Santa Monica In-Line Storm Drain Runoff Infiltration System Project: Final Report

City of Santa Monica

September 12, 2014

Santa Monica Bay Watershed
Stormwater Harvesting and Beneficial Use
Proposition 84 Grant
City of Santa Monica Clean Beaches Fund
$325,662 Project Cost

Final Report

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

Grant Summary

Completed Grant Summaries are made available to the public on the State Water Resources Control Board's (SWRCB) website at http://www.waterboards.ca.gov/funding/grantinfo.html

Use the tab and arrow keys to move through the form. If field is not applicable, please put N/A in field.

Date filled out: August 15, 2014

Grant Information: Please use complete phrases/sentences. Fields will expand as you type.
1. **Grant Agreement Number:** 11-101-554
2. **Project Title:** In-Line Storm Drain System Infiltration Demonstration Project
3. **Project Purpose – Problem Being Addressed:** Reduce urban runoff discharge (volume) and pollution into Santa Monica Bay by harvesting runoff at the project sites for infiltration. Infiltration results in reduced volume and pollution to the Bay.
4. **Project Goals** a. **Short-term Goals:** Install 2 stand-alone treatment and infiltration systems within an existing storm drain line and an existing catch basin to harvest dry and wet weather runoff for onsite beneficial use.
b. **Long-term Goals**: Demonstration Site and Monitoring Program. Demonstrate a new, in-line retrofit storm drain low impact development strategy to reduce urban runoff discharge to surface waters.
5. **Project Location**: (lat/longs, watershed, etc.) 34.0314, -118.4641; 34.0073, -118.4716; Santa Monica Bay watershed
a. **Physical Size of Project**: (miles, acres, sq. ft., etc.) 50' x 50'
b. **Counties Included in the Project:** Los Angeles
c. **Legislative Districts:** (Assembly and Senate) Senate District No.23 Assembly District No. 41
6. **Which SWRCB program is funding this grant?** Please "X" box that applies. ☐ Prop 13 ☐ Prop 40 ☐ Prop 50 ☐ EPA 319(h) ☒ Prop 84
Grant Contact: Refers to Grant Project Director. **Name:** Rick Valte **Job Title:** Watershed Engineer
Organization: City of Santa Monica **Webpage Address:** http://www.smgov.net/departments/publicworks/civeng.aspx
Address: 1437 4th Street, Suite 300, Santa Monica 90401
Phone: 310.458.8234 **Fax:** 310.393.4425
E-mail: rick.valte@smgov.net

Grant Time Frame: Refers to the implementation period of the grant. **From:** April 1, 2012 **To:** November 1, 2014
Project Partner Information: Name all agencies/groups involved with project. RWQCB, City of Los Angeles, County of Los Angeles Flood Control District
Nutrient and Sediment Load Reduction Projection: (If applicable) N/A

Please provide a hard copy to your Grant Manager and an electronic copy to your Program Analyst for SWRCB website posting. All applicable fields are mandatory. Incomplete forms will be returned.

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Acronyms

AB	Assembly Bill
ALERT	Automatic Local Evaluation in Real Time
bgs	Below ground surface
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
C_D	Developed Runoff Coefficient
CPS	Connector Pipe Screen
DL	Detection Limit
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
MDL	Method Detection Limit
µg/L	Micrograms per liter
mg/L	Milligrams per liter
MP	Monitoring Program
MPN/100ml	Most Probably Number per 100 milliliters
ND	Non-Detect or Not Detected
NPDES	National Pollutant Discharge Elimination System
PAHs	Polynuclear Aromatic Hydrocarbons
PP	Pumping Plant
Project	Santa Monica In-Line Storm Drain Runoff Infiltration Project
QAPP	Quality Assurance Project Plan
RL	Reporting Limit
ROW	Right of Way
SMBRC	Santa Monica Bay Restoration Commission
SMURRF	Santa Monica Urban Runoff Reclamation Facility
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids

Executive Summary

Through Grant Agreement No. 11-101-554 with the State Water Resources Control Board, the City of Santa Monica installed the Santa Monica In-Line Storm Drain Runoff Infiltration Project, which consisted of three distinct Green Street, structural Best Management Practices (BMPs), or Watershed Control Measures (WCMs):

- **West Franklin Street**: Where runoff from a 1.2 acre residential catchment is diverted from a catch basin lateral into a subsurface parkway infiltration system composed of plastic crates.
- **East Franklin Street:** Where runoff from a 7.3 acre residential catchment is diverted from a catch basin into a Modified MaxWell® IV dry-well infiltration system (vertical, augered silos or shafts for storing water and allowing infiltration into surrounding soils) placed under the roadway.
- **Hill Street:** Where runoff from a 1.7 acre residential catchment is diverted from a City storm drain into a Modified MaxWell® Plus sump and dry-well infiltration system under the roadway.

<u>Project Goals</u>

1. Educate property owners, tenants, business owners, employees about the impacts of urban runoff pollution and solutions.
2. Comply with Santa Monica Bay TMDLs for a portion of the Kenter Canyon sub-watershed for reducing urban runoff pollution by implementing BMPs.

<u>Desired Outcomes</u>

1. Increase the number of people living and working in the project area who understand the impacts of runoff pollutions and how solutions work to curb pollution.
2. Reduce urban runoff pollutants from a portion of the Kenter Canyon sub-watershed reaching the Santa Monica Bay.

The West Franklin location was selected as the flow and water quality monitoring site from which data was collected and extrapolated to all three sites to assess the effectiveness of the project. Dry- and wet-weather flows to that catch basin were screened of debris and diverted into an infiltration system to achieve runoff and pollutant load reductions from the Municipal Separate Storm Sewer System (MS4) and Santa Monica Bay.

Monitoring took place from October 2013 until May 2014, during which twelve dry-weather and fifteen wet-weather water quality samples were collected and analyzed, along with the enumeration of dry- and wet-weather runoff volumes delivered to the parkway infiltration system. This allowed the estimation of runoff volumes, constituent concentrations, and calculation of pollutant load reductions diverted from the MS4 drainage system and Santa Monica Bay. Dry and wet-weather laboratory analytes are noted in the tables.

With the exception of PAHs which were never detected, the other laboratory water quality analytes were usually measured at quantifiable concentrations. Although analyte concentrations varied significantly, the results were generally comparable between wet- and dry- weather derived samples, with the exception that higher bacteria levels were usually observed in storm runoff samples. Approximately 99% of the assessed annual runoff and pollutant load reduction was associated with infiltration of diverted storm runoff, while dry-weather flows contributed the remaining one percent.

Load Reduction Accomplishments – Post-Installation

Wet-Weather Load Reductions

As referenced in **Table 1 below (Table 5 in report body)**, during a typical year with an assumed 15 inches of rainfall (see **Appendix I**), CWE estimates that the 1.2 acre West Franklin Street site would divert and infiltrate approximately one million liters of runoff, containing 108,000 grams (240 pounds) of solids, 4,100 grams (nine pounds) of oil and grease, 140,000 milligrams (five ounces) of zinc, 30,000 milligrams (one ounce) of copper, and over three billion fecal bacteria, in addition to other constituents and pollutants.

The third column of **Table 1** summarizes the total wet-weather load reductions for the monitoring period. To estimate the load reduction during a more typical storm season, these values were multiplied by the ratio of 15 inches over the 4.34 inches observed during the 2013-2014 season, or approximately 3.5. The annual load reduction is almost entirely attributable to storm flows, rather than dry weather flows.

However, these results are based upon water sampling and monitoring during a rainy year that received below normal rainfall, 4" versus 15", resulting in limited data during an abnormal rainy season. Therefore, these estimates should be used with caution.

Table 1 West Franklin Street Site Wet-Weather Load Reduction Summary

Analyte	Units	2013-14 Storm Season	Average 15" Storm Season
General Constituents			
Total Oil and Grease	grams	1,180	4,100
Total Suspended Solids	grams	31,000	108,000
Total Phosphorous as P	grams	560	1,900
BOD	grams	11,100	39,000
Nitrate, as Nitrogen	grams	320	1,120
Nitrite, as Nitrogen	grams	29	101
Metals			
Cadmium	mg	51	180
Chromium	mg	1,430	5,000
Copper	mg	8,500	30,000
Lead	mg	1,500	5,200
Nickel	mg	2,400	8,400
Silver	mg	35	122
Zinc	mg	40,000	140,000
Bacteria			
Coliform, Total	MPN x 10^9	190	665
Coliform, Fecal	MPN x 10^9	115	400
Enterococcus	MPN x 10^9	90	310

As referenced in **Table 6 in the report body**, **during a typical fifteen inch rainfall year and assuming a combined tributary area of 10.2 residential acres, the combined Santa Monica In-Line Storm Drain Runoff Infiltration Project (3 sites), would infiltrate approximately 7**

acre-feet of runoff, resulting in the diversion of a 920,000 grams (1 ton) of solids, 35,000 grams (77 pounds) of oil and grease, 1,190,000 milligrams (42 ounces)of zinc, 250,000 milligrams (9 ounces)of copper, and 25 billion fecal bacteria, among other pollutants, from the Pico-Kenter MS4 and Santa Monica Bay receiving water. However, these results are based upon water sampling and monitoring during a rainy year that received below normal rainfall, 4" versus 15", resulting in limited data during an abnormal rainy season. Therefore, these estimates should be used with caution.

Dry-Weather Load Reductions

Table 3 below summarizes the estimated mean monthly and annual total dry-weather load reduction for the West Franklin Street site, monthly and annual (estimated). **Table 8** in the report body extrapolates that data to apply to the entire 10.2 acre Santa Monica In-Line Storm Drain Runoff Infiltration Project area.

Table 2 West Franklin Street Site Dry-Weather Load Reduction Summary

Analyte	Units	Monthly Load Reduction	Annual Load Reduction
General Constituents			
Total Oil and Grease	grams	0.40	4.6
Total Suspended Solids	grams	140	1,700
Total Phosphorous as P	grams	3.8	46
BOD	grams	96	1,150
Nitrate, as Nitrogen	grams	0.60	6.8
Nitrite, as Nitrogen	grams	0.10	1.3
Metals			
Cadmium	mg	0.10	1.8
Chromium	mg	2.6	32
Copper	mg	25	290
Lead	mg	4.0	48
Nickel	mg	7.1	86
Silver	mg	0.04	0.50
Zinc	mg	99	1,180
Bacteria			
Total Coliform	MPN x 10^9	2.7	32
Fecal Coliform	MPN x 10^9	0.104	1.25
Enterococcus	MPN x 10^9	0.190	2.3

Budget Summary

The completed project used $280,663 of the $300,000 grant amount. The total cost of the project was $352,534.

Problem Statement & Relevant Issues

The proposed project was needed to address urban runoff, the single largest source of water pollution in the Santa Monica Bay, which is on the 303(d) list of impaired water bodies. This ubiquitous problem is of critical concern to the City of Santa Monica because of the City's proximity to the ocean and its dependence upon a healthy Bay for much of its economy. Millions of people visit Santa Monica, its beaches and pier, as well as beaches of Los Angeles south and north of Santa Monica. With the implementation of Bacterial and Marine Debris TMDLs for the Bay, pending chemical TMDLs, a state Non-point Source Pollution Control Program and a watershed restoration plan through the Santa Monica Bay Restoration Project, the City is committed to continued and expanded treatment of all (dry and wet weather) urban runoff leaving the City. Urban runoff is a major contributor to this impaired water quality problem and the major water pollution problem to the coastal area of Santa Monica and the Bay. Urban runoff causes degradation of water quality, leading to the impairment of beneficial uses of the Bay. The goal of this project was to demonstrate how to reduce urban runoff pollution from City streets and some private properties located in the eastern end of the City, and to contribute to protecting the beneficial uses of the Santa Monica Bay, such as bathing, surfing and fishing, through the control of non-point source pollution found in urban runoff. In addition, the project demonstrated how an existing street area and the storm drain system in and under it can be modified to include infiltration zones in the parkway-sidewalk-gutter and roadway areas, if applicable and feasible. This project also helped the City meet its own goals found within its Sustainable City Plan and Watershed Management Plan, which contain principles about protecting water quality, harvesting local water resources, and public health and safety, which are accomplished in part through this project. The City also has a goal of treating all dry weather and most wet weather urban runoff leaving its borders through storm drain outlets, and this project will assist in meeting this goal.

The sources of urban runoff pollution include vehicles along the transportation grid, pedestrians, pet owners, homeless, business and residential owners, and city facilities.

For receiving waters of the Santa Monica Bay, some eight beneficial uses exist, including the major ones such as swimming, fishing and surfing. Additional uses exist for marine life ecology.

Project Goals

Through a demonstration project on harvesting urban runoff, the primary project goals were to educate the public about harvesting a local water supply and removing pollution, and to improve water quality and reduce beach postings of Santa Monica Bay. To assess the success of these goals, community outreach was performed through the planning and construction phases, and runoff volumes and pollutant load reductions were measured at three infiltration BMPs.

The City hired the consultant, CWE, to perform the following tasks to be able to measure success:

- ☐ Distribute outreach materials throughout the community within the three project locations explaining the goal of the project;
- ☐ Hold community workshop to explain the project, and solicit and address all community input and concerns;
- ☐ Monitor flow at the catch basin lateral and influent (diversion) using Flo-Dar™ sensors;
- ☐ Monitor flow validation based on Los Angeles County Department of Public Works (LACDPW) Rain Gauge No. 461 data;
- ☐ Monitor water quality of wet- and dry-weather runoff samples;
- ☐ Estimate Franklin Street west side load reductions based upon flow and water quality monitoring data;
- ☐ Estimate total Santa Monica In-Line Storm Drain Runoff Infiltration Project load reductions;

☐ Assess the feasibility of in-line catch basin and storm drain systems for infiltrating urban runoff.

Following a discussion with staff from the Los Angeles Regional Water Quality Control Board, the proposed study goal of assessing the beneficial impact of the Santa Monica In-Line Storm Drain Runoff Infiltration Project on Assembly Bill 411 Beach Postings was not undertaken since the project benefits 10.3 acres within a 1,424 acre watershed and would be unlikely to produce a detectable signal amongst notoriously noisy bacterial data. In addition, the existing Santa Monica Urban Runoff Recycling Facility (SMURRF) already captures, and reuses for landscape irrigation, most dry-weather and light storm flows from this catchment; so less than a half dozen storms were anticipated to produce runoff flows, that might impact Beach Postings, at the Pico-Kenter outfall. In essence, there would be too little data upon which to base a statistically significant and defensible analysis.

Project Description

In the year 2011, the City of Santa Monica (City) was awarded funding, approved by the Santa Monica Bay Restoration Commission and provided in full or part through an agreement with the State Water Resources Control Board, to implement the Santa Monica In-Line Storm Drain Runoff Infiltration Project (Project), through agreement No. 11-101-554. As summarized in the Assessment and Evaluation Plan, the Project purpose was to install structural Best Management Practice (BMP) devices to protect water quality and the marine environment of coastal Santa Monica Bay. Once installed, the BMPs were anticipated to achieve these objectives by reducing the volume of wet- and dry-weather runoff flows, and the pollutants it contains, from the City. The City contracted with CWE to conduct dry- and wet-weather flow and water quality monitoring at West Franklin Street catch basin retrofit site and evaluate the resulting pollutant load reduction. This technical report describes the flow and water quality analyses undertaken at the Franklin Street (west side) monitoring site and the load reductions achieved for the 2013-2014 storm season (October 2013 to April 2014), and extrapolates these results to apply to the three Project sites during a more typical storm season of 15" rainfall.

1. Project Site Characteristics and Methodology

Construction for the Santa Monica In-Line Storm Drain Runoff Infiltration Project was implemented at three locations, although the monitoring activities contracted to CWE focused on only one of the three sites. The resulting data was then extrapolated to the combined project extents, based on similarity of land use and individual tributary areas. According to the City of Santa Monica's Watershed Management Plan, all three locations are within the Kenter Canyon sub-watershed, which has a tributary area of 1,424 acres spread between the Cities of Santa Monica and Los Angeles (Brown and Caldwell, 2006). Land use within the subwatershed is primarily residential, with areas of commercial, light manufacturing, and transportation. Groundwater levels in the area, fluctuate based on extraction and seasonal conditions. Recent reports (Irvine Geotechnical, Inc., 2008; Geotechnologies, Inc., 2011) indicate that historic water surface levels are up to 35 feet below ground surface (bgs) providing sufficient filtration and adsorption capacity so as to sufficiently protect the groundwater from potential negative project induced impacts.

The West Franklin Street infiltration retrofit BMP site is located at 1789 Franklin Street, Santa Monica, California, as shown in **Figure 1**. This location was the primary flow and wet-weather monitoring site for the study. The infiltration chamber, as designed by others, was sized to accept runoff from a 0.75 inch design storm and all dry-weather flows. As constructed, dry- and typical wet-weather flows are collected into a catch basin, then diverted from the catch basin lateral as "influent" to an infiltration system constructed in the parkway. During large storm events, that exceed the retention and infiltration capacity of the system, the diversion line fills with water forcing additional accumulating runoff to "by-pass" down the lateral and into the main storm drain. Assuming that parcels within the catchment drain equally to both Franklin Street and the rear alley, the site catch basin tributary area is approximately 1.2 acres of single and multifamily residential parcels, with an estimated impervious proportion of approximately 80% and Developed Runoff Coefficient (C_D) of 0.86.

The East Franklin Street infiltration retrofit BMP site is located at 1777 Franklin Street, Santa Monica, California, as shown in **Figure 1**. As constructed, dry- and first flush wet-weather flows are collected into the site catch basin and diverted into a Modified MaxWell® IV dry-well infiltration system, placed within the public roadway Right of Way (ROW), and allowed to percolate into the ground. During large storm events, that exceed the capacity of the infiltration system, additional accumulating runoff continues down the catch basin lateral and into the storm drain under Nebraska Avenue. The tributary area to the site catch basin is approximately 7.3 acres of single and multifamily residential parcels, with an estimated impervious proportion of approximately 80% and C_D of 0.86.

