ATTACHMENT A

City of South Lake Tahoe

Pollutant Load Reduction Plan

January 2013

Prepared for:

Lahontan Regional
Water Quality Control Board

Submitted by:

Prepared with assistance from:

nhc
northwest hydraulic consultants

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LIST OF ACRONYMS

BMP	Best management practices, e.g. stormwater control measures
CICU	Commercial/institutional/communications/utilities
CRC	Characteristic Runoff Concentration
CSLT	City of South Lake Tahoe
DCIA	Directly connected impervious area
DN	Dissolved nitrogen
DP	Dissolved phosphorus
FSP	Fine sediment particles
GIS	Geographic information system
HSC	Hydrologic source control
ICIA	Indirectly connected impervious area
Lahontan	Lahontan Region Water Quality Control Board
MFR	Multi-family residential
NDEP	Nevada Division of Environmental Protection
NRCS	Natural Resources Conservation Service
PLRP	Pollutant load reduction plan
PSC	Pollutant source control
SEZ	Stream environment zone
SFR	Single family residential
SWT	Storm water treatment
TMDL	Total maximum daily load
TN	Total nitrogen
TP	Total phosphorus
TRPA	Tahoe Regional Planning Agency
UPC	Urban planning catchment
WQIP	Water quality improvement project

1.0 BACKGROUND

The California Regional Water Quality Control Board-Lahontan Region (Lahontan) incorporated the Lake Tahoe Total Maximum Daily Load (TMDL) pollutant load reduction requirements into the updated Tahoe Municipal National Pollutant Discharge Elimination System (NPDES) Permit (Lahontan 2011a). This permit (Board Order R6T-2011-0101) regulates stormwater discharges from each California municipalities' stormwater management infrastructure in the Tahoe Basin. The municipal separate storm sewer system (MS4) infrastructure consists of collection, conveyance, and treatment facilities. Federal rules require operators of MS4 systems to implement programs to control polluted runoff. California regulates MS4s through municipal NPDES permits, and for this document, Lahontan Board Order R6T-2011-0101 is referred to as the MS4 permit.

The MS4 permit requires the City of South Lake Tahoe (City) to prepare a Pollutant Load Reduction Plan (PLRP) by March 15, 2013 detailing the City's approach for meeting pollutant load reduction requirements. Section 2 of this document presents the City's PLRP, which describes the: 1) selected approach for achieving required load reductions; 2) associated performance and cost estimates; 3) urban planning catchment (UPC) registration schedule; 4) annual timeline for load reductions; and, 5) annual adaptive management process.

Section 1 provides background information describing the City's baseline load estimate, specific load reduction requirements specified in the MS4 permit, and previous City planning efforts that have directly informed the development of this PLRP.

1.1 BASELINE LOAD ESTIMATE

In 2011, Lahontan issued an *Order to Submit Technical Reports in Accordance with California Water Code – Lake Tahoe Urban Stormwater Implementation* (13267 Order) to the City and the other Tahoe Basin MS4 permitees (El Dorado County and Placer County). The 13267 Order required the City to estimate a baseline pollutant load discharged to Lake Tahoe for fine sediment particles (FSP), total phosphorus (TP), and total nitrogen (TN). The period of time from October 1, 2003 to May 1, 2004 is defined by the 13267 Order, and the MS4 permit, as the baseline condition and the point of reference for estimating baseline pollutant loading. The City's *Lake Tahoe TMDL Baseline Pollutant Load Estimate Report (CSLT 2011)* was submitted to Lahontan in September of 2011. The City's baseline load estimate (Table 1.1) was subsequently reported in section IV.A of the MS4 Permit (Lahontan 2011b: p. 26).

Table 1.1 – City Baseline Pollutant Load Estimate

Urban Area (acres)	Surface Runoff (acre-feet/year)	Pollutant Loading			
		FSP	TP	TN	Units
5,500	1,200	389,000	1,740	7,410	lb/year
		176,450	789	3,361	kg/year
		1.94E+19	n/a	n/a	# particles/year[1]

[1] One kg FSP = 1.1×10^{14} particles FSP (Lahontan and NDEP 2011, Equation: 0.3)

1.2 LOAD REDUCTION REQUIREMENTS

Through the Lake Tahoe TMDL, Lahontan established five-year load reduction targets to assess a jurisdiction's progress towards meeting overall load reduction goals (Lahontan 2010: p. 10-4). Load reduction targets for FSP, TP, and TN have been established based on attainment of California's Lake Tahoe transparency standard (roughly 97 feet) over an estimated 65-year implementation period. The MS4 permit requires a 10 percent FSP reduction, 7 percent TP reduction, and an 8 percent TN reduction from baseline pollutant loading by September 30, 2016.

Lahontan has developed the Lake Clarity Crediting Program to support the Lake Tahoe TMDL, which specifies the process to link implementation of water quality improvement actions to estimated pollutant load reductions (Lahontan and NDEP 2011). Through this program, Lake Clarity Credits have been defined as a mechanism to provide flexibility for regulated jurisdictions to achieve required load reductions. Lahontan intends to use the Lake Clarity Crediting Program and an accounting system for Lake Clarity Credits to track compliance with stormwater regulatory measures. Table 1.2 displays the City's load reduction requirements and associated Lake Clarity Credits that need to be obtained during the MS4 permit term. Note that the MS4 permit identifies the City's required Lake Clarity Credits as 190, which resulting from rounding the baseline load of FSP particles and associated Lake Clarity Credits to two significant figures.

Table 1.2 – 2016 Load Reduction Requirements

Parameter	Baseline Load (kg/year)	Required Percent Reduction	Required Load Reduction (kg/year)	Allowable Load (kg/year)
Fine Sediment Particles (mass)	176,450	10%	17,650	158,800
Fine Sediment Particles (# of particles)	1.94E+19	10%	1.94E+18	1.75E+19
Total Phosphorus	789	7%	55	734
Total Nitrogen	3,361	8%	269	3,092
Lake Clarity Credits[1]	n/a	n/a	190	n/a

[1] One Lake Clarity Credit = 1.0 $x10^{16}$ particles FSP (Lahontan and NDEP 2011, Equation: 0.2)

1.3 SUPPORTING INFORMATION AND REPORTS

The City authorized development of a *Pollutant Load Reduction Strategy Report* (CSLT 2012) to assess potential approaches for reducing pollutant loading to Lake Tahoe from urban stormwater runoff. The goal of the Strategy Report was to identify feasible and cost effective actions to meet anticipated targets to inform the City's load reduction planning process.

The Strategy Report categorized and analyzed water quality improvement actions as three primary load reduction methodologies:

1. Road maintenance operations for water quality;
2. Public water quality improvement projects (WQIPs); and
3. Private parcel BMPs implemented through retrofit or redevelopment.

Using this framework, the Strategy Report completed an existing conditions assessment that estimated load reductions the City could register from completed water quality improvement actions. Following the existing conditions assessment, each of the three load reduction methodologies was assessed under various assumptions, which included varying levels of implementation. The results identify potential load reduction approaches and associated costs to achieve anticipated load reduction targets.

In addition to the Strategy Report, the City's *Lake Tahoe TMDL Baseline Pollutant Load Estimate Report* (CSLT 2011) provides useful information to help prioritize water quality improvement actions. This report separately identifies urban planning catchments (UPCs) that drain directly to Lake Tahoe and UPCs that drain to a meadow or other natural filtration system prior to reaching Lake Tahoe. The term *catchment connectivity* is used to specify this distinction, which classifies the portion of surface runoff and associated pollutant load discharged from a discrete UPC that reaches Lake Tahoe. Catchment connectivity is expressed as a percentage and termed a *connectivity factor*, where a connectivity factor of 100 percent denotes a directly connected UPC that discharges stormwater directly to Lake Tahoe or a stream flowing to Lake Tahoe. Distinguishing between UPCs based on catchment connectivity is particularly important to the City because much of the City's urban drainage area discharges to meadows prior to reaching Lake Tahoe. For these UPCs, only a fraction of the total pollutant load generated by the urban land uses within the City reaches Lake Tahoe.

1.4 PRESENTATION OF PERFORMANCE AND COST ESTIMATES

Pollutant load reduction performance estimates were developed using the Pollutant Load Reduction Model (PLRM), which is the same modeling tool used to estimate the City's baseline pollutant load. The PLRM is a publicly available long-term continuous simulation model used to evaluate and compare alternatives for storm water quality improvement projects in the Tahoe Basin. The PLRM links urban stormwater hydrology and site specific land use conditions to estimate average annual pollutant loading from urban drainage catchments under varying scenarios (NHC et al. 2009).

The City's PLRP is intended to be a concise and targeted document that communicates to Lahontan the City's approach and timeline for meeting the 2016 load reduction targets set forth in the MS4 permit. For brevity, the PLRP does not include a detailed narrative of the assumptions used to generate the performance and cost estimates presented herein. That information can be found in the City's Strategy Report (NHC 2012), which contains the supporting analysis that informed development of this PLRP.

For each UPC identified within this PLRP for catchment registration during the MS4 permit term, Appendix A summarizes the: 1) approach for load reduction within the UPC; 2) status of the supporting PLRM model; 3) quality assurance steps completed on the supporting PLRM model; and 4) primary and secondary water quality improvements within that UPC providing the majority of the estimated load reductions.

2.0 POLLUTANT LOAD REDUCTION PLAN

This following section summarizes the City's: 1) selected approach for meeting the load reduction requirements; 2) performance and cost estimates; 3) UPCs identified for catchment registration during the MS4 permit term; 4) annual timeline for achieving load reductions; and, 5) adaptive management process.

2.1 LOAD REDUCTION APPROACH

The City's selected approach to meet load reduction requirements combines the registration of WQIPs completed from 2004-2016 with the implementation of a pilot program to improve road operations for water quality. Specific actions include the following:

Register Completed WQIPs (2004-2012): Since the baseline period, the City has completed seven WQIPs. The UPCs that encompass the seven completed project areas will be registered with the Lake Clarity Crediting Program (see Section 2.1.1).

Construct and Register Active WQIPs (2013-2016): Three WQIPs are in active stages of planning and design, and construction should be completed by the load reduction deadline (September 2016). The UPCs that encompasses the three active project areas will be registered with the Lake Clarity Crediting Program (see Section 2.1.2).

Implement Pilot Program for Improved Road Operations: Through a pilot program, the City will implement the following:

- Switch to a road abrasive source with less FSP to reduce the average annual mass of FSP generated by City roads from sanding practices.
- Improve FSP recovery on a subset of City roads that generate high amounts of pollutants through frequent street sweeping.

The UPCs that bound the roads targeted for frequent street sweeping will be registered with the Lake Clarity Crediting Program (see Section 2.1.3). The City may also decide to explore with Lahontan the appropriate methods for registering the change in road abrasive supply as a jurisdiction-wide action. Findings and results from the pilot program will be used to assess the feasibility of expanding City road operations for water quality as a more prominent load reduction strategy in future PLRPs.

The following sections summarize performance estimates for each of the City's selected actions to meet the required load reductions in the MS4 permit.

