County of Placer

Final Annual Monitoring Report for:

Implementation of the Truckee River Water Quality Monitoring Plan

Water Year 2020

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Executive Summary

This report presents the results of Placer County's water year (WY) 2020 implementation of the Truckee River Water Quality Monitoring Plan (TRWQMP). The TRWQMP is a fifteen-year comprehensive water quality monitoring plan that is intended to be implemented in three phases. Phase 1 consisted of baseline data collection and was scheduled to occur over a three to five-year period. The County began implementation of Phase 1 during WY 2010 and continued through WY 2013. Phase 2 was initiated in WY 2014 to strategically expand on the monitoring activities conducted during Phase 1. The program transitioned to Phase 3 during WY 2017 to incorporate adaptive management of TRWQMP monitoring activities based on data and findings from Phases 1 and 2. Phase 3 implementation continued in WY 2020 and will be ongoing through the fifteenth and final year of TRWQMP implementation (WY 2024).

ES.1 Purpose and Objectives

As a Small Municipal Separate Storm Sewer System (MS4), Placer County (County) must comply with the State of California National Pollutant Discharge Elimination System (NPDES) Phase 2 MS4 Permit (Permit). The Permit (Order No. 2003-0005-DWQ) requires the County to develop and implement a Stormwater Management Plan (SWMP) that includes a comprehensive water quality monitoring plan for the Middle Truckee River Watershed (study area). In response to this, and other regulatory requirements, the County developed the TRWQMP to assess the effectiveness of various Permit related actions to protect natural surface waters from the impacts of stormwater runoff. The goals of the TRWQMP are as follows:

- **TRWQMP Goal 1:** Comply with regulatory NPDES permits, Lahontan Board Orders, Middle Truckee River Sediment TMDL, Squaw Creek sediment TMDL, and the Martis Valley Community Plan for Placer County and the Town of Truckee.
- **TRWQMP Goal 2**: Develop water quality monitoring datasets that will be scientifically defensible and provide accurate data to evaluate the effectiveness of NPDES Phase 2 Permit in protecting surface water resources.
- **TRWQMP Goal 3:** Develop a monitoring plan that is economically feasible to implement and maintain over time.
- **TRWQMP Goal 4:** Facilitate collaboration, effort-sharing, and integration of multiple independent private and public monitoring efforts.

To achieve these goals, the TRWQMP includes multiple assessment types that have been implemented since WY 2010. An overview of TRWQMP implementation to date is provided in the following section.

ES.2 Implementation Overview

During the eleven-year period of TRWQMP implementation, the County has conducted a variety of assessments to characterize water quality within the Middle Truckee River watershed. Data collection activities and locations were coordinated with other entities that were also monitoring water quality including the Town of Truckee, the Truckee River Watershed Council, and the

California Department of Water Resources to maximize the effectiveness and value of these efforts.

A summary of the Placer County TRWQMP implementation activities completed to date is presented in Table ES-1. The assessment types, which are defined in the TRWQMP and in the current Sampling and Analysis Plan (SAP), are grouped by sub-watersheds in which they were performed.

Water Year 2020 TRWQMP implementation activities included a set of select monitoring activities in the Martis, Squaw, and Truckee River (Big Chief Corridor) sub-watersheds that included:

- Bioassessments to gage stream health based on its benthic macroinvertebrate community and physical habitat within the Squaw Creek and Martis Creek sub-watersheds;
- Community level water quality sampling to characterize the quality of stormwater runoff from communities with varying land uses and stormwater management characteristics;
- Tributary level water quality sampling to characterize the water quality of the tributaries within the Martis Creek sub-watershed;
- Stream discharge monitoring to characterize annual discharge patterns and volumes for the Truckee River and Martis Creek;
- Near-continuous turbidity monitoring to develop annual suspended-sediment load estimates for the Truckee River and each monitored branch of Martis Creek; and
- Inspection along the stretch of the Truckee River where commercial rafting operations occur to identify sources of potential water quality impairment.

Additional data, collected by the Truckee River Watershed Council (TRWC), The United States Geological Survey (USGS), the Natural Resources Conservation Service (NRCS) SNOpack TELemetry (SNOTEL), and the Desert Research Institute (DRI) are also analyzed and presented in this report. The integration of this information is a result of a coordinated monitoring effort to identify and characterize the sediment and nutrient sources and trends within the Middle Truckee River and its tributaries.

Table ES-1. Placer County TRWQMP Implementation Summary

Stream/ Watershed	Water Year	Assessment Type[1]							
		RAM	DSC	DST	BIO	GS	TURB	GIS Analysis	Rafting Assessments
Truckee (Big Chief Corridor)	2010								
	2011								
	2012								
	2013								
	2014								
	2015								
	2016								X
	2017								
	2018								X
	2019								
	2020								X
Squaw	2010	X			X				
	2011								
	2012	X			X				
	2013								
	2014	X			X				
	2015								
	2016				X			X	
	2017							X	
	2018				X				
	2019							X	
	2020				X				
Bear	2010	X							
	2011								
	2012	X							
	2013								
	2014	X							
	2015								
	2016							X	
	2017							X	
	2018								
	2019							X	
	2020								
Martis	2010	X			X				
	2011		X	X		X			
	2012	X	X	X	X	X			
	2013		X	X		X	X		
	2014	X	X	X	X	X	X		
	2015		X	X			X		
	2016		X	X	X		X	X	
	2017		X	X			X	X	
	2018		X	X	X		X		
	2019		X	X			X	X	
	2020		X	X	X		X		

[1] RAM = Rapid Assessment Methodology; DSC = Discrete Sampling Community Level; DST = Discrete Sampling Tributary Level; BIO = Bioassessment; GS = Stream Gaging Station; TURB = Near-Continuous Turbidity Monitoring

ES.3 Water Year 2020 Summary

WY 2020 was characterized by below average precipitation and snowpack in the Middle Truckee River watershed. The total annual precipitation received during WY 2020 was 67 and 69 percent of average at the Central Sierra Snow (CSS) Lab and Truckee #2 stations, respectively. The water year started with below average precipitation in October and November. December was above average bringing the totals to near normal. The following two months (January and February) were very dry with February precipitation being less than 5% of average. March, April, and May produced near average precipitation to end the wet season. On April 1, 2020, Snow Water Equivalent (SWE) was 63 and 92 percent of average at the CSS Lab Station and Truckee #2 Station, respectively.

ES.4 Results and Discussion

This section summarizes and discusses the results of the WY 2020 TRWQMP implementation activities.

ES.4.1 Bioassessments

Bioassessments in the Martis Creek and Squaw Valley watersheds were performed for the sixth time in WY 2020, with previous efforts completed in WY 2010, WY 2012, WY 2014, WY 2016, and WY 2018. For Squaw Creek, particles less than 3 mm diameter (fines and sands), along with median particle size (D50), are the two physical habitat parameters identified as important indicators of habitat suitability for aquatic life in the context of the Squaw Creek sediment TMDL. Both of these parameters were below the target values in 2020; historical values are also below the TMDL targets. The numerical target for biological health (representing desired stream integrity protective of aquatic life uses) is a Biological Condition Score (BCS) value of 25 or more. Two out of three sites met this minimum target in 2020 (BCS values were 23, 25, and 25 for upper, middle, and lower meadow sites, respectively). The mean BCS value for all survey years is 16.3 (range 7 to 27).

At the Martis Creek locations, D50 was between 13 and 31 millimeters. Particles less than 2 millimeters (<2 mm) in diameter (i.e., “fines and sands” per the SWAMP definition) comprised between 14 and 44 percent of the streambed. Mean cobble embeddedness was between 6 and 46 percent. Bank stability was high (81 to 100 percent) throughout Martis Creek locations. Lower bank stability was formerly an issue in the lower mainstem (e.g., banks were 23 percent eroded at site Bio-MC5 in 2018); however, recent stream restoration efforts have stabilized banks in this reach (e.g., banks were 100 percent stable at Bio-MC5 in 2020). As in previous survey years, 2020 bioassessment results for Martis Creek indicate that upper tributaries with less disturbance had the highest IBI scores with values indicative of conditions supporting regional water quality objectives. The lower mainstem site scored much lower and was indicative of conditions not supporting water-quality objectives.

ES.4.2 Community Level Water Quality Monitoring

During WY 2020, the County collected data from two community level water quality monitoring sites. The two sites identified as Northstar Drive West Outfall (DSC-MC9) and Ridgeline Drive Outfall (DSC-MC10) are located within the Northstar development and discharge to West Martis Creek. WY 2020 was the first year of data collection at both sites.

Northstar Drive West Outfall (DSC-MC9) - DSC-MC9 receives runoff from secondary roadways, and forested uplands. Permanent Best Management Practices (BMPs) upstream of the sampling location include drainage inlets with sediment traps, rock lined channel and earthen channels. Four samples have been collected at this site over one water year (WY 2020). Preliminary results indicate that TSS are elevated at this site relative to other community level sites, and total phosphorus concentrations exceed Martis Creek Water Quality Objective (WQOs). However, a limited number of samples have been collected to date.

Ridgeline Drive Outfall (DSC-MC10) – DSC-MC10 receives runoff from multi-family residential development, secondary roadways, dirt roads, forested uplands, and a solid waste management area. Permanent BMPs upstream of the sampling location include drainage inlets with sediment traps, infiltration basins, rock lined infiltration channels, a treatment vault with pond, and earthen channels. Three samples have been collected at this site over one water year (WY 2020). Preliminary results indicate that BMPs are effective and TSS and total phosphorus are not elevated at this site relative to other community level sites. However, a limited number of samples have been collected to date.

ES.4.3 Tributary Level Water Quality Monitoring

The data shows that the differences in concentrations from site to site are relatively small. However, TSS results tend to be higher at DST-MC7 on Middle Martis Creek and DST-MC8 on upper West Martis Creek which can likely be attributed to roadways, development, and impervious areas located upstream. TSS results also tend to be higher at DST-MC4 on West Martis Creek which can likely be attributed to the relatively dense development located upstream.

The tributary level data indicate that mean total phosphorus concentrations at 6 of the 10 monitored locations are higher than the established water quality objective at the mouth of Martis Creek when considering all years of data. The four sites that did not exceed the total phosphorus water quality objective are located within Middle Martis Creek and two upper branches of West Martis Creek. Total phosphorus concentrations at three of the four sites were significantly less (95 percent confidence level) than the total phosphorus concentrations measured at other sites. Table ES-2 summarizes the results of statistical t-tests that were performed to determine whether differences in pollutant concentration among sites are statistically significant at the 95 percent confidence level. The mean total phosphorus concentration at site DST-MC1 (Martis Creek at Mouth) for WY 2020 was 21 µg/L which meets the water quality objective for total phosphorus of 50 µg/L for the second consecutive year.

Table ES-2. Statistical Differences among Tributary Level Discrete Sampling Data

Constituent	Statistical Difference
TSS	DST-MC4 > DST-MC1, DST-MC5, DST-MC9
	DST-MC8 > DST-MC1, DST-MC5, DST-MC10
Total Phosphorus	DST-MC1 > DST-MC7, DST-MC8, DST-MC9
	DST-MC4 > DST-MC7, DST-MC8, DST-MC9
	DST-MC5 > DST-MC7, DST-MC8, DST-MC9

Notes:
DST-MC1: Lower Martis Creek at Martis Creek Reservoir;
DST-MC4: West Martis Creek; **DST-MC5**: Upper Martis Creek below Martis Camp and Lahontan developments;
DST-MC7: Middle Martis Creek above SR 267 culvert; **DST-MC8**: The western branch of Upper West Martis Creek;
DST-MC9: The eastern branch of Upper West Martis Creek; **DST-MC10**: Lower Middle Martis creek

ES.4.4 Discharge Monitoring

Discharge monitoring in WY 2020 was conducted at four locations within the Martis Creek watershed (upper Martis Creek, West Martis Creek, Middle Martis Creek, and upper West Martis Creek). At each location, a near-continuous record (15-minute interval) of discharge was developed and used for evaluation of annual peak flows, annual mean flow, daily streamflow, and total flow volume. In combination with near-continuous turbidity monitoring, these metrics were used to compute a near-continuous record of suspended-sediment loading. Table ES-3 below presents the key stream discharge related parameters from each of the locations monitored during WY 2020.

Table ES-3. TRWQMP WY 2020 Key Discharge Parameters

Station/Location	Total Annual Discharge	Annual Peak Discharge	Annual Mean Discharge
	(Acre-ft.)	(CFS)	(CFS)
TURB-MC1/West Martis Ck.	1,169	13	1.6
TURB-MC2/Upper Martis Ck. Main Stem	5,214	49	7.0
TURB-MC4/Middle Martis Ck.	652	11	0.9

ES.4.5 Suspended Sediment Loads

Suspended-sediment loads were estimated for three monitoring stations where near-continuous turbidity probes are operated in Martis Creek, West Martis Creek, and Middle Martis Creek (TURB-MC1, TURB MC2, and TURB-M4). Discharge monitoring is also performed at these monitoring stations as presented above. Suspended-sediment daily and total annual loads were computed using two methods: 1) using a near-continuous record of turbidity, and 2) by using discharge-to-sediment load correlations. Near-continuous turbidity monitoring allows for detection of turbidity or suspended-sediment loading events that may be unrelated to changes in discharge. Alternatively, development of discharge-to-sediment load rating curves provides a means to evaluate changes in sediment production over time.

A summary of suspended-sediment load and yield values are presented in Table ES-4 for each of the four co-located turbidity and gaging stations in operation during WY 2020. Yield values are

calculated by dividing the suspended-sediment load by the drainage area to provide a normalized value for comparison of sediment production between sub-watersheds.

Table ES-4. Suspended-Sediment Load and Yield Summary

Station	Stream	Area (mi^2)	Load (tons)	Yield (ton/mi^2)
TURB-MC1	West Martis	5.2	5.0	1.0
TURB-MC2	Mainstem Martis	13.8	14	1.0
TURB-MC4	Middle Martis	4.3	8.0	1.9

ES.5 Water Quality Areas of Concern

After eleven years of TRWQMP implementation, the following areas were identified as areas of the highest concern for water quality:

- **Martis Creek:** Pollutant concentrations discharging into Martis Creek Reservoir are elevated, and total phosphorus concentrations typically exceed the water quality objective for the mouth of Martis Creek. Monitoring results indicate that phosphorus may be naturally occurring in watershed soils, but non-point source pollution related to development in the watershed including roadway shoulder erosion, ski run soil disturbance, golf course operations, commercial and residential construction, and roadway abrasives are other potential sources.

  As in previous survey years, 2020 bioassessment results for Martis Creek indicate that upper tributaries with less disturbance (i.e. Schaeffer, Upper East Branch, and the Middle Branch) are considered Tier 5/4 (or Grade "A/B"), indicative of conditions supporting regional water-quality objectives. Further downstream, the lower mainstem is considered Tier 2 (or Grade "D"), indicative of conditions not supporting water-quality objectives. However, lower mainstem site recently underwent restoration and bank stabilization. This was the first year of post-construction data which will be used to track improvement at this site over time. These results illustrate declining conditions in main stem Martis Creek as the stream flows through the Martis Camp and Lahontan developments.

- **Squaw Creek:** Particles less than 3 mm in diameter (fines and sand) and median particle diameter (D50) are the two physical habitat parameters identified as important indicators of habitat suitability for aquatic life in the context of the Squaw Creek sediment TMDL. The numerical target for D50 is an increasing trend approaching 40 mm or greater, while the target for fines and sand is a decreasing trend approaching 25 percent or less in the Squaw Creek meadow reach. Both of these parameters were far short of target values in 2020; historical values are also well below TMDL targets.

  Two out of three bioassessment results for WY 2020 met the minimum TMDL target (BCS of 25) with BCS values of 23, 25, and 25 for upper, middle, and lower meadow sites, respectively. The mean BCS value for all survey years is 16.3 (range 7 to 27). BCS values have only met or exceeded the target value of 25 during three survey years (at two of the three sites in 2012, one of three sites in 2018, and at two of the three sites in 2020; see Figure 6.3).

ES.6 Adaptive Management Summary

The TRWQMP is currently being implemented as planned. Overall, Phase 3 monitoring activities should be continued per the guidance in the TRWQMP and the adaptive management-based modifications that have been made to the program over the initial eleven years of implementation. There is a continued need to develop more comprehensive and robust datasets that will help to identify specific areas of concern, track trends, and evaluate stormwater management program performance.

Adaptive management strategies and actions were developed and implemented to improve data quality, focus data collection on prioritized objectives and areas of concern, and improve the cost-benefit to the County. Adaptive management actions have included the modification of monitoring protocols and the relocation, addition, and discontinuation of monitoring stations and assessment types. A summary of the adaptive management changes implemented to date by the County is provided in Table ES-5 below. More detailed descriptions of these modifications are documented in the Sampling and Analysis Plans (SAPs) that have been updated annually, or as needed, to document the changes to the program as they occurred.

Recommendations for future TRWQMP adaptive management is discussed in Section 8 of this report.

Table ES-5. Adaptive Management Summary

Water Year	Assessment Type	Entity	Description	Reasons for Modifications
2010	Rapid Assessment Methodology (RAM)	Placer County/Town of Truckee	RAM Protocol Modifications: ▪ Increased transect length ▪ Prioritized reaches ▪ Eliminated rebar staking	▪ Alignment of available funding with required level of effort. ▪ Public safety and aesthetics issues from rebar
2010	Community Level Water Quality Monitoring	Placer County/Town of Truckee	▪ Added staff gages at sampling sites ▪ Added provisions for grab sampling and adjustments to sampler elevations	▪ Visual assessment of flow ▪ Accommodation of fluctuating groundwater levels
2010	Tributary Level Water Quality Monitoring	Placer County	Tributary Level Protocol Modifications: ▪ Replaced multi-stage sampling with USGS Equal Width Increment methodology	▪ Incorporation of established standard method for stream sampling ▪ Address problems associated with fluctuating stream levels ▪ Reduced cost
2010	Near-Continuous Auto-Sampling	Placer County	This assessment type was replaced by the modified tributary level water quality monitoring program in conjunction with a stream gaging station on Martis Creek (GS-MC1).	▪ Improved program cost-effectiveness ▪ Monitored additional locations ▪ Improved data comparability ▪ Simplified protocol and equipment need
2012	Near-Continuous Turbidity Stations	Placer County	Two near–continuous turbidity stations (TURB-MC1 and TURB-MC2) were established in the Martis Creek watershed	▪ Provide an accurate approach for monitoring suspended-sediment loads ▪ Monitor key tributaries of Martis Creek downstream of major development
2014	Community Level Water Quality Monitoring	Placer County	Placer County relocated two community level sites within the Martis Creek watershed.	▪ New sites enabled assessment of different areas in Martis Creek Watershed
2014	Stream Gaging Station	Placer County	The location of the Martis Creek gaging station was moved downstream to a location near the Martis Creek Reservoir.	▪ Stream gage relocation to address interferences from new beaver dam establishment
2014	Near-Continuous Turbidity Stations	Placer County	The locations of the Martis Creek stations were modified slightly	▪ Mitigation of flow bypass and beaver dam issues at the original locations, respectively.

Water Year	Assessment Type	Entity	Description	Reasons for Modifications
2015	Near-Continuous Turbidity Stations	Placer County	Two additional near–continuous turbidity stations (TURB-MC3 and TURB-MC4) were installed in the Martis Creek watershed	▪ Provide for development suspended-sediment load estimates in East Martis and Middle Martis Creeks ▪ Enables comparisons among the four major Martis tributaries
2015	Stream Gaging Station	Placer County	Monitoring at gaging station GS-MC2 was discontinued due to rising water levels in Martis Creek Reservoir. Gaging stations are also incorporated into the four near-continuous turbidity stations currently in operation.	▪ Eliminated redundant data collection ▪ Avoided interferences from rising water levels in reservoir
2016	GIS Source Area Prioritization	Placer County	The original GIS Analysis conducted during the development of the TRWQMP was updated and focused on Martis, Squaw and Bear Creeks. Sub basins were delineated and prioritized based on pollutant loading potential and additional monitoring needs were identified.	▪ Prioritization of stormwater basins within Bear, Squaw and Martis watersheds to focus future monitoring efforts. ▪ Identify potential new monitoring sites
2016	RAM	Placer County	RAM evaluations for Bear Creek, Martis Creek and Squaw Creek were suspended in WY 2016. In place of RAM observations, a GIS Source Area Prioritization Analysis was conducted to prioritize future TRWQMP efforts in these watersheds.	▪ Baseline data collected has limited value. Additional data may be collected in the future if necessary.
2016	Community Level Water Quality Monitoring	Placer County	Two new community level water quality monitoring sites (DSC-MC6 and DSC-MC7) were selected and installed within the Martis Creek watershed. Monitoring at DSC-MC4 and DSC-MC5 was discontinued.	▪ New sites enabled assessment of different areas in Martis Creek Watershed
2016	Truckee River Rafting Segment Inspections	Placer County	Visual inspections and photo monitoring were performed, as needed, to document current conditions for previously identified and newly identified areas of degradation and/or restoration.	▪ Assess changes to the rafting segment over the past decade ▪ To be performed biannually during seasons when rafting operations occur

Water Year	Assessment Type	Entity	Description	Reasons for Modifications
2017	GIS Source Area Prioritization	Placer County	The GIS Analysis that was initiated in 2016, was continued. The 2017 work focused on refining the results from the WY 2016 analysis.	▪ Prioritization of stormwater basins within Bear, Squaw and Martis watersheds to focus future monitoring efforts. ▪ Identify potential new monitoring sites
2018	Tributary Level Water Quality Monitoring	Placer County	Three new tributary level water quality monitoring sites (DST-MC7, DST-MC8, and DST-MC9) were selected and installed within the Martis Creek watershed. Monitoring at DST-MC3 and DST-MC6 was discontinued.	▪ New sites enabled assessment of different areas in Martis Creek Watershed
2018	Community Level Water Quality Monitoring	Placer County	One new community level water quality monitoring site (DSC-MC8) was selected and installed within the Martis Creek watershed.	▪ New sites enabled assessment of different areas in Martis Creek Watershed
2019	GIS Source Area Prioritization	Placer County	The GIS Analysis that was initiated in 2017, was continued. The 2019 work focused on refining the results from the WY 2018 analysis and introduced Conceptual Water Quality Improvements for Placer right of way.	▪ Conceptual Water Quality Improvements Proposed for Martis, Squaw, and Bear Creek
2020	Bioassessments	Placer County	Four previously monitored sites in the Martis Creek watershed were discontinued and two new sites were established in WY 2020. No change from WY 2018 in the Squaw Creek watershed.	▪ New sites enabled assessment of different areas in Martis Creek Watershed
2020	Tributary Level Water Quality Monitoring	Placer County	One new tributary level water quality monitoring site (DST-MC10) was selected and installed in Middle Martis Creek and one site (DST-MC2) on East Martis Creek was discontinued. The analytical list was reduced to TSS and total phosphorus only.	▪ New site enabled assessment of the Middle Martis Creek. ▪ Reduced analytical list focuses on current pollutants of concern.
2020	Community Level Water Quality Monitoring	Placer County	Two new community level water quality monitoring sites (DSC-MC9 and DSC-MC10) were selected and installed within the Martis Creek watershed. Monitoring at DSC-MC6, DSC-MC7 and DSC-MC8 was discontinued. The analytical list was reduced to TSS and total phosphorus only.	▪ New sites enabled assessment of different areas in Martis Creek Watershed ▪ Reduced analytical list focuses on current pollutants of concern.
2020	Near-Continuous Turbidity Stations	Placer County	One additional near–continuous turbidity stations (TURB-MC5) was installed in the Martis Creek watershed. Monitoring at TURB-MC2 on East Martis Creek was discontinued.	▪ Provides for development of suspended-sediment load estimates in Upper West Martis Creek ▪ Enables comparisons within the West Martis Creek Watershed

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Section 1
Introduction

As the owner of a Small Municipal Separate Storm Sewer Systems (MS4), Placer County (County) must comply with the State's National Pollutant Discharge Elimination System (NPDES) Phase 2 MS4 General Permit (Permit) for stormwater discharges. In accordance with the Permit (Order No. 2003-0005-DWQ), the County developed a Stormwater Management Program (SWMP) (Placer County, 2007) which was required by the Lahontan Regional Water Quality Control Board (Lahontan) to include the development of a comprehensive water quality monitoring plan for the Middle Truckee River Watershed (study area). Additionally, Clean Water Act 303(d) Total Maximum Daily Load (TMDL) programs are being implemented in both Squaw Creek and the Middle Truckee River. In response to these regulations, the Truckee River Water Quality Monitoring Plan (TRWQMP) (2NDNATURE, LLC, 2008) was developed collaboratively by the County and Town of Truckee, also a MS4 Permittee, to cost-effectively assess the effectiveness of their ongoing SWMPs with respect to protecting downstream water resources. The Placer County SWMP remained effective until July 1, 2013 when the new NPDES Phase 2 Permit was adopted (Order No. 2013-0001-DWQ). Under the revised permit, SWMPs are no longer required to be developed and submitted by Permittees and the required stormwater control measures are listed within the Permit itself. Annual reports are required to document compliance with these controls. Placer County compliance requirements with the Middle Truckee River TMDL for sediment are now specifically included in the permit. The State Water Board adopted an amendment to the current permit on December 19, 2017. An Unofficial Draft of the amended permit is available for use although it has not been certified by the State Water Board clerk.

The TRWQMP is a fifteen-year comprehensive water quality monitoring plan that is intended to be implemented in three phases. Phase 1 consisted of baseline data collection and was scheduled to occur over a three to five-year period. The County began implementation of Phase 1 during Water Year 2010 (WY 2010) and continued through WY 2013. Phase 2 was initiated in WY 2014 to strategically expand on the monitoring activities conducted during Phase 1. The program has transitioned to Phase 3 during the 2017 and 2018 water years to incorporate adaptive management of TRWQMP elements based on data and findings from Phases 1 and 2. Phase 3 will continue through the fifteenth and final year of TRWQMP implementation (WY 2024). The level of implementation during each phase will depend on a number of factors including cooperation by other independent entities conducting water quality monitoring in the watershed and the availability of funding.

Several documents have been previously produced during the planning and implementation of the monitoring program. These documents and a brief description of their content are as follows:

- *Evaluation of Existing Monitoring for Integration with the Truckee River Water Quality Monitoring Plan* (CDM Smith, 2010a) provides a review of the existing monitoring programs that were identified for potential integration in the TRWQMP and develops recommendations to begin their incorporation.

- *Truckee River Water Quality Monitoring Plan, Phase 1 Permitting and Approvals Requirements* (CDM Smith, 2010b). Identifies and tracks the permitting and approvals required for each type of assessment, their proposed location, property ownership, contact information, approvals schedule, required fees and required submittal information.
- *Truckee River Water Quality Monitoring Plan Monitoring Site Selection Report* (CDM Smith, 2010c) presents evaluations and recommendations for monitoring site locations used for the Phase 1 implementation.
- *Sampling and Analysis Plan, Water Year 2011* (CDM Smith, 2011a) and (CDM Smith, 2011b) describes the initial management strategy and the specific monitoring activities implemented under the first three years of Phase 1.
- *Equipment Installation Report* (CDM Smith, 2011c) documents the installation of the stream gauge and the tributary and community level water quality monitoring stations in the Martis Creek watershed.
- *Truckee River Water Quality Monitoring Plan Field Equipment Operations and Maintenance Manual* (CDM Smith, 2011d) provides an inventory of monitoring equipment as well as the protocols followed for operating and maintaining the equipment.
- *Truckee River Water Quality Monitoring Plan Field Equipment Operations and Maintenance Manual, Revision 1* (CDM Smith, 2012) provides an updated inventory of monitoring equipment as well as the protocols followed for operating and maintaining the equipment.
- *Sampling and Analysis Plan, Water Year 2013* (CDM Smith, 2013a) and (CDM Smith, 2013b) describes the revised management strategy and the specific monitoring activities implemented for WY 2013.
- *Sampling and Analysis Plan, Water Year 2014* (CDM Smith, 2014a) and (CDM Smith, 2014b) provides revisions to the 2013 SAPs to reflect changes implemented as part of the TRWQMP's adaptive management strategy.
- *Truckee River Water Quality Monitoring Plan Field Equipment Operations and Maintenance Manual, Revision 2* (CDM Smith, 2014d) provides an updated inventory of monitoring equipment as well as the protocols followed for operating and maintaining the equipment.
- *Sampling and Analysis Plan, Water Year 2015* (CDM Smith, 2015a) provides revisions to the 2014 SAPs to reflect changes implemented as part of the TRWQMP's adaptive management strategy.
- *Truckee River Water Quality Monitoring Plan Field Equipment Operations and Maintenance Manual, Revision 3* (CDM Smith, 2015b) provides an updated inventory of monitoring equipment as well as the protocols followed for operating and maintaining the equipment.
- *Sampling and Analysis Plan, Water Year 2016* (CDM Smith, 2016b) provides revisions to the 2015 SAP to reflect changes implemented as part of the TRWQMP's adaptive management strategy.

- *Sampling and Analysis Plan, Water Year 2018* (CDM Smith, 2018a) provides revisions to the 2016 SAP to reflect changes implemented as part of the TRWQMP's adaptive management strategy.
- *Sampling and Analysis Plan, Water Year 2020* (CDM Smith, 2020a) provides revisions to the 2018 SAP to reflect changes implemented as part of the TRWQMP's adaptive management strategy.

The results of WY 2010 monitoring activities were presented in two reports that were produced separately by the County and Town. To better document the program as a whole, the results of WY 2011 - 2016 monitoring activities were presented in single documents produced jointly by the County and Town. The Town of Truckee did not participate jointly with Placer County during WY 2017 - WY 2020 so separate reports were prepared for Placer County during these years. The annual reports developed to date include the following:

- *Placer County: Annual Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2010* (CDM Smith, 2010d);
- *Town of Truckee: Annual Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2010* (CDM Smith, 2010e);
- *Town of Truckee/County of Placer: Joint Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2011* (CDM Smith, 2011e);
- *Town of Truckee/County of Placer: Joint Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2012* (CDM Smith, 2013c);
- *Town of Truckee/County of Placer: Joint Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2013* (CDM Smith, 2013d);
- *Town of Truckee/County of Placer: Joint Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2014* (CDM Smith, 2014c);
- *Town of Truckee/County of Placer: Joint Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2015* (CDM Smith, 2016a);
- *Town of Truckee/County of Placer: Joint Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2016* (CDM Smith, 2016c); and
- *County of Placer: Final Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2017* (CDM Smith, 2018b).
- *County of Placer: Final Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2018* (CDM Smith, 2019).
- *County of Placer: Final Annual Monitoring Report for Implementation of the Truckee River Water Quality Monitoring Plan, Water Year 2019* (CDM Smith, 2020b).

This Annual Monitoring Report describes the monitoring activities performed by Placer County during WY 2020 (October 1, 2019 through September 30, 2020) and presents their results. Data collection activities during WY 2020 included:

- Community level discrete water quality sampling within the Martis Creek sub-watershed (Figure 1-1);
- Tributary level discrete water quality sampling within the Martis Creek sub-watershed (Figure 1-2); and
- Continuous discharge and turbidity monitoring within Martis Creek (Figure 1-3).

Figure 1-1
Community Level Discrete Water Quality Sampling Location near Northstar

Figure 1-2
Tributary Level Discrete Water Quality Sampling Location in West Martis Creek

Figure 1-3
Continuous Discharge and Turbidity Monitoring in West Martis Creek

Section 2

TRWQMP Summary

The purpose of the TRWQMP is to provide a strategy and guidance for assessing the effectiveness of the County's stormwater management program in protecting downstream water resources. The TRWQMP provides guidelines for conducting multiple types of monitoring activities, or assessment types, to evaluate the various actions being implemented to protect natural receiving waters from the impacts of stormwater runoff, development, and illicit discharges. This section provides a summary of the TRWQMP's purpose and presents the goals and objectives that were defined to help guide its implementation.

2.1 Purpose

The County's SWMP served as the guiding document for the initial development of the TRWQMP in 2008. The SWMP outlined two categories of assessment for evaluating the effectiveness of stormwater management programs as described below. Note that the SWMP was in effect until July 1, 2013, and requirements of the 2013 NPDES Phase 2 Permit are in effect from that date forward until a new permit comes into effect.

- Compliance assessment focuses on inspections of activities that may contribute to poor quality of stormwater runoff with the goal of enforcing compliance with the guidelines delineated in the NPDES Phase 2 Permit. Compliance monitoring is conducted by the County as outlined in the NPDES Phase 2 Permit and is <u>not</u> addressed by the TRWMQP.

- Performance assessment involves directly evaluating the water quality of stormwater runoff and receiving waters in order to assess the success of the NPDES Phase 2 Permit in protecting surface water resources. Results from the TRWQMP can inform strategies for stormwater management outlined in the NPDES Phase 2 Permit by identifying sub-watersheds of concern and prioritizing pollutant sources that disproportionately affect water quality.

The second category, performance assessment, is the primary focus of the TRWQMP. The overall purpose of the TRWQMP is to assess the effectiveness of various NPDES Phase 2 Permit related actions taken to protect natural surface waters from the impacts of stormwater runoff. The TRWQMP also promotes collaboration among the various independent groups performing monitoring in the Truckee River Watershed. The TRWQMP aims to create a more unified data management and reporting structure which will help to identify and track pollutant sources and evaluate long-term water quality trends.

2.2 Goals and Objectives

The following set of goals and objectives were defined during the development of the TRWQMP to help describe its purpose and the guidelines under which it was developed.

TRWQMP Goal 1: Comply with regulatory NPDES permits, Lahontan Board Orders, Middle Truckee River Sediment TMDL, Squaw Creek sediment TMDL, and the Martis Valley Community Plan for Placer County and the Town of Truckee.

TRWQMP Goal 2: Develop water quality monitoring datasets that will be scientifically defensible and provide accurate and representative data to evaluate the effectiveness of NPDES Phase 2 Permit in protecting surface water resources.

TRWQMP Goal 3: Develop a monitoring plan that is economically feasible to implement and maintain over time.

TRWQMP Goal 4: Facilitate collaboration, effort-sharing and integration of multiple independent private and public monitoring efforts.

To meet the goals of the TRWQMP, a more focused set of objectives were developed as follows:

- Provide a comprehensive and integrated data collection, data analysis and reporting framework to evaluate and track the status of surface water resources within the project area spatially and over time.
- Prioritize monitoring resources on spatial locations determined to be existing and/or future potential source areas.
- Focus monitoring resources on pollutants of concern and indicators that are clearly rationalized for each location of monitoring. Prioritize pollutants based on greatest risk to surface water resources due to specific land use activities.
- Maximize monitoring resources by including a range of monitoring types that vary in frequency of collection, relative cost to complete and statistical accuracy.
- Focus monitoring resources on times (season, storm events, etc.) when potential source area water quality is expected to deviate greatest from observations at minimally impacted locations.

The TRWQMP describes multiple assessment types to be implemented in a phased approach. Also, data collection and analysis activities are intended to be flexible from year to year to allow adjustments based on changes to available funding and new information that is produced through the program's implementation. To focus the monitoring activities and maximize their value, additional objectives, specific to each assessment type, were developed to focus implementation on answering specific water quality related questions. The following additional objectives have been developed for the TRWQMP implementation:

Bioassessments

- Describe the current stream health of Squaw and Martis Creeks as indicated by their benthic macroinvertebrate communities.
- Evaluate the bioassessment results collected during different years in an effort to identify and characterize any trends that may be emerging.
- Identify potential correlations between stream health and watershed characteristics/land uses.

Community Discrete Samples

- Characterize the water quality of stormwater runoff from catchments with varying characteristics and stormwater management practices to identify and prioritize locations within the project area.
- Evaluate monitoring results to identify and characterize any trends that may be emerging.
- Conduct source area analysis for problem locations based on pollutants of concern present in the runoff.

Tributary Discrete Samples

- Characterize the water quality differences among the various Martis Creek tributaries.
- Evaluate monitoring results to identify and characterize any trends that may be emerging.
- Conduct source area analysis based on pollutants present in the tributaries.

Stream Discharge and Turbidity Monitoring

- Collect turbidity and total suspended solids (TSS) data at near-continuous turbidity monitoring sites and develop correlations between these two parameters.
- Characterize annual discharge patterns and volumes for the primary branches of Martis Creek.
- Calculate suspended sediment loads for the primary branches of Martis Creek.

Rafting Segment Inspection

- Document problem sites that may contribute to pollutant loading along the stretch of the Truckee River where commercial rafting operations occur.
- Assess completed restoration projects as to their success with streambank stabilization and revegetation.
- Present results using mapping and narrative discussion of the assessment results and provide recommendations for any needed corrective actions.

Field Surveys for GIS Analysis and Water Quality Improvement Recommendations

- Identify and prioritize potential pollutant source areas within the Bear, Martis, and Squaw Creek watersheds.
- Characterize actual conditions within sub-watersheds including drainage boundaries, outfalls, and existing stormwater infrastructure.
- Develop mapping showing the prioritized sub-basins and narrative descriptions of the methods, assumptions and results of the GIS analysis.
- Utilize the field survey and GIS information, together with other monitoring results, to develop a series of maps showing recommendations for water quality improvements, as appropriate.

The data from each of these assessment types will also provide baseline water quality information to be used for the comparison of future data and evaluation of water quality trends over time. Additionally, the data from sites exhibiting good water quality can provide realistic water quality targets when planning stormwater improvements for problem areas.

Section 3

Summary of the Water Year 2020 Monitoring Period

This section presents a description of the WY 2020 monitoring period in terms of the precipitation patterns, stream discharge, land use activities and regulatory structure in place between October 1, 2019 and September 30, 2020.

3.1 Precipitation Summary

The Natural Resources Conservation Service (NRCS) SNOpack TELemetry (SNOTEL) Central Sierra Snow Laboratory (CSS Lab) (Site 428) and Truckee #2 (Site 834) weather stations were the two sources of precipitation (rainfall and snowfall) data for WY 2020 (USDA, 2020). The CSS Lab is located at approximately 7,000 ft. above sea level, just to the west of the Sierra Crest near Donner Summit. It should be noted that due to its location on the western side of the Sierra Crest, the CSS Lab site most likely receives larger amounts of precipitation than most of the Truckee River watershed, which is located immediately east of the crest and can be affected by a rain shadow effect in the lower elevations. However, for the purpose of this study the CSS Lab data is considered representative of the higher elevations of the Middle Truckee River watershed. The Truckee #2 station is located at approximately 6,500 ft. above sea level and is more representative of the lower elevations in the watershed area being monitored under this program.

Cumulative precipitation and Snow Water Equivalent (SWE) for WY 2020 are presented graphically in Figures 3-1 and 3-2, which also include historical average precipitation and SWE (1981-2010) at these locations. Figure 3-3 presents a comparison at both sites of daily and cumulative precipitation for each water year from WY 2010 to WY 2020 to provide context to WY 2020 precipitation relative to other water years during the implementation of the TRWQMP. Figure 3-4 presents a comparison at both sites of SWE for each water year to provide snowpack context to WY 2020. Tables 3-1 and 3-2 present monthly precipitation totals for Truckee #2 and CSS Lab, respectively while Tables 3-3 and 3-4 present average SWE for Truckee #2 and CSS, respectively, for each of the eleven years of TRWQMP implementation (WY 2010-WY 2020). These values are compared to historical averages (monthly and annual) to illustrate the relative magnitude of the water year, in terms of precipitation and snowfall.

WY 2020 was characterized by well below average precipitation and snowpack in the study area. The total annual precipitation received during WY 2020 was 67 and 69 percent of average at the CSS Lab and Truckee #2 stations, respectively. The water year started with below average precipitation in October and November. December was above average and the following two months (January and February) were very dry with February precipitation being near zero. March, April, and May were near average to end the wet season. Snowfall totals and SWE during WY 2020 were below average, with April 1, 2020 SWE at 63 and 92 percent of average at the CSS Lab Station and Truckee #2 Station, respectively.

During TRWQMP implementation, annual precipitation and snowfall amounts have been highly variable at both weather stations. Annual precipitation totals during WY 2010 were very close to average, while WY 2011 annual totals were 148 to 164 percent of average. Drought conditions persisted for four consecutive water years (2012, 2013, 2014, and 2015) when annual precipitation totals ranged from 61 to 78 percent of average across the study area. WY 2016 represents a return to average precipitation with totals ranging from 104 to 111 percent of average in the study area. WY 2017 was a historic wet season with precipitation totals ranging from 194 to 221 percent of average. WY 2018 had slightly below average precipitation with a low snowpack, and WY 2019 was well above average in terms of precipitation and snowfall. WY 2020 was another dry water year with well below average precipitation and snowpack. In terms of total precipitation, TRWQMP implementation has occurred during five dry water years (2012, 2013, 2014, 2015 and 2020), three average water years (2010, 2016, and 2018), and three wet water years (2011, 2017, and 2019) providing water quality data that is representative of varying climatic conditions.

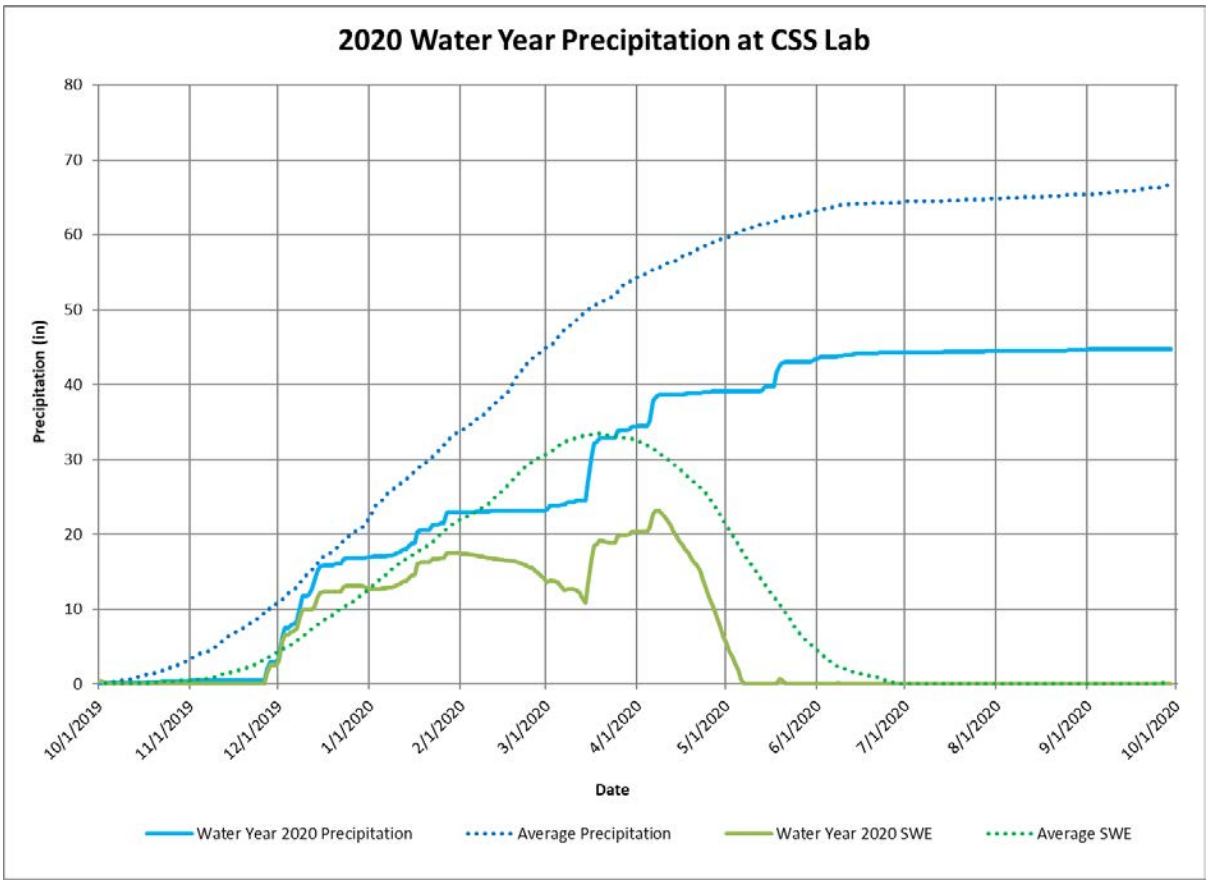


Figure 3-1
Cumulative Precipitation and SWE at the CSS Lab (USDA, 2020)

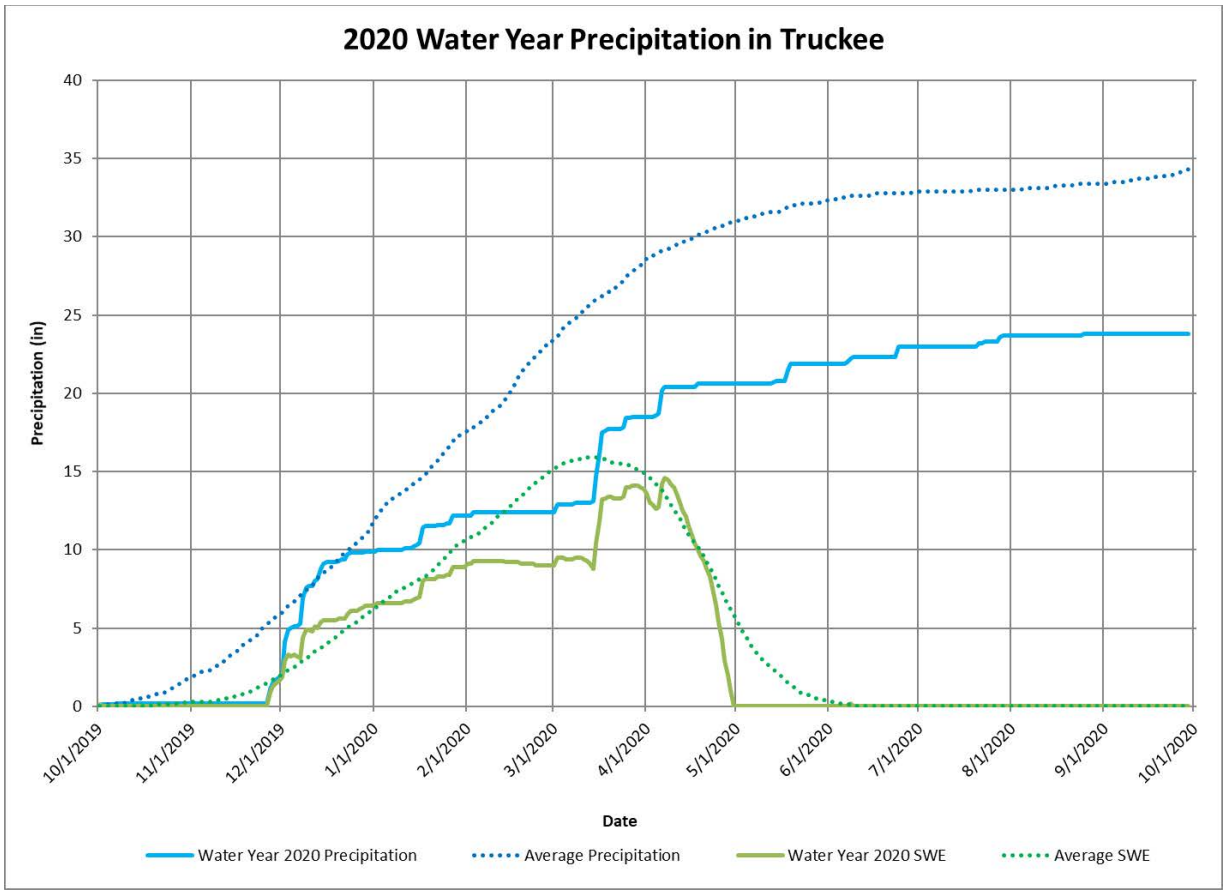


Figure 3-2
Cumulative Precipitation and SWE in Truckee, CA (USDA, 2020)

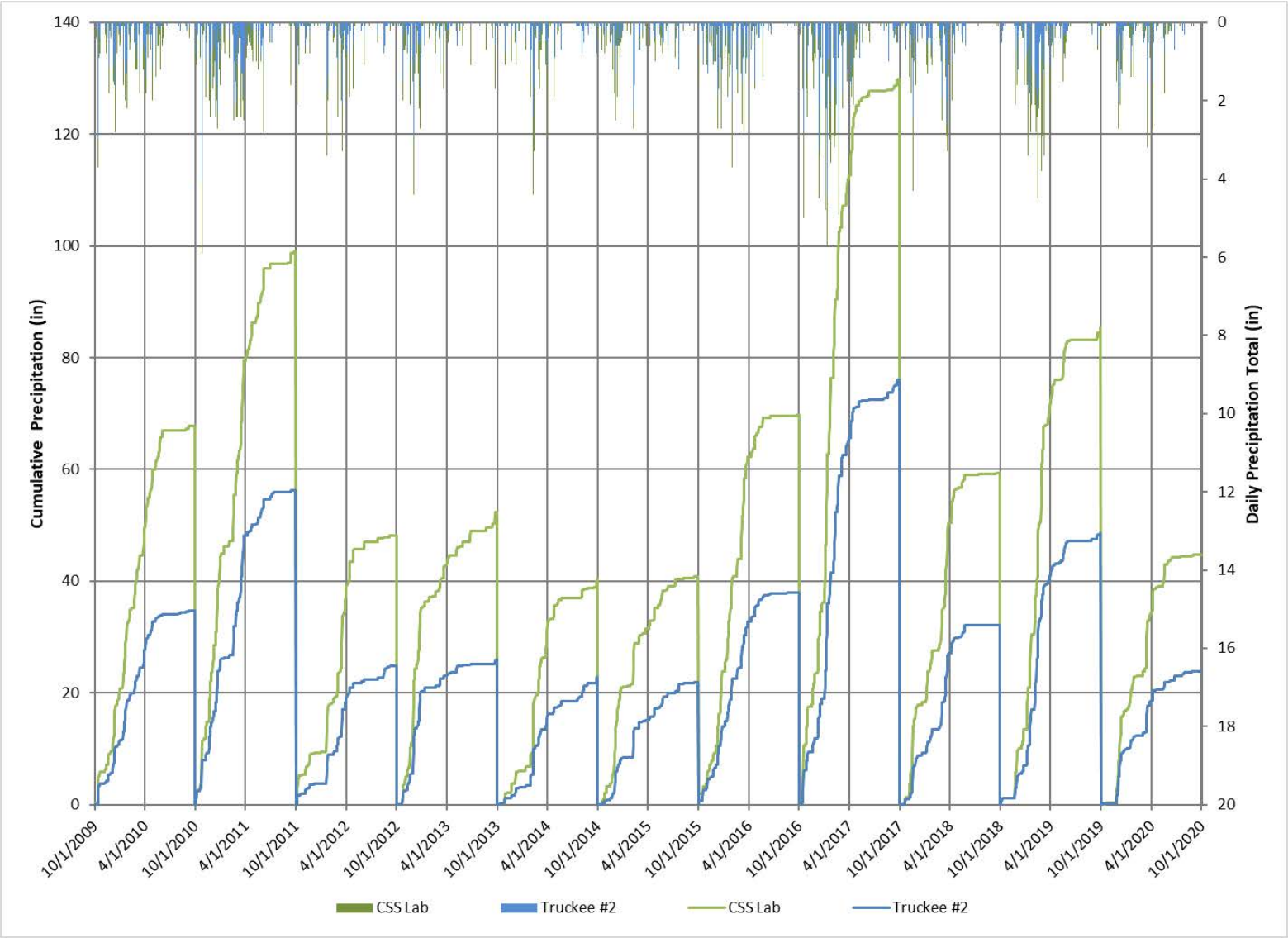


Figure 3-3
11-Year Cumulative Precipation and Daily Precipitaion at CSS Lab and Truckee, CA (USDA, 2020)

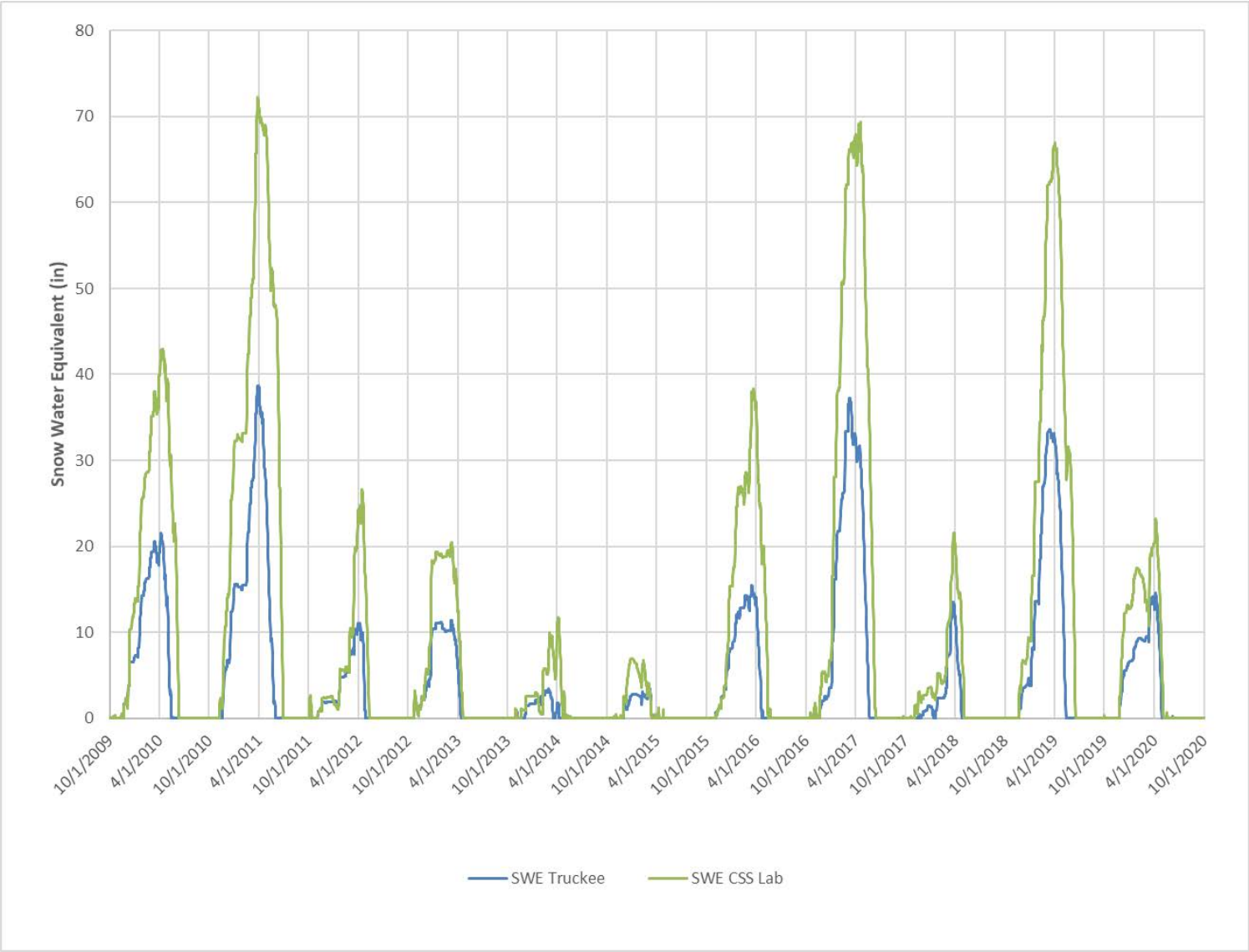


Figure 3-4
11-Year Snow Water Equivalent at CSS Lab and Truckee, CA (USDA, 2020)

Table 3-1. CSS Lab Precipitation Totals for Water Years 2010-2020[1]

WY 2010	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Total
Monthly Precipitation Total	5.8	3.8	10.7	12.4	7.2	9.8	10.3	5.9	1.1	0.0	0.3	0.4	67.7
Percent of Average	161%	49%	90%	114%	65%	105%	197%	160%	106%	0%	48%	25%	101%
WY 2011	**Oct-10**	**Nov-10**	**Dec-10**	**Jan-11**	**Feb-11**	**Mar-11**	**Apr-11**	**May-11**	**Jun-11**	**Jul-11**	**Aug-11**	**Sep-11**	**Total**
Monthly Precipitation Total	11.8	11.9	20.6	2.9	12.1	20.1	6.8	5.4	5.2	0.0	0.1	2.1	99.0
Percent of Average	328%	155%	173%	27%	109%	215%	130%	146%	500%	0.0%	16%	129%	148%
WY 2012	**Oct-11**	**Nov-11**	**Dec-11**	**Jan-12**	**Feb-12**	**Mar-12**	**Apr-12**	**May-12**	**Jun-12**	**Jul-12**	**Aug-12**	**Sep-12**	**Total**
Monthly Precipitation Total	5.3	3.8	0.4	8.4	4.8	16.4	6.7	0	1.3	0.5	0.3	0.3	48.2
Percent of Average	147%	49%	3%	77%	43%	175%	128%	0%	125%	143%	48%	18%	72%
WY 2013	**Oct-12**	**Nov-12**	**Dec-12**	**Jan-13**	**Feb-13**	**Mar-13**	**Apr-13**	**May-13**	**Jun-13**	**Jul-13**	**Aug-13**	**Sep-13**	**Total**
Monthly Precipitation Total	4.4	13.6	17.3	1.9	1.1	5.0	1.3	2.5	1.8	0.0	0.7	2.8	52.4
Percent of Average	122%	177%	146%	17%	10%	53%	25%	68%	173%	0%	113%	172%	78%
WY 2014	**Oct-13**	**Nov-13**	**Dec-13**	**Jan-14**	**Feb-14**	**Mar-14**	**Apr-14**	**May-14**	**Jun-14**	**Jul-14**	**Aug-14**	**Sep-14**	**Total**
Monthly Precipitation Total	2.0	1.7	2.4	2.9	13.4	9.8	3.5	1.3	0.0	0.1	1.7	1.8	40.6
Percent of Average	56%	22%	20%	27%	121%	105%	67%	35%	0%	29%	274%	110%	61%
WY 2015	**Oct-14**	**Nov-14**	**Dec-14**	**Jan-15**	**Feb-15**	**Mar-15**	**Apr-15**	**May-15**	**Jun-15**	**Jul-15**	**Aug-15**	**Sep-15**	**Total**
Monthly Precipitation Total	2.5	6.2	12.4	0.5	8.5	1.3	3.8	3.0	0.9	1.3	0.2	0.4	41.0
Percent of Average	69%	81%	104%	5%	77%	14%	73%	81%	87%	371%	32%	25%	61%
WY 2016	**Oct-15**	**Nov-15**	**Dec-15**	**Jan-16**	**Feb-16**	**Mar-16**	**Apr-16**	**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Total**
Monthly Precipitation Total	3.7	5.6	14.6	16.6	3.5	18.3	4.1	2.8	0.4	0.0	0.0	0.2	69.8
Percent of Average	103%	73%	123%	152%	32%	195%	79%	76%	38%	0%	0%	12%	104%
WY 2017	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**	**Feb-17**	**Mar-17**	**Apr-17**	**May-17**	**Jun-17**	**Jul-17**	**Aug-17**	**Sep-17**	**Total**
Monthly Precipitation Total	17	6.6	12.6	40.1	26.9	9.5	12.5	1.5	1.0	0.1	0.1	1.9	129.8
Percent of Average	472%	86%	106%	368%	243%	101%	239%	41%	96%	29%	16%	117%	194%
WY 2018	**Oct-17**	**Nov-17**	**Dec-17**	**Jan-18**	**Feb-18**	**Mar-18**	**Apr-18**	**May-18**	**Jun-18**	**Jul-18**	**Aug-18**	**Sep-18**	**Total**
Monthly Precipitation Total	1.4	15.9	1.1	9.1	2.3	20.6	6.4	2.3	0.0	0.1	0.0	0.2	59.4
Percent of Average	39%	207%	9%	83%	21%	220%	123%	62%	0%	29%	0%	12%	89%

WY 2019	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Total
Monthly Precipitation Total	1.2	7.2	5.0	17.1	30.4	10.8	4.4	6.7	0.3	0.0	0.1	2.2	85.4
Percent of Average	33%	94%	42%	157%	275%	115%	84%	182%	29%	0%	16%	135%	127%
WY 2020	**Oct-19**	**Nov-19**	**Dec-19**	**Jan-20**	**Feb-20**	**Mar-20**	**Apr-20**	**May-20**	**Jun-20**	**Jul-20**	**Aug-20**	**Sep-20**	**Total**
Monthly Precipitation Total	0.4	3.1	13.4	6	0.4	11.1	4.7	4.4	0.8	0.2	0.2	0	44.7
Percent of Average	11%	40%	113%	55%	4%	118%	90%	119%	77%	57%	32%	0%	67%
Average Monthly Precipitation[2]	*3.6*	*7.7*	*11.9*	*10.9*	*11.1*	*9.4*	*5.2*	*3.7*	*1.0*	*0.4*	*0.6*	*1.6*	*67.1*

[1] Data acquired from the SNOTEL CSS Lab Site (USDA, 2020)
[2] Based on data recorded from 1981 through 2010

Table 3-2. Truckee Precipitation Totals for Water Years 2010-2020[1]

WY 2010	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Total
Monthly Precipitation Total	3.7	2	5.7	7.2	3.7	5.4	5.1	1.1	0.2	0.1	0.4	0.1	34.7
Percent of Average	193%	49%	98%	126%	63%	104%	210%	81%	38%	67%	98%	11%	101%
WY 2011	**Oct-10**	**Nov-10**	**Dec-10**	**Jan-11**	**Feb-11**	**Mar-11**	**Apr-11**	**May-11**	**Jun-11**	**Jul-11**	**Aug-11**	**Sep-11**	**Total**
Monthly Precipitation Total	8.0	6.8	11.0	0.9	8.0	13.5	1.9	2.7	2.3	0.8	0.1	0.2	56.2
Percent of Average	417%	165%	190%	16%	137%	261%	78%	199%	442%	533%	24%	22%	164%
WY 2012	**Oct-11**	**Nov-11**	**Dec-11**	**Jan-12**	**Feb-12**	**Mar-12**	**Apr-12**	**May-12**	**Jun-12**	**Jul-12**	**Aug-12**	**Sep-12**	**Total**
Monthly Precipitation Total	2.0	1.6	0.2	5.1	2.8	7.4	2.7	0.3	0.3	0.3	1.9	0.3	24.9
Percent of Average	104%	39%	3%	89%	48%	143%	111%	22%	58%	200%	463%	33%	72%
WY 2013	**Oct-12**	**Nov-12**	**Dec-12**	**Jan-13**	**Feb-13**	**Mar-13**	**Apr-13**	**May-13**	**Jun-13**	**Jul-13**	**Aug-13**	**Sep-13**	**Total**
Monthly Precipitation Total	2.4	7.2	10.7	0.7	0.2	2.0	0.5	1.3	0.1	0.1	0.0	0.7	25.9
Percent of Average	125%	175%	184%	12%	3%	39%	21%	96%	19%	67%	0%	76%	75%
WY 2014	**Oct-13**	**Nov-13**	**Dec-13**	**Jan-14**	**Feb-14**	**Mar-14**	**Apr-14**	**May-14**	**Jun-14**	**Jul-14**	**Aug-14**	**Sep-14**	**Total**
Monthly Precipitation Total	1.1	0.6	1.4	2.1	6.9	3.9	1.4	1.1	0.0	0.8	2.4	1.2	22.9
Percent of Average	57%	15%	24%	37%	118%	75%	58%	81%	0%	533%	585%	130%	67%
WY 2015	**Oct-14**	**Nov-14**	**Dec-14**	**Jan-15**	**Feb-15**	**Mar-15**	**Apr-15**	**May-15**	**Jun-15**	**Jul-15**	**Aug-15**	**Sep-15**	**Total**
Monthly Precipitation Total	0.7	2.3	5.5	0.0	6.2	0.4	2.1	2.1	0.6	1.7	0.2	0.2	22.0
Percent of Average	36%	56%	95%	0%	106%	8%	86%	154%	115%	1133%	49%	22%	64%
WY 2016	**Oct-15**	**Nov-15**	**Dec-15**	**Jan-16**	**Feb-16**	**Mar-16**	**Apr-16**	**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Total**
Monthly Precipitation Total	2.9	3.7	7.4	8.5	2.0	8.3	2.9	1.7	0.4	0.0	0.1	0.1	38.0
Percent of Average	151%	90%	128%	148%	34%	161%	119%	125%	77%	0%	24%	11%	111%
WY 2017	**Oct-16**	**Nov-16**	**Dec-16**	**Jan-17**	**Feb-17**	**Mar-17**	**Apr-17**	**May-17**	**Jun-17**	**Jul-17**	**Aug-17**	**Sep-17**	**Total**
Monthly Precipitation Total	9.1	2.7	7.2	22.5	17.4	6.7	5.6	1.1	0.1	0.0	1.4	2.2	76.0
Percent of Average	474%	66%	124%	393%	298%	130%	230%	81%	19%	0%	341%	239%	221%
WY 2018	**Oct-17**	**Nov-17**	**Dec-17**	**Jan-18**	**Feb-18**	**Mar-18**	**Apr-18**	**May-18**	**Jun-18**	**Jul-18**	**Aug-18**	**Sep-18**	**Total**
Monthly Precipitation Total	1.0	7.3	1.0	4.1	1.3	12.4	2.9	2.1	0.0	0.0	0.0	0.0	32.1
Percent of Average	52%	177%	17%	72%	22%	240%	119%	154%	0%	0%	0%	0%	93%

WY 2019	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Total
Monthly Precipitation Total	1.2	3.4	2.4	10.1	19.6	4.5	2.1	3.7	0.2	0.0	0.3	1.2	48.7
Percent of Average	63%	83%	41%	176%	336%	87%	86%	272%	38%	0%	73%	130%	142%
WY 2020	**Oct-19**	**Nov-19**	**Dec-19**	**Jan-20**	**Feb-20**	**Mar-20**	**Apr-20**	**May-20**	**Jun-20**	**Jul-20**	**Aug-20**	**Sep-20**	**Total**
Monthly Precipitation Total	0.2	1.9	7.8	2.3	0.2	6.1	2.1	1.3	1.1	0.7	0.1	0.0	23.8
Percent of Average	10%	46%	134%	40%	3%	118%	86%	96%	212%	467%	24%	0%	69%
Average Monthly Precipitation[2]	*1.9*	*4.1*	*5.8*	*5.7*	*5.8*	*5.2*	*2.4*	*1.4*	*0.5*	*0.2*	*0.4*	*0.9*	*34.4*

[1] Data acquired from the SNOTEL Truckee #2 Site (USDA, 2020)
[2] Based on data recorded from 1981 through 2010

Table 3-3. CSS Lab Mean Snow Water Equivalent for Water Years 2010-2020[1]

WY 2010	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10
Snow Water Equivalent	0.0	2.3	13.4	25.8	32.9	39.9	39.3	19.9
Percent of Average	0%	50%	102%	116%	106%	124%	192%	498%
WY 2011	**Nov-10**	**Dec-10**	**Jan-11**	**Feb-11**	**Mar-11**	**Apr-11**	**May-11**	**Jun-11**
Snow Water Equivalent	0.0	10.7	31.1	33.2	46.9	70.9	66.6	47.7
Percent of Average	0%	233%	236%	150%	151%	220%	325%	1193%
WY 2012	**Nov-11**	**Dec-11**	**Jan-12**	**Feb-12**	**Mar-12**	**Apr-12**	**May-12**	**Jun-12**
Snow Water Equivalent	0.0	2.3	2.0	5.5	9.6	24.2	12.5	0.0
Percent of Average	0%	50%	15%	25%	31%	75%	61%	0%
WY 2013	**Nov-12**	**Dec-12**	**Jan-13**	**Feb-13**	**Mar-13**	**Apr-13**	**May-13**	**Jun-13**
Snow Water Equivalent	1.3	3.9	18.0	18.9	19.0	12.6	0.0	0.0
Percent of Average	260%	85%	136%	85%	61%	39%	0%	0%
WY 2014	**Nov-13**	**Dec-13**	**Jan-14**	**Feb-14**	**Mar-14**	**Apr-14**	**May-14**	**Jun-14**
Snow Water Equivalent	0.8	0.9	2.6	0.8	7.7	10.7	0.5	0.0
Percent of Average	160%	20%	20%	4%	25%	33%	2%	0%
WY 2015	**Nov-14**	**Dec-14**	**Jan-15**	**Feb-15**	**Mar-15**	**Apr-15**	**May-15**	**Jun-15**
Snow Water Equivalent	0.1	2.5	7.0	4.4	4.1	0.0	0.0	0.0
Percent of Average	20%	54%	53%	20%	13%	0%	0%	0%
WY 2016	**Nov-15**	**Dec-15**	**Jan-16**	**Feb-16**	**Mar-16**	**Apr-16**	**May-16**	**Jun-16**
Snow Water Equivalent	0.0	2.4	15.4	26.9	27.6	36.1	17.3	0.0
Percent of Average	0%	52%	117%	121%	89%	112%	84%	0%
WY 2017	**Nov-16**	**Dec-16**	**Jan-17**	**Feb-17**	**Mar-17**	**Apr-17**	**May-17**	**Jun-17**
Snow Water Equivalent	1.4	5.3	6.7	38.6	62.1	66.9	60.0	18.1
Percent of Average	280%	115%	51%	174%	200%	207%	293%	453%
WY 2018	**Nov-17**	**Dec-17**	**Jan-18**	**Feb-18**	**Mar-18**	**Apr-18**	**May-18**	**Jun-18**
Snow Water Equivalent	0.0	2.2	3.5	5.2	6.1	20.2	5.3	0.0
Percent of Average	0%	48%	27%	23%	20%	63%	26%	0%
WY 2019	**Nov-18**	**Dec-18**	**Jan-19**	**Feb-19**	**Mar-19**	**Apr-19**	**May-19**	**Jun-19**
Snow Water Equivalent	0.0	5.2	9.0	27.5	56.0	66.4	45.2	28.0
Percent of Average	0%	113%	68%	124%	181%	206%	220%	700%
WY 2020	**Nov-19**	**Dec-19**	**Jan-20**	**Feb-20**	**Mar-20**	**Apr-20**	**May-20**	**Jun-20**
Snow Water Equivalent	0.0	3.0	12.7	17.4	13.5	20.3	5.4	0.0
Percent of Average	0%	65%	96%	78%	44%	63%	26%	0%
Historical Snow Water Equivalent[2]	*0.5*	*4.6*	*13.2*	*22.2*	*31.0*	*32.3*	*20.5*	*4.0*

[1] Data acquired from the SNOTEL CSS Lab Site (USDA, 2020)

[2] Based on monthly averages from 1981 through 2010

Table 3-4. Truckee Mean Snow Water Equivalent for Water Years 2010-2020[1]

WY 2010	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10
Snow Water Equivalent	0.0	1.9	7.2	14.3	18.7	19.2	13.6	0
Percent of Average	0%	90%	116%	134%	123%	130%	247%	0%
WY 2011	**Nov-10**	**Dec-10**	**Jan-11**	**Feb-11**	**Mar-11**	**Apr-11**	**May-11**	**Jun-11**
Snow Water Equivalent	0.0	5.6	15.0	15.5	25.0	38.7	24.2	0.0
Percent of Average	0%	267%	242%	145%	164%	261%	440%	0%
WY 2012	**Nov-11**	**Dec-11**	**Jan-12**	**Feb-12**	**Mar-12**	**Apr-12**	**May-12**	**Jun-12**
Snow Water Equivalent	0.0	1.8	2.0	4.8	7.2	10.7	0.0	0.0
Percent of Average	0%	86%	32%	45%	47%	72%	0%	0%
WY 2013	**Nov-12**	**Dec-12**	**Jan-13**	**Feb-13**	**Mar-13**	**Apr-13**	**May-13**	**Jun-13**
Snow Water Equivalent	1.1	2.6	10.4	11.1	10.2	5.9	0.0	0.0
Percent of Average	367%	124%	168%	104%	67%	40%	0%	0%
WY 2014	**Nov-13**	**Dec-13**	**Jan-14**	**Feb-14**	**Mar-14**	**Apr-14**	**May-14**	**Jun-14**
Snow Water Equivalent	0.9	0.0	1.7	2.5	3.4	1.7	0.0	0.0
Percent of Average	300%	0%	27%	23%	22%	11%	0%	0%
WY 2015	**Nov-14**	**Dec-14**	**Jan-15**	**Feb-15**	**Mar-15**	**Apr-15**	**May-15**	**Jun-15**
Snow Water Equivalent	0.0	0.9	2.8	2.5	3.3	0.0	0.0	0.0
Percent of Average	0%	43%	45%	23%	22%	0%	0%	0%
WY 2016	**Nov-15**	**Dec-15**	**Jan-16**	**Feb-16**	**Mar-16**	**Apr-16**	**May-16**	**Jun-16**
Snow Water Equivalent	0.0	2.7	8.1	12.8	13.7	13.7	0.0	0.0
Percent of Average	0%	129%	131%	120%	90%	93%	0%	0%
WY 2017	**Nov-16**	**Dec-16**	**Jan-17**	**Feb-17**	**Mar-17**	**Apr-17**	**May-17**	**Jun-17**
Snow Water Equivalent	0.4	2.0	3.5	21.8	33.4	32.2	21.0	0.0
Percent of Average	133%	95%	56%	204%	220%	218%	382%	0%
WY 2018	**Nov-17**	**Dec-17**	**Jan-18**	**Feb-18**	**Mar-18**	**Apr-18**	**May-18**	**Jun-18**
Snow Water Equivalent	0.0	0.3	1.3	2.3	3.6	11.8	0.0	0.0
Percent of Average	0%	14%	21%	21%	24%	80%	0%	0%
WY 2019	**Nov-18**	**Dec-18**	**Jan-19**	**Feb-19**	**Mar-19**	**Apr-19**	**May-19**	**Jun-19**
Snow Water Equivalent	0.0	2.8	3.8	13.5	31.0	32.4	14.8	0.0
Percent of Average	0%	133%	61%	126%	204%	219%	269%	0%
WY 2020	**Nov-19**	**Dec-19**	**Jan-20**	**Feb-20**	**Mar-20**	**Apr-20**	**May-20**	**Jun-20**
Snow Water Equivalent	0.0	1.9	6.5	9.1	9.0	13.6	0.0	0.0
Percent of Average	0%	90%	105%	85%	59%	92%	0%	0%
Historical Snow Water Equivalent[2]	*0.3*	*2.1*	*6.2*	*10.7*	*15.2*	*14.8*	*5.5*	*0.3*

[1] Data acquired from the SNOTEL Truckee #2 Site (USDA, 2020)

[2] Based on monthly averages from 1981 through 2010

3.2 Stream Discharge Summary

Stream discharge in the Middle Truckee River is partially regulated by dam operations on Lake Tahoe and Donner Lake. Additional flow is contributed by several unregulated tributaries including Bear, Squaw, Silver, Deer, Pole, Deep, Cabin, and Cold creeks. Below downtown Truckee, additional flows are contributed by Trout, Martis, Union Valley and Prosser creeks and the Little Truckee River. Discharge from Martis Creek, Prosser Creek, and the Little Truckee River are also regulated by dams. Figure 3-5 presents the watersheds of the Middle Truckee River (2NDNATURE, LLC, 2008).

Figures 3-6, 3-7, 3-8 and 3-9 present WY 2020 hydrographs of the Truckee River at Tahoe City (Gage # 10337500), the Truckee River 2.5 miles upstream of Truckee (Gage # 10338000), Donner Creek at Hwy 89 (Gage # 10338700), and Truckee River at Boca Bridge (Gage # 10344505), respectively. These gages are maintained by the United States Geological Survey (USGS), and the data include daily mean discharge and historic median daily discharge values.

Discharge rates from Lake Tahoe into the Truckee River fluctuated as the result of precipitation events, snowmelt runoff and releases from the Lake Tahoe dam in Tahoe City as shown in Figure 3-5. Discharge occurred from Lake Tahoe to the Truckee River throughout WY 2020 from the Lake Tahoe watershed. The lowest discharge rates occurred during the winter months (December-March). Dam operations were minimal due to the below average precipitation during WY 2020. Dam gates were slowly opened during a large storm in March and in June for the summer recreation season. Dam releases were low throughout the spring prior to the June increase. A peak discharge of 300 cubic feet per second was attained in late June to levels near historical median values for this regulated portion of the Truckee River.

The discharge in the Middle Truckee River peaked in mid-May in correlation with spring storms and peak snowmelt runoff. The peak discharge near Truckee (USGS 10338000) was 700 cfs as shown on Figure 3-6. Figure 3-7 shows Donner Creek daily discharge was less than long-term median daily discharge throughout most of WY 2020, with fluctuations due to weather patterns and dam releases. Discharge in the Truckee River at Boca Bridge (USGS 10344505) followed a similar pattern as upstream with a peak discharge rate of approximately 2000 cfs in mid-May 2020. Discharge in the Truckee River was above the long-term median daily discharge values during the spring and summer months.

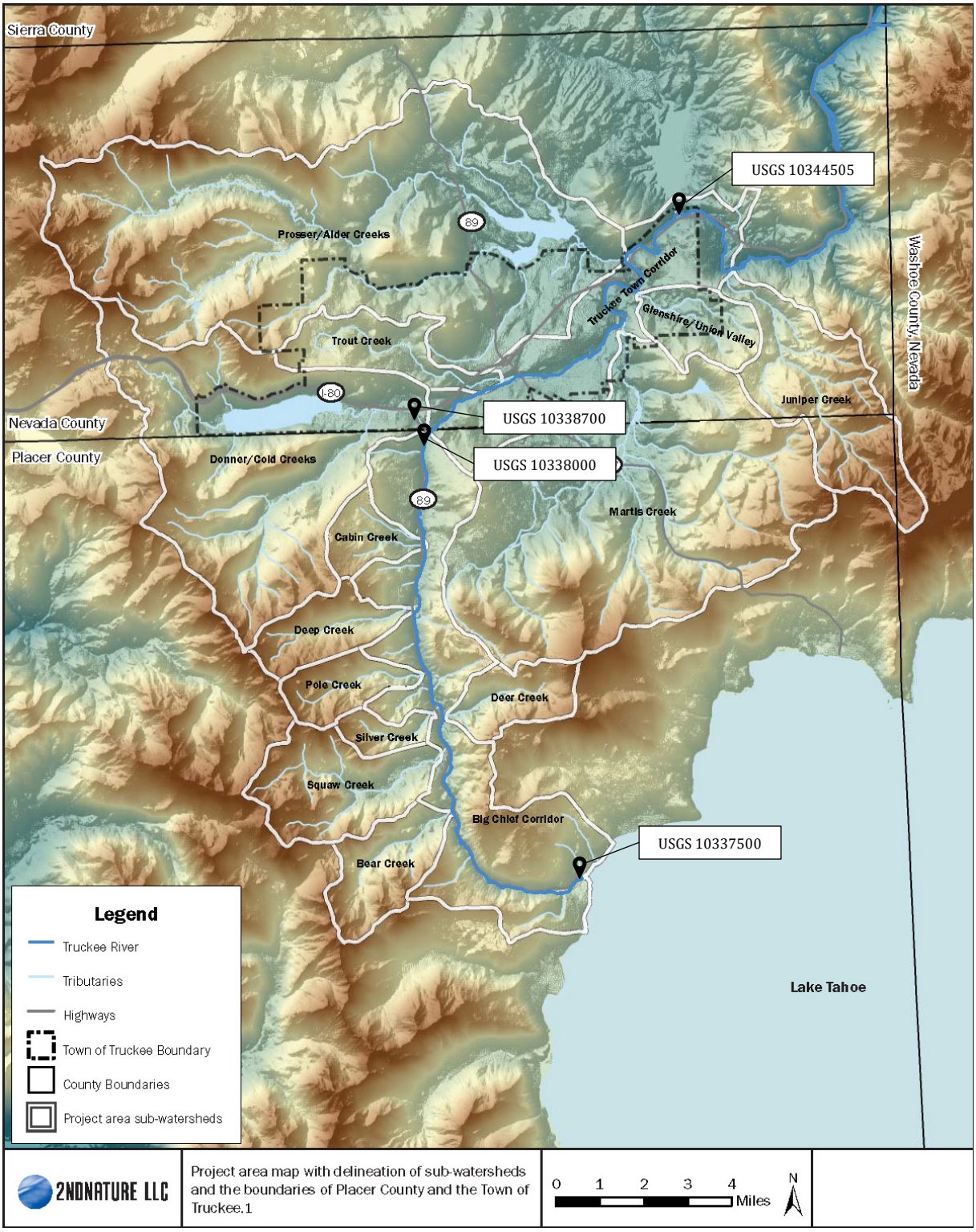
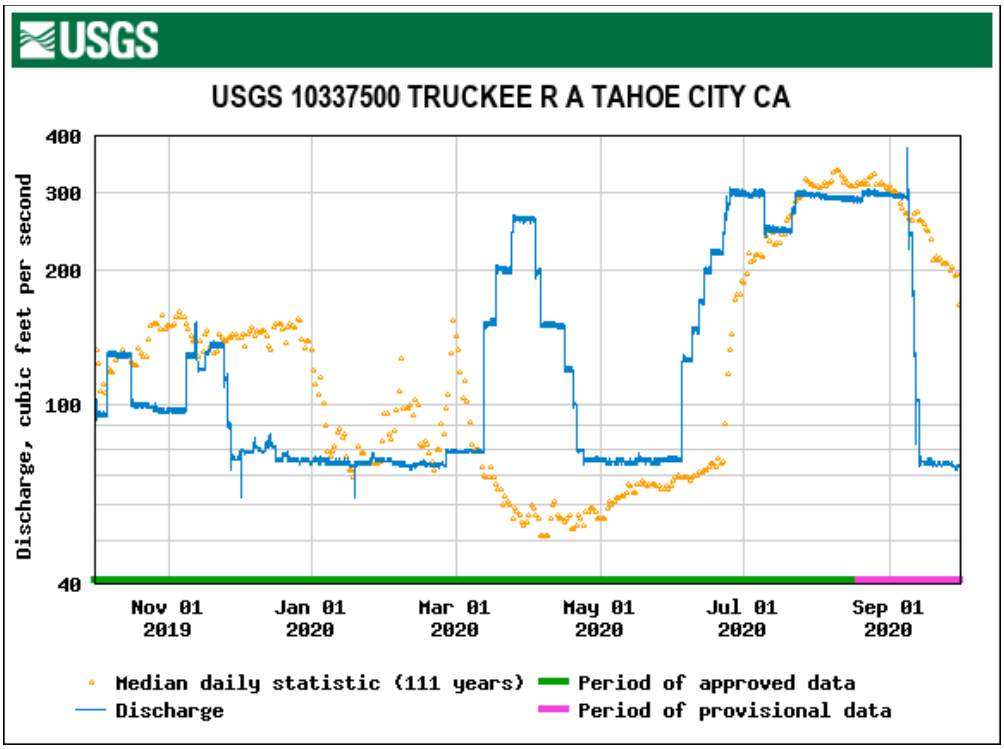
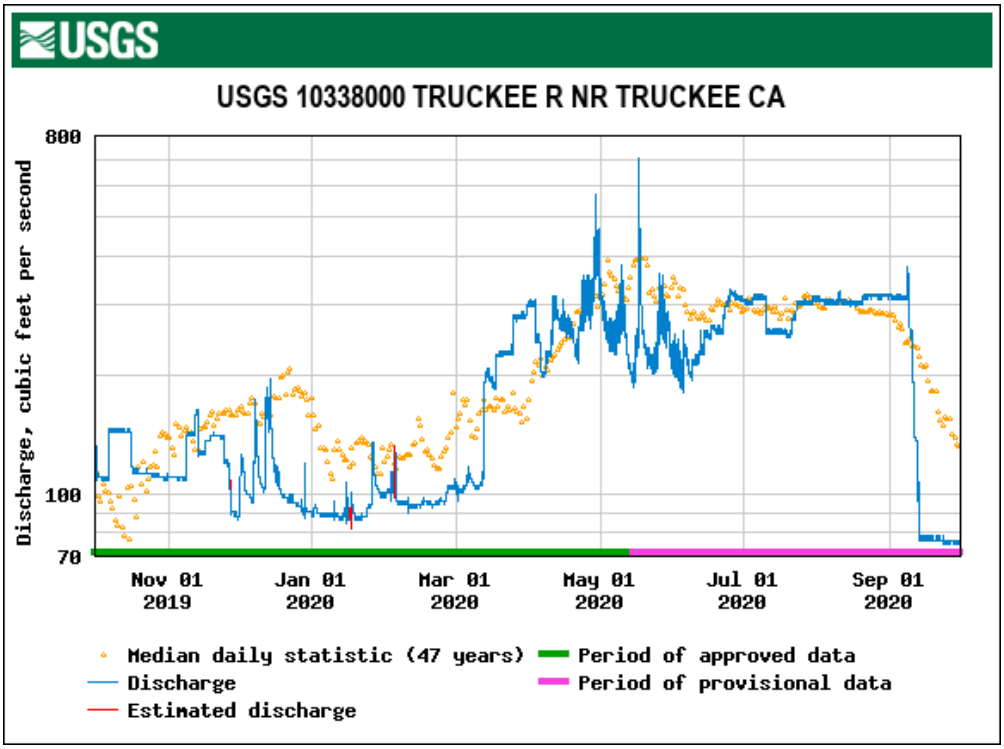


Figure 3-5
Middle Truckee River Watershed (2NDNATURE, LLC, 2008)



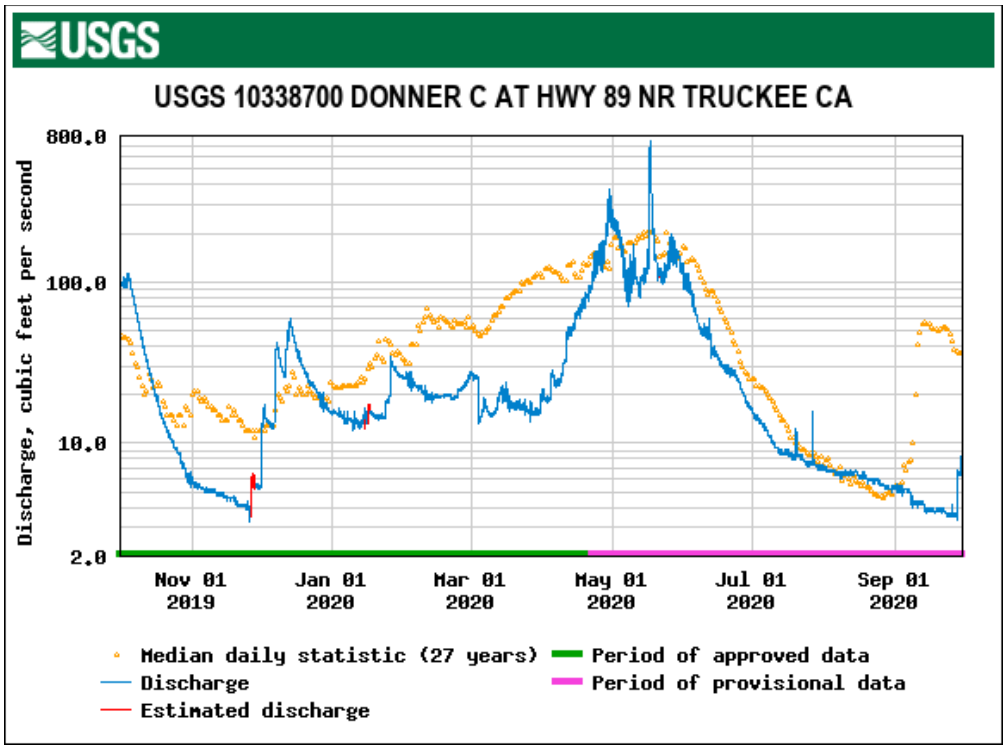
Source: http://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=10337500

Figure 3-6
Truckee River Discharge at Tahoe City (USGS, 2020)



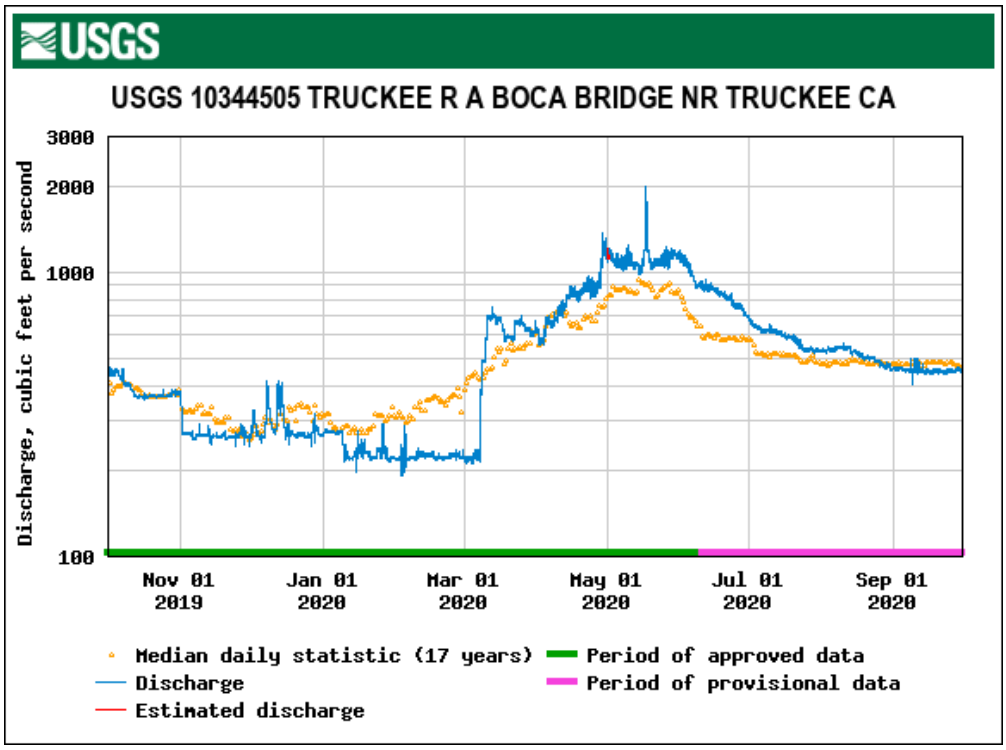
Source: http://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=10338000

Figure 3-7
Truckee River Discharge near Truckee (USGS, 2020)



Source: http://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=10338700

Figure 3-8
Donner Creek Discharge at Highway 89 (USGS, 2020)



Source: http://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=10344505

Figure 3-9
Truckee River at Boca Bridge (USGS, 2020)

3.3 Land Use Conditions

Fifteen sub-watersheds drain to the Truckee River within the TRWQMP study area as shown in Figure 3-5 (Placer County and Town of Truckee). Based on the preliminary quantitative GIS analysis conducted during the development of the TRWQMP, seven of these sub-watersheds are classified as having high disturbance and three of them are classified as having moderate disturbance (disturbance is a measure of the level of urban development and/or construction activity present within the subarea). These sub-watersheds are presented in Table 3-5 along with information on area size, land use, and relative disturbance rating. The remaining five sub-watersheds (Cabin Creek, Deep Creek, Deer Creek, Pole Creek, and Silver Creek) are classified with low disturbance and are not included in this table. Refer to the TRWQMP for additional information on the preliminary GIS analysis (2NDNATURE, LLC, 2008).

