COMMUNITY DEVELOPMENT AGENCY
LONG RANGE PLANNING

2850 Fairlane Court, Placerville, CA 95667
Phone (530) 621-4650, Fax (530) 642-0508

March 14, 2016

Robert Larsen
Lahontan Regional Water Quality Control Board
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150

Subject: 2015 El Dorado County NPDES Annual Report for the Lake Tahoe Basin

Dear Robert:

Enclosed, please find El Dorado County's (County) 2015 National Pollutant Discharge Elimination System (NPDES) Annual Report for the Lake Tahoe Basin. This Annual Report is intended to satisfy the requirements outlined in Attachment C, Monitoring and Reporting Program, of the County's Municipal NPDES Permit - Board Order No. R6T-2011-0101A1. The County feels it has accomplished its NPDES and storm water related functions during the 2015 calendar year and is proud to present this Annual Report to you.

Throughout the year, the County utilized its Storm Water Management Plan (SWMP) to coordinate work amongst Divisions to stay on track with implementing and managing the County's NPDES Program. The County continues to strive to be a leader in protecting water quality in the Tahoe Basin and appreciates the opportunity to collaborate with our partnering agencies to help meet the Basin's regional storm water goals.

If you have any questions or comments, please do not hesitate to contact me at (530) 573-7905 or Russell Wigart at (530) 573-7924.

Sincerely,

Brendan Ferry
Principal Planner

cc: Dave Defanti, El Dorado County
Steve Pedretti, El Dorado County

El Dorado County

National Pollutant Discharge Elimination System (NPDES) Annual Report

Lake Tahoe Basin

March 2016

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1.0 Introduction

The 2011 Municipal National Pollutant Discharge Elimination System Storm Water Permit (NPDES Permit) for the City of South Lake Tahoe, El Dorado and Placer Counties (NPDES Permit No. CAG616001, Board Order R6T-2011-0101A1), requires El Dorado County (County) to report on activities occurring within the Lake Tahoe portion of the County's jurisdictional boundary defined as the Lake Tahoe Hydrologic Unit (LTHU). The contents provided herein reflect the 2015 calendar year defined as beginning on January 1, 2015 and ending on December 31, 2015, with the exception of Section E – the Traction Abrasive and Deicing Material Tracking Program Report, which is reported on by water year (October 1, 2014 to September 30, 2015). For purposes of review, the information included in this report is intended to follow the format outlined in the Monitoring and Reporting Program (MRP) of the NPDES Permit and includes the following components: A) Pollutant Load Reduction Report, B) Storm Water Facilities Inspection Report, C) Construction Site Inspection Report, D) Commercial, Industrial and Municipal Site Inspection Report, E) Traction Abrasive and Deicing Material Report, F) Storm Water Monitoring Report, G) Illicit Discharge Report, H) Education Component Report, I) and Fiscal Analysis.

Also consistent with the NPDES Permit, the County developed, adopted, and is implementing its 2013 Tahoe Basin Storm Water Management Plan (TSWMP) to manage the County's Storm Water Management Program and to assist in meeting state, regional, and federal water quality objectives related to protecting the surface waters of the Lake Tahoe Basin. Finally, the County has continued to devote significant NPDES-related resources to participate in and comply with the Lake Clarity Crediting Program (LCCP), which was born out of the Lake Tahoe Total Maximum Daily Load (TMDL) Program development. The County will continue to work closely with the California Regional Water Quality Control Board – Lahontan Region (Lahontan) on the LCCP and other related program tools.

Lake Tahoe Total Maximum Daily Load (TMDL)

Lake Tahoe is a national treasure and was designated by the Environmental Protection Agency (EPA) as an Outstanding National Resource Water (ONRW). In order to establish long term water clarity trends and to monitor Lake Tahoe's health, Lake Tahoe clarity measurements have been taken consistently since 1968. The long-term trend had shown a historically declining condition, but the trend has exhibited moderate improvement, particularly over the last decade (2002 – 2011)[i]. In order to continue to improve this trend, a TMDL was developed for Lake Tahoe. The TMDL process identifies the maximum load of a particular pollutant that a water body is able to assimilate while fully supporting its designated uses. The Lake Tahoe TMDL has an endpoint target of mean annual water clarity of 97.4 feet, which was the measured clarity during the period from 1967 to 1971.

In 2011, Lahontan completed a TMDL analysis for Lake Tahoe and determined that an increased emphasis should be placed on controlling very fine sediment particles, which are less than 16 micrometers in diameter, from the urban areas surrounding Lake Tahoe[ii]. As a result, Lahontan adopted Basin Plan Amendments (BPA) to modify their water quality protection mandates to focus local Basin jurisdictions' efforts toward controlling fine sediment loading. Along with the BPA, an updated NPDES Permit was adopted, requiring the local jurisdictions to participate in the LCCP. The LCCP is a new administrative process to plan for, track, monitor and report on pollutants of concern. The LCCP has since gone through several renditions; and is still in the final stages of development. This has been a long process of adaptive management, collaboration and negotiation of reasonable technical and practical feasibility for meeting long term goals and expectations with this complex program. The final LCCP tools were released in March 2015 with updated versions of PLRM and the Rapid Assessments released in November 2015. The County has completed significant testing of the tools and continues to do so; and anticipates a full registered catchment by June 2016 with subsequent registrations occurring up to September 30, 2016. The County is committed to this program and anticipates staying on track and schedule with the adopted PLRP as long as the LCCP tools are operational and useable.

2.0 Monitoring & Reporting Program Annual Report

A. Pollutant Load Reduction Report

In March 2013 the County finalized and submitted its Pollutant Load Reduction Plan (PLRP) to Lahontan[iii]. The PLRP outlines how the County intends to meet the first five year NPDES Permit requirements for reducing pollutant loading to Lake Tahoe. The NPDES Permit requires the County to develop a PLRP to outline its strategy to reduce its baseline fine sediment particle (FSP) pollutant load by 10%, its baseline total phosphorus (TP) pollutant load by 7% and its baseline total nitrogen (TN) pollutant load by 8% by September 30, 2016. Based upon the County's Baseline Pollutant Load Calculations[iv], and the above-mentioned Permit requirements, the County is required to obtain 220 credits by September 30, 2016. A credit is defined as approximately 200 pounds of fine sediment particles less than 16 µm in diameter.

The County's strategy to demonstrate compliance with this requirement is to register five (5) Urban Planning Catchments (UPCs) within the LCCP. The five (5) UPCs (Apalachee, Montgomery Estates Area 1, Christmas Valley, Angora 3 and Sawmill/Echo View) contain Water Quality and Erosion Control Projects that the County constructed between 2004 (baseline period) and 2012. By utilizing the Pollutant Load Reduction Model (PLRM), the County has calculated that it

will obtain 251 credits when it registers the water quality and erosion control improvements constructed in the five (5) UPCs. See Table 2 below for more specific detail on this.

As mentioned above, because the final versions of the LCCP tools were just released, it was not possible to register catchments or declare credits in calendar year 2015; therefore the County has not yet taken credit for its pollutant load reduction activities on the ground. When the County dives deeper into the new versions of the tools, it is assuming that both the County baseline and post baseline loads may change. The County anticipates a fairly significant effort will be necessary to revise these load estimates and refine its catchment registration plans if this is the case. With the unknowns that still remain with the PLRM modifications, the County will do its best to maintain its PLRP expectations and load reduction analysis. As always the County will continue to be an active participating partner in the TMDL and will work with Lahontan and its consultants in order to meet the TMDL and permit conditions.

The County's Baseline Pollutant Load Estimate and the County's Expected Pollutant Load Estimate, after registering the five UPCs, is outlined below in Table 1. The County can obtain sufficient credit to meet the pollutant load reduction requirements of the NPDES Permit by registering UPCs where erosion control projects and private property Best Management Practices (BMPs) were constructed between 2004 (baseline condition) and 2012.

Table 1 – Baseline Loading & Expected Condition Loading Estimates

		Pollutant Load (lbs/yr)									
Project Area	**TMDL UPC**	**TSS**	**FSP**	**TP**	**SRP**	**TN**	**DIN**	**lbs FSP Reduced**	**Credits**	**Baseline Load**	**% of Baseline Reduced**
Angora	1	19,506	10,333	57	9	260	31	1,887	9	12,220	15%
Christmas Valley	2	9,358	5,043	29	8	125	14	12,910	65	17,956	72%
Apalachee	3	49,219	28,752	128	19	564	69	22,399	112	44,469	50%
Montgomery Estates	4	12,881	7,212	35	5	156	19	4,938	25	18,832	26%
Echo View / Sawmill	5	17,373	11,896	33	4	112	14	8,127	41	20,023	41%
Total		**108,337**	**63,236**	**283**	**45**	**1,217**	**148**	**50,261**	**251**	**113,500**	

Summary	**Pollutant Load (kg)**							**Credits**
Achieved	**49,141**	**28,683**	**128**	**20**	**552**	**67**	**22,798**	**251**
Required			**73**		**327**		**19,958**	**220**
% Attainment			**176%**		**169%**		**114%**	**114%**

Load Reduction Schedule

The NPDES Permit specifically states that Permittees shall "Earn and maintain Lake Clarity Credits in accordance with Table IV.B.2 for water year October 1, 2015 to September 30, 2016, and for subsequent water years." The MRP in NPDES Permit Attachment C specifically states that "Each Permittee will register additional catchments as needed to earn enough credits to meet the requirements contained in the Permit Table IV.B.2." In order to meet the required pollutant load reduction goals, the County evaluated several scenarios and the load reduction schedule associated with each. The result of this exercise was the formulation of a preferred load reduction registration schedule that County staff believes will both meet the intent of the NPDES Permit and will be the most cost effective.

Catchment Registration Schedule

According to Municipal NPDES Permit Board Order R6T-2011-0101A1, Table IV.B.2, the County must achieve 220 Lake Clarity Credits for water year October 1, 2015 to September 30, 2016 (Water Year 2016), and for subsequent water years. In order to demonstrate compliance with this requirement, the County proposes to register five (5) Urban Planning Catchments (UPCs). Load reduction estimates from the first version of PLRM show that from the erosion control and water quality improvement work completed in the five (5) UPCs, 251 Credits can be achieved. The five (5) UPCs were aggregated based on land use, geography and proximity to a single discharge point. Table 2 outlines the five (5) UPCs that the County intends to register through the LCCP, the credits that can be obtained per UPC and the proposed registration date for each UPC.

The County could not follow its previous timeline for implementation of the UPC registration as the TMDL tools were not fully operational until November 2015. Due to this fact, the County will register (5) catchments in water year 2016 totaling at least 220 credits. Inspections to verify conditions using the BMP Rapid Assessment Method will be completed this field season (2016). All BMPs within registered catchments will be inspected and reported on.

County staff have been testing and using the updated LCCP tools including PLRM, Credit Accounting Platform (CAP) and the RAMs. The County currently has modeled all of its UPCs in the new PLRM and has been inputting data into the BMP RAM database. All of the background information and data processing is continuing now and the County will be submitting catchments into CAP for registration starting in June 2016.

The County is also working on recalculating its baseline loads this calendar year due to the updates in PLRM and will be working toward completing the next phase of the Pollutant Load Reduction Plan for the next permit term. A grant application was submitted to the California Tahoe Conservancy on October 7, 2015, which included the development of a CTC specific Stormwater Resource

Plan and a new analysis and quantification of the baseline loads. The County was not notified until March 7, 2016 that this grant was funded, but at a lower funding level than was requested. The County is now coordinating with our partners on the best way to expend those resources to not only develop a storm water resource plan, but also to recalculate and QAQC our new baseline load.

Table 2 – County's UPCs to be registered in the Lake Clarity Crediting Program

	Project Area	Credits	Status	Primary WQ Improvement	Proposed Registration Date (WY)
UPC1	Angora 3	9	Complete	Infiltration, Sediment & Source Control	2016
UPC2	Christmas Valley (All Phases)	65	Complete	Infiltration, Sediment & Source Control	2016
UPC3	Apalachee (All Phases)	112	Complete	Infiltration, Sediment & Source Control	2016
UPC4	Montgomery Estates (Phase 1)	25	Complete	Infiltration, Sediment & Source Control	2016
UPC5	Echo View / Sawmill	41	Complete	Infiltration, Sediment & Source Control	2016
UPC 1-5	**Total Project Credits**	**251**			
	Credits Required	220			
	% Attainment	114%			

B. Storm Water Facilities Inspection Report

Section II.A of the Municipal Permit requires the County to inspect all of its storm water facilities and perform required maintenance. In order to meet this requirement, the County modified its current database to incorporate the required inspection fields and inspected all storm water facilities in the unincorporated portion of El Dorado County. See Appendix A for a list of all project areas inspected along with the number of inspections that occurred in each area.

The MRP requires, at a minimum, that storm water collection, conveyance, and treatment facilities be visually inspected annually. Such facilities shall include, but are not limited to the following:

- Storm drain inlets
- Sediment collection devices (sediment traps, etc.)
- Storm drain pipes
- Curb and gutter
- Asphalt dikes
- Rock lined ditches
- Swales
- Storm water outfalls/discharge points
- Treatment basins
- Treatment vaults
- Road shoulders

The MRP also requires that all storm water facilities be inspected for signs of needed maintenance, evidence of erosion, damage from snow removal equipment, and accumulated sediment and debris. A summary of many of the BMPs maintained during calendar year 2015 are included in Appendix A. There were many more inspections other than was reported, as structures are visually inspected prior to maintenance. During inspections, permittees also assess potential storm water pollution sources that include but are not limited to the following:

- Private property/residential runoff
- Commercial property runoff
- Eroding cut slopes
- Eroding road shoulders
- Traction abrasive application
- Dislodged sediment from snow removal activities
- Vehicle tracking sediment onto the roadway
- Parking related erosion

Maintenance needs are identified by several methods:

a.) The County has prioritization schedules for BMPs based on maintenance needs and historic records of BMP inspection. The BMPs are sorted in a database to filter out those BMPs that are in need of chronic maintenance and those that require maintenance annually based on specific defined criteria. This method assists in efficient operations by allowing chronically full BMPs to be maintained automatically every year without needing to conduct inspections. To continue to add to this data set, while the maintenance operators are in the field they perform inspections and log data for all infrastructure they visit. Work orders are submitted to the County Maintenance Division in spring so maintenance staff can begin maintenance without conducting separate individual inspections. When the operator of the vactor truck mobilizes to a site they then record information such as the depth to the sediment prior to maintenance being performed and then record the depth after. The site ID# is already established so characteristics such as the structure type, size, and material is already categorized.

County staff inspected individual facilities including curb & gutter, culvert inlets/outlets, rock slope protection, retaining walls, rock channels, grass lined swales, sediment basins, fences, road shoulders and AC pavement/overlays. All inspection logs are stored electronically. Infrastructure maps of all BMPs and structures are located in the trucks of Maintenance staff. The County anticipates testing and using a new real-time mobile software application named Kerata for tracking all field information on a tablet in real time. This summer County staff will also begin performing more extensive BMP Rapid Assessment Methodology (BMP RAM) inspections and recording the data on a field tablet.

Damage and/or necessary repairs of the BMPs are noted during the inspection process, which are entered into a “notes” field in the BMP Inventory Database. BMPs flagged as needing repairs are compiled into a list, which is then provided to the Maintenance Division to perform these repairs. Problem areas are still identified on newer structures through the inspection process of all constructed BMPs. Each BMP and structure is inspected at a minimum annually for performance and storage.

In addition to the above mentioned methods for maintenance prioritization, Tahoe planning and engineering staff prioritizes work orders based on the severity of problems and proper BMP function.

b.) The second method for identifying maintenance needs for water quality improvements is post-storm inspections by Maintenance Division drain crews. The drain crews do their best to go out to all parts of the County after each significant storm to clear the inlet grates of debris and inspect the drainage improvement structures for maintenance needs. As a result the street Maintenance Superintendent and drain crews have developed a

working knowledge of drainage problem areas and have prioritized maintenance efforts to address those areas first. This method identifies maintenance needs and drainage problems throughout the County, in areas that have erosion control projects and in areas that have fragments of drainage infrastructure that have not been remedied with an erosion control project.

All data with regard to Maintenance Division staff activities are logged in a tracking system. Operators simply write down the structure they are working at, the date, the time and material quantities, etc.

Water quality monitoring results also provide insight into drainage improvement maintenance needs for effective BMP operation. Storm water treatment systems such as sediment traps and sand filters are inspected frequently to determine the necessary maintenance interval required for efficient pollutant removal. For example, the County has researched the operational effectiveness and maintenance requirements of a media sandfilter located on Nottaway Street in the Apalachee Erosion Control Project area. This filter is an essential BMP and has been monitored to determine effectiveness of treatment, as well as maintenance schedules for optimal water quality performance.

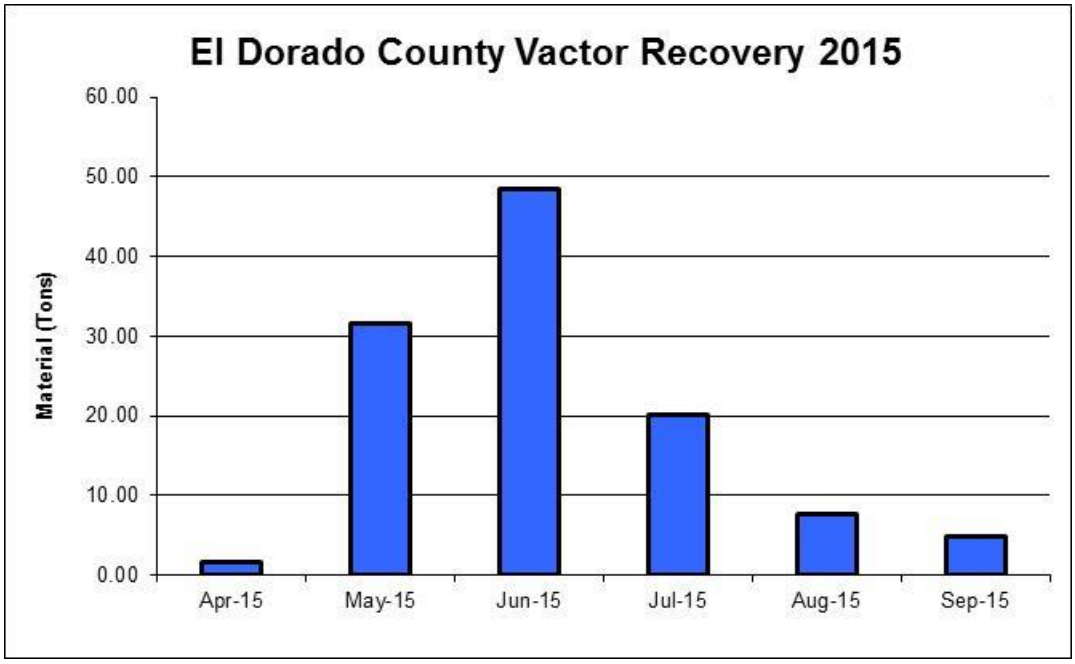
In addition to stated methods of determining maintenance needs, the Maintenance street crew also provides routine maintenance for water quality benefit in the form of street sweeping and sediment collection with vactor trucks. Street sweeping is performed on a full time basis, with sweepers collecting sediment from El Dorado County roadways year round. The summer sweeping strategy focuses on clearing the streets of debris before forecasted rain storms and sweeping problem sedimentation areas after rain storms. The winter sweeping strategy is to sweep whenever and wherever there is dry pavement to collect traction abrasives material that has been applied to or tracked onto roadways during snow storm events. The sweeping effort is intensified during the spring to provide effective collection of sediments concentrated in drainage facilities.

2015 BMP Maintenance results

Vactor

In 2015 the County once again inspected over 1,000 structures, maintained approximately 500 structures and recovered 89 yards or 114 tons of sediment and material. This included all vactor work and maintenance of BMPs, but did not include sweeping. The types of BMPs inspected/maintained included sand/sediment traps, vaults, drop inlets,

conveyance swales, sediment basins, rock lined channels, conveyance pipes and flow lines. The vactor truck was in operation for 232 hours with an operational cost of $37,364. The efficiency of the vactor truck at removing sediment was $.27/lb of sediment and was calculated to remove approximately 678 lbs/hour of operation. The County calculated lower efficiencies of operation when compared to prior years and believes this may be due to drought conditions and little flow and precipitation. Lower precipitation equates to less sediment transport, sand usage and flow which are the driving factors of vactor recovery. However, enhanced County BMP Inspections/tracking that prioritizes and targets maintenance needs is still the best means for effective recovery.



Date	$ / lb	lbs / hour	Total Material (yards)	Total Material (tons)	Total Hours (Vactor)	Date	Operator Cost (Vactor)	Vactor Cost	Refuse Fees	Total Monthly Vactor Cost
Apr-15	$ 0.96	90	1	1.62	18	**Apr-15**	$ 1,695	$ 1,417	$ 17	$ 3,129
May-15	$ 0.17	489	25	31.68	65	**May-15**	$ 5,741	$ 5,119	$ 329	$ 11,188
Jun-15	$ 0.11	705	38	48.48	69	**Jun-15**	$ 6,081	$ 4,922	$ 503	$ 11,506
Jul-15	$ 0.23	350	16	20.19	68	**Jul-15**	$ 5,437	$ 3,853	$ 209	$ 9,499
Aug-15	$ 0.09	833	6	7.61	9	**Aug-15**	$ 860	$ 583	$ 79	$ 1,522
Sep-15	$ 0.05	1603	4	4.81	3	**Sep-15**	$ 282	$ 189	$ 50	$ 521
	$ / lb	**lbs / hour**		**Total Material (tons)**						
Average Annual	$ 0.27	678								
Total Annual			89	114	232	**Total Annual**	$ 20,096	$ 16,082	$ 1,186	$ 37,364

Sweeper

The County has two high efficiency sweepers in operation full time. These include a 2012 Elgin Waterless Eagle and a 2013 Tymco 500x. The operational efficiency varies depending on equipment failures, other problems that occur, as well as availability of maintenance workers time relative to other priority jobs (i.e. paving, overlaying, chip seal, etc.). This year the County recovered **822 tons** of material with its sweeping program, recovering approximately 1,652 lbs/hour with an operational efficiency of $.09/lb.

Date	$ / lb	lbs / hour	Total Material (tons)	Total Man Hours (Sweeper & Dump Truck)	Total Man Hours (Sweeper)	Total Man Hours (Dump Truck)
Jan-15	$ 0.07	1924	123	184	128	56
Feb-15	$ 0.11	1221	82	191	135	56
Mar-15	$ 0.13	1193	43	113	72	41
Apr-15	$ 0.10	1400	137	285	196	89
May-15	$ 0.07	1756	170	255	194	62
Jun-15	$ 0.08	1622	103	165	127	38
Jul-15	$ 0.12	1236	68	186	110	76
Aug-15				0		
Sep-15	$ 0.06	2244	18	16	16	0
Oct-15				0		
Nov-15	$ 0.05	2155	64	72	60	13
Dec-15	$ 0.08	1763	14	24	16	8
	$ / lb	**lbs / hour**	**Total Material (tons)**			
Average Annual	$ 0.09	$ 1,652				
Total Annual			822	1489	1052	437

Date	Operator Cost (Sweeper & Dump)	Operator Cost (Sweeper)	Operator Cost (Dump)	Sweeper and Dump Truck Cost	Sweeper Cost	Dump Truck Cost	Refuse Fees	Total Monthly Sweeper cost
Jan-15	$ 7,754	$ 6,596	$ 56	$ 8,640	$ 6,272	$ 2,368	$ 1,680	$ 18,074
Feb-15	$ 8,297	$ 6,890	$ 56	$ 9,347	$ 6,591	$ 2,757	$ 1,120	$ 18,764
Mar-15	$ 4,877	$ 3,714	$ 41	$ 5,336	$ 3,528	$ 1,808	$ 586	$ 10,799
Apr-15	$ 13,355	$ 8,949	$ 89	$ 13,560	$ 9,212	$ 4,348	$ 1,873	$ 28,788
May-15	$ 11,597	$ 8,758	$ 62	$ 13,485	$ 9,482	$ 4,004	$ 2,319	$ 27,401
Jun-15	$ 7,593	$ 5,768	$ 38	$ 7,805	$ 5,807	$ 1,998	$ 1,400	$ 16,798
Jul-15	$ 8,659	$ 4,510	$ 76	$ 7,057	$ 4,998	$ 2,059	$ 928	$ 16,643
Aug-15								
Sep-15	$ 687	$ 687	$ -	$ 1,376	$ 784	$ 592	$ 245	$ 2,308
Oct-15								
Nov-15	$ 3,225	$ 2,967	$ 259	$ 3,379	$ 2,916	$ 463	$ 875	$ 7,479
Dec-15	$ 1,236	$ 826	$ 410	$ 1,080	$ 784	$ 296	$ 193	$ 2,509
Total Annual	$ 67,279.66	$ 49,666.16	$ 1,084.34	$ 71,065.00	$ 50,373.00	$ 20,692.00	$ 11,217.50	$149,562.16

Sweeper Recovery													
	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Total
Total Miles	534	467	309	745	684	557	427		60		330	77	4,190
Total Material (yds)	96	64	34	107	133	80	53		14		50	11	641
Total lbs	246240	164160	85928	274455	339863	205200	135945		35910		128250	28215	1,644,165
lbs/mile	461.12	352	278	368	497	368	318		599		389	366	
lbs / hour	1924	1221	1193	1400	1756	1622	1236		2244		2155	1763	
Total Cost	$17,924	$18,796	$10,797	$26,915	$25,082	$15,398	$ 15,716		$ 2,063		$ 6,604	$ 2,316	$ 141,611
$/lb	$ 0.07	$ 0.11	$ 0.13	$ 0.10	$ 0.07	$ 0.08	$ 0.12		$ 0.06		$ 0.05	$ 0.08	
lb/$	$ 13.74	8.73	7.96	10.20	13.55	13.33	8.65		17.41		19.42	12.18	

Average Monthly Sweeper Recovery	**Tymco 500X & Elgin Eagle**
Jan 2015 - Dec 2015	
Average Monthly Miles	419
Average Material (yds)	64
Average lbs	164,417
lbs/mile	400
lbs / hour	1,652
Average Monthly Cost	14,161
$/lb	0.09
lb/$	13

C. Construction Site Inspection Report

During the 2015 construction season, the County constructed four (4) Erosion Control Projects (ECP) as part of the Environmental Improvement Program (EIP) and one (1) Overlay Project. The projects included the following:

- Sawmill 2B ECP and Bike Path
- Tahoe Hills ECP
- Montgomery Estates 3 ECP
- Lake Tahoe Blvd ECP/Stream Environment Zone Project
- Black Bart Avenue, Barbara Avenue, and Martin Avenue Overlay Project

Prior to bidding any County sponsored EIP project, County staff prepares a project specific/context sensitive Storm Water Pollution Prevention Plan (SWPPP) associated with the project to provide for protection of nearby surface water bodies. One project (Sawmill 2B) in 2015 was over one (1) acre and required registration in the Water Board's SMARTS database along with permitted SWPPPs. All projects constructed by the County had SWPPPs that were prepared by a Licensed Qualified SWPPP Developer (QSD). The County currently has four (4) QSDs in its Tahoe office to assist with this effort. Since three (3) of the County Erosion Control projects were less than one acre, SWPPPs were not required, however the County did prepare them to protect surface waters and conduct responsible site management practices. SWPPPs help mitigate mobilization of soil from areas of disturbance near Stream Environment Zones (SEZ) and identify pollutant sources that may affect the quality of storm water discharges from the project site. The SWPPP also covers all de-watering and diversion activities that may be required within a construction project and outlines proper temporary and permanent BMP specifications, including installation and maintenance.

SWPPP implementation and compliance is primarily controlled by the project construction inspector with specific guidance from the QSD/project manager for temporary erosion and sediment control should deficiencies be noted. Additional SWPPP compliance is also monitored by County inspectors on a daily basis to ensure the SWPPP and all associated permit conditions and mitigation measures are adhered to. In the event that inclement weather is forecast for the region, the County conducts a series of steps to ensure nearby surface waters are not threatened by run-off from construction activity. These typically include the following:

1.) If a precipitation event is forecast, the QSD/project manager, inspector, and regulatory authority are forwarded storm reports. These help put the contractor and inspector on notice and give them lead time to make sure all BMPs are in place prior to a precipitation event occurring, as required in the SWPPP.

2.) The project inspector checks all active construction areas, making sure properly installed temporary BMPs are in place. If deficiencies are noted, the inspector notifies the contractor of areas that need to be maintained or shored up with increased protection.

3.) The inspector maintains inspection logs that record the amount and type of BMPs installed in the project area.

4.) If necessary, the inspector, with assistance from TEU staff, collects storm water samples and takes photographs as outlined in the SWPPP. Any violations are sent to TEU staff and the proper regulatory authorities.

5.) Proper corrections are decided upon and are carried out to ensure the downstream water body or SEZ is protected and cleaned as necessary to ensure proper function.

In addition to the SWPPP, all projects have a spill prevention plan detailing the methods, proper personnel, and entities to call in the event a spill should occur. The plan covers sewage, petroleum, and chemical spills that could possibly be generated from activities related to the project construction.

In concert with these efforts the County also conducts weekly tailgate meetings with all members of the Project Technical Advisory Committee (TAC) to discuss progress and constraints associated with construction, inspections and monitoring. These weekly tailgate meetings are used as a forum to invite both comments and suggestions regarding design, construction and maintenance by the TAC members.

County personnel provided inspection services for all projects constructed during the 2015 construction season and no spills or discharges from the project areas occurred.

All inspectors are trained professionals and were onsite during all aspects of construction when schedules permitted. This ensures a well-constructed project and compliance with all SWPPP and permit conditions. All notes, logs, and inspection forms filled out as part of daily operations are kept on file in the County office and are available upon request. An example of the inspector's Daily log and/or BMP inspection log is included in Appendix B. The inspectors are responsible for making sure all construction projects are completed according to design

specifications and that all necessary BMPs and protection devices are in place prior to any forecasted storm events in order to protect water quality.

Residential and Commercial Inspections

The County's Development Services (DS) Division managed the private sector construction site management program. For an inventory of active construction sites on May 1, 2015 (the start of the grading season), please see Appendix J. The DS Division has developed methodologies to inventory and inspect all active construction sites. At each site visit a temporary BMP inspection is performed and the County's enforcement provisions are utilized to issue correction notices and stop work orders if necessary.

County staff developed a construction site prioritization process based on threats to surface waters. The County LRP Division developed a high medium and low prioritization based on the size of the development and its proximity to water. LRP and DS are still working to outline this procedure and are incorporating it into the County's Land Management System now. The County anticipates that construction sites will be prioritized and inspected based on that prioritization for the 2016 construction season.

D. Commercial, Industrial & Municipal Site Inspection Report

In 2015 the County continued its refinement of methods to inspect all commercial, industrial and municipal sites based on a prioritized need. The need is based on the property type, potential pollutant sources and proximity to surface waters. This exercise was completed in ArcGIS and used best professional judgment. All high priority sites were inspected in 2015 as required by the NPDES Permit.

In coordination with the Long Range Planning (LRP) Division, the Environmental Management (EM) Division has developed a system to track these inspections in a database. The list of high, medium and low priority sites, as determined through a detailed inventory and geographic information exercise, are included in Appendix C. Also included in that list are the associated inspection summaries. This system allows the County to effectively inspect all its sites on a frequency deemed appropriate to protect water quality. High priority sites are inspected annually and medium and low priority sites are inspected on a less frequent basis in order to protect water quality.

All EM Division inspections include a storm water component. When inspecting any site whether it is for food safety or for hazardous materials,

the inspector is looking at potential contaminants, sources and issues that could affect storm water systems and/or surface waters. All inspectors have been thoroughly trained by qualified LRP NPDES staff to ensure that sites are inspected as required and that information is tracked accordingly. The LRP Division will also be supplementing inspections as needed to ensure that all facilities are inspected and that all sites are in compliance with permit conditions. The inventoried sites and associated data will be reviewed annually by LRP Division staff to ensure that water quality is protected.

The EM Division has specific codes in its inspection database related to NPDES and associated violations. These include:

- AA22 Sewage and Wastewater Properly Disposed
- AA42 Garbage and Refuse Properly Disposed; Facilities Maintained
- AA60 Improper oil/Grease Disposal into Parking/Street
- AA61 Condition of Refuse Containers & Trash Bin Enclosures
- AA62 Washing Mats/Filter/Trash Bins into Parking or Street Areas
- AA63 Improper Methods for spill Cleanup/ Hosing Area
- AA64 Maintenance Records: Lack of/Not Current

The inspectors are routinely trained on specific storm water related enforcement actions including illicit discharges, improper disposal of materials, wash water discharges to storm water systems, improper outdoor grease trap operation and illegal connections. An example of this type of inspection and some code enforcement and follow up is included in Appendix F.

E. Traction Abrasive and Deicing Material Report

The County has led the Tahoe Basin in the design of new abrasive specifications and requirements for responsible winter management. The County is also the first entity to adopt a very strict turbidity specification for its abrasives. This ensures that the selected aggregate meets water quality criteria for fine particles prior to its application to the road. All material is required to meet very strict gradation and water quality specifications prior to selection (see specifications below). The County has also written several white papers describing the benefits of the material for both public safety and environmental protection - El Dorado Department of Transportation (EDOT) 13-01[v] (Appendix D). The County tracks all traction material application quantities and areas to ensure responsible application and recoveries.

General Highlights:

- The sanding and de-icer application map was updated to reflect current sanding data (See Appendix E). The revised PLRM Road Risk layer also incorporated information from the sanding map and strategy.
- Sanding Logs are kept in the sanding truck to track material application amounts and locations. See Appendix E for an example.
- For areas where projects are being planned, structures such as DI's and sand traps are calculated based on seasonal loads of abrasives distributed on the roadway. All projects being planned are designed to incorporate this standard level of treatment for all sanding areas.
- Capture type BMPs are being implemented as part of the EIP projects that the County constructs. The County is currently re-defining project areas to be smaller and more targeted toward the highest priority water quality protection areas. This process will continue as the TMDL is implemented.
- Further work is being done to refine the County's abrasive specification to attempt to reduce the amount of fine sediment being applied to County's roadways.

The County studied multiple materials for winter traction sand management and found a certain material called Washoe Sand to be the best aggregate in terms of fine sediment particle (FSP) volume and nutrients. The County has been working with Caltrans for several years and influenced their research on abrasives and assisted with the development of the Particle Analysis of Abrasives Study (Appendix D). Through similar analysis the County has created white papers to understand and analyze the modification to this practice and its potential benefits to water quality as a source control practice (EDOT 13-01, Appendix D).

Based on the County's research, the new abrasive specification contains ten times less fine particulates and is denser making it easier to settle out in traps and pretreatment devices. The fine particles associated with the Washoe Sand (decomposed granite) are denser particles, thus they settle out faster and break down into less fine fractions. The density and hardness of the material indicate it will last longer on the road, break down less and be easier to sweep up once conditions permit.

Caltrans conducted a study[vi] on many different aggregates for possible road abrasives and determined Washoe Sand to be ranked #2 out of the twenty-two (22) materials tested for ultrafine particles (Appendix D). The County used twenty (20) yards of Washoe Sand in a subsurface Delaware sandfilter and achieved 83-93% load reduction of all particle classes and a 90% reduction of <20 micron particles[vii] (EDOT 08-02). The media functions so well that Caltrans contacted County staff to review this media specification for sand filtration treatment. The end result was Caltrans'

adoption of this new media specification which was based on this Washoe Septic Sand aggregate specification designed through collaboration with the County.

http://www.dot.ca.gov/hq/oppd/storm1/caltrans_20090729.html.

The County is confident that the modification of material specifications to the winter abrasive aggregate will have a notable and measureable benefit to water quality. The County intends to continue to research this in order to make sure goals are achieved and load reductions are realized.

The non-pulverized gradation for the selected material can be seen in the table below.

2/14/2013	Washoe Sand Non - Pulverized							
Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*100	sum Rn	100-sumRn
4	4.750	4750	525.00	541.5	16.50	2.20	2.20	97.80
8	2.360	2360	480.00	739	259.00	34.56	36.76	63.24
16	1.180	1180	442.50	731	288.50	38.49	75.25	24.75
30	0.600	600	398.00	526.5	128.50	17.14	92.39	7.61
50	0.300	300	286.00	329	43.00	5.74	98.13	1.87
100	0.150	150	274.00	282.5	8.50	1.13	99.27	0.73
200	0.075	75	342.00	345	3.00	0.40	99.67	0.33
50 micron	0.050	50			0.62	0.08	99.75	0.25
20 micron	0.020	20			1.14	0.15	99.90	0.10
16 micron	0.016	16			0.13	0.02	99.92	0.08
10 micron	0.010	10			0.21	0.03	99.95	0.05
5 micron	0.005	5			0.18	0.02	99.97	0.03
2 micron	0.002	2			0.13	0.02	99.99	0.01
1 micron	0.001	1			0.06	0.01	100.00	0.00
<1 micron	pan				0.02	0.00	100.00	0.00
Pan			378.50	381	2.50	0.33		
				Dry Sieve Plus Pan	749.50			

Washoe sand	
	mg/kg
NO3-N	<.5
NO2-N	<.5
TKN	40
TN	40
OP	<.5
TP	184

Particles less than 16um are only .08% of the total fraction. For particles <5um, (the particles causing nearly 97% of the light scattering in Tahoe) there is only .03% of the total. For particles <2um (the particles causing 92% of the light scattering degrading clarity) there is .01% of the total. For particles <1um (those responsible for 73% of the light scattering) there was no detectable levels. The County believes this to be a very big deal and one that will have a positive impact on Lake Clarity. This equates to

over a 94% improvement relative to the previously used aggregate for particles <16um.

As Required in Section II.D of the NPDES Permit the County reports the following new specification for Traction Abrasives:

Winter Traction Sand – Specification

Material shall be clean aggregate, free from clay or organic material. Representative samples of the material shall be collected and tested by the supplier as it is produced at a frequency of one test for every 250 tons, or fraction thereof, of material produced. Laboratories performing quality control testing shall be certified in the State of California or completed by or under supervision of the County.

All samples will be taken from delivered stockpiled material in accordance with California Test 125 or the County protocol steps below.

The aggregate must meet the following:

a. Must meet the below grading and durability specifications.
b. Total moisture content must be low enough so that the sand will not freeze in the truck or the sander.
c. Must not contain frozen lumps larger than one (1) inch in size.
d. Sand must be suitable for use as a traction abrasive on highways.
e. Color: sand shall not be the color black or dark gray when material is wet or dry.
f. Quality control test results shall be provided for every 250 tons of material produced.

Aggregate gradation must be within the target value limits for the specified sieve size shown in the following table:

Aggregate Gradation (Percentage Passing)

Sieve Sizes	Target Value Limits[1]
¼”	100
No. 8	40-65
No. 16	15-35
No. 50	0-5
No. 200	0-1

If material does not meet specification on first sample, then three samples will be analyzed and the average will be used for determination of compliance with specifications.

Delivered material will be tested for the following quality control requirements:

Minimum Quality Control Requirements

Quality Characteristic	Test Method	Minimum Sampling and Testing frequency	Values
Grading	California Test 202	250 tons, or any portion there of	Target Values
Moisture Content		250 tons, or any portion there of	5% maximum
Sand Equivalent	California Test 217	250 tons, or any portion there of	80 minimum
Durability fine	California Test 229	250 tons, or any portion there of	55 minimum
Turbidity	Hach 2100P, Hach 2100Q or EPA Method 180.1	250 tons, or any portion there of	100 ntu maximum

Pit or delivery samples will be taken by a County Representative to determine total moisture content and conformity to gradation specifications and turbidity. Materials not meeting these requirements could be rejected. Suppliers are responsible for removal of rejected material. Rejected material will be removed within two (2) days of notification of rejection at no additional cost to the County. Submit all quality control test results to the County within two (2) days of taking samples.

Turbidity Specification

The material shall be tested for the turbidity levels produced when combined with water and respective results shall be reported. The turbidity analyses shall be conducted by County staff or a state certified laboratory in accordance with the following procedures:

The turbidity specification for the County is **100 ntu or less** when analyzed immediately following the procedure below.

Because fine sediment particles are related well to turbidity, the County has developed the following turbidity protocol in order to regulate fine particles associated with abrasive stockpiles and usage.

1. Obtain a representative sample of the material to be tested. Stockpile sampling of aggregates should be conducted according to the procedures in California Test 125 http://www.dot.ca.gov/hq/esc/ctms/pdf/CT_125Nov2010.pdf or following the County developed protocol (a-e) below.

a. Use a large zip lock plastic bag or clean bucket to store the sample.

b. Take three (3) samples from the stockpile; one (1) sample at the top, one (1) sample from the middle section and one (1) sample from the lower section. The lower section should be at a minimum three (3) feet from the edge of the stockpile.

c. Use shovel and dig down approximately one (1) foot in depth

d. Take sample at approximately one (1) foot depth.

e. Combine all samples into zip lock or bucket.

2. Dump contents of zip lock plastic bag or bucket onto a tarp, visqueen or similar.
3. Take three (3) teaspoons of aggregate from the pile. One at the center, middle and edge of the pile. Measure out 30 grams of aggregate.
4. In a sample container, combine 30 grams aggregate into 1000 ml of water.
5. Swirl the container gently for a few seconds and then soak for two (2) minutes.
6. After soaking, gently invert the container ten (10) times at a rate of approx. one (1) inversion per second, to break up material and suspend fines. Do not agitate vigorously or entrain air bubbles in the solution.
7. Allow sample to settle for one (1) minute
8. Using a pipette, withdraw an adequate volume of solution for the turbidity measurement. Withdraw the sample from the center of the container approximately one-inch below the surface.
9. Obtain the turbidity measurement using a Hach 2100Q or per EPA Method 180.1.
10. If out of specification on first measurement, repeat steps three (3) through nine (9) three (3) times and report the average value from the three measurements.

Abrasive Quantities

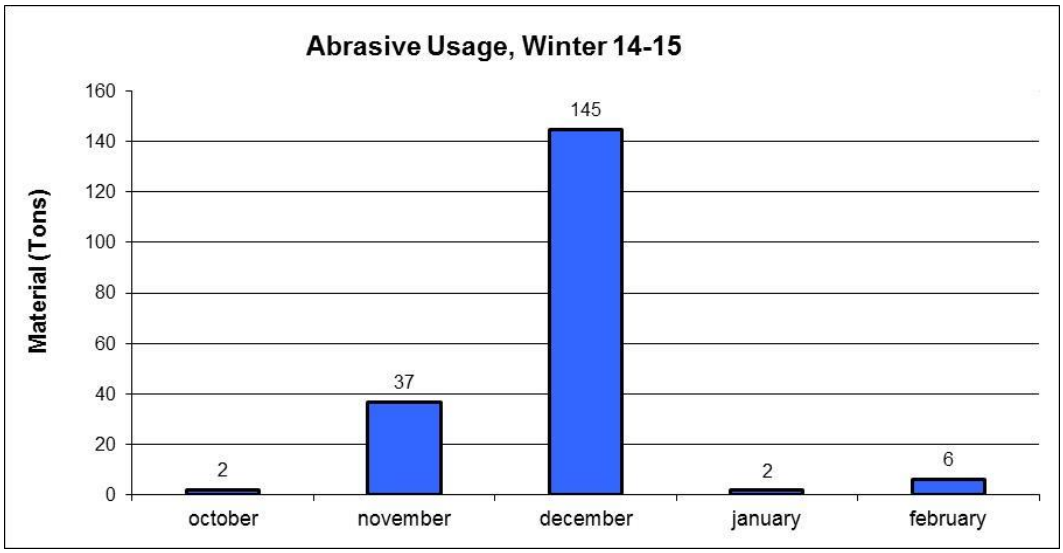
The County has a tracking and record keeping system in place to quantify the total amount of abrasives and deicers applied to the road. Below is a summary of this information.

The County applied approximately **191 tons** of abrasives, **24 tons** of salt and **27 tons** of salt as brine **(26,394 gallons)** as roadway abrasives/anti-icers during winter operations in 14/15. Materials are ordered on an as-needed basis with combined stockpiles of approximately 100 yards kept on the North and South ends of El Dorado County. In winter 14/15 approximately 156 tons of abrasives were applied on the South Shore and 35 tons were applied on the West Shore in the Tahoe Basin of the County.

During the winter months, the goal of the County's winter maintenance program is to maintain safe and efficient driving conditions on County roads in the Lake Tahoe Basin for the citizens of and visitors to the County. To achieve this goal, the County applies traction abrasives to the roadway network as part of the County's winter maintenance program. As a result, these agents are administered to County roads before, during, and after adverse weather conditions.

As a partner in the effort to preserve and restore Lake Tahoe, it is the County's goal to mitigate impacts associated with the application of traction materials (i.e. re-entrained airborne road dust and discharge to storm drain systems and nearby surface waters, etc.) through sediment and debris recovery activities. In order to gauge the effectiveness of these recovery efforts, daily sanding logs are maintained by the County Maintenance Division. The logs document the application amount, location, and time traction materials are administered, which are then correlated to sweeper and vactor truck logs to quantify overall recovery success. The locations identified on the log sheets can then be cross-referenced with the Snowplow Zone and Sanding Maps to identify areas that receive high application rates and will most likely need more intensive vactoring and sweeping after storms and during spring and fall BMP maintenance. The County also used this information to aid in the development of Road Risk in the PLRM. In addition to these efforts, the County also applies a brine solution to some roads when conditions are right, prior to a snow event in order to reduce the need for road sand.

The County has developed a GIS and database to track and monitor these activities electronically. This is conducted by performing a database query that identifies specific DI's and sediment cans that are nearing capacity, which is plotted on a map and printed out for utilization by the Maintenance Division staff. This has allowed the County to better prioritize maintenance activities and has provided for expedited recovery of material applied to County roads. The graph below shows the total abrasives applied to the road based on the County sander log sheets kept in the truck. The total applied was equal to the ordered amount as each warehouse has a stockpile of over 100 yards.



Source: El Dorado County Maintenance Operational Logs

Discussion

Historically, many of the abrasives applied to the road surface were imported material from outside the Tahoe Basin that have physical properties different from those that Tahoe has assimilated prior to anthropogenic influences. Granite is an intrusive igneous rock that has a medium to coarse grained texture. Intrusive igneous rocks are formed from magma that cools and solidifies within the crust of the planet. Surrounded by pre-existing rock, the magma cools slowly, and as a result these rocks are coarse grained. Native aggregates such as decomposed granite have been present in the Tahoe Basin since lake formation. Decomposed granite has natural filtering capabilities, contains coarse aggregates, has a higher density and it appears Lake Tahoe has the capability to assimilate it.

These may be some of the reasons why Lake Tahoe has such extraordinary clarity - this material essentially acts as a natural filter. Many applications use decomposed granite for treatment and in some areas require decomposed granite in the use of septic systems and sand filtration. County evaluated the use of decomposed granite (Washoe Septic Sand, RT Donovan) in a sandfilter system and found the media to be highly effective at removing fine particulates from storm water (EDOT 08-02). http://www.dot.ca.gov/hq/oppd/storm1/caltrans_20090729.html.

Volcanic cinders on the other hand are extrusive igneous rocks that are formed at the crust's surface as a result of the partial melting of rocks within the mantle and crust. Extrusive igneous rocks cool and solidify quicker than intrusive igneous rocks. Since the rocks cool very quickly they are fine grained. Altering abrasives application material type is a

critical component of meeting the TMDL. Preliminary estimates included in the Table below indicate that the total load generated by the County could be reduced by greater than 5%. Based on the analysis of this data and the distribution of material in various size classes from this material, the data indicates a reduction of a factor of 10 in fine particle aggregates <16 micron (table below) by switching from the Volcanic cinders to the Washoe Sand. This equates to an approximate 90% load reduction compared to baseline conditions pre 2004 for this aggregate.

Based on our research, the total load reduction equates to between 24,000-33,000 lbs or 120-165 credits. Based on a TMDL baseline load without connectivity of 439,000 lbs of FSP, the County estimates it is possible to achieve a 7% load reduction by just changing the aggregate specification alone. The annualized cost benefit of this modified aggregate was calculated to range from $.31-$.42/lb-FSP/year. Even the most optimistic street sweeping annualized unit cost reductions from the Placer County TMDL Strategy Report suggest that sweeping may be capable of achieving approximately $4.00/lb-FSP/year.

These hypothetical sweeper numbers are based on many assumptions and may not represent actual field measurement data in the Tahoe Basin. The numbers represented below for the aggregate analysis are based on actual aggregate gradations and particle size analysis. This amount will be reduced by changing the specification of the material prior to application to the road surface.

	<16 micron load (lbs)		
Material Distribution based on 1000 ton of aggregate used as winter abrasive	**Non-Pulverized Aggregate**	**Pulverized Light (.4 KG Weight)**	**Pulverized Heavy (4 KG weight)**
Volcanic Cinders	25559	30731	38815
Washoe Sand (DG)	1636	2021	6281
% Reduction	94%	93%	84%
Total Load Reduction	23923	28710	32534
Credits	120	144	163
EDOT FSP Baseline Load	439000	439000	439000
% of TMDL Baseline Attainment	5%	7%	7%
EDOT FSP First Permit Term	44000	44000	44000
% of TMDL First Permit Term	54%	65%	74%
Increased Cost of New Abrasive (1,000 ton annual usage)	$ 10,000	$ 10,000	$ 10,000
Cost / benefit ($/lb-FSP/year)	$ 0.42	$ 0.35	$ 0.31

Source control practices prevent material from mobilizing in the first place. Sediment control is attempting to recover the material after it has already been displaced. Controlling the aggregate type is a “true” source control and sweeping a sediment control. The source of the material should be the primary target in order to achieve load reductions and a secondary focus should be on attempting to recover fine particle materials once they have been introduced and/or mobilized.

The Tahoe Road RAM is a method to understand the road condition and how the road condition relates to washoff water quality. In future research, the County’s goal is to understand how these abrasive changes translate to changes in RAM scores and what that means from an event mean concentration (EMC) perspective. It is known that road integrity is a critical component to sweeper effectiveness and washoff water quality. It is more effective to sweep a road in good condition then it is to sweep a road in bad condition. Many roads in the County have bad integrity and many are spalling and/or alligatored. These roads may be impossible to sweep effectively, hence the need for alternative strategies to achieving load reductions.

The County plans to implement the TMDL tools as designed and will continue to play a critical role in understanding and quantifying the benefits from the modification to these winter maintenance practices. With collaboration and assistance with partner agencies such as Caltrans and the City of SLT, the County intends to develop TMDL strategies that both make sense and are cost effective.

Brine Use

In addition to being responsible in the application of abrasives and limiting fine sediment on the road surface the County also has a detailed and progressive anti-icing and ice control program. The County is currently in the process of procuring several state of the art pre-wetting systems that mount to our spreaders. This will enable less sand to be used in the aggregate and allow the abrasive to stay on the road longer giving a longer lasting effectiveness for traction.

Brine is used as an anti-icing agent to control ice buildup on the road surface and reduce the freezing point of the road surface down to 14 degrees Fahrenheit to prevent ice from forming. Brine is most effective above 14 degrees Fahrenheit and is best used prior to forecast events where temperatures are anticipated to be below freezing. The brine is mixed at a ratio of 23.5% salt and 76.5% water. The brine is premixed following strict guidance methodologies in a controlled setting in the maintenance yard located on Shakori Drive in South Lake Tahoe, CA. The truck used is a 10 wheel dump truck loaded with a 2004 varitech

slide-in anti-icing system. The distribution is done with an electronic application controller. The system has a computer controlled speed sensor; flow meter and variable application valve to always ensure a steady and consistent flow to the road surface regardless of vehicle speed. The County applies the brine at a recommended 35 gallons per lane mile. The County only brines high use primary roads and high use secondary arterials as needed.

The brine is only applied prior to forecast events and is a needed tool in the winter maintenance toolbox for preventing ice buildup and limiting excessive dry salt usage. If brine were not used, the normal standard requires a dry salt application of 500 lbs salt per lane mile. The dry salt is subject to blow off to the shoulders, does not stay impregnated on the road surface very long and its effectiveness is often short lived with negative consequences on the environment. The brine as applied in aqueous solution stays on the road surface, does not bounce off the road and requires much less salt to achieve a much greater public safety benefit. Table 1 below documents the brine usage for the winter months of 2014/2015. The County keeps detailed records of the brine used on all County Roads.

Table 1

Date	Time	Street	Lane Miles	GPM Rate	Amount (gal)	Operator	Salt Applied (lb)
12/17/2014	1600	NUT (50 to LTB)	4.6	35	161	AP	316
		NUT (50 to Delaware)	2	35	70		137
		LTB (Tahoe Mtn to NUT)	2.6	35	91		178
12/17/2014	1600	LTB (Tahoe Mtn to City)	7.6	35	266	AP	521
		SUT (50 to Kekin)	1.5	35	42		82
		Sawmill (LTB to 50)	1.85	35	64.75		127
12/24/2014	730	Pioneer (50 to City)	10.4	35	364	TR	713
		Black Bart and Barbara	2.5	35	87.5		171
		Elks Club (Pioneer to 50)	1.5	35	52.5		103
		LTB (NUT to Tahoe Mtn)	7.6	35	266		521
12/31/2014	730	Pioneer (50 to City)	10.4	35	364	BH	713
		Black Bart, Martin	2	35	70		137
		Barbara	0.05	35	1.75		3
		NUT (LTB to 50)	1	35	35		69
		LTB (City to Tahoe Mtn)	7.6	35	266		521
12/31/2014	730	LTB (City to NUT)	2.5	35	87.5	BH	171

Table 1 continued

Date	Street	Lane Miles	GPM Rate	Amount	Operator	Salt Applied (lb)
2/26/2015	Pioneer Trail	20.8	35	728	Zorn	1427
	Black Bart/Martin	2	35	70		137
	Barbara	0.5	35	17.5		34
	LTB (NUT to City)	10.2	35	357		700
	NUT (50 to City)	6.6	35	231		453
	Sawmill	3.7	35	129.5		254
	Elks Club	1.6	35	56		110
	SUT (50 to Kekin)	1.2	35	42		82

As an example to demonstrate the superior use of brine when compared to dry salt, the County compared the recommended prior usage of dry salt to the currently used brine (Table 2). By eliminating straight dry salt applications from the County winter maintenance program, the County has reduced its salt usage by approximately 86%. This practice not only reduces the introduction of chloride to the environment but improves public safety through the longer lived benefits that brine offers through single applications on the road surface. Repeated applications are not needed with brine. Once conditions are such that snow buildup is present on the road surface, the County then initiates its advanced abrasives strategy to improve traction. The County is the leader in the development of both specifications that both improve public safety and benefit the environment.

Table 2

Dry Application	
lb/mi	500
total miles	66
NaCl (lb)	32,850
NaCl (ton)	16.4
Brine Application	
lb/mi	68
total miles	66
NaCl (lb)	4,486
NaCl (ton)	2.2
Reduction in NaCl usage	86%

These estimates are based on a dry salt to brine ratio of 1:1. By using brine, less dry salt is ultimately needed because the brine actually adheres

to the road surface and stays on the road longer yielding in a longer effectiveness when compared to using dry salt alone. Following this logic, the total quantity of salt used is much less and the reduction of salt would be much greater than the calculated 86%.

Other Benefits of Using Brine

The utility of brine is much like the Teflon coating on a pan. It prevents the ice from sticking to the road. Brine prevents the freezing of the ice layer on the road surface itself and makes the removal of snow much more efficient as it is more easily brushed off by snow removal equipment, which ultimately leads to less equipment time and damage to the road surface. Because the brine stays on the road longer and has long lasting benefits, this ultimately leads to less equipment time and the application of less sand on the road surface. Needing less sand means having less equipment overall on the road recovering sand after the event occurs, ultimately meaning less cleanup after the event and less disturbance to the road itself. Using brine also has long term conservation benefits due to the reduction in heavy equipment needed after initial application.

Though small, this will ultimately lead to carbon emissions reductions through the burning of less diesel fuel and less damage to snow removal equipment. Again, these are tools the County uses to meet the public safety and environmental requirements to protect its citizens and resources. County staff including street maintenance, fleet maintenance and engineering are annually refining and adjusting these practices to be the most efficient and least impactful possible. County staff has long term practical knowledge and work collaboratively to ensure success of all divisions. The principles of adaptive management are constantly being applied and refined to meet the needs of the taxpayers and safety of the public. This ultimately leads to a successful technology based program using the greatest local and scientific state of knowledge in the industry and a successful overall program based on sound scientific principals and practical local working knowledge.

Sand and Salt mix

The County currently uses a 10:1 ratio of sand to salt. This means that during an average winter if the County uses 1000 tons of sand it will use 100 tons of salt. This is done in varying ratios by every local jurisdiction to prevent caking and clogging of the dump truck spreaders and ensures efficient distribution of the material on the road surface. As mentioned above, the County is in the process of procuring a state of the art pre-wetting system for all sanding trucks in the Tahoe Basin. This involves using two 100 gallon tanks of brine solution that pre-wet the sand prior to placement on the road. This ensures that sand does not clump or cake and helps to ensure the sand can impregnate into the ice and stay on the

road surface longer. This is considered an advanced winter maintenance strategy.

Spreaders and Handbook
The County currently uses Henderson model spreaders. The County is investigating the future purchase of Epoke or similar spreaders which more efficiently spread sand at preprogrammed rates using automated technology. Once the County makes this transition, it will have one of the most sophisticated and high technology winter maintenance operations possible. The County is currently also formulating a winter maintenance handbook to assist with programming and staff training. This will help convey to the public and regulatory agencies the standards by which the County operates for winter road maintenance.

Conclusion
Having a program that is both transparent and responsible will help limit uncertainties and misconceptions of the general public. The County is doing all that it can to blend public safety and water quality protection, including conducting maintenance staff training on an annual basis.

Between the source control quality assurances, the technology updates to equipment and the advanced anti-icing methods being employed, the County is moving forward in a responsible fashion that truly blends public safety and water quality protection. This has taken years of research and trial and error; and the County believes that the interests of the local taxpayer, touring public and local ecology are in mind when making decisions regarding these practices. This will undoubtedly have both positive impacts to the safety of the public and the famed clarity of Lake Tahoe.

F. Storm Water Monitoring Report

See Appendix G for the Storm Water Monitoring Report submitted to all Tahoe Basin implementation agencies by the Tahoe Resource Conservation District and done in coordination with the Implementers Monitoring Program (IMP). This multi-agency effort is a model for the future of Bi-State TMDL collaboration with support from all basin wide jurisdictions to meet regulatory requirements in the protection of Lake Tahoe.

G. Illicit Discharge Report

Illicit Discharge Detection and Elimination

a.) The County inspected all storm water conveyance, collection and treatment systems in 2015. Site visits included visual observations of the potential for illegal connections, illegal discharges and non-storm water discharges. When inspections found violations, the County notified the property owners and took precautions to ensure the protection of water quality. All inspectors in planning, engineering, maintenance and environmental management are trained to recognize illicit discharges and non-storm water discharges. An example of an inspection with associated illicit discharges is included in Appendix F.

b.) The County initiated a detailed tracking and recording system for logging information/enforcement/follow-up regarding Illicit Discharge Detection and Elimination (IDDE) in 2014. The County was successful in incorporating several inspection fields into the EM Division's inspection program. Several NPDES related violation codes (noted above) are now available for specifically inspecting a site regarding storm water and conveyance systems. The EM Division is trained annually on the process of identifying, recording and tracking illicit discharges located within the County limits. In the event that a violation occurs, a storm water coordinator is contacted, the site is evaluated and precautionary measures are taken. Most violations will result in the form of non-storm water discharges, however all inspectors are trained to look for signs of any illicit discharge or illegal connection.

c.) The County possesses the legal authority to implement the NPDES Permit and will enforce the Code to the full extent of the law when violations go uncorrected. The County was very successful in identifying several violations of chronic discharge of sediment to the County right of way and Lake Tahoe. Sites where chronic discharges occur or where discharges directly harm or have potential to harm water quality, biologically sensitive areas or infrastructure, the County took precautions and enforced its ordinances. Several correspondences were sent to homeowners requesting the retrofit and/or cease and desist of storm water discharges. From these correspondences, all property owners either retrofitted and/or fixed the problem. The County used internal resources to find, inspect and correspond with said owners in order to determine solutions and protect water quality. An example of a successful use of County authority to improve water quality is included in Appendix F.

d.) The County created a storm water hotline that is advertised on its Facebook and Web pages and will be incorporated into all storm water outreach pamphlets. Several concerned citizens called the hotline regarding different issues. Every call was thoroughly investigated and responded to. One example is a call the County received on brine applications and its impact on water quality. The County investigated the complaint and determined that it was part of normal winter operations, did not warrant further investigation and notified the citizen. The use of brine as a winter ice control agent will however continue to be tracked and recorded to ensure responsible usage.

This next year the County intends to continue more intensive advertising of the storm water hotline in all public outreach tools and venues. The County Storm water hotline phone number is (530) 573-7906. The hotline is manned during business hours; however the public can leave a message 24 hours a day to relay information. All calls are routed to the responsible divisional staff for enforcement, cleanup and follow up. A chain of command is in place that allows for discharges to be handled by the respective agencies and followed up on as needed. The County storm water coordinator is responsible for coordination, cleanup, follow-up and reporting.

e.) Spill report – The County EM Division tracks all spills that occur in the South Lake Tahoe Vicinity including follow up and enforcement. See Appendix F.

Dry Weather Monitoring

The County continuously conducts dry weather inspections and is continually refining its dry weather monitoring program with the EM and Maintenance Divisions. County inspectors frequently visit all portions of the County and report and take action on all suspicious discharge-related activity/discharges. Several dry weather discharges were reported this past summer and actions were taken to notify proper entities. A tracking system is developed that records all discharges and creates a hierarchy for information dispatched to the proper entities. This is accomplished by utilizing Engineering, Planning and Maintenance Division personnel; by following tips generated by the newly developed hotline; and by using permanent and seasonal staff.

Stormwater System Inspection Logbooks are located in County vehicles to track and record information. This streamlines the efficient logging of information and the reporting of this information to the correct divisions for enforcement. All suspect activities including those that have the potential to create discharges were immediately handled. Many construction sites storing material in the County ROW were notified and corrected, as were

contractors with untidy sites tracking material into the County ROW. This system not only informs immediate enforcement / response, but creates a mechanism to log and track information for reporting and follow-up action if needed. All sites needing attention within the Tahoe Basin portion of the County were addressed for the 2015 calendar year with very good compliance from the respective individuals and contractors.

This year, no major discharges were noted that resulted in any significant threat to water quality. The majority of the detections were in areas where leaky water mains ruptured, minor sewage spills occurred, or where construction areas discharged water into the local storm drain. These are documented in the attached EM and Maintenance Division reports.

H. Education Component Report

The County continues to educate the public with regard to storm water using literature broadcasted through various Divisions' main offices. The County updated its Storm Water Management Program Website this year which can be viewed at:

http://www.edcgov.us/Government/LongRangePlanning/StormWaterManagement/Storm_Water_Pollution_Prevention.aspx

The EM and DS Divisions have pamphlets that educate the public on illicit spills, discharges, construction related BMPs and actions to take when problems arise. Disposal of hazardous waste is also highly incentivized through the County program and has an excellent track record of public participation and disposal. A supplemental hazardous material report and public outreach general observations are included in Appendix F.

County planning/engineering staff has developed a training protocol and mechanism by which Registered Environmental Health Specialists (REHS) look for storm water related issues while conducting site inspections for public safety and health. These include ensuring all potential contaminants on a site are stabilized and contained to prevent them from mobilizing to the County storm drain system. Site condition will also be assessed and reported. The DS Division also has pamphlets on the County's Storm Water Management Program that contain information on actions individuals can take to prevent discharges to storm water.

The DS Division also works with the Tahoe Resource Conservation District (TRCD) by handing out flyers on residential BMP implementation and contact information for site evaluations. The DS Division also conducts regular inspections of all active construction sites for temporary BMP

compliance and proper site stabilization during construction. At each visit, the inspector utilizes a checklist that ranks the site for both permanent and temporary BMPs and ranks the project for compliance with local regulations and conditions. Corrective actions are taken on a site by site basis with priorities given to those with direct connectivity to surface waters.

The following summarizes Education and Outreach activities conducted by County staff during 2015.

- The County meets periodically with South Tahoe High School (High School) science classes to discuss local issues and inform the students of watershed management and storm water. The County was involved in the design of a hydrologic simulator for the High School science class and is now working on the development of a curriculum with local non-profit groups to educate the students on developed sites and their impact on water quality. All activities are coordinated and organized to inform and educate the students to begin dialogue and education that hopefully is brought home and discussed with their parents.

  The County organized a field trip for an entire day with the High School AP Environmental Science class. The league to Save Lake Tahoe and the City of South Lake Tahoe also participated in this event. Several water quality improvement projects, erosion control, Stream Environment Zone and stream restoration projects were visited. A stop was made at the County Maintenance Yard where the students had the opportunity to interact with Maintenance personnel. Winter operations were discussed as well as brine and abrasive use and its impact on Tahoe's clarity. The students had an opportunity to get their hands on a sweeper and a Vactor truck and ask questions. A quiz was given to the students both before and after the field trip to gauge the education they received. The outcome was very impressive as most of the students had a measurable improvement post field tour. Pictures of this event as well as an itinerary and information are included in Appendix K.

- The County routinely holds public meetings for all erosion control projects in development. In this regard, the public is informed on the importance of storm water management and treatment with information distributed on the residential BMP Program and coordination that is necessary for the program's success. A representative from the TRCD is on hand to answer questions on residential BMP design/guidance with free site evaluations given to residents within the project's boundaries. Literature is sent out frequently during the design process that stresses the importance of the BMP Program and the steps

needed for local compliance with local rules and regulations.

- County staff has also been and will continue to be involved in various community outreach activities such as the League to Save Lake Tahoe Pipe Keeper Program and BMP training. These activities are meant to generate public involvement and interest in protecting water quality and identifying/improving the environment through responsible community participation/engagement. The County again presented at the League to Save Lake Tahoe Pipe Keeper forum. This forum consisted of many engaged public citizens and representatives of public agencies. Many local community members were present to listen to presentations from scientific, nonprofit and implementing agencies. The presentation and agenda for this is included in Appendix K.

- The County hosted storm drain marking events within subdivisions to engage the public and inform and educate regarding water quality and surface water protection. This was conducted through the League to Save Lake Tahoe and the SOS youth outreach program.

- County staff chairs meetings including the Stormwater Quality Improvement Committee (SWQIC), Implementer Monitoring Program (IMP) and Operations and Maintenance (O&M) to coordinate science related activities and present the most up to date research to agency staff, research professionals, consultants, and the public.

- The County continued the implementation of its storm water hotline enabling the public to report storm water related activities and issues. The hotline number is (530) 573-7906. The County is advertising this hotline number on all of its storm water related program materials and social media.

- The County implemented a County storm water Facebook page https://www.facebook.com/EDCStormwater. To date, the County has generated 135 friends. Information is distributed to the public in an attempt to educate, inform and update the public with regard to storm water related activities within the County.

- The County trains the Maintenance, EM and DS Divisions regarding BMPs and the County NPDES and Storm Water Management Program. Stormwater Division staff along with other certified staff educates internal staff and responsible Divisions on what to look for during “inspections” as they relate to each Division. The training is then completed with a field tour to individual project sites for on the ground training using exemplary and substandard sites. The sign in sheets, agendas and PowerPoint presentations are provided in

Appendix H.

I. Fiscal Analysis Report

Though not an outlined requirement of the NPDES Annual Report in the MRP, the County presents fiscal analysis information relative to the NPDES and Tahoe Basin Water Quality Program. The information and budget for the County's LRP, Tahoe Transportation and Maintenance Divisions are presented in Appendix I.

The County has continued to commit the required financial resources from its General Fund and Road Fund in order to manage the Storm Water Program and perform the required field maintenance activities. Details on this can be seen in Appendix I. The County has also been successful at obtaining federal, state and local grants to construct large scale water quality improvement projects aimed at reducing pollutant loads from the County's rights of way.

The County is also participating in a long term funding strategy with our California Basin Partners called Road to Blue. The Water Board is also part of this effort, which is currently being led by the TRCD. A Request for Proposals (RFP) was released in early 2015 and a consultant team was hired. To date, Phase 1 of the Project has been completed and a scope of work has been drafted for Phase 2, which will include conducting extensive citizen polling. The group is currently partnering with other similar disciplines in order to generate sufficient funds to proceed with Phase 2. The County is hopeful that favorable results will come from the polling that could lead to the County partnering to conduct a special ballot to generate local dedicated long term funding for the County's Storm Water Management Program. More detail on this study will be included in the next year's Annual Report.

See the response letter from the California Local Jurisdictions to the Water Board in Appendix I, which includes a tentative schedule for the study.

3.0 Conclusions & Next Steps

This Annual Report demonstrates the County's commitment to protecting water quality and developing efficient and cost effective means for meeting NPDES Permit conditions and requirements. The County strives for excellence in its SWMP to formulate plans and programs that protect the public and benefit the local tax payers. The County has been very active in getting all supporting staff/programs to participate and help make the transition between workloads as integrated and seamless as possible for collaborative implementation. There are

several improvements currently being made to support all Divisions with their respective roles in this important effort.

This year 2016 will be challenging in order to begin to meet the requirements of the Lake Clarity program, LCCP and CAP of the TMDL. The County is committed to meeting these requirements and will make every stride necessary to meet continued timelines for compliance with requirements and permit conditions. This will require a team effort from all NPDES and support staff in order to be successful in meeting program goals and objectives.

The County continually uses the premise of adaptive management to streamline, coordinate and implement all aspects of the SWMP. Though the SWMP is adopted, the implementation of it is truly a living document that is perpetually improved and refined to meet the needs of the NPDES Permit. The County is an active partner and key participant in the TMDL and LCCP efforts and considers itself a leader in the development of cost effective solutions to improve programmatic goals. The County is committed to meeting all the conditions of the NPDES Permit and requirements of the Clean Water Act and looks forward to continuing to work with Lahontan staff on the implementation of its program.

4.0 References

[i] Tahoe Regional Planning Agency. 2011. Threshold Evaluation Report – Water Quality. Pg 4-18.

[ii] Lahontan Regional Water Quality Control Board (LRWQCB) and Nevada Division of Environmental Protection (NDEP). 2010. Final Lake Tahoe Total Maximum Daily Load. http://www.swrcb.ca.gov/rwqcb6/water_issues/programs/tmdl/lake_tahoe/docs/tmdl_rpt_nov2010.pdf

[iii] County Of El Dorado. 2014. Pollutant Load Reduction Plan

[iv] County Of El Dorado. 2011. Baseline Pollutant Load Estimate Report.

[v] County Of El Dorado, 2013. Abrasive Study

[vi] California Department of Transportation, 2010. Particle Analysis of Abrasive Study

[vii] County Of El Dorado, 2008. White Paper EDOT 08-02, What it the Water Quality Benefit and TSS / PSD Removal Efficiency of the Sandfilter Located at the Apalachee Phase 1, Nottaway Basin?.

Appendix A

2015 NPDES General Inspections (Zones #1-10)

Zone 1

NPDES General Inspection of Zones #1-8 was conducted on November 23, 2015. NPDES General Inspection of Zone #10 was conducted on November 2, 2015.

Zone #1 Page #1: No major issues noted within this area. All collection, conveyance and treatment systems appeared to be in working order. ST #'s 2357 & 2358 had pine needle/debris accumulation that will need maintenance/cleaning. See Photo's below:

Zone #1 Page #2: Approximately 90% of DI's have debris impeding flow into system. Maintenance is recommended to restore full functionality of DI systems. Residential construction project located at LupineTrail2256_KBrothersConstruction has eroding slopes and failing silt fence. Information about this project site has been forwarded to El Dorado County Building Department via Russ Wigart. **See photos next page**:

2256
LUPINETR
2015/11/23

2256
2015/11/23

2015/11/23

Zone #1 Pages #3-5: No major issues noted within this area. All collection, conveyance and treatment systems appeared to be in working order. El Dorado County street sweeper was running and cleaning up road abrasives on bus routes prior to upcoming storm.

Zone #2 Pages #1-5: DI's have minor debris impeding flows into system. Maintenance is recommended to restore full functionality of DI systems. Residential construction project located at Boren1327_KuelperConstruction has eroding slopes, uncovered spoils piles, information about this project site has been forwarded to El Dorado County Building Department via Russ Wigart. **See photos below**:

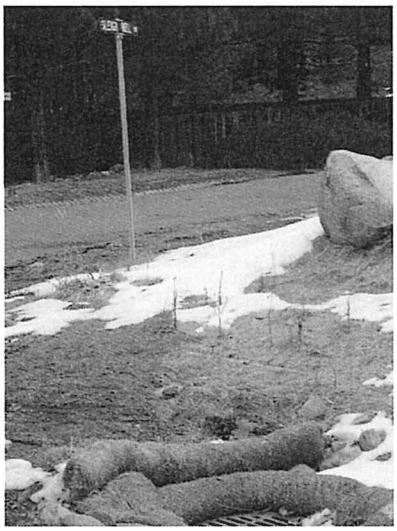
Zone #3: No major issues noted within this area. All collection, conveyance and treatment systems appeared to be in working order.

Zone #4 Pages #1-3: No major issues noted within this area. All collection, conveyance and treatment systems appeared to be in working order.

Zone #5 Pages #1-3: Pipe crossing (pipe #1191) at Han and Blitzen has debris and sediment impeding outlet of pipe. **See photos below:**

Pipe crossing (pipe #1184) South of Colusa Street has debris and sediment impeding inlet and outlet of pipe. See photo below:

Residential construction project located at Sleigh Bell Dr. and Santa Clause Ln. appears to have spoils piles exposed to the elements, coir logs in El Dorado County Drainage way (Blanket Lined Channel) and construction site tracking issues. **See photos next page:**



2015/11/24

2015/11/24

Zone #6: No major issues noted within this area. All collection, conveyance and treatment systems appeared to be in working order.

Zone #7 Pages #1-5: No major issues noted within this area. All collection, conveyance and treatment systems appeared to be in working order.

Zone #8 Pages #1-5: No major issues noted within this area. DI's have minor debris accumulating at system inlet. Maintenance is recommended to restore full functionality of DI systems. All collection, conveyance and treatment systems appeared to be in working order.

Zone #9: Strawberry, Sierra Pines, Echo Summit NPDES Inspections not applicable

Zone #10 Pages #1-6: No major issues noted within this area. DI's have minor debris accumulating at system inlet. Maintenance is recommended to restore full functionality of DI systems. All collection, conveyance and treatment systems appeared to be in working order.

Date	Location /Work Completed	Job	Worker	Hours	Cost	Equip. #	Hours	Cost	Amt/Yds	Mat. Type	Comments
4/1/2015	W end of Modoc Way, drainage to deep ditch/channel:	48111	Klare	1	$42.91	79-02	1	$78.75	0.13		
	cleaned outet		Cruz	1	$51.23						
4/2/2015	E San Bernardino 185' W of Bakersfield: cleaned inlet and	48111	Klare	3	$128.73	79-02	3	$236	0.25		pipe needs replacing
	roddered pipe		Cruz	3	$153.69						
4/2/2015	Culvert at N end of Santa Fe past the STPUD unlcoked gate	48111	Klare	10	$429.10	79-02	10	$787.50	0.38		pipe needs replacing
	cleaned inlet and outlet		Cruz	10	$512.30						
4/2/2015	Culvert at W end of Modoc: vactored inlet/outlet, cleaned	48111	Klare	4	$171.64	79-02	4	$315	0.5		pine needs replacing
	pipe		Cruz	4	$204.92						

Date	Location /Work Completed	Job	Worker	Hours	Cost	Equip. #	Hours	Cost	Amt/Yds	Mat. Type	Comments
5/13/2015	Shakori STD at end of equipment parking lot (left one):	48111	Freeny	2	$85.82	79-02	2	$157.50	1		
	vactored out STD (started at 7.2)		Padilla	2	$85.82						
5/14/2015	Shakori single STD end of yard parking lot: vactored out	48111	Freeny	3	$128.73	79-02	3	$236	2		
	debris from STD, started at 2.6		Padilla	3	$128.73						
5/14/2015	Shakori single STI end of yard parking lot: vactored out	48111	Freeny	2	$85.82	79-02	2	$157.50	1.5		
	debris from STI, started at 1.3		Padilla	2	$85.82						
5/14/2015	Shakori double STI end of yard parking lot: vactored out	48111	Freeny	1.5	$64.37	79-02	1.5	$118.13	2		
	debris from STI, left one start 3.2, right one start 5.9		Padilla	1.5	$64.37						
5/18/2015	Headington yard SST wash pad: vactored out debris from	48111	Freeny	5.5	$236.01	79-02	5.5	$433.13	0.1		
	wash pad and channel to SST		Padilla	5.5	$236.01						
5/18/2015	Mewuk AC dike from driveway 2169 to driveway of 2151:	48111	Freeny	8	$343.28	79-02	8	$630.00	3		
	vactored out debris from the flowline roddered culvert pipe		Padilla	8	$343.28						
	under the driveway about 16'										
5/19/2015	Waverly CMP #1372: roddered out culver pipe about 60'	48111	Freeny	4	$171.64	79-02	4	$315.00	1		
			Padilla	4	$171.64						
5/21/2015	Culvert on W end of Crow St: vactored out inlet/outlet to	48111	Bouchard	0.5	$21.46	79-02	7	$551.25			flowline needs to be reestablished, pipe rusted
	pipe		Padilla	6.5	$278.92						away several feet at outlet, pipe has rock broken
			Freeny	6.5	$278.92						through about 9' from the left side of outlet

5/21/12015	6924 Baumhoff CMP: vactored out inlet and established a	48111	Freeny	3	$128.73	79-02	3	$236.25			
	flowline to it		Padilla	3	$128.73						
5/21/2015	1873 Elks Club AC berm: vactor out debris to establish AC	48111	Freeny	1	$42.91	79-02	1	$78.75	0.1		
	berm back in place before driveway, washed AC swale		Padilla	1	$42.91						
	for repairs										
5/21/2015	1575 Cherry Hills Cir CMP: clean outlet of CMP 1400, clean	48111	Zorn	5	$261.15	79-02	5	$393.75	3		
	outlet to CMP at driveway and roddered pipe about 30'		Padilla	5	$214.55						
5/22/2015	6924 Baumhoff CMP	48111	Zorn	3	$153.69	79-02	3	$236.25	0.5		could not locate outlet to CMP - replacing this
			Padilla	3	$128.73						summer
5/27/2015	AC swale Waverly from Elks Club to CMP #1372: cleaned	48111	Freeny	1.5	$64.37	79-02	1.5	$118.13	0.5		
	out all debris from AC swale		Padilla	1.5	$64.37						
5/27/2015	1057 Elmwood channel/flow line: cleaned about 10' on	48111	Freeny	2	$85.82	79-02	2	$157.50	0.5		
	either side of driveway		Padilla	2	$85.82						
5/27/2015	Geronimo CMP can drop inlet NID #2210 @ E San Bernar-	48111	Freeny	3	$128.73	79-02	3	$236.25	1		
	dino: clean inelt SST and clean outlet SST, roddered out		Padilla	3	$128.73						
	CMP 899 Start inlet: 2.1 Start outlet: 2.8										
5/28/2015	CMP can drop inlet #2208 SW corner of San Diego @ E	48111	Zorn								inlet to 2657 is rusted away, bottom of ST 2208
	San Bernardino: SST NID 2209 started at 1.6, NID ST 2208		Padilla								is rusted away and erosion over the inlet is very
	started at 2.4 to top of can: cleaned flowline to can, clean										visible
	cans out										**combined with work order 228**

5/28/2015	CMP can drop inlet NW corner San Diego @ E San Bern.	48111	Zorn	3.5	$179.31	79-02	3.5	$275.63			bottom of pipe 2657 is rusted away at outlet,
	connected to culvert NID #2658: SST 207 started at 2.6,		Padilla	3.5	$150.19						roots are exposed and ready to cut
	ran rodder 150' and got rusty water coming out, cleaned out										WO #228
	can										
5/28/2015	Choctaw culvert @ San Diego: cleaned inlet/outlet to pipe,	48111	Zorn	2.5	$128.08	79-02	2.5	$196.88	3		
	roddered pipe out around 50'		Padilla	2.5	$107.28						
5/28/2015	San DIego CMP #2659: cleaned outlet side to CMPs 2659	48111	Zorn	3.5	$179.31	79-02	3.5	$275.63	3		did not rodder out pipes due to them being rusted
	and 2658		Padilla	3.5	$150.19						flow line needs a lot of work, hillside around CMP
											2659 is undermined
5/29/2015	TDI/STD Shakori #2838: cleaned out debris	48111	Zorn	2	$102.46	79-02	2	$157.50	0.5		
			Padilla	2	$85.82						
5/29/2015	Shakori SST #2282: cleaned out ST, started at 4.3, cleaned	48111	Zorn	1	$51.23	79-02	1	$78.75	0.5		
	surrounding asphalt		Padilla	1	$42.91						
5/29/2015	Shakori DST 2283 & 2284: cleaned out STs, #2283 started at	48111	Zorn	1	$51.23	79-02	1	$78.75	1.5		
	4.8 and #2284 started at 5.8, cleaned up debris surrounding		Padilla	1	$42.91						
	the cans										

Date	Location /Work Completed	Job	Worker	Hours	Cost	Equip. #	Hours	Cost	Amt/Yds	Mat. Type	Comments
6/1/2015	Country Club CMP #892: cleaned inlet/outlet to pipe and	48111	Freeny	10	$429.10	79-02	10	$787.50	7		
	roddered out pipe		Padilla	10	$429.10						
6/1/2015	1254 Country Club culvert under driveway: vactored out	48111	Freeny	2.5	$107.28	79-02	2.5	$196.88	2.5		CMP outlet is crushed and rusted as well as the
	inlet to pipe, roddered out pipe about 60'		Padilla	2.5	$107.28						inlet. Flowline needs backhoe work- on separate
											list per AC
6/2/2015	Little Bear CMP pipe 595: pothole to locate utilities for	48111	Freeny	0.5	$21.46	79-02	0.5	$39.38			
	pipe replacement around 2'4" from top of asphalt		Padilla	0.5	$21.46						
6/2/2015	Grizzly Mtn CMP pipe 2644: pothole to locate utilities for	48111	Freeny	0.5	$21.46	79-02	0.5	$39.38			
	CMP replacement, gasline about 2'11" from top of asphalt		Padilla	0.5	$21.46						
6/3/2015	Pioneer Trail CMP pipe #1515: clean inlet, roddered pipe	48111	Freeny	1.5	$64.37	79-02	1.5	$118.13	0.5		
	out to can #1736, about 45'		Padilla	1.5	$64.37						
6/3/2015	Pioneer Trail CMP pipe #1514: roddered pipe out NID #481	48111	Freeny	0.5	$21.46	79-02	0.5	$39.38			
	around 131'		Padilla	0.5	$21.46						
6/3/2015	Pioneer SST NID ST #1736: cleaned surrounding area to	48111	Freeny	5	$214.55	79-02	5	$393.75	4		flowline needs backhoe work - on separate list
	access lid to ST, cleaned can out. Started at 2.4, cleaned		Padilla	5	$214.55						per AC
	can CMP outlet and flowline as far as tubes could reach										
6/4/2015	Arapahoe NID 2721 42' back from end of road: stabilized	48111	McComb	2	$85.82	79-02	2	$157.50	1.5		big outlet flow problem into meadow, replace
	flowline to the inlet, cleaned out pond at the outlet,		Padilla	2	$85.82						culvert when flow problem fixed
	roddered pipe out around 40'										

6/4/2015	Bakersfield SST can 2189: cleaned area to exposed asphalt	48111	McComb	4.5	$193.10	79-02	4.5	$354.38	1.5		Big outlet flow problem, needs redesigning and
	flowline cleaned out can, cleaned out flowline at the outlet		Padilla	4.5	$193.10						can replacement
	of the can										
6/4/2015	Bakersfield SST can 2190: cleaned can out started at 2.4	48111	McComb	1	$42.91	79-02	1	$78.75	0.1		
	cleaned debris from the AC leading to can		Padilla	1	$42.91						
6/5/2015	San Diego W of Bakersfield: SST 2214 2.6 DI 2219 2.6	48111	McComb	2	$85.82	79-02	2	$157.50	0.5		
	SST 2215 2.6 Pipe 2426 2.5, reestablished flowline to inlet/		Padilla	2	$85.82						
	outlet, cleaned cans, DI and roddered pipe										
6/5/2015	Country Club culvert 70' E of E San Bernardino: cleaned out	48111	McComb	1	$42.91	79-02	1	$78.75	0.1		
	small retaining pond at the outlet of CMP 2724, roddered out		Padilla	1	$42.91						
	pipe about 70'										
6/5/2015	Bakersfield CMP pipe 2513: roddered out pipe around 30'	48111	McComb	0.5	$21.46	79-02	0.5	$39.38	0.1		
			Padilla	0.5	$21.46						
6/8/2015	728 Nahane ciluvert pipe: pothole serveral locations to locate	48111	Freeny	2	$85.82	79-02	2	$157.50	0.5		
	utilities		Padilla	2	$85.82						
6/8/2015	Hopi CMP can E side of intersection with Modoc: cleaned	48111	Freeny	4	$171.64	79-02	4	$315.00	0.25		pipe has a hole on top about a foot from can,
	can out started at 1.8, roddered pipe out about 320' from		Padilla	4	$171.64						on a separate list per AC
	NID 2212										
6/10/2015	Shakori double ST #2283 and 2284: clean out asphalt around	48111	Bouchard	1	$42.91	79-02	1	$63.00	1		
	cans, clean out cans and conneting pipe. 2283 started at 4.0		Padilla	1	$42.91						
	2284 started at 4.6										
6/10/2015	Shakori TDI 2838: clean out TDI and connecting pipe, started	48111	Bouchard	0.5	$21.46	79-02	0.5	$31.50	0.5		

	at 3.2		Padilla	0.5	$21.46			$0.00			
6/10/2015	Shakori SST 2282: clean out surrounding asphalt to the can,	48111	Bouchard	0.75	$32.18	79-02	0.75	$47.25	0.5		
	started at 6.0		Padilla	0.75	$32.18						
6/10/2015	Shakori TDI 2836: clean out TDI and connecting pipe to can,	48111	Bouchard	0.75	$32.18	79-02	0.75	$47.25	0.5		
	started at 6.3		Padilla	0.75	$32.18						
6/18/2015	Arrowhead @ E San Bernardino: clean inlet/outlet and rodder	48111	Zorn	2.5	$107.28	79-02	2.5	$157.50	3		outfall needs to be ditched to Country Club and
	pipe about 71'		Freeny	2.5	$107.28						inlet, on separate list per AC
6/18/2015	Ute at NE cordner of loop: clean inlet/outlet, roddered pipe	48111	Bouchard	2	$85.82	79-02	3	$189.00	1.5		flow line needs more work, outlet needs
	about 50'		Padilla	2	$85.82						drainage easement to access
			Zorn	1	$51.23						
			Freeny	1	$42.91						
6/19/2015	Arrowhead @ Ute PID (not on map, infrastructure book pg. 157)	48111	Padilla	2	$85.82	79-02	2	$126.00	1.5		flow line needs more work, inlet/outlet needs to
	clean out PID and intlet/outlet, roddered pipe about 65'		Freeny	2	$85.82						be dtiched, on separate list per AC
6/22/2015	Sioux culvert about 850' W of Arrowhead: clean inlet/outlet,	48111	Zorn	4	$204.92	79-02	4	$252.00	3		outlet section of culvert completely rotten about
	rodder pipe, brush willows around inlet/outlet		Freeny	4	$171.64						5-10 feet in
6/22/2015	SUT @ Celio Ranch: rodder culvert to find other side (inlet) 40'	48111	Zorn	2	$102.46	79-02	2	$126.00	1.5		
	of culvert		Freeny	2	$85.82						
6/26/2015	Shakori Yard trap filter, west yard: cleaned around 1 trap and 1	48111	Zorn	6	$307.38	79-02	6	$378.00	0.75		
	filter, removed sediment from 1 trap and 1 filter		Freeny	6	$257.46						
6/26/2015	Shakori yard, east side, trap, filter: cleaned around inlet and	48111	Zorn	2.25	$115.27	79-02	2.25	$141.75	1.5		
	removed sediment from 2 traps and one filter		Freeny	2.25	$96.55						
6/30/2015	Tomahawk W end @ Apache: clean inlet J box and outlet,	48111	Zorn	6.5	$333.00	79-02	6.5	$409.50	4		flow lines need ditching, especially outlet flow
	rodder 135' of pipe		Freeny	6.5	$278.92						line, on separate list per AC

Date	Location /Work Completed	Job	Worker	Hours	Cost	Equip. #	Hours	Cost	Amt/Yds	Mat. Type	Comments
7/1/2015	Sundown Trail PID #913: cleaned ditch line, roddered 275' of	48111	Zorn	15	$768.45	79-02	15	$945.00	5		
	pipe		Freeny	15	$643.65						
7/1/2015	Elks Club PID pipe, N/D, ST 2180, 175: clean flowlines on	48111	Zorn	3	$153.69	79-02	3	$189.00	1.5		
	Skyline, Elks to both NID STs, cleaned N/D-STs, cleaned back		Freeny	3	$128.73						
	behind curb to re-establish curb back										
7/9/2015	Rufus Allen Blvd Vector Control parking lot SST back can: clean	BLD001	Zorn	3	$153.69	79-02	3	$189.00	0.1		
	can out, started at 4.3 finished at 4.7, roddered leach line #1 to		Padilla	3	$128.73						
	street around 52, #2 to property around 52										
7/9/2015	Rufus Allen Blvd Vector Control parking lot SST, first one from	BLD001	Zorn	4	$204.92	79-02	4	$252.00	0.1		
	street: vactored out can, started at 4.7 finished 5.1, roddered		Padilla	4	$171.64						
	out CMPs #1 to street around 66', #2 to property around 90'										
7/14/2015	Mohawk W end culvert: trimmed trees to get to culvert, clean	48111	Zorn	5	$256.15	79-02	5	$315.00	2		inlet smashed up, several feet on the sides is
	inlet/outlet, roddered out CMP around 55'		Padilla	5	$214.55	23-17	3	$96.00			rusted. About 5' on the outlet side is in bad
											shape, rest of pipe is OK. Flowlines need
						97-07	3	$51.00			work.
						94-07	3	$27.00			
						94-18	1	$9.00			
7/21/2015	Scenic & Woodland NID DI 512: cleaned DI and flow line	48111	Zorn	1	$51.23	79-02	1	$63.00	0.25		
			Freeny	1	$42.91						
7/21/2015	Glen and Woodland high side: cleaned DI and flowline	48111	Zorn	0.5	$25.62	79-02	1	$63.00	0.13		no numbers in book, locatoin at intersection
			Freeny	0.5	$21.46						

7/22/2015	Timberwold NID DI Pipe # 1537, 378: cleaned flowline, clean DI	48111	Zorn	2	$102.46	79-02	2	$126.00	0.5		Asphalt dumped in bottom of DI to prevent
	and pipe		Padilla	2	$85.82						flooding of house across street. Should be
											rerouted to next culvert 60' away to prevent
											flooding
7/22/2015	10th Ave PID pipe #1717: cleaned rocks and debris from pipe and outfall	48111	Zorn Padilla	2 2	$102.46 $85.82	79-02	2	$126.00	0.5		
7/23/2015	Antelope DI CMP between 7198 & 7206 Antelope: clean flowline	48111	Zorn	3	$153.69	79-02	3	$189.00	1.25		DI CMP in driveway of 7198 Atenlope is lower
	from 7206 to 7198 Antelope, DI, CMP		Padilla	2	$85.82						than main CMP crossing road. CMP outlet is
			McComb	1	$42.91						covered by 8" cedar tree and flow runs toward res
7/23/2015	Glenridge NID ST 2192: clean flowline and can DI, rodder 34' of CMP	48111	Zorn Padilla	2 2	$102.46 $85.82	79-02	2	$126.00	1		
7/24/2015	8th NID ST 108: cleaned DI	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.25		
			McComb	0.5	$21.46						
7/24/2015	9th NID ST 114: cleaned flowline and DI	48111	Zorn McComb	0.5 0.5	$25.62 $21.46	79-02	0.5	$31.50	0.13		
7/24/2015	10th NID ST 130: cleaned can and flowline	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.25		
			McComb	0.5	$21.46						
7/27/2015	Alder/10th NID ST 129: cleaned flowline, intlet, NID ST, rodder CMP	48111	Zorn Padilla	0.75 0.75	$38.42 $32.18	79-02	0.75	$47.25	1.5		
7/27/2015	Alder/5th NID ST 80: clean material from flowline and NIT ST	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.5		
			Padilla	0.75	$32.18						

7/27/2015	Alder/4th NID ST 72: cleaned flowline and NID ST	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.5		
			Padilla	0.75	$32.18						
7/27/2015	Alder/3rd NID ST 69: cleaned around can and flowline	48111	Zorn	1	$51.23	79-02	1	$63.00	0.5		
			Padilla	1	$42.91						
7/27/2015	Alder/2nd NID ST 62: cleaned flowline and around can	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	1		
			Padilla	0.75	$32.18						
7/27/2015	Alder between 2nd and 1st NID ST 61: cleaned NID ST and flowline	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.5		
			Padilla	0.5	$21.46						
7/27/2015	1st NID DI 441: cleaned DI	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.5		1st ave detention basin #1 needs cleaned
			Padilla	0.5	$21.46						
7/28/2015	1st PID pipes 454, 453: roddered CMP 453 and 454	48111	Zorn	4.5	$230.54	79-02	4.5	$283.50	1		outlet of 454 into detention pond needs to be
			Padilla	4.5	$193.10						cleaned along with detention pond
7/28/2015	Elm NID ST 92: clean flowline, inlet, NID ST	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.5		
			Padilla	0.75	$32.18						
7/29/2015	Fir NID ST 81: clean flowline, can is clean	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.25		
			Padilla	0.75	$32.18						
7/29/2015	Fir NID ST 90: cleaned flowline, can was clean	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	1		
			Padilla	0.75	$32.18						
7/29/2015	Fir NID ST 99: cleaned flowline, can was empty	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.5		
			Padilla	0.5	$21.46						
7/29/2015	8th NID ST 109: cleaned flowline, can was empty	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.13		
			Padilla	0.75	$32.18						
7/29/2015	8th NID ST 110: cleaned flowline, can was clean	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.25		
			Padilla	0.5	$21.46						
7/30/2015	Fir NID ST 73: cleaned flowline, can was clean	48111	Zorn	1	$51.23	79-02	1	$63.00	0.25		

			Padilla	1	$42.91						
7/30/2015	Al Tahoe NID ST SLT Police Dept N end of building 70' straight out into	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.25		
	grassy area: cleaned ST and roddered 30' SW and 60' N		Padilla	0.75	$32.18						
7/30/2015	Elm NID ST 103: clean inlet, flowline, NID ST	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.25		
			Padilla	0.5	$21.46						

Date	Location /Work Completed	Job	Worker	Hours	Cost	Equip. #	Hours	Cost	Amt/Yds	Mat. Type	Comments
8/3/2015	Antelope CMP 7252: cleaned inlet and flowline, CMP clean	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.13		not in map book
			Bouchard	0.5	$21.46						
8/3/2015	Antelope @ Grizzly Ct CMP outlet: cleaned outlet, CMP @ > 20%	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.13		
			Bouchard	0.5	$21.46						
8/3/2015	Grizzly Ct CMP 376: cleaned flowline and inlet to CMP, CMP clean	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.13		not in map book
			Bouchard	0.5	$21.46						
8/3/2015	Fir/2nd NID ST 64: cleaned inlet and flowline	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.5		
			Bouchard	0.75	$32.18						
8/3/2015	Fir/3rd NID ST 70: cleaned flowline and inlet	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.5		Hook on back of can to keep lid secure has
			Bouchard	0.75	$32.18						broken off
8/4/2015	369 Grizzy Ct DI: cleaned flowline and inlet	48111	Zorn	3	$153.69	79-02	3	$189.00	3		not in map book, also located can burried on
			Padilla	3	$128.73						left side of 365 Grizzly Ct with lock #3207
8/4/2015	Oak St/End NIT ST 65: cleaned flowline, can is clean	48111	Zorn	0.75	$38.42	79-02	0.75	$47.25	0.33		
			Padilla	0.75	$32.18						
8/5/2015	Brook NID ST 248: cleaned flowline and asphalt dyke	48111	Zorn	1.5	$76.85	79-02	1.5	$94.50	0.5		
			Padilla	1.5	$64.37						
8/5/2015	Elm/9th NID ST 118: cleaned flowline	48111	Zorn	0.5	$25.62	79-02	0.5	$31.50	0.25		
			Padilla	0.5	$21.46						
8/5/2015	7th-end NID ST 314: cleaned flowline	48111	Zorn	0.25	$12.81	79-02	0.25	$15.75	0.33		
			Padilla	0.25	$10.73						
8/5/2015	6th/Pine NID ST 97: cleaned flowline	48111	Zorn	0.25	$12.81	79-02	0.25	$15.75	0.13		

Date	Location /Work Completed	Job	Worker	Hours	Cost	Equip. #	Hours	Cost	Amt/Yds	Mat. Type	Comments
9/1/2015	Rubicon SDMH, pipe 1816, 1815, 1814, 2583, 1812: cleaned SDMH (3)	48111	Zorn	3	$153.69	79-02	3	$189.00	3.75		
	pip, DI of sediment		Freeny	3	$128.73						

Appendix B

COUNTY OF EL DORADO Storm Water On Site Inspection Checklist

DRAFT

	Project:
	Date/Time:
	Location:
Owner/Contractor:	**Thomas Guide:**
Person Responsible for SWPPP:	**Inspector:**
WDID No:	**Previous Inspection Date/PR:**

Type of Inspection:	**Weather Conditions:**		**Item Rating:**	
☐ Routine/Re-inspection	☐ Clear ☐ Overcast ☐ Raining Other:		Substantial Compliance	1
☐ Prior to Storm Event	%Chance of Rain	Time since last storm	Minor Deficiencies	2
☐ During Extended Storm Event	Start Of Storm Event	Approx Rainfall	Major Deficiencies	3
☐ After Storm Event	Duration of Storm Event		Critical Deficiencies	4

	SWPPP Questions:	Yes	No	Follow Up Required
1	Is grading in progress?			
2	Is there an effective combination of BMP's to control sediment and erosion that is appropriate for the present stage of construction?			
3	Did you observe the presence of any floating materials, oil, grease, odor, toxics and/or sediment at any outfalls, discharge points, or downstream location?			
4	Does the SWPPP Site Map reflect current site conditions?			

	SWPP Items:	Item Rating	Not Applicable	Follow Up Required
1	Construction Entrances / Exits			
2	Straw rolls, Check dams, Sandbags			
3	Silt Fences			
4	Slope Protection-Polymer, Mulch and Matting			
5	Slope Stability			
6	Surface Erosion			
7	Dust Control			
8	V- Ditch and Slope drains			
9	Water Quality Basins (including energy dissipater if applicable)			
10	Drain Inlet Protection			
11	Stockpile Management – Soil and Materials			
12	Debris Cleanup			
13	Covered Trash Bins			
14	Disposal Areas (concrete, paint, and/or stucco clean outs)			
15	Staging Area – vehicles, equipment, and materials spills and leaks			
16	Integrity of Irrigation System			
17	Portable Toilets			
18	Non-Storm Water BMP's			

s appropriate, describe the follow-up work required based upon evaluation in sections above. If necessary, attach additional .eets to this report.

Copy :	□ Project Manager	□ Contractor	□ EDC Storm Water	□ Regional Board	□ Other

Storm Water Inspection Checklist Guidelines

Project Rating:

The County will employ the following sliding scale **project site rating system**:

Project Rating		Next Inspection	Repeat Inspection	Contact
1	Substantial Compliance	See Minimum Frequency		
2	Minor Deficiencies	Monthly	3rd	Storm Water Coordinator
3	Major Deficiencies or discharge(s) noted with prompt correction needed	Within 2 Weeks	2nd	Storm Water Coordinator
4	Critical Deficiencies or discharge(s) with immediate correction required	Daily	1st	Storm Water Coordinator

Minimum non-rainy season inspection review frequency:

1. Sites 5 acres or more in size, every other month.
2. Sites less than 5 acres in size, every third month.

Minimum rainy season inspection review frequency:

1. Sites 5 acres or more in size, every month.
2. Sites less than 5 acres in size, every other month.

Pre-storm inspection review frequency:

Approximately 10% of the construction sites involving 5 acres or more of disturbed soil with the greatest risk for storm water pollution will be inspected prior to major predicted storms.

Post-storm inspection review frequency:

1. Approximately 15% of the construction sites involving 5 acres or more of disturbed soil with the greatest risk for storm water pollution will be inspected following a major storm.
2. Approximately 5% of the construction sites involving less than 5 acres of disturbed soil with the greatest risk for storm water pollution will be inspected following a major storm.

Key Characterization Terms

Biological	Color	Odor	Sedimentation
(Affecting life or living organisms) Dead fish, frogs, etc. Plant health: Excessive growth Lack of growth Wilted Dead	Clear Red Yellow Brown Green Gray Dark White	None Chlorine Fuel/Oil Fishy Musty Sewage Rotten Egg/Sulfur Sour Milk	None Slight 1-3 " Moderate 3-6" Excessive >6" Litter Oily Sewage
Floatables	**Turbidity**	**Stains**	**Miscellaneous**
None Oil Sheen Garbage/Trash Sewage Other	Clear Clouded Opaque Obscured Muddy	None Color	Other

INSPECTOR'S DAILY REPORT
BLACK BART AVE, BARBARA AVE,
D MARTIN AVE OVERLAY
OJECT
(CONTRACT NO. PW 15-31100, CIP NO.72188)

EL DORADO COUNTY CALIFORNIA

Report No.
Page 1 of 4
Date 9 / 23 / 2015
M T (W) T F S S Circle
Contractor's Shift Hours: Start 7:00 Stop 7:00
Contractor's Lunch Hour: Start Stop

Location & Description of Operation BARBARA GRINDING / COLD PLANE OPERATIONS

LABOR AND/OR EQUIPMENT			HOURS – BID ITEM NO.										WEATHER
			#1 MOBILIZATION	#2 TRAFFIC CONTROL SYST.	#3 JOB SITE MGMT	#4 STREET SWEEPING	#6 COLD PLANE AC PAVEMENT						CLEAR, SUNNY
EQPT NO.	NO. MEN	DESCRIPTION (of Equipment or Labor)											REMARKS OR COMMENTS
	1	Jose Gel – Laborer								≈6 HRS			TRANSVERSE DRAIN REMOVAL
4	1	Daniel Graham – Operator											TRANSVERSE DRAIN REMOVAL
	1	Ciprano Franco – Laborer											
1	1	David Nelson – Operator / TRUCK DRIVER											
	1	Fernando Gomez – Laborer									6 HRS		TRANSVERSE DRAIN REMOVAL
	1	Isidro Rojas – Laborer											TRANSVERSE DRAIN REMOVAL
	1	Enrique Alamillo – Operator											
	1	Mike Only									6 HRS		TRANSVERSE DRAIN REMOVAL
	1	Destry Garcia											
3	1	JACOB DAVIS - OPERATOR					4						ANBAC GRINDER
	1	CHRIS ANDERSON - FOREMAN					4						
3	1	SAM HOUSTON - OPERATOR					4						GRINDER
2	1	MEL BROOKINS				10							SWEEPER
	1	LINDA ROMINGER		12									FLAGGER
	1	MIKE MARTIN		12									FLAGGER
5	1	AARON SCHMALENBERGER											THOMAS HAEN CO. / GRINDING
	1	H20 TRUCK VS DOT 352652											
	2	SWEEPER TRUCK CA 332954				11							
	3	WZ10 WIRTGEN # YD4J39											
	4	CASE 580 SUPER M # K-16565											
	5	CAT 256C # TW8Y35											≈3 HRS (GRINDER ATTACH.)

SIGNATURE

TITLE SR ENGINEERING TECH

Distribution: (1) Original-Project File (2) Copy-RE File (3) Copy-PM File (4) Copy-Inspector

INSPECTOR'S DAILY REPORT

PROJECT: BLACK BART AVE, BARBARA AVE, AND MARTIN AVE OVERLAY PROJECT (CONTRACT NO. PW 15-3100, CIP NO. 72188)

REPORT NO.:	WORKING DAY NO.: 8 OF 23	DATE: 9/23/15	M T (W) T F S S (Circle Day)
PAGE:	OF	CONTRACTOR SHIFT HOURS:	START 7:00 STOP 7:00
WEATHER CONDITIONS:		TEMPERATURE:	40's Min. 70's Max.

PRIMARY INSPECTOR

ON-SITE	ARRIVE [i] 7:10		DEPART [ii]		TOTAL ON-SITE INSPECTION HRS ([ii]-[i])			
NON-INSPECTION TIME SUMMARY (HRS)	TRAVEL TIME TO SITE: 10 MIN		WORK EQPT LOAD:		PAPERWORK ON-SITE:		PAY ESTIMATE ON-SITE:	TOTAL (INCL. INSPECTION HRS) ([1]+[2]+[3]+[4])
	FROM SITE: 10 MIN		UNLOAD:		OFF-SITE:		OFF-SITE:	
TOTALS		[1]		[2]		[3]		[4]

7:10 AM (MPB) - ARRIVED ON SITE
- GRINDING/COLD PLANE OPERATIONS STARTED
- 2" GRIND OUTSIDE SECTION OF LANE / 1" GRIND TOWARDS CENTERLINE TO CREATE CROWN ON BARBARA AVE
- BARBARA AVE MEASURED BY CHRIS (AMPAR) @ 24' WIDTH THROUGHOUT LENGTH OF PROJECT AREA

7:20 AM - FIRST PASS WEST BOUND ON NORTH SIDE OF BARBARA COMPLETED

8:00 AM - NORTH SIDE OF BARBARA COMPLETED; STARTING ON SOUTH SIDE; DAN KIKKERT ON SITE

8:15 AM - TRANSVERSE DRAINS BEING REMOVED ON BLACK BLACK BART NORTH BOUND LANE; FLAGGERS PRESENT CONTROLLING TRAFFIC AROUND OPERATIONS

9:30 AM - TOOK PHOTO OF DI THAT IS MISSING FILTER FABRIC PROTECTION @ START OF MARTIN BRIDGE ON NORTH BOUND SIDE - DAN KIKKERT DISCUSSED CORRECTION NEEDED W/ RICK GARCIA

9:40 AM - REMOVAL OF TRANSVERSE DRAIN (2ND OF TWO) STARTED

10:00 AM - BARBARA GRIND COMPLETED

10:15 AM - GRINDER NICKED/SKIMMED FORCE MAIN MANHOLE COVER ON BARBARA NEAR MARTIN - PHOTO TAKEN (SANITARY SEWER)
* STA 43+21.57, 0.78' LT LEFT SITE @ 11:00 ish

11:00 AM - STPUD STAFF ON SITE TO INVESTIGATE MANHOLE COVER/FRAME
- DECIDED TO GRIND COVER & FRAME TO SMOOTH OUT SURFACE

12:45 PM - CONCRETE TRUCK LEFT SITE (TRANSVERSE DRAINS STA 23+42.15, 13.58' LT & 23+62.17

1:15 PM - TRANSVERSE DRAINS COMPLETED (FILLED W/ SLURRY) & CLEANUP PROCESS STARTED

1:30 PM - AARON W/ THOMAS HAGN CO. ARRIVES TO GRIND AC PAVEMENT IN AREAS WHERE NEEDED

SIGNATURE [signature] TITLE SR ENGINEERING TECH

Distribution: (1) Original-Project File (2) Copy-RE File (3) Copy-PM File (4) Copy-Inspector

CONTINUED →

INSPECTOR'S DAILY REPORT	PROJECT: Black Bart Ave, Barbara Ave, & Martin Ave Overlay Project (CONTRACT NO. PW 15-31100, CIP NO. 72188)

REPORT NO.:	WORKING DAY NO.: 3 OF 10	DATE: 9/23/15	M T (W) T F S S (Circle Day)
PAGE:	OF	CONTRACTOR SHIFT HOURS:	START 7:00 STOP 7:00

1:45 PM - GARCIA CREW CHIPPING AC PAVEMENT AWAY FROM C&G, TRANSVERSE DRAINS, RADIUS AREAS, ETC.

- SWEEPER TRUCK MAKING ROUNDS
- MIKE VAN DOORNINK (EDOT INSPECTOR) MARKING REFERENCE POINTS FOR STATIONING LOCATIONS ALONG BARBARA AVE. & WILL CONTINUE ONTO MARTIN & BLACK BART AVENUES (NEEDED FOR AC SPREAD RECORD)

* @ ≈ 1:00 PM STPUD ARRIVED ON-SITE TO GRIND FORCE MAIN COVER @ STA 43+21.57, 0.78' LT

2:30 PM - GARCIA CREW CONTINUING TO CLEAN UP C&G LINES W/ MINI GRINDER, LOADER, HAND TOOLS (REMOVING AC, CRACK FILLER).

- BROOM SWEEPER RUNNING, SWEEPER TRUCK RUNNING
- FILTER FABRIC PLACED IN DI ON SOUTH SIDE OF MARTIN BRIDGE IN NORTH BOUND LANE

4:00 - AARON (EMPIRE CO.) COMPLETED GRINDS & LEFT SITE

4:15 - TRAFFIC CONTROLS MOVED TO HANK MONK & BLACK BART @ PIONEER DIRECTING TRAFFIC ONE DIRECTION (ONE LANING TRAFFIC)

4:40 PM - DISCUSSED TRANSVERSE DRAIN LIP/EDGE HEIGHT W/ MIKE GARCIA ON SOUTH BOUND LANE OF MARTIN (JUST SOUTH OF BRIDGE)

5:15 PM - SWEEPER, BROOM SWEEPER, HAND SWEEPING TAKING PLACE @ SOUTH END OF BLACK BART

5:30 PM - MIKE VAN DOORNINK (EDOT INSPECTOR) CONTINUING TO MARK STATIONS ON BLACK BART AVE

6:30 PM - FLAGGERS LEFT SITE

6:45 PM - GARCIA CREWS CHANGING TRAFFIC CONTROL SIGNS

- BARBARA AVE WATERED DOWN
- LEFT SITE

SIGNATURE	TITLE SR ENGINEERING TECH

2015/09/22 13:17

2015/09/21

COMMUNITY DEVELOPMENT AGENCY

TRANSPORTATION DIVISION

http://www.edcgov.us/DOT/

PLACERVILLE OFFICES:
MAIN OFFICE:
2850 Fairlane Court, Placerville, CA 95667
(530) 621-5900 / (530) 626-0387 Fax

MAINTENANCE:
2441 Headington Road, Placerville, CA 95667
(530) 642-4909 / (530) 642-0508 Fax

LAKE TAHOE OFFICES:
ENGINEERING:
924 B Emerald Bay Road, South Lake Tahoe, CA 96150
(530) 573-7900 / (530) 541-7049 Fax

MAINTENANCE:
1121 Shakori Drive, South Lake Tahoe, CA 96150
(530) 573-3180 / (530) 577-8402 Fax

July 16, 2015

Mr. Martin Louch
V&C Construction
PO Box 1269
Minden, NV 89423

Subject: Montgomery Estates 3 Erosion Control Project (95172) – SWPPP Storm Update

Dear Mr. Louch:

Please be advised that the National Weather Service has forecasted a chance of precipitation for Thursday – Tuesday July 16-21, 2015, indicating the possibility of inclement weather and rain. Please take the necessary actions to ensure all exposed soils are properly stabilized and all spoil piles are covered with visqueen and contained with appropriate temporary Best Management Practices (BMPs) as outlined in the Storm Water Pollution Prevention Plan (SWPPP) during these potential conditions. Please also ensure that all trash is properly disposed of and contained.

The County of El Dorado Community Development Agency, Transportation Division (CDA-TD) requests that the following actions are performed by the site superintendent during the day and especially before ceasing work operations for the day:

- Visually inspect all filter fences, fiber rolls and sediment trap inlet protection locations to ensure proper installation.
- Ensure that exposed channels / soils are properly covered with visqueen and gravel bags per the Project plans.
- Ensure that all materials in the staging area are properly secured and covered throughout the day including when work has ceased for the day.
- Ensure tracking associated with construction equipment entering and leaving the staging areas is minimized and that sweeping is conducted on a routine basis.
- Should showers occur, please coordinate with CDA-TD staff to obtain samples as needed and photographs consistent with the Sampling and Analysis Plan contained in the SWPPP.

Thank you for continuing to inspect and maintain your temporary BMPs to help protect surface waters in the Lake Tahoe Basin. If you have any questions, please feel free to contact me at (530) 573-7924 or Dan Kikkert at (530) 573-7914.

Sincerely,

Russell Wigart, CPSWQ, QSD-QSP
Stormwater Coordinator

Enclosure: National Weather Service Forecast for S. Lake Tahoe

NATIONAL WEATHER SERVICE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

evere weather possible for parts of Midwest

e NWS Storm Prediction Center is forecasting a risk of severe thunderstorms Thursday afternoon and evening across parts of the Midwest, from southeastern Iowa and northeastern Missouri across western d central Illinois. Large hail and damaging winds will be the main threats.

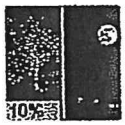
Español Share |

Current conditions at
South Lake Tahoe, Lake Tahoe Airport (KTVL)
Lat: 38.89833°N Lon: -119.99917°W Elev: 6257ft

Fair
76°F
24°C

Humidity 32%
Wind Speed VRBL 6 MPH
Barometer 30.17 in (1015.0 mb)
Dewpoint 44°F (7°C)
Visibility 10.00 mi
Heat Index 77°F (25°C)
Last update 16 Jul 10:53 am PDT

Extended Forecast for
South Lake Tahoe CA

Today	Tonight	Friday	Friday Night	Saturday	Saturday Night	Sunday	Sunday Night	Monday
20%	 10%				20%	30%		
Isolated T-storms	Isolated T-storms then Mostly Clear	Sunny	Mostly Clear	Mostly Sunny	Slight Chance T-storms	Chance T-storms	Chance T-storms	Chance T-storms
High: 78 °F	Low: 52 °F	High: 77 °F	Low: 49 °F	High: 73 °F	Low: 49 °F	High: 71 °F	Low: 49 °F	High: 73 °F

Detailed Forecast

Isolated showers and thunderstorms. Mostly sunny, with a high near 78. Calm wind becoming north around 5 mph in the afternoon. Chance of precipitation is 20%.

Tonight
Isolated showers and thunderstorms before 11pm. Mostly clear, with a low around 52. West wind 5 to 10 mph becoming light southwest in the evening. Chance of precipitation is 10%.

Friday
Sunny, with a high near 77. Light southwest wind becoming west 10 to 15 mph in the afternoon.

Friday Night
Mostly clear, with a low around 49. West wind 10 to 15 mph decreasing to 5 to 10 mph in the evening. Winds could gust as high as 25 mph.

Saturday
Mostly sunny, with a high near 73. Southwest wind 5 to 10 mph.

Saturday Night
A 20 percent chance of showers and thunderstorms after 11pm. Partly cloudy, with a low around 49.

Sunday
A 30 percent chance of showers and thunderstorms, mainly after 11am. Mostly sunny, with a high near 71.

Sunday Night
A chance of showers and thunderstorms, mainly before 11pm. Mostly cloudy, with a low around 49.

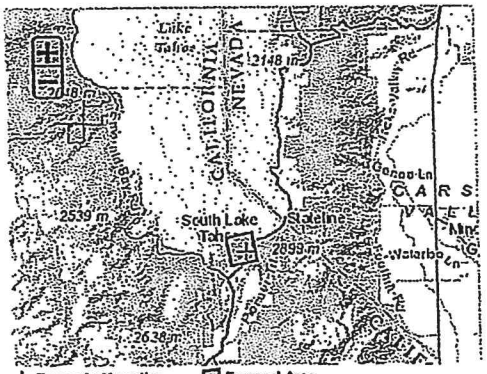
Monday
A chance of showers and thunderstorms, mainly after 11am. Partly sunny, with a high near 73.

Monday Night
A chance of showers and thunderstorms, mainly before 11pm. Partly cloudy, with a low around 48.

Tuesday
A slight chance of showers and thunderstorms. Mostly sunny, with a high near 73.

Tuesday Night
A slight chance of showers and thunderstorms. Partly cloudy, with a low around 48.

Wednesday
Sunny, with a high near 75.



+ Requested Location Forecast Area

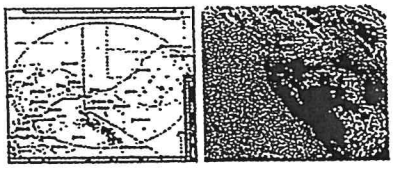
Point Forecast:
South Lake Tahoe CA
38.94°N 119.99°W (Elev. 6293 ft)

Last Update:
10:48 am PDT Jul 16, 2015

Forecast Valid:
11am PDT Jul 16, 2015-6pm PDT Jul 22, 2015

Additional Resources

Radar & Satellite Image



Hourly Weather Graph

INSPECTOR'S DAILY REPORT
MONTGOMERY ESTATES AREA 3
DIVISION CONTROL PROJECT
(CONTRACT NO. PW 14-31077, CIP NO. 95172)

Report No. _____
Page _____ of _____
Date 7 / 16 / 2015
M T W (T) F S S Circle
Contractor's Shift Hours: Start 8:00 Stop 4:00
Contractor's Lunch Hour: Start ____ Stop ____

Location & Description of Operation FAIRMEADOW CT. (2+25.61, 140' RT); REMOVE DI; INSTALL DI, INSTALL TEMPORARY BMP'S, CHECK TEMPORARY BMP'S

LABOR AND/OR EQUIPMENT			HOURS – BID ITEM NO.										WEATHER
													SUNNY, WARM
EQPT NO.	NO. MEN	DESCRIPTION (of Equipment or Labor)	#3 TRAFFIC CONTROL	#4 JOB SITE MAINT	#6 TEMPORARY FIBER ROLL	#8 STREET SWEEPING	#14 REMOVE DI	#27 DI TYPE 2					REMARKS OR COMMENTS
	1	Martin Louch –Superintendent/Oper											
	1	Nick Huddleson-Gradesetter											
4,6,9	(1)	Greg Coltra -Operator		8		1/2	2	5					
	1	Alex Carlson –Operator/Laborer											
	1	Adrian Pelayo - laborer											
	1	Lorenzo Soto - laborer											
2	(1)	Cameron Ewing-laborer	1/2		1/2		2	5					
1		Water Truck 4000 gal -International											
2		Water Truck 4000 gal -Kenworth											
3	✓	Deere 644 H Loader #EF9H58											
4	✓	Elgin Air Cub Sweeper Truck											
5		Bomag BW145PDH-3 Roller w blade											
6	✓	Cat 420D Backhoe #LF5E99											
7		Cat Skip Loader											
8	✓	Chev Work Truck Flatbed - Martin											
9	✓	Water Truck 2000 gal - Ford											

SIGNATURE [signature]

TITLE SR. ENGINEERING TECH

Distribution: (1) Original-Project File (2) Copy-RE File (3) Copy-PM File (4) Copy-Inspector

INSPECTOR'S DAILY REPORT

PROJECT: MONTGOMERY ESTATES AREA 3 EROSION CONTROL PROJECT (CONTRACT NO. PW 14-31077, CIP NO. 95172)

REPORT NO.:	WORKING DAY NO.: 4 OF 25	DATE: 7/16/15	M T W (T) F S S (Circle Day)
PAGE: 2 OF 3		CONTRACTOR SHIFT HOURS:	START 8:00 STOP 4:00
WEATHER CONDITIONS: SUNNY		TEMPERATURE: 40's Min. 80 Max.	

PRIMARY INSPECTOR

ON-SITE	ARRIVE [1] 2:00 PM	DEPART [2] 3:30	TOTAL ON-SITE INSPECTION HRS ([2]-[1])			
NON-INSPECTION TIME SUMMARY (HRS)	TRAVEL TIME TO SITE: 10 MIN	WORK EQPT LOAD:	PAPERWORK ON-SITE: ½ HR	PAY ESTIMATE ON-SITE:		TOTAL (INCL. INSPECTION HRS) ([4]-[3])
	FROM SITE: 10 MIN	UNLOAD:	OFF-SITE: ½ HR	OFF-SITE:		
TOTALS	[1] 20 MIN	[2]	[3] 1 HR	[4]		1 HRS

SECONDARY INSPECTOR

ON-SITE	ARRIVE [1]	DEPART [2]	TOTAL ON-SITE INSPECTION HRS ([2]-[1])			
NON-INSPECTION TIME SUMMARY (HRS)	TRAVEL TIME TO SITE:	WORK EQPT LOAD:	PAPERWORK ON-SITE:	PAY ESTIMATE ON-SITE:		TOTAL (INCL. INSPECTION HRS) ([4]-[3])
	FROM SITE:	UNLOAD:	OFF-SITE:	OFF-SITE:		
TOTALS	[1]	[2]	[3]	[4]		

- ARRIVED @ 2:00 PM @ FAIRMEADOW CT (2+25.61)
- GREG & CAMERON ABOUT TO SET TYPE 2 DI
- SPOKE W/ GREG ABOUT PROPER TEMPORARY BMP INSTALLATIONS & POSSIBLE WEATHER IN AFTERNOON/EVENING
- DISCUSSED SPECS FOR SOD REMOVAL & REPLACEMENT W/ WATERING WHILE STORED (STORED NO LONGER THAN 72 HRS)
  - → SECTION 20, SP 45 CONTRACT DOCUMENTS
  - → TURF WAS REMOVED ON 7/15/15 @ ≈ 11:00 AM
- ASKED GREG FOR LOAD TICKET FOR DRAIN ROCK; HE STATED WILL GET IT FROM DRIVER MOST LIKELY NEXT WEEK
- RUNNING LF5E99 BACKHOE & WILL SET DI W/ LOADER/DEERE 644H/ # EF9H580
- LEFT SITE @ 3:30; GREG & CAMERON WERE PLATING, BACKFILLING, BMPing PROJECT AREA

ITEM # 14/ITEM CODE 150776A REMOVE DI: FAIRMEADOW CT.
ITEM # 27/ITEM CODE 510502B DI-TYPE 2: FAIRMEADOW CT.

SIGNATURE	TITLE SR. ENGINEERING TECH

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TEMPORARY BMP INSPECTION LOG	PROJECT: MONTGOMERY ESTATESA AREA 3 EROSION CONTROL PROJECT (CONTRACT NO. PW 14-31077, CIP NO. 95172)

REPORT NO.:	WORKING DAY NO.: 4 OF 25	DATE: 7 / 16 / 15 M T W (T) F S S (Circle Day)
PAGE: 3 OF 3	WEATHER CONDITIONS: (CLEAR) RAIN SNOW T-STORM OTHER	

	YES	NO	(CIRCLE ONE)
1. DAMAGE TO CONTAINMENT DIKES OR EROSION CONTROL FENCING:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
2. IMPROPERLY INSTALLED OR INEFFECTIVE EROSION CONTROL FENCING:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
3. UNAUTHORIZED ACCESS BY VEHICLES:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
4. BOUNDARY FENCE DAMAGE OR REMOVAL:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
5. DISTURBED AREAS WITH INADEQUATE EROSION PREVENTION AND SEDIMENT CONTROL PROTECTION:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
6. EVIDENCE OF SEDIMENT LEAKAGE THROUGH EROSION CONTROL FENCING OR CONTAINMENT DIKES:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
7. SOIL PILES AND EARTHEN MATERIALS, WHICH ARE UNPROTECTED OR LOCATED IN DRAINAGE WAY:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
8. SPILLED AND IMPROPERLY STORED CHEMICALS, PAINT, FUEL, OIL, SOLVENTS, SEALANTS, ETC.:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
9. RUNOFF DIVERSION/DEWATERING STRUCTURES (IN-PLACE AND OPERATIONAL): N/A	☐	☐	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
10. ANY SIGNS OF SOIL EROSION OR DEPOSITION DOWN GRADIENT FROM RUNOFF DISCHARGES:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
11. SEDIMENT ACCUMULATION WITHIN ON-SITE STORM WATER DRAINAGE CONTROL FACILITIES:	☐	☑	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4
12. SWEEPER PRESENT AND ADEQUATELY CLEANING PROJECT SITE:	☑	☐	SUBSTANTIAL COMPLIANCE (1) / MINOR DEFICIENCIES 2 / MAJOR DEFICIENCIES 3 / CRITICAL DEFICIENCIES 4

INSPECTED BY [signature]	TITLE SR. ENGINEERING TECH

NOTIFIED:	PROJECT MANAGER	YES	NO	CONTRACTOR	YES	NO	REGIONAL BOARD	YES	NO	OTHER	YES	NO
		☐	☐		☐	☐		☐	☐		☐	☐

INSPECTOR'S DAILY REPORT

PROJECT: MONTGOMERY ESTATES AREA 3 EROSION CONTROL PROJECT (CONTRACT NO. PW 14-31077, CIP NO. 95172)

REPORT NO.:	WORKING DAY NO.: 5 OF 25	DATE: 7/17/15	M T W T (F) S S (Circle Day)
PAGE: 2 OF 3		CONTRACTOR SHIFT HOURS:	START — STOP —
WEATHER CONDITIONS: SUNNY		TEMPERATURE: 40 Min.	80 Max.

PRIMARY INSPECTOR

ON-SITE	ARRIVE [1] 12 45		DEPART [2] 100		TOTAL ON-SITE INSPECTION HRS ([2]-[1])		.25 HRS			
NON-INSPECTION TIME SUMMARY (HRS)	TRAVEL TIME TO SITE: 5 MIN		WORK EQPT LOAD:		PAPERWORK ON-SITE: 10 MIN		PAY ESTIMATE ON-SITE:		TOTAL (INCL. INSPECTION HRS) ([1]+[2]+[3]+[4])	
	FROM SITE: 10 MIN		UNLOAD:		OFF-SITE:		OFF-SITE:			
TOTALS		[1] .25 HRS		[2]		[3]		[4]	.5 HRS	

SECONDARY INSPECTOR

ON-SITE	ARRIVE [1]		DEPART [2]		TOTAL ON-SITE INSPECTION HRS ([2]-[1])					
NON-INSPECTION TIME SUMMARY (HRS)	TRAVEL TIME TO SITE:		WORK EQPT LOAD:		PAPERWORK ON-SITE:		PAY ESTIMATE ON-SITE:		TOTAL (INCL. INSPECTION HRS) ([1]+[2]+[3]+[4])	
	FROM SITE:		UNLOAD:		OFF-SITE:		OFF-SITE:			
TOTALS		[1]		[2]		[3]		[4]		

7/17/15 (MPB) NO CREWS ON SITE TODAY
ALL EXCAVATED DI AREAS PLATED & CONED

* NO BID ITEMS COMPLETED

SIGNATURE	TITLE SR. ENGINEERING TECH

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TEMPORARY BMP INSPECTION LOG	PROJECT: MONTGOMERY ESTATESA AREA 3 EROSION CONTROL PROJECT (CONTRACT NO. PW 14-31077, CIP NO. 95172)

PORT NO.:	WORKING DAY NO.: 5 OF 25	DATE: 7/17/15	M T W T (F) S S (Circle Day)
GE: 3 OF 3	WEATHER CONDITIONS:	(CLEAR) RAIN SNOW T-STORM OTHER	

	YES	NO		(CIRCLE ONE)
1. DAMAGE TO CONTAINMENT DIKES OR EROSION CONTROL FENCING:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
2. IMPROPERLY INSTALLED OR INEFFECTIVE EROSION CONTROL FENCING:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
3. UNAUTHORIZED ACCESS BY VEHICLES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
4. BOUNDARY FENCE DAMAGE OR REMOVAL:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
5. DISTURBED AREAS WITH INADEQUATE EROSION PREVENTION AND SEDIMENT CONTROL PROTECTION:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
6. EVIDENCE OF SEDIMENT LEAKAGE THROUGH EROSION CONTROL FENCING OR CONTAINMENT DIKES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
7. SOIL PILES AND EARTHEN MATERIALS, WHICH ARE UNPROTECTED OR LOCATED IN DRAINAGE WAY:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
8. SPILLED AND IMPROPERLY STORED CHEMICALS, PAINT, FUEL, OIL, SOLVENTS, SEALANTS, ETC.:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
9. RUNOFF DIVERSION/DEWATERING STRUCTURES (IN-PLACE AND OPERATIONAL): N/A	☑	☐	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
10. ANY SIGNS OF SOIL EROSION OR DEPOSITION DOWN GRADIENT FROM RUNOFF DISCHARGES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
11. SEDIMENT ACCUMULATION WITHIN ON-SITE STORM WATER DRAINAGE CONTROL FACILITIES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
12. SWEEPER PRESENT AND ADEQUATELY CLEANING PROJECT SITE: N/A	☑	☐	SUBSTANTIAL COMPLIANCE	1
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4

INSPECTED BY MICHAEL P. BROADHURST	TITLE SR. ENGINEERING TECH

NOTIFIED:	PROJECT MANAGER	YES	NO	CONTRACTOR	YES	NO	REGIONAL BOARD	YES	NO	OTHER	YES	NO
		☐	☐		☐	☐		☐	☐		☐	☐

INSPECTOR'S DAILY REPORT
MONTGOMERY ESTATES AREA 3
EROSION CONTROL PROJECT
(CONTRACT NO. PW 14-31077, CIP NO. 95172)

Report No. _____
Page _____ of _____
Date 7 / 17 / 15
M T W T (F) S S Circle
Contractor's Shift Hours: Start _____ Stop _____
Contractor's Lunch Hour: Start _____ Stop _____

Location & Description of Operation
NO CREW ON SITE

HOURS – BID ITEM NO.

WEATHER
SUNNY, WARM
OVERCAST PM.

LABOR AND/OR EQUIPMENT

EQPT NO.	NO. MEN	DESCRIPTION (of Equipment or Labor)	REMARKS OR COMMENTS
	1	Martin Louch –Superintendent/Oper	
	1	Nick Huddleson-Gradesetter	NO CREW ON SITE
	1	Greg Coltra -Operator	
	1	Alex Carlson –Operator/Laborer	
	1	Adrian Pelayo - laborer	
	1	Lorenzo Soto - laborer	
	1	Cameron Ewing-laborer	
1		Water Truck 4000 gal -International	
2		Water Truck 4000 gal -Kenworth	
3		Deere 644 H Loader #EF9H58	
4		Elgin Air Cub Sweeper Truck	
5		Bomag BW145PDH-3 Roller w blade	
6		Cat 420D Backhoe #LF5E99	
7		Cat Skip Loader	
8		Chev Work Truck Flatbed - Martin	
9		Water Truck 2000 gal - Ford	

SIGNATURE

TITLE
SR. ENGINEERING TECH

Distribution: (1) Original-Project File (2) Copy-RE File (3) Copy-PM File (4) Copy-Inspector

INSPECTOR'S DAILY REPORT

PROJECT: SAWMILL 2B BIKE PATH & EROSION CONTROL PROJECT (CONTRACT NO. PW 11-30593, CIP NO. 95192)

REPORT NO.:	WORKING DAY NO.: 67 OF ~~60~~ 135	DATE: 7/7/2015	M (T) W T F S S (Circle Day)
PAGE: 1 OF 2		CONTRACTOR SHIFT HOURS:	START / STOP
WEATHER CONDITIONS: PM T-STORMS		TEMPERATURE: 40s Min.	75 Max.

PRIMARY INSPECTOR

ON-SITE	ARRIVE (i) 2:30 PM	DEPART (ii) 3:30 PM	TOTAL ON-SITE INSPECTION HRS ((ii)-(i))	1.0 HRS	
NON-INSPECTION TIME SUMMARY (HRS)	TRAVEL TIME TO SITE: / FROM SITE: N/A	WORK EQPT LOAD: / UNLOAD: N/A	PAPERWORK ON-SITE: .25 HRS / OFF-SITE: .5 HRS	PAY ESTIMATE ON-SITE: N/A / OFF-SITE: N/A	TOTAL (INCL. INSPECTION HRS) ((i)+(ii)+(iii)+(iv))
TOTALS	(iii)	(iv)	(v) .75 HRS	(vi)	(vii) 1.75

SECONDARY INSPECTOR

ON-SITE	ARRIVE (i)	DEPART (ii)	TOTAL ON-SITE INSPECTION HRS ((ii)-(i))		
NON-INSPECTION TIME SUMMARY (HRS)	TRAVEL TIME TO SITE: / FROM SITE:	WORK EQPT LOAD: / UNLOAD:	PAPERWORK ON-SITE: / OFF-SITE:	PAY ESTIMATE ON-SITE: / OFF-SITE:	TOTAL (INCL. INSPECTION HRS) ((i)+(ii)+(iii)+(iv))
TOTALS	(iii)	(iv)	(v)	(vi)	

~2:30 PM - ARRIVE ON SITE W/ RW, SIGNS OF RAIN WITHIN ½ HR OF ARRIVAL
- ALL WORKERS LEFT SITE FOR DAY DUE TO WEATHER (REMAINING WORKERS INCLUDE PERRY, PJ)
  - PJ IS RUNNING BOBCAT SWEEPER ALONG BIKE PATH; PERRY STATED SWEEPING PATH FOR SAFETY REASONS (SIGNS OF BIKERS)
- LOWBOY DELIVERY OF REDI ROCK W/ ROBERT DRIVING & PERRY & PJ OFFLOADING BLOCK
- CLF IS DOWN BETWEEN 95+75 & 95+25 (THIS AREA MAY NEED ECF DUE TO SLOPE & CONDITION OF SLOPE - WILL DISCUSS W/ DP); (MAY WANT TO EXTEND ECF LENGTH ~~OPEN~~ INSTALL DUE TO CONDITION OF SLOPE)
- GRAVEL IS BEING STORED ON APT. BLDG (NORTH SIDE OF SAWMILL) LOT ≈ 20 CU YDS; ASKED PERRY IF HE HAD PERMISSION & HE REPLIED "YES". PERMISSION FROM LISTING AGENT/BUYERS REP?

* IE OF OUTFALL PIPE ≈ 2" ABOVE IE OF INLET PIPE
(97+25.00) (97+62.34)

(1/DS) SHEET P-5 9 OF 21

SIGNATURE [signature] TITLE SR. ENGINEERING TECH

Distribution: (1) Original-Project File (2) Copy-RE File (3) Copy-PM File (4) Copy-Inspector

TEMPORARY BMP INSPECTION LOG	PROJECT: SAWMILL 2B BIKE PATH & EROSION CONTROL PROJECT (CONTRACT NO. PW 11-30593, CIP NO. 95192)		
REPORT NO.:	WORKING DAY NO.: 67 OF ~~60~~ 135	DATE: 7 17 15	M (T) W T F S S (Circle Day)
PAGE: 2 OF 2	WEATHER CONDITIONS:	CLEAR RAIN SNOW (T-STORM) OTHER	

	YES	NO		(CIRCLE ONE)
1. DAMAGE TO CONTAINMENT DIKES OR EROSION CONTROL FENCING:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
2. IMPROPERLY INSTALLED OR INEFFECTIVE EROSION CONTROL FENCING:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
3. UNAUTHORIZED ACCESS BY VEHICLES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
4. BOUNDARY FENCE DAMAGE OR REMOVAL: CLF MISSING @ STAGING AREA (STA 96+00), CLF DOWN BETWEEN 95+75 & 95+25	☑	☐	SUBSTANTIAL COMPLIANCE	1
			MINOR DEFICIENCIES	(2)
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
5. DISTURBED AREAS WITH INADEQUATE EROSION PREVENTION AND SEDIMENT CONTROL PROTECTION:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
6. EVIDENCE OF SEDIMENT LEAKAGE THROUGH EROSION CONTROL FENCING OR CONTAINMENT DIKES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
7. SOIL PILES AND EARTHEN MATERIALS, WHICH ARE UNPROTECTED OR LOCATED IN DRAINAGE WAY: INFORMED PERRY TO COVER SOILS PILE @ STAGING AREA LOCATED @ ANNACKER'S ACCESS	☑	☐	SUBSTANTIAL COMPLIANCE	1
			MINOR DEFICIENCIES	(2)
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
8. SPILLED AND IMPROPERLY STORED CHEMICALS, PAINT, FUEL, OIL, SOLVENTS, SEALANTS, ETC.:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
9. RUNOFF DIVERSION/DEWATERING STRUCTURES (IN-PLACE AND OPERATIONAL): N/A	☐	☐	SUBSTANTIAL COMPLIANCE	1
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
10. ANY SIGNS OF SOIL EROSION OR DEPOSITION DOWN GRADIENT FROM RUNOFF DISCHARGES:	☐	☑	SUBSTANTIAL COMPLIANCE	1
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
11. SEDIMENT ACCUMULATION WITHIN ON-SITE STORM WATER DRAINAGE CONTROL FACILITIES:	☐	☑	SUBSTANTIAL COMPLIANCE	1
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
12. SWEEPER PRESENT AND ADEQUATELY CLEANING PROJECT SITE:	☑	☐	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4

INSPECTED BY Michael P. Bamhart | TITLE SR. ENGINEERING TECH

NOTIFIED:	PROJECT MANAGER	YES	NO	CONTRACTOR	YES	NO	REGIONAL BOARD	YES	NO	OTHER	YES	NO
		☐	☐		☐	☐		☐	☐		☐	☐

INSPECTOR'S DAILY REPORT
TAHOE HILLS
)SION CONTROL PROJECT
ITRACT NO. PW 14-31075, CIP NO. 95171)

Report No.
Page 1 of 3
Date 9 / 2 / 2015
M T W T F S S Circle
Contractor's Shift Hours: Start 8:00 Stop 4:30
Contractor's Lunch Hour: Start UNKN Stop UN

Location & Description of Operation SHEET P-5 SD STA 20+42.40 TYPE 2 D1 18"Ø PERF HDPE; SHEET P-5 INFILTRATION AREA RSP & 18"Ø PERF HDPE BACKFILL;

			HOURS – BID ITEM NO.										WEATHER
													CLEAR, SUNNY
LABOR AND/OR EQUIPMENT			#3 TRAFFIC CONTROL	#4 JOB SITE MGMT	#9 STREET SWEEPING	#27 DRAINAGE INLET TZ	#33 18"Ø PERF HDPE	#40 ROCK EXCAVATION	#34 36" CSP				
EQPT NO.	NO. MEN	DESCRIPTION (of Equipment or Labor)											REMARKS OR COMMENTS
6,1,3	1	Andy Davis – Superintendent		8			4	3					
1	1	Robert Haen – Operator		3				3					
9,1	1	J J Hernandez - Laborer			1			3					
6,3	1	Barrett Burghard - Laborer				1		3	3				# TIMES ARE
1,3,2	1	Aaron Schmalenberger –Operator/Labore				1		3	3				ESTIMATES - NOT
	1	Cesar Rodriguez – Laborer	3			1		3	3				ON SITE FOR
													COMPLETE WORKING
	1	Jose Gel – Laborer											DAY (EDOT INSPECTOR)
	1	Daniel Graham – Operator											
	1	Ciprano Franco – Laborer											
	1	David Nelson – Operator											
	1	Fernando Gomez – Laborer											
	1	Isidro Rojas – Laborer											
	1	Enrique Alamillo – Operator											
	1	Mike Only											
	1	Destry Garcia											
1	1	Cat 315CL Excavator											
2	1	Cat 303.5C Mini Excavator											
3	1	Cat 928G Loader											
4	1	Cat 414E Skip Loader											
5	1	Cat 420E Backhoe											
6	1	Bob Tail Dump Truck											
7	1	Cat BM-214E 36" Roller											
8	1	ValCon Vactor Truck #102											
9	1	Schwarz A4000 Sweeper Truck											
10	1	GMC 2500HD work truck #08											
11	1	GMC 5500HD work truck #ST18											
12	1	Komatsu WA320PZ Loader											
13	1	Komatsu PC138USLC Hyd. Exc.											

SIGNATURE

TITLE SR ENGINEERING TECH

Distribution: (1) Original Project File (2) Copy RE File (3) Copy PM File (4) Copy inspector

INSPECTOR'S DAILY REPORT

PROJECT: TAHOE HILLS EROSION CONTROL PROJECT (CONTRACT NO. PW 14-31075, CIP NO. 95171)

REPORT NO.:	WORKING DAY NO.: 18 OF 30	DATE: 9/2/15 M T (W) T F S S (Circle Day)	
PAGE: OF		CONTRACTOR SHIFT HOURS: START 800	STOP 430

2^30 PM - ARRIVED ON SITE

- 18"Ø PERF HDPE INSTALLATION STARTED @/FROM 9+78.20 11.50' RT = SD STA 20+42.40 TYPE 2 DI (SHEET P-5)
- DURING INSTALLATION, BOULDER WAS ENCOUNTERED ≈15' FROM DI & CREW WAS UNABLE TO DISLODGE/MOVE.
  * ANDY DAVIS DISCUSSED SITUATION W/ DAN RIKKERT
- CREW WILL DRILL & HAMMER BOULDER ON 9/3/15 IN A.M.

4^00 PM - TEMPORARY BACKFILL/BASE APPLIED TO PIPE CROSSING (LOCATION NOTED ABOVE - SHEET P-5) W/ COMPACTED LIFTS FOR VEHICLE ACCESS TO/FROM MEEKS BAY AVENUE

4^15 PM - SWEEPER TRUCK MAKING ROUNDS
- SITE CLEANUP IN PROCESS

4^20 PM - LEFT SITE

SIGNATURE [signature] TITLE SR ENGINEERING TECH

Distribution: (1) Original-Project File (2) Copy-RE File (3) Copy-PM File (4) Copy-Inspector

TEMPORARY BMP INSPECTION LOG

PROJECT: TAHOE HILLS EROSION CONTROL PROJECT
(CONTRACT NO. PW 14-31075, CIP NO. 95171)

REPORT NO.:	WORKING DAY NO.: 18 OF 30	DATE: 9 / 2 / 15 M T W (T) F S S (Circle Day)
PAGE: 3 OF 3	WEATHER CONDITIONS: (CLEAR) RAIN SNOW T-STORM OTHER	

	YES	NO		(CIRCLE ONE)
DAMAGE TO CONTAINMENT DIKES OR EROSION CONTROL FENCING:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
2. IMPROPERLY INSTALLED OR INEFFECTIVE EROSION CONTROL FENCING:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
3. UNAUTHORIZED ACCESS BY VEHICLES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
4. BOUNDARY FENCE DAMAGE OR REMOVAL:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
5. DISTURBED AREAS WITH INADEQUATE EROSION PREVENTION AND SEDIMENT CONTROL PROTECTION:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
6. EVIDENCE OF SEDIMENT LEAKAGE THROUGH EROSION CONTROL FENCING OR CONTAINMENT DIKES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
SOIL PILES AND EARTHEN MATERIALS, WHICH ARE UNPROTECTED OR LOCATED IN DRAINAGE WAY:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
8. SPILLED AND IMPROPERLY STORED CHEMICALS, PAINT, FUEL, OIL, SOLVENTS, SEALANTS, ETC.:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
9. RUNOFF DIVERSION/DEWATERING STRUCTURES (IN-PLACE AND OPERATIONAL): N/A	☐	☑	SUBSTANTIAL COMPLIANCE	1
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
10. ANY SIGNS OF SOIL EROSION OR DEPOSITION DOWN GRADIENT FROM RUNOFF DISCHARGES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
11. SEDIMENT ACCUMULATION WITHIN ON-SITE STORM WATER DRAINAGE CONTROL FACILITIES:	☐	☑	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4
12. SWEEPER PRESENT AND ADEQUATELY CLEANING PROJECT SITE:	☑	☐	SUBSTANTIAL COMPLIANCE	(1)
			MINOR DEFICIENCIES	2
			MAJOR DEFICIENCIES	3
			CRITICAL DEFICIENCIES	4

INSPECTED BY MICHAEL BROADHURST	TITLE SR ENGINEERING TECH

NOTIFIED:	PROJECT MANAGER	YES	NO	CONTRACTOR	YES	NO	REGIONAL BOARD	YES	NO	OTHER	YES	NO
		☐	☐		☐	☐		☐	☐		☐	☐

Appendix C

Commercial Inspection Checklist

Inspectors Name	Date / Tme	Field / Weather Conditions	Inpsection Location	Observed facility Conditions	NPDES Violation (Yes or No)	Follow Up and Enforcement Action
Michael Broadhurst	10/30/2015	Sunny / Fair	Meeks Fire	Paved parking flows to vegetation, clean site, no signs of erosion	No	None
Michael Broadhurst	10/23/2015	Overcast/cool	Camp Richardson Marina / Resort	Boat storage area clean, no signs of materials storage outside, no signs of erosion, parking on unpaved areas (no signs of tracking into ROW at time of site visit)	No	None
Michael Broadhurst	10/21/2015	Sunny / Fair	Liras Super Market	Grease Bin outside-no visible signs of impact from rainwater to grease bin,good overall site conditions, no signs of water quality impact from site	No	None
Michael Broadhurst	10/22/2015	Sunny / Fair	CCC building	BMP's in place and functioning, no signs of outside materials storage, good overall site conditions	No	None
Michael Broadhurst	10/21/2015	Sunny / Fair	Road Runner	Waste Drums near rear entrance of facility-photo taken. Overall site is in good condition with no signs of water quality impacts	No	None
Michael Broadhurst	10/21/2015	Sunny / Fair	Steves Transmission	Clean Site. No materials stored outside. No signs of threats to water quality.	No	None
Michael Broadhurst	10/21/2015	Sunny / Fair	Paradise Golfcourse	All materials stored inside. Site conditions do not show signs of water quality impacts. Dump site cleaned up (has shipping container for storage of equipment thru winter)	No	None
Michael Broadhurst	10/23/2015	Partly sunny/breezy	Lake Tahoe Golfcourse	No Hazardous or potentially Hazardous waste stored outside, good condition , no signs of erosion.	No	None
Michael Broadhurst	10/30/2015	Sunny / Fair	Cal Trans DOT Maintenance Yard	Stockpiled material and heavy equipment. No signs of Hazardoous material or soil tracking. No signs of erosion or water quality threat	No	None
Michael Broadhurst	10/30/2015	Sunny / Fair	EDOT Maintenance Yard	Clean site overall.	No	
Michael Broadhurst	10/30/2015	Sunny / Fair	USFS Yard	Parking off pavement. No visible signs of tracking, erosion, or water quality impacts.	No	None
Michael Broadhurst	10/29/2014	Sunny / Fair	Meeks Lumber	Clean, BMPs appear to be functional. No erosion or tracking. No outside storage of hazardous or potentially hazardous waste.	No	None

Appendix D

El Dorado County Department of Transportation
Tahoe Engineering Division

County of El Dorado Abrasive Study

Analysis of Particle Size and Particle Distribution of Volcanic Cinders and Decomposed Granite for TMDL Load Reduction Crediting

Russell Wigart[1], Brendan Ferry[2]

November 16, 2015

Purpose and Need

With the advent of source control via sweeping being proposed for reducing the mass of sediment on road surfaces to mitigate abrasive applications, it is becoming increasingly necessary to research all alternatives before decisions are made that direct policy for local jurisdictions and TMDL implementation, which have potentially large financial impacts with little understood benefits to lake clarity.

Lake Tahoe's Water Clarity continues to decline even with the implementation of hundreds of millions of dollars of erosion control and water quality improvement projects. The projects, though necessary and effective, require large capital and associated maintenance. Meanwhile, local jurisdictions around the entire Lake put down tens of thousands of tons of abrasive material to improve public safety. These imported materials, which include volcanic cinders and sands from outside the Tahoe Basin, contain very large amounts of fine material of which is the leading cause of Lake Tahoe's clarity loss. However road abrasives such as sand can end up in the environment in runoff to streams and rivers (EPA, 2002) and during the winter, one way that road maintenance activities can threaten water quality in the Lake Tahoe basin is the application of great quantities of traction sand (Lahontan, 1995). The most dominant pollutant of concern for Lake Tahoe clarity is sediment particles less than 16-microns (Swift, 2005) and Roberts (2007) estimated that 72% of the less than 20-micron sediment load to Lake Tahoe originates from the urban upland source category. The relative percentage contribution of inorganic fine particles from all sources based on annual average for the period 1994–2008 on size classes 0.5–1, 1–2, 2–4, 4–8,and 8–16 μm are 73%, 19%, 5%, 2%, and 1%, respectively (Sahoo 2013). According to the California Stormwater Quality Association Stormwater BMP Handbook (2003), the selection of best management practices (BMPs) should focus first on source control including activities intended to reduce the pollutants to the maximum extent practicable. Based on the above, 92% of the Lake Clarity issue is coming from particles <2 micron in diameter. Focusing on the ultra-fine fractions of fine sediments <2 micron will be the greatest benefit to Lake Clarity based on the research of Sahoo. These results suggest clear priorities for resource managers to establish TMDL on sources and incoming pollutants and preserving lake clarity (Sahoo 2013). The new winter abrasive material contains very little of the particles causing this scattering. Therefore measurements were once again taken to compare ultrafine particles and also analyze the replication of the previously collected data.