Figure 1 Santa Monica In-Line Runoff Infiltration West and East Franklin Street Sites

The Hill Street infiltration system was originally proposed for the south side of Nebraska Avenue near Stanford Street, but was shifted to 1121 Hill Street, Santa Monica as shown in **Figure 2,** due to conflicting utilities. As constructed, runoff is collected into a grated inlet located at the intersection of 11th Court and Ashland Place North and conveyed northwest under 11th Court through a City storm drain to Hill Street. From this storm drain flows are diverted into a Modified MaxWell® Plus sump and dry-well infiltration system under the public roadway ROW. The sump portion is a manhole-like chamber where oil and grease are absorbed and debris is allowed to settle before subsequent removal by Vactor truck (an operation and maintenance truck with a storage tank for storing water and debris removed from subsurface stormwater and wastewater pipes and similar facilities). The partially treated runoff then flows from the sump into the dry well chamber for infiltration. Flows in excess of infiltration capacity continue down the existing Hill Street storm drain. The tributary area to the grated inlet is approximately 1.7 acres of single family residential parcels, with an estimated impervious proportion of approximately 80% and C_D of 0.86.

Figure 2 Santa Monica In-Line Runoff Infiltration Hill Street at 11th Court Site

2. Budget Summary - Actuals

Budget Tasks	Grant	City of Santa Monica	Total
Personnel Services	$22,295		$22,295
Consultant Services	$80,731	$71,790	$152,521
Construction	$177,657	$61	$177,718
Total	$280,683	$71,851	$352,534

The actual cost of construction was under the initial estimate for a few reasons. The original estimate was based upon past similar stormwater projects the city has built; this estimate turned out to be an overestimate for this type of in-line project. While the bids for the RFP varied, the city accepted the lower bid that is reflected in this final construction cost under the estimate. Finally, instead of three separate locations of construction, the project had two sites, though one had two installations. However, there was cost savings for mobilizing only two sites instead of three. No unanticipated construction problems occurred.

3. Project Methodology - Construction Description

The Project had two methods:

- Installation of structural Best Management Practice (BMP) devices to harvest urban runoff; and
- Identification of specific BMP devices to consider for use on future projects based on a number of evaluation factors, such as, but not limited to, the cost of procurement and installation, technical efficiency, ongoing maintenance of these systems, ease of installation, and location of installation.

Cost-benefit analysis associated with these factors respective of this pilot project will be analyzed further by the City of Santa Monica in order to provide insight for future recommended project locations. To accomplish this goal, the City constructed three types of structural BMPs which were located on the west and east side of Franklin/Nebraska Street, and Hill Street/11th Court. The construction process of each system is explained and diagrammed below.

- **West Franklin/Nebraska Street Infiltration BMP (Monitoring site)**

The construction of this system consisted of tying into the catch basin outlet connector pipe (17) via 24" x 6" wye ("Y", Y-shaped part or object) connection with the intention to divert low flow from wet-weather and all dry-weather flows (entering the catch basin) from a 1.2 acre catchment area into a proposed infiltration system just north of the catch basin under the parkway turf area. Monitoring sensors (18) were installed in two locations which were located inside the catch basin to track bypass flows, and in a newly constructed manhole just north of the catch basin to track diverted flows into the infiltration system. A diagram of the system is shown below.

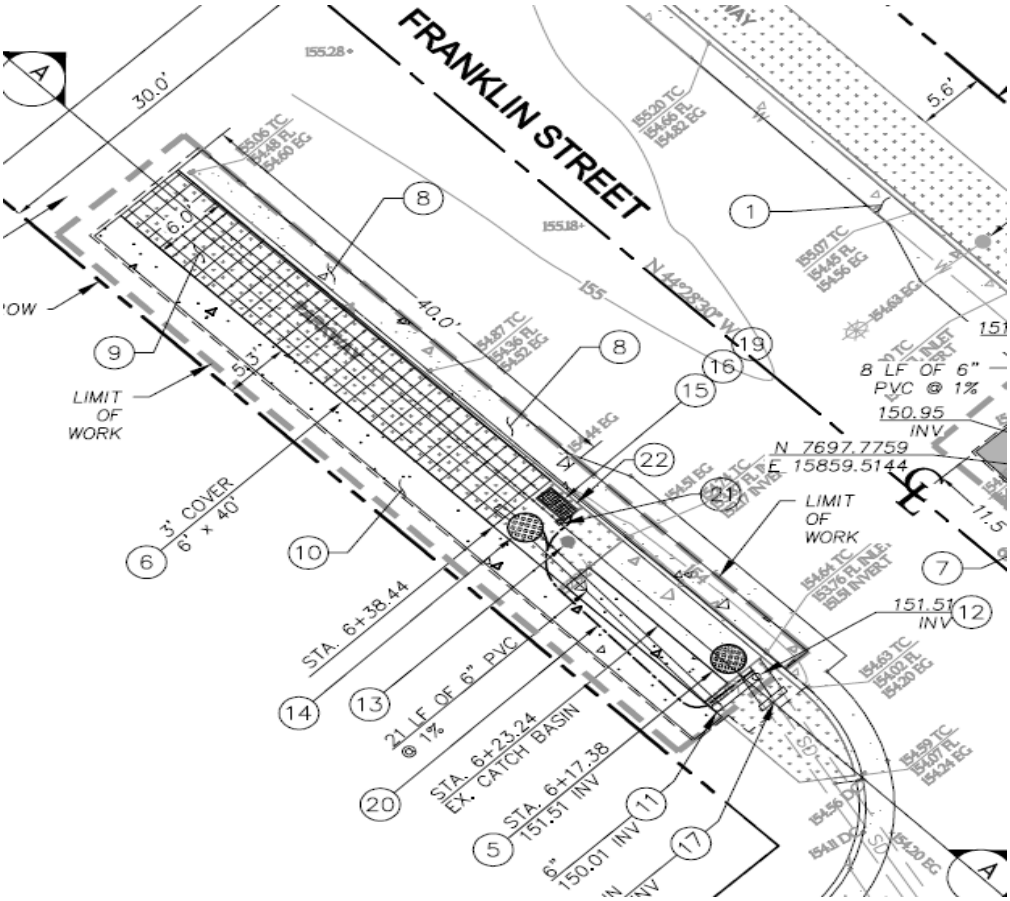


Figure 3: Plan view of Infiltration BMP at West Franklin/Nebraska (Monitoring Site)

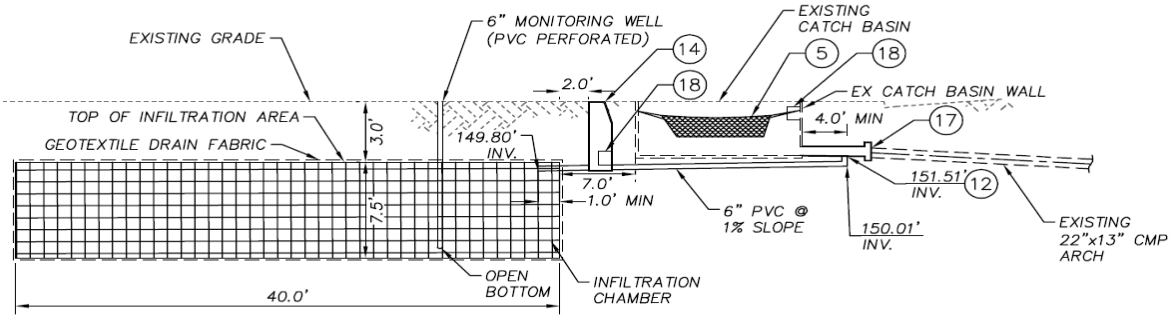


Figure 4: Cross section of Infiltration BMP at West Franklin/Nebraska (Monitoring Site)

Note: call out (5) above shows an inlet debris basket and filter media to be installed adjacent to the catch basin opening in order to improve water quality entering the catch basin. During construction, however, a catch basin face screen and connector pipe screen (CPS) were installed in lieu of the former, as it was concluded that this system was much more appropriate and efficient with respect to the monitoring process and existing catch basin geometry.

- **East Franklin/Nebraska Street Maxwell IV Infiltration BMP**

The Maxwell IV drainage system was constructed just southwest of the existing catch basin on the east side and was intended to divert low flow from wet-weather and all dry-weather flows (entering the catch basin) from a 7.3 acre catchment area via concrete weir constructed just upstream of the catch basin outlet connector pipe. A 6” pipe was cored into the side of the catch basin just upstream of the concrete weir to convey runoff to the Maxwell IV system. The Maxwell IV system receives runoff to its inlet chamber which allows initial sediment of pollutants before discharging to an overflow pipe, and ultimately infiltrating into the soil beneath the system. A diagram of the system is shown below.

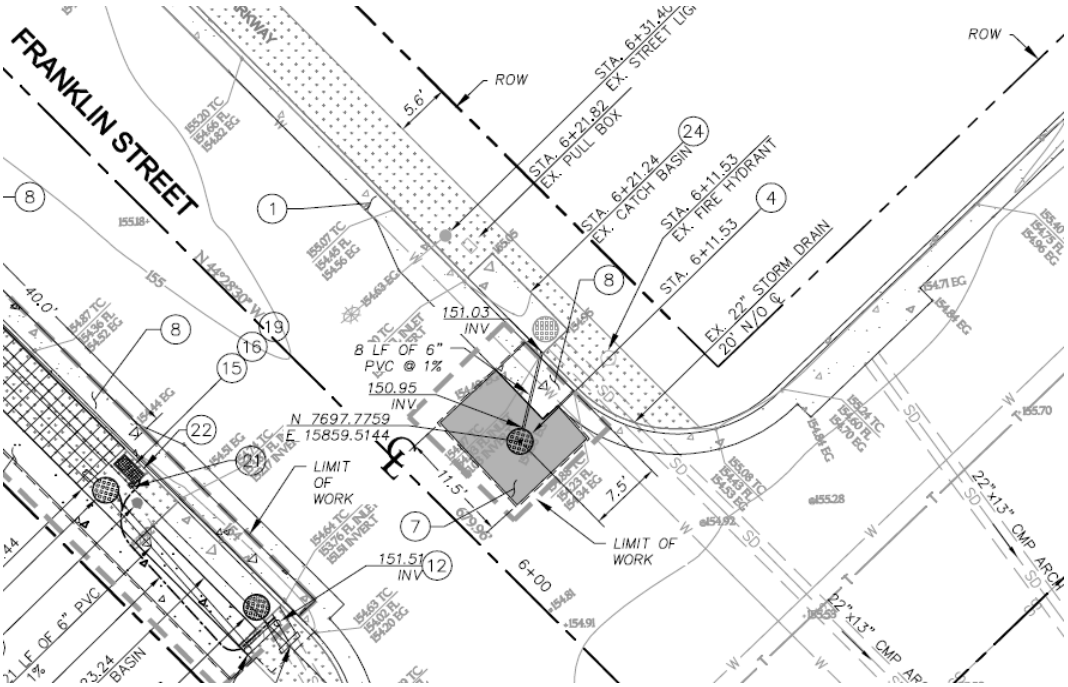


Figure 5: Plan View of Maxwell IV at East Franklin/Nebraska

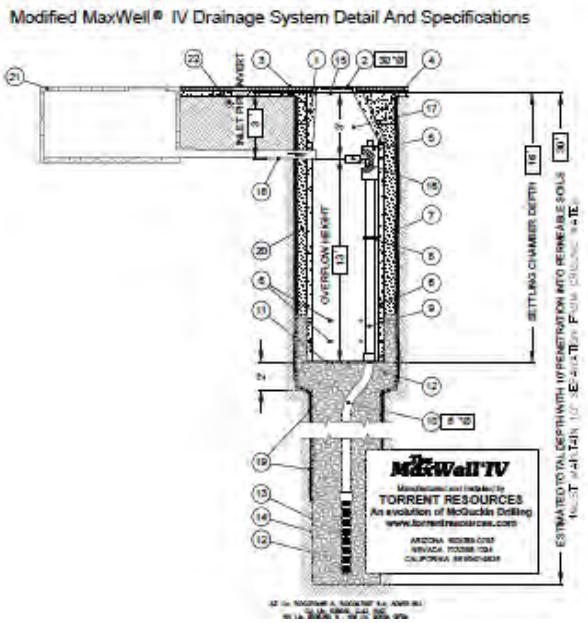


Figure 6: Cross section of Maxwell IV at East Franklin / Nebraska

- **Hill Street and 11th Court Maxwell Plus BMP**

The Maxwell Plus stormwater system was constructed just northeast of Hill Street and 11th Court intersection and was intended to divert low flow from wet-weather and all dry-weather flows (entering the storm drain manhole) from a 1.7 acre catchment area via concrete weir constructed inside the storm drain manhole. A 8" pipe was cored into the side of the storm drain manhole to convey runoff to the Maxwell Plus stormwater system. Maxwell Plus stormwater system consists of two chambers, a pretreatment chamber and an infiltration chamber. The Maxwell Plus stormwater system receives runoff to its inlet pretreatment chamber, which allows initial sedimentation of suspended solids and pollutants before discharging to an overflow pipe and onto the subsequent infiltration chamber where nearly all of the infiltration takes place. A diagram of the system is shown below.

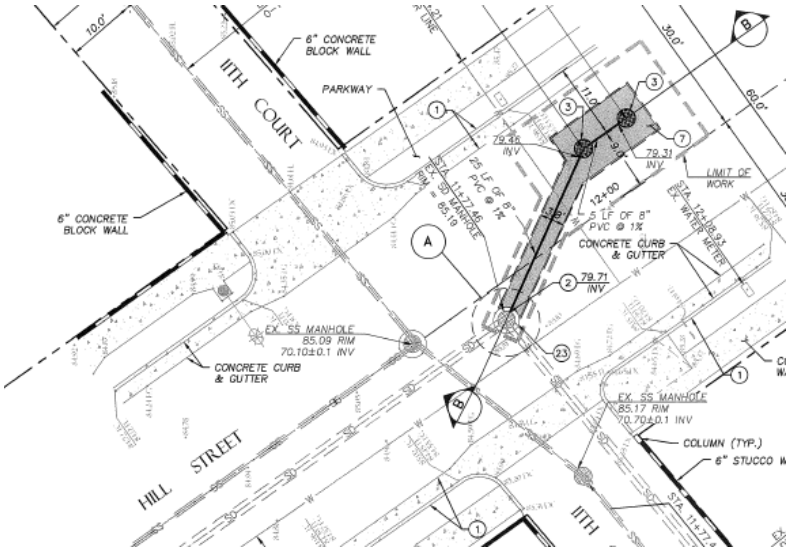


Figure 7: Plan View of Maxwell Plus at Hill Street and 11th Court

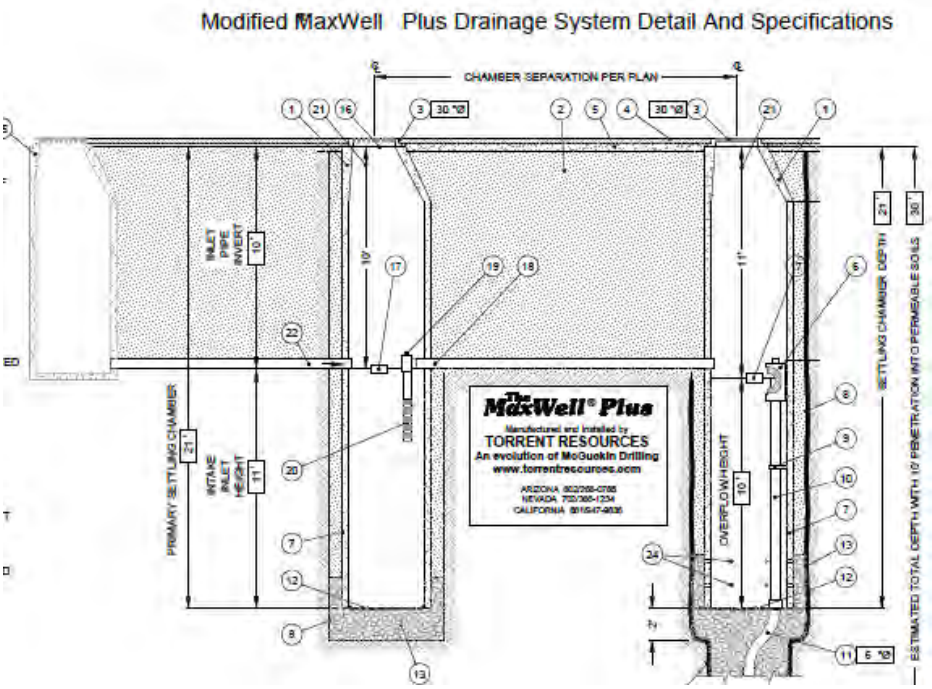


Figure 8: Plan View of Maxwell Plus at Hill Street and 11th Court

4. Data Evaluation - Monitoring Approach

To evaluate BMP performance, flow monitoring of the influent (diversion) to the West Franklin Street infiltration system and bypass (lateral) was undertaken from October 2013 through April 2014, along with the collection of both wet- and dry-weather runoff water quality grab samples.

4.1 Flow Monitoring

Flow monitoring data was collected through the installation of Hach Flo-Dar™ flow sensors (a proprietary device to measure the flow of a liquid in a pipe or channel) and Flo-Station™ data loggers in the catch basin, looking down the bypass (lateral), and within a manhole along the six inch influent (diversion) line to the infiltration system, e.g. Flo-Dar sensor is in the catch basin and in the manhole between the diversion wye connection and infiltration system. (Flo-Dar™ sensors report flow by measuring velocity with an energy intensive Doppler radar and water level with an ultrasonic sensor.) To conserve battery life, the flow data was collected at 15 minute increments and remotely uploaded, using cellular telephone communications, for distribution and reporting through an internet portal.

