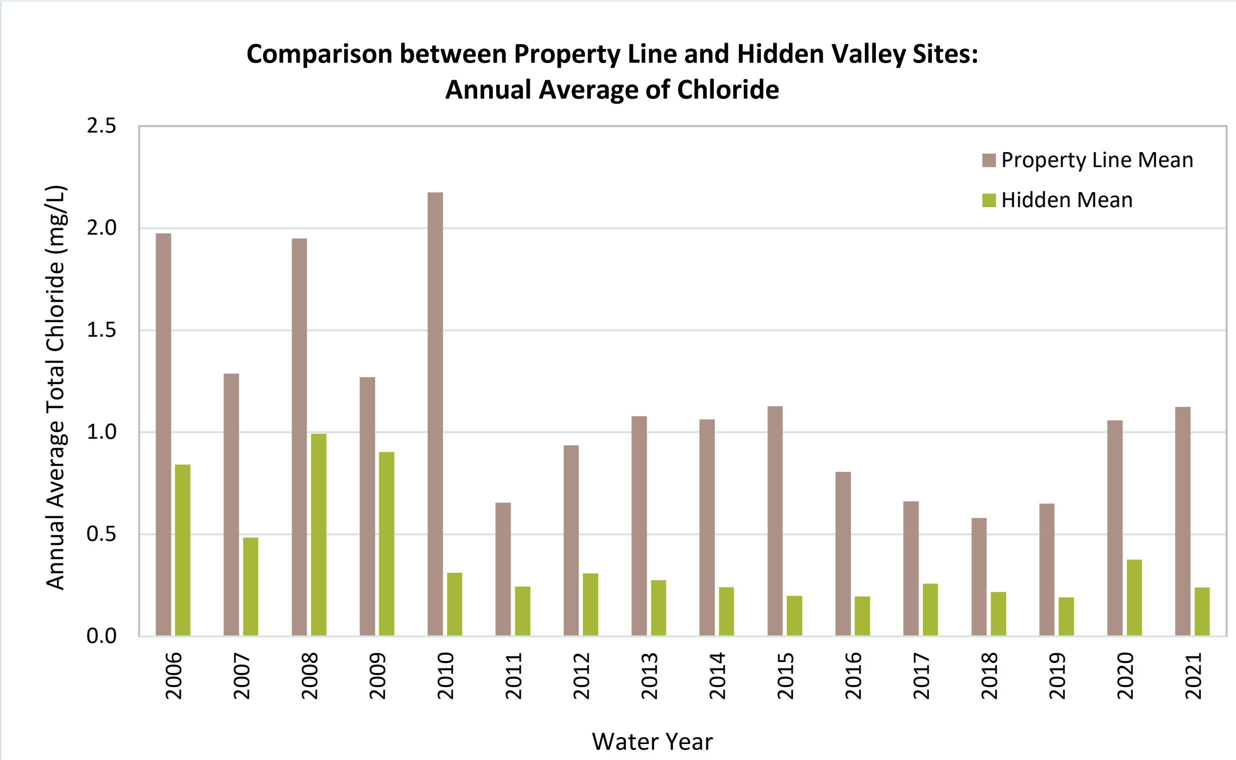

Figure 3-7 **Comparison of Annual Averages of Chloride between the Property Line Monitoring Site and the Reference Reach Site**

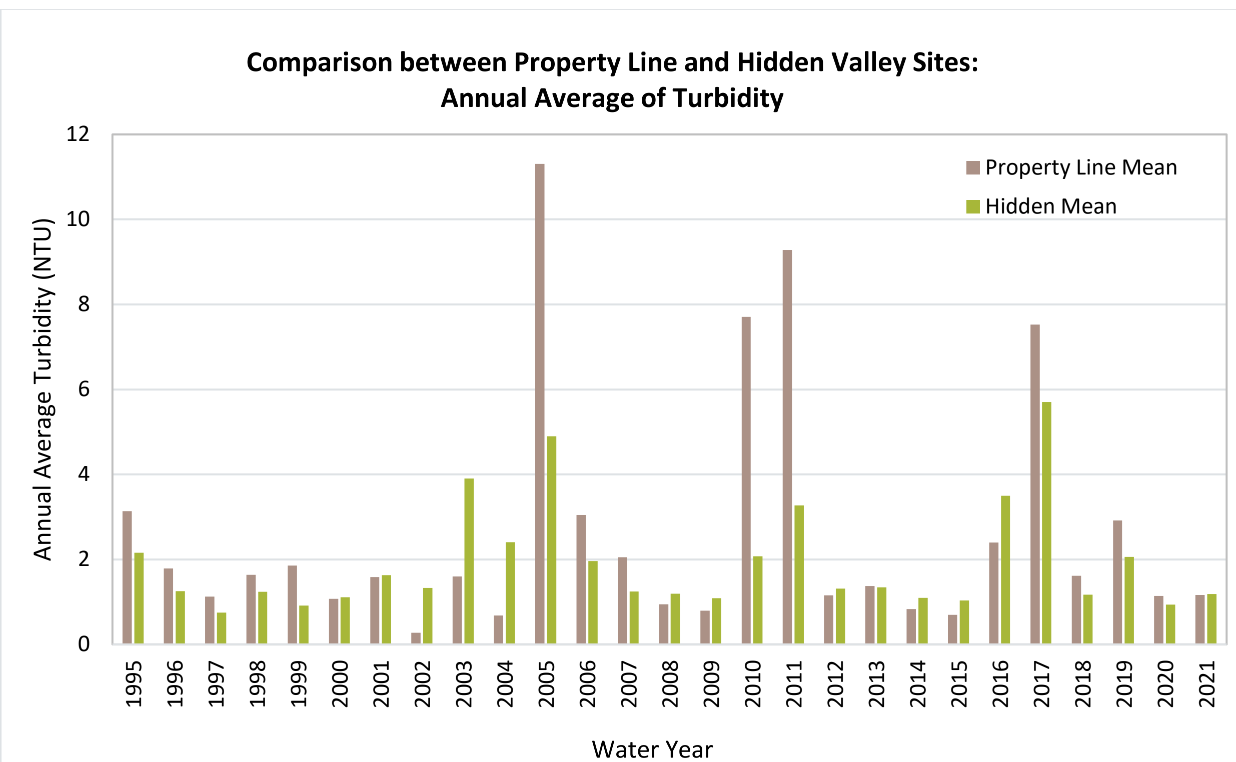

Figure 3-8 **Comparisons of Annual Averages of Turbidity between the Property Line Monitoring Site and the Reference Reach Site**

Box and whisker graphs of the variance between the Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5) data for these constituents are included in Appendix C (Figures C.12-1 to C.12-6). The box represents the upper and lower quartile difference between the annual average values, with the line representing the median. The whiskers represent the upper and lower differences outside of the middle 50 percent. Figure C.12-1 in Appendix C is a legend for the graphs. The graphs include a line overlay connecting and representing the annual median values. Similar to the trend analysis completed for the 2016 comprehensive report, box and whisker graphs were completed to show the difference between the Property Line monitoring site (43HVC-3) and the reference reach site (43HDVC-5). Comparing the difference at each station provides results that are less affected by wet and dry WY variation, as the sites experience similar weather and increases/decreases in flow conditions on any given sampling date. The comparison shown is the variance between the two constituent results. Over time, as water quality conditions have improved at the Property Line monitoring site (43HVC-3), the variance analysis provided by box and whisker graphs has become less relevant to understanding water quality trends at both sites, as the reference reach site (43HDVC-5) has exhibited higher values than the Property Line monitoring site (43HVC-3) on occasion.

3.6.2 Summary of Compliance at the Sky Meadows (43HVC-1A) and Patsy's (43HVC-2) Monitoring Sites

Raw water quality data (WY 2017 through WY 2021) for the Sky Meadows and Patsy's monitoring sites are provided in Appendix A. Means and standard deviations for the Patsy's monitoring site (43HVC-2) and the Sky Meadows monitoring site (43HVC-1A) for WYs 2017 through 2021 are included in Appendix C, and values that have exceeded the applicable annual average standard (non-compliance) are in bold. Graphs showing constituents versus flow for WYs 2006 through 2021 are also included in Appendix C. The tables and graphs show a drastic increase in turbidity and TSS in 2010 and 2011 and reduction and stabilization following those years. In general, increases in constituent concentrations are associated with above-average precipitation years and increased runoff. Table 3-6 summarizes non-compliance frequency at the Patsy's monitoring site (43HVC-2). Table 3-7 summarizes non-compliance frequency at the Sky Meadows monitoring site (43HVC-1A). The data shown in the table for the Sky Meadows monitoring site (43HVC-1A) reflect WYs 2006 and 2015 through 2021, as sampling was not required during the period from 2007 to 2015. The California annual state standards are given in the table, and the total number of samples collected over the 16 WYs are reported below. Non-compliance values are in bold and italicized font, indicating when the annual average was above the state standard. The non-compliance percentages were totaled by dividing by the total number of annual exceedances by the 16- and 8-year periods of record for the Patsy's monitoring site (43HVC-2) and the Sky Meadows monitoring site (43HVC-1A), respectively.

BMP placement and approved dewatering activities associated with the dredging of California Dam, which occurred in the late summer/early fall of 2020, ensured that no turbid or poor water quality releases occurred into Heavenly Valley Creek (as discussed in Chapter 2.9). Monthly sampling during the dredging operation did not show an uptick in constituent loading.

Total Phosphorus

Total phosphorus annual average values at the Patsy's monitoring site (43HVC-2) have exceeded the annual average since 2006. Total phosphorus annual values have also been exceeded at the reference reach site (43HDVC-5) over the period of record. This indicates that high phosphorus is a characteristic of the both the reference watershed as well as Heavenly Valley Creek suggesting that on-mountain operations at Heavenly are not solely responsible for these excess levels. Drought conditions tend to lower the annual average value (WYs 2012–2015 and 2020), while increased precipitation and average to above-average precipitation WYs are correlated with higher total phosphorus annual averages (WYs 2016, 2017, and 2019). However, like TSS in drought conditions in WY 2021, the total phosphorus values also increased during this drought year. The annual average total phosphorus value in 2020 was 0.021

mg/L compared to the 2021 value of 0.028 mg/L at Patsy's (43HVC-2). The September 20, 2021, sample collected at the Patsy's monitoring site (43HVC-2) recorded a total phosphorus value of 0.127 mg/L, which was the second highest reading of total phosphorus at this site over the past 5 years. The highest value of 0.137 mg/L was recorded at the Patsy's monitoring site (43HVC-2) during a flood flow on June 22, 2017, and associated wet year. The Caldor Fire likely contributed to this higher total phosphorus value in 2021 and skewed the results such that they do not align with those of similar drought-stricken years.

While the period of record at the Sky Meadows monitoring site (43HVC-1A) is not as long, the total phosphorus discussion mimics the downstream discussion at the Patsy's monitoring site (43HVC-3). The drought and lower precipitation WYs tend to show lower total phosphorus annual average values, while average and above-average WYs show higher total phosphorus values. WYs 2016 through 2019 have higher total phosphorus annual averages at the Sky Meadows monitoring site (43HVC-1A), while the drought conditions of 2015 and 2020 resulted in much lower annual averages. The post-fire sample in September 2021 recorded a higher total phosphorus value at the Sky Meadows monitoring site (43HVC-1A); however, earlier in the WY the November 19, 2020, sampling event recorded a daily value of 0.147 mg/L for total phosphorus, increasing the annual average above values typical during a drought year. The exact cause of this spike is unknown, though it is known that the fire increased constituent levels for the September samples collected.

Total phosphorus values at the Patsy's monitoring site (43HVC-2) and Sky Meadows monitoring site (43HVC-1A) should continue to be monitored as water quality exceedances continue annually. The trend analysis for these sites, along with the reference reach (43HDVC-5), track similar and there is not a significant difference with regards to total phosphorus.

Total Nitrogen

Like total nitrogen results at the Property Line monitoring site (43HVC-3), the Patsy's (43HVC-2) and Sky Meadows (43HVC-1A) monitoring sites rarely exceed total nitrogen annual average values. The Patsy's monitoring site (43HVC-2) exceeded the annual average only four times in the past 16 years and not once in the past 5-year period (2017–2021). While the data set is not as long at the Sky Meadows (43HVC-1A) monitoring site, the total nitrogen annual average was exceeded only once in the 8-year record (0.301 mg/L in 2016). Occasional daily peaks are collected that are above the total nitrogen standard; however, when averaged with the results from the rest of the WY the annual average total nitrogen value is in compliance. For example, for WY 2021 samples collected at the Sky Meadows monitoring site (43HVC-1A) on November 19, 2020 (0.435 mg/L), as well as on May 20, 2021 (0.023 mg/L), and April 4, 2021 (0.227 mg/L), exceeded the total nitrogen value of 0.19 mg/L. However, when averaged with the other 16 annual samples, the total nitrogen annual average for WY 2021 was 0.152 mg/L. Total nitrogen value collected along Heavenly Valley Creek as well as the reference site along Hidden Valley Creek meet compliance levels and are trending positive with regard to water quality.

Table 3-6 Exceedances of State Standards at the Patsy's Monitoring Site (43HVC-2), WYs 2006 through 2021

	Discharge (cfs)	Turbidity (NTU)	Suspended Sediment (mg/L)[1]	Nitrite/ Nitrate (mg/L)	Total Phosphorus (mg/L)	TKN (mg/L)	Total Nitrogen (mg/L)	Chloride (mg/L)
California State Standard			**60[1]**		**0.015**		**0.19**	**0.15**
43HVC-2 Patsy's Monitoring Site Annual Averages								
2006	2.98	1.95	8.10	0.059	***0.031***	0.094	0.144	***1.34***
2007	0.60	2.77	5.68	0.042	***0.025***	0.092	0.134	***1.36***
2008	0.51	1.22	3.76	0.059	***0.020***	0.100	0.159	***1.93***
2009	0.70	1.12	5.12	0.047	***0.023***	0.099	0.146	***1.25***
2010	1.22	15.2	26.0	0.064	***0.125***	0.341	***0.405***	***1.34***
2011	4.12	14.8	19.2	0.059	***0.135***	0.216	***0.275***	***0.680***
2012	0.655	2.00	9.80	0.039	***0.020***	0.109	0.148	***1.04***
2013	0.487	2.02	8.40	0.030	***0.020***	0.149	0.179	***1.18***
2014	0.307	3.86	11.5	0.035	***0.028***	0.193	***0.228***	***1.26***
2015	0.226	1.93	6.40	0.043	***0.022***	0.115	0.157	***1.62***
2016	2.19	3.87	15.6	0.100	***0.032***	0.158	***0.258***	***1.01***
2017	5.81	4.43	29.1	0.059	***0.036***	0.110	0.169	***0.679***
2018	1.46	4.05	13.4	0.033	***0.025***	0.092	0.126	***0.731***
2019	2.22	3.50	13.8	0.032	***0.027***	0.088	0.121	***0.847***
2020	0.590	2.14	7.50	0.022	***0.021***	0.090	0.105	***0.886***
2021	0.275	3.95	21.1	0.026	***0.028***	0.125	0.151	***1.48***
# Samples	277	277	277	277	277	277	277	203
# Noncompliance	-	-	0	-	16	-	4	16
% Noncompliance	-	-	0.0%	-	100.0%	-	25.0%	100.0%
Maximum Daily	29.2	228	831	0.252	2.08	3.22	3.30	4.20
Minimum Daily	0.005	0.05	0.27	0.001	0.007	0.018	0.024	0.350
Mean Daily	1.58	4.25	9.27[2]	0.047	0.039	0.136	0.182	1.10
Std Error Daily	3.45	16.6	59.3	0.034	0.142	0.225	0.229	0.565

[1] TSS values shown are 90th percentile values.
[2] Value shown is the mean daily value.

Table 3-7 Exceedances of State Standards at Sky Meadows Monitoring Site (43HVC-1A), WYs 2006 through 2021

	Discharge (cfs)	Turbidity (NTU)	Suspended Sediment (mg/L)[1]	Nitrite/ Nitrate (mg/L)	Total Phosphorus (mg/L)	TKN (mg/L)	Total Nitrogen (mg/L)	Chloride (mg/L)
California State Standard			**60[1]**		**0.015**		**0.19**	**0.15**
43HVC-1A Sky Meadows Annual Averages[2]								
2006	2.11	1.55	6.60	0.040	***0.025***	0.10	0.142	***1.02***
2007–2014	No Sampling Data Collected per Report Recommendations							
2015	0.107	1.08	-[3]	0.039	***0.018***	0.094	0.133	***0.813***
2016	1.72	3.70	26.6	0.119	***0.037***	0.181	***0.301***	***0.692***
2017	1.87	5.37	46.3	0.040	***0.048***	0.142	0.182	***0.391***
2018	1.19	2.72	7.95	0.030	***0.022***	0.103	0.132	***0.335***
2019	1.47	3.86	22.6	0.022	***0.030***	0.104	0.126	***0.367***
2020	0.481	1.86	11.7	0.016	***0.018***	0.097	0.113	***0.546***
2021	0.270	4.83	17.4	0.021	***0.031***	0.131	0.152	***0.769***
# Samples	117	124	125	125	125	125	125	103
# Noncompliance	-	-	0	-	8	-	1	8
% Noncompliance	-	-	0.0%	-	100.0%	-	12.5%	100.0%
Maximum Daily	9.75	40.3	93.5	0.248	0.271	0.460	0.586	1.60
Minimum Daily	0.003	0.50	0.53	0.002	0.010	0.039	0.051	0.21
Mean Daily	1.21	3.22	5.74[4]	0.042	0.030	0.122	0.164	0.54
Std Error Daily	1.95	4.90	10.2	0.042	0.031	0.079	0.106	0.27

[1] TSS values shown are 90th percentile values.
[2] Samples were not collected from 2007 to 2014 per permit conditions. Samples for WY 2015 were only collected during the 4th quarter.
[3] There were not enough numbers in the range to interpolate a value for the 90th percentile for WY 2015.
[4] Value shown is the mean daily value.

Chloride

All 16 annual average values for chloride exceeded the annual average state standard for chloride of 0.15 mg/L at the Patsy's monitoring site (43HVC-2), as did all eight annual average values for chloride at the Sky Meadows monitoring site (43HVC-1A). For the 5-year period from 2017 to 2021, the lowest minimum daily chloride reading recorded at the Patsy's monitoring site (43HVC-2) was 0.35 mg/L on June 22, 2017. This value was obtained near peak runoff conditions during the wettest period since 2005. This lowest single daily value still exceeded the state standard by more than double as well. Similarly, the lowest minimum daily chloride reading at the Sky Meadows monitoring site (43HVC-1A) for the 5-year period in question was 0.20 mg/L on January 1, 2020. This daily value is still above the Lahontan state standard annual average for chloride. Chloride levels remain high at both monitoring sites along Heavenly Valley Creek as well as the monitoring site downstream (Property Line monitoring site [43HVC-3]). Salt application occurs at the terrain parks within the Heavenly Valley Creek watershed upslope of both the Patsy's monitoring site (43HVC-2) and the Sky Meadows monitoring site (4HVC-1A); application operations have been previously discussed in Chapter 3.6.1.1. Also, as previously discussed, chloride levels remain high at the reference reach site (43HDVC-5) as well indicating that Heavenly is not solely responsible for these elevated readings. Heavenly operations track huck salt (and thus chloride) and limit application for maximum efficiency (lowering the freezing point to limit melt during spring conditions). There is not a prominent trend showing a decline in chloride annual averages along Heavenly Valley Creek. However, annual averages of chloride have become less variable over time, and although high precipitation years are associated with higher chloride values, these spikes are lower in value overall compared to the earlier period. Chapter 8 includes discussion regarding huck salt application. Application has decreased over the 5-year monitoring period at the terrain park location, which is upstream of the Patsy's monitoring site (43HVC-2), likely reducing the annual average concentration of chloride at that location.

As discussed previously for the Property Line monitoring site (43HVC-3), chloride findings remain high and troublesome in terms of water quality at both the Patsy's monitoring site (43HVC-2), Sky Meadows monitoring site (43HVC-1A) and reference reach (43HDVC-5). Chloride constituent monitoring along Heavenly Valley Creek should continue moving forward to better understand increased background levels as they relate to Heavenly operation and reduction in chloride usage.

Suspended Sediment

At the Patsy's monitoring site (43HVC-2), the 90th percentile standard for TSS has not been exceeded over the 16-year monitoring period. The 4-year drought conditions (2012–2015) and annual 90th percentile average values for TSS are similar to WY 2020 (which was also a drought year) annual TSS average (7.50 mg/L). However, the drought conditions prevalent during WY 2021 had a higher TSS 90th percentile value (21.1 mg/L) compared to the 2012 to 2015 and 2020 drought year values. TSS values of samples taken prior to the Caldor Fire (August 2021) in WY 2021 were all below 11 mg/L; however, the post-fire September sample (September 20, 2021) recorded a TSS value of 29.5 mg/L at the Patsy's monitoring site (43HVC-2). This peak skewed the 90th percentile total higher, which in turn prevents the WY 2021 TSS 90th percentile value from following similar drought year results. This trend is not as prevalent at the Sky Meadows monitoring site (43HVC-1A), since the data set is for fewer years; however, when comparing the TSS 90th percentile values between the two drought condition years of WYs 2020 and 2021, the 2021 90th percentile value is higher than the 2020 value. The post-fire sample in September recorded a higher TSS reading at the Sky Meadows monitoring site as well; however, earlier in the WY, the November sampling event (November 19, 2020) recorded a daily value of 38 mg/L for TSS, increasing the annual 90th percentile value. The November 2020 samples at both the Sky Meadows monitoring site (43HVC-1A) and the Patsy's monitoring site (43HVC-2) occurred over early season snow during a storm event. Unfortunately, the Property Line monitoring site (43HVC-3) was dry during this November sample and the reference reach site (43HDVC-5) only showed a bump in turbidity, total nitrogen, and chloride results. Total phosphorus and TSS did not appear to increase at the reference reach site (43HDVC-5) during the November storm sample. While the November storm sample spike was unusually high for constituents, the post-fire sample also aided in increased annual constituent levels.

While the Caldor Fire did not burn within Heavenly boundaries, September sampling event data at both the Sky Meadows monitoring site (43HVC-1A) and Patsy's monitoring site (43HVC-2) exhibited increased turbidity and TSS that is likely associated with the fire and poor air quality.

For the past 5-year period (2017–2021) the 90th percentile annual average values for TSS are well below the state standard of 60 mg/L at the Patsy's monitoring site (43HVC-3) and for the Sky Meadows monitoring site (43HVC-1A). TSS is a concerning constituent for Lahontan since many other nutrients (phosphorus and nitrogen) are often transported attached to TSS particles. Although TSS annual average values are not concerning at this time with regard to the state standard, monitoring should continue to be tracked due to the correlation with other constituents of concern.

3.6.3 Bijou Park Creek

Raw water quality data (WY 16 through WY 21) for the Bijou Park Creek monitoring site (43BPC-4, below the California Base Parking Lot) are provided in Appendix A. This monitoring reach is closely tied to the Storm Filter Effluent monitoring site (43HVP-2) discussed in Chapter 3.6.5. Additional discussion regarding the Bijou Park Creek watershed can be found in the *Bijou Park Creek Evaluation Report* (Tormey 2017, Appendix J). Graphs showing constituents versus flow for all sites including the Bijou Park

Creek monitoring site (43BPC-4) are included in Appendix C, and Table 3-8 summarizes the annual frequency of non-compliance at the Bijou Park Creek monitoring site (43BPC-4) for WYs 2006 through 2021. It is important to note that effective November 30, 2008, standards for discharges to Bijou Park Creek from the California Base area changed from those for discharges to land treatment to those for discharges to surface waters. Prior to November 30, 2008, effluent limits for discharge at this site were regulated under the permit as maximum concentrations for discharge to land treatment. Proposed, constructed, and implemented improvements to the California Base Parking Lot dictated by the Lahontan permit triggered these more stringent objectives. Table 3-8 shows the standards for each of the permit requirements. Standards for turbidity, total phosphorus, total nitrogen, and oil and grease all decreased by a factor of ten or more. TSS annual average limits remained the same, 60 mg/L based on the 90th percentile of receiving waters to Lake Tahoe (Lahontan Board Order R6T-2003-0032). The chloride state standard increased from a value that was previously set in the 1996 Heavenly Master Plan Collection and Monitoring Agreement at 0.3 mg/L. The annual average for chloride was changed in November 2008 to 3.0 mg/L for Lake Tahoe receiving water limits (Table 3 of Lahontan Board Order R6T-2003-0032). All these state standards remain in the new permit (Board Order No. R6T-2015-0021) signed into effect in May 2015.

As discussed in previous 5-year comprehensive reports (Cardno ENTRIX 2012), prior to 2009, the annual average turbidity standard at Bijou Park Creek monitoring site (43BPC-3) was 200 NTUs, and samples did not exceed this standard. WY 2009 marked the issuance of the new standard of 20 NTU in the permit, and samples at Bijou Park Creek monitoring site consistently exceeded this lower standard, despite a continued trend of declining turbidity samples over time. Turbidity annual average values have declined substantially, so the collection of storm samples at the Bijou Park Creek monitoring site (43BPC-4) is no longer required. Storm samples typically reflect higher turbidity results, data which are currently captured through storm sampling at the California Base Parking Lot filter vaults, as discussed in detail in Chapter 3.6.5. Early season snow or rainstorms that result in elevated runoff prior to development of winter snowpack are often correlated with high turbidity values (such as results from samples in November 2020, following a high-elevation snowstorm that led to increased runoff downstream).

Total Phosphorus

Total phosphorus annual average values collected have lowered substantially since WY 2010. This coincides with the installation of the California Base Parking Lot vault and filtration system installed in 2009. Unfortunately, these lower total phosphorus results still do not meet the WDR standards which were lowered to the state standard of 0.008 mg/L in 2012. All annual average total phosphorus values for the past 5 WYs are in exceedance of the state standard. The lowest annual average for total phosphorus at the Bijou Park Creek monitoring site (43BPC-4) over the past 5 WYs was calculated during the 2020 drought year at 0.100 mg/L. WY 2021 also had below-average precipitation, yet the total phosphorus annual average was higher than in 2020 (0.178 mg/L versus 0.100 mg/L). The storm sample collected in November (0.378 mg/L on November 19, 2020) as well as a high results in January (0.304 mg/L on January 13, 2021) and near peak runoff in March (1.302 mg/L on March 5, 2021) increased the total phosphorus annual average value to 0.178 mg/L for WY 2021 and atypical for drought condition WYs.

Since phosphorus nutrients tend to adhere to larger sediment particles, TSS and turbidity results are often tied to total phosphorus results. The upstream stormwater filter system and phosphorus-absorbing media have helped in removing and limiting total phosphorus exceedance; however, the media are not designed to meet the state standards, and additional inputs above the monitoring location (roadway particulate/deicer) are likely contributing to these exceedances. As mentioned prior with the Heavenly Valley Creek monitoring stations, total phosphorus values were also exceeded at the reference reach site (43HDVC-5) over the 5-year and record period shown (11 years) indicating that these conditions are part of the system and not related to Heavenly.

Total phosphorus values at Bijou Park Creek monitoring site (43BPC-4) continue to exceed the lower threshold standard and should continue to be monitored and compared with the reference reach (43HDVC-5) as the water quality trend for total phosphorus is nowhere near meeting the standard.

Total Nitrogen

Total nitrogen annual average state standard values have continued to decrease over the eleven years of record. The current standard for total nitrogen at the Bijou Park Creek monitoring site (43BPC-4) is 0.15 mg/L. All 5 WYs in questions (2017–2021) exceeded the state standard and the annual average value for the past 16 WYs has not been below 0.516 mg/L in 2020. This value is 3.4 times higher than the state standard. The total phosphorus discussion regarding the dissimilarities between WYs 2020 and 2021 results, even though both years in question saw below-average precipitation, applies to the total nitrogen annual averages as well. Likewise, the storm sample in November and runoff sample in March (both above 1 mg/L for total nitrogen) skewed the annual average higher. Like total phosphorus, total nitrogen particles adhere to sediment particles. Likewise, the trend is evident that total nitrogen values correlate with the annual average turbidity and TSS values. As turbidity and TSS increase so does total nitrogen (and total phosphorus). Improvements are needed for Heavenly to meet the Bijou Park Creek monitoring site (43BPC-4) water quality total nitrogen annual average stated standard. Moving forward, total nitrogen monitoring should continue at the Bijou Park Creek monitoring site (43BPC-4).

Chloride

Over the 16-year record shown in Table 3-8, chloride annual average values did not meet the state standard. See Appendix A for all the monitoring site data over the 5 WYs in question. Chloride concentrations continued to be high at all monitoring locations including the reference reach site (43HDVC-5). Chloride concentrations at the Bijou Park Creek monitoring site (43BPC-4) continued to be magnitudes higher than those on Heavenly Valley Creek and Hidden Valley Creek. In part the background condition is aiding in the exceedances of the threshold, but it appears that Heavenly is adding to that background condition. The proximity of the stream sampling point to the roadway network and connection to the California Base Parking Lot, where deicer application is necessary for safe travel of Heavenly’s guests, is likely the source of these elevated readings.

Deicers are applied to the plowed roadway to lower the freezing point and prevent ice on the roadway. The sand/salt mixture also provides traction on the steep roadways leading to the California Base Parking Lot. However, chloride concentrations observed at the Bijou Park Creek monitoring site (43BPC-4) have both declined and stabilized (i.e., exhibiting smaller annual average fluctuations due to WY), over the past 5-year reporting period, compared to previous years (Table 3-8). Similar results were observed at the storm filter system effluent location at the California Base Parking Lot, even though the filters do not explicitly treat or capture chloride. However, the StormFilter treatment vaults capture sediment and particulate, some of which may contain chloride anions. Additionally, these reductions may be in part due to improved operations of the California Base Parking Lot, as discussed further in Chapter 3.6.5.

Despite a chloride trend reduction, chloride remains above the state standard at this location and continues to be problematic at Bijou Park Creek. Potential future improvement plans regarding chloride were discussed in the *Bijou Park Creek Evaluation Report* (Tormey 2017, Appendix J) and should be initiated. Chloride constituent monitoring should continue to not only analyze the effectiveness of the proposed improvements but to also compare with background levels.

Suspended Sediment

The 90th percentile calculation means that 90 percent of the values obtained during the WY are equal to or lower than the score calculated. The 90th percentile annual TSS levels have exceeded the state standard of 60 mg/L four times in the past 10 years and twice in the last 5 years. Results from WYs 2013, 2016, 2019, and 2021 all exceeded the TSS 90th percentile state standard (101.3 mg/L, 156 mg/L, 81.2

mg/L, and 81.7 mg/L, respectively). The completion of the filter and treatment system, as well as annual sweeping, debris collection, and vault maintenance and filter replacement have likely led to the decreased TSS annual values. Drought conditions from 2012 to 2015 do not appear to correlate with a decrease in the amount of deicer applied in the parking lot and nearby vicinities (see Chapter 7). Instead, storm patterns and duration correlate with application amounts; however, additional training, new equipment, and the switch to Washoe sand have lowered application amounts in recent years (see more detail in Chapter 7). Data from the past 10 WYs show improvement in the annual 90th percentile TSS results over the 2006 to 2009 results, implying improvement based on operational decisions. The 10-year average of the 90th percentile values from 2012 to 2021 is approximately 59 mg/L, while the 2006 to 2011 average is 168 mg/L.

WY 2020 and 2021 data and results for TSS at the Bijou Park Creek monitoring site (43BPC-4) are not particularly similar, despite both years being considered below average in terms of precipitation. While this site was sampled after the Caldor Fire in September (September 20, 2021), the constituent results across the board are higher than during low flows in July and past WYs; the annual average and 90th percentile totals are skewed higher due to two sampling events in November (November 19, 2020) and March (March 5, 2021). The November sample was collected during a storm event and recorded the highest flow (discharge) for the entire WY. The March sampling date correlates to the receding limb of discharge runoff. Increased streamflow often equates to increased constituent readings.

While the overall water quality trend regarding TSS is showing improvements, the annual 90th percentile values are still not meeting the state standard at the Bijou Park Creek monitoring site (43BPC-4). TSS should continue to be monitored at this site moving forward.

Table 3-8 Exceedance of State Standards at the Bijou Park Creek Monitoring Site (43BPC-4), WYs 2012 through 2021

	Discharge (cfs)	Turbidity (NTU)	Suspended Sediment (mg/L)[1]	Nitrite/ Nitrate (mg/L)	Total Phosphorus (mg/L)	TKN (mg/L)	Total Nitrogen (mg/L)	Chloride (mg/L)
43BPC-4 Bijou Park Creek Annual Averages								
California State Standard		**200.0**	**60[1]**	**-**	**1.00**	**-**	**5.00**	**0.20**
2006	0.520	59.4	***457***	0.277	0.516	0.818	1.10	***98.0***
2007	0.257	83.1	***157***	0.270	0.390	1.20	1.47	***82.0***
2008	0.333	79.9	***120***	0.490	0.830	1.39	1.88	***145***
California State Standard[2]		**20**	**60**	**-**	**0.10**	**-**	**0.50**	**3.0**
2009	0.198	***88.8***	***168***	0.332	***0.307***	0.546	***0.878***	***120***
2010	0.151	15.4	***63.6***	0.466	***0.120***	0.268	***0.733***	***94.9***
2011	0.456	18.7	41.7	0.316	0.088	0.342	***0.657***	***76.3***
California State Standard[3]		**20**	**60**	**-**	**0.008**	**-**	**0.15**	**3.0**
2012	0.244	15.8	29.5	0.305	***0.096***	0.306	***0.610***	***94.0***
2013	0.220	***21.2***	***101***	0.392	***0.105***	0.351	***0.742***	***74.0***
2014	0.139	9.52	12.3	0.269	***0.063***	0.269	***0.538***	***56.3***
2015	0.109	12.4	8.40	0.277	***0.070***	0.264	***0.541***	***45.9***
2016	0.116	***41.2***	***156***	0.407	***0.140***	0.316	***0.686***	***87.2***
2017	0.387	***22.8***	39.2	0.249	***0.113***	0.322	***0.570***	***61.1***
2018	0.211	***27.6***	55.2	0.199	***0.147***	0.372	***0.539***	***50.8***
2019	0.271	***38.1***	***81.2***	0.189	***0.166***	0.358	***0.547***	***58.5***
2020	0.170	16.9	26.1	0.249	***0.100***	0.267	***0.516***	***56.2***
2021	0.136	***36.0***	***81.7***	0.229	***0.178***	0.343	***0.572***	***51.7***
# Samples	292	292	292	292	292	292	292	292
# Noncompliance	-	7	9	-	12	-	13	16
% Noncompliance	-	43.8%	56.3%	-	75.0%	-	81.3%	100.0%
Maximum Daily	3.04	978	2,796	1.44	10.1	15.6	16.2	960
Minimum Daily	0.010	3.1	2.00	0.005	0.02	0.014	0.268	0.44
Mean Daily	0.247	34.3	52.06[4]	0.307	0.22	0.46543	0.769	77.5
Std Error Daily	0.317	101.6	256.1	0.167	0.73	1.18	1.18	100.3

[1] TSS values shown are 90th percentile values.
[2] California Annual State Standards for Bijou Park Creek are based on surface runoff effluent limits (Lahontan Discharge Permit)
[3] California annual state standards for Bijou Park Creek are based on Lake Tahoe receiving water limits (Amended Lahontan Discharge Permit)
[4] Value shown is the mean daily value.

3.6.4 Edgewood Creek

Edgewood Creek is located in Nevada and is not subject to Lahontan WDRs. However, this analysis has been included for completeness. Raw data for both Edgewood Creek sites are provided in Appendix A. Graphs showing the 2021 hydrograph are included in Appendix B. Sixteen-year constituents versus flow data for both Edgewood Creek sites are included in Appendix C.

The purpose of the Upper Edgewood (43HVE-1) and Lower Edgewood (43HVE-2) monitoring sites is to show the relative effect of resort activities as well as the influence of the Boulder Parking Lot (located between the two monitoring locations) on water quality. The Upper Edgewood monitoring site (43HVE-1) also serves as a good indicator of the effects of resort operation in the Edgewood Creek watershed. Water quality constituent concentrations have typically been higher at the Lower Edgewood monitoring site (43HVE-2) than those measured at the Upper Edgewood monitoring site (43HVE-1); however, in the latest 5-year reporting period, turbidity, TSS, and phosphorus have been higher at the Upper Edgewood monitoring site (43HVE-1). While this may be related to changes in water quality and Boulder Parking Lot improvements influencing results at the Lower Edgewood monitoring site (43HVE-2), it may also be a result of collection of fewer samples at the Upper Edgewood monitoring site (43HVE-1) over the last several years. Samples can only be collected at the Upper Edgewood monitoring site during runoff season (which typically exhibits higher concentrations of water quality constituents), as there is full ice and snow cover across the channel in the winter and the stream often runs dry (or only has stagnant water present at the cross-section) during the late summer months. Heavenly implemented the BMP retrofit project at the Boulder Parking Lot and Lodge to address the water quality issue at the Lower Edgewood monitoring site, and construction was completed in 2005. Continued parking lot improvements included paving of the entire Boulder Parking Lot (previously a dirt lot) in 2020. Linear K-rail was installed at the west end of the parking lot to prevent snow storage and melt from directly running onto the slope adjacent to Edgewood Creek.

As mentioned above, Edgewood Creek is now subject to Nevada state standards including single value and annual average exceedances for total nitrogen and total phosphorus and annual average exceedances for total nitrogen and TSS (see Appendix A for annual and daily records at both Edgewood Creek monitoring sites). Tables 3-9 and 3-10 show compliance for the Upper Edgewood monitoring site (43HVE-1) and Lower Edgewood monitoring site (43HVE-2) for the 5-year period of this report (2017–2021) as well as the 16-year historical period of record (2006–2021). It is important to note that more samples are collected at the Lower Edgewood monitoring site (43HVE-2) due to low flow, no flow, full snow cover, and resort activities (skiing/grooming) at the Upper Edgewood monitoring site (43HVE-1).

Total Phosphorus

Total phosphorus daily values were exceeded at the Upper Edgewood monitoring site (43HVE-1) 13 times during the 5-year record (2017–2021). Following the 2019 change in standards, total phosphorus annual average values recored in 2019 through 2021 exceeded the state standard. This same trend is present at the Lower Edgewood monitoring site (43HVE-2) as well following state standard changes. Total phophorus values at the Edgewood Creek monitoring sites are trending negative in terms of water quality.

Total Nitrogen

For the Upper Edgewood monitoring site (43HVE-1), only one daily value of total nitrgoen exceeded the single value state standard for the 5-year period of record. This daily exceedance solely contributed to the annual average exceedance in that year; this exceedance occurred on September 19, 2019, and as mentioned above, was associated with upstream prescribed fire. It did not appear that the prescribed burning in September 2019 had as much effect on the Lower Edgewood monitoring site (43HVE-2) as it appears to have had on the Upper Edgewood monitoring site (with the exception of phosphorus), potentially due to greater distance from the fire. For the Lower Edgewood monitoring site (43HVE-2) annual averages for total nitrogen were not exceeded in any years; however, two single value exceedances occurred during the winter of 2019. In addition, as a preemptive measure during the Caldor Fire, vegetation clearing along powerlines was conducted across Edgewood Creek below the water quality monitoring station. This may affect SCI monitoring results in the future, but is not likely to directly affect water quality results.

Overall, water quality appears to be declining at both Edgewood Creek sites. This may be related to changes in the Nevada state standard to include both single value and annual average standards for nitrogen and phosphorus; however, individual spikes have tended to be higher, and it appears that more occurred during the 5-year reporting period compared to the previous 5 years. A decline in the viability of sampling at the Upper Edgewood monitoring site has caused most samples to be collected during the runoff season, which typically exhibits poorer water quality. The September 2019 prescribed fire event in the Upper Edgewood Creek watershed drastically skewed results but does not necessarily explain exceedance in the following years.

Turbidity

The Upper Edgewood monitoring site (43HVE-1) did not exceed the annual average turbidity standard between 2006 and 2018. However, the standard was exceeded recently, both in 2019 and 2021. This may be due to fewer number of samples being collected overall, as described above. Additionally, the samples that were collected were often collected during the runoff season, when water quality constituents are generally higher. The Lower Edgewood monitoring site (43HVE-2) exceeded the state annual standard for turbidity from 2019 through 2021 during the 5-year reporting period, with the exceedance values associated with runoff season. Turbidity values at the Edgewood Creek monitoring sites are trending negative in terms of water quality.

Suspended Sediment

The only year annual average values for TSS exceeded the state standard was in 2019. Annual average exceedance values in 2019 at the Upper Edgewood monitoring site (43HVE-1) are primarily driven by a single exceedance sampling event (September 18, 2019). This sample date coincided with a prescribed burn conducted by Tahoe Douglas Fire Protection District on the slope above the sampling site, which was correlated with a substantial spike in all constituents. There were no TSS exceedances occurred during the reporting period at the Lower Edgewood monitoring site (43HVE-2). TSS compliance values collected along Edgewood Creek vary between the two sites. TSS values should continue to be monitored to better understand the difference between the two monitoring locations as well as exceedances.

Specific Conductivity

Sampling data regarding specific conductivity for both the Upper Edgewood monitoring site (43HVE-1) and the Lower Edgewood monitoring site (43HVE-2) are included in Table 3-9 and Table 3-10 below. Statistical tables as well as graphical representation for specific conductivity are included in Appendix C. Annual average values for specific conductivity do not vary much over the period of record though specific conductivity results are consistently higher at the Lower Edgewood monitoring site (43HVE-2) compared to the Upper Edgewood monitoring site (43HVE-1). Increased sediment from the Boulder Parking Lot likely is the cause for higher values downstream. Fine sediment and constituents associated with the parking lot carry ions that make their way into the stream, increasing specific conductivity. There is no standard for specific conductivity; therefore, there are no exceedances for either the Lower Edgewood (43HVE-2) or Upper Edgewood (43HVE-1) monitoring sites. The trend analysis for these sites track similar, and there is not a significant difference with regard to specific conductivity.

Table 3-9 Exceedances of State Effluent Standards at the Upper Edgewood Monitoring Site (43HVE-1), WYs 2006 through 2021

	Discharge (cfs)	Turbidity (NTU)	Suspended Sediment (mg/L)	Specific Conductivity (mmhos)	Total Phosphorus (mg/L)	Soluble Reactive Phosphorus (mg/L)	Nitrate/ Nitrite (mg/L)	TKN (mg/L)	Total Nitrogen (mg/L)
Nevada State Standard		**10[1]**	**25[1]**		**0.1[1]**				**0.6[2]**
43HVE-1 Upper Edgewood Monitoring Site (2006–2021)									
2006	0.66	3.9	4.4	71	0.040	0.009	0.001	0.164	0.165
2007	0.32	3.9	6.4	66	0.062	0.007	0.001	0.195	0.196
2008	0.57	6.0	11.5	64	0.087	0.004	0.003	0.302	0.304
2009	0.35	3.1	8.0	66	0.056	0.003	0.002	0.134	0.136
2010	0.19	2.3	5.5	69	0.030	0.004	0.002	0.150	0.152
2011	0.38	9.8	23.5	80	0.053	0.005	0.002	0.233	0.235
2012	0.31	5.1	11.3	98	0.064	0.002	0.002	0.185	0.188
2013	0.22	4.5	11.1	90	0.066	0.004	0.001	0.235	0.237
2014	0.18	3.9	7.2	88	0.046	0.005	0.009	0.187	0.196
2015	0.01	1.3	5.3	57	0.042	0.010	0.003	0.174	0.176
2016	0.15	0.7	1.1	64	0.031	0.014	0.003	0.184	0.187
2017	0.76	3.7	3.1	75	0.038	0.012	0.003	0.188	0.191
2018	0.19	5.1	6.0	74	0.047	0.007	0.002	0.137	0.139
Nevada State Standard		**10[1]**	**25[1]**		**0.1[1]/0.05[2]**				**0.6[1]/0.6[2]**
2019	0.31	**31.7**	**76.8**	73	***0.381***	0.008	0.003	0.937	***0.940***
2020	0.15	8.5	13.8	75	***0.099***	0.005	0.004	0.243	0.247
2021	0.12	**13.4**	12.5	61	***0.083***	0.005	0.002	0.218	0.220
# Samples	157	157	157	157	157	157	157	157	157
# Noncompliance	-	17	14	-	26	-	-	-	2
% Noncompliance	-	11%	9%	-	17%	-	-	-	1%
Maximum Daily	3.24	160	308	844	0.09	9.34	9.34	3.82	0.02
Minimum Daily	0.001	14.3	0.3	0.4	0.001	0.054	0.057	0.015	0.001
Mean Daily	0.330	75.9	7.3	14.2	0.003	0.252	0.255	0.081	0.006
Std Error Daily	0.449	20.0	25.7	69.1	0.007	0.741	0.741	0.305	0.004

[1] Not to exceed standard for a single value.
[2] Not to exceed standard for the annual average.

Table 3-10 Exceedances of State Effluent Standards at Lower Edgewood Monitoring Site (43HVE-2), WYs 2006 through 2021

	Discharge (cfs)	Turbidity (NTU)	Suspended Sediment (mg/L)	Specific Conductivity (mmhos)	Total Phosphorus (mg/L)	Soluble Reactive Phosphorus (mg/L)	Nitrate/ Nitrite (mg/L)	TKN (mg/L)	Total Nitrogen (mg/L)
Nevada State Standard		**10[1]**	**25[1]**		**0.1[1]**				**0.6[2]**
43HVE-2 Lower Edgewood Monitoring Site (2006–2021)									
2006	0.69	12.7	18.6	153	0.093	0.009	0.031	0.232	0.263
2007	0.36	7.0	10.8	93	0.060	0.008	0.025	0.196	0.221
2008	0.42	13.4	23.5	97	0.131	0.005	0.018	0.319	0.337
2009	0.22	6.2	16.5	114	0.048	0.003	0.041	0.187	0.228
2010	0.27	6.4	14.1	113	0.035	0.005	0.028	0.182	0.210
2011	0.52	6.0	7.4	151	0.039	0.004	0.031	0.210	0.240
2012	0.32	5.4	9.1	134	0.044	0.003	0.037	0.252	0.289
2013	0.19	6.7	8.7	153	0.053	0.004	0.035	0.228	0.263
2014	0.13	4.3	6.4	133	0.040	0.005	0.042	0.236	0.278
2015	0.03	2.5	3.8	143	0.025	0.005	0.055	0.153	0.208
2016	0.12	5.8	7.5	142	0.039	0.005	0.085	0.200	0.284
2017	0.75	8.7	9.0	120	0.053	0.008	0.043	0.206	0.249
2018	0.34	15.1	11.3	105	0.051	0.007	0.043	0.178	0.221
Nevada State Standard		**10[1]**	**25[1]**		**0.1[1]/0.05[2]**				**0.6[1]/0.6[2]**
2019	0.50	***52.4***	22.2	197	***0.145***	0.008	0.042	0.315	0.356
2020	0.21	***11.0***	9.8	117	***0.069***	0.006	0.056	0.187	0.242
2021	0.13	***13.4***	8.1	121	***0.051***	0.007	0.053	0.202	0.255
# Samples	244	248	248	248	248	248	248	248	248
# Noncompliance	-	46	26	-	28	-	-	-	2
% Noncompliance	-	19%	10%	-	11%	-	-	-	1%
Max	4.17	1407	340	188	0.151	1.42	1.48	0.76	0.01
Min	0.01	18.0	0.5	0.5	0.001	0.06	0.08	0.01	0.00
Mean	0.32	135.5	11.1	10.9	0.043	0.22	0.26	0.06	0.01
Std Err	0.46	94.7	32.0	20.6	0.026	0.15	0.15	0.09	0.00

[1] Not to exceed standard for a single value.
[2] Not to exceed standard for the annual average.

3.6.5 Storm Filter System and Automatic Sampling

3.6.5.1 Introduction

The California Base Parking Lot filter vaults were constructed in 2007, and the stormwater filters were installed the following spring (April 2008), prior to the runoff season, when improved filter media were available. In total, there are 455 storm filters located under the northwest corner of the parking lot and roadways. The goal of the storm filter system is to collect and treat surface and sump water prior to discharge into Bijou Park Creek. See Figure 3-9 for RCI's schematic of the filter system. Automatic sampling locations are located at Locations 1, 7 and 14. Location 1 is the southernmost influent location on the figure, Storm Vault Influent South (43HVP-1B). Location 7 is the northernmost influent sampling location, Storm Vault Influent North (43HVP-1A), and Location 14 is the Storm Vault Effluent monitoring site (43HVP-2), prior to discharge to surface water. An additional vault and filter system is located on Wildwood Avenue, below the intersection with Saddle Road (not shown in Figure 3-9). This filter vault collects and treats runoff along Saddle Road downslope from the parking lot. Bijou Park Creek and the monitoring site (43BPC-4) located downstream is formed by the combination of the Storm Vault Effluent monitoring site (43HVP-2) water, the parking lot drainage, as well as the Wildwood Avenue Storm Vault Effluent water, Saddle Road drainage.

Across the six underground vaults, there are 14 filters with PhosphoSorb™ media (also referred to as sacrificial filters throughout past reports), intended to specifically capture total phosphorus and TSS, and 441 ZPG™ media filters, intended to treat a range of water quality constituents. The underground vaults in the California Base Parking Lot also include an oil and grease separator.

Stormwater sampling began in October 2008 (WY 2009); however, some troubleshooting was required to collect viable samples, and therefore samples collected were not required to be submitted to Lahontan at that time. Preliminary data for WY 2009 were summarized and submitted in a memorandum to Lahontan in November 2009. Stormwater is sampled at two influent locations and one effluent location, with the intention being to better understand the effectiveness of the storm filters across the vault system. The Amended MRP that was issued in May 2011 (2003-0032A1) required the collection and reporting of 10 storm/runoff samples each WY. In WY 2012, storm samples were taken, and results were officially reported to Lahontan. The new WDR and Reporting Program (No. R6T-2015-0021) only requires five samples to be collected and reported per WY. As with past WY samples, infrequent storm cycles, the timing of storm sampling, and equipment failure have been problems and have limited the collection at all three sampling locations per the reporting program requirements. During the ski season and winter months the parking lot is used extensively for customer and employee parking. Parking in addition to snow removal storage and ice over prevent sampling for numerous months (November through March). For the reason listed above, fewer than five samples have been collected in some WYs.

Maintenance of the system was sporadic during the early years of vault installation and operation. The PhosphoSorb™ filters were replaced in the fall of 2009; however, these filters were not replaced again for 2 years, until the fall of 2011. In 2011, Heavenly committed to an annual filter replacement cycle in which all filters (both PhosphoSorb™ and ZPG™) were to be replaced over a 4-year cycle. The replacement of 221 ZPG™ cartridges in June 2014 marked the first time that ZPG filters were replaced since installation. Since that time, at a minimum, the 14 PhosphoSorb™ filters are replaced annually, and ZPG™ filters are replaced as needed during the annual inspection and maintenance event, until all ZPG filters are replaced during the 4-year full replacement cycle.

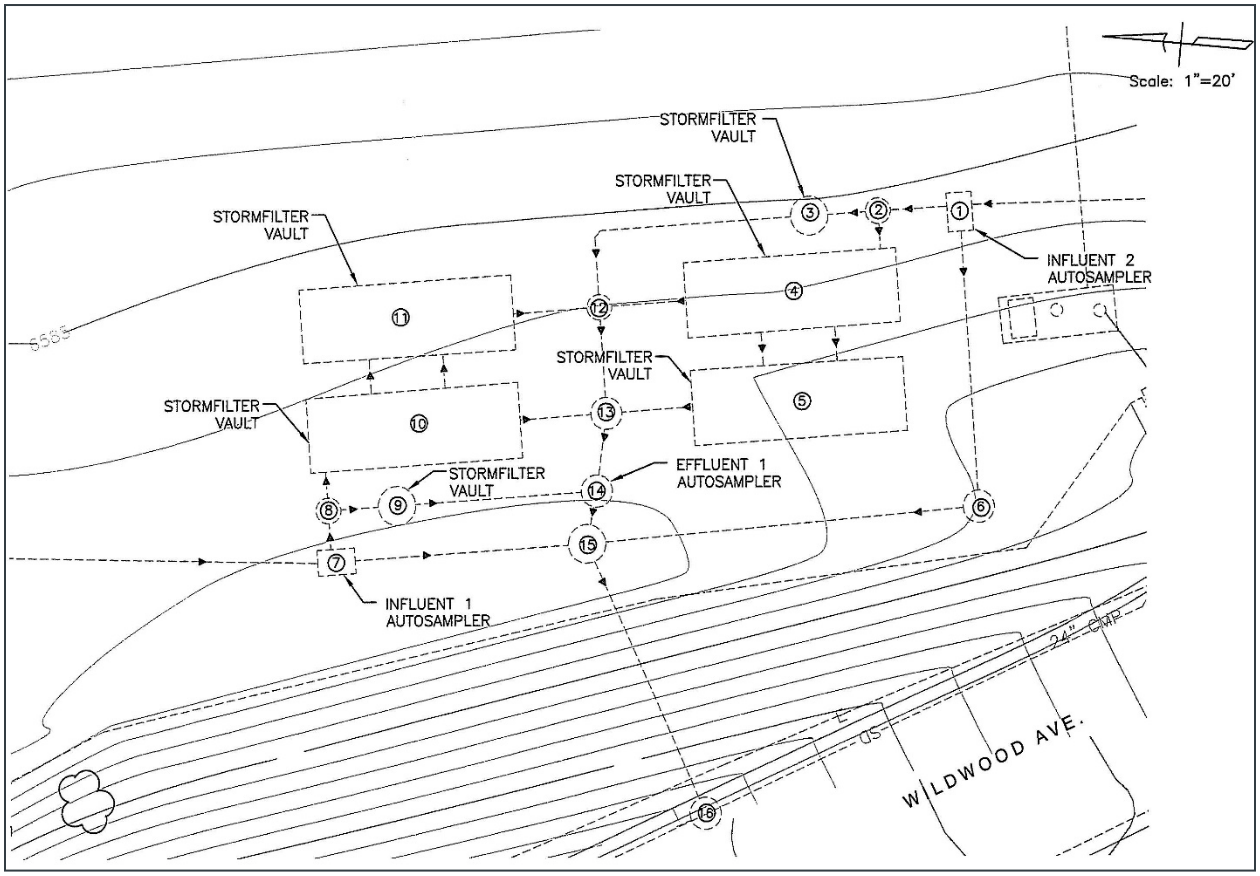

Figure 3-9 California Base Parking Lot Storm Filter Water Quality Treatment System (Source: RCI 1/21/08)

Since installation, various technical issues have prevented the consistent collection of reliable samples for analysis. When in place and functioning properly, the Teledyne ISCO auto-samplers will automatically obtain storm event samples after being powered on. If the auto-samplers are not operational, samples may be collected manually, using both an extension rod and bottles or by manually selecting the pump feature on the system to collect samples within the vaults where the auto-samples would be generated. Details of the auto-sampler procedure are included in the *Draft Heavenly Mountain Resort Water Quality QAPP* (Cardno 2021). Storm events tend to trigger one or two of the automatic samplers, but not always all three. On occasion, the effluent results contained higher levels of analyzed constituents than the influent samples; however, this trend has become less prevalent since maintenance of the systems has resumed. In some cases where an incomplete sample is obtained, grab samples were collected to complete the storm sampling round. In these cases, the results do not adequately represent filtration since the grab sample timing differs from the automated sampling collection time. Corrective actions have been listed in the past and are summarized in the *Bijou Park Creek Evaluation Report* (Tormey 2017, Appendix J). Additionally, this report recommends improvements to the system and sampling collection methodology to gain more useful data for better information and future decision-making.

3.6.5.2 Storm Sampling Water Quality Results and Discussion

Water quality data for both the influent and effluent locations for the most recent 5-year period (2017–2021) are included in Appendix D. Table 3-11 summarizes the Storm Vault Effluent monitoring site (43HVP-2) data between 2017 and 2021. Bold values in the table reflect exceedances of the not-to-exceed state standards for discharge to surface waters. Unlike the California stream sampling standards, the effluent standards are single point not-to-exceed standards instead of annual averages.

As noted in Table 3-11, only 15 samples were collected during the past 5-year period. The only year when it was possible to collect all five required samples was a well-above average precipitation year (2017). Collecting the required storm samples annually has been problematic (see Chapter 3.6.5.3 for more details).

Total Phosphorus and Total Nitrogen

From 2017 to 2021 period, total phosphorus was in exceedance in 27 percent of samples collected, compared to 68 percent during the prior 5 years (2012–2016).

Total nitrogen and turbidity storm samples exceeded the standard on 60 percent and 93 percent of the sample dates (respectively), compared to 88 percent and 91 percent during the 2012 through 2016 period. Table 3-12 shows the comparison of maximum and mean values for the sampled constituents for the 5-year reporting periods of 2012 to 2016 and 2017 to 2021. Total nitrogen single event exceedances occur regularly with 9 of the 15 samples exceeding the standard over the 5-year period. Maximum and mean values for total nitrogen remain high.

While fewer samples have exceeded the standard for total nitrogen and total phosphorus during this 5-year period compared to the previous 5-year period, turbidity exceedances have remained common. Table 3-12 compares maximum and mean values for the sampled constituents for the 5-year reporting periods of 2012 to 2016 and 2017 to 2021. Mean values of total phosphorus have improved across the two reporting periods, although the mean maximum value was nearly double in 2017 to 2021 compared to 2012 to 2016. The PhosphoSorb™ filters appear to be improving the water quality though the system (when comparing the combined influent values to the effluent values—see Appendix D) and improving results over time.

While the trend shows water quality improvement in terms of total phosphorus and total nitrogen through the filter system, additional samples are needed annually to better analyze the effectiveness of the system as well as proposed system improvements. Water quality standards are not being met consistently for either of these constituents.

Chloride

Comparing the two 5-year reporting periods, chloride concentrations show water quality improvement. While there is no standard at the Storm Vault Effluent monitoring site (43HVP-2), there is a reduction of over 50 percent of the maximum and mean chloride values. Also, the reduction in chloride values at the Storm Vault Effluent monitoring site (43HVP-2) aid the downstream compliance water quality at the Bijou Park Creek monitoring site (43BPC-4, below the California Base Parking Lot). Heavenly has made a concerted effort to reduce chloride application: switching to a 5:1 Washoe sand to salt mixture, educating staff and requiring documentation of deicer application around the lodge and tram entrances, switching from the dump truck roadway application to the truck bed and automated application, and use of liquid brine instead of sand/salt roadway deicer, when possible, all discussed in Chapter 7. Since the Storm Vault Effluent monitoring site (43HVP-2) is a portion of the headwaters to Bijou Park Creek, chloride should continue to be monitored throughout the filter vault system as it is constituent of concern for Lahontan.

Suspended Sediment and Turbidity

As discussed with the stream samples, total phosphorus and total nitrogen are tied to TSS as these constituents attach to larger particulate matter. TSS analysis is not required by the permit; however, TSS and turbidity are closely related (higher TSS values typically equate to higher turbidity values), and higher turbidity tends to lead to higher phosphorus and nitrogen. This is evident in the May 16, 2021, Storm Vault Effluent monitoring site (43HVP-2) sample, as the turbidity reading was 760 NTUs and both the total phosphorus (0.63 mg/L) and total nitrogen (3.2 mg/L) values were near the highest reported values obtained over the 5-year period. Daily, maximum, and mean stormwater values for turbidity remain high and should continue to be monitored and analyzed for all water quality samples collected.

Oil and Grease

Five of the 15 samples collected over the 5-year monitoring period exceeded the oil and grease standard. The laboratory reporting limit for oil and grease is the same value as the not-to-exceed standard (2.0 mg/L); therefore, any value lower than the standard is ND. For the purposes of calculating the mean oil and grease value over the 5-year period, all ND samples are considered one half of the reporting limit, since these samples are not likely to be a true “0” value. Comparing the past two 5-year reporting periods, oil and grease results show improvement, with a reduction of over 50 percent of the maximum and mean. Reductions in oil and grease may be related to annual maintenance and replacement of oil and grease booms within the vault system. Spikes of oil and grease appear to occur prior to annual oil and grease boom maintenance, or directly coincide with asphalt paving and maintenance, as occurred just before the June 24, 2021, sample date. However, these parking lot improvements fixing deteriorating pavement should have long-term benefits to effluent water quality, by reducing fine sediment and gravels associated with potholing that was occurring across the parking lot and increasing loading to the vaults. Due to the limited data set, additional oil and grease samples should be collected in order to determine the effectiveness of the filter vaults, maintenance and annual oil boom replacement.

Table 3-11 Exceedances of Standards at the Storm Vault Effluent Location (43HVP-2), WYs 2017 through 2021

	Notes	Time	Total Phosphorus as P (mg/L)	Chloride (mg/L)	Nitrate Nitrogen (mg/L)	Nitrite Nitrogen (mg/L)	TKN (mg/L)	Total Nitrogen Calc. (mg/L)[3]	Turbidity (NTU)	Oil & Grease (mg/L)
Lahontan Standards[1, 2]			**0.10**	N/A	N/A	N/A	N/A	**0.5**	**20**	**2.0**
2017										
10/14/2016	6,7	13:34	0.08	9.2	0.24	0.02	1.40	**1.66**	**59**	ND
10/27/2016	4,7	14:17	0.03	5.4	0.04	ND	ND	0.15	**44**	ND
12/15/2016	7	15:03	0.07	12	0.06	0.02	0.35	0.43	**72**	ND
5/4/2017	8	15:04	0.10	33	0.17	ND	0.27	0.45	**30**	**2.2**
9/21/2017	9	18:21	**0.11**	11	0.11	ND	0.24	0.36	**26**	ND
2018										
11/15/2017	9	12:52	0.07	14	0.05	0.01	0.43	0.49	7	ND
5/24/2018	5,10	14:02	0.04	33	0.22	0.01	0.76	**0.99**	**91**	**3.3**
7/22/2018	6	19:18	0.09	36	0.21	ND	1.90	**2.12**	**100**	**3.3**
2019										
11/27/2018		17:09	0.06	11	0.15	ND	0.34	0.50	**28**	**2.4**
5/16/2019		7:09	0.03	70	0.14	ND	0.50	**0.65**	**77**	ND
9/5/2019	10	15:45	**0.19**	78	0.38	ND	2.30	**2.69**	**270**	ND
2020										
5/18/2020		7:20	0.03	45	0.13	ND	0.46	**0.60**	**49**	ND
2021										
11/18/2020		12:21	0.08	32	0.12	ND	0.90	**1.03**	**150**	ND
5/16/2021		22:02	**0.63**	120	0.29	ND	2.90	**3.20**	**760**	ND
6/24/2021	6	13:30	**0.27**	84	ND	ND	5.80	**5.81**	**150**	**3.7**
Statistical Summary										
# Samples			15	15	15	15	15	15	15	15
# Noncompliance			4	-	-	-	-	9	14	5
% Noncompliance			27%	-	-	-	-	60%	93%	33%
Max			**0.63**	120	0	0	6	**6**	**760**	**4**
Min			0.03	5.40	0.04	0.01	0.24	0.15	7	ND
Mean			**0.12**	**39.57**	0.17	0.02	1.33	**1.41**	**128**	1.7
Std Error			0.15	33.98	0.10	0.01	1.54	1.53	187.32	1.00

1 Standards are maximum concentration for discharge to surface waters, effective November 30, 2008. TSS limits based on the 90th percentile of constituent allowed in receiving waters to Lake Tahoe. Constituent exceedance values are shown in bold.

2 Where values are reported as < values or ND (less than the minimum detection limit or reporting limit), for purposes of calculating the mean or calculating total nitrogen, half the detection limit was used.

3 Where a nitrogen component of the calculation is missing, total nitrogen is calculated in cases where it is exceeding the standard, despite the missing value.

4 Reported total phosphorus value is an estimate; the sample matrix interfered with the analysis.

5 Reported nitrate and nitrite as nitrogen values are an estimate; sample was held beyond acceptable hold time.

6 Reported oil and grease is an estimate; the sample matrix interfered with the analysis.

7 The sample collected was a grab sample. Visual inspection showed stormwater entering both the sacrificial and large filter bays.

8 The sample collected was a snowmelt runoff grab sample. Visual inspection showed runoff entering both the sacrificial and large filter bay (ID4) from the south inlet and runoff only entering the sacrificial unit from the north inlet. No runoff was entering the large filter vault from the north (ID10). Sacrificial vault inspections showed water over the filters, which appeared to be functioning correctly.

9 Sample collected was triggered by the flow sensors collecting composite samples over an approximate 1-hour time period. The outlet sample was collected approximately 15 minutes after the inlet locations, providing residence time for filtration through the storm filter system.

10 There was insufficient sample available to perform a spike and/or duplicate on the oil and grease analytical batch.

Table 3-12 Comparison of 5-Year Reporting Averages from the Storm Vault Effluent Location (43HVP-2)

		Total Phosphorus as P (mg/L)	Chloride (mg/L)	Nitrate Nitrogen (mg/L)	Nitrite Nitrogen (mg/L)	TKN (mg/L)	Total Nitrogen Calc. (mg/L)[3]	Turbidity (NTU)	Oil & Grease (mg/L)
Lahontan Standards[1, 2]		**0.10**	N/A	N/A	N/A	N/A	**0.5**	**20**	**2.0**
Five-year reporting period averages: 2012–2016	**Max**	**0.32**	600	0.83	0.11	4.40	**4.40**	**290**	**11.0**
	Min	0.03	4	0.02	0.01	0.32	0.42	**6**	1.0
	Mean	**0.15**	89	0.24	0.03	1.05	**1.24**	**74**	**5.4**
	Std Error	0.08	120	0.20	0.03	0.86	0.89	**73**	4.0
Five-year reporting period averages: 2017–2021	**Max**	**0.63**	120	0.38	0.02	5.80	**5.81**	**760**	**3.7**
	Min	0.03	5	0.04	0.01	0.24	0.15	7	ND
	Mean	**0.12**	40	0.17	0.02	1.33	**1.41**	**128**	1.7
	Std Error	0.15	34	0.10	0.01	1.54	1.53	**187**	1.0

1 Standards are maximum concentration for discharge to surface waters, effective November 30, 2008. TSS limits based on the 90th percentile of constituent allowed in receiving waters to Lake Tahoe. Constituent exceedance values are shown in bold.

2 Where values are reported as < values or ND (less than the minimum detection limit or reporting limit), for purposes of calculating the mean or calculating total nitrogen, half the detection limit was used.

3 Where a nitrogen component of the calculation is missing, total nitrogen is calculated in cases where it is exceeding the standard, despite the missing value.

3.6.5.3 Storm Filter System Recommendations for Improving Water Quality

Since the effluent water quality from the filter vaults has not been meeting state standards and directly contributes to the downstream stream monitoring location at Bijou Park Creek (43BPC-4), Lahontan required that an additional evaluation be conducted to assess the site and site conditions. The resulting *Bijou Park Creek Evaluation Report* (Tormey 2017, Appendix J) included the following recommendations regarding the storm filter system and automatic sampling:

- Minor structural improvements include:
  - Replace manhole covers (watertight seals in the effluent treatment train);
  - Grout (existing) sumps;
  - Re-establish downhill gradient in Manholes 12, 13, and 14;
  - Plug sacrificial PhosphoSorb™ filter outlet riser (preventing system bypass/non-treatment of stormwater);
  - Eliminate imperfect seal in cartridges.
- *Continue regular maintenance program.*
- Water quality sampling improvements include:
  - *Staggering water quality sampling times;*
  - Continued collection of continuous flow rate data; and
  - Characterization of sediment collected in the system.

Since the release of the report, the regular maintenance program has continued. Vaults and filters are inspected on an annual basis, the 14 PhosphoSorb™ sacrificial filters are replaced annually, and all ZPG filters are inspected and replaced as needed or within a 4-year period. Additionally, water quality sampling times have been staggered, so that the effluent location is sampled approximately 30 minutes after the influent locations, allowing adequate time for water to move through the system in an attempt to capture filtration results.

The success of these improvements should be apparent in the water quality sampling results at the effluent location. However, since the *Bijou Park Creek Evaluation Report* was submitted, not all recommendations have addressed by Heavenly. Those items are italicized in the list above. No structural improvements within the vault system have been completed since issuance of the report.

One additional observation regarding the storm filter system water quality results is the lack of the number of samples and the collection of these samples. As mentioned previously, samples are not collected while the ski resort is operation during the winter months. This leaves only the months of April through October/November for collecting storm samples. Summer storms are very infrequent, and the timing of these storms must align with working days as well as laboratory hours and hold times for constituents. This leaves Sunday to Thursday as optimum sampling days for analysis, which does not always align with a rain or runoff event.

Another issue with the storm filter vault system and water quality results is the seasonal timing of the samples. Looking at the past 5 years, samples are often collected in the fall after late summer maintenance and filter replacement. The fall sample is typically a first flush phenomenon in which any trapped sediment (and constituents) within the vault system is passed through the new filters. While sediment buildup is removed through the vaults, the piping networks leading into the vaults and located throughout both the upper and lower California Base Parking Lot are not cleaned. Additionally, residual and trapped sediment (and constituents) that have been collecting within the parking lot since the previous storm or spring runoff is flushed through the filters. This is evident in the October 14, 2016, sample results.

Comparison of the results of the past 5 years of effluent data with the timing of vault maintenance and filter replacement indicates that the regular maintenance program appears to have substantially improved effluent results, but only for a short duration. For example, water quality samples collected in spring or early summer tend to show decreased filtration and water quality improvement. In this case, filter media are more likely to be spent and inoculated with debris/fine sediment after treating stormwater all winter (including snowmelt runoff). This is evident in Table 3-11 and the Storm Vault Effluent location (43HVP-2) results for WYs 2018, 2019, and 2021. Total nitrogen results in these 3 years progressively get worse later in the WY. The data suggest that there is potential for improving Storm Vault Effluent water quality by switching the timing of filter maintenance and replacement to spring. Additional recommendations for improvement of the storm filter vaults are included in Chapter 3.8.

3.7 Conclusions

Holistically looking at the water quality data over the past 5 years at each of the monitoring site locations, water quality has remained similar to the previous 5-year period. Declines of individual constituent values at Heavenly Valley Creek and Bijou Creek can be attributed to high precipitation years in 2017 and 2019. Water quality at Edgewood Creek appears to have declined slightly compared to the previous 5-year period, although that may be related to sampling frequency, upslope prescribed fire, and/or changes in state standards. Additional data are needed at both Edgewood Creek monitoring sites to determine trends and directionality. Annual averages for each of the stream monitoring sites are provided in previous chapters, and values that are bold and italicized are above the annual state standard. While exceedances are prevalent at the reference reach site (43HDVC-5), the data show that there are higher exceedances recorded for chloride along Heavenly Valley Creek, as well as total phosphorus for most sites. Therefore, these exceedances are likely not attributable solely to Heavenly operations and management activities, but resort activities are likely increasing the constituent annual average values. For the 5-year reporting period (2017–2021), the Patsy’s monitoring site (43HVC-2) had no annual average exceedances for total nitrogen, unlike the previous two 5-year reporting periods (2006–2011, 2012–2016), which both had two annual average exceedances.

Exceedances and values of some water quality constituents (total nitrogen and TSS) at the Bijou Park Creek monitoring site (43BPC-4) located below the California Base Parking Lot site have improved since the previous comprehensive monitoring period, although most constituent values were either similar or slightly higher. This can likely be attributed to two well above-average precipitation years (2017 and 2019) in the most recent 5-year period, compared to 4 years of drought and one above-average precipitation year during the previous 5-year period.

Storm sampling results from the effluent storm filter vaults tend to exceed water quality standards for total phosphorus, total nitrogen, and turbidity. Increased maintenance and filter replacement have improved water quality results from the initial installation of the vaults, particularly when comparing effluent results; however, storm sampling exceedances are still prevalent. Recommended improvements to the filter system and monitoring program are documented in the Catalyst Environmental Solutions report found in Appendix J (*Bijou Park Creek Evaluation Report*) and are summarized in Chapter 3.6.5.3 of this report. With respect to both the storm filter vaults and Bijou Park Creek, Heavenly continues to limit the amount of deicer applied on the parking lot and roadways leading to the California Base Lodge and is working with Lahontan to further reduce source controls and future exceedances. While additional maintenance of the filter vaults is recommended, challenges of biannual maintenance include access to the vaults during times of year when the parking lot is snow covered; maintenance would need to be scheduled opportunistically and could only be minimally planned in advance.

3.8 Water Quality Recommendations

3.8.1 Water Quality Sampling

No adaptive management changes with regard to water quality stream sampling frequency or protocol along Heavenly Valley, Hidden Valley, or Edgewood Creeks are recommended at this time. However, assessments and replacement of the flumes at the Sky Meadows and Patsy's monitoring sites should be conducted. The outlet of the flume at the Sky Meadows monitoring site (43HVC-1A) has become submerged over time, thus reducing the accuracy of the stage-discharge relationship. Flow is typically also measured with the Marsh-McBirney meter at the Sky Meadows monitoring site when conditions permit. During the winter months, the flume is the only viable option for estimating flow due to substantial snow depths and ice cover that can make accessing the stream very difficult and unsafe. The outfall of the flume at the Patsy's monitoring site has shifted to the right over time, thus skewing the stage-discharge relationship. Additionally, the outfall has scoured the section of stream downstream of the flume and may cause undercut at some point. Assessment and replacement of both flumes should be considered in the near future.

As discussed in the Catalyst Environmental Solutions January 2017 report *Bijou Park Creek Evaluation Report* (Appendix J, Sections 5 and 6) and previously recommended in the last 5-year comprehensive report, Heavenly has implemented various BMPs and installed active treatment systems to improve water quality in the stormwater runoff from the California Base area, including construction and operation of the stormwater management system in the California Base Parking Lot to treat the runoff, additional improvements to enhance the effectiveness of the stormwater management system, and improved management of traction sand and brine application to substantially reduce the annual volume used. However, despite implementation of these BMPs, chloride concentrations in the effluent from the Heavenly stormwater management system remain elevated above the water quality objective of 3 mg/L specified in the WDR.

In addition, the findings of the *Bijou Park Creek Evaluation Report* indicate the presence of additional downstream sources of chloride that are higher in concentration and chemically distinct from Heavenly's discharge. These other discharges lead to a stream-wide background condition of elevated levels of chloride, most likely due to the pervasive use of deicers in the area (by the City of South Lake Tahoe, California Department of Transportation (CalTrans), and area residents) to ensure public safety during the winter months. CalTrans and Nevada Department of Transportation have programs that focus on source reduction, but we have not seen other area-wide studies of chloride in urban-affected waters of the basin. The *Bijou Park Creek Evaluation Report* suggests that the issue is watershed-wide, and perhaps basin-wide within developed areas.

The current water quality objective for chloride at Bijou Park Creek of 3 mg/L is based on the anti-degradation standard for Lake Tahoe rather than potential impacts to aquatic life. Lake Tahoe and tributary waters are not listed by the California State Water Resources Control Board as impaired for chloride, and levels safe for aquatic life are greater than 150 mg/L. The data in the *Bijou Park Creek Evaluation Report* suggest that elevated chloride levels could be an area-wide issue within the more developed, populated portions of the Lake Tahoe Basin. Accordingly, the *Bijou Park Creek Evaluation Report* recommends establishing an alternate background water quality sampling site that is more reflective of the level of development within the Bijou Park Creek watershed. In this context, the word “background” is not meant as “unimpaired.” Rather, background is meant as “a general chemical characteristic of the receiving waters.” Hypothetically, were Heavenly to achieve a chloride discharge concentration of 3 mg/L, then the background condition from other sources of greater than 100 mg/L downstream would still cause Bijou Park Creek to, overall, be well above 3 mg/L. Establishing an alternate background station would ensure that the California Base Parking Lot does not further contribute to water quality degradation, and that Heavenly is not held to a standard that would constitute a concentration higher than background.

The continued recommendation is to establish a background station along Bijou Park Creek in the vicinity of sampling points designated BPC-C7, BPC-B8, and BPC-W9 in the *Bijou Park Creek Evaluation Report*. These locations yielded water quality samples that best represent the general chemical characteristics of the receiving water (i.e., background) because they clearly include a geochemical fingerprint of other sources that contribute chloride concentrations in excess of 100 mg/L. Heavenly anticipates working further with Lahontan to further establish the rationale for establishing an alternate background location and in site selection.

A few additional improvements to the storm filter vaults and stormwater quality sampling timing are recommended and discussed in Chapter 3.6.5.3. More detailed information regarding the StormFilter vault recommendations can be found in the *Bijou Park Creek Evaluation Report* (Appendix J). These improvements will slowly be incorporated in the future.

3.8.2 Applicability of Reference Reach and Monitoring Site

The reference reach site (43HVDC-5) (which is within the Lower Hidden Valley reference reach, HDVC-2) was burned during the 2021 Caldor Fire. Figure 3-11 includes a map of Burn Area Emergency Response burn severity of the Caldor Fire within the vicinity of Heavenly. The Lower Hidden Valley reference reach (HDVC-2) is mapped primarily as “moderate” burn severity. The majority of the immediate upstream area is also mapped as “moderate” with some patches of “high” burn severity on the steepest slopes. The Upper Hidden Valley Creek SCI monitoring reach (HDVC-1) appears to have been largely unaffected based on fire extent mapping, although the downstream section of the Upper Hidden reference reach (HDVC-1) is mapped as “low” burn severity. The condition of the site has yet to be visually verified due to forest closures during the fall of 2021 and early season snowpack starting in November 2021. The next scheduled visit to the HDVC-1 is scheduled for the summer of 2022 for BMI sampling.

The Hidden Valley Creek reference reach site (43HDVC-5) could not be sampled in August (due to the active fire) or September (due to forest closures). A photo documenting the site conditions prior to the fire (July 2021) is shown in Figure 3-10. The site was visited and sampled in October 2021, ending WY 2021. The conifer forest surrounding the site was burned, although most of the larger conifer trees still held needles and only exhibited lower truck charring. All understory conifer trees and brush had burned, as had the extensive volume of downed wood on the forest floor. The riparian corridor was largely intact, with leaves of alder and currant still present in October 2021. The rebar and plastic rebar caps marking the water quality cross-section did not burn. A bulldozer fire line had been laid across the forest floor and crossed the stream approximately 20 feet below the cross-section. It appeared that the volume of woody material and rocks at the crossing location allowed the heavy machinery to remain above the water surface. Subsequent sampling events in WY 2022 (not part of this report, but relevant to discuss in term of post-fire observations) have shown substantial sediment mobilization during the fall of 2021, in part due to a substantial storm event in late October (the storm event between October 24 and 26 delivered 7 inches of precipitation), as shown in Figures 3-12 to 3-13.

As Heavenly Valley Creek and the monitoring sites/reaches did not burn, the current conditions at the reference reach are no longer representative of an unimpaired reach for comparison. However, no other more appropriate reaches are present in the nearby vicinity. Close monitoring during the next 5-year period is recommended, and reconsideration of the site for continued use as a reference reach should be weighed, based on the site's recovery to pre-fire conditions, availability of an alternative reference reach, and implications of changing the reference reach for a project that has a long-term data set (more than 30 years). During the next 5-year period, determinations of "background" values for comparison to project values should be made based on previous correlations between streamflow and chemical characteristics at Hidden Valley Creek from past (pre-fire) monitoring.

Figure 3-10 Hidden Valley Creek Reference Reach Site (43HDVC-5) in July 2021 (Pre-Fire), Looking Upstream from Right Bank

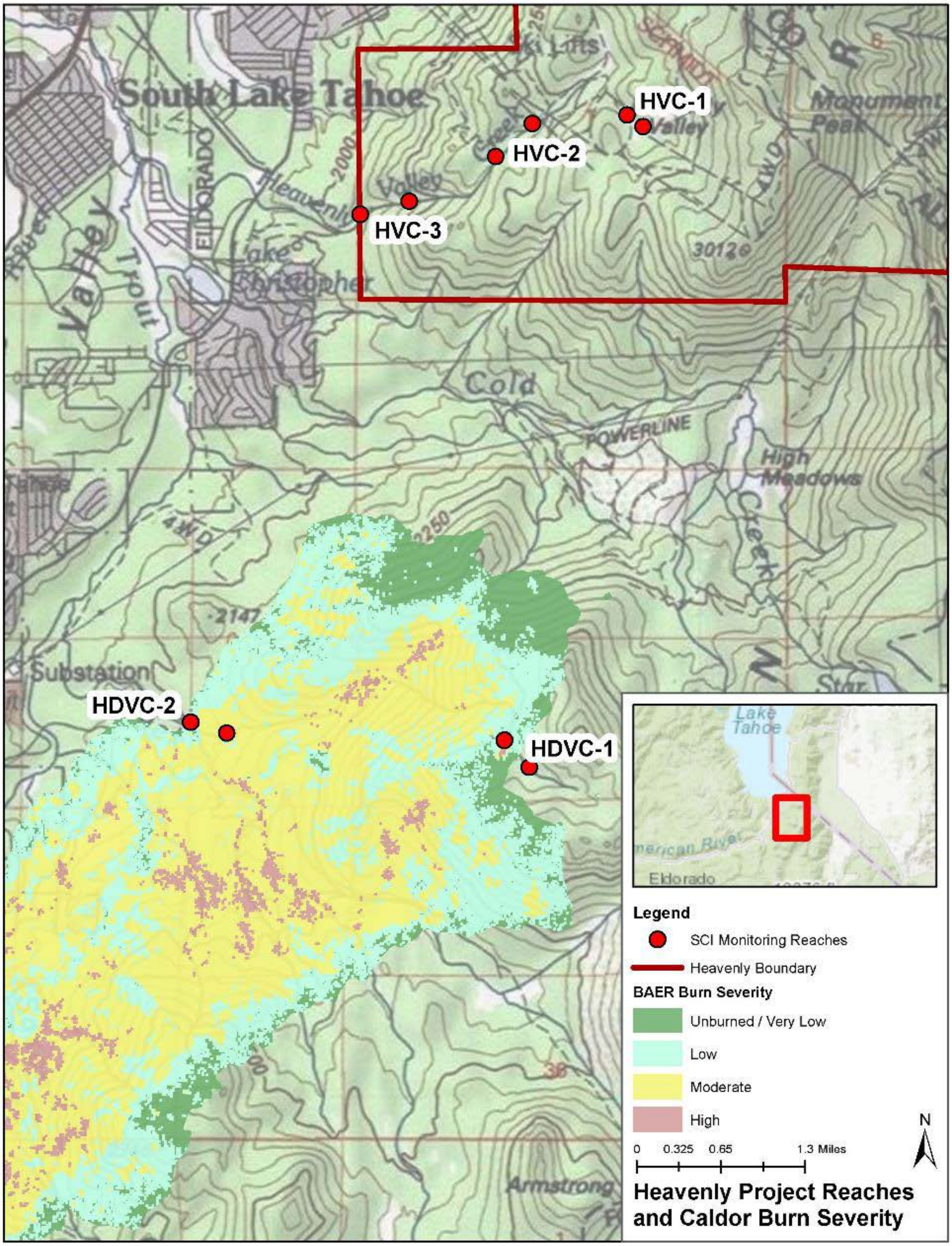

Figure 3-11 Heavenly Project Reaches and Caldor Fire Burn Severity (USFS 2021)

Figure 3-12 Hidden Valley Creek Reference Reach Site (43HDVC-5) in October 2021 (Post-Fire), Looking Upstream from Left Bank

Figure 3-13 Hidden Valley Creek Reference Reach Site (43HDVC-5) in November 2021 (Post-Fire), Looking Upstream from Left Bank

3.8.3 Heavenly Valley Creek TMDL Designations

The TMDL for TSS at Heavenly Valley Creek was established in 2000 at 58 tons/year (based on a 5-year rolling average). While the 5-year rolling average for TSS at the Heavenly Valley Creek Property Line monitoring site (43HVC-3) was above the TMDL in the late 1990s, Heavenly Valley Creek has been in compliance with the TMDL since 2005 (Figure 3-2). Years with high sediment (2010, 2011, and 2017) have all been associated with very high precipitation and runoff, and even these very high values have not contributed to an exceedance of the 5-year rolling average. Additionally, BMI results at the Sky Meadows monitoring site have improved over time (from *very poor* to *fair*; see Chapter 5.6.1 for details), suggesting improved aquatic habitat conditions upstream. Delisting the TSS TMDL at Heavenly Valley Creek at the Property Line monitoring site (43HVC-3) is reasonable based on the improvement seen over the reporting period.

3.8.4 Recent 303(d) Listings

Heavenly reviewed the *2018 Clean Water Act Sections 303(D) and 305(B) Assessment* issued June 2019 in preparation for submittal of the final “Integrated Report” to Lahontan and provided comments (included in Appendix K). The primary concern was that extensive amount of data collected as part of NPDES compliance sampling was not included in the 303(d) considerations because the data were not in the CEDEN database. Heavenly and Cardno have worked with the Lahontan Board over the last 2 years to convert these data to a format suitable for uploading to CEDEN and have uploaded portions of the data. The goal is to have some of the 303(d) listings revisited in light of the more comprehensive data that is available through this and past summary and annual reports.

Overall, comments included the request to review more recent data than were considered. Documents reviewed included “fact sheets” and lines of evidence provided by Lahontan in support of the *Draft California 2018 Integrated Report (303(d) List/305(b) Report)*. Moving forward, Heavenly anticipates working with Lahontan to review the TSS TMDL annual values and certify the recent 5-year data so that this information is included in the next Integrated Report (303(d) List/305(b) update).

3.8.4.1 Bijou Park Creek, New Listing: Iron (Category 5A, Completion Year 2028)

The fact sheet states “that this creek has naturally high levels of iron. Though this creek has naturally high levels of iron, ambient concentrations for this creek have not been established at this time.” In the 2012 fact sheet, Lahontan used these same lines of evidence to recommend that Bijou Park Creek not be listed for iron. Therefore, Heavenly requests Lahontan return to its 2012 conclusion that the lines of evidence do not support placing Bijou Park Creek on the Section 303(d) list for iron.

3.8.4.2 Bijou Park Creek, New Listing: Oil and Grease (Category 5A, Completion Year 2028)

The fact sheet utilized monitoring data from October 2007 to October 2009 to reach a conclusion. The data from this time period were collected during the optimization of the below-ground stormwater treatment system and the automated sampler system for Heavenly’s California Base Parking Lot. At Lahontan’s request, Heavenly worked closely with Lahontan on the design, installation, and optimization of these systems because Heavenly was the first discharger in the basin to install an automated sampling system for the treatment unit. There was a long period of troubleshooting this first-in-the-basin system (as discussed in Chapter 3.6.5), and both Lahontan and Heavenly agreed that the data from this time period were not reliable for decision-making purposes. Oil and grease results have since improved at Storm Vault Effluent monitoring site (43HVP-2) and mean annual averages of oil and grease have remained at or below the state standard of 2.0 mg/L for the past 5 years (Table 3-11 in Chapter 3.6.5.2). The discharges from the system, however, are well below levels that produce visible films or coatings on the water surface. The Lahontan limit is at the detection limit for this constituent; minor exceedances (less than 3.3 mg/L) are within the 30 percent uncertainty that certified laboratories must meet. Therefore, Heavenly has requested Lahontan to consider using updated data to make TMDL listing determinations for oil and grease at Bijou Park Creek.

3.8.4.3 Heavenly Creek (source to USFS Boundary), Benthic Community Effects (Category 5A, Completion Year 2031)

Based on this recent and thorough analysis by Lahontan, the data presented in this report, and a finding of uncertainty regarding an appropriate decision, Heavenly agrees that listing to Category 3 may be appropriate. Heavenly requests that Lahontan clarify the listing category, presumably to listing Category 3, based on this information.

3.8.4.4 Heavenly Creek (source to USFS Boundary), Chloride, Do Not Delist (Category 5A Completion Year 2028)

The amount of data available, using Category 3 Criteria, "is insufficient to determine an appropriate decision recommendation, but the available data and information that does exist indicate beneficial uses may be potentially threatened." This statement is supported by the fact sheet statement that "a minimum of 26 samples is needed for application of Table 3.1. The placeholder LOEs [lines of evidence] used for the original listing based on protection of REC [recreation] are still valid and the recommendation is Do Not Delist." Based on this information, Heavenly respectfully requests that Lahontan modify the listing of Heavenly Valley Creek as a Category 3.

3.9 Rating Criteria for Water Quality

The latest WDRs list the watershed and TMDL target evaluation criteria (found in Appendix C of the WDR). The water quality rating criteria are as follows (Lahontan 2015b: Appendix C):

- *Excellent: All water quality parameters meet State and Tahoe Basin standards; water quality concentrations for all parameters are decreasing.*
- *Good: Most water quality parameters meet State and Tahoe Basin standards; water quality concentrations for most parameters are decreasing compared to baselined data, while others are stable.*
- *Fair: Some water quality parameters meet State and Tahoe Basin standards; water quality concentrations for some parameters are decreasing compared to baseline, while others are stable.*
- *Poor: No water quality parameters meet State and Tahoe Basin standards; water quality concentrations are increasing for some parameters.*

Applying the WDR comprehensive review and rating criteria for the water quality data associated with Heavenly over the past 5 years (2017–2021), Heavenly Valley Creek water quality data exhibit *fair* condition. Daily exceedance occurs on many effluent storm filter samples collected during the 5-year record, and three of the four state standards (total phosphorus, total nitrogen, and chloride) exceed the annual state standards most WYs for the stream sampling sites. Many of these exceedances appear to have been driven by high precipitation in high runoff years (WYs 2017 and 2019), both of which were higher than any WY experienced during the previous 5-year reporting period (2012–2016). Additional water quality constituent improvement or sustained improvement in high-precipitation years is needed for the rating to increase to *good* in terms of water quality.

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4 WMRP and BMP Effectiveness Monitoring

4.1 Introduction

The following chapter summarizes the results of the combined Watershed Maintenance and Restoration Program (WMRP) and BMP effectiveness monitoring results for Heavenly from 2017 through 2021. It has been prepared by RCI, contracted by Cardno, to comply with Lahontan WDRs (Board Order R6T-2015-0021, WDID No. 6A090033000), which require submittal of a comprehensive review every 5 years.

4.1.1 Evaluation Criteria

The summary of activities and monitoring provided by the annual report addresses the requirements in Section C of the 2015 WDRs:

1. *Track and report the status of mitigation/restoration projects included in the WMRP.*
2. *Complete an annual erosion assessment of the ski area and identify restoration projects to be completed.*
3. *Develop an Annual Work List with maintenance and restoration projects to be completed during the summer construction season, including mitigation projects required from previous Master Plan commitments and projects identified by BMP monitoring and erosion assessments.*
4. *Implement and report the results of the Construction Erosion Reduction Program, including the review of the temporary and permanent construction BMPs implemented at the Facility (BMP maintenance and effectiveness).*

Rating criteria are provided in the WDR, Section I.A.D, Table 3 “Heavenly Valley Creek TMDL Targets” for both WMRP implementation and BMP effectiveness scoring or monitoring results. Heavenly Valley Creek must have a rating of *good* or better.

WMRP Implementation Criteria

Excellent: *All WMRP projects implemented and maintained according to Annual Work List timeline*

Good: *All WMRP projects implemented according to Annual Work List; but some project components need reestablishing (for example, reseeding is necessary on some revegetation sites)*

Fair: *Only partial implementation of Annual Work List projects has been achieved according to timeline; or Annual Work List projects are one year behind schedule*

Poor: *No Annual Work List projects have been implemented, or Annual Work List projects are two years or more behind schedule*

BMP Effectiveness Scoring Criteria

Excellent: *90% of BMPs implemented correctly and functioning effectively; no evidence of sediment leaving the site and entering the stream channel*

Good: *75% to 90% of BMPs implemented correctly and functioning effectively; some evidence of sediment leaving the site, but no sediment reaching the stream channel*

Fair: *50% to 75% of BMPs implemented correctly and functioning effectively; some evidence of sediment leaving the site, some sediment reaching the stream channel*

Poor: *Less than 50% of BMPs implemented correctly and functioning correctly; evidence of sediment leaving the site, excessive sediment reaching the stream channel*

For the purposes of the WMRP implementation criteria, "WMRP Projects" and "Annual Work List Projects" are those projects designated as EH-CA or EH-NV on the Annual Work List, whose primary purpose is watershed maintenance and restoration. Other capital projects (P) or Resort Maintenance Projects (RM or M) are primarily infrastructure construction and maintenance projects. While these projects utilize construction BMPs (Construction Erosion Reduction Program [CERP] requirements) and are subject to BMP effectiveness monitoring, the implementation does not satisfy a watershed restoration objective.

4.1.2 Outcome-Based Watershed Management Approach

Watershed maintenance and restoration is an ongoing long-term commitment throughout the Lake Tahoe Basin with an actively managed program at Heavenly. For the last 10 years, Heavenly has been utilizing an outcome-based watershed management system that both meets compliance standards and assesses actual performance of BMPs. Integrated Environmental Restoration Services pioneered this outcome-based watershed approach in the *Watershed Management Guidebook* prepared for the California State Water Resources Control Board (IERS 2013). This management style acknowledges the complexities of a watershed and allows for collection of useful information to make decisions that result in measurable sediment control. Outcome-based management provides a framework to encourage innovative ideas and methods that achieve quantifiable results. The *Watershed Management Guidebook* outlines five steps that drive the outcome-based management process used at Heavenly:

AIMING: articulating goals and objectives, defining success criteria, and identifying known and unknown information.

GAINING UNDERSTANDING: gathering on-the-ground information at the site/project and watershed and assessing strategies for a site-specific implementation plan. Monitoring results from past projects are used as the basis for developing treatment strategies for new projects that are most likely to achieve project objectives and success criteria. Often this step includes small-scale development plots to test different treatment approaches.

DOING: the part of the process where the plan is understood, implemented, and documented to support monitoring and continual improvement.

ACHIEVING: directly assessing project performance/effectiveness relative to goals and success criteria and reporting this information annually.

IMPROVING: embracing unexpected project outcomes, sharing project successes and failures with others, making adjustments to projects that did not achieve their intended outcome(s), and integrating lessons learned into future projects.

One of the results of this outcome-based watershed management approach is the shift from "effective soil cover" based heavily on vegetative cover to "erosion resistance." Erosion resistance combines a wide range of factors including mulch, rock, soil density, infiltration, slope, and surface roughness as well as vegetation. The WMRP has helped Heavenly to shift efforts away from watershed restoration projects that require temporary irrigation and repeated reseeding of disturbed areas. By emphasizing soil edaphic factors (i.e., the physical, chemical, and biologic conditions of the soil), projects have become more successful over time since plant cover is not the only contributor to erosion resistance.

Heavenly's program continues to be one of the most successful, multi-year examples of adaptive management applied to erosion and sediment control in the Lake Tahoe Basin. The following fundamental goals are guiding these efforts (Integrated Environmental Restoration Services 2016).

- Treatment Goals
  - *To implement projects that result in no net increase in runoff or sediment transport;*

- *To implement sediment source control treatments that are either self-sustaining OR are accompanied by a plan for ongoing maintenance and management to maintain erosion resistance; and*
- *To develop and demonstrate an applied adaptive management program for development, management, and maintenance activities in upper watersheds.*

▪ *Monitoring Goals*

- *To quantitatively assess whether projects result in no net increase in runoff or sediment transport;*
- *To identify and quantify indices of long-term ecosystem sustainability to the greatest extent possible;*
- *To use monitoring data to determine the cost-effectiveness of restoration techniques; and*
- *To use monitoring data to improve effectiveness of future treatments.*

Adaptive management principles have been similarly applied to Heavenly's CERP through BMP effectiveness monitoring. The CERP and *Watershed Management Guidebook* (IERS 2013) provide guidelines for the temporary and permanent BMPs incorporated into all construction projects at Heavenly. Since 2004, monitoring results and recommendations have been used by Heavenly to improve structural and non-structural BMPs. Nonstructural practices range from longstanding traffic management on summer access roads to new communication technology for allocating resources during the hectic summer construction season. BMP effectiveness monitoring provides a framework within the WMRP to track performance and meet compliance standards.

4.2 Response to Comprehensive Report Recommendations

Heavenly has maintained a commitment to the adaptive management method by incorporating past recommendations into planning, implementation, effectiveness and monitoring. The following section reviews the recommendations made in the previous comprehensive report for the period 2012 through 2016, and describes Heavenly's responses to those recommendations in 2017 through 2021.

4.2.1 Planning

The following recommendations were developed during the previous 5-year period and incorporated into the planning process from 2017 through 2021.

- Heavenly has continued to look for partnership opportunities for training and new technologies and product information to share with staff and agency partners. Examples include partnering with Northstar to share hydro-mulching equipment, requiring third-party contractors/utilities to obtain and implement project-level Stormwater Pollution Prevention Plans, and developing virtual BMP training during the 2020−2021 pandemic.
- The Annual Work List format was updated to include a completion status column to easily track project phase completion and projected schedule, as well as project categories to track implementation.
- The WMRP has incorporated BMP effectiveness monitoring for consistency with the 2015 WDR evaluation criteria and the Mitigation and Monitoring Plan (MMP) requirements from the 2015 master plan update.

4.2.2 Implementation

Successful implementation of watershed maintenance and restoration and Heavenly's CERP require ongoing communication of planning efforts and resource protection goals. Continuing these efforts is crucial for successful implementation. The following recommendations from the previous 5-year period emphasized fostering communication from 2017 through 2021:

- The environmental manager position was incorporated into the Vail Resorts, Inc. regional management structure, but continued to function as the intermediary between Heavenly operations managers and field crews to convey WMRP goals, implement effective "hotspot" treatments, and ensure maintenance of BMPs at base areas and throughout the resort.
- Heavenly operations managers initiated more comprehensive tracking of project elements such as materials used, workforce required, and installation challenges. This information enhances the annual WMRP/BMP monitoring.

4.2.3 Effectiveness

Heavenly's responses to the recommendations from the 2012 to 2016 period for improving effectiveness through the WMRP and CERP during the 2017 to 2021 period are outlined below:

- Innovative approaches and technology were explored to improve infiltration and enhance erosion resistance included testing hydro-mulch treatments, utilizing a four-wheel drive truck for dust control on steep roads, and fiber installation use in plowing technology rather than traditional trenching to reduce surface disturbance.
- Temporary and permanent access routes and staging areas were identified by Heavenly managers and third-party contractors during project development and delineated through exclusion zones and construction limits.
- The WMRP risk ranking criteria emphasizes proximity to SEZ for prioritizing both facility/road BMP maintenance and "hotspot" projects.
- Road maintenance objectives and methods are coordinated through the road maintenance agreement between Heavenly and the USFS. Maintenance of water bars, water bar outlet structures, roadside ditches, and sediment were added to the summer Work List. Road surfacing stability continues to improve through targeted application of aggregate base that reduces erosion and sediment transport.

4.2.4 Monitoring

Monitoring continued to provide useful results and incorporated the following recommendations from 2012 to 2016 into the 2017 to 2021 monitoring period.

- Prior BMP effectiveness and WMRP monitoring methods were streamlined by merging the monitoring and reporting processes yet remaining consistent with both the 2015 WDR and MMP criteria.
- To Heavenly's knowledge the USFS did not release a final monitoring protocol for its National Core BMP Program. In addition, the road component of the original environmental monitoring program is no longer used by the LTBMU.
- The USFS National Core BMP Program was reviewed for applicability to the monitoring requirements at Heavenly, especially roads. In lieu of using a separate protocol for roads, maintenance of key roadside drainages/sediment basins has been incorporated into the summer Work List (at Powderbowl/Groove, Upper Shop, Maggie's, Hellwinkels, and Galaxy). These key locations near drainages/SEZ were added to the BMP/WMRP monitoring. Heavenly managers have improved coordination directly with the USFS on effective road maintenance BMPs, recognizing there are limited opportunities to reconstruct existing summer access roads to current USFS design standards.

4.3 Results and Discussion

Results of the monitoring period from 2017 to 2021 are summarized and evaluated annually. Recommendations are updated and referenced to guide the planning process and to improve Heavenly's WMRP consistent with the adaptive management process.

4.3.1 Activities

The construction season typically begins in June and ends in November at Heavenly. Annually in the spring, an Annual Work List is developed that reflects work proposed by watershed during the constructions season. The Annual Work List, categorized by "source code," indicates the type and status of projects.

- WMRP Projects ("Erosion Hotspot California" EH-CA and "Erosion Hotspot Nevada" EH-NV) are identified by the prior year watershed assessments for erosion hotspots. Treatments are based on site conditions and may require diverse levels ranging from mulch only to the "full restoration."
- BMP Maintenance Projects (M) regularly consist of routine maintenance of erosion reduction and sediment capture BMPs, resort-wide vehicle barriers, vegetation, and drainage structures.
- Master Plan Implementation Projects (P) typically include key utility projects or capital improvement projects identified through the master plan.
- Resort Maintenance Projects (RM) regularly consist of routine infrastructure maintenance, periodic equipment upgrade/replacement, and preparation of the Top of Gondola (Adventure Peak) area for summer guest access.

A summary of the completed summer activities for the 2017 to 2021 monitoring period is included in Table 4-1. During the 2017 to 2021 period, 18 summer Work List activities for WMRP projects were completed: 16 in California watersheds and 3 in Nevada watersheds. There were six development projects that implemented as outlined in the master plan. Resort-wide BMP maintenance and infrastructure maintenance projects were conducted annually for 19 different work areas.

Table 4-1 Summary of the Annual Work List Activities during the 5-Year Monitoring Period

Source*	Location	Treatment	Watershed
EH-CA	Hand Grenade Chute/Run of Middle Roundabout	Hotspot #1: Rock armor gully, restore water bar above switchback to function properly or convert to infiltration swale, rip and chip slope, install 12-inch culvert at the road crossing.	CA-1 Heavenly Valley Creek
EH-CA	Hellwinkel's Road	Hotspots 45 & 46: Continue monitoring and maintaining treatments annually.	CA-1 Heavenly Valley Creek
EH-CA	Middle Maggie's below summer road before switchback with culverts	Hotspot #5: Minor reshaping of "Basin" area and chip and rip treatment to maximize infiltration and reduce overtopping and runoff to the stream.	CA-1 Heavenly Valley Creek
EH-CA	Remove water bar and add mulch to Middle Maggie's Run	Hotspot #3: This area is located uphill of the culvert crossing where Maggie's Run intercepts the summer road below the switchback at the aspens. Mulch application and removal/re-grade of 1-2 water bars into infiltration spreading areas.	CA-1 Heavenly Valley Creek
EH-CA	Sedimentation area between the face patrol facility and Groove Chair	Hotspot #9: Stabilize bare soil areas with full restoration treatment and/or rip and chip; mulch filter berm or pine needle wattles needed.	CA-1 Heavenly Valley Creek
EH-CA	Small gully connecting road runoff to stream below California Dam	Hotspot #4: Chip and rip road shoulder (to spread and infiltrate runoff) and add pine needle wattles as a sediment barrier. This is the area near the first water bar below California Dam.	CA-1 Heavenly Valley Creek
EH-CA	Maggie's sediment basins	Hotspot #25: Maintain and clean out sediment build-up in Maggie's road shoulder sediment basins.	CA-1 Heavenly Valley Creek
EH-CA	Ridge Bowl	Stabilize gully in Ridge Bowl above Canyon Express Lift, remove and replace degraded geotextile fabric, place rock check dams or riprap.	CA-1 Heavenly Valley Creek
EH-CA	Ridge Run above test plots	Hotspot #7: Repair, loosen, and restore gully above and below summer road near snowmaking vault.	CA-1 Heavenly Valley Creek
EH-CA	Ridge Bowl check dams	Enhance drainage features to withstand and infiltrate concentrated flow.	CA-1 Heavenly Valley Creek
EH-CA	Groove erosion resistance	Improve erosion resistance and drainage stability near summer access road and Groove ski trail.	CA-1 Heavenly Valley Creek
EH-CA	First Ride	Stabilize gully on First Ride Run, reestablish water bar, and manage sediment moving toward lift terminal.	CA-6 Bijou Creek
EH-CA	World Cup	Stabilize gully on World Cup Run and protect existing drop inlets.	CA-6 Bijou Creek
EH-CA	Top of Tram	Stabilize gully on slope between Tram Top Station and Lakeview Lodge.	CA-6 Bijou Creek
EH-CA	California Base summer access	Stabilize summer access road at parking lot entrance and improve erosion resistance behind lodge.	CA-6 Bijou Creek
EH-CA	Blue Angel Chute convert incised gully to infiltration swale at top	Hotspot #6: Create infiltration spreading area by loosening deep gully and restoring it as in an infiltration swale.	CA-1 Heavenly Valley Creek
EH-NV	Galaxy road sediment basins	Maintain and clean out sediment in Galaxy road shoulder sediment basins.	NV-1 Mott Canyon Creek NV-2 + 5 Daggett Creek
EH-NV	Big Dipper Run Water bars	Repair water bars and outlet energy dissipaters; stabilize rilling.	NV-2 + 5 Daggett Creek
EH-NV	Lower Olympic	Improve erosion resistance and rill/gully stabilization.	NV-2 + 5 Daggett Creek
M	Powderbowl/Groove Chair Base	Maintain rock-lined ditches at base of Groove Lift and sediment basin at base of Powderbowl Lift.	CA-1 Heavenly Valley Creek
M	Upper Shop	Maintain existing water bars, ditches, drop inlets, and culverts.	CA-1 Heavenly Valley Creek

Source*	Location	Treatment	Watershed
M	Hellwinkel's sediment basins	Maintain and clean out sediment in Hellwinkel's road shoulder sediment basins.	CA-1 Heavenly Valley Creek
M	Maggie's sediment basins	Maintain and clean out sediment in Maggie's road shoulder sediment basins.	CA-1 Heavenly Valley Creek
M	Galaxy road sediment basins	Maintain and clean out sediment in Galaxy road shoulder sediment basins.	NV-1 Mott Canyon Creek NV-2 + 5 Daggett Creek
M	Rock-lined drainage basins at the bottom of Comet and Dipper Chair	Mechanical removal of sediment buildup from the T-shaped drainage/rock-lined areas. Maintenance is between the bottom of Comet and Dipper Chairlift Terminals.	NV-2 + 5 Daggett Creek
M	Resort-wide	Inspect and restore all areas damaged or affected by winter resort operations, including hydrants and pipe failures, and areas affected by snowcat operations; document treatment.	Resort-wide
M	Resort-wide	Erect and maintain vehicles barriers and/or fences to prevent unauthorized vehicle access off of designated summer roads and facility parking areas.	Resort-wide
M	Resort-wide	Inspect and maintain all drainage structures.	Resort-wide
M	Base areas	Maintain all BMPs and drainage structures. Erect and maintain vehicle barriers and/or fences to prevent unauthorized vehicle access from base areas.	Resort-wide
P	Adventure Peak/Epic Discovery	Landscaping around the Tamarack Lodge Meadow, add new shade umbrellas, add kids' tubing lane, and finish three approved hiking trails not completed in 2016.	CA-1 Heavenly Valley Creek
P	American Tower Company Cell Tower & Fiber Optic Line Replacement	Third-party project to install cable, several monopine towers, and small buildings at lodges and at the Top of the Gondola.	CA-1 Heavenly Valley Creek NV-2 + 5 Daggett Creek
P	NV Energy	Third-party project by NV Energy Project – vault and power line installations.	CA-1, NV-2 + 5, and NV-
P	Galaxy Lift	Replace existing Galaxy Lift in its current alignment. Improve specific summer road segments to allow lift construction and ongoing maintenance access. Daggett Creek realignment and stabilization.	NV-2 + 5 Daggett Creek
P	Olympic Downhill	Replace 3,000 feet of 8-inch waterline and Way Home snowmaking vault. Stabilize disturbed areas following construction.	NV-2 + 5 Daggett Creek
P	East Peak Snowmaking Well	Resort connection to new NV Energy transformer.	NV-2 + 5 Daggett Creek
RM	Heavenly Valley Creek Culvert	Repair existing gate valve.	CA-1 Heavenly Valley Creek
RM	Top of Gondola Snowmaking/Electrical Infrastructure	Upgrade water metering capability in existing snowmaking valve vault known as "Malcolm's Vault."	CA-1 Heavenly Valley Creek
RM	Crossover Waterline Replacement	Replacement of 3,000 feet of 6-inch waterline on Crossover in existing roadway.	CA-1 Heavenly Valley Creek
RM	Top of Gondola Water Tank Power	Underground power extension Top of Gondola water tank.	CA-1 Heavenly Valley Creek
RM	Cal Dam Snowmaking Pond	Sediment removal and placement at low location at Liz's/Ridge Run, stabilization BMPs, and dam face relining for safety.	CA-1 Heavenly Valley Creek
RM	Tram Deck	Replace Tram Top Station Deck and associated permanent BMPs.	CA-6 Bijou Creek
RM	East Peak Dam Liner Replacement	Expose and repair existing liner of dam face.	NV-2 + 5 Daggett Creek
RM	East Peak Lodge Well	Resort maintenance around wellhead for public water system	NV-2 + 5 Daggett Creek
RM	Boulder Parking Lot	Continue phased approach to parking lot repairs in coordination with Heavenly Base Ops.	NV-3 Edgewood Creek

4.3.2 Monitoring Results

Monitoring includes both observations and quantitative scoring protocols. Observations capture successful management activities necessary to implement the WMRP through the outcome-based management approach. Quantitative methods include the protocols for scoring treatment outcomes at erosion hotspots developed by Integrated Environmental Restoration Services (Hauge Brueck Associates 2014, 2015), as well as the protocol used by RCI (Parsons Harland Bartholomew and Associates, Inc. 2006) to score BMP implementation and effectiveness.

Heavenly continued to prioritize reducing erosion and increasing soil resistance for maintenance, construction, and restoration projects during the 5-year period. Results of the monitoring conducted by RCI include BMP effectiveness scoring used for inspections, as well as observations of WMRP treatment implementation and outcomes. As shown in Table 4-2, Heavenly received overall scores of *excellent* in all 5 years for WMRP implementation and in 4 out 5 years for BMP effectiveness.

Table 4-2 Five-Year Evaluation Results (2015 WDR Evaluation Criteria)

Construction Season	WMRP Implementation	BMP Effectiveness
2017	Excellent	Excellent
2018	Excellent	Excellent
2019	Excellent	Good
2020	Excellent	Excellent
2021	Excellent	Excellent[1]

[1] Based on preliminary review of 2021 data evaluations.

Over more than a decade, monitoring programs at Heavenly have been using protocols that quantify erosion reductions and indicators of erosion resistance. Supplemental guidance for applying effective treatments and techniques for achieving WMRP goals is updated annually. The information is available for reference by inspectors, design professionals, and Heavenly staff. Hotspots are evaluated before and after treatment to observe the effectiveness of treatment outcomes.

The annual monitoring includes active construction monitoring, post-construction monitoring (1 year), and follow-up visits after maintenance activities. Temporary BMPs are evaluated at active construction sites on 2-week intervals, unless covered separately under a California or Nevada permit for construction stormwater discharges (Stormwater Pollution Prevention Plan). Average annual results for the BMP scoring over the 5-year monitoring period:

- Temporary BMPs scored “fully implemented” at 95% and effective at 94% of the evaluations conducted.
- Permanent BMPs scored “fully implemented” at 97% and effective at 93% of the evaluations conducted.

4.4 Conclusions and Recommendations

The adaptive management approach uses the results of the implementation and effectiveness monitoring to identify issues and develop solutions during planning process. Results of BMP effectiveness monitoring during the period from 2017 through 2020 produced the following conclusions and recommendations.

4.4.1 Planning

Heavenly continued to incorporate and improve WMRP and implementation of the CERP in maintenance activity and project planning for the 2017 through 2021 period.

- Continuous training for managers, staff, and contractors is critical in conveying the importance of BMP implementation and maintenance to achieve watershed maintenance and restoration goals. Staff changes and impacts from the pandemic in the past 2 years make planning critical for success.
- The summer activities Work List guides and tracks completion of projects.
- Watershed assessments to identify and rank erosion hotspots continue to be an important planning tool to achieve WMRP goals.
- The CERP continues to be a valuable tool for identifying appropriate temporary and permanent BMPs, particularly for projects without detailed sets of plans and specifications.
- Heavenly manager tracking and sharing of program elements (such as materials used, workforce required, and installation challenges) documents activities and allows managers to allocate resources for critical summer activities.

4.4.2 Implementation

Successful implementation of BMPs requires ongoing communication of planning efforts and resource protection goals.

- The Heavenly team's approach makes communication a priority. Ongoing coordination between Heavenly staff, design professionals, resource specialists, contractors, utilities, and agency representatives ensures project plans/specifications and, where required, Stormwater Pollution Prevention Plans incorporate successful temporary and permanent BMPs.
- A Heavenly staff position designated as the primary contact with responsibility for implementing the WMP for the past 5 years has been a substantial asset. Knowledge sharing and experienced field team members improve the success of BMP implementation.
- Annual training for all personnel with "mountain access" including staff and contractors is essential to maintain high-quality BMP implementation.

4.4.3 Effectiveness

Heavenly has a long-term commitment to environmental improvement through both effective planning and regulatory compliance.

- Heavenly has improved the effectiveness of watershed maintenance and restoration techniques by testing new techniques.
- Routinely removing sediment from catchment areas, mountain-wide wood chipping and mulch tilling, and erecting barriers to traffic outside designated roadways and parking areas continue to be critical erosion BMPs.
- Prioritizing treatments and maintenance at locations connecting directly to SEZs and storm drains is the most effective method for reducing water quality threats.

4.4.4 Monitoring

The WMRP and BMP effectiveness monitoring program continues to address the 2015 WDR and MMP requirements and inform WMRP planning through the adaptive management process. The monitoring and reporting program has also been enhanced by incorporating recent technology (e.g., geographic information system–based data management, mapping/viewing tools, phone/tablet applications) and annual project/maintenance resources tracking data supplied by Heavenly.

4.5 Rating Criteria

Based on the WDR BMP effectiveness rating criteria (found in Appendix C of the WDR and summarized in Chapter 4.1.1) and the data presented in this section, Heavenly's BMP effectiveness rating criteria score is *excellent* for 4 of the 5 years in question. The remaining year, the 2019 construction season, had a rating of *good.* WMRP implementation for all 5 years in question was rated *excellent*. All criteria ratings are summarized in Table 4-2 above. Over the past 5 years, Heavenly has over 95 percent implementation of both permanent and temporary BMPs. In addition, the effectiveness of both permanent and temporary BMPs scored greater than 93 percent over the past 5-year period. Heavenly prioritizes BMP installation, maintenance, and annual monitoring during the facility's watershed awareness training, ensuring that minor and basic BMP repairs are addressed prior to the BMP failing. Education and increased awareness of the importance of BMP implementation and maintenance in terms of water quality as it relates to stream and lake clarity continues to push BMP effectiveness scores over 90 percent and e*xcellent* range.

5 Riparian Condition Monitoring

5.1 Introduction and Monitoring Objectives

Riparian areas function as transition zones between uplands and stream channels, linking terrestrial and aquatic ecosystem processes. Their position in the landscape often results in immediate and measurable effects from changes on either side. It is this sensitivity that makes riparian areas ideal for interpreting management effects on the ecosystem over both short and long temporal scales.

Past riparian condition monitoring at Heavenly followed Pfankuch's *Stream Reach Inventory and Channel Stability Evaluation* (Pfankuch 1975) protocols and Rosgen's *Applied River Morphology* stream classification framework (Rosgen 1996). This methodology for riparian condition monitoring last occurred in 2003, and the data were presented by the USFS. Analysis of that data set is therefore not included in this report. All riparian condition monitoring events that occurred after 2003 followed the SCI protocols described in *United States Department of Agriculture Forest Service (USFS) Stream Condition Inventory (SCI) Technical Guide: Pacific Northwest Region, Version 5.0* (Frazier et al. 2005).

This chapter summarizes the stream channel monitoring activities conducted in the last 5-year reporting period and compares these results to past results since 2006. These stream channel monitoring activities are conducted in accordance with the Lahontan Board Order No. R6T-2015-0021 and MRP No. 2015-0021. BMI sampling, which is a component of stream channel monitoring, follows protocols and collection frequency in the *Heavenly Valley BMI QAPP*, which includes standard operating procedures for California's surface water ambient monitoring program (SWAMP). This chapter also reviews the SCI protocols for other components of stream channel monitoring, reflects on the recommendations from the previous 5-year comprehensive report (2012–2016), and makes additional recommendations based on the most recent monitoring and data.

The objective of this long-term monitoring is to assess the effectiveness of erosion control measures, BMPs, and restoration activities on stream and BMI health. Monitoring is conducted to characterize stream and riparian conditions along selected stream reaches within the Heavenly area and along reference reaches unaffected by resort activity. The evaluation and comparison of monitoring data assesses changes in stream and riparian conditions and, if changes are encountered, helps to determine whether they are associated with operations at the resort.