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[1] El Dorado County, South Lake Tahoe, CA 96150 Russell.wigart@edcgov.us
[2] El Dorado County, South Lake Tahoe, CA 96150 Brendan.Ferry@edcgov.us

TMDL crediting and trading is proposing intensified sweeping that will have large cost implications for local jurisdictions and agencies required to meet these load allocation objectives.

Sweeping is known throughout the nation to be effective at removing mass of material; however it is not well understood as far as positive impacts to water quality or improvements. The cost implications of these practices are not well understood and may not fully meet objectives; therefore source control is needed to curtail the increased mass of material being applied to the road surface each year. This paper will identify potential benefits that can be attained by simple source control measures such as changing the abrasive type from volcanic cinders to decomposed granite. This native abrasive granite media will be discussed with results of preliminary investigations into the feasibility and practicality of utilizing native materials for traction. These methods of source control may yet be another option to improve maintenance practices for public safety used by all jurisdictions basin wide, while keeping current sweeping practices at maintainable levels of operations and within available budgets.

Background

El Dorado County uses approximately 1000 ton of aggregate each year. The amount used each winter varies based on precipitation and road conditions. The previously used cinders were purchased from Cinderlite in Carson City, Nevada. Abrasives are applied as needed to improve traction for public safety. Table 1 below shows the aggregate usage since winter 2001.

Table 1

Winter	Abrasive Use (tons)
2001/2002	1457
2002/2003	1094
2003/2004	1096
2004/2005	848
2005/2006	1370
2006/2007	794
2007/2008	716
2008/2009	914
2009/2010	1242
2010/2011	790
2011/2012	832
2012/2013	750
2013/2014	245
2014/2015	191
Average	**881**

The concept for recovering the abrasives is to sweep when conditions permit after the snow has fallen. El Dorado County currently sweeps material from the road surface on an as needed basis. The program targets those areas of highest priority by attempting to recover material such as roadway abrasives in the winter and areas of high sediment accumulation in the summer. The recovery of the material during winter is high, but conditions usually prevent sweeping operations from be able to capture much of the fine particulate material as material is washed from the road surface prior to sweepers being able to mobilize. Regenerative air and vacuum style sweepers are not effective when the road surface is very wet or when conditions are icy. A large majority of the fine particulate material available on the road surface is washed off during conditions when sweepers cannot be run effectively. This is evident in the highly concentrated pulse of stormwater directly after a winter storm event. Sweeper simply cannot mitigate this, however it is important to get out as soon as possible when conditions permit to sweet and prevent further pulverization of road sediments. This makes targeting source control of the abrasive material itself incredibly important for removing large sources of the pollutant of concern prior to aggregate application on the road surface.

In March of 2011, the County was successful in awarding a contract for a new abrasives specification using Washoe Sand. This sand has the correct uniformity and effective size for traction and also contains minimal ultrafine particles (Cal Trans 2010). El Dorado County has been leading the research of this practice and working closely with Cal Trans for over 5 years on this topic. The County discovered this highly effective material while researching sand filtration and discovered that it reduced ultra-fine particulates / sediment by greater than 90% (EDOT 08-02). The concept started simple in that if it could treat stormwater than why not investigate the use of this aggregate for winter traction sand usage. The end results are impressive and one the County believes will improve water quality and the response of Lake Tahoe's famed clarity.

El Dorado County also plans to take credit for the modification of this practice as part of its load reduction strategy. The preliminary estimates / measurements are indicating the load reductions to be well above any other BMP or maintenance management practice (including sweeping) from a benefit / cost standpoint. It may be possible to meet many of the load reduction targets with just a modification to this aggregate specification.

This paper expands upon previous County research and explores the fine particle composition of the previously used volcanic cinders and the new specification Washoe Sand (decomposed granite).

Road Traction Techniques

In the Lake Tahoe basin, one approach to mitigating the water quality impacts of traction sand was to evaluate the use of calcium, magnesium, potassium acetate, and magnesium chloride (Lahontan, 1995). Another technique is the application of traction sand. Angular or crushed sand provides better traction than rounded sand and very small particles and dirt are actually harmful to traction with the material larger than #50 sieve (300 micron) being the most effective (Road Management Journal, 1997). However, for de-icing sand the Nevada State Purchasing Division allows up to 20% passing the #50 sieve (Nevada, 2007) and the State of California allows up to between 20% and 30% passing the #50

sieve (California, 2007). The previous El Dorado County specification for road cinders is 100% passing the 3/8" sieve and no more than 5% pass a #200 sieve. Based on the measurement of grain size distribution for a single sample collected in 2008, the old El Dorado County DOT cinders contained 19% passing the #50 sieve, 6.5% passing the #200 sieve and 2.4% less than 20 microns. This did not meet current specifications, therefore a new specification was developed that allowed 100% passing ¼" sieve, no more than 20% passing #50 sieve and no more than 4% passing #200 sieve.

With assistance from El Dorado County, Cal Trans has developed a new specification for abrasives with a much tighter range in the lower sieve classes (Table below). El Dorado County has adopted this specification with some modifications for all future contracts and is also incorporating turbidity dilution testing standards as developed by the County.

Aggregate Gradation (Percentage Passing)

Sieve Sizes	Target Value Limits[1]
¼"	100
No. 8	40-65
No. 16	15-35
No. 50	0-5
No. 200	0-1

Methods

An analysis and study conducted in August 2011 by El Dorado County staff (EDOT 11-02) demonstrated the reduction potential of the changing of road traction abrasive type on particle size distribution. The results suggested that the County could reduce upwards of 7% of the total TMDL baseline load and achieve upwards of a 91% load reduction of FSP relative to the prior usage of volcanic cinders. Because the County believes that the investment in this management is worthy of investigation a subsequent test was conducted to attempt to replicate these results.

2015 Test

To attempt to replicate the results of the 2011 test and to add more data to the body of knowledge on the abrasives, the County conducted further study on the two abrasive types using different methods.

Test 1 – 50 grams of aggregate wet sieved through a 230 mesh (63micron) using 2000 ml of water.

> Each sample was sieved 10 times in an attempt to wash all fine particles from the aggregate and into solution. Test 1 used representative samples of equal mass of non-pulverized material for the two tests.

Test 2 – 5 grams of <230 sieve (63 micron) pulverized material diluted into 2000 ml water.

> Test 2 attempted to pulverize particles down to small size fractions while analyzing only the Fine Sediment Particles (FSP). Each aggregate was struck 300x's with a 10 pound sledge hammer in an attempt to break the particle down in a worst case scenario. The aggregate was placed in 5 Ziploc 1 gallon bags prior to pulverization. After pulverization the particles were then dry sieved using a 230 mesh screen.

Two tests were completed for each aggregate and sent to WETlab for analysis of TSS, TN, TP, OP and FSP. In all, 4 aggregate tests were completed using these techniques. These include:

Test 1

Washoe Sand – 50 grams 230 wet sieve

Volcanic Cinders – 50 grams 230 wet sieve

Test 2

Washoe Sand – 5 grams pulverized <230 dry sieve

Volcanic Cinders – 5 grams pulverized <230 dry sieve

2011 Test

To add to the body of knowledge on this topic, the County coordinated with Cal Trans and associated consultants to use standard protocols as developed in past studies. The Pulverizer and associated protocols used by Cal Trans for aggregate pulverization were completed along with sieve analysis, aggregate gradation and fine particle analysis. The intent was to estimate the particle reduction using various crushing techniques and the effect of those on fine particle composition.

The pulverization equipment and process were developed by the Caltrans North Region Materials Laboratory (Cal Trans 2010). Samples were placed inside the pulverizing drum, shown in Figure 1, with a weighted rod with rollers that was scaled to produce a pressure on the material similar to that of a typical vehicle tire (Figure 1, 3 & 4). Each sample was treated exactly the same by pulverizing for 21 minutes at approximately 57 rpm. The drum was then decontaminated after each test run. After the pulverization process, the contents of the drum, including all fine particulates, were emptied into the sieves and placed into the shaker for aggregate gradation. The traffic simulation calculations and pulverization process are provided in Appendix A. The rollers used for this analysis include a steel rod with two rubber wheels. The weight of the weighted rollers is 410 grams.

Figure 1

Photo Courtesy of CDM and Cal Trans

The County also used a 4kg piece of rolled steel in a subsequent test to create a worst case scenario (Figure 2). Calculations of the pressure exerted on particles were not calculated; however the rolled steel was solid with a weight 10 times greater than the steel rod with rubber rollers. These subsequent tests using the 4 kilogram steel rod utilized identical pulverizing protocols to the prior tests.

Figure 2

Photo Courtesy of CDM and Cal Trans

In all, six tests were conducted as part of this analysis. These include:

1.) Washoe Sand – Non Pulverized

2.) Volcanic Cinders – Non Pulverized

3.) Washoe Sand – Pulverized (with light 0.4 kilogram weight)

4.) Volcanic Cinders – Pulverized (with light 0.4 kilogram weight)

5.) Washoe Sand – Pulverized (with heavy 4 kilogram weight)

6.) Volcanic Cinders – Pulverized (with heavy 4 kilogram weight)

Figure 3

Figure 4

Each test consisted of an aggregate gradation using sieves 4, 8, 16, 30, 50, 100, 200 and <200 (pan). Figures 5&6 include photographs of the non-pulverized Washoe Sand and

Cinder gradations. The City of South Lake Tahoe Soils laboratory was used to complete all analysis as part of this study.

Figure 5 (Washoe Sand)

Figure 6 (Volcanic Cinders)

Gradation – Gradation for each aggregate utilized a 750 gram sample for all six tests. Dried samples were placed in a shaker for 15 minutes and then sieves re-weighed.

According to the Environmental Protection Agencies (EPA) Stormwater BMP Design Supplement for Cold Climates, one way to reduce the water quality impacts of sand application is to use material free of fine materials (Caraco, 1997). The National Cooperative Highway Research Program (NCHRP) suggests that it is possible to use

dilution testing in combination with water quality standards for suspended fine sediment or turbidity in order to evaluate the suitability of a particular road abrasive (NCHRP, 2007).

A 2.5 - 5 gram dried sample of <200 sieve (75 micron) was separately mixed with 1 liter of tap water and the turbidity of the raw solution measured initially, then sent to the laboratory. Analytical tests performed included Turbidity, Total Suspended Solids (TSS) and Particle Size Distribution (PSD). PSD analysis included 50, 20, 16, 10, 5, 2, 1 and <1 micron (um) Bin sizes.

To understand how the PSD of each sample related to the total mass of material <200 sieve, the percentages of each PSD Bin Size were multiplied by the weight of material in the pan (<200 sieve) following sieve analysis. This then allowed the calculation of mass of particle sizes in all Bin sizes. The water quality results of this analysis are described in more detail below.

DRAFT

2015 Results

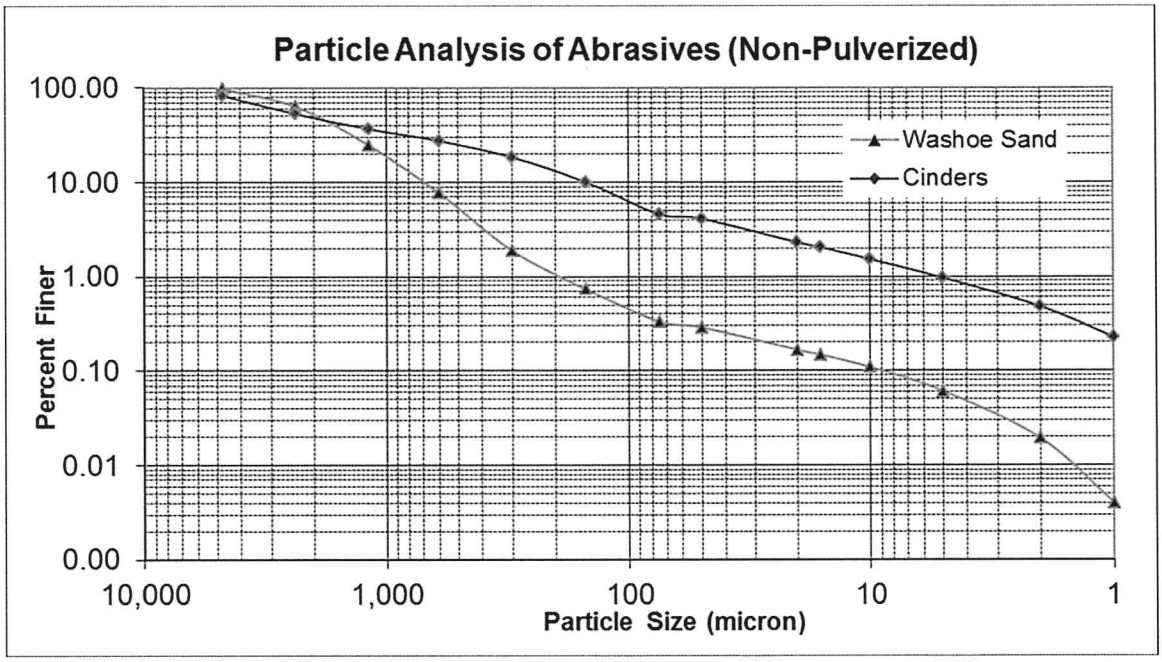
The solution of water for the 50 gram non-pulverized wet sieved Washoe Sand and Volcanic Cinders was initially equal to 134 and 926 NTU respectively measured with a Hach 2100Q portable turbidity meter. The particle size from the laboratory analysis is as follows.

4/6/2015 Washoe Sand Non - Pulverized (50 grams wet sieved)

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*	sum Rn	100-sumRn
4	4.750	4750	525.00	541.5	16.50	2.20	2.20	97.80
8	2.360	2360	480.00	739	259.00	34.56	36.76	63.24
16	1.180	1180	442.50	731	288.50	38.49	75.25	24.75
30	0.600	600	398.00	526.5	128.50	17.14	92.39	7.61
50	0.300	300	286.00	329	43.00	5.74	98.13	1.87
100	0.150	150	274.00	282.5	8.50	1.13	99.27	0.73
200	0.075	75	342.00	345	3.00	0.40	99.67	0.33
50 micron	0.050	50			0.34	0.05	99.71	0.29
20 micron	0.020	20			0.92	0.12	99.83	0.17
16 micron	0.016	16			0.14	0.02	99.85	0.15
10 micron	0.010	10			0.29	0.04	99.89	0.11
5 micron	0.005	5			0.36	0.05	99.94	0.06
2 micron	0.002	2			0.31	0.04	99.98	0.02
1 micron	0.001	1			0.11	0.02	99.996	0.004

4/6/2015 Cinders Non - Pulverized (50 grams wet sieved)

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*	sum Rn	100-sumRn
4	4.750	4750	525.00	655	130.00	17.32	17.32	82.68
8	2.360	2360	480.00	703	223.00	29.71	47.04	52.96
16	1.180	1180	442.50	565	122.50	16.32	63.36	36.64
30	0.600	600	398.00	467	69.00	9.19	72.55	27.45
50	0.300	300	286.00	354	68.00	9.06	81.61	18.39
100	0.150	150	274.00	336.5	62.50	8.33	89.94	10.06
200	0.075	75	342.00	383	41.00	5.46	95.40	4.60
50 micron	0.050	50			3.68	0.49	95.89	4.11
20 micron	0.020	20			13.63	1.82	97.71	2.29
16 micron	0.016	16			1.94	0.26	97.97	2.03
10 micron	0.010	10			3.82	0.51	98.48	1.52
5 micron	0.005	5			4.20	0.56	99.04	0.96
2 micron	0.002	2			3.61	0.48	99.52	0.48
1 micron	0.001	1			1.91	0.25	99.773	0.23



The solution of water for the 5 gram pulverized dry sieved Washoe Sand and Volcanic Cinders was initially equal to 418 and 628 NTU respectively measured with a Hach 2100Q portable turbidity meter. The particle size from the laboratory analysis is as follows.

4/6/2015 Washoe Sand Pulverized (5 grams <230 sieve)

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*	sum Rn	100-sumRn
4	4.750	4750	525.00	540	15.00	2.00	2.00	98.00
8	2.360	2360	480.00	734.5	254.50	33.91	35.91	64.09
16	1.180	1180	442.50	731.5	289.00	38.51	74.42	25.58
30	0.600	600	398.00	534	136.00	18.12	92.54	7.46
50	0.300	300	286.00	328.5	42.50	5.66	98.20	1.80
100	0.150	150	274.00	282	8.00	1.07	99.27	0.73
200	0.075	75	342.00	345	3.00	0.40	99.67	0.33
50 micron	0.050	50			0.47	0.06	99.73	0.27
20 micron	0.020	20			1.15	0.15	99.88	0.12
16 micron	0.016	16			0.13	0.02	99.90	0.10
10 micron	0.010	10			0.22	0.03	99.93	0.07
5 micron	0.005	5			0.21	0.03	99.96	0.04
2 micron	0.002	2			0.18	0.02	99.98	0.02
1 micron	0.001	1			0.09	0.01	99.993	0.01

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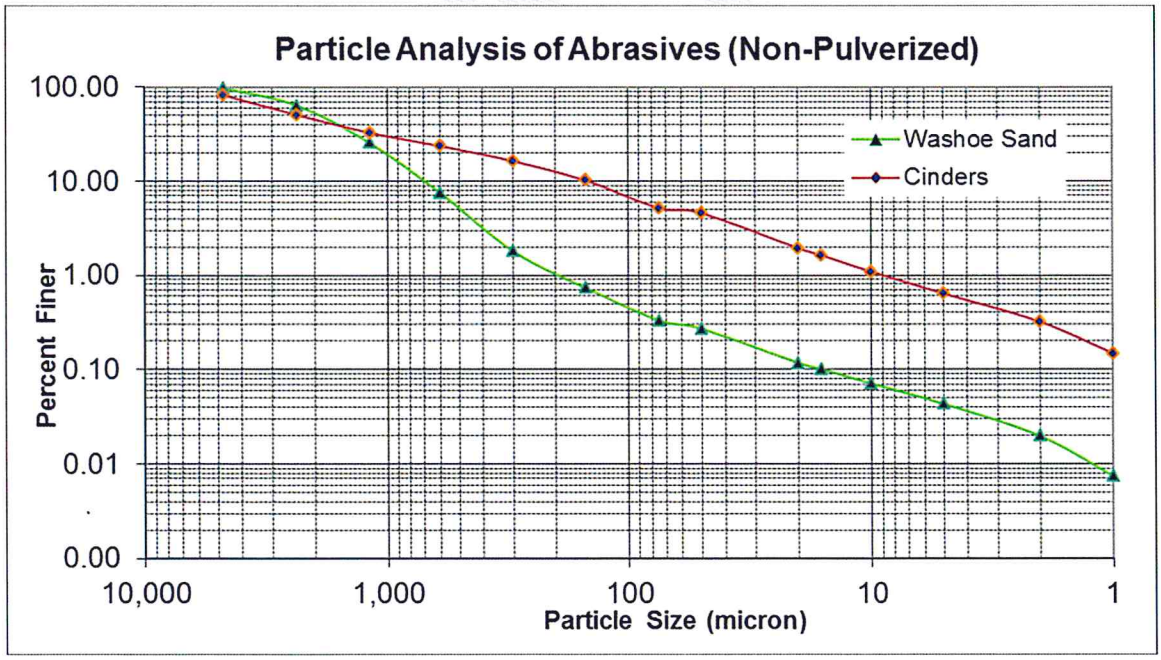
Tahoe Engineering Division

4/6/2015 Cinders Pulverized (5 grams <230 sieve)

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*	sum Rn	100-sumRı
4	4.750	4750	525.00	656.5	131.50	17.66	17.66	82.34
8	2.360	2360	480.00	715	235.00	31.56	49.23	50.77
16	1.180	1180	442.50	577	134.50	18.07	67.29	32.71
30	0.600	600	398.00	466	68.00	9.13	76.43	23.57
50	0.300	300	286.00	340	54.00	7.25	83.68	16.32
100	0.150	150	274.00	320	46.00	6.18	89.86	10.14
200	0.075	75	342.00	379	37.00	4.97	94.83	5.17
50 micron	0.050	50			4.53	0.61	95.44	4.56
20 micron	0.020	20			19.57	2.63	98.07	1.93
16 micron	0.016	16			2.32	0.31	98.38	1.62
10 micron	0.010	10			3.95	0.53	98.91	1.09
5 micron	0.005	5			3.37	0.45	99.36	0.64
2 micron	0.002	2			2.36	0.32	99.68	0.32
1 micron	0.001	1			1.28	0.17	99.85	0.15



2011 Results

The solution of water for the Volcanic Cinders and Washoe Sand dry screened through a #200 mesh (75 micron) and mixed with 1000 ml water was initially equal to 630 NTU and 580 NTU respectively, measured with a laboratory turbidity meter. The particle size from the laboratory analysis is as follows.

Non-Pulverized Sieve and PSD analysis

2/14/2013 Washoe Sand Non - Pulverized

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*10(	sum Rn	100-sumRn
4	4.750	4750	525.00	541.5	16.50	2.20	2.20	97.80
8	2.360	2360	480.00	739	259.00	34.56	36.76	63.24
16	1.180	1180	442.50	731	288.50	38.49	75.25	24.75
30	0.600	600	398.00	526.5	128.50	17.14	92.39	7.61
50	0.300	300	286.00	329	43.00	5.74	98.13	1.87
100	0.150	150	274.00	282.5	8.50	1.13	99.27	0.73
200	0.075	75	342.00	345	3.00	0.40	99.67	0.33
50 micron	0.050	50			0.62	0.08	99.75	0.25
20 micron	0.020	20			1.14	0.15	99.90	0.10
16 micron	0.016	16			0.13	0.02	99.92	0.08
10 micron	0.010	10			0.21	0.03	99.95	0.05
5 micron	0.005	5			0.18	0.02	99.97	0.03
2 micron	0.002	2			0.13	0.02	99.99	0.01
1 micron	0.001	1			0.06	0.01	100.00	0.00
<1 micron	pan				0.02	0.00	100.00	0.00
Pan			378.50	381	2.50	0.33		
				Dry Sieve Plus Pan	749.50			

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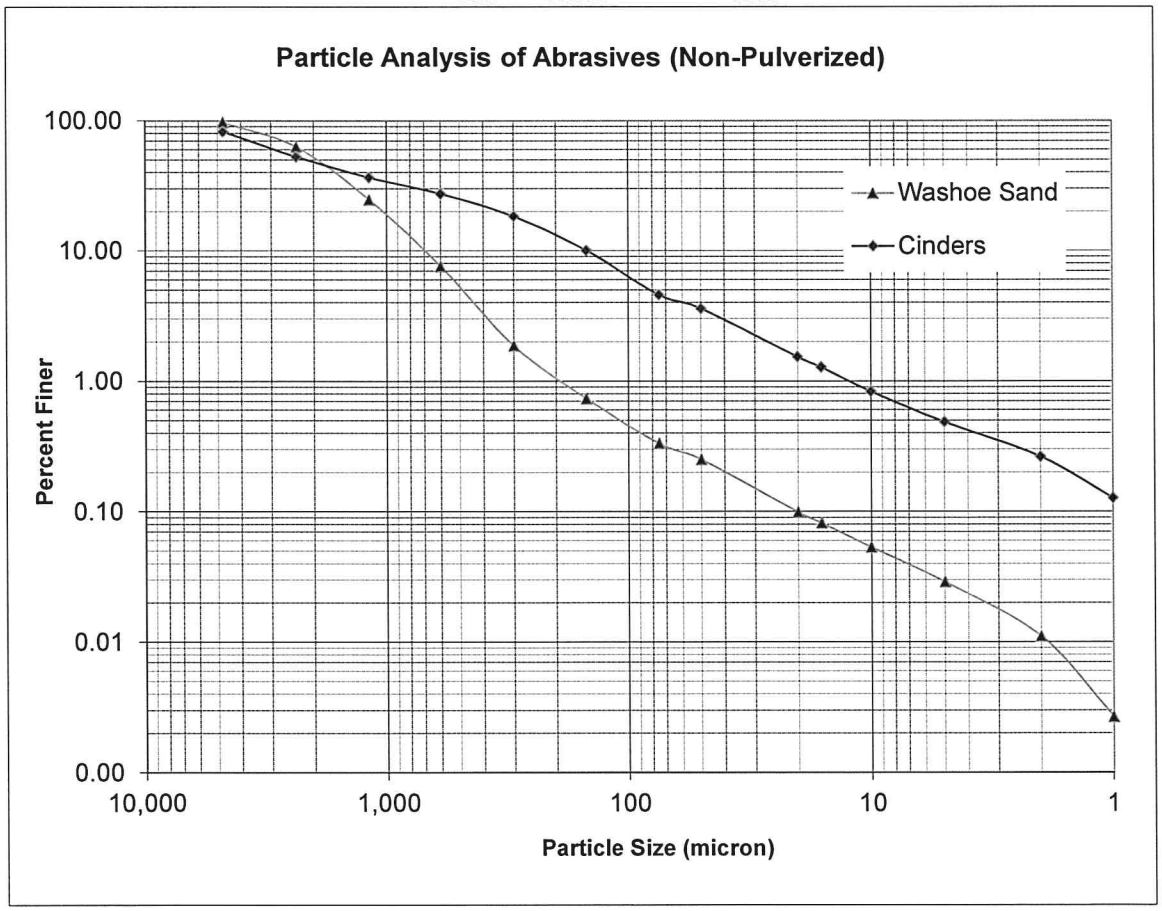
Tahoe Engineering Division

2/14/2013 Cinders Non - Pulverized

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*10	sum Rn	100-sumRn
4	4.750	4750	525.00	655	130.00	17.32	17.32	82.68
8	2.360	2360	480.00	703	223.00	29.71	47.04	52.96
16	1.180	1180	442.50	565	122.50	16.32	63.36	36.64
30	0.600	600	398.00	467	69.00	9.19	72.55	27.45
50	0.300	300	286.00	354	68.00	9.06	81.61	18.39
100	0.150	150	274.00	336.5	62.50	8.33	89.94	10.06
200	0.075	75	342.00	383	41.00	5.46	95.40	4.60
50 micron	0.050	50			7.47	0.99	96.40	3.60
20 micron	0.020	20			15.55	2.07	98.47	1.53
16 micron	0.016	16			1.90	0.25	98.72	1.28
10 micron	0.010	10			3.35	0.45	99.17	0.83
5 micron	0.005	5			2.59	0.34	99.51	0.49
2 micron	0.002	2			1.68	0.22	99.74	0.26
1 micron	0.001	1			1.02	0.14	99.87	0.13
<1 micron	pan				0.95	0.13	100.00	0.00
Pan			378.50	413	34.50	4.60		
			Dry Sieve Plus Pan		750.50			



El Dorado County Department of Transportation
Tahoe Engineering Division

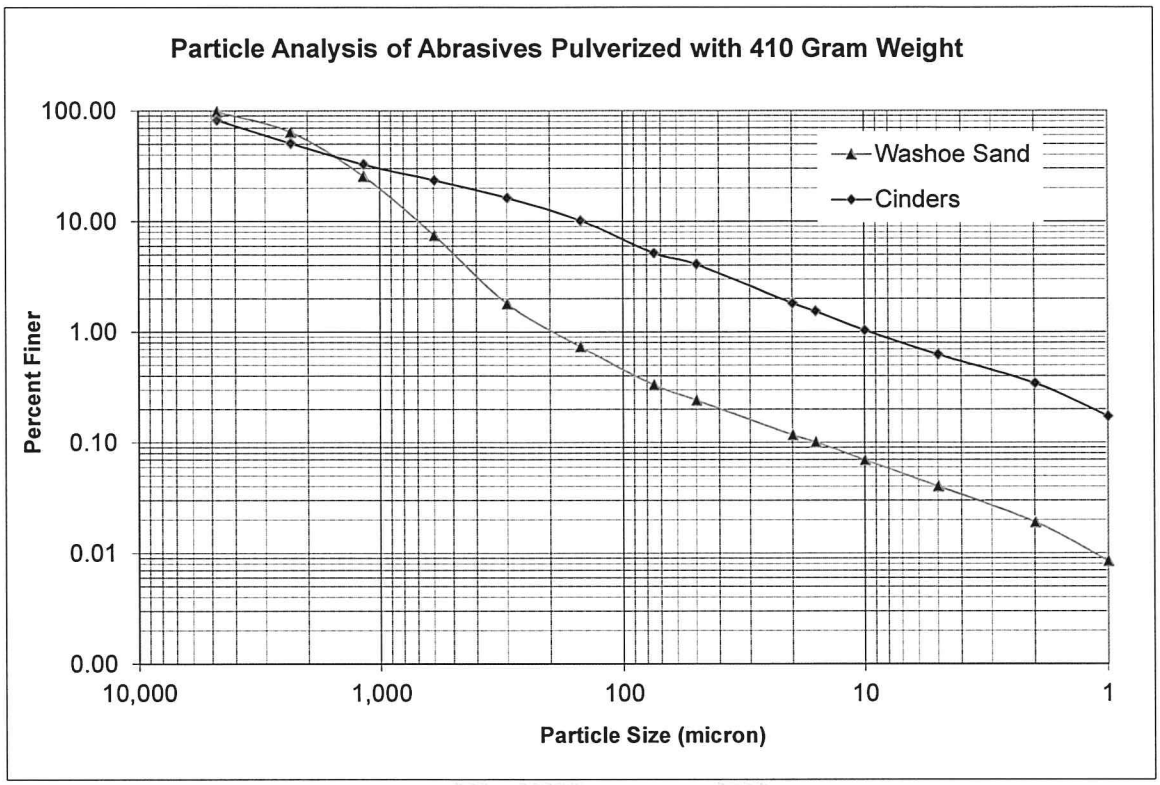
Pulverized Sieve and PSD analysis (0.4 kg weight)

2/14/2013 Washoe Sand Pulverized with 410 gram Small Weight

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*	sum Rn	100-sumRn
4	4.750	4750	525.00	540	15.00	2.00	2.00	98.00
8	2.360	2360	480.00	734.5	254.50	33.91	35.91	64.09
16	1.180	1180	442.50	731.5	289.00	38.51	74.42	25.58
30	0.600	600	398.00	534	136.00	18.12	92.54	7.46
50	0.300	300	286.00	328.5	42.50	5.66	98.20	1.80
100	0.150	150	274.00	282	8.00	1.07	99.27	0.73
200	0.075	75	342.00	345	3.00	0.40	99.67	0.33
50 micron	0.050	50			0.69	0.09	99.76	0.24
20 micron	0.020	20			0.93	0.12	99.88	0.12
16 micron	0.016	16			0.12	0.02	99.90	0.10
10 micron	0.010	10			0.24	0.03	99.93	0.07
5 micron	0.005	5			0.22	0.03	99.96	0.04
2 micron	0.002	2			0.16	0.02	99.98	0.02
1 micron	0.001	1			0.08	0.01	99.99	0.01
<1 micron	pan				0.06	0.01	100.00	0.00
Pan			378.50	381	2.50	0.33		
			Dry Sieve Plus Pan		750.50			

2/14/2013 Cinders Pulverized with 410 gram Small Weight

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*	sum Rn	100-sumRn
4	4.750	4750	525.00	656.5	131.50	17.66	17.66	82.34
8	2.360	2360	480.00	715	235.00	31.56	49.23	50.77
16	1.180	1180	442.50	577	134.50	18.07	67.29	32.71
30	0.600	600	398.00	466	68.00	9.13	76.43	23.57
50	0.300	300	286.00	340	54.00	7.25	83.68	16.32
100	0.150	150	274.00	320	46.00	6.18	89.86	10.14
200	0.075	75	342.00	379	37.00	4.97	94.83	5.17
50 micron	0.050	50			8.08	1.09	95.91	4.09
20 micron	0.020	20			16.90	2.27	98.18	1.82
16 micron	0.016	16			2.10	0.28	98.46	1.54
10 micron	0.010	10			3.73	0.50	98.96	1.04
5 micron	0.005	5			3.06	0.41	99.38	0.62
2 micron	0.002	2			2.09	0.28	99.66	0.34
1 micron	0.001	1			1.27	0.17	99.83	0.17
<1 micron	pan				1.27	0.17	100.00	0.00
Pan			378.50	417	38.50	5.17		
			Dry Sieve Plus Pan		744.50			



Pulverized Sieve and PSD analysis (4 kg weight)

2/14/2013 Washoe Sand Pulverized with 4089 gram Heavy Weight

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*	sum Rn	100-sumRn
4	4.750	4750	525.00	527	2.00	0.27	0.27	99.73
8	2.360	2360	480.00	624	144.00	19.25	19.52	80.48
16	1.180	1180	442.50	757	314.50	42.05	61.56	38.44
30	0.600	600	398.00	573	175.00	23.40	84.96	15.04
50	0.300	300	286.00	356	70.00	9.36	94.32	5.68
100	0.150	150	274.00	297	23.00	3.07	97.39	2.61
200	0.075	75	342.00	353	11.00	1.47	98.86	1.14
50 micron	0.050	50			2.19	0.29	99.16	0.84
20 micron	0.020	20			3.54	0.47	99.63	0.37
16 micron	0.016	16			0.42	0.06	99.69	0.31
10 micron	0.010	10			0.76	0.10	99.79	0.21
5 micron	0.005	5			0.66	0.09	99.88	0.12
2 micron	0.002	2			0.49	0.07	99.94	0.06
1 micron	0.001	1			0.26	0.03	99.98	0.02
<1 micron	pan				0.17	0.02	100.00	0.00
Pan			378.50	387	8.50	1.14		
			Dry Sieve Plus Pan		748.00			

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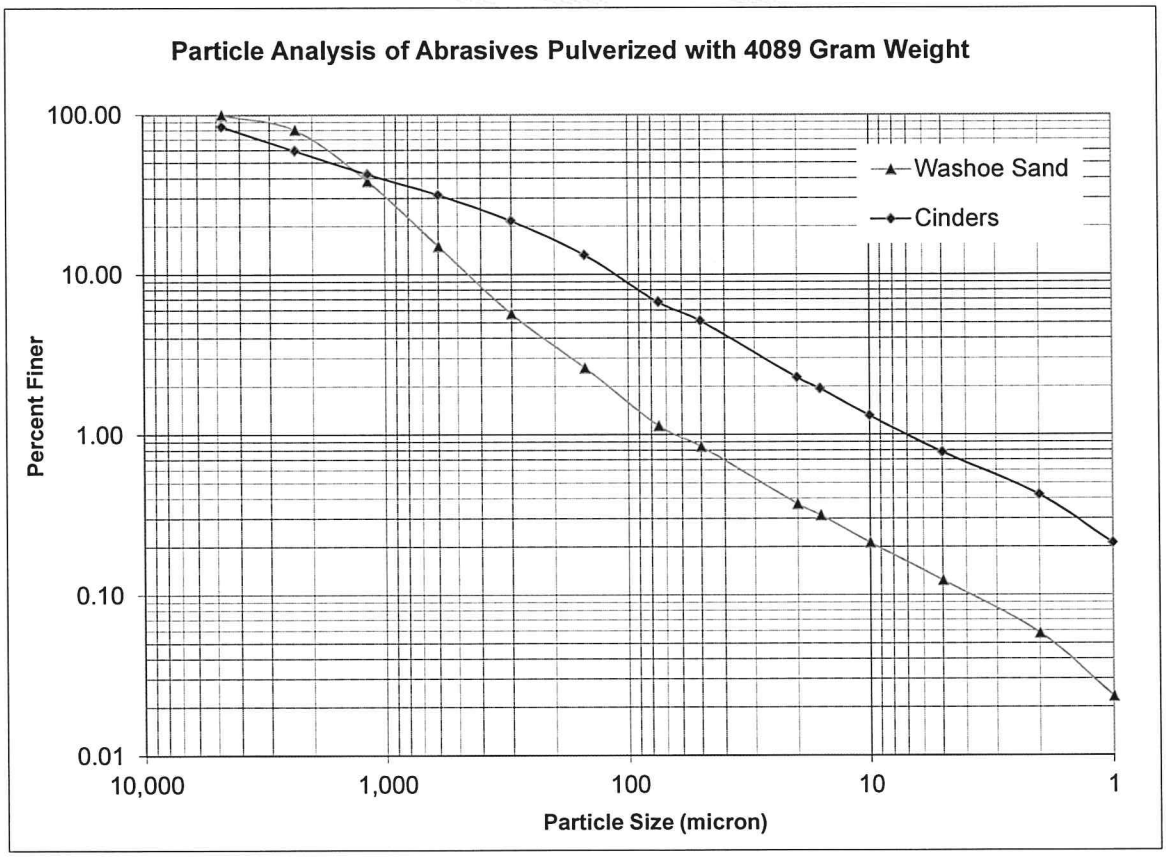
El Dorado County Department of Transportation
Tahoe Engineering Division

2/14/2013 Cinders Pulverized with 4089 gram Heavy Weight

Sieve #	Sieve Size	Sieve Size (micron)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained - Wn (g)	% on each sieve Rn	Cumulative % retained	% finer
					col4-col3	(col5/Wt)*	sum Rn	100-sumRn
4	4.750	4750	525.00	641	116.00	15.47	15.47	84.53
8	2.360	2360	480.00	667	187.00	24.93	40.40	59.60
16	1.180	1180	442.50	571	128.50	17.13	57.53	42.47
30	0.600	600	398.00	480	82.00	10.93	68.47	31.53
50	0.300	300	286.00	360	74.00	9.87	78.33	21.67
100	0.150	150	274.00	337	63.00	8.40	86.73	13.27
200	0.075	75	342.00	391	49.00	6.53	93.27	6.73
50 micron	0.050	50			12.00	1.60	94.87	5.13
20 micron	0.020	20			21.40	2.85	97.72	2.28
16 micron	0.016	16			2.55	0.34	98.06	1.94
10 micron	0.010	10			4.69	0.63	98.68	1.32
5 micron	0.005	5			4.02	0.54	99.22	0.78
2 micron	0.002	2			2.68	0.36	99.58	0.42
1 micron	0.001	1			1.59	0.21	99.79	0.21
<1 micron	pan				1.58	0.21	100.00	0.00
Pan			378.50	429	50.50	6.73		
				Dry Sieve Plus Pan	750.00			



Discussion

2013 and 2015 results Comparison

The test completed in 2013 and 2015 show very repeatable results that replicate one another fairly well. Finish

Much of the large quantities of abrasives applied to the road surface is imported material from outside the Tahoe Basin and contains physical properties different that those Tahoe has assimilated prior to anthropogenic influences. Granite is an intrusive igneous rock that has a medium to coarse grained texture. Intrusive igneous rocks are formed from magma that cools and solidifies within the crust of the planet. Surrounded by pre-existing rock, the magma cools slowly, and as a result these rocks are coarse grained. Native aggregates such as decomposed granite have been present in Tahoe since lake formation. Decomposed granite has natural filtering capabilities, contains coarse aggregates, has a higher density and it appears the lake has the capability to assimilate it. These may be reasons why Lake Tahoe has such extraordinary clarity as this material acts as a natural filter. Many applications use decomposed granite for treatment and in some areas require decomposed granite in the use of septic systems and sand filtration. The El Dorado County Department of Transportation evaluated the use of decomposed granite (Washoe Septic Sand, RT Donovan) in a sandfilter system and found the media to be highly effective at removing fine particulates from stormwater (EDOT 08-02). The media functions so well that Cal Trans contacted El Dorado County staff to review this media specification for sand filtration treatment. The end result was Cal Trans adoption of this new media specification which was based on this Washoe Septic Sand aggregate specification designed through collaboration with El Dorado County research. http://www.dot.ca.gov/hq/oppd/storm1/caltrans_20090729.html .

Volcanic cinders on the other hand are extrusive igneous rocks that are formed at the crust's surface as a result of the partial melting of rocks within the mantle and crust. Extrusive Igneous rocks cool and solidify quicker than intrusive igneous rocks. Since the rocks cool very quickly they are fine grained.

Conclusions

The data for these two abrasives is repeatable with 2 separate tests using different analysis techniques for fine particulates having repeatable and consistent results. The data is suggesting that the modification to this practice will reduce the abrasive application load by upwards of 93% for particles less than 16 microns. The data also suggests that very little ultrafine particulates are present in the Washoe Sand which contains trace amounts of less than 1 and 2 micron particulates and those responsible for 73% and 92% of Lake Tahoe's clarity loss. Being that much of the current program and assessment tools developed for the TMDL are aimed at reducing winter abrasives and accumulation via sweeping, makes this winter management tool a very cost effective source control BMP. The County believes with certainty that this is the largest contributor not fully addressed in the TMDL and will perhaps be the single most important BMP implemented in the Tahoe TMDL. The County is also not convinced that this BMP will get the credit it deserves in the tools developed by the TMDL. The Road Rapid Assessment Method does not capture this change and therefore more science and research needs to be completed in order to establish proper credit for the adjustment of this practice.

Altering abrasives application material type is a critical component of meeting the TMDL. Preliminary estimates included in the Table 2 below indicate that the total load generated by El Dorado County could be reduced by greater than 5%. Based on the analysis of this data and the distribution of material in various size classes from this material, the data indicates a reduction of a factor of 10 in fine particle aggregates <16 micron (table below) by switching from the Volcanic cinders to the Washoe Sand (DG). This equates to an approximate 90% load reduction compared to baseline conditions pre 2004 for this aggregate. The total load reduction equates to between 24,000-33,000 lbs or 120-165 credits. Based on a TMDL baseline load without connectivity of 439,000 lbs fine sediment particles (FSP), the County estimates' it is possible to achieve a 7% load reduction by just changing the aggregate specification alone. The annualized cost benefit of this modified aggregate was calculated to range from $.31-$.42 / lb-FSP / year. Even the most optimistic street sweeping annualized unit cost reductions from the Placer County TMDL strategy report suggest that sweeping may be capable of achieving approximately $4.00 / lb-FSP / year. These hypothetical sweeper numbers are based on many assumptions and may not represent actual field measurement data in Tahoe. The numbers represented below for the aggregate analysis are based on actual aggregate gradations and particle size analysis. This amount will be reduced by changing the specification of the material prior to application to the road surface with load reduction percentages increasing after connectivity is accounted for.

Table 2

	<16 micron load (lbs)		
Material Distribution based on 1000 ton of aggregate used as winter abrasive	**Non-Pulverized Aggregate**	**Pulverized Light (.4 KG Weight)**	**Pulverized Heavy (4 KG weight)**
Volcanic Cinders	25559	30731	38815
Washoe Sand (DG)	1636	2021	6281
% Reduction	94%	93%	84%
Total Load Reduction	23923	28710	32534
Credits	120	144	163
EDOT FSP Baseline Load	439000	439000	439000
% of TMDL Baseline Attainment	5%	7%	7%
EDOT FSP First Permit Term	44000	44000	44000
% of TMDL First Permit Term	54%	65%	74%
Increased Cost of New Abrasive (1,000 ton annual usage)	$ 10,000	$ 10,000	$ 10,000
Cost / benefit ($/lb-FSP/year)	$ 0.42	$ 0.35	$ 0.31

The fine particles associated with the Washoe Sand (DG) are a denser particle; settle out quicker and breakdown less into fine fractions. The density and hardness of the material indicate it will last longer on the road, breakdown less and be easier to sweep up once conditions permit. Cal Trans conducted a study on many different aggregates for possible road abrasives and determined Washoe Sand (DG) to be ranked #2 out of the 22 materials tested for ultrafine particles (Cal Trans 2010). El Dorado County used 20 yards of Washoe Sand in a subsurface Delaware sandfilter and achieved 83-93% load reduction of all particle classes and a 90% reduction of <20 micron particles (EDOT 08-02). The media functions so well that Cal Trans contacted El Dorado County staff to review this media specification for sand filtration treatment. The end result was Cal Trans adoption of this new media specification which was based on this Washoe Septic Sand aggregate specification designed through collaboration with El Dorado County research. http://www.dot.ca.gov/hq/oppd/storm1/caltrans_20090729.html .

Source control practices control the source and prevent material from mobilizing in the first place. Sediment control is attempting to recover the material after it has already been displaced. Controlling the aggregate is a "true" source control and sweeping a sediment control. The source of the material should be the primary target in order to achieve load reductions and focusing less on attempting to recover fine particle materials once they have been introduced and/or mobilized. All agencies attempt to recover the material after it has already been put on the road. This sweeping practice is done by every jurisdiction around the lake.

In future research, the County will be attempting to understand how these abrasive changes translate to changes in RAM scores and what that means from an EMC perspective. Previous studies to improve the RAM score via sweeping have been unsuccessful with limited data to suggest a benefit exists (EDOT 10-03, 10-04, 10-05). Benefits may be potentially attained by regulating sweeper type, speed and # passes, however most studies have not been able to measure a benefit. It is known that road integrity is a critical component to sweeper effectiveness and washoff water quality. It is more effective to sweep a good condition road then it is to sweep and bad condition road. Many roads in El Dorado County have bad integrity and many are spalling and/or aligatored. These roads may be impossible to sweep effectively, hence the need for alternative strategies to achieving a load reduction.

Based on this data, including other research conducted by El Dorado County, EDOT staffs have measured and calculated the benefits from the altercation of this abrasive practice to be far beyond any benefits we may see from sweeping on a cost benefit scale.

DRAFT

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County of El Dorado

Sediment Reduction Project

Grant 13-DG-11051900-013

Progress Report

July 2015

The County of El Dorado (County) was successful in acquiring SNPLMA grant 13-DG-11051900-013 to purchase a sweeper as part of a sediment load reduction project. In fall 2013 the County was successful in procuring a Tymco 500X regenerative air sweeper to meet the needs of this project. Since acquisition, the County has been active in sweeping all high priority roads to ensure sediment reduction in coordination with the Lake Tahoe Total Maximum Daily Load (TMDL) and the associated Lake Clarity effort. Samples taken out of the sweeper hopper have been collected with results reported below. For the purpose of this report and to meet the requirements of this grant, the County will summarize the findings to date on the total mass, total sediment and Fine Sediment Particle (FSP) of material recovered including time and man hours spent to maximize pollutant recovery toward meeting TMDL objectives. Aggregate gradation and Particle Size Distribution (PSD) has also been completed on collected samples and is summarized below.

Goals and objectives

The goal of the Project is to improve the clarity of Lake Tahoe by reducing the detrimental water quality impacts from roadways on Lake Tahoe clarity. The objective of the Project is to reduce the transport of fine sediment from the County ROW area by purchasing and operating a regenerative air sweeper.

Background

Advanced methods are needed to meet the Lake Tahoe TMDL, which is expected to have a direct impact on the clarity of Lake Tahoe. Fine sediment particles < 16 microns in diameter transported by stormwater runoff have been identified as a major factor in the loss of clarity in Lake Tahoe. Much of the fine sediment particles are generated from roadways in urban areas. Recent TMDL cost-effectiveness analysis completed for Placer County (2nd Nature, NHC 2010) through a grant from the US Army Corps of Engineers indicates that increased street sweeping is highly cost-effective for removing fine sediment. The Pollutant Load Reduction Model (PLRM) initial estimates of pollutant

loading have indicated that modifications to existing programs including winter abrasives applications and sediment recovery from roads via enhanced sweeping may constitute a large portion of potential credits for implementation of the TMDL.

High-efficiency street sweepers are included in the Environmental Improvement Program (EIP) Update under the air quality improvement action priority, although it is recognized that they have multiple threshold benefits. EIP number 10174 is for the Purchase and Use of High-Efficiency Street Sweepers. EIP number 10109 is for BMP Effectiveness, and EIP number 10111 is for Loading Rates for Stormwater Runoff. The purchase and use of high efficiency sweepers will result in a reduction of fine sediment particles and nutrient loading from urban roadways and will reduce the amount of fine sediment particles that can become airborne. This will result in direct benefits and contribution to the EIP goals of reducing the pollutants that impact water quality and air quality. Additionally the reduction in fine sediment from the roadways will result in reduced BMP maintenance needs over time due to less pollutant generation. The Lahontan Regional Water Quality Control Board has acknowledged that a benefit does indeed exist to stormwater quality from sweeping and therefore is currently requiring the use of specific hydrologic models and methodology's aimed at understanding pollutant load concentrations and achievable reductions that can be gained through this practice.

To address the current water quality and air quality thresholds and pending Lake Tahoe TMDL load reductions for fine sediment particles, phosphorus and nitrogen, the Tahoe Basin stakeholders needed to explore alternative products and methods to reduce, minimize, and/or eliminate the use of traction abrasives and enhance recovery effectiveness in the Tahoe Basin. The majority of governmental grant programs are focused on site improvements and implementation (design and construction), and there is a need to fund the capital expense of equipment targeted at air and water quality improvement. With the recent Lake Tahoe TMDL adoption, there is urgency in funding equipment to reduce the fine sediment and nutrients generated from urban roadways. Without this grant, budget limitations and shortfalls would have continued to prevent the County from using the best available technology for road abrasive recovery.

Method

Two winter samples were taken on Pioneer Trail and Silver Tip near Tahoma. Two separate roads with different vehicle usage and characteristics were used for this analysis to understand recovery and particle size analysis. Pioneer Trail is a primary road and Silver Tip is a high use secondary arterial road. Both roads have fairly high abrasive applications during winter conditions. Representative samples were taken from the hopper of the sweeper using the County developed Stockpile sampling method (California Test 125). The samples were analyzed for Aggregate gradation using the County Soils Laboratory (California Test 201).

Gradation – Gradation for each aggregate utilized a 500 gram dried sample. Dried samples were placed in a shaker for 15 minutes and then sieves re-weighed.

According to the Environmental Protection Agencies (EPA) Stormwater BMP Design Supplement for Cold Climates, one way to reduce the water quality impacts of sand application is to use material free of fine materials (Caraco, 1997). The National Cooperative Highway Research Program (NCHRP) suggests that it is possible to use dilution testing in combination with water quality standards for suspended fine sediment or turbidity in order to evaluate the suitability of a particular road abrasive (NCHRP, 2007). A 5 gram dried sample of <200 sieve (75 micron) was separately mixed with 2 liters of tap water and the turbidity of the raw solution measured initially, then sent to the laboratory. Analytical tests performed included Turbidity, Total Suspended Solids (TSS) and Particle Size Distribution (PSD). PSD analysis included 63, 20, 16, 10, 5, 4, 2, 1 and <1 micron (um) Bin sizes.

To understand how the PSD of each sample related to the total mass of material <200 sieve, the percentages of each PSD Bin Size were multiplied by the weight of material in the pan (<200 sieve) following sieve analysis. This then allowed the calculation of mass of particle sizes in all Bin sizes. The water quality results of this analysis are described in more detail below.

Data and Findings

The County began using the new Tymco 500X sweeper in October 2013. For the purpose of this report, between October 2014 and March 2015, the County recovered over 500 ton of material with a total operational cost of $100,144. The sweeper collected 1,691 lbs / hour of operation and 420 lbs of material / mile swept. The recovery, personnel and operational data associated with the sweeper are included in Tables 1 - 4 below.

Table 1

Date	$ / lb	lbs / hour	Total Material (tons)	Total Man Hours (Sweeper & Dump Truck)	Total Man Hours (Sweeper)	Total Man Hours (Dump Truck)
Oct-14	$ 0.07	2452	83	84	68	16
Nov-14	$ 0.08	2201	101	95	92	3
Dec-14	$ 0.16	1216	83	221	136	85
Jan-15	$ 0.07	1864	119	184	128	56
Feb-15	$ 0.11	1221	82	191	135	56
Mar-15	$ 0.12	1193	43	105	72	33
	$ / lb	lbs / hour	Total Material (tons)			
Average Semi-Annual	$ 0.10	1,691				
Total Semi-Annual			511	879	630	249

Table 2

Date	Operator Cost (Sweeper & Dump)	Operator Cost (Sweeper)	Operator Cost (Dump)	Sweeper and Dump Truck Cost	Sweeper Cost	Dump Truck Cost	Refuse Fees	Total Monthly Sweeper cost
Oct-14	$ 4,717.76	$ 3,831.68	$ 886.08	$ 6,570.00	$ 4,165.00	$ 2,405.00	$ 1,088.50	$ 12,376.26
Nov-14	$ 5,213.96	$ 5,128.07	$ 85.89	$ 9,443.13	$ 5,604.38	$ 3,838.75	$ 1,314.25	$ 15,971.34
Dec-14	$ 12,405.79	$ 7,966.02	$ 4,439.77	$ 12,759.00	$ 8,330.00	$ 4,429.00	$ 953.75	$ 26,118.54
Jan-15	$ 7,754.40	$ 6,596.32	$ 1,158.08	$ 7,020.00	$ 4,364.00	$ 2,656.00	$ 1,476.00	$ 16,250.40
Feb-15	$ 8,296.92	$ 6,890.44	$ 1,406.48	$ 9,347.00	$ 6,590.50	$ 2,756.50	$ 1,152.00	$ 18,795.92
Mar-15	$ 4,711.42	$ 3,714.48	$ 996.94	$ 5,336.00	$ 3,528.00	$ 1,808.00	$ 584.25	$ 10,631.67
Total Semi-Annual	$ 43,100.25	$ 34,127.01	$ 8,973.24	$ 50,475.13	$ 32,581.88	$ 17,893.25	$ 6,568.75	$100,144.13

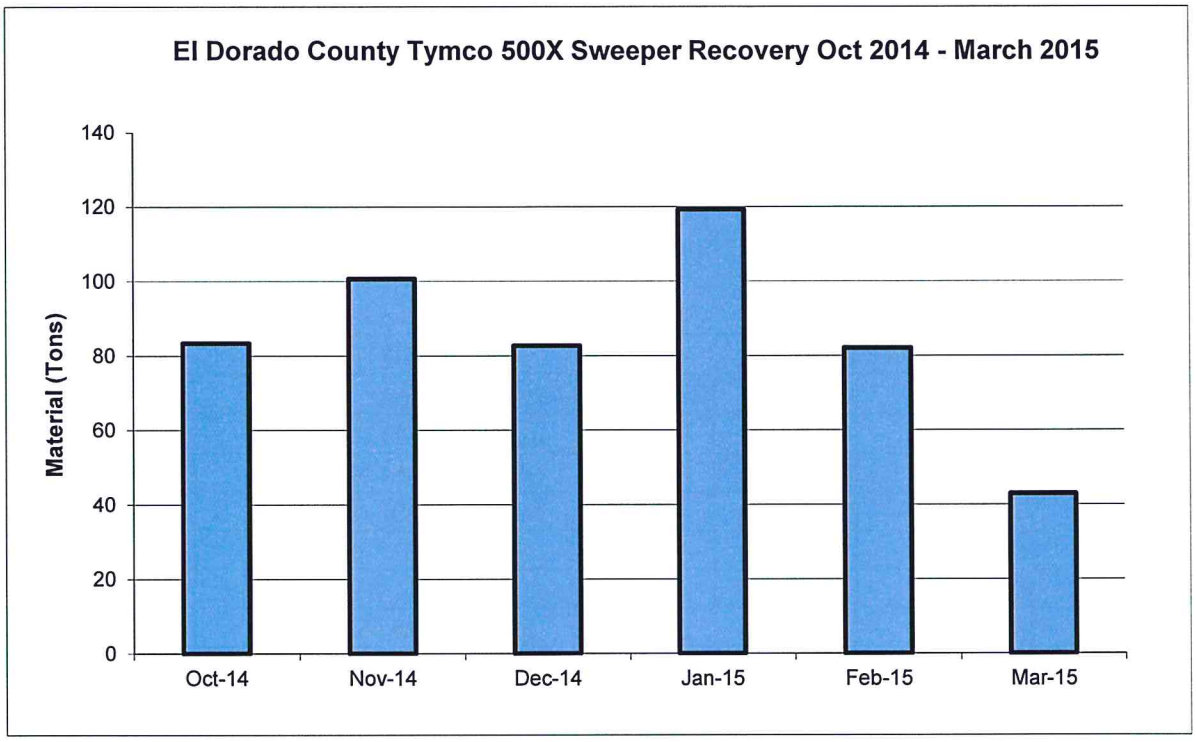
Table 3

Sweeper Recovery							
	Oct-14	**Nov-14**	**Dec-14**	**Jan-15**	**Feb-15**	**Mar-15**	**Total**
Total Miles	242	420	746	476	467	309	2660
Total Material (yds)	65	79	65	93	64	34	399
Total lbs	166725	201353	165443	238545	164160	85928	1022153
lbs/mile	689	479	222	501	352	278	
lbs / hour	2452	2201	1216	1864	1221	1193	
Total Cost	$ 12,376	$ 15,971	$ 26,119	$ 16,250	$ 18,796	$ 10,632	$ 100,144
$/lb	$ 0.07	$ 0.08	$ 0.16	$ 0.07	$ 0.11	$ 0.12	
lb/$	13.47	12.61	6.33	14.68	8.73	8.08	

Table 4

Average Monthly Sweeper Recovery	Tymco 500X
Oct 2014 - Mar 2015	
Average Monthly Miles	443
Average Material (yds)	66
Average lbs	170,359
lbs/mile	420
lbs / hour	1,691
Average Monthly Cost	16,691
$/lb	0.10
lb/$	11

Detail 1



Aggregate gradation and Particle Size Analysis

April 2015 Results

To understand the benefits attained through mechanical vs. regenerative air sweeping the County took a sample from each sweeper and sent off for lab analysis. A sample was collected from the spoils of a Tymco 500X in Tahoma another from an Elgin Eagle off Pioneer Trail in South Lake Tahoe.

The Pioneer site aggregate gradation and fine sediment particle analysis can be seen in table 5. The Tahoma site aggregate gradation and fine sediment particle data are in table 6. Detail 2 contains a graph of the gradation of both samples. Applying the gradation analysis from this analysis to the total load collected from October 2014 to March 2015 yields in the following:

For the six month period the total amount recovered by the sweeper was 511 ton. The average total mass of both samples for <16 micron was calculated to be 12 ton. The total TMDL credit was calculated at 120. The percent < 16 micron was calculated to be 2.3% and 1.2% of the total mass respectively for both sites.

Table 5

4-13-15 Elgin Eagle - Pioneer Trail					*511*	
sieve	mm	micron	%passing	%passing	tons	lbs
4	4.75	4750	1.000	100.0%	511.00	1,022,000
8	2.36	2360	0.900	90.0%	459.90	919,800
16	1.18	1180	0.590	59.0%	301.49	602,980
30	0.6	600	0.250	25.0%	127.75	255,500
50	0.3	300	0.100	10.0%	51.10	102,200
100	0.15	150	0.050	5.0%	25.55	51,100
200	0.075	75	0.030	3.0%	15.33	30,660
63 micron	0.050	50	0.025	2.5%	12.73	25,468
20 micron	0.020	20	0.014	1.4%	6.99	13,988
16 micron	0.016	16	0.012	1.2%	6.17	12,342
10 micron	0.010	10	0.009	0.9%	4.65	9,294
5 micron	0.005	5	0.005	0.5%	2.79	5,584
4 micron	0.004	4	0.004	0.4%	2.30	4,591
2 micron	0.002	2	0.002	0.2%	1.17	2,340
1 micron	0.001	1	0.001	0.1%	0.50	994

	% finer		**% < 200**	
<100 micron	96.5%	96.5	0.030	100
<63 micron	83.1%	83.1	0.025	50
<20 micron	45.6%	45.6	0.014	20
<16 micron	40.3%	40.3	0.012	16
<10 micron	30.3%	30.3	0.009	10
<5 micron	18.2%	18.2	0.005	5
<4 micron	15.0%	15.0	0.004	6
<2 micron	7.6%	7.6	0.002	2
<1 micron	3.2%	3.2	0.001	1

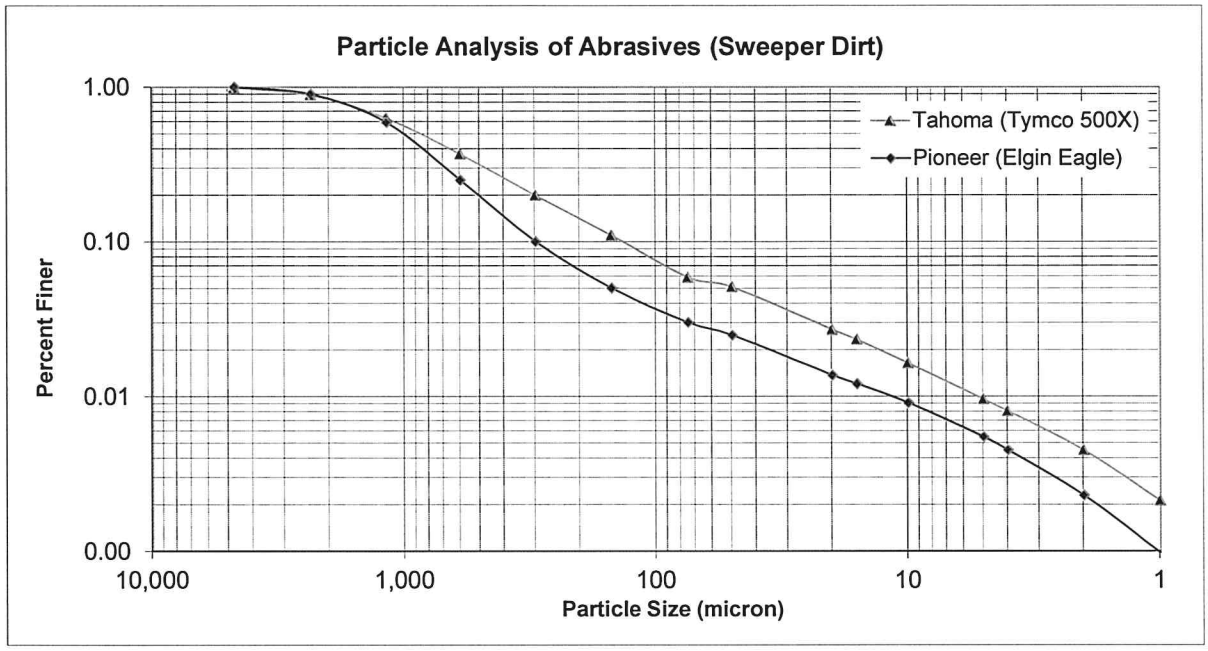
Table 6

4-13-15 Tymco 500X - Tahoma						
sieve	mm	micron	%passing		tons	lbs
4	4.75	4750	0.990	99%	505.89	1,011,780
8	2.36	2360	0.890	89%	454.79	909,580
16	1.18	1180	0.630	63%	321.93	643,860
30	0.6	600	0.370	37%	189.07	378,140
50	0.3	300	0.200	20%	102.20	204,400
100	0.15	150	0.110	11%	56.21	112,420
200	0.075	75	0.059	5.9%	30.15	60,298
63 micron	0.050	50	0.051	5.1%	26.11	52,220
20 micron	0.020	20	0.027	2.7%	13.83	27,660
16 micron	0.016	16	0.023	2.3%	11.95	23,905
10 micron	0.010	10	0.016	1.6%	8.43	16,853
5 micron	0.005	5	0.010	1.0%	4.92	9,840
4 micron	0.004	4	0.008	0.8%	4.12	8,240
2 micron	0.002	2	0.005	0.5%	2.31	4,613
1 micron	0.001	1	0.002	0.2%	1.09	2,179

	% finer		% < 200	
<100 micron	97.9%	97.9	0.059	100
<63 micron	86.6%	86.6	0.051	50
<20 micron	45.9%	45.9	0.027	20
<16 micron	39.6%	39.6	0.023	16
<10 micron	27.9%	27.9	0.016	10
<5 micron	16.3%	16.3	0.010	5
<4 micron	13.7%	13.7	0.008	4
<2 micron	7.7%	7.7	0.005	2
<1 micron	3.6%	3.6	0.002	1

avg <16 um sweeper recovery (lbs)	**23,905**
Credits	**120**
1 Credit = 200 lbs FSP	
Total Cost	**$ 100,144**
$ / Lb - FSP	**$ 4.19**
$ / Lb - Sediment	**$ 0.10**

Detail 2



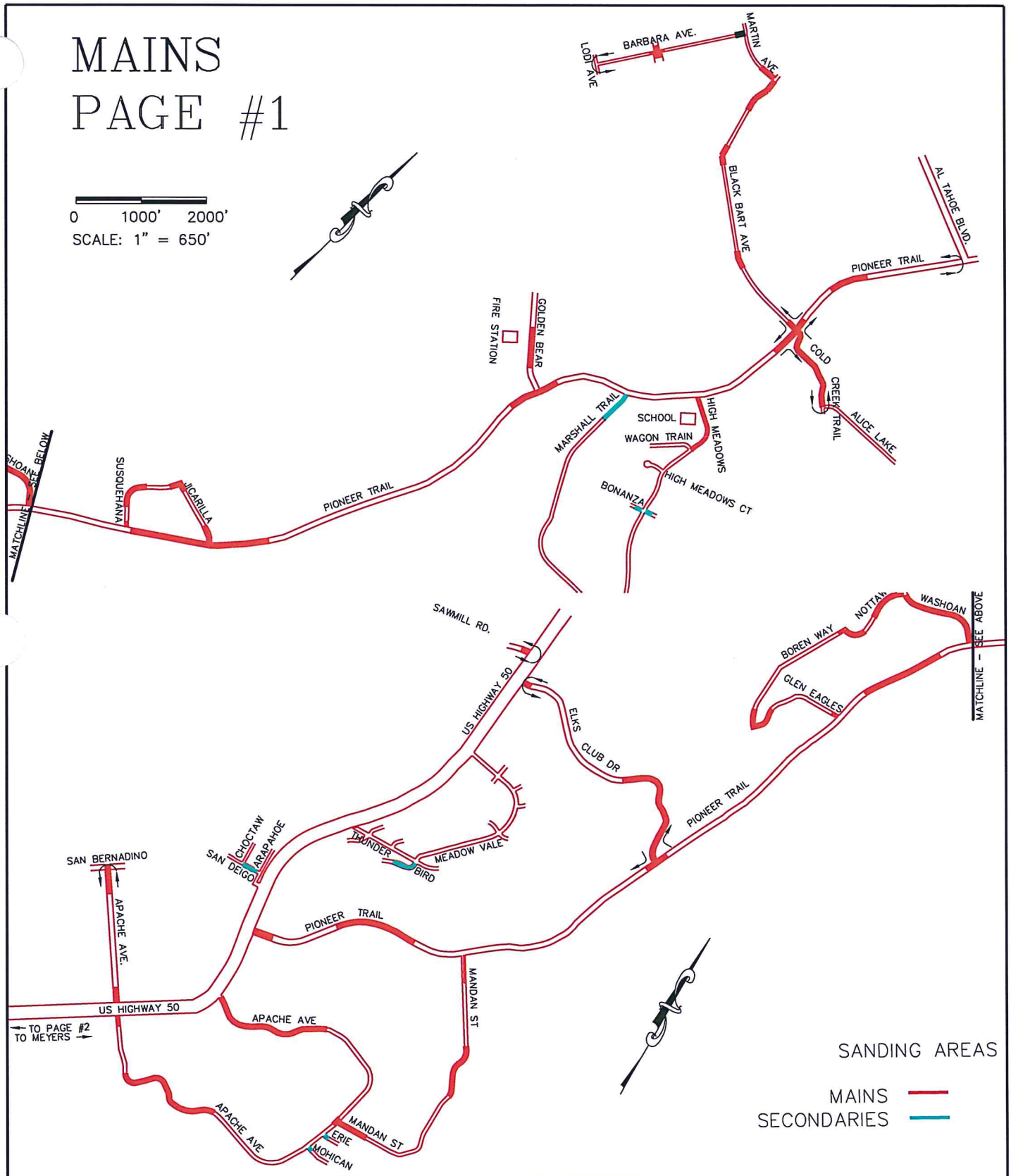
Discussion

As expected the <16um fine sediment particle mass of the regenerative air sweeper was nearly twice as great as that of the mechanical sweeper. This validates many other existing studies and literature on the topic. The mechanical sweeper picks up more of the coarse particles in the 30-50 sieve range than that of the regenerative air. The data did however show that the overall percentages of the Fine Sediment Particles in the <200 sieve fraction were almost identical between the two sweepers. This is interesting and requires further analysis to understand, however does support the use of high efficiency sweepers for meeting the Tahoe TMDL. The mechanical sweeper though nearly half the amount of FSP still recovered a reasonable amount of ultra-fine particles. Each sweeper has its own application and use. The County believes that having several tools in the toolbox will expand options for meeting TMDL targets and winter operations / public safety goals in general.

The County of El Dorado has monitored and estimated the total mass of sediment and fine sediment particles (FSP) captured by the sweeper as required with this grant. Results are indicating that the sweeper did indeed recover and prevent a significant amount of FSP from being available for washoff into stormwater. Continued analysis will be performed to calculate the average annual load reductions from this mobile BMP and the benefits that may be attained by using this advanced source control method.

Appendix E

MAINS PAGE #1

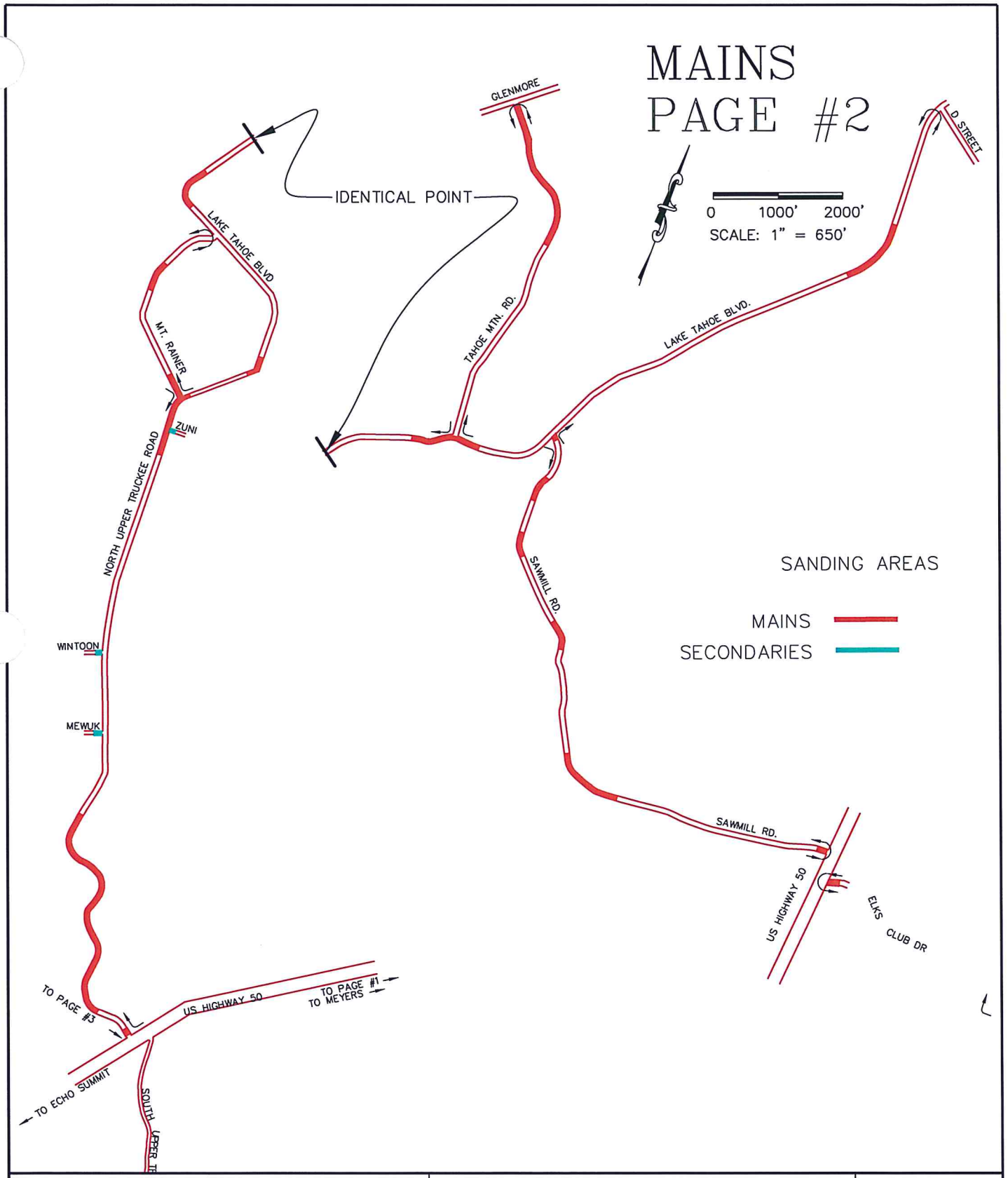


EL DORADO COUNTY
TAHOE ENGINEERING DIVISION

TAHOE BASIN SNOW REMOVAL
SANDING SITES

FIGURE
S-1

DATE: 3/15	PROJECT NO.: 49101	BY: RW



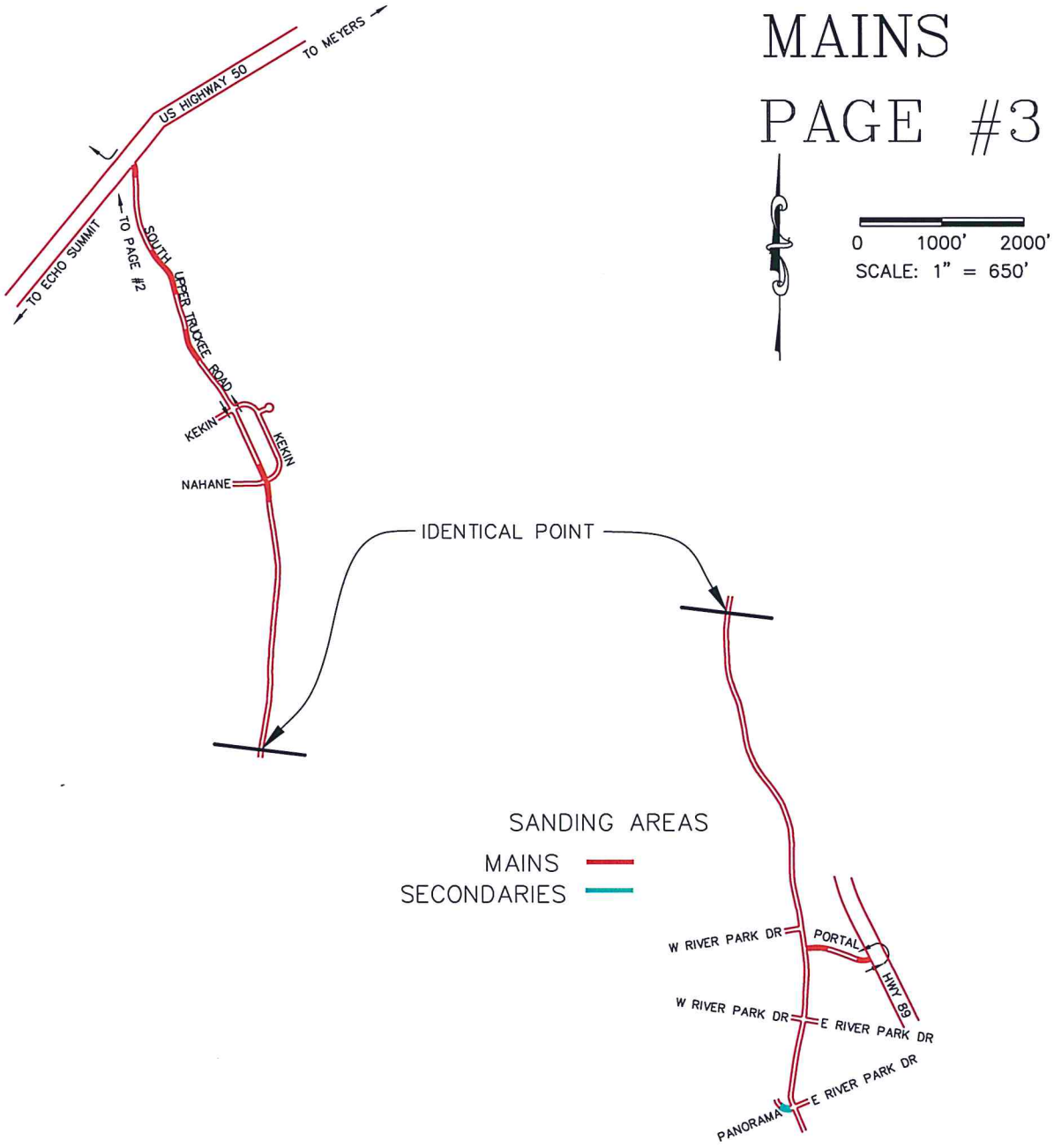
EL DORADO COUNTY
TAHOE ENGINEERING DIVISION

TAHOE BASIN SNOW REMOVAL
SANDING SITES

FIGURE
S-2

DATE: 3/15	PROJECT NO.: 49101	BY: RW

MAINS PAGE #3



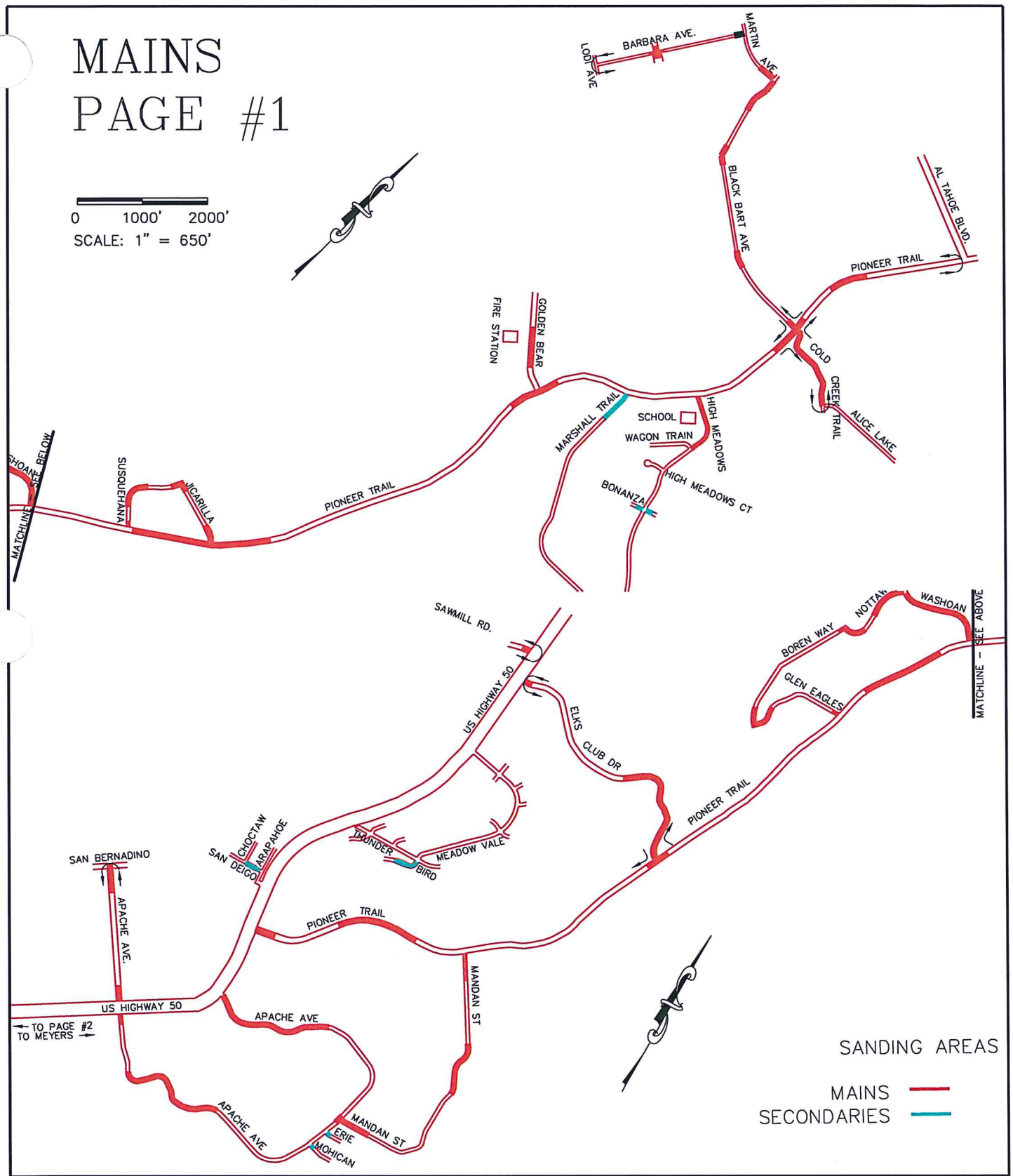
EL DORADO COUNTY
TAHOE ENGINEERING DIVISION

TAHOE BASIN SNOW REMOVAL
SANDING SITES

FIGURE
S-3

DATE: 3/15	PROJECT NO.: 49101	BY: RW

MAINS PAGE #1

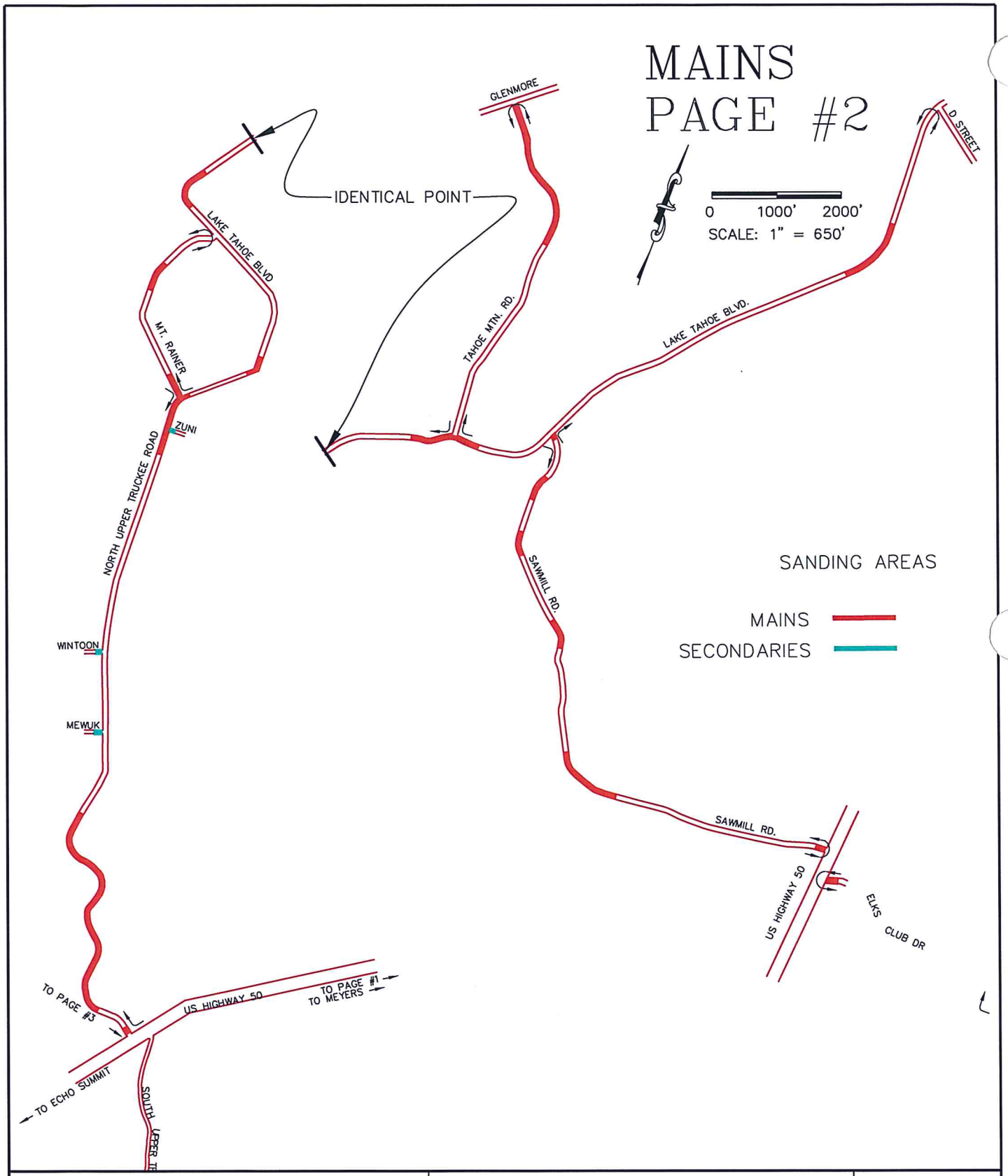


EL DORADO COUNTY
TAHOE ENGINEERING DIVISION

TAHOE BASIN SNOW REMOVAL
SANDING SITES

FIGURE
S-1

DATE: 3/15	PROJECT NO.: 49101	BY: RW



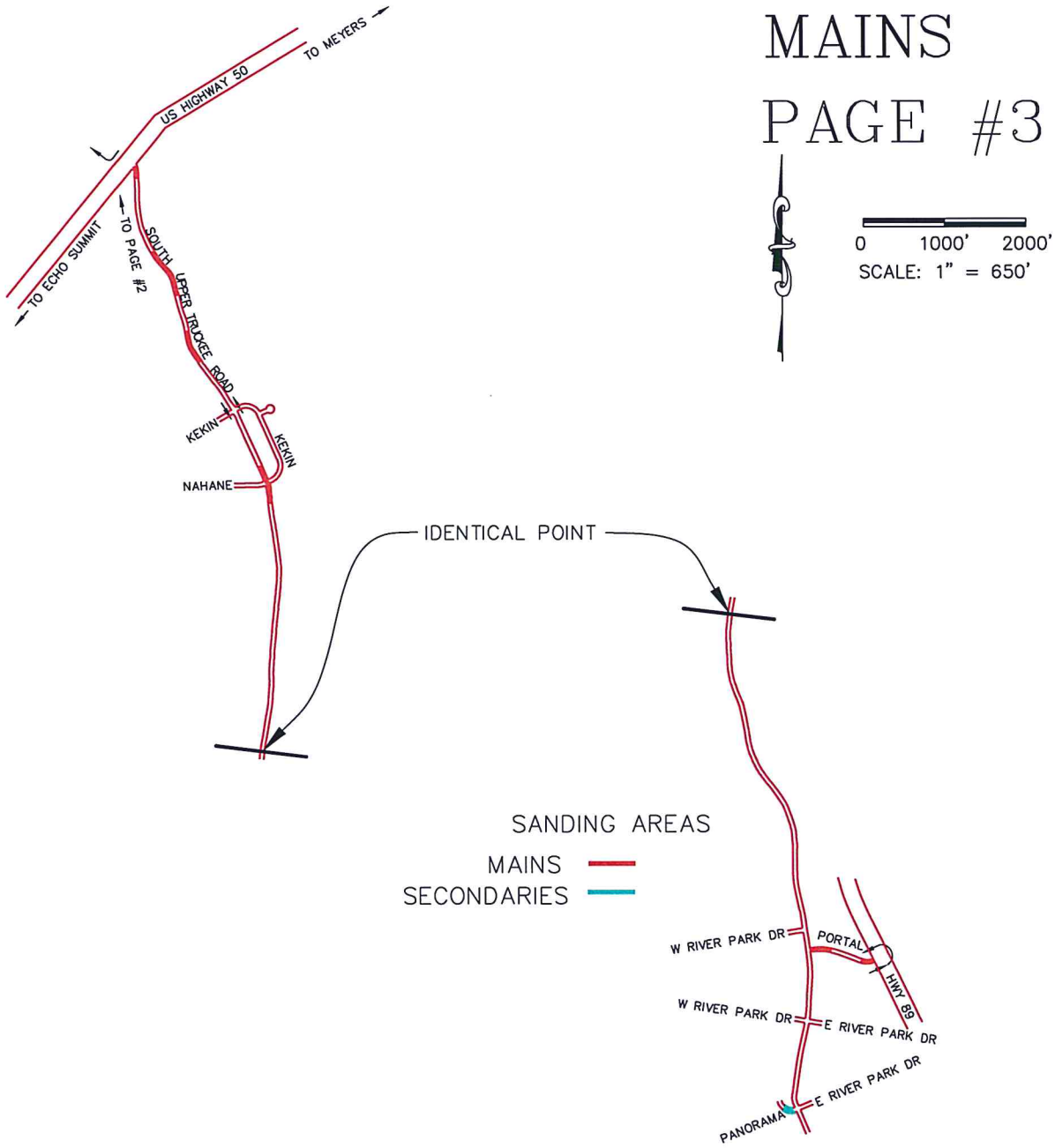
EL DORADO COUNTY
TAHOE ENGINEERING DIVISION

TAHOE BASIN SNOW REMOVAL
SANDING SITES

FIGURE
S-2

DATE: 3/15	PROJECT NO.: 49101	BY: RW

MAINS PAGE #3



EL DORADO COUNTY
TAHOE ENGINEERING DIVISION

TAHOE BASIN SNOW REMOVAL
SANDING SITES

FIGURE
S-3

DATE: 3/15	PROJECT NO.: 49101	BY: RW

Tahoe 24-04

Date	Time	Amount (tons)	Operator	Location	# of Pioneer Passes
10/10/2014	0600-1010	2	TC	Pioneer, Elks Club, Mandan, Apache	1
11/20/2014	0630-0830	2	CM	Pioneer, Black Bart, Barbara, Elks Club, Mandan, Apache, Lower Apache	1
11/20/2014	0830-1130	2	BH	Pioneer E&W, Black Bart N&S, Cold Creek turns, Susquehana loop,	1
				Washoan loop, Elks Club, Mandan	
11/21/2014	0730-1130	4	DW	Pioneer, Black Bart, Cold Creek, Susquehana, Washoan loop, Mandan,	1
				Apache	
11/22/2014	1830-2140	4	MH	Pioneer, Black Bart, Cold Creek, Martin, Barbara, High Meadow,	1
				Susquehana, Mandan, Apache, NUT, LTB	
12/1/2014	0600-1200	1	MH	Pioneer, Black Bart, Barbara, Cold Creek, High Meadow, Marshall,	1
				Golden Bear, Washoan, Susquehana, Jicarilla, Elks Club, Mandan,	
				Apache, Glen Eagles	
12/2/2014	0400-0600	3	TC	Pioneer, Black Bart, Apache, Mandan	1
12/4/2014	1230	4	AP	NUT, LTB, Sawmill, Tahoe Mtn, Mt. Rainier, Zuni, Mewuk, SUT, Elks Club	
				from 50 to Pioneer, Pioneer from Elks to 50	
12/13/2014	730	2	DW	Pioneer, Black Bart, Mandan, Apache	2
12/15/2014	2200-0030	7	AP	NUT, LTB, Sawmill, Tahoe Mtn, Mt. Rainier, Zuni, Wintoon, Mewuk, SUT	
12/16/2014	730	8	CM	Pioneer, Black Bart, Cold Creek, Susquehana, Jicarilla, Washoan,	
				Nottaway, Boren, Glen Eagles, Elks Club, Barbara, Apache, Mandan,	
				Marshall, High Meadow	
12/17/2014	600	2	DW	Pioneer, Black Bart, Cold Creek, Susquehana, Washoan, Elks Club,	2
				Apache, Mandan	
12/23/2014	830	0.5	TC	S turns NUT, 4-lane LTB, Mt. Rainier at NUT, Mandan, Elks Club	
12/24/2014	0700-0900	0.5	JF	S turns NUT, 4 lane LTB, Sawmill, SUT	
12/25/2014	0600-1230	8	DW	NUT, LTB, Sawmill, Tahoe Mtn, SUT, Mt. Rainier	
12/26/2014	0600-0900	8	DW	Pioneer, Black Bart, Washoan, Susquehana, Jicarilla, Mandan, Apache	
12/28/2014	0600-0730	1	TC	Washoan, Nottaway, Glen Eagles, Susquehana, Jicarilla, Cold Creek,	
				Marshall, Golden Bear	
12/29/2014	0730-1430	6	DW	Mewuk, Zuni, Wintoon, Meadowvale, Mohican, Chippewa, Golden Bear,	
				Bonanza	
2/8/2015	0830-1030	1	TC	Pioneer, Black Bart, Barbara, Cold Creek, Susquehana, Jicarilla, Elks	
				Club, Glen Eagles, Mandan, Apache	

Tahoe 24-05

Date	Time	Amount (tons)	Operator	Location	# of Passes on Pioneer
11/20/2014	0700-1600	4	DW	NUT, SUT, Sawmill, LTB, Tahoe Mtn., Mt. Rainer, Pioneer	2
11/20/2014	2030-2330	4	AM	NUT, SUT, Sawmill, LTB, Tahoe Mtn., Mt. Rainer	
11/21/2014	0700-0930	2	MC/AM	NUT, SUT, Sawmill, LTB, Tahoe Mtn., Mt. Rainer	
11/22/2014	1830-2100	4	JZ	NUT, SUT, LTB< Sawmill, Mt. Rainier, Tahoe Mtn, Portal,	
				Elks Club	
11/30/2014	0130-0330	5	AC	NUT, SUT, LTB, Sawmill, Tahoe Mtn, Portal, Elks Club	
12/1/2014	2030-2230	2	TR	NUT, Sawmill, LTB, Tahoe Mtn, SUT, Portal	
12/2/2014		8	GK	NUT, Sawmill, LTB, Tahoe Mtn, SUT, Mandan, Portal	
12/4/2014	2400	4	CM	Pioneer, Apache, Elks club, Glen Eagles, Black Bart, Cold Creek	1
12/16/2014	0600-1300	3	DW	NUT, Sawmill, Tahoe Mtn, SUT, Mt. Rainier	
12/17/2014	0600-1000	5	GK	NUT, SUT, Portal, LTB, Tahoe Mtn, Sawmill, Mt. Rainier, Grizzly,	
				Mewuk, Wintoon, Zuni	
12/19/2014	1600-0030	4	CM	NUT, LTB, Sawmill, Tahoe Mtn, Mt. Rainier	
12/24/2014	0700-0900	1	TR	Pioneer, Mandan, Apache, Black Bart, Elks Club	1
12/24/2014	1600-1130	1	BH	Pioneer, Elks Club, Apache, Mandan, Black Bart, Martin, Barbara	3
12/25/2014	0600-1300	12	TR	Pioneer, Apache, Mandan, Black Bart, Barbara, Elks Club, Cold	6
				Creek	
12/26/2014	0230-0530	6	AC	NUT, SUT, LTB, Sawmill, Tahoe Mtn	
12/26/2014	0600-0800	4	MH	NUT, SUT, LTB, Sawmill, Tahoe Mtn, Elks Club	
12/27/2014	1100-1300	1	BH	Golden Bear, Black Bart, Barbara, NUT, LTB	
12/27/2014	1600-1730		TC	Sierra House @ High Meadow	
12/30/2014	0730-1930	12	MH	NUT, SUT, LTB, Mt. Rainier, Tahoe Mtn, Sawmill	
12/30/2014	0930-2300	8	AP	Pioneer, Black Bart, stops at Barbara and Martin, Cold Creek,	2
				Susquehana, Jicarilla loop, Elks Club, Mandan, upper Apache	
1/5/2015	0730-1600		RW	Training in Sander	

Tahoma

Date	Amount (tons)	Operator	Location
11/1/2014	1.5	MC	Alder, Elm, Wilson, Pine, 7th, 6th, 10th, Lewis, McKinney, Belleview, Placer, Antelope, Grizzly, Glenridge, Valley View, Cedar View, Meeks Bay, Buttermilk, Silvertip, Mountain, Victoria, Sierra, Rubicon, Scenic, Woodland, Glenbrook, S. Scenic
11/3/2014	0.13	MC	Alder, Grizzly, High View
11/20/2014	0.25	MC	Wilson, Pine, Elm, 10th, 7th, McKinney, Lewis, Belleview, Alder, Antelope, Grizzly, Placer, Cedar Ridge, Sierra
11/21/2014	1.5	MC	Wilson, Pine, 6th, 7th, 10th, Elm, Lewis, McKinney, Belleview, Alder, Antelope, Grizzly, Placer, Glenridge, Valley View, Cedar Ridge, Meeks Bay, Buttermilk, Silvertip, Mountain, Victoria, Victoria Loop, Sierra, Rubicon, Scenic, S. Scenic, Woodland, Glen, Brook, Manzanita
11/23/2014	1.5	MC	Wilson, Pine, 6th,7th, 10th, Elm, Lewis, McKinney, Belleview, Alder, Antelope, Grizzly, Placer, Glenridge, Valley View, Cedar Ridge, Meeks Bay, Buttermilk, Victoria, Silvertip, Mountain, Victoria loop, Sierra, Rubicon, Scenic, Woodland, Glenn, Brook, Manzanita, S. Scenic
11/26/2014	1	MC	Wilson, Pine, 10th, Elm, Lewis, McKinney, Placer, Antelope, Alder, Valley View, Cedar Ridge, Meeks Bay, Victoria, Victoria loop, Rubicon, Scenic, Woodland, Glenn, Brook, Manzanita, S. Scenic
12/2/2014	0.13	MC	Wilson, Pine, 10th, Elm Alder
12/12/2014	2	MC	Wilson, Pine, 7th, 6th, Elm, Lewis, McKinney, Belleview, Alder, Antelope, Placer, Grizzly, Glenridge, Valley View, Cedar Ridge, Meeks Bay, Buttermilk, Silvertip, Mountain, Victoria, Victoria Cir, Sierra, Rubicon, Scenic, Woodland, Glenn, Manzanita, Brook, S. Scenic
12/13/2014	2	MC	Wilson, Pine, 6th, 7th, 10th, Elm, Lewis, McKinney, Bellevue, Alder, Antelope, Grizzly, Placer, Glen Ridge, Valley View, Cedar Ridge, Meeks Bay, Buttermilk, Victoria, Silvertip, Mountain, Victoria loop, Sierra, Rubicon, Scenic, Woodland, Glenn, Manzanita, Brook,

			S. Scenic
12/15/2014	0.5	MC	Wilson, Pine, 6th, 7th, 10th, Elm, Lewis, McKinney, Bellevue, Alder, Antelope, Grizzly, Placer
12/16/2014	2	MC	Wilson, Pine, 6th, 7th, 10th, Elm, Lewis, McKinney, Bellevue, Alder, Antelope, Grizzly, Placer, Glen Ridge, Valley View, Cedar Ridge, Meeks Bay, Buttermilk, Victoria, Silvertip, Mountain, Victoria loop, Sierra, Rubicon, Scenic, Woodland, Glenn, Manzanita, Brook, S. Scenic
12/17/2014	2	WM	Wilson, Pine, 6th, 7th, 10th, Elm, Lewis, McKinney, Bellevue, Alder, Antelope, Grizzly, Placer, Glen Ridge, Valley View, Cedar Ridge, Meeks Bay, Buttermilk, Victoria, Silvertip, Mountain, Victoria loop, Sierra, Rubicon, Scenic, Woodland, Glenn, Manzanita, Brook
12/22/2014	1.5	MC	Wilson, Pine, 6th, 7th, 10th, Elm, Lewis, McKinney, Bellevue, Alder, Antelope, Grizzly, Placer, Glenridge, Valley View, Cedar Ridge, Meeks Bay, Buttermilk, Victoria, Silvertip, Mountain, Victoria loop, Sierar, Rubicon, Scenic, Woodland, Glenn, Manzanita, Brook, S. Scenic
12/23/2014	0.5	MC	Wilson, Pine, 10th. Elm, Alder, Valley View, Cedar Ridge, Meeks Bay, Silvertip, Victoria, Victoria Cir, Sierra, Scenic, Woodland, Glenn, Brook, Manzanita
12/25/2014	5	BN	Wilson, Pine, 10th, 9th, 8th, 7th, 6th, Elm, Lewis, McKinney, Bellevue, Alder, Antelope, Placer, Grizzly, Glenridge, Valley View, Lake View, Cedar Ridge, Meeks Bay, Buttermilk, Silvertip, Mountain, Victoria, Victoria Cir, Sierra, View Cir, Rubicon, Scenic loop, Woodland, Glen, Brook, Manzanita, Crest, Forest View, High View, Sweetwater, Sweetwater Ct, Cove, Bayview
12/29/2014	2	MC	Wilson, Pine, Elm, 6th, 7th, 10th, Lewis, McKinney, Bellevue, Alder, Antelope, Grizzly, Placer, Valley View, Cedar Ridge, Lakeview, Victoria loop, King George, Rubicon, Scenic, Woodland, Glen, Brook, Crest, Forest View, High View, Manzanita
12/29/2014	1	MC	Wilson, Pine, Elm, Lewis, McKinney, 10th, Alder, Fir, 8th, Poplar, Antelope, Placer
12/30/2014	2	WM	Wilson, Aplha, Beta, Pine, Elm, 6th, 7th, 10th, Lewis, McKinney, Bellevue, Alder, Antelope, Grizzly, Placer, Alder, Buttermilk, King George, Victoria, lower Rubicon, Glen, Brook, Forest View, Scenic, Woodland, Lakeview, Valley View, Cedar Ridge, Manzanita
12/31/2014	2	WM/MC	Wilson, Pine, Elm, 10th, 7th, 6th, Lewis, McKinney, Bellevue, Alder, Antelope, Grizzly, Placer, Valley View, Cedar Ridge, Cove, Sweetwater, Lake View, Buttermilk, Meeks Bay, Silvertip, Mountain
1/2/2015	1	MC	Pine, Elm, McKinney, Alder, Antelope, Valley View, Cedar Ridge, Lakeview, Victoria loop, Scenic, Woodland, Glen, Manzanita, Brook
1/5/2015	0.13	MC	Pine, Wilson, Elm, Alder, Valley View
1/8/2015	0.5	MC	Wilson, Pine, 6th, Elm, McKinney, Alder, Valley View, Cedar Ridge, Meeks Bay, Victoria loop, Sierra, Scenic, S. Scenic, Woodland, Glen, Manzanita, Brook
1/14/2015	0.13	MC	Valley View, Meeks Bay, Woodland, Brook, Manzanita
2/8/2015	2	MC	Wilson, Pine, 7th, 6th, 10th, Elm, Lewis, McKinney, Bellevue, Alder, Antelope, Placer, Glenridge, Valley View, Cedar Ridge, Buttemilk, Meeks Bay, Silvertip, Mountain, Victoria, Victoria loop, Sierra, Rubicon, Scenic, Glen, Woodland, Brook, Manzanita, Forest View, High View, S. Scenic
2/9/2015	1.5	WM	Wilson, Pine, 7th, 6th, 10th, Elm, Lewis, McKinney, Bellevue, Alder, Antelope, Placer, Grizzly, Glenridge, Valley View, Cedar Ridge, Buttermilk, Meeks Bay, Silvertip, Mountain, Victoria , Victoria loop, Sierra, Rubicon, Forest View, High View, S. Scenic, Manzanita, Brook, Woodland, Scenic, Glen
2/10/2015	0.5	MC	Wilson, Pine, Elm, Alder, Grizzly, Valley View, Cedar Ridge, Meeks bay, Silvertip, Victoria loop, Scenic, Woodland, Glen, Brook, Manzanita, S. Scenic
2/27/2015	1	MC	Wilson, Pine, Elm, 10th, 7th, 6th, Lewis, Bellevue, McKinney, Alder, Antelope, Grizzly, Placer, Valley View, Victoria loop, Sierra, Scenic, Woodland, Glen, Brook, Manzanita, Rubicon, S. Scenic

Appendix F

El Dorado County
Community Development Agency
Environmental Management Division
Tahoe Basin Storm Water Reporting Information 2015

Hazardous Materials Program:
Hazardous Materials (HM) program inspectors conduct routine inspections for several programs which fall under the purview of the Certified Unified Program Agency (CUPA). Facilities which have hazardous materials and/or generate hazardous waste on site are regulated under the CUPA. These programs include facilities which have hazardous materials in quantities over defined thresholds, generate any amount of hazardous wastes, have underground storage tanks, and/or have above ground storage tanks. Many of the regulated facilities are in two or more of these programs. In the Tahoe Basin, the County regulates 139 HM facilities. Most of these facilities are required to be inspected by our division every three years. Facilities in the UST program require an annual inspection.

During inspections, the inspectors look for hazardous materials/wastes that are not being managed per the applicable laws and regulations. They look for the integrity of the hazardous material/wastes containers and secondary containment (if applicable), proper use of lids on these containers, and evidence of leaks. Inspectors discuss spill clean-up procedures and contingency plans with the facility. Each facility is required to provide the division with a list of the hazardous materials inventory (over specified quantities) they have on site, a site map, and plans for response if a release should occur.

In 2015, facilities were issued violations relating to threat of release or actual releases which were not managed appropriately and therefore had potential to impact the storm water system. When there is a threat of a release, inspectors educate facilities on the proper clean-up and containment procedures and ensure that they have the appropriate response equipment.

Environmental Health Programs:
Environmental Health (EH) programs with facilities that could receive violations for storm water discharge or mismanagement of trash and sewage include food facilities and pool/spa facilities. Food facilities need to be cognizant of organization and cleanliness of their outdoor trash and recycling areas as well as sewage release management if it should happen. Inspectors check for leaking trash collection bins and make sure the lids of those containers are kept closed. Inspectors look for excessive debris in the trash collection areas and they look at management of the grease trap collection units which are often stored outside behind the facility.

In the Tahoe basin, El Dorado County has 305 food facilities that are inspected twice a year. The inspection records are included in Appendix F of the Annual Report. The inspector directs

the facilities on how to correct these violations at the time of inspection. None of these violations immediately posed a risk to release into the storm drain.

Pool and spa facilities are not permitted to release waste water into the storm drain. During the plan check and construction phases of a new pool installation, EH inspectors check to ensure that the wastewater discharge plumbing is correctly connected to the sewage system or another approved discharge location. In the Tahoe basin, El Dorado County has 70 pool and/or spa facilities. Pool and spas are inspected at least once a season.

All spills are immediately responded to and corrected. Spills reported and corrected this year include hydraulic oil, sewage, soapy water, vehicle washing, engine oil and solid waste. Summaries of these spills including cleanups are included in Appendix F.

Household Hazardous Waste (HHW) Collection events at South Tahoe Refuse:
Each week South Tahoe Refuse (STR) hosts two household hazardous waste (HHW) collection events. They are held Tuesdays and Saturdays from 9am to Noon, and 1pm to 4pm. The events are open to the public and small businesses; however, there is a charge for the small businesses depending on the waste(s) they are bringing in. There are also limits on the quantities that can be brought in at a time and the container sizes which are manageable by HHW staff (i.e. no 55 gallon drums). At these events, almost all types of hazardous wastes are accepted. Those excluded are explosives, radioactive materials, and controlled substances.

The HHW program provides the public a very cheap ($3 per year included in property taxes) option for legal, safe, and environmentally friendly disposal of these very hazardous wastes which otherwise may end up in the environment and storm water system.

Public Outreach and General Observation:
The Environmental Management division works closely with Long Range Planning NPDES staff. More information regarding this is available at the website at:
http://www.edcgov.us/Government/EMD/HazardousMaterials/Storm_Water_Pollution_Prevention.aspx
The webpage provides information on what storm water is, and provides examples of what businesses and residents can do to prevent storm water pollution. The webpage also provides information on the National Pollution Discharge Elimination System (NPDES) as well as flyers on storm water pollution prevention for the community, construction sites, food facilities, and hazardous materials.

While in the field division inspectors are always on the lookout for incidents that are occurring that may contribute to further pollution our storm water system. Finally we respond to incidents of release of a hazardous material or sewage to ensure that the releases are properly cleaned up and the wastes are disposed of appropriately to minimize the impact on the environment.

IDDE / Stormwater Hotline

Type	Location	Name	date	Problem	Discharged to	Pollutants	Action taken	Problem Addressed	Dated Fixed
Citizen Complaint	North Upper Truckee	John Adamski / 577-1412	12/18/2014	Muliple complaints about Brine applications. Concerned about his car and rust	Road	Brine	Discussed with maintenance	Public safety Issue with winter operations. Not much can be done to satisfy complaint	
Complaint	934 Eloise Ave	Ashleigh	3/26/2015	Paint residue running down street into the Drop Inlet	Storm drain	paint	under investigation		5/5/2015
Sheriff Complaint	2187 Oaxaco	Sheriff Dpt	4/30/2015	Trash all over parcel and into stormwater system and drainage swale originating from home and garage.	Stormwater drainage	Trash	NPDES, Environmental Management and Clean tahoe Program notified homewoner, gave notice and monitored cleanup	Homeowner went out and cleaned up parcel. Clean Tahoe inspected and ensured all trash was cleaned up.	5/6/2015
Citizen Complaint	7307 Seventh Ave, Tahoma	Sarina Christianson	6/23/2015	Washign Machine Discharging straight to ground	Ground	Wash Water, Soap, Phosphates	Warned	Disconnected	6/29/2015
Citizen Complaint									
Sewage Spill	Hwy 89 / 5th	STPUD	11/12/2015	Sewage Spill	Ground	Sewage	Cleaned up OES report 156668	Cleaned and Sanitized	11/12/2015
Hydraulic fluid Spill	2234 Del Norte	Unknown	1/15/2016	hydrualic fluid	ground	hydraulic fluid	Cleaned up by Street Maitnenance	Cleaned up by Street Maitnenance	1/15/2016

NPDES STORMWA . SPILLS REPORT
TAHOE DIVISION
CALENDAR YEAR 2015

Date of Spill	Tracking #	Address	Area	Complaint	Amount	Type of Spill	Outcome
2/4/15	28940	775 Kiowa	So. Upper Truckee	Oil spill on to ground in front of house.	Many gallons	Hydraulic Oil	DOT staff Russ Wigart on site. Had DOT put down grease sweep and swept road. Oil may have gotten to DI but was an old spill.
2/26/15	29000	Kirkwood Inn – Cross Country Ctr	Kirkwood	Discovered sewage spill. Probably a few months old.	Unknown	Sewage	Staff snaked line, placed lime and let settle for 48 hours. Raked into soil and disposed of topsoil.
2/27/15	29011	2304 Wagon Train Trl.	South Lake Tahoe	STPUD discovered 25-30 gallon spill.	25-30 gallons	Sewage	STPUD returned 20 gallons to sewer, disinfected remaining area. Will send camera down to inspect. Probably cause: Roots.
3/5/15	29023	900 Ski Run Blvd. Responsible party: Aramark Sports & Entertainment	South Lake Tahoe	Oil spill	Approx 10 gallons	Hydraulic Oil	Tahoe Queen hydraulic line break. Hydraulic oil spilled into Lake. CalOES, USEPA, notified, EM-HM, City stormwater personnel, Fish & Game on site. Aramark personnel boomed around Queen & waterway leading to marina. Fish & Game took water samples.
3/24/15	29071	913 Friday Ave – Taqueria Jimenez	South Lake Tahoe	Soapy water draining to storm drain	Unknown	Soapy water	Owner cleaning floor mats outside. Water observed draining to DI. Karen Bender discussed, he will wash inside motel next time. City notified.

Date of Spill	Tracking #	Address	Area	Complaint	Amount	Type of Spill	Outcome
3/26/15	29075	2028 Fifth St	South Lake Tahoe	Wash runoff running down street to DI.	Unknown	Vehicle wash runoff	City stormwater personnel on site 3/26/15. Vehicle runoff was indicated. Owner advised against continued cleaning and will clean area.
6/30/15	29368	834 San Fran. Ave	South Lake Tahoe	Sewage on ground in back yard	Unknown	Sewage	Tahoe Prop Mgt called Riley Plumbing 6/29/15. Were unable to fix problem. Karen made site visit 6/20/15 to direct clean up.
7/28/15	29443	966 Modesto	South Lake Tahoe	Sewage backing up in to 2 units.	Unknown	Sewage	Maria on site 7/29/15 found no evidence of active sewage in apts. Referred photo's to Bill Potts for housing issues.
7/30/15	29444	3689 Blackwood	South Lake Tahoe	Illegal repair operations, oil dumping to trench near marshland	Unknown	Engine Oil	Forwarded complaint to city stormwater staff, Bill Potts, and City Code Enforcement. Outcome unknown.
8/24/15	29551	1564 Thunderbird	South Lake Tahoe	Sewage spill to property	40 gallons	Sewage	STPUD called EM. Happened on a Saturday and STPUD staff cleaned area.
9/8/15	29637	735 Emerald Bay Rd	South Lake Tahoe	Sewage draining to ground for 3 weeks.	Unknown	Sewage	Karen on site same day with City staff. Required owner to have pumper truck clean and disinfect area. Roto Rooter repaired broken clean out.
9/29/15	29760	3740 Blackwood	South Lake Tahoe	Sewage spill	Unknown	Sewage, solid waste, oil	Karen on site at Heavenly Valley Estates MHP. Several sites with active sewage and uncapped sewer lines. State HUD inspector was also present and directed manager to clean up multiple sites.
11/11/15	29961	5th & Emerald Bay Rd	South Lake Tahoe	Sewage Spill	1,000 gallons	Sewage to storm drain	STPUD reported to OES. Spill cleaned up by STPUD.
11/17/1[illegible]	29972	1281 Bonanza #8	South Lake	Sewa[illegible]king	Unknown	Sewage	Upstairs renters h[illegible]gged

			Tahoe	from a[illegible]ove			lines. Plumbers cl[illegible]d lines clogged with baby wipes.
12/9/15	30019	1364 June Way	South Lake Tahoe	Clean out taken off and sewage spilling onto ground at VHR	Unknown	Sewage	City Code Enf. Spoke with homeowner. Roto-rooter at site Friday12/4/15 and left lid off. They cleaned up site prior to Maria arriving on site.

Date Run : 2/10/2016 12:26:15PM
Run By : Administration

EL DORADO COUNTY

Listing of K022 & K042 Violations by Activity Date and Facility ID

Report #: 5042
Page #: 1

Selection Criteria:

Inspection Date	1/1/2015 - 12/31/2015
Facility ID	FA0000000 - FA9999999
Program/Element	0000 - 9999

Activity Date — Facility ID, Name & Address

01/15/15 **FA0002412 GOLD HILL VINEYARD & BREWERY 5660 VINEYARD LN PLACERVILLE, CA 95667**

Occurred	Violation Code	Program Record ID	Description	Violation Status
01/15/15	16K022	PR0005578	Sewage and wastewater properly disposed	OU

02/04/15 **FA0000451 MAR-VAL FOOD STORES #6 6049 FRONT ST GEORGETOWN, CA 95634**

Occurred	Violation Code	Program Record ID	Description	Violation Status
02/04/15	16K042	PR0000232	Garbage and refuse properly disposed; facilities mainta	OU

02/06/15 **FA0000461 KATHEE'S KITCHEN 6151 PONY EXPRESS TR POLLOCK PINES, CA 95726**

Occurred	Violation Code	Program Record ID	Description	Violation Status
02/06/15	16K042	PR0000243	Garbage and refuse properly disposed; facilities mainta	OU

03/18/15 **FA0001470 THE GETAWAY CAFE 3140 HIGHWAY 50 SOUTH LAKE TAHOE, CA 96150**

Occurred	Violation Code	Program Record ID	Description	Violation Status
03/18/15	16K042	PR0002717	Garbage and refuse properly disposed; facilities mainta	OU

03/24/15 **FA0001445 JACK IN THE BOX 2649 LAKE TAHOE BLVD SOUTH LAKE TAHOE, CA 96150**

Occurred	Violation Code	Program Record ID	Description	Violation Status
03/24/15	16K042	PR0002673	Garbage and refuse properly disposed; facilities mainta	OU

03/25/15 **FA0004160 HOLIDAY QUALITY FOODS #62 5030 ELLINGHOUSE DR COOL, CA 95614**

Occurred	Violation Code	Program Record ID	Description	Violation Status
03/25/15	16K042	PR0011170	Garbage and refuse properly disposed; facilities mainta	OU

05/06/15 **FA0006091 MAIN STREET MEXICAN FOOD 6260 MAIN ST GEORGETOWN, CA 95634**

Occurred	Violation Code	Program Record ID	Description	Violation Status
05/06/15	16K022	PR0015084	Sewage and wastewater properly disposed	OU

05/13/15 **FA0000170 FORESTER PUB & GRILL 4110 CARSON RD CAMINO, CA 95709**

Occurred	Violation Code	Program Record ID	Description	Violation Status
05/13/15	16K042	PR0001047	Garbage and refuse properly disposed; facilities mainta	OU

/15 **FA0000170 FORESTER PUB & GRILL 4110 CARSON RD CAMINO, CA 95709**

Occurred	Violation Code	Program Record ID	Description	Violation Status
05/28/15	16K042	PR0001047	Garbage and refuse properly disposed; facilities mainta	OU

EL DORADO COUNTY

Listing of K022 & K042 Violations by Activity Date and Facility ID

Activity Date	Facility ID, Name & Address	Occurred	Violation Code	Program Record ID	Description	Violation Status
06/01/15	FA0002831 CALIFORNIA CONSERVATION CORPS. 1949 APACHE AVE SO LAKE TAHOE, CA 96150	06/01/15	16K042	PR0005927	Garbage and refuse properly disposed; facilities mainta	OU
06/03/15	FA0000494 GOLDEN WAFFLE CAFE 1449 BROADWAY PLACERVILLE, CA 95667	06/03/15	16K042	PR0000268	Garbage and refuse properly disposed; facilities mainta	OU
07/24/15	FA0003333 SNOLINE STATION (HEALTH) 5450 PONY EXPRESS TRAIL CAMINO, CA 95709	07/24/15	16K042	PR0000249	Garbage and refuse properly disposed; facilities mainta	OU
08/03/15	FA0000171 CAMINO FOOD CENTER 4124 CARSON RD CAMINO, CA 95709	08/03/15	16K042	PR0000203	Garbage and refuse properly disposed; facilities mainta	OU
08/04/15	FA0001954 JACK IN THE BOX #3439 1023 SARATOGA WAY EL DORADO HILLS, CA 95762	08/04/15	16K042	PR0003625	Garbage and refuse properly disposed; facilities mainta	OU
08/17/15	FA0000171 CAMINO FOOD CENTER 4124 CARSON RD CAMINO, CA 95709	08/17/15	16K042	PR0000203	Garbage and refuse properly disposed; facilities mainta	OU
09/04/15	FA0001675 LIQUOR SHACK 2525 LAKE TAHOE BLVD SOUTH LAKE TAHOE, CA 96158	09/04/15	16K042	PR0003091	Garbage and refuse properly disposed; facilities mainta	OU
09/04/15	FA0001736 THE LAKE HOUSE 1181 EMERALD BAY RD SOUTH LAKE TAHOE, CA 96150	09/04/15	16K022	PR0003174	Sewage and wastewater properly disposed	OU
09/08/15	FA0003640 JIMBOY'S TACO 1405 BROADWAY PLACERVILLE, CA 95667	09/08/15	16K022	PR0007915	Sewage and wastewater properly disposed	OU

Facility ID, Name & Address

09/10/15 **FA0001663 BIG DADDY'S BURGER 3484 LAKE TAHOE Blvd SOUTH LAKE TAHOE, CA 96150**

Occurred	Violation Code	Program Record ID	Description	Violation Status
09/10/15	16K042	PR0007561	Garbage and refuse properly disposed; facilities mainta	OU

09/14/15 **FA0001814 RED HUT CAFE 2723 LAKE TAHOE BLVD SOUTH LAKE TAHOE, CA 96150**

Occurred	Violation Code	Program Record ID	Description	Violation Status
09/14/15	16K042	PR0003308	Garbage and refuse properly disposed; facilities mainta	OU

10/29/15 **FA0002336 BURGER LOUNGE MEYERS 3132 HIGHWAY 50 SOUTH LAKE TAHOE, CA 96150**

Occurred	Violation Code	Program Record ID	Description	Violation Status
10/29/15	16K042	PR0004541	Garbage and refuse properly disposed; facilities mainta	OU
10/29/15	16K042	PR0004541	Garbage and refuse properly disposed; facilities mainta	OU

11/30/15 **FA0000466 R AND R SALOON 5032 GARDEN VALLEY RD GARDEN VALLEY, CA 95633**

Occurred	Violation Code	Program Record ID	Description	Violation Status
11/30/15	16K042	PR0000247	Garbage and refuse properly disposed; facilities mainta	OU
11/30/15	16K022	PR0000247	Sewage and wastewater properly disposed	OU

12/07/15 **FA0000206 THE COLOMA CLUB 7171 HWY 49 COLOMA, CA 95613**

Occurred	Violation Code	Program Record ID	Description	Violation Status
12/07/15	16K042	PR0000810	Garbage and refuse properly disposed; facilities mainta	OU

EL DORADO COUNTY

Listing of AA60 - AA64 NPDES Violations by Activity Date and Facility ID

Report Selection Criteria:		
	Inspection Date	1/1/2015 - 12/31/2015
	Facility ID	FA0000000 - FA9999999
	Program/Element	0000 - 9999

Activity Date	Facility ID, Name & Address			
01/20/15	**FA0002617**	**MY THAI CUISINE**	**2108 LAKE TAHOE BLVD**	**SO LAKE TAHOE, CA 96150**

Occurred	Violation Code	Program Record ID	Description	Violation Status
01/20/15	16AA62	PR0005072	NPDES OBSERVATION	IN

Activity Date	Facility ID, Name & Address			
03/24/15	**FA0004092**	**TAQUERIA JIMENEZ**	**913 FRIDAY AVE**	**SOUTH LAKE TAHOE, CA 96150**

Occurred	Violation Code	Program Record ID	Description	Violation Status
03/24/15	16AA62	CO0029071	NPDES OBSERVATION	IN

EL DORADO COUNTY ENVIRONMENTAL MANAGEMENT COMPLAINT REQUEST

PLACERVILLE OFFICE
2850 FAIRLANE CT. BLDG "C"
PLACERVILLE, CA 95667
530-621-5300
Fax# 530-642-1531

SOUTH LAKE TAHOE OFFICE
3368 LAKE TAHOE BLVD #303
SOUTH LAKE TAHOE, CA 96150
530-573-3450
Fax# 530-542-3364

Date Recd: **07/30/2015**
Assigned to: EE0000084 - BENDER, KAREN
LOCATION: 3689 BLACKWOOD
Property Owner Info: HOBBES & CO CA LLC

OAKLAND CA 94610

Complainant Info: DON CARRINGTON

Complaint #: **CO0029444**
Inactive, Closed
P/E Description: 2160
STORM WATER PROGRAM

Owner Phone:

Complainant Phone: (775) 657-1308

Nature of Complaint :

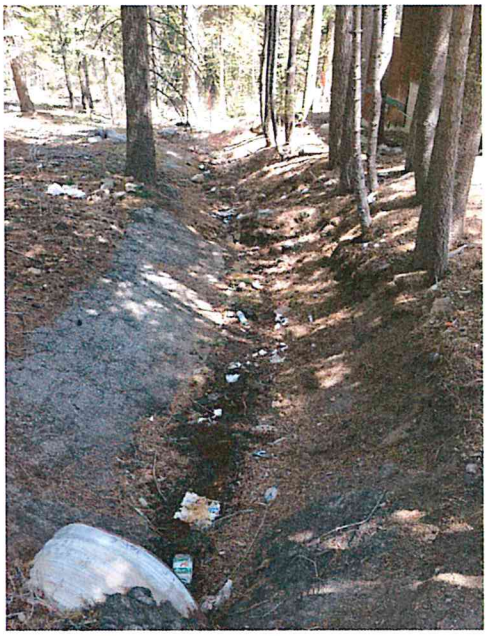
RP STATES THERE IS AN ILLEGAL VEHICLE REPAIR OPERATION ON-GOING IN SMALL STORAGE FACILITY AT THE BACK OF THE PROPERTY. RP STATED THERE HAS BEEN A SMALL TRENCH DUG THAT ENDS UP AT THE WETLANDS TO THE REAR OF THE PROPERTY AND SAW ACTIVITY RECENTLY OF TRANSMISSION REPAIR AND BELIEVES THE FLUIDS HAVE BEEN DUMPED INTO THAT TRENCH.

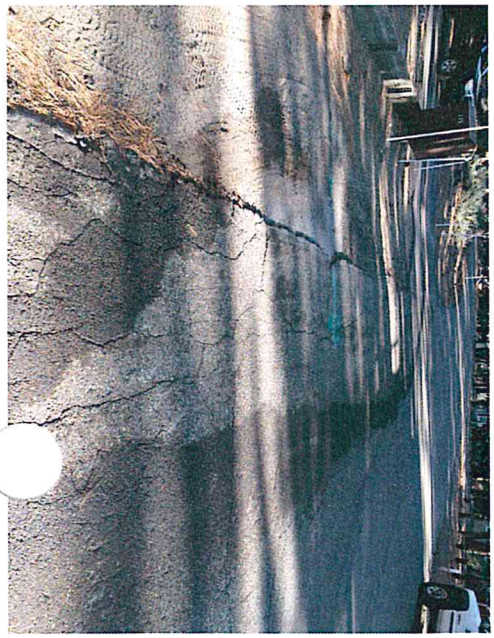
RP STATES HE REPORTED TO POLICE DEPARTMENT BUT HAS CONTINUED TO SEE ACTIVITY AT THE SITE.

HAZ MAT STAFF CURTIS KIESEL WAS IN OFFICE DURING THIS CALL AND SAID BECAUSE THE COMPLAINT IS RESIDENTIAL HZ WILL NOT RESPOND AND SHOULD BE FORWARDED TO CODE ENFORCEMENT AND STORMWATER STAFF FOR THE CITY.

Resolved by : **Date Resolved:**

Original Complainant notified By: _____
(775) 657-1308





June 24, 2015

Violation Address:
7307 7th Ave
Tahoma, CA

Subject: Washing Machine

Dear Homeowner:

During a routine inspection of your neighborhood County Of El Dorado staff recently discovered an illegal outdoor Washing Machine connection. It was observed that the wash water is discharge directly to the ground, which is a water quality violation. County stormwater, Environmental Management and State of California ordinances are in place to prevent these types of practices.

Correction Required:
Please disconnect and discontinue the use of this washing machine that is currently discharging wash water to the ground and contain all potentially harmful pollutants on your property.

For questions, feel free to contact Russell Wigart at (530) 573-7924

Respectfully,

Russell Wigart
Stormwater Coordinator
County of El Dorado, Long Range Planning, Stormwater Program

CC: TRPA, Steve Sweet
Lahontan Regional Water Quality Control Board, Scott Ferguson
Environmental Management Division, Karen Bender

Appendix G

Annual Stormwater Monitoring Report
Water Years 2014-2015

Developed by the

Tahoe Resource Conservation District

for the

Implementers' Monitoring Program

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

March 15, 2016

Implementers' Monitoring Program (IMP)

Component of the Regional Stormwater Monitoring Program (RSWMP)

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Funding for this project has been provided in part through an agreement with the State Water Resources Control Board. The contents of this document do not necessarily reflect the views and policies of the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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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LIST OF ACRONYMS

AC	Autosampler Composite Sample
BMP	Best Management Practice
Caltrans	California Department of Transportation
CEC	Characteristic Effluent Concentration
cf	cubic feet
cfs	cubic feet per second
CI	Contech MFS Inflow
CICU	Commercial, Industrial, Communications, Utilities
CMP	Corrugated Metal Pipe
CPP	Corrugated Plastic Pipe
CO	Contech MFS Outflow
CPC	Characteristic Pollutant Concentration
EMC	Event Mean Concentration
FB	Field Blank
FF	First Flush Sample
FSP	Fine Sediment Particles
GS	Grab Sample
IMP	Implementers' Monitoring Program
IV	Incline Village
JI	Jellyfish Inflow
JO	Jellyfish Outflow
Lahontan	Lahontan Regional Water Quality Control Board
MS	Manual Sample
NDEP	Nevada Division of Environmental Protection
NDOT	Nevada Department of Transportation
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
PD	Pasadena
PI	Pasadena Inflow
PO	Pasadena Outflow
PLRM	Pollutant Load Reduction Model
PSD	Particle Size Distribution
QAPP	Quality Assurance Project Plan
QAQC	Quality Assurance, Quality Control
RI	Rubicon Inflow
RO	Rubicon Outflow
ROW	Right-of-Way
RSWMP	Regional Storm Water Monitoring Program
RCD	Resource Conservation District
RTD	Rapid Transfer Device
RU	Rubicon
SAP	Sampling and Analysis Protocol
SB	Speedboat

S5	SR431 Catchment Outfall
SR	SR431
TA	Tahoma
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
TV	Tahoe Valley
USDA	United States Department of Agriculture
UT	Upper Truckee
WY	Water Year

1 MONITORING PURPOSE

The Implementers' Monitoring Program (IMP) was developed by the California and Nevada implementing jurisdictions to collectively fulfill California National Pollutant Discharge Elimination System (NPDES) Permit requirements and Nevada Interlocal Agreement commitments. Partnership development was inspired by permit language that encouraged jurisdictions to comply collaboratively with regulatory requirements to promote cost savings through economies of scale. IMP is a partnership between the Tahoe Resource Conservation District (Tahoe RCD), El Dorado County, Placer County, the City of South Lake Tahoe, the California Department of Transportation (Caltrans), Douglas County, Washoe County, the Nevada Tahoe Conservation District, and the Nevada Department of Transportation (NDOT). Regulations require that California and Nevada jurisdictions in the Lake Tahoe Basin take measures to decrease pollutant loading from stormwater runoff in urbanized areas by implementing pollutant controls to decrease fine sediment particles (FSP, particles less than 16 microns) and nutrient inputs to Lake Tahoe. Collectively, jurisdictions are required to monitor select urban catchment outfalls at a minimum of four sites and Best Management Practices (BMPs) at a minimum of two sites for flow volumes and pollutant loads. Samples must be taken during a minimum of one event per season. Monitoring provides empirical data that will be used to (1) assess nutrient and sediment loading at chosen catchments (2) evaluate BMP effectiveness at chosen BMPs, and (3) refine Characteristic Effluent Concentrations (CECS) used by the Pollutant Load Reduction Model (PLRM) to calculate load reductions from chosen treatment BMPs. PLRM is the standard tool developed specifically for the Tahoe Basin to calculate pollutant loads and load reductions from water quality improvement projects.

Though this report is intended to fulfill regulatory requirements, the IMP represents a historic first step toward implementing a comprehensive Regional Stormwater Monitoring Program (RSWMP) for the Tahoe Basin. All data has been collected in a manner consistent with RSWMP monitoring protocols designed to provide consistent data collection, management, analysis, and reporting approaches so that results can easily align with RSWMP objectives (Tahoe RCD et al 2015). Data collected for permit and agreement compliance initiate efforts to satisfy RSWMP's primary objective of establishing sites around the Basin for long-term stormwater monitoring and RSWMP's secondary objective of refining CECs for the PLRM. Long-term data will be useful in identifying status and trends in the watershed and verifying PLRM estimates.

2 STUDY DESIGN

During water year 2014 (WY14) five catchments (monitoring sites) were 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 selected BMPs located within three of those catchments. Three additional catchment outfalls were monitored in water year 2015 (WY15). This monitoring program exceeds the minimum regulatory requirement of four monitored catchments and two monitored BMPs. The catchments were chosen because of their direct hydrologic connectivity to Lake Tahoe, diversity of urban land uses, range of sizes, and a reasonably equitable distribution 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 maintenance intervals required to retain effectiveness. See Figure 1 for monitoring site locations.

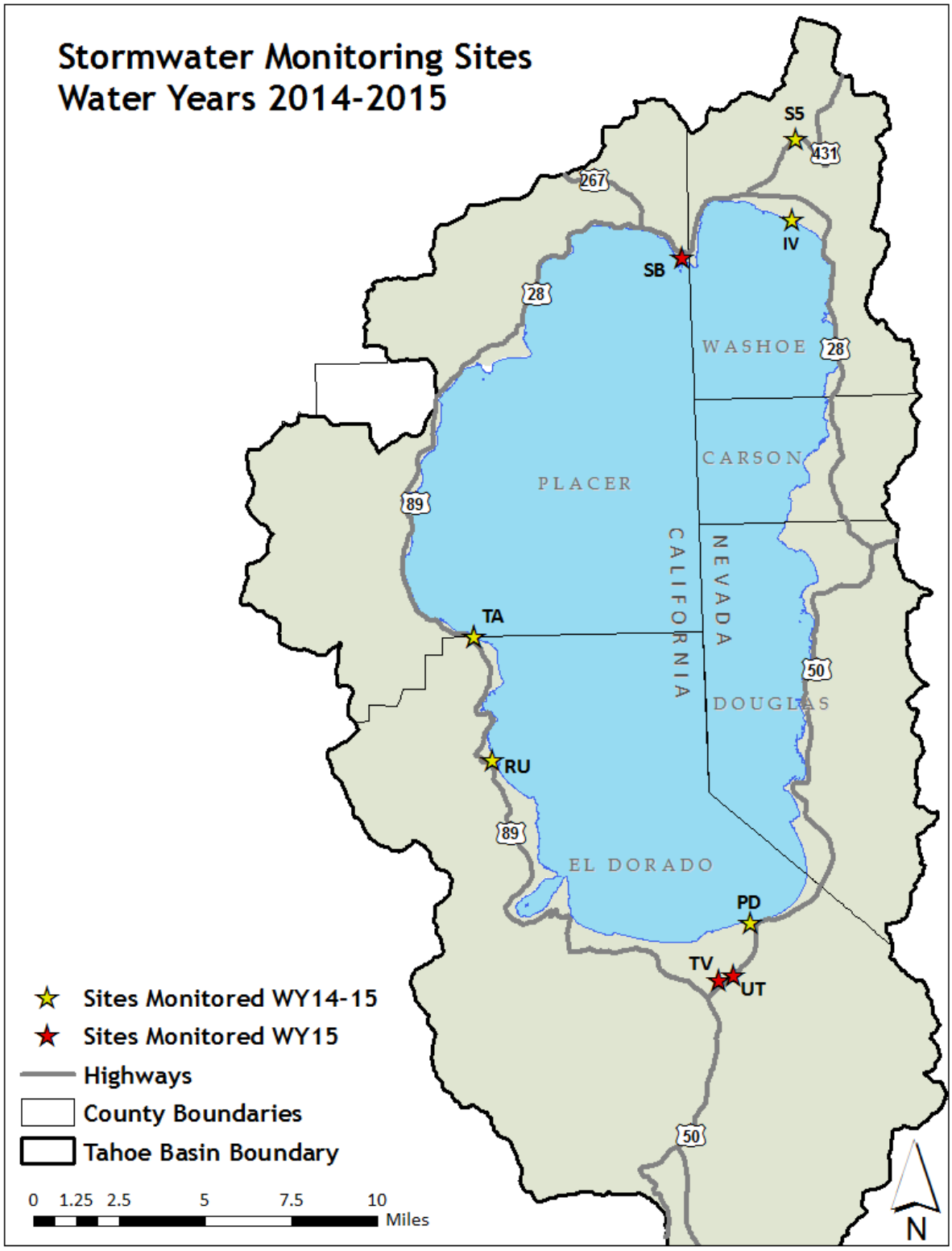

Figure 1: Stormwater monitoring sites. Incline Village (IV), Pasadena (PD), Rubicon (RU), SR431 (S5), and Tahoma (TA) were monitored WY14 and WY15. Speedboat (SB), Tahoe Valley (TV), and Upper Truckee (UT) were monitored WY15 only.

Table 1 summarizes the selected catchments and their corresponding designation as a catchment outfall monitoring site and/or BMP effectiveness monitoring site. Also included are the number of monitoring stations in the catchment, jurisdiction, total catchment area, percent impervious area, and dominant land uses in each catchment.

Table 1: Monitoring site specifics. Dominant urban land use is highlighted in dark pink, second most dominant in medium pink, and third most dominant in light pink. The vegetated class was not considered in this ranking. SR431 has two checkmarks under BMP because there are two different treatment vaults at this site.

Site Name	Outfall	BMP	# Monitoring Stations	Jurisdiction	Total Acres	Impervious Area	Landuse					
							Single Family Residential	Multi-Family Residential	CICU*	Primary Roads	Secondary Roads	Vegetated
Incline Village (IV)	√		1	Washoe	83.6	45%	3%	29%	45%	11%	6%	6%
Pasadena (PD)	√	√	2	CSLT	79.1	34%	52%	12%	10%	0%	21%	6%
Rubicon (RU)	√	√	2	El Dorado	13.8	20%	78%	0%	0%	0%	16%	6%
SR431 (SR)	√	√√	5	NDOT	1.35	96%	0%	0%	0%	100%	0%	0%
Tahoma (TA)	√		1	El Dorado, Placer, Caltrans	49.5	25%	44%	4%	11%	4%	20%	17%
Speedboat (SB)	√		1	Placer, Caltrans	29.0	27%	48%	4%	9%	5%	14%	20%
Tahoe Valley (TV)	√		1	CSLT	321.3	33%	22%	12%	22%	2%	13%	29%
Upper Truckee (UT)	√		1	CSLT, Caltrans	10.5	66%	14%	7%	39%	19%	15%	6%

*Commercial, Industrial, Communications, Utilities

2.1 INCLINE VILLAGE SITE DESCRIPTION

The Incline Village monitoring site is located on the western edge of the parking lot of 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 second 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 due to steep slopes and high density development. Runoff discharges directly to the lake via a 30-inch corrugated metal pipe (CMP) that daylights into a rock-lined ditch before entering Lake Tahoe. The monitoring station was originally located on the rock-lined ditch.

On June 11, 2015 the monitoring station was removed from the rock-lined ditch because the flume installed in the ditch constricted very large flows and caused considerable channel erosion during a large thunderstorm in the summer of 2014. The channel was repaired and on July 7, 2015 and monitoring equipment was reinstalled at the end of the 30” CMP. Flow and turbidity sensors and the sample intake tube were mounted directly to the bottom of the CMP without a flume to ensure that large flows could pass unimpeded.

As part of the Central Incline Village Phase II Water Quality Improvement Project constructed during the summer of 2015, substantial improvements were made in the catchment upstream of the monitoring site. New infiltration features that reduce flows to the existing 30" CMP prior to reaching the monitoring site include: (1) a series of three upstream infiltration basins that are designed to remove 1.8 cfs, (2) two small roadside infiltration pools, and (3) 450 linear feet of roadside infiltration channel that intercepts upstream roadway runoff. A Jellyfish treatment vault similar to the one installed at SR431 (see section 2.4) was also installed downstream of the new infiltration features and immediately upstream of the monitoring site. Calculations used to size the new vault were based on field values and anticipated clogging over time. Calculations indicated the Jellyfish would receive low flows during average annual events even after the new increased upstream infiltration capacity was accounted for. However, the upstream improvements have been exceptionally successful and as of July 2015 this site has experienced only minimal flows that have been insufficient for sampling. Over time the infiltration features will fill with sediment and infiltration rates will decrease. When this occurs actual infiltration rates will better match calculated infiltration rates and low flows are expected to exit the Jellyfish and pass through the 30" CMP.

2.2 PASADENA SITE DESCRIPTION

The Pasadena monitoring site is located at the northernmost end of Pasadena Avenue 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 Avenue conveys runoff directly to Lake Tahoe. The pipe is the terminus of a 78.9 acre catchment designated the "G12" urban planning catchment 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. In addition to the upstream permeable and porous road shoulders and perforated storm drain pipes, a pre-treatment Vortechnics storm vault and two Contech Stormfilter vaults were installed in parallet at the end of the catchment before discharge to the lake through the 36-inch CMP. Prior to WY14 monitoring, one of the Contech Stormfilters was not receiving any flow due to a missing orifice plate and the filter cartridges were therefore clean. The cartridges in the other Contech Stormfilter were replaced at the same time the missing orifice plate was installed (September 30, 2013). Thus, both Contech Stormfilters had clean cartridge filters prior to the start of this study. Pasadena Inflow (PI) is a monitoring station located at the inflow to the pre-treatment Vortechnics vault and two Stormfilter vaults (below the in-situ infiltration BMPs), and Pasadena Outflow (PO) is located in the 36-inch outfall CMP, the outflow from the pre-treatment vault and two Stormfilter vaults.

2.3 RUBICON SITE DESCRIPTION

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 third 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 bordered 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 control neighborhood flooding and 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 Inflow (RI) and Rubicon Outflow (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.

2.4 SR431 SITE DESCRIPTION

The SR431 monitoring site is located on State Route 431 in Washoe County above Incline Village, Nevada. The 1.35 acre catchment encompasses NDOT right-of-way (ROW) of which approximately 96% is impervious. This is the smallest catchment monitored and 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 away. SR431 is monitored as a catchment outfall site and for evaluating and comparing the effectiveness of two adjacent stormwater treatment vaults, the Contech MFS and the Jellyfish, containing different cartridge filters. There are five monitoring stations at SR431; the inflow and outflow to the Contech MFS vault (CI, CO), the inflow and outflow to the Jellyfish vault (JI, JO), and the outflow from the catchment (S5). S5 captures flow that bypasses the treatment vaults. Though located in a rural area with moderate highway traffic density, SR431 is the only site that isolates runoff from primary roads and can therefore be used to characterize runoff from one land-use type. In addition, SR431 is the only site currently available where a true side-by-side comparison of stormwater cartridge filter types can be performed.

2.5 TAHOMA SITE DESCRIPTION

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" 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.

A water quality improvement project completed in the fall of 2014 installed nine sediment traps to slow flow rates and capture coarse sediment, one new drop inlet to more effectively capture and route flow, and more than 80 feet of perforated infiltration pipe to decrease runoff volumes to the catchment outflow.

2.6 SPEEDBOAT SITE DESCRIPTION

The Speedboat monitoring site is located midway along the western side of Speedboat Avenue just south of Dip Street in Kings Beach, California. The 29.0 acre catchment is monitored as a catchment outfall at a single monitoring station (SB). It receives co-mingled runoff from Placer County and Caltrans jurisdictions delivered by a 12 inch CMP. The catchment is comprised of twenty-seven percent impervious surfaces and drains a steep area that is characterized predominately by single family residences, vegetation, and secondary roads. After passing through an H-flume at the monitoring station, runoff from the catchment

drains untreated through a series of CMPs along a pedestrian footpath at the intersection of Lake Street and Harbor Avenue directly to Lake Tahoe.

This site was monitored from 2003 to 2012 by the University of California, Davis, Tahoe Environmental Research Center (UCD TERC) and the Desert Research Institute (DRI). Data collected from this site was included in the initial Total Maximum Daily Load (TMDL) study that ultimately populated the PLRM used to estimate pollutant loading from urban catchments.

2.7 TAHOE VALLEY SITE DESCRIPTION

The Tahoe Valley monitoring site is located on the eastern side of Tahoe Keys Boulevard just south of the intersection with Sky Meadows Court in South Lake Tahoe, California near the entrance to the Sky Meadows Condominium Complex. With an area of 321.3 acres, this is the largest catchment monitored. It is a relatively flat, highly urbanized catchment consisting primarily of CICU, single family residences, secondary roads, and vegetation. Thirty-three percent of the catchment is impervious. This site is monitored as a catchment outfall at a single monitoring site (TV). Runoff to the site is delivered by a 36 inch "squashed" CMP from the City of South Lake Tahoe jurisdiction. After passing by the TV monitoring station, runoff is conveyed through a vegetated swale along the northwest edge of the Sky Meadows Condominium Complex directly to the Upper Truckee River and eventually to Lake Tahoe.

Many water quality improvement projects have been implemented in this catchment in the last 25+ years. The existing Helen Basin and almost 3,200 linear feet of vegetated swales were built as part of the Tahoe Valley Erosion Control Project (ECP) in 1989 to increase stormwater infiltration upstream of the current monitoring site. This area was maintained under a contract with the California Conservation Corps in 2014 and included removing sediment that was blocking pipes, excess vegetation in the basin and swales, drug paraphernalia, empty liquor bottles, and human waste. Additionally, Caltrans completed the $12 Million US Highway 50 water quality improvement project in 2012 which included curb, gutter, rock-lined swales, infiltration chambers and basins along highways 50 and 89 to address highway runoff in the catchment. Lastly, to ensure high infiltration rates, the City of South Lake Tahoe removed accumulated sediment, excess vegetation, and trash in the Caltrans swales upstream of Tahoe Keys Boulevard near Council Rock Road and behind the storage units on Eloise in May and June of 2015, also under a contract with the California Conservation Corps. Nearby homeless camps littered with trash, human waste, empty liquor bottles, and used needles were also removed.

2.8 UPPER TRUCKEE SITE DESCRIPTION

The Upper Truckee monitoring site is located on the eastern bank of the Upper Truckee River at the intersection of Highway 50 and River Drive a short distance upstream of the bridge on Highway 50 that crosses the Upper Truckee River in the City of South Lake Tahoe, California. The 10.5 acre catchment drains a highly urbanized area which is primarily composed of CICU, primary and secondary roads, and single family residences. This is the second smallest catchment monitored, but with a high percentage of impervious coverage (66%) it receives relatively high volumes of co-mingled runoff from the City of South Lake Tahoe and Caltrans jurisdictions through an 18 inch Corrugated Plastic Pipe (CPP). The site is monitored as a catchment outfall site at a single location (UT). Improvements are planned by the City of South Lake Tahoe and Caltrans for the summer of 2016 in this catchment, and there will be an opportunity to assess the

effectiveness of these improvements with the pre- and post-implementation data. After exiting the CPP, runoff is discharged to an 80 inch x 48 inch x 24 inch trash collection device lined with filter fabric and then to a 15 foot rock lined slope that leads directly into the Upper Truckee River and eventually to Lake Tahoe.

3 DATA COLLECTION METHODS, SAMPLING PROTOCOLS, ANALYTIC METHODS

Continuous hydrology and stormwater samples are collected using ISCO brand automated samplers per RSWMP protocols (RSWMP FIG 2015 section 10.2.1, Tahoe RCD et al 2015) at all eleven monitoring stations in WY14 and fourteen monitoring stations in WY15 to support seasonal [fall/winter (October 1-February 28), spring snowmelt (March 1-May 31), and summer (June 1-September 30)] volume and load reporting. Autosamplers were installed and sites maintained according to protocols outlined in the RSWMP FIG sections 10.1.2.2 and 10.2.1.3 respectively. Nine of the eleven WY14 monitoring stations and twelve of the fourteen WY15 monitoring stations collected continuous turbidity with an FTS DTS-12 turbidimeter. Turbidimeters were installed and maintained as outlined in the RSWMP FIG sections 10.2.2.1 and 10.2.2.2. Equations that relate turbidity to FSP concentration have been developed specifically for the Tahoe Basin and can be applied to estimate FSP loads (2NDNATURE et al 2014).

Continuous data series logged at each monitoring station consist of parameters measured in the field at a constant time interval; continuous series consist of data for flow, turbidity, and meteorology. Flow and turbidity data are QAQC'd with frequent stage and turbidity field measurements to ensure that no drift has occurred in the readings and sensors are performing optimally (RSWMP FIG sections 10.2.1.7 and 10.2.2.5). Visual observations are used to confirm when a flume or pipe is dry and stage and turbidity should read zero. Visual observations are also used to determine if ice in the flume or pipe is causing stage errors that needed to be adjusted to zero. Visual observations and field measurements are made every two weeks at a minimum but more often during precipitation events. Recalibration of stage measuring equipment is done by adjusting the level measurement on the autosampler. Turbidimeter accuracy was verified on all in-situ turbidimeters with a solution of known turbidity in late August 2015. All were found to be functioning normally during this exercise. In-situ turbidimeter verification occurs regularly prior to the beginning of each water year. Recalibration of the continuous turbidimeter can only be done by sending the instrument back to the manufacturer, but to date this has not been necessary. Any turbidimeters found to be reading turbidity incorrectly in the future will be sent back to the manufacturer for calibration.

Weather is monitored closely and autosamplers are programmed to sample prior to each runoff event in accordance with RSWMP FIG sections 10.2.1.4 and 10.2.1.5. Samples are selected as singles or made into flow-weighted composites (RSWMP FIG section 10.2.1.10) based on their occurrence on the hydrograph. First flush singles; rising limb composites, falling limb composites, or full event composites; and quality control samples are analyzed for total nitrogen (TN) concentration, total phosphorus (TP) concentration, total suspended solid (TSS) concentration, turbidity, and particle size distribution (PSD) to determine fine sediment particle (FSP) concentration at the UC Davis Tahoe Environmental Research Center Laboratory in Incline Village, NV, the UC Davis Laboratory in Davis, CA, or the High Sierra Water Laboratory, Inc. in Tahoe City, CA. Additional single samples at each station are analyzed for turbidity and PSD to aid in the refinement of a rating curves relating turbidity to FSP. Table 2 summarizes the sample type acronyms and their meaning. Table 3 summarizes the analytical methods and detection limits for all analyses. Raw analytical data for all samples is presented in Appendix A.