As a check or comparison for the Hach flow sensors, rainfall data from the LACDPW ALERT[1] (Automatic Local Evaluation in Real Time) tipping bucket rain gauge network was reviewed and periodically downloaded. At 3.1 miles south of the Franklin Street sites, and 1.3 miles from the Hill Street location, the Electric Avenue Pumping Plant (PP) Rain Gauge (No. 461), in the adjacent community of Venice Beach, is the closest and most representative ALERT gauge for this study. The collected rainfall intensity data were critically analyzed and became the preferred runoff flow data source, as discussed below in **Section 4.3, Results**.

4.2 Water Quality Monitoring

Sampling and analytical methods, whether by city staff or the city's certified lab, were consistent with the September 12, 2012 Monitoring Program (MP) and Quality Assurance Project Program (QAPP) Plans, which were approved by the Regional Board, except that water quality grab samples were collected from the street gutter flow line, as opposed to the planned influent manhole. Based on the best professional judgment of the project consultant, the southwesterly draining gutter flow line, adjacent to and just upstream of the catch basin, provided the most representative storm runoff sample, while also being safer for field personnel and avoiding the risk of knocking the very sensitive flow sensors out of alignment or focus. After passage through the catch basin connector pipe screen (CPS) influent and bypass water quality are comparable, allowing runoff and pollutant load reduction calculation based on infiltration flow. The monitored water quality constituents of concern were derived from the Santa Monica Bay Restoration Plan (SMBRC, 2008) and included:

- Marine Indicator Bacteria (total coliform, fecal coliform, and enterococcus);
- Total Suspended Solids (TSS);
- Biological Oxygen Demand;
- Oil and Grease;
- Nutrients (total phosphorus and nitrate plus nitrite as nitrogen);
- Total Metals (copper, cadmium, lead, silver, chromium, nickel, and zinc); and
- Polynuclear Aromatic Hydrocarbons (PAHs).

The monitoring program at the West Franklin Street site included the sampling of wet-weather flows, while the search for dry-weather flows to sample always started at this location, but consistently expanded to adjacent neighborhood areas. The analysis of this comprehensive suite of water quality parameters was continued for the entire 2013-2014 storm season. Further details of wet- and dry-weather monitoring are discussed in the following subsections.

[1] http://ladpw.org/wrd/precip/

4.2.1 Wet-Weather Water Quality Monitoring

The MP contemplated collecting two grab samples from each of two storm events per month, from October 2013 to April 2014, for a maximum of 28 samples from 14 storm events. Wet-weather sampling was anticipated based on National Weather Service storm forecast of greater than 0.1 inch and 50% probability within 72 hours of event start. A potential sampling event notification was emailed to the City Project Manager; sampling preparations (assembling safety and sampling gear, four sets of sample bottles, labels, and cooler preparations) made, and then field mobilization undertaken. The first water quality sample was collected as early in the storm event as practicable, in order to obtain a first flush sample. The second sample was collected after a variable duration depending on storm characteristics, traffic conditions, laboratory sample acceptance hours, and analytical holding times. In the field, mobile cellular devices, such as smart phones, were used to track Doppler radar, storm progress, intensity projections, traffic, and generally determine an optimal time at which to collect the second storm event sample. Adaptive management strategies were implemented in response to drought conditions, resulting in the successful targeting of smaller, lower probability, storm events. As proposed in the MP and QAPP, unused monthly storm sample fiscal resources, as a result of few storm events, were used instead for dry-weather water quality samples during the following month, supplementing the dry-weather data set.

4.2.2 Dry-Weather Water Quality Monitoring

As contemplated in the MP, at least one dry-weather water quality grab sample was collected each month from October 2013 through April 2014. However, unused monthly storm water quality sampling fiscal resources were used to supplement dry-weather water quality sampling in the following month. For dry-weather sampling events, the West Franklin Street site was checked first, then the East Franklin Street Site, and then the intersection of Nebraska Avenue and Stanford Street. If no dry-weather flows were observed at these locations, a standardized search pattern of adjacent residential areas to the north, and west was initiated. Assuming that dry-weather urban runoff flows were eventually observed and collected, the address was identified in the field log and representative site photographs taken.

While the MP and QAPP intended that dry-weather sampling be scheduled based on flow monitoring data, repetitive dry-weather patterns were not detected by the sensors. Instead dry weather sample were often collected when the sample team arrived on site in anticipation of a storm event. That way, if the storm failed to materialize, the trip would not be wasted and grant resources lost. In some cases, both dry- and wet-weather samples were collected during the same trip, affectively conserving project resources. Dry-weather sampling events were also deferred into as late in the month as possible, so that if the sample team mobilized for a failed storm, a dry-weather sample might be collected and the expense of the sampling trip might not squandered.

4.3 Results and Analyses

To calculate the pollutant load reduction achieved by the West Franklin Street infiltration BMP, flow volume data, derived from the LACDPW Electric Avenue PP Rain Gauge No. 461 and the two (influent and bypass) Flo-Dar™ sensors, was multiplied by wet- or dry-weather water quality sampling results, in a load calculation. Wet- and dry-weather sampling results were analyzed to estimate seasonal and annual loadings for each constituent. The following subsections summarize these data findings.

4.3.1 Precipitation and Flow Sensor Data

Rainfall for the 2013-2014 storm season was far below average and only a few significant wet-weather events occurred. During the monitoring period, the Flo-Dar™ sensors encountered unexpected difficulties in quantifying flow through the influent and bypass lines where the sensors were located. Among the challenges, since the sensors only took measurements at 15 minute increments to conserve battery life,

they appeared to miss peak flows within the very small catchment. This might have been expected since the expected time of concentration would be less than 5 minutes, which is far less than the frequency of flow measurement. In at least one case when peak flows were detected, the sensor apparently measured the velocity of spraying droplets, resulting in flow rates estimates that were beyond the actual capacity of the conveyance. As a result of these difficulties, the rain gauge and sensor data were consolidated to compile a best estimate of runoff flow volumes into the West Franklin Street infiltration BMP, as will be further outlined in the following subsections.

4.3.1.1 Rain Gauge No. 461 (Electric Avenue PP) Data

From October 1, 2013 to April 30, 2014, Rain Gauge No. 461 recorded thirteen precipitation events, six of which each produced less than 0.1 inch of rain. The majority of the season's rainfall occurred between February 26 and March 1, 2014, when 2.94 inches fell, accounting for over two thirds of the October 2013 to April 2014 storm season total of 4.34 inches. Rainfall intensity data can be combined with soil infiltration rates, catchment area, and C_D, using a CWE modified version of the LACDPW Time of Concentration (T_C) calculator[2] spreadsheet program to generate hydrographs and storm runoff flow volumes. The West Franklin Street site catchment area was determined to be 1.2 acres, based on aerial photography and field investigations, with an impervious proportion of 80%, which results in a C_D of 0.86. The January 2006 Los Angeles County Hydrology Manual identifies the site area as being in soil type 16, Yolo Loam (e.g. is slightly pervious, although infiltration rates are rainfall intensity related; assume that for intensity below 0.4"/hour, infiltration is about equal to infiltration on open soils), and provides applicable rainfall intensity based soil infiltration rates. The modified T_C Calculator estimated a total 2013-1-2014 storm runoff volume of 408,479 liters as shown in the second column from the right, at the bottom of **Table 1**. The associated storm hydrographs are presented in **Appendix D.**

4.3.1.2 Flo-Dar™ Sensor Data

Due to discrepancies in the Flo-Dar™ reported data, the Los Angele County ALERT rain gauge data was used to distinguish between periods of wet and dry weather flows measured by either sensor, with the former data summarized on **Table 1** and the latter on **Table 2**. As summarized in **Table 2**, during the period from October 2013 to January 2014, operation of the influent and by-pass sensors were impeded by discovered construction debris and infiltration system modifications, resulting in large reported flows during periods of apparently dry-weather. Data from this period was generally deemed unreliable and omitted. The sensor configuration should have resulted in wet-weather runoff flow volume estimates that were equal to, or higher, at the by-pass or lateral sensor, in comparison to the diversion or influent line. As shown in **Table 1**, this was not the case, suggesting that this data should be considered with caution considering the construction debris and infiltration system modifications.

As shown in the last row of the middle column of **Table 1**, the influent or diversion sensor measured 1,058,419 liters of storm runoff, or over two and a half times more runoff than was projected based on the previously characterized rain gauge data; which was likely an overestimate of actual runoff volumes. Over 90% of the total sensor wet-weather influent volume was associated with the February 28, 2014 event and the sensor estimated runoff volume would be comparable to a ten inch storm over a forty-eight hour period. Data from rain gauges surrounding the West Franklin Street site reported that storm event at less than two and a half inches, suggesting the sensor data for this event was spurious. Monthly influent, or diversion, sensor dry weather flow volumes are summarized in the middle column of **Table 2** and sum of dry weather flows for between January and April of 2014 was 1635 liters, resulting in an average monthly dry-weather flow estimate of 409 liters. This value was used to develop a typical yearly estimate of only 4,908 liters of dry-weather runoff, all of which was assumed to be diverted to infiltration.

[2] After April 8, 2014, LACDPW replaced the T_C Calculator with HydroCalc Version 0.2.0 Beta, a Visual Basic version of the prior Excel spreadsheet file: http://dpw.lacounty.gov/wrd/Publication/index.cfm

The volume estimates are based on actual rainfall-rain gauge data over the project area, using the rational method. The city does not feel a range of volumes per event is necessary. Rather, using the accepted Rational Method and actual rainfall data provided the results in **Table 1**. Due to the lack of storm events last year and problems with the flow sensor, the collected data is not representative of what might be expected during more normal winters. A range of volumes would not correct for this.

Table 1 Wet-Weather Events Rain Fall and Volume Summary								
Event Start	**Event End**	**Duration (hrs)**	**Sample Number(s)**	**Electric Ave. Rainfall (in)**	**(Influent) Diversion Volume (L)**	**(Bypass) Lateral Volume (L)**	**Rational Method Volume (L)**	**Assumed Influent Volume (L)**
10/9/13	10/9/13	6	None	0.07	21,043	2,934	6,357	4,450
11/20/13	11/21/13	16	20131121-SMW1	0.26	5,424	144	23,536	16,475
11/29/13	11/29/13	8	20131129 SMW1 20131129 SMW2	0.22	19,896	0	19,915	13,941
12/7/13	12/7/13	6	20131207-SMW1 20131207-SMW2	0.2	2,953	170	18,132	12,692
12/19/13	12/19/13	5	20131219 SMW1	0.05	2,748	83	4,527	3,169
2/2/14	2/2/14	3	20140202-SMW1	0.05	852	0	4,527	3,169
2/6/14	2/6/14	15	20140206-SMW1 20140206-SMW2	0.24	2,729	0	21,759	15,231
2/26/14	2/27/14	24	20140226-SMW1 20140226-SMW2	0.8	29,080	155	73,039	51,128
2/27/14	3/1/14	48	20140228-SMW1 20140228-SMW2	2.14	970,977	1,173	207,223	145,056
3/25/14	3/26/14	8	None	0.02	64	0	1,809	1,267
3/31/14	4/1/14	7	20140401-SMW1 20140401-SMW2	0.02	908	0	1,809	1,267
4/1/14	4/2/14	10	None	0.25	1,745	0	24,037	16,826
4/25/14	4/25/14	4	None	0.02	0	0	1,809	1,267
			Total	4.34	1,058,419	4,659	408,479	285,938

Table 2 Summary of Dry Weather Flows Based on Sensor Data		
Month	**(Influent) Diversion Volume (L)**	**(Bypass) Lateral Volume (L)**
Oct-13	~~35208~~[1]	~~109996~~[1]
Nov-13	~~492~~[1]	~~6197~~[1]
Dec-13	~~2112~~[1]	~~1264~~[1]
Jan-14	216	~~584755~~[2]
Feb-14	1215	0
Mar-14	0	447
Apr-14	204	765
Mean	409	404

[1] Data omitted from calculated mean due to debris discovered in December 2013
[2] Data omitted from calculated mean due to measurement artifact occurring during CPS installation

As shown in the last row of the middle data column of **Table 1**, the bypass, or lateral, sensor, which was located immediately before the influent sensor, recorded a total volume of 4,659 liters during wet-weather events, which was about 1% of the rain gauge derived estimate and uncorrelated with data from the influent sensor. Dry-weather bypass sensor data is shown in the right most column of **Table 2**; however, as previously indicated, data collected prior to January 2014 was significantly impacted by construction debris and disturbance of the sensor alignment during installation of the connector pipe screen (CPS). As shown in the last row of this column, the average volume of dry-weather flow reported from January to April 2014 was 404 liters per month and is similar to the volume reported by the influent sensor. The bypass sensor results were not utilized due to generally inconsistent data.

Wet- and dry-weather runoff volume mass, or cumulative flow volume, curves for the influent or diversion sensor can be found in **Appendix C**; however, much of the data is suspect and of limited value. The bypass, or lateral, sensor mass curve was of such little value as to not be included.

4.3.1.3 Consolidation of Divergent Flow Data

For reasons identified in the prior subsection, the sensor derived runoff flow and volume estimates were suspect and compared poorly with rain gauge data converted utilizing the Rational Method, as summarized in **Table 1**. The West Franklin Street site tributary area characteristics typically result in a "flashy" runoff response and rapid flow rate changes, which contrasts poorly with the instantaneous sensor readings taken at fifteen minute intervals that would likely miss peak flows. Rainfall intensity variations, over the three mile distance between the rain gauge and project site, may have also contributed to observed differences, especially for smaller storm events.

To assess the discrepancy between the sensor and rain gauge flow estimation methods, and develop runoff volume estimates needed for the load reduction analysis, the sustained regional storm event of February 26, 2014, was selected as being relatively immune to variations observed with smaller events. For this specific event, the estimated runoff volume was assumed to represent an upper bracket on the true runoff volume, since it includes rain lost to evapotranspiration and initial extraction. The influent Flo-Dar™ sensor was then found to have measured approximately 40% of the runoff volume and was assumed to represent a lower bracket on the true volume of runoff received at the site catch basin and diverted to infiltration. An intermediate value of 70% of the rain gauge derived rational method runoff volume was then selected to represent the best professional estimate of the runoff volume delivered to the infiltration system for all storm events. **Figure 9** presents hydrographs for the February 26, 2014 storm event, comparing the rain gauge based Rational Method results, 70% of that value, and the Flo-Dar™ influent sensor. Hydrographs for the other wet-weather events, utilizing the 70% of rational method flow rates, are presented in **Appendix D.**

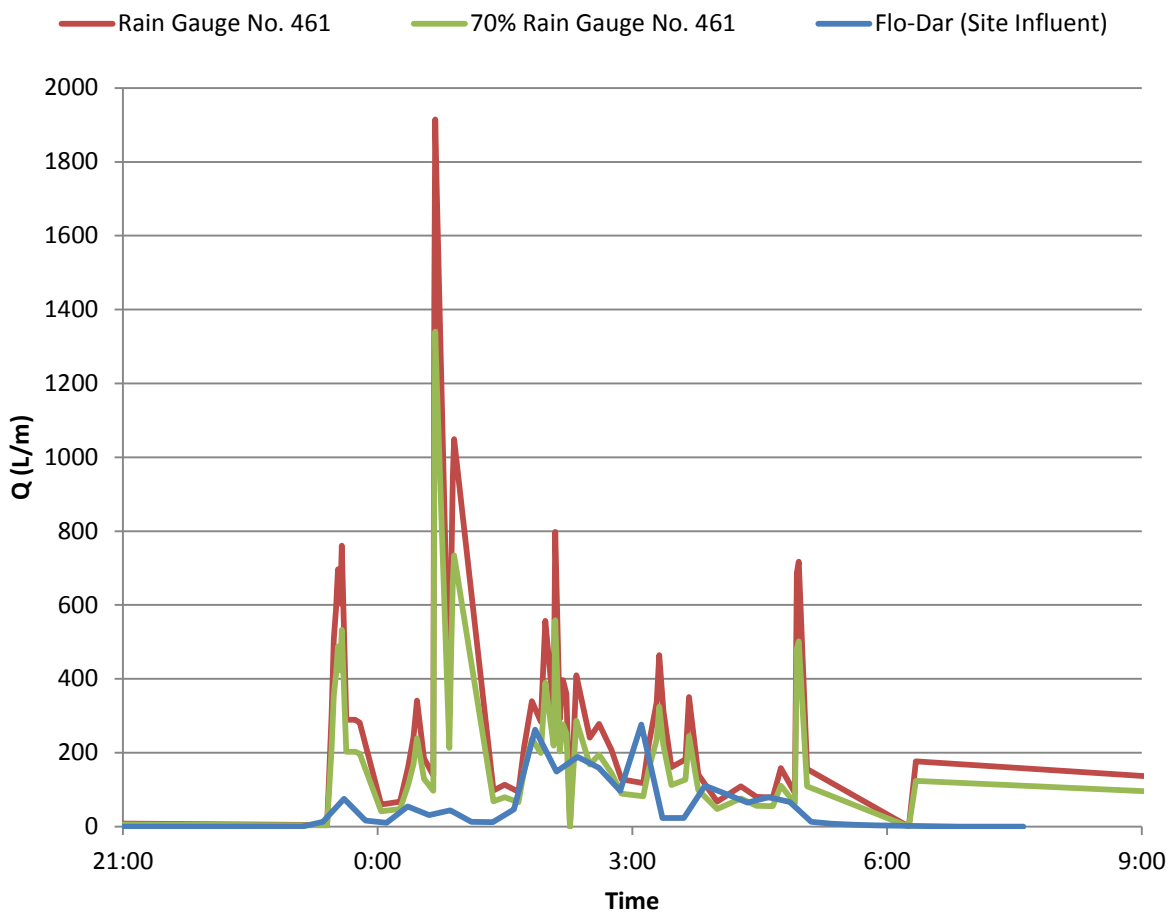


Figure 9. Hydrograph Comparison for Three methods using February 26th, 201 data.

