

Executive Summary

This report presents the results of implementing the third year of the Truckee River Water Quality Monitoring Plan (TRWQMP) which took place during the 2012 water year (October 1, 2011 – September 30, 2012). The report is a joint effort between Placer County (County) and the Town of Truckee (Town) and presents the results of both entities' monitoring activities.

Purpose and Objectives

As a Small Municipal Separate Storm Sewer System (MS4), the County and Town must comply with the State's general National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges. In accordance with this permit and other requirements, the County and Town collaborated to develop a comprehensive water quality monitoring plan.

The overall purpose of the TRWQMP is to assess the effectiveness of various Stormwater Management Plan (SWMP) related actions implemented by the County and Town to protect natural surface waters from the impacts of stormwater runoff. The goals of the TRWQMP are as follows:

- TRWQMP Goal 1: Ensure regulatory compliance with the NPDES permit, Lahontan Board Orders, Middle Truckee River Sediment TMDL, Squaw Creek sediment TMDL, and the Martis Valley Community Plan.
- TRWQMP Goal 2: Develop water quality monitoring datasets that will be scientifically defensible and provide accurate data to evaluate the effectiveness of Stormwater Management Programs 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: Ensure that the TRWQMP allows collaboration, effort-sharing and integration of multiple independent private and public monitoring efforts.

Implementation Overview

Implementation of Phase 1 of the TRWQMP began during the 2010 water year (October 1, 2009 through September 30, 2010) and has been continuous through the 2011 and 2012 water years. Information regarding the monitoring plan and protocols are found in the TRWQMP and the Sampling and Analysis Plans (SAP) that were prepared for the County and Town for the Phase 1 monitoring.

The 2012 water year (WY 2012) was well below average in terms of precipitation as compared to historical records. The discharge measured by the USGS near Truckee was below historical daily median values until January before climbing above the historical daily median values during the spring and summer. Flows peaked in April 2012 in response to the snowmelt runoff and releases from the dam in Tahoe City. There were no major fires, landslides, floods or other events during this period.

New construction activities in the project area during WY 2012 included roadway repair and drainage improvements on SR 267 and Hwy 89, residential construction, and new construction at Northstar-at-Tahoe. In 2011 and 2012, new construction at Northstar-at-Tahoe included new ski trails, a new

chairlift and a 700-seat on-mountain restaurant. The majority of these activities occurred in the Martis Creek watershed.

During the summer of 2011, a restoration project was implemented by the Town of Truckee on Trout Creek near downtown Truckee. Additionally, the Truckee River Watershed Council began the restoration of a portion of Coldstream Creek project during the summer of 2012. Each of these projects has potential to improve downstream water quality.

Data collected during WY 2012 is considered representative of current conditions and improves the baseline dataset which can be used for the evaluation of future changes in the watershed.

Year 3 TRWQMP implementation activities included a set of select monitoring activities in the Squaw Creek, Bear Creek, Martis Creek, and Truckee River (Town corridor) sub-watersheds that included:

- Rapid Assessment Methodology (RAM) to characterize the amount of fine substrate on streambeds,
- Bioassessments to evaluate the benthic macroinvertebrate community and physical habitat conditions Squaw and Martis Creeks,
- Community level water quality sampling to characterize the quality of stormwater runoff from various communities,
- Tributary level water quality sampling to characterize the water quality of the tributaries within the Martis Creek sub-watershed, and
- Stream gauge operation on Martis Creek to develop a continuous record of discharge.

Results and Discussion

Rapid Assessment Methodology

The purpose of the RAM monitoring is to characterize the accumulation and distribution patterns of fine sediment on the bottoms of surveyed channels. A long-term data set will allow tracking of the overall change in fine sediment distribution and identify specific areas of concern. RAM monitoring is conducted on a biannual basis; it was first conducted during WY 2010, and was conducted for a second time during WY 2012.

The second year of RAM monitoring included portions of Squaw, Martis, and Bear Creeks for the County, and Donner Creek, Trout Creek, and the Truckee River for the Town. The results indicate that Bear Creek has the least amount fine sediment on the channel bottom while Trout Creek in Truckee had the most. The channel substrate in the main stem of Martis Creek, the Truckee River, Donner Creek, and East Martis Creek each averaged more fine particles than Bear Creek, but less than other monitored areas. West Martis Creek and Trout Creek contained the largest percentages of particles less than 2mm.

Bioassessment

Bioassessments provide an overall indication of stream health by evaluating the benthic macroinvertebrate community and physical habitat conditions present in a given stream reach. A long-term dataset will allow tracking to determine whether these conditions are improving or

declining with time. Similar to the RAM, bioassessments are performed biannually and have occurred during the 2010 and 2012 water years.

Bioassessments were performed at Squaw Creek and Martis Creek in the summer and fall of 2012 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.