2.1.1 REGISTER COMPLETED WQIPS (2004-2012)

To date, the City's approach for reducing stormwater pollutant loads has focused on implementation of public WQIPs in accordance with TRPA's Environmental Improvement Program. Since the Lake Tahoe TMDL baseline period, the City has constructed seven WQIPs. Performance estimates for the seven completed WQIPs are presented in Table 2.1. Pollutant reduction estimates are derived from PLRM models developed by the City, or consultants to the City. The following are standard assumptions used for each PLRM model:

- Street sweeping is conducted on a regular basis using one mechanical broom sweeper and two dustless regenerative air sweepers. Street sweeping is performed citywide one to two times during the year in the summer and fall months, and more frequently on specific roads during the winter to recover road abrasives applied during snow events.
- Each PLRM simulation for the expected condition assumes the City uses the "High-efficiency" PLRM sweeper type, and a sweeping frequency of 1-2 times per year for all secondary roads.
- Estimates of private property BMP implementation for the expected condition are based on BMP data supplied to the City by TRPA.

Each PLRM model has gone through a peer review process, which is documented in Appendix A. In some cases, additional model refinement and quality assurance may be necessary before registering a WQIP with the Lake Clarity Crediting Program. Where additional quality assurance steps are needed, this information is noted in Appendix A. Final load reduction numbers registered by the City may be different than shown in Table 2.1.

Table 2.1 – Completed WQIP Performance Estimates

City UPC	Water Quality Improvement Project	Year Completed	Load Reduction Estimates (kg/year)			Lake Clarity Credits	% of City's Baseline Load		
			FSP	TP	TN		FSP	TP	TN
B11	Glorene and 8th	2004	2,660	9	31	29	1.5%	1.2%	0.9%
M3	Rocky Point 1 and 2	2004	3,510	13	43	39	2.0%	1.7%	1.3%
J4, J8	Rocky Point 3 and 4	2012	1,100	5	20	12	0.6%	0.6%	0.6%
F1	Sierra Tract Phase 1	2010	150	2	9	2	0.1%	0.2%	0.3%
F1	Sierra Tract Phase 2	2005	200	1	4	2	0.1%	0.1%	0.1%
G12	Al Tahoe Phase 1	2010	900	6	16	10	0.5%	0.8%	0.5%
G11	Al Tahoe Phase 2	2012	1,810	10	33	20	1.0%	1.2%	1.0%
	Totals:	n/a	10,330	45	155	114	5.9%	5.7%	4.6%

For some completed WQIPs the load reduction achieved is a relatively small proportion of the City's baseline load. In these cases, the WQIPs were implemented in UPCs that discharge stormwater to meadows which subsequently were found to have low connectivity factors. Consequently, the load reduction benefit was diminished because much of the stormwater and pollutant loads generated in the pre-project condition would be filtered or infiltrated in meadows and marshes downstream of City storm drain outfalls. The City incorporated the concept of

catchment connectivity into the project prioritization process, and all active WQIPs are within UPCs that discharge stormwater directly to Lake Tahoe or streams flowing to Lake Tahoe.

Of the 29 Lake Clarity Credits attributed to the Glorene and 8th WQIP, 10 Credits result from improvements constructed by the City that treat Caltrans runoff. Previous discussions between City staff and Caltrans staff have indicated that Caltrans may allow the City to take credit for the total load reduction realized by the Glorene and 8th WQIP. However, a formal agreement between the City and Caltrans has not been negotiated.

2.1.2 CONSTRUCT ACTIVE WQIPS (2013-2016)

The City anticipates at least three WQIPs in various stages of planning and design will be constructed by the pollutant load reduction deadline (September 2016). The three WQIPs include:

- Bijou Commercial Core
- Harrison Avenue
- Sierra Tract Phase 3 & 4

These projects highlight a new City strategy to maximize load reductions by selecting project areas that treat runoff from land uses expected to generate high pollutant loads. These projects treat runoff from dense commercial land uses and city streets, as well as Caltrans runoff where feasible. Additionally, these WQIPs are within UPCs that discharge stormwater directly to Lake Tahoe or streams flowing to Lake Tahoe. Consequently, the WQIPs are forecasted to provide greater load reductions relative to most past City WQIPs on a unit area basis.

Pollutant reduction estimates in Table 2.2 are derived from preliminary PLRM models that typically reflect the preferred alternative for project design. These models have gone through a peer review process, and the status of each model is documented in Appendix A. Additional refinement and quality assurance of these PLRM models will be necessary after project construction to ensure the models appropriately represent the functions of the constructed water quality improvements. Final load reduction numbers registered with the Lake Clarity Crediting Program will likely differ from the estimates presented in Table 2.2.

Table 2.2 – Active WQIP Performance Estimates

City UPC	Water Quality Improvement Project	Estimated Construction Year	Load Reduction Estimates (kg/year)			Lake Clarity Credits	% of City's Baseline Load		
			FSP	TP	TN		FSP	TP	TN
I8	Bijou Commercial Core	2013/2014	4,570	17	61	50	2.6%	2.1%	1.8%
G12	Harrison Avenue	2013	2,300	7	25	25	1.3%	0.9%	0.7%
E1	Sierra Tract Phase 3 and 4	2015	3,370	11	19	37	1.9%	1.4%	0.6%
	Totals:	n/a	10,240	35	105	113	5.8%	4.5%	3.1%

The Bijou Commercial Core WQIP is a joint effort with Caltrans. The load reduction estimate presented in Table 2.2 is the City's initial negotiated share (50 percent) of the credited load reduction for the project with Caltrans. Total load reductions for the project, when including

Caltrans negotiated share, is twice the estimate shown in Table 2.2. The City is bearing the maintenance and operational costs of the Bijou Commercial Core WQIP. Dependent upon future negotiations with Caltrans, the City's share of the load reduction achieved from the project may increase dependent upon the City's cumulative costs for long-term operation of the Bijou WQIP.

Performance estimates for the Sierra Tract Phase 3&4 WQIP represent the preferred alternative. These estimates exclude Caltrans stormwater runoff, which currently commingles with City stormwater runoff in the project area. Depending upon the City's potential future coordination with Caltrans on the final project design, the load reductions achieved from the Sierra Tract Phase 3&4 project could be greater than what is shown in Table 2.2 when including treatment of Caltrans runoff.

2.1.3 IMPLEMENT PILOT PROGRAM FOR ROAD OPERATIONS

Approaches for reducing FSP loads generated from roads are categorized as follows: 1) minimizing the amount of FSP generated from application of road abrasives; and 2) maximizing the recovery of FSP on targeted roads, through activities such as frequent street sweeping. As a pilot program, the City will implement the following two actions:

- Switch to an abrasive supply with negligible FSP in the source material
- Test improved FSP recovery through frequent street sweeping on a subset of City roads

Switch to Abrasive Supplies with Negligible FSP in the Source Material

Preliminary Caltrans results (2010) indicate that the volcanic cinders used by the City through the 2011-2012 winter season (#004 in Caltrans study) has comparably high amounts of FSP relative to other available sources. For example, El Dorado County recently switched to a deicing sand (#022 in Caltrans study) with approximately 0.01 percent FSP, compared to the 0.3 percent FSP contained in volcanic cinders (Table 2.3).

The small percentages of FSP within an abrasive supply can become a relatively significant load when calculating total abrasives applied citywide. For example, switching to the abrasive supply used by El Dorado County is estimated to reduce the amount of FSP applied on City roads by 1,470 kilograms per year (Table 2.3). The actual load reduction in the City's baseline load from this action, however, would be less than 1,470 kilograms of FSP because the calculations in Table 2.3 do not consider fate and transport of material applied to City roads.

Table 2.3 – Estimated FSP Applied to City Roads from Road Abrasives

Abrasive Supply	FSP Count (particle count / kg abrasive)[1]	FSP Mass (kg FSP / kg abrasive)[2]	FSP Percentage by Mass in Abrasive Supply	Average Annual City Abrasives Applied (kg)	FSP Applied (kg/year)
Volcanic Cinders - Existing Source	3.29E+11	0.0030	0.30%	503,000	1,500
Deicing Sand - Current El Dorado County Source	6.94E+09	0.0001	0.01%	503,000	30

[1] Caltrans 2010: p. 4-1

[2] One kg FSP = 1.1×10^{14} particles FSP (Lahontan and NDEP 2011: Equation 0.3)

For the 2012-2013 winter season, the City has changed its abrasive supply to the deicing sand used by El Dorado County (Table 2.3). The load reduction benefit that may be realized from this action is not proposed for registration with this PLRP, unless future circumstances require the City to take credit for this action to meet load reduction requirements. The City intends to take credit for this action as part of a future PLRP once the following programmatic steps are completed:

- The methods and associated level of effort for registering and tracking the performance of jurisdictional actions with the Lake Clarity Crediting Program are better defined.
- Updates to the PLRM Road Methodology and Road Rapid Assessment Methodology (Road RAM) are completed.
- Additional research is completed, which is currently being conducted by Caltrans and El Dorado County, to assess the load reduction benefit of various road abrasive materials in terms of resistance to pulverization into FSP.

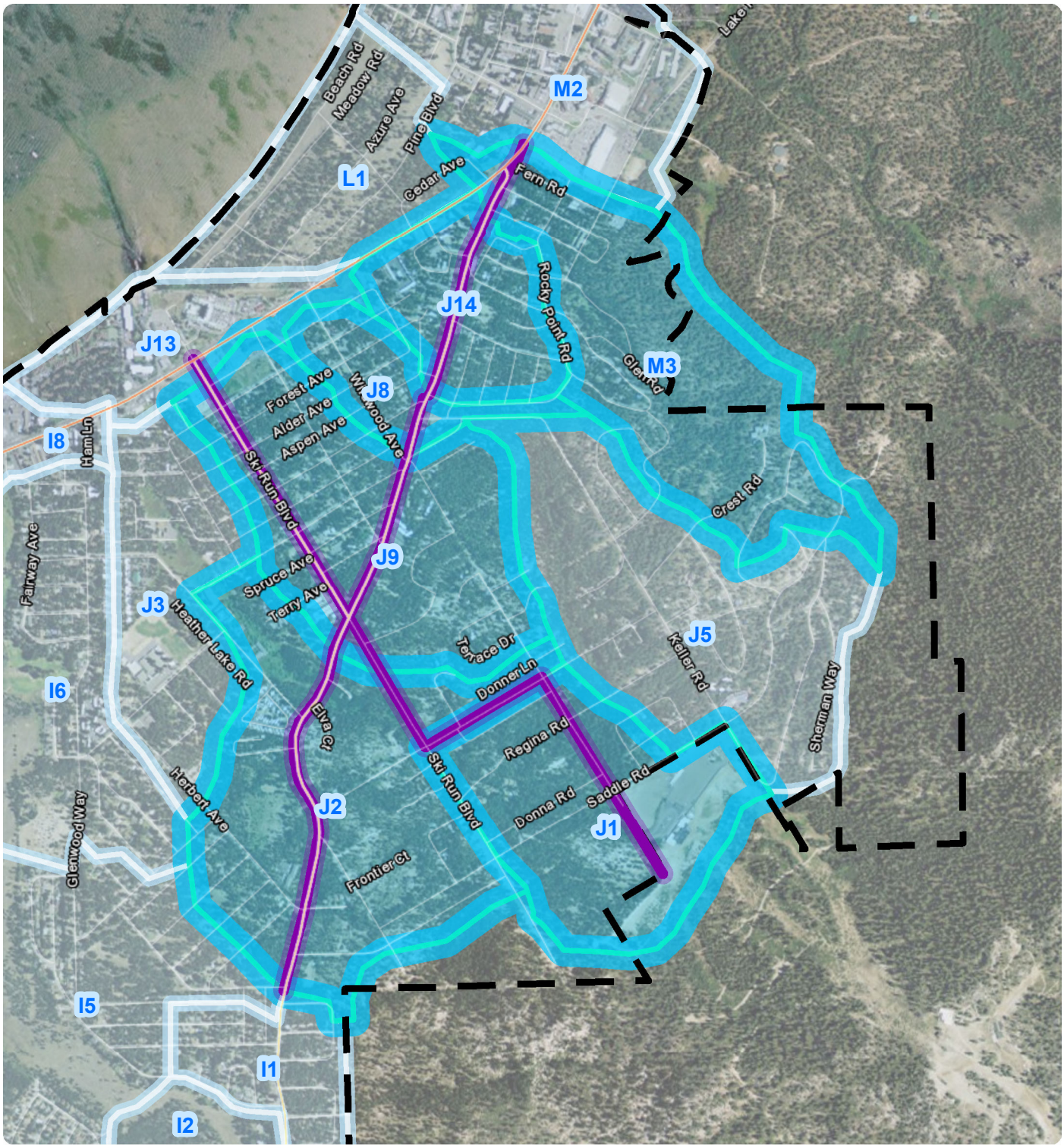
Frequent Street Sweeping on a Subset of City Roads