Since no information was available to assess dynamic West Franklin Street site intra storm infiltration system percolation rates, assumption of a 70% infiltration value also implies that during the major storm event of February 28, 2014, when evapotranspiration and initial were small in comparison to total rainfall depth of about 2.14 inches, approximately 30% of Rational Method estimated runoff volume could not be diverted to the infiltration project and is assumed to have been bypassed down the lateral line and to the drainage system. This was the only event during the 2013-14 storm season that would have been expected to produce runoff in excess of the systems retention and infiltration capacity. As indicated in the lower right cell of **Table 1**, this suggests that during the 2013-2014 storm season, an estimated 286,000 liters of runoff were directed to the infiltration system. Furthermore, multiplying this value by the ratio of a typical 15 inch storm season, divided by the 4.34 inches observed during the study period, implies that during an average year a volume of approximately one million liters, along with the contaminants it contains, would be been diverted for infiltration by the West Franklin Street site, greatly reducing the runoff volume and pollutant load to the drainage system and Santa Monica Bay.

4.3.2 Wet-Weather Constituent Monitoring Results

As indicated in the fourth column of **Table 1**, fifteen water quality samples were collected for nine of the thirteen 2013-2014 storm season events. Both first flush, and mid event, grab samples were collected for six of the nine events, while only a first flush sample was collected for the remaining, small, storms.

In order to prepare the study wet-weather summary constituent concentration statistics on **Table 3**, laboratory results footnoted or qualified with a "J" flag, meaning that the observation was below the laboratory's reporting limit (RL) and above the method detection limit (MDL) and had to be estimated, were treated as unqualified reported values. As often implemented to reduce the impact of outlying low results, non-detected (ND) constituent data were treated as one half of the laboratory's detection limit (DL) for development of the summary statistics. The arithmetic mean was calculated for all constituents except bacteria, for which the geometric mean was determined. The upper and lower values represent 2.5 standard deviations above and below the mean respectively, and are 95th percentile confidence interval around the mean value. Although analyzed for, PAHs were not detected in any of the dry- or wet-weather samples collected during the study and are not presented in the summary tables or graphs. **Figures 10-12** summarize the means, 95% confidence intervals, and extreme concentrations observed during this study for various constituents and pollutants detected in wet-weather samples. For load quantification purposes, all rainfall events were included in the wet-weather analysis and assumed to have produced runoff. Laboratory water quality analytical results, MDLs, and RLs for each sample and analyte are identified in the laboratory reports summarized in **Table 3**.

Table 3 Basic Statistical Summary for Wet-Weather Monitoring Data

Analyte	Units	Minimum[1]	Lower[2]	Mean	Upper[2]	Maximum
General Constituents						
Total O & G	mg/L	0.85	0.85	2.0	3.4	7
TSS	mg/L	12	58	290	510	1,400
Total P, as P	mg/L	0.38	1.35	3.6	5.8	16
BOD	mg/L	5	31	92	150	360
Nitrate, as N	mg/L	0.03	1.08	2.0	2.9	5.1
Nitrite, as N	mg/L	0.009	0.05	0.15	0.26	0.73
Metals						
Cadmium	µg/L	0.05	0.23	0.419	0.59	1.1
Chromium	µg/L	1.4	4.4	7.8	11.2	20
Copper	µg/L	9.2	38	55	74	110
Lead	µg/L	0.6	5.3	11.5	18	35
Nickel	µg/L	2.7	10.3	17	24	40
Silver	µg/L	0.05	0.05	0.22	0.39	1.2
Zinc	µg/L	43	160	260	370	690
Bacteria						
Total Coliform	MPN/100ml	5,000	5,000	45,000	138,00	500,000
Fecal Coliform	MPN/100ml	50	50	10,500	41,000	170,000
Enterococcus	MPN/100ml	6	6	19,000	67,000	300,000

[1] The Lower value is always presented as greater than, or equal to, minimum observed value.
[2] The Upper and Lower values represent the 95th percentile confidence interval around the Mean value.

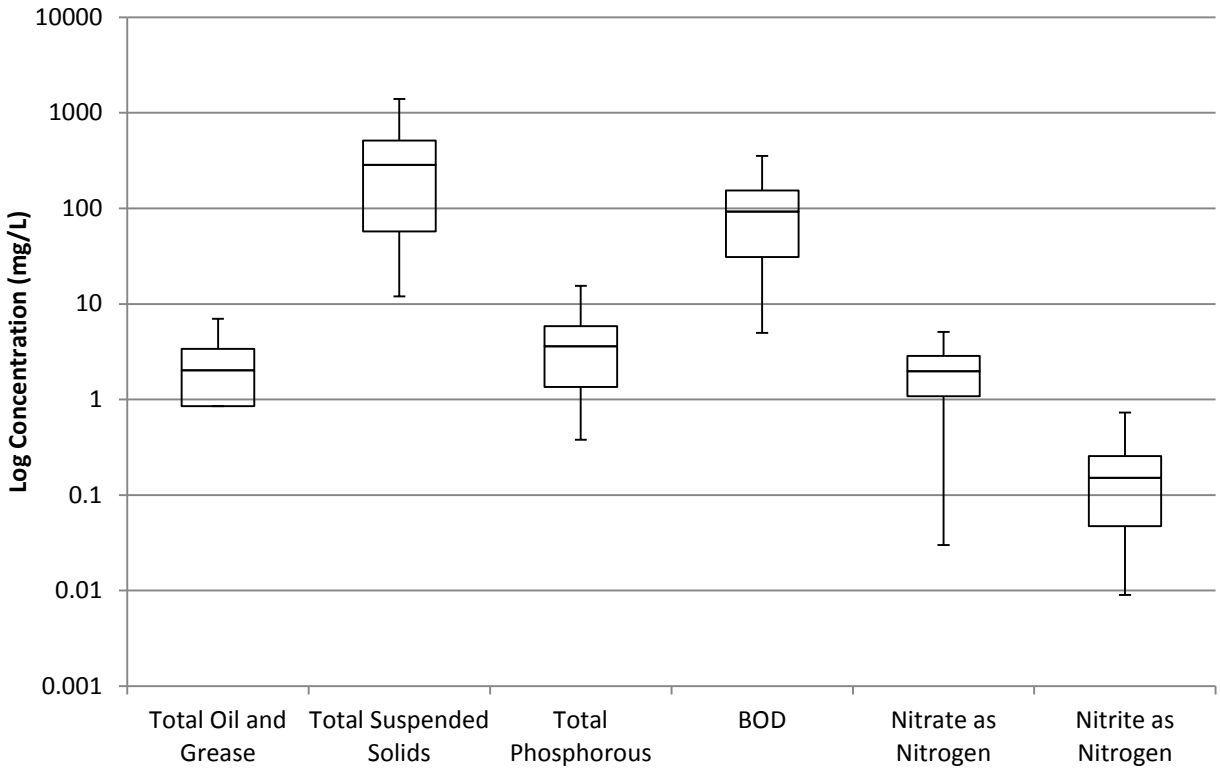


Figure 10. Wet-Weather Runoff Concentrations for General Constituents

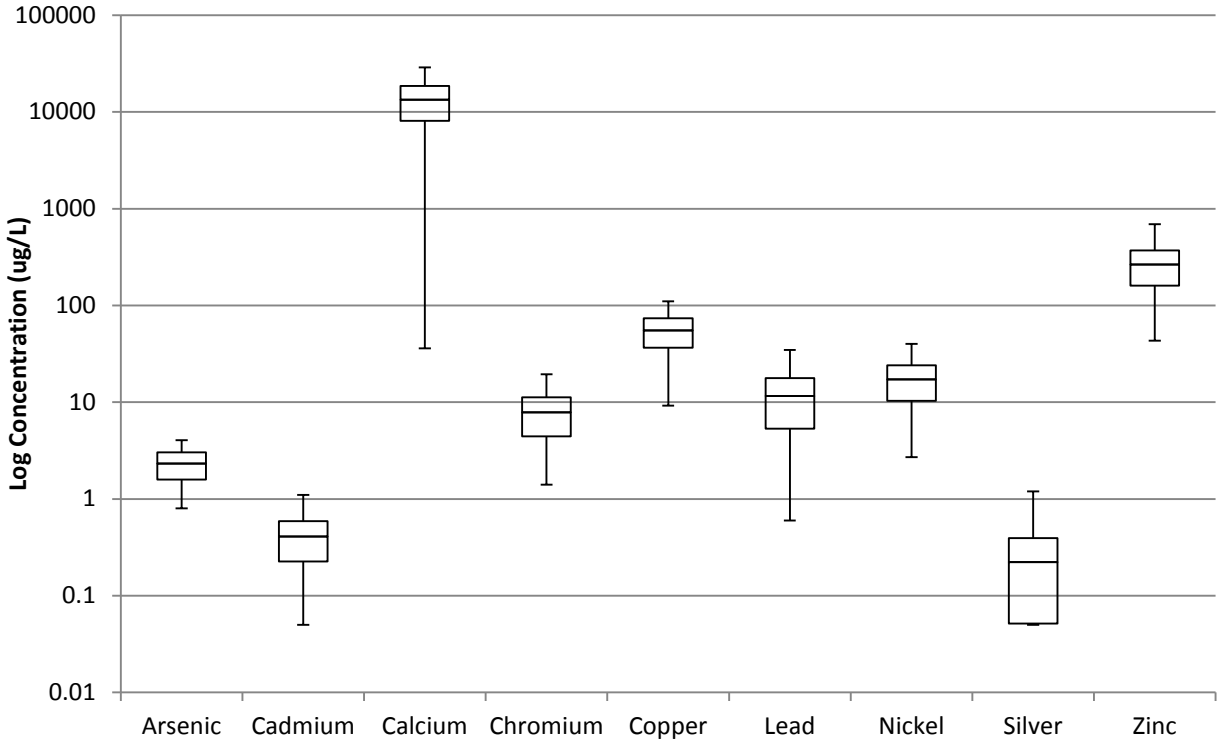


Figure 11. Wet-Weather Runoff Concentrations for Metals

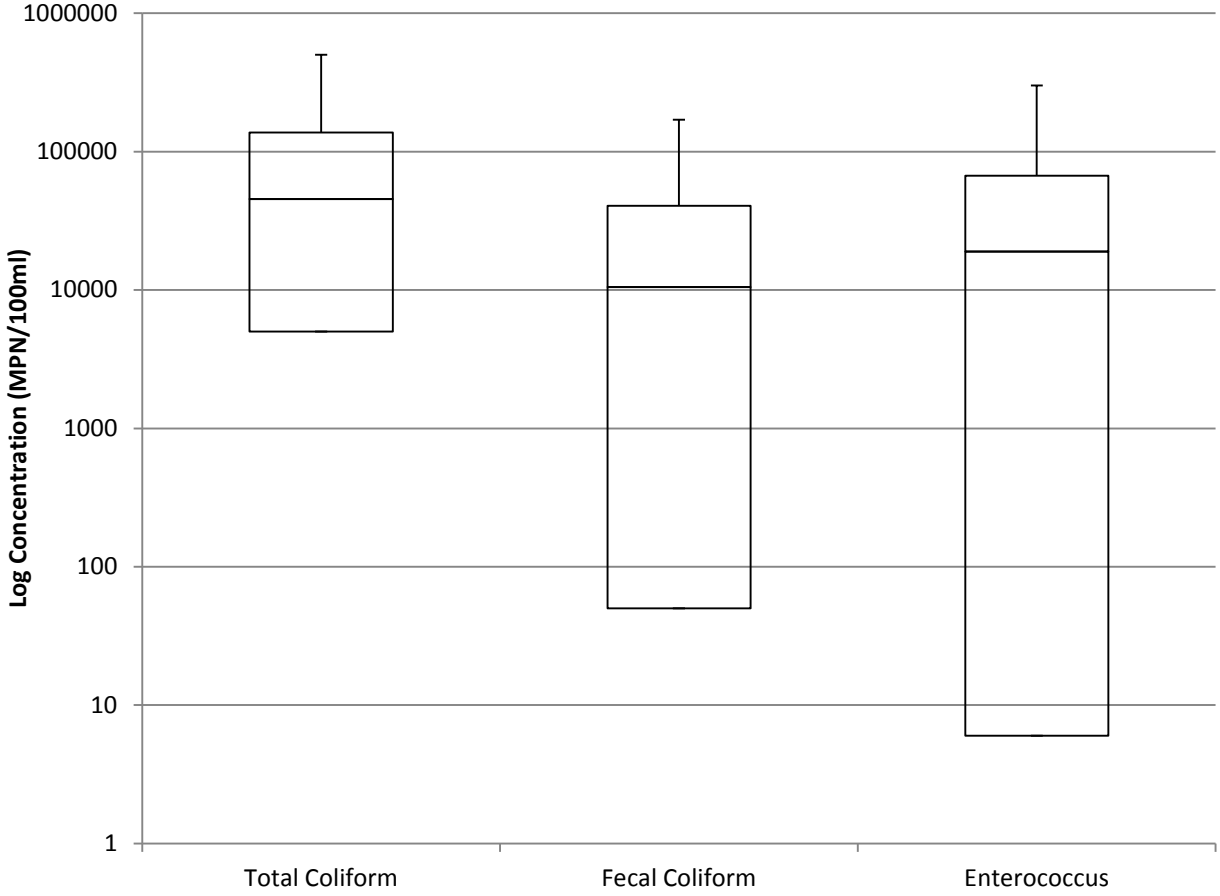


Figure 12. Wet-Weather Results for Bacteria

4.3.3 Dry-Weather Constituent Monitoring Results

A total of twelve dry-weather water quality samples were collected during the monitoring period. Throughout the entire monitoring period, dry-weather flow was not observed at either the West or East Franklin Street sites and the dry-weather samples were collected opportunistically at locations west to northwest of the monitoring site. Similar to the wet-weather analysis, basic summary statistics for the dry-weather samples was generated to evaluate the variability of the dry-weather data during the study period and are summarized on **Table 4**. **Figures 13-15** summarize the means, 95% confidence intervals, and extreme concentrations observed during this study for various constituents and pollutants detected in dry-weather samples. Laboratory water quality analytical results, MDLs, and RLs for each sample and analyte are identified in the laboratory reports summarized in **Appendix E**.

Table 4 Basic Statistical Summary for Dry-Weather Monitoring Data						
Analyte	**Unit**	**Minimum[1]**	**Lower[2]**	**Mean**	**Upper[2]**	**Maximum**
General Constituents						
Total O & G	mg/L	0.85	0.85	0.95	1.00	2.00
TSS	mg/L	22	22	350	550	1,460
Total P as P	mg/L	0.42	0.42	9.3	21	80
BOD	mg/L	6.0	6.0	230	390	1,070
Nitrate, as N	mg/L	0.03	0.03	1.39	1.8	3.5
Nitrite, as N	mg/L	0.09	0.09	0.26	0.42	1.33
Metals						
Cadmium	µg/L	0.05	0.05	0.37	0.52	1.4
Chromium	µg/L	0.81	0.81	6.4	9.3	24
Copper	µg/L	15	15	60	71	125
Lead	µg/L	1.29	1.29	9.7	14.0	33
Nickel	µg/L	1.5	1.5	17	26	63
Silver	µg/L	0.02	0.02	0.10	0.15	0.4
Zinc	µg/L	24	24	240	320	660
Bacteria						
Total Coliform	MPN/100ml	80,000	80,000	650,000	16,000,000	90,000,000
Fecal Coliform	MPN/100ml	700	700	25,000	119,000	500,000
Enterococcus	MPN/100ml	1,600	1,600	47,000	370,000	1,600,000

[1] The Lower value is always presented as greater than, or equal to, minimum observed value.
[2] The Upper and Lower values represent the 95th percentile confidence interval around the Mean value.