The results of the Squaw Creek bioassessments continue to indicate the predominance of DG sand and finer sediments in benthic habitat areas; however, the biological metrics for two of the three bioassessment reaches have improved since the previously conducted surveys in 2010. It is likely that Squaw Creek may have experienced fewer disturbances associated with reduced surface flows and intermittency during the summer of 2011. Snowmelt and saturated ground conditions from the record snowpack of the 2010-2011 winter likely sustained surface flows in Squaw Creek further into the summer and fall than usual in 2011, thereby allowing a more robust benthic community to develop during this period.

The Martis Creek bioassessment results continue to show that the surveyed reaches located upstream of the developed areas ranked higher than the respective downstream reaches in terms of the biological metrics used to evaluate the streams. The scores also improved at five of the six surveyed reaches in Martis Creek and this is also likely related to the large and more continuous flows that occurred in the stream due to the large winter in 2011.

Community Level Water Quality Monitoring

Samples were collected at eleven different sites with varying drainage area characteristics. Five of these sites have been monitored previously, but six new sites were incorporated during WY 2012. Two sites were implemented by the County and the remaining nine were implemented by the Town.

Statistical analyses were performed on the original five community level sites to determine whether significant differences in water quality exist among sites and if any trends were present. The results show the Brickelltown site contained significantly higher concentrations of the four main constituents (TSS, turbidity, total phosphorus, and total nitrogen) and samples from the Lahontan site had significantly lower concentrations of these constituents.

The Brickelltown site is located within historic downtown Truckee. The land uses include primary and secondary roadways, commercial, residential, and upland forest. Little to no water quality improvements have been implemented in this drainage area.

The Lahontan Golf Club site is located within the Lahontan residential community. The land uses include secondary roadway, residential, and golf course. Some water quality improvements have been implemented in the drainage area, and no impervious areas are directly connected to the sample location. This site also receives a large amount of groundwater baseflow which likely dilutes the stormwater samples.

Statistical analyses were also conducted for the six new Town of Truckee sites; however, the data is very limited (5 data points per site) and any conclusions are considered preliminary. Based on the data collected to date, these sites discharge runoff with high concentrations of TSS although they are lower than those observed at the Brickelltown site.

The results of the trend analysis are very sensitive to the more extreme values in this limited dataset and are not clearly indicative of changes/activities in the watersheds.

Tributary Level Water Quality Monitoring

Samples were collected from six different sites that represent the major tributaries to Martis Creek. The largest differences in mean concentrations were observed between DST-MC1 and DST-MC6 for turbidity and DST-MC2 and DST-MC6 for total nitrogen. The t-test results show that these differences are significant at the 95 percent confidence level. These are the only two combinations showing statistically significant differences. Site DST-MC1 is located on the main stem of Martis Creek just upstream of Martis Creek Reservoir. This site receives the most flow of all the tributary sites, and had the highest levels of turbidity and TSS. Site DST-MC6 is located on an unnamed branch of Martis Creek near Martis Creek Lake Road, and it receives the least flow of all tributary sites. This site had the lowest levels of TSS and turbidity, but had the highest concentrations of total nitrogen. Site DST-MC2 is located on East Martis Creek, and had the lowest concentrations of total nitrogen.

For all other site and constituent combinations, the differences in mean concentrations are relatively small, and no sites had consistently higher or lower mean values. The largest variation in data occurred at the lower Martis Creek site (DST-MC1) and the smallest variation in the data occurred at the East Martis Creek site (DST-MC2).

The tributary level data indicates decreasing trends in TSS and turbidity values at the tributary sites, most likely a result of WY 2011 being an above average precipitation year, and WY 2012 being a below average precipitation year. Runoff rates and volumes during WY 2012 were much lower than the previous year and carried less sediment downstream.

Trends in nutrient concentrations are inconsistent and additional data is needed to make meaningful conclusions. Decreasing trends in total phosphorus are likely related to the decrease in sediment discussed above. The slightly increasing total nitrogen and dissolved phosphorus trends are most likely caused by a few more extreme values in the data set.

A site by site comparison of the WY 2012 total pollutant load per acre of watershed (the summation of TSS, total phosphorus, and total nitrogen) shows that the unnamed tributary site (DST-MC6) had the lowest value with approximately 9 pounds per acre. The West Martis Creek site had the highest load with a value of 21 pounds per acre. The Middle Martis Creek, East Martis Creek, and Upper Main Stem Martis Creek sites had totals of 11, 15, and 17 pounds per acre, respectively. The East Martis Creek site was not expected to have higher pollutant loading than other sites since its sub-watershed is undeveloped upland forest. The sub-watershed of the Middle Martis Creek site contains a portion of SR 267, and the West Martis Creek site contains a majority of the Northstar ski resort, residential areas, and a golf course.

Stream Flow Monitoring

The site selected for the Martis Creek gauging station is at Frank's Fish Bridge just upstream of SR 267. The gauge was installed in November of 2011 and has been operated continuously since that time. During WY 2011, velocity measurements were obtained at surveyed stream locations at varying stream stages, and a stage to discharge relationship was developed. Due to the interfering effects of a beaver dam downstream of the stream gauge, velocity measurements were again collected during WY 2012 to develop a revised rating curve for the new condition. Therefore, two rating curves have been developed to date. The two relationships allowed for the estimation of total discharge and peak discharge at the gauging station for water years 2011 and 2012.