Various sweeping scenarios evaluated within the City's Strategy Report (CSLT 2012: p. 22-25) suggest refinement and augmentation of current sweeping operations could be a viable pollutant load reduction action. Evaluating more frequent and targeted sweeping activities during the current MS4 permit term will help the City assess options for achieving future pollutant load reductions, which must be estimated and submitted as part of the updated Pollutant Load Reduction Plan due on June 9, 2016. As a pilot program, the City will begin frequent street sweeping on a subset of City roads to assess the feasibility of expanding road operations as part of future PLRPs. The pilot program will target frequent sweeping on Primary Roads within UPCs that are directly connected to Lake Tahoe. Specifically, these roads include Ski Run Boulevard, Pioneer Trail, and the portion of Needle Peak Road and Wildwood Avenue used to access the Heavenly Mountain Resort California Base Area. The UPCs that bound the targeted roads will be registered with the Lake Clarity Crediting Program as part of this PLRP (Figure 2.1).

The targeted streets will be swept with the City's dustless regenerative air sweepers after each winter abrasive application, as road conditions allow, and once a month otherwise. This frequency equates to the most frequent sweeping interval in PLRM. The City has modeled sweeper performance in PLRM from this action using the "High-Efficiency Vacuum-Assisted Dry Sweeper" option. The City's regenerative air sweepers employ a dust separation and filtration system, which meets the definition of a high-efficiency sweeper (Sutherland 2011: p. 4). Table 2.4 displays load reduction estimates from PLRM simulations for the pilot program sweeping activities.

Table 2.4 – Pilot Street Sweeping Performance Estimate

City UPCs	Parameter	Pollutant of Concern			Lake Tahoe TMDL Credits
		FSP	TP	TN	
J1, J2, J8, J9, J14, and M3	Load Reduction Estimate (kg/year)	1,850	1.9	6.1	20
	Percent Load Reduction Compared to Baseline	1.0%	0.2%	0.2%	n/a



Data Sources: ArcGIS Online Basemaps, 2012.

City Limits

Targeted Roads for Frequent Street Sweeping

UPCs Included in Pilot Sweeping Program

Other UPCs

City of South Lake Tahoe

Pollutant Load Reduction Plan

Scale - 1:18,000 1 inch = 1,500 feet

0 750 1,500 3,000 Feet

CA State Plane, Zone II	NAD 83	horiz. units: feet
northwest hydraulic consultants	project no. 500019	January 2013

Figure 2.1 - Pilot Street Sweeping Program

2.1.4 PERFORMANCE SUMMARY

Using Lake Clarity Credits as the defining performance metric, the PLRM analysis estimates that the City can obtain 114 Credits by registering WQIPs completed since the baseline period (Table 2.1). If the three active WQIPs currently in various planning and design stages are completed by 2016, an additional 113 Credits will be available (see Table 2.2). Based on this estimate, it may be possible for the City to obtain the required amount of Credits (190) through the implementation and registration of WQIPs. However, this overall performance estimate contains some uncertainty as a number of individual WQIP performance estimates are based on preliminary PLRM models, which in some cases reflect the preferred alternative for project design. Additionally, Lake Clarity Credits could be reduced if City operations and maintenance activities are unable to sustain load reductions at the levels estimated by the stormwater modeling and supporting assumptions. To address these uncertainties the City has selected a diversified approach that includes registration of all WQIPs completed by 2016 with the registration of the pilot street sweeping effort. The selected approach will ensure that a flexible and adaptable load reduction program will be in place by 2016 to meet the MS4 permit requirements. Table 2.5 summarizes the estimated load reductions and associated Lake Clarity Credits the City anticipates achieving with the selected approach.

Table 2.5 – Load Reduction Performance Summary

Action	Load Reduction Estimates (kg/year)			Lake Clarity Credits	% of City's Baseline Load		
	FSP	TP	TN		FSP	TP	TN
Register Completed WQIPs (2004-2012)	10,330	45	155	114	6%	6%	5%
Construct and Register Active WQIPs (2013-2016)	10,240	35	105	113	6%	4%	3%
Implement Pilot Program for Improved Road Operations	1,850	2	6	20	1%	0%	0%
Totals:	**22,420**	**82**	**267**	**247**	**13%**	**10%**	**8%**
Minimum MS4 Permit Requirements:				**190**	**10%**	**7%**	**8%**

2.1.5 ESTIMATED COST

Table 2.6 presents the estimated costs to achieve the load reduction requirements specified in the MS4 permit. Estimated costs are segmented into categories of project delivery, water quality operations and maintenance, and Lake Clarity Crediting program reporting tasks.

- Project delivery costs include planning, environmental documentation, permitting, design, acquisition, and construction.
- Operation and maintenance costs are annualized based on the estimated time and resources necessary to maintain stormwater treatment infrastructure and supporting drainage infrastructure; operate street sweepers; and maintain street sweepers.
- Lake Clarity Crediting Program costs are annualized and include City staff time to:
    - Complete the initial catchment registration process for each UPC

- o Perform BMP Rapid Assessment Methodology (RAM) observations and complete annual reporting
- o Perform Road RAM observations and complete annual reporting
- o Update catchment registration schedules for UPCs, when necessary

The total project delivery cost to meet load reduction requirements is estimated to be roughly $48 million. Of this amount, approximately $34 million has been expended on completed WQIPs and the planning and design of active WQIPs. The cost estimate includes annual operation and maintenance and Lake Tahoe TMDL reporting costs from 2012-2016, which average roughly $300,000 per year during that time period. Details regarding the assumptions and methods used to calculate costs shown in Table 2.6 can be found in the City's Strategy Report (CSLT 2012: Appendix B).

Table 2.6 – Cost Estimate for Achieving Load Reduction Targets

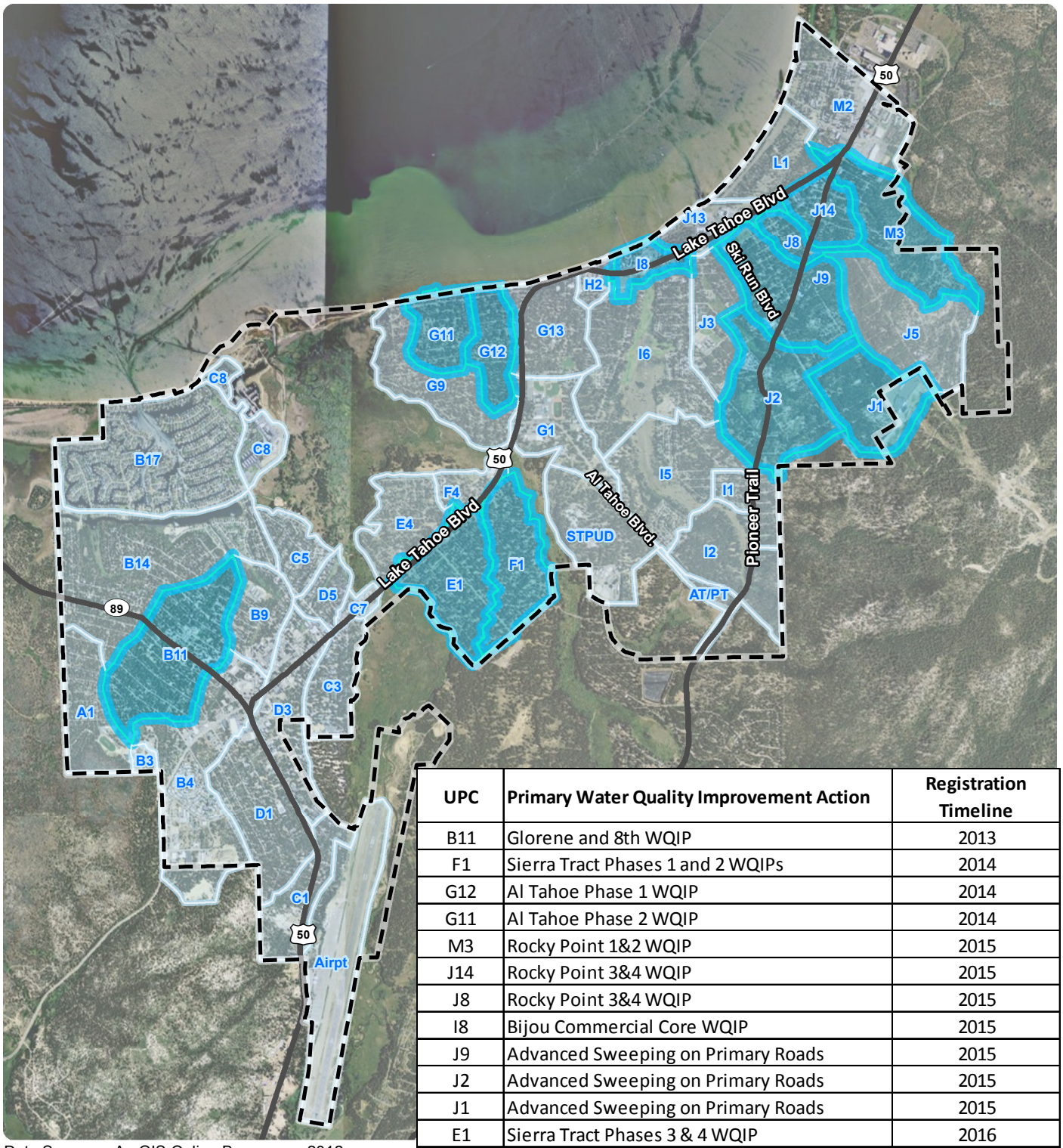
Action	Project Delivery Cost	Operations and Maintenance ($/year)	Lake Clarity Crediting Program ($/year)
Register Completed WQIPs (2004-2012)	$31,010,000	$58,000	$41,000
Construct and Register Active WQIPs (2013-2016)	$17,070,000	$140,000	$25,000
Implement Pilot Program for Improved Road Operations	$300,000	$23,000	$19,000
Total Project Delivery Costs:	**$48,380,000**		
Average Annual Costs of Maintaining Actions ($/year):		**$221,000**	**$85,000**

2.2 CATCHMENT REGISTRATION SCHEDULE

The City intends to register 12 of the 45 UPCs delineated in the *Baseline Pollutant Load Estimate Report* (CSLT 2011) to document achievement of the required load reductions with the Lake Clarity Crediting program. Table 2.7 identifies the: 1) UPCs proposed for registration as part of this PLRP; 2) calendar year each UPC will be registered; 3) water quality improvement action(s) taken within each UPC to reduce pollutant loading; 4) and timeline for completion of water quality improvement actions. For each UPC planned for registration, Appendix A documents that status of the PLRM models used to estimate pollutant load reductions, as well as the baseline pollutant loading and expected pollutant loading. Figure 2.2 identifies the UPCs planned for registration.

