Appendix A

Synthesis of existing assessments of water quality and ecological condition within the middle Truckee River as of April 2008.

Goal 4 of the TRWQMP is to facilitate collaboration, effort-sharing and integration of multiple independent private and public water quality assessment efforts. Appendix A presents a synthesis of existing water quality assessment efforts within the project area. The purpose of this exercise is to identify existing monitoring efforts, particularly those within high disturbance sub-watersheds, and to evaluate whether or not each of these efforts has the potential to be integrated into the TRWQMP. Figure A.1 spatially displays sampling locations and general assessment types for the monitoring programs described below. Monitoring stations with unknown locations and those stations located in ponds or other surface drainages that do not drain to the Truckee River or its tributaries are not included in Figure A.1 (Timilick, Old Greenwood Golf Course). A summary of the key components of the monitoring programs are also presented in Table A.1.

Section 5.0 indicates which existing assessments will be incorporated into the TRWQMP to meet the standards, goals and objectives of the comprehensive monitoring plan.

<u>Martis Creek Sub-watershed</u>

Monitoring Program: Martis Camp (MAR-1)
Operating Entity: DMB/Highlands

Pursuant to Placer County's "Martis Valley Community Plan", and the water quality certification requirements (Resolution R6T-2006-0021) of the Lahontan Regional Water Quality Control Board (the Board), DMB/Highlands has developed and implemented a monitoring plan for Martis Camp (formerly Siller Ranch) on Martis Creek.

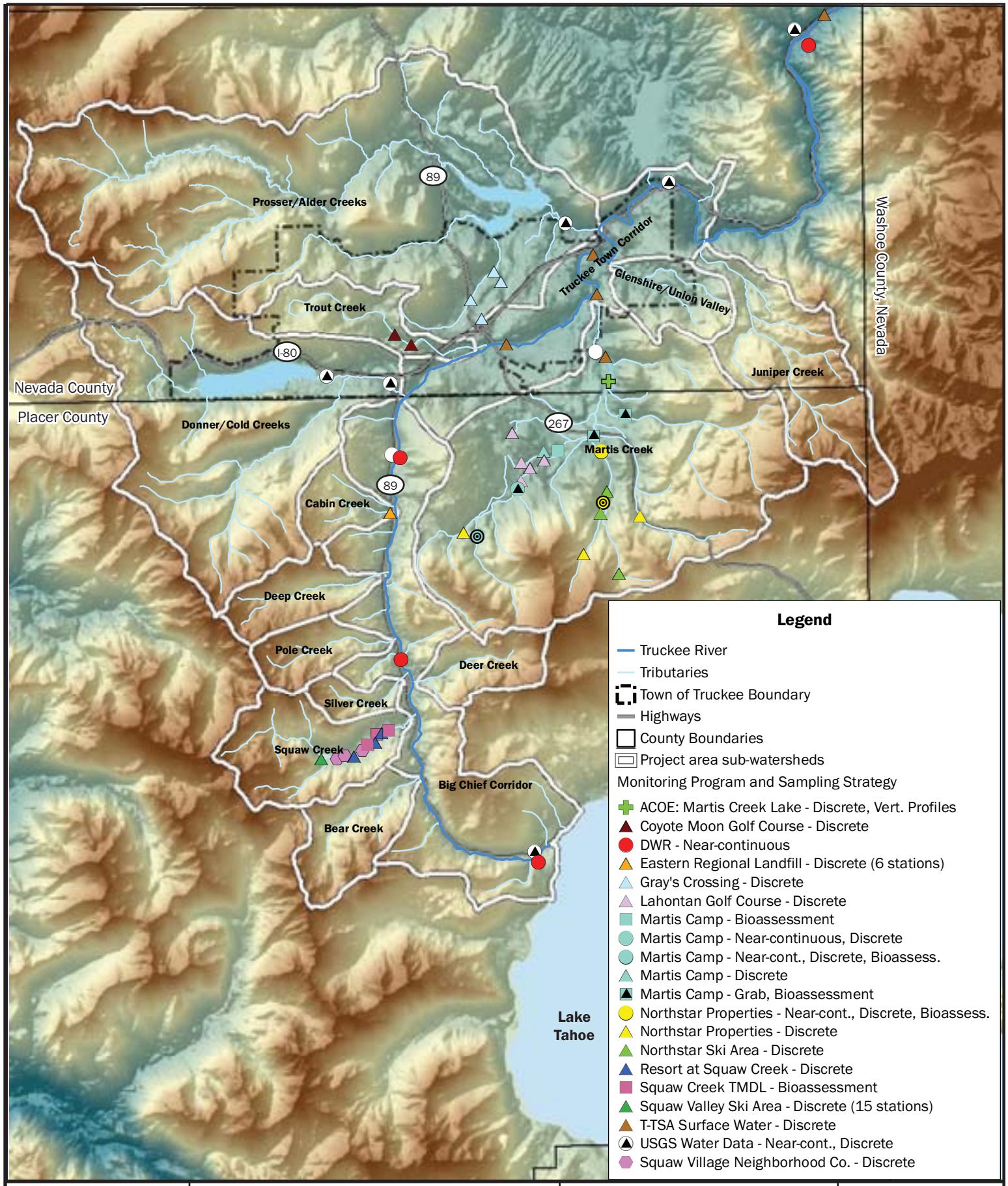
The Martis Camp Monitoring Program is meant to be consistent with the Martis Valley Community Plan, which states:

"The County shall work with the Lahontan WQCB, the ACOE, TSA, and private landowners to initiate a comprehensive water quality monitoring program to address the cumulative impacts on water quality in Martis Creek Lake and the creeks which drain into it. The programs shall strive to coordinate existing water quality monitoring efforts underway presently and modify those as necessary to create a comprehensive program."