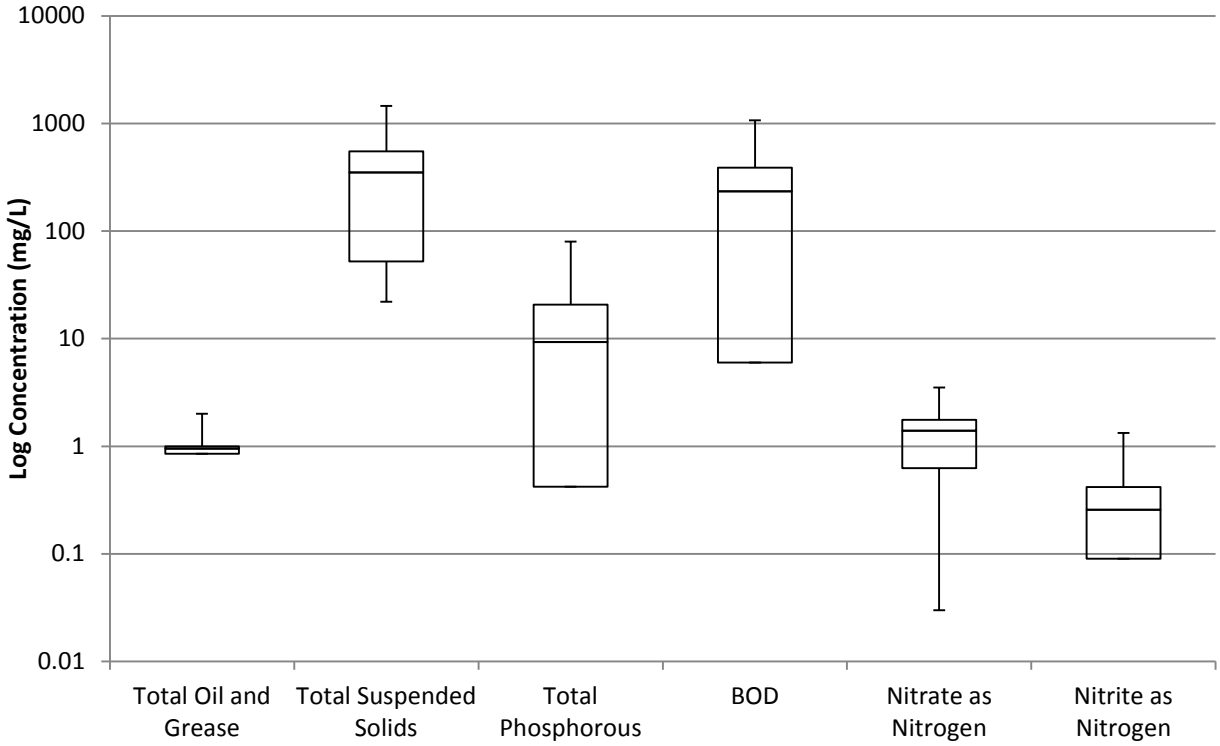


Figure 13. Dry-Weather Results for General Constituents

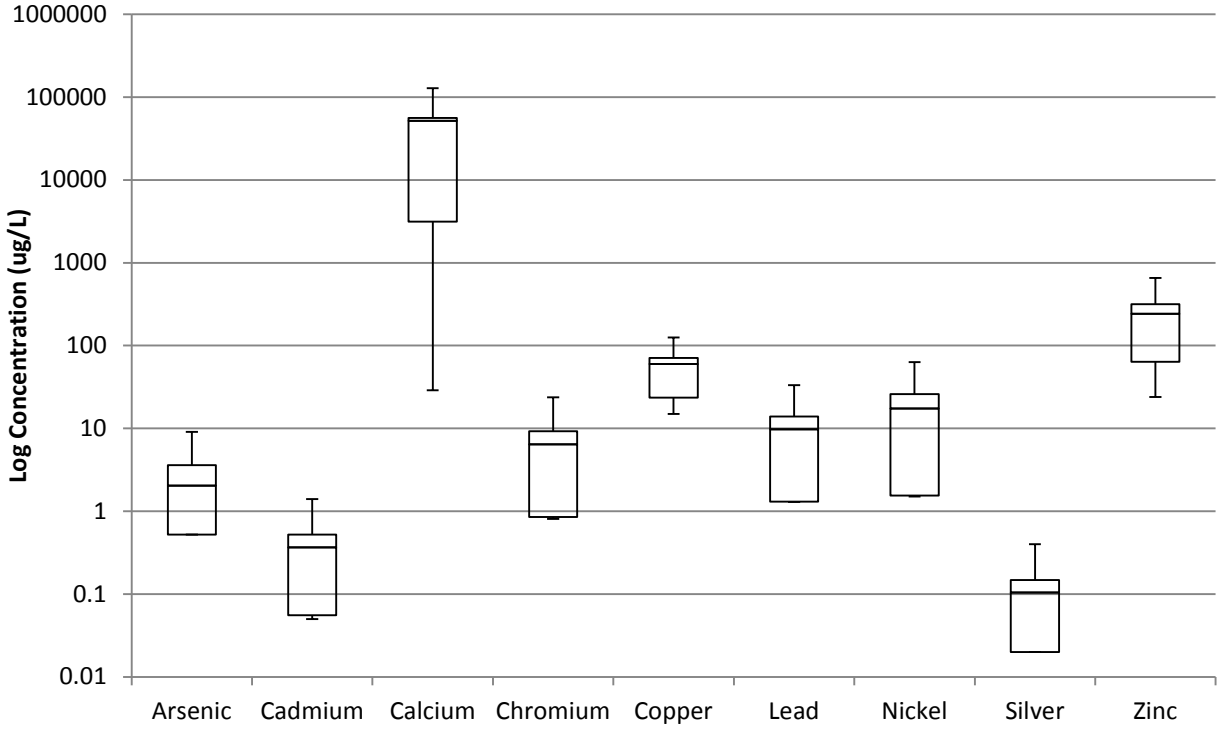


Figure 14. Dry-Weather Results for Metals

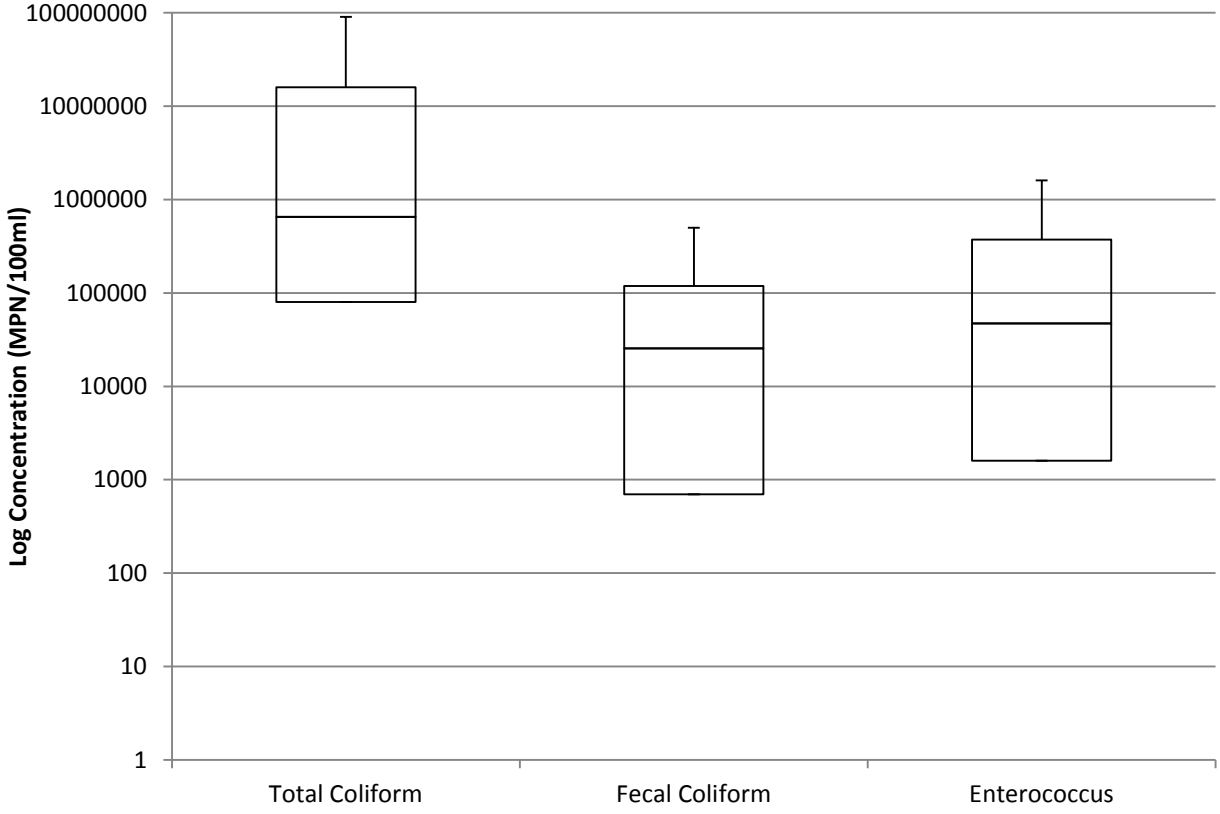


Figure 15. Dry-Weather Results for Bacteria

4.3.4 Load Reduction Accomplishments – Post-Installation

Pollutant loads diverted from the MS4 and Santa Monica Bay were calculated as the multiple of the laboratory determined analyte concentrations and flow volumes estimated to have entered the infiltration BMP. Several different scenarios for combining these data were observed during the study:

- For storm events where a water quality sample was not collected, the mean analyte concentrations from **Table 3,** the other storm water sample summary statistics, were used.
- For storm events where one water quality sample was collected, analyte concentrations from that sample were applied to the entire event runoff volume.
- For a storm event with two samples, the hydrograph was split based on the midpoint between sample collection times, and the sample results used to represent the respective parts.
- For dry-weather loads, the mean sample analyte concentration from **Table 4** was used.

4.3.4.1 Wet-Weather Load Reductions

Pollutant load reductions from the 1.2 acre West Franklin Street tributary area, over the unusually dry 2013-2014 storm season, were significant. The third column of **Table 5** summarizes the total wet-weather load reductions for the monitoring period. To estimate the load reduction during a more typical storm season, these values were multiplied by the ratio of 15 inches over the 4.34 inches observed during the 2013-2014 season, or approximately 3.5. The annual load reduction is almost entirely attributable to storm flows, rather than dry weather flows. **Table 6** summarizes the wet-weather load reductions for the entire 10.2 acre Santa Monica In-Line Storm Drain Runoff Infiltration Project area.

However, these results are based upon water sampling and monitoring during a rainy year that received below normal rainfall, 4" versus 15", resulting in limited data during an abnormal rainy season. Therefore, these estimates should be used with caution.

Table 5 West Franklin Street Site Wet-Weather Load Reduction Summary

Analyte	Units	2013-14 Storm Season	Average 15" Storm Season
General Constituents			
Total Oil and Grease	grams	1,180	4,100
Total Suspended Solids	grams	31,000	108,000
Total Phosphorous as P	grams	560	1,900
BOD	grams	11,100	39,000
Nitrate, as Nitrogen	grams	320	1,120
Nitrite, as Nitrogen	grams	29	101
Metals			
Cadmium	mg	51	180
Chromium	mg	1,430	5,000
Copper	mg	8,500	30,000
Lead	mg	1,500	5,200
Nickel	mg	2,400	8,400
Silver	mg	35	122
Zinc	mg	40,000	140,000
Bacteria			
Coliform, Total	MPN x 10^9	190	665

Table 5 West Franklin Street Site Wet-Weather Load Reduction Summary			
Analyte	**Units**	**2013-14 Storm Season**	**Average 15" Storm Season**
Coliform, Fecal	MPN x 10^9	115	400
Enterococcus	MPN x 10^9	90	310

Table 6 Santa Monica Infiltration Project Wet-Weather Load Reduction Summary			
Analyte	**Units**	**2013-14 Storm Season**	**Typical 15" Storm Season**
General Constituents			
Total Oil and Grease	grams	10,000	35,000
Total Suspended Solids	grams	260,000	920,000
Total Phosphorous as P	grams	4,800	16,000
BOD	grams	94,000	33,000
Nitrate, as Nitrogen	grams	2,700	9,500
Nitrite, as Nitrogen	grams	250	860
Metals			
Cadmium	mg	430	1,530
Chromium	mg	12,200	42,000
Copper	mg	72,000	250,000
Lead	mg	12,800	44,000
Nickel	mg	20,000	71,000
Silver	mg	300	1,040
Zinc	mg	340,000	1,190,000
Bacteria			
Coliform, Total	MPN x 10^9	1,600	5,600
Coliform, Fecal	MPN x 10^9	980	3,400
Enterococcus	MPN x 10^9	760	2,600

4.3.4.2 Dry-Weather Load Reductions

Table 7 summarizes the estimated mean monthly and annual total dry-weather load reduction for the West Franklin Street site. **Table 8** extrapolates that data to apply to the entire 10.2 acre Santa Monica In-Line Storm Drain Runoff Infiltration Project area.

Table 7 West Franklin Street Site Dry-Weather Load Reduction Summary

Analyte	Units	Monthly Load Reduction	Annual Load Reduction
General Constituents			
Total Oil and Grease	grams	0.40	4.6
Total Suspended Solids	grams	140	1,700
Total Phosphorous as P	grams	3.8	46
BOD	grams	96	1,150
Nitrate, as Nitrogen	grams	0.60	6.8
Nitrite, as Nitrogen	grams	0.10	1.3
Metals			
Cadmium	mg	0.10	1.8
Chromium	mg	2.6	32
Copper	mg	25	290
Lead	mg	4.0	48
Nickel	mg	7.1	86
Silver	mg	0.04	0.50
Zinc	mg	99	1,180
Bacteria			
Total Coliform	MPN x 10^9	2.7	32
Fecal Coliform	MPN x 10^9	0.104	1.25
Enterococcus	MPN x 10^9	0.190	2.3

Table 8 Santa Monica Infiltration Project Dry-Weather Load Reduction Summary			
Analyte	**Units**	**Monthly Load Reduction**	**Annual Load Reduction**
General Constituents			
Total Oil and Grease	grams	3.4	39
Total Suspended Solids	grams	1,200	14,500
Total Phosphorous as P	grams	32	390
BOD	grams	820	9,800
Nitrate, as Nitrogen	grams	5	58
Nitrite, as Nitrogen	grams	1	11
Metals			
Cadmium	mg	1	15
Chromium	mg	22	270
Copper	mg	210	2,500
Lead	mg	34	410
Nickel	mg	60	730
Silver	mg	0	4
Zinc	mg	840	10,000
Bacteria			
Total Coliform	MPN x 10^9	23	270
Fecal Coliform	MPN x 10^9	1	11
Enterococcus	MPN x 10^9	2	20

Public Outreach

Prior to commencing work at all three locations, the contractor submitted to the City's Project Manager and Public Works Inspector for review and approval, a public notification letter to businesses and residents on the Contractor's letterhead. This letter indicated the scope of work, type of construction, location and limits of work, start date and duration of the construction, impact of the work, and contact person. The public notification letter to businesses and residents was distributed within 500 feet of the work, 72 hours prior to start of work per Santa Monica Municipal Section 7.06.340 (c) of the Right of Way Management Regulations.

The City did not hold any workshops with community members to describe the intent of the project. Normal routine for excavation projects is just to distribute leaflets within the 500 foot impact zone. No educational materials were distributed that explained the project goals.

Conclusions and Recommendations

Although the 2013-2014 storm season was relatively dry, the Santa Monica In-Line Storm Drain Runoff Infiltration Project greatly reduced the pollutant load from 10.2 acres within the City of Santa Monica

portion of the Pico-Kenter sub-watershed in the Santa Monica Bay Watershed. This was accomplished by diverting all dry- and most wet-weather runoff from catch basins and storm drains, into public roadway ROW, through three sub-surface parkway and street infiltration systems. For a typical year with around 15 inches of rainfall over the project area, we estimate that, as constructed, the Project would infiltrate approximately 7 acre-feet of runoff, resulting in the diversion of a 920,000 grams (1 ton) of solids, 35,000 grams (77 pounds) of oil and grease, 1,190,000 milligrams (42 ounces)of zinc, 250,000 milligrams (9 ounces)of copper, and 25 billion fecal bacteria, among other pollutants, from the Pico-Kenter MS4 and Santa Monica Bay receiving water.

While effective where electricity is readily available and flow rates higher and less variable, the flow monitoring sensor systems used in this study could likely have been eliminated or replaced with a less costly water level monitoring device in a modified tiered infiltration system. This system would have also provided useful data on infiltration or percolation rates within the installed devices.

PAHs were not detected in any samples and could be cost-effectively eliminated in future monitoring, or reduced to an early screening level effort.

While the original project intent was to install the infiltration systems at locations with larger tributary areas, the West Franklin Street monitoring site was used to take advantage of the observed high soil percolation rates. The location at Hill and 11th Streets also has good draining soils, and a secondary monitoring site could have been installed in retrospect. Ultimately, the East Franklin Street site has the largest tributary area and probably provides the most benefit based on construction costs.

The City is pleased with the results, and considers the demonstration project a success. Moving forward, the City hopes to undertake a second year of monitoring and, assuming a more typical storm season prevails, would intend to install more in-line infiltration systems where good locations, with large tributary areas, and high percolation rate soils can be identified, if adequate grant funds remain available.

It is further recommended that consideration be given to modifying the generic project design to include maintenance access at the infiltration system and level sensors within the infiltration systems.

1. Project Assessment & Evaluation Plan

1.1 Project Performance Measures Table – Pre-Construction

Project Goal	Desired Outcome	Output Indicator	Outcome Indicator	Measurement Tool & Method	Target
Educate the public about urban runoff pollution.	Increase the number of the public who know about this problem and solutions.	Number of the public contacted.	Percent increase in urban runoff knowledge.	Questionnaire	100% increase of those who have no knowledge of subject.
Comply with TMDLs for the Santa Monica Bay.	Reduce amounts and types of runoff pollutants reaching the Bay.	Number of BMPs installed at the project site.	Percent reduction of runoff to the Bay. Percent reduction in pollutants. (100% reduction as explained above, complete removal from storm drain system).	Estimate of runoff volume entering BMPs. Water quality analyses of pollutants.	Up to 80% reduction in runoff volume to the Bay from the project site. 100% reduction of pollutants found in runoff within the project treatment zone, such as trash, bacterial indicators, heavy metals, organic chemicals, and oil and grease.

1.2 Project Performance Measures Table - Results

Project Goal	Desired Outcome	Output Indicator	Outcome Indicator	Measurement Tool & Method	Target
Educate the public about urban runoff pollution. Goal partially met.	Increase the number of the public who know about this problem and solutions.	Public notification letter was distributed to businesses and residents within 500 feet of the work areas.	100% of community in the construction area informed about the project goals.	Questionnaire – not done. Community meetings and construction notices distributed in the construction site areas.	100% increase of those who have no knowledge of subject.
Comply with TMDLs for the Santa Monica Bay. Goal met.	Reduce volumes and types of runoff pollutants reaching the Bay.	One BMP system installed at each of the project sites. Three total systems.	Up to 80% percent reduction of wet weather runoff to the Bay. 100% all dry weather runoff eliminated from Bay. Percent reduction in pollutants. (100% reduction as explained above, complete removal from storm drain system).	Estimate of runoff volume entering BMPs. Water quality analyses of pollutants.	Up to 80% wet weather, 100% dry weather reduction in runoff volume to the Bay from the project sites. 100% reduction of pollutants found in runoff within the project treatment zone, such as trash, bacterial indicators, heavy metals, organic chemicals, and oil and grease.

The project goals were met, educating the local community of the project sites about the project and its goal of keeping urban runoff pollution out of the Bay. And the BMP systems retain 100% of dry weather and up to 80% of all stormwater, including all pollutants, thereby keeping water pollution out of the Bay.

