Implementers' Monitoring Program (IMP)

Component of the
Regional Storm Water Monitoring Program (RSWMP)

Interim Storm Water Monitoring Report WY2014

Submitted to the Lahontan Regional Water Quality Control Board and the Nevada Division of Environmental Protection

March 15, 2014

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Submitted by the Tahoe Resource Conservation District in cooperation with:

California

El Dorado County

Placer County

City of South Lake Tahoe

California Department of Transportation

Nevada

Douglas County

Washoe County

Nevada Tahoe Conservation District

Nevada Department of Transportation

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MONITORING PURPOSE AND STUDY DESIGN

This Implementers' Monitoring Program (IMP) Monitoring Report summarizes the results of catchment monitoring and BMP effectiveness evaluation monitoring for the first four and a half months of Water Year 2014 (October 1, 2013 – February 15, 2014). This report is designed to meet the California NPDES Permit and Nevada Interlocal Agreements Storm Water Monitoring Report schedule; a full analytical report for WY14 will be submitted by March 15, 2015.

The Implementers' Monitoring Program (IMP) was developed jointly by the California and Nevada implementing jurisdictions to collectively fulfill California National Pollutant Discharge Elimination System (NPDES) Permit requirements or Nevada Interlocal Agreement commitments. It is a partnership between the Tahoe Resource Conservation District, El Dorado County, Placer County, the City of South Lake Tahoe, Douglas County, Washoe County, the Nevada Tahoe Conservation District, the Nevada Department of Transportation, and Caltrans. Regulations require that California and Nevada jurisdictions in the Lake Tahoe Basin take measures to decrease pollutant loading from stormwater runoff in urbanized areas. Regulations require the implementation of pollutant controls to decrease fine sediment particles (FSP) and nutrient inputs, as well as monitoring and evaluation of select urban catchment outfalls and Best Management Practices (BMPs) for flow volumes and pollutant loads. Monitoring data will provide empirical data that will begin to (1) inform assumptions used to estimate runoff volumes and pollutant loads modeled with the Pollutant Load Reduction Model (PLRM) (2) assess nutrient and sediment loading at chosen catchments, (3) evaluate BMP effectiveness at chosen BMPs.

The IMP also represents a historic first step toward implementing a comprehensive Regional Stormwater Monitoring Program (RSWMP) for the Tahoe Basin, as it fulfills a component of RSWMP designated as compliance monitoring. Though this data is being collected for permit and agreement compliance, long-term data sets will eventually be evaluated as part of the larger RSWMP effort, allowing for the development of consistent monitoring design, data collection, analysis, and reporting approaches. Long-term data will also be useful in refining Pollutant Load Reduction Model predictions and identifying status and trends in the watershed. All data has been collected in a manner consistent with RSWMP monitoring protocols so it can easily be analyzed to align with the goals and objectives presented in the multi-agency driven RSWMP Data Quality Objective Plan (Heyvaert et al 2011a), Quality Assurance Project Plan (Heyvaert et al 2011b), and Sample Analysis Plan (Heyvaert et al 2011c).

MONITORING SITES

Five catchments (monitoring sites) are being monitored for continuous flow and sampled for water quality at eleven monitoring stations: the outfalls of the five selected catchments, and the inflows to and outflows from the selected BMPs located within three of those catchments. The monitoring sites were chosen because of their high direct hydrologic connectivity to Lake Tahoe, diversity of urban land uses, range of catchment sizes, and a reasonably equitable distribution of sites among the participating jurisdictions. BMP effectiveness sites were selected because of their potential efficacy in treating storm water runoff characteristic of the Lake Tahoe basin, the broad interest in and lack of conclusive data regarding the efficiency of the selected BMPs in reducing runoff volumes and pollutant loads, especially FSP, and the importance of determining the maintenance required to retain effectiveness. See Figure 1 for catchment (monitoring site) locations. A brief description of each monitoring site and associated stations follows, please see the Implementers' Monitoring Plan (TRCD, 2013) for complete descriptions.

SR431

The SR431 monitoring site is located on State Route 431 in Washoe County above Incline Village, Nevada. At this location, State Route 431 is a two-lane road with a catchment area that includes 0.61 acres of NDOT right-of-way (ROW) of which approximately 95% of the surface is impervious. The catchment outfall discharges directly into a perennial stream called Deer Creek which connects with Third Creek and discharges into Lake Tahoe, giving this site the distinction of being directly connected to the lake despite being 2.5 miles from it. SR431 is monitored as a catchment outfall site and for evaluating and comparing the effectiveness of two adjacent stormwater treatment vaults containing different cartridge filters, a Contech Stormfilter and an Imbrium Jellyfish. There are five monitoring stations at SR431; the inflow and outflow to the Contech Stormfilter (CI, CO), the inflow and outflow to the Imbrium Jellyfish (JI, JO), and the outflow from the catchment (S5). Though located in a rural area with moderate highway traffic density, SR431 is the only site that isolates the characterization of runoff from primary roads. In addition, SR431 is the only site currently available where a true side-by-side comparison of stormwater cartridge filter types can be performed.

Incline Village

The Incline Village monitoring site is located on the western edge of the parking lot for Incline Beach Park near the end of Village Blvd on the south side of Lakeshore Blvd in Incline Village, Nevada. It is monitored as a catchment outfall at one monitoring station (IV). At 83.6 acres, this is the largest catchment monitored and it includes runoff from

Washoe County and NDOT jurisdictions. The catchment drains a relatively steep, highly urbanized area of Incline Village with dominant urban land-uses consisting of moderate to high density residential, commercial, and primary roads. Forty-six percent of the area is impervious and there is a lack of any intervening natural dispersion and infiltration areas. Runoff discharges directly to the lake via a 30-inch CMP that day-lights into a rock-lined ditch before entering Lake Tahoe. The monitoring station is located on the rock-lined ditch.

Tahoma

Tahoma is monitored as a catchment outfall at one monitoring station (TA). The 49.5 acre catchment straddles the Placer County/El Dorado County border and comingles waters from both jurisdictions, plus waters from the Caltrans maintained Highway 89. The land-uses in this catchment are primarily moderate density residential and secondary roads in the Tahoe Cedars subdivision, but also include some commercial/industrial/communications/utilities (CICU) and primary roads. Twenty-eight percent of the catchment area is impervious. The runoff from this catchment discharges directly into Lake Tahoe via a 36-inch oval “squashed” corrugated metal pipe (CMP) at the bottom of the Water’s Edge North condominium complex driveway without infiltration or treatment. Because of the high direct connectivity between the catchment and Lake Tahoe, this storm drain system has great potential to deliver high FSP loads to the lake.

Rubicon

The Rubicon monitoring site is located on Rubicon Drive in the Rubicon Estates subdivision on the west shore of Lake Tahoe. At 13.8 acres, Rubicon is the second smallest monitored catchment and is characterized by low density single-family residential properties and relatively gentle slope near lake level. Most of the roadways have unimproved shoulders but a few steeper sections are lined by asphalt dikes. Twenty-four percent of the catchment is impervious. The Rubicon V Erosion Control Project in 2010 (EIP#713.3) installed two sets of parallel Stormtech stormwater retention chambers at the lowest point in the catchment to reduce stormwater runoff volumes prior to discharge into Lake Tahoe. The Rubicon site is monitored as a catchment outfall and a BMP effectiveness project at two monitoring stations, Rubicon In (RI) and Rubicon Out (RO). RI is located at the inflow to the Stormtech chambers and RO is located at the outflow from the Stormtech chambers and is also considered the catchment outfall.

Pasadena

The Pasadena monitoring site is located at the northern most end of Pasadena Ave. in the City of South Lake Tahoe. It is monitored as a catchment outfall and BMP effectiveness site. A 36-inch outfall CMP emerging from the side of the steep slope at the end of Pasadena Ave conveys runoff directly to Lake Tahoe. The pipe is the terminus of a 78.9 acre catchment designated the "G12 basin" by the City of South Lake Tahoe. The dominant land uses are moderate density single and multi-family residential and secondary roads. Thirty-nine percent of the catchment is impervious. Two Contech Stormfilter vaults were installed in parallel at the end of the catchment before discharge to the lake through the 36-inch CMP. Pasadena In (PI) is a monitoring station located at the inflow to the Stormfilter vaults, and Pasadena Out (PO) is located in the 36-inch outfall CMP, the outflow from the Stormfilter vaults.

Table 1 summarizes the selected catchments, monitoring sites and their corresponding designation as catchment outfall and/or BMP effectiveness project. Also included are existence/absence of a continuous turbidimeter and total catchment area.

Table 1: Monitoring station specifics.