The purpose of the Martis Camp program is to:

1) Demonstrate compliance with Board Resolution R6T-2006-0021;
2) Develop a better understanding of whether and where water quality impacts may be occurring; and
3) Develop an adaptive management program as a contingency and mitigation measure for project related impacts to water quality within the Project Area.

The Martis Camp compliance monitoring program emphasizes testable hypotheses to track the frequency of exceedance of either Lahontan Basin Plan standards or the non-degradation standards for specific water quality parameters.



2NDNATURE LLC

Map of existing surface water quality monitoring efforts in the project area of the Middle Truckee River.

0 1 2 3 4 Miles

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FIGURE A.1

Table A.1. Summary of existing assessments within the TRWQMP project area (April 2008)

Monitoring Program	Program Code	Operating Entity	# of Sites	Spatial area of assessment	General Area of Assessment	Site name (Site code)	Performance Assessment Type	Monitoring Span	Frequency of Sampling	Parameters	Hydrology data	Strategy for Data Analysis	Purpose
MARTIS CREEK SUB-WATERSHED													
Martis Camp	MAR-1	DMB/Highlands	5	Community	Martis Creek, and Martis Camp Golf Course	MC-1 to MC-5	Near Continuous at MC1&2; Discrete only at MC3-5	2004-present at MC1 & 2; 2007-present at MC3-5	Weekly	Nut., TSS, TDS, Turb., C	Continuous at MC1 & MC2, 2004-06	Upstream/downstream and WQO comparisons	The purposes of the Martis Camp monitoring program are 1) to demonstrate compliance with Board Resolution R6T-2006-0021; 2) to identify where and when WQ impacts are occurring so that corrective action can be taken.
			5		Surface runoff to and from Martis Camp	G-1 to G5	Discrete WQ	2007-present	6X/yr, when flowing	Nut., TSS	not measured	Comparison to WQO	
			20	BMP Effectiveness	Golf course greens & treatement BMPs	O1-O6; GRN1-18; GRN28-2929	Discrete WQ	2007-present	4-6X/yr, when flowing	Nut., TSS	not measured	Comparison to WQO	
Lahontan Golf Course	MAR-2	Lahontan Golf Course	4	Community	Martis Creek	QW1 - QW-4	Discrete WQ	3/1/03 - present	Quarterly	Nut., Met., TSS, PHC, OG	not measured	Comparison to WQO	The purposes are to assure compliance with the Basin Plan standards, and to identify WQ problems so that they can be corrected.
			12			5-16	Discrete WQ	3/1/03 - present	Quarterly	Nut., Met., TSS, PHC, OG	not measured	Comparison to WQO	
Northstar Properties	MAR-3	Northstar Mountain Properties, LLC (East West Partners)	2	Community	Martis Creek	West Martis Creek at Bridge (Northstar-4), West Martis Creek (Northstar - 7)	Automated, continuous	2007-present	Near-continuous	C, T, Turb., pH	Continuous	Comparison to WQO	The purpose of Northstar Mountain Properties' monitoring program is to 1) demonstrate compliance with the Board's Order; 2) to comply with the Martis Valley Community Plan, and 3) to identify water quality problems so they can be corrected.
			5			West Martis Creek at Bridge (Northstar-4), Martis Creek (Northstar-5), Middle Martis Creek (Northstar-6), West Martis Creek (Northstar - 7), West Fork of West Martis Creek (Northstar-8)	Discrete WQ	2007-present	Varies by parameter (weekly to yearly)	Nut., Met., TSS, TDS, Pest., D	Instantaneous at time of sample	Upstream/downstream, WQO and baseline comparisons	
			2			West Martis Creek at Bridge (Northstar-4), West Martis Creek (Northstar - 7)	Bioassessment	2007-present	Yearly	Invertebrate metrics	not measured	Annual repetition of bioassessment	
Northstar Ski Area	MAR-4	Northstar-at-Tahoe (Trimont Properties)	3	Community	West Martis Creek	N-1, N-2, N-3	Discrete WQ	1993-present	Weekly during snowmelt	Nut., Turb., OG	Instantaneous at time of sample (estimated)	Comparison to WQO	The purposes of the monitoring program for the Ski Area are 1) to ensure compliance with Board Order 93-89A1; 2) identify problems so that they can be corrected.
Timilick	MAR-5	Martis Valley Associates, LLC	4	Community	Timilick GC and runoff from development	WC4, 5, 8 & 9	Discrete WQ	3/2007-present	monthly	Nut., TTS, TDS, Turb., C, OG, TPH	not measured	Comparison to WQO	The purpose is to comply with Board Order and with the Martis Valley Community Plan. Some plan details may be renegotiated.
Martis Creek Lake	MAR-6	U.S. Army Corps of Engineers	4	Receiving waters	All developments in West and Upper Martis Creeks	WC4, 5, 8 & 9	Discrete WQ	1974-1978; 1996-present	2x/yr	Clarity, Nut., MTBE, pH, T, Alk., DO, Met., phytoplankton	not measured	Long-term time series	The purpose is to ensure a continuous level of water quality in the lake for both recreation and environmental health and to satisfy the Department of Army Engineering Regulation 1110-2-8154, "Water Quality and Environmental Management for Corps Civil Works Projects".