2. Next Steps

2.1 Lessons Learned

- Evaporation Loss – Regarding dry weather flow, there was very little directly from the project drainage area. To sample some, adjacent streets were sampled, and volumes and pollutants quantified. It was assumed that all runoff would enter a storm drain. However, some evaporative loss would occur as the runoff flowed across a heated gutter toward a storm drain, or if the runoff volume was minimal such that it would not flow to a storm drain but remain in the gutter. No evaporative loss was included in the results. In a future estimation, such loss should be included, though it may be a small percent of the total, and not be significant. Moreover, such volume loss does not reduce the amounts of pollutants; pollutant quantities would remain in the remaining runoff.
- Utilities – Finding an appropriate project location depends directly on if utilities are present, either overhead or underground. The city encountered utilities in the parkway. One has to be careful in finding a location free from these utilities.
- Soils – Where infiltration is the many beneficial use of harvested stormwater, soils with high infiltration rates are required. The city had great difficulty finding locations with good percolating rates.
- Upstream Drainage – A successful project should have a large enough drainage area to collect enough runoff to make the data and results statistically relevant and significant. To draw appropriate conclusions on the success of a project, higher volumes of runoff are desirable.
- Total Volume Harvested – The estimated stormwater volume harvested for infiltration is impressive for a small, pilot project. The city did not feel estimating the percent of runoff harvested by this project versus the city's total runoff to the Bay would add any valuable information, nor estimating the fraction of total stormwater runoff entering the Bay from the Bay watershed. For practical purposes, the percent is certainly less than one percent. The main purpose of the project was to demonstrate the feasibility of such a BMP to harvest stormwater flowing in the transportation infrastructure.
- The City needs to do a more effective educational outreach effort for projects that have environmentally beneficial impacts, e.g. reducing runoff and pollution. In the future, for such projects, the City will include a more effective effort to connect the physical project activity, e.g. digging a hole, to the real message, e.g. harvesting runoff to improve water quality and restore local water supply.

2.2 Additional Monitoring

If additional construction funds are available, the City intends to do a second year of monitoring in the hopes of nature cooperating with a more "normal" wet season.

2.3 Signage

Project signage has to be installed at the three sites to explain to the community what water quality improvement systems are under the street, and how they function to improve Bay water quality and protect human and non-human life.

2.4 Future In-Line Projects

The City's Watershed Engineer and the Clean Beaches internal staff committee will continue to investigate possible locations for additional In-Line storm drain and catch basin installations during annual planning and CIP reviews. For new projects to occur, the onsite conditions need to be conducive for this type of infiltration project, e.g. reasonably infiltrating soils, adequate urban runoff flow in the storm drain

system, operational space for new permanent infrastructure and annual maintenance, space for construction, and minimal to no competing utilities.

Appendices

Appendix A

List of Deliverables

- **Project Assessment & Evaluation Plan**
- **Monitoring Plan**
- **Quality Assurance Project Plan**
- **Final CEQA / NEPA Documentation**
- **Final Project Design**
- **Notice to Proceed**
- **As-Builts**
- **Annual Progress Report**
- **Final Project Report**
- **Final Project Summary**

Appendix B

List of Contractor and Sub-contractors

General Contractor

Blois Construction, Inc.
3201 Sturgis Road
Oxnard, CA 93030
Contact: James Blois, President
Abel Rosas, Project Manager
Phone: 805-656-1432

Sub - Contractors

Surveyor

Peak Survey, Inc.
2488 Townsgate Rd. Suite D
Westlake Village, CA 91361
Contact: Eric Widmer, President
Phone: 805-497-0102

Drainage

Torrent Resources, Inc.
3200 E. Guasti Rd. Ste 100
Ontario, California 91761
Contact: Philip R. LeBlanc, President
Phone: 661-947-9836

BioClean Environmental Services, Inc.
P.O. Box 869
Oceanside, California 91761
Contact: info@biocleanenvironmental.net
Phone: 760-433-7640

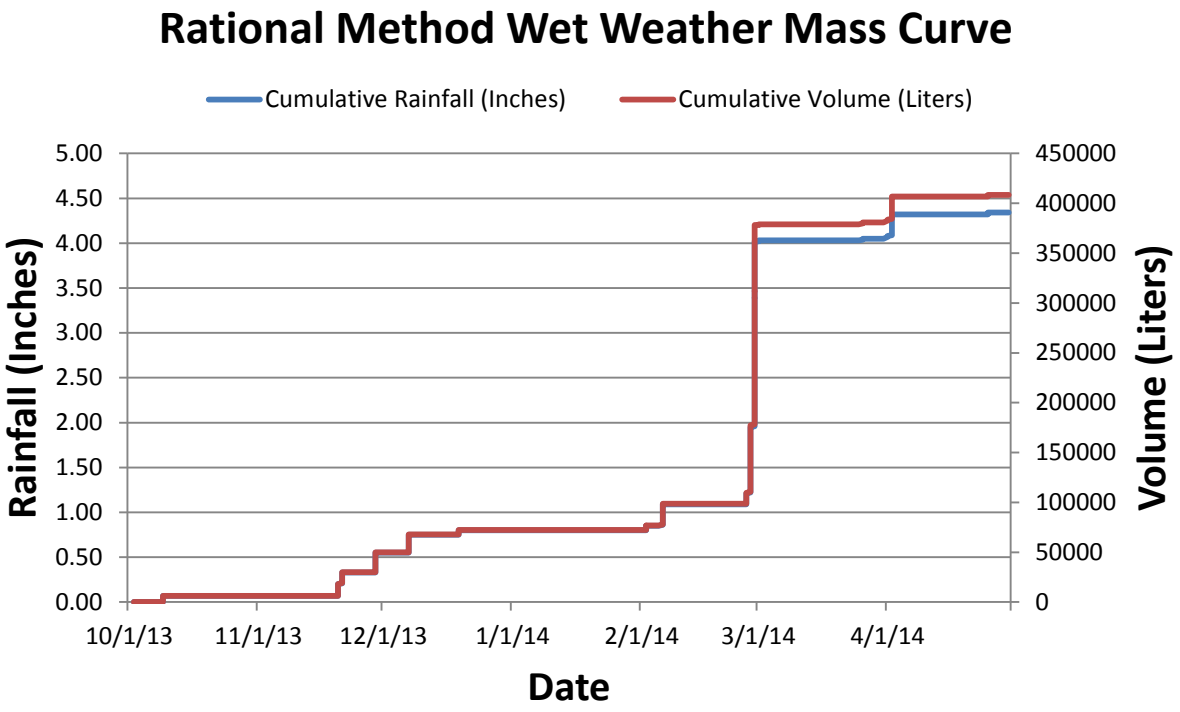
Paul's Welding
Contact: Paul Padilla
Phone: 310-396-4406

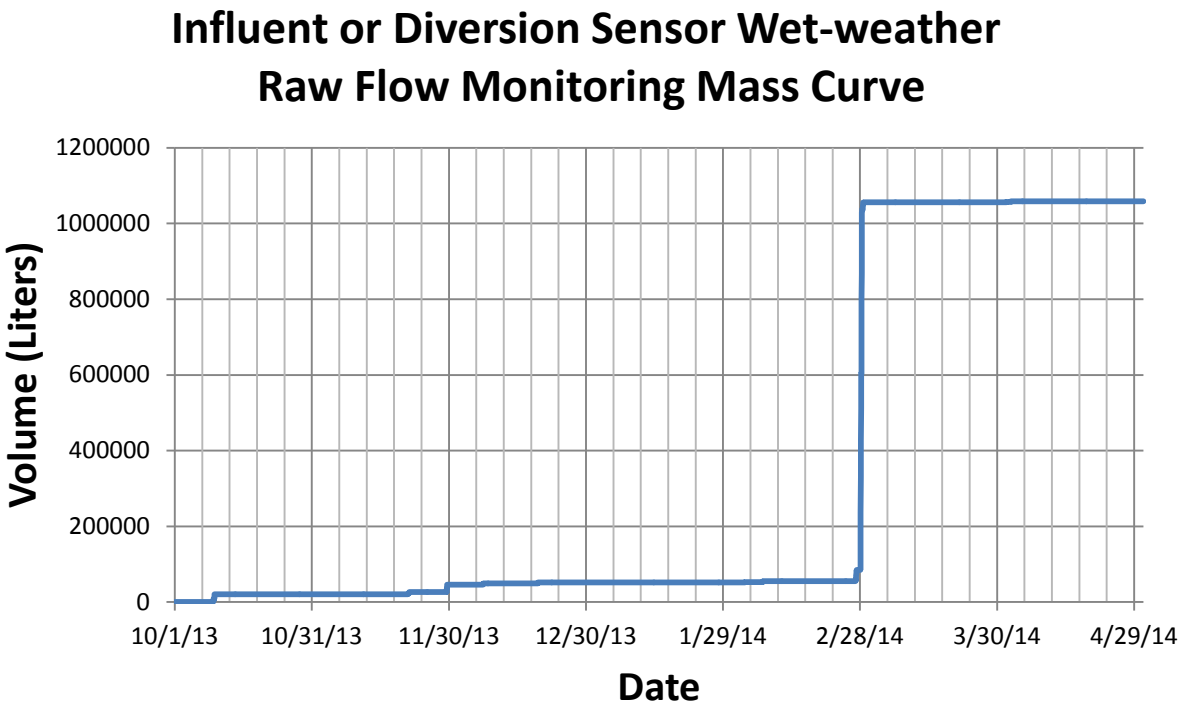
Monitoring Equipment

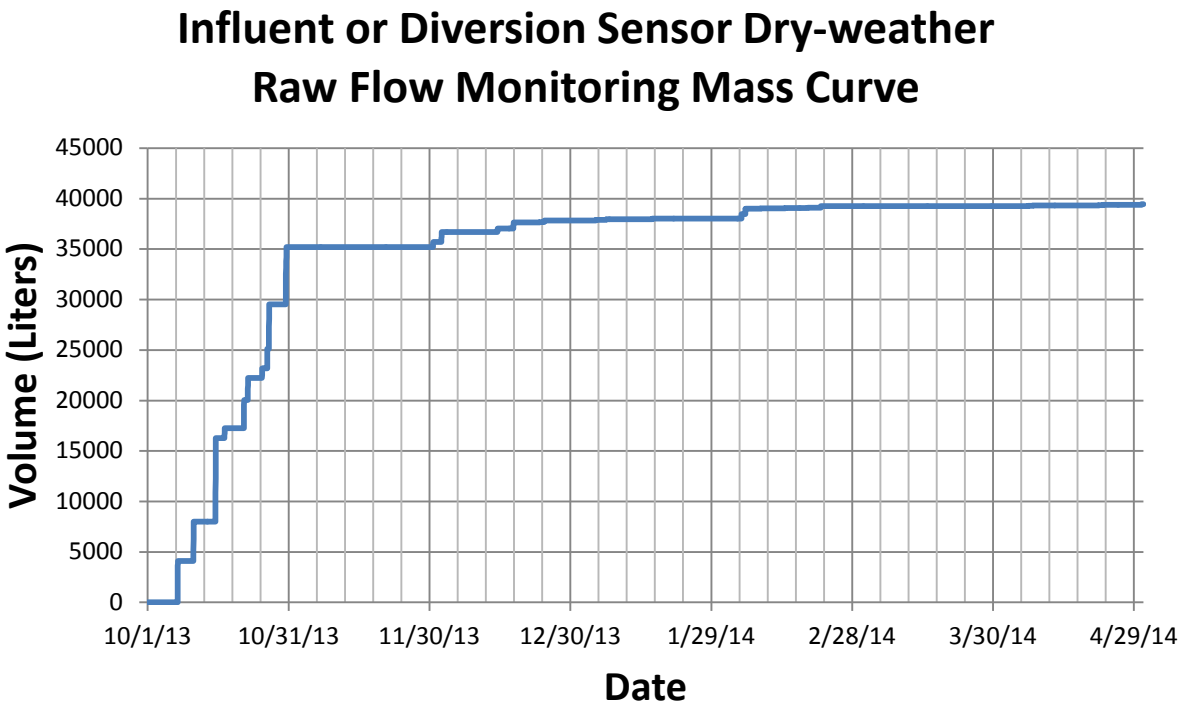
Utility Systems Science and Software (US3)
6190 Fairmount Avenue, Suite E
San Diego, California 92120
Contact: Bret Houston, Senior Software Developer
Phone: 619-546-4281

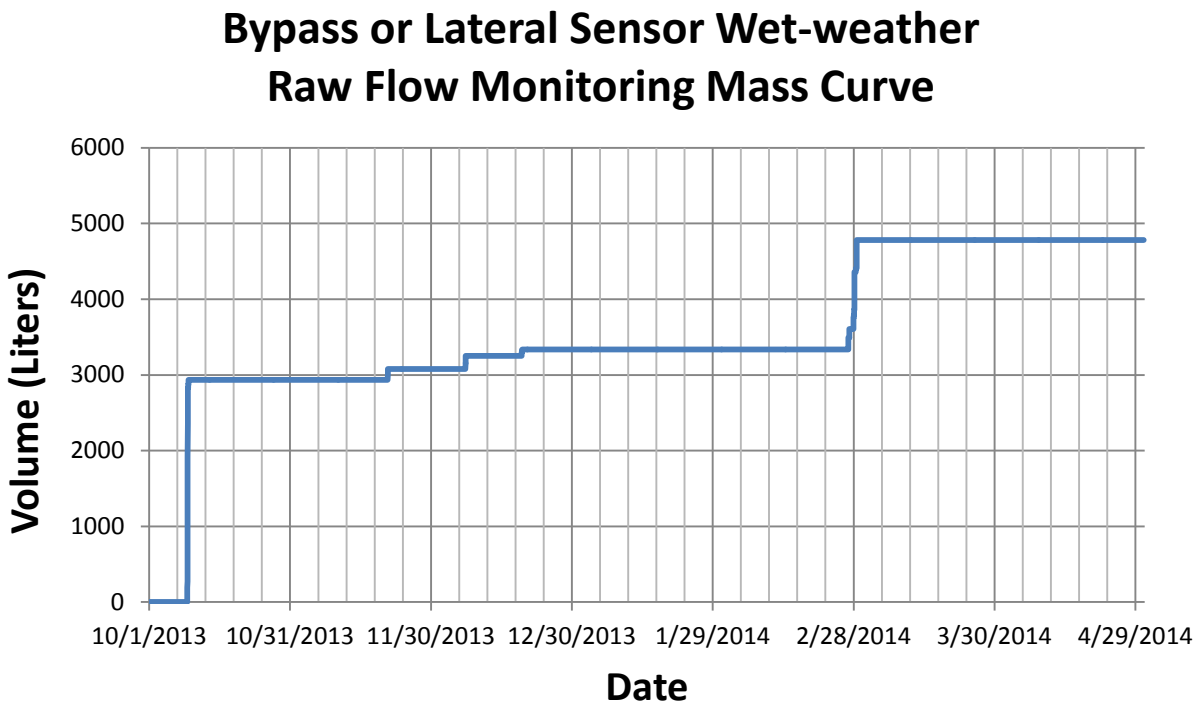
Appendix C

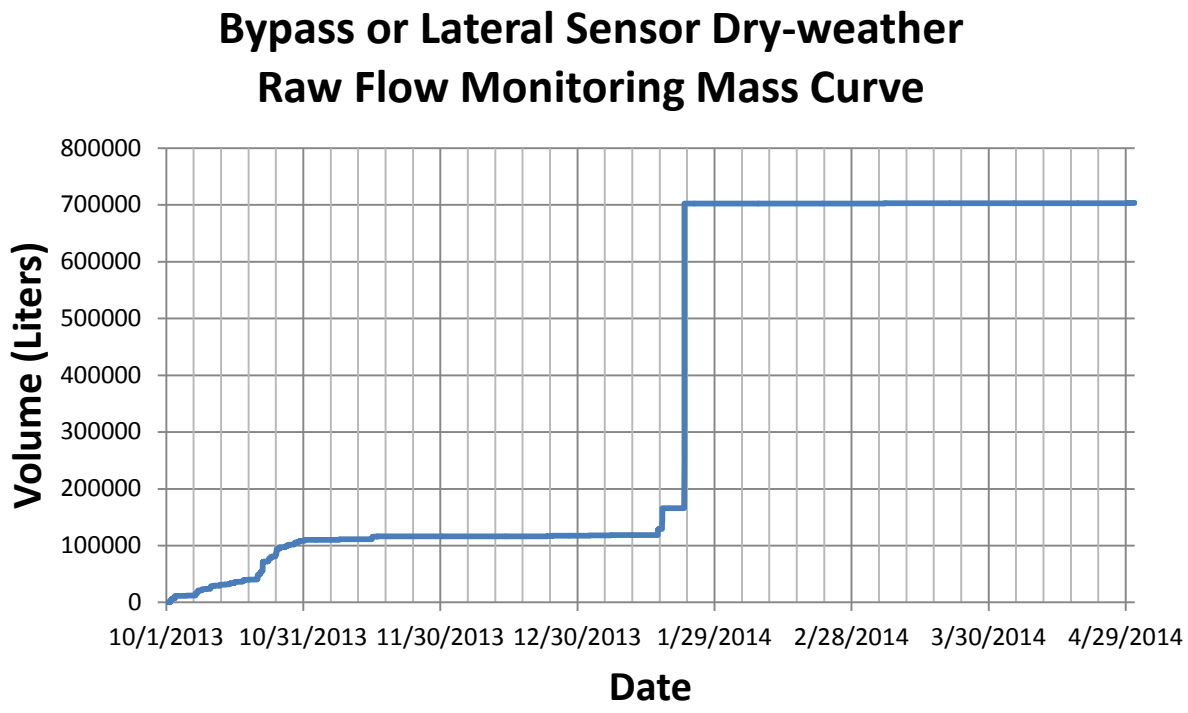
Study Duration Flow Monitoring Mass Curves


Rational Method Wet Weather Mass Curve
Cumulative Rainfall (Inches)
Cumulative Volume (Liters)
Rainfall (Inches)
Volume (Liters)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
10/1/13
11/1/13
12/1/13
1/1/14
2/1/14
3/1/14
4/1/14
Date


Influent or Diversion Sensor Wet-weather
Raw Flow Monitoring Mass Curve
Volume (Liters)
1200000
1000000
800000
600000
400000
200000
0
10/1/13
10/31/13
11/30/13
12/30/13
1/29/14
2/28/14
3/30/14
4/29/14
Date