Table 2: Sample types and acronyms.

Sample Acronym	Sample Type
FF	**F**irst **F**lush single
AC	**A**uto-sampler **C**omposite, flow-weighted composite of whole or part of hydrograph
AS	**A**uto-sampler **S**ingle
FB	**F**ield **B**lank (QA/QC)
GS	**G**rab **S**ample single (QA/QC)
MS	**M**anually triggered auto-**S**ampler 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

Meteorological data in each catchment is recorded using a Davis Instruments Vantage Pro weather station installed and maintained following recommendations in the RSWMP FIG sections 10.2.3.1 and 10.2.3.2. Meteorological data is used to calculate seasonal and annual precipitation totals (RSWMP FIG section 10.2.3.5) and to estimate the amount of flow that can be expected in a particular catchment for a particular amount of precipitation to aid with autosampler programming for event based sampling (RSWMP FIG section 10.2.1.4).

Sample handling and processing includes proper labeling of samples in the field, transporting samples to a laboratory immediately after collection in a cooler with ice, 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 QAQC samples to identify problems related to field sampling and sample processing (RSWMP FIG section 10.2.1.6). Analytical data for all QAQC samples is presented in Appendix B.

4 DATA MANAGEMENT PROCEDURE

Continuous data series and sample dates and times are offloaded from the auto-samplers with rapid transfer devices (RTDs) (or through an online data management system at SR431) at the time samples are collected, maintenance is required, or every two weeks during dry periods. Any other field measurements and observations are recorded in a field notebook. Samples, RTDs, and notes are transported to a processing lab immediately after collection. Hydrology and turbidity data and sample dates and times are offloaded from the RTDs to the Tahoe RCD server using the software program Flowlink; all data are input into an Excel workbook for storing continuous parameters and sample dates and times. A separate Excel workbook is used for calculating flow-weighted compositing schedules for the rising limb, falling limb, or full event composites at each monitoring station. All samples are measured for turbidity and values are recorded on standard data sheets in the laboratory and entered into an Excel workbook for storing nutrient and sediment data. All samples are sent to proper laboratories within appropriate holding times for TN, TP, TSS, and PSD analysis. For a complete description of holding times for sampled parameters, see the RSWMP Quality Assurance Project Plan (QAPP) (DRI et al 2011a). Results from analytical laboratories are entered into the same Excel workbook for storing nutrient and sediment data. Data are offloaded from meteorological stations every two weeks using a laptop and the software program Weatherlink, and input into an Excel workbook for storing continuous meteorological data. A separate sheet in the meteorological station Excel workbook is used to extract discrete storm statistics such as event total precipitation, event duration, and maximum and minimum temperatures. All Excel workbooks are housed on one central server (with backup device) and managed by Tahoe RCD staff. All data management procedures described above follow protocols outlined in the RSWMP FIG section 10.2.1.

5 DATA ANALYSIS

The raw hydrologic data set includes stage, velocity (at select sites), flow (determined by an equation relating stage in a weir, flume or pipe, or stage and velocity in a smooth walled pipe to flow), and turbidity recorded every 10 minutes throughout the water year. Data gaps were short and rare. Erroneous readings are corrected and data gaps are filled following protocols outlined in the RSWMP FIG sections 10.2.1.7 for flow and 10.2.2.5 for turbidity.

Seasonal and annual volumes are calculated in accordance with RSWMP FIG sections 10.2.1.8 and 10.2.1.9. Results from lab analysis are used to calculate a flow-weighted event mean concentration (EMC) as outlined in section 10.2.1.10 of the RSWMP FIG. EMCs are grouped by season and a seasonal characteristic pollutant concentration is calculated for each site; these concentrations are then applied to each hydrology measurement for that season. Loads are calculated by summing concentrations multiplied by runoff volumes over time as outlined in section 10.1.2.11 of the RSWMP FIG. Turbidity is converted to FSP concentration (in both mass per liter and number of particles per liter) using equations relating turbidity to FSP (2NDNATURE et al 2014) and integrated over time to calculate seasonal and annual load estimates in pounds and number of particles (RSWMP FIG sections 10.2.2.6 and 10.2.2.7).

Raw meteorological data include a precipitation and a temperature reading every 5 or 10 minutes (depending on the site) throughout the water year. Precipitation occurring as snow is converted to inches of water by a heated tipping bucket at the meteorological station that melts falling snow upon contact with the device. Data is QAQC'd by comparing event, seasonal and annual totals to the closest neighboring

meteorological station. Data gaps were rare, but were filled with data from a neighboring station when they occurred (RSWMP FIG section 10.2.3.4). Individual storm events were extracted from the raw data and compiled on a summary page that includes beginning and end time of the event, event duration, total precipitation, peak precipitation, minimum and maximum temperature, storm event type, and whether the event produced significant runoff to sample or not. This summary page was used to sum seasonal and annual precipitation totals for reporting and to determine what size, intensity, and type of events were required for successful sampling.

6 CATCHMENT OUTFALL MONITORING

6.1 SUMMARY DATA FOR ALL MONITORING SITES

According to the Association of California Water Agencies, WY14 and WY15 were some of the driest in the State's recorded history. The Natural Resources Conservation Service (NRCS) maintains a Snotel meteorological station called the Tahoe City Cross located north of Tahoe City at an elevation of 6800 feet (www.wcc.nrcs.usda.gov). As per RSWMP protocols, this station is to be used as a reference station to determine if a particular water year is wet, average, or dry (assuming that a wet, average, or dry season in Tahoe City will be the same around the lake). Using a 34 year precipitation record (water year 1981-2015) from this station, WY14 and WY15 fall into the lowest quartile at 24.6 and 22.9 total inches respectively and are therefore designated dry years (Table 4, Figure 2).

Table 4: Annual precipitation statistics from the Tahoe City Cross meteorological reference station, water years 1981-2015.

WY 1981-2015	Annual Precipitation (in)
minimum	17.5
1st quartile	26.1
median	30.7
3rd quartile	45.3
maximum	73.9

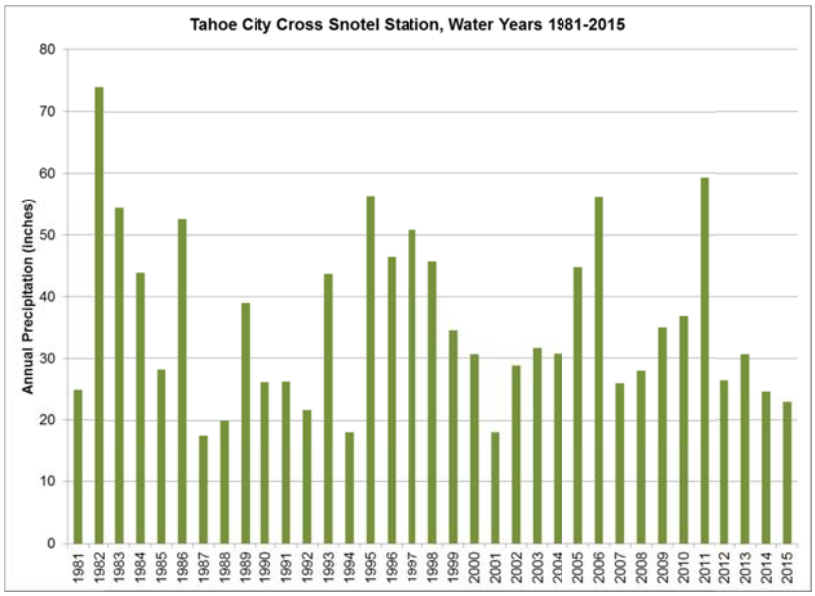

Figure 2: Long-term precipitation record at the Tahoe City Cross meteorological station, water years 1981-2015.

Three primary "seasons" are defined by the NPDES permit; fall/winter (October 1 – February 28), spring (March 1 – May 31), and summer (June 1 – September 30). The seasons are defined as such to better fit with precipitation patterns and storm event types that occur in the Tahoe Basin. The primary event types in the fall/winter are frontal rain storms, rain on snow, mixed rain/snow, or event snowmelt. An event snowmelt

occurs during and shortly after a snow event when enough snow melts (generally on the roads from the heat generated by automobile traffic) to produce runoff at a given monitoring site. Spring event types include the fall/winter event types plus non-event snowmelts. A non-event snowmelt event generally occurs in the spring when temperatures are greater than 50 degrees Fahrenheit and accumulated snowpack melts. With the exception of Tahoma in WY14 and WY15 and Upper Truckee in WY15, monitoring sites did not receive sufficient spring non-event snowmelt to sample. Summer events are primarily thunderstorms and frontal rain storms.

Summary data for all sites are presented in Table 5a for WY14 and 5b for WY15. Figures 3 – 9 illustrate Tables 5a and 5b in graphical form. Seasonal and annual precipitation values represent the total precipitation that fell in the catchment for that period, not just the sum of the storm totals of the events sampled. Seasonal and annual runoff volumes represent the cumulative runoff volume measured at the sampling stations during the respective period, not just the sum of the volumes of the events sampled. FSP loads are calculated from continuous turbidity, and TN and TP loads are calculated from event sampling. As not every runoff event was sampled during the year, the seasonal and annual TN and TP loads represent an average (volume weighted) load estimation for the respective period based on the events that were sampled in that period. (Average seasonal and annual FSP loads at Rubicon Inflow (RI) are calculated in this manner as well as there is no continuous turbidimeter installed at this site.)

The two west shore monitoring sites, Tahoma and Rubicon, received the most precipitation in both water years, while the Incline Village site received the least in WY14 and Speedboat received the least in WY15. Both Incline Village and Speedboat are located in the northeastern quadrant of the Tahoe Basin. The SR431 site on the north shore and two south shore monitoring sites (Tahoe Valley, and Upper Truckee) received comparable amounts in both water years. In general the west shore of the lake gets more precipitation than the north, south, or east shores. Though located within the same region, SR431 likely got more precipitation than Incline Village as it lies about 900 feet higher in elevation. All regions of the lake received the greatest amount of precipitation during the fall/winter season, and most sites received the least amount of precipitation during the summer. However, both Pasadena and Tahoma received more precipitation during the summer than the spring in WY14. It is interesting to note that Tahoma received less precipitation in the spring of WY14 when compared to its neighbor Rubicon. The Rubicon meteorological station recorded greater precipitation during the March 5-6, March 29-30, April 25, and May 19-21, 2014 events than the Tahoma station did, plus an event on March 31, 2014 that did not occur in the Tahoma catchment. In contrast, during WY15, the Rubicon meteorological station recorded substantially less precipitation than the Tahoma station did during events occurring December 2 and December 10, 2014. This is evidence of how localized precipitation events can be in the Tahoe Basin. With few exceptions, sites received less precipitation across all seasons in WY15 than WY14.

Tahoma had the greatest seasonal and annual runoff volumes in WY14, likely due to its median catchment size, relatively large precipitation totals and high direct connectivity to the outfall despite being only 30% impervious. In WY15 two of the three new sites, Speedboat and Tahoe Valley, had higher seasonal and annual runoff volumes than Tahoma except during the summer when Tahoma had more runoff than any other site despite having slightly less precipitation than the south shore. Fall/winter runoff volumes at Tahoe Valley far exceeded any other site, undoubtedly explained by its very large catchment size (321.3 acres), more than three times the size of the next largest catchment (Incline Village; 83.6 acres). Pasadena and Incline Village have similar catchment areas with similar impervious area and received similar amounts of precipitation in both water years, but Pasadena had approximately twice the runoff that Incline Village

did in the fall/winter and for the whole year in WY14. In WY15 Pasadena had approximately half the runoff that Incline Village did in the fall/winter though they had comparable runoff volumes for the year. This illustrates the great variability within a site and between sites, but with only two years of data it is difficult to pinpoint a reason for these differences. Pasadena inflow and outflow volumes are similar because the Stormfilter installed in this catchment is not designed to infiltrate flows. This is true for the Contech MFS and Jellyfish treatment vaults at SR431 as well. Slightly higher inflow volumes may be due either to a small amount of error inherent in the flow monitoring equipment or because some of the inflow remains trapped in the treatment vaults and a portion eventually evaporates and never outflows. The Rubicon catchment received the greatest amount of precipitation both water years but produced little runoff at the inflow station either year, undoubtedly due to its small catchment area and the improvements (such as a series of microbasins designed to increase infiltration) that have been made upstream of the inflow. The outflow station recorded no outflow at all from the Stormtech chambers installed at the end of the catchment, indicating that all runoff was infiltrated and there was no discharge from this catchment outfall to Lake Tahoe. The small SR431 catchment (only 1.35 acres) received a significant amount of precipitation both years, much of which fell as snow due to its elevation, and produced very little runoff despite being 96% impervious. The outfall site at SR431 got the least amount of runoff of any site both years because the treatment vaults divert most of the runoff away from this site. Summer runoff volumes in this catchment in WY14 were higher than any other season because of a few high intensity thunderstorms.

Average seasonal and annual FSP concentrations are within the same order of magnitude at all the sites, but overall in WY14 the inflows to the two vaults on SR431 were the dirtiest and Rubicon was the cleanest. The highest average concentration was seen in the fall/winter at the inflow to the Jellyfish vault and in the spring at the inflows to both vaults on SR431, likely due to the catchment's high imperviousness, classification as primary road, and the relatively large amount of road sand that runs off after snow events in that catchment. In WY15, Rubicon was again the cleanest and the SR431 sites were among the dirtiest, but Speedboat and Tahoma had the highest and second highest annual FSP concentrations respectively. Both these catchments receive primary road (highway) runoff. Speedboat is relatively steep, which may contribute to greater erosion in this catchment. The greatest FSP loading came from the Tahoma catchment during all seasons in WY14, primarily due to the large runoff volumes and relatively high FSP concentrations in this catchment, especially during the fall/winter season. While Tahoma had the second highest FSP loading in WY15, the new Speedboat catchment had a load 1.6 times higher than Tahoma due to high volumes and very high FSP concentrations, possibly a result of runoff from Highway 28. Inflow to the Pasadena Stormfilter in WY14 and Tahoe Valley and Upper Truckee outfalls in WY15 also resulted in relatively high loads because of their large runoff volumes. Despite a comparatively low annual FSP concentration, Tahoe Valley had the third highest FSP load because of its very large flow volumes. The SR431 catchment outfall and Rubicon produced the smallest FSP loads in both years as they have very small runoff volumes.

Generally, average seasonal TN and TP concentrations at all sites were highest in the summer. All five SR431 and the Incline Village stations had the highest average annual TN concentrations in WY14. In WY15 Incline Village had an average annual TN concentration more than twice as high as the next highest average annual TN concentration (SR431 catchment outfall). The SR431 catchment outfall and Incline Village had the highest average annual TP concentrations in WY14 and Incline Village had the highest TP concentration in WY15. Rubicon and Tahoe Valley had lower TN and TP concentrations in general. However, the Pasadena and Rubicon inflows had high TP concentrations in the summer of 2014, and Pasadena had the highest in the summer of 2015. TN and TP loads were much smaller than FSP loads at all sites for all seasons during both

water years. TN and TP loads were greatest at Tahoma and second greatest at the Pasadena inflow in all seasons due to the large runoff volumes in WY14. Despite typical TN and TP concentrations, TN and TP loads were the greatest at Tahoe Valley due to very large runoff volumes in WY15. TN and TP loads were lowest at the SR431 catchment outfall and Rubicon in both water years due to the small runoff volumes. Average seasonal and annual TP concentrations were lower than average TN concentrations at every site in every season, as were the loads. TN and TP concentrations and loads are not available for the spring season of WY14 at Pasadena due to equipment failure during the only spring event that produced sufficient runoff to sample in this catchment. TN and TP concentrations and loads are not available for the summer season of WY15 at Incline Village because improvements in this catchment increased infiltration above the monitoring site and resulted in little to no flow at the monitoring station. TN and TP concentrations and loads are not available for the summer season of WY15 at Upper Truckee due to numerous short duration flows that did not produce enough runoff to sample effectively.

In summary, the greatest loads of all pollutants come from catchments with high pollutant concentrations and large runoff volumes. However, current monitoring data indicates that runoff volume has more influence on loads than concentrations do. Therefore even catchments with relatively low pollutant concentrations can discharge very large pollutant loads if they have large runoff volumes. The fall/winter season has the highest discharge volumes and therefore contributes the greatest pollutant load to the lake. As only one to two years of data have been collected in these catchments it is difficult to say with confidence that loads from all catchments are lower these two very dry water years than they would be in a wetter water year due to lower runoff volume but it is likely that this is the case. FSP concentrations and loads are generally greatest in the fall/winter, but concentrations can spike in the summer with intense thunderstorms, likely due to increased erosion potential from high impact raindrops on dry, exposed soil. TN concentrations tend to be highest in the summer, especially at sites near primary roads, likely due to increased vehicular traffic, but loads are generally higher in the fall/winter because of larger runoff volumes. TP concentrations and loads can be very high in the spring and summer, but loads tend to be highest in the fall/winter due to high runoff volumes. From this data we can infer that implementing improvements that reduce stormwater runoff volumes is more effective in treating pollutant loading to the lake than installing treatment devices that aim to reduce pollutant concentrations.

Table 5a: Summary statistics for all catchments for WY14.

Water Year 2014 Oct. 1, 2013 - Sep. 30, 2014			Seasonal Precipitation (in)			Total Annual Precip (in)	Seasonal Volumes (cf)			Total Annual Runoff Volume (cf)	Average Seasonal FSP Concentrations (mg/L)			Average Annual FSP Concen-tration (mg/L)	Seasonal FSP Load (lbs)			Total Annual FSP Load (lbs)	Seasonal FSP Load (#particles)			Total Annual FSP Load (#particles)
Catchment (Site) Name	Station Name	Station Acronym	Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)	
Incline Village	Incline Village	IV	8.76	3.59	2.13	14.47	47,074	12,321	16,610	76,005	78	27	113	77	228	21	117	364	2.3E+16	1.7E+15	8.7E+15	3.4E+16
Pasadena	Pasadena In	PI	8.34	3.59	4.54	16.47	99,687	9,943	25,424	135,054	85	35	81	81	530	22	128	680	5.2E+16	1.7E+15	9.4E+15	6.3E+16
	Pasadena Out	PO					99,382	9,301	24,478	133,161	36	84	118	55	225	49	180	454	2.0E+16	4.2E+15	1.3E+16	3.8E+16
Rubicon	Rubicon In	RI	13.66	5.78	3.64	23.08	19,012	15,545	1,816	36,374	12	16	106	18	<1	<1	<1	<1	1.2E+15	1.2E+15	8.2E+14	3.3E+15
	Rubicon Out	RO					0	0	0	0	0	0	0	0	0	0	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SR431	Contech In	CI	8.91	4.36	3.83	17.10	4,024	6,372	7,561	17,957	269	431	116	262	68	171	55	293	7.8E+15	1.8E+16	3.9E+15	2.9E+16
	Contech Out	CO					3,003	4,007	6,575	13,584	182	236	92	155	34	59	38	131	3.8E+15	5.7E+15	2.7E+15	1.2E+16
	Jellyfish In	JI					3,022	4,837	8,377	16,236	442	433	103	264	83	131	54	268	1.0E+16	1.3E+16	3.8E+15	2.7E+16
	Jellyfish Out	JO					3,320	4,695	8,122	16,136	109	230	74	127	23	67	38	128	2.4E+15	6.4E+15	3.8E+01	8.8E+15
	SR431 Outfall	S5					245	329	3,249	3,823	65	195	69	80	1	4	14	19	1.2E+14	3.9E+14	9.4E+14	1.4E+15
Tahoma	Tahoma	TA	14.95	3.13	4.01	22.09	207,798	65,114	59,000	331,911	111	50	70	92	1,446	204	258	1,908	1.6E+17	2.0E+16	2.4E+16	2.1E+17

Water Year 2014 Oct. 1, 2013 - Sep. 30, 2014			Seasonal Volumes (cf)			Total Annual Runoff Volume (cf)	Average Seasonal TN Concentrations (ug/L)			Average Annual TN Concen-tration (ug/L)	Seasonal TN load (lbs)			Total Annual TN load (lbs)	Average Seasonal TP Concentrations (ug/L)			Average Annual TP Concen-tration (ug/L)	Seasonal TP load (lbs)			Total Annual TP load (lbs)
Catchment (Site) Name	Station Name	Station Acronym	Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)	
Incline Village	Incline Village	IV	47,074	12,321	16,610	76,005	1,141	915	4,938	1,935	3.4	0.7	5.1	9.2	758	343	1,698	896	2.2	0.3	1.8	4.3
Pasadena	Pasadena In	PI	99,687	9,943	25,424	135,054	1,034	na	3,355	1,395	6.4	na	5.3	11.8	484	na	2,197	771	3.0	na	3.5	6.5
	Pasadena Out	PO	99,382	9,301	24,478	133,161	748	na	2,036	932	4.6	na	3.1	7.7	462	na	1,558	631	2.9	na	2.4	5.2
Rubicon	Rubicon In	RI	19,012	15,545	1,816	36,374	272	417	5,078	574	0.3	0.4	0.6	1.3	112	157	2,188	235	0.1	0.2	0.2	0.5
	Rubicon Out	RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR431	Contech In	CI	4,024	6,372	7,561	17,957	2,078	2,194	2,084	2,122	0.5	0.9	1.0	2.4	670	1,207	406	749	0.2	0.5	0.2	0.8
	Contech Out	CO	3,003	4,007	6,575	13,584	1,672	1,451	2,221	1,873	0.3	0.4	0.9	1.6	419	635	354	451	0.1	0.2	0.1	0.4
	Jellyfish In	JI	3,022	4,837	8,377	16,236	1,936	2,646	2,076	2,220	0.4	0.8	1.1	2.3	1,056	1,341	407	806	0.2	0.4	0.2	0.8
	Jellyfish Out	JO	3,320	4,695	8,122	16,136	1,109	1,372	1,816	1,542	0.2	0.4	0.9	1.6	300	627	299	394	0.1	0.2	0.2	0.4
	SR431 Outfall	S5	245	329	3,249	3,823	726	2,426	1,490	1,522	<0.1	<0.1	0.3	0.4	57	1,077	965	916	<0.1	<0.1	0.2	0.2
Tahoma	Tahoma	TA	207,798	65,114	59,000	331,911	538	1,193	2,383	994	7	5	9	21	345	857	1,643	676	4	3	6	14

Table 5b: Summary statistics for all catchments for WY15.

Water Year 2015 Oct. 1, 2014 - Sep. 30, 2015			Seasonal Precipitation (in)			Total Annual Precip (in)	Seasonal Volumes (cf)			Total Annual Runoff Volume (cf)	Average Seasonal FSP Concentrations (mg/L)			Average Annual FSP Concen-tration (mg/L)	Seasonal FSP Load (lbs)			Total Annual FSP Load (lbs)	Seasonal FSP Load (#particles)			Total Annual FSP Load (#particles)
Catchment (Site) Name	Station Name	Station Acronym	Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)	
Incline Village	Incline Village	IV	7.41	4.68	2.05	14.14	59,355	3,239	13	62,607	20	15	<1	19	73	3	<1	76	6.5E+15	2.8E+14	0.0E+00	6.8E+15
Pasadena	Pasadena In	PI	6.61	2.86	2.85	12.32	31,797	2,931	16,402	51,130	51	46	157	85	102	8	161	272	9.3E+15	6.6E+14	1.1E+16	2.1E+16
	Pasadena Out	PO					30,276	2,739	15,887	48,902	39	41	130	68	73	7	129	209	6.5E+15	4.7E+14	8.5E+15	1.6E+16
Rubicon	Rubicon In	RI	13.33	4.16	3.05	20.54	11,902	640	1,245	13,787	7	1	25	8	5	<1	2	7	3.7E+14	2.3E+12	1.3E+14	5.1E+14
	Rubicon Out	RO					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR431	Contech In	CI	9.78	5.58	3.53	18.88	11,877	9,804	3,831	25,512	128	142	17	117	95	87	4	186	1.0E+16	8.3E+15	2.0E+14	1.9E+16
	Contech Out	CO					9,379	7,976	3,295	20,650	118	94	19	93	69	47	4	120	7.1E+15	4.1E+15	3.0E+14	1.2E+16
	Jellyfish In	JI					11,014	11,281	4,359	26,654	125	119	18	105	86	84	5	175	9.5E+15	8.0E+15	3.0E+14	1.8E+16
	Jellyfish Out	JO					10,976	10,977	3,780	25,733	155	99	25	112	106	68	6	180	1.1E+16	6.1E+15	4.0E+14	1.8E+16
	SR431 Outfall	S5					460	635	758	1,853	21	15	6	13	<1	<1	<1	2	5.1E+13	4.9E+13	2.2E+13	1.2E+14
Speedboat	Speedboat	SB	6.60	3.23	2.02	11.85	154,783	53,349	22,481	230,613	150	354	195	201	1,446	1,178	274	2,898	1.5E+17	1.2E+17	2.5E+16	3.0E+17
Tahoma	Tahoma	TA	13.59	3.90	2.92	20.41	113,102	35,155	27,445	175,702	182	116	159	165	1,283	254	272	1,809	1.5E+17	2.5E+16	2.0E+16	1.9E+17
Tahoe Valley	Tahoe Valley	TV	11.06	3.63	3.06	17.75	517,596	45,322	22,580	585,498	21	34	58	23	669	95	82	846	5.6E+16	7.5E+15	5.4E+15	6.9E+16
Upper Truckee	Upper Truckee	UT	11.06	3.63	3.06	17.75	51,589	28,338	22,738	102,665	118	131	101	118	380	231	143	754	3.7E+16	2.1E+16	9.9E+15	6.8E+16

Water Year 2015 Oct. 1, 2014 - Sep. 30, 2015			Seasonal Volumes (cf)			Total Annual Runoff Volume (cf)	Average Seasonal TN Concentrations (ug/L)			Average Annual TN Concen-tration (ug/L)	Seasonal TN load (lbs)			Total Annual TN load (lbs)	Average Seasonal TP Concentrations (ug/L)			Average Annual TP Concen-tration (ug/L)	Seasonal TP load (lbs)			Total Annual TP load (lbs)
Catchment (Site) Name	Station Name	Station Acronym	Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)	
Incline Village	Incline Village	IV	59,355	3,239	13	62,607	4,269	8,811	na	4,503	15.8	1.8	na	17.6	647	599	na	645	2.4	0.1	na	2.5
Pasadena	Pasadena In	PI	31,797	2,931	16,402	51,130	804	939	5,174	2,214	1.6	0.2	5.3	7.1	505	438	1,598	852	1.0	<0.1	1.6	2.7
	Pasadena Out	PO	30,276	2,739	15,887	48,902	1,118	873	3,031	1,725	2.1	0.1	3.0	5.3	468	458	1,367	759	0.9	<0.1	1.4	2.3
Rubicon	Rubicon In	RI	11,902	640	1,245	13,787	1,522	671	1,224	1,455	1.1	<0.1	<0.1	1.3	218	150	262	219	0.2	<0.1	<0.1	0.2
	Rubicon Out	RO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SR431	Contech In	CI	11,877	9,804	3,831	25,512	1,174	1,046	891	1,082	0.9	0.6	0.2	1.7	899	703	153	711	0.7	0.4	<0.1	1.1
	Contech Out	CO	9,379	7,976	3,295	20,650	1,107	942	1,437	1,096	0.6	0.5	0.3	1.4	728	565	212	583	0.4	0.3	<0.1	0.8
	Jellyfish In	JI	11,014	11,281	4,359	26,654	1,157	968	153	913	0.8	0.7	<0.1	1.5	948	736	153	728	0.7	0.5	<0.1	1.2
	Jellyfish Out	JO	10,976	10,977	3,780	25,733	898	976	1,153	969	0.6	0.7	0.3	1.6	740	532	214	574	0.5	0.4	<0.1	0.9
	SR431 Outfall	S5	460	635	758	1,853	1,061	1,591	4,204	2,528	<0.1	<0.1	0.2	0.3	593	1,365	1,152	1,086	<0.1	<0.1	<0.1	0.1
Speedboat	Speedboat	SB	154,783	53,349	22,481	230,613	1,024	1,387	3,356	1,335	9.9	4.6	4.7	19.2	406	397	467	410	3.9	1.3	0.7	5.9
Tahoma	Tahoma	TA	113,102	35,155	27,445	175,702	631	814	5,680	1,456	4.5	1.8	9.7	16.0	602	295	1,281	647	4.3	0.6	2.2	7.1
Tahoe Valley	Tahoe Valley	TV	517,596	45,322	22,580	585,498	874	1,331	2,976	990	28.2	3.8	4.2	36.2	239	233	664	255	7.7	0.7	0.9	9.3
Upper Truckee	Upper Truckee	UT	51,589	28,338	22,738	102,665	1,708	3,360	na	1,786	5.5	5.9	na	11.4	766	1,043	na	673	2.5	1.8	na	4.3

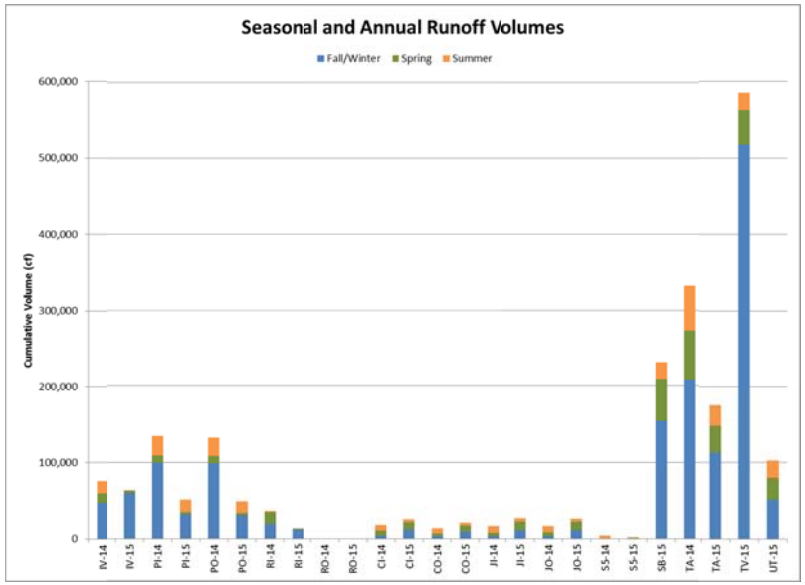

Figure 3: Runoff volumes at each monitoring station, WY14 and WY15.

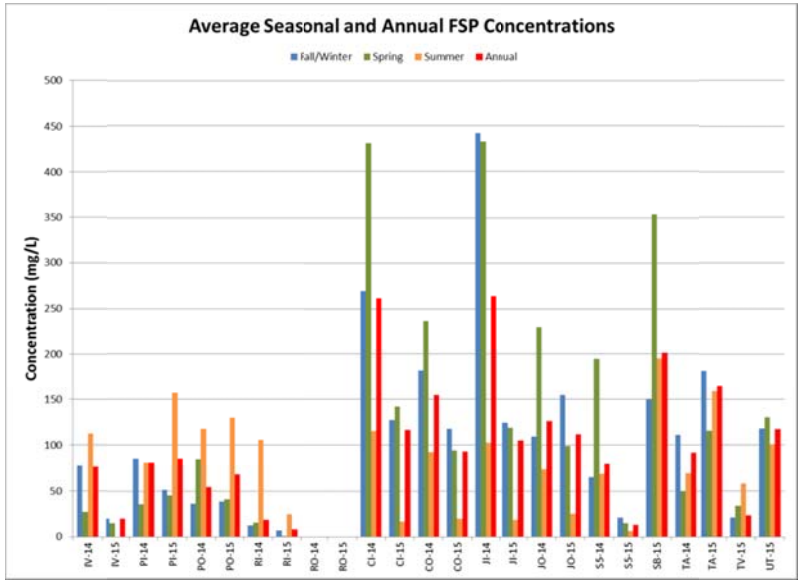

Figure 4: FSP concentrations at each monitoring station, WY14 and WY15.

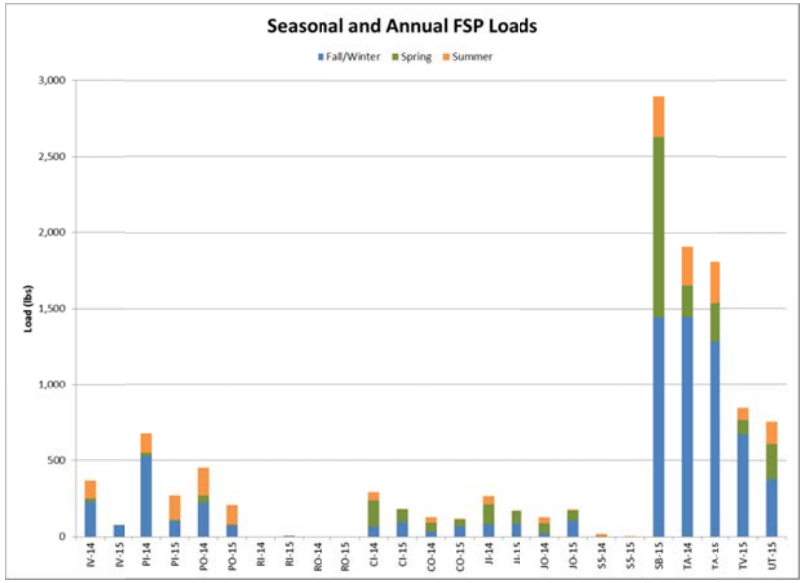

Figure 5: FSP loads at each monitoring station, WY14 and WY15.

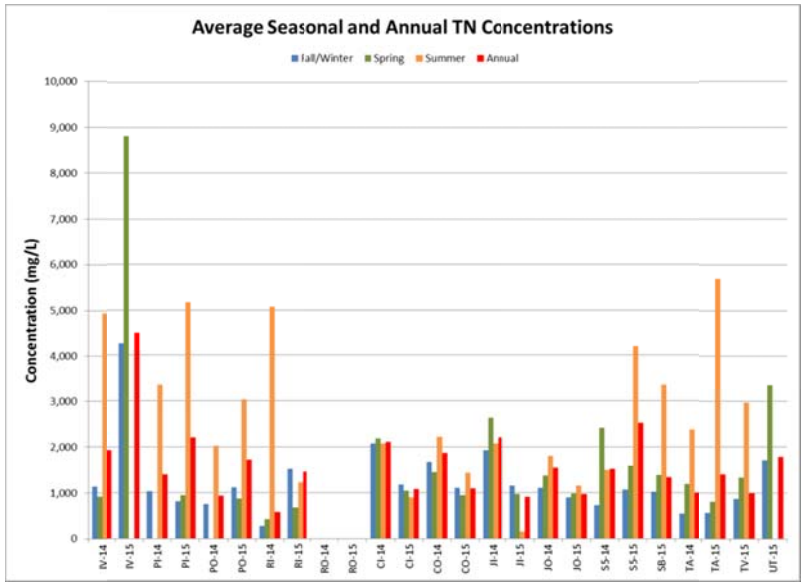

Figure 6: TN concentrations at each monitoring station, WY14 and WY15.

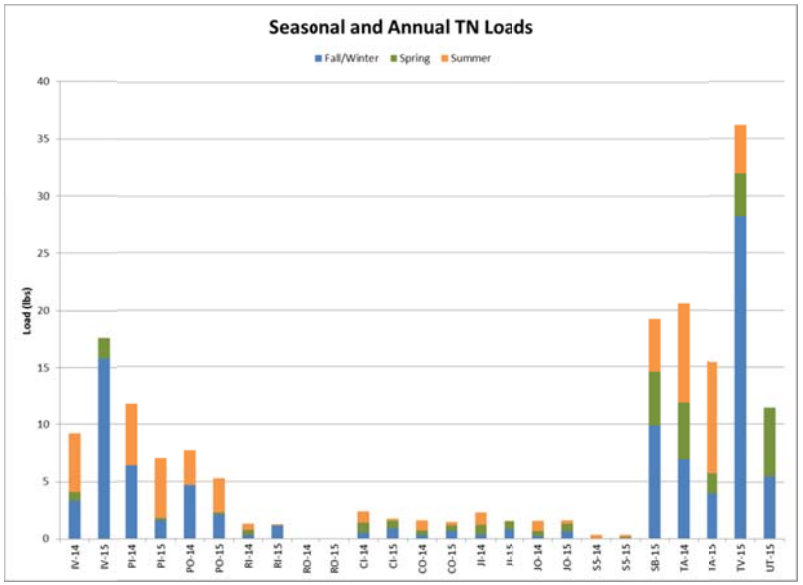

Figure 7: TN loads at each monitoring station, WY14 and WY15.

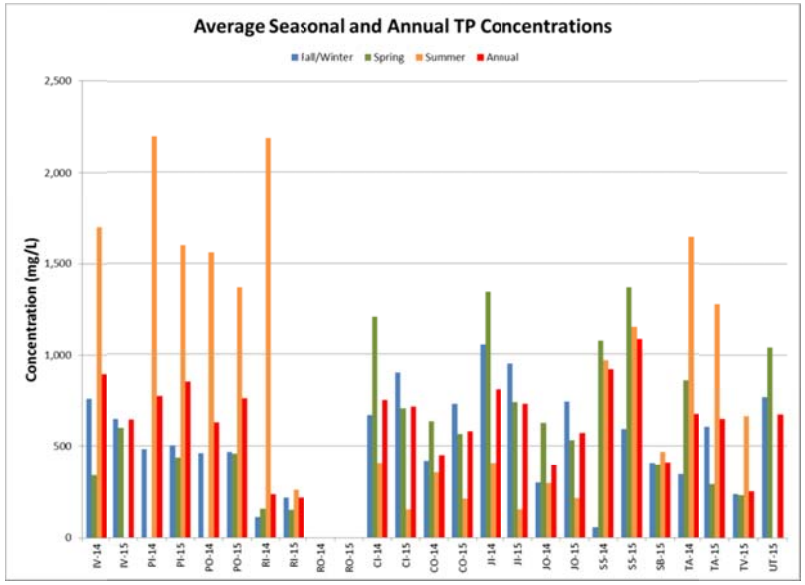

Figure 8: TP concentrations at each monitoring station, WY14 and WY15.

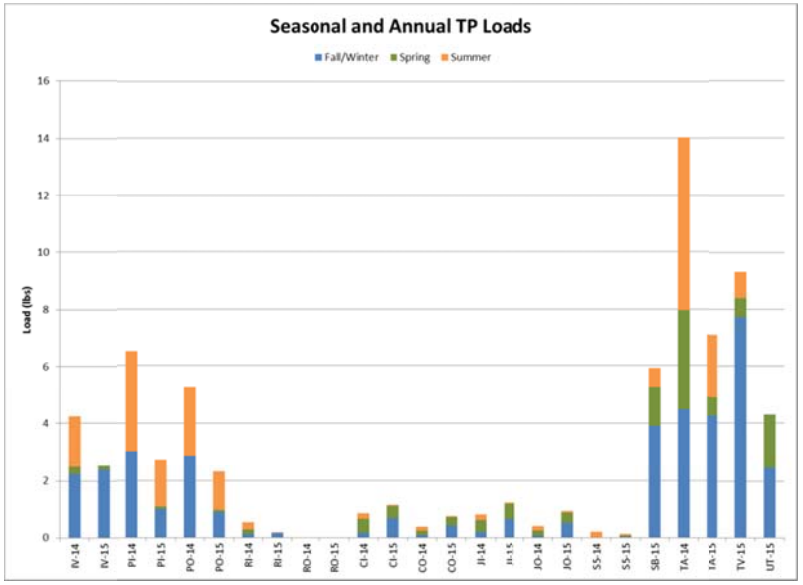

Figure 9: TP loads at each monitoring station, WY14 and WY15.

6.2 SUMMARY DATA FOR INDIVIDUAL CATCHMENTS

6.2.1 INCLINE VILLAGE

The total precipitation for WY14 in the Incline Village catchment was 14.47 inches, more than three inches less than the minimum annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 10a shows the continuous hydrology and cumulative precipitation for WY14. The majority of the precipitation fell in the fall/winter season (8.76 inches). The spring season received 3.59 inches and the summer season received 2.13 inches. A total of 31 discrete precipitation events were measured at the Incline Village meteorological station, 13 in the fall/winter, 12 in the spring, and 6 in the summer. Approximately one third of the events during WY14 produced less than a tenth of an inch of precipitation, and just under three quarters of the events produced less than half an inch. The largest storm occurred between February 6, 2014 and February 10, 2014, falling as mixed rain and snow and producing 4.80 inches of precipitation in Incline Village. Though not sampled, the highest peak flows (about 1.44 cubic feet per second (cfs)) were experienced during a high intensity thunderstorm on July 20, 2014.

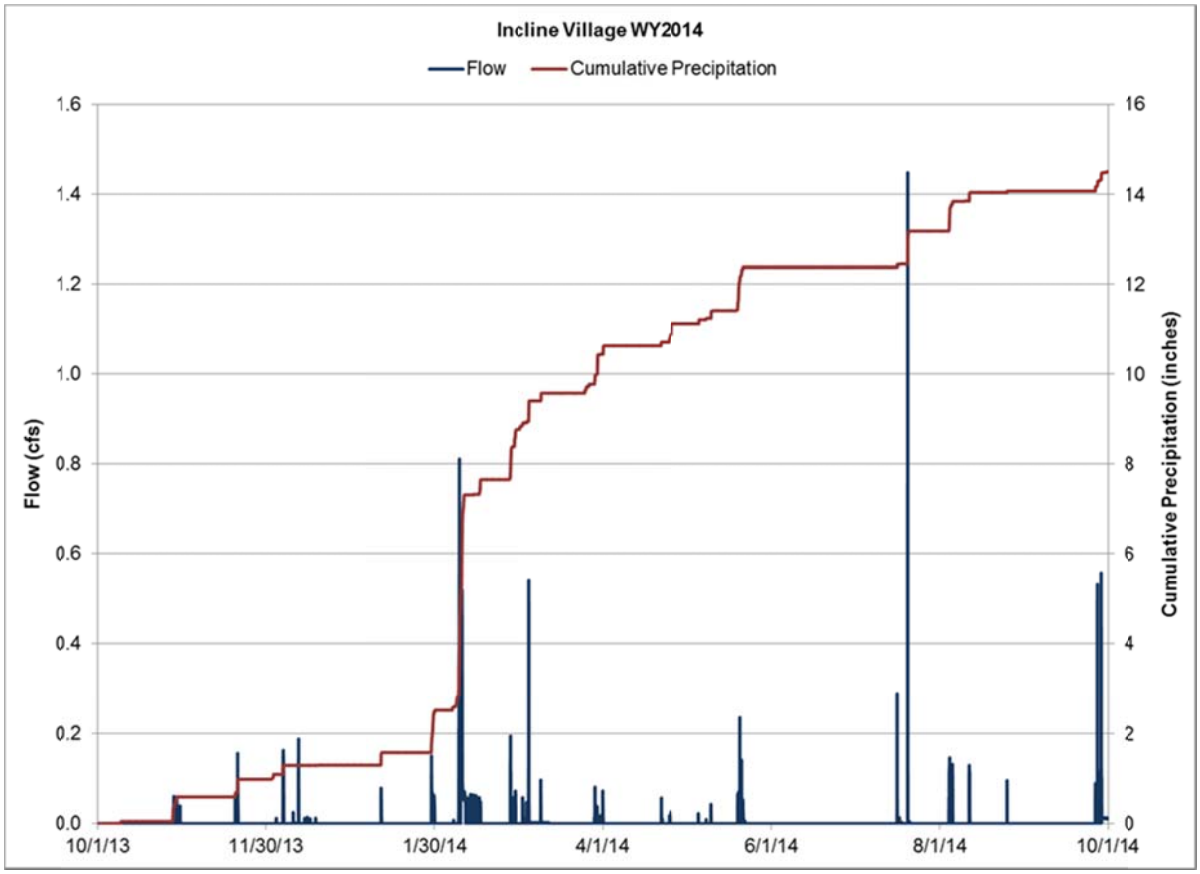

Figure 10a: Continuous hydrology and cumulative precipitation at the Incline Village catchment outfall, WY14.

The total precipitation for WY15 in the Incline Village catchment was 14.14 inches, more than three inches less than the minimum annual precipitation recorded at the Tahoe City Cross reference station since 1981. Figure 10b shows the continuous hydrology and cumulative precipitation for WY15. The majority of the precipitation fell in the fall/winter season (7.41 inches). The spring season received 4.68 inches and the

summer season received 2.05 inches. A total of 36 discrete precipitation events were measured at the Incline Village meteorological station, 15 in the fall/winter, 12 in the spring, and 9 in the summer. Approximately 33% of the events during WY15 produced less than a tenth of an inch of precipitation, and approximately 75% of the events produced less than half an inch. The largest storm occurred between February 6, 2015 and February 11, 2015, falling as mixed rain and snow and resulting in 3.34 inches of precipitation in the Incline Village catchment. The highest peak flows (about 0.95 cfs) occurred during this precipitation event.

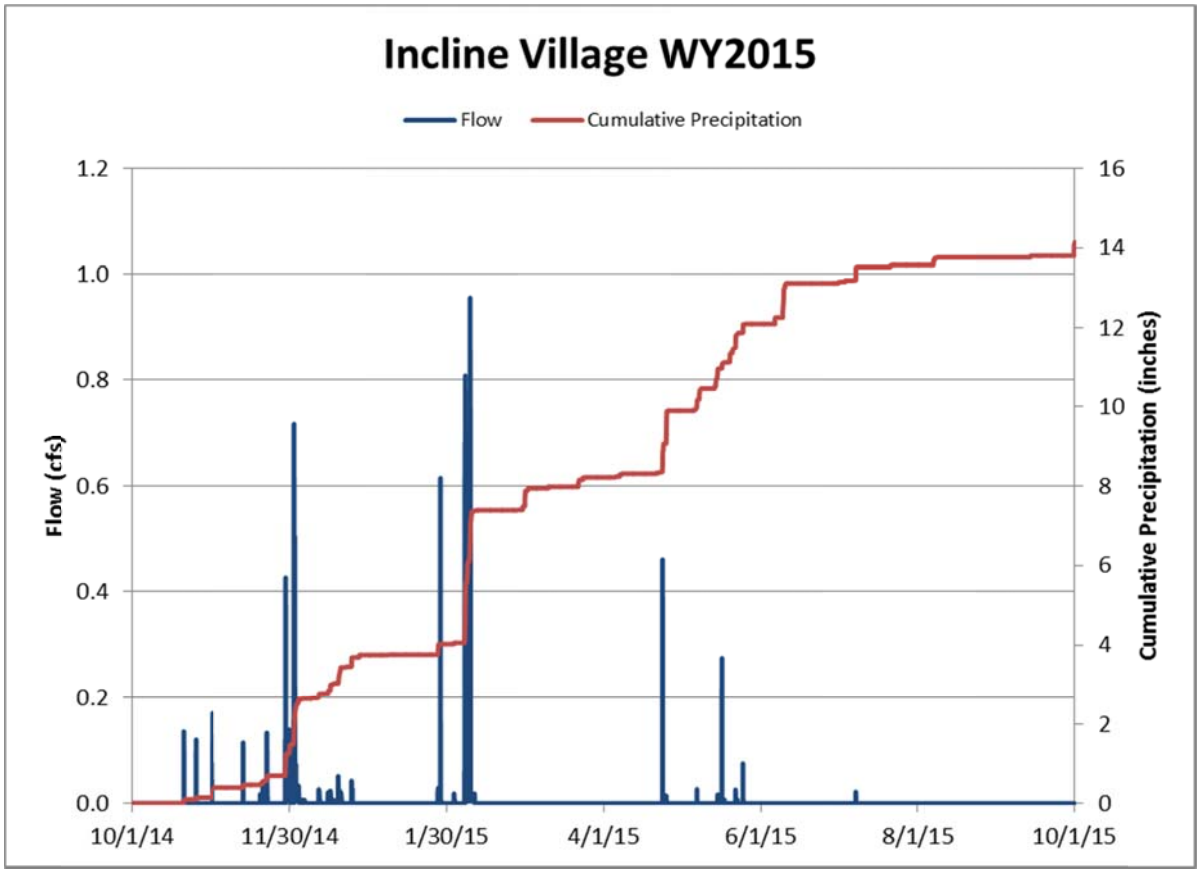

Figure 10b: Continuous hydrology and cumulative precipitation at the Incline Village catchment outfall, WY15.

In WY14, nine precipitation events in the Incline Village catchment produced sufficient runoff to sample and water quality samples were taken across the hydrograph during six of these runoff events. As this was the first year of monitoring, two extra events were sampled at Incline Village in an effort to learn the nuances of the site and to guarantee successful capture of the requisite four runoff events. Continuous hydrology, continuous turbidity and events sampled during WY14 are presented in Figure 11a. The highest turbidities occurred during the September 26, 2014 storm, and the highest peak flows occurred during the July 20, 2014 storm, but these storms were not sampled as the required one summer event had already been sampled on July 16, 2014. Additionally, the high peak flows on July 20, 2014 produced by a peak precipitation of 0.29 inches in 10 minutes overwhelmed the flume and severely eroded the channel below the sampling station. Washoe County has since repaired the channel, but the eroded channel did not affect sampling at this location.

In WY15, ten precipitation events in the Incline Village catchment produced sufficient runoff to sample during the fall/winter and spring seasons and water quality samples were taken across the hydrograph during three of these runoff events, thereby fulfilling the requisite number of sample events for fall/winter and spring. The requisite summer runoff event was not captured primarily due to lack of runoff, but also due to equipment failure during an event that could have been large enough to sample. As a result of improvements in the upper watershed (section 2.1), the CMP where the monitoring equipment is now located is designed to discharge flow only during 10-year (or larger) storm events. Unfortunately, the equipment that was installed in the CMP was later found to be faulty, so not only is it uncertain whether any of the summer thunderstorms would have generated enough runoff to sample, but no summer thunderstorms were captured. Continuous hydrology, continuous turbidity, and events sampled during WY15 are presented in Figure 11b. The highest turbidities occurred during the November 19, 2014 storm, but the event was not sampled as it did not produce sufficient flow to sample. The highest peak flows occurred during the large February 2015 storm event which produced 1.52 total inches of precipitation.

Continuous hydrology, continuous turbidity, and water quality samples for the six individual events sampled in WY14 and the three individual events sampled in WY15 are presented in Appendix C.

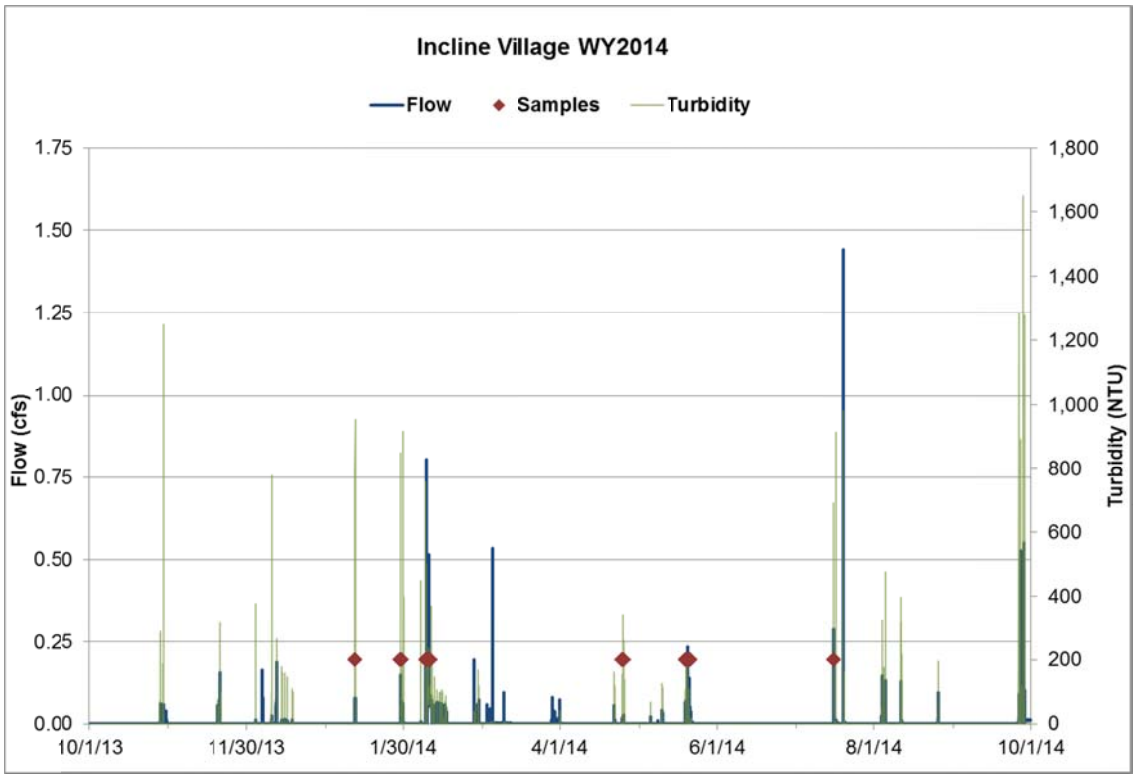

Figure 11a: Continuous hydrology, turbidity and sampled events at the Incline Village catchment outfall, WY14.

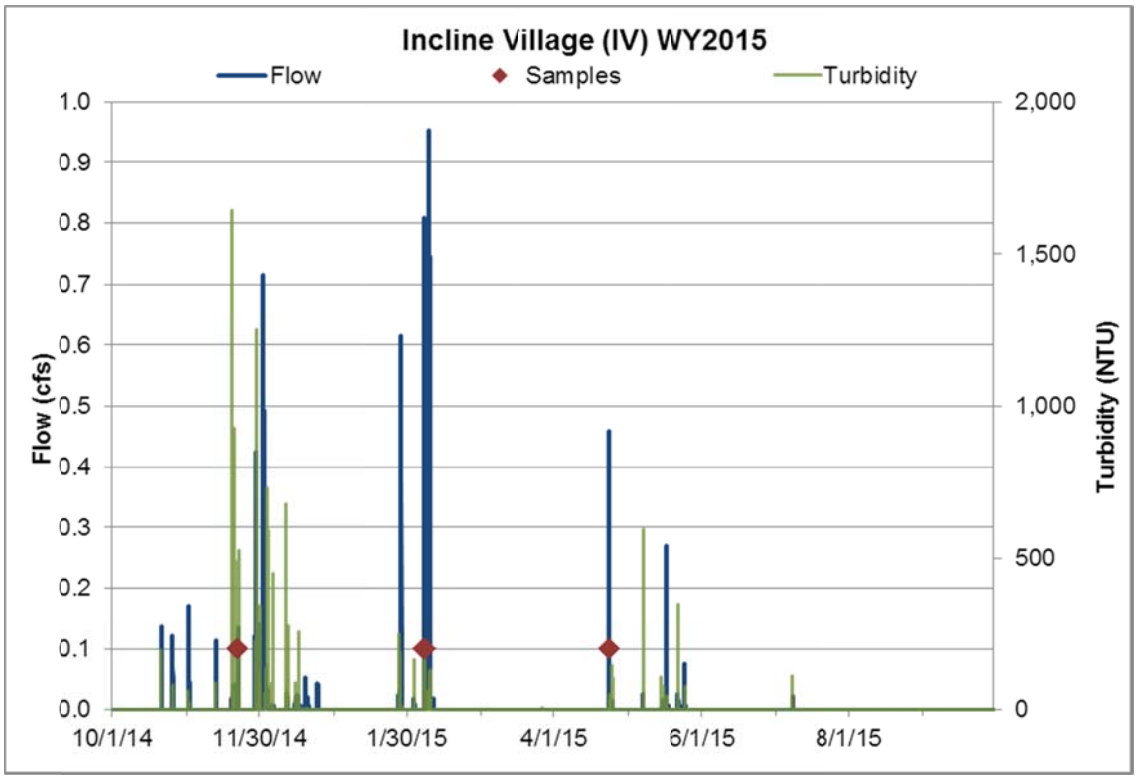

Figure 11b: Continuous hydrology, turbidity and sampled events at the Incline Village catchment outfall, WY15.

Summary data for all six events sampled at Incline Village in WY14 are presented in Table 6a. Three runoff events were sampled during the fall/winter, two during the spring, and one during the summer. In general, only precipitation events greater than 0.2 inches produced sufficient runoff for water quality sampling, though the summer thunderstorm on July 16, 2014 of only 0.06 inches produced sufficient runoff to sample as peak precipitation reached 0.03 inches in 10 minutes. The largest runoff event, with a runoff volume of 23,950 cubic feet, occurred February 8 – 10, 2014 and resulted in the highest FSP, TN, and TP loads of the year despite mid-range concentrations for all three pollutants. The highest concentrations for all three pollutants occurred during the summer thunderstorm on July 16, 2014, however loading was low because the total runoff volume was low. Fall/winter and summer events had peak turbidities of 700-1,000 NTU occurring at the beginning of each runoff event, likely due to the roads being washed clean in the beginning of each storm. Spring events had peak turbidities of only 200-350 NTU occurring in the middle of the storm when the flows were the highest (Appendix C).

Table 6a: Event summary data for six sampled events at Incline Village in WY14.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
IV	Fall/Winter	1/11/14 12:40	1/11/14 18:50	6:10	3,856	0.28	rain/snow	90%	193	46	1,555	0.4	1,114	0.3
IV	Fall/Winter	1/29/14 13:30	1/30/14 5:00	15:30	7,577	0.94	rain/snow	100%	191	90	1,556	0.7	1,117	0.5
IV	Fall/Winter	2/8/14 7:00	2/10/14 21:30	62:30	23,950	4.80	rain on snow	85%	103	154	944	1.4	587	0.9
IV	Spring	4/25/14 4:40	4/26/14 2:30	21:50	856	0.41	event snowmelt	95%	88	5	1,869	0.1	225	<0.1
IV	Spring	5/20/14 5:20	5/21/14 11:20	30:00	3,897	0.96	thunderstorm	100%	62	15	706	0.2	369	0.1
IV	Summer	7/16/14 20:10	7/16/14 22:50	2:40	578	0.06	thunderstorm	80%	391	14	4,938	0.2	1,698	0.1

Summary data for all three events sampled at Incline Village in WY15 are presented in Table 6b. Two runoff events were sampled during the fall/winter, one during the spring, and none during the summer due to insufficient runoff volumes for sampling and equipment failure (described above). Similar to WY14, only precipitation events greater than 0.2 inches produced sufficient runoff for water quality sampling. The largest runoff event, with a runoff volume of 11,284 cubic feet, occurred February 6 – 7, 2015 (only about half of the runoff of the February event in 2014) and resulted in the highest FSP, TN, and TP concentrations and loads of the year. In WY14, the highest concentrations for all three pollutants occurred during a summer thunderstorm, but WY15 thunderstorms likely produced no runoff in this catchment due to upstream improvements to infiltration (though this is uncertain due to equipment failure after reinstallation of monitoring equipment, described above). Peak turbidities this year were much lower than last year across all seasons, likely due to catchment improvements. Peak turbidities occurred at the beginning of each event (Appendix C).

Table 6b: Event summary data for three sampled events at Incline Village in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
IV	Fall/Winter	11/22/14 5:50	11/22/14 12:20	6:30	1,434	0.13	489	0.23	rain	100%	74	7	2,513	0.2	493	<0.1
IV	Fall/Winter	2/6/15 15:30	2/7/15 12:00	114:00	11,284	0.81	195	1.52	snow, rain	100%	141	99	4,492	3.2	667	0.5
IV	Spring	4/24/15 0:10	4/24/15 6:30	6:20	1,081	0.46	50	0.56	rain	80%	123	8	1,146	0.6	599	<0.1

6.2.2 PASADENA

The total precipitation for WY14 in the Pasadena catchment was 16.47 inches, approximately one inch less than the minimum annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 12a shows the continuous hydrology and cumulative precipitation for WY14. The majority of the precipitation fell in the fall/winter season (8.34 inches). The spring season received 3.59 inches and the summer season received 4.54 inches. A total of 30 discrete precipitation events were measured at the Pasadena meteorological station, 10 in the fall/winter, 13 in the spring, and 7 in the summer. Almost 40% of the events during WY14 produced less than a tenth of an inch of precipitation, and three quarters of the events produced less than half an inch. The largest storm occurred between February 7, 2014 and February 10, 2014, falling as mixed rain and snow and producing 3.93 inches of precipitation in South Lake Tahoe. The highest peak flows (about 1.4 cfs at Pasadena Inflow and about 1.5 cfs at Pasadena Outflow) were experienced during this same precipitation event.

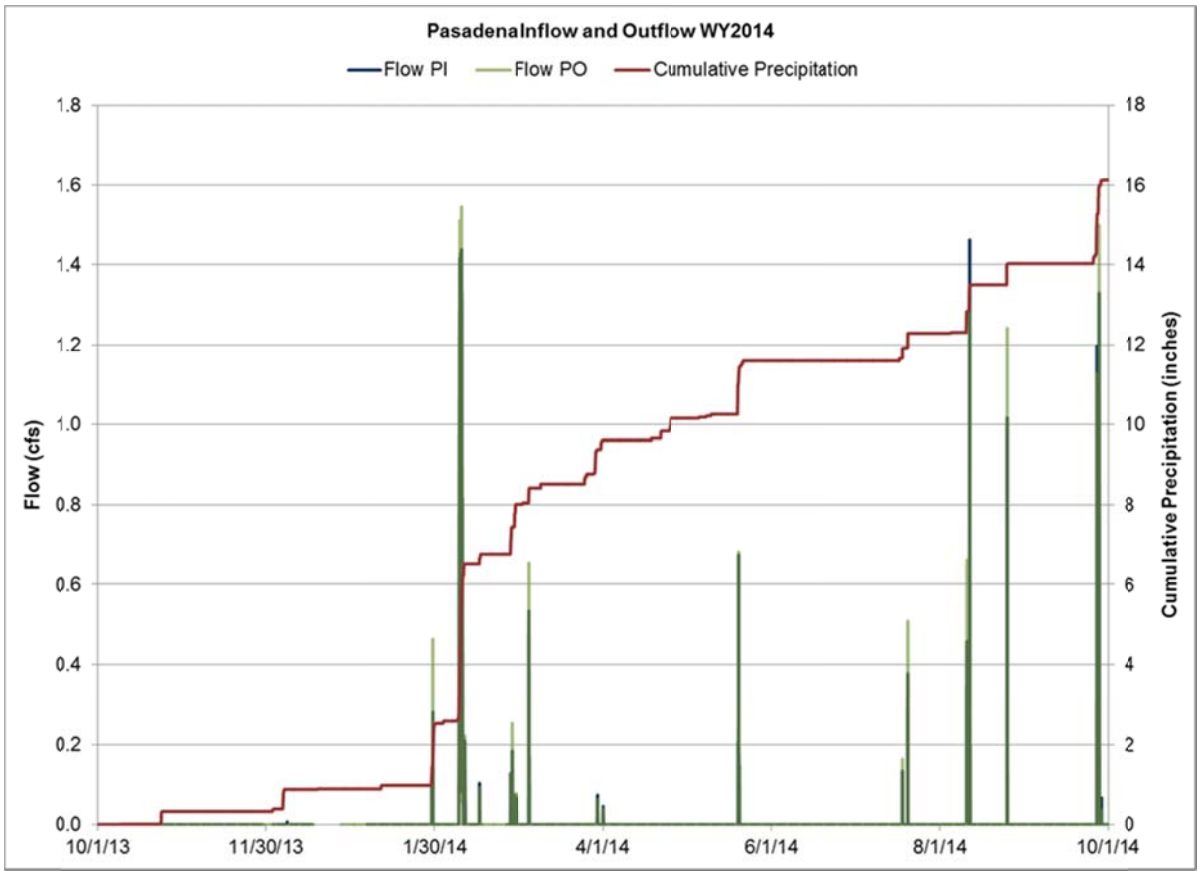

Figure 12a: Continuous hydrology and cumulative precipitation at the Pasadena monitoring site, WY14.

The total precipitation for WY15 in the Pasadena catchment was 12.32 inches, more than five inches less than the minimum annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 12b shows the continuous hydrology and cumulative precipitation for WY15. The majority of the precipitation fell in the fall/winter season (6.61 inches). The spring season received 2.86 inches and the summer season received 2.85 inches. A total of 37 discrete precipitation events were measured at the Pasadena meteorological station, 17 in the fall/winter, 9 in the spring, and 11 in the summer. Approximately 57% of the events during WY15 produced less than a tenth of an inch of precipitation, and approximately 92% of the events produced less than half an inch. The largest storm occurred between February 6, 2015 and February 9, 2015, falling as mixed rain and snow and resulting in 3.09 inches of precipitation in the Pasadena catchment. The highest peak flows (about 1.81 cfs at Pasadena Inflow and about 2.2 cfs at Pasadena Outflow) occurred during this precipitation event.

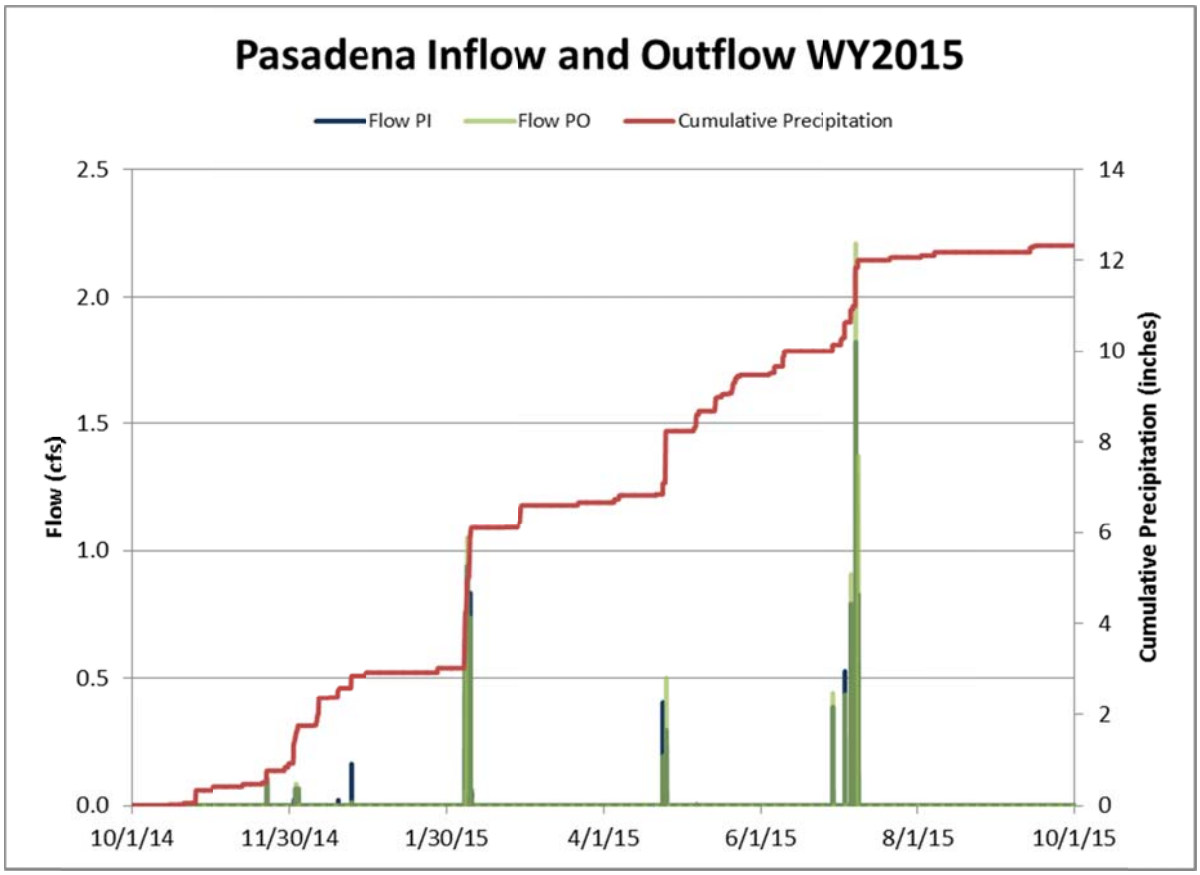

Figure 12b: Continuous hydrology and cumulative precipitation at the Pasadena monitoring site, WY15

Though nine precipitation events in the Pasadena catchment produced sufficient runoff to sample during WY14, water quality samples were taken across the hydrograph during four runoff events as required for regulatory compliance. Continuous hydrology, continuous turbidity, and events sampled during WY14 are presented in Figure 13a (Pasadena Inflow) and Figure 14a (Pasadena Outflow). The highest inflow turbidities to the storm filter occurred during the first storm of the year, January 29-30, 2014. The highest inflow volumes occurred during the largest storm of the year (February 8-10, 2014) and the thunderstorm that occurred on August 10, 2014 as the peak precipitation reached 0.28 inches in ten minutes. However, this event was not sampled as the requisite one summer event was already sampled on July 17, 2014. Peak outflow turbidities for WY14 occurred during the intense August 10, 2014 thunderstorm, and highest peak outflows occurred during the large February 2014 event.

In WY15, only four precipitation events in the Pasadena catchment produced sufficient runoff to sample and water quality samples were taken across the hydrograph during all four runoff events as required for regulatory compliance. Continuous hydrology, continuous turbidity, and events sampled during WY15 are presented in Figure 13b (Pasadena Inflow) and Figure 14b (Pasadena Outflow). The highest inflow and outflow turbidities to the Stormfilter occurred on June 29, 2015, but the storm did not produce enough flow to sample. The highest peak flows for both the inflow and outflow occurred during a high intensity summer thunderstorm on July 8, 2015 which produced a peak precipitation rate of 0.32 inches in 10 minutes.

Continuous hydrology, continuous turbidity, and water quality samples for the four individual events in WY14 and four individual events in WY15 are presented in Appendix D.

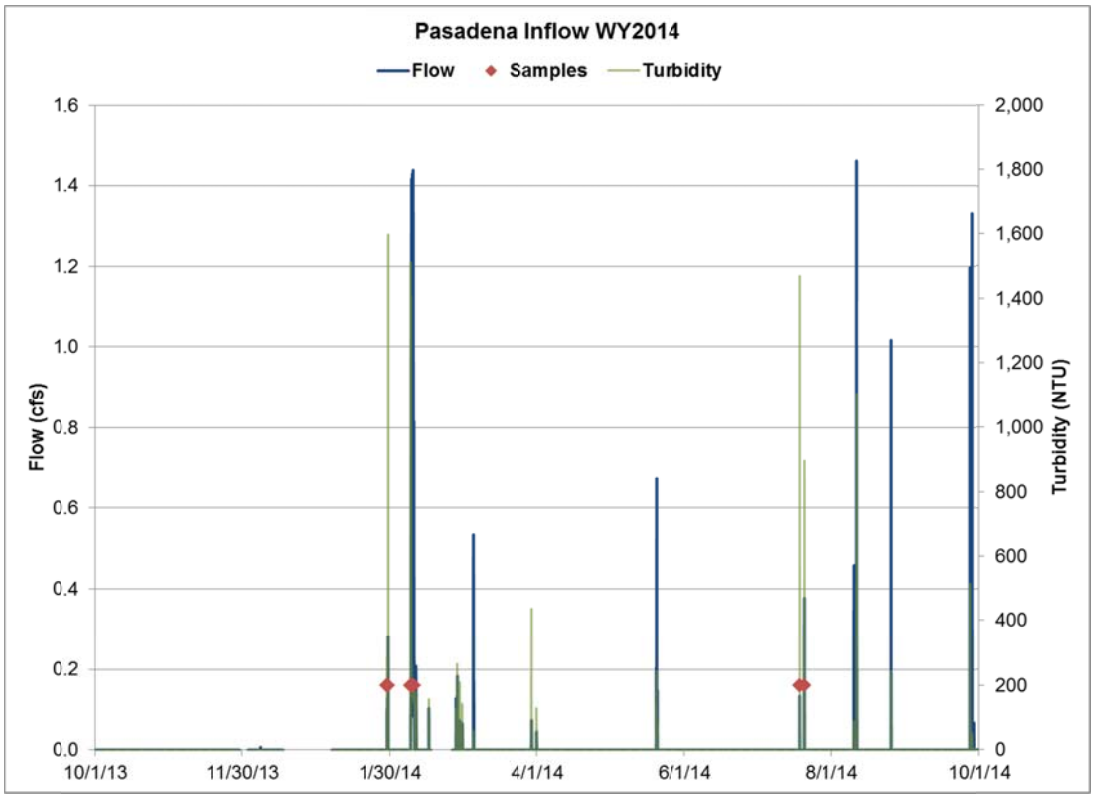

Figure 13a: Continuous hydrology, turbidity and sampled events at the inflow to the Pasadena Stormfilter, WY14. Two events were sampled mid-July (July 18 and July 20, 2014).

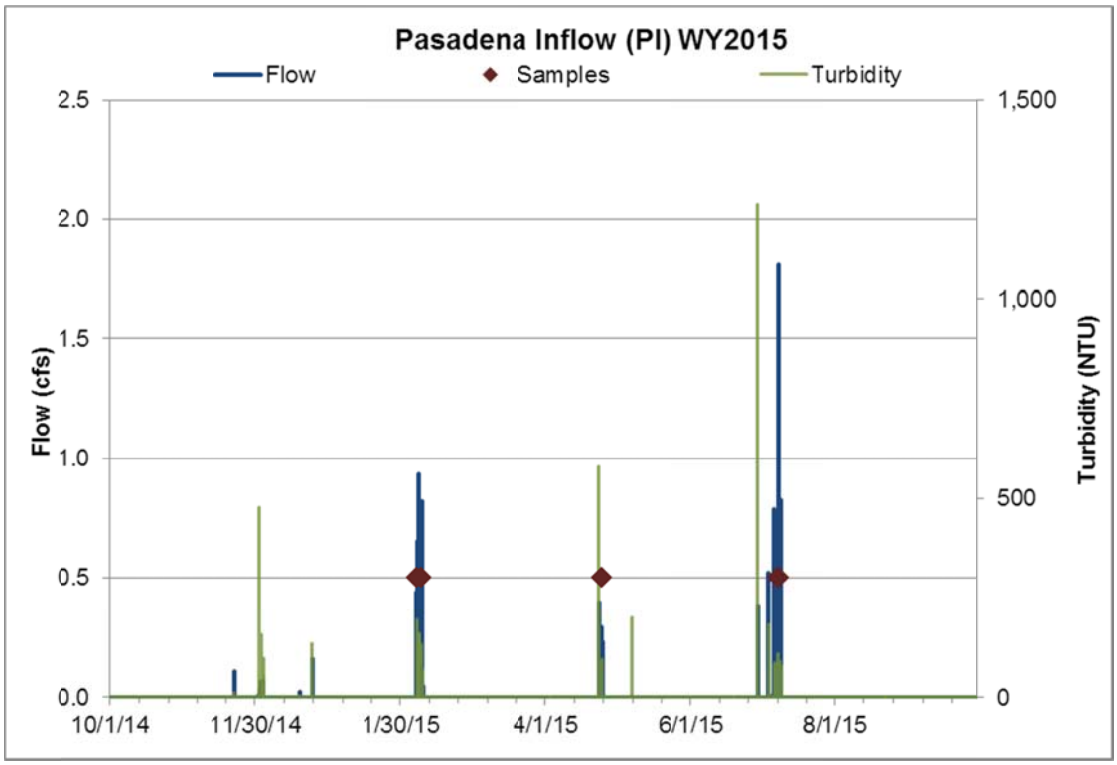

Figure 13b: Continuous hydrology, turbidity and sampled events at the inflow to the Pasadena Stormfilter, WY15. (Two events were sampled during the large February 6-8, 2015 storm).

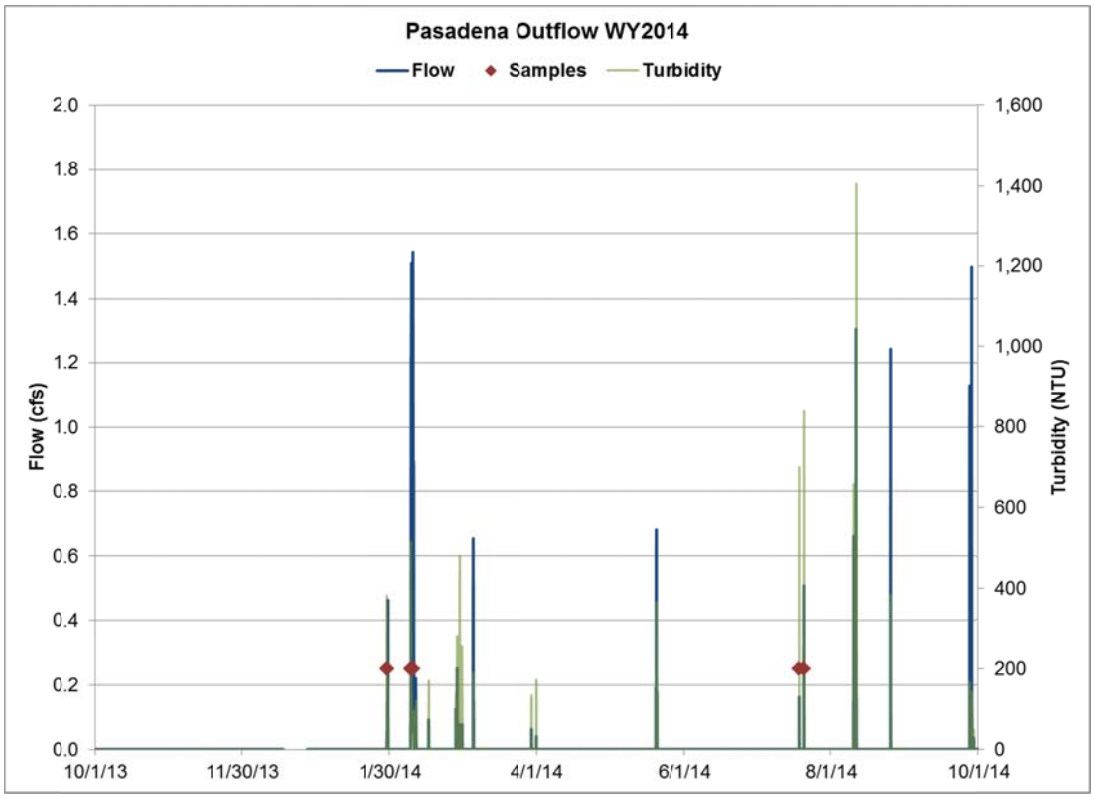

Figure 14a: Continuous hydrology, turbidity and sampled events at the outflow from the Pasadena Stormfilter, WY14. Two events were sampled mid-July (July 18 and July 20, 2014).

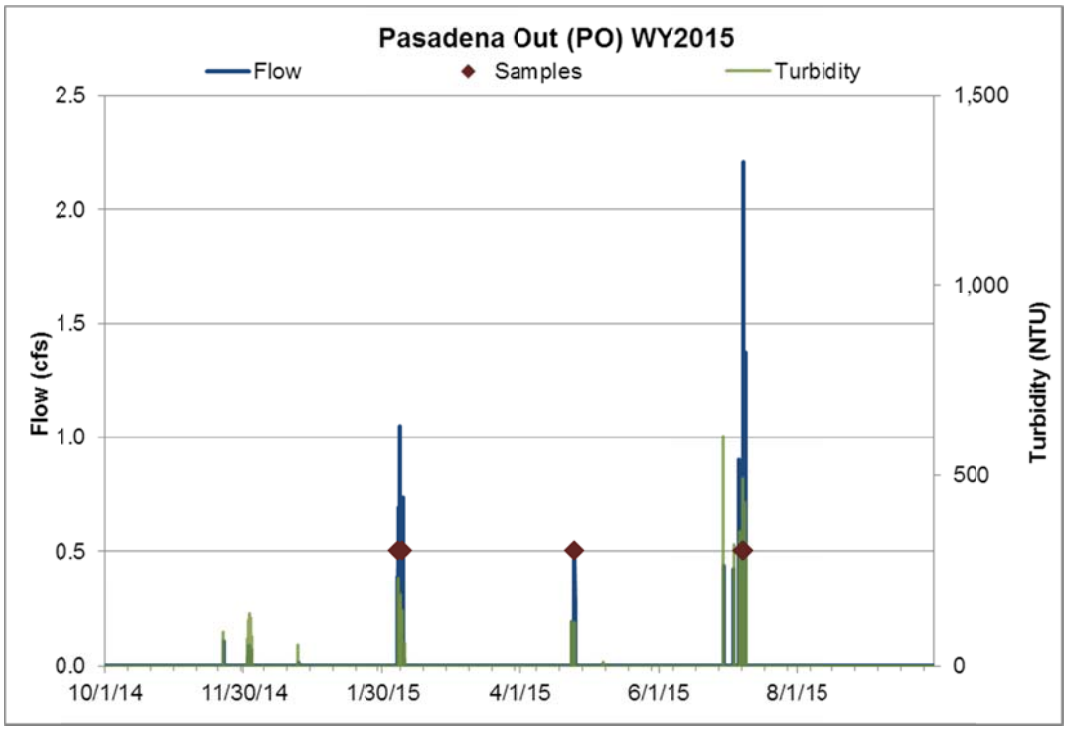

Figure 14b: Continuous hydrology, turbidity and sampled events at the outflow from the Pasadena Stormfilter, WY15. Two events were sampled during the large February 6-8, 2015 storm.

Summary data for the four events sampled at Pasadena in WY14 are presented in Table 7a. Two runoff events were sampled during the fall/winter and two during the summer. Only one runoff event during the spring produced sufficient runoff to sample (May 20, 2014) but unfortunately equipment failure at the outflow did not allow for successful sampling. Due to the effectiveness of the upstream in-situ infiltration BMPs, this site requires a relatively large amount of precipitation before it begins to flow, and therefore only precipitation events greater than 1.5 inches and high intensity thunderstorms greater than 0.3 inches produced sufficient runoff for water quality sampling. With greater than 90,000 cubic feet of runoff between February 8th and 10th, this rain on snow event resulted in the highest FSP, TN, and TP loading at the outflow, despite having the lowest concentrations of all three pollutants. The highest inflow concentrations of all three pollutants occurred during the July 18th thunderstorm despite the low runoff volumes, likely due to the high intensity of the storm (0.14 inches in 10 minutes) that is easily able to mobilize sediments and nutrients and deliver them to the monitoring site. The highest outflow concentrations of FSP and TP occurred during the July 20, 2014 event, and the highest outflow TN concentration occurred two days prior during the July 18th event. Since the requisite number of summer events had already been sampled, the larger summer events occurring August 10th (1.20 inches of precipitation, runoff volume 1,947 cubic feet), August 25th (0.52 inches of precipitation, runoff volume 2,020 cubic feet) and September 26th (2.09 inches of precipitation, runoff volume 8,066 cubic feet) were not sampled. Because of large runoff volumes, it is likely that loading from these events, the September event in particular, were large. Stormfilter efficiency will be discussed in section 7.1. Fall/winter events and the first summer event had peak inflow turbidities of close to 1,600 NTU. The second summer event had peak inflow turbidities of about 900 NTU and peak outflow turbidities of about 850 NTU (Appendix D).

Table 7a: Event summary data for four sampled events at Pasadena in WY14.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
PI	Fall/Winter	1/29/14 15:10	1/30/14 3:40	12:30	10,109	1.54	rain/snow	70%	64	40	1,884	1.2	873	0.6
PO		1/29/14 15:50	1/30/14 2:40	10:50	10,072			100%	110	69	2,583	1.6	980	0.6
PI	Fall/Winter	2/8/14 9:10	2/10/14 5:20	44:10	90,399	3.93	rain/snow	100%	46	257	939	5.3	440	2.5
PO		2/8/14 9:20	2/10/14 6:30	45:10	90,934			100%	46	260	544	3.1	404	2.3
PI	Summer	7/18/14 17:00	7/18/14 18:20	1:20	280	0.32	thunderstorm	90%	534	9	9,837	0.2	3,615	0.1
PO		7/18/14 17:20	7/18/14 18:10	0:50	245			70%	207	3	3,627	0.1	1,497	<0.1
PI	Summer	7/20/14 14:10	7/20/14 16:40	2:30	1,671	0.37	thunderstorm	95%	262	27	2,269	0.2	1,960	0.2
PO		7/20/14 14:30	7/20/14 17:30	3:00	1,646			100%	250	26	1,799	0.2	1,567	0.2

Summary data for the four events sampled at Pasadena in WY15 are presented in Table 7b. Two runoff events were sampled during the fall/winter, one in the spring, and one in the summer. Similar to WY14, this site requires greater than one inch of precipitation in order to flow. The events beginning February 6, 2015 and February 8, 2015 were actually one four day rain event split in two because of a cessation in flow between the morning of February 7 and the afternoon of February 8. Similar to Upper Truckee, the EMCs of all three pollutants remained relatively high during the latter part of the storm at this site potentially indicating that the streets were not washed clean by the first pulse of the storm. This is unlike results at Speedboat, Tahoma, and Tahoe Valley where the second portion of the runoff was significantly cleaner than the first part. The highest EMCs of all three pollutants occurred during the very large summer thunderstorm, and consequently resulted in the greatest loads of all three pollutants as well. Stormfilter efficiency will be discussed in section 7.1. Interestingly, peak turbidities were higher at the outflow (PO) for all events, generally occurring at the beginning of each event, perhaps due to flushing of sediments from previous

events retained in the vault. Peak turbidities in WY15 ranged from about 100 to 400 NTU, significantly lower than in WY14 and low compared to most other sites (Appendix D).

Table 7b: Event summary data for four sampled events at Pasadena in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
PI	Fall/Winter	2/6/15 19:10	2/7/15 5:10	10:00	10,347	0.82	195	1.24	snow, rain	90%	62	40	889	0.6	611	0.4
PO		2/6/15 19:20	2/7/15 6:00	24:00	10,033	0.69	231			100%	57	36	1,690	1.1	589	0.4
PI	Fall/Winter	2/8/15 13:10	2/9/15 7:20	18:10	12,855	2.38	131	1.85	rain	100%	43	35	736	0.6	419	0.3
PO		2/8/15 13:20	2/9/15 0:10	10:50	12,258	3.13	143			100%	35	27	649	0.5	369	0.3
PI	Spring	4/25/15 9:40	4/25/15 14:30	4:50	3,406	0.49	96	1.38	rain	100%	46	10	939	0.2	438	0.1
PO		4/25/15 10:10	4/25/15 15:20	5:10	2,369	0.50	114			100%	51	8	873	0.1	458	0.1
PI	Summer	7/8/15 11:30	7/8/15 19:50	8:20	10,021	1.81	108	1.36	thunderstorm	90%	157	98	5,174	3.2	1,598	1.0
PO		7/8/15 12:00	7/8/15 21:40	9:40	10,173	2.21	428			100%	112	71	3,031	1.9	1,367	0.9

6.2.3 RUBICON

The total precipitation for WY14 at the Rubicon meteorological station was 23.08 inches, within the first quartile of the annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 15a shows the continuous hydrology and cumulative precipitation for WY14. The majority of the precipitation fell in the fall/winter season (13.66 inches). The spring season received 5.78 inches and the summer season received 3.64 inches. A total of 33 discrete precipitation events were measured at the Rubicon meteorological station, 13 in the fall/winter, 13 in the spring, and 7 in the summer. About a fifth of the events during WY14 produced less than a tenth of an inch of precipitation, and two thirds of the events produced less than half an inch. The largest storm occurred between February 8, 2014 and February 10, 2014, falling as mixed rain and snow and producing 5.60 inches of precipitation in Rubicon. The highest peak flows (about 0.5 cfs) were experienced during a high intensity thunderstorm on July 17, 2014.

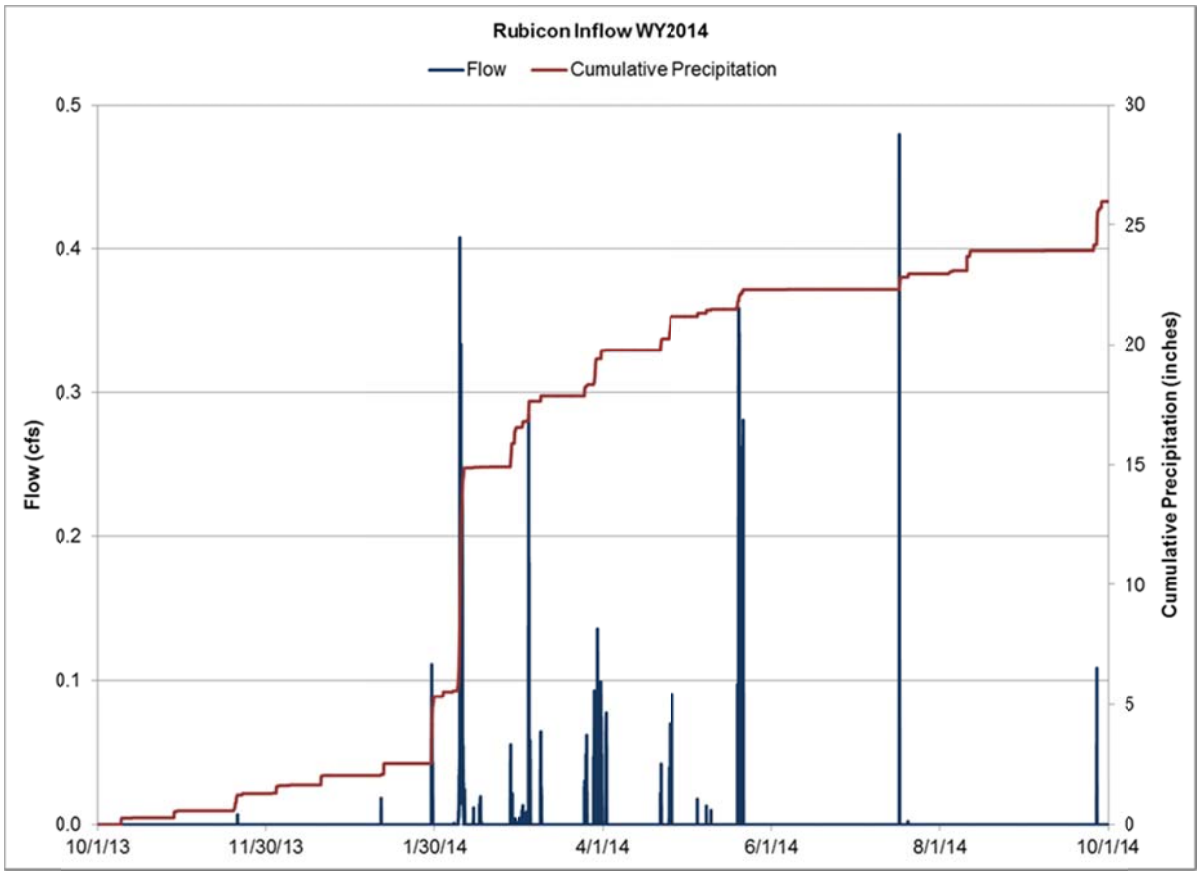

Figure 15a: Continuous hydrology and cumulative precipitation at the Rubicon Inflow station, WY14.

The total precipitation for WY15 at the Rubicon meteorological station was 20.54 inches, which falls within the first quartile of the annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 15b shows the continuous hydrology and cumulative precipitation for WY15. The majority of the precipitation fell in the fall/winter season (13.33 inches). The spring season received 4.16 inches and the summer season received 3.05 inches. A total of 37 discrete precipitation events were measured at the Rubicon meteorological station, 15 in the fall/winter, 12 in the spring, and 10 in the summer. Approximately 32% of the events during WY15 produced less than a tenth of an inch of precipitation, and approximately 70% of the events produced less than half an inch. The largest storm occurred between February 6, 2015 and February 9, 2015, falling as rain and resulted in 6.40 inches of precipitation in the Rubicon catchment. The highest peak flows (about 0.3 cfs) occurred during this precipitation event.

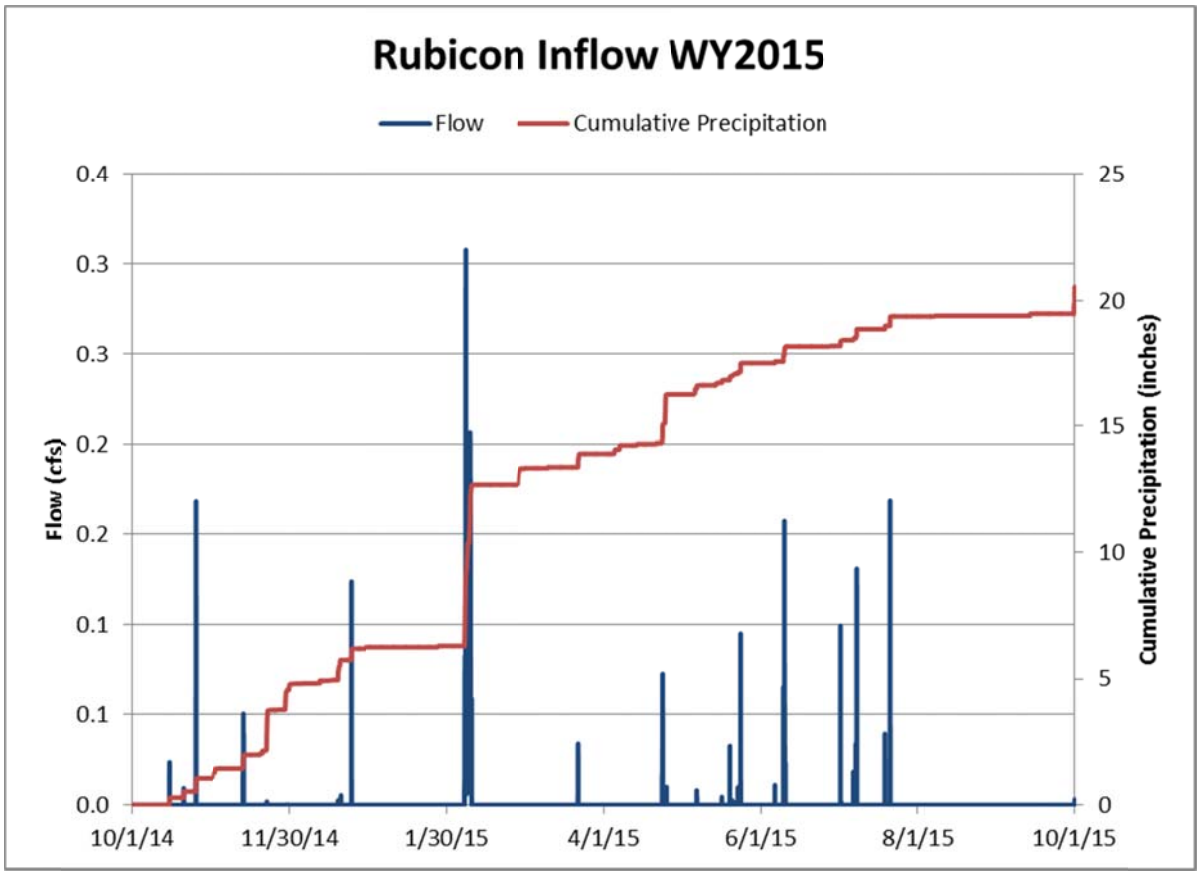

Figure 15b: Continuous hydrology and cumulative precipitation at the Rubicon Inflow station, WY15.

During both WY14 and WY15, the monitoring station at the outflow from the Stormtech chambers at Rubicon never measured any flow, indicating that 100% of runoff volumes were successfully infiltrated and no pollutant loads were delivered to the lake.

Though six runoff events in the Rubicon catchment in WY14 produced sufficient runoff to sample at the inflow, water quality samples were taken across the hydrograph during four runoff events as required for regulatory compliance. Continuous hydrology at the inflow to the Stormtech chambers and events sampled during WY14 are presented in Figure 16a. (There is no continuous turbidimeter at this station). The greatest inflows for WY14 occurred during the July 17, 2014 thunderstorm even though peak precipitation only reached 0.03 inches in ten minutes.

In WY15, though four runoff events in the Rubicon catchment produced sufficient runoff to sample at the inflow, water quality samples were taken across the hydrograph during three runoff events; the large February storm event was missed due to equipment failure. Continuous hydrology at the inflow and events sampled during WY15 are presented in Figure 16b. For WY15, the greatest inflows occurred during the large February 6-8, 2015 event, however, as previously mentioned, this storm was not sampled due to equipment failure.

Continuous hydrology, continuous turbidity, and water quality samples for the four individual events in WY14 and three individual events in WY15 are presented in Appendix E.

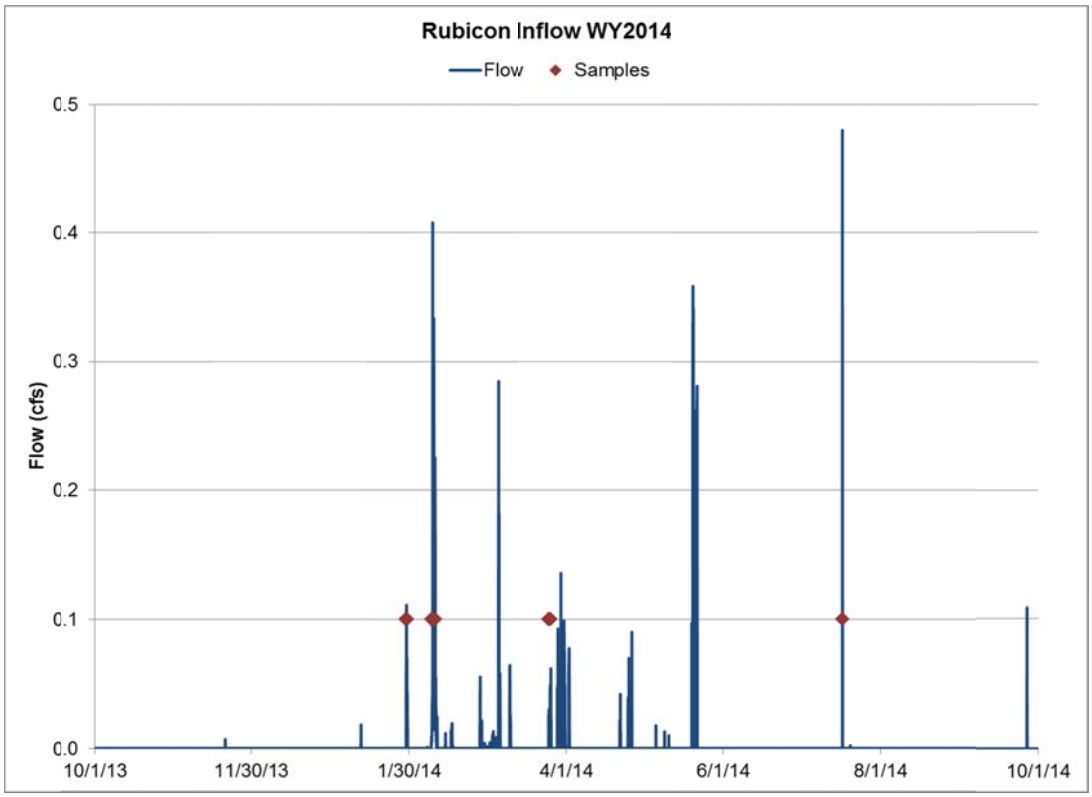

Figure 16a: Continuous hydrology and sampled events at the inflow to the Rubicon Stormtech chambers, WY14.

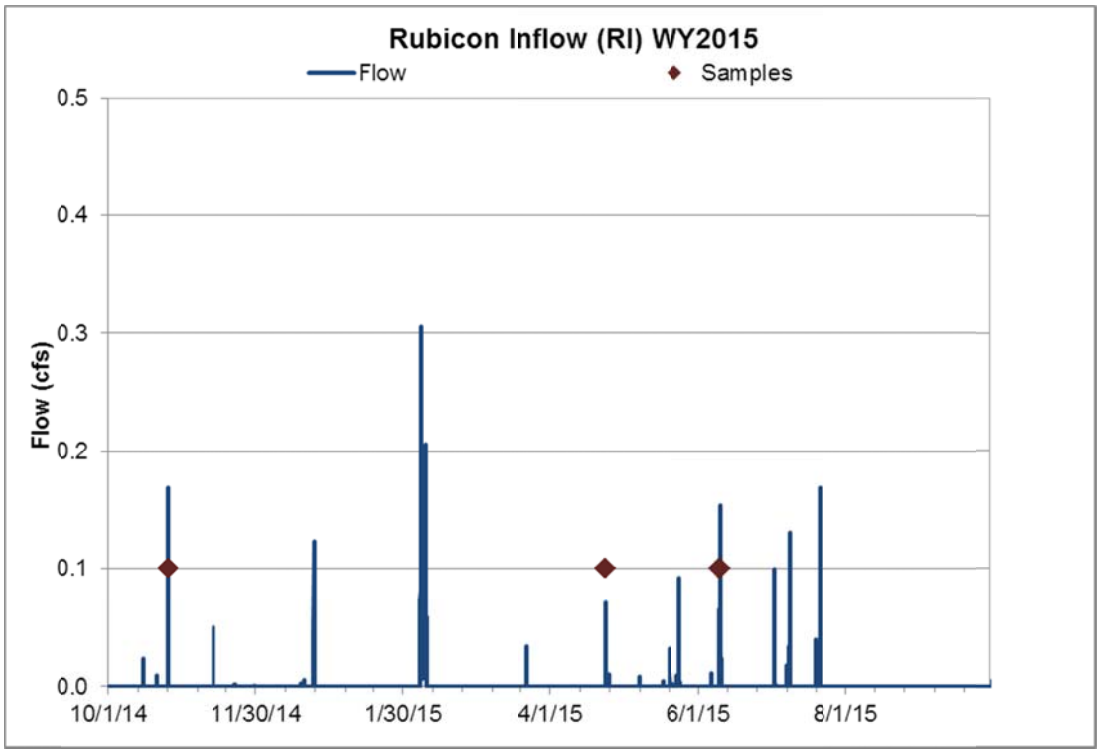

Figure 16b: Continuous hydrology and sampled events at the inflow to the Rubicon Stormtech chambers, WY15. The large February 6, 2015 storm was not sampled due to equipment failure.

Summary data for the four events sampled at Rubicon in WY14 are presented in Table 8a. Two runoff events were sampled during the fall/winter, one during the spring, and one during the summer. Due to the very large runoff volumes, FSP, TN, and TP loads were the greatest for the event occurring February 8-10, 2014 despite having the lowest pollutant concentrations. As with Pasadena, concentrations of all three pollutants were the highest during the large thunderstorm on July 17, 2014 that produced the highest flows of the year in this catchment. The relatively high flows that occurred on May 20, 2014 were not sampled because the requisite one spring event had already been successfully sampled on March 25, 2014.

Table 8a: Event summary data for four sampled events at Rubicon in WY14.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
RI	Fall/Winter	1/29/14 12:30	1/30/14 2:30	14:00	1,829	3.29	rain/snow	100%	28	3	378	<0.1	259	<0.1
RO		na	na	na	0			-	-	-	-	-	-	-
RI	Fall/Winter	2/8/14 2:50	2/10/14 4:50	50:00	16,441	5.60	rain/snow	100%	11	11	261	0.3	95	0.1
RO		na	na	na	0			-	-	-	-	-	-	-
RI	Spring	3/25/14 20:20	3/26/14 20:50	24:30	1,073	0.47	event snowmelt	100%	16	1	417	<0.1	157	<0.1
RO		na	na	na	0			-	-	-	-	-	-	-
RI	Summer	7/17/14 14:40	7/17/14 17:20	2:40	1,501	0.50	thunderstorm	75%	106	10	5,078	0.5	2,188	0.2
RO		na	na	na	0			-	-	-	-	-	-	-

Summary data for the three events sampled at Rubicon in WY15 are presented in Table 8b. One runoff event was sampled in each season. Mean FSP and TP concentrations were the highest in the summer, and mean TN concentration was highest in the fall/winter. Mean FSP concentration and event load were very small in the spring; in fact, the sample was too clean for PSD analysis. Mean FSP concentration and event load were highest in the summer after a relatively high intensity thunderstorm on June 10, 2015. TN and TP loads were very small for all events because of minimal runoff volumes.

Table 8b: Event summary data for three sampled events at Rubicon in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
RI	Fall/Winter	10/25/14 11:50	10/25/14 15:00	3:10	742	0.17	na	0.51	rain	95%	7	0.3	1,522	<0.1	218	<0.1
RO		na	na	na	0	na	na			-	-	-	-	-	-	-
RI	Spring	4/23/15 21:20	4/24/15 2:50	5:30	274	0.07	na	0.72	rain	100%	na	na	671	<0.1	150	<0.1
RO		na	na	na	0	na	na			-	-	-	-	-	-	-
RI	Summer	6/10/15 1:10	6/10/15 21:40	20:30	603	0.15	na	0.62	thunderstorm	85%	25	0.9	1,224	<0.1	262	<0.1
RO		na	na	na	0	na	na			-	-	-	-	-	-	-

Efficiency of the Rubicon infiltration chamber will be discussed in section 7.2.

6.2.4 SR431

The total precipitation for WY14 at the SR431 meteorological station was 17.10 inches, 0.4 inches lower than the minimum annual precipitation value at the Tahoe City Cross reference station since 1981 (Table 4). Figure 17a shows the continuous hydrology at the catchment outfall station (S5) and the inflow to the treatment vaults (obtained by the sum of the inflow to the Contech MFS (CI) and the inflow to the Jellyfish (JI)) as well as cumulative precipitation for WY14. Incoming flow to the treatment vaults is split roughly in half, as water is diverted equally into the Jellyfish and Contech MFS treatment vaults. The majority of the precipitation fell in the fall/winter season (8.91 inches). The spring season received 4.36 inches and the summer season received 3.83 inches. A total of 39 discrete precipitation events were measured at the SR431 meteorological station, 14 in the fall/winter, 13 in the spring, and 12 in the summer. Fall/winter and

spring precipitation events were either snow, rain, or mixed rain and snow. Summer events were either thunderstorms or frontal rain storms. Close to 40% of the events during WY14 produced less than a tenth of an inch of precipitation, and three quarters of the events produced less than half an inch. The largest storm occurred between February 6, 2014 and February 10, 2014, falling as mixed rain and snow and producing 4.80 inches of precipitation at SR431, but failed to produce sufficient runoff to sample. Almost 60% of the precipitation events resulted in no runoff at the outfall station. The highest peak flows (about 1.4 cfs) occurred during a high intensity thunderstorm on July 20, 2014.

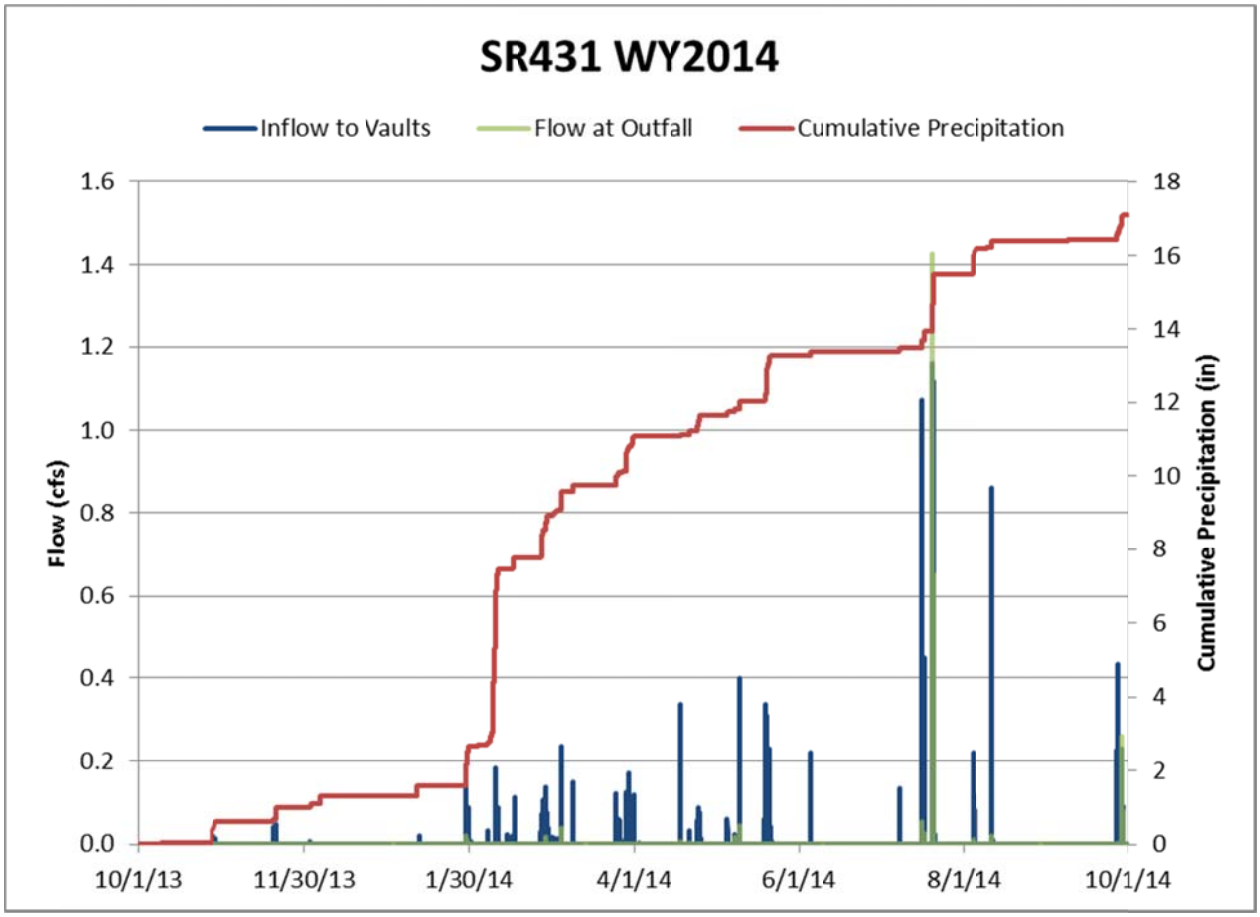

Figure 17a: Continuous hydrology at the inflow to the SR431 treatment vaults and the catchment outfall, and cumulative precipitation, WY14.

The total precipitation for WY15 at the SR431 meteorological station was 18.88 inches, which falls within the first quartile of the annual precipitation recorded at the Tahoe City Cross reference since 1981 (Table 4). Figure 17b shows the continuous hydrology at the catchment outfall station (S5) and the inflow to the treatment vaults. The majority of the precipitation fell in the fall/winter season (9.78 inches). The spring season received 5.58 inches and the summer season received 3.53 inches. A total of 41 discrete precipitation events were measured at the SR431 meteorological station, 17 in the fall/winter, 12 in the spring, and 12 in the summer. Approximately 40% of the events during WY15 produced less than a tenth of an inch of precipitation, and approximately 78% of the events produced less than half an inch. The largest storm occurred between February 6, 2015 and February 9, 2015, falling as mixed rain and snow and resulting in 3.77 inches of precipitation at in the SR431 catchment. Just over 60% of the precipitation events resulted in no runoff at the outfall station. The highest peak flow at the catchment outfall station (about 0.2 cfs)

occurred during a thunderstorm on July 4, 2015, while the peak flow at the treatment vault inlets occurred during a mixed rain and snow event on May 5, 2015.

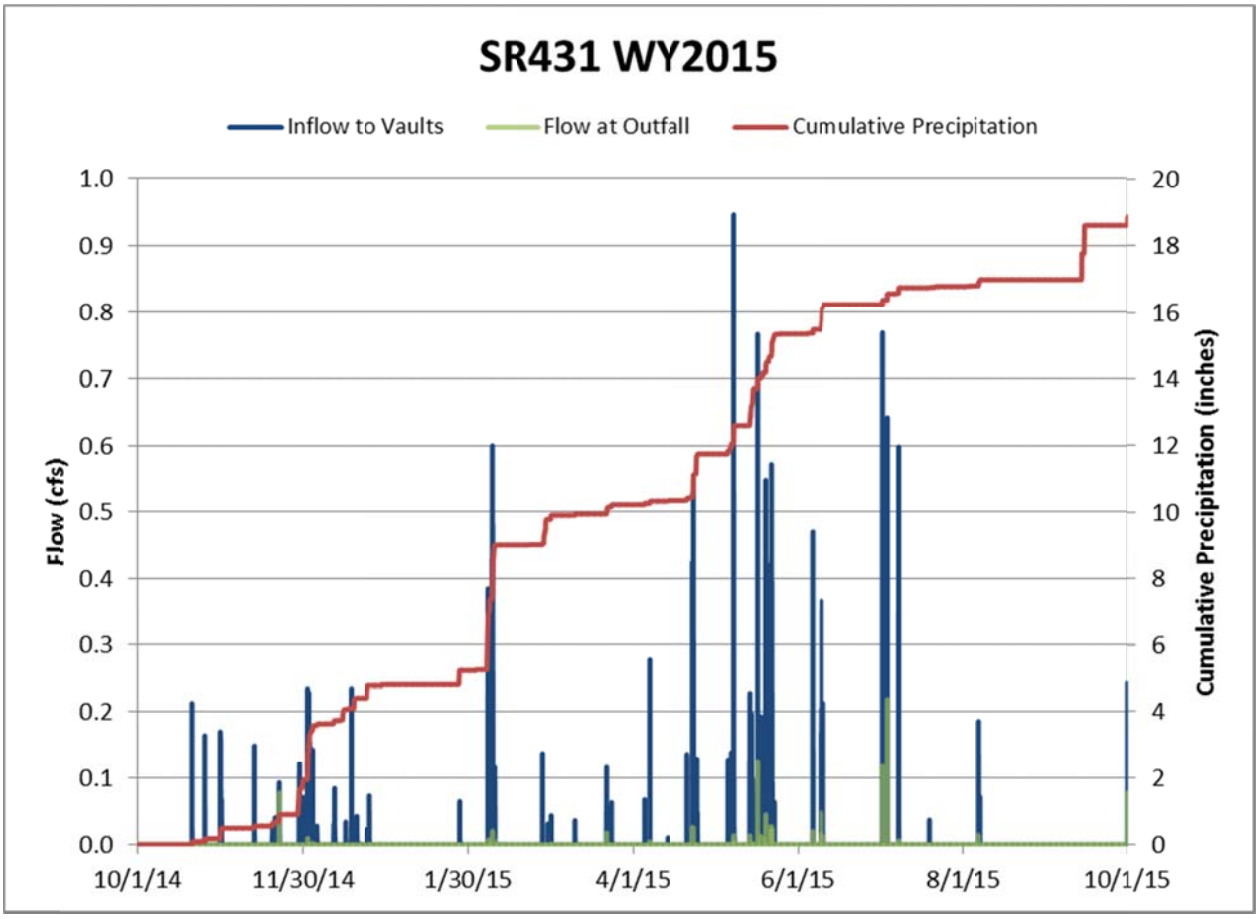

Figure 17b: Continuous hydrology at the inflow to the SR431 treatment vaults and the catchment outfall, and cumulative precipitation, WY15.

SR431 Treatment Vaults

There were eight runoff events successfully monitored at both the Contech MFS vault and the Jellyfish vault during WY14, representing almost 50% of total runoff through these vaults during the year. Continuous hydrology, continuous turbidity, and events sampled during WY14 are presented in Figures 18a – 21a. Higher inflow turbidities were observed earlier in the year, in part due to excessive sediment accumulation in the system from highway runoff, as discussed further in section 7.3. The highest inflows occurred during thunderstorms that occurred in July and August 2014. The first of these large events produced a peak precipitation of 0.074 inches per five minutes and was successfully sampled (July 16, 2014). Lower turbidities were measured after the spring runoff, in part due to retrofits upstream of the flumes to remove coarse sediments that were fouling sensors and conveyance lines.

In WY15, ten events produced sufficient runoff to sample and water quality samples were taken across the hydrograph during nine of these events. Four events were sampled in the fall/winter season, four in the spring season, and only one thunderstorm in the summer produced enough runoff to sample. Continuous

hydrology, continuous turbidity, and events sampled during WY15 are presented in Figures 18b - 21b. Similar to WY14, higher inflow turbidities were observed earlier in the year, and lower turbidities were measured after the spring runoff. The highest inflows occurred during thunderstorms that occurred in May 2015. The first of these events produced a peak precipitation of only 0.05 inches per five minutes and was successfully sampled (May 6, 2015).

Annual inflow and outflow hydrographs and cumulative volumes for vaults are presented in Appendix F. See DRI et al 2015 for additional information on individual events.

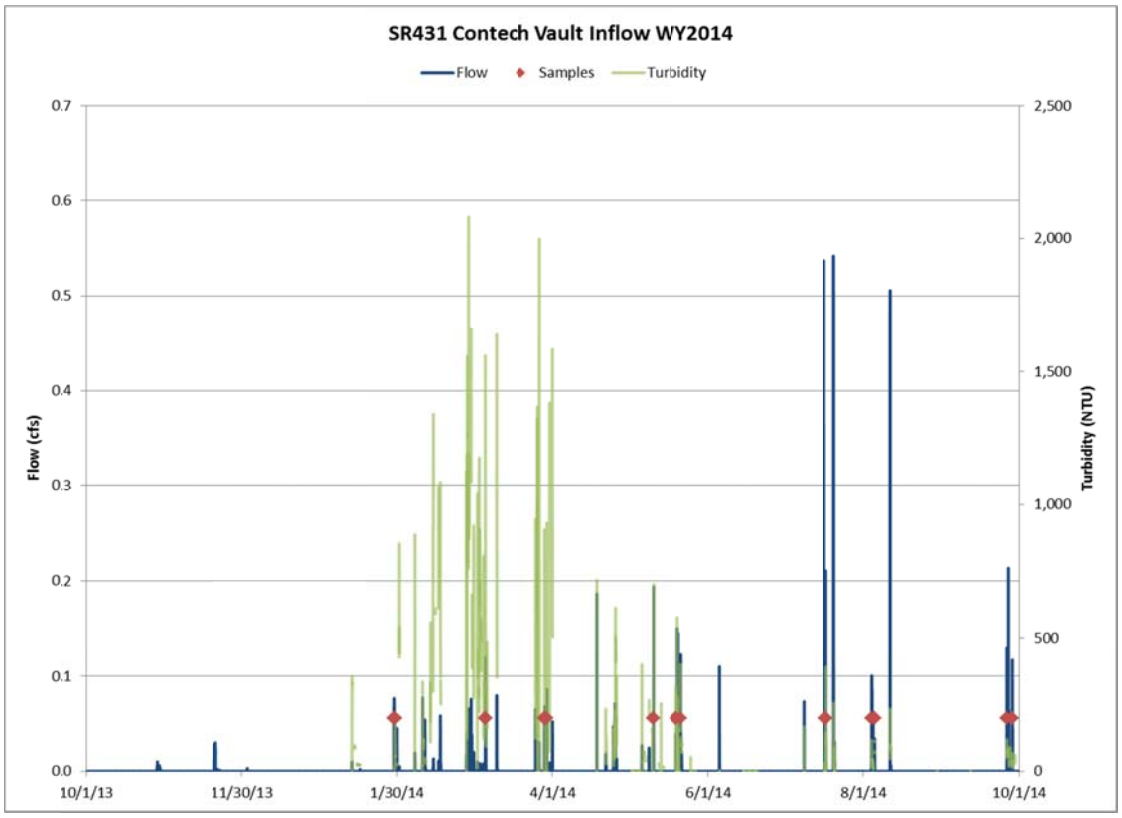

Figure 18a: Continuous hydrology, turbidity and sampled events at the inflow to the Contech MFS vault at SR431, WY14.

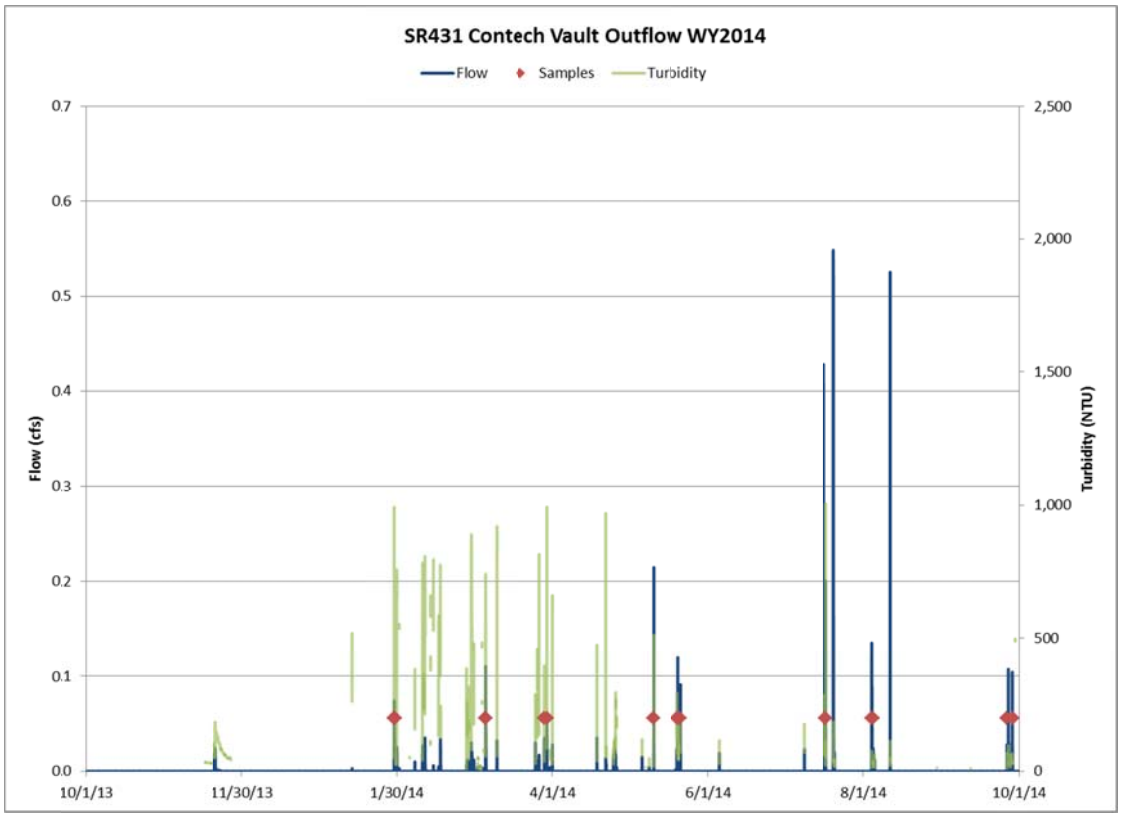

Figure 19a: Continuous hydrology, turbidity and sampled events at the outflow from the Contech MFS vault at SR431, WY14.

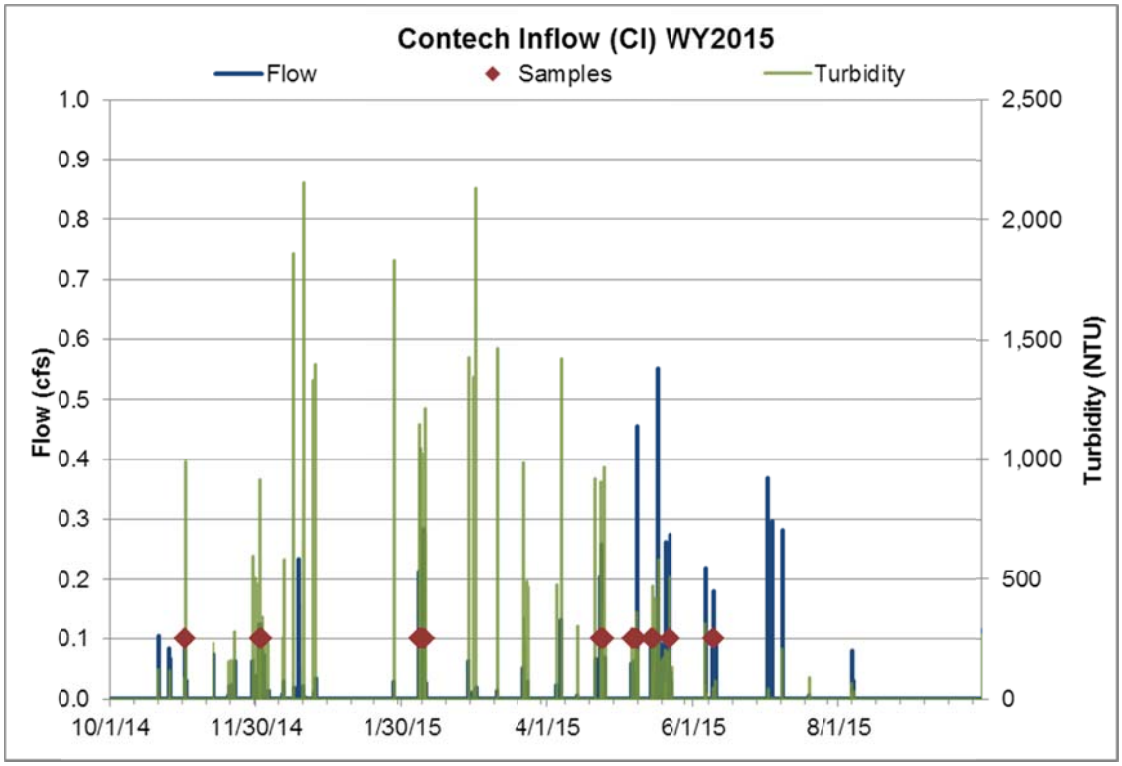

Figure 18b: Continuous hydrology, turbidity and sampled events at the inflow to the Contech MFS vault at SR431, WY15. Two events were sampled during the large February 6, 2015 storm.

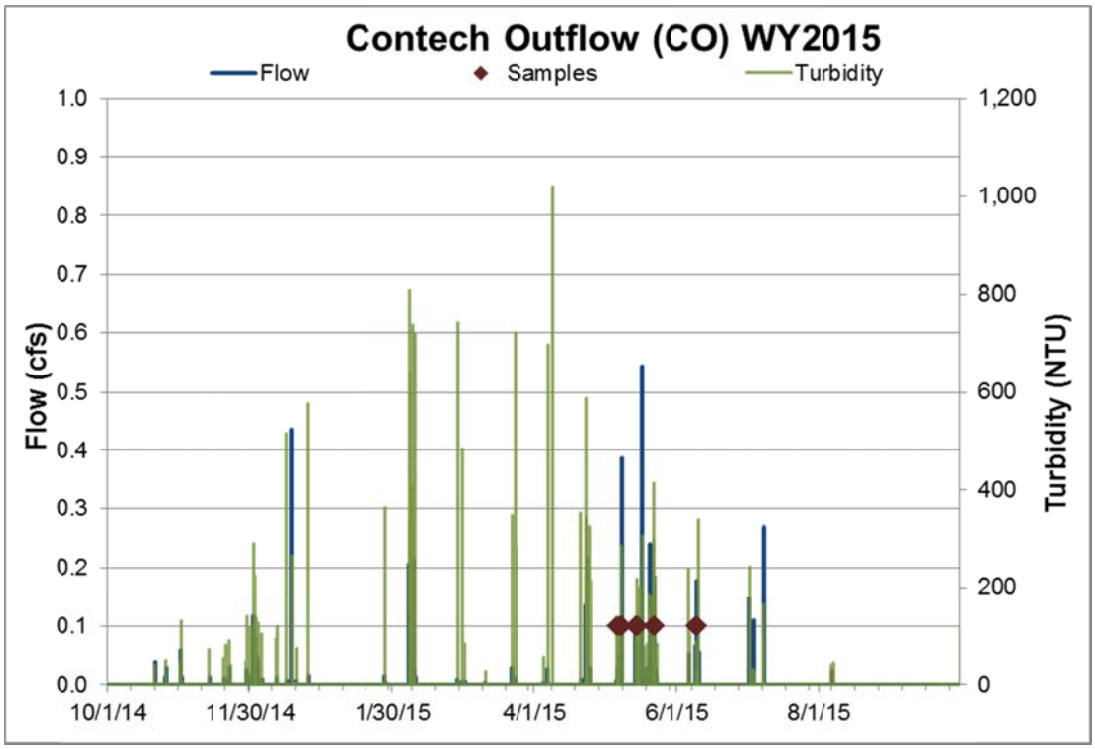

Figure 19b: Continuous hydrology, turbidity and sampled events at the outflow from the Contech MFS vault at SR431, WY15. Two events were sampled during the large February 6, 2015 storm.

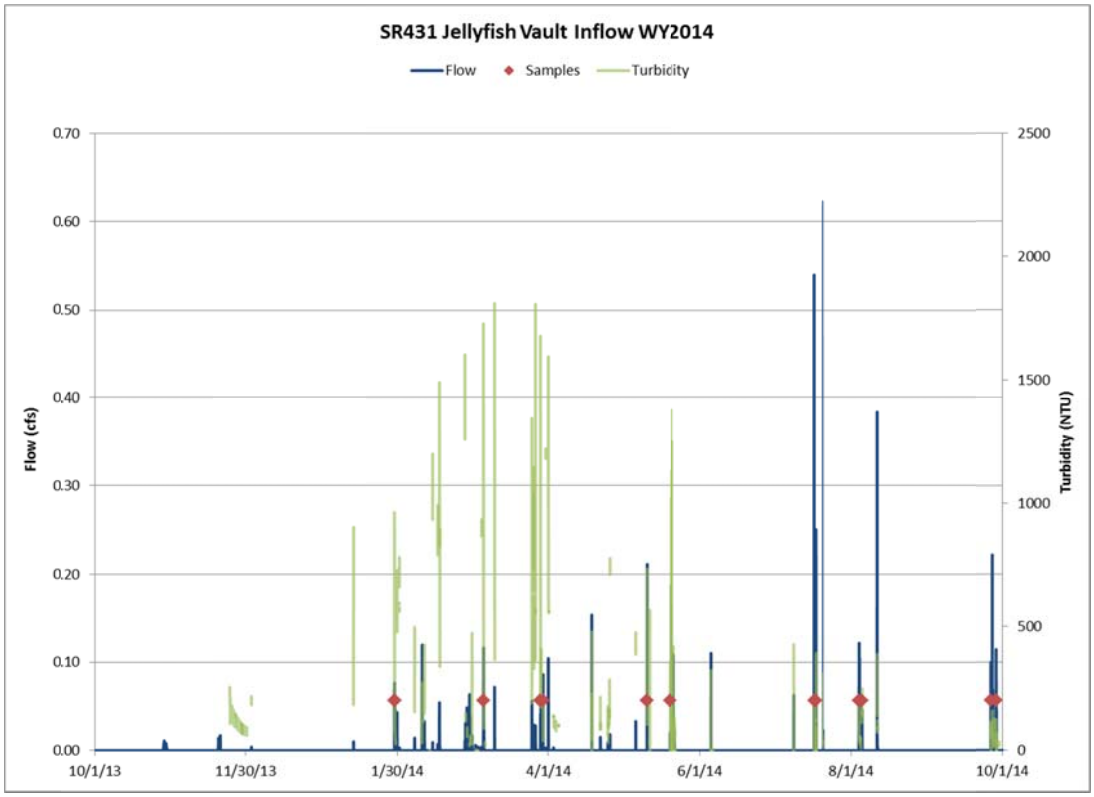

Figure 20a: Continuous hydrology, turbidity and sampled events at the inflow to the Jellyfish vault at SR431, WY14.

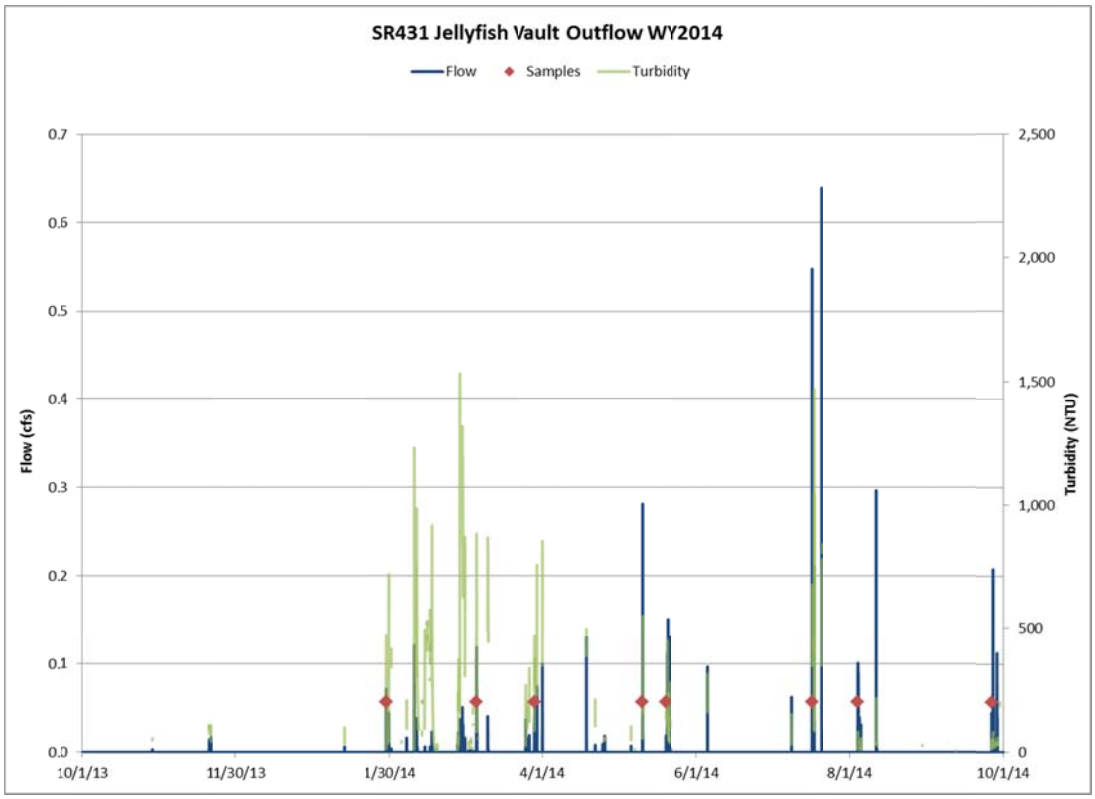

Figure 21a: Continuous hydrology, turbidity and sampled events at the outflow from the Jellyfish vault at SR431, WY14.

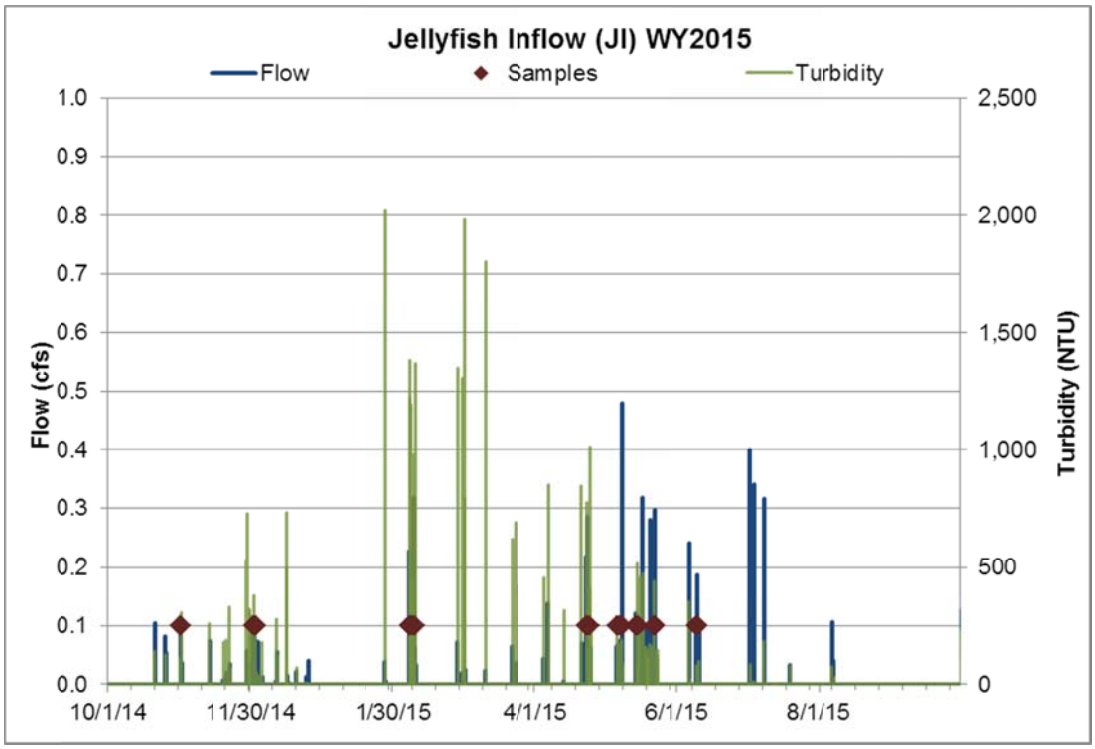

Figure 20b: Continuous hydrology, turbidity and sampled events at the inflow to the Jellyfish vault at SR431, WY15. Two events were sampled during the large February 6, 2015 storm.

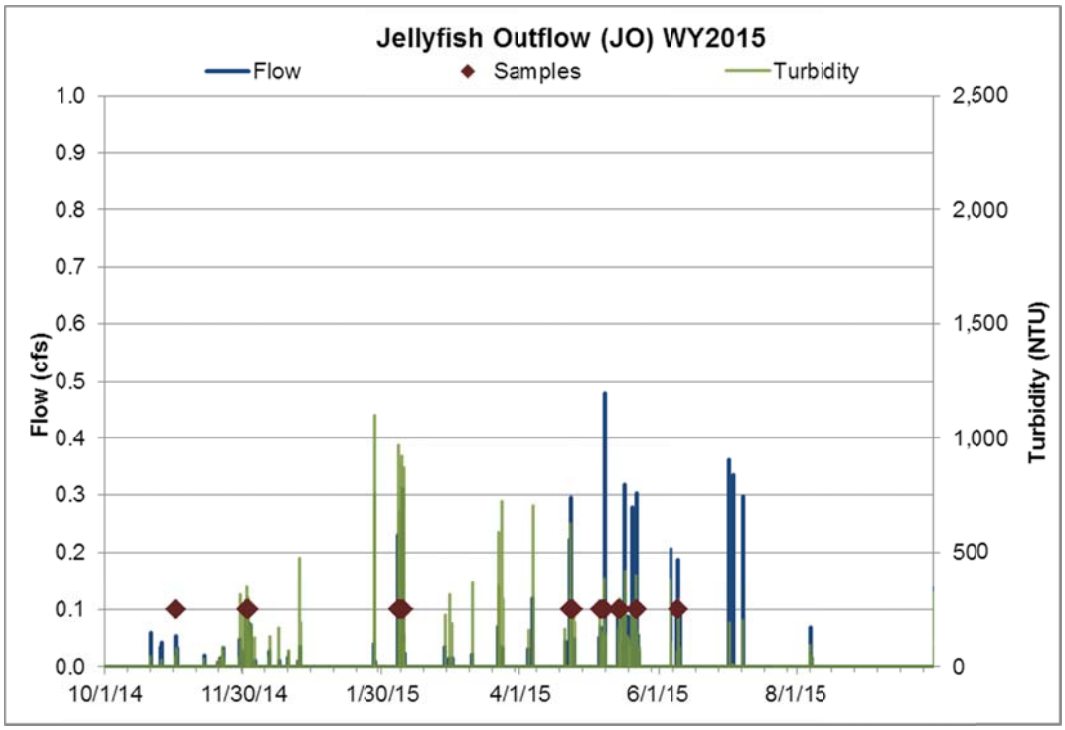

Figure 21b: Continuous hydrology, turbidity and sampled events at the outflow from the Jellyfish vault at SR431, WY15. Two events were sampled during the large February 6, 2015 storm.

Summary data for the eight sampled events at the SR431 treatment vaults in WY14 are presented in Table 9a (Contech MFS vault) and Table 10a (Jellyfish vault). One runoff event was sampled during the fall/winter period, four events were sampled during the spring period and three events were sampled during summer. Although runoff at this site responds relatively quickly to precipitation, it takes a large volume to fill vaults before matched sampling can occur at both the inflow and outflow stations. After a year of many attempts, it is evident that the precipitation events must be greater than about 0.5 inches to produce sufficient runoff for successful water quality sampling. In WY14 the largest runoff events sampled occurred in January, May and August. These did not always produce the highest concentrations or loading of pollutants. The highest outflow concentrations for FSP and TP occurred during the May 10th event, along with relatively high runoff, but inflow loading was lower than during previous sampled runoff events that year. The highest outflow concentration for TN occurred during the July 16th event, which was the first large summer thunderstorm. Relative efficiency of pollutant removal for each of these two vaults will be discussed in section 7.3. See DRI et al 2015 for more information on individual events.

Table 9a: Event summary data for eight sampled events at the Contech MFS vault at SR431 in WY14.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Storm Total (in)	Event Type	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
CI	Fall/Winter	1/29/14 12:05	1/30/14 1:30	13:25	1,395	1.09	rain on snow	269	23	2,078	0.18	670	0.06
CO		1/29/14 12:20	1/30/14 1:30	13:10	1,142			182	13	1,672	0.12	419	0.03
CI	Spring	3/5/14 6:15	3/6/14 15:35	33:20	821	0.52	rain on snow	744	38	3,420	0.18	2,180	0.11
CO		3/5/14 6:25	3/6/14 5:50	23:25	633			286	11	1,394	0.06	740	0.03
CI	Spring	3/29/14 8:40	3/30/14 12:55	28:15	829	0.97	rain on snow	514	27	2,882	0.15	1,383	0.07
CO		3/29/14 9:20	3/30/14 11:55	26:35	677			322	14	1,924	0.08	844	0.04
CI	Spring	5/10/14 13:40	5/10/14 17:05	3:25	514	0.22	event snowmelt	458	15	1,702	0.05	1,210	0.04
CO		5/10/14 13:55	5/10/14 16:55	3:00	285			332	6	1,554	0.03	970	0.02
CI	Spring	5/19/14 18:55	5/22/14 4:55	58:00	1,389	1.23	rain/snow	186	16	1,242	0.11	525	0.05
CO		5/19/14 18:55	5/22/14 4:55	58:00	957			115	7	1,124	0.07	319	0.02
CI	Summer	7/16/14 19:55	7/17/14 16:55	21:00	878	0.45	thunderstorm	311	17	2,791	0.15	940	0.05
CO		7/16/14 19:55	7/17/14 17:00	21:05	823			208	11	2,645	0.14	765	0.04
CI	Summer	8/4/14 7:25	8/5/14 14:10	30:45	1,240	0.69	rain	40	3	1,176	0.09	160	0.01
CO		8/4/15 8:15	8/5/15 14:20	30:05	1,013			31	2	1,520	0.10	125	0.01
CI	Summer	9/26/14 8:00	9/28/14 14:40	54:40	1,194	0.67	rain	51	4	2,506	0.19	270	0.02
CO		9/26/14 8:05	9/28/14 14:40	54:35	791			49	2	2,679	0.13	220	0.01

Table 10a: Event summary data for eight sampled events at the Jellyfish vault at SR431 in WY14.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Storm Total (in)	Event Type	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
JI	Fall/Winter	1/29/14 12:05	1/30/14 1:40	13:35	1,237	1.09	rain on snow	442	34	1,936	0.15	1,056	0.08
JO		1/29/14 12:15	1/30/14 2:15	14:00	1,318			109	9	1,109	0.09	300	0.02
JI	Spring	3/5/14 6:15	3/6/14 5:20	23:05	641	0.52	rain on snow	681	27	3,598	0.14	2,180	0.09
JO		3/5/14 6:55	3/6/14 18:05	35:10	801			345	17	1,511	0.08	970	0.05
JI	Spring	3/29/14 8:45	3/30/14 11:30	26:45	615	0.97	rain on snow	511	20	2,891	0.11	1,598	0.06
JO		3/29/14 9:10	3/30/14 11:45	26:35	588			196	7	1,315	0.05	465	0.02
JI	Spring	5/10/14 13:40	5/10/14 17:05	3:25	462	0.22	event snowmelt	605	17	2,404	0.07	1,790	0.05
JO		5/10/14 14:00	5/10/14 16:50	2:50	325			442	9	1,753	0.04	1,220	0.02
JI	Spring	5/19/14 18:55	5/22/14 4:55	58:00	2,315	1.23	rain/snow	309	45	2,366	0.34	950	0.14
JO		5/19/14 18:55	5/22/14 4:55	58:00	2,536			174	28	1,293	0.20	480	0.08
JI	Summer	7/16/14 19:55	7/17/14 16:50	20:55	1,119	0.45	thunderstorm	244	17	2,988	0.21	910	0.06
JO		7/16/14 19:55	7/17/14 17:00	21:05	1,052			210	14	2,920	0.19	802	0.05
JI	Summer	8/4/14 7:25	8/5/14 15:25	32:00	1,405	0.69	rain	37	3	1,336	0.12	145	0.01
JO		8/4/14 7:50	8/5/14 23:25	39:35	2,165			25	3	1,143	0.15	109	0.01
JI	Summer	9/26/14 8:00	9/28/14 14:45	54:45	1,158	0.67	rain	48	3	2,094	0.15	240	0.02
JO		9/26/14 8:10	9/28/14 14:50	54:40	1,001			39	2	2,111	0.13	180	0.01

Summary data for the eight sampled events at the SR431 treatment vaults in WY15 are presented in Table 9b (Contech MFS vault) and Table 10b (Jellyfish vault). Three runoff events were sampled in the fall/winter, four events in the spring, and one in the summer. Runoff volumes are very small at this site when compared to other sites. Even the very large precipitation event in February 2015 of 3.77 inches produced only approximately 5,000 cubic feet of runoff. Differences between the two treatment vaults are generally negligible. Flow gets split at the inflows relatively evenly (though the Jellyfish tends to get a slightly larger portion of the flow), and since the vaults are not designed to reduce volumes, outflow volumes are consequently similar. Inflow EMCs of all three pollutants should be very similar; differences are likely due to small variations in concentrations at the slightly different times samples were taken. Relative efficiency of pollutant removal for these two vaults will be discussed in section 7.3, but EMCs of pollutants at the outflows are typically similar as well. Though runoff volumes, and consequently loads, are very small at this site, the largest runoff volumes and loads occurred with the large February event. The highest inflow concentrations of TN occurred with the event beginning October 31, 2014, perhaps due to accumulation of TN on the highway during a month-long dry period (the storm prior to October 31 occurred September 29, 2014). The highest EMCs of TP occurred with the large February event and the April 23, 2015 event. Relative efficiency of pollutant removal for each of these two vaults will be discussed in section 7.3. Turbidities

ranged from about 50 NTU in the summer to about 1,300 NTU during the February event and generally occurred with peak flows (Appendix F). See DRI et al 2015 for more information on individual events.