Table A.1. Summary of existing assessments within the TRWQMP project area (April 2008) (continued)

Monitoring Program	Program Code	Operating Entity	# of Sites	Spatial area of assessment	General Area of Assessment	Site name (Site code)	Performance Assessment Type	Monitoring Span	Frequency of Sampling	Parameters	Hydrology data	Strategy for Data Analysis	Purpose
TRUCKEE RIVER MAINSTEM AND MULTIPLE SUB-WATERSHEDS													
USGS Water Data	TR-1	USGS	8	Main stem Tributary	Truckee River Main Stem, Donner Creek, Prosser Creek, Martis Creek	Truckee River at Tahoe City , Truckee River near Truckee, Truckee River at Boca Bridge, Truckee River at Farad, Donner Cr. at HW89, Donner Cr. at Donner Lake, Prosser Cr. near Truckee, Martis Cr. near Truckee	Automated sampling, near continuous probes	1890-present (varies by site)	Near-continuous	C, T, D, Precip. (varies by site)	Continuous	Long-term time series	The purpose is to collect long-term information on the quantity and quality of surface waters and disseminate that information to the public, State and local governments, public and private utilities, and other Federal agencies involved with managing our water resources.
			5			Truckee River at Tahoe City, Truckee River near Truckee, Truckee River at Farad, Prosser Cr. near Truckee, Martis Cr. near Truckee	EWI	1960-1996 (varies by site)	Varies by parameter	Nut., Met., Org., SCC,D	Continuous		
T-TSA Surface Water Sampling	TR-2	T-TSA	5	Community	Truckee River Main Stem, Martis Creek	Truckee River Main Stem (T-1, T-2, T-3); Martis Creek (M-1, M-2)	Discrete WQ	1978-present	Monthly and Quarterly	pH, Alk., Turb., T, DO, DOC, TDS, Nut., Met., TC, FC, SO4	not measured	Comparison to WQO	The purpose of this program is to fulfill surface water sampling under the Waste Discharge Requirements (WDR) (WDID No. 6A290011000) issued by Lahontan.
Gray's Crossing	TR-3	East West Partners	7	Community	Intermittant & ephemeral streams on site	SW-1 to SW-4	Discrete WQ	2005-present	3X/yr	Nut.,TDS,C, Turb., T, pH, DO,Pest.	not measured	Comparison to WQO	The purposes of the Old Greenwood program are 1) to measure compliance with a Board order and other regulatory requirements; and 2) to ensure that the golf course IPM program is functioning properly.
Old Greenwood Golf Course	TR-4	East West Partners	3	Golf Course	Ponds on GC	SW-1 to SW-3	Discrete WQ	2005-present	3X/yr	Nut.,TDS,C, Turb., T, pH, DO,Pest.	not measured	Comparison to WQO	The purposes of the Gray's Crossing program are to 1) establish a pre-project WQ baseline; 2) measure compliance with a Board order and other regulatory requirements; 3) Ensure that the golf course IPM program is functioning properly.
Coyote Moon Golf Course	TR-5	Tahoe Mountain Club	4	Golf Course	Trout Cr. Watershed	QW-1 to QW-4	Discrete WQ	1996-present	Monthly May-Oct, and at beginning and end of season	Nut, pH, TSS, C, DO, O&G, Turb.	not measured	Comparison to WQO	The purpose of the water quality monitoring is to evaluate any impacts to surface water as a result of stormwater runoff or applications of fertilizers or chemicals to the golf course.
Eastern Regional Landfill	TR-6	Holdrege and Kull (for Placer County)	6	Community	Surface water drainages to Truckee River main stem	S-2, S-6, S-7, S-11, S-12, S-13	Discrete WQ		2x during wet season; additional storm events if determined to be necessary	Nut., Met., Cl, Fe, TSS, C, pH, COD	not measured	Comparison to WQO	The goal of the monitoring is to comply with monitoring required by a WDRs (WDID No. 6A310041000) and NPDES General Permit No. CAS000001 issued by Lahontan, and to track the effectiveness of the Storm Water Pollution Prevention Plan (SWPPP).
Department of Water Resources Truckee River Water Quality Monitoring Program	TR-7	DWR	4	Main Stem	Truckee River Main Stem	Truckee River at Tahoe City (DWR-TAHOECIT, Truckee River at Bridge 8 (DWR-BRIDGE8), Truckee River near Truckee (DWR-TRNT), Truckee River at Farad (DWR-FARAD)	Automated sampling, near continuous probes	3/2000-present	Near-continuous (every 15 minutes)	S, C, pH, Turb., T, DO	Continuous	Sediment load time-series; Long term status and trend.	The purpose of this program is primarily to provide baseline data which can be of use to: (1) The public and other interested parties, including local watershed groups, researchers, as well as local, state, and federal agencies who may have an interest in the quality of Truckee River waters. (2) Interested parties involved in the development of the Truckee River Operating Agreement (TROA) and its related efforts.
							Discrete WQ	3/2006-7/2006	Monthly	Nut., Met., TDS, Alk., pH, Turb., SO4	Continuous		
Truckee River Sanpshot Day	TR-8	Truckee River Watershed Council	28 +/-	Middle Truckee R. Basin	Main Stem and tributaries	varies	Discrete WQ	2003-present	Annually	Nut, DO, C, Turb,, pH, T, FC	not measure	Annual repetition of discrete measurements	The purpose of the program is to provide a synoptic sample of water quality across a broad range of streams
Truckee River Aquatic Monitors	TR-9	Truckee River Watershed Council	18 +/-	Middle Truckee R. Basin	Main Stem and tributaries	varies	Bioassessment	2000-present	Annually, sites vary each year	T, DO, C, pH, benthic macro-invertebrates, physical habitat	not measure	Annual repetition of bioassessment	The purpose of the program is to provide a synoptic sample of benthic macro-invertebrate community health across a broad range of streams

Table A.1. Summary of existing assessments within the TRWQMP project area (April 2008) (continued)