Table 2.7 – Catchment Registration Schedule

City UPC	Planned Registration Year	Primary Water Quality Improvement Actions	Status of Improvements
B11	2013	Glorene and 8th WQIP	Completed
G12	2014	Al Tahoe Phase 1 WQIP; Harrison Avenue WQIP	Al Tahoe completed; Harrison construction planned for 2013
G11	2014	Al Tahoe Phase 2 WQIP	Completed
F1	2014	Sierra Tract Phases 1 and 2 WQIPs	Completed
I8	2015	Bijou Commercial Core WQIP	Construction planned for 2013-2014
M3	2015	Rocky Point 1&2 WQIP; Frequent Street Sweeping on Primary Roads	WQIP Completed; Sweeping initiated in 2014-2015
J14	2015	Rocky Point 3&4 WQIP; Frequent Street Sweeping on Primary Roads	WQIP Completed; Sweeping initiated in 2014-2015
J18	2015	Rocky Point 3&4 WQIP; Frequent Street Sweeping on Primary Roads	WQIP Completed; Sweeping initiated in 2014-2015
J1	2015	Frequent Street Sweeping on Primary Roads	Initiated in 2014-2015
J2	2015	Frequent Street Sweeping on Primary Roads	Initiated in 2014-2015
J9	2015	Frequent Street Sweeping on Primary Roads	Initiated in 2014-2015
E1	2016	Sierra Tract Phases 3 & 4 WQIP	Construction planned for 2015



UPC	Primary Water Quality Improvement Action	Registration Timeline
B11	Glorene and 8th WQIP	2013
F1	Sierra Tract Phases 1 and 2 WQIPs	2014
G12	Al Tahoe Phase 1 WQIP	2014
G11	Al Tahoe Phase 2 WQIP	2014
M3	Rocky Point 1&2 WQIP	2015
J14	Rocky Point 3&4 WQIP	2015
J8	Rocky Point 3&4 WQIP	2015
I8	Bijou Commercial Core WQIP	2015
J9	Advanced Sweeping on Primary Roads	2015
J2	Advanced Sweeping on Primary Roads	2015
J1	Advanced Sweeping on Primary Roads	2015
E1	Sierra Tract Phases 3 & 4 WQIP	2016

Data Sources: ArcGIS Online Basemaps, 2012.

City Limits

City UPCs Planned for Registration

Other City UPCs

UPC - Urban Planning Catchment

City of South Lake Tahoe

Pollutant Load Reduction Plan

Scale - 1:48,000 1 inch = 4,000 feet

0 2,000 4,000 8,000 Feet

CA State Plane, Zone II	NAD 83	horiz. units: feet
northwest hydraulic consultants	project no. 500019	January 2013

Figure 2.2 - UPCs Proposed for Registration with Lake Clarity Crediting Program

2.3 LOAD REDUCTION SCHEDULE

Figure 2.3 presents the City's catchment registration schedule to attain at least 190 Lake Clarity Credits by the end of the MS4 permit term in 2016. Load reduction performance estimates, which are used to estimate anticipated Lake Clarity Credits, are based on the PLRM results presented in Section 2.1. The UPC registration schedule presented in Section 2.2 is used to estimate Lake Clarity Credits projected for obtainment during each calendar year of the MS4 permit term (Figure 2.3).

Figure 2.3 – Load Reduction Catchment Registration Schedule

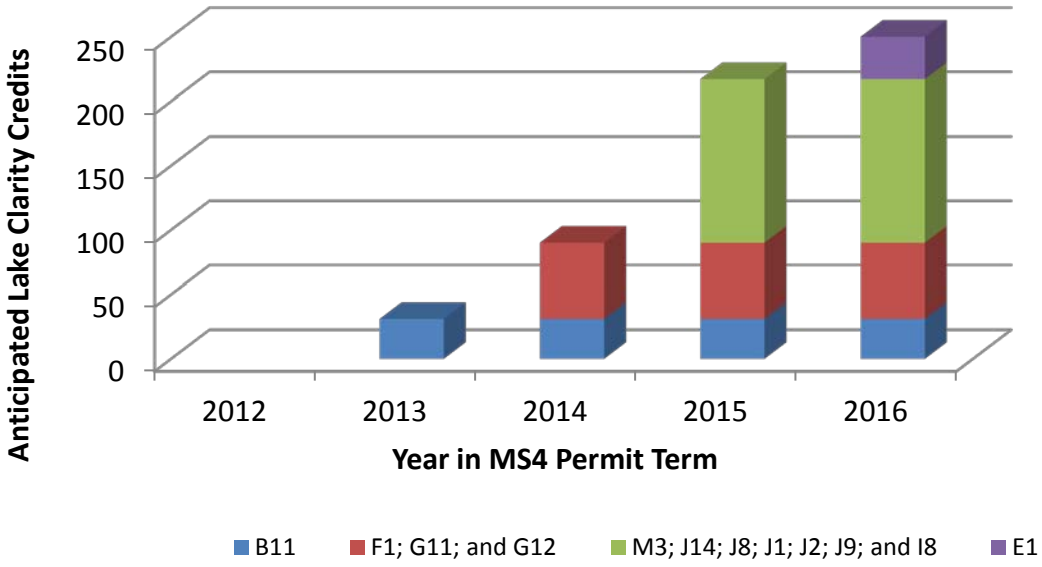
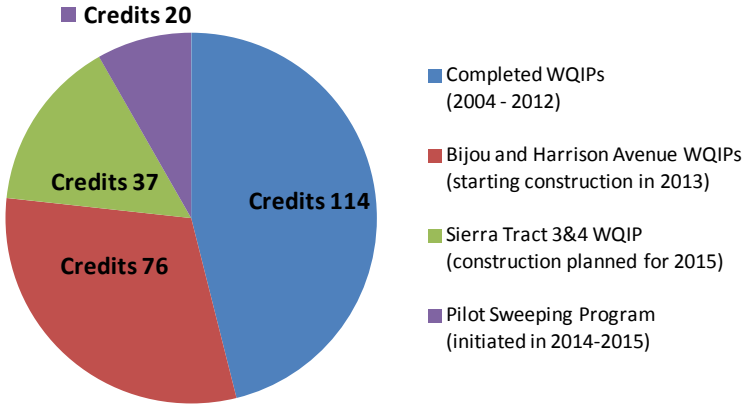


Figure 2.4 presents estimated Lake Clarity Credits categorized based on the timing of water quality improvement actions. As shown in Figure 2.4, the majority of Lake Clarity Credits the City plans to register during the MS4 permit term are associated with completed WQIPs and WQIPs that will begin construction in the summer of 2013.

Figure 2.4 – Estimated Credits Categorized by Action



2.4 ADAPTIVE MANAGEMENT PROCESS

Since 2009, the City has been developing an Asset Information System, which is a web-based geographic information system (GIS) tool that allows City staff to review and assess its stormwater infrastructure and treatment systems citywide. The City will also continue to track abrasive applications and materials recovered by sweeping and vactoring, which helps identify areas with high pollutant loading. City staff and consultants will continue to inspect facilities during large runoff events, to determine whether constructed source control, conveyance, and treatment measures are functioning as designed. City staff will also complete annual storm water system, construction and commercial, industrial, and municipal site inspections required in the MS4 permit. With a new stormwater ordinance in place, the City has additional tools to control pollutant and fine sediment discharges generated within our jurisdiction.

These existing tools and processes form the foundation of the City's internal approach to assess its stormwater management activities. The tools can also support assessments and reporting of load reduction progress during the implementation of this PLRP. For example, Appendix A of this PLRP indentifies the water quality improvements that provide the majority of credited load reductions within each UPC planned for registration. This information (identified by the Lake Clarity Crediting Program as primary and secondary load reduction components) will be integrated and highlighted in the Asset Information System. This process will allow City staff to identify and track the performance of stormwater treatment systems and water quality improvements that produce the majority of the City's credited load reduction. Using this system, City staff can efficiently direct inspection resources to ensure that BMP RAM and Road RAM observations are conducted on the most important stormwater treatment and conveyance infrastructure. Information obtained from the RAM observations will be used to identify necessary maintenance actions, and the frequency of maintenance actions, to ensure that key stormwater infrastructure functions as intended.

As mentioned in previous sections of this PLRP, a number of the estimated load reductions are based on preliminary PLRM models that will require additional refinement and quality assurance prior to registration with the Lake Clarity Crediting Program. In addition, if water quality maintenance activities in response to field inspection assessments are not sufficient to maintain the Lake Clarity Credits estimated by the stormwater modeling, awarded Lake Clarity Credits may be reduced. Recognizing this uncertainty, the City has developed a PLRP that is projected to obtain as much as 250 Lake Clarity Credits, which is in excess of the 190 required by the MS4 permit. If Lake Clarity Credits exceed the minimum required under the current MS4 permit they can be applied to meet future load reduction requirements. The City will update its load reduction schedule annually (Figure 2.3), after catchment registration activities are completed, to track and assess progress towards obtainment of the required load reductions by 2016.

3.0 REFERENCES

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APPENDIX A – PLRM QUALITY ASSURANCE DOCUMENTATION BY UPC

Quality assurance documentation last updated on January 24, 2013.

In some cases, additional model refinement and quality assurance may be necessary before registering a WQIP with the Lake Clarity Crediting Program. Where additional quality assurance steps are needed, this information is highlighted within Appendix A. As part of the City's Adaptive Management Process, additional quality assurance checks will be completed prior to catchment registration.

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate

Date: 24-Jan-13

UPC ID:	B11	**PLRM Project Name:**	Glorene_8th	**Date PLRM Project Last Revised:**	23-Jan-13

Background Information

Baseline Scenario Name:	BaselineCondition	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	CSLT	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):	City Provide		

UPC Connectivity Factors

Surface Runoff:	19%	**FSP:**	19%	**TP:**	19%	**TN:**	19%

Narrative of Water Quality Improvements Represented in PLRM

The Glorene and 8th ECP is located in the Gardner Mountain neighborhood, which is one of the steeper areas of the City. Runoff eventually drains to Tallac Lagoon and flows out to Pope Marsh before discharging to Lake Tahoe. Due to a barrier beach in Pope Marsh, the estimated connectivity to Lake Tahoe is roughly 20%. Source controls consist of curb and gutter on most streets that route storm water runoff to many drain inlets. Drain inlets convey the storm water to several treatment basins. Treatment controls consist of two infiltration basins and two dry basins adjacent State Highway 89. There are also several small infiltration basins in the upper watershed as well as rock lined channels that provide further infiltration and conveyance.