Table 3-5. Summary of TRWQMP Sub-Watersheds with High and Moderate Disturbance Ratings[1]

Sub-Watershed	Size (mi^2)	Land Uses	Disturbance Rating
Squaw Creek	8.2	Forest, meadow, ski resort, commercial, residential, dirt roads, golf course, secondary roadways	High
Martis Creek	40.9	Forest, meadow, ski resort, commercial, residential, dirt roads, golf courses, primary roadway, secondary roadways, industrial, State Route 267	High
Truckee Town Corridor	14.1	Forest, commercial, residential, primary roadways, secondary roadways, legacy sites, industrial	High
Bear Creek	5.3	Forest, ski resort, commercial, residential, secondary roadways	High
Donner/Cold Creeks	17.0	Forest, residential, commercial, dirt roads, primary roadway, secondary roadways, legacy sites	High
Trout Creek	4.9	Forest, meadow commercial, residential, primary roadway, secondary roadways, golf courses	High
Big Chief Corridor	23.4	Forest, commercial, residential, primary roadway, State Route 89	High
Glenshire/Union Valley	4.1	Forest, residential, secondary roadways	Moderate
Prosser/Alder Creeks	54	Forest, residential, ski area, dirt roads, secondary roadways	Moderate
Juniper Creek	10.8	Forest, residential commercial, dirt roads, secondary roadways	Moderate

[1] Information acquired from the TRWQMP (2NDNATURE, LLC, 2008)

There were no major fires, landslides, floods, or other events during WY 2020 or during previous years of TRWQMP implementation. Construction activities during WY 2020 included the following:

- State Route (SR) 89/Fanny Bridge Revitalization Project (Big Chief Corridor) – Caltrans completed construction of a new SR 89 road segment near the Tahoe City Transit Center, a new bridge over the Truckee River downstream of the Lake Tahoe dam near the existing Caltrans yard, and two new roundabouts, one where the new road segment connects to SR 89 south in Tahoe City and another where the new bridge connects with SR 89 north to Truckee. Construction of this phase was completed in October 2019. The Class 1 trail through this location was re-aligned which required grading, paving, and striping during the summer of 2020. Additional work including rebuilding Fanny Bridge and construction of the new roundabout at the Tahoe City wye will continue in the summer of 2021.

- Bike Path Maintenance along Truckee River (Big Chief Corridor)– Bike path maintenance activities occurred during the 2020 construction season and may have involved minor grading activities and paving.
- Martis Wildlife Area Restoration Project (Martis Creek). The Truckee River Watershed Council completed this project in October of 2019. The project restored 70 acres of meadow, 2 miles of streams along Martis Creek.
- Truckee Railyard Mixed-Use Development Master Plan (Truckee Town Corridor) – This plan and project has been approved by the Town of Truckee and is currently under construction. The plan includes redevelopment of the existing railyard consisting of multi-family residential, commercial, transportation improvements and recreational amenities near downtown Truckee. Some improvements are also proposed along Trout Creek, a tributary to the Truckee River. The project area is adjacent to Trout Creek and near the Truckee River.
- Tahoe Expedition Academy New Martis Valley Campus (Martis Creek) – This project has been approved by Placer County and is currently under construction. The project is building a new school campus in Martis Valley near Martis Creek.

Several private development plans and projects were also approved recently, which when implemented could potentially affect the Truckee River watershed within the study area and are listed below.

- Martis Valley West Parcel Specific Plan (Martis Creek) – This plan has been approved by Placer County and is currently in litigation with no imminent plans for construction. The plan proposes the transfer of 760 residential units and 6.6 acres of commercial to the West Parcel on the west side of SR 267 near Northstar, from designated development on the East Parcel on the eastside of SR 267. Prior to plan approval the East Parcel designated development of 1,360 residential units and 6.6 acres of commercial under the existing Martis Valley Community Plan. A portion of the West Parcel would also be rezoned from Timberland Production to allow the development. The East Parcel would be permanently preserved as open space.
- Village at Squaw Valley Specific Plan (Squaw Creek) – This plan has been approved by Placer County and is currently in litigation with no imminent plans for construction. The plan proposes expansion of the Village at Squaw Valley and other residential, employee housing, tourist, commercial and ski area facilities development into the existing Squaw Valley Parking lot and at the Olympic Village Lodge and former Squaw Valley Public Service District sites. The Specific Plan also proposes a Village-Conservation Preserve corridor along Squaw Creek to limit development within this area and allow for future creek improvements and recreational amenities with low impact to Squaw Creek.
- Northstar Mountain Master Plan (Martis Creek) – This plan has been approved by Placer County and is a 10-year plan. Project-level components of the plan include additional ski trails, ski trail widening, snow making lines, lift upgrades, and improvements and expansion of skier service site improvements. Program-level components include infill

resort development on Lookout Mountain, a six-passenger gondola from Castle Peak parking area to the Village; skier access from Lookout Mountain to the Backside; additional skier service sites on the mountain and a backside campsite area. The first project was recently approved and includes the snow making line which is currently under construction.

- PlumpJack Squaw Valley Inn (Squaw Creek) – A project has been approved by Placer County; however, the project applicant proposed a modification to the project which requires approval. The project proposes to demolish the existing PlumpJack Squaw Valley Inn and construct 3 new buildings that are connected by elevated walkways. The development shall consist of a 5-story condominium/hotel, two residential structures, parking garage and associated tourist amenities. The project area is adjacent to Squaw Creek.

- Alpine Sierra Subdivision (Bear Creek) – This subdivision plan has been approved by Placer County and is with the Alpine Meadows General Plan area. A total of 52 residential units are proposed to be constructed on 47.3 acres on the east side of Alpine Meadows Road, roughly 0.25 miles north of Alpine Meadows. Construction documents have not yet been submitted to Placer County for approval.

- Squaw Creek Associates meadow restoration (Squaw Creek) – During the summer and fall of 2019, the Friends of Squaw Creek constructed a stream improvement project within a 0.8 acre section of the creek between the stables and the townhomes located across Squaw Valley Road from the U.S. Post Office. Work continued on downstream of this project during the summer and fall of 2020. The purpose of this project is to improve hydrology and backfill artificial drainages with native vegetation.

- Squaw Valley to Alpine Gondola (Squaw and Bear Creeks) – This project was approved by Placer County in late 2019. Construction has not started. However, it is anticipated that construction on this project could begin in the spring or summer of 2021.

- Truckee Town Corridor – Construction was very active within the Truckee River watershed in the Town of Truckee in 2020, although these activities were not within Placer County jurisdiction. These projects included the new Raley's shopping center, Truckee Lumber Yard, and road improvements on Soaring Way. All of these projects are located near the Truckee Airport. Other major projects were implemented on Donner Pass Road through the Town of Truckee, and a new multi-family residential project was constructed near I-80 and downtown Truckee.

3.4 Regulatory Requirements

The development and implementation of the TRWQMP is guided by regulations to protect the beneficial uses defined for the Truckee River. The regulatory documents guiding the County and Town's development and implementation of the TRWQMP are summarized as follows:

- Section 13267 Lahontan Regional Water Quality Control Board Orders required the County and Town to develop a comprehensive water quality monitoring plan (LRWQCB, 2007). To comply with this requirement, the County and Town developed the TRWQMP in 2008.

- Water Quality Control Plan for the Lahontan Region (Lahontan Basin Plan). March 31, 1995. The Lahontan Basin Plan took effect in 1995 and sets forth water quality standard for surface waters and ground waters within the Region. The Lahontan Basin Plan identifies general types of water quality problems and requires or recommends control measures for these problems. In some cases, it prohibits certain types of discharges and establishes specific water quality objectives in particular areas. The most recent amendments to the Lahontan Basin Plan were adopted in 2008 and 2010 to reflect the Middle Truckee River and Lake Tahoe TMDLs, respectively (LRWQCB, 2010). Data collected under TRWQMP implementation are compared to water quality objectives defined in the Lahontan Basin Plan where applicable. In 2018, the Lahontan Region completed their Triennial Review of the Basin Plan and identified several projects under review that could change future regulatory requirements. The Board is currently evaluating whether to propose a new water quality objective for deposited/embedded sediment for the Middle Truckee River. This work includes collaboration with the Truckee River Watershed Council for development of strategies for data collection, analysis and needs assessment. The Board is also evaluating the need for region-specific water quality objectives to protect biological integrity of the Region's surface waters (LRWQCB, 2018).

- TMDL for Sediment, Squaw Creek, Placer County. April 2006. The objective of the Squaw Creek TMDL is to attain sediment-related water quality objectives that focus on the protection of in-stream aquatic life. The TMDL establishes indicators for biologic health and physical habitat. Responsible entities are required by the TMDL to implement monitoring programs (LRWQCB, 2006). Data collected under TRWQMP implementation are used to support County compliance with the Squaw Creek TMDL.

- TMDL for Sediment, Middle Truckee River, Placer, Nevada and Sierra Counties. May 2008. The objective of the Middle Truckee River TMDL is to attain sediment-related water quality objectives that focus on the protection of in-stream aquatic life. The TMDL establishes a water column indicator and target value as an annual 90th percentile suspended sediment concentration (SSC) of less than or equal to 25 milligrams per liter (mg/L) at Farad (USGS gage 10346000). Additional implementation-based indicators for the TMDL include road sand application BMPs and recovery tracking; ski area BMPs and maintenance; dirt road improvement or decommissioning; and legacy site BMPs and restoration. Responsible entities are required to implement these programs. The estimated time frame for meeting the numeric targets and achieving the TMDL is 20 years (LRWQCB, 2008b). Data collected under TRWQMP implementation are used to support County and Town compliance with the Middle Truckee River TMDL.

- The renewed MS4 Permit incorporates the required stormwater control measures directly and requires permittees to submit annual reports summarizing activities and certifying compliance with all requirements. Permittees are required to submit Program Effectiveness Assessments and Improvement Plans for their stormwater programs that include water quality monitoring data. A section summarizing the effectiveness of the County and Town MS4 programs as they relate to TRWQMP implementation is included in this report.

In addition to the development and implementation of the TRWQMP, the County has developed the following programs and plans:

- Stormwater Management Program (SWMP). The document provides a comprehensive implementation plan for the years 2007-2012. It describes the six minimum control measures (MCMs) required by the program as well as funding, monitoring, and evaluation. The six MCMs are public education and outreach, public involvement/participation, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction stormwater management, and pollution prevention (Placer, 2007). Although the written SWMPs are no longer required to be updated and submitted under the renewed MS4 Permit, the elements of the stormwater program continue to be implemented and reporting on their effectiveness will be conducted per the Permit requirements.
- Martis Valley Community Plan. December 16, 2003. Prepared by Placer County. The Martis Valley Community Plan (MVCP), in combination with the Placer County General Plan, is the official statement of Placer County setting forth goals, policies, assumptions, guidelines, standards, and implementation measures that will guide the physical, social, and economic development of the Martis Valley area to at least the year 2020. The MVCP includes the goals, policies, standards, implementation programs, the Land Use Diagram, the Circulation Plan Diagram, and the Recreation and Trails Diagram which together constitute Placer County's formal policies for land use, development, and environmental quality (Pacific Municipal Consultants, 2003a).
- Martis Valley Community Plan Environmental Impact Report. The Environmental Impact Report (EIR) identified environmental resources, including water quality, which would potentially be impacted by implementing the MVCP (Pacific Municipal Consultants, 2003b). One of the mitigations for potential water quality impacts included the development of a comprehensive water quality monitoring program by the County.

Section 4

Data Collection and Analysis Methodologies

This section presents the data collection and analysis methodologies that were implemented during the eleventh year of TRWQMP implementation (WY 2020). The monitoring activities conducted during WY 2020 included:

- Bioassessments;
- Community level discrete water quality sampling;
- Tributary level discrete water quality sampling;
- Stream discharge and near-continuous turbidity monitoring; and
- Truckee River rafting segment inspections.

The TRWQMP (2ND NATURE, LLC, 2008) serves as the overarching guidance document for the implementation of this monitoring program and contains documentation of field protocols, data analysis and reporting procedures. This section provides detailed descriptions of activities performed during WY 2020 and any modifications that were made to the TRWQMP guidance.

Table 4-1 presents a summary of the WY 2020 assessments conducted by the County, the locations where monitoring was conducted, and a short description of each. The subsequent sections present more detailed descriptions of the monitoring site locations and the data collection and analysis methodologies. Additional subsections are also included to present the data quality objectives that have been developed for this program, the statistical analyses conducted on the various data groups and, finally, a summary of modifications that were made to the data collection and/or analysis methodologies.

Additional information regarding specific monitoring protocols, site selection, equipment installation, and equipment operation and maintenance may be found in the WY 2020 Sampling and Analysis Plan (SAP) (CDM Smith 2020a) and other supporting documents listed in Section 1 of this report.

Table 4-1. WY 2020 TRWQMP Assessment Types

Assessment Type	Locations	Assessment Type Description
Bioassessment	Three sites on Squaw Creek Four sites in the Martis Creek Watershed	Surveys of benthic macroinvertebrates and physical habitat to provide an indication of overall stream health and the impacts of upstream pollutant sources.
Community Level Discrete Water Quality	Two sites in the Martis Creek Watershed	Collection of discrete samples of stormwater runoff to characterize and track the impacts of upstream land uses and water quality improvements.

Table 4-1. WY 2020 TRWQMP Assessment Types

Assessment Type	Locations	Assessment Type Description
Tributary Level Discrete Water Quality	Seven sites in the Martis Creek Watershed	Collection of in-stream discrete water quality samples to characterize and track water quality in the various branches of Martis Creek.
Discharge and Near-Continuous Turbidity Monitoring	Four sites in the Martis Creek Watershed	A continuous record of stream discharge and turbidity for Martis Creek to evaluate trends, determine turbidity/suspended-sediment relationships and develop annual pollutant load estimates.
Rafting Segment Inspections	Truckee River from Tahoe City to Alpine Meadows Road	Document problems such as excessive erosion and habitat degradation, along with the success of completed restoration projects.

Each of these assessments are described in the following subsections.

4.1 Bioassessment Monitoring

Bioassessments provide an indication of stream health by evaluating the benthic macroinvertebrate communities and physical habitat conditions present in a given stream reach. Under the TRWQMP schedule, data collection activities for the project are conducted biannually beginning in 2010. Bioassessment data collection is conducted during the same years and at the same time of year at all sites in the project area to improve comparability of results.

Bioassessments were performed in the Squaw Creek and Martis Creek watersheds in the summer of 2020 following slightly different protocols. Squaw Creek sampling followed the specific bioassessment protocol developed in conjunction with the Squaw Creek sediment TMDL, while Martis Creek sampling followed the statewide standard bioassessment protocol (i.e., California's Surface Water Ambient Monitoring Program [SWAMP] protocol [SWRCB, 2007]).

4.1.1 Monitoring Locations

Bioassessments are conducted in Squaw Creek, Martis Creek, East Martis Creek, West Martis Creek, and Middle Martis Creek. All of the bioassessment sites monitored prior to WY 2020 as part of TRWQMP implementation were previously established and monitored by various other groups. The sites and access routes are mapped using available GIS data and aerial photography so that they can be accurately relocated in the field for each subsequent monitoring event.

As part of TRWQMP implementation, bioassessments were performed at nine sites during the 2010, 2012, 2014, 2016 and 2018 water years. For WY 2020, four bioassessment sites in the Martis Creek watershed (Bio-MC2, Bio-MC3, Bio-MC4 and Bio-MC6) were discontinued and two new sites were established and monitored for the first time. The new sites are Bio-MC7 (the former Bio-MC6 site relocated upstream in East Martis Creek) and Bio-MC8 on Middle Martis Creek. Bio-MC1 was considered as a site to discontinue but remained as part of WY 2020 TRWQMP implementation because it is an associated reference site. See Section 4.8 for further information and rationale for monitoring site modifications.

The bioassessment stream and station location information are summarized in Table 4-2 and maps showing the locations are provided in Figures 4-1 and 4-2. A total of seven bioassessment locations were monitoring during WY 2020 including two newly established sites in the Martis Creek watershed.

Table 4-2. Summary of Bioassessment Monitoring Locations

Bioassessment ID	Location	Latitude / Longitude (Downstream end of Reach)[1]	Latitude / Longitude (Upstream end of Reach)[1]
Squaw Creek			
Bio-SC1	Squaw Creek	39° 12' 2.60" N 120° 13' 12.11" W	39° 12' 5.02" N 120° 13' 10.68" W
Bio-SC2	Squaw Creek	39° 12' 17.18" N 120° 13' 1.98" W	39° 12' 18.53" N 120° 12' 56.59" W
Bio-SC3	Squaw Creek	39° 12' 19.19" N 120° 12' 49.61" W	39° 12' 18.99" N 120° 12' 44.69" W
Martis Creek			
Bio-MC1	Upper Martis Creek	39° 16' 17.96" N 120° 10' 17.30" W	39° 16' 22.03" N 120° 10' 17.88" W
Bio-MC5	Lower Martis Creek	39° 18' 5.88" N 120° 7' 22.08" W	39° 18' 7.26" N 120° 7' 16.62" W
Bio-MC7[2]	Upper East Martis Creek	39° 18' 28.66" N 120° 6' 20.75" W	39° 18' 26.65" N 120° 6' 15.62" W
Bio-MC8[2]	Middle Martis Creek	43° 38' 19.39" N 116° 14' 28.86" W	39° 17' 41.58" N 120° 6' 14.43" W

[1] Coordinate System: NAD 1983 State Plane California II FIPS 0402 Feet
[2] New sites established and monitored in WY 2020.

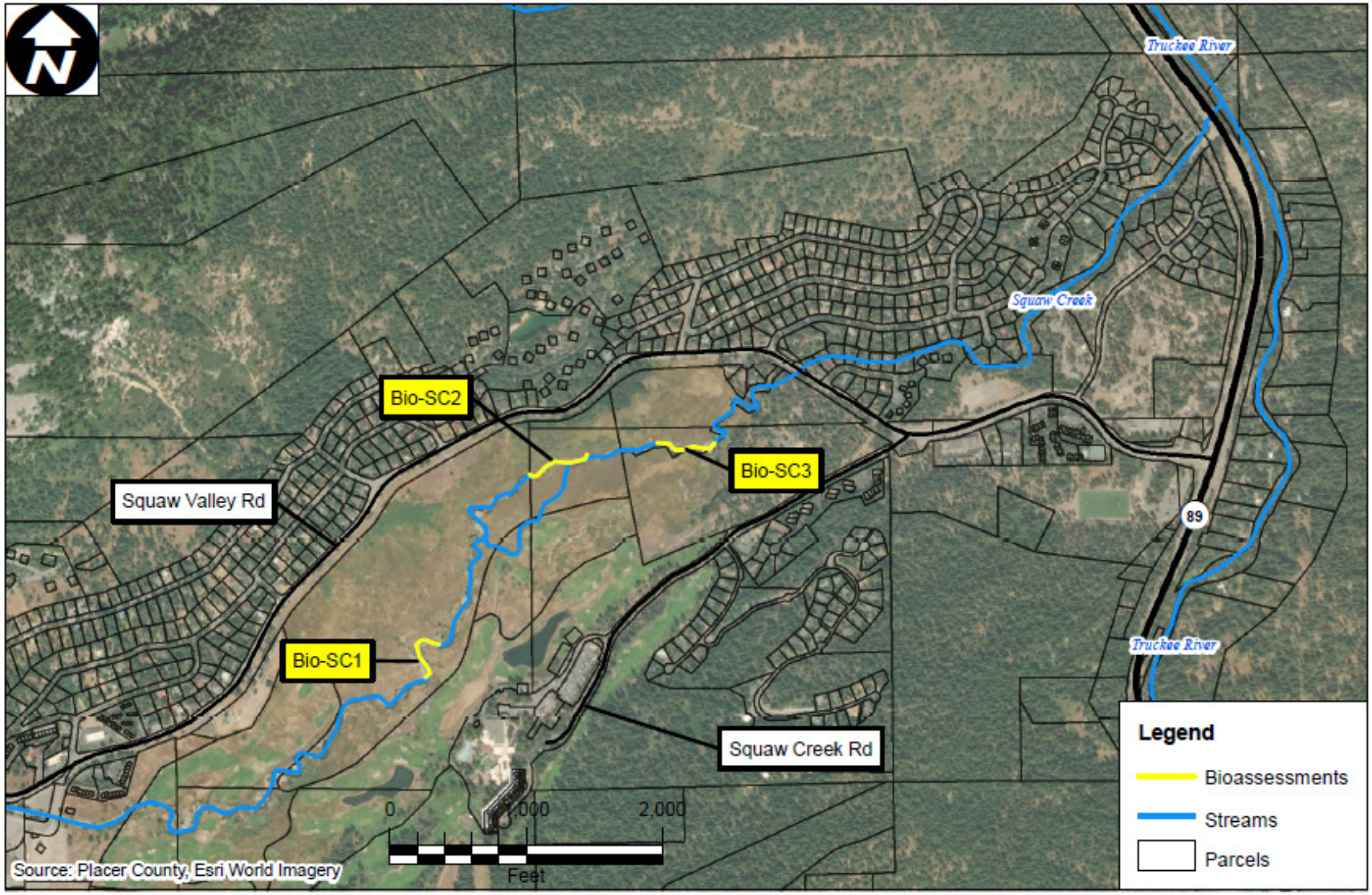


Figure 4-1
Squaw Creek Bioassessment Monitoring Locations

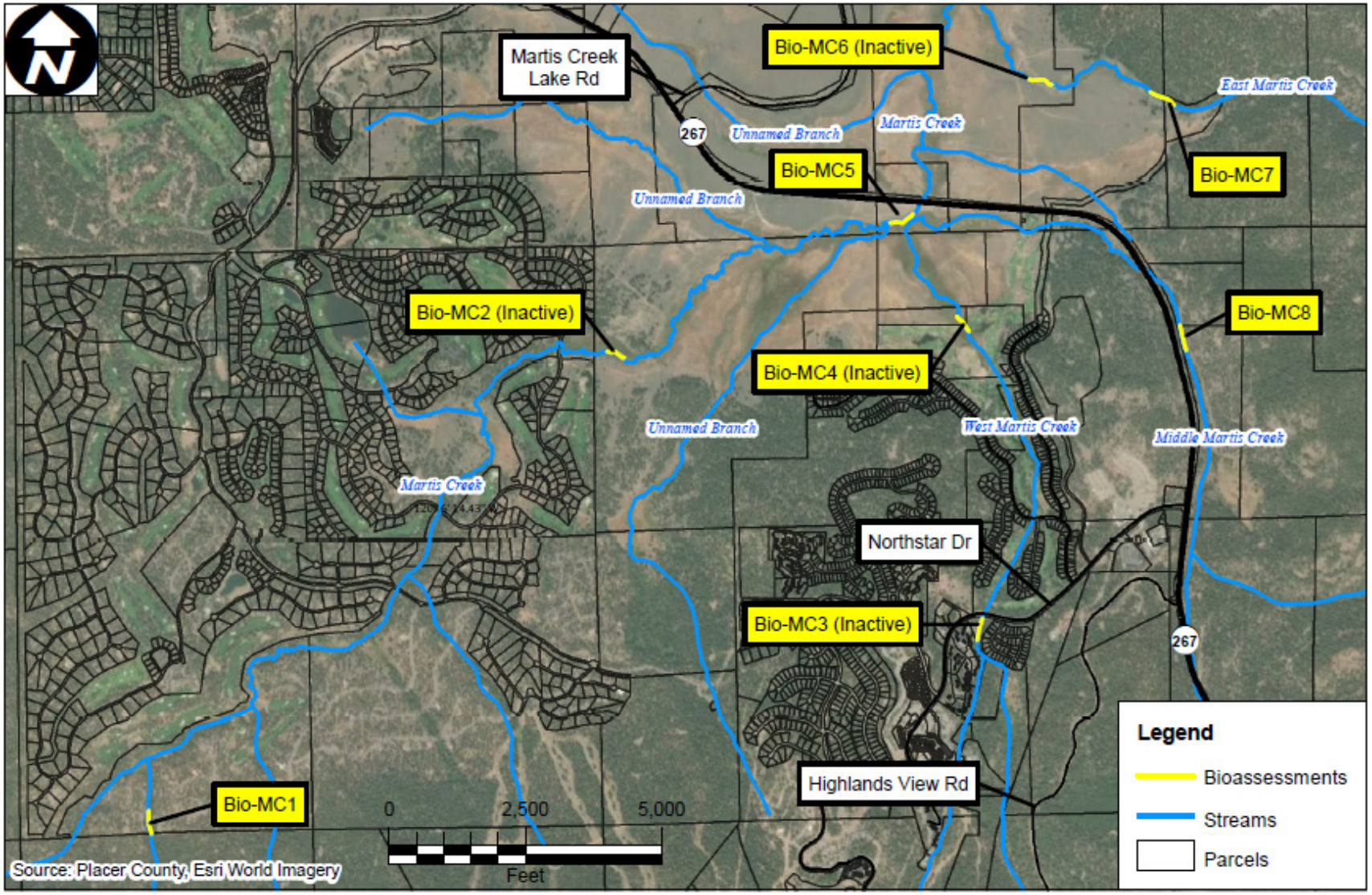


Figure 4-2
Martis Valley Bioassessment Monitoring Locations

4.1.2 Field Evaluation Protocols

The TRWQMP bioassessments are conducted biannually in Squaw and Martis Creeks although the specific protocols used for each stream are somewhat different as described below.

4.1.2.1 Squaw Creek

Surveys in Squaw Creek followed the Sampling and Analysis Requirements for Numeric Target Monitoring for the Squaw Creek Sediment TMDL (LRWQCB, 2006). Upper, middle, and lower meadow sampling locations each consisted of a 150m reach of Squaw Creek. The upper and lower boundaries of each site were marked using GPS, and digital photographs were taken (looking upstream and downstream) at several points along each reach (i.e., 0m, 50m, 100m, and 150m). Per the sampling protocol, benthic macroinvertebrate samples were collected as targeted riffle composites (each comprised of three 1 ft^2 kick samples) using a specialized 250-micron mesh D-framed net. Five replicate samples were collected from each site (one each from 5 randomly selected riffle areas within each 150m reach).

Physical habitat parameters (width, depth, substrate composition, cobble embeddedness, bank cover, bank angle, canopy cover, aquatic vegetation, algae, detritus, etc.) were measured at cross-sectional transects located every 10m along the 150m reach. Riparian vegetation, slope, sinuosity, and stream discharge were evaluated for each 150m reach. In situ water quality (temperature, pH, conductivity, and dissolved oxygen concentration and saturation) was also measured at each site using a YSI model 556 multi-meter.

4.1.2.2 Martis Creek

Surveys in the Martis Creek watershed followed the Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California (SWRCB, 2007). All sites consisted of a 150m reach of stream. Benthic macroinvertebrate samples were collected as both targeted riffle composite (TRC) samples (comprised of eight 1 ft^2 kick samples) and reach-wide benthos/multi-habitat (RWB-MH) samples (comprised of eleven 1 ft^2 kick samples). Both types of samples were collected from each of the three sites.

Physical habitat parameters (bankfull and wetted width, depth, substrate composition, cobble embeddedness, algal cover, riparian vegetation, in stream habitat complexity, canopy cover, human influence, bank stability, etc.) were evaluated at a combination of 11 primary and 10 secondary cross-sectional transects located along the 150m reach. Stream gradient, sinuosity, and discharge were also measured for each survey reach. The upper, middle, and lower portions of each survey reach were documented with photographs taken in both the upstream and downstream directions, and both ends of each reach were marked using GPS.

4.1.3 Data Analysis and Validation

Following the completion of the field work, the data were compiled and entered into electronic data tables then reviewed by a secondary staff member who was also responsible for backchecking any corrections that were required. All field datasheets were then stored and will be kept on file for a minimum of five years following the completion of the project.

Bioassessment samples were sent to accredited taxonomic experts for processing, enumeration, and identification. Both Squaw Creek and Martis Creek samples were processed by Jon Lee Consulting who specializes in stream bioassessment and freshwater macroinvertebrate taxonomy with over 20 years of experience in the western Unites States. Taxa were identified to the genus/species level wherever possible (i.e., standard Level II effort as defined by the Southwest Association of Freshwater Taxonomists [SAFIT, 2006]).

Taxonomic data from each site were randomized and consolidated into a 500-fixed-count taxa list representing that site (per the analytical approach described in the TRWQMP). These data were analyzed and reported at the SAFIT Level II standard taxonomic effort. All biological metric calculations were based on the standardized 500-fixed-count-sample data for each site. The Eastern Sierra Nevada Index of Biotic Integrity (IBI) was calculated for all Squaw Creek and Martis Creek sites as described in the TRWQMP (and following Herbst and Sildorff, 2009). For the three Squaw Creek sites, a separate index (i.e., the Biological Condition Score or BCS) was also calculated as specified in the TMDL sampling and analysis requirements for Squaw Creek (LRWQCB, 2008a). BCS and IBI scores were calculated and reported for targeted riffle composite samples only because these indices were developed from riffle-only data. In addition, targeted riffle samples were collected at all Squaw and Martis Creek sites, whereas multi-habitat (reach-wide benthos) samples were only collected at Martis Creek sites per the established sampling protocols.

4.2 Community Level Discrete Water Quality Monitoring

Community level discrete water quality monitoring in the Martis Creek watershed continued in WY 2020 where sites DSC-MC9 and DSC-MC10 were established and monitored for the first time. The sites were selected to provide data that identify and characterize water quality problem areas within the Martis Creek watershed. No monitoring was conducted at the remaining community level sites during WY 2020.

4.2.1 Monitoring Site Descriptions

The community level discrete sampling sites monitored to date were selected and monitored in accordance with the TRWQMP and represent a range of lightly to densely developed areas. Potential sites were evaluated with consideration of safety and access, representativeness, permitting requirements, and ease of installation. For WY 2020, two new sites were established and monitored within the Martis Creek watershed. Descriptions of these two sites are provided below.

- **Northstar Drive West Outfall (DSC-MC9) -** The drainage area for DSC-MC9 includes secondary paved roadway and forested uplands. BMPs incorporated into the drainage area include drainage inlets with sediment traps, rock lined channels, and earthen channels that capture runoff from Highlands View Road and Northstar Drive and convey it through storm drain pipes that discharge at the sampling location on Northstar Drive across from the solid waste management access road. Downstream of the sampling location, an open vegetated earthen channel conveys runoff to a culvert that crosses under Basque Drive. The culvert discharges to another earthen channel leading to West Martis Creek approximately 300 ft. downstream.

- **Ridgeline Drive Outfall (DSC-MC10) -** The drainage area for DSC-MC10 includes multi-family residential, secondary roadways, dirt roads, forested uplands, and a solid waste management area. BMPs incorporated into the drainage area include drainage inlets with sediment traps, infiltration basins, rock lined channels, a treatment vault, and earthen channels that capture runoff from Highlands View Road and Ridgeline Drive and convey it through a storm drain pipe that discharges at the sampling location on Northstar Drive. Stormwater runoff from the solid waste management area and a portion of Northstar Drive is routed to a treatment vault and small pond before being discharged to the sampling location. A larger infiltration basin exists further upstream to manage runoff from the multi-family residential development. Downstream of the sampling location, an open vegetated earthen channel conveys runoff to a culvert that crosses under Basque Drive. The culvert discharges to another earthen channel leading to West Martis Creek approximately 300 ft. downstream.

Table 4-3 presents the key characteristics of the community level monitoring sites including: station ID, locations and jurisdictions, latitude, longitude, elevations, and information about the drainage area. An aerial map showing the sampling point locations and their estimated tributary drainage areas is presented in Figure 4-3.

Table 4-3. Discrete Monitoring Site Characteristics

	Northstar Drive West Outfall	Ridgeline Drive Outfall
Station ID	DSC-MC9	DSC-MC10
Receiving Water	West Martis Creek	West Martis Creek
County	Placer	Placer
Regional Water Board	Lahontan Region 6	Lahontan Region 6
Latitude	39.284333	39.284047
Longitude	-120.110366	-120.110600
Elevation (ft.)	6,160	6,153
Roadway Access	Northstar Drive	Northstar Drive
Monitoring Location	Outfall Channel	18-inch Pipe
Runoff Type	▪ Secondary Roadway ▪ Forested Uplands	▪ Multi-Family Residential ▪ Secondary Roadway ▪ Solid Waste Handling ▪ Forested Uplands
Upstream BMPs	▪ Sediment Traps ▪ Rock-lined Channels ▪ Earthen Channels	▪ Sediment Traps ▪ Rock Lined and Infiltration Channels ▪ Vegetated Channel ▪ Treatment Vault and Pond ▪ Infiltration Basin
Approximate Drainage Area (acres)	1.2	16.6
Installation Date	January 2020	January 2020

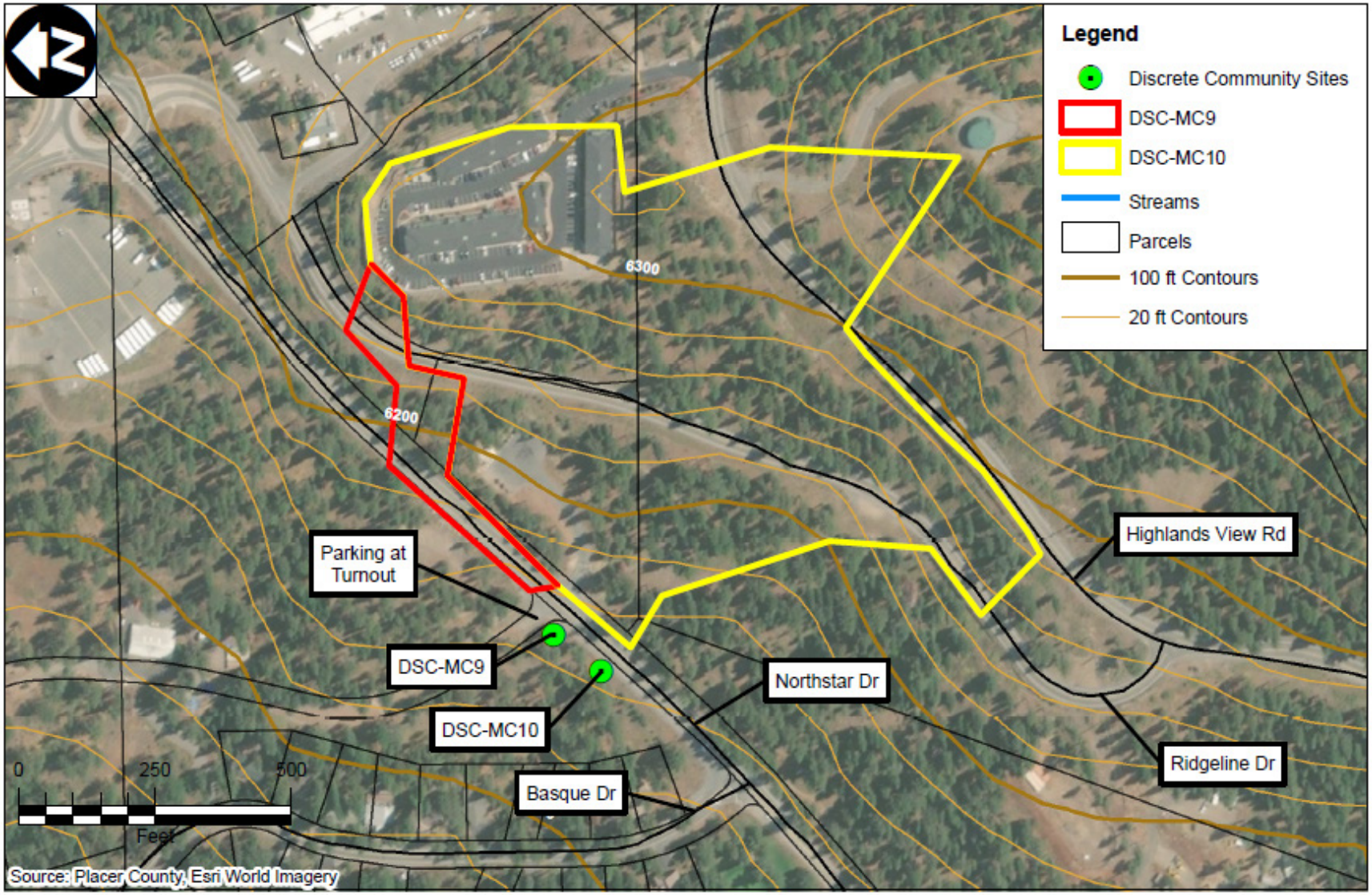


Figure 4-3
Discrete Community Water Quality Sampling Locations for Water Year 2020

4.2.2 Field Evaluation Protocols

The community level sampling protocols include the use of passive sampling devices for the collection of discrete stormwater runoff samples (grab samples) at stormwater drainage outfalls or other locations of interest within targeted communities. This water quality monitoring targets stormwater runoff from developed areas generated from events considered to have the highest potential for mobilizing and transporting the pollutants of concern. Examples are runoff events that occur after extended dry periods or that result in substantial increases of stormwater runoff flows at the monitoring locations. The use of passive samplers allows the collection of samples from the same part of the rising hydrograph limb during each event resulting in higher quality comparisons among sites and over time.

The monitoring team tracks weather conditions and potential storms that may produce stormwater runoff at the monitoring stations. Events are characterized by:

- Type: snowmelt, mixed (winter rain/snow), and rain; and
- Number of days prior to the event without rainfall or runoff (dry antecedent conditions).

The events to be monitored are selected based on the antecedent conditions and the predicted amount of precipitation, or the predicted temperature and amount of snow in the drainage area if snowmelt flows are being targeted.

To collect the samples, clean samplers and containers are installed at the monitoring sites prior to the targeted event. Runoff enters the container when the flow reaches a predetermined depth at the sampling point. When the container is full, a floating ball valve seals the bottle. After the event, the passive samplers are carefully examined to ensure the samples were collected as planned and the bottles sealed adequately to prevent contamination. After retrieving the samples, the site is secured, and samples are prepared for shipment to the laboratory.

4.2.3 Data Management and Analysis

Samples are delivered to the laboratory under chain of custody documentation to track the samples and the requested analyses. Lab analysis is performed in accordance with standardized analytical and quality assurance/quality control (QA/QC) methods. Lab reports containing the analytical results and QA/QC documentation are then validated prior to entering data into the project database. Each analytical report is thoroughly reviewed, and the data evaluated to determine if the data quality objectives described below have been achieved. Once the data have been validated, they are ready for statistical analyses, evaluation, and comparisons. The results are compared across sites and over time to identify potential pollutant sources, determine how community discharges are impacting the water quality of receiving water bodies and evaluate the performance of any existing water quality improvements or actions (i.e., BMPs).

The initial list of laboratory analytical constituents implemented prior to WY 2020 was developed based on land uses in the up-gradient catchment area, the water quality pollutants of concern for the Truckee River and the available funding. For WY 2020, the analytical list was reduced to include only Total Suspended Solids (TSS) and total phosphorus which have been identified as constituents of concern for the Martis Creek watershed based on TRWQMP data analysis. Table 4-4 lists the WY 2020 constituents, sample type (sample collection method), analytical

method, sample bottle type, target reporting limit, volume required for analysis, sample preservation, and maximum holding times. These are also the standard operating procedures for Western Environmental Testing Laboratory (WETLAB). WETLAB was the selected analytical laboratory for community level water quality samples.

Table 4-4. Analytical List for Community Level Water Quality Samples

Constituent[1]	Sample Type	Analytical Method	Sample Collection Bottle	Detection Limit[2]	Volume (mL)	Preservation[3]	Holding Time to Lab
TSS	Depth integrated; discharge weighted	SM 2540D	HDPE[4]	1 mg/L	2000	4°C	7 days
Total Phosphorus		SM 4500-P E		10 µg/L		4°C & H_2SO_4 (added at lab)	28 days

[1] TSS = total suspended solids.
[2] µg/L = micrograms per liter; mg/L = milligrams per liter.
[3] H2SO4 = Sulfuric acid, °C = Celsius
[4] HDPE = High-density polyethylene

4.3 Tributary Level Discrete Water Quality Sampling

Tributary level discrete water quality data collection and analysis activities were performed at seven sites along multiple branches of Martis Creek during WY 2020. This was the tenth year of data collection at three of these sites (DST-MC1, DST-MC4, and DST-MC5) and the third year of data collection at three different sites (DST-MC7, DST-MC8, and DST-MC9). For WY 2020, an additional tributary level discrete water quality monitoring site (DST-MC10) was established in January 2020 to further assess the water quality in the Middle Martis Creek watershed. This site was installed in lower Middle Martis Creek below the Middle Martis Restoration Project of 2016, and data from this site will be compared to data from DST-MC7 to assess the effectiveness of this project. Monitoring at site DST-MC2 on East Martis Creek was discontinued in WY 2020. See Section 4.8 for further information and rationale for monitoring site modifications.

4.3.1 Monitoring Site Descriptions

The Martis Creek tributary sampling locations provide water quality information on the natural receiving waters in the Martis Creek watershed. The monitoring sites are located in major branches of Martis Creek and two smaller branches in West Martis Creek with the goals of identifying potential pollutant source areas and identifying and tracking water quality trends. The upstream and downstream configuration of some of these sampling locations are also used to characterize water quality changes that occur as flow travels through development and the Martis Valley meadow system.

The key characteristics of the Martis Creek tributary monitoring locations are presented in Table 4-5 and the locations are shown in Figure 4-4. Photographs of each site are provided in Figure 4-5.

Table 4-5. Tributary Water Quality Site Characteristics

Water Body	Martis Creek Main Stem	West Martis Creek	Upper Martis Creek Main Stem	Middle Martis Creek	Upper West Martis Creek	Upper West Martis Creek	Lower Middle Martis Creek
Station ID	DST-MC1	DST-MC4	DST-MC5	DST-MC7	DST-MC8	DST-MC9	DST-MC10
Location Description	Mouth of creek at Martis Creek Lake	Downstream of Northstar Golf Course	Downstream of Lahontan and Martis Camp	Upstream of Martis valley	Upper West Martis Creek (West)	Upper West Martis Creek (East)	Martis valley near confluence with Martis Creek main stem
Latitude[1]	39° 18' 53.73" N	39° 17' 47.97" N	39° 18' 1.59" N	39° 17' 42.67" N	39° 16' 46.38" N	39° 16' 46.38" N	39° 18' 18.48" N
Longitude[1]	120° 7' 1.75" W	120° 7' 5.89" W	120° 7' 43.52" W	120° 6' 14.66" W	120° 7' 2.41" W	120° 7' 1.03" W	120° 7' 04.45" W
Elevation (ft.)	5,830	5,860	5,835	6,040	6,209	6,209	5,845
Major land use descriptions in tributary watershed	Ski Area; Commercial; Single and Multi-Family Residential; Primary and Secondary Roadway; Forested Uplands; Golf Courses; Unpaved Roads and Trails	Ski Area; Commercial; Single and Multi-Family Residential; Secondary Roadway; Forested Uplands; Golf Course; Unpaved Roads and Trails	Ski Area; Single Family Residential; Secondary Roadway; Forested Uplands; Golf Courses; Unpaved Roads and Trails	Primary Roadway; Forested Uplands; Unpaved Roads	Ski Area; Commercial; Single and Multi-Family Residential; Secondary Roadway; Forested Uplands; Unpaved Roads and Trails	Secondary Roadway; Forested Uplands; Unpaved Roads and Trails	Primary Roadway; Forested Uplands; Unpaved Roads
Drainage Area Size (ac)	22,360	3,320	8,865	2,730	1,355	1,190	3,200

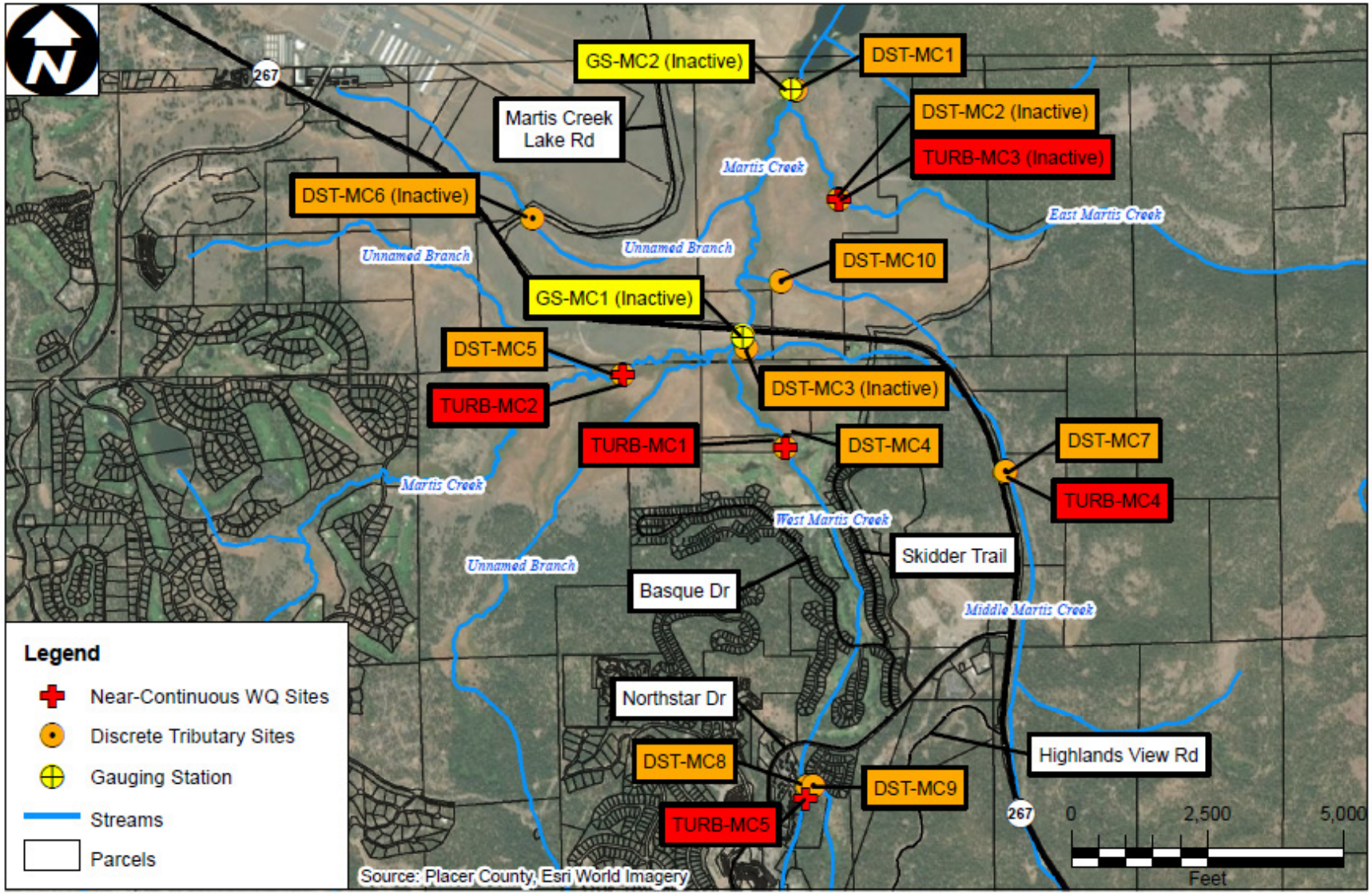


Figure 4-4
Discrete Tributary Water Quality Sampling and Near-Continuous Turbidity Locations for Water Year 2020

FIGURE 4-5a. DST-MC1 monitoring location on Martis Creek near Martis Creek Lake.

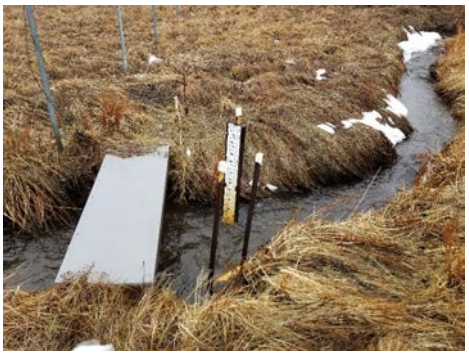


FIGURE 4-5b. DST-MC4 and TURB-MC1 monitoring location on West Martis Creek.

FIGURE 4-5c. DST-MC5 and TURB-MC2 monitoring location on Martis Creek.

FIGURE 4-5d. DST-MC7 and TURB-MC4 monitoring location on Middle Martis Creek.

FIGURE 4-5e. DST-MC8 monitoring location on upper West Martis Creek (West).

FIGURE 4-5f. DST-MC9 monitoring location on upper West Martis Creek (East).

FIGURE 4-5g. DST-MC10 monitoring location on Middle Martis Creek.

Figure 4-5
Tributary Level Discrete Monitoring Site Photographs

4.3.2 Field Evaluation Protocols

The TRWQMP methodology for tributary level discrete sampling follows the USGS equal width increment (EWI) protocols for collecting depth-integrated, discharge-weighted samples from targeted flow conditions. To collect the samples, a transect is established across the stream channel and the wetted width is divided into a series of equally spaced increments. Sub-samples are collected at the center of each increment using a depth-integrated suspended-sediment sampler that is lowered and raised through the water column at a constant rate. The subsample volumes produced are proportional to the amount of flow occurring in each increment and are composited into a single composite sample to be submitted to the lab.

Similar to the community level sampling, these in-stream water quality measurements focus on events when high pollutant concentrations and/or loads are expected to be present within surface waters (i.e., the worst-case scenarios). Sampling times target the rising limb of the event hydrograph and are coordinated across the project area to allow for the most direct comparisons between tributary stations. Because storm events vary widely, a range of runoff event types and magnitudes are targeted for sampling during the monitoring season. Precipitation data is also reviewed and compared to stream discharge rates, where available, to help define the runoff response times. This information is used to guide the timing of the tributary water quality sampling to help identify when the period of peak discharge will occur.

4.3.3 Data Management and Analysis

The data management and analysis procedures for the community and tributary level water quality monitoring are similar. Table 4-6 lists the WY 2020 constituents, sample type, analytical method, sample bottle type, target detection limit, volume required for analysis, sample preservation requirements, and maximum holding times for each constituent.

Table 4-6. Analytical List for Tributary Level Water Quality Samples

Constituent[1]	Sample Type	Analytical Method	Sample Collection Bottle	Detection Limit[2]	Volume (mL)	Preservation[3]	Holding Time to Lab
TSS	Depth integrated; discharge weighted	SM 2540D	HDPE[4]	1 mg/L	2000	4°C	7 days
Total Phosphorus		SM 4500-P E		10 µg/L		4°C & H_2SO_4 (added at lab)	28 days

[1] TSS = total suspended solids.
[2] µg/L = micrograms per liter; mg/L = milligrams per liter.
[3] H2SO4 = Sulfuric acid, °C = Celsius
[4] HDPE = High-density polyethylene

4.4 Martis Creek Discharge and Near-Continuous Turbidity Monitoring

Four stream gaging stations that include near-continuous turbidity meters were operated during WY 2020 in the Martis Creek watershed. WY 2020 was the eighth year of data collection at two sites (TURB-MC1 and TURB-MC2) and the sixth year of data collection at site TURB-MC7. During WY 2020, monitoring at site TURB-MC3 on East Martis Creek was suspended and site TURB-MC5 was established and monitored for the first time. See Section 4.8 for further information and rationale for monitoring site modifications.

4.4.1 Monitoring Site Descriptions

The locations of the Martis Valley stream gaging stations with near-continuous turbidity meters are shown in Figure 4-4. All four stations are co-located with tributary level discrete water quality monitoring stations. Table 4-7 presents general information for each site including: Station IDs, locations and jurisdictions, latitude, longitude, land use, and elevations.

Table 4-7. Discharge and Near Continuous Water Quality Monitoring Site Characteristics

	West Martis Creek	Martis Creek	Middle Martis Creek	West Martis Creek
Station ID	TURB-MC1	TURB-MC2	TURB-MC4	TURB-MC5
Receiving Water	West Martis Creek	Martis Creek	Middle Martis Creek	West Martis Creek
County	Placer	Placer	Placer	Placer
Regional Water Board	Lahontan Region 6	Lahontan Region 6	Lahontan Region 6	Lahontan Region 6
Latitude	39° 17’ 47.97” N	39° 18' 1.59" N	39° 17' 42.67" N	39° 16' 46.65" N
Longitude	120° 7' 5.89" W	120° 7' 43.52" W	120° 6' 14.66" W	120° 7' 3.11" W
Elevation (ft.)	5,831	5,878	6,016	6,193
Roadway Access	SR 267	SR 267	SR 267	Northstar Drive
Land Use	Ski Area; Commercial; Single and Multi-Family Residential; Secondary Roadway; Forested Uplands; Golf Course; Unpaved Roads and Trails	Ski Area; Single Family Residential; Secondary Roadway; Forested Uplands; Golf Courses; Unpaved Roads and Trails	Primary Roadway; Forested Uplands; Unpaved Roads	Residential; Secondary Roadway; Forested Uplands; Ski Area
Installation Date	Summer 2012	Summer 2012	Winter 2015	Winter 2020

The first of these stations is in West Martis Creek (TURB-MC1) at the discrete tributary level sampling station DST-MC4, adjacent to the Northstar golf course boundary. The second station is located on the main stem of Martis Creek above the confluences with Middle and West Martis Creek (TURB-MC2) at discrete tributary level sampling station DST-MC5, downstream of Martis Valley development. At the beginning of WY 2014, these two stations were moved slightly to improve data quality by reducing bypassed flows at TURB-MC1 and avoiding beaver dam interference at TURB-MC2. Stream discharge measured at TURB-MC1 since 2014 includes flows that had bypassed the original location, so data from the new location will differ and should not be combined with discharge data from previous years. Discharge data from TURB-MC2 is similar to that collected at the previous location and can reasonably be combined with previous data to provide a longer continuous record of discharge.

An existing gaging station operated by the Truckee River Watershed Council in Middle Martis Creek was equipped with a turbidity probe creating station TURB-MC4. This station is collocated with discrete tributary sampling station DST-MC7 upstream of the Martis Valley. The discharge data from TURB-MC4 is representative of the upper portion of Middle Martis Creek which receives stormwater inputs from SR 267. A new station is located on Upper West Martis Creek in the same location as discrete tributary sampling station DST-MC8. A turbidity probe was also installed in this location, creating monitoring location TURB-MC5. Stream discharge at TURB-MC5 is representative of flows emanating from Northstar ski area and village.

4.4.2 Discharge Monitoring Methods

Discrete monitoring involves installation and operation of the stream gages, development of the site-specific stage-flow rating curves, and data management. Each of the elements are summarized in this subsection.

4.4.2.1 Installation and Operation

Installation activities included surveying channel cross-sections and longitudinal profile, establishment of a local benchmark, and installation of a staff gage and pressure transducer. Type A staff plates were installed in the stream channel to allow visual depth measurements by field personnel from the bank and confirmation of automated stage measurements by the pressure transducers. A vented *In-Situ Level Troll 500* pressure transducer was installed at site TURB-MC5 and *Instrumentation Northwest, Inc. PS9805* pressure transducers with Campbell Scientific dataloggers were installed at sites TURB-MC1 and TURB-MC2. The gaging station at TURB-MC4 was originally operated by the Truckee River Watershed Council and is now operated by Placer County. The pressure transducers were programmed to measure and log 15-minute average stage data at the measurement locations. The pressure transducers are securely mounted to the same posts as the staff gages with the cable installed in conduit leading to an accessible location on the bank. The conduits are perforated along the bottom 2 feet and anchored to the bank by stakes and rocks. Photographs of the four gaging stations are provided in Figure 4-6.

Prior to installation, pressure transducers were factory calibrated and tested. Sensor calibration continued during operation by recording water levels at the time of each visit as well as the height of any observed high-water marks deposited since the last visit. These measurements were compared, and the electronic record was adjusted, as necessary.

Field staff made routine visits to each gaging station during WY 2020. During periods of rain or peak snowmelt, site visits were made more frequently. Activities during site visits consisted of manual flow measurements and stage observations, observation of recent high-water marks (if visible), data downloads, probe inspection, and data logger battery and desiccant replacement, as necessary. If any component was malfunctioning (e.g., pressure transducer), it was repaired or replaced as soon as possible.

FIGURE 4-6a. TURB-MC1 monitoring location on West Martis Creek.

FIGURE 4-6b. TURB-MC2 monitoring location on Upper Martis Creek.

FIGURE 4-6c. TURB-MC4 monitoring location on Middle Martis Creek.

FIGURE 4-6d. TURB-MC5 monitoring location on Upper West Martis Creek.

Figure 4-6
Discharge and Near-Continuous Turbidity Monitoring Site Photographs

4.4.2.2 Development of Stage-Discharge Rating Curves

A stage-discharge rating curve is needed at each gaging station based on site specific characteristics. Rating curves were developed after the initial year of monitoring and are then updated after each year of operation. Placer County developed and maintains the rating curves for TURB-MC1, TURB-MC2, and TURB-MC5. The Truckee River Watershed Council originally developed the rating curve for the gage at TURB-MC4 which is now operated by Placer County.

To develop the Placer County rating curves, velocity measurements were obtained using a *Swoffer 2100* current velocity meter at various stream stages. Velocity measurements were collected using the 0.6 depth methodology outlined in the USGS Measurement and Computation of Streamflow Manual (USGS, 1982) at equal intervals along a transect to account for varying flow conditions across the stream channel. Flow was then calculated for each interval by multiplying the measured velocity by the cross-sectional area of that interval. The summation of all incremental flow rates was used to obtain the stream discharge at the time the measurements were taken.

Rating curves were developed using the stage and discharge data and were calibrated based on the quality and timing of the field measurements. These relationships are expressed as mathematical formulas which are used to calculate continuous records of discharge using the logged and calibrated stage data from the pressure transducers at each site.

During rating curve development, an effort was made to obtain manual discharge measurements at a range of stages including upper and lower extremes. This limits extrapolation requirements to stream stages above which manual discharge measurements could not safely be collected. New discharge measurements were only collected during WY 2020 if discharge data were not previously collected at a particular stream stage. This approach focused on reducing data gaps to improve the accuracy of the stage-discharge rating curves while reducing the overall effort associated with on-going rating curve development.

4.4.2.3 Data Management and Analysis

After downloading the stage data from the pressure transducer, it is reviewed for any anomalies or data gaps and then imported into a spreadsheet to apply calibrations, calculate a record of stage, compute discharge, and apply stage shifts to account for natural channel scour or fill.

Similarly, ice can commonly affect stage. When ice forms, the stream cross-section generally becomes constricted, causing backwater, which results in a higher stage than would exist during ice-free periods under the same discharge conditions. Because the amount of backwater will vary significantly more complex procedures involving meteorological and hydrological data from other stations in the area are required to estimate discharge at ice-affected stations (USGS, 1996). These procedures are applied during review of data. Periods of estimated discharge for ice-affected stations are indicated where applied.

Once a preliminary record of discharge is completed, daily, monthly, and annual hydrologic metrics are computed. These include daily maximum, mean, and minimum discharges (cfs), monthly and annual maximum, mean, and minimum discharge (cfs), total-annual discharge volume (cfs-days; acre-feet), and annual peak instantaneous- discharge (cfs).

4.4.3 Near-Continuous Turbidity Monitoring

The turbidity monitoring is designed to provide a near-continuous record of stream turbidity (measured in nephelometric turbidity units or NTUs). Turbidity is a common proxy for suspended-sediment concentration (SSC) (measured in milligrams per Liter; mg/L) and can be converted to suspended-sediment loads through application of the discharge record. Turbidity monitoring is being conducted to understand suspended-sediment loading within the Martis Creek Watershed. Turbidity monitoring is also being conducted by USGS and the California Department of Water Resources (DWR) along the Truckee River to define sediment loading from tributaries in the Middle Truckee River Basin and evaluate compliance with the Middle Truckee River TMDL for sediment.

Station operations include the collection of data for the development of turbidity (NTU) to SSC correlation at each site.

4.4.3.1 Installation and Operation

Turbidity at TURB-MC1 and TURB-MC2 is measured using Optical Back-Scatter (OBS 3+ and OBS 500) submersible turbidity probes with a range of up to 4,000 nephelometric turbidity units (NTUs). The OBS 500 has a factory installed wiper mechanism to keep the sensor clear of fouling from biological activity in Martis Creek. These turbidity probes are connected to Campbell Scientific dataloggers which operate on a solar-powered 12-volt battery contained within a locked, water-resistant and sealed, hard-case enclosure. Turbidity at TURB-MC4 and TURB-MC5 is measured using Eureka Manta2 turbidity sensors with a range of up to 3000 NTU. The Eureka Manta2 turbidity probe has a factory installed integrated wiper to remove accumulated debris from the optical lens. Power is supplied to the unit by a removable battery pack that provides power for up to six weeks. Turbidity data is logged directly to onboard memory. Turbidity sensors were either factory calibrated or calibrated prior to installation using laboratory standards covering the range of anticipated turbidity levels. Data are collected every 15-minutes together with measurements of stream stage. The stations are visited weekly and the probes are inspected and cleaned of algae, ice, or debris. The dataloggers are downloaded monthly.

4.4.3.2 Fluvial Sediment Measurements

Suspended-sediment samples are collected at the turbidity stations to provide a means for developing turbidity-to-SSC correlations and continuous suspended-sediment records using the near-continuous turbidity measurements. Suspended-sediment consists primarily of fine sand, silt, and clay supported by turbulence within the water column and transported at a rate approaching the mean velocity of flow. Bedload sediment, another component of the total sediment load, is defined as material which rolls along the streambed, and is not sampled or analyzed for this study.

Suspended-Sediment Sampling Equipment

Suspended-sediment samples are collected using standard equipment and methods adopted by the Federal Interagency Sedimentation Project (FISP) to make measurements of suspended-sediment transport. This equipment includes a hand-held DH-48 suspended-sediment sampler with a 1/4-inch nozzle for use when flows are wadeable.

Suspended-Sediment Sampling and Analysis

Suspended-sediment samples were collected at channel locations exhibiting the most ideal characteristics (i.e., relatively straight and uniform) for the flow event sampled, but always near the gaging station. The sampling method follows USGS equal width increment (EWI) protocols for collecting depth-integrated, discharge-weighted samples from targeted flow conditions. To collect the samples, a transect is established across the stream channel and the wetted width is divided into a series of equally spaced increments. Sub-samples are collected at the center of each increment using a depth-integrated suspended-sediment sampler that is lowered and raised through the water column at a constant rate. The subsample volumes produced are proportional to the amount of flow occurring in each increment and are composited into a single composite sample to be submitted to the lab. Following this protocol avoids the confounding effects of significant changes in sediment transport rates in different locations in the channel and in different discharges.

Each sample is transferred to a clean 500 milliliter (mL) or 1,000 mL high-density polyethylene (HDPE) bottle and transported to WETLAB in Sparks, Nevada for analysis of total suspended solids (TSS) using EPA method 160.2 (gravimetric method).

McGraw and others (2001) evaluated the relationship between TSS and SSC at monitoring sites in the Middle Truckee River watershed and found a nearly one-to-one relationship between the two parameters, suggesting that both TSS and SSC are reliable for calculating suspended-sediment loads. For the remainder of this report, the term SSC is used when referring to suspended-sediment concentrations of samples collected and analyzed for TSS for this study.

4.4.3.3 Data Management and Analysis

This section describes the two methods used in this study to calculate annual records of suspended-sediment load: 1) using site-specific, discharge-to-suspended-sediment load relationships, herein referred to as the "discharge-based method"; and 2) using the relationship between the turbidity and SSC, herein referred to as the "turbidity-based method."

Because turbidity can fluctuate independent of discharge variations, near-continuous turbidity monitoring can help identify discrete events not related to rainfall or fluctuations in discharge, such as bank failures or illegal discharges. Based on calculations of suspended-sediment loads from both methods, results are presented as daily and annual loads (i.e., tons per day or tons) and compared. To improve the comparisons between tributaries with different contributing watershed areas, results are normalized by watershed area or presented as suspended-sediment yields (i.e., tons per square mile).

Discharge-Based Method for Calculating Suspended-Sediment Load

To calculate suspended-sediment loads using the discharge-based method, suspended-sediment samples collected in the field are correlated with instantaneous discharge at the time of sampling, either from concurrent manual measurements or from the near-continuous record. Samples are analyzed at the laboratory for SSC, then the results are converted to suspended-sediment loads by multiplying the concentration (mg/L) by the instantaneous discharge (cfs) and applying a factor of 0.0027 to convert the units into tons per day. This approach allows suspended-sediment loading data to be plotted against instantaneous discharge data to develop a relationship using best-fit, empirical equations (typically a power function). The resulting relationship is then applied to the (15-minute) record of discharge to compute a 15-minute record of suspended-sediment load.

The error associated with discharge-based suspended-sediment rating curves is generally assumed to have an inherent uncertainty of at least 25 to 50 percent (Walling, 1977; MacDonald and others, 1991). Significant scatter in rates of suspended-sediment loads can produce results differing by an order of magnitude at any given discharge. To address this variation and error in sediment load computations, potential temporal patterns in the data were evaluated. Data were separated by event type (e.g., snowmelt runoff, rain-on-snow, thunderstorm, or first flush) and position on the storm hydrograph (e.g., rising limb vs. falling limb). Where differences were observed, separate relationships (equations) were developed, and separate power functions were applied to the record. Since ongoing sampling efforts may help define and extend the existing

rating curves and improve their accuracy, the data presented in this report should be considered provisional and subject to revision when additional data become available.

Turbidity-Based Method for Calculating Suspended-Sediment Load

Measurement of instantaneous turbidity at the time of suspended-sediment sample collection typically results in a definable relationship between turbidity and SSC. The continuous record of turbidity can then be converted into a 15-minute record of SSC (mg/L per 15 min.) and, through application of the discharge record, converted into a daily suspended-sediment load (tons/day). Because turbidity can fluctuate independent of discharge variations, continuous turbidity monitoring can help identify discrete events not related to rainfall or snowmelt runoff, such as bank failures or dam releases, and has been found to explain at least 80 percent of the temporal variation in SSC (MacDonald and others, 1991).

There are several factors that can complicate collection and interpretation of continuous-logging turbidity data including algal growth on the optical sensor; ice or debris collecting on the probe; sediment accumulation on the probe; probe exposure above the water column (unsubmerged); and sunlight affects. To reduce the chances of these conditions and to minimize instrument error, field teams made frequent site visits to evaluate site conditions and instrument integrity. Missing turbidity values or periods of turbidity data identified as erroneous were removed and replaced with values calculated using the discharge-based method described above to allow for computation of total annual loads.

4.5 Rafting Segment Inspections

Visual inspections and photo-monitoring were conducted during WY 2020 along the segment of the Truckee River where commercial rafting companies operate to document potential recreational impacts on water quality. The rafting companies operate between Fanny Bridge (Highway 89) in Tahoe City to River Ranch near the intersection of Highway 89 and Alpine Meadows Road. The Truckee River rafting segment inspections are conducted biannually, and only during years when commercial rafting companies operate. The inspections during WY 2020 were the third round of inspections conducted under the TRWQMP (the first inspections were performed during WY 2016 and WY 2018).

Inspected sites include those previously identified during a Watershed Improvement Needs (WIN) Survey completed in 2006 (Placer, 2006). During the survey, a total of fifteen WIN sites and two potential WIN sites were identified. These sites were renamed during WY 2016 as shown in Figures 4-7 and 4-8. Site names reflect whether the site is located on River Right (RR) or River Left (RL) when facing downstream and include the river mile measured from the Lake Tahoe dam. Inspection sites also include three points of interest that were located during the 2016 and 2020 inspections and three Truckee River Stabilization and Restoration Projects that were constructed in 2016.

The field inspections consisted of walking the entire length of the Truckee River rafting segment. Locations of known, and newly identified, water quality issues were inspected, characterized, and documented with field notes and photographs. Previously collected data by Placer County and the Truckee River Watershed Council were reviewed and used to help focus and guide the inspections.

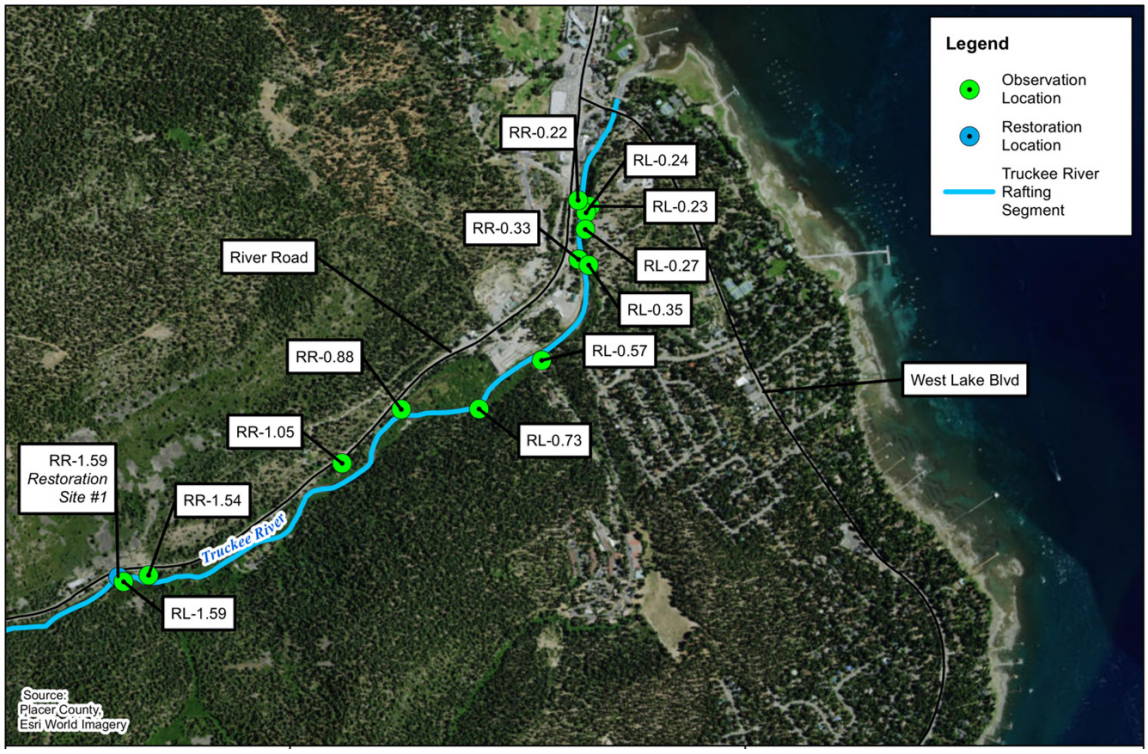


Figure 4-7
2020 Truckee River Rafting Segment Inspection Sites – Upper Segment

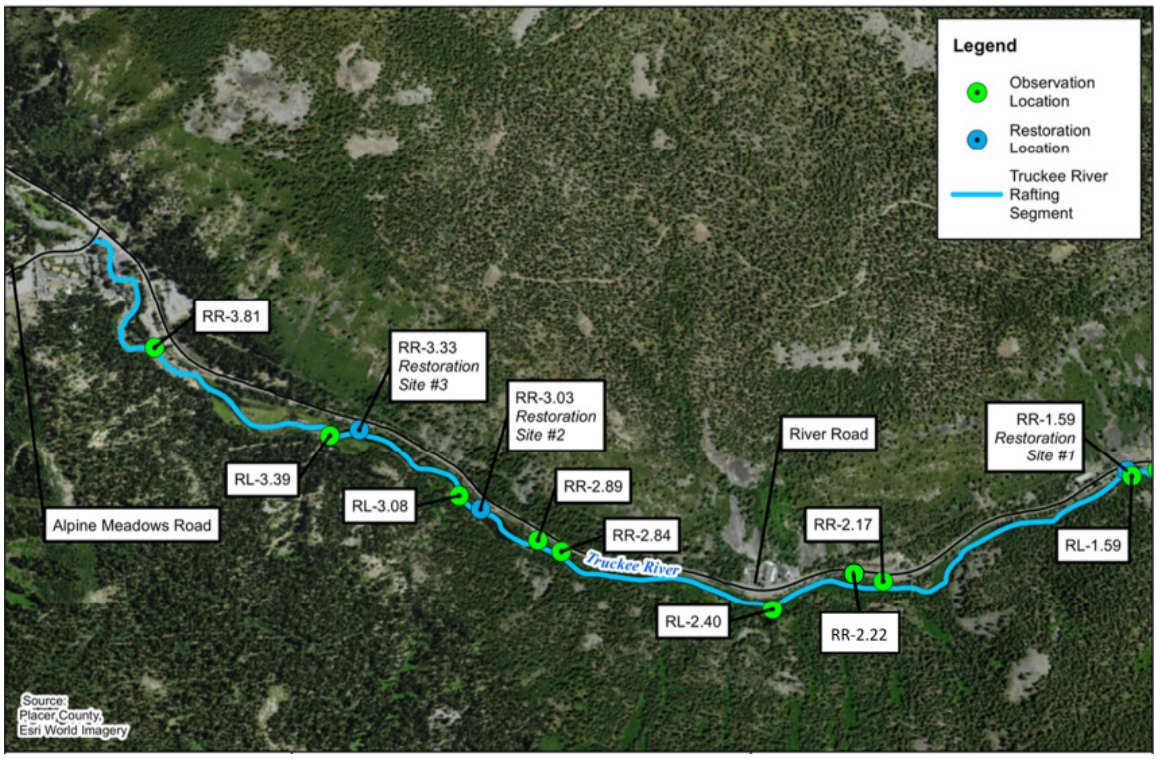


Figure 4-8
2020 Truckee River Rafting Segment Inspection Sites – Lower Segment

4.6 Quality Assurance/Quality Control

The TRWQMP quality assurance/quality control (QA/QC) system includes specifications and procedures for both field work and laboratory analyses. Basic QA/QC requirements include:

- Developing and maintaining a sampling and analysis plan (SAP) with detailed guidance on the various monitoring activities to be undertaken during TRWQMP implementation (CDM Smith, 2020a). The SAP presents protocols for monitoring preparation, equipment maintenance, sample collection, laboratory methods, data reporting and management and quality assurance/quality control (QA/QC) procedures.
- Maintaining the data quality objectives (DQOs) that establish acceptable measures of quality for all data collected during implementation of the TRWQMP in WY 2020.
- Employing professionals trained in the methods and procedures presented in the SAP.
- Adhering to established procedures, EPA methods, written Standard Operating Procedures, and other accepted methods (e.g., Standard Methods).
- Calibrating and operating all field equipment per manufacturer specifications outlined in the *Field Equipment Operations and Maintenance Manual, Revision 3* (CDM Smith, 2015b).
- Complete documentation of field activities, sample tracking and analysis.

4.7 Statistical Analyses

Statistical testing is conducted to analyze the data sets and determine whether various groups of data exhibit significant differences or trends. In cases where results are inconclusive, power analyses can be conducted to estimate the sample size (number of total measurements) required to discern a statistical difference. Statistical testing is performed to compare data from the community level and tributary level water quality monitoring assessment types. This section describes the statistical methodology applied to the water quality data. Statistical analyses are not conducted on discharge and suspended-sediment relationships as these data are evaluated independently and a best "eye-fit" approach is applied.

To compare water quality results, a test is performed of the statistical hypotheses that the two data groups exhibit significant differences. Basic statistics (mean, standard deviation, coefficient of variation, median) are calculated for each group included in each test. Additional statistical analyses include:

- Shapiro-Wilk and Lilliefors Normality Tests, including probability plots, to determine the data distribution;
- t-Tests to compare two data sets or to compare a data set to a regulatory standard;
- Power Analysis to determine whether additional samples are needed to discern a statistically significant difference in two data sets,
- Mann-Kendall Trend Tests to determine whether concentrations are significantly increasing or decreasing over time.

A statistical spreadsheet workbook is used to conduct these analyses, and is provided electronically in Appendix A.

4.7.1 Normality Tests

Normality tests are conducted to formally test whether the grouped data sets are normally distributed. Several different types of normality test methods are available. For this study, the method known as the Lilliefors test is used primarily. The Lilliefors test is evaluated by examining a probability value, known as a p-value, which indicates the probability of obtaining the particular Lilliefors statistic given that the data represent random samples from a normally distributed population. The Lilliefors normality test results are used to confirm the graphical results derived from the statistical spreadsheet workbook (box plots and parallel probability plots). In addition to the Lilliefors test, results from another normality test method, known as the Shapiro-Wilk method, are also examined. Generally, the Shapiro-Wilk method tends to be more sensitive to a few extreme values (possible outliers) than the Lilliefors method. Thus, if a data set passes the Lilliefors test but not the Shapiro-Wilk test, this indicated that the data set contained extreme values but is otherwise normally distributed. This serves as a flag to further evaluate whether the extreme values are statistical outliers.

4.7.2 t-Tests

Data comparison t-tests are conducted to test the null hypothesis that the mean difference (Delta) is equal to zero against the alternative that it is either less than or greater than zero, i.e., a two-sided test. To account for non-detects or left-censored data, the mean differences and their standard deviations are calculated on paired difference intervals using the maximum likelihood estimation (MLE) method. From the mean and standard deviation, a t-statistic and a critical t-value are determined. The critical t-value is determined from the corresponding value of the noncentral t-distribution using the effect size (mean divided by the standard deviation) as the noncentrality parameter. From the t-statistic and effect size, a p-value is calculated, which is compared to a critical value (α) of 0.05, i.e., a p-value less than or equal to 0.05 is indicative of a significant difference at the 95 percent confidence level. From the p-value, the power of the test is also calculated to allow subsequent estimation of the sample size (number of additional data measurements) that will be required to obtain a significant difference given the current mean and standard deviation. For sample size estimation purposes, a critical power of 0.80 is assumed. The t-test procedure is conducted on the original untransformed data (Delta), the natural log transformed data (LnDelta), and the ranked data (RkDelta). The appropriate results used to evaluate a particular data set are based on the normality test results. For example, if the differences are determined to be normally distributed, then the data t-test results conducted on the untransformed data are used. The comparison test conducted on the ranked data is essentially a censored data equivalent of the nonparametric Wilcoxon rank test.

4.7.3 Power Analysis

The power analysis is performed for those data groups exhibiting a difference that was not declared statistically significant (i.e. the p-value was greater than 0.05). A power analysis is conducted to estimate the sample size (amount of additional data) required to establish a statistically significant difference for the comparison tests, given the assumption that group means and standard deviations, and distributional shapes, would remain the same (at current

values) following subsequent collection of the additional data. For power analysis purposes, a Type II error rate (ß) of 0.20 is used, i.e., power (1- ß) = 0.80. Basically, the amount of additional data required is determined by incrementing the number of samples in each group until a power of 0.80 is attained.

4.7.4 Trend Analysis

Trends in analytical concentrations over time are evaluated visually using time-series plots and formally using the Mann-Kendall test method. The Mann-Kendall test is a nonparametric method that looks at each data point in chronological order and compares the point to all the previous data, noting if the data point has increased or decreased. The test counts the number of increases and decreases. A p-value is calculated which is then compared to critical value (α) of 0.1, i.e., a p-value less than or equal to 0.1 is indicative of a significant trend at the 90 percent confidence level. If the p-value was greater than 0.1 but less than 0.2, the observed trend was acknowledged to be either "Slightly Increasing" or "Slightly Decreasing."

4.8 Monitoring Modifications

The methodologies presented in Section 4 were developed using guidance provided in the TRWQMP and are consistent with the protocols and methods described in the WY 2020 SAP prepared for the County. WY 2020 modifications to the monitoring approaches are documented in the SAP (CDM Smith, 2020a) and summarized below:

- **Rapid Assessment Methodology (RAM)** – Suspended after WY 2014. Watersheds previously assessed using RAM are included in the GIS Analysis.
- **Bioassessment** – Four previously monitored sites in the Martis Creek watershed were discontinued and two new sites were established in WY 2020. No change from WY 2018 in the Squaw Creek watershed.
    - Monitoring at site Bio-MC2 in the middle mainstem of Martis Creek just downstream of the Lahontan property was discontinued. Site Bio-MC2 was not sampleable in 2018 due to extensive beaver activity which effectively backwatered the stream throughout the entire reach, making it both unwadeable and not comparable to previous data years.
    - Monitoring at site Bio-MC6 on East Martis Creek was discontinued since sufficient data has been collected. A new site Bio-MC7 was established on East Martis further upstream out of the meadow area, to a higher gradient channel section, to see if the persistent low scores are also present further upstream.
    - A new site Bio-MC8 was established on Middle Martis Creek near tributary level water quality monitoring site DST-MC7 to evaluate benthic habitat in this tributary.
    - Monitoring at two bioassessment sites (Bio-MC3 on upper West Martis Creek and Bio-MC4 on lower West Martis Creek) was discontinued to reduce overall monitoring efforts in the Martis Creek watershed.

- **Community Level Water Quality Sampling** – For WY 2020, two new sites were established and monitored within the Martis Creek watershed near Northstar based on results from the WY 2019 GIS Analysis. Monitoring at all other sites was discontinued since sufficient data has been collected to characterize these sites. The analytical list was reduced to TSS and total phosphorus only.
- **Tributary Level Water Quality Sampling** – One new site was established in Lower Middle Martis Creek to evaluate water quality benefits provided by the restored meadow reach of Middle Martis Creek. Monitoring at site DST-MC2 on East Martis Creek was discontinued in WY 2020 since sufficient data has been collected to characterize this site. The analytical list was reduced to TSS and total phosphorus only.
- **Stream Discharge Monitoring Stations** – No change from WY 2019. Stream discharge monitoring is incorporated into the four near-continuous turbidity monitoring stations within the Martis Creek watershed (TURB-MC1, TURB-MC2, TURB-MC4 and TURB-MC5).
- **Near-Continuous Turbidity Monitoring** – One new site was established in Upper West Martis Creek (TURB-MC5) for comparison to data collected in Lower West Martis Creek (TURB-MC1). Monitoring at site TURB-MC3 on East Martis Creek was discontinued in WY 2020 since sufficient data has been collected to characterize this site.
- **GIS Analysis** – Not performed in WY 2020.
- **Rafting Segment Inspections** – No change from WY 2018.

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Section 5

Water Year 2020 Monitoring Results

This section presents the results of TRWQMP implementation activities conducted during WY 2020 as described in Section 4. Where appropriate, results are combined with historical TRWQMP data to improve representativeness and evaluate for trends if possible.

5.1 Bioassessment Monitoring

Bioassessments were conducted in Squaw and Martis Creeks during the summer of 2020. Squaw Creek surveys were completed in early August and Martis Creek surveys were completed in September and October. Squaw Creek bioassessments are performed earlier in the season because flows in Squaw Creek are known to dry up or become intermittent later in the summer or early fall. The bioassessment results are presented for each creek and include general descriptions of conditions and field observations.

5.1.1 Bioassessment Results

Bioassessment results are presented in this section beginning with a discussion of field conditions and measurements and followed with the presentation of detailed laboratory results and calculations. A complete set of the original field data forms are provided in Appendix B.

5.1.1.1 Squaw Creek

Weather conditions were fair and warm during bioassessment surveys in Squaw Creek. Stream temperatures ranged from 18.9 to 21.5°C and pH was 7.2. Specific conductance ranged from 144 to 187 µS/cm and dissolved oxygen ranged from 9.4 to 19.7 mg/L at 102 to 223 percent saturation.

Discharge in Squaw Creek was less than 1 cfs during our surveys. Surface flows between pool-riffle-run sequences were still continuous (i.e., no intermittent flows or dry channel sections were present along the longitudinal profile). Mean wetted width was between 3.8 and 4.5 meters and mean depth was between 20 and 23 centimeters. Median particle size (D50) was between 5 and 11 millimeters. Particles less than 2 millimeters (<2 mm) in diameter (i.e., “fines and sands” per the SWAMP definition) comprised between 25 and 41 percent of the streambed. Particles less than 3 millimeters (<3 mm) in diameter (i.e., “fines and sands” per the Squaw Creek sediment TMDL definition) comprised between 29 and 44 percent of the streambed. Filamentous algae growth was substantial as in previous study years, typical of summer conditions when lower and/or intermittent flow conditions develop. Aquatic macrophytes were also abundant as in previous study years, particularly in depositional and lower gradient erosional areas within the stream. Representative photos of each site are provided in Figure 5-1.

The channel in this meadow section of Squaw Creek is very low gradient (0.01 to 0.35 percent slope) with varying sinuosity (1.1 to 1.9). The channel is typically open and un-shaded (canopy cover was between 0 and <1 percent). Stream banks are lined with low herbaceous cover (grasses, sedges, etc.) and sparse willow bushes. The channel appeared incised with stream banks at all sites showing signs of erosion (100 percent eroded banks). Several banks had boulder rip-rap placed as protection, most of which has been in disrepair for years.

5.1.1.2 Martis Creek

Weather conditions were fair during the September/October surveys in Martis Creek. Stream temperatures ranged from 2.8 to 7.6°C and pH ranged from 6.5 to 7.4. Specific conductance ranged from 118 to 255 µS/cm and dissolved oxygen ranged from 11.3 to 14.7 mg/L at 42 to 91 percent saturation.

Discharge in mainstem Martis Creek was less than 1 to 2 cfs during the surveys. Mean wetted width was between 1.7 and 3.4 meters and mean depth was between 10 and 26 centimeters. Median particle size (D50) was between 13 and 31 millimeters. Particles less than 2 millimeters in diameter (fines and sands) comprised between 14 and 44 percent of the streambed. Mean cobble embeddedness was between 6 and 46 percent. Representative photos of each site are provided in Figure 5-2.

The channels in the upstream headwater sections of Martis Creek are relatively high gradient (e.g., 3.1 percent in the Schaeffer Branch [site Bio-MC1]) with relatively low sinuosity (1.1 to 1.2). Stream gradient in the downstream meadow sections of Martis Creek is lower (between 0.4 and 2.5 percent) with slightly higher sinuosity (between 1.1 and 1.4). In the upper reaches, the channel is typically well shaded by alder and willow bushes and an overstory of conifers (e.g., mean canopy cover was 95 percent in the Schaeffer Branch [site Bio-MC1]); whereas in the lower reaches, no overstory is present and stream banks are lined with low herbaceous cover (grasses, sedges, etc.) and some sparse willow bushes (mean canopy cover in the lower reaches was 0 percent in lower mainstem Martis [site Bio-MC5]). Bank stability was high (81 to 100 percent) throughout Martis Creek locations. Lower bank stability was formerly an issue in the lower mainstem (e.g., banks were 23 percent eroded at site Bio-MC5 in 2018); however, recent stream restoration efforts have stabilized banks in this reach (e.g., banks were 100 percent stable at Bio-MC5 in 2020).

Figure 5-1a. Looking upstream from the bottom of site Bio-SC1 in the upper meadow (8/3/20).

Figure 5-1b. Fine sediment deposition in the upper meadow reach of Squaw Creek (8/3/20).

Figure 5-1c. Looking upstream from the bottom of site Bio-SC2 in the middle meadow (8/3/20).

Figure 5-1d. Channel incision and bank erosion near the middle meadow (8/3/20).

Figure 5-1e. Looking upstream from the bottom of site Bio-SC3 in the lower meadow (8/3/20).

Figure 5-1f. Failing rip-rap armor along the bank of site Bio-SC1 in the upper meadow (8/3/20).

Figure 5-1
Squaw Creek Bioassessment Photos

Figure 5-2a. Looking upstream from the bottom of site Bio-MC1 in the Schaeffer Branch (9/15/20).

Figure 5-2b. Looking upstream from the bottom of site Bio-MC5 in lower Martis Creek (9/25/20).

Figure 5-2c. Looking upstream from the top of site Bio-MC5 in the lower Martis Creek (9/25/20).

Figure 5-2d. Looking downstream from the top of site Bio-MC5 in the lower Martis Creek (9/25/20).

Figure 5-2e. Looking upstream from the bottom of site Bio-MC7 in the upper East Branch (10/12/20).

Figure 5-2f. Looking upstream from the bottom of site Bio-MC8 in Middle Martis Creek (10/16/20).