Monitoring Program	Program Code	Operating Entity	# of Sites	Spatial area of assessment	General Area of Assessment	Site name (Site code)	Performance Assessment Type	Monitoring Span	Frequency of Sampling	Parameters	Hydrology data	Strategy for Data Analysis	Purpose
SQUAW CREEK SUB-WATERSHED													
Resort at Squaw Creek	SQV-1	Resort at Squaw Creek	3	Community	Squaw Creek Tributary	R-5, R-9, Pond A Outflow	Discrete WQ	1986-present	2x/yr	Nut., TSS, TDS, Cl, SO4, Fe, OG	Instaneous at time of sample	Comparison to WQO	The purpose of this program is to comply with Board Order 6-93-26 and 6-93-26A1.
Village at Squaw Valley	SQV-2	Squaw Village Neighborhood Company	5	Urbanized area, Squaw Valley	Squaw Creek Tributary	Inflow, Outflow, Squaw Creeek above & below discharge	Flow weighted composites of discrete samples	1993-present	Periodic during runoff	Nut., TSS, Turb., Fe, OG	Continuous when flow is present	BMP effectiveness	The purpose of this program is to measure the effectiveness of a stormwater treatment facility that treats runoff from the Village and parking lot, pursuant to orders 6-23-25 and R6T-2003-0002.
Squaw Valley Ski Corp. (SVSC)	SQV-3	Squaw Valley Ski Corporation (SVSC)	15	Community	Squaw Creek Tributary	SC-2 to SC-18	Discrete WQ	1993-present	Weekly Apr-June; during runoff events	Nut., Turb., TSS,Fe, Cl, TDS	Instantaneous at time of sample (estimated)	Comparison to WQO	The purpose is to comply with Board Order and Reporting Program 6-93-25
Squaw Creek TMDL Bioassessment	SQV-4	SVSC, Intrawest, Resort at Squaw Creek, Placer County	3	Tributary	Squaw Creek Tributary	Upper, Middle & Lower Meadow	Bioassessment	Begins in 2009	Every 2 yrs	Macro-invertebrate metrics, physical habitat, pH, T, DO, C	Instantaneous at time of sample (estimated)	Comparison to defined scores of relative condition	The goal of the monitoring appears to be to establish long-term trends in the indices of stream health and biodiversity, rather than to determine the exceedance (of lack of it) of in absolute values terms..
Herbst Bioassessment (2002)	SQV-5	Sierra Nevada Aquatic Research Laboratory	22	Tributary	Squaw Creek Tributary and several other tributaries	6 Squaw Creek sites (Herbst-SC1 - Herbst-SC5); 16 reference sites (Herbst-REF1 - Herbst-REF16)	Bioassessment	8/2000 - 7/2001	Annual	Benthic macro-invertebrates, algae, organic matter, physical habitat,	Instantaneous at time of sample (estimated)	Bioassessment comparison across disturbance gradient	Bioassessment surveys of baseline conditions can provide an evaluation of the existing status of target watersheds in contrast to reference watersheds that have been selected to reflect the natural spatial and temporal variability expected for similar stream types in minimally disturbed habitats. Differences between reference and target conditions on Squaw Creek will be used here to evaluate the extent of sediment effects on biological integrity and provide a baseline and goal for monitoring ecological restoration.

In fall 2004, Martis Camp program installed near continuous water quality equipment at 2 stations on Martis Creek, at the upstream and downstream property lines. These included data loggers and probes for measuring and recording water depth, turbidity, temperature, pH and conductivity. Water velocity has been measured at surveyed cross-sections at the stations, and combined with stage (depth) data to calculate near continuous discharge. Samples have been collected on weekly intervals (more or less) for nutrient species analyses: nitrate + nitrite (NOx), ammonium (NH_4^+), total organic nitrogen (TKN), total P (TP) and soluble reactive P (SRP).

The Annual Monitoring Report for 2007 by Huffman & Carpenter does not include any discharge data or load calculations for either 2006 or 2007, so it in unclear if near continuous discharge is still being measured. Total load calculations and interpretation of concentration data are not possible without measurement of discharge.

In 2007, Martis Camp purchased data loggers, probes and automated (ISCO) sampling equipment for 3 additional stations. The equipment was installed at stations at the downstream boundary of the Lahontan golf course/subdivision, and just upstream of Highway 267. The station planned for the E. Fork of Martis Creek has not yet been installed. Since all three sites are located on property of the U.S. Army Corps of Engineers, the project proponent requested that the County be the ACOE permittee, as there are some administrative advantages, and because the stations would be part of the anticipated Martis Creek comprehensive monitoring program (part of this current effort). The County is unwilling to accept this responsibility and liability, until it is proven that these monitoring elements are part of the overall monitoring program, and until the County is ready to implement the monitoring program.

At present, the two installed stations are not being operated or maintained, and equipment for the third remains in storage. The cost to get these stations in working order may be significant. Martis Camp is, however, collecting weekly grab samples at these 3 additional stations for analysis of the same nutrient species analyzed upstream.

In addition to the 5 stations presented above on Martis Creek, discrete water quality samples are collected during storm events at five additional sites locations that represent surface flow onto or from the developed areas. Samples are also collected from overflow during runoff events at overflow sites in the BMP “treatment train”, and on the golf course greens. Three groundwater wells have been installed and are sampled quarterly (when water is present) for total nitrogen (TN), total phosphorus (TP) and suspended sediment (TSS).

The current monitoring plan includes sampling of benthic invertebrates at 4 stations along Martis Creek in every other year. Samples were collected in Sept. 2006, but the results are not included in the 2007 annual monitoring report prepared by Huffman & Carpenter.

2NDNATURE comments: Groundwater wells should only be sampled for dissolved species as particulate material (>0.45um) is assumed to not be mobile in the subsurface environment. TSS measurements from a monitoring well are essentially meaningless and provide no information on the quality of the groundwater resources.