Catchment (Site) Name	Station Name	Station Acronym	Catchment Area (acres)	Outfall	BMP	Turbidi-meter
Tahoma	Tahoma	TA	49.5	√		√
Incline Village	Incline Village	IV	83.6	√		√
Pasadena	Pasadena In	PI	78.9		√	√
	Pasadena Out	PO		√	√	√
Rubicon	Rubicon In	RI	13.8		√	
	Rubicon Out	RO		√	√	
SR431	Contech In	CI	0.61		√	√
	Contech Out	CO			√	√
	Jellyfish In	JI			√	√
	Jellyfish Out	JO			√	√
	SR431 Outfall	S5		√		√

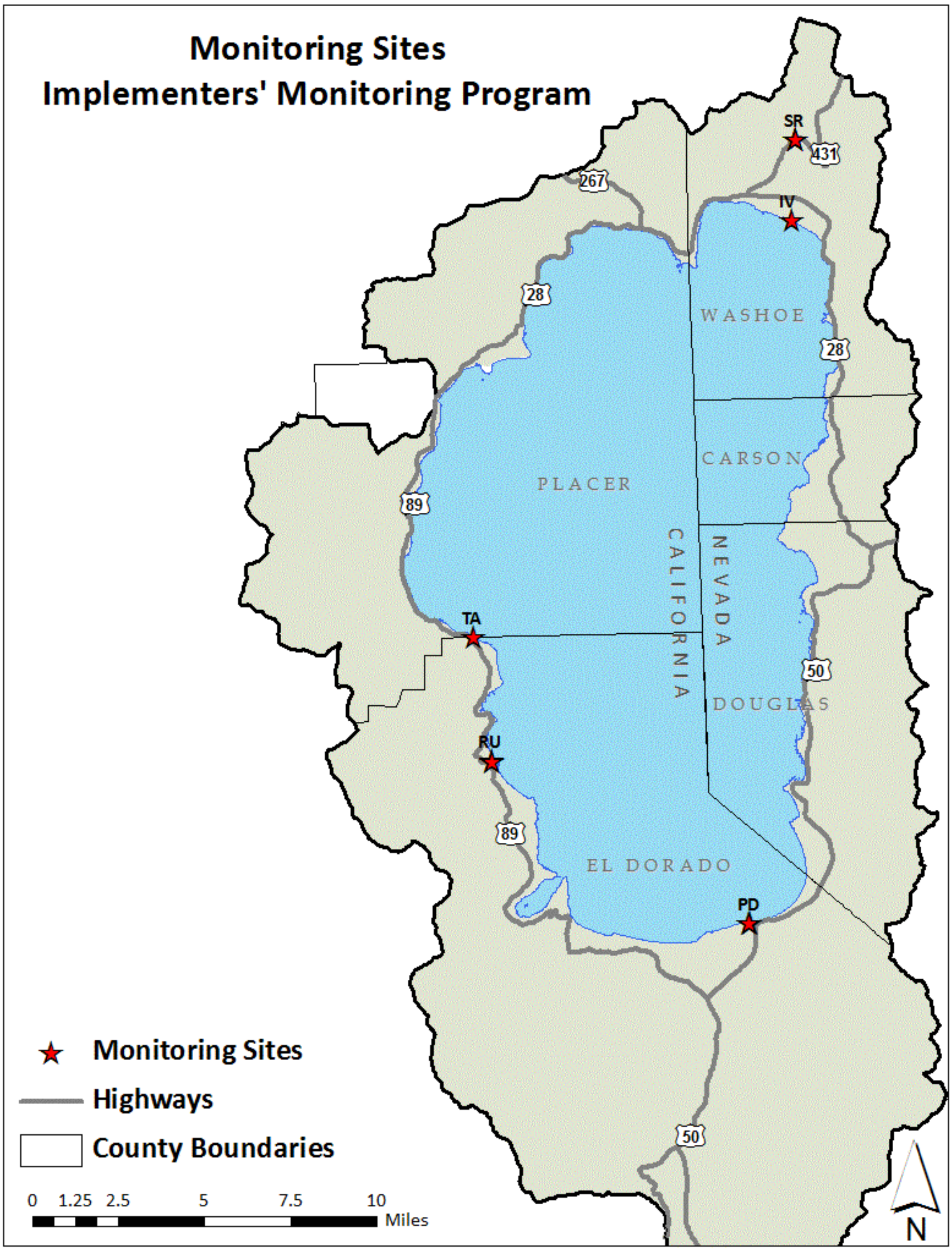

Figure 1: Distribution of selected monitoring sites. SR is SR431, IV is Incline Village, TA is Tahoma, RU is Rubicon, and PD is Pasadena.

DATA COLLECTION METHODS, SAMPLING PROTOCOLS, ANALYTIC METHODS

Continuous flow data and samples are collected using ISCO brand automated samplers at all eleven monitoring stations to support seasonal [fall/winter (October 1-February 28), snowmelt (March 1-May 31), and summer (June 1-September 30)] volume reporting. Nine of the eleven monitoring stations are collecting continuous turbidity with an FTS DTS-12 turbidimeter, which, with the help of site specific turbidity to FSP rating curves, will allow for FSP load calculations to be made (Table 1). These series were reviewed and corrected following rules outlined in the RSWMP SAP section 12.2. Meteorological data in each catchment is recorded using a Davis Instruments Vantage Pro weather station. Flow and meteorological data is offloaded post precipitation event, or at regular intervals during dry periods. Raw data, including but not limited to, flow, stage, velocity, sampling times, turbidity readings, and precipitation, are transferred and stored on one central District server. Continuous data series logged at each monitoring station consist of parameters measured in the field at a constant time interval.

Runoff events, as defined by the permit, are the result of (a) fall rain, (b) rain-on-snow, (c) spring snowmelt, and (d) summer thunderstorms. This reporting period was unusually dry, and no fall precipitation events produced runoff significant enough to sample. There were two rain-on-snow events in January and one in February that produced enough runoff to sample at some of the stations. Samples were selected as singles or made into flow weighted composites based on their placement in the hydrograph. First flush singles, rising limb composites, falling limb composites, and quality control samples are being analyzed for total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), turbidity, and fine sediment particles (FSP) at the UC Davis Tahoe Environmental Research Center Laboratory in Incline Village, NV, the UC Davis Laboratory in Davis, CA, or the Desert Research Institute Laboratory in Sparks, NV. Additional single samples at each station are being analyzed for turbidity and FSP concentration to aid in the development of a site specific rating curve relating turbidity to FSP. Table 2 summarizes the sample type IDs and their meaning. Table 3 summarizes the analytical methods and detection limits for all analyses.

Table 2: Sample Types and acronyms.

Acronym	Sample Type
FF	**F**irst **F**lush single
AC	**A**uto-sample **C**omposite, either rising or falling limb of hydrograph
AS	**A**uto-sample **S**ingle
FB	**F**ield **B**lank (QA/QC)
GS	**G**rab **S**ample single (QA/QC)
MS	**M**anually triggered auto-**S**ample single (QA/QC)
PT	Single sample for **P**SD and **T**urbidity analysis only

Table 3: Analytical methods and detection limits.

Analyte	Methods	Description	Target Reporting Limit
Total Dissolved Phosphorus as P	EPA 365.1 w/ USGS I-4600-85; or EPA 365.2; or EPA 365.3; or SM 4500-P-F	Colorimetric, persulfate digestion, phosphomolybdate	10 ug/L
Total Kjeldahl Nitrogen	EPA 351.1; or EPA 351.2	Colorimetric, block digestion, phenate	50 ug/L
Total Suspended Solids	EPA 160.2 or SM 2540-D	Gravimetric	1 mg/L
Turbidity	EPA 180.1 or SM 2130-B	Nephelometric	0.1 NTU
Particle Size Distribution	SM 2560 or RSWMP addendum SOP	Laser backscattering	na

STORM EVENTS

Three rain-on-snow events occurred during this reporting period that produced significant runoff. Events began on January 11, 2014, January 29, 2014, and February 8, 2014. Runoff was triggered at a site-specific water level (stage) and sampling was attempted at all monitoring stations during all three runoff events. Figures 2-14 show hydrographs for each event at each monitoring station that received enough runoff to sample. (Influent and effluent hydrographs from the two treatment vaults at SR431 are pending.) The hydrographs also include continuous turbidity, where available, and samples taken throughout the course of the storm. Samples are indicated by red circles and are grouped on different horizontal lines to show first flush singles, rising limb composites and falling limb composites.

The first storm (January 11, 2014) produced runoff significant enough to sample at Tahoma (Figure 2) and Incline Village (Figure 3) stations only. The turbidimeter at Tahoma did not function correctly during this storm, and the first flush sample was missed due to auto-sampler failure. The second storm (January 29, 2014) produced enough runoff to sample at Tahoma (Figure 4), Incline Village (Figure 5), Pasadena In (Figure 6), Pasadena Out (Figure 7), Rubicon In (Figure 8), Contech In (hydrograph pending), Contech Out (hydrograph pending), Jellyfish In (hydrograph pending), Jellyfish Out (hydrograph pending), and SR431 Outfall (Figure 9). This event produced only 180 cubic feet (cf) at the SR431 Outfall and therefore only two samples were triggered by the autosampler; a first flush sample and a single sample during the rising limb of the hydrograph. The third storm (February 8, 2014) produced enough runoff to sample at Tahoma (Figure 10), Incline Village (Figure 11), Pasadena In (Figure 12), Pasadena Out (Figure 13), and Rubicon In (Figure 14). No stations at SR431 flowed during this event because precipitation fell primarily as snow.