Figure 5-2
Martis Creek Bioassessment Photos

5.1.2 Bioassessment Laboratory Results

The most common taxa collected in Squaw Creek during 2020 were aquatic earthworms (Oligochaeta), stoneflies of the genus *Zapada* and *Capnia*, chironomid midges of the genus *Micropsectra*, and mayflies of the genus *Baetis.* Other abundant taxa included orthoclad midges of the genus *Parametriocnemus*, leptophlebiid mayflies of the genus *Paraleptophlebia,* stoneflies of the genus *Skwala*, and midges of the genus *Cricotopus/Orthocladius*. Benthic density in Squaw Creek averaged 3,864 individuals/ft^2 for all samples.

The most common taxa collected in Martis Creek during 2020 were leptophlebiid mayflies of the genus *Paraleptophlebia,* ephemerellid mayflies of the genus *Cinygmula,* and stoneflies of the genus *Yoroperla*. Other abundant taxa included aquatic earthworms (Oligochaeta), chironomid midges of the genera *Cricotopus* and *Micropsectra*, seed shrimp of the class Ostracoda, flatworms of the class Turbellaria, and heptageniid mayflies of the genus *Ironodes*. Benthic density in Martis Creek averaged 1,269 individuals/ft^2 for all Martis Creek samples.

Eastern Sierra IBI scores and values for the component IBI metrics are listed in Table 5-1 for all targeted riffle composite samples from Squaw Creek and Martis Creek sites. Complete 500-fixed-count taxa lists for these samples are provided in Appendix B. Squaw Creek sites had IBI scores in the A through C range (78.5 to 92.0 out of a possible 100) and Martis Creek sites had IBI scores in the A through D range (58.1 to 92.0 out of a possible 100). Lower IBI scores were mostly attributable to poor taxa richness (i.e., low total richness, as well as low mayfly [Ephemeroptera], stonefly [Plecoptera], and caddisfly [Trichoptera] richness), and low shredder abundance. The highest IBI scores were from the middle meadow site in Squaw Creek (Bio-MC2) and the new upper East Branch site in Martis Creek (Bio-MC7) (92.0 out of a possible 100).

However, TMDL-specific Biological Condition Scores (BCS) for the three Squaw Creek sites were better than most years. The upper meadow site (Bio-SC1) scored 23 out of a possible 35; the middle meadow site (Bio-SC2) scored 25 out of a possible 35, and the lower meadow (Bio-SC3) scored 25 out of a possible 35.

Discussion and interpretation of 2020 bioassessment results from Squaw Creek and Martis Creek and comparisons with data from previous monitoring years is provided in Section 6.1, including further discussion of numerical targets for biological health and physical habitat specific to the Squaw Creek sediment TMDL.

Table 5-1. Summary of 2020 TRWQMP Bioassessment Results (Squaw Creek and Martis Creek Riffle Samples)

BIOASSESSMENT STATION ID		BIO-SC1	BIO-SC2	BIO-SC3	BIO-MC1	BIO-MC5	BIO-MC7	BIO-MC8
LOCATION (Stream Reach)		Upper Meadow	Middle Meadow	Lower Meadow	Schaeffer Branch	Lower Mainstem	Upper East Branch	Middle Branch
GENERAL	Survey Date	8/3/2020	8/3/2020	8/3/2020	9/15/2020	9/25/2020	10/12/2020	10/16/2020
	Discharge (cfs)	< 1	< 1	< 1	<1	2	< 1	< 1
	Reach Slope (%)	0.2	0.2	0.3	3.1	0.4	3.9	4.1
	Reach Sinuosity	1.8	1.1	1.3	1.2	1.1	1.2	1.1
	Mean Wetted Width (m)	3.8	4.4	4.5	1.7	3.4	1.9	2.1
	Mean Depth (cm)	20	21	23	8	26	10	10
BED	Median Particle Size (D50) (mm)	11	5	8	19	13	31	17
	% Particles < 2 mm	25	41	30	14	44	26	26
	% Particles < 3 mm	29	44	34	15	44	26	28
	Mean Cobble Embeddedness (%)	n/a	n/a	n/a	46	6	27	26
BANK	Stable Banks (%)	0	0	0	100	100	100	81
	Eroded Banks (%)	100	100	100	0	0	0	5
	Mean Canopy Cover (%)	0	0	0	95	0	65	63
WATER QUALITY	Survey Time	1425	1315	1200	1035	1300	1505	930
	Water Temperature (°C)	21.2	21.5	18.9	7.4	7.6	7.6	2.8
	pH	7.2	7.2	7.2	7.4	6.5	6.5	6.6
	DO Concentration (mg/L)	19.7	9.6	9.4	10.8	5.1	5.1	9.3
	DO Saturation (%)	223	109	102	91	42	42	69
	Spp. Conductance (µS)	187	173	144	118	145	145	255
BIOLOGICAL METRICS	Total Taxa Richness	56	54	50	45	38	54	56
	Ephemeroptera Richness	9	9	10	8	5	11	6
	Plecoptera Richness	7	6	5	9	2	9	4
	Trichoptera Richness	4	7	4	5	3	10	7
	Acari Richness	5	6	4	3	6	2	6
	% Chironomidae Richness	41	37	40	20	26	15	27
	% Tolerant Taxa	13	14	11	9	13	6	13
	% Shredders	24	17	22	33	0	13	14
	% Dominant 3 Taxa	28	30	42	39	47	34	24
	Hilsenhoff Biotic Index	4.4	4.1	4.2	3.2	4.2	3.3	4.7
	Eastern Sierra IBI Score (0-100)	80.9	92	78.5	84.8	58.1	92	85.3

5.2 Community Level Water Quality Monitoring

This section describes the community level water quality monitoring performed by the County at two locations in the

Martis Creek watershed including a summary of monitored events, water quality data, statistical analyses, and QA/QC documentation.

5.2.1 Monitored Events

During WY 2020, discrete stormwater runoff samples were collected from two newly established sites as described in Section 4. WY 2020 was the first year of sampling at sites DSC-MC9 (Northstar Drive East) and DSC-MC10 (Ridgeline Drive).

A summary of all monitored runoff events at the two sites from WY 2020 is presented in Table 5-2. Included in Table 5-2 are the event date, event type, antecedent dry time, and total precipitation. The antecedent dry time is the period without measurable precipitation prior to each monitored event. Longer dry antecedent periods allow more pollutants to accumulate and wash off during the next stormwater runoff event. Precipitation type, depth, intensity, and duration may also strongly influence pollutant concentrations in stormwater runoff. For example, large rain on snow events can result in higher runoff volumes, which may mobilize large amounts of sediment due to erosion and increased deicer and abrasives applications on roadways. Collecting and analyzing samples from events with varying characteristics produces a robust dataset that better represents stormwater quality.

Table 5-2. WY 2020 Community Level Water Quality Monitoring Event Summary

	Event Date	Event Type[1]	Antecedent Dry Time	Event Precipitation	Sample Collected	
					Northstar Drive East (DSC-MC9)	Ridgeline Drive (DSC-MC10)
2020 Water Year	1/23/2020	M	6	0.5	X	X
	3/26/2020	S	2	NA	X	X
	4/15/2020	S	9	NA	X	X
	7/27/2020	R	5	0.25	X	
				Total Number of Samples	4	3

[1] M = Mixed snow/rain or rain on snow; R = Rain; S = Snowmelt; X = Sample Collected
[2] Consecutive days' daily precipitation did not exceed 0.1 inches.
[3] Truckee #2 SNOTEL station 834.

5.2.2 Water Quality Results

Tables containing the complete analytical results for all community level water quality monitoring conducted to date are presented in Appendix C. The results for TSS and total phosphorus analyses for DSC-MC9 and DSC-MC10 from WY 2020 are presented in Table 5-3. Results varied from event to event with higher concentrations being observed at DSC-MC9 which drains a portion of Northstar Drive. These results indicate that pollutant sources do exist in this area, and these pollutants are likely transported downstream to West Martis Creek when certain

conditions are present. Results at DSC-MC10 are much lower in comparison and do not present a high level of concern. Overall, data is limited and additional sampling is needed to evaluate water quality conditions at these sites.

Table 5-3. WY 2020 Community Level Water Quality Monitoring Data

Site Name	Site ID	Event Date	Event Type	TSS, mg/L	Total Phosphorus, mg/L
Northstar Drive	(DSC-MC9)	1/26/2020	Mix	480	0.087
Ridgeline Drive	(DSC-MC10)	1/26/2020	Mix	9.7	0.042
Northstar Drive	(DSC-MC9)	3/26/2020	Snowmelt	210	0.03
Ridgeline Drive	(DSC-MC10)	3/26/2020	Snowmelt	5.5	0.01U
Northstar Drive	(DSC-MC9)	4/15/2020	Snowmelt	46	0.092
Ridgeline Drive	(DSC-MC10)	4/15/2020	Snowmelt	2J	0.01U
Northstar Drive	(DSC-MC9)	7/27/2020	Rain	483J	0.74J

Notes:
Mixed events include variable rain/snow events and rain on snow events.
J = Associated value is an estimate.
U = Analyte was not detected at the associated value (reporting limit).

The results for TSS and total phosphorus are presented graphically in Figures 5-3 and 5-4 respectively. These figures combine the data from WY 2011 through WY 2020 for all community sites monitored to date. DSC-MC9 and DSC- MC10 have been monitored for one year and therefore have limited data. The data are presented in the box/whisker plot format. The box represents the range of values falling within 25 to 75 percent of the total range. The horizontal lines with values represent median values while the diamonds represent mean values. The vertical lines (whiskers) represent the range of values within the lower and upper quartiles. The vertical position and overall shape of each box provides an indication whether the water quality at one individual site is similar or different to the water quality at the other sites.

The figures show that TSS and total phosphorus concentrations are typically highest at the two Northstar Drive sites (DSC-MC4 and DSC-MC9). Results from DSC-MC10 were in the low range compared to past results from other community sites, likely due to the series of BMPs that are present within the drainage catchment to reduce pollutant concentrations.

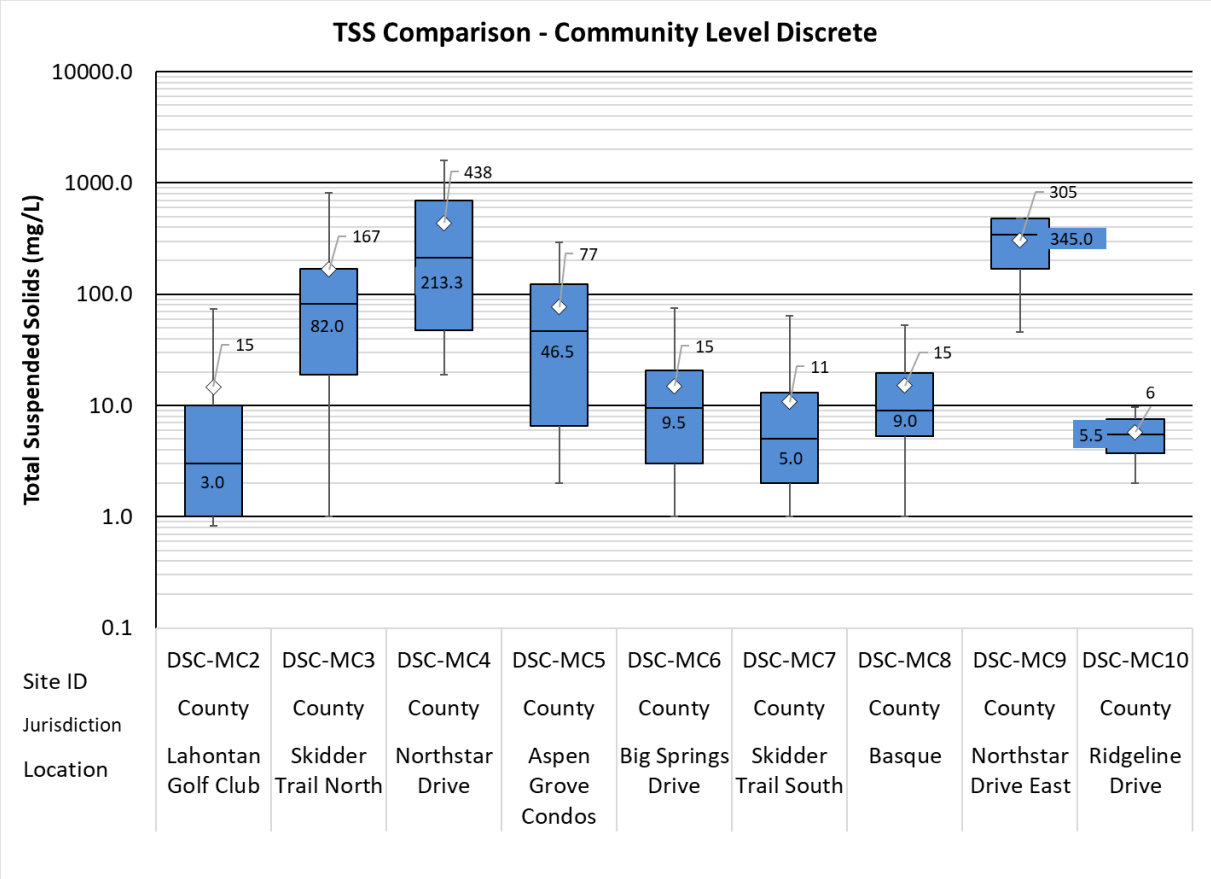


Figure 5-3
Community Site Comparisons – TSS

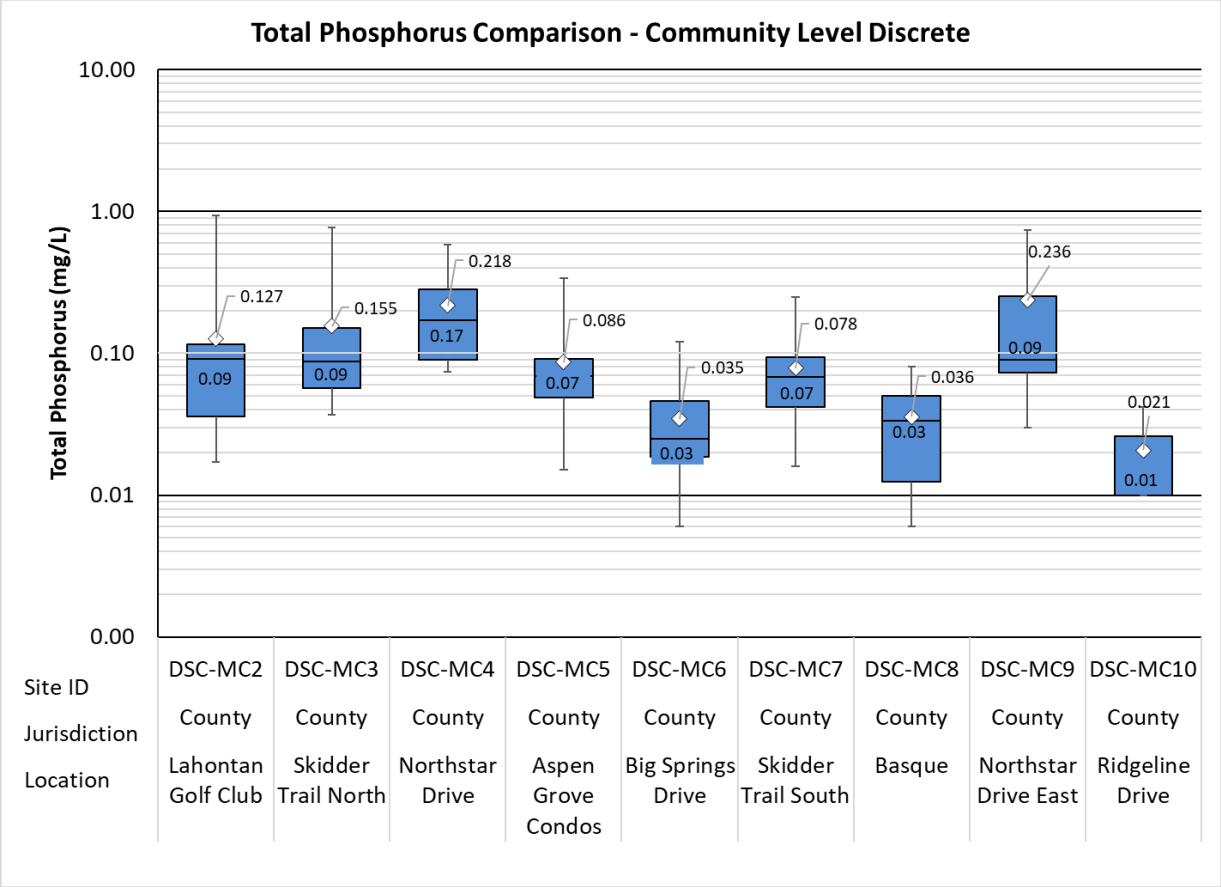


Figure 5-4
Community Site Comparisons – Total Phosphorus

5.2.3 Statistical Analyses

Statistical analyses were performed to further evaluate the community level monitoring results. These analyses consisted of summary statistics, t-tests at the 95 percent confidence level, and Mann-Kendall trend analyses. A statistical spreadsheet workbook is used to conduct these analyses, and is provided electronically in Appendix A.

5.2.3.1 Summary Statistics

Summary level statistics for sites DSC-MC9 and DSC-MC10 were generated for the WY 2020 dataset and are presented in Tables 5-4 and 5-5. These summary statistics characterize the data from each site and include the number of samples, percent detection, minimum, maximum, mean, median, standard deviation and CV.

The summary statistics indicate that data from DSC-MC9 were much more variable for both parameters as demonstrated by the ranges (e.g., differences between minimum and maximum values), differences between mean and median values, and the higher values for standard deviations and CVs. The results also illustrate that TSS and total phosphorus results were significantly higher at DSC-MC9 as compared to results from DSC-MC10. However, the sites DSC-MC9 and DSC- MC10 have been monitored for only one year and therefore data is limited.

Table 5-4. DSC-MC9 Summary Statistics (WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	4	100%	46.0	483	305	345	215	0.70
Total Phosphorus as P	mg/L	4	100%	0.03	0.74	0.24	0.09	0.33	1.4

Note:
mg/L =milligrams per liter; NTU = nephelometric turbidity units
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
NC = Not calculated; insufficient number of detections to generate statistics

Table 5-5. DSC-MC10 Summary Statistics (WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	3	100%	2.0	9.7	5.7	5.5	3.9	0.67
Total Phosphorus as P	mg/L	3	33%	0.01	0.04	NC	0.01	NC	NC

Note:
mg/L =milligrams per liter; NTU = nephelometric turbidity units
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
NC = Not calculated; insufficient number of detections to generate statistics

5.2.3.2 Statistical Trends (Mann-Kendall)

Temporal trends in individual parameter concentrations and levels over time are evaluated qualitatively by visually inspecting time-series plots and analytically using the Mann-Kendall test method. Insufficient data currently exists to perform these analyses for sites DSC-MC9 and DSC-MC10. Statistical trends should be evaluated at a later date when more data is available.

5.2.3.3 Statistical Comparisons (t-tests)

Statistical comparisons (two-sided t-tests at the 95 percent confidence level) were conducted using the datasets for all community sites monitored to date for TSS and total phosphorus. The results can be used to determine whether pollutant concentrations at a given site are significantly greater than concentrations observed at another site. The results of all statistical comparisons are presented in Table 5-6. Results are summarized as follows for sites monitored in WY 2020 (DSC-MC9 and DSC-MC10) which have limited data:

- **DSC-MC9 (Northstar Drive West)**: Results for TSS were significantly higher than results at all other sites except DSC-MC3 and DSC-MC4;
- **DSC-MC10 (Ridgeline Drive)**: Results for TSS were significantly lower than results at DSC-MC3, DSC-MC4, DSC-MC5, and DSC-MC9.

Table 5-6. Statistical t-tests for Constituents of Concern at Community Monitoring Sites

Constituent	Site	DSC-MC3	DSC-MC4	DSC-MC5	DSC-MC6	DSC-MC7	DSC-MC8	DSC-MC9	DSC-MC10
TSS	DSC-MC2	MC3>MC2	MC4>MC2	MC5>MC2	None	None	MC8>MC2	MC9>MC2	None
	DSC-MC3		MC4>MC3	None	MC3>MC6	MC3>MC7	MC3>MC8	None	MC3>MC10
	DSC-MC4			MC4>MC5	MC4>MC6	MC4>MC7	MC4>MC8	None	MC4>MC10
	DSC-MC5				MC5>MC6	MC5>MC7	None	MC9>MC5	MC5>MC10
	DSC-MC6					None	None	MC9>MC6	None
	DSC-MC7						None	MC9>MC7	None
	DSC-MC8							MC9>MC8	None
	DSC-MC9								MC9>MC10
Total Phosphorus	DSC-MC2	None	MC4>MC2	None	MC2>MC6	None	MC2>MC8	None	NC
	DSC-MC3		None	None	MC3>MC6	None	MC3>MC8	None	NC
	DSC-MC4			MC4>MC5	MC4>MC6	MC4>MC7	MC4>MC8	None	NC
	DSC-MC5				MC5>MC6	None	None	None	NC
	DSC-MC6					MC7>MC6	None	None	NC
	DSC-MC7						MC7>MC8	None	NC
	DSC-MC8							None	NC
	DSC-MC9								NC

NC = Not calculated; insufficient number of detections to generate statistics

5.2.4 Community Level Discussion

WY 2020 was the first year of data collection at DSC-MC9 (Northstar Drive East) and DSC-MC10 (Ridgeline Drive) community level water quality monitoring sites. To put these results into a regional context, the Event Mean Concentrations (EMCs) that were developed for the Lake Tahoe TMDL (LRWQCB and NDEP, 2010) for TSS and total phosphorus for various land use categories are provided in Table 5-7 along with mean concentrations from each community level site. Comparison of these values indicate that TSS and total phosphorus concentrations from sites DSC-MC9 and DSC-MC10 are below the Tahoe TMDL concentration ranges for some land use categories for TSS and below concentrations for all land use categories for total phosphorus.

Table 5-7. Tahoe TMDL Event Mean Concentrations Comparison

Land Use Category	TSS (mg/L)	Total Phosphorus (mg/L)
Vegetation/Turf	34	2.41
Ski Runs	848	0.45
Single Family Residential - Pervious	103	0.75
Single Family Residential - Impervious	56	0.44
Multi-Family Residential - Pervious	418	1.22
Multi-Family Residential - Impervious	160	0.52
Commercial/Institutional/ Communications/Utilities - Pervious	555	1.04
Commercial/Institutional/ Communications/Utilities - Impervious	260	0.52
Primary Roads	950	2.01
Secondary Roads	154	0.6
DSC-MC9 Mean Concentration	305	0.24
DSC-MC10 Mean Concentration	5.7	NC

NC = Not calculated; insufficient number of detections to generate statistics

5.2.4.1 Northstar Drive West (DSC-MC9)

The Northstar Drive West drainage area consists of secondary paved roadways and forested uplands. A system of rock-lined and earthen channels and curb and gutter convey runoff to drainage inlets with sediment traps. Runoff is then piped to the sampling location. The monitoring location is shown in Figure 5-5.

TSS and total phosphorus concentrations greatly exceed those measured in West Martis Creek at tributary level site DST-MC4. This indicates that this site is contributing to elevated TSS and total phosphorus in West Martis Creek. This could be attributed to heavy traction sand applications on Northstar Drive and unmaintained drainage infrastructure that contains significant sediment.

5.2.4.2 Ridgeline Drive (DSC-MC10)

The Ridgeline Drive site receives runoff from multi-family residential, secondary paved roadways, a solid waste handling area, and forested uplands. Runoff from the multi-family residential area is conveyed to an infiltration basin that captures runoff before discharging it into a long rock-lined channel leading to the sampling location. Runoff from the solid waste handling area is conveyed to a treatment vault and small pond before being discharged to the sampling location. These BMPs effectively reduce runoff volumes and pollutant concentrations observed at the outfall. The monitoring location is shown in Figure 5-6.

TSS and total phosphorus concentrations were lower than those measured in West Martis Creek at tributary level site DST-MC4. This indicates that this site may not be contributing to elevated TSS and total phosphorus in West Martis Creek. However, data is limited and could be influenced by the dry winter season and low runoff rates observed at this site.

Figure 5-5
Northstar Drive West Site

Figure 5-6
Ridgeline Drive Site

5.2.5 QA/QC Results

Upon receipt from the laboratory, each analytical report was thoroughly reviewed, and the data evaluated to determine if the data met the study objectives. Initially, the data were screened for the following major items:

- A 100 percent check between electronic data provided by the laboratory and the hard copy reports;
- Conformity check between the chain-of-custody forms, compositing protocol, and laboratory reports;
- A check for laboratory data report completeness; and,
- A check for typographical errors on the laboratory reports.

After performing the data screening, the laboratory was notified of any deficiencies, if any, detailing the problems encountered during the initial screening process.

Following the initial screening, a more complete QA/QC review was performed which included an evaluation of accuracy, precision, and data quality. Accuracy was evaluated by reviewing MS, MSD, and LCS recoveries; precision was evaluated by reviewing field duplicate, spike duplicate and laboratory sample duplicate RPDs. The data quality assessment was based upon review of holding times, method blank contamination, laboratory blanks, laboratory control samples, laboratory duplicates, matrix spikes and matrix spike duplicates, reporting limits, and field duplicates. Based on the data review, none of the constituent results were rejected. Appendix D provides the detailed descriptions of specific items that were evaluated during the QA/QC review process and data that were qualified as estimated due to QC exceedances.

5.3 Tributary Level Discrete Water Quality Monitoring

In this section, the results of the WY 2020 tributary level water quality monitoring are presented including a description of the monitored events, water quality results, statistical analysis results, and a discussion of the QA/QC results. Data and results from the seven previous years of monitoring are also presented and discussed relative to WY 2020 data.

5.3.1 Monitored Events

During WY 2020, tributary level discrete samples were collected from the seven monitoring locations described in Section 4. A summary of the events that were successfully monitored during WY 2020 is presented in Table 5-8. An effort was made to collect the tributary samples during the rising limb of an event, when possible, to provide data representative of first flush conditions that are typically considered the worst-case scenario in terms of water quality. Figures 5-7 through 5-13 illustrate when the samples were collected in relation to stream stage at the main stem Martis Creek gaging station (TURB-MC2). Figure 5-7 shows when tributary level samples were collected throughout WY 2020, and Figures 5-8 through 5-13 show when samples were collected for each of the six individual events.

Table 5-8. WY 2011 - WY 2020 Tributary Level Water Quality Monitoring Event Summary[1]

	Event Date	Event Type[1]	Antecedent Dry Time (Days)[2]	Total Precipitation (inches)[3]		Event Date	Event Type[1]	Antecedent Dry Time (Days)[2]	Total Precipitation (inches)[3]
2011 Water Year	12/14/2010	M	5	1.6	2012 Water Year	1/21/2012†	M	60	5.1
	12/18/2010	M	2	2		3/14/2012†	M	6	0.8
	3/15/2011†	M	2	3.9		3/16/2012	M	1	2.6
	4/1/2011	S	5	NA		3/21/2012	S	2	NA
	5/5/2011	S	9	NA		4/20/2012	S	6	NA
	6/6/2011	M	3	1.5		4/23/2012	S	9	NA
	6/29/2011	R	22	0.4		4/26/2012	R	11	0.8
2013 Water Year	11/17/2012	M	6	1	2014 Water Year	1/30/2014†	M	17	1.7
	11/30/2012†	M	1	3.2		2/9/2014†	M	7	4.3
	12/5/2012	R	2	1		2/27/2014	M	9	1
	12/17/2012	M	1	0.5		3/29/2014	M	2	1.1
	3/13/2013	S	5	NA		4/8/2014	S	6	NA
	3/20/2013	M	12	0.3		5/20/2014	R	24	0.7
	3/31/2013	M	10	0.2		7/21/2014	R	1	0.2
	4/26/2013	S	21	NA		8/4/2014	R	13	0.8
	5/7/2013†	R	31	1.2					
2015 Water Year	12/3/2014†	M	2	2.3	2016 Water Year	11/2/2015†	M	3	1.6
	2/7/2015†	M	38	3.1		12/21/2015	M	1	1.4
	2/8/2015	M	<1	1.6		1/29/2016	R	5	2.1
	3/6/2015	S	5	NA		2/24/2016	S	5	NA
	4/21/2015	R	13	0.1		3/5/2016†	M	14	1.9
	4/23/2015	R	15	0.4		4/7/2016	S	9	NA
	6/10/2015	R	15	0.5		4/22/2016	R	7	1.5
2017 Water Year	10/16/2016	R	11	5.6	2018 Water Year	3/8/2018	S	3	NA
	10/28/2016	R	6	1.6		3/13/2018	M	2	0.6
	12/10/2016	R	3	3.3		3/22/2018	M	3	3.8
	12/16/2016	M	2	2.3		3/29/2018	S	5	NA
	1/9/2017	M	1	5.4		4/7/2018	R	10	1.9
	2/9/2017	R	1	6.7		5/9/2018	S	10	NA
	3/20/2017	S	14	NA		5/16/2018	R	3	0.4
	5/24/2017	S	8	NA		5/25/2018	R	2	1.1
2019 Water Year	11/29/2018	M	3	1.5	2020 Water Year	1/26/2020	M	6	0.5
	12/17/2018	M	7	0.4		2/6/2020	B	11	NA
	1/7/2019	M	1	1.9		3/26/2020	S	2	NA
	1/9/2019	M	2	0.6		4/15/2020	S	9	NA
	2/14/2019	M	1	1.5		4/29/2020	S	9	NA
	3/6/2019	M	1	1.3		8/5/2020	B	8	NA
	3/19/2019	S	5	0.1					
	4/18/2019	S	3	NA					
	4/24/2019	S	9	NA					

Notes:

[1] M = Mixed snow/rain or rain on snow; R = Rain; S = Snowmelt; B= Baseflow

[2] Days since daily total precipitation exceeded 0.1 inches

[3] Total precipitation measured at Truckee #2 SNOTEL Station 834

†Multi-day event monitored

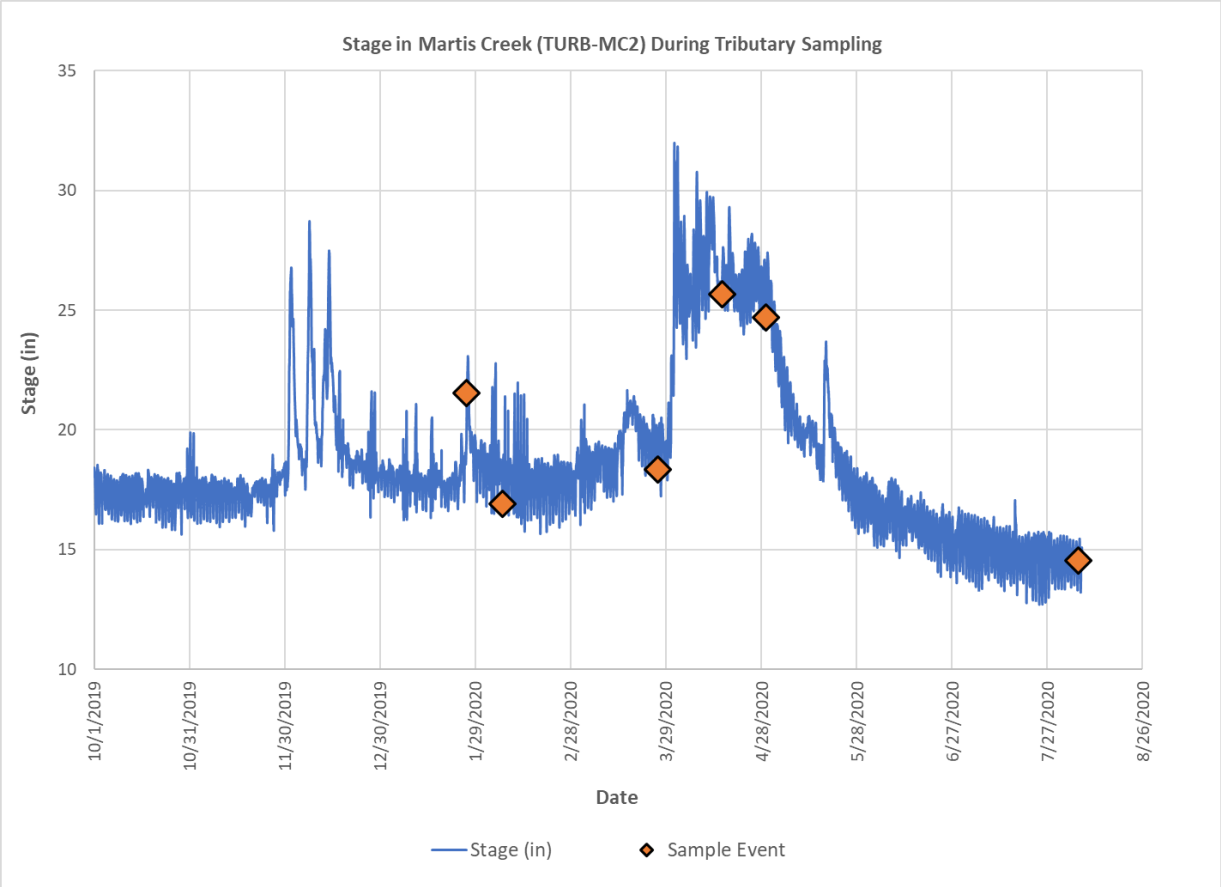


Figure 5-7
WY 2020 Tributary Event Overview

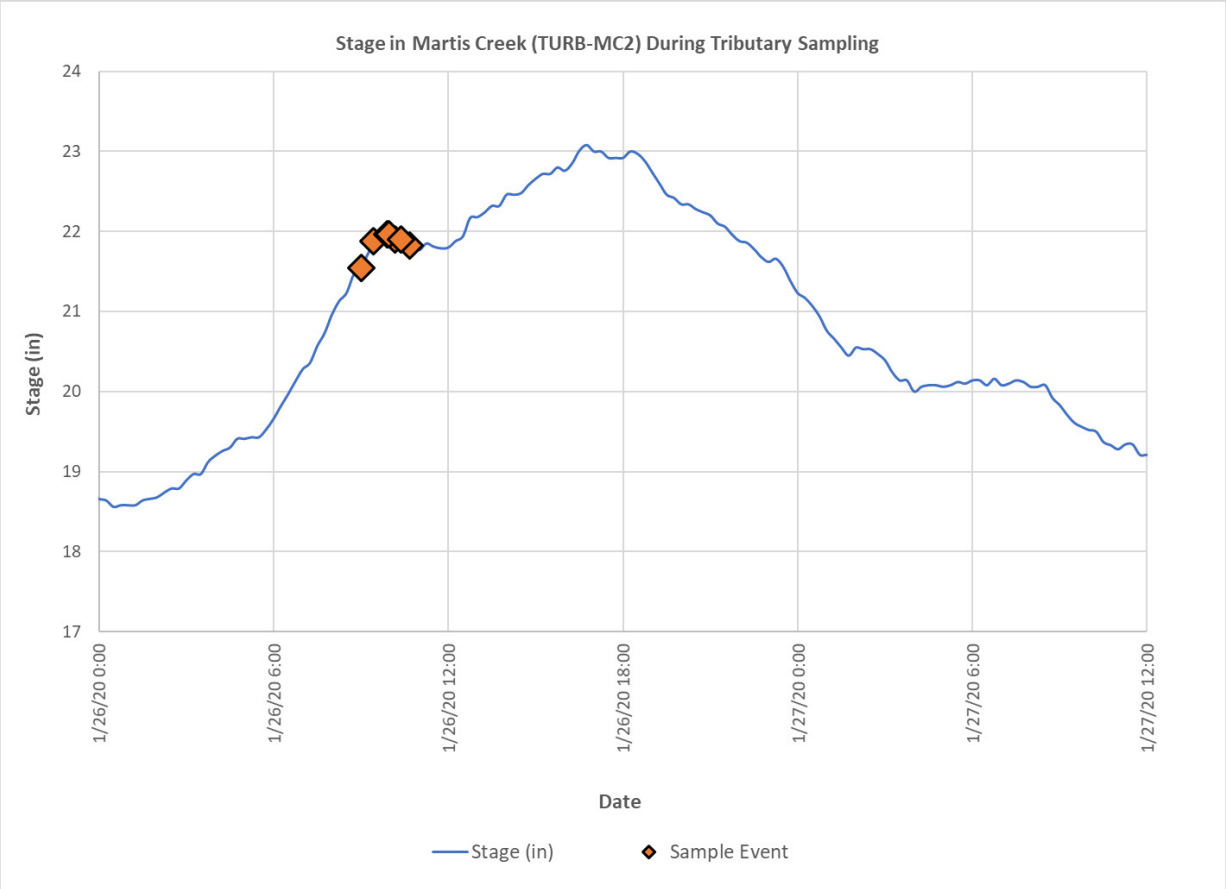


Figure 5-8
Tributary Event 01/26/2020

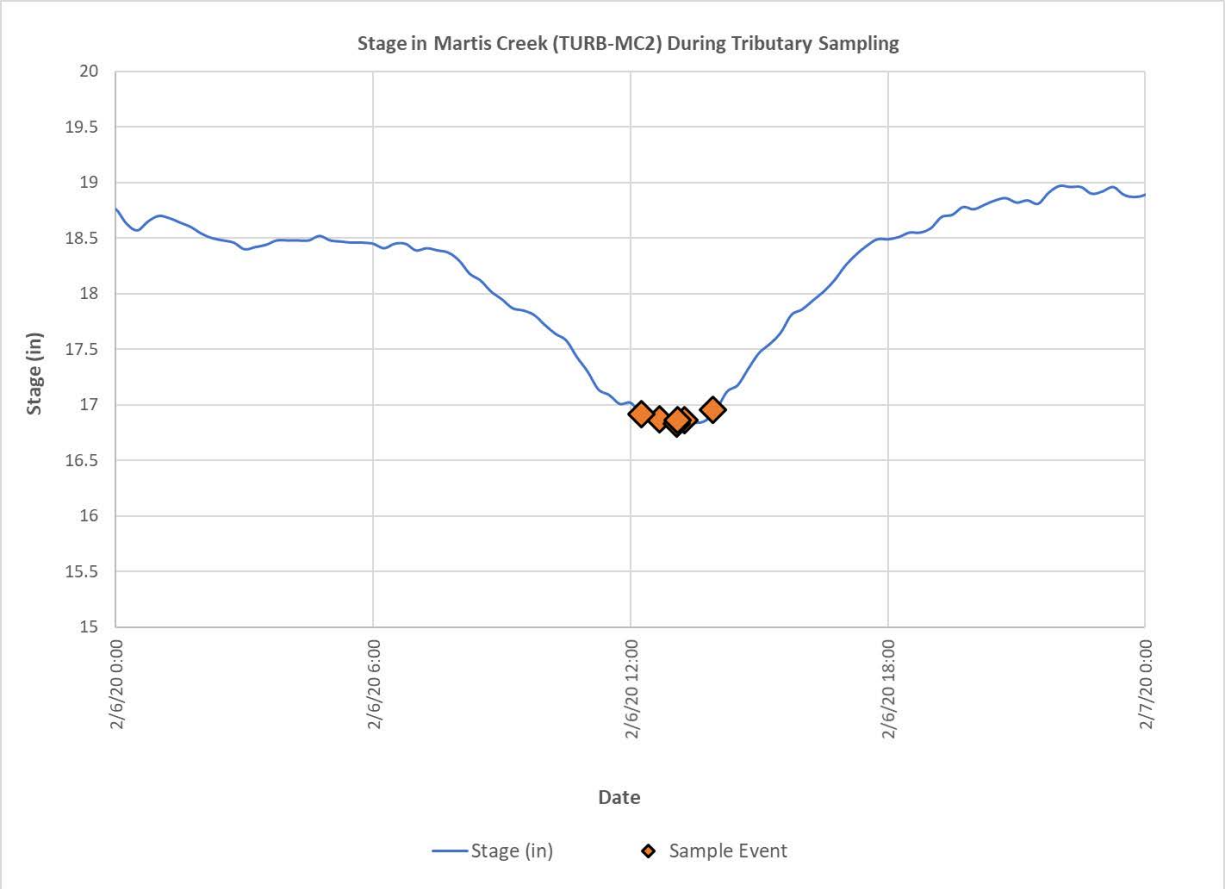


Figure 5-9
Tributary Event 02/06/2020

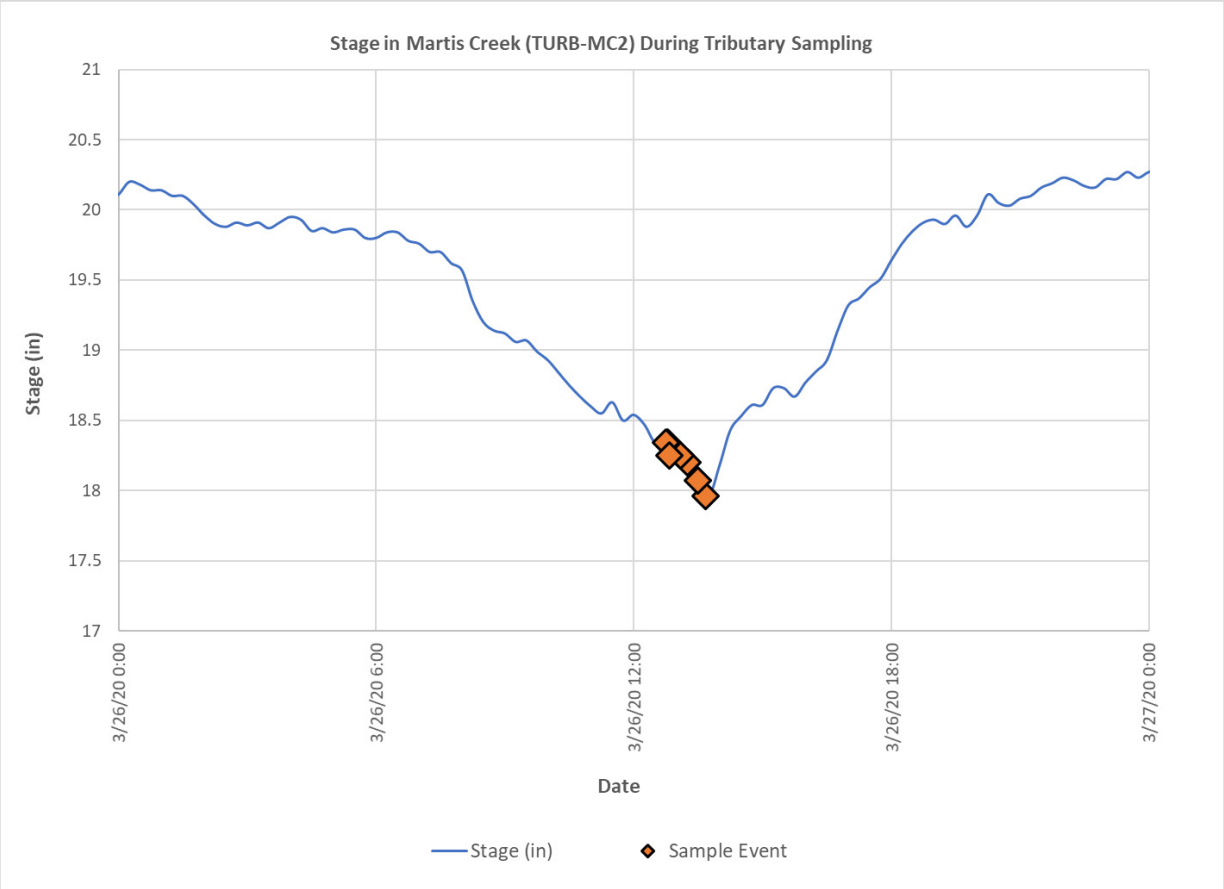


Figure 5-10
Tributary Event 3/26/2020

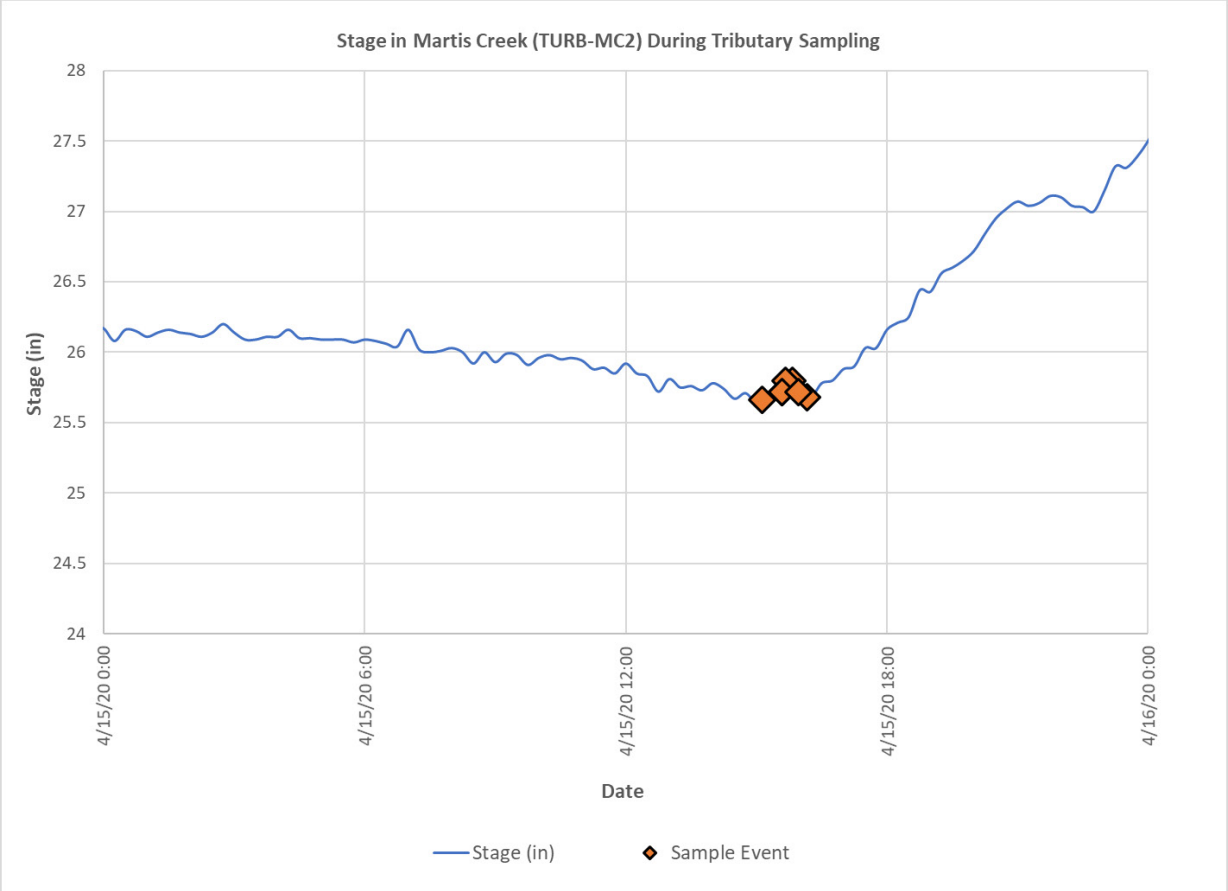


Figure 5-11
Tributary Event 4/15/2020

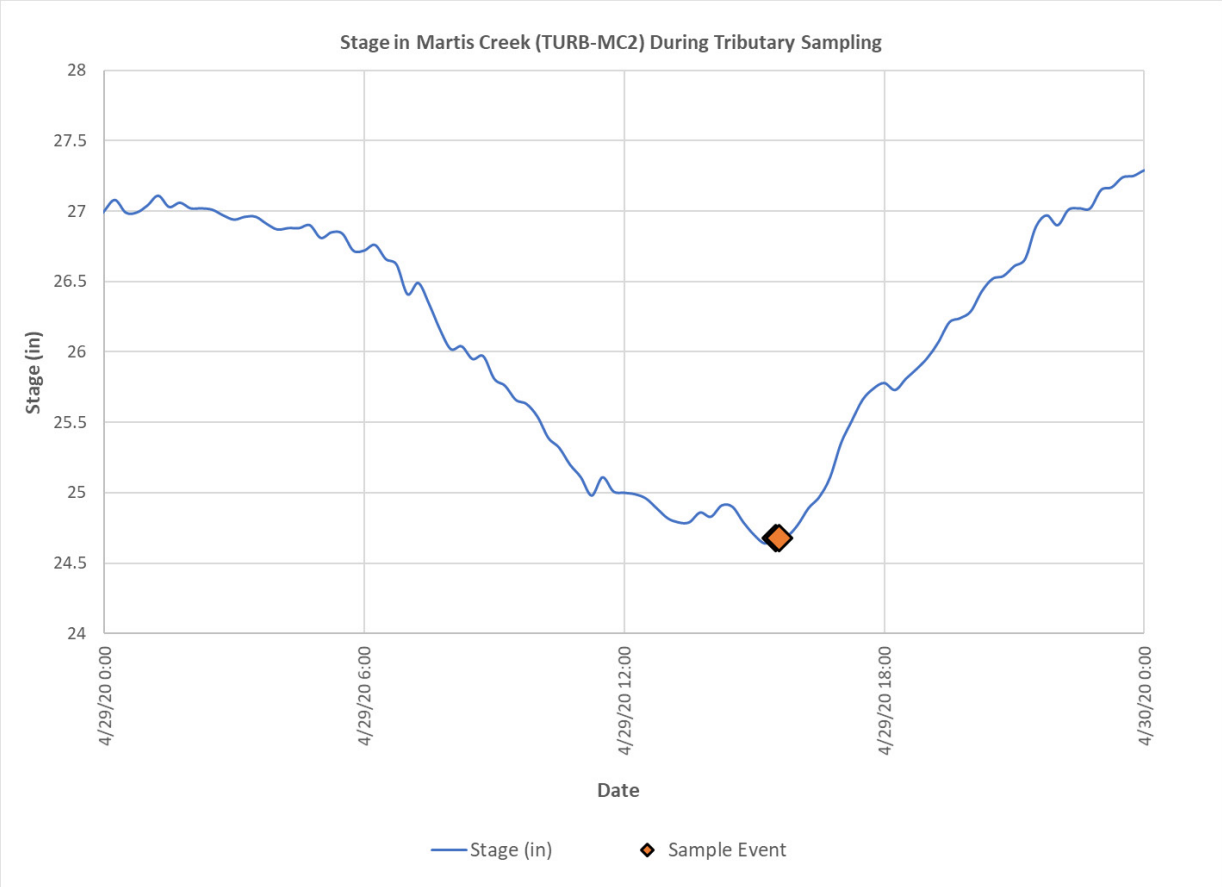


Figure 5-12
Tributary Event 4/29/2020

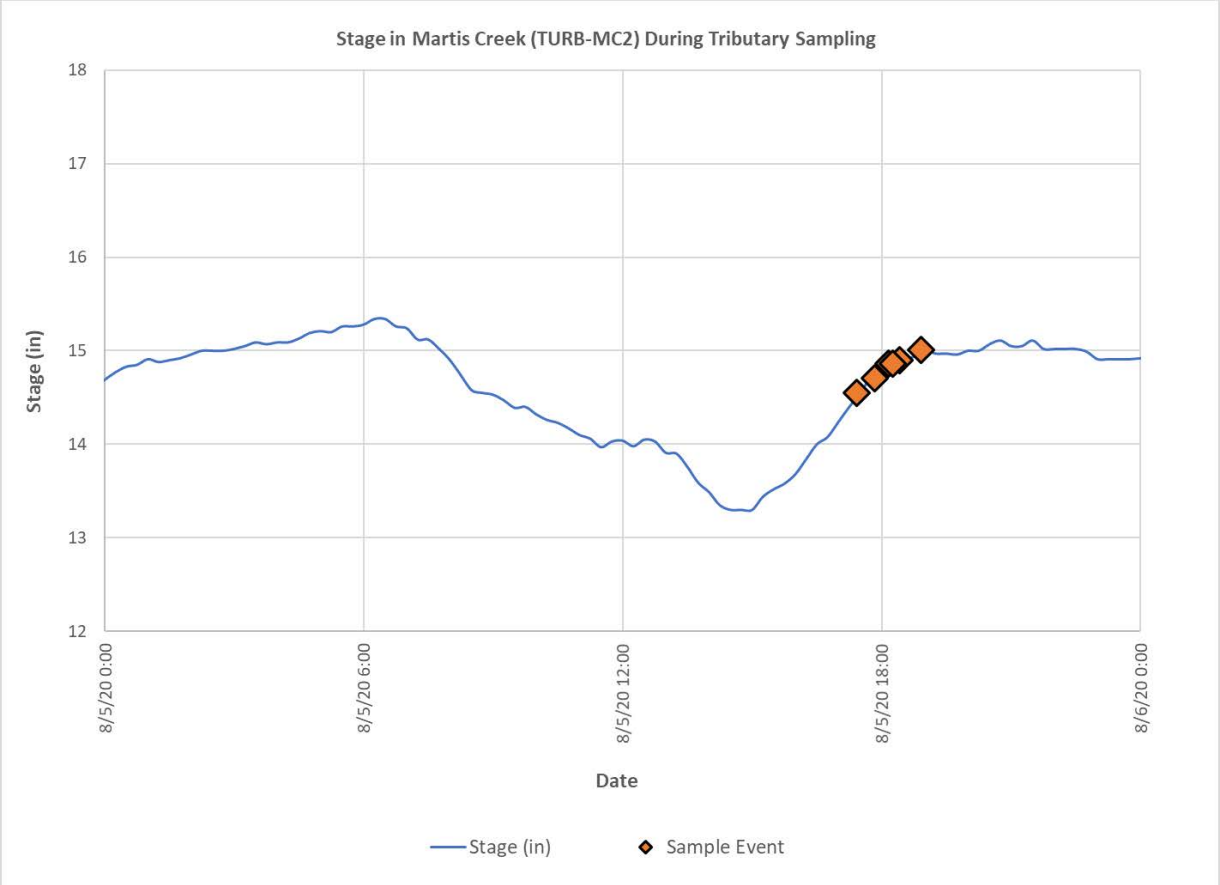


Figure 5-13
Tributary Event 8/5/2020

5.3.2 Water Quality Results

The complete analytical results for the tributary level water quality monitoring are presented in Appendix C. Results are presented for WY 2020, along with previous data from WY 2011 to WY 2019.

The results for TSS and total phosphorus are presented graphically in Figures 5-14 and 5-15. These figures combine the data from WY 2011 to WY 2020. The data are presented in the box/whisker plot format. The box represents the range of values falling within 25 to 75 percent of the total range. The horizontal line with label represents the median value while the diamond represents the mean value. The vertical lines represent the range of values within the upper and lower quartiles. The vertical position and overall shape of each box provides an indication of whether water quality at the individual site is similar or different to the water quality at the other five sites.

The figures show that the differences in concentrations from site to site are relatively small; the boxes have similar shape and plot at a similar position on the vertical scale. However, the box plots do illustrate a couple notable differences. TSS results tend to be higher at DST-MC7 on Middle Martis Creek and DST-MC8 in West Martis Creek which can likely be attributed to runoff

from SR 267 and Northstar Ski Resort, respectively. TSS results are also elevated at DST-MC4 on West Martis Creek which can likely be attributed to the relatively dense development in this sub-watershed.

Total phosphorus concentrations were relatively similar across sites with the lowest concentrations observed at sites DST-MC8 and DST-MC9 on upper West Martis Creek and DST-MC10 on Middle Martis Creek. Concentrations typically increase at sites in the lower part of the Martis Creek watershed with the exception of Middle Martis Creek. However, data from site DST-MC10 on lower Middle Martis Creek are limited and may not reflect long term trends. Total phosphorus concentrations are of particular interest since the water quality objective of 50 µg/L (Martis Creek at Mouth) was exceeded approximately 40 percent of the time across all sites and years.

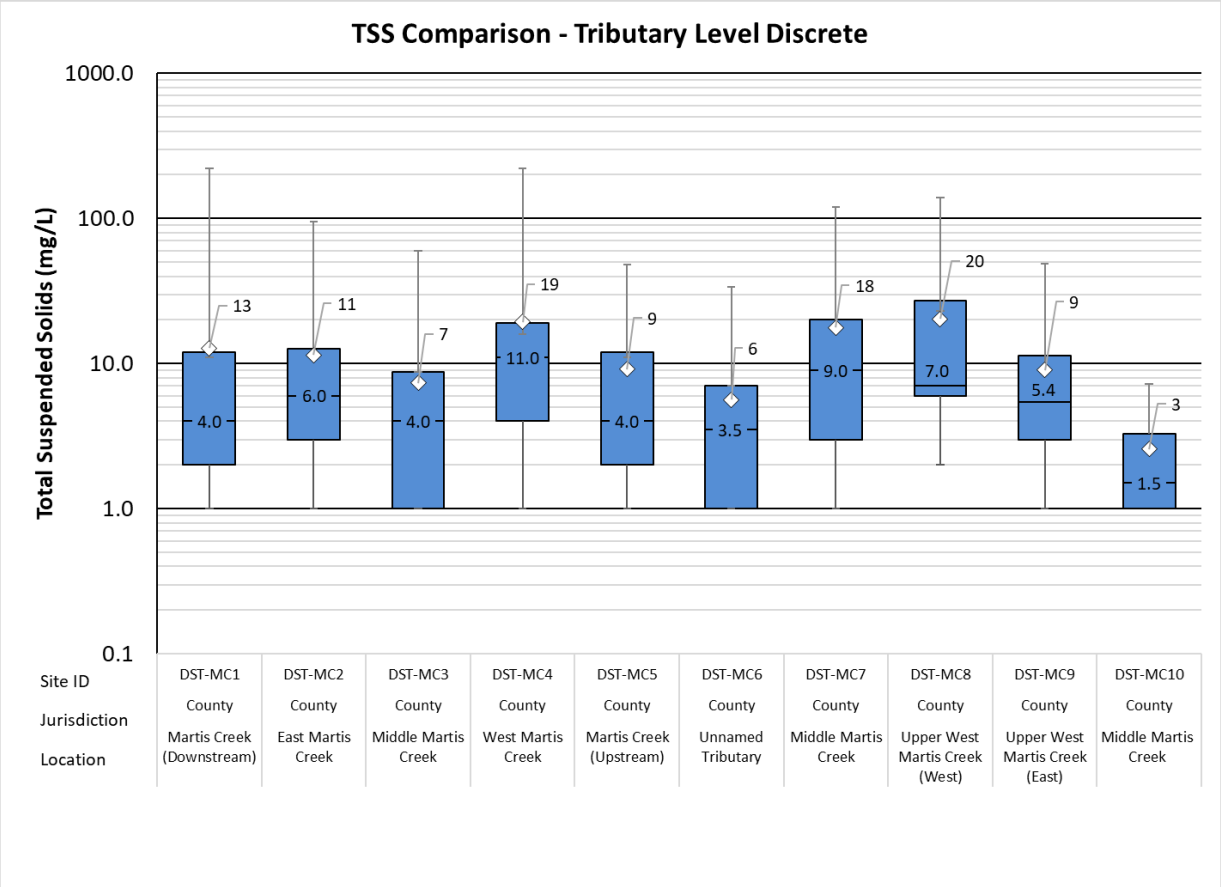


Figure 5-14
Tributary Site Comparisons – TSS

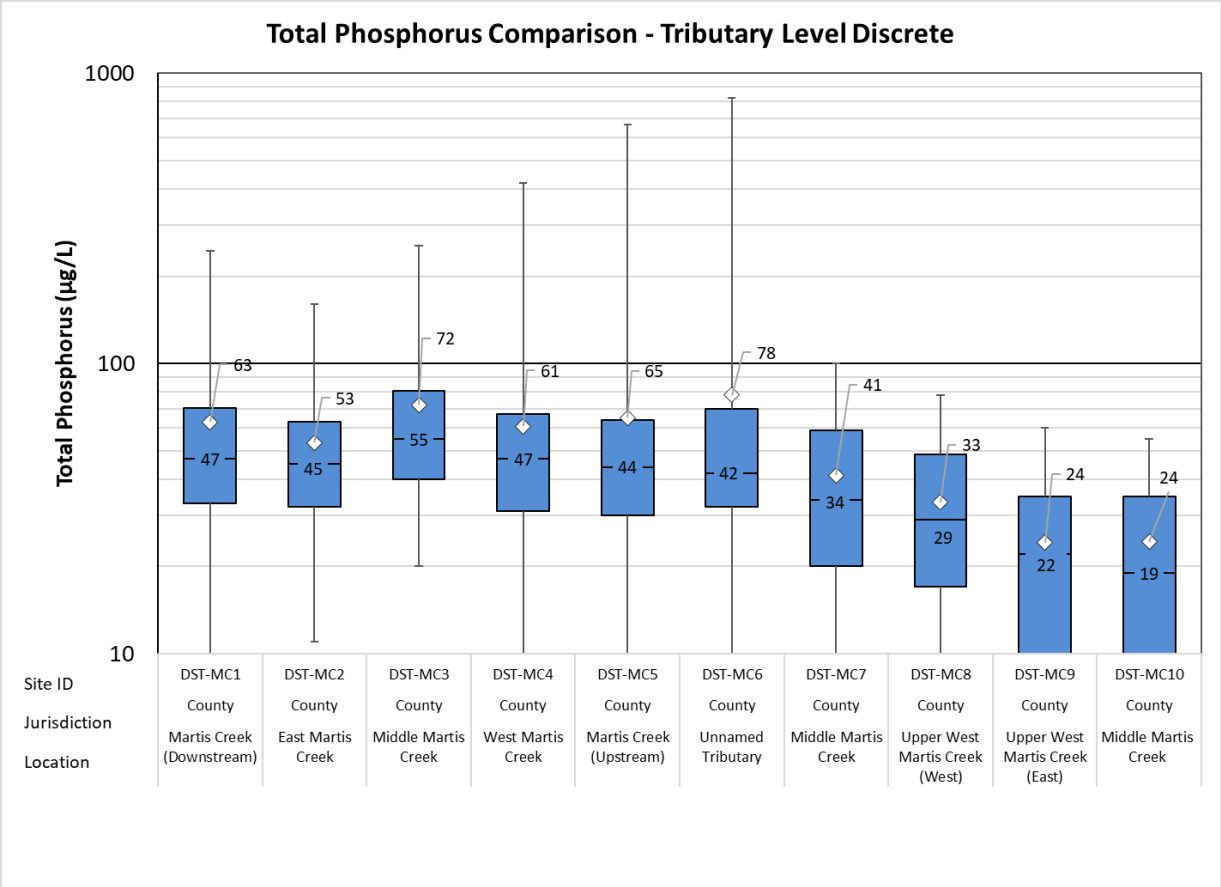


Figure 5-15
Tributary Site Comparisons – Total Phosphorus

5.3.3 Statistical Analyses

Statistical analyses were performed to further evaluate the tributary level monitoring results. These analyses consisted of summary statistics, t-tests at the 95 percent confidence level, and Mann-Kendall temporal trend analyses. A statistical spreadsheet workbook is used to conduct these analyses, and is provided electronically in Appendix A.

5.3.3.1 Summary Statistics

Summary level statistics were generated for the WY 2011 through WY 2020 combined dataset and are presented in Tables 5-9 through 5-15. These summary statistics characterize the data from each site and include the number of samples, percent detection, minimum, maximum, mean, median, standard deviation and CV.

An evaluation of the summary statistics shows few non-detectable concentrations of TSS and total phosphorus. Data for TSS exhibit high variability at all sites as demonstrated by the ranges (e.g., differences between minimum and maximum values), differences between mean and median values, and the typically high values for standard deviations and CVs. Total phosphorus was less variable across sites in comparison. This finding may indicate that total phosphorus

concentrations are not directly related to TSS concentrations, likely due to dissolved phosphorus content not accounted for in TSS results.

Table 5-9. DST-MC1 (Martis Creek) Summary Statistics (WY 2011 - WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	75	91%	1.0	220	13	4.0	29	2.2
Total Phosphorus as P	µg/L	75	95%	10	244	63	47	48	0.77

Note:
µg/L = micrograms per liter; mg/L =milligrams per liter; NTU = nephelometric turbidity units.
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit.
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
Total Nitrogen is the sum of nitrite (as N), nitrate (as N) and total Kjeldahl nitrogen
NC = Not calculated; insufficient number of detections to generate statistics

Table 5-10. DST-MC4 (West Martis Creek) Summary Statistics (WY 2011 - WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	75	96%	1.0	220	19	11	31	1.6
Total Phosphorus as P	µg/L	75	93%	10	420	61	47	56	0.92

Note:
µg/L = micrograms per liter; mg/L =milligrams per liter; NTU = nephelometric turbidity units.
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit.
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
Total Nitrogen is the sum of nitrite (as N), nitrate (as N) and total Kjeldahl nitrogen
NC = Not calculated; insufficient number of detections to generate statistics

Table 5-11. DST-MC5 (Upper Martis Creek) Summary Statistics (WY 2011 - WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	75	98%	1.0	48	9	4.0	11	1.2
Total Phosphorus as P	µg/L	75	100%	10	665	65	44	82	1.3

Note:
µg/L = micrograms per liter; mg/L =milligrams per liter; NTU = nephelometric turbidity units.
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit.
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
Total Nitrogen is the sum of nitrite (as N), nitrate (as N) and total Kjeldahl nitrogen
NC = Not calculated; insufficient number of detections to generate statistics

Table 5-12. DST-MC7 (Middle Martis Creek) Summary Statistics (WY 2018 - WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	21	90%	1.0	120	18	9	27	1.5
Total Phosphorus as P	µg/L	21	86%	10	100	41	34	30	0.72

Note:
µg/L = micrograms per liter; mg/L =milligrams per liter; NTU = nephelometric turbidity units.
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit.
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
Total Nitrogen is the sum of nitrite (as N), nitrate (as N) and total Kjeldahl nitrogen
NC = Not calculated; insufficient number of detections to generate statistics

Table 5-13. DST-MC8 (Upper West Martis Creek - West) Summary Statistics (WY 2018 - WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	22	100%	2.0	140	21	8.0	30	1.4
Total Phosphorus as P	µg/L	22	82%	10	78	33	29	20	0.61

Note:
µg/L = micrograms per liter; mg/L =milligrams per liter; NTU = nephelometric turbidity units.
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit.
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
Total Nitrogen is the sum of nitrite (as N), nitrate (as N) and total Kjeldahl nitrogen
NC = Not calculated; insufficient number of detections to generate statistics

Table 5-14. DST-MC9 (Upper West Martis Creek - East) Summary Statistics (WY 2018 - WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	22	95%	1.0	49	9	5.4	11	1.2
Total Phosphorus as P	µg/L	22	68%	10	60	24	22	14	0.60

Note:
µg/L = micrograms per liter; mg/L =milligrams per liter; NTU = nephelometric turbidity units.
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit.
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
Total Nitrogen is the sum of nitrite (as N), nitrate (as N) and total Kjeldahl nitrogen
NC = Not calculated; insufficient number of detections to generate statistics

Table 5-15. DST-MC10 (Lower Middle Martis Creek) Summary Statistics (WY 2020)

Constituent	Units	n	Percent Detection	Range		Mean	Median	Standard Deviation	Coefficient of Variation
				Min	Max				
Total Suspended Solids	mg/L	4	75%	1.0	7	3	1.5	3	1.2
Total Phosphorus as P	µg/L	4	50%	10	55	24	19	23	0.94

Note:
µg/L = micrograms per liter; mg/L =milligrams per liter; NTU = nephelometric turbidity units.
n = Number of samples
Percent Detection = percent of samples that were detected above the reporting limit.
Min values equal to reporting limit when percent detection is less than 100%
The Robust ROS method was used to calculate mean values when non-detects were present
Total Nitrogen is the sum of nitrite (as N), nitrate (as N) and total Kjeldahl nitrogen
NC = Not calculated; insufficient number of detections to generate statistics

5.3.3.2 Statistical Trends (Mann-Kendall)

Trends in TSS and total phosphorus concentrations over time are evaluated qualitatively by visually inspecting time-series plots and analytically using the Mann-Kendall test method. The results are summarized in Table 5-16 below. Trend evaluations were conducted on the combined ten-year dataset.

Table 5-16. Statistical Trends of Constituents of Concern at Tributary Monitoring Sites

	TSS	Total Phosphorus
DST-MC1	Decreasing	Decreasing
DST-MC4	Decreasing	Decreasing
DST-MC5	Decreasing	Decreasing
DST-MC7	Decreasing	Slightly Decreasing
DST-MC8	None	Slightly Decreasing
DST-MC9	None	Slightly Decreasing
DST-MC10	NC	NC

Note: Mann-Kendall (MK) Trend Analyses used to determine significance.
NC = Not calculated; insufficient data available

Table 5-16 primarily indicates deceasing trends or undiscernible trends (None). No increasing trends were observed at any site. Temporal trends were not calculated for site DST-MC10 since limited data was collected WY 2020 only. Trend analysis at DST-MC10 should be performed in the future when more data is available. To put the trend results in context, WY 2011, WY 2017 and WY 2019 were above average precipitation years and runoff generated during storm events in these years may differ from runoff generated during WY 2012 through WY 2015 and WY 2020, when the precipitation was below average, and from WY 2016 and WY 2018 which received near average precipitation. While decreasing trends are encouraging and have been observed in recent years, these results are partially attributed to differences in hydrologic conditions and do not necessarily reflect stormwater management improvements in the watershed.

5.3.3.3 Statistical Comparisons (t-tests)

Statistical comparisons (two-sided t-tests at the 95 percent confidence level) were conducted using the complete datasets of TSS and total phosphorus for all sites to determine whether concentrations at a given site are significantly greater than concentrations observed at another site. The results of all statistical comparisons are presented in Table 5-17 and are summarized as follows for the sites monitored in WY 2020:

- TSS concentrations at DST-MC4 (West Martis Creek) were found to be significantly greater than the TSS concentrations at DST-MC1 (Martis Creek Downstream), DST-MC5 (Martis Creek Upstream), and DST-MC9 (Upper West Martis Creek – East);
- TSS concentrations at DST-MC1 (Martis Creek Downstream), DST-MC4 (West Martis Creek), and DST-MC5 (Martis Creek Upstream) were found to be significantly greater than the total phosphorus concentrations at DST-MC7 (Upper Middle Martis Creek), DST-MC8 (Upper West Martis Creek – West) and DST-MC9 (Upper West Martis Creek – East).

High TSS concentrations observed at DST-MC4 (West Martis Creek) and DST-MC8 (Upper West Martis Creek – West) can likely be attributed to development in the Northstar Ski Resort and surrounding area. Traction abrasives applied to roadways, ski run erosion, and channel erosion due to hydromodification are all plausible sources of TSS in the West Martis Creek watershed. The lower total phosphorus at DST-MC7 (Upper Middle Martis Creek), DST-MC8 (Upper West Martis Creek – West) and DST-MC9 (Upper West Martis Creek – East) may be an indication that upper portions of the Martis Creek watershed are not significant phosphorus sources.

Statistical differences cannot yet be discerned for many comparisons despite ten years of data collection. The number of additional samples required to determine significance (as indicated by power analysis results) varies greatly for each comparison being performed. For many comparisons, mean values between the two groups are similar and there is large variability in each dataset. Statistical differences may therefore never be discernable for all comparisons presented in Table 5-17.

Table 5-17. Statistical t-test Results for Constituents of Concern at Tributary Monitoring Sites[1]

Constituent	Site	DST-MC2	DST-MC3	DST-MC4	DST-MC5	DST-MC6	DST-MC7	DST-MC8	DST-MC9	DST-MC10
TSS	DST-MC1	None	None	MC4>MC1	None	MC1>MC6	None	MC8>MC1	None	None
	DST-MC2		MC2>MC3	MC4>MC2	None	MC2>MC6	None	None	None	None
	DST-MC3			MC4>MC3	None	None	None	MC8>MC3	None	None
	DST-MC4				MC4>MC5	MC4>MC6	None	None	MC4>MC9	None
	DST-MC5					None	None	MC8>MC5	None	None
	DST-MC6						None	None	None	None
	DST-MC7							None	None	None
	DST-MC8								None	MC8>MC10
	DST-MC9									None
Total Phosphorus	DST-MC1	None	None	None	None	None	MC1>MC7	MC1>MC8	MC1>MC9	None
	DST-MC2		MC3>MC2	None	None	None	None	MC2>MC8	MC2>MC9	None
	DST-MC3			MC3>MC4	None	None	MC3>MC7	MC3>MC8	MC3>MC9	None
	DST-MC4				None	None	MC4>MC7	MC4>MC8	MC4>MC9	None
	DST-MC5					None	MC5>MC7	MC5>MC8	MC5>MC9	None
	DST-MC6						MC6>MC7	MC6>MC8	MC6>MC9	None
	DST-MC7							None	None	None
	DST-MC8								None	None
	DST-MC9									None

5.3.4 Tributary Level Discussion

The results for each of the tributary sites are discussed further in this section in terms of watershed characteristics and land uses and how they may relate to pollutant concentrations in Martis Creek. Table 5-18 summarizes the tributary level results by presenting mean concentrations for TSS and total phosphorus at each of the monitoring sites and provides a comparison to the regulatory water quality objectives that have been defined for the mouth of Martis Creek. The results to date indicate that Martis Creek is exceeding the water quality objective for total phosphorus at six of the ten monitored locations. Only the monitoring locations located in upper elevations of the watershed (DST-MC7, DST-MC8, DST-MC9) and lower Middle Martis Creek (DST-MC10), which has limited data, had mean total phosphorus concentrations below the water quality objective. However, it should be noted that the water quality objectives are established for the mouth of Martis Creek where it discharges to the Truckee River, and no data has been collected at this location as part of TRWQMP implementation.

Table 5-18. Tributary Level Summary of Mean Pollutant Concentrations (All Water Years)

Sites		Mean TSS (mg/L)	Mean Total Phosphorus (µg/L)
Martis Creek at Mouth	***TRWQMP Objectives***	***N/A***	***50***
Martis Creek at Martis Creek Lake	DST-MC1	13	63
East Martis Creek	DST-MC2	11	53
Middle Martis Creek	DST-MC3	7.4	72
West Martis Creek	DST-MC4	19	61
Martis Creek (Upstream)	DST-MC5	9.1	65
Unnamed Tributary	DST-MC6	5.7	78
Middle Martis Creek	DST-MC7	18	41
Upper West Martis Creek (West)	DST-MC8	20	33
Upper West Martis Creek (East)	DST-MC9	9.0	24
Middle Martis Creek	DST-MC10	2.6	24

Meets TRWQMP Objective
Exceeds TRWQMP Objective
No TRWQMP Objective

5.3.4.1 DST-MC1 (Martis Creek at Martis Creek Lake)

This monitoring site is located in Martis Creek near Martis Creek Lake (Figure 5-16) and is downstream of all tributary confluences. This site had concentrations of TSS in the moderate/high range when compared to the other tributary sites. The mean concentration of total phosphorus exceeded the established water quality objective at this location indicating elevated phosphorus loads into Martis Creek Lake.

Figure 5-16
Site DST-MC1 on 1/26/2020

5.3.4.2 DST-MC2 (East Martis Creek)

This site is located on East Martis Creek approximately 0.5 mile upstream of its confluence with the main stem. The sub-watershed for this site consists of 100 percent pervious, upland meadow and forest with some dirt roads and legacy impacts. The mean TSS and total phosphorus concentrations at this site ranked near the middle when compared to the other tributary sites. The higher particulate concentrations at this site are somewhat unexpected given the minimal development in the sub-watershed but may be attributed to erosion of dirt roads, channel downcutting, or other legacy impacts of past disturbances. A photograph of East Martis Creek at the sampling location is presented in Figure 5-17. Monitoring at this site was discontinued during WY 2020 as part of the TRWQMP's adaptive management process

Figure 5-17
Site DST-MC2 looking downstream toward Martis Creek Lake on 1/3/2019

5.3.4.3 DST-MC3 (Lower Middle Martis Creek)

This monitoring site is located on Middle Martis Creek approximately 250 feet upstream of its confluence with the main stem. The sub-watershed for this site consists of upland forest and meadow with some dirt roads as well as an approximately four-mile section of SR 267. This portion of SR 267 includes a steep grade to Brockway Summit where traction sand is applied during winter driving conditions. In 2016, the Truckee River Watershed Council completed a restoration project for Middle Martis Creek (Figure 5-18). The intent of this project was to divert the majority of stream discharge into the meadow setting on the north side of SR 267. In doing so, the quantity of discharge reaching site DST-MC3 was greatly reduced, and this site is no longer representative of water quality in Middle Martis Creek. Site DST-MC10 was established in the new channel of lower Middle Martis Creek in WY 2020.

Figure 5-18
The newly constructed Middle Martis Creek channel diverts stream flows away from site DST-MC3

5.3.4.4 DST-MC4 (West Martis Creek)

DST-MC4 is located on West Martis Creek approximately 0.5 miles upstream of its confluence with the main stem. West Martis Creek originates within the Northstar ski resort and flows through the Northstar residential development and golf course (Figure 5-19). The mean concentrations of TSS and total phosphorus were moderate/high relative to the other tributary sites. The high pollutant concentrations observed at DST-MC4 can likely be attributed to development in the Northstar area. Traction abrasives applied to roadways, ski run erosion, channel erosion due to hydromodification, and golf course fertilization are all plausible sources of constituents of concern.

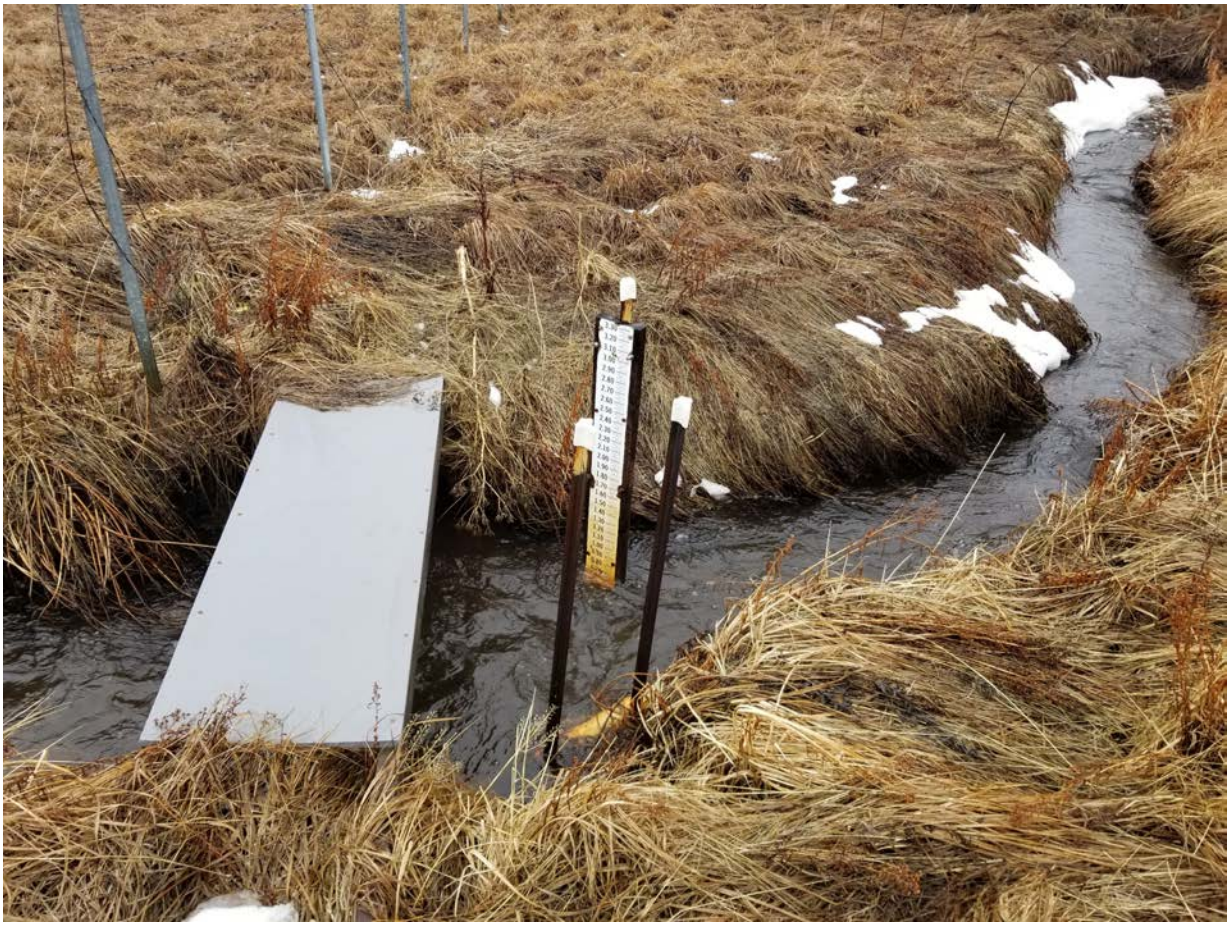


Figure 5-19
Site DST-MC4 looking upstream towards Northstar Golf Course on 1/26/2020

5.3.4.5 DST-MC5 (Martis Creek)

This site is located on the main stem of Martis Creek approximately 100 feet downstream of an unnamed tributary that receives flow from a portion of the Lahontan development and a dirt road. This site is located upstream of all major tributary confluences, and its sub-watershed consists of a portion of the Northstar ski resort, upland forest and meadow with some dirt roads, and the developed residential areas of Lahontan Golf Club and Martis Camp. This site has a large sub-watershed and receives more flow than the other tributary sites (except for DST-MC1). Site DST-MC5 had high concentrations of total phosphorus and moderate concentrations of TSS relative to the other tributary sites. A photograph of the site is provided in Figure 5-20.

Figure 5-20
Site DST-MC5 with staff gage and instrumentation on 3/26/2020

5.3.4.6 DST-MC6 (Unnamed Tributary)

This site is located on an unnamed tributary of Martis Creek approximately 100 feet downstream of Martis Lake Road. This site had the lowest flow rates of all tributary sites due to its relatively small and flat watershed which consists of commercial development, a portion of the Truckee Tahoe Airport, and open meadow areas. After discharging from the developed areas, runoff flows through a meadow where infiltration and treatment can occur as shown in Figure 5-21. This site had low concentrations for TSS, but it had the highest mean concentration of total phosphorus. These relatively high total phosphorus concentrations could be attributed to long contact times with living and decaying vegetation which is present in the meadow area upstream of the monitoring site. Monitoring at this site was discontinued during WY 2018 as part of the TRWQMP's adaptive management process.

Figure 5-21
Low flow snowmelt event at Site DST-MC6 on 3/20/17

5.3.4.7 DST-MC7 (Middle Martis Creek)

Site DST-MC7 is located on Middle Martis Creek upstream of Martis Valley. The site is located just above the Middle Martis Restoration Project that was completed by the Truckee River Watershed Council in 2016. This segment of Middle Martis creek collects runoff from SR 267 and the undeveloped corridor between Martis Valley and Brockway Summit. This site had the third highest mean concentration of TSS low concentrations of total phosphorus when compared to the other tributary sites. This can likely be attributed to runoff from SR 267 where traction abrasives are applied to the roadway during winter months and subsequently transported to Middle Martis Creek during stormwater runoff events. The high TSS at this site can also be attributed to the relatively steep channel gradient which creates turbulence and decreases sediment settling rates. As indicated by data collected from DST-MC10 in lower Middle Martis Creek, it is likely that a significant portion of the TSS measured at this site is deposited in the restored channel and meadow located downstream. A photograph of site DST-MC7 is provided in Figure 5-22.

Figure 5-22
Site DST-MC7 with staff gage and instrumentation on 1/26/2020

5.3.4.8 DST-MC8 and DST-MC9 Upper West Martis Creek

These monitoring sites are located in two separate branches of upper West Martis Creek near the Northstar ski resort. The sites are located south of Northstar Drive just upstream of the point where the two channels converge. Site DST-MC8 (west branch) receives runoff from the Northstar ski resort, Northstar Village, single and multi-family residential, Highlands View Road, and unpaved roads and trails. The DST-MC9 (east branch) watershed is primarily undeveloped and includes Highlands View Road, forested uplands, and unpaved roads and trails. Flows in the east branch are partially regulated by releases from Sawmill Lake where commercial fishing operations occur during the summer months. Photographs of site DST-MC8 and DST-MC9 are provided in Figure 5-23 and Figure 5-24, respectively.

Both sites had low concentrations total phosphorus relative to the other tributary sites. DST-MC8 had the highest mean concentration for TSS while the mean TSS concentration at DST-MC9 was substantially lower which may demonstrate that the high TSS at DST-MC8 is associated with the Northstar development.

Figure 5-23
Site DST-MC8 looking upstream on 1/26/2020

Figure 5-24
Site DST-MC9 looking upstream on 1/26/2020

5.3.4.9 DST-MC10 (Middle Martis Creek)

Site DST-MC10 is located on lower Middle Martis Creek in the Martis Valley just upstream of the confluence with Martis Creek. The site is located below the Middle Martis Restoration Project that was completed by the Truckee River Watershed Council in 2016. This segment of Middle Martis creek collects runoff from SR 267 and the undeveloped corridor between Martis Valley and Brockway Summit. WY 2020 was the first year this site was monitored, and data is therefore limited at this time. However, preliminary data indicate that the restoration project and meadow setting is effective in reducing TSS concentrations. A photograph of site DST-MC7 is provided in Figure 5-25.

Figure 5-25
Site DST-MC10 looking upstream on 1/26/2020

5.3.5 QA/QC Results

Upon receipt from the laboratory, each analytical report was thoroughly reviewed, and the data were evaluated to determine if it met the study objectives. Initially, the data were screened for the following major items:

- A 100 percent check between electronic data provided by the laboratory and the hard copy reports;

- Conformity check between the chain-of-custody forms, compositing protocol, and laboratory reports;
- A check for laboratory data report completeness; and
- A check for typographical errors on the laboratory reports.

After performing the data screening, the laboratory was notified of any deficiencies, if any, detailing the problems encountered during the initial screening process.

Following the initial screening, a more complete QA/QC review was performed which included an evaluation of accuracy, precision, and data quality. Accuracy was evaluated by reviewing MS, MSD, and LCS recoveries; precision was evaluated by reviewing field duplicate, spike duplicate and laboratory sample duplicate RPDs. The data quality assessment was based upon review of holding times, method blank contamination, laboratory blanks, laboratory control samples, laboratory duplicates, matrix spikes and matrix spike duplicates, reporting limits, and field duplicates. Based on the data review, none of the constituent results were rejected. Appendix D provides the detailed descriptions of specific items that were evaluated during the QA/QC review process and data that were qualified as estimated due to QC exceedances.

5.4 Gaging Stations: WY 2020 Discharge and Suspended Sediment Load Summary

The WY 2020 discharge monitoring results from the West Martis Creek gaging station (TURB-MC1), Mainstem Martis Creek gaging station (TURB-MC2), Middle Martis Creek gaging station (TURB-MC4), and Upper West Martis Creek gaging station (TURB-MC5) are presented in this section. Gaging stations at TURB-MC1 and TURB-MC2 were installed in October 2012 as described in Section 4 and were relocated in WY 2014 to optimize and better characterize conditions within these streams. The gaging station at TURB-MC4 was installed in February 2015 in order to monitor discharge from the Middle Martis tributary. The newest gaging station, TURB-MC5, was installed in January 2020 to evaluate stream conditions in upper West Martis Creek near the Northstar Ski Resort. Data from each station provide complete, near-continuous records (15-minute) of discharge used for computation of daily discharge, annual peak discharge, and total annual discharge volumes. Stage-to-discharge rating curves are provided in Appendix E.

In combination with suspended-sediment sampling and near-continuous turbidity monitoring, discharge data were also used to compute near-continuous records of suspended-sediment loading at all stations. Suspended-sediment daily and total annual loads were computed using two methods as described in detail in Section 4.4.3. These include: 1) using a near-continuous record of turbidity, and 2) by using discharge-to-sediment load correlations. Near-continuous turbidity monitoring allows for detection of turbidity or suspended-sediment loading events that may be unrelated to changes in discharge. Alternatively, development of discharge-to-sediment load rating curves provides a means to evaluate changes in sediment production over time. Field observation logs and computed suspended-sediment loading rates for each site are provided in Appendix E.

5.4.1 West Martis Creek: Site TURB-MC1

West Martis Creek gaging station (TURB-MC1) monitors a 5.2 square mile watershed with legacy impacts from logging and grazing, and which now includes portions of Tahoe National Forest, Northstar ski resort and golf course, and residential areas. This station is located on an inactive alluvial fan characterized by anastomosing channels and groundwater mounds or springs. The station is located at the property boundary between the Northstar Golf Course and United States Army Core of Engineers (USACE) lands. In most cases, the main channel captures the entirety of discharge but at extreme high flows an estimated 10 to 20 percent of the total discharge bypasses the gage in other secondary channels.

5.4.1.1 Daily and Annual Discharge

A stage-to-discharge rating curve for West Martis Creek was developed using data from WY 2014 through WY 2020 (Appendix E). Each year, new measurements may necessitate a revised rating curve or shifting the existing curve to account for channel filling or scour. Daily mean and maximum discharge are presented graphically in Figure 5-26, and a description of the WY 2020 discharge in West Martis Creek is presented below.