Monitoring Program: Lahontan Golf Club (MAR-2)
Operating Entity: Lahontan Golf Club

As part of its Chemical Application Management Plan, the Lahontan Golf Club has collected (since 2003) discrete water quality samples quarterly at 5 locations on Martis Creek or small tributaries within its property. The purpose of the sampling is to assure compliance with

Lahontan Basin Plan water quality standards, and to identify problems that should be addressed in the future. Samples are analyzed for pH, conductivity, dissolved oxygen (DO), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), 3 species of nitrogen (TKN, NOx, NH_4^+), 2 species of phosphorus (TP, SRP), total petroleum hydrocarbons (TPH), Oil & Grease, applied pesticides (which vary quarterly), iron, sodium, chloride, sulfate and boron.

In addition to the quarterly discrete sample collection, stormwater runoff samples are collected on the golf course at several sites, and analyzed for the same constituents.

Monitoring Program: Northstar Properties (MAR-3)
Operating Entity: Northstar East West Partners (Northstar Mountain Properties LLC)

East West Partners has recently developed a monitoring program for their project at Northstar (Northstar Mountain Properties LLC). The purpose of the monitoring program is to demonstrate compliance with the Board's Section 401 Water Quality Certification and Waste Discharge Prohibition Exemption (WDID 6A310503002). The Northstar Properties program is also aimed to comply with the Martis Valley Community Plan's requirement for cumulative effects monitoring, and to ensure the effectiveness of mitigation measures so that project impacts remain less than significant.

Five sampling sites have been identified, and data collection began in January 2007. Table A.2 describes the site locations. At sites 4 and 7, the program includes annual macroinvertebrate sampling, physical habitat assessment, and near-continuous (15 min.) measurement of stage, turbidity, conductivity and pH. Discharge is calculated from stage, velocity measurements and surveyed cross sections. At all of the sites, weekly measurements and grab samples are taken for: discharge, TP, SRP, Particulate P (PP), TN, TKN, NOx, NH_4^+, Particulate Organic N (PON), and total suspended sediment (TSS). TDS is measured from samples monthly, and chloride, sulfate, TPH, and applied pesticides are measured in samples quarterly. One sample is taken in July or August at each of the 5 sites for analysis of sediment toxicity.

Site I.D.	Monitoring Location Description
4	West Martis Creek, at bridge, where it exits the golf course
5	Martis Creek upstream of Shaffer Creek tributary, just south of Sect. 2 section line (USGS 15 min map)
6	Middle Martis Creek, just upstream of Northstar's old access road in Sect. 33 (USGS 15 min map)
7	West Martis Creek, between confluence with West Fork West Martis Creek and culvert under Northstar Drive
8	West Fork of West Martis Creek, upstream of Highlands Drive Project

Table A.2. Locations of the Northstar Properties monitoring stations.

Monitoring Program: Northstar Ski Area (MAR-4)
Operating Entity: Northstar-at-Tahoe/Trimont Properties

Northstar-at-Tahoe has been monitoring water quality on and below their ski area since 1993, pursuant to Board Order No. 93-89A1. Samples from 3 stations on West Martis Creek are collected weekly during April-June, when flow at the middle station exceeds 5 cfs at 3 stations. The samples are analyzed for TKN, NOx, TP, TSS, TDS, turbidity and Oil and Grease.

Monitoring Program: Timilick (MAR-5)
Operating Entity: Martis Valley Associates, LLC

In order to comply with the terms of the Martis Valley Community Plan as well as requirement of the Board, the Timilick Tahoe Development has developed a Chemical Application Management Plan (CHAMP) and monitoring plan that includes a) monthly monitoring of surface water in four ponds on the golf course; b) sampling of shallow groundwater wells located near the golf course; c) event-based discrete monitoring of water from golf course green "dry sumps". Samples are analyzed for TP, dissolved phosphorous (DP), NOx, TDS, dissolved organic nitrogen (DKN), TKN, turbidity, TSS, conductivity, oil & grease, and TPH. The first successful sampling was carried out in March 2007.

Monitoring Program: Martis Creek Lake (MAR-6)
Operating Entity: U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers conducted annual water quality monitoring in Martis Creek Lake between 1974 and 1978, and this program resumed in 1996. The purpose of this monitoring program is to ensure a continuous level of water quality in the lake for both recreation and environmental health and to satisfy the Department of Army Engineering Regulation 1110-2-8154, "Water Quality and Environmental Management for Corps Civil Works Projects". Sampling is conducted twice each year – once in the spring (April) and once during the summer (August). Vertical profiles of temperature, dissolved oxygen, and pH are conducted, and discrete samples are analyzed for a suite of metals, nutrients, methyl tertiary-butyl ether (MTBE), and phytoplankton community abundance. The Secchi depth is also measured.

<u>Truckee River Main Stem and Multiple Sub-watersheds</u>

Monitoring Program: U.S. Geological Survey Water Data (TR-1)
Operating Entity: U.S. Geological Survey

The U.S. Geological Survey (USGS) has maintained near-continuous monitoring stations at several locations within and around the project area. Four stations are located along the Truckee River: at Tahoe City (USGS Site #10337500), near Truckee (USGS Site #10338000), at the Boca Bridge (USGS Site #10344505), and at Farad (USGS Site #10346000). The Truckee, Boca Bridge, and Tahoe City sites are within the project area, and the Farad site is downstream of the project area. Additional tributary stations include two sites along Donner Creek (USGS Site #10338500 at Donner Lake, and USGS Site #10338700 at Highway 89), one site along Martis Creek near the Truckee River (USGS Site #10339400), and one site along Prosser Creek downstream from Prosser Creek Dam (USGS Site #10340500). Instrumentation at the Farad site includes an automated probe to measure *in situ* turbidity. Near continuous stage is also collected at all stations and combined with periodic manual discharge measurements to convert stage to discharge. The tributary sites only have near-continuous discharge and temperature records. Discharge measurements date back to 1890 for some sites. Between 1960 and 1996, periodic grab samples were collected for nutrients, metals, priority organics, and suspended sediment concentration (SSC).