Table 9b: Event summary data for eight sampled events at the Contech MFS vault at SR431 in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
CI	Fall/Winter	10/31/14 21:00	11/1/14 11:05	14:05	595	0.10	991	0.31	rain	100%	76	3	3,150	0.1	293	<0.1
CO		10/31/14 21:10	11/1/14 10:00	12:50	370	0.06	131			100%	59	1	2,200	<0.1	233	<0.1
CI	Fall/Winter	12/2/14 11:05	12/4/14 13:35	50:30	3,709	0.12	914	2.73	snow, rain	100%	141	33	730	0.2	424	<0.1
CO		12/2/14 11:25	12/4/14 12:05	48:40	2,738	0.12	289			100%	121	21	820	0.1	328	<0.1
CI	Fall/Winter	2/7/15 0:20	2/8/15 22:00	45:40	4,920	0.28	1,214	3.77	rain, snow	100%	402	123	1,270	0.4	1,330	0.4
CO		2/7/15 0:35	2/8/15 22:55	46:20	4,595	0.21	808			100%	342	98	1,190	0.3	1,006	0.3
CI	Spring	4/23/15 15:55	4/25/15 15:25	47:30	1,930	0.26	968	1.44	rain, snow	100%	332	40	1,260	0.2	1,101	0.1
CO		4/23/15 22:40	4/25/15 14:05	39:25	1,612	0.22	588			100%	275	28	1,170	0.1	812	<0.1
CI	Spring	5/6/15 16:10	5/8/15 23:25	55:15	1,600	0.46	360	0.84	rain	100%	316	32	1,006	0.1	126	<0.1
CO		5/6/15 16:25	5/9/15 0:10	55:45	1,310	0.39	285			100%	239	20	494	<0.1	92	<0.1
CI	Spring	5/14/15 15:50	5/15/15 19:40	27:50	1,436	0.11	472	1.11	snow	100%	168	15	829	<0.1	662	<0.1
CO		5/14/15 16:05	5/15/15 20:35	28:30	1,116	0.10	218			100%	149	10	1,378	<0.1	648	<0.1
CI	Spring	5/22/15 8:40	5/22/15 23:00	14:20	1,391	0.27	375	0.46	snow, rain	100%	211	18	1,020	<0.1	856	<0.1
CO		5/22/15 11:25	5/23/15 0:35	13:10	1,289	0.18	414			100%	160	13	734	<0.1	665	<0.1
CI	Summer	6/9/15 19:30	6/10/15 7:50	12:20	1,641	0.18	47	0.75	thunderstorm	100%	78	8	891	<0.1	153	<0.1
CO		6/9/15 19:40	6/10/15 8:10	12:30	1,536	0.18	87			100%	49	5	1,437	0.1	212	<0.1

Table 10b: Event summary data for eight sampled events at the Jellyfish vault at SR431 in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
JI	Fall/Winter	10/31/14 21:00	11/1/2014 11:05	14:05	401	0.08	307	0.31	rain	100%	76	2	4,080	0.1	299	<0.1
JO		10/31/14 21:15	11/1/2014 10:35	13:20	320	0.05	80			100%	27	1	1,220	<0.1	172	<0.1
JI	Fall/Winter	12/2/2014 11:10	12/4/2014 11:55	48:45	3,000	0.11	381	2.73	snow, rain	100%	149	28	850	0.2	445	<0.1
JO		12/2/2014 11:25	12/4/2014 11:55	48:30	2,904	0.12	347			100%	114	21	860	0.2	312	<0.1
JI	Fall/Winter	2/7/2015 0:20	2/9/2015 3:15	50:55	5,406	0.32	1,382	3.77	rain, snow	100%	405	137	1,110	0.4	1,275	0.4
JO		2/7/2015 0:30	2/9/2015 1:40	49:10	5,166	0.31	970			100%	342	110	900	0.3	1,015	0.3
JI	Spring	4/23/2015 15:55	4/25/2015 16:00	48:05	1,922	0.29	1,014	1.44	rain, snow	100%	394	47	1,350	0.2	1,322	0.2
JO		4/23/2015 16:00	4/25/2015 15:25	47:25	1,812	0.30	627			100%	264	30	1,170	0.1	792	<0.1
JI	Spring	5/6/15 16:10	5/8/15 23:50	55:40	1,847	0.48	265	0.84	rain	100%	256	30	760	<0.1	56	<0.1
JO		5/6/15 16:20	5/8/15 23:50	55:30	1,800	0.48	385			95%	243	27	889	<0.1	48	<0.1
JI	Spring	5/14/15 15:50	5/15/15 19:50	28:00	1,783	0.12	517	1.11	snow	100%	167	19	1,144	0.1	664	<0.1
JO		5/14/15 15:55	5/15/15 19:55	28:00	1,674	0.11	286			100%	113	12	1,294	0.1	519	<0.1
JI	Spring	5/22/15 11:25	5/22/15 23:40	12:15	1,526	0.30	335	0.46	snow, rain	100%	196	19	531	<0.1	906	<0.1
JO		5/22/15 11:25	5/22/15 23:30	12:05	1,534	0.30	201			100%	202	19	502	<0.1	806	<0.1
JI	Summer	6/9/15 19:30	6/10/15 7:55	12:25	1,658	0.19	76	0.75	thunderstorm	95%	73	8	988	0.1	153	<0.1
JO		6/9/15 19:35	6/10/15 8:05	12:30	1,658	0.19	59			90%	52	5	1,153	0.1	214	<0.1

SR431 Catchment Outfall

In WY14 there were seven events at the SR431 catchment outfall that produced sufficient runoff to sample and water quality samples were taken across the hydrograph during all of them. It should be noted that this site produces very little runoff, and "sufficient runoff" at this site is a paltry 30cf. Continuous hydrology, continuous turbidity, and events sampled during WY14 are presented in Figure 22a. The highest turbidities were seen during the largest storm of the year (February 6-10, 2014), but the event resulted in only 7 cubic feet of flow on the morning of February 10. Despite the 4.65 inches of precipitation, temperatures remained below freezing for the duration of the storm at this site and therefore the precipitation fell as snow and did not produce significant runoff. The highest flow occurred during the July 20, 2014 thunderstorm, as peak precipitation reached 0.13 inches in five minutes. It is interesting to note that the highest turbidities did not occur during this event, likely because the event occurring just four days earlier had removed existing sediment.

In WY15 twelve precipitation events produced sufficient runoff to sample at the SR431 catchment outfall, and water quality samples were taken across the hydrograph at seven of these events. Continuous hydrology, continuous turbidity, and events sampled during WY15 are presented in Figure 22b. The highest flow occurred during the July 4, 2014 thunderstorm, as peak precipitation reached only 0.05 inches in five minutes. The highest turbidity was observed on March 2, 2015, but the event did not produced sufficient runoff to sample.

Continuous hydrology, continuous turbidity, and water quality samples for the seven individual events in WY14 and the seven individual events in WY15 are presented in Appendix G.

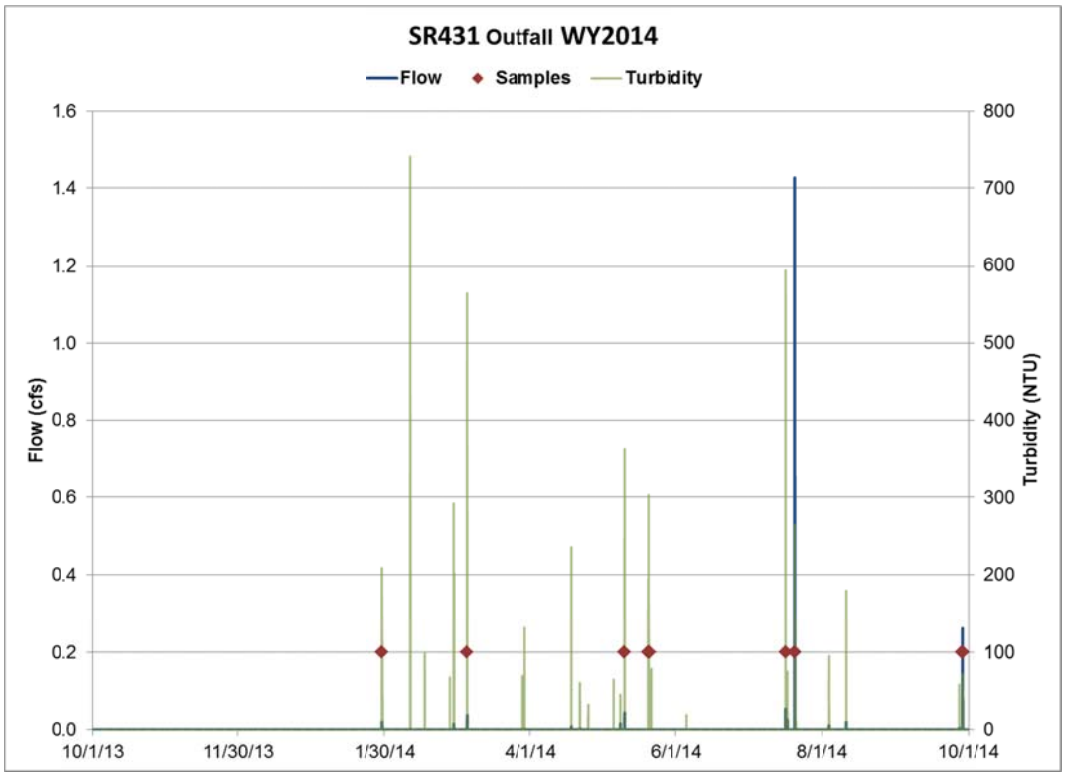

Figure 22a: Continuous hydrology, turbidity and sampled events at the SR431 catchment outfall, WY14.

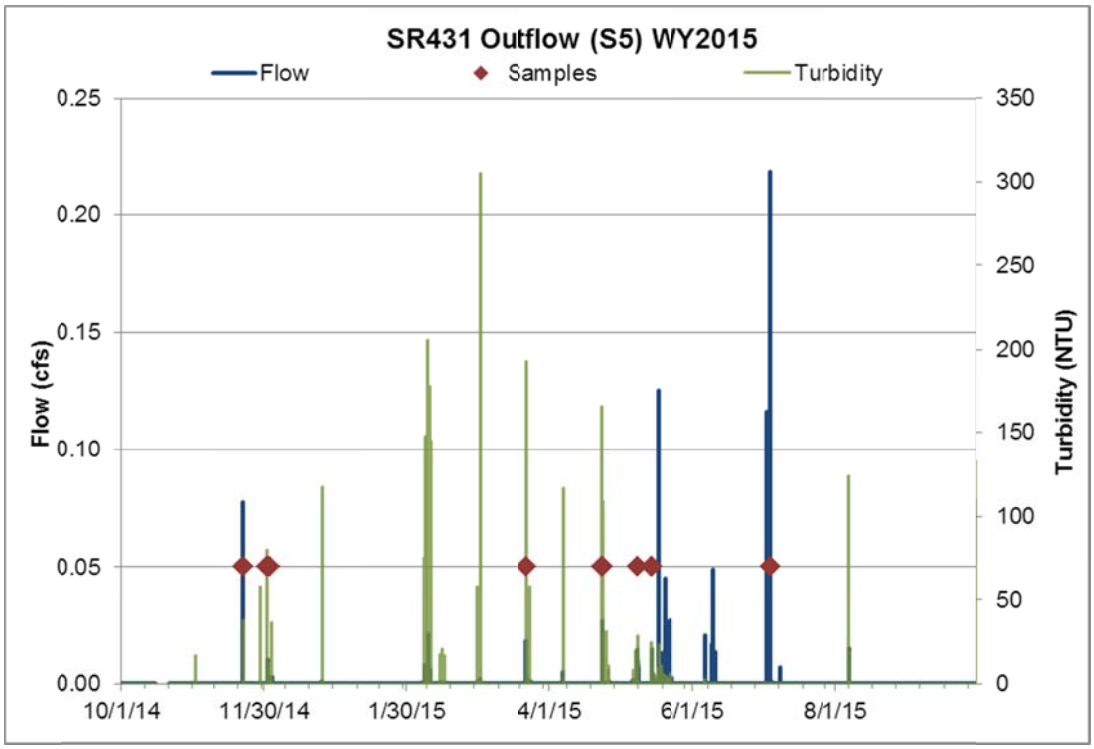

Figure 22b: Continuous hydrology, turbidity and sampled events at the SR431 catchment outfall, WY15.

Summary data for all seven events sampled at the SR431 Outfall in WY14 are presented in Table 11a. One runoff event was sampled during the fall/winter, three during the spring, and three during the summer. In general, only precipitation events greater than 0.5 inches produced sufficient runoff for water quality sampling, though one spring snow event of only 0.22 inches produced sufficient snowmelt to sample. However, the total runoff volume was only 88 cubic feet, and sample density was low. It was unusually difficult to capture runoff events at this site as runoff volumes were consistently lower than would be assumed for a catchment that is 96% impervious, but much of the runoff is diverted to the treatment vaults and only flow bypassing the treatment vaults is captured at the catchment outfall station (S5). This caused staff to set the sample pacing too high, and resulted in poor sampling density for the first two storms sampled. Consequently, staff began to set a lower pacing, which caused the sampler to run out of bottles too quickly during the July 20, 2014 thunderstorm. Only the beginning of this storm was sampled successfully. There is no nutrient data available for the May 10, 2014 storm as samples were not delivered to the lab within the proper holding time. All events at SR431 had peak turbidities in the range of 250-600 NTU usually concurrent with peak flow (Appendix G).

Table 11a: Event summary data for seven sampled events at the SR431 catchment outfall in WY14.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
S5	Fall/Winter	1/29/14 15:20	1/30/14 1:20	10:00	180	1.09	rain on snow	10%	63	1	726	<0.1	57	<0.1
S5	Spring	3/5/14 23:50	3/6/14 3:00	3:10	200	0.52	rain on snow	10%	319	4	1,714	<0.1	922	<0.1
S5	Spring	5/10/14 13:50	5/10/14 16:30	2:40	88	0.22	event snowmelt	65%	246	1	na	na	na	na
S5	Spring	5/20/14 6:50	5/21/14 1:00	18:10	103	1.23	rain/snow	95%	88	1	1,149	<0.1	198	<0.1
S5	Summer	7/16/14 19:50	7/16/14 20:30	0:40	37	0.45	thunderstorm	100%	441	1	2,142	<0.1	2,450	<0.1
S5	Summer	7/20/14 14:30	7/20/14 16:50	2:20	2,319	1.57	thunderstorm	45%	271	39	1,780	0.3	1,179	0.2
S5	Summer	9/28/14 9:50	9/28/14 12:10	2:20	699	0.67	rain	100%	48	2	414	<0.1	125	<0.1

Summary data for all seven events sampled at the SR431 Outfall in WY15 are presented in Table 11b. Two runoff events were sampled during the fall/winter, four during the spring, and one during the summer. With the exception of a high intensity thunderstorm on July 4, 2015 and a rain on snow event on March 22, 2015 relatively large precipitation events are required for sufficient runoff to sample at this site. Sampling was more successful this water year than last, but due to consistently miniscule runoff volumes this site was retired at the end of WY15. The highest EMCs of all three pollutants occurred during the March 22, 2015 rain event, but loads were very low due to the low runoff volume. As with other sites, TN concentrations were highest in the summer, possibly due to high traffic density and nitrogen build-up during long dry periods. Peak turbidities are low compared to the inflows to the treatment vaults but much of the sediment that could potentially reach this monitoring station has likely settled out in the three sediment traps directly upstream of this station (Appendix G).

Table 11b: Event summary data for seven sampled events at the SR431 catchment outfall in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
S5	Fall/Winter	11/22/14 5:55	11/22/14 8:20	2:25	270	0.08	38	0.35	rain	100%	128	2.2	1,016	<0.1	608	<0.1
S5	Fall/Winter	12/2/14 11:25	12/3/14 16:20	28:55	32	0.01	212	1.44	rain/snow	100%	101	0.2	1,443	<0.1	461	<0.1
S5	Spring	3/22/15 19:45	3/22/15 21:45	2:00	30	0.02	192	0.21	rain	85%	791	1.5	3,090	<0.1	3,383	<0.1
S5	Spring	4/23/15 15:50	4/24/15 0:55	9:05	88	0.03	166	0.68	snow	100%	351	1.9	1,670	<0.1	1,202	<0.1
S5	Spring	5/8/15 18:05	5/8/15 21:15	3:10	41	0.01	28	0.84	rain	80%	106	0.3	845	<0.1	774	<0.1
S5	Spring	5/14/15 16:00	5/15/15 9:45	17:45	28	0.01	24	1.11	snow	85%	126	0.2	802	<0.1	556	<0.1
S5	Summer	7/4/15 10:00	7/4/15 11:55	1:55	136	0.22	1	0.19	thunderstorm	90%	320	2.7	4,204	<0.1	1,152	<0.1

6.2.5 TAHOMA

The total precipitation for WY14 at the Tahoma meteorological station was 22.09 inches, within the first quartile of the annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 23a shows the continuous hydrology and cumulative precipitation for WY14. The majority of the precipitation fell in the fall/winter season (14.95 inches). The spring season received 3.13 inches and the summer season received 4.01 inches. A total of 36 discrete precipitation events were measured at the Tahoma meteorological station, 15 in the fall/winter, 13 in the spring, and 8 in the summer. Half of the events during WY14 produced less than a tenth of an inch of precipitation, and three quarters of the events produced less than half an inch. The largest storm occurred between February 7, 2014 and February 10, 2014, falling as mixed rain and snow and producing 9.32 inches of precipitation in Tahoma. However, the highest peak flows (about 3.2 cfs) were experienced during a high intensity thunderstorm on August 10, 2014.

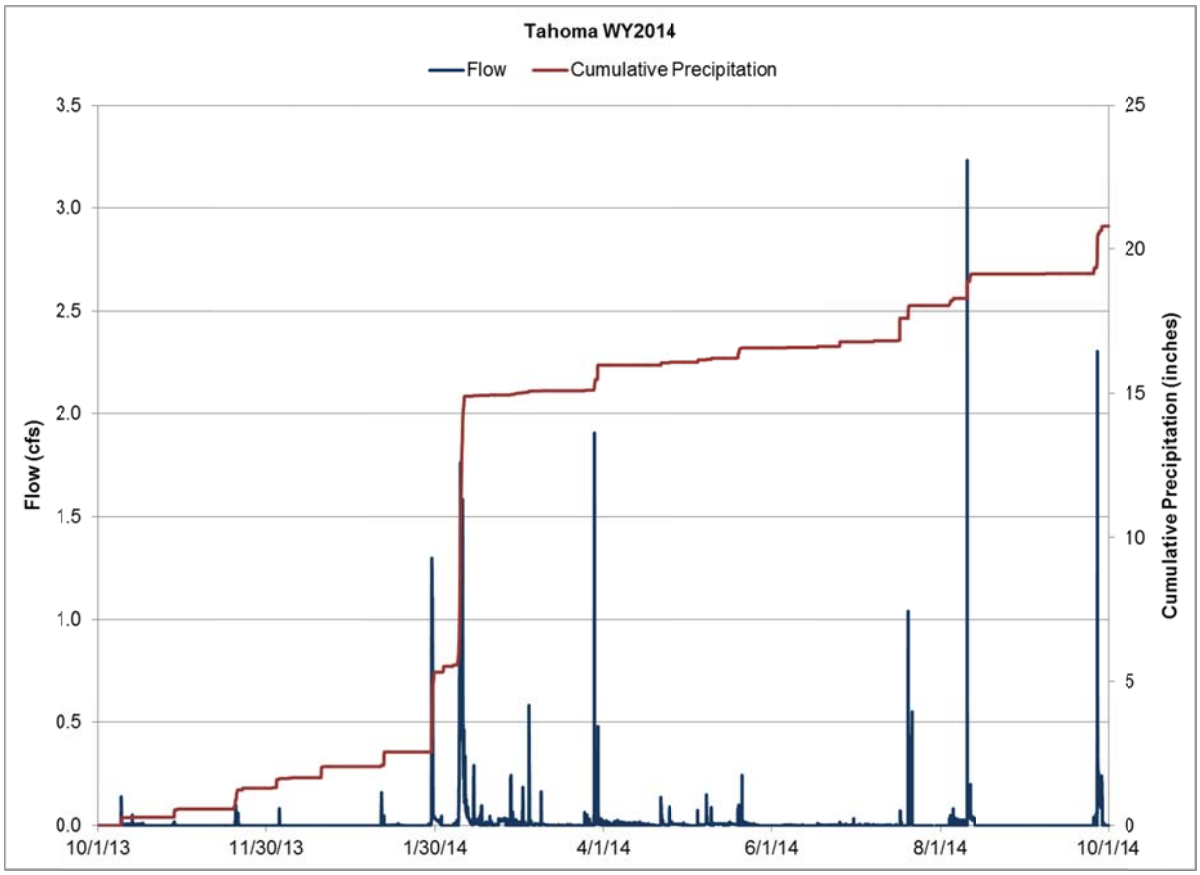

Figure 23a: Continuous hydrology and cumulative precipitation at the Tahoma catchment outfall, WY14.

The total precipitation for WY15 at the Tahoma meteorological station was 20.41 inches, which falls within the first quartile of the annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 23b shows the continuous hydrology and cumulative precipitation for WY15. The majority of the precipitation fell in the fall/winter season (13.59 inches). The spring season received 3.9 inches and the summer season received 2.92 inches. A total of 35 discrete precipitation events were measured at the Tahoma meteorological station, 15 in the fall/winter, 11 in the spring, and 9 in the summer. 29% of the events during WY15 produced less than a tenth of an inch of precipitation and 63% of the events produced less than half an inch. The largest storm occurred between February 6, 2015 and February 9, 2015, falling as mixed rain and snow and resulted in 4.91 inches of precipitation in the Tahoma catchment. However, the highest peak flows (about 4.7 cfs) occurred during a high intensity thunderstorm on July 19, 2015.

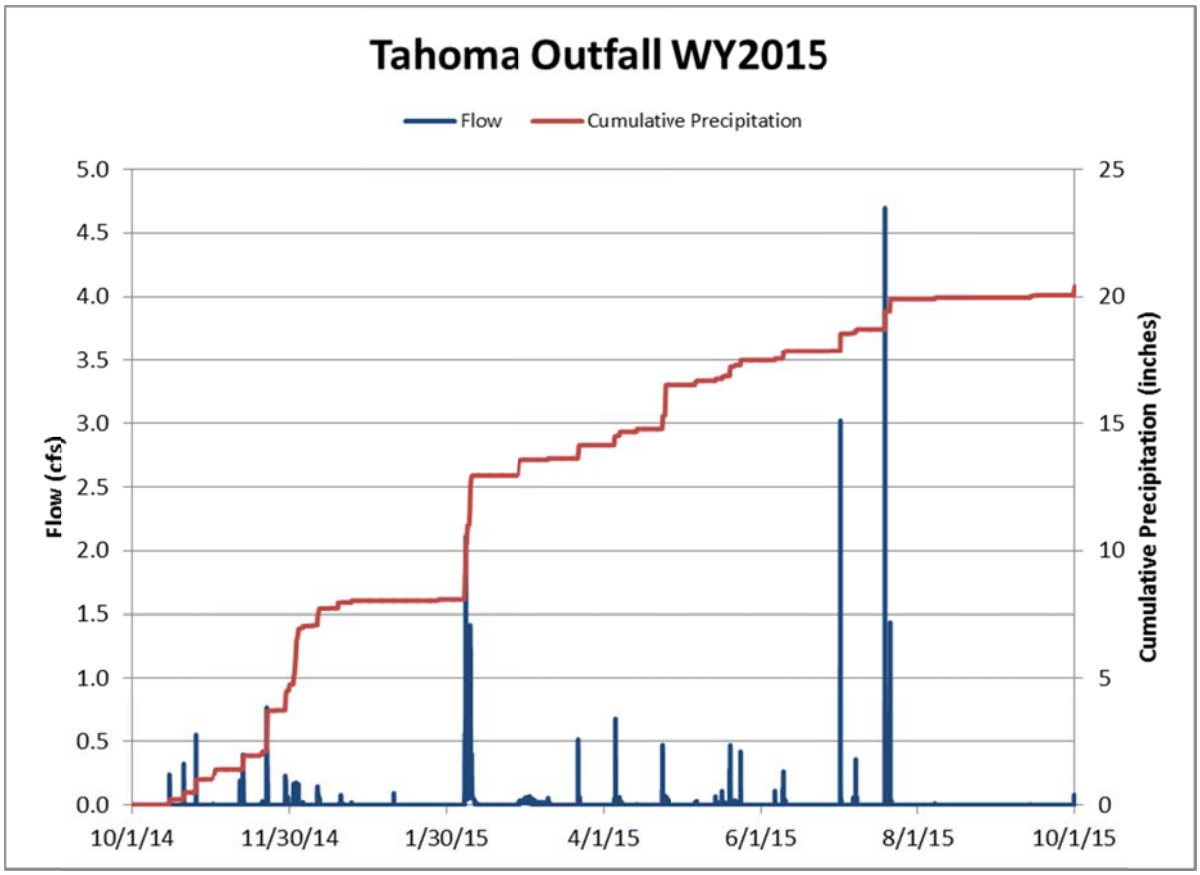

Figure 23b: Continuous hydrology and cumulative precipitation at the Tahoma catchment outfall, WY15

Water quality samples were taken across the hydrograph at every feasible opportunity at the Tahoma monitoring station and successful sampling occurred during eleven runoff events. (This site had additional funding through an EPA sponsored SNPLMA grant; hence the number of events sampled was greater than required for regulatory compliance.) Continuous hydrology, continuous turbidity and events sampled during WY14 are presented in Figure 24a. The highest turbidities in WY14 were seen during the largest storm of the year (February 7-10, 2014). The greatest flows in WY14 were seen during the thunderstorm that occurred on August 10, 2014 as the peak precipitation reached 0.28 inches in ten minutes.

During WY15 there were twenty-four precipitation events in the Tahoma catchment that produced sufficient runoff to sample and water quality samples were taken across the hydrograph during fourteen runoff events. Continuous hydrology, continuous turbidity and events sampled during WY15 are presented in Figure 24b. (This site had additional funding through Proposition 84 during WY15; hence the number of events sampled was greater than required for regulatory compliance.) The highest turbidities in WY15 were seen during the largest storm of the year (February 6-8, 2015). The greatest flows in WY15 were seen during the thunderstorm that occurred on August 19, 2015 as the peak precipitation reached 0.31 inches in ten minutes.

Continuous hydrology, continuous turbidity, and water quality samples for the four individual events in WY14 and fourteen individual events in WY15 are presented in Appendix H.

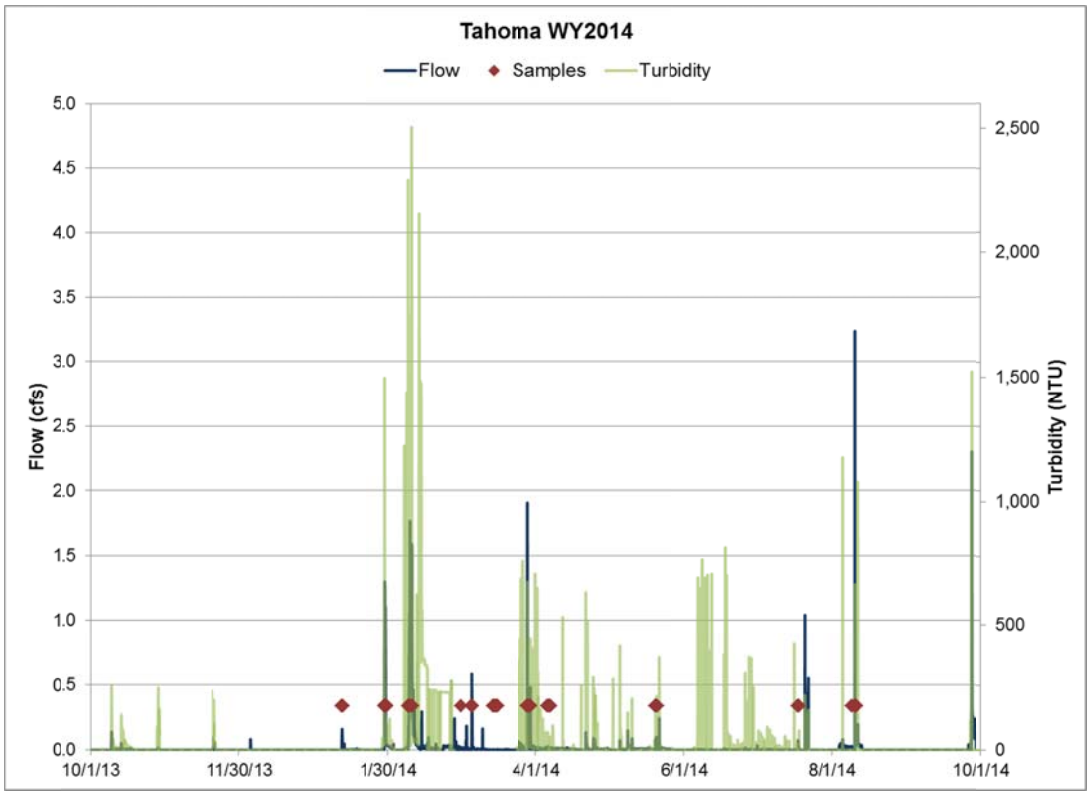

Figure 24a: Continuous hydrology, continuous turbidity, and sampled events at the Tahoma catchment outfall, WY14.

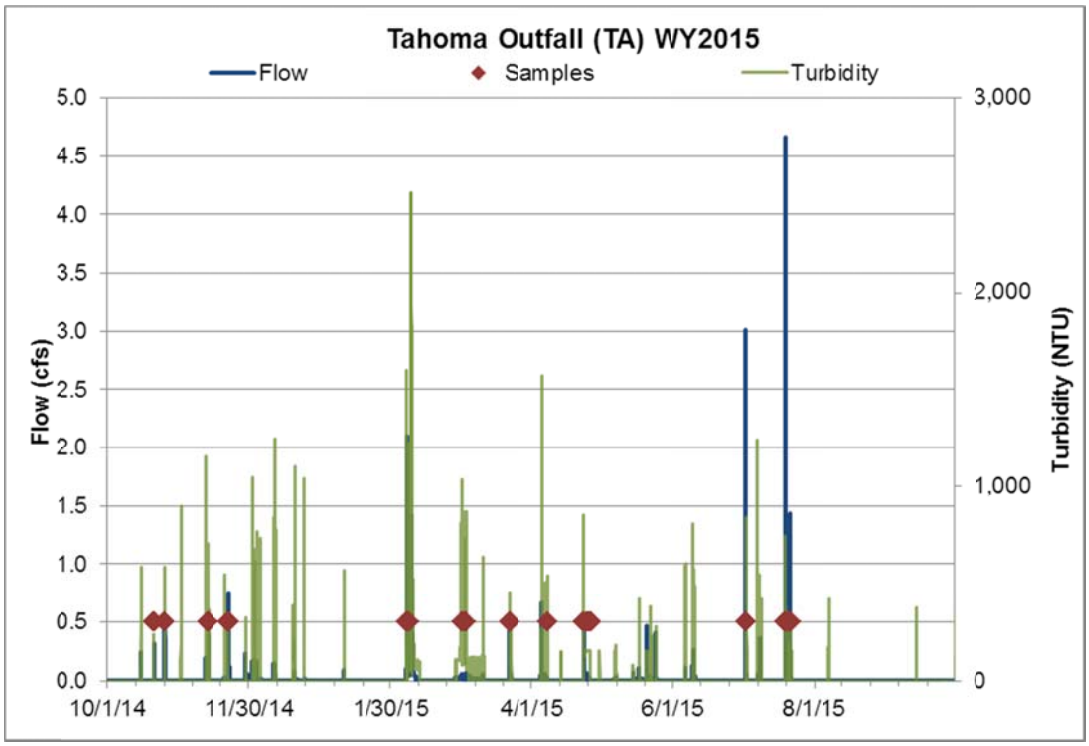

Figure 24b: Continuous hydrology, continuous turbidity, and sampled events at the Tahoma catchment outfall, WY15. Two events were sampled during the large February 6-8, 2015 storm, two events were sampled at the end of April (April 23, 2015 and April 25, 2015), and two events were sampled towards the end of July (July 19, 2015 and July 21, 2015).

Summary data for the eleven events sampled in WY14 are presented in Table 12a. Three precipitation events were sampled during the fall/winter, six during the spring, and two during the summer. In general, only precipitation events greater than 0.3 inches produced sufficient runoff for water quality sampling, though one spring rain on snow event of only 0.05 inches produced sufficient runoff to sample as melting snow increased the total runoff volume. Two snowmelt events were sampled when temperatures rose to the mid-50˚F and snowmelt at the Tahoma catchment outfall was sufficient to sample. It is interesting to note that while FSP concentrations were not detectable for both snowmelt events, TN and TP concentrations were generally very high. However, loads for all three pollutants were low for these two events as total runoff volumes were relatively low. The high intensity thunderstorm that began on August 10, 2014 had very high concentrations of all three pollutants, as did the first significant storm of the fall/winter season beginning on January 11, 2014. Though FSP concentrations were about average, the highest FSP loads were produced during the two fall/winter mixed rain and snow events that occurred beginning January 29, 2014 and February 8, 2014 because of the large runoff volumes. These two events also produced the highest loads for TN and TP. The March 29, 2014 and August 10, 2014 events also produced relatively large FSP loads. It is also interesting to note that though summer received significantly more precipitation than the spring did, the runoff volumes were similar. This is likely due to the additional runoff produced by snowmelt in the spring.

Fall/winter events had peak turbidities in the range of 1,500-2,500 NTU usually occurring at the beginning of each runoff event, likely due to the roads being washed clean in the beginning of each storm. Spring events had peak turbidities in the range of 400-700 NTU usually occurring in the middle of the storm when the flows were the highest. The April 6-8, 2014 non-event snowmelt had a very low peak turbidity of about 70 NTU (Appendix H).

Table 12a: Summary data for eleven sampled events at the Tahoma catchment outfall in WY14.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
TA	Fall/Winter	1/11/14 11:30	1/11/14 22:10	10:40	2,048	0.52	rain/snow	75%	383	49	3,762	0.5	1,015	0.1
TA	Fall/Winter	1/29/14 9:10	1/30/14 2:20	17:10	34,160	2.79	rain/snow	100%	120	255	1,408	3.0	318	0.7
TA	Fall/Winter	2/8/14 1:20	2/10/14 4:30	51:10	120,236	9.32	rain/snow	100%	51	381	235	1.8	341	2.6
TA	Spring	3/5/14 22:20	3/6/14 8:40	10:20	5,672	0.05	rain on snow	100%	179	63	793	0.3	984	0.3
TA	Spring	3/14/14 16:00	3/16/14 16:00	48:00	175	na	snowmelt	100%	<1	<0.1	346	<0.1	55	<0.1
TA	Spring	3/29/14 3:00	3/29/14 17:00	14:00	10,630	0.37	rain	100%	170	113	1,510	1.0	942	0.6
TA	Spring	3/30/14 2:40	3/30/14 23:50	21:10	3,735	0.50	snow	70%	188	44	1,554	0.4	1,116	0.3
TA	Spring	4/6/14 7:00	4/8/14 7:00	48:00	2,039	na	snowmelt	100%	<1	<0.1	388	<0.1	87	<0.1
TA	Spring	5/20/14 0:00	5/20/14 21:40	21:40	1,943	0.38	rain	100%	57	7	851	0.1	402	<0.1
TA	Summer	7/17/14 18:40	7/18/14 6:10	11:30	645	0.77	thunderstorm	100%	28	1	2,887	0.1	265	<0.1
TA	Summer	8/10/14 14:50	8/11/14 6:00	15:10	7,086	0.59	thunderstorm	100%	270	120	2,337	1.0	1,769	0.8

Summary data for the fourteen events sampled in WY15 are presented in Table 12b. Six precipitation events were sampled during the fall/winter, five events were sampled during the spring, three of which were snowmelt events and two of which were precipitation events, and three precipitation events were sampled during the summer. In general, only precipitation events greater than 0.5 inches produced sufficient runoff for water quality sampling, though one small fall/winter rain event of 0.27 inches was successfully sampled. The events beginning February 6, 2015 and February 7, 2015 were actually part of the same four day rain event split in two because of a cessation in precipitation the morning of February 7. Similar to Speedboat and Tahoe Valley, concentrationss of all three pollutants dropped significantly during the second part of the storm at this site potentially indicating that the streets were washed clean by the first pulse of the storm. The first and largest of the three snowmelt events sampled occurred between March 2 and March 4, 2015

after a medium size snow event when temperatures rose to the high 30's and low 40's (°F). The smallest snowmelt event sampled, only 109 cubic feet, occurred on April 8, 2015 after another medium sized snow event when temperatures rose to the low 40's (°F). The third snowmelt event occurred April 25 through April 27, 2015 after a large mixed snow and rain event when temperatures reached the mid 50's (°F). All three snowmelt events produced very low FSP loads. Concentrations were the highest during the summer for all three pollutants, especially during the high intensity thunderstorms that occurred between July 2 and July 3, 2015. TN EMCs were notably higher in the summer than any other season, perhaps due to high summer traffic densities. The thunderstorms that occurred between July 19 and 20, 2015 produced the highest summer runoff volume and resulted in the highest TN load of the entire year, more than twice the load of the next highest TN load two weeks earlier. The February 6-7, 2015 fall/winter event was the largest precipitation event of the year and had the highest FSP and TP loads due to the large runoff volumes and relatively high EMCs. However, event mean TN concentrations during that event were relatively low and resulted in an average TN load.

The highest peak turbidities occurred in the winter concurrent with peak flows. The force of the very high peak flows during the February 6-7, 2015 event blew the continuous turbidimeter out of position, thus there is no continuous turbidity data and no peak turbidity calculated for this event. The turbidimeter was restored to its permanent position on February 7 for the February 7-8, 2015 event. High peak turbidity also occurred during the first snowmelt event on March 2, 2015 but turbidity tended to come in short pulses and resulted in the smallest event mean FSP concentration and event load of the year. High turbidities generally occurred with peak flows and at the beginning of events (Appendix H).

Table 12b: Summary data for fourteen sampled events at the Tahoma catchment outfall in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
TA	Fall/Winter	10/20/14 19:50	10/21/14 6:00	10:10	1,005	0.40	236	0.27	rain	100%	40	2	4,390	0.3	495	<0.1
TA	Fall/Winter	10/25/14 12:00	10/25/14 16:10	4:10	1,910	0.55	585	0.51	rain	100%	21	3	1,427	0.2	486	<0.1
TA	Fall/Winter	11/13/14 2:50	11/13/14 13:40	10:50	2,705	0.39	706	0.54	rain	100%	19	3	794	0.1	329	<0.1
TA	Fall/Winter	11/22/14 2:40	11/22/14 18:00	15:20	7,464	0.76	1,728	1.76	rain	100%	43	20	462	0.2	437	0.2
TA	Fall/Winter	2/6/15 14:50	2/7/15 11:00	20:10	21,616	2.10	na	2.22	snow, rain	100%	164	222	309	0.4	970	1.3
TA	Fall/Winter	2/7/15 11:00	2/8/15 6:00	19:00	13,808	0.78	1,221	0.73	rain	90%	29	25	563	0.5	200	0.2
TA	Spring	3/2/15 12:00	3/4/15 12:00	48:00	5,404	0.11	1,033	na	snowmelt	100%	<1	<1	320	0.1	79	<0.1
TA	Spring	3/22/15 18:40	3/23/15 16:40	22:00	3,183	0.51	452	0.52	rain, snow	95%	94	19	1,828	0.4	428	<0.1
TA	Spring	4/8/15 8:20	4/8/15 16:50	8:30	109	0.03	537	na	snowmelt	60%	105	<1	1,731	<0.1	358	<0.1
TA	Spring	4/23/15 21:30	4/24/15 5:20	7:50	2,168	0.46	855	0.51	rain	90%	116	16	719	<0.1	690	<0.1
TA	Spring	4/25/15 7:30	4/27/15 7:30	58:40	2,155	0.06	154	na	snowmelt	100%	54	7	605	<0.1	243	<0.1
TA	Summer	7/2/15 15:20	7/3/15 2:20	11:00	5,131	3.01	839	0.69	thunderstorm	90%	186	60	6,783	2.2	2,029	0.6
TA	Summer	7/19/15 15:00	7/20/15 9:30	18:30	12,699	4.66	745	0.72	rain	100%	149	118	6,411	5.1	1,203	1.0
TA	Summer	7/21/15 13:10	7/22/15 7:20	18:10	4,570	1.44	347	0.48	rain	100%	146	42	2,409	0.7	657	0.2

6.2.6 SPEEDBOAT

The total precipitation for WY15 in the Speedboat catchment was 11.85 inches, more than five and a half inches less than the minimum annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 25 shows the continuous hydrology and cumulative precipitation for WY15. The majority of the precipitation fell in the fall/winter season (6.6 inches). The spring season received 3.23 inches and the summer season received 2.02 inches. A total of 40 discrete precipitation events were measured at the Speedboat meteorological station, 17 in the fall/winter, 12 in the spring, and 11 in the summer. Approximately 48% of the events during WY15 produced less than a tenth of an inch of precipitation, and approximately 85% of the events produced less than half an inch. The largest storm

occurred between February 6, 2015 and February 9, 2015, falling as mixed rain and snow and resulted in 3.06 inches of precipitation in the Speedboat catchment. The highest peak flows (about 3.2 cfs) occurred during this precipitation event.

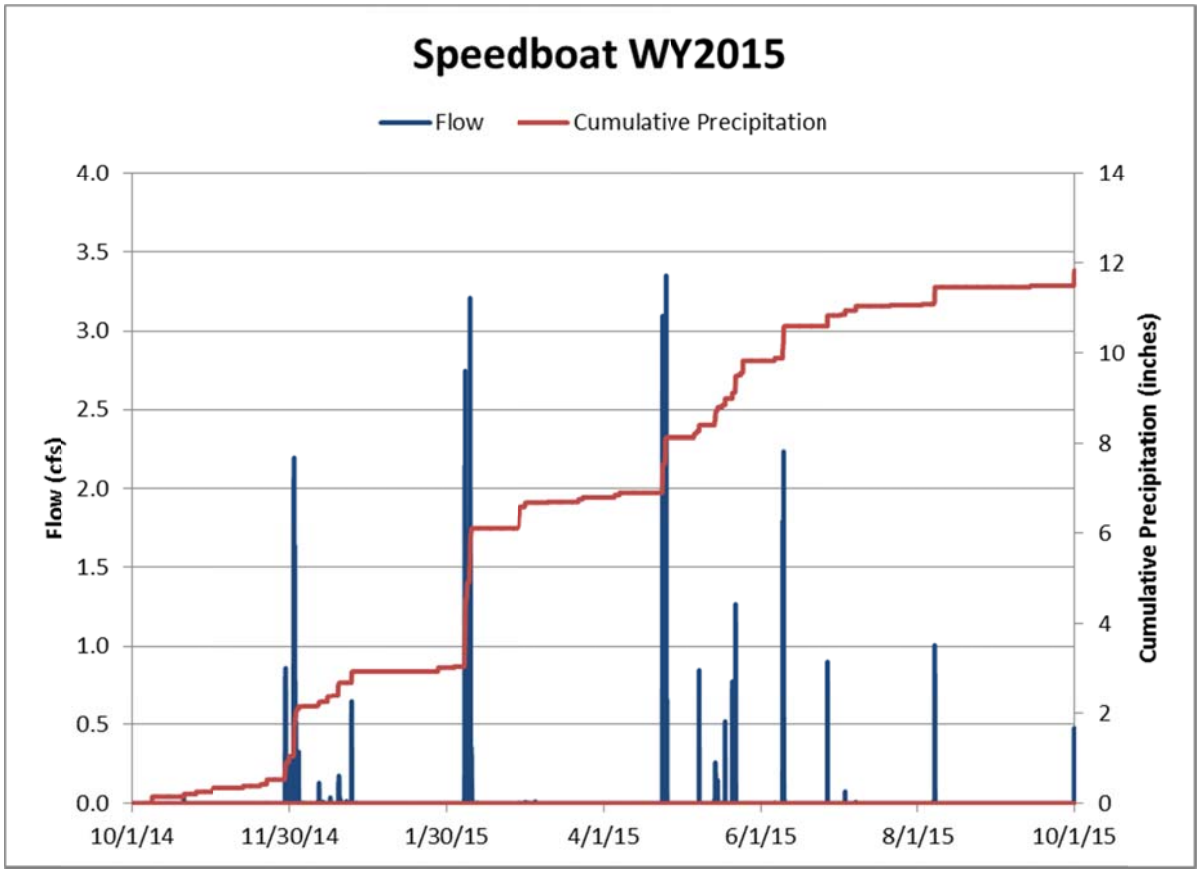

Figure 25: Continuous hydrology and cumulative precipitation at the Speedboat catchment outfall, WY15.

Though there were fifteen precipitation events in the Speedboat catchment during WY15 that produced sufficient runoff to sample, water quality samples were taken across the hydrograph during eleven runoff events. Continuous hydrology, continuous turbidity and events sampled during WY15 are presented in Figure 26. (This site had funding through Proposition 84; hence the number of events sampled was greater than required for regulatory compliance.) The highest turbidities in WY15 were observed on March 6, 2015 during a snowmelt event that did not produce enough runoff to sample. The greatest flows in WY15 occurred during the February 6-8, 2015 storm.

Continuous hydrology, continuous turbidity, and water quality samples for the eleven individual events in WY15 are presented in Appendix I.

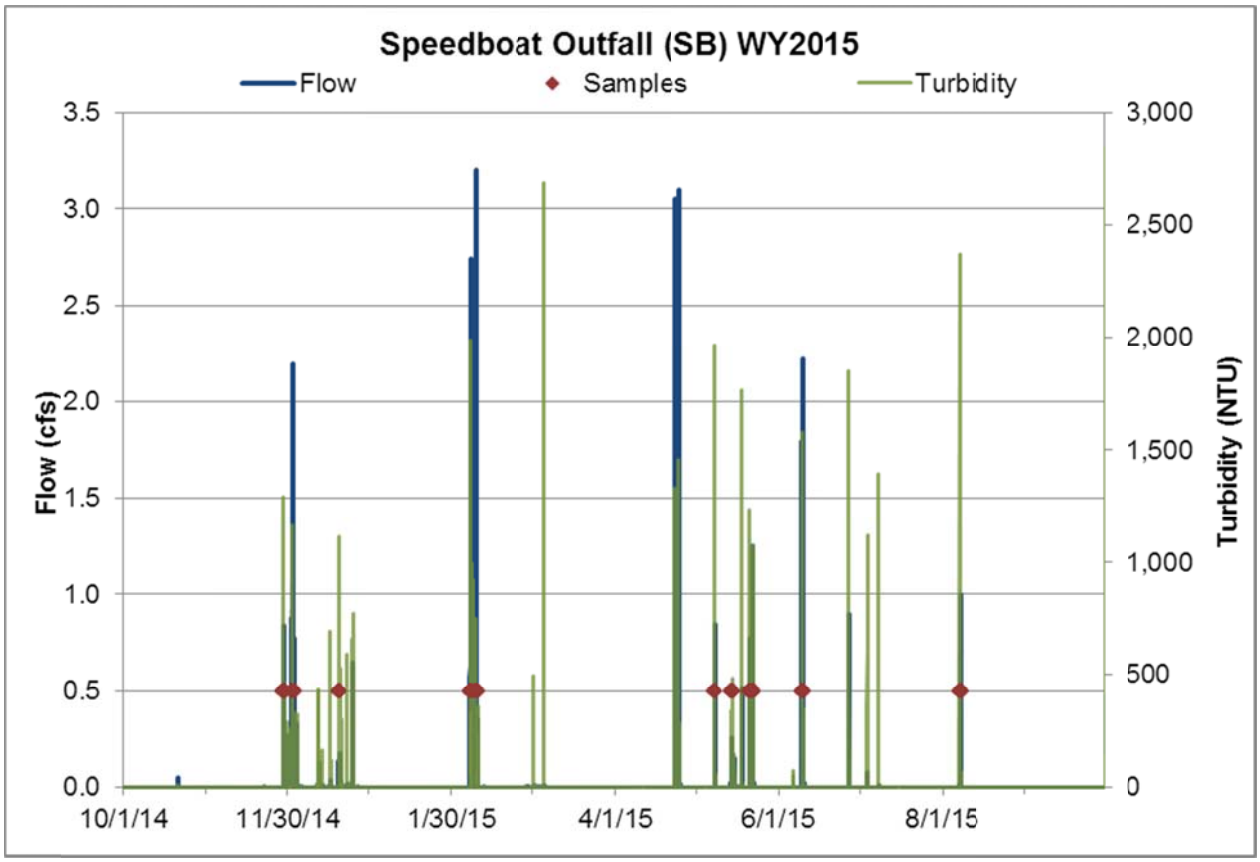

Figure 26: Continuous hydrology, continuous turbidity, and sampled events at the Speedboat catchment outfall, WY15. Two events were sampled during the large February 6-8, 2015 storm and two events were sampled towards the end of (May 21 and May 22, 2015).

Summary data for the eleven events sampled at Speedboat in WY15 are presented in Table 13. Five precipitation events were sampled during the fall/winter, four events were sampled during the spring, and two precipitation events were sampled during the summer. In general, only precipitation events greater than 0.25 inches produced sufficient runoff for water quality sampling, though one small spring rain event of 0.13 inches was successfully sampled. The two largest events, beginning February 6, 2015 and February 8, 2015 could be interpreted as one combined event with 2.70 inches of rain and a total runoff volume of 89,141 cubic feet, but the event was split in two because of a cessation of flow between the morning of February 7 and the afternoon of February 8. It is interesting to note that the EMC of FSP for the first part of this event was 136 mg/L and subsequently dropped to less than 1 mg/L for the second part of the event. It is likely that the majority of the FSP had been washed off the roadways in the latter part of this four day rainstorm. The same pattern is evident with FSP load, as well as the concentrations and loads of TN and TP. The first part of this event delivered the greatest loads of all three pollutants the entire year. The thunderstorm of August 7, 2015 had relatively high concentrations of FSP and TP, but very high TN. Considerable build-up of nitrogen from high summer traffic during a long period without precipitation may have contributed to this very high TN concentration. (The turbidimeter malfunctioned during the August 7, 2015 event, but replaced with turbidity measurements taken on all single autosampler samples across the hydrograph.)

Speedboat has some of the highest peak turbidities of all sites, generally greater than 1,000 NTU, likely due to runoff received from highway 28. Peak turbidities generally occur at the beginning of each event as roads are being washed clean (Appendix I).

Table 13: Summary data for eleven sampled events at the Speedboat catchment outfall in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
SB	Fall/Winter	11/29/14 10:40	11/29/14 15:50	5:10	3,351	0.84	1,294	0.52	rain/snow	85%	62	13	1,555	0.3	493	0.1
SB	Fall/Winter	12/2/14 12:20	12/3/14 17:50	29:30	37,175	2.19	1,167	1.10	rain/snow	90%	30	69	707	1.6	138	0.3
SB	Fall/Winter	12/19/14 12:10	12/20/14 15:30	27:20	2,987	0.18	1,116	0.29	snow	70%	147	27	1,214	0.2	774	0.1
SB	Fall/Winter	2/6/15 15:00	2/7/15 9:30	18:10	47,735	2.74	1,989	1.51	rain	100%	136	405	1,474	4.4	677	2.0
SB	Fall/Winter	2/8/15 12:30	2/9/15 13:50	26:30	41,406	3.20	751	1.19	rain	85%	<1	3	732	1.9	301	0.8
SB	Spring	5/8/15 18:00	5/8/15 20:50	2:50	1,284	0.85	1,966	0.27	rain	75%	236	19	2,825	0.2	1,110	<0.1
SB	Spring	5/14/15 15:00	5/15/15 12:10	0.88	2,660	0.26	481	0.40	rain	100%	29	5	1,097	0.2	231	<0.1
SB	Spring	5/21/15 12:00	5/21/15 14:40	2:40	1,599	0.77	1,238	0.13	rain	95%	137	14	1,759	0.2	542	<0.1
SB	Spring	5/22/15 14:20	5/22/15 22:50	8:30	7,905	1.25	620	0.37	rain	90%	61	30	1,175	0.6	307	0.2
SB	Summer	6/9/15 19:20	6/10/15 8:00	13:10	15,626	2.19	1,579	0.72	thunderstorm	100%	57	56	3,101	3.0	407	0.4
SB	Summer	8/7/15 14:30	8/7/15 18:40	4:10	3,163	1.00	373	0.38	thunderstorm	95%	88	17	4,614	0.9	764	0.2

6.2.7 TAHOE VALLEY

The total precipitation for WY15 at the Tahoe Valley meteorological station was 17.75 inches, which falls within the first quartile of the annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 27 shows the continuous hydrology and cumulative precipitation for WY15. The majority of the precipitation fell in the fall/winter season (11.06 inches). The spring season received 3.63 inches and the summer season received 3.06 inches. A total of 36 discrete precipitation events were measured at the Tahoe Valley meteorological station, 16 in the fall/winter, 10 in the spring, and 10 in the summer. Roughly 31% of the events during WY15 produced less than a tenth of an inch of precipitation, and 75% of the events produced less than half an inch. The largest storm occurred between February 6, 2015 and February 9, 2015, falling as mixed rain and snow and resulted in 5.49 inches of precipitation in the Tahoe Valley catchment. The highest peak flows (about 5.3 cfs) occurred during this event.

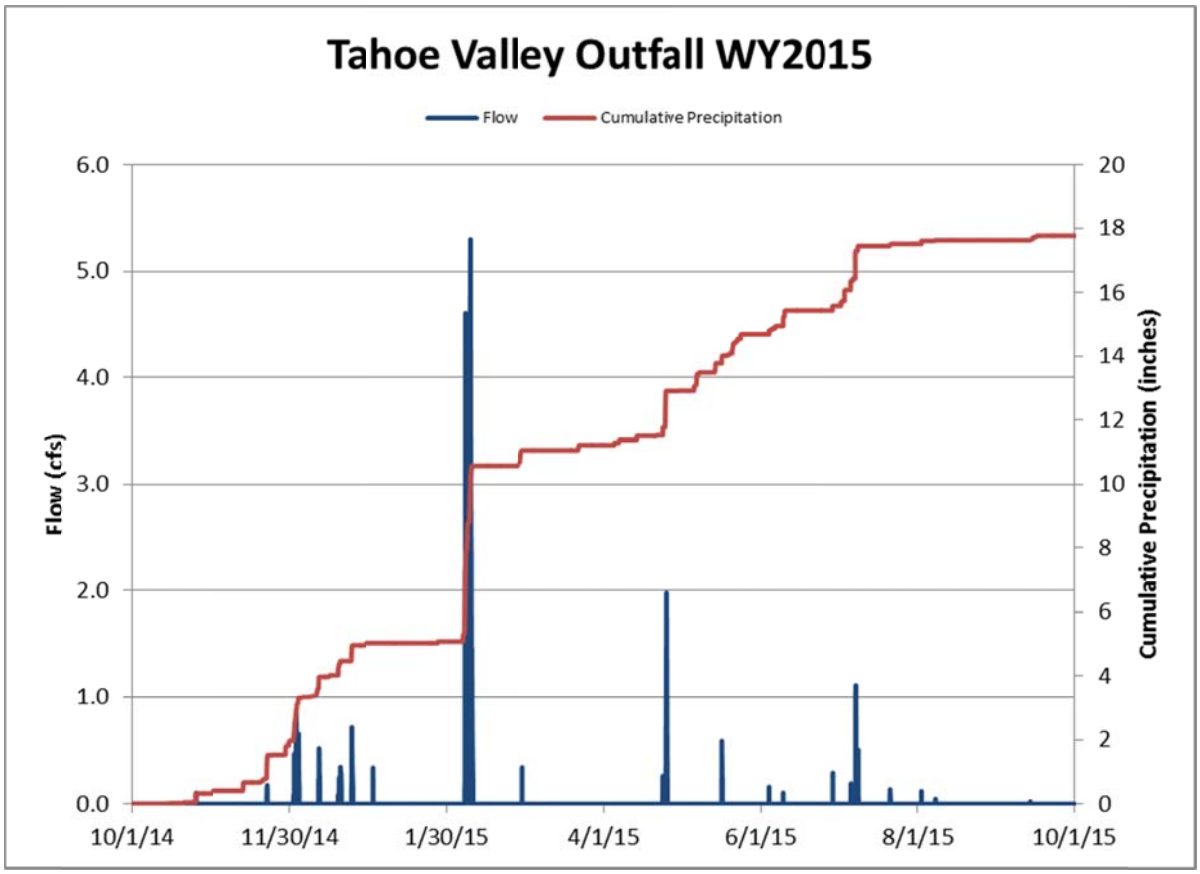

Figure 27: Continuous hydrology and cumulative precipitation at the Tahoe Valley catchment outfall, WY15.

Though there were eleven precipitation events in the Tahoe Valley catchment during WY15 that produced sufficient runoff to sample, water quality samples were taken across the hydrograph during seven runoff events. Three of the unsampled events occurred in the fall/winter season after the requisite number of sample events had been met. One spring event was missed due to equipment failure, and the one event during the summer that produced enough runoff to sample was sampled. Continuous hydrology, continuous turbidity and events sampled during WY15 are presented in Figure 28. (This site had funding through Proposition 84; hence the number of events sampled was greater than required for regulatory compliance.) The highest turbidities and greatest flows in WY15 were seen during the largest storm of the year (February 6-8, 2015).

Continuous hydrology, continuous turbidity, and water quality samples for the seven individual events in WY15 are presented in Appendix J.

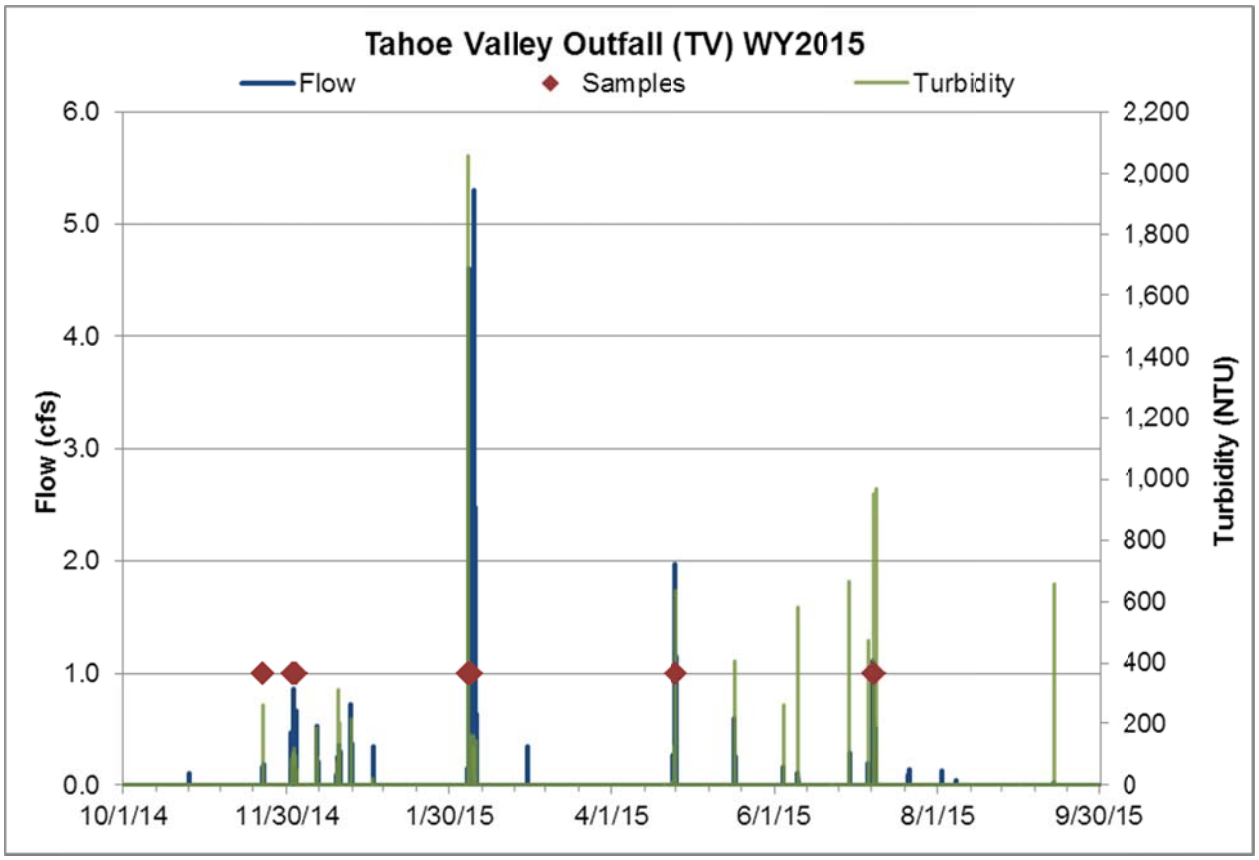

Figure 28: Continuous hydrology, continuous turbidity, and sampled events at the Tahoe Valley catchment outfall, WY15. Two events were sampled during the large February 6-8, 2015 storm and two events were sampled at the beginning of December (December 3 and December 4, 2015).

Summary data for the seven events sampled at Tahoe Valley in WY15 are presented in Table 14. Five precipitation events were sampled during the fall/winter, one event in the spring, and one event in the summer. This site only flows during very large precipitation events of at least 0.8 inches but generally greater than one inch. The 0.18 inch precipitation event that began on December 4, 2014 was actually a continuation of the event that began on December 3, 2014 but was split in two because of the significant decrease in flow between 2:40 and 6:00 on December 4. Similarly, the very large event that began on February 6, 2015 and ended on February 8, 2015 was split in two. With 3.71 inches of rain and a cumulative 203,753 cubic feet of runoff, the February event was nearly ten times greater than the next two largest events. The first half of this event resulted in average EMCs but highest loads of all three pollutants all year while the second half of the event had EMCs of less than 1 mg/L of FSP and the lowest TN and TP concentrations of the year. Much like at Speedboat and Tahoma, the roads were likely washed clean in the latter part of the four day rainstorm. It is interesting to note that, with the exception of the first runoff event of the year (November 2014), the largest event of the year (February 2015), and a very large thunderstorm (July 2015), event mean FSP concentrations at this site were consistently below 1 mg/L and loads were correspondingly low. EMCs and loads of TN and TP are within the same range as the other sites. Though the Tahoe Valley catchment has relatively high density development with a significant amount of commercial and industrial areas, low pollutant concentrations may be the result of extensive water quality improvements implemented in this catchment in the last 25+ years (see section 2.7 for description). Data collected in future years may elucidate other reasons for the low concentrations. The greatest peak

turbidity occurred at the beginning of the February 6, 2015 event. Peak turbidities are generally concurrent with peak flows at this site (Appendix J).

Table 14: Summary data for seven sampled events at the Tahoe Valley catchment outfall in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
TV	Fall/Winter	11/22/14 6:30	11/22/14 12:40	6:10	1,975	0.18	259	0.85	rain	95%	84	10	1,235	0.2	545	<0.1
TV	Fall/Winter	12/3/14 9:50	12/4/14 2:40	16:50	23,891	0.86	119	1.19	rain	85%	<1	1	685	1.0	269	0.4
TV	Fall/Winter	12/4/14 6:00	12/4/14 14:00	8:00	9,691	0.66	93	0.18	rain	100%	<1	<1	885	0.5	199	0.1
TV	Fall/Winter	2/6/15 17:00	2/7/15 13:00	20:30	99,321	4.61	2,058	2.87	rain	100%	83	517	1,185	7.3	291	1.8
TV	Fall/Winter	2/7/15 13:00	2/8/15 9:50	20:50	104,432	3.80	124	0.84	rain	90%	<1	7	613	4.0	181	1.2
TV	Spring	4/25/15 9:10	4/25/15 21:20	12:10	36,010	1.97	636	1.13	rain	100%	<1	2	1,331	3.0	233	0.5
TV	Summer	7/8/15 11:20	7/9/15 6:10	18:50	18,058	1.11	956	1.36	thunderstorm	100%	143	161	2,976	3.4	664	0.7

6.2.8 UPPER TRUCKEE

The total precipitation for WY15 at the Upper Truckee meteorological station was 17.75 inches, which falls within the first quartile of the annual precipitation recorded at the Tahoe City Cross reference station since 1981 (Table 4). Figure 29 shows the continuous hydrology and cumulative precipitation for WY15. The majority of the precipitation fell in the fall/winter season (11.06 inches). The spring season received 3.63 inches and the summer season received 3.06 inches. A total of 36 discrete precipitation events were measured at the Tahoe Valley meteorological station, 16 in the fall/winter, 10 in the spring, and 10 in the summer. Roughly 31% of the events during WY15 produced less than a tenth of an inch of precipitation, and 75% of the events produced less than half an inch. The largest storm occurred between February 6, 2015 and February 9, 2015, falling as mixed rain and snow and resulted in 5.49 inches of precipitation in the Upper Truckee catchment. However, the highest peak flows (about 3.3 cfs) occurred during a high intensity thunderstorm on July 8, 2015.

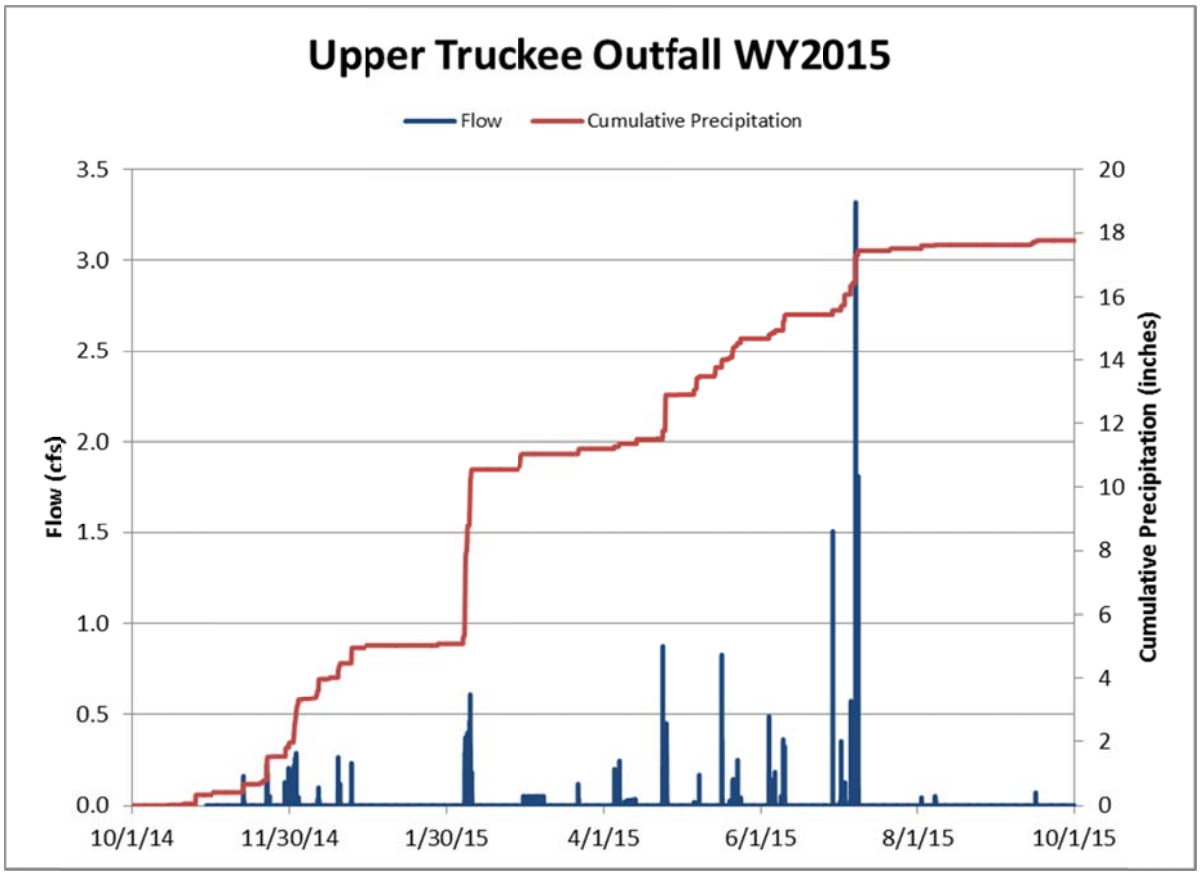

Figure 29: Continuous hydrology and cumulative precipitation at the Upper Truckee catchment outfall, WY15.

During WY15, though there were fifteen precipitation events in the Upper Truckee catchment that produced sufficient runoff to sample; water quality samples were taken across the hydrograph during nine runoff events. However, despite the many thunderstorms that occurred during the summer season, only one thunderstorm on July 8, 2015 produced enough runoff to sample and unfortunately the station experienced a power failure during that time that prevented sampling. Fortunately, the requisite number of sampled events was reached during the fall/winter and spring seasons. Continuous hydrology, continuous turbidity and events sampled during WY15 are presented in Figure 30. (This site had funding through Proposition 84; hence the number of events sampled was greater than required for regulatory compliance.) The highest turbidities in WY15 were seen on Dec 24, 2014, but the storm did not produce enough runoff to sample. The greatest flows in WY15 were seen during the thunderstorm that occurred on July 8, 2015 as the peak precipitation reached 0.32 inches in ten minutes. As previously mentioned, the July 8, 2015 thunderstorm event was not sampled due to equipment failure.

Continuous hydrology, continuous turbidity, and water quality samples for nine individual events in WY15 are presented in Appendix K.

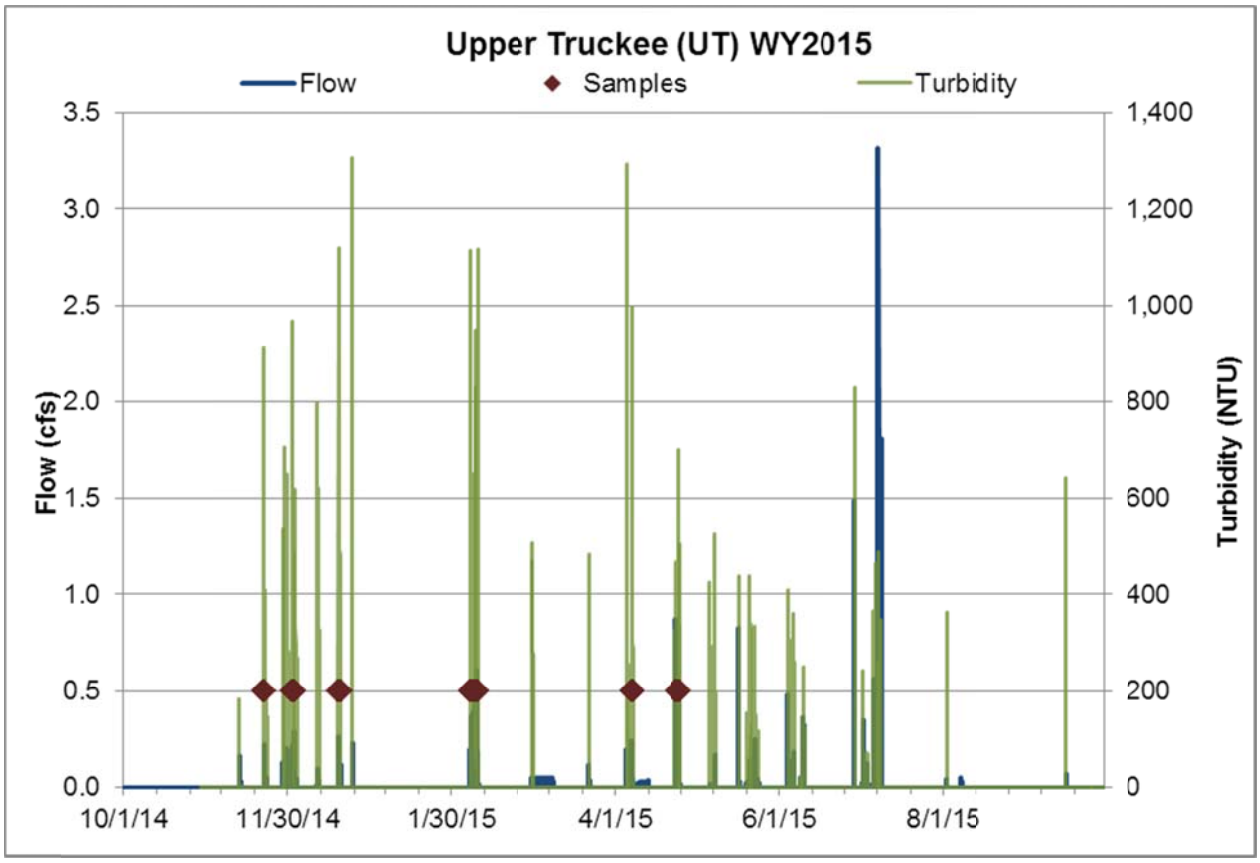

Figure 30: Continuous hydrology, continuous turbidity, and sampled events at the Upper Truckee catchment outfall, WY15. Three events were sampled during the large February 6-8, 2015 storm and two events were sampled towards the end of April (April 23 and April 25, 2015).

Summary data for the nine events sampled at Upper Truckee in WY15 are presented in Table 15. Six precipitation events were sampled during the fall/winter and three events were sampled in the spring. No events were sampled at this site during the summer due to numerous small events that of themselves did not produce sufficient runoff for successful sampling, and equipment failure during the one event that produced enough runoff to sample. Upper Truckee will produce low flows with small amounts of precipitation; however it generally produces sufficient runoff to sample only during moderately sized precipitation events of about 0.4 inches. A portion of the runoff that occurred in the first two events of April was likely due to melting of the accumulated snowpack and is not attributable exclusively to the precipitation that fell during that period. The December 19, 2015 event had significantly higher event mean FSP concentrations and relatively high nutrient concentrations but a small runoff volume resulted in average loads of all three pollutants. Like Speedboat, Tahoma, and Tahoe Valley, the large February event was split. At Upper Truckee it was split into three events due to significant drops in flow on the mornings of February 7 and 8. Unlike Speedboat, Tahoma, and Tahoe Valley, the latter portion of the event did not see greatly reduced concentrations of all three pollutants. In fact, the last sampling event in the series, beginning February 8, had EMCs of all three pollutants on par with the first sampling event in the series. Not surprisingly, since the last event in the series had the greatest flow, it delivered the largest loads of all pollutants. This catchment receives runoff largely from highway 50 and it is possible that because of the high traffic density in this area road abrasive application continued throughout the four day storm and the roads were not washed clean as in the other three catchments. EMCs for TN and TP were highest during the

April 7-8 event but loading was small as the runoff volume was small. High peak turbidities were about 1,110 NTU during three fall/winter events and occurred at the beginning of each event (Appendix K).

Table 15: Summary data for nine sampled events at the Upper Truckee catchment outfall in WY15.

Station Acronym	Season	Runoff Start (Date Time)	Runoff End (Date Time)	Runoff Duration (hh:mm)	Runoff Volume (cf)	Peak Flow (cfs)	Peak Turb (NTU)	Storm Total (in)	Event Type	% of Storm Sampled	FSP EMC (mg/L)	FSP event load (lbs)	TN EMC (ug/L)	TN event load (lbs)	TP EMC (ug/L)	TP event load (lbs)
UT	Fall/Winter	11/22/14 5:20	11/22/14 13:50	8:30	2,594	0.22	259	0.85	rain	60%	354	57	1,349	0.2	1,001	0.2
UT	Fall/Winter	12/2/14 12:40	12/3/14 16:20	27:40	9,689	0.29	967	1.37	rain/snow	80%	195	116	1,749	1.0	858	0.5
UT	Fall/Winter	12/19/14 11:40	12/20/14 12:10	24:30	2,062	0.26	1,117	0.45	rain/snow	100%	709	91	3,449	0.4	1,999	0.3
UT	Fall/Winter	2/6/15 15:10	2/7/15 8:10	17:00	6,712	0.37	1,113	2.87	rain	85%	268	112	1,856	0.8	844	0.4
UT	Fall/Winter	2/7/15 11:40	2/8/15 3:00	15:20	5,749	0.40	651	0.84	rain	100%	137	49	1,772	0.6	538	0.2
UT	Fall/Winter	2/8/15 9:00	2/9/15 12:30	27:30	15,708	0.61	1,114	1.78	rain	100%	163	160	1,428	1.4	560	0.5
UT	Spring	4/7/15 11:30	4/8/15 6:40	19:10	1,697	0.24	997	0.09	snow	95%	470	50	5,877	0.6	2,067	0.2
UT	Spring	4/23/15 11:10	4/24/15 5:50	18:30	2,413	0.88	468	0.25	rain	80%	94	14	3,885	0.6	863	0.1
UT	Spring	4/25/15 2:30	4/25/15 17:50	15:20	7,106	0.45	701	1.13	rain	95%	270	120	2,580	1.1	860	0.4

7 BMP EFFECTIVENESS MONITORING

7.1 PASADENA

The cartridge filters currently installed in the Contech Stormfilter vaults at Pasadena had treated no flow at the beginning of WY14 monitoring (see Section 2.1 for details), so the filters were functioning at optimal levels at the beginning of this study. To date, maintenance of the system includes only vactoring of the pre-treatment chambers in the spring and fall of WY14 and WY15.

WY14 data suggests that the Stormfilter at Pasadena had a variable ability to reduce FSP, TN, and TP during runoff events. Though Table 16a suggests that the Stormfilter was about 58% effective in reducing FSP in the winter and 33% efficient overall for the year, data shows increases in loads in the spring (123%) and summer (41%). Load increases of over 100% in the spring may be due to sediment accumulation in the Stormfilter chamber from fall/winter events that was flushed out during a spring event. Therefore, it may be beneficial to perform annual maintenance in the early spring to ensure that accumulated fall/winter pollutants are not released to the lake. The Stormfilter is not designed to reduce runoff volumes. Reductions shown in the tables may be due to runoff that remains in the chamber after the end of an event that slowly evaporates, or to the small allowable error in the flow monitoring equipment.

WY15 data suggests that the Stormfilter at Pasadena has a somewhat less variable but diminished ability to reduce FSP, TN, and TP when compared with WY14. Table 16b shows that the Stormfilter was relatively consistent in annual and seasonal FSP load reductions (reductions of 23%, 16%, 20%, and 21% for fall/winter, spring, summer, and annual respectively). Additionally, unlike WY14, sediments were not flushed from the vaults in the spring and summer. The pretreatment chambers upstream of the cartridge filters were vactored out at the end of WY14 and in the spring of WY15 and the WY15 fall/winter volume was about one third the WY14 fall/winter volume; therefore, it is possible that there was less accumulated sediment available to flush out in the spring and summer of WY15. Additionally, Table 16b also shows that on an average annual basis the Stormfilter was more effective at reducing TN than TP, but in general annual reductions of all three pollutants were similar in WY15. The increase in TN load during the fall/winter may have been the result of flushing accumulated pollutants stored in the vault from previous events. The

reduced pollutant removal efficiency in WY15 compared to WY14 may indicate a need to perform maintenance on this treatment vault.

Table 16a: Summary statistics for volume and load reductions at the Pasadena Stormfilter in WY14.

Water Year 2014 Oct. 1, 2013 - Sep. 30, 2014			Seasonal Volumes (cf)			Total Annual Runoff Volume (cf)	Seasonal FSP Load (lbs)			Total Annual FSP Load (lbs)	Seasonal TN load (lbs)			Total Annual TN load (lbs)	Seasonal TP load (lbs)			Total Annual TP load (lbs)
Catchment (Site) Name	Station Name	Station Acronym	Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Seasonal TN load (lbs)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)	
Pasadena	Pasadena In	PI	99,687	9,943	25,424	135,054	530	22	128	680	6.4	na	5.3	11.8	3.0	na	3.5	6.5
	Pasadena Out	PO	99,382	9,301	24,478	133,161	225	49	180	454	4.6	na	3.1	7.7	2.9	na	2.4	5.2
Volume or Load Reduction			305	642	946	1,893	305	-27	-52	226	1.8	na	2.2	4.1	0.1	na	1.1	1.3
% Change			-0.3%	-6%	-4%	-1%	-58%	123%	41%	-33%	-28%	na	-42%	-34%	-5%	na	-32%	-19%

Table 16b: Summary statistics for volume and load reductions at the Pasadena Stormfilter in WY15.

Water Year 2015 Oct. 1, 2014 - Sep. 30, 2015			Seasonal Volumes (cf)			Total Annual Runoff Volume (cf)	Seasonal FSP Load (lbs)			Total Annual FSP Load (lbs)	Seasonal TN load (lbs)			Total Annual TN load (lbs)	Seasonal TP load (lbs)			Total Annual TP load (lbs)
Catchment (Site) Name	Station Name	Station Acronym	Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)	
Pasadena	Pasadena In	PI	31,797	2,931	16,402	51,130	95	8	161	265	1.6	0.2	5.3	7.1	1.0	<0.1	1.6	2.7
	Pasadena Out	PO	30,276	2,739	15,887	48,902	73	7	129	209	2.1	0.1	3.0	5.3	0.9	<0.1	1.4	2.3
Volume or Load Reduction			1,521	192	515	2,228	22	1	32	56	-0.5	<0.1	2.3	1.8	0.1	<0.1	0.3	0.4
% Change			-5%	-7%	-3%	-4%	-23%	-16%	-20%	-21%	32%	-13%	-43%	-25%	-12%	-2%	-17%	-15%

Table 17a compares the efficiency of the Stormfilter at reducing concentrations and loads of all three pollutants for the individual events sampled in WY14. The event that began January 29, 2014 constituted 8% of the total flow, but showed increases greater than 70% in both FSP EMCs and event loads. The January 29th storm also saw about a one third increase in TN, and a small increase in TP. Since this was the first large event of the season, smaller previous events may have filled the Stormfilter chamber with turbid water that got flushed out during this event. This is supported by FSP concentrations that were higher at the outflow for all samples that were used to calculate the EMC (i.e. first flush sample, and rising and falling limb composites, see Table A2a, Appendix A). The City of South Lake Tahoe believes that the increase in turbidity could also be the result of filter replacement that occurred September 30, 2013. Since this time, the filters have not been cleaned or replaced, and maintenance activities have been limited to vactoring the pretreatment chambers upstream of the cartridge filters in the spring and fall. Further investigation of filter effectiveness is warranted to validate this assumption and will be determined with continued water quality data collection. The event that began February 8, 2014 accounted for 68% of the total runoff volume but showed no improvement in FSP. This event showed reasonable reductions in TN, but only nominal reductions in TP. The event that began July 18, 2014 had reasonable reductions for all pollutants, but only comprised 0.2% of the total annual flow. The July 20, 2014 event showed nominal reductions for all pollutants and only accounted for 1% of the total annual flow. Overall, the vault showed little to no pollutant removal in WY14.

Table 17b compares the efficiency of the Stormfilter at reducing concentrations and loads of all three pollutants for the individual events sampled in WY15. The event that began February 6, 2015 showed nominal reductions in FSP and TP EMCs and loads, and a very large increase in TN EMC and load. The event that began February 8, 2015 is a continuation of the February 6 event and showed less than 20% reductions in concentrations and loads of all three pollutants (with the exception of a 22% reduction in FSP load). This is noteworthy as the combined event constituted 45% of the annual flow measured at Pasadena and could indicate a need to change the filters prior to the beginning of every water year. The April 25, 2015 event showed variable removal efficiency of all three pollutants. Perceived increases in concentrations for FSP and TP during this event may have been due to allowable margins of error in laboratory analysis. Calculated load reductions in these two pollutants, despite concentration increases, are due to smaller effluent volumes than influent volumes (as a result of some volume retention in the Stormfilter). The greatest removal efficiency for FSP and TN occurred with the summer thunderstorm on July 8, 2015 when concentrations of all three pollutants were at their highest. Overall, the vault showed minimal pollutant removal efficiency in WY15.

Table 17a: Efficiency summary for the Pasadena Stormfilter in WY14. Increases in concentrations and loads for all pollutants during the January 29, 2014 storm may have been due to flushing from previous events or filter maintenance prior to the event.

Event Start Date	Event Volume as a % of Total Annual Volume (cf)	FSP Concentration (mg/L)			FSP Load (lbs)			TN Concentration (ug/L)			TN Load (lbs)			TP Concentration (ug/L)			TP Load (lbs)		
		in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change
1/29/14	8%	64	110	72%	40	69	73%	1,884	2,583	37%	1.2	1.6	33%	873	980	12%	0.6	0.6	0%
2/8/14	68%	46	46	0%	257	260	1%	939	544	-42%	5.3	3.1	-42%	440	404	-8%	2.5	2.3	-8%
7/18/14	0.2%	534	207	-61%	9	3	-67%	9,837	3,627	-63%	0.2	0.1	-50%	3,615	1,497	-59%	0.1	<0.1	-50%
7/20/14	1%	262	250	-5%	27	26	-4%	2,269	1,799	-21%	0.2	0.2	0%	1,960	1,567	-20%	0.2	0.2	0%

Table 17b: Efficiency summary for the Pasadena Stormfilter in WY15. Perceived increases in concentrations for FSP and TP during the April 25, 2015 event may have been due to allowable margins of error in laboratory analysis. The large increase in TN concentrations and loads during the February 6, 2015 event may have been due to flushing from previous events.

Event Start Date	Event Volume as a % of Total Annual Volume (cf)	FSP Concentration (mg/L)			FSP Load (lbs)			TN Concentration (ug/L)			TN Load (lbs)			TP Concentration (ug/L)			TP Load (lbs)		
		in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change
2/6/15	20%	62	57	-7%	40	36	-10%	889	1,690	90%	0.6	1.1	84%	611	589	-4%	0.4	0.4	-7%
2/8/15	25%	43	35	-18%	35	27	-22%	736	649	-12%	0.6	0.5	-16%	419	369	-12%	0.3	0.3	-16%
4/25/15	7%	46	51	12%	10	8	-22%	939	873	-7%	0.2	0.1	-35%	438	458	5%	0.1	0.1	-27%
7/8/15	20%	157	112	-29%	98	71	-28%	5,174	3,031	-41%	3.2	1.9	-41%	1598	1367	-14%	1.0	0.9	-13%

The discrepancy between Tables 16a/b and 17a/b with respect to FSP are due to how the average seasonal and annual concentrations and loads are calculated. Since continuous turbidimeter data is available from both the inflow and outflow stations at Pasadena, seasonal and annual loads and average concentrations in Values in Tables 16a/b were calculated using equations relating turbidity to FSP. Values in Tables 17a/b show event mean FSP concentrations calculated using results from water quality samples submitted to the analytical laboratory for PSD analysis and loads calculated from those concentrations. Both of these methods have limitations. Despite numerous comparisons to lab analyzed turbidity at the same date and time, the turbidimeter is not always accurate and could over or underestimate loads. In addition, though converting turbidity to FSP using universal equations has been shown to yield reasonable results, this method will likely introduce some error as turbidity to FSP relationships tend to show some site specificity. Calculating average seasonal and annual concentrations and loads from just a few events sampled can also introduce error as events can vary significantly in pollutant concentrations and loads and therefore average concentrations and loads will depend on which events were successfully sampled. (Average seasonal and annual concentrations and loads for TN and TP in Tables 16a/b are necessarily calculated from events sampled, so the alignment between the numbers in Tables 16a/b and the numbers from individual sampled events in Tables 17a/b is good.)

7.2 RUBICON

There has been no outflow from the Stormtech chambers at Rubicon recorded at RO in either WY14 or WY15. All runoff volumes measured at RI have been infiltrated by the Stormtech chambers thus far. This indicates 100% efficiency of the Stormtech chambers in reducing FSP, TN, and TP.

7.3 SR431

Data collected from matched inflow and outflow sampling at the Contech MFS stormwater treatment vault and at the Jellyfish stormwater treatment vault at SR431 during WY14 show relatively effective but variable removal of sediment and nutrients. Table 18a presents the summary data on removal efficiency for each vault in WY14. These data suggest that both vaults removed about equivalent amounts of FSP (52-55%), TN (33-31%) and TP (51-54%) on an annual basis, with less variability observed in seasonal load reductions during summer storms. Table 18b presents the summary data on removal efficiency for WY15. The data suggest that the vaults did not remove approximately equivalent amounts of pollutants as they did WY14. The pollutant removal efficiency of Contech MFS dropped a bit on an average annual basis; from 55% to 35% for FSP, from 33% to 18% for TN, and from 54% to 34% of TP in WY14 and WY15 respectively. However, the removal efficiency of the Jellyfish diminished significantly. In fact, on an average annual basis it released FSP and TN (from a 52% reduction to 3% increase in FSP and from a 31% reduction to a 3% increase in TN for WY14 and WY15 respectively). Its ability to remove TP dropped from 51% to 24% on an average annual basis. The Jellyfish was cleaned September 23, 2015, shortly before the beginning of WY16.

Note that the Contech MFS vault shows a volume reduction in outflow relative to inflow during each season, especially during the fall/winter and spring seasons. In the absence of bypass flows, which were not observed, the inflow and outflow volumes should match. This difference is considered an artifact of monitoring limitations inherent to the station, when low flows out of the treatment vaults persist below detection limits of the flumes (installed during highway construction by the contractor).

In WY14 there were problems with maintaining stage transducers and turbidity sensors during fall/winter and spring runoff seasons due to extensive sediment accumulation in the conveyance lines and flume units. To help solve this problem, riser pipes were installed in the diverter vault in late summer of 2014 to retain coarse sediments prior to discharge into conveyance lines that lead into the monitoring flumes and treatment vaults. This has resulted in much less sensor fouling and improved data collection.

Event efficiency results for both vaults are shown in Tables 19a/b and 20a/b. Though Table 18b shows an increase in FSP loads during the fall/winter and summer seasons from the Jellyfish, Table 20b indicates FSP load reductions for every fall/winter and all but one summer event. This is because values in Table 18b are calculated from continuous turbidity and account for all flow that passed through the monitoring station the whole year. Values in Table 20b are calculated from samples taken during events and analyzed for PSD. Even though each event sampled may have shown a decrease in FSP load from the Jellyfish, it does not mean there was a decrease in load from the Jellyfish during all flow not sampled.

The Desert Research Institute (DRI) submitted a summary report of the efficiency study they conducted on these vaults during WY14 and WY15 to the Nevada Department of Transportation and the Nevada Division of Environmental Protection (NDEP) in December 2015. A full analysis of treatment vault efficiencies and comparison of the two different types can be found in DRI et al 2015.

Table 18a: Summary statistics for volume and load reductions at the SR431 Contech MFS and Jellyfish vaults in WY14.

Water Year 2014 Oct. 1, 2013 - Sep. 30, 2014			Seasonal Volumes (cf)			Total Annual Runoff Volume (cf)	Seasonal FSP Load (lbs)			Total Annual FSP Load (lbs)	Seasonal TN load (lbs)			Total Annual TN load (lbs)	Seasonal TP load (lbs)			Total Annual TP load (lbs)
Catchment (Site) Name	Station Name	Station Acronym	Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)	
SR431	Contech In	CI	4,024	6,372	7,561	17,957	68	171	55	293	0.5	0.9	1.0	2.4	0.2	0.5	0.2	0.8
	Contech Out	CO	3,003	4,007	6,575	13,584	34	59	38	131	0.3	0.4	0.9	1.6	0.1	0.2	0.1	0.4
Volume or Load Reduction			1,021	2,365	986	4,373	34	112	17	162	0.2	0.5	0.1	0.8	0.1	0.3	<0.1	0.5
% Change			-25%	-37%	-13%	-24%	-50%	-65%	-31%	-55%	-40%	58%	7%	-33%	53%	67%	24%	54%
SR431	Jellyfish In	JI	3,022	4,837	8,377	16,236	83	131	54	268	0.4	0.8	1.1	2.3	0.2	0.4	0.2	0.8
	Jellyfish Out	JO	3,320	4,695	8,122	16,136	23	67	38	128	0.2	0.4	0.9	1.6	0.1	0.2	0.2	0.4
Volume or Load Reduction			-298	142	255	100	61	63	16	140	0.1	0.4	0.2	0.7	0.1	0.2	<0.1	0.4
% Change			10%	-3%	-3%	-1%	-73%	-48%	-30%	-52%	37%	-50%	15%	-31%	-69%	-55%	-29%	-51%

Table 18b: Summary statistics for volume and load reductions at the SR431 Contech MFS and Jellyfish vaults in WY15.

Water Year 2015 Oct. 1, 2014 - Sep. 30, 2015			Seasonal Volumes (cf)			Total Annual Runoff Volume (cf)	Seasonal FSP Load (lbs)			Total Annual FSP Load (lbs)	Seasonal TN load (lbs)			Total Annual TN load (lbs)	Seasonal TP load (lbs)			Total Annual TP load (lbs)
Catchment (Site) Name	Station Name	Station Acronym	Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)		Fall/Winter (Oct1-Feb28)	Spring (Mar1-May31)	Summer (Jun1-Sep30)	
SR431	Contech In	CI	11,877	9,804	3,831	25,512	95	87	4	186	0.9	0.6	0.2	1.7	0.7	0.4	<0.1	1.1
	Contech Out	CO	9,379	7,976	3,295	20,650	69	47	4	120	0.6	0.5	0.3	1.4	0.4	0.3	<0.1	0.8
Volume or Load Reduction			2,498	1,828	536	4,862	26	40	<0.1	66	0.2	0.2	<0.1	0.3	0.2	0.1	<0.1	0.4
% Change			-21%	-19%	-14%	-19%	-27%	-46%	0%	-35%	-26%	-27%	39%	-18%	-36%	-35%	19%	-34%
SR431	Jellyfish In	JI	11,014	11,281	4,359	26,654	86	84	5	175	0.8	0.7	<0.1	1.5	0.7	0.5	<0.1	1.2
	Jellyfish Out	JO	10,976	10,977	3,780	25,733	106	68	6	180	0.6	0.7	0.3	1.6	0.5	0.4	<0.1	0.9
Volume or Load Reduction			38	304	579	921	-20	16	-1	-5	0.2	<0.1	<0.1	<0.1	0.1	0.2	<0.1	0.3
% Change			0%	-3%	-13%	-3%	23%	-19%	20%	3%	-23%	-2%	555%	3%	-22%	-30%	21%	-24%

Table 19a: Efficiency summary for the Contech MFS vault at SR431 in WY14.

Event Start Date	Event Volume as a % of Total Annual Volume (cf)	FSP Concentration (mg/L)			FSP Load (lbs)			TN Concentration (ug/L)			TN Load (lbs)			TP Concentration (ug/L)			TP Load (lbs)		
		in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change
1/29/2014	8%	269	182	-32%	23	13	-43%	2,078	1,672	-20%	0.2	0.1	-33%	670	419	-37%	<0.1	<0.1	-48%
3/5/2014	5%	744	286	-62%	38	11	-71%	3,420	1,394	-59%	0.2	<0.1	-67%	2,180	740	-66%	0.1	<0.1	-74%
3/29/2014	5%	514	322	-37%	27	14	-48%	2,882	1,924	-33%	0.2	<0.1	-47%	1,383	844	-39%	<0.1	<0.1	-50%
5/10/2014	3%	458	332	-28%	15	6	-60%	1,702	1,554	-9%	<0.1	<0.1	-50%	1,210	970	-20%	<0.1	<0.1	-56%
5/19/2014	8%	186	115	-38%	16	7	-56%	1,242	1,124	-10%	0.1	<0.1	-36%	525	319	-39%	<0.1	<0.1	-59%
7/16/2014	5%	311	208	-33%	17	11	-35%	2,791	2,645	-5%	0.2	0.1	-7%	940	765	-19%	<0.1	<0.1	-25%
8/4/2014	7%	40	31	-23%	3	2	-35%	1,176	1,520	29%	<0.1	0.1	11%	160	125	-22%	<0.1	<0.1	-33%
9/26/2014	7%	51	49	-4%	4	2	-37%	2,506	2,679	7%	0.2	0.1	-32%	270	220	-19%	<0.1	<0.1	-45%

Table 19b: Efficiency summary for the Contech MFS vault at SR431 in WY15.

Event Start Date	Event Volume as a % of Total Annual Volume (cf)	FSP Concentration (mg/L)			FSP Load (lbs)			TN Concentration (ug/L)			TN Load (lbs)			TP Concentration (ug/L)			TP Load (lbs)		
		in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change
10/31/14	2%	76	59	-23%	3	1	-52%	3,150	2,200	-30%	0.1	<0.1	-57%	293	233	-20%	<0.1	<0.1	-51%
12/2/14	15%	141	121	-14%	33	21	-36%	730	820	12%	0.2	0.1	-17%	424	328	-23%	<0.1	<0.1	-43%
2/7/15	19%	402	342	-15%	123	98	-21%	1,270	1,190	-6%	0.4	0.3	-12%	1330	1006	-24%	0.4	0.3	-29%
4/23/15	8%	332	275	-17%	40	28	-31%	1,260	1,170	-7%	0.2	0.1	-22%	1101	812	-26%	0.1	<0.1	-38%
5/6/15	6%	316	239	-25%	32	20	-38%	1,006	494	-51%	0.1	<0.1	-60%	126	92	-27%	<0.1	<0.1	-40%
5/14/15	6%	168	149	-11%	15	10	-31%	829	1,378	66%	<0.1	<0.1	29%	662	648	-2%	<0.1	<0.1	-24%
5/22/15	5%	211	160	-24%	18	13	-30%	1,020	734	-28%	<0.1	<0.1	-33%	856	665	-22%	<0.1	<0.1	-28%
6/9/15	6%	78	49	-37%	8	5	-41%	891	1,437	61%	<0.1	0.1	51%	153	212	38%	<0.1	<0.1	30%

Table 20a: Efficiency summary for the Jellyfish vault at SR431 in WY14.

Event Start Date	Event Volume as a % of Total Annual	FSP Concentration			FSP Load (lbs)			TN Concentration			TN Load (lbs)			TP Concentration			TP Load (lbs)		
		in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change
1/29/2014	8%	442	110	-75%	34	9	-74%	1,936	1,109	-43%	0.2	<0.1	-40%	1,056	300	-72%	<0.1	<0.1	-70%
3/5/2014	4%	681	345	-49%	27	17	-37%	3,598	1,511	-58%	0.1	<0.1	-43%	2,180	970	-56%	<0.1	<0.1	-44%
3/29/2014	4%	511	197	-61%	20	7	-65%	2,891	1,315	-55%	0.1	<0.1	-55%	1,589	465	-71%	<0.1	<0.1	-72%
5/10/2014	3%	606	442	-27%	18	9	-50%	2,404	1,753	-27%	<0.1	<0.1	-43%	1,790	1,220	-32%	<0.1	<0.1	-52%
5/19/2014	14%	309	174	-44%	45	28	-38%	2,366	1,293	-45%	0.3	0.2	-38%	950	480	-49%	0.1	<0.1	-45%
7/16/2014	7%	244	210	-14%	17	14	-18%	2,988	2,920	-2%	0.2	0.2	-10%	910	802	-12%	<0.1	<0.1	-17%
8/4/2014	9%	37	25	-32%	3	2	-43%	1,336	1,143	-14%	0.1	<0.1	-31%	145	109	-25%	<0.1	<0.1	-39%
9/26/2014	7%	48	39	-19%	3	2	-29%	2,094	2,111	1%	0.2	0.1	-13%	240	180	-25%	<0.1	<0.1	-35%

Table 20b: Efficiency summary for the Jellyfish vault at SR431 in WY15.

Event Start Date	Event Volume as a % of Total Annual Volume (cf)	FSP Concentration (mg/L)			FSP Load (lbs)			TN Concentration (ug/L)			TN Load (lbs)			TP Concentration (ug/L)			TP Load (lbs)		
		in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change	in-flow	out-flow	% change
10/31/14	2%	76	27	-64%	2	1	-71%	4,080	1,220	-70%	0.1	<0.1	-76%	299	172	-42%	<0.1	<0.1	-54%
12/2/14	11%	149	114	-24%	28	21	-26%	850	860	1%	0.2	0.2	-2%	445	312	-30%	<0.1	<0.1	-32%
2/7/15	20%	405	342	-16%	137	110	-19%	1,110	900	-19%	0.4	0.3	-23%	1275	1015	-20%	0.4	0.3	-24%
4/23/15	7%	394	264	-33%	47	30	-37%	1,350	1,170	-13%	0.2	0.1	-18%	1322	792	-40%	0.2	<0.1	-44%
5/6/15	7%	256	243	-5%	30	27	-8%	760	889	17%	<0.1	<0.1	14%	56	48	-15%	<0.1	<0.1	-17%
5/14/15	7%	167	113	-32%	19	12	-36%	1,144	1,294	13%	0.1	0.1	6%	664	519	-22%	<0.1	<0.1	-27%
5/22/15	6%	196	202	3%	19	19	4%	531	502	-5%	<0.1	<0.1	-5%	906	806	-11%	<0.1	<0.1	-11%
6/9/15	6%	73	52	-30%	8	5	-30%	988	1,153	17%	0.1	0.1	17%	153	214	40%	<0.1	<0.1	40%

8 PLRM MODELING RESULTS

The Tahoe RCD conducted a mini study to compare average annual runoff volumes and pollutant loads as predicted by PLRMv2.1 to annual volumes and loads measured in WY14 and WY15 at all sites to assess model performance; results are presented in Table 21. In reviewing model performance, it is important to highlight that PLRM represents average annual conditions, and WY14 and WY15 were exceptionally dry years. Thus, it is not surprising that PLRM overpredicted average annual runoff volumes for WY14 and WY15 at all sites with one exception: PLRM predicted that there would never be flow that bypassed the two treatment vaults at SR431 and thus all values for the SR431 catchment outfall (S5) are zero (underpredicted). Similarly, FSP loads were overpredicted at all sites for WY14 and WY15. TN loads were overpredicted by PLRM at all sites for both water years, with the exception of Rubicon Outflow, which was successfully predicted to be zero. TP loads were also overpredicted at all sites for both water years, with the exceptions of Pasadena Inflow and Outflow, which were underpredicted in WY14, and Rubicon Outflow, which was accurately predicted to be zero. Although PLRM tended to overpredict the average annual runoff volumes and pollutants in the unusually dry WY14 and WY15, it is still reasonably predictive of actual conditions. For example, Tahoe Valley has the highest annual runoff volume, which was predicted by PLRM.

Though much of the difference between predicted and measured values can be explained by the drought that characterized the two monitored water years, other adjustments could be made to the models to more closely predict actual conditions. For example, many innovative water quality improvements that have been implemented in the monitored catchments were not included in the models due to difficulty in obtaining pertinent information about them (size, infiltration rate, etc.). Also, there are limited BMPs that can be selected in the model. In particular, distributed small scale infiltration features are difficult to accurately model. As models are refined to better represent actual conditions, the accuracy of modeled volume and pollutant loads should improve. Lastly, models calibrated using refined CEC values (Pasadena Outflow, Jellyfish Outflow, and Contech MFS Outflow) tended to perform better than uncalibrated models. The improved model performance when predicting FSP, TN, and TP load at the three treatment vault outfalls emphasizes the utility of model calibration with empirical data (see section 9 for full discussion of refined CECs and model performance).

Table 21: PLRM predicted and WY14 and WY15 measured values for all monitored catchments.

Catchment (Site) Name	Station Name	Annual Runoff Volumes (cf)			Annual FSP Loads (lbs)			Annual TN Loads (lbs)			Annual TP Loads (lbs)		
		PLRM Predicted	2014 Measured	2015 Measured	PLRM Predicted	2014 Measured	2015 Measured	PLRM Predicted	2014 Measured	2015 Measured	PLRM Predicted	2014 Measured	2015 Measured
Incline Village	Incline Village	731,808	76,005	62,607	4,121	364	76	145	9.2	18	24	4.3	2.5
Pasadena	Pasadena Inflow	143,748	135,054	51,130	1,184	680	272	20	12	7.1	5	6.5	2.7
	Pasadena Outflow	143,748	133,161	48,902	552	454	209	11	7.7	5.3	5	5.2	2.3
Rubicon	Rubicon Inflow	130,680	36,374	13,787	2,057	<1	6.9	24	1.3	1.3	7	0.5	0.2
	Rubicon Outflow	4,356	0	0	87	0	0	1	0	0	0	0	0
SR431	Contech Inflow	43,560	17,957	25,512	1,095	293	186	12	2.4	1.7	3	0.8	1.1
	Contech Outflow	43,560	13,584	20,650	332	131	120	4	1.6	1.4	1	0.4	0.8
	Jellyfish Inflow	43,560	16,236	26,654	1,095	268	175	12	2.3	1.5	3	0.8	1.2
	Jellyfish Outflow	43,560	16,136	25,733	346	128	180	4	1.6	1.6	1	0.4	0.9
	Catchment Outfall	0	3,823	1,853	0	19	1.5	0	0.4	0.3	0	0.2	0.1
Speedboat	Speedboat	317,988	-	230,613	4,911	-	2,898	58	-	19	17	-	5.9
Tahoma	Tahoma	666,468	331,911	175,702	10,801	1,908	1,809	127	21	16	37	14	7.1
Tahoe Valley	Tahoe Valley	5,449,356	-	585,498	53,305	-	846	764	-	36	196	-	9.3
Upper Truckee	Upper Truckee	283,140	-	102,665	5,476	-	754	57	-	11	17	-	4.3

9 CHARACTERISTIC EFFLUENT CONCENTRATIONS

PLRMv2.1 uses a Characteristic Effluent Concentration (CEC) to estimate pollutant loading from a particular BMP. Refining the CECs for specific BMP types modeled in PLRM can be achieved by consistently sampling the treated effluent of a collection of stormwater BMPs of the same type over the range of event types and flow conditions that occurred at the sites during the duration of monitoring. RSWMP protocols to achieve this objective specify a three year data collection effort to sample a range of effluent conditions from three specific BMPs of the same type (Tahoe RCD et al 2015). It also outlines a data analysis approach that translates three years of measured effluent concentrations into a single measured recommended CEC (mg/L) for a specific BMP type for each pollutant (RSWMP FIG sections 9 and 11). These protocols will be followed to recommend a single CEC at the end of three years of data collection and will be included in next year's annual report. However, at this time only two years of data have been collected, and therefore a simple CEC estimation for each site is included in this report (Table 22).

The three BMPs of the same type monitored under this program are the Pasadena Stormfilter, the SR431 Contech MFS,and the SR431 Jellyfish as they all contain cartridge filters. The FSP, TN, and TP CECs shown in Table 22 for the outflows from the Pasadena (PO), Contech MFS (CO), and Jellyfish (JO) treatment vaults were estimated as the average of the average annual concentrations from WY14 and WY15 (see Table 5 for average annual concentrations of each pollutant at each site). The current default FSP, TN, and TP CEC values used in PLRMv2.1 are 13 mg/L, 1500 µg/L and 140 µg/L respectively. (NOTE: PLRM uses TN and TP concentrations in mg/L. However, this report reports all TN and TP concentrations in µg /L.) As the default FSP CEC of 13 mg/L is significantly lower than any of the three estimated FSP CECs in Table 22 (62 to 124 mg/L) and the default TP CEC of 140 µg/L is significantly lower than any of the three estimated TP CECs in Table 22 (485 to 695 µg /L), using the default CECs when modeling these catchments will result in an overestimation of vault pollutant removal efficiency. Accordingly, FSP and TP loads discharged from these catchments will be underestimated. The current default TN CEC value for cartridge filters in PLRM is very similar to the estimated values in Table 22 (1,329 to 1,485 µg /L) so modeled pollutant loads from these three treatment vaults should be similar to measured values if runoff volume is accurately predicted.

To evaluate model performance, the PLRM was run on these two catchments (Pasadena and SR431) using the refined CECs for each treatment vault as shown in Table 22. Runoff volumes, FSP, TN, and TP loads (Table 22) were overpredicted in all model simulations, with the exception of TP load at the Pasadena Outflow in WY14. It is important to keep in mind that PLRM results represent average annual conditions, and WY14 and WY15 were particularly dry years. Since loads are dependent on runoff volume, it is not surprising that PLRM predicted loads were higher than measured in these two years even when using the refined CECs. The runoff volume, FSP, TN, and TP loads predicted by PLRM in these two catchments could very conceivably be observed during an average year if filters are properly maintained and replaced. Overall PLRM provided very reasonable results for both runoff volumes and pollutant loads when the refined CECs were used.

Table 22: CECs for FSP, TN, and TP and PLRM estimated annual runoff volumes and pollutant loads for outflows at three monitored treatment vaults. NOTE: PLRM uses TN and TP concentrations in mg/L. However, this report reports all TN and TP concentrations in µg /L.

		Refined CEC			Annual Runoff Volumes (cf)			Annual FSP Loads (lbs)			Annual TN Loads (lbs)			Annual TP Loads (lbs)		
Station Name	Station Acronym	FSP (mg/L)	TN (ug/L)	TP (ug/L)	PLRM Predicted	2014 Measured	2015 Measured	PLRM Predicted	2014 Measured	2015 Measured	PLRM Predicted	2014 Measured	2015 Measured	PLRM Predicted	2014 Measured	2015 Measured
Pasadena Out	PO	62	1,329	695	143,748	133,161	48,902	552	454	209	11.0	7.7	5.3	5.0	5.2	2.3
Contech Out	CO	124	1,485	517	43,560	13,584	20,650	332	131	120	4.0	1.6	1.4	1.0	0.4	0.8
Jellyfish Out	JO	119	1,256	484	43,560	16,136	25,733	346	128	180	4.0	1.6	1.6	1.0	0.4	0.9

For the SR431 Contech MFS and Jellyfish treatment vaults, the model results for percent FSP removed by the filters using CEC values from Table 22 is shown in Figure 31, depicted as a square and a triangle, respectively. Though obviously not as effective as the default CEC of 13mg/L (which provides a 97% FSP removal rate), the model with refined CEC values still shows very high FSP removal rates (68% for the Contech MFS and 70% for the Jellyfish). The PLRM models were also run with theoretical CECs for reference purposes (Figure 31). At this site, the relationship between FSP removed and FSP CEC is a negative linear relationship, and the filters continue to provide FSP removal up to a CEC of 393mg/L. This means these filters should provide some FSP removal most of the time.

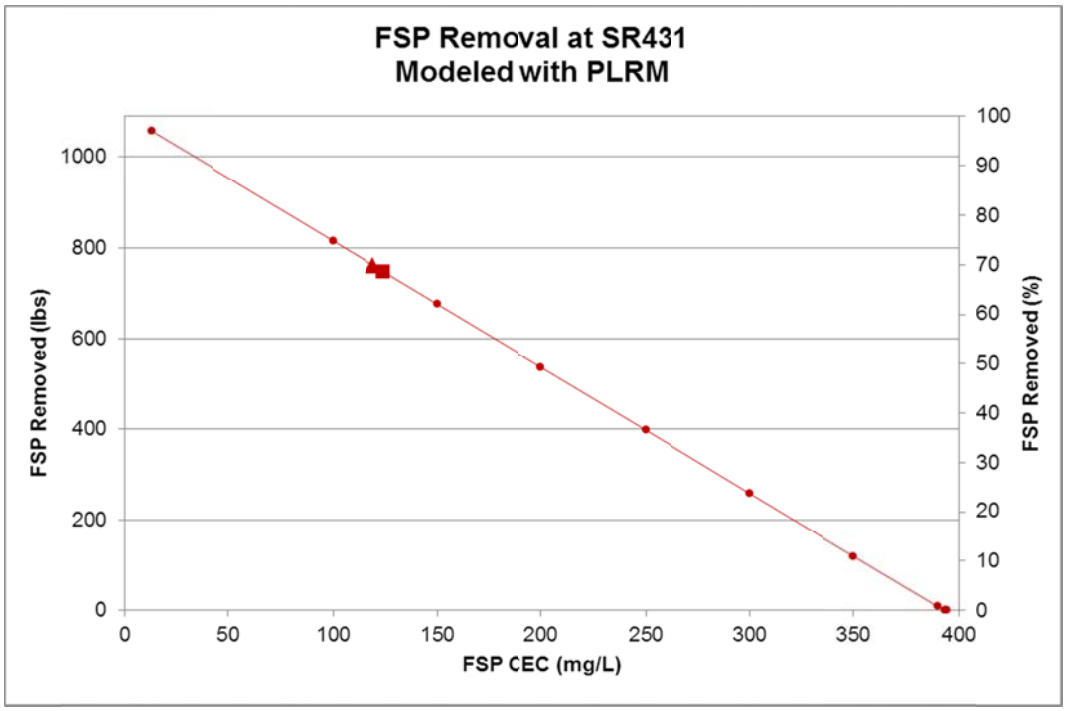

Figure 31: FSP removal at SR431 for the Contech MFS and Jellyfish treatment vaults, as modeled by PLRM. Dots represent model runs with theoretical CECs, the square represents the model run with the refined CEC value for the Contech MFS filter (124 mg/L), and the triangle represents the model run with the refined CEC for the Jellyfish filter (119 mg/L).

For the Pasadena treatment vaults, filter vault #1 is modeled to treat up to 0.6 cfs; flows greater than this are routed to filter vault #2, which treats up to 1.6 cfs, and any flows greater than this bypass the filter vaults and is routed directly to the outlet. The FSP removal using the refined CEC as shown in Table 22 (Figures 32 and 33, represented as a diamond), as well as theoretical CECs for reference purposes

(represented as dots) were modeled with PLRM. The refined CEC of 62 mg/L provides 53% FSP removal for this catchment as modeled by PLRM. For both filter vaults, the amount of FSP removed increases rapidly with decreasing CEC. With a CEC greater than 200 mg/L, filter vault #1 provides no water quality treatment, while filter vault #2 provides treatment up to a CEC of 392 mg/L.

It is unlikely that stormfilters in the Tahoe basin are treating runoff to a CEC of 13 mg/L for FSP, and these BMP effectiveness studies provide data to better understand storm filter treatment efficiency and to refine CECs. Treatment efficiency of the filters depends on (1) catchment characteristics and storm event type that dictate the input pollutant concentration, and (2) the extent (vactoring pretreatment chamber versus cleaning and replacing filters) and schedule of maintenance which determines filter performance. Because of this, treatment efficiency varies widely between catchments and storms. Continued monitoring of these and other filters in the Tahoe basin is suggested to better understand storm filter function and cost-effectiveness, and to further refine static CECs to use in PLRM.

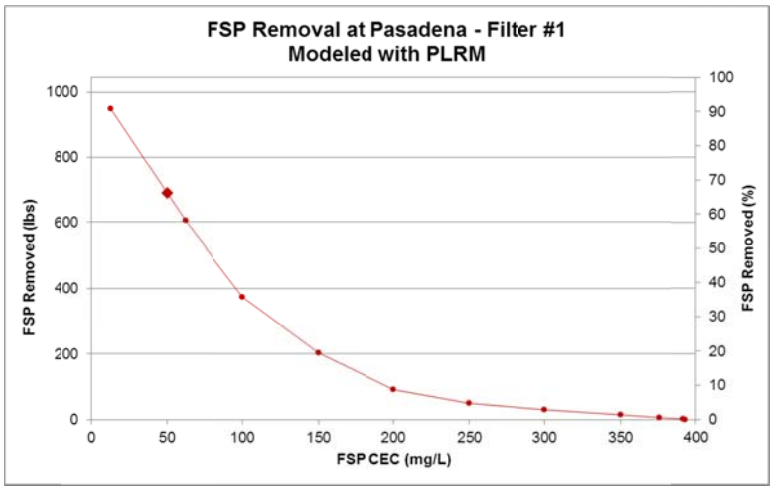

Figure 32: FSP removal at Pasadena filter vault #1, as modeled by PLRM. Dots represent model runs with theoretical CECs and the diamond represents the model run with the estimated CEC (62 mg/L).

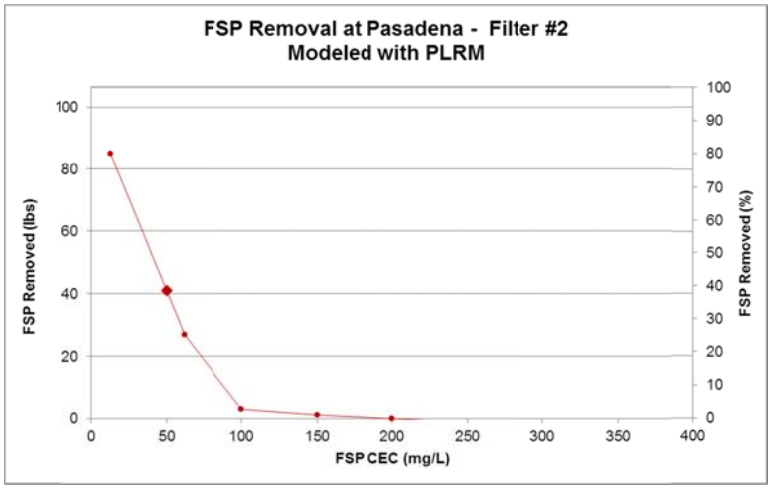

Figure 33: FSP removal at Pasadena filter vault #2, as modeled by PLRM. Dots represent model runs with theoretical CECs and the diamond represents the model run with the estimated CEC (62 mg/L).

10 LESSONS LEARNED

One of the most valuable lessons learned is the importance of checking monitoring stations regularly, especially during runoff events, to identify any potential equipment malfunctions that may result in data gaps. There are a multitude of technical difficulties that can be encountered with stormwater monitoring, including equipment failure, freezing conditions, power failure, vandalism, and obstruction by sediment, snow, trash or other debris. Identifying and correcting these problems early results in a more accurate data set with fewer and shorter data gaps. The biggest cause of data gaps at monitoring stations was power failure. Although all stations are equipped with solar panels to recharge batteries, some stations do not have enough sun exposure to keep batteries continuously charged, and during periods of extended cloud cover and subsequent decrease in solar recharge, all stations are subject to power failure. Regularly checking battery voltage is recommended to avoid this.

Field verifying data as a QAQC procedure is essential to ensure an accurate and reliable dataset. Tahoe RCD staff members regularly check stage and make note of precipitation type and totals during storms to ensure equipment is functioning properly. The greater the level of QAQC during precipitation events, the higher the level of certainty the dataset is representative. The importance of detailed field notes and photographs cannot be understated. With passing time, the human memory lapses, while field notes and photographs can be referred to years and even decades after a monitoring event to explain what happened throughout the monitoring period.

Standing water can accumulate in the treatment vaults at Pasadena and SR431 after runoff events and be flushed out with the following runoff event. Investigations into the cost-effectiveness of maintaining these vaults by pumping them out after each storm may be valuable. It may also be valuable to analyze inflow and outflow data shortly after each storm to determine if filter maintenance or replacement is required before the next event.

Real-time data from the SR431 vault monitoring site can be accessed through on online interface, which has proven exceptionally useful and efficient for site and staff management. For all other sites, it is necessary to physically visit the sites to learn the current status of sampling and thus the amount of extra effort to manage these sites is tremendous. In order to improve program efficiency, Tahoe RCD intends to get all sites on the West and North Shores online by the end of WY16. We also hope to get South Shore sites online by March 2017. Although this will greatly reduce the burden on the amount of staff time needed to check on sites during storms, it is still essential for staff to regularly check sites both during and between storms to QAQC data and ensure equipment is functioning properly.

Short duration, high intensity thunderstorms can be particularly difficult to sample, as the sometimes unpredictably large flow volumes can quickly fill all 24 sample bottles in the autosampler if the flow pacing is set too low. The result is that a portion of the end of the runoff hydrograph is not sampled. Due to the short nature of these events, it is incredibly difficult for staff to reach sites before runoff has ended to replace the full bottles with empty ones. Summer thunderstorms also tend to be very episodic in nature, and not all sites receive runoff over the summer period. As a result, several of the requisite summer events were missed or did not produce enough runoff to sample. In the future, it may be advisable to amend permit and agreement language to relax the summer thunderstorm sampling requirement.

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 (Lahontan). However, all efforts should be made to successfully sample an event within each season so that average seasonal pollutant concentrations and loads can be calculated. Fortunately, FSP concentrations and loads can be calculated from the continuous turbidity data, so these values should never be missing from any season.

Improvements implemented in the Incline Village catchment (such as an infiltration swale along Lakeshore Blvd. west of the monitoring station) have been exceptionally effective at reducing flows, and therefore pollutant loads, to the lake (see section 2.1 for full description). The success of this project has prompted the need to move the location of the Incline Village (IV) monitoring site to a nearby channel that actually receives sufficient flow to monitor so that long-term status and trends monitoring can continue. The move has been approved and will occur sometime during WY16. The Annual Stormwater Monitoring Report WY14-16 will reflect this change in Section 11 below.) Abandoning monitoring of successful sites and continuing monitoring at a catchment outfall that flows will skew long-term status and trends data and encourage a false perception that erosion control projects do not have a measureable benefit. It is documented here that the Central Incline Village Phase II was so successful that it effectively eliminated flows and pollutant loads to Lake Tahoe.

11 CHANGES: PROPOSED AND ACCEPTED

Following WY15, the Tahoe RCD suggested to IMP that the two Rubicon monitoring stations (RI and RO) and the catchment outfall station at SR431 (S5) be removed from the monitoring network in WY16 due to extremely low flow volumes. Since three new sites had been added for WY15, the requisite number of monitoring sites was already met and exceeded (see Section 1 for description of requisite number of sites). The very small pollutant loads from these catchments and the relative difficulty of monitoring sites with low flow did not warrant the effort and cost required to continue monitoring these stations. The IMP agreed with this assessment and the request was brought to Lahontan and NDEP who approved the change for WY16. It is important to document that the reason that these monitoring sites receive such limited flow. In the case of Rubicon, the improvements to infiltration in this catchment (small infiltration basins, the well sized infiltration gallery) have been very successful and reduced flows significantly. In the case of SR431, the upstream treatment vaults divert the majority of the runoff in this catchment away from the outfall site. The outfall site does not receive the treated runoff from the outflows of the treatment vaults. Improvements made in this catchment have been successful in attempting to treat the majority of the runoff before discharge to the creek.

In addition, the Tahoe RCD has urged IMP to propose removing the first flush sample requirement to the regulators for the next permit term (beginning WY17) for three reasons:

1. The first flush sample is limited to the first sample collected in the series of samples taken across an event hydrograph with the autosampler. It is a single sample (i.e. not part of a composite) that does not represent a consistent percentage of the total runoff volume for an event and therefore it is difficult to compare the results across events or sites or to infer anything about loading during

different parts of an event. This is due to the fact that the pacing of samples taken with an autosampler is determined by a flow volume and triggered when a certain level is reached. Generally the level trigger is consistent at each site, but the pacing is changed regularly depending on the predicted size of the incoming storm. The larger the storm, the greater the amount of flow expected, and the higher the pacing is set. Due to the unpredictability of precipitation patterns in the Tahoe Basin, the first sample (first flush) rarely represents a consistent volume, and never represents a consistent percentage of the total runoff volume for the whole event. For example, an autosampler can be programmed to take a sample every 1,000 cubic feet and triggered to begin when the level reaches half an inch. If the pacing was set too low for a large storm, the first flush sample could represent a mere 1% or less of the total flow volume, or if the pacing was set too high for a small storm, that first sample could represent up to 100% of the total flow volume (if that was the only sample taken) or any combination in between. Though first flush samples do tend to be dirtier than composite samples representing the rest of the hydrograph, it is impossible to infer anything about what portion of the pollutant load is delivered during the first period of runoff because of what the first flush samples actually represent. In other words, it would be impossible to calculate that 75% of the pollutant load is delivered in the first 25% of the runoff volume, which would be valuable to the jurisdictions when trying to size an infiltration basin for example.

2. Since the first flush sample generally represents a very small portion of the total runoff volume, its contribution to the calculation of the flow-weighted EMC is often negligible. The concentrations of the pollutants in the bulk of the runoff volume dominate the calculation and make the first flush sample insignificant. The contribution of the first flush sample is even more insignificant when calculating seasonal and annual loads as the volume represented by the first flush sample is far out-weighed by the seasonal or annual volume. First flush when defined as the first bottle is insignificant, but sample processing methods could be changed to reflect that most academic studies define the first 30% of the storm as the first flush. Two composites could be made for each event, one that covers the first 30% of the runoff and one that covers the last 70% of the runoff.

3. Since continuous turbidimeters are installed at all monitoring sites, the calculation most valuable to implementers described in reason #1 above can be calculated easily and effectively, at least for FSP (which many argue is the pollutant of greatest concern). Continuous turbidimeters provide turbidity data every 10 minutes. Turbidity can be converted to FSP concentration using equations from 2NDNATURE et al 2014. Continuous FSP concentrations can then be converted to loads if multiplied by flow over the 10 minute interval. The result is that the cumulative FSP load can be calculated for any time period that corresponds to any percentage of the total runoff volume during the runoff event. For example, if a jurisdiction knows that a certain basin can only hold 10,000 cf before it is bypassed (based solely on basin size), it would be easy to calculate the portion of the total FSP load that was delivered in the first 10,000 cf of runoff for each event and then estimate an annual average pollutant load retention capacity. Conversely, this data could also be used to estimate basin sizes required to retain given percentages of FSP.

Recommendation: Since cost is a concern and questions pertinent to the jurisdictions can be answered much more effectively with continuous turbidity data as described in reason #3 above, the preferred solution to this issue is that the first flush requirement is dropped in the next permit term to reduce staff and analytical costs associated with collecting, processing, and analyzing these samples. Instead,

continuous turbidity data will be analyzed to quantify pollutant loads associated with the first flush. Alternatively, the first flush could be redefined to include the first 30% of each runoff event and composites will be made accordingly as described in reason #2 above.

12 REFERENCES

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13 APPENDIX A: RAW ANALYTICAL DATA

Tables A1a and A1b, A2a and A2b, A3a and A3b, A4b, A5b, A6a and A6b, A7a and A7b, A8, A9, and A10 present all available raw analytical data for first flush (FF) and autosampler composite (AC) samples. The Sample ID is comprised of a two letter monitoring site acronym and a two letter sample type acronym (see table 5 for station acronyms and Table 2 for sample type acronyms). Tables A4a and A5a present available EMC data for events sampled at the inflow and outflow of the Contech MFS and Jellyfish vaults at SR431 in WY14. Please see DRI et al 2015 for additional SR431 vault data.

Table A1a: Raw analytical data for samples taken at the Incline Village catchment outfall in WY14.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
IV-FF	1/11/14 12:43	121	218	79	3,378	756	0.48	4.19	10.6	20.5	41.1	65.6	75.5	100	100	100	100	100	100
IV-AC	1/11/14 13:06	514	1,236	413	5,963	1,727	0.59	5.89	15.4	29.8	55.9	80.4	86.9	100	100	100	100	100	100
IV-AC	1/11/14 14:15	335	865	266	3,802	1,835	0.63	6.55	18.1	33.8	58.3	79.3	84.9	100	100	100	100	100	100
IV-FF	1/29/14 13:33	559	1,178	484	8,204	2,849	0.90	9.45	26.0	45.2	70.1	86.6	90.5	100	100	100	100	100	100
IV-AC	1/29/14 13:59	293	536	230	4,084	1,427	0.57	5.96	17.0	33.2	58.0	78.6	84.3	100	100	100	100	100	100
IV-AC	1/29/14 21:15	45	69	33	1,341	315	0.68	6.90	18.3	33.1	54.5	73.1	78.3	96.1	100	100	100	100	100
IV-FF	2/8/14 8:08	385	915	325	2,998	1,874	0.78	8.07	22.0	39.8	65.8	84.3	88.5	100	100	100	100	100	100
IV-AC	2/8/14 9:29	223	279	152	1,352	913	0.48	4.78	12.6	24.2	44.1	68.0	75.9	100	100	100	100	100	100
IV-AC	2/9/14 1:41	111	108	75	714	404	0.63	5.66	14.2	25.7	46.0	68.0	75.2	100	100	100	100	100	100
IV-FF	4/25/14 4:33	46	38	31	1,426	531	0.83	6.43	14.4	24.2	47.1	67.0	77.5	100	100	100	100	100	100
IV-AC	4/25/14 10:13	101	164	88	1,874	222	0.97	9.76	25.0	43.9	70.6	87.3	92.7	100	100	100	100	100	100
IV-FF	5/20/14 5:25	59	52	42	5,732	359	0.71	6.34	15.6	28.7	51.4	70.7	78.5	99.8	100	100	100	100	100
IV-AC	5/20/14 6:34	80	94	67	686	393	0.79	7.90	20.7	39.7	66.2	84.1	90.0	100	100	100	100	100	100
IV-AC	5/20/14 23:12	73	60	50	700	309	0.50	5.01	13.2	26.0	47.4	68.5	76.1	99.4	100	100	100	100	100
IV-FF	7/16/14 20:13	2,039	>1000	844	6,460	2,664	0.25	2.39	6.04	12.2	24.5	41.4	48.2	83.1	92.9	100	100	100	100
IV-AC	7/16/14 20:20	499	329	292	4,608	1,489	0.33	3.26	8.51	18.3	36.7	58.6	67.0	97.2	100	100	100	100	100

Table A1b: Raw analytical data for samples taken at the Incline Village catchment outfall in WY15.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
IV-FF	11/22/14 6:07	58	70	42	3,493	335	2.77	19.3	36.3	54.2	82.1	87.4	90.4	100	100	100	100	100	100
IV-AC	11/22/14 6:40	101	124	75	2,488	496	0.97	7.71	18.7	32.2	58.4	80.8	89.1	100	100	100	100	100	100
IV-FF	2/6/15 15:32	309	419	233	4,272	1,126	0.82	7.00	16.9	29.2	53.2	77.2	86.2	100	100	100	100	100	100
IV-AC	2/6/15 17:07	194	178	141	4,493	666	0.69	5.92	16.7	31.0	57.8	76.8	86.5	100	100	100	100	100	100
IV-FF	4/24/15 0:11	97	78	93	1,659	561	1.92	13.5	30.8	53.0	88.0	97.9	100	100	100	100	100	100	100
IV-AC	4/24/15 0:27	145	107	125	1,112	601	0.63	5.78	17.3	31.8	59.6	86.3	94.6	100	100	100	100	100	100

Table A2a: Raw analytical data for samples taken at the inflow and outflow of the Pasadena Stormfilter in WY14 (the outflow is also the catchment outfall).

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
PI-FF	1/29/14 15:15	273	525	190	3,712	1,737	0.45	4.49	11.9	23.8	45.5	69.7	77.8	100	100	100	100	100	100
PI-AC	1/29/14 15:28	143	69	91	2,338	1,106	0.42	4.26	11.4	22.8	42.3	63.9	71.4	100	100	100	100	100	100
PI-AC	1/29/14 22:42	79	94	38	1,459	654	0.34	3.41	8.97	17.3	31.8	48.5	54.7	89.3	95.6	100	100	100	100
PO-FF	1/29/14 15:52	505	508	258	5,791	1,750	0.26	2.70	7.54	15.9	31.3	51.0	58.5	90.0	95.7	100	100	100	100
PO-AC	1/29/14 16:02	171	312	108	3,072	983	0.39	3.89	10.4	20.7	39.4	63.2	71.7	100	100	100	100	100	100
PO-AC	1/30/14 1:17	193	165	100	718	885	0.30	3.03	8.44	17.2	32.4	51.6	58.9	94.6	97.4	100	100	100	100
PI-FF	2/8/14 9:15	196	463	165	2,044	1,132	0.81	8.18	21.7	40.1	66.7	84.1	88.8	100	100	100	100	100	100
PI-AC	2/8/14 11:20	92	107	54	1,135	532	0.48	4.53	12.0	22.8	41.3	59.2	66.5	95.8	99.3	100	100	100	100
PI-AC	2/9/14 5:41	53	47	31	632	296	0.42	4.23	11.4	22.3	40.8	59.6	66.1	92.4	94.7	100	100	100	100
PO-FF	2/8/14 9:28	32	22	15	1,488	344	0.27	2.68	6.88	13.6	27.7	44.8	51.1	85.1	91.4	100	100	100	100
PO-AC	2/8/14 12:04	79	106	57	572	516	0.57	5.86	16.0	30.7	53.0	72.7	79.3	100	100	100	100	100	100
PO-AC	2/9/14 7:56	40	46	27	499	226	0.69	5.40	14.0	26.3	48.9	67.3	74.0	98.2	99.3	100	100	100	100
PI-FF	7/18/14 17:04	914	600	348	5,406	2,262	0.21	1.99	4.97	10.3	21.5	38.1	44.9	78.2	90.0	99.0	100	100	100
PI-AC	7/18/14 17:15	1,243	1,400	663	14,193	4,341	0.29	2.87	7.47	15.8	31.8	53.3	61.3	92.9	100	100	100	100	100
PI-AC	7/18/14 17:33	543	927	376	4,211	2,763	0.42	4.14	10.9	23.2	45.7	69.2	77.4	99.0	100	100	100	100	100
PO-FF	7/18/14 17:21	222	177	132	4,060	988	0.34	3.32	8.64	17.5	35.5	59.4	68.9	99.3	100	100	100	100	100
PO-AC	7/18/14 17:29	304	328	174	1,967	1,440	0.32	3.05	7.79	16.5	33.8	57.3	66.2	98.1	100	100	100	100	100
PO-AC	7/18/14 17:40	540	732	324	4,564	2,151	0.30	3.12	8.82	18.2	37.2	60.0	68.7	95.3	98.5	100	100	100	100
PI-FF	7/20/14 14:16	463	343	200	3,044	1,477	0.25	2.39	6.01	12.5	25.3	43.3	50.6	85.4	94.0	100	100	100	100
PI-AC	7/20/14 14:35	403	735	260	2,108	1,941	0.57	5.47	13.5	25.5	45.1	64.6	71.8	97.4	100	100	100	100	100
PI-AC	7/20/14 15:39	373	829	273	2,417	2,064	0.83	8.00	19.4	34.3	56.0	73.2	79.8	99.6	100	100	100	100	100
PO-FF	7/20/14 14:36	314	293	166	2,249	1,365	0.35	3.37	8.41	16.8	32.5	53.0	61.3	94.7	99.5	100	100	100	100
PO-AC	7/20/14 14:41	314	536	228	2,182	1,390	0.71	5.97	14.9	27.9	52.8	72.6	82.3	99.6	100	100	100	100	100
PO-AC	7/20/14 15:42	394	784	291	1,112	1,885	0.86	7.95	19.2	33.5	56.2	73.9	81.9	99.4	100	100	100	100	100

Table A2b: Raw analytical data for samples taken at the inflow and outflow of the Pasadena Stormfilter in WY15 (the outflow is also the catchment outfall).

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
PI-FF	2/6/15 19:16	218	315	135	888	1,078	0.50	4.68	12.3	23.9	43.8	63.8	71.6	96.8	100	100	100	100	100
PI-AC	2/6/15 19:36	89	105	61	889	610	0.52	5.22	14.1	28.9	51.0	72.3	79.7	100	100	100	100	100	100
PO-FF	2/6/15 19:29	128	97	56	1,497	662	0.28	2.73	6.97	14.0	26.8	44.5	51.6	85.9	98.7	100	100	100	100
PO-AC	2/6/15 19:49	82	135	57	1,692	588	0.74	5.80	15.1	28.8	55.7	75.4	85.8	100	100	100	100	100	100
PI-FF	2/8/15 13:11	103	163	61	1,432	511	0.59	4.91	12.3	21.7	41.6	61.9	70.9	97.6	100	100	100	100	100
PI-AC	2/8/15 13:49	62	96	43	728	418	0.52	5.18	13.9	28.4	50.1	71.6	78.9	100	100	100	100	100	100
PO-FF	2/8/15 13:23	213	144	87	961	901	0.31	2.81	7.38	13.8	26.4	41.2	48.3	81.5	93.8	100	100	100	100
PO-AC	2/8/15 14:03	48	72	35	649	368	0.58	5.46	14.8	29.2	53.0	75.4	83.7	100	100	100	100	100	100
PI-FF	4/25/15 9:45	51	41	34	1,233	302	0.54	4.82	13.3	24.1	45.6	67.2	75.0	94.2	100	100	100	100	100
PI-AC	4/25/15 10:30	65	66	46	923	445	0.51	5.14	13.9	28.0	48.8	72.1	79.8	100	100	100	100	100	100
PO-FF	4/25/15 10:12	76	54	38	1,443	564	0.39	3.38	8.99	16.5	32.1	49.5	56.9	88.5	99.8	100	100	100	100
PO-AC	4/25/15 10:47	61	65	52	841	452	0.71	6.17	17.1	32.1	59.3	84.7	91.9	100	100	100	100	100	100
PI-FF	7/8/15 11:36	478	205	131	2,184	982	0.18	1.68	4.27	8.82	16.8	27.5	32.0	60.4	81.2	92.9	98.8	100	100
PI-AC	7/8/15 11:46	421	366	157	5,186	1,601	0.25	2.39	6.03	12.2	23.2	37.4	43.0	73.9	96.1	100	100	100	100
PO-FF	7/8/15 11:49	243	162	88	2,620	1,122	0.24	2.31	5.73	11.2	21.3	36.4	42.2	74.1	96.9	100	100	100	100
PO-AC	7/8/15 11:56	262	330	113	3,053	1,380	0.30	2.82	7.28	14.3	27.7	43.3	49.0	80.0	100	100	100	100	100

Table A3a: Raw analytical data for samples taken at inflow to the Rubicon Stormtech chambers in WY14. Composite sample on 1/29/14 at 19:10 was too clear for PSD analysis. The outflow from the Rubicon Stormtech chambers (also the catchment outfall) never flowed, thus no samples were possible.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
RI-FF	1/29/14 12:33	338	351	148	1,545	1,654	0.29	2.94	7.83	14.6	26.5	43.7	51.0	87.8	95.2	100	100	100	100
RI-AC	1/29/14 13:03	53	33	35	433	324	0.65	5.42	12.9	24.9	43.3	66.1	72.2	99.7	100	100	100	100	100
RI-AC	1/29/14 19:10	4	4	na	168	9	na	na	na	na	na	na	na	na	na	na	na	na	na
RI-FF	2/8/14 2:59	6	14	2	309	91	0.90	6.20	9.60	17.6	26.3	40.9	42.1	65.4	97.5	100	100	100	100
RI-AC	2/8/14 9:04	29	14	10	323	93	0.53	3.51	6.57	12.3	22.2	34.0	40.0	72.5	84.4	100	100	100	100
RI-AC	2/9/14 14:06	31	15	14	25	105	0.66	4.24	7.50	14.4	26.8	44.5	52.9	92.6	97.9	100	100	100	100
RI-FF	3/25/14 20:21	139	107	81	1,097	538	0.41	4.20	11.5	22.5	41.5	58.5	64.1	86.4	91.8	98.7	100	100	100
RI-AC	3/25/14 22:16	15	14	12	429	142	1.08	7.44	18.2	34.0	62.5	78.2	81.1	100	100	100	100	100	100
RI-AC	3/26/14 10:02	18	26	17	396	159	1.78	12.0	28.2	51.2	82.8	93.9	98.1	100	100	100	100	100	100
RI-FF	7/17/14 14:42	1,684	707	564	15,995	2,751	0.20	1.95	5.36	11.9	22.5	33.5	38.0	67.1	83.3	93.5	98.4	100	100
RI-AC	7/17/14 14:50	666	287	188	5,375	1,823	0.16	1.56	4.14	8.82	16.9	28.3	33.4	70.4	92.6	100	100	100	100
RI-AC	7/17/14 15:12	181	85	50	4,499	2,330	0.19	1.86	4.74	9.89	18.6	27.7	31.6	59.9	73.7	86.0	93.4	100	100

Table A3b: Raw analytical data for samples taken at inflow to the Rubicon Stormtech chambers in WY15. Composite sample on 4/24/15 at 1:07 was too clear for PSD analysis. The outflow from the Rubicon Stormtech chambers (also the catchment outfall) never flowed, thus no samples were possible.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
RI-FF	10/25/14 11:52	90	52	33	2,594	469	0.28	2.52	6.78	13.7	27.1	39.2	45.9	73.9	86.9	98.2	100	100	100
RI-AC	10/25/14 12:15	37	13	6	1,510	215	0.15	1.31	2.98	6.06	12.5	19.5	23.5	43.2	60.5	79.1	96.8	100	100
RI-FF	4/23/15 21:28	455	186	150	1,562	1,149	0.23	2.29	5.83	11.2	20.3	33.0	38.4	68.4	87.6	99.3	100	100	100
RI-AC	4/24/15 1:07	25	10	na	661	139	na	na	na	na	na	na	na	na	na	na	na	na	na
RI-FF	6/10/15 1:14	156	120	38	2,706	209	0.19	1.86	4.92	9.81	16.9	24.5	27.2	53.9	82.7	93.3	98.9	100	100
RI-AC	6/10/15 1:57	73	42	24	1,199	263	0.28	2.8	7.24	13.6	22.9	34.1	39.0	60.7	83.5	97.9	100	100	100

Table A4a: EMCs for samples taken at the inflow and outflow of the SR431 Contech MFS vault in WY14.

Event ID	Runoff Start (Date Time)	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
CI-14-01	1/29/14 12:05	396	283	269	2,078	670	0.45	5.08	13.8	25.7	45.3	65.5	83.5	92.8	98	100	100	100	100
CO-14-01	1/29/14 12:20	209	236	182	1,672	419	0.58	6.62	18.4	34.2	58.4	79.4	95.0	100.0	100	100	100	100	100
CI-14-02	3/5/14 6:15	1,330	638	744	3,420	2,180	0.36	4.03	11.1	21.4	38.5	55.3	72.5	88.4	94	100	100	100	100
CO-14-02	3/5/14 6:25	356	249	286	1,394	740	0.71	6.52	18.4	34.2	61.3	77.3	92.1	100.0	100	100	100	100	100
CI-14-03	3/29/14 8:40	771	539	514	2,882	1,383	0.45	5.34	15.5	29.2	48.5	62.3	75.9	89.5	96	100	100	100	100
CO-14-03	3/29/14 9:20	366	359	322	1,924	844	0.80	7.60	20.7	38.5	65.1	80.9	94.4	100.0	100	100	100	100	100
CI-14-04	5/10/14 13:40	641	240	458	1,702	1,210	0.48	5.11	14.7	29.1	52.5	69.8	86.3	99.0	100	100	100	100	100
CO-14-04	5/10/14 13:55	439	224	332	1,554	970	0.46	4.98	14.0	27.7	51.7	72.6	90.3	100.0	100	100	100	100	100
CI-14-05	5/19/14 18:55	241	148	186	1,242	525	0.63	5.94	16.7	31.0	56.7	71.4	87.7	99.7	100	100	100	100	100
CO-14-05	5/19/14 18:55	126	104	115	1,124	319	0.62	6.99	19.4	36.7	61.9	79.6	93.3	100.0	100	100	100	100	100
CI-14-06	7/16/14 19:55	595	182	311	2,791	940	0.32	3.44	9.0	17.8	33.3	51.3	70.2	88.4	95	100	100	100	100
CO-14-06	7/16/14 19:55	323	146	208	2,645	765	0.40	4.33	11.7	23.4	43.8	63.1	81.1	94.9	98	100	100	100	100
CI-14-07	8/4/14 7:25	69	44	40	1,176	160	0.11	3.82	10.2	20.4	34.7	50.8	62.6	73.6	83	97	100	100	100
CO-14-07	7/16/14 19:55	39	33	31	1,520	125	0.52	6.00	14.9	29.3	47.8	65.8	76.1	82.6	90	98	100	100	100
CI-14-08	9/26/14 8:00	88	53	51	2,506	270	0.00	3.18	8.8	18.4	33.5	52.9	68.9	83.0	93	99	100	100	100
CO-14-08	9/26/14 8:05	69	46	49	2,679	220	0.10	4.32	11.6	24.1	44.3	69.8	86.3	95.5	99	100	100	100	100

Table A4b: Raw analytical data for samples taken at the inflow and outflow of the SR431 Contech MFS vault in WY15.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
CI-AC	10/31/14 21:11	93	75	76	3,150	293	0.33	5.72	14.9	29.1	49.5	72.1	79.5	93.6	97.9	99.9	100	100	100
CO-AC	10/31/14 21:25	72	55	59	2,200	233	0.35	5.68	14.8	29.2	49.8	72.3	79.4	92.5	97.9	100	100	100	100
CI-AC	12/2/14 11:34	174	128	141	730	424	1.64	8.38	19.0	34.4	55.4	76.4	82.8	95.2	98.8	99.9	100	100	100
CO-AC	12/2/14 11:51	131	118	121	820	328	2.33	10.0	22.6	40.7	64.1	84.9	90.4	98.3	100	100	100	100	100
CI-AC	2/7/15 0:42	562	383	402	1,270	1,330	1.90	8.11	17.7	31.0	49.5	69.6	76.3	93.0	98.7	100	100	100	100
CO-AC	2/7/15 0:57	409	324	342	1,190	1,006	2.82	10.1	21.5	37.4	58.7	79.7	86.1	97.7	99.9	100	100	100	100
CI-AC	4/23/15 16:08	435	279	332	1,260	1,101	1.52	7.88	17.9	32.0	52.0	73.2	79.8	94.5	99.0	100	100	100	100
CO-AC	4/23/15 16:14	302	221	275	1,170	812	2.60	10.5	23.5	41.7	65.4	86.4	91.4	98.4	99.6	100	100	100	100
CI-FF	5/6/15 16:22	875	445	338	4,887	305	0.33	3.27	8.83	17.4	28.3	39.0	42.6	71.2	83.7	97.7	100	100	100
CI-AC	5/7/15 7:12	367	320	316	950	123	0.66	6.75	18.6	36.6	62.4	88.8	96.8	100	100	100	100	100	100
CO-FF	5/6/15 16:48	173	161	157	1,395	80	0.86	9.33	28.0	54.9	91.6	100	100	100	100	100	100	100	100
CO-AC	5/7/15 21:59	258	188	240	481	92	0.80	8.09	21.9	42.9	72.0	97.5	99.9	100	100	100	100	100	100
CI-FF	5/14/15 16:01	212	193	196	3,538	852	1.29	11.5	29.5	53.5	89.6	100	100	100	100	100	100	100	100
CI-AC	5/14/15 16:31	179	201	168	792	659	1.94	13.5	31.6	52.9	88.3	100	100	100	100	100	100	100	100
CO-FF	5/14/15 16:33	143	88	130	1,266	584	1.13	8.81	22.8	39.8	71.8	94.4	98.9	100	100	100	100	100	100
CO-AC	5/14/15 17:12	161	192	150	1,382	650	2.13	14.7	34.1	56.7	92.2	100	100	100	100	100	100	100	100
CI-AC	5/22/15 11:29	275	217	211	1,020	856	0.66	6.39	18.9	32.9	59.0	81.8	91.4	100	100	100	100	100	100
CO-AC	5/22/15 11:43	177	168	160	734	665	1.83	12.5	28.7	49.3	87.5	100	100	100	100	100	100	100	100
CI-AC	6/9/15 19:37	80	59	78	891	153	4.51	25.8	47.7	69.1	95.3	100	100	100	100	100	100	100	100
CO-AC	6/9/15 20:01	54	38	49	1,437	212	1.83	12.7	30.1	53.2	88.1	96.9	99.6	100	100	100	100	100	100

Table A5a: EMCs for samples taken at the inflow and outflow of the SR431 Jellyfish vault in WY14.