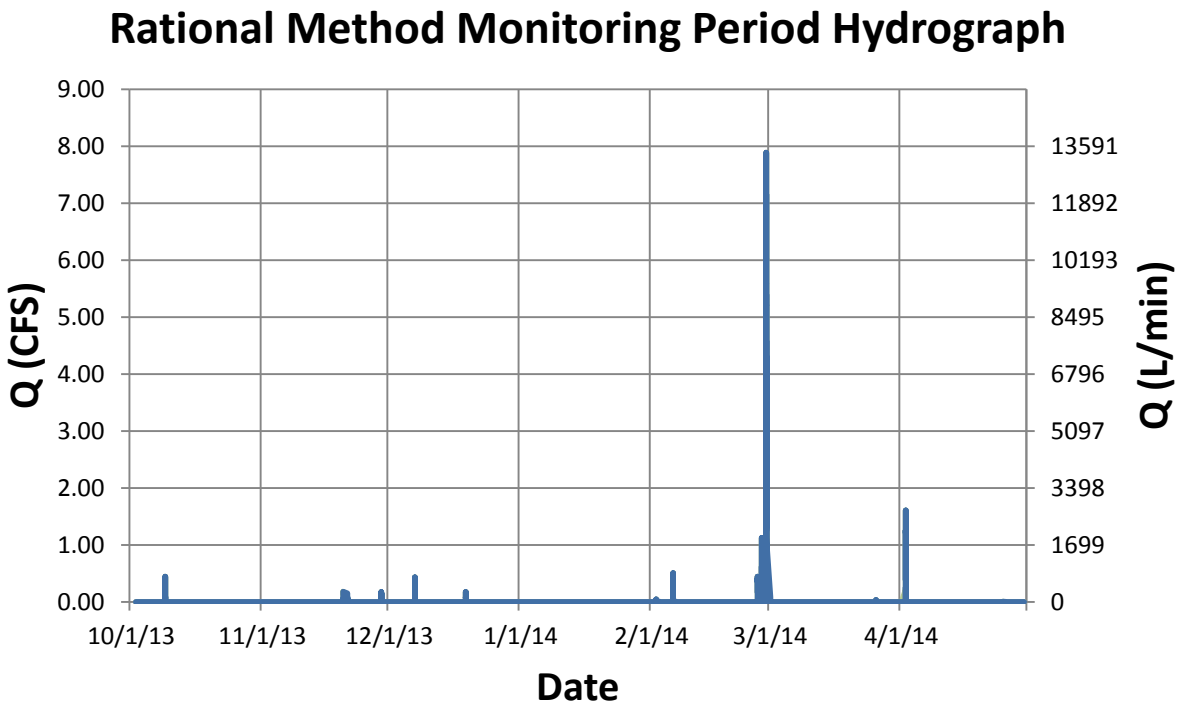

Influent or Diversion Sensor Dry-weather
Raw Flow Monitoring Mass Curve
Volume (Liters)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
10/1/13
10/31/13
11/30/13
12/30/13
1/29/14
2/28/14
3/30/14
4/29/14
Date

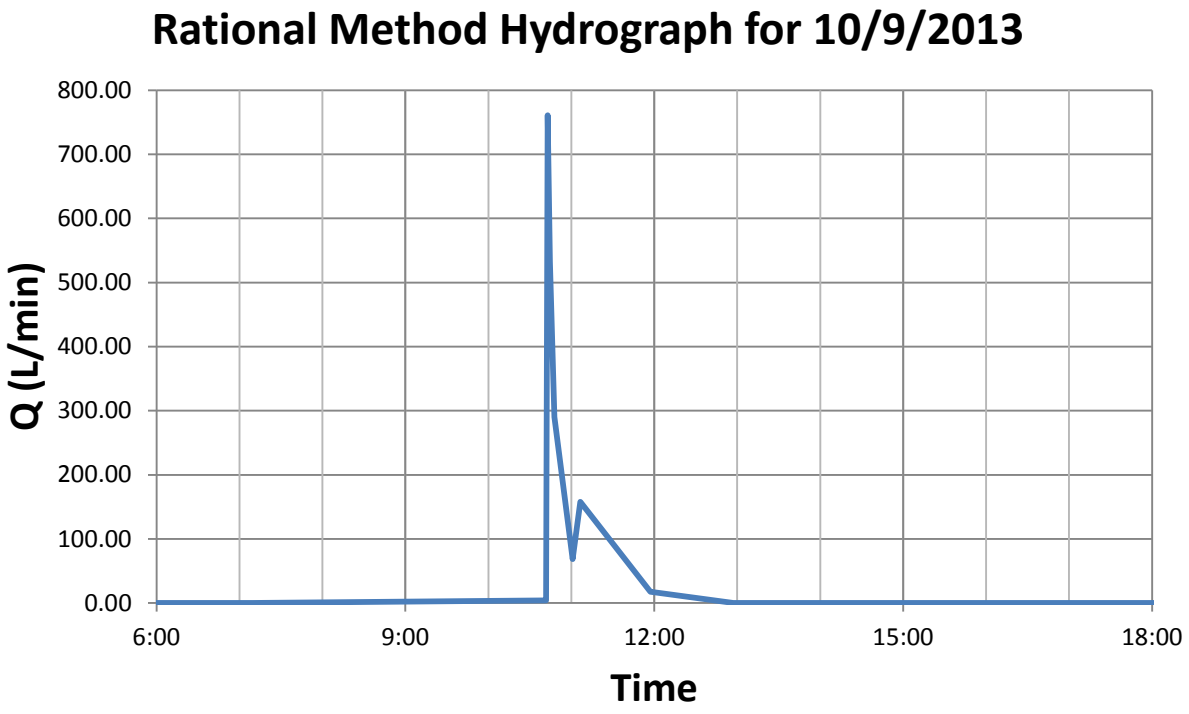

Bypass or Lateral Sensor Wet-weather
Raw Flow Monitoring Mass Curve
Volume (Liters)
6000
5000
4000
3000
2000
1000
0
10/1/2013
10/31/2013
11/30/2013
12/30/2013
1/29/2014
2/28/2014
3/30/2014
4/29/2014
Date

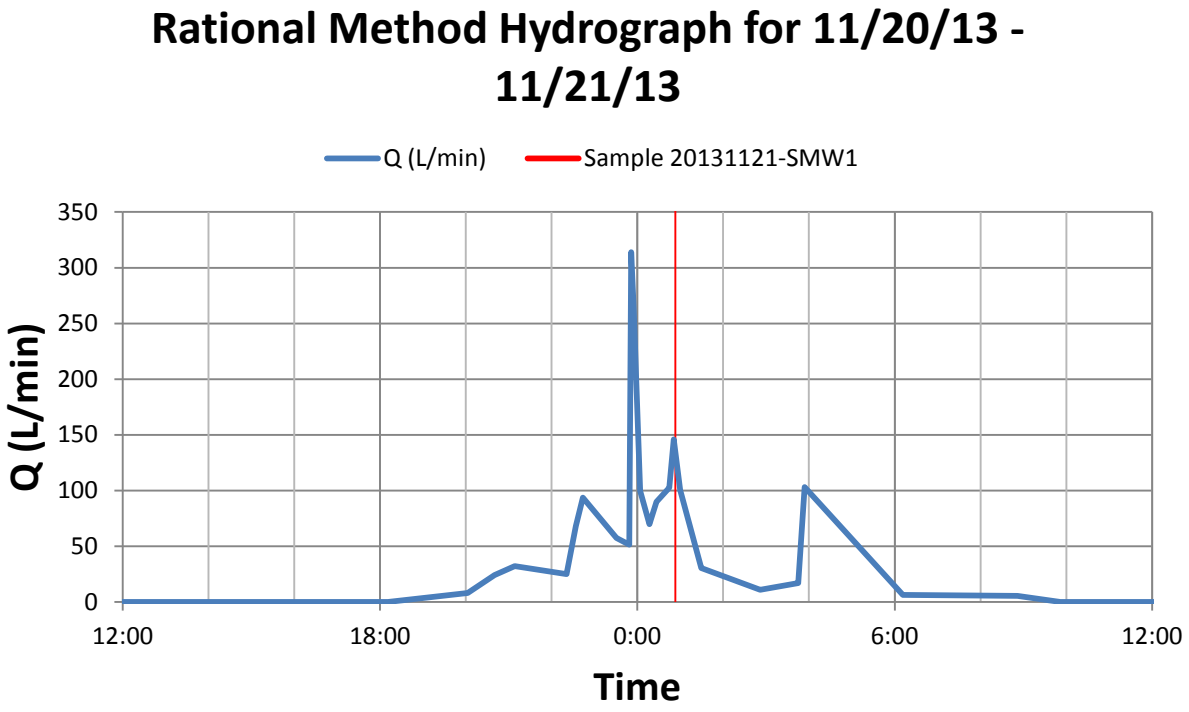

Bypass or Lateral Sensor Dry-weather
Raw Flow Monitoring Mass Curve
Volume (Liters)
800000
700000
600000
500000
400000
300000
200000
100000
0
10/1/2013
10/31/2013
11/30/2013
12/30/2013
1/29/2014
2/28/2014
3/30/2014
4/29/2014
Date

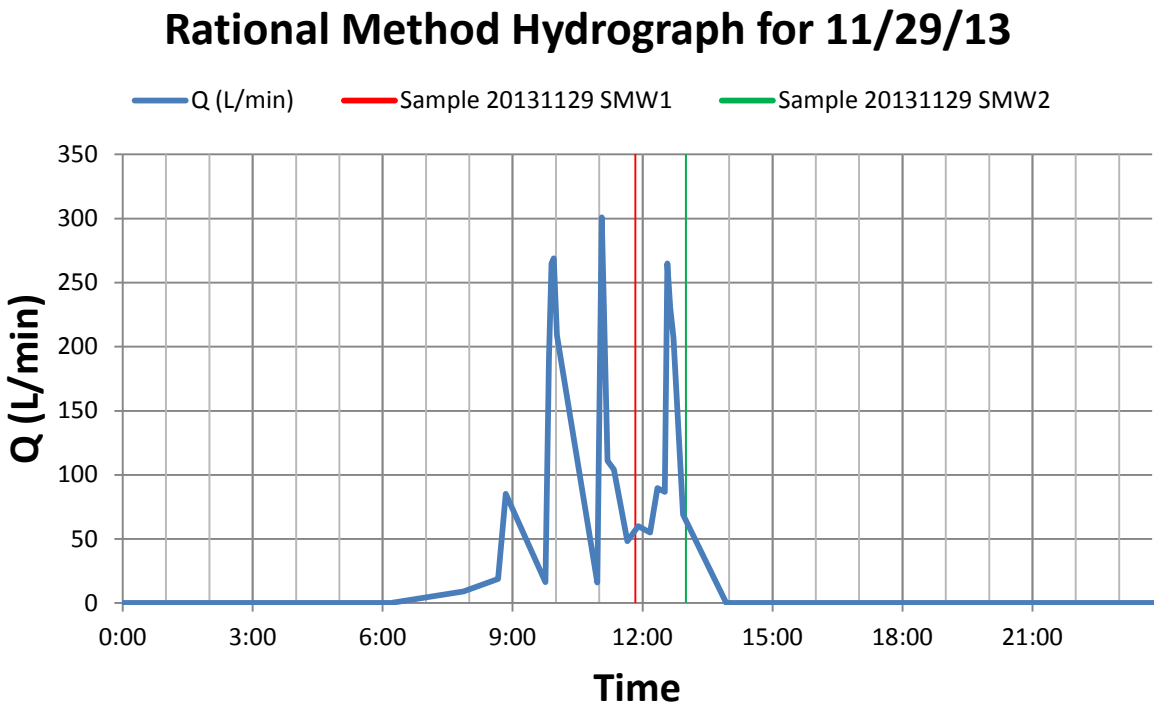
Appendix D

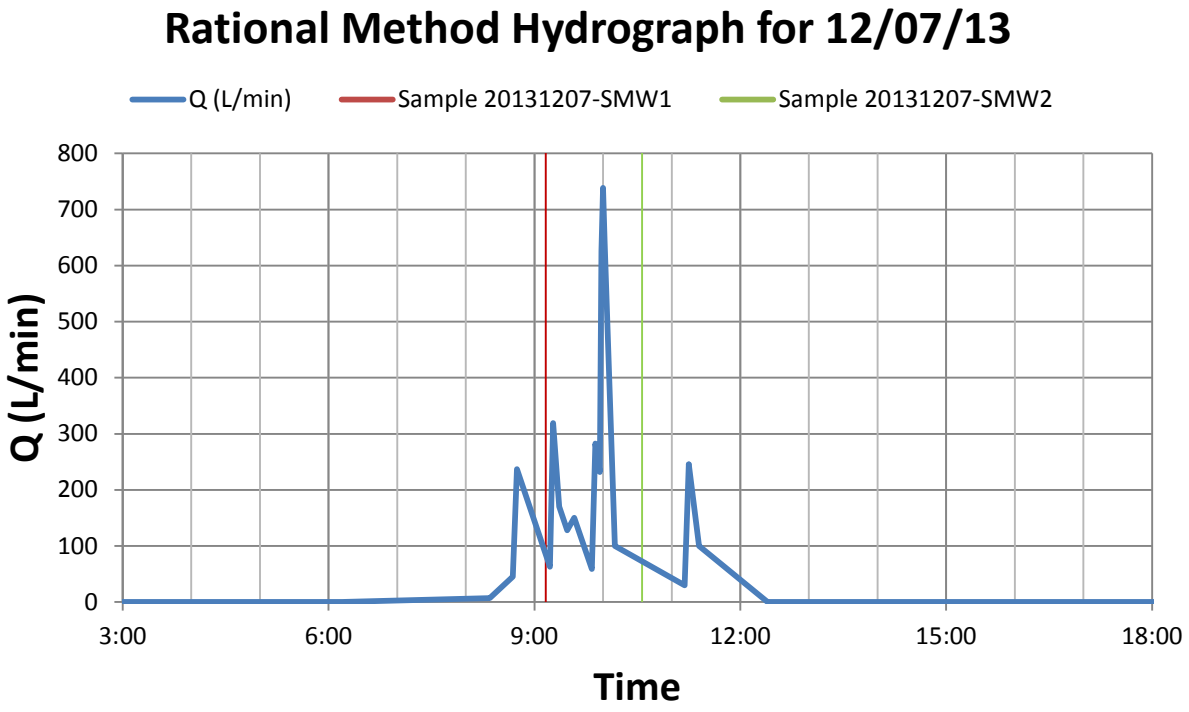
Study Duration and Storm Event Hydrographs

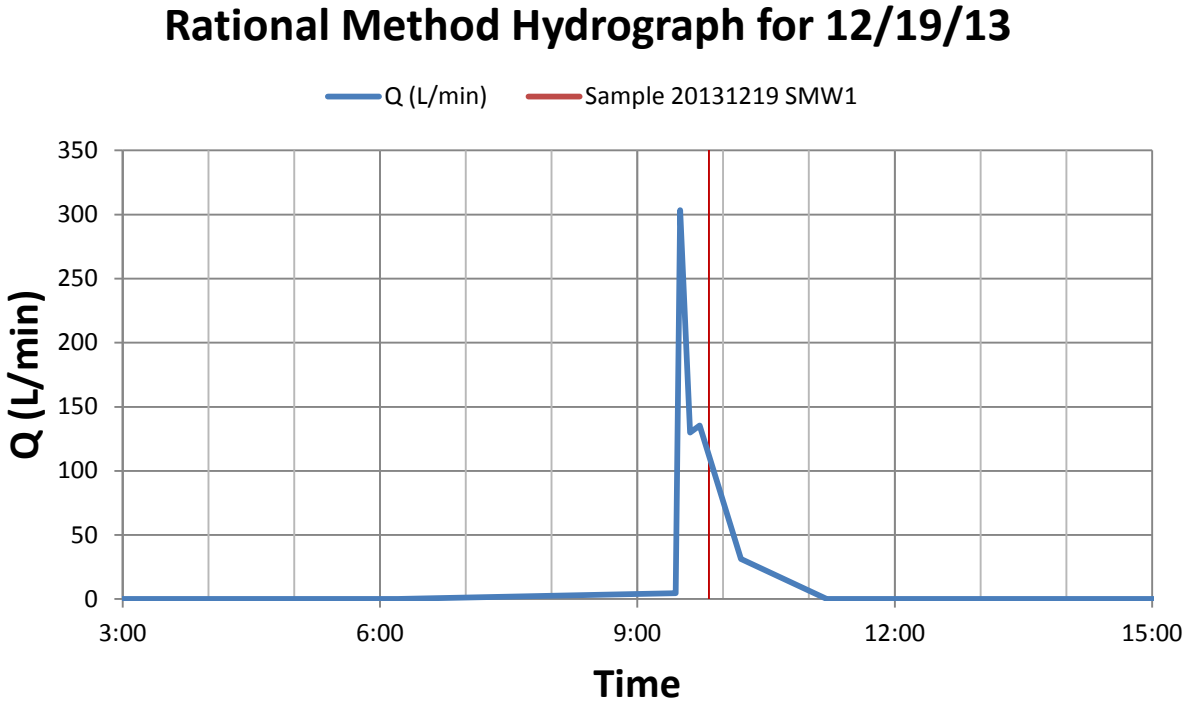

Rational Method Monitoring Period Hydrograph
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Q (CFS)
13591
11892
10193
8495
6796
5097
3398
1699
0
Q (L/min)
10/1/13
11/1/13
12/1/13
1/1/14
2/1/14
3/1/14
4/1/14
Date