Baseflow in October, the beginning of WY 2020, averaged roughly 1.2 cfs. Rain in late November and early December increased daily mean discharge through mid-December. Several storms of mixed precipitation (rain and snow) affected the region in late November and early December 2019. A mixed precipitation event on November 30 and December 1, 2019 resulted in the annual peak flow of 13 cfs. A small precipitation event in early February resulted in another peak flow of 12 cfs on February 4, 2020. February remained unseasonably dry and winter baseflow averaged 2 cfs. Snowmelt began in March and increased through April with daily mean flows exceeding 3 cfs throughout the month and into the beginning of May. Peak snowmelt discharges of 6.9 and 6.8 cfs were recorded on March 27, 2020 and March 31, 2020, respectively. Snowmelt recession continued through the beginning of June with daily mean baseflow recorded less than 1 cfs after June 10, 2020. Baseflow continued to recede through the summer and averaged between 0.6 cfs and 0.1 from July through the end of the water year. In WY 2020, the estimated annual mean discharge for West Martis Creek was 1.6 cfs and the total annual discharge volume was 1,169 acre-feet.

5.4.1.2 Suspended-Sediment Loads

Appendix E includes a log of samples collected from West Martis Creek and analyzed for SSC with associated computed suspended-sediment loading rates for WY 2015 through WY 2020. A description of annual suspended-sediment loads at this station is provided below.

Suspended-sediment loads computed using a record of near-continuous turbidity is graphically included in Figure 5-26. During much of the year, daily suspended-sediment loads were less than 0.05 tons/day. A daily peak load of 0.06 tons/day was recorded on December 1, 2019 as the result of a rain-on-snow event. In contrast, the peak daily load of 0.04 tons/day was computed for peak snowmelt runoff on April 12, 2020. The total annual load for WY 2020 was calculated to be 5 tons (0.014 tons/day).

5.4.2 Mainstem Martis Creek (TURB-MC2)

The Mainstem Martis Creek gaging station (TURB-MC2) monitors a 13.8 square mile watershed with legacy impacts from logging and grazing, and which now includes portions of Tahoe National Forest, Northstar ski resort, several golf resorts, rural residential and open space. This station is located upstream from the confluence with West Martis Creek and in a meadow system with a defined channel characterized by historical incision and moderate inset floodplain development. Higher-magnitude floods commonly occupy secondary channels and inundate adjacent meadow areas during discharges greater than approximately 85 cfs, roughly equivalent to the annual flood. Restoration of segments of Mainstem Martis Creek was completed in early WY 2020 (Hastings et al, 2016). Goals of the restoration efforts were focused on increasing overbank flooding and sediment retention. As a result, the project hopes to observe muted peak flow at this station and decreased suspended-sediment loads.

5.4.2.1 Daily and Annual Discharge

A stage-to-discharge rating curve for TURB-MC2 was developed using data from WY 2014 through WY 2020 (Appendix E). A station observation log with manual discharge measurements is located in Appendix E. Daily mean and maximum discharge are presented graphically in Figure 5-27, and a description of the WY 2020 discharge for this station is presented below.

Baseflow in the beginning of WY 2020 averaged between 5 cfs and 6 cfs. Rain in late November and early December increased mean daily discharge through mid-December. Several storms of mixed precipitation (rain and snow) affected the region in late November and early December 2019. A rain-on-snow event on December 7, 2019 resulted in a peak discharge of 31 cfs and a rain on snow event on March 31, 2020 resulted in the annual peak discharge of 49 cfs. Snowmelt began in March and peak discharge from snowmelt runoff of 37 cfs occurred on April 7, 2020. Snowmelt continued through May with daily mean discharge dropping below 10 cfs in late May 2020. Sustained baseflow was recorded in August with daily mean discharge ranging between 1 and 3 cfs for the rest of the water year. In WY 2020, the estimated annual mean discharge for Mainstem Martis Creek was 7 cfs and the total estimated annual discharge volume was 5,214 acre-feet.

5.4.2.2 Suspended-Sediment Loads

Appendix E includes a log of samples collected from Mainstem Martis Creek and analyzed for SSC with associated computed suspended-sediment loading rates for WY 2013 through WY 2020. A description of annual suspended-sediment loads at this station is provided below.

Suspended-sediment loads computed primarily using a record of near-continuous turbidity are graphically included in Figure 5-27. During most of the year, daily suspended-sediment loads were less than 0.05 tons/day. Higher mean daily loads of 0.15 tons/day to 0.18 tons/day were measured during the peak snowmelt runoff months of March and April. Rain-on-snow events in late November and early December did not generate measurable daily suspended-sediment loads in contrast to other stations; these findings may be the result of recent restoration in Mainstem Martis Creek. Total annual load was calculated to be 14 tons (0.04 tons/day).

5.4.3 Middle Martis Creek (TURB-MC4)

Middle Martis Creek station (TURB-MC4) monitors a 4.3 square mile watershed with known impacts from current and legacy logging activities which now includes portions of Tahoe National Forest, Sierra Pacific Industries (private), SR 267 and open space. Discharge gaging data at this location is provided courtesy of Truckee River Watershed Council (TRWC).

This station is located upstream from the confluence with Martis Creek at the head of an alluvial fan with a defined channel that has experienced recent incision and some bank instabilities. Discharge in Middle Martis Creek is flashy with rapid rises in stage as the result of runoff from adjacent SR 267. In WY 2017, Middle Martis Creek was restored below the monitoring station to relocate peak discharges to the former channel, located north of SR 267. Baseflow continues to support a wetted channel on the south side of SR 267.

5.4.3.1 Daily and Annual Discharge

This gage was installed in WY 2013 and a stage-to-discharge rating curve was developed using data from WY 2013 through the current water year (Appendix E). A station observation log with manual discharge measurements is located in Appendix E. WY 2020 daily mean and maximum discharge is presented graphically in Figure 5-28, and a description of the annual discharge for this station is presented below.

Baseflow in the beginning of WY 2020 averaged between 0.3 cfs and 0.6 cfs. Several storms of mixed precipitation (rain and snow) affected the region in late November and early December 2019 increased average discharge through mid-December. The early December storm resulted in an annual peak discharge of 10.6 cfs. Mean daily discharge for the month of December was 1.8 cfs. Spring snowmelt began in March and a late March precipitation event increased discharge to 7.4 cfs. Another snowmelt peak discharge of 7.3 cfs was recorded on April 8, 2020. Daily discharge fell below 1 cfs in mid-May and was below 0.2 in early July. Discharge remained between 0.1 and 0.2 cfs for the rest of the water year. In WY 2020, the annual mean discharge for Middle Martis Creek was 0.9 cfs and the total annual discharge volume was 652 acre-feet.

5.4.3.2 Suspended-Sediment Loads

Appendix E includes a log of samples collected from Middle Martis Creek and analyzed for SSC with associated computed suspended-sediment loading rates for WY 2013 through WY 2020. A description of annual suspended-sediment loads at this station is provided below.

Suspended-sediment loads computed using discharge-based method is graphically included in Figure 5-28. During much of the year, daily suspended-sediment loads averaged below 0.01 tons. Higher loads over 0.2 tons/day were measured during rain and rain-on-snow events in early December 2019. Higher daily mean loads of 0.1 tons/day were measured during the peak snowmelt runoff in April. Total annual load was calculated to be 8 tons (0.02 tons/day).

5.4.4 Upper West Martis Creek (TURB-MC5)

Upper West Martis Creek station (TURB-MC5) monitors a 2.2 square mile watershed with cumulative impacts from legacy logging, road building, and residential and ski-area development. This station is located upstream of station TURB-MC1 (West Martis Creek) within a residential area upstream of the Northstar Golf Course. The station is on the west fork of upper West Martis Creek. The east fork of upper West Martis Creek drains a largely undeveloped area and includes a small reservoir. TURB-MC5 was installed and instrumented on January 10, 2020.

5.4.4.1 Daily Stage and Manual Discharge Measurements

A stage-to-discharge rating curve is still under development for this station. Daily mean stage is presented graphically in Figure 5-29, and a description of the partial WY 2020 record of stage is presented below.

Manual streamflow measurements of winter baseflow ranged between 0.6 and 0.7 cfs. Spring snowmelt began in March and a manual discharge measurement of 2.6 cfs was conducted on April 12, 2020. Snowmelt peak stage was recorded on April 28, 2020. Snowmelt runoff continued through June. July baseflow measurements were around 0.2 cfs. A total discharge volume could not be accurately estimated at this site for WY 2020.

5.4.4.2 Suspended-Sediment Loads

Appendix E includes a log of water samples collected from Upper West Martis Creek and analyzed for SSC. Suspended-sediment loading rates will be computed once a stage-to-discharge rating curve is established and streamflow can be identified for each stage when water samples were collected.

5.4.5 Martis Creek Discharge Summary

A summary of discharge monitoring results over a continuous 10-year period are presented in Table 5-19 for Martis Creek. Annual discharge values for un-gaged tributaries were estimated based on the measured discharge volumes at gaging stations located in the Martis Creek Watershed, the USGS computed flow calculated for Martis Creek Reservoir under the Truckee River Operating Agreement (TROA), and the size of each tributary's sub-watershed as a percentage of the total watershed size. This approach assumes that the precipitation and runoff response in the tributaries was uniform over the entire watershed. Although differences in elevation, impervious area, land use, and other factors, are known causes of variation in the amount of runoff produced in each watershed, this assumption is considered to be reasonable for the purpose of estimating discharge for each un-gaged tributary area.

Table 5-19. Martis Creek Tributary Annual Discharge Volumes[1]

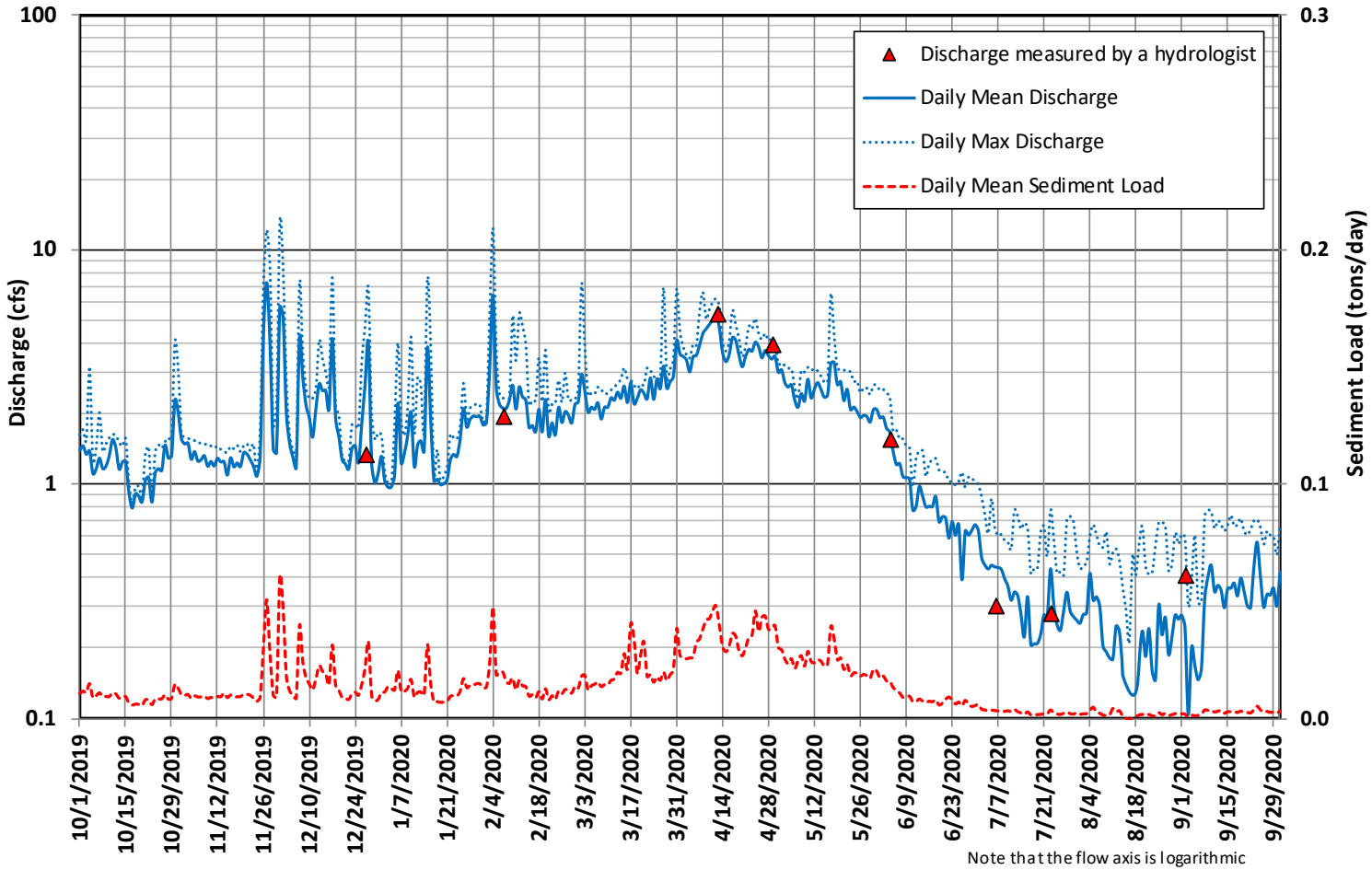
Station ID	Drainage Area (ac)	Percent of Martis Creek Sub-watershed	WY 2011 Total Flow (acre-ft)	WY 2012 Total Flow (acre-ft)	WY 2013 Total Flow (acre-ft)	WY 2014 Total Flow (acre-ft)	WY 2015 Total Flow (acre-ft)	WY 2016 Total Flow (acre-ft)	WY 2017 Total Flow (acre-ft)	WY 2018 Total Flow (acre-ft)	WY 2019 Total Flow (acre-ft)	WY 2020 Total Flow (acre-ft)
			Water Year Precipitation Category									
			Wet	Dry	Dry	Dry	Dry	Average	Wet	Average	Wet	Dry
DST-MC1/TROA[2]	22,360	100%	32,842	7,833	8,718	4,529	4,434	15,629	69,922	17,596	32,429	7,858
DST-MC2 / TURB-MC3	4,615	21%	6,778	1,617	1,747	724	715	***2,106***	***6,228***	***3,000***	***4,689***	510
DST-MC4 / TURB-MC1	3,320	15%	4,876	1,163	1,257	***637***	***614***	***1,483***	***5,176***	***1,948***	***2,810***	***1,169***
DST-MC5 / TURB-MC2	8,865	40%	13,021	3,105	***3,610***	***2,296***	***2,094***	***7,152***	***29,495***	***9,400***	***14,064***	***5,214***
DST-MC6	205	1%	301	72	78	32	32	249	1,679	136	584	23
DST-MC7 / TURB-MC4	2,730	12%	4,010	956	1,033	428	***572***	***1,448***	***5,851***	***1,368***	***2,810***	***652***
DST-MC8/ TURB-MC5	1,355	6%	1,990	475	513	213	210	1,647	11,095	900	3857	150
DST-MC9	1,190	5%	1,748	417	450	187	184	1,447	9,744	791	3388	132
Un-Gaged Area[3]	2,625	12%	3,856	920	994	412	407	3,191	21,493	1,744	7472	290

Notes:

[1] Bold italic values represent gaging station measurements

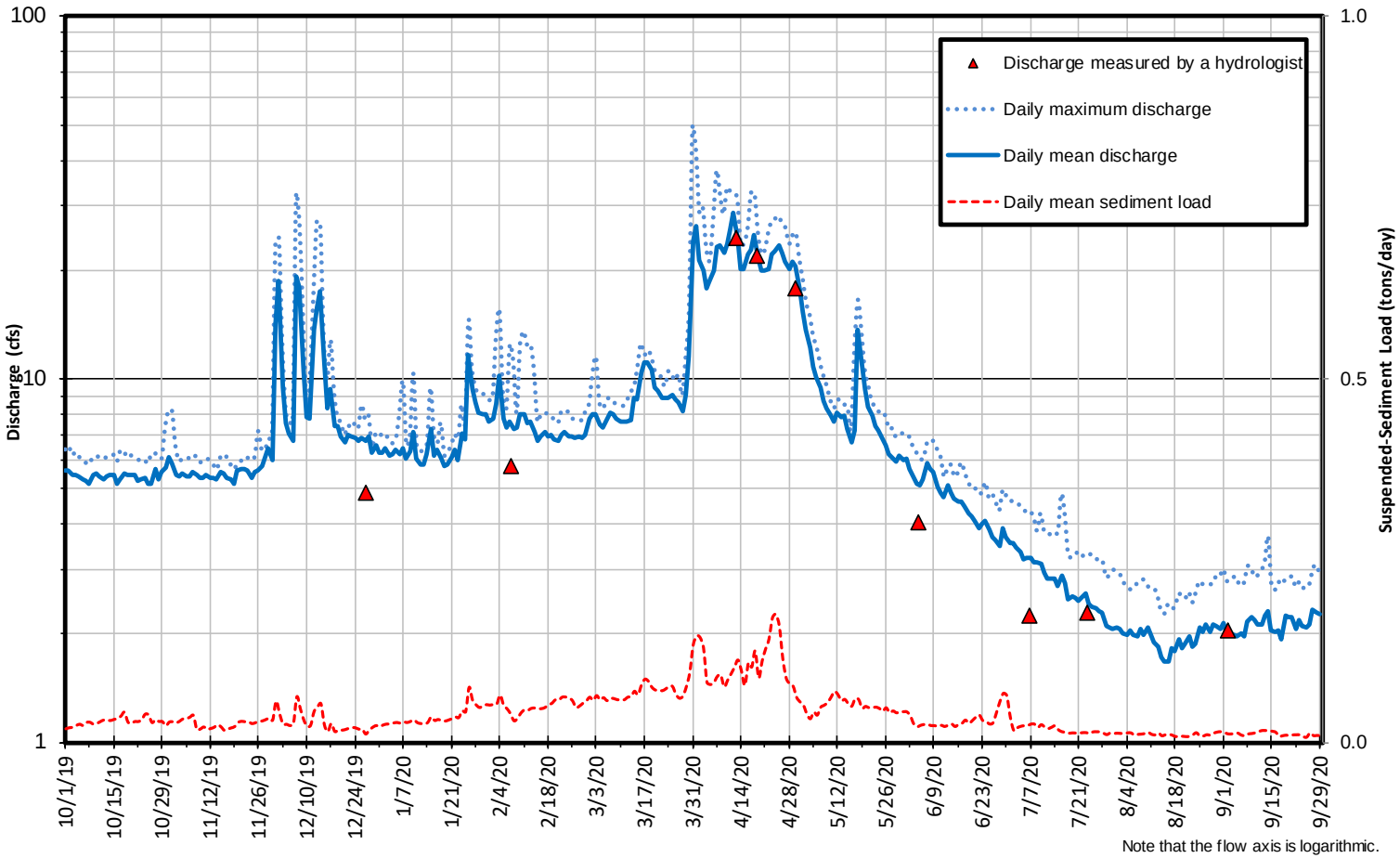
[2] USGS computed flow data for Martis Creek Reservoir near Truckee (TROA, 2020)

[3] Un-gaged drainage area includes an unnamed branch of Martis Creek and the area upstream DST-MC1 and downstream of all other DST sites



Balance Hydrologics

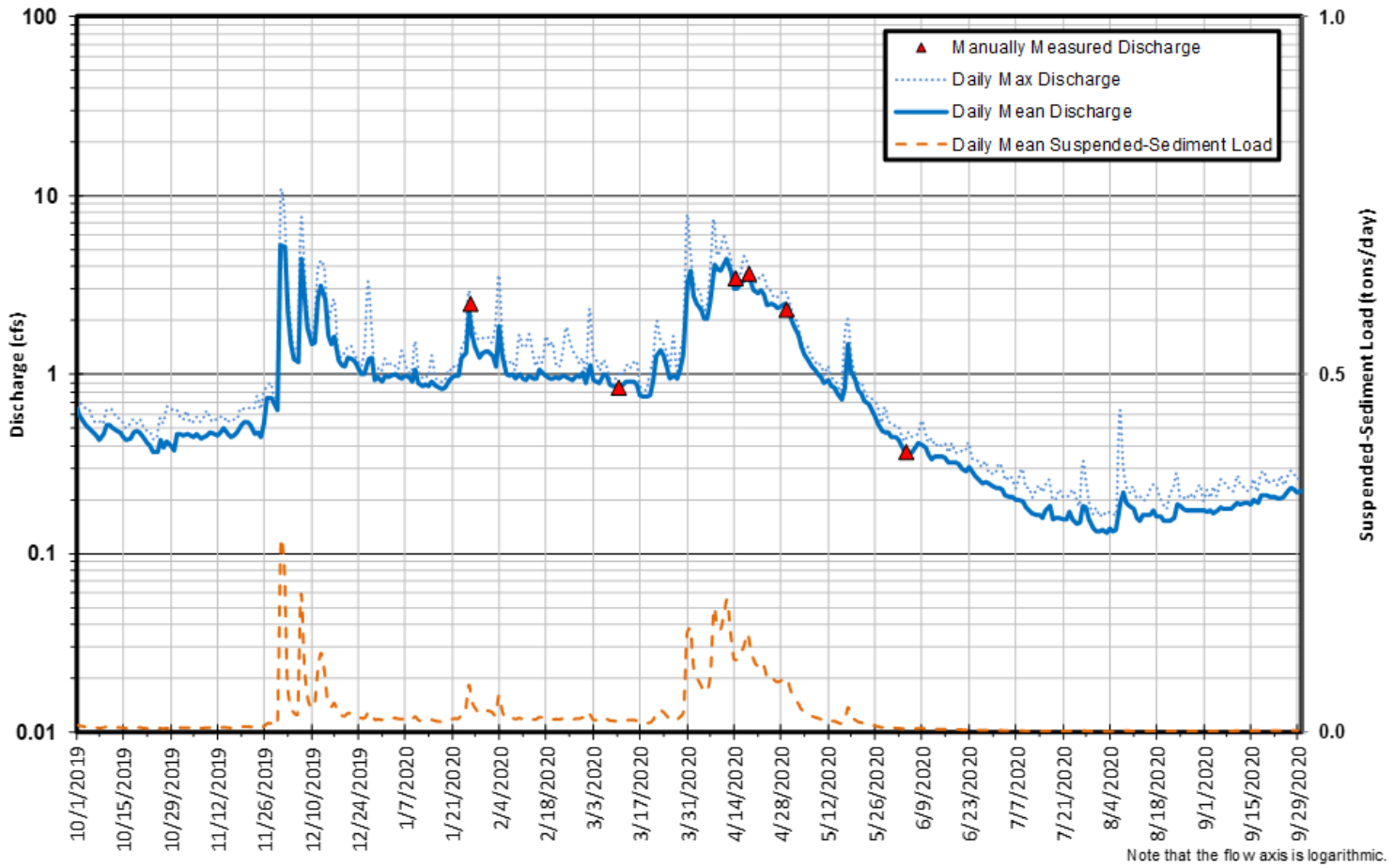
Figure 5-26
Daily Mean and Maximum Discharge Hydrograph and Daily Suspended-Sediment Loads
West Martis Creek, Station TURB-MC1, WY 2020



Balance Hydrologics

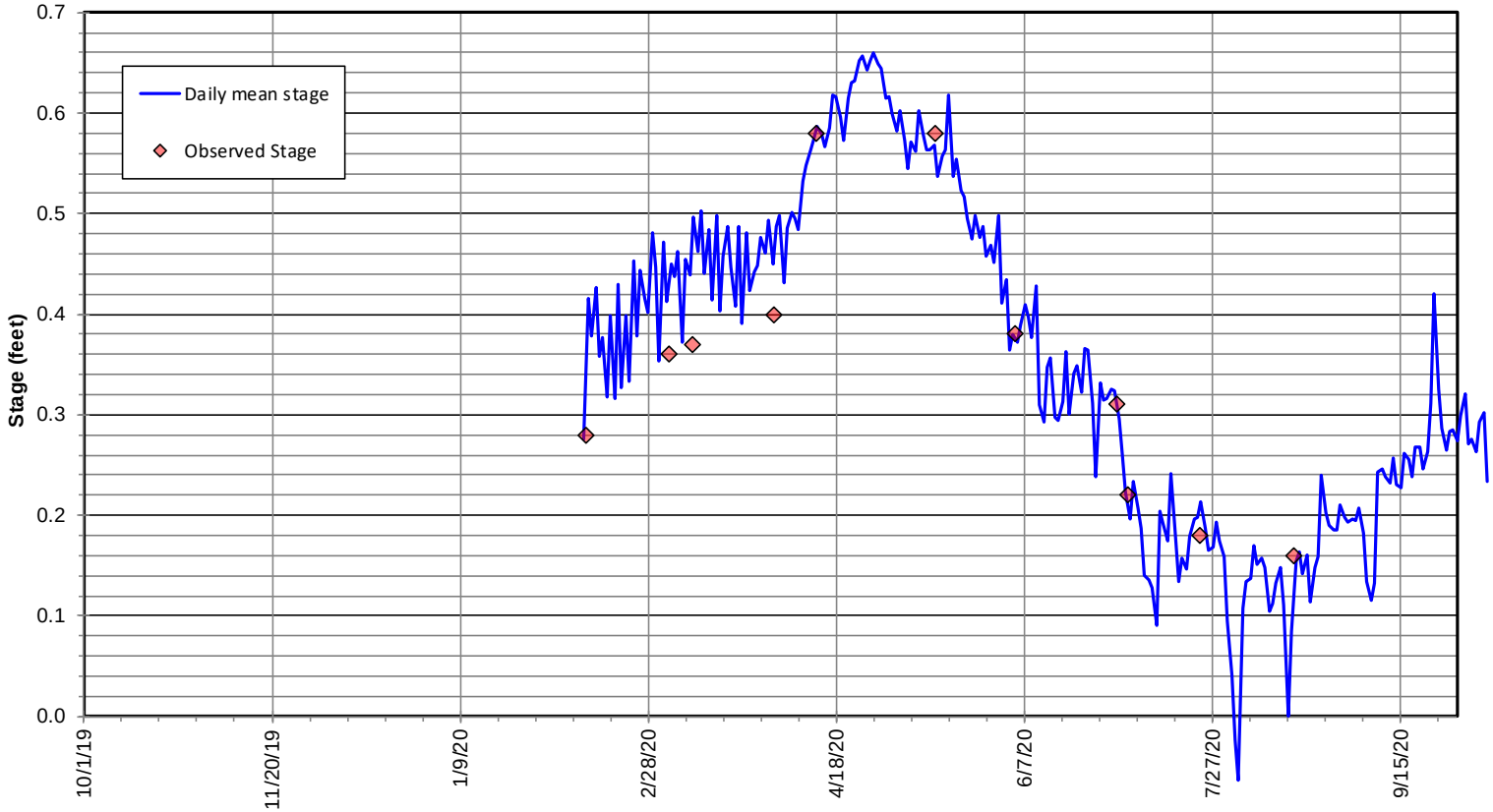
Figure 5-27
Daily Mean and Maximum Discharge Hydrograph and Daily Suspended-Sediment Loads
Mainstem Martis Creek, Station TURB-MC2, WY 2020

CDM Smith



Balance Hydrologics

Figure 5-28
Daily Mean and Maximum Discharge Hydrograph and Daily Suspended-Sediment Loads
Middle Martis Creek, Station TURB-MC4, WY 2020



Balance Hydrologics

Figure 5-29
Daily Stage
Upper West Martis Creek, Station TURB-MC5, WY 2020

CDM Smith

5.4.6 Martis Watershed Total Suspended-Sediment Load and Yield Summary

A summary of suspended-sediment load and yield values are presented in Table 5-20 for each of the three co-located turbidity and gaging stations in operation during WY 2020. Yield values are calculated by dividing the suspended-sediment load by the drainage area to provide a normalized value for comparison of sediment production between sub-watersheds.

Table 5-20. WY 2020 Suspended-Sediment Load and Yield Summary

Station	Stream	Area (mi^2)	Load (tons)	Yield (ton/mi^2)
TURB-MC1	West Martis	5.2	5	1.0
TURB-MC2	Mainstem Martis	13.8	14	1.0
TURB-MC4	Middle Martis	4.3	8	1.9

Annual suspended-sediment loads ranged between 5 tons (West Martis, TURB-MC1) and 14 tons (Mainstem Martis Creek, TURB-MC4). When normalized by watershed area, the WY 2020 suspended-sediment yield for West Martis Creek (TURB-MC1) and Mainstem Martis Creek (TURB-MC2) are both estimated at 1.0 ton/square mile. Middle Martis Creek exhibited the highest yield, estimated to be 1.9 tons/square mile. While geology differs slightly among the watersheds, the main difference with Middle Martis Creek is the presence of SR 267 and its ability to rapidly generate runoff and deliver it directly to the creek. Winter-applied road traction sand and road-side ditch erosion are likely contributors to higher suspended-sediment yields. Multiple years of data collection have consistently indicated higher yields in the Middle Martis Watershed and suggest that drainage improvements and road sand capture could reduce sediment loading in the watershed (Table 5-21).

Table 5-21. Martis Creek Tributary Annual Suspended-Sediment Yields, WY 2013 - WY 2020

Station ID	Drainage Area (mi^2)	Percent of Martis Creek Sub-watershed	Total Annual Suspended-Sediment Yields (tons/sq. mile) by Water Year									
			WY 2011	WY 2012	WY 2013	WY 2014	WY 2015	WY 2016	WY 2017	WY 2018	WY 2019	WY 2020
			Water Year Type									
			Wet	Dry	Dry	Dry	Dry	Average	Wet	Average	Wet	Dry
West Martis Creek TURB-MC1	5.2	15%	--	--	2.9	1.8	0.8	4.2	10	4.1	3.8	1.0
Martis Creek (main stem above 267) TURB-MC2	13.8	40%	--	--	3.2	1.3	0.8	5.3	12.5	2.2	3.2	1.0
Middle Martis Creek (above confluence) TURB-MC4	4.3	12%	--	--	--	--	3.4	10	39.3	9.9	10.1	1.9

Notes:

Bold values represent loads calculated using a record of near-continuous turbidity; all other loads computed using either streamflow-based load computation or combination of turbidity-based and streamflow--based calculations.

Italic values represent partial water year data.

Mainstem Martis Creek and West Martis Creek turbidity probes installed in WY2013.

Middle Martis Creek turbidity probe installed in WY2015.

5.5 Rafting Segment Inspection Results

The results of the visual inspections and photo-monitoring conducted during WY 2020 along the segment of the Truckee River with commercial rafting are presented in this section. The rafting companies operate between Fanny Bridge (Highway 89) in Tahoe City to River Ranch near the intersection of Highway 89 and Alpine Meadows Road. In WY 2020, rafting companies operated primarily during July and August when water levels were suitable. Inspections were conducted later in the water year (October) when water levels were low (75cfs).

A total of 23 sites were inspected in WY 2020. They included:

- Seventeen previously identified sites from the Watershed Improvement Needs (WIN) Survey completed in 2006 (Placer, 2006);
- Two points of interest that were located during the 2016 inspection;
- Three Truckee River Stabilization and Restoration Projects completed in 2016; and
- One point of interest that was located during the 2020 inspection.

The location of each site along with its site ID is identified on Figures 4-7 and 4-8. The site ID designates river left (RL) or river right (RR) and the river mile from the Lake Tahoe Dam. The Truckee River Stabilization and Restoration Projects shown in Figures 4-7 and 4-8 were under construction during the time of the 2016 inspections. These sites were first inspected during WY 2018.

5.5.1 Inspection Results

Table 5-22 summarizes the results of the inspections at each of the 23 sites. Photographs of each site are provided in Appendix F. Table 5-22 is organized by site ID and includes site location, BMP description and site conditions, potential cause of observed problems, impact trend, and recommendations for mitigating any problems. Impact trends indicate if the potential water quality impacts are becoming worse ("downward" trend) or improving ("upward" trend). A "not apparent" impact trend indicates the WY 2020 inspection was unable to determine if the water quality impacts were worse or better since the previous inspection.

Downward trends were assigned to seven of the sites, indicating the potential for negative water quality impacts has increased. These sites include RR-0.22, RL-0.23, RL-0.57, RR-1.05, RR-2.17, RR-2.84 and RR-2.89. Causes for the downward trends include heavy use of the site by the public, improper installation of BMPs, and clogging of stormwater drainage structures. Recommendations included replacing existing structures with improved designs, regular maintenance, and restricting access in some areas to allow vegetation to become reestablished.

Upward trends were assigned to five of the sites, indicating the potential for negative water quality impacts has decreased. These sites included RR-0.88, RR-1.54, RR-1.59, RR-3.03, and RR-3.33. Improved conditions are associated primarily with the Truckee River Trail Stabilization and Restoration Project that was completed in 2018. This project included reconstruction of the entire length of bike trail from Tahoe City to River Ranch, rock energy dissipation at culverts, rock slope stabilization, paver installation, stair installation to improve access from the highway, and three restoration sites with in-stream improvements and ingress/egress improvements.

The remaining eleven sites were assigned the "not apparent" trend. These sites were located at river access points or former construction sites. No evidence was found that the access points were stabilizing or deteriorating. However, limiting access, providing engineered steps and/or reestablishing vegetation are recommended to further stabilize the riverbanks and limit erosion. The construction sites now have permanent BMPs in place to prevent erosion.

Table 5-22. Truckee River Rafting Segment Inspection Results

Site ID	Location	BMP Description and Site Condition	Potential Cause	Impact Trend	Recommendations
RR-0.22	River mile: 0.22 Stream bank: RIGHT Latitude: 39.165368 Longitude: -120.147393 Previous Site ID: PNS A	Moderate (2 ft.) bank erosion observed on right bank near river access trail. Bare soils may erode and contribute sediment to river. No erosion improvements made since 2018 inspections. No weed matting present.	A dirt trail provides public access to the river.	Downward	Restrict access to river in this location and stabilize bare soils.
RL-0.23	River mile: 0.23 Stream bank: LEFT Latitude: 39.16502 Longitude: -120.147152 Previous Site ID: WIN 1	A concrete landing and paver blocks on left bank provide stable river access from adjacent public parking lots. Bare soils and bank erosion exist immediately upstream of pavers which are not properly anchored and are migrating laterally.	Heavy public use and improper paver block installation.	Downward	Replace pavers with articulated block to prevent lateral migration; increase extent of block to stabilize bare soils.
RL-0.24	River mile: 0.24 Stream bank: LEFT Latitude: 39.164937 Longitude: -120.147416 Previous Site ID: WIN 2	Bare soils exist on steep bank adjacent to picnic area. Log terracing and paver block limit erosion but are need of maintenance/repair. Blocks have been further eroded and appear to be more sloped. Log terracing degraded with weeds growing under.	Heavy public use and improper installation of stabilization measures.	Not Apparent	Install steps to limit slope erosion; vegetate bare soil areas; replace pavers with articulated block to prevent lateral migration.
RL-0.27	River mile: 0.27 Stream bank: LEFT Latitude: 39.164563 Longitude: -120.147801 Previous Site ID: WIN 12	Minor erosion observed. Riverbanks are grass covered but show slightly more erosion than 2018 observations. Heavily accessed from bike path. Eurasian watermilfoil and floating algae are not present. Picnic table not present.	Public river access point and picnic area.	Not Apparent	Stabilize soils near picnic table to prevent erosion.
RR-0.33	River mile: 0.33 Stream bank: RIGHT Latitude: 39.163968 Longitude: -120.148654 Previous Site ID: WIN 4	Location was inaccessible due to Caltrans bridge construction during 2018 site visit. Permanent BMPs in place in 2020. Shoulder is stabilized and does not show signs of erosion.	Not applicable	Not Apparent	None

Site ID	Location	BMP Description and Site Condition	Potential Cause	Impact Trend	Recommendations
RL-0.35	River mile: 0.35 Stream bank: LEFT Latitude: 39.163667 Longitude: -120.148468 Previous Site ID: WIN 13	Location inaccessible due to Caltrans bridge construction during 2018 site visit. No signs of erosion. Rip rap under bridge in good condition.	Not applicable	Not Apparent	None
RL-0.57	River mile: 0.57 Stream bank: LEFT Latitude: 39.162212 Longitude: -120.151956 Previous Site ID: WIN 3	A severely eroded channel adjacent to a U.S. Forest Service road gate discharges to river in this location. Channel banks are bare and do not resist further erosion. Conditions have deteriorated since 2018 site visit, as channel appears deeper with steeper side slopes. The channel originally flowed through a culvert under road, but vegetation and debris (including a car tire) restrict flows at the culvert inlet. A separate rock armored channel downstream is stable.	A clogged culvert led to formation of secondary unprotected channel.	Downward	Remove vegetation and debris that restricts flows from entering the road culvert. Prevent flows from entering secondary channel or install a new larger culvert at eroding channel location and stabilize. In general, culverts should be inspected and maintained regularly.
RL-0.73	River mile: 0.73 Stream bank: LEFT Latitude: 39.162123 Longitude: -120.154887 Previous Site ID: PNS B	A spur trail off the Tahoe Rim Trail provides river access in this location. Bare soils exist on steep riverbank and are susceptible to erosion. Woody vegetation limits lateral bank erosion. Very similar conditions to 2018 site visit.	A dirt trail provides public access to the river that is not ideal for river access or regress.	Not Apparent	Stabilize bare soil areas; install steps to provide river access for Tahoe Rim Trail users.
RR-0.88	River mile: 0.88 Stream bank: RIGHT Latitude: 39.163423 Longitude: -120.157256 Previous Site ID: POI 1	The riverbanks receive heavy ingress/egress use which has resulted in bare soil areas susceptible to erosion. Bank conditions appear similar to 2018 with no significant erosion observed. Rock rip-rap was installed in 2018 near this site to stabilize the bank adjacent to bike trail.	Multiple river access/egress points exist in this area.	Upward	Highly disturbed access points should be stabilized with vegetation and/or articulated block; restrict access to steep trails showing signs of erosion; manage invasive weeds.
RR-1.05	River mile: 1.05 Stream bank: RIGHT Latitude: 39.163469 Longitude: -120.157706 Previous Site ID: POI 2	The culvert under multi-use trail at a Caltrans outfall is full of sediment and debris which will likely result in localized flooding and erosion.	Caltrans outfall and clogged trail culvert.	Downward	Remove sediment and debris from trail culvert to ensure capacity during storms.

Site ID	Location	BMP Description and Site Condition	Potential Cause	Impact Trend	Recommendations
RR-1.54	River mile: 1.54 Stream bank: RIGHT Latitude: 39.163769 Longitude: -120.168482 Previous Site ID: WIN 5	This site previously had significant erosion where a Caltrans outfall discharged across trail, undercutting trail and eroding riverbank.	Caltrans outfall	Upward	Clear culvert under road and clean or add rock around outlet for stabilization.
RL-1.59	River mile: 1.59 Stream bank: LEFT Latitude: 39.164039 Longitude: -120.169383 Previous Site ID: WIN 14	Heavy ingress/egress use has resulted in bare soils and erosion in multiple locations adjacent to Ellis Island. A specific problem on the left bank has not been identified. Restoration Site #1 has improved conditions on the right bank. Regress point on Ellis Island shows signs of erosion but are not of large concern.	Multiple river access/egress points exist in this area.	Not Apparent	Highly disturbed access points should be stabilized with vegetation and/or rock.
RR-1.59 Restoration Site #1	River mile: 1.59 Stream bank: RIGHT Latitude: 39.164039 Longitude: -120.169383 Previous Site ID: WIN 14	Paver blocks have been installed on edge of bike trail in areas where public usage is very heavy, and stairs provide stable access from highway in two locations. No significant bank erosion was observed, but eroding trails on road shoulder still exist and should be abandoned.	Multiple river access/egress points exist in this area.	Upward	Steps should be considered to improve ingress/egress from the river at Restoration Site #1. Dirt trails on steep road shoulder should be blocked off or abandoned.
RR-2.17	River mile: 2.17 Stream bank: RIGHT Latitude: 39.165746 Longitude: -120.179089 Previous Site ID: WIN 6	Paver blocks limit erosion at river access point on right bank, but they are not properly anchored and are migrating laterally. Bare soils exist around edges of pavers and are susceptible to erosion, and moderate (2 ft.) bank erosion observed immediately downstream of pavers. Invasive weeds including water hemlock, bull thistle, and cheatgrass exist in localized areas along multi-use trail. New wood block added as bench.	Heavy public use and improper paver block installation.	Downward	Replace pavers with articulated block to prevent lateral migration; increase extent of block to stabilize bare soils. Grade and stabilize river access to prevent further erosion.
RR-2.22	River mile: 2.22 Stream bank: RIGHT Latitude: 39.16666 Longitude: -120.18054 Previous Site ID: N/A	Moderate bank erosion with exposed roots and rock. This site was added from 2020 observations.	Heavy public use from direct access from adjacent bike path	Not Apparent	Vegetate bare soil and provide stabilization.

Site ID	Location	BMP Description and Site Condition	Potential Cause	Impact Trend	Recommendations
RL-2.40	River mile: 2.40 Stream bank: LEFT Latitude: 39.166915 Longitude: -120.183034 Previous Site ID: WIN 15	Moderate bank erosion with undercutting observed on left bank where areas of bare soil exist on Propane Point Island. Erosion is occurring where public access river near highway turnout. The highway slope is very weedy with cheatgrass and tumble mustard.	Multiple river access/egress points exist in this area.	Not Apparent	Revegetate bare soil areas on left bank and stabilize hillside; stabilize eroding highway bank; restrict river access from highway turnout or install stairs to prevent erosion. Upgrade wood retaining wall along bike path on east side.
RR-2.84	River mile: 2.84 Stream bank: RIGHT Latitude: 39.171805 Longitude: -120.188107 Previous Site ID: WIN 7	Rock protection was installed in 2018 to prevent erosion at culvert inlet and outlet. The culvert under highway is 80% clogged with sediment. Culvert under path is rusting. Sediment deposits at downstream outlet.	Lack of maintenance.	Downward	Clean out highway culvert to ensure sufficient capacity during storm or replace culvert.
RR-2.89	River mile: 2.89 Stream bank: RIGHT Latitude: 39.172465 Longitude: -120.188568 Previous Site ID: WIN 8	This location, referred to as Porta Potty Point, has had a raft landing area installed to provide access to portable rest rooms. Riverbanks appear stable and the improvements are effective. Vegetation to south has been trampled (above log).	Not applicable	Downward	Revegetate area adjacent to stabilized raft exit.
RR-3.03 Restoration Site #2	River mile: 3.03 Stream bank: RIGHT Latitude: 39.17416 Longitude: -120.18963	The restoration project appears effective overall, but bare soils still exist in areas where willow stakes were unsuccessful. Slower flows have accumulated milfoil and other potential algae growth.	Public river access point.	Upward	Vegetation monitoring should be performed, and new plantings installed as necessary to stabilize bare soils.
RL-3.08	River mile: 3.08 Stream bank: LEFT Latitude: 39.17481 Longitude: -120.189992 Previous Site ID: WIN 9	Previously identified gullies appear stable; area is lightly used and of minimal concern. No erosion or water quality issues observed on left bank. Heavy usage does occur on right bank where bare soils are susceptible to erosion.	Heavy public use.	Not Apparent	Stabilize bare soils on right bank and revegetate.
RR-3.33 Restoration Site #3	River mile: 3.33 Stream bank: RIGHT Latitude: 39.17805 Longitude: -120.19155	Site is stable and restoration appears effective. Vegetation has become re-established within floodplain. No erosion observed where public access river from highway.	Not applicable.	Upward	None

Site ID	Location	BMP Description and Site Condition	Potential Cause	Impact Trend	Recommendations
RL-3.39	River mile: 3.39 Stream bank: LEFT Latitude: 39.178388 Longitude: -120.192568 Previous Site ID: WIN 10	Bare soils exist, but area appears lightly used with no significant erosion. Right bank vegetated and appears stable (tree removal occurring on right bank). Left bank is stable (pine trees taking hold, no further erosion). Some undercutting occurring slightly downstream (gets little use, not of major concern but some bare soils could be revegetated).	Landslide deposition and public access/egress points.	Not Apparent	Monitor bank conditions on left and right banks.
RR-3.81	River mile: 3.81 Stream bank: RIGHT Latitude: 39.183349 Longitude: -120.195958 Previous Site ID: WIN 11	Bare soils exist on upper bank adjacent to multi-use trail. A steep river access trail is comprised of bare soils susceptible to erosion.	A dirt access/egress trail and remnants of an old roadway.	Not Apparent	Safety concern is elevated due to steeper slope. Install steps to limit erosion of access trail; vegetate bare soil areas in upper bank. Gravel should be redispersed on flat area to prevent sediment transport into river.

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Section 6
Discussion

This section provides an interpretation and discussion of the integrated results of the TRWQMP implementation activities completed to date. The information focuses primarily on new information from the WY 2020 monitoring activities, but also presents information from prior years to evaluate possible water quality trends. Information regarding water quality areas of concern and the effectiveness of MS4 permit activities is also included. Recommendations for TRWQMP adaptive management are presented in Section 8.

6.1 Integration of the Assessment Data

The results of various assessment types are evaluated from a holistic perspective to identify water quality related issues or problems that are supported by multiple lines of evidence, thereby increasing confidence in the conclusions, or where different data appear to contradict one another. The discussions are organized by watershed and include Squaw Creek and Martis Creek.

6.1.1 Squaw Creek

Bioassessments were conducted in Squaw Creek during WY 2020. This was the sixth round of bioassessments under the TRWQMP, with previous efforts completed in WY 2010, WY 2012, WY 2014, WY 2016, and WY 2018.

Observations made in the field during the Squaw Creek bioassessments indicate the predominance of decomposed granite (DG) sand and finer sediments in benthic habitat areas. Median particle size (D50) sizes measured during 2020 bioassessment surveys were 11, 5, and 8 mm at the upper, middle, and lower meadow sites, respectively. In addition, particles less than 2 mm (<2 mm) in diameter (i.e., "fines and sands" per the SWAMP definition) comprised 25, 41, and 30 percent of the bed substrate at these sites, and particles less than 3 mm (<3 mm) in diameter (i.e., "fines and sands" per the Squaw Creek sediment TMDL definition) comprised 29, 44, and 34 percent of the bed substrate at these sites in 2020, respectively. The percentage of particles <3 mm in diameter and D50 are the two physical habitat parameters identified as important indicators of habitat suitability for aquatic life in the context of the Squaw Creek sediment TMDL. The numerical target for D50 is an increasing trend approaching 40 mm or greater, while the target for percent fines and sands is a decreasing trend approaching 25 percent or less in the Squaw Creek meadow reach. As described above, both of these parameters were far short of these target values in 2020. Indeed, the mean D50 value for all survey years (2000, 2001, 2010, 2012, 2014, 2016, 2018, 2020) is 10.1 mm (range 4 to 25 mm) and the mean percent fines and sands value for all survey years is 34.3 percent (range 21 to 49 percent). D50 and percent fines and sands values for all years are summarized in Figures 6-1 and 6-2.

The numerical target for biological health (representing desired stream integrity protective of aquatic life uses) is a BCS value of 25 or more. Two out of three sites met this minimum target in 2020 (BCS values were 23, 25, and 25 for upper, middle, and lower meadow sites, respectively). The mean BCS value for all survey years is 16.3 (range 7 to 27). Indeed, BCS values have only met

or exceeded the target value of 25 during three survey years (at two of the three sites in 2012 and one of three sites in 2018 and at two of three sites in 2020; see Figure 6-3). Improved BCS values in 2012, 2018, and 2020 may have resulted from better flow conditions and fewer disturbances prior to the 2012, 2018, and 2020 sampling events. Heavy snowpack during the 2010-2011, 2016-2017, and 2018-2019 winters helped sustain surface flows in Squaw Creek further into the summer and fall than usual in 2011, 2017, and 2019, thereby allowing a more robust benthic community to develop during these periods. Low precipitation during the subsequent mild 2011-2012, 2017-2018, and 2019-2020 winters produced fewer flood disturbances such that the benthic communities that were sampled in summer 2012, 2018, and 2020 were likely more robust and well-developed than in other years when disturbances were more regular.

Eastern Sierra IBI scores for the three Squaw Creek sites were also better in 2020 (Figure 6-4). The IBI score for the middle meadow site (Bio-SC2) was 92.0 out of a possible 100, which is considered at the low end of Tier 5 (or Grade "A"), indicative of conditions supporting regional water-quality objectives (Table 6-1). The upper and lower meadow sites (Bio-SC1 and Bio-SC3) had IBI scores of 80.9 and 78.5, respectively, which are considered Tier 4 (or Grade "B") and Tier 3 (or Grade "C"), also indicative of conditions supporting or partially supporting water-quality objectives for the region.

Table 6-1. Thresholds for interpreting Eastern Sierra IBI scores (from Herbst and Silldorff [2009]).

IBI SCORE	TIER / GRADE	DESIGNATION	RATIONALE
> 85.5	5 / A	supporting	>50th percentile (median) reference condition
80.1 - 85.5	4 / B	supporting	25th-50th percentile reference condition
62.2 - 80.1	3 / C	partially supporting	5th-25th percentile reference condition
46.0 - 62.2	2 / D	not supporting	<5th percentile reference condition (impairment level)
< 46.0	1 / F	not supporting	<median of test values in impaired range

The GIS pollutant source area prioritization analysis performed in WY 2017 and refined in WY 2019 identified the highest priority stormwater outfalls in areas that drain the denser residential and commercial areas with larger roadway areas. The GIS analysis identified the watersheds that include the Squaw Valley ski resort as having the highest potential as pollutant source areas. Limited field observations appear to support these findings. For example, no discharge was observed at several outfalls draining the residential areas and public roads of Squaw Valley during a moderate early season rain event in October 2016; however, turbid discharge was observed during this same event at an outfall draining a Squaw Valley ski resort parking lot.

Together, the Squaw Creek bioassessments and GIS analysis indicate excessive erosion within the watershed and identify the likely priority areas. Implementing additional assessment types such as community level discrete sampling, tributary level discrete sampling, and/or continuous turbidity monitoring in the stream would also provide further insight into pollutant source areas.

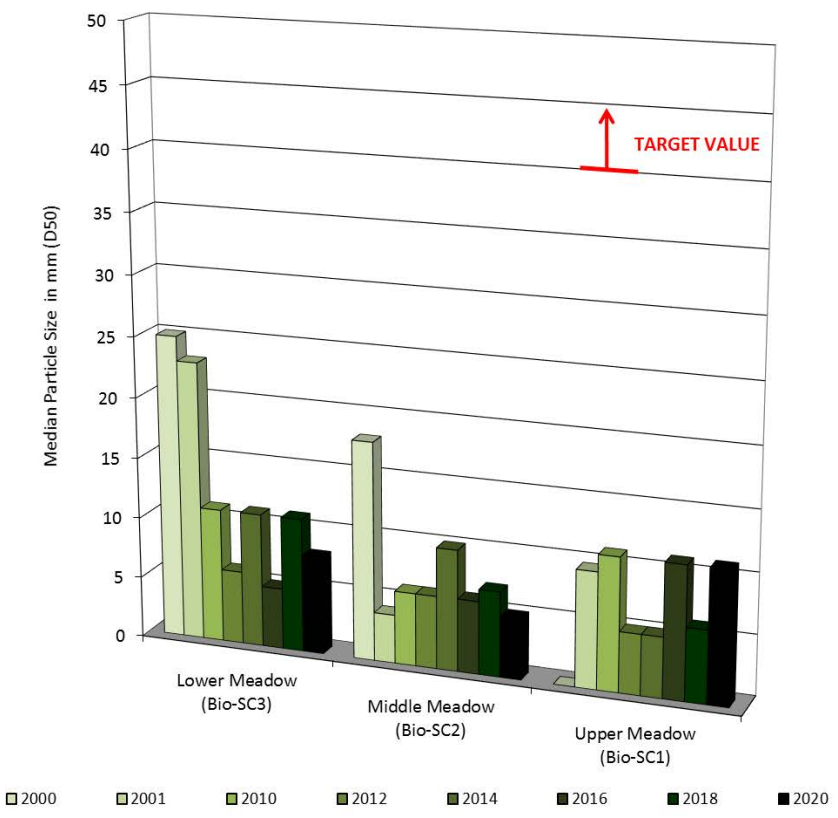

Figure 6-1
Median Particle Size (D50) at Squaw Creek Meadow Sites

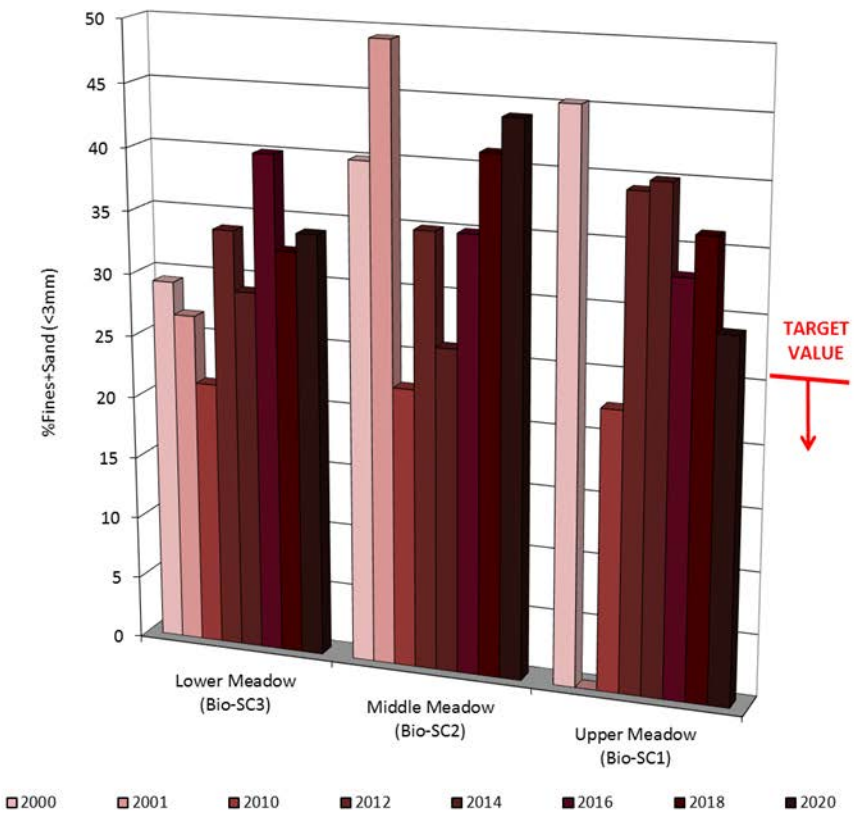

Figure 6-2
Percent Fines and Sands (<3mm) at Squaw Creek Meadow Sites

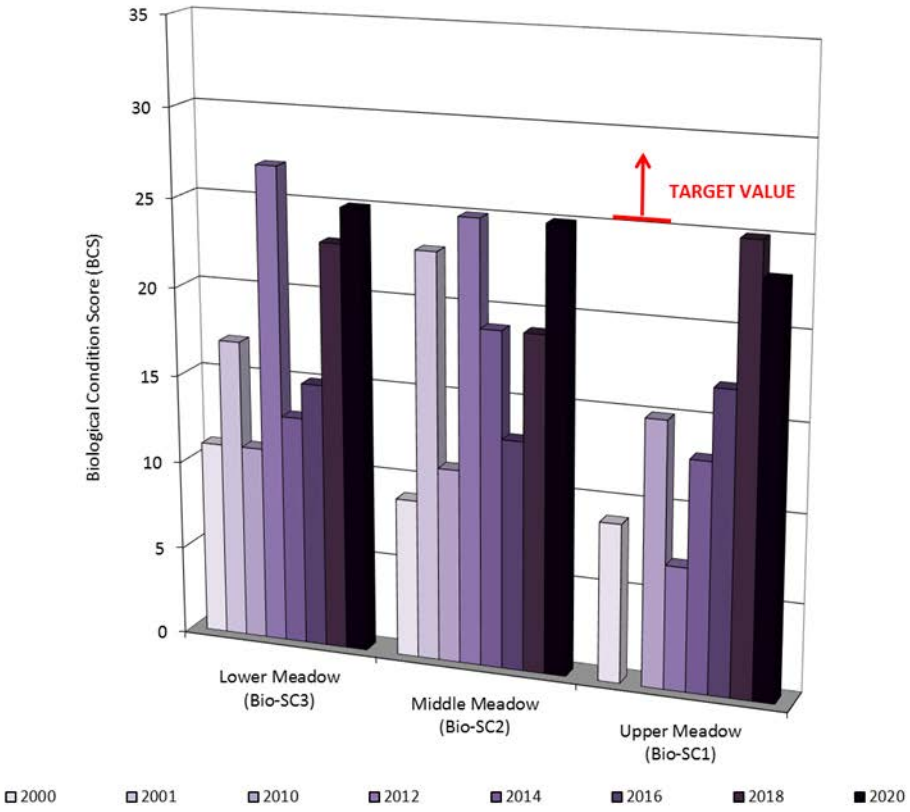

Figure 6-3
Biological Condition Scores at Squaw Creek Meadow Sites

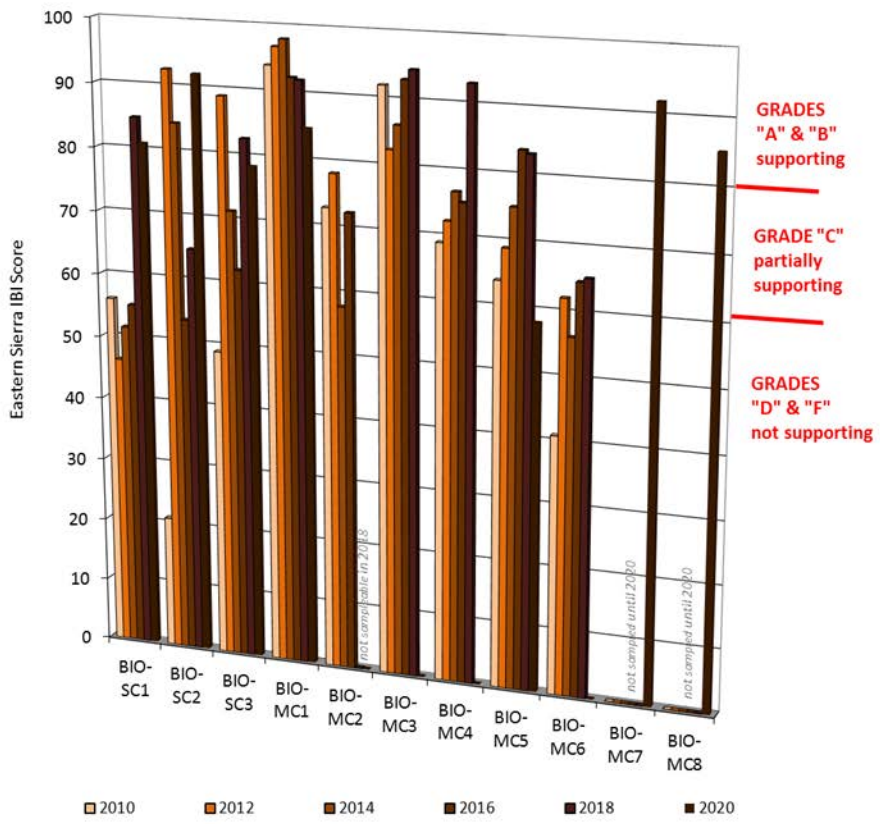

Figure 6-4
Eastern Sierra IBI Scores at Squaw Creek and Martis Creek Sites

6.1.2 Martis Creek

The assessments conducted within the Martis Creek watershed during WY 2020 include bioassessments (WY 2010, WY 2012, WY 2014, WY 2016, WY 2018 and WY 2020), community level discrete water quality sampling (WY 2011 – WY 2020), tributary level discrete water quality sampling (WY 2011 – WY 2020), stream discharge monitoring (WY 2011 – WY 2020) and near-continuous turbidity monitoring (WY 2013 – WY 2020).

WY 2020 was characterized by below average snowpack with below average annual runoff. In Martis Valley, the annual peak discharge occurred on December 1, 2019 at West Martis (TURB MC-1) and Middle Martis (TURB MC-4) as the result of a rain-on-snow event. Annual peak discharge at mainstem Martis Creek (TURB MC-2) occurred on March 31, 2020, also the result of a rain-on-snow event. Peak discharge from snowmelt runoff occurred on April 7 (TURB- MC-2) and April 8, 2020 (TURB MC-1 and TURB MC-4). Discharge during WY2020 was lower than years past due to the dry winter and below average snowpack.

Subsequently, records of near-continuous discharge and turbidity were used to estimate suspended-sediment loads and yields for the mainstem and major tributaries in the Martis Creek watershed. A comparison across tributaries was made between stations with different watershed areas through calculation of watershed yields (tons/ mi^2) (Table 5-21). Overall, the Martis Creek watershed is not considered to be a large contributor of suspended-sediment to the Truckee

River due to the retention treatment provided by the Martis Creek Reservoir, located downstream of all tributaries and monitoring stations. No monitoring is being conducted downstream of the Martis Dam under this program and therefore the suspended-sediment load entering the Truckee River from Martis Creek has not been measured. Adding a monitoring station below Martis Dam would allow for more accurate assessment of suspended-sediment loading to the Truckee River from Martis Creek Reservoir. However, this area it outside of Placer County limits.

As in previous survey years, 2020 bioassessment results for Martis Creek indicate that upper tributaries with less disturbance had the highest IBI scores with values of 84.8, 92.0, and 85.3 out of 100 at the Schaeffer Branch (Bio-MC1), upper East Branch (Bio-MC7), and the Middle Branch (Bio-MC8) sites, respectively. These scores are considered Tier 5/4 (or Grade "A/B"), indicative of conditions supporting regional water-quality objectives. The lower mainstem site (Bio-MC5) had and IBI score of 58.1 which is considered Tier 2 (or Grade "D"), indicative of conditions not supporting water-quality objectives. However, site Bio-MC5 recently underwent restoration and bank stabilization. This was the first year of post-construction data which will be used to track improvement at this site over time. Eastern Sierra IBI scores for all TRWQMP survey years (2010–2020) are summarized in Figure 6-4.

Results from tributary level water quality monitoring provide a snapshot of water quality during sampled events, but do not account for the temporal fluctuations in water quality that occur during runoff events and throughout the season. However, because the sampling events focus on conditions where most pollutant loading is expected to occur, the results can provide an indication of potential pollutant source areas and areas of concern. The tributary level water quality monitoring results from WY 2020 were compared to TRWQMP water quality objectives defined for the mouth of Martis Creek. The mean total phosphorus concentration at site DST-MC1 (Martis Creek at Mouth) for WY 2020 was 21 µg/L which meets the water quality objective for total phosphorus of 50 µg/L for the second consecutive year. This is a very notable improvement since the mean total phosphorus concentration at site DST-MC1 for all years of sampling (WY 2011 – WY 2020) is 63 µg/L. When using only data collected from WY 2020, mean total phosphorus concentrations at all tributary level sites were below the 50 µg/L water quality objective.

Stormwater runoff from the densely developed Northstar community and resort areas are likely contributing sediment loads to West Martis Creek that are above natural levels. Hydromodification by the large amount of impervious area that has been constructed in the watershed has altered runoff patterns and is accelerating erosion within the channel and unstable stormwater drainage pathways. The concentrations of sediment and nutrients in the stormwater discharges to West Martis Creek (discrete community level water quality monitoring) are often higher than those within the stream itself and are therefore contributing to elevated concentrations measured at tributary level monitoring site DST-MC4. Community level monitoring results indicate that improvements such as vegetated swales, rock-lined swales, infiltration facilities, treatment vaults, and wetland areas can effectively reduce pollutant loads entering West Martis Creek.

The GIS pollutant source area prioritization analysis focused on the West Martis Creek sub-watershed. The results indicate that the stormwater catchments with the highest potential pollutant source rankings coincide with relatively dense residential and commercial areas and catchments with relatively large areas of roadway. Water quality problems identified during the GIS analysis typically consist of eroding stormwater channels, unprotected outfalls, unstable road shoulders, dirt roads, trails, and deteriorating stormwater infrastructure. Many of the existing culverts, swales, and sand traps are damaged, full of sediment, and need maintenance or replacement.

6.2 Suspended-Sediment Load Comparisons Across Years, Martis Creek

Historical discharge and suspended-sediment monitoring on Martis Creek were conducted from WY 1975 to WY 1985 by the USGS (1985) and in WY 2000 by Desert Research Institute (DRI; McGraw and others, 2001) (Figure 6-5). However, all previous monitoring was completed on Martis Creek below Martis Creek Reservoir. As such, these data are presented to show historical trends in Martis Creek below Martis Creek Reservoir. These data suggest a slight reduction in suspended-sediment delivery to the Truckee River over time. It is important to note that this comparison is between 2 different data sets and investigators: a 10-year dataset representing different year types (i.e., wet, dry, average) and a 1-year dataset from a dry year. No new data has been collected at this station since WY 2000.

Suspended-sediment monitoring upstream of the Martis Creek Reservoir began in WY 2013 as part of this Truckee River Water Quality Monitoring Program and has continued into the current water year. Discharge-to-suspended-sediment rating curves were established for each year at each station for comparison. In this section, annual suspended-sediment rating curves are compared across all years for each station. Sediment rating curves are shown across all stations using similar axis values for ease of comparison across stations as well.

Figure 6-6, 6-7, and 6-8 show the discharge-based suspended-sediment rating curves for West Martis Creek (TURB-MC1), Mainstem Martis Creek (TURB-MC2), and Middle Martis Creek (TURB-MC4), respectively across all years. Insufficient data is currently available to perform this analysis for the Upper West Martis Creek (TURB-MC5) station that was established in WY 2020. Based on these data, sediment rating curves exhibit wide variability across years and within each year with no clear trend in rating curve shifts. Variability in loads measured for a given discharge are likely associated with timing of sampling (i.e., rising limb, peak flow, falling limb) and/or event type (i.e., rain on snow, rain, snowmelt runoff).

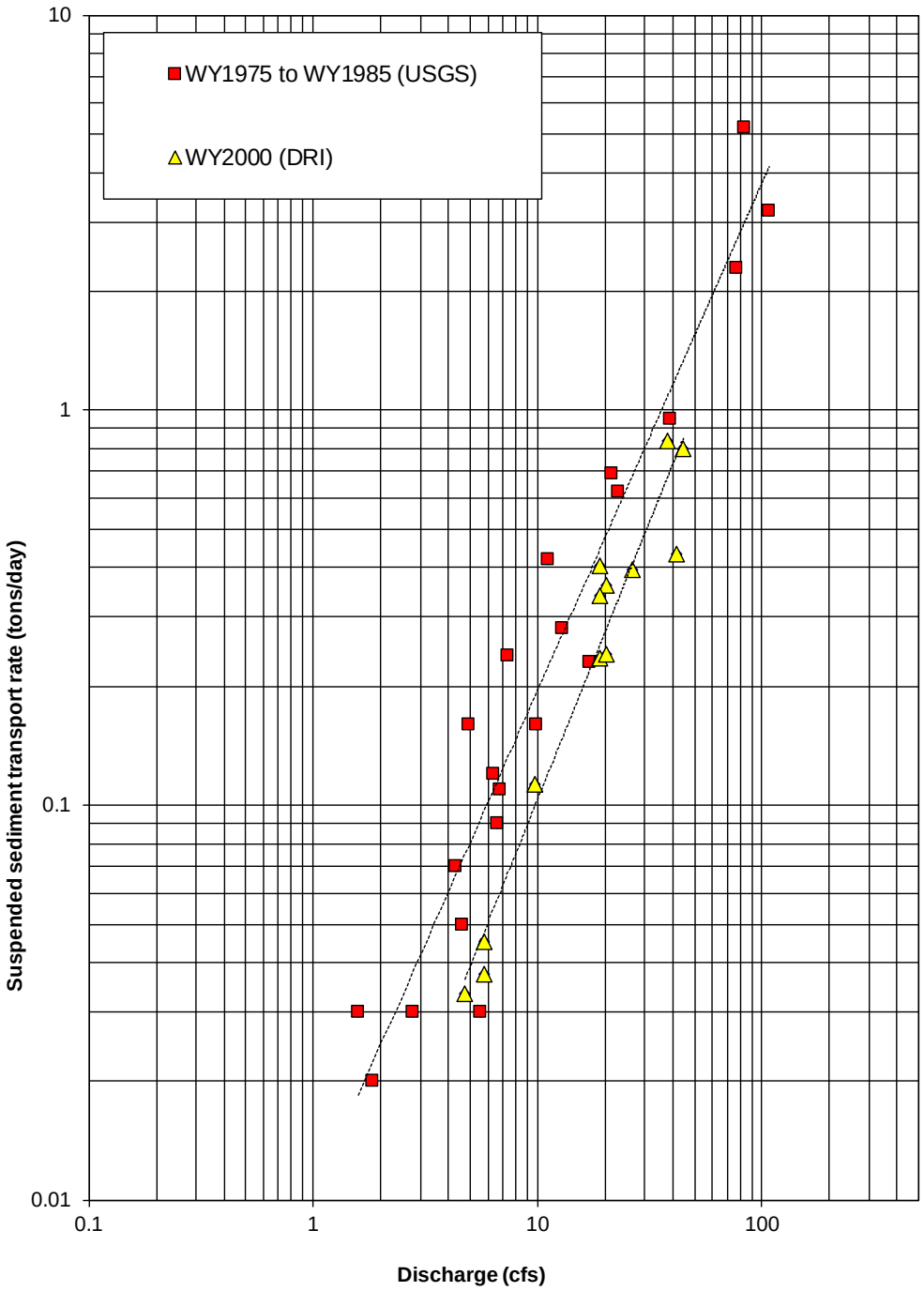

Figure 6-5
Relationship between discharge and suspended-sediment load, Martis Creek, below Martis Creek Reservoir, Nevada County, California, water years 1975-1985 and 2000

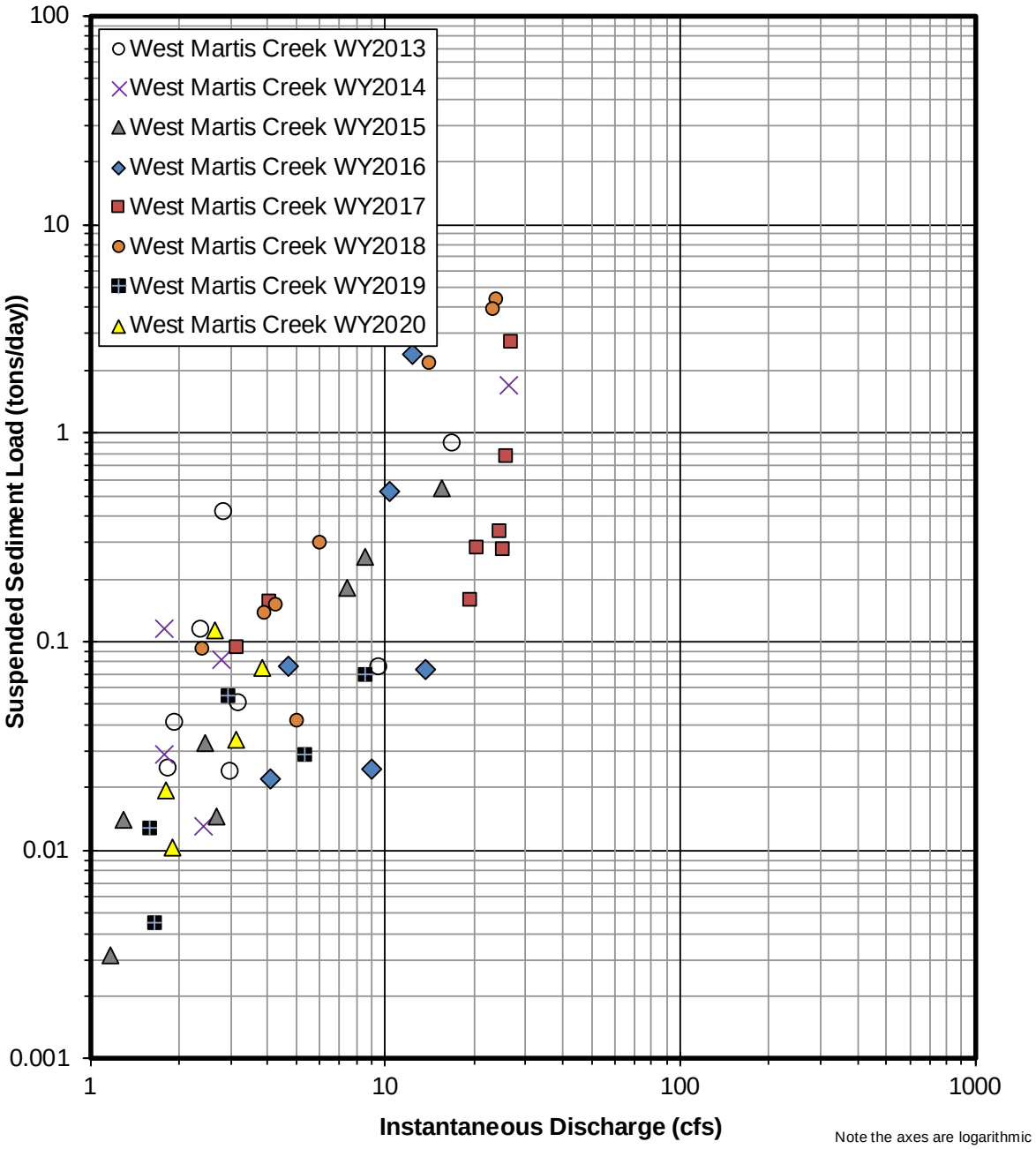

Figure 6-6
Relationship between discharge and suspended-sediment load, West Martis Creek (TURB-MC1), Placer County, California, water years 2013-2020

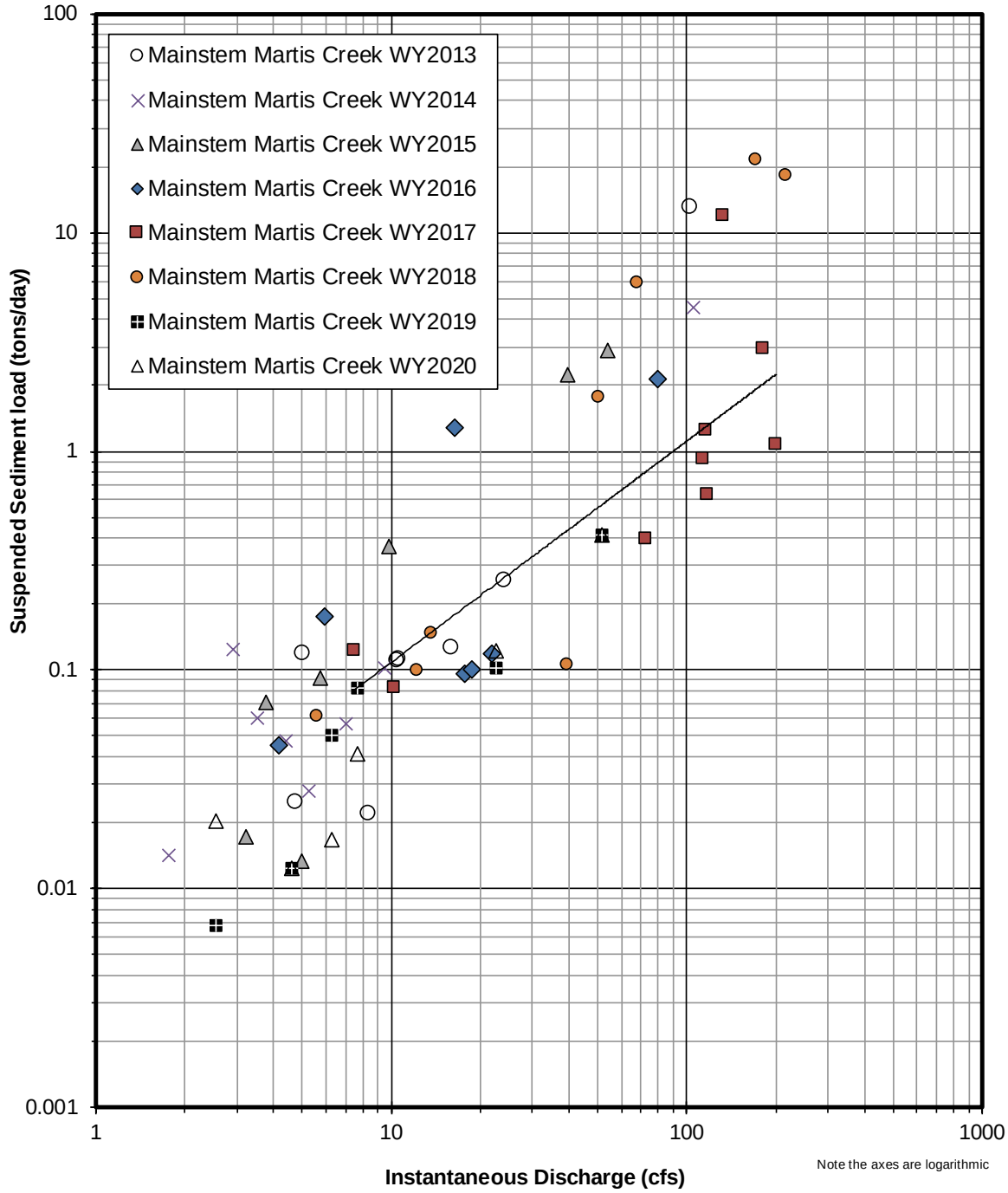

Figure 6-7
Relationship between discharge and suspended-sediment load, Mainstem Martis Creek (TURB-MC2), Placer County, California, water years 2013-2020

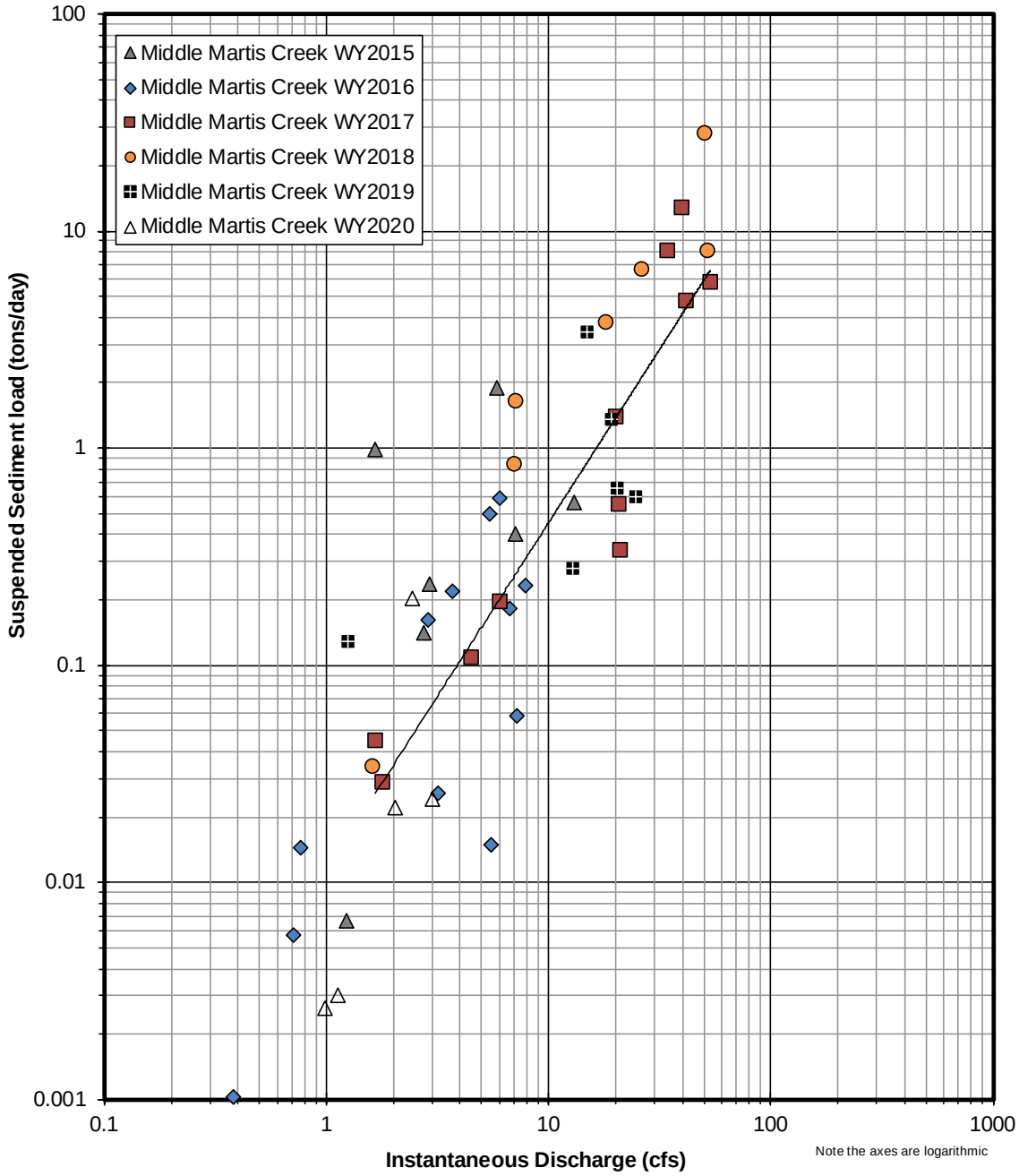

Figure 6-8
Relationship between discharge and suspended-sediment load, Middle Martis Creek (TURB-MC4), Placer County, California, water years 2015-2020

6.3 Water Quality Areas of Concern

After eleven years of TRWQMP implementation, the following areas are identified as areas of the highest concern for water quality:

- **Martis Creek:** Pollutant concentrations discharging into Martis Creek Reservoir are elevated, and total phosphorus concentrations typically exceed the water quality objective for the mouth of Martis Creek. Monitoring results indicate that phosphorus may be naturally occurring in watershed soils, but increased channel erosion and non-point source pollution related to development in the watershed including roadway shoulder erosion, ski run soil disturbance, golf course operations, commercial and residential construction, and roadway abrasives are other potential sources.

  Although the dam in Martis Creek Reservoir likely decreases pollutant loading to the Truckee River, it could represent problems to the reservoir in terms of decreased storage capacity and excessive growth of aquatic plants. Also, if the Martis Dam were removed (i.e. due to the ongoing concerns of safety) a temporary increase in pollutant loading to the Truckee River would likely occur.

  Bioassessment results for Martis Creek in previous years have indicated that the upper tributaries with less disturbance (i.e. Schaeffer, Upper East Branch, and the Middle Branch) are considered Tier 5/4 (or Grade "A/B"), indicative of conditions supporting regional water-quality objectives. Further downstream, the lower mainstem is considered Tier 2 (or Grade "D"), indicative of conditions partially supporting water-quality objectives. However, lower mainstem site recently underwent restoration and bank stabilization. This was the first year of post-construction data which will be used to track improvement at this site over time. These results illustrate declining conditions in main stem Martis Creek as the stream flows through the Martis Camp and Lahontan developments.

- **Squaw Creek:** Particles less than 3 mm diameter (fines and sand) and D50 are the two physical habitat parameters identified as important indicators of habitat suitability for aquatic life in the context of the Squaw Creek sediment TMDL. The numerical target for D50 is an increasing trend approaching 40 mm or greater, while the target for fines and sand is a decreasing trend approaching 25 percent or less in the Squaw Creek meadow reach. Both of these parameters were far short of target values in 2020; historical values are also well below TMDL targets.

  Two out of three bioassessment results for WY 2020 met the minimum TMDL target (BCS of 25) with BCS values of 23, 25, and 25 for upper, middle, and lower meadow sites, respectively. The mean BCS value for all survey years is 16.3 (range 7 to 27). BCS values have only met or exceeded the target value of 25 during three survey years (at two of the three sites in 2012, one of three sites in 2018, and at two of the three sites in 2020; see Figure 6.3).

6.4 Effectiveness of MS4 Permit Activities

One of the primary goals of the TRWQMP is to provide a strategy to assess the effectiveness of implementing Permit related stormwater management activities. The Permit requires the development and implementation of a Program Effectiveness Assessment and Improvement Plan (PEAIP) to address the elements outlined in Provision E.14 (traditional small MS4s). The County's stormwater program in the Middle Truckee River Basin addresses many pollutants of concern (POCs) and implements a wide range of BMPs; however, consistent with Provision E.14 requirements, the County's PEAIP (Placer County, 2015) presents a plan for assessing the effectiveness of a subset of prioritized BMPs that are focused on high priority POCs. This approach provides a manageable assessment program that can be improved, targeted, and refined.

Placer County developed its PEAIP as a guidance document for its stormwater staff to assist them in conducting program effectiveness assessments (EAs). The PEAIP is modeled after the methodology described within the California Stormwater Quality Association (CASQA) document, *A Strategic Approach to Planning for and Assessing the Effectiveness of Stormwater Programs* (February 2015). Of the potential POCs identified in the PEAIP, the following high priority POCs will be the focus of Placer County EAs:

- Sediment
- Nitrogen
- Phosphorus

In accordance with the Permit requirements, the Annual Report, to be submitted by Placer County by October 15th of each year, will describe the implementation of the PEAIP, summarize the data obtained, and provide an analysis of the data (i.e., the EA), and describe any program modifications identified. The CASQA EA approach utilizes a general model that aggregates three primary components from six outcome levels and associated outcome types. The three primary components are:

- Sources and Impacts (Outcome Levels 4-6) – This component addresses the generation, transport, and fate of urban runoff pollutants. It includes sources (sites, facilities, areas, etc.), stormwater conveyance systems, and the water bodies that ultimately receive the source discharges (receiving waters). This component is typically assessed on a long-term basis.
- Target Audiences (Outcome Levels 2-3) – This component focuses on understanding the behaviors of the people responsible for source contributions. It explores the factors that determine existing behavioral patterns and looks for ways to replace polluting behaviors with non-polluting behaviors. This component is typically assessed on a short- and/or long-term basis.
- Stormwater Programs (Outcome Level 1) – Stormwater programs are the road map for the improvements that managers wish to attain in receiving waters. Their immediate purpose is to describe programs that will facilitate changes in the behaviors of key target audiences. This component is typically assessed on a short-term basis.

The TRWQMP water quality monitoring results and related analyses presented in this report focus on identifying pollutant sources and assessing their impacts to receiving waters. Results applicable to Outcome Levels 4 – 6 are summarized in Table 6-2 below.

Table 6-2. Effectiveness Assessment Outcome Levels and Corresponding TRWQMP Assessment Type

Outcome Level	TRWQMP Assessment Type
6 – Receiving Water Conditions	Tributary Level Discrete Water Quality Monitoring Near-Continuous Turbidity Monitoring
5 – Urban Runoff and MS4 Contributions	Community Level Discrete Water Quality Monitoring
4 – Source Contributions	Watershed Surveys GIS Source Area Prioritization

6.4.1 PEAIP Management Questions

Placer County identified prioritized Stormwater Program Elements and associated BMPs in the PEAIP that may be implemented to address the high priority POCs (sediment and nutrients). For each prioritized Program Element, corresponding management questions were identified to guide EA development. The TRWQMP assessment data and information collected by Placer County and presented in this report can be used to answer the "Water Quality Monitoring" management questions (Outcome Levels 4 through 6) as presented in the PEAIP and summarized below. The more programmatic management questions (Outcome Levels 1-3) presented in the PEAIP were not considered in the effectiveness evaluation presented in this section.

6.4.1.1 Sediment Management Questions

- Is water quality monitoring being performed to evaluate sediment contributions from Placer's MS4 system outfalls?
  - Are Placer's MS4 inputs contributing sediment to receiving waters?
  - Have potential significant sources of sediment been identified, evaluated, and reported?
- Is water quality monitoring being performed within receiving waters to evaluate sediment loading to the Truckee River?
  - Do suspended-sediment concentrations in receiving waters meet the TMDL target value of less than or equal to 25 mg/L?
  - Do temporal trends indicate decreasing sediment concentrations in receiving waters over time?

6.4.1.2 Nutrient Management Questions

- Is water quality monitoring being performed to evaluate nutrient contributions from Placer's MS4 system outfalls?
  - Are Placer's MS4 inputs contributing nutrients to receiving waters?
  - Have potential significant sources of nutrients been identified, evaluated, and reported?

- Is water quality monitoring being performed within receiving waters to evaluate nutrient inputs to the Truckee River?
  - Do nutrient concentrations in receiving waters meet the Water Quality Objectives (WQOs) specified in the Lahontan Basin Plan?
  - Do temporal trends indicate decreasing nutrient concentrations in receiving waters over time?

6.4.2 Effectiveness Assessment

Data and information collected as part of TRWQMP implementation were used to answer the PEAIP management questions and evaluate the effectiveness of the County's stormwater program. Table 6-3 presents applicable data assessment methods and EA results for each management question. The CASQA Outcome Levels and TRWQMP assessment types are also provided. The information in Table 6-3 considers Outcome Levels 4-6 only and is intended to assist Placer County in preparing their comprehensive EA that considers all Outcome Levels.

The EA results in Table 6-3 indicate that Placer County's stormwater program is effectively controlling transport of sediment and nutrients to receiving waters. Although elevated sediment/nutrient concentrations were observed at specific stormwater outfalls and tributaries, these inputs do not typically translate to impairment in downstream receiving waters. Mean receiving water sediment (i.e., TSS) concentrations within the lower elevations of the Martis Creek watershed were below the target value of 25 mg/L used in the Truckee River TMDL, and TSS concentrations exhibit a decreasing trend over the eight-year TRWQMP implementation period for most sites. For nutrients, receiving water mean concentrations for nitrogen species were almost always below the Martis Creek WQOs. Sampling and analysis of nitrogen species was therefore discontinued in WY 2020. Conversely, mean total phosphorus concentrations at most receiving water sites were slightly above the Martis Creek WQO of 50 µg/L when considering all years of TRWQMP implementation. However, decreasing trends in total phosphorus have been observed and the mean total phosphorus concentrations in Martis Creek at Martis Creek lake have been below WQO for two consecutive years. Elevated phosphorus results may be partially attributed to naturally occurring phosphorus in native soils in the area, but non-point sources of phosphorus due to development may also exist.