Event ID	Runoff Start (Date Time)	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
JI-14-01	1/29/14 12:05	711	519	442	1,936	1,056	0.38	4.47	12.7	24.1	42.5	60.6	77.8	89.2	97	100	100	100	100
JO-14-01	1/29/14 12:15	135	104	109	1,109	300	0.52	6.01	16.8	31.7	54.6	75.3	92.8	100.0	100	100	100	100	100
JI-14-02	3/5/14 6:15	1,191	604	681	3,598	2,180	0.37	4.13	11.2	21.6	38.9	56.6	74.7	90.3	95	100	100	100	100
JO-14-02	3/5/14 6:55	462	311	345	1,511	970	0.61	5.80	16.5	30.6	55.8	72.1	88.9	100.0	100	100	100	100	100
JI-14-03	3/29/14 8:45	883	592	511	2,891	1,598	0.41	4.74	13.3	25.1	42.6	56.2	70.5	84.5	93	100	100	100	100
JO-14-03	3/29/14 9:10	206	213	196	1,315	465	0.78	8.54	24.2	44.3	71.1	84.8	95.7	100.0	100	100	100	100	100
JI-14-04	5/10/14 13:40	873	341	605	2,404	1,790	0.42	4.50	12.9	26.0	48.5	67.9	84.6	98.7	100	100	100	100	100
JO-14-04	5/10/14 14:00	593	248	442	1,753	1,220	0.42	4.69	13.6	27.6	51.4	72.8	91.7	100.0	100	100	100	100	100
JI-14-05	5/19/14 18:55	355	243	309	2,366	950	0.57	6.60	18.6	35.9	61.2	80.1	93.2	100	100	100	100	100	100
JO-14-05	5/19/14 18:55	177	131	174	1,293	480	0.63	7.24	20.2	38.1	63.0	79.9	93.1	100.0	100	100	100	100	100
JI-14-06	7/16/14 19:55	446	154	244	2,988	910	0.33	3.53	9.4	18.6	35.4	53.4	72.9	91.7	97	100	100	100	100
JO-14-06	7/16/14 19:55	363	121	210	2,920	802	0.34	3.53	9.7	19.0	37.1	56.0	76.3	93.0	97	100	100	100	100
JI-14-07	8/4/14 7:25	61	42	37	1,336	145	0.24	4.14	10.6	21.3	36.3	53.3	65.7	76.7	86	98	100	100	100
JO-14-07	8/4/14 7:50	29	29	25	1,143	109	0.73	6.17	14.4	26.9	45.8	67.1	81.9	92.0	98	100	100	100	100
JI-14-08	9/26/14 8:00	88	47	48	2,094	240	0.00	3.01	8.3	17.5	32.4	51.7	67.8	81.8	91	98	100	100	100
JO-14-08	9/26/14 8:10	54	35	39	2,111	180	0.05	3.96	10.8	23.1	41.3	65.1	82.7	93.7	99	100	100	100	100

Table A5b: Raw analytical data for samples taken at the inflow and outflow of the SR431 Jellyfish vault in WY15.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
JI-AC	10/31/14 21:11	106	74	76	4,080	299	0.26	5.22	13.4	25.8	44.1	65.2	72.9	90.2	96.6	99.7	100	100	100
JO-AC	10/31/14 21:22	33	35	27	1,220	172	0.13	4.62	12.5	27.1	47.8	70.5	78.7	94.3	98.8	100	100	100	100
JI-AC	12/2/14 11:34	192	130	149	850	445	1.60	8.10	18.2	32.8	52.9	73.7	80.3	94.4	98.6	99.9	100	100	100
JO-AC	12/2/14 11:40	129	102	114	860	312	1.48	8.37	19.7	36.8	60.2	82.1	88.2	97.4	99.8	100	100	100	100
JI-AC	2/7/15 0:41	579	352	405	1,110	1,275	1.90	8.03	17.4	30.3	48.3	67.9	74.5	92.2	98.4	100	100	100	100
JO-AC	2/7/15 0:49	424	290	342	900	1,015	2.70	9.66	20.5	35.4	55.7	76.6	83.3	96.8	99.7	100	100	100	100
JI-AC	4/23/15 16:08	516	328	394	1,350	1,322	1.35	7.42	17.1	31.4	52.3	74.1	80.6	94.6	98.2	99.9	100	100	100
JO-AC	4/23/15 16:11	317	203	264	1,170	792	1.61	8.35	19.3	35.4	57.9	79.8	85.9	97.2	99.6	100	100	100	100
JI-FF	5/6/15 16:22	684	398	541	5,479	121	0.56	5.76	16.1	33.1	56.8	80.3	90.8	100	100	100	100	100	100
JI-AC	5/6/15 16:54	343	245	253	706	56	1.05	8.03	17.5	33.5	61.2	76.7	82.7	100	100	100	100	100	100
JO-FF	5/6/15 16:28	209	283	131	794	29	4.97	37.9	73.9	100	100	100	100	100	100	100	100	100	100
JO-AC	5/7/15 7:18	301	214	244	891	48	0.63	6.54	18.3	36.3	60.9	84.2	91.7	100	100	100	100	100	100
JI-FF	5/14/15 16:01	205	185	190	2,815	1,009	2.02	13.5	30.4	52.1	92.6	100	100	100	100	100	100	100	100
JI-AC	5/14/15 16:29	176	179	167	1,123	659	2.15	14.5	33.0	55.1	91.7	100	100	100	100	100	100	100	100
JO-FF	5/14/15 16:07	100	125	65	1,303	342	4.32	29.9	55.5	80.9	100	100	100	100	100	100	100	100	100
JO-AC	5/14/15 16:36	126	142	114	1,294	521	2.18	15.0	33.7	56.2	94.6	100	100	100	100	100	100	100	100
JI-AC	5/22/15 11:29	272	209	196	531	906	0.63	6.32	16.8	31.9	53.1	76.3	84.5	100	100	100	100	100	100
JO-AC	5/22/15 11:32	220	189	202	502	806	1.54	10.9	26.4	46.5	82.7	100	100	100	100	100	100	100	100
JI-AC	6/9/15 19:37	77	49	73	988	153	2.14	14.5	32.9	58.7	99.9	100	100	100	100	100	100	100	100
JO-AC	6/9/15 19:45	56	42	52	1,153	214	2.23	14.8	33.8	59.3	99.9	100	100	100	100	100	100	100	100

Table A6a: Raw analytical data for samples taken at the SR431 catchment outfall in WY14. Nutrient analysis was not completed for 5/10/14 samples (samples not delivered to the analytical lab within adequate holding times).

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
S5-FF	1/29/14 15:22	200	239	140	1,221	850	0.50	5.18	14.4	27.6	49.0	69.9	76.2	97.0	99.7	100	100	100	100
S5-AS	1/29/14 16:27	93	139	62	718	44	0.50	5.21	14.5	27.7	48.1	66.8	72.5	93.2	99.6	100	100	100	100
S5-AS	3/6/14 0:52	440	538	352	2,159	886	0.31	3.70	12.9	30.0	56.3	80.1	86.8	100	100	100	100	100	100
S5-AS	3/6/14 1:14	405	504	303	1,500	940	0.52	5.37	14.9	30.1	53.8	74.8	81.4	100	100	100	100	100	100
S5-FF	5/10/14 13:57	257	198	179	na	na	0.66	5.46	15.5	29.4	53.9	69.8	78.6	99.5	100	100	100	100	100
S5-AC	5/10/14 14:15	281	243	205	na	na	0.53	5.18	14.8	29.6	53.9	72.8	80.6	99.4	100	100	100	100	100
S5-FF	5/20/14 6:54	166	180	132	932	678	0.83	7.09	20.4	36.6	63.7	79.5	87.3	100	100	100	100	100	100
S5-AC	5/20/14 8:59	97	108	87	1,369	105	0.98	8.70	24.7	45.4	77.3	90.2	96.9	100	100	100	100	100	100
S5-AC	5/20/14 14:15	110	106	87	575	433	0.78	6.63	19.1	34.9	64.1	79.0	88.3	100	100	100	100	100	100
S5-FF	7/16/14 19:57	1,369	568	661	3,527	2,763	0.30	2.91	7.13	14.1	28.2	48.3	56.4	91.8	97.4	100	100	100	100
S5-AC	7/16/14 19:59	800	499	435	2,103	2,442	0.34	3.31	8.21	16.3	32.3	54.4	62.9	96.6	100	100	100	100	100
S5-FF	7/20/14 14:31	363	152	182	2,070	1,075	0.35	3.35	8.36	16.1	30.6	50.2	58.2	94.9	98.2	100	100	100	100
S5-AC	7/20/14 14:36	594	195	277	1,761	1,186	0.32	3.12	7.68	14.6	27.6	46.7	54.8	92.8	97.2	100	100	100	100
S5-FF	9/28/14 9:56	146	88	67	1,240	510	0.34	3.30	8.38	16.7	30.5	46.0	52.3	85.2	91.8	100	100	100	100
S5-AC	9/28/14 10:02	73	52	48	413	125	0.62	4.93	13.5	26.0	50.2	66.2	75.8	93.3	100	100	100	100	100

Table A6b: Raw analytical data for samples taken at the SR431 catchment outfall in WY15.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
S5-FF	11/22/14 5:56	245	146	158	1,435	714	0.59	5.81	14.7	26.7	45.9	67.8	76.0	100	100	100	100	100	100
S5-AC	11/22/14 6:06	176	148	125	982	600	0.63	6.05	16.6	31.4	54.4	75.9	83.4	100	100	100	100	100	100
S5-FF	12/2/14 11:23	103	125	84	3,255	421	1.11	9.65	23.8	39.5	66.4	88.7	95.5	100	100	100	100	100	100
S5-AC	12/2/14 12:23	120	119	102	1,385	463	1.05	8.10	20.5	36.9	67.8	89.3	96.7	100	100	100	100	100	100
S5-FF	3/22/15 19:48	627	466	418	2,760	1,986	0.50	5.02	13.1	25.0	44.1	67.4	76.1	99.9	100	100	100	100	100
S5-AC	3/22/15 20:00	1,131	876	833	3,127	3,538	0.54	5.49	14.9	29.1	50.9	74.0	81.2	100	100	100	100	100	100
S5-FF	4/23/15 15:54	948	830	713	1,313	na	0.65	5.96	16.3	29.3	53.4	75.9	83.6	100	100	100	100	100	100
S5-AC	4/23/15 16:01	328	358	314	1,705	1,202	0.81	7.95	22.8	43.6	75.5	97.9	99.9	100	100	100	100	100	100
S5-FF	5/8/15 18:20	82	66	73	792	3,272	0.86	8.90	25.0	47.9	75.1	95.6	99.6	100	100	100	100	100	100
S5-AC	5/8/15 18:26	122	92	115	860	49	0.67	7.18	21.0	42.2	72.7	97.1	99.7	100	100	100	100	100	100
S5-AC	5/14/15 16:01	131	92	126	802	556	1.63	11.6	28.1	49.7	87.7	100	100	100	100	100	100	100	100
S5-FF	7/4/15 10:02	1,069	373	409	2,796	2,623	0.30	2.86	6.83	11.7	21.5	38.3	45.6	81.0	100	100	100	100	100
S5-AC	7/4/15 10:03	375	200	319	4,214	1,141	4.11	23.3	42.7	60.3	78.1	85.7	89.2	100	100	100	100	100	100

Table A7a: Raw analytical data for samples taken at the Tahoma catchment outfall in WY14. In all cases where FSP is not available, samples were too clear for PSD analysis.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
TA-AC	1/11/14 13:55	274	944	213	4,504	1	0.96	9.69	24.8	40.6	61.3	77.7	83.2	100	100	100	100	100	100
TA-AC	1/11/14 15:18	655	835	519	3,167	1,829	0.85	8.64	22.8	39.3	62.0	79.3	84.2	100	100	100	100	100	100
TA-FF	1/29/14 9:17	195	336	68	2,536	1,013	0.26	2.50	5.98	10.6	19.6	35.1	42.6	89.3	96.3	100	100	100	100
TA-AC	1/29/14 10:56	356	456	175	1,324	170	0.37	3.69	9.31	17.1	30.7	49.1	56.9	94.8	99.1	100	100	100	100
TA-AC	1/29/14 19:17	117	85	35	1,536	545	0.21	2.12	5.50	10.1	18.5	30.2	34.8	69.9	82.5	92.3	97.1	100	100
TA-FF	2/8/14 1:52	422	886	373	1,950	1,935	1.35	13.4	33.1	51.8	75.6	88.4	93.1	100	100	100	100	100	100
TA-AC	2/8/14 7:12	153	137	96	405	611	0.59	5.43	13.9	24.8	43.6	62.8	70.5	99.4	100	100	100	100	100
TA-AC	2/8/14 23:49	53	38	26	188	210	0.36	3.73	10.1	18.0	32.2	49.0	54.7	88.4	95.9	100	100	100	100
TA-AC	2/9/14 13:10	36	30	20	58	136	0.82	5.49	11.0	20.9	37.1	54.9	58.6	89.7	94.5	100	100	100	100
TA-FF	3/5/14 23:29	358	573	251	2,110	720	0.64	6.42	16.4	29.4	50.2	70.2	77.6	100	100	100	100	100	100
TA-AC	3/6/14 0:43	625	595	376	1,196	1,957	0.46	4.55	11.8	22.1	39.7	60.2	68.0	98.4	99.4	100	100	100	100
TA-AC	3/6/14 2:11	74	82	53	439	410	0.65	6.54	17.2	31.3	52.6	71.0	77.0	99.6	100	100	100	100	100
TA-AC	3/14/14 16:33	8	12	na	350	65	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-AC	3/15/14 16:33	2	5	na	341	42	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-FF	3/29/14 3:02	226	323	162	1,299	914	0.80	6.94	17.8	31.3	55.2	71.8	80.5	100	100	100	100	100	100
TA-AC	3/29/14 6:37	202	314	150	1,720	870	0.78	7.06	18.3	33.2	57.7	74.2	81.6	100	100	100	100	100	100
TA-AC	3/29/14 9:29	296	341	204	1,159	1,064	0.61	5.45	14.7	26.8	49.7	69.0	78.0	99.9	100	100	100	100	100
TA-FF	3/30/14 2:48	9	10	na	628	55	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-AC	3/30/14 5:03	191	239	142	1,140	888	0.67	6.60	16.6	30.6	53	74.1	81.1	99.9	100	100	100	100	100
TA-AC	3/30/14 13:50	307	379	217	1,801	1,256	0.64	5.96	15.4	28.5	51.1	70.6	78.8	99.9	100	100	100	100	100
TA-AC	4/6/14 8:11	12	21	na	462	103	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-AC	4/7/14 10:10	6	13	na	315	72	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-FF	5/20/14 3:38	163	113	76	1,914	625	0.27	2.59	6.55	13.6	27.3	46.6	54.6	93.0	97.9	100	100	100	100
TA-AC	5/20/14 5:38	67	72	52	874	371	0.78	7.18	18.5	34.4	59.9	77.3	84.2	99.9	100	100	100	100	100
TA-AC	5/20/14 12:18	89	83	60	771	412	0.62	6.09	15.2	28.2	48.5	67.1	73.8	98.0	100	100	100	100	100
TA-AC	7/17/14 18:47	72	37	28	2,887	265	0.23	2.01	5.44	10.3	23.7	38.9	47.4	88.8	94.0	100	100	100	100
TA-FF	8/10/14 14:55	2,678	749	1,125	4,136	4,632	0.28	2.69	6.37	11.9	23.2	42.0	50.3	89.7	97.4	100	100	100	100
TA-AC	8/10/14 14:56	1,615	755	585	3,324	3,636	0.24	2.31	5.51	10.4	20.2	36.2	43.5	80.4	91.4	99.9	100	100	100
TA-AC	8/10/14 15:18	169	95	69	1,732	639	0.28	2.62	6.34	12.4	24.2	40.6	47.3	83.9	91.5	99.5	100	100	100

Table A7b: Raw analytical data for samples taken at the Tahoma catchment outfall in WY15. In all cases where FSP is not available, samples were too clear for PSD analysis.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
TA-FF	10/20/14 19:54	59	46	40	4,390	495	0.69	5.55	14.6	25.8	49.7	67.5	78.3	99.6	100	100	100	100	100
TA-AC	10/20/14 20:19	49	29	na	1,642	673	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-FF	10/25/14 12:21	88	53	19	2,050	523	0.15	1.52	3.90	7.49	14.1	21.6	24.5	42.1	49.0	66.1	85.4	99.9	100
TA-AC	10/25/14 12:32	80	35	21	1,424	486	0.20	1.81	4.21	8.42	16.7	26.8	31.3	61.2	71.0	89.1	99.0	100	100
TA-FF	11/13/14 3:00	74	57	42	552	240	0.45	3.14	7.77	16.4	39.5	57.3	68.8	96.8	100	100	100	100	100
TA-AC	11/13/14 4:04	48	37	18	796	330	0.51	3.38	7.51	13.3	27.8	38.0	47.1	75.6	93.5	99.3	100	100	100
TA-FF	11/22/14 4:28	76	144	61	1,228	418	2.29	15.9	30.6	47.7	82.3	90.4	94.0	100	100	100	100	100	100
TA-AC	11/22/14 5:27	87	57	43	457	437	0.44	4.22	10.5	20.0	35.5	53.7	61.2	94.4	99.8	100	100	100	100
TA-FF	2/6/15 14:54	4,074	6,664	2,302	14,721	7,893	0.49	4.79	11.9	21.7	37.6	56.5	63.9	91.6	98.4	100	100	100	100
TA-AC	2/6/15 18:43	275	270	163	301	966	0.58	5.08	13.3	23.3	42.2	60.6	68.7	96.3	100	100	100	100	100
TA-AC	2/7/15 12:02	54	57	29	563	200	0.96	6.21	11.8	18.8	38.3	53.2	62.0	91.9	95.4	100	100	100	100
TA-AC	3/2/15 12:30	16	19	na	338	91	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-AC	3/3/15 12:29	7	10	na	303	67	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-AC	3/22/15 18:44	112	119	94	1,828	428	0.79	7.97	21.1	39	64.5	88.6	94.0	100	100	100	100	100	100
TA-AC	4/8/15 9:25	117	122	105	1,731	358	1.25	10.1	26.0	45.1	78.2	94.8	98.5	100	100	100	100	100	100
TA-FF	4/23/15 21:34	239	252	224	2,368	1,022	1.52	11	25.6	44.6	80.0	98.2	100	100	100	100	100	100	100
TA-AC	4/24/15 0:06	152	109	116	714	689	0.63	5.65	15.6	28.0	52.1	76.6	85.2	100	100	100	100	100	100
TA-AC	4/25/15 9:05	81	90	75	681	296	7.03	41.5	83.2	100	100	100	100	100	100	100	100	100	100
TA-AC	4/26/15 9:05	22	20	na	402	102	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-FF	7/2/15 15:21	2,428	840	603	13,565	7,946	0.19	1.83	4.39	7.82	14.4	24.9	29.1	56.2	78.1	85.7	93.0	100	100
TA-AC	7/2/15 15:25	788	365	160	6,363	1,663	0.15	1.47	3.67	6.75	12.2	20.5	23.7	45.1	63.6	73.4	84.0	100	100
TA-AC	7/19/15 14:59	484	226	149	6,411	1,203	0.24	2.29	5.70	10.7	19.1	31.0	36.0	67.1	87.1	97.3	100	100	100
TA-AC	7/21/15 13:12	233	132	146	2,409	657	0.57	4.90	12.7	22.6	41.9	63.9	73.1	94.6	100	100	100	100	100

Table A8: Raw analytical data for samples taken at the Speedboat catchment outfall in WY15. In all cases where FSP is not available, samples were too clear for PSD analysis.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
SB-FF	11/29/14 7:32	194	116	81	8,106	1,120	0.25	2.29	6.93	13.1	26.6	42.0	48.8	84.5	100	100	100	100	100
SB-AC	11/29/14 7:47	125	102	88	1,877	669	0.71	5.77	15.1	27.8	52.1	70.0	80.2	99.7	100	100	100	100	100
SB-FF	11/29/14 11:25	74	50	24	1,619	446	0.29	2.56	6.56	12.1	22.8	32.5	38.2	64.6	73.7	100	100	100	100
SB-AC	11/29/14 11:45	84	72	62	1,555	493	0.89	7.62	18.7	33.5	57.9	74.4	83.2	100	100	100	100	100	100
SB-FF	12/2/14 12:25	62	35	18	1,101	335	0.22	1.84	4.71	8.96	18.4	29.6	35.4	64.0	85.5	100	100	100	100
SB-AC	12/2/14 12:57	51	41	30	826	325	0.48	4.56	11.1	21.3	38.5	58.3	65.9	95.7	100	100	100	100	100
SB-FF	12/19/14 16:05	301	633	300	1,800	1477	1.21	13.1	37.0	63.5	91.9	100	100	100	100	100	100	100	100
SB-AC	12/19/14 17:23	125	222	125	1,129	671	1.29	13.8	38.5	65.4	95.1	100	100	100	100	100	100	100	100
SB-AC	2/6/15 15:11	198	158	136	1,474	677	0.77	5.77	14.1	26.1	48.5	68.8	79.4	100	100	100	100	100	100
SB-AC	2/8/15 15:01	63	49	na	732	301	na	na	na	na	na	na	na	na	na	na	na	na	na
SB-AC	5/8/15 17:57	375	245	236	2,825	1,110	0.42	4.16	10.8	21.3	39.4	63.4	71.8	96.9	100	100	100	100	100
SB-AC	5/14/15 15:05	36	28	29	1,097	231	8.14	46.0	87.9	100	100	100	100	100	100	100	100	100	100
SB-AC	5/21/15 12:06	154	127	137	1,759	542	0.75	6.91	19.9	35.7	64.9	92.6	98.9	100	100	100	100	100	100
SB-AC	5/22/15 14:22	76	59	61	1,175	307	2.9	17.9	40.2	56.1	74.2	88.5	94.8	100	100	100	100	100	100
SB-AC	6/9/15 19:38	84	61	57	3,101	407	3.77	20.1	34.8	45.3	56.3	72.0	78.1	99.9	100	100	100	100	100
SB-AC	8/7/15 14:54	207	113	88	4,614	764	0.32	3.04	7.96	14.9	27.7	43.7	49.8	83.2	99.6	100	100	100	100

Table A9: Raw analytical data for samples taken at the Tahoe Valley catchment outfall in WY15. In all cases where FSP is not available, samples were too clear for PSD analysis.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
TV-FF	11/22/14 6:35	297	189	139	1,913	666	0.34	3.35	8.47	16.4	29.8	47.5	54.7	88.4	99.3	100	100	100	100
TV-AC	11/22/14 7:22	106	146	83	1,220	542	1.61	11.9	26.9	44.6	74.7	88.7	93.8	100	100	100	100	100	100
TV-AC	12/3/14 11:25	40	80	na	685	269	na	na	na	na	na	na	na	na	na	na	na	na	na
TV-AC	12/4/14 6:06	27	62	na	885	199	na	na	na	na	na	na	na	na	na	na	na	na	na
TV-AC	2/6/15 18:32	116	119	83	1,185	291	0.96	6.46	14.1	25.8	50.7	71.9	82.8	100	100	100	100	100	100
TV-AC	2/7/15 14:36	37	71	na	613	181	na	na	na	na	na	na	na	na	na	na	na	na	na
TV-AC	4/25/15 9:49	51	65	na	1,331	233	na	na	na	na	na	na	na	na	na	na	na	na	na
TV-AC	7/8/15 11:22	546	180	143	2,976	664	0.24	2.27	5.60	10.3	17.7	26.4	29.6	45.0	59.8	74.4	89.7	100	100

Table A10: Raw analytical data for samples taken at the Upper Truckee catchment outfall in WY15.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
UT-AC	11/22/14 6:34	417	341	354	1,349	1,001	1.18	9.35	22.8	40.1	68.9	87.7	95.4	100	100	100	100	100	100
UT-FF	12/2/14 12:41	349	430	259	2,016	1174	0.54	5.49	14.9	30.1	52.9	74.5	81.6	99.9	100	100	100	100	100
UT-AC	12/2/14 12:48	251	355	195	1,746	855	0.65	6.49	17.0	32.1	55.3	77.6	84.4	100	100	100	100	100	100
UT-FF	12/19/14 11:47	679	887	673	5,483	1305	1.13	10.9	30.0	53.5	86.3	99.2	100	100	100	100	100	100	100
UT-AC	12/19/14 12:03	959	1,244	908	4,098	2433	0.93	9.59	26.0	48.1	76.2	94.7	99.1	100	100	100	100	100	100
UT-AC	12/20/14 4:43	179	343	178	1,692	849	1.32	13.1	32.7	54.2	83.8	99.4	100	100	100	100	100	100	100
UT-AC	2/6/15 17:06	344	330	268	1,856	844	0.65	6.20	16.7	31.6	55.7	78.0	85.9	100	100	100	100	100	100
UT-AC	2/7/15 13:21	185	242	137	1,772	538	0.68	5.81	16.2	29.0	54.5	73.8	83.8	100	100	100	100	100	100
UT-AC	2/8/15 10:47	182	282	163	1,428	560	1.02	8.58	20.8	37.2	65.7	89.8	94.3	100	100	100	100	100	100
UT-AC	4/7/15 11:29	495	910	470	5,877	2,067	1.06	12.0	36.0	63.7	95.0	100	100	100	100	100	100	100	100
UT-AC	4/23/15 22:55	117	257	94	3,885	863	0.67	6.68	17.6	34.7	60.5	85.2	93.4	100	100	100	100	100	100
UT-AC	4/25/15 8:15	281	359	270	2,580	860	2.27	15.4	35.2	57.7	95.4	100	100	100	100	100	100	100	100

Field duplicates are samples collected at the same time and treated identically and 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). 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.

Tables B1a and B2a summarize the QAQC samples that were taken during WY14. Pink cells highlight differences in values of greater than 20%. Most analytical results between field duplicate pairs (either MS/MS or GS/MS) are very similar. With regards to sediment (TSS, turbidity, and FSP), only two sample pairs show a difference greater than 20%, the RI-MS/RI-MS pair on January 29, 2014 for turbidity and the TA-GS/TA-MS pair on May 20, 2014 for TSS and FSP. The pair from Rubicon Inflow may have experienced a quick pulse in turbidity between when the two manual samples were triggered by the autosampler. Since FSP is calculated by multiplying TSS by the percent fraction less than 16 microns it is not surprising that they are both off by greater than 20% in the Tahoma pair. The difference in TSS may come from the fact that the autosampler intake tube may have been partially covered by sediment and therefore sucked up more sediment than was representative of the runoff. Only two sample pairs showed TP concentrations that differed by more than 20%, both of which were MS/MS pairs and may attest to the fact that concentrations can fluctuate significantly in the short time period between the triggering of each sample. The same could be true of the difference in the smallest sediment fraction in the Pasadena Inflow pair on July 20, 2014. The difference in the smallest sediment fraction in the GS/MS pair from Tahoma on February 9, 2014 may be due to the difference in where the suction tube for the autosampler is mounted compared to where the grab sample was taken, though every effort is made to sample as close to the same location as possible. There are seven pairs of samples that have a greater than 20% difference in TN values. These values are the sum of Total Kjeldahl Nitrogen (TKN) from a raw sample and Nitrate-Nitrite (NO3+NO2) from a filtered sample. Summing the results from two different analyses introduces much more error along the whole sequence of analytical steps and therefore it is not surprising that TN has more error than the other analyses.

All field blanks with the exception of TN at S5 on September 28, 2014 were below detection limit for TSS, FSP, TN, and TP. Smoke from the large King Fire that occurred in late September 2014 may have caused the elevated TN value at S5. Turbidity values are not below their detection limit of 0.1 NTU, but are extremely low and within the range of what would be expected in a field blank.

Tables B1b and B2b summarize the QAQC samples that were taken during WY15. Pink cells highlight differences in values of greater than 20%. Like in WY14, most analytical results between the field duplicate pairs (either MS/MS or GS/MS) are very similar. However, six samples had differences greater than 20% in several analyses, especially with regard to sediment. The paired MS/MS samples at Pasadena Inflow (PI) on

April 25, 2015 and Rubicon Inflow (RI) on October 25, 2014 both show differences greater than 20% for FSP and TSS. The paired samples at PI also show unusually large differences in all particle size classes that comprise FSP (<16µm). Because MS sample pairs require that both samples in the pair are taken with the autosampler, it is possible that a pulse of more turbid water with a greater proportion of FSP passed the sample intake tube just as the second sample in each case was taken. The paired MS/GS samples are more likely to be different than the MS/MS pairs as the collection method is different. This could account for most or all of the differences, though every attempt is made to collect the GS sample as close to the intake tube where the MS sample is collected as possible. The MS/GS pairs from Speedboat (SB) on December 4, 2014, and Tahoe Valley and Upper Truckee on November 22, 2014 all show differences greater than 20% for TSS, FSP, and TN. The Speedboat pair also shows a difference in TP and particle size classes less than 20µm. It is unusually difficult to collect a GS sample at Speedboat, and the collection location may not have been as representative of the flow sampled by the autosampler in the MS sample as at other sites. The Tahoe Valley pair also shows a difference in particle size classes less than 4µm and the Upper Truckee pair shows a difference in turbidity. The intent of the MS/GS pairs is to indicate whether or not the auto-sampler is collecting a representative sample. In most cases the auto-sampler does collect a representative sample, but as indicated by the data there are times when errors occur, especially with regards to sediment collection.

All field blanks in WY15 were below detection limits for all analytes.

Table B1a: MS and GS sample data from all sites in WY14. Pink cells indicate paired samples that have a difference between them of greater than 20%.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
IV-MS	1/11/14 15:06	361	865	295	2,818	873	0.62	6.39	17.6	33.8	59.4	81.6	87.3	100	100	100	100	100	100
IV-MS	1/11/14 15:07	367	887	309	4,281	895	0.61	6.39	17.8	34.6	61.5	84.3	90.9	100	100	100	100	100	100
IV-MS	1/29/14 14:13	562	528	446	3,704	2,436	0.58	6.13	17.4	33.4	58.9	79.4	84.7	100	100	100	100	100	100
IV-MS	1/29/14 14:14	495	639	385	3,344	1,832	0.56	5.75	15.8	30.9	55.7	77.7	83.5	100	100	100	100	100	100
PI-MS	2/8/14 11:03	253	479	191	1,491	1,275	0.64	6.42	16.9	31.8	55.2	75.4	82.4	100	100	100	100	100	100
PI-MS	2/8/14 11:04	253	477	189	870	1,320	0.62	6.28	16.7	31.4	54.3	74.8	82.0	100	100	100	100	100	100
PI-MS	7/18/14 17:15	1,510	1,468	657	9,379	2,095	0.25	2.41	6.04	12.0	24.9	43.5	50.9	83.3	92.7	100	100	100	100
PI-MS	7/18/14 17:17	1,515	1,474	670	9,650	2,337	0.25	2.42	6.10	12.6	25.6	44.2	51.4	83.3	93.6	100	100	100	100
PI-MS	7/20/14 15:24	456	817	291	2,076	2,231	0.80	6.59	15.7	27.3	47.8	63.9	72.1	95.2	99.7	100	100	100	100
PI-MS	7/20/14 15:26	444	803	292	2,836	2,002	0.63	6.05	14.8	27.2	46.8	65.7	73.0	97.7	100	100	100	100	100
PO-MS	2/8/14 11:16	226	445	185	1,242	1,256	0.85	7.90	21.3	39.4	65.9	81.8	88.3	100	100	100	100	100	100
PO-MS	2/8/14 11:17	230	448	181	1,153	1,190	0.75	6.92	18.1	33.8	59.4	78.5	85.8	100	100	100	100	100	100
PO-MS	7/18/14 17:30	292	325	156	2,060	1,291	0.30	2.83	7.44	14.8	32.0	53.5	63.5	95.0	99.5	100	100	100	100
PO-MS	7/18/14 17:32	325	377	177	2,314	1,440	0.31	3.02	7.68	16.0	32.6	54.6	63.1	95.5	99.7	100	100	100	100
PO-MS	7/20/14 15:15	288	540	219	1,584	1,452	0.68	6.40	16.2	31.0	56.0	75.9	83.8	99.6	100	100	100	100	100
PO-MS	7/20/14 15:16	292	542	216	1,844	1,483	0.76	6.40	16.3	29.9	55.8	73.9	83.5	99.3	100	100	100	100	100
PO-GS	7/20/14 15:17	286	564	211	1,362	1,495	0.64	6.08	15.4	29.4	53.4	73.7	81.8	99.3	100	100	100	100	100
RI-MS	1/29/14 15:35	81	57	26	555	369	0.22	2.32	6.75	13.2	22.9	31.6	34.6	54.4	66.0	81.3	89.1	99.9	100
RI-MS	1/29/14 15:36	77	42	27	389	353	0.23	2.48	7.03	13.7	24.5	34.8	37.9	56.4	67.3	81.0	95.0	100	100
S5-MS	9/28/14 9:59	118	90	61	1,250	152	0.43	4.18	10.4	20.1	35.9	51.8	58.6	92.2	97.0	100	100	100	100
S5-MS	9/28/14 10:00	118	83	61	1,581	213	0.42	3.81	9.82	19.0	35.5	51.6	59.5	91.0	97.3	100	100	100	100
TA-MS	1/11/14 16:45	429	662	349	2,537	1,562	0.84	8.63	23.1	40.0	63.0	81.4	85.9	100	100	100	100	100	100
TA-MS	1/11/14 16:46	380	605	284	1,802	1,549	0.72	7.18	19.4	33.5	54.2	74.8	80.5	100	100	100	100	100	100
TA-MS	1/29/14 12:44	2,184	2,268	1,520	3,369	3,639	0.56	5.64	14.7	27.2	49.0	69.6	76.4	100	100	100	100	100	100
TA-GS	1/29/14 12:45	2,130	2,133	1,399	2,341	3,715	0.53	5.25	13.2	24.1	44.1	65.7	73.0	99.4	99.7	100	100	100	100
TA-GS	2/9/14 11:25	62	52	37	69	237	0.64	5.37	13.3	23.4	41.9	59.7	65.8	93.4	96.1	100	100	100	100
TA-MS	2/9/14 11:26	80	57	44	37	259	0.44	4.35	11.0	20.5	37.0	55.6	61.9	89.6	95.4	100	100	100	100
TA-MS	3/29/14 9:34	424	566	300	2,274	1,635	0.55	5.51	14.3	26.9	48.4	70.8	78.4	99.9	100	100	100	100	100
TA-MS	3/29/14 9:35	409	497	287	1,743	1,508	0.56	5.49	13.9	26.2	47.7	70.1	78.1	100	100	100	100	100	100
TA-GS	3/29/14 9:36	435	521	304	2,618	1,613	0.58	5.48	14.2	26.3	48.7	69.8	78.6	100	100	100	100	100	100
TA-GS	5/20/14 11:23	36	59	27	946	313	1.08	8.90	21.0	34.8	58.7	74.3	82.7	99.0	100	100	100	100	100
TA-MS	5/20/14 11:24	67	60	50	863	398	0.86	8.32	20.3	35.3	56.0	73.9	79.6	99.5	100	100	100	100	100
TA-MS	8/10/14 16:52	42	42	24	1,837	397	0.42	3.99	11.2	21.3	43.1	58.1	67.2	96.4	99.3	100	100	100	100
TA-GS	8/10/14 16:53	47	41	26	1,738	368	0.46	3.95	10.3	19.4	39.7	55.2	64.6	93.4	97.9	100	100	100	100

Table B1b: MS and GS sample data from all sites in WY15. Pink cells indicate paired samples that have a difference between them of greater than 20%.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
PI-MS	4/25/15 13:06	40	46	32	733	390	0.73	6.23	17.5	33.2	60.7	82.6	89.7	100	100	100	100	100	100
PI-MS	4/25/15 13:07	69	45	69	585	386	6.85	41.2	82.1	100	100	100	100	100	100	100	100	100	100
RI-MS	10/25/14 13:31	14	14	3	1,867	296	0.46	3.11	7.16	12.5	27.0	42.5	48.8	72.1	82.1	94.9	100	100	100
RI-MS	10/25/14 13:32	18	15	6	1,469	256	0.37	2.90	7.08	13.2	27.8	43.2	49.4	74.4	84.0	94.9	100	100	100
SB-MS	12/4/14 10:56	74	78	47	1,605	9,932	0.60	5.10	13.4	24.5	45.3	63.6	72.0	97.7	100	100	100	100	100
SB-GS	12/4/14 10:57	33	63	33	1,215	7,270	2.46	16.7	33.0	59.8	91.5	100	100	100	100	100	100	100	100
SB-GS	2/9/15 10:28	21	33	na	612	203	na	na	na	na	na	na	na	na	na	na	na	na	na
SB-MS	2/9/15 10:29	20	40	na	532	187	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-MS	10/25/14 14:12	26	21	na	1,210	418	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-GS	10/25/14 14:13	22	19	na	1,190	437	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-GS	2/7/15 13:21	196	212	73	1,287	595	0.31	3.04	7.79	14.3	24.6	37.5	42.8	68.8	79.9	92.3	96.1	99.9	100
TA-MS	2/7/15 13:22	182	216	71	1,229	547	0.32	3.18	8.12	15.1	26.0	39.1	44.8	73.3	87.1	98.4	100	100	100
TA-MS	3/23/15 8:12	50	72	42	971	264	5.22	37.9	81.6	100	100	100	100	100	100	100	100	100	100
TA-GS	3/23/15 8:13	53	75	45	897	280	4.81	36.8	81.2	100	100	100	100	100	100	100	100	100	100
TV-MS	11/22/14 11:45	41	92	30	956	329	3.69	26.1	50.0	78.3	100	100	100	100	100	100	100	100	100
TV-GS	11/22/14 11:46	67	87	53	1,468	291	2.04	16.7	38.3	59.1	89.2	95.4	99.1	100	100	100	100	100	100
TV-GS	2/7/15 16:52	35	81	30	824	206	3.51	19.6	39.5	54.4	72.3	84.8	92.7	100	100	100	100	100	100
TV-MS	2/7/15 16:53	39	76	34	885	212	4.37	20.7	39.8	54.3	71.3	85.9	92.0	100	100	100	100	100	100
TV-MS	4/25/15 12:24	98	119	91	1,516	330	5.64	36.0	75.5	100	100	100	100	100	100	100	100	100	100
TV-GS	4/25/15 12:25	92	117	86	1,460	349	2.75	17.8	39.0	66.4	100	100	100	100	100	100	100	100	100
UT-MS	11/22/14 8:00	132	92	106	1,175	685	0.88	8.23	20.8	37.8	63.4	85.8	92.6	100	100	100	100	100	100
UT-GS	11/22/14 8:01	278	203	222	1,650	797	0.88	7.80	20.2	36.4	63.0	82.9	90.1	100	100	100	100	100	100
UT-MS	12/2/14 12:34	349	488	299	2,403	1,234	0.72	6.74	18.5	36.2	63.5	85.5	93.2	100	100	100	100	100	100
UT-GS	12/2/14 12:35	383	522	293	2,118	1,177	0.65	5.83	15.9	30.8	55.8	76.4	85	100	100	100	100	100	100
UT-GS	2/7/15 17:01	281	371	203	1,366	787	0.58	5.56	15.0	28.7	51.2	72.4	80.9	100	100	100	100	100	100
UT-MS	2/7/15 17:02	329	351	232	1,587	715	0.66	5.46	14.7	26.9	51.0	70.5	80.3	100	100	100	100	100	100
UT-MS	4/25/15 12:49	241	270	228	2,387	669	1.81	13.8	32.7	55.3	92.9	100	100	100	100	100	100	100	100
UT-GS	4/25/15 12:50	230	263	216	2,540	685	1.62	12.6	29.8	49.8	82.3	100	100	100	100	100	100	100	100

Table B2a: Field blank sample data from all sites in WY14. Pink cell highlights value greater than the method detection limit indicating possible contamination, likely from King Fire smoke. All samples were too clear for PSD analysis.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
TA-FB	1/11/14 15:44	<1	0.18	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
IV-FB	1/11/14 21:38	<1	0.16	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
IV-FB	1/29/14 14:35	<1	0.11	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
S5-FB	1/29/14 15:21	<1	0.16	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
RI-FB	1/29/14 15:37	<1	0.46	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-FB	1/29/14 16:15	<1	0.17	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
PO-FB	2/8/14 11:10	<1	0.22	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
PI-FB	2/8/14 11:15	<1	0.10	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
RI-FB	3/27/14 10:32	<1	0.15	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-FB	5/20/14 11:15	<1	0.29	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
TA-FB	7/18/14 8:00	<1	0.12	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
S5-FB	9/28/14 10:46	<1	0.09	na	70	<10	na	na	na	na	na	na	na	na	na	na	na	na	na

Table B2b: Field blank sample data from all sites in WY15. All samples were too clear for PSD analysis.

Sample	Date Time	TSS (mg/L)	Turbidity (NTU)	FSP (mg/L)	TN (ug/L)	TP (ug/L)	%< 0.5	%< 1	%< 2	%< 4	%< 8	%< 16	%< 20	%< 63	%< 125	%< 250	%< 500	%< 1000	%< 2000
CO-FB	5/22/15 12:01	<1	<0.10	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
JO-FB	5/22/15 12:02	<1	<0.10	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
S5-FB	4/24/15 6:00	<1	<0.10	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
TV-FB	7/8/15 14:03	<1	<0.10	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na
UT-FB	4/24/15 8:00	<1	<0.10	na	<50	<10	na	na	na	na	na	na	na	na	na	na	na	na	na

15 APPENDIX C: INCLINE VILLAGE EVENT HYDROGRAPHS

All event hydrographs in Appendices C-K show continuous hydrology, continuous turbidity, and water quality samples taken for each event sampled. Sample points on the same horizontal line represent samples that were composited into one bottle and sent to the lab for analysis. Single sample points on a horizontal line represent single samples that were sent to the lab for analysis.

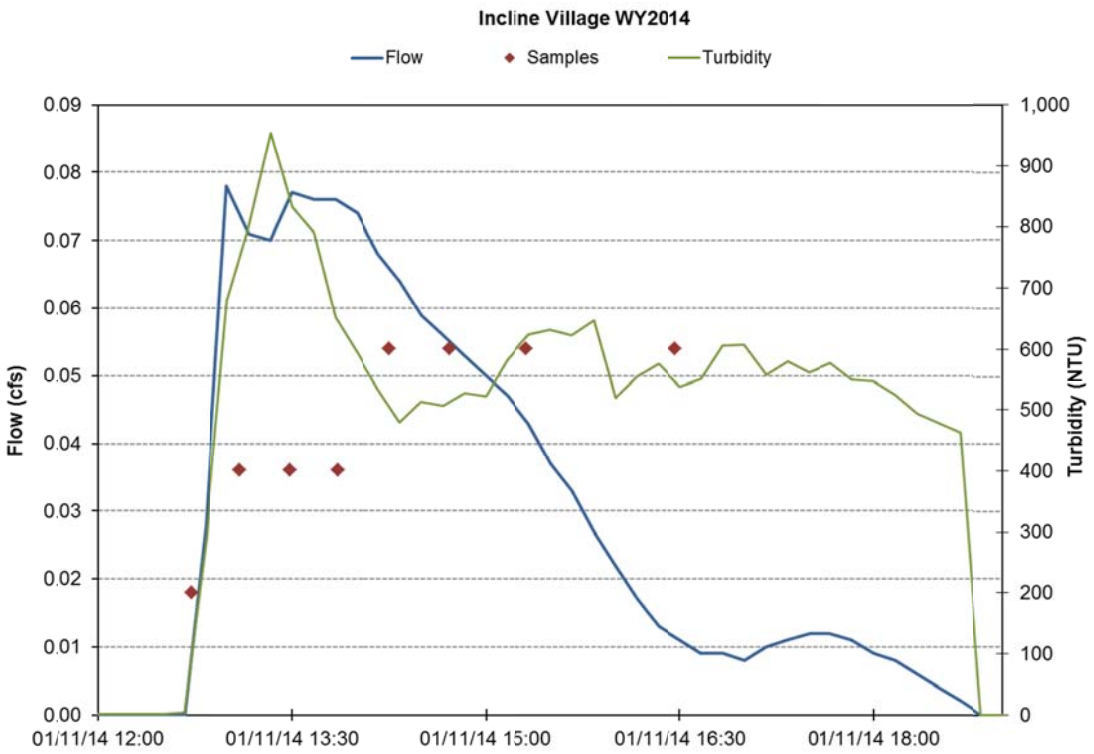

Figure C1: Continuous hydrology, continuous turbidity, and water quality samples for the 1/11/2014 event. Total volume sampled: 757 cf.

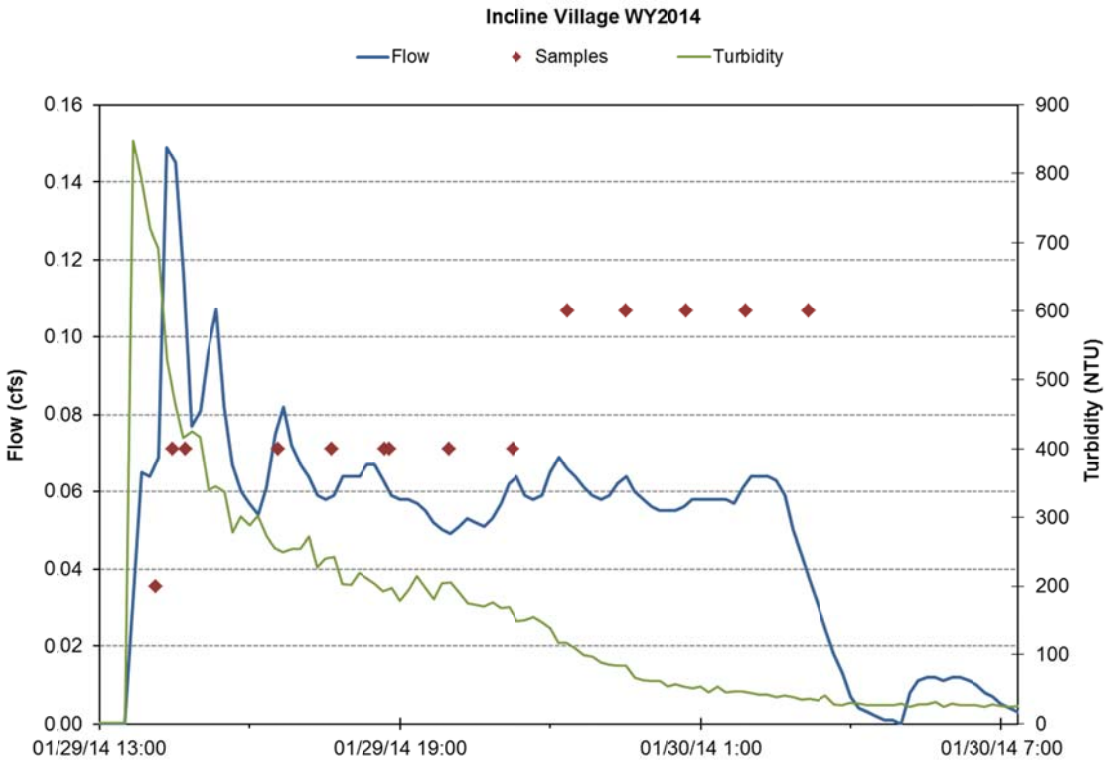

Figure C2: Continuous hydrology, continuous turbidity, and water quality samples for the 1/29/2014 event. Total volume sampled: 3,207 cf.

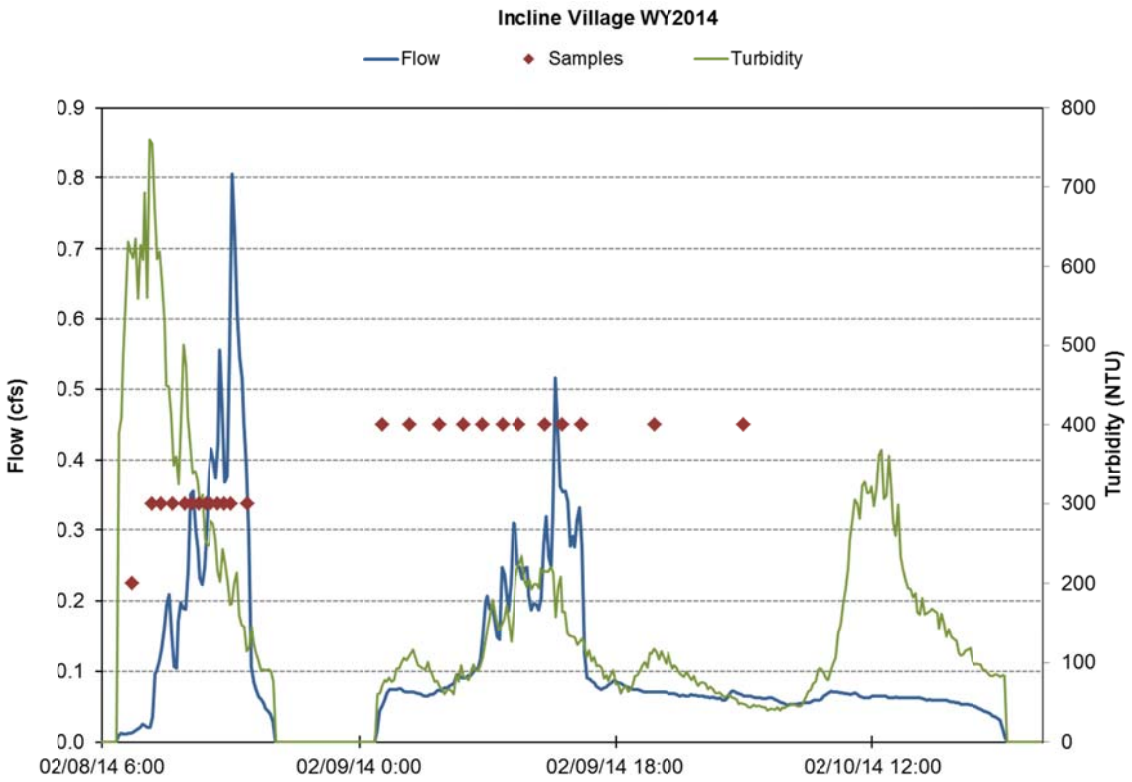

Figure C3: Continuous hydrology, continuous turbidity, and water quality samples for the 2/8/2014 event. Total volume sampled: 23,950 cf.

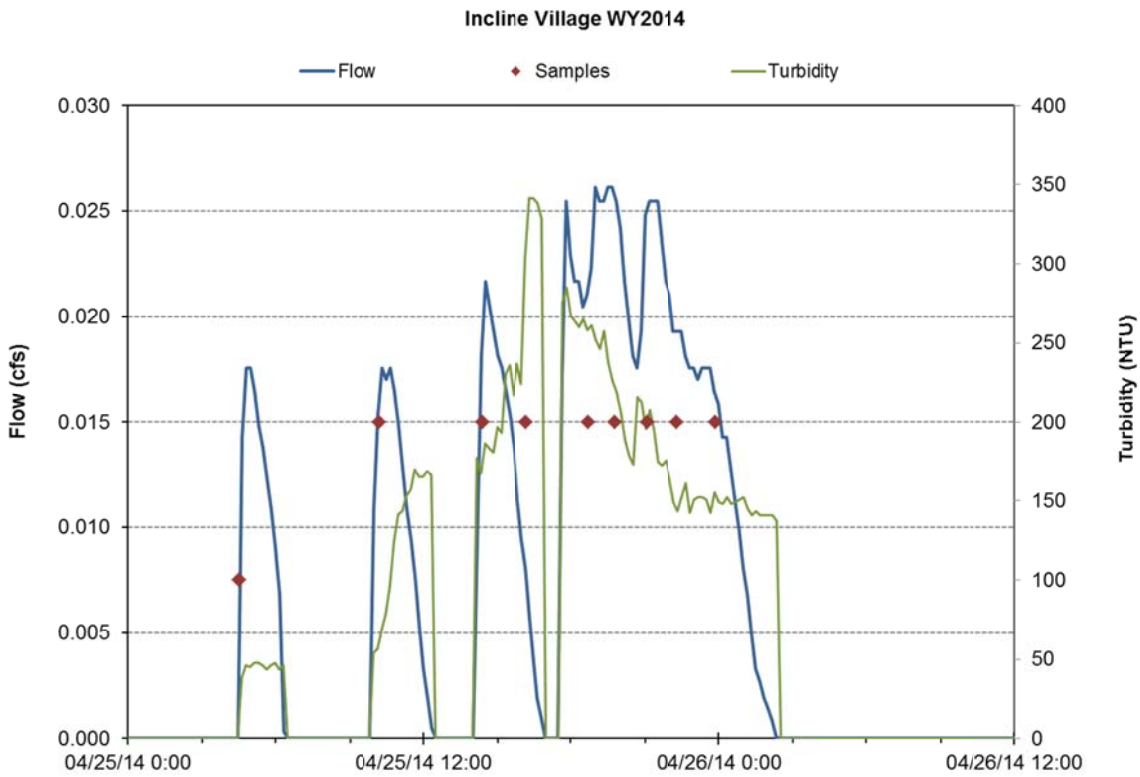

Figure C4: Continuous hydrology, continuous turbidity, and water quality samples for the 4/25/2014 event. Total volume sampled: 856 cf.

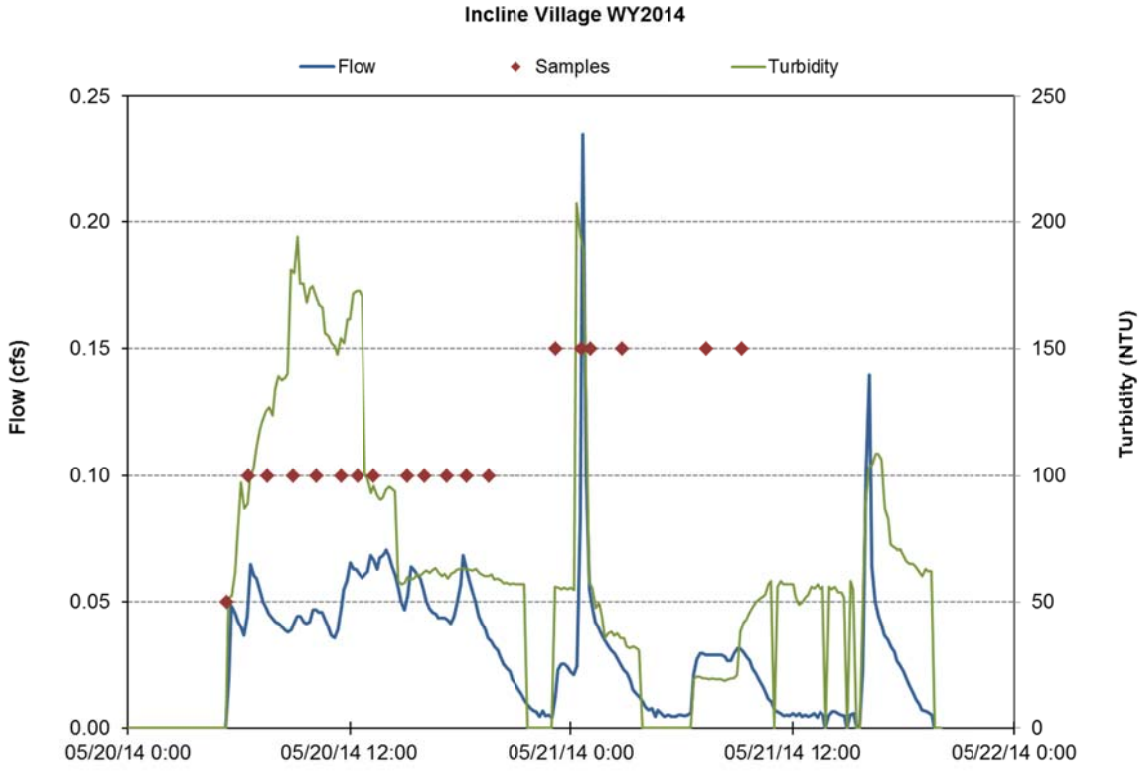

Figure C5: Continuous hydrology, continuous turbidity, and water quality samples for the 5/20/2014 event. Total volume sampled: 3,897 cf.

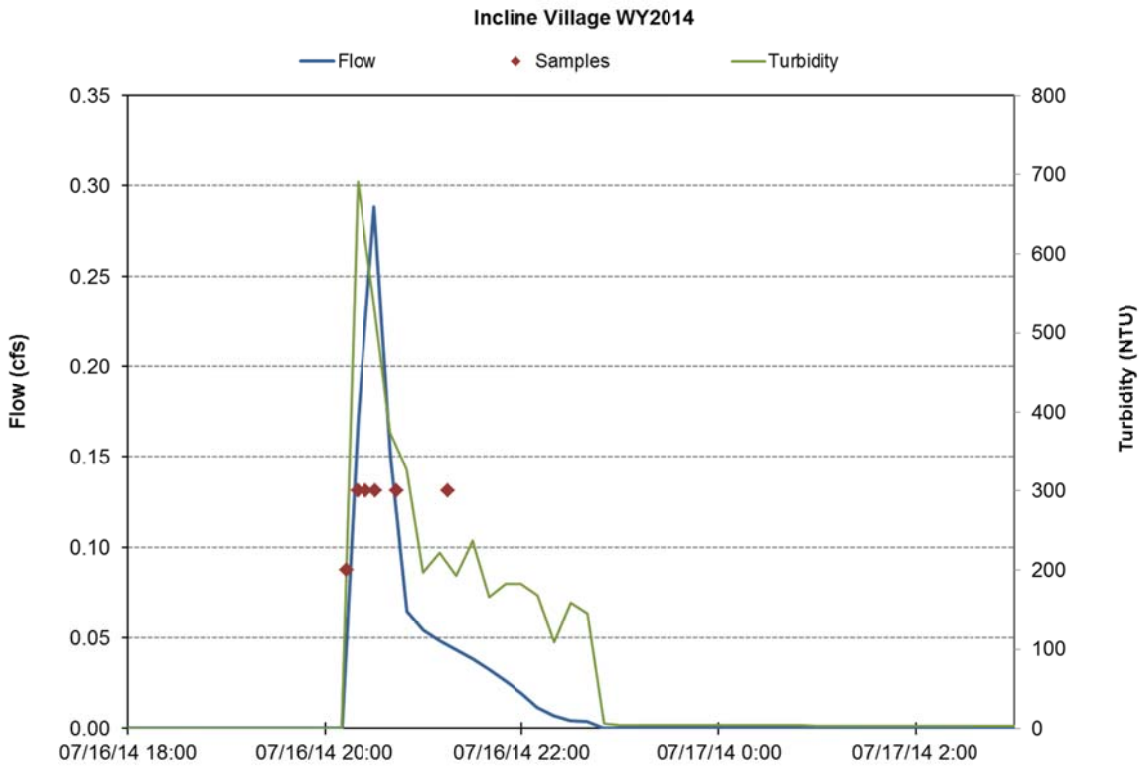

Figure C6: Continuous hydrology, continuous turbidity, and water quality samples for the 7/16/2014 event. Total volume sampled: 578 cf.

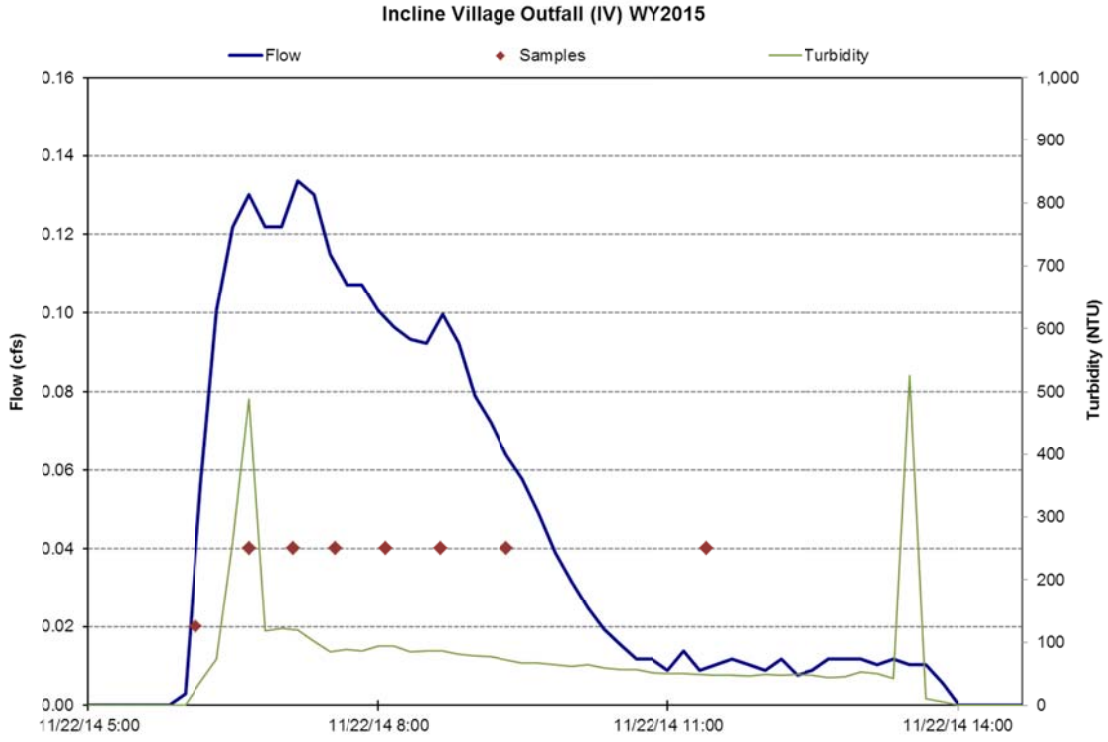

Figure C7: Continuous hydrology, continuous turbidity, and water quality samples for the 11/22/2014 event. Total volume sampled: 1,434 cf.

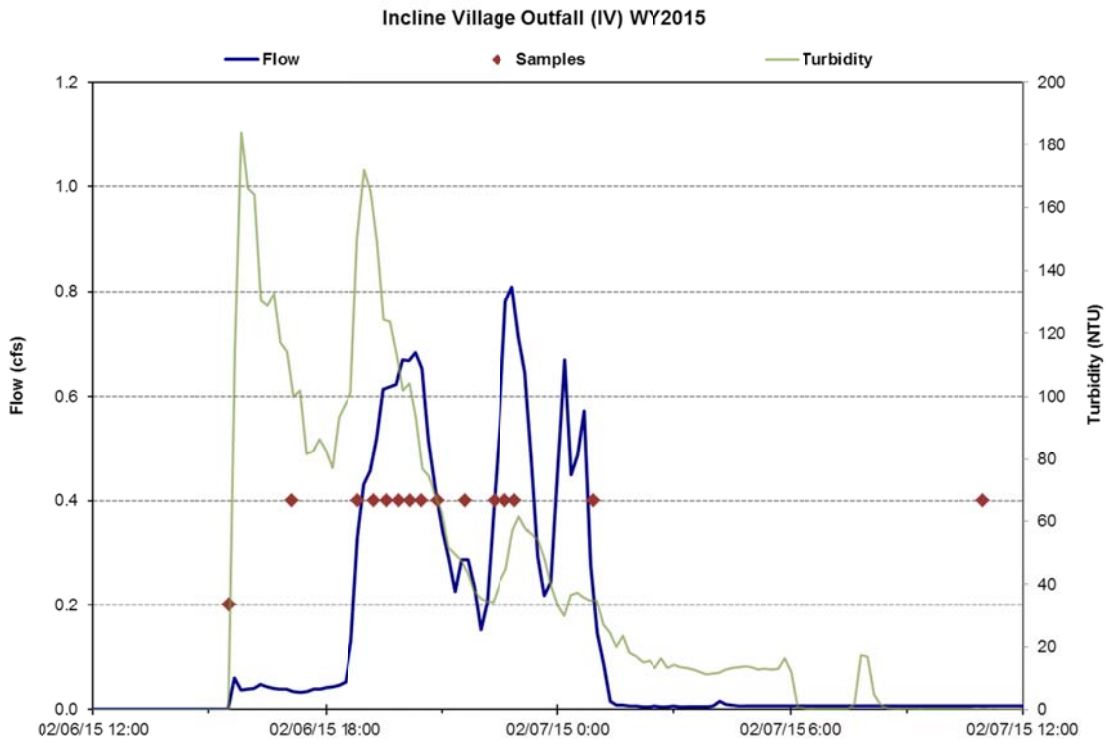

Figure C8: Continuous hydrology, continuous turbidity, and water quality samples for the 2/6/2015 event. Total volume sampled: 11,285 cf.

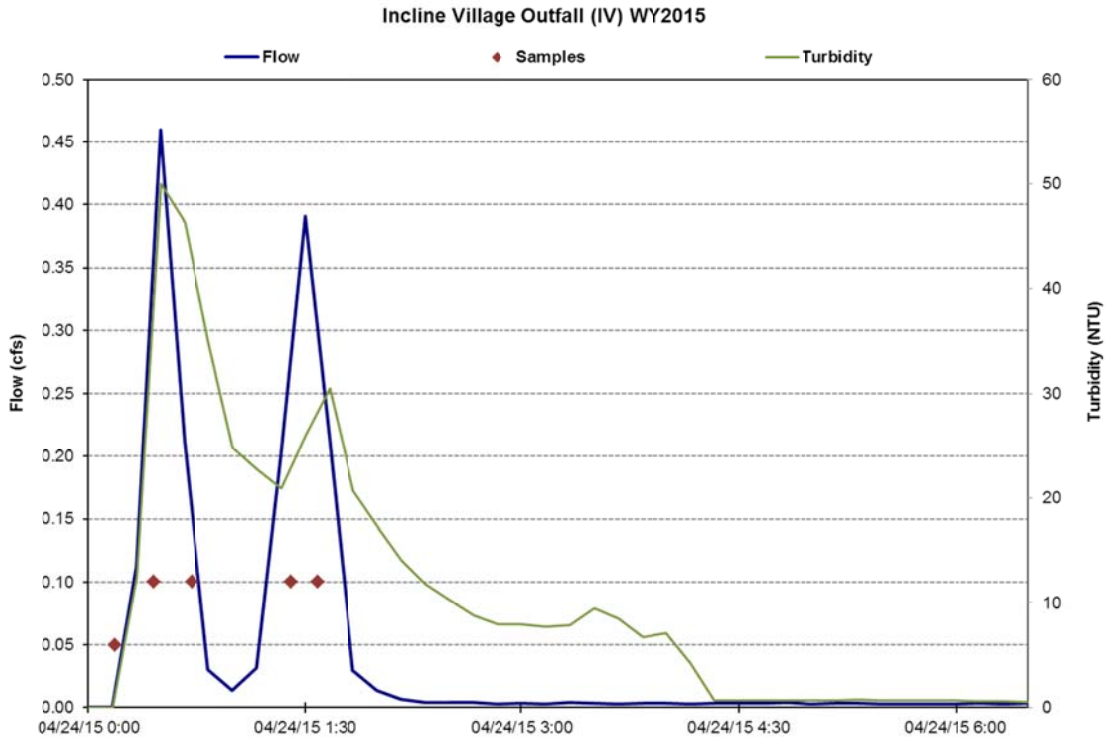

Figure C9: Continuous hydrology, continuous turbidity, and water quality samples for the 4/24/2015 event. Total volume sampled: 1,081 cf.

16 APPENDIX D: PASADENA EVENT HYDROGRAPHS

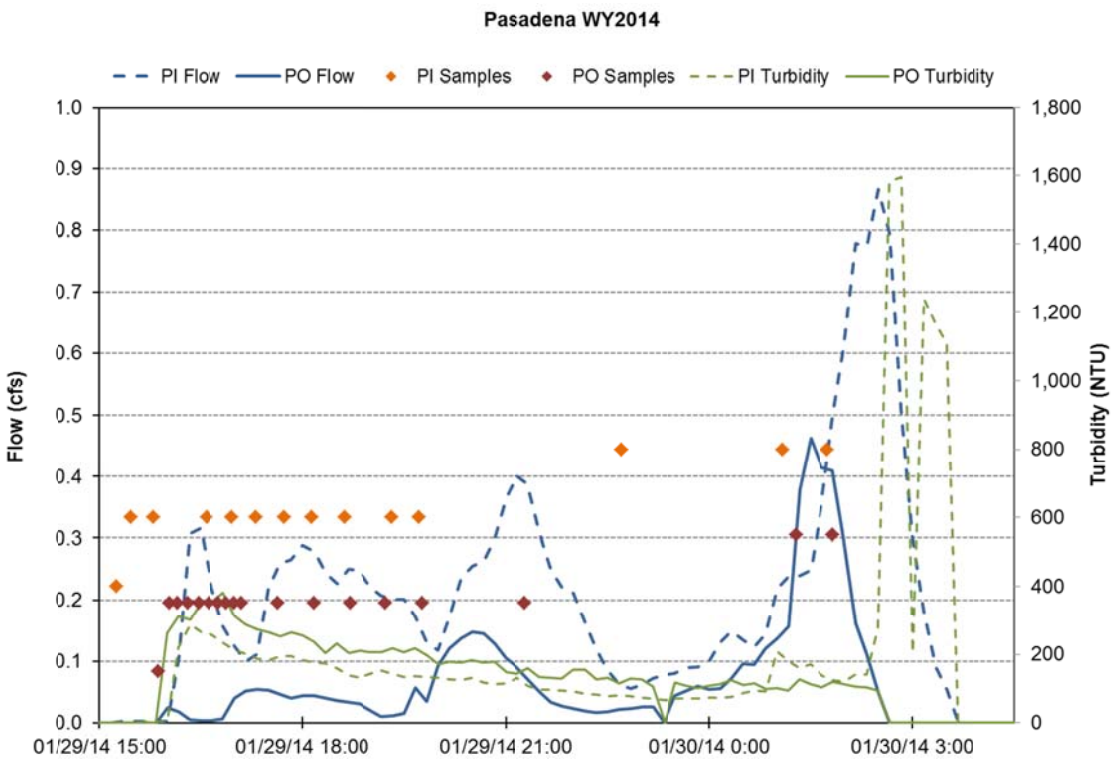

Figure D1: Continuous hydrology, continuous turbidity, and water quality samples for the 1/29/2014 event. Total volume sampled: 10,109 cf.

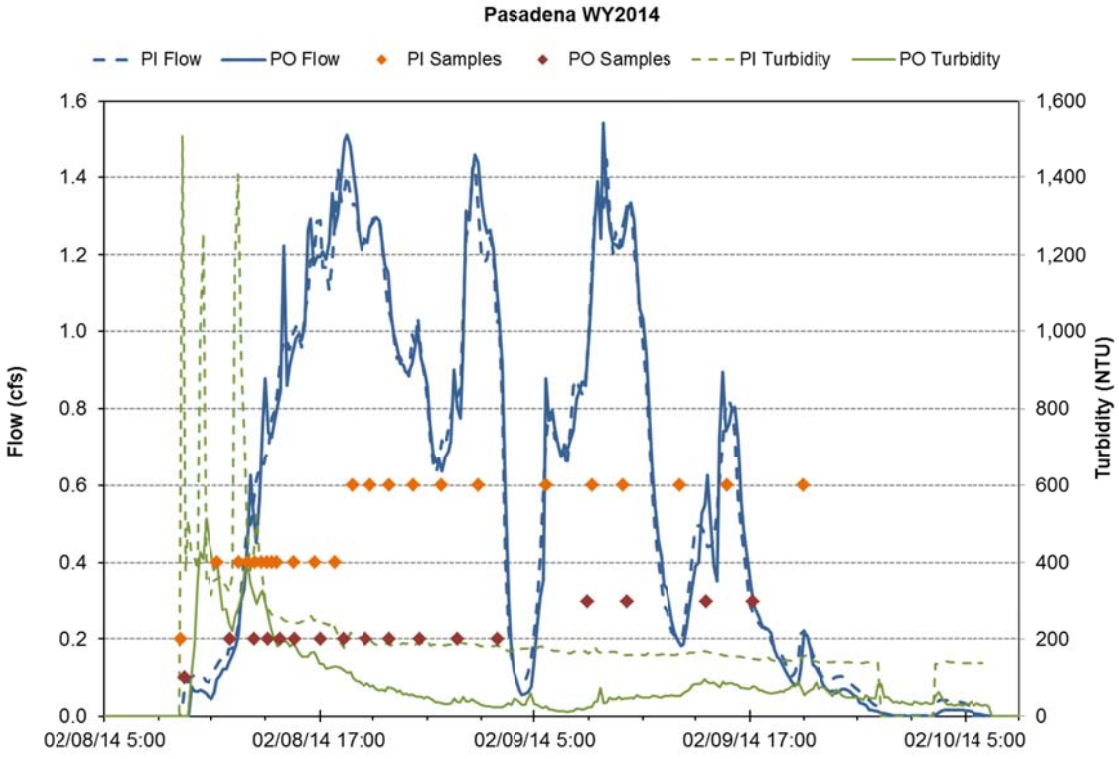

Figure D2: Continuous hydrology, continuous turbidity, and water quality samples for the 2/8/2014 event. Total volume sampled: 90,918 cf.

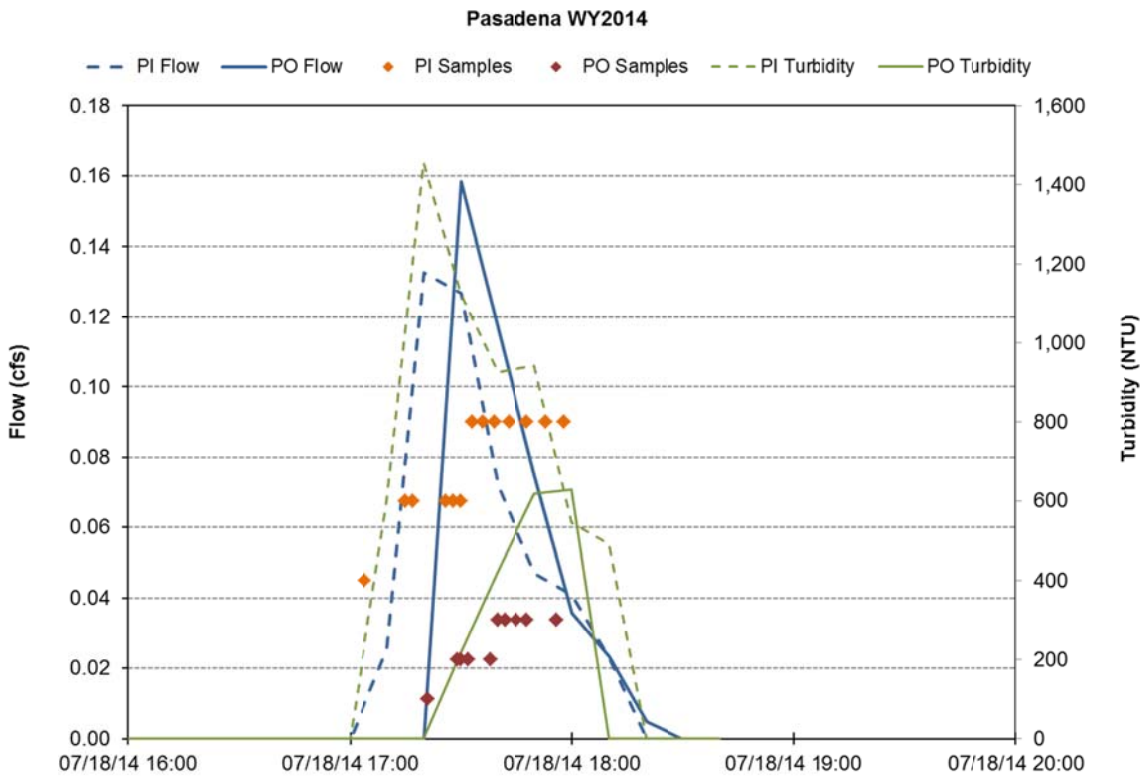

Figure D3: Continuous hydrology, continuous turbidity, and water quality samples for the 7/18/2014 event. Total volume sampled: 280 cf.

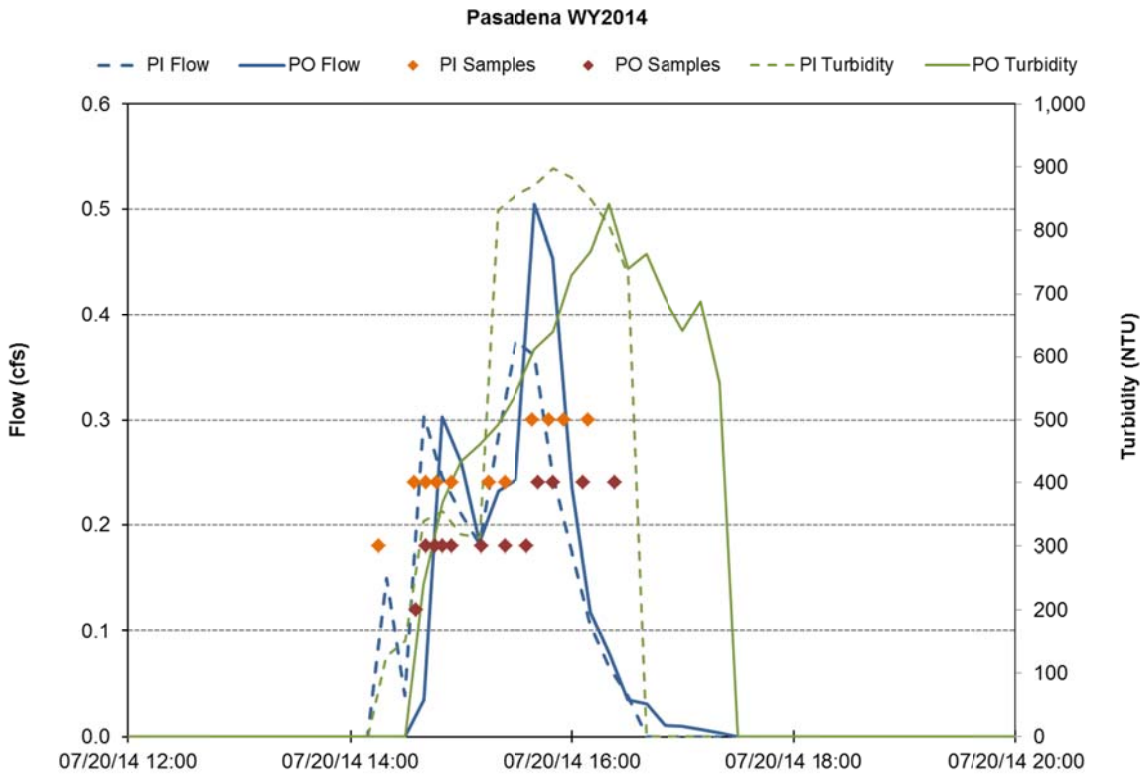

Figure D4: Continuous hydrology, continuous turbidity, and water quality samples for the 7/20/2014 event. Total volume sampled: 1,670 cf.

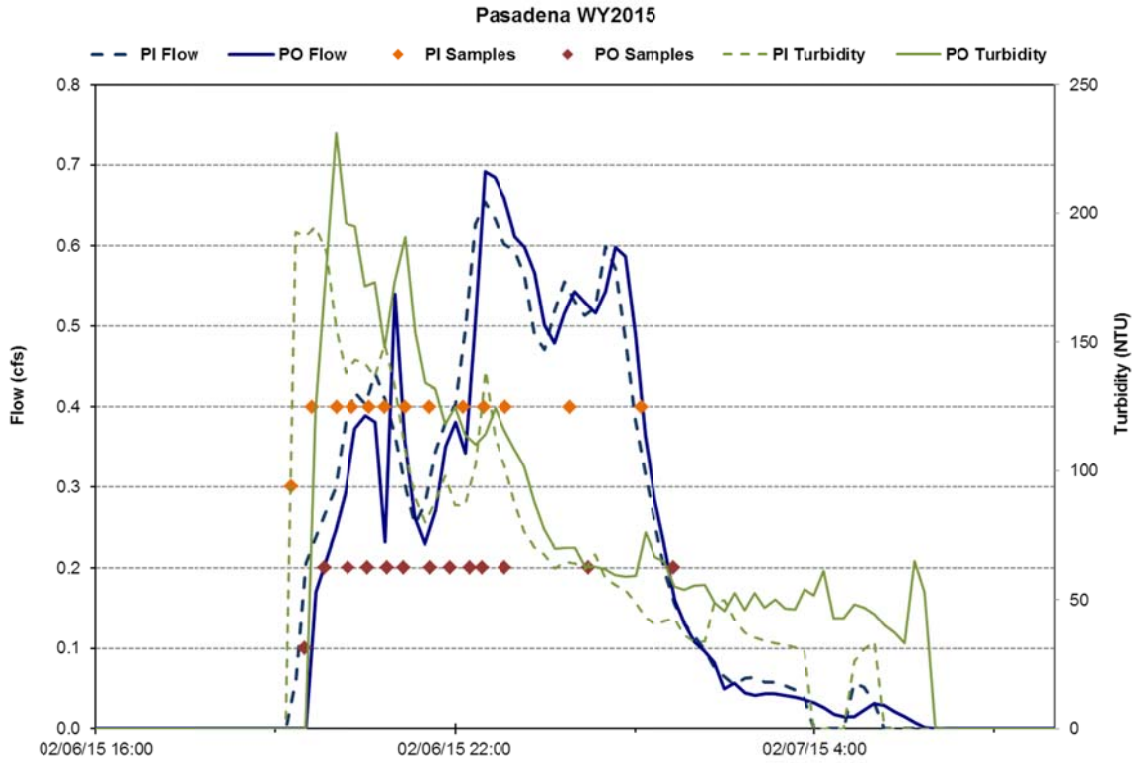

Figure D5: Continuous hydrology, continuous turbidity, and water quality samples for the 2/6/2015 event. Total volume sampled: 10,347 cf.

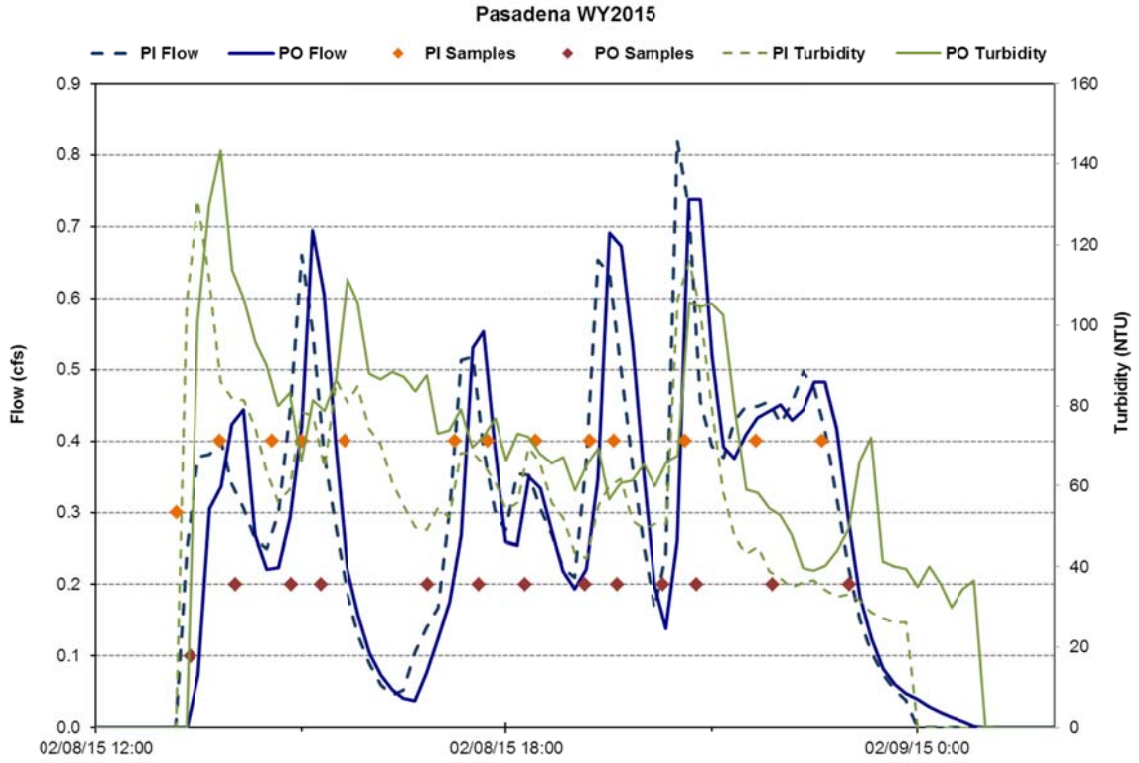

Figure D6: Continuous hydrology, continuous turbidity, and water quality samples for the 2/8/2015 event. Total volume sampled: 12,855 cf.

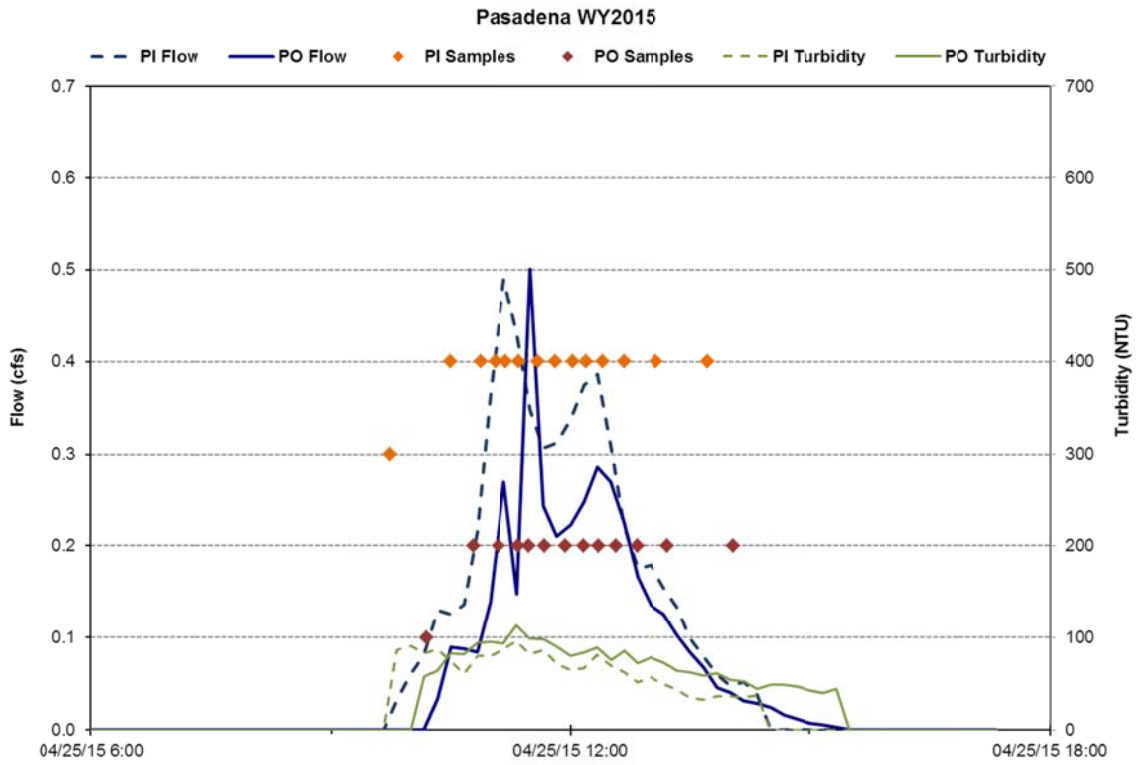

Figure D7: Continuous hydrology, continuous turbidity, and water quality samples for the 4/25/2015 event. Total volume sampled: 3,405 cf.

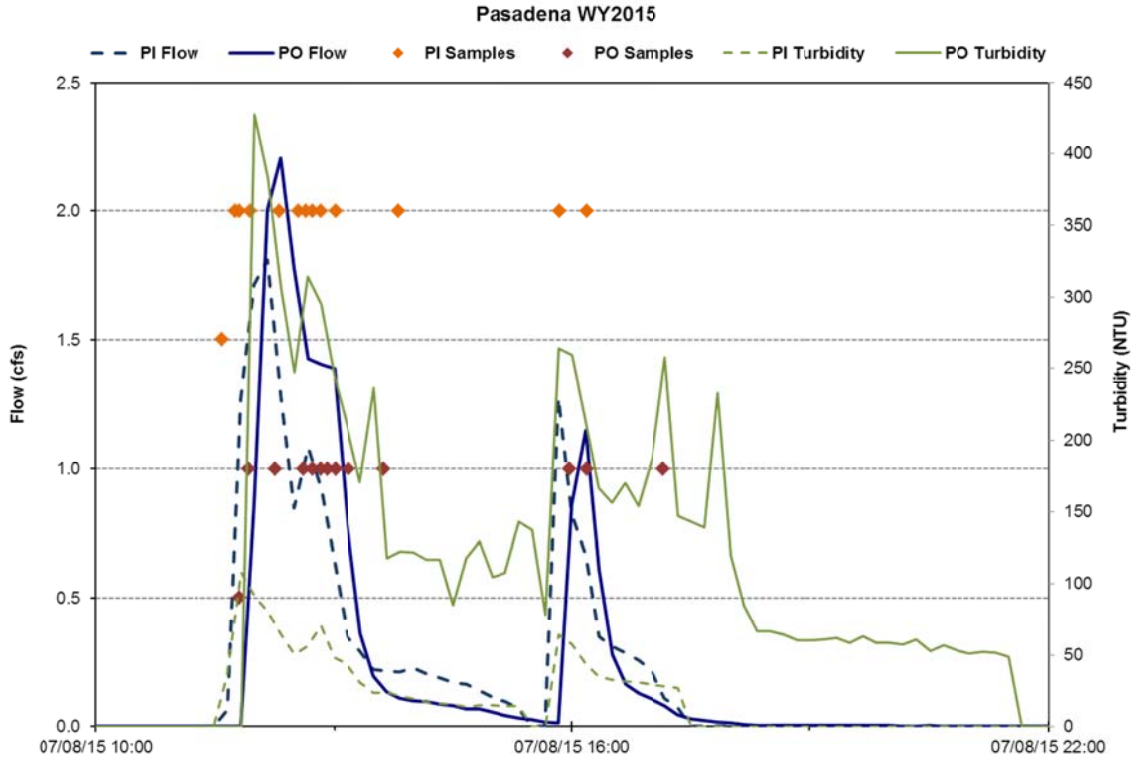

Figure D8: Continuous hydrology, continuous turbidity, and water quality samples for the 7/8/2014 event. Total volume sampled: 10,022 cf.

17 APPENDIX E: RUBICON EVENT HYDROGRAPHS

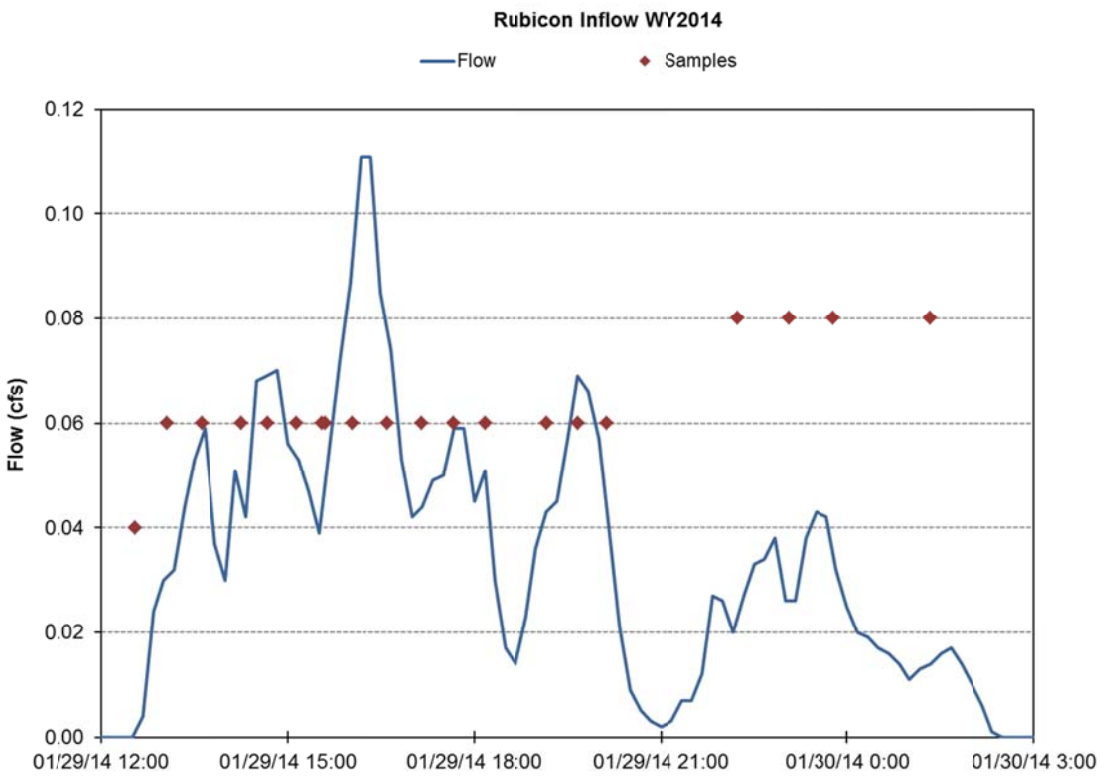

Figure E1: Continuous hydrology and water quality samples for the 1/29/2014 event. Total volume sampled: 392 cf.

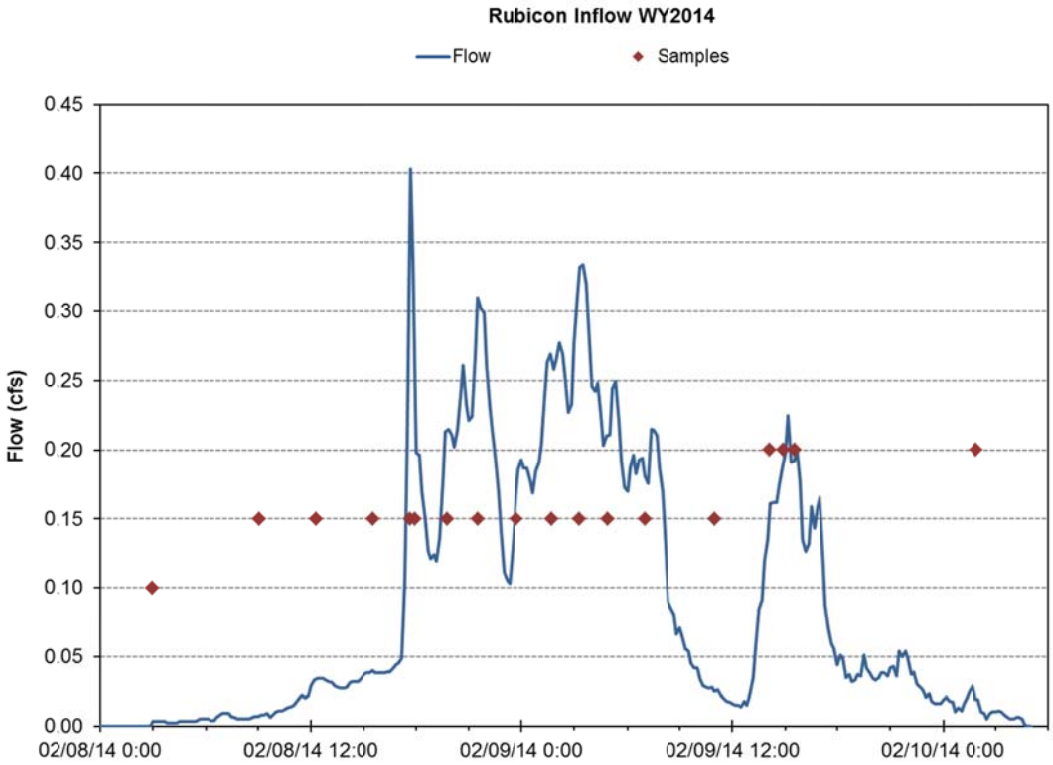

Figure E2: Continuous hydrology and water quality samples for the 2/8/2014 event. Total volume sampled: 16,441 cf.

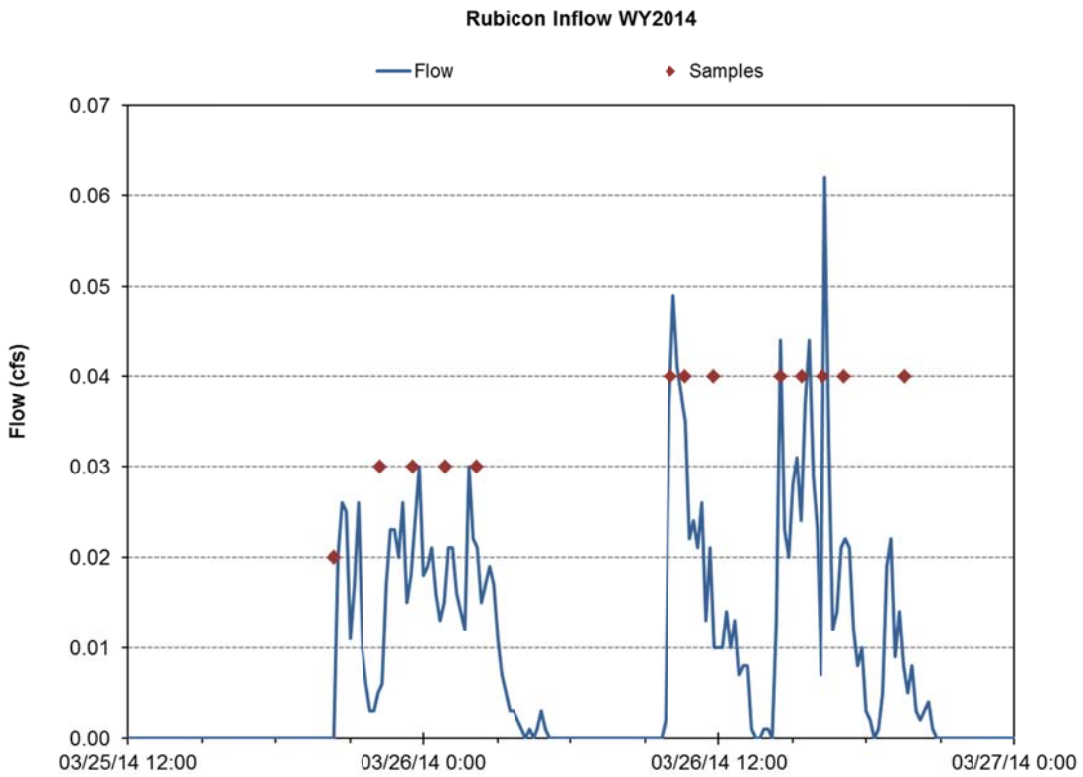

Figure E3: Continuous hydrology and water quality samples for the 3/25/2014 event. Total volume sampled: 1,073 cf.

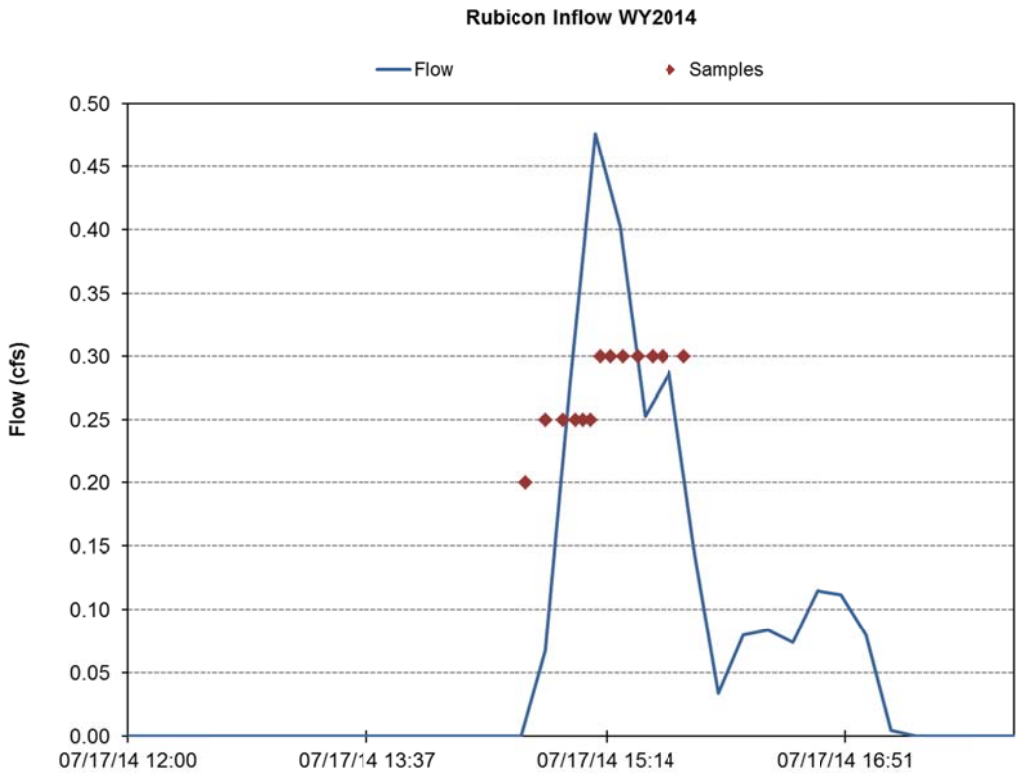

Figure E4: Continuous hydrology and water quality samples for the 7/17/2014 event. Total volume sampled: 1,501 cf.

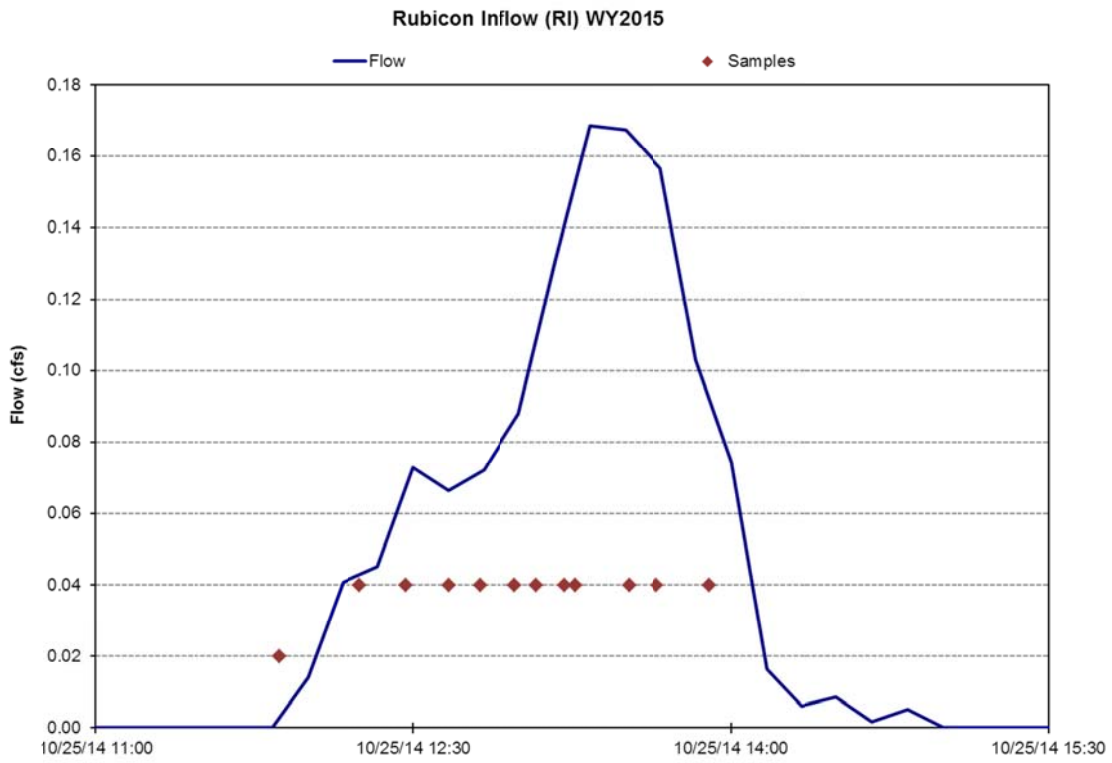

Figure E5: Continuous hydrology and water quality samples for the 10/25/2014 event. Total volume sampled: 741 cf.

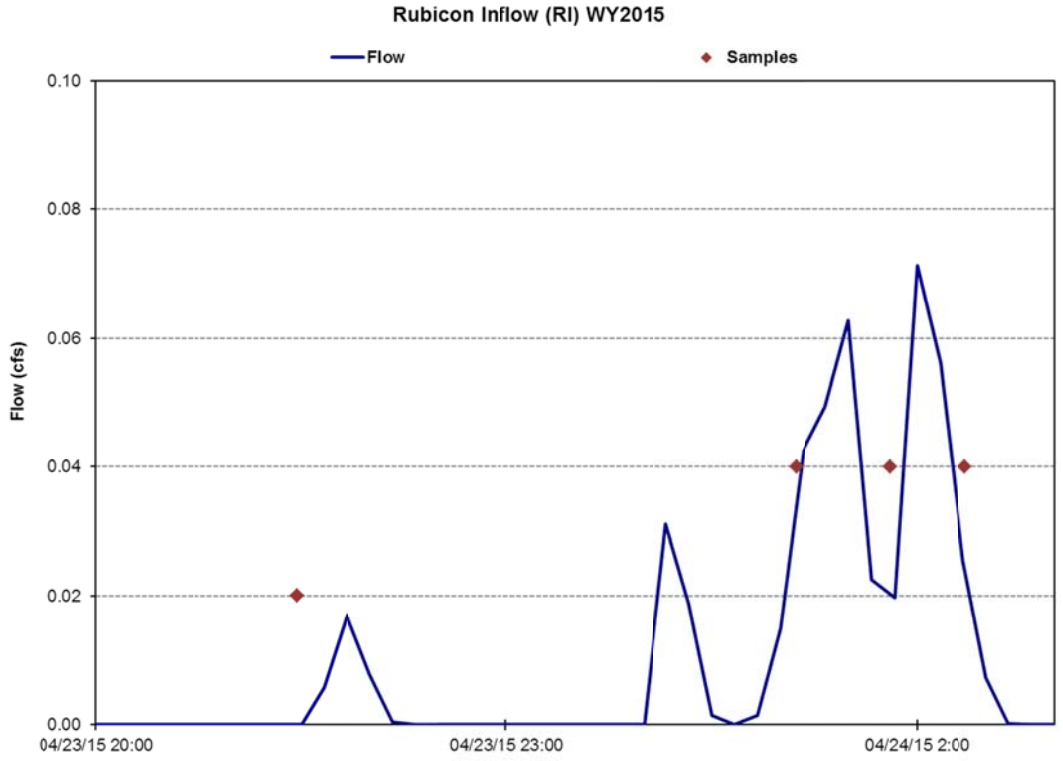

Figure E6: Continuous hydrology and water quality samples for the 4/23/2015 event. Total volume sampled: 273 cf.

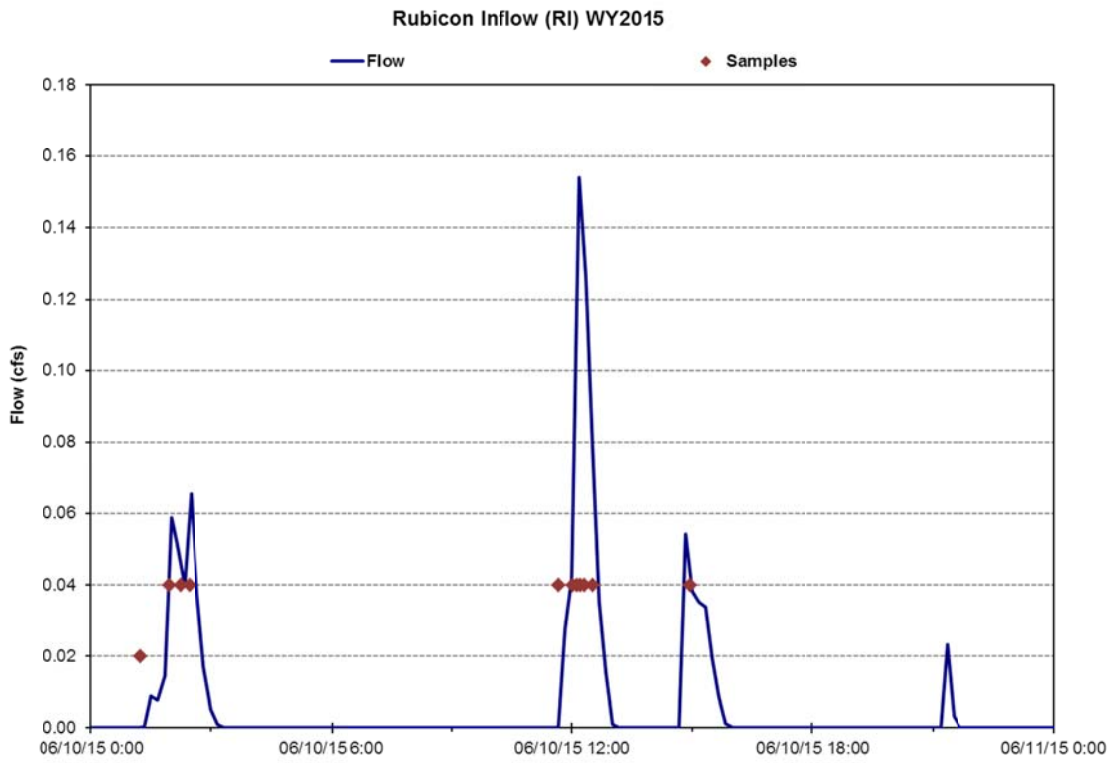

Figure E7: Continuous hydrology and water quality samples for the 6/10/2015 event. Total volume sampled: 603 cf.

18 APPENDIX F: SR431 VAULTS, ANNUAL HYDROGRAPHS

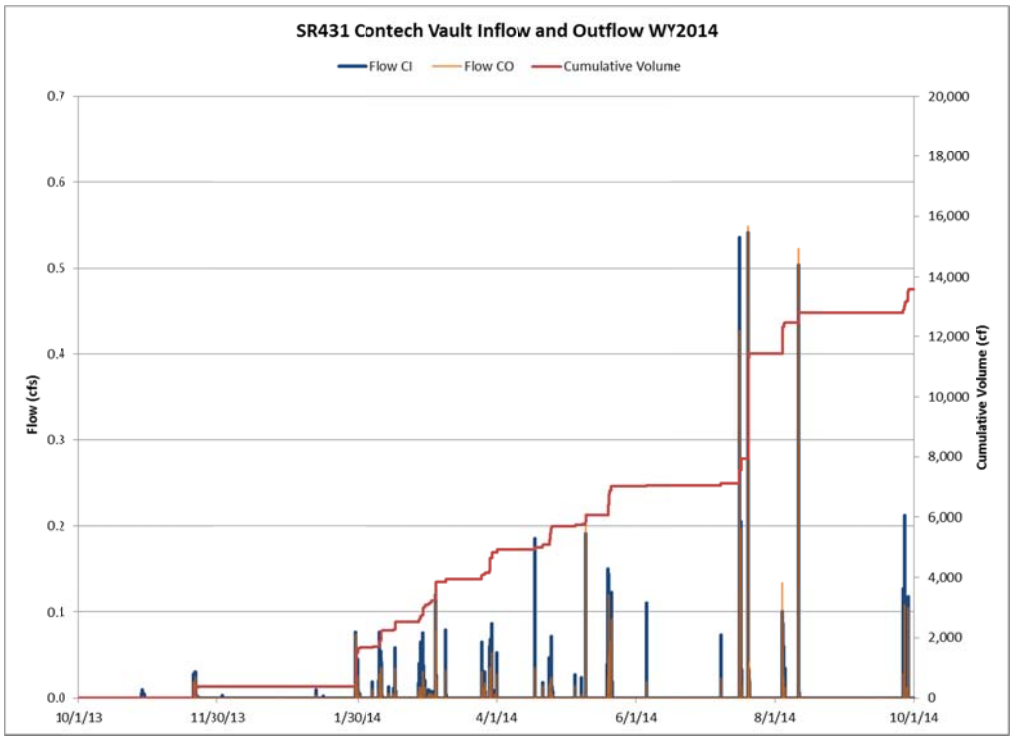

Figure F1a: Continuous hydrology and cumulative volume for the SR431 Contech MFS vault inflow (CI) and outflow (CO) in WY14. Data for individual sampled runoff events is presented in DRI et al 2015.

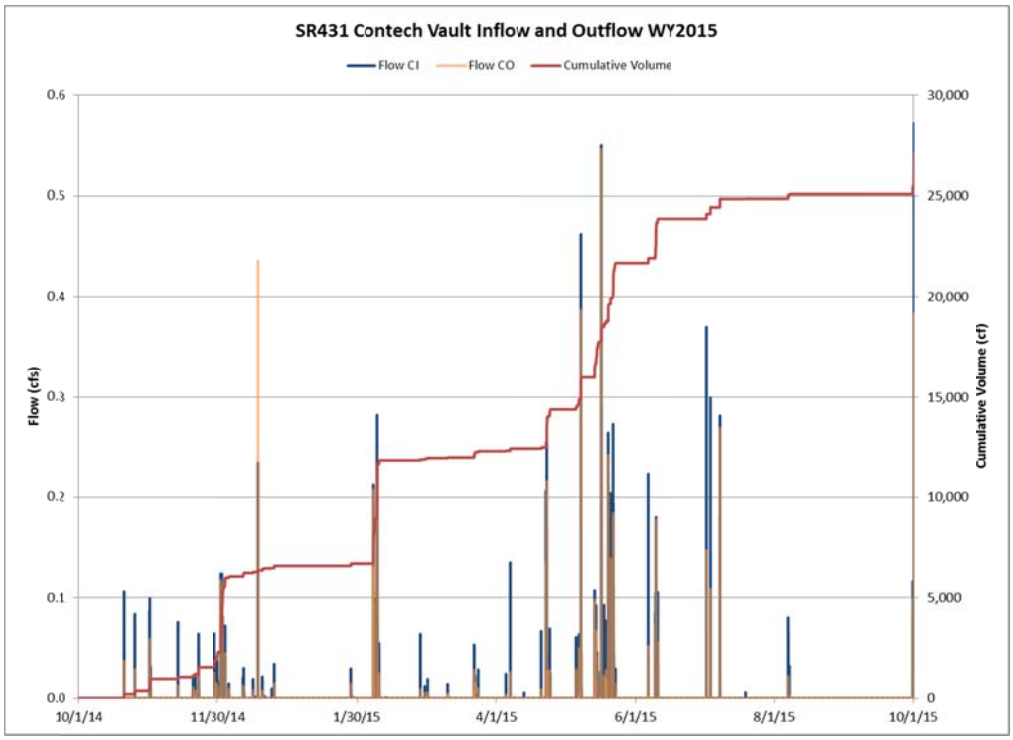

Figure F1b: Continuous hydrology and cumulative volume for the SR431 Contech MFS vault inflow (CI) and outflow (CO) in WY15. Data for individual sampled runoff events through April 2015 is presented in DRI et al 2015.

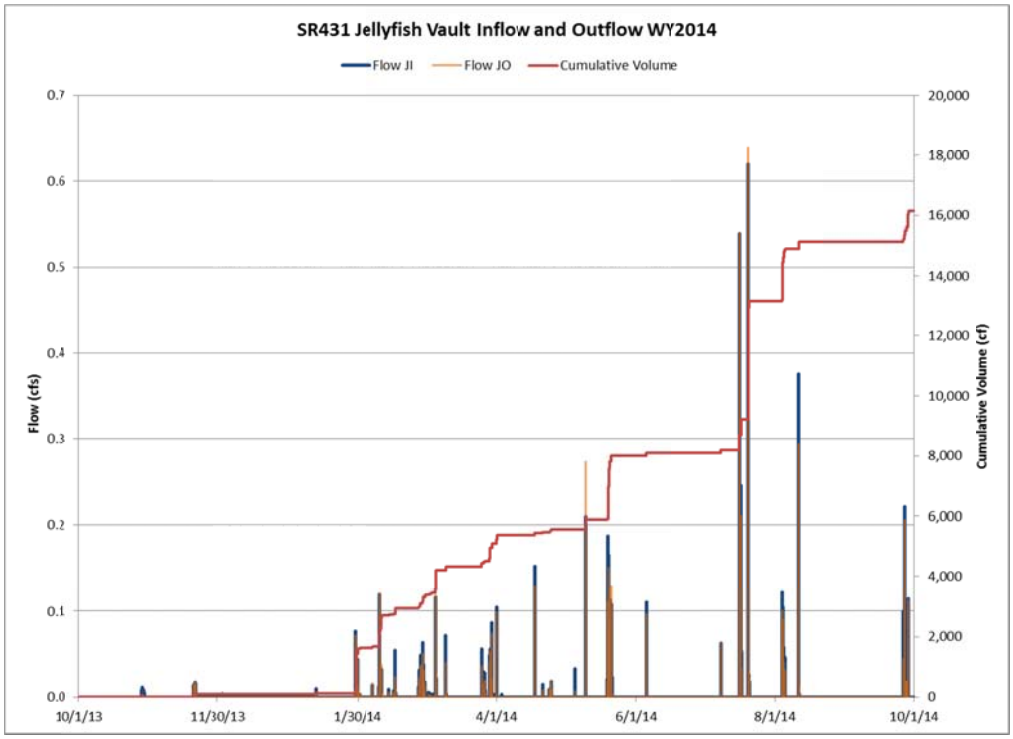

Figure F2a: Continuous hydrology and cumulative volume for the SR431 Jellyfish vaults in WY14. Data for individual sampled runoff events is presented in DRI et al 2015.

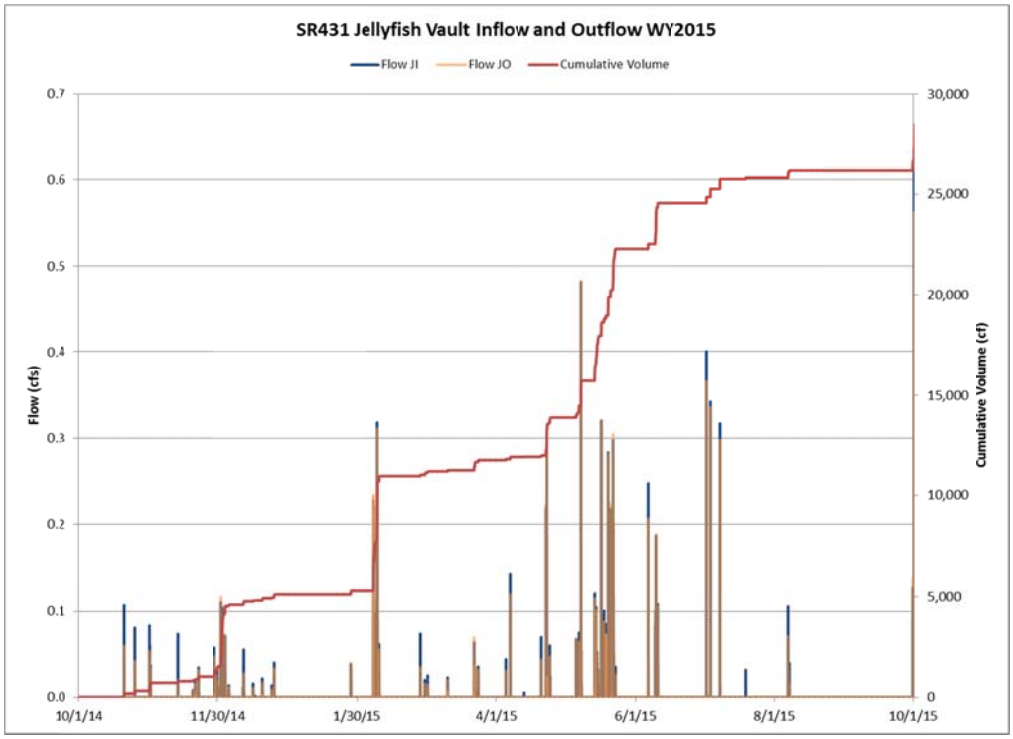

Figure F2b: Continuous hydrology and cumulative volume for the SR431 Jellyfish vaults in WY15. Data for individual sampled runoff events through April 2015 is presented in DRI et al 2015.

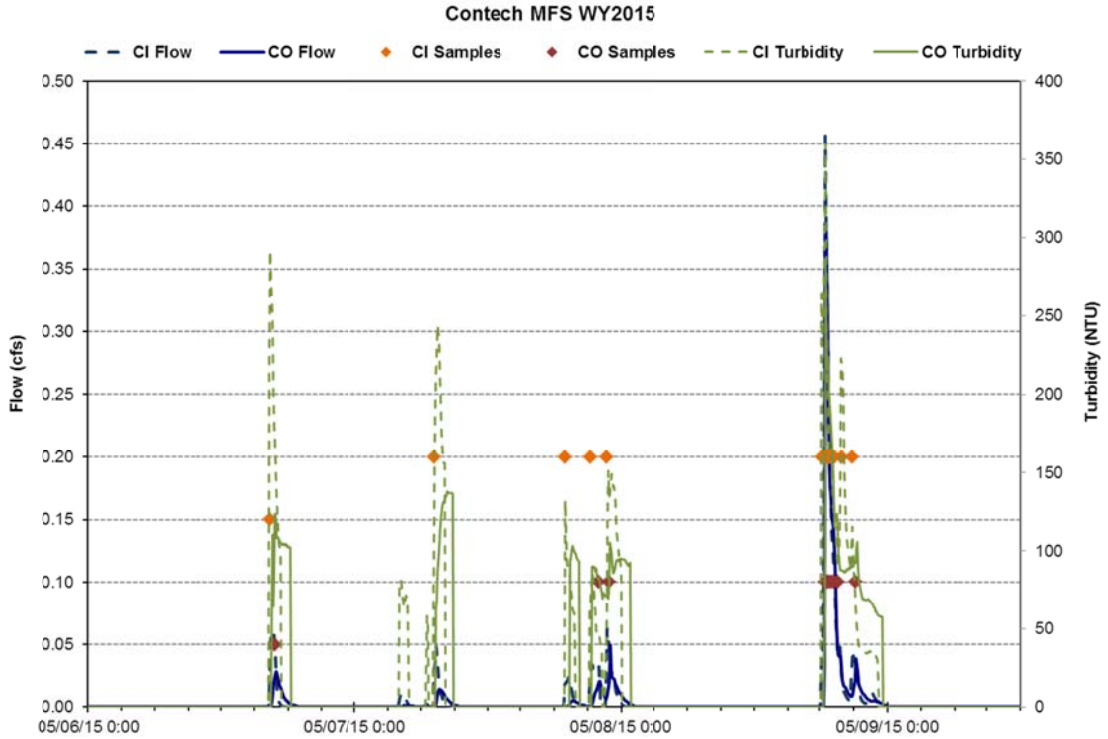

Figure F3: Continuous hydrology, continuous turbidity, and water quality samples for the 5/6/2015 event. Total volume sampled: 1,310 cf.

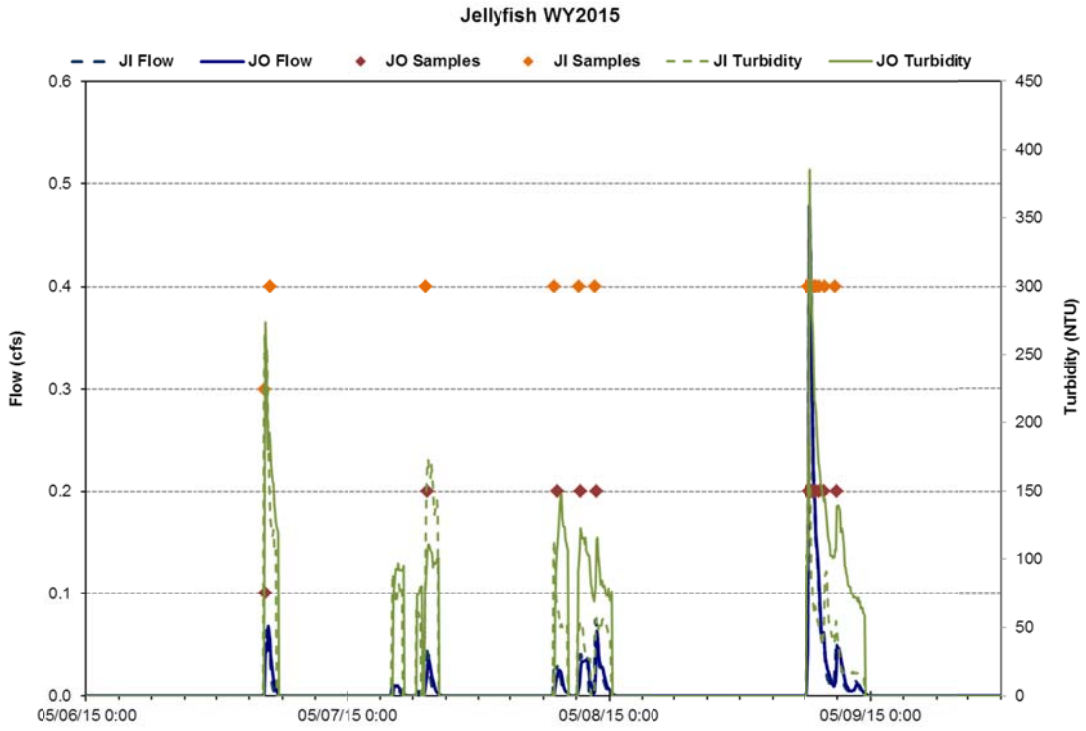

Figure F4: Continuous hydrology, continuous turbidity, and water quality samples for the 5/6/2015 event. Total volume sampled: 1,847 cf.

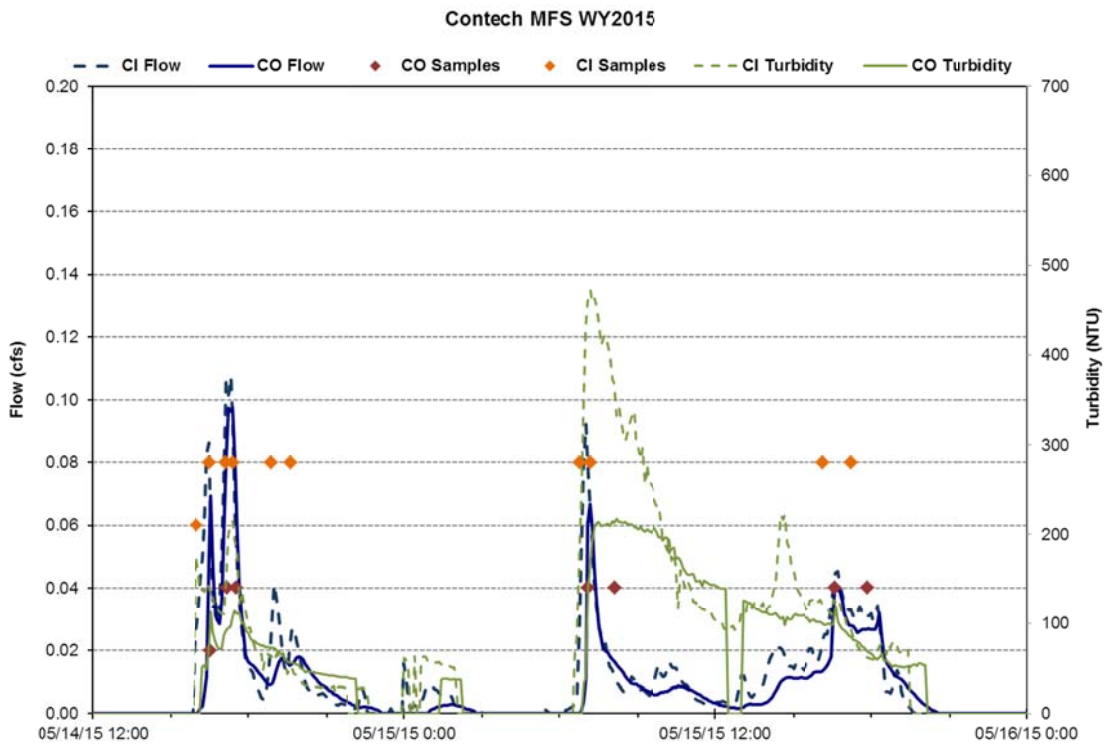

Figure F5: Continuous hydrology, continuous turbidity, and water quality samples for the 5/14/2015 event. Total volume sampled: 1,116 cf.

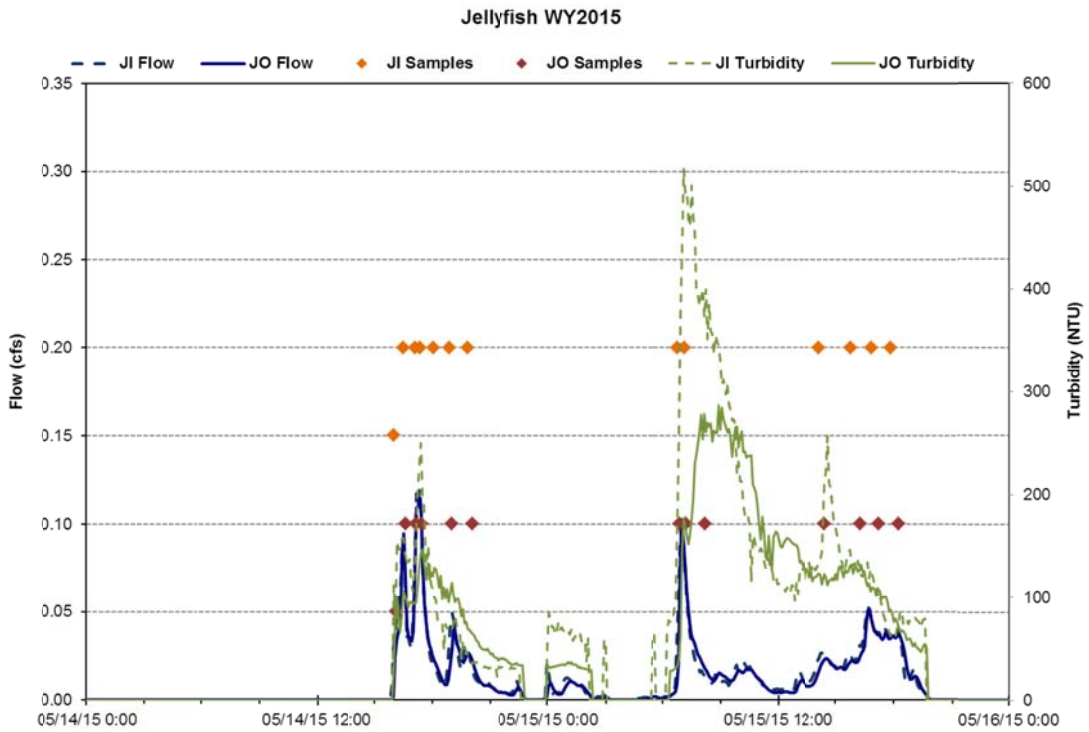

Figure F6: Continuous hydrology, continuous turbidity, and water quality samples for the 5/14/2015 event. Total volume sampled: 1,783 cf.

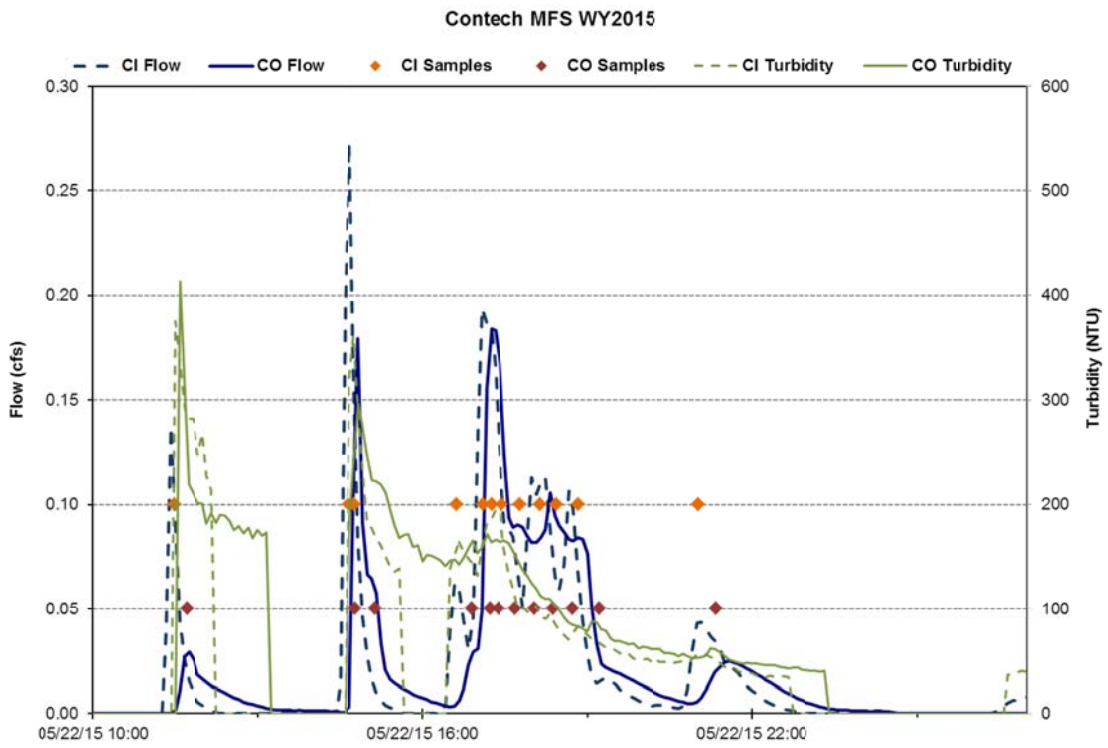

Figure F7: Continuous hydrology, continuous turbidity, and water quality samples for the 5/22/2015 event. Total volume sampled: 1,289 cf.

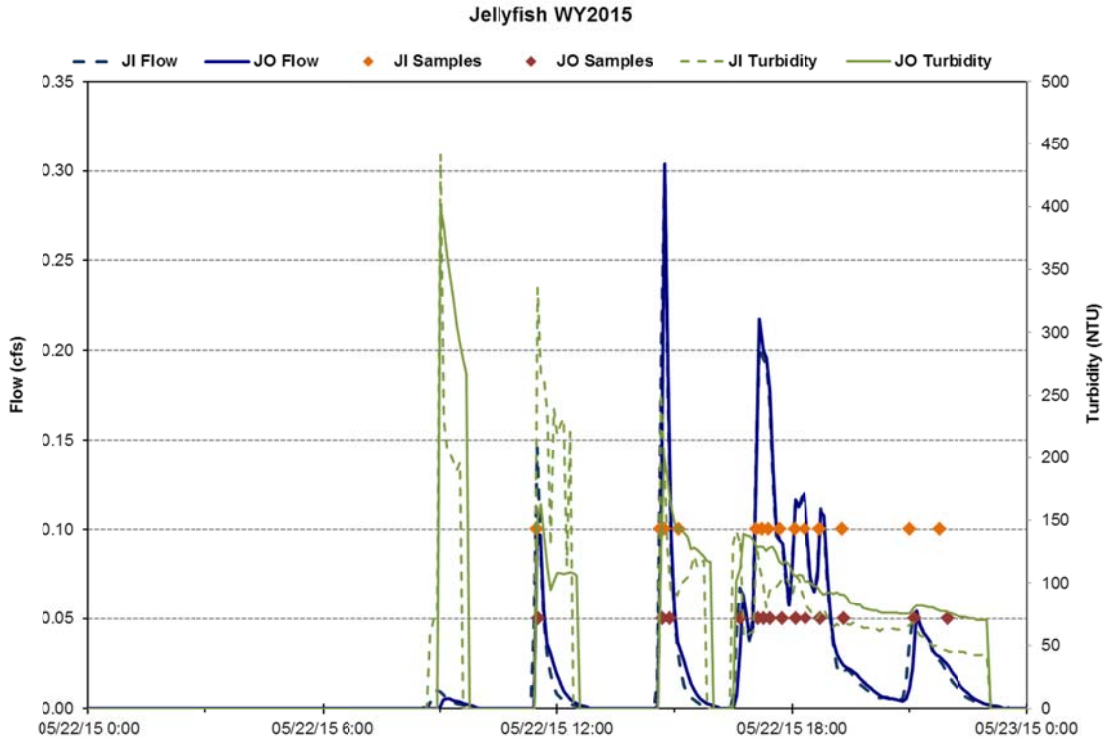

Figure F8: Continuous hydrology, continuous turbidity, and water quality samples for the 5/22/2015 event. Total volume sampled: 1,526 cf.

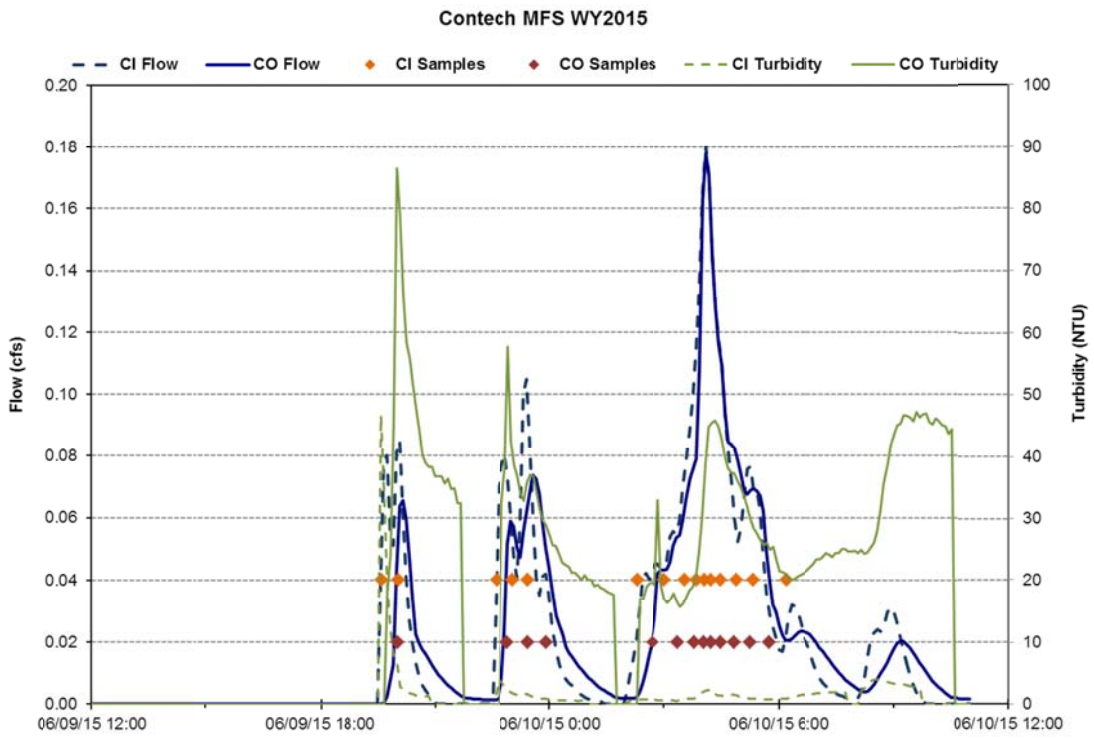

Figure F9: Continuous hydrology, continuous turbidity, and water quality samples for the 6/9/2015 event. Total volume sampled: 1,536 cf.

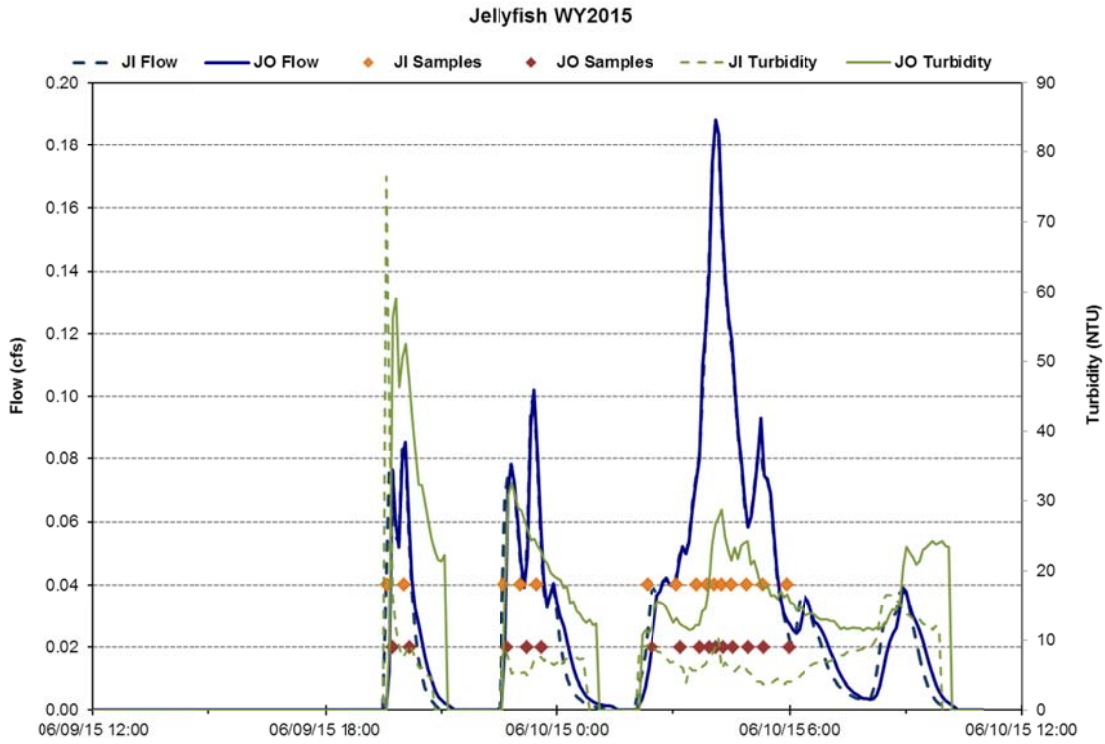

Figure F10: Continuous hydrology, continuous turbidity, and water quality samples for the 6/9/2015 event. Total volume sampled: 1,658 cf.

19 APPENDIX G: SR431 OUTFALL EVENT HYDROGRAPHS

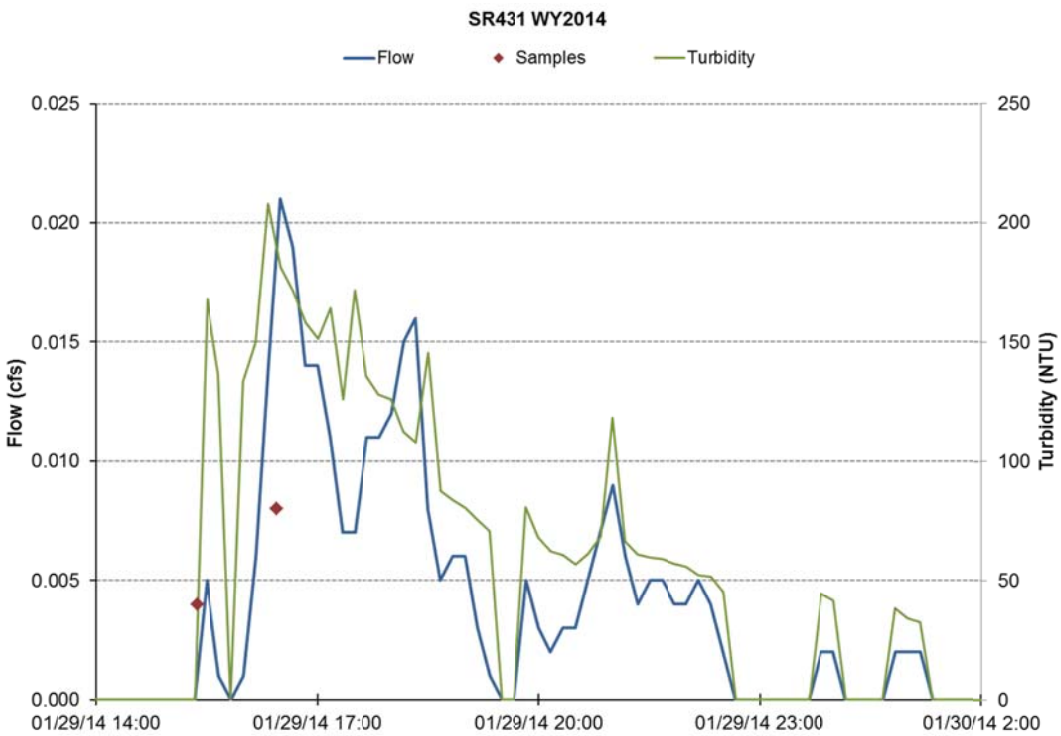

Figure G1: Continuous hydrology, continuous turbidity, and water quality samples for the 1/29/2014 event. End of event missed because of erratic flow and high sample pacing. Total volume sampled: 180 cf.

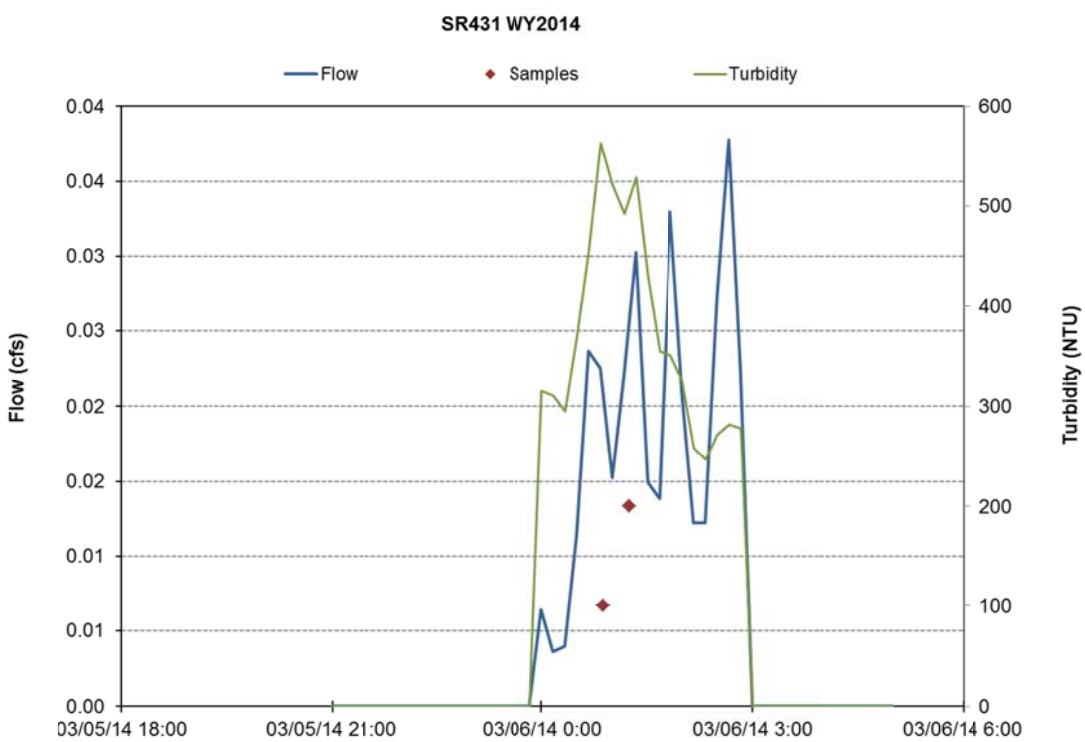

Figure G2: Continuous hydrology, continuous turbidity, and water quality samples for the 3/5/2014 event. End of event missed because of erratic flow and high sample pacing. Total volume sampled: 200 cf.

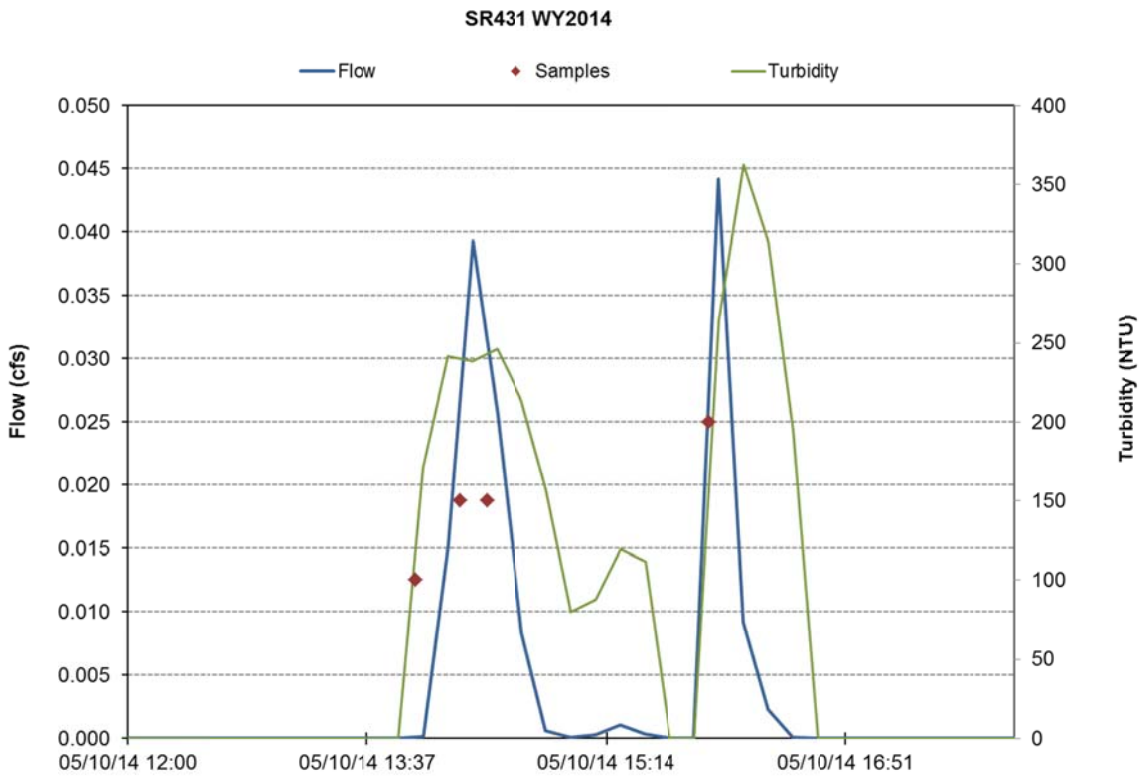

Figure G3: Continuous hydrology, continuous turbidity, and water quality samples for the 5/10/2014 event. Total volume sampled: 88 cf.