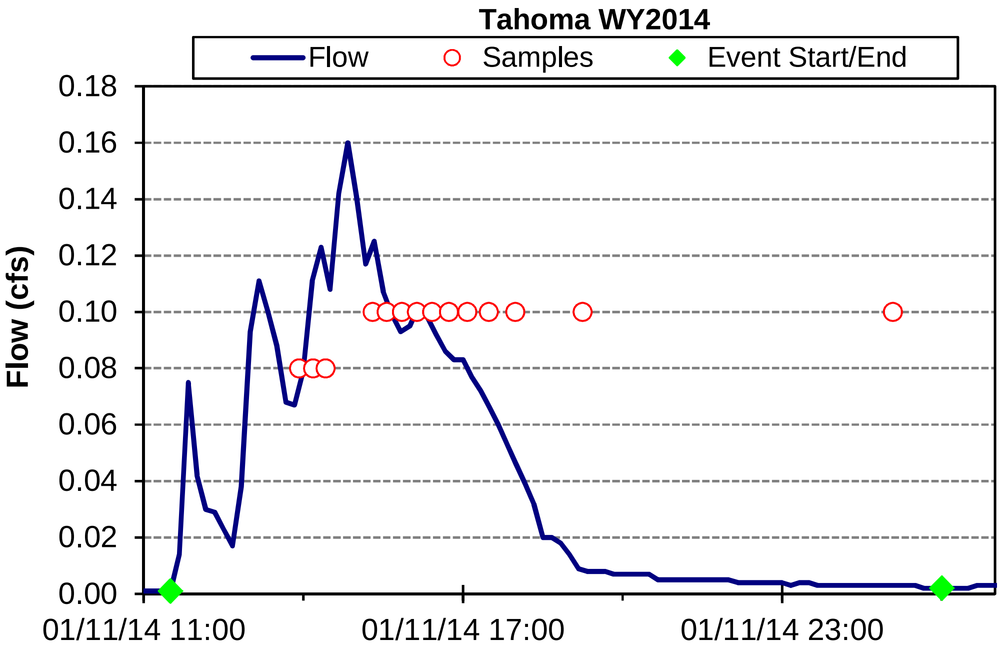

Figure 2: Flow and water quality samples at Tahoma for the 1/11/2014 event.
Total volume sampled: 2,218 cf. *Data is preliminary and subject to change.*

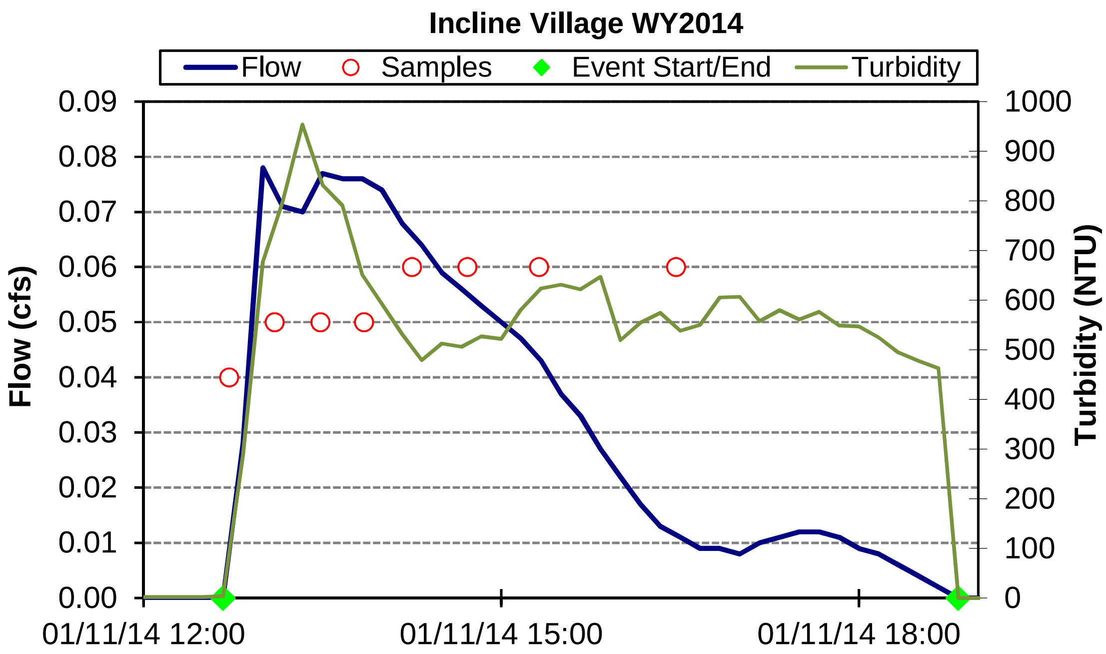

Figure 3: Flow, turbidity, and water quality samples at Incline Village for the 1/11/2014 event. Total volume sampled: 757 cf. *Data is preliminary and subject to change.*

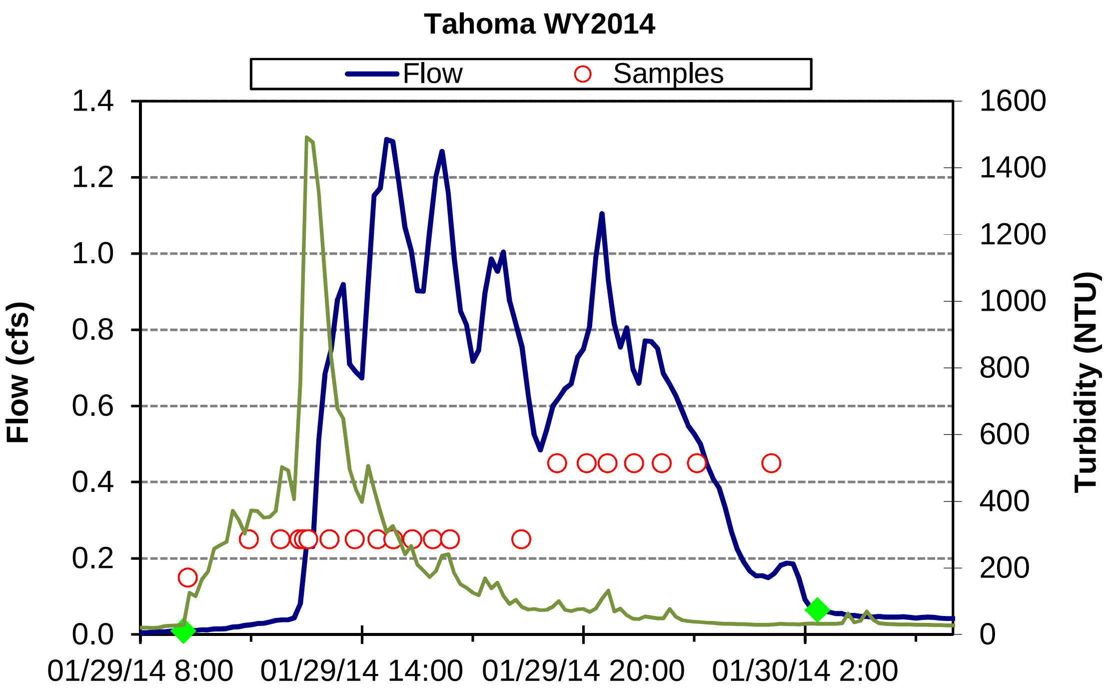

Figure 4: Flow, turbidity, and water quality samples at Tahoma for the 1/29/2014 event. Total volume sampled: 34,160 cf. *Data is preliminary and subject to change.*

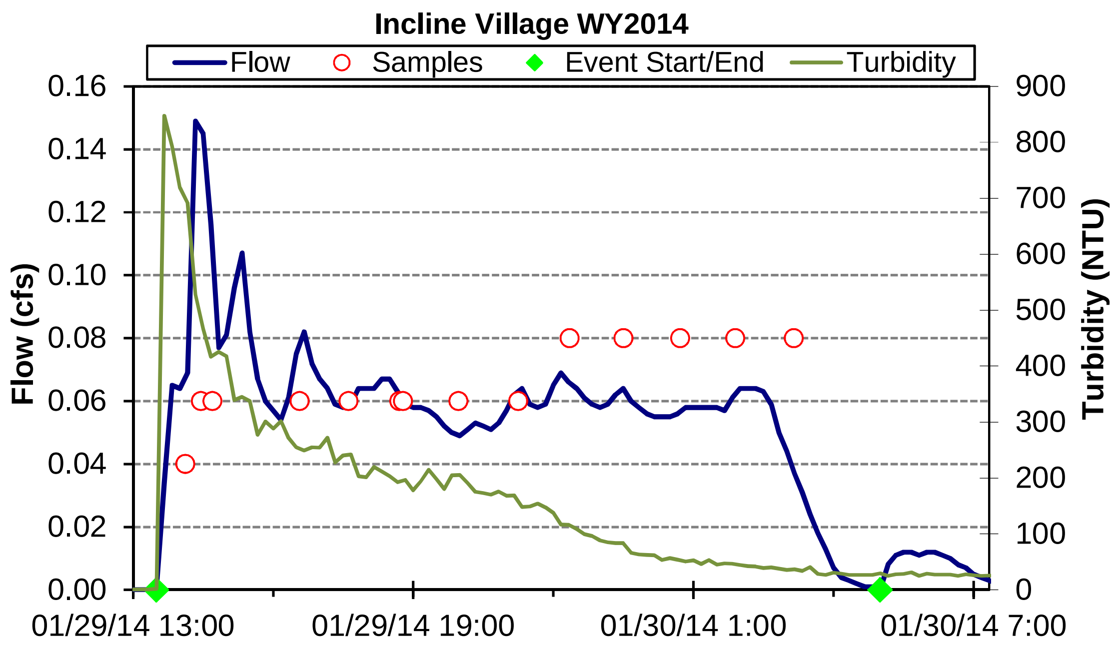

Figure 5: Flow, turbidity, and water quality samples at Incline Village for the 1/29/2014 event. Total volume sampled: 3,207cf. *Data is preliminary and subject to change.*