5.1.1 Monitoring Schedule

In accordance with the EIR/EIS/EIS and subsequent TMDL from the MRP, Heavenly is required to monitor and survey SCI at least once every 4 years, corresponding with the second year of BMI sampling on Heavenly Valley and Hidden Valley Creeks (Lahontan 2015b: 3–4). The 2019 season marked the second year of BMI collection, followed later in the year by SCI surveys. Although Edgewood and Daggett Creeks are not sampled for BMI, these streams are included in SCI. The next round of required BMI sampling will occur in 2022 and 2023, while the next SCI surveys will occur in 2023. The required sampling sites and monitoring schedule are documented in Lahontan's MRP No. 2015-0021 (WDID No. 6A090033000).

Past SCI monitoring was conducted once every 3 years (in 2006, 2009, 2011, and 2015) at three sites on Heavenly Valley Creek and two sites on Hidden Valley Creek. Monitoring also occurred at two sites on Daggett Creek (in 2006, 2009, and 2015) and a single site on Mott Creek (in 2006 and 2009). The 3-year schedule was modified after 2011 to align monitoring with the latest amended Lahontan permit and reporting requirements; thus, all sites (with the exception of Mott Creek, which was dropped from sampling requirements) were sampled in 2015 and again in 2019. The new schedule requires that SCI data be collected during the second year of BMI collection.

During the investigation and reporting phase of the EIR/EIS/EIS, 2014 and 2015 BMI sampling and results at the Sky Meadows monitoring site (43HVC-1A) found limited BMI presence and thus low scoring. Continued BMI sampling and renewed water quality monitoring at the Sky Meadows monitoring site are now required by the WDR and MRP. Additional discussion regarding the Sky Meadows monitoring site can be found in the WDR (Board Order No. R6T-2015-0021). Because the Sky Meadows monitoring site is an alpine meadow, Upper Hidden Valley Creek (HDVC-1) is used as the reference SCI reach; however, BMI samples were not collected at Upper Hidden Valley Creek until 2015. BMI samples were also collected at Upper Hidden Valley Creek in 2016, and then again in 2018 and 2019, following the revised monitoring schedule.

5.2 Monitoring Methods

Riparian condition monitoring activities are conducted to collect geomorphology and riparian data in accordance with the *United States Department of Agriculture Forest Service (USFS) Stream Condition Inventory (SCI) Technical Guide: Pacific Northwest Region, Version 5.0* (Frazier et al. 2005). The USFS SCI method was developed to collect intensive and repeatable data from stream reaches to monitor conditions over time. SCI monitoring last occurred on Heavenly Valley, Hidden Valley, Edgewood, and Daggett Creeks following the second year of BMI sampling in the summer of 2019.

The SCI methodology also includes BMI sampling, which was conducted on a 2-year on, 2-year off consecutive schedule in 2006–2007, 2010–2011, 2014–2015, and 2018–2019 on Heavenly Valley and Hidden Valley Creeks in support of monitoring required by the 2003 *Heavenly Valley Creek Total Maximum Daily Load (TMDL) Bioassessment Monitoring Plan* (USFS 2003), which was updated in the Lahontan MRP (2015b). In order to collect two consecutive years of BMI data at the Upper Hidden Valley Creek reference reach, BMI data were collected in 2016 at the Upper Hidden Valley Creek and Sky Meadows reaches. Discussion of BMI protocols, monitoring, and results is presented in Chapter 5.6.

5.3 Monitoring Locations

The project monitoring locations consist of three project reaches along Heavenly Valley Creek (HVC-1, HVC-2, and HVC-3), two project reaches on Edgewood Creek (EC-1 and EC-2), two project reaches on Daggett Creek (DC-1 and DC-2), and, in the past, one project reach on Mott Creek (MC-1). Two reference reaches are on Hidden Valley Creek (HDVC-1 and HDVC-2). These locations are shown in Figures 5-1 and 5-2.

The project reaches on Heavenly Valley Creek are in California and were established by the USFS in 2001. The Sky Meadows reach (HVC-1) is situated in the vicinity of Sky Meadows between the snowmaking pond and the 90-degree bend in the stream immediately downstream of the Sky Express Chair. Patsy’s reach (HVC-2) extends downstream of the culverts near Patsy’s Chair to immediately upstream of the steep boulder field situated beyond the ski area boundary. Property Line reach (HVC-3) extends downstream from the USFS boundary to immediately upstream of Powerline Trail.

The project reaches on Edgewood Creek, Daggett Creek, and Mott Creek are located in Nevada and were established by Cardno (formerly ENTRIX, Inc. and Cardno ENTRIX), and the USFS in 2006. Upper Edgewood reach (EC-1) on Edgewood Creek is located in the upstream section of a stream restoration project completed in 2006 along the proposed alignment for the new North Bowl Express Lift and is used to monitor the restoration project in that area. Lower Edgewood reach (EC-2) extends downstream from the Boulder Parking Lot and past the Lower Edgewood monitoring site (43HVE-2); it is used to monitor the stream restoration project completed in 2007. Along Daggett Creek, Upper Daggett reach (DC-1) is located downstream of the dam outlet culvert and Lower Daggett reach (DC-2) is located downstream of DC-1 under the Galaxy chairlift. The monitoring reach MC-1 on Mott Creek is located downstream of the Tahoe Rim Trail creek crossing. Based on feedback from the LTBMU following the submittal and review of the 2015 EIR/EIS/EIS, no additional surveys were recommended at the Mott Creek location. The boulder-dominated channel is inherently stable and resistant to change and is unlikely to be affected by ongoing and proposed management activities proposed in the contributing watershed (Norman 2015), and thus was dropped from subsequent monitoring.

The two reference reaches are located on Hidden Valley Creek in California and were established by the USFS in 2001. These two reference reaches are used for comparison with the project reaches on Heavenly Valley Creek. The Upper Hidden Valley Creek reach (HDVC-1) is located near the headwaters in the Upper Hidden Valley Creek watershed and is used as a reference site for the Sky Meadows reach (HVC-1). Lower Hidden Valley Creek reach (HDVC-2) extends approximately 270 meters (m) upstream from the Trout Creek confluence and is used as a reference site for the Heavenly Valley Creek Property Line reach (HVC-3).

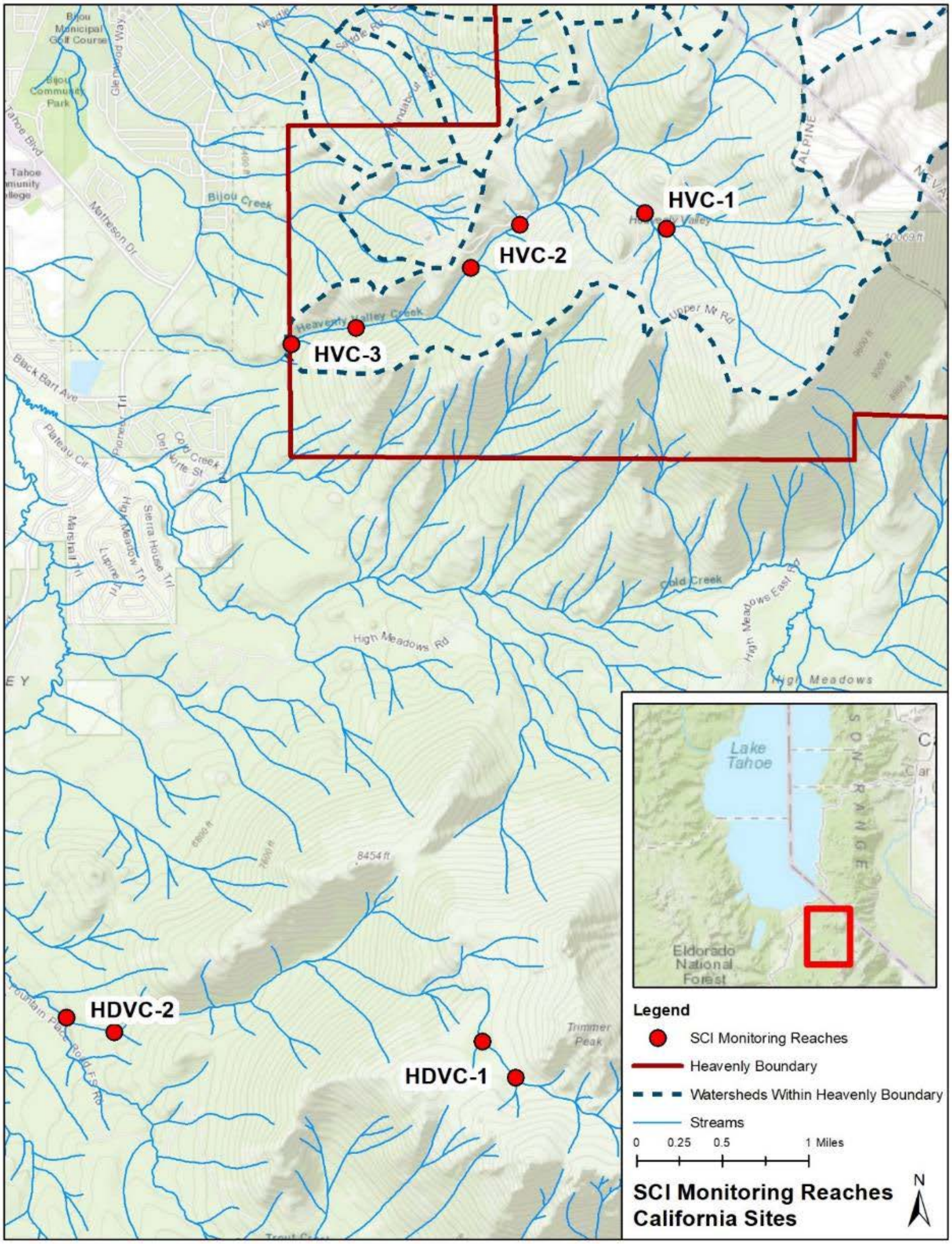

Figure 55-1 SCI Monitoring Sites in California Established in 2001

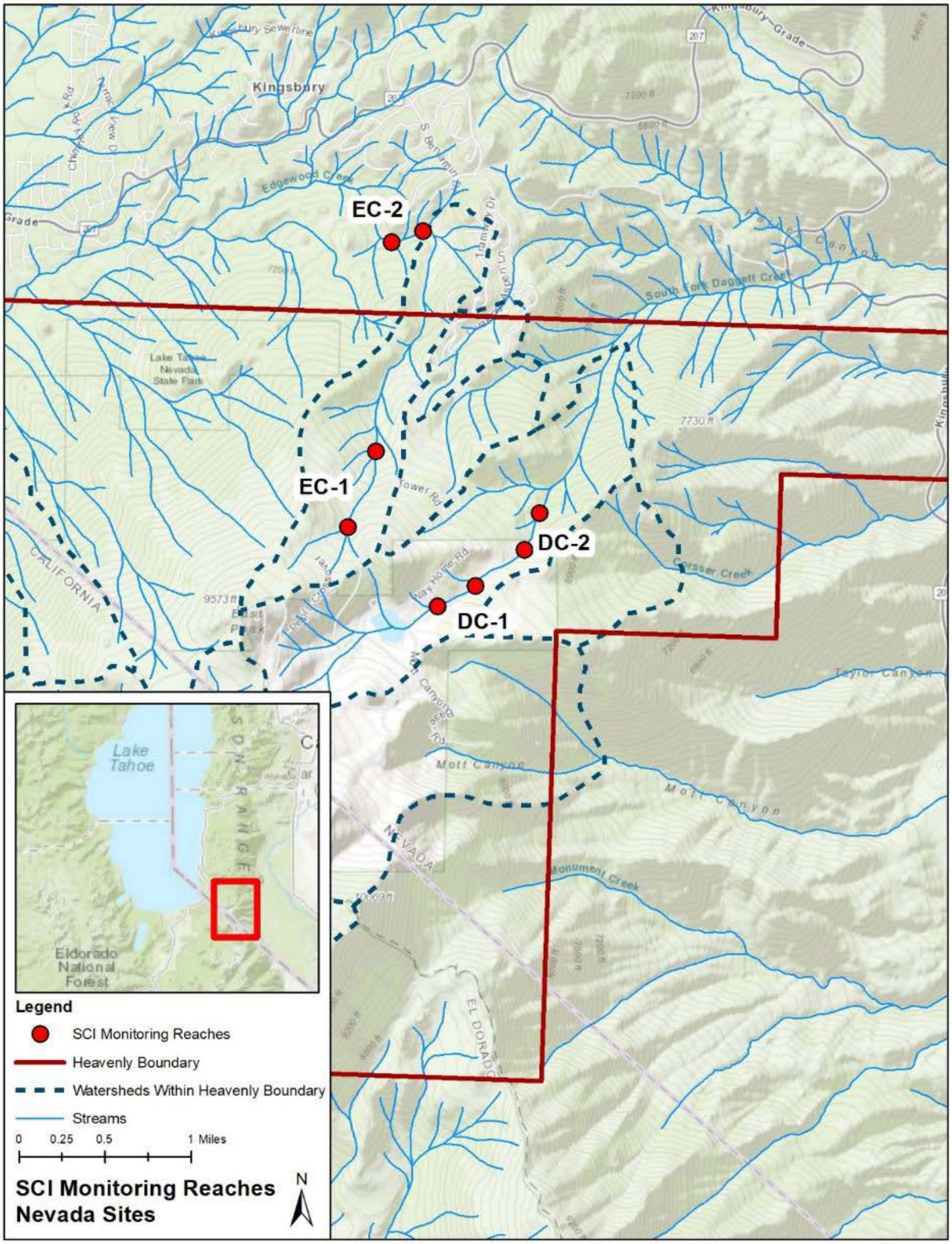

Figure 55-2 SCI Monitoring Sites in Nevada Established in 2006

5.4 Monitoring Results – Stable Functional Channel

SCI monitoring measures channel stability and functionality through measurement of channel type, bank and cross-section geometry, channel gradient, and streambank stability. The permanent monumented cross-sections at each monitoring reach provide a consistent location to evaluate the functionality of a channel and to evaluate changes over time. Along with longitudinal profiles and streambank stability assessments, comparisons of these data over time can help assess channel stability. Three cross-sections were established within each of the 10 monitoring reaches prior to 2006 and continue to be used. Where monumented pins cannot be located, a new pin is established using global positioning system (GPS) points and photographs to best replicate the previous location. The cross-sections were located in fast-water habitats and were oriented perpendicular to flow. At each cross-section, headpins were established along the left and right streambanks (viewed in the downstream direction) and a measuring tape was run horizontally across the channel from the left bank monument to the right bank monument. Tables, graphs, description of metrics and methods, and discussion of channel stability and channel functionality at each site are included in Appendix H, and a summary of each measurement is included below.

Rosgen stream classifications (Rogen 1996) were determined in 2006 by USFS, and these channel type characteristics have not changed for any of the reaches.

Bankfull stage was identified in the field to determine the associated channel characteristics such as bankfull width, bankfull depth, and bankfull width-to-depth ratio, and as input to the entrenchment ratio. Overall, bankfull widths have remained generally consistent at each site over the full monitoring period (2006–2019).

Another characterization of bankfull channel geometry is the width-to-depth ratio, which is the ratio of bankfull channel width to the mean bankfull channel depth. The width-to-depth ratio describes the distribution of available energy within a channel and the ability of discharge events to move sediment. It also describes channel cross-section shape, and comparing changes in width-to-depth ratios over time can be used to interpret shifts in channel stability. Overall, bankfull width-to-depth ratios have remained consistent over time, with a few exceptions. Floodplain sediment deposition at Sky Meadows XS-3 covered headpins after 2006, and this section of stream appears to be morphing into a wide, braided channel that encompasses a larger portion of the meadow, resulting in large changes of channel geometry. While these changes show the system is not necessarily stable, flow is spreading out and accessing a larger portion of the meadow, which is overall a positive change, as discussed in more detail in Chapter 5.7.

One more characterization of bankfull channel geometry is the entrenchment ratio, which is calculated as the ratio of the floodprone width (measured in the field at twice the maximum bankfull depth) to bankfull width. The objective of this measurement is to measure the degree of likely connection between the channel and floodplain. Overall, the entrenchment ratio at cross-sections at the monitoring reaches have remained stable or improved over time.

The channel cross-section area and net scour/fill measurement quantifies the change in channel shape and changes in deposition and/or scour. Overall, the channel cross-section area monitoring showed minimal changes over time, although any changes were specific to an individual cross-section and not indicative of changes at all cross-sections at a given reach. The most upstream cross-sections at both Sky Meadows and Upper Hidden Valley Creek reaches both experienced deposition over time, as discussed in more detail in Chapter 5.7. Lower Edgewood reach has continued to experience deposition, likely as a result of the 2007 restoration project within the reach.

The channel gradient surveys measured the water surface slope, if flow was present, or streambed slope (along the thalweg), if the channel was dry. Minor differences from year to year at some cross-sections may reflect changes in the start/end locations of the profiles and whether the channel was dry at the time of survey. The channel gradients in all of the Heavenly Valley Creek and Hidden Valley Creek monitoring reaches have remained consistent over the monitoring period, within the same range of gradient across the entire reporting period. No profile steepening from net down-cutting, knickpoint establishment, or knickpoint migration is apparent, and in all instances, the profile change was equal or less than 1 percent since 2006. The gradient at Upper Edgewood Creek has remained stable over time while the gradient at Lower Edgewood Creek has fluctuated more drastically, between 9.1 percent and 4.9 percent, likely as a result of deposition associated with the 2007 restoration project. The gradient at the Daggett Creek reaches has fluctuated over time but may be due to comparing the bed surface slope to water surface slope, as the creek has sometimes been dry during sampling.

Streambank stability is a measure of the vulnerability of streambanks to erosion. Stable streambanks were identified as having 75 percent or more cover of living plants and/or other stability components that are not easily eroded (such as binding roots, rocks, and logs). Stable banks show no indicator of instability (e.g., erosion). Vulnerable banks have 75 percent or more cover but have one or more instability indicators. Unstable banks have less than 75 percent cover and have instability indicators. Unstable streambanks are often bare, or nearly bare, composed of particle sizes too small or non-cohesive to resist erosion at high flows. The percent of stable banks has been variable in most reaches since 2006, with a similar pattern from year to year. Stability improvements may be due to increased vegetation growth, which typically occurs during wetter than normal years; however, flows during those years may also be higher and contribute to increased scouring. Drought conditions from 2012 to 2015 resulted in decreased flows and in some instances no flow conditions (Property Line reach at Heavenly Valley Creek). Changes in stability may also be related to volume of large woody debris (LWD) within the channel, particularly directly adjacent to banks. LWD in the majority of monitoring reaches has increased since 2006, and LWD continues to be redistributed by high flow events.

5.5 Monitoring Results – Quality Aquatic Habitat

SCI monitoring also measures the quality of aquatic habitat based on channel characteristics. Quality of aquatic habitat can be an indicator of overall watershed health and water quality. Improvements in measures of aquatic habitats often have correlations with improvements in water quality.

Habitat types were classified along entire monitoring reaches to describe the spatial distribution of fast and slow-water habitat units. Fast water (riffles and runs) and slow water (pools) are important core attributes because they are the base stratification of physical habitats that support aquatic life. All the monitoring reaches are dominated by fast water habitats, with the highest percentages of fast water typically in the higher gradient reaches. Observations of slow water increased at nearly all monitoring reaches in 2019. Increases of slow water may be due to sediment deposition or increases in LWD across the reach. Slow water at Sky Meadows has been increasing over time, which is consistent with other observations of meadow sediment deposition and channel braiding.

Pool measurements included quantifying the number of pools in each survey reach, determining the range of residual pool depths within the survey segment, and documenting whether wood is a factor in pool formation. Surveys completed in 2019, following an above average precipitation year, generally documented a greater number of pools, and increased mean lengths and depths, and correlated with greater percentages of slow water. The data trends suggest that surveys done following dry WYs and the lack of sediment transport are typically correlated with fewer pool observations, while surveys done following above average precipitation winters was correlated with more pool observations and greater mean lengths and depths.

Pool tail surface fine sediment is measured along with the residual pool depths at each identified pool in each reach. The variability of the pool tail fines data is somewhat consistent with the changes in hydrology and associated sediment transportation/deposition patterns from year-to-year: greater observations of fines following dry years (2009, 2015) and fewer observations of fines following wet years

(2006, 2011, 2019). It is possible that fines are mobilized in wet years, thus distributing fines across the entire reach more evenly, and during dry years, lower flows concentrate fines at the tails of pools.

Particle size distribution surveys have changed over time, as discussed in detail in Appendix H, which may account for some changes in median particle size over time. However, the median particle diameter varies somewhat at the sites from year to year, but not usually by more than a few millimeters.

LWD characterizes the abundance of woody debris that can influence channel morphology and stability. In general, woody debris is considered beneficial, as LWD can enhance channel stability and habitat complexity. In general, lower elevation, forested sites exhibited higher volumes of LWD (e.g., Property Line, Lower Hidden Valley, and Lower Edgewood), whereas high-elevation, meadow sites (e.g., Sky Meadows, Upper Hidden Valley Creek) had lower volumes of LWD.

Stream shading measures the average canopy cover in each monitoring reach. The percent mean stream shading has remained relatively consistent by site and reach over the years, with the exception of Daggett Creek, which experienced the large increase of downed trees between 2006 and 2009. This may be a result of trees along the project reach being downed due to natural causes during this time (high wind events). Lower Daggett has remained consistent since that time but shading at Upper Daggett has increased over time to near 2006 levels.

Streambank angle measures the dominant angle of the streambank between the bottom of the bank and the bankfull stage. These measurements are only made for streams with gradient less than 2 percent. Therefore, only observation at Sky Meadows and Upper Hidden Valley reaches were recorded. No substantial changes in streambank angle were noted at these reaches from year to year; however, Sky Meadows reach has experienced a slight increasing trend in streambank angle since 2009.

Streamshore water depth was measured at each of the 50 equally spaced transects along the entire channel reach, on each bank, as described in detail in Appendix H. Greater streamshore depths are indicative of undercut banks. Like streambank angle, these measurements are only made for streams with gradients less than 2 percent (Sky Meadows and Upper Hidden Valley Creek). The streamshore depth at Upper Hidden Valley has remained constant over the years, and slight increases were correlated with an increase in the number of pools throughout the reach, which are likely to have greater streamshore depth.

As recommended in the last comprehensive report, due to a lack of consistent methods and varied observers from year to year and the fact that the aquatic fauna observations are not considered useful or reliable, data for this metric have not been collected and reported.

5.6 Monitoring Results – Benthic Macroinvertebrates

Pursuant to MRP No. 2015-0021, WDID No. 6A06003300 issued by Lahontan in 2015, Environmental Monitoring Program BMI sampling is performed at five sampling sites on a 2-year-on, 2-year-off cycle, as required by the TMDL. The 2015 MRP requires the use of the BMI standard operating procedures described in the California Regional Water Quality Control Board’s SWAMP protocol (Ode et al. 2016), and sampling protocols, frequency, and data submission are provided in the *Heavenly Mountain Resort QAPP* (Cardno 2018), approved by Lahontan in 2018. The reach-wide benthos (multi-habitat) procedure in the SWAMP protocol is to be used for BMI sampling. The SWAMP procedure allows for electronic submittal of BMI data into an automated system, which automatically calculates both an O/E score (from multivariate River Invertebrate Prediction and Classification System [RIVPACS]-type model/s) and an index of biological integrity (IBI) score, based on the region from which the samples were collected (i.e., a Lahontan IBI for this study). The new WDR and Monitoring Program require additional pebble counts and cobble embeddedness measurements, as described in the SWAMP protocols, concurrent with BMI sampling. Since the WDR (and additional metrics) were not in place prior to scoping and budgeting for BMI sampling in 2015, these protocols were put into place in 2016. BMI data have been submitted to

CEDEN for all past sample events, according to protocols in the *Heavenly Mountain Resort QAPP* and will continue to be submitted in the future using the Taxonomy Data Template.

Four original sampling sites have remained the same since 2006, and include three locations on Heavenly Valley Creek (Sky Meadows [HVC-1], Patsy's [HVC-2], and Property Line [HVC-3]) and a lower elevation reference site on Hidden Valley Creek (LHC-1). An additional control site on Hidden Valley Creek (UHC-1) was added in 2015, to provide an upper elevation meadow reach as a reference for the Sky Meadows site. UHC-1 was surveyed again in 2016 to provide 2 years of consecutive data, as specified in the protocols. The BMI sampling sites are nested within the SCI monitoring reaches at each stream. During the timeframe of this 5-year report, BMI surveys were collected in 2018 and in 2019. The next round of BMI surveys will occur in 2022 and 2023.

Permit and protocol dictate that BMI sampling must occur within the index period for the area (between July 1 and August 31). The exact date is dependent on flow conditions; sampling should occur earlier during the index period in dry years and later in wet years. Sampling occurred in early to mid-July in 2018, following an approximately average-precipitation winter and in mid to late-July in 2019, following a slightly higher-than-average-precipitation winter. Streamflow was present at all sites during the sampling events.

5.6.1 2018 and 2019 Benthic Macroinvertebrate Monitoring Results

Laboratory results from the 2018 and 2019 sampling were submitted and scored by Lahontan. As discussed in the EIR/EIS/EIS, BMI results through WY 2011 are inconclusive (Suk 2014). Additional data collected in 2014 were reported in April 2015, and annual classification scores were noted for each of the sampling reaches (Suk 2015). However, "due to the relatively low number of samples, and variability in results over the years, upward trends in biotic condition at the Heavenly Valley Creek sites cannot be confirmed" (Suk 2015). Future surveys along Heavenly Valley Creek will include collecting particle size and stream embeddedness values (added in the new WDR and Monitoring Program). Along with BMI results, particle size and embeddedness results will contribute to clarifying the invertebrate and stream health trend analysis.

Tables 5-1 and 5-2 list the scoring threshold for both the Eastern Sierra IBI (ESIBI) California Stream Condition Inventory (CSCI). Survey and scoring results from the 2006 to 2019 sampling years are shown below in Table 5-3. These values differ slightly from the previous data and scores shown in the 2014 and 2015 internal memoranda submitted to Tom Suk. The previously posted scores for the CSCI were lower due to the original tool not processing the BMI taxonomy results properly (Sigala 2016). The 2018 and 2019 sampling results were included in past annual reports. Graphical representations of both the Eastern Sierra IBI and CSCI BMI data are presented in Figures 5-3 and 5-4.

Table 5-1 Thresholds Applicable to Eastern Sierra IBI

Supporting (Unimpaired)			Impaired	
Acceptable		**Intermediate Supporting but Uncertain**	**Partially Supporting**	**Not Supporting**
>89.7	89.7–80.4	80.4–63.2	63.2–42.2	<42.2
A	B	C	D	F
Very Good	Good	Fair	Poor	Very Poor
Good		Fair	Poor	

Source: Herbst and Silldorff 2009

Table 5-2 Thresholds used to Define Condition Classes for the CSCI

Index	Very Likely Intact (≥0.50)	Likely Intact (0.30 to 0.50)	Possibly Altered (0.10 to 0.30)	Likely Altered (0.01 to 0.10)	Very Likely Altered (< 0.01)
CSCI	> 1.0	1.00–0.92	0.91–0.79	0.78–0.63	0.62–0.00

Source: Suk 2014

Table 5-3 Bioassessment Scores for Sampling Events at Five Stream Locations near Heavenly (2006–2019)[1]

Sample Year	Sample Dates	Sky Meadows (HVC-1)		Patsy's (HVC-2)		Property Line (HVC-3)		Lower Hidden Valley Creek (LHC-1)		Upper Hidden Valley Creek (UHC-1)[2]	
		ESIBI	CSCI	ESIBI	CSCI	ESIBI	CSCI	ESIBI	CSCI	ESIBI	CSCI
2006	9/6 & 9/7	55.3	0.93	52.2	0.92	69.1	0.95	80.6	1.21	-	-
2007	8/29 & 8/30	23.6	0.41	67	0.96	74.7	0.98	93.3	1.15	-	-
2010	8/10 & 8/11	36.8	0.67	55.2	0.86	80.7	1.04	94.6	1.11	-	-
2011	8/29	49.8	0.61	75	0.75	83.5	1.01	87.8	0.90	-	-
2014	7/28 & 7/29	13.5	0.26	52.7	0.75	72.7	0.82	80.5	0.88	-	-
2015	6/8 & 6/11	55.2	0.93	39.5	0.77	72.2	0.87	91.6	0.92	32.1	0.58
2016	7/21 & 7/22	56.0	0.88	--	--	--	--	--	--	44.8	0.73
2018	7/9–7/11	61.2	0.85	43.6	0.77	66.9	0.85	99.3	1.14	57.0	0.78
2019	7/23–7/25	67.5	0.85	82.0	0.88	76.4	0.91	93.3	1.16	68.0	0.72

Notes: ESIBI – Eastern Sierra Index of Biological Integrity; CSCS – California Stream Condition Index

[1] Scoring calculated using ESIBI, 9-point metric values, and the CSCI.

[2] 2015 marked the first time BMI data were collected at Upper Hidden Valley Creek.

As stated above, annual scores can be assigned a rating; however, definitive long-term positive trend analysis could not be made in 2015 during the issuance of the updated WDR, due to the small number of samples collected (Suk 2015). While the new scores have varied from the first collected scores, the assessments have only minimally changed. Using the tables below and the parameters established in the *Heavenly Valley Creek – Bioassessment Site Scores for 2014* (Suk 2015) memorandum, the 2019 scores indicate the following biotic conditions:

- Sky Meadows (HVC-1) – Biotic conditions have improved over time, and the 2019 biotic condition was *fair/supporting* according to the ESIBI and *possibly altered* according to CSCI. The ESIBI scores since 2015 show improvement over time, reaching into the *supporting (unimpaired)* category for the first time since monitoring began. The 2019 CSCI scores were similar to the 2018 scores and have remained in the *possibly altered* classification since 2016.
- Patsy's (HVC-2) – Biotic conditions have improved dramatically over the 2018 results, according to both ESIBI and CSCI. In previous years, conditions at the Patsy's site consistently scored in the *poor/impaired* biotic condition according to the ESIBI but scored in the *good/supporting* condition in 2019. The CSCI score also improved from a *likely altered* classification to *possibility altered* between 2018 and 2019, although better results were observed when monitoring was first initiated.

- Property Line (HVC-3) – Biotic conditions are *fair/supporting* according to the ESIBI and are considered *possibility altered* according to CSCI, with both of the numerical scores improving slightly over the 2018 scores, while still keeping the site within the same condition classification.
- Lower Hidden Valley Creek reference site (LHC-1) – Biotic conditions are *very good/supporting* according to ESIBI and *very likely intact* according to CSCI. The ESIBI score dropped slightly from 2018, although overall scores have improved since 2011. This site has been classified as being in *good/supporting* biotic condition and as either *very likely intact* or *likely intact* since BMI sampling began in 2006.
- Upper Hidden Valley Creek reference site (LHC-2) – Biotic conditions improved from the 2018 scores to the *fair/supporting* conditions according to the ESIBI, although they are still considered *likely altered* according to the CSCI. Both threshold scores have improved over time, with a slight drop in CSCI scores in 2019, although sampling at this site only began in 2015.

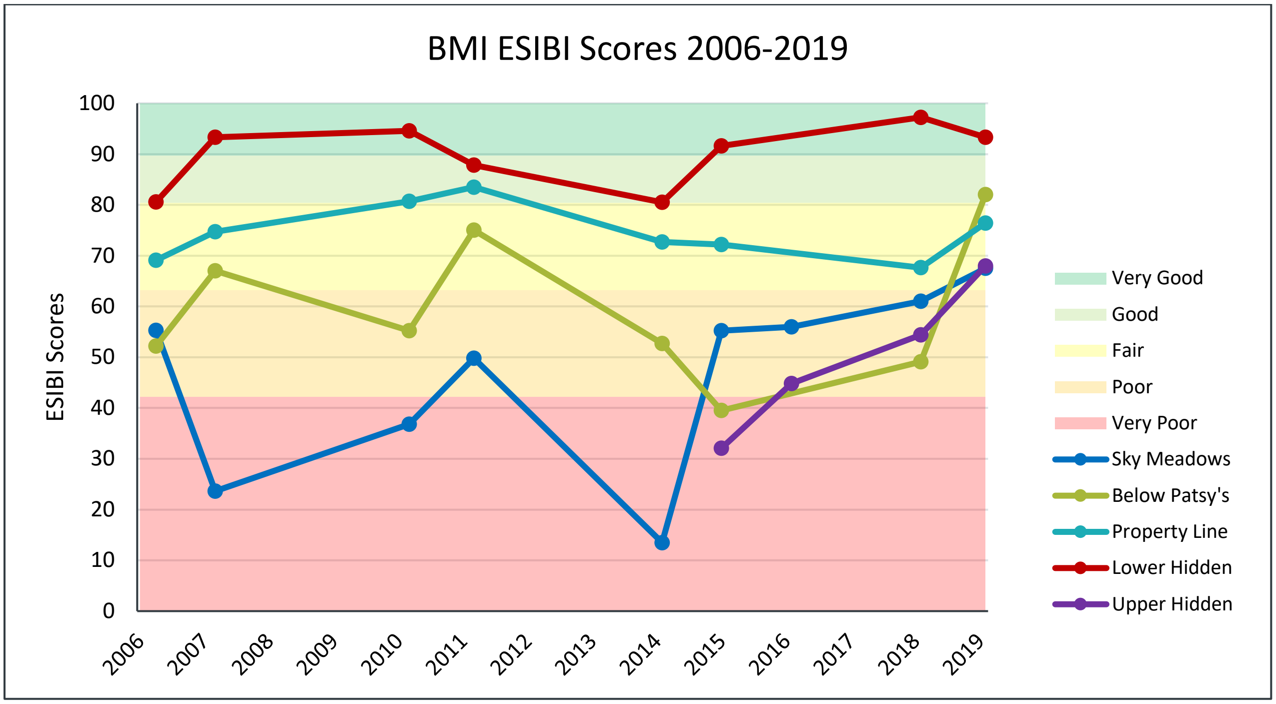

Figure 5-3 BMI ESIBI Scores for 2006–2019 by Sampling Site

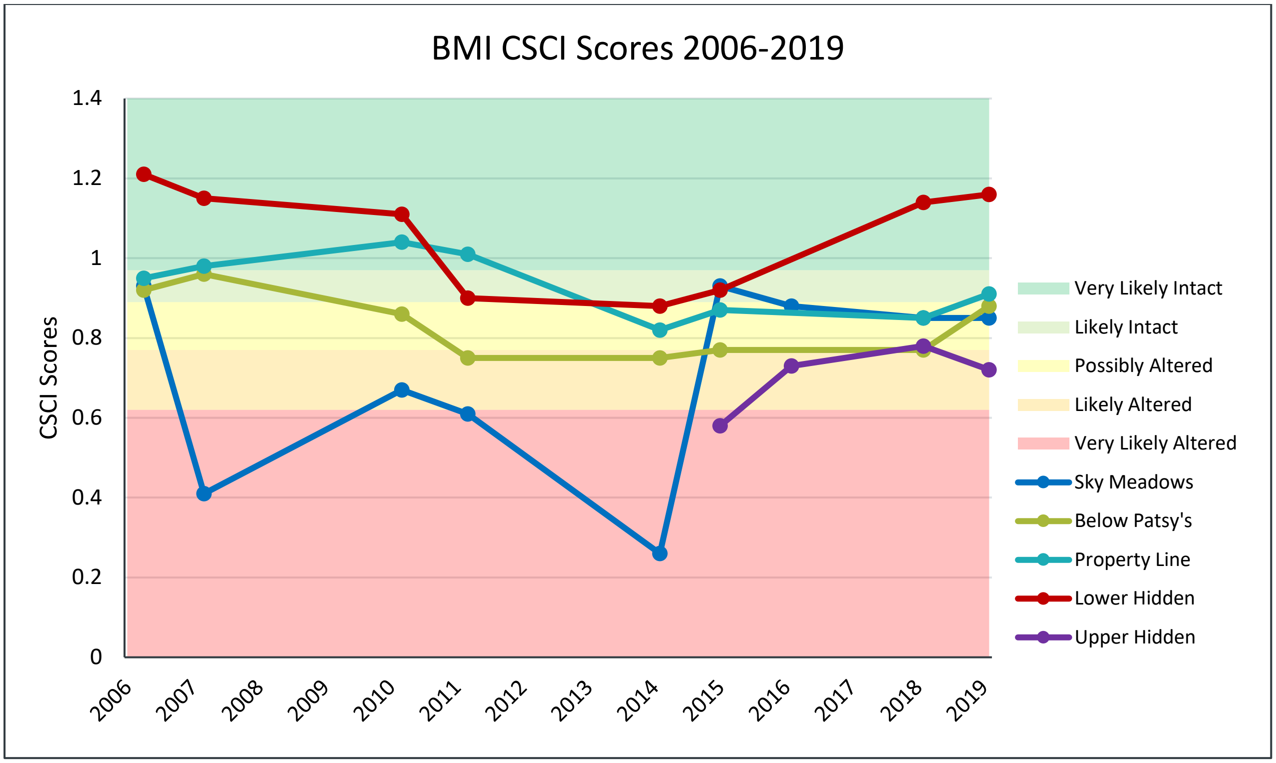

Figure 5-4 BMI CSCI Scores for 2006–2019 by Sampling Site

The 2019 BMI data show an improvement over the 2014 and 2015 data at all sites, with all sites categorized as *fair* or better according to the ESIBI scoring matrix and all sites categorized as *possibly altered* or better, with the exception of the Upper Hidden Valley Creek reference reach site (LHC-2), under the CSCI scoring methodology. The Upper Hidden Valley Creek undisturbed reference site (LHC-2) had the lowest CSCI score in 2019, though the scoring trend for ESIBI at this site is in the positive direction.

5.7 Conclusions

5.7.1 Subjectivity and Variability

One aspect of analyzing and interpreting repeated field observations from several years collected by different personnel is the inherent subjective variability. Despite standard protocols and training of personnel, there are several parameters that are fairly sensitive to subjective interpretations, particularly under different streamflow and water stage conditions. A very sensitive parameter is the bankfull stage, which can be difficult to decipher at many locations and which directly impacts calculations of bankfull area, width-to-depth ratio, and entrenchment ratio. Additionally, field identification of bankfull stage controls other field measurements (e.g., floodprone width), which cannot be easily adjusted in retrospect during data analysis. Parameters such as LWD and bank stability are also subjective in requiring visual estimates of sizes and spatial percentages by field teams. Parameters such as the number of pools may also be affected by streamflow and stage differences. Observer subjectivity and flow differences primarily contribute to variability from year-to-year rather than between sites, as the field teams in a given year observe all sites under similar conditions.

Some variability in the data is expected given fluctuations in precipitation, snowpack, runoff, and watershed sediment yield as a result of year-to-year variation in weather patterns (which can vary by sub-basin for some intense storms) and differences between sub-basin snowmaking, which can increase potential snowmelt over background. The Snow Telemetry (SNOTEL) precipitation data show that snow water content ranged from well above average in 2006 to well below average in 2007 and was below average in 2008, 2009, and 2010. WY 2011 marked an above-average snow water content year in the period of record, but was followed by conditions that were well below average in 2012, 2013, 2014, and 2015. The 2015 precipitation and snow water content were the lowest values recorded over the monitoring period. In WY 2016, conditions rebounded to above-average snow water content conditions, followed by a well above-average WY in 2017. WYs 2018 and 2019 were both above average, rounding out four consecutive years of average or above-average snow water content. See Appendix B for hydrograph and snow water content information.

Relative discharges on both Heavenly Valley and Hidden Valley Creeks correlate with the SNOTEL precipitation pattern closely (see Chapter 3, Figure 3-2). Edgewood Creek differed in having relatively higher discharge in 2008 compared to 2007 and 2009 (see Appendix B, pages B-21 through B-30). This is likely due to less frequent sampling and earlier runoff hydrograph information being missing from the data set.

5.7.2 Heavenly Valley Creek

Discharge in lower sections of Heavenly Valley Creek is influenced by the Sky Meadows Dam, which is located downstream of the Sky Meadows monitoring reach (HVC-1). Examination of three permanent cross-sections in the Patsy's reach (HVC-2) shows that the channel morphology has remained similar between 2006 and 2019. The slight moderation of flow by the dam could affect channel morphology since the dam regulates high flow discharges as well as likely provides more streamflow during drought conditions. However, the data indicate that any effects of the dam are minor.

5.7.3 Sky Meadows Compared to Upper Hidden Valley Creek

The Upper Hidden Valley Creek reference reach (HDVC-1) is used for comparison with Sky Meadows (HVC-1). Both channels exhibit characteristics of a "C" type channel and are located in a low-gradient meadow environment. However, the reaches are dissimilar in that the project reach is known to be a perennial reach while the reference reach is thought to be non-perennial or subsurface, which could be due to its close proximity to the headwaters. Since there are no known discharge data available for the reference reach (due to the remoteness of the site), the flow regime is also unknown. No water was present in the channel during the 2006 survey, but flow has been present in all subsequent monitoring events.

The Sky Meadows and Upper Hidden Valley Creek reaches have similar and consistent bankfull channel widths and width-to-depth ratios, although the Upper Hidden Valley Creek reference reach appears to be a smaller system (smaller bankfull widths and depths), which is consistent with meadows closer to headwaters with lower flow. Both systems are similar in that upstream cross-sections tend to have greater widths and width-to-depth ratios, and cross-sections became smaller toward the downstream section. Entrenchment ratios at the Sky Meadows reach were much higher and variable during the 2019 monitoring period, following years of similar and consistent entrenchment ratios. The Upper Hidden Valley Creek reference reach also experienced an increase in entrenchment ratios, although not as drastically. The Sky Meadows reach has experienced substantial scour at XS-1 over time, and minor deposition at XS-3 (the most upstream cross-section). This deposition appears to be related to a widening and braiding of the channel, resulting in a greater bankfull area. The Upper Hidden Valley Creek reference reach has experienced similar scour at XS-1 over time but has also experienced minor scour at the other two cross-sections and does not appear to be experiencing widening and braiding of the channel at the upstream section. The California Dam and backwater associated with decreased reservoir capacity would cause slower water velocities within the meadow causing sediment deposition and the cross-sectional changes at XS-3. However, deposition at the most upstream cross-sections could also be due to the channel profile grade break going from a steeper reach to gentler meadow environment.

Overall, the channels have experienced similar magnitude and percent changes in channel areas over the sampling years and similar trends over time, with some lateral and vertical changes in channel position at most (but not all) of the cross-sections at both sites. These observations are consistent with normal dynamics of a stable meadow channel. Additionally, the streambank stability and streambank angles are similar for both sites and display similar trends. Both reaches have displayed a decline in bank stability since 2009, and banks were recorded as 56 percent stable in 2019 (average of 72 percent stable over entire monitoring period) at Sky Meadows versus 33 percent stable in 2019 (average of 53 percent stable over entire monitoring period) at the Upper Hidden Valley reference reach. Slow water has increased at both reaches over the monitoring period, and the traits of pools have remained consistent, apart from a greater increase in the number of pools at the Upper Hidden Valley Creek reference reach in 2019. Both reaches have similar aquatic habitat distributions and changes by year. LWD and particle sizes are similar across both reaches. Stream shading has consistently been higher at the Upper Hidden Valley Creek reference reach, although within each reach, shading has remained constant over the monitoring period.

5.7.4 Property Line Reach Compared to Lower Hidden Valley Creek

The Lower Hidden Valley Creek reference reach (HDVC-2) is a reference reach for comparison with the Property Line reach (HVC-3). The Lower Hidden Valley Creek reference reach has an average water surface gradient of nearly 9 percent, while the Property Line reach has an average water surface gradient of approximately 5 percent, which could lead to differences in channel characteristics. Both reaches are classified as Rosgen A type channels, with both having high energy to transport sediment and relatively low in-channel sediment storage capacity.

The Property Line and Lower Hidden Valley Creek reaches have similar and consistent bankfull channel widths and width-to-depth ratios, although there are differences between cross-sections. Both reaches have cross-sections with similar ranges, and the trends are similar. The entrenchment ratios are also similar; the reference reach ratios have been lower across the monitoring period (more entrenched), which may be linked to the steeper slope of that reach. The scour and fill data show that the channels have had similar magnitude and percent changes in channel areas over the sampling years, with similar scour volumes at some cross-sections and similar fill volumes at the other cross-section. There are some minor vertical and lateral changes at some (but not all) of the cross-sections at both reaches. The streambank stability ratings have had nearly identical patterns from year to year at both reaches, although the decrease in stability that was observed at both reaches in 2011 was greater at the Property Line reach. Aquatic habitats are somewhat similar, although more slow water has been observed at the Property Line reach during most years. This may be due to either variable survey reach distance at the Property Line reach (until the reach distance was standardized in 2011). The number and dimensions of pools have similar trends over time at the project and reference reach, and both appear stable. Pool tail fines have not necessarily been comparable at the reaches over time, largely due to uncorrelated variability from year to year at both reaches. Comparisons of LWD across the reaches was variable during the first half of the reporting period; however, both reaches appear to have stabilized at similar numbers during the second half of the reporting period. Changes at the Lower Hidden Valley Creek reference reach are expected to be observed during the next SCI monitoring event (2023) due to impacts of the Caldor Fire, particularly in relation to sediment and LWD movement, which can affect many aspects of channel geometry and aquatic habitats. Sediment deposition has already been observed at the Lower Hidden Valley Creek reference reach (Figure 3-12 and Figure 3-13). These changes may make comparison to the Property Line reach less relevant, as discussed more extensively in Chapter 2.9.

5.7.5 Patsy's

There is no reference reach associated with the Patsy's reach (HVC-2) on Heavenly Valley Creek, but the bankfull channel widths, width-to-depth ratio, and entrenchment ratio measurements at this reach are all consistent over time. The scour and fill values appear to be minor with the same pattern from year to year as at other reaches. Similarly, the bank stability ratings are good; they compare predictably to the other reaches on Heavenly Valley Creek and have a similar year-to-year trend. The habitat types and pool numbers and dimensions are stable, and stream shading is good. Some variation in pool tail fines and LWD abundance from year to year occurred and may be related to changes in transport and storage.

5.7.6 Edgewood Creek

5.7.6.1 Upper Edgewood Creek

After undergoing extensive stream restoration efforts, the Upper Edgewood Creek reach (EC-1) shows no increase in degradation from previous resort management activities. The cross-section and longitudinal profile surveys show that elevations in the reach are largely unchanged since completion of the restoration projects. The restoration projects completed in 2006 and 2007 appear to have prevented further down-cutting and widening of the channel. Very little change is observable in all three cross-sections. Restoration in 2007 repaired the largest headcuts within the reach. Some of the step pool morphology was retained from pre-restoration through the construction of rock gabion weirs that created steps in the channel profile. The gabions and downed logs in the restored reach provide hard points that should resist down-cutting at the most vulnerable points. To date the North Bowl Stream Environment Restoration Project is meeting its long-term goals and objectives.

5.7.6.2 Lower Edgewood Creek

After undergoing extensive restoration efforts, the Lower Edgewood Creek reach (EC-2) shows no increase in degradation from previous resort management activities. This reach shows either unchanged or slightly improved conditions. Recovery at this reach has slowly progressed since the restoration in 2007. Lower Edgewood Creek’s channel morphology is highly influenced by dense riparian vegetation that supplies a large amount of wood to the channel, which creates complex channel morphology. The reach continues to see reduced bankfull areas and increased deposition over time, suggesting that problematic scouring forces have been addressed with the restoration project. It appears that continued observations have verified that the Lower Edgewood Creek Stream Environment Restoration Project and Edgewood Vault in the Boulder Parking Lot are meeting their long-term goals and objectives.

5.7.7 Daggett Creek

Although channel width, gradient, sediment size, and bank stability on Daggett Creek have remained consistent, there are variations across the years in the channel geometry at both Upper and Lower Daggett Creek that are uncertain in their trend. The habitat at Lower Daggett Creek appears to be improving overall, and past declines observed at Upper Daggett Creek appear to have improved or stabilized.

5.8 Trend Analysis

SCI metrics collected and discussed in the sections above were rated to better understand trends across each watershed and monitoring reach. Ratings were created for each metric based on qualitative assumptions regarding the trend analysis of the metric. Trend analysis of each metric is only completed on the 2006 to 2019 data, as data prior to 2006 were collected using a different set of protocols and should not be used in comparison. Metric ratings of each stream reach and cross-sections are included in Table 5-4. A rating of *improving* (+), *stable* (✔), or *declining* (-) was recorded for each monitoring metric in each cross-section location. The assessment for each metric uses varied units and a qualitative comparison of conditions rather than a particular percent change or absolute value threshold to determine *improving* vs *stable* or *declining*. These definitions are customized to reflect the range of past and present conditions at the site, and the project goals and objectives; they should not be extrapolated to other sites or projects.

Table 5-4 Stream Condition Inventory Monitoring Metric Trend Analysis Summary

Monitoring Metric	Trend Definitions[1]	Sky Meadows			Below Patsy's			Property Line			Upper Hidden Creek			Lower Hidden Creek			Lower Edgewood			Upper Daggett			Lower Daggett		
	Improving (+) Stable (✔) Declining (-)	XS-1	XS-2	XS-3	XS-1	XS-2	XS-3	XS-1	XS-2	XS-3	XS-1	XS-2	XS-3	XS-1	XS-2	XS-3	XS-1	XS-2	XS-3	XS-1	XS-2	XS-3	XS-1	XS-2	XS-3
Bankful Width	<u>Improving</u>: Decrease in width <u>Stable</u>: Little or no change in width <u>Declining</u>: Increase in width	✔	—	✔	✔	+	+	+	✔	+	+	—	✔	+	+	✔	+	+	+	✔	✔	+	+	+	+
Bankful Width/Depth Ratio	<u>Improving</u>: decrease in width/depth ratio <u>Stable</u>: Little or no change in width/depth ratio <u>Declining</u>: increase in width/depth ratio	✔	✔	—	+	—	+	+	+	+	✔	—	✔	+	✔	+	✔	✔	+	—	✔	+	✔	+	+
Entrenchment Ratio	<u>Improving</u>: Increase in entrenchment ratio <u>Stable</u>: Little or no change in entrenchment ratio <u>Declining</u>: Decrease in entrenchment ratio	+	+	+	+	✔	+	+	✔	✔	✔	+	+	✔	✔	✔	✔	✔	✔	+	—	+	✔	+	+
Channel Cross Section Area	<u>Improving</u>: n/a <u>Stable</u>: No change or slight change in area <u>Declining</u>: Increase in area	✔	—	✔	✔	✔	✔	✔	—	✔	✔	✔	✔	—	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Bank Stability	<u>Improving</u>: Increase in % stable banks <u>Stable</u>: Little or no change in % stable banks <u>Declining:</u> Decrease in % stable banks	—			—			—			✔			—			✔			—			—		
Habitat Type	<u>Improving:</u> Increase in slow water <u>Stable:</u> No change or slight change in slow water habitat <u>Declining:</u> Decrease in slow water habitat	+			+			+			+			✔			—			+			✔		
Pools	<u>Improving</u>: Increase in number and/or size of pools <u>Stable:</u> Little or no change in number and/or size of pools <u>Declining:</u> Decrease in number and/or size of pools	+			+			✔			+			✔			—			+					
Particle Class Size	<u>Improving:</u> n/a <u>Stable:</u> Little or no shift in size distribution or median diameter <u>Declining</u>: Shift in size distribution and/or median class	✔			✔			✔			✔			✔			✔			—			✔		
Stream Shading	<u>Improving</u>: Increase in shading percent <u>Stable</u>: Little or no change in shading percent <u>Declining</u>: Decrease in shading percent	✔			✔			✔			✔			✔			✔			✔			✔		
BMI Results (ESIBI Scores)[2]	Refer to BMI Section	Fair (+)			Good (+)			Fair (+)			Fair (+)			Very Good (✔)			n/a			n/a			n/a		

[1] Ratings based on period of record data (2006–2019). The assessment for each metric uses varied units and a qualitative comparison of conditions rather than a particular percent change or absolute value threshold to determine *improving* vs. *stable* or *declining*. These definitions are customized to reflect the range of past and present conditions at the site, and the project goals and objectives; they should not be extrapolated to other sites or projects.

[2] 2019 BMI results reported, followed by trend in parenthesis

5.9 Recommendations

While the Work Plan for Riparian Condition Monitoring (ENTRIX 2005) and the *USFS Stream Condition Inventory Technical Guide: Pacific Northwest Region, Version 5* (Frazier et al. 2005) are guidelines for gathering field data, some of the data collected have limited use for assessing stream health through repeated observations.

For future monitoring, we continue to offer the following recommendations:

1. Continue to replace or add headpins, where necessary, that are secured far enough away from the bank laterally and vertically (outside of the expected floodprone width) to allow for normal channel dynamics to occur without eliminating survey control. For reaches that have headpins now located within the active channel (such as Property Line XS-2 and Upper Hidden Valley Creek XS-2), new headpins farther up the bank should be added. Some replacement of headpins occurred in 2019.

2. Add one or two valley pins at each cross-section well outside of the floodplain acting as an additional reference point (floodplain placement). These new pin placements will be located in areas where little to no change from the channel will occur. They also can be used in future surveys if the original pin is lost or damaged to ensure control. This recommendation is particularly relevant for meadow reaches, such as Sky Meadows and Upper Hidden Valley Creek.

3. Take advantage of recent improvements in available field technology options to collect data using tablet computers that have data dictionaries and electronic formats that will reduce quality assurance/quality control needs and provide more efficient data processing and reporting. Consider using GPS survey-grade equipment to collect topographic data if site conditions allow.

4. Modify the linear profile metric, removing cross-section profiles, relative elevations, and average slope calculations (for each cross-section). Instead pins at the downstream and upstream reach will be placed and an entire linear profile (from start to finish) will be collected. This will require a few turning points with the auto level or total station in order to survey the entire reach; however, the profile will be more accurate by removing the average values and relative elevations. In addition, this profile will be easier to compare and contrast slopes over time as the start and ending locations will not change.

5. Consider removal of the Upper Edgewood reach from further SCI monitoring, unless construction has occurred in the near vicinity. Due to the lack of water, high gradient nature of the channel, and the unreliability of bankfull indicators because of the restoration project, very limited data (longitudinal profile and cross-section topographic surveys) are currently collected at this site. The data that have been collected show the channel is very stable. Continued monitoring may be required in the near future as Heavenly is in the planning stages of replacing the North Bowl Chairlift. Construction in the vicinity of the stream and upper watershed may have future impacts.

The following recommendations have previously been reported and are in implementation, but for completion they are documented here in the 5-year comprehensive report:

6. Photo document all bankfull stage indicators and ensure that bankfull stage is also noted on the cross-section surveys and field-checked for consistency on both banks and upstream/downstream locations prior to field survey of the floodprone width.

7. Collect streambed profiles and water surface profile data simultaneously so that comparisons to data from years without streamflow are more reliable.

8. BMI sampling at Upper Hidden Valley Creek was collected in both 2018 and 2019. Continued BMI sampling at this reach will commence in alignment with the monitoring schedule presented in the WDR (2 years on and 2 years off). Collecting samples at this reach continues to provide a high-elevation meadow reference reach for comparison with Sky Meadows instead of the Lower Hidden Valley Creek

reference reach, which is a steeper riffle pool stream channel segment. The next round of BMI stream sampling will occur in 2022 for all five reaches.

5.10 Rating Criteria

The latest permit WDRs define the watershed and TMDL target evaluation criteria (found in Appendix C of the WDRs). As documented by Lahontan, the stream condition rating criteria are as follows (Lahontan 2015b: Appendix C):

- *Excellent: All channel conditions are stable or improving*
- *Good: Most channel conditions are stable or improving*
- *Fair: Some channel conditions are stable or improving*
- *Poor: Most channel conditions are not stable or improving*

Table 5-5 summarizes the ratings and scores of each reach based on the criteria set forth in the WDR. Lower Hidden Valley Creek received an *excellent* rating during the prior 5-year comprehensive report. However, declines in bank stability and increases in cross-sectional area in more recent years warrant an updated rating of *good* according to the specific criteria set forth. Only Upper Edgewood Creek received a rating of *excellent*, which is likely related both to the limited amount of data collected at this location and the inherently stable conditions created by the restoration project. No reach was rated as being in *poor* condition, in which most of the channel conditions are not stable or are not showing signs of improvement. Instead, the remaining monitoring reaches received a *good* or *fair* score based on the monitoring data collected. Improved BMI scores at most locations helped to improve the ratings of reaches that had mostly stable channel conditions.

Table 5-5 Stream Condition Rating

Monitoring Reach	**Rating (Excellent, Good, Fair, or Poor)**	**Rationale**
Heavenly Valley Creek at Sky Meadows (HVC-1)	Fair	While most channel conditions are stable, bankfull widths at all cross-sections have increased over time, and bank stability has declined. Entrenchment improved across all cross-sections, and the numbers of pools increased, as did the percentage of slow water. While BMI metrics have improved over time, they are currently rated *fair*.
Heavenly Valley Creek at Patsy's (HVC-2)	Good	Nearly all channel conditions are stable or improving, including continued improvement of BMI scores to a current rating of *good*.
Heavenly Valley Creek at Property Line (HVC-3)	Good	Nearly all channel conditions are stable or improving, with the exception of a *fair* BMI score.
Hidden Valley Creek at Lower Hidden (LHC-1)	Good	Nearly all channel conditions are stable or improving; the BMI score *very good* has remained stable over the last several monitoring periods. 2019 observations included a decline in bank stability and an increase in channel cross-sectional area; thus, the prior rating of *excellent* has been reduced to *good*.
Hidden Valley Creek at Upper Hidden (LHC-2)	Fair	Most channel conditions are stable or improving, with the exception of continued scouring at cross-section 1 and a BMI rating of *fair*.
Edgewood Creek at Upper Edgewood (EC-1)	Excellent	Minimal data are collected at this reach, but the data collected indicated excellent stability across the reach, likely as a result of the restoration project.
Edgewood Creek at Lower Edgewood (EC-2)	Good	Most channel conditions are stable or improving, with all cross-sections experiencing some level of deposition over time and improved entrenchment ratios.
Daggett Creek at Upper Daggett (DC-1)	Fair	Some conditions are stable or improving; trends are uncertain.
Daggett Creek at Lower Daggett (DC-2)	Fair	Some conditions are stable or improving; trends are uncertain.

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6 Watershed Condition

As required in the WDRs, an overall watershed condition “rating” is warranted during the 5-year comprehensive report. Each of the watershed condition ratings are defined in the WDR and summarized below as the “overall watershed condition is a qualitative evaluation that considers water quality, erosion monitoring, channel condition and BMI scores. The trend evaluations gauge the overall watershed condition to determine if ski area management activities are improving or degrading water quality and ecological health. The ratings are as follows:

- **Much Improved:** Watershed condition (as measured by water quality, effective soil cover, channel condition, and BMP and CWE project implementation) greatly improved compared to 2005 conditions; all watershed components have improved.
- **Improved:** Watershed condition improved compared to 2005 conditions; most watershed components have improved.
- **Stable:** Watershed condition has remained more or less static as compared to 2005 conditions; some watershed components may have improved while others may have degraded.
- **Degenerating:** Watershed conditions have degraded; several watershed components have degraded while none have improved as compared to 2005 conditions.” (Lahontan 2015b: Appendix C).

Individual watershed conditions such as water quality, stream condition, BMP effectiveness, and WMRP are discussed in previous chapters of the report. Table 6-1 summarizes the condition metrics for Watershed CA-1. Watershed CA-1 includes all three monitoring locations along Heavenly Valley Creek: Sky Meadows, Patsy’s, and Property Line. The overall score of Watershed CA-1 would be *stable*, seeing as how water quality, stream condition, and the scores for the watershed condition components have shown neither improvement nor degradation over the past years.

Table 6-1 Watershed CA-1 Rating Criteria Summary

Watershed CA-1	Watershed Condition	Rating Criteria
Heavenly Valley Creek	Water Quality	*Fair* for Heavenly Valley Creek
Heavenly Valley Creek	Stream Condition	*Good* for 2 of the 3 reaches along Heavenly Valley Creek
Watershed CA-1	BMP Effectiveness	*Excellent* for the entire resort including Watershed CA-1
Watershed CA-1	Watershed Maintenance & Restoration Program	*Excellent* – most master plan projects are located in Watershed CA-1
Overall Rating		*Stable* – conditions have not improved substantially but have not deteriorated either.

Likewise, Table 6-2 summarizes the metric conditions for Watershed CA-6A. This watershed includes the contributing areas around the California Base Lodge, parking lots, and filter vaults, which all drain into Bijou Park Creek. Stream condition monitoring is not conducted along Bijou Park Creek at this time; hence no score is given for this metric. Also, no master plan projects were completed from 2017 to 2021 in Watershed CA-6A. Thus, no score was rated for the WMRP for this watershed. Annual BMP maintenance projects along with asphalt repairs and vault cleaning and filter replacement are completed each year, but these practices are not accounted for in the criteria ranking. Despite improvements in water quality results at Bijou Park Creek, constituent levels are still exceeding state standards. Thus, the ranking of Watershed CA-6A is rated *stable*; however, not all metrics were measured or scored leading to this ranking.

Table 6-2 Watershed CA-6A Rating Criteria Summary

Reaches within Watershed CA-6A	Watershed Condition	Rating Criteria
Bijou Park Creek and Storm Vault Effluent monitoring site	Water Quality	*Fair* for Bijou Park Creek and vault storm samples
Bijou Park Creek and California Base Parking Lot	Stream Condition	"N/A" – SCI monitoring not required along Bijou Park Creek at this time
Watershed CA-6A	BMP Effectiveness	*Excellent* for the entire resort including Watershed CA-6A
Watershed CA-6A	Watershed Maintenance & Restoration Program	"N/A" – no master plan projects are located in Watershed CA-6 (mostly maintenance-related projects)
Overall Rating		*Stable* – not all metrics are measured in this watershed

7 Deicers/Abrasives Application and Recovery Monitoring

7.1 Background Information

Deicer and abrasive application are safety measures that Heavenly employs to provide a safe route to and from the resort. While the City of South Lake Tahoe (CSLT) is responsible for snow removal and deicing application to allow access to the California Base Parking Lot and Lodge, Heavenly augments this service by providing additional plowing and application of deicer/abrasives to the roadway leading up to the entrance and parking lots. These roadways include the following streets: Ski Run Blvd., Needle Peak Road, Wildwood Avenue, and Saddle Road). As required by permit conditions (Lahontan MRP No. 2015-0021), daily and monthly logs record the following information:

- The location and dates of application, including street names if applied within the CSLT.
- The rate and amount of each material applied daily, with subtotals for Heavenly property and CSLT streets.

Additional coverage by Heavenly's plow/spreader truck allows for increased frequency and continual snow and deicer removal during treacherous driving conditions. While beneficial to travel and public safety, the application of deicer and abrasives is likely linked to water quality exceedances at the Storm Vault Effluent monitoring site (43HVP-2) within the California Base Parking Lot and Bijou Park Creek (43BPC-4) monitoring site. Both locations collect runoff from the parking lot and roadways leading to Heavenly.

Once the ski season commences and weather permits, Heavenly collects excess roadway materials from the parking lot and roadways leading up to the California Base Lodge. Permit conditions require that the following information be collected:

- Location and dates of maintenance, including street names if within CSLT.
- Amounts of material recovered by maintenance activities.
- Location of disposal facilities.

Typically, collection of the roadway and parking lot debris material occurs in the summer months. The roadway material is collected by a subcontracted sweeper vehicle (vactor truck); in some instances, excess material in the parking lot can be collected with the use of a backhoe. All collected material is placed into rented 10-cubic-yard drop boxes. When these boxes are full, or when recovery is completed, the boxes are weighed and disposed of at the South Lake Tahoe Refuse transfer station located at 2140 Ruth Avenue in South Lake Tahoe. The boxes are weighed when they are both full and empty. Dispatch tickets that show the amount of material disposed are returned to Heavenly operations. No material was recovered during the fourth quarter of WY 2021. The earlier 2021 collection and weight tickets were previously provided in both the second and third quarter monitoring reports.

7.2 Application and Monitoring

During the 2017 winter months, 230,644 pounds of deicer were applied on the roadway. This amount substantially decreased in both 2018 and 2019 to 76,543 and 28,982 pounds, respectively. These lower application amounts can be attributed to less snow and precipitation in these years relative to 2017. Deicer application increased in 2020 to 115,925 pounds, which correlates to the increase in average precipitation and snowfall during WY 2020. Deicer application decreased during 2021 to 71,292 pounds. In total, 523,386 pounds of deicer was applied between 2017 and 2021; this is significantly less than the amount applied between 2012 and 2016 (1,008,362 pounds). A total of 559,960 pounds of deicer was recovered between 2017 and 2021, which is a removal percentage of 107 percent. In several years, Heavenly has recovered a greater volume of deicer and abrasives than it has applied. This may be due to removal of deicer that CSLT has applied on the roads leading to Heavenly, removal of portions of deteriorated parking lot, or removal of natural sediment that has built up on the roadway.

In the past, Heavenly has investigated alternatives to deicer and deicer application and storage practices. Alternative deicer methods did not provide enough traction and cause more detrimental environmental effects. In 2016, Heavenly switched from a volcanic cinder–based abrasive to Washoe sand in accordance with the new WDRs (2015-0021). From 2012 to 2016, Heavenly switched from a 1:1 ratio (half cinder/half salt) to a 3:1 ratio (Washoe sand/salt). In 2016, Heavenly began using a 5:1 ratio of Washoe sand to salt deicer mixture on the parking lot and nearby roadways leading to the resort entrance to limit the amount of salt applied to the roadways. In 2017, Heavenly began using a liquid brine composed of dissolved magnesium and sodium chloride to pre-treat roadways before storms. Heavenly subcontracts a vendor to apply brine prior to storm events to prevent icing. Unlike deicer, sprayed application of the liquid (brine) does not bounce or roll (like rounded sand particles) off the asphalt roadway surface and provides more complete coverage in cracks, helping to melt snow and prevent ice build-up. Annual deicer application, recovery, and liquid brine application amounts for the past five seasons are shown in Table 7-1.

Table 7-1 Deicer Application and Recovery 5-Year Totals

Water Year	Total Amount of Deicer and Abrasives Applied (lbs)	Total Amount of Deicer and Abrasives Recovered (lbs)	Total Amount of Liquid Brine Applied (gallons)
2017	230,644	171,620	150
2018	76,543	127,180	550
2019	28,982	120,080	0
2020	115,925	39,040	495
2021	71,292	102,040	300
Total	523,386	559,960	1,495

Removal percentage = 107%

In addition to a decreased ratio of salt (chloride) application to the parking lots and roadways and the use of liquid brine as an alternative to deicer application, Heavenly has invested in a smaller plow truck. The use of this smaller truck and attached digital tracker provided a more reliable method for accounting of deicer application. See Figure 7-1 for a picture of the smaller truck and Figure 7-2 for the older, larger truck. Since WY 2015, the smaller truck has been the primary deicer application vehicle.

Figure 7-1 Smaller Deicer Application Truck

Figure 7-2 Dump Truck Deicer Vehicle

Laboratory analysis of the 5:1 Washoe sand deicer mixture was first performed on the material during the first quarter of WY 2015. Results were previously reported in the second quarter report (May 1, 2015). Laboratory analysis of the 5:1 Washoe sand deicer mixture has also been performed during WYs 2017, 2018, and 2020; results are included in each respective annual report. The abrasives passed all of the Tahoe Basin Specifications listed in MRP No. 2015-0021.

Heavenly received a new stockpile of abrasives in March 2021. Samples of this material were delivered to WET Lab in Reno, Nevada, for analysis. In the past Heavenly has worked in conjunction with El Dorado County Department of Transportation, who also uses the same “spec H aggregate” Washoe sand from Cinderlite, for analysis using their in-house laboratory. Due to staff turnover at both Heavenly and WET Lab, analysis was delayed. In addition, we were not able to find a certified laboratory to perform the required testing methodology prescribed in the WDR. Black Eagle Consulting, Inc. was able to perform most of the analysis, though it should be noted that they are no longer certified in the methodologies requested and performed. Results from this analysis are included in Appendix I and summarized below. Laboratory analysis was performed in July 2021 on the Washoe sand sample and the results are presented below in Tables 7-2 and 7-3. Due to the lack of Nevada laboratory certifications, moving forward future cinder samples will be sent to El Dorado County Department of Transportation for certified analysis.

Table 7-2 Abrasive Results (July 2021)[1]

Parameter	Method of Test	Minimum Reporting Limit	Results
Sand Equivalent	CTM 217	80 min	96% (passing)
Durability	CTM 229	55 min	82% (passing)
Moisture Content	CTM 226	< 5%	0.2%
Gradation	CTM 202	NA	Not to Specification – See Below for Details
Turbidity[2]	CalTrans 6	NA	Not Tested

[1] Results provided by Black Eagle Consulting, Inc.
[2] Turbidity testing was not performed as no Nevada laboratory could perform CalTrans turbidity methodology.

Table 7-3 Gradation Results[1]

Sieve Size	Percentage Passing (Requirements)	Percentage Passing (Results)	Meets WDR Requirements
⅜ inch	100%	100%	✓
¼ inch	95–100%	Not Supplied	N/A
#8	40–60%	65%	No
#16	10–30%	29%	✓
#50	0–5%	6%	No
#200	0–1%	2.1%	No

[1] Results provided by Black Eagle Consulting, Inc. performing CTM 202

MRP No. 2015-0021 lists the parameters and method for testing required for abrasive usage. The testing methodology provided in Table 7-2 denotes Lahontan’s preferred testing methods. Only turbidity testing was not provided at this time; however, future analysis will request this information. Sand equivalent, durability, and moisture content results met the WDR specifications; however, the gradation results did not meet the standards specified especially at the smaller sieve sizes. Heavenly and El Dorado County Department of Transportation continue to use the same material for deicer usage, and moving forward, Heavenly will work solely with El Dorado County for joint testing efforts. Future laboratory analysis will be conducted again at a minimum annually when either the abrasive sample is delivered, derived from a new source, or from a new vendor.

7.3 Recommendations

As discussed in the *Bijou Park Creek Evaluation Report* (Tormey 2017, Appendix J) chloride levels continue to be problematic, in that chloride levels at the Bijou Park Creek monitoring site (43BPC-4), adjacent to the California Base Parking Lot, continue to exceed the state standards. Chloride levels at the Storm Vault Effluent monitoring site (43HVP-2) within the California Base Parking Lot have improved dramatically when comparing the maximum and mean values of the 5-year reporting periods of 2012 to 2016 and 2017 to 2021 (Table 3-11 in Chapter 3.6.5), although there is no state standard for chloride at this location. Deicer (which includes salt/chloride) is needed to provide employees and guests safer access to the resort. Heavenly has made a concerted effort to reduce chloride application: switching to a 5:1 Washoe sand to salt mixture, educating staff and requiring documentation of deicer application around the lodge and tram entrances, switching from the dump truck roadway application to the truck bed and automated application, and use of liquid brine instead of sand/salt roadway deicer when possible. Beginning in the 2016–2017 ski season, Heavenly has contracted with an outside vendor to apply brine (a liquid salt mixture) to parking lots prior to predicted storm events and after the parking lot has been plowed in an effort to decrease downstream chloride levels. Liquid brine is similarly used by the transportation districts in the basin (Nevada Department of Transportation and CalTrans) for the same reason. By pre-treating the roadways, it aids in limiting snow accumulation and icing, and ultimately brine application limits the amount of additional deicer/salt application needed. Deicer (sand/cinder and rock salt) tends to bounce on application and is not 100 percent effective in covering the vehicular travel lanes, requiring additional application and passes for the intended treatment. Since this application and treatment is relatively new, additional monitoring is needed to determine the effectiveness of brine application and to compare application amounts with future water quality chloride sampling results. As previously recommended, the following information is being collected:

- The dates and times brine is applied to the parking lots.
- The amount of brine applied.

Additional information that should be collected moving forward to assist in the determination of brine effectiveness and chloride limitations should be:

- Application rate (quantity over time).
- The number of passes across the parking lot and/or location of brine application (if not the entire lot).
- The mixture ratio and chemical makeup of brine (ensuring that magnesium chloride is not used due to its highly corrosive properties and addition of magnesium to the environment).
- Post-storm monitoring, noting the effectiveness of the treatment. This will also help application amounts and passes for future storms.

While actively working with Lahontan, Heavenly is attempting to reduce chloride application and monitored chloride levels within Bijou Park Creek. The reduction in deicer usage, lowered chloride mixture percentage, and use of brine are all to actively limit chloride exceedance readings in the stream while maintaining public safety and access to the resort. Data collection in the future will help to determine the effectiveness of brine application while limiting deicer usage and instream chloride levels.

Continued maintenance and improved operations of the filters vaults should continue to improve chloride results at the Storm Vault Effluent monitoring site (43HVP-2), which in turn influences the results at the Bijou Park Creek monitoring site (43BPC-4). Additionally, educating staff on the importance of water quality and limitation of deicer/chloride in the streams aids in their participation in properly applying and documenting deicer usage.

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8 Snow Conditions/Snowmaking Enhancement Monitoring

8.1 Background Information

Snow conditioning and snowmaking enhancement monitoring is reported monthly with the monitoring checklists. These reports are attached and included in the Lahontan quarterly reports submitted throughout the year. Four sites were initially monitored in 2011, and monitoring has expanded to include additional sites over time. Huck salt application at the Adventure Peak Tubing Area ceased in WY 2014 due to procedural changes, and this originally monitored site is no longer included in annual summaries of huck salt. The California Base Parking Lot location began to be monitored in WY 2015. Beginning in WY 2017, monitoring began at three additional sites: Tamarack Lodge, Tram Base, and World Cup Foundation Building. These sites have been added to better track all salt (deicer) applied in and around Heavenly during winter operations. The fourth quarter monitoring reports for WY 2021 are included in Appendix E. No salt application occurred during the fourth quarter because the resort is closed during the fall and snow/ice management is not an issue. No on-mountain snow operations or snowmaking occurred during the fourth quarter (July, August, and September), as these months are typically the warmest and driest of the WY. Heavenly does not add any additional snowmaking enhancement chemicals during snowmaking. If in the future chemical additives are added for the snowmaking operation, this information will be provided in future reports.

Snow conditioning typically entails the addition of huck salt to areas throughout the resort. Salt application is often used in the spring and during long periods of above average temperatures to lower the freezing point of water/ice/snow. The application of salt to the runs and areas around the terrain park lowers the temperature of the surface snow to prevent melting at night when temperatures do not reach freezing. This helps to maintain snow in areas of high traffic and usage (ramps, rails, boxes and landing areas). Snow and ice melt products are also applied to heavily used pedestrian areas including parking lots, walkways, and tram egress locations to provide safer guest access during the ski/snowboarding season. Application amounts are tracked to compare, contrast and limit salt (chloride) usage. As discussed above, the application of brine in the parking lots beginning during the 2016–2017 ski season was implemented to help to lower the application amount of salt and deicer usage.

8.2 Application and Monitoring

As stated above, no additional salt was applied during the fourth quarter of WY 2021. The fourth quarter monthly maintenance and applications logs are included in Appendix E along with the annual summary tables (Tables E-1 and E-2). A summary of each of the past 11 years of salt application is provided in Table 8-1 (WYs 2011–2021). Huck salt application values decreased across the mountain from 2013 to 2015. Total salt usage increased during 2016 and 2017, which were both years of above-average winter snowfall. Due to higher chloride levels recorded at the stream monitoring locations, salt application has been limited. Huck salt is stored in sealed bags, and approval by Mountain Operations managers is required prior to on-mountain application. As mentioned above, salt application at the Adventure Peak Tubing Area ceased in 2014 due to procedural changes. As discussed in past reports, snow and ice melt is applied to the upper parking lot walkways providing safer guest access to the main lodge from the parking areas. A hand spreader, or similar, is used to apply snowmelt in and around the lodge area. WY 2015 marked the first year huck salt (deicer) was tracked and reported at the California Base Lodge. The total use of huck salt at the California Base Lodge has varied since monitoring began in 2015. The highest recorded value for salt application at the California Base Lodge occurred in 2017, which can be attributed to the well-above-average precipitation and snowfall totals during WY 2017. Salt application at the California Base Lodge decreased substantially the following year but has steadily increased since

2018. Total salt application usage was below average during WY 2020, likely related to the below-average winter snowfall and resort closure due to COVID-19 concerns. Employee training and required approval of salt application by managers have been implemented over the years, helping to limit salt usage and correlated chloride levels in water samples.

8.3 Recommendations

Monthly and quarterly monitoring of deicer application should continue into the next 5-year comprehensive period. Results over the past 10 years generally show a decreasing trend in on-mountain salt application amounts, with some variation that may be correlated to precipitation and snowfall. Heavenly will continue to monitor and limit applied amounts of snowmelt (salt) to the access points in and around the California Base Lodge, providing safer means of preventing slip and fall occurrences. In theory, decreased salt application amounts and improvement associated with brine application (see Chapter 7), should correlate with lower chloride levels in Bijou Park Creek and Heavenly Valley Creek. Additional monitoring records over a longer period, and over varying precipitation years, will help to verify the application relationship with WY precipitation (snowfall) totals.

Table 8-1 Annual Huck Salt Application Records (2011–2021)

Water Year	Top of the Gondola (lbs)	World Cup Race Course (lbs)	Terrain Park (lbs)	Adventure Peak – Tubing Area (lbs)	California Base Parking Lot Application (lbs)	Tamarack Lodge Deck (lbs)	Tram Base Decks (lbs)	World Cup Foundation Building (lbs)	Total Salt Usage (lbs)
2011	250	900	3,360	3,400	-	-	-	-	7,910
2012	300	800	1,962	100	-	-	-	-	3,162
2013	450	1,680	4,160	400	-	-	-	-	6,690
2014	80	60	2,840	0	-	-	-	-	2,980
2015[1]	16	50	418	0	544	-	-	-	1,028
2016	38	240	0	0	2,982	-	-	-	3,260
2017[2]	0	0	555	0	3,295	463	1,050	31	5,394
2018	0	0	370	0	675	200	641	0	1,886
2019	40	0	1,580	0	1,737	359	380	0	4,096
2020	6	0	700	0	1,900	125	285	0	3,016
2021	10	0	705	0	2,626	10	55	0	3,406
Totals	1,190	3,730	16,650	3,900	13,759	1,157	2,411	31	42,828

1 WY 2015 marked the first year that deicer/salt application near and around the California Base Lodge was tracked on a monthly basis. Application is needed to provide safer walkability during the ski season (preventing slips/falls). Application has occurred in the past WYs; however, the amounts were not recorded.

2 WY 2017 was the first year that deicer/salt application monitoring occurred near and around the following locations: Tamarack Lodge, Tram Base and World Cup Foundation Building. Application was tracked on a monthly basis. Application likely occurred in the past WYs; however, the amounts were not recorded.

9 USFS Roads Monitoring

The latest MRP requires monitoring of USFS roads within Heavenly's boundary (Lahontan 2015b: 9). In March 2015, Vail Resorts, Inc. (Heavenly) and the LTBMU (USFS) entered a roads maintenance and reporting agreement to coordinate and cooperate on future maintenance and monitoring of the on-mountain roadway network (USFS 2015). This agreement lays out the framework for roadway maintenance, new roadway construction, annual meetings, and annual reporting activities.

The Heavenly Roads Maintenance Report for 2021 was submitted to the USFS in November 2021. The 2021 roads maintenance summary tables are included in this report as Appendix F. During the 2021 construction season, 14.03 miles of the on-mountain roadway network were maintained. No roadway improvements occurred in 2021. Effectiveness of road BMPs were evaluated in 2017, fulfilling a separate monitoring requirement. Results of this report were included as part of the BMP Effectiveness Annual Report submitted in May 2018. In lieu of using a separate/new protocol for roads, additional maintenance of key roadside drainages/sediment basins have been added annually into the Annual Work List (Powderbowl/Groove, Upper Shop, Maggie's, Hellwinkel's, and Galaxy). Heavenly continues to coordinate directly with the USFS on road maintenance activities, which has facilitated the additional monitoring of these key locations near drainages in association with continual BMP effectiveness/WMRP monitoring. The annual 2021 monitoring was limited in the summer and fall by the Caldor Fire. Unhealthy air quality (smoke) conditions, and National Forest closures resulted in a long period without reasonable on-mountain access.

In addition to implementing the new MRP, USFS Region 5 has phased out the Regional BMP Evaluation Program. In the past, this program provided additional roadway maintenance and monitoring. Moving forward, the USFS will require the new National USFS BMP Monitoring Program, which will address roadways, ski runs, and facilities. The program and protocol are still in draft form at the time of this report's preparation; however, the agency has actively been using these protocols over the past few years. A final version of the technical guide is not currently available to the public. The new National BMP Monitoring Program protocols programmatically assess BMP implementation and effectiveness for roadways and other land management practices (facilities and ski runs for example). All management practices associated with Heavenly will be included in the sample pool for random selection and annual monitoring conducted and reported on USFS staff.

Due to the small number of sites selected and random monitoring associated with the National BMP Monitoring Program targets (approximately six evaluations per forest per year), Heavenly and its consultants will continue to identify and address erosion and BMP effectiveness on resort roadways, ski runs, and facilities annually.

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10 Facilities Maintenance Monitoring

Additional required documentation for on-mountain monitoring can be found in Appendix E. Appendix E includes facilities monitoring checklists for the months of July and August of WY 2021; an August checklist was not completed due to the Caldor Fire, associated USFS forest closures, and use of the California Base Parking Lot for firefighting personnel and staging, as discussed in Chapter 2.9. Past quarterly monitoring report logs for WY 2021 can be found in the previously submitted quarterly reports. Appendix E also includes the salt application table for WY 2021, facilities watershed awareness training information, and stormwater maintenance reports. In July 2021, Pacific Stormwater inspected, cleaned, and maintained the stormwater vaults at the main lodge. All units were found to be in good working condition. The next maintenance is recommended for spring 2022.

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11 Facilities Watershed Awareness Training

As required by the MRP, Appendix E also includes a sign-in sheet documenting attendance at the facilities watershed awareness training, which was held on June 1, 7, and 14, 2021. A total of 47 employees attended the June 1 training, 50 employees attended the June 7 training, and 48 employees attended the June 14 training. In addition to the sign-in sheet, Appendix E also includes the slideshow presentation viewed during the training. Training topics included BMPs, weeds, fire danger, summer rules of the road, and rain shutdown.

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Heavenly Mountain Resort
Water Years 2017–2021

APPENDIX A

RAW WATER QUALITY CONSTITUENTS: WY 2017–2021

Appendix A
Raw Data for Water Quality Constituents: WY 2017–2021

A.1 Water Quality Tables

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Table A-1:		**Heavenly Mountain Resort water year 2016/2017 water quality monitoring data from station 43HVC-1A, Heavenly Valley Creek at Sky Meadows. This station is located above the snowmaking pond at an elevation of 8,525 feet.**									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2016-2017											
10/13/16	14:00	0.211	1.36	4.0	0.046	0.064	0.110	**0.024**	**0.46**	7.78	0
11/15/16	13:45	0.243	1.06	2.5	0.034	0.102	0.136	**0.017**	**0.57**	6.67	0
12/20/16	14:45	0.202	2.19	6.0	0.029	0.145	0.174	**0.026**	**0.56**	1.11	0.1
Second Quarter WY 2016-2017											
1/17/17	15:15	0.229	1.21	1.5	0.037	0.053	0.090	0.013	**0.47**	1.67	0
2/23/17	14:30	0.173	1.86	3.0	0.040	0.090	0.130	0.013	**0.45**	-8.89	0.1
3/16/17	14:05	0.173	3.74	3.5	0.038	0.096	0.134	**0.020**	**0.42**	5.00	0
Third Quarter WY 2016-2017											
4/4/17	14:00	0.244	2.87	5.0	0.033	0.140	0.173	**0.024**	**0.38**	2.78	0
4/19/17	13:50	0.215	4.25	5.0	0.034	0.157	**0.191**	**0.027**	**0.40**	2.78	0
5/4/17	13:30	0.939	4.48	8.0	0.064	0.241	**0.305**	**0.034**	**0.36**	10.56	0
5/18/17	13:35	1.58	2.40	4.0	0.035	0.117	0.152	**0.023**	**0.36**	3.33	0
6/1/17 [3]	14:30	5.75	5.48	13.0	0.035	0.186	**0.221**	**0.069**	**0.36**	6.11	0
6/8/17 [3]	14:00	6.45	5.18	13.5	0.057	0.151	**0.208**	**0.058**	**0.36**	6.11	0
6/22/17 [4]	15:10	-	40.3	**93.5**	0.083	0.460	**0.543**	**0.271**	**0.30**	16.11	0
6/29/2017[3]	14:30	6.69	9.33	34.5	0.059	0.167	**0.226**	**0.143**	**0.32**	11.67	0
Fourth Quarter WY 2016-2017											
7/13/17	14:05	4.980	1.44	3.0	0.026	0.083	0.109	**0.021**	**0.30**	15.00	0
8/23/17	13:30	1.306	2.12	2.0	0.018	0.084	0.102	**0.018**	**0.27**	11.67	0.1
9/14/17	14:05	0.593	2.06	1.0	0.016	0.077	0.093	**0.017**	**0.30**	8.33	0
Annual Summary	**Minimum**	0.173	1.060	1.00	0.016	0.053	0.090	0.013	0.27	-8.9	-
	Maximum	6.690	40.300	93.50	0.083	0.460	0.543	0.271	0.57	16.1	-
	Average	1.874	5.372	11.94	0.040	0.142	**0.182**	**0.048**	**0.39**	6.3	-
90th Percentile		-	-	46.30	-	-	-	-	-	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

[3] Flow is approximate due to flume being overtopped

[4] Unable to measure flow/depth at flume due to unsafe access at flood stage (Overtopping Flume and Stream Banks).

Table A-1:		Heavenly Mountain Resort water year 2017/2018 water quality monitoring data from station 43HVC-1A, Heavenly Valley Creek at Sky Meadows. This station is located above the snowmaking pond at an elevation of 8,525 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2017-2018											
10/18/17	14:00	0.361	0.88	1.0	0.012	0.074	0.086	0.014	**0.31**	7.22	0
11/14/17	***UNABLE TO SAMPLE DUE TO ACCESS ISSUES ON MOUNTAIN									0.56	0.3
12/21/17 [3]	13:50	-	0.92	1.0	0.027	0.071	0.098	0.010	**0.40**	-6.11	0.2
Second Quarter WY 2017-2018											
1/17/18	13:30	0.187	1.30	1.5	0.009	0.093	0.102	0.013	**0.38**	3.89	0
2/14/18	14:25	0.135	2.73	1.5	0.020	0.062	0.082	0.015	**0.36**	-5.56	0
3/20/18	14:15	0.100	1.92	1.5	0.032	0.057	0.089	0.013	**0.35**	0.00	0.1
Third Quarter WY 2017-2018											
4/4/18	14:25	0.187	3.49	4.5	0.036	0.099	0.135	**0.019**	**0.34**	4.44	0
4/18/18	13:35	0.340	1.93	2.5	0.036	0.089	0.125	0.015	**0.38**	-1.11	0
5/3/18	13:50	0.753	4.88	6.0	0.036	0.201	**0.237**	**0.041**	**0.33**	5.00	0
5/17/18	14:15	1.462	7.03	9.0	0.037	0.174	**0.211**	**0.042**	**0.31**	4.44	0.7
5/23/18	13:45	1.904	4.38	6.0	0.044	0.149	**0.193**	**0.032**	**0.31**	6.67	0.2
5/30/18	14:00	2.554	2.36	5.0	0.038	0.128	0.166	**0.027**	**0.31**	9.44	0
6/6/18[4]	13:30	3.489	5.85	7.5	0.063	0.171	**0.234**	**0.038**	**0.35**	8.89	0
6/20/18	13:20	1.904	1.39	2.5	0.030	0.073	0.103	**0.020**	**0.35**	13.33	0
Fourth Quarter WY 2017-2018											
7/19/18	13:20	0.868	1.37	2.5	0.020	0.073	0.093	**0.020**	**0.30**	16.67	0
8/16/18	14:05	0.340	1.54	2.0	0.018	0.066	0.084	**0.013**	**0.28**	13.89	0
9/12/18	14:00	0.244	1.52	2.5	0.016	0.060	0.076	**0.019**	**0.30**	7.78	0
Annual Summary	**Minimum**	0.10	0.88	1.00	0.009	0.057	0.076	0.010	0.28	-6.1	-
	Maximum	3.49	7.03	9.00	0.063	0.201	0.237	0.042	0.40	16.7	-
	Average	1.19	2.72	3.53	0.030	0.103	0.132	**0.022**	**0.34**	5.3	-
	90th Percentile	-	-	7.95	-	-	-	-	-	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

[3] Unable to measure flow due to ice on 12/21; however, water quality samples collected

[4] Unable to measure flow/depth at the flume due to flood stage (overtopping flume). Flow was measured using the Marsh Mcbirney flow meter.

Table A-1: Heavenly Mountain Resort water year 2018/2019 water quality monitoring data from station 43HVC-1A, Heavenly Valley Creek at Sky Meadows. This station is located above the snowmaking pond at an elevation of 8,525 feet.

Date	Time	Discharge (cfs)	Turbidity (ntu)	Suspended Sediment [2] (mg/L)	Total Nitrite/Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Average Temperature (Deg C)	Precipitation (in)
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2018-2019											
10/17/18	13:35	0.187	0.72	1.0	0.011	0.055	0.066	0.014	**0.38**	5.00	0
11/15/18	13:25	0.135	0.83	1.5	0.011	0.043	0.054	0.011	**0.31**	3.33	0
12/12/18	14:00	0.135	0.99	1.0	0.014	0.065	0.079	0.011	**0.41**	-1.11	0
Second Quarter WY 2018-2019											
1/23/19	14:00	0.111	1.59	2.0	0.012	0.067	0.079	**0.016**	**0.42**	0.00	0
2/12/19	14:45	0.069	1.48	1.5	0.015	0.048	0.063	**0.019**	**0.40**	-3.33	0.1
3/20/19	14:40	0.046	1.81	2.5	0.016	0.058	0.074	0.012	**0.37**	-2.78	0.1
Third Quarter WY 2018-2019											
4/10/19	13:35	0.069	2.50	3.0	0.019	0.098	0.117	**0.028**	**0.37**	-1.67	0
4/24/19	13:20	0.323	1.86	3.0	0.029	0.124	0.153	**0.023**	**0.45**	7.78	0
5/8/19	13:55	1.037	8.88	8.0	0.030	0.142	0.172	**0.047**	**0.40**	6.67	0
5/22/19	13:30	0.963	1.47	3.5	0.037	0.061	0.098	**0.018**	**0.43**	0.00	0.7
6/5/19[3]	13:20	< 3.456	13.90	22.0	0.025	0.286	**0.311**	**0.096**	**0.36**	11.67	0
6/19/19[3]	13:20	< 5.982	10.70	25.0	0.055	0.240	**0.295**	**0.096**	**0.38**	13.33	0
6/26/19[3]	13:10	< 5.087	3.25	2.5	0.035	0.084	0.119	**0.025**	**0.35**	7.78	0
Fourth Quarter WY 2018-2019											
7/2/19[3]	13:20	< 4.244	5.52	2.5	0.025	0.088	0.113	**0.023**	**0.35**	10.56	0
7/17/19	13:00	1.966	1.81	2.0	0.016	0.072	0.088	**0.023**	**0.28**	12.78	0
8/14/19	13:50	0.753	2.66	2.0	0.017	0.090	0.107	**0.018**	**0.25**	15.56	0
9/18/19	13:30	0.503	2.57	2.5	0.012	0.15	0.162	**0.025**	**0.33**	4.44	0
Annual Summary	**Minimum**	0.046	0.72	1.00	0.011	0.043	0.054	0.011	**0.25**	-3.33	-
	Maximum	5.982	13.90	25.00	0.055	0.286	**0.311**	**0.096**	**0.45**	15.56	-
	Average	1.474	3.86	5.03	0.022	0.104	0.126	**0.030**	**0.37**	5.29	-
	90th Percentile	-	-	22.60	-	-	-	**-**	**-**	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

[3] Flow measurement is approximate (underestimate) due to flow out of banks and flume being overtopped.

Heavenly Valley Creek - Sky Meadows (43HVC-1A)

Table A-1:		Heavenly Mountain Resort water year 2019/2020 water quality monitoring data from station 43HVC-1A, Heavenly Valley Creek at Sky Meadows. This station is located above the snowmaking pond at an elevation of 8,525 feet.										
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A	N/A
First Quarter WY 2019-2020												
10/15/19	13:10	0.357	1.27	2.0	0.011	0.137	0.148	0.015	**0.3**	5.8	16.9	0.0
11/13/19	12:50	0.244	1.17	1.5	0.007	0.134	0.141	0.014	**0.3**	9.8	11.8	0.0
12/11/19	13:40	0.173	1.06	1.0	0.015	0.061	0.076	0.012	**0.7**	1.8	-0.3	0.0
Second Quarter WY 2019-2020												
1/14/20	14:10	0.123	1.82	2.5	0.007	0.055	0.062	**0.016**	**0.4**	0.2	-0.1	0.1
2/11/20	13:40	0.100	3.18	14.5	0.009	0.141	0.150	**0.021**	**0.4**	1.0	1.4	0.0
3/23/20	-	Neither flow nor water quality samples could be collected because of restricted on-mountain access due to COVID-19 resort closure.										0.0
Third Quarter WY 2019-2020												
4/7/20	-	Neither flow nor water quality samples could be collected because of restricted on-mountain access due to COVID-19 resort closure.										0.5
4/21/20	-	Neither flow nor water quality samples could be collected because of restricted on-mountain access due to COVID-19 resort closure.										0.0
5/5/20	-	Neither flow nor water quality samples could be collected because of restricted on-mountain access due to COVID-19 resort closure.										0.0
5/20/20	13:05	0.830	1.69	4.0	0.037	0.078	0.115	**0.025**	**0.7**	4.5	4.7	0.2
5/27/20	13:00	0.939	2.83	2.5	0.025	0.101	0.126	**0.023**	**0.8**	9.8	20.3	0.0
6/2/20	13:20	1.062	2.17	5.0	0.024	0.114	0.138	**0.019**	**0.7**	10.3	18.3	0.0
6/16/20	12:55	1.037	1.88	7.5	0.027	0.089	0.116	**0.020**	**0.8**	10.0	14.1	0.0
6/30/20	13:30	0.503	1.59	4.0	0.018	0.097	0.115	**0.020**	**0.5**	11.9	19.7	0.0
Fourth Quarter WY 2019-2020												
7/14/20	13:05	0.307	1.19	2.5	0.013	0.100	0.113	**0.021**	**0.5**	14.0	25.0	0.0
8/18/20	13:25	0.111	2.01	5.0	0.008	0.100	0.108	**0.016**	**0.5**	14.0	23.0	0.0
9/22/20	13:00	0.069	2.36	3.5	0.005	0.059	0.064	**0.017**	**0.5**	8.5	25.0	0.0
Annual Summary	**Minimum**	0.069	1.06	1.00	0.005	0.055	0.062	0.012	**0.30**	0.2	-0.3	-
	Maximum	1.062	3.18	14.50	0.037	0.141	0.150	**0.025**	**0.80**	14.0	25.0	-
	Average	0.481	1.86	4.27	0.016	0.097	0.113	**0.018**	**0.55**	7.8	13.8	-
	90th Percentile	-	-	11.70	-	-	-	**-**	**-**		-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

Table A-1:			Heavenly Mountain Resort water year 2020-2021 water quality monitoring data from station 43HVC-1A, Heavenly Valley Creek at Sky Meadows. This station is located above the snowmaking pond at an elevation of 8,525 feet.										
Date	**Notes**	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards	1		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A	N/A
First Quarter WY 2020-2021													
10/20/20		13:40	0.026	1.81	3.0	0.002	0.065	0.067	0.015	**0.6**	11.5	22.5	0.0
11/19/20		13:30	0.060	32.0	38	0.002	0.433	**0.435**	**0.147**	**1.4**	N/A	18.0	2.2
12/9/20		13:20	0.069	1.08	1.0	0.004	0.047	0.051	**0.016**	**0.9**	N/A	N/A	0.0
Second Quarter WY 2020-2021													
1/13/21		13:10	0.060	5.94	6.0	0.009	0.235	**0.244**	**0.035**	**0.579**	2.5	3.9	0.0
2/17/21	3	13:45	0.042	1.65	2.5	0.003	0.079	0.082	0.015	**0.469**	2.7	1.0	0.0
3/17/21	3	13:25	0.027	2.11	2.5	0.003	0.05	0.054	0.011	**0.214**	1.8	5.3	0.0
Third Quarter WY 2020-2021													
4/6/21	3	13:25	0.079	1.09	1.5	0.027	0.118	0.145	**0.021**	**0.719**	3.7	10.1	0.0
4/20/21		13:15	0.187	1.69	2.0	0.032	0.171	**0.203**	**0.029**	**0.954**	5.7	13.6	0.0
5/4/21		13:30	0.357	2.85	4.5	0.031	0.20	**0.227**	**0.025**	**0.824**	8.20	22.9	0.0
5/18/21	3	12:55	0.511	1.32	1.5	0.035	0.098	0.133	**0.019**	**0.850**	10.7	16.2	0.0
5/25/21		12:50	0.624	1.58	2.5	0.030	0.124	0.154	**0.020**	**0.718**	7.7	14.0	0.0
6/1/21	3	12:55	0.556	1.25	2.0	0.020	0.087	0.107	0.012	**0.763**	11.9	18.6	0.0
6/15/21		13:15	0.651	1.84	4.0	0.050	0.114	0.164	**0.020**	**1.04**	11.8	14.4	0.0
6/30/21	3	12:35	0.308	1.76	4.0	0.050	0.087	0.137	**0.018**	**0.767**	12.7	22.8	0.0
Fourth Quarter WY 2020-2021													
7/13/21		13:15	0.078	1.94	3.5	0.014	0.111	0.125	**0.024**	**0.644**	14.1	24.3	0.0
No WQ Samples Collected in August due to Caldor Fire, Forest Closures and Basin Evacuation													
9/20/21		11:50	0.034	11.70	8.5	0.003	0.104	0.107	**0.043**	**0.452**	8.3	17.5	0.0
Annual Summary		**Minimum**	0.026	1.08	1.00	0.002	0.047	0.051	0.011	0.214	1.80	1.00	0.0
		Maximum	0.651	32.0	38.0	0.050	0.433	0.435	0.147	1.40	14.1	24.3	2.2
		Average	0.270	4.83	5.88	0.021	0.131	0.152	0.031	0.769	8.69	15.7	0.17
		90th Percentile			17.4								

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

[3] The Chloride Sample Batch Matric Spike (MS) and/or Matrix Spike Duplicate (MSD) were outside acceptable limits, batch Laboratory Control Sample (LCS) was acceptable.

Table A-2: **Heavenly Mountain Resort water year 2016/2017 water quality monitoring data from station 43HVC-2, Heavenly Valley Creek below Patsy's Chair. This station is located just beyond ski area development within this watershed at an elevation of 8,000 feet.**

Date	Time	Discharge (cfs)	Turbidity (ntu)	Suspended Sediment [2] (mg/L)	Total Nitrite/Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Average Temperature (Deg C)	Precipitation (in)
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2016-2017											
10/13/16	13:45	0.100	0.48	1.0	0.080	0.053	0.133	**0.023**	**0.96**	7.78	0
11/15/16	13:25	0.174	0.45	1.0	0.062	0.056	0.118	0.013	**1.0**	6.67	0
12/20/2016 [3]	15:05	0.123	0.73	1.5	0.075	0.067	0.142	**0.016**	**0.72**	1.11	0.1
Second Quarter WY 2016-2017											
1/17/17	15:30	0.201	2.08	2.0	0.066	0.090	0.156	**0.020**	**1.4**	1.67	0
2/23/17	15:40	0.230	1.06	1.0	0.074	0.057	0.131	0.011	**0.99**	-8.89	0.1
3/16/17	14:45	0.292	1.06	1.5	0.068	0.063	0.131	**0.016**	**0.87**	5.00	0
Third Quarter WY 2016-2017											
4/4/17	14:35	0.505	0.96	1.5	0.078	0.065	0.143	0.015	**0.78**	2.78	0
4/19/17	14:30	0.544	1.58	1.0	0.096	0.060	0.156	**0.019**	**0.81**	2.78	0
5/4/17	13:45	3.09	14.6	20.0	0.073	0.242	**0.315**	**0.075**	**0.54**	10.56	0
5/18/17	13:45	4.67	2.43	3.5	0.064	0.104	0.168	**0.025**	**0.56**	3.33	0
6/1/17 [4]	14:00	13.45	15.3	24.5	0.047	0.198	**0.245**	**0.096**	**0.43**	6.11	0
6/8/17 [4]	14:20	20.88	5.79	9.0	0.052	0.166	**0.218**	**0.047**	**0.39**	6.11	0
6/22/17 [4]	14:45	29.23	20.5	47.5	0.064	0.235	**0.299**	**0.137**	**0.35**	16.11	0
6/29/17	14:45	17.03	2.89	5.0	0.052	0.092	0.144	**0.029**	**0.36**	11.67	0
Fourth Quarter WY 2016-2017											
7/13/17	13:20	6.000	1.62	3.0	0.024	0.103	0.127	**0.024**	**0.38**	15.00	0
8/23/17	13:05	1.466	2.06	2.0	0.011	0.120	0.131	**0.021**	**0.49**	11.67	0.1
9/14/17	13:52	0.712	1.71	1.0	0.016	0.107	0.123	**0.022**	**0.52**	8.33	0
Annual Summary	**Minimum**	0.100	0.450	1.00	0.011	0.053	0.118	0.011	0.35	-8.9	-
	Maximum	29.230	20.500	47.50	0.096	0.242	0.315	0.137	1.40	16.1	-
	Average	5.806	4.429	7.41	0.059	0.110	0.169	**0.036**	**0.68**	6.3	-
90th Percentile		-	-	29.10	-	-	-	**-**	**-**	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

[3] The matrix spike/matrix spike duplicate (MS/MSD) values for the chloride sample were

[4] Flow is approximate due to flume being overtopped

Table A-2:		Heavenly Mountain Resort water year 2017/2018 water quality monitoring data from station 43HVC-2, Heavenly Valley Creek below Patsy's Chair. This station is located just beyond ski area development within this watershed at an elevation of 8,000 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2017-2018											
10/18/17	13:40	0.626	1.05	1.5	0.015	0.101	0.116	**0.017**	**0.55**	7.22	0
11/14/17	13:40	0.393	0.67	1.5	0.028	0.068	0.096	**0.019**	**0.76**	0.56	0.3
12/21/17	13:50	0.174	0.77	1.5	0.063	0.095	0.158	0.011	**1.00**	-6.11	0.2
Second Quarter WY 2017-2018											
1/17/18	14:00	0.174	5.24	4.5	0.048	0.073	0.121	**0.027**	**0.96**	3.89	0
2/14/18	15:00	0.100	1.47	1.0	0.047	0.064	0.111	0.012	**0.95**	-5.56	0
3/20/18	14:35	0.148	1.42	1.0	0.051	0.050	0.101	**0.016**	**0.96**	0.00	0.1
Third Quarter WY 2017-2018											
4/4/18	15:15	0.292	0.76	1.0	0.049	0.053	0.102	0.012	**1.40**	4.44	0
4/18/18	13:40	0.668	1.38	1.5	0.051	0.054	0.105	0.014	**0.81**	-1.11	0
5/3/18	14:05	1.638	32.3	29.0	0.051	0.162	**0.213**	**0.114**	**1.00**	5.00	0
5/17/18	13:50	2.527	8.73	9.5	0.018	0.171	0.189	**0.041**	**0.63**	4.44	0.7
5/23/18	13:30	2.665	3.31	2.5	0.027	0.107	0.134	**0.022**	**0.55**	6.67	0.2
5/30/18	13:45	3.316	2.40	3.0	0.030	0.085	0.115	**0.021**	**0.49**	9.44	0
6/6/18	13:15	3.543	2.04	3.5	0.021	0.089	0.110	**0.024**	**0.44**	8.89	0
6/20/18	13:10	3.093	1.85	2.0	0.016	0.096	0.112	**0.017**	**0.44**	13.33	0
Fourth Quarter WY 2017-2018											
7/19/18	13:05	0.894	1.46	3.0	0.017	0.112	0.129	**0.021**	**0.46**	16.67	0
8/16/18	13:50	0.505	2.0	3.0	0.018	0.104	0.122	**0.017**	**0.49**	13.89	0
9/12/18	13:35	0.358	2.0	1.0	0.017	0.084	0.101	**0.022**	**0.54**	7.78	0
Annual Summary	**Minimum**	0.10	0.67	1.00	0.015	0.050	0.096	0.011	0.44	-6.1	-
	Maximum	3.54	32.30	29.00	0.063	0.171	0.213	0.114	1.40	16.7	-
	Average	1.46	4.05	4.12	0.033	0.092	0.126	**0.025**	**0.73**	5.3	-
	90th Percentile	-	-	13.40	-	-	-	-	-	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

Table A-2:		Heavenly Mountain Resort water year 2018/2019 water quality monitoring data from station 43HVC-2, Heavenly Valley Creek below Patsy's Chair. This station is located just beyond ski area development within this watershed at an elevation of 8,000 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2018-2019											
10/17/18	13:15	0.324	1.01	1.0	0.008	0.061	0.069	**0.019**	**0.58**	5.00	0
11/15/18	13:05	0.230	0.80	1.0	0.021	0.05	0.071	0.012	**1.10**	3.33	0
12/12/18	14:40	0.079	0.52	0.5	0.032	0.059	0.091	**0.016**	**0.97**	-1.11	0
Second Quarter WY 2018-2019											
1/23/19	14:30	0.060	0.73	2.0	0.022	0.052	0.074	**0.016**	**1.20**	0.00	0
2/12/19	15:15	0.015	1.45	1.0	0.026	0.052	0.078	0.012	**1.30**	-3.33	0.1
3/21/19	15:00	0.187	0.83	1.0	0.046	0.048	0.094	0.011	**0.99**	-2.78	0.1
Third Quarter WY 2018-2019											
4/10/19	13:55	0.260	1.06	1.0	0.052	0.045	0.097	**0.020**	**2.30**	-1.67	0
4/24/19	13:45	0.756	2.34	2.0	0.046	0.102	0.148	**0.023**	**0.99**	7.78	0
5/8/19	13:20	2.066	7.30	6.0	0.066	0.137	**0.203**	**0.038**	**0.75**	6.67	0
5/22/19	14:00	2.326	10.20	10.5	0.054	0.128	0.182	**0.049**	**0.64**	0.00	0.7
6/5/19	14:00	6.000	16.10	27.0	0.029	0.197	**0.226**	**0.092**	**0.50**	11.67	0
6/19/19	13:00	11.194	9.31	10.0	0.045	0.119	0.164	**0.044**	**0.48**	13.33	0
6/26/19	12:50	8.044	1.88	1.5	0.030	0.091	0.121	**0.020**	**0.42**	7.78	0
Fourth Quarter WY 2018-2019											
7/2/19	13:00	1.757	1.02	1.5	0.024	0.082	0.106	**0.023**	**0.57**	10.56	0
7/17/19	12:30	3.241	1.67	2.0	0.01	0.127	0.137	**0.020**	**0.40**	12.78	0
8/14/19	12:40	0.894	1.16	1.0	0.016	0.073	0.089	**0.019**	**0.49**	15.56	0
9/18/19	12:55	0.230	2.15	3.0	0.023	0.080	0.103	**0.030**	**0.72**	4.44	0
Annual Summary	**Minimum**	0.015	0.52	0.50	0.008	0.045	0.069	0.011	**0.40**	-3.33	-
	Maximum	11.194	16.10	27.0	0.066	0.197	**0.226**	**0.092**	**2.30**	15.56	-
	Average	2.215	3.50	4.24	0.032	0.088	0.121	**0.027**	**0.85**	5.29	-
	90th Percentile	-	-	13.80	-	-	-	**-**	**-**	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

Heavenly Valley Creek - Below Patsys
(43HVC-2)

Table A-2:		Heavenly Mountain Resort water year 2019/2020 water quality monitoring data from station 43HVC-2, Heavenly Valley Creek below Patsy's Chair. This station is located just beyond ski area development within this watershed at an elevation of 8,000 feet.										
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A	N/A
First Quarter WY 2019-2020												
10/15/19	12:50	0.505	0.87	1.0	0.007	0.069	0.076	**0.016**	**0.4**	5.1	13.3	0.0
11/13/19	12:35	0.358	0.53	1.0	0.008	0.055	0.063	0.015	**0.6**	10.1	4.7	0.0
12/11/19	13:05	0.100	0.65	0.5	0.002	0.078	0.080	**0.018**	**1.3**	2.5	0.9	0.0
Second Quarter WY 2019-2020												
1/14/20	14:40	0.100	0.29	2.0	0.015	0.054	0.069	**0.017**	**0.9**	1.6	0.9	0.1
2/11/20	14:00	0.100	0.27	1.5	0.025	0.052	0.077	0.015	**0.9**	2.0	4.9	0.0
3/23/20	-	Neither flow nor water quality samples could be collected because of restricted on-mountain access due to COVID-19 resort closure.										0.0
Third Quarter WY 2019-2020												
4/7/20	-	Neither flow nor water quality samples could be collected because of restricted on-mountain access due to COVID-19 resort closure.										0.5
4/21/20	-	Neither flow nor water quality samples could be collected because of restricted on-mountain access due to COVID-19 resort closure.										0.0
5/5/20	12:45	0.942	1.37	2.7	0.049	0.115	0.164	**0.020**	**1.3**	6.8	15.1	0.0
5/20/20	12:45	1.142	1.69	2.5	0.037	0.100	0.137	**0.026**	**0.9**	4.6	4.2	0.2
5/27/20	12:45	1.194	1.62	2.5	0.023	0.119	0.142	**0.019**	**0.9**	9.6	20.8	0.0
6/2/20	13:00	1.142	1.62	3.0	0.020	0.103	0.123	**0.019**	**0.9**	10.0	20.8	0.0
6/16/20	12:40	1.638	17.10	12.0	0.010	0.170	0.180	**0.051**	**1.0**	9.9	14.4	0.0
6/30/20	13:15	0.668	1.24	3.0	0.013	0.122	0.135	**0.018**	**0.6**	11.9	19.7	0.0
Fourth Quarter WY 2019-2020												
7/14/20	12:45	0.090	0.80	1.5	0.054	0.077	0.131	**0.018**	**1.3**	11.0	23.5	0.0
8/18/20	13:05	0.174	0.89	3.0	0.026	0.074	0.100	**0.020**	**0.7**	11.0	25.0	0.0
9/22/20	12:40	0.100	1.03	3.0	0.021	0.070	0.091	**0.024**	**0.7**	7.0	17.0	0.0
Annual Summary	**Minimum**	0.090	0.27	0.50	0.002	0.052	0.000	0.015	**0.40**	1.6	0.9	-
	Maximum	1.638	17.10	12.00	0.054	0.170	0.180	**0.051**	**1.30**	11.9	25.0	-
	Average	0.590	2.14	2.80	0.022	0.090	0.105	**0.021**	**0.89**	7.4	13.2	-
	90th Percentile	-	-	7.50	-	-	-	-	-		-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

Table A-2:			Heavenly Mountain Resort water year 2020-2021 water quality monitoring data from station 43HVC-2, Heavenly Valley Creek below Patsy's Chair. This station is located just beyond ski area development within this watershed at an elevation of 8,000 feet.										
Date	**Notes**	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards	1		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A	N/A
First Quarter WY 2020-2021													
10/20/20		13:20	0.060	1.11	1.5	0.017	0.051	0.068	**0.018**	**1.2**	10.0	25.0	0.0
11/19/20		14:05	0.079	1.31	1.0	0.001	0.091	0.092	**0.022**	**1.9**	N/A	N/A	2.2
12/9/20		13:00	0.079	0.30	2.0	0.030	0.043	0.073	**0.023**	**1.6**	N/A	N/A	0.0
Second Quarter WY 2020-2021													
1/13/21		13:40	0.123	10.3	8.5	0.028	0.332	**0.360**	**0.044**	**3.71**	3.2	3.9	0.0
2/17/21		14:10	No samples collected or flow measured due to extremely low flow conditions as the site.								N/A	N/A	0.0
3/17/21		14:10	No samples collected or flow measured due to extremely low flow conditions as the site.								N/A	N/A	0.0
Third Quarter WY 2020-2021													
4/6/21		13:40	No samples collected or flow measured due to extremely low flow conditions as the site.								N/A	N/A	0.0
4/20/21		13:25	0.292	4.95	3.5	0.03	0.119	0.149	**0.032**	**1.38**	N/A	N/A	0.0
5/4/21		13:10	0.467	1.03	1.5	0.062	0.085	0.147	**0.018**	**1.40**	7.4	25.2	0.0
5/18/21	3	12:40	0.505	0.83	1.5	0.038	0.103	0.141	0.014	**1.19**	9.6	19.2	0.0
5/25/21		12:40	0.544	0.61	1.5	0.026	0.086	0.112	0.013	**1.12**	7.7	14.0	0.0
6/1/21	3	12:40	0.505	0.57	1.0	0.022	0.073	0.095	0.009	**1.08**	11.6	23.8	0.0
6/15/21		12:55	0.505	0.99	3.0	0.017	0.083	0.100	0.015	**1.04**	12.6	16.0	0.0
6/30/21	3	12:20	0.292	0.86	3.5	0.017	0.086	0.103	0.014	**1.06**	13.3	23.3	0.0
Fourth Quarter WY 2020-2021													
7/13/21		13:00	0.123	0.40	1.0	0.046	0.078	0.124	**0.021**	**1.19**	13.7	30.4	0.0
No WQ Samples Collected in August due to Caldor Fire, Forest Closures and Basin Evacuation													
9/20/21		11:30	0.005	28.10	29.5	0.008	0.392	0.400	**0.127**	**1.35**	7.9	10.4	0.0
Annual Summary		**Minimum**	0.005	0.30	1.00	0.001	0.043	0.068	0.009	**1.04**	3.2	3.9	0.0
		Maximum	0.544	28.10	29.50	0.062	0.392	0.400	**0.127**	**3.71**	13.7	30.4	2.2
		Average	0.275	3.95	4.54	0.026	0.125	0.151	**0.028**	**1.48**	9.7	19.1	0.1
		90th Percentile			21.10								

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

[3] For Chloride, batch MS and/or MSD were outside acceptance limits, batch LCS was acceptable.