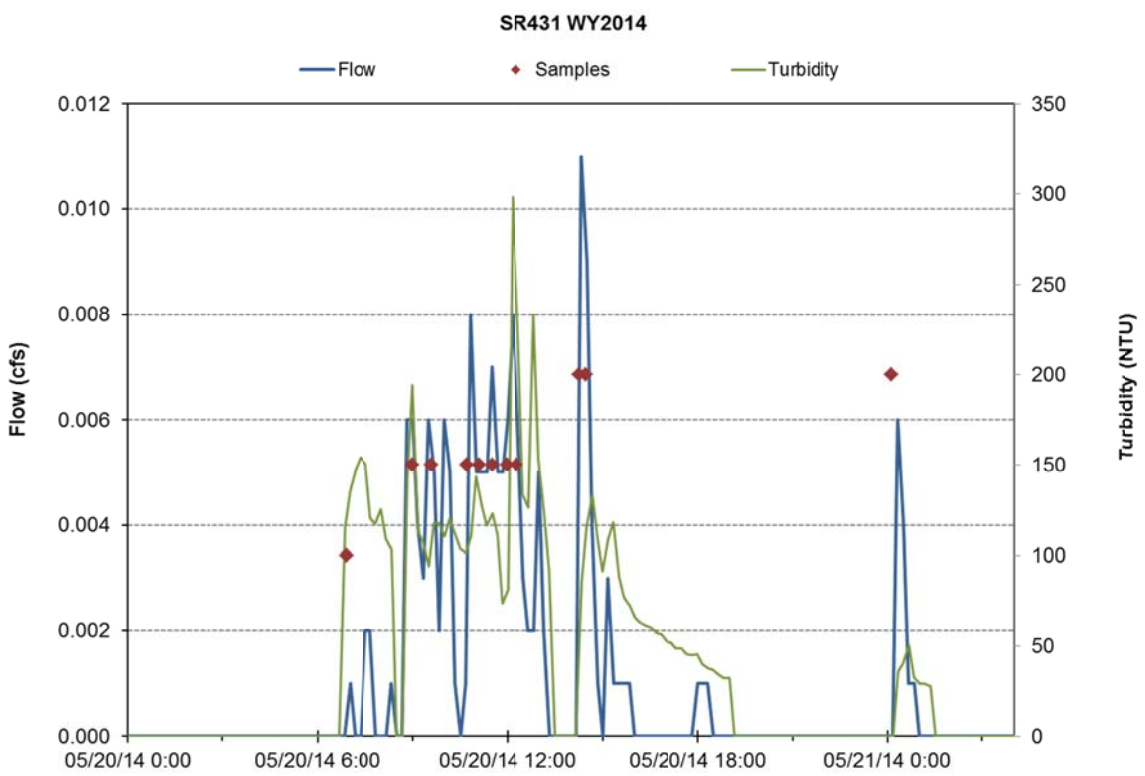

Figure G4: Continuous hydrology, continuous turbidity, and water quality samples for the 5/20/2014 event. Total volume sampled: 103 cf.

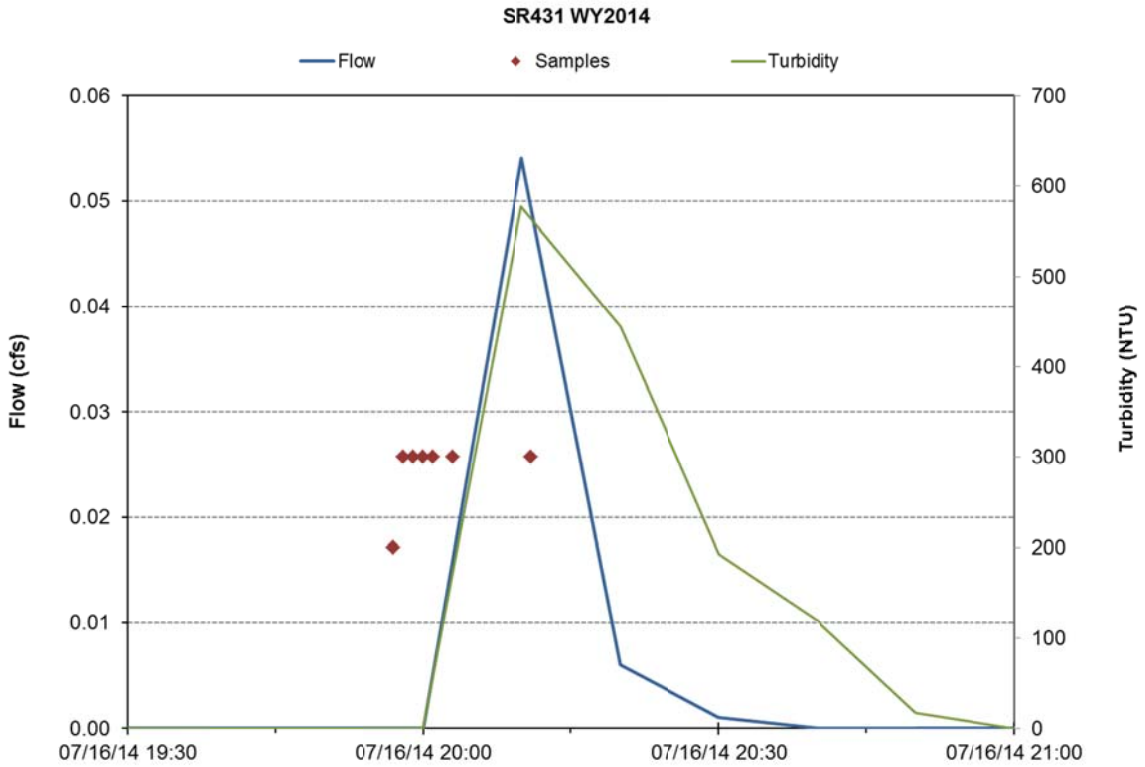

Figure G5: Continuous hydrology, continuous turbidity, and water quality samples for the 7/16/2014 event. Total volume sampled: 37 cf.

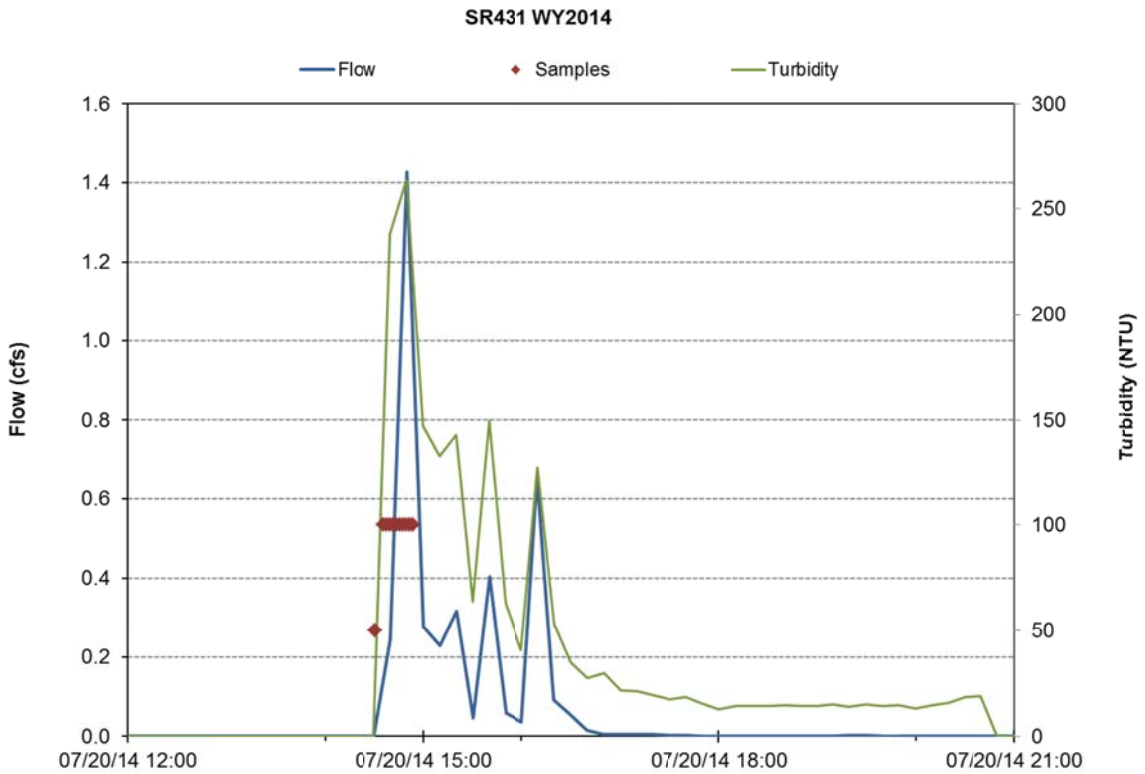

Figure G6: Continuous hydrology, continuous turbidity, and water quality samples for the 7/20/2014 event. End of event missed because sample pacing was too low. Total volume sampled: 2,319 cf.

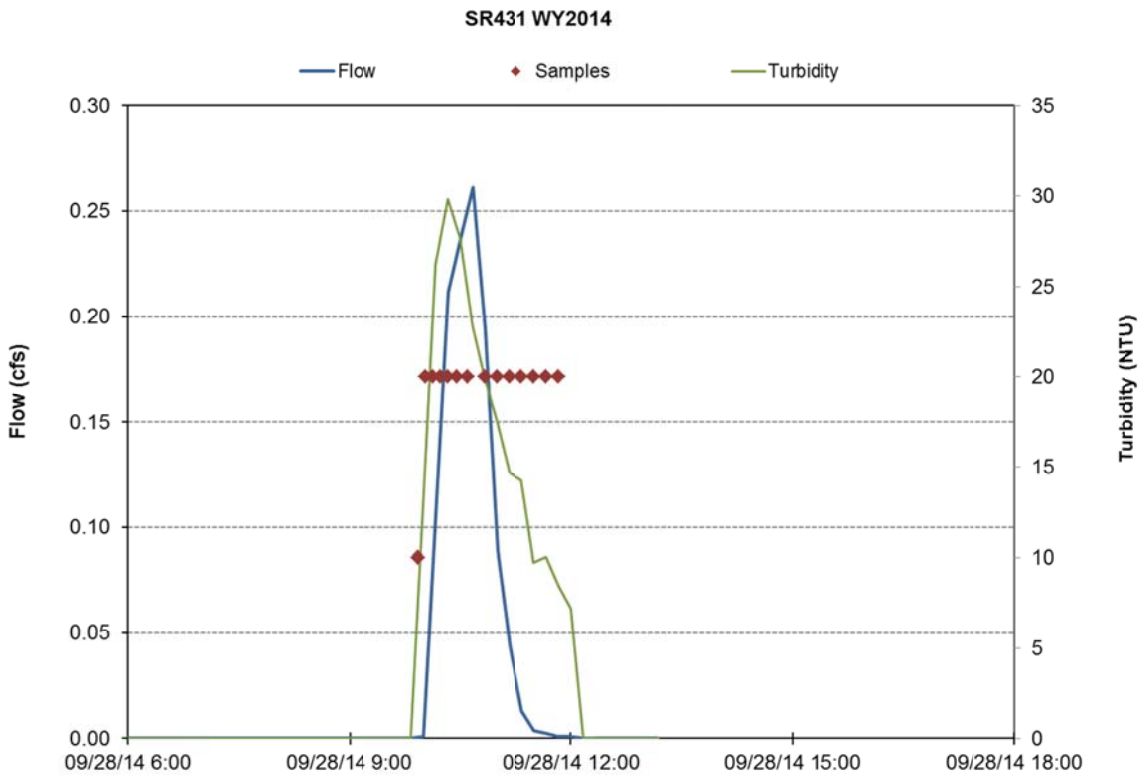

Figure G7: Continuous hydrology, continuous turbidity, and water quality samples for the 9/28/2014 event. Total volume sampled: 699 cf.

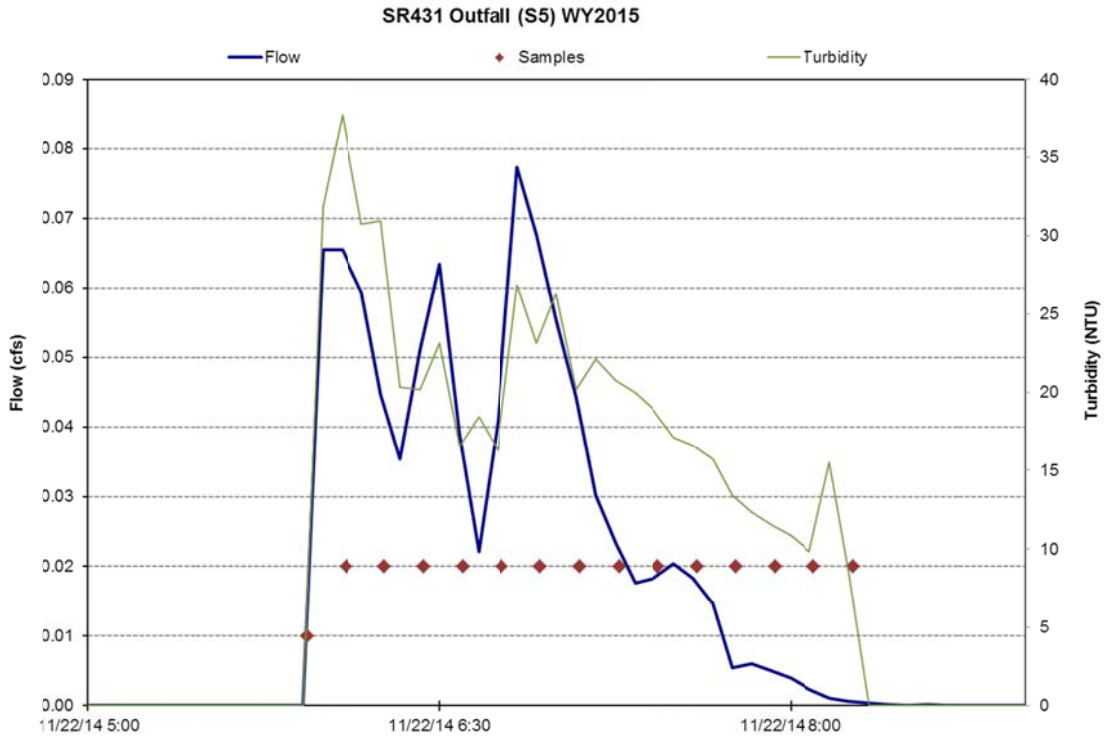

Figure G8: Continuous hydrology, continuous turbidity, and water quality samples for the 11/22/2014 event. Total volume sampled: 270 cf.

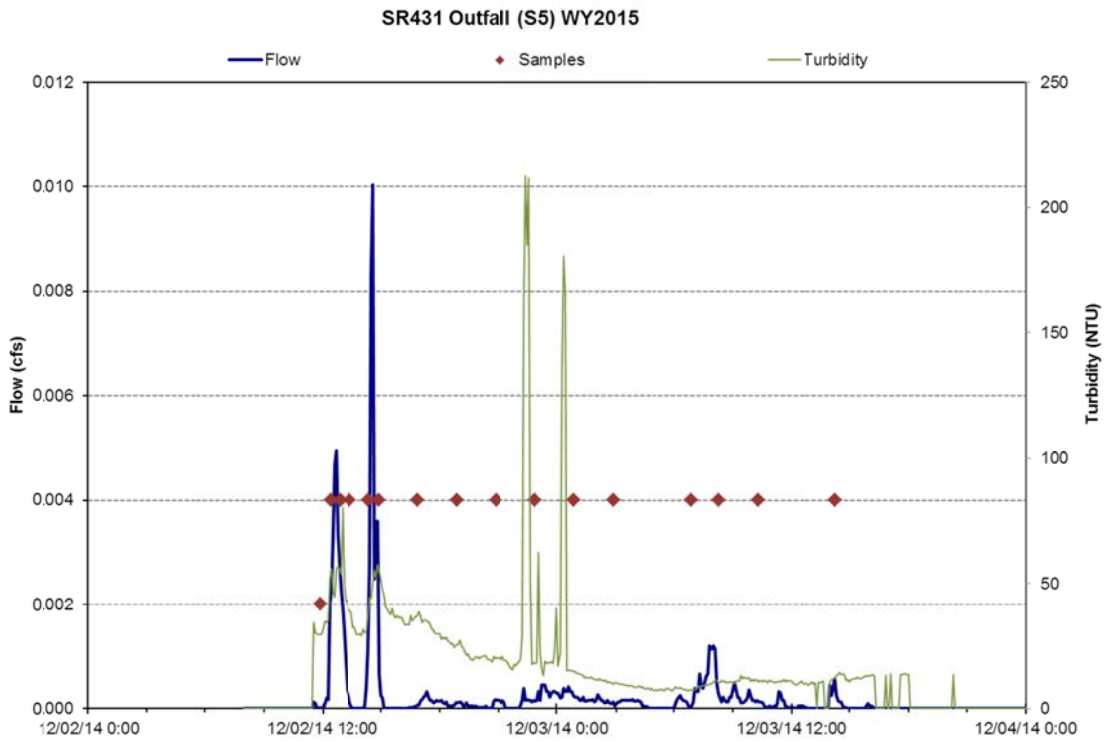

Figure G9: Continuous hydrology, continuous turbidity, and water quality samples for the 12/2/2014 event. Total volume sampled: 32 cf.

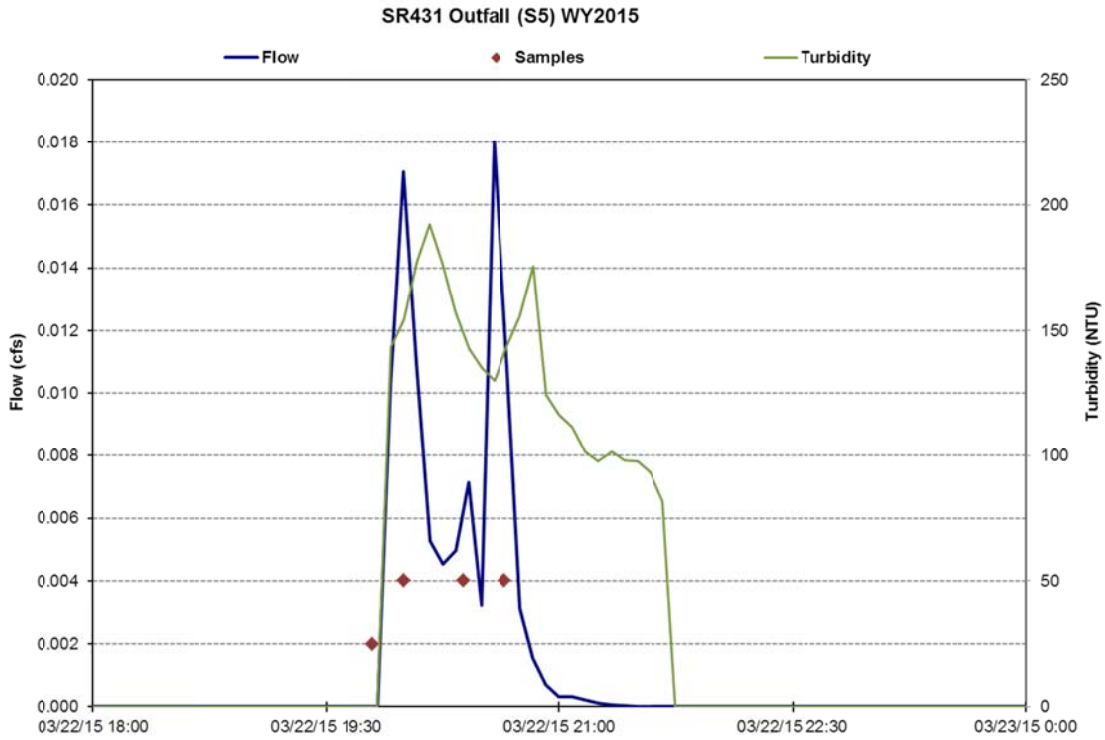

Figure G10: Continuous hydrology, continuous turbidity, and water quality samples for the 3/22/2015 event. Total volume sampled: 30 cf.

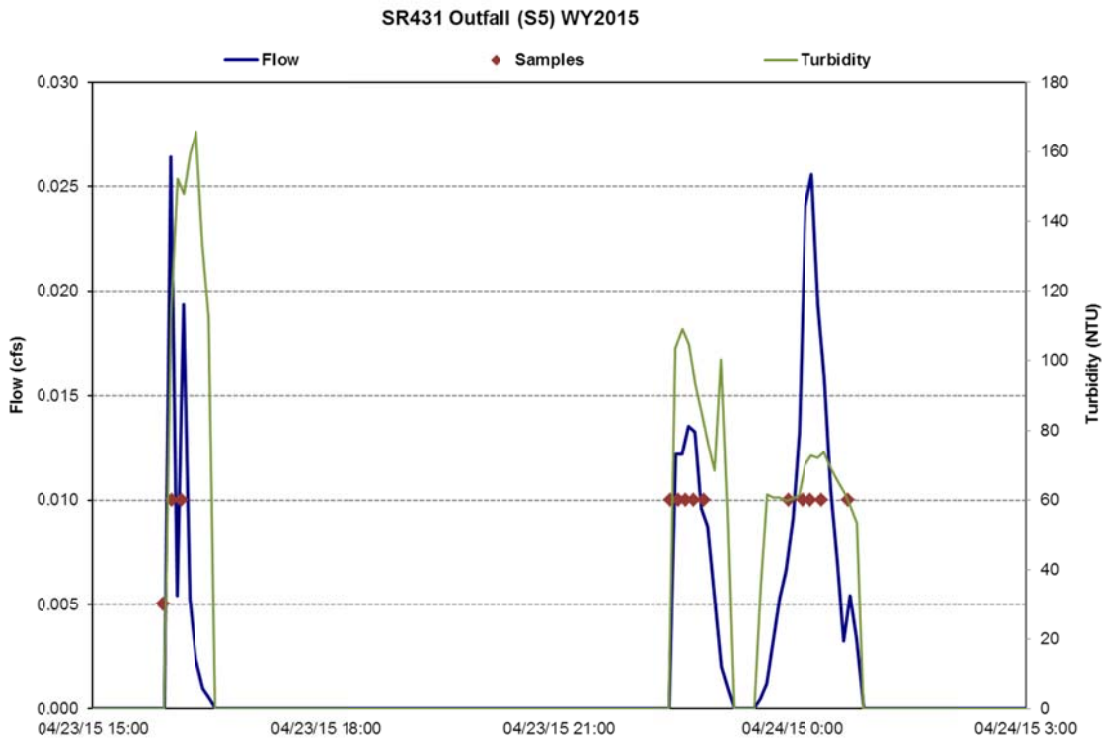

Figure G11: Continuous hydrology, continuous turbidity, and water quality samples for the 4/23/2015 event. Total volume sampled: 88 cf.

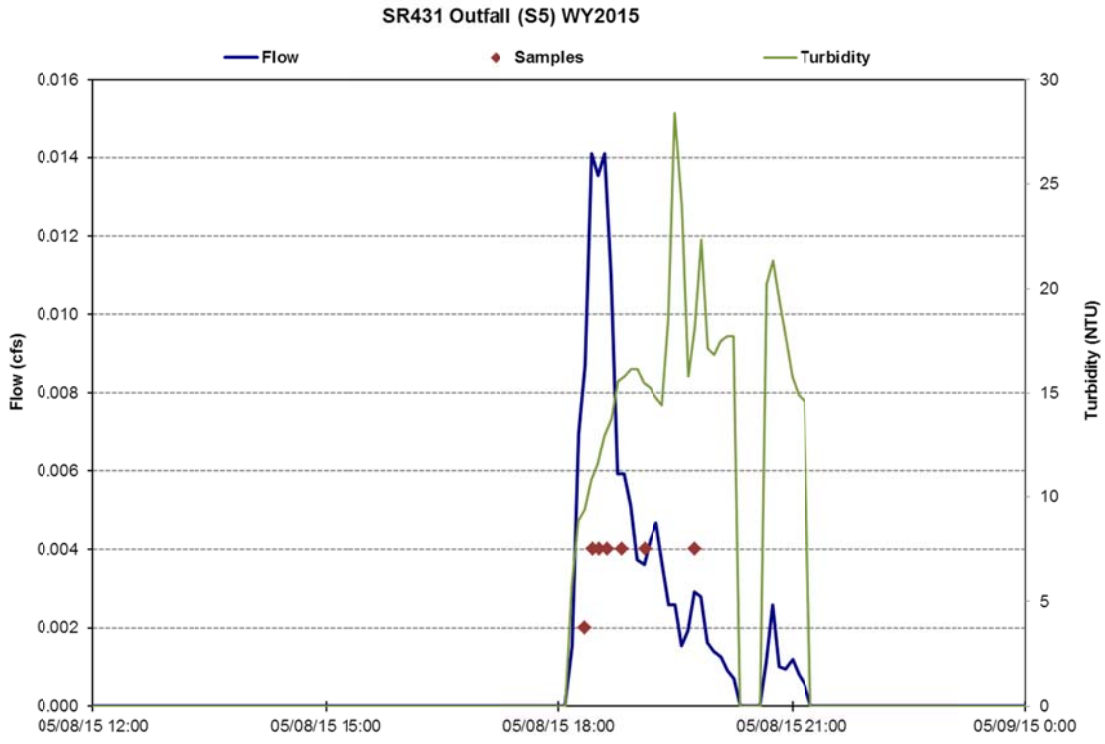

Figure G12: Continuous hydrology, continuous turbidity, and water quality samples for the 5/8/2015 event. Total volume sampled: 40 cf.

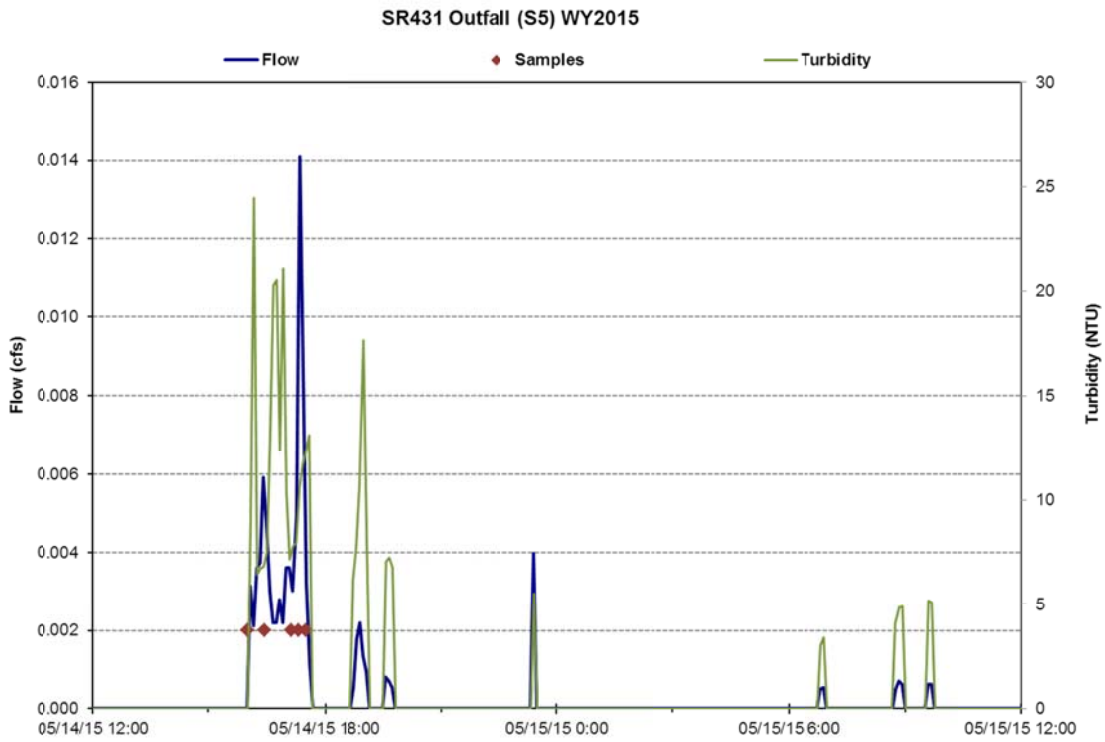

Figure G13: Continuous hydrology, continuous turbidity, and water quality samples for the 5/14/2015 event. Total volume sampled: 28 cf.

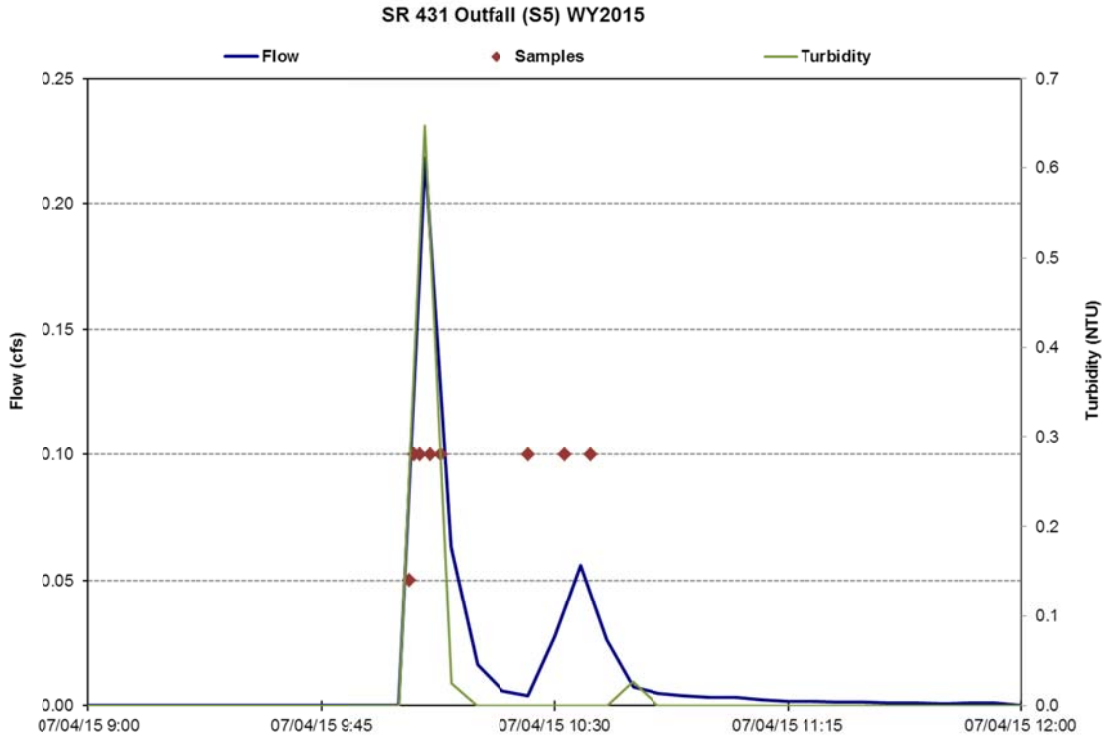

Figure G14: Continuous hydrology, continuous turbidity, and water quality samples for the 7/4/2015 event. Total volume sampled: 136

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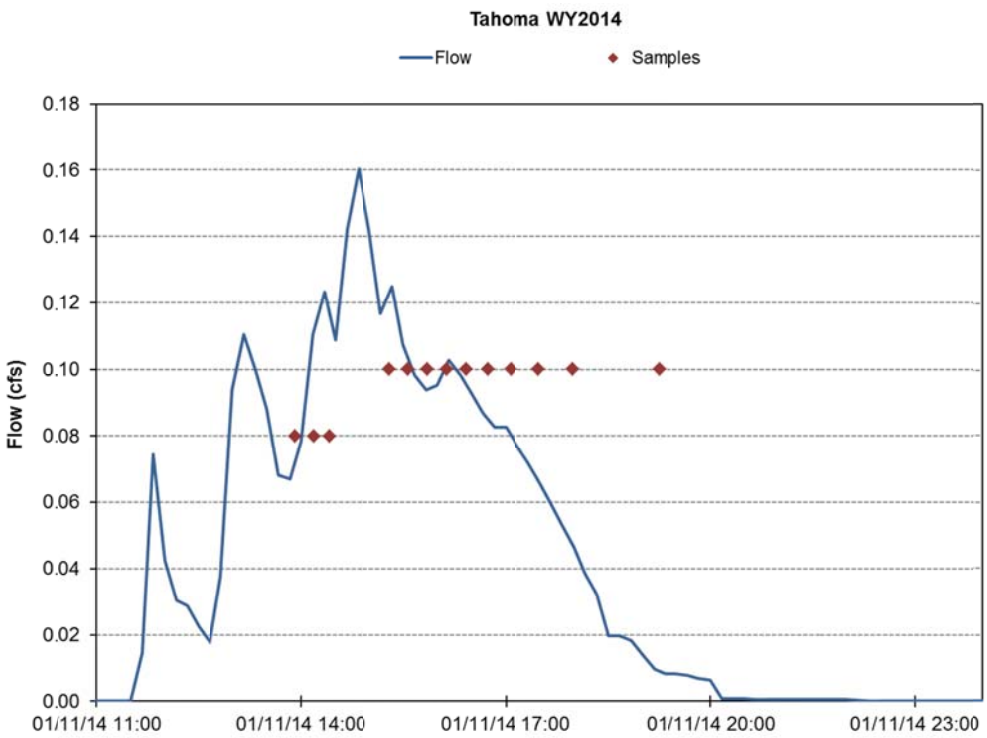

Figure H1: Continuous hydrology and water quality samples for the 1/11/2014 event. Turbidity data not available; sensor malfunctioned. Total volume sampled: 2,048 cf.

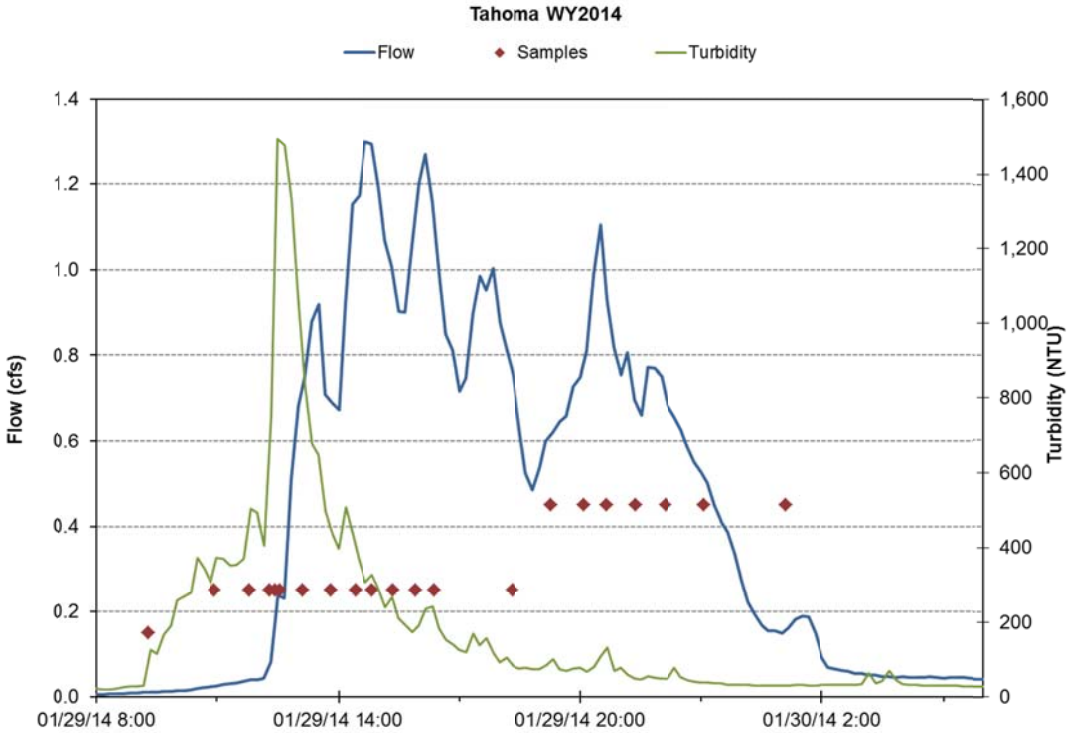

Figure H2: Continuous hydrology, continuous turbidity, and water quality samples for the 1/29/2014 event. Total volume sampled: 34,160 cf.

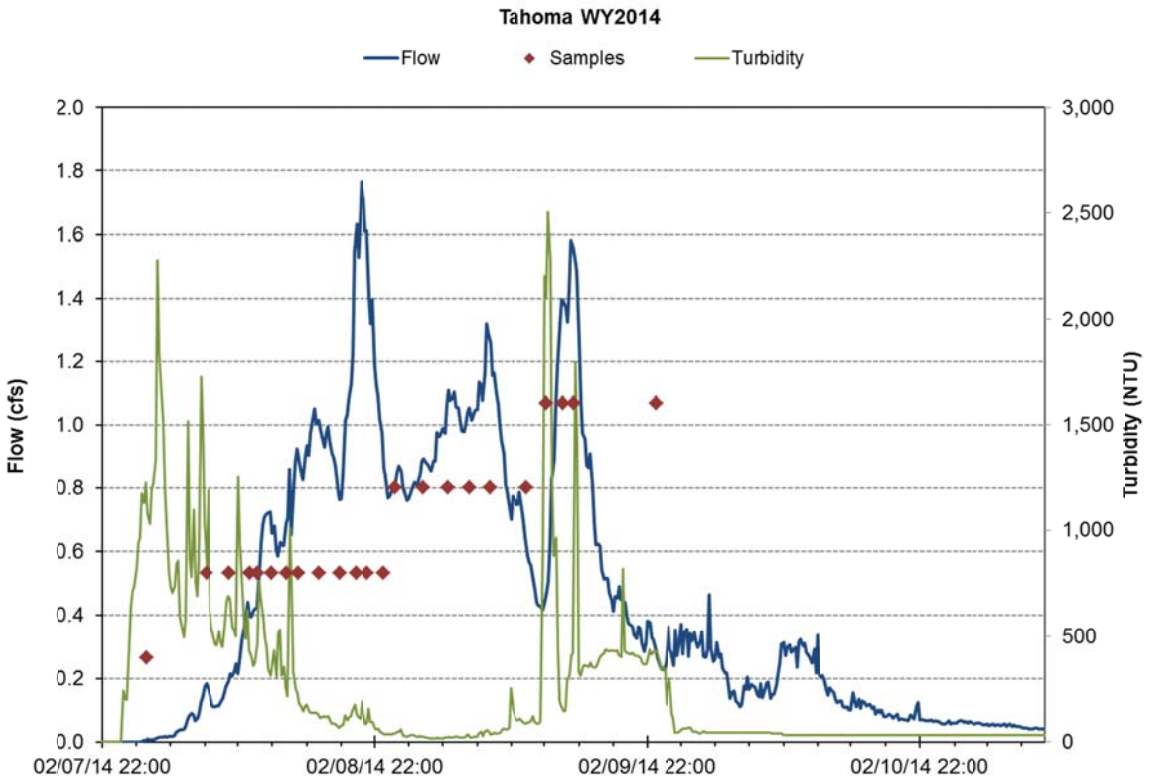

Figure H3: Continuous hydrology, continuous turbidity, and water quality samples for the 2/8/2014 event. Total volume sampled: 120,236 cf.

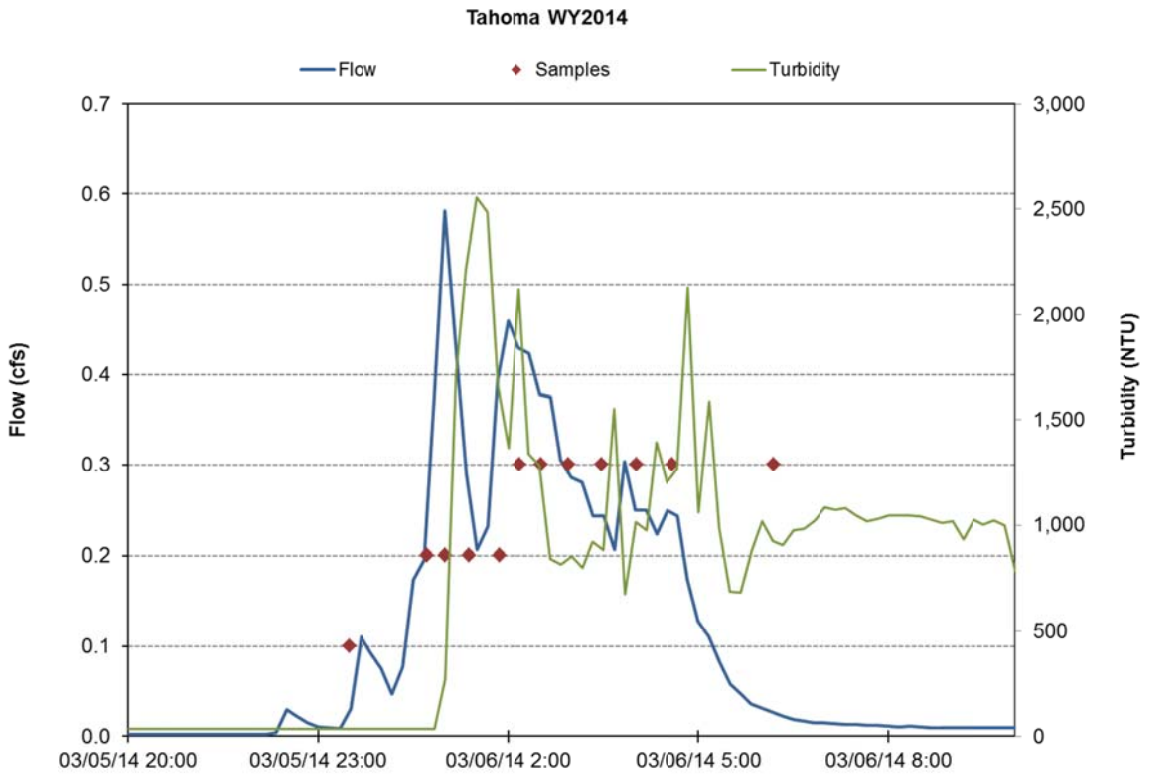

Figure H4: Continuous hydrology, continuous turbidity, and water quality samples for the 3/5/2014 event. Total volume sampled: 5,672 cf.

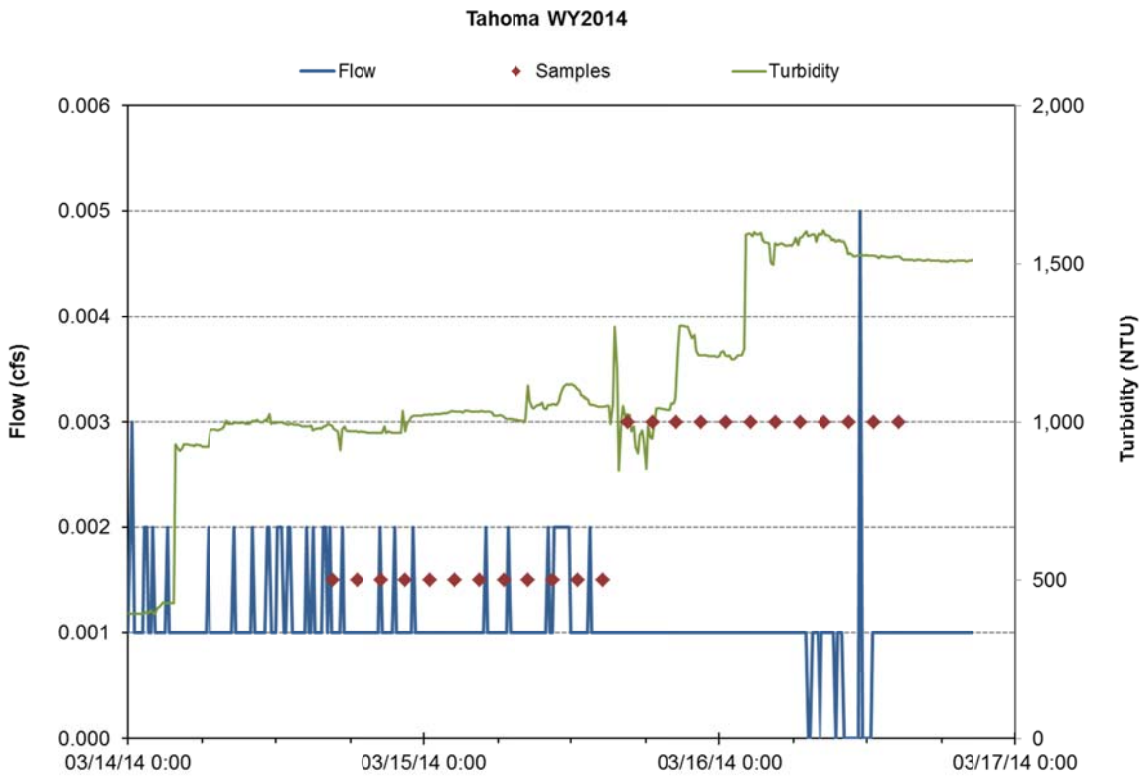

Figure H5: Continuous hydrology, continuous turbidity, and water quality samples for the 3/14/2014 event. Total volume sampled: 175 cf.

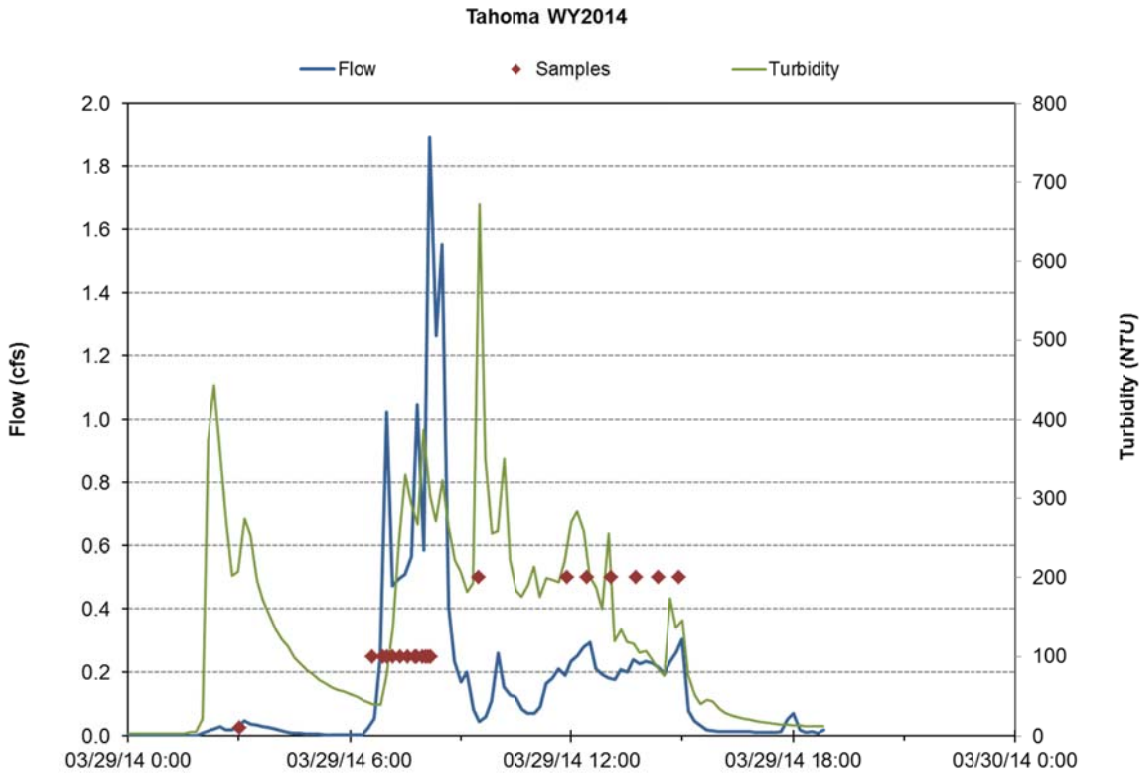

Figure H6: Continuous hydrology, continuous turbidity, and water quality samples for the 3/29/2014 event. Total volume sampled: 10,630 cf.

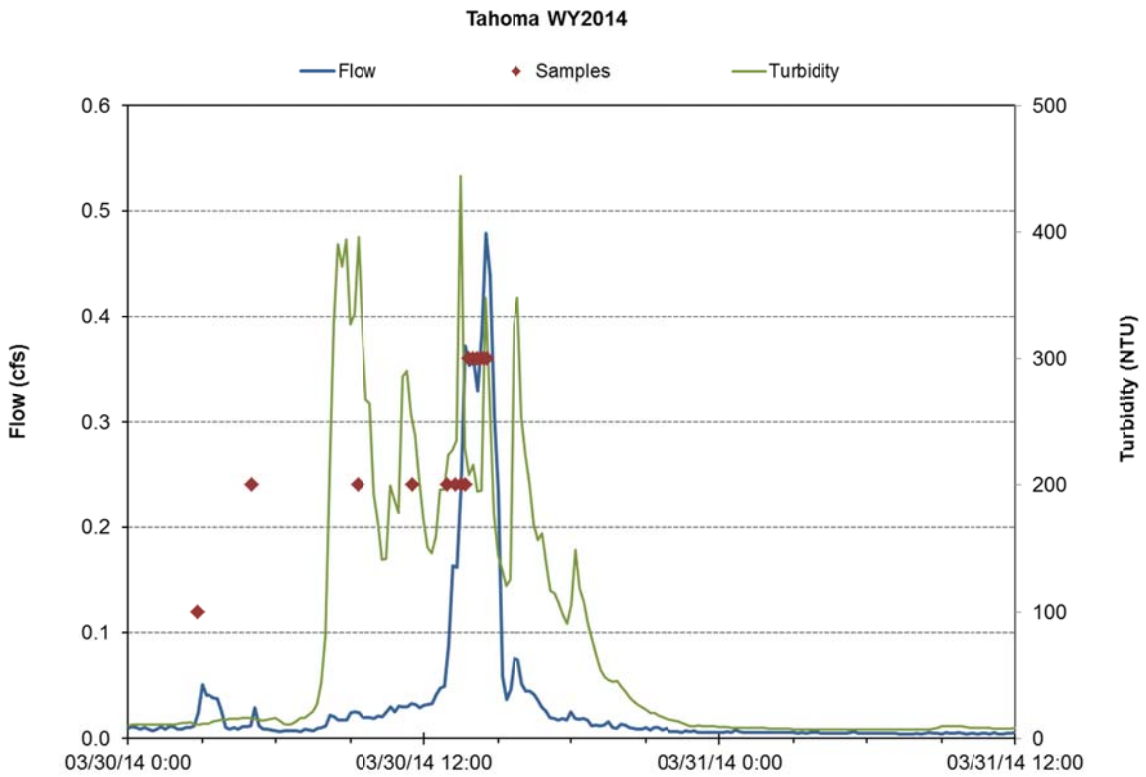

Figure H7: Continuous hydrology, continuous turbidity, and water quality samples for the 3/30/2014 event. Total volume sampled: 3,735 cf.

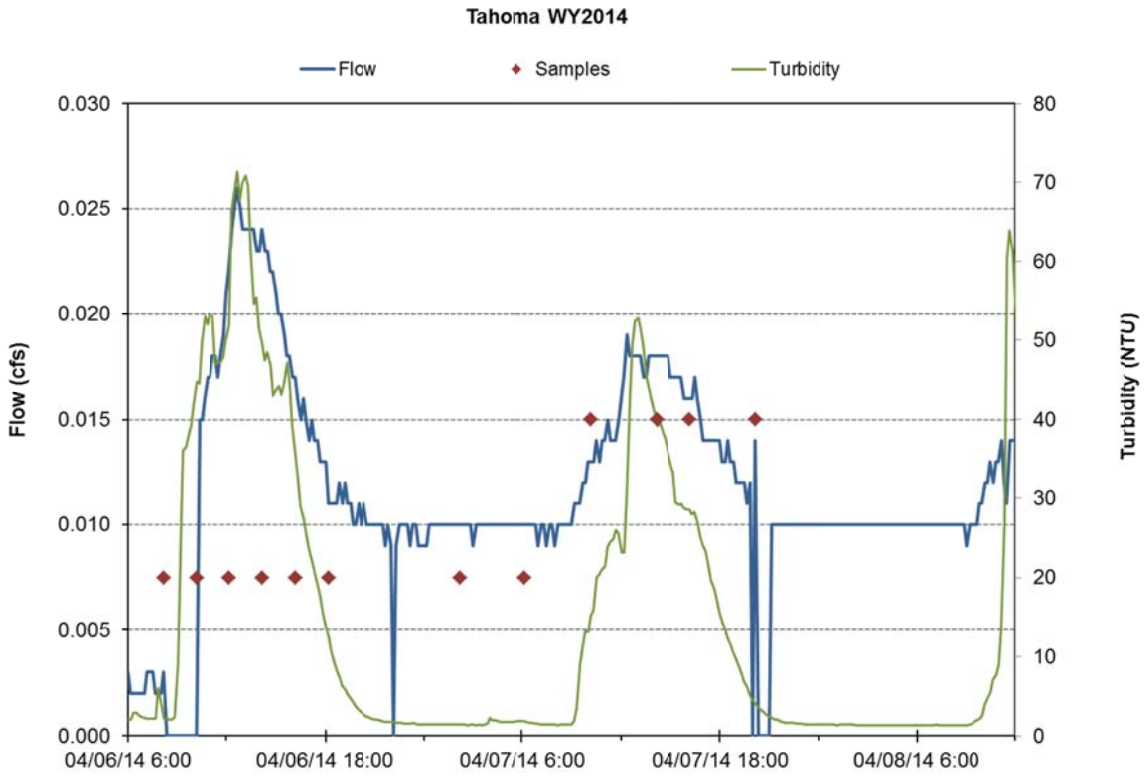

Figure H8: Continuous hydrology, continuous turbidity, and water quality samples for the 4/6/2014 event. Total volume sampled: 2,039 cf.

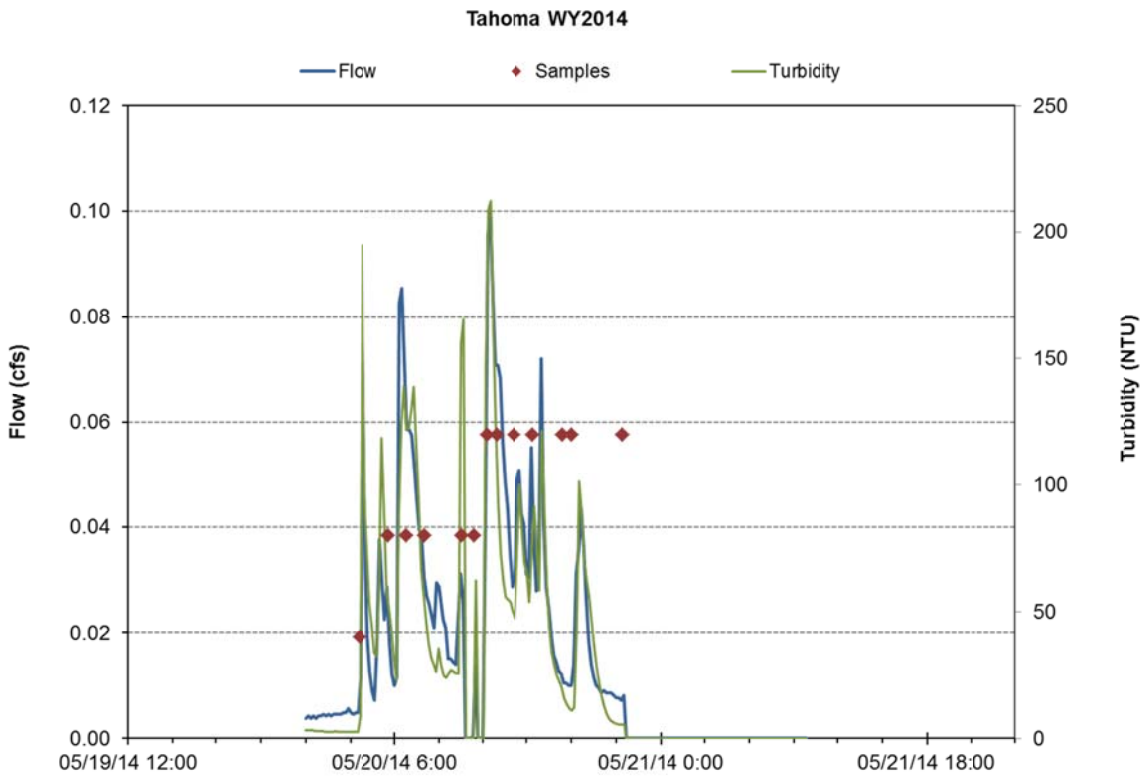

Figure H9: Continuous hydrology, continuous turbidity, and water quality samples for the 5/20/2014 event. Total volume sampled: 1,943 cf.

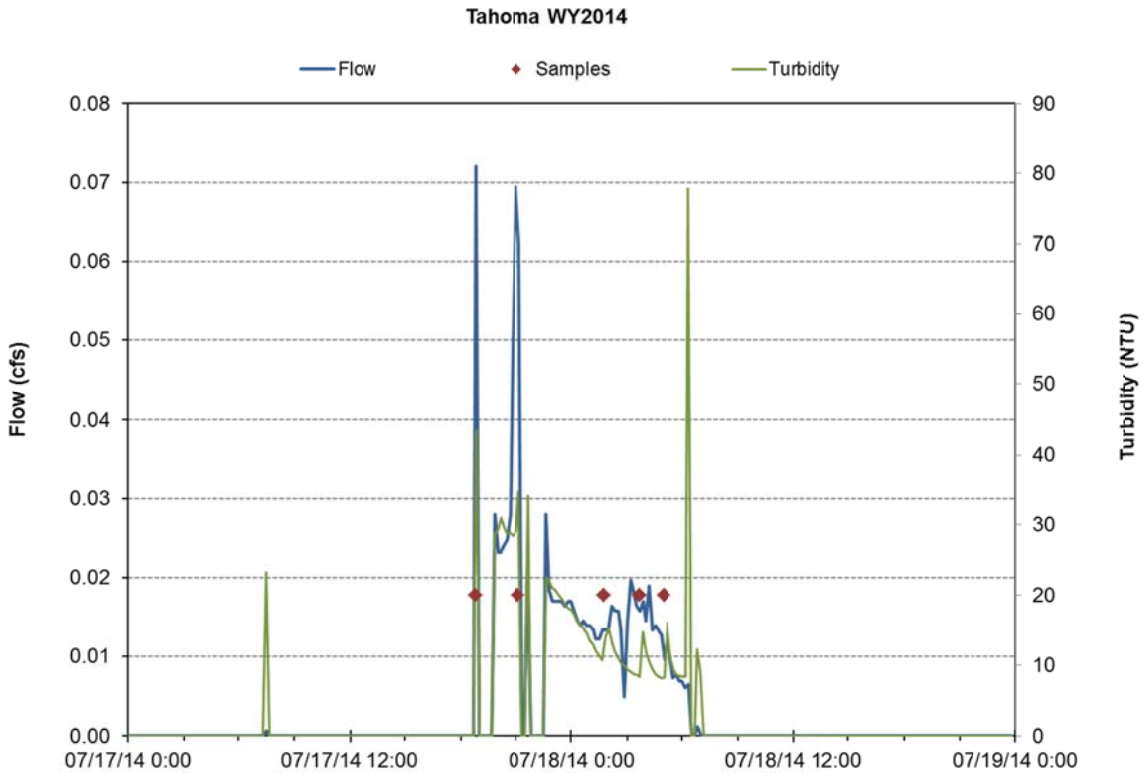

Figure H10: Continuous hydrology, continuous turbidity, and water quality samples for the 7/17/2014 event. Total volume sampled: 645 cf.

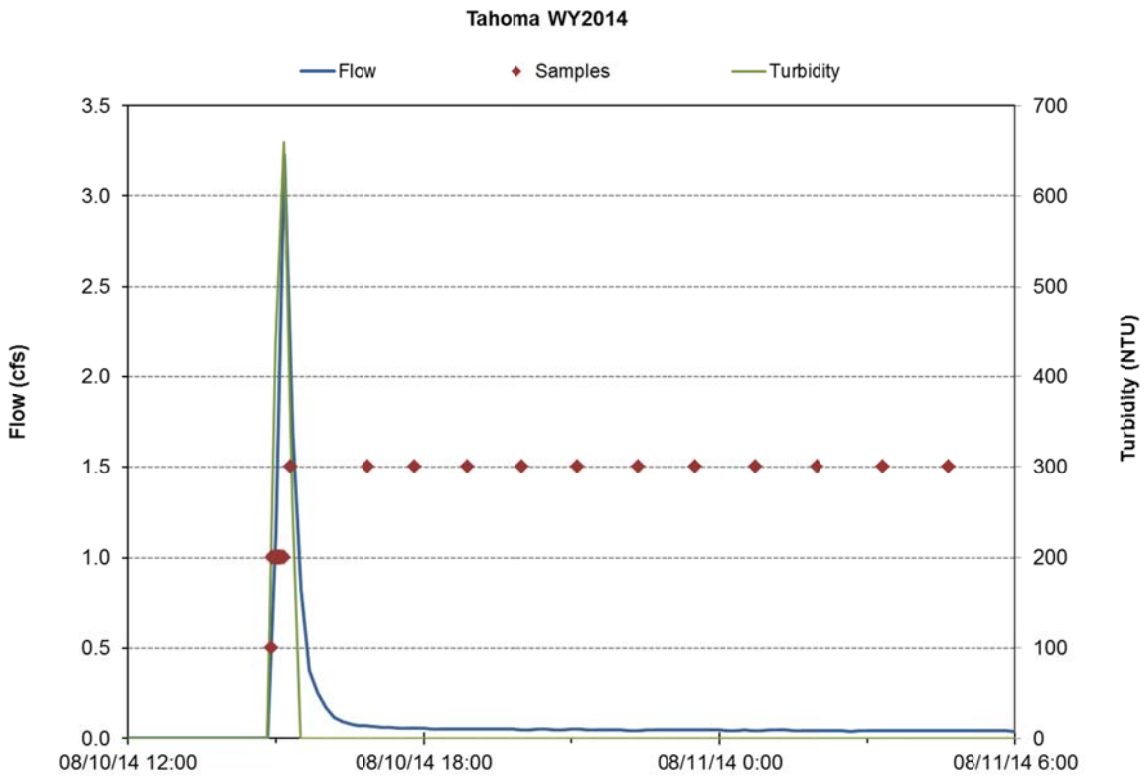

Figure H11: Continuous hydrology, continuous turbidity, and water quality samples for the 8/10/2014 event. Total volume sampled: 7,086 cf.

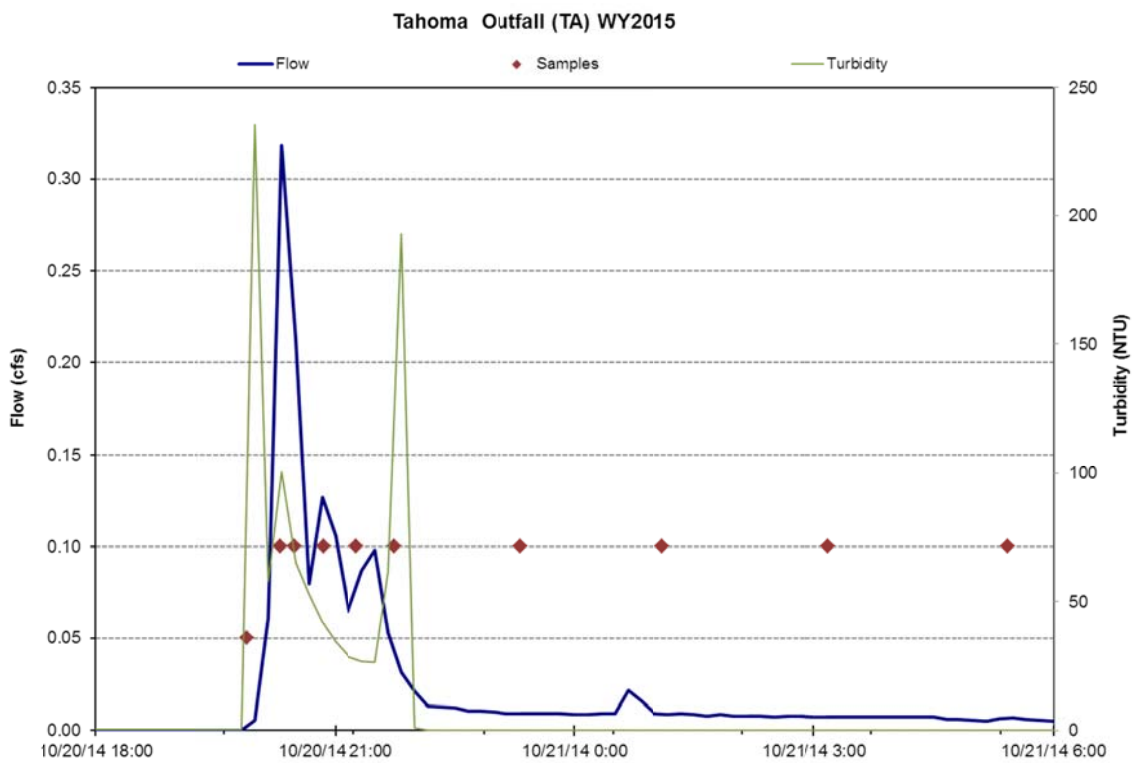

Figure H12: Continuous hydrology, continuous turbidity, and water quality samples for the 10/20/2014 event. Total volume sampled: 1,005 cf.

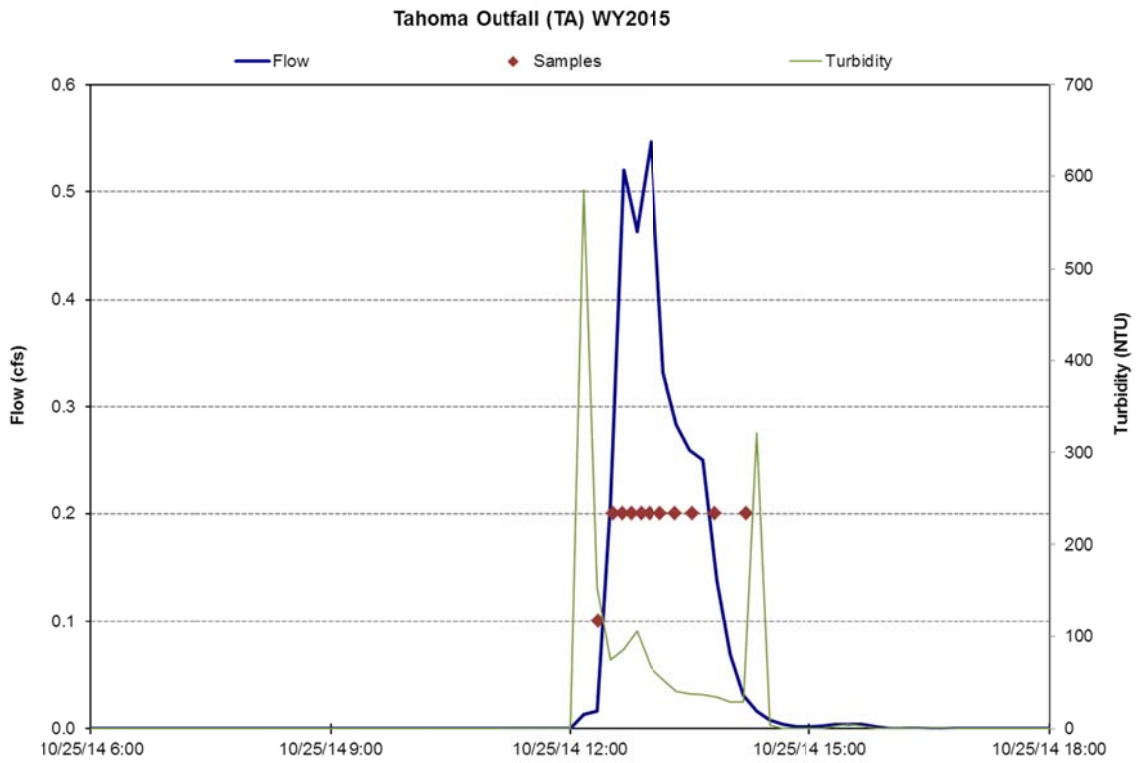

Figure H13: Continuous hydrology continuous turbidity, and water quality samples for the 10/25/2014 event. Total volume sampled: 1,910 cf.

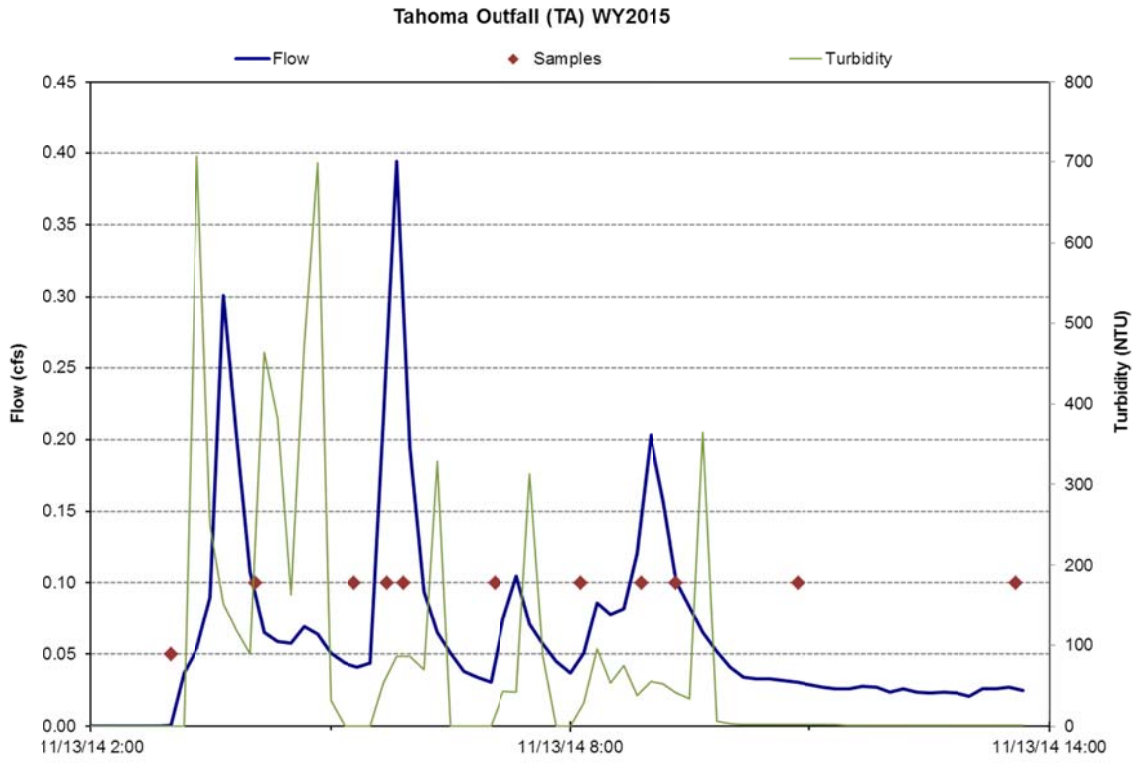

Figure H14: Continuous hydrology, continuous turbidity, and water quality samples for the 11/13/2014 event. Total volume sampled: 2,705 cf.

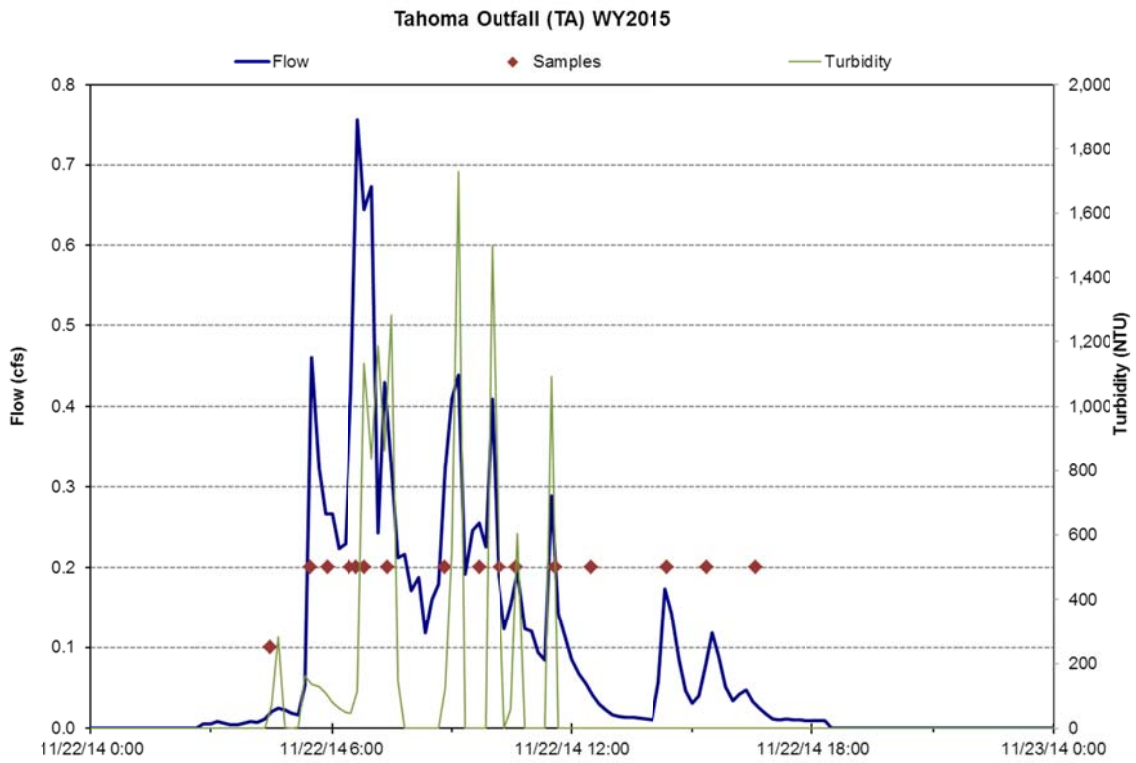

Figure H15: Continuous hydrology, continuous turbidity, and water quality samples for the 11/22/2014 event. Total volume sampled: 7,464 cf.

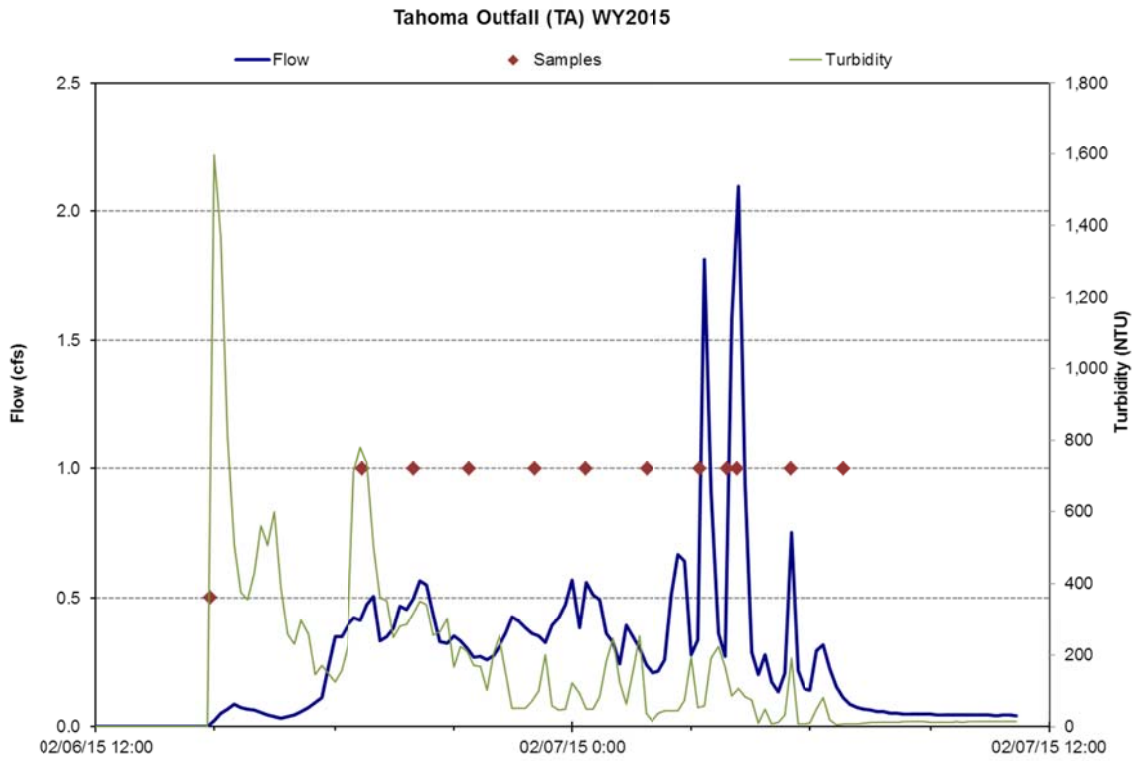

Figure H16: Continuous hydrology, continuous turbidity, and water quality samples for the 2/6/2015 event. Total volume sampled: 21,615 cf.

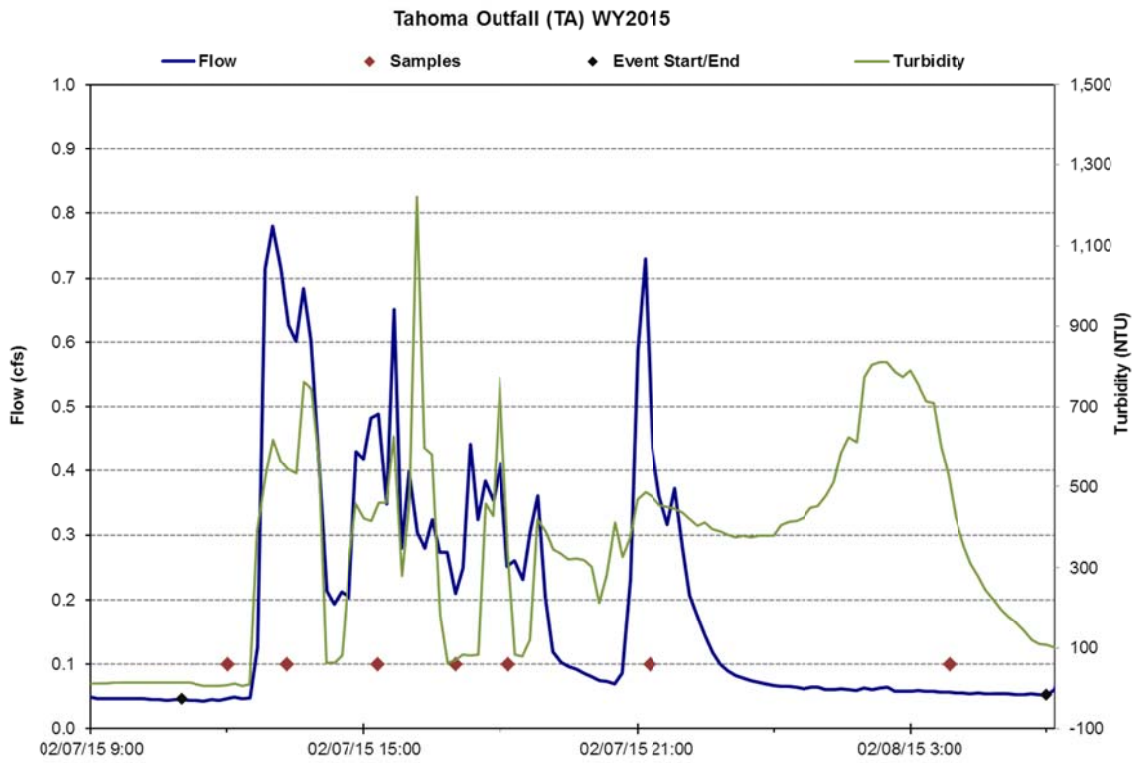

Figure H17: Continuous hydrology, continuous turbidity, and water quality samples for the 2/7/2015 event. Total volume sampled: 13,808 cf.

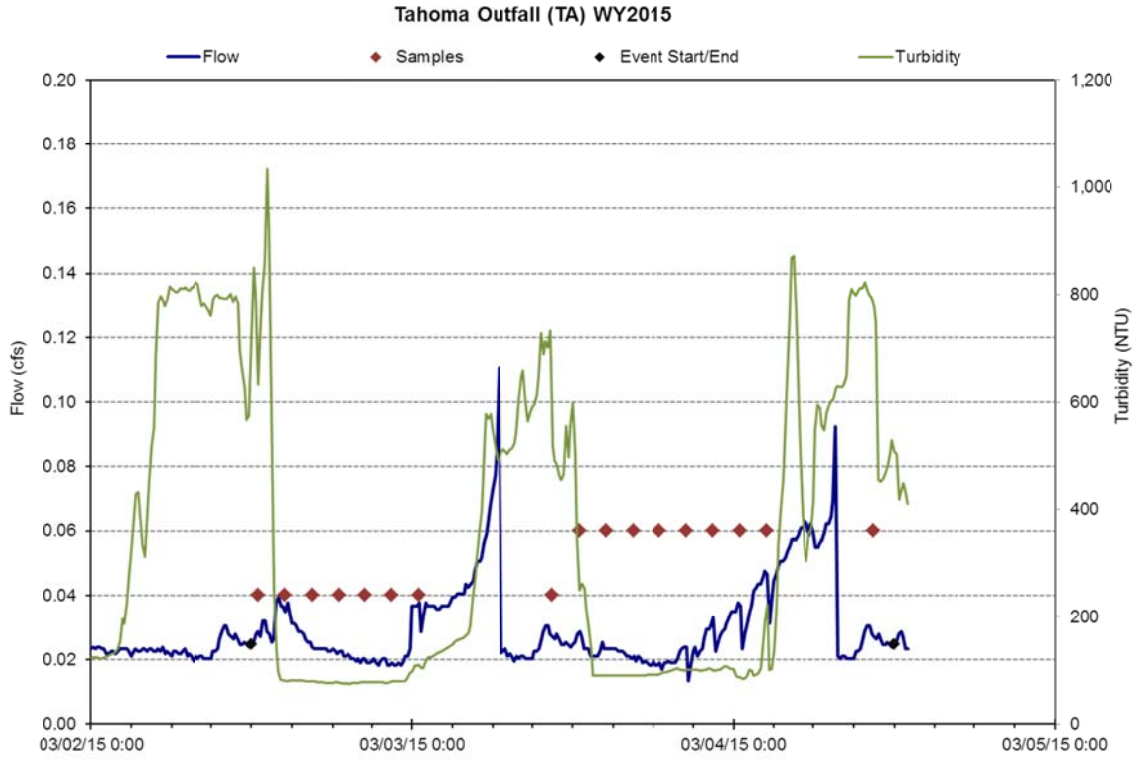

Figure H18: Continuous hydrology, continuous turbidity, and water quality samples for the 3/2/2015 event. Total volume sampled: 5,404 cf.

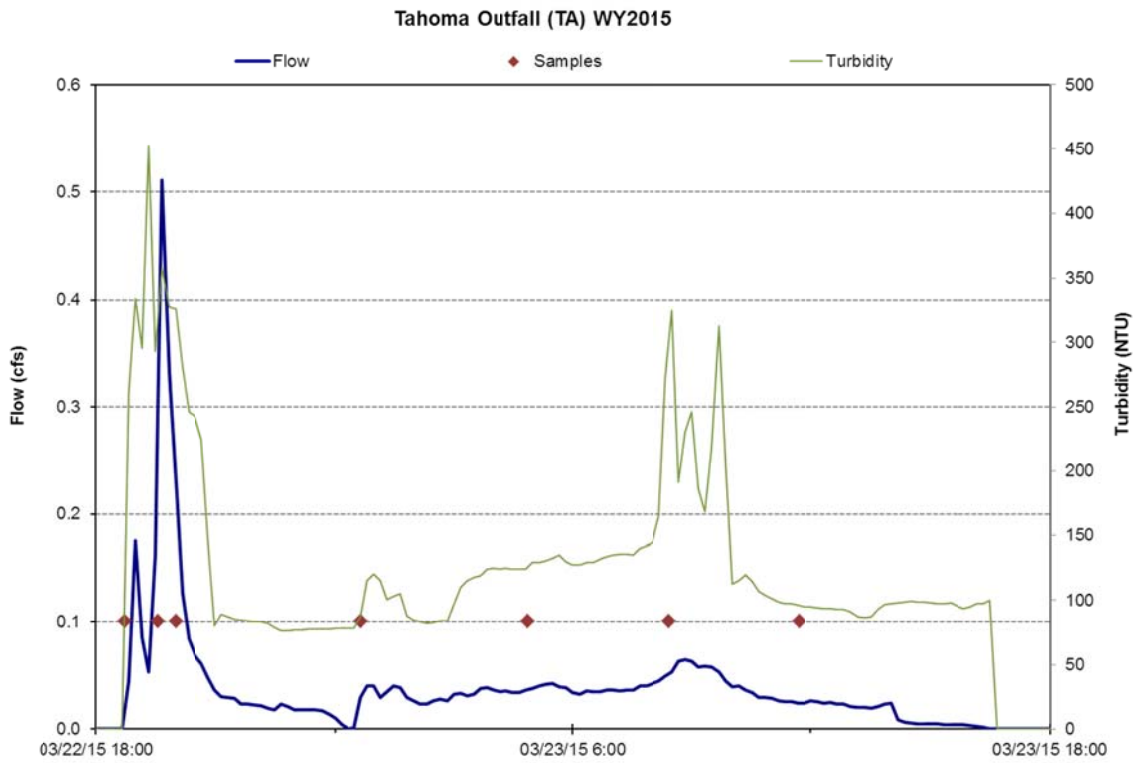

Figure H19: Continuous hydrology, continuous turbidity, and water quality samples for the 3/22/2015 event. Total volume sampled: 3,183 cf.

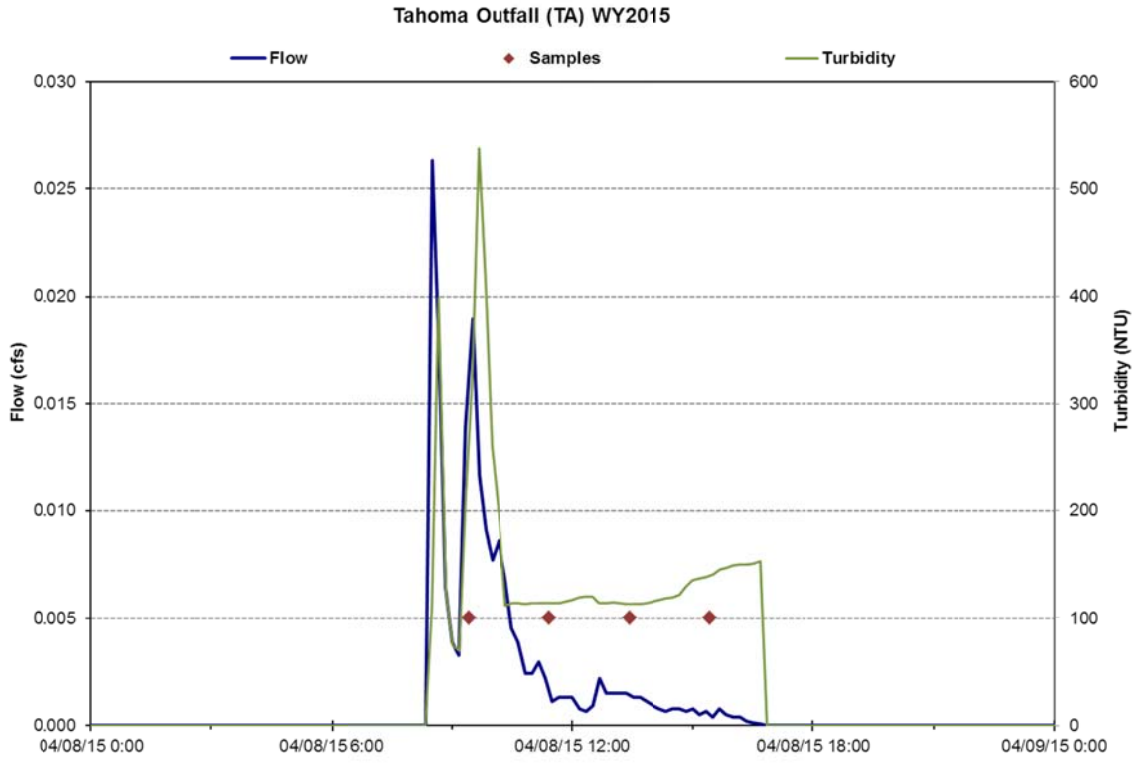

Figure H20: Continuous hydrology, continuous turbidity, and water quality samples for the 4/8/2015 event. Total volume sampled: 109 cf.

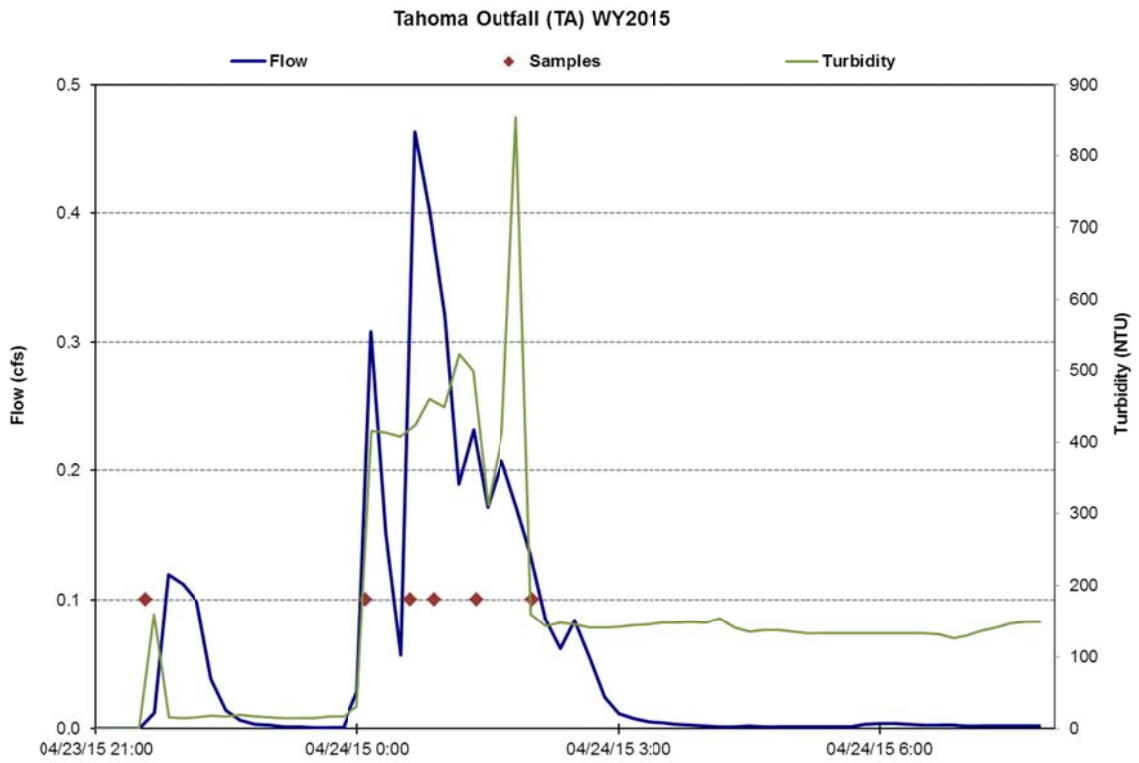

Figure H21: Continuous hydrology, continuous turbidity, and water quality samples for the 4/23/2015 event. Total volume sampled: 2,168 cf.

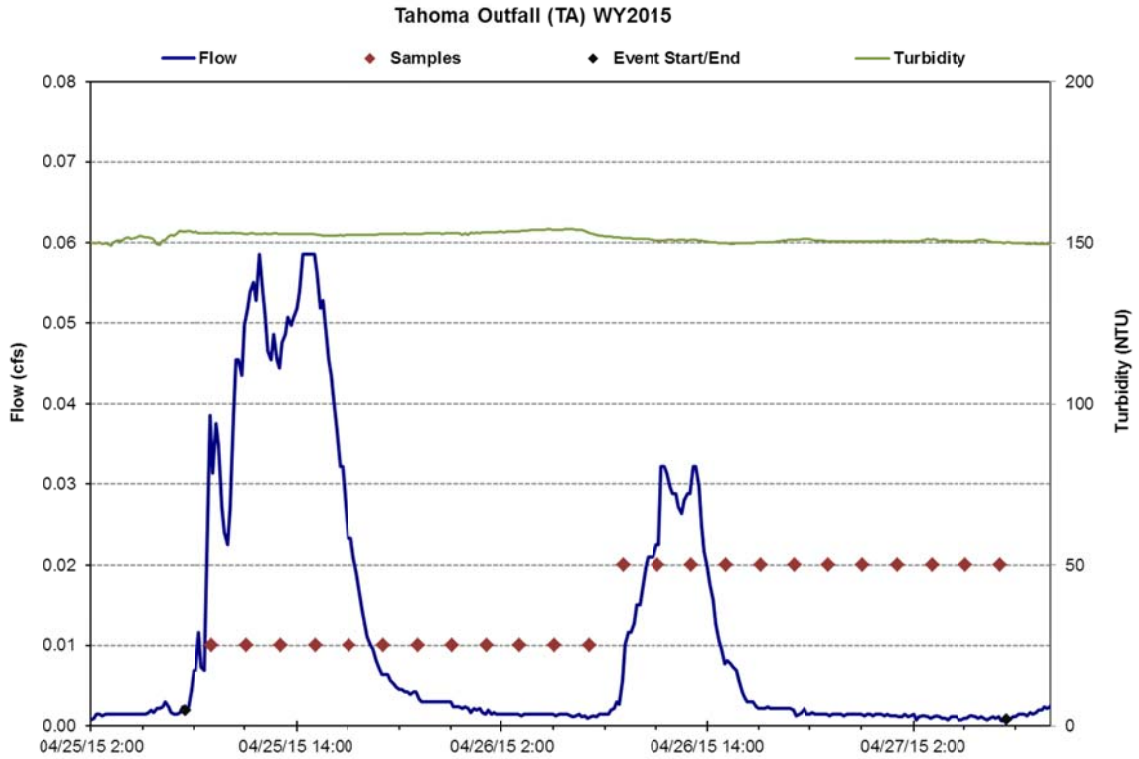

Figure H22: Continuous hydrology, continuous turbidity, and water quality samples for the 4/25/2015 event. Debris covering turbidity sensor likely causing steady reading. Total volume sampled: 2,155 cf.

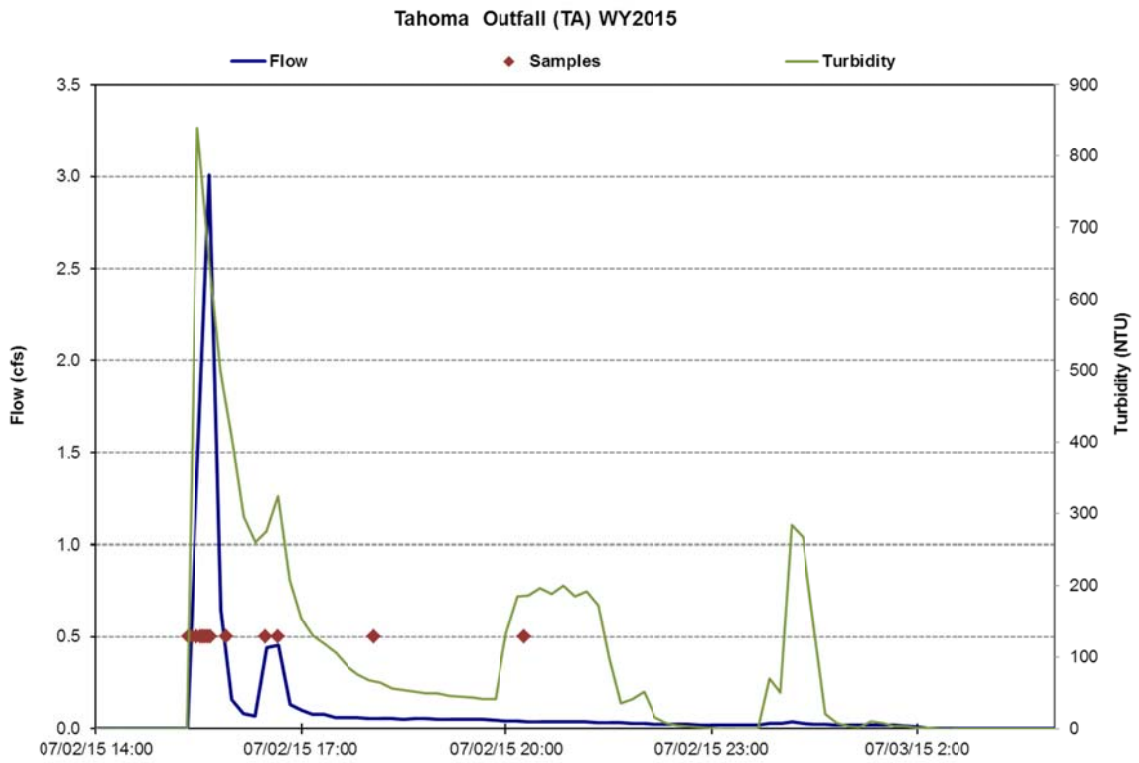

Figure H23: Continuous hydrology, continuous turbidity, and water quality samples for the 7/2/2015 event. Total volume sampled: 5,130 cf.

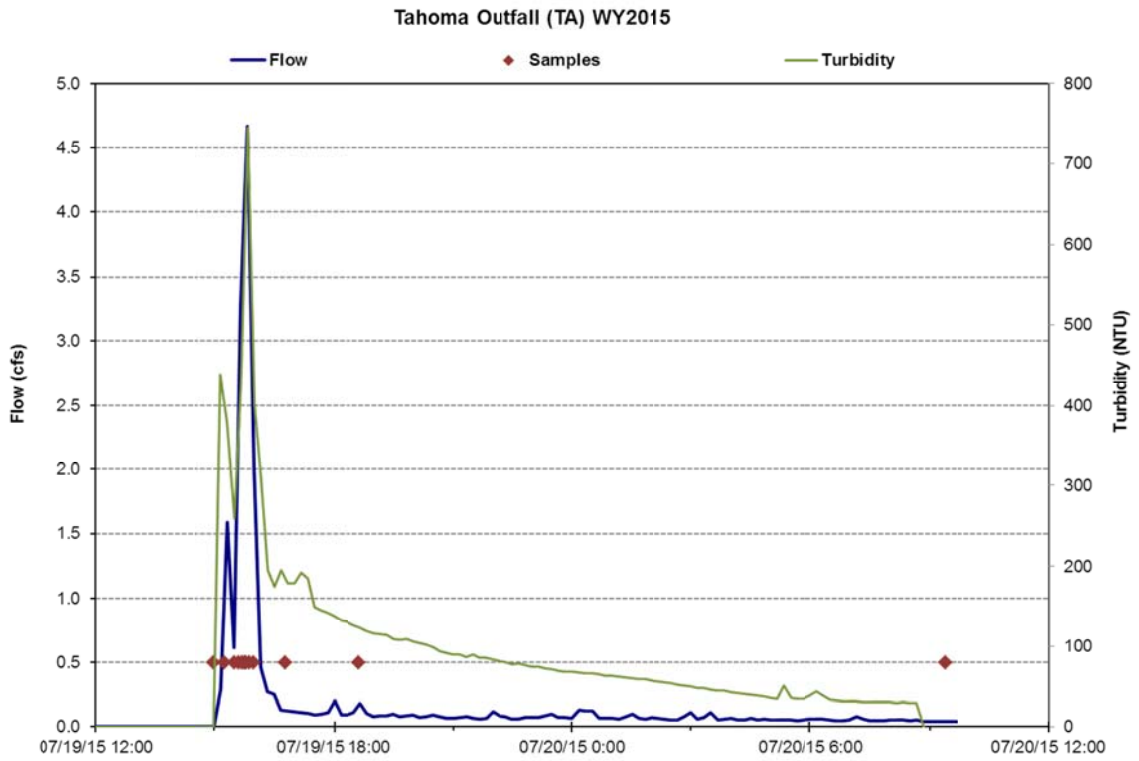

Figure H24: Continuous hydrology, continuous turbidity, and water quality samples for the 7/19/2015 event. Total volume sampled: 12,699 cf.

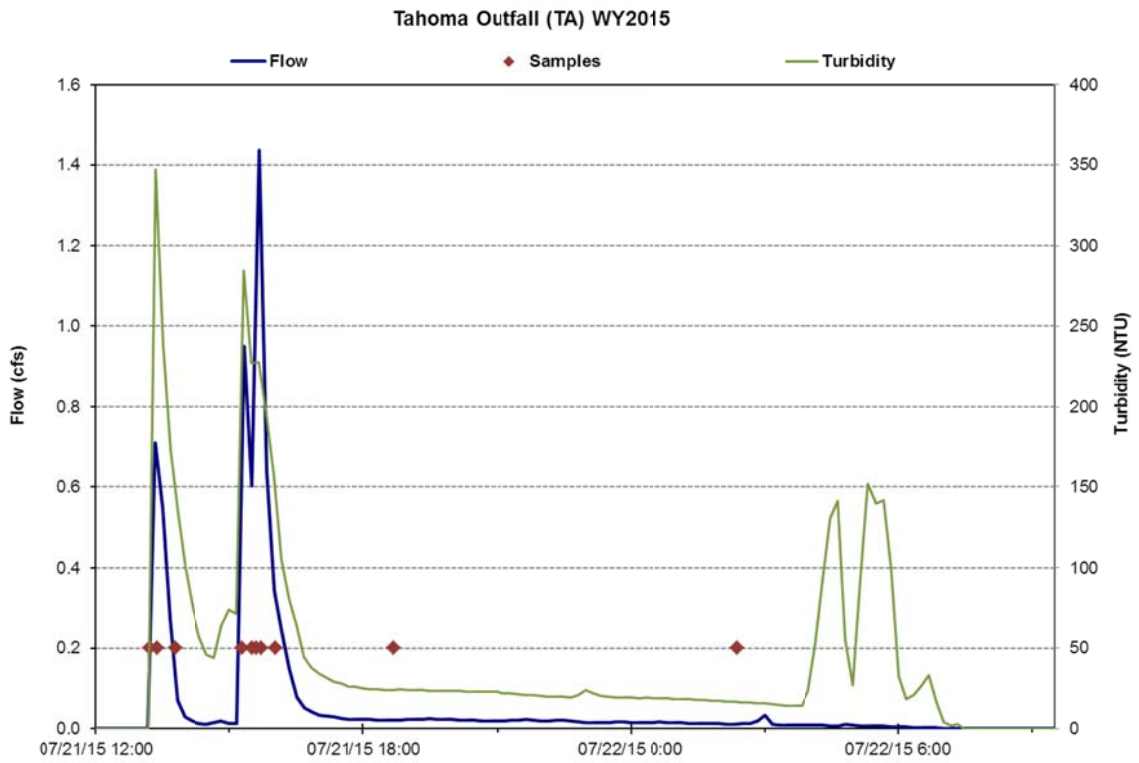

Figure H25: Continuous hydrology, continuous turbidity, and water quality samples for the 7/21/2015 event. Total volume sampled: 4,570 cf.

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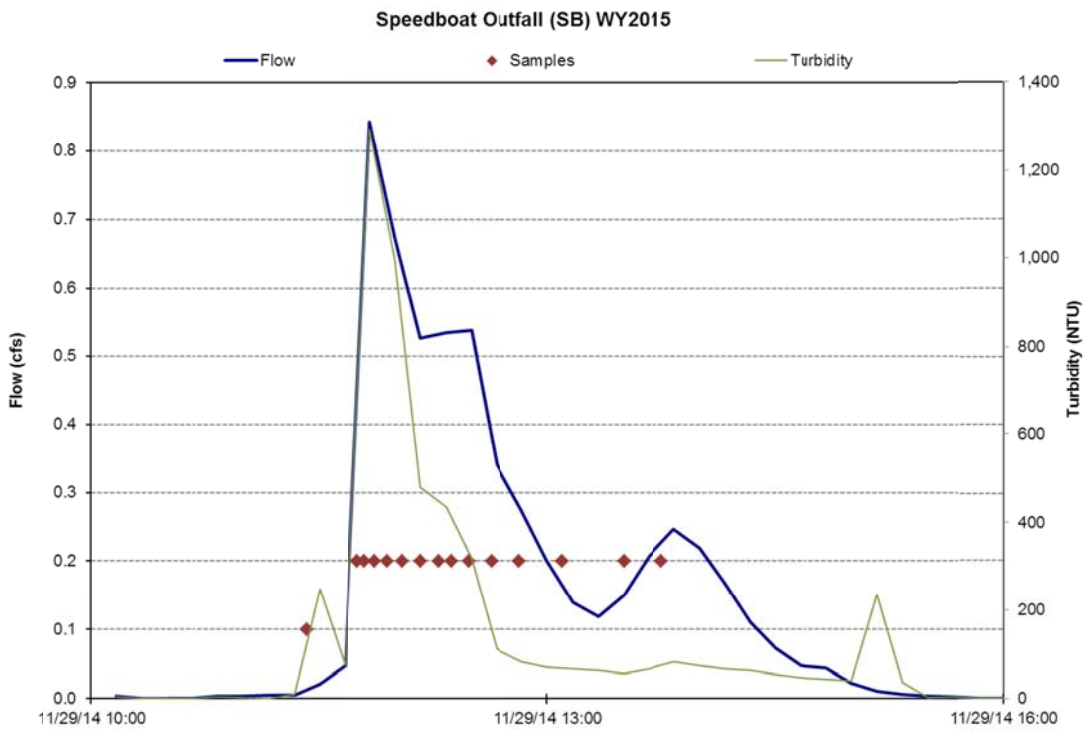


Figure I1: Continuous hydrology, continuous turbidity, and water quality samples for the 11/29/2014 event. Total volume sampled: 3,351 cf.

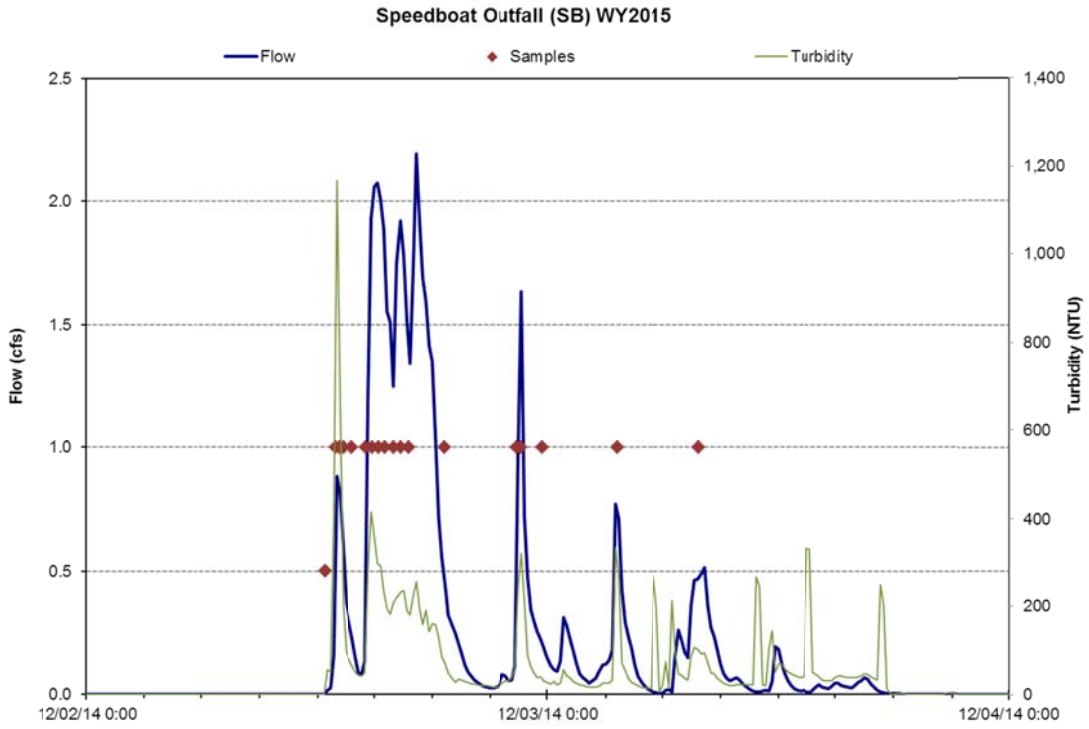


Figure I2: Continuous hydrology, continuous turbidity, and water quality samples for the 12/2/2014 event. Total volume sampled: 37,174 cf.

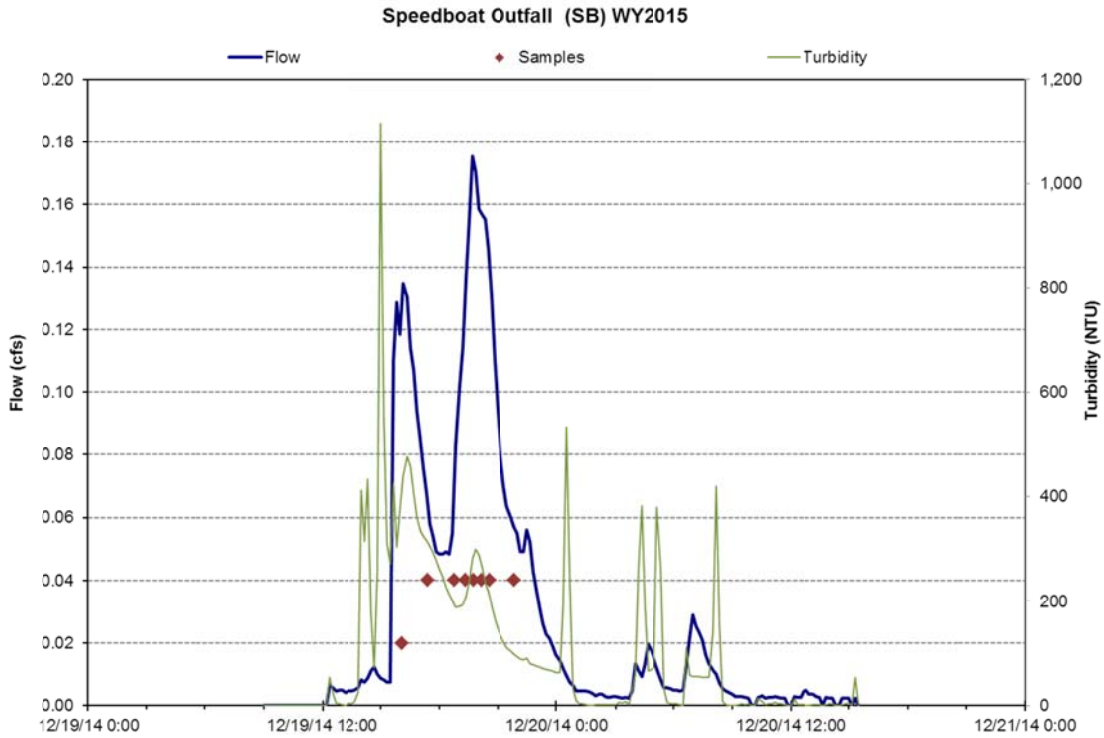


Figure I3: Continuous hydrology, continuous turbidity, and water quality samples for the 12/19/2014 event. Total volume sampled: 2,987 cf.

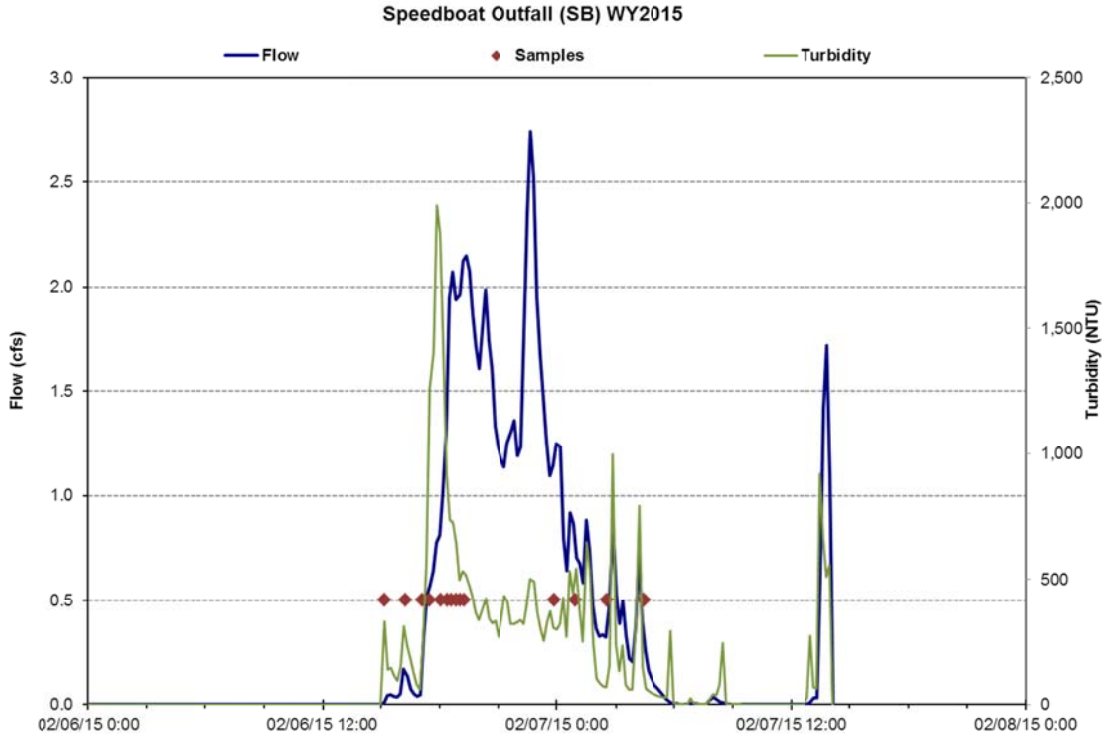


Figure I4: Continuous hydrology, continuous turbidity, and water quality samples for the 2/6/2015 event. Bottles ran out at peak of flow. Total volume sampled: 47,735 cf.

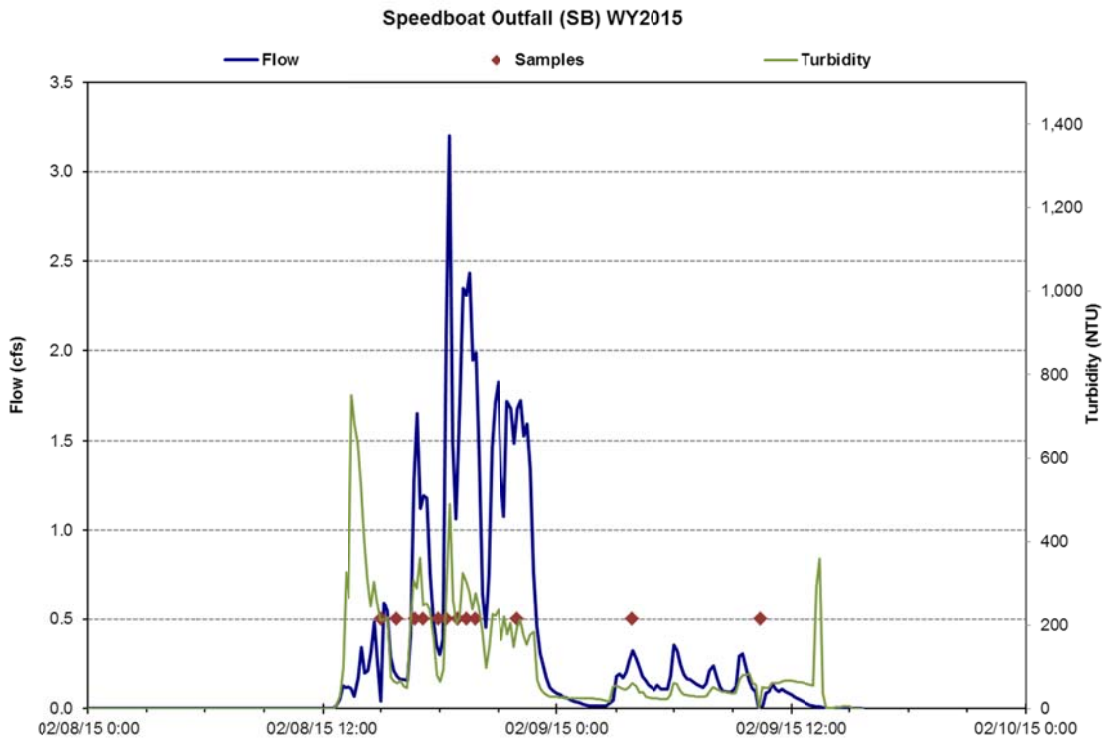


Figure I5: Continuous hydrology, continuous turbidity, and water quality samples for the 2/8/2015 event. Total volume sampled: 41,394 cf.

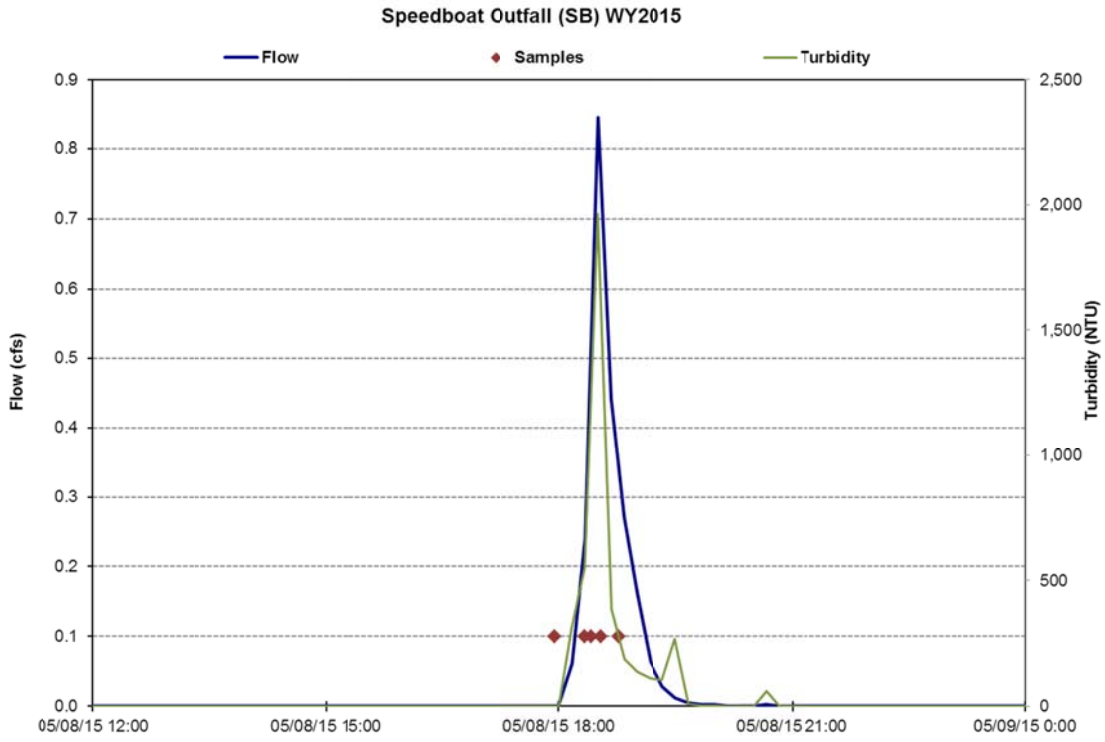


Figure I6: Continuous hydrology, continuous turbidity, and water quality samples for the 5/8/2015 event. Total volume sampled: 1,284 cf.

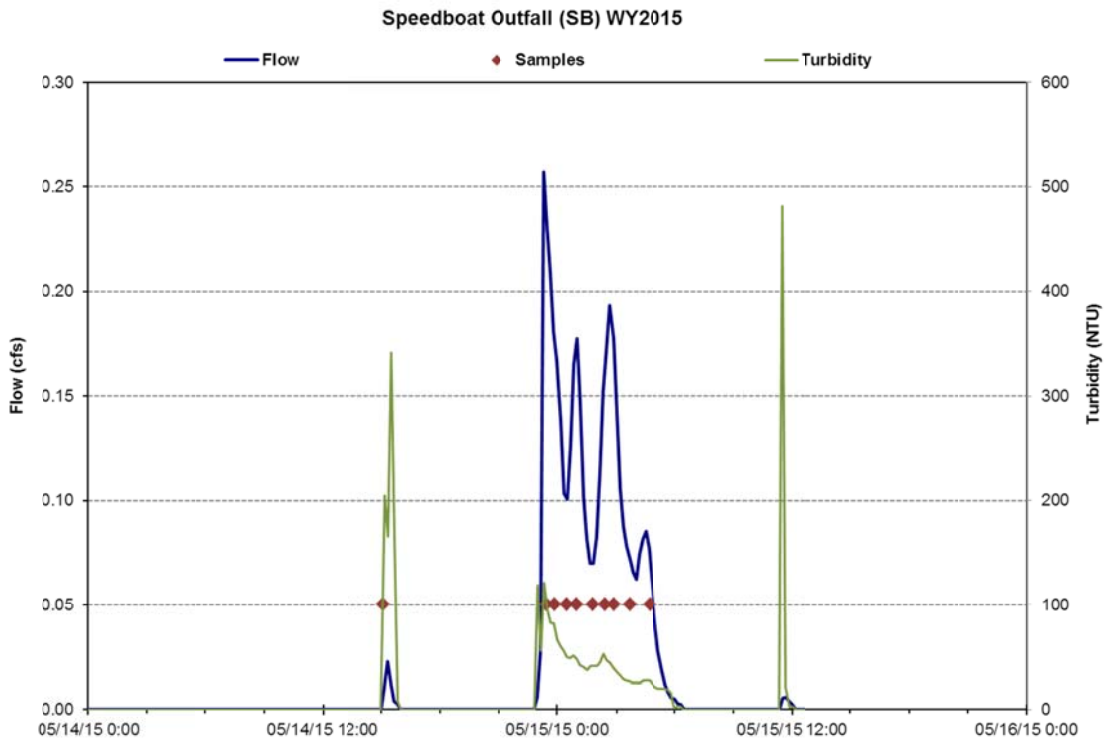


Figure I7: Continuous hydrology, continuous turbidity, and water quality samples for the 5/14/2015 event. Total volume sampled: 2,660 cf.

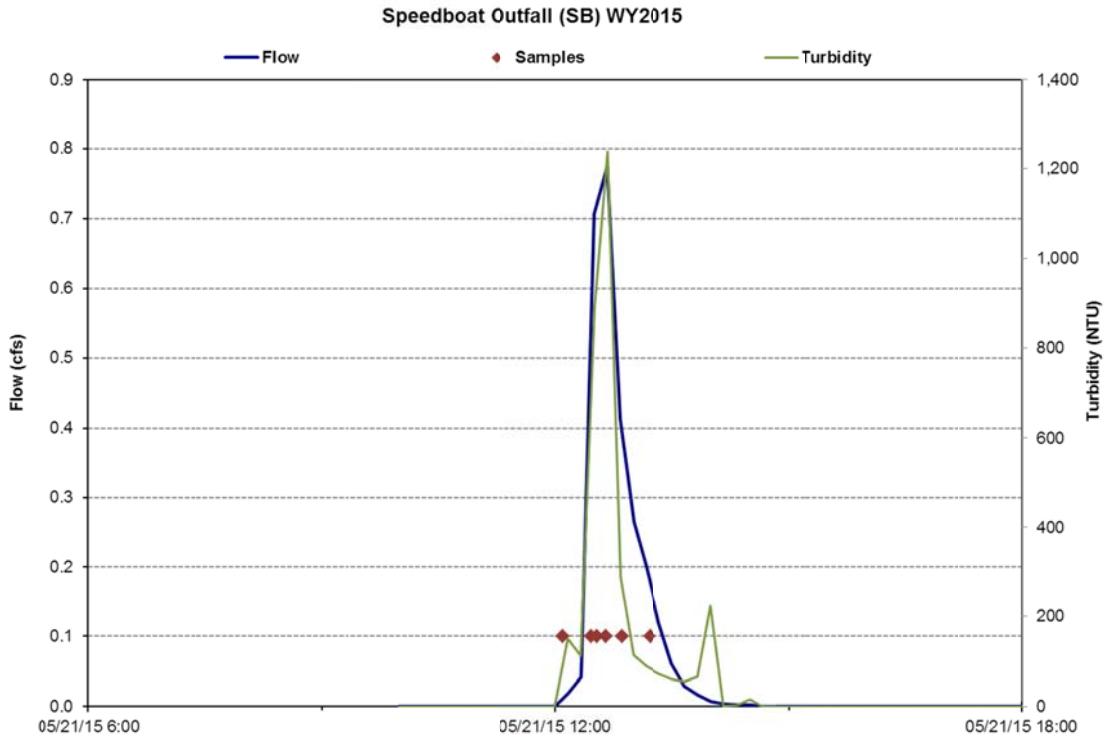


Figure I8: Continuous hydrology, continuous turbidity, and water quality samples for the 5/21/2015 event. Total volume sampled: 1,599 cf.

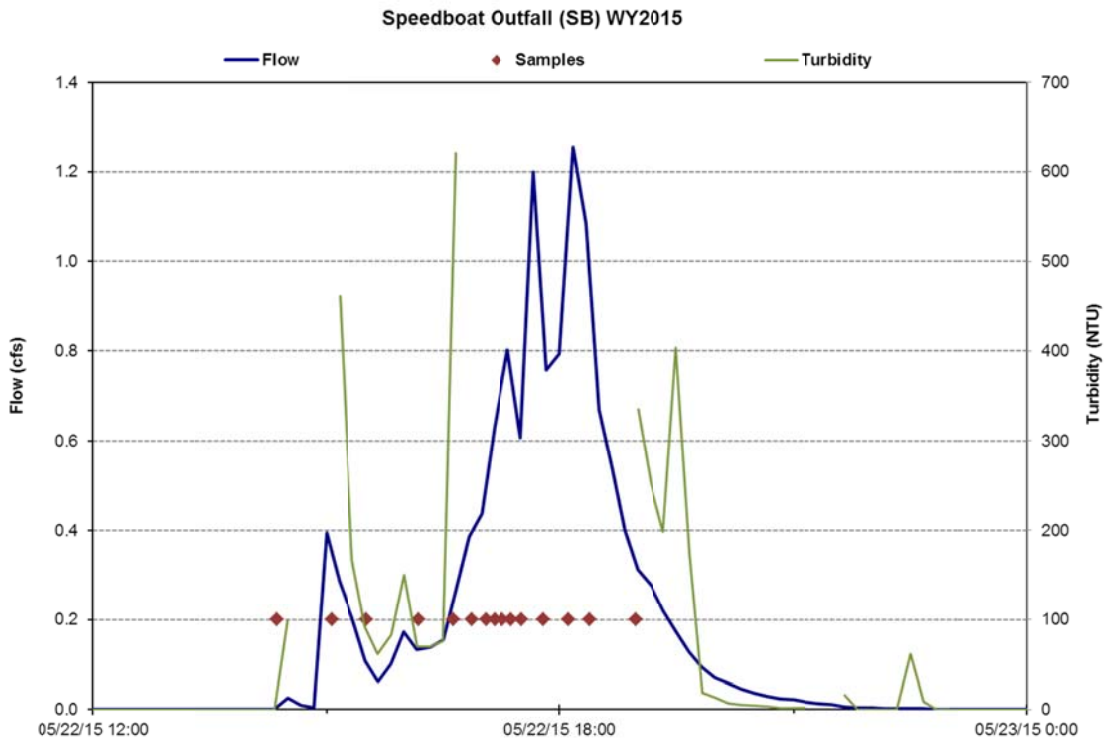


Figure I9: Continuous hydrology, continuous turbidity, and water quality samples for the 5/22/2015 event. Debris on turbidity sensor caused erroneous readings that were removed. Total volume sampled: 7,905 cf.

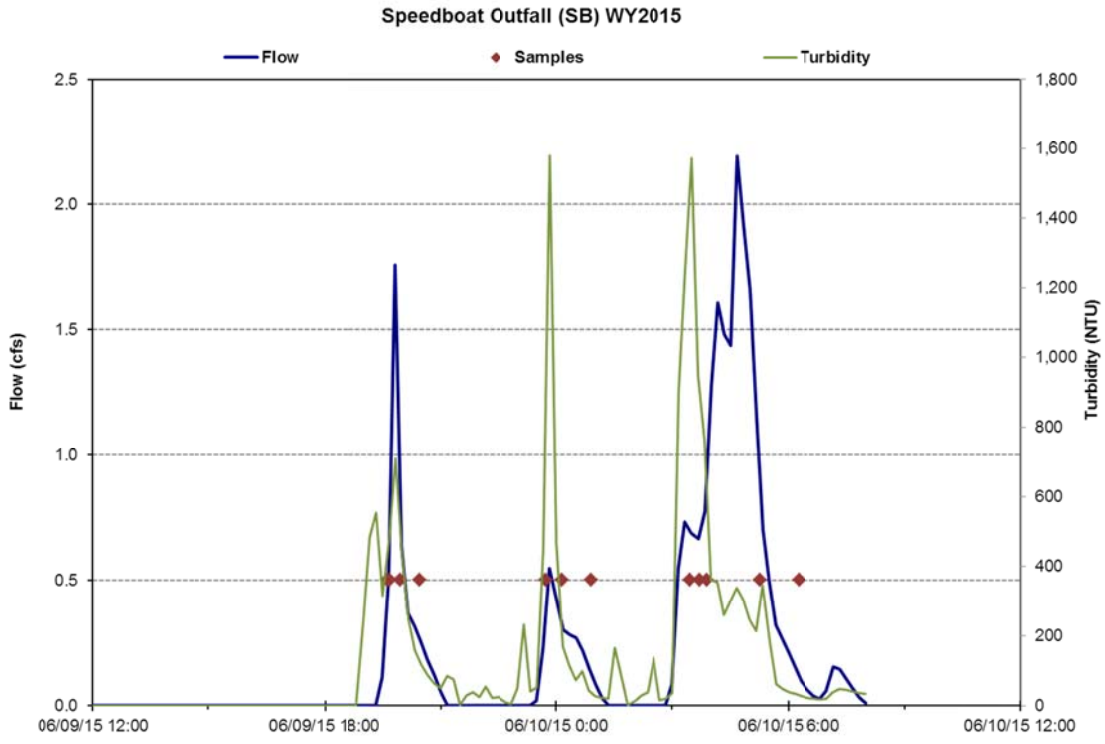


Figure I10: Continuous hydrology, continuous turbidity, and water quality samples for the 6/9/2015 event. Total volume sampled: 15,626 cf.

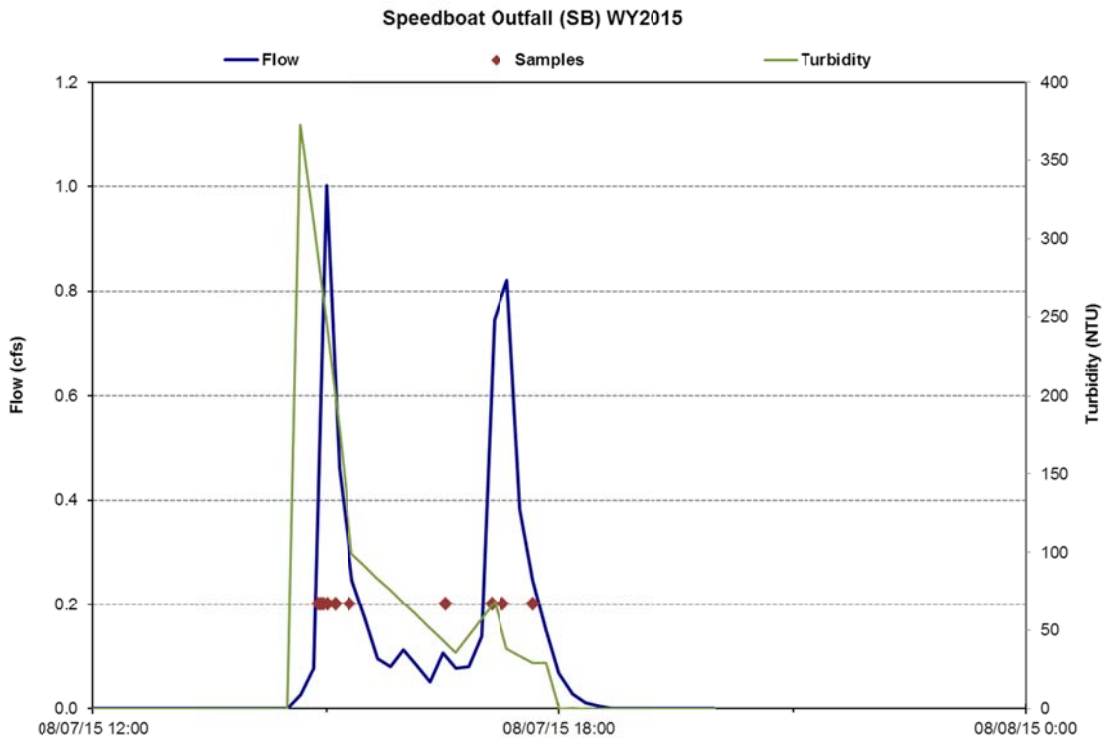


Figure I11: Continuous hydrology, continuous turbidity, and water quality samples for the 8/7/2015 event. Total volume sampled: 3,163 cf.

22 APPENDIX J: TAHOE VALLEY EVENT GRAPHS

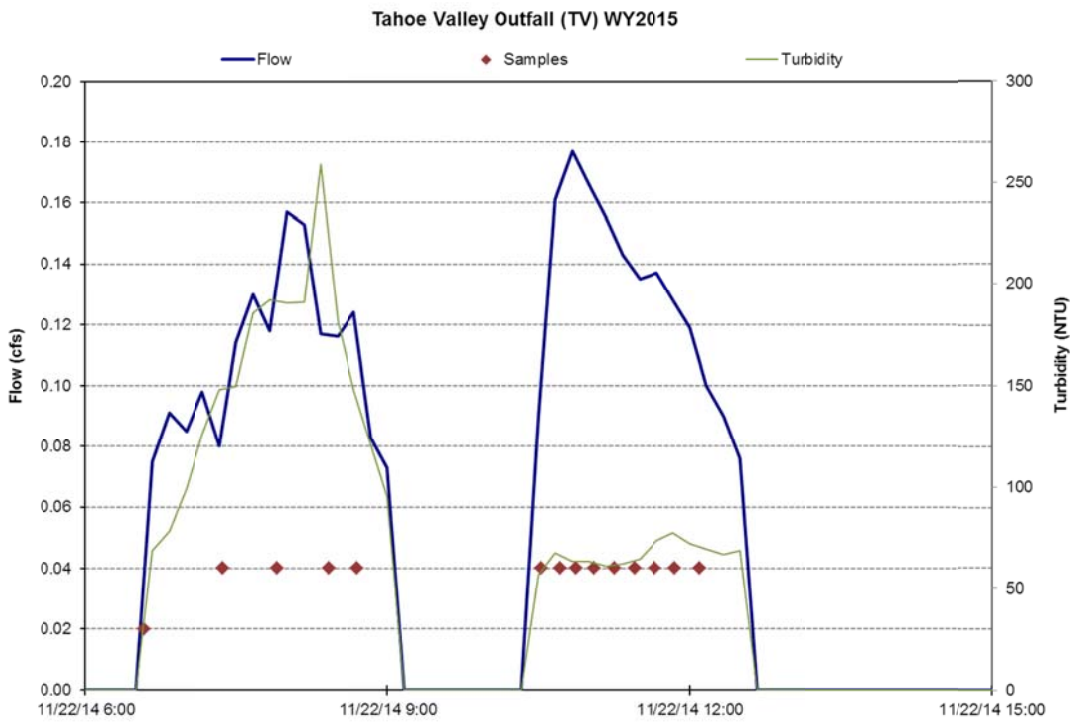


Figure J1: Continuous hydrology, continuous turbidity, and water quality samples for the 11/22/2014 event. Total volume sampled: 1,975 cf.

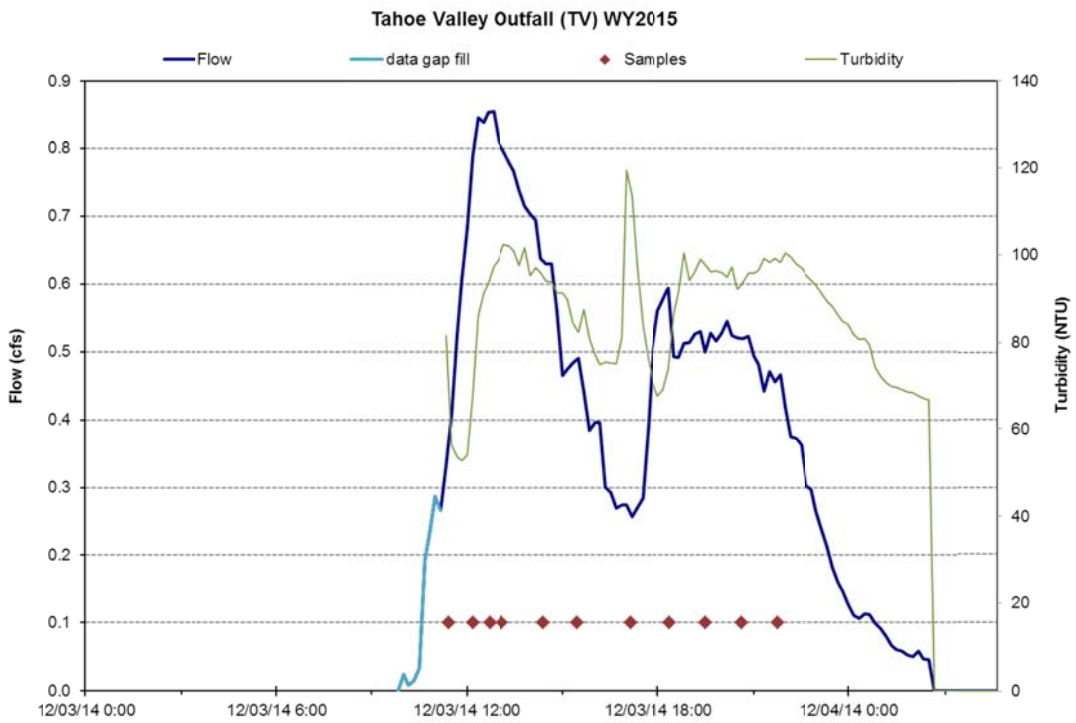


Figure J2: Continuous hydrology, continuous turbidity, and water quality samples for the 12/3/2014 event. Equipment failure caused the data gap, flow estimated from Upper Truckee site. Total volume sampled: 23,891 cf.

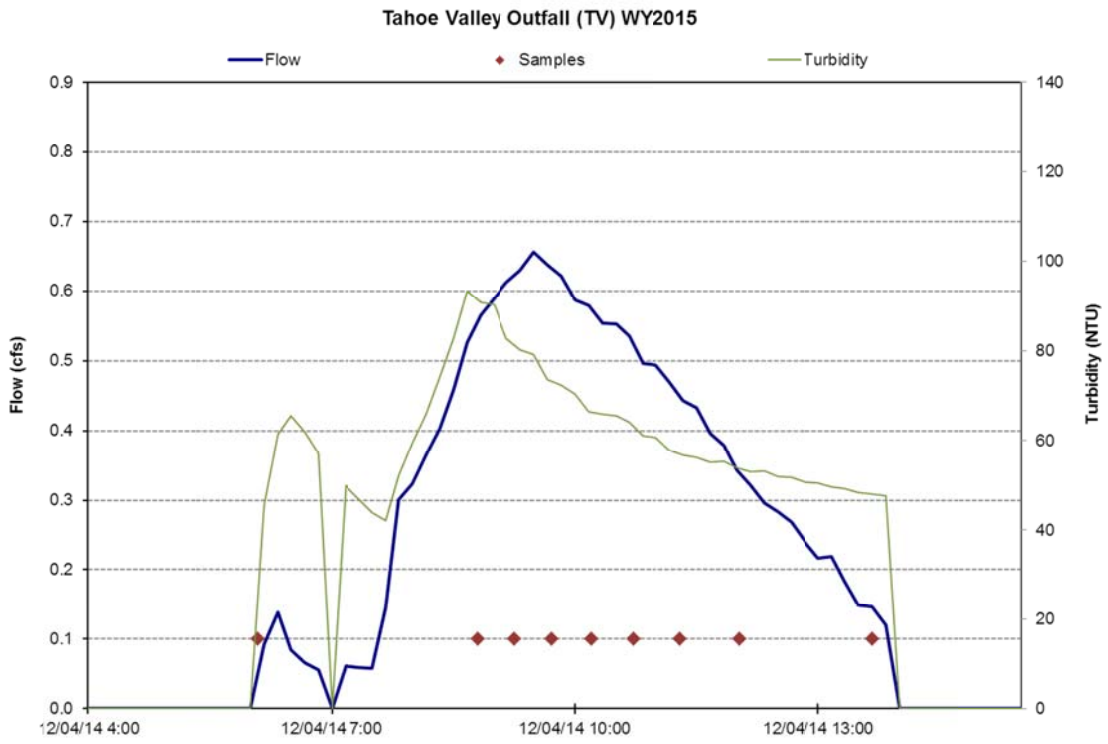


Figure J3: Continuous hydrology, continuous turbidity, and water quality samples for the 12/4/2014 event. Total volume sampled: 9,691 cf.

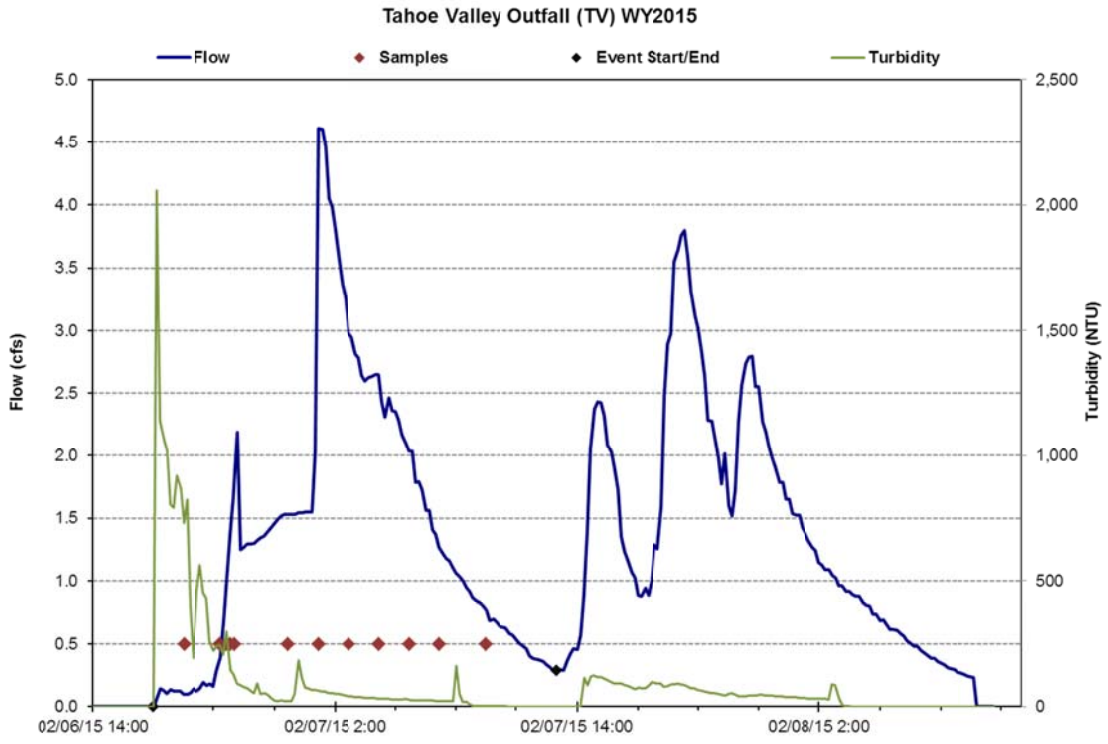


Figure J4: Continuous hydrology, continuous turbidity, and water quality samples for the 2/6/2015 event. Total volume sampled: 99,321 cf.

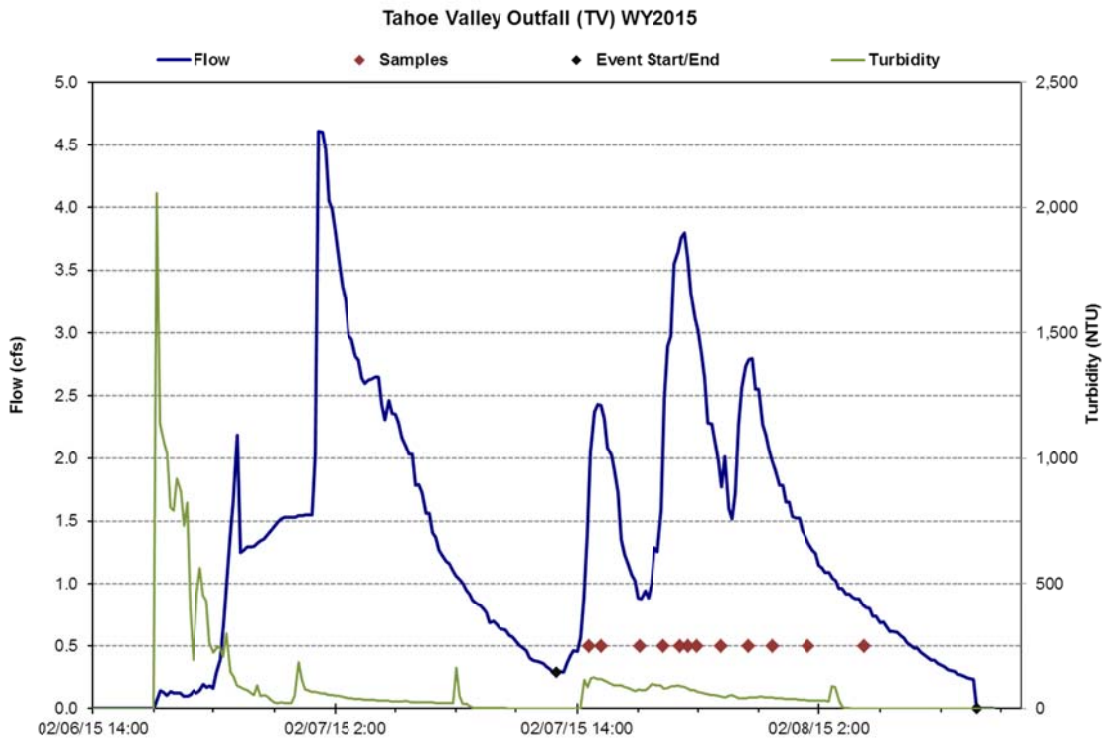


Figure J5: Continuous hydrology, continuous turbidity, and water quality samples for the 2/7/2015 event. Total volume sampled: 104,432 cf.

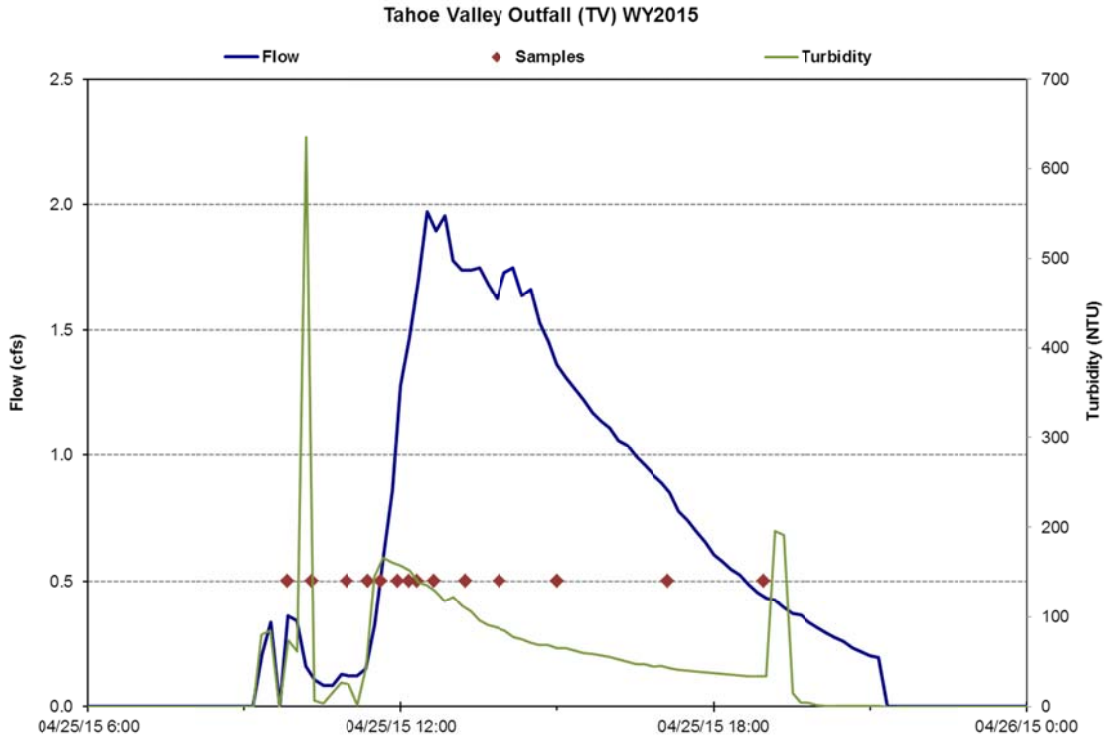


Figure J6: Continuous hydrology, continuous turbidity, and water quality samples for the 4/25/2015 event. Total volume sampled: 36,010 cf.