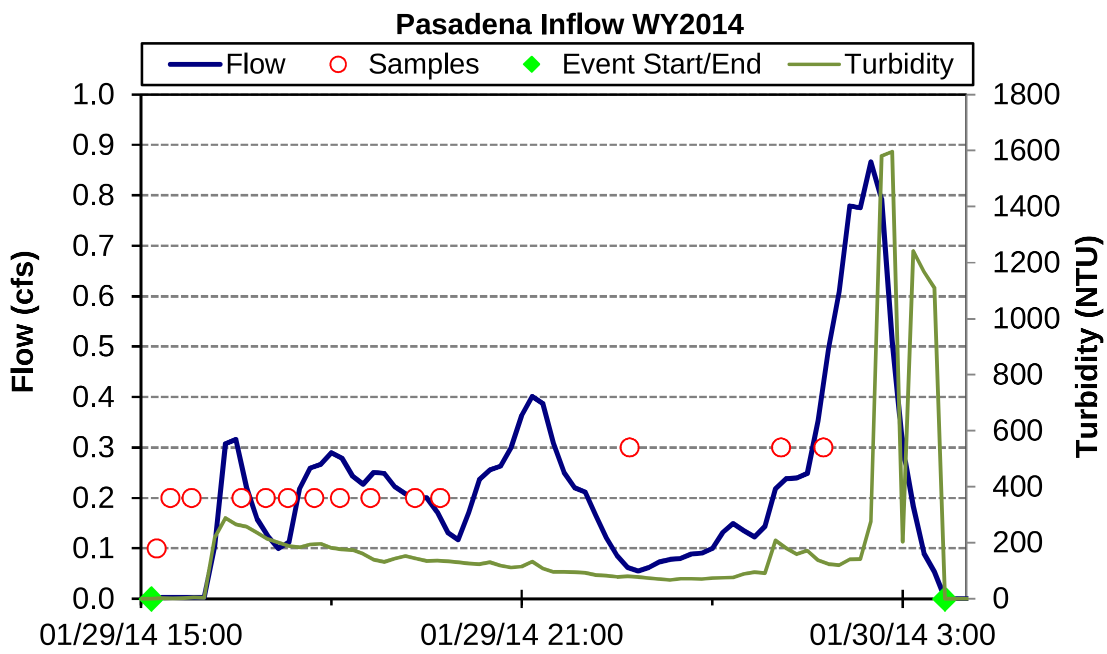

Figure 6: Flow, turbidity, and water quality samples at Pasadena Inflow for the 1/29/2014 event. Total volume sampled: 10,109 cf. *Data is preliminary and subject to change.*

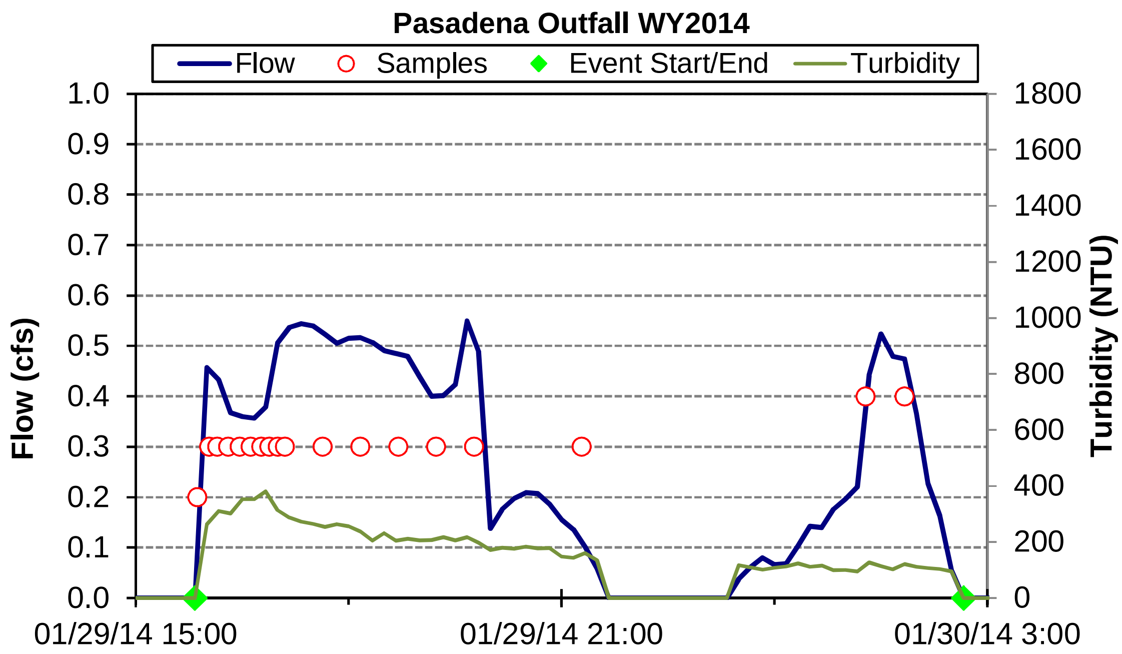

Figure 7: Flow, turbidity, and water quality samples at Pasadena Outfall for the 1/29/2014 event. Total volume sampled: 10,072 cf. *Data is preliminary and subject to change.*

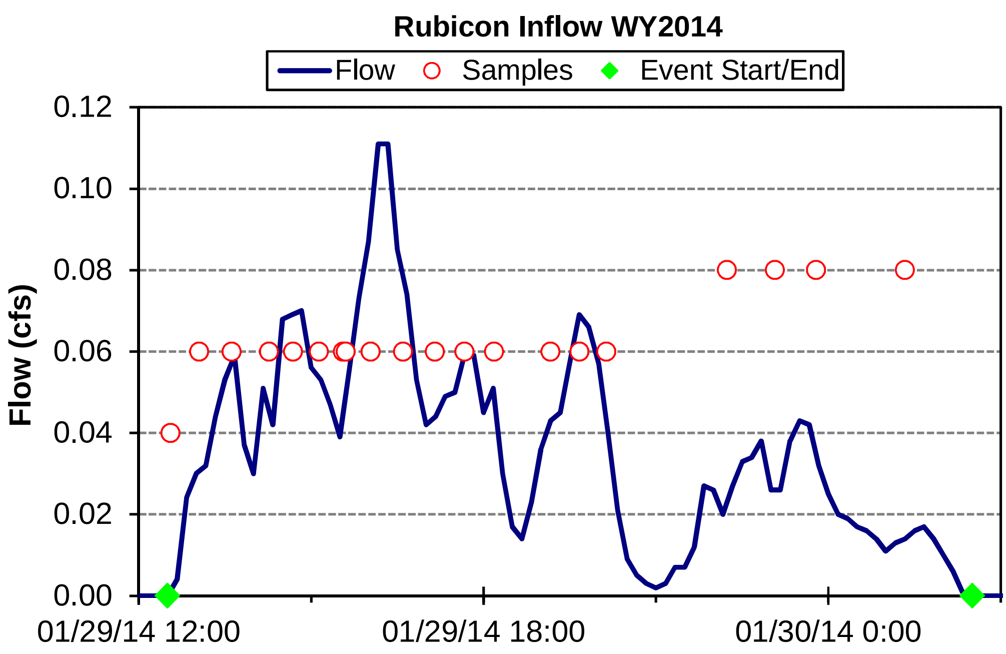

Figure 8: Flow and water quality samples at Rubicon Inflow for the 1/29/2014 event. Total volume sampled: 1,829 cf. *Data is preliminary and subject to change.*