Monitoring Program: Tahoe-Truckee Sanitation Agency Surface Water Monitoring
Operating Entity: Tahoe-Truckee Sanitation Agency (TR-2)

The Tahoe-Truckee Sanitation Agency (T-TSA) is responsible for treating and disposing of wastewater delivered to it by its 5 member entities. The T-TSA wastewater treatment facilities

are located about 2 mi. east of the Highway 267 bridge over the Truckee River. Treated wastewater is discharged into a subsurface effluent disposal field about 1/3 mi. southwest of the wastewater treatment facilities. T-TSA is currently collecting grab samples at 3 sites along the Truckee River and 2 sites along Martis Creek (below Martis Dam, and just upstream of the confluence with the Truckee River.) in fulfillment of WDRs (WDID 6A290011000) issued by the Board. The samples are analyzed for a suite of chemical and biological constituents, including nutrients, metals, turbidity, and total and fecal coliform.

Monitoring Program: Gray's Crossing (TR-3)
Operating Entity: East West Partners

The Gray's Crossing golf course and subdivision sits on a 789 acre site north of I-80 and east of Highway 89. The development is a project of East West Partners. There are two intermittent or ephemeral streams on the site, and some large wet meadows, but no perennial streams.

The monitoring plan for the golf course and subdivision is described in the Natural Resource Management Plan prepared for East West Partners by the Audubon International Institute. Discrete samples are collected 3 times per year (fall, winter and spring) at 7 sites. They are analyzed for chloride, NOx, TP, TDS, conductivity, turbidity, pH, DO, and applied pesticides. Sampling began in 2005 and continues today.

Monitoring Program: Old Greenwood Golf Course (TR-4)
Operating Entity: East West Partners

The Old Greenwood Golf Course is located northeast of Truckee, just south of I-80. There are 3 surface water sampling sites, at ponds in the golf course, and 3 shallow groundwater monitoring wells. Samples are collected 3 times/yr, in spring, summer and fall, and are analyzed for DO, NOx, nitrite (NO_2^-), TP, chloride, TDS and turbidity. Samples are also analyzed for applied pesticides, which in 2006 included Clopyralid, Ethofumesate, Oryzalin, PCNB, Propiconazole, Pyraclostrobin, and Glyphosate. Sampling began in 2005 and continues today.

Monitoring Program: Coyote Moon Golf Course, Truckee (TR-5)
Operating Entity: Tahoe Mountain Club

Coyote Moon Golf Course (Coyote Moon) located in Truckee, California, conducts water quality monitoring as a condition of their Chemical Application Management Plan (CHAMP) (January 1996). The purpose of the water quality monitoring is to evaluate any impacts to surface water as a result of stormwater runoff or applications of fertilizers or chemicals to the golf course. The monitoring program consists of collecting surface water grab samples and flow measurements on a monthly basis during the open season of the course, collection before and after the open season of the course, and sampling storm events. Water samples are analyzed for constituents as specified in the water quality objectives for Trout Creek from the Lahontan Basin Plan (LRWQCB 1995). Trout Creek is the receiving water body, thus water quality standards have been and continue to be evaluated with respect to the designated Trout Creek numerical standards in the Lahontan Basin Plan.

Samples are collected monthly during the open season of the golf course (May through October), one sample in early May approximately one month prior to season opening, and one sample in November approximately one month after the season closing. Samples are collected during approximately the same week of each month.

During monthly sampling and the pre- and post-season sampling events, samples are collected from two locations, QW-1 and QW-4 on Trout Creek. These locations represent water quality delivered onto the Coyote Moon property (QW-1), and water leaving the property (QW-4). Every other month, a duplicate sample is taken from one of the sites.

During the pre- and post-season sampling events, samples are collected from two additional locations, QW-2 and QW-3, on Trout Creek. These locations represent water quality in Trout Creek at the point where drainages running through the golf course discharge to Trout Creek.

Water quality samples are analyzed for NO_x-N, TKN, TP, pH, TSS, TDS, DO, oil and grease, and turbidity.

Monitoring Program: Eastern Regional Landfill (TR-6)
Operating Entity: Holdrege and Kull (for Placer County)

The Eastern Regional Landfill (ERL) is a closed solid waste facility about 1.5 mi. south of Truckee, on the east side of Highway 89. The approximately 150 acre site was closed in 1994, and a program was implemented to collect discrete surface and groundwater samples. The monitoring program, undertaken by the firm of Holdrege and Kull for Placer County, includes surface water sampling at the beginning and end of the wet season, and during storm runoff. At 6 sites, surface water samples are collected and analyzed for chloride, total iron, TSS, conductivity, and pH. NH_4^+-N and a suite of heavy metals are analyzed in samples from 2 sites, and chemical oxygen demand (COD) is analyzed in samples from 3 sites. Samples are collected twice during the wet season, with additional samples collected during or after prolonged storm events if determined to be necessary.

Monitoring Program: Department of Water Resources (DWR) Truckee River Water Quality Monitoring Program (TR-7)
Operating Entity: Department of Water Resources

Since March 2003, the Department of Water Resources has operated 4 near-continuous monitoring stations along the Truckee River. Three of the sites are located within the project area, and one is located downstream at Farad. The stations correspond to existing USGS gages at Tahoe City, near Truckee, and at Farad. The sites include automated probes for turbidity, salinity, conductivity, pH, temperature, and DO, as well as stage recorders. Periodic discrete water samples were collected during 2006 but are not currently part of the monitoring plan.