Table A-3:		Heavenly Mountain Resort water year 2016/2017 water quality monitoring data from station 43HVC-3, Heavenly Valley Creek at the Property Line. This station is located just above the Forest Service property line and subdivision development at an elevation of 6,620 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2016-2017											
10/13/16	12:15	0.042	6.25	1.0	0.005	0.057	0.062	**0.023**	**0.82**	7.78	0
11/15/16	12:00	0.158	0.20	1.0	0.003	0.050	0.053	0.011	**0.95**	6.67	0
12/20/16	12:00	0.088	1.77	4.0	0.003	0.094	0.097	**0.021**	**1.1**	1.11	0.1
Second Quarter WY 2016-2017											
1/17/17	13:50	0.394	1.47	2.0	0.001	0.075	0.076	**0.018**	**1.1**	1.67	0
2/23/17	12:30	0.475	0.75	1.0	0.002	0.048	0.050	0.011	**0.95**	-8.89	0.1
3/16/17	12:30	0.913	0.80	1.5	0.003	0.067	0.070	0.015	**0.80**	5.00	0
Third Quarter WY 2016-2017											
4/4/17	12:20	1.69	0.55	1.0	0.003	0.060	0.063	**0.017**	**0.70**	2.78	0
4/19/17	12:25	1.81	0.74	1.0	0.003	0.062	0.065	**0.019**	**0.72**	2.78	0
5/4/17	12:05	5.0	9.50	17.0	0.025	0.254	**0.279**	**0.050**	**0.56**	10.56	0
5/18/17	12:10	8.66	6.36	14.0	0.025	0.104	0.129	**0.040**	**0.56**	3.33	0
6/1/17	12:15	20.02	8.72	18.0	0.030	0.158	0.188	**0.080**	**0.45**	6.11	0
6/8/17	12:30	23.62	40.5	**71.0**	0.036	0.280	**0.316**	**0.202**	**0.40**	6.11	0
6/22/17	12:50	31.60	33.0	**87.0**	0.047	0.414	**0.461**	**0.213**	**0.36**	16.11	0
6/29/17	12:30	20.30	5.82	18.0	0.041	0.121	0.162	**0.074**	**0.38**	11.67	0
Fourth Quarter WY 2016-2017											
7/13/17	11:45	6.82	8.52	14.0	0.017	0.179	**0.196**	**0.054**	**0.39**	15.00	0
8/23/17	11:40	2.09	1.89	1.5	0.005	0.175	0.180	**0.022**	**0.5**	11.67	0.1
9/14/17	12:20	1.45	1.05	3.0	0.003	0.118	0.121	**0.027**	**0.51**	8.33	0
Annual Summary	**Minimum**	0.04	0.20	1.00	0.001	0.048	0.050	0.011	0.36	-8.9	-
	Maximum	31.60	40.50	87.00	0.047	0.414	0.461	0.213	1.10	16.1	-
	Average	7.36	7.52	15.06	0.015	0.136	0.151	**0.053**	**0.66**	6.3	-
90th Percentile		-	-	**74.20**	-	-	-	-	-	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

Table A-3:		Heavenly Mountain Resort water year 2017/2018 water quality monitoring data from station 43HVC-3, Heavenly Valley Creek at the Property Line. This station is located just above the Forest Service property line and subdivision development at an elevation of 6,620 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2017-2018											
10/18/17	12:10	1.029	0.70	0.5	0.001	0.068	0.069	0.015	**0.51**	7.22	0
11/14/17	12:05	0.448	0.45	1.0	0.003	0.063	0.066	**0.020**	**0.69**	0.56	0.3
12/21/17	12:25	0.223	2.89	11.5	0.004	0.13	0.134	**0.024**	**0.87**	-6.11	0.2
Second Quarter WY 2017-2018											
1/17/18	11:40	0.195	0.46	0.5	0.004	0.054	0.058	0.015	**0.76**	3.89	0
2/14/18	12:25	0.088	1.34	1.0	0.005	0.06	0.065	0.015	**0.76**	-5.56	0
3/20/18	12:55	0.229	0.43	0.5	0.004	0.052	0.056	0.014	**0.79**	0.00	0.1
Third Quarter WY 2017-2018											
4/4/18	12:30	0.616	2.50	2.5	0.004	0.075	0.079	**0.022**	**0.97**	4.44	0
4/18/18	11:50	1.155	1.04	1.0	0.007	0.056	0.063	0.015	**0.77**	-1.11	0
5/3/18	12:20	2.292	1.78	1.5	0.011	0.067	0.078	**0.016**	**0.33**	5.00	0
5/17/18	12:00	2.923	3.33	3.0	0.010	0.083	0.093	**0.027**	**0.31**	4.44	0.7
5/23/18	12:15	3.073	2.59	3.0	0.007	0.086	0.093	**0.022**	**0.31**	6.67	0.2
5/30/18	12:15	5.280	2.45	2.5	0.010	0.097	0.107	**0.020**	**0.31**	9.44	0
6/6/18	11:50	4.497	2.59	4.0	0.009	0.091	0.100	**0.028**	**0.45**	8.89	0
6/20/18	11:50	3.144	1.84	2.0	0.009	0.142	0.151	**0.023**	**0.46**	13.33	0
Fourth Quarter WY 2017-2018											
7/19/18	11:35	1.354	1.26	2.5	0.008	0.082	0.090	**0.020**	**0.48**	16.67	0
8/16/18	12:25	0.642	1.13	2.0	0.010	0.072	0.082	**0.016**	**0.51**	13.89	0
9/12/18	12:25	0.364	0.63	1.0	0.007	0.053	0.060	**0.022**	**0.57**	7.78	0
Annual Summary	**Minimum**	0.09	0.43	0.50	0.001	0.052	0.056	0.014	0.31	-6.1	-
	Maximum	5.28	3.33	11.5	0.011	0.142	0.151	0.028	0.97	16.7	-
	Average	1.85	1.61	2.35	0.007	0.078	0.085	**0.020**	**0.58**	5.3	-
	90th Percentile	-	-	5.50	-	-	-	-	-	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

Table A-3:		**Heavenly Mountain Resort water year 2018/2019 water quality monitoring data from station 43HVC-3, Heavenly Valley Creek at the Property Line. This station is located just above the Forest Service property line and subdivision development at an elevation of 6,620 feet.**									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2018-2019											
10/17/18	11:40	0.233	0.94	1.0	0.003	0.059	0.062	**0.020**	**0.62**	5.00	0
11/15/18	11:30	0.092	0.35	1.0	0.005	0.041	0.046	0.015	**0.67**	3.33	0
12/12/18	12:20	0.075	1.32	3.0	0.004	0.071	0.075	**0.023**	**0.78**	-1.11	0
Second Quarter WY 2018-2019											
1/23/19	12:10	0.019	1.36	4.0	0.005	0.089	0.094	**0.028**	**0.79**	0.00	0
2/12/19	12:45	0.007	1.80	4.0	0.006	0.092	0.098	**0.023**	**0.76**	-3.33	0.1
3/21/19	12:15	0.254	0.90	1.5	0.003	0.059	0.062	0.012	**0.92**	-2.78	0.1
Third Quarter WY 2018-2019											
4/10/19	11:55	0.579	0.93	1.5	0.003	0.080	0.083	**0.019**	**1.00**	-1.67	0
4/24/19	11:55	1.541	1.15	3.0	0.005	0.075	0.080	**0.023**	**0.87**	7.78	0
5/8/19	11:30	2.891	3.04	3.5	0.026	0.090	0.116	**0.026**	**0.70**	6.67	0
5/22/19	11:40	3.430	4.20	5.0	0.021	0.086	0.107	**0.030**	**0.63**	0.00	0.7
6/5/19	11:20	4.817	8.49	10.5	0.013	0.125	0.138	**0.040**	**0.53**	11.67	0
6/19/19	11:30	12.216	10.80	21.0	0.029	0.166	**0.195**	**0.065**	**0.43**	13.33	0
6/26/19	11:30	7.814	3.52	3.5	0.017	0.095	0.112	**0.026**	**0.42**	7.78	0
Fourth Quarter WY 2018-2019											
7/2/19	11:30	2.346	6.67	11.5	0.006	0.132	0.138	**0.044**	**0.45**	10.56	0
7/17/19	11:13	3.183	1.25	1.5	0.004	0.080	0.084	**0.021**	**0.40**	12.78	0
8/14/19	11:30	1.345	1.49	1.0	0.004	0.062	0.066	**0.018**	**0.46**	15.56	0
9/18/19	11:30	0.301	1.34	1.0	0.002	0.05	0.052	**0.024**	**0.63**	4.44	0
Annual Summary	**Minimum**	0.007	0.35	1.00	0.002	0.041	0.046	0.012	**0.40**	-3.33	-
	Maximum	12.216	10.80	21.0	0.029	0.166	**0.195**	**0.065**	**1.00**	15.56	-
	Average	2.420	2.91	4.56	0.009	0.085	0.095	**0.027**	**0.65**	5.29	-
	90th Percentile	-	-	13.40	-	-	-	-	-	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

Table A-3:	Heavenly Mountain Resort water year 2019/2020 water quality monitoring data from station 43HVC-3, Heavenly Valley Creek at the Property Line. This station is located just above the Forest Service property line and subdivision development at an elevation of 6,620 feet.											
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A	N/A
First Quarter WY 2019-2020												
10/15/19	11:30	0.739	0.79	1.0	0.001	0.078	0.079	**0.016**	**0.4**	4.2	7.3	0.0
11/13/19	11:20	0.516	0.61	1.0	0.001	0.068	0.069	**0.019**	**0.6**	4.5	11.1	0.0
12/11/19	11:55	0.254	0.48	0.5	0.019	0.066	0.085	**0.016**	**0.9**	2.0	1.5	0.0
Second Quarter WY 2019-2020												
1/14/20	12:00	0.102	6.27	14.5	0.002	0.218	**0.220**	**0.055**	**0.7**	1.3	-1.8	0.1
2/11/20	11:40	0.080	0.52	1.0	0.005	0.073	0.078	**0.016**	**0.7**	1.4	3.8	0.0
3/23/20	13:00	0.215	0.44	1.5	0.005	0.051	0.056	0.013	**0.7**	1.7	3.4	0.0
Third Quarter WY 2019-2020												
4/7/20	12:30	0.152	0.84	1.5	0.001	0.056	0.057	**0.019**	**1.6**	1.8	4.6	0.5
4/21/20	11:35	0.479	0.44	2.0	0.002	0.063	0.065	**0.016**	**4.0**	3.3	8.5	0.0
5/5/20	11:25	1.496	1.01	3.3	0.005	0.079	0.084	**0.019**	**1.3**	5.1	14.6	0.0
5/20/20	11:20	1.513	0.83	1.5	0.001	0.066	0.067	**0.026**	**1.0**	3.9	6.0	0.2
5/27/20	11:20	1.433	1.61	3.0	0.001	0.105	0.106	**0.021**	**0.8**	8.5	23.3	0.0
6/2/20	11:35	1.361	1.06	3.0	0.003	0.083	0.086	**0.018**	**0.9**	8.3	18.4	0.0
6/16/20	11:20	1.095	1.92	3.5	0.001	0.082	0.083	**0.017**	**1.0**	8.6	17.0	0.0
6/20/20	11:45	0.557	0.79	3.0	0.003	0.086	0.089	**0.018**	**0.7**	10.4	20.3	0.0
Fourth Quarter WY 2019-2020												
7/14/20	11:20	0.035	0.61	2.0	0.004	0.075	0.079	**0.020**	**1.1**	11.5	25.5	0.0
8/18/20	11:40	0.068	0.58	3.0	0.001	0.076	0.077	**0.019**	**0.9**	10.0	23.0	0.0
9/22/20	11:30	N/A[3]	0.54	3.0	0.002	0.060	0.062	**0.030**	**0.7**	8.5	21.5	0.0
Annual Summary	**Minimum**	0.035	0.44	0.50	0.001	0.051	0.000	0.013	**0.40**	1.3	-1.8	-
	Maximum	1.513	6.27	14.5	0.019	0.218	0.220	**0.055**	**4.00**	11.5	25.5	-
	Average	0.631	1.14	2.84	0.003	0.081	0.080	**0.021**	**1.06**	5.6	12.2	-
	90th Percentile	-	-	5.70	-	-	-	**-**	**-**		-	-

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] Standards are for receiving waters of Trout Creek, 90th Percentile.

[3] Flow could not be sample due to low water conditions, but water quality samples were taken.

Table A-3:			Heavenly Mountain Resort water year 2020-2021 water quality monitoring data from station 43HVC-3, Heavenly Valley Creek at the Property Line. This station is located just above the Forest Service property line and subdivision development at an elevation of 6,620 feet.										
Date	**Notes**	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment [2] (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards	1		N/A	N/A	**60**	N/A	N/A	**0.190**	**0.015**	**0.15**	N/A	N/A	N/A
First Quarter WY 2020-2021													
10/20/20		12:15	No samples collected or flow measured due to extremely low flow conditions as the site.								N/A	N/A	0.0
11/19/20		11:35	No samples collected or flow measured due to extremely low flow conditions as the site.								7.0	8.0	2.2
12/9/20		11:40	No samples collected or flow measured due to extremely low flow conditions as the site.								N/A	N/A	0.0
Second Quarter WY 2020-2021													
1/13/21		11:20	No samples collected or flow measured due to extremely low flow conditions as the site.								N/A	N/A	0.0
2/17/21		11:50	No samples collected or flow measured due to extremely low flow conditions as the site.								N/A	N/A	0.0
3/17/21		11:35	No samples collected or flow measured due to extremely low flow conditions as the site.								N/A	N/A	0.0
Third Quarter WY 2020-2021													
4/6/21	3	11:45	No flow, but sample taken	1.48	2.5	0.009	0.086	0.095	**0.032**	**0.812**	5.6	13.1	0.0
4/20/21		11:30	0.058	4.69	6.5	0.014	0.451	**0.465**	**0.065**	**1.29**	5.5	17.3	0.0
5/4/21		11:50	0.386	0.71	1.0	0.003	0.074	0.077	**0.019**	**1.20**	6.4	20.5	0.0
5/18/21	3	12:00	0.578	0.58	1.0	0.003	0.057	0.060	**0.016**	**1.18**	8.0	19.9	0.0
5/25/21		11:25	0.600	0.58	1.0	0.002	0.053	0.055	0.014	**1.11**	6.5	15.8	0.0
6/1/21	3	11:25	0.415	0.49	1.0	0.001	0.058	0.059	0.011	**1.21**	9.1	23.8	0.0
6/15/21		11:45	0.480	0.30	1.0	0.001	0.402	**0.403**	**0.047**	**1.01**	10.5	23.5	0.0
6/30/21	3	11:10	0.118	0.46	2.5	0.001	0.058	0.059	0.013	**1.24**	12.0	25.4	0.0
Fourth Quarter WY 2020-2021													
7/13/21		11:20	0.009	0.53	1.0	0.002	0.057	0.059	**0.025**	**1.07**	13.3	30.4	0.0
No WQ Samples Collected in August due to Caldor Fire, Forest Closures and Basin Evacuation													
9/20/21	5	-	-	-	**-**	-	-	**-**	**-**	**-**	-	-	-
Annual Summary		**Minimum**	0.009	0.30	1.0	0.001	0.053	0.055	0.011	0.812	5.5	13.1	0.0
		Maximum	0.600	4.69	6.5	0.014	0.451	0.465	0.065	1.29	13.3	30.4	0.0
		Average	0.331	1.09	1.9	0.004	0.144	0.148	**0.027**	**1.12**	8.5	21.1	0.0
90th Percentile [4]					6.50								

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

[3] For Chloride, batch MS and/or MSD were outside acceptance limits, batch LCS was acceptable.

[4] There are not enough numbers in the range to interpolate a value for the 90th percentile.

[5] Site was not sampled due to Caldor fire/USFS closure.

Table A-4:		Heavenly Mountain Resort water year 2016/2017 water quality monitoring data from station 43BPC-4, Bijou Park Creek below California Parking Lot. This station is located 1/4 miles below the culvert outlet draining the parking lot off of Wildwood Avenue at an elevation of 6,530 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/ Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	**20**	**60**	N/A	N/A	**0.15**	**0.008**	**3.0**	N/A	N/A
First Quarter WY 2016-2017											
10/13/16	12:55	0.020	12.5	5.0	0.362	0.184	**0.546**	**0.081**	**51**	7.78	0
11/15/16	12:40	0.031	18.7	5.0	0.273	0.281	**0.554**	**0.069**	**57**	6.67	0
12/20/16	12:45	0.063	18.2	9.0	0.274	0.311	**0.585**	**0.067**	**71**	1.11	0.1
Second Quarter WY 2016-2017											
1/17/17	16:00	0.172	**47.2**	28.0	0.189	0.524	**0.713**	**0.163**	**160**	1.67	0
2/23/17	16:20	0.249	**35.8**	30.0	0.398	0.395	**0.793**	**0.136**	**250**	-8.89	0.1
3/16/17	15:30	0.592	**63.9**	64.0	0.207	0.592	**0.799**	**0.230**	**58**	5.00	0
Third Quarter WY 2016-2017											
4/4/17	13:05	0.489	19.9	17	0.471	0.304	**0.775**	**0.093**	**53**	2.78	0
4/19/17	13:10	0.745	15.4	11.5	0.432	0.278	**0.710**	**0.088**	**48**	2.78	0
5/4/17	12:45	1.46	**24.2**	33.0	0.211	0.365	**0.576**	**0.155**	**23**	10.56	0
5/18/17	12:50	0.638	14.0	11.5	0.240	0.228	**0.468**	**0.094**	**31**	3.33	0
6/1/17	13:00	0.490	**24.0**	19.5	0.174	0.288	**0.462**	**0.117**	**33**	6.11	0
6/8/17	14:50	0.361	15.1	5.5	0.168	0.283	**0.451**	**0.082**	**35**	6.11	0
6/22/17	13:50	0.431	16.9	9.5	0.135	0.257	**0.392**	**0.117**	**33**	16.11	0
6/29/17	15:10	0.255	16.4	10.0	0.207	0.275	**0.482**	**0.107**	**36**	11.67	0
Fourth Quarter WY 2016-2017											
7/13/17	12:36	0.259	17.6	10.0	0.159	0.294	**0.453**	**0.108**	**32**	15.00	0
8/23/17	12:25	0.174	15.4	5.5	0.158	0.271	**0.429**	**0.119**	**33**	11.67	0.1
9/14/17	13:10	0.150	12.3	4.5	0.171	0.335	**0.506**	**0.103**	**34**	8.33	0
Annual Summary	**Min**	0.02	12.30	4.50	0.135	0.184	0.392	0.067	23.0	-8.9	-
	Max	1.46	63.90	64.00	0.471	0.592	0.799	0.230	250.0	16.1	-
	Average	0.39	**22.8**	16.38	0.249	0.321	**0.570**	**0.113**	**61.1**	6.3	-

[1] Standards are for receiving water objectives from the Lahontan Basin Plan expressed as an annual average.

Table A-4:		Heavenly Mountain Resort water year 2017/2018 water quality monitoring data from station 43BPC-4, Bijou Park Creek below California Parking Lot. This station is located 1/4 miles below the culvert outlet draining the parking lot off of Wildwood Avenue at an elevation of 6,530 feet.									
Date	Time	Discharge (cfs)	Turbidity (ntu)	Suspended Sediment (mg/L)	Total Nitrite/ Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Average Temperature (Deg C)	Precipitation (in)
Lahontan Standards[1]		N/A	**20**	**60**	N/A	N/A	**0.15**	**0.008**	**3.0**	N/A	N/A
First Quarter WY 2017-2018											
10/18/17	12:55	0.188	**23.4**	11.0	0.106	0.759	**0.865**	**0.193**	**46**	7.22	0
11/14/17	12:55	0.119	9.52	3.5	0.169	0.303	**0.472**	**0.095**	**36**	0.56	0.3
12/21/17	14:30	0.120	16.0	11.5	0.205	0.680	**0.885**	**0.136**	**40**	-6.11	0.2
Second Quarter WY 2017-2018											
1/17/18	12:25	0.141	18.2	7.0	0.207	0.200	**0.407**	**0.049**	**35**	3.89	0
2/14/18	13:10	0.131	10.8	3.5	0.210	0.211	**0.421**	**0.088**	**40**	-5.56	0
3/20/18	15:10	0.284	**208**	**108**	0.182	1.398	**1.580**	**0.590**	**350**	0.00	0.1
Third Quarter WY 2017-2018											
4/4/18	13:30	0.333	18.2	12	0.282	0.300	**0.582**	**0.095**	**45**	4.44	0
4/18/18	12:35	0.479	11.3	7.0	0.352	0.261	**0.613**	**0.077**	**37**	-1.11	0
5/3/18	13:30	0.423	11.7	5.5	0.227	0.185	**0.412**	**0.073**	**21**	5.00	0
5/17/18	12:50	0.337	9.5	5.5	0.207	0.222	**0.429**	**0.080**	**28**	4.44	0.7
5/23/18	14:30	0.298	12.4	5.0	0.239	0.185	**0.424**	**0.074**	**32**	6.67	0.2
5/30/18	13:05	0.217	15.1	12.0	0.184	0.212	**0.396**	**0.072**	**27**	9.44	0
6/6/18	12:30	0.171	16.3	9.0	0.193	0.256	**0.449**	**0.117**	**27**	8.89	0
6/20/18	12:30	0.174	15.6	5.5	0.190	0.236	**0.426**	**0.091**	**26**	13.33	0
Fourth Quarter WY 2017-2018											
7/19/18	12:15	0.133	**21.4**	42.0	0.134	0.409	**0.543**	**0.408**	**21**	16.67	0
8/16/18	13:05	0.050	**23.6**	6.0	0.151	0.256	**0.407**	**0.137**	**26**	13.89	0
9/12/18	16:00	0.064	**27.6**	8.5	0.150	0.246	**0.396**	**0.131**	**27**	7.78	0
Annual Summary	Min	0.050	9.49	3.50	0.106	0.185	0.396	0.049	21.0	-6.1	-
	Max	0.479	208	108	0.352	1.398	1.580	0.590	350.0	16.7	-
	Average	0.211	**27.6**	15.4	0.199	0.372	**0.539**	**0.147**	**50.8**	5.3	-

[1] Standards are for receiving water objectives from the Lahontan Basin Plan expressed as an annual average.

Table A-4:		Heavenly Mountain Resort water year 2018/2019 water quality monitoring data from station 43BPC-4, Bijou Park Creek below California Parking Lot. This station is located 1/4 miles below the culvert outlet draining the parking lot off of Wildwood Avenue at an elevation of 6,530 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/ Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	**20**	**60**	N/A	N/A	**0.150**	**0.008**	**3.0**	N/A	N/A
First Quarter WY 2018-2019											
10/17/18	12:35	0.051	17.1	4.0	0.157	0.21	**0.367**	**0.093**	**30**	5.00	0
11/15/18	12:15	0.058	13.60	4.0	0.149	0.203	**0.352**	**0.075**	**31**	3.33	0
12/12/18	13:10	0.044	13.7	4.5	0.171	0.238	**0.409**	**0.082**	**41**	-1.11	0
Second Quarter WY 2018-2019											
1/23/19	13:00	0.166	**134.0**	**86.0**	0.140	1.058	**1.198**	**0.453**	**170**	0.00	0
2/12/19	13:55	0.429	**134.0**	**80.0**	0.063	0.933	**0.996**	**0.628**	**210**	-3.33	0.1
3/21/19	13:05	0.243	**144.0**	**78.0**	0.152	0.792	**0.944**	**0.364**	**140**	-2.78	0.1
Third Quarter WY 2018-2019											
4/10/19	12:35	0.363	18.5	10.0	0.313	0.264	**0.577**	**0.088**	**58**	-1.67	0
4/24/19	14:24	1.222	**32.5**	36.0	0.283	0.335	**0.618**	**0.184**	**22**	7.78	0
5/8/19	12:20	0.563	17.4	10.5	0.294	0.285	**0.579**	**0.104**	**45**	6.67	0
5/22/19	12:25	0.399	15.1	8.5	0.238	0.225	**0.463**	**0.089**	**33**	0.00	0.7
6/5/19	12:25	0.329	13.7	4.5	0.228	0.214	**0.442**	**0.065**	**33**	11.67	0
6/19/19	12:20	0.168	14.4	5.5	0.212	0.237	**0.449**	**0.090**	**33**	13.33	0
6/26/19	12:25	0.168	14.6	4.0	0.201	0.199	**0.400**	**0.084**	**32**	7.78	0
Fourth Quarter WY 2018-2019											
7/2/19	12:30	0.152	17.1	6.0	0.196	0.212	**0.408**	**0.093**	**31**	10.56	0
7/17/19	11:55	0.129	16.2	5.5	0.161	0.248	**0.409**	**0.102**	**29**	12.78	0
8/14/19	14:40	0.063	18.3	6.0	0.156	0.176	**0.332**	**0.108**	**28**	15.56	0
9/18/19	12:20	0.061	13.3	6.0	0.102	0.25	**0.352**	**0.116**	**28**	4.44	0
Annual Summary	**Min**	0.044	13.3	4.0	0.063	0.176	**0.332**	**0.065**	**22**	-3.33	-
	Max	1.222	**144.0**	**86.0**	0.313	1.058	**1.198**	**0.628**	**210**	15.56	-
	Average	0.271	**38.1**	21.1	0.189	0.358	**0.547**	**0.166**	**58.5**	5.29	-

[1] Standards are for receiving water objectives from the Lahontan Basin Plan expressed as an annual average.

Bijou Park Creek - Below California Parking Lot
(43BPC-4)

Table A-4:		Heavenly Mountain Resort water year 2019/2020 water quality monitoring data from station 43BPC-4, Bijou Park Creek below California Parking Lot. This station is located 1/4 miles below the culvert outlet draining the parking lot off of Wildwood Avenue at an elevation of 6,530 feet.										
Date	Time	Discharge (cfs)	Turbidity (ntu)	Suspended Sediment (mg/L)	Total Nitrite/ Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Site Water Temperature (Deg C)	Site Ambient Temperature (Deg C)	Precipitation (in)
Lahontan Standards[1]		N/A	20	60	N/A	N/A	0.150	0.008	3.0	N/A	N/A	N/A
First Quarter WY 2019-2020												
10/15/19	12:15	0.048	16.4	8.0	0.143	0.233	0.376	0.116	23.6	11.8	11.6	0.0
11/13/19	12:00	0.107	45.3	19.0	0.200	0.210	0.410	0.267	26.0	11.0	10.6	0.0
12/11/19	14:20	0.112	12.6	5.0	0.157	0.594	0.751	0.075	371.0	7.2	2.8	0.0
Second Quarter WY 2019-2020												
1/14/20	12:45	0.249	12.9	5.5	0.171	0.225	0.396	0.087	66.0	5.3	-0.5	0.1
2/11/20	12:30	0.118	11.8	7.0	0.201	0.461	0.662	0.087	66.0	6.3	4.5	0.0
3/23/20	14:00	0.307	10.9	7.5	0.227	0.234	0.461	0.072	47.7	6.2	3.5	0.0
Third Quarter WY 2019-2020												
4/7/20	13:30	0.359	58.3	54.5	0.128	0.547	0.675	0.278	48.7	6.6	2.5	0.5
4/21/20	12:20	0.189	9.4	5.3	0.222	0.204	0.426	0.069	48.0	9.2	11.7	0.0
5/5/20	12:05	0.308	7.8	6.7	0.378	0.201	0.579	0.073	28.7	10.0	16.0	0.0
5/20/20	12:00	0.272	8.2	2.0	0.340	0.246	0.586	0.036	29.2	9.9	8.0	0.2
5/27/20	12:05	0.166	9.9	3.0	0.382	0.208	0.590	0.059	29.9	12.4	22.0	0.0
6/2/20	12:20	0.161	11.3	4.0	0.359	0.228	0.587	0.065	29.6	12.3	18.0	0.0
6/16/20	12:00	0.137	12.2	5.0	0.333	0.208	0.541	0.060	30.1	11.9	17.0	0.0
6/30/20	12:35	0.080	14.7	5.0	0.244	0.196	0.440	0.079	28.0	13.6	20.4	0.0
Fourth Quarter WY 2019-2020												
7/14/20	12:05	0.081	16.3	7.5	0.248	0.184	0.432	0.111	26.5	15.5	25.5	0.0
8/18/20	12:25	0.161	11.4	6.5	0.134	0.213	0.347	0.041	27.8	15.0	25.0	0.0
9/22/20	12:05	0.040	17.1	8.5	0.362	0.153	0.515	0.123	28.5	13.5	21.5	0.0
Annual Summary	Minimum	0.040	7.8	2.0	0.128	0.153	0.347	0.036	23.6	5.3	-0.5	-
	Maximum	0.359	58.3	54.5	0.382	0.594	0.751	0.278	371.0	15.5	25.5	-
	Average	0.170	16.9	9.4	0.249	0.267	0.516	0.100	56.2	10.5	12.9	-

[1] Standards are for receiving water objectives from the Lahontan Basin Plan expressed as an annual average.

Bijou Park Creek - Below California Parking Lot
(43BPC-4)

Table A-4:			Heavenly Mountain Resort water year 2020-2021 water quality monitoring data from station 43BPC-4, Bijou Park Creek below California Parking Lot. This station is located 1/4 miles below the culvert outlet draining the parking lot off of Wildwood Avenue at an elevation of 6,530 feet.										
Date	**Notes**	**Time**	**Discharge (cfs)**	**Turbidity (ntu) [2]**	**Suspended Sediment [3] (mg/L)**	**Total Nitrite/ Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards	1		N/A	**20**	**60**	N/A	N/A	**0.150**	**0.008**	**3.0**	N/A	N/A	N/A
First Quarter WY 2020-2021													
10/20/20		12:40	0.033	11.9	3.5	0.141	0.179	**0.320**	**0.091**	**30.7**	16.5	21.0	0.0
11/19/20		12:10	0.556	**123.0**	**74.5**	0.122	0.903	**1.025**	**0.378**	**133**	19.0	17.0	2.2
12/9/20		12:10	0.040	12.0	4.0	0.130	0.197	**0.327**	**0.058**	**38.0**	N/A	N/A	0.0
Second Quarter WY 2020-2021													
1/13/21		12:00	0.154	**86.9**	45.5	0.207	0.504	**0.711**	**0.304**	**85.0**	7.0	8.7	0.0
2/17/21		14:40	0.086	**21.1**	10.5	0.160	0.327	**0.487**	**0.081**	**80.6**	1.7	4.7	0.0
3/17/21	4	12:05	0.050	11.8	4.5	0.142	0.265	**0.407**	**0.065**	**69.4**	6.3	3.7	0.0
Third Quarter WY 2020-2021													
4/6/21	4	12:15	0.137	13.2	5.0	0.205	0.222	**0.427**	**0.072**	**41.8**	8.0	11.6	0.0
4/20/21		12:15	0.187	**24.0**	15.5	0.240	0.266	**0.506**	**0.116**	**38.5**	9.9	16.9	0.0
5/4/21		12:30	0.146	**174.0**	**98.5**	0.271	1.031	**1.302**	**1.092**	**40.5**	11.4	16.5	0.0
5/18/21	4	12:40	0.060	7.9	3.0	0.290	0.251	**0.541**	**0.065**	**48.0**	13.1	20.8	0.0
5/25/21		12:00	0.088	12.1	4.0	0.299	0.192	**0.491**	**0.064**	**47.0**	11.9	15.5	0.0
6/1/21	4	12:00	0.059	13.0	4.5	0.301	0.299	**0.600**	**0.056**	**43.7**	12.8	25.0	0.0
6/15/21		12:20	0.480	15.4	5.0	0.287	0.236	**0.523**	**0.072**	**38.3**	10.5	23.5	0.0
6/30/21	4	11:45	0.050	13.0	6.0	0.287	0.200	**0.487**	**0.071**	**35.0**	15.2	26.5	0.0
Fourth Quarter WY 2020-2021													
7/13/21		12:10	0.032	15.5	6.5	0.390	0.171	**0.561**	**0.090**	**31.0**	16.2	27.4	0.0
No WQ Samples Collected in August due to Caldor Fire, Forest Closures and Basin Evacuation													
9/20/21		12:45	0.022	21.6	20.0	0.199	0.239	**0.438**	**0.171**	**27.2**	14.3	17.9	0.0
Annual Summary		**Minimum**	0.022	7.9	3.0	0.122	0.171	**0.320**	**0.056**	**27.2**	1.7	3.7	0.0
		Maximum	0.556	**174.0**	98.5	0.390	1.031	**1.302**	**1.092**	**133.0**	19.0	27.4	2.2
		Average	0.136	**36.0**	19.4	0.229	0.343	**0.572**	**0.178**	**51.7**	11.6	17.1	0.1
90th Percentile					**81.7**								

[1] Standards are for receiving water objectives from the Lahontan Basin Plan expressed as an annual average.

[2] Turbidiy standard value, for discharge from California Base Area, is calculated as the daily average of all effluent samples collected from a single discharge point.

[3] For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

[4] For Chloride, batch MS and/or MSD were outside acceptance limits, batch LCS was acceptable.

Table A-5:		Heavenly Mountain Resort water year 2016/2017 water quality monitoring data from station 43HDVC-5, Hidden Valley Creek baseline station. This station is located just above the confluence with Trout Creek, at an elevation of 6,680 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.19**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2016-2017											
10/13/16	11:00	0.331	0.37	1.0	0.005	0.048	0.053	**0.030**	**0.26**	7.78	0
11/15/16	10:45	0.350	0.44	2.5	0.003	0.070	0.073	**0.017**	**0.29**	6.67	0
12/20/16	10:35	0.619	3.05	2.5	0.005	0.099	0.104	**0.024**	**0.42**	1.11	0.1
Second Quarter WY 2016-2017											
1/17/17	11:33	0.92	47.2	3.5	0.005	0.124	0.129	**0.026**	**0.40**	1.67	0
2/23/17	10:30	2.30	2.37	1.5	0.004	0.125	0.129	**0.020**	**0.35**	-8.89	0.1
3/16/17	10:45	2.80	1.92	2.5	0.005	0.118	0.123	**0.025**	**0.33**	5.00	0
Third Quarter WY 2016-2017											
4/4/17	10:45	3.74	2.34	3.5	0.004	0.131	0.135	**0.025**	**0.29**	2.78	0
4/19/17	10:40	4.69	1.97	2.5	0.004	0.134	0.138	**0.031**	**0.32**	2.78	0
5/4/17	10:40	7.41	4.62	6.0	0.008	0.222	**0.230**	**0.038**	**0.25**	10.56	0
5/18/17	10:50	7.52	2.35	2.5	0.004	0.119	0.123	**0.021**	**0.23**	3.33	0
6/1/17	10:50	17.03	4.73	13.0	0.005	0.168	0.173	**0.035**	**0.17**	6.11	0
6/8/17	11:00	23.06	10.1	20.5	0.005	0.285	**0.290**	**0.057**	**0.16**	6.11	0
6/22/17	11:15	28.38	10.0	26.0	0.004	0.284	**0.288**	**0.066**	0.13	16.11	0
6/29/17	10:55	16.02	2.79	7.5	0.001	0.109	0.110	**0.032**	0.15	11.67	0
Fourth Quarter WY 2016-2017											
7/13/17	10:30	7.024	1.34	3.0	0.004	0.090	0.094	**0.021**	0.15	15.00	0
8/23/17	10:30	2.681	0.86	1.0	0.003	0.101	0.104	**0.024**	**0.26**	11.67	0.1
9/14/17	10:30	1.595	0.54	0.5	0.003	0.083	0.086	**0.026**	**0.24**	8.33	0
Annual Summary	**Minimum**	0.331	0.37	0.50	0.001	0.048	0.053	0.017	0.13	-8.9	-
	Maximum	28.38	47.20	26.00	0.008	0.285	0.290	0.066	0.42	16.1	-
	Average	7.440	5.71	5.85	0.004	0.136	0.140	**0.030**	**0.26**	6.6	-
90th Percentile		-	-	21.60	-	-	-	**-**	**-**	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek. For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

Table A-5:		Heavenly Mountain Resort water year 2017/2018 water quality monitoring data from station 43HDVC-5, Hidden Valley Creek baseline station. This station is located just above the confluence with Trout Creek, at an elevation of 6,680 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.19**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2017-2018											
10/18/17	10:35	1.163	0.60	1.0	0.002	0.082	0.084	**0.020**	**0.24**	7.22	0
11/14/17	11:00	1.163	0.65	1.5	0.003	0.076	0.079	**0.027**	**0.32**	0.56	0.3
12/21/17	10:45	0.824	0.86	1.0	0.006	0.085	0.091	**0.016**	**0.29**	-6.11	0.2
Second Quarter WY 2017-2018											
1/17/18	10:30	0.713	1.3	1.5	0.006	0.114	0.120	**0.018**	**0.26**	3.89	0
2/14/18	11:00	0.538	0.94	1.0	0.008	0.058	0.066	**0.018**	**0.28**	-5.56	0
3/20/18	10:50	0.547	1.29	1.5	0.009	0.055	0.064	**0.020**	**0.29**	0.00	0.1
Third Quarter WY 2017-2018											
4/4/18	10:30	1.197	2.09	2.0	0.007	0.121	0.128	**0.021**	**0.27**	4.44	0
4/8/18	10:30	2.091	1.66	2.5	0.006	0.099	0.105	**0.020**	**0.24**	-1.11	0
5/3/18	11:05	2.619	1.14	1.0	0.006	0.062	0.068	**0.016**	**0.21**	5.00	0
5/17/28	10:35	3.771	1.06	2.0	0.006	0.070	0.076	**0.021**	**0.16**	4.44	0.7
5/23/18	11:00	4.249	1.28	1.0	0.004	0.067	0.071	**0.016**	0.14	6.67	0.2
5/30/18	11:00	7.259	1.50	2.5	0.004	0.093	0.097	**0.018**	0.12	9.44	0
6/6/18	10:45	5.997	0.81	2.0	0.005	0.096	0.101	**0.016**	0.12	8.89	0
6/20/18	10:40	3.672	1.93	1.5	0.001	0.076	0.077	**0.018**	0.12	13.33	0
Fourth Quarter WY 2017-2018											
7/19/18	10:30	0.997	0.97	3.0	0.010	0.090	0.100	**0.023**	**0.23**	16.67	0
8/16/18	11:05	0.501	0.69	1.5	0.016	0.074	0.090	**0.018**	**0.20**	13.89	0
9/12/18	11:00	0.375	1.09	1.0	0.017	0.068	0.085	**0.027**	**0.22**	7.78	0
Annual Summary	**Minimum**	0.38	0.60	1.00	0.001	0.055	0.064	0.016	0.12	-6.1	-
	Maximum	7.26	2.09	3.00	0.017	0.121	0.128	0.027	0.32	16.7	-
	Average	2.49	1.17	1.62	0.007	0.082	0.088	**0.020**	**0.22**	5.3	-
90th Percentile		-	-	2.60	-	-	-	-	-	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek. For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

Table A-5:		Heavenly Mountain Resort water year 2018/2019 water quality monitoring data from station 43HDVC-5, Hidden Valley Creek baseline station. This station is located just above the confluence with Trout Creek, at an elevation of 6,680 feet.									
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L) [2, 3]**	**Average Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.19**	**0.015**	**0.15**	N/A	N/A
First Quarter WY 2018-2019											
10/17/18	10:30	0.423	0.51	1.0	0.003	0.053	0.056	**0.021**	**0.24**	5.00	0
11/15/18	10:30	0.420	0.47	1.0	0.006	0.048	0.054	**0.019**	**0.25**	3.33	0
12/12/18	10:30	0.461	1.39	0.5	0.006	0.060	0.066	**0.018**	**0.30**	-1.11	0
Second Quarter WY 2018-2019											
1/23/19	10:30	0.424	1.0	1.5	0.009	0.079	0.088	**0.022**	**0.30**	0.00	0
2/12/19	10:45	0.503	1.67	3.5	0.017	0.095	0.112	**0.023**	**0.30**	-3.33	0.1
3/21/19	10:30	0.810	1.46	1.0	0.009	0.100	0.109	**0.017**	**0.32**	-2.78	0.1
Third Quarter WY 2018-2019											
4/10/19	10:30	2.321	3.80	3.0	0.011	0.169	0.180	**0.031**	**0.36**	-1.67	0
4/24/19	10:30	2.745	3.34	4.0	0.011	0.153	0.164	**0.034**	**0.27**	7.78	0
5/8/19	10:30	2.066	2.32	2.0	0.008	0.119	0.127	**0.027**	ND	6.67	0
5/22/19	10:30	3.146	1.87	2.0	0.004	0.070	0.074	**0.022**	ND	0.00	0.7
6/5/19	10:30	5.236	4.15	5.0	0.006	0.147	0.153	**0.027**	ND	11.67	0
6/19/19	10:30	15.882	4.79	7.0	0.003	0.149	0.152	**0.027**	ND	13.33	0
6/26/19	10:30	11.209	1.66	2.5	0.002	0.074	0.076	**0.021**	ND	7.78	0
Fourth Quarter WY 2018-2019											
7/2/19	10:30	7.806	4.20	2.0	0.001	0.079	0.080	**0.024**	ND	10.56	0
7/17/19	10:30	3.963	0.68	1.5	0.001	0.061	0.062	**0.021**	ND	12.78	0
8/14/19	10:30	1.916	0.85	1.0	0.004	0.070	0.074	**0.022**	ND	15.56	0
9/18/19	10:30	0.594	0.81	1.0	0.002	0.07	0.072	**0.028**	ND	4.44	0
Annual Summary	**Minimum**	0.420	0.47	0.50	0.001	0.048	0.054	**0.017**	ND	-3.33	-
	Maximum	15.88	4.79	7.00	0.017	0.169	0.180	**0.034**	**0.36**	15.56	-
	Average	3.525	2.06	2.32	0.006	0.094	0.100	**0.024**	**0.22**	5.73	-
	90th Percentile	-	-	5.40	-	-	-	-	-	-	-

[1] Standards are annual averages for the receiving waters of Trout Creek. For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

[2] In January 2019, EPA changed the methodology reporting limits. The chloride minimum detection reporting limit is now 0.25 mg/L which is greater than the Lahontan standard.

[3] ND samples were considered as (0.15 mg/L) for calculation of the annual average.

Table A-5:		Heavenly Mountain Resort water year 2019/2020 water quality monitoring data from station 43HDVC-5, Hidden Valley Creek baseline station. This station is located just above the confluence with Trout Creek, at an elevation of 6,680 feet.										
Date	**Time**	**Discharge (cfs)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Chloride (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
Lahontan Standards[1]		N/A	N/A	**60**	N/A	N/A	**0.19**	**0.015**	**0.15**	N/A	N/A	N/A
First Quarter WY 2019-2020												
10/15/19	10:30	0.630	0.73	1.0	0.001	0.058	0.059	**0.021**	**0.3**	3.9	4.5	0.0
11/13/19	10:30	0.665	0.50	1.0	0.001	0.049	0.050	**0.021**	**0.5**	4.5	8.0	0.0
12/11/19	10:30	0.743	0.51	0.5	0.003	0.069	0.072	**0.021**	**0.5**	2.0	1.0	0.0
Second Quarter WY 2019-2020												
1/14/20	10:30	0.566	0.41	2.0	0.002	0.054	0.056	**0.024**	**0.3**	0.4	-1.8	0.1
2/11/20	10:30	0.739	0.50	4.0	0.009	0.074	0.083	**0.023**	**0.3**	-0.2	-3.1	0.0
3/23/20	11:00	0.545	0.59	2.0	0.006	0.074	0.080	**0.018**	**0.2**	1.6	0.8	0.0
Third Quarter WY 2019-2020												
4/7/20	10:30	0.624	0.57	1.0	0.011	0.118	0.129	**0.019**	**0.5**	2.5	1.4	0.5
4/21/20	10:30	0.704	1.48	3.3	0.011	0.100	0.111	**0.023**	**0.4**	2.2	3.3	0.0
5/5/20	10:30	1.635	1.48	4.0	0.006	0.096	0.102	**0.023**	**0.8**	4.7	11.0	0.0
5/20/20	10:30	2.783	1.39	3.5	0.001	0.114	0.115	**0.028**	**0.3**	3.2	4.4	0.2
5/27/20	10:30	2.377	1.62	3.0	0.001	0.123	0.124	**0.020**	**0.2**	7.2	17.6	0.0
6/2/20	10:30	3.741	1.31	2.0	0.004	0.098	0.102	**0.018**	ND	6.5	15.8	0.0
6/16/20	10:30	2.180	0.79	3.5	0.001	0.072	0.073	**0.016**	**0.6**	7.7	14.5	0.0
6/30/20	10:30	1.280	1.13	2.5	0.004	0.090	0.094	**0.020**	**0.3**	8.9	16.1	0.0
Fourth Quarter WY 2019-2020												
7/14/20	10:30	0.749	0.96	3.0	0.010	0.091	0.101	**0.024**	ND	10.5	23.5	0.0
8/18/20	10:30	0.373	1.32	4.0	0.001	0.096	0.097	**0.028**	**0.6**	13.0	22.0	0.0
9/22/20	10:30	0.341	0.65	3.0	0.001	0.065	0.066	**0.028**	**0.5**	7.0	18.5	0.0
Annual Summary	**Minimum**	0.341	0.41	0.50	0.001	0.049	0.050	**0.016**	**0.20**	-0.2	-3.1	-
	Maximum	3.741	1.62	4.00	0.011	0.123	0.129	**0.028**	**0.80**	13.0	23.5	-
	Average	1.216	0.94	2.55	0.004	0.085	0.089	**0.022**	**0.42**	5.0	9.3	-
90th Percentile[2]		-	-	4.00	-	-	-	**-**	**-**		-	-

[1] Standards are annual averages for the receiving waters of Trout Creek. For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

Table A-5:			Heavenly Mountain Resort water year 2020-2021 water quality monitoring data from station 43HDVC-5, Hidden Valley Creek baseline station. This station is located just above the confluence with Trout Creek, at an elevation of 6,680 feet.										
Date	Notes	Time	Discharge (cfs)	Turbidity (ntu)	Suspended Sediment [2] (mg/L)	Total Nitrite/Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)	Site Water Temperature (Deg C)	Site Ambient Temperature (Deg C)	Precipitation (in)
Lahontan Standards	1		N/A	N/A	**60**	N/A	N/A	**0.19**	**0.015**	**0.15**	N/A	N/A	N/A
First Quarter WY 2020-2021													
10/20/20		11:00	0.437	0.74	1.0	0.002	0.076	0.078	**0.023**	**0.6**	9.5	17.5	0.0
11/19/20		10:30	0.319	1.78	1.0	0.002	0.110	0.112	**0.023**	**1.1**	5.5	4.5	2.2
12/9/20		10:30	0.405	0.35	3.0	0.001	0.052	0.053	**0.028**	**0.8**	N/A	N/A	0.0
Second Quarter WY 2020-2021													
1/13/21		10:30	0.476	0.94	0.5	0.003	0.106	0.109	**0.029**	**0.287**	2.1	1.2	0.0
2/17/21	3	10:30	0.307	0.74	1.0	0.005	0.079	0.084	**0.020**	**0.292**	0.2	-2.6	0.0
3/17/21	3	10:30	0.451	0.49	0.5	0.006	0.048	0.054	**0.018**	**0.282**	0.9	-0.3	0.0
Third Quarter WY 2020-2021													
4/6/21	3	10:30	0.494	0.97	0.5	0.021	0.116	0.137	**0.026**	**0.348**	2.9	2.8	0.0
4/20/21		10:30	0.453	0.80	0.5	0.018	0.126	0.144	**0.028**	**0.322**	3.8	8.9	0.0
5/4/21		10:30	0.447	0.57	1.5	0.003	0.092	0.095	**0.022**	**0.258**	5.0	15.0	0.0
5/18/21	3	10:30	1.647	3.11	2.5	0.006	0.102	0.108	**0.020**	**0.212**	6.4	14.3	0.0
5/25/21		10:30	1.781	1.06	2.0	0.003	0.102	0.105	**0.018**	**0.226**	5.2	11.9	0.0
6/1/21	3	10:30	1.737	1.05	2.5	0.001	0.105	0.106	**0.016**	**0.185**	9.5	21.3	0.0
6/15/21		10:30	1.077	0.81	3.0	0.002	0.086	0.088	**0.021**	**0.149**	10.6	21.4	0.0
6/30/21	3	10:30	0.809	1.09	4.5	0.002	0.089	0.091	**0.021**	**0.261**	12.5	22.8	0.0
Fourth Quarter WY 2020-2021													
7/13/21	4	10:30	0.418	-	-	-	-	-	-	**0.197**	14.0	24.2	0.0
No WQ Samples Collected in August due to Caldor Fire, Forest Closures and Basin Evacuation													
9/20/21	5	-	-	-	-	-	-	-	-	-	-	-	-
Annual Summary		**Minimum**	0.307	0.35	0.50	0.001	0.048	0.053	**0.016**	0.15	0.2	-2.6	0.0
		Maximum	1.781	3.11	4.50	0.021	0.126	0.144	**0.029**	**1.10**	14.0	24.2	2.2
		Average	0.751	1.04	1.71	0.005	0.092	0.097	**0.022**	**0.37**	6.3	11.6	0.1
		90th Percentile			3.75								

[1] Standards are annual averages for the receiving waters of Trout Creek.

[2] For Suspended Sediment, standards are for streams tributary to Lake Tahoe. Suspended Sediment concentrations shall not exceed a 90th percentile value of 60 mg/L.

[3] The Chloride Sample Batch Matric Spike (MS) and/or Matrix Spike Duplicate (MSD) were outside acceptable limits, batch Laboratory Control Sample (LCS) was acceptable.

[4] The WQ Analysis Bottle broke/leaked during shippment to Laboratory (High Sierra Labs). No sample was available for analysis.

[5] Site was not sampled due to Caldor fire/USFS closure.

Edgewood Creek -Above Boulder Parking Lot
(43HVE-1)

Table A-6:		Heavenly Mountain Resort water year 2016/2017 water quality monitoring data from station 43HVE-1, Edgewood Creek above Boulder Parking Lot. This station is located in Edgewood Bowl above the learn-to-ski center, at an elevation of 7,280 feet.											
Date	**Time**	**Discharge (cfs)**	**Specific Conductivity (mmhos)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Soluble Reactive P (mg/L)**	**Dissolved P (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
NDEP Standards[1]		N/A	N/A	**10**	**25.0**	N/A	N/A	**0.6** [2]	**0.1**	N/A	N/A	N/A	N/A
First Quarter WY 2016-2017													
10/13/16	No Samples Collected Due to Low Flows											7.78	0
11/15/16	No Samples Collected Due to Low Flows											6.67	0
12/20/16 [3]	16:00	-	92.9	2.33	2.5	0.003	0.284	0.287	0.045	0.015	0.028	1.11	0.1
Second Quarter WY 2016-2017													
1/17/17	No Samples Collected Due to groomed ski run over creek											1.67	0
2/23/17	No Samples Collected Due to groomed ski run over creek											-8.89	0.1
3/16/17	No Samples Collected Due to groomed ski run over creek											5.00	0
Third Quarter WY 2016-2017													
4/4/17	No Samples Collected Due to groomed ski run over creek											2.78	0
4/19/17	No Samples Collected Due to groomed ski run over creek											2.78	0
5/4/17	14:30	1.13	53.5	2.02	3.0	0.004	0.097	0.101	0.017	0.009	0.015	10.56	0
5/18/17	14:25	1.48	54.8	0.74	1.0	0.002	0.093	0.095	0.022	0.010	0.018	3.33	0
6/1/17	15:35	2.43	39.8	0.89	1.0	0.002	0.086	0.088	0.030	0.016	0.026	6.11	0
6/8/17	15:35	0.965	46.5	0.73	0.5	0.002	0.112	0.114	0.026	0.015	0.020	6.11	0
6/22/17	16:40	0.308	73.5	0.82	1.5	0.002	0.227	0.229	0.038	0.017	0.029	16.11	0
6/29/17	15:45	0.234	81.5	1.14	4.0	0.002	0.211	0.213	0.039	0.015	0.029	11.67	0
Fourth Quarter WY 2016-2017													
7/13/17	15:05	0.096	97.70	3.92	5.50	0.003	0.356	0.359	0.059	0.01	0.025	15.00	0
8/23/17	14:32	0.131	104.80	3.87	3.00	0.003	0.162	0.165	0.037	0.008	0.019	11.67	0.1
9/14/17	15:15	0.076	105.70	**20.80**	8.50	0.002	0.252	0.254	0.07	0.005	0.016	8.33	0
Annual Summary	**Minimum**	0.076	39.80	0.73	0.50	0.002	0.086	0.088	0.017	0.005	0.015	-8.89	-
	Maximum	2.426	105.70	20.80	8.50	0.004	0.356	0.359	0.070	0.017	0.029	16.11	-
	Average	0.760	73.09	3.88	3.11	0.002	0.177	0.180	0.038	0.012	0.022	6.34	-

[1] NDEP Standards are from the Nevada Administrative Code (NAC) Chapter 445A.1915. All listed numbers are standards for single values no greater than a given parameter unless otherwise noted.

[2] Annual Average

[3] Flows too low to measure; however water quality samples collected.

Edgewood Creek - Above
(43HVE-1)

Table A-6:		Heavenly Mountain Resort water year 2017/2018 water quality monitoring data from station 43HVE-1, Edgewood Creek above Boulder Parking Lot. This station is located in Edgewood Bowl above the learn-to-ski center, at an elevation of 7,280 feet.											
Date	**Time**	**Discharge (cfs)**	**Specific Conductivity (mmhos)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Soluble Reactive P (mg/L)**	**Dissolved P (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
NDEP Standards[1]		N/A	N/A	**10**	**25**	N/A	N/A	**0.6 [2]**	**0.1**	N/A	N/A	N/A	N/A
First Quarter WY 2017-2018													
10/18/17	14:50	0.05	85.1	1.11	2.0	0.001	0.126	0.127	0.023	0.004	0.011	7.22	0
11/14/17	14:35	0.04	73.2	5.47	13.0	0.003	0.224	0.227	0.1	0.006	0.016	0.56	0.3
12/21/17	15:15	***UNABLE TO SAMPLE DUE TO ICE ON STREAM***										-6.11	0.2
Second Quarter WY 2017-2018													
1/17/18	14:45	0.09	59.0	0.87	1.00	0.002	0.104	0.106	0.015	0.005	0.01	3.89	0
2/14/18	15:45	***UNABLE TO SAMPLE DUE TO ICE ON STREAM***										-5.56	0
3/20/18	15:42	***UNABLE TO SAMPLE DUE TO ICE ON STREAM***										0.00	0.1
Third Quarter WY 2017-2018													
4/4/18	16:05	0.16	78.2	3.17	3.5	0.003	0.124	0.127	0.029	0.003	0.007	4.44	0
4/18/18	15:05	0.19	70.5	0.84	1.0	0.002	0.062	0.064	0.017	0.005	0.012	-1.11	0
5/3/18	15:00	0.57	56.2	2.97	3.0	0.002	0.131	0.133	0.034	0.008	0.013	5.00	0
5/17/18	16:15	0.35	54.2	1.05	1.0	0.002	0.080	0.082	0.025	0.009	0.021	4.44	0.7
5/23/18	15:30	0.34	54.9	0.95	1.0	0.002	0.095	0.097	0.021	0.007	0.016	6.67	0.2
5/30/18	14:55	0.17	60.0	0.79	0.5	0.001	0.106	0.107	0.022	0.004	0.015	9.44	0
6/6/18	15:00	0.16	67.7	0.93	1.5	0.003	0.084	0.087	0.029	0.006	0.020	8.89	0
6/20/18	14:40	0.17	80.2	2.89	6.0	0.003	0.191	0.194	0.053	0.007	0.015	13.33	0
Fourth Quarter WY 2017-2018													
7/19/18	14:45	0.16	101.7	**11.7**	10.5	0.004	0.166	0.170	0.065	0.012	0.023	16.67	0
8/16/18	14:50	0.03	118.4	**33.3**	**34.0**	0.004	0.285	0.289	**0.184**	0.012	0.016	13.89	0
9/12/18	15:30	**UNABLE TO SAMPLE DUE TO LOW FLOWS, STAGNANT WATER, AND HEAVY VEGETATION IN CHANNEL**										7.78	0
Annual Summary	**Minimum**	0.032	54.2	0.79	0.50	0.001	0.062	0.064	0.015	0.003	0.007	-6.11	-
	Maximum	0.565	118.4	33.30	34.0	0.004	0.285	0.289	0.184	0.012	0.023	16.67	-
	Average	0.192	75.0	5.43	6.42	0.003	0.140	0.142	0.050	0.007	0.015	6.507	-

[1] NDEP Standards are from the Nevada Administrative Code (NAC) Chapter 445A.1915. All listed numbers are standards for single values no greater than a given parameter unless otherwise noted.

[2] Annual Average

Table A-6: **Heavenly Mountain Resort water year 2018/2019 water quality monitoring data from station 43HVE-1, Edgewood Creek above Boulder Parking Lot. This station is located in Edgewood Bowl above the learn-to-ski center, at an elevation of 7,280 feet.**

Date	Time	Discharge (cfs)	Specific Conductivity (mmhos)	Turbidity (ntu)	Suspended Sediment (mg/L)	Total Nitrite/Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Soluble Reactive P (mg/L)	Dissolved P (mg/L)	Average Temperature (Deg C)	Precipitation (in)
NDEP Standards[1]		N/A	N/A	**10**	**25**	N/A	N/A	**0.6 [2]**	**0.1**	N/A	N/A	N/A	N/A
First Quarter WY 2018-2019													
10/17/18	15:00	Unable to measure flow or collect water quality samples on 10/17 due to low flows and heavy vegetation in channel at monitoring location										5.00	0
11/15/18	15:00	0.103	61.3	1.45	2.5	0.004	0.085	0.089	0.023	0.004	0.011	3.33	0
12/12/18	16:20	-[3]	63.9	3.75	4.0	0.003	0.124	0.127	0.039	0.005	0.011	-1.11	0
Second Quarter WY 2018-2019													
1/23/19	16:00	Unable to measure flow or collect water quality samples on 1/23 due to complete stream snow cover at monitoring location										0.00	0
2/12/19	16:45	Unable to measure flow or collect water quality samples on 2/12 due to complete stream snow cover at monitoring location										-3.33	0.1
3/21/19	16:30	Unable to measure flow or collect water quality samples on 3/21 due to complete stream snow cover at monitoring location										-2.78	0.1
Third Quarter WY 2018-2019													
4/10/19	15:20	Unable to measure flow or collect water quality samples on 4/10 due to complete stream snow cover at monitoring location										-1.67	0
4/24/19	15:30	0.554	59.6	**13.00**	16.0	0.005	0.259	0.264	**0.145**	0.007	0.015	7.78	0
5/8/19	15:20	1.241	49.8	3.35	4.0	0.003	0.107	0.110	0.047	0.008	0.015	6.67	0
5/22/19	15:20	0.401	50.2	3.83	5.0	0.001	0.103	0.104	0.054	0.007	0.015	0.00	0.7
6/5/19	14:45	0.342	58.2	3.00	1.5	0.002	0.110	0.112	0.031	0.013	0.019	11.67	0
6/19/19	14:35	0.159	77.5	2.18	1.5	0.002	0.171	0.173	0.032	0.007	0.017	13.33	0
6/26/19	14:35	0.161	74.6	**13.80**	11.0	0.002	0.235	0.237	**0.112**	0.009	0.019	7.78	0
Fourth Quarter WY 2018-2019													
7/2/19	14:40	0.177	79.7	**8.4**	8.0	0.001	0.196	0.197	0.076	0.006	0.018	10.56	0
7/17/19	14:45	0.084	91.4	**8.3**	8.0	0.001	0.22	0.221	0.079	0.008	0.021	12.78	0
8/14/19	15:40	0.071	108.70	**11.80**	16.0	0.003	0.296	0.299	**0.105**	0.011	0.021	15.56	0
9/18/19	16:00	0.152	106.10	**308.00**	**844.0**	0.003	9.340	**9.343**	**3.824**	0.008	0.023	4.44	0
Annual Summary	**Minimum**	0.071	49.8	1.45	1.50	0.001	0.085	0.089	0.023	0.004	0.011	-3.33	-
	Maximum	1.241	108.7	**308.00**	**844.00**	0.005	9.340	**9.343**	**3.824**	0.013	0.023	15.56	-
	Average	0.301	73.4	**31.74**	**76.79**	0.003	0.937	**0.940**	**0.381**	0.008	0.017	6.87	-

[1] NDEP Standards are from the Nevada Administrative Code (NAC) Chapter 445A.1915. All listed numbers are standards for single values no greater than a given parameter unless otherwise noted.

[2] Annual Average

[3] Unable to measure flow due to low flows and snow cover on 12/12; however, water quality samples were collected

[4] Unable to measure flow or collect water quality samples on 1/23 or 2/12 due to complete stream snow cover at monitoring location

Edgewood Creek - Above
(43HVE-1)

Table A-6:		Heavenly Mountain Resort water year 2019/2020 water quality monitoring data from station 43HVE-1, Edgewood Creek above Boulder Parking Lot. This station is located in Edgewood Bowl above the learn-to-ski center, at an elevation of 7,280 feet.												
Date	**Time**	**Discharge (cfs)**	**Specific Conductivity (mmhos)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Soluble Reactive P (mg/L)**	**Dissolved P (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
NDEP Standards[1]		N/A	N/A	**10[2]**	**25[2]**	N/A	N/A	**0.6[2] / 0.6[3]**	**0.1[2] / 0.05[3]**	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2019-2020														
10/15/19	14:30	0.071	81.3	6.08	9.0	0.001	0.175	0.176	0.066	0.005	0.011	11.9	13.3	0.0
11/13/19	14:05	-[4]	68.5	9.40	12.0	0.001	0.202	0.203	0.083	0.004	0.013	8.4	12.9	0.0
12/11/19	15:45	-[5]	60.7	3.25	3.0	0.002	0.138	0.140	0.037	0.004	0.011	N/A	N/A	0.0
Second Quarter WY 2019-2020														
1/14/20	15:45	Neither flow nor water quality samples could be collected due to snow cover across channel.												0.1
2/11/20	15:30	Neither flow nor water quality samples could be collected due to ice cover across channel. No flow was apparent under ice.												0.0
3/23/20	15:45	Neither flow nor water quality samples could be collected due to snow cover across channel.												0.0
Third Quarter WY 2019-2020														
4/7/20	14:50	-[4]	72.5	5.28	8.5	0.001	0.258	0.259	0.059	0.002	0.013	1.9	6.2	0.5
4/21/20	13:30	0.208	67.7	**19.3**	32.7	0.003	0.301	0.304	**0.209**	0.005	0.013	8.9	16.2	0.0
5/5/20	14:00	0.243	55.0	7.76	16.0	0.001	0.216	0.217	**0.115**	0.005	0.022	14.9	18.0	0.0
5/20/20	14:30	0.195	57.0	3.17	5.0	0.001	0.151	0.152	0.050	0.003	0.022	14.8	9.5	0.2
5/27/20	14:20	0.160	68.7	2.61	4.0	0.024	0.211	0.235	0.042	0.003	0.016	20.8	26.5	0.0
6/2/20	14:45	0.111	69.2	3.26	4.0	0.003	0.149	0.152	0.043	0.008	0.017	21.8	30.0	0.0
6/16/20	14:20	0.057	75.8	5.19	6.5	0.002	0.145	0.147	0.052	0.008	0.015	18.1	17.6	0.0
6/30/20	14:55	-[4]	86.3	**11.3**	17.5	0.003	0.323	0.326	**0.119**	0.005	0.019	20.0	18.6	0.0
Fourth Quarter WY 2019-2020														
7/14/20	14:05	-[4]	92.4	**15.0**	30.5	0.003	0.377	0.380	**0.212**	0.009	0.021	24.0	28.0	0.0
8/18/20	14:20	-[4]	120.4	**19.0**	31.0	0.002	0.514	0.516	**0.201**	0.009	0.02	24.0	25.0	0.0
9/22/20	14:20	Neither flow nor water quality samples could be collected due to low flow conditions.												
Annual Summary	**Minimum**	0.057	55.0	2.61	3.00	0.001	0.138	0.140	0.037	0.002	0.011	1.9	6.2	-
	Maximum	0.243	120.4	**19.30**	**32.70**	0.024	0.514	0.516	**0.212**	0.009	0.022	24.0	30.0	-
	Average	0.149	75.0	8.51	13.82	0.004	0.243	0.247	**0.099**	0.005	0.016	15.8	18.5	-

[1] NDEP Standards are from the Nevada Administrative Code (NAC) Chapter 445A.1664.

[2] Not to exceed standard for a single value.

[3] Not to excced standard for the annual average.

[4] Collected water quality samples, but could not measure flow due to stagnant water and muck layer on channel bottom

[5] Collected water quailty samples, but could not measure flow due to partial snow cover across channel

Table A-6:			Heavenly Mountain Resort water year 2020-2021 water quality monitoring data from station 43HVE-1, Edgewood Creek above Boulder Parking Lot. This station is located in Edgewood Bowl above the learn-to-ski center, at an elevation of 7,280 feet.												
Date	**Notes**	**Time**	**Discharge (cfs)**	**Specific Conductivity (mmhos)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L) [3]**	**Soluble Reactive P (mg/L)**	**Dissolved P (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
NDEP Standards	[1]		N/A	N/A	**10.0**	**25.0**	N/A	N/A	**0.6** [2]	**0.1 (SV) 0.05 (AA)**	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2020-2021															
10/20/20		15:00	No samples collected or flow measured due to extremely low flow conditions as the site.										N/A	N/A	0.0
11/19/20		16:04	No samples collected or flow measured due to extremely low flow conditions and snow cover at the site.										N/A	N/A	2.2
12/9/20		15:10	No samples collected or flow measured due to extremely low flow conditions and snow cover at the site.										N/A	N/A	0.0
Second Quarter WY 2020-2021															
1/13/21		15:15	No samples collected or flow measured due to extremely low flow conditions and snow cover at the site.										N/A	N/A	0.0
2/17/21		15:40	No samples collected or flow measured due to extremely low flow conditions and snow cover at the site.										N/A	N/A	0.0
3/17/21	[4]	15:15	N/A	77.5	5.72	10.0	0.002	0.206	0.208	0.057	0.003	0.011	2.5	3.5	0.0
Third Quarter WY 2020-2021															
4/6/21		14:55	0.122	70.5	**15.80**	23.5	0.001	0.295	0.296	**0.152**	0.006	0.015	10.5	13.8	0.0
4/20/21		14:35	0.192	60.6	**12.6**	21.0	0.003	0.3	0.303	**0.143**	0.009	0.021	14.9	18.6	0.0
5/4/21		15:00	0.114	14.3	**55.0**	**26.0**	0.003	0.303	0.306	**0.155**	0.007	0.020	16.9	17.5	0.0
5/18/21		14:30	0.114	65.6	1.50	1.5	0.001	0.156	0.157	0.028	0.003	0.013	21.0	21.1	0.0
5/25/21		14:15	0.059	62.5	1.26	3.0	0.002	0.112	0.114	0.022	0.002	0.014	18.5	13.8	0.0
6/1/21		14:10	No flow measured, but samples were taken	73.1	1.61	2.5	0.001	0.154	0.155	0.021	0.003	0.009	24.1	24.1	0.0
6/15/21		14:30	No samples collected or flow measured due to extremely low flow conditions as the site.										N/A	20.3	0.0
6/30/21		14:00	No samples collected or flow measured due to extremely low flow conditions as the site.										24.9	27.5	0.0
Fourth Quarter WY 2020-2021															
7/13/21		14:25	No samples collected or flow measured due to no water at the site.										-	29.7	0.0
No WQ Samples Collected in August due to Caldor Fire, Forest Closures and Basin Evacuation															
9/20/21		13:45	No samples collected or flow measured due to no water at the site.										-	19.5	0.0
Annual Summary		**Minimum**	0.1	14.3	1.26	1.5	0.001	0.112	0.114	0.021	0.002	0.009	2.5	3.5	0.0
		Maximum	0.2	77.5	55.00	26.0	0.003	0.303	0.306	0.155	0.009	0.021	24.9	29.7	2.2
		Average	0.1	60.6	13.36	12.5	0.002	0.218	0.220	0.083	0.005	0.015	16.7	19.0	0.1

[1] NDEP Standards are from the Nevada Administrative Code Chapter 445A.1664 Truckee Region: Edgewood Creek at Palisades Dr. All listed numbers are standards for single values no greater than a given parameter unless otherwise noted.

[2] The Total Nitrogen Standard shown is for both single values as well as annual average values no greater than 0.6 mg/L listed.

[3] There are two standards for Total Phosphorus provided by NDEP Code 445A.1664. The single value of 0.1 mg/L for all samples collected, as well the annual average standard value of 0.05 mg/L.

[4] Collected water quality samples, but could not measure flow due to partial snow cover across channel

Table A-7: **Heavenly Mountain Resort water year 2016/2017 water quality monitoring data from station 43HVE-2, Edgewood Creek below Boulder Parking Lot. . This station is located 1/4 mile below the parking lot, underneath the power lines at an elevation of 7,120 feet.**

Date	Time	Discharge (cfs)	Specific Conductivity (mmhos)	Turbidity (ntu)	Suspended Sediment (mg/L)	Total Nitrite/Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Soluble Reactive P (mg/L)	Dissolved P (mg/L)	Average Temperature (Deg C)	Precipitation (in)
NDEP Standards[1]		N/A	N/A	**10.0**	**25.0**	N/A	N/A	**0.6 [2]**	**0.1**	N/A	N/A	N/A	N/A
First Quarter WY 2016-2017													
10/13/16	15:00	0.007	141.7	0.68	2.0	0.035	0.068	0.103	0.023	0.004	0.022	7.78	0
11/15/16	15:00	0.013	154.9	0.53	1.0	0.046	0.102	0.148	0.011	0.003	0.010	6.67	0
12/20/16	16:20	0.090	185.3	3.16	1.5	0.069	0.256	0.325	0.02	0.006	0.011	1.11	0.1
Second Quarter WY 2016-2017													
1/17/17	No samples collected due to snow/access/winter resort operations											1.67	0
2/23/17	No samples collected due to snow/access/winter resort operations											-8.89	0.1
3/16/17	No samples collected due to significant snow depth											5.00	0
Third Quarter WY 2016-2017													
4/4/17	15:35	0.688	118.7	**18.2**	13.0	0.052	0.258	0.310	0.058	0.012	0.016	2.78	0
4/16/17	15:40	1.00	142.4	**11.0**	8.5	0.067	0.226	0.293	0.095	0.007	0.016	2.78	0
5/4/17	15:00	1.92	91.5	**30.0**	**39.0**	0.024	0.374	0.398	**0.155**	0.009	0.029	10.56	0
5/18/17	14:45	1.72	82.1	6.17	7.0	0.012	0.174	0.186	0.037	0.007	0.015	3.33	0
6/1/17	16:00	2.26	57.4	6.04	9.0	0.007	0.173	0.180	0.052	0.009	0.017	6.11	0
6/8/17	15:55	1.22	71.9	3.73	2.5	0.012	0.15	0.162	0.026	0.009	0.016	6.11	0
6/22/17	16:20	0.480	105.2	3.92	3.5	0.032	0.238	0.270	0.038	0.010	0.023	16.11	0
6/29/17	16:05	0.258	116.8	5.59	4.0	0.044	0.198	0.242	0.039	0.010	0.023	11.67	0
Fourth Quarter WY 2016-2017													
7/13/17	15:30	0.217	135.7	9.06	5.5	0.067	0.228	0.295	0.043	0.011	0.025	15.00	0
8/23/17	14:58	0.523	144.1	8.90	3.0	0.074	0.173	0.247	0.036	0.008	0.023	11.67	0.1
9/14/17	15:45	0.155	135.2	**14.70**	**26.0**	0.061	0.264	0.325	**0.106**	0.012	0.021	8.33	0
Annual Summary	**Minimum**	0.007	57.40	0.53	1.000	0.007	0.068	0.103	0.011	0.003	0.010	-8.9	-
	Maximum	2.255	185.30	30.00	39.000	0.074	0.374	0.398	0.155	0.012	0.029	16.1	-
	Average	0.753	120.21	8.69	8.964	0.043	0.206	0.249	0.053	0.008	0.019	6.3	-

[1] NDEP Standards are from the Nevada Administrative Code (NAC) Chapter 445A.1915. All listed numbers are standards for single values no greater than a given parameter unless otherwise noted.

[2] Annual Average

Table A-7: **Heavenly Mountain Resort water year 2017/2018 water quality monitoring data from station 43HVE-2, Edgewood Creek below Boulder Parking Lot. This station is located 1/4 mile below the parking lot, underneath the power lines at an elevation of 7,120 feet.**

Date	Time	Discharge (cfs)	Specific Conductivity (mmhos)	Turbidity (ntu)	Suspended Sediment (mg/L)	Total Nitrite/Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Soluble Reactive P (mg/L)	Dissolved P (mg/L)	Average Temperature (Deg C)	Precipitation (in)
NDEP Standards[1]		N/A	N/A	**10.0**	**25.0**	N/A	N/A	**0.6** [2]	**0.1**	N/A	N/A	N/A	N/A
First Quarter WY 2017-2018													
10/18/17	15:15	0.637	123.3	4.43	1.5	0.034	0.117	0.151	0.022	0.005	0.014	7.22	0
11/14/17	15:00	0.261	107.4	4.11	2.5	0.034	0.13	0.164	0.029	0.006	0.017	0.56	0.3
12/21/17	15:30	0.193	72.2	5.50	**25.5**	0.046	0.224	0.270	0.037	0.005	0.011	-6.11	0.2
Second Quarter WY 2017-2018													
1/17/18	15:10	0.237	94.9	7.19	3.5	0.048	0.135	0.183	0.024	0.005	0.011	3.89	0
2/14/18	16:00	0.186	55.7	4.81	1.5	0.046	0.117	0.163	0.024	0.006	0.014	-5.56	0
3/20/18	16:02	0.327	212.0	**125**	**82.0**	0.061	0.513	0.574	**0.254**	0.004	0.008	0.00	0.1
Third Quarter WY 2017-2018													
4/4/18	16:35	0.731	96.4	**44.6**	**34.0**	0.038	0.262	0.300	**0.142**	0.004	0.008	4.44	0
4/18/18	14:35	0.593	96.2	6.9	5.0	0.028	0.128	0.156	0.032	0.005	0.013	-1.11	0
5/3/18	15:30	0.952	73.3	**15.7**	11.0	0.015	0.178	0.193	0.065	0.007	0.012	5.00	0
5/17/18	16:00	0.630	75.5	4.13	3.0	0.018	0.123	0.141	0.032	0.008	0.021	4.44	0.7
5/23/18	15:15	0.392	83.0	3.44	3.0	0.019	0.145	0.164	0.027	0.007	0.019	6.67	0.2
5/30/18	15:30	0.265	88.8	3.90	2.0	0.023	0.132	0.155	0.031	0.005	0.018	9.44	0
6/6/18	14:30	0.186	97.8	4.67	3.0	0.039	0.141	0.180	0.032	0.007	0.025	8.89	0
6/20/18	14:00	0.100	109.6	3.75	2.5	0.057	0.121	0.178	0.027	0.007	0.016	13.33	0
Fourth Quarter WY 2017-2018													
7/19/18	14:20	0.044	126.2	6.18	4.5	0.093	0.147	0.240	0.033	0.010	0.022	16.67	0
8/16/18	14:30	0.027	135.8	8.19	6.0	0.082	0.290	0.372	0.036	0.014	0.018	13.89	0
9/12/18	15:05	0.032	134.4	4.53	2.0	0.046	0.123	0.169	0.026	0.006	0.019	7.78	0
Annual Summary	**Minimum**	0.027	55.70	3.44	1.50	0.015	0.117	0.141	0.022	0.004	0.008	-6.1	-
	Maximum	0.952	212.0	125	82.0	0.093	0.513	0.574	0.254	0.014	0.025	16.7	-
	Average	0.341	104.9	**15.1**	11.32	0.043	0.178	0.221	0.051	0.007	0.016	5.3	-

[1] NDEP Standards are from the Nevada Administrative Code (NAC) Chapter 445A.1915. All listed numbers are standards for single values no greater than a given parameter unless otherwise noted.

[2] Annual Average

Table A-7:	Heavenly Mountain Resort water year 2018/2019 water quality monitoring data from station 43HVE-2, Edgewood Creek below Boulder Parking Lot. This station is located 1/4 mile below the parking lot, underneath the power lines at an elevation of 7,120 feet.												
Date	**Time**	**Discharge (cfs)**	**Specific Conductivity (mmhos)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L)**	**Soluble Reactive P (mg/L)**	**Dissolved P (mg/L)**	**Average Temperature (Deg C)**	**Precipitation (in)**
NDEP Standards[1]		N/A	N/A	**10.0**	**25.0**	N/A	N/A	**0.6** [2]	**0.1**	N/A	N/A	N/A	N/A
First Quarter WY 2018-2019													
10/17/18	14:30	0.116	117.7	**12.0**	1.5	0.032	0.127	0.159	0.023	0.005	0.015	5.00	0
11/15/18	14:30	0.124	105.9	3.48	3.0	0.033	0.107	0.140	0.020	0.003	0.012	3.33	0
12/12/18	15:50	0.106	104.2	5.37	2.5	0.050	0.158	0.208	0.033	0.009	0.015	-1.11	0
Second Quarter WY 2018-2019													
1/23/19	15:30	0.309	1407.0	**324.0**	**176.0**	0.063	1.421	**1.484**	**0.761**	0.005	0.013	0.00	0
2/12/19	16:15	Unable to measure flow or collect water quaility samples on 2/12 due to complete stream snow cover at monitoring location										-3.33	0.1
3/21/19	16:00	0.384	233.0	**340.0**	**44.5**	0.061	1.113	**1.174**	**0.684**	0.005	0.008	-2.78	0.1
Third Quarter WY 2018-2019													
4/10/19	14:50	0.861	123.6	**15.3**	11.5	0.035	0.187	0.222	0.055	0.006	0.014	-1.67	0
4/24/19	15:00	1.151	87.2	**62.8**	**56.0**	0.025	0.402	0.427	**0.254**	0.009	0.018	7.78	0
5/8/19	15:00	2.185	66.9	**26.2**	**34.7**	0.011	0.237	0.248	**0.173**	0.009	0.019	6.67	0
5/22/19	14:55	1.143	77.0	8.01	6.5	0.015	0.126	0.141	0.042	0.005	0.014	0.00	0.7
6/5/19	15:15	0.582	88.8	4.48	3.0	0.015	0.125	0.140	0.034	0.009	0.018	11.67	0
6/19/19	14:15	0.321	110.9	5.39	2.5	0.038	0.147	0.185	0.034	0.010	0.021	13.33	0
6/26/19	14:10	0.246	114.2	5.54	1.5	0.043	0.197	0.240	0.037	0.007	0.023	7.78	0
Fourth Quarter WY 2018-2019													
7/2/19	14:30	0.179	119.0	7.35	4.0	0.049	0.145	0.194	0.042	0.010	0.023	10.56	0
7/17/19	14:20	0.138	128.6	6.47	3.0	0.063	0.164	0.227	0.041	0.012	0.027	12.78	0
8/14/19	15:20	0.016	135.9	5.46	1.5	0.081	0.217	0.298	0.035	0.012	0.022	15.56	0
9/18/19	15:35	0.134	126.7	6.62	3.5	0.053	0.160	0.213	0.047	0.013	0.027	4.44	0
Annual Summary	**Minimum**	0.016	66.90	3.48	1.50	0.011	0.107	0.140	0.020	0.003	0.008	-3.33	-
	Maximum	2.185	1407.0	**340**	**176.0**	0.081	1.421	**1.484**	0.761	0.013	0.027	15.56	-
	Average	0.500	196.7	**52.4**	**22.20**	0.042	0.315	0.356	0.145	0.008	0.018	5.29	-

[1] NDEP Standards are from the Nevada Administrative Code (NAC) Chapter 445A.1915. All listed numbers are standards for single values no greater than a given parameter unless otherwise noted.
[2] Annual Average
[3] Unable to measure flow or collect water quaility samples on 2/12 due to stream snow cover and recent tree fall activity at monitoring location

Edgewood Creek - Below
(43HVE-2)

Table A-7: Heavenly Mountain Resort water year 2019/2020 water quality monitoring data from station 43HVE-2, Edgewood Creek below Boulder Parking Lot. This station is located 1/4 mile below the parking lot, underneath the power lines at an elevation of 7,120 feet.

Date	Time	Discharge (cfs)	Specific Conductivity (mmhos)	Turbidity (ntu)	Suspended Sediment (mg/L)	Total Nitrite/Nitrate (mg/L)	Total Kjeldahl N (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Soluble Reactive P (mg/L)	Dissolved P (mg/L)	Site Water Temperature (Deg C)	Site Ambient Temperature (Deg C)	Precipitation (in)
NDEP Standards[1]		N/A	N/A	**10[2]**	**25[2]**	N/A	N/A	**0.6[2] / 0.6[3]**	**0.1[2] / 0.05[3]**	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2019-2020														
10/15/19	14:10	0.118	122.3	4.51	1.0	0.045	0.100	0.145	0.024	0.007	0.015	7.4	10.9	0.0
11/13/19	13:45	0.133	105.2	**35.60**	19.0	0.038	0.272	0.310	**0.135**	0.005	0.016	6.0	8.4	0.0
12/11/19	15:15	0.314	130.4	9.59	5.0	0.056	0.165	0.221	0.052	0.009	0.018	2.3	1.2	0.0
Second Quarter WY 2019-2020														
1/14/20	15:00	0.087	108.3	4.67	3.0	0.055	0.121	0.176	0.026	0.007	0.018	N/A	N/A	0.1
2/11/20	15:10	0.198	114.3	6.09	4.5	0.064	0.157	0.221	0.034	0.004	0.012	1.5	1.4	0.00
2/23/20	15:00	0.251	140.6	6.75	7.5	0.073	0.169	0.242	0.037	0.003	0.010	1.9	1.0	0.00
Third Quarter WY 2019-2020														
4/7/20	14:20	0.287	131.2	**16.1**	8.5	0.073	0.223	0.296	0.066	0.004	0.018	1.7	2.6	0.5
4/21/20	13:00	0.579	91.3	**65.7**	**74.7**	0.032	0.515	0.547	**0.427**	0.006	0.013	6.3	8.4	0.0
5/5/20	13:30	0.632	76.3	**11.2**	16.0	0.020	0.220	0.240	**0.102**	0.005	0.017	12.0	15.5	0.0
5/20/20	14:10	0.317	90.4	3.96	5.0	0.034	0.139	0.173	0.046	0.006	0.023	10.0	5.2	0.2
5/27/20	14:00	0.232	101.1	3.62	3.5	0.033	0.153	0.186	0.034	0.005	0.017	14.1	23.3	0.0
6/2/20	14:20	0.180	107.4	3.68	2.5	0.048	0.131	0.179	0.030	0.008	0.019	13.6	20.9	0.0
6/16/20	14:00	0.139	114.8	3.14	2.5	0.046	0.114	0.160	0.026	0.007	0.017	11.2	15.4	0.0
6/30/20	14:30	0.044	128.2	2.21	2.5	0.089	0.137	0.226	0.031	0.006	0.022	12.4	22.6	0.0
Fourth Quarter WY 2019-2020														
7/14/20	14:20	0.037	137.5	3.19	3.0	0.106	0.165	0.271	0.032	0.005	0.018	13.0	24.5	0.0
8/18/20	14:45	0.033	149.7	3.85	5.5	0.070	0.253	0.323	0.035	0.011	0.022	15.0	24.0	0.0
9/22/20	14:00	0.031	141.5	2.4	3	0.064	0.139	0.203	0.029	0.005	0.021	7.5	20.5	0.0
Annual Summary	**Minimum**	0.031	76.30	2.21	1.00	0.020	0.100	0.145	0.024	0.003	0.010	1.5	1.0	-
	Maximum	0.632	149.7	**65.70**	**74.70**	0.106	0.515	0.547	**0.427**	0.011	0.023	15.0	24.5	-
	Average	0.212	117.1	**10.96**	9.81	0.056	0.187	0.242	**0.069**	0.006	0.017	8.5	12.9	-

[1] NDEP Standards are from the Nevada Administrative Code (NAC) Chapter 445A.1664.

[2] Not to exceed standard for a single value.

[3] Not to excced standard for the annual average.

Table A-7:			Heavenly Mountain Resort water year 2020-2021 water quality monitoring data from station 43HVE-2, Edgewood Creek below Boulder Parking Lot. This station is located 1/4 mile below the parking lot, underneath the power lines at an elevation of 7,120 feet.												
Date	**Notes**	**Time**	**Discharge (cfs)**	**Specific Conductivity (mmhos)**	**Turbidity (ntu)**	**Suspended Sediment (mg/L)**	**Total Nitrite/Nitrate (mg/L)**	**Total Kjeldahl N (mg/L)**	**Total Nitrogen (mg/L)**	**Total Phosphorus (mg/L) [3]**	**Soluble Reactive P (mg/L)**	**Dissolved P (mg/L)**	**Site Water Temperature (Deg C)**	**Site Ambient Temperature (Deg C)**	**Precipitation (in)**
NDEP Standards	1		N/A	N/A	**10.0**	**25.0**	N/A	N/A	**0.6 [2]**	**0.1(SV) 0.05 (AA)**	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2020-2021															
10/20/20		14:40	0.033	133.4	1.45	1.5	0.035	0.085	0.120	0.018	0.002	0.012	10.5	21.5	0.0
11/19/20		15:40	0.117	122.4	7.12	6.0	0.033	0.262	0.295	0.036	0.006	0.014	N/A	N/A	2.2
12/9/20		14:40	0.075	119.7	2.66	2.0	0.060	0.106	0.166	0.025	0.004	0.017	N/A	N/A	0.0
Second Quarter WY 2020-2021															
1/13/21		14:45	0.230	157.1	**22.50**	12.5	0.057	0.279	0.336	0.090	0.011	0.022	2.5	3.2	0.0
2/17/21		15:20	0.084	144.2	6.05	2.5	0.076	0.196	0.272	0.027	0.007	0.013	0.6	-3.4	0.0
3/17/21		14:55	0.050	144.0	9.89	3.0	0.087	0.131	0.218	0.038	0.009	0.017	3.4	6.0	0.0
Third Quarter WY 2020-2021															
4/6/21		14:30	0.428	103.1	**26.4**	22.5	0.038	0.343	0.381	**0.133**	0.008	0.019	7.0	10.1	0.0
4/20/21		14:15	0.357	87.0	**15.0**	14.0	0.038	0.3	0.338	**0.100**	0.01	0.023	10.7	12.5	0.0
5/4/21		14:40	0.339	18.0	**80.1**	13.5	0.028	0.236	0.264	0.099	0.009	0.020	13.4	18.1	0.0
5/18/21		14:00	0.051	106.3	3.10	1.5	0.034	0.179	0.213	0.026	0.01	0.017	12.6	21.1	0.0
5/25/21		13:50	0.043	107.5	4.12	2.0	0.044	0.148	0.192	0.028	0.009	0.021	10.2	12.9	0.0
6/1/21		13:45	0.036	123.9	3.42	2.0	0.054	0.135	0.189	0.017	0.005	0.012	12.5	22.8	0.0
6/15/21		14:10	0.024	137.0	3.23	3.5	0.069	0.125	0.194	0.029	0.003	0.015	17.3	18.8	0.0
6/30/21		13:35	0.016	146.1	3.81	6.5	0.069	0.138	0.207	0.028	0.004	0.013	12.6	25.0	0.0
Fourth Quarter WY 2020-2021															
7/13/21	4	14:25	N/A	144.1	6.66	10.0	0.099	0.213	0.312	0.06	0.007	0.019	12.6	26.9	0.0
No WQ Samples Collected in August due to Caldor Fire, Forest Closures and Basin Evacuation															
9/20/21		13:25	N/A	142.0	18.5	26	0.032	0.356	0.388	0.066	0.011	0.013	8.5	14.2	0.0
Annual Summary		**Minimum**	0.016	18.00	1.45	1.50	0.028	0.085	0.120	0.017	0.002	0.012	0.60	-3.4	0.0
		Maximum	0.428	157.1	**80.10**	26.00	0.099	0.356	0.388	0.133	0.011	0.023	17.3	26.9	2.2
		Average	0.135	121.0	13.38	8.06	0.053	0.202	0.255	0.051	0.007	0.017	9.60	15.0	0.1

[1] NDEP Standards are from the Nevada Administrative Code Chapter 445A.1664 Truckee Region: Edgewood Creek at Palisades Dr. All listed numbers are standards for single values no greater than a given parameter unless otherwise noted.

[2] The Total Nitrogen Standard shown is for both single values as well as annual average values no greater than 0.6 mg/L listed.

[3] There are two standards for Total Phosphorus provided by NDEP Code 445A.1664. The single value of 0.1 mg/L for all samples collected, as well the annual average standard value of 0.05 mg/L.

[4] No flow measurements taken, due to instrument malfunction.

Heavenly Mountain Resort
Water Years 2017–2021

APPENDIX

B

HYDROLOGY GRAPHS

Appendix B
Hydrology Graphs

B.1 SNOTEL Hydrology Graph

B.2 Heavenly Valley Creek versus Hidden Valley Creek

Total Nitrogen 5 Year Rolling Average

Total Phosphorus 5 Year Rolling Average

B.3 Heavenly Valley, Hidden Valley Creek, Bijou Park Creek, and Edgewood Creek Hydrology Graphs

Hydrograph Representing Heavenly Valley Creek and Hidden Valley Creek for the Water Year Ending in 2021

Hydrograph Representing Bijou Park Creek for the Water Year Ending in 2021

Hydrograph Representing Edgewood Creek for the Water Year Ending in 2021

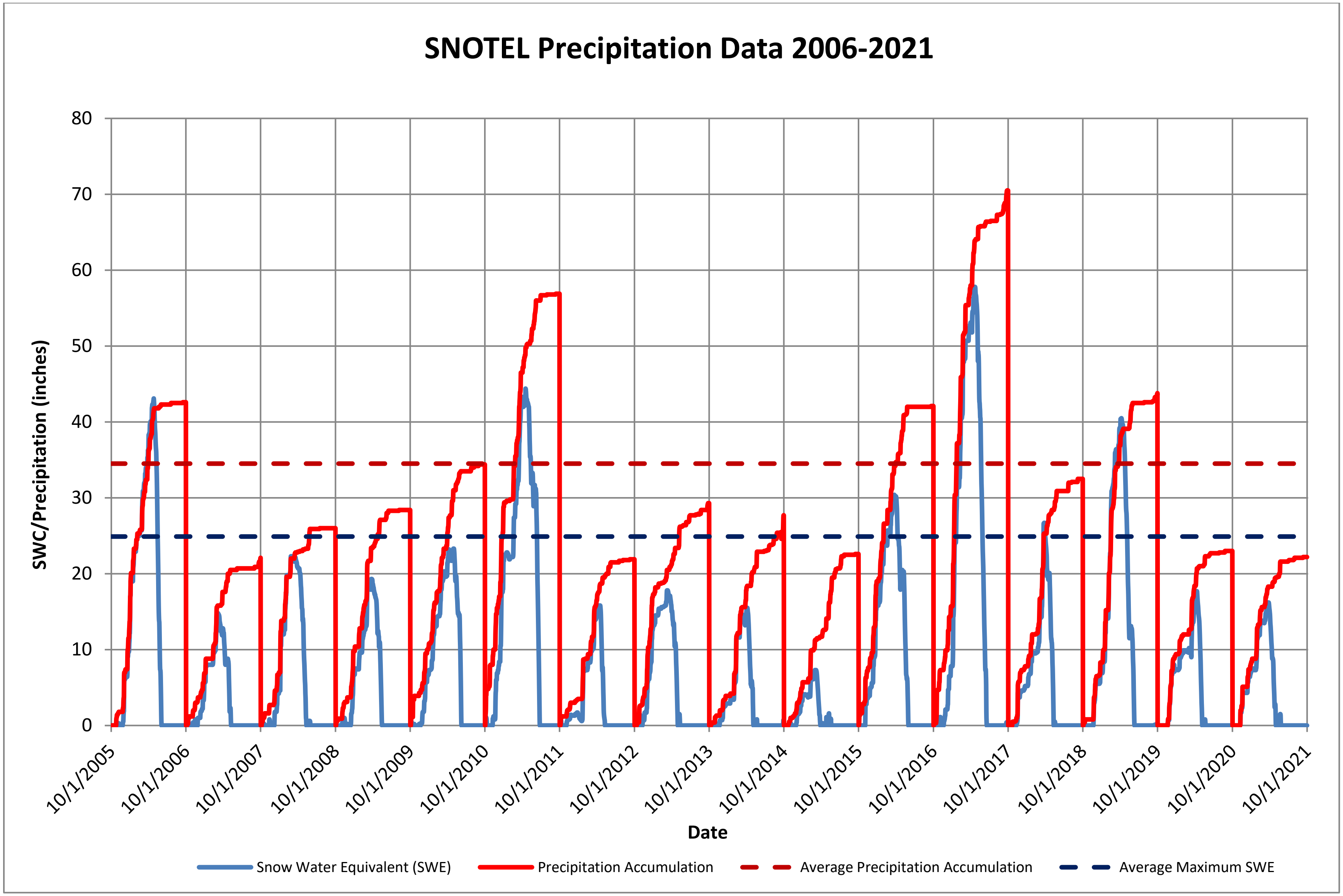

Figure B.1 SNOTEL Precipitation Data 2006–2021

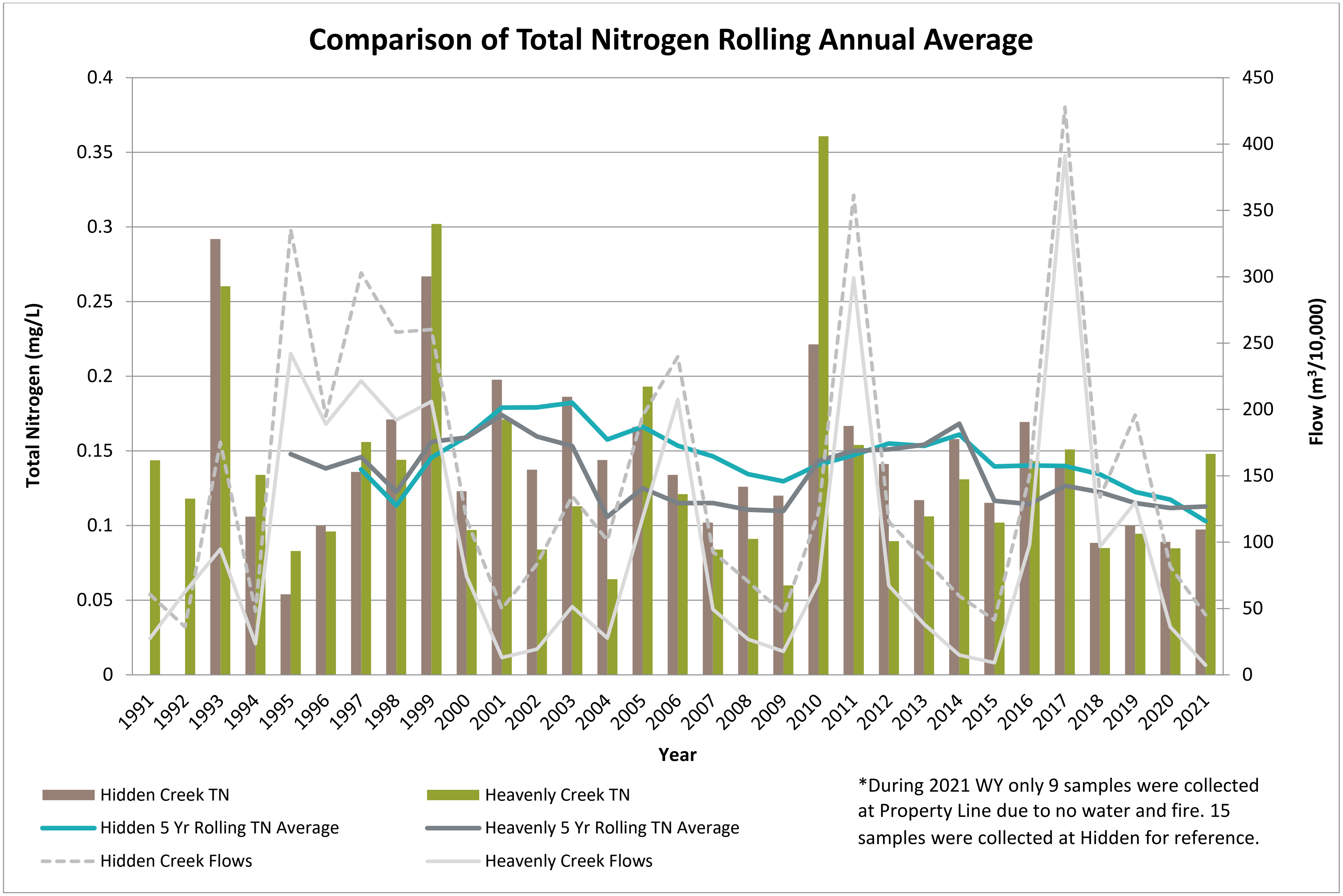

Figure B.2-1 Heavenly Valley Creek and Hidden Valley Creek Total Nitrogen Rolling Average (1991–2016)

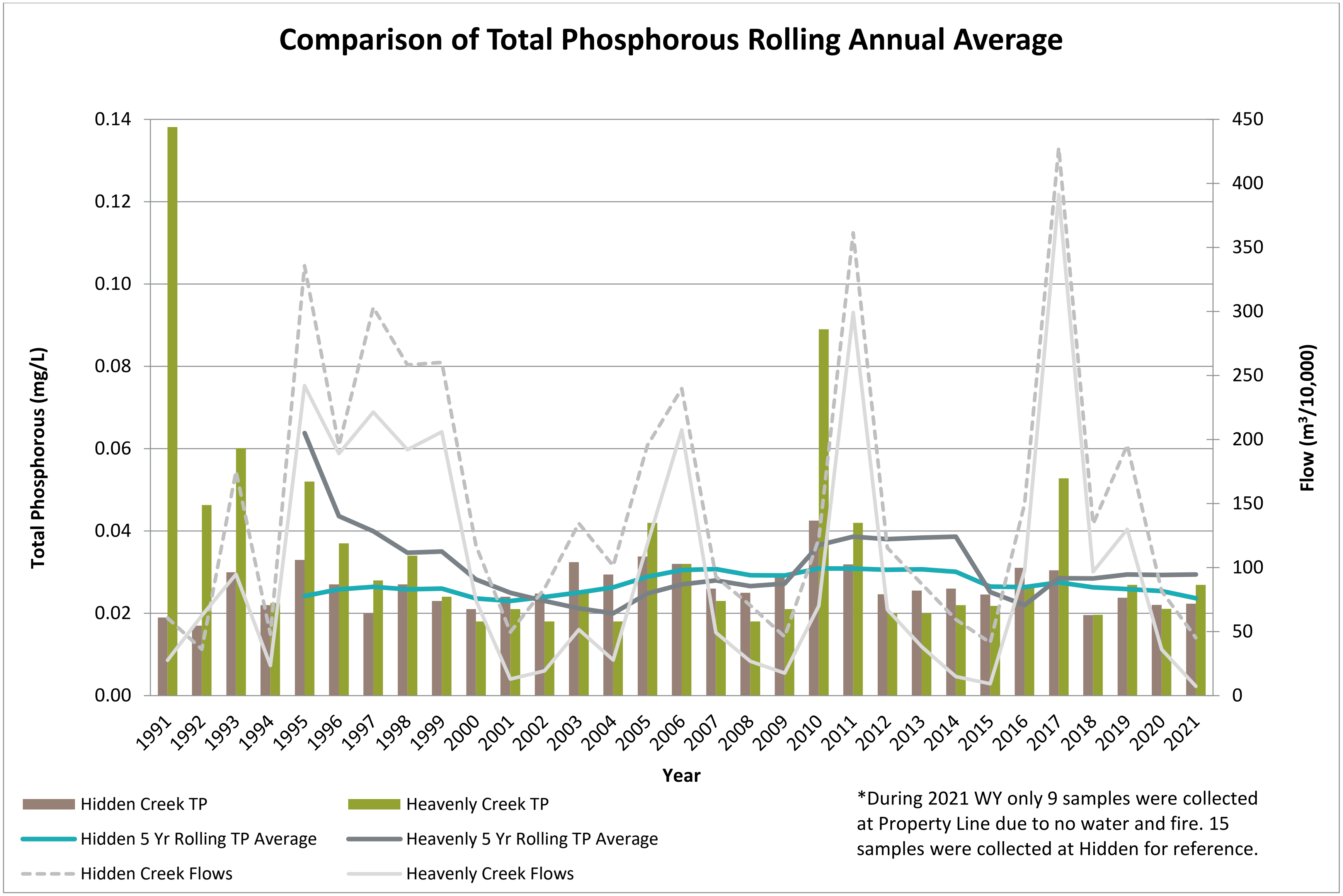

Figure B.2-2 Heavenly Valley Creek and Hidden Valley Creek Total Phosphorus Rolling Average (1991–2016)

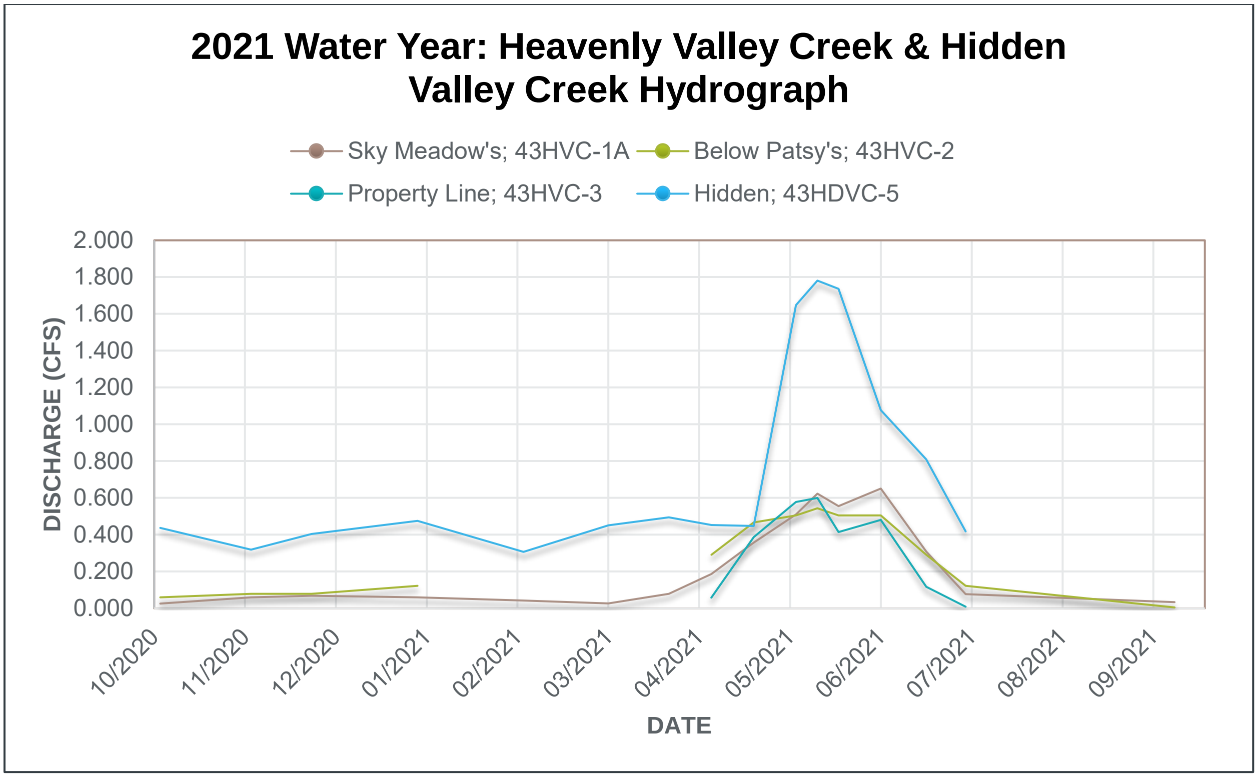

Figure B.3-1 Hydrograph Representing Heavenly Valley Creek and Hidden Valley Creek for the Water Year Ending in 2021

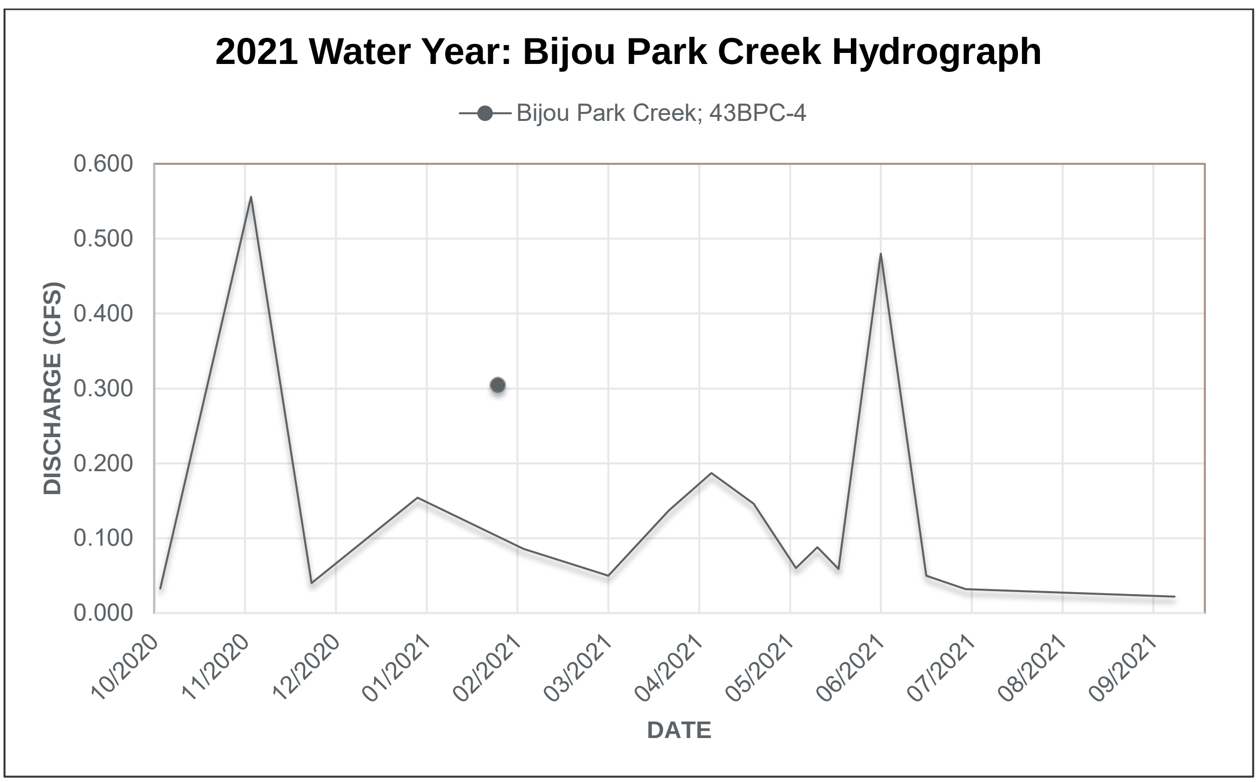

Figure B.3-2 Hydrograph Representing Bijou Park Creek for the Water Year Ending in 2021

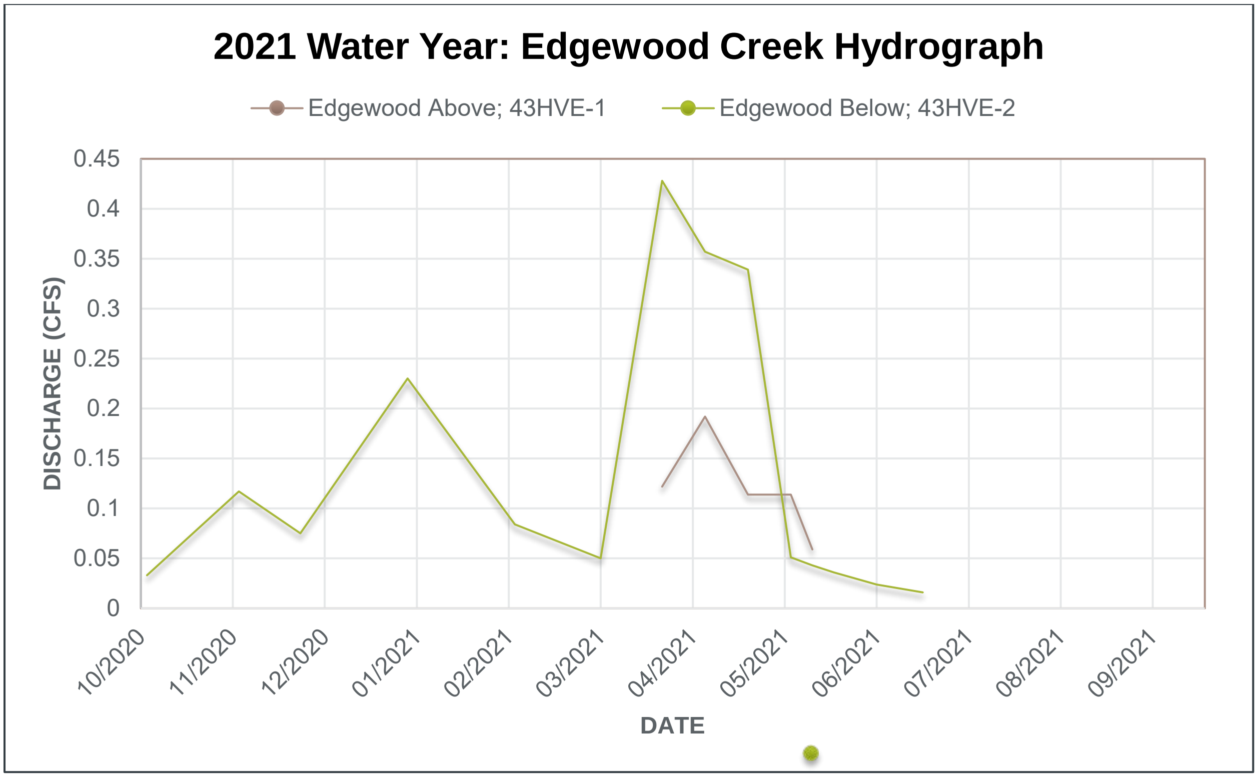

Figure B.3-3 Hydrograph Representing Edgewood Creek for the Water Year Ending in 2021

APPENDIX C

STREAMFLOW STATISTICAL INFORMATION TABLES AND GRAPHS

Appendix C
Streamflow Statistical Information Tables and Graphs

C.1 Statistical Tables

C.1-1 Sky Meadows (43HVC-1a)

C.1-2 Below Patsy's (43HVC-2)

C.1-3 Property Line (43HVC-3)

C.1-4 Bijou Park Creek (43BPC-4)

C.1-5 Hidden Valley Creek (43HDVC-5)

C.2 Annual Average Discharge compared to Constituent Data for Sky Meadows (43HVC-1a) (2006–2021)

C.2-1 Turbidity Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

C.2-2 Suspended Sediment Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

C.2-3 Total Nitrite/Nitrate Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

C.2-4 TKN Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

C.2-5 Total Nitrogen Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

C.2-6 Total Phosphorus Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

C.2-7 Chloride Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

C.3 Annual Average Discharge compared to Constituent Data for Patsy's (43HVC-2) (2006–2021)

C.3-1 Turbidity Versus Flow, Patsy's (43HVC-2) (2006–2021)

C.3-2 Suspended Sediment Versus Flow, Patsy's (43HVC-2) (2006–2021)

C.3-3 Total Nitrite/Nitrate Versus Flow, Patsy's (43HVC-2) (2006–2021)

C.3-4 TKN Versus Flow, Patsy's (43HVC-2) (2006–2021)

C.3-5 Total Nitrogen Versus Flow, Patsy's (43HVC-2) (2006–2021)

C.3-6 Total Phosphorus Versus Flow, Patsy's (43HVC-2) (2006–2021)

C.3-7 Chloride Versus Flow, Patsy's (43HVC-2) (2006–2021)

C.4 Annual Average Discharge compared to Constituent Data for Property Line (43HVC-3) (2006–2021)

C.4-1 Turbidity Versus Flow, Property Line (43HVC-3) (2006–2021)

C.4-2 Suspended Sediment Versus Flow, Property Line (43HVC-3) (2006–2021)

C.4-3 Total Nitrite/Nitrate Versus Flow, Property Line (43HVC-3) (2006–2021)

C.8 Annual Average Discharge compared to Constituent Data for Upper Edgewood (43HVE-1) (2006–2021)

C.9 Constituent Data for Bijou Park Creek (43BPC-4) and Hidden Valley Creek (43HDVC-5) (1991–2021)

C.10 Constituent Data for Heavenly Valley Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (1991–2021)

C.11 Constituent Data for Edgewood Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (2006–2021)

C.12 Box and Whisker Plots showing the Variance between Property Line (43HVC-3) and Hidden Valley Creek (43HDVC-5)

C.1-1

Water Year: 2017							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.173	6.69	1.874	0.4185	2.502	-	-
Turbidity (NTU)	1.06	40.3	5.372	2.4	9.243	-	-
Suspended Sediment (mg/L)	1.00	93.50	11.941	4	22.480	46.30	60.0
Nitrite/Nitrate (mg/L)	0.016	0.083	0.040	0.035	0.017	-	-
Total Kjeldahl Nitrogen (mg/L)	0.053	0.46	0.142	0.117	0.096	-	-
Total Nitrogen (mg/L)	0.09	0.543	0.182	0.152	0.109	-	0.19
Total Phosphorus (mg/L)	0.013	0.271	**0.048**	0.024	0.066	-	0.015
Chloride (mg/L)	0.27	0.57	**0.391**	0.36	0.088	-	0.15

Water Year: 2018							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.10	3.49	1.19	0.75	1.16	-	-
Turbidity (NTU)	0.88	7.03	2.72	1.93	1.94	-	-
Suspended Sediment (mg/L)	1.00	9.00	3.53	2.50	2.53	7.95	60.0
Nitrite/Nitrate (mg/L)	0.01	0.06	0.03	0.03	0.02	-	-
Total Kjeldahl Nitrogen (mg/L)	0.06	0.20	0.10	0.08	0.05	-	-
Total Nitrogen (mg/L)	0.08	0.24	0.13	0.10	0.06	-	0.19
Total Phosphorus (mg/L)	0.01	0.04	**0.02**	0.02	0.01	-	0.015
Chloride (mg/L)	0.28	0.40	**0.34**	0.35	0.03	-	0.15

Water Year: 2019							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.046	1.966	0.484	0.187	0.565	-	-
Turbidity (NTU)	0.72	13.90	3.857	2.18	3.898	-	-
Suspended Sediment (mg/L)	1.00	25.00	5.029	2.5	7.145	22.60	60.0
Nitrite/Nitrate (mg/L)	0.011	0.055	0.022	0.017	0.012	-	-
Total Kjeldahl Nitrogen (mg/L)	0.043	0.286	0.104	0.084	0.068	-	-
Total Nitrogen (mg/L)	0.054	0.311	0.126	0.107	0.075	-	0.19
Total Phosphorus (mg/L)	0.011	0.096	**0.030**	0.023	0.026	-	0.015
Chloride (mg/L)	0.25	0.45	**0.367**	0.37	0.053	-	0.15

Water Year: 2020							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.069	1.062	0.450	0.307	0.381	-	-
Turbidity (NTU)	1.06	3.18	1.863	1.82	0.650	-	-
Suspended Sediment (mg/L)	1.00	14.50	4.269	3.5	3.533	11.70	60.0
Nitrite/Nitrate (mg/L)	0.005	0.037	0.016	0.013	0.010	-	-
Total Kjeldahl Nitrogen (mg/L)	0.055	0.141	0.097	0.1	0.029	-	-
Total Nitrogen (mg/L)	0.062	0.15	0.113	0.115	0.030	-	0.19
Total Phosphorus (mg/L)	0.012	0.025	**0.018**	0.019	0.004	-	0.015
Chloride (mg/L)	0.30	0.80	**0.546**	0.5	0.176	-	0.15

Water Year: 2021							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.026	0.651	0.229	0.079	0.235	-	-
Turbidity (NTU)	1.08	32	4.476	1.785	7.812	-	-
Suspended Sediment (mg/L)	1.00	38	5.438	2.750	8.888	17.35	60.0
Nitrite/Nitrate (mg/L)	0.002	0.05	0.020	0.017	0.017	-	-
Total Kjeldahl Nitrogen (mg/L)	0.047	0.433	0.133	0.108	0.095	-	-
Total Nitrogen (mg/L)	0.051	0.435	0.152	0.135	0.095	-	0.19
Total Phosphorus (mg/L)	0.011	0.147	**0.029**	0.020	0.032	-	0.015
Chloride (mg/L)	0.214	1.40	**0.743**	0.741	0.272	-	0.15

Below Pasty's
(43HVC-2)

Water Year: 2017							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.1	29.23	5.806	0.712	8.871	-	-
Turbidity (NTU)	0.45	20.5	4.429	1.710	6.136	-	-
Suspended Sediment (mg/L)	1.00	47.50	7.412	2.000	12.424	29.10	60.0
Nitrite/Nitrate (mg/L)	0.011	0.096	0.059	0.064	0.023	-	-
Total Kjeldahl Nitrogen (mg/L)	0.053	0.242	0.110	0.092	0.062	-	-
Total Nitrogen (mg/L)	0.118	0.315	0.169	0.143	0.062	-	0.19
Total Phosphorus (mg/L)	0.011	0.137	**0.036**	0.022	0.035	-	0.015
Chloride (mg/L)	0.35	1.40	**0.679**	0.560	0.296	-	0.15

Water Year: 2018							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.10	3.54	1.46	0.63	1.26	-	-
Turbidity (NTU)	0.67	32.30	4.05	1.85	7.55	-	-
Suspended Sediment (mg/L)	1.00	29.00	4.12	2.00	6.74	13.40	60.0
Nitrite/Nitrate (mg/L)	0.02	0.06	0.03	0.03	0.02	-	-
Total Kjeldahl Nitrogen (mg/L)	0.05	0.17	0.09	0.09	0.03	-	-
Total Nitrogen (mg/L)	0.10	0.21	0.13	0.12	0.03	-	0.19
Total Phosphorus (mg/L)	0.01	0.11	**0.03**	0.02	0.02	-	0.015
Chloride (mg/L)	0.44	1.40	**0.73**	0.63	0.28	-	0.15