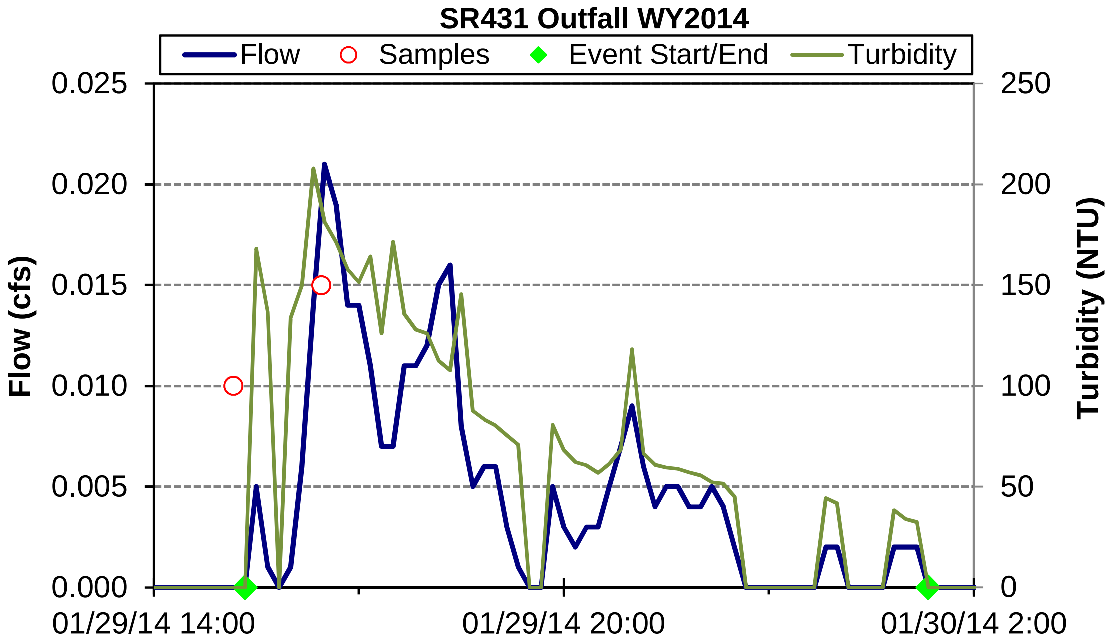

Figure 9: Flow, turbidity, and water quality samples at SR431 Outfall for the 1/29/2014 event. Total volume sampled: 180 cf. *Data is preliminary and subject to change.*

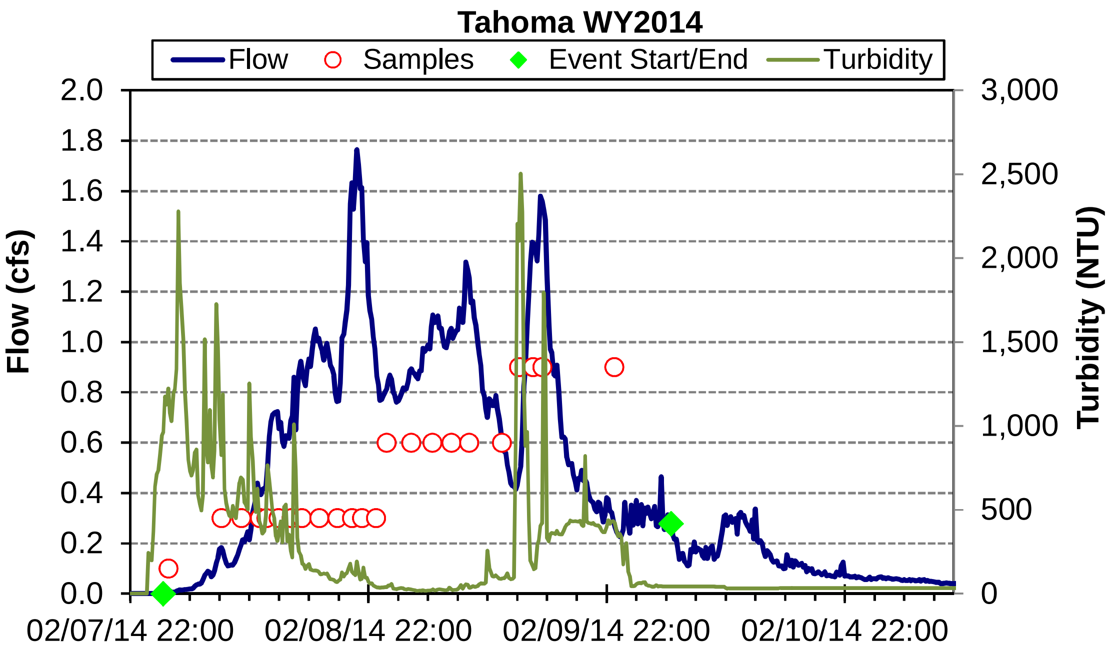

Figure 10: Flow, turbidity, and water quality samples at Tahoma for the 2/8/2014 event. Total volume sampled: 120,236 cf. *Data is preliminary and subject to change.*

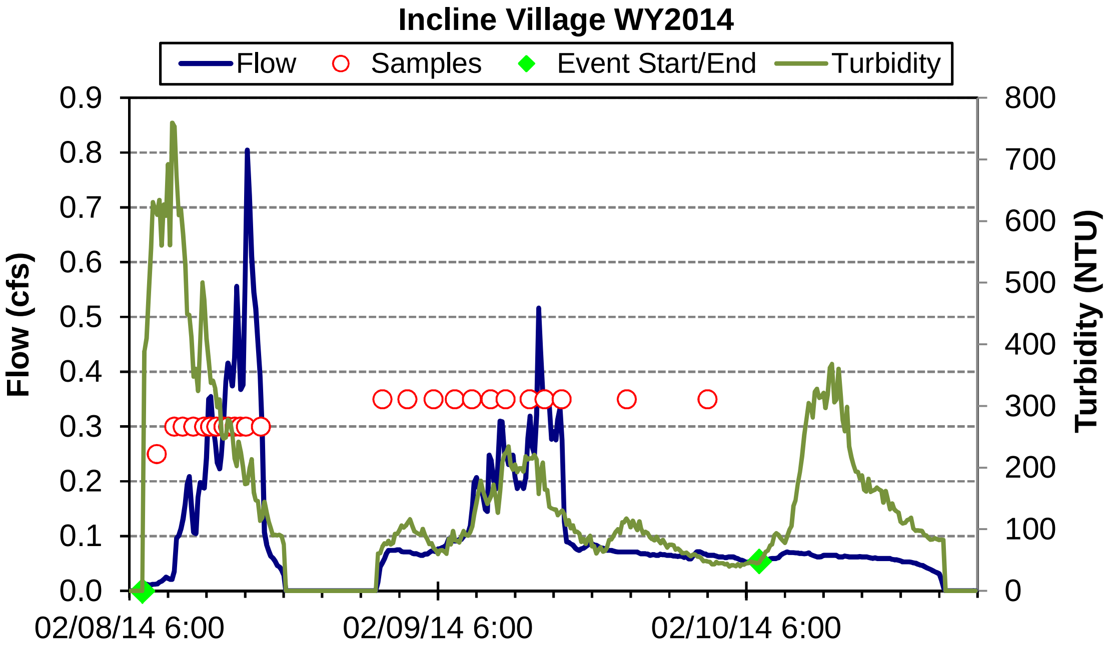

Figure 11: Flow, turbidity, and water quality samples at Incline Village for the 2/8/2014 event. Total volume sampled: 20,964 cf. *Data is preliminary and subject to change.*

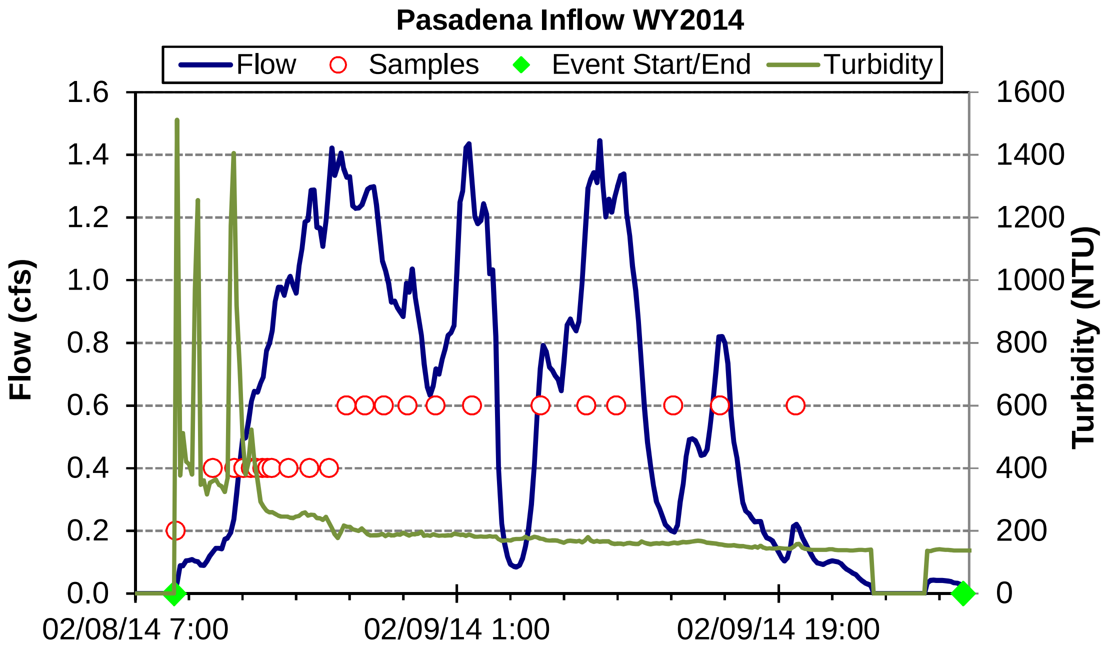

Figure 12: Flow, turbidity, and water quality samples at Pasadena Inflow for the 2/8/2014 event. Total volume sampled: 90,918 cf. *Data is preliminary and subject to change.*