Monitoring Program: Truckee River Snapshot Day (TR-8)
Operating Entity: Truckee River Watershed Council

The Truckee River Watershed Council mobilizes and coordinates stakeholders and volunteers one day per year, typically in spring, at approximately 28 sites along the Truckee River and associated tributaries. Not all of the 28 sites are located within the TRWQMP project areas. Snapshot day consists of discrete water quality measurements using hand-help probes and water sample collection for a number of water quality parameters. *In situ* measurements include DO, conductivity, pH temperature. Collected samples are analyzed by a laboratory for turbidity, nutrients, and fecal coliform. The intensity of sampling (number of sites and parameters measured) depends on the number of volunteers and that availability of hand-held equipment. The purpose this community event is to provide a one-day "Snapshot" of the health of the rivers

and streams that flow into and within the Truckee River. Long-term continuation of these efforts can improve the data available to determine long-term condition of these surface water systems.

(Note: Sites not indicated on Figure A.1 due to number of sites)

Monitoring Program: Truckee River Aquatic Monitors (TR-9)
Operating Entity: Truckee River Watershed Council

The Truckee River Aquatic Monitors (TRAM) volunteer group has been collecting bioassessment data on streams within the Truckee River watershed since 1999. Sampling locations are described in Table A.3. Data collected include a basic physical habitat assessment, basic stream chemistry (temp., DO, conductivity, pH), and benthic macroinvertebrates (BMI). BMI samples are analyzed either by volunteers (300 count, taxonomic resolution: family) or by professional laboratories (900 count, taxonomic resolution: genus/species).

Stream	Location	Years monitored
Bear Creek	Near confluence with Truckee River	2002, 2003, 2004, 2006
Cold Creek	Near horseshoe bend in railroad	2000
Deep Creek	1.75 miles from confluence with Truckee River	2005
Deer Creek	About 1 mile upstream of confluence with Truckee River	2004
Donner Creek	Immediately downstream of Highway 89	2005
Juniper Creek	About 1.3 miles upstream of confluence with Truckee River	2004
Lower Martis Creek	Near confluence with Truckee River	2006
Martis Creek – East	Immediately upstream of dirt road crossing	2003
Martis Creek - Main	In Wildlife Area (upstream of Hwy 267)	2001, 2002, 2003, 2004, 2005, 2007
Martis Creek – Main	Main branch, downstream of highway 267	2000
Martis Creek – West	Below golf course, on USACE land	2003
Pole Creek	About 1.4 miles upstream of confluence with Truckee River	2004
Prosser Creek	Below the dam – just upstream of I-80	2003, 2007
Squaw Creek	Lower end of Squaw Meadow	2002, 2003, 2007
Trout Creek	Lower – near mouth	2000, 2003, 2007
Trout Creek	At Bennett Flat	2003
Truckee River at Granite Flat	Granite Flat Campground	2001, 2004
Truckee River at Horseshoe Bend	Near Hirschdale	2001, 2004

Table A.3. Truckee River Aquatic Monitors bioassessment sites and years monitored (Sites not indicated on Figure A.1 due to variability in monitoring years and number of sites).

<u>Squaw Creek</u>

Monitoring Program: Resort at Squaw Creek (SQV-1)
Operating Entity: Resort at Squaw Creek

Pursuant to the Board's updated waste discharge requirements (Board Order 6-93-26 and 6-93-26A1), the Resort at Squaw Creek collects discrete surface water samples at 3 sites in or near Squaw Creek, twice yearly. Samples are analyzed for chloride, sulfate, iron, NOx^-, TKN, Total

N, Total P, TDS, TSS, oil & grease, and (*in situ*) conductivity, pH temperature and DO. Shallow monitoring wells on the golf course are also sampled. Applied pesticides have been included in the analyses in the past, but results are not included in the most recent monitoring report (November 2007). Kleinfelder Inc. began the sampling (and an intensive experiment on golf course water quality) in 1986, and has continued to the present, making this one of the longest continuous discrete water quality monitoring programs within TRWQMP project area.

Monitoring Program: Squaw Village Neighborhood Company (SQV-2)
Operating Entity: The Village at Squaw Valley

Runoff from the Village at Squaw Valley and the Squaw Valley Ski Area parking lot at the East end of the valley floor is treated in a facility that includes sand/oil separators and a vertical media filter (VMF), pursuant to Board Orders No. 6-93-25, and No. R6T-2003-0002. The permit has three required elements: VMF treatment system effectiveness monitoring, surface water monitoring for Squaw Creek, and flow monitoring. During runoff events, the facility stormwater inflow and outflow volumes are measured and discrete samples are collected. The VMF samples are composited in proportion to instantaneous flow. Discrete samples are also collected from Squaw Creek, just upstream and 100 ft. downstream of the discharge point, during any week when the VMF is discharging. Samples are analyzed for TSS, turbidity, NOx, TKN, TN, DP, SRP, TP, total Fe, and (for the creek only) oil & grease. A minimum of 4 sample sets per year must be collected, during 24-hour periods of high flow. High flow is defined as follows: “Individual sample aliquots shall be collected using either equal flow-based or equal time-based collection techniques for a minimum of 4 runoff events per year that during any 24-hr period produce either a minimum peak influent flow of 0.55 cfs or a minimum total runoff volume of 3,000 ft^3.”

Monitoring Program: Squaw Valley Ski Area (SQV-3)
Operating Entity: Squaw Valley Ski Corporation (SVSC)

Pursuant to Board Order No. 6-93-25 and Monitoring and Reporting Program 93-25, the Squaw Valley Ski Corporation collects surface water samples at 15 surface sites and from 3 monitoring wells in the ski area. Most of the surface water sites are ephemeral. According to the Board Order, discrete samples are to be collected weekly in April-June when the flow in the South Fork of Squaw Creek (at its confluence with the North Fork) exceeds 20 cfs. During other months of the year, samples are to be collected during significant rainfall runoff when the South Fork discharge exceeds 1 cfs. Flow rate at each station is estimated, and samples are analyzed for Turbidity, TSS, TDS, TKN, NOx, TP, Total Fe, Cl, and (at two stations) Oil and Grease.