These EA results should be revised regularly as additional TRWQMP monitoring data becomes available. Water quality data collection in watersheds other than Martis Creek should also be considered to further evaluate the effectiveness of Placer County's stormwater program throughout the Truckee River permit area. The Lahontan Basin Plan has WQOs for multiple locations along the Truckee River as well as Squaw and Bear Creeks; these WQOs were not considered in the performance evaluation presented herein.

Table 6-3. Stormwater Program Effectiveness Assessment (Outcome Levels 4-6)

Management Questions	CASQA Outcome Level	TRWQMP Assessment Type	Data Assessment Methods	Effectiveness Assessment Results
Have potential significant sources of sediment/nutrients been identified, evaluated, and reported?	**4**	**GIS Pollutant Source Area Prioritization**	**GIS Analysis** • Identify potential sediment/nutrient sources • Prioritize stormwater basins/outfalls for additional monitoring and/or corrective actions	• The GIS Analysis identified and prioritized sub-watersheds and stormwater catchments based on the size and number of likely sediment and nutrient sources in the Martis, Squaw, and Bear Creek watersheds. • Results were used to develop recommendations for TRWQMP adaptive management and corrective actions.
Are Placer's MS4 outfalls contributing sediment/nutrients to receiving waters?	**5**	**Community Level Discrete Water Quality Monitoring**	**Descriptive Statistics** • Mean, median, minimum, maximum, and standard deviation values **Statistical Analyses** • Spatial comparisons to identify pollutant source areas	• Descriptive statistics indicate that some MS4 outfalls in the Martis Creek watershed contribute sediment/nutrients to receiving waters. • Statistical analyses were applied to identify which outfalls have the highest sediment/nutrient concentrations.
Do suspended-sediment concentrations in receiving waters meet the TMDL target value of less than or equal to 25 mg/L?	**6**	**Tributary Level Discrete Water Quality Monitoring**	**Descriptive Statistics** • Mean, median, minimum, maximum, and standard deviation values • Compare mean TSS concentrations in receiving waters to TMDL targets	• Mean TSS concentrations from 7 out of 9 tributary level sites within the Martis Creek watershed were ***below*** the TMDL target of 25 mg/L. This includes the main stem of Martis Creek at Martis Creek Lake.
		Near-Continuous Turbidity Monitoring	**Turbidity/Suspended Sediment Analysis** • Analyze turbidity data to attain a near-continuous record of suspended-sediment concentrations • Compare mean suspended-sediment concentrations in receiving waters to TMDL targets	• Mean suspended sediment concentrations from all four near-continuous turbidity sites within the Martis Creek watershed were ***below*** the TMDL target of 25 mg/L.

Management Questions	CASQA Outcome Level	TRWQMP Assessment Type	Data Assessment Methods	Effectiveness Assessment Results
Do nutrient concentrations in receiving waters meet the Water Quality Objectives (WQOs) specified in the Lahontan Basin Plan?	**6**	**Tributary Level Discrete Water Quality Monitoring**	**Descriptive Statistics** • Mean, median, minimum, maximum, and standard deviation values • Compare mean nutrient concentrations in receiving waters to Water Quality Objectives specified in the Lahontan Basin Plan	• **Nitrogen**: mean concentrations for nitrate, TKN, and total nitrogen were almost always ***below*** the WQOs for Martis Creek. The one exception was TKN at an unnamed tributary (DST-MC6) where the WQO was slightly exceeded. • **Phosphorus:** mean concentrations at 6 out of 10 tributary level sites were slightly ***above*** the Martis Creek WQO for total phosphorus across all monitoring years. This includes the main stem of Martis Creek at Martis Creek Lake.
Do temporal trends indicate decreasing sediment/nutrient concentrations in receiving waters over time?	**6**	**Tributary Level Discrete Water Quality Monitoring**	**Statistical Analyses** • Temporal analysis to evaluate sediment/nutrient trends over time	• Concentrations of TSS, total nitrogen, and total phosphorus have ***decreased*** over time at most tributary level sites (WY 2010 to WY 2020). A statistical trend was not observed for TSS in West Martis Creek.

Section 7

Fiscal Summary

The table below provides a summary of costs incurred by Placer County from the program's inception in 2010 through the current 2020 water year (Year 11). Years 1-3, 4-6, 7-8, and 9-10 are combined, matching the consultant contract terms. Year 11 is the first year of the current two-year contract. Costs for year 11 will be updated for the final report when more accurate costs can be provided.

Table 7-1. TRWQMP Implementation Fiscal Summary

Placer County TRWQMP Implementation Costs		
Administrative	Years 1 – 3	$72,000
	Years 4 – 6	$75,000
	Years 7-8	$80,000
	Years 9-10	$90,000
	Year 11	
Planning and Permitting	Years 1 – 3	$106,000
	Years 4 – 6	$35,000
	Years 7-8	$12,000
	Years 9-10	$10,000
	Year 11	
Data Collection	Years 1 – 3	$171,000
	Years 4 – 6	$199,000
	Years 7-8	$200,000
	Years 9-10	$220,000
	Year 11	
Laboratory	Years 1 – 3	$45,000
	Years 4 – 6	$42,000
	Years 7-8	$40,000
	Years 9-10	$40,000
	Year 11	
Analysis and Reporting	Years 1 – 3	$160,000
	Years 4 – 6	$166,000
	Years 7-8	$168,000
	Years 9-10	$190,000
	Year 11	
Total	**Years 1 – 3**	**$554,000**
	Years 4 – 6	**$517,000**
	Years 7-8	**$500,000**
	Years 9-10	**$550,000**
	Year 11	

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Section 8

Conclusions and Recommendations

This section presents the conclusions and recommendations that have been developed in consideration of the TRWQMP implementation results from WY 2020 and previous years. The recommendations focus both on TRWQMP adaptive management revisions to improve and build on the data collection and reporting activities, and on the SWMP implementation to improve and protect water quality in the Middle Truckee River watershed.

8.1 Conclusions

The conclusions below are organized by individual assessment type and on the cumulative integrated results of the program's implementation.

8.1.1 Community Level Water Quality Monitoring

The community level monitoring is a cost-effective means of characterizing stormwater runoff and evaluating the effectiveness of the water quality controls in individual stormwater catchments. Together with other results, the data can be applied to support the following activities:

- Identifying and prioritizing areas where water quality improvements should be implemented;
- Planning and design of these improvements such as BMP selection and sizing; and
- Pursuit of grant funding for water quality projects.

Implementation activities in WY 2020 included sampling at new sites DSC-MC9 and DSC-MC10. These sites are located along Northstar Drive at the outfalls of two stormwater catchment areas that discharge to West Martis Creek. DSC-MC9 is highly impervious catchment that drains a small portion of Northstar Drive and DSC-MC10 is a larger catchment with a long rock-lined channel with infiltration and treatment BMPs incorporated. Discharge at DSC-MC9 occurs in response to relatively small amounts of precipitation/snowmelt while discharge at DSC-MC10 requires a moderate to large rainfall event or snowmelt cycle to produce runoff. Initial first year field observations indicate that the pervious channel and infiltration BMPs provide substantial reductions of runoff volumes. Soil conditions within both catchments are likely to be suitable for additional infiltration if runoff can be retained in proper locations.

In addition, the following more specific statements can be made:

- Flows during WY 2020 only occurred at the two sites during periods of wet weather and during the spring snowmelt cycle indicating the channels are intermittent with no dry weather flows.

- Pollutant concentrations at the two sites greatly differed. Concentrations were much higher at DSC-MC9, most likely due to the lack of BMPs in its drainage area. DSC-MC9 may contribute to the relatively high pollutant concentrations measured in West Martis Creek.
- DSC-MC9 receives runoff from secondary roadways, and forested uplands. Permanent BMPs upstream of the sampling location are limited to sediment traps and a short rock-lined channel uphill from Northstar Drive. Only four samples have been collected at this site during one water year. Initial results indicate that TSS and total phosphorus are elevated at this site relative to other community level sites. Mean concentrations of total phosphorus exceed Martis Creek WQOs.
- DSC-MC10 receives runoff from residential development, roadways, forested upland, and a solid waste handling area. Permanent BMPs upstream of the sampling location include, sediment traps, infiltration basins, rock lined infiltration channels, treatment vault and pond and a vegetated channel. Only three samples have been collected at this site over one water year. Initial results indicate that TSS and total phosphorus are not elevated at this site relative to other community level sites.
- DSC-MC4 is no longer monitored, but the previous data from this location on Northstar Drive indicate this site also had the high TSS and total phosphorus concentrations similar to those observed at DSC-MC9. Figure 8-1 below presents a comparison of TSS results from all community level sites that have been monitored by Placer County to date. Comparisons for total phosphorus are provided in Section 5.2.

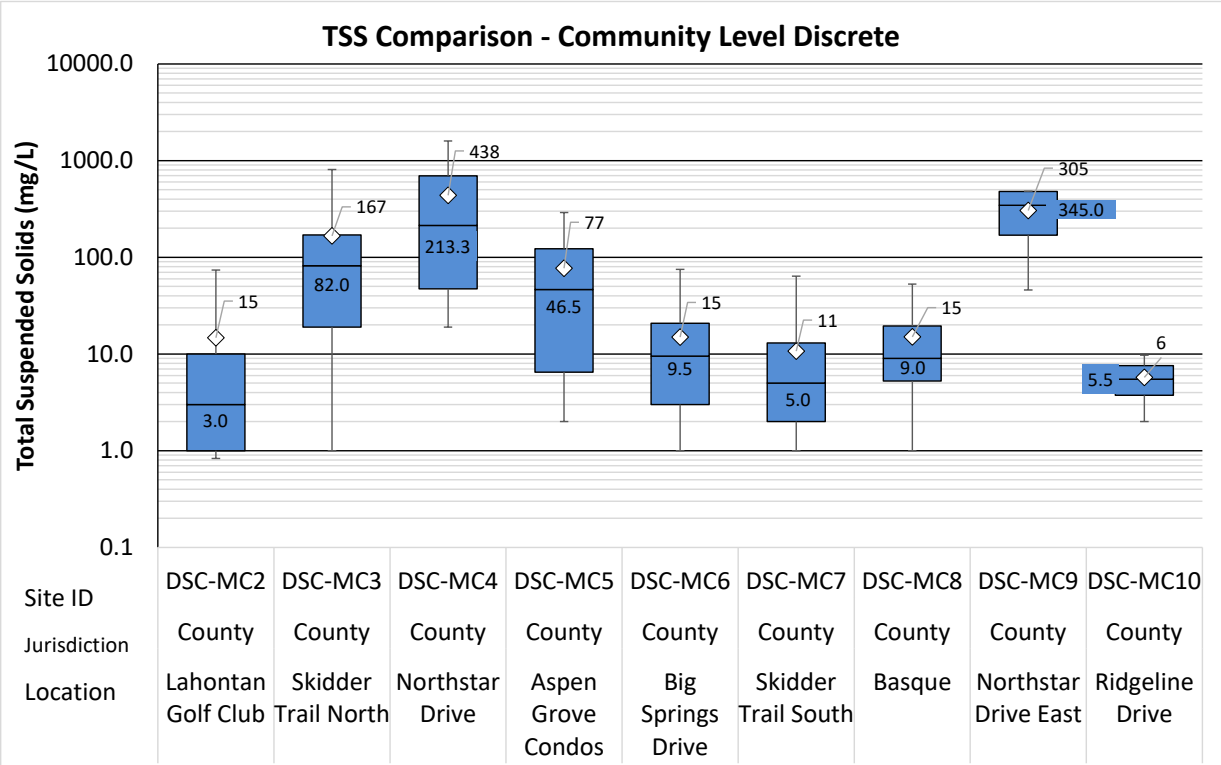

Figure 8-1
Community Level TSS Comparison

8.1.2 Tributary Level Water Quality Monitoring

Tributary level water quality monitoring was conducted at seven different locations on Martis Creek during WY 2020. The results provide meaningful information regarding the types of pollutants and their relative concentrations and loads at the various locations. The conclusions are strengthened when the results of other assessment types such as discharge and continuous turbidity monitoring are considered. Continued monitoring will further increase the statistical confidence in making comparisons among sites and evaluating water quality trends. Furthermore, continued monitoring will be important in characterizing seasonal variability due to differences in annual precipitation patterns and the effects of continuing development, stormwater management and/or watershed restoration activities. It is important to note that sampling efforts have generally focused on larger runoff events where concentrations are typically elevated. For this reason, the reported mean values of all pollutants likely overestimate the annual average pollutant concentrations in each stream.

The tributary level data indicate that mean total phosphorus concentrations at 6 of the 10 monitored locations are higher than the established water quality objective at the mouth of Martis Creek when considering all years of data. The four sites that did not exceed the total phosphorus water quality objective (DST-MC7, DST-MC8, DST-MC9 and DST-MC10) are located within Middle Martis Creek and two upper branches of West Martis Creek. Total phosphorus concentrations at three of the four sites were significantly less (95% confidence level) than the total phosphorus concentrations measured at other sites. Overall, the results suggest that phosphorus is naturally present in the native soils and concentrations can increase when disturbance causes erosion of these soils. Other potential non-point sources of phosphorus include golf course operations, commercial and residential construction, and roadway abrasives applications.

The highest mean annual TSS concentrations were measured in Middle Martis Creek (DST-MC7) located adjacent to SR 267, Upper West Martis Creek – West (DST-MC8) downstream of the Northstar village and ski area, and West Martis Creek (DST-MC4) downstream of the Northstar village and ski area, residential development, and golf course. For the seven sites monitored in WY 2020, sites DST-MC4 and DST-MC8 had statistically higher TSS concentrations (95% confidence level) than some of the other tributary sites. The elevated sediment concentrations at these two sites can likely be attributed to the extensive development in the area and the associated non-point source pollution, such as soil erosion and traction sand usage during winter driving conditions. This area includes a major ski resort with a base area village, parking lots, residential development, a golf course, public roadways, and other infrastructure. Development in this area is the oldest and largest in size relative to development in other Martis Creek sub-watersheds, and a significant portion of this development occurred before water quality BMPs were required to be included. Much of the area is therefore lacking in stormwater treatment measures and stormwater runoff is conveyed directly to West Martis Creek.

A statistical trend analysis shows that concentrations at each monitoring location are generally decreasing with time. It should be noted that data were collected from site DST-MC10 during WY 2020 only and additional data is needed to properly evaluate temporal trends at this site. While decreasing trends are encouraging, these results are partially attributed to differences in

hydrologic conditions and do not necessarily reflect stormwater management improvements in the watershed.

Table 8-1 below summarizes the results of statistical t-tests that were performed to determine whether differences in pollutant concentration among sites are statistically significant at the 95% confidence level.

Table 8-1. Statistical Differences among Tributary Level Discrete Sampling Data

Constituent	Statistical Difference
TSS	DST-MC4 > DST-MC1, DST-MC5, DST-MC9
	DST-MC8 > DST-MC1, DST-MC5, DST-MC10
Total Phosphorus	DST-MC1 > DST-MC7, DST-MC8, DST-MC9
	DST-MC4 > DST-MC7, DST-MC8, DST-MC9
	DST-MC5 > DST-MC7, DST-MC8, DST-MC9

Notes:
DST-MC1: Lower Martis Creek at Martis Creek Reservoir;
DST-MC4: West Martis Creek; **DST-MC5**: Upper Martis Creek below Martis Camp and Lahontan developments;
DST-MC7: Middle Martis Creek above SR 267 culvert; **DST-MC8**: The western branch of Upper West Martis Creek; **DST-MC9**: The eastern branch of Upper West Martis Creek; **DST-MC10**: Lower Middle Martis creek.

8.1.3 Stream Discharge Monitoring

During WY 2020, discrete stage and velocity measurements were conducted in order to further develop the discharge rating curves in four Martis Creek tributaries. Discharge monitoring is performed as part of the near-continuous turbidity assessment type in order to provide for load-based evaluations of suspended-sediment. Data collection at the Martis Creek sites occurred during the following time periods:

- TURB-MC1: October 2012 – September 2020
- TURB–MC2: October 2012 – September 2020
- TURB-MC4: February 2015 – September 2020
- TURB-MC5: February 2020 - September 2020

Table 8-2 below presents the key stream discharge related parameters from each of the locations monitored during WY 2020. Note that there is insufficient data to establish a discharge rating curve for TURB-MC5 which was established in the middle of the WY 2020 wet season.

Table 8-2. TRWQMP WY 2019 Key Discharge Parameters

Station/Location	Total Annual Discharge	Annual Peak Discharge	Annual Mean Discharge
	(Acre-ft.)	(CFS)	(CFS)
TURB-MC1/West Martis Ck.	1,169	13	1.6
TURB-MC2/Upper Martis Ck. Main Stem	5,214	49	7
TURB-MC4/Middle Martis Ck.	652	11	0.9

8.1.4 Suspended-Sediment Load Estimates

Near-continuous turbidity monitoring in WY 2020 occurred at the same four sites where stream gaging was performed. The purpose is to collect data that allows for the development of suspended-sediment rating curves, identifying sediment source areas, and characterizing loading patterns from different Martis Creek sub-watersheds. The following conclusions and observations can be made based on results collected to date. Note that suspended-sediment rating curves could not be developed for site TURB-MC5 due to insufficient data.

- The total suspended-sediment load in WY 2020 from the tributaries monitored above Martis Creek Reservoir was approximately 27 tons, 14 tons of which originated from mainstem Martis Creek. Overall, the Martis Creek watershed is not considered to be a large contributor of suspended-sediment to the Truckee River due to the retention treatment provided by the Martis Creek Reservoir, located downstream of all tributaries and monitoring stations.

- The largest yield in the Martis watershed in WY 2020 occurred at Middle Martis (TURB-MC4) with a value of 1.9 tons/mi^2. The higher yield at this site is likely associated with stormwater runoff from SR 267 which parallels the creek for much of its length. Road traction sand applied in the winter is easily transported to the creek via stormwater outfalls and has been observed to increase turbidity relative to other Martis tributaries. Suspended-sediment yields at TURB-MC4 have consistently been much higher than those observed at other monitoring stations.

- West Martis Creek (TURB-MC1) exhibited yields of 1.0 tons/mi^2. Reduced yields at TURB-MC1 relative to TURB-MC4 may be a result of improved stormwater management practices within the watershed and the location of the monitoring site further downstream from roadways and development. Below average precipitation and stream discharge are also factors in reduced yields at this site.

- Mainstem Martis Creek (TURB-MC2) also exhibited a yield of 1.0 tons/mi^2. Low yields at site TURB-MC2 may be attributed to the recent restoration in Mainstem Martis Creek that occurred in 2019 in combination with below average precipitation and stream discharge.

8.1.5 Bioassessments

Bioassessments in the Martis Creek and Squaw Valley watersheds were performed for the sixth time in WY 2020, with previous efforts completed in WY 2010, WY 2012, WY 2014, WY 2016, and WY 2018. Conclusions for each watershed are presented below.

8.1.5.1 Squaw Creek

- Particles less than 3 mm diameter (percent fines and sand) and D50 are the two physical habitat parameters identified as important indicators of habitat suitability for aquatic life in the context of the Squaw Creek sediment TMDL. Both of these parameters were well below the target values in 2020; historical values are also below the TMDL targets.

- Bioassessment results for water year 2020 were below the TMDL target (BCS of 25) at one of the three monitoring locations with BCS values of 23, 25, and 25 for upper, middle, and

lower meadow sites, respectively. The mean BCS value for all survey years is 16.3 (range 7 to 27). Historically, BCS values have only met or exceeded the target value of 25 during three survey years (at two of the three sites in 2012, one of three sites in 2018, and at two of the three sites in 2020).

8.1.5.2 Martis Creek

- As in previous survey years, 2020 bioassessment results for Martis Creek indicate that the upper tributaries with less disturbance had the highest IBI scores with values of 84.8, 92.0, and 85.3 out of 100 at the Schaeffer Branch (Bio-MC1), upper East Branch (Bio-MC7), and the Middle Branch (Bio-MC8) sites, respectively. These scores are considered Tier 5/4 (or Grade "A/B"), indicative of conditions supporting regional water-quality objectives.

- The lower mainstem site (Bio-MC5) had and IBI score of 58.1 which is considered Tier 2 (or Grade "D"), indicative of conditions not supporting water-quality objectives. However, site Bio-MC5 recently underwent restoration and bank stabilization. This was the first year of post-construction data which will be used to track improvement at this site over time.

8.1.6 Rafting Segment Survey

Visual inspections and photo-monitoring were conducted during WY 2016, WY 2018, and WY 2020 along the segment of the Truckee River where recreational rafting occurs. The rafting companies operate between Fanny Bridge (Highway 89) in Tahoe City to River Ranch near the intersection of Highway 89 and Alpine Meadows Road. In WY 2020, rafting companies operated primarily during July and August when water levels were suitable. Inspections were conducted later in October 2020 when water levels were low.

A total of 23 sites were inspected during WY 2020 including three Truckee River Stabilization and Restoration Projects completed in 2016. Downward trends were assigned to seven of the sites, indicating the potential for negative water quality impacts has increased. Causes for the downward trends included moderate to heavy use of the site by the public, improper installation of BMPs, and clogging of stormwater drainage structures. Upward trends were assigned to five of the sites, indicating the potential for negative water quality impacts has decreased. Improved conditions are associated primarily with the Truckee River Trail Stabilization and Restoration Project that was completed in 2018. Trends at the remaining eleven sites were not apparent. These sites were located at river access points or prior construction sites. No evidence was found that the access points were stabilizing or deteriorating. The construction sites now have permanent BMPs in place to prevent erosion.

Overall, the survey of the Truckee River rafting segment indicates that rafting activities and general public use are negatively impacting the river. Recent projects have resulted in clear improvements, but additional corrective actions are needed to stabilize identified points of erosion and prevent water quality impairment. Where possible, access to the river should be limited to designated areas where stabilization BMPs are in place and functional. Invasive and noxious weeds including watermilfoil and thistles are abundant in some areas and should be managed to prevent their spread.

8.2 Recommendations

Placer County TRWQMP implementation continues to build upon the Middle Truckee River water quality dataset, and monitoring activities should be continued per the TRWQMP and the adaptive management modifications that have been made to the program. There is a continued need to develop more comprehensive and robust datasets to help identify areas of concern and evaluate the performance of stormwater management activities. As the dataset is further developed, it will also provide an increasingly valuable tool for the identification and prioritization of potential future stormwater management activities to protect water quality in the Truckee River and its tributaries.

The continued implementation of TRWQMP monitoring is dependent on the availability of funding and the available funding mechanisms for different watersheds will continue to dictate which activities are feasible in each location. The recommendations described below have been developed from a comprehensive perspective of continuous improvement and expansion of the program. They are included for completeness and it is understood that all of them will not likely be immediately financially feasible.

Recommendations for the continued implementation of the TRWQMP, and for the application of results, are provided below and are organized within two sub-sections as follows:

1. TRWQMP adaptive management recommendations to further identify and characterize pollutant sources, track trends, and evaluate the effectiveness of newly installed water quality measures.

2. Stormwater management strategies, actions, and measures for consideration in the Middle Truckee River watershed.

8.2.1 TRWQMP Adaptive Management Recommendations

The existing datasets generated by the tributary and community level water quality sampling have enabled valuable comparisons among different watershed areas and their relative water quality impacts. The tributary level data have been used for comparisons at the sub-watershed level, while the community level data have provided for finer-scale comparisons among some of the developed stormwater catchments. The sub-watersheds contributing the highest pollutant loads have been identified and some pollutant sources have been identified in developed areas. As described in Section 6, other Martis Creek assessment types such as the bioassessments and near-continuous turbidity monitoring also support the findings of the tributary and community level water quality sampling.

As TRWQMP implementation continues, it is recommended that existing monitoring sites, where sufficient data has been collected, be relocated, and/or repurposed with modified data collection strategies, to progressively assess new parts of the watershed with differing land uses or other characteristics. Monitoring would also generally progress from the larger downgradient sub-watersheds, where more substantial data already exists, to smaller and more upgradient sub-watersheds and urban stormwater catchments to further identify and prioritize source areas.

The following recommendations were developed based on the integrated results from all different TRWQMP monitoring activities including the GIS-based pollutant source area prioritization effort that was last updated in WY 2019. These recommendations should be considered for future years of TRWQMP implementation as opportunities allow.

- Truckee River
  - Continue biannual surveys of the Truckee River rafting segment to assess trends and evaluate effectiveness of restoration projects.
- Martis Creek
  - Bioassessments
    - *Continue biannual bioassessments at the same four sites monitored in WY 2020 to improve the dataset at newly established sites and evaluate long-term trends in benthic and physical habitats.*
  - Tributary Level Water Quality Monitoring
    - *Continue monitoring at the same seven sites monitored in WY 2020 to improve the datasets and evaluate long-term trends in water quality associated with development, stormwater management improvements, and stream restoration.*
  - Community Level Water Quality Monitoring
    - *Continue monitoring at the same two monitoring sites that were established in WY 2020 to improve the dataset and evaluate water quality at outfalls discharging to West Martis Creek.*
  - Near-Continuous Turbidity Monitoring
    - *Continue monitoring at the same seven sites monitored in WY 2020 to improve the datasets and evaluate long-term trends in suspended-sediment loading associated with development, stormwater management improvements, and stream restoration.*
- Squaw and Bear Creeks
  - Targeted community level water quality sampling stations at priority watershed outfalls identified during the GIS pollutant source area prioritization.
  - Tributary level water quality sampling stations and/or near-continuous turbidity monitoring in the primary stream channels to evaluate impacts from future development, stormwater management improvements, and stream restoration.

8.2.2 Stormwater Management Plan Implementation Recommendations

The results of the TRWQMP implementation activities, including water quality monitoring data and GIS pollutant source area prioritization, provide a valuable tool for evaluating and improving

the effectiveness of stormwater management actions that can address multiple objectives including:

- Flood and erosion control;
- Water quality protection and improvement;
- Wetlands and ecosystem restoration and management;
- Water supply and aquifer recharge;
- Public amenities and parks;
- Funding opportunities, and
- Development and redevelopment guidance and standards.

The revised GIS pollutant source area analysis from WY 2017 produced mapping and data that provides more accurately defined stormwater catchment areas, outfall locations, and problem areas. Water quality problems in all the monitored watersheds typically consist of eroding stormwater channels, unprotected outfalls, unstable road shoulders, dirt roads, trails, and deteriorating stormwater infrastructure. Many of the existing culverts, swales, and sand traps are damaged, full of sediment, and need maintenance or replacement.

WY 2019 activities included observations at previously identified problem areas and development of water quality improvement recommendations. A brief memorandum presenting the recommendations for water quality improvements was provided in Appendix A of the WY 2019 Annual Report (CDM Smith, 2020b). Recommendations for water quality improvements focus on road shoulder areas, culvert locations, and outfall locations owned and maintained by Placer County. In certain instances, water quality improvements are recommended on non-Placer County property if specific water quality concerns were identified. The recommended water quality improvements generally follow a low impact development (LID) based strategy and include:

- **Source control/soil stabilization practices** - Soil stabilization controls erosion and reduces the transport of sediment and associated pollutants (e.g. nutrients) to receiving waters. Recommended locations for stabilization improvements include drainage channels, outfalls, road shoulders, cut slopes, bare soil areas, dirt roads, and trails. In addition to improving water quality, these improvements preserve existing infrastructure and reduce property damage caused by erosion.
- **Infiltration/bioretention/biotreatment BMPs** - These types of green stormwater infrastructure improve water quality by reducing stormwater runoff volumes and removing pollutants from stormwater. Recommended roadside BMPs include infiltration channels, bioretention and biotreatment facilities, with appropriate pre-treatment BMPs such as catch basin inserts, sand traps, and treatment vaults. In some locations where public space is available, larger regional facilities such as detention basins and infiltration basins are also recommended.

- **Maintenance/repair activities** - Maintenance and repair recommendations focus on improving the function of existing stormwater infrastructure to renew capacities and reduce the transport of pollutants to receiving waters. Field observations identified several locations where repair and maintenance of channels and culverts is needed for these facilities to function as intended. Performing these actions would reduce flooding and sediment transport while preventing erosion issues from developing, propagating, or causing damage to infrastructure.

The prioritized implementation of one or more of the recommendations provided in Appendix A of the WY 2019 Annual Report will produce incremental water quality benefits at discrete locations. The overall cost-effectiveness of these measures can be improved by implementing them through a regionally coordinated plan that includes integrating structural BMPs and maintenance activities to work together as systems in new and existing developments. The recommended planning process should be conducted incrementally beginning with high priority improvements in water quality areas of concern. In addition to identifying the types and locations of improvements, other actions may include a process for defining water quality goals and objectives and conducting outreach and coordination with potential stakeholders. As Phase III of TRWQMP implementation continues, the initial water quality recommendations in Appendix A of the WY 2019 Annual Report could be further refined into a more comprehensive and detailed plan to improve water quality at the watershed scale.

Section 9

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Appendix A
Statistical Workbook

(Provided Electronically)

Appendix B

B-1: 2020 Bioassessment Field Forms

B-2: 2020 Benthic Macroinvertebrate 500-Count Taxa List

B-1: 2000 Bioassessment Field Forms

STREAM: SQUAW CREEK SITE: U M DATE: 8-3-2000 2001

RIFFLE SERIES: 21-36 / 73-77 / 85-93 / 101-104 / 133-143 / / / / / meters
RW U 0-10 / 77-85 / 104-119 / / / / / / meters
POOL SERIES: 10-21 / 36-73 / 93-101 / 119-133 / 143-150 / / / / / meters

Transects at 10 meter intervals along 150 meter reach

T	Stream Width	Bank Cover L	Bank Cover R	Angle Left	Angle Right	Densio. Left	Densio. Up	Densio. Down	Densio. Right	Rndm No.
1	3.4	VgE	VgE	m	m					
2	4.6	VgE	OE	m	m					
3	5.8	VgE	VgE	m	m					
4	3.4	VgE	VgE	S	m					
5	5.7	OE	VgE	S	m					
6	4.6	VgE	OE	U	S					
7	4.0	VgE	OE	U	S					
8	4.9	VgE	OE	U	S					
9	3.2	VgE	OE	U	S					
10	3.1	VgE	OE	m	S					
11	1.7	VgE	OE	U	S					
12	3.4	VgE	VgE	m	m					
13	2.4	VgE	AgE	m	m					
14	4.9	VgE	AgE	m	m					
15	1.0	VgE	VgE	m	U					
	5.0	VgE	VgE	m	U					

GPS: ELEVATION:

SLOPE(s):
stream length(s) upper level reading(s) lower level reading(s)

Pic 80

LINEAR DISTANCE ALONG 150 METER REACH LENGTH: WATER CHEM. SAMPLED? ✓

TEMPERATURE 21.23 pH 7.17 CONDUCTIVITY 174-187 D.O. ~~[illegible]~~ 19.74 ALKALINITY 222.6

Surrounding **RIPARIAN VEGETATION** Cover (w/in 2 m of channel)
[descriptions of species present if known and sparse/common/ or dense]
[Sparse=<25%, Common=50%, Dense=>75%; S-C=25-50%, C-D=50-75%]

Herbaceous Cover DENSE
Woody Bushes SPARSE
Deciduous Trees —
Evergreen Trees SPARSE

ALGAE TYPE(s) Present:
- ☒ Diatom Film (olive green)
- ☒ Filamentous Form (green)
- ☐ Mat / Slime (blue-green)

PHOTOS:

BIO-SC 1 (UPPER MEADOW)

STREAM: SQUAW CREEK SITE: U M DATE: 8-3-20 2001

T	D-1	V-1	ST-1	D-2	V-2	ST-2	D-3	V-3	ST-3	D-4	V-4	ST-4	D-5	V-5	ST-5
1	4		6	34		28	30		9	30		14	6		<1
2	10		1	34		17	29		5	12		4	1		7
3	40		1	39		22	42		18	35		25	2		10
4	2		1	14		11	10		21	1		18	1		2
5	2		2	24		6	18		20	11		5	1		<1
6	1		<1	30		<1	30		Bed	39		8	2		1
7	8		<1	28		15	44		26	29		26	1		19
8	2		<1	35		bed	60		4	20		1	5		32
9	4		38	25		41	28		4	12		5	1		2
10	2		11	4		40	2		19	1		12	1		29
11	21		1	23		11	18		20	11		1	1		30
12	1		23	15		22	31		19	29		1	2		<1
13	[illegible]	1	15	11		5	25		32	30		50	10		<1
14	1		1	39		1	81		10	40		510	2		<1
15	8		17	13		18	12		27	8		18	1		25
	1		1	40		1	100		34	110		Bed	60		<1

COBBLE EMBEDDEDNESS MEASURES (n=25)				

Current Meter used and units:

Photo

0 76 77
50 81 82
100 83 84
150 78 79

BIO-SC2

STREAM: Squaw Creek **SITE:** MIDDLE MEADOW **DATE:** 8-3-2001

RIFFLE SERIES: 0-4 / 65-66 / 98-111 / 128-131 / / / / / / .
RUN 4-50 / 120-128 / 131-137 / / / / / / meters
POOL SERIES: 50-65 / 66-98 / 111-120 / 138-150 / / / / / / meters

Transects at 10 meter intervals along 150 meter reach

T	Stream Width	Bank Cover L	Bank Cover R	Angle Left	Angle Right	Densio. Left	Densio. Up	Densio. Down	Densio. Right	Rndm No.
0 1	3.1	VgE	VgE	M	M					
10 2	4.1	VgE	VgE	M	U					
20 3	4.5	VgE	VgE	M	M					
30 4	4.3	VgE	VgE	M	M					
40 5	4.5	VgE	VgE	U	U					
50 6	5.8	VgE	VgE	M	M					
60 7	6.1	VgE	VgE	M	M					
70 8	5.5	VgE	VgE	U	U					
80 8	3.1	VgE	VgE	U	M					
90 10	3.5	VgE	VgE	U	U					
100 11	6.0	VgE	VgE	U	M					
110 12	2.2	VgE	VgE	M	M					
120 13	4.9	VgE	VgE	S	M					
130 14	2.8	VgE	VgE	M	M					
140 15	5.3	VgE	VgE	M	U					
150	5.5	VgE	VgE	S	M					

GPS: _____ **ELEVATION:** _____

SLOPE(s):
stream length(s) upper level reading(s) lower level reading(s)

LINEAR DISTANCE ALONG 150 METER REACH LENGTH: _____ **WATER CHEM. SAMPLED?** ✓

TEMPERATURE 21.51 **pH** 7.17 **CONDUCTIVITY** 162/173 **D.O.** 9.59 108.7 **ALKALINITY** _____

Surrounding **RIPARIAN VEGETATION** Cover (w/in 2 m of channel)
[descriptions of species present if known and sparse/common/ or dense]
[Sparse=<25%, Common=50%, Dense=>75%; S-C=25-50%, C-D=50-75%]

Herbaceous Cover DENSE
Woody Bushes SPARSE
Deciduous Trees —
Evergreen Trees —

ALGAE TYPE(s) Present:
- ☒ Diatom Film (olive green)
- ☒ Filamentous Form (green)
- ☐ Mat / Slime (blue-green)

PHOTOS: _____

B10-SC2

STREAM: Squaw Creek SITE: mm DATE: 8-3 2001

T	D-1	V-1	ST-1	D-2	V-2	ST-2	D-3	V-3	ST-3	D-4	V-4	ST-4	D-5	V-5	ST-5
1	2		1	3		20	12		21	6		26	1		28
2	29		1	22		27	18		7	29		25	22		<1
3	8		1	8		6	24		20	34		<1	10		<1
4	14		5	26		6	23		13	20		30	18		<1
5	11		1	22		6	31		5	45		40	10		<1
6	3		<1	45		5	26		1	2		1	10		<1
7	35		<1	130		<1	150		1	79		5	10		2
8	22		<1	44		<1	30		31	2		30	1		7
9	10		<1	45		<1	32		20	17		23	3		5
10	30		<1	35		24	28		42	20		18	2		6
11	29		1	4		1	12		2	19		4	5		1
12	1		5	20		6	29		32	15		1	2		<1
13	2		1	10		60	15		23	19		30	8		<1
14	1		21	7		11	9		7	10		44	9		<1
15	8		1	14		28	32		1	38		1	10		1
	2		25	33		29	40		7	42		5	3		<1

COBBLE EMBEDDEDNESS MEASURES (n=25)

Current Meter used and units:

Pts	V	A
0	67	68
50	71	72
100	73	74
150	69	70

BIO-SCB

STREAM: SQUAW CREEK **SITE:** LM Lower meadow **DATE:** 8-3 2001

RIFFLE SERIES: 0-5 / 35-44 / 94-101 / 139-145 / / / / / / / .
RUN 5-34 / 55-67 / 117-139 / / / / / / / meters
POOL SERIES: 44-55 / 67-94 / 101-117 / 145-150 / 14 / / / / / meters

Transects at 10 meter intervals along 150 meter reach

	T	Stream Width	Bank Cover L	Bank Cover R	Angle Left	Angle Right	Densio. Left	Densio. Up	Densio. Down	Densio. Right	Rndm No.
0	1	2.7	VgOE	VgE	S	M					
10	2	5.9	OE	VgE	S	U					
20	3	3.9	OE	VgE	S	U					
30	4	4.8	OE	VgE	S	U					
40	5	3.2	VgE	VgE	M	M					
50	6	4.4	VgE	VgE	M	M					
60	7	6.0	VgE	VgE	M	M					
70	8	4.4	VgE	VgE	M	M					
80	9	4.9	VgE	VgE	M	M					
90	10	6.0	VgE	VgE	S	M					
100	11	3.4	OE	VgE	S	U					
110	12	11.0	VgE	VgE	M	U					
120	13	2.1	VgE	VgE	M	S					
130	14	3.1	VgE	VgE	M	S					
145		1.4	VgO	O	M	S					
150		4.6	VgE	VgE	M	U					

GPS: _____ **ELEVATION:** _____

SLOPE(s):
stream length(s) upper level reading(s) lower level reading(s)

LINEAR DISTANCE ALONG 150 METER REACH LENGTH: _____ **WATER CHEM. SAMPLED?** ✓

TEMPERATURE 18.89 **pH** 7.16 **CONDUCTIVITY** 120/144 **D.O.** 9.43 101.5% **ALKALINITY** _____

Surrounding **RIPARIAN VEGETATION** Cover (w/in 2 m of channel)
[descriptions of species present if known and sparse/common/ or dense]
[Sparse=<25%, Common=50%, Dense=>75%; S-C=25-50%, C-D=50-75%]

Herbaceous Cover DENSE
Woody Bushes SPARSE
Deciduous Trees —
Evergreen Trees —

ALGAE TYPE(s) Present:
- ☒ Diatom Film (olive green)
- ☒ Filamentous Form (green)
- ☐ Mat / Slime (blue-green)

PHOTOS: _____

D = cm

STREAM: Squaw Creek SITE: Lm DATE: 8-3 2001

T	D-1	V-1	ST-1	D-2	V-2	ST-2	D-3	V-3	ST-3	D-4	V-4	ST-4	D-5	V-5	ST-5
1	4 cm	18	18	5		36	6		19	1		5	9		21
2	2		<1	28		2	79		<1	81		<1	5		Bed
3	1		18	29		21	49		4	62		5	1		bed
4	2		31	5		28	24		10	35		1	20		<1
5	1		30	4		15	7		14	11		20	2		1
6	9		<1	20		23	28		18	18		9	2		13
7	29		<1	36		4	30		26	23		10	12		1
8	29		<1	54		5	46		5	45		4	29		<1
9	44		<1	70		5	59		11	28		8	10		1
10	2		1	29		17	65		30	49		12	35		Bed
11	29		2	11		13	22		21	19		bed	15		Bed
12	1		1	76		6	50		9	40		1	49		<1
13	1		<1	6		<1	20		bed	14		<1	1		5
14	1		<1	20		<1	40		20	11		26	1		22
15	4		<1	22		18	19		23	7		10	2		25
	30		<1	32		4	34		7	30		5	10		1

COBBLE EMBEDDEDNESS MEASURES (n=25)				

Current Meter used and units:

PICS (INC) Up/Down

0 59 60
50 61 62
100 63 64
151 65 66

REACH DOCUMENTATION

Standard Reach Length (wetted width ≤ 10 m) = 150 m Distance between transects = 15 m
Alternate Reach Length (wetted width >10 m) = 250 m Distance between transects = 25 m

Project Name: TRWQMP WATER QUALITY	Date: 09/15/20	Sample Collection Time:
Stream Name: MARTIS CREEK	Site Name/ Description: MARTIS CREEK	
Site Code: MC1	Crew Members: JAC, KRM, CBS	
Latitude (actual – decimal degrees): °N	datum: NAD83	
Longitude (actual – decimal degrees): °W	other:	GPS Device:

AMBIENT WATER QUALITY MEASUREMENTS

* Turbidity, silica, oxygen saturation, and air temp are optional; calibration date required on page 24

Water Temp (Deg C)	pH	~~Alkalinity~~ TDS (mg/L)	Turbidity (ntu)*	Oxygen Sat. (%)*
7.43		0.077		
Dissolved O^2 (mg/L)	**Specific. Conduct (uS/cm)**	**Salinity (ppt)**	**Silica (mg/L)***	**Air Temp (Deg C)***
	79/118	0.06		

Actual Reach Length (m) *(see reach length guidelines at top of form)*

Explanation:

DISCHARGE MEASUREMENTS

1st measurement = left bank (looking downstream)

check if discharge measurements not possible (explain in field notes section) ☐

VELOCITY AREA METHOD (preferred)

cal. date | Transect Width (m):

	Distance from Left Bank (cm)	Depth (cm)	Velocity (ft/sec)		Distance from Left Bank (cm)	Depth (cm)	Velocity (ft/sec)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

BUOYANT OBJECT METHOD (use ONLY if velocity area method not possible)

	Float 1	Float 2	Float 3
Distance (m)			
Float Time (sec)			

Float Reach Cross Section

width (m) depth(cm)	Upper Section	Middle Section	Lower Section
Width			
Depth 1			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

Notable Field Conditions (check one box per topic)

Evidence of recent rainfall (enough to increase surface runoff)	NO		minimal		>10% flow increase	
Evidence of fires in reach or immediately upstream (<500 m)	NO		< 1 year		< 5 years	
Dominant landuse/landcover in area surrounding reach	Agriculture		Forest		Rangeland	
	Urban/ Industrial		Suburb/Town		Other	
Site is affected by recent scouring event	NO		YES			
Channel Engineered	NO		YES			

ADDITIONAL COBBLE EMBEDDEDNESS MEASURES

(carry over from transect forms if needed to attain target count of 25; measure in %)

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	

Site Code: MC1 Date: 09 / 15 / 20

SLOPE and BEARING FORM (transect based - for Full PHAB only)

AUTOLEVEL ☐
CLINOMETER ☐
HANDLEVEL ☐
OTHER ☐

Starting Transect	MAIN SEGMENT (record percent of inter-transect distance in each segment if supplemental segments are used)						SUPPLEMENTAL SEGMENT (record percent of inter-transect distance in each segment if supplemental segments are used)					
	Stadia rod measurements		Slope (%) or Elevation Difference cm ☐ % ☐	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)	Stadia rod measurements		Slope or Elevation Difference cm ☐ % ☐	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)
K												
J												
I												
H												
G												
F												
E												
D												
C												
B												
A												
additional calculation area												

ADDITIONAL HABITAT CHARACTERIZATION

High Gradient ☐ Low Gradient ☐

Parameter	Optimal	Suboptimal	Marginal	Poor
Epifaunal Substrate/ Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover (50% for low-gradient streams); mix of submerged logs, undercut banks, cobble or other stable habitat	40-70% mix of stable habitat (30-50% for low-gradient streams); well-suited for full colonization potential	20-40% mix of stable habitat (10-30% in low-gradient streams); substrate frequently disturbed or removed	Less than 20% stable habitat (10% in low-gradient streams); lack of habitat is obvious; substrate unstable or lacking
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition (<20% in low-gradient streams)	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected (20-50% in low-gradient streams)	Moderate deposition of new gravel, sand, or fine sediment on bars; 30-50% of the bottom affected (50 - 80% in low-gradient streams)	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently (>80% in low-gradient streams)
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, (e.g., bridge abutments); evidence of past channelization (> 20yrs) may be present but recent channelization not present	Channelization may be extensive: embankments or shoring structures present on both banks; 40 to 80% of stream reach disrupted	Banks shored with gabian or cement; Over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Site Code: MC1	Site Name: MARTIS CREEK		Date: 09 / 15 / 20
Wetted Width (m): 2.2	Bankfull Width (m): 2.9	Bankfull Height (m): 0.4	**Transect A**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	<1		P (A) D	0	P (A) D	P (A) D	(P) A D
Left Center		8	11		P (A) D	1	P (A) D	P (A) D	P (A) D
Center		8	5		P (A) D	0	P (A) D	P (A) D	P (A) D
Right Center		6	13		P (A) D	1	P (A) D	P (A) D	P (A) D
Right Bank		4	1		P (A) D	1	P (A) D	P (A) D	(P) A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	(0) 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	
Center Upstream	
Center Right	
Center Downstream	
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**optional**) ☑

Upstream (**required**) ☑

Inter-Transect: AB

Wetted Width (m): 1.5

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		13	3		P (A) D	0	P (A) D	P (A) D	P (A) D
Left Center		14	28		P (A) D	1	P (A) D	P (A) D	P (A) D
Center		12	90	80	(P) A D	1	P (A) D	P (A) D	P (A) D
Right Center		15	29		(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		4	9		P (A) D	1	P (A) D	P (A) D	P (A) D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	50
Run	50
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK	Date: 09 / 15 / 20
Wetted Width (m): 1.7	Bankfull Width (m): 1.9 / Bankfull Height (m): 0.25	**Transect B**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		14	104	~~0~~	(P) A D	1	P (A) D	P (A) D	P (A) D
Left Center		10	25		(P) A D	1	P (A) D	P (A) D	P (A) D
Center		9	31		(P) A D	1	P (A) D	P (A) D	P (A) D
Right Center		9	6		P (A) D	1	P (A) D	P (A) D	P (A) D
Right Bank		2	7		P (A) D	1	P (A) D	P (A) D	P (A) D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
- **0** = No microalgae present, Feels rough, not slimy;
- **1** = Present but not visible, Feels slimy;
- **2** = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
- **3** = 1-5mm;
- **4** = 5-20mm;
- **5** = >20mm;
- **UD** = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
- **D** = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	17
Center Upstream	16
Center Right	17
Center Downstream	17
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: BC

Wetted Width (m): 1.2

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		19	21		P (A) D	1	P (A) D	P (A) D	P (A) D
Left Center		10	250	85	(P) A D	1	P (A) D	P (A) D	P (A) D
Center		10	3		P (A) D	0	P (A) D	P (A) D	P (A) D
Right Center		5	68	0	(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		1	11		P (A) D	1	P (A) D	P (A) D	P (A) D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK	Date: 09/15/28
Wetted Width (m): 2.2	Bankfull Width (m): 2.5 / Bankfull Height (m): 0.45	**Transect C**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	BED		P A D	1	P A D	P A D	P A D
Left Center		10	<1		P A D	0	P A D	P A D	P A D
Center		6	1		P A D	0	P A D	P A D	P A D
Right Center		15	9		P A D	1	P A D	P A D	P A D
Right Bank		20	<1		P A D	0	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

RIPARIAN VEGETATION (facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)
0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

INSTREAM HABITAT COMPLEXITY (5 m u/s, 5 m d/s)
0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

DENSIOMETER READINGS (0-17) *count covered dots*

Center Left	
Center Upstream	
Center Right	
Center Downstream	
Left Bank	
Right Bank	

HUMAN INFLUENCE (circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)
0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

BANK STABILITY (assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: CD

Wetted Width (m): 1.3

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	79	90	P A D	2	P A D	P A D	P A D
Left Center		14	37		P A D	1	P A D	P A D	P A D
Center		19	8		P A D	1	P A D	P A D	P A D
Right Center		11	6		P A D	0	P A D	P A D	P A D
Right Bank		2	52		P A D	1	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK		Date: 09 / 15 / 20
Wetted Width (m): 1.9	Bankfull Width (m): 2.5	Bankfull Height (m): 0.35	**Transect D**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		8	32		P (A) D	1	P (A) D	P (A) D	(P) A D
Left Center		10	6		P (A) D	1	P (A) D	P (A) D	P (A) D
Center		7	6		P (A) D	1	P (A) D	P (A) D	P (A) D
Right Center		9	19		(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		4	3		(P) A D	0	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	(0) 1 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 (1) 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	14
Center Upstream	14
Center Right	17
Center Downstream	16
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: DE

Wetted Width (m): 1.4

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		10	7		P A D	1	P A D	P A D	P A D
Left Center		11	21		P A D	1	P A D	P A D	P A D
Center		4	42		P A D	1	P A D	P A D	P A D
Right Center		3	29		P A D	1	P A D	P A D	P A D
Right Bank		3	35		P A D	1	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: ML1	Site Name: MARTIS CREEK	Date: 09/15/20
Wetted Width (m): 2.2	Bankfull Width (m): 2.5 / Bankfull Height (m): 0.35	**Transect E**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		8	39		P (A) D	1	P (A) D	P (A) D	P (A) D
Left Center		7	19		P (A) D	1	P (A) D	P (A) D	P (A) D
Center		9	<1		P (A) D	0	P (A) D	P (A) D	P (A) D
Right Center		9	12		P (A) D	1	P (A) D	P (A) D	P (A) D
Right Bank		8	13		P (A) D	1	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	17
Center Upstream	17
Center Right	17
Center Downstream	17
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: EF

Wetted Width (m): 1.3

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	<1		P (A) D	0	P (A) D	P (A) D	P (A) D
Left Center		6	110	~~D~~	(P) A D	1	P (A) D	P (A) D	P (A) D
Center		7	<1		P (A) D	0	P (A) D	P (A) D	P (A) D
Right Center		6	42		(P) A D	1	P (A) D	P (A) D	(P) A D
Right Bank		4	13		P (A) D	1	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK	Date: 09 / 15 / 20
Wetted Width (m): 1.5	Bankfull Width (m): 2.5 / Bankfull Height (m): 0.4	**Transect F**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		8	BED		P A D	1	P A D	P A D	P A D
Left Center		9	"		P A D	2	P A D	P A D	P A D
Center		10	60		P A D	2	P A D	P A D	P A D
Right Center		3	25		P A D	1	P A D	P A D	P A D
Right Bank		1	12		P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	17
Center Upstream	17
Center Right	17
Center Downstream	17
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**required**) ☑

Upstream (**required**) ☑

Inter-Transect: FG

Wetted Width (m): 1.4

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		1	10		P (A) D	0	P (A) D	P (A) D	P (A) D
Left Center		8	4		P (A) D	0	P (A) D	P (A) D	P (A) D
Center		12	280		(P) A D	1	P (A) D	P (A) D	P (A) D
Right Center		12	130	90	(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		1	<1		(P) A D	0	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK	Date: 09/15/20
Wetted Width (m): 2.1	Bankfull Width (m): 2.4 / Bankfull Height (m): 0.8	**Transect G**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	11		P A D	0	P A D	P A D	P A D
Left Center		8	30		P A D	1	P A D	P A D	P A D
Center		10	24		P A D	1	P A D	P A D	P A D
Right Center		8	<1		P A D	0	P A D	P A D	P A D
Right Bank		5	4		P A D	0	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	
Center Upstream	
Center Right	
Center Downstream	
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: GH

Wetted Width (m): 1.7

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		10	15		P A D	1	P A D	P A D	P A D
Left Center		9	9		P A D	0	P A D	P A D	P A D
Center		5	31		P A D	1	P A D	P A D	P A D
Right Center		4	<1		P A D	0	P A D	P A D	P A D
Right Bank		1	3		P A D	0	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK	Date: 09 / 15 / 20
Wetted Width (m): 1.9	Bankfull Width (m): 2.1 / Bankfull Height (m): 0.45	**Transect H**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		1	14		P A D	1	P A D	P A D	P A D
Left Center		11	180	0	P A D	2	P A D	P A D	P A D
Center		10	140	75	P A D	1	P A D	P A D	P A D
Right Center		10	13		P A D	1	P A D	P A D	P A D
Right Bank		5	121	25	P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	
Center Upstream	
Center Right	
Center Downstream	
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: HI

Wetted Width (m): 2.6

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		6	90	20	P A D	1	P A D	P A D	P A D
Left Center		4	4		P A D	0	P A D	P A D	P A D
Center		8	28		P A D	1	P A D	P A D	P A D
Right Center		12	150	30	P A D	2	P A D	P A D	P A D
Right Bank		10	2		P A D	0	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK	Date: 09 / 15 / 20
Wetted Width (m): 1.4	Bankfull Width (m): 3.9 / Bankfull Height (m): 0.55	**Transect I**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		11	21		(P) A D	1	P (A) D	P (A) D	P (A) D
Left Center		21	7		P (A) D	1	P (A) D	P (A) D	P (A) D
Center		18	15		(P) A D	1	P (A) D	P (A) D	P (A) D
Right Center		10	1		P (A) D	0	P (A) D	P (A) D	P (A) D
Right Bank		8	<1		P (A) D	0	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 (1) 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	
Center Upstream	
Center Right	
Center Downstream	
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: IJ

Wetted Width (m): 2.1

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		10	29		P A D	1	P A D	P A D	P A D
Left Center		7	45		P A D	1	P A D	P A D	P A D
Center		5	120	95	P A D	1	P A D	P A D	P A D
Right Center		3	64	50	P A D	1	P A D	P A D	P A D
Right Bank		2	55		P A D	2	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK	Date: 09 / 15 / 20
Wetted Width (m): 1.6	Bankfull Width (m): 25 / Bankfull Height (m): 0.25	**Transect J**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		10	31		(P) A D	1	P (A) D	P (A) D	P (A) D
Left Center		12	22		(P) A D	1	P (A) D	P (A) D	P (A) D
Center		10	90	D	P (A) D	1	P (A) D	P (A) D	P (A) D
Right Center		10	65	D	(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		11	55		P (A) D	1	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 (2) 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	
Center Upstream	
Center Right	
Center Downstream	
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: JK

Wetted Width (m): 1.2

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		5	180	50	P A D	1	P A D	P A D	P A D
Left Center		9	150	70	P A D	2	P A D	P A D	P A D
Center		14	220	90	P A D	1	P A D	P A D	P A D
Right Center		12	49		P A D	1	P A D	P A D	P A D
Right Bank		2	<1		P A D	0	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	
Dry	

Site Code: MC1	Site Name: MARTIS CREEK	Date: 09 / 15 / 20
Wetted Width (m): 2.0	Bankfull Width (m): 2.5 / Bankfull Height (m): 0.5	**Transect K**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		16	7		P (A) D	0	P (A) D	P (A) D	P (A) D
Left Center		11	5		P (A) D	1	P (A) D	P (A) D	P (A) D
Center		12	24		P (A) D	1	P (A) D	P (A) D	P (A) D
Right Center		10	5		P (A) D	0	P (A) D	P (A) D	P (A) D
Right Bank		1	<1		P (A) D	0	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
U = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 (1) 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	
Center Upstream	
Center Right	
Center Downstream	
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P (C) B 0	(Y) N	0 B (C) P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**required**) ☑

Upstream (**optional**) ☑

SWAMP Stream Habitat Characterization Form FULL VERSION

REACH DOCUMENTATION

Standard Reach Length (wetted width ≤ 10 m) = 150 m Distance between transects = 15 m
Alternate Reach Length (wetted width >10 m) = 250 m Distance between transects = 25 m

Project Name: TRWQMP	Date: 09/25/20
Stream Name: MARTIS CREEK	Site Name/ Description: LOWER MARTIS CREEK
Site Code: MC5	Crew Members: JAC, KDW KAM
Latitude (actual – decimal degrees): °N	datum: NAD83 other:
Longitude (actual – decimal degrees): °W	GPS Device:

Sample Collection Time:

AMBIENT WATER QUALITY MEASUREMENTS

* Turbidity, silica, oxygen saturation, and air temp are optional; calibration date required on page 24

Water Temp (Deg C)	pH	~~Alkalinity (mg/L)~~ TDS	~~Turbidity (ntu)~~ ORP	Oxygen Sat. (%)*
7.56	6.43	0.094	66.7	42.1%
Dissolved O^2 (mg/L)	**Specific Conduct (uS/cm)**	**Salinity (ppt)**	**~~Silica (mg/L)~~ Ph mV***	**Air Temp (Deg C)***
5.06	97/145	0.07	-340.2	31.5

Actual Reach Length (m) (see reach length guidelines at top of form)

Explanation:

☐ check if discharge measurements not possible (explain in field notes section)

DISCHARGE MEASUREMENTS

1st measurement = left bank (looking downstream)

cal. date

Transect Width (m):

VELOCITY AREA METHOD (preferred)

	Distance from Left Bank (cm)	Depth (cm)	Velocity (ft/sec)		Distance from Left Bank (cm)	Depth (cm)	Velocity (ft/sec)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

BUOYANT OBJECT METHOD (use ONLY if velocity area method not possible)

	Float 1	Float 2	Float 3
Distance (m)			
Float Time (sec)			

Float Reach Cross Section

width (m) depth(cm)	Upper Section	Middle Section	Lower Section
Width			
Depth 1			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

Notable Field Conditions (check one box per topic)

Evidence of recent rainfall (enough to increase surface runoff)	NO		minimal		>10% flow increase	
Evidence of fires in reach or immediately upstream (<500 m)	NO		< 1 year		< 5 years	
Dominant landuse/landcover in area surrounding reach	Agriculture		Forest		Rangeland	
	Urban/ Industrial		Suburb/Town		Other	
Site is affected by recent scouring event	NO		YES			
Channel Engineered	NO		YES			

ADDITIONAL COBBLE EMBEDDEDNESS MEASURES

(carry over from transect forms if needed to attain target count of 25; measure in %)

1	2	3	4	5	6	7	8	9	10	11	12	13

14	15	16	17	18	19	20	21	22	23	24	25

Site Code: MC5 Date: 09 / 25 / 20

SLOPE and BEARING FORM (transect based - for Full PHAB only)

AUTOLEVEL ☐
CLINOMETER ☐
HANDLEVEL ☐
OTHER ☐

Starting Transect	MAIN SEGMENT (record percent of inter-transect distance in each segment if supplemental segments are used)						SUPPLEMENTAL SEGMENT (record percent of inter-transect distance in each segment if supplemental segments are used)					
	Stadia rod measurements		Slope (%) or Elevation Difference cm☐ %☐	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)	Stadia rod measurements		Slope or Elevation Difference cm☐ %☐	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)
K												
J				15	58							
I					72							
H					78							
G					58							
F					86							
E					72							
D					32							
C					34							
B					35							
A					51							
additional calculation area												

ADDITIONAL HABITAT CHARACTERIZATION

High Gradient ☐ Low Gradient ☐

Parameter	Optimal	Suboptimal	Marginal	Poor
Epifaunal Substrate/ Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover (50% for low-gradient streams); mix of submerged logs, undercut banks, cobble or other stable habitat	40-70% mix of stable habitat (30-50% for low-gradient streams); well-suited for full colonization potential	20-40% mix of stable habitat (10-30% in low-gradient streams); substrate frequently disturbed or removed	Less than 20% stable habitat (10% in low-gradient streams); lack of habitat is obvious; substrate unstable or lacking
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition (<20% in low-gradient streams)	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected (20-50% in low-gradient streams)	Moderate deposition of new gravel, sand, or fine sediment on bars; 30-50% of the bottom affected (50 - 80% in low-gradient streams)	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently (>80% in low-gradient streams)
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, (e.g., bridge abutments); evidence of past channelization (> 20yrs) may be present but recent channelization not present	Channelization may be extensive: embankments or shoring structures present on both banks; 40 to 80% of stream reach disrupted	Banks shored with gabian or cement; Over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

SWAMP Stream Habitat Characterization Form FULL VERSION Revision Date: January 3, 2017

Site Code: MC5	Site Name: LOWER MARTIS CREEK		Date: 09 / 25 / 20
Wetted Width (m): 2.6	Bankfull Width (m): 6.3	Bankfull Height (m): 0.42	**Transect A**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	<1	-	(P) A D	-	P (A) D	P (A) D	(P) A D
Left Center		52	84	30	(P) A D	2	P (A) D	P (A) D	P (A) D
Center		15	585		(P) A D	3	(P) A D	P (A) D	P (A) D
Right Center		61	32		P (A) D	1	P (A) D	P (A) D	(P) A D
Right Bank		3	<1	-	(P) A D	-	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

RIPARIAN VEGETATION (facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)
0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	(0) 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 (1) 2 3 4	0 1 2 3 (4)
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 (3) 4	0 (1) 2 3 4
Herbs/ grasses	0 1 (2) 3 4	0 1 2 (3) 4
Barren, bare soil/ duff	0 1 2 (3) 4	(0) 1 2 3 4

INSTREAM HABITAT COMPLEXITY (5 m u/s, 5 m d/s)
0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 (2) 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 (4)
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	(0) 1 2 3 4
Undercut Banks	(0) 1 2 3 4
Overhang. Vegetation	0 (1) 2 3 4
Live Tree Roots	(0) 1 2 3 4
Artificial Structures	(0) 1 2 3 4

DENSIOMETER READINGS (0-17) *count covered dots*

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

HUMAN INFLUENCE (circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)
0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	(P) C B 0		0 B C (P)
Bridges/ Abutments	P C B 0	(Y) N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

BANK STABILITY (assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

TAKE PHOTOGRAPHS *(check box if taken & record photo code)*

Downstream (**optional**)
KAW 8 ☑

Upstream (**required**)
KAW 7 ☑

Inter-Transect: AB

Wetted Width (m): 2.2

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	3	<1	P A D	–	P A D	P A D	P A D
Left Center		75	45		P A D	2	P A D	P A D	P A D
Center		73	24		P A D	2	P A D	P A D	P A D
Right Center		65	275		P A D	2	P A D	P A D	P A D
Right Bank		4	<1	—	P A D	–	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	100
Glide	
Pool	
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK	Date: 09 / 25 / 20
Wetted Width (m): 3.0	Bankfull Width (m): 4.9 / Bankfull Height (m): 0.48	**Transect B**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		1	<1	–	P A D	–	P A D	P A D	P A D
Left Center		19	<1	–	P A D	–	P A D	P A D	P A D
Center		41	38		P A D	2	P A D	P A D	P A D
Right Center		8	<1	–	P A D	–	P A D	P A D	P A D
Right Bank		2	<1	–	P A D	–	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: BC

Wetted Width (m): 2.9

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	<1	-	P A D	-	P A D	P A D	P A D
Left Center		40	<1	-	P A D	-	P A D	P A D	P A D
Center		41	88	40	P A D		P A D	P A D	P A D
Right Center		34	24		P A D	2	P A D	P A D	P A D
Right Bank		16	<1	-	P A D	-	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	10
Run	90
Glide	
Pool	
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK		Date: 09/25/20
Wetted Width (m): 5.1	Bankfull Width (m): 6.2	Bankfull Height (m): 0.38	**Transect C**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	<1		P A D		P A D	P A D	P A D
Left Center		45	265		P A D	2	P A D	P A D	P A D
Center		51	17		P A D	1	P A D	P A D	P A D
Right Center		35	<1		P A D		P A D	P A D	P A D
Right Bank		4	<1		P A D	-	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	6
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: CD

Wetted Width (m): 4.2

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		45	<1		P A D	-	P A D	P A D	P A D
Left Center		52	<1		P A D	-	P A D	P A D	P A D
Center		54	105	60	P A D	3	P A D	P A D	P A D
Right Center		50	75	50	P A D	2	P A D	P A D	P A D
Right Bank		2	<1		P A D	-	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	70
Glide	
Pool	30
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK	Date: 09/25/20
Wetted Width (m): 5.6	Bankfull Width (m): 6.8 / Bankfull Height (m): 0.35	**Transect D**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		18	<1		(P) A D		P (A) D	P (A) D	(P) A D
Left Center		36	8		(P) A D	1	P (A) D	P (A) D	P (A) D
Center		40	28		(P) A D	3	P (A) D	P (A) D	P (A) D
Right Center		31	218	0	(P) A D	3	(P) A D	P (A) D	P (A) D
Right Bank		10	205	0	(P) A D	1	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	(0) 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 (1) 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 (1) 2 3 4	0 (1) 2 3 4
Herbs/ grasses	0 1 (2) 3 4	0 1 (2) 3 4
Barren, bare soil/ duff	0 1 2 (3) 4	0 1 2 3 (4)

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 (1) 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 (1) 2 3 4
Boulders	0 (1) 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 (1) 2 3 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 (1) 2 3 4
Live Tree Roots	(0) 1 2 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	(P) C B 0		0 B C (P)
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: DE

Wetted Width (m): 4.2

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		21	<1		P A D		P A D	P A D	P A D
Left Center		36	<1		P A D	–	P A D	P A D	P A D
Center		52	96	~~0~~	P A D	2	P A D	P A D	P A D
Right Center		44	222	~~0~~	P A D	3	P A D	P A D	P A D
Right Bank		5	<1		P A D		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	60
Glide	
Pool	40
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK	Date: 09 / 25 / 20
Wetted Width (m): 3.9	Bankfull Width (m): 4.6 / Bankfull Height (m): 0.49	**Transect E**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		28	<1		P A D	–	P A D	P A D	P A D
Left Center		46	<1		P A D	–	P A D	P A D	P A D
Center		55	73	0	P A D	2	P A D	P A D	P A D
Right Center		47	265		P A D	3	P A D	P A D	P A D
Right Bank		3	310		P A D	2	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: EF

Wetted Width (m): 2.9

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	<1		P A D	-	P A D	P A D	P A D
Left Center		22	22		P A D	1	P A D	P A D	P A D
Center		28	205	0	P A D	3	P A D	P A D	P A D
Right Center		30	15		P A D	1	P A D	P A D	P A D
Right Bank		14	6		P A D	1	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	10
Run	90
Glide	
Pool	
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK		Date: 09 / 25 / 20
Wetted Width (m): 2.1	Bankfull Width (m): 5.3	Bankfull Height (m): 0.58	**Transect F**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		13	<1		P A D		P A D	P A D	P A D
Left Center		25	52		P A D	2	P A D	P A D	P A D
Center		22	43		P A D	2	P A D	P A D	P A D
Right Center		17	13		P A D	2	P A D	P A D	P A D
Right Bank		3	<1		P A D	–	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

RIPARIAN VEGETATION (facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

INSTREAM HABITAT COMPLEXITY (5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

DENSIOMETER READINGS (0-17) *count covered dots*

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

HUMAN INFLUENCE (circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

BANK STABILITY (assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

TAKE PHOTOGRAPHS *(check box if taken & record photo code)*

Downstream (**required**)
KON 10 ☑

Upstream (**required**)
KON 9 ☑

Inter-Transect: FG

Wetted Width (m): 5.0

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	82	~~0~~	P A D	1	P A D	P A D	P A D
Left Center		15	<1		P A D		P A D	P A D	P A D
Center		22	34		P A D	2	P A D	P A D	P A D
Right Center		21	5		P A D	2	P A D	P A D	P A D
Right Bank		4	<1	-	P A D	-	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	10
Run	60
Glide	
Pool	30
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK	Date: 09 / 25 / 20
Wetted Width (m): 3.7	Bankfull Width (m): 4.7 / Bankfull Height (m): 0.64	**Transect G**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		8	<1		P A D		P A D	P A D	P A D
Left Center		27	26		P A D	–	P A D	P A D	P A D
Center		29	43		P A D	2	P A D	P A D	P A D
Right Center		19	17		P A D	2	P A D	P A D	P A D
Right Bank		5	25	–	P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: GH

Wetted Width (m): 3.6

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		43	<1		P A D	–	P A D	P A D	P A D
Left Center		50	13		P A D	2	P A D	P A D	P A D
Center		53	32		P A D	2	P A D	P A D	P A D
Right Center		53	<1		P A D	–	P A D	P A D	P A D
Right Bank		23	<1		P A D	–	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	50
Glide	
Pool	50
Dry	

Site Code: ML5	Site Name: LOWER MARTIS CREEK	Date: 09 / 25 / 20
Wetted Width (m): 3.1	Bankfull Width (m): 4.8 / Bankfull Height (m): 0.63	**Transect H**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	<1		(P) A D		P (A) D	P (A) D	(P) A D
Left Center		27	3		(P) A D	1	P (A) D	P (A) D	P (A) D
Center		39	13		(P) A D	2	P (A) D	P (A) D	P (A) D
Right Center		42	54		(P) A D	3	P (A) D	P (A) D	P (A) D
Right Bank		24	<1		(P) A D	–	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	(0) 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	(0) 1 2 3 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	(0) 1 2 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 2 (3) 4	0 1 (2) 3 4
Barren, bare soil/ duff	0 1 2 (3) 4	(0) 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 (1) 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 (1) 2 3 4
Boulders	0 (1) 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	(0) 1 2 3 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 (1) 2 3 4
Live Tree Roots	(0) 1 2 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	(P) C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: HI

Wetted Width (m): 2.2

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		5	<1		P A D		P A D	P A D	P A D
Left Center		16	46		P A D	2	P A D	P A D	P A D
Center		20	63		P A D	3	P A D	P A D	P A D
Right Center		16	54		P A D	3	P A D	P A D	P A D
Right Bank		8	<1		P A D		P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Flow Habitats
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	20
Run	80
Glide	
Pool	
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK	Date: 09 / 25 / 20
Wetted Width (m): 2.3	Bankfull Width (m): 4.0 / Bankfull Height (m): 0.55	**Transect I**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	<1		P A D		P A D	P A D	P A D
Left Center		41	48		P A D	3	P A D	P A D	P A D
Center		44	213	80	P A D	2	P A D	P A D	P A D
Right Center		34	32		P A D	2	P A D	P A D	P A D
Right Bank		6	<1		P A D	—	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: IJ

Wetted Width (m): 1.8

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	<1		P A D	1	P A D	P A D	P A D
Left Center		15	41		P A D	2	P A D	P A D	P A D
Center		17	62		P A D	1	P A D	P A D	P A D
Right Center		13	58		P A D	3	P A D	P A D	P A D
Right Bank		3	<1		P A D	-	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	90
Run	10
Glide	
Pool	
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK		Date: 09 / 25 / 20
Wetted Width (m): 3.2	Bankfull Width (m): 4.8	Bankfull Height (m): 0.72	**Transect J**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		5	<1		P A D		P A D	P A D	P A D
Left Center		22	34		P A D	2	P A D	P A D	P A D
Center		10	34		P A D	1	P A D	P A D	P A D
Right Center		DRY	<1		P A D	–	P A D	P A D	P A D
Right Bank		3	<1		P A D		P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	
Center Upstream	
Center Right	
Center Downstream	
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank	
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P	1m 1+m
Buildings	P C B 0	Y N	0 B C P	
Pavement/ Cleared Lot	P C B 0		0 B C P	
Road/ Railroad	P C B 0	Y N	0 B C P	
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P	
Landfill/ Trash	P C B 0	Y N	0 B C P	
Park/ Lawn	P C B 0		0 B C P	
Row Crop	P C B 0		0 B C P	
Pasture/ Range	P C B 0		0 B C P	
Logging Operations	P C B 0		0 B C P	
Mining Activity	P C B 0	Y N	0 B C P	
Vegetation Management	P C B 0		0 B C P	upstream veg mgmt.
Bridges/ Abutments	P C B 0	Y N	0 B C P	
Orchards/ Vineyards	P C B 0		0 B C P	

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: JK

Wetted Width (m): 3.9

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		6	<1		P A D		P A D	P A D	P A D
Left Center		45	46		P A D	1	P A D	P A D	P A D
Center		47	66	0	P A D	1	P A D	P A D	P A D
Right Center		41	50		P A D	1	P A D	P A D	P A D
Right Bank		14	<1		P A D	-	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	60
Glide	
Pool	40
Dry	

Site Code: MC5	Site Name: LOWER MARTIS CREEK	Date: 09/25/20
Wetted Width (m): 3.4	Bankfull Width (m): 6.3 / Bankfull Height (m): 0.53	**Transect K**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	<1		(P) A D	-	P (A) D	P (A) D	(P) A D
Left Center		43	13		(P) A D	1	P (A) D	P (A) D	P (A) D
Center		51	88	0	(P) A D	3	(P) A D	P (A) D	P (A) D
Right Center		53	43		(P) A D	2	(P) A D	P (A) D	(P) A D
Right Bank		29	<1		(P) A D	-	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
U = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	(0) 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 (3) 4	0 1 2 (3) 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 (1) 2 3 4	(0) 1 2 3 4
Herbs/ grasses	0 1 2 (3) 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 1 (2) 3 4	0 1 2 (3) 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 (2) 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 (1) 2 3 4
Boulders	0 (1) 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	(0) 1 2 3 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 (1) 2 3 4
Live Tree Roots	(0) 1 2 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	0
Center Right	0
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	(P) C B 0		0 B C (P)
Bridges/ Abutments	(P) C B 0	Y N	0 B C (P)
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**required**)
KDN 6 ☑

Upstream (**optional**)
KUN 5 ☑

REACH DOCUMENTATION

Standard Reach Length (wetted width ≤ 10 m) = 150 m Distance between transects = 15 m
Alternate Reach Length (wetted width >10 m) = 250 m Distance between transects = 25 m

Project Name: TRWQMP	Date: 10 / 12 / 20	Sample Collection Time:
Stream Name: E MARTIS CREEK	Site Name/ Description: MC7 / E. MARTIS CREEK	
Site Code: MC7	Crew Members: JAC, KRM, KMW	
Latitude (actual – decimal degrees): °N	datum: NAD83	
Longitude (actual – decimal degrees): °W	other:	GPS Device:

AMBIENT WATER QUALITY MEASUREMENTS

* Turbidity, silica, oxygen saturation, and air temp are optional; calibration date required on page 24

Water Temp (Deg C)	pH	Alkalinity (mg/L)	Turbidity (ntu)*	Oxygen Sat. (%)*
7.64	6.21	0.100	-337.5	61.5%
Dissolved O^2 (mg/L)	**Specific. Conduct (uS/cm)**	**Salinity (ppt)**	**Silica (mg/L)***	**Air Temp (Deg C)***
7.35	103/154	0.07	57.7	29°

Actual Reach Length (m) *(see reach length guidelines at top of form)*

Explanation:

DISCHARGE MEASUREMENTS

1st measurement = left bank (looking downstream)

check if discharge measurements not possible (explain in field notes section) ☐

VELOCITY AREA METHOD (preferred)

cal. date

Transect Width (m):

	Distance from Left Bank (cm)	Depth (cm)	Velocity (ft/sec)		Distance from Left Bank (cm)	Depth (cm)	Velocity (ft/sec)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

BUOYANT OBJECT METHOD (use ONLY if velocity area method not possible)

	Float 1	Float 2	Float 3
Distance (m)			
Float Time (sec)			

Float Reach Cross Section

width (m) depth(cm)	Upper Section	Middle Section	Lower Section
Width			
Depth 1			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

Notable Field Conditions (check one box per topic)

Evidence of recent rainfall (enough to increase surface runoff)	NO		minimal		>10% flow increase	
Evidence of fires in reach or immediately upstream (<500 m)	NO		< 1 year		< 5 years	
Dominant landuse/landcover in area surrounding reach	Agriculture		Forest		Rangeland	
	Urban/ Industrial		Suburb/Town		Other	
Site is affected by recent scouring event	NO		YES			
Channel Engineered	NO		YES			

ADDITIONAL COBBLE EMBEDDEDNESS MEASURES

(carry over from transect forms if needed to attain target count of 25; measure in %)

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	

Site Code: MC7 Date: 10 / 12 / 20

SLOPE and BEARING FORM (transect based - for Full PHAB only)

AUTOLEVEL ☐
CLINOMETER ☐
HANDLEVEL ☐
OTHER ☐

Starting Transect	Main Segment (record percent of inter-transect distance in each segment if supplemental segments are used)						Supplemental Segment (record percent of inter-transect distance in each segment if supplemental segments are used)					
	Stadia rod measurements		Slope (%) or Elevation Difference cm ☐ % ☑	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)	Stadia rod measurements		Slope or Elevation Difference cm ☐ % ☐	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)
K												
J			4	15	294							
I			3		272							
H			4.5		264							
G			7		238							
F			3		264							
E			3.5		292							
D			4		228							
C			3.5		270							
B			3.5		290							
A			2.5		300							
additional calculation area												

ADDITIONAL HABITAT CHARACTERIZATION

High Gradient ☐ Low Gradient ☐

Parameter	Optimal	Suboptimal	Marginal	Poor
Epifaunal Substrate/ Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover (50% for low-gradient streams); mix of submerged logs, undercut banks, cobble or other stable habitat	40-70% mix of stable habitat (30-50% for low-gradient streams); well-suited for full colonization potential	20-40% mix of stable habitat (10-30% in low-gradient streams); substrate frequently disturbed or removed	Less than 20% stable habitat (10% in low-gradient streams); lack of habitat is obvious; substrate unstable or lacking
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition (<20% in low-gradient streams)	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected (20-50% in low-gradient streams)	Moderate deposition of new gravel, sand, or fine sediment on bars; 30-50% of the bottom affected (50 - 80% in low-gradient streams)	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently (>80% in low-gradient streams)
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, (e.g., bridge abutments); evidence of past channelization (> 20yrs) may be present but recent channelization not present	Channelization may be extensive: embankments or shoring structures present on both banks; 40 to 80% of stream reach disrupted	Banks shored with gabian or cement; Over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Site Code: MC7	Site Name: E MARIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 1.6	Bankfull Width (m): 2.8 / Bankfull Height (m): 0.32	**Transect A**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	46	—	P A D	1	P A D	P A D	P A D
Left Center		18	24		P A D	1	P A D	P A D	P A D
Center		13	84	40	P A D	1	P A D	P A D	P A D
Right Center		13	23		P A D	1	P A D	P A D	P A D
Right Bank		9	4		P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	18
Center Upstream	16
Center Right	11
Center Downstream	11
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**optional**)
KDW48 ☑

Upstream (**required**)
KDW47 ☑

Inter-Transect: AB

Wetted Width (m): 2.0

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		10	<1		P A D	–	P A D	P A D	P A D
Left Center		15	31		P A D	1	P A D	P A D	P A D
Center		13	34		P A D	2	P A D	P A D	P A D
Right Center		8	28		P A D	1	P A D	P A D	P A D
Right Bank		6	<1		P A D	–	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	100
Glide	
Pool	
Dry	

Site Code: MC7	Site Name: E MARTIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 2.2	Bankfull Width (m): 2.4 / Bankfull Height (m): 0.48	**Transect B**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		8	<1		P A D	0	P A D	P A D	P A D
Left Center		6	6		P A D	0	P A D	P A D	P A D
Center		14	118	40	P A D	2	P A D	P A D	P A D
Right Center		13	27		P A D	1	P A D	P A D	P A D
Right Bank		4	<1		P A D	—	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	17
Center Upstream	17
Center Right	13
Center Downstream	14
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: BC

Wetted Width (m): 1.6

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	<1		P A D	—	P A D	P A D	P A D
Left Center		20	6		P A D	0	P A D	P A D	P A D
Center		16	118	80	P A D	2	P A D	P A D	P A D
Right Center		19	<1		P A D	—	P A D	P A D	P A D
Right Bank		3	<1		P A D	—	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	10
Run	90
Glide	
Pool	
Dry	

Site Code: MC7	Site Name: E. MARTIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 1.4	Bankfull Width (m): 2.3 / Bankfull Height (m): 0.41	**Transect C**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	<1		(P) A D	—	P (A) D	P (A) D	(P) A D
Left Center		13	<1		(P) A D	—	P (A) D	P (A) D	P (A) D
Center		18	12		(P) A D	1	(P) A D	P (A) D	P (A) D
Right Center		157	134	80	(P) A D	2	(P) A D	P (A) D	P (A) D
Right Bank		8	<1		(P) A D	—	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	(0) 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 (1) 2 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 2 (3) 4	0 1 2 (3) 4
Barren, bare soil/ duff	0 1 (2) 3 4	0 1 (2) 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	(0) 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 (1) 2 3 4
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 (1) 2 3 4
Undercut Banks	0 1 (2) 3 4
Overhang. Vegetation	0 (1) 2 3 4
Live Tree Roots	(0) 1 2 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	6
Center Upstream	4
Center Right	2
Center Downstream	9
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: CD

Wetted Width (m): 1.7

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		7	23		P A D	0	P A D	P A D	P A D
Left Center		3	148	~~0~~	P A D	2	P A D	P A D	P A D
Center		0	211	10	P A D	2	P A D	P A D	P A D
Right Center		13	138	80	P A D	2	P A D	P A D	P A D
Right Bank		4	<1	–	P A D	–	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	50
Run	50
Glide	
Pool	
Dry	

Site Code: MC7	Site Name: E. MARTIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 1.8	Bankfull Width (m): 24 / Bankfull Height (m): 0.46	**Transect D**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		8	<1		P A D	—	P A D	P A D	P A D
Left Center		21	18		P A D	0	P A D	P A D	P A D
Center		22	<1		P A D	—	P A D	P A D	P A D
Right Center		12	26		P A D	1	P A D	P A D	P A D
Right Bank		4	<1		P A D	—	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	18
Center Upstream	14
Center Right	14
Center Downstream	12
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: DE

Wetted Width (m): 1.3

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		8	84	~~0~~	P A D	2	P A D	P A D	P A D
Left Center		13	106	~~0~~	P A D	3	P A D	P A D	P A D
Center		5	143	40	P A D	3	P A D	P A D	P A D
Right Center		13	38	—	P A D	2	P A D	P A D	P A D
Right Bank		8	<1	—	P A D	—	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

- **0** = No microalgae present, Feels rough, not slimy;
- **1** = Present but not visible, Feels slimy;
- **2** = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
- **3** = 1-5mm;
- **4** = 5-20mm;
- **5** = >20mm;
- **UD** = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
- **D** = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	30
Run	60
Glide	
Pool	
Dry	

Site Code: MC7	Site Name: E MARTIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 1.9	Bankfull Width (m): 3.1	Bankfull Height (m): 0.46

Transect E

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	63		P A D	1	P A D	P A D	P A D
Left Center		10	88	0	P A D	1	P A D	P A D	P A D
Center		0	228	30	P A D	2	P A D	P A D	P A D
Right Center		18	12		P A D	1	P A D	P A D	P A D
Right Bank		3	<1		P A D	—	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	18
Center Upstream	19
Center Right	3
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: EF

Wetted Width (m): 1.9

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	14		P A D	1	P A D	P A D	P A D
Left Center		12	145	70	P A D	2	P A D	P A D	P A D
Center		11	121	~~0~~	P A D	1	P A D	P A D	P A D
Right Center		6	98	~~0~~	P A D	1	P A D	P A D	P A D
Right Bank		3	<1	—	P A D	—	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	40
Run	50
Glide	
Pool	10
Dry	

Site Code: MC7	Site Name: E. MARTIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 1.7	Bankfull Width (m): 2.8 / Bankfull Height (m): 0.47	**Transect F**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		19	8		(P) A D	0	P (A) D	P (A) D	(P) A D
Left Center		26	84	0	(P) A D	1	P (A) D	P (A) D	P (A) D
Center		6	205	60	(P) A D	2	(P) A D	P (A) D	P (A) D
Right Center		10	<1	—	(P) A D	—	P (A) D	P (A) D	P (A) D
Right Bank		5	<1		(P) A D	—	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 (1) 2 3 4	0 (1) 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 (1) 2 3 4	0 1 (2) 3 4
Barren, bare soil/ duff	0 (1) 2 3 4	0 1 (2) 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 (1) 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 (1) 2 3 4
Boulders	0 (1) 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	0 1 2 (3) 4
Overhang. Vegetation	0 1 2 (3) 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	19
Center Upstream	3
Center Right	6
Center Downstream	20
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**required**)
KDW50 ☑

Upstream (**required**)
KDU 49 ☑

Inter-Transect: FG

Wetted Width (m): 2.2

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		6	4		P A D	0	P A D	P A D	P A D
Left Center		0	3,3		P A D	2	P A D	P A D	P A D
Center		15	17		P A D	1	P A D	P A D	P A D
Right Center		17	103	20	P A D	1	P A D	P A D	P A D
Right Bank		3	<1		P A D	—	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	20
Run	80
Glide	
Pool	
Dry	

Site Code: MC7	Site Name: E. MARTIS CREEK	Date: 10/12/20
Wetted Width (m): 2.1	Bankfull Width (m): 2.8 / Bankfull Height (m): 0.58	**Transect G**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	<1		P A D	—	P A D	P A D	P A D
Left Center		19	111	70	P A D	2	P A D	P A D	P A D
Center		14	167	0	P A D	2	P A D	P A D	P A D
Right Center		6	94	0	P A D	2	P A D	P A D	P A D
Right Bank		3	<1		P A D	—	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	4
Center Upstream	7
Center Right	8
Center Downstream	7
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: GH

Wetted Width (m): 1.8

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		8	78	100	P A D	1	P A D	P A D	P A D
Left Center		15	58	–	P A D	1	P A D	P A D	P A D
Center		14	174	~~0~~	P A D	2	P A D	P A D	P A D
Right Center		8	74	~~0~~	P A D	1	P A D	P A D	P A D
Right Bank		3	94	~~0~~	P A D	2	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	60
Run	40
Glide	
Pool	
Dry	

Site Code: MC7	Site Name: E MARTIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 3.0	Bankfull Width (m): 4.6 / Bankfull Height (m): 0.51	**Transect H**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	<1		(P) A D	—	P (A) D	P (A) D	P (A) D
Left Center		15	112	0	(P) A D	1	P (A) D	P (A) D	P (A) D
Center		12	187	100	(P) A D	3	(P) A D	P (A) D	P (A) D
Right Center		19	52		(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		4	<1		(P) A D	—	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 (2) 3 4	0 1 (2) 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 (1) 2 3 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 1 (2) 3 4	0 1 2 (3) 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 (1) 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 (2) 3 4
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 (1) 2 3 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 (1) 2 3 4
Live Tree Roots	0 (1) 2 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	20
Center Upstream	18
Center Right	12
Center Downstream	12
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: HI

Wetted Width (m): 2.7

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	<1		P A D	–	P A D	P A D	P A D
Left Center		16	112	30	P A D	1	P A D	P A D	P A D
Center		22	5	–	P A D	0	P A D	P A D	P A D
Right Center		0	414	–	P A D	2	P A D	P A D	P A D
Right Bank		8	25		P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	30
Run	50
Glide	
Pool	20
Dry	

Site Code: MC7	Site Name: E. MARTIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 1.1	Bankfull Width (m): 1.9 / Bankfull Height (m): 0.87	**Transect I**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	196	30	(P) A D	1	P (A) D	P (A) D	P (A) D
Left Center		13	148	100	(P) A D	2	(P) A D	P (A) D	P (A) D
Center		22	42		(P) A D	0	P (A) D	P (A) D	P (A) D
Right Center		13	7		(P) A D	0	P (A) D	P (A) D	P (A) D
Right Bank		5	<1		(P) A D	—	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

RIPARIAN VEGETATION (facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 (2) 3 4	0 1 2 (3) 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 (1) 2 3 4	0 (1) 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 (1) 2 3 4
Herbs/ grasses	0 1 (2) 3 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 (1) 2 3 4	0 1 (2) 3 4

INSTREAM HABITAT COMPLEXITY (5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 (1) 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 (1) 2 3 4
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 (1) 2 3 4
Undercut Banks	0 1 (2) 3 4
Overhang. Vegetation	0 1 (2) 3 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	(0) 1 2 3 4

DENSIOMETER READINGS (0-17) *count covered dots*

Center Left	15
Center Upstream	15
Center Right	19
Center Downstream	18
Left Bank	
Right Bank	

HUMAN INFLUENCE (circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

BANK STABILITY (assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: IJ

Wetted Width (m): 1.8

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	33		P A D	0	P A D	P A D	P A D
Left Center		13	14		P A D	0	P A D	P A D	P A D
Center		8	13		P A D	0	P A D	P A D	P A D
Right Center		4	72	Ø	P A D	1	P A D	P A D	P A D
Right Bank		3	41		P A D	1	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	20
Run	80
Glide	
Pool	
Dry	

Site Code: MC7	Site Name: E. MARTIS CREEK	Date: 10 / 12 / 20
Wetted Width (m): 2.4	Bankfull Width (m): 3.3 / Bankfull Height (m): 0.66	**Transect J**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	4		(P) A D	0	P (A) D	P (A) D	P (A) D
Left Center		11	12		(P) A D	0	P (A) D	P (A) D	P (A) D
Center		8	97	0	(P) A D	2	P (A) D	P (A) D	P (A) D
Right Center		0	144	0	(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		5	21	-	(P) A D	—	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 (1) 2 3 4	0 1 (2) 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 (1) 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 (1) 2 3 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 1 (2) 3 4	0 1 2 (3) 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 (1) 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 (1) 2 3 4
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	0 (1) 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 1 (2) 3 4
Live Tree Roots	0 1 2 (3) 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	15
Center Upstream	16
Center Right	18
Center Downstream	16
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: JK

Wetted Width (m): 2.9

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		5	22		P A D	1	P A D	P A D	P A D
Left Center		18	35		P A D	0	P A D	P A D	P A D
Center		24	72	5	P A D	2	P A D	P A D	P A D
Right Center		15	260	-	P A D	1	P A D	P A D	P A D
Right Bank		8	64	70	P A D	2	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	30
Run	65
Glide	
Pool	5
Dry	