Water Year: 2019							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.015	11.194	2.22	0.76	3.24	-	-
Turbidity (NTU)	0.52	16.10	3.50	1.45	4.47	-	-
Suspended Sediment (mg/L)	0.50	27	4.24	1.50	6.62	13.80	60.0
Nitrite/Nitrate (mg/L)	0.008	0.066	0.03	0.03	0.02	-	-
Total Kjeldahl Nitrogen (mg/L)	0.045	0.197	0.09	0.08	0.04	-	-
Total Nitrogen (mg/L)	0.069	0.226	0.12	0.10	0.05	-	0.19
Total Phosphorus (mg/L)	0.011	0.092	**0.03**	0.02	0.02	-	0.015
Chloride (mg/L)	0.40	2.30	**0.85**	0.72	0.47	-	0.15

Water Year: 2020							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.09	1.638	0.59	0.4315	0.53	-	-
Turbidity (NTU)	0.27	17.10	2.14	0.96	4.33	-	-
Suspended Sediment (mg/L)	0.50	12.00	2.80	2.5	2.78	7.50	60.0
Nitrite/Nitrate (mg/L)	0.002	0.054	0.02	0.0205	0.02	-	-
Total Kjeldahl Nitrogen (mg/L)	0.052	0.17	0.09	0.0775	0.03	-	-
Total Nitrogen (mg/L)	0	0.18	0.10	0.1	0.05	-	0.19
Total Phosphorus (mg/L)	0.015	0.051	**0.02**	0.0185	0.01	-	0.015
Chloride (mg/L)	0.40	1.30	**0.89**	0.9	0.28	-	0.15

Water Year: 2021							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.005	0.544	0.28	0.29	0.21	-	-
Turbidity (NTU)	0.30	28.10	3.95	0.99	7.77	-	-
Suspended Sediment (mg/L)	1.00	29.50	4.54	1.50	7.77	21.10	60.0
Nitrite/Nitrate (mg/L)	0.001	0.062	0.03	0.03	0.02	-	-
Total Kjeldahl Nitrogen (mg/L)	0.043	0.392	0.12	0.09	0.11	-	-
Total Nitrogen (mg/L)	0.068	0.4	0.15	0.11	0.11	-	0.19
Total Phosphorus (mg/L)	0.009	0.127	**0.03**	0.02	0.03	-	0.015
Chloride (mg/L)	1.04	3.71	**1.48**	1.20	0.71	-	0.15

C.1-3

Water Year: 2017							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.042	31.602	7.360	1.809	10.028	-	-
Turbidity (NTU)	0.20	40.500	7.52	1.89	11.54	-	-
Suspended Sediment (mg/L)	1.000	87.000	15.059	3.00	25.15	74.20	60.0
Nitrite/Nitrate (mg/L)	0.001	0.047	0.01	0.005	0.016	-	-
Total Kjeldahl Nitrogen (mg/L)	0.048	0.414	0.136	0.104	0.10	-	-
Total Nitrogen (mg/L)	0.05	0.461	0.151	0.12	0.11	-	0.19
Total Phosphorus (mg/L)	0.011	0.213	**0.05**	0.02	0.062	-	0.015
Chloride (mg/L)	0.36	1.10	**0.662**	0.560	0.25	-	0.15

Water Year: 2018							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.088	5.28	1.85	1.155	1.694	-	-
Turbidity (NTU)	0.43	3.330	1.61	1.78	0.932	-	-
Suspended Sediment (mg/L)	0.50	11.50	2.353	2.00	2.46	5.50	60.0
Nitrite/Nitrate (mg/L)	0.001	0.01	0.01	0.007	0.00	-	-
Total Kjeldahl Nitrogen (mg/L)	0.052	0.142	0.08	0.08	0.028	-	-
Total Nitrogen (mg/L)	0.06	0.151	0.085	0.08	0.03	-	0.19
Total Phosphorus (mg/L)	0.01	0.03	**0.020**	0.020	0.00	-	0.015
Chloride (mg/L)	0.310	0.97	**0.58**	0.510	0.205	-	0.15

Water Year: 2019							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.007	12.22	2.42	1.345	3.302	-	-
Turbidity (NTU)	0.35	10.800	2.91	1.36	3.005	-	-
Suspended Sediment (mg/L)	1.00	21.00	4.559	3.00	5.25	13.40	60.0
Nitrite/Nitrate (mg/L)	0.002	0.03	0.01	0.005	0.01	-	-
Total Kjeldahl Nitrogen (mg/L)	0.041	0.166	0.09	0.08	0.032	-	-
Total Nitrogen (mg/L)	0.05	0.195	0.095	0.08	0.04	-	0.19
Total Phosphorus (mg/L)	0.01	0.07	**0.027**	0.023	0.01	-	0.015
Chloride (mg/L)	0.400	1.00	**0.65**	0.630	0.186	-	0.15

Water Year: 2020							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.035	1.513	0.631	0.498	0.564	-	-
Turbidity (NTU)	0.44	6.27	1.138	0.790	1.384	-	-
Suspended Sediment (mg/L)	0.50	14.5	2.841	2.000	3.154	5.70	60.0
Nitrite/Nitrate (mg/L)	0.001	0.019	0.003	0.002	0.004	-	-
Total Kjeldahl Nitrogen (mg/L)	0.051	0.218	0.081	0.075	0.037	-	-
Total Nitrogen (mg/L)	0	0.22	0.080	0.079	0.041	-	0.19
Total Phosphorus (mg/L)	0.013	0.055	**0.021**	0.019	0.010	-	0.015
Chloride (mg/L)	0.40	4.00	**1.059**	0.900	0.808	-	0.15

Water Year: 2021							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.009	0.6	0.331	0.4005	0.236	-	-
Turbidity (NTU)	0.30	4.69	1.091	0.58	1.391	-	-
Suspended Sediment (mg/L)	1	6.5	1.944	1.00	1.828	6.50	60.0
Nitrite/Nitrate (mg/L)	0.001	0.014	0.004	0.00	0.005	-	-
Total Kjeldahl Nitrogen (mg/L)	0.053	0.451	0.144	0.06	0.161	-	-
Total Nitrogen (mg/L)	0.055	0.465	0.148	0.06	0.163	-	0.19
Total Phosphorus (mg/L)	0.011	0.065	**0.027**	0.02	0.018	-	0.015
Chloride (mg/L)	0.812	1.29	**1.125**	1.18	0.146	-	0.15

C.1-4

Water Year: 2017							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.02	1.46	0.39	0.26	0.35	-	-
Turbidity (NTU)	12.30	63.90	**22.79**	17.60	13.85	-	20.0
Suspended Sediment (mg/L)	4.50	64.00	16.38	10.00	15.29	39.20	60.0
Nitrite/Nitrate (mg/L)	0.14	0.47	0.25	0.21	0.10	-	-
Total Kjeldahl Nitrogen (mg/L)	0.18	0.59	0.32	0.29	0.10	-	-
Total Nitrogen (mg/L)	0.39	0.80	**0.57**	0.55	0.14	-	0.15
Total Phosphorus (mg/L)	0.07	0.23	**0.11**	0.11	0.04	-	0.008
Chloride (mg/L)	23.00	250.00	**61.06**	36.00	57.85	-	3.0

Water Year: 2018							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.05	0.479	0.21	0.17	0.12	-	-
Turbidity (NTU)	9.49	208	**27.57**	16.00	46.80	-	20.0
Suspended Sediment (mg/L)	3.50	108	15.44	7.00	25.43	55.20	60.0
Nitrite/Nitrate (mg/L)	0.106	0.352	0.20	0.19	0.06	-	-
Total Kjeldahl Nitrogen (mg/L)	0.185	1.398	0.37	0.26	0.31	-	-
Total Nitrogen (mg/L)	0.396	1.58	**0.54**	0.43	0.30	-	0.15
Total Phosphorus (mg/L)	0.049	0.59	**0.15**	0.10	0.14	-	0.008
Chloride (mg/L)	21	350	**50.82**	32.00	77.48	-	3.0

Water Year: 2019							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.044	1.222	0.27	0.17	0.29	-	-
Turbidity (NTU)	13.3	144	**38.09**	17.10	47.60	-	20.0
Suspended Sediment (mg/L)	4	86	21.12	6.00	29.72	81.20	60.0
Nitrite/Nitrate (mg/L)	0.063	0.313	0.19	0.17	0.07	-	-
Total Kjeldahl Nitrogen (mg/L)	0.176	1.058	0.36	0.24	0.28	-	-
Total Nitrogen (mg/L)	0.332	1.198	**0.55**	0.44	0.26	-	0.15
Total Phosphorus (mg/L)	0.065	0.628	**0.17**	0.09	0.16	-	0.008
Chloride (mg/L)	22	210	**58.47**	33.00	56.76	-	3.0

Water Year: 2020							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.04	0.359	0.17	0.16	0.10	-	-
Turbidity (NTU)	7.84	58.3	16.85	12.20	13.62	-	20.0
Suspended Sediment (mg/L)	2	54.5	9.41	6.50	12.18	26.10	60.0
Nitrite/Nitrate (mg/L)	0.128	0.382	0.25	0.23	0.09	-	-
Total Kjeldahl Nitrogen (mg/L)	0.153	0.594	0.27	0.21	0.13	-	-
Total Nitrogen (mg/L)	0.347	0.751	**0.52**	0.52	0.12	-	0.15
Total Phosphorus (mg/L)	0.036	0.278	**0.10**	0.08	0.07	-	0.008
Chloride (mg/L)	23.6	371	**56.19**	29.60	82.26	-	3.0

Water Year: 2021							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.022	0.556	0.14	0.07	0.16	-	-
Turbidity (NTU)	7.91	174	**36.03**	14.30	48.51	-	20.0
Suspended Sediment (mg/L)	3	98.5	19.41	5.50	28.60	81.7	60.0
Nitrite/Nitrate (mg/L)	0.122	0.39	0.23	0.22	0.08	-	-
Total Kjeldahl Nitrogen (mg/L)	0.171	1.031	0.34	0.25	0.26	-	-
Total Nitrogen (mg/L)	0.32	1.302	**0.57**	0.50	0.26	-	0.15
Total Phosphorus (mg/L)	0.056	1.092	**0.18**	0.08	0.26	-	0.008
Chloride (mg/L)	27.2	133	**51.73**	41.15	27.67	-	3.0

Hidden Valley Creek
(43HDVC-5)

Water Year: 2017							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.331	28.38	7.440	3.743	8.529	-	-
Turbidity (NTU)	0.37	47.20	5.705	2.35	11.081	-	-
Suspended Sediment (mg/L)	0.50	26.00	5.853	2.5	7.265	21.60	60
Nitrite/Nitrate (mg/L)	0.001	0.008	0.004	0.004	0.001	-	-
Total Kjeldahl Nitrogen (mg/L)	0.048	0.285	0.136	0.119	0.068	-	-
Total Nitrogen (mg/L)	0.053	0.29	0.140	0.123	0.068	-	0.19
Total Phosphorus (mg/L)	0.017	0.066	**0.030**	0.026	0.013	-	0.015
Chloride (mg/L)	0.13	0.42	**0.259**	0.26	0.088	-	0.15

Water Year: 2018							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.375	7.259	2.492	1.197	2.166	-	-
Turbidity (NTU)	0.600	2.090	1.168	1.090	0.452	-	-
Suspended Sediment (mg/L)	1.000	3.000	1.618	1.500	0.597	2.600	60
Nitrite/Nitrate (mg/L)	0.001	0.017	0.007	0.006	0.004	-	-
Total Kjeldahl Nitrogen (mg/L)	0.055	0.121	0.082	0.076	0.018	-	-
Total Nitrogen (mg/L)	0.064	0.128	0.088	0.085	0.018	-	0.19
Total Phosphorus (mg/L)	0.016	0.027	**0.020**	0.018	0.003	-	0.015
Chloride (mg/L)	0.120	0.320	**0.218**	0.220	0.069	-	0.15

Water Year: 2019							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.42	15.88	3.525	2.066	4.355	-	-
Turbidity (NTU)	0.47	4.79	2.056	1.66	1.443	-	-
Suspended Sediment (mg/L)	0.50	7.00	2.324	2	1.722	5.40	60
Nitrite/Nitrate (mg/L)	0.001	0.017	0.006	0.006	0.004	-	-
Total Kjeldahl Nitrogen (mg/L)	0.048	0.169	0.094	0.079	0.039	-	-
Total Nitrogen (mg/L)	0.054	0.18	0.100	0.08	0.041	-	0.19
Total Phosphorus (mg/L)	0.017	0.034	**0.024**	0.022	0.005	-	0.015
Chloride (mg/L)	ND	0.36	**0.217**	0.15	0.078	-	0.15

Water Year: 2020							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.341	3.741	1.216	0.739	0.986	-	-
Turbidity (NTU)	0.41	1.62	0.938	0.79	0.420	-	-
Suspended Sediment (mg/L)	0.50	4.00	2.547	3	1.162	4.00	60
Nitrite/Nitrate (mg/L)	0.001	0.011	0.004	0.003	0.004	-	-
Total Kjeldahl Nitrogen (mg/L)	0.049	0.123	0.085	0.09	0.023	-	-
Total Nitrogen (mg/L)	0.05	0.129	0.089	0.094	0.024	-	0.19
Total Phosphorus (mg/L)	0.016	0.028	**0.022**	0.021	0.004	-	0.015
Chloride (mg/L)	0.20	0.80	**0.420**	0.4	0.170	-	0.15

Water Year: 2021							
Parameters	Min	Max	Mean	Median	Std Err	90th Percentile	Applicable Annual Average Standard
Streamflow (cfs)	0.307	1.781	0.751	0.453	0.539	-	-
Turbidity (NTU)	0.35	3.11	1.036	0.875	0.687	-	-
Suspended Sediment (mg/L)	0.50	4.50	1.714	1.25	1.236	3.75	60
Nitrite/Nitrate (mg/L)	0.001	0.021	0.005	0.003	0.006	-	-
Total Kjeldahl Nitrogen (mg/L)	0.048	0.126	0.092	0.097	0.023	-	-
Total Nitrogen (mg/L)	0.053	0.144	0.097	0.1	0.026	-	0.19
Total Phosphorus (mg/L)	0.016	0.029	**0.022**	0.0215	0.004	-	0.015
Chloride (mg/L)	0.15	1.10	**0.368**	0.282	0.264	-	0.15

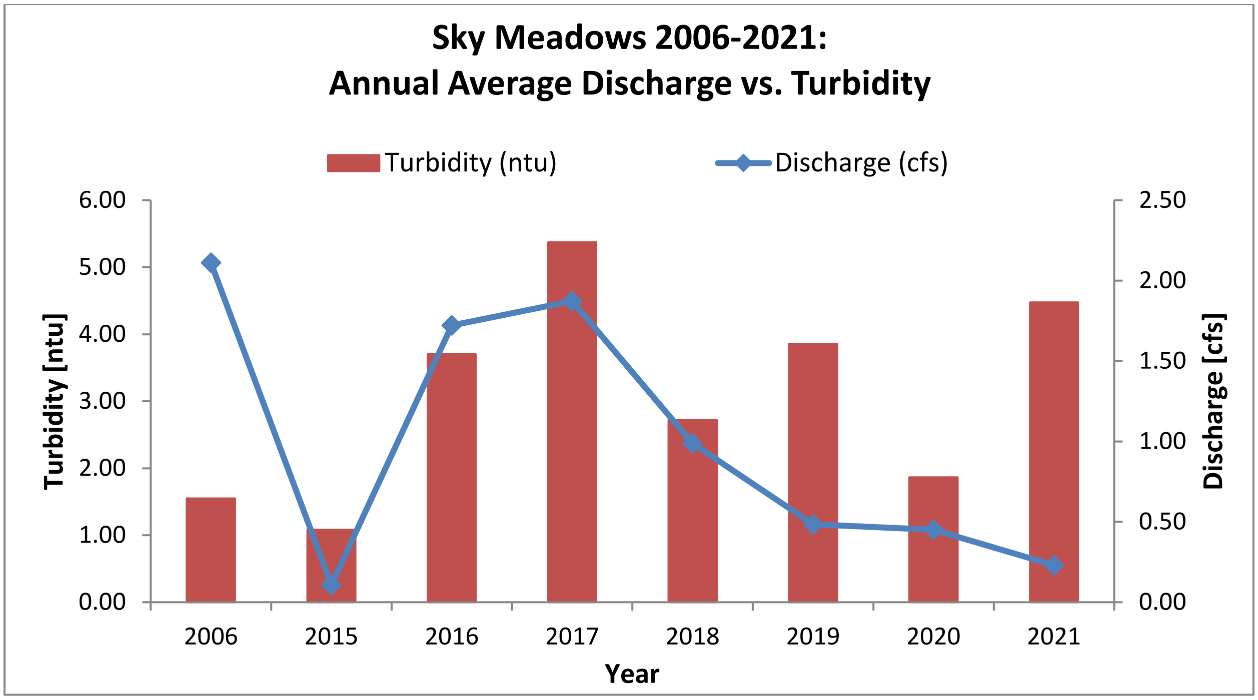

Figure C.2-1 Turbidity Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

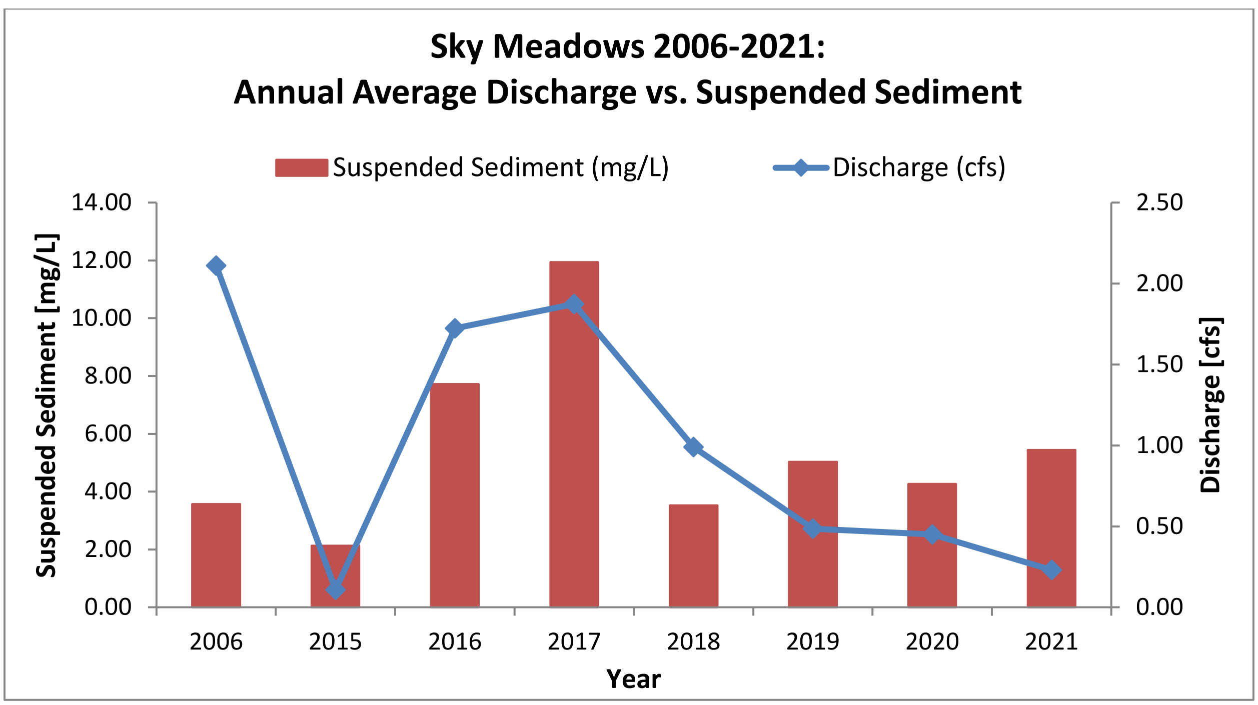

Figure C.2-2 Suspended Sediment Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

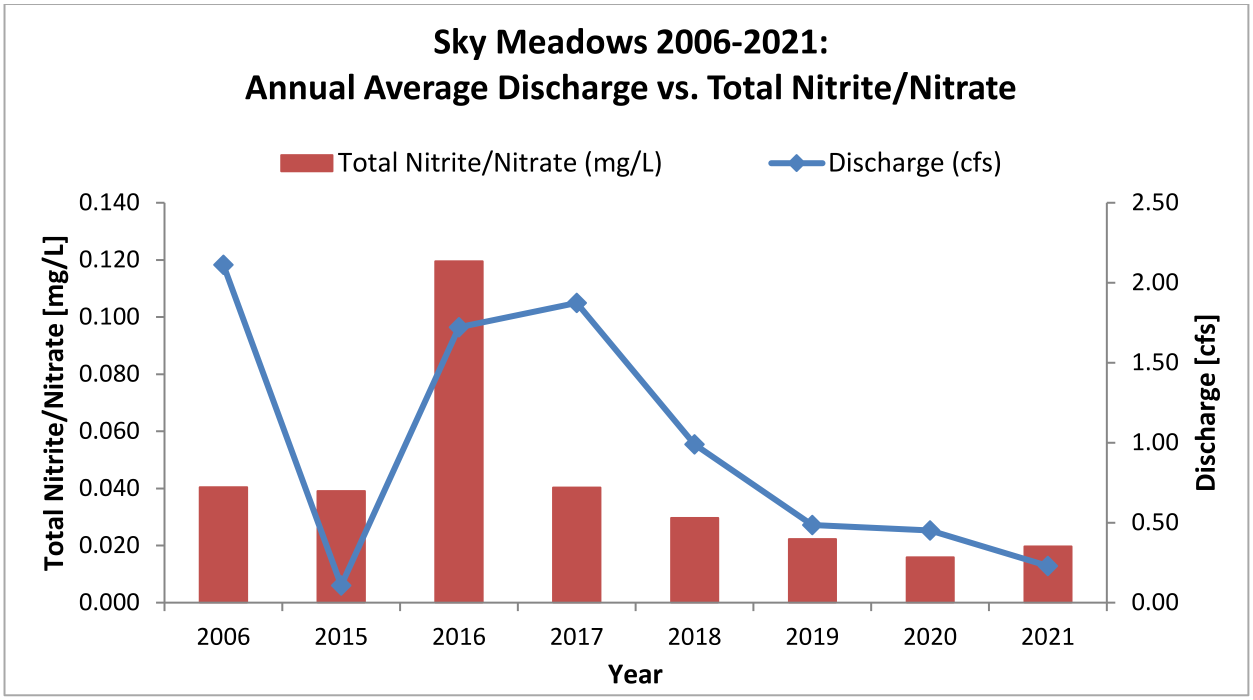

Figure C.2-3 Total Nitrite/Nitrate Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

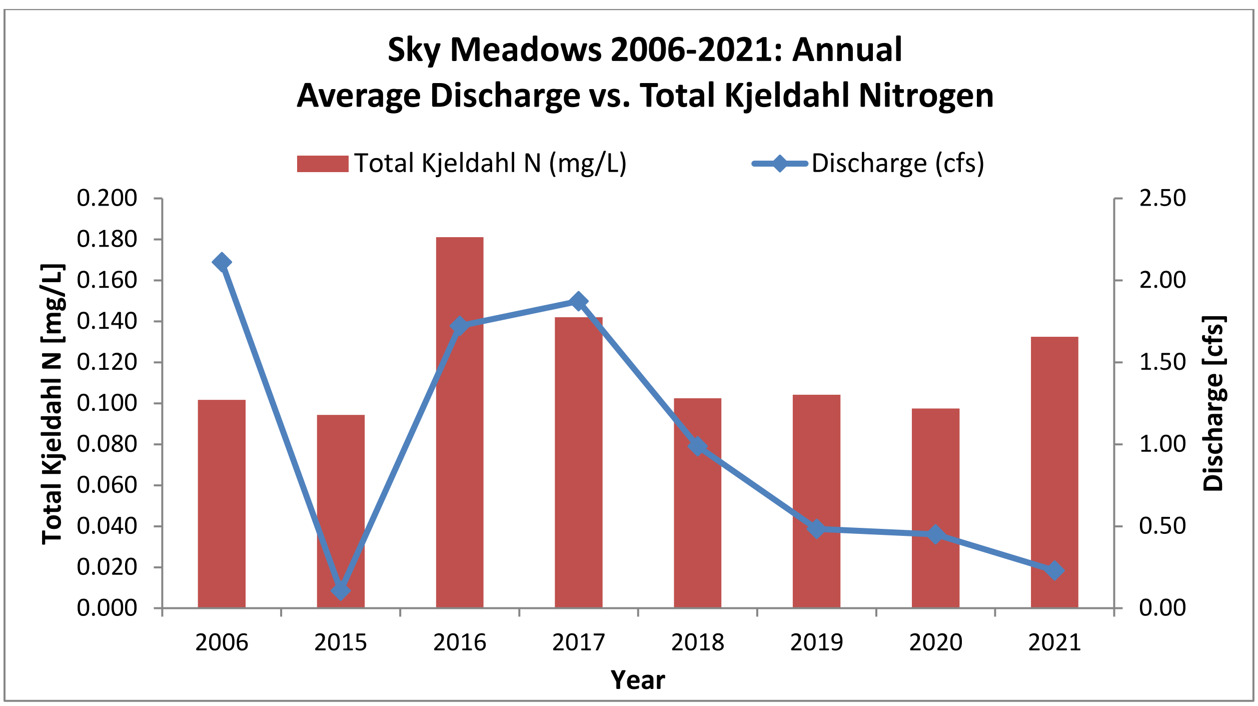

Figure C.2-4 TKN Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

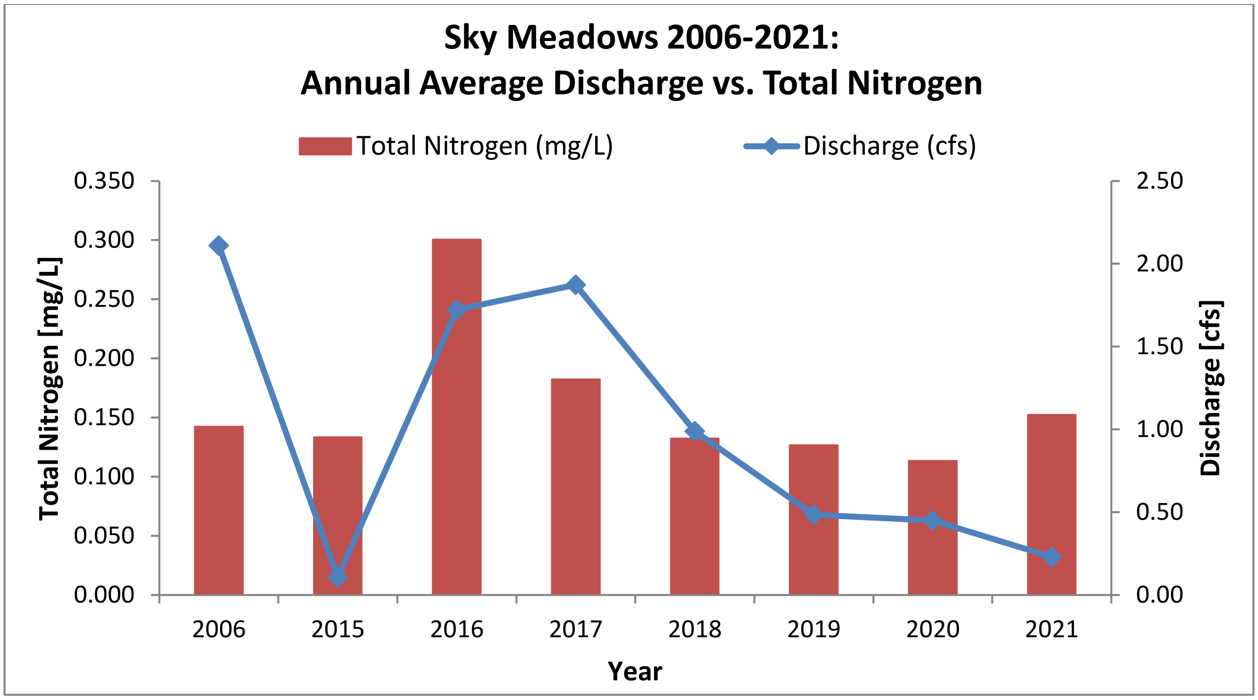

Figure C.2-5 Total Nitrogen Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

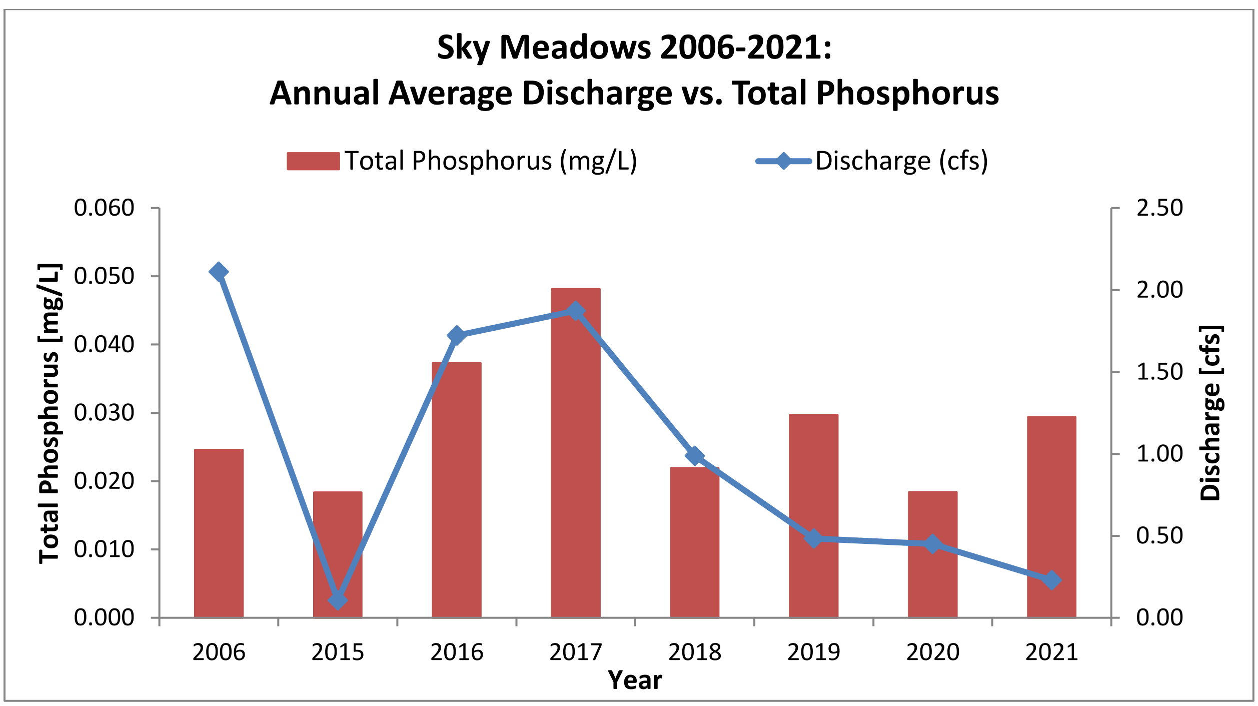

Figure C.2-6 Total Phosphorus Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

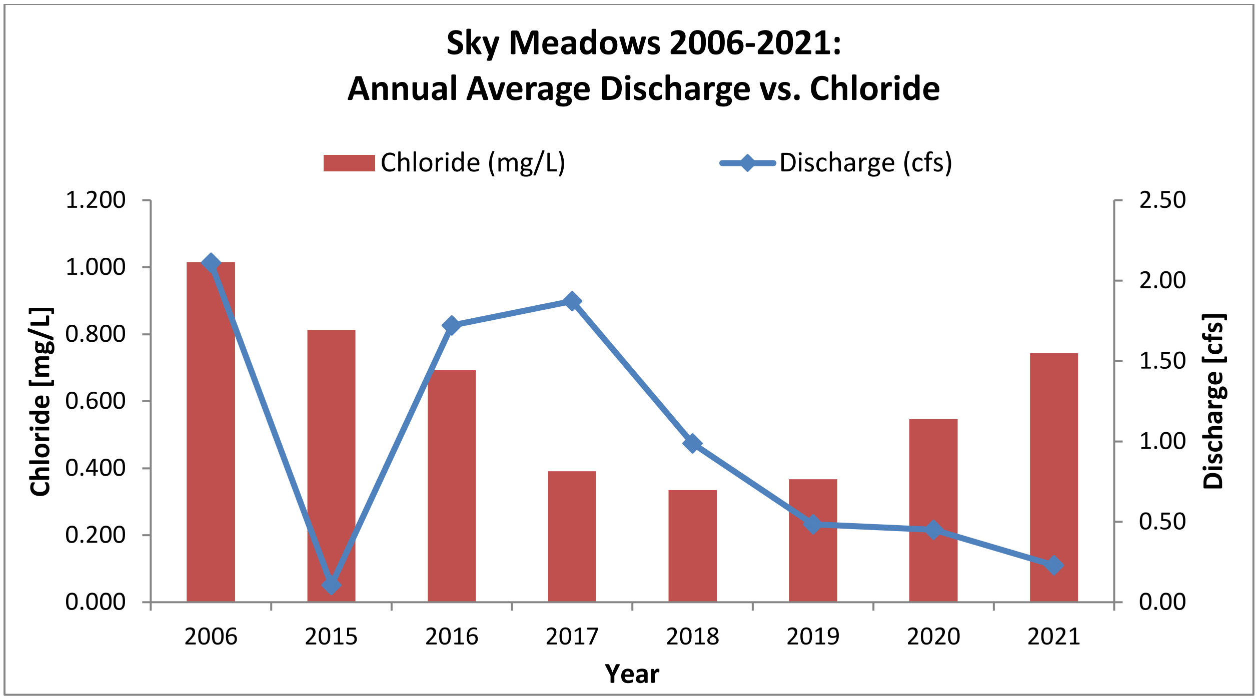

Figure C.2-7 Chloride Versus Flow, Sky Meadows (43HVC-1A) (2006–2021)

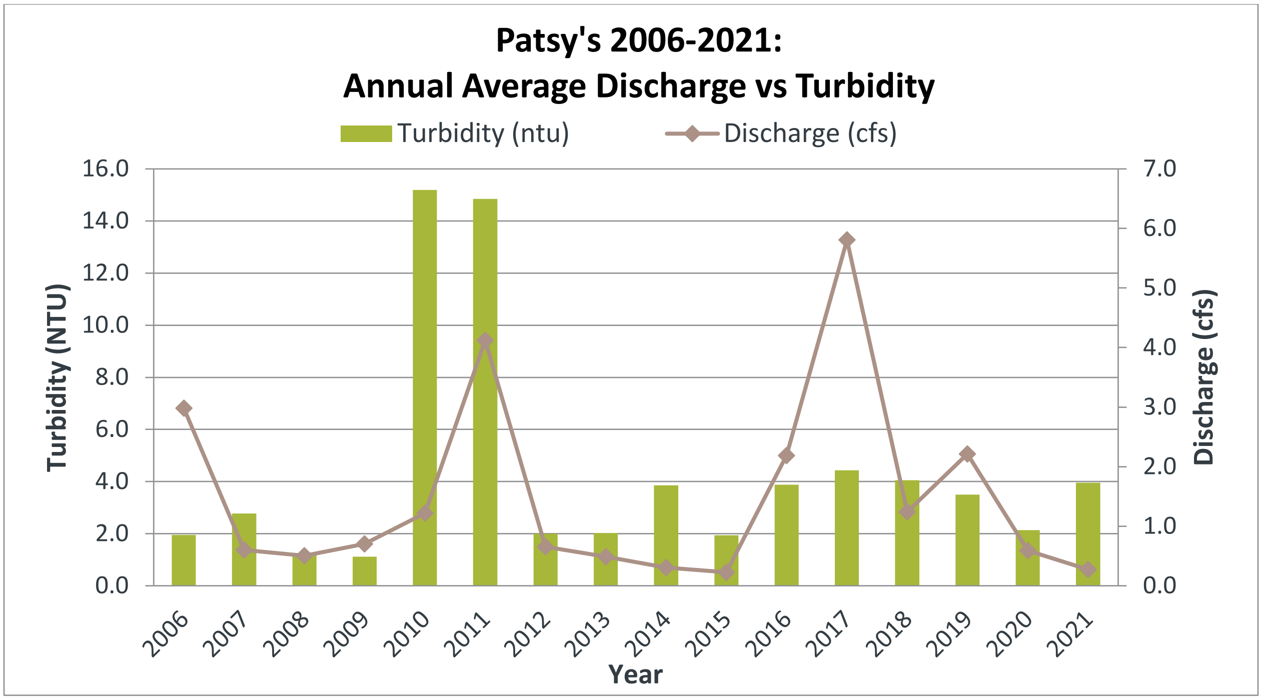

Figure C.3-1 Turbidity Versus Flow, Patsy's (43HVC-2) (2006–2021)

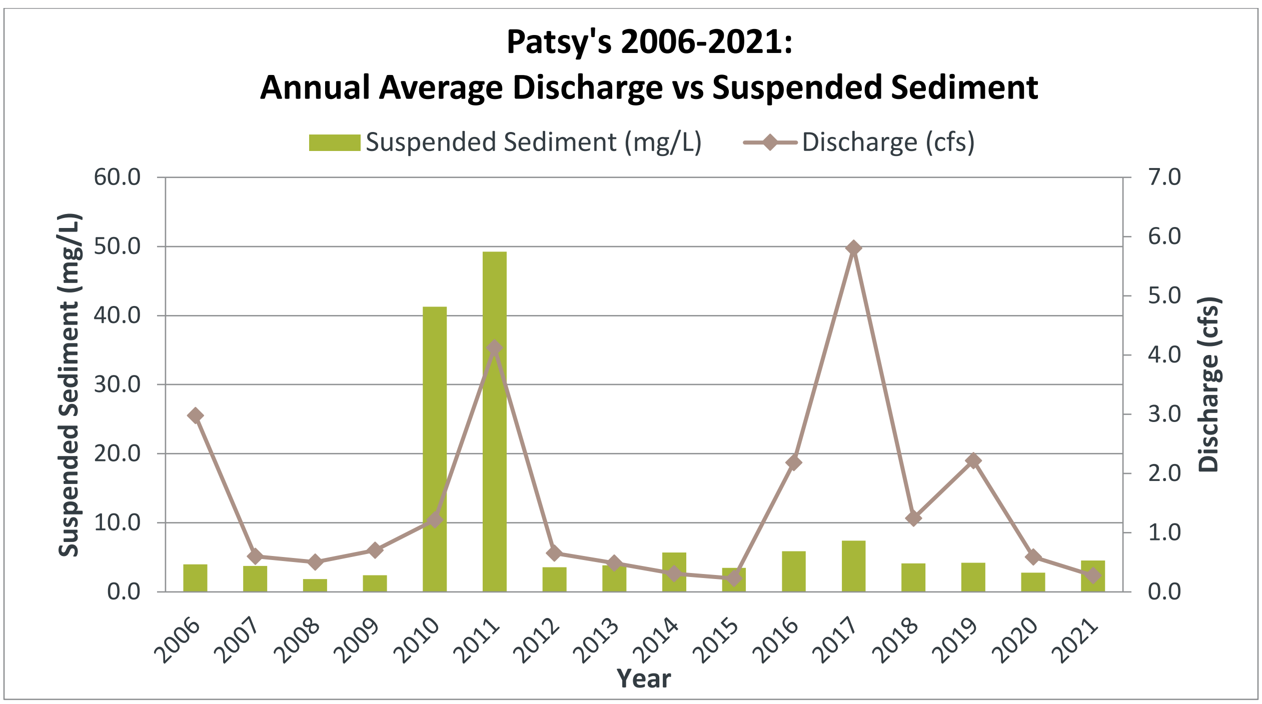

Figure C.3-2 Suspended Sediment Versus Flow, Patsy's (43HVC-2) (2006–2021)

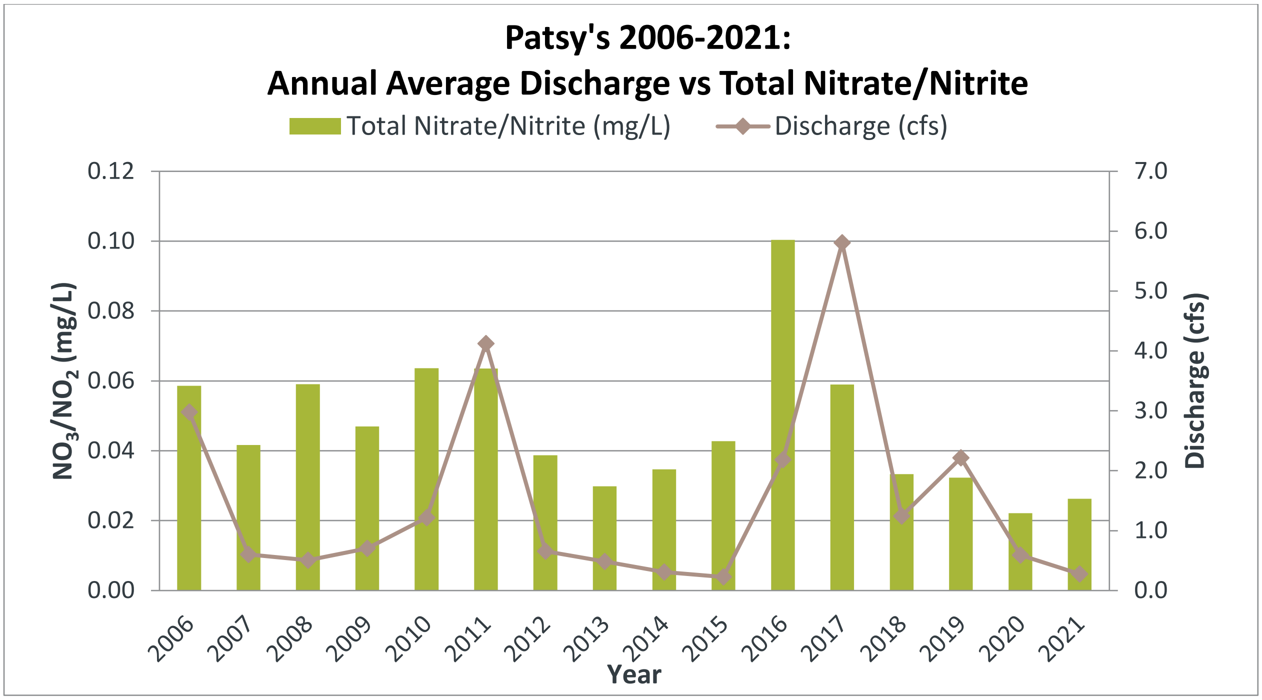

Figure C.3-3 Total Nitrite/Nitrate Versus Flow, Patsy's (43HVC-2) (2006–2021)

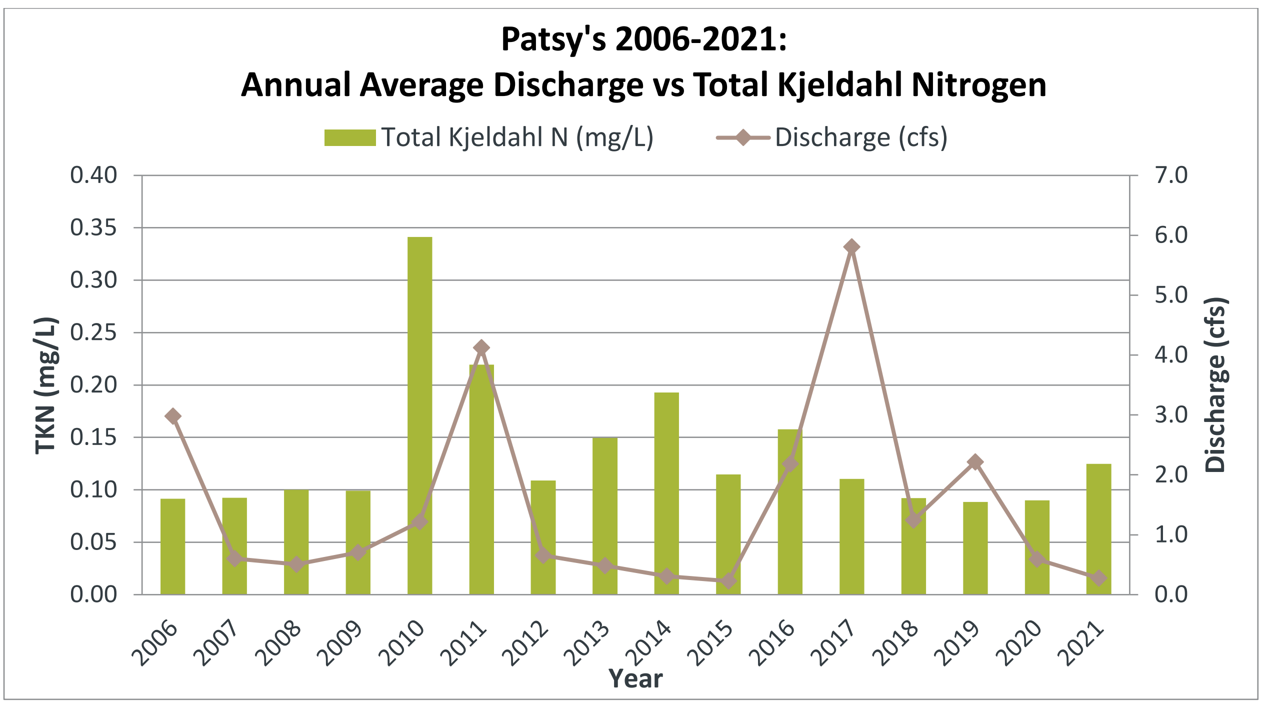

Figure C.3-4 TKN Versus Flow, Patsy's (43HVC-2) (2006–2021)

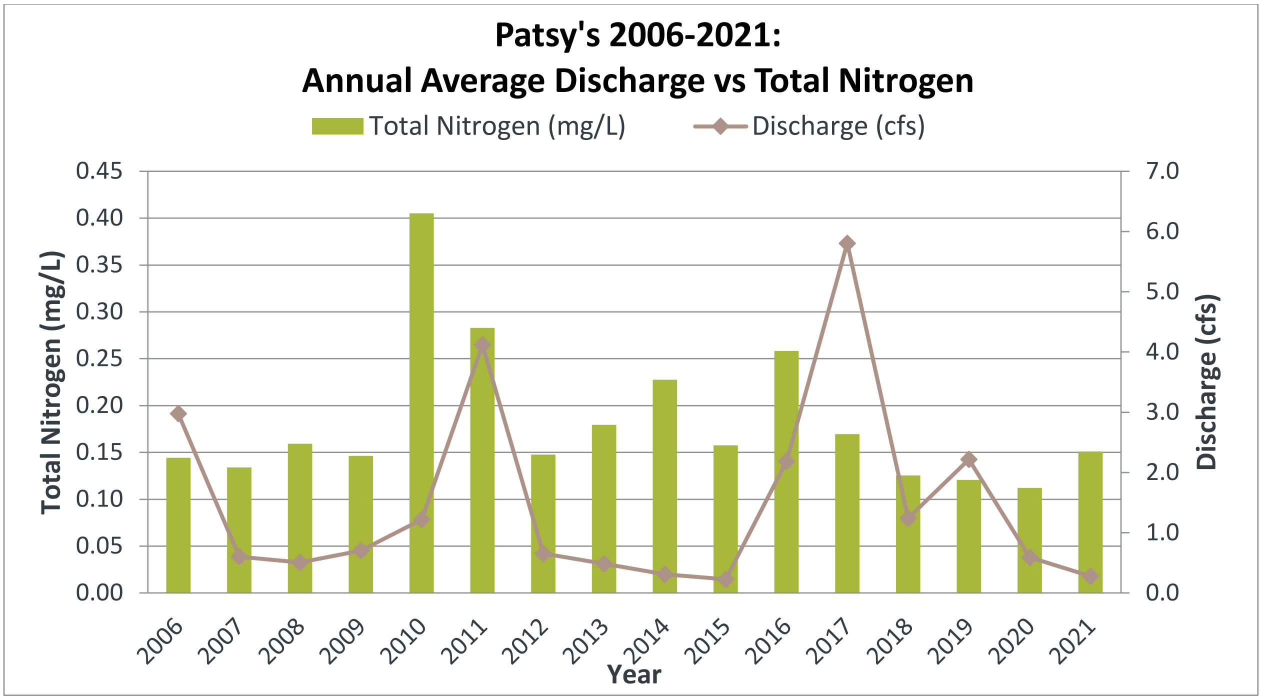

Figure C.3-5 Total Nitrogen Versus Flow, Patsy's (43HVC-2) (2006–2021)

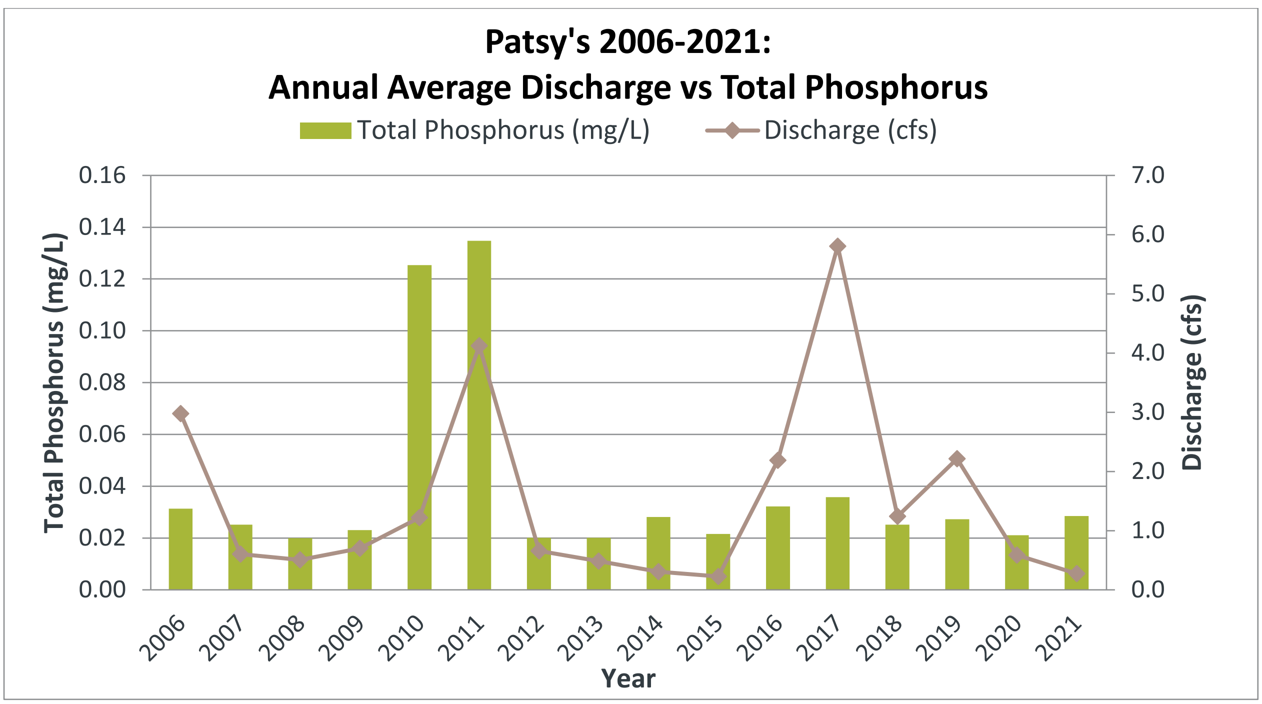

Figure C.3-6 Total Phosphorus Versus Flow, Patsy's (43HVC-2) (2006–2021)

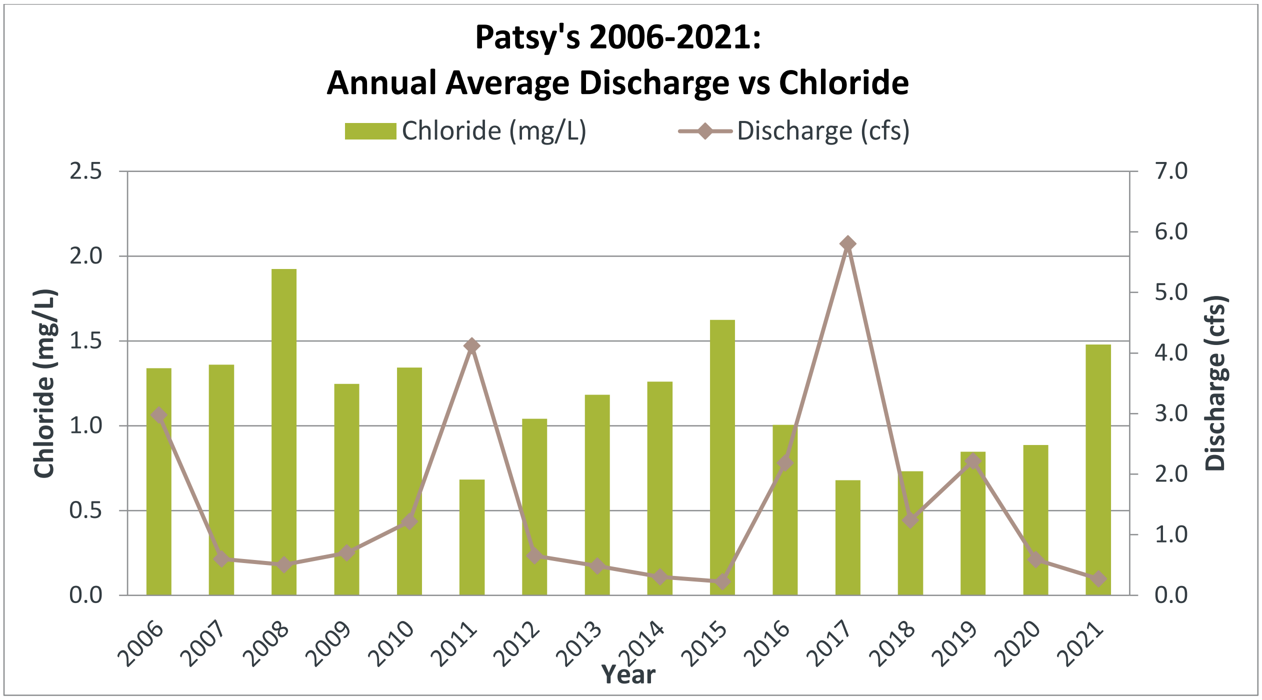

Figure C.3-7 Chloride Versus Flow, Patsy's (43HVC-2) (2006–2021)

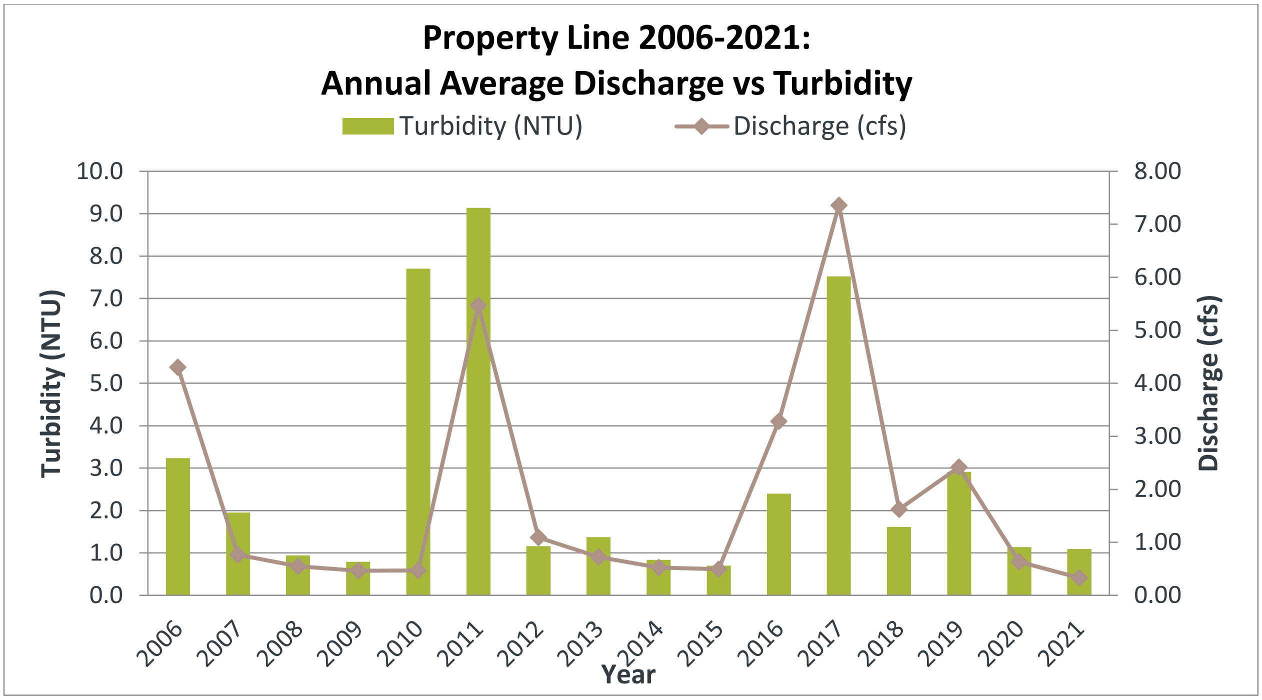

Figure C.4-1 Turbidity Versus Flow, Property Line (43HVC-3) (2006–2021)

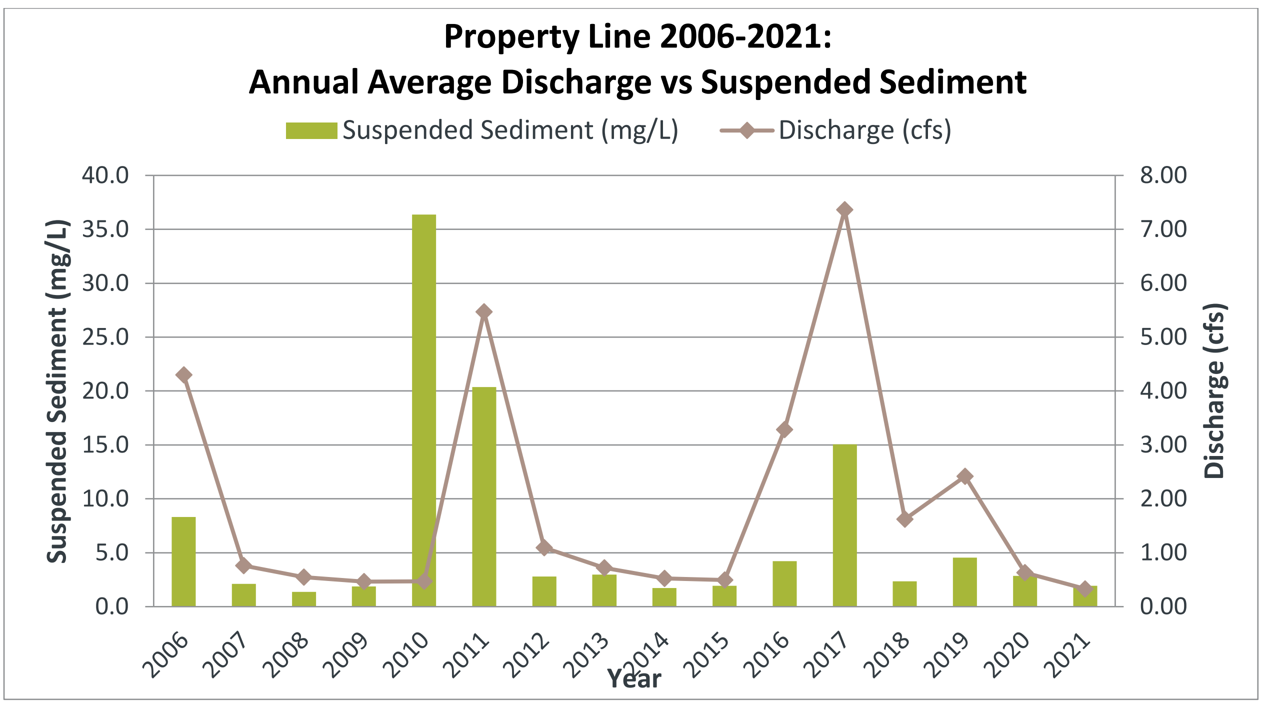

Figure C.4-2 Suspended Sediment Versus Flow, Property Line (43HVC-3) (2006–2021)

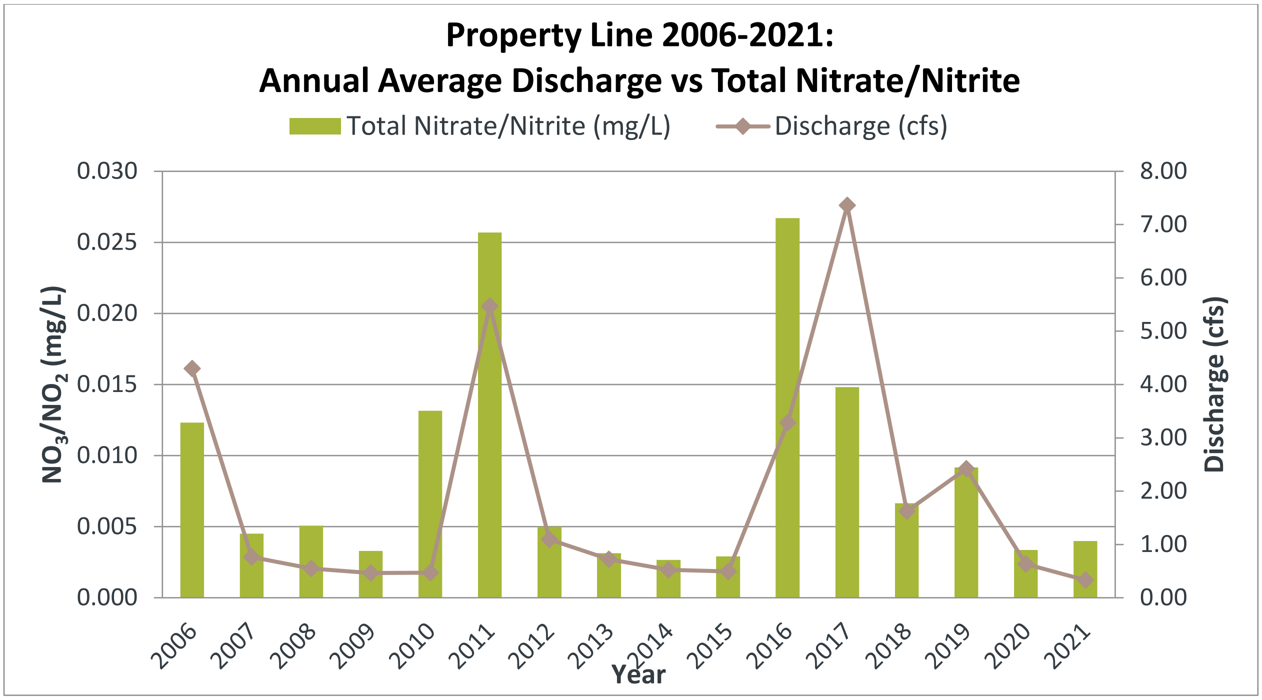

Figure C.4-3 Total Nitrite/Nitrate Versus Flow, Property Line (43HVC-3) (2006–2021)

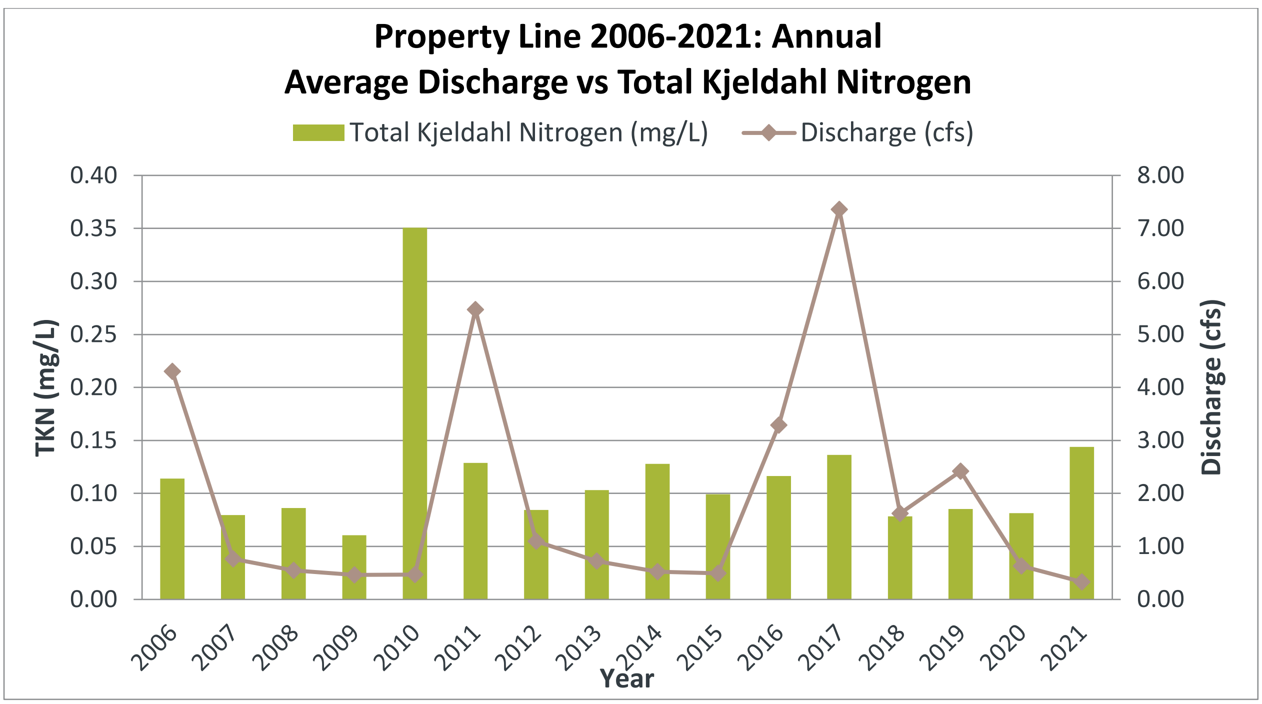

Figure C.4-4 Total Kjedahl Nitrogen Versus Flow, Property Line (43HVC-3) (2006–2021)

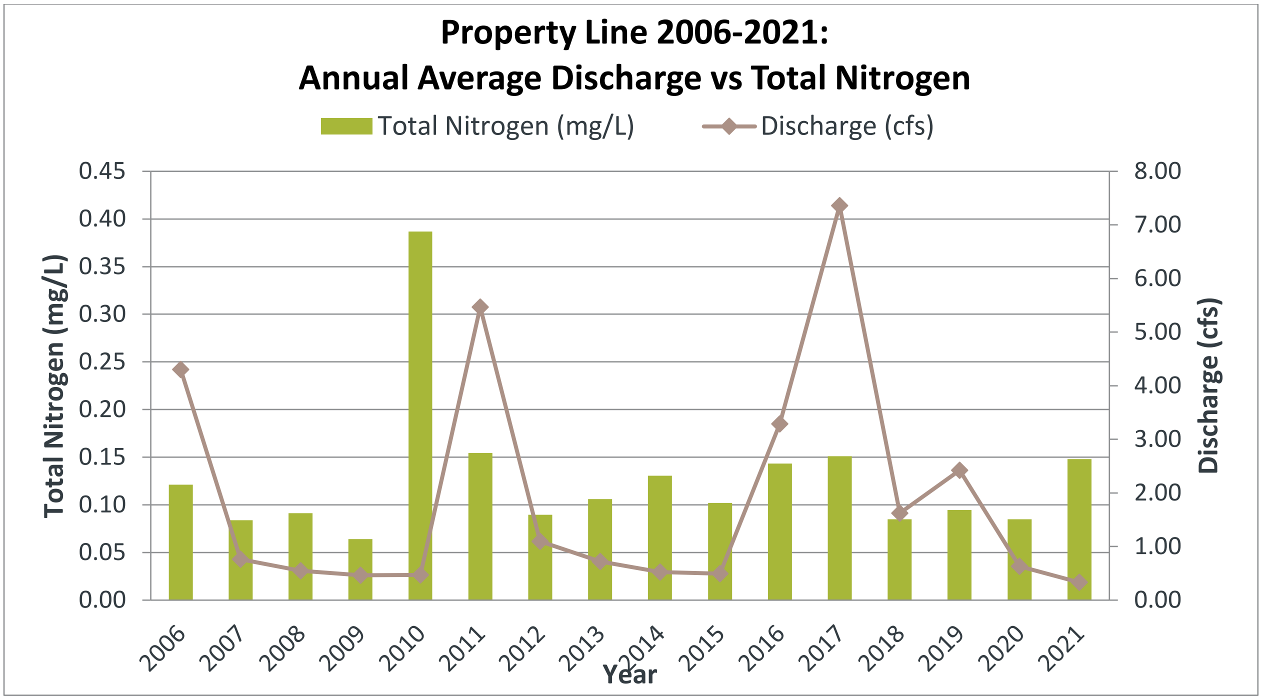

Figure C.4-5 Total Nitrogen Versus Flow, Property Line (43HVC-3) (2006–2021)

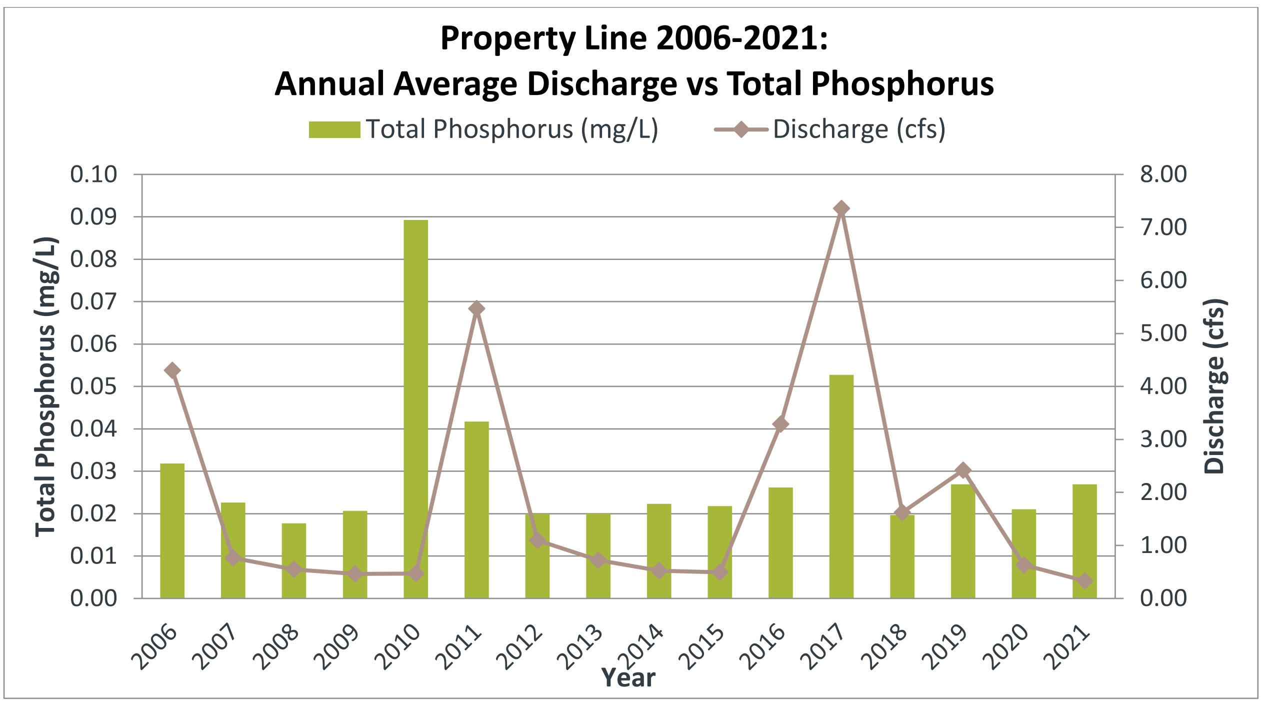

Figure C.4-6 Total Phosphorus Versus Flow, Property Line (43HVC-3) (2006–2021)

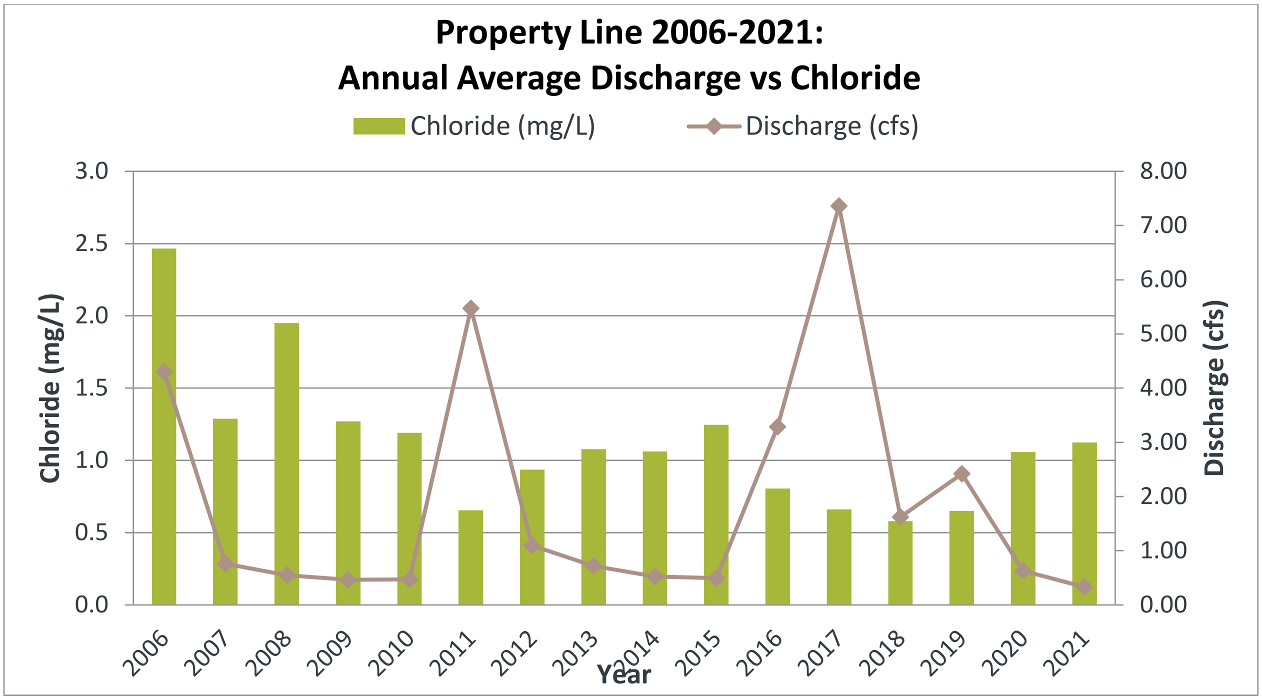

Figure C.4-7 Chloride Versus Flow, Property Line (43HVC-3) (2006–2021)

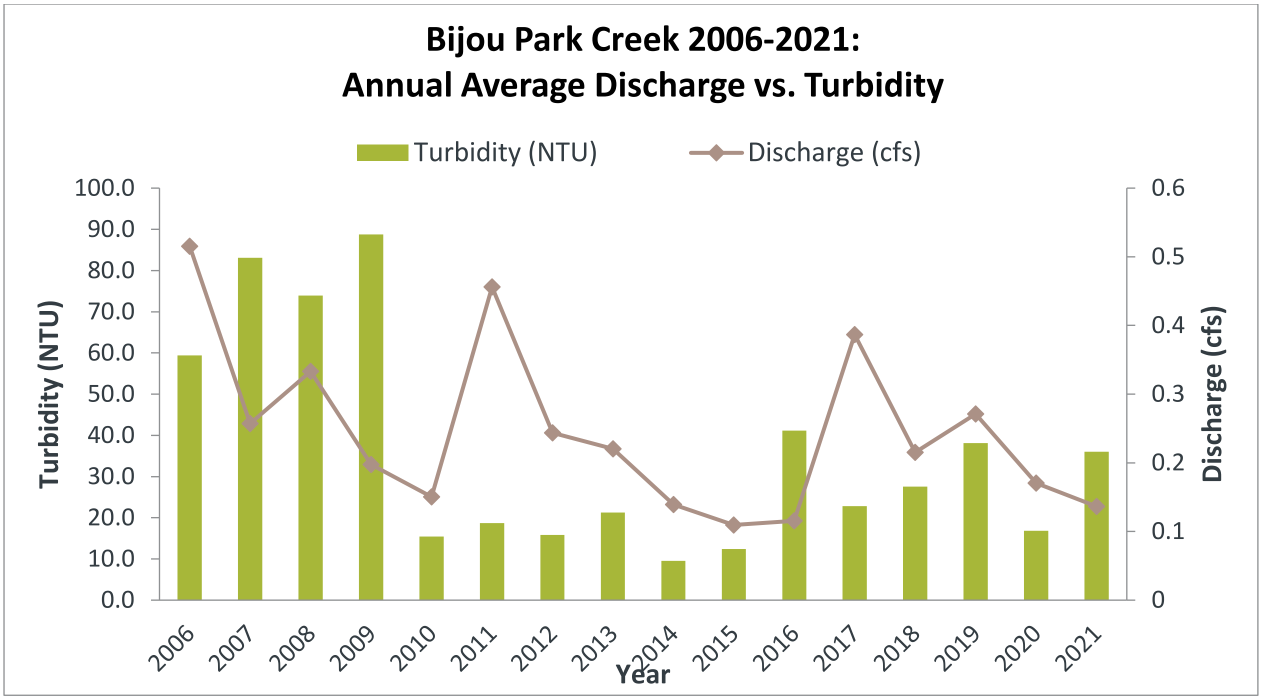

Figure C.5-1 Turbidity Versus Flow, Bijou Park Creek (43BPC-4) (2006–2021)

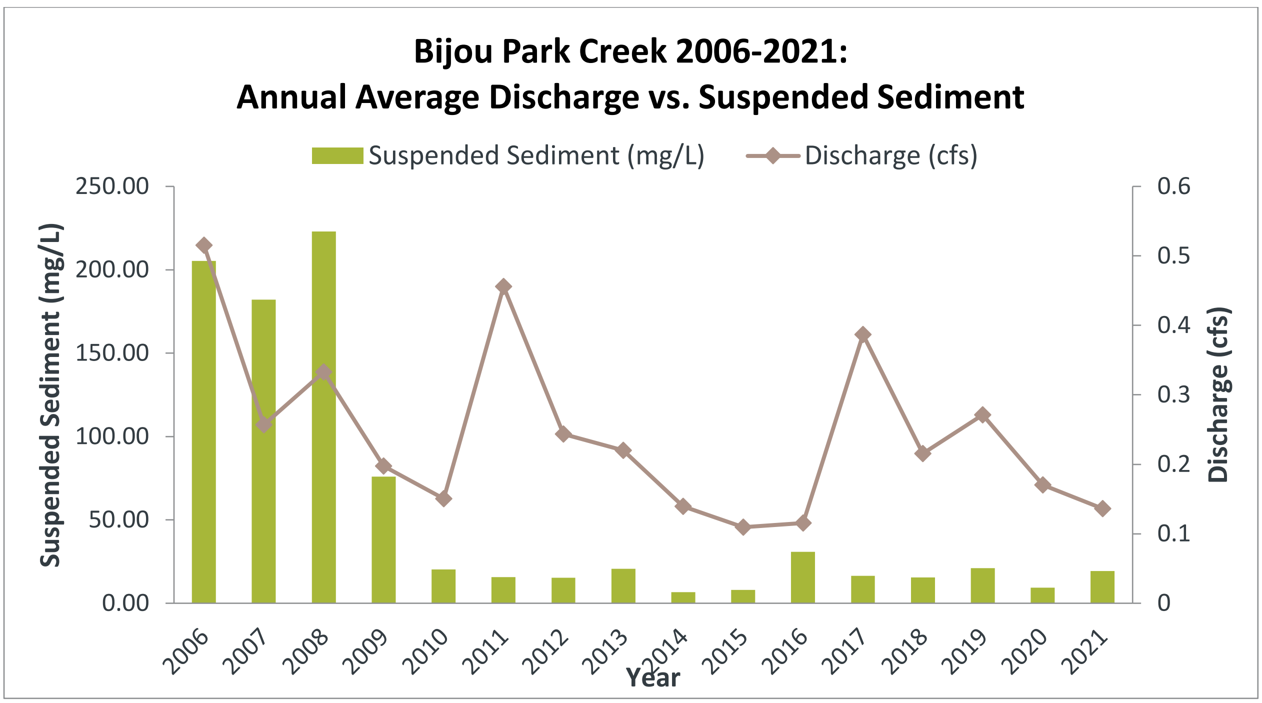

Figure C.5-2 Suspended Sediment Versus Flow, Bijou Park Creek (43BPC-4) (2006–2021)

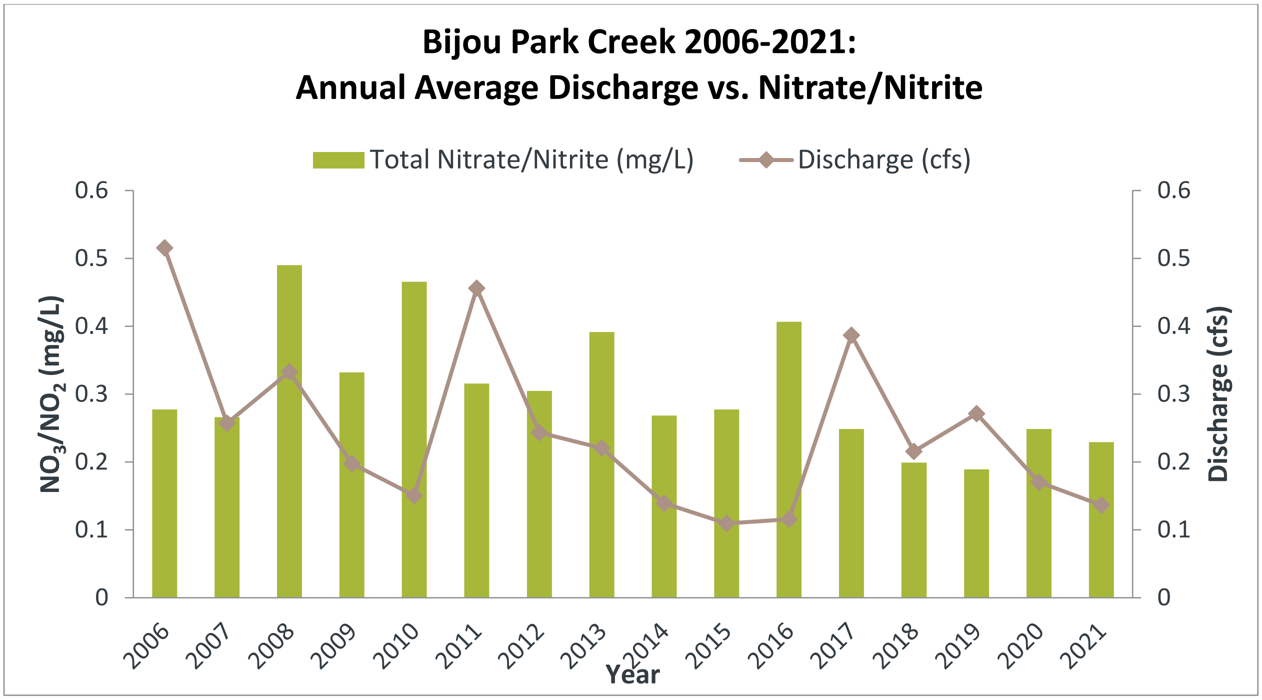

Figure C.5-3 Total Nitrite/Nitrate Versus Flow, Bijou Park Creek (43BPC-4) (2006–2021)

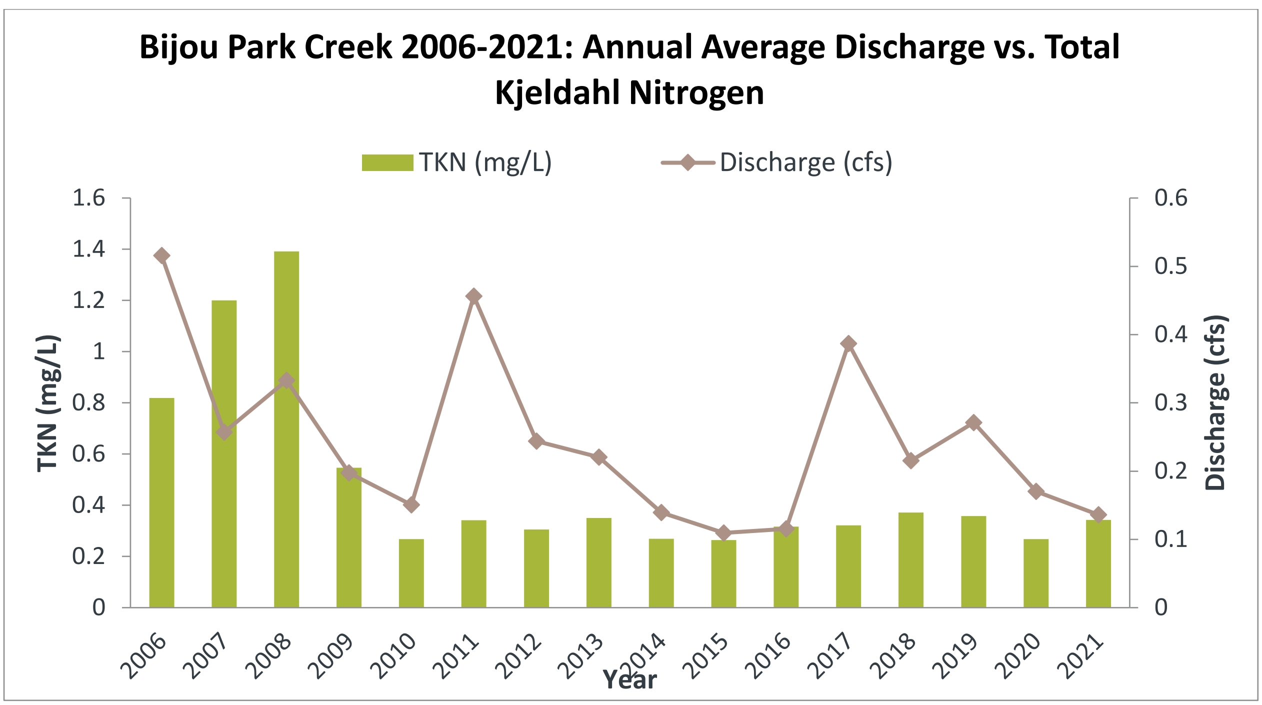

Figure C.5-4 TKN Versus Flow, Bijou Park Creek (43BPC-4) (2006–2021)

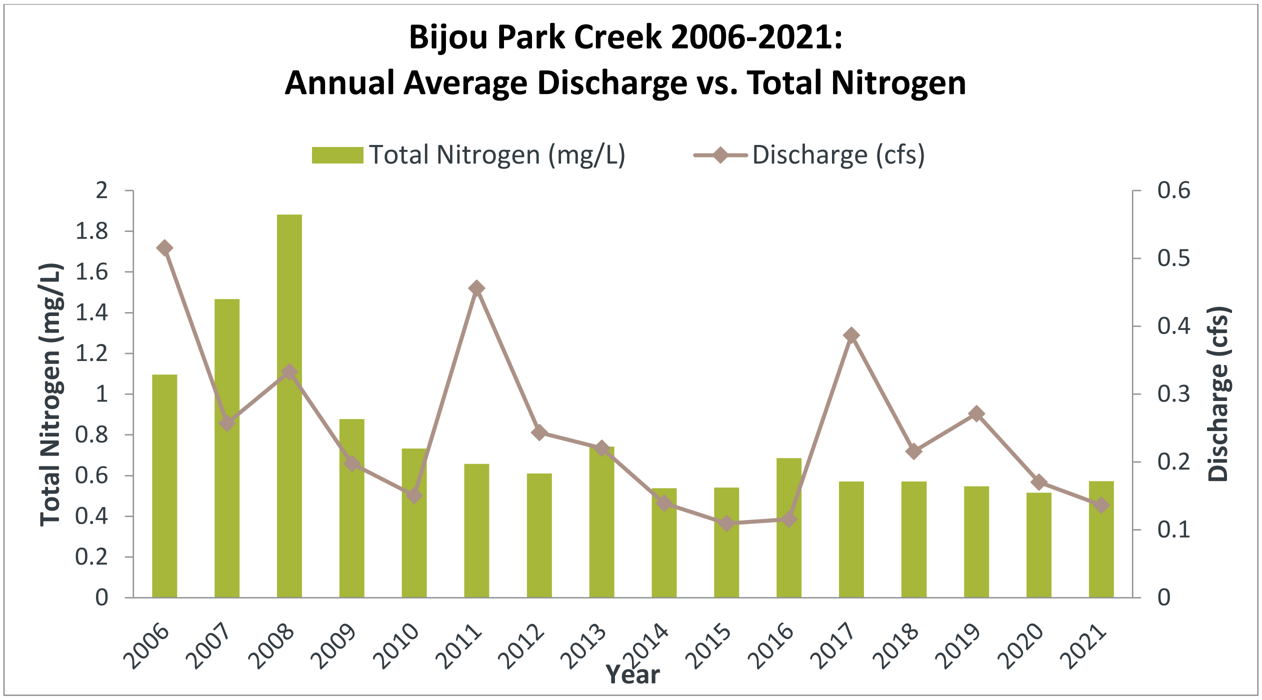

Figure C.5-5 Total Nitrogen Versus Flow, Bijou Park Creek (43BPC-4) (2006–2021)

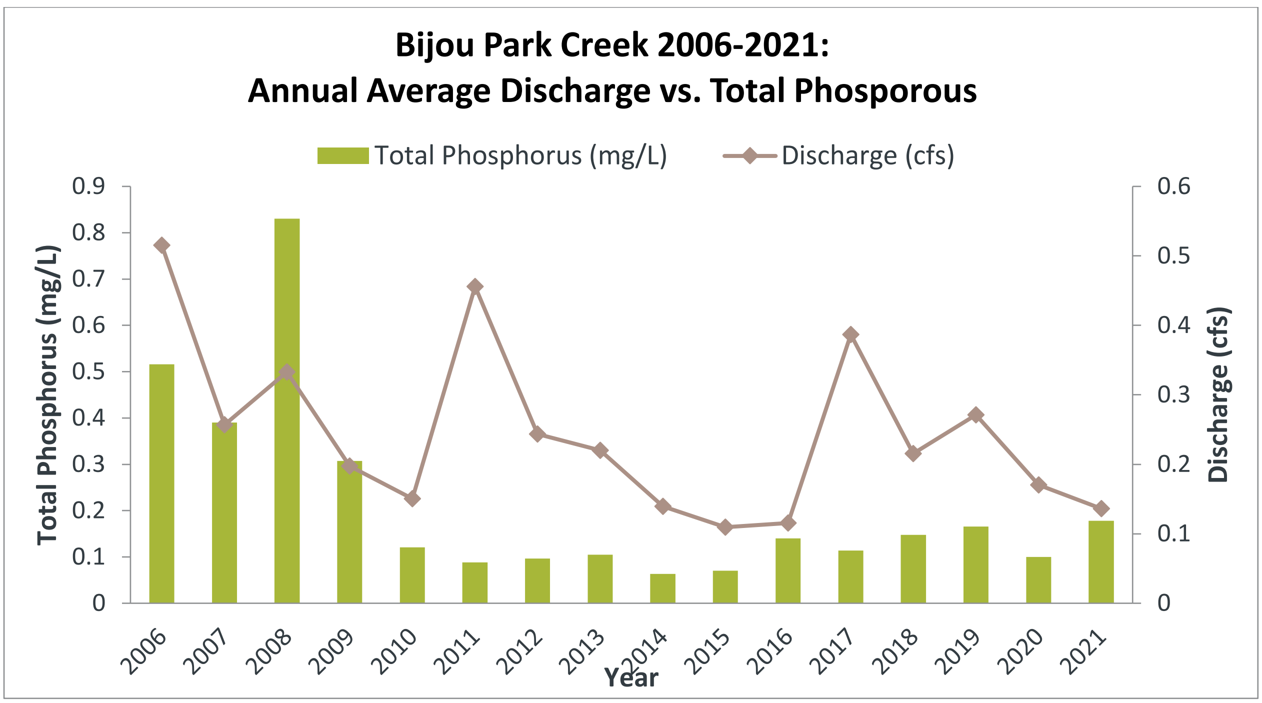

Figure C.5-6 Total Phosphorus Versus Flow, Bijou Park Creek (43BPC-4) (2006–2021)

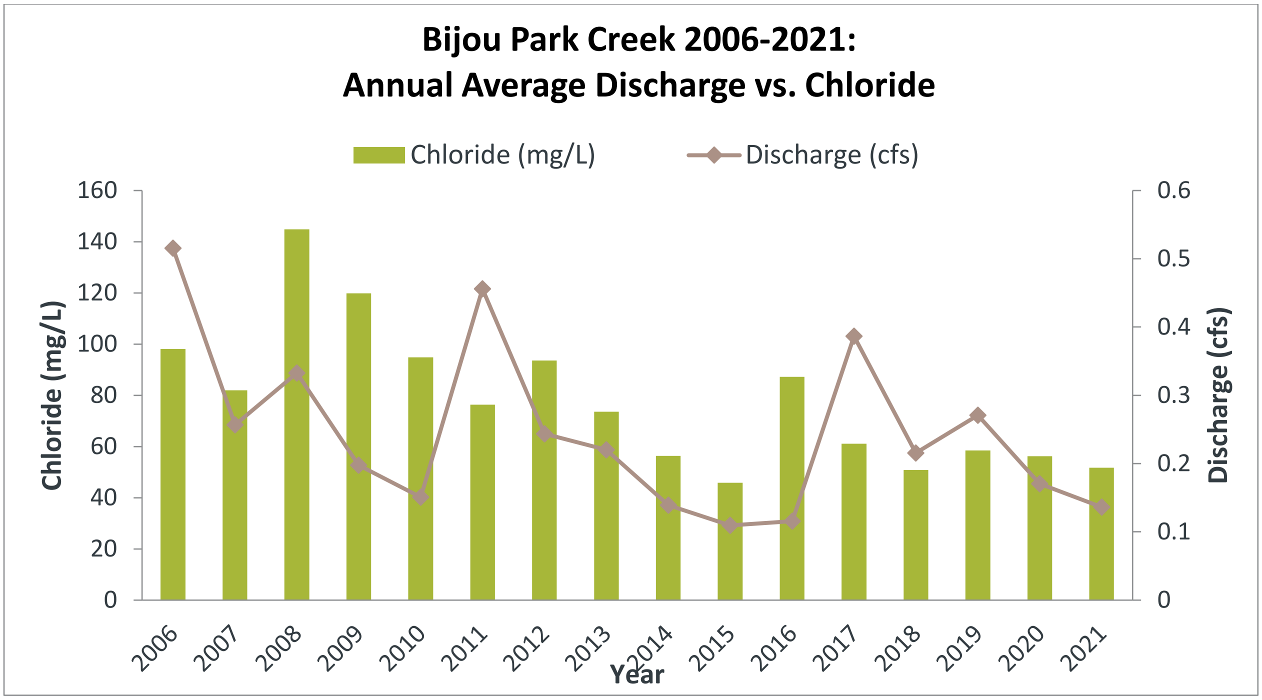

Figure C.5-7 Chloride Versus Flow, Bijou Park Creek (43BPC-4) (2006–2021)

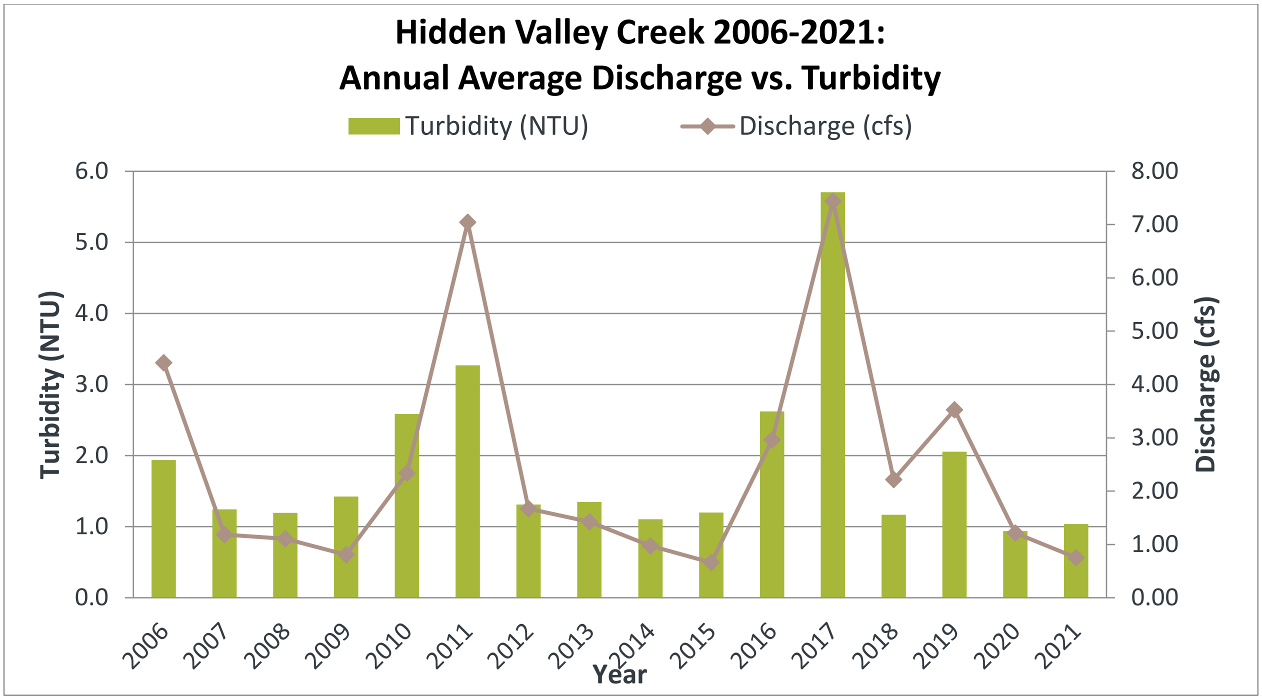

Figure C.6-1 Turbidity Versus Flow, Hidden Valley Creek (43HDVC-5) (2006–2021)

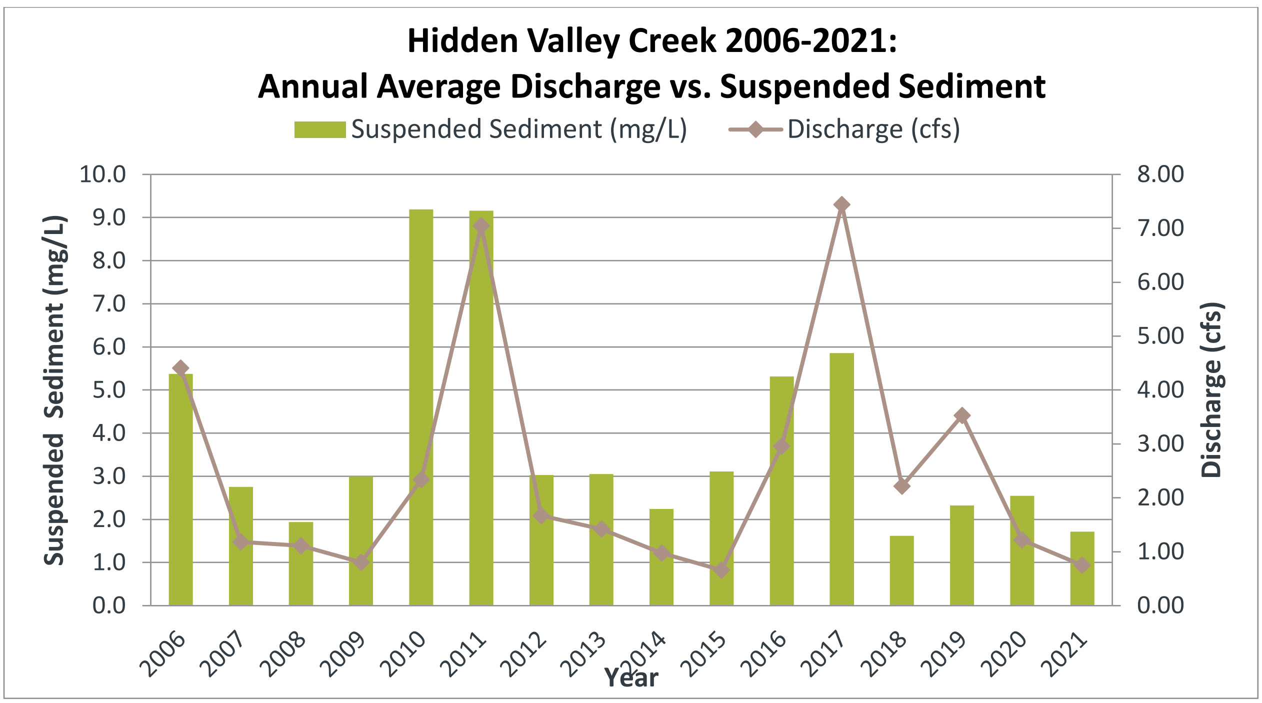

Figure C.6-2 Suspended Sediment Versus Flow, Hidden Valley Creek (43HDVC-5) (2006–2021)

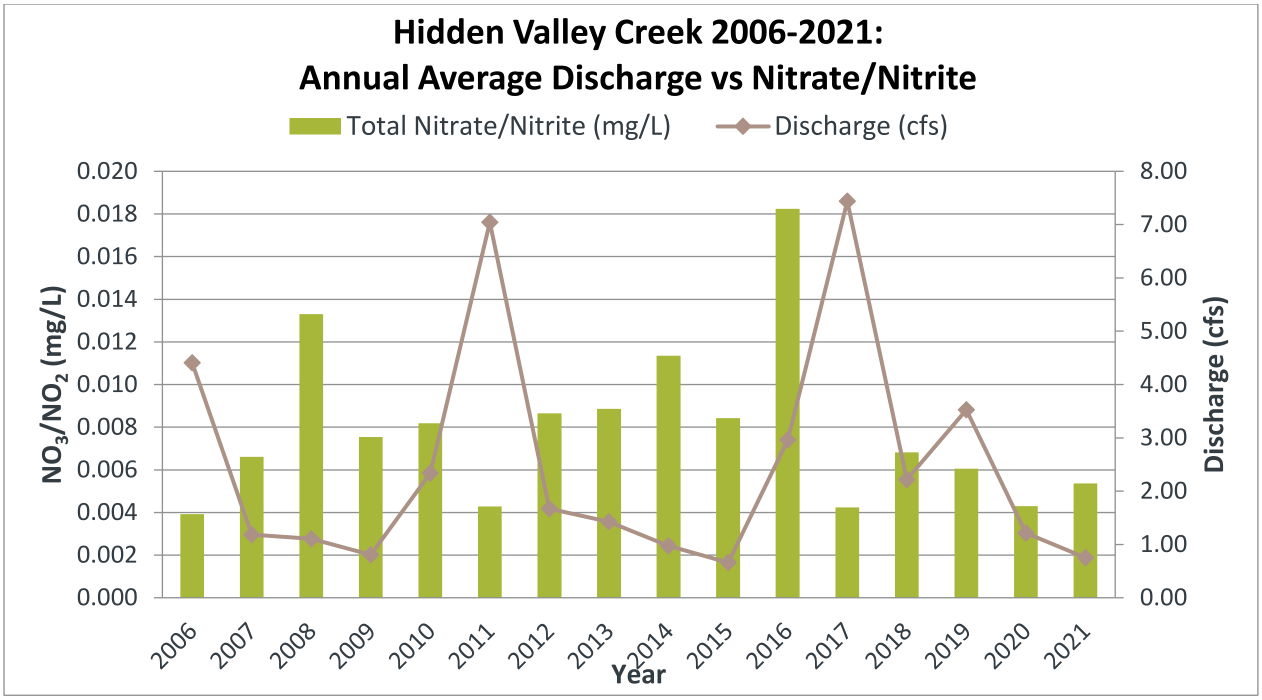

Figure C.6-3 Total Nitrite/Nitrate Versus Flow, Hidden Valley Creek (43HDVC-5) (2006–2021)

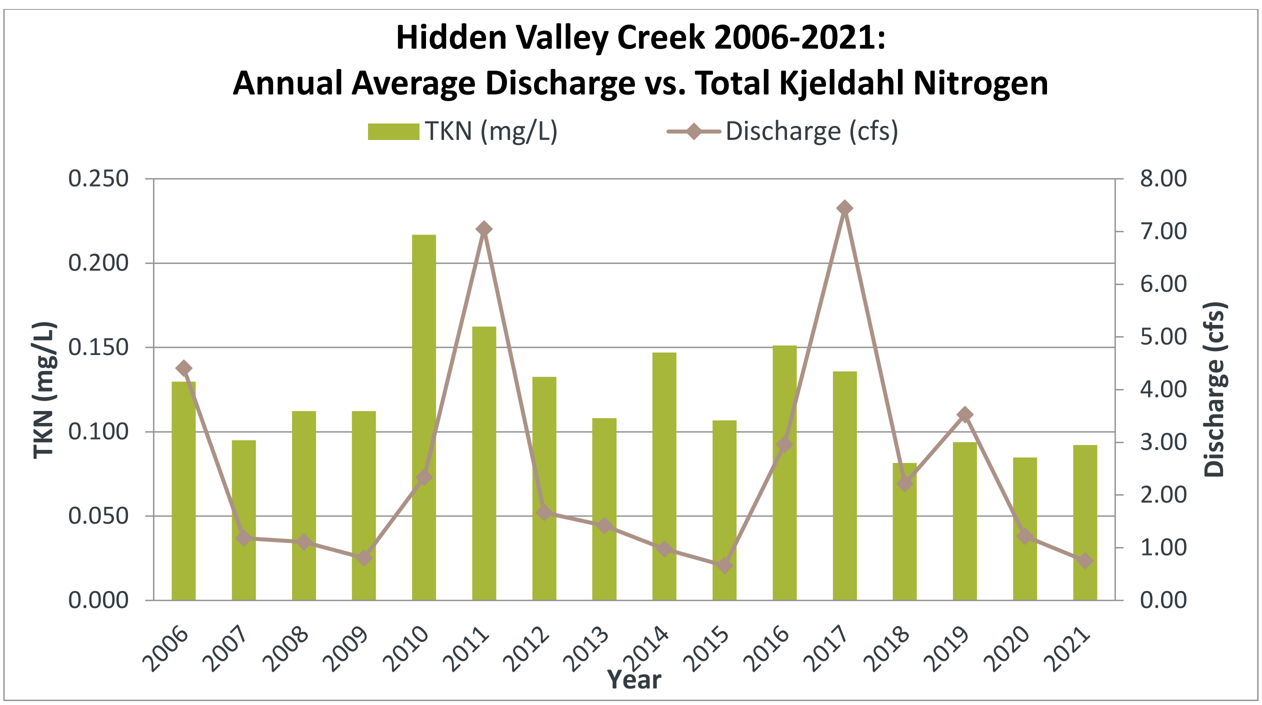

Figure C.6-4 TKN Versus Flow, Hidden Valley Creek (43HDVC-5) (2006–2021)

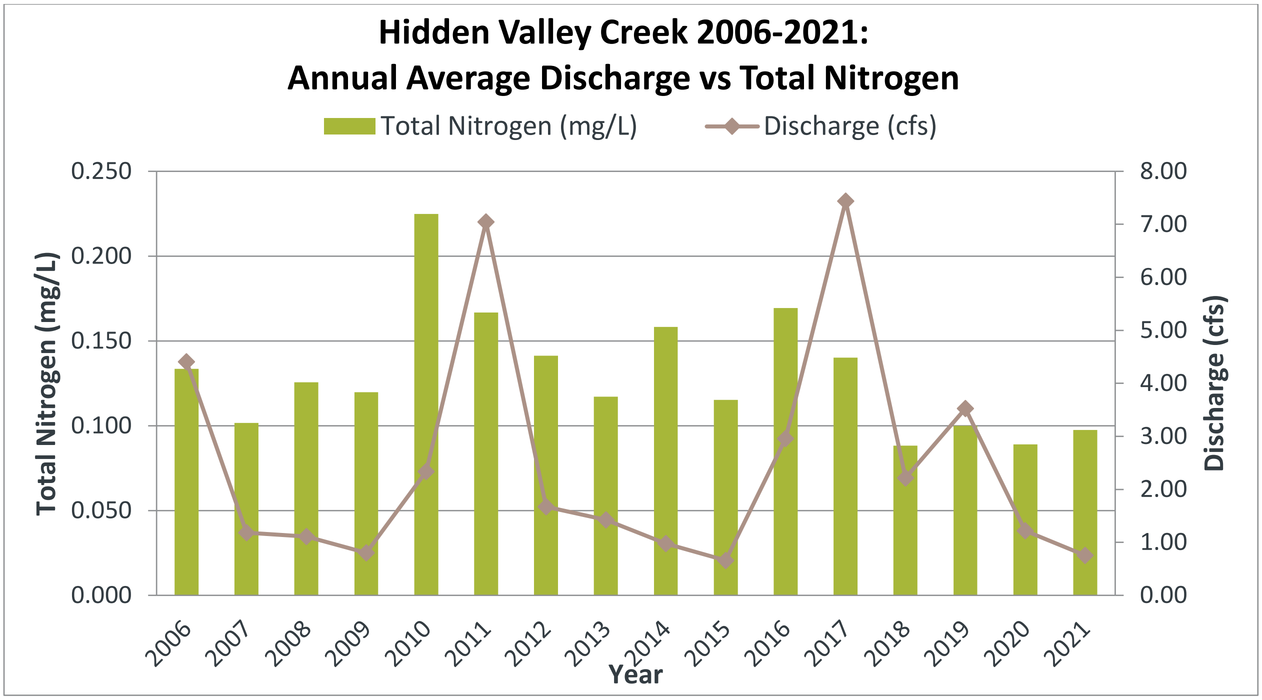

Figure C.6-5 Total Nitrogen Versus Flow, Hidden Valley Creek (43HDVC-5) (2006–2021)

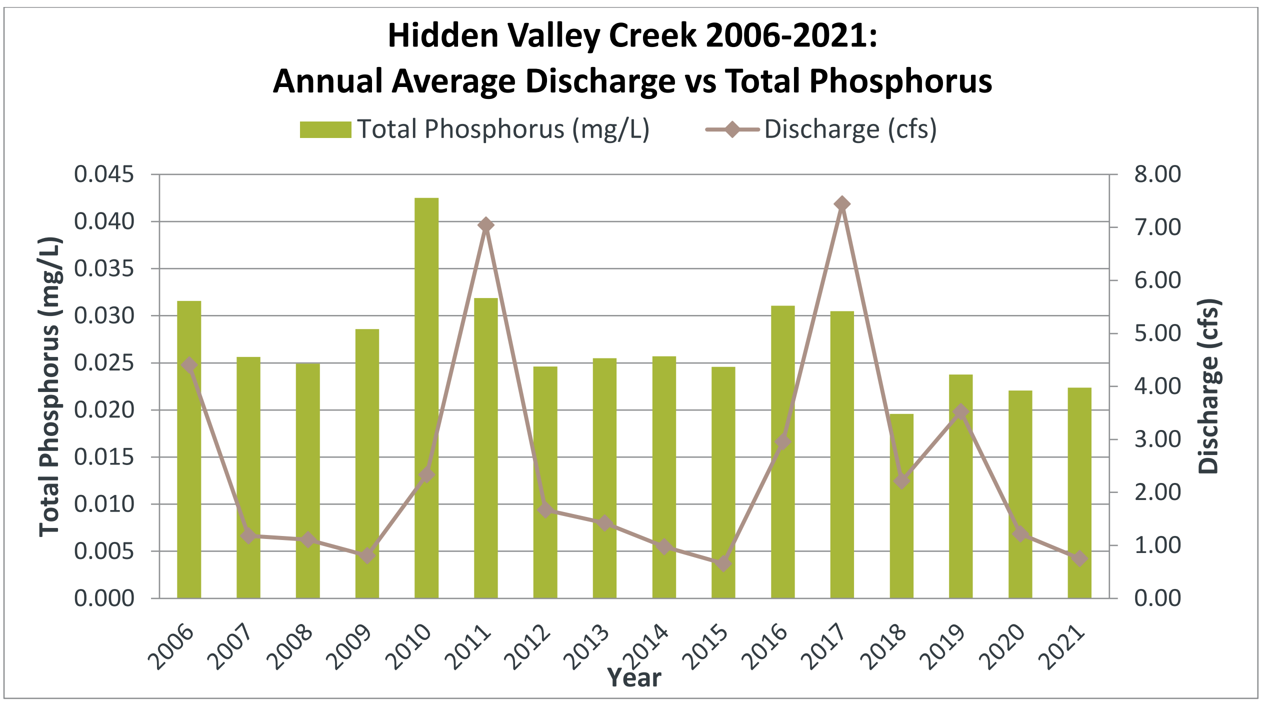

Figure C.6-6 Total Phosphorus Versus Flow, Hidden Valley Creek (43HDVC-5) (2006–2021)

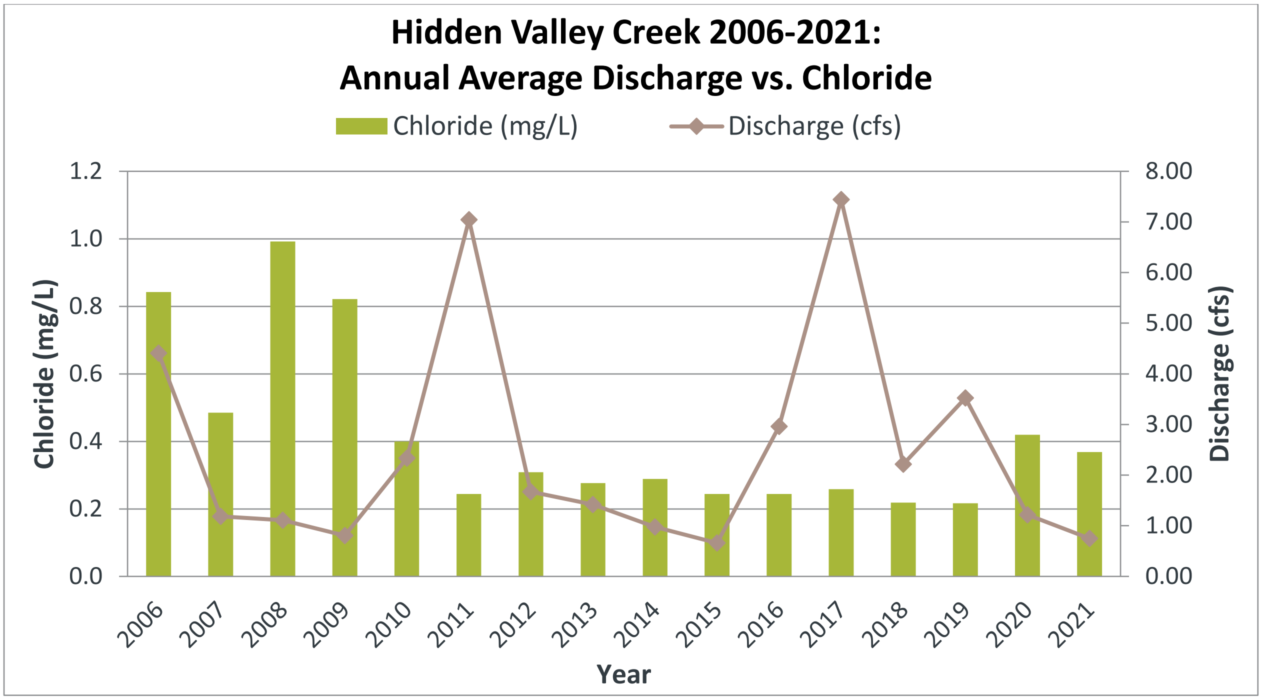

Figure C.6-7 Chloride Versus Flow, Hidden Valley Creek (43HDVC-5) (2006–2021)