Monitoring Program: Squaw Creek TMDL Bioassessment (SQV-4)
Operating Entities: 4 Waste Discharge Requirement (WDR) holders in the sub-watershed (Squaw Village Neighborhood Company, Placer County Department of Public Works, Resort at Squaw Creek, Squaw Valley Ski Corporation)

Squaw Creek is on the 303(d) list as sediment-impaired, and the Board recently prepared a sediment TMDL for the stream. The TMDL is based on sampling and analysis of macroinvertebrates (mostly aquatic insect larvae) rather than on direct measurement of suspended sediment (SS). This is because many aquatic macroinvertebrates are very sensitive to SS, and the diversity and taxa in samples are known to integrate (over time) the biological effects of sediment and temperature. If the statistical challenges can be overcome, invertebrate sampling provides a good measure of “stream health”.

The goal of the Squaw Creek bioassessment appears to be to establish long-term trends in the indices of stream health and biodiversity, rather than to determine the exceedance (or lack of it) of specific macroinvertebrate indices.

Benthic invertebrate samples will be collected at 3 stations (the upper, middle, and lower meadows) in Squaw Creek, once every two years beginning in 2009. Sampling will be conducted and data analyzed according to detailed methods and protocols for bioassessment as outlined by Herbst (2001 and 2002). Sampling will also include measurements of stream velocity, depth, discharge and substrate size, along with pH, DO, temperature and conductivity.

The Squaw Creek bioassessment is the responsibility of Placer County, in addition to the three main operators in Squaw Valley (see above).

Monitoring Program: Herbst Bioassessment (2002) (SQV-5)
Operating Entity: Sierra Nevada Aquatic Research Laboratory

Within the Squaw Creek sub-watershed, Herbst (2002) enumerated benthic communities and monitored a number of physical and water quality site characteristics at 6 locations along the Squaw Creek tributary and at 16 reference tributaries within the TRWQMP project area, including Pole Creek, Juniper Creek, Cold Creek, Prosser Creek, North Prosser Creek, Bear Creek and Trout Creek. Sites within Martis Creek were also included as potential low disturbance sites, but biotic metrics suggested impaired conditions.

The habitat conditions evaluated in Herbst (2002) included riffle and pool distribution and length, slope, sinuosity, physical habitat, velocity, water depth, bank structure/stability, bank angle, ancillary water quality parameters (e.g. dissolved oxygen, water temperature, pH, etc.). Discrete water samples were analyzed for nitrogen and phosphorous concentrations. Samples were also collected and analyzed for algae and organic matter to determine the benthic food resources. Herbst (2002) tested the correlation of eight potential benthic biological response metrics to six sediment measurements. These measurements were based on both on-site habitat characterizations as well as the outputs of the DRI-developed AnnAGNPS (Annual Agricultural NonPoint Source) Model that predicted maximum sediment load at each study site (tons/upstream mile/meter of stream width).

Herbst (2002) found that the model's estimates of distributed sediment load, as well as the site's D50 particle size (median) in substrate and the percent of substrate that was sand-sized or smaller, all had a dose-response relationship with 7 benthic invertebrate community structure metrics : biotic index (a composite measure of community tolerance to pollution based on tolerance values and relative abundance), total taxa diversity, EPT (abundance of ephemeroptera, plecoptera, trichoptera) diversity (number of taxa belonging to mayfly, stonefly and caddisfly orders, typically regarded as intolerant to pollution), percent EPT, number of sensitive species, percent of tolerant taxa, and R50 dominance (number of taxa required to reach 50% of ranked abundance of all organisms, an inverse dominance measurement). Based on the multi-metric approach methods describe in Karr and Chu (1999), Herbst (2002) assigned a biological condition score (1, 3, 5) to a range of metric values. The scores for all 7 biological response metrics are summed to give an overall biological condition score to rate the relative biological integrity at the site.

The Herbst (2002) findings suggest that substrate grain size has a strong influence on the benthic community assemblage and integrity within the project area. Herbst (2002) defined the following water quality targets for the sediment dose measurements: a distributed load of less

than 400 tons/mile/m, a D50 particle size greater than 40mm, and a percent substrate as fines and sand less than 25%. Future bioassessment evaluations within the TRWQMP project area should focus upon station and reach characteristics that measure the substrate sediment conditions. The Sediment TMDL for Squaw Creek, approved in 2007 by the US EPA, will conduct substrate sediment and benthic invertebrate community condition monitoring at the 3 low-gradient, sites along the meadow reach of Squaw Creek every 2 years during the summer months (LRWQCB 2006), following the sampling and analysis methods used by Herbst (2002).

Appendix A References

Herbst, D.B. 2002. Development of Biological Water Quality Targets for Assessment of Total Maximum Daily Load (TMDL) of Sediment in the Squaw Creek Watershed. Final Report. Prepared for Lahontan Regional Water Quality Control Board. April 16 2002.

Herbst, D.B. 2001. Quality Assurance Project Plan – Aquatic Invertebrate Bioassessment Monitoring in the Eastern Sierra Nevada. Sierra Nevada Aquatic Research Laboratory and Lahontan Regional Water Quality Control Board.

Karr, J.R. & Chu, E.W. 1999 Restoring Life in Running Waters Better Biological Monitoring. Island Press, Washington DC.

LRWQCB. 2006. Total Maximum Daily Load for Sediment, Squaw Creek, Placer County. Final Staff Report. April 2006.