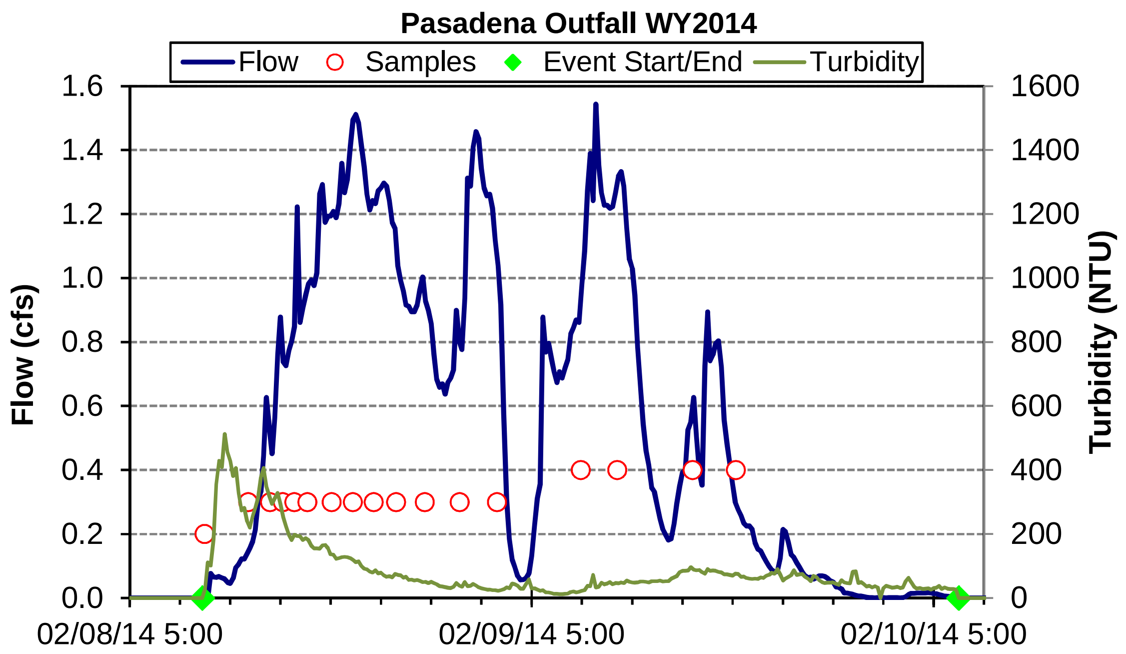

Figure 13: Flow, turbidity, and water quality samples at Pasadena Outfall for the 2/8/2014 event. Total volume sampled: 90,934 cf. *Data is preliminary and subject to change.*

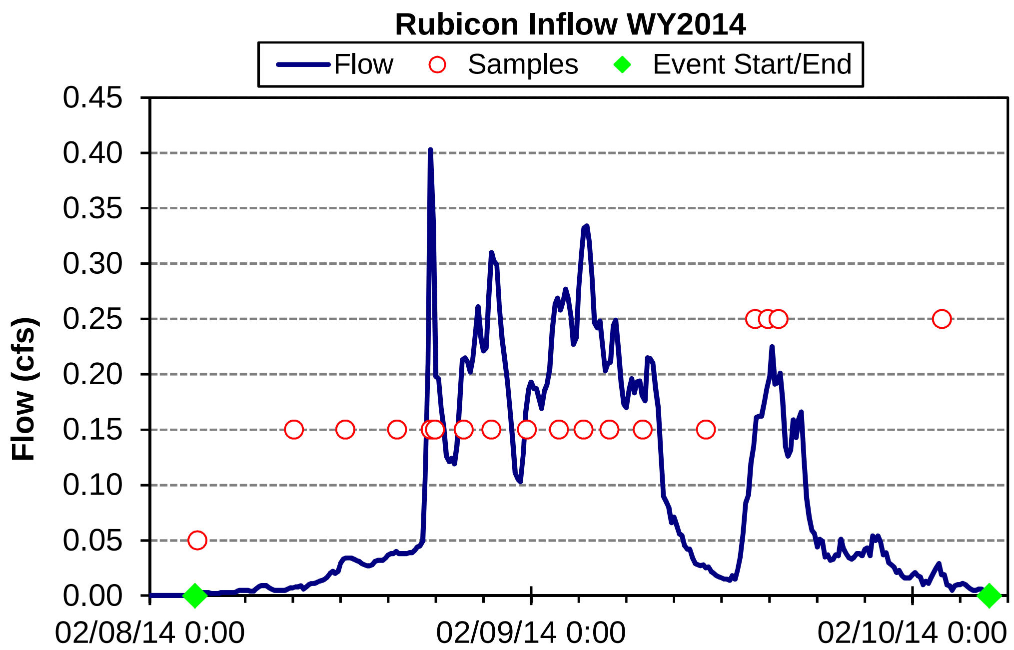

Figure 14: Flow and water quality samples at Rubicon Inflow for the 2/8/2014 event. Total volume sampled: 16,441 cf. *Data is preliminary and subject to change.*

RAW ANALYTICAL DATA

Table 4 summarizes all available raw analytical data available through February 10, 2014. Laboratory results are pending because data can take up to two months to become available due to staff time to enter results and QA/QC procedures regarding data input and management. The Sample ID is comprised of a two letter monitoring site acronym and a two letter sample type acronym (see Tables 1 and 2 for acronym meanings).

Table 4: Raw analytical data October 1, 2013 – February 10, 2014. *All data is preliminary and subject to change.*

Project	Sample ID	Sample Type	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	NO3+NO4 (um/L)	TKN (um/L)	TN (um/L)	TP (um/L)
IMP	IV-FF	first flush	1/11/14 12:43	121	218	pending	pending	pending	pending	pending
IMP	IV-AC	rising limb	1/11/14 13:06	514	1236	pending	pending	pending	pending	pending
IMP	IV-AC	falling limb	1/11/14 14:15	335	865	pending	pending	pending	pending	pending
IMP	IV-PT	PSD/turb	1/11/14 13:29	na	1438	pending	na	na	na	na
IMP	IV-PT	PSD/turb	1/11/14 14:15	na	727	pending	na	na	na	na
IMP	TA-AC	rising limb	1/11/14 13:55	274	944	pending	pending	pending	pending	pending
IMP	TA-AC	falling limb	1/11/14 15:18	655	835	pending	pending	pending	pending	pending
IMP	TA-PT	PSD/turb	1/11/14 14:11	na	981	pending	na	na	na	na
IMP	TA-PT	PSD/turb	1/11/14 15:18	na	779	pending	na	na	na	na
IMP	IV-FF	first flush	1/29/14 13:33	559	1178	pending	pending	pending	pending	pending
IMP	IV-AC	rising limb	1/29/14 13:59	293	536	pending	pending	pending	pending	pending
IMP	IV-AC	falling limb	1/29/14 21:15	45.0	68.5	pending	pending	pending	pending	pending
IMP	IV-PT	PSD/turb	1/29/14 14:27	na	573	pending	na	na	na	na
IMP	IV-PT	PSD/turb	1/29/14 23:30	na	60.3	pending	na	na	na	na
IMP	PI-FF	first flush	1/29/14 15:15	273	525	pending	pending	pending	pending	pending
IMP	PI-AC	rising limb	1/29/14 15:28	143	68.5	pending	pending	pending	pending	pending
IMP	PI-AC	falling limb	1/29/14 22:42	79.0	94.4	pending	pending	pending	pending	pending
IMP	PI-PT	PSD/turb	1/29/14 18:08	na	221	pending	na	na	na	na
IMP	PI-PT	PSD/turb	1/29/14 19:19	na	108	pending	na	na	na	na
IMP	PO-FF	first flush	1/29/14 15:52	505	508	pending	pending	pending	pending	pending
IMP	PO-AC	rising limb	1/29/14 16:02	171	312	pending	pending	pending	pending	pending
IMP	PO-AC	falling limb	1/30/14 1:17	193	165	pending	pending	pending	pending	pending
IMP	PO-PT	PSD/turb	1/29/14 16:18	na	346	pending	na	na	na	na
IMP	PO-PT	PSD/turb	1/29/14 16:53	na	396	pending	na	na	na	na
IMP	RI-FF	first flush	1/29/14 12:33	338	351	pending	pending	pending	pending	pending
IMP	RI-AC	rising limb	1/29/14 13:03	53.0	33.1	pending	pending	pending	pending	pending
IMP	RI-AC	falling limb	1/29/14 19:10	4.40	4.18	pending	pending	pending	pending	pending
IMP	RI-PT	PSD/turb	1/29/14 13:37	na	108	pending	na	na	na	na
IMP	RI-PT	PSD/turb	1/29/14 16:02	na	29.0	pending	na	na	na	na
IMP	CI-FF	first flush	pending	pending	pending	pending	pending	pending	pending	pending
IMP	CI-AC	rising limb	pending	pending	pending	pending	pending	pending	pending	pending
IMP	CI-AC	falling limb	pending	pending	pending	pending	pending	pending	pending	pending
IMP	CI-PT	PSD/turb	pending	pending	pending	pending	na	na	na	na
IMP	CI-PT	PSD/turb	pending	pending	pending	pending	na	na	na	na
IMP	CO-FF	first flush	pending	pending	pending	pending	pending	pending	pending	pending
IMP	CO-AC	rising limb	pending	pending	pending	pending	pending	pending	pending	pending
IMP	CO-AC	falling limb	pending	pending	pending	pending	pending	pending	pending	pending
IMP	CO-PT	PSD/turb	pending	pending	pending	pending	na	na	na	na
IMP	CO-PT	PSD/turb	pending	pending	pending	pending	na	na	na	na