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	Yes
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	Yes
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	No, see Comment 1
5. Is the total impervious area the same between the baseline and expected condition scenarios?	No, see Comment 1

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	Yes
2. Are road abrasive application and sweeping strategies the same as baseline assumptions?	No, see Comment 2
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	Not present
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	No, see Comment 3
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	Yes

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Expected	Expected	Expected
PLRM Name	InfiltrationBasin1	InfiltrationBasin2	DryBasin1
Type	Infiltration Basin	Infiltration Basin	Dry Basin
Physical Location	2 parcels between Tenth and Eight Streets	833 Emerald Bay Rd	825 Emerald Bat Rd between Hwy 89 and

Scenario	Expected
PLRM Name	DryBasin2
Type	Dry Basin
Physical Location	829 James Ave between James and Eloise

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline	69.9	38,239	142.2	528.2
Expected	33.0	7,459	35.6	164.7
Load Reduction	36.8	30,780	106.7	363.5
% Load Reduction	53%	80%	75%	69%

FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
17,345	64.5	239.6	1.91E+18
3,383	16.1	74.7	3.72E+17
13,961	48.4	164.9	1.54E+18

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr):	7.0	**FSP (kg/yr):**	2,653	**TP (kg/yr):**	9.2	**TN (kg/yr):**	31.3	**Credits:**	29.2

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load	69.9	38,294	142.4	528.9

Catchment Notes

Need to rectify land use distribution between the

Expected Load	49.2	21,251	88.4	354.5
Load Reduction	20.7	17,043	54.0	174.3

Baseline Condition and Expected Condition before finalizing load reduction diagnostics.

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
InfiltrationBasin1	7.0	2,342	10.5	47.2
InfiltrationBasin2	1.6	1,469	4.6	15.9
DryBasin1	2.7	6,407	23.3	77.8
DryBasin2	4.8	3,563	14.4	48.7

SWT Notes

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	56%	55%	51%	48%
InfiltrationBasin1	19%	8%	10%	13%
InfiltrationBasin2	4%	5%	4%	4%
DryBasin1	7%	21%	22%	21%
DryBasin2	13%	12%	14%	13%
Check on Percentages	100%	100%	100%	100%

Summary Notes

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

Need to rectify land use distribution between the Baseline Condition and Expected Condition before finalizing assessment.

Secondary Components

Tertiary Components

None noted

Comments

1. The baseline condition has roughly 5 acres more Secondary Roads in total area and 4 more acres of impervious area associated with Secondary Roads. This discrepancy should be resolved.
2. High-Efficiency sweeper option selected in PLRM for all roads (City has two dustless regenerative air sweepers). 1-2 times per year sweeping on all Secondary Roads.
3. Infiltration facilities are sized to PLRM defaults to store 1-inch of runoff from tributary impervious areas. This input does not appear to have been assessed.

Model Status

1. Load reduction estimate includes approximately 5 acres of Caltrans runoff, which is treated by the Glorene and 8th project. The entity that received credit for this portion of the project's load reduction has not been finalized between the City and Caltrans.

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate

Date: 7-Jan-13

UPC ID:	I8	**PLRM Project Name:**	Bijou_CommercialCore	**Date PLRM Project Last Revised:**	7-Jan-13

Background Information

Baseline Scenario Name:	BaselineCondition	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	CSLT and NHC	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):	City to provide		

UPC Connectivity Factors

Surface Runoff:	100%	**FSP:**	100%	**TP:**	100%	**TN:**	100%

Narrative of Water Quality Improvements Represented in PLRM

The Bijou Area Erosion Control Project, Phase 1 (Project) is a water quality improvement project for one of the highest pollutant load outfalls to Lake Tahoe. The purpose of the Project is to treat high pollutant load stormwater runoff generated in the Bijou commercial area, adjacent to Lake Tahoe (Commercial Core). The Bijou Commercial Core is comprised of 47 acres of nearly 100% impervious area (pavement and dense urban development), which includes US Highway 50, commercial development, and City roads immediately adjacent to and hydraulically connected to Lake Tahoe. Project construction focuses on two key elements: (1) Construction of a comprehensive regional treatment system for runoff generated in the Commercial Core. The regional treatment system is designed to collect and treat co-mingled urban stormwater runoff from the City right-of-way (ROW), California Department of Transportation (Caltrans) ROW, and private property. Urban storm water runoff from the Commercial Core watershed will be collected in a separate drainage system from that of the upper watershed (i.e., a double box culvert) and directed through a series of underground sediment vaults to remove oil/grease and larger-sized sediment. Stormwater would then be pumped and conveyed through an underground force main to infiltration basins in the upper watershed; and (2) Replacement of the existing Bijou Creek storm drain system that conveys storm water runoff from the 1,300-acre Bijou Creek watershed, through the Commercial Core, to Lake Tahoe. This work includes replacing the 50-year-old drainage, that is failing and undersized, with an underground double box culvert. The replacement will allow the cleaner storm water runoff from Bijou Meadow to be separated and conveyed to Lake Tahoe without co-mingling with high pollutant load runoff from the Commercial Core (current configuration). This will allow for greater water quality treatment of the highest pollutant load runoff to Lake Tahoe.

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	Yes
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	No, see Comment 1
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	Yes
5. Is the total impervious area the same between the baseline and expected condition scenarios?	Yes

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	No, see Comment 2
2. Are road abrasive application and sweeping strategies the same as baseline assumptions?	No, see Comment 3
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	Not present
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	Not present
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	No, see Comment 4

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Expected	Expected	
PLRM Name	Vaults	USFSBasin	
Type	Dry Basin	Infiltration Basin	
Physical Location	Bijou Commercial Core near Bal Bijou Rd	West side of Walkup Rd	

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline	39.6	21,293	78.5	285.6
Expected	2.3	1,175	4.4	15.9
Load Reduction	37.3	20,118	74.1	269.7
% Load Reduction	94%	94%	94%	94%

FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
9,658	35.6	129.5	1.06E+18
533	2.0	7.2	5.86E+16
9,125	33.6	122.3	1.00E+18

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr):	37.3	**FSP (kg/yr):**	9,125	**TP (kg/yr):**	33.6	**TN (kg/yr):**	122.3	**Credits:**	100.4

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load	39.6	21,302	78.5	285.8
Expected Load	41.4	22,516	83.4	301.7
Load Reduction	-1.8	-1,214	-4.9	-16.0

Catchment Notes

Increased catchment runoff and loading results by reducing private BMP implementation to zero. See comment 2.

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Vaults	0.1	903	3.0	11.0
USFSBasin	39.0	19,290	71.7	259.8

SWT Notes

The Vaults are used to regulate flow to the pumping system. Based on the drain time and associated pumping rate, they are simulated with minimal ability to remove FSP, TP, and TN.

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	-5%	-6%	-7%	-6%
Vaults	0%	4%	4%	4%
USFSBasin	105%	96%	97%	96%
Check on Percentages	100%	94%	94%	94%

Summary Notes

The current simulation has some water quality continuity problems, see Comment #5.

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

1. Maintaining infiltration capacity and function of the USFSBasin.
2. Ensuring that the pumping system effectively transports stormwater to the USFSBasin.

Secondary Components

1. Maintaining conveyance to the vaults and pumping system.
2. Removing trash and debris from the vaults.

Tertiary Components

Comments

1. Project area was extended west past Takela Drive toward Freemont Ave. Entire project area = 54 acres including Caltrans (5.1 acres). The current UPC delineation for I8 is roughly 45 acres.
2. Proposed project improvements address private runoff through a regional treatment system. To avoid double-counting, private property BMP implementation is set to zero for private land uses.
3. The City's regenerative air sweeper is used (change from baseline) with the same sweeping frequency of twice per year (same as baseline). Caltrans sweeping on Highway 50 is not adjusted from baseline assumptions.
4. The Pre-treatment vault named "Vaults" has CECs adjusted upwards to reflect that this facility has minimal ability to remove FSP, TP, and TN.
5. The current representation of the Bijou pump and treat system is producing reasonable results. However, there area some continuity errors with the calculations of pollutant loads. The issue is caused by a number of factors associated with PLRM version 1 (simplicity of algorithms, simulation time step, constraints associated with the use of dividers to represent stormwater pumping). Given that there are no continuity errors with the water balance, the load reduction estimate appears reasonable and could be registered.

Model Status

1. Pollutant load numbers include Caltrans runoff. The City's initial share of the project is 50%. Load reductions estimates registered by the City should be 50% of the estimates shown herein.
2. Need to rectify the UPC delineation after project completion since the project changes the current drainage boundaries.

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate **Date:** 22-Jan-13

UPC ID: J8 & J14 **PLRM Project Name:** Rocky_Point_3_4 **Date PLRM Project Last Revised:** 14-Jan-13

Background Information

Baseline Scenario Name:	BaselineCondition	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	CSLT	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):		City to provide	

UPC Connectivity Factors

Surface Runoff:	100%	**FSP:**	100%	**TP:**	100%	**TN:**	100%

Narrative of Water Quality Improvements Represented in PLRM

The Rocky Point ECP, Phases 3 and 4 was completed in 2012, although the majority of project improvements were constructed in 2008. Improvements include curb and gutter, storm drain pipes, drainage swales, infiltration features/channels and numerous storm water treatment basins in the upper catchment. Runoff in the lower catchment is collected at the Wildwood Wet Basin where significant treatment takes place. A connection to the Marriot Wet Basin on the west side of Highway 50 was does not function as designed. The junction box could be redesigned reconstructed in the future to add additional downstream treatment prior to discharge to Lake Tahoe.

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	No, see Comment 1
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	Yes
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	No see Comment 2
5. Is the total impervious area the same between the baseline and expected condition scenarios?	No see Comment 2

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	Yes
2. Are road abrasive application and sweeping strategies the same as baseline assumptions?	No, see Comment 3
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	Not present
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	No, see Comment 4
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	No, see Comment 5-6

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Expected	Expected	Expected
PLRM Name	PentagonBasin	CelladorGallery	ShepherdsBasins
Type	Dry Basin	Infiltration Basin	Infiltration Basin
Physical Location	Between Pentagon and Hwy 50.	West end of Cellador Rd.	1049 Shepherds Dr
Scenario	Expected	Expected	Expected
PLRM Name	LowerPioneerBasin	UpperPioneerBasin	AspenwaldBasin
Type	Dry Basin	Dry Basin	Dry Basin
Physical Location	3833 Pioneer Trail	3802 Pioneer Trail	3830 Aspenwald
Scenario	Expected	Expected	Baseline and Expected
PLRM Name	LostSheepBasins	KellerBasin	WildwoodBasin
Type	Dry Basin	Dry Basin	Wet Basin
Physical Location	Corner of Larch Dr Lost Sheep Ln (4 Basins)	Corner of Keller and Steven	Wildwood Ave and Hwy 50
Scenario	Baseline and Expected		
PLRM Name	MarriotWetBasin		
Type	Wet Basin		
Physical Location	Ski Run Marina behind Marriot Vacation Resort		

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)	FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
Baseline	26.7	4,040	19.8	107.1	1,833	9.0	48.6	2.02E+17
Expected	19.0	1,623	9.8	63.8	736	4.4	28.9	8.10E+16
Load Reduction	7.7	2,417	10.0	43.3	1,096	4.5	19.6	1.21E+17

% Load Reduction	29%	60%	51%	40%

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr): 7.7 **FSP (kg/yr):** 1,096 **TP (kg/yr):** 4.5 **TN (kg/yr):** 19.6 **Credits:** 12.1

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load				
Expected Load				
Load Reduction	0.0	0	0.0	0.0

Catchment Notes

Need to rectify land use distribution between the Baseline Condition and Expected Condition before checking load reduction diagnostics.