Site Code: MC7	Site Name: E. MARTIS CREEK		Date: 10 / 12 / 20
Wetted Width (m): 1.7	Bankfull Width (m): 3.2	Bankfull Height (m): 0.49	**Transect K**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		6	7		P A D	0	P A D	P A D	P A D
Left Center		12	108	0	P A D	1	P A D	P A D	P A D
Center		10	288		P A D	2	P A D	P A D	P A D
Right Center		11	82	0	P A D	0	P A D	P A D	P A D
Right Bank		3	48	–	P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
U = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

RIPARIAN VEGETATION (facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

INSTREAM HABITAT COMPLEXITY (5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

DENSIOMETER READINGS (0-17) *count covered dots*

Center Left	14
Center Upstream	10
Center Right	16
Center Downstream	16
Left Bank	
Right Bank	

HUMAN INFLUENCE (circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

BANK STABILITY (assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

TAKE PHOTOGRAPHS *(check box if taken & record photo code)*

Downstream (**required**)
KDW 53 ☑

Upstream (**optional**)
KDW 52 ☑

REACH DOCUMENTATION

Standard Reach Length (wetted width ≤ 10 m) = 150 m Distance between transects = 15 m
Alternate Reach Length (wetted width >10 m) = 250 m Distance between transects = 25 m

Project Name: TRWQMP	Date: 10 / 16 / 20	Sample Collection Time:
Stream Name: MARTIS CREEK (MIDDLE)	Site Name/ Description: MIDDLE MARTIS CREEK	
Site Code: MC8	Crew Members: TAG, KRM, CBS	
Latitude (actual – decimal degrees): °N	datum: NAD83	
Longitude (actual – decimal degrees): °W	other:	GPS Device:

AMBIENT WATER QUALITY MEASUREMENTS

* Turbidity, silica, oxygen saturation, and air temp are optional; calibration date required on page 24

Water Temp (Deg C)	pH	~~Alkalinity (mg/L)~~ TDS	~~Turbidity (ntu)*~~ ORP	Oxygen Sat. (%)*
2.81	6.56	0.166	-163.8	68.6
Dissolved O² (mg/L)	**Specific. Conduct (uS/cm)**	**Salinity (ppt)**	**~~Silica (mg/L)*~~ PUMV**	**Air Temp (Deg C)***
9.28	147/255	0.12	-357.0	8°

Actual Reach Length (m) *(see reach length guidelines at top of form)*

Explanation:

DISCHARGE MEASUREMENTS

1st measurement = left bank (looking downstream)

check if discharge measurements not possible (explain in field notes section) ☐

VELOCITY AREA METHOD (preferred)

cal. date | Transect Width (m):

	Distance from Left Bank (cm)	Depth (cm)	Velocity (ft/sec)		Distance from Left Bank (cm)	Depth (cm)	Velocity (ft/sec)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

BUOYANT OBJECT METHOD (use ONLY if velocity area method not possible)

	Float 1	Float 2	Float 3
Distance (m)			
Float Time (sec)			

Float Reach Cross Section

width (m) depth(cm)	Upper Section	Middle Section	Lower Section
Width			
Depth 1			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

Notable Field Conditions (check one box per topic)

Evidence of recent rainfall (enough to increase surface runoff)	NO		minimal		>10% flow increase	
Evidence of fires in reach or immediately upstream (<500 m)	NO		< 1 year		< 5 years	
Dominant landuse/landcover in area surrounding reach	Agriculture		Forest		Rangeland	
	Urban/ Industrial		Suburb/Town		Other	
Site is affected by recent scouring event	NO		YES			
Channel Engineered	NO		YES			

ADDITIONAL COBBLE EMBEDDEDNESS MEASURES

(carry over from transect forms if needed to attain target count of 25; measure in %)

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	

Site Code: MC8 Date: 10 / 16 / 20

SLOPE and BEARING FORM (transect based - for Full PHAB only)

AUTOLEVEL ☐
CLINOMETER ☐
HANDLEVEL ☐
OTHER ☐

Starting Transect	Main Segment (record percent of inter-transect distance in each segment if supplemental segments are used)						Supplemental Segment (record percent of inter-transect distance in each segment if supplemental segments are used)					
	Stadia rod measurements		Slope (%) or Elevation Difference cm ☐ % ☑	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)	Stadia rod measurements		Slope or Elevation Difference cm ☐ % ☐	Segment Length (m)	Bearing (0°-359°)	Percent of Total Length (%)
K												
J			56	15	58							
I			2		318							
H			6		332							
G			5		312							
F			5		316							
E			3.5		304							
D			3		312							
C			2		290							
B			2.5		338							
A			6	↓	332							
additional calculation area												

ADDITIONAL HABITAT CHARACTERIZATION

High Gradient ☐ Low Gradient ☐

Parameter	Optimal	Suboptimal	Marginal	Poor
Epifaunal Substrate/ Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover (50% for low-gradient streams); mix of submerged logs, undercut banks, cobble or other stable habitat	40-70% mix of stable habitat (30-50% for low-gradient streams); well-suited for full colonization potential	20-40% mix of stable habitat (10-30% in low-gradient streams); substrate frequently disturbed or removed	Less than 20% stable habitat (10% in low-gradient streams); lack of habitat is obvious; substrate unstable or lacking
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition (<20% in low-gradient streams)	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected (20-50% in low-gradient streams)	Moderate deposition of new gravel, sand, or fine sediment on bars; 30-50% of the bottom affected (50 - 80% in low-gradient streams)	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently (>80% in low-gradient streams)
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, (e.g., bridge abutments); evidence of past channelization (> 20yrs) may be present but recent channelization not present	Channelization may be extensive: embankments or shoring structures present on both banks; 40 to 80% of stream reach disrupted	Banks shored with gabian or cement; Over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Site Code: MC8	Site Name: MARTIS CREEK (MIDDLE)	Date: 10 / 16 / 20
Wetted Width (m): 0.98	Bankfull Width (m): 3.8	Bankfull Height (m): 0.52

Transect A

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		1	200	10	P A D	1	P A D	P A D	P A D
Left Center		8	68	~~0~~	P A D	2	P A D	P A D	P A D
Center		9	108	90	P A D	2	P A D	P A D	P A D
Right Center		10	<1	–	P A D	–	P A D	P A D	P A D
Right Bank		4	<1	–	P A D	–	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	5
Center Upstream	12
Center Right	8
Center Downstream	8
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**optional**)
KRM 1224 ☑

Upstream (**required**)
KRM 1225 ☑

Inter-Transect: AB

Wetted Width (m): 0.84

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	9	–	P (A) D	1	P (A) D	P (A) D	P (A) D
Left Center		7	15	–	(P) A D	2	P (A) D	P (A) D	P (A) D
Center		8	3	–	P (A) D	1	P (A) D	P (A) D	P (A) D
Right Center		4	13	–	(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		4	<1	–	(P) A D	–	P (A) D	P (A) D	(P) A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	15
Run	85
Glide	
Pool	
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIS CREEK	Date: 10 / 16 / 20
Wetted Width (m): 1.9	Bankfull Width (m): 4.2 / Bankfull Height (m): 0.45	**Transect B**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		1	<1		P (A) D	–	P (A) D	P (A) D	(P) A D
Left Center		2	45	–	(P) A D	2	P (A) D	P (A) D	(P) A D
Center		<1	38		(P) A D	2	P (A) D	P (A) D	(P) A D
Right Center		2	7		P (A) D	1	P (A) D	P (A) D	(P) A D
Right Bank		2	<1		(P) A D	–	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	0 1 (2) 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 2 (3) 4	0 1 2 (3) 4
Barren, bare soil/ duff	0 1 (2) 3 4	0 (1) 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	(0) 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 (4)
Boulders	0 (1) 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	(0) 1 2 3 4
Overhang. Vegetation	0 1 2 3 (4)
Live Tree Roots	0 (1) 2 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	9
Center Upstream	7
Center Right	17
Center Downstream	17
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	(P) C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: BC

Wetted Width (m): 1.8

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	<1		P A D	—	P A D	P A D	P A D
Left Center		3	<1		P A D		P A D	P A D	P A D
Center		18	9		P A D	1	P A D	P A D	P A D
Right Center		15	25		P A D	1	P A D	P A D	P A D
Right Bank		3	<1		P A D	—	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	20
Glide	
Pool	80
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIS CREEK	Date: 10/16/20
Wetted Width (m): 2.1	Bankfull Width (m): 6.4 / Bankfull Height (m): 0.54	**Transect C**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	7	–	P A D	1	P A D	P A D	P A D
Left Center		10	<1		P A D	–	P A D	P A D	P A D
Center		10	<1		P A D	–	P A D	P A D	P A D
Right Center		9	<1		P A D	–	P A D	P A D	P A D
Right Bank		3	12		P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	0
Center Upstream	1
Center Right	6
Center Downstream	0
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: CD

Wetted Width (m): 1.3

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		13	<1		P A D	–	P A D	P A D	P A D
Left Center		34	4/10	–	P A D	2	P A D	P A D	P A D
Center		42	221	30	P A D	2	P A D	P A D	P A D
Right Center		40	<1		P A D		P A D	P A D	P A D
Right Bank		10	<1		P A D		P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	
Glide	
Pool	100
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIS CREEK	Date: 10 / 16 / 20
Wetted Width (m): 2.1	Bankfull Width (m): 2.8 / Bankfull Height (m): 0.49	**Transect D**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		30	<1		(P) A D	–	P (A) D	P (A) D	(P) A D
Left Center		36	<1		(P) A D	–	P (A) D	P (A) D	P (A) D
Center		36	<1		(P) A D		P (A) D	P (A) D	P (A) D
Right Center		40	310		(P) A D	2	P (A) D	P (A) D	P (A) D
Right Bank		24	5		(P) A D	1	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	0 (1) 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 (1) 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 2 (3) 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 (1) 2 3 4	0 1 2 (3) 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	(0) 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 (2) 3 4
Boulders	(0) 1 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	0 1 (2) 3 4
Overhang. Vegetation	0 1 (2) 3 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	0 (1) 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	4
Center Upstream	6
Center Right	11
Center Downstream	4
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	(P) C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	(eroded)	vulnerable	stable
Right Bank	(eroded)	vulnerable	stable

Inter-Transect: DE

Wetted Width (m): 0.85

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		12	171	20	P A D	1	P A D	P A D	P A D
Left Center		10	44	-	P A D	1	P A D	P A D	P A D
Center		9	<1		P A D	—	P A D	P A D	P A D
Right Center		7	65	0	P A D	1	P A D	P A D	P A D
Right Bank		3	12		P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	100
Glide	
Pool	
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIN CREEK	Date: 10 / 16 / 20
Wetted Width (m): 0.48	Bankfull Width (m): 5.2 / Bankfull Height (m): 0.54	**Transect E**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		6	16		P (A) D	1	P (A) D	P (A) D	P (A) D
Left Center		4	12		(P) A D	1	P (A) D	P (A) D	P (A) D
Center		4	29		(P) A D	1	P (A) D	P (A) D	P (A) D
Right Center		2	18		P (A) D	1	P (A) D	P (A) D	P (A) D
Right Bank		2	<1		(P) A D	—	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 (1) 2 3 4	0 1 (2) 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 (2) 3 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 (1) 2 3 4	0 1 2 (3) 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	(0) 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 (2) 3 4
Boulders	(0) 1 2 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 2 (3) 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 1 (2) 3 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	17
Center Upstream	17
Center Right	17
Center Downstream	16
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	(P) C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	(vulnerable)	stable
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: EF

Wetted Width (m): 1.1

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		6	<1		P A D	–	P A D	P A D	P A D
Left Center		8	3		P A D	1	P A D	P A D	P A D
Center		9	488		P A D	2	P A D	P A D	P A D
Right Center		7	<1		P A D	–	P A D	P A D	P A D
Right Bank		5	<1		P A D	–	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	50
Glide	
Pool	50
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIS CREEK	Date: 10 / 16 / 20
Wetted Width (m): 1.2	Bankfull Width (m): 4.8 / Bankfull Height (m): 0.91	**Transect F**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	110	20	(P) A D	1	P (A) D	P (A) D	P (A) D
Left Center		5	77	0	(P) A D	1	P (A) D	P (A) D	P (A) D
Center		4	53		(P) A D	2	(P) A D	P (A) D	P (A) D
Right Center		3	174	10	(P) A D	2	(P) A D	P (A) D	P (A) D
Right Bank		2	3		(P) A D	1	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	0 1 (2) 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 (1) 2 3 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 (2) 3 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 (1) 2 3 4	0 1 2 (3) 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	(0) 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 (1) 2 3 4
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	0 (1) 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 1 (2) 3 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	13
Center Upstream	5
Center Right	15
Center Downstream	17
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	(P) C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	(eroded)	vulnerable	stable

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**required**)
KRM 1226 ☑

Upstream (**required**)
KRM 1227 ☑

Inter-Transect: FG

Wetted Width (m): 0.73

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	<1	—	P A D	—	P A D	P A D	P A D
Left Center		4	<1	—	P A D	—	P A D	P A D	P A D
Center		4	49	—	P A D	2	P A D	P A D	P A D
Right Center		5	68	85	P A D	2	P A D	P A D	P A D
Right Bank		1	389	-	P A D	2	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	90
Glide	
Pool	10
Dry	

Site Code: MCB	Site Name: MIDDLE MARTIS CREEK		Date: 10 / 16 / 20
Wetted Width (m): 1.6	Bankfull Width (m): 3.9	Bankfull Height (m): 0.72	**Transect G**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	BED		P A D	2	P A D	P A D	P A D
Left Center		5	BED		P A D	2	P A D	P A D	P A D
Center		6	BED		P A D	2	P A D	P A D	P A D
Right Center		6	362		P A D	2	P A D	P A D	P A D
Right Bank		5	98	75	P A D	2	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 2 3 4	0 1 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 3 4	0 1 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 2 3 4	0 1 2 3 4
Herbs/ grasses	0 1 2 3 4	0 1 2 3 4
Barren, bare soil/ duff	0 1 2 3 4	0 1 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4
Artificial Structures	0 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	17
Center Upstream	17
Center Right	16
Center Downstream	16
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

Inter-Transect: GH

Wetted Width (m): 0.66

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		1	54		P A D	1	P A D	P A D	P A D
Left Center		4	BED		P A D	1	P A D	P A D	P A D
Center		2	"		P A D	1	P A D	P A D	P A D
Right Center		1	12		P A D	1	P A D	P A D	P A D
Right Bank		1	15		P A D	1	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	10
Run	85
Glide	
Pool	5
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIS CREEK	Date: 10 / 16 / 20
Wetted Width (m): 0.7	Bankfull Width (m): 1.8 / Bankfull Height (m): 0.58	**Transect H**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		5	11		(P) A D	1	P (A) D	P (A) D	P (A) D
Left Center		5	2		(P) A D	0	P (A) D	P (A) D	P (A) D
Center		7	195	80	(P) A D	2	P (A) D	P (A) D	P (A) D
Right Center		8	97	0	(P) A D	2	(P) A D	P (A) D	P (A) D
Right Bank		1	102	50	P A D	1	(P) A D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 (1) 2 3 4	0 1 2 (3) 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) (3) 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 (2) 3 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 1 2 (3) 4	0 1 2 (3) 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 (1) 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 (2) 3 4
Boulders	0 1 2 (3) 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 2 (3) 4
Undercut Banks	0 1 (2) 3 4
Overhang. Vegetation	0 1 2 (3) 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	17
Center Upstream	17
Center Right	17
Center Downstream	17
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	(P) C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	(vulnerable)	stable
Right Bank	eroded	vulnerable	(stable)

Inter-Transect: HI

Wetted Width (m): 1.6

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		9	<1		P A D	–	P A D	P A D	P A D
Left Center		10	<1		P A D	–	P A D	P A D	P A D
Center		13	15		P A D	1	P A D	P A D	P A D
Right Center		12	210	90	P A D	2	P A D	P A D	P A D
Right Bank		3	46		P A D	2	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	20
Glide	
Pool	80
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIS CREEK	Date: 10/16/20
Wetted Width (m): 0.45	Bankfull Width (m): 2.8 / Bankfull Height (m): 0.80	**Transect I**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		2	95	~~0~~	(P) A D	2	P (A) D	P (A) D	P (A) D
Left Center		4	101	~~0~~	(P) A D	2	P (A) D	P (A) D	P (A) D
Center		8	19	–	(P) A D	2	P (A) D	P (A) D	P (A) D
Right Center		9	11	–	(P) A D	1	P (A) D	P (A) D	P (A) D
Right Bank		6	34	–	(P) A D	2	P (A) D	P (A) D	(P) A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 (2) 3 4	0 1 2 (3) 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 (1) 2 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 (1) 2 3 4	0 (1) 2 3 4
Herbs/ grasses	0 1 2 (3) 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 1 (2) 3 4	0 1 2 (3) 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	0 (1) 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 (2) 3 4
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 (2) 3 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 1 (2) 3 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	17
Center Upstream	17
Center Right	16
Center Downstream	14
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	(P) C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	(eroded)	vulnerable	stable

Inter-Transect: IJ

Wetted Width (m): 6.9

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		13	240	30	P A D	2	P A D	P A D	P A D
Left Center		64	<1		P A D	–	P A D	P A D	P A D
Center		58	311	–	P A D	2	P A D	P A D	P A D
Right Center		66	4	–	P A D	1	P A D	P A D	P A D
Right Bank		65	2	–	P A D	1	P A D	P A D	P A D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	
Run	20
Glide	
Pool	80
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIS CREEK	Date: 10 / 16 / 20
Wetted Width (m): 0.88	Bankfull Width (m): 2.6 / Bankfull Height (m): 1.25	**Transect J**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		4	153	~~0~~	(P) A D	2	(P) A D	P (A) D	P (A) D
Left Center		6	92	50	(P) A D	2	(P) A D	P (A) D	(P) A D
Center		7	217	50	(P) A D	2	(P) A D	P (A) D	P (A) D
Right Center		7	8	–	P (A) D	1	P (A) D	P (A) D	P (A) D
Right Bank		4	185	50	(P) A D	2	(P) A D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	(0) 1 2 3 4	0 (1) 2 3 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 2 (3) 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 (2) 3 4	0 (1) 2 3 4
Barren, bare soil/ duff	0 1 2 (3) 4	0 1 (2) 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	(0) 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 (2) 3 4
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 2 (3) 4
Undercut Banks	0 (1) 2 3 4
Overhang. Vegetation	0 1 (2) 3 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	2
Center Upstream	1
Center Right	2
Center Downstream	1
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	(P) C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	(eroded)	vulnerable	stable

Inter-Transect: JK

Wetted Width (m): 1.9

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		1	<1		P A D	–	P A D	P A D	P A D
Left Center		3	34		P A D	1	P A D	P A D	P A D
Center		3	5		P A D	1	P A D	P A D	P A D
Right Center		7	197	0	P A D	2	P A D	P A D	P A D
Right Bank		4	212	10	P A D	2	P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes

0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type	%
Cascade/ Falls	
Rapid	
Riffle	10
Run	80
Glide	
Pool	10
Dry	

Site Code: MC8	Site Name: MIDDLE MARTIS CREEK		Date: 10 / 16 / 20
Wetted Width (m): 1.1	Bankfull Width (m): 1.5	Bankfull Height (m): 0.58	**Transect K**

Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank		3	56		(P) A D	2	P (A) D	P (A) D	P (A) D
Left Center		3	27		(P) A D	1	P (A) D	P (A) D	P (A) D
Center		18	85	30	(P) A D	2	P (A) D	P (A) D	P (A) D
Right Center		17	63	–	P (A) D	1	P (A) D	P (A) D	P (A) D
Right Bank		15	27		(P) A D	1	P (A) D	P (A) D	P (A) D

Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
U = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

Riparian Vegetation
(facing downstream, 5 m u/s, 5 m d/s, 10 m from wetted width)

0 = Absent (0%) 3 = Heavy (40-75%)
1 = Sparse (<10%) 4 = Very Heavy (>75%)
2 = Moderate (10-40%)

Vegetation Class	Left Bank	Right Bank
Upper Canopy (>5 m high)		
Trees and saplings >5 m high	0 1 (2) 3 4	0 1 2 (3) 4
Lower Canopy (0.5 m-5 m high)		
All vegetation 0.5 m to 5 m	0 1 (2) 3 4	0 1 (2) 3 4
Ground Cover (<0.5 m high)		
Woody shrubs & saplings <0.5 m	0 1 (2) 3 4	0 1 (2) 3 4
Herbs/ grasses	0 1 (2) 3 4	0 1 (2) 3 4
Barren, bare soil/ duff	0 1 (2) 3 4	0 (1) 2 3 4

Instream Habitat Complexity
(5 m u/s, 5 m d/s)

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Filamentous Algae	(0) 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 (2) 3 4
Boulders	0 1 (2) 3 4
Woody Debris >0.3 m	(0) 1 2 3 4
Woody Debris <0.3 m	0 1 2 (3) 4
Undercut Banks	(0) 1 2 3 4
Overhang. Vegetation	0 1 2 (3) 4
Live Tree Roots	0 1 (2) 3 4
Artificial Structures	(0) 1 2 3 4

Densiometer Readings (0-17)
count covered dots

Center Left	13
Center Upstream	14
Center Right	17
Center Downstream	15
Left Bank	
Right Bank	

Human Influence
(circle only the closest to wetted channel; assess 5 m u/s, 5 m d/s)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No; if Y for an analyte, do not assess banks)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	(P) C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Bank Stability
(assess point of transect between wetted width and bankfull)

Left Bank	eroded	vulnerable	(stable)
Right Bank	(eroded)	vulnerable	stable

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream (**required**)
KRM1231 ☑

Upstream (**optional**)
KRM 1230 ☐

B-2: 2020 Benthic Macroinvertebrate 500-Count Taxa List

Final SAFIT ID	MC1 RWB	MC1 TRC	MC5 RWB	MC5 TRC	MC7 RWB	MC7 TRC	MC8 RWB	MC8 TRC	SC1 TRC	SC2 TRC	SC3 TRC
Ameletus	1						1	1	5	15	11
Amiocentrus aspilus			1			1	1				
Anagapetus	9	13			11	14	1				
Antocha	1		4	10	7	5	1	4			
Apatania										1	2
Apedilum											1
Atractides				1		1	1	1	7	7	13
Attenella soquele											2
Aturus								1		2	
Baetis									38	42	18
Baetis tricaudatus	29	30		4	8	4	1	1			
Bezzia/ Palpomyia		1	7	1		1	5	14	12	5	4
Brachycentrus americanus	6	7	1	7							
Brillia		3			2	6	11	9			
Calineuria californica					5	8					
Capnia									44	39	52
Capniidae	6	10					1				
Caudatella hystrix	4	8				3					
Centroptilum							2				
Ceratopsyche									4	2	
Chloroperlidae	2	5			4	2					
Cinygma		2			3	3	10				
Cinygmula	43	45	12	27	73	54	41	33	2	8	6
Cleptelmis addenda			13	1	1	3	28	23			
Clinocera									1		
Corynoneura							3	1	1	3	
Cricotopus			55	64	23	36	5	9			
Cricotopus/ Orthocladius									46	2	7
Demicryptochironomus										4	1
Diamesa										1	2
Dicranota	1				1			1			
Diphetor hageni	3	1	1	8	23	10	7	6	11	4	6
Dixa								1			
Doroneuria baumanni	4	9				2					
Drunella									1	2	2
Drunella doddsii	4	2			3	3					
Drunella grandis						1			5	7	3
Drunella spinifera					8	4					
Ecdyonurus									15	5	7
Epeorus					12	19					
Ephemerella			32	65							
Eubrianax edwardsii				1		1					
Eucapnopsis brevicauda									2	1	
Eukiefferiella	1		3	3	4	3	2		2	2	1
Feltria									5		
Ferrissia			1								
Glossosoma										2	
Glutops	6	4			1			1			
Heleniella		1					2	1			
Helobdella stagnalis			3								
Heterotrissocladius							1	1			
Hexatoma	2	1			1	1					
Hyalella			1								
Hydra			1	1		1					
Hydraena							1		1		
Hydropsyche				2	11	49	13	27			
Hydroptila			16	1					12	2	
Hygrobates			1							1	
Ironodes	5	10			19	63	10	17			
Isoperla	1				1						
Kogotus						1					
Kogotus/Rickera									2		
Lara	1	4				2					
Larsia									1	1	
Lebertia	3		3	9		1	8	2	2	2	
Lepidostoma			1		13	1	20	5		1	1
Limnephilidae	2							1			
Limnophora									1		1
Limnophyes					1		1				
Macropelopiini			1								
Malenka									3	4	1
Micrasema	2				26	26	8	14	3		2
Micropsectra	28	24	1		78	11	18	25	19	40	71
Microtendipes pedellus group			64								
Microtendipes rydalensis group		1	1				14	18			

Nanocladius				4					3	1	1
Neophylax											1
Neoplasta	1	2	1	2	1	1	8	5			
Ochrotrichia						1					
Oligochaeta	50	22	90	21	8	5	10	7	50	66	89
Onocosmoecus									2		
Optioservus			55	41	2	2	1	6			
Oreodytes											1
Oribatei										3	3
Orthocladius complex		1	1		4	1	15	10			
Orthocladius lignicola	1			1	1			1			
Ostracoda	41	16	1		9		35	59	2	6	3
Pacifastacus					1						
Pagastia			2	3					2	2	5
Paracladopelma									1		
Paraleptophlebia	17	13	60	108	45	52	47	14	17	20	27
Paraleuctra	3	1			2	1					
Parametriocnemus	3	2		1			10	19	32	21	20
Paramideopsis	1	1									
Parapsyche	2	2			1	2					
Paratanytarsus										2	1
Pentaneura									18	8	6
Pericoma/ Telmatoscopus	13	13	1	7		1	1	2			
Phaenopsectra			1					2	1		
Piona											1
Pisidium	3	6			16		1				
Polycentropus							6	2			
Polypedilum	1				1				1	1	1
Potthastia gaedii group									3		1
Probezzia							2	1			
Protzia	5	6	3	10			1	4			
Psectrocladius			1						1		
Pseudochironomus			7							1	
Ptychoptera					1						
Rheocricotopus	1	1	1	1			3	1	6	1	3
Rheotanytarsus				1	7	4			3	1	
Rhithrogena									3	2	6
Rhyacophila betteni group	2	9			7	2	3	5			
Rhyacophila brunnea group	4				1	1				1	
Rhyacophila sibirica group	7	3			1	1	2				
Rhyacophila vofixa group	2						1	1			
Serratella									10	20	8
Sialis					3		1	5			
Simulium	7	12	1	2	6	5	9	18	25	13	8
Skwala			1	5	2				12	33	17
Sperchon		1	7	9			8	5	2	4	3
Sperchonopsis							1	1			
Stempellina					3	2	3				
Stempellinella					3						
Stictochironomus									9	13	5
Stictotarsus									1		
Stilobezzia										1	
Sublettea							1				
Sweltsa	22	20	6	10	6	6	18	13	11	16	3
Synorthocladius			3	1				1	1		2
Tabanidae			1								
Tanytarsus			2						4	1	5
Testudacarus			1	1							
Thaumalea								1			
Thienemanniella									3		1
Thienemannimyia group		2	5			1	6	9	7	3	5
Tipula							4	4			
Tipulidae								1			
Torrenticola			2	3					3	4	1
Turbellaria	18	37	10	16	3	9	32	20			
Tvetenia bavarica group	7	4	7	12	2	5	14	8	4	9	10
Tvetenia discoloripes group									1		
Visoka cataractae	3	3				1					
Wormaldia										4	
Yoraperla	116	113			15	39	10	21			
Zaitzevia parvula			6	36	2	1	5	2			
Zapada									17	38	49
Zapada cinctipes	5	17	1		2	6	16	25			
Zapada columbiana		1			1						
Zapada frigida					2						
Zapada oregonensis group	1	11			3	11	3	7			
Zavrelimyia							6	3			

Appendix C
Monitoring Event Summaries and Analytical Data

Electronic Analytical Data Appendix
(Provided Electronically)

Community Level Events and Analytical Data

WY 2010 Town of Truckee Community Level Discrete Water Quality Monitoring				
Sample Dates	Event	Brickelltown (DSC-TT1)	Trout Creek (DSC-TC1)	Comments
2/5/2010	S	WQ(P1)		Sites DSC-TT1 and DSC-TC1 were set up to sample this snowmelt event. A sample was successfully obtained from Site DSC-TT1; however, insufficient flow occurred at Site DSC-TC1. Flow has been observed in drainage structures connected to Site DSC-TC1, but it does not make it to the outfall.
2/24/2010	M	WQ(P1)	WQ(P1)	Sites DSC-TT1 and DSC-TC1 were set up to sample this mixed event. Samples were successfully collected at both sites.
2/26/2010	M	WQ(P1)	WQ(P1)	Sites DSC-TT1 and DSC-TC1 were set up to sample this mixed event. Samples were successfully collected at both sites.
3/12/2010	M	WQ(P1)		Sites DSC-TT1 and DSC-TC1 were set up to sample this mixed event. Samples were successfully collected at Site DSC-TT1, but no flow occurred at Site DSC-TC1. It appeared that all of the flow was infiltrating in the earthen swale on the north side of Donner Pass Road.
3/29/2010	R	WQ(P1)	WQ(P1)	Sites DSC-TT1 and DSC-TC1 were set up to sample this rain event. Samples were successfully collected at both sites.
4/22/2010	S	WQ(P1)	WQ(P1)	Sites DSC-TT1 and DSC-TC1 were set up to sample this snowmelt event. Samples were successfully collected at both sites.
4/27/2010	R	WQ(P1)	WQ(P1)	Sites DSC-TT1 and DSC-TC1 were set up to sample this snowmelt event. Samples were successfully collected at both sites.
5/10/2010	M	WQ(P1)		Sites DSC-TT1 and DSC-TC1 were set up to sample this mixed event. Samples were successfully collected at Site DSC-TT1, but insufficient flow occurred at Site DSC-TC1.
5/25/2010	R		WQ(P1)	Sites DSC-TT1 and DSC-TC1 were set up to sample this mixed event. Samples were successfully collected at Site DSC-TC1, but insufficient flow occurred at Site DSC-TT1.

WY 2011 Town of Truckee Community Level Discrete Water Quality Monitoring					
Sample Dates	Event	Brickelltown (DSC-TT1)	Trout Creek	Airport (DSC-	Comments
10/4/2010	R		WQ(P1)	WQ(P1)	Sites DSC-TT1 and DSC-MC1 were set up to sample this mixed event. Samples were successfully collected at both sites. Site DSC-TT1 was not setup. The sample housing and DI sump were full of sediment.
10/24/2010	R	WQ(P1)	WQ(P1)	WQ(P1)	Sites DSC-TT1, DSC-TC1 and DSC-MC1 were set up to sample this mixed event. Samples were successfully collected at the three sites.
12/14/2010	M	WQ(P1)	WQ(P1)	WQ(P1)	Sites DSC-TT1, DSC-TC1 and DSC-MC1 were set up to sample this mixed event. Samples were successfully collected at the three sites.
12/18/2010	M		WQ(P1)		Site DSC-TC1 was set up to sample this mixed event. A sample was successfully collected. Site DSC-TT1and Site DSC-MC1 were not setup due to site safety concerns. Snow and ice on the roadway and heavy traffic at the site impeded station set up.

WQ(P1) = Passive water quality sample collected
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

12/28/2010	M		WQ(P1)		Sites DSC-TT1, DSC-TC1 and DSC-MC1 were set up to sample this mixed event. A sample was successfully collected at DSC-TC1. Due to cold temperatures, this storm produced mostly snowfall. Flow did not reach the required level for a sample to be collected at Sites DSC-TT1 and DSC-MC1.
1/17/2011	S	WQ(P1)			Sites DSC-TT1, DSC-TC1 and DSC-MC1 were set up to sample this snowmelt event. A sample was successfully collected at DSC-TT1. Flow did not reach the required level for a sample to be collected at Sites DSC-TC1 and DSC-MC1.
2/22/2011	S		WQ(P1)		Sites DSC-TT1, DSC-TC1 and DSC-MC1 were set up to sample this snowmelt event. A sample was successfully collected at DSC-TC1. Flow did not reach the required level for a sample to be collected at Sites DSC-TT1 and DSC-MC1.
3/2/2011	M	WQ(P1)		WQ(P1)	Sites DSC-TT1, DSC-TC1 and DSC-MC1 were set up to sample this mix event. A sample was successfully collected at DSC-TT1 and DSC-MC1. Flow did not reach the required level for a sample to be collected at Site DSC-TC1.
3/6/2011	M		WQ(P1)	WQ(P1)	Precipitation fell as a mixture of rain and snow on top of snow. Sites DSC-TC1 and DSC-MC1 were set up to sample this mix event. A sample was successfully collected at DSC-TC1 and DSC-MC1. DSC-TT1 was not setup due to high flow rates occurring at time of setup.
3/14/2011	S	WQ(P1)	WQ(P1)		Sites DSC-TT1, DSC-TC1 and DSC-MC1 were set up to sample this snowmelt event. A sample was successfully collected at DSC-TC1 and DSC-TC1. DSC-MC1 was not set up because high flow rates were occurring.
3/28/2011	S	WQ(P1)		WQ(P1)	Sites DSC-TT1 and DSC-MC1 were set up to sample this snowmelt event, and a sample was successfully collected at both sites. DSC-TC1 was not set up because the sample quota has been reached.
3/31/2011	S	TPH (Extractable)	-	-	A grab sample pulled from site DSC-TT1 during snowmelt conditions to be analyzed for extractable TPH (total petroleum hydrocarbon). No sites were set up to sample this event, just the one grab sample.
4/11/2011	S			WQ(P1)	A snowmelt sample was collected from DSC-MC1. The other 2 sites were not setup to sample this event. Event type sample quota reached.
4/20/2011	M	WQ(P1)			
5/25/2011	R	WQ(P1)		WQ(P1)	Rain turned to snow in the afternoon. No road maintenance activities occurred. Successful samples were collected at DSC-TT1 and DSC- MC1 when the snow melted in the early evening of 5/25/2011.

WQ(P1) = Passive water quality sample collected
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2012 Town of Truckee Community Level Discrete Water Quality Monitoring											
Sample Dates	Event Type	Brickelltown (DSC-TT1)	Trout Creek SE (DSC-TC1)	Airport (DSC-MC1)	Bridge St SW (DSC-TT2)	Bridge St SE (DSC-TT3)	Bridge St NW (DSC-TT4)	Trout Creek NW (DSC-TC2)	Donner Creek (DSC-DC1)	West River (DSC-TT5)	Comments
10/5/2011	R	WQ(P1)		WQ(P1)							Sites DSC-TT1 and DSC-MC1 were set up to sample this rain event. Samples were successfully collected at both sites. Site DSC-TC1 was not setup. Trout Creek restoration project obstructing site. Precipitation and Temp from the Truckee Tahoe NWS gauge and Antecedent Dry from the Truckee #2 SNOTEL gauge.
1/20/2012	M	WQ(P1)	WQ(P1)								Sites DSC-TT1 and DSC-TC1 were set up to sample this mix event. Samples were successfully collected at both sites. Site DSC-MC1 was not setup due to ice in the sampling location.
1/21/2012	S			WQ(P1)							Site DSC-MC1 was set up to sample this snowmelt event and a sample was successfully collected. Sites DSC-MC1 and DSC-TT1 were not set up because samples were collected on the previous day.
1/26/2012	S	WQ(P1)		WQ(P1)							Sites DSC-MC1, DSC-TC1, and DSC-TT1 were set up to sample this snowmelt event. Samples were successfully collected at sites DSC-MC1 and DSC-TT1. Inadequate flow occurred at site DSC-TC1, and the sample bottle did not fill.
3/1/2012	S				WQ(P1)		WQ(P1)				Sites DSC-TC1, MC1, and TT1, along with new sites DSC-TT2, TT3, TT4, TT5, TC2, and DC1 were set up to sample this snowmelt event. A sample was successfully collected at site DSC-TT4. Inadequate flow occurred at sites DSC-TT1, TT2, TT3, TT5, TC2, TC1, MC1, and DC1 and the sample bottle did not fill.
3/2/2012	S									WQ(P1)	Sites DSC-TC1, MC1, and TT1, along with new sites DSC-TT2, TT3, TT4, TT5, TC2, and DC1 were set up to sample this snowmelt event. Samples were successfully collected at sites DSC-TT2, TT4 and TT5. Inadequate flow occurred at sites DSC-TT1, TT3, TC2, TC1, MC1, and DC1 and the sample bottle did not fill.
3/5/2012	S						WQ(P1)			WQ(P1)	Sites DSC-TC1, TT1, TT2, TT3, TT4, TT5, TC2, and DC1 were set up to sample this snowmelt event. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. Samples were successfully collected at sites DSC-TT4 and TT5. Inadequate flow occurred at sites DSC-TT1, TT2, DC1, TT3, TC2, and DC1 and the sample bottle did not fill.
3/8/2012	S				WQ(P1)						Sites DSC- TT1, TT2, TT3, TC2, and DC1 were set up to sample this snowmelt event. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. A sample was successfully collected at site DSC-TT2. Inadequate flow occurred at sites DSC-TT1, DC1, TT3, TC2, and DC1 and the sample bottle did not fill.
3/13/2012	M				WQ(P1)		WQ(P1)	WQ(P1)		WQ(P1)	Sites DSC- TT1, TT2, TT3, TT4, TT5, TC1, TC2, and DC1 were set up to sample this mixed event. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. A sample was successfully collected at sites DSC-TT2, TT4, TT5, and TC2. Inadequate flow occurred at sites DSC-TT1, DC1, TT3, and TC1 and the sample bottle did not fill.
3/15/2012	M								WQ(P1)		Sites DSC-TT1, TC1, TT3, and DC1 were set up to sample this mixed event. Sites DSC-TT2, TT4, TT5, and TC2 were not set up because samples were collected at these sites earlier in the week. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. A sample was successfully collected at Site DSC-DC1. Inadequate flow occurred at sites DSC-TT1, TT3, and TC1.
3/16/2012	M	WQ(P1)	WQ(P1)		WQ(P1)	WQ(P1)	WQ(P1)	WQ(P1)	WQ(P1)	WQ(P1)	Sites DSC- TT1, TT2, TT3, TT4, TT5, TC1, TC2, and DC1 were set up to sample this mixed event. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. A sample was successfully collected at all monitoring sites set up (DSC-TT1, TT2, TT3, TT4, TT5, DC1, TC1and TC2).
3/21/2012	S		WQ(P1)				WQ(P1)	WQ(P1)			Sites DSC- TT1, TT2, TT3, TT4, TT5, TC1, TC2, and DC1 were set up to sample this snowmelt event. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. A sample was successfully collected at sites DSC-TT4, TC1and TC2. Flow did not reach the required level for sample collection at sites DSC-TT1, DSC-TT2, DSC-TT3, DSC-TT5, or DSC-DC1.
3/28/2012	M	WQ(P1)	WQ(P1)		WQ(P1)	WQ(P1)	WQ(P1)	WQ(P1)	WQ(P1)	WQ(P1)	Sites DSC- TT1, TT2, TT3, TT4, TT5, TC1, TC2, and DC1 were set up to sample this mix event. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. A sample was successfully collected at sites DSC- TT1, TT2, TT3, TT4, TT5, TC1, TC2, and DC1.
4/12/2012	S					WQ(P1)		WQ(P1)	WQ(P1)		Sites DSC TT3, TC1, TC2, and DC1 were set up to sample this mix event. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. A sample was successfully collected at sites DSC- TT3, TC2, and DC1. Flow did not reach the required level for sample collection at site DSC-TC1.
4/26/2012	R		WQ(P1)			WQ(P1)			WQ(P1)		Sites DSC TT3, TC1, and DC1 were set up to sample this mix event. Site DSC-MC1 was not set up, as it has been retired for the remainder of the sampling season. A sample was successfully collected at sites DSC- TT3, TC1, and DC1.
8/14/2012	R					WQ(P1)					Sample obtained at site DSC-TT3 during intense thunderstorm. Did not mobilize to other sites because quota of 5 samples have been collected.

WQ(P1) = Passive water quality sample collected
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2011 Placer County Community Level Discrete Water Quality Monitoring				
Sample Dates	Event Type	Lahontan (DSC-MC2)	Northstar (DSC-MC3)	Comments
12/14/2010	M	WQ(P1)	WQ(P1)	
12/18/2010	M	WQ(P1)	WQ(P1)	
12/28/2010	M			Due to cold temperatures, this storm produced mostly snowfall. Flow did not reach the required level for a sample to be collected at Sites DSC-MC2 and DSC-MC3.
1/17/2011	S	WQ(P1)		Snowmelt runoff did not produce enough flow for a sample at DSC-MC3
3/2/2011	M	WQ(P1)		This was a rain on snow event that produced large quantities of runoff. However, the infiltration basins at DSC-MC3 did not fill, and insufficient flow occurred at this site.
3/10/2011	M	WQ(P1)		This was a rain on snow event that produced runoff. However, the infiltration basins at DSC-MC3 did not fill, and insufficient flow occurred at this site.
3/14/2011	S	WQ(P1)	WQ(P1)	Snowmelt event.
3/31/2011	S	WQ(P1)	WQ(P1)	Snowmelt event.
4/17/2011	M		WQ(P1)	Mix Event.
5/25/2011	R	WQ(P1)		Rain turned to snow at end of event. (0.8 inches at Truckee SNOTEL); No road maintenance activities observed. The channel that feeds Site DSC-MC2 began to flow at approximately 18:00. The basin above DSC-MC3 did not fill. The snow infiltrated and did not run into channel above site.
6/6/2011	M		WQ(P1)	Mix Event began during the evening of 6/6/2011 and changed to snow overnight. Sample was successfully collected at approximately 00:30 on the morning of 6/6/2011. Northstar parking lot basin overflowed.

WY 2012 Placer County Community Level Discrete Water Quality Monitoring				
Sample Dates	Event Type	Lahontan (DSC-MC2)	Northstar (DSC-MC3)	Comments
10/5/2011	R		WQ(P1)	No flow observed at Lahontan Site. Drainage channel and area soils dry.
1/20/2012	M	WQ(P1)		No flow observed or evident at Northstar site. Upstream basin did not fill.
1/25/2012	S	WQ(P1)		No flow observed or evident at Northstar site. Upstream basin did not fill.
3/5/2012	S	WQ(P1)		No flow observed or evident at Northstar site. Upstream basin did not fill.
3/13/2012	M	WQ(P1)		Low baseflow observed at Northstar site, but flow did not increase sufficiently for sample collection. Upstream basin did not fill.
3/16/2012	M	WQ(P1)	WQ(P1)	Samples obtained from both monitoring sites.
3/21/2012	S	WQ(P1)	WQ(P1)	Samples obtained from both monitoring sites. Upstream basin at Northstar site did not fill.
3/28/2012	M	WQ(P1)		Low baseflow observed at Northstar site, but flow did not increase sufficiently for sample collection. Upstream basin did not fill.
4/26/2012	R	WQ(P1)	WQ(P1)	Samples obtained from both monitoring sites. Rain event.
8/14/2012	R		WQ(P1)	Sample obtained at site DSC-MC3 during intense thunderstorm. Did not mobilize to site DSC-MC2 because quota of 8 samples have been collected.

WQ(P1) = Passive water quality sample collected
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2013 Placer County Community Level Discrete Water Quality Monitoring				
Sample Dates	Event Type	Lahontan (DSC-MC2)	Northstar (DSC-MC3)	Comments
11/17/2012	M	WQ(P1)	WQ(P1)	~0.8" of precip falling from Friday afternoon, picking up during the afternoon of Saturday, when bottles most likely filled. Mostly rain, slight amounts of snow overnight.
11/28/2012	R	WQ(P1)	WQ(P1)	~0.8" of rain falling from late morning 11/28, through late afternoon. Bottle actively filling at Lahontan while personnel were at site at 1500. Nstar bottle filled earlier (likely ~1400). Nstar basin at parking lot not filled at time of bottle filling. Flow came from roadway (Skidder Trail).
11/30/2012	M	WQ(P1)	WQ(P1)	~3.2" of rain falling from evening 11/29, through late evening 11/30. Nstar parking lot basin overflowed, contributing to sample volume.
12/5/2012	R	WQ(P1)	WQ(P1)	~.75" of rain falling from evening 12/4 through evening 12/5/12. Nstar parking lot overflowed, contributing to sample volume.
3/20/2013	M	WQ(P1)	WQ(P1)	Mixed event overnight into the morning hours, tapering off by early afternoon. Most intense period of precip from 4-6am. Northstar Basin did not overflow during this event.
3/31/2013	M	WQ(P1)	WQ(P1)	Mixed event during the early morning hours, tapering off by mid morning. Most intense period of precip from 4-6am. Northstar Basin did not overflow during this event.
5/8/2013	R	WQ(P1)	WQ(P1)	Rain event starting afternoon of 5/713, becoming more intense overnight. Tapered off by morning. Northstar basin did not overflow during this event.
9/21/2013	R		WQ(P1)	Rain event starting morning of 9/21/13. Sample collected mid storm at 12:20 on 9/21/13 Northstar basin did not overflow during this event.

WY 2014 Placer County Community Level Discrete Water Quality Monitoring				
Sample Dates	Event Type	Northstar Drive (DSC-MC4)	Aspen Grove (DSC-MC5)	Comments
1/30/2014	M	WQ(P1)	WQ(P1)	Event started as rain at 1300 1-29-14 and turned to snow at 0100 1-30-14. Approximately 1" of rainfall fell before changing to snow. Grab samples obtained morning of 1-30-14 when low flow was still occurring. No roadway surface flow was visible and samples are representative of residual runoff/falling limb.
2/8/2014	M	WQ(P1)	WQ(P1)	Mixed event. Snow Level above 6500 ft throughout event. Grab samples obtained morning of 2-8- 14 when high flows were still occurring.
2/26/2014	M	WQ(P1)	WQ(P1)	Mixed event. Snow Level 7000 ft - 6000 ft during event. Passive samples collected late evening on 2/26/14.
3/6/2014	M	WQ(P1)	WQ(P1)	Mixed event. Snow Level 7000 ft during event. Passive samples collected early morning on 3/6/14.
3/27/2014	S	WQ(P1)	WQ(P1)	Snowmelt event. Samples collected as temperatures warmed and runoff increased.
4/25/2014	R	WQ(P1)	WQ(P1)	Rain event; No snow accumulation on roadway. Sample collected mid morning during increase in rainfall intensity.
5/20/2014	R	WQ(P1)	WQ(P1)	Rain event; No snow accumulation on roadway.
7/31/2014	R	WQ(P1)	WQ(P1)	Thunderstorm event. No abrasives used. Road swept during late spring / early summer.

WQ(P1) = Passive water quality sample collected
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2015 Placer County Community Level Discrete Water Quality Monitoring				
Sample Dates	Event Type	Northstar Drive (DSC-MC4)	Aspen Grove (DSC-MC5)	Comments
12/3/2014	M	WQ(P1)	WQ(P1)	Mixed event. Snow Level started at 5000 and increased to 7500 ft throughout event. Grab samples obtained morning of 12-3-14 when moderate flows were occurring.
2/7/2015	M	WQ(P1)	WQ(P1)	Mixed event. Snow Levels around 8000 ft throughout event. Heavy evening through overnight rains. Passive samples obtained around 4:00 morning of 2-7-15 when peak flows were occurring.
2/8/2015	M	WQ(P1)	WQ(P1)	Mixed event. Snow Levels around 8000 ft throughout event. Heavy daytime into evening rains. Grab samples obtained around 18:00 evening of 2-8-15 when peak flows were occurring.
3/6/2015	S	WQ(P1)	WQ(P1)	Snowmelt event. Low flows.
4/21/2015	R	WQ(P1)	WQ(P1)	Afternoon Thunderstorms
4/23/2015	R	WQ(P1)	WQ(P1)	Overnight Thunderstorms (4/23-4/24)
5/25/2015	R	WQ(P1)	WQ(P1)	Afternoon Thunderstorms
7/21/2015	R	WQ(P1)	WQ(P1)	Afternoon Thunderstorms

WY 2016 Placer County Community Level Discrete Water Quality Monitoring				
Sample Dates	Event Type	Northstar Drive (DSC-MC6)	Skidder Trail (DSC-MC7)	Comments
2/24/2016	S	WQ(P1)	WQ(P1)	First samples at newly relocated sites. Temps increased to 56 degrees at approximately 14:00. The samples were collected at approximately 16:00.
4/22/2016	R		WQ(P1)	Spring rain event, later turned to snow. No flow at Northstar Dr site (dry streambed). Skidder Trail site flow elevated at time of grab sample.
5/5/2016	R		WQ(P1)	Spring rain event and localized thunderstorms. No flow at Northstar Dr site (dry streambed). Skidder Trail site flow elevated sample was collected at approximately 19:30.

WY 2017 Placer County Community Level Discrete Water Quality Monitoring				
Sample Dates	Event Type	Northstar Drive (DSC-MC6)	Skidder Trail (DSC-MC7)	Comments
10/15/2016	R	WQ(P1)	WQ(P1)	First samples of WY 2017. Large rain event with multiple waves of precipitation from 10/14 to 10/17. High intensity rainfall occurred during the evening hours of 10/15, and estimated time of sample collection is 20:00 on 10/15. No abrasives applied to roadways before or during event.
10/28/2016	R	WQ(P1)	WQ(P1)	Rain event with precipitation beginning morning of 10/27 and continuing through morning of 10/28. Sufficient flow at DSC-MC7 to fill sampler. At DSC-MC6, flow was present but depth was not sufficient to fill sampler. Grab sample collected.

WQ(P1) = Passive water quality sample collected
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

12/10/2016	R	WQ(P1)	WQ(P1)	Rain event. Precipitation started the early morning of 12/10 in the area and continued through the early evening of 12/10. Samples collected passively at approximately 10:30 AM.
12/15/2016	M	WQ(P1)	WQ(P1)	Mixed event. Precipitation started the evening of 12/15/2016 in the area and ended on the morning of 12/16/2016. Snow was observed during sample collection.
1/9/2017	M	WQ(P1)	WQ(P1)	Mixed event. Precip started on Saturday 1/7/17, as snow, and changed to rain in the afternoon, and continued through Monday morning 1/9/17 when it changed back to snow for a few hours. Fresh snow was observed in Martis Valley and Northstar community sites.
2/7/2017	R	WQ(P1)	WQ(P1)	Rain event. Rain started on 2/6/17 and continued through 2/7/17.
3/9/2017	S	WQ(P1)	WQ(P1)	Snowmelt Event. 2 ft of snow fell on 3/5/17. Temps warmed and sample was collected on 3/9/17. First significant snowmelt cycle of the season.
4/7/2017	M	WQ(P1)	WQ(P1)	Mixed event.

WY 2018 Placer County Community Level Discrete Water Quality Monitoring					
Sample Dates	Event Type	Northstar Drive (DSC-MC6)	Skidder Trail (DSC-MC7)	Basque (DSC-MC8)	Comments
3/13/2018	M	WQ(P1)	WQ(P1)	WQ(P1)	Mixed rain and snow event resulted in moderate rise in stormwater channels.
3/22/2018	M	WQ(P1)	WQ(P1)	WQ(P1)	Very large mixed rain and snow event created flooding conditions throughout the project area.
3/29/2018	S	WQ(P1)	WQ(P1)	WQ(P1)	Snowmelt Event.
4/6/2018	R	WQ(P1)	WQ(P1)	WQ(P1)	Rain Event.
4/7/2018	R	WQ(P1)	WQ(P1)	WQ(P1)	Rain Event.
4/16/2018	S	WQ(P1)	WQ(P1)	WQ(P1)	Snowmelt Event.
5/9/2018	S			WQ(P1)	Snowmelt Event.
5/16/2018	R		WQ(P1)	WQ(P1)	Rain Event.
5/25/2018	R	WQ(P1)	WQ(P1)	WQ(P1)	Rain Event.

WY 2019 Placer County Community Level Discrete Water Quality Monitoring					
Sample Dates	Event Type	Northstar Drive (DSC-MC6)	Skidder Trail (DSC-MC7)	Basque (DSC-MC8)	Comments
11/29/2018	M		WQ(P1)	WQ(P1)	Field triplicates collected at DSC-MC8.
12/17/2018	M			WQ(P1)	Small storm, but flow was elevated.
1/7/2019	M		WQ(P1)	WQ(P1)	Storm started as snow, but changed to rain.
1/9/2019	M	WQ(P1)	WQ(P1)	WQ(P1)	Mixed rain/snow event.
2/14/2019	M	WQ(P1)	WQ(P1)	WQ(P1)	Storm started as rain but changed to snow in the afternoon.
3/6/2019	M	WQ(P1)	WQ(P1)	WQ(P1)	Mixed rain/snow event with snowmelt.
3/19/2019	S	WQ(P1)	WQ(P1)	WQ(P1)	Snowmelt Event.
4/18/2019	S	WQ(P1)	WQ(P1)	WQ(P1)	Snowmelt Event.
4/24/2019	S	WQ(P1)	WQ(P1)	WQ(P1)	Snowmelt Event.

WQ(P1) = Passive water quality sample collected
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2020 Placer County Community Level Discrete Water Quality Monitoring				
Sample Dates	Event Type	Dirt Road Outfall (DSC-MC9)	Solid Waste Outfall (DSC-MC10)	Comments
1/26/2020	M	WQ(P1)	WQ(P1)	Mixed overnight precip. Morning samples.
3/26/2020	S	WQ(P1)	WQ(P1)	Snowmelt sample.
4/15/2020	S	WQ(P1)	WQ(P1)	Snowmelt sample
7/27/2020	R	WQ(P1)		No flow from DSC-MC10. The BMP contained all flow.
11/18/2020	M	WQ(P1)	WQ(P1)	Mixed rain/snow/snowmelt sample.

WQ(P1) = Passive water quality sample collected
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]	pH	Electrical Conductivity [µS]	C10-C22 [mg/L]	C22-C36 [mg/L]	C6-C10 [mg/L]	Total Extractable Hydrocarbons (C6-C36) [mg/L]
Water Year 2010																				
DSC-TT1	05-Feb-10	Town of Truckee			0.22			3	3.2	0.037	0.01 U	0.44	1600	1300						
DSC-TC1	24-Feb-10	Town of Truckee				0.11	0.073	0.49	0.68	0.016	0.018	0.24	82	120						
DSC-TT1	24-Feb-10	Town of Truckee				0.12	0.1	1	1.2	0.068	0.058	0.12	270 J	990						
DSC-TT2	24-Feb-10	Town of Truckee	Duplicate			0.11	0.073	1.2	1.4	0.07	0.045	0.14	480 J	940						
DSC-TC1	26-Feb-10	Town of Truckee				0.36	0.034	0.71	1.1	0.081	0.078	0.16	71	63						
DSC-TT1	26-Feb-10	Town of Truckee				0.28	0.045	2.9	3.3	0.1	0.084	0.26	2200	470						
BottleBlank	12-Mar-10	Town of Truckee				0.01 U	0.01 U	0.05 U	0.07 U	0.01 U	0.01 U	0.01 U	1 U	0.1 U						
DSC-TT1	12-Mar-10	Town of Truckee				0.43	0.33	2.3	3.1	0.057	0.012	2	1500	770						
DSC-TC1	29-Mar-10	Town of Truckee				0.21	0.01 U	0.49	0.7	0.044	0.1	0.13	14	24						
DSC-TT1	29-Mar-10	Town of Truckee				0.15	0.01 U	0.39	0.54	0.092	0.055	0.076	33	58						
DSC-TC1	22-Apr-10	Town of Truckee				0.69	0.01 U	0.27	0.96	0.044	0.057	0.18	20	30						
DSC-TT1	22-Apr-10	Town of Truckee				0.12	0.015	1.5	1.7	0.042	0.028	0.42	470	400						
DSC-TC1	27-Apr-10	Town of Truckee				0.39	0.01 U	0.42	0.81	0.042	0.049	0.27	38	48						
DSC-TT1	27-Apr-10	Town of Truckee				0.14	0.01 U	1.7	1.9	0.084	0.081	1.5	1000	470						
DSC-TT1	10-May-10	Town of Truckee				0.3	0.056	1.8	2.2	0.059	0.048	0.53	470	300						
DSC-TC1	25-May-10	Town of Truckee				1.6	0.01 U	0.28	1.9	0.089	0.13	0.14	2	5.1						
DSC-TC2	25-May-10	Town of Truckee	Duplicate			1.6	0.01 U	0.27	1.9	0.092	0.077	0.11	3	5						
Water Year 2011																				
DSC-MC1	04-Oct-10	Town of Truckee				0.17	0.01 U	0.31	0.48			0.25	4	7.9						
DSC-TC1	04-Oct-10	Town of Truckee				0.07	0.01 U	0.37	0.44			1.5	20	36						
DSC-MC1	24-Oct-10	Town of Truckee				0.27	0.01 U	0.31	0.58			0.088	190	54						
DSC-TC1	24-Oct-10	Town of Truckee				0.021	0.01 U	0.18	0.21			0.072	140	42						
DSC-TT1	24-Oct-10	Town of Truckee				0.16	0.01 U	0.21	0.37			0.098	1300	300						
DSC-MC1	14-Dec-10	Town of Truckee			0.25	0.25	0.01 U							140						
DSC-MC2	14-Dec-10	Town of Truckee		0.05 U		0.012	0.01 U	0.27	0.28	0.028	0.03	0.099	3	1.3						
DSC-MC3	14-Dec-10	Town of Truckee		0.05 U		0.01 U	0.01 U	0.82	0.82	0.039	0.051	0.17	170	83						
DSC-TC1	14-Dec-10	Town of Truckee			0.055	0.055	0.01 U	0.81	0.92			0.22	240	120						
DSC-TT1	14-Dec-10	Town of Truckee			0.031	0.031	0.01 U	2	2			0.63	1000	600						
DSC-MC2	18-Dec-10	Town of Truckee		0.05 U		0.04	0.01 U	0.05 U	0.07 U	0.046	0.036	0.058	11	2.8						
DSC-MC3	18-Dec-10	Town of Truckee		0.053		0.01 U	0.01 U	0.33	0.33	0.088	0.062	0.092	16	15						
DSC-TC1	18-Dec-10	Town of Truckee			0.079	0.073	0.01 U	0.71	0.86			0.072	58	96						
DSC-TC1	28-Dec-10	Town of Truckee				1.1	0.01 U	0.24	1.3			0.058	6	12						
DSC-MC2	17-Jan-11	Town of Truckee		0.05 U	0.01 U	0.01 U	0.01 U	0.16	0.16	0.012	0.025	0.024	1 U	0.35						
DSC-MC2	17-Jan-11	Town of Truckee	Duplicate	0.05 U	0.01 U	0.01 U	0.01 U	0.08	0.08	0.011	0.03	0.022	1	0.42						
DSC-MC2	17-Jan-11	Town of Truckee	Triplicate	0.05 U	0.01 U	0.01 U	0.01 U	0.054	0.07 U	0.012	0.025	0.02	1 U	0.52						
DSC-TT1	17-Jan-11	Town of Truckee			0.14	0.1	0.044	2.7	2.8			0.25	1200	620						
DSC-TT1	17-Jan-11	Town of Truckee	Duplicate		0.13	0.094	0.038	2.7	2.9			0.27	1200	660						
DSC-TC1	22-Feb-11	Town of Truckee				0.82	0.01 U	0.26	1.1			0.064	1	5.8						
DSC-TC1	22-Feb-11	Town of Truckee	Duplicate			0.82	0.01 U	0.3	1.1			0.077	1 U	6.5						
DSC-TC1	22-Feb-11	Town of Truckee				0.82	0.01 U	0.35	1.2			0.067	1 U	5.9						
DSC-MC1	02-Mar-11	Town of Truckee				0.17	0.01 U	0.7	0.87			0.19	250	220						
DSC-MC2	02-Mar-11	Town of Truckee		0.063		0.13	0.01 U	0.16	0.29	0.015	0.03	0.036	1 U	1.9						
DSC-TT1	02-Mar-11	Town of Truckee				0.13	0.021	1.6	1.8			0.26	220	530						
DSC-MC1	06-Mar-11	Town of Truckee				0.23	0.01 U	0.62	0.85			0.19	240	120						
DSC-TC1	06-Mar-11	Town of Truckee				0.7	0.01 U	0.28	0.98			0.054	34	29						
DSC-MC2	10-Mar-11	Town of Truckee		0.082		0.18	0.01 U	0.22	0.4	0.02	0.024	0.032	1 U	1.9						
DSC-MC2	14-Mar-11	Town of Truckee		0.05 U		0.18	0.01 U	0.36	0.54	0.025	0.03	0.1	73	11						
DSC-MC3	14-Mar-11	Town of Truckee		0.05 U		0.011	0.01 U	0.17	0.19	0.034	0.05	0.065	25	10						
DSC-TC1	14-Mar-11	Town of Truckee				0.64	0.01 U	0.6	1.2			0.13	150	100						

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]	pH	Electrical Conductivity [µS]	C10-C22 [mg/L]	C22-C36 [mg/L]	C6-C10 [mg/L]	Total Extractable Hydrocarbons (C6-C36) [mg/L]
DSC-TT1	14-Mar-11	Town of Truckee				0.79	0.01 U	0.5	1.3			0.37	900	910						
DSC-MC1	28-Mar-11	Town of Truckee				0.59	0.01 U	0.055	0.65			0.048	15	13						
DSC-TT1	28-Mar-11	Town of Truckee				0.09	0.01 U	1.7	1.8			0.36	580	370						
DSC-MC2	31-Mar-11	Town of Truckee		0.05 U		0.01 U	0.01 U	0.14	0.14	0.016	0.018	0.017	9	2.8						
DSC-MC3	31-Mar-11	Town of Truckee		0.05 U		0.013	0.01 U	0.12	0.14	0.038	0.034	0.065	6	8.3						
DSC-TT1	31-Mar-11	Town of Truckee															1 U	1.5	1 U	1.5
DSC-MC1	11-Apr-11	Town of Truckee				0.49	0.01 U	0.1	0.59			0.051	11	7.3						
DSC-MC3	18-Apr-11	Town of Truckee		0.05 U		0.01 U	0.01 U	0.14	0.14	0.026	0.04	0.05	1	4.9						
DSC-TT1	20-Apr-11	Town of Truckee				0.16	0.01 U	1.3	1.4			0.46	1100	300						
DSC-MC1	25-May-11	Town of Truckee				0.01 U	0.025 U	1.4	1.4			0.33	640	230						
DSC-MC2	25-May-11	Town of Truckee		0.05 U		0.21	0.025 U	0.37	0.58	0.023	0.036	0.072	8	2.1						
DSC-TT1	25-May-11	Town of Truckee				0.19	0.025 U	1.9	2.1			0.36	870	350						
DSC-MC3	06-Jun-11	Town of Truckee		0.05 U		0.019	0.01 U	1.3	1.3	0.013	0.023	0.13	530	120						
Water Year 2012																				
DSC-MC1	05-Oct-11	Town of Truckee			0.34	0.31	0.032	0.54	0.89			0.13	180	40						
DSC-MC3	05-Oct-11	Town of Truckee		0.17	0.81	0.81	0.01 U	3.6	4.4	0.58	0.41	0.77	110	46						
DSC-TT1	05-Oct-11	Town of Truckee			0.31	0.31	0.01 U	1.5	1.8			0.18	540	120						
DSC-TT4	03-Jan-12	Town of Truckee	Field											>1000	8.11	2130				
DSC-MC2	20-Jan-12	Town of Truckee		0.05 U		0.01 UJ	0.01 UJ	3.7	3.7	1.1	0.96	0.94	69	16						
DSC-TC1	20-Jan-12	Town of Truckee				0.056 J	0.01 UJ	1.2	1.3			0.25	360	98						
DSC-TT1	20-Jan-12	Town of Truckee				0.13 J	0.018 J	2.7	3			0.37 J	1300 J	600						
DSC-TT1	20-Jan-12	Town of Truckee	Duplicate			0.12 J	0.01 UJ	2.8	3.1			0.79 J	2400 J	600						
DSC-TT1	20-Jan-12	Town of Truckee	Triplicate			0.11 J	0.01 UJ	2.1	2.3			0.14 J	2000 J	610						
DSC-MC1	21-Jan-12	Town of Truckee				0.01 UJ	0.01 UJ	0.21	0.21			0.093	26	18						
DSC-MC2	25-Jan-12	Town of Truckee		0.05 U		0.39	0.01 U	0.63	1	0.084	0.1	0.14	1 U	1.1						
DSC-MC1	26-Jan-12	Town of Truckee				0.24	0.01 U	0.51	0.75			0.056	20	20						
DSC-TT1	26-Jan-12	Town of Truckee				0.07	0.01 U	1.3	1.4			0.096	450	300						
DSC-TT2	03-Feb-12	Town of Truckee	Field											116	7.8	1315				
DSC-TT5	03-Feb-12	Town of Truckee	Field											>1000	8.27	362				
DSC-TT2	01-Mar-12	Town of Truckee											48							
DSC-TT4	01-Mar-12	Town of Truckee											1000							
DSC-TT5	02-Mar-12	Town of Truckee											770							
DSC-MC2	05-Mar-12	Town of Truckee		0.063		0.2	0.01 U	0.46	0.66	0.053	0.058	0.084	2	2.3						
DSC-TT4	05-Mar-12	Town of Truckee											96							
DSC-TT5	05-Mar-12	Town of Truckee											650							
DSC-TT2	08-Mar-12	Town of Truckee											63							
DSC-MC2	13-Mar-12	Town of Truckee		0.05 U		0.037	0.01 U	0.69	0.73	0.11	0.091	0.21	43	11						
DSC-TC2	13-Mar-12	Town of Truckee	Field											112	7.51	3730				
DSC-TC2	13-Mar-12	Town of Truckee											120							
DSC-TT2	13-Mar-12	Town of Truckee	Field											426	7.87	593				
DSC-TT2	13-Mar-12	Town of Truckee											650							
DSC-TT4	13-Mar-12	Town of Truckee	Field											982	7.81	1890				
DSC-TT4	13-Mar-12	Town of Truckee											470							
DSC-TT5	13-Mar-12	Town of Truckee	Field											98.6	8.36	118.3				
DSC-TT5	13-Mar-12	Town of Truckee											33							
DSC-DC1	15-Mar-12	Town of Truckee	Field											>1000	8	135.8				
DSC-DC1	15-Mar-12	Town of Truckee											750							
DSC-DC1	16-Mar-12	Town of Truckee	Field											170 / 172	8.05	126.1				
DSC-DC1	16-Mar-12	Town of Truckee											140							
DSC-MC2	16-Mar-12	Town of Truckee		0.05 U		0.05	0.01 U	0.5	0.6	0.07	0.099	0.15	17	6.8						

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]	pH	Electrical Conductivity [µS]	C10-C22 [mg/L]	C22-C36 [mg/L]	C6-C10 [mg/L]	Total Extractable Hydrocarbons (C6-C36) [mg/L]
DSC-MC3	16-Mar-12	Town of Truckee		0.05 U		0.01 U	0.01 U	0.34	0.34	0.017	0.021	0.13	39	26						
DSC-TC1	16-Mar-12	Town of Truckee											68							
DSC-TC1	16-Mar-12	Town of Truckee	Duplicate										69							
DSC-TC1	16-Mar-12	Town of Truckee	Triplicate										68							
DSC-TC1	16-Mar-12	Town of Truckee	Field											111 / 111	7.72	382				
DSC-TC2	16-Mar-12	Town of Truckee	Field											350 / 338	7.03	4060				
DSC-TC2	16-Mar-12	Town of Truckee											440							
DSC-TT1	16-Mar-12	Town of Truckee	Field											932 / 942	8.06	36.4				
DSC-TT1	16-Mar-12	Town of Truckee											1100							
DSC-TT2	16-Mar-12	Town of Truckee	Field											371 / 395	7.3	79.7				
DSC-TT2	16-Mar-12	Town of Truckee											1400							
DSC-TT3	16-Mar-12	Town of Truckee	Field											378 / 353	7.71	76.7				
DSC-TT3	16-Mar-12	Town of Truckee											360							
DSC-TT4	16-Mar-12	Town of Truckee	Field											654 / 630	7.23	247				
DSC-TT4	16-Mar-12	Town of Truckee											460							
DSC-TT5	16-Mar-12	Town of Truckee	Field											264 / 242	7.31	95.3				
DSC-TT5	16-Mar-12	Town of Truckee											280							
DSC-MC2	21-Mar-12	Town of Truckee		0.05 U		0.01 U	0.01 U	0.21	0.21	0.025	0.014	0.035	5	2.8						
DSC-MC3	21-Mar-12	Town of Truckee		0.05 U		0.01 U	0.01 U	0.095	0.095	0.021	0.014	0.042	1 U	9.8						
DSC-TC1	21-Mar-12	Town of Truckee											3							
DSC-TC1	21-Mar-12	Town of Truckee	Field											12.1 / 12.7	7.81	182.9				
DSC-TC2	21-Mar-12	Town of Truckee	Field											278 / 285	7.55	687				
DSC-TC2	21-Mar-12	Town of Truckee											140							
DSC-TT4	21-Mar-12	Town of Truckee	Field											45.3 / 47.6	7.58	171.2				
DSC-TT4	21-Mar-12	Town of Truckee											50							
DSC-DC1	28-Mar-12	Town of Truckee	Field											939	8.13	86.1				
DSC-DC1	28-Mar-12	Town of Truckee											960							
DSC-MC2	28-Mar-12	Town of Truckee		0.05 U		0.01 U	0.01 U	0.25	0.25	0.016	0.022	0.036	1	0.81						
DSC-TC1	28-Mar-12	Town of Truckee											2							
DSC-TC1	28-Mar-12	Town of Truckee	Field											13.8	8.58	280				
DSC-TC2	28-Mar-12	Town of Truckee	Field											518	7.86	1202				
DSC-TC2	28-Mar-12	Town of Truckee											180							
DSC-TT1	28-Mar-12	Town of Truckee	Field											>1000	7.96	184.9				
DSC-TT1	28-Mar-12	Town of Truckee											1500							
DSC-TT2	28-Mar-12	Town of Truckee	Field											37.6	8.41	234				
DSC-TT2	28-Mar-12	Town of Truckee											26							
DSC-TT3	28-Mar-12	Town of Truckee											330							
DSC-TT3	28-Mar-12	Town of Truckee	Field											261	7.57	6790				
DSC-TT4	28-Mar-12	Town of Truckee	Field											900	8.22	745				
DSC-TT4	28-Mar-12	Town of Truckee											320							
DSC-TT5	28-Mar-12	Town of Truckee	Field											272	8.26	107.7				
DSC-TT5	28-Mar-12	Town of Truckee											390							
DSC-DC1	12-Apr-12	Town of Truckee											1200							
DSC-TC2	12-Apr-12	Town of Truckee											570							
DSC-TT3	12-Apr-12	Town of Truckee											1600							
DSC-DC1	26-Apr-12	Town of Truckee	Field											152	8.39	99.6				
DSC-DC1	26-Apr-12	Town of Truckee											730							
DSC-MC2	26-Apr-12	Town of Truckee		0.05 U		0.049	0.01 U	0.28	0.33	0.01 U	0.038	0.12	6	2.5						
DSC-MC3	26-Apr-12	Town of Truckee		0.05 U		0.055	0.055	0.55	0.66	0.01 U	0.015	0.13	290	120						
DSC-MC3	26-Apr-12	Town of Truckee	Duplicate	0.05 U		0.053	0.053	0.47	0.58	0.01 U	0.016	0.088	290	120						

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]	pH	Electrical Conductivity [µS]	C10-C22 [mg/L]	C22-C36 [mg/L]	C6-C10 [mg/L]	Total Extractable Hydrocarbons (C6-C36) [mg/L]
DSC-MC3	26-Apr-12	Town of Truckee	Triplicate	0.05 U		0.072	0.051	1.3 J	1.4 J	0.01 U	0.016	0.096	280	130						
DSC-TC1	26-Apr-12	Town of Truckee											99							
DSC-TC1	26-Apr-12	Town of Truckee	Field											103	8.76	243				
DSC-TT3	26-Apr-12	Town of Truckee	Field											401	7.93	275				
DSC-TT3	26-Apr-12	Town of Truckee											340							
DSC-TT4	03-May-12	Town of Truckee	Field											151 / 155	7.57	396				
DSC-TT5	03-May-12	Town of Truckee	Field											705 / 701	7.9	104.3				
DSC-TT2	03-Aug-12	Town of Truckee	Field											106	8.1	1240				
DSC-MC3	14-Aug-12	Town of Truckee		0.17		1 U	0.025 U	3.2	3.2	0.15	0.15	0.17	810	310						
DSC-TT3	14-Aug-12	Town of Truckee											80							
Water Year 2013																				
DSC-MC2	17-Nov-12	Town of Truckee		0.055		2.2	0.01 U	0.78	2.9	0.029	0.092	0.11	1	3.2						
DSC-MC3	17-Nov-12	Town of Truckee		0.05 U		0.044	0.016	0.87	0.93	0.01 U	0.028	0.05	88	55						
DSC-MC2	28-Nov-12	Town of Truckee		0.05 U		0.38	0.012	0.5	0.9	0.06	0.082	0.11	7	5						
DSC-MC3	28-Nov-12	Town of Truckee		0.05 U		0.022	0.01 U	0.77	0.8	0.028	0.017	0.048	97	55						
DSC-MC2	30-Nov-12	Town of Truckee		0.05 U		0.18	0.011	0.87	1.1	0.27	0.29	0.27	74	43						
DSC-MC3	30-Nov-12	Town of Truckee		0.05 U		0.044	0.01 U	0.53	0.58	0.055	0.063	0.087	82	89						
DSC-DC1	04-Dec-12	Town of Truckee	Field											>1000	8.55	211				
DSC-TC2	04-Dec-12	Town of Truckee	Field											643	8.13	7260				
DSC-TT3	04-Dec-12	Town of Truckee	Field											>1000	8.03	294				
DSC-MC2	05-Dec-12	Town of Truckee		0.056		0.16	0.052	0.15	0.37	0.045	0.07	0.091	3	6.1						
DSC-MC3	05-Dec-12	Town of Truckee		0.05 U		0.03	0.035	0.31	0.37	0.03	0.052	0.076	64	5.9						
DSC-MC2	20-Mar-13	Town of Truckee		0.05 U	0.1 U			0.2 U	0.2 U	0.01 U	0.038	0.039	2	1.5						
DSC-MC3	20-Mar-13	Town of Truckee		0.05 U	0.1 U			0.2 U	0.2 U	0.01 U	0.036	0.037	1	5.6						
DSC-MC2	31-Mar-13	Town of Truckee	Duplicate	0.05 U	0.1 U			0.2 U	0.2 U	0.013	0.027	0.033	1 U	0.59 J						
DSC-MC2	31-Mar-13	Town of Truckee	Triplicate	0.05 U	0.1 U			0.2 U	0.2 U	0.015	0.027	0.038	1	1 J						
DSC-MC2	31-Mar-13	Town of Truckee		0.05 U	0.1 U			0.2 U	0.2 U	0.013	0.026	0.032	1	0.6 J						
DSC-MC3	31-Mar-13	Town of Truckee	Duplicate	0.14	0.5			1.9	2.4	0.045 J	0.022	0.18 J	650	280						
DSC-MC3	31-Mar-13	Town of Truckee	Triplicate	0.15	0.5			1.9	2.4	0.036 J	0.029	0.29 J	660	250						
DSC-MC3	31-Mar-13	Town of Truckee		0.17	0.5			1.9	2.4	0.027 J	0.021	0.25 J	630	250						
DSC-MC2	08-May-13	Town of Truckee		0.05 U	0.17			0.39	0.57	0.045	0.078	0.11	2	2.1						
DSC-MC3	08-May-13	Town of Truckee		0.14	0.22			0.82	1	0.023	0.044	0.064	170	95						
DSC-MC3	21-Sep-13	Town of Truckee		0.24		0.37	0.09	2.3	2.7	0.4	0.47	0.56	22	16						
Water Year 2014																				
DSC-MC4	30-Jan-14	Town of Truckee		0.11		0.44	0.01 U	0.41	0.84	0.01 U	0.031	0.24	39	32						
DSC-MC5	30-Jan-14	Town of Truckee		0.1 U		0.4	0.01 U	0.2 U	0.4	0.01 U	0.01 U	0.14	4	5.4						
DSC-MC4	08-Feb-14	Town of Truckee		0.063		0.09	0.028	1.1	1.2	0.024	0.058	0.26	610	310						
DSC-MC5	08-Feb-14	Town of Truckee		0.05 U		0.25	0.019	0.56	0.83	0.01 U	0.03	0.062	130	50						
DSC-MC4	26-Feb-14	Town of Truckee		0.1		0.056	0.034	0.77	0.86	0.037	0.019	0.47	890	270						
DSC-MC5	26-Feb-14	Town of Truckee		0.05 U		0.15	0.01 U	0.38	0.53	0.12	0.012	0.06	55	62						
DSC-MC4	06-Mar-14	Town of Truckee		0.074		0.19	0.16	2.1	2.4		0.041	0.35	1600	250						
DSC-MC5	06-Mar-14	Town of Truckee		0.061		0.14	0.12	1.2	1.5		0.011	0.12	220	88						
DSC-MC4	27-Mar-14	Town of Truckee		0.59		0.28	0.1 U	1.3	1.6	0.021	0.029	0.096	100	120						
DSC-MC5	27-Mar-14	Town of Truckee		0.05 U		0.1 U	0.05 U	0.2 U	0.35 U	0.01 U	0.015	0.015	2	3.7						
DSC-MC4	25-Apr-14	Town of Truckee		0.05 U		0.043	0.01 U	0.33	0.37	0.047	0.058	0.077	50	54						
DSC-MC5	25-Apr-14	Town of Truckee		0.05 U		0.059	0.01 U	0.12	0.18	0.01 U	0.015	0.031	5	9.1						
DSC-MC4	20-May-14	Town of Truckee	Duplicate	0.21		0.55	0.025	2	2.5	0.11	0.18	0.2	170	94						
DSC-MC4	20-May-14	Town of Truckee		0.22		0.56	0.024	2.1	2.6	0.11	0.17	0.19	160	110						
DSC-MC4	20-May-14	Town of Truckee	Triplicate	0.22		0.56	0.026	1.9	2.5	0.11	0.18	0.18	140	93						
DSC-MC5	20-May-14	Town of Truckee		0.05 U		0.064	0.01 U	0.35	0.41	0.01 U	0.028	0.086	38	33						

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]	pH	Electrical Conductivity [µS]	C10-C22 [mg/L]	C22-C36 [mg/L]	C6-C10 [mg/L]	Total Extractable Hydrocarbons (C6-C36) [mg/L]
DSC-MC4	31-Jul-14	Town of Truckee		2.3		0.95	0.01 U	8.6	9.6	0.13	0.18	0.15	840	330						
DSC-MC5	31-Jul-14	Town of Truckee		0.058		0.39	0.016	1.4	1.8	0.01 U	0.01 U	0.05	120	120						
Water Year 2015																				
DSC-MC4	03-Dec-14	Town of Truckee		0.05 U		0.61	0.027	0.57	1.2	0.023	0.054	0.094	26	66						
DSC-MC5	03-Dec-14	Town of Truckee		0.05 U		0.35	0.02	0.31	0.68	0.012	0.069	0.097	30	35						
DSC-MC4	07-Feb-15	Town of Truckee		0.072		0.12	0.01 U	1.4	1.5	0.027	0.028	0.58	620	500						
DSC-MC5	07-Feb-15	Town of Truckee		0.05 U		0.17	0.02 U	2	2.2	0.01 U	0.056	0.34	290	290						
DSC-MC4	08-Feb-15	Town of Truckee		0.05 U		0.38	0.034	0.34	0.75	0.022	0.066	0.17	19	56						
DSC-MC5	08-Feb-15	Town of Truckee		0.05 U		0.24	0.011	0.22	0.47	0.014	0.04	0.089	7	20						
DSC-MC4	06-Mar-15	Town of Truckee		0.05 U		0.24	0.01 U	0.17 J	0.24	0.016	0.077	0.078	28	49						
DSC-MC5	06-Mar-15	Town of Truckee		0.05 U		0.038	0.01 U	0.1 U	0.22 U	0.01 U	0.052	0.038	4	2.4						
DSC-MC4	21-Apr-15	Town of Truckee		0.46		0.41	0.026	1.5	1.9	0.01 U	0.043	0.076	980	130						
DSC-MC5	21-Apr-15	Town of Truckee		0.05 U		0.22	0.02	1.1	1.3	0.01 U	0.015	0.12 J	150	31						
DSC-MC5	21-Apr-15	Town of Truckee	Duplicate	0.05 U		0.22	0.023	1	1.3	0.01 U	0.019	0.054 J	160	29						
DSC-MC5	21-Apr-15	Town of Truckee	Triplicate	0.05 U		0.22	0.02	0.74	0.98	0.01 U	0.017	0.061 J	150	32						
DSC-MC4	23-Apr-15	Town of Truckee		0.22		0.66	0.02 U	1.4	2	0.012	0.044	0.074	130	65						
DSC-MC5	23-Apr-15	Town of Truckee		0.05 U		0.15	0.02 U	0.22	0.37	0.015	0.02	0.056	20 J	17						
DSC-MC4	25-May-15	Town of Truckee		0.05 U		0.32	0.022	1.1	1.5	0.01 U	0.024	0.17	270	56						
DSC-MC5	25-May-15	Town of Truckee		0.05 U		0.038	0.01 U	0.94	0.98	0.01 U	0.038	0.076	96	15						
DSC-MC4	21-Jul-15	Town of Truckee		2.7		0.71	0.02	7.7	8.4	0.032	0.35	0.41	650	220						
DSC-MC5	21-Jul-15	Town of Truckee		0.05 U		0.054	0.01 U	1.2	1.2	0.01 U	0.016	0.044	56	48						
Water Year 2016																				
TURB-MS3	29-Jan-16	Town of Truckee											160							
TURB-TT1	29-Jan-16	Town of Truckee											60							
TURB-MS3	30-Jan-16	Town of Truckee											16							
TURB-TT1	30-Jan-16	Town of Truckee											52							
DSC-MC6	24-Feb-16	Placer		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.014	0.01 U	0.022	3	0.97						
DSC-MC7	24-Feb-16	Placer		0.05 U		0.01 U	0.01 U	0.11 J	0.11	0.027	0.028	0.048	1 U	4						
TURB-MS3	06-Mar-16	Town of Truckee											6 J							
TURB-TT1	06-Mar-16	Town of Truckee											18 J							
TURB-MS3	21-Mar-16	Town of Truckee											6 J							
TURB-TT1	21-Mar-16	Town of Truckee											15 J							
TURB-MS3	10-Apr-16	Town of Truckee											9 J							
TURB-TT1	10-Apr-16	Town of Truckee											12 J							
DSC-MC7	22-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.21 J	0.21	0.03	0.064	0.074	13	13						
DSC-MC7	05-May-16	Placer		0.05 U		0.01 U	0.01 U	0.29	0.29	0.05	0.076	0.19 J	8	14						
DSC-MC7	05-May-16	Placer	Triplicate	0.05 U		0.01 U	0.01 U	0.33	0.33	0.046	0.061	0.089 J	8	12						
DSC-MC7	05-May-16	Placer	Duplicate	0.05 U		0.01 U	0.01 U	0.32	0.33	0.048	0.067	0.12 J	9	11						
TURB-MS3	11-May-16	Town of Truckee											4 J							
TURB-TT1	11-May-16	Town of Truckee											6 J							
TURB-MS3	13-May-16	Town of Truckee											11							
TURB-TT1	13-May-16	Town of Truckee											14							
TURB-MS3	03-Jun-16	Town of Truckee											5							
TURB-TT1	03-Jun-16	Town of Truckee											4							
Water Year 2017																				
DSC-MC6	15-Oct-16	Placer		0.05 U		0.18	0.02	0.44	0.63	0.05	0.09	0.12	20.00	12.00						
DSC-MC7	15-Oct-16	Placer		0.05		0.15	0.04	0.80	0.99	0.16	0.21	0.24	5.00	9.00						
DSC-MC6	28-Oct-16	Placer		0.05 U		0.04	0.01 U	0.18 J	0.22	0.02	0.02	0.06	5.00	8.20						
DSC-MC7	28-Oct-16	Placer		0.05 U		0.04 U	0.01	0.24	0.28	0.05	0.06	0.10	4.00	12.00						
DSC-MC6	10-Dec-16	Placer		0.05 U		0.06	0.01 U	0.22	0.28	0.02	0.01 U	0.01 J	75.00	57.00						

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]	pH	Electrical Conductivity [µS]	C10-C22 [mg/L]	C22-C36 [mg/L]	C6-C10 [mg/L]	Total Extractable Hydrocarbons (C6-C36) [mg/L]
DSC-MC7	10-Dec-16	Placer		0.05 U		0.04 J	0.01 J	0.41	0.46	0.07	0.06	0.06 J	61.00	60.00						
DSC-MC6	15-Dec-16	Placer		0.05 U		0.04	0.01 U	0.09 J	0.13	0.02	0.04	0.05	17.00	24.00						
DSC-MC7	15-Dec-16	Placer		0.05 U		0.01	0.01 U	0.19 J	0.20	0.04	0.05	0.07	13.00	27.00						
DSC-MC6	09-Jan-17	Placer		0.05 U		0.03	0.01 U	0.21	0.24	0.02	0.03	0.06	15.00	15.00						
DSC-MC7	09-Jan-17	Placer		0.05 U		0.04	0.01 U	0.22	0.26	0.04	0.06	0.08	2.00	34.00						
DSC-MC6	07-Feb-17	Placer		0.05 U		0.05	0.01 U	0.20 U	0.22 U	0.01	0.02	0.02	33.00	29.00						
DSC-MC7	07-Feb-17	Placer		0.05 U		0.08	0.01 U	0.20 U	0.27	0.04	0.04	0.12	13.00	22.00						
DSC-MC6	09-Mar-17	Placer		0.05 U		0.03	0.01 U	0.13 J	0.16	0.01	0.03	0.02	3.00	7.30						
DSC-MC7	09-Mar-17	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.16	0.02	0.05	0.04	1.00	5.30						
DSC-MC6	07-Apr-17	Placer		0.05 U		0.02	0.01 U	0.08 U	0.10	0.01 U	0.03	0.02	9.00	13.00						
DSC-MC7	07-Apr-17	Placer		0.05 U		0.02	0.01 U	0.26 J	0.28	0.03	0.05	0.05	3.00	20.00						
Water Year 2018																				
DSC-MC6	13-Mar-18	Placer		0.05 U		0.11	0.01 U	0.16 J	0.27	0.01 U	0.025	0.087	31	65						
DSC-MC7	13-Mar-18	Placer		0.05 U		0.038	0.01 U	0.22	0.26	0.01 U	0.046	0.074	15	23						
DSC-MC8	13-Mar-18	Placer		0.05 U		0.02	0.01 U	0.24	0.26	0.01 U	0.025	0.059	30	29						
DSC-MC6	22-Mar-18	Placer		0.052 U		0.047	0.01 U	0.13 J	0.18	0.018	0.021	0.042	24	38						
DSC-MC7	22-Mar-18	Placer		0.052 U		0.14	0.021	0.22	0.38	0.04	0.052	0.088	64	58						
DSC-MC8	22-Mar-18	Placer		0.052 U		0.021	0.01 U	0.2 J	0.22	0.018	0.022	0.052	44	46						
DSC-MC6	29-Mar-18	Placer		0.05 U		0.018	0.01 U	0.08 U	0.1 U	0.042	0.021	0.016	2	4.6						
DSC-MC7	29-Mar-18	Placer		0.05 U		0.01 U	0.01 U	0.13 J	0.14	0.022	0.039	0.033	2	7.9						
DSC-MC8	29-Mar-18	Placer		0.05 U		0.01 U	0.01 U	0.12 J	0.12	0.01 U	0.013	0.034	3	6.2						
DSC-MC6	06-Apr-18	Placer		0.05 U		0.028	0.01 U	0.11 J	0.14	0.012	0.025	0.026	21	32						
DSC-MC7	06-Apr-18	Placer		0.05 U		0.01 U	0.01 U	0.22	0.22 U	0.029	0.042	0.086	28	27						
DSC-MC8	06-Apr-18	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.16	0.013	0.028	0.051	22	18						
DSC-MC6	07-Apr-18	Placer		0.05 U		0.03 J	0.01 UJ	0.08 U	0.12	0.012	0.01 U	0.01 U	10	17						
DSC-MC7	07-Apr-18	Placer		0.05 U		0.016 J	0.01 UJ	0.16 J	0.19	0.035 J	0.011	0.016	13	23						
DSC-MC8	07-Apr-18	Placer		0.05 U		0.014 J	0.01 UJ	0.14 J	0.16	0.014 J	0.047	0.058	16	18						
DSC-MC6	16-Apr-18	Placer		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.01 U	0.02 U	0.02 U	1	1.9						
DSC-MC7	16-Apr-18	Placer		0.05 U		0.01 U	0.01 U	0.14 J	0.14	0.015	0.02 U	0.02 U	1	3.2						
DSC-MC8	16-Apr-18	Placer		0.05 U		0.01 U	0.01 U	0.13 J	0.13	0.01 U	0.02 U	0.02 U	6	5						
DSC-MC8	09-May-18	Placer		0.05 U		0.018	0.01 U	0.13 J	0.15	0.015	0.021	0.08	20	22 J						
DSC-MC7	16-May-18	Placer		0.052 U		0.036	0.01 U	1.4	1.4	0.039	0.22	0.25	4	5.4						
DSC-MC8	16-May-18	Placer		0.051 U		0.01 U	0.01 U	0.2 J	0.21	0.01 U	0.011	0.036	9	8						
DSC-MC6	25-May-18	Placer		0.052 U		0.04	0.01 U	0.17 J	0.21	0.01 U	0.03	0.035	3	5.4						
DSC-MC7	25-May-18	Placer		0.051 U		0.01 U	0.01 U	0.36	0.37	0.032	0.068	0.083	6	27						
DSC-MC8	25-May-18	Placer		0.051 U		0.014	0.01 U	0.18 J	0.2	0.01 U	0.029	0.038	9	10						

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]	pH	Electrical Conductivity [µS]	C10-C22 [mg/L]	C22-C36 [mg/L]	C6-C10 [mg/L]	Total Extractable Hydrocarbons (C6-C36) [mg/L]
Water Year 2019																				
DSC-MC7	29-Nov-18	Placer		0.052 U		0.53	0.01 U	0.7	1.2	0.044	0.051	0.1	1	4.9						
DSC-MC8	29-Nov-18	Placer	Original	0.051 U		0.01 U	0.01 U	0.19 J	0.2	0.01 U	0.029 J	0.01 U	2 J	4.3						
DSC-MC8	29-Nov-18	Placer	Duplicate	0.052 U		0.01 U	0.01 U	0.17 J	0.18	0.01 U	0.01 UJ	0.01 U	1 J	3.5						
DSC-MC8	29-Nov-18	Placer	Triplicate	0.052 U		0.01 U	0.01 U	0.2 J	0.21	0.01 U	0.01 UJ	0.01 U	4 J	5.2						
DSC-MC8	17-Dec-18	Placer		0.052 U		0.01 U	0.01 U	0.12 J	0.12	0.01 U	0.01 U	0.01 U	1 U	1.5						
DSC-MC7	07-Jan-19	Placer		0.05 U		0.033	0.01 U	0.28	0.32	0.017	0.029	0.044	3	3						
DSC-MC8	07-Jan-19	Placer		0.05 U		0.032	0.01 U	0.17 J	0.2	0.01 U	0.025	0.028	6	7.8						
DSC-MC6	09-Jan-19	Placer		0.05 U		0.06	0.01 U	0.54	0.6	0.01 U	0.015	0.029	5	6.2						
DSC-MC7	09-Jan-19	Placer		0.05 U		0.11	0.01 U	0.27	0.38	0.022	0.036	0.042	4	6.8						
DSC-MC8	09-Jan-19	Placer		0.05 U		0.028	0.01 U	0.24	0.27	0.01 U	0.01 U	0.033	18	16						
DSC-MC6	14-Feb-19	Placer		0.05 U		0.082	0.01 U	0.24	0.32	0.01 U	0.029	0.051	19	23						
DSC-MC7	14-Feb-19	Placer		0.05 U		0.15	0.01 U	0.28	0.43	0.029	0.073	0.11	10	23						
DSC-MC8	14-Feb-19	Placer		0.05 U		0.044	0.01 U	0.28	0.32	0.013	0.039	0.047	16	13						
DSC-MC6	06-Mar-19	Placer		0.05 U		0.025 J	0.01 U	0.15 J	0.17	0.01 U	0.01 U	0.044	27	38						
DSC-MC7	06-Mar-19	Placer		0.05 U		0.031	0.01 U	0.15 J	0.19	0.01 U	0.031	0.036	8	10						
DSC-MC8	06-Mar-19	Placer		0.05 U		0.01 U	0.01 U	0.12 J	0.13	0.01 U	0.016 J	0.01 U	7	8.4						
DSC-MC6	19-Mar-19	Placer		0.05 U		0.022 J	0.01 U	0.28	0.3	0.01 U	0.01 U	0.01 U	2	4.3						
DSC-MC7	19-Mar-19	Placer		0.05 U		0.012 J	0.01 U	0.69	0.7	0.013 J	0.01 U	0.032	1 U	8						
DSC-MC8	19-Mar-19	Placer		0.05 U		0.01 U	0.01 U	0.12 J	0.12	0.01 U	0.01 U	0.01 U	3	3.6						
DSC-MC6	18-Apr-19	Placer		0.05 U		0.021 J	0.01 U	0.055 U	0.1 U	0.004 U	0.006 U	0.006 U	1 J	2.5						
DSC-MC7	18-Apr-19	Placer		0.05 U		0.009 U	0.01 U	0.14 J	0.14	0.017 J	0.037	0.038	1 J	3.7						
DSC-MC8	18-Apr-19	Placer		0.05 U		0.009 U	0.01 U	0.11 J	0.12	0.006 J	0.015 J	0.006 U	5 J	6.4						
DSC-MC6	24-Apr-19	Placer		0.05 U		0.014 J	0.01 U	0.08 U	0.1 U	0.02 U	0.02 U	0.02 U	3 J	2.9						
DSC-MC7	24-Apr-19	Placer		0.05 U		0.01 U	0.01 U	0.25	0.25	0.02	0.023	0.043	6 J	3.9						
DSC-MC8	24-Apr-19	Placer		0.05 U		0.13	0.01 U	0.14 J	0.28	0.02 U	0.02 U	0.023	53	24						
Water Year 2020																				
DSC-MC9	26-Jan-20	Placer										0.087	480							
DSC-MC10	26-Jan-20	Placer										0.042	9.7							
DSC-MC9	26-Mar-20	Placer										0.03	210							
DSC-MC10	26-Mar-20	Placer										0.01 U	5.5							
DSC-MC9	15-Apr-20	Placer										0.092	46							
DSC-MC10	15-Apr-20	Placer										0.01 U	2 J							
DSC-MC9	27-Jul-20	Placer	Original									0.53 J	640 J							
DSC-MC9	27-Jul-20	Placer	Duplicate									1.3 J	400 J							
DSC-MC9	27-Jul-20	Placer	Triplicate									0.38 J	410 J							

Tributary Level Events and Analytical Data

WY 2011 Placer County Tributary Level Water Quality Monitoring								
Sample Date	Event Type	Martis Creek Station ID						Comments
		MC1	MC2	MC3	MC4	MC5	MC6	
12/14/2010	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	The storm began as rain during the early morning hours on 12/14/2010. Samples successfully collected during rising limb of storm between 09:00 and 11:40 on 12/14/2010. Later in the afternoon, temps dropped and precip became spotty and changed to snow.
12/18/2010	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)2	WQ(C1)	Large Storm began as snow during the afternoon of 12/17/2010, and changed to rain overnight. Samples were successfully collected during rising limb of storm between 09:30 and 11:40 on the morning of 12/18/10, before the storm changed back to snow (early afternoon). Flow rates at site DST-MC1 were too high to wade the entire transect.
3/15/2011	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Large Storm began during the morning of 3/15/2010, and changed to snow overnight. Samples were successfully collected during rising limb of storm between 16:20 and 19:00 on the afternoon of 3/15/2011, before the storm changed to snow (late evening). Flow rates at site DST-MC1 were too high to wade the entire transect.
4/1/2011	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt event. April1, 2011 was chosen to collect samples based on the previous days' snowmelt cycle recorded at the Martis Creek gauging station and predicted high temperatures on April 1. On April 1 the gauging station recorded a 0.45 ft. rise from 08:15 to 20:45. Rising limb was successfully sampled. Post event data review showed that April 2, 2011 was the peak snowmelt day during this early spring snowmelt cycle as an uncommonly warm low temperature (45F) may have been a factor in the larger rise (0.6 ft). The high temperature on April 1 was 68F, the high temperature on April 2 was 53F. Flow rates at site DST-MC1 were too high to wade the entire transect. Flow at Placer County Martis Creek stream gauge shows <20% increase over winter baseflow.
5/5/2011	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt event. May 5, 2011 was chosen to collect samples based on the previous days' snowmelt cycle recorded at the Martis Creek gauging station and predicted high temperatures on May 5. On May 5 the gauging station recorded a 0.28 ft. rise from 14:15 to 23:15. Rising limb was successfully sampled. The high temperature on May 5 was 65F. Flow rates at site DST-MC1 were too high to wade the entire transect.
6/6/2011	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mix Event began during the evening of 6/6/2011 and changed to snow overnight. Samples were successfully collected during high flow between 0830 and 1040 on the morning of 6/6/2011. Flow rates at site DST-MC1 were too high to wade the entire transect.
6/29/2011	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain Event began during the late evening of 6/28/2011 and continued until approximately 7AM on 6/29/2011. Samples were successfully collected during high flow between 0630 and 0840 on the morning of 6/29/2011. Flow rates at site DST-MC1 were too high to wade the entire transect.