Table 4 continued: Raw analytical data October 1, 2013 – February 10, 2014. *All data is preliminary and subject to change.*

Project	Sample ID	Sample Type	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	NO3+NO4 (um/L)	TKN (um/L)	TN (um/L)	TP (um/L)
IMP	JI-FF	first flush	pending	pending	pending	pending	pending	pending	pending	pending
IMP	JI-AC	rising limb	pending	pending	pending	pending	pending	pending	pending	pending
IMP	JI-AC	falling limb	pending	pending	pending	pending	pending	pending	pending	pending
IMP	JI-PT	PSD/turb	pending	pending	pending	pending	na	na	na	na
IMP	JI-PT	PSD/turb	pending	pending	pending	pending	na	na	na	na
IMP	JO-FF	first flush	pending	pending	pending	pending	pending	pending	pending	pending
IMP	JO-AC	rising limb	pending	pending	pending	pending	pending	pending	pending	pending
IMP	JO-AC	falling limb	pending	pending	pending	pending	pending	pending	pending	pending
IMP	JO-PT	PSD/turb	pending	pending	pending	pending	na	na	na	na
IMP	JO-PT	PSD/turb	pending	pending	pending	pending	na	na	na	na
IMP	S5-FF	first flush	1/29/14 15:10	200	239	pending	pending	pending	pending	pending
IMP	S5-AS	single	1/29/14 16:27	93.0	139	pending	pending	pending	pending	pending
IMP	TA-FF	first flush	1/29/14 9:17	195	336	pending	pending	pending	pending	pending
IMP	TA-AC	rising limb	1/29/14 10:56	356	456	pending	pending	pending	pending	pending
IMP	TA-AC	falling limb	1/29/14 19:17	117	84.8	pending	pending	pending	pending	pending
IMP	TA-PT	PSD/turb	1/29/14 12:33	na	2436	pending	na	na	na	na
IMP	TA-PT	PSD/turb	1/29/14 20:05	na	73.1	pending	na	na	na	na
IMP	IV-FF	first flush	2/8/14 8:08	385	915	pending	pending	pending	pending	pending
IMP	IV-AC	rising limb	2/8/14 9:29	223	279	pending	pending	pending	pending	pending
IMP	IV-AC	falling limb	2/9/14 1:41	111	108	pending	pending	pending	pending	pending
IMP	IV-PT	PSD/turb	2/8/14 10:08	na	691	pending	na	na	na	na
IMP	IV-PT	PSD/turb	2/8/14 13:19	na	273	pending	na	na	na	na
IMP	PI-FF	first flush	2/8/14 9:15	196	463	pending	pending	pending	pending	pending
IMP	PI-AC	rising limb	2/8/14 11:20	92.0	107	pending	pending	pending	pending	pending
IMP	PI-AC	falling limb	2/9/14 5:41	52.8	46.5	pending	pending	pending	pending	pending
IMP	PI-PT	PSD/turb	2/8/14 12:32	na	452	pending	na	na	na	na
IMP	PI-PT	PSD/turb	2/8/14 22:14	na	41.4	pending	na	na	na	na
IMP	PO-FF	first flush	2/8/14 9:28	32.4	21.6	pending	pending	pending	pending	pending
IMP	PO-AC	rising limb	2/8/14 12:04	79.0	106	pending	pending	pending	pending	pending
IMP	PO-AC	falling limb	2/9/14 7:56	40.4	45.8	pending	pending	pending	pending	pending
IMP	PO-PT	PSD/turb	2/8/14 13:23	na	326	pending	na	na	na	na
IMP	PO-PT	PSD/turb	2/9/14 0:42	na	26.4	pending	na	na	na	na
IMP	RI-FF	first flush	2/8/14 2:59	5.60	13.6	pending	pending	pending	pending	pending
IMP	RI-AC	rising limb	2/8/14 9:04	28.8	14.1	pending	pending	pending	pending	pending
IMP	RI-AC	falling limb	2/9/14 14:06	30.8	14.8	pending	pending	pending	pending	pending
IMP	RI-PT	PSD/turb	2/8/14 17:57	na	12.9	pending	na	na	na	na
IMP	RI-PT	PSD/turb	2/9/14 3:18	na	14.2	pending	na	na	na	na
IMP	TA-FF	first flush	2/8/14 1:52	422	886	pending	pending	pending	pending	pending
IMP	TA-AC	rising limb	2/8/14 7:12	153	137	pending	pending	pending	pending	pending
IMP	TA-AC	falling limb	2/8/14 23:49	53.2	37.7	pending	pending	pending	pending	pending
CWP	TA-AC	falling limb	2/9/14 13:10	35.6	29.6	pending	pending	pending	pending	pending
IMP	TA-PT	PSD/turb	2/8/14 14:16	na	138	pending	na	na	na	na
IMP	TA-PT	PSD/turb	2/9/14 2:18	na	7.55	pending	na	na	na	na

QUALITY ASSURANCE/QUALITY CONTROL

Sample handing and processing includes proper labeling of samples in the field, transporting samples to a laboratory immediately after collection in a cooler, compositing single samples on a flow-weighted basis, taking turbidity measurements with a calibrated instrument, shipping to an analytical laboratory with proper chain-of-custody procedures, and filtering samples within a 24-hour period. A minimum of 10% of all samples analyzed were quality control (QC) samples to identify problems related to field sampling and sample processing. The monitoring methods implemented for this plan are comparable to methods outlined in the RSWMP SAP and the RSWMP QAPP. These methods have been developed over a decade, have withstood the rigors of intensive monitoring, and are generally used by the monitoring community in Lake Tahoe.

Table 5 summarizes the QA/QC samples that were taken during the January 11, 2014, January 29, 2014, and February 8, 2014 storms. Field blanks (FB) are collected to identify sample contamination occurring during field collection, handling, transport, storage, and during laboratory handling and analysis. Field blanks are collected throughout the sampling season by pouring reagent-grade “blank” water into the autosampler bottles in the field and then exposing them to equivalent conditions as the standard sample bottles. Field duplicates are samples collected at the same time and treated identically are used to assess the reproducibility of collected data. This provides a measure of analytical precision and can be used for detecting problems in sample collection, handling, transport processing, and analysis. The actual procedures for collecting field duplicate samples depend on the sampling methods and protocols used. When automated sampling equipment is used, duplicates need to be collected manually either by: (a) triggering the sampler manually twice in quick succession (two MS samples) or (b) manually triggering a sample and then collecting a grab sample at the same time (one MS sample and one GS sample), (RSWMP SAP, 2011).

No conclusions will be drawn from the QA/QC data at this time. All analytical results will be analyzed and reported in the full IMP Stormwater Monitoring Report for water year 2014 submitted March 15, 2015.

Table 5: QA/QC data October 1, 2013 – February 10, 2014. *All data is preliminary and subject to change.*

Project	Sample ID	Sample Type	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	NO3+NO4 (um/L)	TKN (um/L)	TN (um/L)	TP (um/L)
IMP	IV-FB	QA/QC	1/11/14 21:38	<0.4	0.16	pending	pending	pending	pending	pending
IMP	IV-MS	QA/QC	1/11/14 15:06	361	865	pending	pending	pending	pending	pending
IMP	IV-MS	QA/QC	1/11/14 15:07	367	887	pending	pending	pending	pending	pending
IMP	TA-FB	QA/QC	1/11/14 15:44	<0.4	0.18	pending	pending	pending	pending	pending
IMP	TA-MS	QA/QC	1/11/14 16:45	429	662	pending	pending	pending	pending	pending
IMP	TA-MS	QA/QC	1/11/14 16:46	380	605	pending	pending	pending	pending	pending
IMP	IV-FB	QA/QC	1/29/14 14:35	<0.4	0.11	pending	pending	pending	pending	pending
IMP	IV-MS	QA/QC	1/29/14 14:13	562	528	pending	pending	pending	pending	pending
IMP	IV-MS	QA/QC	1/29/14 14:14	495	639	pending	pending	pending	pending	pending
IMP	RI-FB	QA/QC	1/29/14 15:37	<0.4	0.46	pending	pending	pending	pending	pending
IMP	RI-MS	QA/QC	1/29/14 15:35	80.8	56.7	pending	pending	pending	pending	pending
IMP	RI-MS	QA/QC	1/29/14 15:36	76.8	41.9	pending	pending	pending	pending	pending
IMP	S5-FB	QA/QC	1/29/14 15:21	<0.4	0.16	pending	pending	pending	pending	pending
IMP	TA-FB	QA/QC	1/29/14 16:15	<0.4	0.17	pending	pending	pending	pending	pending
IMP	TA-GS	QA/QC	1/29/14 12:44	2130	2133	pending	pending	pending	pending	pending
IMP	TA-MS	QA/QC	1/29/14 12:45	2184	2268	pending	pending	pending	pending	pending
IMP	PI-FB	QA/QC	2/8/14 11:15	<0.4	0.10	pending	pending	pending	pending	pending
IMP	PI-MS	QA/QC	2/8/14 11:03	253	479	pending	pending	pending	pending	pending
IMP	PI-MS	QA/QC	2/8/14 11:04	253	477	pending	pending	pending	pending	pending
IMP	PO-FB	QA/QC	2/8/14 11:10	<0.4	0.22	pending	pending	pending	pending	pending
IMP	PO-MS	QA/QC	2/8/14 11:16	226	445	pending	pending	pending	pending	pending
IMP	PO-MS	QA/QC	2/8/14 11:17	230	448	pending	pending	pending	pending	pending
IMP	TA-GS	QA/QC	2/9/14 11:25	62.0	52.0	pending	pending	pending	pending	pending
IMP	TA-MS	QA/QC	2/9/14 11:26	79.6	57.3	pending	pending	pending	pending	pending