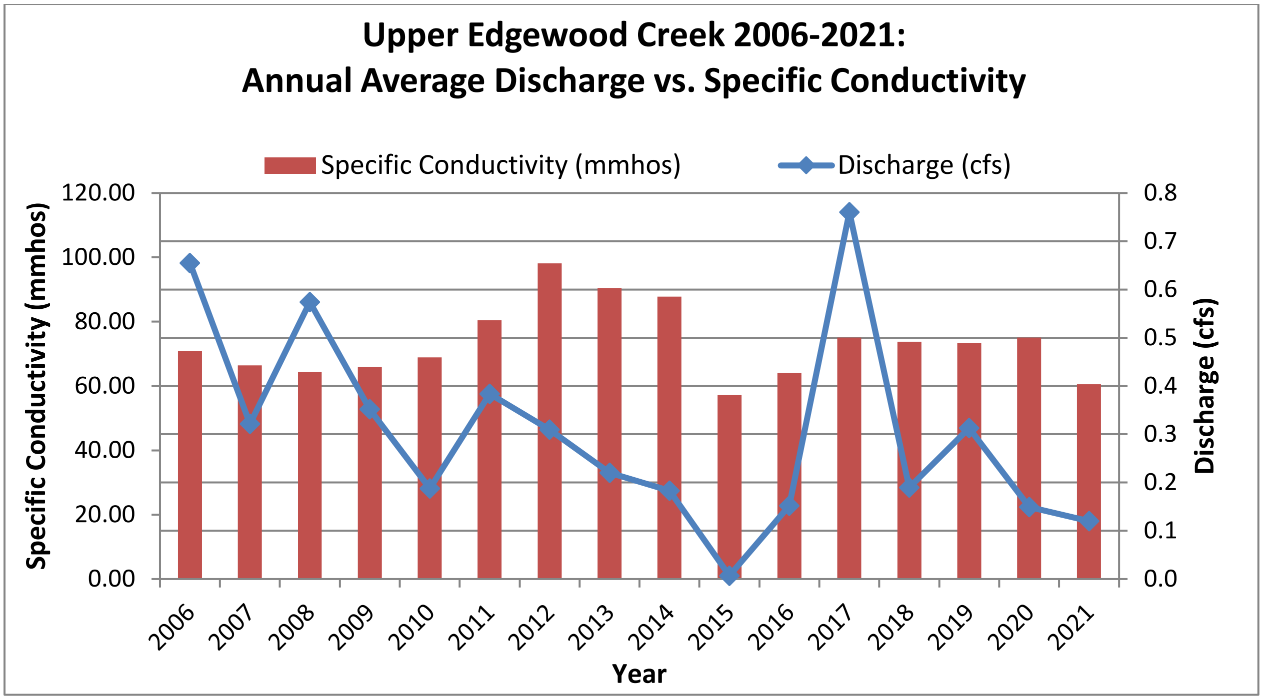

Figure C.7-1 Specific Conductivity Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)

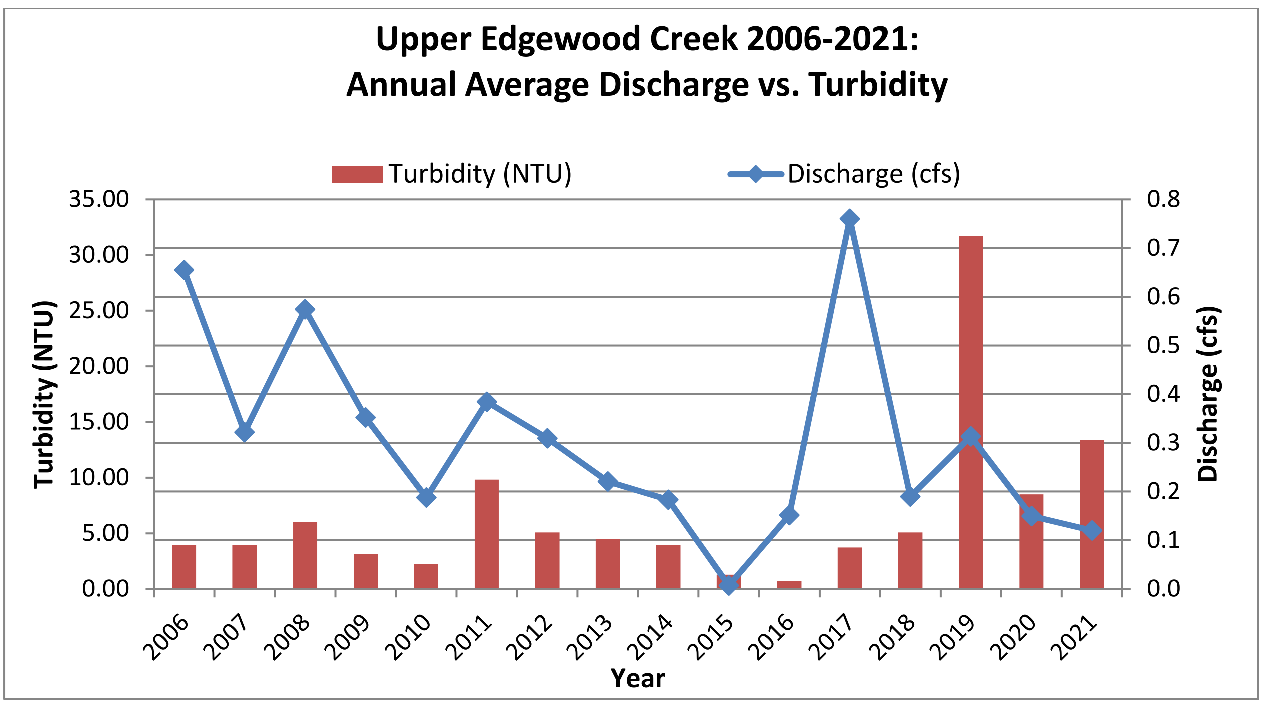

Figure C.7-2 Turbidity Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)

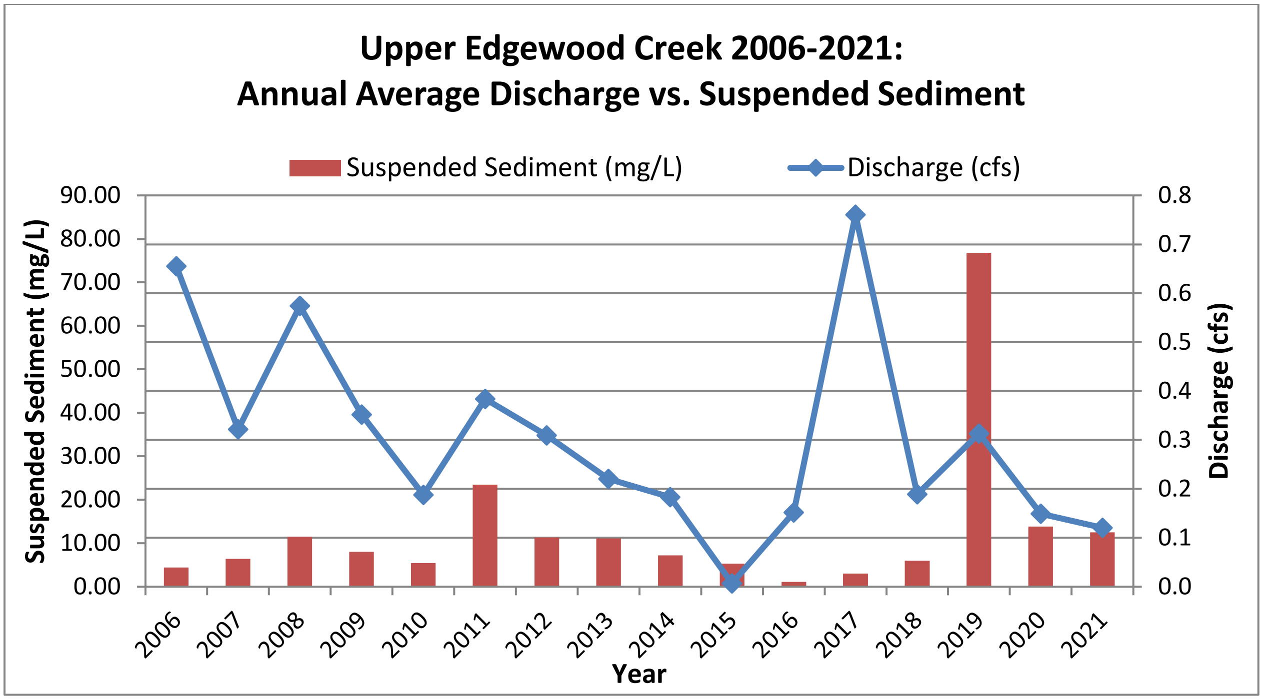

Figure C.7-3 Suspended Sediment Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)

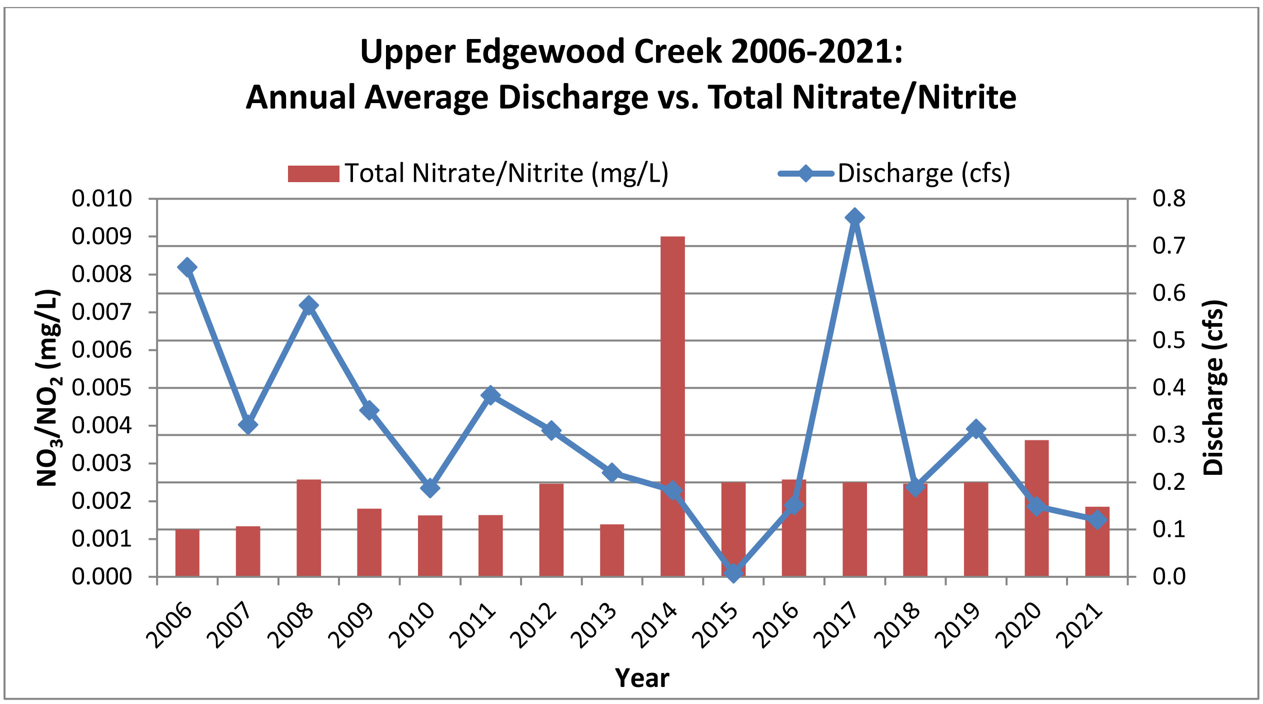

Figure C.7-4 Total Nitrate/Nitrite Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)

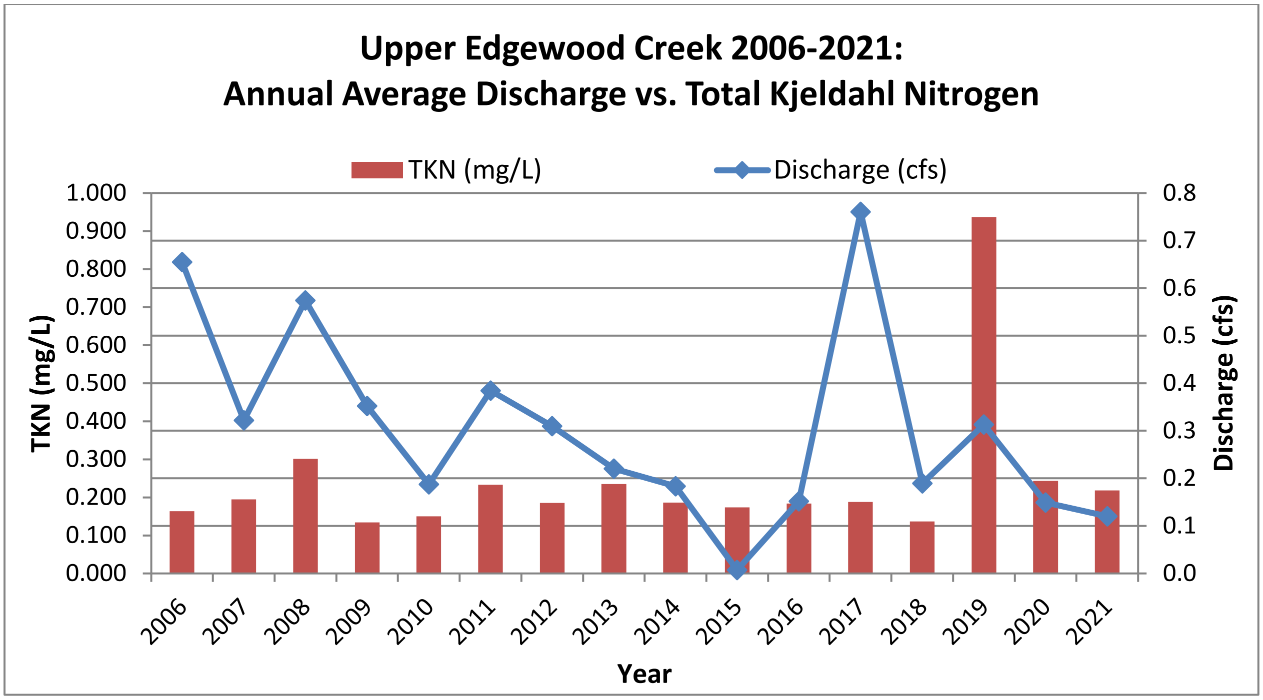

Figure C.7-5 TKN Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)

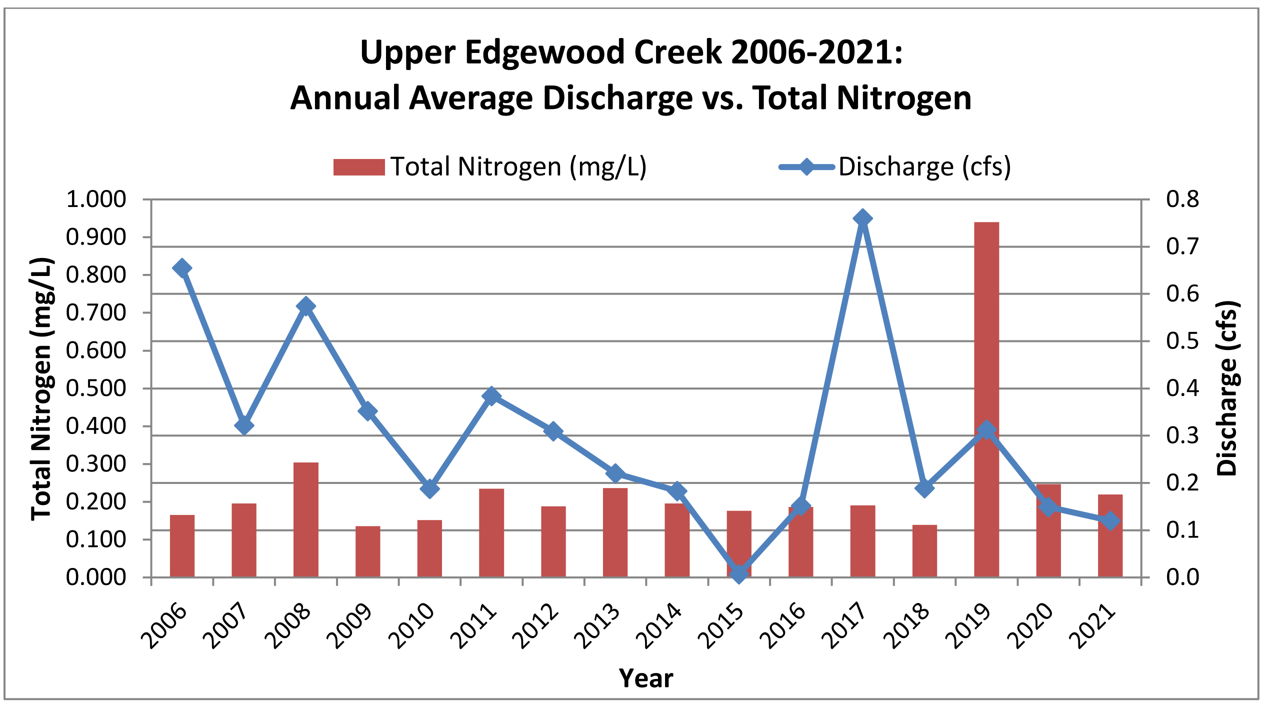

Figure C.7-6 Total Nitrogen Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)

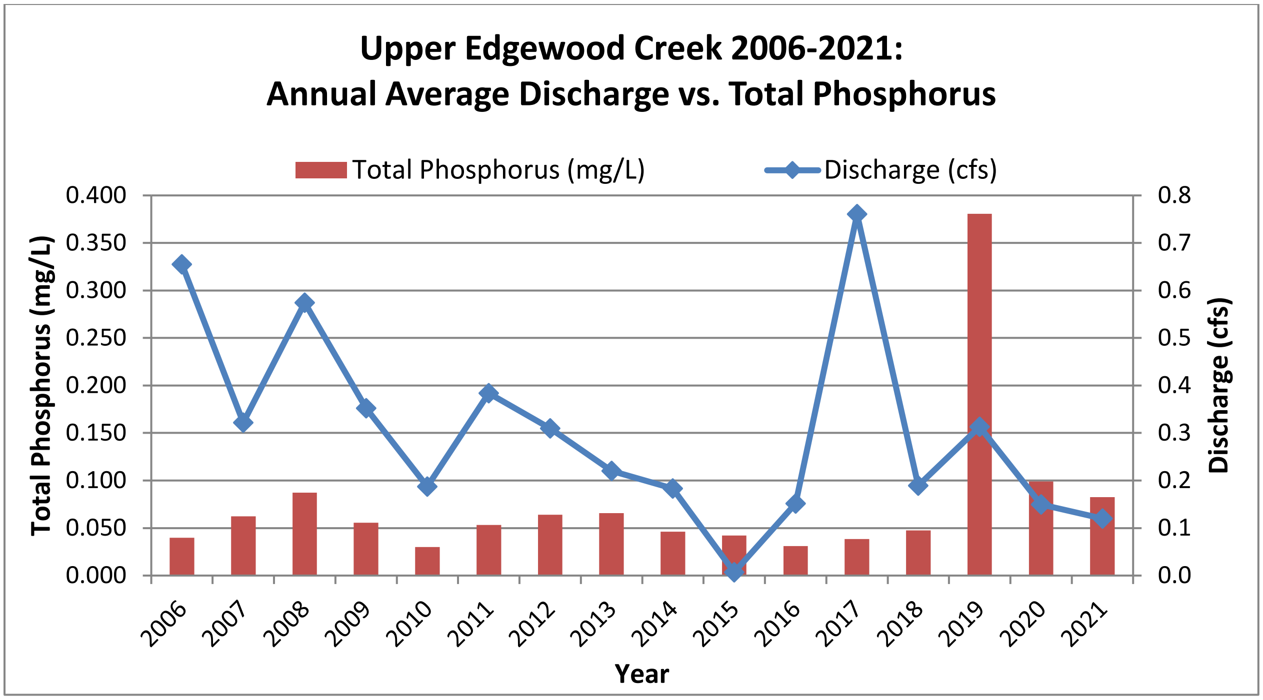

Figure C.7-7 **Total Phosphorus Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)**

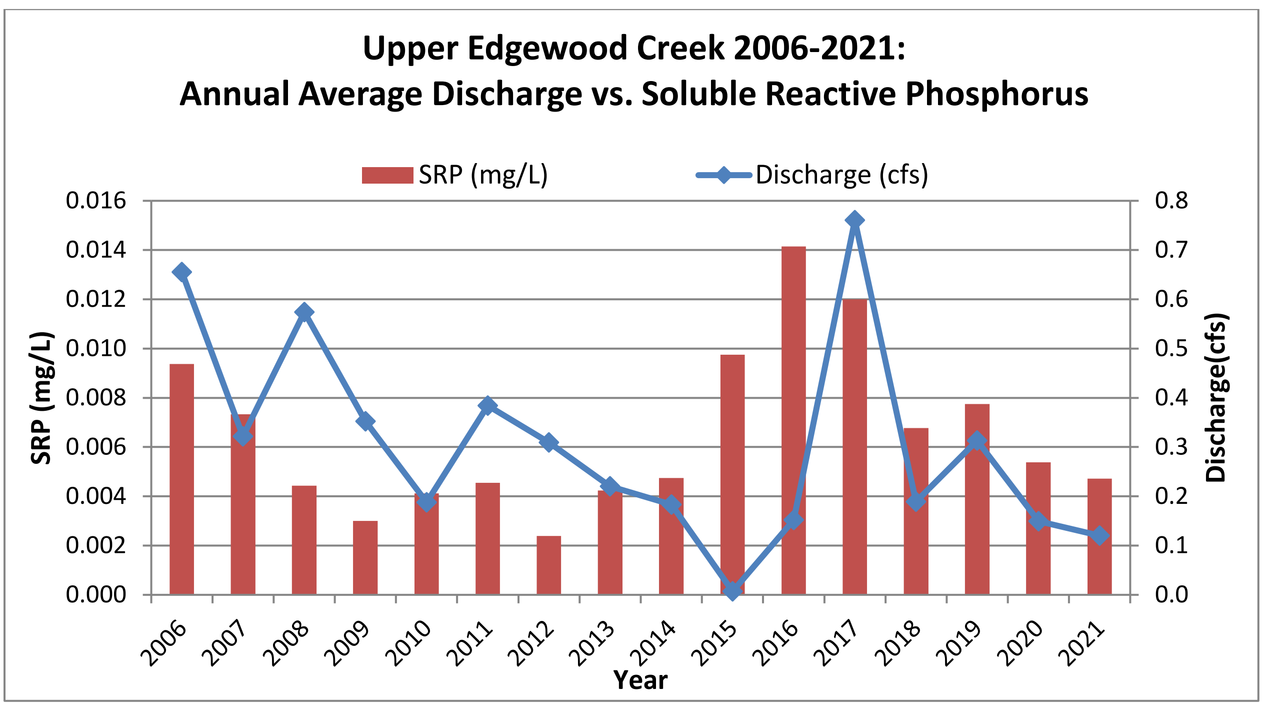

Figure C.7-8 **Soluble Reactive Phosphorus Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)**

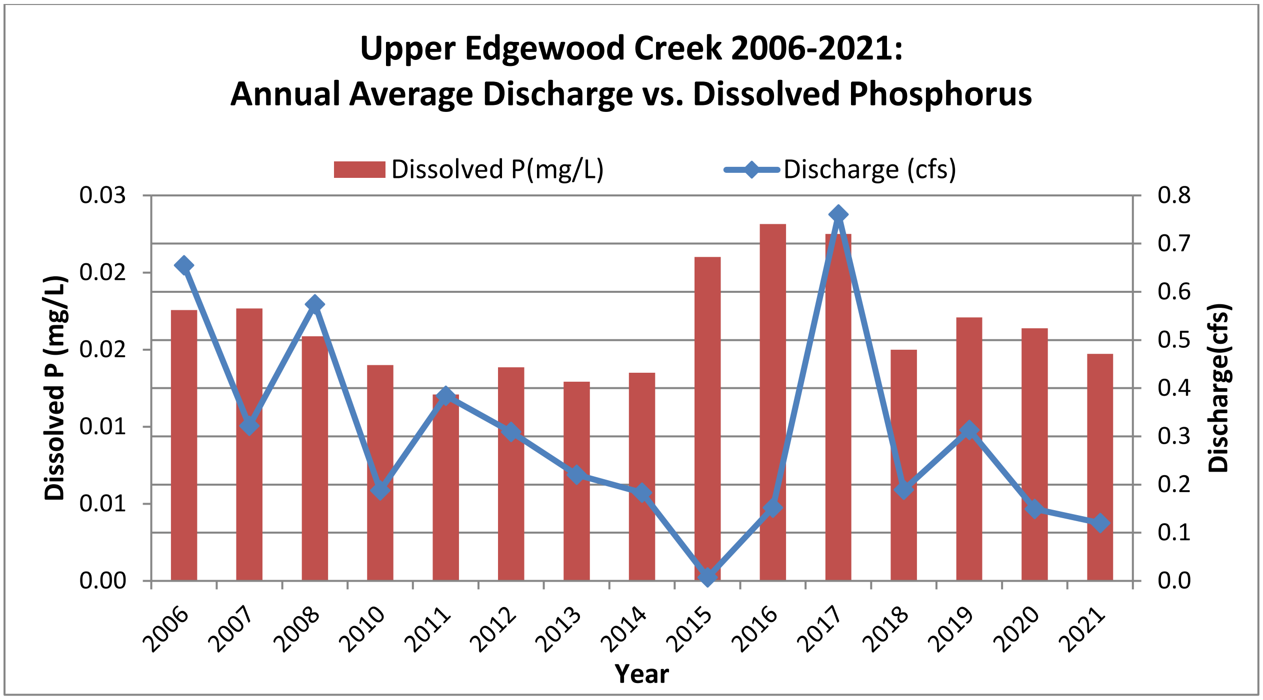

Figure C.7-9 Dissolved Phosphorus Versus Flow, Upper Edgewood Creek (43HVE-1) (2006–2021)

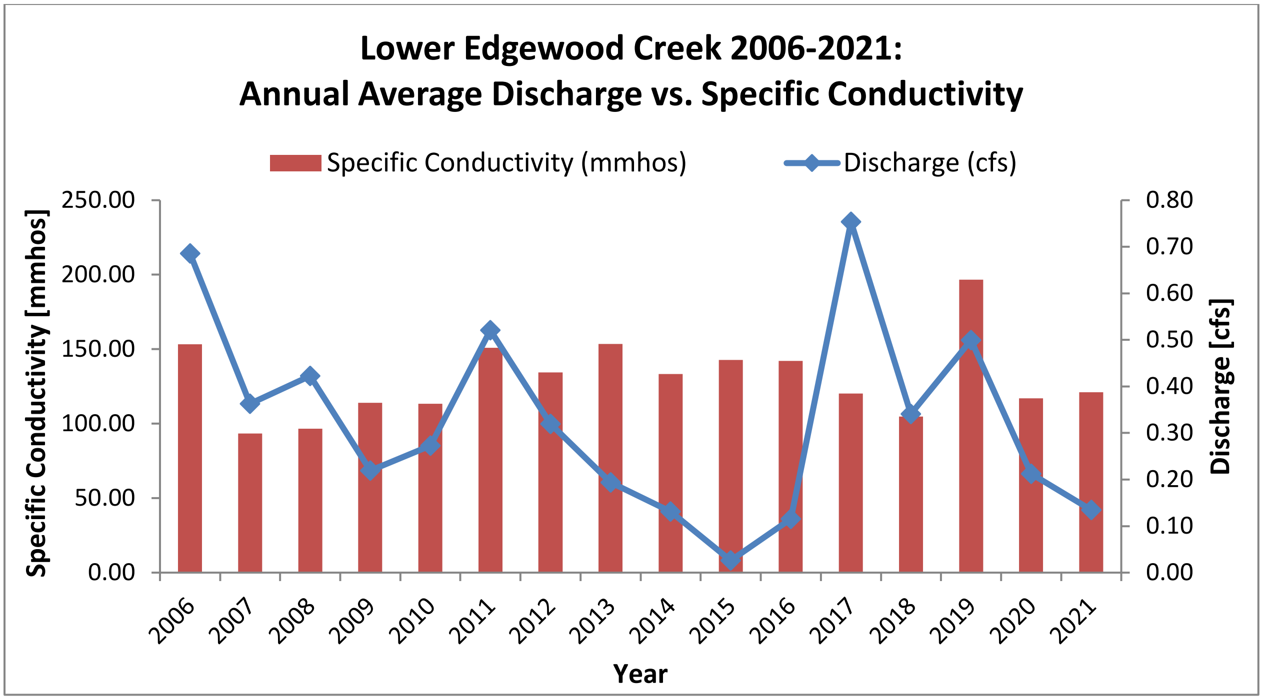

Figure C.8-1 Specific Conductivity Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

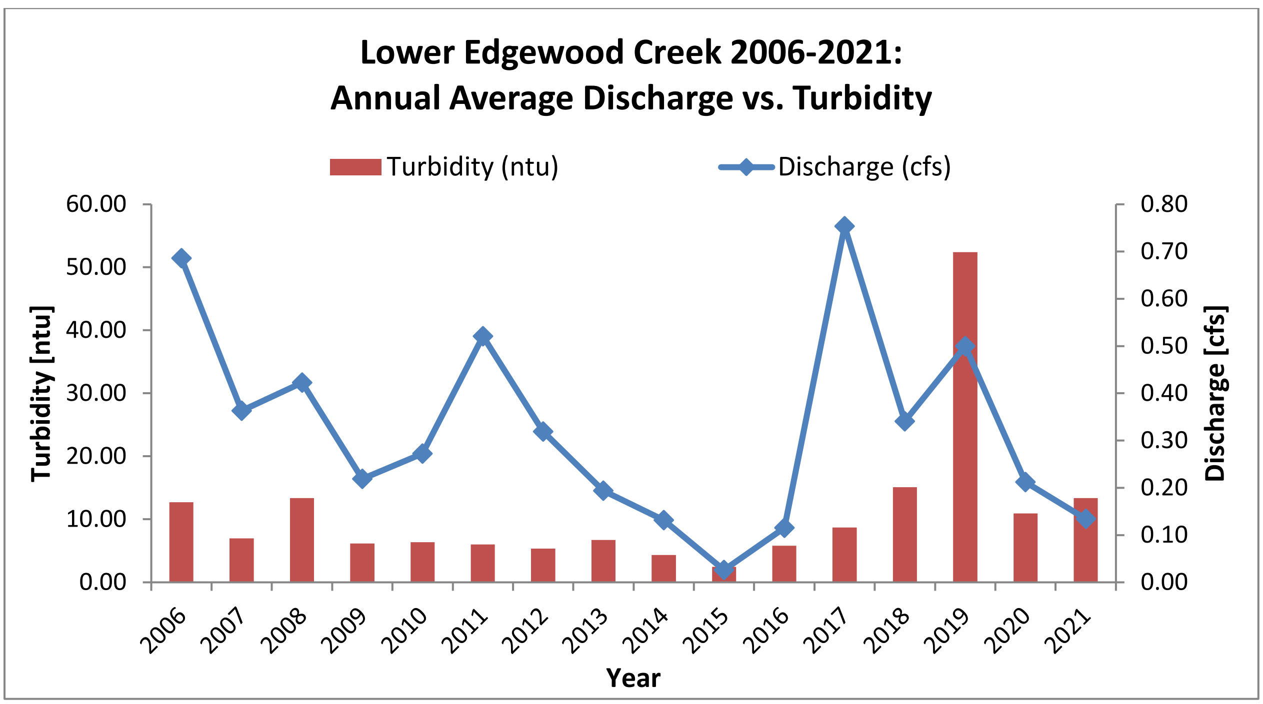

Figure C.8-2 Turbidity Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

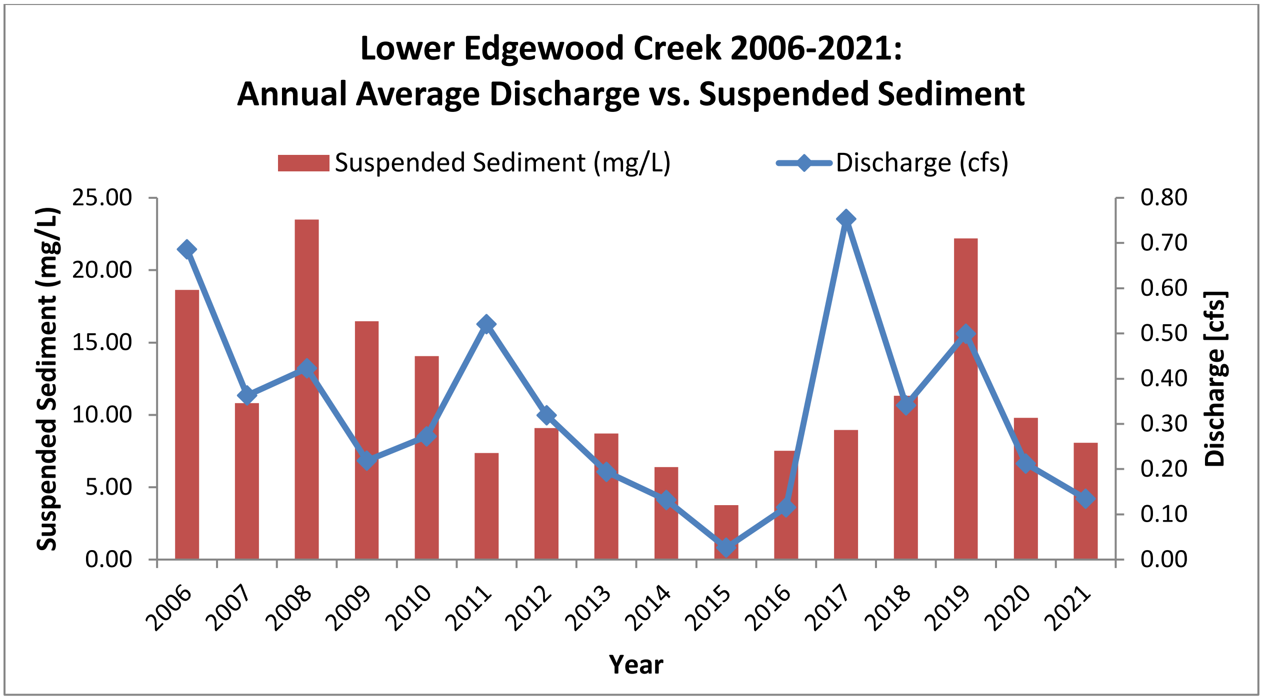

Figure C.8-3 Suspended Sediment Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

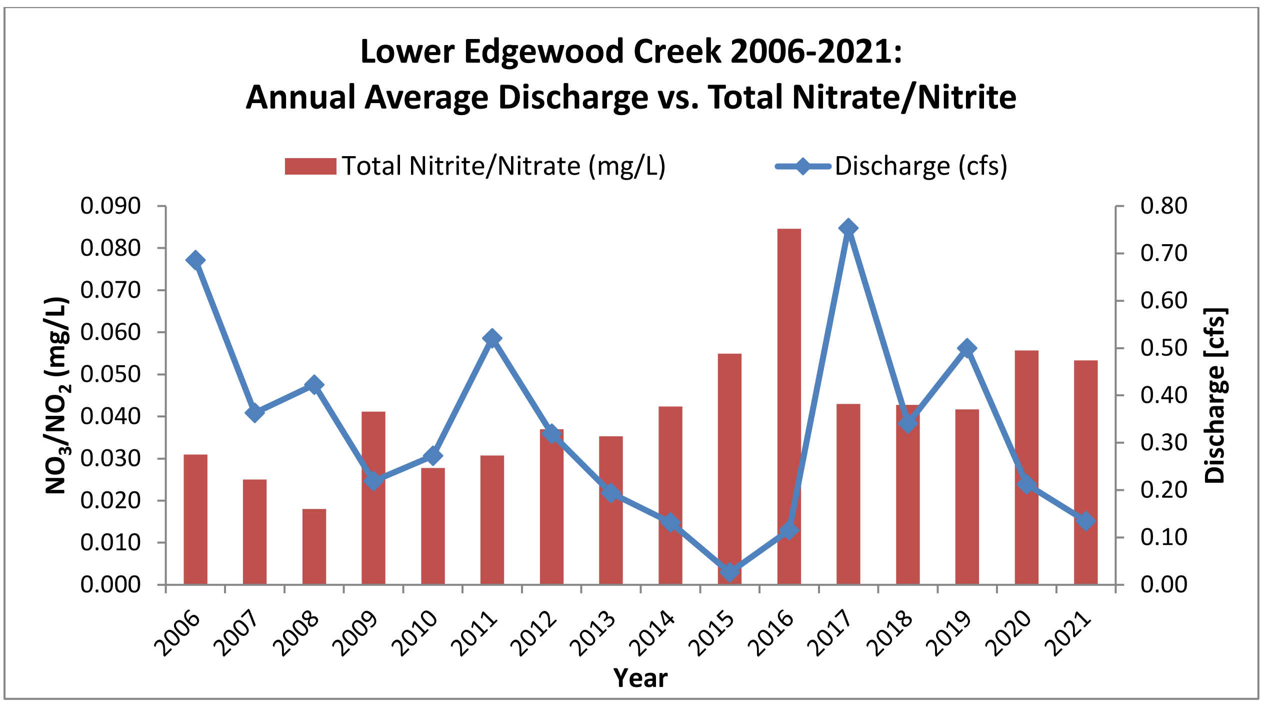

Figure C.8-4 Total Nitrate/Nitrite Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

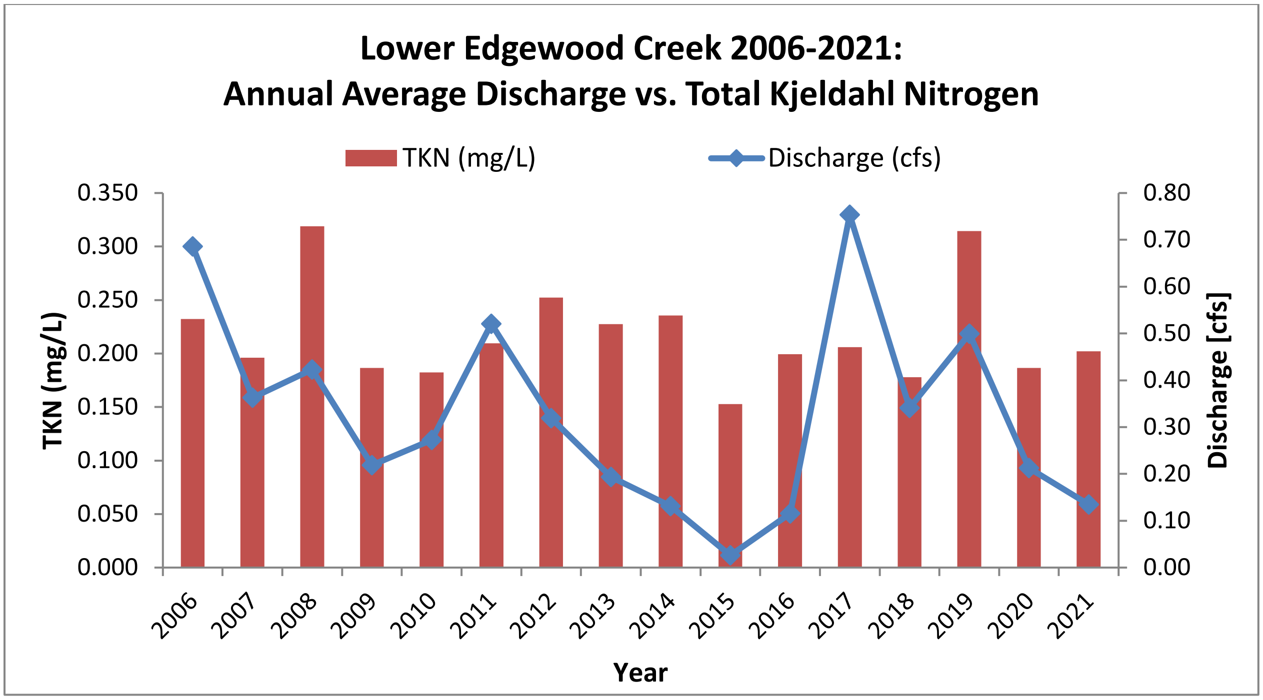

Figure C.8-5 TKN Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

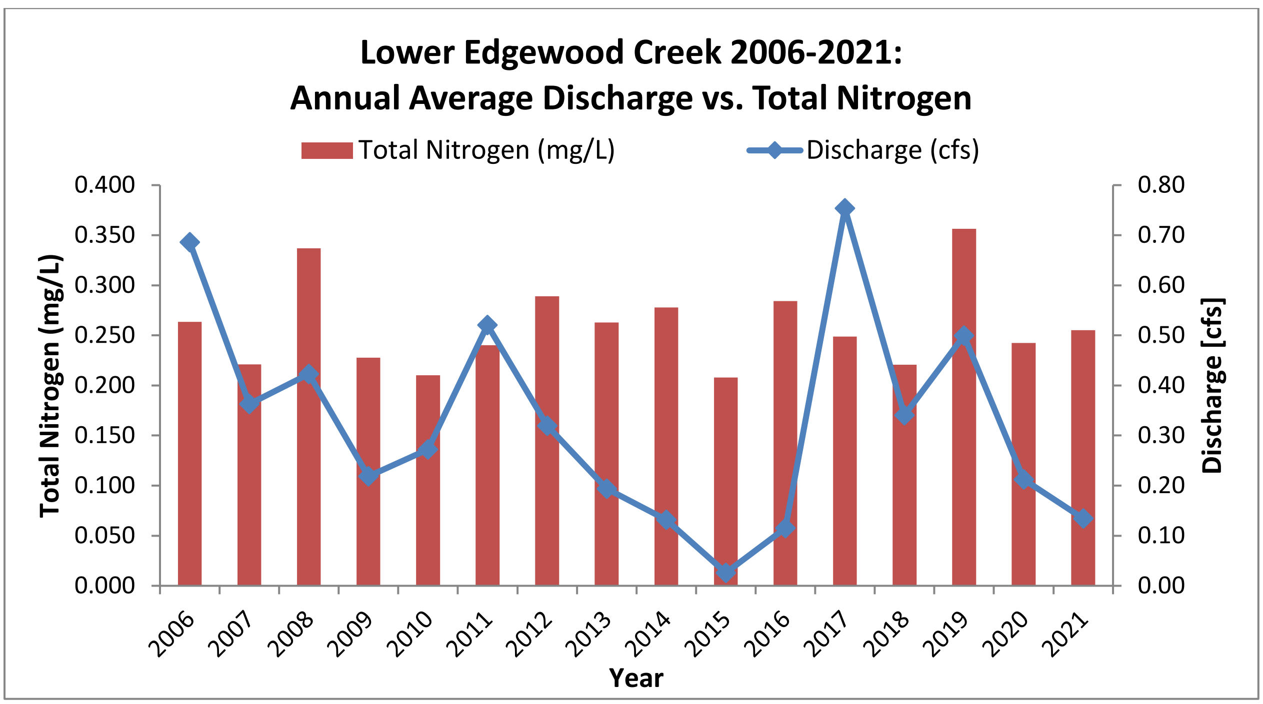

Figure C.8-6 Total Nitrogen Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

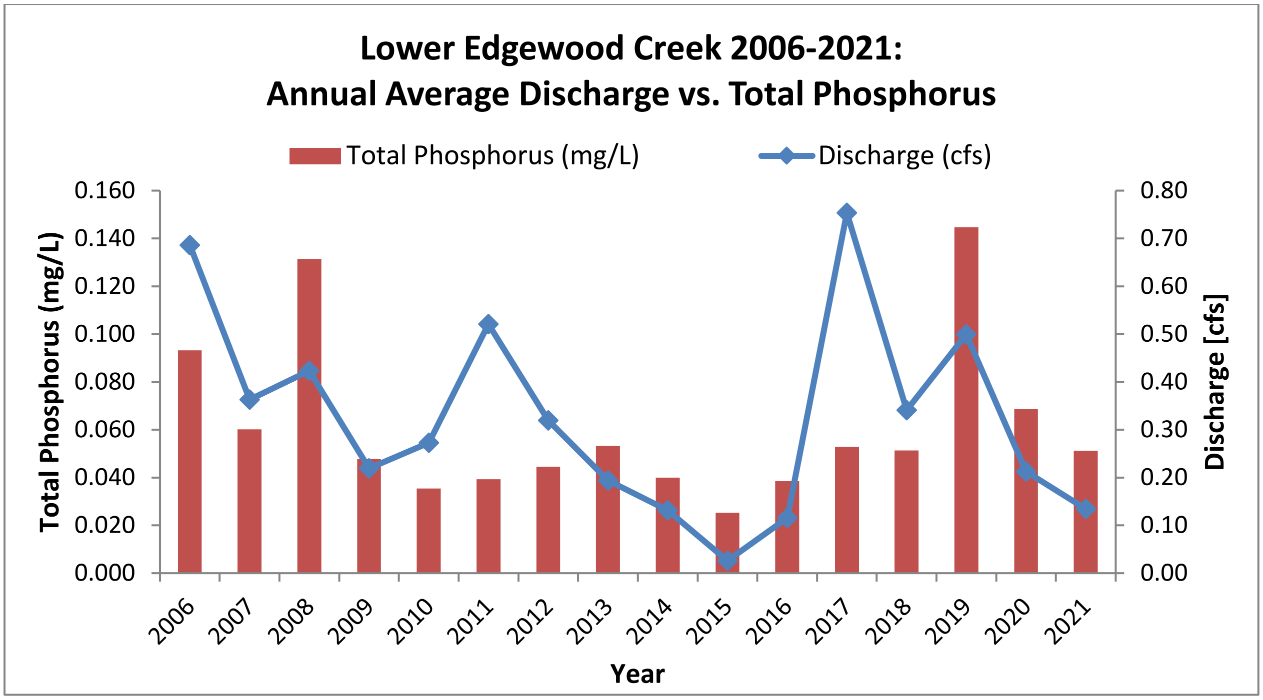

Figure C.8-7 Total Phosphorus Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

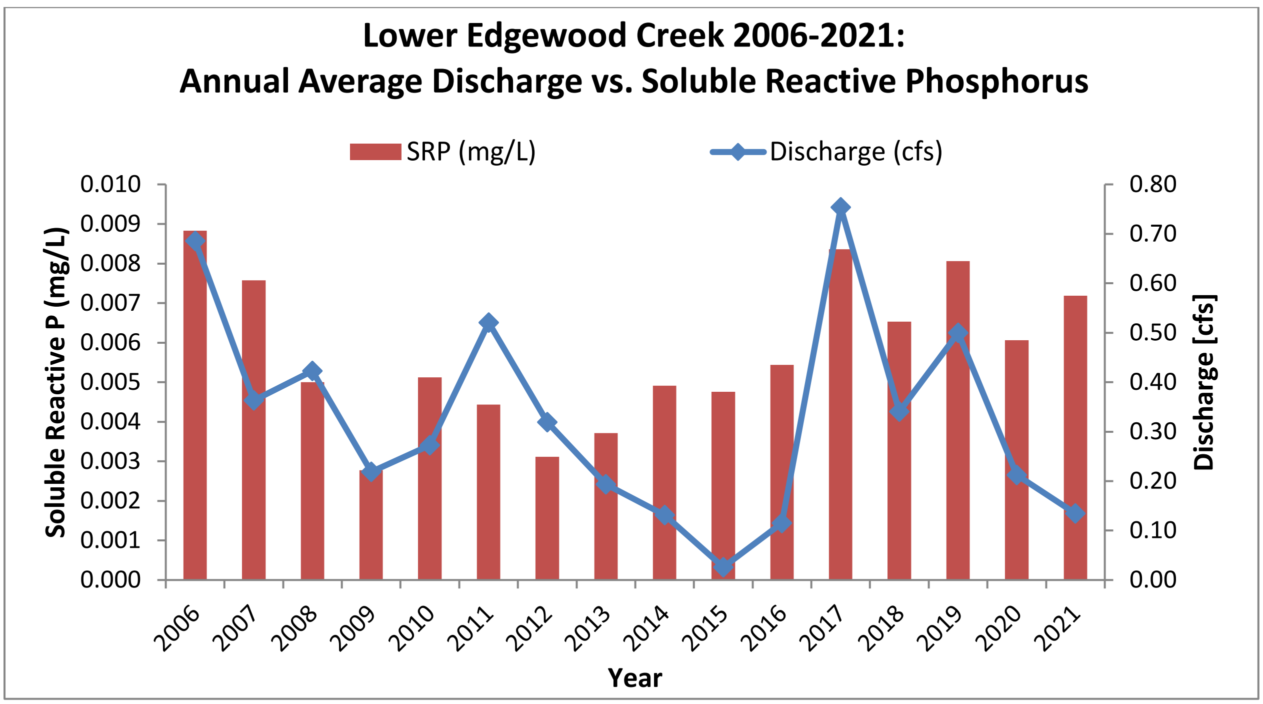

Figure C.8-8 Soluble Reactive Phosphorus Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

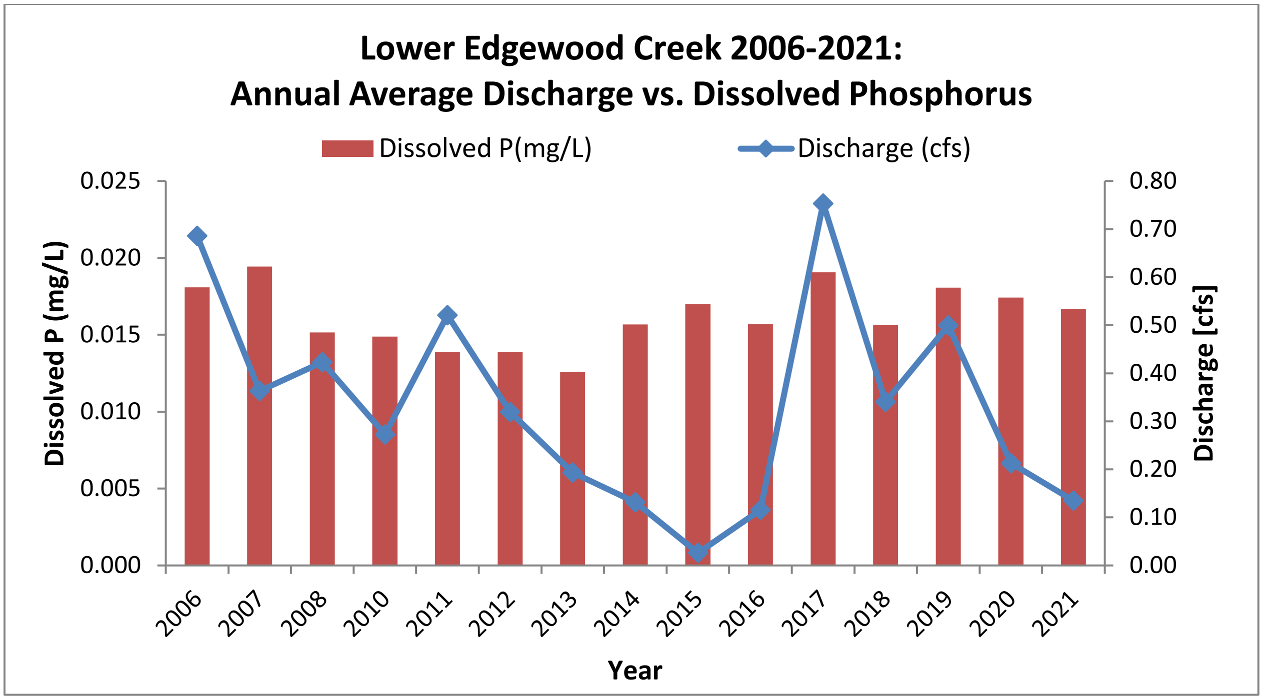

Figure C.8-9 Dissolved Phosphorus Versus Flow, Lower Edgewood Creek (43HVE-2) (2006–2021)

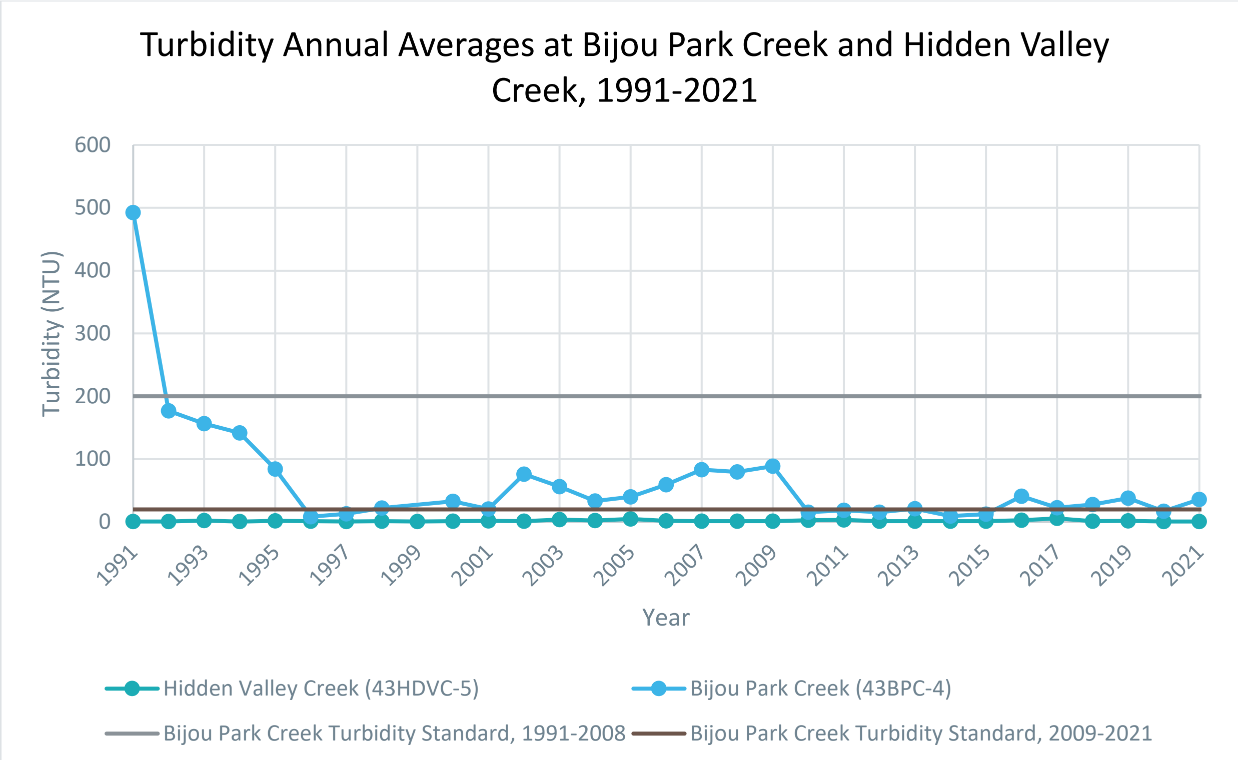

Figure C.9-1 Turbidity Annual Averages, Bijou Park Creek (43BPC-4) and Hidden Valley Creek (43HDVC-5) (1991–2021)

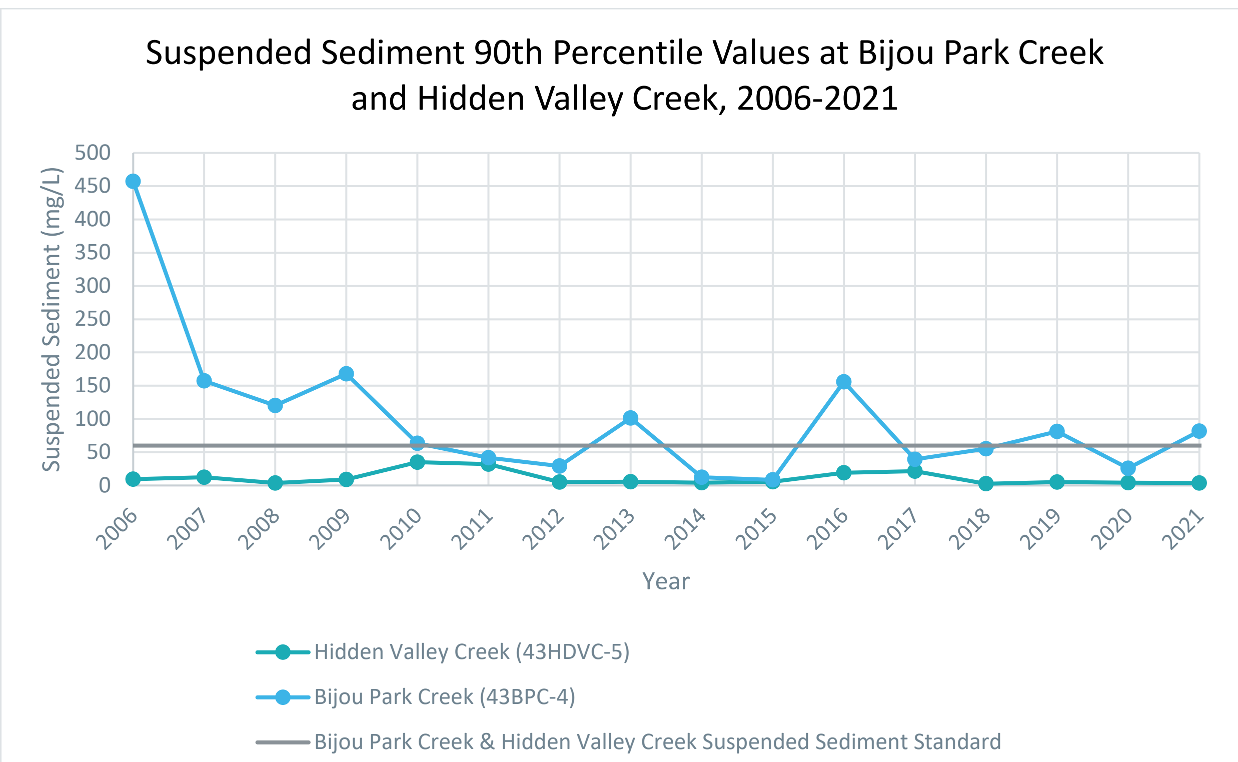

Figure C.9-2 Suspended Sediment 90th Percentile Values, Bijou Park Creek (43BPC-4) and Hidden Valley Creek (43HDVC-5) (1991–2021)

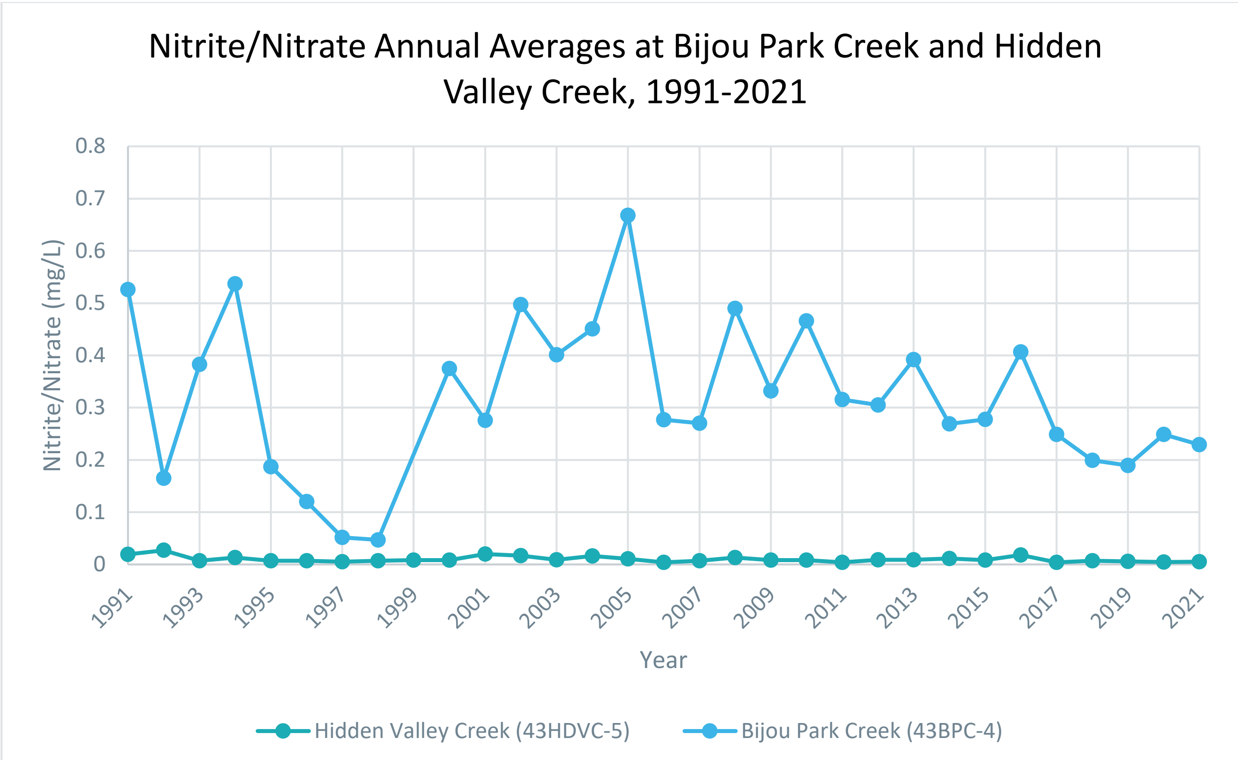

Figure C.9-3 Nitrate/Nitrite Annual Averages, Bijou Park Creek (43BPC-4) and Hidden Valley Creek (43HDVC-5) (1991–2021)

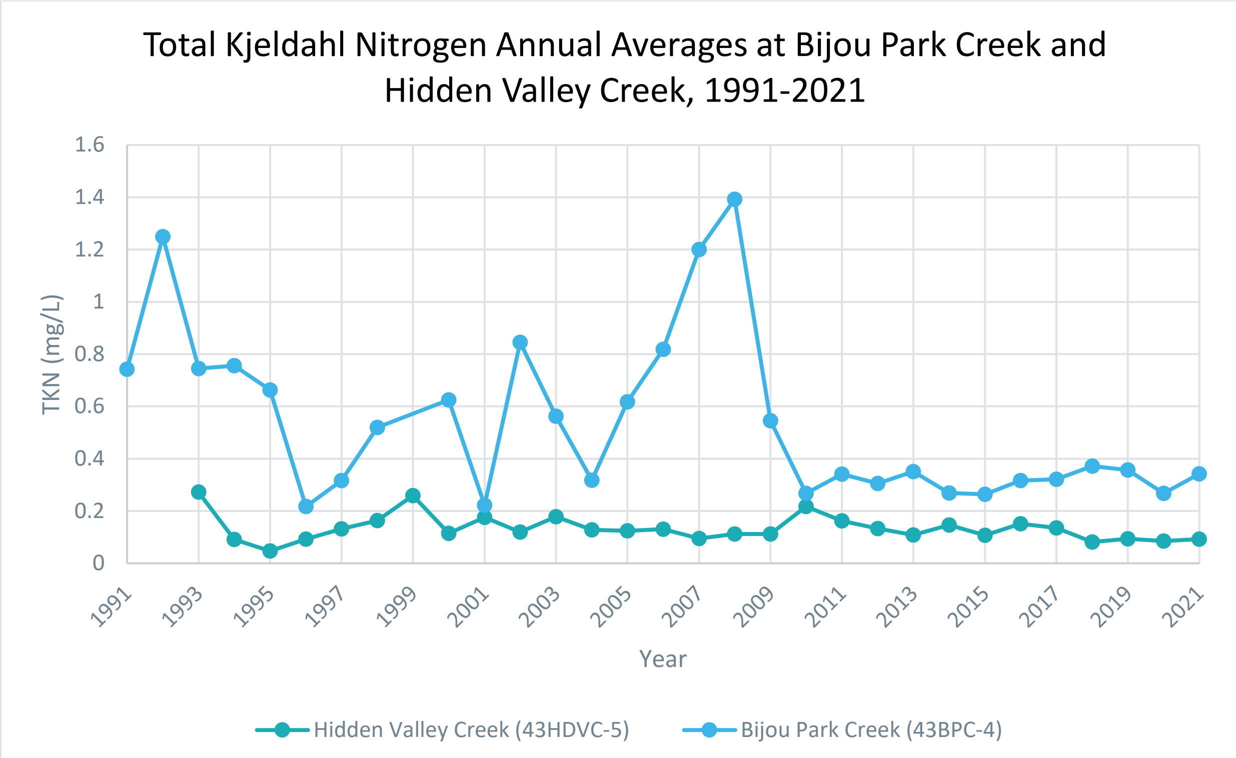

Figure C.9-4 TKN Annual Averages, Bijou Park Creek (43BPC-4) and Hidden Valley Creek (43HDVC-5) (1991–2021)

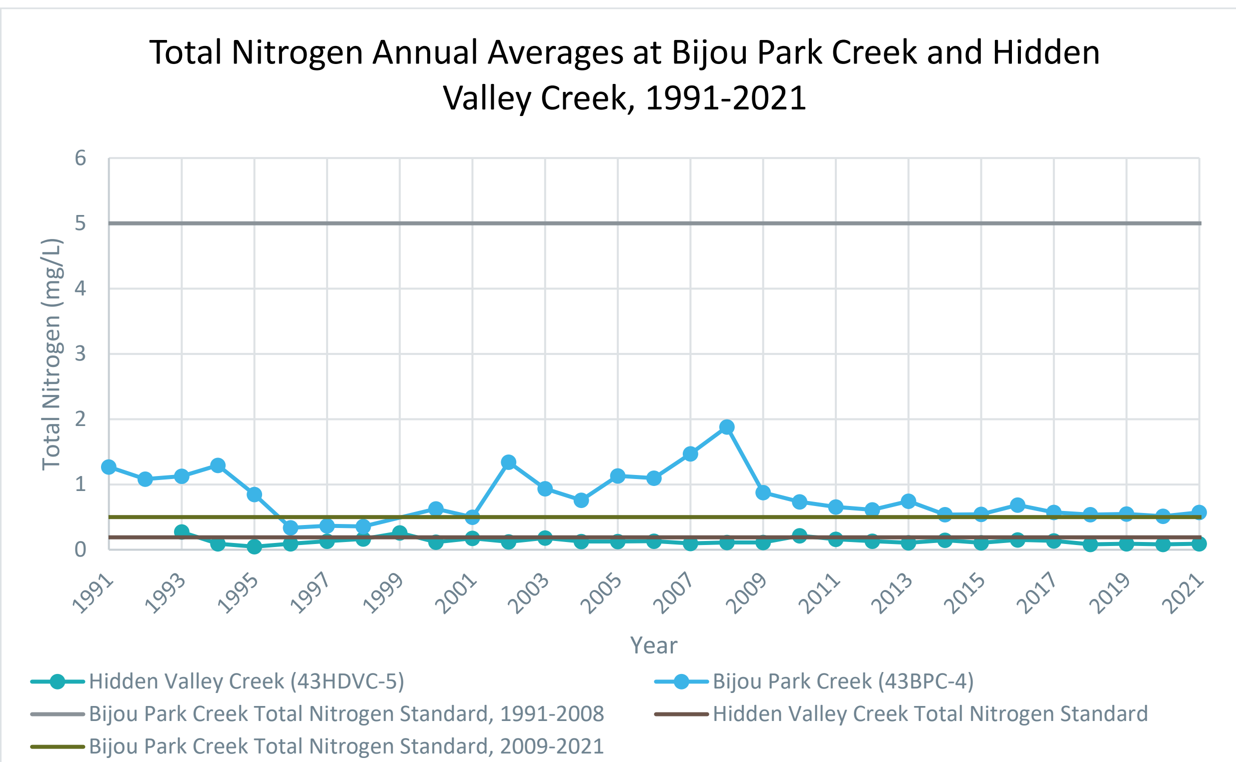

Figure C.9-5 Total Nitrogen Annual Averages, Bijou Park Creek (43BPC-4) and Hidden Valley Creek (43HDVC-5) (1991–2021)

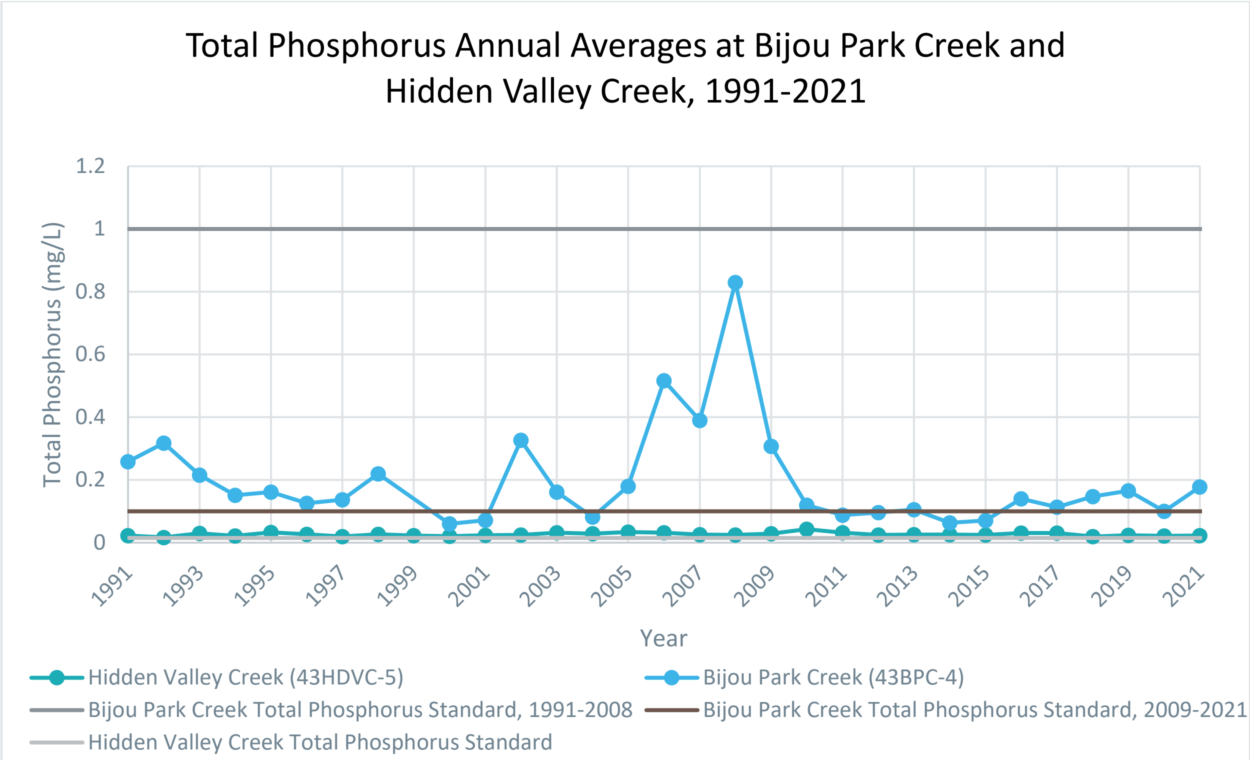

Figure C.9-6 Total Phosphorus Annual Averages, Bijou Park Creek (43BPC-4) and Hidden Valley Creek (43HDVC-5) (1991–2021)

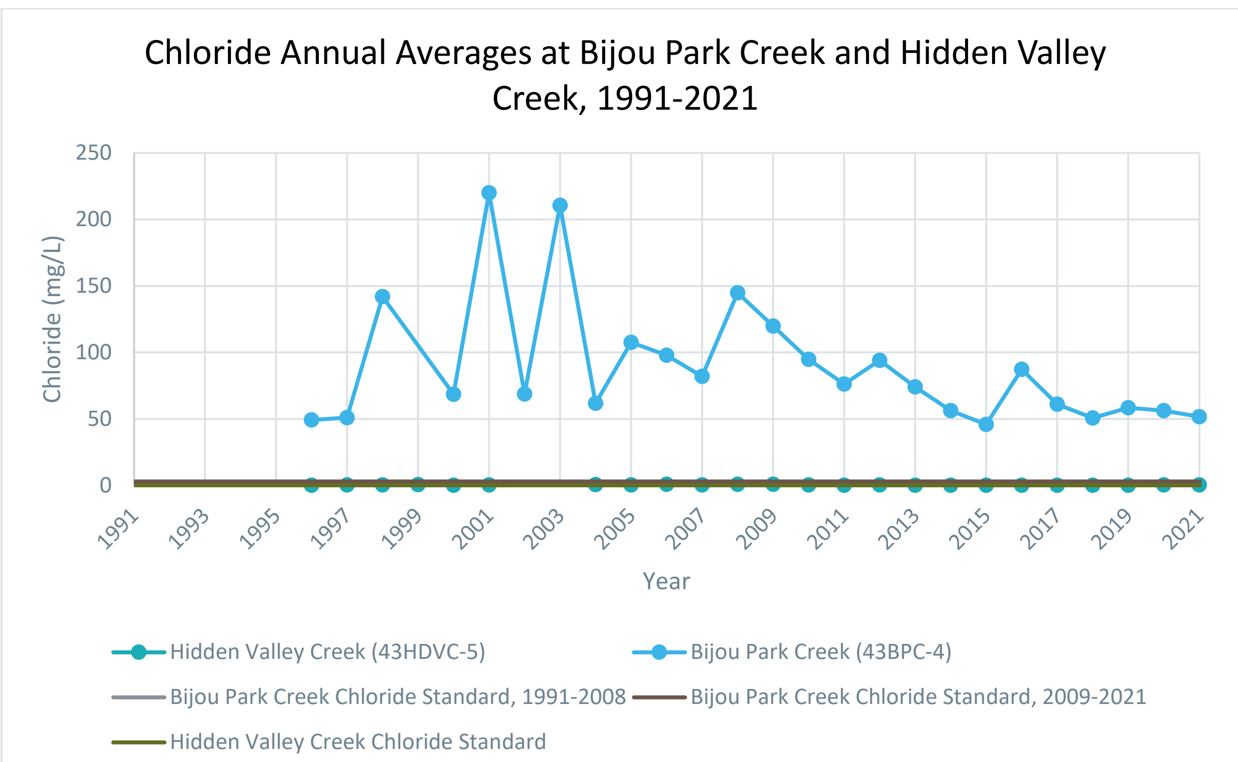

Figure C.9-7 Chloride Annual Averages, Bijou Park Creek (43BPC-4) and Hidden Valley Creek (43HDVC-5) (1991–2021)

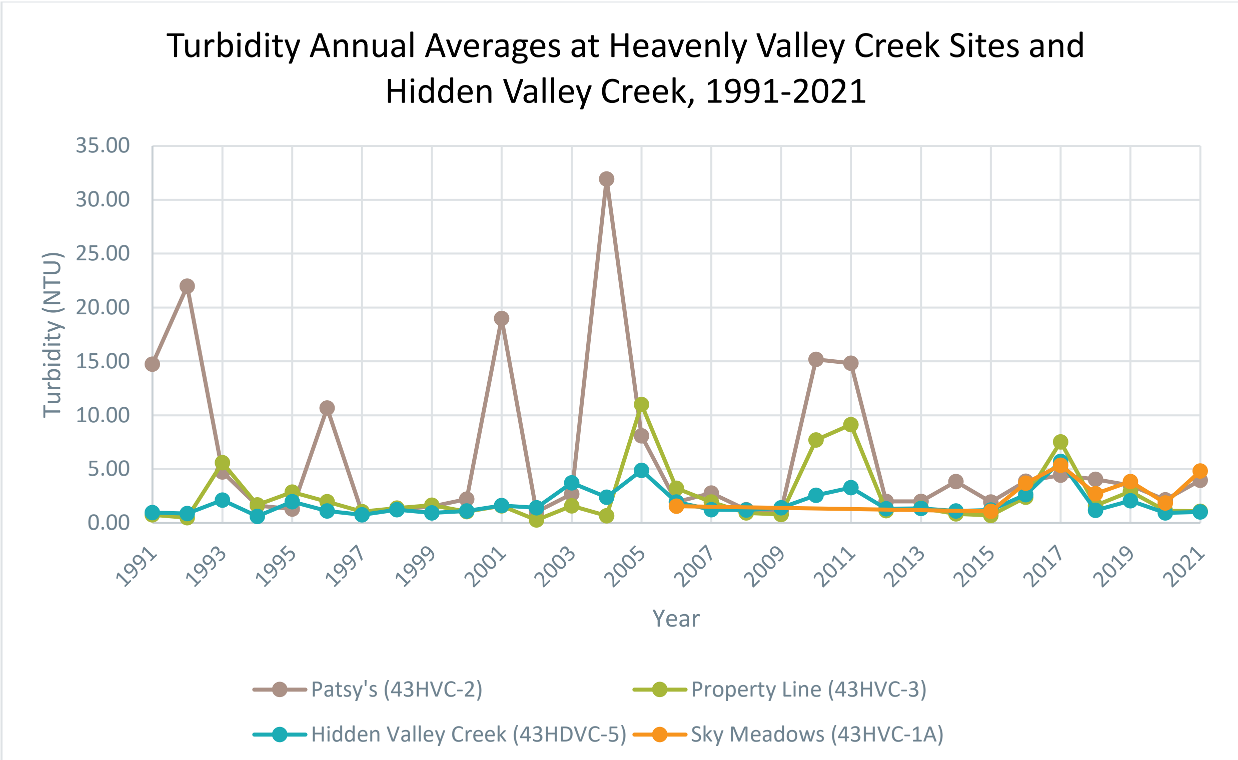

Figure C.10-1 Turbidity Annual Averages, Heavenly Valley Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (1991–2021)

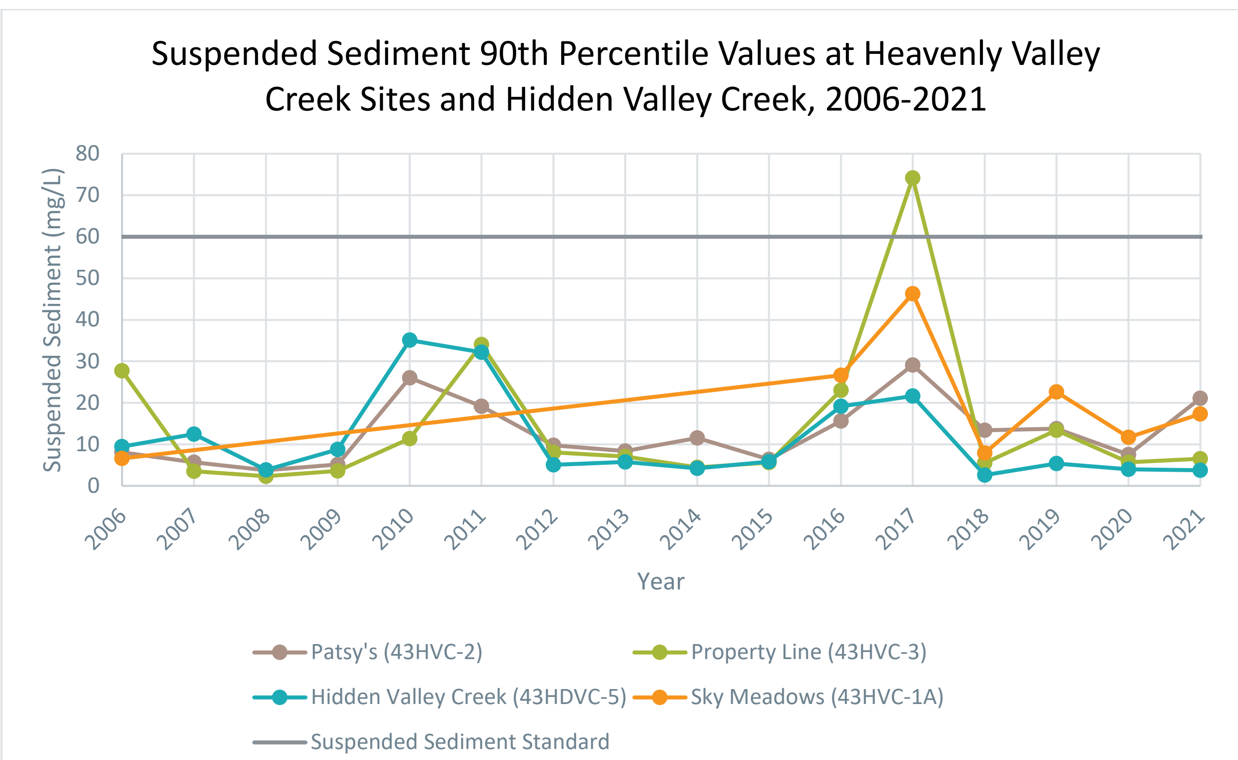

Figure C.10-2 Suspended Sediment 90th Percentile Values, Heavenly Valley Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (1991–2021)

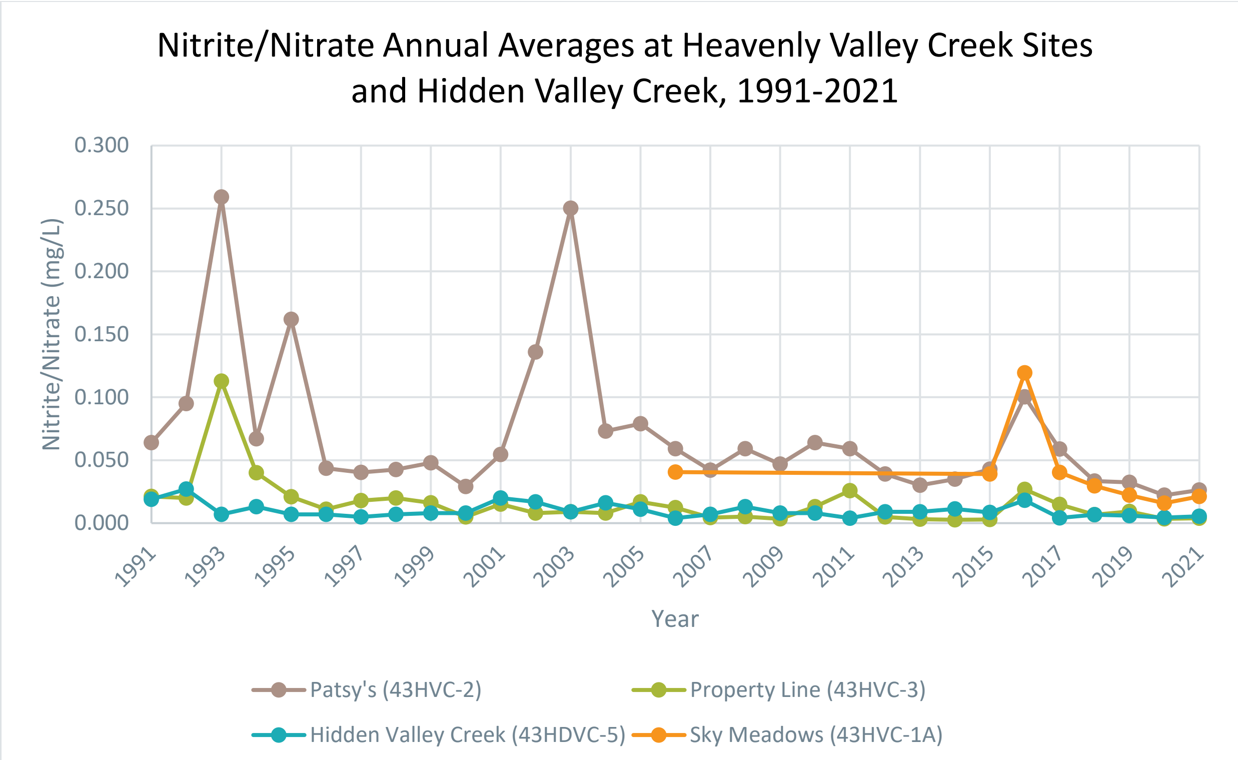

Figure C.10-3 Nitrate/Nitrite Annual Averages, Heavenly Valley Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (1991–2021)

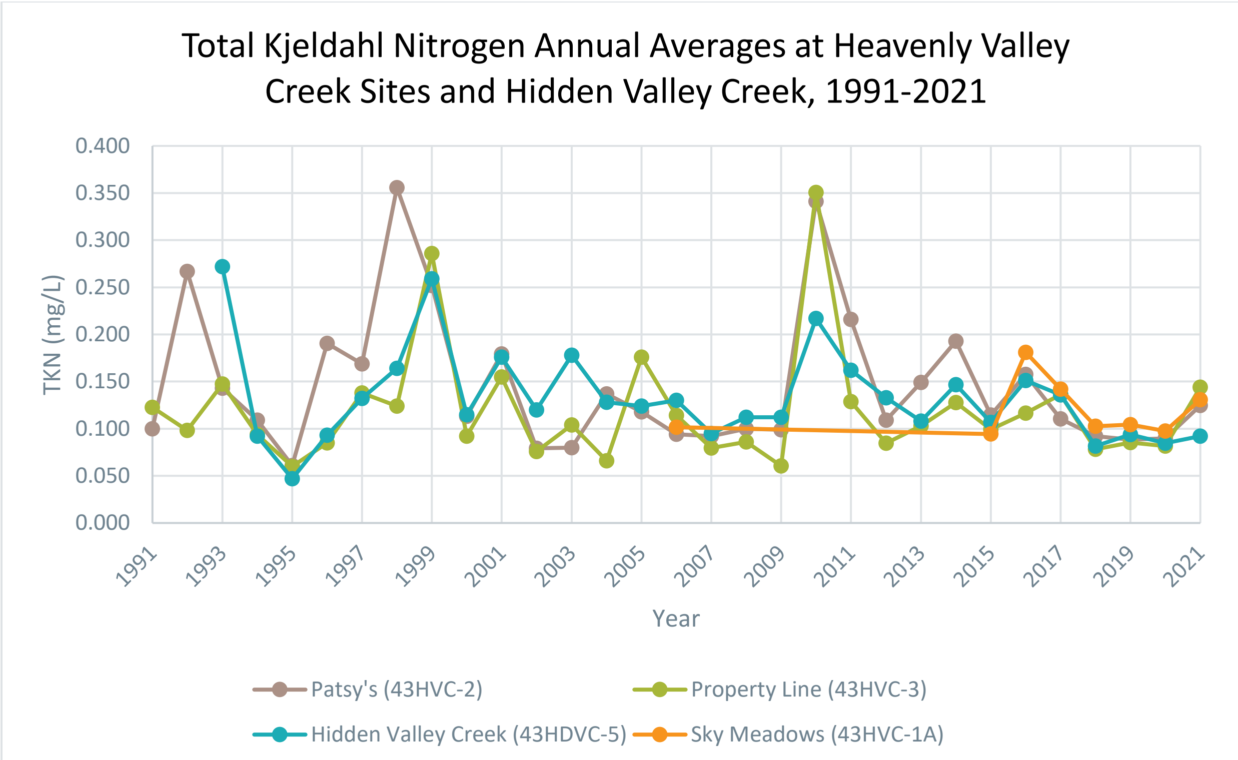

Figure C.10-4 TKN Annual Averages, Heavenly Valley Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (1991–2021)

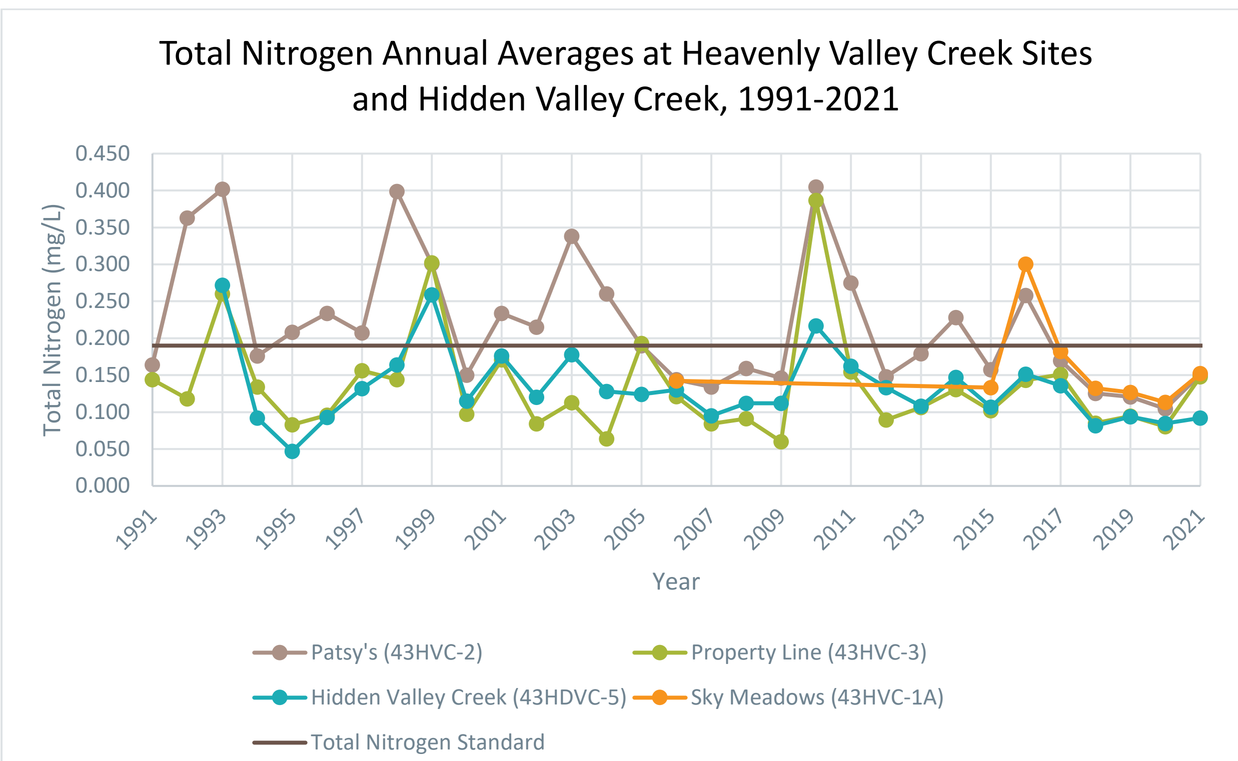

Figure C.10-5 Total Nitrogen Annual Averages, Heavenly Valley Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (1991–2021)

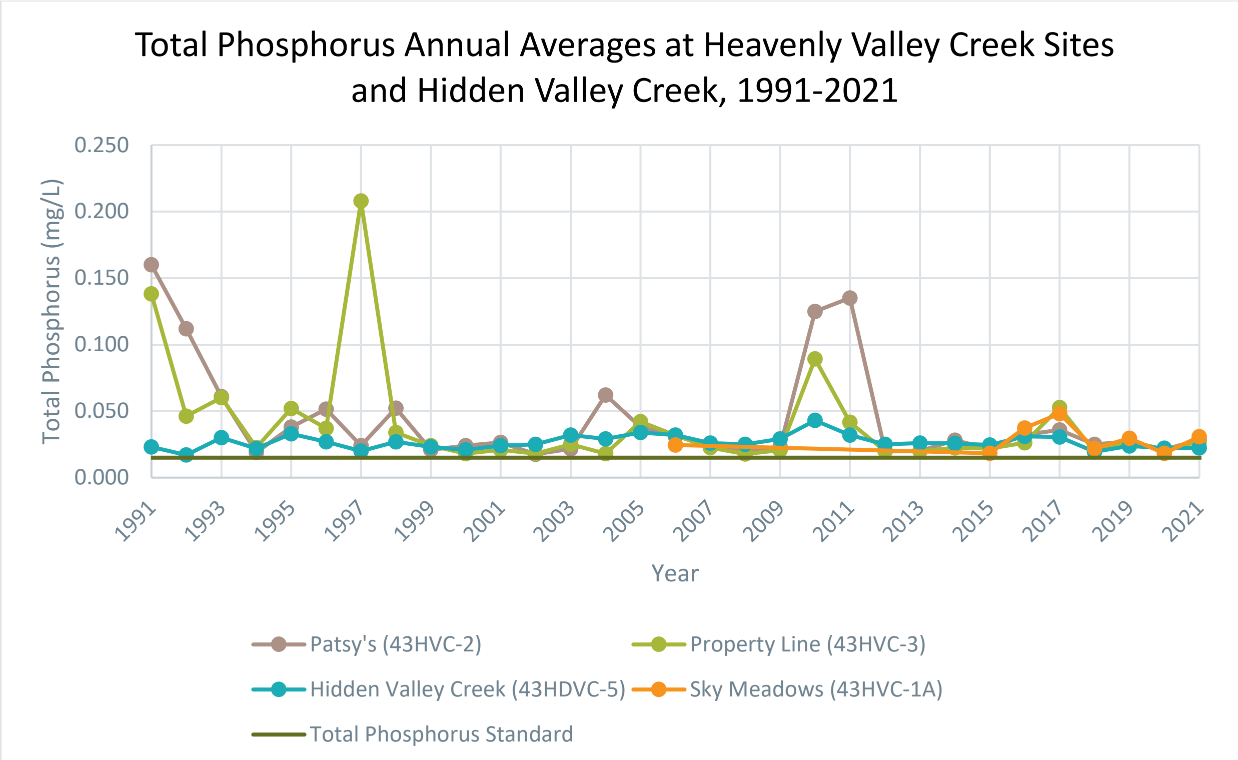

Figure C.10-6 Total Phosphorus Annual Averages, Heavenly Valley Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (1991–2021)

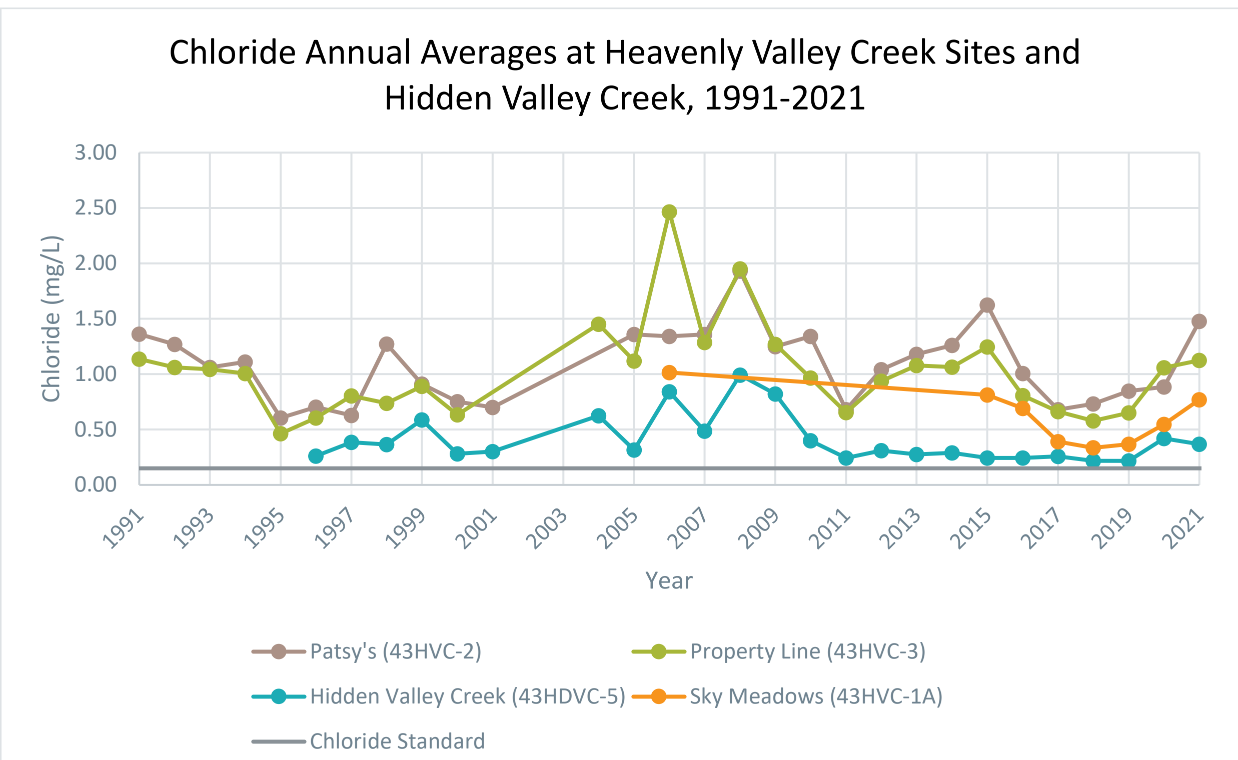

Figure C.10-7 Chloride Annual Averages, Heavenly Valley Creek (43HVC-1A, 43HVC-2, 43HVC-3) and Hidden Valley Creek (43HDVC-5) (1991–2021)

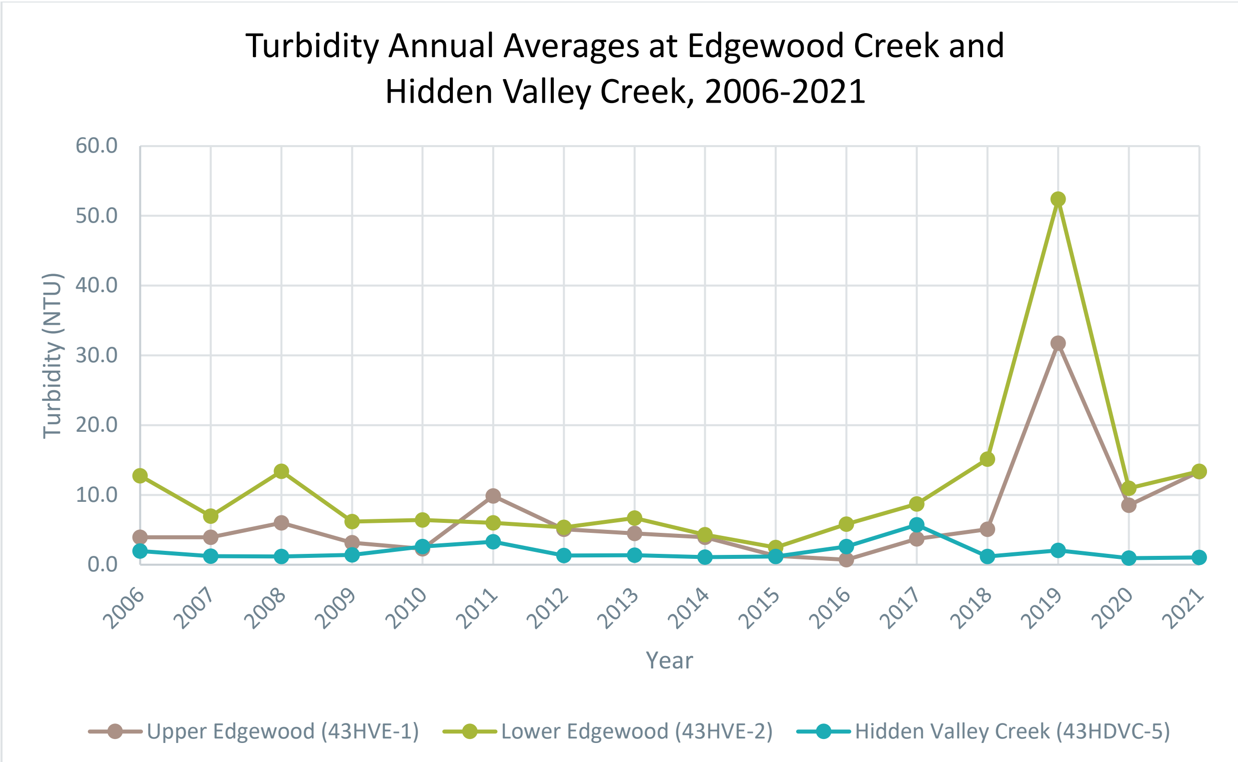

Figure C.11-1 Turbidity Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) and Hidden Valley Creek (43HDVC-5) (2006–2021)

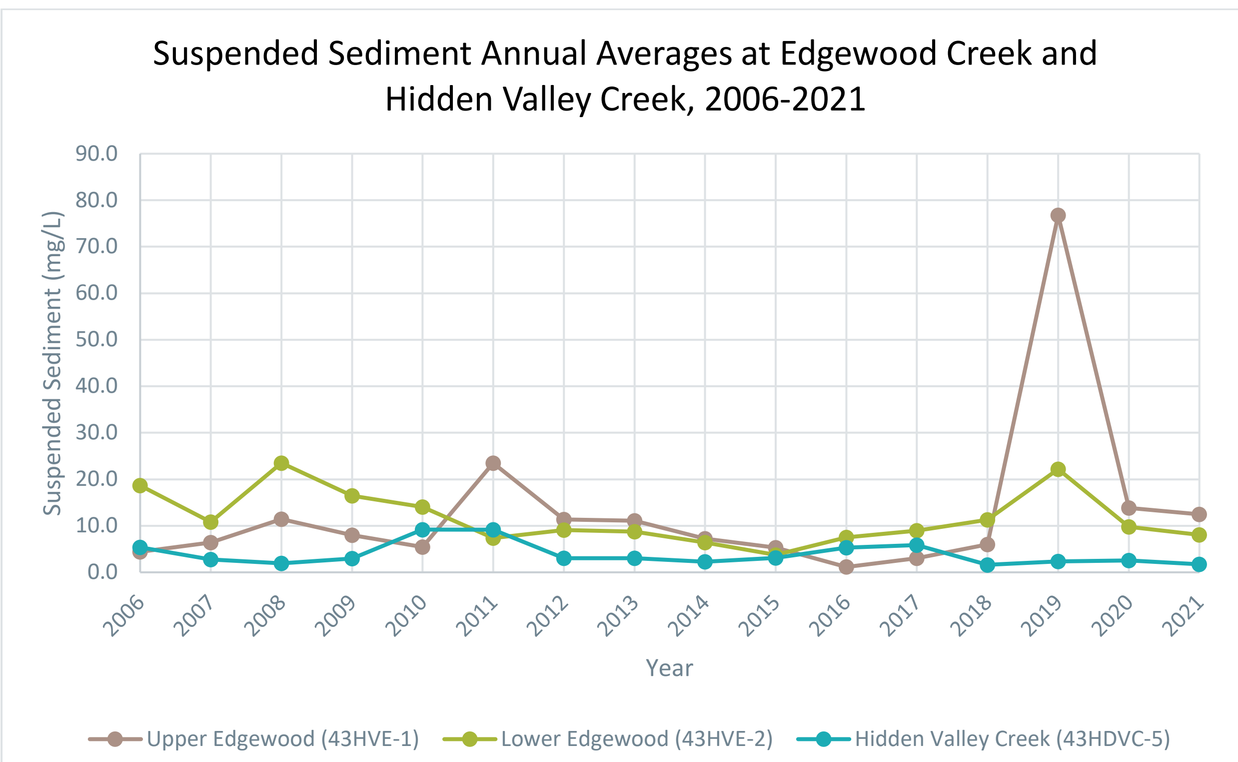

Figure C.11-2 Suspended Sediment Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) and Hidden Valley Creek (43HDVC-5) (2006–2021)

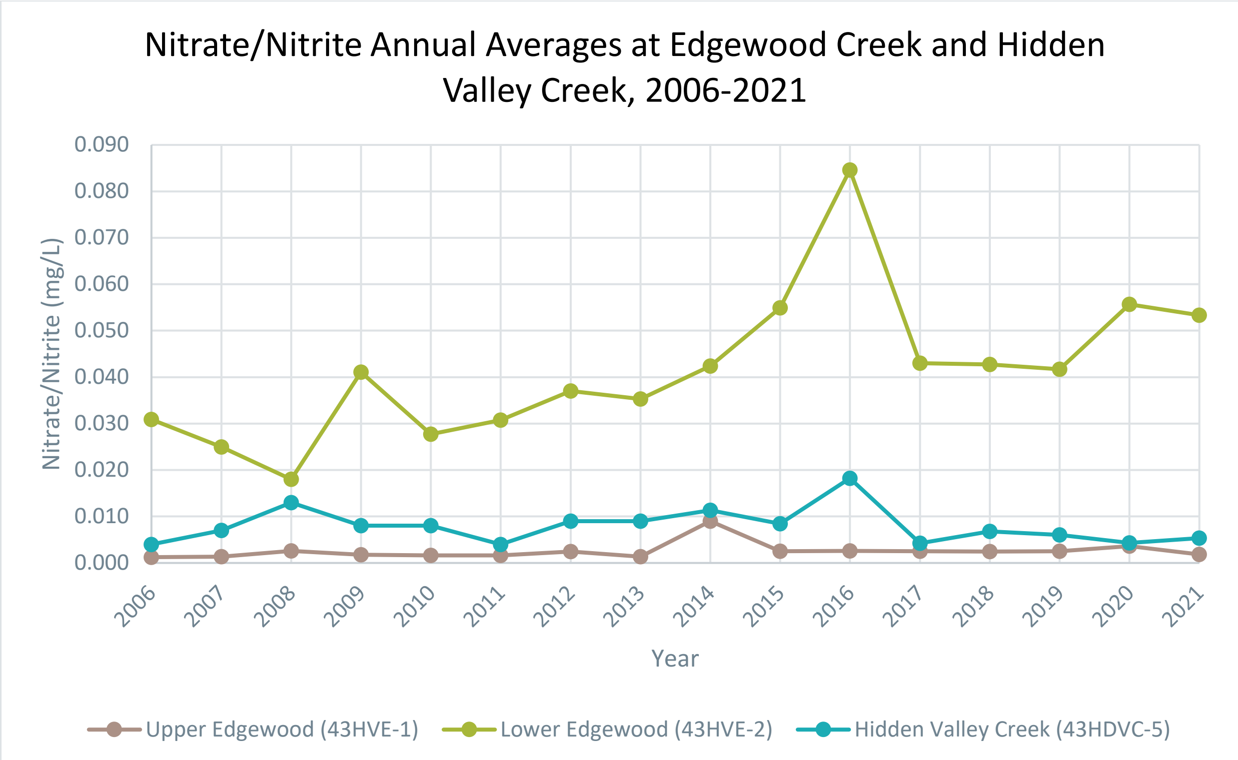

Figure C.11-3 Nitrate/Nitrite Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) and Hidden Valley Creek (43HDVC-5) (2006–2021)

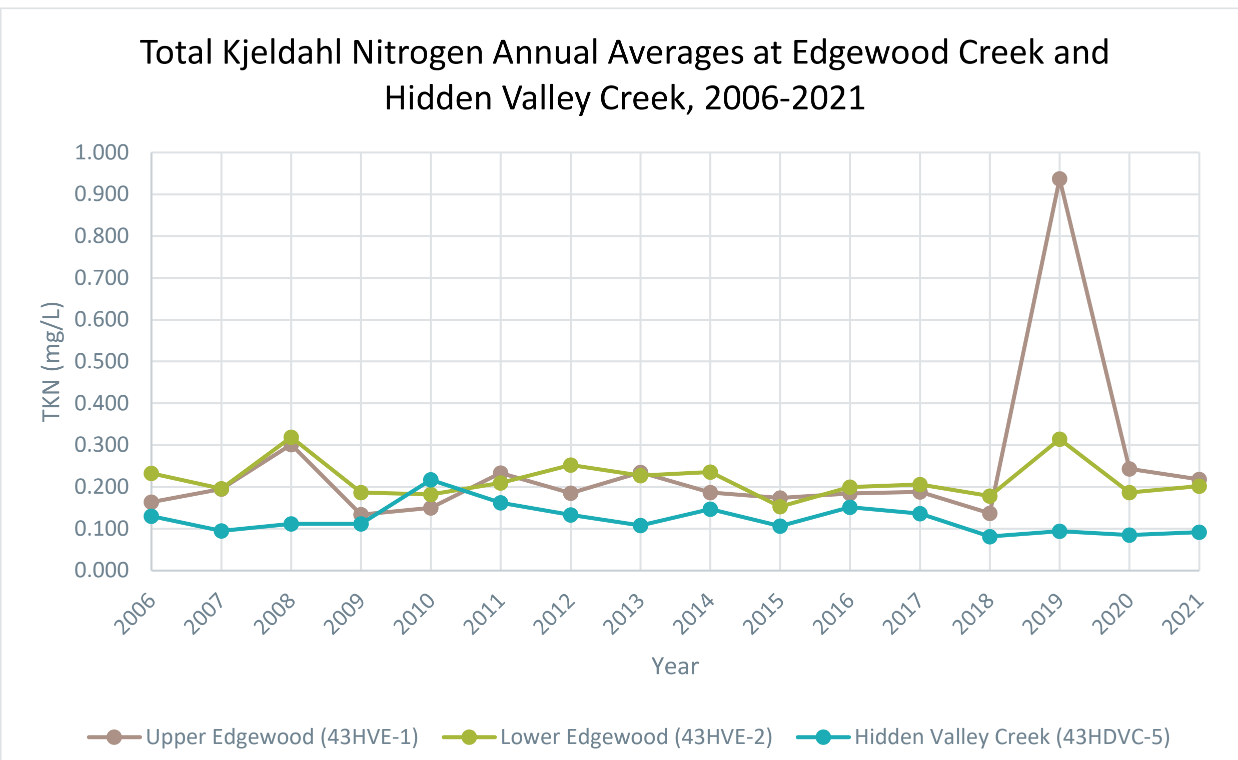

Figure C.11-4 TKN Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) and Hidden Valley Creek (43HDVC-5) (2006–2021)

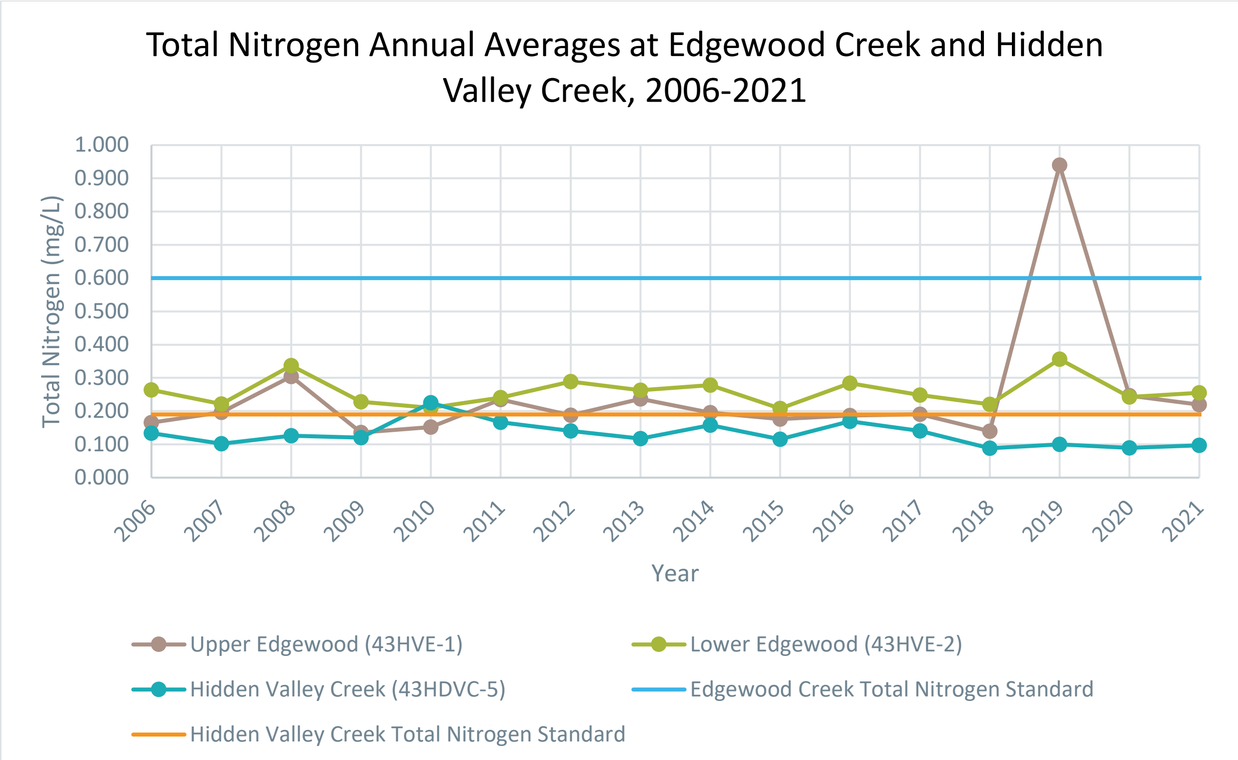

Figure C.11-5 Total Nitrogen Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) and Hidden Valley Creek (43HDVC-5) (2006–2021)

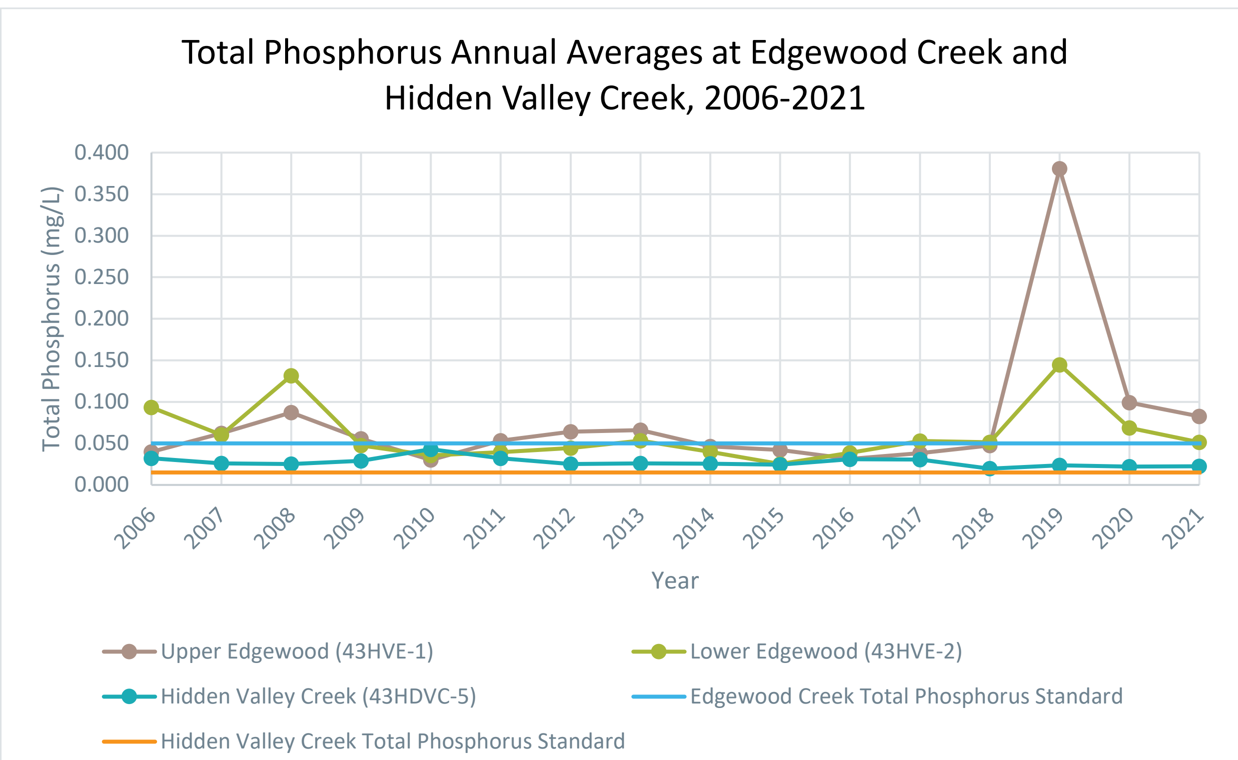

Figure C.11-6 Total Phosphorus Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) and Hidden Valley Creek (43HDVC-5) (2006–2021)

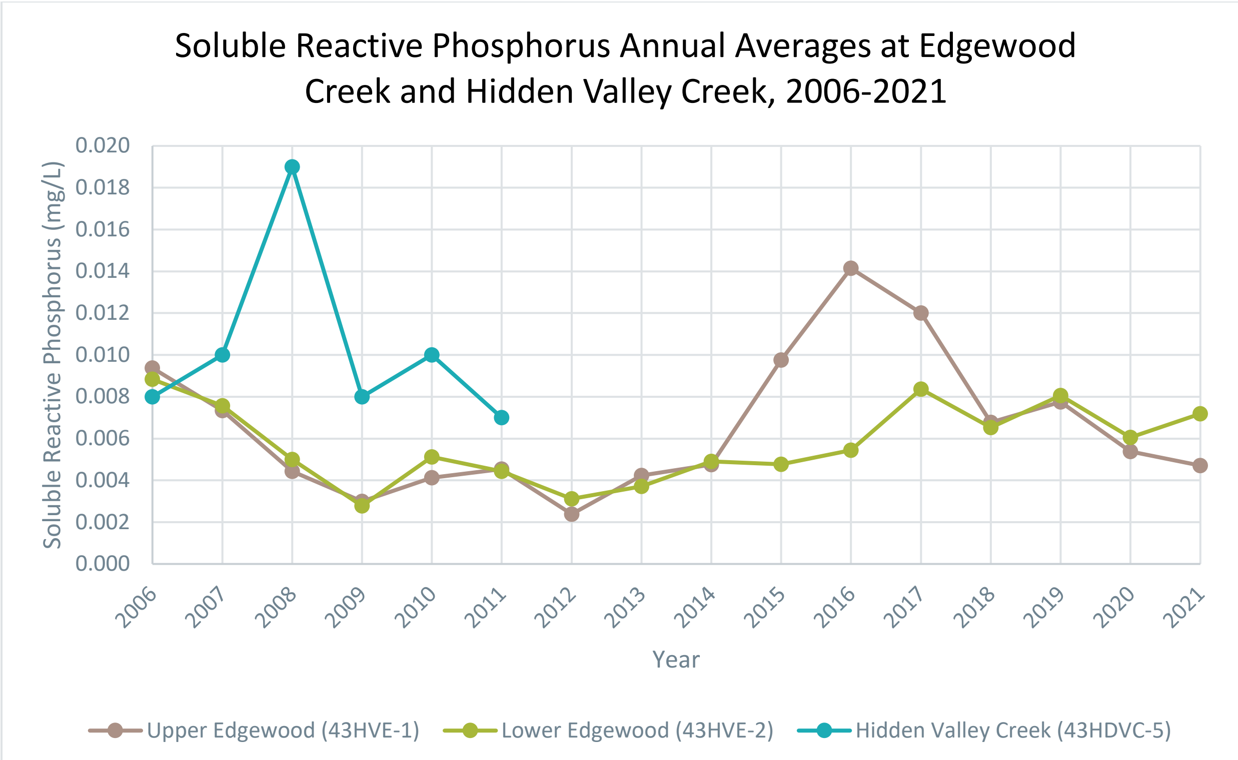

Figure C.11-7 Soluble Reactive Phosphorus Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) and Hidden Valley Creek (43HDVC-5) (2006–2021)

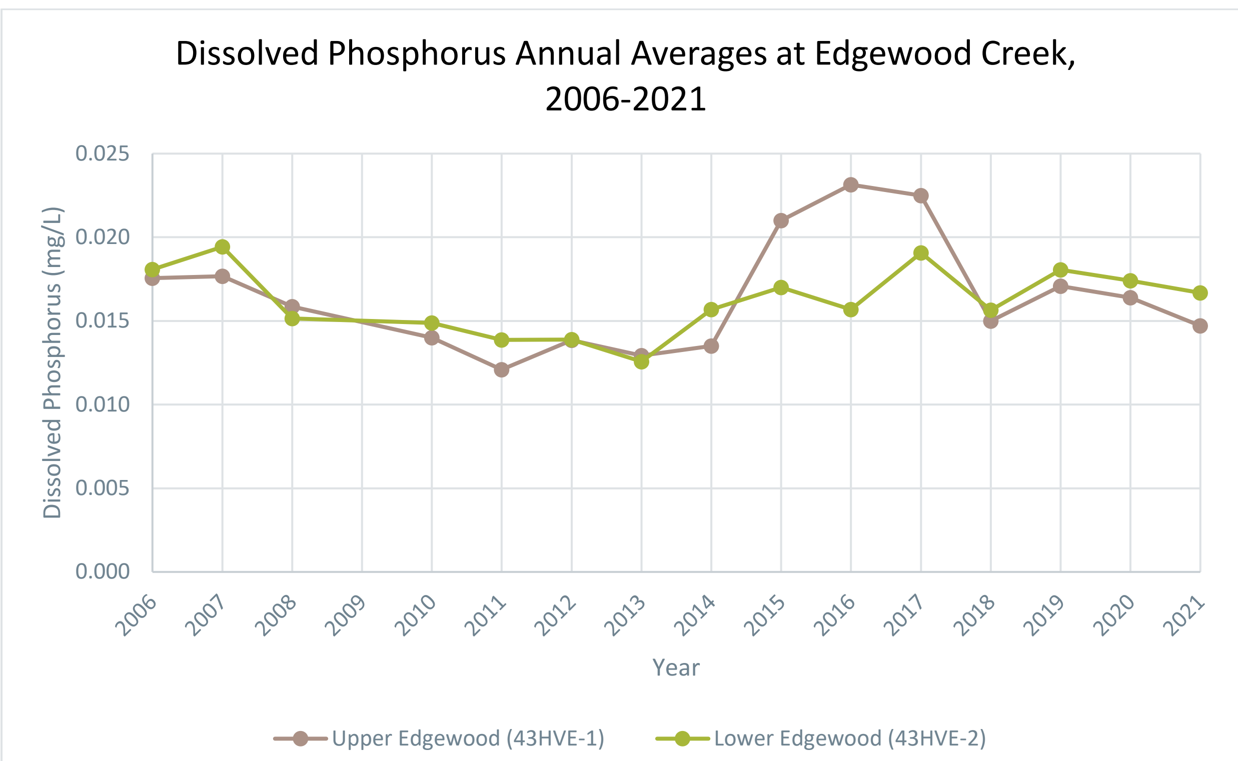

Figure C.11-8 Dissolved Phosphorus Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) (2006–2021)

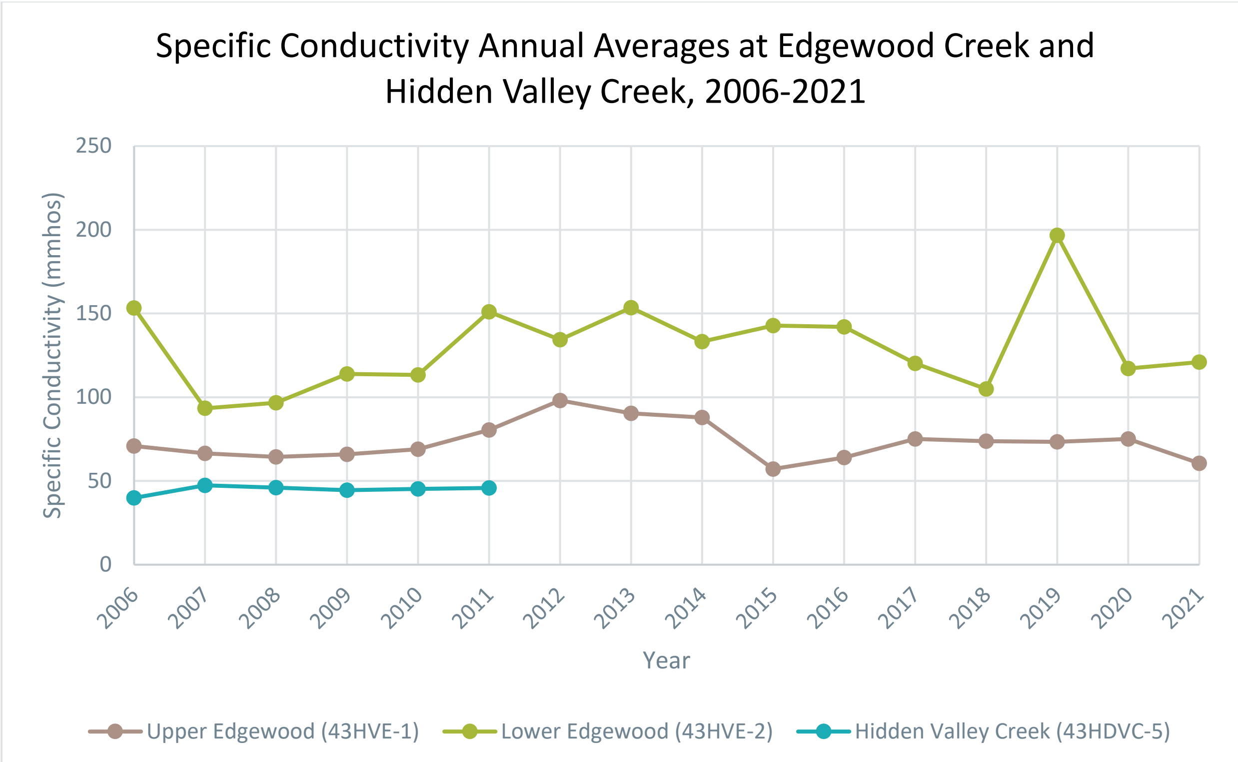

Figure C.11-9 Specific Conductivity Annual Averages, Edgewood Creek (43HVE-1, 43HVE-2) and Hidden Valley Creek (43HDVC-5) (2006–2021)

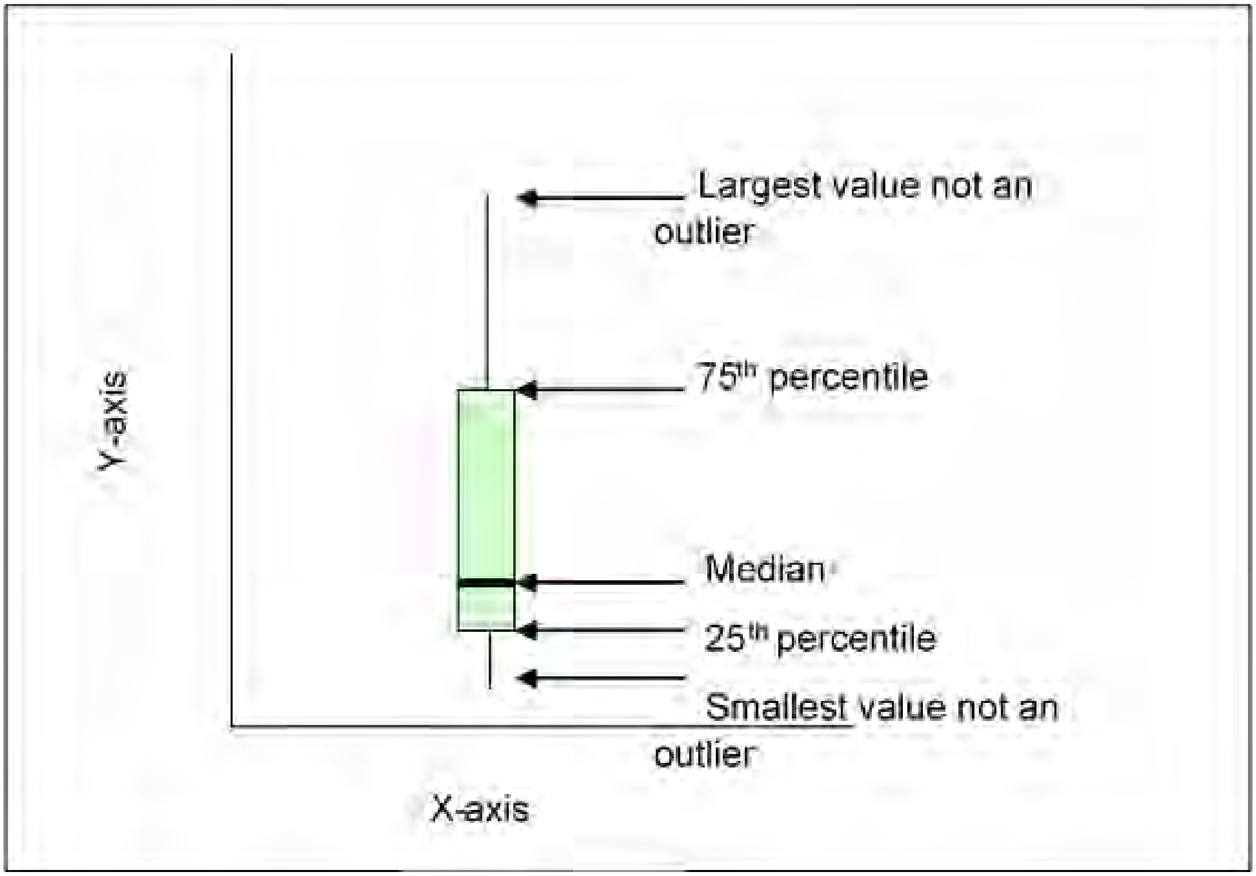

Figure C.12-1 Box and Whisker Legend[1]

[1] Past analysis excluded outlier values for suspended sediment, total nitrogen, and total phosphorus, most often the case during the 90's, when averages at Property Line were very high. Therefore, those outliers have continued to be excluded for this analysis for comparison to past reports. Analysis for turbidity and chloride were first conducted for this report, and no values have been excluded as outliers. During instances when Property Line exhibited no flow (WY 2014, WY 2015, WY 2016, and WY 2021), analysis of suspended sediment assumed that no sediment was contributed downstream, thus a "0" value for that date. For all other constituents, the sample date was excluded from analysis.