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
PentagonBasin				
CelladorGallery				
ShepherdsBasins				
LowerPioneerBasin				
UpperPioneerBasin				
AspenwaldBasin				
LostSheepBasins				
KellerBasin				
WildwoodBasin				
MarriotWetBasin				

SWT Notes

The WildwoodBasin and MarriotWetBasin facilities exist in the baseline condition. The load reduction/increase for these facilities is the difference in pollutant removal from the baseline to expected condition. A hydraulic issue is causing runoff to bypass the MarriotWetBasin. This issue is simulated in both the baseline and expected condition using a Diversion in PLRM.

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	0%	0%	0%	0%
PentagonBasin	0%	0%	0%	0%
CelladorGallery	0%	0%	0%	0%
ShepherdsBasins	0%	0%	0%	0%
LowerPioneerBasin	0%	0%	0%	0%
UpperPioneerBasin	0%	0%	0%	0%
AspenwaldBasin	0%	0%	0%	0%
LostSheepBasins	0%	0%	0%	0%
KellerBasin	0%	0%	0%	0%
WildwoodBasin	0%	0%	0%	0%
MarriotWetBasin	0%	0%	0%	0%
Check on Percentages	0%	0%	0%	0%

Summary Notes

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

Secondary Components

Tertiary Components

Comments

1. Assumptions for Primary Roads does not match; need to note that Wildwood submitted as a dry basin in baseline load estimate but City feels is more appropriate to represent as a wet basin the baseline. Assumptions for Primary Roads adjusted. Sweeping still set to 1-2 times per year, needs to be 1-2 times per season on Primary Roads.
2. Land use distribution for secondary roads and primary roads does not match. Suspect its an issue with the Expected Condition tabulation because the

land use layer hasn't been updated to reflect the City's designation of Pioneer Trail and Ski Run Blvd. as Primary Roads.
3. High-Efficiency sweeper option selected in PLRM for all roads (City has two dustless regenerative air sweepers). 1-2 times per year sweeping on all Secondary Roads; need to adjust City Primary Roads to sweeping 20 times per year (PLRM maximum) to represent PLRP approach. Rocky Point ECP's (phases 1/2, 3/4) will be registered later in the registration process so as to allow for the Pilot Sweeping Program to be established. Once this occurs, PLRM will be updated.
4. Infiltration facilities are sized to PLRM defaults to store 1-inch of runoff from tributary impervious areas. This input does not appear to have been assessed. Adjusted to 0.50 in. Are these basins or something else, still seems a little high for an assumption?
5. Drain times for dry basins are low. To compensate for this issue, CECs are adjusted upwards to reflect less treatment.
6. Infiltration rate selected for all infiltration basins (2.5 inches/hour) may be difficult to maintain at that rate based on estimated load inputs - should standardize these assumptions across models. Originally designed to infiltrate at a 7-8 in/hr. Adjustment to 2.5 in/hr is a big downgrade. Still probably too high, could be quite burdensome to maintain at a rate of 2.5 inch/hour.

Model Status

1. Address issues mentioned above in the Comments section.

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate

Date: 24-Jan-13

UPC ID:	M3	**PLRM Project Name:**	Rocky_Point_1_2	**Date PLRM Project Last Revised:**	11-Dec-12

Background Information

Baseline Scenario Name:	Baseline_Conditions	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	CSLT	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):	City to provide		

UPC Connectivity Factors

Surface Runoff:	100%	**FSP:**	100%	**TP:**	100%	**TN:**	100%

Narrative of Water Quality Improvements Represented in PLRM

The objective of the project was to reduce erosion and protect water quality through a combination of erosion control, drainage and water quality treatment measures. The project included stabilization of road shoulders and roadside ditches on Rocky Point. Source control was achieved through the construction of concrete curb and gutter. Concrete curb and gutter as well as adjoining asphalt paving were constructed on existing road shoulders or drainage swales. Concentrated stormwater flow is routed to dry basin sites for treatment and infiltration. Stormwater is routed to several basins in the upper catchment before joining the Park Avenue basin system in the lower catchment. Flows eventually discharge at the North Ditch outfall.

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	Yes
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	Yes
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	Yes
5. Is the total impervious area the same between the baseline and expected condition scenarios?	Yes

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	Yes
2. Are road abrasive application and sweeping strategies the same as baseline assumptions?	No, see Comment 1
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	Not present
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	Not present
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	No, see Comment 2

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Baseline	Baseline	Baseline
PLRM Name	Shepards	RockyPoint	FernBasins
Type	Dry Basin	Dry Basin	Dry Basin
Physical Location	Shepards & Rocky Pt.	Glen Rd.	Hwy 50 & Pioneer Tr.

Scenario	Baseline and Expected	Baseline and Expected	Baseline and Expected
PLRM Name	UpperPark	LowerPark2a	LowerPark2b
Type	Wet Basin	Infiltration Basin	Dry Basin
Physical Location	End of Pine Blvd.	Park Ave.	Park Ave.

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)	FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
Baseline	59.6	26,631	100.8	407.2	12,080	45.7	184.7	1.33E+18
Expected	54.9	18,904	72.0	313.7	8,575	32.7	142.3	9.43E+17
Load Reduction	4.7	7,727	28.8	93.5	3,505	13.1	42.4	3.86E+17
% Load Reduction	8%	29%	29%	23%				

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr):	4.7	**FSP (kg/yr):**	3,505	**TP (kg/yr):**	13.1	**TN (kg/yr):**	42.4	**Credits:**	38.6

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load	77.5	40,032	152.2	577.5
Expected Load	79.7	37,924	150.0	577.2
Load Reduction	-2.2	2,108	2.2	0.3

Catchment Notes

Catchment improvements are primarily curb and gutter, which slightly increases road DCIA and surface runoff relative to baseline condition.

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Shepards	0.2	294	2.1	5.8
RockyPoint	0.6	1,163	6.3	21.6
FernBasins	1.7	3,419	16.8	52.7
UpperPark	-0.1	-623	-3.1	-8.8
LowerPark2a	1.1	137	0.1	3.2
LowerPark2b	3.4	1,191	4.2	18.0

SWT Notes

The UpperPark, LowerPark2a, and LowerPark2b facilities exist in the baseline condition. The load reduction/increase for these facilities is the difference in pollutant removal from the baseline to expected condition after Rocky Point runoff is routed to them.

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	-48%	27%	8%	0%
Shepards	5%	4%	7%	6%
RockyPoint	13%	15%	22%	23%
FernBasins	36%	44%	58%	56%
UpperPark	-1%	-8%	-11%	-9%
LowerPark2a	23%	2%	0%	3%
LowerPark2b	73%	15%	14%	19%
Check on Percentages	100%	100%	99%	99%

Summary Notes

Load and runoff reductions primarily result from the FernBasins, RockyPoint basin, and LowerPark system. Loads from the UpperPark wet basin slightly increase relative to the baseline condition, which indicates the basin is at capacity and additional stormwater runoff routed through is not treated. The UpperPark basin routes runoff to the LowerPark system, so overall there is a net load reduction from diverting Rocky Point runoff to the UpperPark and LowerPark treatment system.

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

1. Maintaining infiltration capacity and function of the Fern Basins, Rocky Point basin, and Lower Park basins.
2. Ensuring that conveyance systems effectively transport stormwater to these treatment facilities.

Secondary Components

1. Maintaining the infiltration and treatment capacity of the Shepards basin.
2. Maintaining the conveyance of runoff from the Rocky Point drainage to the UpperPark basin, and from the UpperPark basin to the LowerPark basins.

Tertiary Components

None noted

Comments

1. High-Efficiency sweeper option selected in PLRM for all roads (City has two dustless regenerative air sweepers). 1-2 times per year sweeping on all Secondary Roads; 20 times per year (PLRM maximum) on City Primary Roads. Will be adjusted once Pilot Sweeping Program is established
2. Drain times for dry basins (based on built outlet structures) are below PLRM recommended values. To compensate for this issue, CECs are adjusted upwards to reflect less treatment for FSP, TP, and TN.

Model Status

1. Rocky Point ECP's (phases 1/2, 3/4) will be registered later in the registration process so as to allow for the Pilot Sweeping Program to be established. Once this occurs, PLRM will be updated.

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate **Date:** 24-Jan-13

UPC ID: G11 **PLRM Project Name:** AlTahoe_Phase2 **Date PLRM Project Last Revised:** 14-Dec-12

Background Information

Baseline Scenario Name:	BaselineCondition	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	Wood Rodgers and CSLT	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):		City to provide	

UPC Connectivity Factors

Surface Runoff:	100%	**FSP:**	100%	**TP:**	100%	**TN:**	100%

Narrative of Water Quality Improvements Represented in PLRM

The Al Tahoe ECP, Phase 2 includes installation of an in-line pretreatment vault at the terminus of the Regan Beach storm drain upstream and connected to a media filter treatment vault (Stormfilter). The stormfilter has two chambers. The first chamber to receive runoff is designed for low-flow with cartridges specified to remove FSP, and the second chamber is designed for bypass flow during larger storms. The project also includes rehabilitation of approximately 0.8 miles of unpaved compacted shoulder. Improvements along Lakeview Avenue will include curb and gutter, soil stabilization, soil amendment/revegetation and permanent parking deterrents. Improvements along Fresno, Nevada, Sacramento and Oakland Avenues from Lakeview to Merced will include installation of pervious concrete. Removal and replacement of drain inlets and additional 7 inlets, and replacement of storm drain pipes will improve conveyance to the treatment system at Reagan beach.

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	Yes
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	Yes, see Comment 1
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	Yes
5. Is the total impervious area the same between the baseline and expected condition scenarios?	Yes

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	Yes
2. Are the road abrasive application and sweeping strategies the same as baseline assumptions?	No, see Comment 2
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	Not present
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	Yes, see Comment 3
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	No, see Comment 4

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Expected	Expected	Expected
PLRM Name	TreatmentVault1	CartridgeFilter1	CartridgeFilter2
Type	Treatment Vault	Cartridge Filter	Cartridge Filter
Physical Location	Reagan Beach Parking Lot	Reagan Beach Parking Lot	Reagan Beach Parking Lot

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)	FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
Baseline	19.5	4,584	28.1	127.9	2,079	12.7	58.0	2.29E+17
Expected	13.0	604	6.6	55.8	274	3.0	25.3	3.02E+16
Load Reduction	6.5	3,980	21.5	72.1	1,805	9.8	32.7	1.99E+17
% Load Reduction	33%	87%	77%	56%				

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr): 6.5 **FSP (kg/yr):** 1,805 **TP (kg/yr):** 9.8 **TN (kg/yr):** 32.7 **Credits:** 19.9

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load	19.52	4,591	28.2	128.1
Expected Load	13.0	2,131	17.2	81.2
Load Reduction	6.5	2,460	10.9	46.9

Catchment Notes

Catchment runoff reductions result from routing runoff to distributed infiltration facilities (e.g., pervious pavement road shoulders).