WQ(C1) - A composite sample collected containing a series of grab samples
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2012 Placer County Tributary Level Water Quality Monitoring								
Sample Date	Event Type	Martis Creek Station ID						Comments
		MC1	MC2	MC3	MC4	MC5	MC6	
1/21/2012	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Low flow at DST-MC6
3/14/2012	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Low flow at DST-MC6;Light mix event;
3/16/2012	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	
3/21/2012	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	
4/20/2012	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Low flow @ MC6.
4/23/2012	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Low flow @ MC6.
4/26/2012	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Turbid flows.

WY 2013 Placer County Tributary Level Water Quality Monitoring								
Sample Date	Event Type	Martis Creek Station ID						Comments
		MC1	MC2	MC3	MC4	MC5	MC6	
11/17/2012	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	NO FLOW	Mixed event. (Rain occurring during sampling) No flow occurring at DST MC6. Beaver dam has been constructed ~10 ft downstream of DST MC1. Sufficient flow still occurring there for sampling efforts. Visual observation of higher than normal turbidity and slight amber coloring of flow at DST MC4.
11/30/2012	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mostly rain, with slight amounts of snow towards the end of the event. Flow at DST MC1 too high for a complete crossing. Half the channel was sampled.
12/5/2012	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain overnight, tapering while samples were being collected. Flow at DST MC1 too high for a complete crossing. Half the channel was sampled. Flows at all sites (except MC5) even higher than 11/30 event. Groundwater seems to be flowing at MC6.
12/17/2012	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Slushy snow overnight, continuing into the morning.
3/13/2013	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt from warm daytime temperatures on existing snowpack.
3/20/2013	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mixed event overnight into the morning hours, tapering off by early afternoon. Most intense period of precip from 4-6am.
3/31/2013	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mixed event from the early morning hours, tapering off by late morning. Most intense period of precip from 4-6am.
4/26/2013	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt from warm daytime temperatures on existing snowpack.
5/7/2013	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Heavy rain overnight to early morning. Light showers through the day.

WQ(C1) - A composite sample collected containing a series of grab samples
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2014 Placer County Tributary Level Water Quality Monitoring								
Sample Date	Event Type	Martis Creek Station ID						Comments
		MC1	MC2	MC3	MC4	MC5	MC6	
1/30/2014	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	NO FLOW	Mixed event. (Snow occurring during sampling) No flow occurring at DST MC6. DST-MC4 and DST- MC5 have been relocated for better channel representation and beaver dam issues. Ice covering half of stream channel at DST-MC1, so only half of channel sampled. Ice on bottom of channel at DST-MC3, First flow of season from Middle Martis (DST-MC3)
2/9/2014	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mixed event. Snow Level above 6500 ft throughout event. DST-MC4 and DST- MC5 have been relocated for better channel representation and beaver dam issues. Samples were collected at only half the channel at DST-MC1 due to high flows. Flows were at bank full condition and flowing onto the surrounding terraces.
2/27/2014	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mixed event. Snow Level above 6500 ft throughout event. DST-MC4 and DST- MC5 have been relocated for better channel representation and beaver dam issues.
3/29/2014	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snow level started above 7000 ft and dropped to 5000 ft by the end of the event.
4/8/2014	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	NO FLOW	Several days of above average temperatures caused a diurnal snowmelt cycle to occur. Samples taken on rising limb. No flow at DST MC6.
5/20/2014	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	NO FLOW	Samples collected mid afternoon during the rising limb. No flow at DST-MC6.
7/21/2014	R	WQ(C1)	WQ(C1)	NO FLOW	WQ(C1)	WQ(C1)	NO FLOW	Rain / Tstorm event. Monsoonal moisture caused light to moderate rain from afternoon of 7/20 through early am of 7/21.
8/4/2014	R	WQ(C1)	WQ(C1)	NO FLOW	WQ(C1)	WQ(C1)	NO FLOW	Rain Event. Extended overcast period from Sunday 8/3 through Tuesday 8/5, with consistent, light rain from Monday morning 8/4, through early morning 8/5.

WY 2015 Placer County Tributary Level Water Quality Monitoring								
Sample Date	Event Type	Martis Creek Station ID						Comments
		MC1	MC2	MC3	MC4	MC5	MC6	
12/3/2014	M	WQ(C1)	WQ(C1)	NO FLOW	WQ(C1)	WQ(C1)	NO FLOW	Mixed event. Snow level started at 5000 ft and increased to 7500 ft by the end of the event.
2/7/2015	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Large rain event after 37 days of dry weather. Snow levels hovered around 8,000 ft throughout event.
2/8/2015	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Second wave of rain after approximately 18 hour dry period. Snow levels again hovered around 8,000 ft.
3/6/2015	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt event. Several days of above average temperatures caused a diurnal snowmelt cycle to occur. Samples taken on rising limb. Low flows.

WQ(C1) - A composite sample collected containing a series of grab samples
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

4/21/2015	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	NO FLOW	Isolated Afternoon Thunderstorms.
4/23/2015	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Overnight Thunderstorms (4/23-4/24)
6/10/2015	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	NO FLOW	Rain storm from low pressure system.

WY 2016 Placer County
Tributary Level Water Quality Monitoring

Sample Date	Event Type	Martis Creek Station ID						Comments
		MC1	MC2	MC3	MC4	MC5	MC6	
11/2/2015	M	WQ(C1)	WQ(C1)	No flow	WQ(C1)	WQ(C1)	No flow	Mixed event. Snow level started at 9000 ft and dropped to ~4500 ft by the end of the event.
12/21/2015	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	No flow	Mix event. Snow level 6000-7000 ft.
1/29/2016	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain on snow event. Snow level 8,000 during sample collection.
2/24/2016	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt event.
3/5/2016	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mix event. Snow level 6000-7000 ft.
4/7/2016	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt event.
4/22/2016	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Spring Rain event. Turned to snow after initial downpour.

WY 2017 Placer County
Tributary Level Water Quality Monitoring

Sample Date	Event Type	Martis Creek Station ID						Comments
		MC1	MC2	MC3	MC4	MC5	MC6	
10/16/2016	R	WQ(C1)	WQ(C1)	No flow	WQ(C1)	WQ(C1)	No flow	Rain event. First storm event of WY 2017. Flows in Middle Martis (DST-MC3) are being diverted through meadow upstream of sample point.
10/28/2016	R	WQ(C1)	WQ(C1)	No flow	WQ(C1)	WQ(C1)	No flow	Rain event. Precipitation started the morning of 10/27 in the area and continued through the morning of 10/28. No flow was observed at DST-MC3 or DST-MC6.
12/10/2016	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain event. Precipitation started the early morning of 12/10 in the area and continued through the early evening of 12/10.
12/16/2016	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mixed event. Precipitation started the evening of 12/15/2016 in the area and ended on the
1/9/2017	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mixed event. Precip started on Saturday 1/7/17, as snow, and changed to rain in the afternoon, and continued through Monday morning 1/9/17 when it changed back to snow for a few hours. Fresh snow was observed in Martis Valley and Northstar community sites.
2/9/2017	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain Event. Multi day pineapple express. Samples collected near the end of the event during flood stage. All tributaries above the natural stream channel banks.
3/20/2017	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt Event. 2 weeks dry weather with temps in the 50s.
5/24/2017	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt Event. Peak of final snowmelt cycle of 2016-2017 wet season.

WQ(C1) - A composite sample collected containing a series of grab samples
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2018 Placer County Tributary Level Water Quality Monitoring									
Sample Date	Event Type	Martis Creek Station ID							Comments
		MC1	MC2	MC4	MC5	MC7	MC8	MC9	
3/8/2018	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)			Snowmelt event. The first large snow storm of the winter produced 39" of snow from 3/1-3/3. Warm temperatures on 3/8 resulted in minor rise of stream flow during afternoon hours. Most snowmelt runoff was infiltrated due to drier than normal soil conditions.
3/13/2018	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mixed rain and snow event resulted in moderate rise of stream flow.
3/22/2018	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Very large mixed rain and snow event created flooding conditions throughout the project area
3/29/2018	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt event.
4/7/2018	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain showers.
5/9/2018	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt event.
5/16/2018	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain showers.
5/25/2018	R	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain showers.

WY 2019 Placer County Tributary Level Water Quality Monitoring									
Sample Date	Event Type	Martis Creek Station ID							Comments
		MC1	MC2	MC4	MC5	MC7	MC8	MC9	
11/29/2018	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	
12/17/2018	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Small storm, but created enough runoff for the streams to rise.
1/7/2019	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)		WQ(C1)	WQ(C1)	Storm started as snow, but changed to rain during the overnight hours. DST-MC7 not sampled due to thick ice at this location.
1/9/2019	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	
2/14/2019	M						WQ(C1)	WQ(C1)	Storm started as rain but changed to snow in the afternoon. DST-MC1, DST-MC2, DST-MC4, DST-MC5, and DST-MC7 not accessible due to deep snow and flooding.
3/6/2019	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Mixed rain/snow and snowmelt resulted in a significant rise in all streams.
3/19/2019	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Field Triplicates taken at DST-MC5.
4/18/2019	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	
4/24/2019	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	

WQ(C1) - A composite sample collected containing a series of grab samples
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

WY 2020 Placer County Tributary Level Water Quality Monitoring									
Sample Date	Event Type	Martis Creek Station ID							Comments
		MC1	MC4	MC5	MC7	MC8	MC9	MC10	
1/26/2020	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Rain / mixed precip overnight.
2/6/2020	B	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)		Baseflow Sample; No flow at DST-MC10.
3/26/2020	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt sample.
4/15/2020	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt sample.
4/29/2020	S	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	Snowmelt sample.
8/5/2020	B	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)		Baseflow Sample; No flow at DST-MC10.
11/18/2020	M	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)	WQ(C1)		Mixed event; no flow at DST-MC10.

WQ(C1) - A composite sample collected containing a series of grab samples
Event Types: M = Mixed Snow/Rain, S = Snow Melt, R = Rain

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
Water Year 2011														
DST-MC1	14-Dec-10	Town of Truckee		0.005	0.205			0.999		0.018	0.034	0.186	82.24	37.2
DST-MC2	14-Dec-10	Town of Truckee		0.003	0.007			0.319		0.014	0.032	0.063	19.23	11.2
DST-MC3	14-Dec-10	Town of Truckee		0.01	0.029			0.872		0.034	0.052	0.154	60	27.25
DST-MC4	14-Dec-10	Town of Truckee		0.005	0.133			0.651		0.031	0.048	0.127	35.19	22.2
DST-MC5	14-Dec-10	Town of Truckee		0.004	0.099			0.515		0.021	0.041	0.114	37.5	23.5
DST-MC6	14-Dec-10	Town of Truckee		0.006	0.246			0.645		0.01	0.031	0.104	33.85	25.25
DST-MC1	18-Dec-10	Town of Truckee		0.003	0.215			0.534		0.028	0.041	0.103	28	15.5
DST-MC2	18-Dec-10	Town of Truckee		0.004	0.013			0.233		0.013	0.033	0.05	12	11.2
DST-MC3	18-Dec-10	Town of Truckee		0.004	0.042			0.383		0.027	0.044	0.076	21	12.45
DST-MC4	18-Dec-10	Town of Truckee		0.003	0.083			0.394		0.02	0.031	0.064	14	8.75
DST-MC5	18-Dec-10	Town of Truckee		0.003	0.196			0.503		0.032	0.043	0.096	22	12.5
DST-MC6	18-Dec-10	Town of Truckee		0.005	0.268			0.426		0.015	0.03	0.059	12	10.75
DST-MC1	15-Mar-11	Town of Truckee		0.004	0.088			0.376		0.018	0.024	0.094	37	19.3
DST-MC2	15-Mar-11	Town of Truckee		0.004	0.048			0.475		0.023	0.027	0.083	32	14.5
DST-MC3	15-Mar-11	Town of Truckee		0.006	0.048			0.377		0.026	0.033	0.1	25.61	12.4
DST-MC4	15-Mar-11	Town of Truckee		0.003	0.102			0.296		0.016	0.023	0.064	24	10.1
DST-MC5	15-Mar-11	Town of Truckee		0.003	0.09			0.305		0.02	0.028	0.057	17.07	9.95
DST-MC5	15-Mar-11	Town of Truckee	Duplicate	0.003	0.087			0.301		0.02	0.027	0.057	17.07	9.9
DST-MC5	15-Mar-11	Town of Truckee	Triplicate	0.004	0.089			0.31		0.02	0.028	0.059	17.5	10
DST-MC6	15-Mar-11	Town of Truckee		0.003	0.126			0.281		0.008	0.013	0.042	14.63	7.5
DST-MC1	01-Apr-11	Town of Truckee		0.003	0.015			0.231		0.012	0.021	0.045	12	6.75
DST-MC2	01-Apr-11	Town of Truckee		0.002	0.006			0.202		0.014	0.025	0.048	12.67	9.95
DST-MC3	01-Apr-11	Town of Truckee		0.002	0.003			0.22		0.018	0.027	0.058	12.67	9.5
DST-MC4	01-Apr-11	Town of Truckee		0.001	0.037			0.241		0.009	0.018	0.047	11	6.25
DST-MC5	01-Apr-11	Town of Truckee		0.001	0.015			0.174		0.012	0.021	0.035	4.5	3.1
DST-MC6	01-Apr-11	Town of Truckee		0.006	0.016			0.188		0.005	0.014	0.034	5.2	3.5
DST-MC1	05-May-11	Town of Truckee		0.001	0.004			0.219		0.019	0.026	0.047	6	7.25
DST-MC2	05-May-11	Town of Truckee		0.001	0.006			0.446		0.061	0.072	0.152	34	18
DST-MC3	05-May-11	Town of Truckee		0.002	0.005			0.218		0.028	0.035	0.068	14	10.25

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC4	05-May-11	Town of Truckee		0.001	0.016			0.333		0.004	0.017	0.052	16	5.5
DST-MC5	05-May-11	Town of Truckee		0.003	0.005			0.149		0.016	0.022	0.035	3.5	4.1
DST-MC6	05-May-11	Town of Truckee		0.004	0.004			0.403		0.009	0.025	0.04	2.5	3.25
DST-MC1	06-Jun-11	Town of Truckee		0.005	0.01			0.274		0.022	0.033	0.067	16.5	11.2
DST-MC2	06-Jun-11	Town of Truckee		0.004	0.008			0.192		0.017	0.03	0.05	13	10.3
DST-MC3	06-Jun-11	Town of Truckee		0.005	0.007			0.302		0.024	0.035	0.073	13.5	14.6
DST-MC4	06-Jun-11	Town of Truckee		0.004	0.061			0.329		0.011	0.023	0.059	14.5	10.1
DST-MC5	06-Jun-11	Town of Truckee		0.003	0.009			0.245		0.018	0.033	0.048	6.5	7.5
DST-MC6	06-Jun-11	Town of Truckee		0.003	0.007			0.445		0.019	0.031	0.076	16.5	9.95
DST-MC1	29-Jun-11	Town of Truckee		0.004	0.007			0.275		0.02	0.033	0.051	4.8	3.2
DST-MC2	29-Jun-11	Town of Truckee		0.003	0.002			0.309		0.022	0.033	0.056	11.2	6.5
DST-MC3	29-Jun-11	Town of Truckee		0.002	0.003			0.337		0.031	0.04	0.068	8.4	7.75
DST-MC4	29-Jun-11	Town of Truckee		0.001	0.08			0.391		0.012	0.018	0.05	8.4	1.85
DST-MC5	29-Jun-11	Town of Truckee		0.002	0.007			0.243		0.021	0.031	0.048	4.4	3.1
DST-MC6	29-Jun-11	Town of Truckee		0.002	0.002			0.717		0.021	0.03	0.093	11.6	6.5
Water Year 2012														
DST-MC1	21-Jan-12	Town of Truckee		0.006	0.435			1.152		0.121	0.153	0.244	30.56	13.45
DST-MC2	21-Jan-12	Town of Truckee		0.004	0.183			0.443		0.045	0.065	0.101	13.33	10.5
DST-MC3	21-Jan-12	Town of Truckee		0.003	0.302			0.968		0.181	0.2	0.255	20	10.45
DST-MC4	21-Jan-12	Town of Truckee		0.006	0.661			0.682		0.067	0.108	0.142	16.22	10.25
DST-MC5	21-Jan-12	Town of Truckee		0.006	0.361			1.189		0.138	0.167	0.214	19.44	10.65
DST-MC6	21-Jan-12	Town of Truckee		0.179	0.419			1.845		0.078	0.112	0.122	8.33	2.25
DST-MC1	14-Mar-12	Town of Truckee		0.002	0.018			0.574		0.027	0.039	0.066	15.33	5.75
DST-MC2	14-Mar-12	Town of Truckee		0.001	0.002			0.572		0.022	0.034	0.057	3.6	2.1
DST-MC3	14-Mar-12	Town of Truckee		0.002	0.002			0.602		0.02	0.028	0.055	6.67	2.75
DST-MC4	14-Mar-12	Town of Truckee		0.006	0.045			0.678		0.026	0.037	0.09	28.67	8.2
DST-MC5	14-Mar-12	Town of Truckee		0.002	0.005			0.633		0.049	0.058	0.089	14	5.5
DST-MC6	14-Mar-12	Town of Truckee		0.003	0.058			0.49		0.025	0.054	0.068	7.2	2.5
DST-MC1	16-Mar-12	Town of Truckee		0.001	0.092			0.673		0.021	0.033	0.097	24	15.4
DST-MC2	16-Mar-12	Town of Truckee		0.002	0.014			0.658		0.016	0.037	0.06	10.89	5.15

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC3	16-Mar-12	Town of Truckee		0.003	0.041			0.558		0.022	0.036	0.078	16	8.05
DST-MC4	16-Mar-12	Town of Truckee		0.015	0.242			0.542		0.007	0.018	0.068	17	7.65
DST-MC5	16-Mar-12	Town of Truckee		0.002	0.086			0.66		0.031	0.043	0.103	29.41	9.9
DST-MC5	16-Mar-12	Town of Truckee	Duplicate	0.001	0.085			0.654		0.031	0.043	0.102	29	9.95
DST-MC5	16-Mar-12	Town of Truckee	Triplicate	0.001	0.085			0.658		0.03	0.045	0.101	29	9.95
DST-MC6	16-Mar-12	Town of Truckee		0.003	0.197			0.544		0.014	0.04	0.078	14	8
DST-MC1	21-Mar-12	Town of Truckee		0.005	0.025			0.486		0.014	0.033	0.049	6	4.75
DST-MC2	21-Mar-12	Town of Truckee		0.002	0.004			0.215		0.012	0.03	0.044	5.5	2.25
DST-MC3	21-Mar-12	Town of Truckee		0.005	0.004			0.432		0.016	0.032	0.047	4	2.05
DST-MC4	21-Mar-12	Town of Truckee		0.006	0.078			0.283		0.011	0.024	0.041	8.5	3.55
DST-MC5	21-Mar-12	Town of Truckee		0.008	0.037			0.342		0.021	0.034	0.058	7.66	5.15
DST-MC6	21-Mar-12	Town of Truckee		0.005	0.036			0.588		0.011	0.027	0.042	6.5	4.3
DST-MC1	20-Apr-12	Town of Truckee		0.005	0.007			0.222		0.011	0.032	0.044	5.6	3.5
DST-MC2	20-Apr-12	Town of Truckee		0.006	0.003			0.237		0.013	0.045	0.055	7.2	4.25
DST-MC3	20-Apr-12	Town of Truckee		0.004	0.001			0.211		0.017	0.062	0.077	4.4	1.75
DST-MC4	20-Apr-12	Town of Truckee		0.005	0.109			0.286		0.006	0.031	0.047	7.2	3.75
DST-MC5	20-Apr-12	Town of Truckee		0.006	0.02			0.193		0.016	0.037	0.053	6.4	3.25
DST-MC6	20-Apr-12	Town of Truckee		0.005	0.003			0.507		0.009	0.032	0.052	4	1.8
DST-MC1	23-Apr-12	Town of Truckee		0.004	0.019			0.26		0.01	0.033	0.045	8	5.25
DST-MC2	23-Apr-12	Town of Truckee		0.004	0.003			0.475		0.012	0.028	0.045	8.5	5.15
DST-MC3	23-Apr-12	Town of Truckee		0.003	0.002			0.23		0.013	0.031	0.054	6.5	3.5
DST-MC4	23-Apr-12	Town of Truckee		0.005	0.1			0.765		0.008	0.023	0.098	38.5	10.1
DST-MC5	23-Apr-12	Town of Truckee		0.005	0.053			0.257		0.012	0.027	0.077	10.5	6.1
DST-MC6	23-Apr-12	Town of Truckee		0.003	0.004			0.669		0.008	0.025	0.045	8	2.5
DST-MC1	26-Apr-12	Town of Truckee		0.003	0.025			0.451		0.014	0.036	0.057	16.4	7.6
DST-MC2	26-Apr-12	Town of Truckee		0.003	0.006			0.753		0.016	0.037	0.082	46.5	9.95
DST-MC3	26-Apr-12	Town of Truckee		0.007	0.003			0.347		0.021	0.044	0.061	9	7.25
DST-MC4	26-Apr-12	Town of Truckee		0.004	0.102			0.402		0.062	0.1	0.143	18	7.8
DST-MC5	26-Apr-12	Town of Truckee		0.004	0.048			0.535		0.222	0.603	0.665	24.5	8.5
DST-MC6	26-Apr-12	Town of Truckee		0.005	0.004			0.6		0.009	0.038	0.05	4.95	2.35

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
Water Year 2013														
DST-MC1	17-Nov-12	Town of Truckee		0.05 U		0.01 U	0.01 U	0.46	0.46	0.01 U	0.033	0.056	10	7.5
DST-MC2	17-Nov-12	Town of Truckee		0.05 U		0.01 U	0.01 U	0.31	0.31	0.01 U	0.04	0.064	11	7.8
DST-MC3	17-Nov-12	Town of Truckee		0.05 U		0.01 U	0.01 U	0.34	0.34	0.031	0.064	0.11	1 U	3.6
DST-MC4	17-Nov-12	Town of Truckee		0.05 U		0.11	0.01 U	0.78	0.89	0.16	0.34	0.42	56	31
DST-MC5	17-Nov-12	Town of Truckee		0.05 U		0.01 U	0.01 U	0.24	0.24	0.01 U	0.028	0.054	9	5.5
TURB-MS3	17-Nov-12	Town of Truckee											11	
TURB-TT1	17-Nov-12	Town of Truckee											5	
TURB-MS3	18-Nov-12	Town of Truckee											72	
DST-MC1	30-Nov-12	Town of Truckee		0.05 U		0.18	0.01 U	1	1.18	0.074	0.083	0.1	82	54
DST-MC2	30-Nov-12	Town of Truckee		0.05 U		0.26	0.01 U	0.84	1.1	0.04	0.058	0.082	26	27
DST-MC3	30-Nov-12	Town of Truckee		0.05 U		0.14	0.01 U	0.6	0.74	0.089	0.11	0.11	10	26
DST-MC4	30-Nov-12	Town of Truckee		0.05 U		0.18	0.01 U	0.57	0.75	0.06	0.075	0.096	20	32
DST-MC5	30-Nov-12	Town of Truckee		0.05 U		0.14	0.01 U	0.71	0.85	0.083	0.1	0.11	48	49
DST-MC6	30-Nov-12	Town of Truckee		0.1		2.4	0.014	1.4	3.814	0.069	0.091	0.096	20	68
TURB-MS3	30-Nov-12	Town of Truckee											40	
TURB-TT1	30-Nov-12	Town of Truckee											140	
TURB-MS3	02-Dec-12	Town of Truckee											220	
TURB-MS3	02-Dec-12	Town of Truckee											3	
TURB-TT1	02-Dec-12	Town of Truckee											190	
TURB-TT1	02-Dec-12	Town of Truckee											240	
DST-MC1	05-Dec-12	Town of Truckee		0.05 U		0.15	0.044	0.48	0.674	0.14	0.049	0.075	4	16
DST-MC2	05-Dec-12	Town of Truckee		0.05 U		0.051	0.046	0.4	0.497	0.017	0.038	0.044	2	15
DST-MC3	05-Dec-12	Town of Truckee		0.05 U		0.037	0.043	0.28	0.36	0.037	0.056	0.11	1	19
DST-MC4	05-Dec-12	Town of Truckee		0.05 U		0.071	0.051	0.22	0.342	0.021	0.038	0.04	3	12
DST-MC5	05-Dec-12	Town of Truckee		0.05 U		0.11	0.055	0.32	0.485	0.029	0.047	0.052	2	14
DST-MC6	05-Dec-12	Town of Truckee		0.05 U		0.01 U	0.05	0.32	0.37	0.01 U	0.024	0.029	1 U	5.3
DST-MC1	17-Dec-12	Town of Truckee		0.05 U		0.089	0.01 U	0.29	0.379	0.011	0.022	0.043	4	8.3
DST-MC2	17-Dec-12	Town of Truckee		0.051		0.01 U	0.01 U	0.2	0.2	0.012	0.018	0.041	1 U	4.2
DST-MC3	17-Dec-12	Town of Truckee		0.05 U		0.031	0.01 U	0.33	0.361	0.018	0.021	0.044	1	3.8

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC4	17-Dec-12	Town of Truckee		0.05 U		0.063	0.01 U	0.41	0.473	0.011	0.017	0.044	18	9.3
DST-MC5	17-Dec-12	Town of Truckee		0.05 U		0.06	0.01 U	0.26	0.32	0.019	0.03	0.041	4	5.6
DST-MC6	17-Dec-12	Town of Truckee		0.05 U		0.056	0.01 U	0.33	0.386	0.01	0.027	0.82	1 U	4.2
DST-MC1	13-Mar-13	Town of Truckee		0.05 U		0.01 U	0.01 U	0.21	0.21	0.01	0.021	0.03	2	3.4
DST-MC2	13-Mar-13	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 U	0.1 U	0.024	0.015	0.023	2	3.3
DST-MC3	13-Mar-13	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 U	0.1 U	0.017	0.016	0.029	1 U	3
DST-MC4	13-Mar-13	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 U	0.1 U	0.01 U	0.01	0.02	5	3.8
DST-MC5	13-Mar-13	Town of Truckee		0.05 U		0.01 U	0.01 U	0.16	0.16	0.01 U	0.014	0.028	4	5.3
DST-MC6	13-Mar-13	Town of Truckee		0.05 U		0.01 U	0.01 U	0.21	0.21	0.016	0.04	0.05	1	1.9
DST-MC1	20-Mar-13	Town of Truckee		0.05 U		0.01 U	0.025 U	0.2 U	0.2	0.01 U	0.02	0.022	2	5.7
DST-MC2	20-Mar-13	Town of Truckee		0.05 U		0.01 U	0.025 U	0.2 U	0.2 U	0.01 U	0.023	0.032	1	8.3
DST-MC3	20-Mar-13	Town of Truckee		0.05 U		0.01 U	0.025 U	0.2 U	0.2 U	0.01 U	0.026	0.035	1	5
DST-MC4	20-Mar-13	Town of Truckee		0.05 U		0.04	0.025 U	0.2 U	0.04	0.01 U	0.029	0.037	3	3.8
DST-MC5	20-Mar-13	Town of Truckee		0.05 U		0.01 U	0.025 U	0.2 U	0.2 U	0.01 U	0.023	0.025	4	5.3
DST-MC6	20-Mar-13	Town of Truckee		0.05 U		0.01 U	0.025 U	0.31	0.31	0.01 U	0.016	0.017	1 U	3.1
TURB-MS3	20-Mar-13	Town of Truckee											2	
TURB-TT1	20-Mar-13	Town of Truckee											5	
DST-MC1	31-Mar-13	Town of Truckee		0.05 U		0.013	0.01 U	0.22	0.233	0.01 U	0.024	0.15	3	5
DST-MC2	31-Mar-13	Town of Truckee		0.05 U		0.013	0.01 U	0.2	0.213	0.011	0.022	0.037	4	8.3
DST-MC3	31-Mar-13	Town of Truckee		0.05 U		0.012 J	0.01 UJ	0.2 U	0.2 U	0.011	0.024	0.035	1 U	6.4
DST-MC4	31-Mar-13	Town of Truckee		0.05 U		0.084 J	0.01 J	0.22	0.314	0.01 U	0.016	0.024	6	5.3
DST-MC5	31-Mar-13	Town of Truckee		0.05 U		0.018 J	0.011 J	0.2	0.229	0.01 U	0.023	0.027	3	3.5
DST-MC6	31-Mar-13	Town of Truckee		0.05 U		0.017 J	0.01 UJ	0.38	0.397	0.01 U	0.023	0.02	1 U	2.2
TURB-MS3	24-Apr-13	Town of Truckee											1 J	
TURB-TT1	24-Apr-13	Town of Truckee											1 J	
DST-MC1	26-Apr-13	Town of Truckee		0.05 U		0.02 U	0.02 U	0.2 U	0.2 U	0.01	0.028	0.036	2	2.5
DST-MC2	26-Apr-13	Town of Truckee		0.05 U		0.02 U	0.02 U	0.2 U	0.2 U	0.02	0.031	0.032	3	3.8
DST-MC3	26-Apr-13	Town of Truckee		0.05 U		0.02 U	0.02 U	0.2 U	0.2 U	0.02	0.032	0.033	1	2.6
DST-MC4	26-Apr-13	Town of Truckee		0.05 U		0.035	0.02 U	0.2 U	0.035	0.014	0.024	0.028	3	1.5
DST-MC5	26-Apr-13	Town of Truckee		0.05 U		0.02 U	0.02 U	0.2 U	0.2 U	0.017	0.024	0.033	2	2.1

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC6	26-Apr-13	Town of Truckee		0.05 U		0.02 U	0.02 U	0.5	0.5	0.015	0.021	0.029	6	4.1
TURB-MS3	29-Apr-13	Town of Truckee											15 J	
TURB-TT1	29-Apr-13	Town of Truckee											6 J	
TURB-TT1	29-Apr-13	Town of Truckee											3 J	
DST-MC1	07-May-13	Town of Truckee		0.05 U	0.1 U			0.25	0.25	0.014	0.1 U	0.04	3	4.7
DST-MC2	07-May-13	Town of Truckee		0.05 U	0.1 U			0.26	0.26	0.018	0.03	0.037	7	7.6
DST-MC3	07-May-13	Town of Truckee		0.05 U	0.1 U			0.3	0.3	0.023	0.037	0.046	1 U	4.2
DST-MC4	07-May-13	Town of Truckee		0.05 U	0.1 U			0.29	0.29	0.014	0.031	0.043	8	7.8
DST-MC5	07-May-13	Town of Truckee		0.05 U	0.1 U			0.18 J	0.18	0.015	0.026	0.031	1	2.7
DST-MC6	07-May-13	Town of Truckee		0.05 U	0.1 U			0.44	0.44	0.01 U	0.021	0.029	1	2.1
TURB-MS3	13-May-13	Town of Truckee											10 J	
TURB-TT1	13-May-13	Town of Truckee											4 J	
TURB-TT1	13-May-13	Town of Truckee											3 J	
TURB-MS3	25-Jun-13	Town of Truckee											10	
TURB-TT1	25-Jun-13	Town of Truckee											6	
TURB-MS3	04-Jul-13	Town of Truckee											11	
TURB-TT1	04-Jul-13	Town of Truckee											120	
Water Year 2014														
TURB-MS3	29-Jan-14	Town of Truckee											2	
TURB-MS3	29-Jan-14	Town of Truckee											7	
TURB-TT1	29-Jan-14	Town of Truckee											3	
DST-MC1	30-Jan-14	Town of Truckee		0.05 U		0.087	0.01 U	0.4	0.49	0.051	0.068	0.22	3	4.4
DST-MC2	30-Jan-14	Town of Truckee		0.1 U		0.012	0.01 U	0.22	0.23	0.025	0.03	0.15	3	3.6
DST-MC3	30-Jan-14	Town of Truckee		0.05 U		0.12	0.01 U	0.41	0.53	0.07	0.08	0.22	1	4.9
DST-MC4	30-Jan-14	Town of Truckee		0.05 U		0.62	0.01 U	0.29	0.91	0.027	0.03	0.2	24	10
DST-MC5	30-Jan-14	Town of Truckee		0.05 U		0.037	0.01 U	0.35	0.39	0.04	0.05	0.18	4	5
TURB-MS3	30-Jan-14	Town of Truckee											11	
TURB-TT1	30-Jan-14	Town of Truckee											30	
TURB-MS3	08-Feb-14	Town of Truckee											100	
TURB-TT1	08-Feb-14	Town of Truckee											34	

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC1	09-Feb-14	Town of Truckee		0.05 U		0.25	0.011	0.73	0.99	0.059	0.088	0.13	25	19
DST-MC2	09-Feb-14	Town of Truckee		0.05 U		0.21	0.01 U	0.59	0.79	0.044	0.068	0.13	24	14
DST-MC3	09-Feb-14	Town of Truckee		0.05 U		0.26	0.011	0.55	0.82	0.081	0.11	0.16	5	13
DST-MC4	09-Feb-14	Town of Truckee		0.05 U		0.39	0.012	0.57	0.97	0.042	0.064	0.13	24	17
DST-MC5	09-Feb-14	Town of Truckee		0.05 U		0.22	0.01	0.54	0.77	0.061	0.15	0.14	16	15
DST-MC6	09-Feb-14	Town of Truckee		0.05 U		0.16	0.01 U	0.33	0.49	0.068	0.076	0.12	6	11
TURB-MS3	09-Feb-14	Town of Truckee											100	
TURB-MS3	09-Feb-14	Town of Truckee											48	
TURB-TT1	09-Feb-14	Town of Truckee											100	
TURB-TT1	09-Feb-14	Town of Truckee											98	
TURB-MS3	10-Feb-14	Town of Truckee											16	
TURB-TT1	10-Feb-14	Town of Truckee											17	
DST-MC1	27-Feb-14	Town of Truckee		0.05 U		0.017	0.01 U	0.21	0.22	0.011	0.032	0.047	2	4.3
DST-MC2	27-Feb-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.2 U	0.22 U	0.18	0.022	0.028	1 U	4.6
DST-MC3	27-Feb-14	Town of Truckee		0.05 U		0.018	0.01 U	0.25	0.27	0.042	0.03	0.033	1 U	2.4
DST-MC4	27-Feb-14	Town of Truckee		0.05 U		0.23	0.01 U	0.2 U	0.23	0.023	0.024	0.031	2	4.2
DST-MC5	27-Feb-14	Town of Truckee		0.05 U		0.059	0.01 U	0.22	0.28	0.14	0.027	0.038	1 U	4.7
DST-MC6	27-Feb-14	Town of Truckee		0.05 U		0.16	0.01 U	0.66	0.82	0.1	0.027	0.029	1 U	1.6
TURB-MS3	06-Mar-14	Town of Truckee											19 J	
TURB-TT1	06-Mar-14	Town of Truckee											24 J	
DST-MC1	29-Mar-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.2 U	0.22 U	0.01 U	0.022	0.031	4	3
DST-MC2	29-Mar-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.2 U	0.22 U	0.01	0.023	0.032	5	3.3
DST-MC3	29-Mar-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.2 U	0.22 U	0.01 U	0.022	0.024	1 U	0.59
DST-MC4	29-Mar-14	Town of Truckee		0.05 U		0.066	0.01 U	0.2 U	0.22 U	0.01 U	0.016	0.043	11	5.9
DST-MC5	29-Mar-14	Town of Truckee		0.05 U		0.011	0.01 U	0.2 U	0.22 U	0.01 U	0.024	0.03	3	3.5
DST-MC6	29-Mar-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.52	0.52	0.01 U	0.016	0.02	1	1.7
TURB-MS3	29-Mar-14	Town of Truckee											3 J	
DST-MC1	08-Apr-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 U	0.12 U	0.01 U	0.02	0.033	4	2.2
DST-MC2	08-Apr-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 U	0.12 U	0.011	0.024	0.031	4	3.7
DST-MC3	08-Apr-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 U	0.12 U	0.015	0.02	0.022	1 U	0.43

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC4	08-Apr-14	Town of Truckee		0.05 U		0.065	0.01 U	0.1 U	0.12 U	0.01 U	0.018	0.028	6	2.7
DST-MC5	08-Apr-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 U	0.12 U	0.01 U	0.024	0.03	2	2.1
TURB-MS3	16-Apr-14	Town of Truckee											36 J	
TURB-TT1	16-Apr-14	Town of Truckee											2 J	
DST-MC1	20-May-14	Town of Truckee		0.05 U		0.016	0.014	0.2	0.23	0.017	0.034	0.049	18	4.1
DST-MC2	20-May-14	Town of Truckee		0.05 U		0.017	0.019	0.14	0.18	0.019	0.041	0.044	6	3.6
DST-MC3	20-May-14	Town of Truckee		0.05 U		0.016	0.01 U	0.17	0.18	0.012	0.024	0.045	2	0.82
DST-MC4	20-May-14	Town of Truckee		0.05 U		0.016	0.01 U	0.23	0.25	0.01	0.022	0.05	19	7.7
DST-MC5	20-May-14	Town of Truckee	Duplicate	0.05 U		0.018	0.018	0.2	0.23	0.035 J	0.052	0.06	7	6.1 J
DST-MC5	20-May-14	Town of Truckee		0.05 U		0.017	0.018	0.21	0.25	0.014 J	0.048	0.062	6	3.6 J
DST-MC5	20-May-14	Town of Truckee	Triplicate	0.05 U		0.016	0.023	0.14	0.18	0.018 J	0.052	0.058	6	3.3 J
TURB-MS3	17-Jul-14	Town of Truckee											240	
DST-MC1	21-Jul-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.48	0.48	0.013	0.042	0.058	3	2.8
DST-MC2	21-Jul-14	Town of Truckee		0.05 U		0.011	0.01 U	0.11	0.13	0.015	0.033	0.032	4	2.2
DST-MC4	21-Jul-14	Town of Truckee		0.05 U		0.14	0.01 U	0.23	0.36	0.016	0.04	0.068	17	7.7
DST-MC5	21-Jul-14	Town of Truckee		0.05 U		0.011	0.01 U	0.24	0.26	0.015	0.049	0.058	3	2.6
DST-MC1	04-Aug-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.37	0.37	0.014	0.035	0.096	9	4.3
DST-MC2	04-Aug-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.24	0.24	0.036	0.035	0.096	11	4.4
DST-MC4	04-Aug-14	Town of Truckee		0.05 U		0.072	0.01 U	0.5	0.57	0.025	0.042	0.092	17	8.6
DST-MC5	04-Aug-14	Town of Truckee		0.05 U		0.01 U	0.01 U	0.61	0.61	0.023	0.036	0.089	16	8.4
TURB-TT1	08-Aug-14	Town of Truckee											6	
TURB-TT1	08-Aug-14	Town of Truckee											52	
Water Year 2015														
TURB-MS3	07-Oct-14	Town of Truckee											1	
TURB-TT1	07-Oct-14	Town of Truckee											2	
DST-MC1	03-Dec-14	Town of Truckee		0.05 U		0.063	0.023	0.46	0.54	0.036	0.061	0.1	9	12
DST-MC2	03-Dec-14	Town of Truckee		0.05 U		0.052	0.021	0.56	0.64	0.032	0.065	0.098	18	19
DST-MC4	03-Dec-14	Town of Truckee		0.05 U		0.51	0.022	1.1	1.6	0.043	0.077	0.16	120	59
DST-MC5	03-Dec-14	Town of Truckee		0.05 U		0.027	0.019	2.8	2.8	0.024	0.052	0.088	14	11
TURB-MS3	08-Jan-15	Town of Truckee											1 U	

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
TURB-TT1	08-Jan-15	Town of Truckee											2	
DST-MC1	07-Feb-15	Town of Truckee		0.05 U		0.71	0.01 U	0.78	1.5	0.048	0.12	0.11	11	31
DST-MC2	07-Feb-15	Town of Truckee		0.05 U		0.66	0.01 U	0.62	1.3	0.025	0.073	0.098	10	17
DST-MC3	07-Feb-15	Town of Truckee		0.05 U		0.69	0.01 U	0.73	1.4	0.064	0.1	0.14	4	17
DST-MC4	07-Feb-15	Town of Truckee		0.05 U		0.64	0.01 U	0.51	1.2	0.025	0.078	0.094	21	23
DST-MC5	07-Feb-15	Town of Truckee		0.063		0.62	0.01 U	0.78	1.4	0.046	0.093	0.18	20	40
DST-MC6	07-Feb-15	Town of Truckee		0.13		4.1	0.015	1.1	5.3	0.03	0.095	0.22	2	120
TURB-MS3	07-Feb-15	Town of Truckee											16	
TURB-TT1	07-Feb-15	Town of Truckee											56	
DST-MC1	08-Feb-15	Town of Truckee		0.05 U		0.64	0.023	0.73	1.4	0.035	0.092	0.16	13	31
DST-MC2	08-Feb-15	Town of Truckee		0.05 U		0.33	0.021	0.77	1.1	0.035	0.076	0.16	41	30
DST-MC3	08-Feb-15	Town of Truckee		0.05 U		0.39	0.04	0.71	1.1	0.053	0.1	0.13	5	16
DST-MC4	08-Feb-15	Town of Truckee		0.05 U		0.3	0.015	0.53	0.84	0.035	0.08	0.13	16	20
DST-MC5	08-Feb-15	Town of Truckee		0.05 U		0.64	0.019	0.75	1.4	0.041	0.097	0.2	21	27
DST-MC6	08-Feb-15	Town of Truckee		0.05 U		2.4	0.04	1.2	3.6	0.031	0.096	0.23	7	77
TURB-MS3	08-Feb-15	Town of Truckee											260 J	
TURB-TT1	08-Feb-15	Town of Truckee											100	
TURB-MS3	09-Feb-15	Town of Truckee											13	
TURB-TT1	09-Feb-15	Town of Truckee											31	
DST-MC1	06-Mar-15	Town of Truckee		0.05 U		0.011	0.01 U	0.1 U	0.22 U	0.012	0.05	0.045	4	2.6
DST-MC2	06-Mar-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 U	0.22 U	0.014	0.041	0.072	1	1.6
DST-MC3	06-Mar-15	Town of Truckee		0.05 U		0.012	0.01 U	0.2 J	0.22 U	0.014	0.059	0.055	1 U	1.3
DST-MC4	06-Mar-15	Town of Truckee		0.05 U		0.032	0.01 U	0.1 U	0.22 U	0.011	0.05	0.057	2	2
DST-MC5	06-Mar-15	Town of Truckee		0.05 U		0.02	0.01 U	0.1 U	0.22 U	0.013	0.053	0.04	1	2.7
DST-MC6	06-Mar-15	Town of Truckee		0.05 U		0.061	0.01 U	0.46	0.52	0.01 U	0.044	0.036	2	2.8
TURB-MC4	06-Mar-15	Town of Truckee											1 U	
DST-MC1	21-Apr-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.01 U	0.026	0.034	2	2.2
DST-MC2	21-Apr-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.08 J	0.1 U	0.01 U	0.037	0.046	6	4.2
DST-MC3	21-Apr-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.01 U	0.027	0.036	3	2.2
DST-MC4	21-Apr-15	Town of Truckee		0.05 U		0.046	0.01 U	0.25	0.3	0.01 U	0.029	0.1	220	91

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC5	21-Apr-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.01 U	0.037	0.043	2	2.9
TURB-MC4	21-Apr-15	Town of Truckee											3	
DST-MC1	24-Apr-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.1 J	0.1	0.01 U	0.03	0.041	5	5.8
DST-MC2	24-Apr-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.01 U	0.041	0.045	6	4.9
DST-MC3	24-Apr-15	Town of Truckee		0.05 U		0.02 U	0.02 U	0.16 J	0.16	0.01 U	0.031	0.029	1 U	1.3
DST-MC4	24-Apr-15	Town of Truckee		0.05 U		0.12	0.01 U	0.24	0.36	0.01 U	0.029	0.044	19	15
DST-MC5	24-Apr-15	Town of Truckee		0.05 U		0.023	0.01 U	0.12 J	0.15	0.01 U	0.034	0.045	6	5.1
DST-MC6	24-Apr-15	Town of Truckee		0.05 U		0.011	0.01 U	0.77	0.78	0.01 U	0.024	0.031	1 U	4.8
TURB-MC4	24-Apr-15	Town of Truckee											9	
TURB-MS3	24-Apr-15	Town of Truckee											5 J	
TURB-TT1	24-Apr-15	Town of Truckee											5 J	
DST-MC1	10-Jun-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.25	0.25	0.018	0.023	0.044	1	3
DST-MC2	10-Jun-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.31	0.31	0.025	0.026	0.036	4	4.1
DST-MC3	10-Jun-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.62	0.62	0.01 U	0.038	0.083	1 U	1.6
DST-MC4	10-Jun-15	Town of Truckee		0.05 U		0.21	0.01 U	0.62	0.82	0.01 U	0.014	0.061	30	18
DST-MC5	10-Jun-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.37	0.37	0.01 U	0.022	0.04	7	4.5
TURB-MC4	10-Jun-15	Town of Truckee		0.05 U		0.01 U	0.01 U	0.46	0.46	0.01 U	0.02	0.038	19	12
Water Year 2016														
DST-MC1	02-Nov-15	Placer		0.05 U		0.01 U	0.01 U	0.32	0.32	0.02	0.031	0.053	4	4
DST-MC2	02-Nov-15	Placer		0.05 U		0.01 U	0.01 U	0.3	0.3	0.019	0.025	0.047	4	4
DST-MC4	02-Nov-15	Placer		0.05 U		0.23	0.01 U	0.68	0.91	0.016	0.029	0.052	7	8.2
DST-MC5	02-Nov-15	Placer		0.05 U		0.01 U	0.01 U	0.37	0.37	0.016	0.035	0.053	4	3.6
TURB-MC4	02-Nov-15	Placer											7 J	
TURB-MC4	02-Nov-15	Placer											1	
DST-MC1	21-Dec-15	Placer		0.05 U		0.017	0.01 U	0.18 J	0.22 U	0.029	0.025	0.069	6	5.4
DST-MC2	21-Dec-15	Placer		0.05 U		0.01 U	0.01 U	0.15 J	0.15	0.031	0.025	0.046	7	5.5
DST-MC3	21-Dec-15	Placer		0.05 U		0.24	0.01 U	0.56	0.8	0.037	0.048	0.097	43	34
DST-MC4	21-Dec-15	Placer		0.05 U		0.48	0.01 U	0.37	0.85	0.03	0.049	0.054	1	2.1
DST-MC5	21-Dec-15	Placer		0.05 U		0.059	0.01 U	0.29	0.35	0.016	0.042	0.054	11	9.2
TURB-MC4	21-Dec-15	Placer											34 J	

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
TURB-MC4	21-Dec-15	Placer											36 J	
TURB-MC4	22-Dec-15	Placer											10 J	
DST-MC1	29-Jan-16	Placer		0.05 U		0.64	0.01 U	0.54	1.2	0.01 U	0.063	0.071	10	14
DST-MC2	29-Jan-16	Placer		0.05 U		0.012	0.01 U	0.16 J	0.17	0.01 U	0.05	0.057	9	8.6
DST-MC3	29-Jan-16	Placer		0.05 U		0.15	0.01 U	0.32	0.47	0.01 U	0.045	0.072	4	7.1
DST-MC4	29-Jan-16	Placer		0.05 U		0.082	0.01 U	0.33	0.42	0.01 U	0.042	0.054	72	28
DST-MC5	29-Jan-16	Placer		0.05 U		0.31	0.01 U	0.46	0.78	0.01 U	0.048	0.076	29	18
DST-MC6	29-Jan-16	Placer		0.05 U		1.7	0.01 U	0.59	2.3	0.01 U	0.046	0.068	3	7.5
TURB-MC4	29-Jan-16	Placer											21	
TURB-MC4	29-Jan-16	Placer											22	
TURB-MS3	29-Jan-16	Town of Truckee											160	
TURB-TT1	29-Jan-16	Town of Truckee											60	
TURB-MS3	30-Jan-16	Town of Truckee											16	
TURB-TT1	30-Jan-16	Town of Truckee											52	
DSC-MC6	24-Feb-16	Placer		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.014	0.01 U	0.022	3	0.97
DSC-MC7	24-Feb-16	Placer		0.05 U		0.01 U	0.01 U	0.11 J	0.11	0.027	0.028	0.048	1 U	4
DST-MC1	24-Feb-16	Placer		0.05 U		0.01 U	0.01 U	0.17 J	0.18	0.016	0.02	0.04	1	5.6
DST-MC2	24-Feb-16	Placer		0.05 U		0.01 U	0.01 U	0.11 J	0.12	0.017	0.017	0.044	2	5.8
DST-MC3	24-Feb-16	Placer		0.05 U		0.01 U	0.01 U	0.21	0.21	0.023	0.024	0.058	3	3.9
DST-MC4	24-Feb-16	Placer		0.05 U		0.088	0.01 U	0.1 J	0.19	0.016	0.012	0.026	2	3.4
DST-MC5	24-Feb-16	Placer		0.05 U		0.022	0.01 U	0.18 J	0.2	0.017	0.029	0.041	2	3.5
DST-MC6	24-Feb-16	Placer		0.05 U		0.011	0.01 U	0.34	0.35	0.01 U	0.01 U	0.038	4	4.4
DST-MC1	05-Mar-16	Placer		0.05 U		0.01 U	0.01 U	0.27	0.27	0.013	0.018	0.032	1 U	4
DST-MC2	05-Mar-16	Placer		0.05 U		0.061	0.01 U	0.18 J	0.25	0.026	0.026	0.044	6	7.2
DST-MC3	05-Mar-16	Placer		0.05 U		0.19	0.01 U	0.11 J	0.3	0.021	0.017	0.036	11	9.1
DST-MC4	05-Mar-16	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.16	0.026	0.033	0.033	2	7.6
DST-MC5	05-Mar-16	Placer		0.05 U		0.048	0.01 U	0.21	0.26	0.028	0.036	0.038	10	15
DST-MC6	05-Mar-16	Placer		0.05 U		0.024	0.01 U	0.21	0.23	0.021	0.028	0.056	3	7.3
TURB-MC4	05-Mar-16	Placer											5 J	
TURB-MS3	06-Mar-16	Town of Truckee											6 J	

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
TURB-TT1	06-Mar-16	Town of Truckee											18 J	
TURB-MS3	21-Mar-16	Town of Truckee											6 J	
TURB-TT1	21-Mar-16	Town of Truckee											15 J	
DST-MC1	07-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.15 J	0.16	0.011	0.029	0.031	2	5.3
DST-MC2	07-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.17 J	0.17	0.015	0.026	0.031	3	7.4
DST-MC3	07-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.17	0.017	0.04	0.04	1	6.8
DST-MC4	07-Apr-16	Placer		0.05 U		0.038	0.01 U	0.15 J	0.19	0.01 U	0.018	0.027	6	3.3
DST-MC5	07-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.15 J	0.15	0.011	0.023	0.034	2	2.6
DST-MC6	07-Apr-16	Placer		0.05 U		0.016	0.01 U	0.4	0.42	0.01 U	0.026	0.037	2 J	2.3
DST-MC6	07-Apr-16	Placer	Duplicate	0.05 U		0.013	0.01 U	0.4	0.41	0.01	0.027	0.03	1 J	2.3
DST-MC6	07-Apr-16	Placer	Triplicate	0.05 U		0.013	0.01 U	0.4	0.41	0.012	0.027	0.03	1 J	2.3
TURB-MC4	07-Apr-16	Placer											5 J	
TURB-MC4	10-Apr-16	Placer											9 J	
TURB-MS3	10-Apr-16	Town of Truckee											9 J	
TURB-TT1	10-Apr-16	Town of Truckee											12 J	
DSC-MC7	22-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.21 J	0.21	0.03	0.064	0.074	13	13
DST-MC1	22-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.17 J	0.17	0.01 U	0.02	0.044	3	3.3
DST-MC2	22-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.15 J	0.15	0.01	0.021	0.048	2	5.4
DST-MC3	22-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.21 J	0.21	0.018	0.033	0.052	3	6.4
DST-MC4	22-Apr-16	Placer		0.05 U		0.075	0.01 U	0.16 J	0.24	0.01 U	0.015	0.031	19	9.7
DST-MC5	22-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.14 J	0.15	0.01 U	0.021	0.044	2	2.1
DST-MC6	22-Apr-16	Placer		0.05 U		0.01 U	0.01 U	0.36 J	0.36	0.01 U	0.043	0.05	2	2.6
DSC-MC7	05-May-16	Placer		0.05 U		0.01 U	0.01 U	0.29	0.29	0.05	0.076	0.19 J	8	14
DSC-MC7	05-May-16	Placer	Duplicate	0.05 U		0.01 U	0.01 U	0.33	0.33	0.046	0.061	0.089 J	8	12
DSC-MC7	05-May-16	Placer	Duplicate	0.05 U		0.01 U	0.01 U	0.32	0.33	0.048	0.067	0.12 J	9	11
TURB-MC4	11-May-16	Placer											120 J	
TURB-MS3	11-May-16	Town of Truckee											4 J	
TURB-TT1	11-May-16	Town of Truckee											6 J	
TURB-MS3	13-May-16	Town of Truckee											11	
TURB-TT1	13-May-16	Town of Truckee											14	

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
TURB-MC4	03-Jun-16	Placer											3	
TURB-MS3	03-Jun-16	Town of Truckee											5	
TURB-TT1	03-Jun-16	Town of Truckee											4	
Water Year 2017														
DST-MC1	16-Oct-16	Placer		0.05 U		0.01 U	0.01 U	0.22	0.22	0.03	0.06	0.07	12.00	7.00
DST-MC2	16-Oct-16	Placer		0.05 U		0.01 U	0.01 U	0.20 J	0.20	0.02	0.06	0.07	14.00	6.10
DST-MC4	16-Oct-16	Placer		0.05 U		0.18 U	0.01	0.39	0.57	0.01	0.06	0.07	11.00	7.50
DST-MC5	16-Oct-16	Placer		0.05 U		0.01 U	0.01 U	0.24	0.25	0.03	0.08	0.07	3.00	4.70
TURB-MC4	16-Oct-16	Placer											9.00	
DST-MC1	28-Oct-16	Placer		0.05 U		0.01 U	0.01 U	0.11 J	0.12	0.02	0.04	0.02	3.00	3.90
DST-MC2	28-Oct-16	Placer		0.05 U		0.01 U	0.01 U	0.20	0.22 U	0.02	0.03	0.06	17.00	10.00
DST-MC4	28-Oct-16	Placer		0.05 U		0.04	0.01 U	0.28	0.32	0.01	0.02	0.05	14.00	11.00
DST-MC5	28-Oct-16	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.16	0.02	0.03	0.06	6.00	6.50
DST-MC1	10-Dec-16	Placer		0.05 U		0.45	0.01 U	1.50	2.00	0.03	0.05	0.13 J	220.00	80.00
DST-MC2	10-Dec-16	Placer		0.05 U		0.57	0.01 U	1.30	1.90	0.03	0.03	0.05 J	95.00	67.00
DST-MC3	10-Dec-16	Placer		0.05 U		0.38	0.01 U	0.56	0.95	0.06	0.05	0.05 J	6.00	29.00
DST-MC4	10-Dec-16	Placer		0.05 U		0.49	0.01 U	0.65	1.10	0.04	0.04	0.04 J	37.00	43.00
DST-MC5	10-Dec-16	Placer		0.05 U		0.38	0.01 U	0.71	1.10	0.04	0.03	0.08 J	33.00	32.00
DST-MC6	10-Dec-16	Placer		0.05 U		0.08	0.01 U	0.36	0.44	0.02	0.02	0.01 UJ	4.00	18.00
TURB-MC4	10-Dec-16	Placer											120.00 J	
TURB-MC4	10-Dec-16	Placer											43.00 J	
TURB-MC4	10-Dec-16	Placer											89.00 J	
DST-MC1	16-Dec-16	Placer		0.05 U		0.08	0.01 U	0.28	0.36	0.03	0.05	0.06	2.00	16.00
DST-MC2	16-Dec-16	Placer		0.05 U		0.06	0.01 U	0.28	0.34	0.02	0.04	0.05	4.00	19.00
DST-MC3	16-Dec-16	Placer	Original	0.05 U		0.05	0.01 U	0.27	0.31	0.03	0.05	0.06	2.00 J	16.00
DST-MC3	16-Dec-16	Placer	Duplicate	0.05 U		0.04	0.01 U	0.25	0.30	0.03	0.06	0.06	3.00 J	16.00
DST-MC3	16-Dec-16	Placer	Triplicate	0.05 U		0.04	0.01 U	0.26	0.31	0.04	0.06	0.07	1.00 J	16.00
DST-MC4	16-Dec-16	Placer		0.05 U		0.08	0.01 U	0.20 J	0.28	0.02	0.04	0.06	5.00	13.00
DST-MC5	16-Dec-16	Placer		0.05 U		0.07	0.01 U	0.26	0.34	0.03	0.05	0.06	3.00	11.00
DST-MC6	16-Dec-16	Placer		0.05 U		0.02	0.01 U	0.19 J	0.21	0.01 U	0.03	0.04	1.00 U	10.00

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
TURB-MC4	16-Dec-16	Placer											10.00	
TURB-MC4	16-Dec-16	Placer											6.00	
DST-MC1	09-Jan-17	Placer		0.09		0.01	0.01 U	0.44	0.45	0.03	0.05	0.07	23.00	31.00
DST-MC2	09-Jan-17	Placer		0.08		0.01	0.01 U	0.44	0.45	0.04	0.06	0.07	21.00	26.00
DST-MC3	09-Jan-17	Placer		0.05 U		0.02	0.01 U	0.22	0.24	0.03	0.04	0.05	5.00	22.00
DST-MC4	09-Jan-17	Placer		0.05 U		0.03	0.01 U	0.35	0.38	0.02	0.04	0.05	11.00	18.00
DST-MC5	09-Jan-17	Placer		0.05 U		0.02	0.01 U	0.30	0.32	0.02	0.04	0.06	6.00	13.00
DST-MC6	09-Jan-17	Placer		0.05 U		0.35	0.01 U	0.48	0.83	0.02	0.04	0.04	2.00	5.10
TURB-MC4	07-Feb-17	Placer											40.00 J	
DST-MC1	09-Feb-17	Placer		0.05 U		0.02	0.01 U	0.21	0.23	0.03	0.02	0.05	5.00	12.00
DST-MC2	09-Feb-17	Placer		0.05 U		0.02	0.01 U	0.18 J	0.19	0.02	0.02	0.03	3.00	10.00
DST-MC3	09-Feb-17	Placer		0.05 U		0.02	0.01 U	0.19 J	0.21	0.02	0.02	0.05	1.00	8.90
DST-MC4	09-Feb-17	Placer		0.05 U		0.05	0.01 U	0.17 J	0.22	0.02	0.02	0.03	4.00	9.30
DST-MC5	09-Feb-17	Placer		0.05 U		0.04	0.01 U	0.15 J	0.19	0.02	0.02	0.03	2.00	5.90
DST-MC6	09-Feb-17	Placer		0.05 U		0.38	0.01 U	0.19 J	0.57	0.02	0.02	0.03	3.00	7.50
DST-MC1	20-Mar-17	Placer		0.05 U		0.01 U	0.01 U	0.13 J	0.13	0.01	0.04	0.03	2.00	5.90
DST-MC2	20-Mar-17	Placer		0.05 U		0.01 U	0.01 U	0.10 J	0.10	0.01	0.03	0.03	2.00	7.90
DST-MC3	20-Mar-17	Placer		0.05 U		0.01 U	0.01 U	0.13 J	0.13	0.02	0.05	0.04	2.00	7.20
DST-MC4	20-Mar-17	Placer		0.05 U		0.01 U	0.01 U	0.08 J	0.10 U	0.01 U	0.03	0.03	5.00	6.20
DST-MC5	20-Mar-17	Placer		0.05 U		0.01 U	0.01 U	0.08 J	0.10 U	0.01	0.03	0.03	2.00	2.80
DST-MC6	20-Mar-17	Placer		0.05 U		0.01 U	0.01 U	0.46	0.46	0.01 U	0.02	0.04	4.00	4.40
TURB-MC4	02-May-17	Placer											26.00 J	
DST-MC1	25-May-17	Placer		0.05 U		0.01 U	0.01 U	0.10 J	0.10	0.01	0.02	0.03	3.00	5.20
DST-MC2	25-May-17	Placer		0.05 U		0.01 U	0.01 U	0.11 J	0.11	0.01 U	0.01	0.02	3.00	5.90
DST-MC3	25-May-17	Placer		0.05 U		0.03	0.01 U	0.08 J	0.10	0.01 U	0.01	0.02	5.00	3.80
DST-MC4	25-May-17	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.16	0.01 U	0.02	0.04	3.00	10.00
DST-MC5	25-May-17	Placer		0.05 U		0.01 U	0.01 U	0.12 J	0.12	0.01 U	0.01	0.03	2.00	2.90
DST-MC6	25-May-17	Placer		0.05 U		0.01 U	0.01 U	0.28	0.28	0.01 U	0.03	0.04	1.00	2.10
TURB-MC4	26-May-17	Placer											12.00 J	
TURB-MC4	02-Jun-17	Placer											9.00	

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
TURB-MC4	21-Jun-17	Placer											10.00	
Water Year 2018														
TURB-MC4	08-Jan-18	Placer											8 J	
DST-MC1	08-Mar-18	Placer		0.05 UJ		0.01 U	0.01 U	0.14 J	0.14	0.015	0.047	0.047	4	2
DST-MC2	08-Mar-18	Placer		0.05 UJ		0.01 U	0.01 U	0.09 J	0.1 U	0.016	0.045	0.05	2	1.8
DST-MC4	08-Mar-18	Placer		0.05 UJ		0.049	0.01 U	0.21	0.26	0.014	0.032	0.055	14	6.7
DST-MC5	08-Mar-18	Placer		0.05 UJ		0.016	0.01 U	0.17 J	0.19	0.023	0.045	0.062	4	2
DST-MC7	08-Mar-18	Placer		0.05 UJ		0.03	0.01 U	0.23	0.26	0.038	0.056	0.081	18	11
DST-MC1	13-Mar-18	Placer		0.05 U		0.037	0.01 U	0.42	0.45	0.01 U	0.036	0.097	35	29
DST-MC2	13-Mar-18	Placer		0.05 U		0.01 U	0.01 U	0.17 J	0.18	0.01 U	0.03	0.087	11	8.6
DST-MC4	13-Mar-18	Placer		0.05 U		0.094	0.01 U	0.24	0.34	0.01 U	0.045	0.079	56	39
DST-MC5	13-Mar-18	Placer		0.05 U		0.014	0.01 U	0.31	0.33	0.01 U	0.043	0.1	32	18
DST-MC7	13-Mar-18	Placer		0.05 U		0.027	0.01 U	0.18 J	0.21	0.01 U	0.034	0.092	20	29
DST-MC8	13-Mar-18	Placer		0.05 U		0.14	0.01 U	0.08 U	0.15	0.01 U	0.017	0.065	6	5
DST-MC9	13-Mar-18	Placer		0.05 U		0.15	0.01 U	0.11 J	0.26	0.01 U	0.032	0.054	7	6.8
TURB-MC4	13-Mar-18	Placer											86 J	
TURB-MC4	21-Mar-18	Placer											79	
DST-MC1	22-Mar-18	Placer		0.053 U		0.075	0.01 U	0.23	0.3	0.022	0.057	0.07	40	38
DST-MC2	22-Mar-18	Placer		0.052 U		0.13	0.01 U	0.21	0.34	0.022	0.038	0.043	19	22
DST-MC4	22-Mar-18	Placer		0.053 U		0.094	0.01 U	0.27	0.37	0.024	0.028	0.081	67	66
DST-MC5	22-Mar-18	Placer		0.054 U		0.063	0.01 U	0.23	0.3	0.02	0.027	0.056	31	33
DST-MC7	22-Mar-18	Placer		0.052 U		0.041	0.01 U	0.53	0.57	0.038	0.054	0.1	59	57
DST-MC8	22-Mar-18	Placer		0.052 U		0.17	0.01 U	0.15 J	0.32	0.014	0.022	0.036	24	25
DST-MC9	22-Mar-18	Placer		0.052 U		0.21	0.01 U	0.27	0.47	0.01	0.01 U	0.031	49	26
TURB-MC4	22-Mar-18	Placer											58	
DST-MC1	29-Mar-18	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.17	0.13	0.025	0.039	2	6.3
DST-MC2	29-Mar-18	Placer		0.05 U		0.01 U	0.01 U	0.13 J	0.14	0.012	0.035	0.042	1 U	9.7
DST-MC4	29-Mar-18	Placer		0.05 U		0.031	0.01 U	0.11 J	0.14	0.022	0.02	0.032	3	4.8
DST-MC5	29-Mar-18	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.17	0.013	0.034	0.027	1	4.3
DST-MC7	29-Mar-18	Placer		0.05 U		0.011	0.01 U	0.15 J	0.16	0.019	0.023	0.036	5	13

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC8	29-Mar-18	Placer		0.05 U		0.14	0.01 U	0.08 U	0.21	0.01 U	0.019	0.025	2	4
DST-MC9	29-Mar-18	Placer		0.05 U		0.073	0.01 U	0.12 J	0.19	0.01 U	0.015	0.019	2	2.7
TURB-MC4	06-Apr-18	Placer											94	
DST-MC1	07-Apr-18	Placer		0.05 U		0.021 J	0.01 J	0.23	0.26	0.019 J	0.01 U	0.036	15	19 J
DST-MC2	07-Apr-18	Placer		0.05 U		0.031 J	0.013 J	0.34	0.39	0.019 J	0.01 U	0.025	70	65
DST-MC4	07-Apr-18	Placer		0.05 U		0.056 J	0.01 J	0.21	0.28	0.02 J	0.016	0.019	62	57 J
DST-MC5	07-Apr-18	Placer		0.05 U		0.079 J	0.01 UJ	0.18 J	0.27	0.013	0.01 U	0.028	46	23
DST-MC7	07-Apr-18	Placer		0.05 U		0.041 J	0.011 J	0.26	0.31	0.032	0.024	0.02	120	87
DST-MC8	07-Apr-18	Placer		0.05 U		0.14 J	0.011 J	0.18 J	0.33	0.017	0.01 U	0.01 U	140	160
DST-MC9	07-Apr-18	Placer		0.05 U		0.025 J	0.011 J	0.21	0.24	0.023	0.029	0.036	12	150
TURB-MC4	07-Apr-18	Placer											210	
DST-MC1	09-May-18	Placer		0.05 U		0.01 U	0.01 U	0.1 J	0.1 U	0.01	0.033	0.21	3	2.7 J
DST-MC2	09-May-18	Placer		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.01 U	0.022	0.036	4	3.5 J
DST-MC4	09-May-18	Placer		0.05 U		0.018	0.01 U	0.08 U	0.1 U	0.01 U	0.01 U	0.035	13	7.4 J
DST-MC5	09-May-18	Placer		0.05 U		0.01 U	0.01 U	0.11 J	0.11	0.01	0.014	0.032	3	3 J
DST-MC7	09-May-18	Placer		0.05 U		0.01 U	0.01 U	0.14 J	0.14	0.01 U	0.025	0.033	4	7.5 J
DST-MC8	09-May-18	Placer		0.05 U		0.065	0.01 U	0.08 U	0.1 U	0.01 U	0.017	0.038	6	3.8 J
DST-MC9	09-May-18	Placer		0.05 U		0.012	0.01 U	0.08 U	0.1 U	0.01 U	0.01 U	0.022	5	2.2 J
DST-MC1	16-May-18	Placer		0.052 U		0.01 U	0.01 U	0.18 J	0.18	0.01 U	0.02	0.031	4	4.1
DST-MC2	16-May-18	Placer		0.052 U		0.01 U	0.01 U	0.17 J	0.17	0.01 U	0.013	0.035	10	7.8
DST-MC4	16-May-18	Placer		0.05 U		0.037	0.01 U	0.19 J	0.23	0.01 U	0.015	0.039	13	8.1
DST-MC5	16-May-18	Placer		0.051 U		0.01 U	0.01 U	0.18 J	0.18	0.011	0.023	0.059	4	4.4
DST-MC7	16-May-18	Placer		0.052 U		0.01 U	0.01 U	0.19 J	0.19	0.012	0.028	0.041	10	12
DST-MC8	16-May-18	Placer		0.05 U		0.098	0.01 U	0.14 J	0.24	0.025	0.018	0.031	9	6.8
DST-MC9	16-May-18	Placer		0.051 U		0.021	0.01 U	0.17 J	0.19	0.019	0.018	0.018	5	4.1
DST-MC1	25-May-18	Placer		0.051 U		0.012	0.01 U	0.32	0.34	0.023	0.048	0.043	12	17
DST-MC2	25-May-18	Placer		0.051 U		0.027	0.01 U	0.31	0.34	0.014	0.051	0.068	28	32
DST-MC4	25-May-18	Placer		0.052 U		0.11	0.01 U	0.21	0.31	0.01 U	0.039	0.06	18	17
DST-MC5	25-May-18	Placer		0.051 U		0.017	0.01 U	0.3	0.32	0.024	0.061	0.066	13	12
DST-MC7	25-May-18	Placer		0.051 U		0.024	0.01 U	0.26	0.29	0.016	0.032	0.03	20	32

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC8	25-May-18	Placer		0.051 U		0.12	0.01 U	0.1 J	0.22	0.01 U	0.037	0.037	6	7.5
DST-MC9	25-May-18	Placer		0.05 U		0.12	0.01 U	0.16 J	0.28	0.01 U	0.029	0.027	6	6
TURB-MC4	25-May-18	Placer											45	
Water Year 2019														
TURB-MC4	23-Nov-18	Placer											38.00	
DST-MC1	29-Nov-18	Placer		0.05 U		0.01 U	0.01 U	0.28	0.28	0.016	0.022	0.029	1 U	3.8
DST-MC2	29-Nov-18	Placer		0.05 U		0.01 U	0.01 U	0.13 J	0.13	0.01 U	0.01 U	0.019	2	2
DST-MC4	29-Nov-18	Placer		0.05 U		0.062	0.01 U	0.2	0.27	0.01 U	0.01 U	0.01 U	1 U	2.6
DST-MC5	29-Nov-18	Placer		0.05 U		0.01 U	0.01 U	0.22	0.22 U	0.011	0.032	0.022	1 U	3.4
DST-MC7	29-Nov-18	Placer		0.05 U		0.01 U	0.01 U	0.21	0.22 U	0.01 U	0.018	0.01 U	1 U	1.7
DST-MC8	29-Nov-18	Placer		0.05 U		0.19	0.01 U	0.15 J	0.34	0.01 U	0.019	0.02	7	12
DST-MC9	29-Nov-18	Placer		0.05 U		0.23	0.01 U	0.15 J	0.38	0.01 U	0.01 U	0.01 U	3	1.2
DST-MC1	17-Dec-18	Placer		0.051 U		0.01 U	0.01 U	0.26	0.26	0.01 U	0.01 U	0.01 U	1 U	1.9
DST-MC2	17-Dec-18	Placer		0.051 U		0.01 U	0.01 U	0.08 U	0.1 U	0.01 U	0.01 U	0.017	2	1.6
DST-MC4	17-Dec-18	Placer		0.051 U		0.033	0.01 U	0.11 J	0.15	0.01 U	0.01 U	0.01 U	1	1.5
DST-MC5	17-Dec-18	Placer		0.052 U		0.01 U	0.01 U	0.15 J	0.15	0.01 U	0.01 U	0.022	1	1.9
DST-MC7	17-Dec-18	Placer		0.051 U		0.01 U	0.01 U	0.1 J	0.1	0.01 U	0.01 U	0.01 U	1	1.6
DST-MC8	17-Dec-18	Placer		0.051 U		0.12	0.01 U	0.16 J	0.28	0.01 U	0.01 U	0.01 U	2	1.2
DST-MC9	17-Dec-18	Placer		0.052 U		0.1	0.01 U	0.15 J	0.25	0.01 U	0.011	0.01 U	2	2.9
DST-MC1	07-Jan-19	Placer		0.05 U		0.01 U	0.01 U	0.13 J	0.14	0.01	0.042	0.072	1 U	1.8
DST-MC2	07-Jan-19	Placer		0.05 U		0.012	0.01 U	0.1 J	0.11	0.01 U	0.017	0.017	2	2.2
DST-MC4	07-Jan-19	Placer		0.05 U		0.1	0.01 U	0.14 J	0.24	0.01 U	0.02	0.033	3	2.4
DST-MC5	07-Jan-19	Placer		0.05 U		0.033	0.01 U	0.2	0.24	0.012	0.019	0.03	3	2.5
DST-MC8	07-Jan-19	Placer		0.05 U		0.19	0.01 U	0.2 J	0.39	0.01 U	0.01 U	0.058	7	3.1
DST-MC9	07-Jan-19	Placer		0.05 U		0.14	0.01 U	0.2 J	0.33	0.01 U	0.01 U	0.01 U	6	5.2
DST-MC1	09-Jan-19	Placer		0.05 U		0.01 U	0.01 U	0.31	0.32	0.019	0.014	0.028	1	3.2
DST-MC2	09-Jan-19	Placer		0.05 U		0.01 U	0.01 U	0.16 J	0.17	0.01 U	0.02	0.011	3	3.2
DST-MC4	09-Jan-19	Placer		0.05 U		0.12	0.01 U	0.23	0.35	0.01 U	0.01 U	0.05	7	5.4
DST-MC5	09-Jan-19	Placer		0.05 U		0.02	0.01 U	0.22	0.24	0.012	0.023	0.044	4	3.5
DST-MC7	09-Jan-19	Placer		0.05 U		0.018	0.01 U	0.18 J	0.2	0.01 U	0.01 U	0.037	9	18

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC8	09-Jan-19	Placer		0.05 U		0.16	0.01 U	0.17 J	0.33	0.01 U	0.01 U	0.054	35	46
DST-MC9	09-Jan-19	Placer		0.05 U		0.21	0.01 U	0.25	0.47	0.01 U	0.01 U	0.031	1 U	7.5
TURB-MC4	17-Jan-19	Placer											8	
TURB-MC4	02-Feb-19	Placer											84 J	
DST-MC8	14-Feb-19	Placer		0.05 U		0.32	0.01 U	0.3	0.61	0.01 U	0.047	0.05	42	25
DST-MC9	14-Feb-19	Placer		0.05 U		0.18	0.01 U	0.38	0.55	0.01 U	0.072	0.046	18	9.3
DST-MC1	06-Mar-19	Placer		0.05 U		0.011 J	0.01 U	0.19 J	0.2	0.01 U	0.01 U	0.018 J	7	5.6
DST-MC2	06-Mar-19	Placer		0.05 U		0.014 J	0.01 U	0.14 J	0.16	0.01 U	0.01 U	0.011 J	2	4.5
DST-MC4	06-Mar-19	Placer		0.05 U		0.031 J	0.01 U	0.14 J	0.17	0.01 U	0.01 U	0.01 U	3	4
DST-MC5	06-Mar-19	Placer		0.05 U		0.01 U	0.01 U	0.17 J	0.18	0.01 U	0.01 U	0.014 J	3	3.4
DST-MC7	06-Mar-19	Placer		0.05 U		0.013 J	0.01 U	0.17 J	0.18	0.01 U	0.01 U	0.034	12	22
DST-MC8	06-Mar-19	Placer		0.028		0.16	0.01 U	0.23	0.39	0.01 U	0.014 J	0.059	33	44
DST-MC9	06-Mar-19	Placer		0.05 U		0.089	0.01 U	0.14 J	0.23	0.01 U	0.012 U	0.06 U	5	4.1
DST-MC1	19-Mar-19	Placer		0.05 U		0.01 U	0.01 U	0.17 J	0.17	0.01 U	0.01 U	0.01 U	3	3.7
DST-MC2	19-Mar-19	Placer		0.05 U		0.01 U	0.01 U	0.08 U	0.1 U	0.01 U	0.01 U	0.037	3	5.4
DST-MC4	19-Mar-19	Placer		0.05 U		0.012 J	0.01 U	0.14 J	0.15	0.01 U	0.01 U	0.026	2	1.3
DST-MC5	19-Mar-19	Placer	Original	0.05 U		0.01 U	0.01 U	0.19 J	0.19	0.011 J	0.01 U	0.01 UJ	1 J	2.2
DST-MC5	19-Mar-19	Placer	Duplicate	0.05 U		0.01 U	0.01 U	0.17 J	0.17	0.01 U	0.01 U	0.018 J	2 J	2.5
DST-MC5	19-Mar-19	Placer	Triplicate	0.05 U		0.01 U	0.01 U	0.17 J	0.17	0.01 U	0.01 U	0.053 J	2 J	2.8
DST-MC7	19-Mar-19	Placer		0.05 U		0.015 J	0.01 U	0.08 U	0.1 U	0.01 U	0.01 U	0.012 J	3	10
DST-MC8	19-Mar-19	Placer		0.05 U		0.15	0.01 U	0.14 J	0.29	0.01 U	0.01 U	0.016 J	42	18
DST-MC9	19-Mar-19	Placer		0.05 U		0.059	0.01 U	1.1	1.2	0.01 U	0.01 U	0.01 U	2	3.1
TURB-MC4	02-Apr-19	Placer											26 J	
TURB-MC4	09-Apr-19	Placer											9 J	
DST-MC1	18-Apr-19	Placer		0.05 U		0.009 U	0.01 U	0.15 J	0.15	0.01 J	0.021	0.047	1 J	5.9
DST-MC2	18-Apr-19	Placer		0.05 U		0.009 U	0.01 U	0.08 J	0.1 U	0.013 J	0.012 J	0.03	4 J	8.4
DST-MC4	18-Apr-19	Placer		0.05 U		0.031	0.01 U	0.1 J	0.13	0.006 J	0.006 U	0.016 J	3 J	4.4
DST-MC5	18-Apr-19	Placer		0.05 U		0.009 U	0.01 U	0.14 J	0.14	0.01 J	0.026	0.019 J	2 J	2
DST-MC7	18-Apr-19	Placer		0.05 U		0.009 U	0.01 U	0.17 J	0.17	0.022	0.029	0.059	26	22
DST-MC8	18-Apr-19	Placer		0.05 U		0.14	0.01 U	0.08 J	0.22	0.005 J	0.013 J	0.02	28	12

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC9	18-Apr-19	Placer		0.05 U		0.061	0.01 U	0.07 J	0.13	0.004 J	0.014 J	0.022	12 J	6.4
TURB-MC4	18-Apr-19	Placer											7 J	
DST-MC1	24-Apr-19	Placer		0.05 U		0.01 U	0.01 U	0.11 J	0.11	0.02 U	0.024	0.033	4 J	7
DST-MC2	24-Apr-19	Placer		0.05 U		0.01 U	0.01 U	0.15 J	0.15	0.02 U	0.034	0.035	8 J	12
DST-MC4	24-Apr-19	Placer		0.05 U		0.033	0.01 U	0.13 J	0.16	0.02 U	0.02 U	0.029	7 J	7.7
DST-MC5	24-Apr-19	Placer		0.05 U		0.01 U	0.01 U	0.11 J	0.11	0.02 U	0.02 U	0.02 U	1 J	3
DST-MC7	24-Apr-19	Placer		0.05 U		0.01 U	0.01 U	0.25	0.25	0.02 U	0.033	0.062	24	24
DST-MC8	24-Apr-19	Placer		0.05 U		0.01 U	0.01 U	0.51	0.51	0.02 U	0.02 U	0.078	6 J	7.4
DST-MC9	24-Apr-19	Placer		0.05 U		0.039	0.01 U	0.27	0.31	0.02 U	0.02 U	0.04	22	9.8
TURB-MC4	16-May-19	Placer											12	
Water Year 2020														
DST-MC1	26-Jan-20	Placer										0.042	5 J	
DST-MC4	26-Jan-20	Placer										0.066	16	
DST-MC5	26-Jan-20	Placer										0.036	3 J	
DST-MC7	26-Jan-20	Placer										0.038	31	
DST-MC8	26-Jan-20	Placer										0.027	19	
DST-MC9	26-Jan-20	Placer										0.027	17	
DST-MC10	26-Jan-20	Placer										0.055	7.2	
DST-MC1	06-Feb-20	Placer										0.01 U	1 U	
DST-MC4	06-Feb-20	Placer										0.026	4 J	
DST-MC5	06-Feb-20	Placer										0.01 U	1 U	
DST-MC7	06-Feb-20	Placer										0.013 J	1 J	
DST-MC8	06-Feb-20	Placer										0.011 J	3 J	
DST-MC9	06-Feb-20	Placer										0.01 U	2 J	
DST-MC1	26-Mar-20	Placer										0.01 U	2 J	
DST-MC4	26-Mar-20	Placer										0.042	2 J	
DST-MC5	26-Mar-20	Placer										0.03	1 U	
DST-MC7	26-Mar-20	Placer										0.01 U	1 J	
DST-MC8	26-Mar-20	Placer										0.01 U	2 J	
DST-MC9	26-Mar-20	Placer										0.018 J	3 J	
DST-MC10	26-Mar-20	Placer										0.01 U	1 U	
DST-MC1	15-Apr-20	Placer										0.01 J	1 J	
DST-MC4	15-Apr-20	Placer										0.01 U	4 J	
DST-MC5	15-Apr-20	Placer										0.01 U	2 J	
DST-MC7	15-Apr-20	Placer										0.025	3 J	
DST-MC8	15-Apr-20	Placer										0.01 U	6.8	

Site	Date	Jurisdiction	Type	Ammonia as N [mg/L]	Nitrate & Nitrite as N [mg/L]	Nitrate as N [mg/L]	Nitrite as N [mg/L]	Nitrogen, Total Kjeldahl [mg/L]	Nitrogen, Total [mg/L]	Orthophosphate as P [mg/L]	Phosphorus as P, Dissolved [mg/L]	Phosphorus as P, Total [mg/L]	Total Suspended Solids [mg/L]	Turbidity [mg/L]
DST-MC9	15-Apr-20	Placer										0.01 U	9.5	
DST-MC10	15-Apr-20	Placer										0.01 U	2 J	
DST-MC1	29-Apr-20	Placer										0.018 J	4 J	
DST-MC4	29-Apr-20	Placer										0.01 U	7.2	
DST-MC5	29-Apr-20	Placer										0.024	3 J	
DST-MC7	29-Apr-20	Placer										0.026	4 J	
DST-MC8	29-Apr-20	Placer	Original									0.015 J	17	
DST-MC8	29-Apr-20	Placer	Duplicate									0.01 J	14	
DST-MC8	29-Apr-20	Placer	Triplicate									0.04 J	14	
DST-MC9	29-Apr-20	Placer										0.01 J	5.8	
DST-MC10	29-Apr-20	Placer										0.028	1 J	
DST-MC1	05-Aug-20	Placer										0.051	2 J	
DST-MC4	05-Aug-20	Placer										0.033	16	
DST-MC5	05-Aug-20	Placer										0.041	2 J	
DST-MC7	05-Aug-20	Placer										0.1	1 U	
DST-MC8	05-Aug-20	Placer										0.045	7	
DST-MC9	05-Aug-20	Placer										0.05	4 J	

Electronic Analytical Data Appendix

(Provided Electronically)

Appendix D

Analytical Data Quality Evaluation

Analytical Data Quality Evaluation

D.1 Overview

This appendix summarizes the quality assurance/quality control (QA/QC) procedures that were implemented in the laboratory and field to ensure that the data collected during the water year 2020 implementation of the Truckee River Water Quality Monitoring Plan for Placer County. The purpose of the data review was to evaluate the data to ensure they were of known quality and met the project objectives. A general description of the laboratory and field QA/QC procedures is discussed in Section D.2. Upon receipt from the laboratory, a complete data quality evaluation was performed on all data generated during this program to ensure that the reported data accurately represent the concentrations of constituents present in the water samples. The process results of the data quality evaluation are discussed in Section D.3.