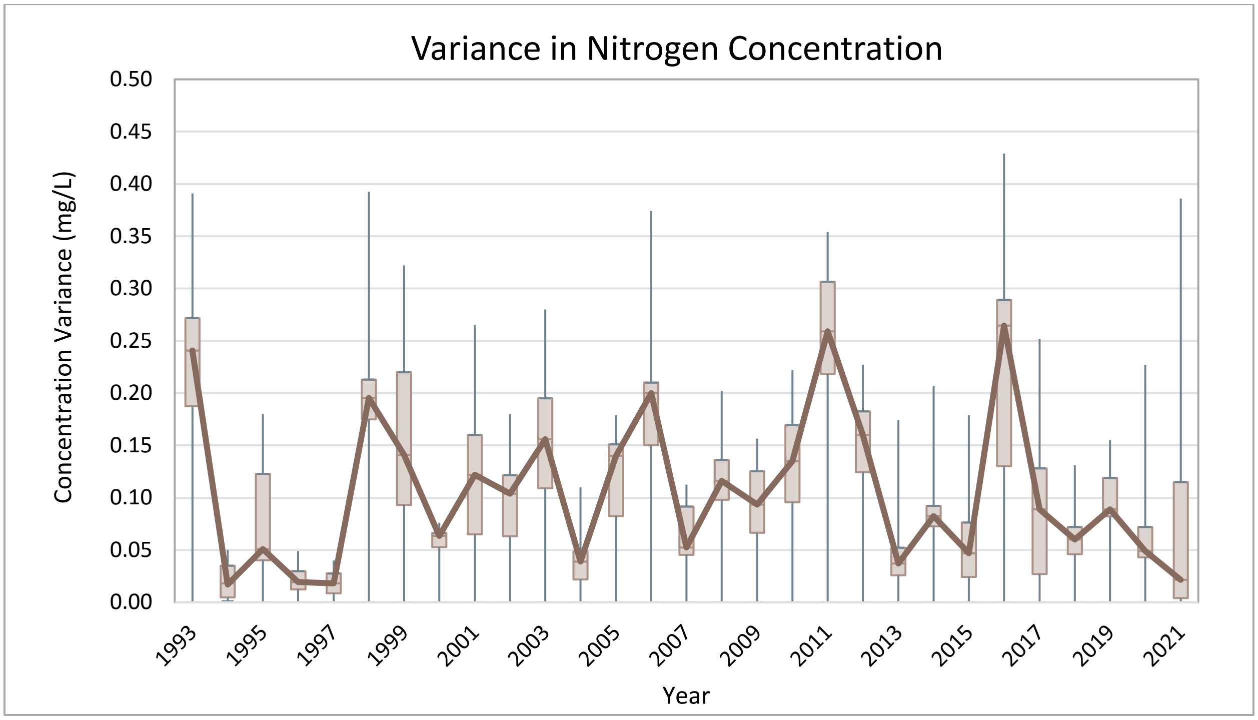

Figure C.12-2 Heavenly and Hidden Valley Creek Total Nitrogen Graphical Comparison (1993–2021)

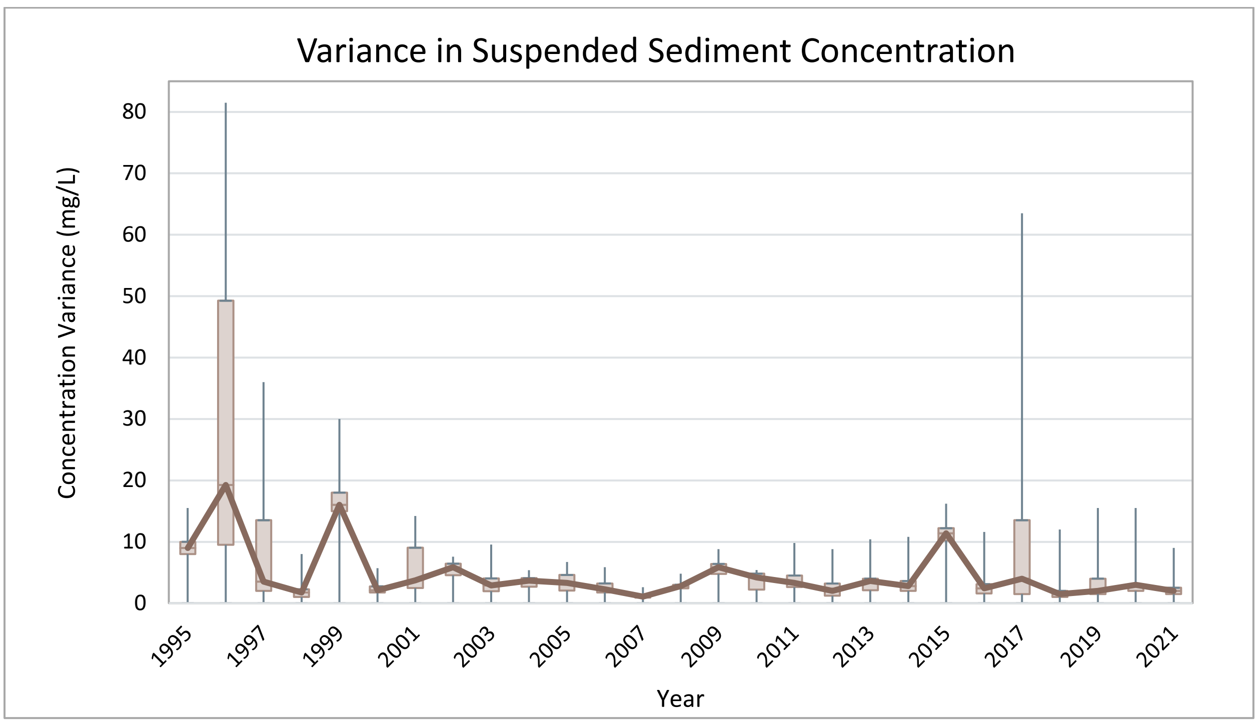

Figure C.12-3 Heavenly and Hidden Valley Creek TSS Graphical Comparison (1995–2021)

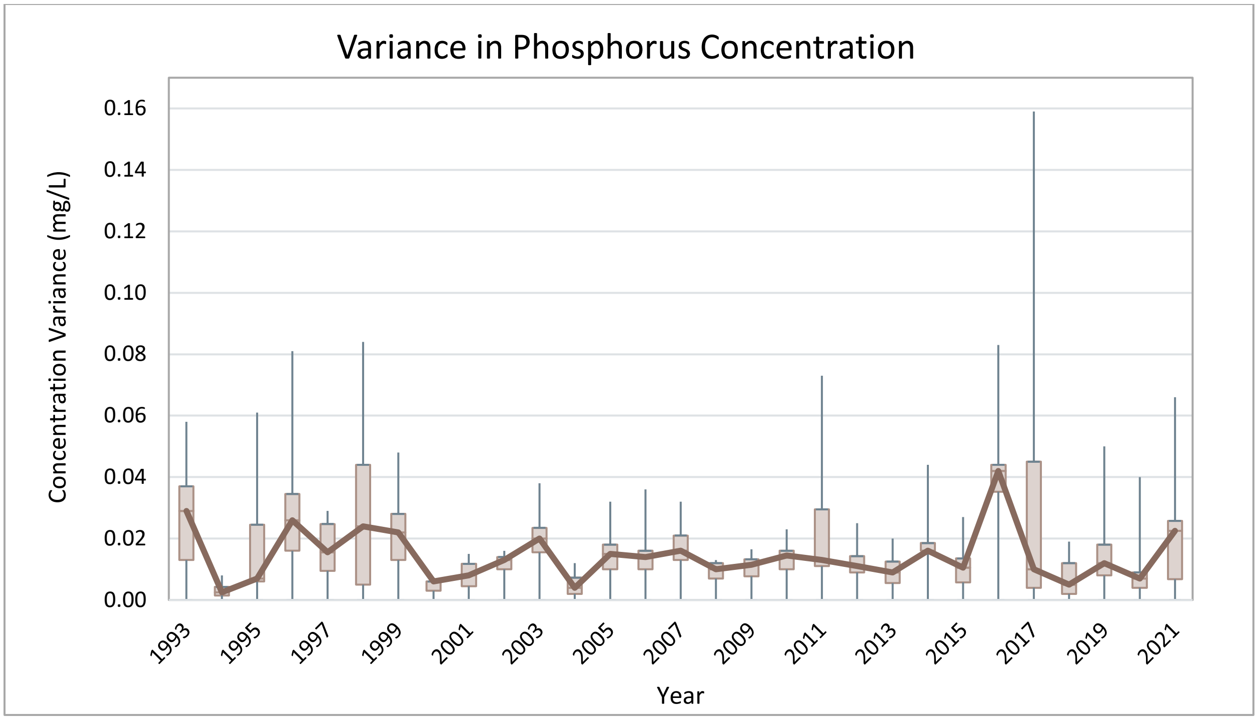

Figure C.12-4 Heavenly and Hidden Valley Creek Total Phosphorus Graphical Comparison (1993–2021)

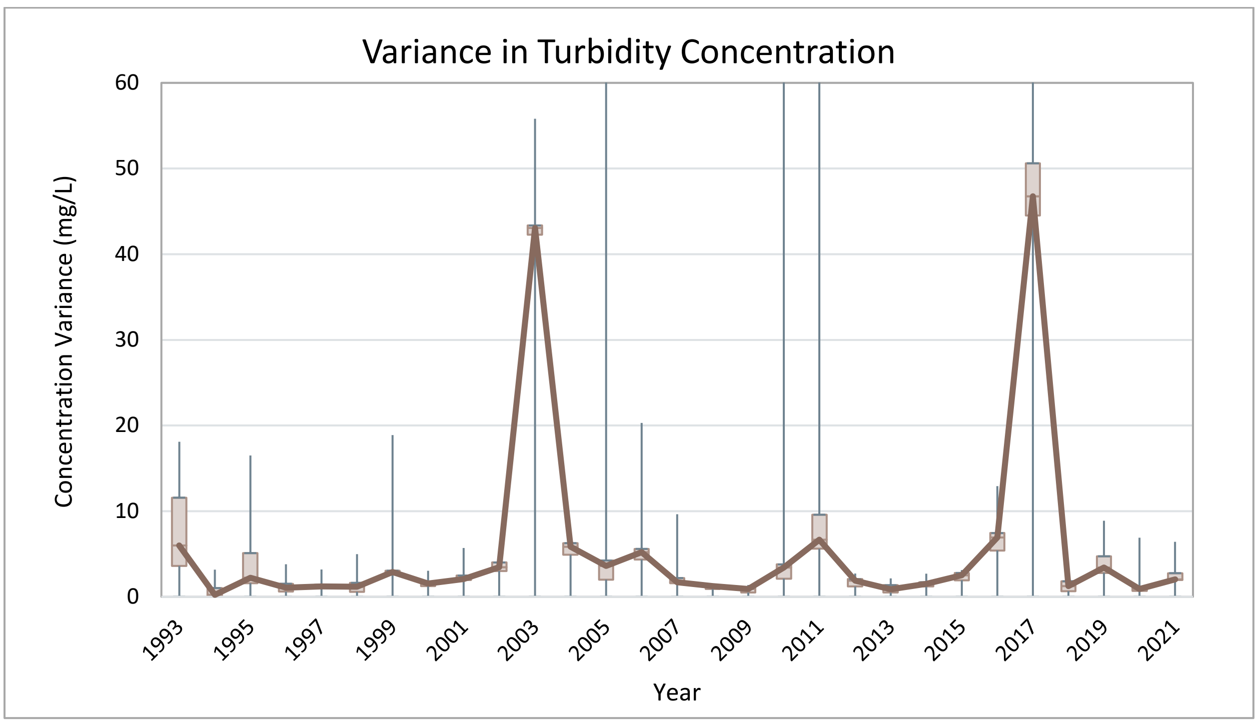

Figure C.12-5 Heavenly and Hidden Valley Creek Turbidity Graphical Comparison (1993–2021)

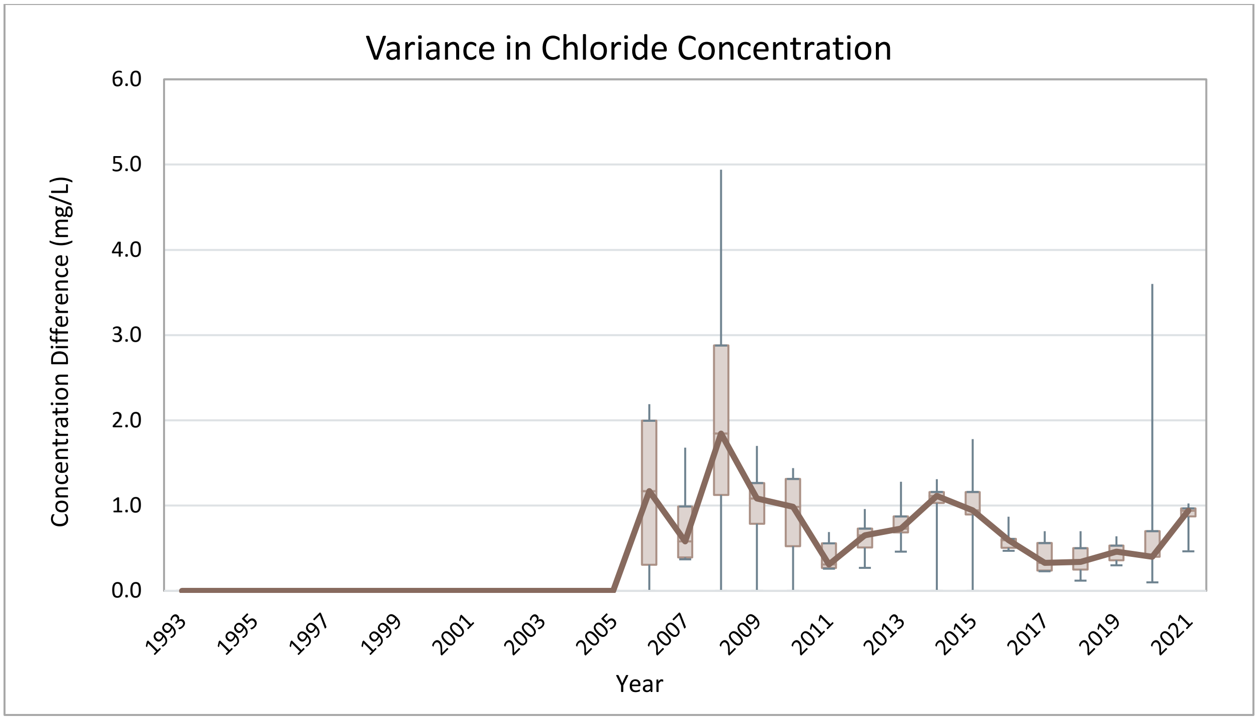

Figure C.12-6 Heavenly and Hidden Valley Creek Chloride Graphical Comparison (2012–2021)

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APPENDIX D

RAW WATER QUALITY CONSTITUENTS CALIFORNIA FILTER VAULTS, 2017–2021

Appendix D
Raw Water Quality Constituents California Filter Vaults, 2017–2021

D.1 California Base Parking Lot Vault Water Quality Tables (2017–2021)

Table D-1: Water Quality Data for Influent Station 43HVP-1a (North)

Table D-2: Water Quality Data for Influent Station 43HVP-1b (South)

Table D-3: Water Quality Data for Effluent Station 43HVP-2 (Compliance Point)

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Table D-1	Heavenly Mountain Resort water year 2017 water quality monitoring data from influent station 43HVP-1a (North), California Parking Lot Filter Vault influent point one. This station is located within the CA parking lot.									
Date	**Notes [1]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L) [3]**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2016-2017										
10/14/2016	2,3	13:18	35	0.15	0.22	0.020	1.5	1.8	18	ND
10/27/2016	2,4	13:30	28	0.13	0.080	ND	0.24	0.33	12	ND
12/15/2016	5	14:18	55	0.047	0.040	0.020	0.24	0.30	7.1	ND
Second Quarter WY 2016-2017										
No Samples were collected during the Second Quarter of water year 2016-2017.										
Third Quarter WY 2016-2017										
5/4/2017	6,7	14:56	74	0.094	0.45	ND	0.40	0.86	61	ND
Fourth Quarter WY 2016-2017										
9/21/2017	8	18:02	23	0.088	0.11	ND	0.33	0.44	12	ND

[1] Reported values analyzed by WetLAB in Reno, NV.

[2] The matrix spike/matrix spike duplicate (MS/MSD) value for the analysis of TKN were outside acceptance criteria due to probable matrix interference. The reported values should be considered an estimate.

[3] The sample collected on 10/14/16 was a grab sample. The automated units did not sample. Also, this storm infiltrated the sacrificial filters only upon inspection.

[4] The sample collected on 10/27/16 was a grab sample. Visual inspection showed storm water entering both the sacrificial and large filter bays.

[5] The sample collected on 12/15/16 was a grab sample. Visual inspection showed storm water entering both the sacrificial and large filter bays (Specifically ID4 & ID10). Beginning of large storm event.

[6] The sample collected on 05/4/2017 was a snow melt runoff grab sample. Visual inspection showed runoff only entering the sacrificial unit from the North Inlet. Sacrificial bays were full of water and appeared to be functioning.

[7] The matrix spike/matrix spike duplicate (MS/MSD) values for TKN were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate.

[8] Samples collected on 9/21/17 were triggered by the flow sensors collecting composite samples over an approximate one hour time period.

Table D-2	Heavenly Mountain Resort water year 2017 water quality monitoring data from influent station 43HVP-1b (South), California Parking Lot Filter Vault influent point two. This station is located within the CA parking lot.									
Date	**Notes [1]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2016-2017										
10/14/2016	2	13:11	39	0.12	0.23	0.017	1.2	1.4	6.4	ND
10/27/2016	3	13:20	50	0.038	0.022	ND	0.24	0.26	1.8	ND
12/15/2016	4	14:49	99	0.059	0.073	0.026	0.43	99	15	ND
Second Quarter WY 2016-2017										
No Samples were collected during the Second Quarter of water year 2016-2017.										
Third Quarter WY 2016-2017										
5/4/2017	5,6	14:56	33	0.12	0.17	ND	0.26	0.44	32	2.1
Fourth Quarter WY 2016-2017										
9/21/2017	7	17:54	24	0.11	0.075	ND	0.25	0.33	6.4	ND

[1] Reported values analyzed by WetLAB in Reno, NV.
[2] The sample collected on 10/14/16 was a grab sample. The automated units did not sample. Also, this storm infiltrated the sacrificial filters only upon inspection.
[3] The sample collected on 10/27/16 was a grab sample. Visual inspection showed storm water entering both the sacrificial and large filter bays.

[4] The sample collected on 12/15/16 was a grab sample. Visual inspection showed storm water entering both the sacrificial and large filter bays (Specifically ID4 & ID10). Beginning of large storm event.

[5] The sample collected on 05/4/2017 was a snow melt runoff grab sample. Visual inspection showed runoff entering both the sacrificial and large filter bay (ID4) from the South Inlet. Sacrificial bays were full of water and appeared to be functioning.
[6] The matrix spike/matrix spike duplicate (MS/MSD) values for total Phosphorus were outside acceptance criteria due to probable matrix interference.
The reported result should be considered an estimate.
[7] Samples collected on 9/21/17 were triggered by the flow sensors collecting composite samples over an approximate one hour time period.

Table D-3	Heavenly Mountain Resort water year 2017 water quality monitoring data from effluent station 43HVP-2, California Parking Lot Filter Vault effluent point. This station is located within the CA parking lot.									
Date	**Notes [2]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards[1]			**20.0**	**0.10**	N/A	N/A	N/A	**0.5**	N/A	**2.0**
First Quarter WY 2016-2017										
10/14/2016	3,4	13:34	**59**	0.076	0.24	0.018	1.4	**1.6**	9.2	ND
10/27/2016	5,6	14:17	**44**	0.033	0.044	ND	ND	0.24	5.4	ND
12/15/2016	7	15:03	**72**	0.071	0.058	0.023	0.35	0.43	12	ND
Second Quarter WY 2016-2017										
No Samples were collected during the Second Quarter of water year 2016-2017.										
Third Quarter WY 2016-2017										
5/4/2017	8	15:04	**30**	0.10	0.17	ND	0.27	0.45	33	**2.2**
Fourth Quarter WY 2016-2017										
9/21/2017	9	18:21	**26**	**0.11**	0.11	ND	0.24	0.35	11	ND
Annual Summary		**Min**	26	0.033	0.044	0.018	0.24	0.24	5.4	ND
		Max	72	0.11	0.24	0.023	1.4	1.6	33	2.2
		# of Samples	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
# of Noncompliance Samples			**5.0**	**1.0**	-	-	-	**1.0**	-	**1.0**
% of Noncompliance Samples			**100%**	**20%**	-	-	-	**20%**	-	**20%**

[1] Standards are maximum concentration for discharge to surface waters not to exceed, effective November 30, 2008.
[2] Reported values analyzed by WetLAB in Reno, NV.
[3] The matrix spike/matrix spike duplicate (MS/MSD) value for the analysis of Oil & Grease were outside acceptance criteria due to probable matrix interference. The reported values should be considered an estimate.
[4] The sample collected on 10/14/16 was a grab sample. The automated units did not sample. Also, this storm infiltrated the sacrificial filters only upon inspection.
[5] The matrix spike/matrix spike duplicate (MS/MSD) value for the analysis of total Phosphorus were outside acceptance criteria due to probable matrix interference. The reported values should be considered an estimate.
[6] The sample collected on 10/27/16 was a grab sample. Visual inspection showed storm water entering both the sacrificial and large filter bays.
[7] The sample collected on 12/15/16 was a grab sample. Visual inspection showed storm water entering both the sacrificial and large filter bays (Specifically ID4 & ID10). Beginning of large storm event.
[8] The sample collected on 05/4/2017 was a snow melt runoff grab sample. Visual inspection showed runoff entering both the sacrificial and large filter bay (ID4) from the South Inlet and runoff was only entering the sacrificial unit from the North Inlet. No runoff was entering the Large Filter Vault from the North (ID10). Sacrificial vault inspections showed water over the filters which appear to be functioning correctly.
[9] Samples collected on 9/21/17 were triggered by the flow sensors collecting composite samples over an approximate one hour time period. The outlet sample was collected approximately 15 minutes after the inlet locations providing residence time for filtration through the storm filter system.

Table D-1	Heavenly Mountain Resort water year 2018 water quality monitoring data from influent station 43HVP-1a (North), California Parking Lot Filter Vault influent point one. This station is located within the CA parking lot.									
Date	**Notes [1]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L) [3]**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2017-2018										
11/15/2017	2	12:02	37	0.053	0.072	0.012	0.49	0.57	23	ND
Second Quarter WY 2017-2018										
No Samples were collected during the Second Quarter of water year 2017-2018.										
Third Quarter WY 2017-2018										
5/24/2018	3,4	14:02	70	0.061	0.31	0.012	0.92	1.2	54	3.4
Fourth Quarter WY 2017-2018										
7/22/2018		18:53	130	0.093	0.17	ND	2.3	2.5	59	2.1

[1] Reported values analyzed by WetLAB in Reno, NV.
[2] Due to laboratory equipment issues, Nitrate and Nitrite Nitrogen levels were analyzed beyond the acceptable holding times. The reported values should be considered an estimate.
[3] The matrix spike/matrix spike duplicate (MS/MSD) values for TKN and TP were outside acceptance criteria due to probable matrix interference. The reported results should be considered an estimate.
[4] There was insufficient sample available to perform a spike and/or duplicate on the oil and grease analytical batch.

Table D-2	Heavenly Mountain Resort water year 2018 water quality monitoring data from influent station 43HVP-1b (South), California Parking Lot Filter Vault influent point two. This station is located within the CA parking lot.									
Date	**Notes [1]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2017-2018										
11/15/2017	2, 3	12:03	40	0.046	0.097	0.013	0.41	0.52	5.7	ND
Second Quarter WY 2017-2018										
No Samples were collected during the Second Quarter of water year 2017-2018.										
Third Quarter WY 2017-2018										
5/24/2018	4	13:51	140	0.11	0.13	ND	0.92	1.1	19	3.8
Fourth Quarter WY 2017-2018										
7/22/2018		18:38	180	0.13	0.059	0.053	2.9	3.0	20	2.8

[1] Reported values analyzed by WetLAB in Reno, NV.
[2] Due to laboratory equipment issues, Nitrate and Nitrite Nitrogen levels were analyzed beyond the acceptable holding times.The reported values should be considered an estimate.
[3] The matrix spike/matrix spike duplicate (MS/MSD) values for total Phosphorous were outside acceptance criteria due to probable matrix interference.
The reported result should be considered an estimate.
[4] There was insufficient sample available to perform a spike and/or duplicate on the oil and grease analytical batch.

Table D-3	Heavenly Mountain Resort water year 2018 water quality monitoring data from effluent station 43HVP-2, California Parking Lot Filter Vault effluent point. This station is located within the CA parking lot.									
Date	**Notes [2]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards[1]			**20.0**	**0.10**	N/A	N/A	N/A	**0.5**	N/A	**2.0**
First Quarter WY 2017-2018										
11/15/2017	3	12:52	6.7	0.070	0.049	0.014	0.43	0.49	14	ND
Second Quarter WY 2017-2018										
No Samples were collected during the Second Quarter of water year 2017-2018.										
Third Quarter WY 2017-2018										
5/24/2018	4,5	14:02	**91**	0.043	0.22	0.011	0.76	**0.99**	33	**3.3**
Fourth Quarter WY 2017-2018										
7/22/2018	6	19:18	**100**	0.089	0.21	ND	1.9	**2.2**	36	**3.3**
Annual Summary		**Min**	6.7	0.043	0.049	0.011	0.43	0.49	14.0	ND
		Max	100	0.09	0.22	0.014	1.9	2.2	36	3.3
		# of Samples	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
# of Noncompliance Samples			**2.0**	**0.0**	-	-	-	**2.0**	-	**2.0**
% of Noncompliance Samples			**67%**	**0%**	-	-	-	**67%**	-	**67%**

[1] Standards are maximum concentration for discharge to surface waters not to exceed, effective November 30, 2008.
[2] Reported values analyzed by WetLAB in Reno, NV.
[3] Due to laboratory equipment issues, Nitrate and Nitrite Nitrogen levels were analyzed beyond the acceptable holding times. The reported values should be considered an estimate.
[3] The matrix spike/matrix spike duplicate (MS/MSD) values for total Phosphorous were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate.
[5] There was insufficient sample available to perform a spike and/or duplicate on the oil and grease analytical batch.
[6] The matrix spike/matrix spike duplicate (MS/MSD) values for Oil & Grease were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate.

Table D-1	Heavenly Mountain Resort water year 2019 water quality monitoring data from influent station 43HVP-1a (North), California Parking Lot Filter Vault influent point one. This station is located within the CA parking lot.									
Date	**Notes [1]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2018-2019										
11/27/2018		16:24	15	0.043	0.17	ND	0.37	0.55	14	2.7
Second Quarter WY 2018-2019										
N/A		No storm filter treatment vault inlet samples were taken due to sustained snow cover over the vault systems during the second quarter.								
Third Quarter WY 2018-2019										
5/16/2019		6:40	63	0.042	0.24	0.011	0.50	0.75	79	ND
Fourth Quarter WY 2018-2019										
9/4/2019		14:57	290	0.310	0.25	ND	2.60	2.9	ND[2]	ND[3]

[1] Reported values analyzed by WetLAB in Reno, NV.
[2] In January 2019, EPA changed the methodology reporting limits. The choloride minimum detection reporting limit is now 0.25 mg/L.
[3] Due to laboratory issues, there was insufficient sample available to preform a spike and/or duplicate on this analytical batch. The reported results should be considered an estimate.

Table D-2	Heavenly Mountain Resort water year 2019 water quality monitoring data from influent station 43HVP-1b (South), California Parking Lot Filter Vault influent point two. This station is located within the CA parking lot.									
Date	**Notes [1]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2018-2019										
11/27/2018		15:56	37	0.016	0.220	ND	0.21	0.43	38	2.4
Second Quarter WY 2018-2019										
N/A		No storm filter treatment vault inlet samples were taken due to sustained snow cover over the vault systems during the second quarter.								
Third Quarter WY 2018-2019										
5/16/2019		6:31	170	0.070	0.07	ND	0.60	0.67	60	ND
Fourth Quarter WY 2018-2019										
9/5/2019		15:45	150	0.170	0.33	ND	2.50	2.83	19	ND[2]

[1] Reported values analyzed by WetLAB in Reno, NV.
[2] Due to laboratory issues, there was insufficient sample available to preform a spike and/or duplicate on this analytical batch. The reported results should be considered an estimate.

Table D-3	Heavenly Mountain Resort water year 2019 water quality monitoring data from effluent station 43HVP-2, California Parking Lot Filter Vault effluent point. This station is located within the CA parking lot.									
Date	**Notes [2]**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards[1]			**20**	**0.10**	N/A	N/A	N/A	**0.5**	N/A	**2**
First Quarter WY 2018-2019										
11/27/2018		17:09	**28**	0.06	0.15	ND	0.34	**0.51**	11	**2.4**
Second Quarter WY 2018-2019										
N/A		No storm filter treatment vault outlet samples were taken due to sustained snow cover over the vault systems during the second quarter.								
Third Quarter WY 2018-2019										
5/16/2019		7:09	**77**	0.03	0.14	ND	0.50	**0.64**	70	ND
Fourth Quarter WY 2018-2019										
9/5/2019		15:45	**270**	**0.19**	0.38	ND	2.3	**2.68**	78	ND[3]
Annual Summary		**Min**	28	0.03	0.14	ND	0.34	0.51	11.0	ND
		Max	270	0.19	0.38	ND	2.30	2.68	78.0	2.4
		# of Samples	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
# of Noncompliance Samples			**3.0**	**1.0**	-	-	-	**3.0**	-	**1.0**
% of Noncompliance Samples			**100%**	**33%**	-	-	-	**100%**	-	**33%**

[1] Standards are maximum concentration for discharge to surface waters not to exceed, effective November 30, 2008.
[2] Reported values analyzed by WetLAB in Reno, NV.
[3] Due to laboratory issues, there was insufficient sample available to preform a spike and/or duplicate on this analytical batch. The reported results should be considered an estimate.

Table D-1	Heavenly Mountain Resort water year 2020 water quality monitoring data from influent station 43HVP-1a (North), California Parking Lot Filter Vault influent point one. This station is located within the CA parking lot.									
Date	**Notes**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2020										
No samples were taken during the first quarter of WY 2020										
Second Quarter WY 2020										
No samples were taken during the second quarter of WY 2020										
Third Quarter WY 2020										
5/18/2020	[1,2]	7:00	53	0.041	0.14	ND	0.61	0.75	76	ND
Fourth Quarter WY 2020										
No samples were taken during the fourth quarter of WY 2020										

Notes:

[1] The Oil & Grease matrix spike/matrix spike duplicate (MS/MSD) values for the analysis of this parameter were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate.

[2] The Oil & Grease analyte was analyzed for, but was not detected above the level of the reported sample reporting/quantitation limit. The reported result should be considered an estimate.

Table D-2	Heavenly Mountain Resort water year 2020 water quality monitoring data from influent station 43HVP-1b (South), California Parking Lot Filter Vault influent point two. This station is located within the CA parking lot.									
Date	**Notes**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2020										
No samples were taken during the first quarter of WY 2020										
Second Quarter WY 2020										
No samples were taken during the second quarter of WY 2020										
Third Quarter WY 2020										
5/18/2020	1	6:40	44	0.030	0.090	ND	0.50	0.59	21	ND
Fourth Quarter WY 2020										
No samples were taken during the fourth quarter of WY 2020										

Notes:

[1] The Oil & Grease analyte was analyzed for, but was not detected above the level of the reported sample reporting/quantitation limit. The reported result should be considered an estimate.

Table D-3	Heavenly Mountain Resort water year 2020 water quality monitoring data from effluent station 43HVP-2, California Parking Lot Filter Vault effluent point. This station is located within the CA parking lot.									
Date	**Notes**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards[1]			**20.0**	**0.10**	N/A	N/A	N/A	**0.5**	N/A	**2.0**
First Quarter WY 2020										
No samples were taken during the first quarter of WY 2020										
Second Quarter WY 2020										
No samples were taken during the second quarter of WY 2020										
Third Quarter WY 2020										
5/18/2020	2	7:20	**49**	0.027	0.13	ND	0.46	**0.60**	45	ND
Fourth Quarter WY 2020										
No samples were taken during the fourth quarter of WY 2020										
Annual Summary		**Min**	49	0.027	0.13	ND	0.46	0.60	45.0	0.0
		Max	49	0.027	0.13	ND	0.46	0.60	45.0	0.0
		# of Samples	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
# of Noncompliance Samples			**1.0**	**0.0**	-	-	-	**1.0**	-	**0.0**
% of Noncompliance Samples			**100%**	**0%**	-	-	-	**100%**	-	**0%**

Notes:
[1] Standards are maximum concentration for discharge to surface waters not to exceed, effective November 30, 2008.
[2] The Oil & Grease analyte was analyzed for, but was not detected above the level of the reported sample reporting/quantitation limit. The reported result should be considered an estimate.

Table D-1	Heavenly Mountain Resort water year 2021 water quality monitoring data from influent station 43HVP-1a (North), California Parking Lot Filter Vault influent point one. This station is located within the CA parking lot.									
Date	**Notes**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2021										
11/18/2020	1, 2	11:48	76	0.020	0.15	ND	0.83	0.98	34	ND
Second Quarter WY 2021										
No samples were taken during the second quarter of WY 2021										
Third Quarter WY 2021										
5/16/2021	2,3	21:13	390	0.12	0.28	ND	3.3	3.5	280	ND
6/24/2021	4	12:39	290	0.47	ND	ND	5.9	5.9	93	2.6
Fourth Quarter WY 2021										
No samples were taken during the fourth quarter of WY 2021										

Notes:

[1] The reported Total Phosphorous value is between the laboratory method detection limit and the laboratory practical quantitation limit. The reported result should be considered an estimate.

[2] The Oil & Grease analyte was analyzed for, but was not detected above the level of the reported sample reporting/quantitation limit. The reported result should be considered an estimate.

[3] Due to sample, matrix dilution was required in order to properly detect and report the analyte Nitrite. The reporting limit has been adjusted accordingly.

[4] The reported Oil & Grease value is between the laboratory method detection limit and the laboratory practical quantitation limit. The reported result should be considered an estimate.

Table D-2	Heavenly Mountain Resort water year 2021 water quality monitoring data from influent station 43HVP-1b (South), California Parking Lot Filter Vault influent point two. This station is located within the CA parking lot.									
Date	**Notes**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
First Quarter WY 2021										
11/18/2020	1	11:30	150	0.037	0.085	ND	0.84	0.93	50	ND
Second Quarter WY 2021										
No samples were taken during the second quarter of WY 2021										
Third Quarter WY 2021										
5/16/2021	2, 3	20:59	390	0.095	0.16	ND	2.3	2.4	63	2.9
6/24/2021	1	12:30	180	0.40	ND	ND	4.7	4.7	39	ND
Fourth Quarter WY 2021										
No samples were taken during the fourth quarter of WY 2021										

Notes:

[1] The Oil & Grease analyte was analyzed for, but was not detected above the level of the reported sample reporting/quantitation limit. The reported result should be considered an estimate.

[2] The reported Oil and Grease value is between the laboratory method detection limit and the laboratory paractical quantitation limit. The reported result should be considered an estimate.

[3] The Total Kjeldahl Nitrogen Spike recovery was not calculated. Sample concentration >4X the spike amount; therefore, the spike could not be adequately recovered.

Table D-3	Heavenly Mountain Resort water year 2021 water quality monitoring data from effluent station 43HVP-2, California Parking Lot Filter Vault effluent point. This station is located within the CA parking lot.									
Date	**Notes**	**Time**	**Turbidity (NTU)**	**Total Phosphorus (mg/L)**	**Nitrate Nitrogen (mg/L)**	**Nitrite Nitrogen (mg/L)**	**Total Kjeldahl Nitrogen (mg/L)**	**Total Nitrogen Calc. (mg/L)**	**Chloride (mg/L)**	**Oil & Grease (mg/L)**
Lahontan Standards[1]			**20.0**	**0.10**	N/A	N/A	N/A	**0.5**	N/A	**2.0**
First Quarter WY 2021										
11/18/2020	2	12:21	**150**	0.08	0.12	ND	0.90	**1.0**	32	ND
Second Quarter WY 2021										
No samples were taken during the second quarter of WY 2021										
Third Quarter WY 2021										
5/16/2021	2	22:02	**760**	**0.63**	0.29	ND	2.9	**3.2**	120	ND
6/24/2021	3	13:30	**150**	**0.27**	ND	ND	5.8	**5.8**	84	**3.7**
Fourth Quarter WY 2021										
No samples were taken during the fourth quarter of WY 2021										
Annual Summary		**Min**	150	0.08	0.12	ND	0.90	1.0	32.0	3.7
		Max	760	0.63	0.29	ND	5.80	5.8	120.0	3.7
		# of Samples	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
# of Noncompliance Samples			**3.0**	**2.0**	-	-	-	**3.0**	-	**1.0**
% of Noncompliance Samples			**100%**	**67%**	-	-	-	**100%**	-	**33%**

Notes:

[1] Standards are maximum concentration for discharge to surface waters not to exceed, effective November 30, 2008.

[2] The Oil & Grease analyte was analyzed for, but was not detected above the level of the reported sample reporting/quantitation limit. The reported result should be considered an estimate.

[3] The matrix spike/matrix spike duplicate (MS/MSD) values for the analysis of the Oil & Grease parameter were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate.

Heavenly Mountain Resort
Water Years 2017–2021

APPENDIX E

WATER YEAR 2021, ADDITIONAL ANNUAL REPORTING INFORMATION

Appendix E
Water Year 2021, Additional Annual Reporting Information

E.1 Facilities Monitoring

E.1.1 Water Year 2021, Application and Recovery Table

E.1.2 Water Year 2021, Huck Salt Application Records

E.1.3 July Monthly Monitoring/Reporting

E.1.4 There were no August CML Reports were completed due to Caldor Fire (USFS closures/mandatory evacuation/ USFS Basecamp in Parking Lot)

E.1.5 September Monthly Monitoring/Reporting

E.1.6 2021 Water Year Salt Application Tracking

E.2 Erosion Control Monitoring

E.2.7 4th Quarter On Mountain Monitoring Log and Photos

E.3 2021 Annual Work List

E.3.8 2021 Annual Work List Completion Status as of 12/5/21

E.4 Vault Inspection Reports

E.4.9 Pacific Stormwater Solutions, LLC Stormwater Inspection Report, Units 3, 4, and 9

E.4.10 Pacific Stormwater Solutions, LLC Stormwater Inspection Report, Units 5, 10, and 11

E.4.11 Pacific Stormwater Solutions, LLC Stormwater Inspection Report, Wildwood Ave

E.5 Facilities Watershed Awareness Training

E.5.12 Facilities and Watershed Awareness Sign-in Sheets

E.5.13 Facilities and Watershed Awareness Presentation

Table E-1 Summary of Deicer Application and Recovery Water Year 2021

Month/Year	Total Amount of Deicer and Abrasives Applied (lbs.)	Total Amount of Deicer and Abrasives Recovered (lbs.)
October 2020	0	0
November 2020	2,222	0
December 2020	9,088	0
January 2021	13,632	0
February 2021	9,997	37,580
March 2021	35,949	0
April 2021	0	64,460
May 2021	404	0
June 2021	0	0
July 2021	0	0
August 2021	0	0
September 2021	0	0
WY 2021 Totals	**71,292**	**102,040**

Table E-2 The Location and the Application Amount of Huck Salt (Obtained from the Monthly Monitoring Logs, Water Year 2021)

Month/Year	Top of the Gondola (lbs.)	World Cup Race Course (lbs.)	Terrain Park (lbs.)	Adventure Peak Tubing Area (lbs.)	California Base Parking Lot (lbs.)	Tamarack Lodge Deck (lbs.)	Tram Base Decks (lbs.)	World Cup Foundation Building (lbs.)
October 2020	0	0	0	0	0	0	0	0
November 2020	0	0	0	0	50	0	0	0
December 2020	10	0	0	0	1,166	8	9	0
January 2021	0	0	0	0	750	0	14	0
February 2021	0	0	0	0	380	0	16	0
March 2021	0	0	125	0	280	2	16	0
April 2021	0	0	580	0	0	0	0	0
May 2021	0	0	0	0	0	0	0	0
June 2021	0	0	0	0	0	0	0	0
July 2021	0	0	0	0	0	0	0	0
August 2021	0	0	0	0	0	0	0	0
September 2021	0	0	0	0	0	0	0	0
WY 2021 Totals	**10**	**0**	**705**	**0**	**2,626**	**10**	**55**	**0**

Appendix E-2
4th Quarter Erosion Control Monitoring

HEAVENLY SKI RESORT
DEICERS and ABRASIVES APPLICATION

(MONITORING AND REPORTING PROGRAM) BOARD ORDER NO. R6T-2015-0021
WDID 6A090033000
WASTE DISCHARGE REQUIREMENTS

DAILY LOG

MONTH/YEAR: Jul-21

LOCATION NAME: California Main Lodge

For days when Heavenly Ski Resort (discharger) applies abrasives or ice control agents on parking lots and roadways, Heavenly Personnel shall record the following daily use for weekly submittal to supervisors and monthly submittal to Blair Davidson for input into Quarterly reporting to LRWQCB:

Location Codes:
1 H/UL – Cal Base Upper Lot
2 H/LL – Cal Base Lower Lot
3 H/W – Entrance Road (Wildwood above Saddle)
4 C/WN CSLT – Wildwood – Needle Peak
5 C/SR CSLT - Ski Run
6 C/K CSLT – Keller
7 C/S CSLT-Sherman Way
8 C/R CSLT- Regina
9 Other – **Describe**:

Material Codes
C – Cinders
NaCl- Salt
S - Sand
Other – **Describe:**
B - Brine

Date/Time	Quantity (lbs)	Location Code	Type of Material

Total Monthly APPLICATION Heavenly (lbs?) **salt** **sand**

salt **sand**
Total Monthly APPLICATION in CSLT (lbs?)
Submit Weekly to Supervisor.
Time period covered **7/1/2021** **7/31/2021**

Employee Signature/DATE
Aryn Yancher 08.01.21

HEAVENLY SKI RESORT
DEICERS and ABARSIVES APPLICATION and RECOVERY

Monthly Summary Report

(MONITORING AND REPORTING PROGRAM) BOARD ORDER NO. R6T-2015-0021
WDID 6A090033000
WASTE DISCHARGE REQUIREMENTS

Quantity of ice control agents and abrasives used on Heavenly property and on CSLT streets. When the Dischargers apply deicers and/or abrasives on parking lots, base facilities, private roads, or City of South Lake Tahoe roads to the California Base area, the Dischargers shall keep a daily log and report a monthly summary of the following to Blair Davidson for Quarterly reporting to LRWQCB:

Month and Year: Jul-21 **Reporter:** Aryn Yancher

Location Name: Heavenly California Base and City of South Lake Tahoe Roads
Total Monthly Application: **0** lbs
Total Monthly Recovery: **0** lbs

Location of Disposal Facilities: Carson Landfill (by Tahoe Refuse)

Aryn Yancher 08/01/21
Employee Signature

HEAVENLY SKI RESORT
DEICERS and ABRASIVES RECOVERY

(MONITORING AND REPORTING PROGRAM) BOARD ORDER NO. R6T-2015-0021
WDID 6A090033000
WASTE DISCHARGE REQUIREMENTS

DAILY LOG

MONTH/YEAR: Jul-21

LOCATION NAME: Heavenly Upper Lot (15 min, bus drop, tram)

For abrasives or ice control agents that Heavenly Ski Resort (discharger) **removed** from parking lots and roadways, Heavenly Personnel shall record the following in a daily log for weekly submittal to supervisors and monthly submittal to Blair Davidson for input into Quarterly reporting to LRWQCB:

Location Codes:
H/UL – Cal Base Upper Lot
H/LL – Cal Base Lower Lot
H/W – Entrance Road (Wildwood above Sa S - Sand
C/WN CSLT – Wildwood – Needle Peak
C/SR CSLT - Ski Run
C/K CSLT – Keller
C/S CSLT- Sherman Way
C/R CSLT - Regina
Other – **Describe**:

Material Codes
DG - Spec H Sand
NaCl - Salt
Other – **Describe:**

Equipment/Method Used: (first three loads fromdraingage improvement.
Mechanical Sweeper: Desert Commerical Sweeping

Date	Type of Material	Quantity (lbs)

Total Monthly RECOVERY Heavenly (lbs?) 0 Sand 0 salt

Total Monthly RECOVERY in CSLT (lbs?) 0 Sand 0 salt
Submit Monthly to Supervisor. Time period covered 7/1/2021 to 7/31/2021

Aryn Yancher 08/01/21
Employee Signature **Supervisor Signature**

HEAVENLY SKI RESORT
CALIFORNIA PARKING LOT, LODGE and ROADS
MONITORING CHECKLIST

(MONITORING AND REPORTING PROGRAM NO.R6T-2015-0021)

Date: Jul-21 Inspector: Aryn Yancher

Complete the following inspection at the **CA Parking Lot, CA Base Lodge, and associated roads**, **at least once monthly** and **after significant storm events**. Turn in Checklists to Supervisor for submittal to Blair Davidson for input into Quarterly reports to LRWQCB.

Were any of the following Observed?	Yes	No	Comments
a. Drop Inlets (CA parking Lot and Roads)			Describe Problems, Locations and Corrective Actions
1) Clogged by Debris, ice, or sediment?		X	
2) Runoff movement into the infiltration gallery?		X	
3) Damaged by vehicles or snow plow?		X	
b. Drainage Collection System (Ca Parking Lot, Roads)			Describe Problems, Locations and Corrective Actions
1) Clogged by debris, ice, or sediment?		X	
2) Movement of water through pipes, channels and appurtenances impeded?	X		
3) Drainage collection system damages?		X	
4) Inadequate energy dissipation?			
c. Sediment Traps and Vaults (CA Prkng Lot & Roads)			Describe Problem and Corrective Actions
1) sediment accumulated in each chamber of trap vaults, or galleries? If Yes, estimate depth and volume.		X	0" (Cleaned in July)
2) Traps and Vaults recently cleaned? List date of last cleaning	X		Clean Harbors DIC 07/30/2021 Pacific Stormwater Filters 07/15/2021
3) Presence of sheen, foam trash or scum?		X	
d. Erosion Control (CA parking Lot, Lodges, and Maintenance Shops)			Please Note Locations and Corrective Actions
1) Vegetation appears unhealthy?		X	
2) Gully or rill erosion on slopes?		X	
3) Sediment buildup at toes of slopes?		X	
4) Vegetation damages by vehicles or heavy foot traffic?		X	

e. **Culvert Outlet (west of Wildwood Ave)**	Please Note Locations and Corrective Actions		
1) Inadequate energy dissipation		X	
2) Trash or debris needs to be removed from		X	
f. Upstream Drainage Diversion (Located on First Ride Run)	Please Note Locations and Corrective Actions		
1) Inadequate energy dissipation		X	
2) Trash or debris needs to be removed from drainage way?		X	
g. Spilled Chemicals, Paints, Fuels, Sealants, Oils, Greases, Antifreeze, etc? (all locations)		X	
h. Sediment/Sand Buildup in CA parking Lot?		X	
i. Grease Interceptor Not Operating Properly? (CA Base Lodge)		X	

Describe any problems / activities, dates and times of problems/activities and the personnel to which problems were reported:

Filter Replacement on 7/15 and Cleanout Occurred on 7/30/2021.

Upper Cal Lot replacement of degraded asphalt. R&R of 11,600 sq ft (inc 3000 sq ft patches). Lower lot R&R 13000 sq ft. Swept and crackfill & seal 283,500 (whole lot) sq ft.

Improvements made to French Drain (lower lot) and repair of 2 drop inlets

Documentation of resulting actions and dates problems corrected:

INSPECTION PURPOSE AND GOALS:

The purpose of the inspection is to identify actual or potential erosion and surface runoff on the project site and to identify BMP maintenance needs so that corrective measures may be immediately undertaken.

Any erosion, surface runoff problems, wastewater disposal problems, or other adverse conditions, which are found on the subject property, shall be clearly described and the corrective measures proposed by the Dischargers (Heavenly) shall be included in the quarterly monitoring report. **In the event that no such problems are found on the property, a statement certifying this condition must be included for each monthly inspection.**

PLEASE ADD ADDITIONAL INFORMATION IF NECESSARY AND ATTACH PHOTO DOCUMENTATION

CHECKLIST FOR OPERATION AND MAINTENANCE INSPECTION RECORD

Name of Area: California Base Lodge Parking Lot

Date of Inspection: 08/01/21

Name of Inpector: Aryn Yancher

System/Structure Inspected: Wildwood Culvert

Structure ID or Location	Comments and Observations	Acceptable	Unacceptable	Required maintenance
Wildwood Culvert	steady water flow, recently cleaned	Yes		Clean Harbors Cleaned on 7/30

NO AUGUST CML Reports were completed due to Caldor Fire (USFS closures/mandatory evacuation/ USFS Basecamp in Parking Lot).

HEAVENLY SKI RESORT
DEICERS and ABRASIVES APPLICATION

(MONITORING AND REPORTING PROGRAM) BOARD ORDER NO. R6T-2015-0021
WDID 6A090033000
WASTE DISCHARGE REQUIREMENTS

DAILY LOG

MONTH/YEAR: Sep-21

LOCATION NAME: California Main Lodge

For days when Heavenly Ski Resort (discharger) applies abrasives or ice control agents on parking lots and roadways, Heavenly Personnel shall record the following daily use for weekly submittal to supervisors and monthly submittal to Blair Davidson for input into Quarterly reporting to LRWQCB:

Location Codes:
1 H/UL – Cal Base Upper Lot
2 H/LL – Cal Base Lower Lot
3 H/W – Entrance Road (Wildwood above Saddle)
4 C/WN CSLT – Wildwood – Needle Peak
5 C/SR CSLT - Ski Run
6 C/K CSLT – Keller
7 C/S CSLT-Sherman Way
8 C/R CSLT- Regina
9 Other – **Describe**:

Material Codes
C – Cinders
NaCl- Salt
S - Sand
Other – **Describe:**
B - Brine

Date/Time	Quantity (lbs)	Location Code	Type of Material

Total Monthly APPLICATION Heavenly (lbs?) **salt** **sand**

salt **sand**
Total Monthly APPLICATION in CSLT (lbs?)
Submit Weekly to Supervisor.
Time period covered **9/1/2021** **9/30/2021**

Employee Signature/DATE
Aryn Yancher 10.01.21

<u>**HEAVENLY SKI RESORT**</u>

DEICERS and ABARSIVES APPLICATION and RECOVERY

Monthly Summary Report

(MONITORING AND REPORTING PROGRAM) BOARD ORDER NO. R6T-2015-0021
WDID 6A090033000
WASTE DISCHARGE REQUIREMENTS

Quantity of ice control agents and abrasives used on Heavenly property and on CSLT streets. When the Dischargers apply deicers and/or abrasives on parking lots, base facilities, private roads, or City of South Lake Tahoe roads to the California Base area, the Dischargers shall keep a daily log and report a monthly summary of the following to Blair Davidson for Quarterly reporting to LRWQCB:

Month and Year: Sep-21 **Reporter:** Aryn Yancher

Location Name: Heavenly California Base and City of South Lake Tahoe Roads
Total Monthly Application: **0** lbs
Total Monthly Recovery: **0** lbs

Location of Disposal Facilities: Carson Landfill (by Tahoe Refuse)

<u>**Aryn Yancher 10/01/21**</u>
Employee Signature

HEAVENLY SKI RESORT
DEICERS and ABRASIVES RECOVERY

(MONITORING AND REPORTING PROGRAM) BOARD ORDER NO. R6T-2015-0021
WDID 6A090033000
WASTE DISCHARGE REQUIREMENTS

DAILY LOG

MONTH/YEAR: Sep-21

LOCATION NAME: Heavenly Upper Lot (15 min, bus drop, tram)

For abrasives or ice control agents that Heavenly Ski Resort (discharger) **removed** from parking lots and roadways, Heavenly Personnel shall record the following in a daily log for weekly submittal to supervisors and monthly submittal to Blair Davidson for input into Quarterly reporting to LRWQCB:

Location Codes:	**Material Codes**
H/UL – Cal Base Upper Lot	DG - Spec H Sand
H/LL – Cal Base Lower Lot	NaCl - Salt
H/W – Entrance Road (Wildwood above Sa S - Sand	Other – **Describe:**
C/WN CSLT – Wildwood – Needle Peak	
C/SR CSLT - Ski Run	
C/K CSLT – Keller	
C/S CSLT- Sherman Way	
C/R CSLT - Regina	
Other – **Describe**:	

Equipment/Method Used: (first three loads fromdraingage improvement.
Mechanical Sweeper: Desert Commerical Sweeping

Date	**Type of Material**	**Quantity (lbs)**

Total Monthly RECOVERY Heavenly (lbs?) 0 Sand 0 salt

Total Monthly RECOVERY in CSLT (lbs?) 0 Sand 0 salt
Submit Monthly to Supervisor. Time period covered 9/1/2021 to 9/30/2021

Aryn Yancher 10/01/21
Employee Signature **Supervisor Signature**

HEAVENLY SKI RESORT
CALIFORNIA PARKING LOT, LODGE and ROADS
MONITORING CHECKLIST

(MONITORING AND REPORTING PROGRAM NO.R6T-2015-0021)

Date: Sep-21 Inspector: Aryn Yancher

Complete the following inspection at the **CA Parking Lot, CA Base Lodge, and associated roads**, **at least once monthly** and **after significant storm events**. Turn in Checklists to Supervisor for submittal to Blair Davidson for input into Quarterly reports to LRWQCB.

Were any of the following Observed?	Yes	No	Comments
a. Drop Inlets (CA parking Lot and Roads)			Describe Problems, Locations and Corrective Actions
1) Clogged by Debris, ice, or sediment?			
2) Runoff movement into the infiltration gallery?			
3) Damaged by vehicles or snow plow?			
b. Drainage Collection System (Ca Parking Lot, Roads)			Describe Problems, Locations and Corrective Actions
1) Clogged by debris, ice, or sediment?			
2) Movement of water through pipes, channels and appurtenances impeded?			
3) Drainage collection system damages?			
4) Inadequate energy dissipation?			
c. Sediment Traps and Vaults (CA Prkng Lot & Roads)			Describe Problem and Corrective Actions
1) sediment accumulated in each chamber of trap vaults, or galleries? If Yes, estimate depth and volume.			
2) Traps and Vaults recently cleaned? List date of last cleaning		X	Clean Harbors DIC 07/30/2021 Pacific Stormwater Filters 07/15/2021
3) Presence of sheen, foam trash or scum?			
d. Erosion Control (CA parking Lot, Lodges, and Maintenance Shops)			Please Note Locations and Corrective Actions
1) Vegetation appears unhealthy?			
2) Gully or rill erosion on slopes?			
3) Sediment buildup at toes of slopes?			
4) Vegetation damages by vehicles or heavy foot traffic?			

e. Culvert Outlet (west of Wildwood Ave)	Please Note Locations and Corrective Actions		
1) Inadequate energy dissipation			
2) Trash or debris needs to be removed from			
f. Upstream Drainage Diversion (Located on First Ride Run)	Please Note Locations and Corrective Actions		
1) Inadequate energy dissipation			
2) Trash or debris needs to be removed from drainage way?			
g. Spilled Chemicals, Paints, Fuels, Sealants, Oils, Greases, Antifreeze, etc? (all locations)			
h. Sediment/Sand Buildup in CA parking Lot?			
i. Grease Interceptor Not Operating Properly? (CA Base Lodge)			

Describe any problems / activities, dates and times of problems/activities and the personnel to which problems were reported:
See attached.

Due to the staging of Fire Crews at the parking lot, inspections could not be performed in September

Documentation of resulting actions and dates problems corrected:

INSPECTION PURPOSE AND GOALS:

The purpose of the inspection is to identify actual or potential erosion and surface runoff on the project site and to identify BMP maintenance needs so that corrective measures may be immediately undertaken.

Any erosion, surface runoff problems, wastewater disposal problems, or other adverse conditions, which are found on the subject property, shall be clearly described and the corrective measures proposed by the Dischargers (Heavenly) shall be included in the quarterly monitoring report. **In the event that no such problems are found on the property, a statement certifying this condition must be included for each monthly inspection.**

PLEASE ADD ADDITIONAL INFORMATION IF NECESSARY AND ATTACH PHOTO DOCUMENTATION

CHECKLIST FOR OPERATION AND MAINTENANCE INSPECTION RECORD

Name of Area: California Base Lodge Parking Lot

Date of Inspection: 10/01/21

Name of Inpector: Aryn Yancher

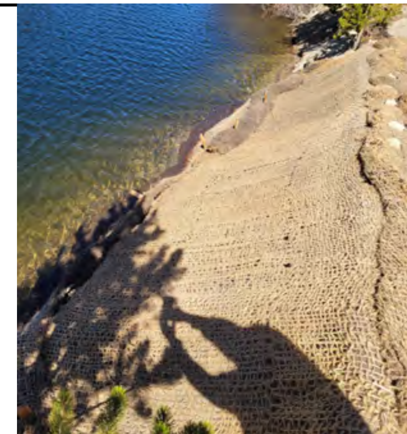
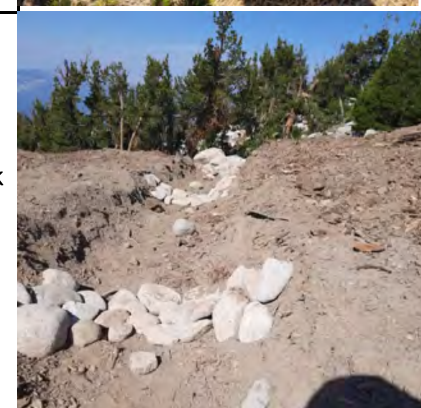
System/Structure Inspected: N/A - Due to Fire Support Camp

Structure ID or Location	Comments and Observations	Acceptable	Unacceptable	Required maintenance

Date	Department/Location	Pounds used	Reporter	Month
12/04/20	Activities - Coaster	1.5	John Lanouette	12
12/08/20	Activities - Coaster	3.0	John Lanouette	12
12/17/20	Activities - Coaster	2.0	John Lanouette	12
12/27/20	Activities - Coaster	2.0	John Lanouette	12
12/29/20	Activities - Coaster	1.0	John Lanouette	12
02/26/21	Activities - Coaster	1.0	John lanouette	02
12/04/20	Base Ops/Snow Removal - CA Base	150.0	Ryan Smith	12
12/08/20	Base Ops/Snow Removal - CA Base	300.0	Ryan Smith	12
12/13/20	Base Ops/Snow Removal - CA Base	75.0	Ryan Smith	12
12/16/20	Base Ops/Snow Removal - CA Base	75.0	Ryan Smith	12
12/17/20	Base Ops/Snow Removal - CA Base	75.0	Ryan Smith	12
12/18/20	Base Ops/Snow Removal - CA Base	75.0	Ryan Smith	12
12/19/20	Base Ops/Snow Removal - CA Base	75.0	Ryan Smith	12
12/22/20	Base Ops/Snow Removal - CA Base	75.0	Ryan Smith	12
12/23/20	Base Ops/Snow Removal - CA Base	75.0	Ryan Smith	12
12/26/20	Base Ops/Snow Removal - CA Base	100.0	Ryan Smith	12
12/31/20	Base Ops/Snow Removal - CA Base	91.0	Ryan Smith	12
01/01/21	Base Ops/Snow Removal - CA Base	25.0	Justin Gross	01
01/04/21	Base Ops/Snow Removal - CA Base	25.0	Justin Gross	01
01/05/21	Base Ops/Snow Removal - CA Base	50.0	Justin Gross	01
01/07/21	Base Ops/Snow Removal - CA Base	100.0	Justin Gross	01
01/12/21	Base Ops/Snow Removal - CA Base	100.0	Justin Gross	01
01/25/21	Base Ops/Snow Removal - CA Base	125.0	Justin Gross	01
01/30/21	Base Ops/Snow Removal - CA Base	325.0	Justin	01
	CA Base - January Summary	**750.0**		
02/01/21	Base Ops/Snow Removal - CA Base	75.0	Justin Gross	02
02/03/21	Base Ops/Snow Removal - CA Base	50.0	Justin Gross	02
02/14/21	Base Ops/Snow Removal - CA Base	255.0	Justin Gross	02
	CA Base - February Summary	**380.0**		
03/12/21	Base Ops/Snow Removal - CA Base	140.0	Justin Gross	03
03/13/21	Base Ops/Snow Removal - CA Base	60.0	Justin Gross	03
03/20/21	Base Ops/Snow Removal - CA Base	80.0	Justin Gross	03
	CA Base - March Summary	**280.0**		
WY 2021 Q4	**CA Base - 4th Qtr Summary**	**0.0**	**-**	**7, 8, 9**
12/04/20	F&B - Tamarack Lodge Deck	1.5	Dave Davis	12
12/08/20	F&B - Tamarack Lodge Deck	3.0	Dave Davis	12
12/11/20	F&B - Tamarack Lodge Deck	0.5	dave davis	12
12/13/20	F&B - Tamarack Lodge Deck	0.5	dave davis	12
12/22/20	F&B - Tamarack Lodge Deck	0.5	dave davis	12
12/26/20	F&B - Tamarack Lodge Deck	1.0	dave davis	12
12/30/20	F&B - Tamarack Lodge Deck	0.5	dave davis	12
12/31/20	F&B - Tamarack Lodge Deck	0.5	dave davis	12
03/25/21	F&B - Tamarack Lodge Deck	2.0	Dave Davis	03
	Tamarack Lodge - March Summary	**2.0**		
WY 2021 Q4	**Tamarack Lodge - 4th Qtr Summary**	**0.0**	**-**	**7, 8, 9**
12/01/20	Lift Ops - Tram Top and Bottom	1.0	Rich Mcadon	12
12/04/20	Lift Ops - Tram Top and Bottom	1.0	Rich Mcadon	12
12/05/20	Lift Ops - Tram Top and Bottom	2.0	Rich Mcadon	12
12/28/20	Lift Ops - Tram Top and Bottom	1.0	Rich Mcadon	12
12/31/20	Lift Ops - Tram Top and Bottom	4.0	Rich Mcadon	12
01/04/21	Lift Ops - Tram Top and Bottom	3.0	Alex	01
01/05/21	Lift Ops - Tram Top and Bottom	1.0	Alex	01
01/09/21	Lift Ops - Tram Top and Bottom	1.0	Alex	01
01/21/21	Lift Ops - Tram Top and Bottom	1.0	Alex	01
01/25/21	Lift Ops - Tram Top and Bottom	2.0	Jacob	01
01/26/21	Lift Ops - Tram Top and Bottom	5.0	Alex	01
01/27/21	Lift Ops - Tram Top and Bottom	1.0	Jimmy	01
	Tram - January Summary	**14.0**		
02/03/21	Lift Ops - Tram Top and Bottom	3.0	Scotty Auld	02
02/04/21	Lift Ops - Tram Top and Bottom	2.0	Scotty Auld	02
02/12/21	Lift Ops - Tram Top and Bottom	2.0	Scotty Auld	02
02/17/21	Lift Ops - Tram Top and Bottom	6.0	Scotty Auld	02
02/21/21	Lift Ops - Tram Top and Bottom	1.0	Scotty Auld	02
02/25/21	Lift Ops - Tram Top and Bottom	2.0	Scotty Auld	02
	Tram - February Summary	**16.0**		
03/11/21	Lift Ops - Tram Top and Bottom	2.0	Scotty Auld	03
03/15/21	Lift Ops - Tram Top and Bottom	2.0	Jimmy Price	03
03/18/21	Lift Ops - Tram Top and Bottom	2.0	Alex	03
03/19/21	Lift Ops - Tram Top and Bottom	3.0	Alex	03
03/20/21	Lift Ops - Tram Top and Bottom	3.0	Alex	03
03/23/21	Lift Ops - Tram Top and Bottom	2.0	Alex	03
03/24/21	Lift Ops - Tram Top and Bottom	1.0	Alex	03
03/30/21	Lift Ops - Tram Top and Bottom	1.0	Alex	03
	Tram - March Summary	**16.0**		
WY 2021 Q4	**Tram - 4th Qtr Summary**	**0.0**	**-**	**7, 8, 9**
03/28/21	Terrain Parks	25.0	David Spurlock	03
03/29/21	Terrain Parks	20.0	David Spurlock	03
03/30/21	Terrain Parks	40.0	David Spurlock	03
03/31/21	Terrain Parks	40.0	David Spurlock	03
	Terrain Parks - March Summary	**125.0**		
04/01/21	Terrain Parks	60.0	David Spurlock	04
04/02/21	Terrain Parks	40.0	David Spurlock	04
04/03/21	Terrain Parks	40.0	David Spurlock	04
04/04/21	Terrain Parks	80.0	David Spurlock	04
04/05/21	Terrain Parks	40.0	David Spurlock	04
04/06/21	Terrain Parks	80.0	David Spurlock	04
04/07/21	Terrain Parks	40.0	David Spurlock	04
04/08/21	Terrain Parks	40.0	David Spurlock	04
04/09/21	Terrain Parks	40.0	David Spurlock	04
04/10/21	Terrain Parks	40.0	David Spurlock	04
04/11/21	Terrain Parks	40.0	David Spurlock	04
04/13/21	Terrain Parks	40.0	David Spurlock	04
	Terrain Parks - April Summary	**580.0**		
WY 2021 Q4	**Terrain Parks - 4th Qtr Summary**	**0.0**	**-**	**7, 8, 9**

Appendix E-2
4th Quarter On Mountain Monitoring

Heavenly Mountain Resort
Quarter: 4th   Year: 2021
Erosion Control and Facilities Maintenance Monitoring
Inspection by: Bryan Hickman

Location	Date	Notes/Observations/Problems Identified	Corrective Measures Taken	Photos
Cal Dam	10/1/2021	Slope stabilization on east side of the reservoir remains effective. 401 WQC marked as historical effective 12/30/21	n/a	
Upper Ridge Run	10/1/2021	Minor overtopping of sediment basins along the roadway at the receiving area of the Cal Dam Sediment Removal Project.	Addition of water bar with check dams and increased capacity of basins.	
Maggie's, HV Creek, and High Five	10/1/2021	All 12", 24", and 36" culverts inspected clear and free of any obstructions.	n/a	

All Mountain	10/1/2021	Mountain roadways used by employees and vendors inspected and in good condition.	Ongoing maintenance taking place, including addition of road base, maintaining water bars. Data provided to USFS as part of annual roads report.	
All Mountain	10/1/2021	Rope lines in place along roadways to prevent unauthorized "off road" driving. Triple rope lines used in Draba areas on Upper Mountain.	Ropes to be removed prior to first snow for winter season.	
Maggie's & Hellwinkles	10/1/2021	Sediment basins and energy dissipaters are in good condition, maintained and cleaned out post storm events	Sediment basins have adequate capacity and are ready for winter	
Creek Area & Groove	10/1/2021	Rock Lined channels are in good shape. Rock Lined ditch at Groove chair has plenty of remaining sediment holding capacity.	Routine maintenance was done on the rock lined ditch around the base terminal of Groove chair.	
Shop Area	10/1/2021	Sediment basins and energy dissipaters are in good condition, maintained and cleaned out post storm events	Sediment basins have adequate capacity and are ready for winter	

Cal Base Parking Lot	9/20/2021	French drain in driveway not functional due to build up of sediment in trench	Crews cleaned out and removes sediment. Functional and ready for winter.	
Boulder Base Parking Lot	9/20/2021	Snow storage basins cleaned out of sediment. Material hauled off.	Sediment basins have adequate capacity and are ready for winter	
All Mountain	10/1/2021	Gullies and rills on slopes and roadways ok. After any major rain events our Trails Maintenance Crews and Heavy Equipment Operators address any problems right away.	Middle Section of Groove Trail identified as a Hot Spot due to riling. Crew performed a "rip and chip" treatment, seeded and irrigated.	
All Mountain	10/1/2021	Stockpiles of soils or road base materials observed on the mountain have proper BMP's.	Stockpiles will be removed before winter.	
Enchanted Forest	10/1/2021	Caldor Fire crews put dozer lines through the Enchanted Forest Ski School area damaging an electrical line and leaving large scars	Electrical crews repaired the damaged power line and Trail Crew fixed the dozer line.	

Appendix E-3
2021-12-05 Completed 2021 Annual Work List

HEAVENLY MOUNTAIN RESORT
2021 ANNUAL SUMMER WORK LIST
Completed Status

#	Source*	Location	Treatment	Status
Watershed: CA-1 Heavenly Valley Creek				
1	M	Upper Shop	Maintain existing water bars, ditches, drop inlets and culverts.	Partially Completed – Review 2022
2	M	Powderbowl/Groove Chair Base	Maintain rock-lined ditches at base of Groove Lift and sediment basin at base of Powderbowl Lift.	Completed
3	M	Maggie's Sediment Basins	Maintain and clean out sediment in Maggie's road shoulder sediment basins.	Completed
4	M	Hellwinkel's Sediment Basins	Maintain and clean out sediment in Hellwinkel's road shoulder sediment basins.	Completed
5	P/RM	Cal Dam Snowmaking Pond	Work to be completed is post construction 401 Certification monitoring (Activities completed in 2020, included: sediment removal and placement at low location at Liz's/Ridge Run, stabilization BMPs, and dam face relining for safety.)	Completed
6	P	American Tower Company Cell Tower & Fiber Optic Line Replacement	Third party project – Work to be completed includes gas line connection at the Top of the Gondola and possible fiber relocation near Mombo.	Completed
7	P	NV Energy	Third party project by NV Energy Project – Vault and Power Line Installations	2nd Year Completed Multi Year Phased Project
8	EH-CA	Groove Erosion Resistance	Improve erosion resistance and drainage stability near summer access road and Groove ski trail.	Completed
9	RM	TOG Water Tank Power	Underground power extension TOG Water Tank	Completed
Watershed: CA-6 Bijou Creek				
10	EH-CA	Cal Base Summer Access	Stabilize summer access road at parking lot entrance and improve erosion resistance behind lodge.	Completed
Watershed: CA-7 Unnamed Creek - Gondola				
		NONE		

*Source Codes	
M	BMP Maintenance
P	Master Plan Implementation Project
RM	Resort Maintenance Project
EH-CA	Erosion Hotspot California
EH-NV	Erosion Hotspot Nevada

Watershed: NV-1 Mott Canyon Creek				
11	M	Galaxy Road Sediment Basins	Maintain and clean out sediment in Galaxy road shoulder sediment basins.	Completed
Watershed: NV-3 Edgewood Creek				
7 cont.	P	NV Energy	Third party project by NV Energy Project – Vault and Power Line Installations	2nd Year Completed Multi Year Phased Project
11	RM	Boulder Parking Lot	Continue phased approach to parking lot repairs in coordination with Heavenly Base Ops.	3rd Year Completed Multiyear phased project
Watershed: NV-2 + 5 Daggett Creek				
7 cont.	P	NV Energy	Third party project by NV Energy Project – Vault and Power Line Installations	2nd Year Completed Multi Year Phased Project
11cont.	M	Galaxy Road Sediment Basins	Maintain and clean out sediment in Galaxy road shoulder sediment basins.	Completed
12	RM	East Peak Lodge Well	Resort maintenance around wellhead for public water system	Completed
13	P	East Peak Snowmaking Well	Resort connection to new NV Energy transformer	Completed

Resort-Wide Annual Maintenance

Installation of rope fencing along roadways and along sensitive areas.
Water quality inspections.
Inspect and maintain roads, apply road base as needed after inspections.
Snowmaking systems repair and maintenance. Repairs to hydrants.
Repair and replace signage damaged by storm events.
Remove marked hazardous trees.

*Source Codes	
M	BMP Maintenance
P	Master Plan Implementation Project
RM	Resort Maintenance Project
EH-CA	Erosion Hotspot Inventory California
EH-NV	Erosion Hotspot Inventory Nevada

Appendix E-4
2021 Vault Inspection Reports

Pacific Stormwater BMP Solutions
P.O. Box 12246
Santa Rosa , Ca
(707)994.3711 office
www.pacstorm.com

Stormwater Maintenance Report 2021

Heavenly Ski Resort Main Lodge Units 3,4 and 9

REPORT CONTENTS

This report contains information regarding the results off the BMP(s) maintenance performed at the Heavenly Ski site.
The following information is provided for each BMP:

Maintenance Date
Maintenance Information
Weather Conditions
BMP Location
BMP Designation, Type and Configuration
Sediment, Water, and Hydrocarbon Levels if present
BMP overall Condition
BMP Components Condition
Additional Comments and Observations
Maintenance Photos
Any further recommended Action

MAINTENANCE SUMMARY

Based on the results of an inspection of BMP(s), the following action was completed:

- [x] All maintained BMP's are operating within manufacturer's established specifications. Next inspection to take place Spring 2022.
- [ ] Repairs to one or more off the inspected BMPs is required.
- [x] Full service maintenance completed on one or more of the BMP's. See report specifics for details.

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

PROJECT INFORMATION

Name Heavenly Main Lodge **Unit #** 3
Address 1504 Wildwood Dr, South Lake Tahoe, Ca.

MAINTENANCE DETAILS

Field Manager Gordon Clem **System ID** .03
Date 7/15/2021 **GPS Coordinates**

Weather Dry

SYSTEM TYPE StormFilter SF **MEDIA TYPE** Phoso
CONFIGURATION Manhole **CARTRIDGE#** 7
SIZE

Sediment Depth - inlet bay N/A **Pronounced Scum Line?** Yes

Sediment Depth - Cartridge Bay 4" **Excessive Hydrocarbons?** No

Sediment Depth - Annular N/A

Water Level - Static 13"

Physical Condition of Unit: Unit appears to be in good working condition.

Field Managers Comments:
Maintenance completed and system is treating runoff as designed. Maintenance included sediment removal and replacement of filters.

Maintenance completed? Yes **Repairs Required?** No

MAINTENANCE AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem **Company:** **Pacific Stormwater Solutions**

Signature: Gordon Clem **Date:** 8/10/21

Title: Maintenance Manager

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

PROJECT INFORMATION

Name Heavenly Main Lodge **Unit#** 9

Address 1504 Wildwood Dr, South Lake Tahoe, Ca.

MAINTENANCE DETAILS

Inspector Gordon Clem **System ID** .09

Date 7/15/2021 **GPS Coordinates**

Weather Dry

SYSTEM TYPE StormFilter SF **MEDIA TYPE** Phoso

CONFIGURATION Manhole **CARTRIDGE#** 7

SIZE

Sediment Depth - inlet bay N/A **Pronounced Scum Line?** No

Sediment Depth - Cartridge Bay 3" **Excessive Hydrocarbons?** No

Sediment Depth - Annular N/A

Water Level - Static 12"

Physical Condition of Unit: Unit appears to be in good working condition.

Inspector Comments:

Maintenance completed and system is treating runoff as designed. Maintenance included sediment removal and replacement of filters.

Maintenance completed? Yes **Repairs Required?** No

AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem **Company:** **Pacific Stormwater Solutions**

Signature: Gordon Clem **Date:** 8/10/21

Title: Maintenance Manager

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

PROJECT INFORMATION

Name Heavenly Main Lodge **Unit #** 4

Address 1504 Wildwood Dr, South Lake Tahoe, Ca.

MAINTENANCE DETAILS

Inspector Gordon Clem **System ID** .04

Date 7/15/2021 **GPS Coordinates**

Weather Dry

SYSTEM TYPE StormFilter SF **MEDIA TYPE** ZPG

CONFIGURATION Vault **CARTRIDGE#** 93

SIZE

11x34

Sediment Depth - inlet bay 2" **Pronounced Scum Line?** Yes

Sediment Depth - Cartridge Bay 1" **Excessive Hydrocarbons?** No

Sediment Depth - Annular N/A

Water Level - Static 1"

Physical Condition of Unit: Unit appears to be in good working condition.

Inspector Comments:
Partial maintenance completed with sediment being removed. No filter replacement done at this time due to media is loose and unimpacted.

Maintenance completed? Yes **Repairs Required?** No

AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem **Company:** **Pacific Stormwater Solutions**

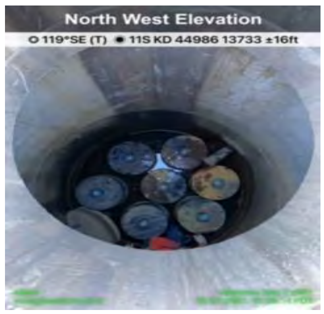
Signature: **Date:** 8/10/21

Title: Maintenance Manager

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

MAINTENANCE PHOTOS

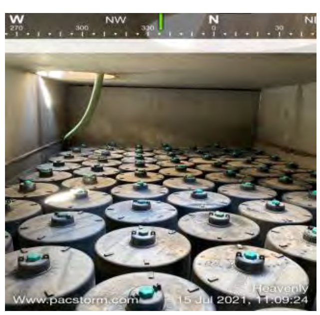


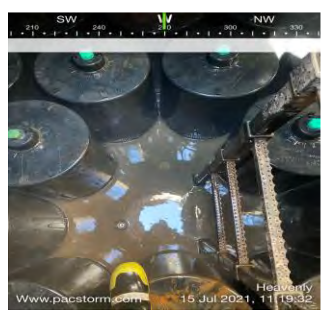

Unit #3 Cartridge bay New filters installed

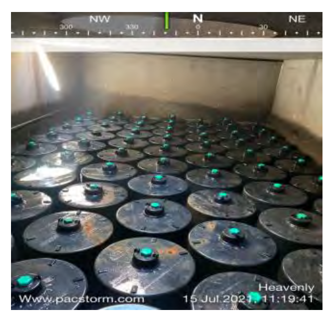
Maintenance completed with new filters installed.

Unit #9 Cartridge bay New filters installed

Maintenance completed with new filters installed.







Unit #4

Partial maintenance with sediment removal due to filters are not impacted.

STORMWATER TREATMENT UNIT

MAINTENANCE COMPLIANCE 2021

Heavenly Main Lodge
1504 Wildwood Ave
South Lake Tahoe, Ca.

Let it be known that on July 15th, 2021 Three CONTECH stormwater Media Filter systems were maintained by a qualified professional at a frequency and in a manner consistent with the manufacturer's guidelines for general inspection and maintenance. All systems are operating as designed. Maintenance was completed on all three units. Recommend next inspection Spring 2022.

Therefore, based on these activities and by signed authorization below, this hereby certifies that the StormFilter Stormwater treatment systems at the above referenced location are currently performing as designed.

CERTIFICATE AUTHORIZATION

Gordon Clem
Maintenance Manager
Pacific Stormwater BMP Solutions
08/10/21

Pacific Stormwater BMP Solutions
P.O. Box 12246
Santa Rosa , Ca
(707)994.3711 office
www.pacstorm.com

Stormwater Maintenance Report 2021

Heavenly Ski Resort Main Lodge Units 5, 10, 11

REPORT CONTENTS

This report contains information regarding the results off the BMP(s) maintenance performed at the Heavenly Ski site.
The following information is provided for each BMP:

Maintenance Date
Maintenance Information
Weather Conditions
BMP Location
BMP Designation, Type and Configuration
Sediment, Water, and Hydrocarbon Levels if present
BMP overall Condition
BMP Components Condition
Additional Comments and Observations
maintenance Photos
Any further recommended Action

MAINTENANCE SUMMARY

Based on the results of an inspection of BMP(s), the following action was completed:

- [x] All maintained BMP's are operating within manufacturer's established specifications. Next inspection to take place Spring 2022
- [ ] Repairs to one or more off the inspected BMPs is required.
- [x] Full service maintenance was performed on the following BMP's. See report specifics for details.

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

PROJECT INFORMATION

Name Heavenly Main Lodge — **Unit #** 5

Address 1504 Wildwood Dr, South Lake Tahoe, Ca.

MAINTENANCE DETAILS

Field Manager Gordon Clem — **System ID** .05

Date 07/15/21 — **GPS Coordinates**

Weather Dry

SYSTEM TYPE StormFilter SF — **MEDIA TYPE** ZPG

CONFIGURATION Vault — **CARTRIDGE#** 114

SIZE

11x34

Sediment Depth - inlet bay N/A — **Pronounced Scum Line?** Yes

Sediment Depth - Cartridge Bay 1" — **Excessive Hydrocarbons?** No

Sediment Depth - Annular N/A

Water Level - Static 1"

Physical Condition of Unit: Unit appears to be in good working condition.

Field Managers Comments:

Partial maintenance completed. Sediment removed. Power wash internal components. Filter replacement not recommended due to media is loose and unimpacted. Unit is ready for Winter.

Maintenance Required? No — **Repairs Required?** No

MAINTENANCE AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem — **Company:** **Pacific Stormwater Solutions**

Signature: Gordon Clem — **Date:** 08/10/21

Title: Maintenance Manager

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

PROJECT INFORMATION

Name Heavenly Main Lodge **Unit#** 10

Address 1504 Wildwood Dr, South Lake Tahoe, Ca.

MAINTENANCE DETAILS

Inspector Gordon Clem **System ID** .10

Date 07/15/21 **GPS Coordinates**

Weather Dry

SYSTEM TYPE StormFilter SF **MEDIA TYPE** ZPG

CONFIGURATION Vault **CARTRIDGE#** 93

SIZE **11x34**

Sediment Depth - inlet bay 7" **Pronounced Scum Line?** Yes

Sediment Depth - Cartridge Bay 3" **Excessive Hydrocarbons?** No

Sediment Depth - Annular N/A

Water Level - Static 1"

Physical Condition of Unit: Unit appears to be in good working condition.

Inspector Comments:
Maintenance completed. Sediment and spent filters removed. Power wash internal components and installed manufacturer supplied OEM filters. Inlet bay had 7" of sediment removed. Unit is ready for Winter.

Maintenance Required? No **Repairs Required?** No

AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem **Company:** **Pacific Stormwater Solutions**

Signature: Gordon Clem **Date:** 08/10/21

Title: Maintenance Manager

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

PROJECT INFORMATION

Name Heavenly Main Lodge **Unit #** 11

Address 1504 Wildwood Dr, South Lake Tahoe, Ca.

MAINTENANCE DETAILS

Inspector Gordon Clem **System ID** .11

Date 07/15/21 **GPS Coordinates**

Weather Dry

SYSTEM TYPE StormFilter SF **MEDIA TYPE** ZPG

CONFIGURATION Vault **CARTRIDGE#** 114

SIZE **11x34**

Sediment Depth - inlet bay 2" **Pronounced Scum Line?** Yes

Sediment Depth - Cartridge Bay 2.5" **Excessive Hydrocarbons?** No

Sediment Depth - Annular N/A

Water Level - Static 1"

Physical Condition of Unit: Unit appears to be in good working condition.

Inspector Comments:

Partial maintenance completed. Sediment removed. Power wash internal components. Filter replacement not recommended due to media is loose and unimpacted. Unit is ready for Winter.

Maintenance Required? Yes **Repairs Required?** No

AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem **Company:** **Pacific Stormwater Solutions**

Signature: Gordon Clem **Date:** 8/10/21

Title: Maintenance Manager

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

MAINTENANCE PHOTOS


Unit #5 | Partial maintenance | No filter replaced




Unit #11 | Partial maintenance | No filters replaced






Unit #10 | During maintenance | New filters

Maintenance was completed with filter replacements. Inlet bay was cleaned.

STORMWATER TREATMENT UNIT

MAINTENANCE COMPLIANCE 2021

Heavenly Main Lodge
1504 Wildwood Ave
South Lake Tahoe, Ca.

Let it be known that on July 15th, 2021 Three CONTECH stormwater Media Filter systems were maintained by a qualified professional at a frequency and in a manner consistent with the manufacturer's guidelines for general inspection and maintenance. All systems are operating as designed. Partial maintenance was completed on unit #5 and #11. Maintenance was completed on unit #10 including filter replacement. Recommend next inspection Spring 2022.

Therefore, based on these activities and by signed authorization below, this hereby certifies that the StormFilter Stormwater treatment systems at the above referenced location are currently performing as designed.

CERTIFICATE AUTHORIZATION

Gordon Clem

Gordon Clem
Maintenance Manager
Pacific Stormwater BMP Solutions
08/10/21

Pacific Stormwater BMP Solutions
P.O. Box 12246
Santa Rosa , Ca
(707)544-5012 office
www.pacstorm.com

Stormwater Maintenance Report 2021

Heavenly Ski Resort Main Lodge Wildwood Ave

REPORT CONTENTS

This report contains information regarding the results off the BMP(s) maintenance performed at the Heavenly Ski site.
The following information is provided for each BMP:

Maintenance Date
Maintenance Information
Weather Conditions
BMP Location
BMP Designation, Type and Configuration
Sediment, Water, and Hydrocarbon Levels if present
BMP overall Condition
BMP Components Condition
Additional Comments and Observations
Maintenance Photos
Any further recommended Action

MAINTENANCE SUMMARY

Based on the results of an inspection of BMP(s), the following action was completed:

- [x] All inspected BMPs are operating within manufacturer's established specifications. Next inspection to take place Spring 2022
- [ ] Repairs to one or more off the inspected BMPs is required.
- [x] Maintenance of one or more of the BMP systems completed. See report specifics for details.

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

PROJECT INFORMATION

Name Heavenly Main Lodge **Unit #** 11

Address Wildwood Ave, South Lake Tahoe, Ca.

MAINTENANCE DETAILS - WILDWOOD AVE Unit

Field Manager Gordon Clem
Date 07/15/21

System ID
GPS Coordinates Wildwood Ave

Weather Dry

SYSTEM TYPE StormFilter SF
CONFIGURATION Vault
SIZE

MEDIA TYPE ZPG
CARTRIDGE# 27

Sediment Depth - inlet bay N/A

Sediment Depth - Cartridge Bay 10"

Sediment Depth - Annular N/A

Water Level - Static 8"

Pronounced Scum Line? Yes

Excessive Hydrocarbons? No

Physical Condition of Unit: Unit appears to be in good working condition.

Field Managers Comments:
Maintenance completed and system is treating runoff as designed. Sediment and static water removed from StormFilter and CDS unit. Manufacturer supplied OEM filters replaced at this time.

Maintenance completed? Yes **Repairs Required?** No

MAINTENANCE AUTHENTICITY

This hereby certifies that the information contained in this report is accurate and was obtained using accepted industry practices.

By: Gordon Clem

Signature: Gordon Clem

Title: Maintenance Manager

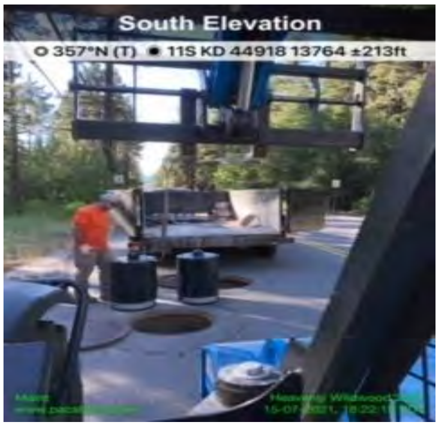
Company: **Pacific Stormwater Solutions**

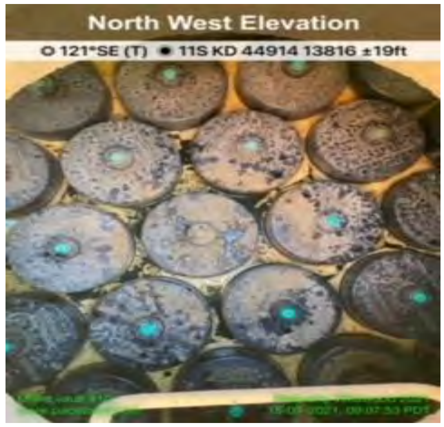
Date: 8/10/21

Pacific Stormwater BMP Solutions

Stormwater Maintenance Report

MAINTENANCE PHOTOS





Before maintenance

During maintenance

Wildwood unit

CDS unit had sediment and static water removed.

STORMWATER TREATMENT UNIT

MAINTENANCE COMPLIANCE 2021

Heavenly Main Lodge
1504 Wildwood Ave
South Lake Tahoe, Ca.

Let it be known that on July 15th, 2021 Wildwood CONTECH stormwater filtration system and One CDS hydrodynamic separater were maintained by a qualified professional at a frequency and in a manner consistent with the manufacturer's guidelines for general inspection and maintenance. System is operating as designed. Full service maintenance with OEM filter replacement was completed. Recommend next inspection Spring 2022.

Therefore, based on these activities and by signed authorization below, this hereby certifies that the StormFilter Stormwater treatment systems at the above referenced location are currently performing as designed.

CERTIFICATE AUTHORIZATION

Gordon Clem

Gordon Clem
Maintenance Manager
Pacific Stormwater BMP Solutions
8/10/21

Appendix E-5
Facilities Watershed Awareness Training

WEEK 1
6/1/2021

Heavenly
LAKE TAHOE

OUR PARTNERS, WHY BMP'S?, HELLWINKEL'S, WATTLES

BMP's/Facilities and Watershed Training

FIRST NAME	LAST NAME	Employee ID
John	Lamonette	216563
Blair	Davidson	214832
David	Caputo	170767
~~Tim~~	MCCALL	223339
Matt	Lighthart	247263
Matt	Entrup	296902
Richard ~~Scott~~	Scott	222587
Albrecht	Don	128681
Kelby	murphy	254772
CONOR	BLAKE	255049
GRAEME	GROVER	128648
Rory	Fitzgerald	226447
Gary	Rawlings	128581
KEVIN	HIGGINS	128598
Lupe	Barrientos	128669
André	Villaret	128595
Kyle	Nelson	257694
Ross	Brunson	339089
Ryan	Albertson	161603
MARC	Bagg	128604
Scott	Rohde	148258
RJ	Mitchell	208281
John	Fontanetti	193625
Kevin	Cleland	192249
Sean	Hutchinson	291656
Mitchell	Rittman	242567

Heavenly
LAKE TAHOE

BMP's/Facilities and Watershed Training

FIRST NAME	LAST NAME	Employee ID
William	Clark	129456
David	Hager	200421
Ian	Clark	175145
Victor	Gutierrez	156012
Joe	Flores	318857
Kyle	Ferguson	242517
Gabe	Decker	312379
Christine	Averett	484806
Will	Cain	194601
Sarah	Kozielski	345553
Gordon	Vizenor	212516
Dave	Zebo	128632
Roger	TAVARES	130274
Eric	BATES	130290
BRAD	LEIGH	130272
Chris	Hansen	148370
Glen	Reed	195512
Marc	Bugg	128604
Jeff	Ruiz	129626
Paul	Erdmann	214619
BRYAN	HICKMAN	142876

WEEK 1

2021 ~~2020~~ BMP's, Facilities & Watershed Awareness Training

Heavenly Operations Staff

Purpose/Agenda

- Review Heavenly's Watershed Protection Commitment, BMP's & Your Role
- Review the Summer Rules of the Road
- Provide Awareness & understanding
- What to do when weather is expected
- Operating and disturbance in the Tahoe Basin

- TAKES PLACE OF BMP BREAKFAST
- WE WILL COVER A FEW TOPICS PER WEEK FOR THE NEXT FEW WEEKS
- PLEASE SIGN IN, PART OF OUR ANUALL PERMIT REQUIREMENT.

Our Commitment

- USDA Forest Service: Our partner in outdoor recreation & resource management
- Tahoe Regional Planning Agency: The Master Plan Mitigation & Monitoring, Project Permit Conditions
- State of California Regional Water Quality Control Board Lahontan Region: Waste Discharge Requ[illegible] & SWPPP's/Stormwater Require[illegible]
- NDEP (Nevada Department of Env. [illegible]) requirements

OUR PARTNERS/REGULATORS

- USFS
- TRPA
- LAHONTAN
- NDEP

Agency Partners

- TRPA-Taylor Currier (BMP's, code enforcement) and Julie Roll (Senior Planner)
- Lahontan- Dale Payne (Env. Scientist) & Liz vanDiepen (Engineering Geologist)
- Consultant- Jill Sutherland (BMP's 3rd Party Inspectors, w/ RCI)
- LTBMU – Stephanie Heller, Hydrologist US Forest Service CECILIA REED

— MTN RESORT ADMINISTRATOR

THEY ARE REPRESENTED BY THE FOLLOWING:

TRPA'S REPRESENTATIVE DOING INSPECTIONS.

Erosion Control & BMP's

- Hellwinkel's Steeps Road Maintenance, now able to water steeper sections of road with small watering truck. 5MPH, 4WD Low Required
- Snowmaking Projects

Water Bars/Stabilization & Drainage Improvements, Cal Dam Maintenance.

- Maintain effectiveness of ski run BMP's, including maintaining water bars, Culverts and re-vegetation/soil cover.
- Roads Maintenance and Dust Control

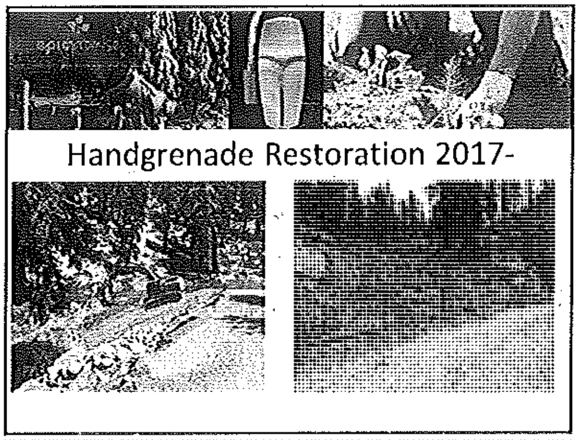
OUR EFFORTS:

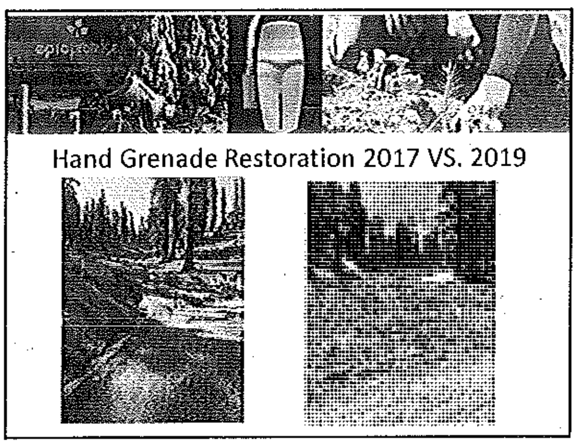
THINGS WE DO: BMP'S

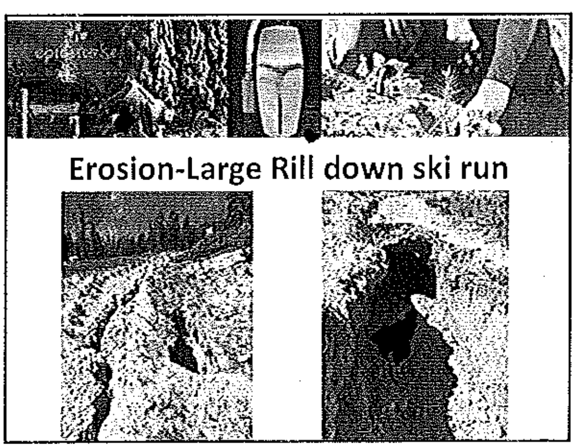
Hellwinkel's - Low & Slow!

HELLWINKELS: LOW & SLOW
- 5 MPH MAX
- 4x4 LOW.
- DO NOT SPIN TIRES
- TAKING VENDORS THAT WAY.

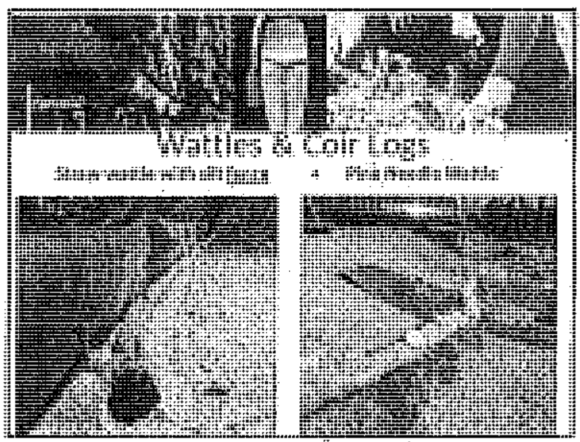
PROX. TO CREEK



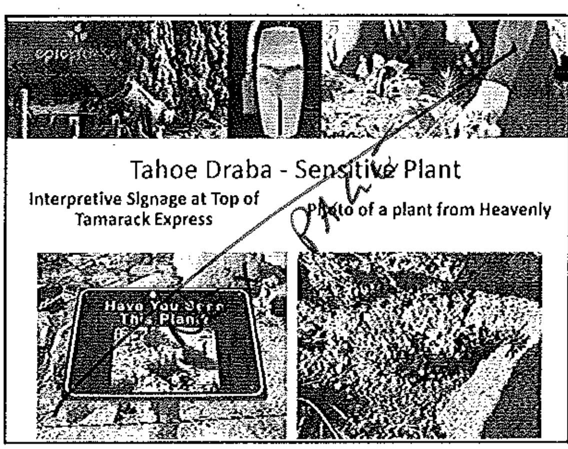




THIS IS THE KIND OF STUFF THAT SHOULD BE REPORTED TO US AFTER RAIN EVENT



WATTLES:
USED TO COMBAT
EROSION
2 TYPES:
STRAW: SHORT TERM
PINE NEEDLE: LONG TERM
ALSO SILT FENCE DEPENDING
ON PROJECT.
PRIOR TO A PROJECT, REACH OUT
AND WE WILL DEVELOP A
BMP PLAN



Pine Needle Wattles

On mountain use for erosion control, and roads materials stockpiles.

Manufacturing by trails crew

[illegible]

Important takeaways for you to ponder, with regard to BMP's:

- Is it working? (rather than "are we in trouble?")
- Source control – we're trying to stop the "bleeding" at the source rather than chasing it downstream.
- Water flow – its all connected, "Think like a water droplet." Look uphill of problem areas to determine if there is a root cause of the erosion issue...
- Heavenly Prioritization – address the highest risk spot first (e/g/ nearest to creek, most erosive, problem spots, etc)
- Keep Turbid Stormwater out of the water ways

Be especially aware during Thunderstorm activity and listen to weather updates from Central Dispatch on Radio. Contact dispatch if you hear thunder. Shut downs may impacts operations, work sites, and the mountain might be shelter in place.
Major weather "Events" can cause environmental damage
If you see damage occurring Call Dispatch. 530-542-6900 Take a [illegible]

WEEK 2
6/7/21

Heavenly
LAKE TAHOE

WEEDS, DRABA, HOT WORK / FIRE DANGER

BMP's/Facilities and Watershed Training

FIRST NAME	LAST NAME	Employee ID
Kevin	Cleland	192249
Paul	Erdmann	214619
Sarah	Kozielski	345553
Gabe	Decker	312379
Ryan	Albertson	161603
Kory	Fitzgerald	221497
Don	Abicht	128681
Chris	Cadmus	245498
Gordon	Vizenor	212516
Jesse	Zerr	324229
Fouad	Dbouk	240969
Ross	Branson	339087
Lupe	Barrientos	128669
STEVE	CLINE	142875
Kyle	Nelson	257894
CONOR	BLAKE	255049
André	Villaret	128595
Frederick	Newberry	198259
RICH	McADAM	130254
JIMMY	PRICE	239053
GRAEME	GROVER	128648
Christine	Averett	218486
David	Caputo	170767
Richard	Scott	222587
Matt	Lighthart	247203

Heavenly
LAKE TAHOE

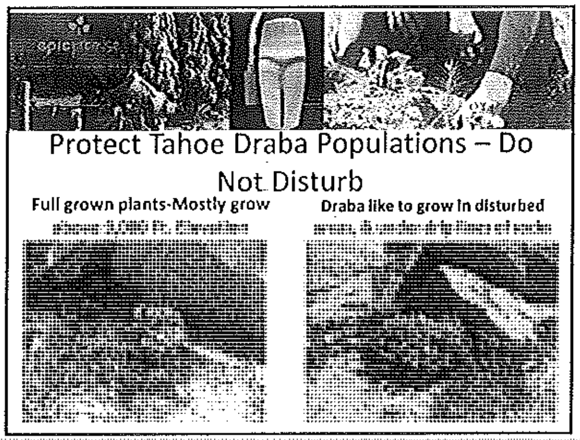
BMP's/Facilities and Watershed Training

FIRST NAME	LAST NAME	Employee ID
Kyle	Ferguson	242517
Ian	Clark	175145
William	Clark	129456
Jen	Kawaratani	175733
Joe	Flores	318851
Victor	Gutierrez	156012
David	Hager	200421
Pat	Hogan	171756
Paul	Bergeron	212674
Sean	Hutchinson	291656
Will	Cain	194601
Scott	Rohde	148258
Eric	Bates	130290
Marc	Bugg	128604
Curtis	Kezich	128566
David	Bourque	317274
Chris Williams	Williams	194981
Glen Reed	Reed	195512
Jeff	Reid	125026
John	Fontanelli	193625
Colton	Terry	129624
Bryan	Hickman	142876

Heavenly
LAKE TAHOE

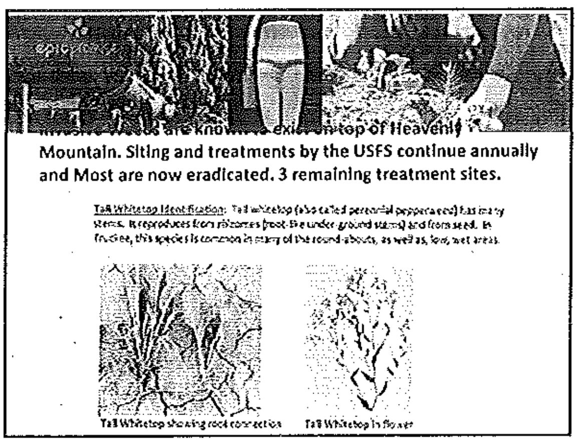
BMP's/Facilities and Watershed Training

FIRST NAME	LAST NAME	Employee ID
Tim	McCALL	223339
John	Lanouette	216563
Chris	Hansen	148370



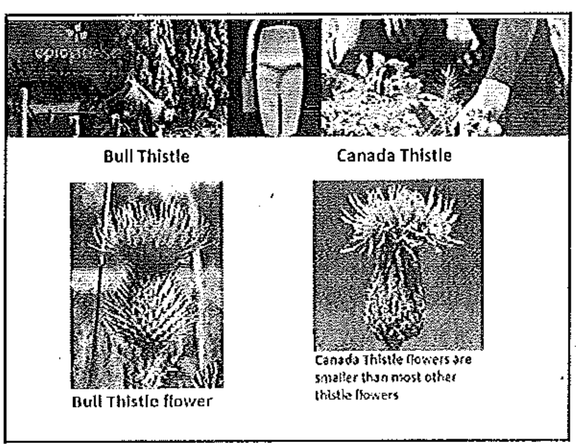
DRABA:
WHERE DO WE FIND IT?

DO NOT DISTURB
– GARTH WILL MARK



INVASIVE WEEDS:
– CLEAN VENDORS TRUCKS.

TALL WHITE TOP: MUST BE SPRAYED – CAN'T BE PULLED



THISTLES: BULL: PURPLE
CANADA: REDISH/PURPLE

BULL: 2 YEAR CYCLE
YR 1: LOW SPIKEY ON GROUND. FLIP OVER
YR 2: TALL W/ BUDS. GET RID OF BUDS.

USFS Wildlife Trash Management and Education Program:

- As a condition of the approved EIS for the Epic Discovery Program a wildlife trash management and education plan is implemented annually and reviewed by Heavenly and the US Forest Service LTBMU. The Heavenly Mountain Resort Master Redevelopment Plan (2015) Includes a number of Operations and Maintenance Measures as part of the Mitigation and Monitoring Plan. 7.5-21 BIO 8: Wildlife Trash Management and Education Program.
- A number of the activities at Heavenly Mountain Resort are located at the Top of The Gondola/Adventure Peak. As part of the Epic Discovery Project implementation the resort shall create and implement a trash management and education program. The goal of this program is for timely removal of refuse from deposit points, education of our guests and staff about proper waste management, and to keep any interactions between humans and wildlife to a minimum.
- Animal resistant "bear box" receptacles are in place @ TOG in summer.

USFS WILDLIFE TRASH MANAGEMENT PLAN:
- REVIEWED W/ USFS ANNUALLY
- GOAL IS TO LIMIT INTERACTIONS BETWEEN HUMANS AND WILDLIFE
- BEAR BOXES @ TOG
- TAKE TRASH OFF HILL, DON'T LEAVE IT IN TRUCKS

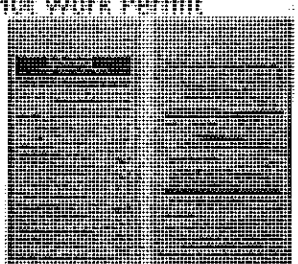
Heavenly Hot Work Permit

Required for any hot work outside of a designated weld shop. Proper tools in trucks, Fire caches on hill.

Know the PAL code for the day.

Issued by Kevin Higgins, Bryan Hickman, ~~[illegible]~~ & Curtis Kerich.

Must be posted on site.



- NEEDED ANYTIME WORK IS DONE OUTSIDE OF A "DESIGNATED HOT WORK AREA"
- KEVIN, CURTIS, HICKMAN TO ISSUE & NOTIFY H&S
- KNOW THE PAL CODE
  A, B, C - OK
  D - DONE BY 1 - DEPENDS ON TYPE OF WORK
  EV - NO HOT WORK

- LIFT CLASS FOR ANYONE INVOLVED W/ H.W.