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)

SWT Notes

The treatment vault default CECs were modified

TreatmentVault1	0.0	6	0.2	0.2
CartridgeFilter1	0.0	802	5.1	12.5
CartridgeFilter2	0.0	712	5.3	12.4

(upwards) to represent TreatmentVault1 as a pre-treatment system having minimal ability to remove FSP, TP, and TN.

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	100%	62%	51%	65%
TreatmentVault1	0%	0%	1%	0%
CartridgeFilter1	0%	20%	24%	17%
CartridgeFilter2	0%	18%	25%	17%
Check on Percentages	100%	100%	100%	100%

Summary Notes

The majority of project load reductions result from 1) runoff volume reductions within the catchments; and 2) the performance of the cartridge filters.

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

1. Maintaining infiltration capacity of distributed infiltration systems within the catchments (e.g., ensuring pervious pavement road shoulders do not clog).
2. Ensuring that conveyance systems effectively transport stormwater to distributed infiltration systems within the catchments.
3. Maintaining the treatment capacity of CartridgeFilter1 and Cartridge Filter2.

Secondary Components

1. Ensuring that conveyance systems (curb and gutter and storm drain) effectively transport stormwater to the cartridge filters.

Tertiary Components

1. Removing trash and debris in the pre-treatment vault.

Comments

1. Upon detailed inspection, UPC delineation required a slight modification. This change should be noted when registering the catchment.
2. High-Efficiency sweeper option selected in PLRM for all roads (City has two dustless regenerative air sweepers). 1-2 times per year sweeping on all Secondary Roads.
3. Infiltration facilities (which are used to represent the pervious pavement) are sized to store 0.84 inches of runoff. This sizing is likely appropriate, however, Catch1 is sized to store 0.084 inches. Was this a data entry error?
4. Pre-treatment vault named TreatmentVault1 has CECs adjusted upwards to reflect that this facility has minimal ability to remove FSP, TP, and TN.

Model Status

1. Note any modifications to UPC boundary when registering catchment.

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate

Date: 24-Jan-13

UPC ID:	G12	**PLRM Project Name:**	Harrison_Ave	**Date PLRM Project Last Revised:**	4-Jan-13

Background Information

Baseline Scenario Name:	BaselineCondition	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	R.O. Anderson and CSLT	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):		City to provide	

UPC Connectivity Factors

Surface Runoff:	100%	**FSP:**	100%	**TP:**	100%	**TN:**	100%

Narrative of Water Quality Improvements Represented in PLRM

The reconfigured drainage system of the Harrison Avenue project redirects flows to a new storm drain system beneath Riverside Avenue, which will discharge into an expanded treatment basin located adjacent to merced Avenue in the northern portion of the boat parking lot. The drainage system incorporates a series of drain inlets, drainage pipes and infiltration pipes to direct storm water flows along Riverside Avenue to the expanded infiltration basin in the boat parking lot.

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	Yes
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	No, see Comment 1
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	yes
5. Is the total impervious area the same between the baseline and expected condition scenarios?	Yes

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	No, see Comment 2
2. Are the road abrasive application and sweeping strategies the same as baseline assumptions?	No, see comment 3
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	Not present
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	Not present
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	Yes

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Expected	Expected	Expected
PLRM Name	PerfPipe1	PerfPipe2	InfiltrationBasin1
Type	Infiltration Basin	Infiltration Basin	Infiltration Basin
Physical Location	Beneath Riverside Ave between Tallac and Merced	Beneath Riverside Ave between Tallac and Alameda	Beneath Riverside Ave between Alameda and San Jose

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline	7.1	5,206	16.5	57.0
Expected	0.3	140	0.5	2.1
Load Reduction	6.8	5,066	16.0	54.9
% Load Reduction	96%	97%	97%	96%

FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
2,361	7.5	25.9	2.60E+17
64	0.2	1.0	6.99E+15
2,298	7.3	24.9	2.53E+17

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr):	6.8	**FSP (kg/yr):**	2,298	**TP (kg/yr):**	7.3	**TN (kg/yr):**	24.9	**Credits:**	25.3

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load	7.1	5,210	16.5	57.0
Expected Load	7.4	3,694	14.3	54.4
Load Reduction	-0.2	1,516	2.2	2.6

Catchment Notes

Pollutant loading decreases primarily from road shoulder improvements.

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
PerfPipe1	1.4	736	2.8	10.6
PerfPipe2	2.3	1,132	4.4	16.9

SWT Notes

InfiltrationBasin1	3.4	1,660	6.4	24.4

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	-3%	29%	13%	5%
PerfPipe1	20%	14%	17%	19%
PerfPipe2	32%	22%	27%	30%
InfiltrationBasin1	47%	32%	39%	43%
Check on Percentages	96%	97%	96%	96%

Summary Notes

The stormwater treatment facilities provide all the runoff reductions and the majority of the load reductions (70%-95%). Maintaining the infiltration rates in the stormwater treatment facilities is key to continued performance.

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

1. Maintaining infiltration capacity the stormwater treatment system (infiltration basin and infiltration pipes).
2. Ensuring that conveyance systems effectively transports stormwater to the stormwater treatment system.

Secondary Components

1. Removing material accumulated in the pre-treatment vaults to reduce loading discharged to the infiltration systems.
2. Pollutant source controls (e.g., sweeping) to reduce loading discharged to the infiltration systems.

Tertiary Components

None noted.

Comments

1. This PLRM model represents a portion of UPC = G12. The Al Tahoe Phase 1 model should be registered with this model to provide complete registration of the UPC = G12.
2. Proposed project improvements address private runoff through a regional treatment system. To avoid double-counting in PLRM, private property BMP implementation is set to zero for private land uses in the expected condition.
3. High-Efficiency sweeper option selected in PLRM for all roads (City has two dustless regenerative air sweepers). 1-2 times per year sweeping on all Secondary Roads.

Model Status

1. The expected condition scenario represents the preliminary project design. The PLRM scenario should be reviewed and revised after project construction and prior to catchment registration.
2. Catchment registration of UPC = G12 should include both the Al Tahoe Phase 1 PLRM model and the Harrison Avenue PLRM model.

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate

Date: 24-Jan-13

UPC ID:	G12	**PLRM Project Name:**	AlTahoe_Phase1	**Date PLRM Project Last Revised:**	14-Dec-12

Background Information

Baseline Scenario Name:	BaselineCondition	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	Wood Rodgers and CSLT	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):		City to provide	

UPC Connectivity Factors

Surface Runoff:	100%	**FSP:**	100%	**TP:**	100%	**TN:**	100%

Narrative of Water Quality Improvements Represented in PLRM

The Al Tahoe Erosion Control Project 1 (Project) installed a proprietary media filter with a pretreatment vault at the terminus of the existing Pasadena storm drain. The Project reconstructed and/or rehabilitated the entire Pasadena storm drain system, i.e. replaced existing damaged and/or deteriorated storm drain pipes with perforated storm drain pipes to encourage infiltration. The Project replaced approximately 24 existing drainage inlets (DI) along the storm drain with DIs which include sediment collection sumps for pre-treatment and repaired two dry wells. To provide source control, the Project installed curb and gutter along one major street and revegetated the right-of-way (ROW) area behind the curb. Trench drains connected to infiltration galleries were installed periodically behind the curb and gutter to remove runoff from the road and distribute it, sub-surface, to the vegetated shoulder area. Finally, road shoulders throughout the Project area were rehabilitated. Rehabilitation included construction of a porous surface with revegetation and the installation of parking deterrents to encourage drivers to park on the pavement to allow for the re-establishment of shoulder vegetation.

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	Yes
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	No, see Comment 1
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	Yes
5. Is the total impervious area the same between the baseline and expected condition scenarios?	Yes

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	Yes
2. Are the road abrasive application and sweeping strategies the same as baseline assumptions?	No, see Comment 2
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	Not present
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	Yes
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	No, see Comment 3

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Expected	Expected	Expected
PLRM Name	TreatmentVault1	CartridgeFilter1	CartridgeFilter2
Type	Treatment Vault	Cartridge Filter	Cartridge Filter
Physical Location	End of Pasadena Ave.	End of Pasadena Ave.	End of Pasadena Ave.

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline	12.4	2,328	17.3	77.3
Expected	10.0	330	4.1	41.0
Load Reduction	2.4	1,998	13.2	36.3
% Load Reduction	19%	86%	76%	47%

FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
1,056	7.8	35.1	1.16E+17
150	1.9	18.6	1.65E+16
906	6.0	16.5	9.97E+16

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr):	2.4	**FSP (kg/yr):**	906	**TP (kg/yr):**	6.0	**TN (kg/yr):**	16.5	**Credits:**	10.0

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load	12.4	2,328	17.3	77.3
Expected Load	10.0	1,431	13.2	60.1
Load Reduction	2.4	897	4.1	17.2

Catchment Notes

Catchment runoff reductions result from routing runoff to distributed infiltration facilities (e.g., pervious pavement road shoulders).

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
TreatmentVault1	0.0	5	0.1	0.2
CartridgeFilter1	0.0	882	7.4	14.8
CartridgeFilter2	0.0	158	1.5	2.9

SWT Notes

The treatment vault default CECs were modified (upwards) to represent TreatmentVault1 as a pre-treatment system having minimal ability to remove FSP, TP, and TN.

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	99%	45%	31%	47%
TreatmentVault1	0%	0%	1%	0%
CartridgeFilter1	0%	44%	56%	41%
CartridgeFilter2	0%	8%	11%	8%
Check on Percentages	99%	97%	98%	97%

Summary Notes

The majority of project load reductions result from 1) runoff volume reductions within the catchments; and 2) the performance of the cartridge filters.

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

1. Ensuring that the conveyance and storm drain system distributes stormwater to the cartridge filters as designed.
2. Maintaining the treatment capacity of CartridgeFilter1.
3. Maintaining infiltration capacity of distributed infiltration systems within the catchments (e.g., ensuring pervious pavement road shoulders do not clog).

Secondary Components

1. Ensuring that conveyance systems (curb and gutter and storm drain) effectively transport stormwater to the cartridge filters.
2. Maintaining the treatment capacity of CartridgeFilter2. Note that this treatment system by design gets significantly less runoff and pollutant loading relative to CartridgeFilter1. The maintenance interval for activities such as cartridge replacement should be less frequent relative to CartridgerFilter1.

Tertiary Components

1. Removing trash and debris in the pre-treatment vault.

Comments

1. This PLRM model represents a portion of UPC = G12. The Harrison Avenue model should be registered with this model to provide complete registration of the UPC = G12.
2. High-Efficiency sweeper option selected in PLRM for all roads (City has two dustless regenerative air sweepers). 1-2 times per year sweeping on all Secondary Roads.
3. Pre-treatment vault named TreatmentVault1 has CECs adjusted upwards to reflect that this facility doesn't target pollutants simulated by PLRM.