The total discharge volume in WY 2011 was almost four times as large as in WY 2012 with values of 23,400 cfs and 6,200 cfs, respectively. The difference in discharge volume between the two years can be attributed to the large differences in precipitation between the two years. The peak discharge values during the 2011 and 2012 water years were approximately 430 cfs and 250 cfs, respectively. The 430 cfs discharge occurred on March 16, 2011 after nearly 4 inches of precipitation fell over a 72 hour period. In general, the discharge at the gauging station tends to be greatest during the spring snowmelt cycles and lowest during the late summer and fall.

Water Quality Areas of Concern

After three years of monitoring, the following areas were identified as areas of the highest concern for water quality:

- **Brickelltown:** Community level water quality sampling indicated that stormwater runoff from this portion of historic downtown Truckee often contains high concentrations of sediment and nutrients.
- **Donner Creek:** Community level water quality sampling indicated that stormwater runoff entering Donner Creek from West River Street contains high concentrations of suspended solids. Visual observations at the Donner Creek/Truckee River confluence also indicate that Donner Creek discharges large amounts of sediment into the Truckee River during large storm events.
- **West Martis Creek:** Monitoring results show that this site had the greatest pollutant loading of TSS, total phosphorus, and total nitrogen per acre of watershed. RAM monitoring also show a high percentage of fine substrate in West Martis Creek.
- **Trout Creek:** Results of the RAM indicate Trout Creek has very high percentages of fine substrate covering the streambed. The newly restored portion in the upper reaches of the RAM survey segment shows improvement over conditions during the previous survey but also indicates a large amount of sediment is being transported from upstream.
- **Squaw Creek:** RAM and bioassessment results indicate a continued impact to this stream by sediment deposition. The area of highest concern identified from 2012 bioassessment monitoring was the upper meadow site in Squaw Creek (site Bio-SC1). This site had the lowest IBI score of all sites sampled in 2012 (IBI score= 46), as well as the smallest median particle size (D50= 2 mm). The middle meadow (site Bio-SC2) and lower meadow (site Bio-SC3) sites in Squaw Creek also had very small median particle sizes (D50= 3 mm), although these sites scored well in terms of Biological Condition Scores (BCS= 25 and 27 out of a possible 35, respectively) and the Eastern Sierra IBI (93 and 89 out of a possible 100, respectively).
- **Truckee River (Town Corridor):** The results of the Truckee River RAM did not indicate high percentages of fine substrate despite a very high percentage in Trout Creek and elevated TSS concentrations at the community level monitoring sites discharging into the Truckee River throughout the downtown corridor. The integrated results indicate that most fine sediment is discharged to the Truckee River from areas of high vehicle traffic where traction sand is used and is then transported downstream where it settles in lower energy reaches downstream and along the channel fringes where flows are slow.

Evaluation of SWMP Performance

The effectiveness of the implementation of SWMP related activities can generally be evaluated through the comparisons presented above. Because this is only the third year of implementation and little improvements to the watershed have occurred, spatial comparisons are most appropriate at this time. The temporal water quality trends that were identified are likely related to differences in precipitation amounts and are not related to SWMP activities. Temporal analyses will become more valuable with the continued, long-term, implementation of this program. Also, in some cases, a specific project or action may cause an immediate improvement that is recognizable in the data from one year to the next.

For the activities implemented during WY 2012, the community level discrete sampling provides some demonstration of the effectiveness of SWMP activities. The permanent stormwater treatment BMPs present in some of the drainage systems provide clear benefits as shown in the monitoring results. When compared to other sites, the water quality at the treated sites is clearly improved with respect to all the monitored pollutants in almost every runoff event.

Prioritization of Existing TRWQMP Elements

The TRWQMP is currently being implemented as planned. Overall, 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 three years of implementation. There is a continued need to develop more comprehensive and robust datasets that will help to identify specific areas of concern and evaluate SWMP performance.

For the WY 2013, monitoring will take on a new focus on continuous turbidity monitoring and sediment load evaluations. Two new automated stations will be operated in the Martis Creek Watershed at the West Martis Creek (DST-MC4) and main stem Martis Creek (DST-MC5) tributary sites. These new stations will be equipped with continuous turbidity probes and pressure transducers to monitoring discharge. Two new continuous turbidity probes will also be installed and operated in the Truckee River upstream and downstream of the Town boundary. The Town's turbidity probes will be installed at existing USGS gauging stations so that stream discharge data will also be available from those locations. The implementation of continuous turbidity probes in the Truckee River and Martis Creek will provide valuable insight on the current sediment loading patterns within these watershed systems. This data, combined with data collected by other groups and through other TRWQMP elements, will be valuable in identifying watershed areas of concern and developing recommendations for water quality protection and improvement activities.