Absolutely NO SMOKING

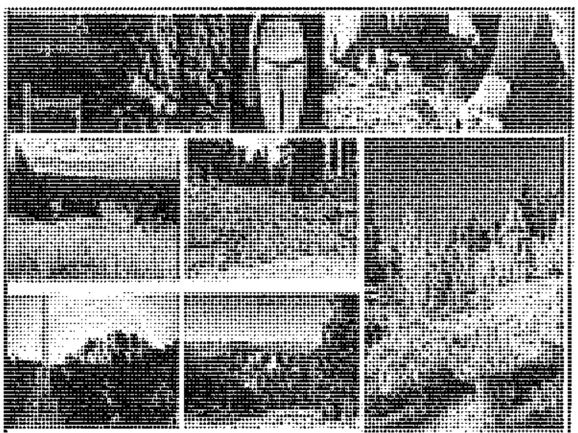
- Due to EXTREME fire danger, smoking is prohibited on the mountain.
- This includes Smoking in Heavenly company or 3rd Party vehicles.

EE'S, VENDORS, GUESTS

Wildland Fire Awareness- Be alert and aware / report any smoke to Dispatch.

FIRE HOSES/NOZZLES WILL BE PROVIDED FOR MTN. TRUCKS IN THE COMING WEEKS.

SEE SNOWMAKING



WEEK 3
6/14/21

Heavenly
LAKE TAHOE

SUMMER RULES OF THE ROAD / RAIN SHUTDOWN

BMP's/Facilities and Watershed Training

FIRST NAME	LAST NAME	Employee ID
Ross	Branson	339089
CONOR	BLAKE	255049
Jesse	Zerr	324229
Kory	Fitzgerald	221997
Fooad ~~[illegible]~~	Dhaik	240969
KEVIN	HIGGINS	128598
Sabastian	Johnson	214419
Richard	Scott	222587
GRAEME	GROVER	128648
STEPHEN	CLINE	142875
Chris Hamsen	Hamsen	148370
Lupe Barrientos	Barrientos	128669
André ~~Villaret~~	Villaret	128525
Matt ~~[illegible]~~	Entrup	296902
Curtis	Keziah	128566
Don	Abicht	128681
ERIC	BATES	130290
Marc	Bugg	128604
BRAD	LEIGH	130272
Colton	Terry	129624
Chris Williams	Chris	194981
Paul	Erdmann	214619
Christine	Arenett	284086
Bryan	Hickman	142876

WEEK 3
6/14/21

Heavenly
LAKE TAHOE

BMP's/Facilities and Watershed Training

FIRST NAME	LAST NAME	Employee ID
JEN	KAWARATANI	175733
Blair	Davidson	214832
Ian	Clark	175145
Bill	Clark	129456
Joe	Flores	318857
Jen	Menzel Cumbria	130211
Paul	Bergeron	312619
Victor	Gutierrez	156012
Matt	Collins	230360
Sean	Hutchinson	291656
Ryan	Albertson	161603
Gabe	Decker	312379
Paul	Erdmann	214619
Chris	Williams	194981
Kevin	Cleland	192249
Sarah ~~Kozielski~~	Kozielski	345553
Jeff	Reed	129026
RJ ~~Mitchell~~	Mitchell	208281
John	Fontanelli	193625
David	Bongue	312274
JIMMY	PRICE	239053
Will	Cain	194601
Ryan	McAdoo	130254
Frederick	Newberry	198259

Summer Rules of the Road

- Drive on Designated Roads only, DO NOT Park on Vegetation
- Park only in Designated Parking Areas
- If you see someone not complying, tell your supervisor
- Just because you drive an ATV/Rhino does not mean you can drive, onto a ski slope or down a decommissioned road or Ski Trail. This will create unnecessary disturbance and erosion.
- When accessing the mountain all vehicles MUST be in 4WD to prevent erosion on the roads, and stay at or below 20 mph. Be especially aware of Fugitive Dust
- All Vehicles must call 530-542-6900 upon entering and exiting through a mountain gates

More Summer Rules of the Road

- Stay out of erosion control project areas
- Report anything that looks like an obvious erosion, Water Quality, or sediment problem to your supervisor.
- All outside contractors and vendors must have a Mountain Access Permit issued by the Central Dispatch Dept., except utilities.
- Prior to accessing the mountain roads anyone from outside of the Tahoe Basin will need to spray the bottom of their vehicle to prevent the spread of invasive weeds. Heavenly may require proof.
- If you don't see a mountain access permit, stop them & ask to see their permit. If you see Utility trucks Like SW Gas or Liberty, ask them if they need any guidance or direction.

Steve's Road - Von Schmitt's

Summer Rules of the Road

- Park in Designated Areas only
- Stay within footprint of road.
- Never Park on Vegetation, don't Idle!
- Never pull down ropes unless you have permission from Heavenly Mt. Ops.
- Keep speeds to a minimum to reduce dust.

Rain Shut Down Process Information:

- View current custom Weather Forecast and Construction Activity Guidelines. Be sure to listen to Dispatch.
- The weather forecast should be checked daily on the NOAA forecast:
- www.noaa.gov (South Lake Tahoe, CA)
- **Days with 10% - 49% Chance of Rain or a Chance of Thunderstorms – Tier 1, Be prepared to Shut-Down active construction sites w/in 1 Hour**
- **Days with 50% or More Chance of Rain – Tier 2, Be prepared to Shut-Down Site immediately.**

CHECK IN BEFORE STARTING A PROJECT. HAVE BMP'S ON SITE.

Construction Rain Shut Down Process

- Know the Weather Forecast
- Listen closely to the radio
- Grading Operations and Exposed Soils—Pay attention to your work sites. Button up sites at end of each shift
- Stockpile BMP's supplies
- Vehicle Access-open and closed roads
- BMP Inspections – Pre & Post Storm—Take Pictures!


2021 BMP’s, Facilities & Watershed Awareness Training

Heavenly Operations Staff


Purpose/Agenda

- Review Heavenly's Watershed Protection Commitment, BMP's & Your Role
- Review the Summer Rules of the Road
- Provide Awareness & understanding
- What to do when weather Is expected
- Operating and disturbance in the Tahoe Basin


Our Commitment

- USDA Forest Service: Our partner in outdoor recreation & resource management
- Tahoe Regional Planning Agency: The Master Plan, Mitigation & Monitoring, Project Permit Conditions
- State of California Regional Water Quality Control Board, Lahontan Region: Waste Discharge Requirements (WDRs) & SWPPP’s/Stormwater Requirements.
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Erosion Control & BMP’s

- Hellwinkel’s Steeps Road Maintenance, now able to water steeper sections of road with small watering truck. 5MPH, 4WD Low Required
- Snowmaking Projects

Water Bars/Stabilization & Drainage Improvements, Cal Dam Maintenance.

- Maintain effectiveness of ski run BMP’s, including maintaining water bars, Culverts and re-vegetation/soil cover.
- Roads Maintenance and Dust Control


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el’s Low & Slow!



TTENTION
HELLWINKEL'S
STEEPS AHEAD
5 MPH
4WD LOW
REQUIRED
NEXT 1/4 MILE


Handgrenade Restoration 2017-



Hand Grenade Restoration 2017 VS. 2019



Erosion-Large Rill down ski run



Restorations:


Wattles & Coir Logs

Straw wattle with silt fence

Pine Needle Wattle

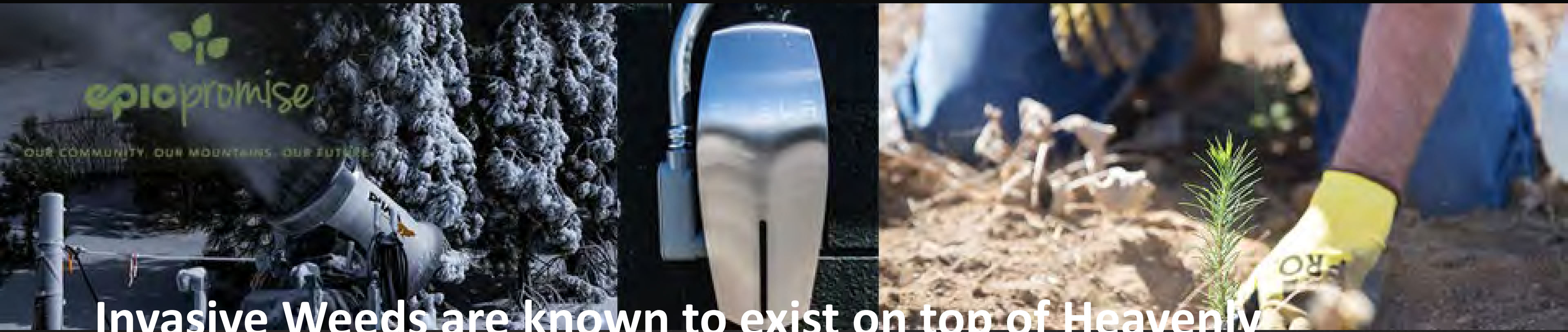
Tahoe Draba - Sensitive Plant

Photo of a plant from Heavenly

Protect Tahoe Draba Populations – Do Not Di

Full grown plants-Mostly grow above 9,000 Ft. Elevation

s



Invasive Weeds are known to exist on top of Heavenly Mount[...]eatments by the USFS continue annually and Mo[...]icated. 3 remaining treatment sites.

Tall Whitetop showing root connection

Tall Whitetop in flower

Bull Thistle

Bull Thistle flower

Canada Thistle

Canada Thistle flowers are smaller than most other thistle flowers

Pine Needle Wattles

On mountain use for erosion

Important takeaways for you to ponder, with regard to BMP's:

- Is it working? (rather than "are we in trouble?")
- Source control – we're trying to stop the "bleeding" at the source rather than chasing it downstream.
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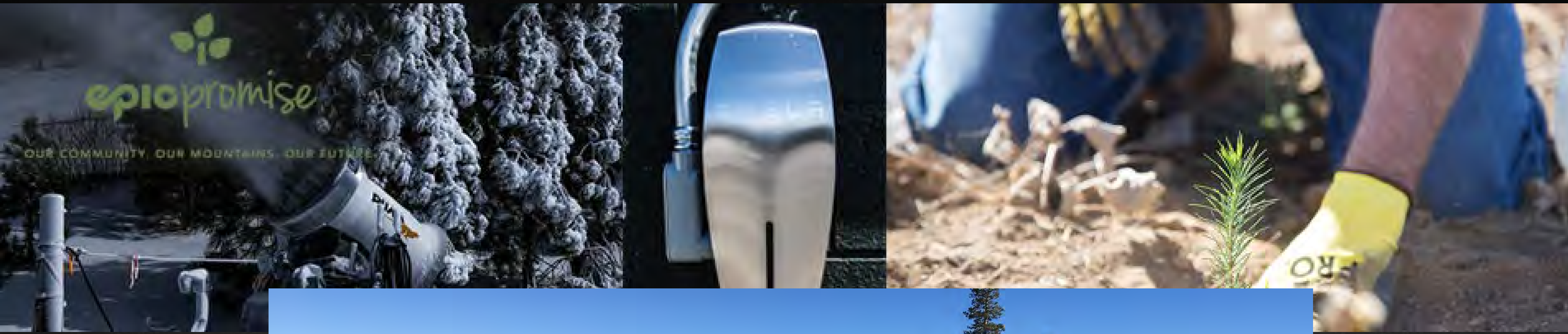
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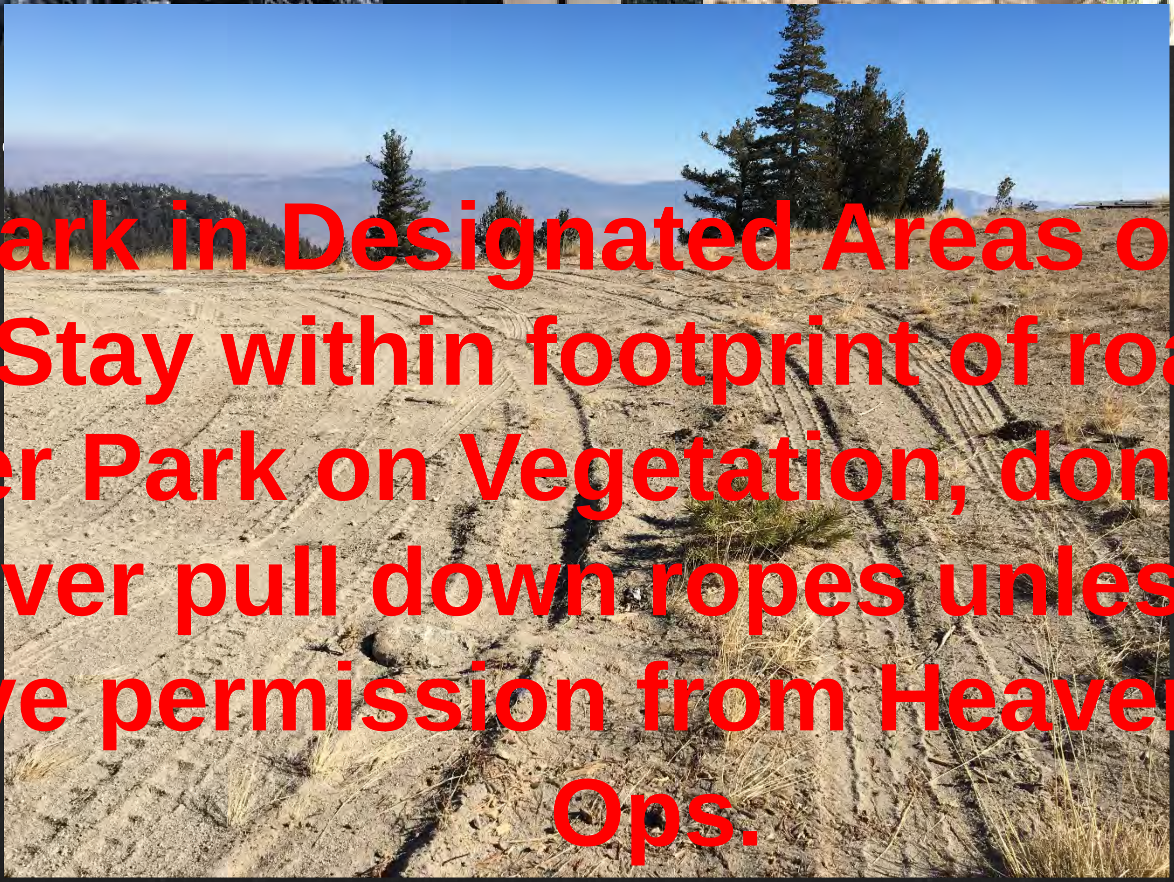
OUR COMMUNITY. OUR MOUNTAINS. OUR FUTURE.





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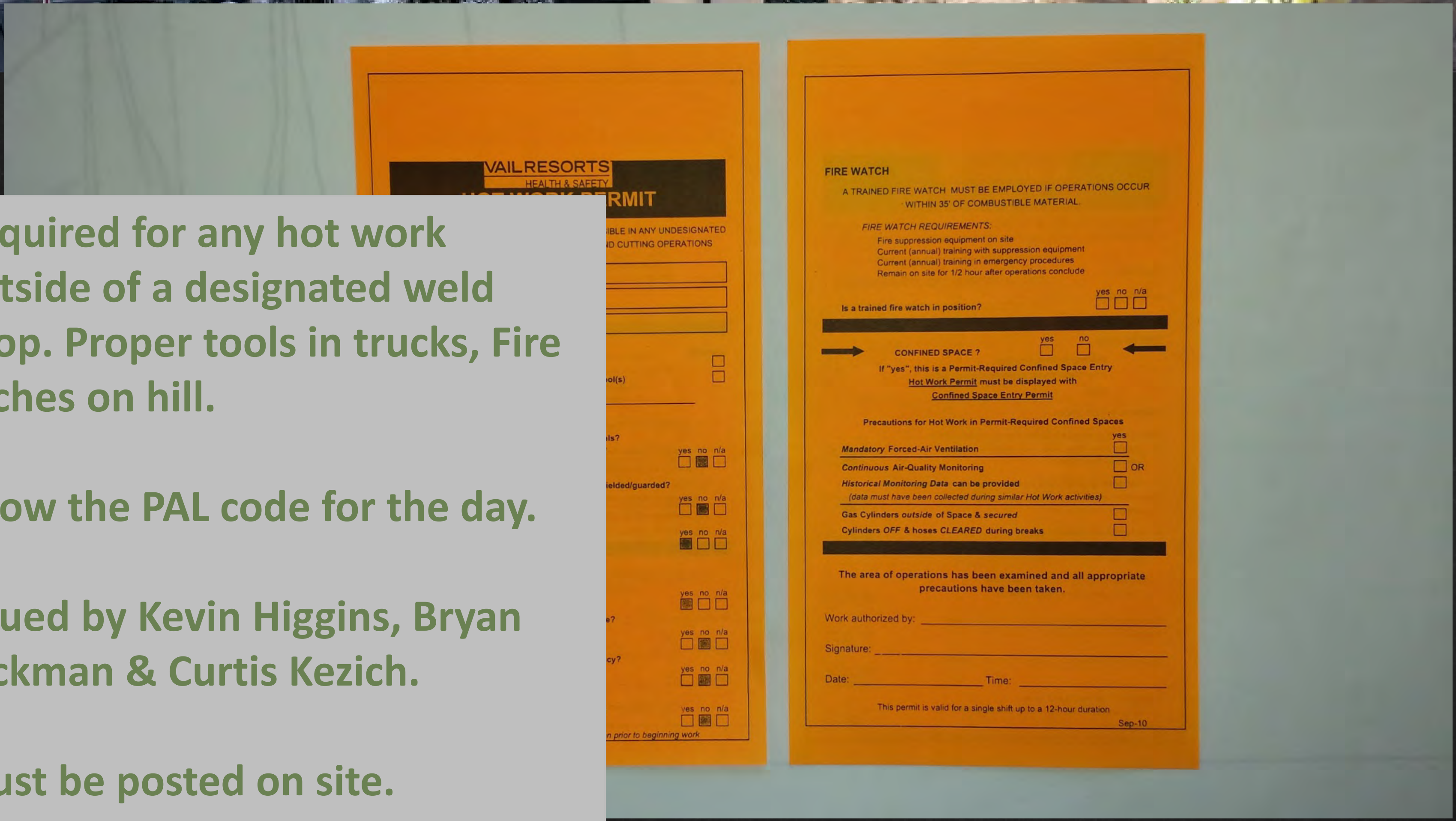

Required for any hot work outside of a designated weld shop. Proper tools in trucks, Fire caches on hill.

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Issued by Kevin Higgins, Bryan Hickman & Curtis Kezich.

Must be posted on site.

Absolutely NO SMOKING

- Due to EXTREME fire danger, smoking is prohibited on the mountain.
- This includes Smoking in Heavenly company or 3rd Party vehicles.


Wildland Fire Awareness- Be alert and aware y smoke to


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OUR COMMUNITY. OUR MOUNTAINS. OUR FUTURE.






Heavenly Mountain Resort
Water Years 2017–2021

APPENDIX F

2021 ANNUAL ROADWAY MAINTENANCE MAPPING AND WORK LISTS

Appendix F
2021 Annual Roadway Maintenance Mapping and Work Lists

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From:	Blair Davidson
To:	michael.gabor@usda.gov
Cc:	Frederick Newberry; Bryan Hickman; Anthony D"angelo; Chris Donley
Subject:	Heavenly Roads Maintenance Report 2021
Date:	Wednesday, November 10, 2021 5:01:28 PM
Attachments:	image001.png 2021 Heavenly Roads Maintenance Report.xlsx

Hi Mike,

Attached you will find the annual road maintenance report for Heavenly roads. Most of this work was completed during the 2021 summer season.

I apologize for the delay in getting this to you. Frank Papandrea left Heavenly in March and we are trying our best to pick up where he left off. Thanks to Chris at Cardno for reminding us of this submission.

Please let us know if you need any additional information.

Thank you,

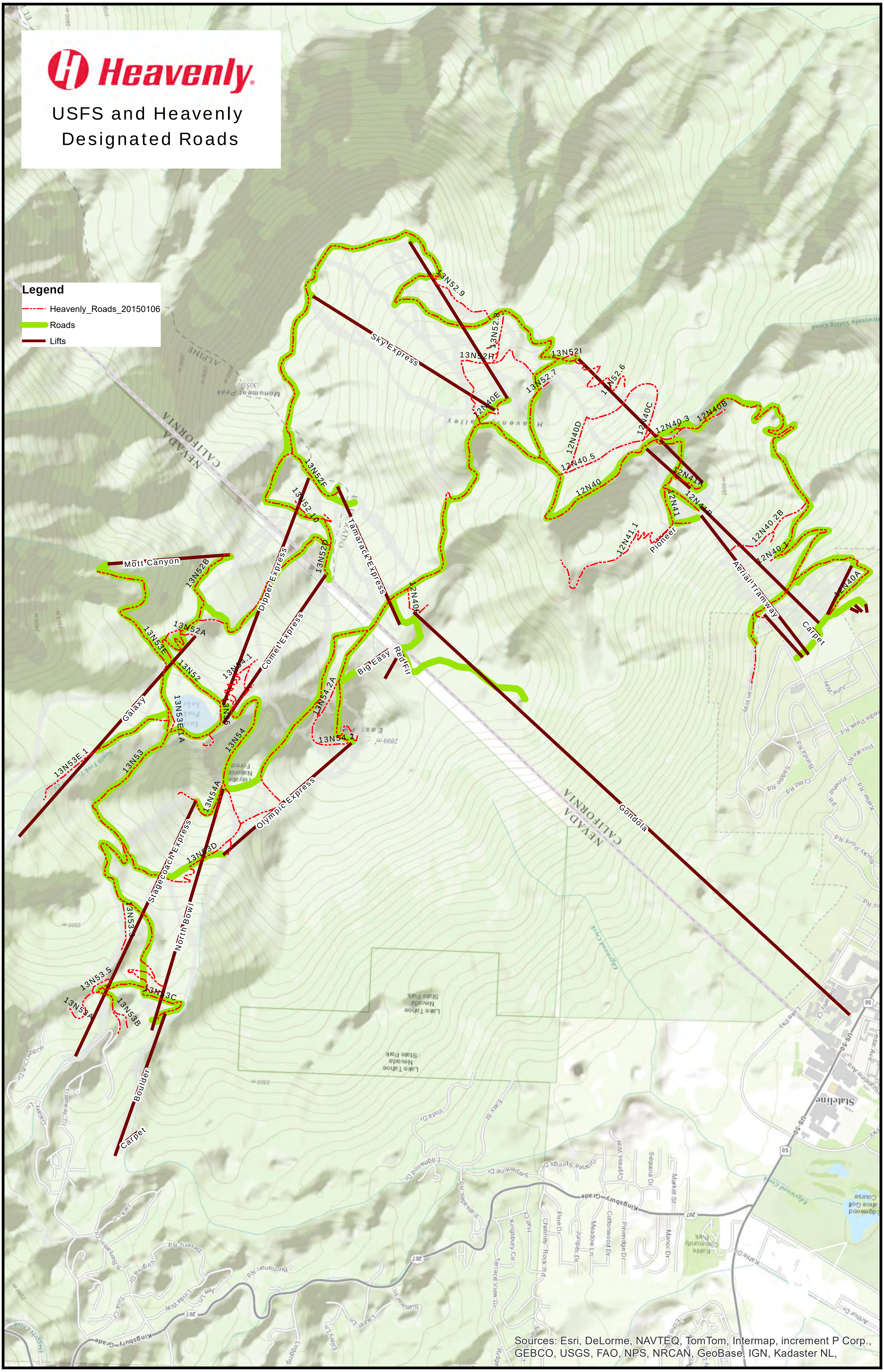
Blair Davidson
Mountain Operations | Senior Administrative Assistant
Heavenly Mountain Resort
Cell: (949)887-7812 (**try first)* | Office: (530)542-5194 | Internal: x6269
Office Hours: Monday - Friday 7:30am – 4:00pm

Summer 2021

Road Section	Road	Distance	Treatment
NV			
NV Gate to Titos Corner	13N53B	0.1	Water Bar Maintenance & Road Base where needed
Titos	13N53.5	0.2	Water Bar Maintenance & Road Base where needed- NVE Tree Maintenance
Chute to Midway Switchbacks	13N53	0.4	Water Bar Maintenance & Road Base where needed- NVE Tree Maintenance
*Titos to base of NB	13N53C	0.3	Inspect, minor maintenance- no road base needed
Stage switchbacks	13N53	0.6	Water Bar Maintenance & Road Base where needed- NVE Tree Maintenance
NV Trail Stage to EP	13N53	0.8	Water Bar Maintenance & Road Base where needed- NVE Tree Maintenance
Pepis/Comet to base EP to top NB	13N54	0.5	Water Bar Maintenance & Road Base where needed
T7 Road	13N54	0.2	Inspect, minor maintenance- no road base needed- NVE Powerline project
Steve's & Crossover	13N54	0.9	Inspect, minor maintenance- no road base needed- NVE Powerline project
Power Station Road	13N53A	0.4	Inspect, minor maintenance- no road base needed
Galaxy	13N53E.1	1.2	Water Bar Maintenance & Road Base/Drain Rock where needed
Orion's	13N52B	0.6	Water Bar Maintenance & Road Base where needed
Top of Dipper Road	13N52F	0.2	Water Bar Maintenance & Road Base
Total		6.4	
CA			
Groove RD to Upper Shop	12N41	0.6	Water Bar Maintenance, Sed pond cleanout & Road Base where needed
Maggies- Creek to Cal Dam	12N40	0.9	Water Bar Maintenance, Sed pond cleanout & Road Base where needed
Cal Dam to Sky Deck	12N40	0.3	Inspect, minor maintenance- no road base needed
Hellwinkle's	12N40	0.4	BMPs, Road Base, compaction and water
LCT to VS/TOG	12N40	1.4	Water Bar Maintenance & Road Base where needed
TOG Tam to Coaster	12N40.5	0.2	Compaction of walking trails. Water Bar @ Tube hill
Upper CA- Ridge	13N52	1.2	Water Bar Maintenance, Grade work & Road Base
Upper CA Switchbacks	13N52i	0.33	Grade, compaction and BMPs (Woods Trail to Upper Ridge Run)
Roundabout			
Top WC-Pistol	12N40	0.7	Water Bar Maintenance & Road Base where needed
Pistol-Cut	12N40	1.1	Water Bar Maintenance & Road Base where needed
Cut-Creek	12N40	0.5	Water Bar Maintenance & Road Base where needed, V-ditch cleanout
Total		7.63	

	ML4
Roads Improved	0
Roads Maintained	14.03
Roads Decommissioned	0

USFS and Heavenly Designated Roads



Heavenly Mountain Resort
Water Years 2017–2021

APPENDIX G

WATER YEAR 2021, 4TH QUARTER LABORATORY ANALYSIS

Appendix G
Water Year 2021, 4th Quarter Laboratory Analysis

G.1 Laboratory Analytical Report – Excelchem Laboratories, Inc. (4th Quarter)

G.2 Laboratory Analytical Report – High Sierra (4th Quarter)

G.3 Laboratory Analytical Report – WET Lab (Filter Vault 3rd Quarter Amended Report)

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EXCELCHEM
Laboratories, Inc.
A Silver State Analytical Company
1135 W Sunset Boulevard
Suite A
Rocklin, CA 95765
Phone# 916-543-4445
Fax# 916-543-4449

ELAP Certificate No. : 2119

29 July 2021

Michelle Hochrein

Cardno

5496 Reno Corporate Drive

Reno, NV 89511

RE: Heavenly

Work order number:2107097

Enclosed are the results of analyses for samples received by the laboratory on 07/15/21 12:54. All Quality Control results are within acceptable limits except where noted as a case narrative. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

Joshua Cox, Lab Director

Excelchem Laboratories, Inc.

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E320404110	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	07/29/21 08:30

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
HDVC-5	2107097-01	Water	07/13/21 10:30	07/15/21 12:54
HVC-3	2107097-02	Water	07/13/21 11:20	07/15/21 12:54
HVC-2	2107097-03	Water	07/13/21 13:00	07/15/21 12:54
HVC-1a	2107097-04	Water	07/13/21 13:15	07/15/21 12:54
BPC-4	2107097-05	Water	07/13/21 12:10	07/15/21 12:54

Excelchem Laboratories. Inc.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E320404110	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	07/29/21 08:30

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E320404110	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	07/29/21 08:30

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Notes and Definitions

ND	Analyte not detected at reporting limit.
NR	Not reported

Excelchem Laboratories, Inc.

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E320404110	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	07/29/21 08:30

Excelchem Laboratories, Inc
1135 W. Sunset Blvd. Suite A
Rocklin, CA 95765
Ph: 916-543-4445 Fx: 916-543-4449

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: Michelle Hochrein
Phone #: 775-828-4362
Fax#: /
Company/Address: 5496 Reno Corporate Drive Reno, NV 89511
Project Number/P.O.#: E320404110
Billing Address: Same
Project Location: Heavenly
Project Name: Heavenly
Sampler Name and Signature: MH, JB

Electronic Data Deliverables Request:
- [x] PDF/Standard Report
- [ ] EDD
- [ ] Geotracker (Global ID) ______
- [ ] Other (please specify) ______

Email Address: michelle.hochrein@cardno.com chris.donley@cardno.com

ANALYSIS REQUEST Page 1 of 1

Sample ID	Sampling Date	Sampling Time	VOA	SLEEVE	GLASS	PLASTIC	ACID	ICE	NONE/OTHER	WATER	SOIL	AIR	Chloride	Requested TAT
HDVC-5	7/13/21	10:30				X		X		X			X	
HVC-3	↓	11:20				X		X		X			X	
HVC-2	↓	13:00				X		X		X			X	
HVC-1a	↓	13:15				X		X		X			X	
BPC-4	↓	12:10				X		X		X			X	

LAB USE ONLY: Bin# Due Date: Work Order:

2107097
BIN $SAL Veggs

Relinquished by: (sign and print)	Date	Time	Received by: (sign and print)
Michelle Hochrein	7/13/21	3pm	

Relinquished by: (sign and print)	Date	Time	Received by Laboratory: (sign and print)
	7/15/21	12:54	Excelchem Kate Albertson

Remarks/Notes:

Excelchem Laboratories. Inc.

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E320404110	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	07/29/21 08:30

Sample Integrity

WORK ORDER: 2107097

Date Received: 7/15/21

Company Name: Cardno
New Client: Y N

Section 1 – Sample Arrival Information

Sample Transport: ONTRAC UPS USPS Walk-In EXCELCHEM Courier Fed-Ex Other:

Transported In: Ice Chest Box Hand

Packing materials: Bubble Wrap Foam Packing Peanuts Paper Other:

Has chilling process begun? Y N **Samples Received:** Chilled to Touch / Ambient / On Ice

Temperature of Samples (°C): 25.2 **Ice Chest Temperature(s) (°C):** 24.0

Section 2 – Bottle/Analysis Info.

	Yes	No	N/A	Comments
Did all bottles arrive unbroken and intact?	X			
Did all bottle labels agree with COC?	X			
Were correct containers used for the tests requested?	X			
Were correct preservations used for the tests requested?	X			
Was a sufficient amount of sample sent for tests indicated?	X			
Were bubbles present in VOA Vials?: **(Volatile Methods Only)**			X	
Is there head space in the VOA vials? **(Volatile Methods Only)**			X	

Section 3– COC Information

	Yes	No	Comments		Yes	No
COC Received	X			Analysis Requested	X	
Date Sampled	X			Samples arrived within holding time	X	
Time Sampled	X			Hold times less than 72 hours		X
Sample ID	X			Client Name	X	
Rush Turn Around Time		X		Client Contact Information	X	

SHORT HOLD LIST (<72 hours)

pH	Chlorine	Corrosivity	Coliform	Dissolved Oxygen	Odor	Nitrate	Nitrite	Ortho-phosphate
MB As	Asbestos	Settable Solids	Turbidity	Biochemical Oxygen Demand	HPC	Color	Tedlars	Ammonia/TKN (unpreserved)

Section 4 – Comments / Discrepancies

Client notified of discrepancies: Yes / No **Notified by:**

Comments:

Bin Number/ Location:	SSAL Vegas
COC Scanned/Attached by:	SV
Samples labeled by:	SV
Sample labels reviewed by:	SV

Filled out by: Kate Albertson

Date: 7/15/21
Time: 12:55

Sierra Environmental Monitoring

July 28, 2021

Joe Trapasso
Excelchem Laboratories, Inc.
1135 W. Sunset Blvd. Suite A
Rocklin, CA 95765

Lab ID:

☒ Las Vegas, NV (NV930, CA3029)

☐ Reno, NV (NV015, CA2990)

Project: 2107097

Workorder No.: 21070906

Dear Joe Trapasso:

Silver State Labs-Las Vegas received 5 sample(s) on 7/20/2021 for the analyses presented in the following report.

There were no problems with the analytical events associated with this report unless noted below. Analytical results reported as non-detect (ND) in the result field are below the Practical Quantification Limit (PQL). Analytical results above the PQL are reported as the measured value in the results field.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

David J. Frohnen

David Frohnen, PE
President
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

Analytical Report

WO#: **21070906**
Date Reported: **7/28/2021**

CLIENT:	Excelchem Laboratories, Inc.	**Collection Date:**	7/13/2021 10:30:00 AM
Project:	2107097		
Lab ID:	21070906-01	**Matrix:**	WATER
Client Sample ID:	HDVC-5		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ANIONS-CWA (CL, F, NO2, NO3, SO4)				**EPA 300.0**		Analyst: **DB**
Chloride	0.197	0.100		mg/L	1	7/21/2021 2:38:00 AM

Qualifiers: (Qual)

DF	Dilution Factor.	H	Holding times for preparation or analysis exceeded.
MCL	Maximum Contaminant Level.	ND	Not Detected at the PQL.
PQL	Practical Quantitation Limit.		

Original

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

Analytical Report

WO#: **21070906**
Date Reported: **7/28/2021**

CLIENT:	Excelchem Laboratories, Inc.	**Collection Date:**	7/13/2021 11:20:00 AM
Project:	2107097		
Lab ID:	21070906-02	**Matrix:**	WATER
Client Sample ID:	HVC-3		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ANIONS-CWA (CL, F, NO2, NO3, SO4)				**EPA 300.0**		Analyst: **DB**
Chloride	1.07	0.100		mg/L	1	7/21/2021 2:59:00 AM

Qualifiers: (Qual)

DF	Dilution Factor.	H	Holding times for preparation or analysis exceeded.
MCL	Maximum Contaminant Level.	ND	Not Detected at the PQL.
PQL	Practical Quantitation Limit.		

Original

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

Analytical Report

WO#: **21070906**
Date Reported: **7/28/2021**

CLIENT:	Excelchem Laboratories, Inc.	**Collection Date:**	7/13/2021 1:00:00 PM
Project:	2107097		
Lab ID:	21070906-03	**Matrix:**	WATER
Client Sample ID:	HVC-2		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ANIONS-CWA (CL, F, NO2, NO3, SO4)				**EPA 300.0**		Analyst: **DB**
Chloride	1.19	0.100		mg/L	1	7/21/2021 3:20:00 AM

Qualifiers: (Qual)

DF	Dilution Factor.	H	Holding times for preparation or analysis exceeded.
MCL	Maximum Contaminant Level.	ND	Not Detected at the PQL.
PQL	Practical Quantitation Limit.		

Original

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

Analytical Report

WO#: **21070906**
Date Reported: **7/28/2021**

CLIENT: Excelchem Laboratories, Inc.
Collection Date: 7/13/2021 1:15:00 PM
Project: 2107097
Lab ID: 21070906-04
Matrix: WATER
Client Sample ID: HVC-1a

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ANIONS-CWA (CL, F, NO2, NO3, SO4)				**EPA 300.0**		Analyst: **DB**
Chloride	0.644	0.100		mg/L	1	7/21/2021 3:41:00 AM

Qualifiers: (Qual)

DF Dilution Factor.
MCL Maximum Contaminant Level.
PQL Practical Quantitation Limit.
H Holding times for preparation or analysis exceeded.
ND Not Detected at the PQL.

Original

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

Analytical Report

WO#: **21070906**
Date Reported: **7/28/2021**

CLIENT: Excelchem Laboratories, Inc. **Collection Date:** 7/13/2021 12:10:00 PM
Project: 2107097
Lab ID: 21070906-05 **Matrix:** WATER
Client Sample ID: BPC-4

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ANIONS-CWA (CL, F, NO2, NO3, SO4)				**EPA 300.0**		Analyst: **DB**
Chloride	31.0	0.100		mg/L	1	7/21/2021 4:02:00 AM

Qualifiers: (Qual)
DF Dilution Factor.
MCL Maximum Contaminant Level.
PQL Practical Quantitation Limit.
H Holding times for preparation or analysis exceeded.
ND Not Detected at the PQL.

Original

Excelchem

1135 W. Sunset Blvd. Suite A
Rocklin, CA 95765
Ph: 916-543-4445 Fx: 916-543-4449

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: Joe Trapasso
Phone #: See above
Company/Address: See above
Fax #: See above
Project Number/P.O#: 2107097
Project Name: 2107097
Project Location: Rocklin, CA
Sampler Signature:

Electronic Data Deliverables Request:
- [X] .PDF
- [ ] Geotracker (Global ID) ______
- [ ] Other (please specify) ______

Email Address: JoeT@excelchem.net
Please Invoice To: Finance@excelchem.net

ANALYSIS REQUEST — Page ___ of ___

Bin#:
Due Date:
Work Order:

Sample ID 21070906-XA	Sampling Date	Sampling Time	VOA Clear	jar 4 oz	Amber 1 ltr	poly	HCl	HNO3	ICE/NONE	Na2S2O3	Drinking Water	WATER	SOIL	LL Chloride	DUE:	LAB USE ONLY:
HDVC-5 1A	7/13/2021	10:30				X			X			X		X	x	
HVC-3 2A	7/13/2021	11:20				X			X			X		X	x	
HVC-2 3A	7/13/2021	13:00				X			X			X		X	x	
HVC-1a 4A	7/13/2021	13:15				X			X			X		X	x	
BPC-4 5A	7/13/2021	12:10				X			X			X		X	x	

Relinquished by: Excel Chem — Date: 7/14/21 16:4 — Received by:
Relinquished by: — Date: — Received by Laboratory: 7/20 1420

Remarks/Condition of Sample: SSAL Vegas

Bill To:

EXCELCHEM
Laboratories, Inc.

A Silver State Analytical Company

1135 W Sunset Boulevard
Suite A
Rocklin, CA 95765
Phone# 916-543-4445
Fax# 916-543-4449

ELAP Certificate No. : 2119

05 October 2021

Michelle Hochrein

Cardno

5496 Reno Corporate Drive

Reno, NV 89511

RE: Heavenly

Work order number:2109142

Enclosed are the results of analyses for samples received by the laboratory on 09/22/21 12:45. All Quality Control results are within acceptable limits except where noted as a case narrative. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

Joshua Cox, Lab Director

Excelchem Laboratories, Inc.

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E32140300	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	10/05/21 10:10

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
HVC-2	2109142-01	Water	09/20/21 11:30	09/22/21 12:45
HVC-1A	2109142-02	Water	09/20/21 11:50	09/22/21 12:45
BPC-4	2109142-03	Water	09/20/21 13:25	09/22/21 12:45

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E32140300	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	10/05/21 10:10

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E32140300	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	10/05/21 10:10

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E32140300	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	10/05/21 10:10

Notes and Definitions

ND Analyte not detected at reporting limit.

NR Not reported

Excelchem Laboratories, Inc.

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E32140300	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	10/05/21 10:10

Excelchem Laboratories, Inc
1135 W. Sunset Blvd. Suite A
Rocklin, CA 95765
Ph: 916-543-4445 Fx: 916-543-4449

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: MICHELLE HOCHREIN
Phone #: 775-828-[illegible]
Fax#: /
Company/Address: 5496 RENO CORPORATE DRIVE RENO, NV 89511
Project Number/P.O.#: E32140300
Billing Address: SAME AS ABOVE
Project Location: HEAVENLY
Project Name: HEAVENLY
Sampler Name and Signature: PJ SB

Electronic Data Deliverables Request:
- [X] PDF/Standard Report
- [X] EDD
- [ ] Geotracker (Global ID) ______
- [ ] Other (please specify) ______

Email Address: michelle.hochrein@cardno.com, chris.donley@cardno.com

ANALYSIS REQUEST — Page 1 of 1

Sample ID	Sampling Date	Sampling Time	VOA	SLEEVE	GLASS	PLASTIC	ACID	ICE	NONE/OTHER	WATER	SOIL	AIR	CHLORIDE
HVC-2	9-20-21	11:30				X		X		X			X
HVC-1A	9-20-21	11:50				X		X		X			X
APC-4	9-20-21	13:25				X		X		X			X

Requested TAT:

LAB USE ONLY: Bin#: Due Date: Work Order:

2109142

Relinquished by: (sign and print)	Date	Time	Received by: (sign and print)
Parker Johnson	9-20-21	153	Fed Ex
Fed Ex	9/22/21	12:45	Received by Laboratory: (sign and print) Excel chem

Remarks/Notes:

Excelchem Laboratories. Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Laboratory Representative

Excelchem Laboratories, Inc.

Cardno	Project:	Heavenly	
5496 Reno Corporate Drive	Project Number:	E32140300	Date Reported:
Reno, NV 89511	Project Manager:	Michelle Hochrein	10/05/21 10:10

Sample Integrity

WORK ORDER: 2109142

Date Received: 9/22/21

Company Name: Cardno
New Client: Y N

Section 1 – Sample Arrival Information

Sample Transport: ONTRAC UPS USPS Walk-In EXCELCHEM Courier Fed-Ex Other:

Transported In: Ice Chest Box Hand

Packing materials: Bubble Wrap Foam Packing Peanuts Paper Other:

Has chilling process begun? Y N **Samples Received:** Chilled to Touch / Ambient / On Ice

Temperature of Samples (°C): 9.6 **Ice Chest Temperature(s) (°C):** 11.0

Section 2 – Bottle/Analysis Info.

	Yes	No	N/A	Comments
Did all bottles arrive unbroken and intact?	X			
Did all bottle labels agree with COC?	X			
Were correct containers used for the tests requested?	X			
Were correct preservations used for the tests requested?	X			
Was a sufficient amount of sample sent for tests indicated?	X			
Were bubbles present in VOA Vials?: **(Volatile Methods Only)**			X	
Is there head space in the VOA vials? **(Volatile Methods Only)**			X	

Section 3– COC Information

	Yes	No	Comments		Yes	No
COC Received	X			Analysis Requested	X	
Date Sampled	X			Samples arrived within holding time	X	
Time Sampled	X			Hold times less than 72 hours		X
Sample ID	X			Client Name	X	
Rush Turn Around Time		X		Client Contact Information	X	

SHORT HOLD LIST (<72 hours)

pH	Chlorine	Corrosivity	Coliform	Dissolved Oxygen	Odor	Nitrate	Nitrite	Ortho-phosphate
MB As	Asbestos	Settable Solids	Turbidity	Biochemical Oxygen Demand	HPC	Color	Tedlars	Ammonia/TKN (unpreserved)

Section 4 – Comments / Discrepancies

Client notified of discrepancies: Yes / No **Notified by:**

Comments:

Bin Number/ Location:	SUB
COC Scanned/Attached by:	PC
Samples labeled by:	PC
Sample labels reviewed by:	PC

Filled out by: Patrick Clark

Date: 9/22/21
Time: 12:50

Sierra Environmental Monitoring

September 28, 2021

Joe Trapasso
Excelchem Laboratories, Inc.
1135 W. Sunset Blvd. Suite A
Rocklin, CA 95765

Lab ID:

☒ Las Vegas, NV (NV930, CA3029)

☐ Reno, NV (NV015, CA2990)

Project: 2109142

Workorder No.: 21091109

Dear Joe Trapasso:

Silver State Labs-Las Vegas received 3 sample(s) on 9/23/2021 for the analyses presented in the following report.

There were no problems with the analytical events associated with this report unless noted below. Analytical results reported as non-detect (ND) in the result field are below the Practical Quantification Limit (PQL). Analytical results above the PQL are reported as the measured value in the results field.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Michael Mitchell

Michael Mitchell
Laboratory Director
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

Analytical Report

WO#: **21091109**
Date Reported: **9/28/2021**

CLIENT:	Excelchem Laboratories, Inc.	**Collection Date:**	9/20/2021 11:30:00 AM
Project:	2109142		
Lab ID:	21091109-01	**Matrix:**	WATER
Client Sample ID	HVC-2		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ANIONS-CWA (CL, F, NO2, NO3, SO4)				**EPA 300.0**		Analyst: **DB**
Chloride	1.35	0.100		mg/L	1	9/25/2021 6:41:00 AM

Qualifiers: (Qual)

*	Value exceeds Maximum Contaminant Level.	DF	Dilution Factor.
H	Holding times for preparation or analysis exceeded.	MCL	Maximum Contaminant Level.
ND	Not Detected at the PQL.	PQL	Practical Quantitation Limit.

Original

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

Analytical Report

WO#: **21091109**
Date Reported: **9/28/2021**

CLIENT:	Excelchem Laboratories, Inc.	**Collection Date:**	9/20/2021 11:50:00 AM
Project:	2109142		
Lab ID:	21091109-02	**Matrix:**	WATER
Client Sample ID	HVC-1A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ANIONS-CWA (CL, F, NO2, NO3, SO4)				**EPA 300.0**		Analyst: **DB**
Chloride	0.452	0.100		mg/L	1	9/25/2021 8:04:00 AM

Qualifiers: (Qual)

*	Value exceeds Maximum Contaminant Level.	DF	Dilution Factor.
H	Holding times for preparation or analysis exceeded.	MCL	Maximum Contaminant Level.
ND	Not Detected at the PQL.	PQL	Practical Quantitation Limit.

Original

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

Analytical Report

WO#: **21091109**
Date Reported: **9/28/2021**

CLIENT: Excelchem Laboratories, Inc. **Collection Date:** 9/20/2021 1:25:00 PM
Project: 2109142
Lab ID: 21091109-03 **Matrix:** WATER
Client Sample ID BPC-4

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ANIONS-CWA (CL, F, NO2, NO3, SO4)				**EPA 300.0**		Analyst: **DB**
Chloride	27.2	0.100		mg/L	1	9/25/2021 8:25:00 AM

Qualifiers: (Qual)

*	Value exceeds Maximum Contaminant Level.	DF	Dilution Factor.
H	Holding times for preparation or analysis exceeded.	MCL	Maximum Contaminant Level.
ND	Not Detected at the PQL.	PQL	Practical Quantitation Limit.

Original

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

QC SUMMARY REPORT

WO#: **21091109**
28-Sep-21

Client: Excelchem Laboratories, Inc.
Project: 2109142
TestCode: ANIONS-CWA

Sample ID: ICB 210924-1	SampType: ICB	TestCode: ANIONS-CWA	Units: mg/L	Prep Date: 9/24/2021	RunNo: 58531					
Client ID: ICB	Batch ID: R58531	TestNo: E300.0		Analysis Date: 9/24/2021	SeqNo: 1421199					
Analyte	**Result**	**PQL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**RPD Ref Val**	**%RPD**	**RPDLimit**	**Qual**
Chloride	ND	0.100									

Sample ID: ICV 210924-1 5 ppm	SampType: ICV	TestCode: ANIONS-CWA	Units: mg/L	Prep Date: 9/24/2021	RunNo: 58531						
Client ID: ICV	Batch ID: R58531	TestNo: E300.0		Analysis Date: 9/24/2021	SeqNo: 1421200						
Analyte	**Result**	**PQL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**RPD Ref Val**	**%RPD**	**RPDLimit**	**Qual**
Chloride	5.20	0.100	5.000	0	104	90	110				

Sample ID: MB 210924-1	SampType: MBLK	TestCode: ANIONS-CWA	Units: mg/L	Prep Date: 9/24/2021	RunNo: 58531						
Client ID: PBW	Batch ID: R58531	TestNo: E300.0		Analysis Date: 9/24/2021	SeqNo: 1421201						
Analyte	**Result**	**PQL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**RPD Ref Val**	**%RPD**	**RPDLimit**	**Qual**
Chloride	ND	0.100									

Sample ID: LCS 210924-1 5 ppm	SampType: LCS	TestCode: ANIONS-CWA	Units: mg/L	Prep Date: 9/24/2021	RunNo: 58531						
Client ID: LCSW	Batch ID: R58531	TestNo: E300.0		Analysis Date: 9/24/2021	SeqNo: 1421202						
Analyte	**Result**	**PQL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**RPD Ref Val**	**%RPD**	**RPDLimit**	**Qual**
Chloride	5.07	0.100	5.000	0	101	90	110				

Qualifiers:
* Value exceeds Maximum Contaminant Level.
ND Not Detected at the PQL.
H Holding times for preparation or analysis exceeded.
MCL Maximum Contaminant Level.

Original

Silver State Labs-Las Vegas
3626 E. Sunset Road, Suite 100
Las Vegas, NV 89120
(702) 873-4478 FAX: (702) 873-7967
www.ssalabs.com

QC SUMMARY REPORT

WO#: **21091109**

28-Sep-21

Client: Excelchem Laboratories, Inc.

Project: 2109142

TestCode: ANIONS-CWA

Sample ID: **LCS 210924-1 5 ppm** SampType: **LCS** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/24/2021** RunNo: **58531**

Client ID: **LCSW** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/24/2021** SeqNo: **1421202**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID: **21091135-01BDUP** SampType: **DUP** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/24/2021** RunNo: **58531**

Client ID: **BatchQC** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/24/2021** SeqNo: **1421204**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	303	0.100						302.3	0.117	10	

Sample ID: **21091135-01BMS** SampType: **MS** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/24/2021** RunNo: **58531**

Client ID: **BatchQC** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/24/2021** SeqNo: **1421205**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	304	0.100	5.000	302.3	40.4	90	110				S

Sample ID: **CCV-210924-1 5 ppm** SampType: **CCV** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/24/2021** RunNo: **58531**

Client ID: **CCV** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/24/2021** SeqNo: **1421215**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	5.08	0.100	5.000	0	102	90	110				

Qualifiers: * Value exceeds Maximum Contaminant Level. H Holding times for preparation or analysis exceeded. MCL Maximum Contaminant Level.
ND Not Detected at the PQL.

Original

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www.ssalabs.com

QC SUMMARY REPORT

WO#: **21091109**
28-Sep-21

Client: Excelchem Laboratories, Inc.
Project: 2109142
TestCode: **ANIONS-CWA**

Sample ID: **CCB-210924-1** SampType: **CCB** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/24/2021** RunNo: **58531**
Client ID: **CCB** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/24/2021** SeqNo: **1421216**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	ND	0.100									

Sample ID: **21091188-01B DUP** SampType: **DUP** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/24/2021** RunNo: **58531**
Client ID: **BatchQC** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/24/2021** SeqNo: **1421218**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	13.5	0.100						13.51	0.219	10	

Sample ID: **21091188-01B MS** SampType: **MS** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/24/2021** RunNo: **58531**
Client ID: **BatchQC** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/24/2021** SeqNo: **1421219**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	18.4	0.100	5.000	13.51	98.0	90	110				

Sample ID: **CCV-210924-1 5 ppm** SampType: **CCV** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/25/2021** RunNo: **58531**
Client ID: **CCV** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/25/2021** SeqNo: **1421229**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	5.04	0.100	5.000	0	101	90	110				

Qualifiers:
* Value exceeds Maximum Contaminant Level.
H Holding times for preparation or analysis exceeded.
MCL Maximum Contaminant Level.
ND Not Detected at the PQL.

Original

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QC SUMMARY REPORT

WO#: **21091109**

28-Sep-21

Client: Excelchem Laboratories, Inc.

Project: 2109142

TestCode: ANIONS-CWA

Sample ID: **CCV-210924-1 5 ppm** SampType: **CCV** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/25/2021** RunNo: **58531**
Client ID: **CCV** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/25/2021** SeqNo: **1421229**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual

Sample ID: **CCB-210924-1** SampType: **CCB** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/25/2021** RunNo: **58531**
Client ID: **CCB** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/25/2021** SeqNo: **1421230**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	ND	0.100									

Sample ID: **CCV-210924-1 5 ppm** SampType: **CCV** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/25/2021** RunNo: **58531**
Client ID: **CCV** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/25/2021** SeqNo: **1421244**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	5.09	0.100	5.000	0	102	90	110				

Sample ID: **CCB-210924-1** SampType: **CCB** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/25/2021** RunNo: **58531**
Client ID: **CCB** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/25/2021** SeqNo: **1421245**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	ND	0.100									

Qualifiers:
* Value exceeds Maximum Contaminant Level.
H Holding times for preparation or analysis exceeded.
MCL Maximum Contaminant Level.
ND Not Detected at the PQL.

Original

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QC SUMMARY REPORT

WO#: **21091109**

28-Sep-21

Client: Excelchem Laboratories, Inc.

Project: 2109142

TestCode: ANIONS-CWA

Sample ID: **CCV-210924-1 5 ppm** SampType: **CCV** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/25/2021** RunNo: **58531**

Client ID: **CCV** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/25/2021** SeqNo: **1421249**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	5.09	0.100	5.000	0	102	90	110				

Sample ID: **CCB-210924-1** SampType: **CCB** TestCode: **ANIONS-CWA** Units: **mg/L** Prep Date: **9/25/2021** RunNo: **58531**

Client ID: **CCB** Batch ID: **R58531** TestNo: **E300.0** Analysis Date: **9/25/2021** SeqNo: **1421250**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	ND	0.100									

Qualifiers:
* Value exceeds Maximum Contaminant Level.
ND Not Detected at the PQL.
H Holding times for preparation or analysis exceeded.
MCL Maximum Contaminant Level.

Original

Excelchem

1135 W. Sunset Blvd. Suite A
Rocklin, CA 95765
Ph: 916-543-4445 Fx: 916-543-4449

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: Joe Trapasso | Phone #: See above

Company/Address: See above | Fax #: See above

Project Number/P.O#: 2109142 | Project Name: 2109142

Project Location: Rocklin, CA | Sampler Signature:

Electronic Data Deliverables Request:
- [X] .PDF
- [ ] Geotracker (Global ID) ____
- [ ] Other (please specify) ____

Email Address: JoeT@excelchem.net

Please Invoice To: Finance@excelchem.net

ANALYSIS REQUEST

Page ___ of ___

Bin#:

Due Date:

Work Order:

Sample ID 2109109-	Sampling Date	Sampling Time	Container: VOA Clear	Container: jar 4 oz	Container: Amber 1 ltr	Container: poly	Method Preserved: HCl	Method Preserved: HNO3	Method Preserved: ICE/NONE	Method Preserved: Na2S2O3	Matrix: Drinking Water	Matrix: WATER	Matrix: SOIL	LL Chloride	DUE: STANDARD	LAB USE ONLY:
HVC-2 1A	9/20/2021	11:30				X			X			X		X	x	
HVC-1A 2A	9/20/2021	11:50				X			X			X		X	x	
BPC-4 3A	9/20/2021	13:25				X			X			X		X	x	

Relinquished by: Excel Chem	Date: 9/22/21 1600	Received by:	Remarks/Condition of Sample: SSAL Vegas
Relinquished by:	Date	Received by Laboratory: 9/23 1100	Bill To:

ANALYSIS REPORT

Client: Cardno - Heavenly Water Quality Sampling
295 Highway 50, Suite 1
PO Box 1533
Zephyr Cove, NV 89448
(775) 588-9069
E-mail: chris.donley@cardno.com

Lab: High Sierra Water Lab
Collin Strasenburgh
PO Box 64
Oakland, OR 97462
Phone (530) 205-7720
E-mail: collin@highsierrawaterlab.com

Report Date: 7/13/2021 (file name: HV071321.xls)

Site	ID	Date	Time	NO3/NO2-N (ppb)	SRP-P (ppb)	DP-P (ppb)	TP-P (ppb)	TKN (ppb)	TSS (mg/L)	Cond (µs/cm)	Turbidity (ntu)
Sky Meadows	HVC-1a	7/13/21	13:15	14			24	111	3.5		1.94
Below Patsy's	HVC-2	7/13/21	13:00	46			21	78	1.0		0.40
Property Line	HVC-3	7/13/21	11:20	2			25	57	1.0		0.53
Hidden Valley Creek	HDVC-5	7/13/21	10:30	-			-	-	-		-
Bijou Park Creek	BPC-4	7/13/21	12:10	390			90	171	6.5		15.5
Edgewood Below	HVE-2	7/13/21	14:25	99	7	19	60	213	10	144.1	6.66

ANALYSIS REPORT

Client:	**Cardno - Heavenly Water Quality Sampling**	**Lab:**	**High Sierra Water Lab**
	295 Highway 50, Suite 1		**Collin Strasenburgh**
	PO Box 1533		**PO Box 64**
	Zephyr Cove, NV 89448		**Oakland, OR 97462**
	(775) 588-9069		**Phone (530) 205-7720**
			E-mail: collin@highsierrawaterlab.com
	E-mail: chris.donley@cardno.com		

Report Date: 9/20/2021 (file name: HV092021.xls)

Site	ID	Date	Time	NO3/NO2-N	SRP-P	DP-P	TP-P	TKN	TSS	Cond	Turbidity
				(ppb)	(ppb)	(ppb)	(ppb)	(ppb)	(mg/L)	(µs/cm)	(ntu)
Sky Meadows	HVC-1a	9/20/21	11:50	3			43	104	8.5		11.7
Below Patsy's	HVC-2	9/20/21	11:30	8			127	392	29.5		28.1
Bijou Park Creek	BPC-4	9/20/21	12:45	199			171	239	20.0		21.6
Edgewood Below	HVE-2	9/20/21	13:25	32	11	13	66	356	26	142	18.5

12/20/2021

Cardno
PO Box 1533
Zephyr Cove, NV 89448
Attn: Parker Johnson

OrderID: *21060889*
Amended

Dear: Parker Johnson

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, online edition, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WETLAB-Western Environmental Testing Laboratory in good condition on 6/25/2021. Additional comments are located on page 2 of this report.

This report has been generated to amend the result for the Total Nitrogen calculation and the date of analysis for Total Kjeldahl Nitrogen for sample 21060889-003. If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Cory Baker
QA Specialist

Mckenna Oh
Project Manager

MckennaO@wetlaboratory.com
(775) 200-9876

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LAS VEGAS
3230 Polaris Ave. Suite 4
Las Vegas, Nevada 89102
tel (702) 475-8899
fax (702) 622-2868
EPA LAB ID: NV00932

Western Environmental Testing Laboratory
Report Comments

Cardno - 21060889   Amended

Specific Report Comments

None

Report Legend

B	--	The analysis of the method blank revealed concentrations of the target analyte above the reporting limit. The client results were greater than ten times the blank amount or non-detect; therefore, the data was not impacted.
D	--	Due to the sample matrix dilution was required in order to properly detect and report the analyte. The reporting limit has been adjusted accordingly.
HT	--	Sample analyzed beyond the accepted holding time
J	--	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit. The reported result should be considered an estimate.
K	--	The TPH Diesel Concentration reported here likely includes some heavier TPH Oil hydrocarbons reported in the TPH Diesel range as per EPA 8015.
L	--	The TPH Oil Concentration reported here likely includes some lighter TPH Diesel hydrocarbons reported in the TPH Oil range as per EPA 8015.
M	--	The matrix spike/matrix spike duplicate (MS/MSD) values for the analysis of this parameter were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate.
N	--	There was insufficient sample available to perform a spike and/or duplicate on this analytical batch.
NC	--	Not calculated due to matrix interference
QD	--	The sample duplicate or matrix spike duplicate analysis demonstrated sample imprecision. The reported result should be considered an estimate.
QL	--	The result for the laboratory control sample (LCS) was outside WETLAB acceptance criteria and reanalysis was not possible. The reported data should be considered an estimate.
S	--	Surrogate recovery was outside of laboratory acceptance limits due to matrix interference. The associated blank and LCS surrogate recovery was within acceptance limits
SC	--	Spike recovery not calculated. Sample concentration >4X the spike amount; therefore, the spike could not be adequately recovered
U	--	The analyte was analyzed for, but was not detected above the level of the reported sample reporting/quantitation limit. The reported result should be considered an estimate.

General Lab Comments

Per method recommendation (section 4.4), Samples analyzed by methods EPA 300.0 and EPA 300.1 have been filtered prior to analysis.

The following is an interpretation of the results from EPA method 9223B:
A result of zero (0) indicates absence for both coliform and Escherichia coli meaning the water meets the microbiological requirements of the U.S. EPA Safe Drinking Water Act (SDWA). A result of one (1) for either test indicates presence and the water does not meet the SDWA requirements. Waters with positive tests should be disinfected by a certified water treatment operator and retested.

Per federal regulation the holding time for the following parameters in aqueous/water samples is 15 minutes: Residual Chlorine, pH, Dissolved Oxygen, Sulfite.

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Las Vegas, Nevada 89102
tel (702) 475-8899
fax (702) 622-2868
EPA LAB ID: NV00932

Western Environmental Testing Laboratory
Analytical Report

Cardno
PO Box 1533
Zephyr Cove, NV 89448
Attn: Parker Johnson
Phone: (775) 588-9069 **Fax:** (775) 588-9219
PO\Project: *Heavenly*

Date Printed: 12/20/2021
OrderID: *21060889*
Amended

Customer Sample ID: HVP-1A (NORTH) **Collect Date/Time:** 6/24/2021 12:39
WETLAB Sample ID: 21060889-001 **Receive Date:** 6/25/2021 14:46

Analyte	Method	Results		Units	DF	RL	Analyzed	LabID
General Chemistry								
Total Phosphorous as P	SM 4500-P E	0.47		mg/L	1	0.020	6/28/2021	NV00925
Total Suspended Solids (TSS)	SM 2540D	300		mg/L	1	10	6/29/2021	NV00925
Total Nitrogen	Calc.	5.9		mg/L	1	0.61	7/1/2021	NV00925
Turbidity (Nephelometric)	EPA 180.1	290		NTU	30	3.0	6/25/2021	NV00925
Oil & Grease (HEM)	EPA 1664	2.6	J	mg/L	1	2.0	7/7/2021	NV00925
Anions by Ion Chromatography								
Chloride	EPA 300.0	93		mg/L	1	1.0	6/25/2021	NV00925
Nitrate Nitrogen	EPA 300.0	ND		mg/L	1	0.15	6/25/2021	NV00925
Nitrite Nitrogen	EPA 300.0	ND		mg/L	1	0.060	6/25/2021	NV00925
Flow Injection Analyses								
Total Kjeldahl Nitrogen	EPA 351.2	5.9		mg/L	1	0.40	7/1/2021	NV00925

Customer Sample ID: HVP-1B (SOUTH) **Collect Date/Time:** 6/24/2021 12:30
WETLAB Sample ID: 21060889-002 **Receive Date:** 6/25/2021 14:46

Analyte	Method	Results		Units	DF	RL	Analyzed	LabID
General Chemistry								
Total Phosphorous as P	SM 4500-P E	0.40		mg/L	1	0.020	6/28/2021	NV00925
Total Suspended Solids (TSS)	SM 2540D	200		mg/L	1	10	6/29/2021	NV00925
Total Nitrogen	Calc.	4.7		mg/L	1	0.41	7/1/2021	NV00925
Turbidity (Nephelometric)	EPA 180.1	180		NTU	30	3.0	6/25/2021	NV00925
Oil & Grease (HEM)	EPA 1664	ND	U	mg/L	1	2.0	7/7/2021	NV00925
Anions by Ion Chromatography								
Chloride	EPA 300.0	39		mg/L	1	1.0	6/25/2021	NV00925
Nitrate Nitrogen	EPA 300.0	ND		mg/L	1	0.15	6/25/2021	NV00925
Nitrite Nitrogen	EPA 300.0	ND		mg/L	1	0.060	6/25/2021	NV00925
Flow Injection Analyses								
Total Kjeldahl Nitrogen	EPA 351.2	4.7		mg/L	0.5	0.20	7/1/2021	NV00925

DF=Dilution Factor, RL = Reporting Limit (minimum 3X the MDL), ND = Not Detected <RL or <MDL (if listed)

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EPA LAB ID: NV00926

LAS VEGAS
3230 Polaris Ave. Suite 4
Las Vegas, Nevada 89102
tel (702) 475-8899
fax (702) 622-2868
EPA LAB ID: NV00932

Customer Sample ID: HVP-2 (OUTLET)

Collect Date/Time: 6/24/2021 13:30

WETLAB Sample ID: 21060889-003

Receive Date: 6/25/2021 14:46

Analyte	Method	Results		Units	DF	RL	Analyzed	LabID
General Chemistry								
Total Phosphorous as P	SM 4500-P E	0.27		mg/L	1	0.020	7/1/2021	NV00925
Total Suspended Solids (TSS)	SM 2540D	220		mg/L	1	10	6/29/2021	NV00925
Total Nitrogen	Calc.	5.8		mg/L	1	0.61	7/2/2021	NV00925
Turbidity (Nephelometric)	EPA 180.1	150		NTU	30	3.0	6/25/2021	NV00925
Oil & Grease (HEM)	EPA 1664	3.7	M	mg/L	1	2.7	7/7/2021	NV00925
Anions by Ion Chromatography								
Chloride	EPA 300.0	84		mg/L	1	1.0	6/25/2021	NV00925
Nitrate Nitrogen	EPA 300.0	ND		mg/L	1	0.15	6/25/2021	NV00925
Nitrite Nitrogen	EPA 300.0	ND		mg/L	1	0.060	6/25/2021	NV00925
Flow Injection Analyses								
Total Kjeldahl Nitrogen	EPA 351.2	5.8		mg/L	1	0.40	7/2/2021	NV00925

DF=Dilution Factor, RL = Reporting Limit (minimum 3X the MDL), ND = Not Detected <RL or <MDL (if listed)

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Western Environmental Testing Laboratory
QC Report

QCBatchID	QCType	Parameter	Method	Result	Actual	% Rec	Units
QC21061131	Blank 1	Chloride	EPA 300.0	ND			mg/L
		Nitrate Nitrogen	EPA 300.0	ND			mg/L
		Nitrite Nitrogen	EPA 300.0	ND			mg/L
QC21061166	Blank 1	Total Phosphorous as P	SM 4500-P E	ND			mg/L
QC21061214	Blank 1	Turbidity (Nephelometric)	EPA 180.1	ND			NTU
QC21061252	Blank 1	Total Suspended Solids (TSS)	SM 2540D	ND			mg/L
QC21070034	Blank 1	Total Phosphorous as P	SM 4500-P E	ND			mg/L
QC21070045	Blank 1	Total Kjeldahl Nitrogen	EPA 351.2	ND			mg/L
QC21070272	Blank 1	Oil & Grease (HEM)	EPA 1664	ND			mg/L

QCBatchID	QCType	Parameter	Method	Result	Actual	% Rec	Units
QC21061131	LCS 1	Chloride	EPA 300.0	10.1	10.0	101	mg/L
		Nitrate Nitrogen	EPA 300.0	1.94	2.00	97	mg/L
		Nitrite Nitrogen	EPA 300.0	0.512	0.500	102	mg/L
QC21061166	LCS 1	Total Phosphorous as P	SM 4500-P E	0.266	0.250	107	mg/L
QC21061214	LCS 1	Turbidity (Nephelometric)	EPA 180.1	5.00	5.00	100	NTU
QC21061252	LCS 1	Total Suspended Solids (TSS)	SM 2540D	202	200	101	mg/L
QC21061252	LCS 2	Total Suspended Solids (TSS)	SM 2540D	199	200	100	mg/L
QC21070034	LCS 1	Total Phosphorous as P	SM 4500-P E	0.279	0.250	112	mg/L
QC21070045	LCS 1	Total Kjeldahl Nitrogen	EPA 351.2	1.01	1.00	101	mg/L
QC21070272	LCS 1	Oil & Grease (HEM)	EPA 1664	16.0	20.0	80	mg/L

QCBatchID	QCType	Parameter	Method	Duplicate Sample	Sample Result	Duplicate Result	Units	RPD
QC21061214	Duplicate 1	Turbidity (Nephelometric)	EPA 180.1	21060889-001	293	295	NTU	<1%
QC21061252	Duplicate 1	Total Suspended Solids (TSS)	SM 2540D	21060839-005	ND	ND	mg/L	<1%
QC21061252	Duplicate 2	Total Suspended Solids (TSS)	SM 2540D	21060861-001	24.0	23.0	mg/L	4 %

QCBatchID	QCType	Parameter	Method	Spike Sample	Sample Result		MS Result	MSD Result	Spike Value	Units	MS %Rec	MSD %Rec	RPD %
QC21061131	MS 1	Chloride	EPA 300.0	21060862-003	80.0		105	105	5	mg/L	99	98	<1
		Nitrate Nitrogen	EPA 300.0	21060862-003	6.17		16.6	16.5	2	mg/L	105	103	<1
		Nitrite Nitrogen	EPA 300.0	21060862-003	ND	D	2.51	2.46	0.5	mg/L	100	98	2
QC21061131	MS 2	Chloride	EPA 300.0	21060853-001	11.7		16.4	16.5	5	mg/L	94	95	<1
		Nitrate Nitrogen	EPA 300.0	21060853-001	0.687		2.73	2.75	2	mg/L	102	103	<1
		Nitrite Nitrogen	EPA 300.0	21060853-001	ND		0.481	0.484	0.5	mg/L	96	97	<1
QC21061166	MS 1	Total Phosphorous as P	SM 4500-P E	21060771-002	0.138		0.383	0.385	0.25	mg/L	98	99	<1
QC21061166	MS 2	Total Phosphorous as P	SM 4500-P E	21060878-001	0.026	QD	0.242	0.302	0.25	mg/L	87	110	22
QC21070034	MS 1	Total Phosphorous as P	SM 4500-P E	21060921-006	0.039		0.324	0.323	0.25	mg/L	114	113	<1
QC21070034	MS 2	Total Phosphorous as P	SM 4500-P E	21070001-001	0.356		0.596	0.571	0.25	mg/L	96	86	4
QC21070045	MS 1	Total Kjeldahl Nitrogen	EPA 351.2	21060763-001	0.256		0.763	0.727	0.5	mg/L	101	94	5
QC21070045	MS 2	Total Kjeldahl Nitrogen	EPA 351.2	21060878-001	0.089	J	0.606	0.578	0.5	mg/L	103	98	5
QC21070272	MS 1	Oil & Grease (HEM)	EPA 1664	21060889-003	3.70	M	5.70		10	mg/L	NC	NA	NA

DF=Dilution Factor, RL = Reporting Limit (minimum 3X the MDL), ND = Not Detected <RL or <MDL (if listed)

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WETLAB Order ID. 21060889
Sparks Control #
Elko Control #
LV Control #
Report Due Date
Page ___ of ___

Client: CARDNO
Address: 295 HWY 50, SUITE #1
City, State & Zip: ZEPHYR COVE, NV, 89449
Contact: PARKER JOHNSON
Phone: 775-588-9069
Collector's Name: RAPH TOWNSEND
Fax:
PWS/Project Name: HEAVENLY
P.O. Number:
PWS/Project Number:
Email:

Turnaround Time Requirements
Standard ✓
5 Day* (25%) ___ 72 Hour* (50%) ___
48 Hour* (100%) ___ 24 Hour* (200%) ___
*Surcharges Will Apply

Samples Collected From Which State? NV ___ CA ✓ Other ___
Compliance Monitoring? Yes ✓ No
Report to Regulatory Agency? Yes ✓ No
Report Results Via: PDF ✓ EDD Other ___
Standard QC Required? Yes ✓ No

Billing Address (if different than Client Address)
Company
Address
City, State & Zip
Contact
Phone Fax
Email

SAMPLE ID/LOCATION	DATE	TIME	PRES TYPE *	SAMPLE TYPE **	NO. OF CONTAINERS	OIL & GREASE (LOW LEVEL)	TOTAL PHOSPHOROUS	CHLORIDE	NITRATE NITROGEN	NITRITE NITROGEN	TKN (KJELDAHL)	TOTAL NITROGEN	TURBIDITY	TSS		Spl. No.
HVP-1A (NORTH)	6/24/21	12:39PM		SW	4	✓	✓	✓	✓	✓	✓	✓	✓	✓		
HVP-1B (SOUTH)	6/24/21	12:30PM		SW	4	✓	✓	✓	✓	✓	✓	✓	✓	✓		
HVP-2 (OUTLET)	6/24/21	1:30PM		SW	6	✓	✓	✓	✓	✓	✓	✓	✓	✓		

2106 0889 3 4

Instructions/Comments/Special Requirements: REPORTING LIMITS: O&G = 2.0 mg/L, TP = 0.01 mg/L, TN = 0.1 mg/L, TURB = 1 NTU, Cl = 0.1 mg/L

Sample Matrix Key** DW = Drinking Water WW = Wastewater SW = Surface Water MW = Monitoring Well SD = Solid/Sludge SO = Soil HW = Hazardous Waste OTHER:

*SAMPLE PRESERVATIVES: 1=Unpreserved 2=H2SO4 3=NaOH 4=HCl 5=HNO3 6=Na2S2O3 7=ZnOAc+NaOH 8=HCl/VOA Vial

Temp	Custody Seal	# of Containers	DATE	TIME	Samples Relinquished By	Samples Received By
8.8°C	Y N None	14	6/25/21	2:46	Parker Johnson	[signature]
°C	Y N None					
°C	Y N None					
°C	Y N None					

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Client/Collector attests to the validity and authenticity of this (these) sample(s) and, is (are) aware that tampering with or intentionally mislabeling the sample(s) location, date or time of collection may be considered fraud and subject to legal action (NAC445.0636). ___ initial
To the maximum extent permitted by law, the Client agrees to limit the liability of WETLAB for the Client's damages to the total compensation received, unless other agreements are made in writing. This limitation shall apply regardless of the cause of action or legal theory pled or asserted. ___ initial
WETLAB will dispose of samples 90 days from sample receipt. Client may request a longer sample storage time for an additional fee. Please contact your Project Manager for details. ___ initial

301.2E

Heavenly Mountain Resort
Water Years 2017–2021

APPENDIX H

STREAM CONDITION INVENTORY (SCI) RIPARIAN DATA & DISCUSSION

Appendix H
Stream Condition Inventory (SCI) Riparian Data & Discussion

H.1 Riparian Condition Monitoring Data

H.1.1 Monitoring Results – Stable Functional Channel

SCI monitoring measures channel stability and functionality through measurement of channel type, bank and cross-section geometry, channel gradient, and streambank stability. The permanent monumented cross-sections at each monitoring reach provide a consistent location to evaluate the functionality of the channel and changes over time. Along with longitudinal profiles and streambank stability assessments, comparisons of these data over time can help assess channel stability. Three cross-sections were established within each of the 10 monitoring reaches prior to 2006 and continue to be used. Where monumented pins cannot be located, a new pin is established using global positioning system (GPS) points and photographs to best replicate the previous location. The cross-sections were located in fast-water habitats and were oriented perpendicular to flow. At each cross-section, headpins were established along the left and right streambanks (viewed in the downstream direction) and a measuring tape was run horizontally across the channel from the left bank monument to the right bank monument. Channel stability and channel functionality, as measured through various assessments, are discussed below.

H.1.2 Channel Type

Channel classification and known characteristics of monitored reaches are summarized below in Table H-1. Channel classification and gradient dictate specific SCI data to be collected at each reach, as discussed in detail below.

Table H-1 Rosgen Stream Classifications and Characteristics of Monitored Reaches

Rosgen Stream Classification	Typical Characteristics[1]	Monitored Reaches
Aa+	Very steep gradient (>10 percent), well entrenched, and confined. Typically characterized by a step/pool morphology with capacity for debris transport.	Upper Edgewood (EC-1) Upper Daggett (DC-1)
A	Steep gradient (4–10%), entrenched, and cascading step/pool morphology with attendant plunge or scour pools. Typically has high energy to transport sediment and relatively low in-channel sediment storage capacity.	Property Line (HVC-3) Lower Hidden Valley (HDVC-2) Lower Daggett (DC-2)
B	Moderate gradient, moderately entrenched, channel is dominated by riffles with infrequently spaced pools, with stable banks and a stable profile. Often with a structurally controlled valley side-slope that limits the development of a wide floodplain.	Patsy's (HVC-2)
C	Low gradient, meandering, characterized by alternating and linked riffles and pools. An alluvial channel with broad, well-defined floodplains in narrow to wide valleys.	Sky Meadows (HVC-1) Upper Hidden Valley (HDVC-1)
G	Entrenched, narrow, and deep, with step/pool channel morphology with low to moderate sinuosity. Typically exhibits very high bank erosion rates and a high sediment supply.	Lower Edgewood (EC-2)

[1] Adapted from Rosgen 1996

California Project Reaches

The Sky Meadows reach (HVC-1) is the upper-most monitoring reach on Heavenly Valley Creek and was established by the USFS in 1996. It is a perennial reach that falls under the "C" type channel under the Rosgen classification system. This channel type has not changed since 2006. Because the mean surface water gradient is less than 2 percent, with surface flow present during 2019 monitoring, all SCI measurements were recorded along this reach.

The Patsy's reach (HVC-2) is the second downstream monitoring reach located on Heavenly Valley Creek and was established by the USFS in 1996. This reach exhibits the characteristics of a Rosgen "B" type channel. The channel type has not changed since 2006. Because this reach has a water surface gradient greater than 2 percent, bank angle and stream shore depth are not measured. During 2019 monitoring, all other SCI measurements were recorded, as the stream was flowing during monitoring.

The Property Line reach (HVC-3) downstream of Heavenly's boundaries was established in 2001 to detect temporal changes in channel morphology resulting from cumulative impacts. This reach exhibits Rosgen "A" type channel characteristics. In 2006, the classification was changed from a "B" type to an "A" type channel due to the steepness of the reach, although some attributes fit both channel types (such as its stable banks and moderate entrenchment). Bank angle and stream shore depth are not recorded because this reach has a water surface gradient greater than 2 percent. During 2019 monitoring, all other SCI measurements were recorded, as the stream was flowing.

California Reference Reaches

The Upper Hidden Valley reach (HDVC-1) is located in the headwaters area of Hidden Valley Creek. Established in 1996, HDVC-1 is a reference reach undisturbed by ski resort activities and is comparable to the Sky Meadows reach (HVC-1) on Heavenly Valley Creek. The Upper Hidden Valley reach (HDVC-1) exhibits the characteristics of a Rosgen "C" type channel. The channel type has not changed since 2006. The channel was dry during 2006 monitoring; thus, the full SCI monitoring protocol could not be completed. On subsequent inventory dates the stream has been flowing. Bed profile gradient was reported in 2006, as there was no water present in the channel to measure surface water gradient. Bank angle and stream shore depth measurements are recorded because this reach has a gradient of less than 2 percent. The stream had active flow in 2009, 2011, 2015, and 2019.

The Lower Hidden Valley reach (HDVC-2) was established in 2001 as a reference site for the Property Line reach (HVC-3). While both reaches have similar gradient, canopy cover, adjacent streamside vegetation types, elevations, and bankfull widths, Heavenly Valley and Hidden Valley Creeks have dissimilar flow regimes. The discharge in Heavenly Valley Creek is influenced by the California Dam (snowmaking pond just below the Sky Meadows reach), while Hidden Valley Creek flows are not regulated. The Lower Hidden Valley reach (HDVC-2) exhibits Rosgen "A" type channel characteristics. In 2006, the classification was changed from a "B" type channel to an "A" type channel due to the steepness of the reach, although some attributes fit both types (such as stable banks and moderate entrenchment). Bank angle and stream shore depth are not recorded because this reach has a water surface gradient of greater than 2 percent. During 2019 monitoring, all other SCI measurements were recorded, as the stream was flowing.

Nevada Project Reaches

The Edgewood Creek watershed has been the location of multiple restoration projects. The restoration project in the portion of Edgewood Creek including the Upper Edgewood reach (EC-1) is referred to as the North Bowl Restoration Stream Environment Project. Phase 1 (the downstream two-thirds of the project) of the North Bowl Restoration Stream Environment Project was completed in 2006. Other activities in 2006 included installation of gabion structures for gully improvements upstream of the restoration project and installation of BMPs on the road that descends from Boulder Parking Lot along Edgewood Creek. Phase 2 of the North Bowl Restoration Stream Environment Project was completed in the summer of 2007. Phase 2 involved the installation of additional gabion structures, strategic placement of large woody debris, and vegetation establishment. For a more thorough description, please reference the *Final Edgewood Watershed Assessment and Enhancement Plan: Upper Edgewood Creek* (Swanson Hydrology and Geomorphology 2006).

Edgewood Creek at the Upper Edgewood reach (EC-1) exhibits Rosgen “Aa+” type channel characteristics. The channel resembles a gully, and the step/pool morphology is a result of a large number of downed trees in the channel (Rosgen 1996) and the installed gabion structures. As the stream is a high-gradient stream at this location, only a longitudinal bed profile and cross-section analysis is conducted. Water has not been present during any SCI monitoring events; therefore, much of the SCI data cannot be collected, according to the protocols. The three permanent cross-sections extend across the entire valley floor width and were selected in 2006 to avoid construction disturbance; thus, any cross-sectional data collected prior to 2006 are not comparable to data collected after 2006. Because of the restoration construction and gabion basket placement, information such as bankfull width and entrenchment is difficult to reliably identify and therefore is not recorded.

Edgewood Creek below the Boulder Parking Lot (EC-2) exhibits characteristics of a Rosgen “G” type channel and underwent restoration in 2007. Restoration activities included repair of a head-cut and channel incision by constructing plunge pools and riparian planting. The restoration occurred directly upstream of EC-2 and extended down to the upstream cross-section of the riparian monitoring reach. A vault treatment system was installed in the Boulder Parking Lot in 2005. Pebble counts have not been completed regularly along this reach because the majority of the bed sediment is less than 8 millimeters (mm) (gravel or sand). A pebble count was conducted in 2019 and confirmed these results.

The Upper Daggett Creek reach (DC-1) exhibits characteristics of a Rosgen “Aa+” type channel. Typical characteristics of this reach include a step/pool morphology with chutes and waterfalls (Rosgen 1996). Mean bank angle and mean shore depth are not measured as the stream gradient is 2 percent.

The Lower Daggett reach (DC-2) exhibits characteristics of a Rosgen “A” type channel. It is similar to an “Aa+” type channel in terms of several channel characteristics, yet has a smaller channel slope (Rosgen 1996). Mean bank angle and mean shore depth are not measured as the stream gradient is 2 percent.

The Mott Creek reach (MC-1) exhibits characteristics of a Rosgen “Aa+” type channel. As discussed in Chapter 5.3, LTBMU does not feel the establishment of an SCI monitoring reach is necessary in the Mott Creek watershed due to the boulder-dominated stability of the channel. No further discussion of this site is included in this report.

H.1.3 Bankfull Channel Geometry

Bankfull stage is identified in the field in order to determine the associated channel characteristics such as bankfull width, bankfull depth, and bankfull width-to-depth ratio, and as input to the entrenchment ratio. The bankfull stage is not readily apparent at some of the steep channel sites that lack a well-defined floodplain surface. In such cases, best professional judgment was used to identify other bankfull indicators such as break in bank slope, vegetation, changes in sizes of bank materials, water stains or lichen lines on substrate, and scour lines or undercut banks.

Bankfull width is the width of the channel at the bankfull stage elevation, measured at the permanent monumented cross-sections. The bankfull widths for each of the monumented cross-sections in the monitoring reaches are reported in Tables H-2 through H-5.

Overall, bankfull widths have remained generally consistent at each site over the full monitoring period (2006–2019). The bankfull widths at some cross-sections at Sky Meadows (HVC-1) and Upper Hidden Valley Creek (HDVC-1) increased slightly in 2019 or stabilized following an increase in 2015. Increases may indicate a slight decline in condition at these locations, although these findings were not consistent across the entire monitoring reach. Other cross-sections appeared stable or improving. Bankfull width measurements were taken in 2015 at Upper Edgewood (EC-1) despite the presence of water and despite restoration features that prevented accurate bankfull stage identification (bankfull stage was not recorded during any other monitoring events). The Lower Edgewood reach (EC-2) showed a slight decrease (considered an improvement) in bankfull width measurements in both 2015 and 2019.

Table H-2 Bankfull Widths (m) – Heavenly Valley Creek

Year	HVC-1 (Sky Meadows)				HVC-2 (Patsy's)				HVC-3 (Property Line)			
	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3	Mean
2006	1.2	1.5	1.5	1.4	1.3	2.0	1.7	1.7	2.6	3.1	2.6	2.7
2009	1.7	1.5	1.7	1.6	1.7	1.9	1.8	1.8	2.4	4.0	2.7	3.1
2011	1.7	1.7	1.8	1.7	1.5	2.4	1.7	1.9	2.6	4.0	2.7	3.1
2015	2.4	1.3	2.6	2.1	1.7	2.1	1.9	1.9	2.3	4.3	2.5	3.0
2019	2.1	2.1	2.7	2.3	1.2	1.7	1.5	1.5	1.9	4.4	2.0	2.8

Table H-3 Bankfull Widths (m) – Hidden Valley Creek

Year	HDVC-1 (Upper Hidden Valley Creek)				HDVC-2 (Lower Hidden Valley Creek)			
	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3	Mean
2006	2.3	NA[1]	1.1	1.7	4.4	2.2	2.9	3.2
2009	1.9	NA[1]	1.7	1.8	4.5	2.3	2.9	3.2
2011	2.0	NA[1]	1.6	1.8	4.6	2.4	3.0	3.3
2015	2.0	1.8	2.1	2.0	4.5	2.4	3.5	3.5
2019	1.1	2.8	1.7	1.9	3.7	2.0	3.7	3.1

1 XS-2 could not be located in 2006, 2009, or 2011. Since at least 2011, the channel has moved so that one headpin is now located within the current stream channel.

Table H-4 Bankfull Widths (m) – Edgewood Creek

Year	EC-1 (Upper Edgewood)				EC-2 (Lower Edgewood)			
	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3[1]	Mean
2006	NA[2]				4.4	0.9	1.8	2.4
2008	NA[2]				3.4	0.7	2.7	2.3
2009	NA[2]				4.0	0.7	2.4	2.4
2010	NA[2]				4.0	0.9	2.8	2.6
2011	NA[2]				3.9	0.9	2.6	2.5
2015	11.6	10.4	10.2	10.7	4.4	0.6	2.1	2.4
2019	NA[2]				3.4	0.5	1.2	1.7

1 XS-3 was relocated in 2008 due to restoration activities destroying the permanent monument; therefore, 2006 data should not be used for comparison. The new location is directly below the rock grade control structure constructed as part of the Lower Edgewood Restoration Project completed in 2007.

2 Only longitudinal bed profile and cross-section analysis are conducted at Edgewood Creek, apart from the 2015 monitoring. Bankfull indicators have been manipulated due to restoration (e.g., gabion installation), and field observations are unreliable.

Table H-5 Bankfull Widths (m) – Daggett Creek

Year	DC-1 (Upper Daggett Creek)				DC-2 (Lower Daggett Creek)			
	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3	Mean
2006	2.0	2.4	3.5	2.6	1.2	3.2	2.1	2.2
2009	2.7	2.4	2.4	2.5	1.8	3.0	0.8	1.9
2015	2.7	2.1	2.1	2.3	1.1	2.4	2.4	2.0
2019	2.4	2.4	1.6	2.1	0.8	2.1	0.5	1.1

The slight variation in bankfull widths over the period of record for all three cross-sections at Upper Daggett Creek indicates that the reach is in a stable condition. After an increase in bankfull width at Lower Daggett Creek (DC-2) XS-3 in 2015, the bankfull width decreased. This may suggest stabilization of the system or may be related to nearby disturbance from the replacement of Galaxy chairlift Tower 7. Slight decreases in bankfull width at the other cross-sections indicate improvements over time.

Another characterization of bankfull channel geometry is the width-to-depth ratio, which is the ratio of bankfull channel width to the mean bankfull channel depth. The width-to-depth ratio describes the distribution of available energy within a channel and the ability of discharge events to move sediment. It also describes channel cross-section shape. Comparing changes in width-to-depth ratios over time can be used to interpret shifts in channel stability. In channels with high width-to-depth ratios, the distribution of energy is generally placed near the bank. Hydraulic stress against banks increases as the width-to-depth ratio increases; thus, bank erosion may similarly increase in systems with unstable banks. This is a common metric used to characterize stream morphology and aquatic habitat. The width-to-depth ratio based on survey data for each of the monumented cross-sections is reported in Tables H-6 through H-9.

Table H-6 Bankfull Width-to-Depth Ratios – Heavenly Valley Creek

Year	HVC-1 (Sky Meadows)				HVC-2 (Patsy's)				HVC-3 (Property Line)			
	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3	mean	XS-1	XS-2	XS-3	Mean
2006	8.5	8.2	5.9	7.5	4.4	4.9	8.5	5.9	8.3	24.4	8.0	13.6
2009	9.3	8.5	9.9	9.3	6.3	4.7	6.9	5.9	9.2	24.4	7.7	13.7
2011	4.9	9.8	12.2	9.0	4.9	6.0	7.7	6.2	15.6	32.7	8.6	19.0
2015	7.1	10.1	18.9	12.0	6.2	5.4	7.5	6.4	9.6	28.9	7.3	15.3
2019	7.0	10.1	32.4	16.5	2.4	7.7	5.9	5.3	4.6	21.8	5.2	10.5

The width-to-depth ratio for the Sky Meadows reach (HVC-1) has remained low over the period of record. There has been a consistent increase in the width-to-depth ratio at XS-3 across the years. Floodplain sediment deposition at Sky Meadows XS-3 covered headpins after 2006, and this section of stream appears to be morphing into a wide, braided channel that encompasses a larger portion of the meadow, resulting in large changes of channel geometry. While these changes show the system is not necessarily stable, flow is spreading out and accessing a larger portion of the meadow, which is overall a positive change. The bankfull width-to-depth ratios at XS-1 and XS-2 have remained stable over time.

The width-to-depth ratios at Patsy's reach (HVC-2) have fluctuated only slightly across the years, which likely indicates channel stability. In 2019, width-to-depth ratios decreased at both XS-1 and XS-3, while increasing at XS-2. The increase at XS-2, accompanied by the decreased in bankfull width, indicates that some incision may be occurring at this location, and should be monitored closely.

The width-to-depth ratios at the Property Line reach (HVC-3) have also been relatively consistent over the period of record, and although width-to-depth ratios throughout the reach were notably higher in 2011, ratios decreased slightly in both 2015 and 2019.

Table H-7 Bankfull Width-to-Depth Ratios – Hidden Valley Creek

	HDVC-1 (Upper Hidden Valley Creek)				HDVC-2 (Lower Hidden Valley Creek)			
Year	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3	Mean
2006	43.7	NA[1]	9.9	26.8	25.0	5.7	18.7	16.5
2009	53.9	NA[1]	9.8	31.9	19.7	5.2	13.1	12.7
2011	14.9	NA[1]	8.6	11.7	23.1	7.1	21.6	17.3
2015	5.9	9.2	15.0	10.0	16.6	7.0	20.3	14.6
2019	8.8	18.1	12.5	13.1	9.0	6.8	14.5	10.1

1 XS-2 could not be located in 2006, 2009, or 2011. Since at least 2011, the channel has moved so that one headpin is now located within the current stream channel.

The width-to-depth ratios at the Upper Hidden Valley Creek reach (HDVC-1) increased at both XS-1 and XS-2 between 2015 and 2019, but the ratio has decreased dramatically at XS-1 over the period of record, indicating overall improvement since 2006. While bankfull width at XS-1 has been declining since 2006, the entrenchment ratio has increased (Table H-11) and the cross-sectional area has decreased (Figure H-9) since 2015, indicating that any incision that may have been occurring is stabilizing. Comparison of ratios at XS-2 is inconclusive, since data are missing from prior years.

The width-to-depth ratios at the Lower Hidden Valley reach (HDVC-2) have either remained stable or improved, as indicated by a decrease in the ratio.

Table H-8 Bankfull Width-to-Depth Ratios – Edgewood Creek

	EC-1 (Upper Edgewood)				EC-2 (Lower Edgewood)			
Year	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3[1]	Mean
2006	NA[2]				18.8	0.8	9.0	9.5
2008	NA[2]				16.1	0.6	9.5	8.7
2009	NA[2]				15.7	1.4	8.2	8.4
2010	NA[2]				17.3	1.8	11.4	10.1
2011	NA[2]				20.0	1.4	15.7	12.3
2015	27.0	12.5	9.0	16.2	25.8	1.1	9.4	12.1
2019	NA[2]				19.9	1.8	5.6	9.1

1 XS-3 was relocated in 2008 due to restoration activities destroying the permanent monument; therefore, 2006 data should not be used for comparison. The new location is directly below the rock grade control structure constructed as part of the Lower Edgewood Restoration Project completed in 2007.

2 Only longitudinal bed profile and cross-section analysis are conducted at Edgewood Creek, apart from the 2015 monitoring. Bankfull indicators have been manipulated due to restoration (e.g., gabion installation), and field observations are unreliable.

Bankfull width-to-depth ratios cannot be compared over time at Upper Edgewood reach (EC-1), with only 1 year's data available. Width-to-depth ratios at the Lower Edgewood reach (EC-2) indicate a trend of increased values between 2006 and 2015, although 2019 values declined. Bankfull channel widths at the Lower Edgewood reach have declined over time (Table H-4), particularly between 2015 and 2019. Channel depths have also decreased, likely due to sediment deposition correlated with restoration efforts on the stream. The decrease in depths has further decreased width-to-depth ratios, most dramatically at XS-3, which was within the restoration project footprint.

Table H-9 Bankfull Width-to-Depth Ratios – Daggett Creek

Year	DC-1 (Upper Daggett Creek)				DC-2 (Lower Daggett Creek)			
	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3	Mean
2006	7.3	9.7	20.5	12.5	2.3	47.7	5.1	18.3
2009	10.4	11.5	7.4	9.7	8.8	69.0	6.9	28.2
2015	4.7	12.7	9.7	9.0	14.5	33.0	16.4	21.3
2019	19.7	13.3	6.4	13.1	11.0	22.7	3.8	12.5

The width-to-depth ratios at the Upper Daggett reach (DC-1) varied by cross-section between 2006 and 2019, most notably at XS-1 and XS-3. The ratio at XS-1 increased dramatically between 2015 and 2109. Channel widths were stable at XS-1; therefore, the increased ratio is due to increased depths and potentially incision. At XS-3, the ratio declined only slightly between 2015 and 2019, but it has declined dramatically since monitoring began in 2006 and is correlated in a decrease in channel width.

The width-to-depth ratios at the Lower Daggett reach (DC-2) showed an increasing trend between 2006 and 2015, but declined in 2019, largely dominated by changes at XS-2 and XS-3. Between 2015 and 2019, both channel width and depth declined at all cross-sections, showing improvement over past data, but not being indicative of a stable system.

One more characterization of bankfull channel geometry is the entrenchment ratio, which is calculated as the ratio of the floodprone width (measured in the field at twice the maximum bankfull depth) to bankfull width. The objective of this measurement is to measure the degree of likely connection between the channel and floodplain. Larger entrenchment ratios are indicative of greater floodplain connectivity, although some reaches will have inherently low connectivity depending on channel geometry and gradient. The entrenchment ratios for the monumented cross-sections along each reach is reported in Tables H-10 through H-13.

Table H-10 Entrenchment Ratios – Heavenly Valley Creek

	HVC-1 (Sky Meadows)				HVC-2 (Patsy's)				HVC-3 (Property Line)			
Year	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3	mean	XS-1	XS-2	XS-3	Mean
2006	2.0	1.7	3.0	2.2	2.8	3.4	2.1	2.7	2.0	2.5	1.9	2.2
2009	2.2	2.0	1.5	1.9	2.1	2.5	2.2	2.2	2.3	2.1	2.1	2.2
2011	2.2	1.9	2.0	2.0	2.5	3.1	2.2	2.6	1.9	2.2	2.2	2.1
2015	1.5	2.3	1.4	1.7	4.4	3.3	4.4	4.0	2.5	2.5	2.0	2.3
2019	20.0	6.2	7.8	11.3	4.7	2.0	4.8	3.8	3.5	2.7	2.4	2.9

Entrenchment ratios at Sky Meadows have increased over time, most dramatically between 2015 and 2019. This was qualitatively evident in the field, as the channel appeared to be spreading out across a larger portion of the meadow and creating braids, rather than being confined to a single channel. This may be related to sediment deposition in the channel, which may have raised the channel bottom and forced flow out on to the floodplain more regularly during the runoff season. Entrenchment ratios at the other Heavenly Valley Creek sites (Patsy's and Property Line) remained fairly consistent between 2006 and 2019, indicating stability of the floodplain connectivity.

Table H-11 Entrenchment Ratios – Hidden Valley Creek

Year	HDVC-1 (Upper Hidden Valley Creek)				HDVC-2 (Lower Hidden Valley Creek)			
	XS-1	XS-2	XS-3	mean	XS-1	XS-2	XS-3	mean
2006	3.0	NA[1]	1.7	2.3	1.2	2.1	1.6	1.6
2009	1.2	NA[1]	1.4	1.3	1.4	2.4	1.9	1.9
2011	1.2	NA[1]	1.4	1.3	1.4	2.0	1.8	1.7
2015	4.8	9.3	4.9	6.3	1.6	2.1	2.1	1.9
2019	4.8	14.1	7.0	8.6	1.7	2.1	2.1	2.0

1 XS-2 could not be located in 2006, 2009, or 2011. Since at least 2011, the channel has moved so that one headpin is now located within the current stream channel.

Entrenchment ratios at the Hidden Valley Creek sites remained fairly consistent from 2006 to 2019, aside from a large increase at XS-2 at Upper Hidden Valley Creek, which may only be due to the limited data available. However, entrenchment ratios also increased at XS-3 (upstream of XS-2), and it is possible Upper Hidden Valley Creek is undergoing similar changes as Sky Meadows, where sediment deposition in the channel is creating greater floodplain connectivity. However, minor topography and thalweg depth measurements can create larger ratio values as the floodplain width is calculated as two times this measured depth. These minor measured undulations can increase the floodplain width value substantially and thus increase the entrenchment ratio. Regardless, consistent trends of increased entrenchment ratios indicate a trend of less entrenchment at all cross-sections. Lower Hidden Valley Creek exhibited nearly identical entrenchment ratios compared to 2019, and relatively fixed ratios across the entire monitoring period, indicating long-term stability across the reach.

Table H-12 Entrenchment Ratios – Edgewood Creek

Year	EC-1 (Upper Edgewood)				EC-2 (Lower Edgewood)			
	XS-1	XS-2	XS-3	Mean	XS-1	XS-2	XS-3[1]	mean
2006	NA[2]				2.4	12.0	5.0	6.5
2008	NA[2]				2.9	15.8	2.7	7.1
2009	NA[2]				2.7	16.5	3.1	7.4
2010	NA[2]				2.7	13.6	2.6	6.3
2011	NA[2]				2.8	12.5	2.8	6.0
2015	3.3	4.9	4.6	4.3	2.4	16.8	3.5	7.6
2019	NA[2]				3.2	20.6	4.4	9.4

1 XS-3 was relocated in 2008 due to restoration activities destroying the permanent monument, therefore 2006 data should not be used for comparison. The new location is directly below the rock grade control structure constructed as part of the Lower Edgewood Restoration Project completed in 2007.

2 Only longitudinal bed profile and cross-section analysis are conducted at Edgewood Creek, apart from the 2015 monitoring date. Bankfull indicators have been manipulated due to restoration (e.g. gabion installation) and field observations are unreliable.

The 2015 measurements marked the first time in the reporting period that this metric was measured at Upper Edgewood Creek, despite unreliable measures of bankfull width, and entrenchment ratios cannot be compared over time with only one year's data. Entrenchment ratios at the Lower Edgewood Creek sites remained fairly consistent from 2006 to 2019, with slight improvements in floodplain connectivity in the recent past. Overall, entrenchment ration at Lower Edgewood Creek indicate stability.

Table H-13 Entrenchment Ratios – Daggett Creek

Year	DC-1 (Upper Daggett Creek)				DC-2 (Lower Daggett Creek)			
	XS-1	XS-2	XS-3	mean	XS-1	XS-2	XS-3	mean
2006	15.6	6.0	4.0	8.6	17.1	3.7	5.7	8.8
2009	6.7	5.3	5.0	5.6	8.0	3.9	14.4	8.8
2015	11.8	4.6	5.1	7.2	10.9	4.0	3.9	6.3
2019	10.7	3.9	5.9	6.8	10.2	4.5	13.9	9.5

Entrenchment ratios at Upper Daggett Creek have fluctuated slightly during the reporting period, but have remained fairly consistent, particularly between 2015 and 2019. These trends likely indicate overall stability at Upper Daggett Creek across the years. The Lower Daggett reach entrenchment ratios at XS-1 and XS-2 have remained stable over the past several survey dates, while XS-1 decreased dramatically in 2015, it increased again in 2019 to levels observed in 2009.

H.1.4 Cross-Section Geometry

Cross-section elevations were surveyed with either an auto-level or total station along the ground surface, including the left and right edge of water surfaces, breaks in slope, apparent location of bankfull stage, and at notable changes in vegetation or substrate. All elevations were recorded as relative to the left bank headpin. Photographs of each cross-section were taken during each survey.

The bankfull area geometry of Sky Meadows (HVC-1) cross-sections remained generally similar between 2006 and 2009. Beginning in 2011, observations indicated the bankfull channel cross-sectional area at XS-1 doubled from approximately 3 square feet to over 6 square feet. This change appears to have stabilized between 2011 and 2019. Based on the 2019 observations, the bankfull area at XS-2 has increased over time, and while the bankfull area at XS-3 has decreased over time, it could be characterized as relatively stable (Figure H-1). As discussed in Chapter H.1.3, 2019 observations show the channel through the low-gradient meadow appears to be widening, braiding, and experiencing deposition, resulting in a greater bankfull area.

The net scour/fill change from 2006 to 2019 (Figure H-2) was small at XS-2 and XS-3; however, both the channel area and net fill/scour at XS-1 has increased over time relative to the 2006 observations. It appears that this section of the reach is both widening and becoming more incised, although incision rates appeared to be stabilizing in 2019. This cross-section is directly above the California Dam snowmaking pond.

Conversely, upstream XS-3 has experienced sediment deposition (or fill) over time. As discussed in Chapter H.1.3, 2019 observations show the channel through the low-gradient meadow appears to be widening, braiding, and experiencing deposition, resulting in a greater bankfull area. This entire reach is within in a meadow, located where the stream slope decreases as it enters the lower gradient meadow, dissipating energy and allowing sediment deposition. The channel exhibits evidence of lateral channel migration, particularly at the upstream section, that is natural for alluvial meadow channels, whereby bank erosion on one side of the channel is offset by sediment fill on the other. At XS-3, the repeat surveys suggest that both lateral migration and some aggradation have occurred. Across the entire reporting period, the channel shifted laterally and bed elevations have shifted slightly, having experienced both scour and fill.

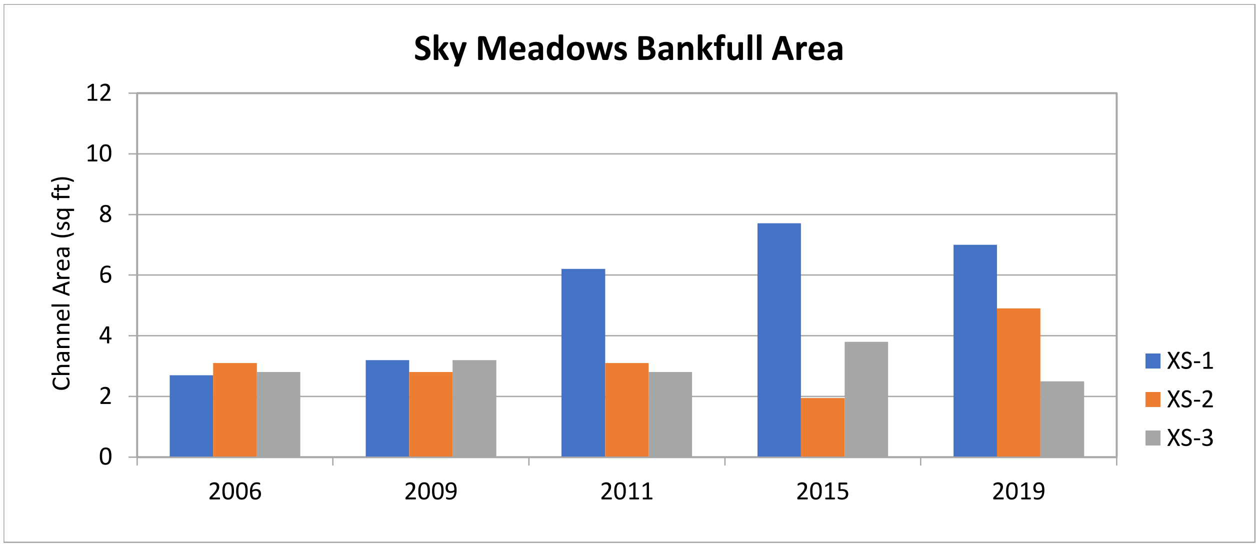
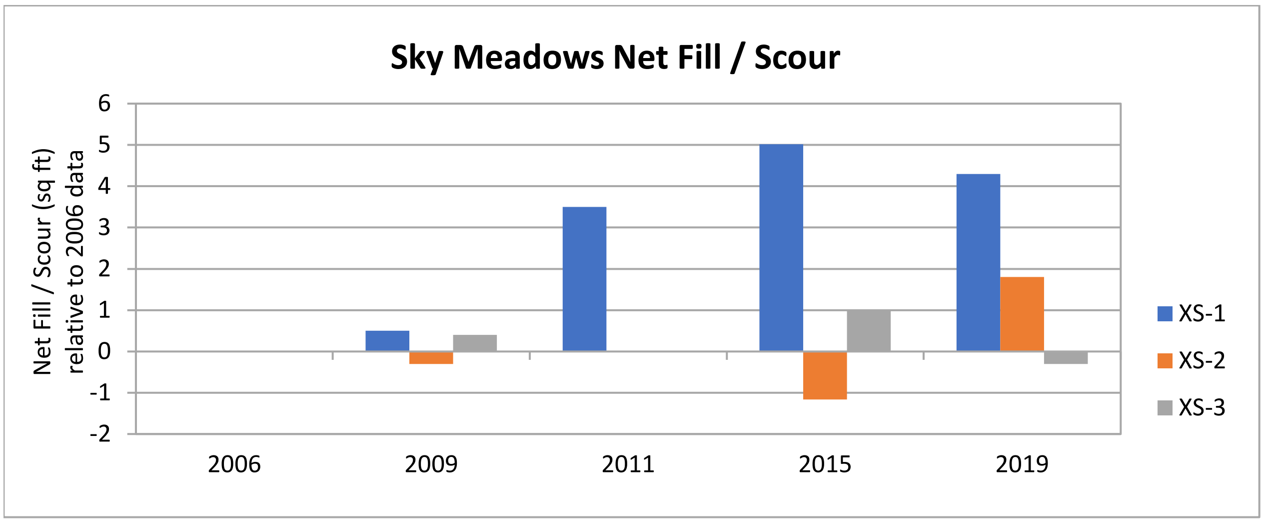


Figure H-1 Bankfull Area – Sky Meadows



Note: No change in net fill/scour was observed for XS-2 and XS-3 in 2011, thus reporting of "0" values

Figure H-2 Net Fill/Scour – Sky Meadows

The bankfull area geometry of Patsy's (HVC-2) XS-1 and XS-3 have remained very similar between 2006 and 2019 (Figure H-3). XS-2 shifted dramatically in 2019, having experienced substantial deposition (Figure H-4), bringing it more line with the bankfull sizes of XS-1 and XS-3. The natural alignment and size of XS-2 may have been suitable for the deposition of material that was moved downstream.

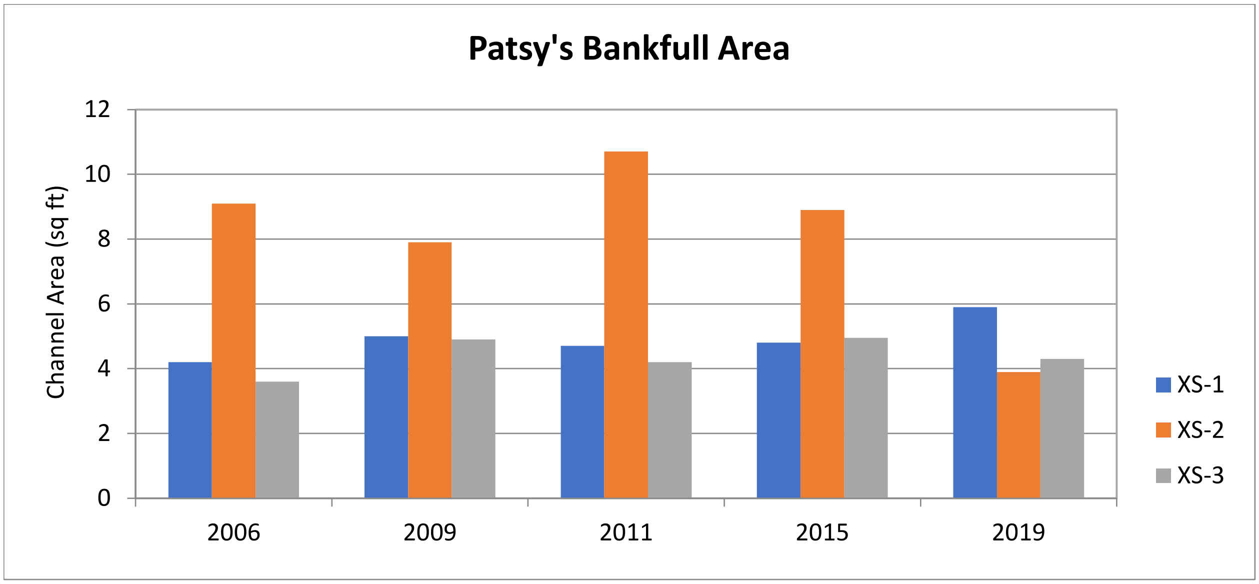


Figure H-3 Bankfull Area – Patsy's

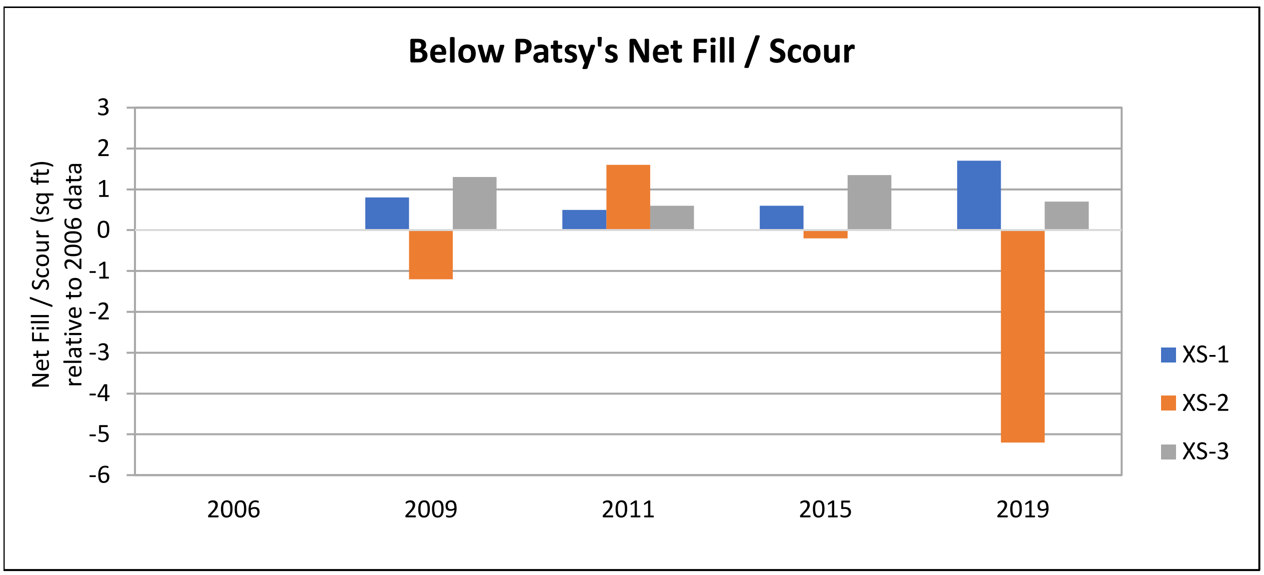


Figure H-4 Net Fill/Scour – Patsy's

The bankfull area geometry of Property Line (HVC-3) XS-1 and XS-3 has remained consistent over time (Figure H-5) compared to 2006 data. XS-2 has experienced scour over the reporting period, particularly between 2015 and 2019 (Figure H-6). Little to no scour has occurred at XS-3 over the period of record. Fill and scour values in 2015 and 2009 at XS-1 and XS-3 are similar, suggesting a potential link in these values during low-flow water conditions (drought).

XS-1 and XS-2 show a rise in the channel bed between 2009 and 2011, but the channel bed dropped in 2015 and 2019. XS-1 and XS-2 also indicate some lateral migration. In the past, the thalweg at XS-2 was at the approximate center of the channel, but in 2015 and 2019, the thalweg was located along the left bank, increasingly so for each monitoring year and so much so that in 2019, the headpin was under water. Sediment is being deposited along the right bank and aggrading the channel. Sediment deposit is likely due to downed logs in the reach that are slowing water velocities, allowing sediment and fine material to fall out. An angled downed log at XS-2 has also created a step-pool at the cross-section transect line.