D.2 Laboratory Quality Assurance/Quality Control Procedures

Quality assurance is defined as the integrated program designed for assuring reliability of monitoring and measurement of data. Quality control is defined as the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measuring process. This section presents quality control procedures that were conducted by the laboratory to ensure analytical data quality. A description of the general practices required of the laboratory is summarized below.

D.2.1 Standard Operating Procedures (SOPs)

Western Environmental Testing Laboratory (WETLAB) performed all analyses and QA/QC procedures in accordance with published analytical methods and internal SOPs. The internal SOPs provide step-by-step instructions for performing analytical methods. Utilizing SOPs is a method to ensure uniformity and compliance in the measurement process.

D.2.2 Purity of Standards, Solvents and Reagents

The purity/quality of reagents, solvents and standards used in the analytical process is a critical component in the generation of high quality data. All reagents used were of reagent-grade (equivalent) or higher grade quality whenever obtainable. Where applicable, reference standard solutions were traceable to the National Institute of Standards Technology (NIST), the American Association for Laboratory Accreditation (AALA), or to an equivalent source. Each new lot of reagent-grade chemicals was tested for quality of performance, and laboratory records were kept to document the results of lot tests.

D.2.3 Calibration

Instrument calibration is performed to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for target compounds. Calibration procedures vary by analytical method. In general, each instrument is calibrated initially using certified standards, followed by periodic (i.e., daily) calibration verifications to confirm that the initial calibration is valid.

D.2.4 Method Blank

A method blank (MB) is a QC sample that consists of all reagents specific to the method and is carried through every aspect of the procedure, including preparation, cleanup and analysis. The MB is used to identify any interferences or contamination of the analytical system that may lead to the reporting of elevated analyte concentrations or false positive data. Potential sources of contamination include solvent, reagents, glassware, or the laboratory environment. The MB is prepared with each group of samples processed. One batch of samples is generally defined as a group of 20 samples or less of the same sample matrix that are processed using the same procedures, reagents and standards within the same time period.

D.2.5 Laboratory Control Sample

A laboratory control sample (LCS) is a laboratory-generated clean matrix sample that is fortified with known concentrations of target analytes. The LCS is then carried along with the environmental samples through the entire sample preparation/ analysis sequence. Review of the LCS recovery data is used to monitor the performance of the analytical methods. The results of the LCS, used in conjunction with the matrix spike samples, can provide evidence that the laboratory performed the method correctly or the sample matrix affected the results.

D.2.6 Matrix Spike Sample

Matrix spikes (MS) and matrix spike duplicates (MSDs) are analyzed to evaluate the effect of the sample matrix on the accuracy of the analytical procedures. A matrix spike is an environmental sample that has been spiked with known concentrations of target analytes. The matrix-spiked sample is then carried through the entire analytical sequence like all other samples. The analyte concentrations detected during the analysis are compared to the known spike concentrations to obtain a percent recovery for each spiked analyte. The recoveries are compared to acceptance limits and the results are used to evaluate accuracy and the presence of matrix interferences.

The difference between the MS and the MSD analyses is expressed as the relative percent difference (RPD). RPDs are used to evaluate analytical precision and can also be a measure of relative sample heterogeneity.

D.3 Data Quality Evaluation

Upon receipt from the laboratory, each analytical report was thoroughly reviewed, and the data evaluated to determine if the data met the project objectives. Data reviewed included storm water samples. Initially, the data were screened for the following major items:

- A 100 percent check between electronic data provided by the laboratory and the hard copy reports;
- Conformity check between the chain-of-custody forms, compositing protocol, and laboratory reports;
- A check for laboratory data report completeness; and,
- A check for typographical errors on the laboratory reports.

After performing the aforementioned data screening, the laboratory was notified of any deficiencies, if any, by way of a telephone call detailing the problems encountered during the initial screening process.

Following the initial screening, a more complete QA/QC review was performed, which included an evaluation of method holding times, method blank contamination, and accuracy and precision. Accuracy was evaluated by reviewing MS, MSD and LCS recoveries; precision was evaluated by reviewing field duplicate, spike duplicate and laboratory sample duplicate RPDs.

A total of 102 constituents were measured among 51 samples (including field QC samples). Data quality assessment was based upon review of holding times, laboratory blanks, laboratory control samples, laboratory duplicates, matrix spikes and matrix spike duplicates, reporting limits, and field duplicates. Based on the data review, none of the constituent results were rejected. The following sections describe specific items that were evaluated during the QA/QC review process and data that were qualified as estimated due to laboratory QC exceedances.

D.3.1 Holding Times

A sample holding time is defined as the maximum allowable time a sample can be stored after sample collection and preservation until analysis. If the holding time was exceeded, results were flagged with a “J” qualifier. If the holding time was significantly exceeded, then the results were rejected and flagged with an “R” qualifier. During the data review process, it was determined that no holding time exceedances occurred, and no data was rejected.

D.3.2 Blank Evaluation

As mentioned previously, analytical results from laboratory method blanks were evaluated during the QA/QC review process. Blanks can be used to identify the presence and potential source of sample contamination. If no contamination is present in the blanks, then no further action is required. Laboratory method blanks were analyzed with every batch of samples for most analyses.

In the 2019-2020 dataset, no analytes were detected in the laboratory method blanks at concentrations greater than their respective reporting limits. Therefore, none of the data were qualified as a result of laboratory contamination.

D.3.3 Accuracy and Precision

Accuracy is the degree of agreement between a measurement and the true or expected value or between the average of a number of measurements and the true or expected value. Systematic errors affect accuracy. For chemical properties, accuracy is expressed as percent recovery (%R), which is calculated as follows:

$$\%R = [(Cs - C)/S] * 100$$

where:

%R	=	percent recovery
Cs	=	spiked sample concentration
C	=	background sample concentration
S	=	concentration equivalent of spike added

MS, MSD and LCS results were checked to assess the accuracy of the analytical process. MS and MSD results provided an evaluation of accuracy in environmental sample matrices; whereas, LCS results provided a measure of accuracy throughout the entire recovery process.

Precision is an estimate of variability. In other words, precision is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. Precision can be calculated as the relative percent difference (RPD) as follows:

$$RPD = 2 * [(S - D)/(S + D)] * 100$$

where:

RPD	=	relative percent difference
S	=	concentration measured in original sample
D	=	concentration measured in duplicate sample

Duplicate sample results (laboratory duplicates) were checked to assess the variability and precision between samples. Depending on the analytical method, various types of laboratory duplicate results were compared to assess precision. For example, some methods require the analysis of an MS and an MSD sample pair, whereas other methods are not as specific. When MS/MSD analyses are not specified, the laboratory calculated precision using a sample and a duplicate of the same sample.

Control limits for spike recoveries and RPDs are shown on Table D-1. These are the acceptance limits used to evaluate the usability of the project data.

Table D-1. Accuracy and Precision Control Limits

Analyte	LCS % Recovery (Accuracy)	MS/MSD % Recovery (Accuracy)	RPD (Precision)
Ammonia	80 - 120	80 - 120	20
Nitrate (as N)	90 - 110	80 - 120	20
Nitrite (as N)	90 - 110	80 - 120	20
Orthophosphate	85 - 115	80 - 120	20
Phosphorus (total)	85 - 115	80 - 120	20
Phosphorus (dissolved)	90 - 110	80 - 120	20
TKN	90 - 110	90 - 110	20
TSS	90 - 110	--	5*
Turbidity	90 - 110	--	20

*If the difference between the sample and the duplicate is less than or equal to the report limit, then the data is not qualified.

The following sections discuss the results of accuracy and precision measurements.

Laboratory Duplicates

In the 2019-2020 dataset, no results were qualified as estimated due to laboratory duplicate exceedances.

Field Triplicates

There are no specific regulatory criteria available to evaluate field triplicate results. However, the TRWQMP specifies that the average percent error between field triplicates should be less than 20 percent. Average percent error is calculated by the following formula:

$$\text{Average Percent Error} = \frac{100^* \text{ Standard Deviation of triplicates}}{\text{Average result of triplicates}}$$

In the 2019-2020 dataset, two triplicate sample sets were collected from Site DST-MC8 on April 29, 2020 and DSC-MC9 on July 27, 2020. Triplicate samples were collected to assess field and laboratory precision. The following table summarizes the triplicate sample results and average percent error results at each site.

DST-MC8 Triplicate Results (April 29, 2020)

Analyte	Primary	Duplicate	Triplicate	Average % Error
	DSTMC82004291530	DSTMC82004291530B	DSTMC82004291530C	
Total Phosphorus	0.015	0.01	0.04	74.2
Total Suspended Solids	17	14	14	11.5

DSC-MC9 Triplicate Results (July 27, 2020)

Analyte	Primary	Duplicate	Triplicate	Average % Error
	DSCMC92007271540	DSCMC9B2007271540	DSCMC9C2007271540	
Total Phosphorus	0.53	1.3	0.38	67.0
Total Suspended Solids	640	400	410	28.1

Based on the data presented above for the 2019-2020 dataset, average percent error was within 20 percent for the TSS field triplicate results on April 29, 2020. The remaining triplicates had average percent errors that were greater than 20 percent. These included: total phosphorus at DST-MC8 on April 29, 2020, and total phosphorus and TSS at DCS-MC9 on July 27, 2020, as shown in the tables above. Therefore, the total phosphorus triplicate results from Site DST-MC8, and the total phosphorus and TSS triplicate results from DSC-MC9 were qualified with "Js" to indicate estimated concentrations as a result of precision. All other results are usable as reported without qualification.

The following table summarizes the sample results that were qualified as a result of percent error greater than 20 percent:

Summary of Analyte Qualification – Percent Error Greater Than 20 Percent

Constituent	Total Number	Total Qualified	Qualifier	Percent Qualified
Total Phosphorus	51	6	J	11.8
Total Suspended Solids	51	3	J	65.9
TOTAL NUMBER OF CONSTITUENTS	**102**	**9**	**J**	**8.8**

Laboratory Control Samples

In the 2019-2020 dataset, no results were qualified due to out-of-range LCS recoveries.

Matrix Spike/Matrix Spike Duplicate Samples (MS/MSDs)

All MS/MSD samples in the 2019-2020 dataset were recovered at levels within acceptable limits and the RPDs between the two were also within acceptable limits. No samples required qualification as a result of accuracy and precision issues.

Overall Summary

All results were evaluated against Truckee River Water Quality Monitoring Program specified quality control criteria. Total phosphorus results from triplicate samples at site DST-MC8 and total phosphorus and TSS results from triplicate samples at DSC-MC9 were qualified with "Js" due to precision exceedances (9 results total).

Overall, the QA/QC review of analytical results found all the data to be of acceptable quality and usable for the intended purposes, including sample data qualified as estimated due to precision or holding time issues.

Appendix E

Suspended Sediment Data and Rating Curves

Appendix E. Suspended-sediment concentration and loading rates: West Martis Creek (TURB-MC1), WY2013 - WY2020

		Site Conditions					Suspended Sediment		
Sample Date:Time	Observer(s)	Stage	Discharge	Discharge Value Source	Stream Condition	Event Type	Suspended-Sediment Concentration	15-minute Turbidity	Suspended-Sediment Transport Rate
		(ft)	(cfs)	M,R,E	R,F,B,U,S	R, R/S, SM, BF	(mg/l)	(NTU)	(tons/day)
WY2013									
11-17-12 14:07	CDM	1.91	2.82	R	R	R	56.0	*31*	0.43
11-30-12 12:30	CDM	3.12	16.7	R	R	R/S	20	*32*	0.90
12-5-12 10:44	CDM	2.73	9.49	R	R	R/S	3.0	14	0.08
12-17-12 9:55	CDM	1.97	2.37	R	R	R/S	18	5.4	0.11
3-13-13 15:15	CDM	1.88	1.84	R	S	SM	5.0	4.30	0.02
3-20-13 10:07	CDM	1.98	2.96	R	S	R	3.0	3.70	0.02
3-31-13 9:45	CDM	1.98	3.18	M	F	R	6.0	5.10	0.05
4-26-13 13:15	CDM	1.68	0.99	R	F	SM	3.0	2.36	0.01
5-7-13 12:00	CDM	1.97	1.92	R	F	R	8.0	n/a	0.04
WY2014									
1-30-14 7:45	CDM	0.79	1.78	R	F	R/S	24	12.60	0.12
2-9-14 10:10	CDM	2.60	26.1	M	F	R/S	24	29.0	1.69
2-27-14 8:05	CDM	0.82	2.42	R	F	R/S	2	6.1	0.01
3-29-14 14:50	CDM	0.88	2.78	R	R	R	11	7.9	0.08
4-8-14 19:20	CDM	0.71	1.78	R	R	SM	6	3.3	0.03
5-20-14 14:15	CDM	0.52	0.93	R	R	R	19	13	0.05
7-21-14 9:30	CDM	0.43	0.64	R	Peak	R	17	13	0.03
2014-08-04 15:24	CDM	0.47	0.77	R	R	BF	17	15.0	0.04
WY2015									
2014-12-03 14:00	CDM	1.48	7.42	R	R	R	9	12.0	0.18
2015-02-07 9:25	CDM	1.78	8.55	R	F	R/S	11	31.0	0.25
2015-02-08 17:15	CDM	2.42	15.5	R	U	R/S	13	31.0	0.54
2015-03-06 15:15	CDM	0.69	1.30	R	S	R/S	4	3.0	0.01
2015-04-21 17:35	CDM	0.86	2.70	R	F	R	2	2.2	0.01
2015-04-24 9:15	CDM	0.82	2.44	R	F	R	5	13.3	0.03
2015-06-10 11:47	CDM	0.58	1.17	R	R	R	1	3.0	0.00
WY2016									
2015-10-17 18:11	CDM	0.52						5.8	
2015-11-02 11:21	CDM	0.59	0.24	R	R	Mixed	7	5.1	0.00
2015-12-21 13:30	CDM	1.98	9.02	R	R	R/S	1	18.0	0.02
2016-01-29 13:55	CDM	1.69	12.3	R	R	R/S	72	23.3	2.39
2016-02-24 15:33	CDM	0.99	4.08	R	R	SM	2	2.6	0.02
2016-03-05 17:30	CDM	1.80	13.7	R	R	R/S	2	5.5	0.07
2016-04-07 15:30	CDM	1.09	4.70	R	R	SM	6	3.2	0.08
2016-04-22 13:42	CDM	1.55	10.3	R	F	R	19	6.4	0.53
WY2017									
2016-10-16 12:25	CDM	0.84	3.15	R	R	R	11	32.1	0.09
2016-10-28 8:39	CDM	1.02	4.07	R	R	R	14	18.3	0.15
2016-12-10 11:55	CDM	2.64	27.0	R	R	R/S	37	41.4	2.70
2016-12-16 9:40	CDM	2.40	24.6	R	R	R/S	5	13.8	0.33
2017-01-09 11:30	CDM	2.54	26.0	R	R	R/S	11	19.7	0.77
2017-02-09 10:25	CDM	2.51	25.3	R	R	R/S	4	13.0	0.27
2017-03-20 14:33	CDM	2.19	20.7	R	R	R/S	5	9.5	0.28
2017-05-25 7:42	CDM	2.15	19.5	R	F	SM	3	7.7	0.16
WY2018									
2018-03-08 14:10	CDM	0.64	2.43	R	R	SM	14	18.9	0.09
2018-03-13 16:11	CDM	1.69	14.3	R	R	R/S	56	125.8	2.15
2018-03-22 13:15	CDM	2.52	24.1	R	R	R/S	67	63.0	4.34
2018-03-29 13:18	CDM	1.26	5.10	R	R	SM	3	8.4	0.04
2018-04-07 8:45	CDM	2.47	23.3	R	R	R/S	62	59.5	3.89
2018-05-09 14:05	CDM	1.05	4.28	R	R	SM	13	11.2	0.15
2018-05-16 14:50	CDM	1.00	3.91	R	S	R	13	16.1	0.14
2018-05-25 11:30	CDM	1.17	6.08	R	F	R	18	22.4	0.29
WY2019									
2018-11-29 13:20	CDM	0.54	1.66	R	R	R	1	6.0	0.00
2018-12-17 10:45	CDM	0.31	0.9	R	R	R/S	1	4.6	0.00
2019-01-07 11:00	CDM	0.58	1.6	R	R	R/S	3	4.9	0.01
2019-01-09 12:05	CDM	0.84	2.94	R	R	R/S	7	6.9	0.06
2019-03-06 12:15	CDM	1.44	8.6	R	R	SM	3	5.1	0.07
2019-03-19 15:50	CDM	1.13	5.33	R	R	SM	2	5.6	0.03
2019-04-18 16:24	CDM	1.84	13.46	R	S	SM	10u	7.8	--
2019-04-24 16:05	CDM	1.95	14.86	R	F	SM	10u	13.9	--
WY2020									
2020-01-26 9:26	CDM	0.67	2.65	R	R	R	16	4.6	0.11
2020-02-06 12:40	CDM	0.44	1.8	R	U	BF	*4*	4.6	0.02
2020-03-26 13:15	CDM	0.59	1.9	R	R	SM	*2*	4.9	0.01
2020-04-15 15:35	CDM	0.84	3.12	R	R	SM	*4*	6.9	0.03
2020-04-29 16:02	CDM	0.95	3.9	R	R	SM	7.2	5.1	0.07
2020-08-05 17:50	CDM	0.15	0.33	R	S	BF	16	5.6	0.01

Notes

Observer Key: CDM: various staff from Truckee Office

Stage: arbitrary datum, station was relocated in WY2014 and stage is not comparable between years.

Discharge is the measured or 15-minute recorded flow when sediment was sampled, and usually differs from the daily discharge.

Discharge Value Source: M = measured; R = rating curve; E = estimated

Stream Condition: R = rising, F = falling, B = baseflow, U = uncertain, S = steady

Event Type: BF = baseflow, R = rain, R/S = rain on snow, SM = snowmelt runoff

Turbidity is the 15-minute recorded value when sediment was sampled;

Suspended-sediment load (tons/day) is calculated by multiplying suspended-sediment concentration (SCC) by discharge (cfs) and a conversion factor of 0.0027

Values are preliminary and subject to revision; SSC with values of 0.1 are used for plotting, laboratory results are ND; u =reporting limit

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Appendix E. Station Observer Log:
West Martis Creek (TURB-MC1), Water Year 2020

Site Conditions				Discharge				Water Quality Observations				Remarks
Date/Time (observer time)	Observer	Stage	Hydrograph	Measured	Estimated Accuracy	HWM	Estimated Date of HWM	Water Temperature	Field Specific Conductance	Adjusted Specific Conductance	Additional sampling?	
		(feet)	(R/F/S/B)	(cfs)	(e/g/f/p)	(ft)		(oC)	(µmhos/cm)	(at 25 oC)	(Qss, NTU etc.)	
2019-09-27 10:29	bt	0.32	B	1.10	g/f	--	--	9.3	114	162	--	Grasses drying out; vegetation still full; water clear; baseflow
2019-12-27 10:29	bt, lg	1.00	B	1.33	g	--	--	0.0	152	288	--	Some ice on pools and low flow areas; slushy not solid; water cold and clear; some ice around the probe and loggers
2020-02-07 13:31	bt	0.46	B	1.93	g	--	--	3.5	96	163	--	Water clear; winter baseflow; no snow in meadow; some ice on the turbidity and transducer assembly at surface
2020-04-12 15:45	bkh	0.93±0.02	R	5.31	g/f	--	--	9.2	110	158	--	Meadow free of snow; ground wet and saturated; snow cover in watershed is just above the meadow; willow still dormant; secondary channel flowing from other pond to the east
2020-04-29 14:20	bt	0.78±0.02	S	3.93	g	--	--	12.8	126.9	165.5	5.24	Water clear; algae on probe-cleaned; Lookout mountain starting to melt out at lower elevations; no overbank flow; meadow soil damp but no snow or water in the meadow; willows budding
2020-06-04 13:03	bt pr	0.34	S	1.55	G	--	--	16.7	182	216	--	Clear water; cleaned algae on turbidity probe; No snow, no water in meadow; green grasses; some sprinklers on upstream of golf course; course not opened for season yet.
2020-07-06 13:45	pr	0.15	B	0.3	g	--	--	none	220	268	--	Meadow drying up; some maintenance staff at golf course; but no evidence of recent sprinklers
2020-07-23 11:35	pr	0.16	B	0.28	f	--	--	14.5	155.1	194	--	Golf course open for play; no sprinklers on during visit, but likely have been running; plants almost covering entire channel from growth on edges; grasses turning brown in meadows
2020-09-02 10:20	pr	0.14	B	0.41	g	--	--	10.8	134.4	183.5	--	Golf course open,; sprinklers running u/s; meadow turning brown; veg along banks are post-bloom, covering the stream from sunlight in lots of areas; water is mostly clear, some murky bends
2020-10-12 13:37	bt	0.16	B	0.40	g	--	--	9.2	123	176	--	Water clear; grass dry; leaves have fallen off of willows

Observer Key: (bkh) is Brian Hastings, (bt) is Ben Trustman, (pr) is Paxton Ridgeway

Stage: Water level observed at staff plate

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B), (U) uncertain

Estimated accuracy of manual flow measurements: Excellent (+/- 2%), Good (+/- 5%), Fair (+/- 8%), Poor (>8%)

Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

Additional Sampling: Qss = suspended-sediment concentration

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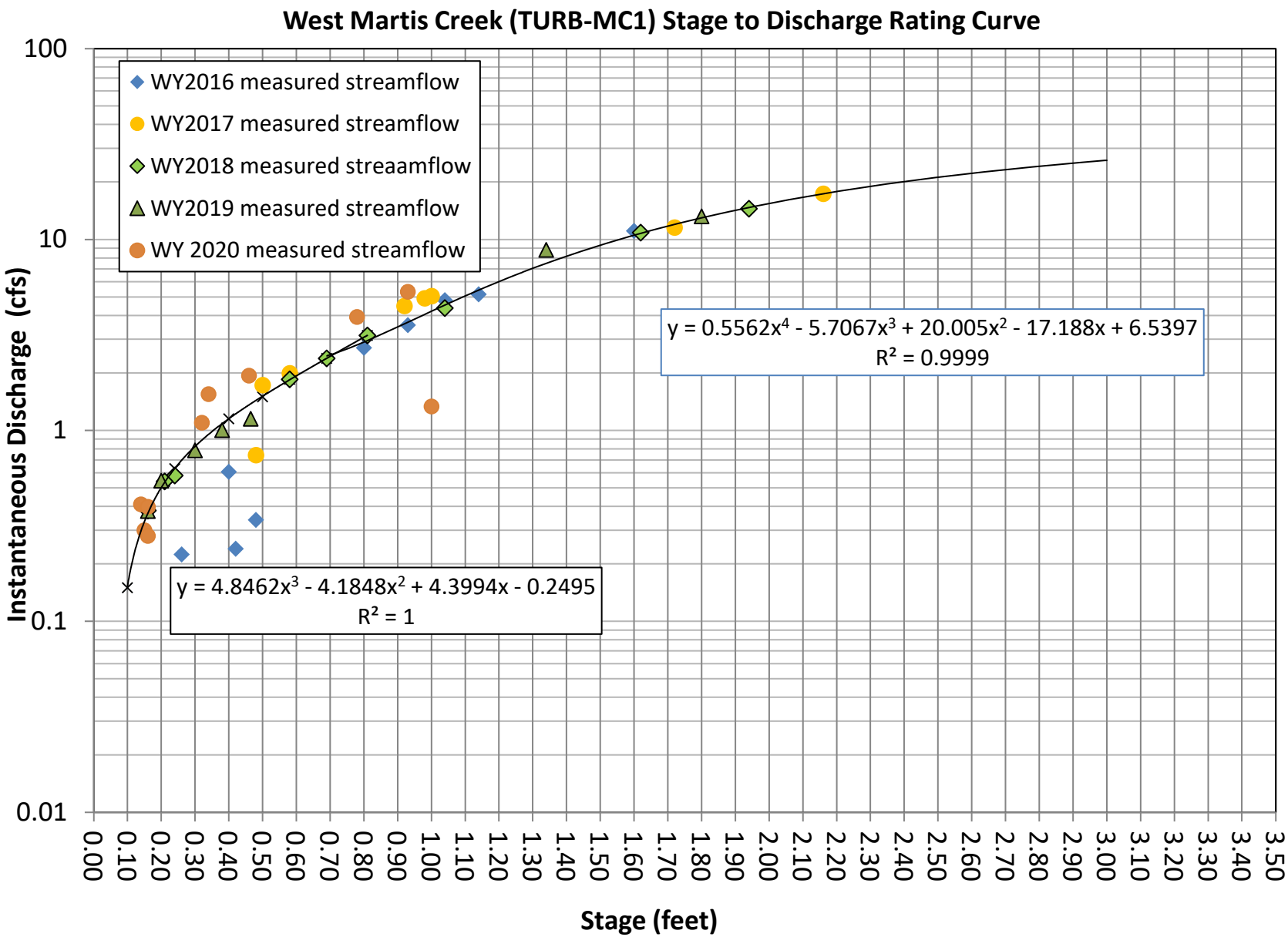

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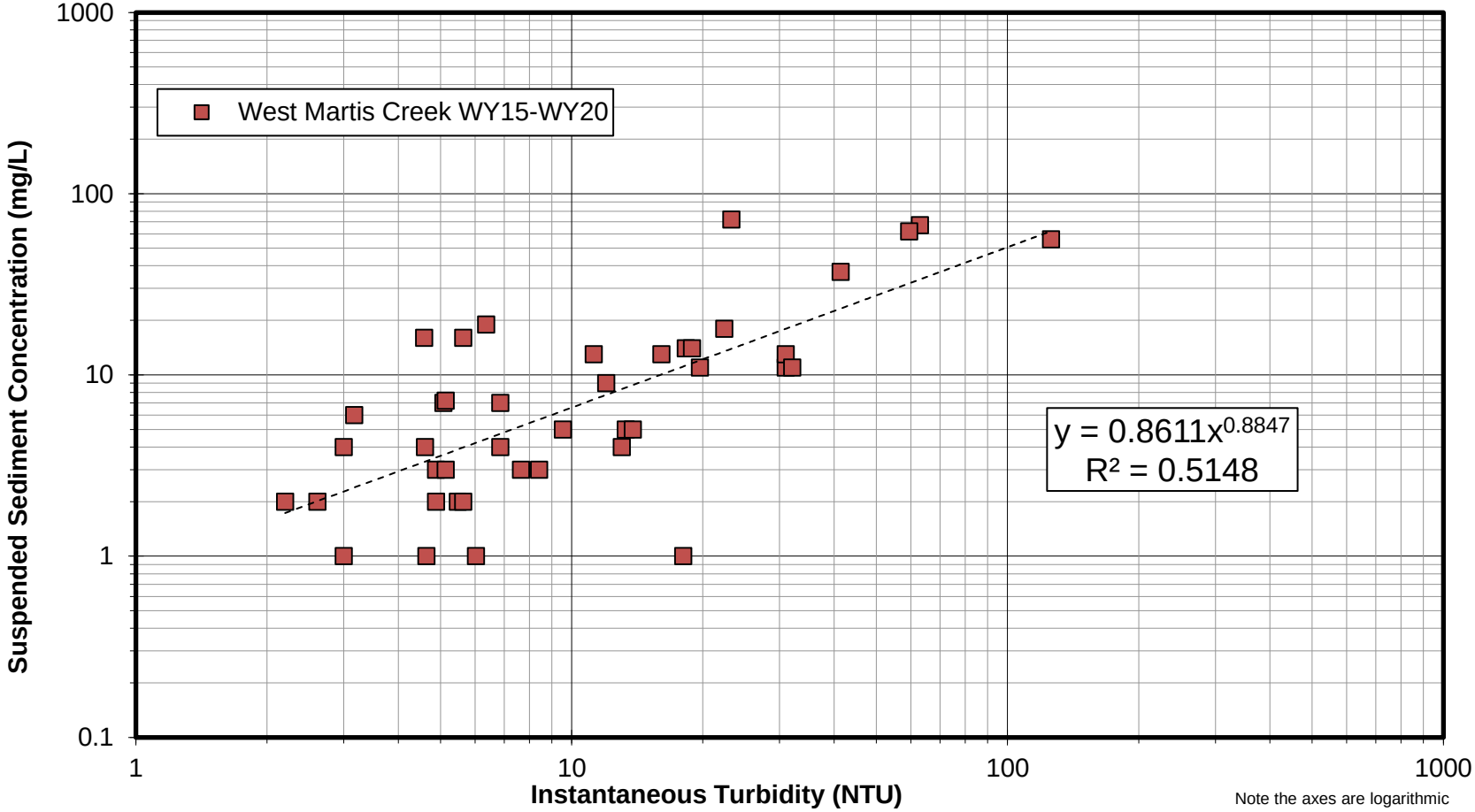
West Martis Creek (Turb-MC1) Discharge to SSC Rating Curve



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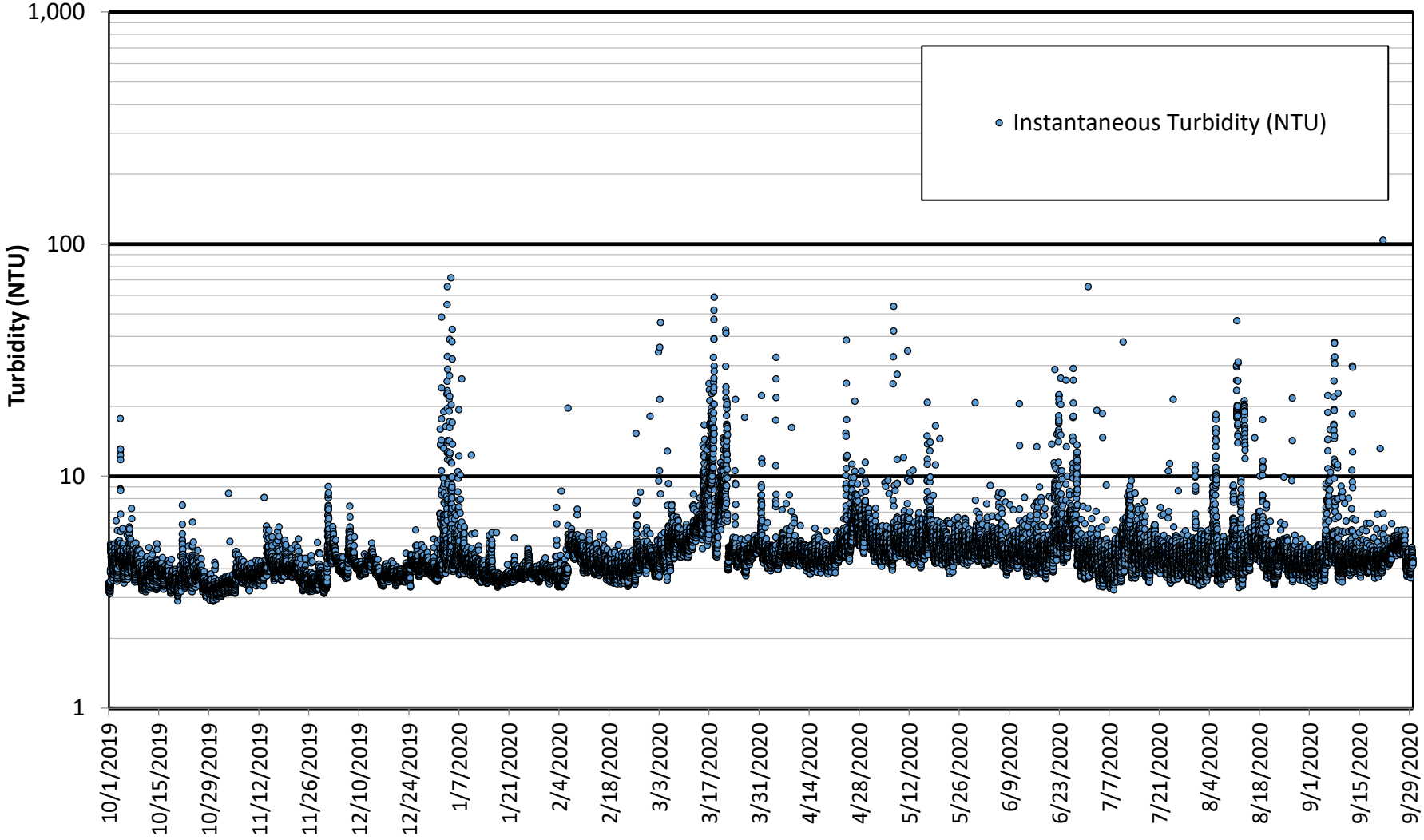
West Martis Creek (Turb-MC1) 15-Minute Turbidity Hydrograph



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Appendix E. Suspended-sediment concentration and loading rates:
Mainstem Martis Creek (TURB-MC2), near Truckee, California
WY2013 through WY2020

	Site Conditions						*Suspended Sediment*		
Sample Date:Time	**Observer(s)**	**Stage**	**Discharge**	**Discharge Value Source**	**Stream Condition**	**Event Type**	**Suspended-Sediment Concentration**	**15-minute Turbidity**	**Suspended-Sediment Transport Rate**
WY2013		*(ft)*	*(cfs)*	*M,R,E*	*R,F,B,U,S*	*R, R/S, SM*	*(mg/l)*	*(NTU)*	*(tons/day)*
2012-11-17 13:46	CDM	0.73	5.0	R	R	R	9.0	*5.5*	0.12
2012-11-30 11:57	CDM	2.87	102	R	R	R/S	48	*49*	13
2012-12-05 10:30	CDM	2.71	85.8	R	F	R/S	--	*14.0*	--
2012-12-17 9:27	CDM	0.97	10.4	R	S	R/S	4.0	*5.3*	0.11
2013-03-13 14:50	CDM	1.16	10.5	R	R	--	4.0	*5.3*	0.11
2013-03-20 9:37	CDM	1.72	24.0	R	R	R	4.0	*1.5*	0.26
2013-03-31 9:07	CDM	1.49	15.8	R	R	SM	3.0	*3.5*	0.13
2013-04-26 12:53	CDM	0.76	4.7	R	F	SM	2.0	*2.1*	0.03
2013-05-07 11:33	CDM	0.87	8.3	R	R	R	1.0	*2.7*	0.02
WY2014									
2014-01-30 6:45	CDM	1.52	4.4	M	F	R/S	4.0	*5.0*	0.05
2014-02-09 9:40	CDM	4.18	105	R	Peak	R/S	16.0	21.0	4.53
2014-02-27 7:35	CDM	1.82	9.5	R	F	SM	4.0	4.2	0.10
2014-03-29 14:30	CDM	1.67	7.0	R	R	R	3.0	3.6	0.06
2014-04-08 19:50	CDM	1.57	5.2	R	R	SM	2.0	2.5	0.03
2014-05-20 14:00	CDM	1.44	3.5	R	R	R	6.3	2.4	0.06
7-21-14 9:15	CDM	1.28	1.77	R	F	R	3.0	2.6	0.01
8-4-14 15:04	CDM	1.40	2.90	R	R	R	16.0	10.0	0.13
WY2015									
12-3-14 12:50	CDM	1.87	9.8	R	R	R/S	14.0	13.2	0.37
2-7-15 7:55	CDM	3.04	53.70	M	F	R/S	20.0	37.0	2.89
2-8-15 16:00	CDM	2.81	39.30	M	R	R/S	21.0	37.5	2.22
3-6-15 13:29	CDM	1.50	4.98	R	R	SM	1.0	1.6	0.01
4-21-15 16:30	CDM	1.42	3.21	R	R	R	2.0	4.3	0.02
4-24-15 8:10	CDM	1.63	5.73	R	R	R	6.0	4.3	0.09
6-10-15 9:37	CDM	1.45	3.75	R	R	R	7.0	4.4	0.07
WY2016									
2015-11-02 10:00	CDM	1.54	4.18	R	U	Mixed	4.0	5.2	0.05
2015-12-21 12:49	CDM	1.73	5.94	R	R	R/S	11.0	9.2	0.18
2016-01-29 13:25	CDM	2.35	16.30	R	R	R/S	29.0	52.3	1.27
2016-02-24 15:10	CDM	2.18	17.80	R	B	SM	2.0	3.9	0.10
2016-03-05 17:15	CDM	3.20	79.70	R	R	R/S	10.0	8.5	2.15
2016-04-07 14:30	CDM	2.46	18.75	R	B	SM	2.0	3.6	0.10
2016-04-22 13:24	CDM	2.50	22.0	R	R	R	2.0	7.0	0.12
WY2017									
2016-10-16 11:54	CDM	1.81	10.3	R	R	R	3.0	8.60	0.08
2016-10-28 9:04	CDM	1.76	7.53	R	Peak/F	R	6.0	8.3	0.12
2016-12-10 12:30	CDM	3.97	133	R	R	ROS	33.0	37.0	11.8
2016-12-16 12:25	Balance	3.69	114	R	F	ROS	3.0	15.2	0.92
2017-01-09 12:00	CDM	4.68	182	R	F	ROS	6.0	*13.0*	2.94
2017-02-09 9:45	CDM	4.79	200	est	R	ROS	2.0	*5.9*	1.08
2017-03-20 14:00	CDM	3.70	116	R	R	ROS	4.0	2.4	1.25
2017-03-20 14:15	CDM	3.73	118	R	R	ROS	2.0	3.5	0.64
2017-05-25 7:30	CDM	3.32	73.00	R	F	SM	2.0	1.7	0.39
WY2018									
2018-03-08 13:25	CDM	1.54	5.65	R	R	SM	4.0	*2.0*	0.06
2018-03-13 15:51	CDM	3.11	68.3	R	R	ROS	32.0	*18.0*	5.89
2018-03-22 14:15	CDM	5.75	217	R	R	ROS	31.0	*33.0*	18.1
2018-03-29 13:58	CDM	2.66	39.3	R	R	SM	1.0	*4.3*	0.11
2018-04-07 9:25	CDM	4.61	172	R	F	ROS	46.0	*23.0*	21.3
2018-05-09 13:57	CDM	1.93	12.2	R	F	SM	3.0	*3.0*	0.10
2018-05-16 15:10	CDM	1.98	13.7	R	R	R	4.0	*4.4*	0.15
2018-05-25 11:30	CDM	2.53	50.3	R	R	R	13.0	*12.0*	1.76
WY2019									
2018-11-29 13:04	CDM	1.34	2.5	R	B	R/S	1.0	4.2	0.01
2018-12-17 10:25	CDM	1.51	4.6	R	B	R/S	1.0	9.1	0.01
2019-01-07 10:30	CDM	1.60	6.3	R	S	R/S	3.0	4.9	0.05
2019-01-09 11:40	CDM	1.71	7.7	R	R	R/S	4.0	5.7	0.08
2019-03-06 11:20	CDM	2.97	51.4	R	R	R/S	3.0	1.0	0.42
2019-03-19 15:30	CDM	2.43	22.7	R	R	SM	1.7	3.6	0.10
2019-04-18 16:00	CDM	3.27	62.8	R	R	SM	10u	2.5	--
2019-04-24 15:45	CDM	3.36	70.1	R	R	SM	10u	2.7	--
WY2020									
2020-01-26 9:00	CDM	1.34	2.5	R	B	R/S	3.0	3.0	0.02
2020-02-06 12:15	CDM	1.51	4.6	R	B	BF	1.0	2.9	0.01
2020-03-26 12:48	CDM	1.60	6.3	R	S	SM	1.0	4.4	0.02
2020-04-15 15:08	CDM	1.71	7.7	R	R	SM	2.0	2.0	0.04
2020-04-29 15:45	CDM	2.97	51.4	R	R	SM	3.0	1.5	0.42
2020-08-05 17:25	CDM	2.43	22.7	R	R	BF	2.0	2.6	0.12

Notes

Observer Key: CDM staff

Gage height: arbitrary datum, station was relocated in WY2014 and therefore gage height cannot be compared between years.

Discharge is the measured or 15-minute recorded discharge when sediment was sampled, and usually differs from the daily discharge.

Discharge Value Source: M = measured; R = rating curve; E = estimated

Stream Condition: R = rising, F = falling, B = baseflow, U = uncertain, S = steady

Event Type: R = rain, R/S = rain on snow, SM = snowmelt runoff

In this case, turbidity values (in *italics)* are based on laboratory analysis and selected when 15-minute turbidity values are unavailable

Suspended-sediment load (tons/day) is calculated by multiplying SSC by discharge (cfs) and a conversion factor of 0.0027

Values are preliminary and subject to revision

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Appendix E. Station Observer Log:
Mainstem Martis Creek (TURB-MC2), Water Year 2020

Site Conditions					Discharge				Water Quality Observations				Remarks
Date/Time (observer time)	Observer	Stage (CDM)	Stage (Balance)	Hydrograph	Measured	Estimated Accuracy	HWM (CDM)	HWM date	Water Temperature	Field Specific Conductance	Adjusted Specific Conductance	Additional sampling?	
		(feet)	(feet)	(R/F/S/B)	(cfs)	(e/g/f/p)	(ft)		(oC)	(µmhos/cm)	(at 25 oC)	Turbidity (NTU)	
2019-09-27 11:06	bt	1.44	--	B	4.31	g	--	--	9.6	101	143	--	Water clear; some leaves falling off of willows; vegetation is still very green; baseflow; cleaned optics on turbidity probe
2019-12-27 9:37	bt,lg	*1.78*	--	B	4.87	ice affected	--	--	0.1	113	220	--	Ice on edges; < 6 inches of snow in the meadow; cold temperatures; water clear; bed is coarse sand and mid sized rocks; gage pool is completely iced over
2020-02-07 12:36	bt	1.50	--	B	5.79	g	--	-	2.8	71	123	--	Water cold; clear; winter baseflow; some algae on bed; cleaned optics
2020-04-12 15:00	bkh	2.32	5.35	S	24.5	g	--	--	8.8	45	62	--	First warm, dry spell since February; snowmelt signal likely; meadow free of snow; snow covering watershed at elevations above meadow; BDAs upstream from project are all blown out, any sediment stored may have filled some of gaging pool (stage shift?); willows still dormant
2020-04-18 11:15	bkh	2.27	5.31	S	21.8	g	2.6	2020-03-31	5.2	46	74	--	Rain yesterday: 0.43" at Martis gage; lower stage since last visit; snowmelt signal likely. Water slightly turbid
2020-04-29 15:00	bt	2.14	--	S	17.7	g	--	--	12.4	63	84	6.0	Water clear; CDM downloading instruments and said he would clean probe; willows budding; grasses are greening in meadow; elevated snowmelt flow
2020-06-04 13:45	bt,pr	1.4	--	S	4.05	g	--	--	15.6	147	179	--	Water clear; vegetation and grasses green; meadow is dry; cleaned turbidity probe
2020-07-06 15:00	pr	1.26	--	B	2.24	g	--	--	15.8	234	284.0	--	Plants full green, reveg contractor watering erosion control blankets and new plants just downstream of gage. More plants installed along banks from what remembered of last visit.
2020-07-23 10:35	pr	1.26	--	B	2.28	f	--	--	12.9	122	159	--	Meadow starting to brown, no revegetation contractor
2020-09-02 8:45	pr	1.25	--	B	2.04	g	--	--	11.4	117.5	158.9	--	Erosion contractor watering ECB downstream of gage, meadow starting to brown, several small fish in pool just u/s, water clear, sunny blue skies
2020-10-12 12:45	bt	1.28	--	B	2.09	g	--	--	13.6	109	140	--	Water clear; algae on streambed; willows have dropped leaves; cleaned turbidity probe

Observer Key: (bkh) is Brian Hastings, (bt) is Ben Trustman, (lg) is Lynell Garfield, (pr) is Paxton Ridgeway

Stage: Water level observed at staff plate; arbitrary datum

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)

Estimated accuracy of manual streamflow measurements: Excellent (+/- 2%), Good (+/- 5%), Fair (+/- 8%), Poor (>8%)

Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

Additional Sampling: Qss = suspended-sediment concentration

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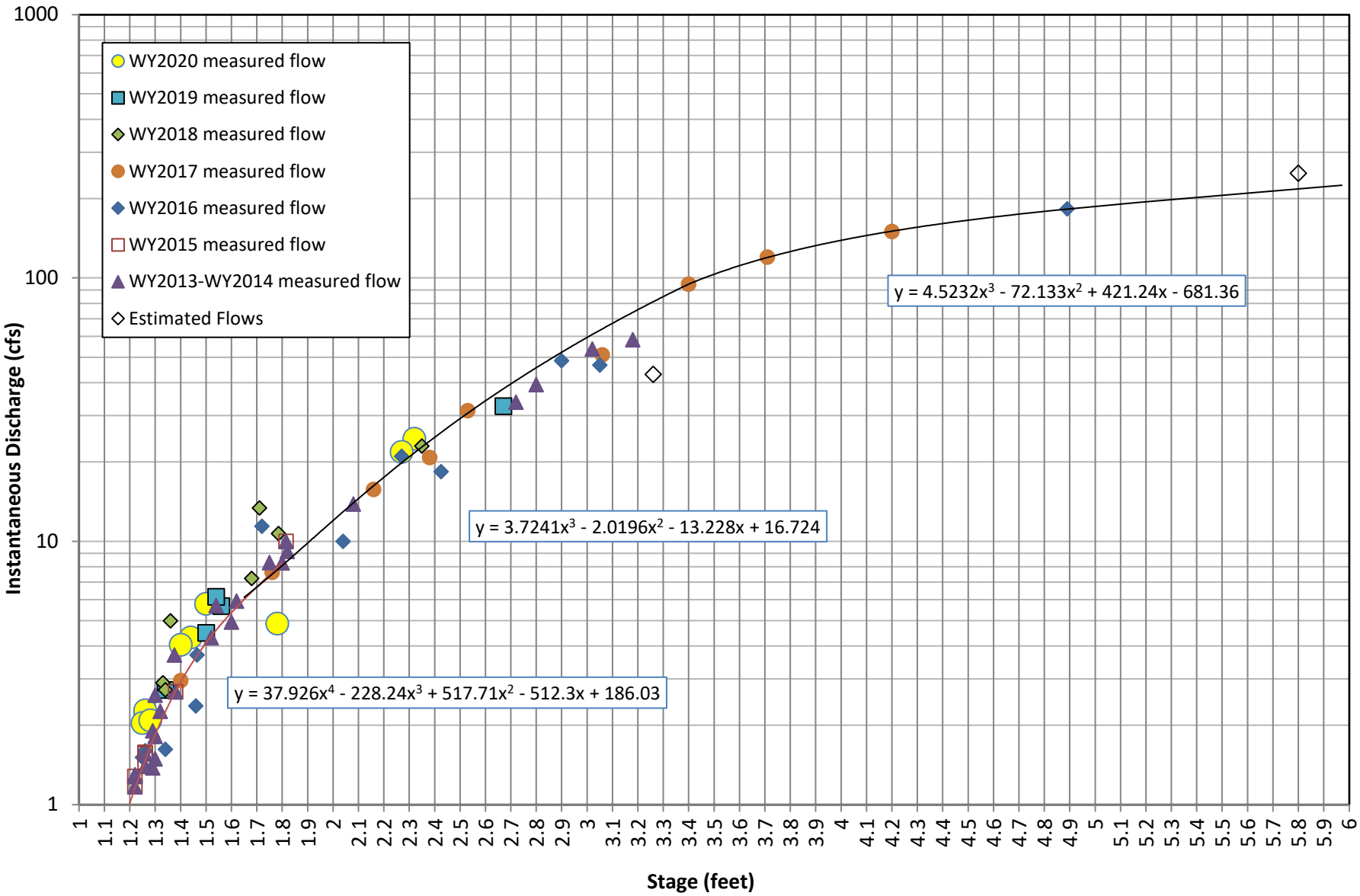
Mainstem Martis Creek (TURB-MC2) Stage to Discharge Rating Curve



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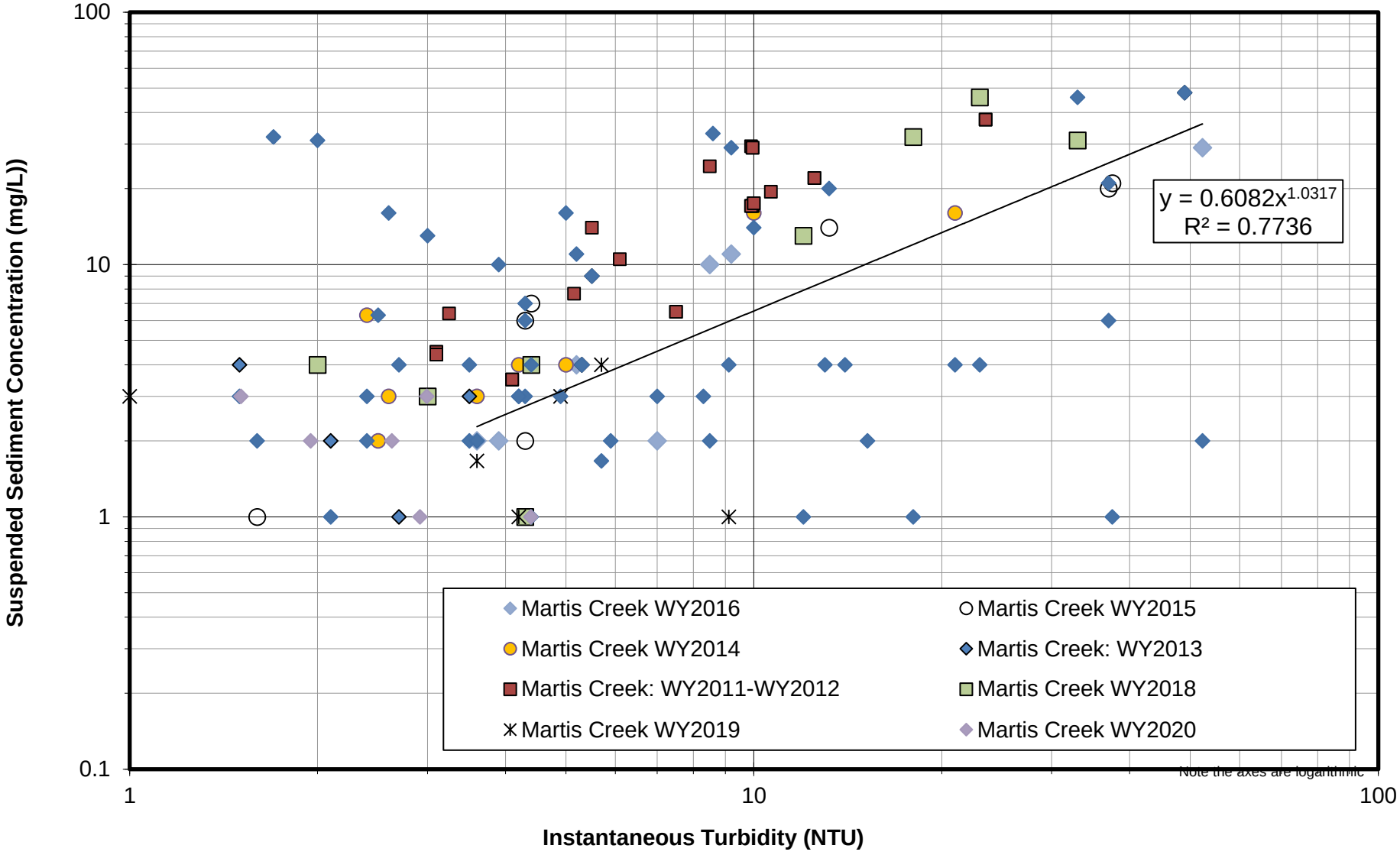

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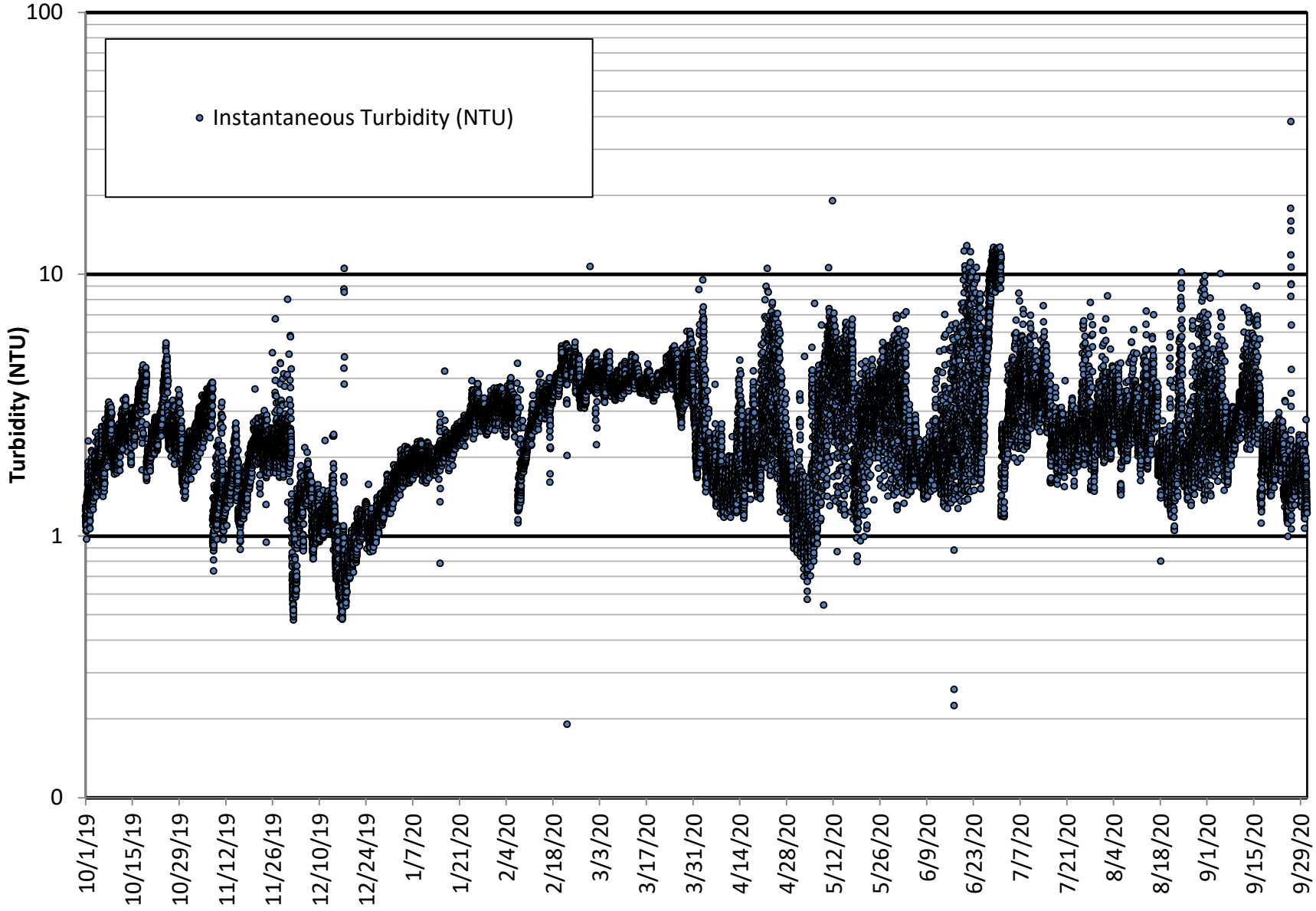
Mainstem Martis Creek (Turb-MC2) 15-Minute Turbidity Hydrograph



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Appendix E. Suspended-sediment concentration and loading rates: Middle Martis Creek (TURB-MC4), near Truckee, California WY2015 through WY2020

	Site Conditions						*Suspended Sediment*		
Sample Date:Time	**Observer(s)**	**Stage**	**Discharge**	**Discharge Value Source**	**Stream Condition**	**Event Type**	**Suspended-Sediment Concentration**	**15-minute Turbidity**	**Suspended-Sediment Transport Rate**
WY2015		*(ft)*	*(cfs)*	*M,R,E*	*R,F,B,U,S*	*R, R/S, SM*	*(mg/l)*	*(NTU)*	*(tons/day)*
2014-12-03 13:15	Balance	5.39	5.86	R	R	R/S	120	*59.0*	1.90
2015-02-07 8:25	Balance	5.60	7.1	R	F	R/S	21.0	*23.0*	0.40
2015-02-08 16:35	Balance	5.93	13.0	R	U	R/S	16.0	*20.0*	0.56
2015-03-06 14:00	Balance	4.88	1.23	R	F	SM	2.0	0.8	0.01
2015-04-21 16:50	Balance	4.94	1.65	R	R	R	220	*91.0*	0.98
2015-04-24 8:25	Balance	5.03	2.75	R	F	R	19.0	*15.0*	0.14
2015-06-10 10:37	Balance	5.05	2.93	R	F	R	30.0	13.2	0.24
WY2016									
2015-11-02 8:45	Balance	5.01	0.77	R	F	R	7.0	11.6	0.01
2015-11-02 14:36	Balance	4.93	0.38	R	F	R	1.0	5.6	0.001
2015-12-21 14:47	Balance	5.48	5.40	R	R	R/S	34.0	76.0	0.50
2015-12-21 15:16	Balance	5.51	6.03	R	R	R/S	36.0	83.0	0.59
2015-12-22 10:00	Balance	5.54	6.73	R	F	R/S	10.0	12.0	0.18
2016-01-29 12:10	Balance	5.30	2.85	R	R	R/S	21.0	30.0	0.16
2016-01-29 12:30	Balance	5.36	3.67	R	R	R/S	22.0	25.0	0.22
2016-02-24 15:45	Balance	5.32	3.17	R	R	--	3.0	7.0	0.03
2016-03-05 9:00	Balance	5.62	7.81	R	F	R/S	11.0	9.1	0.23
2016-04-07 15:49	Balance	5.44	5.49	R	R	SM	1.0	6.8	0.01
2016-04-22 13:52	Balance	5.57	7.25	R	R	SM	3.0	6.4	0.06
2016-05-11 15:05	Balance	5.40	4.01	R	S	SM			
2016-06-03 15:00	Balance	5.03	0.71	R	F	SM	3.0	3.0	0.01
WY2017									
2016-10-17 12:30	Balance	5.43	1.79	R	R	R	6	9.1	0.03
2016-12-10 8:35	Balance	6.87	34.0	R	R	R/S	89	186	8.17
2016-12-10 9:15	Balance	6.91	39.5	R	R	R/S	120	183	12.8
2016-12-10 13:10	Balance	6.95	41.5	R	R	R/S	43.0	93.0	4.82
2016-12-16 11:30	Balance	6.31	21.1	R	S	R/S	6.0	40.3	0.34
2016-12-16 12:25	Balance	6.28	20.5	R	S	R/S	10.0	36.3	0.55
2017-02-07 13:22	Balance	7.09	53.6	R	S	R/S	40	71.0	5.79
2017-05-02 13:22	Balance	6.30	20.0	R	S	SM, R/S	26	23.7	1.40
2017-05-26 15:45	Balance	6.10	6.05	R	S	SM	12.0	18.8	0.20
2017-06-02 12:45	Balance	5.95	4.50	R	S	SM	9.0	23.9	0.11
2017-06-21 9:30	Balance	5.56	1.66	R	F	SM	10.0	20.7	0.04
WY2018									
2018-01-08 13:00	Balance	5.44	1.60	R	S	R	8.0	18.5	0.03
2018-03-13 13:56	Balance	5.83	7.09	R	R	R/S	86	99.0	1.65
2018-03-21 14:55	Balance	6.19	18.00	R	R	R/S	79	89.0	3.84
2018-03-22 13:32	Balance	6.87	52.10	R	Peak	R/S	58	84.0	8.16
2018-04-06 14:25	Balance	6.35	26.30	R	R	R/S	94	135	6.67
2018-04-07 7:50	Balance	6.79	50.10	R	R	R/S	210	227	28.4
2018-05-25 8:42	Balance	5.79	6.96	R	R	R	45	58.6	0.85
WY2019									
2018-11-23 15:03	Balance	5.61	1.25	M	R	R	38	14.5	0.13
2019-01-17 9:50	Balance	6.09	12.90	M	F	R/S	8	11.0	0.28
2019-02-02 11:25	Balance	6.15	15.00	M	F	R/S	84	43.2	3.40
2019-04-02 13:45	Balance	6.32	19.30	M	R	R	26	20.5	1.35
2019-04-09 10:45	Balance	6.60	24.70	M	F	R/S	9	15.0	0.60
2019-04-18 0:00									
2019-05-16 8:43	Balance	6.35	20.30	M	F	R/S	12	4.4	0.66
WY2020									
2020-01-26 10:10	Balance	5.61	2.42	R	S	R/S	31	34.0	0.20
2020-02-06 13:15	CDM	5.46	1.12	R	S	BF	1	6.8	0.00
2020-03-26 13:05	CDM	5.46	0.98	R	S	SM	1	8.4	0.00
2020-04-15 15:50	CDM	5.66	3.00	R	R	SM	3	20.5	0.02
2020-04-29 15:45	CDM	5.62	2.05	R	R	SM	4	22.0	0.02
2020-08-05 18:25	CDM	5.16	0.10	R	S	BF	1	8.9	0.00

Notes

Observer Key: CDM staff, Balance staff

Gage height: arbitrary datum

Discharge is the measured or 15-minute recorded discharge when sediment was sampled, and usually differs from the daily discharge.

Discharge Value Source: M = measured; R = rating curve; E = estimated

Stream Condition: R = rising, F = falling, B = baseflow, U = uncertain, S = steady

Event Type: R = rain, R/S = rain on snow, SM = snowmelt runoff

In this case, turbidity values (in *italics)* are based on laboratory analysis and selected when 15-minute turbidity values are unavailable

Suspended-sediment load (tons/day) is calculated by multiplying SSC by discharge (cfs) and a conversion factor of 0.0027

Values are preliminary and subject to revision

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Appendix E. Station Observer Log:
Middle Martis Creek adjacent to CA 267, Water Year 2020

Site Conditions				*Discharge*			*Water Quality Observations*					*Remarks*
Date/Time (observer time)	Observer	Stage	Hydrograph	Measured Discharge	Instrument Used	Estimated Accuracy	Water Temperature	Field Specific Conductance	Adjusted Specific Conductance	Water Quality Collected?		
		(feet)	*(R/F/S/B)*	*(cfs)*	*(AA/PY/MM)*	*(e/g/f/p)*	*(oC)*	*(µmhos/cm)*	*(at 25 oC)*	*Qss?*	*NTU*	
2019-09-27 9:18	bt	5.28	B	0.37	MM	g/f	9.2	177.0	253.0	no	--	Re-installed Manta Probe at 9:18; leaves are falling off of trees; lots of grasses in channel; baseflow; no flow in downstream culvert
2019-10-25 8:45	bt	5.32	B	--	--	--	2.5	126	220	no		Download loggers; replace failing logger with new: SN 2069297 MM267_03
2019-12-27 11:20	bt, lg	ice	B	--	--	--	0.6	214	401	no	--	Staff was frozen with >2 inches of ice; gage pool completely iced over; did not measure flow due to inability to get gage measurement; downstream area where flow is usually measured was covered with > 2 inches of ice but able to break apart; turbidity probe was frozen and took some effort to remove; downloaded Manta probe; data suggested batteries died on 12/5/19; replaced batteries; no connection issues
2020-01-26 11:12	bt	5.64	S/F	2.48	PY	f	1.0	285	526	yes		Rain over night early morning; just stopped about 45 minutes before site visit; water brown and turbid; grasses in channel on right side made measurement difficult so used surface measurements
2020-01-28 13:33	bt	5.51	S	--	--	--	--	--	--	--	--	Downloaded Manta probe and changed batteries; noted manta data was 3 hrs. ahead on time; water clear
2020-03-10 15:52	bt,np	5.43	B	0.85	MM	g	5.7	155	245	no	--	Snow melted out; saturated soils; grass dead and no buds on willows; downloaded Manta probe and changed batteries; downloaded pressure transducers
2020-04-14 14:45	bt	5.67	R	3.42	MM	g	8.0	152	225	no		Water milky in color; rising flow from snowmelt; warm temps over last few days, no HWM
2020-04-18 12:30	bkh	5.68	U	3.68	PY	g/f	6.4	127	200	no		0.43 inches of rain yesterday; near peak snowmelt runoff
2020-04-29 15:55	bt	5.64	S	2.29	MM	g	13.2	140	181	no	12.0	Water milky; willows starting to bud; grass starting to green; all snow melted out
2020-06-04 12:01	bt,pr	5.29	S	0.37	MM	g	13.0	234	305	no	--	Vegetation green; trees and willows leafed out; water clear; 5-6 inch fish in gage pool; downloaded and changed Manta probe batteries
2020-07-06 12:45	pr	5.22	B	0.09	MM	f	13.0	387	502	no		Very low flow, barely enough to justify taking flow measurement. Plants fully green
2020-07-24 12:14	bt	5.20	B	--	--	--	13.9	207	264	no	--	Water clear; estimated <0.1 cfs flow; grasses have grown in the downstream section of the channel; small flow channel through the grasses; no flow at overflow culvert downstream; downloaded Manta and changed batteries; time on Manta was 2 hours ahead; synced Manta time and created new file MM072420
2020-10-12 14:53	bt	5.24	B	--	--	--	10.9	216	292	no	--	No visible flow in gage pool; covered with leaves; grasses dry; downstream end of measurement pool has lots of grasses with estimated flow of <0.05 cfs; downloaded Manta probe; downloaded leveloggers and restarted MM267)3 to sync clock

Observer Key: (ds) is David Shaw, (bkh) is Brian Hastings, (bt) is Ben Trustman, (pk) is Peter Kulchawik, (jj) is Jack Jacquet, (lg) is Lynell Garfield, (np) is Noelle Patterson. (pr) is Paxton Ridgeway

Stage: Water level observed at outside staff plate (arbitrary datum)

Instruments used to measure velocity: AA: Standard meter; PY: Pygmy meter; MM: Marsh McBurney

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), baseflow (B) or uncertain (U)

Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

Additional Sampling: Qss = Suspended sediment concentration

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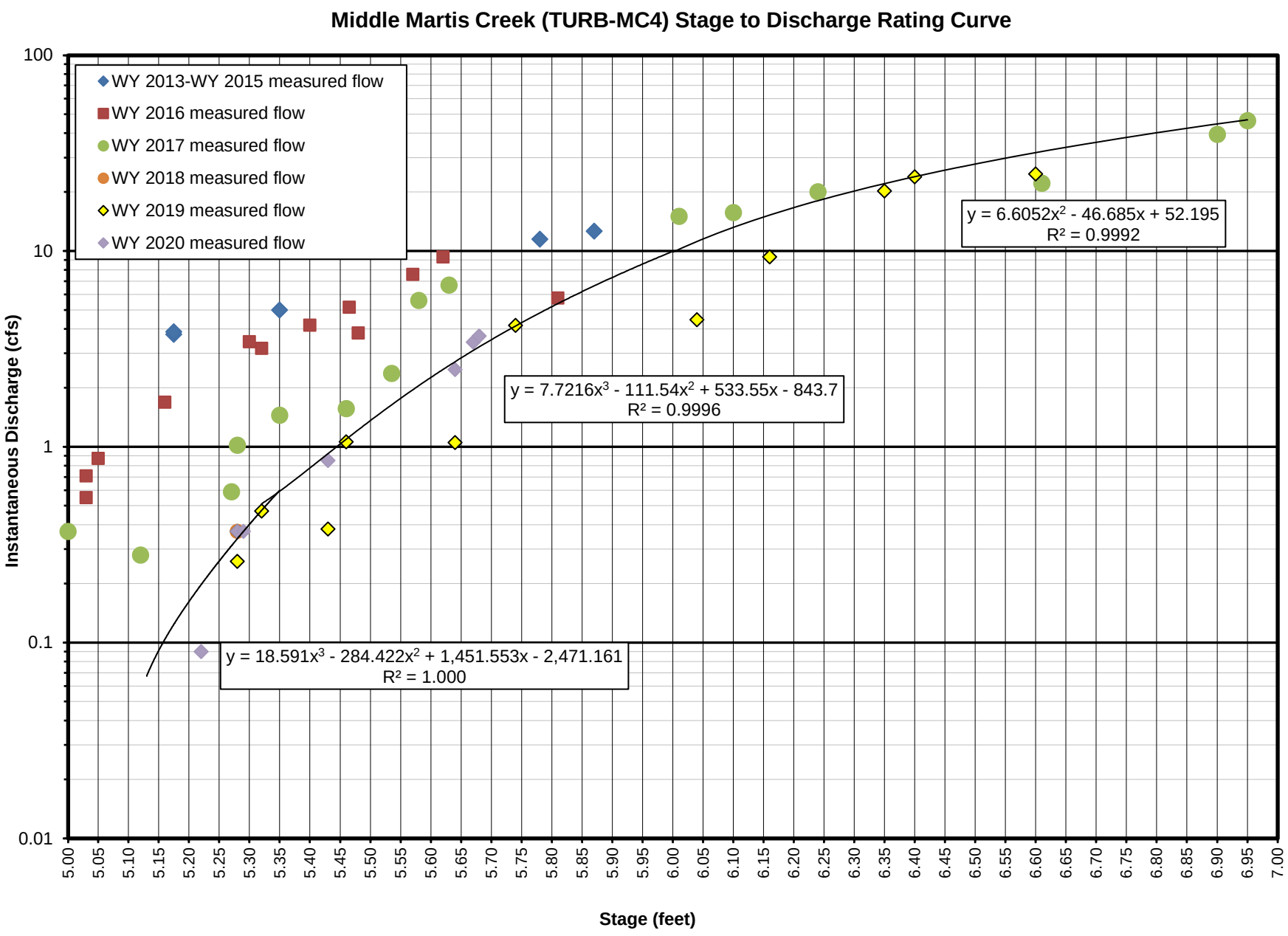

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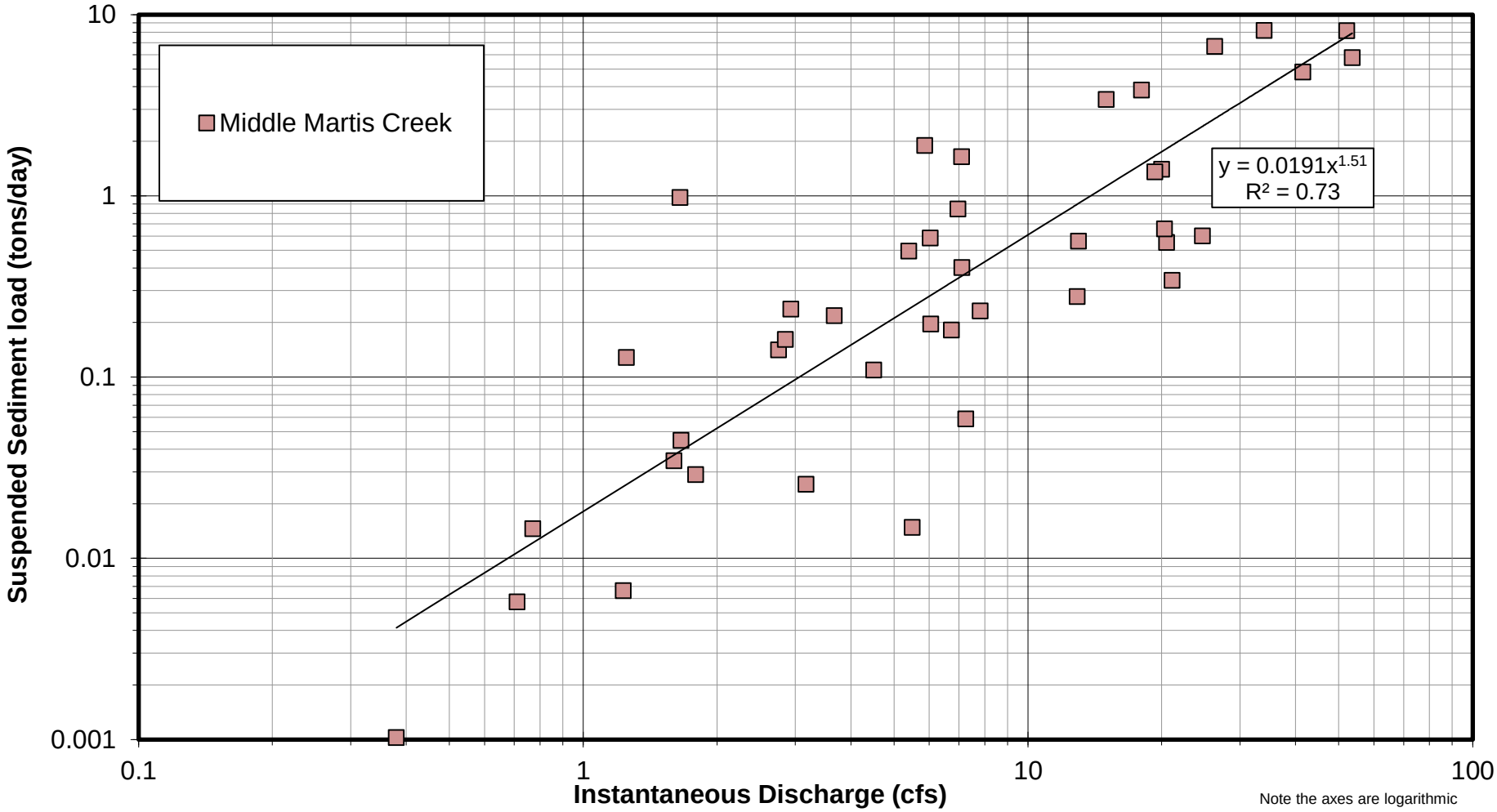
Middle Martis Creek (Turb-MC4) Discharge to Sediment Rating Curve



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Appendix E. Suspended-sediment concentration and loading rates: Upper West Martis Creek (TURB-MC5), WY2020

	Site Conditions						*Suspended Sediment*		
Sample Date:Time	**Observer(s)**	**Stage**	**Discharge**	**Discharge Value Source**	**Stream Condition**	**Event Type**	**Suspended-Sediment Concentration**	**15-minute Turbidity**	**Suspended-Sediment Transport Rate**
		(ft)	*(cfs)*	*M,R,E*	*R,F,B,U,S*	*R, R/S, SM*	*(mg/l)*	*(NTU)*	*(tons/day)*
WY 2020									
2020-01-26 9:55	CDM	--	--	--	--	R/S	19.0	--	--
2020-02-06 13:05	CDM	--	--	--	--	BF	3.0	--	--
2020-03-26 12:45	CDM	0.47	--	--	S	SM	2.0	--	--
2020-04-15 15:40	CDM	0.57	--	--	R	SM	6.8	--	--
2020-04-29 15:30	CDM	0.68	--	--	R	SM	17.0	--	--
2020-08-05 18:10	CDM	0.11	--	--	S	BF	7.0	--	--

Notes

Observer Key: CDM: various staff from Truckee Office

Stage: arbitrary datum, station was relocated in WY2014 and stage is not comparable between years.

Discharge is the measured or 15-minute recorded flow when sediment was sampled, and usually differs from the daily discharge.

Discharge Value Source: M = measured; R = rating curve; E = estimated

Stream Condition: R = rising, F = falling, B = baseflow, U = uncertain, S = steady

Event Type: BF = baseflow, R = rain, R/S = rain on snow, SM = snowmelt runoff

Turbidity is the 15-minute recorded value when sediment was sampled;

Suspended-sediment load (tons/day) is calculated by multiplying suspended-sediment concentration (SCC) by discharge (cfs) and a conversion factor of 0.0027

Values are preliminary and subject to revision; SSC with values of 0.1 are used for plotting, laboratory results are ND; u =reporting limit

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Appendix E. Station Observer Log:
Upper West Martis Creek (TURB-MC5), Water Year 2020

Site Conditions				*Discharge*				*Water Quality Observations*				*Remarks*
Date/Time (observer time)	Observer	Stage	Hydrograph	Measured	Estimated Accuracy	HWM	Estimated Date of HWM	Water Temperature	Field Specific Conductance	Adjusted Specific Conductance	Additional sampling?	
		(feet)	*(R/F/S/B)*	*(cfs)*	*(e/g/f/p)*	*(ft)*		*(oC)*	*(µmhos/cm)*	*(at 25 oC)*	*(Qss, NTU etc.)*	
2020-01-06 13:00	bt, bkh	--	-- --	--	--	--	--	--	--	--	--	Site visit to select install location with Neal and Craig from CDM
2020-01-07 13:26	bt	0.22	B	--	--	--	--	--	--	--	--	Install satff plate and transducers with CDM; bolster gage and select upstream location for turbidity probe
2020-01-10 11:23	bt	0.32	B	0.62	f	--	--	1.2	99	181	--	Water clear; some ice on willow and edges of channel; baseflow is hard to measure due to lack of good location; 2 inches of new snow in last two days
2020-02-07 14:16	bt	0.38	B	0.72	f	--	--	4.5	104	171	--	Water clear; low flow; snow melted from east side banks
2020-03-10 15:05	bt	0.36±0.02	B	0.68	f	--	--	6.2	108	169	--	Clear water; baseflow; grass dead and no buds on willows; little snow around stream and none on banks
2020-04-12 16:30	bkh	0.58±0.01	B	2.62	f	--	--	5.7	103	164	--	Water clear; snow melted from banks; another tributary is flowing just west under parking area est. 0.5 cfs; other fork of the tributary to east is flowing with≤ water; snowmelt; turbidity probe in plunge pool might overestimate true turbidity in high flows
2020-06-04 11:14	bt,pr	0.38	B	0.68	g/f	--	--	10.1	140	196	--	Grasses and vegetation on bank are greenand verdant; willows and trees leafing but not full
2020-07-04 11:32	pr	0.22	B	0.12	f	--	--	11.8	244	326	--	Grasses green; flowers mid-bloom; no water in meadow; trees filled out
2020-07-23 12:30	pr	0.18	B	0.16	g/f	--	--	14	83	105	--	Trees full bloom; banks green; grasses starting to brown
2020-10-12 14:18	bt	0.38	B	0.57	g/f	--	--	9.2	111	159	--	Water clear; measurement site pool downstream of gage was dammed up-possible beaver, possible kids; removed debris from pool and let water flow; dam did not affect gage

Observer Key: (bkh) is Brian Hastings, (bt) is Ben Trustman, (jj) is Jack Jacquet, (lg) is Lynell Garfield, (pk) is Peter Kulchawik, (np) is Noelle Patterson, (pr) is Paxton Ridgeway

Stage: Water level observed at staff plate

Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B), (U) uncertain

Estimated accuracy of manual flow measurements: Excellent (+/- 2%), Good (+/- 5%), Fair (+/- 8%), Poor (>8%)

Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance

Additional Sampling: Qss = suspended-sediment concentration

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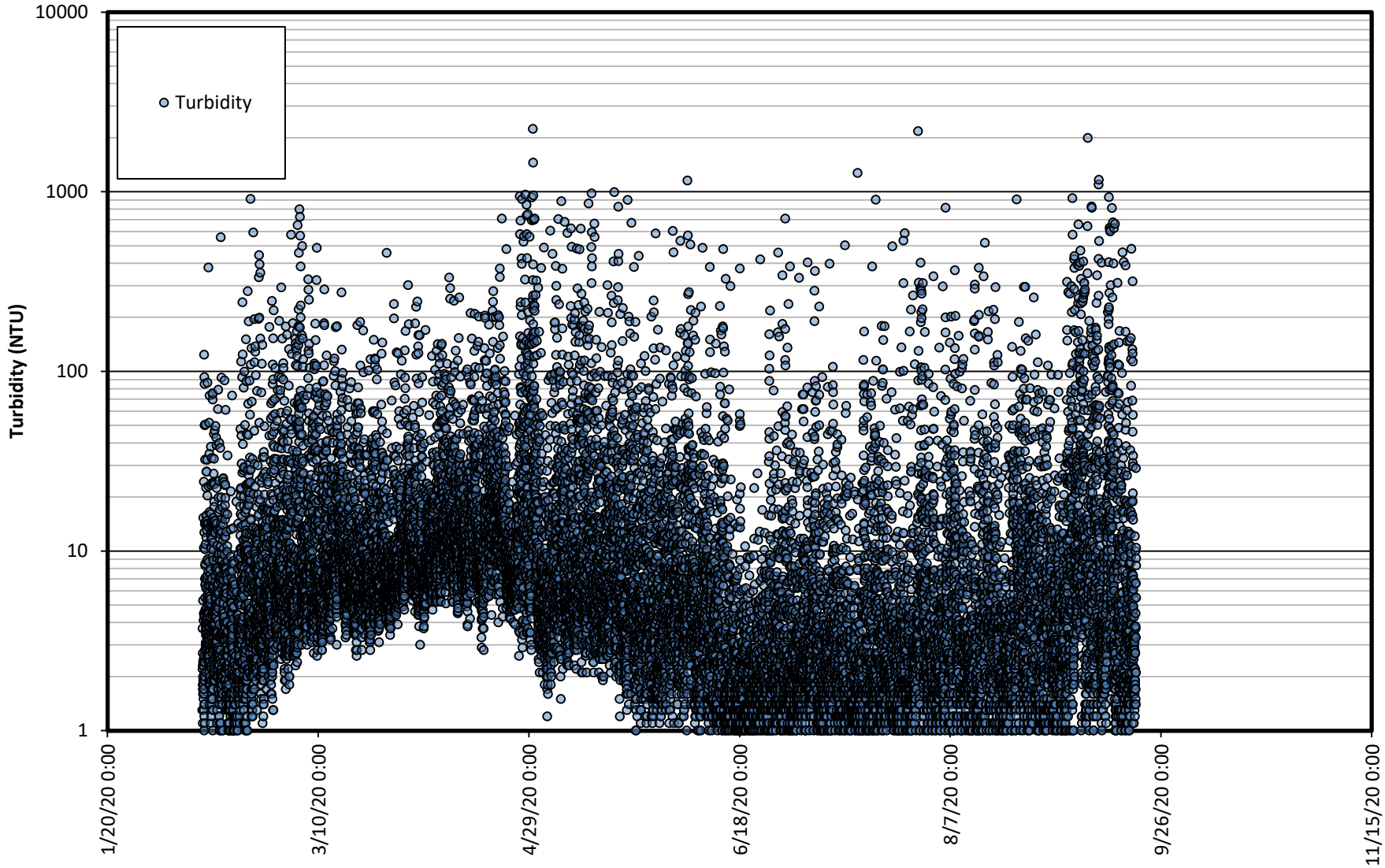
Upper West Martis Creek (TURB MC-5) 15-Min Turbidity Hydrograph



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Appendix F

Truckee River Rafting Inspections Photo Log

RR-0.22 20201007

RL-0.23 20201007

RL-0.24 20201007

RL-0.24 20201007

RL-0.24 20201007

RL-0.27 20201007

RL-0.27 20201007

RL-0.35 20201007

RL-0.35 20201007

RL-0.57 20201007

RL-0.57 20201007

RL-0.57 20201007

RL-0.57 20201007

RL-0.73 20201007

RL-0.73 20201007

RR-0.88 20201007

RR-0.88 20201007

RR-0.88 20201007

RR-1.05 20201007

RR-1.05 20201007

RR-1.05 20201007

RR-1.54 20201007

RR-1.54 20201007

RR-1.59 20201007

RR-1.59 20201007

RR-2.17 20201007

RR-2.17 20201007

RL-2.40 20201007

RR-2.84 20201007

RR-2.89 20201007

RR-2.89 20201007

RR-3.03 20201007

RR-3.03 20201007

RR-3.03 20201007

RL-3.08 20201007

RR-3.33 20201007

RR-3.33 20201007

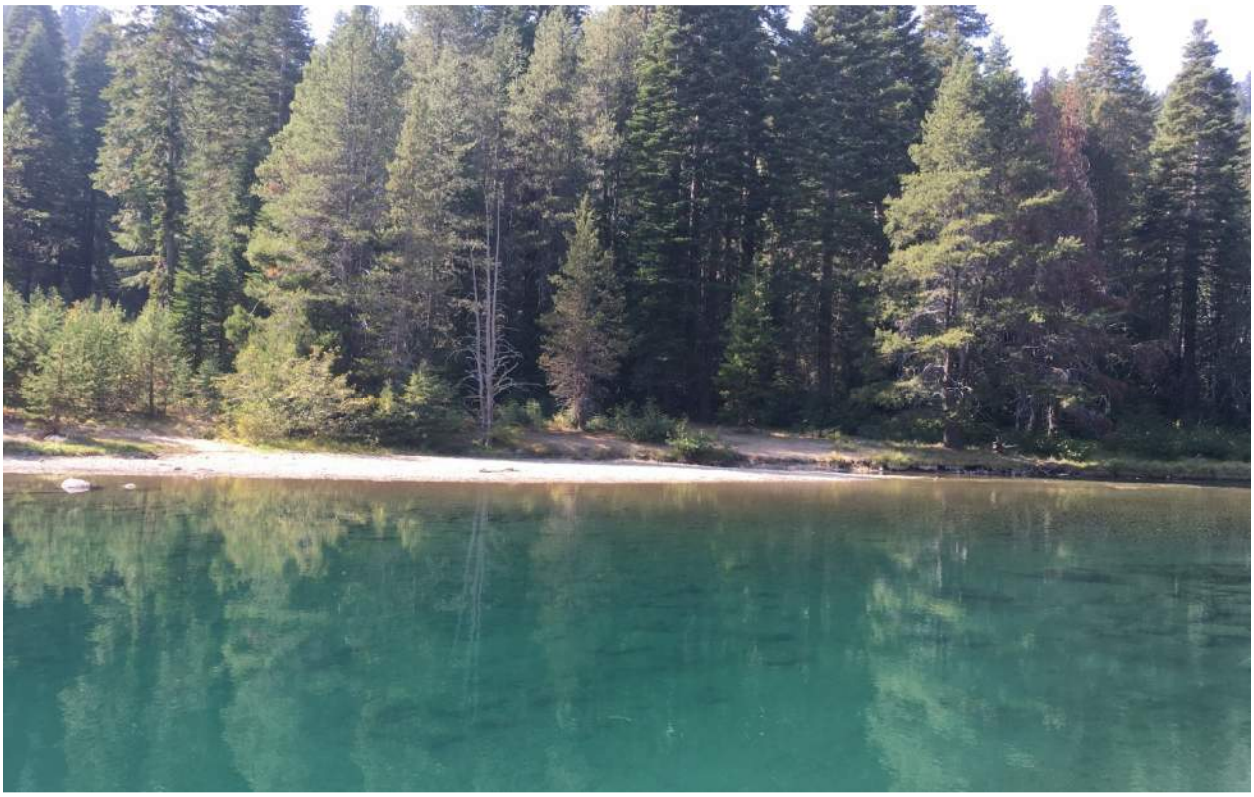
RR-3.33 20201007

RR-3.33 20201007

RR-3.33 20201007

RR-3.33 20201007

RR-3.33 20201007



RL-3.39 20201007

RL-3.39 20201007

RR-3.81 20201007

RR-3.81 20201007

RR-3.81 20201007