DATA MANAGEMENT PROCEDURE

Data was offloaded from the auto-samplers with data transfer devices at the time samples were collected or maintenance was required. Any other field measurements and observations were recorded in a field notebook. Samples, data transfer devices and notes were transported to a processing lab immediately after collection. Data transfer devices were offloaded from the site, and all data was input into an Excel template for storing continuous parameters as well as sample dates and times. A separate Excel template was also used for calculating flow-weighted compositing schedules for the rising and falling limb composites at each monitoring station. All samples were measured for turbidity and filtered for TSS; values were recorded on standard data sheets in the laboratory and entered into an Excel template for storing turbidity, nutrient and sediment data. All samples were sent to proper laboratories within appropriate holding times for total phosphorus, total nitrogen, and particle size distribution (FSP) analysis. Results from analytical laboratories are entered into the same Excel template for storing turbidity, nutrient and sediment data. All Excel workbooks are housed on one central computer (with backup device) and managed by District staff.

DATA ANALYSIS

No data analysis was conducted on data for this partial water year. Analytical results are not available at this time and will be reported in the full IMP Stormwater Monitoring Report for water year 2014 submitted March 15, 2015.

CATCHMENT OUTLET MONITORING

Preliminary data for the October 1, 2013 through February 10, 2014 period suggests that Tahoma had the greatest runoff volumes and received the most precipitation. Pasadena and Incline Village have similar catchment areas, received approximately equal amounts of precipitation, and had similar runoff volumes despite differences in topography and BMP installations. Rubicon received the second greatest amount of precipitation but did not produce a great amount of runoff, undoubtedly due to its small catchment area. SR431 received a total of 7.38 inches of precipitation, but most of it fell as snow and therefore produced very little runoff. Table 6 shows total runoff volume and total precipitation between October 1, 2013 and February 10, 2014, as well as rainfall-runoff response. Rainfall-runoff response is a dimensionless value relating the amount of runoff to the amount of precipitation received. It is larger for areas with low infiltration (pavement, steep gradients) and lower for permeable, well vegetated areas (forest, flat land). The very low value of 0.01 at SR431, a highly impermeable catchment, is likely due to much of the precipitation falling as snow at this higher elevation site.

Preliminary data also indicates that runoff at Tahoma has experienced some of the highest TSS and turbidity values but in general all catchments are within a similar range for both TSS and turbidity. A complete analysis of catchment water quality data will be reported in the full IMP Stormwater Monitoring Report for water year 2014 submitted March 15, 2015.

Table 6: Summary statistics for each catchment October 1, 2013 through February 10, 2014.

October 1, 2013 - February 10, 2014						
Catchment (Site) Name	Station Name	Station Acronym	Catchment Area (acres)	Total Runoff Volume (cf)	Total Precip (in)	Rainfall-Runoff Response
Tahoma	Tahoma	TA	49.5	182,614	14.42	0.07
Incline Village	Incline Village	IV	83.6	99,911	6.46	0.05
Pasadena	Pasadena In	PI	78.9	99,634	6.84	0.05
	Pasadena Out	PO		99,579		
Rubicon	Rubicon In	RI	13.8	18,353	11.49	0.00
	Rubicon Out	RO		0		
SR431	Contech In	CI	0.61	pending	7.38	0.01
	Contech Out	CO		pending		
	Jellyfish In	JI		pending		
	Jellyfish Out	JO		pending		
	SR431 Outfall	S5		187		

BMP EFFECTIVENESS MONITORING

Preliminary data suggests that the Stormfilter at Pasadena has variable ability to reduce TSS and turbidity during a runoff event. The January 29, 2014 storm saw increases in TSS at the outflow from the Stormfilter for first flush, rising and falling limb samples, as well as increases in turbidity for rising and falling limb samples. This is likely due to the filter replacement that occurred September 30, 2013. The maintenance entailed removing most of the accumulated sediment and breaking the seal outflow seals to remove the old filters and install the new cartridge filters. During this process, it is inevitable that trace amounts of sediment will be dislodged into the outfall pipes beneath the cartridge filters, resulting in temporary increases in outflow TSS after the required maintenance. The February 8, 2014 storm saw significant decreases in TSS and turbidity at the outflow for the first flush samples, but approximately equal TSS and turbidity values for the rising and falling limb samples (Table 4).

There has been no outflow from the infiltration gallery at Rubicon recorded at Rubicon Out (RO) so all runoff volumes have been infiltrated thus far.

Preliminary results are pending at for the two stormwater treatment vaults at SR431 and will be reported in the full IMP Stormwater Monitoring Report for water year 2014 submitted March 15, 2015.

MONITORING SUMMARY

The fall season was unusually dry with no storms producing runoff significant enough to sample. Instead, runoff from a winter season rain on snow event was or will be (depending on monitoring station) substituted for a fall rain event. Table 7 summarizes the events that were monitored at each monitoring station. Without exception, if a station was not monitored during an event, it was due to lack of significant runoff for sampling. SR431 is the only site that has not completed the permit and agreement requirement of two storm events monitored for the fall and winter seasons combined. Table 8 summarizes the total volume sampled and total event precipitation for each monitoring station for each runoff event sampled. The February 8, 2014 storm was not sampled at SR431 despite 4.65 inches of precipitation because it fell as snow and did not produce enough runoff to sample.

Table 7: Summary of events sampled at each monitoring station.

Storm events sampled October 1, 2013 - February 10, 2014						
Catchment (Site) Name	Station Name	Station Acronym	Storm Event Start Date 1/11/2014	1/29/2014	2/8/2014	% complete for fall and winter seasons
Tahoma	Tahoma	TA	√	√	√	150%
Incline Village	Incline Village	IV	√	√	√	150%
Pasadena	Pasadena In	PI		√	√	100%
	Pasadena Out	PO		√	√	100%
Rubicon	Rubicon In	RI		√	√	100%
	Rubicon Out	RO				0%
SR431	Contech In	C1		√		50%
	Contech Out	C2		√		50%
	Jellyfish In	J1		√		50%
	Jellyfish Out	J2		√		50%
	SR431 Outfall	S5		√		50%

Table 8: Summary of volumes sampled and total event precipitation at each monitoring station for runoff events sampled. *All data is preliminary and subject to change.*

Storm events sampled October 1, 2013 - February 10, 2014								
			1/11/2014		1/29/2014		2/8/2014	
Catchment (Site) Name	Station Name	Station Acronym	Volume Sampled (cf)	Precip (in)	Volume Sampled (cf)	Precip (in)	Volume Sampled (cf)	Precip (in)
Tahoma	Tahoma	TA	2,128	0.52	34,160	2.79	120,236	9.32
Incline Village	Incline Village	IV	757	0.28	3,207	0.94	20,964	3.99
Pasadena	Pasadena In	PI	0	0.09	10,109	1.54	90,918	3.93
	Pasadena Out	PO	0		10,072		90,934	
Rubicon	Rubicon In	RI	0	0.52	1,829	3.29	16,441	5.60
	Rubicon Out	RO	0		0		0	
SR431	Contech In	C1	0	0.28	pending	1.09	0	4.65
	Contech Out	C2	0		pending		0	
	Jellyfish In	J1	0		pending		0	
	Jellyfish Out	J2	0		pending		0	
	SR431 Outfall	S5	0		180		0	

LESSONS LEARNED

It is advantageous to take pictures of problems encountered at monitoring stations during events. For example, plowed snow blocked the inlet to S5 during the February 8, 2014 storm. Fortunately the runoff was not significant enough to sample at any of the SR431 sites because precipitation at this elevation fell primarily as snow. However, had runoff been significant, it is possible that it would have bypassed the S5 inlet due to snow blockage.

Storm events not captured in a particular season due to insignificant runoff can be substituted by a different storm in the next season to meet permit and agreement requirements of one storm event per season as approved by the Lahontan Regional Water Quality Control Board.

There are noted discrepancies between the turbidity values logged by the continuous turbidimeter and the turbidity values reported by the HACH turbidimeter in the laboratory on paired samples. These inconsistencies will be investigated by periodically analyzing individual samples for turbidity across the hydrograph at selected effectiveness monitoring sites.

PROPOSED CHANGES

No changes are proposed at this time.

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