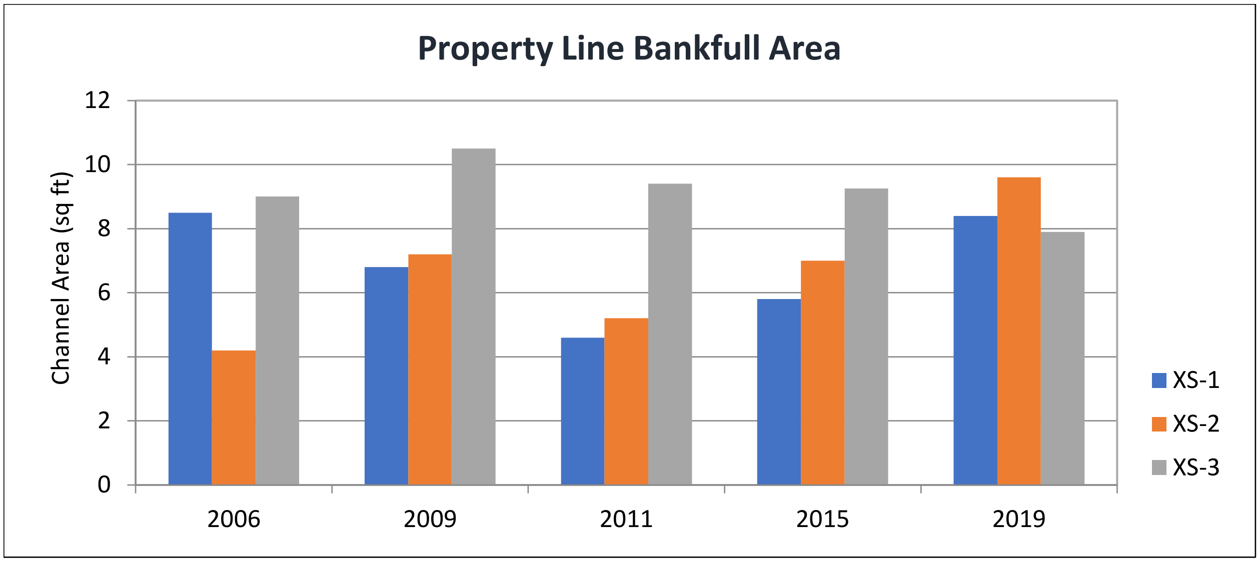


Figure H-5 Bankfull Area – Property Line

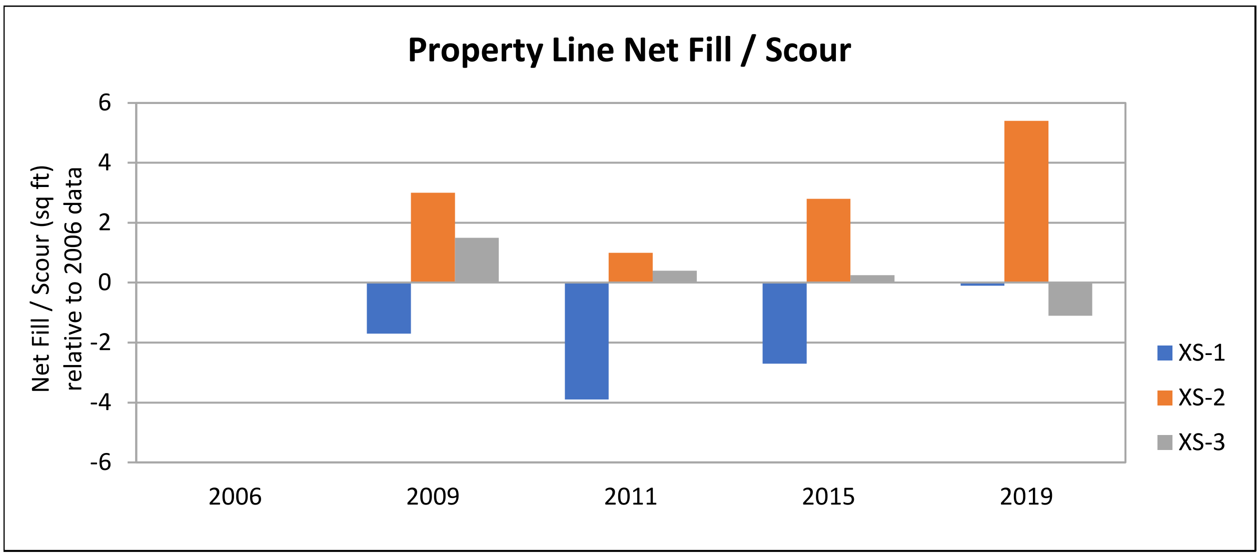
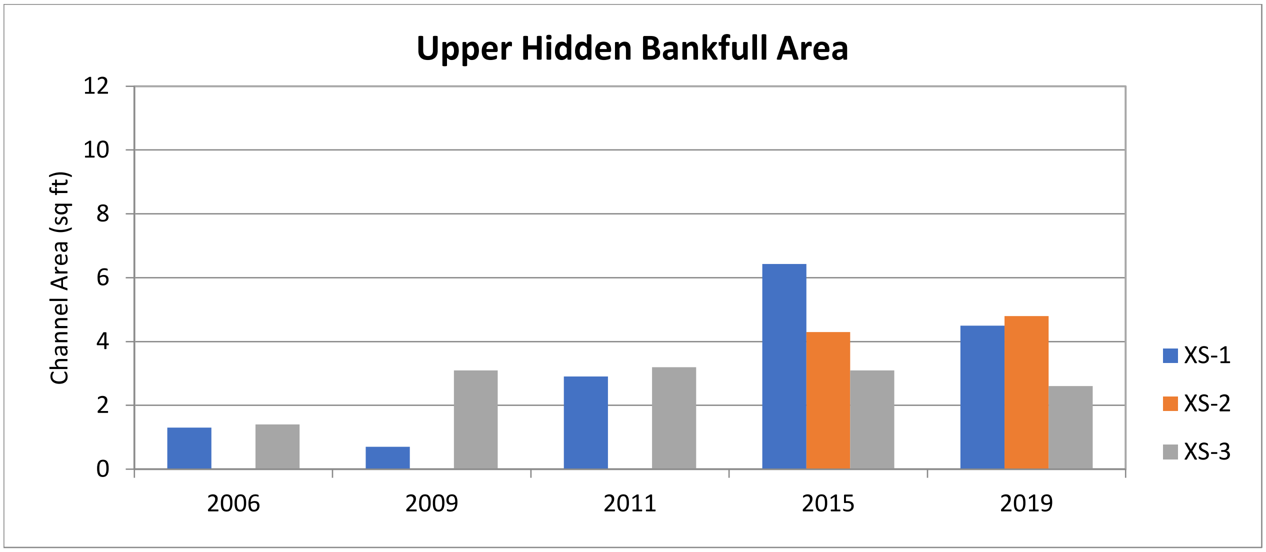


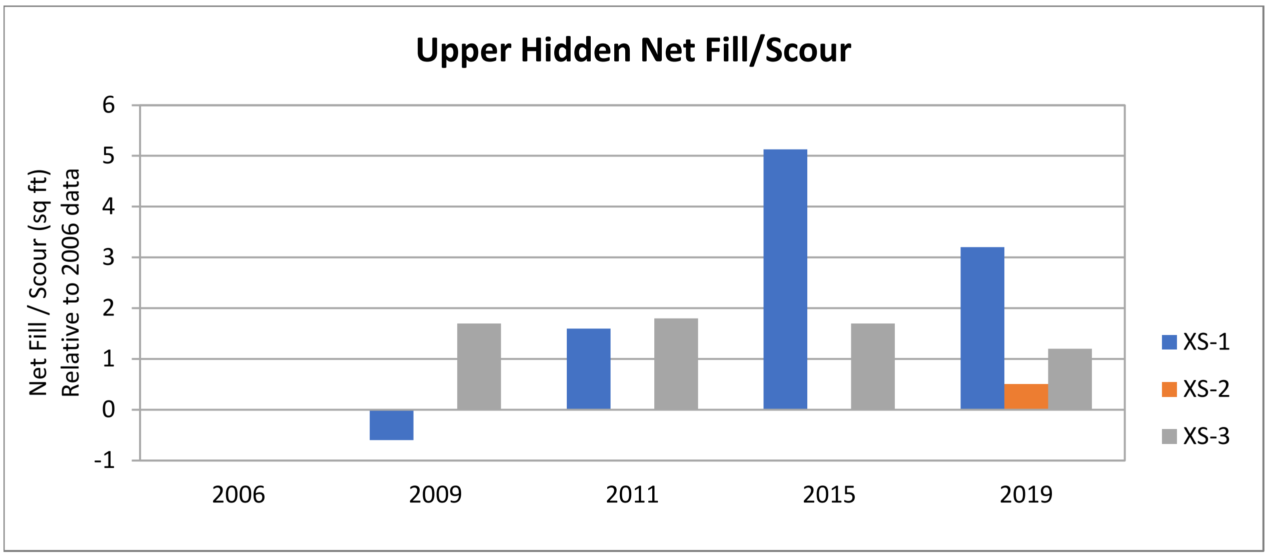
Figure H-6 Net Fill/Scour – Property Line

The Upper Hidden Valley Creek reference reach (HDVC-1) cross-sections showed some variability and have typically exhibited scour, but only XS-1 and XS-3 have been located reliably in the past. Data from XS-2 are only available for 2015 and 2019. The bankfull area at all cross-sections at Upper Hidden Valley Creek is very small but increased over time at XS-1 and XS-2 (Figure H-7). The net scour/fill changes indicate that scour at all cross-sections has occurred, even though the absolute magnitude has been small (Figure H-8). XS-1 has demonstrated the most variability.



Note: Data for XS-2 is not included for monitoring years when the headpins could not be located.

Figure H-7 Bankfull Area – Upper Hidden Valley Creek



Note: Data for XS-2 are not included for monitoring years when the headpins could not be located. Net fill/scour for XS-2 is compared to 2015 data.

Figure H-8 Net Fill/Scour – Upper Hidden Valley Creek

The Lower Hidden Valley Creek reference reach (HDVC-2) cross-sections have some differences across cross-sections, since XS-1 and XS-2 are larger than XS-3. However, all three exhibited similar changes in channel area over time, with the exception of changes in 2019 (Figure H-9). The net scour/fill changes indicate that scour was dominant relative to 2006, except at XS-2, which experienced scour in 2009, followed by deposition in 2019. Scour at XS-1 and XS-3 has increased over time (Figure H-10).

The channel shape and elevations have shown minor variability at Lower Hidden Valley Creek between 2006 and 2019, primarily with bed elevation decreasing trends at XS-1. XS-2 bed elevations are relatively stable, while XS-3 elevations have decreased slightly. Limited lateral channel migrations have occurred at all locations.

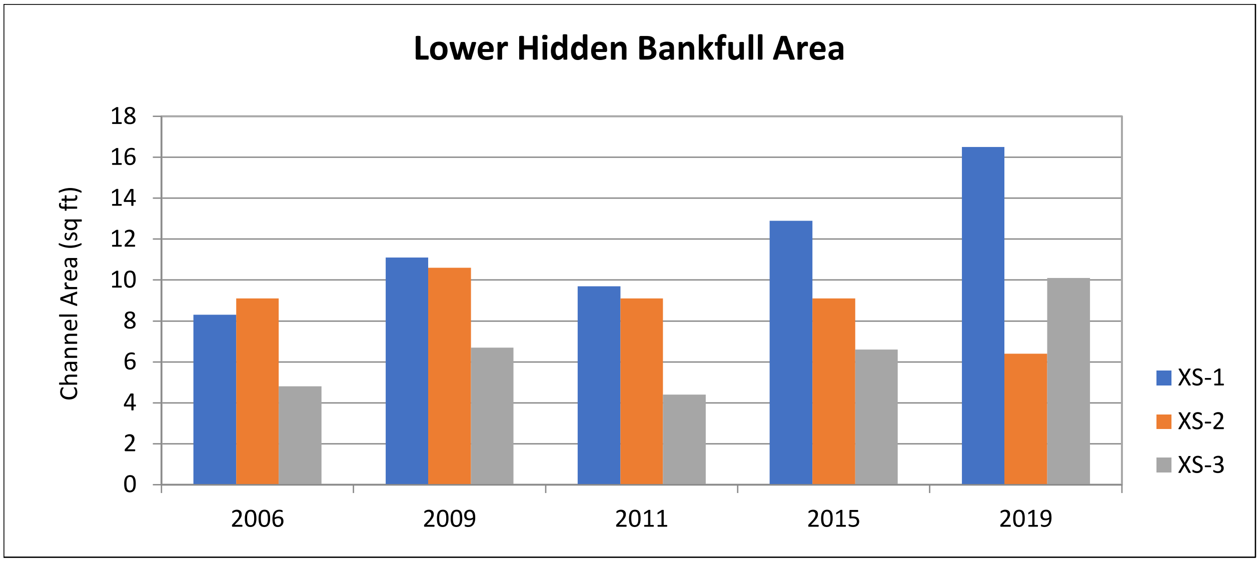
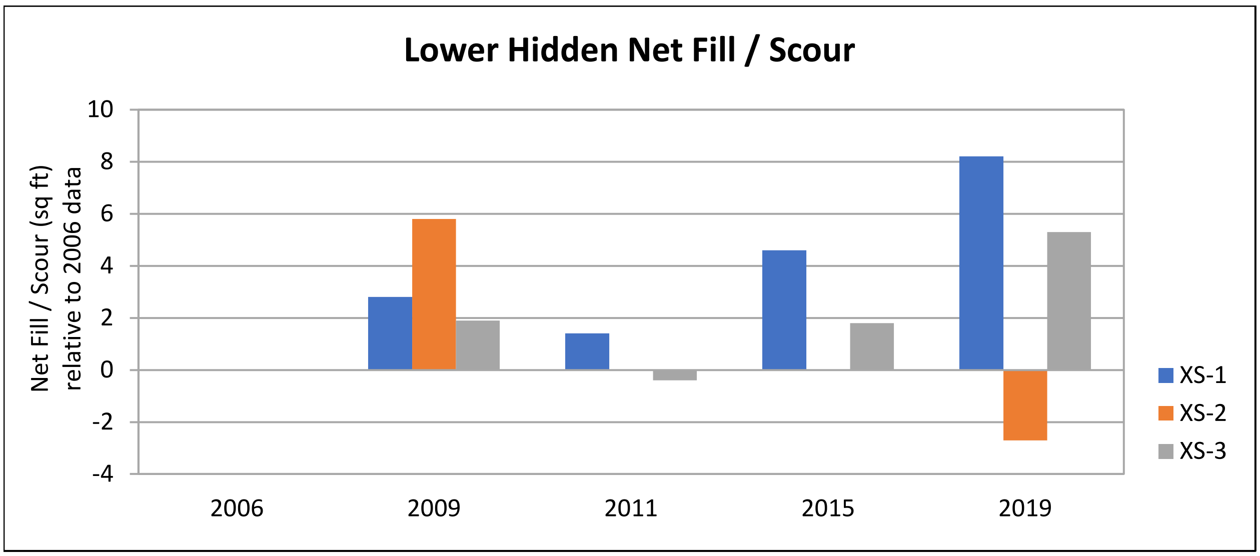


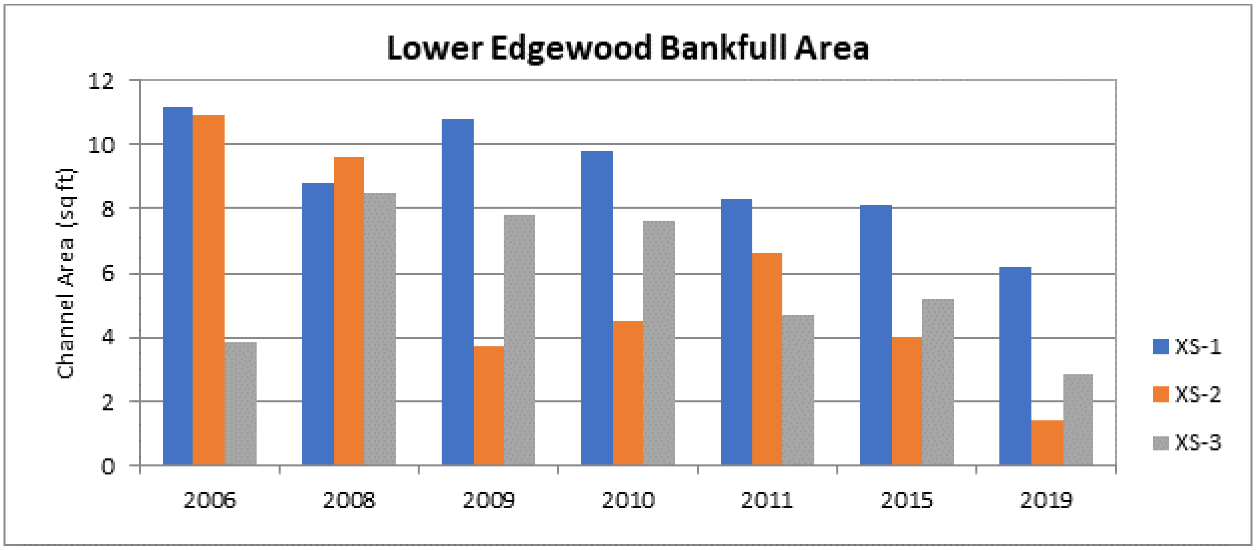
Figure H-9 **Bankfull Area – Lower Hidden Valley Creek**



Note: No change in net fill/scour was observed for XS-2 in 2011 and 2015, thus reporting of "0" values

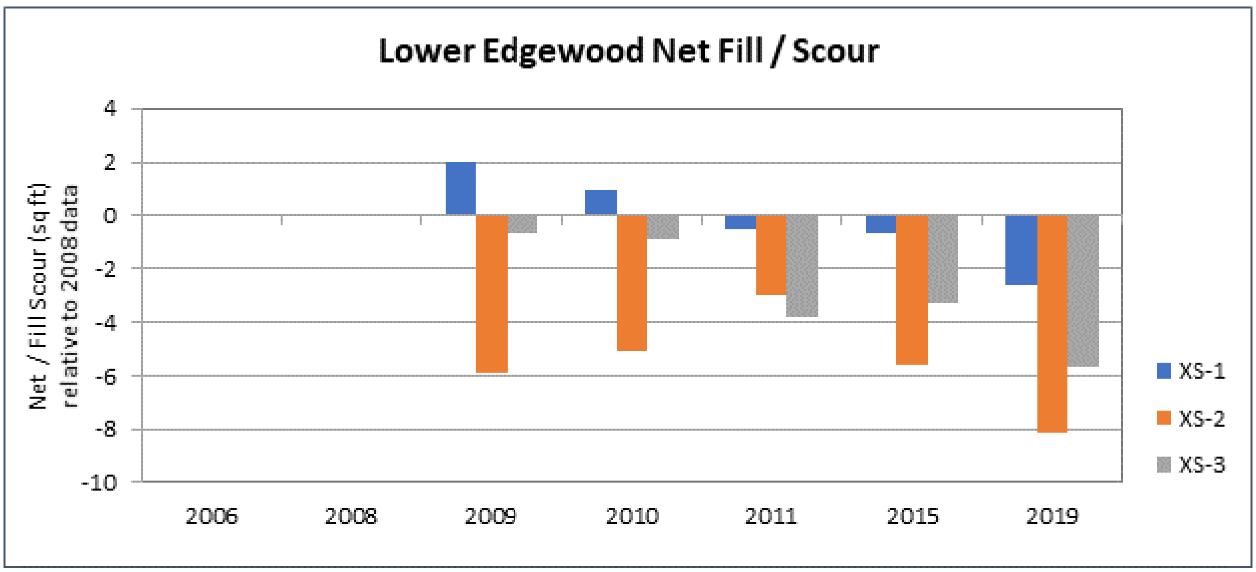
Figure H-10 **Net Fill/Scour – Lower Hidden Valley Creek**

Channel cross-section geometry for Upper Edgewood Creek (EC-1) is not included, as bankfull measurements were only recorded in 2015 and the past restoration project makes it difficult to reliably identify bankfull indicators. Comparison of cross-section topography shows that the channel location has not moved laterally. The bankfull geometry at Lower Edgewood Creek (EC-2) cross-sections varies by cross-section and surveyed years since 2006; however, only comparisons between post-restoration data should be made (2008 data and later; Figure H-11). Changes at XS-1 include minimal scour changes during the first part of the monitoring period (Figure H-12), followed by increasing deposition. XS-2 and XS-3 have experienced a larger volume of deposition since the 2008 restoration effort. Continued deposition has reduced the channel area at all cross-sections over time, potentially encouraging water to access the floodplain under a greater number of flow regimes. The dominant substrate in EC-2 is small particles (fine gravel or sand) that is readily mobilized and allows the channel to adjust to varied flow and sediment supply by vertical changes. The channel may migrate depending on flow, sand volumes, and vegetation.



Note: 2006 data not shown.

Figure H-11 Bankfull Area – Lower Edgewood



Note: Comparisons made to 2008, since XS-3 was relocated after 2006. 2006 data not shown.

Figure H-12 Net Fill/Scour – Lower Edgewood

The channel cross-section geometry of Upper Daggett (DC-1) saw an increase in area at XS-1 in 2015 due to channel widening, with a slight decrease in bankfull channel area at XS-2 and XS-3 (Figure H-13); however, XS-1 stabilized to pre-2015 conditions in 2019, and XS-2 and XS-3 remained consistent. The 2015 net scour/fill compared to the 2006 area increased substantially at XS-1, but deposition was observed at all three cross-sections in 2019 (Figure H-14). Emergency repairs of East Peak Dam in early summer 2015 created uncontrolled runoff, which may have altered flows into Daggett Creek (increased volume, velocity, and scour), potentially accounting for cross-sectional changes seen during surveys later in 2015.

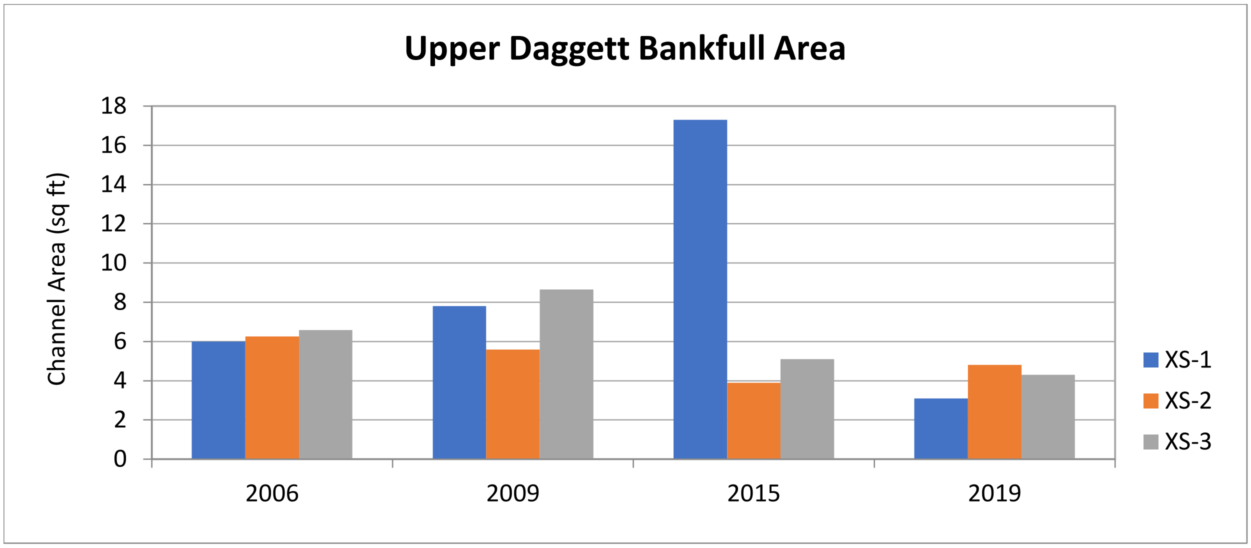


Figure H-13 Bankfull Area – Upper Daggett

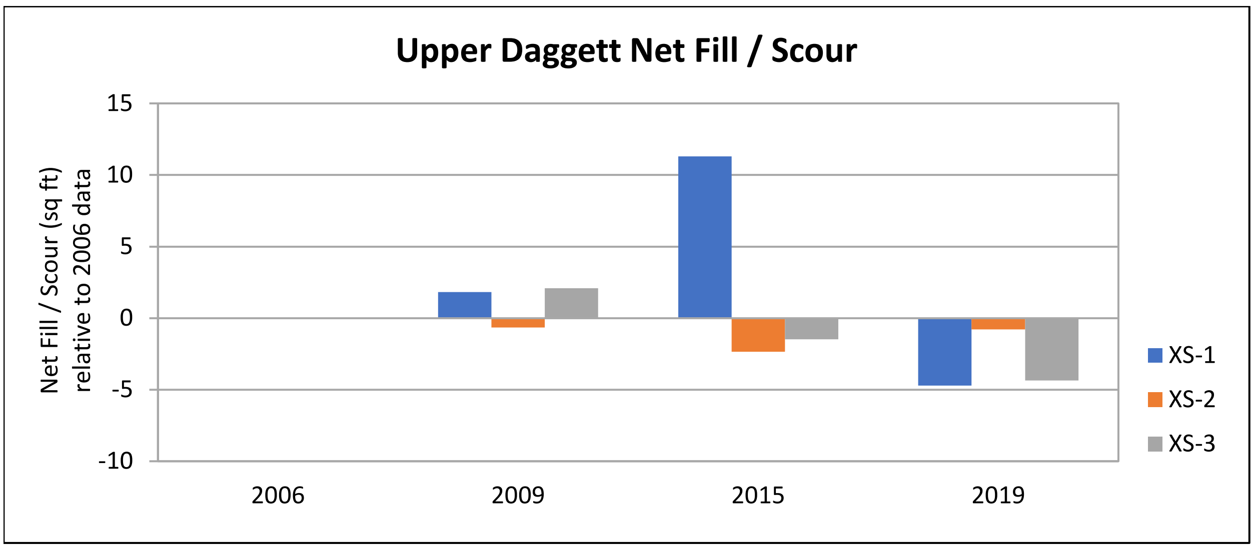


Figure H-14 Net Fill/Scour – Upper Daggett

The channel cross-section geometry at Lower Daggett Creek (DC-2) varies by cross-section following 2006 for XS-1 and XS-3 (Figure H-15). The bankfull channel area at XS-2 is very small, and has remained fairly consistent over the monitoring period. XS-3 and XS-1 channel area was relatively large in 2006, and both have experienced substantial deposition (Figure H-16) and both channel areas have drastically reduced in size. However, depositional rates appear to have tapered off and stabilized over time.

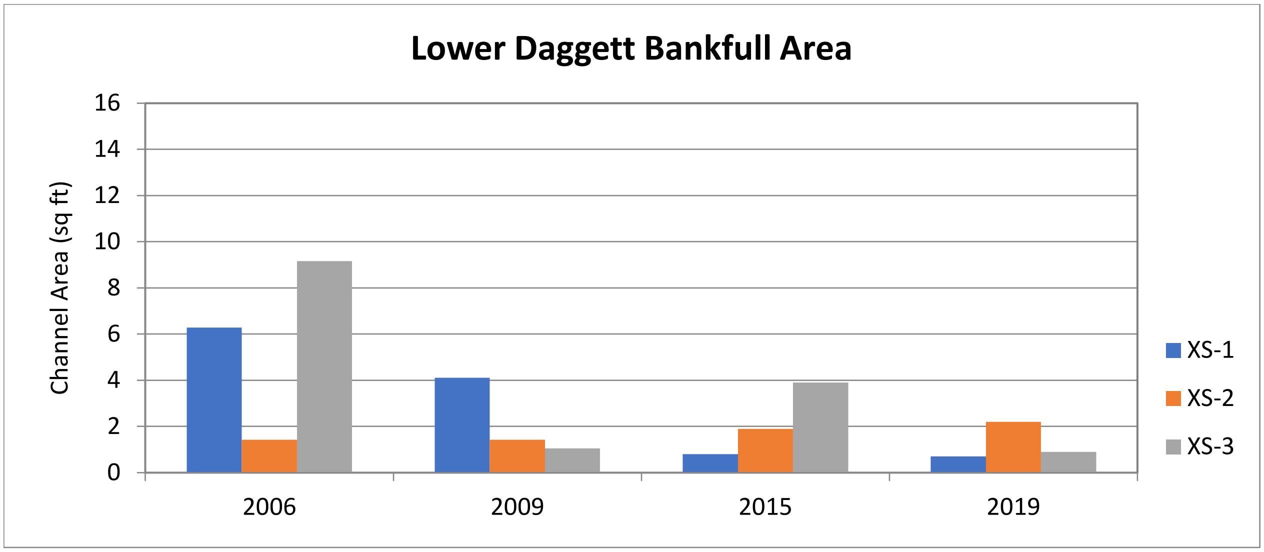


Figure H-15 Bankfull Area – Lower Daggett

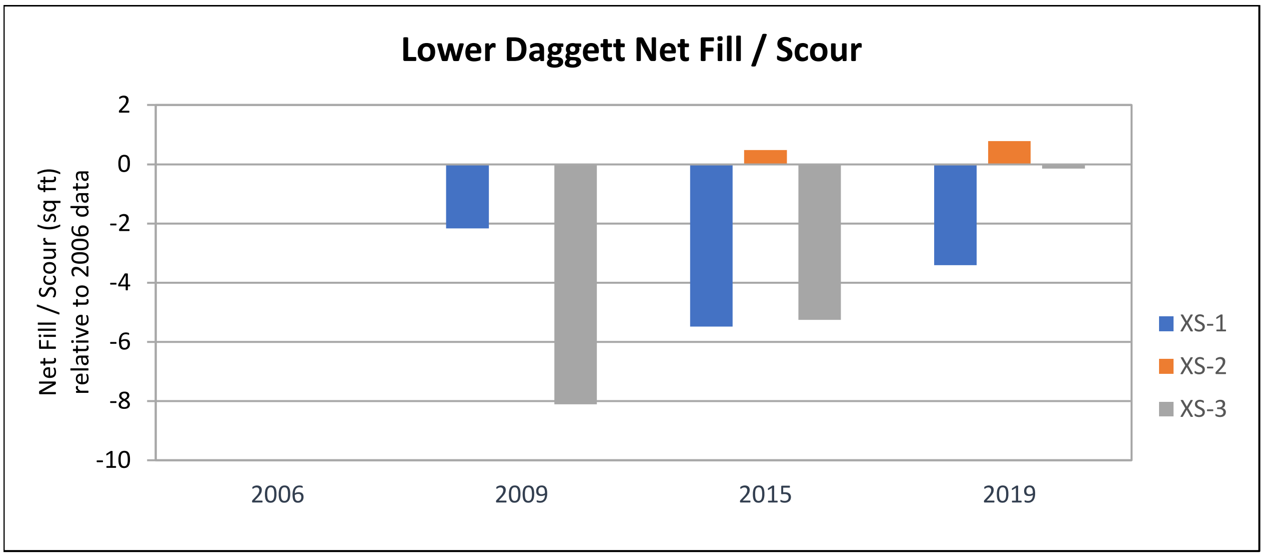


Figure H-16 Net Fill/Scour – Lower Daggett

H.1.5 Channel Gradient

The channel gradient surveys measured the water surface slope if flow was present or streambed slope (along the thalweg) if the channel was dry. Surveys were conducted with either an auto-level or total station through each of the three cross-sections within each site extending several bankfull widths upstream and downstream of the bounding cross-sections.

Minor differences from year to year at some cross-sections may reflect changes in the start/end locations of the profiles and whether or not the channel was dry at the time of survey. In 2015, pins were added at the upper and lower most cross-sections to provide consistent starting and ending points for future measurements. In 2015, both water surface and bed elevations began to be measured.

The channel gradients in all of the Heavenly Valley Creek monitoring reaches have remained consistent over the monitoring period, within the same range of gradient across the entire reporting period (Tables

H-14). No profile steepening from net down-cutting, knickpoint establishment, or knickpoint migration is apparent, and in all instances, the profile change was equal or less than 1 percent since 2006.

The gradient at Upper Hidden Valley Creek has remained stable over time (Table H-15). The gradient at Lower Hidden Valley Creek has fluctuated over time (within 2 percent), but the 2019 gradient was nearly identical to the originally observed 2006 gradient.

The gradient at Upper Edgewood Creek has remained stable over time and has only fluctuated within 1 percent (Table H-16). Only minimal gradient fluctuation would be expected, due to the volume of restoration and gabion basket installations that control gradation. The gradient at Lower Edgewood Creek has fluctuated more drastically, between 9.1 percent and 4.9 percent (when only looking at data following restoration in 2007).

The gradient at Upper Daggett Creek has only fluctuated between about 2 percent, and is trending toward a lower gradient, perhaps due to deposition along the channel (Table H-17). The gradient at Lower Daggett Creek has fluctuated more (between 5.1 percent and 8.1 percent), although the creek has often been dry during sampling, and thus comparing the bed surface slope to water surface slope may not be an appropriate comparison.

The larger variability in water surface slopes (Lower Hidden Valley Creek, Lower Edgewood Creek, and Lower Daggett Creek) may solely be due to the inherent variability in channel survey methods. Because there are no permanent start and end points at the middle cross-section for the longitudinal profile survey, changes from year to year can be due to surveying different habitat units at the start and end points, which are exaggerated in steep channels over shorter distances. As such, it is recommended that the longitudinal survey methodology be refined, which is discussed further in the recommendations section.

Table H-14 Heavenly Valley Creek Water Surface Slopes (%)

Year	HVC-1 (Sky Meadows)	HVC-2 (Patsy's)	HVC-3 (Property Line)
2006	1.1	4.5	5.9
2009	1.2	4.2	4.7
2011	1.3	4.2	5.0
2015	0.8	3.3	5.7
2019	1.3	3.5	5.3

Table H-15 Hidden Valley Creek Water Surface Slopes (%)

Year	HDVC-1 (Upper Hidden Valley Creek)	HDVC-2 (Lower Hidden Valley Creek)
2006	0.6[1]	9.4
2009	1.5	8.6
2011	1.0	8.9
2015	0.9	7.3
2019	1.0	9.3

[1] Upper Hidden Valley Creek channel was dry in 2006. Reported value is the bed slope rather than water surface slope.

Table H-16 Edgewood Creek Water Surface Slopes (%)

Year	EC-1 (Upper Edgewood)[1, 2]	EC-2 (Lower Edgewood)
2006	15.1	5.6
2008	14.8	6.2
2009	14.8	4.9
2010	14.8	5.9
2011	14.8	6.2
2015	14.8	9.1
2019	14.4	7.2

[1] All Upper Edgewood profiles are of the bed slope.
[2] 2006–2015 channel slopes are based on complete longitudinal profile survey as opposed to the average of local slopes at each monumented cross-section, which is typical for 2015 and all other sites.

Table H-17 Daggett Creek Water Surface Slopes (%)

Year	DC-1 (Upper Daggett Creek)	DC-2 (Lower Daggett Creek)
2006	14.3	8.1[1]
2009	12.3	7.2
2015	11.7	5.7
2019	12.1	5.1[1]

[1] Lower Daggett Creek channel was dry. Reported value is the bed slope rather than water surface slope.

H.1.6 Streambank Stability

Streambank stability is a measure of the vulnerability of streambanks to erosion. Streambank stability was measured along the entire length of a monitoring reach at equally spaced intervals. Observations on streambank stability were recorded using a 1, 2, and 3 ranking system as follows: 1 = stable, 2 = vulnerable, and 3 = unstable. Stable streambanks were identified as having 75 percent or more cover of living plants and/or other stability components that are not easily eroded (such as binding roots, rocks, and logs). Stable banks show no indicator of instability (e.g., erosion). Vulnerable banks have 75 percent or more cover, but have one or more instability indicators. Unstable banks have less than 75 percent cover and have instability indicators. Unstable streambanks are often bare, or nearly bare, and are composed of particle sizes too small or non-cohesive to resist erosion at high flows. Figures below include a percentage of banks rated as “1.”

The percent of stable banks has been variable in most reaches since 2006, with a similar pattern from year to year. Stability improvements may be due to increased vegetation growth, which typically occurs during wetter than normal years; however, flows during those years may also be higher and contribute to increased scouring. Drought conditions from 2012 to 2015 resulted in decreased flows and in some instances no flow conditions (Property Line at Heavenly Valley Creek). Changes in stability may also be related to volume of large woody debris (LWD) within the channel, particularly directly adjacent to banks. LWD in the majority of monitoring reaches has increased since 2006, and LWD continues to be redistributed by high flow events.

The percent of stable banks along Heavenly Valley Creek varied over time at each of the three reaches (Figure H-17). Stability increased from 2006 to 2009, substantially at Sky Meadows and Patsy’s reaches, and only slightly at Property Line reach; however, results from 2011 and 2019 show decreases in streambank stability. The Property Line reach experienced an increase in stability in 2015, from 4 percent in 2011 to 29 percent in 2015. The Patsy's and Sky Meadows reaches have experienced slight declines in stability since 2009 and 2011.

The Sky Meadows reach exhibits the most stable streambank measurements over the monitoring period, with the average percentage of stability at 72 percent. The stability at Sky Meadows is likely associated with the high vegetation cover (primarily graminoids) present in the meadow complex. The Patsy's reach stability average over the monitoring period is 61 percent, while the Property Line reach stability average over the same time frame is 32 percent. The reason for the decline in stability at the Property Line reach in 2011 is uncertain, although it may be due to variability in surveyors across the years. It is possible that differences in LWD (LWD observed in 2011 was 50 percent of that observed in 2009) and/or rock material along the banks and/or aggradation changes occurred during higher flows in 2011. Stability at the Property Line reach increased in 2015, but the reach experienced a slight decline again in 2019. Drought conditions from 2012 to 2015 likely account for the decreased stability and vegetation cover at both the Sky Meadows and Patsy's reaches; however, stability at these reaches continued to decline through 2019, despite above-average or average precipitation conditions preceding 2019. Stability at the Property Line reach increased in 2015, but experienced a slight decline again in 2019.

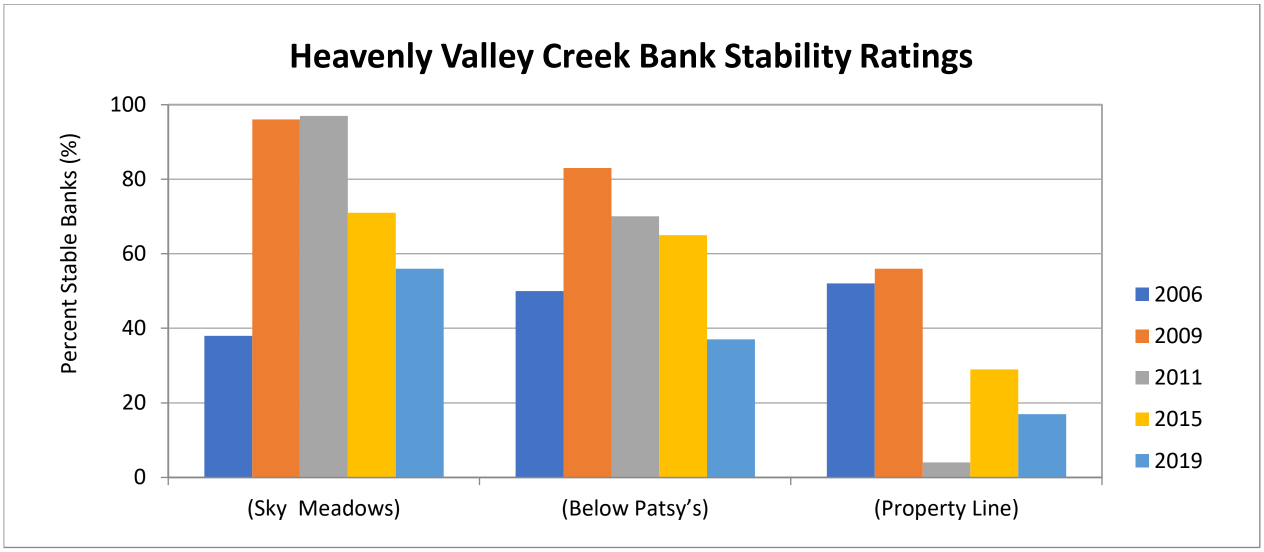


Figure H-17 Bank Stability – Heavenly Valley Creek

The percent of stable banks along Hidden Valley Creek varied over time at the two reaches (Figure H-18), but similar to Heavenly Valley Creek, all stability ratings were the highest in 2009 (86 percent at Upper Hidden Valley Creek and 79 percent at Lower Hidden Valley Creek). The Lower Hidden Valley Creek reference reach displays a similar pattern to the Property Line reach, with a decline of stability in 2011, followed by subsequent increases in 2015. Stability increased at both reference reach locations in 2015; however, the increase did not meet or exceed the 2006 observations. Stability at both reaches also experienced a decline in 2019.

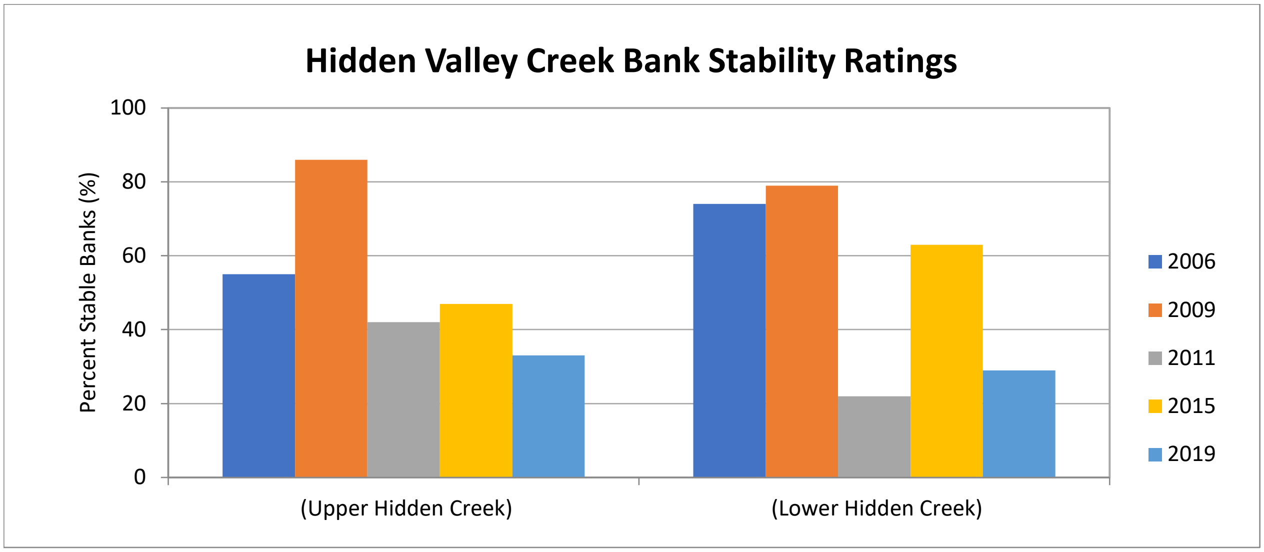


Figure H-18 Bank Stability – Hidden Valley Creek

The percent of stable banks along Lower Edgewood Creek varied over time and has steadily decreased since its peak in 2009 (Figure H-19). The Lower Edgewood stability chart correlates with the Patsy's reach along Heavenly Valley Creek, which showed an initial improvement in stability in 2009, followed by a slow decline. Stability measurements were not collected along Upper Edgewood Creek, with the exception of 2015. Should future measurements be collected at Upper Edgewood Creek, 2015 will be used as the baseline for comparison.

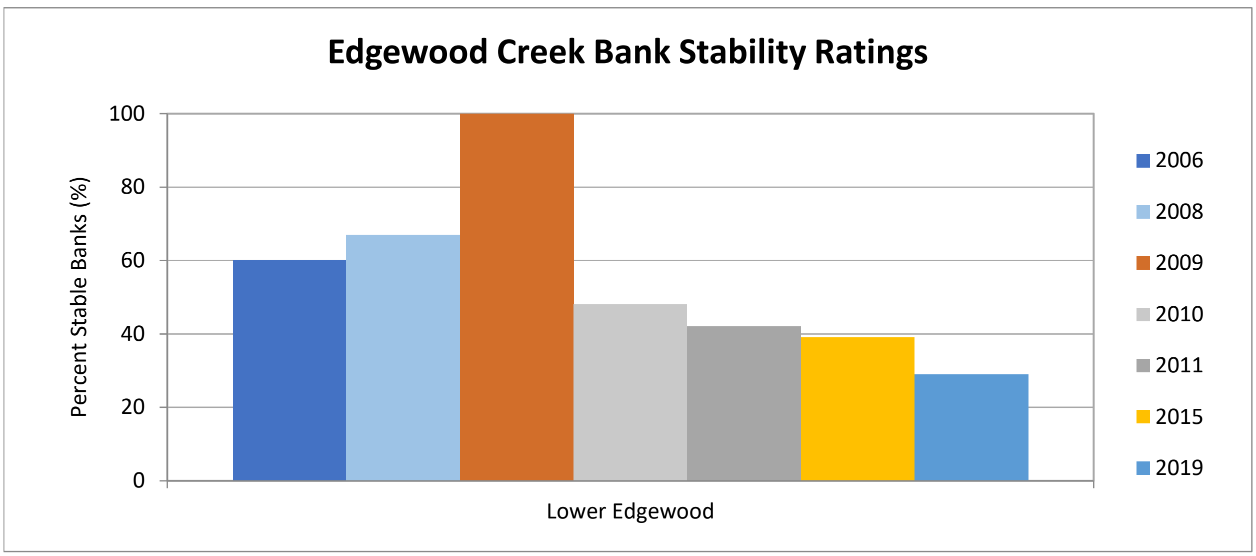


Figure H-19 Bank Stability – Lower Edgewood Creek

The percent of stable banks along Upper Daggett Creek (Figure H-20) displayed the same pattern of increased stability between 2006 and 2009 and decreased stability in 2015. Bank stability observations further declined (by over 50 percent) in 2019.

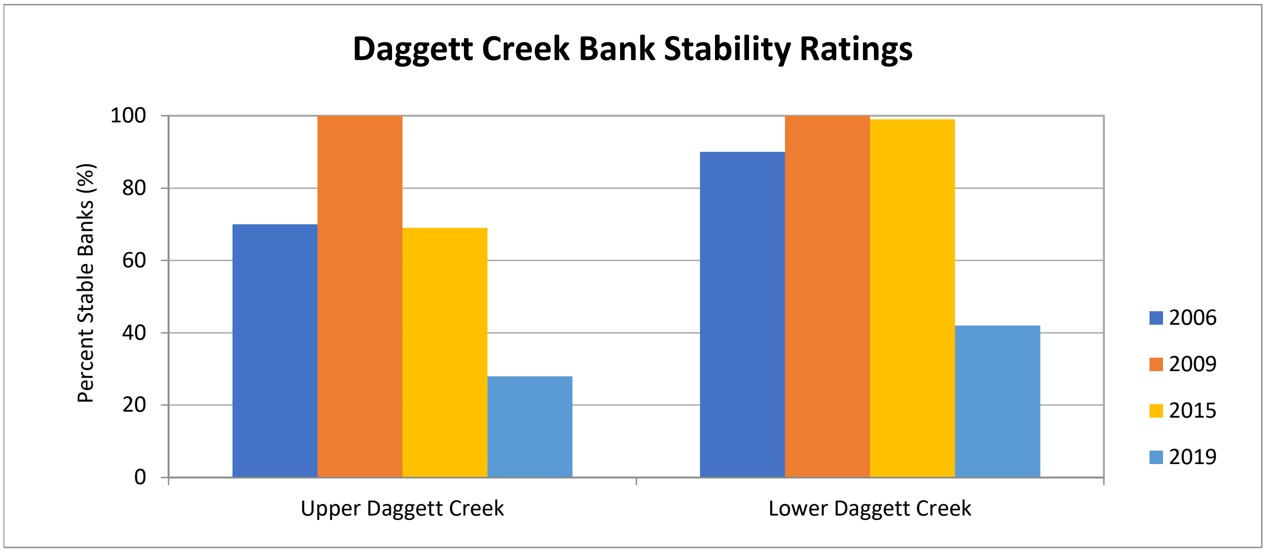


Figure H-20 Bank Stability – Daggett Creek

H.2 Monitoring Results – Quality Aquatic Habitat

SCI monitoring also measures the quality of aquatic habitat based on channel characteristics. Quality aquatic habitat can be an indicator of overall watershed health and water quality. Improvements in measures of aquatic habitats often have correlations with improvements in water quality.

H.2.7 Habitat Types

Habitat types were classified along entire monitoring reaches to describe the spatial distribution of fast- and slow-water habitat units. Fast water (riffles and runs) and slow water (pools) are important core attributes because they are the base stratification of physical habitats that support aquatic life. The habitat types were measured and described based on stationing established along each monitoring reach.

All of the monitoring reaches are dominated by fast-water habitats (Figures H-21 to H-28), with the highest percentages of fast water typically in the higher gradient reaches. Observations of slow water increased at nearly all monitoring reaches in 2019. Of the reaches with greater than 5 percent channel slopes, Property Line and Upper Daggett reaches have relatively more slow-water habitat than the other steep reaches. Some increase in slow-water habitats is documented over time, but it may be related to interpretations of habitat affected by flow at the time of observation. Other increases of slow water may be due to sediment deposition or increases in LWD across the reach. Slow water at the Sky Meadows reach has been increasing over time, which is consistent with other observations of meadow sediment deposition and channel braiding. Upper Edgewood Creek has been dry during monitoring; therefore, it is not included in this metric. Lower Edgewood habitat types have been surveyed for 2015 and 2019 only, as water was present during those years.

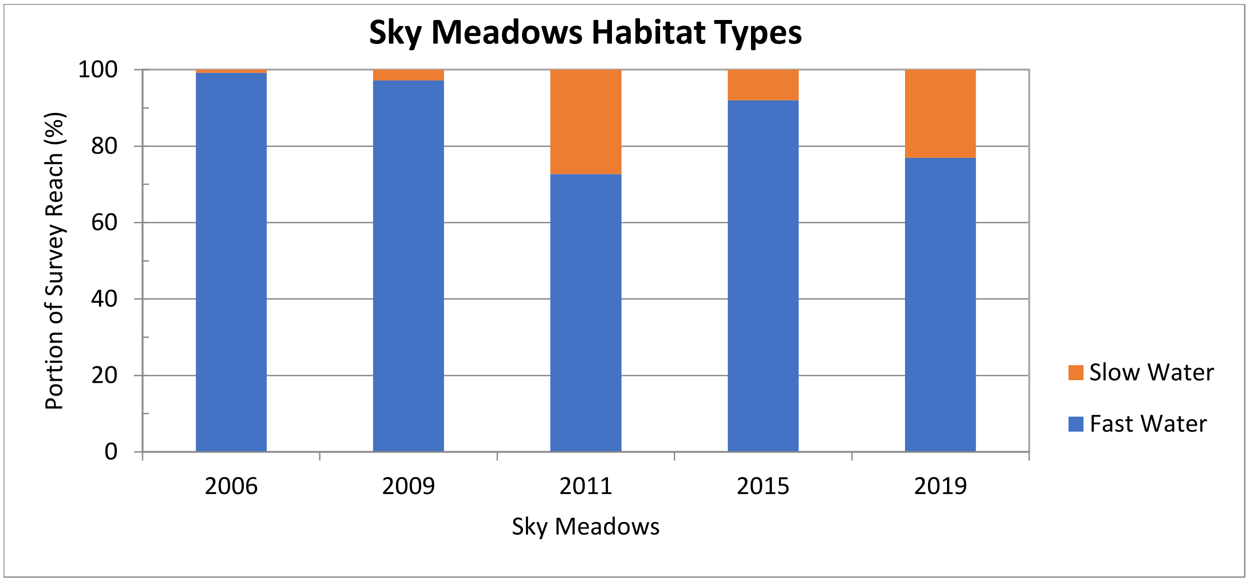


Figure H-21 Habitat Types – Sky Meadows

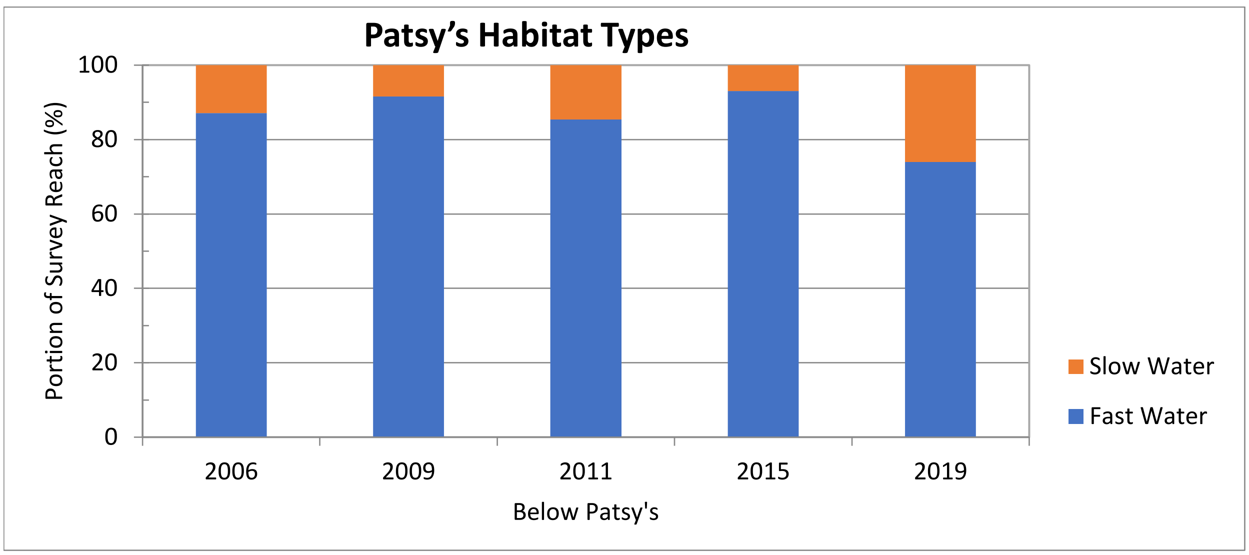
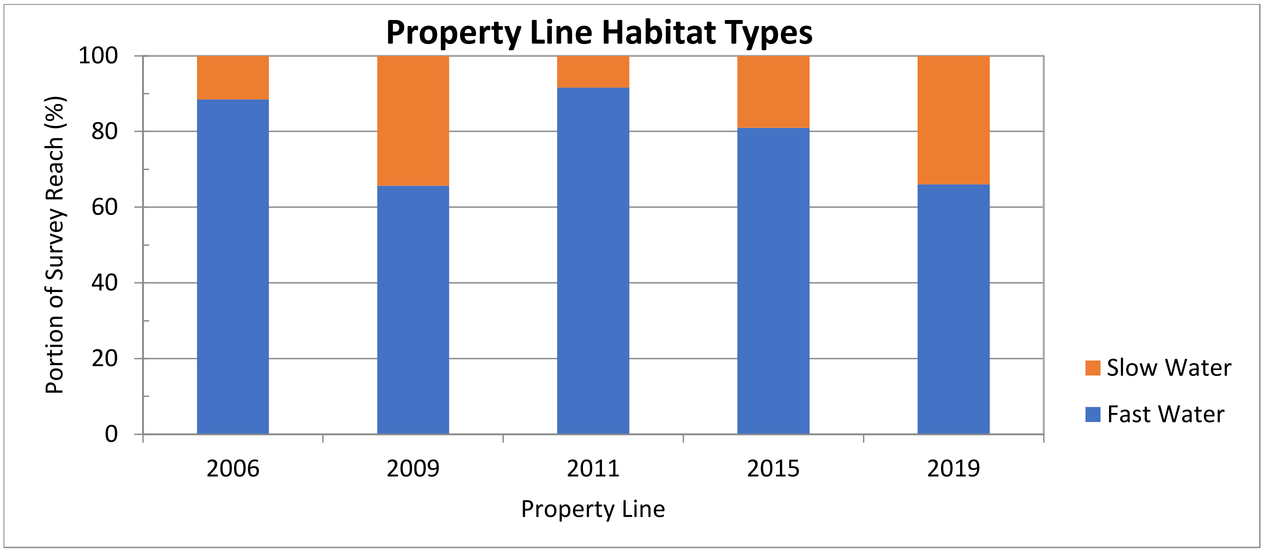


Figure H-22 Habitat Types – Patsy's



Note: Property Line reach lengths varied greatly during the beginning of the reporting period, which may account for some variability.

Figure H-23 Habitat Types – Property Line

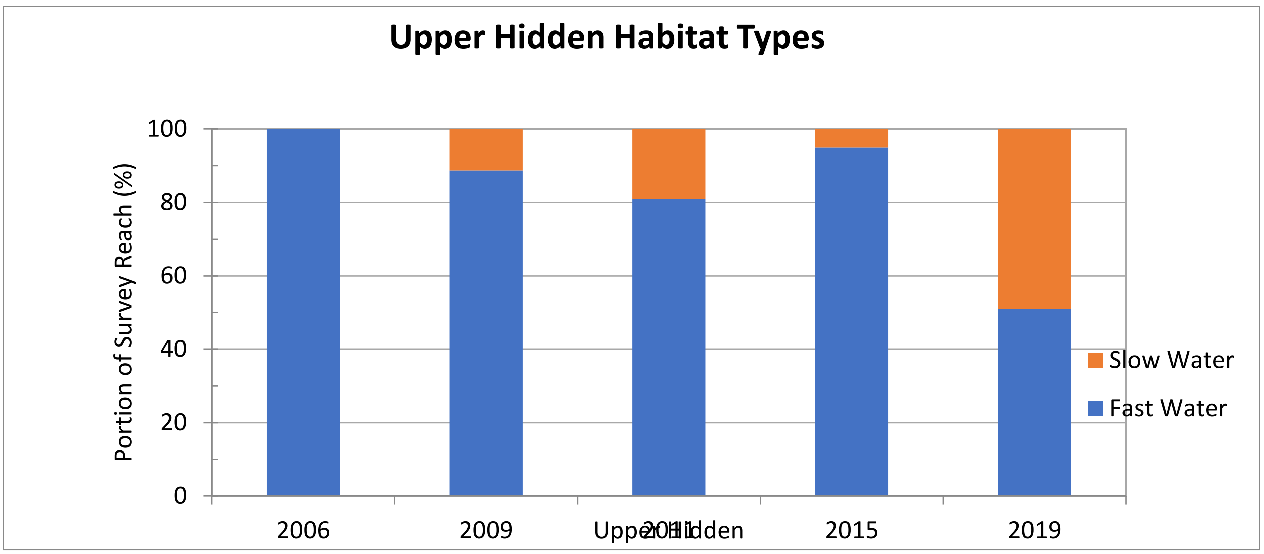


Figure H-24 Habitat Types – Upper Hidden Valley Creek

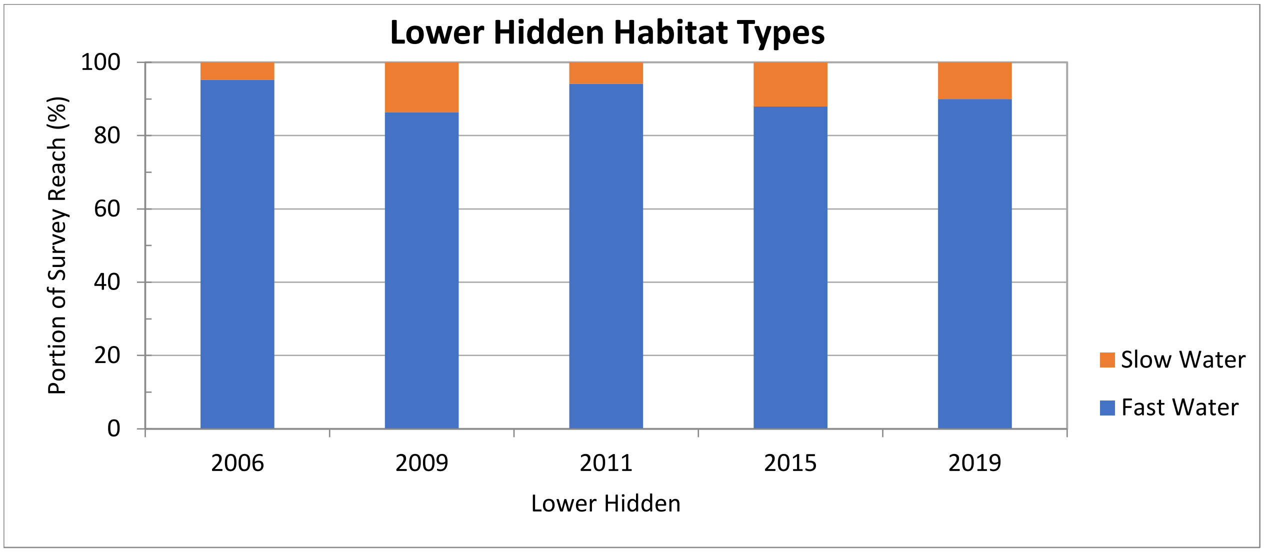


Figure H-25 Habitat Types – Lower Hidden Valley Creek

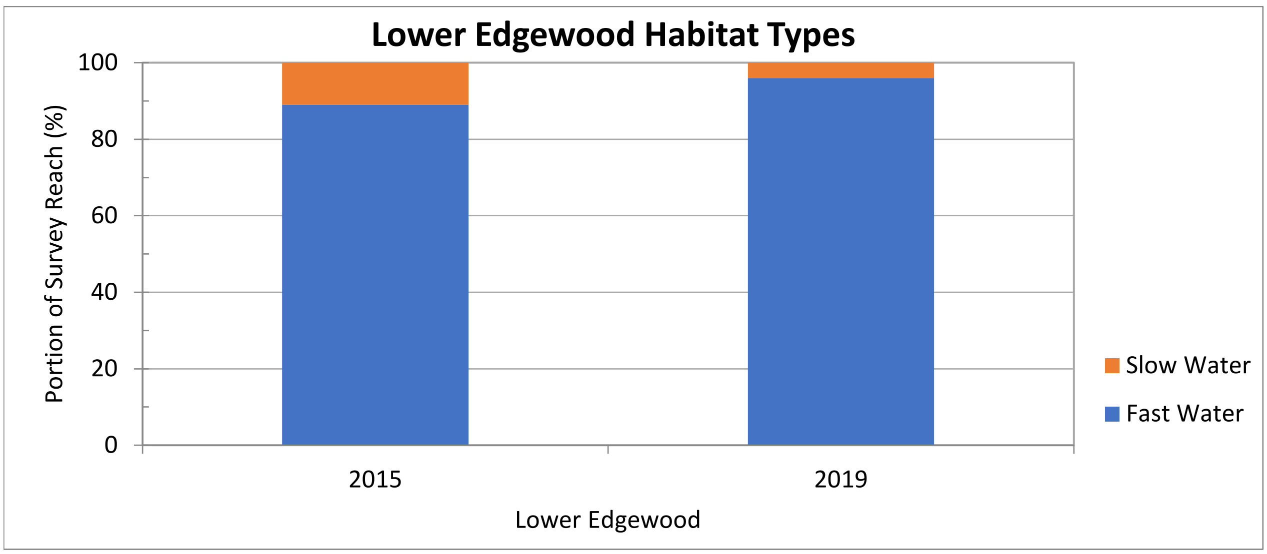


Figure H-26 Habitat Types – Lower Edgewood

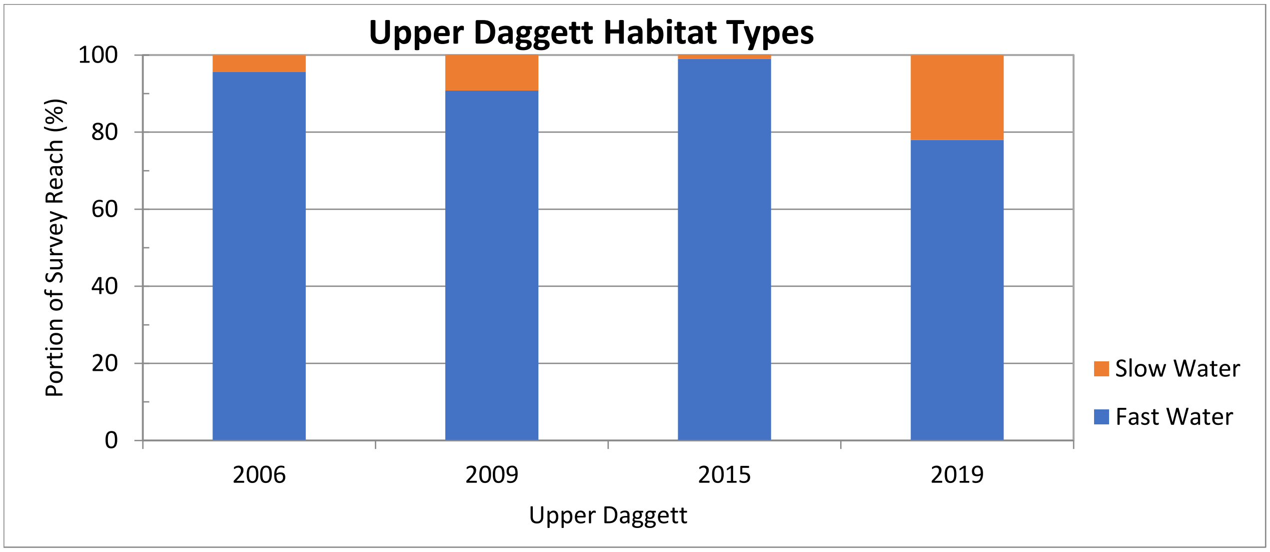


Figure H-27 Habitat Types – Upper Daggett

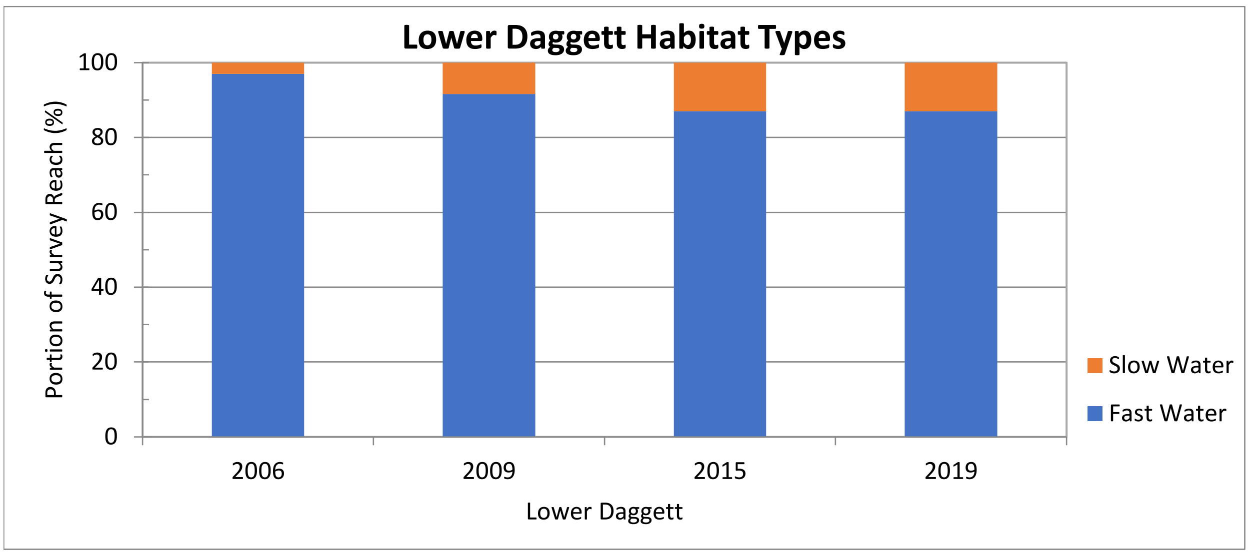


Figure H-28 Habitat Types – Lower Daggett

H.2.8 <u>Pools</u>

The objectives of pool measurements include quantifying the number of pools in each reach, determining the range of residual pool depths within the monitoring segment, and documenting whether wood is a factor in pool formation. The number of pools per 100 feet of reach has been additionally calculated, to account for any changes in reach length by monitoring year. Residual pool depth was measured to characterize pools because it corrects for possible variability in pool depths that results from differences in the stage at the time of observation. Residual pool depth was determined by identifying the point of zero flow elevation on the controlling riffle downstream and then measuring the depth from the bottom of the pool up to the point of zero flow elevation. Pools were identified on the basis of three key criteria: (1) flow (slow or no velocity during summer low flows), (2) morphology (hydraulic control at the pool tail, usually a concave longitudinal profile, and (3) dimension (length is greater than the wetted width, depth is greater than non-pools, and the maximum depth is more than twice the pool tail depth). To be considered a pool, the slow water must occupy most of stream width and include the thalweg. Backwater and side water pools were not measured. At each pool, the depth at the deepest point was measured along with the pool tail crest depth.

The number of pools, pool length, and residual pool depths increased over time at the Sky Meadows and Property Line reaches along Heavenly Valley Creek (Tables H-18 and H-20). The number of pool and length increased at the Patsy's reach, but the residual pool depth remained fairly consistent (Table H-19). The number of pools observed at Upper Hidden Valley Creek has increased over time, while the mean lengths and depths have remained fairly constant (Table H-21). Observations of pools at Lower Hidden Valley Creek have remained relatively consistent over time (Table H-22). While the number of pools at Lower Edgewood and Upper Daggett Creeks have increased over time, the mean lengths and depths have remained fairly constant over time (Table H-23 and H-24). It is difficult to identify pool trends at Lower Daggett, due to the limited volume of data available, as a result of no flow conditions during the time of surveys (Table H-25). In general, surveys in 2011 at all sites documented pools of both greater length and depth, which followed a winter of greater-than-average precipitation. Pool measurements were taken in 2006 after an average precipitation WY (42.6 inches of precipitation were measured from October 1–September 30). SNOTEL annual precipitation totals are graphically shown in Appendix B. The 2009 and 2015 pool measurements were taken during drought years when the average precipitation values were 28.4 and 22.6 inches, respectively. The 2011 measurements followed the WY with the most precipitation, in which 56.8 inches of precipitation were recorded, and surveys at all sites documented pools of both greater length and depth. While the increased flow in the channel at the time of the 2011 surveys does not affect the residual pool depth calculation, the increased flows may have led to increases in sediment transport. The spatial pattern of sediment transport at reaches and between sites may have resulted in deepening of some pools and shallowing of others. Surveys completed in 2019, following an above-average precipitation year, generally documented a greater number of pools and increased mean lengths and depths, and correlated with greater percentages of slow water. The data trends suggest that surveys done following dry WYs and lack of sediment transport are typically correlated with fewer pool observations, while surveys done following above-average precipitation winters were correlated with more pool observations and greater mean lengths and depths.

Table H-18 Pool Length (m) and Residual Pool Depth (cm) – Sky Meadows

HVC-1 (Sky Meadows)				
Year	**Number of Pools (n)**	**Number of Pools per 100 ft. of Channel (n)**	**Mean Pool Length (m)**	**Mean Pool Residual depth (cm)**
2006	1	0.2	1.5	18.3
2009	3	0.4	2.1	18.3
2011	17	2.4	3.4	27.4
2015	3	0.6	3.3	16.7
2019	8	1.7	4.7	31.3

Table H-19 Pool Length (m) and Residual Pool Depth (cm) – Patsy's

HVC-2 (Patsy's)				
Year	Number of Pools (n)	Number of Pools per 100 ft. of Channel (n)	Mean Pool Length (m)	Mean Pool Residual depth (cm)
2006	18	1.4	2.8	27.4
2009	19	1.4	1.8	18.3
2011	17	1.3	3.4	33.5
2015	10	0.8	3.0	31.2
2019	30	2.3	3.9	26.3

Table H-20 Pool Length (m) and Residual Pool Depth (cm) – Property Line

HVC-3 (Property Line)				
Year	Number of Pools (n)	Number of Pools per 100 ft. of Channel (n)	Mean Pool Length (m)	Mean Pool Residual depth (cm)
2006	2	1.0	3.5	9.1
2009	24	3.3	3.1	18.3
2011	12	1.0	2.7	37.5
2015	24	2.0	2.3	41
2019	20	1.5	4.9	34.4

Note: Property Line reach lengths varied greatly during the beginning of the reporting period. Number of pools per 100 feet of channel standardizes that variability.

Table H-21 Pool Length (m) and Residual Pool Depth (cm) – Upper Hidden Valley Creek

HDVC-1 (Upper Hidden Valley Creek)				
Year	Number of Pools (n)	Number of Pools per 100 ft. of Channel (n)	Mean Pool Length (m)	Mean Pool Residual depth (cm)
2006	-	-	-	-
2009	4	0.59	2.3	21.3
2011	11	1.48	3.9	24.4
2015	4	0.57	1.5	19.8
2019	37	5.29	3.2	20.3

Note: Due to lack of flow at Upper Hidden Valley Creek in 2006, pools were not measured

Table H-22 Pool Length (m) and Residual Pool Depth (cm) – Lower Hidden Valley Creek

HDVC-2 (Lower Hidden Valley Creek)				
Year	**Number of Pools (n)**	**Number of Pools per 100 ft. of Channel (n)**	**Mean Pool Length (m)**	**Mean Pool Residual depth (cm)**
2006	4	0.68	2.1	24.4
2009	16	3.06	1.8	18.3
2011	4	0.54	3.3	24.4
2015	15	1.76	2.5	20.8
2019	9	1.06	3.4	25.8

Table H-23 Pool Length (m) and Residual Pool Depth (cm) – Lower Edgewood Creek

EC-2 (Lower Edgewood Creek)				
Year	**Number of Pools (n)**	**Number of Pools per 100 ft. of Channel (n)**	**Mean Pool Length (m)**	**Mean Pool Residual depth (cm)**
2015	8	2.29	1.6	18.5
2019	3	0.86	1.7	19.9

Table H-24 Pool Length (m) and Residual Pool Depth (cm) – Upper Daggett Creek

DC-1 (Upper Daggett Creek)				
Year	**Number of Pools (n)**	**Number of Pools per 100 ft. of Channel (n)**	**Mean Pool Length (m)**	**Mean Pool Residual depth (cm)**
2006	7	0.88	1.5	18.3
2009	8	1.33	2.1	33.5
2015	12	1.85	2.0	21.2
2019	26	4.00	1.9	22.0

Table H-25 Pool Length (m) and Residual Pool Depth (cm) – Lower Daggett Creek

DC-2 (Lower Daggett Creek)				
Year	**Number of Pools (n)**	**Number of Pools per 100 ft. of Channel (n)**	**Mean Pool Length (m)**	**Mean Pool Residual depth (cm)**
2006	2	0.54	N/A	N/A
2009	5	1.20	0.4	27.3
2015	3	0.64	2.4	21.3
2019	-	-	-	-

Note: Detailed pool measurements for pools in 2006, and no measurements of pools were taken during 2019, under no flow conditions.

H.2.9 Pool Tail Fines

Pool tail surface fine sediment is measured along with the residual pool depths at each identified pool in each reach. The objective of this measurement is to quantify the percentage of fine sediment less than 2 mm (silt and clay size material) on the pool tail substrate. Measurements were taken at each pool tail using a grid designed by the USFS. The grid is a 14 x 14–inch square frame with 49 line-intersections and one corner, totaling 50 intersecting points. Three random tosses of the grid were done at each pool tail, space allowing. If the pool tail was too narrow, only one toss was made. Within the area where the grid fell, the survey crew counted and recorded the number of grid intersections lying above substrate 2 mm or less. Each counted intersection represents 2 percent fines. The number of intersects counted was multiplied by two to reveal a percentage of fines within the pool tail.

The variability of the pool tail fines data is somewhat consistent with the changes in hydrology and associated sediment transportation/deposition patterns from year-to-year, with greater observations of fines following dry years (2009, 2015) and fewer observations of fines following wet years (2006, 2011, 2019). It is possible that fines are mobilized in wet years, thus distributing fines across the entire reach more evenly, and during dry years, lower flows concentrate fines at the tails of pools. Tables H-26 through H-29 list the measured pool tail fine values collected over the reporting period. Data on pool tail fines were not collected at Lower Edgewood until 2015. Surface water was not present at Upper Edgewood during any survey, so it was not possible to survey for pool fines. The 2019 surveys documented a lower percentage of pool tail fines at all locations, with the exception on Lower Daggett and Lower Edgewood, which have exhibited consistent patterns of pool tail fines across the reporting period.

Table H-26 Pool Tail Fines (Percent) – Heavenly Valley Creek

Heavenly Valley Creek			
Year	**HVC-1 (Sky Meadows)**	**HVC-2 (Patsy's)**	**HVC-3 (Property Line)**
2006	80	63	48
2009	64	63	71
2011	70	12	61
2015	99	63	41
2019	29	16	27

Note: Property Line reach lengths varied greatly during the beginning of the reporting period.

Table H-27 Pool Tail Fines (Percent) – Hidden Valley Creek

Hidden Valley Creek		
Year	**HDVC-1 (Upper Hidden Valley Creek)**	**HDVC-2 (Lower Hidden Valley Creek)**
2006	N/A	N/A
2009	34	73
2011	62	13
2015	40	59
2019	17	13

Table H-28 Pool Tail Fines (Percent) – Daggett Creek

Daggett Creek		
Year	**DC-1 (Upper Daggett Creek)**	**DC-2 (Lower Daggett Creek)**
2006	59	70
2009	74	89
2015	66	76
2019	23	69

Table H-29 Pool Tail Fines (Percent) – Edgewood Creek

Year	EC-2 (Lower Edgewood Creek)
2015	89
2019	98

H.2.10 Particle Size Distribution

In 2015, particle size distribution surveys began to be conducted in conjunction with the timing of BMI sampling, rather than during SCI. For all data collected in 2015 and prior, particle size distribution measurements on the streambed surface were conducted at the four riffles in each reach that were sampled for BMI during the previous sampling years. At each marked and counted riffle location, measurements were collected from the streambed along ten equally spaced transects that were oriented perpendicular to streamflow. A minimum of ten particles were selected along each transect using the blind touch method and were measured using a gravelometer. The median particle size and associated particle size class for the reach was determined from the pebble counts, and are reported here. Revised BMI sampling methodology (following SWAMP protocols) was instituted for surveys since 2016. The protocol dictates that five particles are measured with a gravelometer at the 21 evenly spaced transects, oriented perpendicular to flow, throughout the reach regardless of habitat type. Particles were selected for measurement using the blind touch method at evenly spaced points within the wetted width of each transect. The median particle size and associated particle size class for the reach was determined from the pebble counts, and are reported here. Since monitoring protocols changed slightly in 2016, results across the monitoring period are not directly comparable; however, it’s generally expected that the median particle size (reported here) would be similar, regardless of monitoring protocol. Current protocols that dictate measurements are taken evenly across a reach, regardless of habitat type, suggesting that it would be possible that average measurements would tend to be finer particles (as a greater number of pools may be sampled), compared to previous protocols that only sample riffles. With the change of protocol to sample particle sizes during BMI surveys, particles were only sampled at Sky Meadows and Upper Hidden Valley Creek reaches in 2016, as the other sites were not included in BMI surveys that year. This change in BMI protocol and survey frequency is discussed further in Chapter 5.1.1 and Chapter H.6.1.

The median particle diameter varies somewhat at the sites from year to year, but not usually by more than a few mm (Tables H-30 through H-33). The Heavenly Valley Creek sites vary from very coarse gravels to coarse gravel at the Patsy’s and Property Line reaches (with one instance of fine gravel at Property Line in 2018, likely as a result of sediment movement throughout the reach during the 2017 well-above-average precipitation year), and from coarse gravel to very fine gravel at the Sky Meadows reach. Sky Meadows reach has exhibited a decline in average particle size and class across the monitoring period. Particle classes at the Patsy’s and Property Line reaches have remained fairly constant.

The Upper Hidden Valley Creek reach median particle class has declined from medium gravel to fine or very fine gravel over the monitoring period, while Lower Hidden Valley Creek has fluctuated consistently between coarse and very coarse gravel.

Particle size measurements were taken at Upper Edgewood in 2015; however, particle size measurements were not collected following that date, as BMI surveys are not conducted at this reach, and only topographic data are collected. Particle size measurements have also been inconsistently collected at Lower Edgewood, although observations have consistently trended toward small particle size, including very fine gravel or sand.

Table H-30 Median Particle Diameter Class (mm) – Heavenly Valley Creek

Heavenly Valley Creek						
Year	HVC-1 (Sky Meadows)		HVC-2 (Patsy's)		HVC-3 (Property Line)	
	Average Size (mm)	Average Class	Average Size (mm)	Average Class	Average size (mm)	Average Class
2006	16.8	gravel (coarse)	34.5	gravel (very coarse)	21.5	gravel (coarse)
2009	13.0	gravel (medium)	26.5	gravel (coarse)	22.0	gravel (coarse)
2011	11.8	gravel (medium)	33.0	gravel (very coarse)	33.0	gravel (very coarse)
2015	17.0	gravel (coarse)	25.2	gravel (coarse)	26.6	gravel (coarse)
2016[1]	3.1	gravel (very fine)	-	-	-	-
2018	3.4	gravel (very fine)	26.7	gravel (coarse)	8.0	gravel (fine)
2019	7.3	gravel (fine)	51.3	gravel (very coarse)	18.2	gravel (coarse)

[1] Survey data collected at Sky Meadows only in 2016 as part of the new SWAMP BMI collection protocol.

Table H-31 Median Particle Diameter Class (mm) – Hidden Valley Creek

Hidden Valley Creek				
	HDVC-1 (Upper Hidden Valley Creek)		HDVC-2 (Lower Hidden Valley Creek)	
Year	Average Size (mm)	Average Class	Average Size (mm)	Average Class
2006*	10.0	gravel (medium)	34.3	gravel (very coarse)
2009	10.5	gravel (medium)	19.8	gravel (coarse)
2011	13.0	gravel (medium)	29.3	gravel (coarse)
2015	11.9	gravel (medium)	33.6	gravel (very coarse)
2016[1]	6.5	gravel (fine)	-	-
2018	3.2	gravel (very fine)	51.5	gravel (very coarse)
2019	5.8	gravel (fine)	27.3	gravel (coarse)

[1] Survey data collected at Upper Hidden Valley Creek only in 2016 as part of the new SWAMP BMI collection protocol.

Table H-32 Median Particle Diameter Class (mm) – Edgewood Creek

Year	EC-1 (Upper Edgewood Creek)		EC-2 (Lower Edgewood Creek)	
	Average Size (mm)	Average Class	Average Size (mm)	Average Class
2015	7.8	gravel (fine)	3.8	gravel (very fine)
2018[1]	-	-	-	-
2019[2]	-	-	0.062 - 2	sand

[1] Only California monitoring sites were sampled in 2018, as associated with BMI sample collections.

[2] Only longitudinal bed profile and cross-section analysis was conducted at Edgewood Creek in 2019.

Table H-33 Median Particle Diameter Class (mm) – Daggett Creek

Year	DC-1 (Upper Daggett Creek)		DC-2 (Lower Daggett Creek)	
	Average Size (mm)	Average Class	Average Size (mm)	Average Class
2006[1]	9.5	gravel (medium)	9.5	gravel (medium)
2009[1]	9.5	gravel (medium)	9.5	gravel (medium)
2015[1]	6.0	gravel (fine)	6.0	gravel (fine)
2018[2]	-	-	-	-
2019	38.1	gravel (very coarse)	6.0	gravel (fine)

[1] Determined from field notes, rather than actual measurements.

[2] Only California monitoring sites were sampled in 2018, as associated with BMI sample collections.

Particle size measurement have not been collected consistently at Daggett Creek in the past, and the data provided here have mostly been compiled from field notes. No information was collected along the Daggett Creek reaches in 2011. However, particle sizes at both Daggett Creek reaches appears to have remained consistent over the monitoring period—fluctuating between fine to very coarse gravel.

H.2.11 Large Woody Debris/Total Wood

LWD characterizes the abundance of woody debris that can influence channel morphology and stability. Current protocols define LWD as longer than one-half the bankfull width and located within a portion of the bankfull width of the channel. However, in 2006, definitions of LWD also included a minimum diameter measurement. Therefore, following 2006, most reaches have much larger wood tallies in 2009 and 2015, and 2006 observations were noted qualitatively, rather than quantitatively. Field observers noted more downed trees in the area in 2009 than in 2006 (from natural causes, as no cut trees or stumps were noted). The larger snowpack and increased runoff in the spring of 2011 may have mobilized woody debris. In general, woody debris is considered beneficial, as LWD can enhance channel stability and habitat complexity. This report also includes a calculation of LWD per 100 feet of channel, in order to standardize across years of varying reach lengths (as occurred at the Property Line reach at the beginning of the monitoring period) and allow comparisons of LWD across reaches (Tables H-34 through H-37).

In 2001, due to ski area management, much of the LWD had been removed from the reach at Sky Meadows (USFS 2001). Qualitative observations of LWD in 2006 indicated an increase in LWD, and LWD quantitatively increased substantially in 2009, followed by a decline in 2011. LWD counts stabilized between 2015 and 2019 at 6 to 7 pieces per 100 feet of reach. Similar trends were observed at Patsy's reach, and counts have stabilized at 1 to 12 pieces per 100 feet of reach. More variability has been observed at the Property Line reach, with observations on the high end (84 pieces per 100 feet) in 2009, to stabilizing at 27 to 29 pieces per 100 feet between 2015 and 2019. Overall, observations of LWD at Upper Hidden and Lower Hidden Valley Creek reaches have remained relatively consistent.

Two years of data from Lower Edgewood show a large increase (more than 50 percent) of LWD. LWD per 100 feet of channel has increased over time at both the Upper and Lower Daggett Creek reaches. In general, lower elevation, forested sites exhibited higher volumes of LWD (Property Line, Lower Hidden, and Lower Edgewood), whereas high-elevation, meadow sites (Sky Meadows, Upper Hidden) had lower volumes of LWD.

Table H-34 Total Wood – Heavenly Valley Creek

	HVC-1 (Sky Meadows)		HVC-2 (Patsy's)		HVC-3 (Property Line)	
Year	# of pieces	pieces/100 ft	# of pieces	pieces/100 ft	# of pieces	pieces/100 ft
2006[1]	10	2	57	4	16 [2]	8
2009	54	7	270	20	618	84
2011	18	3	79	6	524	42
2015	29	6	144	11	342	29
2019	31	7	155	12	356	27

[1] Qualitative observations taken from field notes.

[2] Field notes for 2006 have just 4 aggregate LWD.

Table H-35 Total Wood – Hidden Valley Creek

	HDVC-1 (Upper Hidden Valley Creek)		HDVC-2 (Lower Hidden Valley Creek)	
Year	# of pieces	pieces/100 ft	# of pieces	pieces/100 ft
2006[1]	22	3	164	28
2009	63	9	167	32
2011	50	7	316	42
2015	96	14	207	24
2019	42	6	291	34

[1] Qualitative observations taken from field notes.

Table H-36 Total Wood – Edgewood Creek

	EC-2 (Lower Edgewood Creek)	
Year	# of pieces	pieces/100 ft
2015	153	44
2019	320	91

Table H-37 Total Wood – Daggett Creek

	DC-1 (Upper Daggett Creek)		DC-2 (Lower Daggett Creek)	
Year	# of pieces	pieces/100 ft	# of pieces	pieces/100 ft
2006[1]	29	4	15	4
2009	49	8	24	6
2015	76	12	68	14
2019	130	20	132	26

[1] Qualitative observations taken from field notes.

H.2.12 Stream Shading

Stream shading measures the average canopy cover in each monitoring reach. Stream shading was measured at the same 50 equally spaced transects used to assess streambank stability. At each of the 50 transects, stream shading was measured using a Solar Pathfinder. The Solar Pathfinder was oriented to the south at approximately 0.3 m above the water surface. Looking at the reflection of the sky in the Solar Pathfinder dome along the August or September sun path (depending on time of surveys), the field crew was able to add up the shaded sections to yield the percent shade for each transect. An average for stream shading across each reach is included in Tables H-38 through H-41.

The percent mean stream shading has remained relatively consistent by site and reach over the years, with the exception of Daggett Creek, which experienced a large increase of downed trees between 2006 and 2009. This may be a result of trees along the project reach being downed due to natural causes during this time (high wind events). Lower Daggett has remained consistent since that time, but shading at Upper Daggett has increased over time to near 2006 levels.

Table H-38 Mean Stream Shading (%) – Heavenly Valley Creek

Year	HVC-1 (Sky Meadows)	HVC-2 (Patsy's)	HVC-3 (Property Line)
2006	37	73	84
2009	30	75	87
2011	29	80	92
2015	24	80	92
2019	32	82	93

Table H-39 Mean Stream Shading (%) – Hidden Valley Creek

Year	HDVC-1 (Upper Hidden Valley Creek)	HDVC-2 (Lower Hidden Valley Creek)
2006	58	87
2009	51	88
2011	51	89
2015	41	92
2019	53	90

Table H-40 Mean Stream Shading (%) – Edgewood Creek

Year	EC-2 (Lower Edgewood)
2006	92
2008	93
2009	95
2010	89
2011	92
2015	94
2019	93

Table H-41 Mean Stream Shading (%) – Daggett Creek

Year	DC-1 (Upper Daggett Creek)	DC-2 (Lower Daggett Creek)
2006	86	61
2009	51	32
2015	80	33
2019	72	36

H.2.13 Streambank Angle

Streambank angle measures the dominant angle of the streambank between the bottom of the bank and the bankfull stage. Measurements were collected at the same 50 transects used to assess streambank stability and stream shading. At each transect, each bank was measured for an angle using a clinometer. These measurements are only made for streams with gradient less than 2 percent. Therefore, only observation at Sky Meadows and Upper Hidden Valley Creek reaches were recorded. Edgewood Creek, Daggett Creek, the lower reaches along Heavenly Valley Creek, and Lower Hidden Valley Creek all exhibited gradients greater than 2 percent. No substantial changes in streambank angle were noted at the reaches from year to year (Table H-42); however, Sky Meadows has experienced a slight increasing trend in streambank angle since 2009.

Table H-42 Mean Streambank Angle (degree)

Year	Heavenly Valley Creek HVC-1 (Sky Meadows)	Hidden Valley Creek HDVC-1 (Upper Hidden Valley Creek)
2006	107	128
2009	94	115
2011	111	118
2015	125	125
2019	122	112

H.2.14 Streamshore Water Depth

Streamshore water depth was measured at each of the 50 equally spaced transects along the entire channel reach, on each bank. At each transect and each bank, the water depth was measured at the water’s edge. If the bank angle was equal to or less than 90 degrees (some range of undercut), the water depth was measured (in centimeters) using a measuring tape. If the bank angle was greater than 90 degrees the bank shore depth was recorded as zero. Greater streamshore depths are indicative of undercut banks. Similar to streambank angle, these measurements are only made for streams with gradients less than 2 percent (Sky Meadows and Upper Hidden Valley Creek; Table H-43). The streamshore depth at Upper Hidden Valley Creek has remained constant over the years, fluctuating between 2.3 and 3.3 cm, with the exception of 2019, where it increased to 5.6 cm. This is correlated with an increase in the number of pools throughout the reach, which are likely to have greater streamshore depth. Sky Meadows, which did not exhibit a large increase in pools in 2019, had a smaller increase in streamshore depth, which was most similar to 2006 and 2009 values.

Table H-43 Mean Shore Depth (cm)

Year	Heavenly Valley Creek HVC-1 (Sky Meadows)	Hidden Valley Creek* HDVC-1 (Upper Hidden Valley Creek)
2006	5.9	2.6
2009	5.8	3.3
2011	7.0	3.3
2015	3.8	2.3
2019	5.2	5.6

H.2.15 Aquatic Fauna

As recommended in the last comprehensive report, due to a lack of consistent methods and varied observers from year to year and the fact that the aquatic fauna observations are not considered useful or reliable, data for this metric has not been collected and reported.

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APPENDIX

I

TRACTION SAND ANALYSIS – JULY 2021

WETLAB
WESTERN ENVIRONMENTAL TESTING LABORATORY
Specializing in Soil, Hazardous Waste and Water Analysis.

475 E. Greg Street #119 | Sparks, Nevada 89431 | www.WETLaboratory.com
tel (775) 355-0202 | fax (775) 355-0817
1084 Lamoille Highway | Elko, Nevada 89801
tel (775) 777-9933 | fax (775) 777-9933
3230 Polaris Ave., Suite 4 | Las Vegas, Nevada 89102
tel (702) 475-8899 | fax (702) 776-6152

WETLAB Order ID. 2104195
Sparks Control #
Elko Control #
LV Control #
Report Due Date
Page 1 of 1

Client Cardno, Inc.
Address 295 Hwy 50, Suite 1
City, State & Zip Zephyr Cove, NV 89448
Contact Michelle Hochrein
Phone 775 335 2389
Collector's Name F. Papandrea
Fax
PWS/Project Name Heavenly
P.O. Number
PWS/Project Number
Email michelle.hochrein@cardno.com

Turnaround Time Requirements
Standard ✓
5 Day* (25%) ☐ 72 Hour* (50%) ☐
48 Hour* (100%) ☐ 24 Hour* (200%) ☐
*Surcharges Will Apply

Samples Collected From Which State? NV ☐ CA ✓ Other ☐
Compliance Monitoring? Yes ✓ No ☐
Report to Regulatory Agency? Yes ✓ No ☐
Report Results Via PDF ✓ EDD ☐ Other
Standard QC Required? Yes ✓ No ☐

Billing Address (if different than Client Address)
Company
Address
City, State & Zip
Contact
Phone Fax
Email michelle.hochrein@cardno.com

Analyses Requested

SAMPLE ID/LOCATION	DATE	TIME	PRES TYPE *	SAMPLE TYPE **	NO. OF CONTAINERS	Total Moisture Content Method CTM 226	Turbidity Method Caltrans (attached)	Sand Equivalent Method CTM 217	Durability Method CTM 229	Gradation Method CTM 202						Spl. No.
Heavenly Cinders			N/A	SO	1	✓	✓	✓	✓	✓						
X																
X											2104 1					
X																
X											0195 1					
X																
X																
X																
X																

Instructions/Comments/Special Requirements: See attached CalTrans methodology for turbidity analysis

Sample Matrix Key** DW = Drinking Water WW = Wastewater SW = Surface Water MW = Monitoring Well SD = Solid/Sludge SO = Soil HW = Hazardous Waste OTHER:

***SAMPLE PRESERVATIVES:** 1=Unpreserved 2=H2SO4 3=NaOH 4=HCl 5=HNO3 6=Na2S2O3 7=ZnOAc+NaOH 8=HCl/VOA Vial

Temp	Custody Seal	# of Containers	DATE	TIME	Samples Relinquished By	Samples Received By
16.1 °C	Y N None	1	4/7/21	1005	[signature]	[signature]
°C	Y N None					
°C	Y N None					
°C	Y N None					

WETLAB'S Standard Terms and Conditions apply unless written agreements specify otherwise. Payment terms are Net 30.

Client/Collector attests to the validity and authenticity of this (these) sample(s) and, is (are) aware that tampering with or intentionally mislabeling the sample(s) location, date or time of collection may be considered fraud and subject to legal action (NAC445.0636). MK initial
To the maximum extent permitted by law, the Client agrees to limit the liability of WETLAB for the Client's damages to the total compensation received, unless other agreements are made in writing. This limitation shall apply regardless of the cause of action or legal theory pled or asserted. MK initial
WETLAB will dispose of samples 90 days from sample receipt. Client may request a longer sample storage time for an additional fee. MK initial
Please contact your Project Manager for details. MK initial

301.2E

403005.indd 1 3/26/2015 5:35:15 PM

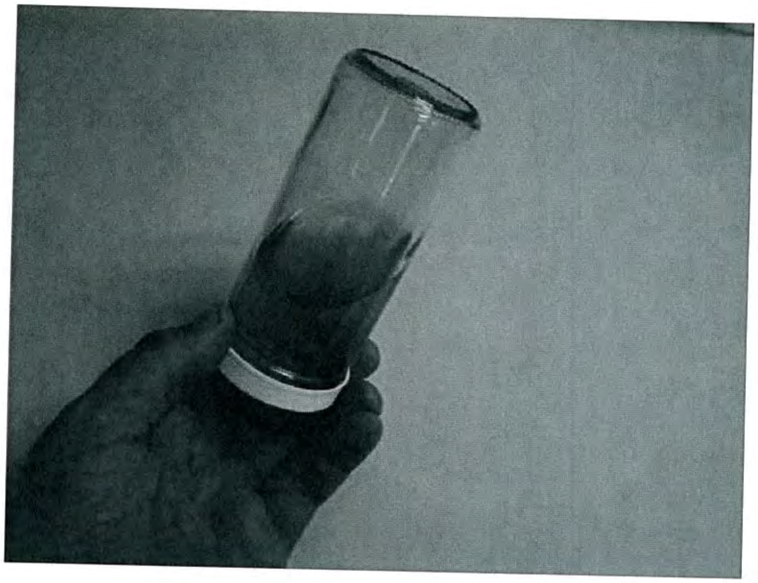
6. Obtain the turbidity measurement of the sample following the procedures specified by the manufacturer of the specific turbidimeter being used.
7. Repeat the above procedure three times and calculate an average value from the three measurements.

F. Quality Assurance Procedures

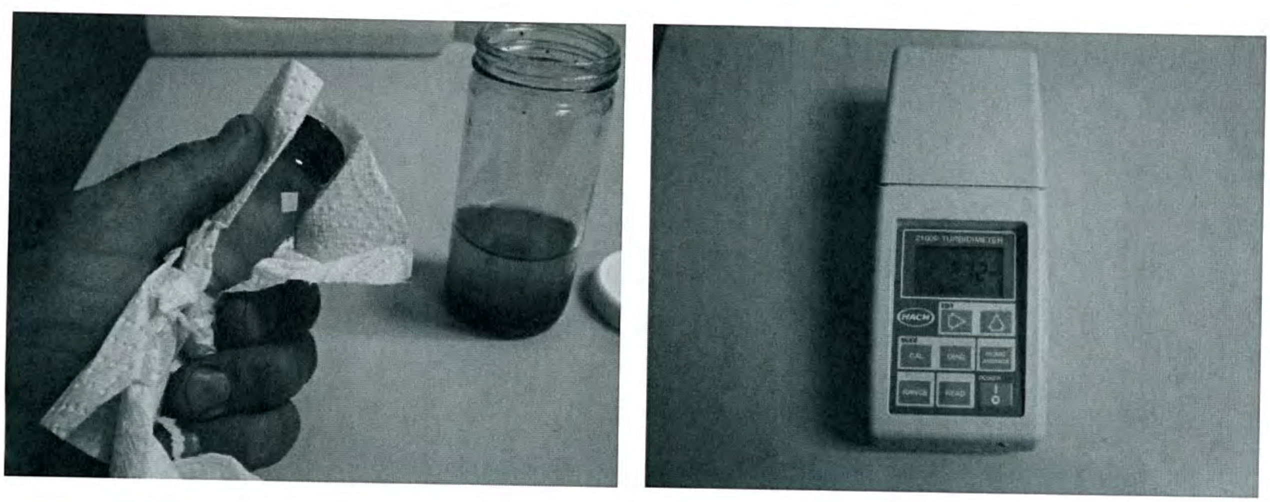
1. Turbidimeter Verification of Accuracy and Calibration:
   a. Follow the manufacturer's instructions to perform all recommended maintenance procedures and verify that the instrument is accurate to the specified limits for the measurement range of interest.
   b. If necessary, calibrate the instrument per the manufacturer's instructions using calibration standards appropriate for the measurement range of interest.
   c. Document all verification and calibration procedures and measurements and include with the reported test results.

G. Troubleshooting

1. Consult the instrument manufacturer for additional guidance if the suggestions below do not remedy the problem.
2. For erratic readings:
   a. Check voltage of the batteries and replace if needed.
   b. There may be bubbles in the system: tap the sample chamber system to dislodge bubbles.
3. For unusually high or low turbidity readings:
   a. See 2b: Bubbles
   b. There may be fouling of optical surfaces: clean with a lint-free cloth or toothbrush.
4. If readings at first appear stable and then begin to increase inexplicably:
   a. Check for moisture condensation on the cell wall
   b. Wipe cell dry with a soft, lint-free cloth.
   c. Apply a thin veneer of silicon oil (if compliant with manufacturer's instructions).
5. If blank samples or calibration standards do not read accurately:
   a. Check that the cells are oriented as instructed.
   b. Check the age/expiration of the calibration solutions.
   c. Check the accuracy against another instrument.



Mixing the abrasives with the water by gently inverting the sample jar. The inversion process is repeated twice with a 10-minute soaking period in between.



Withdrawing a sub-sample and obtaining the turbidity measurement

7/23/2021

Cardno
PO Box 1533
Zephyr Cove, NV 89448
Attn: Michelle Hochrein

OrderID: *21040195*

Dear: Michelle Hochrein

This is to transmit the attached analytical report. The analytical data and information contained therein was generated using specified or selected methods contained in references, such as Standard Methods for the Examination of Water and Wastewater, online edition, Methods for Determination of Organic Compounds in Drinking Water, EPA-600/4-79-020, and Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW846) Third Edition.

The samples were received by WETLAB-Western Environmental Testing Laboratory in good condition on 4/7/2021. Additional comments are located on page 2 of this report.

If you should have any questions or comments regarding this report, please do not hesitate to call.

Sincerely,

Jennifer Delaney

Jennifer Delaney
QA Manager

Mckenna Oh
Project Manager

MckennaO@wetlaboratory.com
(775) 200-9876

Western Environmental Testing Laboratory
Report Comments

Cardno - 21040195

Specific Report Comments

None

Subcontracting Comments

The analysis for Various AASHTO Method was performed by Black Eagle Consulting, Inc of Reno, NV. Their report is attached.

Report Legend

B	--	Blank contamination; Analyte detected above the method reporting limit in an associated blank
D	--	Due to the sample matrix dilution was required in order to properly detect and report the analyte. The reporting limit has been adjusted accordingly.
HT	--	Sample analyzed beyond the accepted holding time
J	--	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit. The reported result should be considered an estimate.
K	--	The TPH Diesel Concentration reported here likely includes some heavier TPH Oil hydrocarbons reported in the TPH Diesel range as per EPA 8015.
L	--	The TPH Oil Concentration reported here likely includes some lighter TPH Diesel hydrocarbons reported in the TPH Oil range as per EPA 8015.
M	--	The matrix spike/matrix spike duplicate (MS/MSD) values for the analysis of this parameter were outside acceptance criteria due to probable matrix interference. The reported result should be considered an estimate.
N	--	There was insufficient sample available to perform a spike and/or duplicate on this analytical batch.
NC	--	Not calculated due to matrix interference
QD	--	The sample duplicate or matrix spike duplicate analysis demonstrated sample imprecision. The reported result should be considered an estimate.
QL	--	The result for the laboratory control sample (LCS) was outside WETLAB acceptance criteria and reanalysis was not possible. The reported data should be considered an estimate.
S	--	Surrogate recovery was outside of laboratory acceptance limits due to matrix interference. The associated blank and LCS surrogate recovery was within acceptance limits
SC	--	Spike recovery not calculated. Sample concentration >4X the spike amount; therefore, the spike could not be adequately recovered
U	--	The analyte was analyzed for, but was not detected above the level of the reported sample reporting/quantitation limit. The reported result should be considered an estimate.

General Lab Comments

Per method recommendation (section 4.4), Samples analyzed by methods EPA 300.0 and EPA 300.1 have been filtered prior to analysis.

The following is an interpretation of the results from EPA method 9223B:
A result of zero (0) indicates absence for both coliform and Escherichia coli meaning the water meets the microbiological requirements of the U.S. EPA Safe Drinking Water Act (SDWA). A result of one (1) for either test indicates presence and the water does not meet the SDWA requirements. Waters with positive tests should be disinfected by a certified water treatment operator and retested.

Per federal regulation the holding time for the following parameters in aqueous/water samples is 15 minutes: Residual Chlorine, pH, Dissolved Oxygen, Sulfite.

SPARKS
475 E. Greg Street, Suite 119
Sparks, Nevada 89431
tel (775) 355-0202
fax (775) 355-0817
EPA LAB ID: NV00925 - ELAP No: 2523

ELKO
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Elko, Nevada 89801
tel (775) 777-9933
fax (775) 777-9933
EPA LAB ID: NV00926

LAS VEGAS
3230 Polaris Ave. Suite 4
Las Vegas, Nevada 89102
tel (702) 475-8899
fax (702) 622-2868
EPA LAB ID: NV00932

Western Environmental Testing Laboratory
Analytical Report

Cardno
PO Box 1533
Zephyr Cove, NV 89448
Attn: Michelle Hochrein
Phone: (775) 588-9069 **Fax:** (775) 588-9219
PO\Project: *Heavenly*

Date Printed: 7/23/2021
OrderID: *21040195*

Customer Sample ID: Heavenly Cinders
WETLAB Sample ID: 21040195-001
Collect Date/Time: 3/23/2021
Receive Date: 4/7/2021 10:05

Analyte	Method	Results	Units	DF	RL	Analyzed	LabID
Subcontracted Analyses							
Various AASHTO Method	N/A	See Attached		1			

DF=Dilution Factor, RL = Reporting Limit (minimum 3X the MDL), ND = Not Detected <RL or <MDL (if listed)

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LAS VEGAS
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Las Vegas, Nevada 89102
tel (702) 475-8899
fax (702) 622-2868
EPA LAB ID: NV00932

LABORATORY TEST DATA SUMMARY TABLE

Project: Testing as Ordered
Project Number: 0630-01-1

Client: Western Environmental Testing Laboratory

Log Number: 8652
Date Sampled: 3/23/21
Sampled By: Client

Date Received: 7/19/21
Date Tested: 7/19/21
Tested By: GH / DF

Sample Identification: WETLAB Job ID: 21040195-001

Supplier / Sample Source: Heavenly Cinders

TEST DATA

Sieve Size	Percent Passing
3/8″	100
No. 4	95
8	65
16	29
30	13
50	6
100	3
200	2.1
Atterberg Limits	NOT TESTED
Moisture Content (%)	0.2
Sand Equivalent (%)	96
Durability Index (%)	82

PROFESSIONAL ENGINEER - STATE OF NEVADA
LINDSEY M. OWENS
Exp: 12/31/21
CIVIL
No. 27759
7/22/21

FOR INFORMATIONAL PURPOSES ONLY
TESTS PERFORMED IN ACCORDANCE WITH CALTRANS METHODS

BLACK EAGLE CONSULTING, INC.
1345 CAPITAL BOULEVARD, SUITE A
RENO, NEVADA 89502-7140
PHONE (775) 359-6600
FAX (775) 359-7766

Respectfully Submitted By:

Diane Frias
Assistant Laboratory Manager
Date: July 21, 2021

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Heavenly Mountain Resort
Water Years 2017–2021

APPENDIX J

BIJOU PARK CREEK EVALUATION REPORT

Appendix J
Bijou Park Creek Evaluation Report

J.1 Bijou Park Creek Evaluation Report (Catalyst, January 2017)

Provided under separate cover

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Heavenly Mountain Resort
Water Years 2017–2021

APPENDIX K

COMMENT LETTER TO 2018 INTEGRATED 303(D) AND 305(B) ASSESSMENT REPORT

Appendix K
Comment Letter to 2018 Integrated CWA Section 303(D) & 305(B) Assessment and Draft Integrated Report

K.1 Comment Letter to 2018 Integrated CWA Section 303(D) & 305(B) Assessment and Draft Integrated Report

Heavenly LAKE TAHOE

August 14, 2019

Lahontan Regional Water Quality Control Board

Attn: Jennifer Watts and Ed Hancock

2501 Lake Tahoe Blvd.

South Lake Tahoe CA 96150

RE: Comments-2018 Integrated Report: Heavenly Mountain Resort Comments on the Lahontan Regional Water Quality Control Board's Clean Water Act Section 303(D) and 305(B) Assessment and Draft Integrated Report

Dear Ms. Watts and Mr. Hancock:

Heavenly Valley Limited Partnership DBA as Heavenly Mountain Resort (Heavenly, a subsidiary of Vail Resorts) appreciates the opportunity to comment on the Lahontan Regional Water Quality Control Board (Regional Board) draft *2018 Clean Water Act Sections 303(D) and 305(B) Assessment* issued June 2019, in preparation for submittal of the final "Integrated Report" to the State Water Resources Control Board.

Heavenly is a permittee under Order No. R6T-2015-0021. Heavenly has worked actively for more than three decades with the Regional Board and the United States Forest Service, Lake Tahoe Basin Management Unit, to reduce sediment, nutrients, and other loads from the facility, including successful operation of a stormwater runoff treatment system from its California Base parking lot, which discharges to Bijou Park Creek. These efforts have been very successful, and Heavenly remains committed to continued stewardship of water resources.

Based on a review of the information contained in the water body "Fact Sheets" and lines of evidence (LOE) provided by the Regional Board in support of Appendix H (Draft California 2018 Integrated Report (303(d) List/305(b) Report), Heavenly would direct the Regional Board's consideration to more recent data than was considered, and to corresponding comments.

Bijou Park Creek, New Listing: Iron (Category 5A, Completion Year 2028)

The fact sheet states "that this creek has naturally high levels of iron. Though this creek has naturally high levels of iron, ambient concentrations for this creek have not been established at this time." In the 2012 Fact Sheet, the Regional Board used these same lines of evidence to recommend that Bijou Park Creek ***not*** be listed for iron. Therefore, Heavenly requests the Regional Board staff return to its 2012 conclusion that the lines of evidence do ***not*** support placing Bijou Park Creek on the section 303(d) list for iron.

If, however, the Regional Board decides to include Bijou Park Creek as impaired for Iron, Heavenly requests the water segment be listed as Category 4B rather than Category 5A. Heavenly believes that the resources required to develop and implement a TMDL to address a pollutant such as iron, for which the levels are naturally high, would be more effectively utilized to address existing TMDLs addressing pollutants with documented anthropogenic sources.

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Stateline, NV 89449
775/586-7000
www.skiheavenly. com

VAIL RESORTS
EXPERIENCE OF A LIFETIME

Bijou Park Creek, New Listing: Oil and Grease (Category 5A, Completion Year 2028)

The Fact Sheet uses data from Heavenly's discharge monitoring reports from October 2007 to September 2009 to reach its conclusion. The data from this time period were collected during the optimization of the below-ground stormwater treatment system and the automated sampler system for Heavenly's California Base Area Parking Lot. At the Regional Board's request, Heavenly worked closely with the Regional Board on the design, installation, and optimization of these systems because Heavenly was the first discharger in the basin to install an automated sampling system for the treatment unit. There was a long period of trouble-shooting this first-in-the-basin system, and both the Regional Board and Heavenly agreed that the data from this time period were not reliable for decision making purposes. However, the data from this period are referenced in the Fact Sheet as the LOE to list Bijou Park Creek as a Category 5a impaired water segment.

Heavenly's 2016 report to the Board, prepared by Catalyst Environmental Solutions *Bijou Park Creek Evaluation Report Heavenly Mountain Resort* included a lengthy demonstration that the system (and other best management practices) had been successfully implemented at the California Base Parking Lot. Since 2016, Heavenly has been submitting discharge monitoring reports on a quarterly basis to the Regional Board, which provide an abundance of more current and reliable data for the Board's assessment of this segment of Bijou Park Creek. These data indicate oil and grease concentrations in this segment of Bijou Park Creek at or near the detection limit of 2.0 mg/L (maximum: 3.3 mg/L). The water quality objective cited in the Fact Sheet for oil and grease is as follows:

Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect the water for beneficial uses (Lahontan Region Water Quality Control Plan).

The discharges from the system, however, are well below levels that produce visible films or coatings on the water surface. The Lahontan limit is at the detection limit for this constituent; minor exceedances (less than 3.3 mg/L) are within the 30 percent uncertainty that certified laboratories must meet.

Heavenly Creek (source to USFS Boundary), Benthic Community Effects (Category 5A, completion year 2031)

Appendix A lists Heavenly Creek as a proposed addition to the 303(d) List for Benthic Community Effects. The Fact Sheet States:

Based on the readily available data and information, the weight of evidence indicates that there is sufficient justification for placing Benthic Community Effects in this waterbody segment on the CWA section 303(d) List.

However, Appendix E states that Heavenly Creek Benthic Community Effects are under Category 3, which are water segments "…with water quality information that is insufficient to determine an appropriate decision recommendation, but the available data and information that does exist indicate beneficial uses may be potentially threatened."

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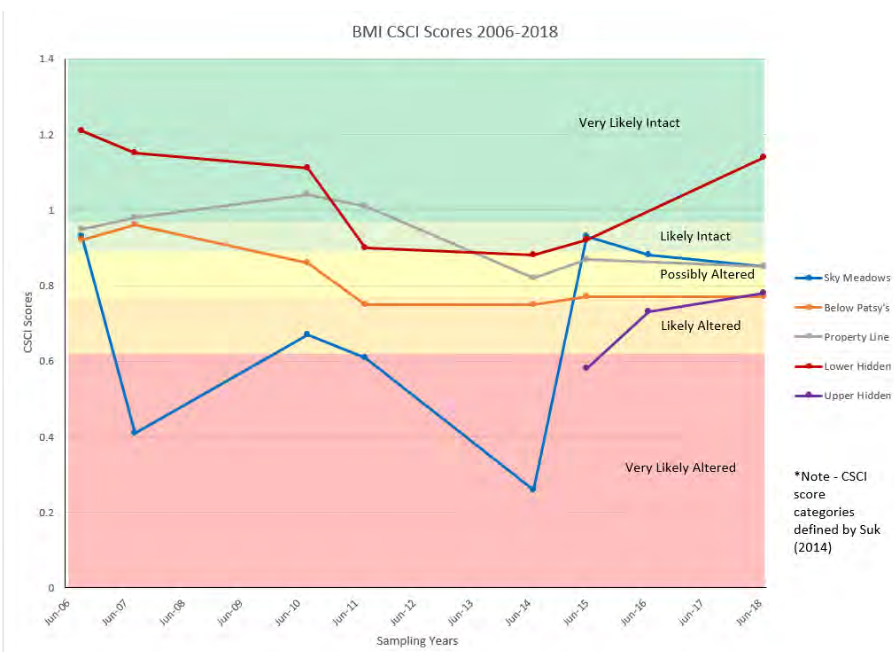
Heavenly has worked closely with the Regional Board on gathering and interpreting the benthic macroinvertebrate (BMI) data in Heavenly Creek, and in identifying the causes of the measured impairments. Benthic macroinvertebrate data are sensitive to water quality, temperature, and physical habitat, which are in turn dependent on both natural and anthropogenic change. In addition, the analysis methods and metrics used by the State Board in conducting the analysis have changed over time, further complicating a straightforward trend analysis.

The Heavenly Mountain Resort Epic Discovery EIR/EIS/EIS, for which the Regional Board was the CEQA lead agency, included a detailed review of BMI data and the potential causes of impairment. The review concluded "it is not certain that fine sediment is the primary or only source of impairment in the Sky Meadows reach. Several of the fine-sediment intolerant taxa screened are also intolerant to stream temperatures greater than 13 degrees Celsius." Heavenly agrees with Appendix E that data exists that indicate impairment of the benthic community at this location, and that the information is insufficient to support a decision recommendation owing to a lack of clear cause of the impairment. Among the many potential causes, cycles of drought and wet years (which are clearly natural causes) have a profound effect on the health of the benthic community.

The chart below shows Sky Meadows, which had some of its highest quality benthic community health scores after the recent drought (2015 scores), perhaps due both to greater temperatures and lesser degrees of erosion. Benthic community data from the undisturbed reference reach, Upper Hidden Valley Creek, are also showing similar variability, further suggesting natural causes for the observed impairments.



The Regional Board's 2015 EIR/EIS/EIS also cites a regional study to reach the same conclusion of uncertainty for other Lake Tahoe Basin streams with similar conditions to Sky Meadows:

"BMI data collected and analyzed in 2009 and 2010 from 85 sites located within 29

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watersheds of the Lake Tahoe Basin (Stream Condition Assessment of the Lake Tahoe Basin in 2009 and 2010 using the River Invertebrate Prediction and Classification System (RIVPACS). Habitat analysis of "marginal" or "impaired" sites in this report identified possible causative stressors of the degraded conditions. For higher elevation low gradient sites, like the Sky Meadows reach, very open canopy conditions with limited riparian shade are typical. Open meadow areas are typically more exposed to solar radiation and higher stream temperatures than stream segments with shade created by riparian shrubs and trees. Thick riparian canopy, in addition to providing shade, also drop-leaf litter providing a base for the BMI food web. Streams with very low flows, like Sky meadows can experience elevated stream temperatures and low dissolved oxygen levels. Additional data collection and interpretation completed as part of the ongoing Environmental Monitoring Program is warranted to further identify potential habitat stressors that may be contributing to impaired biotic condition in the Sky Meadows Reach. This will inform adaptive management strategies, and track improvement in both physical and biological metrics."

Based on this recent and thorough analysis by the Regional Board, and a finding of uncertainty regarding an appropriate decision, Heavenly agrees that listing to Category 3 may be appropriate. Heavenly requests that the Regional Board clarify the listing category, presumably to listing Category 3, based on this information.

Heavenly Creek (source to USFS Boundary), Chloride, do not delist (Category 5A completion year 2028)

The Fact Sheet (Appendix H) states that in 2006 this waterbody segment was listed for exceedances of chloride for a non-contact recreation beneficial use. Based on data reported by Heavenly to the Board, while chloride concentrations have exceeded the state standard over the past eight monitoring years in Heavenly Creek, the chloride readings are also above the state standard at Hidden Valley Creek. This topic was discussed in both the Regional Board's 2015 EIR/EIS/EIS for Heavenly's Epic Discovery Project, and in Heavenly Mountain Resort's Bijou Park Creek Evaluation Report. In both cases, the reports note that the causes for these increased chloride concentrations are uncertain and require further investigation. Winter application of salts is one plausible cause and is likely a basin-wide concern. However, the amount of data available, using Category 3 Criteria, "is insufficient to determine an appropriate decision recommendation, but the available data and information that does exist indicate beneficial uses may be potentially threatened." This statement is supported by the Fact Sheet statement that "a minimum of 26 samples is needed for application of Table 3.1. The placeholder LOEs used for the original listing based on protection of REC are still valid and the recommendation is Do Not Delist." Based on this information, Heavenly respectfully requests the Board modify the listing of Heavenly Creek as a Category 3.

Concluding Remarks

Thank you for the opportunity to provide comments on the Lahontan Regional Water Quality Control Board's Clean Water Act Section 303(d) and 305(b) Assessment and Draft Integrated Report. Heavenly is dedicated to improving water quality in all receiving waters within the Lake Tahoe basin, and supports policies that effectively utilize existing efforts

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Stateline, NV 89449
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www.skiheavenly.com

and prioritize feasible solutions to meet water quality objectives within the basin. Please contact Frank Papandrea, Heavenly's Environmental Compliance and Sustainability Manager, at 775-586-2315 if you have any questions or need additional information.

DocuSigned by:
Mike Goar
88703E1EA6B0471...

8/13/2019

MIKE GOAR Date

VICE PRESIDENT AND C.O.O.

VR HEAVENLY, I, ITS GENERAL PARTNER

P.O. Box 2180
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www.skiheavenly.com

About Cardno

Cardno is an ASX-200 professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage, and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

Cardno Zero Harm

Cardno ZERO HARM EVERY JOB. EVERY DAY.

At Cardno, our primary concern is to develop and maintain safe and healthy conditions for anyone involved at our project worksites. We require full compliance with our Health and Safety Policy Manual and established work procedures and expect the same protocol from our subcontractors. We are committed to achieving our Zero Harm goal by continually improving our safety systems, education, and vigilance at the workplace and in the field. Safety is a Cardno core value and through strong leadership and active employee participation, we seek to implement and reinforce these leading actions on every job, every day