Model Status

1. Catchment registration of UPC = G12 should include both the Al Tahoe Phase 1 PLRM model and the Harrison Avenue PLRM model.

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate

Date: 24-Jan-13

UPC ID:	F1	**PLRM Project Name:**	SierraTract_Phase1	**Date PLRM Project Last Revised:**	21-Dec-12

Background Information

Baseline Scenario Name:	Baseline_Conditions	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	CSLT	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):		City to provide	

UPC Connectivity Factors

Surface Runoff:	46%	**FSP:**	20%	**TP:**	19%	**TN:**	26%

Narrative of Water Quality Improvements Represented in PLRM

The Sierra Tract Phase 1 Erosion Control Project is represented through this model. The project consists of road shoulder stabilization (curb and gutter) on a number of roads in the project area. While this improvement increases DCIA of roads in the expected condition, a number of curb and gutter sections have been designed with curb cuts to allow water to flow into the pervious area behind the curb. This project feature is represented in the PLRM Drainage Conditions Editor using the "Area Routed to Pervious Drainage Area" option. Stormwater runoff from the project area is routed to a number of Infiltration Basins that are connected in series. The treatment capacity within individual Infiltration Basins varies greatly, from a few hundred cubic feet to roughly 10,000 cubic feet.

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	Yes
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	No, see Comment 1
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	Yes
5. Is the total impervious area the same between the baseline and expected condition scenarios?	Yes

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	Yes
2. Are the road abrasive application and sweeping strategies the same as baseline assumptions?	No, see Comment 2
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	No, see Comment 3
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	Not present
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	Yes

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Expected	Expected	Expected
PLRM Name	BasinA	BasinC	BasinD
Type	Dry	Infiltration	Infiltration
Physical Location	1191 O'Malley	Corner of Charles, Osbourne and O'Malley	2696 Osbourne

Scenario	Expected	Expected	Expected
PLRM Name	BasinE	BasinF	BasinG
Type	Infiltration	Infiltration	Infiltration
Physical Location	NW Corner of Kubel and Martin	1313 and 1309 O'Malley	Adjacent to 1245 O'Malley

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline	14.9	1,893	19.7	82.5
Expected	1.6	275	2.0	9.8
Load Reduction	13.3	1,618	17.7	72.7
% Load Reduction	89%	85%	90%	88%

Conversion to Metric Units

FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
859	8.9	37.4	9.45E+16
125	0.9	4.4	1.37E+16
734	8.0	33.0	8.07E+16

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr):	6.1	**FSP (kg/yr):**	147	**TP (kg/yr):**	1.5	**TN (kg/yr):**	8.6	**Credits:**	1.6

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load	14.9	1,893	19.7	82.5
Expected Load	12.2	2,293	16.2	75.6

Catchment Notes

Why so much change in runoff between this version of the model and the older version for the expected

Load Reduction	2.7	-400	3.5	7.0

condition? Need to check what caused change.

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Basin A	0.1	14	0.1	0.5
Basin C	2.8	473	3.7	17.0
Basin D	0.2	28	0.3	1.3
Basin E	1.0	131	1.2	5.9
Basin F	1.6	268	1.9	9.6
Basin G	4.9	1,101	7.1	31.4

SWT Notes

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	20%	-25%	20%	10%
Basin A	1%	1%	1%	1%
Basin C	21%	29%	21%	23%
Basin D	2%	2%	1%	2%
Basin E	8%	8%	7%	8%
Basin F	12%	17%	11%	13%
Basin G	37%	68%	40%	43%
Check on Percentages	100%	100%	100%	100%

Summary Notes

The infiltration basins appear to be highly effective at reducing runoff volumes, and associated pollutant loads leaving the project area, well below the baseline condition. Three of the infiltration basins (C, F, and G) are providing roughly 90% of the volume and load reduction.

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

1. Maintaining the infiltration capacity and overall function of Infiltration Basins C, F, and G.
2. Ensuring that conveyance systems (curb and gutter and storm drain) transport stormwater to key infiltration basins.

Secondary Components

1. Maintaining infiltration capacity and the function of Infiltration Basins A, D, and E
2. Ensuring that conveyance systems (curb and gutter and storm drain) transport stormwater to these infiltration basins.

Tertiary Components

None noted

Comments

1. This PLRM model only represents a portion of UPC = F1. The Sierra Tract Phase 2 PLRM model should be registered with this model to provide complete registration of the UPC = F1.
2. High-Efficiency sweeper option selected in PLRM for all roads (City has two dustless regenerative air sweepers). 1-2 times per year sweeping on all Secondary Roads.
3. Pervious dispersion areas are using PLRM defaults. The physical characteristics of these area should be reviewed in the field to make sure estimates are reasonable. These would be curb-cuts. Would like some guidance as to how I should interpret these features. NHC will set up a meeting with City staff to work on representation of these.

Model Status

Quality Assurance Documentation for PLRM Project Supporting Pollutant Load Reduction Estimate

Date: 7-Jan-13

UPC ID:	F1	**PLRM Project Name:**	SierraTract_Phase2	**Date PLRM Project Last Revised:**	21-Dec-12

Background Information

Baseline Scenario Name:	Baseline_Conditions	**Expected Scenario Name:**	ExpectedCondition
Model Built By:	CSLT	**QA/QC Review By:**	B. Wolfe, NHC
GIS shapefile(s) showing catchment delineations (Baseline and Expected):	City to provide		

UPC Connectivity Factors

Surface Runoff:	46%	**FSP:**	20%	**TP:**	19%	**TN:**	26%

Narrative of Water Quality Improvements Represented in PLRM

City to provide

Standard Checks ***"No" answers require an explanation in the Comments Section***

1. Do the baseline scenario assumptions match the baseline submittal to Lahontan for this UPC?	Yes
2. Does the modeled area for baseline scenario match the delineated area for this UPC?	No, see Comment 1
3. Are the total areas modeled in the baseline and expected condition scenarios the same?	Yes
4. Is the distribution of land uses the same between the baseline and expected condition scenarios?	Yes
5. Is the total impervious area the same between the baseline and expected condition scenarios?	Yes

Expected Condition Scenario Checks ***"No" answers require an explanation in the Comments Section***

1. Is an estimate of the existing levels of private property BMP implementation used?	Yes
2. Are the road abrasive application and sweeping strategies the same as baseline assumptions?	No, see Comment 2
3. Do estimates of DCIA appear to be assessed and adjusted from the PLRM default of 50%?	Yes
4. Where present, do pervious dispersion areas draining roads appear to be adjusted from defaults?	No, see Comment 3
5. Where present, do infiltration facilities draining roads appear to be assessed and adjusted from defaults?	Not present
6. Do the sizing/function inputs for SWT facilities appear reasonable; are default CECs used?	No, see Comment 4

Identification of Stormwater Treatment (SWT) Facilities

Scenario	Expected	Expected	Expected
PLRM Name	YoungStA	YoungStB	OmalleyB
Type	Infiltration	Infiltration	Infiltration
Physical Location	NW corner of Young St and William	NW corner of Young St and Marjorie	1135 O'Malley

Scenario	Expected	Expected	
PLRM Name	OmalleyA	BlueLakeBasin	
Type	Infiltration	Dry Basin	
Physical Location	1114 O'Malley, corner of O'Malley and Blue Lake	1067 Blue Lake	

PLRM Estimates (no UPC connectivity factors applied)

Scenario	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline	7.0	2,693	12.1	48.1
Expected	4.3	424	2.6	15.4
Load Reduction	2.7	2,269	9.5	32.7
% Load Reduction	39%	84%	79%	68%

Conversion to Metric Units

FSP (kg/yr)	TP (kg/yr)	TN (kg/yr)	FSP (# part)
1,222	5.5	21.8	1.34E+17
192	1.2	7.0	2.12E+16
1,029	4.3	14.8	1.13E+17

Effective Load Reductions for Catchment Registration (after UPC connectivity factors applied)

Surface Runoff (af/yr):	1.2	**FSP (kg/yr):**	206	**TP (kg/yr):**	0.8	**TN (kg/yr):**	3.9	**Credits:**	2.3

Catchment Load Reduction Diagnostics

Sum all Catchments	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
Baseline Load	7.0	2,696	12.1	48.1

Catchment Notes

Improvements (e.g., curb and gutter) are increasing

Expected Load	9.1	2,356	13.4	60.2
Load Reduction	-2.1	341	-1.3	-12.1

runoff volumes. Quality of runoff is improved, with net effect being minimal change in loading from catchment improvements.

Stormwater Treatment Load Reduction Diagnostics

SWT Facilities	Volume and Load Reductions			
	Vol (af/yr)	FSP (lb/yr)	TP (lb/yr)	TN (lb/yr)
YoungStA	1.4	441	2.2	9.8
YoungStB	0.5	162	0.8	3.5
OmalleyB	1.0	218	1.5	6.7
OmalleyA	0.6	117	0.8	3.8
BlueLakeBasin	1.2	988	5.5	21.1

SWT Notes

Summary of Load Reduction Diagnostics

Project Component	% of Project Reduction			
	Vol	FSP	TP	TN
Catchment Changes	-76%	15%	-14%	-37%
YoungStA	52%	19%	23%	30%
YoungStB	19%	7%	8%	11%
OmalleyB	38%	10%	15%	20%
OmalleyA	22%	5%	9%	12%
BlueLakeBasin	45%	44%	58%	64%
Check on Percentages	100%	100%	100%	100%

Summary Notes

While the road shoulder improvements have increased runoff transported within the drainage catchments, the infiltration basins are effective at reducing runoff volumes, and associated pollutant loads leaving the project area below the baseline condition. The Blue Lakes dry basin provides roughly 50% of the load reduction.

Importance of Project Components Related to Estimated Load Reductions and Ongoing Maintenance

Primary Components

1. Maintaining the infiltration capacity and overall function of the Blue Lakes dry basin, YoungStA infiltration basin, and OmalleyB infiltration basin.
2. Ensuring that conveyance systems (curb and gutter and storm drain) transport stormwater to these facilities.

Secondary Components

1. Maintaining the infiltration capacity and overall function of the YoungStB infiltration basin and OmalleyA infiltration basin.
2. Ensuring that conveyance systems (curb and gutter and storm drain) transport stormwater to these facilities.

Tertiary Components

None noted

Comments

1. This PLRM model only represents a portion of UPC = F1. The Sierra Tract Phase 1 PLRM model should be registered with this model to provide complete registration of the UPC = F1.
2. High-Efficiency sweeper option selected in PLRM for all roads (City has two dustless regenerative air sweepers). 1-2 times per year sweeping on all Secondary Roads.
3. Pervious dispersion areas are using PLRM defaults. The physical characteristics of these area should be reviewed in the field to make sure estimates are reasonable. These inputs are small (10-20%) and insignificant. Especially for a modeled catchment that is only 20% connected. Willing to revisit, but may decide to simply exclude them from the model. Agree the effect is minor, suggest deleting pervious dispersion areas from this model.
4. Blue Lakes inputs for water quality volume, footprint, and draw down needs additional assessment. On hold until Spring due to snow in basin

Model Status

1. After edits and final qa/qc, will need to update final loading numbers in this worksheet.
2. Catchment registration of UPC = F1 should include both the Sierra Tract Phase 1 and Phase 2 PLRM models.