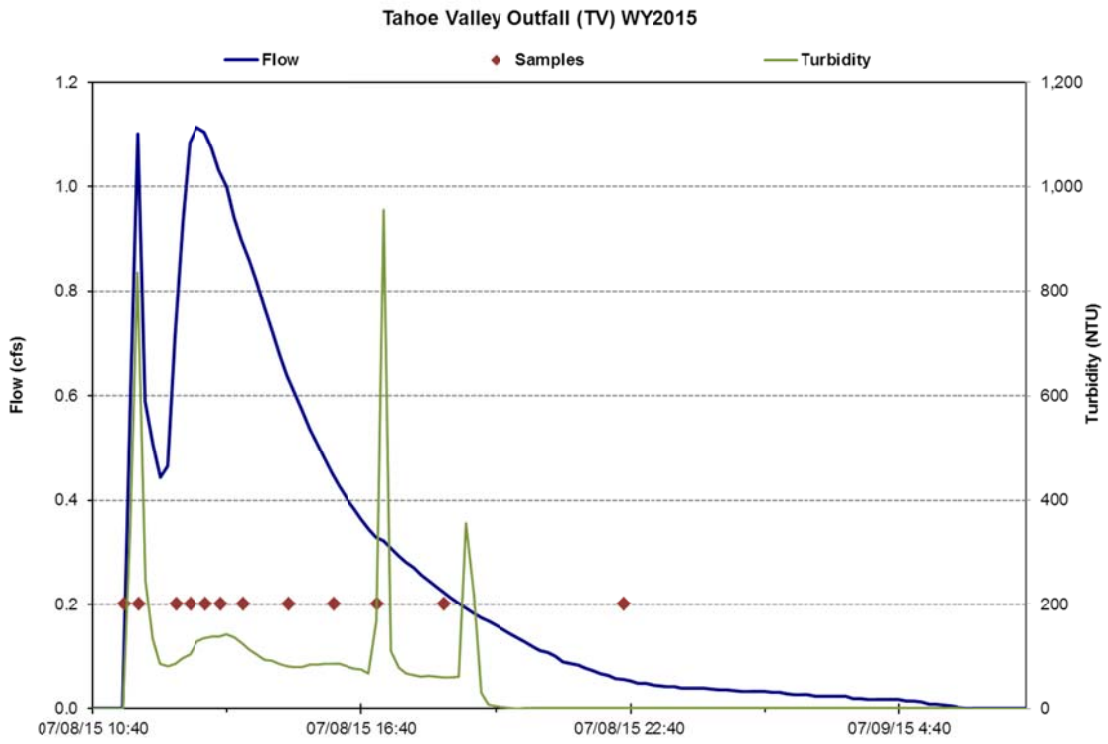


Figure J7: Continuous hydrology, continuous turbidity, and water quality samples for the 7/8/2015 event. Total volume sampled: 18,058 cf.

23 APPENDIX K: UPPER TRUCKEE EVENT GRAPHS

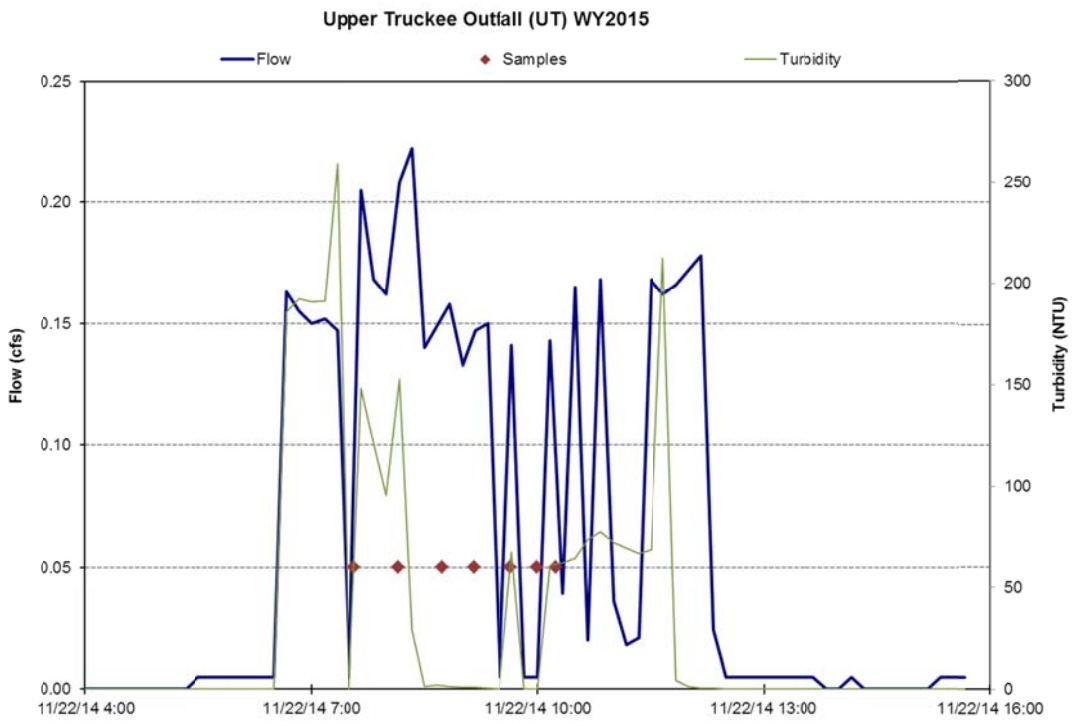


Figure K1: Continuous hydrology, continuous turbidity, and water quality samples for the 11/22/2014 event. Total volume sampled: 2,594 cf.

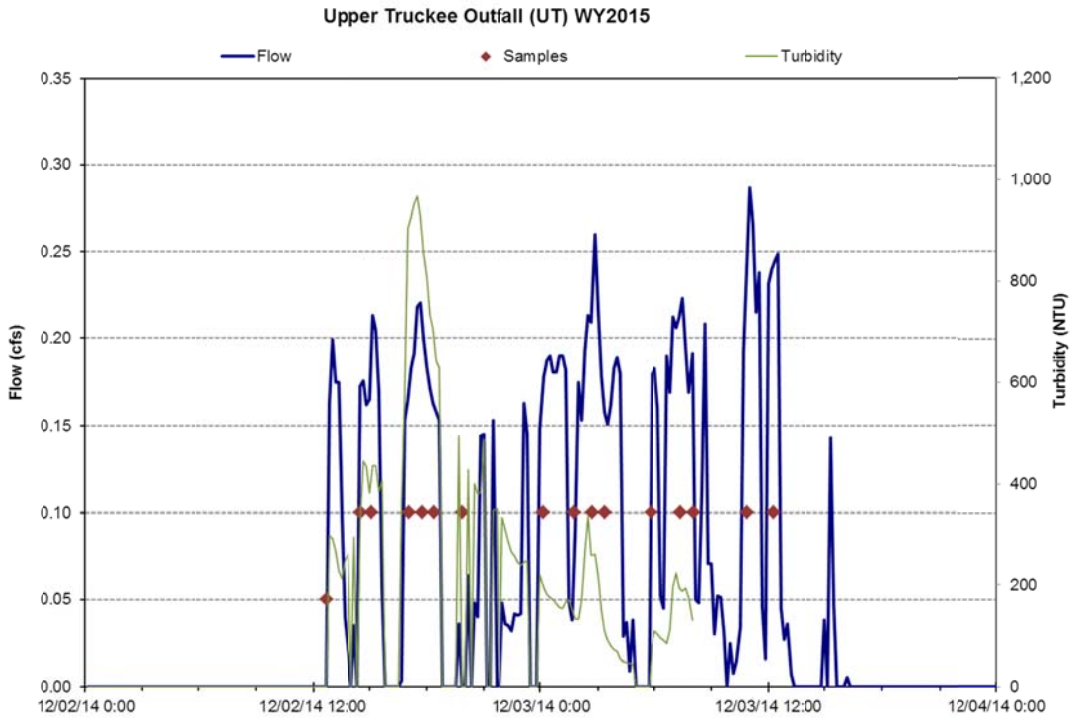


Figure K2: Continuous hydrology, continuous turbidity, and water quality samples for the 12/2/2014 event. Total volume sampled: 9,549 cf.

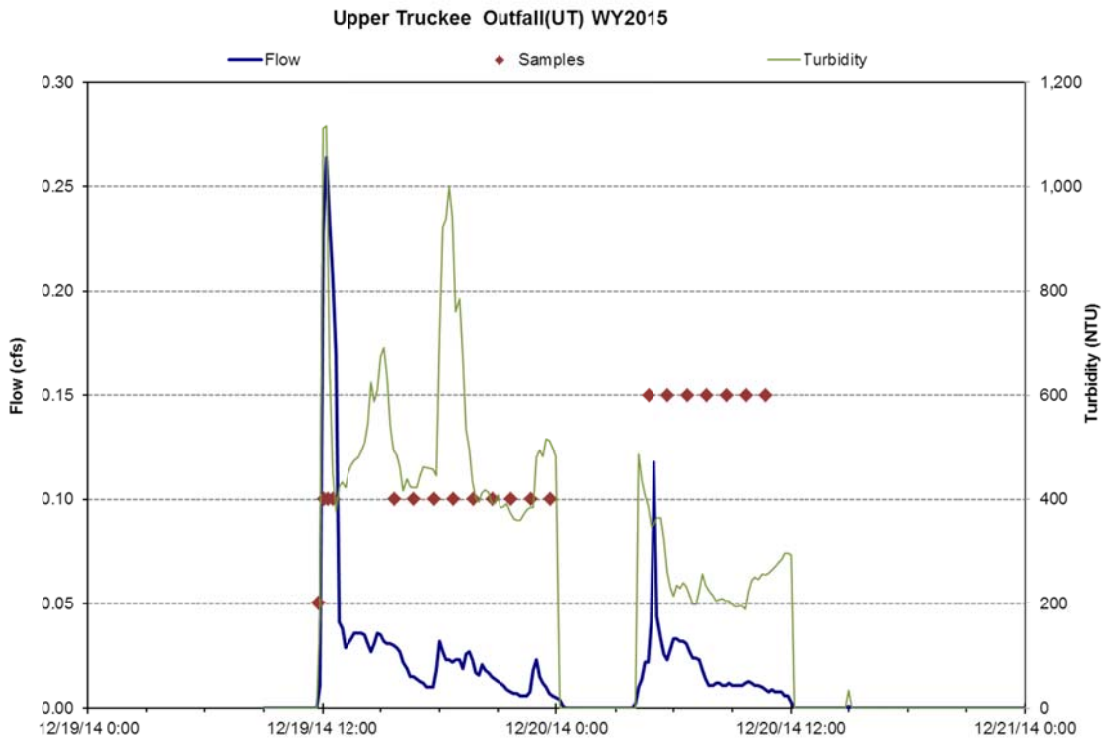


Figure K3: Continuous hydrology, continuous turbidity, and water quality samples for the 12/19/2014 event. Total volume sampled: 2,063 cf.

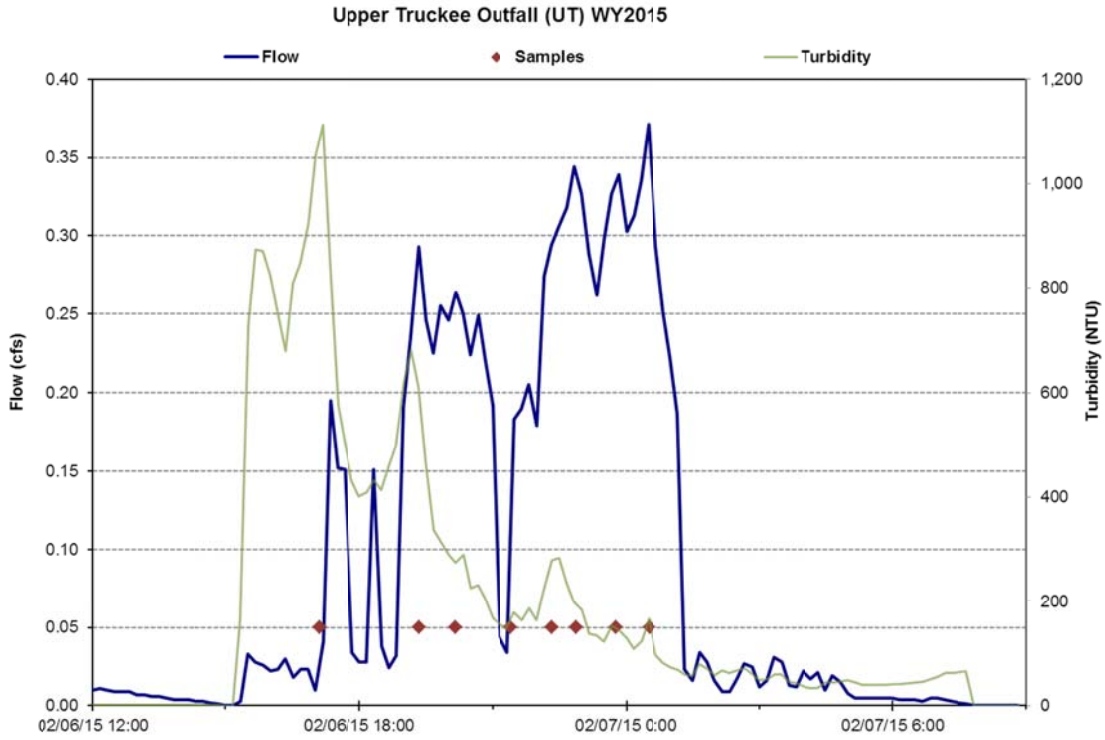


Figure K4: Continuous hydrology, continuous turbidity, and water quality samples for the 2/6/2015 event. Total volume sampled: 6,712 cf.

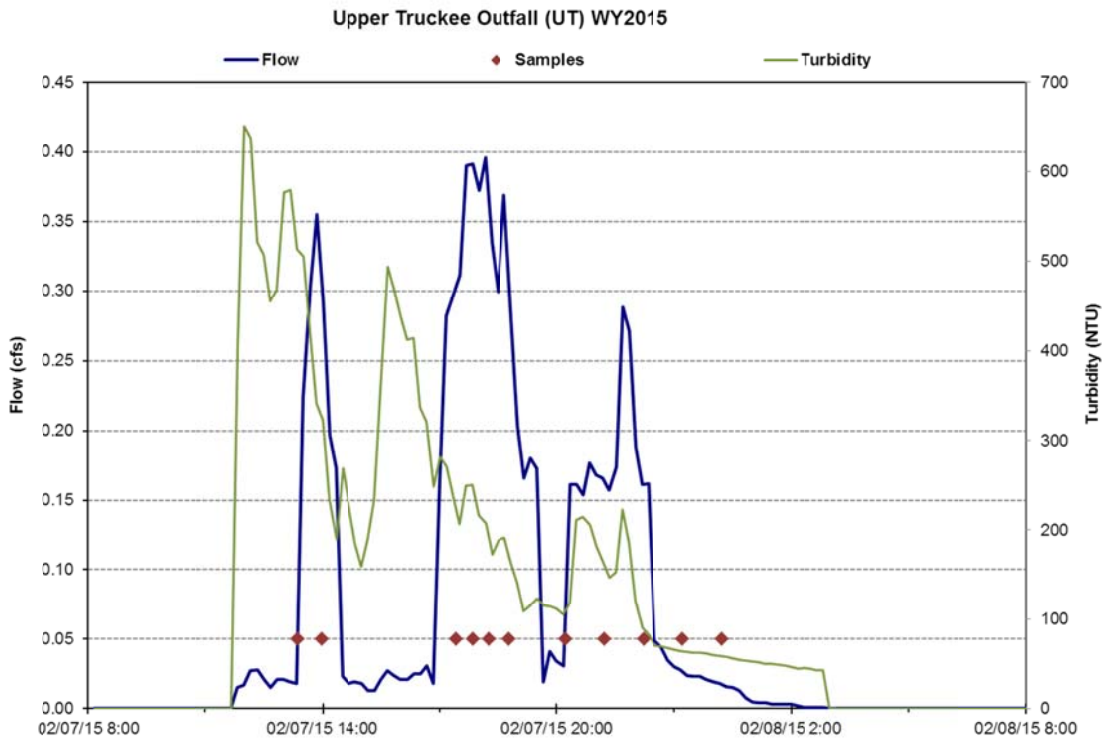


Figure K5: Continuous hydrology, continuous turbidity, and water quality samples for the 2/7/2015 event. Total volume sampled: 5,749 cf.

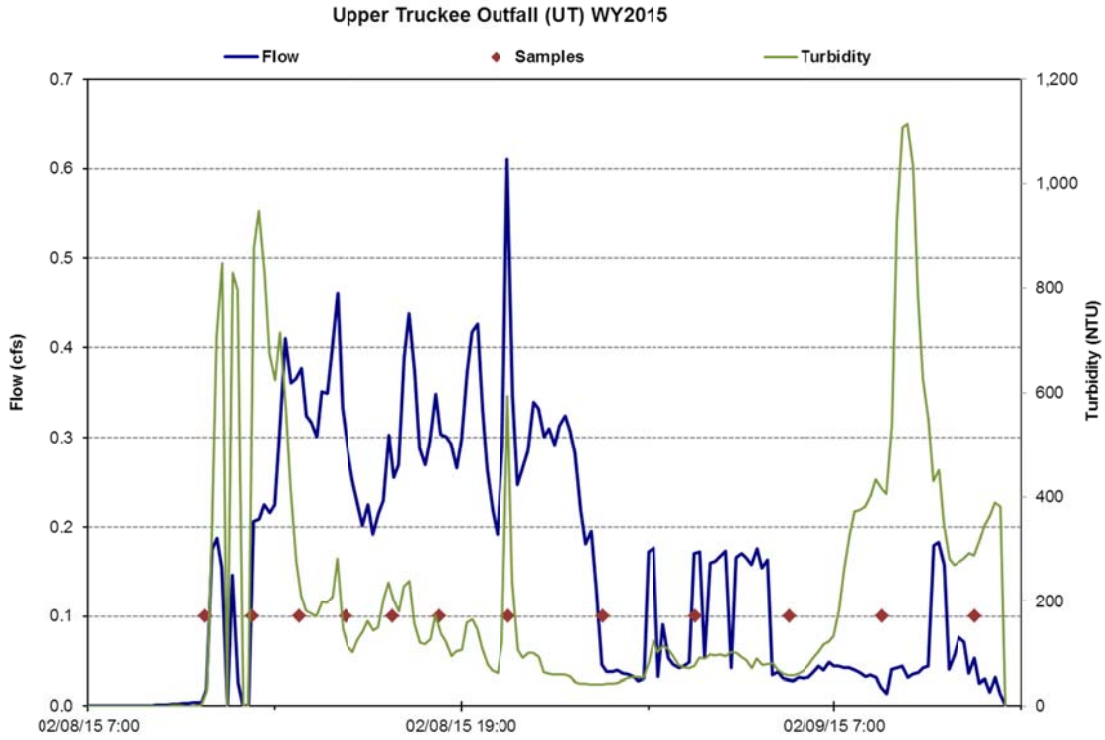


Figure K6: Continuous hydrology, continuous turbidity, and water quality samples for the 2/8/2015 event. Total volume sampled: 15,705 cf.

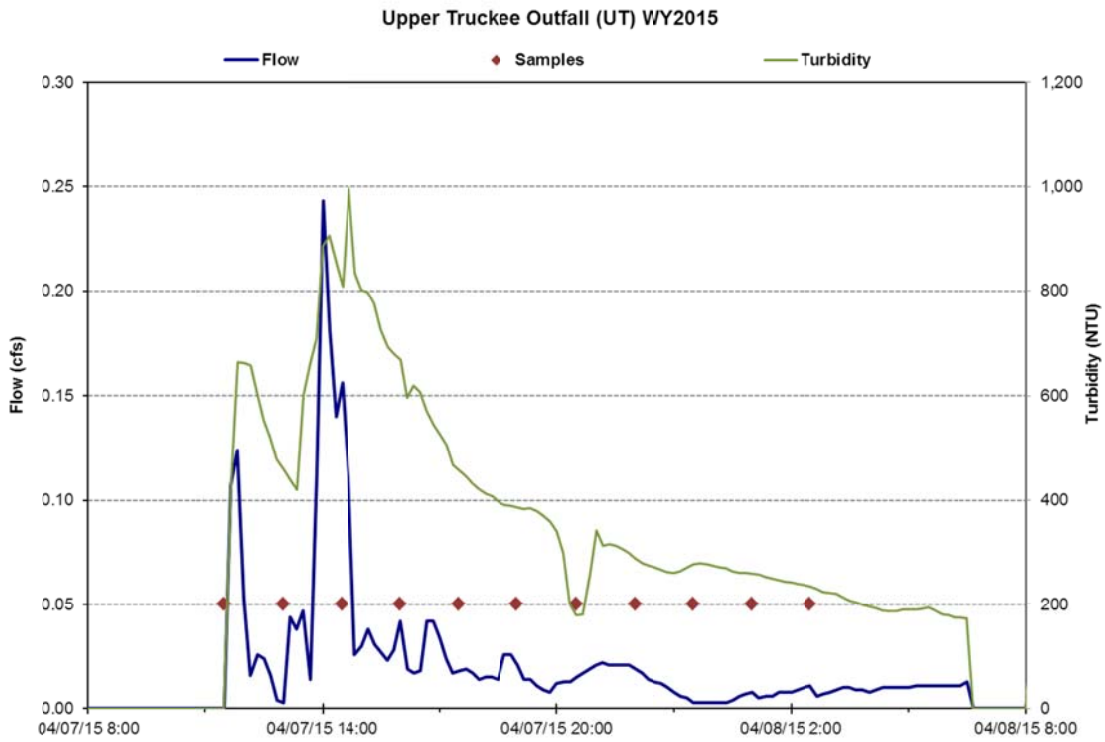


Figure K7: Continuous hydrology, continuous turbidity, and water quality samples for the 4/7/2015 event. Total volume sampled: 1,697 cf.

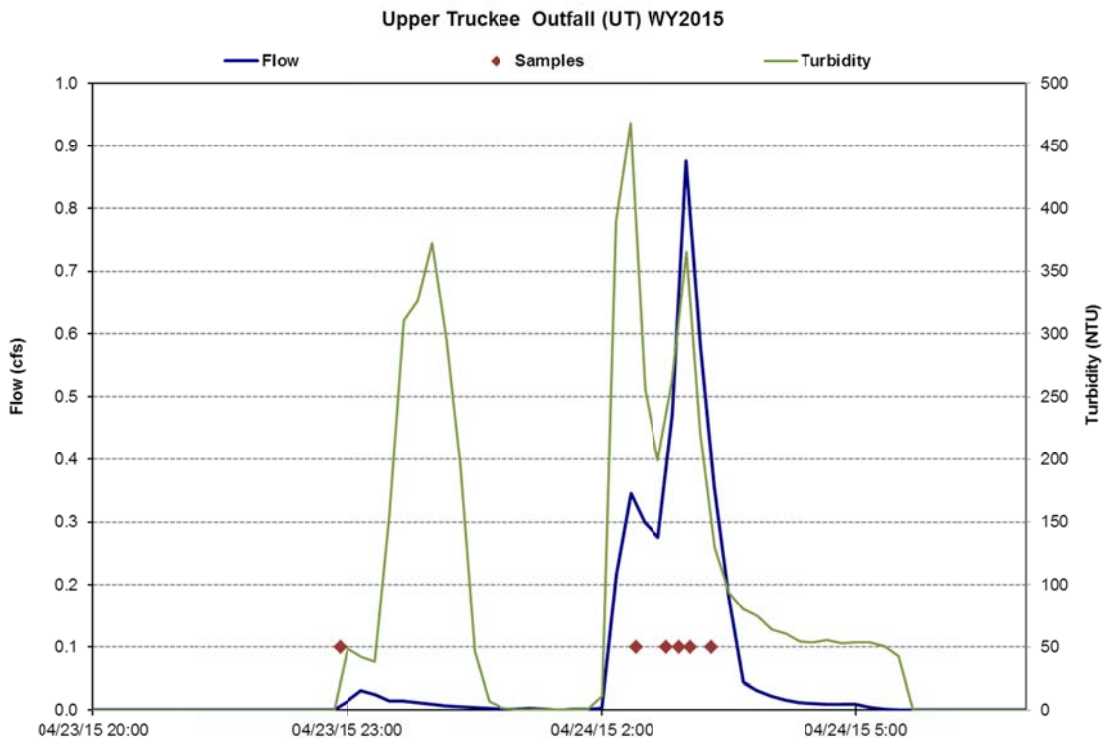


Figure K8: Continuous hydrology, continuous turbidity, and water quality samples for the 4/23/2015 event. Total volume sampled: 2,413 cf.

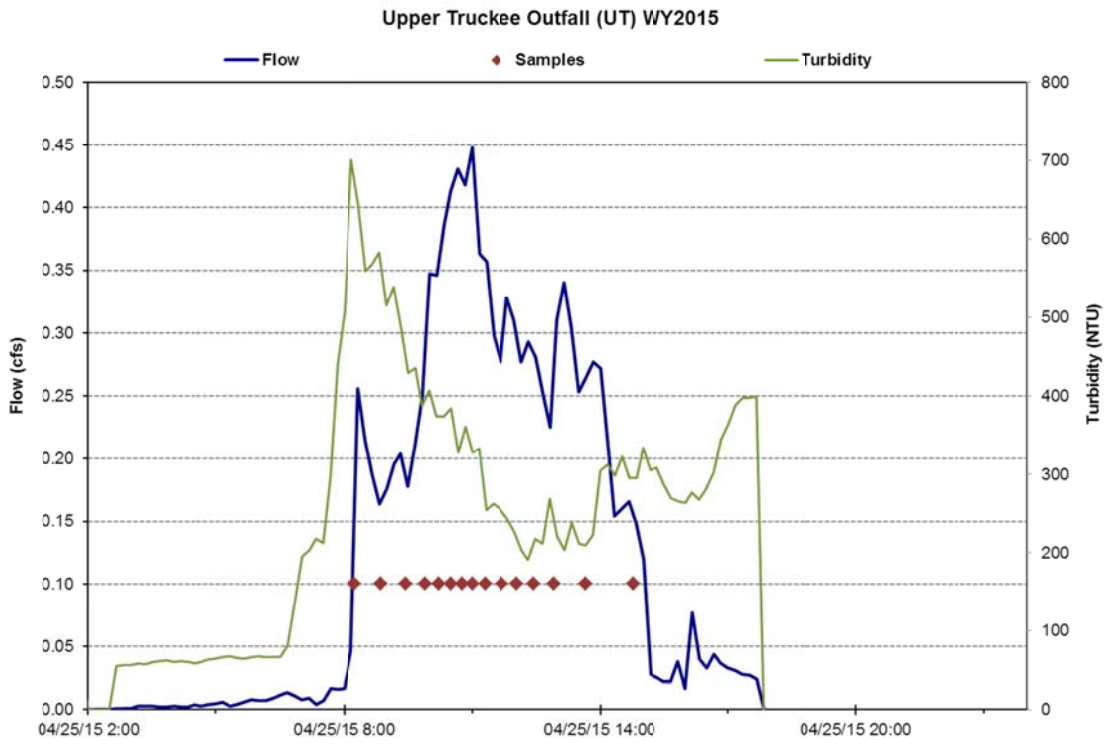


Figure K9: Continuous hydrology, continuous turbidity, and water quality samples for the 4/25/2015 event. Total volume sampled: 7,106 cf.

Appendix H

DOT Maintenance NPDES Training / Discussion

May 20, 2015

1. NPDES Permit
    a. General Overview

2. TMDL Processes
    a. Where we are at? Current schedule, timelines and expectations
    b. Loads and Load reductions needed
    c. Future Projects
    d. Condition Assessments
        i. Road RAM
        ii. BMP RAM
        iii. Catchment Credits and watershed modeling

3. Maintenance Actions

4. General Overview of large scale Stormwater BMPs

5. General Overview of Construction BMPs

6. General Overview of Maintenance Management BMPs
    a. Sweeping
        i. New Sweeper Purchases, Type and Style
        ii. Sanders - Epoke
        iii. What to look for - Observations
    b. Vactoring
        i. Work orders and priorities. Filling in worksheets
    c. Shoveling / Cleaning DIs
    d. Channel Clearing

4. Round Table Discussion with Maintenance Staff

Questions for Road Crew

1.) What is a BMP?
    i. Anyone know the difference between source control and sediment control?
2.) Name several types of BMP's you could use on a construction site?
    i. Go around room
3.) What types of stormwater and infrastructure BMPs do we have in El Dorado County?
    i. Go around room
4.) Name the 2 maintenance practices that recover sediment from infrastructure?

Bonus Questions

1.) What does NPDES stand for?
2.) What is the main cause of Lake Tahoe's Clarity Loss? (type and size)
3.) What does TMDL stand for?
4.) What is El Dorado County's Pollutant Load reduction requirement in the next 5 years? What are some ways we can achieve that requirement?
5.) What kind of sand do we use in El Dorado County?
    i. Any idea why sand is better for water quality than the cinders?

COUNTY OF EL DORADO

TAHOE ENGINEERING:
924B Emerald Bay Road
South Lake Tahoe, CA 96150
Phone: (530) 573-7900
Fax: (530) 541-7049

Internet Web Site:
http://edcgov.us/dot

MAIN OFFICE:
2850 Fairlane Court
Placerville CA 95667
Phone: (530) 621-5900
Fax: (530) 626-0387

2015 NPDES / BMP Training
Sign-in Sheet

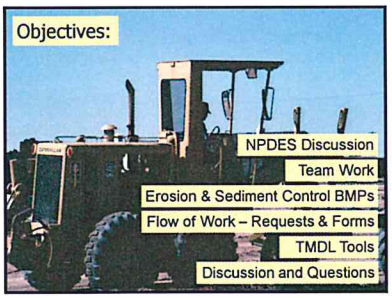
Milton Bern
Thomas M Raney
Philip Moreno
Bill Haughton
[illegible]
Marcos Cerrin
Craig Mah
Wayne McKay
Jacob Zorn
Thomas Cruz
JACK FREENY
Mike Harrell
MATT MOODY
TODD BRANSCOMBE
Todd Bouchard
Alex Padilla
Aaron Carrams

Best Management Practices Discussion & Training

El Dorado County

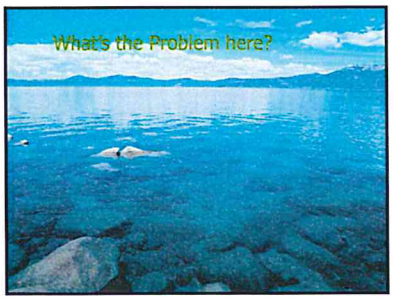
May 2015

Part 1
Regulatory Requirements
&
Roles and Responsibilities



Driving Forces For Watershed Management & Storm Water Control

- Clean Water Act
- State & Federal Water Laws - NPDES
- TRPA - 208 Water Quality Management Plan
- Lahontan - Basin Plan



Clean Water Act Goals:

- "Restore and maintain the chemical, physical and biological integrity of the Nation's waters"
- "Water quality which provides for ensuring the nation's waters are fishable and swimmable"

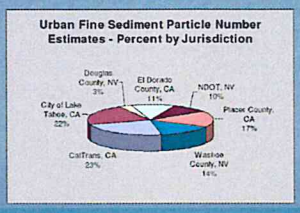
NPDES

- National Pollutant Discharge Elimination System
- Deals with urban & construction site storm water runoff
- Part of Clean Water Act
- Administered by EPA and Lahontan
- Required development of a Storm Water Management Plan (SWMP)
- County and other CA Jurisdictions covered under General Permit
- Also Obtain Construction Permits
- Requires development of a Project Level Storm Water Pollution Prevention Plan (SWPPP)

What pollutants are causing Lake Tahoe's clarity loss?

- Suspended fine sediment particles
- Floating algae – fed by nutrients
- Fine sediment particle(<16 micrometers) accounts for ~2/3 of the clarity conditions

Urban Particle Loads – How the 72% is Distributed



Total Maximum Daily Load (TMDL)

Recommended Implementation Strategy Review

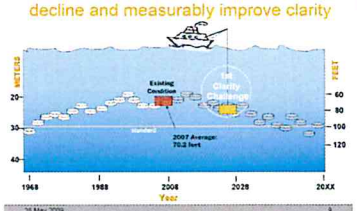
Continue stream restoration efforts

Focus on discrete disturbance in undeveloped areas

Emphasize dust control measures to address atmospheric fine sediment particle inputs

Implement innovative practices, policies, and operations and maintenance programs to treat urban stormwater

The Clarity Challenge: Reverse clarity decline and measurably improve clarity



Core TMDL Questions…and Answers

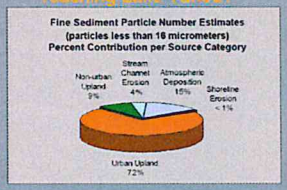
What pollutants are causing Lake Tahoe's clarity loss?

How much of each pollutant is reaching Lake Tahoe?

How much of each pollutant can Lake Tahoe accept and still achieve clarity goals?

Draft Lake Tahoe TMDL Technical Report

How much of each pollutant is reaching Lake Tahoe?



Total Fine Particle Load: 481 x 10^{18} Particles

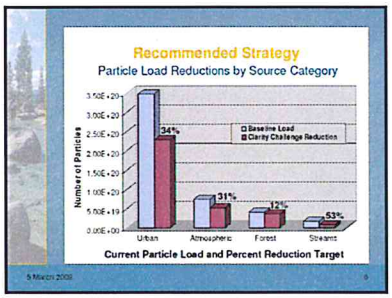
Pollutant Load Allocations and TMDL Implementation

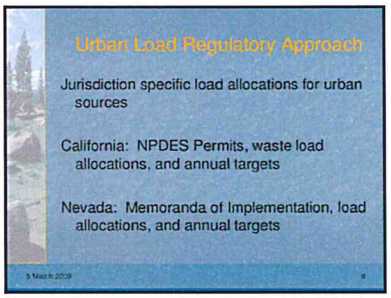
Focus on achieving the Clarity Challenge within 20 years

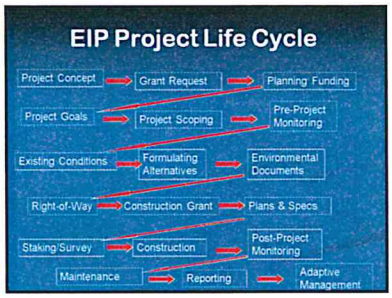
Follows Recommended Strategy

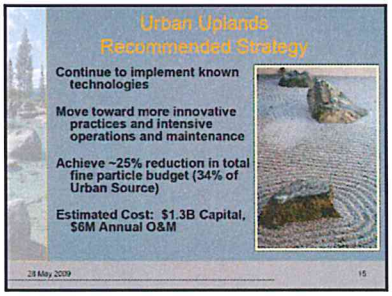
Includes load reduction milestones to chart progress

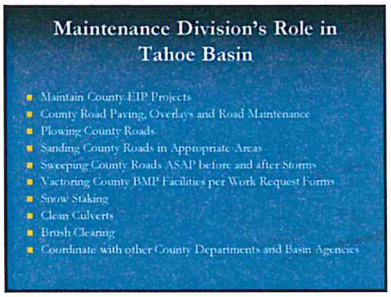
Base permit load reduction targets on TMDL milestones

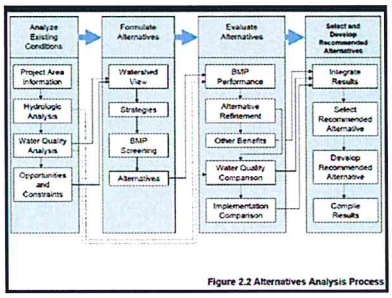

Recommended Strategy
Particle Load Reductions by Source Category
Number of Particles
Baseline Load
Clarity Challenge Reduction
34%
31%
12%
53%
Urban
Atmospheric
Forest
Streams
Current Particle Load and Percent Reduction Target
5 March 2009
6

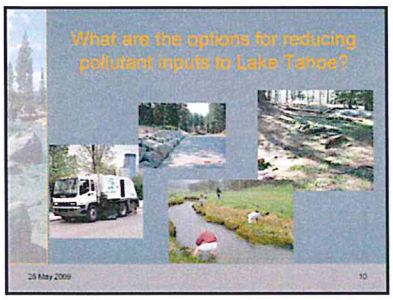

Urban Load Regulatory Approach
Jurisdiction specific load allocations for urban sources
California: NPDES Permits, waste load allocations, and annual targets
Nevada: Memoranda of Implementation, load allocations, and annual targets
5 March 2009
8

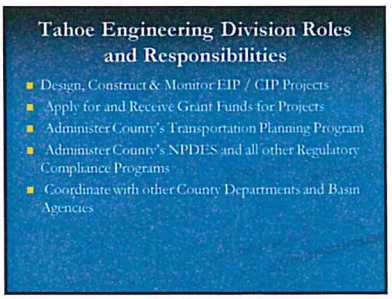

EIP Project Life Cycle
Project Concept
Grant Request
Planning Funding
Project Goals
Project Scoping
Pre-Project Monitoring
Existing Conditions
Formulating Alternatives
Environmental Documents
Right-of-Way
Construction Grant
Plans & Specs
Staking/Survey
Construction
Post-Project Monitoring
Maintenance
Reporting
Adaptive Management

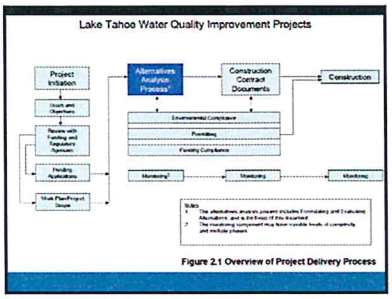

Urban Uplands
Recommended Strategy
Continue to implement known technologies
Move toward more innovative practices and intensive operations and maintenance
Achieve ~25% reduction in total fine particle budget (34% of Urban Source)
Estimated Cost: $1.3B Capital, $6M Annual O&M
28 May 2009
15

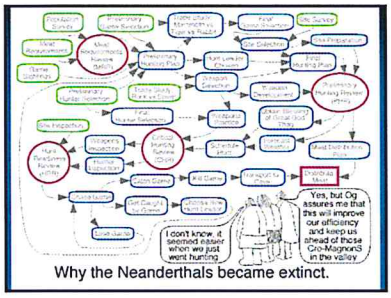

Maintenance Division's Role in Tahoe Basin
Maintain County EIP Projects
County Road Paving, Overlays and Road Maintenance
Plowing County Roads
Sanding County Roads in Appropriate Areas
Sweeping County Roads ASAP before and after Storms
Vactoring County BMP Facilities per Work Request Forms
Snow Staking
Clean Culverts
Brush Clearing
Coordinate with other County Departments and Basin Agencies


Analyze Existing Conditions
Formulate Alternatives
Evaluate Alternatives
Select and Develop Recommended Alternatives
Project Area Information
Hydrologic Analysis
Water Quality Analysis
Opportunities and Constraints
Watershed View
Strategies
BMP Screening
Alternatives
BMP Performance
Alternative Refinement
Other Benefits
Water Quality Comparison
Implementation Comparison
Integrate Results
Select Recommended Alternative
Develop Recommended Alternative
Compile Results
Figure 2.2 Alternatives Analysis Process


What are the options for reducing pollutant inputs to Lake Tahoe?
28 May 2009
10


Tahoe Engineering Division Roles and Responsibilities
Design, Construct & Monitor EIP / CIP Projects
Apply for and Receive Grant Funds for Projects
Administer County's Transportation Planning Program
Administer County's NPDES and all other Regulatory Compliance Programs
Coordinate with other County Departments and Basin Agencies


Lake Tahoe Water Quality Improvement Projects
Project Initiation
Alternatives Analysis Process
Construction Contract Documents
Construction
Figure 2.1 Overview of Project Delivery Process



Why the Neanderthals became extinct.

Team Work

- The County has assembled a SWAG to distribute permit responsibilities to the various County Divisions such as development services, Environmental Health, Maintenance and Engineering
- Permit obligations are described in the County Stormwater Management Plan (SWMP), which was adopted in 2007 and approved by the Board of Supervisors.
- This year all County Departments met requirements and obligations as required by regulatory authorities.
- Street Maintenance along with Engineering staff are working together to meet objectives on the limited budget available.
- The County is investigating the feasibility for development of a stormwater utility to help generate resources for sustainable funding levels.
- All Departments must continue to work together to meet long term goals and objectives in the effort to "KEEP TAHOE BLUE"

Urban Stormwater Runoff

- Impervious surfaces (roads) increase runoff
- Runoff carries pollutants to surface waters
- Fine Sediment - primary pollutant affecting Lake Tahoe
- Increased peak flows create flooding and maintenance requirements
- Pavement increases runoff temperature

El Dorado County Storm Water Management Program

- County is a Lake Tahoe Basin Partnering Agency
  - NPDES – Env. Mgmt., DOT / TED, Building Dept., Maintenance
  - EIP Project Design, Construction, Maintenance
  - Storm Water Management Plan (SWMP)
- County Best Management Practices (BMP)
  - Road & BMP Maintenance
  - Installation
  - BMP Maintenance
  - Sweeping/Vactoring/Sanding
- Team Work
- Communication - Work Requests

Without Street Maintenance Staff the Effort to Save Lake Tahoe is Futile.

Proper Maintenance = Properly Functioning BMP's

Otherwise:

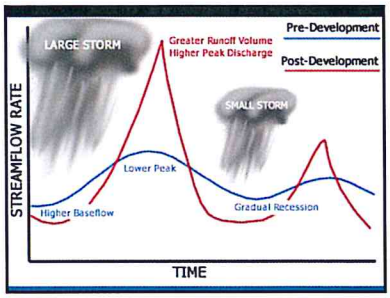
Urban Runoff Pollutants

- Fine Sediment & Nutrients
- Metals
  - (Cd, Cu, Hg, Ni, Pb, Zn)
- Hydrocarbons
  - (Petroleum products – PAH's, PCB's)
- Pesticides and Herbicides
  - (Diazinon, chlorpyrifos, DDT, dieldrin, dioxins)
- Pathogens
- Trash and Debris

Partnering Lake Tahoe Agencies

- Tahoe Regional Planning Agency
  - Excavation & Grading Ordinances
  - Storm Water and Soil Conservation Ordinances
  - Environmental Improvement Program
  - Funding
- Lahontan Regional Water Quality Control Board
  - National Pollutant Discharge Elimination System (NPDES)
  - Effluent Discharge Limits
  - TMDL
- California Tahoe Conservancy
  - Funding
  - Conservation
- US Forest Service
  - Funding
  - Conservation

Part II
Urban Runoff and BMP's



Uncontrolled Urban Runoff

Causes uncontrolled discharges of large volumes of sediments and pollutants into surface waters

Which in turn causes:

Damage to fish spawning areas

Permanent vs. Temporary BMPs

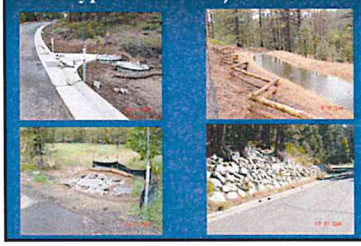
- Permanent BMPs
  - Curb & Gutter
  - Sediment Can
  - Detention Basin
  - Pretreatment Vault
  - Grass Lined Swale
  - Rock Lined Channel
  - Rock Check Dam
  - Rock Rip-Rap
  - Retaining Wall
  - Vegetation
- Temporary BMPs
  - Silt Fence
  - Fiber Roll Log
  - Drop Inlet Protection
  - Tree Protection
  - Stabilized Construction Entrance
  - Construction Limit Fence
  - Erosion Control Blanket
  - Mulch

Which in turn causes:

Excess erosion of creek banks

Erosion Control Measures

Typical EIP Project BMPs



Which in turn causes:

Flooding and property damage

Erosion control vs. Sediment control

Erosion control means:

Source control. By preventing erosion from occurring in the first place, by preserving vegetation, hydroseeding, mulching, mats and other techniques, the biggest problem is prevented.

Sediment control means:

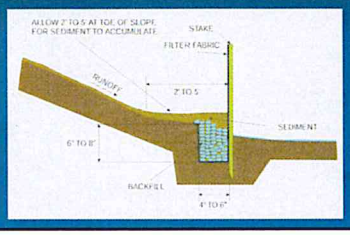
Recovery of particles of soil or pollutants after they have already been dislodged. This is much more difficult and costly than prevention, and must be used in concert with erosion control to be effective.

Typical EIP Project BMPs

Temporary BMP Examples

Filter Fence - How to do it right.

Key in filter fabric a minimum of 4" below the ground surface and 2 to 5 feet from the slope toe, then backfill with dirt or gravel to 6 to 8 inches deep.

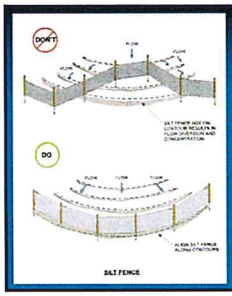


Fiber Roll Logs

Preserve existing vegetation

Existing vegetation has already stabilized the area it is growing in, to some degree, so if you can leave it in place, do it!

Without plants, we would have lost all our topsoil already. They are uniquely and perfectly suited to prevent erosion in all its forms.



Always align silt fences along the natural contours of slopes. If silt fences divert and concentrate flow, they only make the problem worse. To be effective, silt fences must disrupt the flow of runoff.

For this drain inlet, which is not on a paved road, a combination of multiple levels of fiber rolls and gravel beds, in concert with mulch and tackifier, was sufficient to minimize sediment discharges.

The way a slope is graded can make a big difference in the slope's susceptibility to erosion.

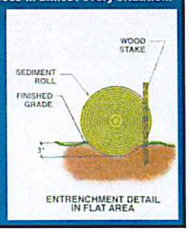
Proper terracing and contouring of graded slopes slows the velocity of running water, and therefore reduces erosion.

Fiber Rolls

Fiber Rolls are alternative to hay bales and silt fences in almost every situation.

Installation Instructions:

- Place rolls into key trench 3 inches deep
- Place excavated soil on uphill or flow side of the roll
- Rolls should be abutted at the ends, not overlapped
- Alternate stakes on both sides of the roll, every six inches



Stabilized Construction Entrance

Paving operations should only be carried out a minimum of 72 hours prior to a rain event to allow proper curing. Rain on fresh paving will cause petrochemical and solvent releases.

... leads to uncontrolled sediment discharges

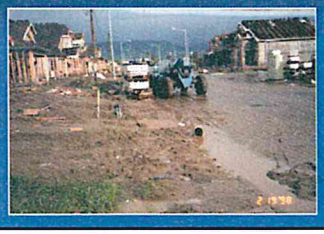
A successful project requires a combination of all the techniques, working together to protect the environment.

In Summary

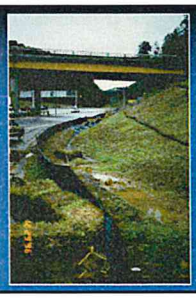
Proper implementation of Erosion and Sediment Control BMP's ...

Part III
Flow of Work between Departments

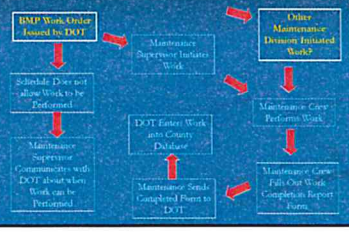
Improper BMP Management ...

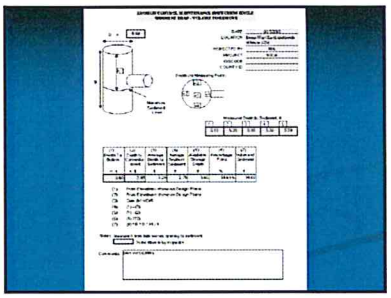


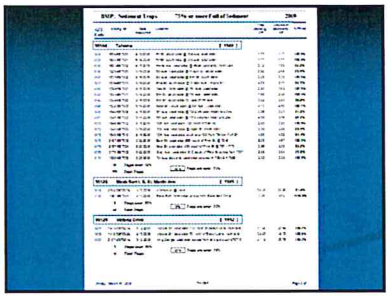
... results in successful erosion and sediment control.

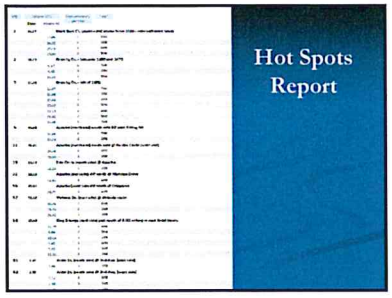


BMP Work Order Flow Chart



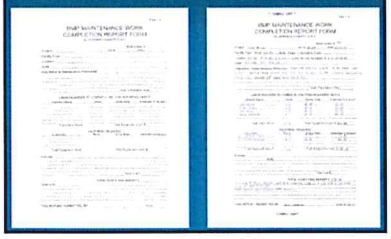


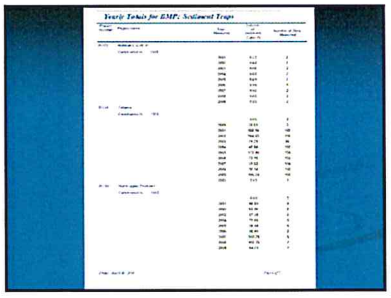


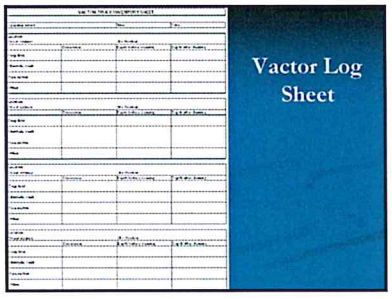


Hot Spots Report

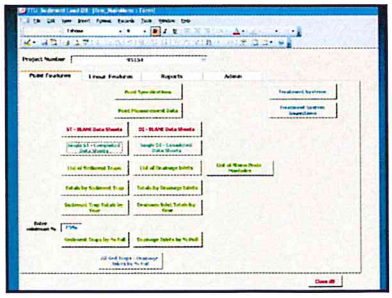
Completed BMP Maintenance Forms

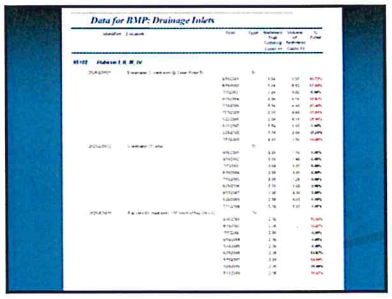






Vactor Log Sheet



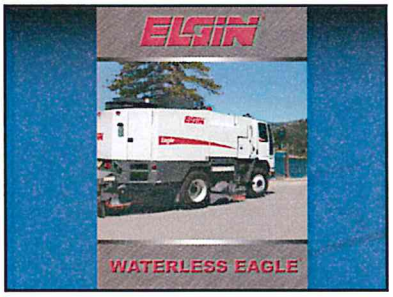


Importance of Sweeping and Vactoring

- Crucial to remove primary pollutants of concern
- Reduces air pollution
- Prevents increased maintenance requirements on detention facilities
- Should be performed as soon as possible after storm events

Sweeping:

- Performed on a year round basis during all seasons.
- Goal is to recover traction abrasive material during winter months.
- During summer the goal is to remove material from road surface prior to storm events.



Sweeper – Elgin Waterless Eagle

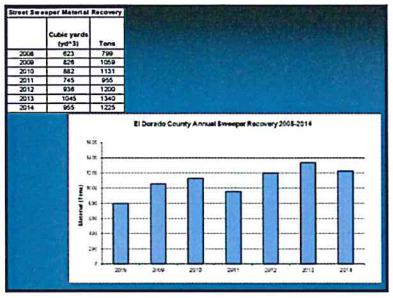
- Sweep System: No-Jam Conveyor
- Sweeping Path (Max): 10 ft (3,048 mm)
- Hopper Capacity (volumetric): 4.5 yd3 (3.5 m3)
- Dust Suppression: Waterless Dust Control System
- Auxiliary Water System: 320 gal (1,210 L)
- Dumping Height (max): 10 ft 2 in (3,100 mm)
- Dump Location: Right Side

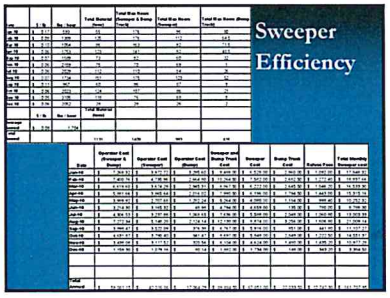
Sweeper – Tymco 500x

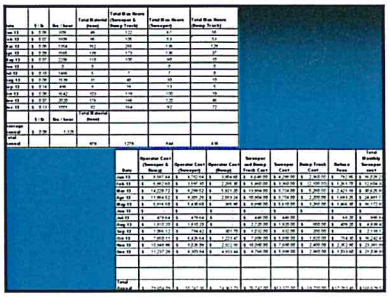
- Sweep System: No-Jam Conveyor
- Sweeping Path (Max): 8 ft
- Hopper Capacity (volumetric): 5.7 yd3
- Dust Suppression: Waterless Dust Control System
- Auxiliary Water System: 250 gal
- Dumping Height (max): 11 ft
- Dump Location: Right Side

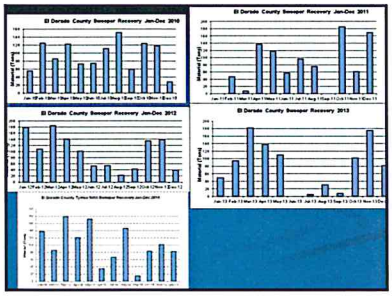
Sweeper Efficiency

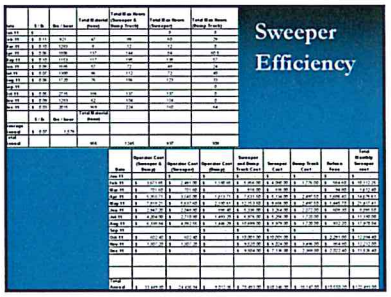
- TED will be spending a few hours with the street sweeper and its operator to look at the efficiency of the sweeper at sediment removal and performing some tests.
- Discuss with group the sweepers operation such as single vs. multiple passes, water application etc… Characterize sediment removal efficiencies.
- The results of the study will be presented to the Maintenance division with possible suggestions and methods to maximize sediment removal.
- Discuss tests and findings from research

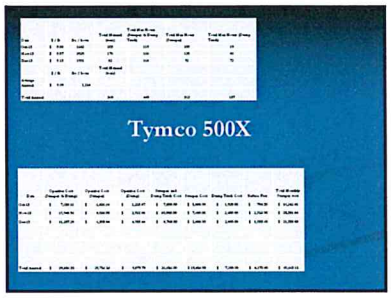

Street Sweeper Material Recovery
Cubic yards (yd^3)
Tons
2008 623 799
2009 629 1058
2010 882 1131
2011 745 955
2012 938 1200
2013 1045 1340
2014 955 1225
El Dorado County Annual Sweeper Recovery 2008-2014
Material (Tons)
2008
2009
2010
2011
2012
2013
2014

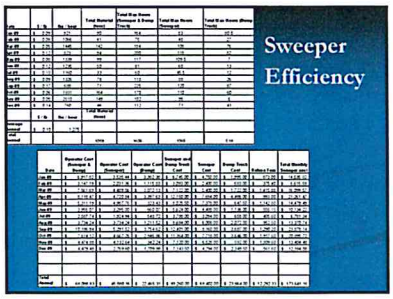

Sweeper Efficiency

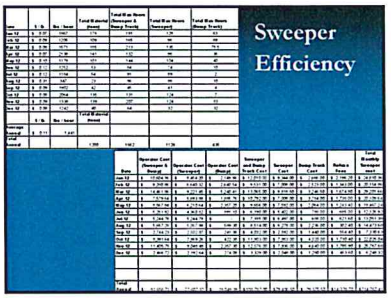


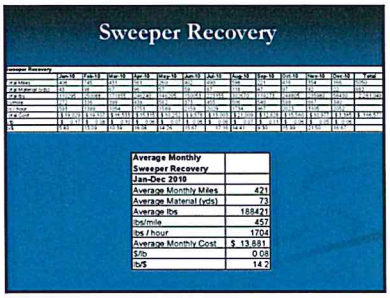

El Dorado County Sweeper Recovery Jan-Dec 2010
El Dorado County Sweeper Recovery Jan-Dec 2011
El Dorado County Sweeper Recovery Jan-Dec 2012
El Dorado County Sweeper Recovery 2013


Sweeper Efficiency


Tymco 500X


Sweeper Efficiency


Sweeper Efficiency


Sweeper Recovery
Average Monthly Sweeper Recovery
Jan-Dec 2010
Average Monthly Miles 421
Average Material (yds) 73
Average lbs 188421
lbs/mile 457
lbs / hour 1704
Average Monthly Cost $ 13,881
$/lb 0.08
lb/$ 14.2

Sweeper Recovery

Sweeper Recovery	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Total
Total Miles		157	81	153	167	119	169	142		119	143	147	1,396
Total Material (yds)		20	14	107	115	121	47	16		140	68	131	1,487
Total lbs		34,470	17,240	184,010	198,038	114,147	152,375	61,195		317,925	117,120	337,240	1,410,170
lbs/mile		219	213	1,203	1,186	959	901	431		2,672	819	2,296	
lbs / hour		1,722	1,437	1,404	1,414	1,426	1,523	1,219		1,769	1,561	2,247	1,411
Total Cost		$ 12,503	$ 7,114	$ 75,149	$ 80,717	$ 46,611	$ 64,103	$ 24,125		$ 134,408	$ 49,187	$ 142,120	$ 634,943
$/lb		$ 0.36	$ 0.41	$ 0.41	$ 0.41	$ 0.41	$ 0.42	$ 0.39		$ 0.42	$ 0.42	$ 0.42	
lb/$		2.76	2.42	2.45	2.45	2.45	2.38	2.54		2.36	2.38	2.37	

Average Monthly Sweeper Recovery	
Jan-Dec 2011	
Average Monthly Miles	399
Average Material (yds)	75
Average lbs	191093
lbs/mile	493
lbs / hour	1578
Average Monthly Cost	$ 12,484
$/lb	0.08
lb/$	15.3

Sweeper Repair Cost Summary

Annual Repair Cost Summary			
Date Range (Calendar year)	Unit	Maintenance Cost	Maintenance Cost / hour of operation
1-04 to 12-31-04	Gilmartin A8000	$ 36,105.56	$ 41.81
1-04 to 12-31-05	Gilmartin A8000	$ 38,151.76	$ 44.18
1-04 to 12-31-06	Gilmartin A8000	$ 52,976.30	$ 58.92
1-01 to 12-31-07	Gilmartin A8000	$ 49,770.53	$ 53.84
1-01 to 12-31-08	Gilmartin A8000	$ 39,288.88	$ 37.83
1-01 to 12-31-09	Gilmartin A8000	$ 44,377.35	$ 40.49
1-01 to 12-31-10	Gilmartin A8000	$ 28,821.53	$ 28.36
	Total Repair Cost (1-1-2004 to 12-31-10)	$ 283,528.11	
	Average Annual Repair Cost (January 04 - December 10)	$ 40,504.16	$ 45.14
	Average Annual Fuel Cost	$ 3,745.12	
	Calculated Average Annual Repair Cost + Fuel	$ 44,249.48	
	Actual Cost to Run Sweeper (avg from Jan 10 Dec 10 (9 months))	$ 33,175.10	

2007 Vactor Material Recovery

232 CY	27 CF	95 lbs	1 Ton
	1 CY	1 CF	2000 lbs.
207 Tons Recovered in 2007			

Sweeper Recovery

Sweeper Recovery	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Total
Total Miles	152	147	158	170	170	170	164	164	158	170	158	170	1,928
Total Material (yds)	116	69	68	117	75	81	42	12	13	25	118	11	654
Total lbs	192,858	114,276	112,643	193,550	122,276	134,108	69,762	20,170	21,450	41,500	195,920	18,216	1,126,154
lbs/mile	1,268	778	713	1,138	719	789	425	123	136	244	1,240	107	
lbs / hour	1,607	1,141	1,171	1,128	1,173	1,072	1,164	1,167	1,022	1,184	1,136	1,216	
Total Cost	$ 14,503	$ 10,455	$ 10,203	$ 17,533	$ 11,207	$ 12,175	$ 10,203	$ 10,414	$ 9,333	$ 10,203	$ 16,766	$ 9,349	$ 132,102
$/lb	$ 0.08	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.15	$ 0.52	$ 0.43	$ 0.25	$ 0.09	$ 0.51	$ 0.12
lb/$	13.30	10.93	11.03	11.03	10.91	11.01	6.83	1.94	2.30	4.07	11.68	1.95	8.52

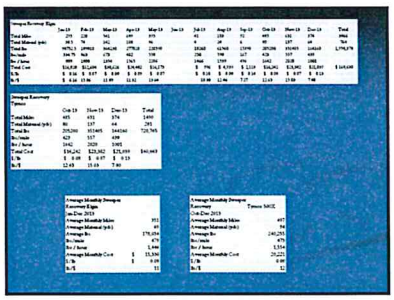
Average Monthly Sweeper Recovery	
Jan-Dec 2012	
Average Monthly Miles	475
Average Material (yds)	78
Average lbs	199963
lbs/mile	422
lbs / hour	1441
Average Monthly Cost	$ 17,879
$/lb	0.11
lb/$	10.8

Vactoring:

- Early spring all County infrastructure is inspected with data input into a database. All devices that are chronically full are queried with work orders developed for maintenance.
- Post-storm inspections by Street Maintenance drain crews. The drain crews go out to all parts of the County after each significant storm to clear the inlet grates of debris and inspect the drainage improvement structures for maintenance needs
- General Maintenance – Street Maintenance staff have developed a working knowledge of areas that require intensive or routine maintenance.
- EDOT-TED is working to develop prioritized scheduled maintenance for problem and / or chronic BMP's in need of maintenance.
- Tablet for Logging and Tracking Data

2008 Vactor Material Recovery

97 CY	27 CF	95 lbs	1 Ton
	1 CY	1 CF	2000 lbs
125 Tons Recovered in 2008			



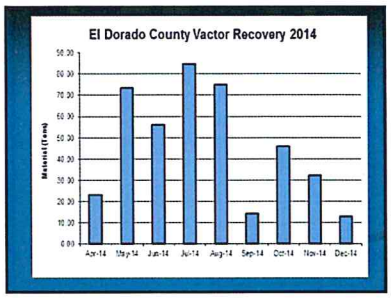
2009 Vactor Material Recovery

236 CY	27 CF	95 lbs	1 Ton
	1 CY	1 CF	2000 lbs
270 Tons Recovered in 2009			

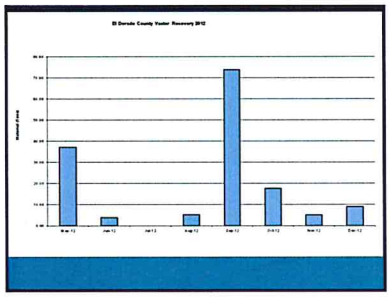
2010 Vactor Material Recovery			
194 CY	27 CF	95 lbs	1 Ton
	1 CY	1 CF	2000 lbs.
269 Tons Recovered in 2010			

Vactor Efficiency

Date	$ / lb	lbs / hour	Total Material (yards)	Total Material (tons)	Total Man Hours (Vactor)	Date	Operator Cost (Vactor)	Vactor Cost	Refuse Fees	Total Monthly Vactor cost
Mar-10	$ 0.10	321	1	1.26	8	Mar-10	$ 330	$ 112	$ 13	$ 455
Apr-10	$ 0.20	321	1	1.26	8	Apr-10	$ 330	$ 176	$ 13	$ 519
May-10	$ 0.13	518	23	29.00	111.5	May-10	$ 4,605	$ 2,459	$ 300	$ 7,364
Jun-10	$ 0.28	331	11	13.76	119.5	Jun-10	$ 5,303	$ 2,373	$ 143	$ 7,819
Jul-10	$ 0.16	407	35	44.97	221.25	Jul-10	$ 9,682	$ 4,528	$ 466	$ 14,677
Aug-10	$ 0.15	443	37	47.00	212.5	Aug-10	$ 8,918	$ 4,675	$ 498	$ 13,991
Sep-10	$ 0.18	346	17	22.12	121	Sep-10	$ 5,903	$ 2,649	$ 279	$ 7,873
Oct-10	$ 0.09	797	55	70.52	177	Oct-10	$ 7,729	$ 4,070	$ 731	$ 12,530
Nov-10	$ 0.11	617	15	19.26	62.50	Nov-10	$ 2,584	$ 1,408	$ 200	$ 4,191
	$ / lb	lbs / hour		Total Material (tons)						
Average Annual	$ 0.16	447								
Total Annual			194	269	681	Total Annual	$ 29,067	$ 14,323	$ 1,423	$ 44,814

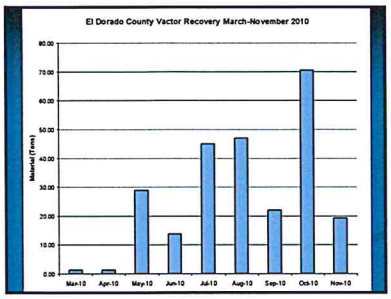


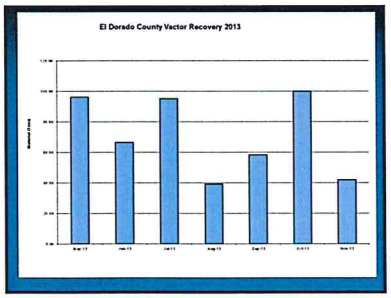
2012 Vactor Material Recovery			
118 CY	27 CF	95 lbs	1 Ton
	1 CY	1 CF	2000 lbs.
142 Tons Recovered in 2012			



Vactor Efficiency

Date	$ / lb	lbs / hour	Total Material (yards)	Total Material (tons)	Total Hours (Vactor)	Date	Operator Cost (Vactor)	Vactor Cost	Refuse Fees	TOTAL Monthly Vactor cost
May-13	$ 0.11	630	75	96.23	116	May-13	$14,679	$ 6,969	$ 996	$ 22,645
Jun-13	$ 0.12	542	52	66.50	86	Jun-13	$11,333	$ 5,062	$ 496	$ 17,035
Jul-13	$ 0.08	1108	74	95.30	86	Jul-13	$10,837	$ 5,216	$ 988	$ 17,041
Aug-13	$ 0.11	949	31	39.13	41	Aug-13	$ 6,081	$ 2,516	$ 406	$ 8,923
Sep-13	$ 0.15	629	45	58.29	94	Sep-13	$12,169	$ 5,734	$ 604	$ 18,508
Oct-13	$ 0.12	791	79	100.84	132	Oct-13	$16,637	$ 7,512	$ 1,037	$ 25,186
Nov-13	$ 0.20	497	33	42.00	96	Nov-13	$11,199	$ 5,295	$ 436	$ 16,910
	$ / lb	lbs / hour		Total Material (tons)						
Average Annual	$ 0.13	792								
Total Annual			388	497	651	Total Annual	$82,845	$ 38,233	$ 5,159	$ 126,236





Vactor Efficiency

Date	$ / lb	lbs / hour	Total Material (yards)	Total Material (tons)	Total Hours (Vactor)	Date	Operator Cost (Vactor)	Vactor Cost	Refuse Fees	Total Monthly Vactor Cost
Apr-14	$ 0.29	357	16	23.38	69	Apr-14	$ 7,867	$ 5,588	$ 259	$ 13,713
May-14	$ 0.17	821	57	73.42	125	May-14	$ 14,124	$ 10,158	$ 761	$ 25,044
Jun-14	$ 0.11	853	44	56.28	65	Jun-14	$ 7,638	$ 5,241	$ 564	$ 13,442
Jul-14	$ 0.11	872	66	84.75	105	Jul-14	$ 11,706	$ 7,381	$ 879	$ 19,966
Aug-14	$ 0.15	862	59	75.38	122	Aug-14	$ 15,582	$ 8,623	$ 779	$ 25,003
Sep-14	$ 0.22	408	11	14.45	36	Sep-14	$ 4,872	$ 2,597	$ 150	$ 6,553
Oct-14	$ 0.23	428	36	45.88	109	Oct-14	$ 12,942	$ 8,932	$ 478	$ 21,852
Nov-14	$ 0.18	541	25	32.34	60	Nov-14	$ 6,815	$ 4,705	$ 335	$ 11,856
Dec-14	$ 0.14	754	10	12.83	25	Dec-14	$ 2,158	$ 1,436	$ 133	$ 3,728
	$ / lb	lbs / hour		Total Material (tons)						
Average Annual	$ 0.18	605								
Total Annual			329	478	718	Total Annual	$ 81,211	$ 53,796	$ 4,338	$ 138,345

Importance of Proper Road Sanding

- Public Safety
- Crucial to prevent excessive amounts of fine sediment from being deposited on roadways, which affect surface waters and Lake Tahoe
- Reduces air pollution
- Prevents increased maintenance requirements on down stream detention facilities
- Benefits of Decomposed Granite

Cinders Analysis

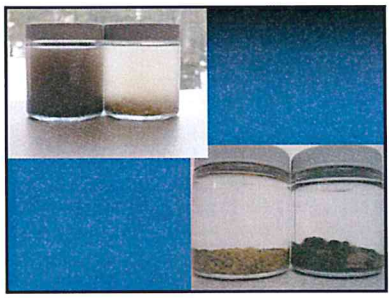
Sieve #	Sieve Size	Sieve Size (microns)	Mass of each sieve (mm)	Mass of each sieve + retained soil	Mass of soil retained Wt (g) (mm-mm)	% on each sieve Wt (mm/MT)	Cumulative % retained	% Finer (10 sieve)
4	4.75	4750	516.00	[illegible]	77.0	13.6%	13.6%	87.0%
8	2.36	2360	451.00	552.0	102.0	18.0%	31.6%	68.4%
16	1.18	1180	444.00	566.0	146.0	25.8%	57.3%	42.7%
30	0.60	600	395.00	474.0	81.0	14.3%	71.6%	28.4%
50	0.30	300	387.00	534.0	147.0	26.0%	97.6%	2.4%
100	0.15	150	384.00	387.0	3.0	0.5%	98.1%	1.9%
200	0.075	75	343.00	347.0	4.0	0.7%	98.8%	1.2%
10 micron	0.01	10			7.0	1.2%	99.9%	0.1%
10 micron	0.01	10			0.0	0.0%	99.9%	0.1%
5 micron	0.005	5			0.0	0.0%	99.9%	0.1%
2 micron	0.002	2			0.0	0.0%	99.9%	0.1%
1 micron	0.001	1			0.0	0.0%	99.9%	0.1%
1 micron pan					0.0	0.0%	100.0%	0.0%
Pan			379.00	416.0	37.0			

If 1000 tons of cinders are used as abrasives for public safety during any given winter then approximately 25 tons or 50,000 lbs of <20 micron sediment is applied to the road each year.

Vactor and Sweeper Operations

Maintenance Sediment Removal Rate and Cost

2010	Hrs / hour	$ / lb
Sweeper	130	$ 0.[illegible]
Vactor	[illegible]	$ 0.[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
2013	Hrs / hour	$ / lb
Sweeper	1300	$ 0.[illegible]
Shaker	752	$ 0.[illegible]
2014	Hrs / hour	$ / lb
Sweeper	1755	$ 0.[illegible]
Vactor	680	$ 0.[illegible]



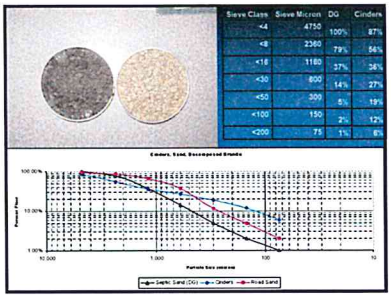
New Abrasive Specification

- Material that is a clean aggregate free from dirt or organic matter. Material shall possess durable properties.
- Meet AASHTO M 29 specification, 3 Degradation, Fine aggregate shall be classified by the following Sand Equivalent (SE) ASTM D 2419 – 95 part
  - Durability Fine (3) ASTM D 2419 – 95 part
- The material shall conform to the following grading as measured by ASTM C 136, SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- Must meet the above grading and durability specifications
- [illegible] Material must be large enough so that the sand will not freeze to the road or the sander
- [illegible] material currently meeting this recommended
- Must meet certain frame/sieve angles that are [illegible] each sieve
- Can be [illegible] for [illegible] roads
- Cinder Sand shall not be the only black or dark gray other material is not to be
- Durability: [illegible] (Recovery)

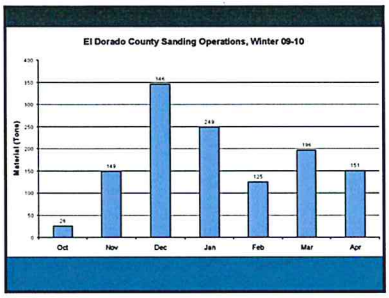
EDOT Sanding Strategy

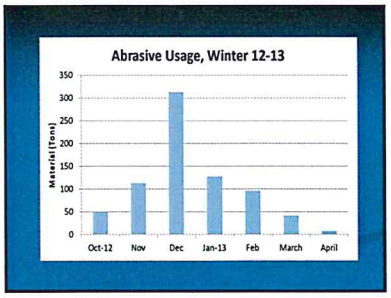
- Target only those areas that require abrasives for Public Safety.
- Limit to specific areas within the County
- Recover material as quickly as possible after storm when weather permits.

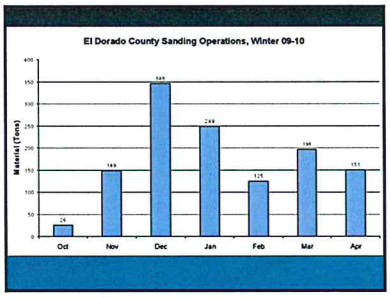
Imhoff Cone Settling Characteristics

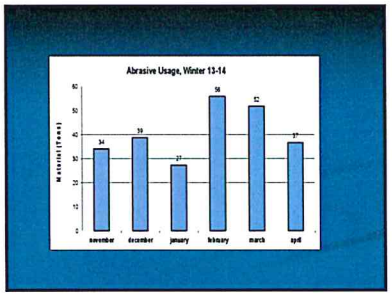


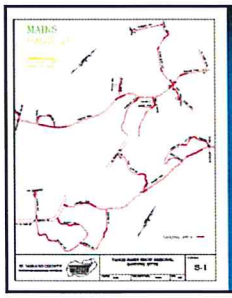
Sieve Class	Sieve Micron	DG	Cinders
<4	4750	100%	87%
<8	2360	79%	56%
<16	1180	37%	36%
<30	600	14%	27%
<50	300	5%	19%
<100	150	2%	12%
<200	75	1%	6%



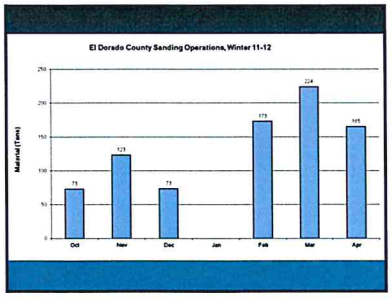








EDOT Sanding Map



Cinder Usage

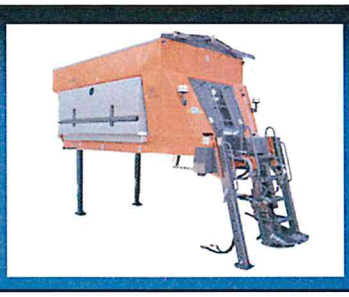
Winter Year	Cinder (tons)
2001/2002	1457
2002/2003	1094
2003/2004	1096
2004/2005	848
2005/2006	1370
2006/2007	794
2007/2008	716
2008/2009	914
2009/2010	1242
2010/2011	790
2011/2012	832
2012/2013	750
Average	992

Material Distribution based on 1000 ton of aggregate used as winter abrasive	<16 micron load (lbs)		
	Non-Pulverized Aggregate	Pulverized Light (4 KG Weight)	Pulverized Heavy (4 KG weight)
Volcanic Cinders	25559	30731	38815
Washoe Sand (DG)	1636	2021	6281
% Reduction	94%	93%	84%
Total Load Reduction	23923	28710	32534
Credits	120	144	163
EDOT FSP Baseline Load	439000	439000	439000
% of TMDL Baseline Attainment	5%	7%	7%
EDOT FSP First Permit Term	44000	44000	44000
% of TMDL First Permit Term	54%	65%	74%
Increased Cost of New Abrasive (1,000 ton annual usage)	$ 10,000	$ 10,000	$ 10,000
Cost / benefit ($/lb-FSP/year)	$ 0.42	$ 0.35	$ 0.31

Dry Application	
lb/mi	500
total miles	66
NaCl (lb)	32,850
NaCl (ton)	16.4
Brine Application	
lb/mi	68
total miles	66
NaCl (lb)	4,486
NaCl (ton)	2.2
Reduction in NaCl usage	86%

EIP Project Construction

- Montgomery Estates Area 3 (2015)
- Golden Bear (2014/15)
- Sawmill 2B Bike Path (2014/2015)
- Tahoe Hills (2015)
- CSA # 5 (2015)
- Lake Tahoe Blvd. Bike Path (2015/16)
- Meyers (2015/16)



Team Work

County Departments **must** communicate well and work together to serve the citizens of El Dorado County and to help protect Lake Tahoe

TMDL Tools Discussion

- Lake Clarity Crediting Program
  - Road RAM
  - BMP RAM
  - Pollutant Load Reduction Model (PLRM)
  - Catchment Credit Schedule
  - Accounting & Tracking Tool

Brine

Date	Time	Street	Lane Miles	GPM	Rate	Amount (gal)	Operator	Salt Applied (lb)
10/17/2014	1600	NUT (50 to LTB)	4.6	35	161	AP		316
		NUT (50 to Delaware)	2	35	70			137
		LTB (Tahoe Mtn to NUT)	2.6	35	91			179
10/17/2014	1600	LTB (Tahoe Mtn to City)	7.6	35	266	AP		521
		SJT (50 to Kevin)	1.5	35	42			82
		Sawmill (LTB to 50)	1.85	35	64.75			127
10/24/2014	730	Pioneer (50 to City)	10.4	35	364	TR		713
		Black Bart and Barbara	2.5	35	87.5			171
		Elks Club (Pioneer to 50)	1.5	35	52.5			103
		LTB (NUT to Tahoe Mtn)	7.6	35	266			521
10/31/2014	730	Pioneer (50 to City)	10.4	35	364	BH		713
		Black Bart, Martin	2	35	70			137
		Barbara	0.05	35	1.75			3
		NUT (LTB to 50)	1	35	35			69
		LTB (City to Tahoe Mtn)	7.6	35	266			521
10/31/2014	730	LTB (City to NUT)	2.5	35	87.5	BH		171

Part 4
Future Projects, Observations and Recommendations

Ugh

		Pollutant Load (lb/yr)										
Project Area	TMDL UPC	TSS	FSP	TP	SRP	TN	DIN	lbs FSP Reduced	Credits	Baseline Load	% of Baseline Reduced
Angora	1	19,506	10,333	57	9	200	31	1,887	9	12,220	15%
Christmas Valley	2	9,358	5,043	29	8	125	14	12,910	65	17,956	72%
Apalachee	3	49,219	28,752	128	19	564	69	22,309	112	44,469	50%
Montgomery Estates	4	12,881	7,212	35	5	156	19	4,938	25	18,832	26%
Echo View / Sawmill	5	17,373	11,896	33	4	112	14	8,127	41	20,023	41%
Total		108,337	63,236	282	45	1,317	148	50,261	251	113,500	
	Summary	Pollutant Load (kg)							Credits		
	Achieved	49,141	28,683	128	20	552	67	22,798	251		
	Required			73		327		19,958	229		
	% Attainment			176%		169%		114%	114%		

Are expected pollutant reductions being achieved?

Lake Clarity Crediting Program

Implementation Tools
- **Pollutant Load Reduction Model**
- **Operations and Maintenance RAM**
- **Roadway Conditions RAM**

TMDL Accounting and Tracking System

Road RAM

- The **Road Rapid Assessment Methodology (Road RAM)** is a set of quick and simple field observations that, when
- coupled with its complimentary web-based data management tool, assists Tahoe Basin natural resource managers
- in determining **road condition1** with respect to the downslope water quality risk. RAM field observations are based
- on scientific and engineering analysis, informed by rigorous monitoring and sampling across Tahoe Basin roads and
- correlated to the concentration of fine sediment particles (FSP; particles <16µm in diameter) generated from a
- road segment. Results of the Road RAM help inform maintenance needs, track condition over time and convey
- progress towards meeting stormwater program goals.

Road RAM

- **Road RAM STEP 2** – Create INVENTORY of road attributes
- The user creates a spatial **inventory** of the roads within the STEP 1 area of interest using an existing road GIS layer.
- Depending on the user's analysis goals, the roads can be categorized based on a variety of **road attributes** that are
- expected to vary across the area of interest. Typical attributes in Tahoe Basin include **PLRM road risk, road**
- **shoulder condition, road surface integrity, road shoulder connectivity**, etc. The product of Road RAM STEP 2 is
- one or more GIS layers of the road attributes within the area of interest defined in STEP 1.

Pollutant Load Reduction Model and Rapid Assessment Methods

Provide a consistent method to estimate pollutant load reductions

Provide a consistent method to assess stormwater facility maintenance needs

Provide a consistent method to assess roadway conditions/pollutant potential

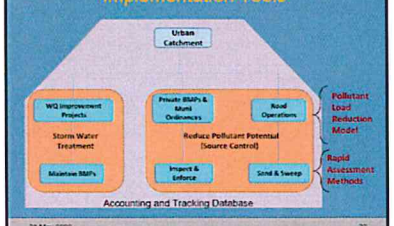
Road RAM

- **Road RAM STEP # Road RAM STEP Name**
- **1** Define AREA of interest
- **2** Create INVENTORY of road attributes
- **3** CLASSIFY roads
- **4A** - Select ROAD SEGMENTS
- **4B** - Conduct FIELD OBSERVATIONS
- **5** Obtain Road RAM SCORE
- **6** ANALYZE results

Road RAM

- **Road RAM STEP 3** – CLASSIFY roads
- Road RAM STEP 3 is the grouping of roads within the area of interest by similar road maintenance practices as
- conducted by the local jurisdiction. Road maintenance practices must be consistently defined by the **abrasive**
- **application priority, sweeping effectiveness**, and any other pollutant control practices that are expected to have a
- significant effect on the resulting road condition. Abrasive application priority and sweeping effectiveness are the
- most likely priority pollutant sources and sinks that influence ongoing road maintenance practices, but
- jurisdictions have flexibility to define the combined road maintenance practices for each class. Road RAM STEP 3
- product is a road class map which categorizes all roads into one of 9 potential road classes and used to by Road
- RAM to spatially extrapolate discrete field observations to the network defined in STEP 1.

Lake Clarity Crediting Program & Implementation Tools



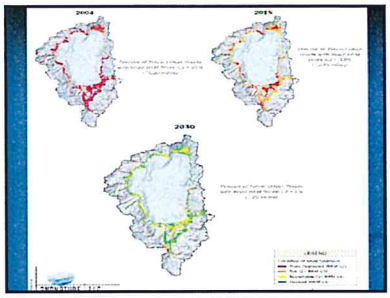
- **Road RAM STEP 1** – Define AREA of interest
- Users define the spatial area of interest within which to complete the Road RAM. This could include a single
- catchment, an entire jurisdiction, or any other area as defined by the user. The product of Road RAM STEP 1 is the
- delineation of the area of interest and each user may have multiple areas defined within the Road RAM tool.
- Ideally, the boundaries of areas do not have overlap. Jurisdictions will want to use the same catchment boundaries
- as registered with the Crediting Program.

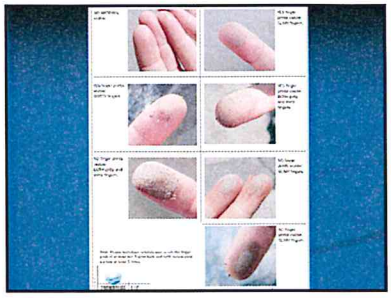
Road RAM

- **Road RAM STEP 4** – Select ROAD SEGMENTS (4A) and Conduct FIELD OBSERVATIONS (4B)
- The evaluation and tracking of Road RAM scores on roads is based on a set of standardized, repeatable and rapid
- **field observations** conducted on a series of road segments. Road segments are 100/0012 locations selected by the
- user based on road class and are chosen prior to going into the field. Road RAM field observations take two trained
- field personnel approximately 10 minutes per road segment and include both visual observations and
- measurements that are proxies to predict the FSP concentration of the road segment. Typically a user conducts
- field observations on multiple road segments over 3-5 days, terms of an **observation period**
- STEP 4 can be
- repeated as frequently as desired and results in discrete records of actual observed road conditions that are
- tracked over time. Standardized user data entry forms facilitate consistent data input into the database. Figure
- E3-1 illustrates how a road segment is a spatially discrete point within a road network of interest.

Road RAM

- **Road RAM STEP 5** – Obtain Road RAM SCORE
- After entering field observation data into the database, the resulting RAM score is used to express road condition
- using a continuous 0-5 scale where 0 indicates poor road condition and a high risk to downslope water quality, and
- 5 is the best possible condition with minimal immediate water quality risk downslope (Table ES.2). The field
- observation data is used to calculate road segment scores that can be spatially extrapolated by road class to obtain
- Road RAM scores for all roads within the area of interest (see Figure ES.1). Road RAM results are displayed
- spatially using a color gradation from red to green for simple communication of actual conditions.

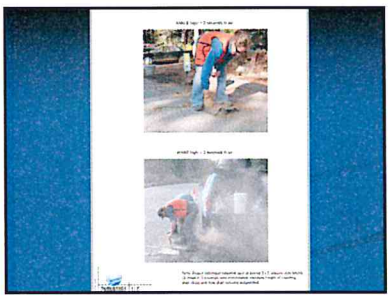




Road RAM

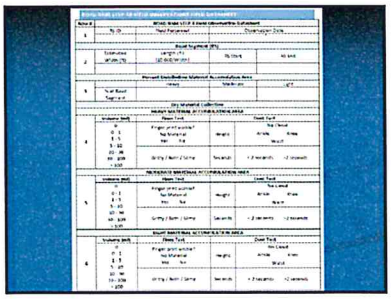
Road RAM Score	Condition	PSP Concentration (mg/L) range	Description
0 - 1.0	Poor	3,542-680	• Significant potential risk to downslope water quality should runoff event occur • Road maintenance practices require immediate improvements • Capital improvement projects downslope may need to be considered to capture mud generated pollutants
>1.0 - 2.0	Degraded	679-194	• Likely potential risk to downslope water quality • Road maintenance practices require immediate improvements • Capital improvement projects downslope may need to be considered to capture mud generated pollutants
>2.0 - 3.9	Fair	190-124	• Road condition is closer to degraded than desired, may pose downstream water quality risk • Road maintenance should be prioritized as needed if time and resources permit
>3.0 - 4.9	Acceptable	123-52	• No immediate risk to downslope water quality should runoff event occur • Minimal need to improve road maintenance practices
>4.9 - 5.0	Desired	52-25	• Maximum achievable road condition • No need to improve road maintenance practices

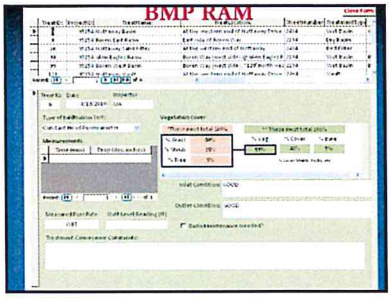
Road RAM STEP #	Road RAM STEP Name	GIS Analysis[1]	Online Database[2]	Frequency of STEP completion	Likely Users[3]
1	Define AREA of interest	Edit Export	Download Data Upload Data View Map	2-5 years	UJ
2	Create INVENTORY of road attributes	Copy Edit Split/Merge	Download Data	2-5 years	UJ
3	CLASSIFY roads	Copy Split/Merge Intersect Clip Export	Upload Data View Map View Query	2-5 years	UJ
4A	Select ROAD SEGMENTS	Edit Spatial Join Export	Download Data Upload Data View Map View Query	2-5 years	All
4B	Conduct FIELD OBSERVATIONS	n/a	Enter Data	Seasonally	All
5	Obtain Road RAM SCORE	n/a	View Map View Query	Seasonally	All
6	ANALYZE results	n/a	View Map View Query	Seasonally	All

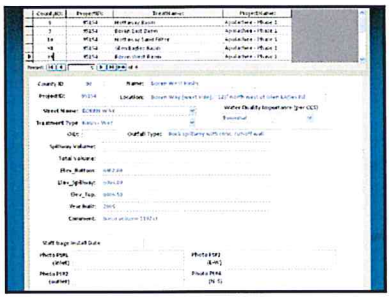


Road RAM

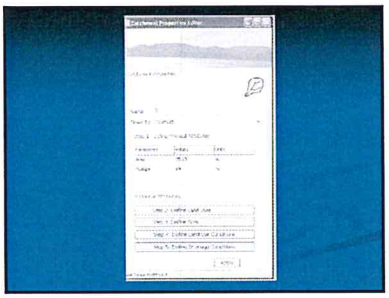
- **Road RAM STEP 6** – ANALYZE results
- The Road RAM tool establishes a standardized methodology for evaluating the road condition and can be used to
- track and inform changes in road condition over time (Figure ES.2). These changes can be used to prioritize future
- water quality improvement actions, improve the scientific basis for numerous Tahoe stormwater tools, evaluate
- the performance of various road maintenance practices, and address other gaps in our knowledge of pollutant
- generation and transport from this priority land use. Moreover, Road RAM results can be used to document actual
- annual road conditions and verify the expected conditions used in other Tahoe stormwater tools.

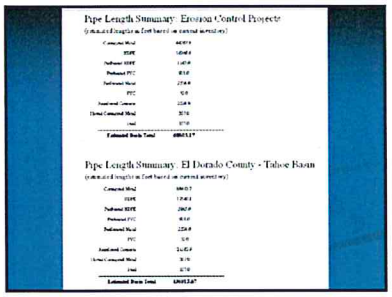


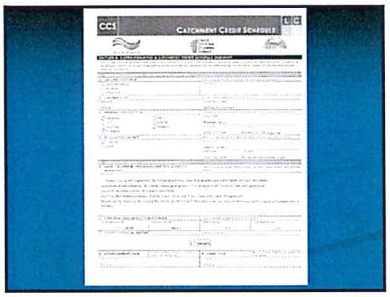


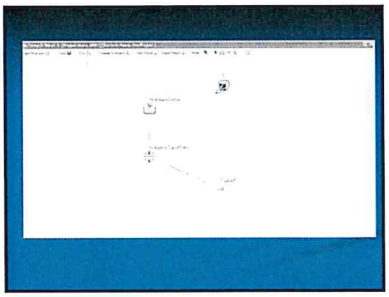


Catchment Credit Schedule



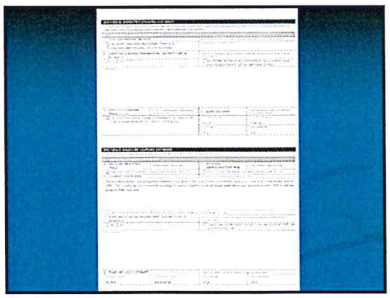


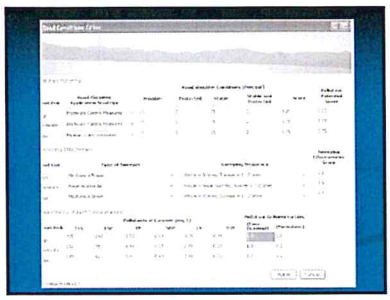


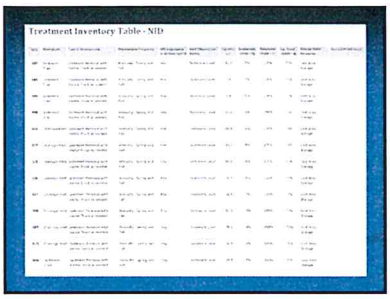


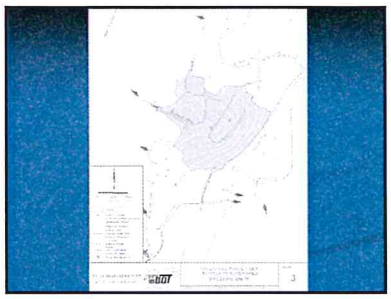
PLRM

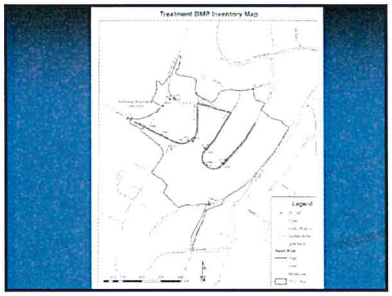
- The Pollutant Load Reduction Model (PLRM) is intended to be used for evaluating and comparing pollutant load reduction alternatives for storm water quality improvement projects in the Tahoe Basin. The PLRM uses publicly available software and source code to provide users with complete access to the tools developed. The PLRM is intended to be practical for application by users possessing a basic understanding of hydrology, water quality, and water resources modeling.





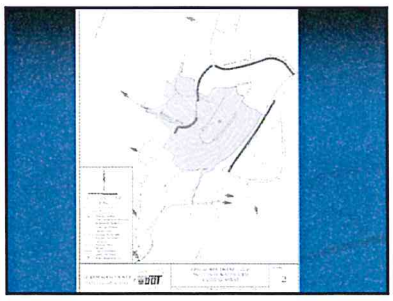






Tahoe Integrated SW Tool

Discuss



Questions & Discussion

THANKS!

Appendix I

National Pollutant Discharge Elimination System
Program Overview

Storm water from urban runoff is one of the leading causes of pollution in creeks, rivers and lakes. In developed areas, rainwater often travels over paved areas, into gutters and ditches, and through concrete storm drains. Everything that flows into a storm drain without best management practices (BMPs) goes untreated directly into our creeks, rivers, lakes, delta and eventually, the ocean.

Storm water can become polluted by pesticides, paint, fertilizers, pet waste, litter, oil and other automotive fluids, eroded soil and household chemicals. Even small amounts of pollutants that accumulate on roads, parking lots, and sidewalks can be transported into nearby streams and rivers. Identifying sources of storm water pollution and keeping this pollution away from storm drains and ditches is the best and most economical way to keep storm water clean.

NPDES Requirements

Storm water pollution is controlled by the Clean Water Act amendments of 1987. The amendments authorized the U.S. Environmental Protection Agency to expand the National Pollutant Discharge Elimination System (NPDES) to cover storm water discharges. The NPDES is a permitting mechanism that requires the implementation of controls designed to prevent harmful pollutants from being washed by storm water runoff into local water bodies.

Both the Tahoe and West Slope portions of the County are facing increased NPDES requirements which come with more restrictions and with limited funding sources. In 2012, the County staff successfully negotiated the Municipal NPDES Permit with the Lahontan Water Board. This resulted in reduced permit costs and requirements, and extended deliverable dates.

On the West Slope, a Phase II "MS4" Permit was adopted by the State Water Resources Control Board (SWRCB) on February 5, 2013. The permit includes a significant ramp-up in the Clean Water Act's six minimum control measure requirements.

NPDES Costs

Currently the Tahoe NPDES Program and the West Slope NPDES Program are funded by the General Fund and Public Utility Franchise Fees in a 50/50 split. Possible additional funding options include the Road Fund, storm water utility fees, State and Federal grants, public/private partnerships, and increased contributions from the County General Fund or Public Utility Franchise Fees.

The Tahoe Engineering Division is currently spending approximately $2,000,000 per year in grant funds on the Environmental Improvement Program (EIP) in the Tahoe Basin. The Tahoe EIP projects help the County achieve the Total Maximum Daily Load (TMDL) as defined within the NPDES requirements.

To date, the County has been looking for win-win opportunities to secure grant funds to comply with its NPDES requirements. Failure to comply with NPDES permit requirements

can result in notices of violation, clean up and abatement orders, and related monetary penalties.

West Slope Program Cost Estimate

The West Slope "MS4" Permit includes nine program elements:

- E.6 Program Management Element
- E.7 Public Outreach and Education Program
- E.8 Public Involvement and Participation Program
- E.9 Illicit Discharge Detection and Elimination Program
- E.10 Construction Site Storm Water Runoff Control Program - Pollution Prevention/Good Housekeeping for Permittee
- E.11 Operations Program
- E.12 Post Construction Storm Water Management Program
- E.13 Water Quality Monitoring
- E.14 Program Effectiveness Assessment
- E.15 Total Maximum Daily Loads Compliance Requirements

The annual costs of the Phase II MS4 permit are expected to average $410,000. Estimates of West Slope program costs are summarized in Table 1-8.

Table 1-8: West Slope MS4 Permit Cost Estimates

COST BY YEAR					
YEAR	**2013 -14**	**2014 -15**	**2015 -16**	**2016 -17**	**2017 -18**
Base Costs	388,200	388,200	388,200	388,200	388,200
One Time Costs	13,100	52,500	26,900	-	11,900
Total Cost	**401,300**	**440,700**	**415,100**	**388,200**	**400,100**
Est Population	180,938	181,843	182,752	183,666	184,584
Cost per resident	2	2	2	2	2
Cost per household	6	6	6	5	6

Cost estimates are comprised of staff costs and other costs, which include consultants, equipment, lab tests, etc.

Tahoe Program Cost Estimate

The annual cost of the Tahoe NPDES permit is expected to average $435,000. Annual cost estimates are outlined in Table 1-9 below. The Tahoe NPDES permit includes the Monitoring and Reporting Program (MRP), which is Attachment C of the permit.

Table 1-9: Tahoe NPDES Cost Estimates

COST BY YEAR					
YEAR	**2011 -12**	**2012 -13**	**2013 -14**	**2014 -15**	**2015 -16**
Base Costs	$390,000	$390,000	$390,000	$390,000	$390,000
One Time Costs	$55,000	$30,000	$50,000	$30,000	$65,000
Total Cost	**$ 445,000**	**$ 420,000**	**$ 440,000**	**$ 420,000**	**$ 455,000**

Cost estimates are comprised of staff costs and other costs, which include consultants, equipment, lab tests, etc.

Recommended Budget Highlights for CDA—Transportation Division (cont)

The use of Road Fund - fund balance for the recommended budget is increasing by $602,529 or 10% compared to the approved FY 2014-15 budget. This increase is related to the CIP program ($240,914) and additional various operational increases for the Transportation Division ($361,615). The use of Fund Balance is a one-time revenue source and the division will need to identify new revenues or sustainable savings to fund operations in the long term. Long-term financial health of the Road Fund appears to be a concern in the near future unless significant changes are made within the Division. Gas Tax revenue has declined significantly and long-term solutions are needed to structurally balance the Road Fund.

Road Fund Operations

Road Fund Operations includes the Maintenance Division, Transportation Planning and Land Development, and Engineering functions. The Recommended Budget includes a decrease in revenues of $1,321,943 and a decrease in appropriations of $733,196 when compared to the current year approved budget. The reduction in revenue is primarily attributable to a reduction in the allocation of Local Tribe Funding contributions that will only be partially re-budgeted in FY 2015-16 per Board direction on March 31, 2015 ($1.25M for Road Maintenance activities; $1.25 to be "saved" for the Diamond Springs Parkway project). This amount is down from the $2.5M allocated to the Road Maintenance program in the FY 2014-15 approved budget. Additionally, Highway Users Tax/Gas Tax is being reduced ($1.4M) partially offset with an increase in Regional Surface Transportation Program (RSTP) from the State ($273K).

Appropriations are reduced primarily related to salary savings ($102K), reduced services and supplies ($914K) related to less road maintenance contracted work, and fixed asset reductions ($458K). Large items on the Capital Asset purchase list include a Thermoplastic hot Pot and Cart, Rotary Snow Plow (carryover), Road Paint Striper Truck (carryover), Dump Truck with Hook Loader, Pull Broom and Falcon Asphalt Hot-Box Recycler with 4-foot trailer.

There is no General Fund contribution to the road fund included in the Recommended Budget which represents a decrease of $500K from FY 2014-15. This reduction is consistent with the Board direction to reduce the overall General Fund budget.

Within the General Fund, Public Utility Franchise Fees are utilized to fund half of the NPDES program as well as Road Maintenance activities. It is important to note that the Public Utility Franchise Fees (PUFF) are a discretionary source of revenue and can be spent on any County function. The table below summarizes the recommended use of these funds in FY 2015-16, and represent a $69,000 or 6.9% increase in total PUFF revenue.

Public Utility Franchise Fees	Amount
50% of NPDES program (now in LRP)	$458,391
Road Maintenance	$606,609
Total	$1,065,000

Recommended Budget Highlights for CDA—Transportation Division (cont)

Road Fund Capital Improvement Program (CIP)

The Recommended Budget for the Road Fund Capital Improvement Program (CIP) represents a decrease of $18,833,835 in revenues and appropriations when compared to the FY 2014-15 approved budget. This budget fluctuates depending on the Board approved CIP, as well as with the availability of funding. Funding and appropriations are consistent with the Proposed 2015 CIP and is based on a per project basis.

Example of Major projects scheduled for construction during FY 2015-16 include:

- U.S. 50/Missouri Flat Road Interchange Improvements - Phase 1B.2
- U.S. 50/Silva Valley Road Parkway Interchange – Phase 1
- Gold Hill Road Overlay
- Silva Valley/Serrano Parkway Traffic Circulation Improvement Project
- Ice House Road Surface Rehabilitation
- Tahoe Basin Overlays (Black Bart Avenue, Barbara Avenue and Martin Avenue)
- Class II Bikeway on Green Valley Road
- Hollow Oak Drainage Improvements
- Cold Springs Road Realignment
- Salmon Falls Road at Glenesk Lane – Realignment
- Green Valley Road at Weber Creek – Bridge Replacement
- Pleasant Valley Road at Oak Hill Road Intersection Improvements

Erosion Control Program

The Tahoe Environmental Improvement Program (EIP) is included in the division's Proposed 2015 CIP program and the budget is being submitted consistent with that document. The Recommended Budget represents a decrease of $159,798 in revenues and appropriations when compared to the FY 2014-15 approved budget. This budget fluctuates depending on the Board approved CIP, as well as with the availability of funding. The Tahoe program is funded through available grant funds primarily USFS, CMAQ, CTC, and TRPA mitigation funds. There is no cost to the General Fund for this program.

Projects scheduled for construction include:

- Tahoe Hills Erosion Control Project
- Montgomery Estates Area 3 Erosion Control Project
- Lake Tahoe Boulevard Erosion Control Project
- Sawmill 2B Bike Path and Erosion Control Project

Tahoe Environmental Improvement Program Current Year Projects

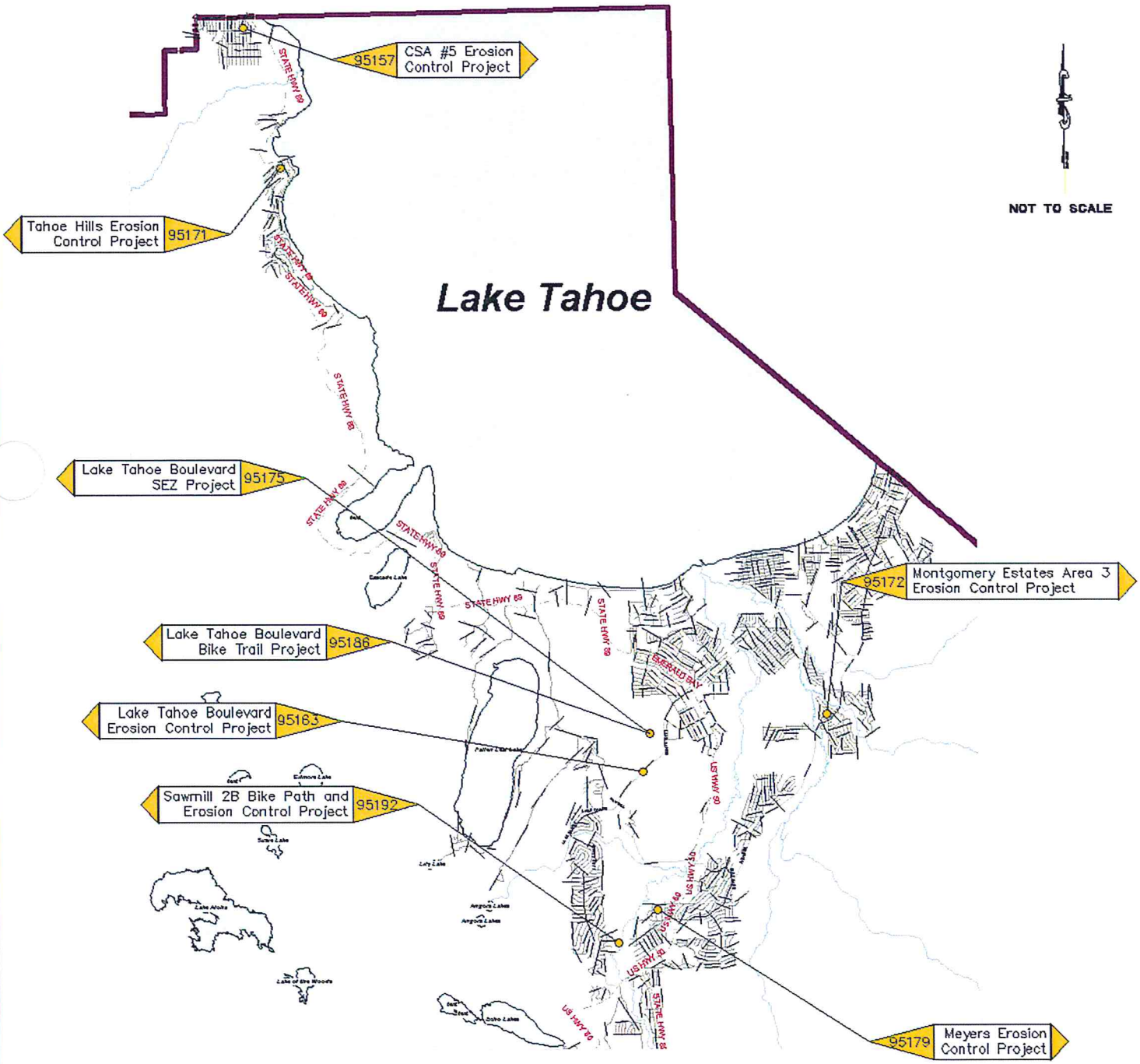
Index by Project Name

Project Number	Project Name	Page #
Section 8.2 - Tahoe EIP Current Year Projects		
73120	Apache Avenue/US 50 Intersection Signalization	2
95153	Boulder Mountain Erosion Control Project	4
95190	Christmas Valley Phase 2C Erosion Control Project	8
95191	Country Club Heights Erosion Control Project	12
95196	CSA # 5 Upper Area Erosion Control Project	14
95157	CSA #5 Erosion Control Project	16
95195	Forest View Water Quality Project	18
95176	Golden Bear Erosion Control Project	22
95708	Highway 89 Class 1 Trail	24
95186	Lake Tahoe Boulevard Bike Trail Project	26
95163	Lake Tahoe Boulevard Erosion Control Project	28
95175	Lake Tahoe Boulevard SEZ Project	30
95179	Meyers Erosion Control Project	32
95170	Montgomery Estates Area 2 Erosion Control Project	34
95172	Montgomery Estates Area 3 Erosion Control Project	36
95177	Oflyng Erosion Control Project	40
95192	Sawmill 2B Bike Path and Erosion Control Project	44
95171	Tahoe Hills Erosion Control Project	48

Figure 4-2

SOUTH LAKE TAHOE CURRENT YEAR EIP

PROJECTS CURRENTLY IN CONSTRUCTION OR TO BEGIN IN FY 15/16



Tahoe Environmental Improvement Program Five-Year Projects

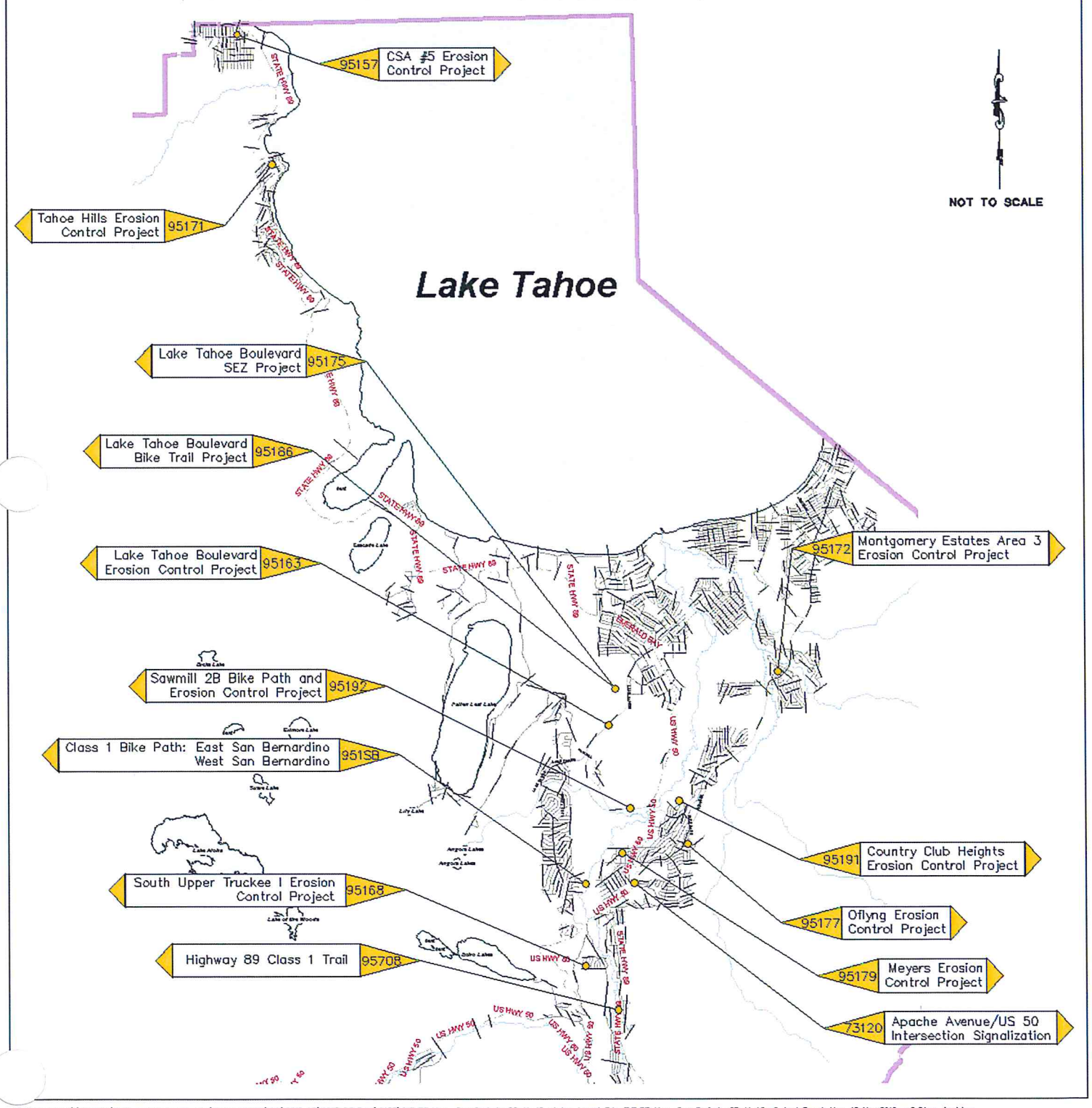
Index by Project Name

Project Number	Project Name	Page #
Section 8.2 - Tahoe EIP Five-Year Projects		
73120	Apache Avenue/US 50 Intersection Signalization	2
95153	Boulder Mountain Erosion Control Project	4
95174	Chiapa Erosion Control Project	6
95190	Christmas Valley Phase 2C Erosion Control Project	8
951SB	Class 1 Bike Path: East San Bernardino - West San Bernardino	10
95191	Country Club Heights Erosion Control Project	12
95196	CSA # 5 Upper Area Erosion Control Project	14
95157	CSA #5 Erosion Control Project	16
95195	Forest View Water Quality Project	18
95180	Glenridge Erosion Control Project	20
95176	Golden Bear Erosion Control Project	22
95708	Highway 89 Class 1 Trail	24
95186	Lake Tahoe Boulevard Bike Trail Project	26
95163	Lake Tahoe Boulevard Erosion Control Project	28
95175	Lake Tahoe Boulevard SEZ Project	30
95179	Meyers Erosion Control Project	32
95170	Montgomery Estates Area 2 Erosion Control Project	34
95172	Montgomery Estates Area 3 Erosion Control Project	36
95166	North Upper Truckee SEZ Restoration Project	38
95177	Oflyng Erosion Control Project	40
95838	Passenger Facility	42
95192	Sawmill 2B Bike Path and Erosion Control Project	44
95168	South Upper Truckee I Erosion Control Project	46
95171	Tahoe Hills Erosion Control Project	48

Figure 5-2

SOUTH LAKE TAHOE 5-YEAR EIP

PROJECTS IN CONSTRUCTION BETWEEN FY 15/16 AND 19/20



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Community Development Agency Management Reports

Services and Supplies Posted Through: 7/1/2014 - 8/14/2015 (11 % of Year)

Labor Posted Through: 6/30/2015

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
13000	**Shop - Direct Vehicle Repair**				
Expenditures					
9000	Standard Regular Labor	$0	$8,354	0%	($8,354)
9004	Standard Indirect	$0	$1,653	0%	($1,653)
9005	Standard Equipment	$0	$39	0%	($39)
	Total Expenditures	**$0**	**$10,045**		**($10,045)**
	Summary of Revenues less Expenditures for Project #13000	**$0**	**($10,045)**		**($10,045)**
21800	**Administration-Community Development Agency**				
Expenditures					
9000	Standard Regular Labor	$0	$2,357	0%	($2,357)
	Total Expenditures	**$0**	**$2,357**		**($2,357)**
	Summary of Revenues less Expenditures for Project #21800	**$0**	**($2,357)**		**($2,357)**
22001	**Maintenance - Shop - Job Training**				
Expenditures					
9000	Standard Regular Labor	$0	$1,639	0%	($1,639)
	Total Expenditures	**$0**	**$1,639**		**($1,639)**
	Summary of Revenues less Expenditures for Project #22001	**$0**	**($1,639)**		**($1,639)**
22320	**Maintenance - Tahoe Road Maintenance Indirect Charges**				
Revenues					
0000	Discretionary	$274,101	$0	0%	$274,101
	Total Revenues	**$274,101**	**$0**		**$274,101**
Expenditures					
4020	Clothing & Personal Supplies	$2,500	$2,950	118%	($450)
4080	Household Expense	$0	$154	0%	($154)
4085	Refuse Disposal	$4,000	$6,163	154%	($2,163)
4086	Janitorial / Custodial Services	$7,621	$6,525	86%	$1,096
4145	Maint: Equipment Parts	$20,000	$2,275	11%	$17,725
4197	Maintenance - Building Supplies	$1,000	$14	1%	$986
4334	Fire Prevention & Inspection	$500	$0	0%	$500
4420	Rent & Lease: Equipment	$600	$570	95%	$30
4460	Equip: Small Tools & Instruments	$1,500	$795	53%	$705
4461	Equip: Minor	$1,000	$1,573	157%	($573)
4463	Equip: Telephone & Radio	$0	$753	0%	($753)
4500	Special Dept Expense	$2,000	$13,238	662%	($11,238)
4503	Staff Development	$1,000	$290	29%	$710
4507	Fire & Safety Supplies	$1,000	$754	75%	$246
4562	Road: Marking Supplies	$0	$199	0%	($199)
4571	Road: Signs	$0	$347	0%	($347)

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
22320	**Maintenance - Tahoe Road Maintenance Indirect Charges**				
4600	Transportation & Travel	$0	$608	0%	($608)
4605	Rent & Lease: Vehicle	$0	$160	0%	($160)
4606	Fuel Purchases	$4,000	$25	1%	$3,975
4620	Utilities	$10,000	$9,699	97%	$301
5300	Interfnd: Service Between Fund Types	$0	$25	0%	($25)
9000	Standard Regular Labor	$217,380	$238,987	110%	($21,607)
9002	Standard Temporary Labor	$0	$455	0%	($455)
9005	Standard Equipment	$0	$14,966	0%	($14,966)
	Total Expenditures	**$274,101**	**$301,525**		**($27,424)**
	Summary of Revenues less Expenditures for Project #22320	**$0**	**($301,525)**		**($301,525)**
22510	**Maintenance - Shop Operations West Slope**				
Expenditures					
9000	Standard Regular Labor	$0	$202	0%	($202)
	Total Expenditures	**$0**	**$202**		**($202)**
	Summary of Revenues less Expenditures for Project #22510	**$0**	**($202)**		**($202)**
22520	**Maintenance - Shop Operations Tahoe Basin**				
Expenditures					
4620	Utilities	$0	$0	0%	$0
9000	Standard Regular Labor	$0	$9,276	0%	($9,276)
9005	Standard Equipment	$0	$21	0%	($21)
	Total Expenditures	**$0**	**$9,297**		**($9,297)**
	Summary of Revenues less Expenditures for Project #22520	**$0**	**($9,297)**		**($9,297)**
25000	**General Department**				
Expenditures					
4080	Household Expense	$0	$0	0%	$0
	Total Expenditures	**$0**	**$0**		**$0**
	Summary of Revenues less Expenditures for Project #25000	**$0**	**$0**		**$0**
25004	**Union Activities - Meet and Confer/Grievances**				
Expenditures					
9000	Standard Regular Labor	$0	$256	0%	($256)
9005	Standard Equipment	$0	$35	0%	($35)
	Total Expenditures	**$0**	**$291**		**($291)**
	Summary of Revenues less Expenditures for Project #25004	**$0**	**($291)**		**($291)**

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
25009	**Drug & Alcohol Testing/Maintenance**				
Revenues					
0000	Discretionary	$1,000	$0	0%	$1,000
	Total Revenues	**$1,000**	**$0**		**$1,000**
Expenditures					
4324	Medical, Dental & Lab Services	$1,000	$1,250	125%	($250)
	Total Expenditures	**$1,000**	**$1,250**		**($250)**
	Summary of Revenues less Expenditures for Project #25009	**$0**	**($1,250)**		**($1,250)**
35000	**Services Support - Operating**				
Revenues					
0000	Discretionary	$1	$0	0%	$1
	Total Revenues	**$1**	**$0**		**$1**
Expenditures					
9000	Standard Regular Labor	$1	$0	0%	$1
	Total Expenditures	**$1**	**$0**		**$1**
	Summary of Revenues less Expenditures for Project #35000	**$0**	**$0**		**$0**
46101	**Chip Seal - Tahoe Basin**				
Revenues					
0000	Discretionary	$540,289	$0	0%	$540,289
0001	Use of Fund Balance	($675)	$0	0%	($675)
0746	ST: Rstp 182.6h Rgnl Surface Tran Plan	$37,255	$0	0%	$37,255
	Total Revenues	**$576,869**	**$0**		**$576,869**
Expenditures					
4500	Special Dept Expense	$1,000	$0	0%	$1,000
4565	Road: Chips	$82,000	$0	0%	$82,000
4570	Road: Emulsion	$304,325	$0	0%	$304,325
9000	Standard Regular Labor	$96,347	$2,473	3%	$93,874
9004	Standard Indirect	$28,595	$489	2%	$28,106
9005	Standard Equipment	$64,602	$1,111	2%	$63,492
	Total Expenditures	**$576,869**	**$4,072**		**$572,797**
	Summary of Revenues less Expenditures for Project #46101	**$0**	**($4,072)**		**($4,072)**
48102	**Routine Maintenance - Asphalt Patching**				
Revenues					
0000	Discretionary	$730,621	$0	0%	$730,621

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
48102	**Routine Maintenance - Asphalt Patching**				
0746	ST: Rstp 182.6h Rgnl Surface Tran Plan	$0	$37,255	0%	($37,255)
	Total Revenues	**$730,621**	**$37,255**		**$693,366**
Expenditures					
4085	Refuse Disposal	$0	$511	0%	($511)
4162	Veh Maint: Supplies	$0	$56	0%	($56)
4300	Professional & Specialized Services	$0	$20,966	0%	($20,966)
4420	Rent & Lease: Equipment	$7,400	$8,616	116%	($1,216)
4460	Equip: Small Tools & Instruments	$0	$26	0%	($26)
4500	Special Dept Expense	$3,000	$16	1%	$2,984
4566	Road: Plant Mix	$180,000	$285,356	159%	($105,356)
4567	Road: Ab Rock	$0	$593	0%	($593)
4570	Road: Emulsion	($11,000)	$5,297	-48%	($16,297)
4590	Road: Hauling Plant Mix	$10,000	$20,847	208%	($10,847)
4591	Road: Hauling Ab Rock	$0	$830	0%	($830)
4606	Fuel Purchases	$0	$2,642	0%	($2,642)
9000	Standard Regular Labor	$325,749	$427,986	131%	($102,237)
9002	Standard Temporary Labor	$0	$1,489	0%	($1,489)
9004	Standard Indirect	$81,460	$84,995	104%	($3,535)
9005	Standard Equipment	$134,012	$172,036	128%	($38,024)
	Total Expenditures	**$730,621**	**$1,032,263**		**($301,642)**
	Summary of Revenues less Expenditures for Project #48102	**$0**	**($995,008)**		**($995,008)**
48104	**Routine Maintenance - Crack Seals**				
Revenues					
0000	Discretionary	$90,198	$0	0%	$90,198
	Total Revenues	**$90,198**	**$0**		**$90,198**
Expenditures					
4085	Refuse Disposal	$0	$7	0%	($7)
9000	Standard Regular Labor	$55,116	$119,630	217%	($64,514)
9002	Standard Temporary Labor	$0	$10,919	0%	($10,919)
9004	Standard Indirect	$13,783	$25,836	187%	($12,053)
9005	Standard Equipment	$21,299	$32,275	152%	($10,976)
	Total Expenditures	**$90,198**	**$188,666**		**($98,468)**
	Summary of Revenues less Expenditures for Project #48104	**$0**	**($188,666)**		**($188,666)**
48107	**Routine Maintenance - Brush and Weed**				
Revenues					
0000	Discretionary	$138,783	$0	0%	$138,783
	Total Revenues	**$138,783**	**$0**		**$138,783**

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining

306232 MAINTENANCE - TAHOE ROAD

48107 Routine Maintenance - Brush and Weed

Expenditures

4085	Refuse Disposal	$4,000	$2,773	69%	$1,227
4145	Maint: Equipment Parts	$0	$75	0%	($75)
4197	Maintenance - Building Supplies	$0	$0	0%	$0
4500	Special Dept Expense	$0	$23	0%	($23)
9000	Standard Regular Labor	$81,077	$110,269	136%	($29,192)
9002	Standard Temporary Labor	$0	$8,789	0%	($8,789)
9004	Standard Indirect	$20,275	$23,562	116%	($3,287)
9005	Standard Equipment	$33,431	$39,877	119%	($6,446)
	Total Expenditures	**$138,783**	**$185,368**		**($46,585)**
	Summary of Revenues less Expenditures for Project #48107	**$0**	**($185,368)**		**($185,368)**

48108 Routine Maintenance - Road Side Ditching

Revenues

0000	Discretionary	$13,658	$0	0%	$13,658
	Total Revenues	**$13,658**	**$0**		**$13,658**

Expenditures

4085	Refuse Disposal	$4,000	$2,486	62%	$1,514
4300	Professional & Specialized Services	$0	$0	0%	$0
4500	Special Dept Expense	$500	$0	0%	$500
4567	Road: Ab Rock	$1,000	$829	83%	$171
9000	Standard Regular Labor	$4,473	$15,280	342%	($10,807)
9002	Standard Temporary Labor	$0	$372	0%	($372)
9004	Standard Indirect	$1,119	$3,098	277%	($1,979)
9005	Standard Equipment	$2,566	$8,427	328%	($5,861)
	Total Expenditures	**$13,658**	**$30,492**		**($16,834)**
	Summary of Revenues less Expenditures for Project #48108	**$0**	**($30,492)**		**($30,492)**

48110 Routine Maintenance - Sweeping

Revenues

0000	Discretionary	$210,717	$0	0%	$210,717
	Total Revenues	**$210,717**	**$0**		**$210,717**

Expenditures

4085	Refuse Disposal	$12,000	$18,782	157%	($6,782)
4500	Special Dept Expense	$0	$4	0%	($4)
9000	Standard Regular Labor	$79,066	$138,565	175%	($59,499)
9002	Standard Temporary Labor	$0	$4,601	0%	($4,601)
9004	Standard Indirect	$19,772	$28,333	143%	($8,561)
9005	Standard Equipment	$99,879	$123,427	124%	($23,548)

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
48110	**Routine Maintenance - Sweeping**				
	Total Expenditures	**$210,717**	**$313,712**		**($102,995)**
	Summary of Revenues less Expenditures for Project #48110	**$0**	**($313,712)**		**($313,712)**
48111	**Routine Maintenance - Clean and Repair Culvert**				
Revenues					
0000	Discretionary	$380,560	$0	0%	$380,560
	Total Revenues	**$380,560**	**$0**		**$380,560**
Expenditures					
4085	Refuse Disposal	$4,000	$5,756	144%	($1,756)
4300	Professional & Specialized Services	$0	$116	0%	($116)
4303	Road Maint & Construction	$0	($1,018)	0%	$1,018
4500	Special Dept Expense	$5,000	$41	1%	$4,959
4567	Road: Ab Rock	$1,500	$684	46%	$816
4569	Road: Culverts	$3,000	$2,625	88%	$375
9000	Standard Regular Labor	$216,391	$148,598	69%	$67,793
9002	Standard Temporary Labor	$0	$1,365	0%	($1,365
9004	Standard Indirect	$54,113	$29,678	55%	$24,435
9005	Standard Equipment	$96,556	$76,376	79%	$20,181
	Total Expenditures	**$380,560**	**$264,221**		**$116,339**
	Summary of Revenues less Expenditures for Project #48111	**$0**	**($264,221)**		**($264,221)**
48112	**Rout Maint - Curb/Gutter/Sidewalk Repair**				
Expenditures					
4085	Refuse Disposal	$0	$104	0%	($104)
4197	Maintenance - Building Supplies	$0	$0	0%	$0
4300	Professional & Specialized Services	$0	$26	0%	($26)
4500	Special Dept Expense	$0	$261	0%	($261)
4566	Road: Plant Mix	$0	$677	0%	($677)
	Total Expenditures	**$0**	**$1,068**		**($1,068)**
	Summary of Revenues less Expenditures for Project #48112	**$0**	**($1,068)**		**($1,068)**
48119	**Building and Yard Maintenance**				
Revenues					
0000	Discretionary	$13,436	$0	0%	$13,436
	Total Revenues	**$13,436**	**$0**		**$13,436**
Expenditures					
4085	Refuse Disposal	$2,000	$17	1%	$1,983
4197	Maintenance - Building Supplies	$0	$61	0%	($61
4460	Equip: Small Tools & Instruments	$0	$0	0%	$0

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
48119	**Building and Yard Maintenance**				
4500	Special Dept Expense	$2,000	$20	1%	$1,980
4569	Road: Culverts	$0	$849	0%	($849)
9000	Standard Regular Labor	$6,290	$2,392	38%	$3,898
9004	Standard Indirect	$1,573	$473	30%	$1,100
9005	Standard Equipment	$1,573	$660	42%	$913
	Total Expenditures	**$13,436**	**$4,472**		**$8,964**
	Summary of Revenues less Expenditures for Project #48119	**$0**	**($4,472)**		**($4,472)**
48120	**Somerset Mine Maintenance**				
Expenditures					
9000	Standard Regular Labor	$0	$666	0%	($666)
9004	Standard Indirect	$0	$132	0%	($132)
9005	Standard Equipment	$0	$56	0%	($56)
	Total Expenditures	**$0**	**$854**		**($854)**
	Summary of Revenues less Expenditures for Project #48120	**$0**	**($854)**		**($854)**
122	**Routine Maintenance - Erosion Control**				
Expenditures					
4560	Road: Bridge Material	$0	$805	0%	($805)
9000	Standard Regular Labor	$0	$1,577	0%	($1,577)
9004	Standard Indirect	$0	$312	0%	($312)
9005	Standard Equipment	$0	$215	0%	($215)
	Total Expenditures	**$0**	**$2,909**		**($2,909)**
	Summary of Revenues less Expenditures for Project #48122	**$0**	**($2,909)**		**($2,909)**
48123	**Emergency Response**				
Revenues					
0000	Discretionary	$1,700	$0	0%	$1,700
	Total Revenues	**$1,700**	**$0**		**$1,700**
Expenditures					
9000	Standard Regular Labor	$1,118	$1,699	152%	($581)
9002	Standard Temporary Labor	$0	$176	0%	($176)
9004	Standard Indirect	$280	$371	133%	($91)
9005	Standard Equipment	$302	$795	263%	($493)
	Total Expenditures	**$1,700**	**$3,041**		**($1,341)**
	Summary of Revenues less Expenditures for Project #48123	**$0**	**($3,041)**		**($3,041)**

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
48128	**Hazard - Tree Removal**				
Revenues					
0000	Discretionary	$5,000	$0	0%	$5,000
	Total Revenues	**$5,000**	**$0**		**$5,000**
Expenditures					
4303	Road Maint & Construction	$5,000	$1,570	31%	$3,430
	Total Expenditures	**$5,000**	**$1,570**		**$3,430**
	Summary of Revenues less Expenditures for Project #48128	**$0**	**($1,570)**		**($1,570)**
48131	**Routine Maintenance - Sign Maintenance - Tahoe Basin**				
Expenditures					
9000	Standard Regular Labor	$0	$257	0%	($257)
9004	Standard Indirect	$0	$51	0%	($51)
	Total Expenditures	**$0**	**$308**		**($308)**
	Summary of Revenues less Expenditures for Project #48131	**$0**	**($308)**		**($308**
48132	**Routine Maintenance - Centerline Maintenance - Tahoe Basin**				
Expenditures					
9000	Standard Regular Labor	$0	$172	0%	($172)
9004	Standard Indirect	$0	$34	0%	($34)
	Total Expenditures	**$0**	**$206**		**($206)**
	Summary of Revenues less Expenditures for Project #48132	**$0**	**($206)**		**($206)**
48134	**Routine Maintenance - Fence, Guardrail, Barrier Repair - Tahoe Basin**				
Expenditures					
4085	Refuse Disposal	$0	$21	0%	($21)
4500	Special Dept Expense	$0	$1,085	0%	($1,085)
4561	Road: Guardrail	$0	$699	0%	($699)
9000	Standard Regular Labor	$0	$3,527	0%	($3,527)
9004	Standard Indirect	$0	$698	0%	($698)
9005	Standard Equipment	$0	$388	0%	($388)
	Total Expenditures	**$0**	**$6,418**		**($6,418)**
	Summary of Revenues less Expenditures for Project #48134	**$0**	**($6,418)**		**($6,418)**
49101	**Snow Removal/Tahoe Basin**				
Revenues					
0000	Discretionary	$1,976,806	$0	0%	$1,976,806
	Total Revenues	**$1,976,806**	**$0**		**$1,976,806**

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining

306232 MAINTENANCE - TAHOE ROAD

49101 Snow Removal/Tahoe Basin

Expenditures

4145	Maint: Equipment Parts	$0	$0	0%	$0
4162	Veh Maint: Supplies	$0	$0	0%	$0
4197	Maintenance - Building Supplies	$0	$0	0%	$0
4460	Equip: Small Tools & Instruments	$0	$79	0%	($79)
4500	Special Dept Expense	$61,500	$46,923	76%	$14,577
4574	Road: Salt & Sand - Snow Removal	$45,455	$18,878	42%	$26,577
9000	Standard Regular Labor	$651,802	$247,800	38%	$404,002
9001	Standard Overtime Labor	$70,928	$0	0%	$70,928
9002	Standard Temporary Labor	$155,129	$21,487	14%	$133,642
9004	Standard Indirect	$219,523	$53,292	24%	$166,231
9005	Standard Equipment	$772,469	$94,500	12%	$677,969
	Total Expenditures	**$1,976,806**	**$482,960**		**$1,493,846**
	Summary of Revenues less Expenditures for Project #49101	**$0**	**($482,960)**		**($482,960)**

49102 Snow Removal/West Shore (Tahoma)

Revenues

0000	Discretionary	$325,511	$0	0%	$325,511
	Total Revenues	**$325,511**	**$0**		**$325,511**

Expenditures

4044	Cable/Internet Service	$0	$246	0%	($246)
4086	Janitorial / Custodial Services	$0	$644	0%	($644)
4440	Rent & Lease: Building & Improvements	$7,500	$6,000	80%	$1,500
4460	Equip: Small Tools & Instruments	$0	$88	0%	($88)
4574	Road: Salt & Sand - Snow Removal	$4,545	$0	0%	$4,545
4620	Utilities	$0	$725	0%	($725)
9000	Standard Regular Labor	$142,584	$96,606	68%	$45,978
9001	Standard Overtime Labor	$14,318	$0	0%	$14,318
9002	Standard Temporary Labor	$10,000	$0	0%	$10,000
9004	Standard Indirect	$41,737	$19,119	46%	$22,618
9005	Standard Equipment	$104,827	$17,668	17%	$87,160
	Total Expenditures	**$325,511**	**$141,096**		**$184,415**
	Summary of Revenues less Expenditures for Project #49102	**$0**	**($141,096)**		**($141,096)**

49253 Tahoma Tahoe Storm Drain & Erosion control

Expenditures

9000	Standard Regular Labor	$0	$18,643	0%	($18,643)
9004	Standard Indirect	$0	$3,690	0%	($3,690)
9005	Standard Equipment	$0	$2,764	0%	($2,764)
	Total Expenditures	**$0**	**$25,097**		**($25,097)**
	Summary of Revenues less Expenditures for Project #49253	**$0**	**($25,097)**		**($25,097)**

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
49269	**Maintenance - Erosion Control - Air Projects**				
Revenues					
1940	Misc: Revenue	$0	$12,480	0%	($12,480)
	Total Revenues	**$0**	**$12,480**		**($12,480)**
Expenditures					
9000	Standard Regular Labor	$0	$6,901	0%	($6,901)
9004	Standard Indirect	$0	$1,366	0%	($1,366)
9005	Standard Equipment	$0	$2,240	0%	($2,240)
	Total Expenditures	**$0**	**$10,507**		**($10,507)**
	Summary of Revenues less Expenditures for Project #49269	**$0**	**$1,973**		**$1,973**
49294	**Maint Pioneer Trail Bike Path(SLT City limits to Glen Eagles Rd)**				
Revenues					
1940	Misc: Revenue	$7,650	$1,508	20%	$6,142
	Total Revenues	**$7,650**	**$1,508**		**$6,142**
Expenditures					
9000	Standard Regular Labor	$5,033	$538	11%	$4,495
9004	Standard Indirect	$1,258	$107	8%	$1,151
9005	Standard Equipment	$1,359	$709	52%	$650
	Total Expenditures	**$7,650**	**$1,354**		**$6,296**
	Summary of Revenues less Expenditures for Project #49294	**$0**	**$154**		**$154**
49297	**Maintenance - Sawmill Bikepath**				
Revenues					
1940	Misc: Revenue	$33,114	$723	2%	$32,391
	Total Revenues	**$33,114**	**$723**		**$32,391**
Expenditures					
4460	Equip: Small Tools & Instruments	$0	$18	0%	($18)
4500	Special Dept Expense	$0	$181	0%	($181)
9000	Standard Regular Labor	$23,484	$172	1%	$23,312
9004	Standard Indirect	$5,873	$34	1%	$5,839
9005	Standard Equipment	$3,757	$270	7%	$3,487
	Total Expenditures	**$33,114**	**$674**		**$32,440**
	Summary of Revenues less Expenditures for Project #49297	**$0**	**$49**		**$49**

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
49300	**Traffic Accident Repair/Sign, Bridge, Guardrail**				
Revenues					
0000	Discretionary	($239)	$0	0%	($239)
1942	Misc: Reimbursement	$1,413	$0	0%	$1,413
	Total Revenues	**$1,174**	**$0**		**$1,174**
Expenditures					
9000	Standard Regular Labor	$939	$0	0%	$939
9004	Standard Indirect	$235	$0	0%	$235
	Total Expenditures	**$1,174**	**$0**		**$1,174**
	Summary of Revenues less Expenditures for Project #49300	**$0**	**$0**		**$0**
81162	**Fixed Asset - Shakori Yard BMP Project**				
Expenditures					
7000	Operating Transfers Out	$0	$71	0%	($71)
	Total Expenditures	**$0**	**$71**		**($71)**
	Summary of Revenues less Expenditures for Project #81162	**$0**	**($71)**		**($71)**
95000	**Erosion Control Roll Up**				
Revenues					
0000	Discretionary	($2,346)	$0	0%	($2,346)
	Total Revenues	**($2,346)**	**$0**		**($2,346)**
Expenditures					
7383	Intrfnd Abatement: Erosion Control	($15,424)	$0	0%	($15,424)
9000	Standard Regular Labor	$9,229	$0	0%	$9,229
9004	Standard Indirect	$2,308	$0	0%	$2,308
9005	Standard Equipment	$1,541	$0	0%	$1,541
	Total Expenditures	**($2,346)**	**$0**		**($2,346)**
	Summary of Revenues less Expenditures for Project #95000	**$0**	**$0**		**$0**
95116	**Erosion Control Meyers Landscape & Bikepath**				
Revenues					
1940	Misc: Revenue	$7,320	$0	0%	$7,320
	Total Revenues	**$7,320**	**$0**		**$7,320**
Expenditures					
9000	Standard Regular Labor	$5,228	$0	0%	$5,228
9004	Standard Indirect	$1,308	$0	0%	$1,308
9005	Standard Equipment	$784	$0	0%	$784

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	MAINTENANCE - TAHOE ROAD				
95116	Erosion Control Meyers Landscape & Bikepath				
	Total Expenditures	**$7,320**	**$0**		**$7,320**
	Summary of Revenues less Expenditures for Project #95116	**$0**	**$0**		**$0**
95165	Sawmill 2 Bike Path Erosion Control Project				
Expenditures					
7383	Intrfnd Abatement: Erosion Control	$0	($552)	0%	$552
9000	Standard Regular Labor	$0	$194	0%	($194)
9004	Standard Indirect	$0	$38	0%	($38)
9005	Standard Equipment	$0	$265	0%	($265)
	Total Expenditures	**$0**	**($55)**		**$55**
	Summary of Revenues less Expenditures for Project #95165	**$0**	**$55**		**$55**
95170	Montgomery Estates Area 2 Erosion Control Project				
Expenditures					
7383	Intrfnd Abatement: Erosion Control	$0	($8,807)	0%	$8,807
9000	Standard Regular Labor	$0	$4,516	0%	($4,516)
9004	Standard Indirect	$0	$894	0%	($894)
9005	Standard Equipment	$0	$2,107	0%	($2,107)
	Total Expenditures	**$0**	**($1,291)**		**$1,291**
	Summary of Revenues less Expenditures for Project #95170	**$0**	**$1,291**		**$1,291**
95176	Golden Bear Erosion Control Project				
Expenditures					
7383	Intrfnd Abatement: Erosion Control	$0	($8,753)	0%	$8,753
9000	Standard Regular Labor	$0	$4,097	0%	($4,097)
9004	Standard Indirect	$0	$811	0%	($811)
9005	Standard Equipment	$0	$2,675	0%	($2,675)
	Total Expenditures	**$0**	**($1,171)**		**$1,171**
	Summary of Revenues less Expenditures for Project #95176	**$0**	**$1,171**		**$1,171**
95186	Lake Tahoe Boulevard - Bike Trail Project				
Expenditures					
7383	Intrfnd Abatement: Erosion Control	$0	($11,401)	0%	$11,401
9000	Standard Regular Labor	$0	$6,258	0%	($6,258)
9002	Standard Temporary Labor	$0	$41	0%	($41)
9004	Standard Indirect	$0	$1,247	0%	($1,247)
9005	Standard Equipment	$0	$2,054	0%	($2,054)
	Total Expenditures	**$0**	**($1,801)**		**$1,801**
	Summary of Revenues less Expenditures for Project #95186	**$0**	**$1,801**		**$1,801**

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	**MAINTENANCE - TAHOE ROAD**				
95192	**Sawmill 2B Bike Path and Erosion Control Project**				
Expenditures					
7383	Intrfnd Abatement: Erosion Control	$0	($2,334)	0%	$2,334
9000	Standard Regular Labor	$0	$1,471	0%	($1,471)
9004	Standard Indirect	$0	$291	0%	($291)
9005	Standard Equipment	$0	$151	0%	($151)
	Total Expenditures	**$0**	**($421)**		**$421**
	Summary of Revenues less Expenditures for Project #95192	**$0**	**$421**		**$421**
95195	**Forest View Water Quality Project**				
Expenditures					
7383	Intrfnd Abatement: Erosion Control	$0	($400)	0%	$400
9000	Standard Regular Labor	$0	$216	0%	($216)
9004	Standard Indirect	$0	$43	0%	($43)
9005	Standard Equipment	$0	$80	0%	($80)
	Total Expenditures	**$0**	**($62)**		**$62**
	Summary of Revenues less Expenditures for Project #95195	**$0**	**$62**		**$62**
95196	**CSA # 5 Upper Area Erosion Control Project**				
Expenditures					
7383	Intrfnd Abatement: Erosion Control	$0	($2,229)	0%	$2,229
9000	Standard Regular Labor	$0	$1,063	0%	($1,063)
9004	Standard Indirect	$0	$210	0%	($210)
9005	Standard Equipment	$0	$652	0%	($652)
	Total Expenditures	**$0**	**($304)**		**$304**
	Summary of Revenues less Expenditures for Project #95196	**$0**	**$304**		**$304**
98000	**Special Districts - Drainage Zones**				
Revenues					
0000	Discretionary	($2,584)	$0	0%	($2,584)
1856	Interfnd Rev: Special Districts	$17,923	$0	0%	$17,923
	Total Revenues	**$15,339**	**$0**		**$15,339**
Expenditures					
9000	Standard Regular Labor	$10,169	$0	0%	$10,169
9004	Standard Indirect	$2,543	$0	0%	$2,543
9005	Standard Equipment	$2,627	$0	0%	$2,627
	Total Expenditures	**$15,339**	**$0**		**$15,339**
	Summary of Revenues less Expenditures for Project #98000	**$0**	**$0**		**$0**

		Adopted Budget	Y.T.D. Actuals	Y.T.D Percent	Balance Remaining
306232	MAINTENANCE - TAHOE ROAD				
99246	Meyers Landfill Hauling				
Revenues					
0000	Discretionary	$25,000	$0	0%	$25,000
	Total Revenues	**$25,000**	**$0**		**$25,000**
Expenditures					
4085	Refuse Disposal	$0	$630	0%	($630)
4300	Professional & Specialized Services	$0	$2,286	0%	($2,286)
4420	Rent & Lease: Equipment	$5,000	$6,767	135%	($1,767)
9000	Standard Regular Labor	$18,000	$9,952	55%	$8,048
9004	Standard Indirect	$0	$1,970	0%	($1,970)
9005	Standard Equipment	$2,000	$4,170	209%	($2,170)
	Total Expenditures	**$25,000**	**$25,775**		**($775)**
	Summary of Revenues less Expenditures for Project #99246	**$0**	**($25,775)**		**($25,775)**
blank					
Expenditures					
4606	Fuel Purchases	$0	$0	0%	$0
5300	Interfnd: Service Between Fund Types	$0	$0	0%	$0
	Total Expenditures	**$0**	**$0**		**$0**
	Summary of Revenues less Expenditures for Project #blank	**$0**	**$0**		**$0**
	Summary of Revenues less Expenditures for Department 306232	**$0**	**($2,996,710)**		**($2,996,710)**

October 31, 2014

Patty Kouyoumdjian
Executive Officer
Lahontan Regional Water Quality Control Board
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150

RECEIVED
OCT 30 2014
BY: PZK

RE: Community Survey Schedule

Dear Ms. Patty Kouyoumdjian:

The co-permittees (City of South Lake Tahoe, El Dorado County, and Placer County) and Tahoe Resource Conservation District (Tahoe RCD) acknowledge the receipt of your August 29, 2014 Fiscal Analysis Plan Submittal letter. The co-permittees look forward to a future meeting to continue discussing various approaches to implementation of the Lake Tahoe Total Maximum Daily Load (TMDL) and National Pollutant Discharge Elimination System (NPDES) permit.

As noted in the Response to Revised Fiscal Plan Request (July 11, 2014), the co-permittees are committed to conduct a voter or property owner survey to assess public support for a new parcel assessment, or equivalent, to fund a regional or local stormwater utility.

This effort to examine the feasibility and public support regarding a conceptual long-term funding mechanism (stormwater utility, or equivalent) would be undertaken in collaboration from the larger TMDL and NPDES regulatory and implementation framework developers (including representatives from the Lahontan Regional Water Quality Control Board [Lahontan], Environmental Protection Agency, Tahoe Regional Planning Agency [TRPA]), Tahoe RCD and respective co-permittees.

Tentative Community Survey Schedule

The following information details the schedule for the community survey and polling effort and outlines funding sources and specific actions to accomplish these tasks. The co-permittees and Tahoe RCD seek input and guidance from Lahontan and Environmental Protection Agency staff throughout the polling and outreach framework development and for measuring public support of a regional or local stormwater management program (SWMP) or equivalent long-term funding mechanism. As a part of this process, co-

permittees and Tahoe RCD will hire a qualified consultant through an RFP process, incorporating with Lahontan and EPA staff input. Items below include tentative dates and participants for each step.

1) **Co-permittee conference call (October 7, 2014)** - Discuss project schedule and scope, complete letters of commitment from co-permittees
   (Co-permittees, Tahoe RCD)

2) **Kickoff meeting (October 31, 2014)** – Discuss Project Approach
   (Co-permittees, Tahoe RCD, Lahontan, EPA, TRPA)
   - Review previous surveys and existing fiscal plans
   - Determine demographics and regions to be surveyed
   - Identify partners for RPF development process

3) **Draft and Finalize RFP (Nov. – Dec. 2014)**
   (Co-permittees, Tahoe RCD, Lahontan, EPA, TRPA)

4) **Issue/post RFP (January 2015)**
   (Tahoe RCD)

5) **Review of proposals and Statement of Qualifications (Feb. – March, 2015)**
   (Co-permittees, Tahoe RCD, Lahontan, EPA, TRPA)

6) **Selection of Contractor and Award Contract (April 2015)**
   (Co-permittees, Tahoe RCD, Lahontan, EPA, TRPA)

7) **Kickoff meeting with Contractor to Develop Survey Design *(May 2015)***
   (Co-permittees, Tahoe RCD, Lahontan, EPA, TRPA, Public Opinion Survey Contractor)

8) **Conduct Outreach and Public Survey (June – July 2015)**
   (Public Opinion Survey Contractor)

9) ***Completion of DRAFT Summary of Findings Report (August 2015)***
   (Public Opinion Survey Contractor)

10) ***Review of DRAFT Summary of Findings Report (September 2015)***
   (Co-permittees, Tahoe RCD, Lahontan, EPA, TRPA)

11) ***Finalize Summary of Findings Report (October 2015)***
   (Public Opinion Survey Contractor)

12) ***Review of feasible long term funding opportunities and relationship to AB 2403 from Summary of Findings Report (November 2015)***
   (Co-permittees, Tahoe RCD, Lahontan, EPA, TRPA)

Community Survey Funding

Funding for this community survey and outreach effort will be provided through Tahoe RCD's Community Watershed Partnership program sponsored by the Environmental Protection Agency, with matching funds provided by the co-permittees. Combined feasibility and public preferences review survey funding totals $42,000, with individual sources shown in Table 1.

AGENCY	Community Watershed Partnership	Local Match	TOTAL
Administered by TRCD	**$27,000**		
El Dorado County		**$5,000**	
Placer County		**$5,000**	
City of South Lake Tahoe		**$5,000**	
SubTotals	**$27,000**	**$15,000**	**$42,000**

Table 1

Since the co-permittees are only now beginning to beta test the Lake Clarity Crediting (LCCP) system and associated Stormwater Tools, it is difficult to accurately assess the full administrative costs of compliance and storm water program management. The co-permittees appreciate Lahontan's efforts to address the lack of operational integration within the existing suite of LCCP tools and have actively participated in the Stormwater Tools Improvement Project. However, without the final version of the tools and assessment methodologies, frequencies and data entry requirements finalized, it is difficult to accurately estimate costs for compliance and determine the full scope of the administrative requirements for the LCCP at this time.

As stated above, the co-permittees and Tahoe RCD are actively pursuing feasible funding options for SWMP implementation through this process. Once the co-permittees receive the results of the survey Summary of Findings Report, appropriate follow-up actions will be taken based on the survey outcome such as further consideration of pursuing a funding mechanism if the public is in support of this action or, if no support, continuing to seek other funding options. Other follow-up actions would include a refined public outreach effort based on a more detailed understanding of public preferences and funding priorities. Benefits of this project will include:

- An accurate and current understanding of existing community commitment for financing solutions for stormwater management within the California portion of the Tahoe Basin
- Detailed assessment of the opportunities and limitations of establishing a California stormwater utility

- Developing a partnership between implementers and policy/regulatory framework developers within the State of California for development of a long-term funding strategy.

We appreciate the collaboration with Lahontan and joint efforts to continue to improve Lake Tahoe's water quality.

Ray Jarvis
Public Works Director
City of South Lake Tahoe

Brendan Ferry
Stormwater Program Manager
El Dorado County

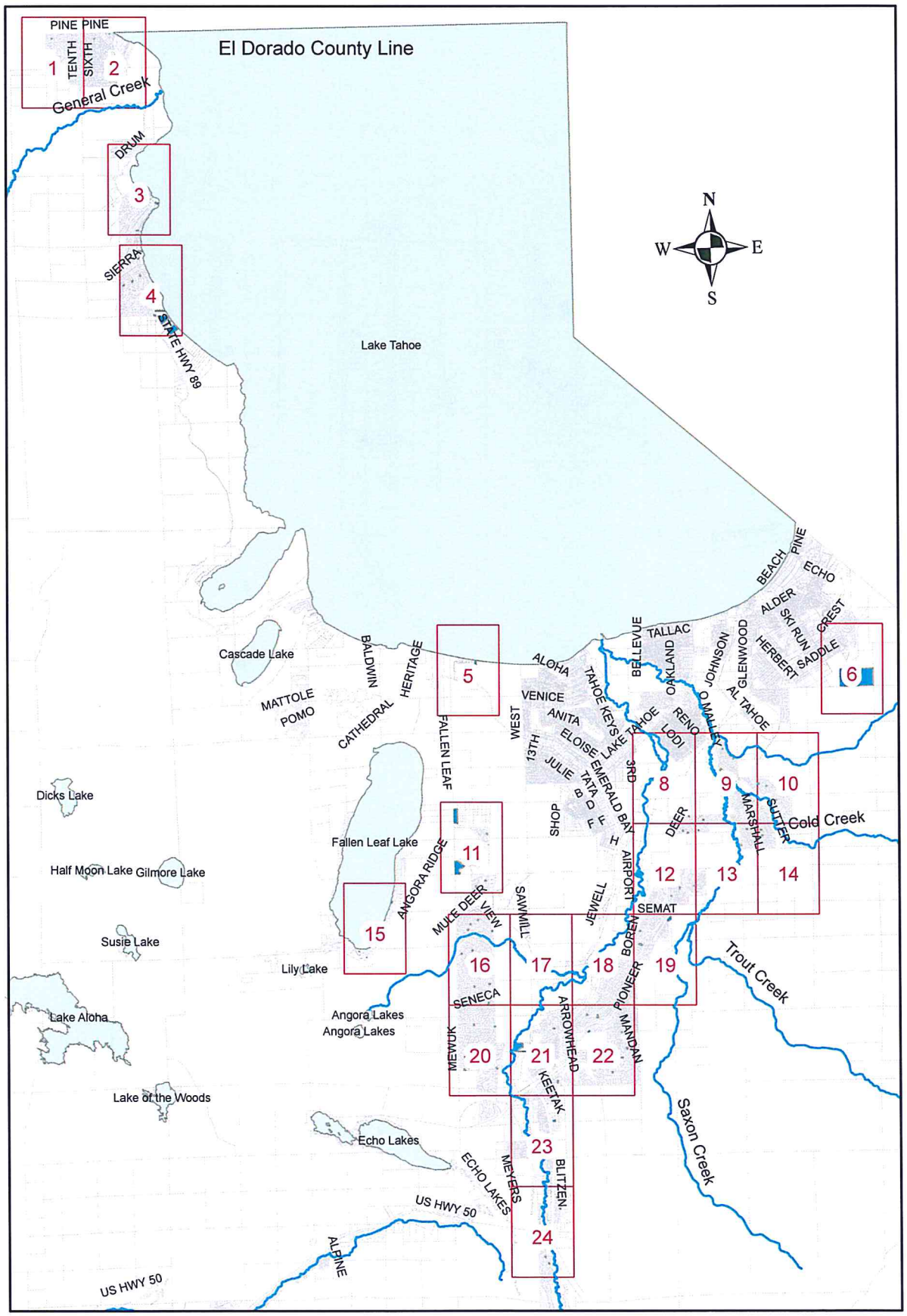
Ken Grehm
Department of Public Works Director
Placer County

Kim Boyd
District Manager
Tahoe Resource Conservation District

cc: Robert Larsen, Senior Environmental Scientist, Lahontan Regional Water Quality Control Board
Jacques Landy, Lake Tahoe Coordinator, California Environmental Protection Agency
Julie Regan, External Affairs Chief, Tahoe Regional Planning Agency

Appendix J

Parcels with Construction 2015



Index Sheet

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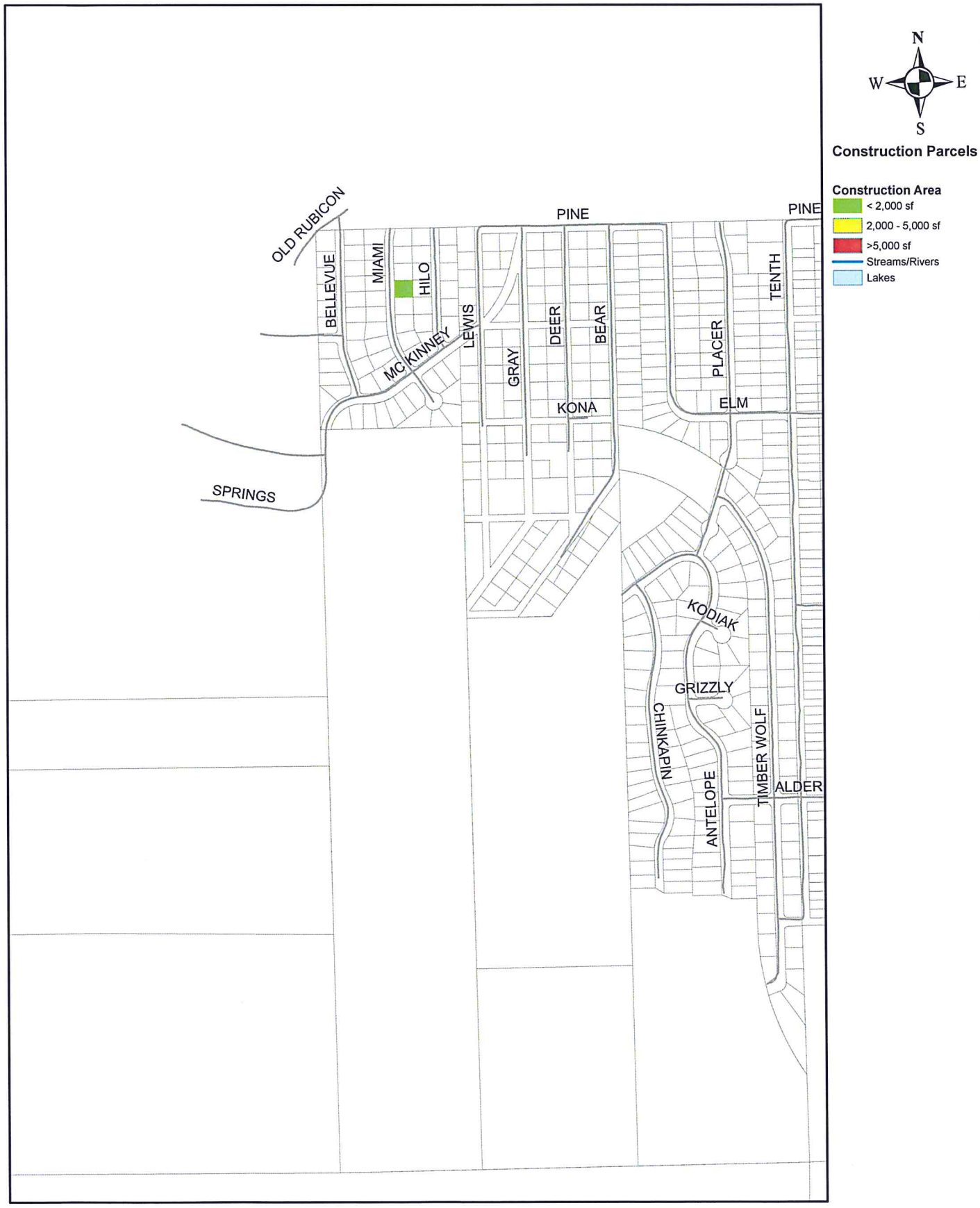

Index Sheet 1

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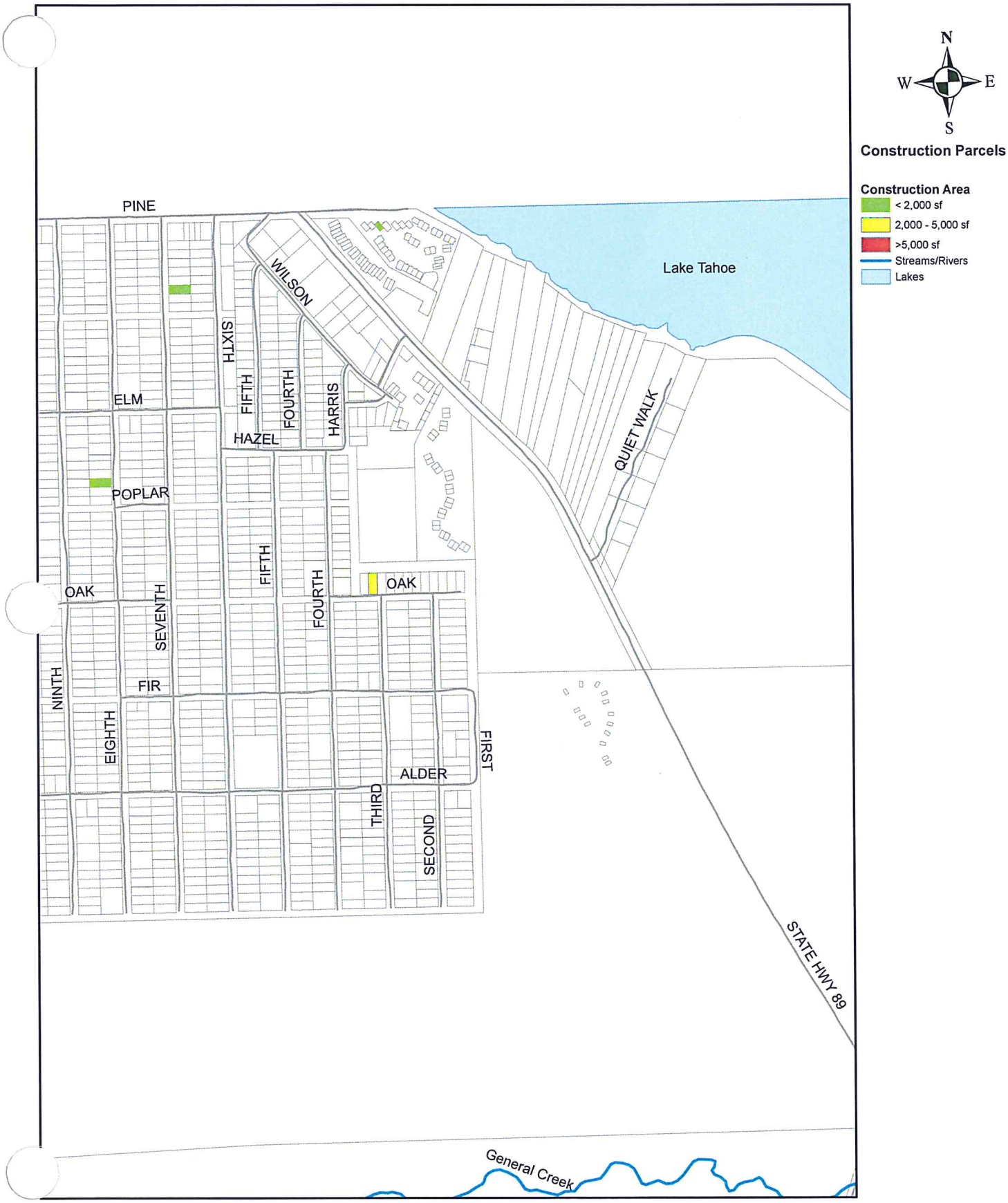

Index Sheet 2

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N
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Construction Parcels

Construction Area

- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

Index Sheet 3

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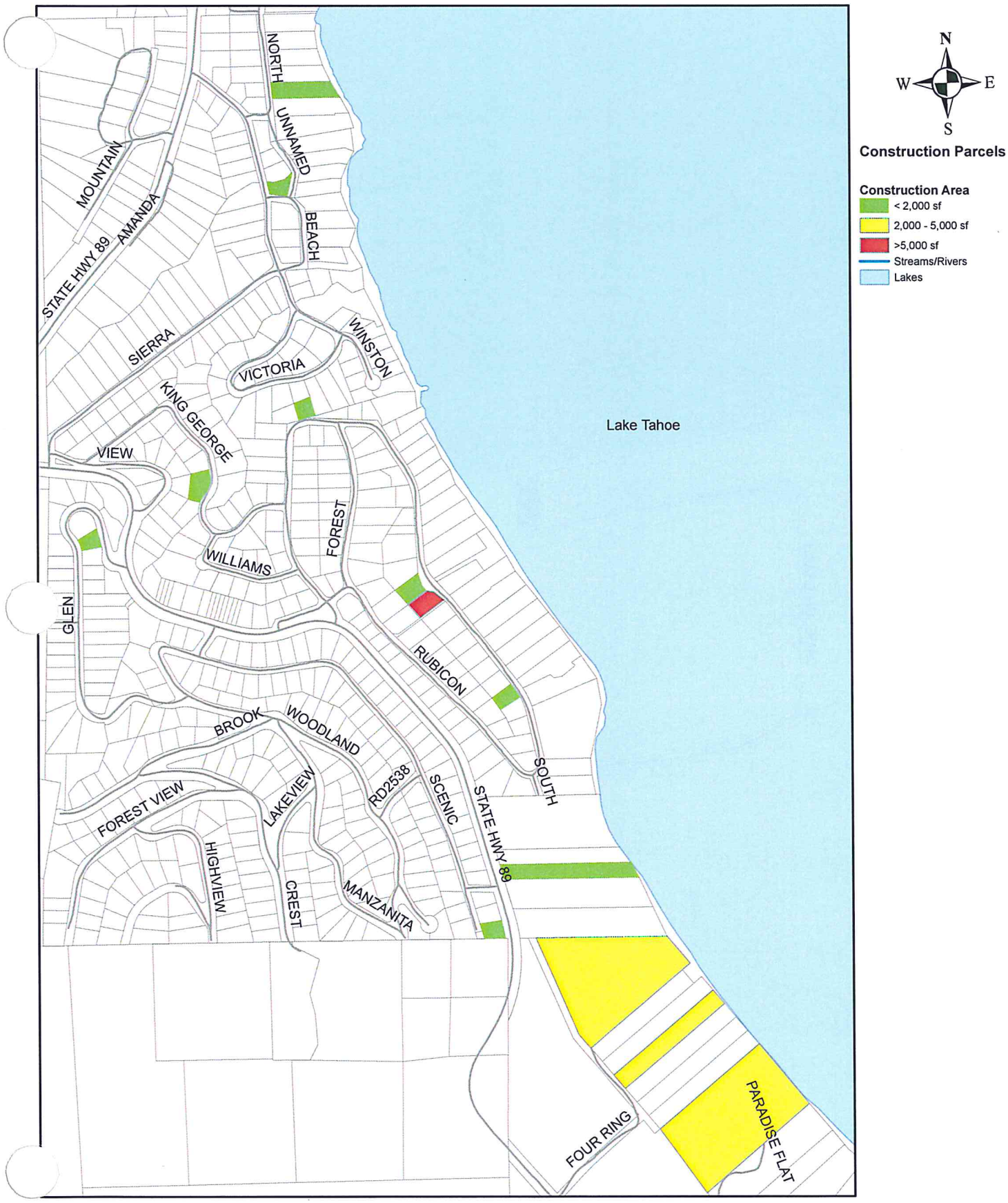

Index Sheet 4

0 0.05 0.1 0.2 0.3 Miles

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Construction Parcels

Construction Area

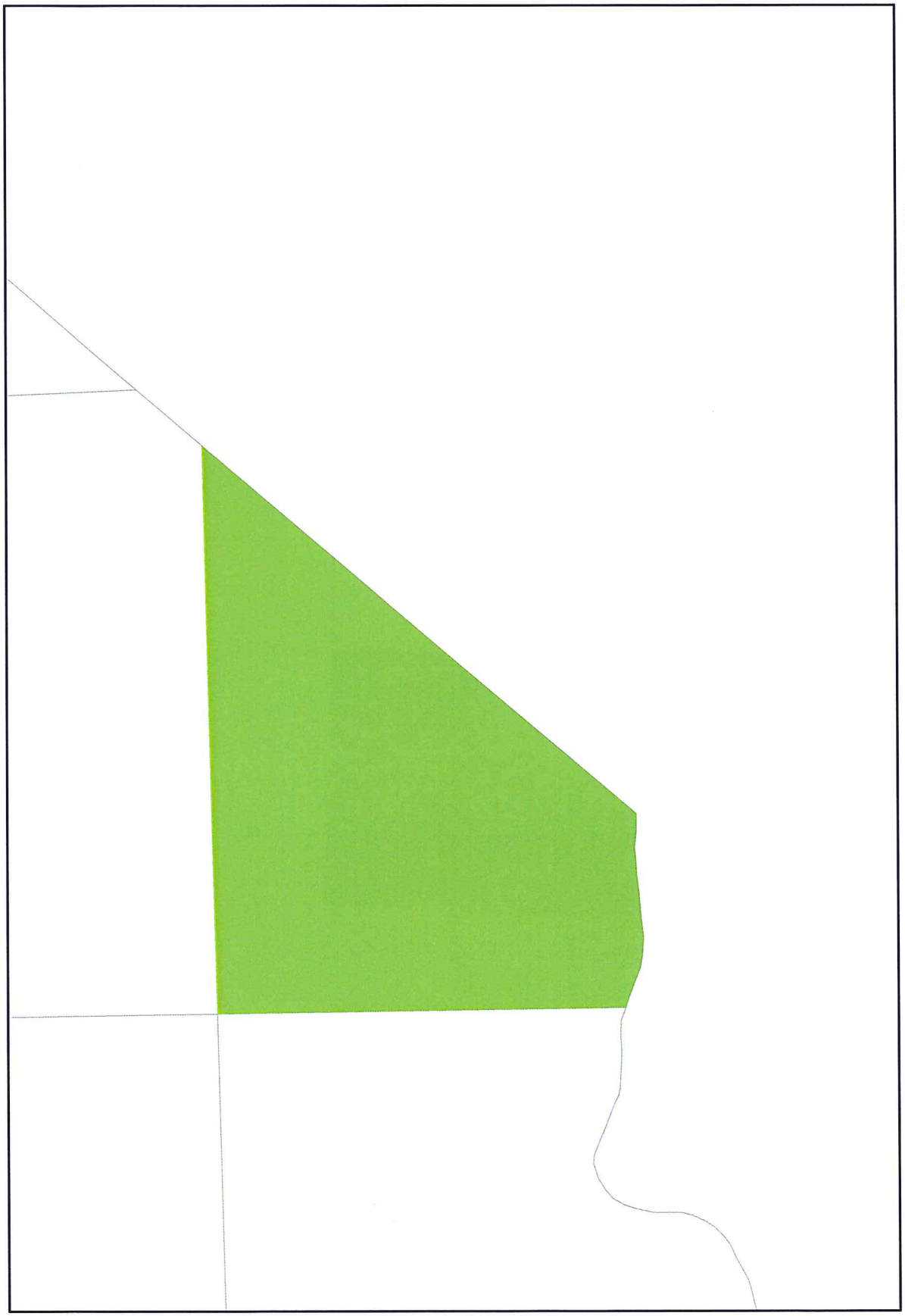
- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

Index Sheet 5

0 0.05 0.1 0.2 0.3 Miles

Index Sheet 6

0 0.05 0.1 0.2 0.3 Miles



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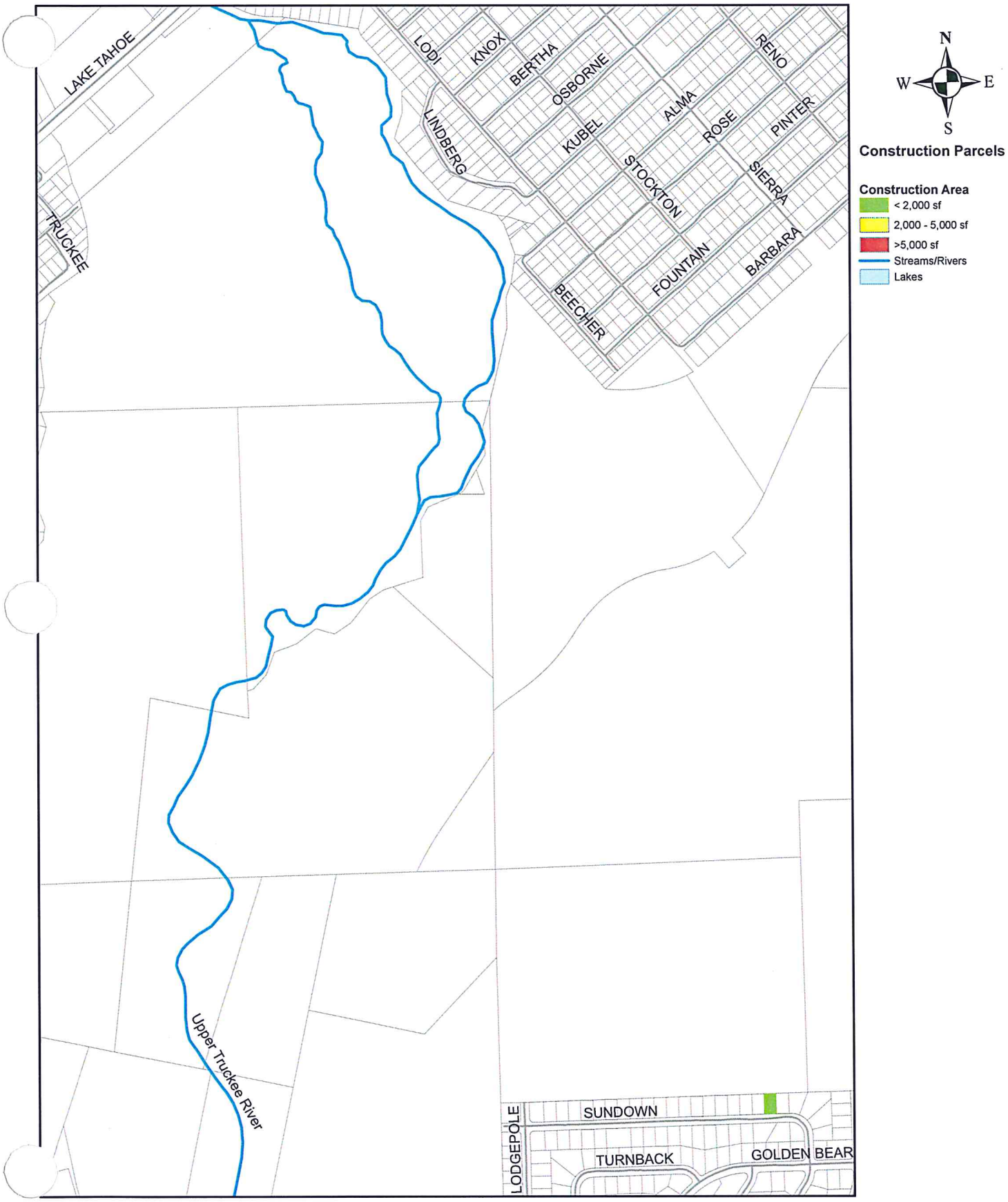
Construction Parcels

Construction Area

- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

Index Sheet 7

0 0.05 0.1 0.2 0.3 Miles



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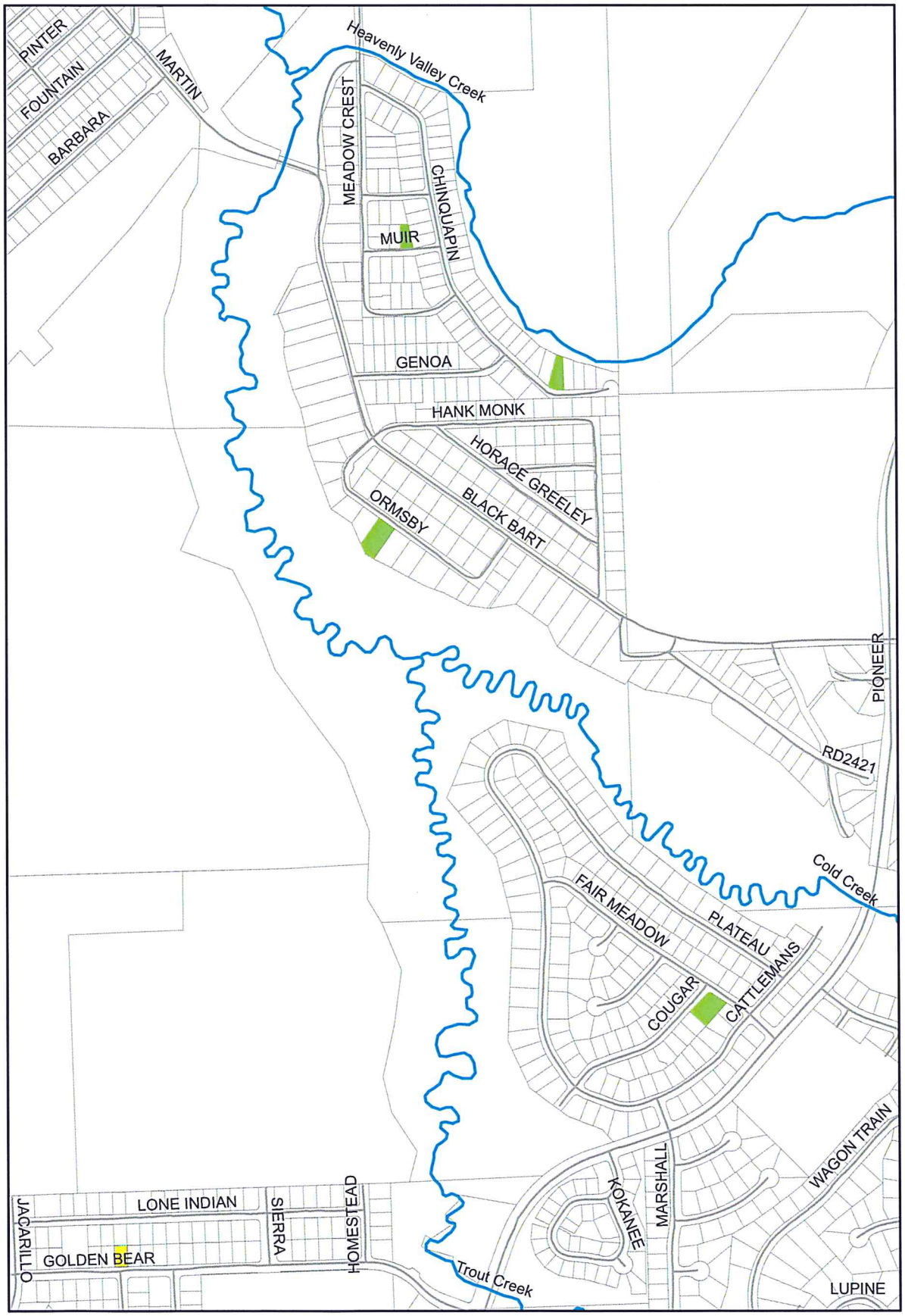

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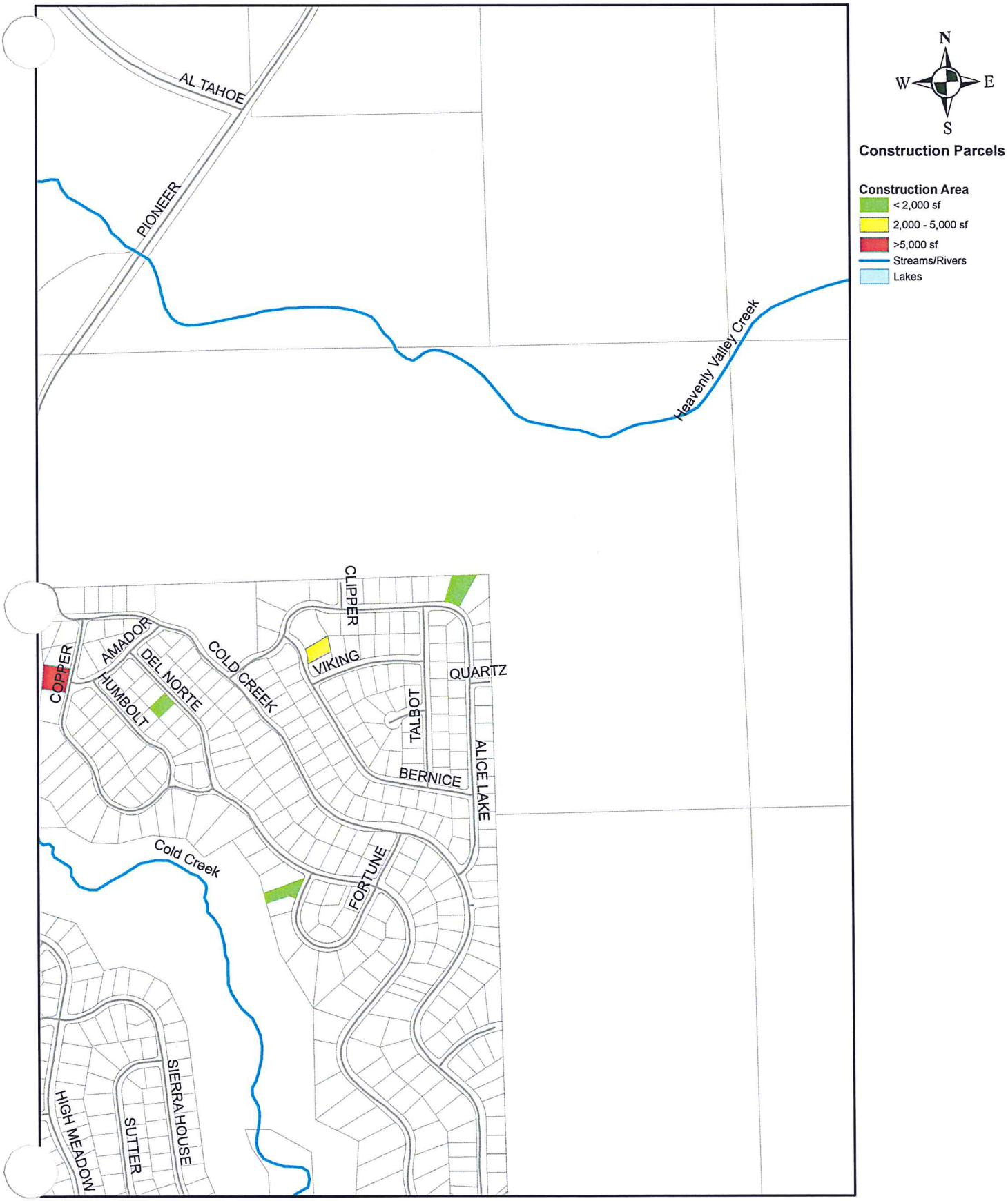
Construction Parcels

Construction Area

- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

Index Sheet 9

0 0.05 0.1 0.2 0.3 Miles



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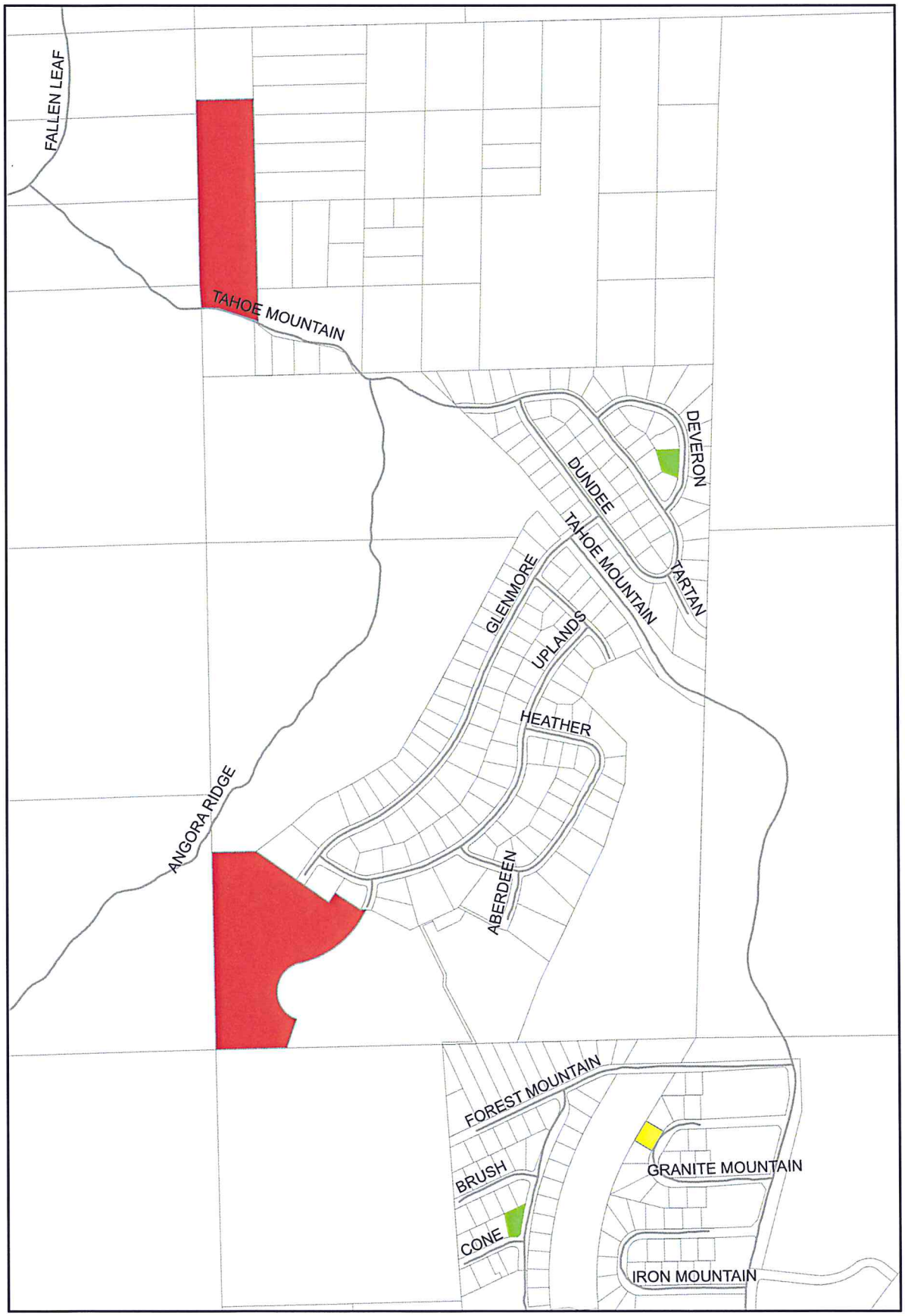

N
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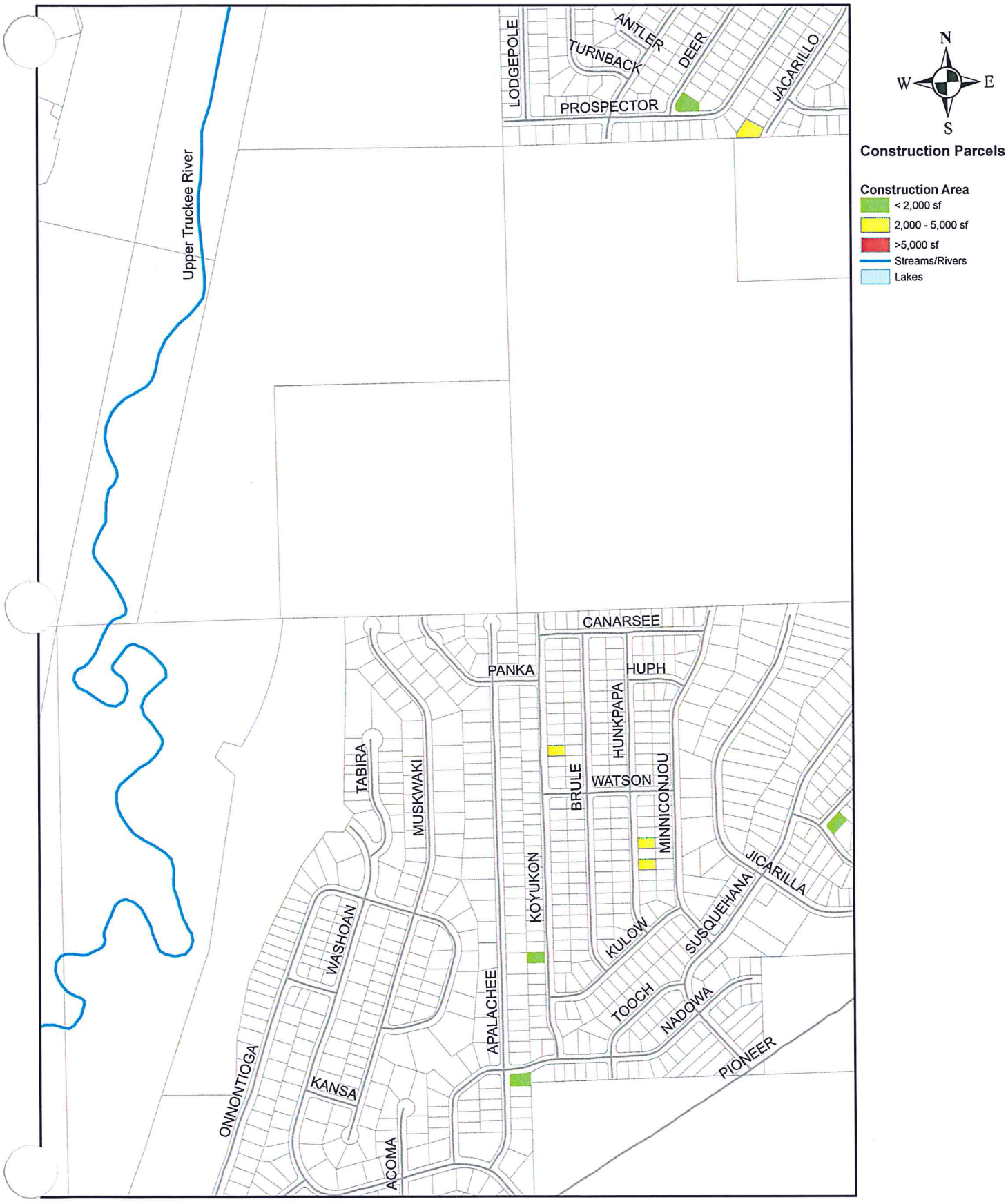
Construction Parcels

Construction Area
- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

Index Sheet 11

0 0.05 0.1 0.2 0.3 Miles



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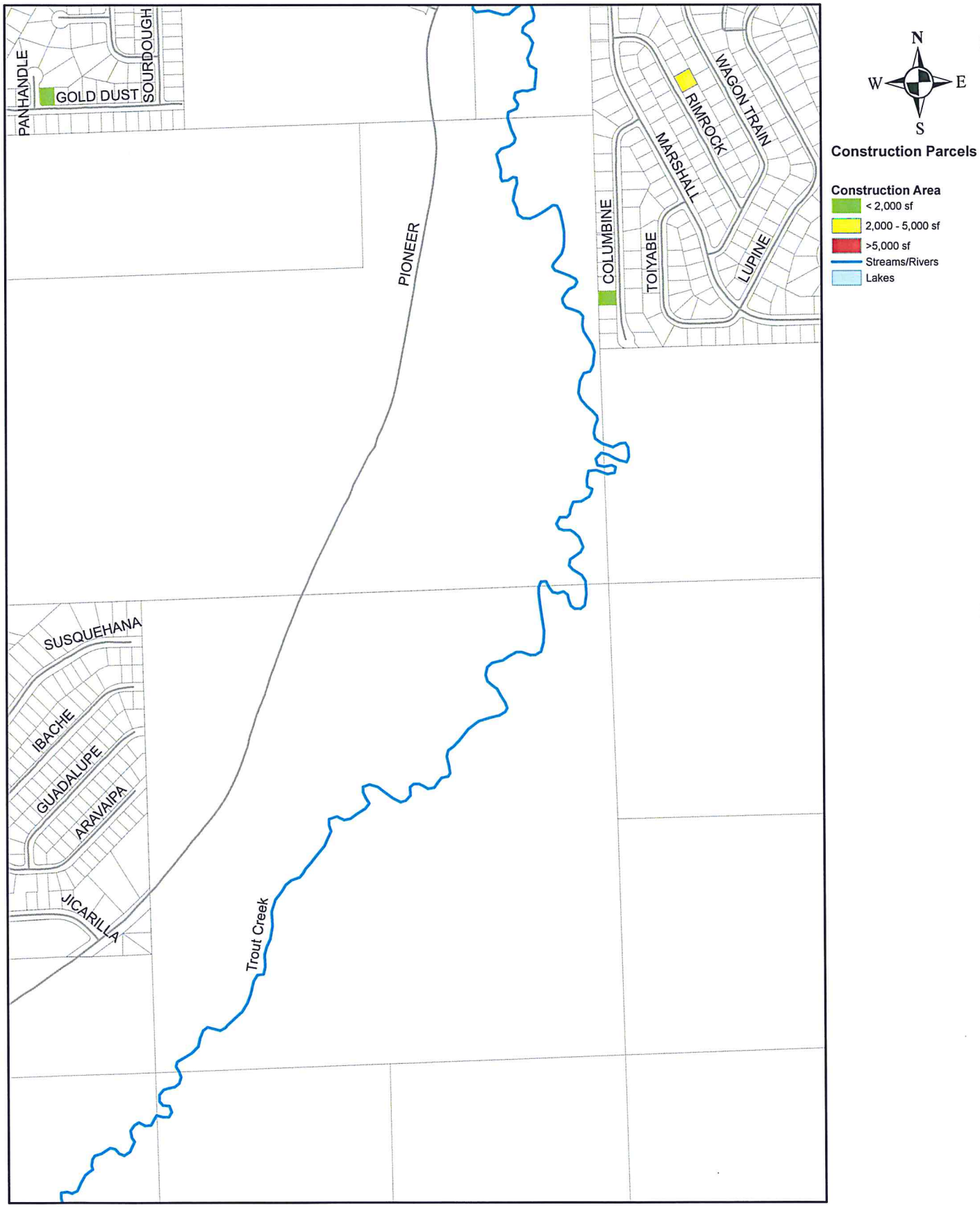
0 0.05 0.1 0.2 0.3 Miles



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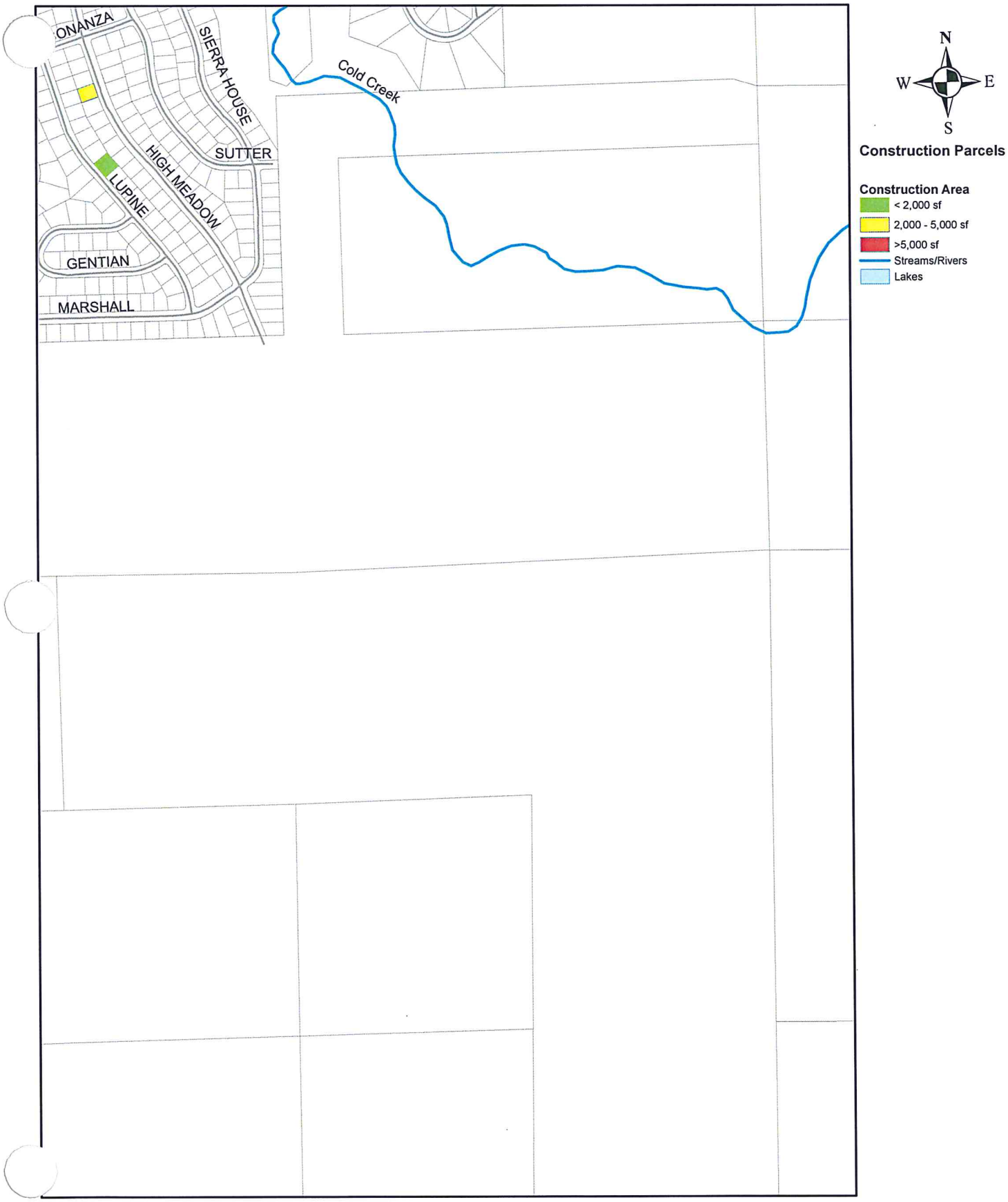
0 0.05 0.1 0.2 0.3 Miles



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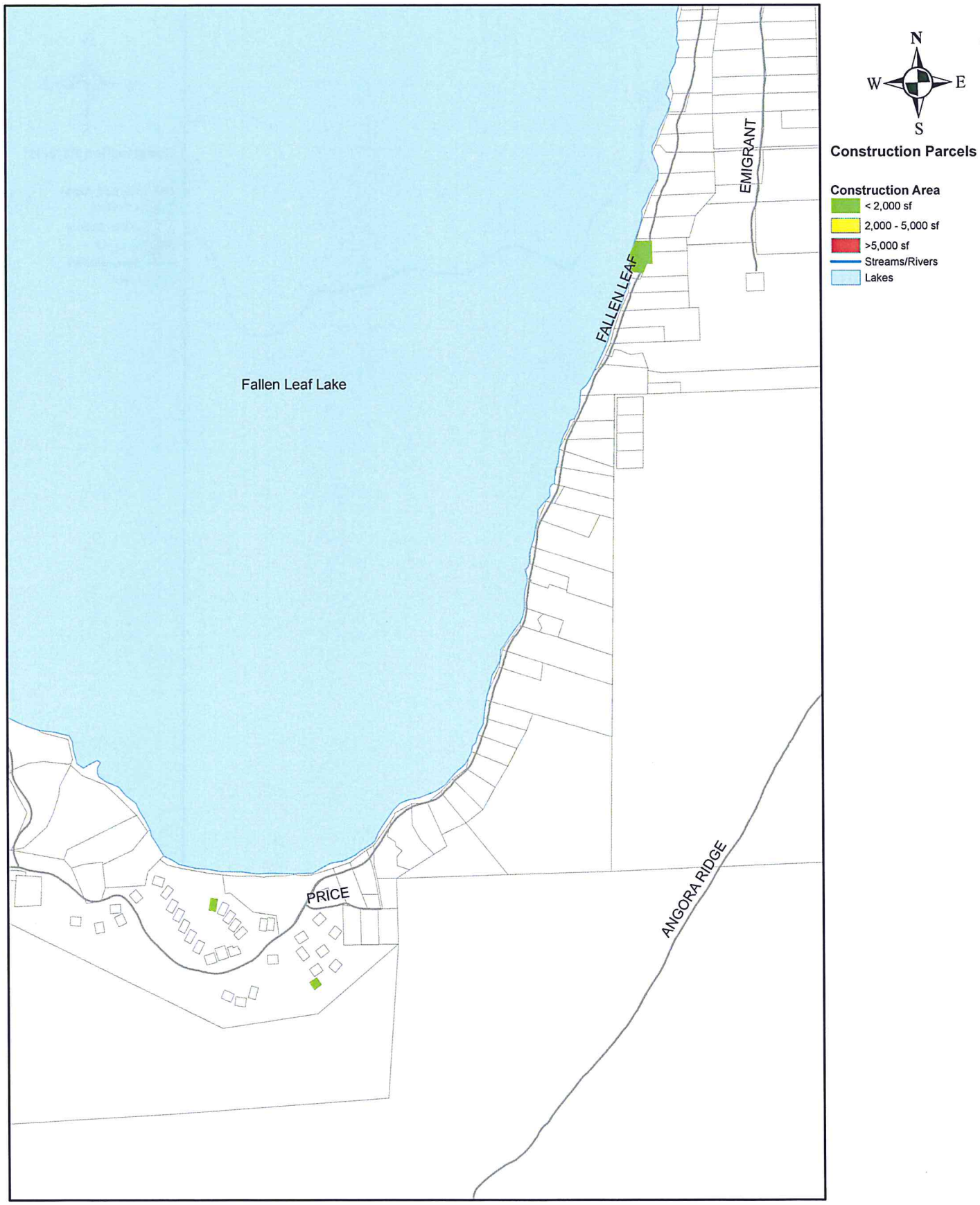
0 0.05 0.1 0.2 0.3 Miles



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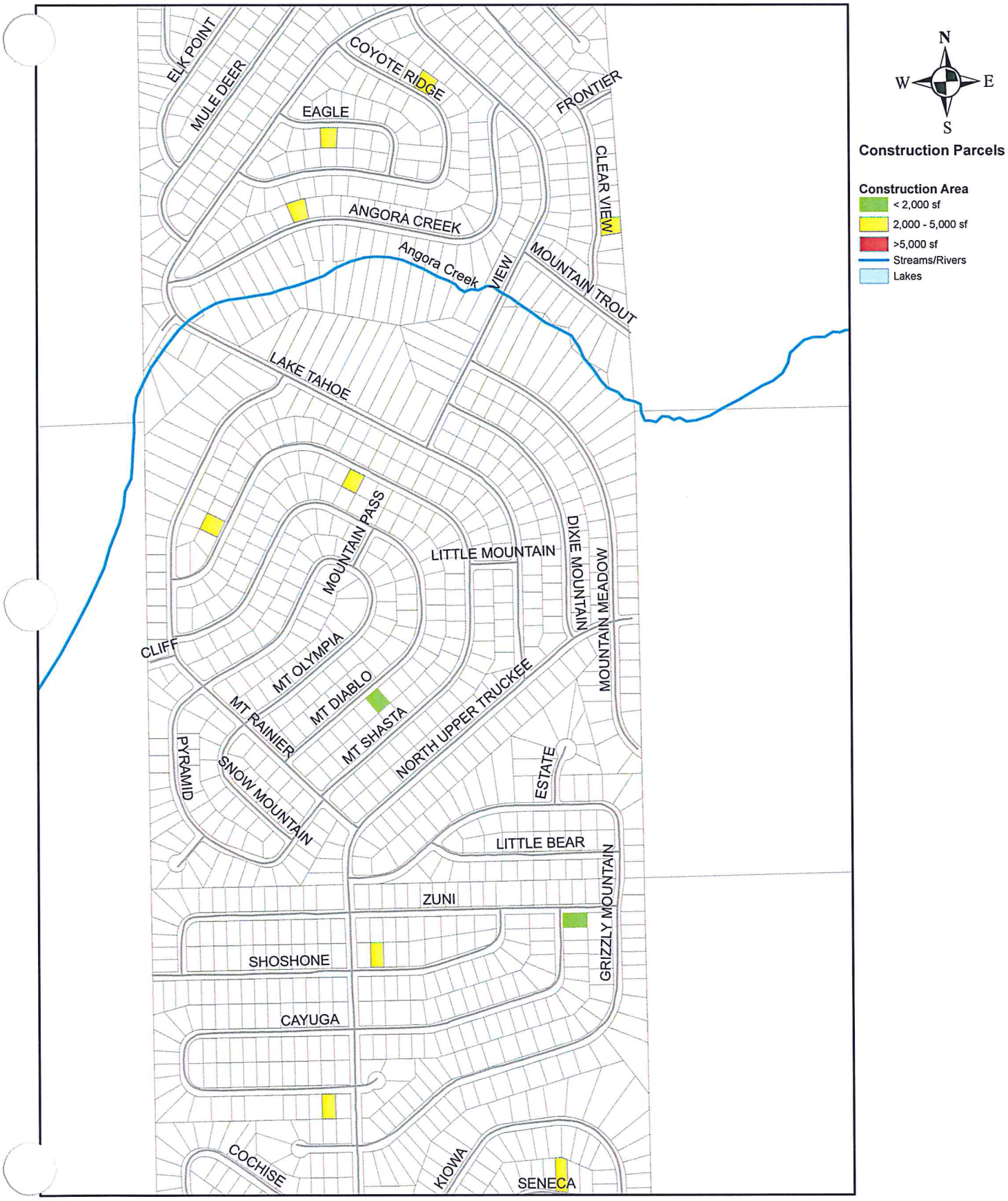
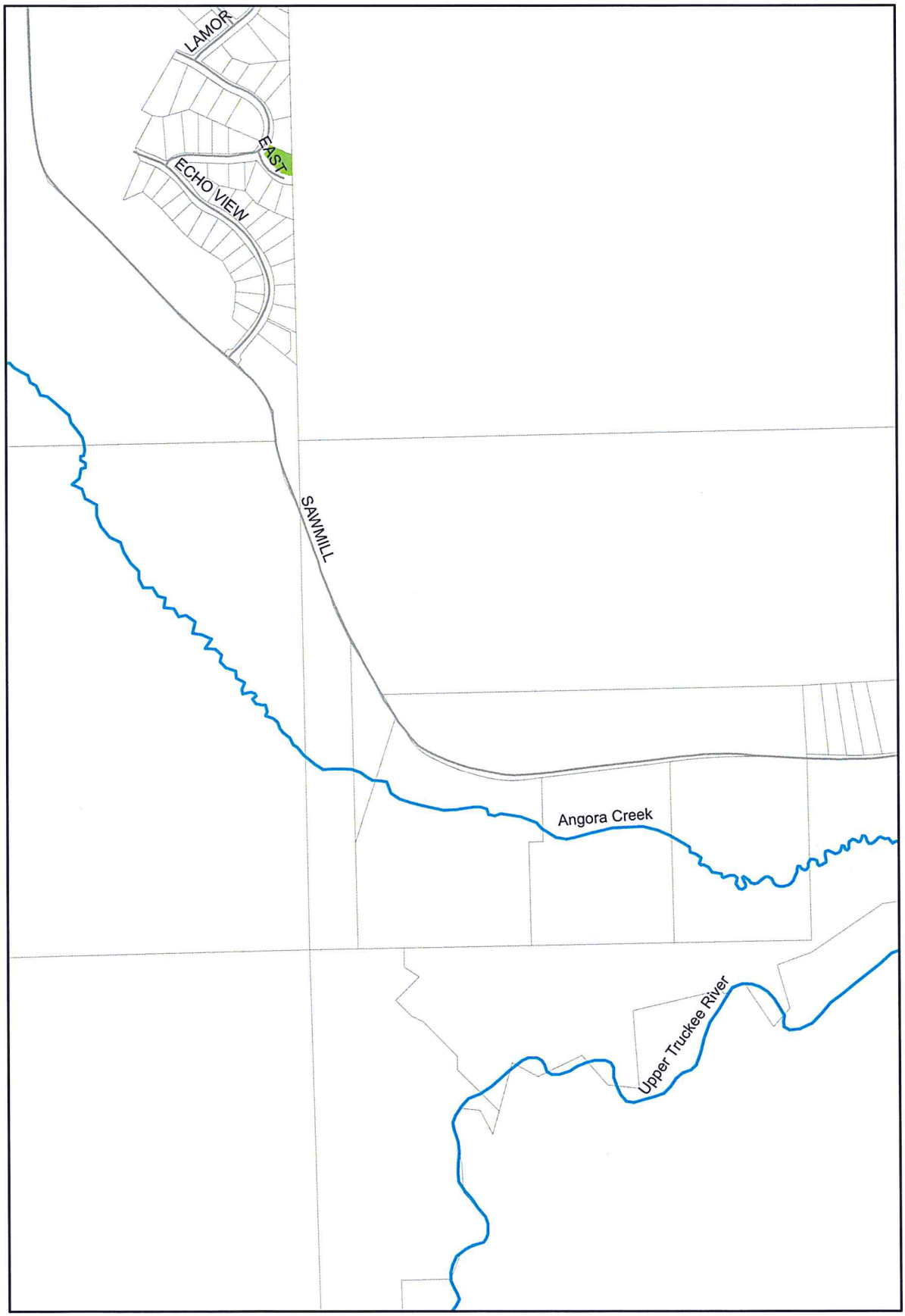
0 0.05 0.1 0.2 0.3 Miles



Index Sheet 16

0 0.05 0.1 0.2 0.3 Miles



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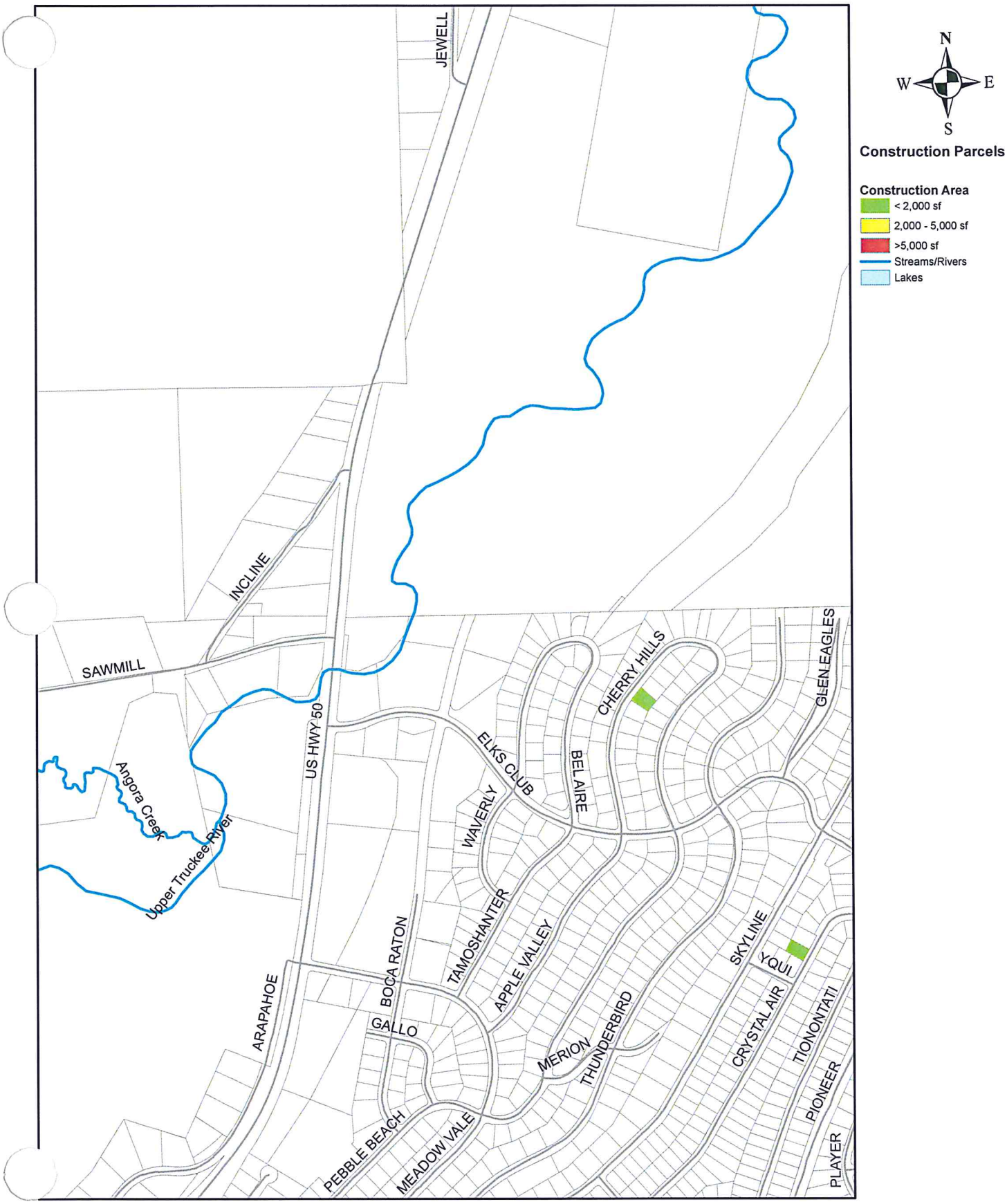
Construction Parcels

Construction Area

- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

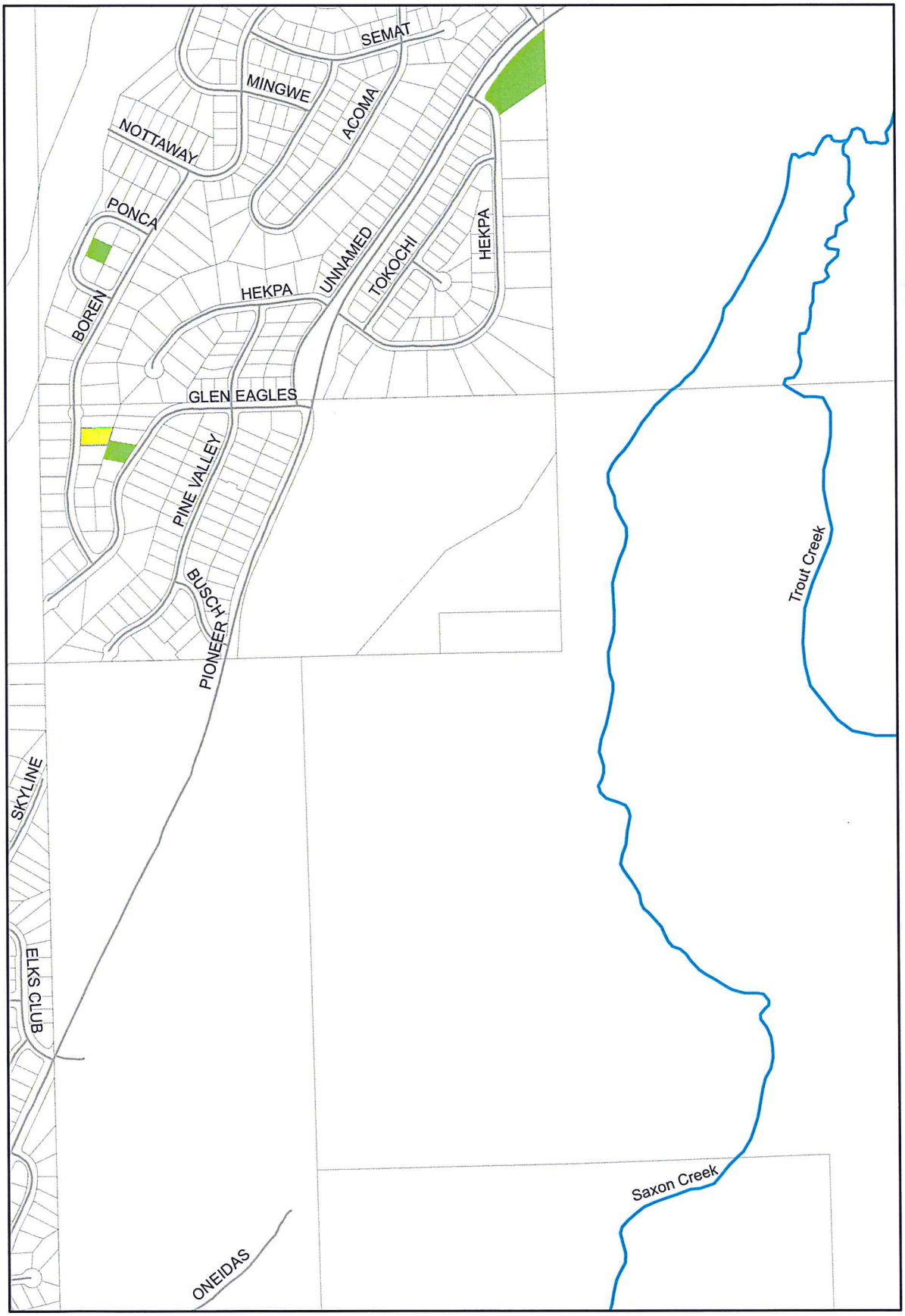
Index Sheet 17

0 0.05 0.1 0.2 0.3 Miles



Index Sheet 18

0 0.05 0.1 0.2 0.3 Miles



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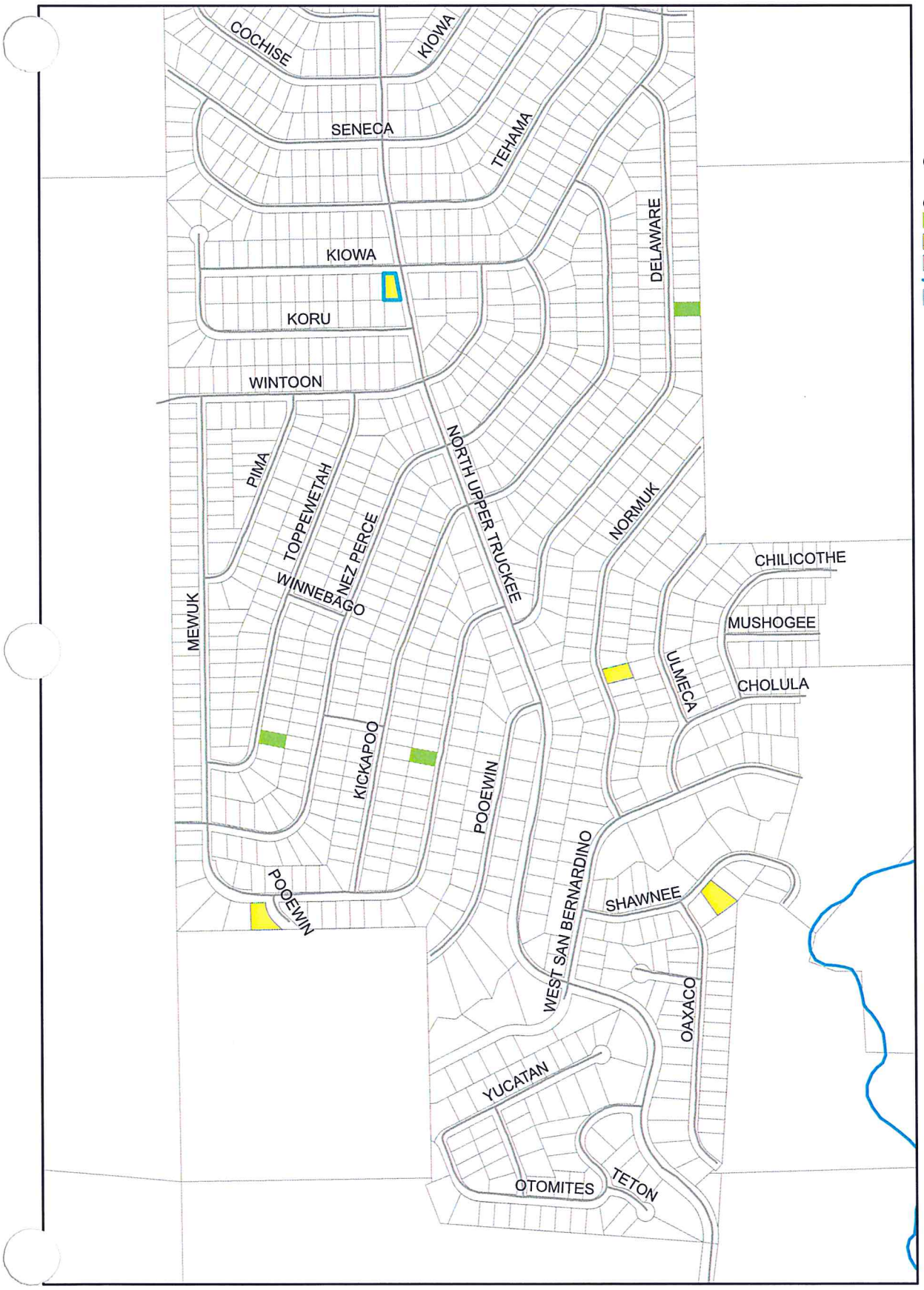
Construction Parcels

Construction Area

- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

Index Sheet 19

0 0.05 0.1 0.2 0.3 Miles



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Construction Parcels

Construction Area

- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

Index Sheet 20

0 0.05 0.1 0.2 0.3 Miles

N
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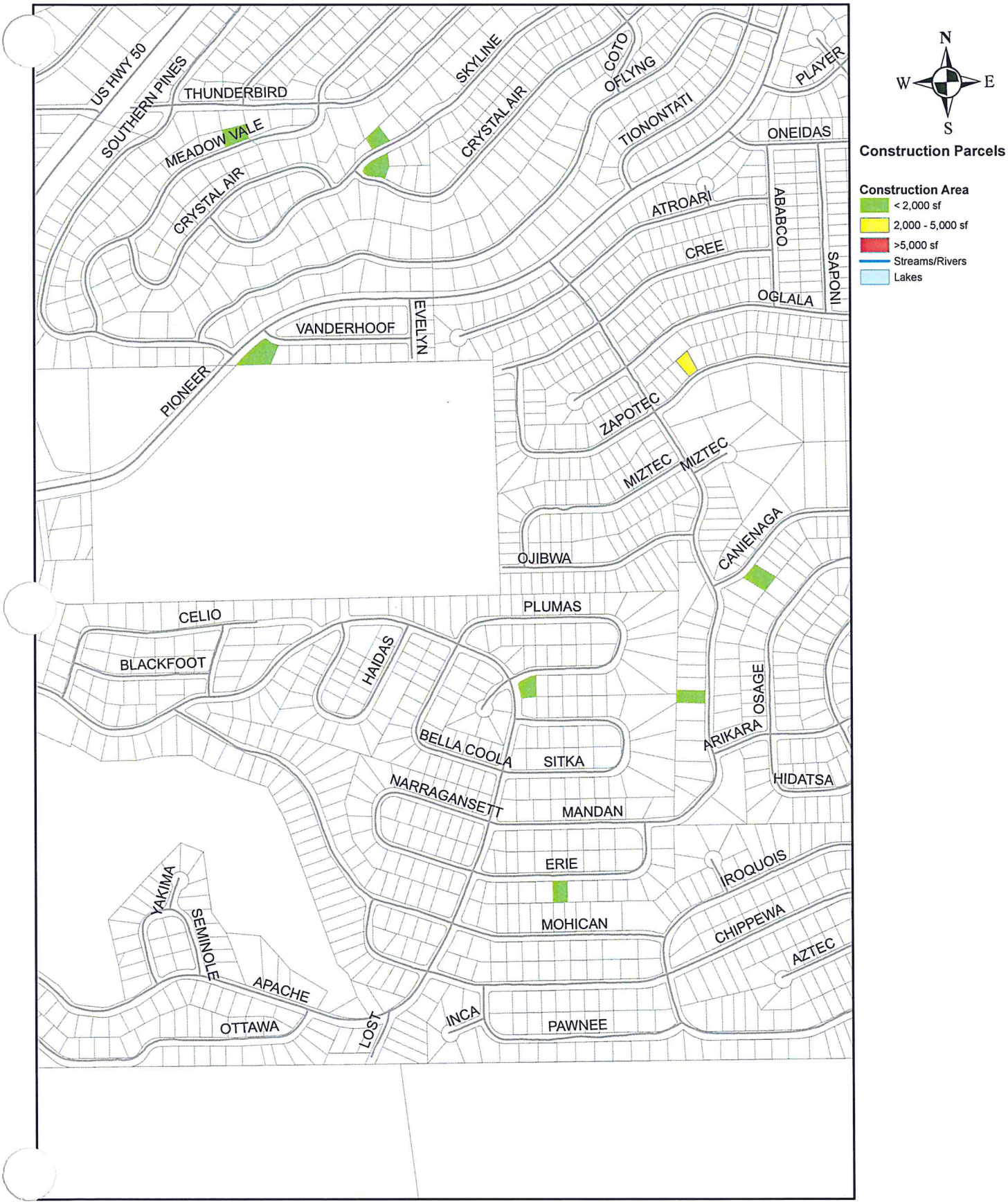
Construction Parcels

Construction Area
- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

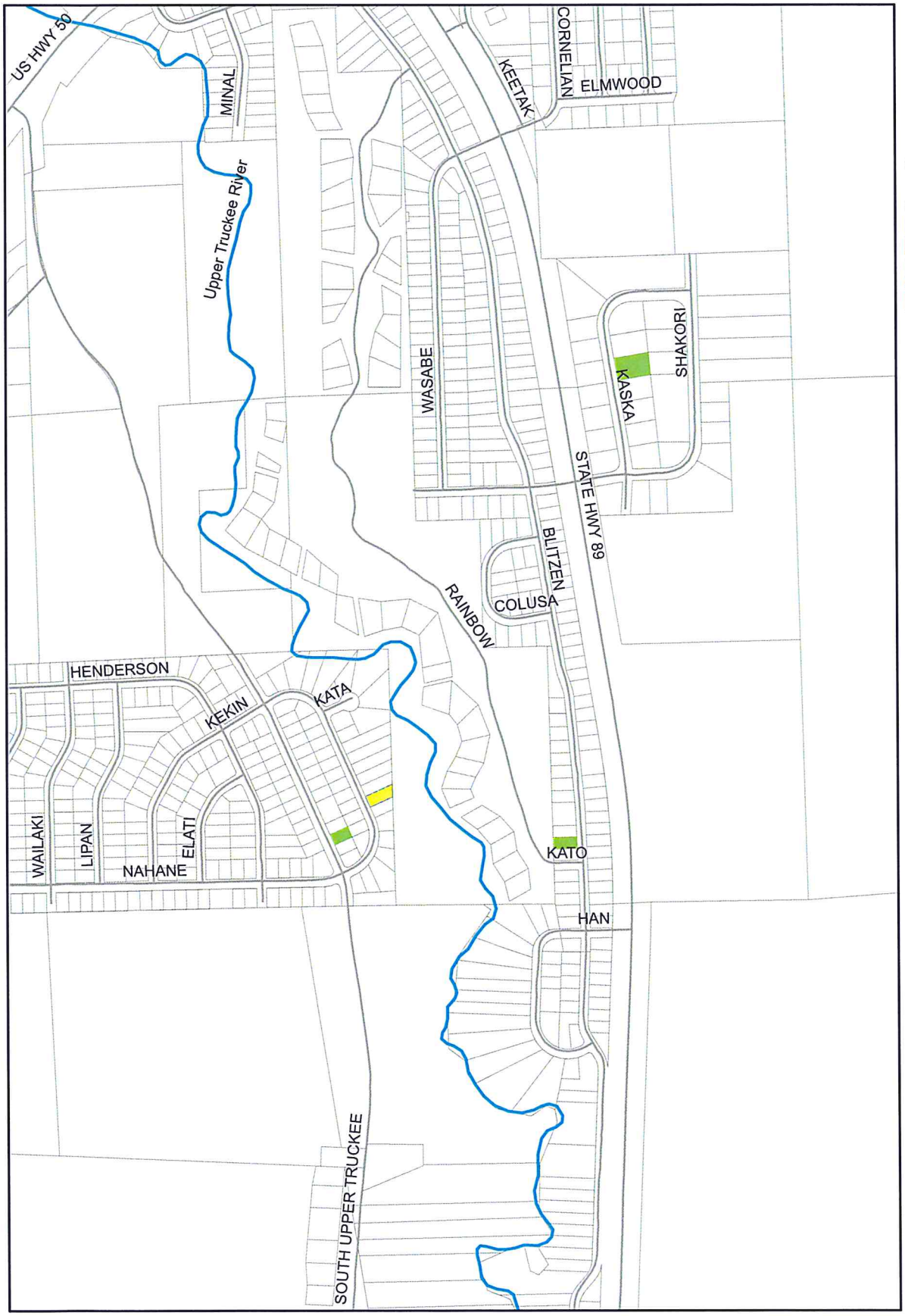
Index Sheet 21

0 0.05 0.1 0.2 0.3 Miles



Index Sheet 22

0 0.05 0.1 0.2 0.3 Miles



N
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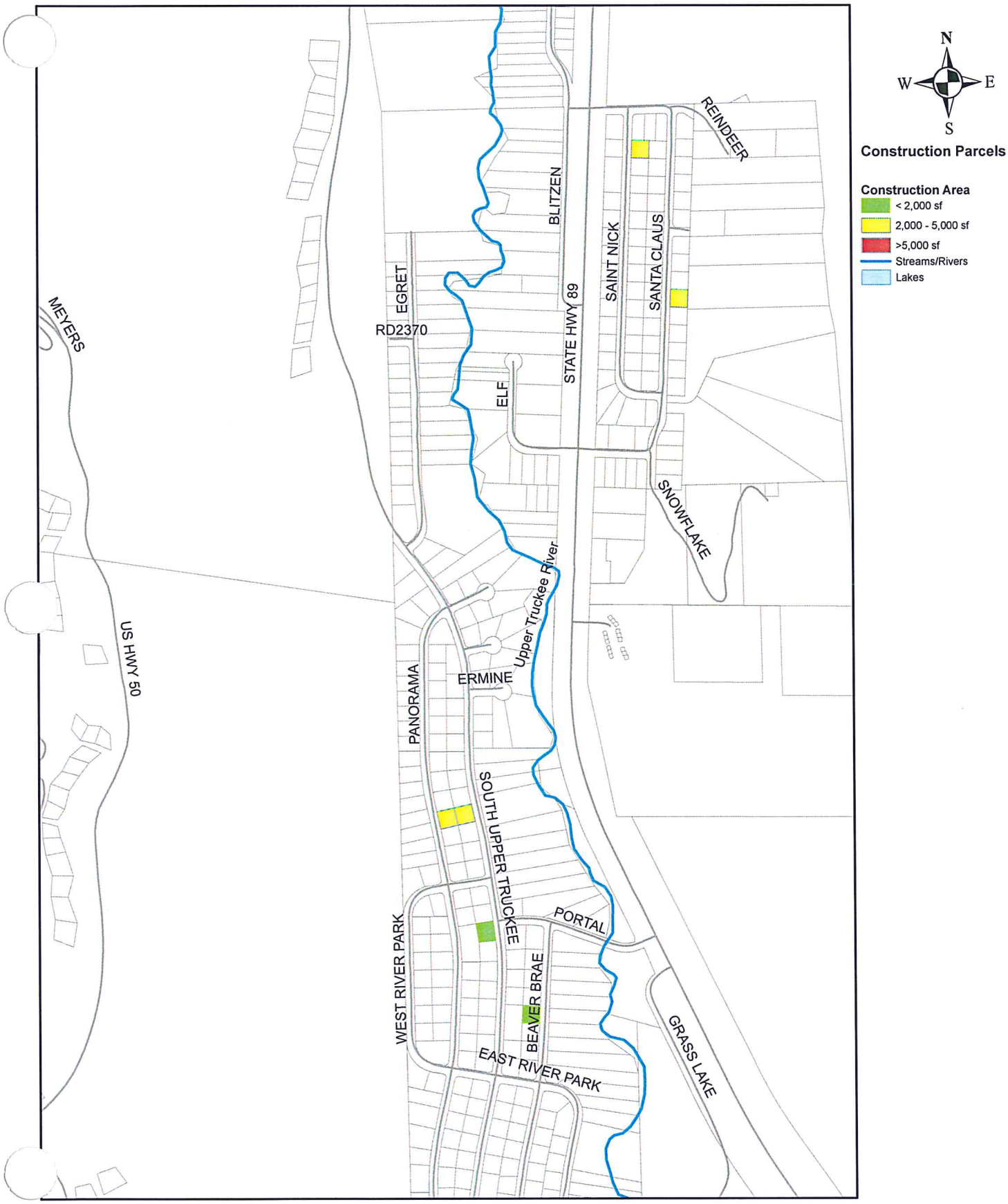
Construction Parcels

Construction Area

- < 2,000 sf
- 2,000 - 5,000 sf
- >5,000 sf
- Streams/Rivers
- Lakes

Index Sheet 23

0 0.05 0.1 0.2 0.3 Miles



Index Sheet 24

Miles
0 0.05 0.1 0.2 0.3

Parcel	Index Page #	Address	SqFt of Construction	SqFt Color	Distance to Water	Name
03206014	11	350 GLENMORE WAY	8733	R	>2500	
02545118	10	2611 COPPER WAY	8721	R	250-1000 ft 1000-2500 ft 1000-2500 ft	Cold Creek Heaven Valley Creek Trout Creek
03205075	11	2081 TAHOE MOUNTAIN RD	5949	R	1000-2500 ft	Fallen Leaf Lake
01623207	4	8822 RUBICON DR	5392	R	250-1000 ft	Lake Tahoe
02580302	13	2310 RIMROCK TRL	4954	Y	250-1000 ft 1000-2500 ft	Trout Creek Cold Creek
03325112	16	1045 COYOTE RIDGE CIR	4683	Y	250-1000 ft	Angora Creek
01702101	4	256 FOUR RING RD	4637	Y	<250 ft	Lake Tahoe
03656209	24	3281 PANORAMA DR	4530	Y	250-1000 ft	Upper Truckee River
03433404	21	1076 NAVAHOE DR	4400	Y	1000-2500 ft	Upper Truckee River
03341322	16	779 SENECA DR	4380	Y	>2500	
03459305	20	2144 SHAWNEE ST	4349	Y	250-1000 ft	Upper Truckee River
03527119	23	963 KEKIN ST	4274	Y	<250 ft	Upper Truckee River
01609127	3	8486 MEEKS BAY AVE	4232	Y	<250 ft	Lake Tahoe
03641206	24	2779 SAINT NICK WAY	4003	Y	250-1000 ft	Upper Truckee River
03354407	16	1131 CLEAR VIEW DR	3853	Y	250-1000 ft	Angora Creek
03421208	21	1222 EAST SAN BERNARDINO AVE	3836	Y	1000-2500 ft	Upper Truckee River
03472239	22	1597 ZAPOTEC DR	3754	Y	>2500	
03352316	16	811 ANGORA CREEK DR	3737	Y	250-1000 ft	Angora Creek
02574207	14	1914 HIGH MEADOW TRL	3730	Y	1000-2500 ft 1000-2500 ft	Cold Creek Trout Creek
03334403	16	681 SHOSHONE ST	3681	Y	1000-2500 ft	Angora Creek
08017201	9	1165 GOLDEN BEAR TRL	3571	Y	1000-2500 ft	Trout Creek
01516408	2	298 OAK ST	3520	Y	1000-2500 ft	Lake Tahoe
01658206	3	394 SUNNYVIEW DR	3513	Y	250-1000 ft	Lake Tahoe
03328513	16	1024 EAGLE LN	3495	Y	250-1000 ft	Angora Creek
03344124	16	1288 MT SHASTA CIR	3429	Y	1000-2500 ft	Angora Creek
03455205	20	2044 MEWUK DR	3363	Y	>2500	
02564311	10	2546 BERNICE LN	3360	Y	1000-2500 ft 1000-2500 ft	Cold Creek Heaven Valley Creek
03656204	24	3290 SOUTH UPPER TRUCKEE RD	3348	Y	250-1000 ft	Upper Truckee River
03386407	12	1921 HUNKPAPA ST	3278	Y	1000-2500 ft	Trout Creek
03434306	21	1141 NAVAHOE DR	3223	Y	>2500	
03383601	20	Next to 623 Kiowa	3200	Y	>2500	
03385418	12	1861 KOYUKON DR	3186	Y	1000-2500 ft	Upper Truckee River
03386405	12	1913 HUNKPAPA ST	3186	Y	1000-2500 ft	Trout Creek
01702118	4	234 FOUR RING RD	3185	Y	<250 ft	Lake Tahoe
03458410	20	1951 NORMUK ST	3024	Y	1000-2500 ft	Upper Truckee River

Parcel	Index Page #	Address	SqFt of Construction	SqFt Color	Distance to Water	Name
03344221	16	1207 MT SHASTA CIR	2946	Y	250-1000 ft	Angora Creek
08115211	19	1311 BOREN WAY	2628	Y	1000-2500 ft	Upper Truckee River
03437214	21	1890 INDIGO WAY	2404	Y	1000-2500 ft	Upper Truckee River
03642112	24	2847 SANTA CLAUS DR	2390	Y	250-1000 ft	Upper Truckee River
01702128	4	171 PARADISE FLAT LN	2189	Y	<250 ft	Lake Tahoe
03336246	16	491 CAYUGA CIR	2068	Y	>2500	
08015532	12	3143 JACARILLO TRL	2054	Y	>2500	
03356107	11	1001 GRANITE MOUNTAIN CIR	2035	Y	>2500	
08115205	19	1306 GLEN EAGLES RD	1943	G	1000-2500 ft 1000-2500 ft	Saxon Creek Upper Truckee River
01624213	4	8880 RUBICON DR	1880	G	250-1000 ft	Lake Tahoe
03477303	22	1722 SKYLINE DR	1833	G	>2500	
03655205	24	3344 SOUTH UPPER TRUCKEE RD	1788	G	250-1000 ft	Upper Truckee River
01614205	4	8613 NORTH LN	1486	G	<250 ft	Lake Tahoe
03477107	22	1768 CRYSTAL AIR DR	1371	G	>2500	
01637102	4	8750 KING GEORGE DR	1305	G	1000-2500 ft	Lake Tahoe
03037017	6	3860 SADDLE RD	1260	G	1000-2500 ft	Heaven Valley Creek
03381202	19	1633 PONCA ST	1179	G	250-1000 ft	Upper Truckee River
03212012	5	3115 JAMESON BEACH RD	1173	G	<250 ft	Lake Tahoe
03478310	22	1414 VANDERHOOF RD	1140	G	>2500	
03365201	19	1857 HEKPA DR	1088	G	1000-2500 ft 1000-2500 ft 1000-2500 ft	Saxon Creek Trout Creek Upper Truckee River
03525113	23	2540 BLITZEN RD	1036	G	250-1000 ft	Upper Truckee River
02132132	15	750 FALLEN LEAF RD	1004	G	<250 ft	Fallen Leaf Lake
01510206	2	7118 EIGHTH AVE	924	G	1000-2500 ft	Lake Tahoe
03518203	23	2355 KASKA ST	800	G	1000-2500 ft	Upper Truckee River
01613106	4	9105 STATE HWY 89	750	G	<250 ft	Lake Tahoe
03466107	22	1976 MANDAN ST	741	G	>2500	
08016315	13	1175 GOLD DUST TRL	723	G	1000-2500 ft	Trout Creek
02535414	9	1471 CHINQUAPIN DR	720	G	<250 ft 1000-2500 ft 1000-2500 ft	Heaven Valley Creek Cold Creek Trout Creek
02527112	9	1494 ORMSBY DR	716	G	250-1000 ft 1000-2500 ft 250-1000 ft	Cold Creek Heaven Valley Creek Trout Creek
03451206	20	1969 TOPPEWETAH ST	710	G	>2500	
03329214	18	1520 CHERRY HILLS CIR	705	G	1000-2500 ft 1000-2500 ft	Angora Creek Upper Truckee River
02559307	10	1718 FORTUNE WAY	700	G	250-1000 ft	Cold Creek

Parcel	Index Page #	Address	SqFt of Construction	SqFt Color	Distance to Water	Name
03368505	12	1683 NADOWA ST	680	G	1000-2500 ft 1000-2500 ft 1000-2500 ft	Saxon Creek Trout Creek Upper Truckee River
03655301	24	3384 BEAVER BRAE DR	624	G	250-1000 ft	Upper Truckee River
03436310	22	1713 ERIE CIR	576	G	>2500	
01614220	4	8660 BEACH LN	562	G	250-1000 ft	Lake Tahoe
08106209	18	1480 CRYSTAL AIR DR	555	G	>2500	
02564101	10	2442 ALICE LAKE RD	530	G	250-1000 ft 1000-2500 ft	Heaven Valley Creek Cold Creek
08015411	12	1232 PROSPECTOR TRL	530	G	>2500	
03465201	22	1602 CANIENAGA ST	516	G	>2500	
03343505	20	1787 DELAWARE ST	505	G	1000-2500 ft	Upper Truckee River
03475212	22	1700 MEADOW VALE DR	493	G	1000-2500 ft	Upper Truckee River
01428311	1	7025 MIAMI AVE	454	G	>2500	
03357504	11	840 BOULDER MOUNTAIN DR	432	G	>2500	
03003001	7	4080 LAKE TAHOE BLVD	392	G	1000-2500 ft	Heaven Valley Creek
02574219	14	2240 LUPINE TRL	391	G	1000-2500 ft 1000-2500 ft	Cold Creek Trout Creek
02581112	13	2225 COLUMBINE TRL	388	G	<250 ft	Trout Creek
03409803	22	1516 PLUMAS CIR	369	G	>2500	
02543313	10	2573 DEL NORTE ST	316	G	250-1000 ft 1000-2500 ft	Cold Creek Heaven Valley Creek
03333101	17	1115 EAST CT	304	G	1000-2500 ft	Angora Creek
03346603	16	1443 MT DIABLO CIR	304	G	1000-2500 ft	Angora Creek
01646207	4	8917 GLEN DR	298	G	1000-2500 ft	Lake Tahoe
01620207	4	8814 RUBICON DR	261	G	250-1000 ft	Lake Tahoe
01535134	2	7001 STATE HWY 89	260	G	250-1000 ft	Lake Tahoe
03456113	20	2163 MEWUK DR	240	G	1000-2500 ft	Upper Truckee River
01503407	2	7033 SEVENTH AVE	227	G	1000-2500 ft	Lake Tahoe
08010212	12	1911 IBACHE ST	186	G	1000-2500 ft	Trout Creek
01631204	4	9173 SCENIC DR	176	G	250-1000 ft	Lake Tahoe
03335421	16	774 CAYUGA ST	174	G	>2500	
03401013	21	1011 EAST SAN BERNARDINO AVE	172	G	<250 ft	Upper Truckee River
08011423	9	2490 COUGAR TRL	168	G	250-1000 ft 1000-2500 ft	Cold Creek Trout Creek
08015113	8	1109 SUNDOWN TRL	159	G	>2500	
02142014	15	379 FALLEN LEAF RD	150	G	<250 ft	Fallen Leaf Lake
01628404	4	8713 RUBICON DR	111	G	250-1000 ft	Lake Tahoe

Parcel	Index Page #	Address	SqFt of Construction	SqFt Color	Distance to Water	Name
03527226	23	2715 SOUTH UPPER TRUCKEE RD	89	G	250-1000 ft	Upper Truckee River
02142030	15	756 PRICE LN	75	G	250-1000 ft	Fallen Leaf Lake
03232215	11	2300 DEVERON WAY	72	G	>2500	
01606310	3	8315 MEEKS BAY AVE	65	G	<250 ft	Lake Tahoe
03387101	12	1954 KOYUKON DR	33	G	1000-2500 ft	Saxon Creek
					1000-2500 ft	Trout Creek
					1000-2500 ft	Upper Truckee River
02534308	9	2699 MUIR LN	12	G	250-1000 ft	Cold Creek
					1000-2500 ft	Trout Creek
					250-1000 ft	Heaven Valley Creek

NPDES - Tahoe Inventory Report

Date Range: 7/1/2014-6/30/2015

PLAN REVIEW Count: 67

APN: 015-102-06 Site: 7118 EIGHTH AVE
Distance to Water: 2177 Feet <1/2 Mile
Area of Disturbance: 924

Permit Nbr	Permit Type	Permit Status
237354	BUILDG-NEW-1-FMLY	P
237355	TRPA-NEW-PRJCT	P

APN: 015-164-08 Site: 298 OAK ST
Distance to Water: 1961 Feet <1/2 Mile
Area of Disturbance: 3520

Permit Nbr	Permit Type	Permit Status
230954	BUILDG-NEW-1-FMLY	P

APN: 015-351-34 Site: 7001 STATE HWY 89
Distance to Water: 196 Feet <1/4 Mile
Area of Disturbance: 260

Permit Nbr	Permit Type	Permit Status
237368	BUILDG-REPLAC-DECK	P

APN: 016-062-08 Site: 8282 MEEKS BAY AVE
Distance to Water: 361 Feet <1/4 Mile
Area of Disturbance:

Permit Nbr	Permit Type	Permit Status
237561	TRPA-NEW-SITEAS	P

APN: 017-021-01 Site: 256 FOUR RING RD
Distance to Water: 426 Feet <1/4 Mile
Area of Disturbance: 4637

Permit Nbr	Permit Type	Permit Status
236576	BUILDG-NEW-ACCBLD	P

APN: 017-021-08 Site: 281 PARADISE FLAT LN
Distance to Water: 117 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236659	BUILDG-REMODL-1-FMLY	P
236660	BUILDG-REMODL-2NDDW	P

APN: 021-301-16 Site: 910 EMIGRANT RD
Distance to Water: 689 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
234350	TRPA-NEW-SITEAS	P

APN: 025-354-14 Site: 1471 CHINQUAPIN DR
Distance to Water: 174 Feet <1/4 Mile
Area of Disturbance: 720

Permit Nbr	Permit Type	Permit Status
235223	BUILDG-NEW-DECK	P
235224	TRPA-NEW-PRJCT	P

APN: 025-451-18 Site: 2611 COPPER WAY
Distance to Water: 685 Feet <1/4 Mile
Area of Disturbance: 8721

Permit Nbr	Permit Type	Permit Status
234676	BUILDG-NEW-1-FMLY	P
234677	TRPA-NEW-PRJCT	P

APN: 025-754-07 Site: 2115 MARSHALL TRL
Distance to Water: 1283 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
234025	BUILDG-REMODL-1-FMLY	P

APN: 032-060-14 Site: 350 GLENMORE WAY
Distance to Water: 2635 Feet <1/2 Mile
Area of Disturbance: 8733

Permit Nbr	Permit Type	Permit Status
234680	BUILDG-NEW-1-FMLY	P
234681	TRPA-NEW-PRJCT	P

APN: 032-322-15 Site: 2300 DEVERON WAY
Distance to Water: 3243 Feet < 1 Mile
Area of Disturbance: 72

Permit Nbr	Permit Type	Permit Status
236712	BUILDG-NEW-DECK	P
236713	TRPA-NEW-PRJCT	P

APN: 033-354-21 Site: 774 CAYUGA ST
Distance to Water: 2884 Feet < 1 Mile
Area of Disturbance: 174

Permit Nbr	Permit Type	Permit Status
233817	BUILDG-NEW-DECK	P
233818	TRPA-NEW-PRJCT	P

APN: 033-442-21 Site: 1207 MT SHASTA CIR
Distance to Water: 568 Feet <1/4 Mile
Area of Disturbance: 2946

Permit Nbr	Permit Type	Permit Status
236466	BUILDG-REPLAC-1-FMLY	P
236467	TRPA-NEW-PRJCT	P

APN: 033-561-07 Site: 1001 GRANITE MOUNTAIN CIF
Distance to Water: 2043 Feet <1/2 Mile
Area of Disturbance: 2035

Permit Nbr	Permit Type	Permit Status
235447	BUILDG-EXPAND-1-FMLY	P
235448	TRPA-NEW-PRJCT	P

APN: 033-575-04 Site: 840 BOULDER MOUNTAIN DR
Distance to Water: 2612 Feet <1/2 Mile
Area of Disturbance: 432

Permit Nbr	Permit Type	Permit Status
236601	BUILDG-NEW-STORAG	P
236602	TRPA-NEW-PRJCT	P
236604	TRPA-EXMPT-PRJCT	P

APN: 033-652-01 Site: 1857 HEKPA DR
Distance to Water: 1440 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
237478	BUILDG-EXPAND-TOWR-C	P

APN: 033-812-02 **Site: 1633 PONCA ST**
Distance to Water: 825 Feet <1/4 Mile
Area of Disturbance: 1179

Permit Nbr	Permit Type	Permit Status
229836	BUILDG-EXPAND-1-FMLY	P
229837	TRPA-NEW-PRJCT	P
229840	BUILDG-DEMLTN-GARAGE	P

APN: 033-836-01 **Site: 0**
Distance to Water: 2914 Feet < 1 Mile
Area of Disturbance: 3200

Permit Nbr	Permit Type	Permit Status
235998	BUILDG-NEW-1-FMLY	P
235999	TRPA-NEW-PRJCT	P

APN: 033-864-05 **Site: 1913 HUNKPAPA ST**
Distance to Water: 2431 Feet <1/2 Mile
Area of Disturbance: 3186

Permit Nbr	Permit Type	Permit Status
227966	BUILDG-NEW-1-FMLY	P
227967	TRPA-NEW-PRJCT	P

APN: 033-864-07 **Site: 1921 HUNKPAPA ST**
Distance to Water: 2344 Feet <1/2 Mile
Area of Disturbance: 3278

Permit Nbr	Permit Type	Permit Status
233748	BUILDG-NEW-1-FMLY	P
233749	TRPA-NEW-PRJCT	P

APN: 033-871-01 **Site: 1954 KOYUKON DR**
Distance to Water: 1934 Feet <1/2 Mile
Area of Disturbance: 33

Permit Nbr	Permit Type	Permit Status
236729	BUILDG-EXPAND-1-FMLY	P

APN: 034-010-13 **Site: 1011 EAST SAN BERNARDINO AV**
Distance to Water: 252 Feet <1/4 Mile
Area of Disturbance: 172

Permit Nbr	Permit Type	Permit Status
227976	BUILDG-NEW-PUBBLD	P

APN: 034-363-10 **Site: 1713 ERIE CIR**
Distance to Water: 1328 Feet <1/2 Mile
Area of Disturbance: 576

Permit Nbr	Permit Type	Permit Status
235306	BUILDG-NEW-GARAGE	P

APN: 034-372-14 **Site: 1890 INDIGO WAY**
Distance to Water: 1245 Feet <1/4 Mile
Area of Disturbance: 2404

Permit Nbr	Permit Type	Permit Status
236867	BUILDG-REMODL-1-FMLY	P
236869	TRPA-NEW-PRJCT	P

APN: 034-472-19 **Site: 1868 PIMA ST**
Distance to Water: 2111 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
237823	BUILDG-REMODL-1-FMLY	P

APN: 034-722-39 **Site: 1597 ZAPOTEC DR**
Distance to Water: 847 Feet <1/4 Mile
Area of Disturbance: 3754

Permit Nbr	Permit Type	Permit Status
237650	BUILDG-NEW-1-FMLY	P
237651	TRPA-NEW-PRJCT	P

APN: 034-752-12 **Site: 1700 MEADOW VALE DR**
Distance to Water: 1401 Feet <1/2 Mile
Area of Disturbance: 493

Permit Nbr	Permit Type	Permit Status
236679	BUILDG-REMODL-1-FMLY	P
236680	TRPA-NEW-PRJCT	P

APN: 034-771-01 **Site: 1705 SKYLINE DR**
Distance to Water: 2411 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
233286	BUILDG-NEW-TOWR-C	P

APN: 034-771-07 **Site: 1768 CRYSTAL AIR DR**
Distance to Water: 2219 Feet <1/2 Mile
Area of Disturbance: 1371

Permit Nbr	Permit Type	Permit Status
230190	BUILDG-EXPAND-1-FMLY	P

APN: 034-783-10 **Site: 1414 VANDERHOOF RD**
Distance to Water: 1693 Feet <1/2 Mile
Area of Disturbance: 1140

Permit Nbr	Permit Type	Permit Status
229607	BUILDG-NEW-GARAGE	P

APN: 035-182-03 **Site: 2355 KASKA ST**
Distance to Water: 1870 Feet <1/2 Mile
Area of Disturbance: 800

Permit Nbr	Permit Type	Permit Status
232374	GRADNG-NEW-COMM'L	P
232379	BUILDG-NEW-STRG-C	P

APN: 035-271-19 **Site: 963 KEKIN ST**
Distance to Water: 226 Feet <1/4 Mile
Area of Disturbance: 4274

Permit Nbr	Permit Type	Permit Status
232330	BUILDG-NEW-1-FMLY	P

APN: 035-272-26 **Site: 2715 SOUTH UPPER TRUCKEE**
Distance to Water: 491 Feet <1/4 Mile
Area of Disturbance: 89

Permit Nbr	Permit Type	Permit Status
232110	BUILDG-EXPAND-1-FMLY	P

APN: 036-401-06 **Site: 3575 SOUTH UPPER TRUCKEE**
Distance to Water: 277 Feet <1/4 Mile
Area of Disturbance:

Permit Nbr	Permit Type	Permit Status
234758	TRPA-NEW-SITEAS	P

APN: 036-552-05 **Site: 3344 SOUTH UPPER TRUCKEE**
Distance to Water: 651 Feet <1/4 Mile
Area of Disturbance: 1788

Permit Nbr	Permit Type	Permit Status
234686	BUILDG-EXPAND-1-FMLY	P
234687	TRPA-NEW-PRJCT	P
234689	TRPA-EXMPT-PRJCT	P

APN: 080-151-13 Site: 1109 SUNDOWN TRL
Distance to Water: 2645 Feet < 1 Mile
Area of Disturbance: 159

Permit Nbr	Permit Type	Permit Status
237289	BUILDG-EXPAND-1-FMLY	P
237290	TRPA-NEW-PRJCT	P
237292	TRPA-EXMPT-PRJCT	P

APN: 081-151-22 Site: 1291 GLEN EAGLES RD
Distance to Water: 1655 Feet <1/2 Mile
Area of Disturbance:

Permit Nbr	Permit Type	Permit Status
236906	TRPA-NEW-SITEAS	P

APN: 081-152-05 Site: 1306 GLEN EAGLES RD
Distance to Water: 1496 Feet <1/2 Mile
Area of Disturbance: 1943

Permit Nbr	Permit Type	Permit Status
235780	BUILDG-EXPAND-1-FMLY	P
235781	TRPA-NEW-PRJCT	P

APN: 081-152-11 Site: 1311 BOREN WAY
Distance to Water: 1357 Feet <1/2 Mile
Area of Disturbance: 2628

Permit Nbr	Permit Type	Permit Status
229346	BUILDG-EXPAND-1-FMLY	P
229347	TRPA-NEW-PRJCT	P
229349	TRPA-EXPAND-DRIVWY	P

UNDER CONSTRUCTION Count: 164

APN: 014-283-11 Site: 7025 MIAMI AVE
Distance to Water: 959 Feet <1/4 Mile
Area of Disturbance: 454

Permit Nbr	Permit Type	Permit Status
235034	BUILDG-EXPAND-1-FMLY	I
235035	TRPA-NEW-PRJCT	I

APN: 015-034-07 Site: 7033 SEVENTH AVE
Distance to Water: 1141 Feet <1/4 Mile
Area of Disturbance: 227

Permit Nbr	Permit Type	Permit Status
232921	BUILDG-EXPAND-1-FMLY	I
232922	TRPA-NEW-PRJCT	I

APN: 015-063-04 Site: 7082 SEVENTH AVE
Distance to Water: 1770 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
234537	BUILDG-REACT-1-FMLY	I

APN: 015-253-12 Site: 7246 SEVENTH AVE
Distance to Water: 2584 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
230435	TRPA-REPLAC-DRIVWY	I

APN: 015-351-30 Site: 7001 STATE HWY 89
Distance to Water: 113 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
234532	BUILDG-REMODL-1-FMLY	I

APN: 016-062-02 Site: 8274 MEEKS BAY AVE
Distance to Water: 361 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
230502	TRPA-NEW-DRIVWY	I

APN: 016-063-10 Site: 8315 MEEKS BAY AVE
Distance to Water: 130 Feet <1/4 Mile
Area of Disturbance: 65

Permit Nbr	Permit Type	Permit Status
234987	BUILDG-EXPAND-1-FMLY	I

APN: 016-091-27 Site: 8486 MEEKS BAY AVE
Distance to Water: 320 Feet <1/4 Mile
Area of Disturbance: 4232

Permit Nbr	Permit Type	Permit Status
229178	BUILDG-NEW-1-FMLY	I
229179	TRPA-NEW-PRJCT	I

APN: 016-131-06 Site: 9105 STATE HWY 89
Distance to Water: 271 Feet <1/4 Mile
Area of Disturbance: 750

Permit Nbr	Permit Type	Permit Status
232882	BUILDG-REPLAC-DECK	I

APN: 016-142-05 Site: 8613 NORTH LN
Distance to Water: 158 Feet <1/4 Mile
Area of Disturbance: 2756

Permit Nbr	Permit Type	Permit Status
233182	TRPA-NEW-PRJCT	I
233183	BUILDG-NEW-GARAGE	I
233184	BUILDG-EXPAND-ACCBLD	I

APN: 016-142-20 Site: 8660 BEACH LN
Distance to Water: 327 Feet <1/4 Mile
Area of Disturbance: 562

Permit Nbr	Permit Type	Permit Status
236330	BUILDG-REPLAC-DECK	I

APN: 016-202-07 Site: 8814 RUBICON DR
Distance to Water: 510 Feet <1/4 Mile
Area of Disturbance: 261

Permit Nbr	Permit Type	Permit Status
235872	BUILDG-EXPAND-1-FMLY	I
235873	TRPA-NEW-PRJCT	I

APN: 016-232-02 Site: 9012 RUBICON DR
Distance to Water: 654 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
237567	TRPA-REPLAC-DRIVWY	I

APN: 016-232-07 Site: 8822 RUBICON DR
Distance to Water: 485 Feet <1/4 Mile
Area of Disturbance: 5392

Permit Nbr	Permit Type	Permit Status
235239	BUILDG-REPLAC-1-FMLY	I
235240	TRPA-NEW-PRJCT	I

APN: 016-242-13 Site: 8880 RUBICON DR
Distance to Water: 464 Feet <1/4 Mile
Area of Disturbance: 1880

Permit Nbr	Permit Type	Permit Status
237702	BUILDG-REACT-GARAGE	I

APN: 016-284-04 **Site: 8713 RUBICON DR**
Distance to Water: 437 Feet <1/4 Mile
Area of Disturbance: 111

Permit Nbr	Permit Type	Permit Status
235840	BUILDG-EXPAND-DECK	I

APN: 016-312-04 **Site: 9173 SCENIC DR**
Distance to Water: 614 Feet <1/4 Mile
Area of Disturbance: 176

Permit Nbr	Permit Type	Permit Status
234989	BUILDG-EXPAND-DECK	I

APN: 016-371-02 **Site: 8750 KING GEORGE DR**
Distance to Water: 95 Feet <1/4 Mile
Area of Disturbance: 1305

Permit Nbr	Permit Type	Permit Status
234334	BUILDG-EXPAND-1-FMLY	I
234335	TRPA-NEW-PRJCT	I

APN: 016-462-07 **Site: 8917 GLEN DR**
Distance to Water: 376 Feet <1/4 Mile
Area of Disturbance: 298

Permit Nbr	Permit Type	Permit Status
234912	BUILDG-EXPAND-1-FMLY	I

APN: 016-493-09 **Site: 8581 SILVERTIP DR**
Distance to Water: 751 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
229854	TRPA-NEW-PRJCT	I

APN: 016-582-06 **Site: 394 SUNNYVIEW DR**
Distance to Water: 764 Feet <1/4 Mile
Area of Disturbance: 3513

Permit Nbr	Permit Type	Permit Status
234533	BUILDG-NEW-1-FMLY	I
234534	TRPA-NEW-PRJCT	I

APN: 017-021-18 **Site: 234 FOUR RING RD**
Distance to Water: 355 Feet <1/4 Mile
Area of Disturbance: 3185

Permit Nbr	Permit Type	Permit Status
236553	BUILDG-DEMLTN-1-FMLY	I

APN: 017-021-28 **Site: 171 PARADISE FLAT LN**
Distance to Water: 353 Feet <1/4 Mile
Area of Disturbance: 2189

Permit Nbr	Permit Type	Permit Status
235378	BUILDG-EXPAND-1-FMLY	I

APN: 021-311-03 **Site: 839 FALLEN LEAF RD**
Distance to Water: 166 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
235143	BUILDG-NEW-RETWAL	I

APN: 021-321-32 **Site: 750 FALLEN LEAF RD**
Distance to Water: 120 Feet <1/4 Mile
Area of Disturbance: 1467

Permit Nbr	Permit Type	Permit Status
229691	BUILDG-REPLAC-DECK	I
229692	BUILDG-REPLAC-DECK	I

APN: 021-420-14 **Site: 379 FALLEN LEAF RD**
Distance to Water: 229 Feet <1/4 Mile
Area of Disturbance: 290

Permit Nbr	Permit Type	Permit Status
229300	BUILDG-EXPAND-DECK	I
229301	TRPA-EXMPT-PRJCT	I

APN: 021-420-30 **Site: 756 PRICE LN**
Distance to Water: 686 Feet <1/4 Mile
Area of Disturbance: 75

Permit Nbr	Permit Type	Permit Status
233055	BUILDG-EXPAND-DECK	I
233056	TRPA-EXMPT-PRJCT	I

APN: 025-010-23 **Site: 1360 JOHNSON BLVD**
Distance to Water: 1740 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
231118	BUILDG-REMODL-PUBBLD	I

APN: 025-271-09 **Site: 1454 BLACK BART AVE**
Distance to Water: 288 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
228199	BUILDG-REMODL-GARAGE	I

APN: 025-271-12 **Site: 1494 ORMSBY DR**
Distance to Water: 117 Feet <1/4 Mile
Area of Disturbance: 716

Permit Nbr	Permit Type	Permit Status
231604	BUILDG-EXPAND-1-FMLY	I
231605	TRPA-NEW-PRJCT	I

APN: 025-271-23 **Site: 1572 BLACK BART AVE**
Distance to Water: 397 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
233268	BUILDG-REMODL-1-FMLY	I
234141	BUILDG-REMODL-1-FMLY	I

APN: 025-271-53 **Site: 1470 ORMSBY DR**
Distance to Water: 91 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
232284	TRPA-NEW-PRJCT	I

APN: 025-343-08 **Site: 2699 MUIR LN**
Distance to Water: 395 Feet <1/4 Mile
Area of Disturbance: 12

Permit Nbr	Permit Type	Permit Status
230953	BUILDG-NEW-DECK	I

APN: 025-432-03 **Site: 2515 COLD CREEK TRL**
Distance to Water: 793 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236387	BUILDG-REMODL-1-FMLY	I

APN: 025-433-13 **Site: 2573 DEL NORTE ST**
Distance to Water: 885 Feet <1/4 Mile
Area of Disturbance: 316

Permit Nbr	Permit Type	Permit Status
235545	BUILDG-REMODL-1-FMLY	I

APN: 025-593-07 **Site: 1718 FORTUNE WAY**
Distance to Water: 385 Feet <1/4 Mile
Area of Disturbance: 700

Permit Nbr	Permit Type	Permit Status
235126	BUILDG-EXPAND-1-FMLY	I
235127	TRPA-NEW-PRJCT	I

APN: 025-641-01 **Site: 2442 ALICE LAKE RD**
Distance to Water: 1027 Feet <1/4 Mile
Area of Disturbance: 530

Permit Nbr	Permit Type	Permit Status
229007	BUILDG-EXPAND-1-FMLY	I

APN: 025-643-11 **Site: 2546 BERNICE LN**
Distance to Water: 1457 Feet <1/2 Mile
Area of Disturbance: 3360

Permit Nbr	Permit Type	Permit Status
228426	BUILDG-NEW-1-FMLY	I
228427	TRPA-NEW-PRJCT	I

APN: 025-742-07 **Site: 1914 HIGH MEADOW TRL**
Distance to Water: 1110 Feet <1/4 Mile
Area of Disturbance: 3730

Permit Nbr	Permit Type	Permit Status
232647	BUILDG-NEW-1-FMLY	I
232648	TRPA-NEW-PRJCT	I

APN: 025-742-19 **Site: 2240 LUPINE TRL**
Distance to Water: 1157 Feet <1/4 Mile
Area of Disturbance: 545

Permit Nbr	Permit Type	Permit Status
228536	BUILDG-REMODL-1-FMLY	I
228537	TRPA-EXMPT-PRJCT	I

APN: 025-803-02 **Site: 2310 RIMROCK TRL**
Distance to Water: 825 Feet <1/4 Mile
Area of Disturbance: 4954

Permit Nbr	Permit Type	Permit Status
236608	BUILDG-NEW-1-FMLY	I
236609	TRPA-NEW-PRJCT	I

APN: 025-811-12 **Site: 2225 COLUMBINE TRL**
Distance to Water: 167 Feet <1/4 Mile
Area of Disturbance: 388

Permit Nbr	Permit Type	Permit Status
235383	BUILDG-EXPAND-1-FMLY	I
235384	TRPA-NEW-PRJCT	I

APN: 025-832-04 **Site: 1759 GENTIAN CIR**
Distance to Water: 1489 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
235654	TRPA-EXMPT-PRJCT	I

APN: 030-030-01 **Site: 4080 LAKE TAHOE BLVD**
Distance to Water: 3348 Feet < 1 Mile
Area of Disturbance: 392

Permit Nbr	Permit Type	Permit Status
235419	BUILDG-NEW-DECK-C	I

APN: 030-370-17 **Site: 3860 SADDLE RD**
Distance to Water: 3467 Feet < 1 Mile
Area of Disturbance: 1260

Permit Nbr	Permit Type	Permit Status
227761	BUILDG-EXPAND-OFFICE	I

APN: 032-050-75 **Site: 2081 TAHOE MOUNTAIN RD**
Distance to Water: 1494 Feet <1/2 Mile
Area of Disturbance: 8117

Permit Nbr	Permit Type	Permit Status
228406	BUILDG-DEMLTN-1-FMLY	I
228407	BUILDG-REPLAC-1-FMLY	I
228408	TRPA-NEW-PRJCT	I
235048	BUILDG-NEW-GARAGE	I
235049	GRADNG-NEW-GRADNG	I

APN: 032-120-12 **Site: 3115 JAMESON BEACH RD**
Distance to Water: 168 Feet <1/4 Mile
Area of Disturbance: 1173

Permit Nbr	Permit Type	Permit Status
232659	BUILDG-CNVRTO-ACCBLD	I

APN: 032-353-10 **Site: 286 HEATHER CIR**
Distance to Water: 3232 Feet < 1 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
237541	BUILDG-REMODL-1-FMLY	I

APN: 032-362-03 **Site: 309 GLENMORE WAY**
Distance to Water: 2658 Feet < 1 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236883	BUILDG-NEW-RETWAL	I

APN: 032-364-04 **Site: 315 UPLANDS WAY**
Distance to Water: 3058 Feet < 1 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
234779	BUILDG-REACT-1-FMLY	I

APN: 033-251-12 **Site: 1045 COYOTE RIDGE CIR**
Distance to Water: 1148 Feet <1/4 Mile
Area of Disturbance: 4683

Permit Nbr	Permit Type	Permit Status
229255	BUILDG-REACT-1-FMLY	I

APN: 033-285-13 **Site: 1024 EAGLE LN**
Distance to Water: 889 Feet <1/4 Mile
Area of Disturbance: 3495

Permit Nbr	Permit Type	Permit Status
229760	BUILDG-REPLAC-1-FMLY	I
229761	TRPA-NEW-PRJCT	I

APN: 033-292-14 **Site: 1520 CHERRY HILLS CIR**
Distance to Water: 1156 Feet <1/4 Mile
Area of Disturbance: 1085

Permit Nbr	Permit Type	Permit Status
233473	BUILDG-NEW-DECK	I
233474	TRPA-NEW-PRJCT	I
233550	TRPA-EXMPT-PRJCT	I

APN: 033-331-01 **Site: 1115 EAST CT**
Distance to Water: 1489 Feet <1/2 Mile
Area of Disturbance: 304

Permit Nbr	Permit Type	Permit Status
229959	BUILDG-REMODL-1-FMLY	C

APN: 033-344-03 **Site: 681 SHOSHONE ST**
Distance to Water: 2339 Feet <1/2 Mile
Area of Disturbance: 3681

Permit Nbr	Permit Type	Permit Status
236016	BUILDG-NEW-1-FMLY	I
236017	TRPA-NEW-PRJCT	I

APN: 033-354-02 **Site: 672 CAYUGA CT**
Distance to Water: 2688 Feet < 1 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236695	BUILDG-REMODL-1-FMLY	I

APN: 033-362-46 **Site: 491 CAYUGA CIR**
Distance to Water: 2428 Feet <1/2 Mile
Area of Disturbance: 2068

Permit Nbr	Permit Type	Permit Status
233478	BUILDG-EXPAND-1-FMLY	I
233479	TRPA-NEW-PRJCT	I

APN: 033-413-22 **Site: 779 SENECA DR**
Distance to Water: 2648 Feet < 1 Mile
Area of Disturbance: 4380

Permit Nbr	Permit Type	Permit Status
230605	BUILDG-NEW-1-FMLY	I
230606	TRPA-NEW-PRJCT	I

APN: 033-435-05 **Site: 1787 DELAWARE ST**
Distance to Water: 1839 Feet <1/2 Mile
Area of Disturbance: 1005

Permit Nbr	Permit Type	Permit Status
229856	BUILDG-REMODL-1-FMLY	I
229857	TRPA-NEW-PRJCT	I
231696	TRPA-EXMPT-PRJCT	I

APN: 033-441-24 **Site: 1288 MT SHASTA CIR**
Distance to Water: 1052 Feet <1/4 Mile
Area of Disturbance: 3429

Permit Nbr	Permit Type	Permit Status
230530	BUILDG-REPLAC-1-FMLY	I
230531	TRPA-NEW-PRJCT	I

APN: 033-466-03 **Site: 1443 MT DIABLO CIR**
Distance to Water: 1717 Feet <1/2 Mile
Area of Disturbance: 304

Permit Nbr	Permit Type	Permit Status
230353	BUILDG-REACT-DECK	I

APN: 033-494-04 **Site: 1591 GRIZZLY MOUNTAIN DR**
Distance to Water: 2281 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
232228	TRPA-NEW-PRJCT	I

APN: 033-523-16 **Site: 811 ANGORA CREEK DR**
Distance to Water: 482 Feet <1/4 Mile
Area of Disturbance: 3737

Permit Nbr	Permit Type	Permit Status
235422	BUILDG-REPLAC-1-FMLY	I
235423	TRPA-NEW-PRJCT	I

APN: 033-544-07 **Site: 1131 CLEAR VIEW DR**
Distance to Water: 617 Feet <1/4 Mile
Area of Disturbance: 3853

Permit Nbr	Permit Type	Permit Status
233794	BUILDG-NEW-1-FMLY	I
233795	TRPA-NEW-PRJCT	I

APN: 033-622-11 **Site: 1082 MOUNTAIN CANARY DR**
Distance to Water: 1159 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
235077	BUILDG-REMODL-1-FMLY	I

APN: 033-652-01 **Site: 1857 HEKPA DR**
Distance to Water: 1440 Feet <1/2 Mile
Area of Disturbance: 1088

Permit Nbr	Permit Type	Permit Status
234814	BUILDG-EXPAND-1-FMLY	I
234815	TRPA-NEW-PRJCT	D

APN: 033-685-05 **Site: 1683 NADOWA ST**
Distance to Water: 1990 Feet <1/2 Mile
Area of Disturbance: 680

Permit Nbr	Permit Type	Permit Status
235131	BUILDG-EXPAND-1-FMLY	I
235132	TRPA-NEW-PRJCT	I

APN: 033-712-26 **Site: 1844 APALACHEE DR**
Distance to Water: 1767 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
232220	TRPA-NEW-PRJCT	I

APN: 033-732-01 **Site: 1570 BOCA RATON DR**
Distance to Water: 1356 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
230278	TRPA-REPLAC-DRIVWY	I

APN: 033-854-18 **Site: 1861 KOYUKON DR**
Distance to Water: 2240 Feet <1/2 Mile
Area of Disturbance: 3186

Permit Nbr	Permit Type	Permit Status
233949	BUILDG-NEW-1-FMLY	I
233950	TRPA-NEW-PRJCT	I

APN: 034-098-03 **Site: 1516 PLUMAS CIR**
Distance to Water: 707 Feet <1/4 Mile
Area of Disturbance: 369

Permit Nbr	Permit Type	Permit Status
229172	TRPA-EXMPT-PRJCT	I

APN: 034-212-08 **Site: 1222 EAST SAN BERNARDINO .**
Distance to Water: 794 Feet <1/4 Mile
Area of Disturbance: 3836

Permit Nbr	Permit Type	Permit Status
229741	BUILDG-NEW-1-FMLY	I
229742	TRPA-NEW-PRJCT	I

APN: 034-261-04 **Site: 1111 TOMAHAWK LN**
Distance to Water: 1497 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
231832	BUILDG-CNVRTO-GARAGE	I

APN: 034-263-04 **Site: 2008 WASHOE ST**
Distance to Water: 1300 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
230764	TRPA-REPLAC-DRIVWY	I

APN: 034-294-07 **Site: 1941 ARROWHEAD AVE**
Distance to Water: 1923 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
234984	BUILDG-REMODL-1-FMLY	I

APN: 034-321-21 **Site: 3206 US HWY 50**
Distance to Water: 1288 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
235666	BUILDG-REACT-OFFICE	I

APN: 034-334-04 **Site: 1076 NAVAHOE DR**
Distance to Water: 2032 Feet <1/2 Mile
Area of Disturbance: 4400

Permit Nbr	Permit Type	Permit Status
234848	BUILDG-NEW-1-FMLY	I
234849	TRPA-NEW-PRJCT	I

APN: 034-343-06 **Site: 1141 NAVAHOE DR**
Distance to Water: 1363 Feet <1/2 Mile
Area of Disturbance: 3223

Permit Nbr	Permit Type	Permit Status
229697	BUILDG-NEW-1-FMLY	I
229698	TRPA-NEW-PRJCT	I

APN: 034-363-10 **Site: 1713 ERIE CIR**
Distance to Water: 1328 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236813	TRPA-NEW-PRJCT	U

APN: 034-512-06 **Site: 1969 TOPPEWETAH ST**
Distance to Water: 990 Feet <1/4 Mile
Area of Disturbance: 710

Permit Nbr	Permit Type	Permit Status
228955	BUILDG-NEW-DECK	I

APN: 034-515-10 **Site: 1934 MEWUK DR**
Distance to Water: 1184 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
233969	BUILDG-REMODL-1-FMLY	I

APN: 034-552-05 **Site: 2044 MEWUK DR**
Distance to Water: 105 Feet <1/4 Mile
Area of Disturbance: 4948

Permit Nbr	Permit Type	Permit Status
230439	BUILDG-REPLAC-1-FMLY	I
230440	TRPA-NEW-PRJCT	I
231267	BUILDG-NEW-ACCBLD	I
231268	TRPA-NEW-PRJCT	I

APN: 034-561-13 **Site: 2163 MEWUK DR**
Distance to Water: 1075 Feet <1/4 Mile
Area of Disturbance: 240

Permit Nbr	Permit Type	Permit Status
228533	BUILDG-CNVRTO-GARAGE	I

APN: 034-584-10 **Site: 1951 NORMUK ST**
Distance to Water: 698 Feet <1/4 Mile
Area of Disturbance: 3888

Permit Nbr	Permit Type	Permit Status
235212	BUILDG-DEMLTN-1-FMLY	I
235213	BUILDG-REPLAC-1-FMLY	I
235214	TRPA-NEW-PRJCT	I

APN: 034-593-05 **Site: 2144 SHAWNEE ST**
Distance to Water: 522 Feet <1/4 Mile
Area of Disturbance: 4349

Permit Nbr	Permit Type	Permit Status
228996	BUILDG-NEW-1-FMLY	I
228997	TRPA-NEW-PRJCT	I

APN: 034-652-01 **Site: 1602 CANIENAGA ST**
Distance to Water: 256 Feet <1/4 Mile
Area of Disturbance: 516

Permit Nbr	Permit Type	Permit Status
229279	BUILDG-REPLAC-DECK	I

APN: 034-661-07 **Site: 1976 MANDAN ST**
Distance to Water: 246 Feet <1/4 Mile
Area of Disturbance: 741

Permit Nbr	Permit Type	Permit Status
230490	BUILDG-EXPAND-1-FMLY	I
230491	TRPA-NEW-PRJCT	I

APN: 034-722-07 **Site: 1600 OGLALA ST**
Distance to Water: 922 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
230645	BUILDG-REMODL-1-FMLY	I

APN: 034-753-14 **Site: 1840 CRYSTAL AIR DR**
Distance to Water: 1326 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236011	BUILDG-REMODL-1-FMLY	I

APN: 034-773-03 **Site: 1722 SKYLINE DR**
Distance to Water: 2153 Feet <1/2 Mile
Area of Disturbance: 1833

Permit Nbr	Permit Type	Permit Status
229384	BUILDG-REACT-1-FMLY	I

APN: 034-781-11 **Site: 1358 OFLYNG DR**
Distance to Water: 1517 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
233865	BUILDG-REMODL-1-FMLY	I

APN: 035-251-13 **Site: 2540 BLITZEN RD**
Distance to Water: 446 Feet <1/4 Mile
Area of Disturbance: 1036

Permit Nbr	Permit Type	Permit Status
229658	BUILDG-NEW-ACCBLD	I

APN: 035-286-05 **Site: 816 NAHANE DR**
Distance to Water: 1275 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
229953	TRPA-REPLAC-DRIVWY	I

APN: 036-380-32 **Site: 3112 ELF LN**
Distance to Water: 16 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236626	BUILDG-REMODL-1-FMLY	I

APN: 036-412-06 **Site: 2779 SAINT NICK WAY**
Distance to Water: 732 Feet <1/4 Mile
Area of Disturbance: 4003

Permit Nbr	Permit Type	Permit Status
230211	BUILDG-NEW-1-FMLY	I

APN: 036-421-12 **Site: 2847 SANTA CLAUS DR**
Distance to Water: 980 Feet <1/4 Mile
Area of Disturbance: 2390

Permit Nbr	Permit Type	Permit Status
228905	BUILDG-NEW-1-FMLY	I
228906	TRPA-NEW-PRJCT	I

APN: 036-475-07 **Site: 3481 EAST RIVER PARK DR**
Distance to Water: 47 Feet <1/4 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236826	BUILDG-REMODL-1-FMLY	I

APN: 036-553-01 **Site: 3384 BEAVER BRAE DR**
Distance to Water: 435 Feet <1/4 Mile
Area of Disturbance: 624

Permit Nbr	Permit Type	Permit Status
228254	BUILDG-EXPAND-GARAGE	I

APN: 036-562-04 **Site: 3290 SOUTH UPPER TRUCKEE R**
Distance to Water: 451 Feet <1/4 Mile
Area of Disturbance: 3348

Permit Nbr	Permit Type	Permit Status
234759	BUILDG-NEW-1-FMLY	I
234760	TRPA-NEW-PRJCT	I

APN: 036-562-09 **Site: 3281 PANORAMA DR**
Distance to Water: 550 Feet <1/4 Mile
Area of Disturbance: 4530

Permit Nbr	Permit Type	Permit Status
233799	BUILDG-NEW-1-FMLY	I
233800	TRPA-NEW-PRJCT	I

APN: 080-101-04 **Site: 1904 IBACHE ST**
Distance to Water: 1744 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
236076	BUILDG-REACT-1-FMLY	I

APN: 080-102-12 **Site: 1911 IBACHE ST**
Distance to Water: 1655 Feet <1/2 Mile
Area of Disturbance: 372

Permit Nbr	Permit Type	Permit Status
228881	BUILDG-NEW-DECK	I
228883	TRPA-NEW-PRJCT	I

APN: 080-114-23 **Site: 2490 COUGAR TRL**
Distance to Water: 507 Feet <1/4 Mile
Area of Disturbance: 204

Permit Nbr	Permit Type	Permit Status
230771	BUILDG-NEW-DECK	I
230772	TRPA-EXMPT-PRJCT	I

APN: 080-143-03 **Site: 3031 LODGEPOLE TRL**
Distance to Water: 1532 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
237487	TRPA-REPLAC-DRIVWY	I

APN: 080-144-25 **Site: 1296 PROSPECTOR TRL**
Distance to Water: 1866 Feet <1/2 Mile
Area of Disturbance: 0

Permit Nbr	Permit Type	Permit Status
228632	BUILDG-REACT-1-FMLY	I

APN: 080-154-11 **Site: 1232 PROSPECTOR TRL**
Distance to Water: 2638 Feet <1/2 Mile
Area of Disturbance: 530

Permit Nbr	Permit Type	Permit Status
228510	BUILDG-EXPAND-1-FMLY	I

APN: 080-155-32 **Site: 3143 JACARILLO TRL**
Distance to Water: 2924 Feet < 1 Mile
Area of Disturbance: 2054

Permit Nbr	Permit Type	Permit Status
228899	BUILDG-REACT-1-FMLY	I

APN: 080-163-15 **Site: 1175 GOLD DUST TRL**
Distance to Water: 2115 Feet <1/2 Mile
Area of Disturbance: 723

Permit Nbr	Permit Type	Permit Status
229232	BUILDG-REACT-1-FMLY	I

APN: 080-172-01 **Site: 1165 GOLDEN BEAR TRL**
Distance to Water: 1597 Feet <1/2 Mile
Area of Disturbance: 3571

Permit Nbr	Permit Type	Permit Status
229735	BUILDG-NEW-1-FMLY	I

APN: 081-062-09 **Site: 1480 CRYSTAL AIR DR**
Distance to Water: 2589 Feet <1/2 Mile
Area of Disturbance: 555

Permit Nbr	Permit Type	Permit Status
230099	BUILDG-EXPAND-1-FMLY	I
230100	TRPA-NEW-PRJCT	I

KUELPER
1327 BOREN
530-880
091-152-13
2015/11/23

2015/11/23

K BROTHERS
2256
LUPINE TR
APN 25-742-17
2015/11/23

2015/11/23

2015/11/23

2015/11/23

2015/11/23

2256
LUPINE TR
APN 25-342-1
2015/11/23

Appendix K

Itinerary STHS Field Trip 2015 – Stormwater Management
November 17, 2015

8:15 - 8:30 – General Discussion about lake clarity, stormwater and BMPs

8:30 – 9:00 - Pasadena - Have UC Davis explain monitoring, evaluation of projects and show monitoring equipment

9:15 - 10:15 - Walk from Senior Center down bike path to Cal Trans Basins, filters, over to Lakeview Commons and Fremont Pipe. Meet with the League to Save Lake Tahoe.

Lake Clarity / Water Quality
Regulatory Program
Discuss BMP and Sediment basins
Filtration
Community monitoring and pipe keeper

10:15 – 11:00 – Drive to Bijou Water Quality Project (Meet Jason Burke from City)

11:00 – 11:40 - Drive over to Ski Run (check out ski run / wildwood)

11:40 – 12:00 – Bathroom break at Sierra House Elementary

12:00 – 12:15 - Drive to Cattleman's basin.

12:00 - 12:30 – Lunch at Montgomery Estates Water Quality Project

12:30 - 1:45 - Head over to the County Yard. See / discuss BMP's, Vactor, Sweeper and Heavy Equipment for snow removal, Road Sanding

1:45 - 2:15 - Angora Creek Restoration project

Discuss Restoration Intent / Destruction of Wetlands / Importance

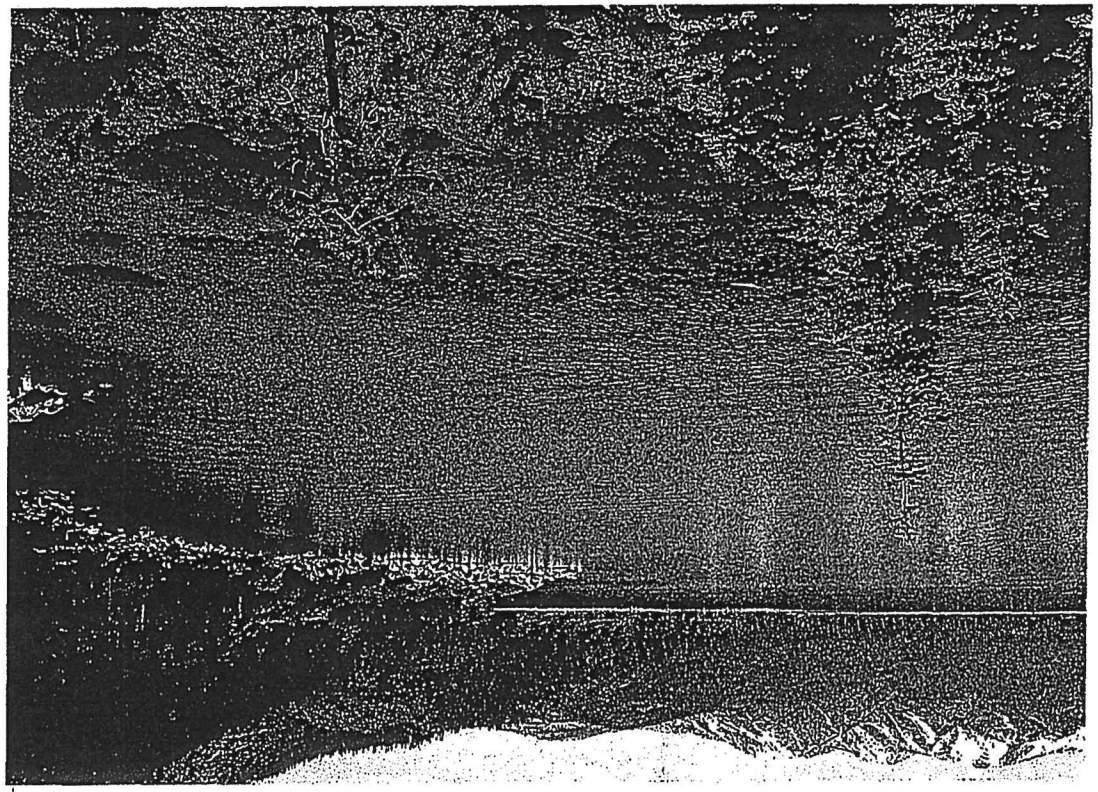
2:30 - Finish at High School

2015 STHS Stormwater Field Trip
Sign-in Sheet

Joe Moreau
Brady Montgomery
Stephanie Cook
Melanie Anchez
Mariel Penollar
Samantha Kallas
Emily Doyle
Orion Maxwell
Brianda Ortega
Emily Abourailek
Alysa Hokanson
IVY Alvarez
Bre Griffles
Emily Griffen
[illegible] Zoe G
Zach S
Hirshal S
Tommy C
Saran

Sabrina
Korinne Bracker
Fabian Navarro
Carson Alexander
Kendall Melroges

ASSOCIATED STUDENT COUNCIL
KEEP
TAHOE
BLUE
League to Save Lake Tahoe



What does the League to Save Lake Tahoe do to Keep Tahoe Blue?

We **advocate** for strong environmental regulation and enforcement to protect Lake Tahoe for this and future generations.

We **educate** and engage the Tahoe Community to foster continued environmental stewardship that will Keep Tahoe Blue.

We support **collaborative**, innovative and science-based solutions to environmental issues facing the Lake.

League to Save Lake Tahoe
2608 Lake Tahoe Boulevard
South Lake Tahoe, CA 96150
530.541.5388 · keeptahoeblue.org

Photo: PeterSpain.com

Dear Russ,

Thank you for providing the community with your knowledge at the Pipe Keeper's Forum at Lake Tahoe Community College. Your presentation was fun and very informative. We appreciate your lively spirit and passion to inspire others. We look forward to continuing our partnership with you.

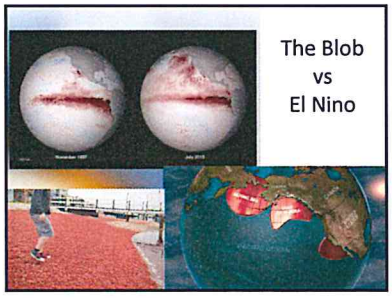
Sincerely,

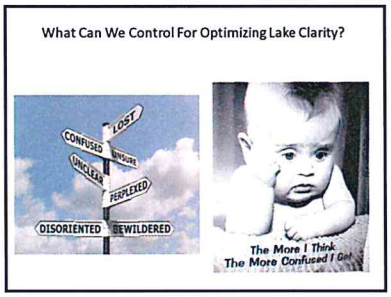
Jesse

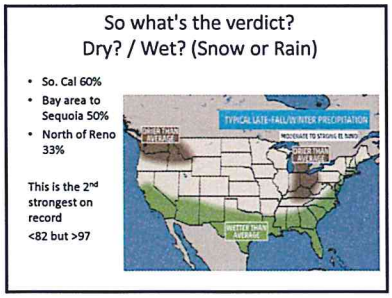
Savannah Zack Amanda Marilee

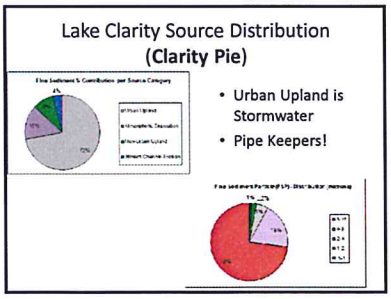
WINTER IS COMING!!!
EL NIÑO
THE BLOB
RUSSELL WIGART, CPSWQ, CPESC
COUNTY OF EL DORADO
STORMWATER

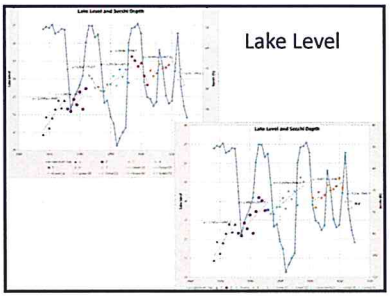
The Great Flood of '97

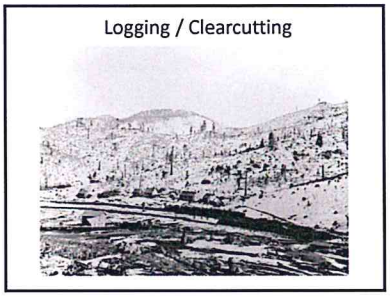

The Blob
vs
El Nino


What Can We Control For Optimizing Lake Clarity?
LOST
CONFUSED
UNSURE
UNCLEAR
PERPLEXED
DISORIENTED
BEWILDERED
The More I Think
The More Confused I Get


So what's the verdict?
Dry? / Wet? (Snow or Rain)
• So. Cal 60%
• Bay area to Sequoia 50%
• North of Reno 33%
This is the 2nd strongest on record
<82 but >97
TYPICAL LATE-FALL/WINTER PRECIPITATION
MODERATE TO STRONG EL NINO
SPRING WARM AVERAGE
SPRING WARM AVERAGE
WETTER THAN AVERAGE


Lake Clarity Source Distribution
(Clarity Pie)
• Urban Upland is Stormwater
• Pipe Keepers!


Lake Level

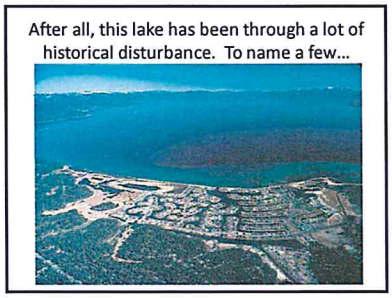

Logging / Clearcutting

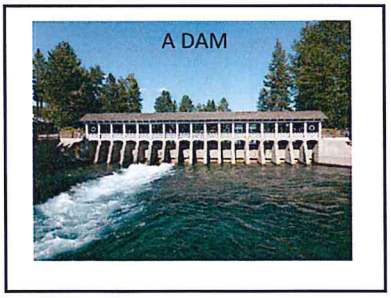
Introduction of Invasives
We are also invasive

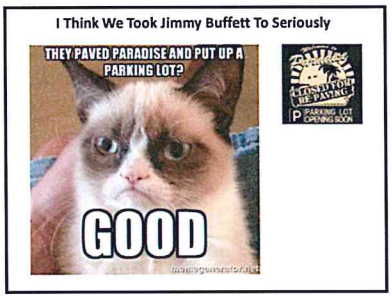
Why Should We Save Lake Tahoe
Why Should We?

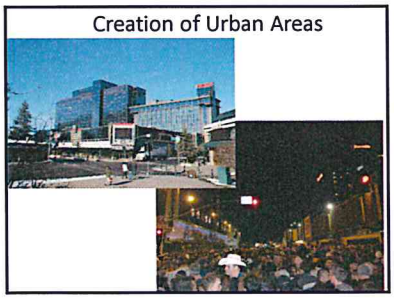
Overfishing

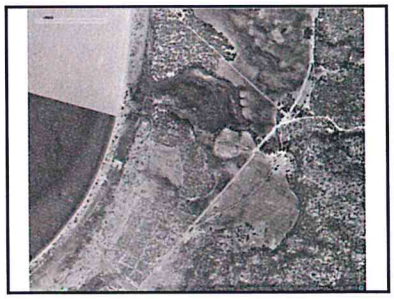
Destruction of Our Wetlands


After all, this lake has been through a lot of historical disturbance. To name a few...


A DAM


I Think We Took Jimmy Buffett To Seriously
THEY PAVED PARADISE AND PUT UP A PARKING LOT?
GOOD
PARKING LOT OPENING SOON


Creation of Urban Areas



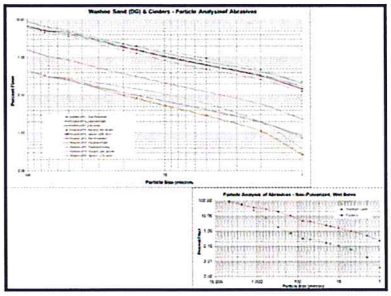
Winter Traction Sand

Conclusions

1.) Modifying abrasives and switching to Washoe Sand (DG) will result in upwards of a 93 – 98% reduction for particles <16 um and 1 um respectively.
2.) Trace amounts of ultrafine particles <2 um (Those responsible for majority of clarity loss) are found in this Washoe Sand granite specification.
3.) Based on 1000 ton of annual usage this equates to an almost 40,000 lb. reduction in <16um particles.
4.) The annualized cost-benefit of this practice is calculated to range from $.27 - $.42 / lb-FSP / year.
5.) There is very little breakdown into ultrafine fine fractions with the new winter sand specification.
6.) Results are repeatable with 5 individual tests yielding very similar results.

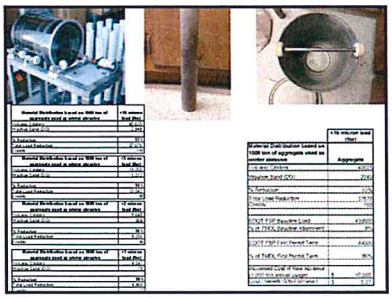
Sand trucks

- 3 Sand trucks equipped with Brine prewetting systems



The Men That Maintain and Plow

12 Graders



What Level of Snow Removal Do we Have In El Dorado County

- Sand Trucks
- Graders
- Front End Loaders
- Rotary Blowers
- Brine truck

This Level of Service for ~ $20 / parcel / year

*** Advanced Controls and Green tech cost $$$$**

8 Rotary Blowers

Brine

Dry Application	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Brine Application	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Reduction in NaCl usage	[illegible]

- 23% salt
- 77% Water

Effective to 14 degree F

Acts like Teflon

Long lasting – Doesn't bounce

Reduces Chloride Application

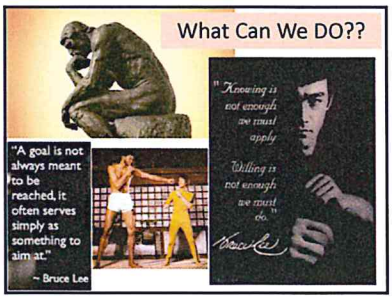
Infiltrate Urban Runoff

Sweepers

What Can You Do?

- Only rain belongs in the drain!
- Wash your car at a Car Wash.
- Keep your car well-maintained.
- Use lawn or garden chemicals sparingly. Low or No Phosphorous
- Plant native, low maintenance plants and grasses.
- Minimize runoff by not over-watering your lawn and garden.
- Clean up pet waste.
- Be sure to minimize the amount of ice-melt used.
- Consider minimizing impervious surfaces around your home.
- Make sure storm drain outfalls are not running in dry weather.
- Do not drain your pool, spa, or fountain to a storm drain.
- Walk, bike, or share a ride when possible.
- Properly maintain your neighborhood stormwater pond / Garden.
- Install BMPs, rain barrel or cistern to capture roof runoff.
  - Consider disconnecting your downspouts.

What Can We DO??



We Can Still Save This Lake

Russell Wigart – Stormwater Coordinator Tahoe - El Dorado County Stormwater
russell.wigart@edcgov.us – (530) 573 7924

If You Identify Stormwater Pollution or Threats to Lake Tahoe Water Resources Call:
Stormwater Hotline – (530) 573 7906

LAKE TAHOE ENVIRONMENTAL IMPROVEMENT PROGRAM

CALIFORNIA TAHOE ALLIANCE
THE PARTNERSHIP ADVOCATING FOR LAKE TAHOE'S NATURAL RESOURCES AND THE ENVIRONMENTAL IMPROVEMENT PROGRAM

Tahoe Field Tour for Legislative Staff

October 15, 2015 * 10:00 am - 3:00 pm

Key Projects and Messages to Highlight:

- Upper Truckee River Restoration
- Aquatic Invasive Species
- Public Utility District Fire Fighting Infrastructure
- Area Plan/Regional Plan Implementation
- Funding Issues

Agenda:

10:00-10:10	California Alpine Club Lodge	9010 Johnson Pass Road, Echo Lake, CA 95721	Presenter: Julie (TRPA)

- Overview/Welcome

10:20-10:50	Upper Truckee River: State Parks Golf Course Reach	Bakersfield Street & Country Club Drive	Presenter: Cyndie Walk (State Parks)

- **Upper Truckee River Restoration & Golf Course Reconfiguration Project.** Years of logging, gravel mining, cattle grazing, and the development of a golf course along the Upper Truckee River have led to erosion, increased sediment entering Lake Tahoe, and reduced riparian habitat.
  - *Lead agency:* California State Parks
  - *Status:* In planning.
  - *Funding needed:* $14 million to implement project

11:00-11:40	Utility firefighting infrastructure	Angora burn area	Presenter: Lynn (STPUD),

- **Firefighting infrastructure in Tahoe Basin is inadequate.** Many Tahoe neighborhoods lack fire hydrants and other water-related infrastructure necessary to fight fires. This issue affects water suppliers throughout the Basin. Many suppliers operate in disadvantaged communities. Funding for water infrastructure upgrades is extremely limited at the state and federal levels.
  - *Lead agency:* Local water suppliers
  - *Status:* Areas needing upgrades have been identified
  - *Funding needed:* ?