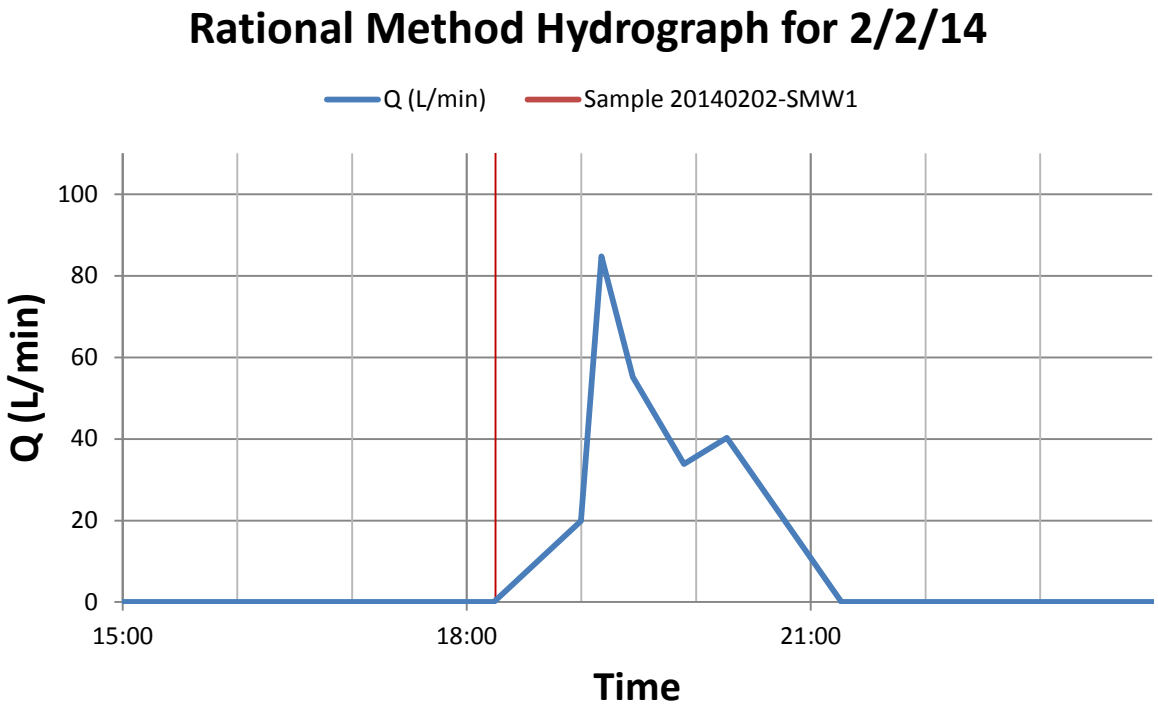

Rational Method Hydrograph for 10/9/2013
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Q (L/min)
6:00
9:00
12:00
15:00
18:00
Time

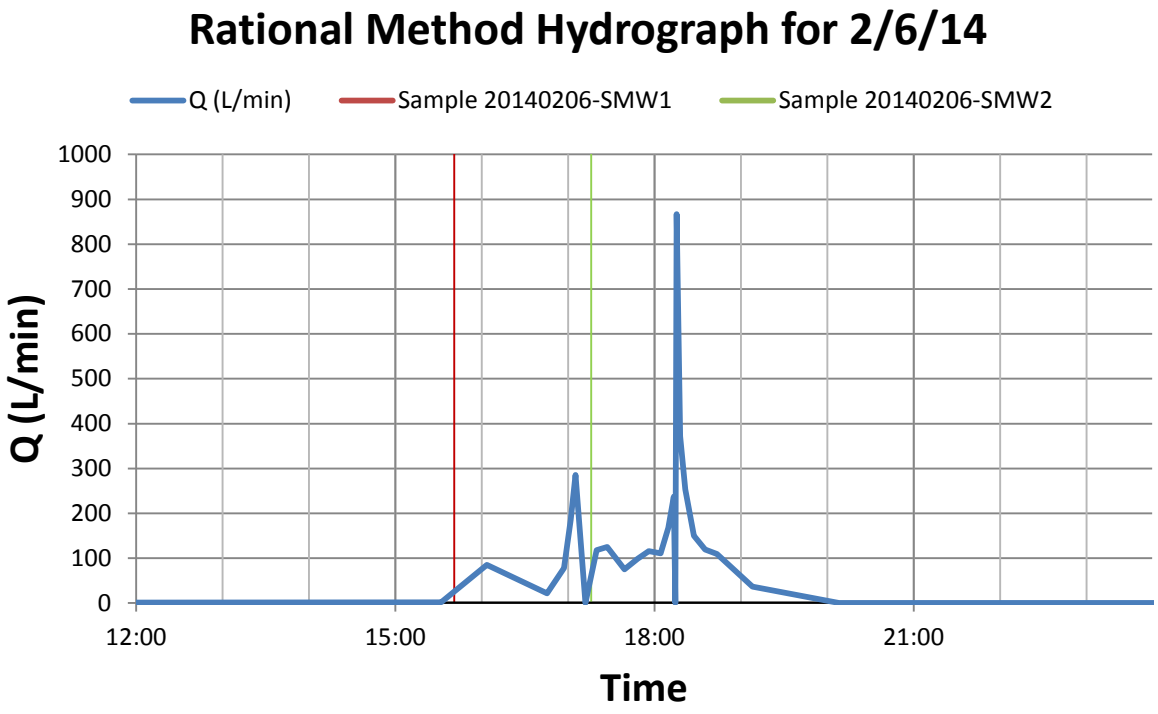

Rational Method Hydrograph for 11/20/13 - 11/21/13
Q (L/min)
Sample 20131121-SMW1
350
300
250
200
150
100
50
0
Q (L/min)
12:00
18:00
0:00
6:00
12:00
Time


Rational Method Hydrograph for 11/29/13
Q (L/min)
Sample 20131129 SMW1
Sample 20131129 SMW2
350
300
250
200
150
100
50
0
Q (L/min)
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
Time

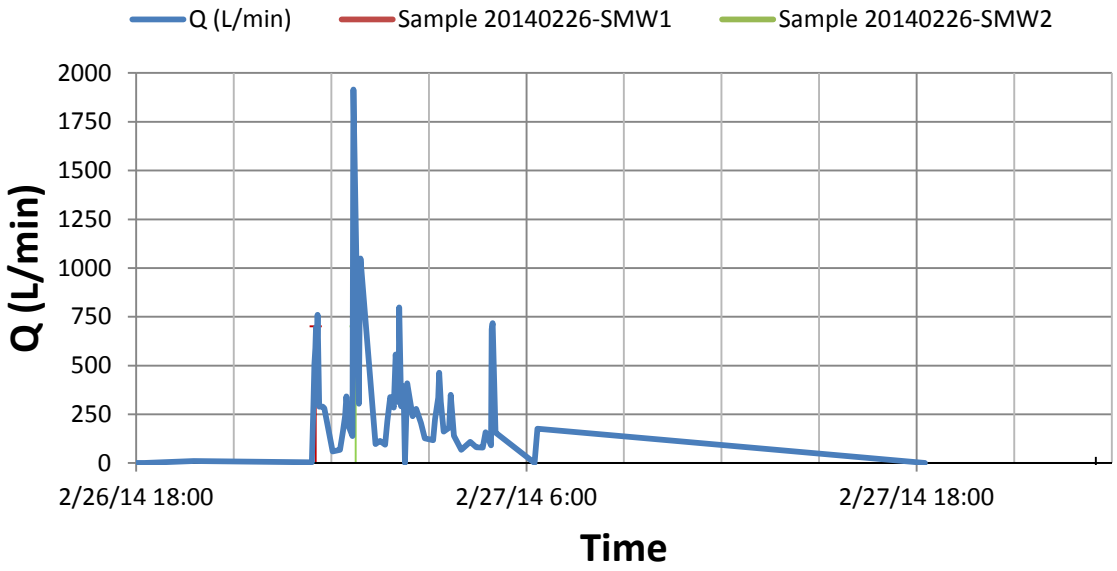

Rational Method Hydrograph for 12/07/13
Q (L/min)
Sample 20131207-SMW1
Sample 20131207-SMW2
800
700
600
500
400
300
200
100
0
Q (L/min)
3:00
6:00
9:00
12:00
15:00
18:00
Time


Rational Method Hydrograph for 12/19/13
Q (L/min)
Sample 20131219 SMW1
350
300
250
200
150
100
50
0
Q (L/min)
3:00
6:00
9:00
12:00
15:00
Time

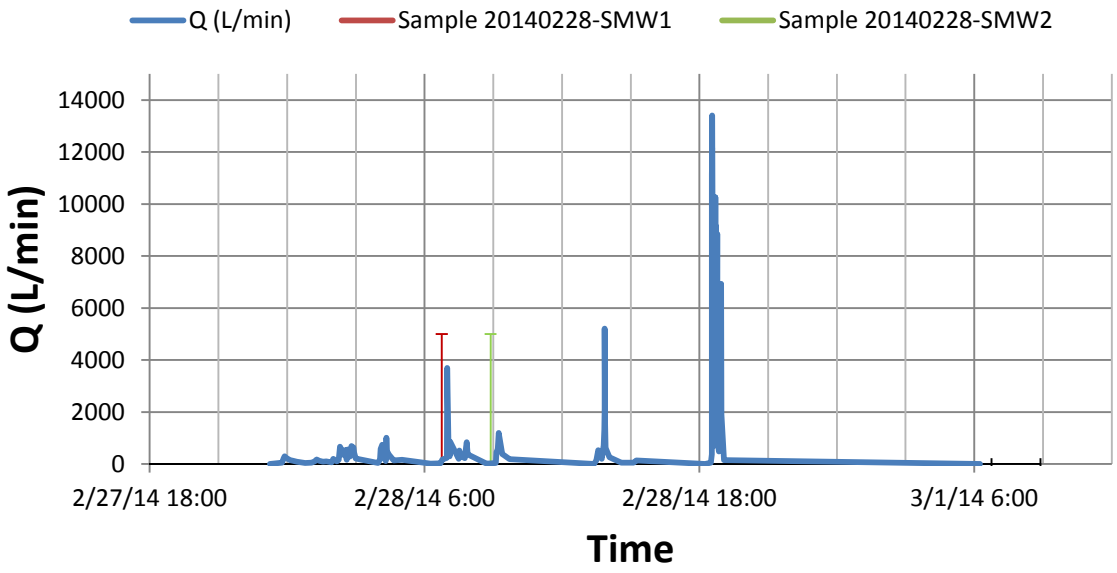

Rational Method Hydrograph for 2/2/14
Q (L/min)
Sample 20140202-SMW1
100
80
60
40
20
0
Q (L/min)
15:00
18:00
21:00
Time


Rational Method Hydrograph for 2/6/14
Q (L/min)
Sample 20140206-SMW1
Sample 20140206-SMW2
1000
900
800
700
600
500
400
300
200
100
0
Q (L/min)
12:00
15:00
18:00
21:00
Time

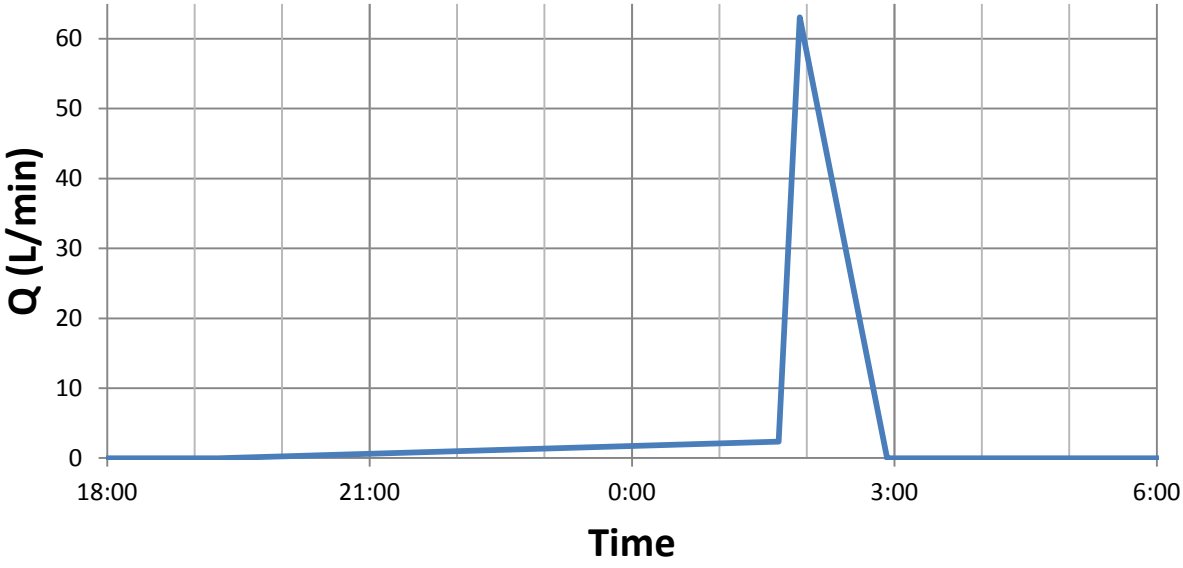
Rational Method Hydrograph for 2/26/14 - 2/27/14



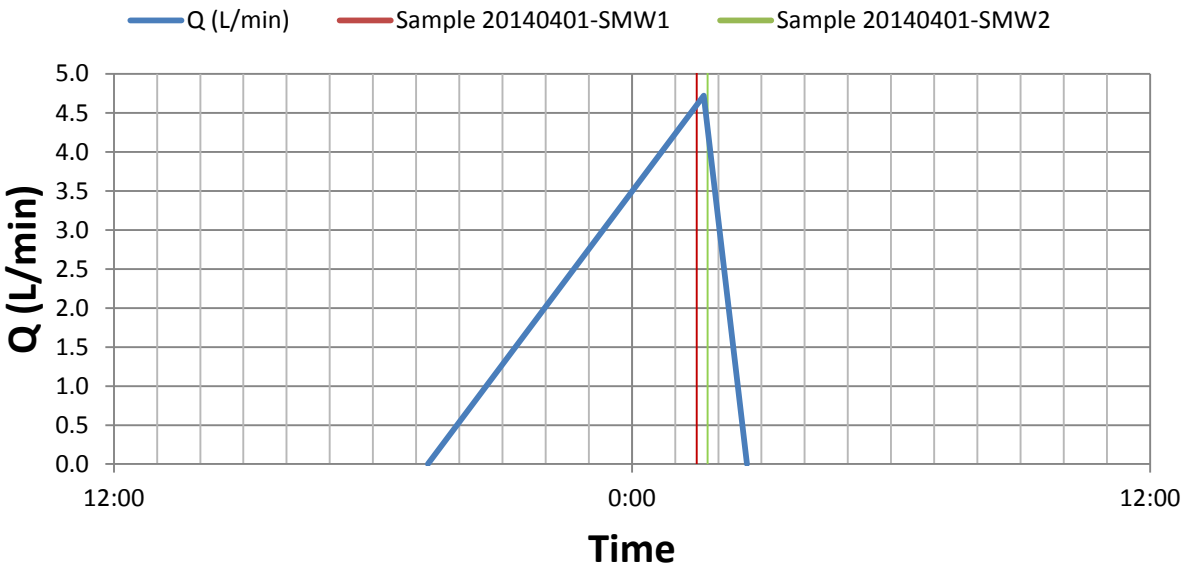
Rational Method Hydrograph for 2/27/14 - 3/1/14

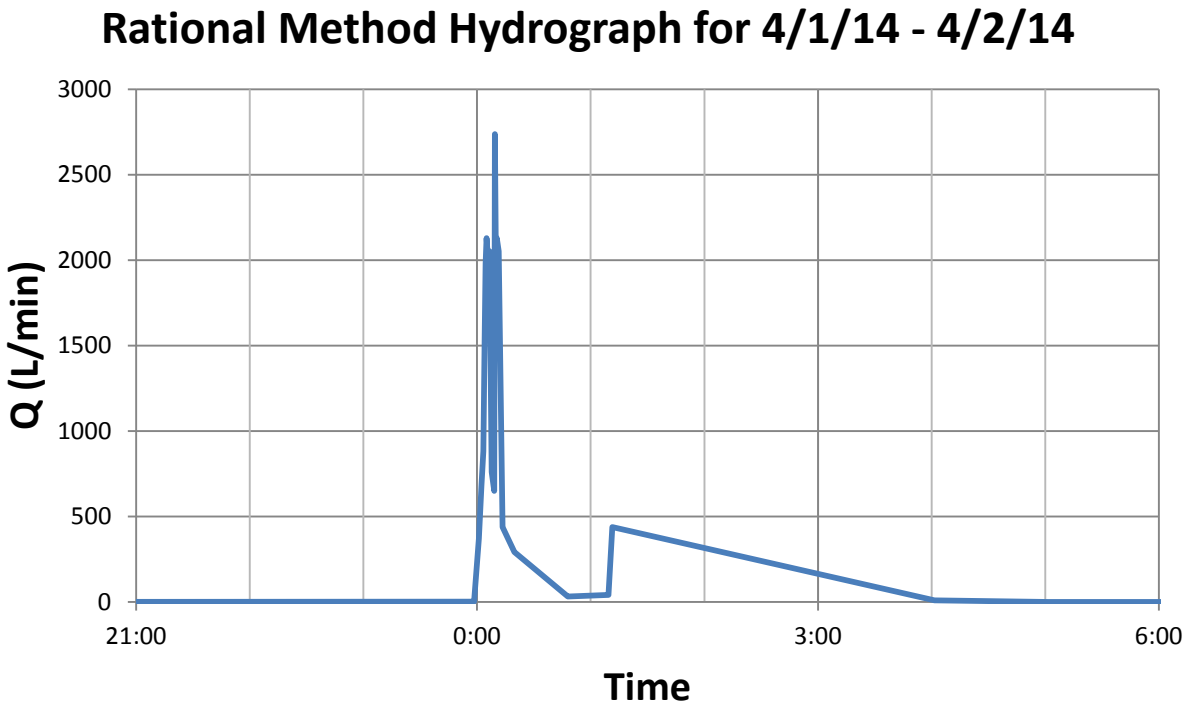


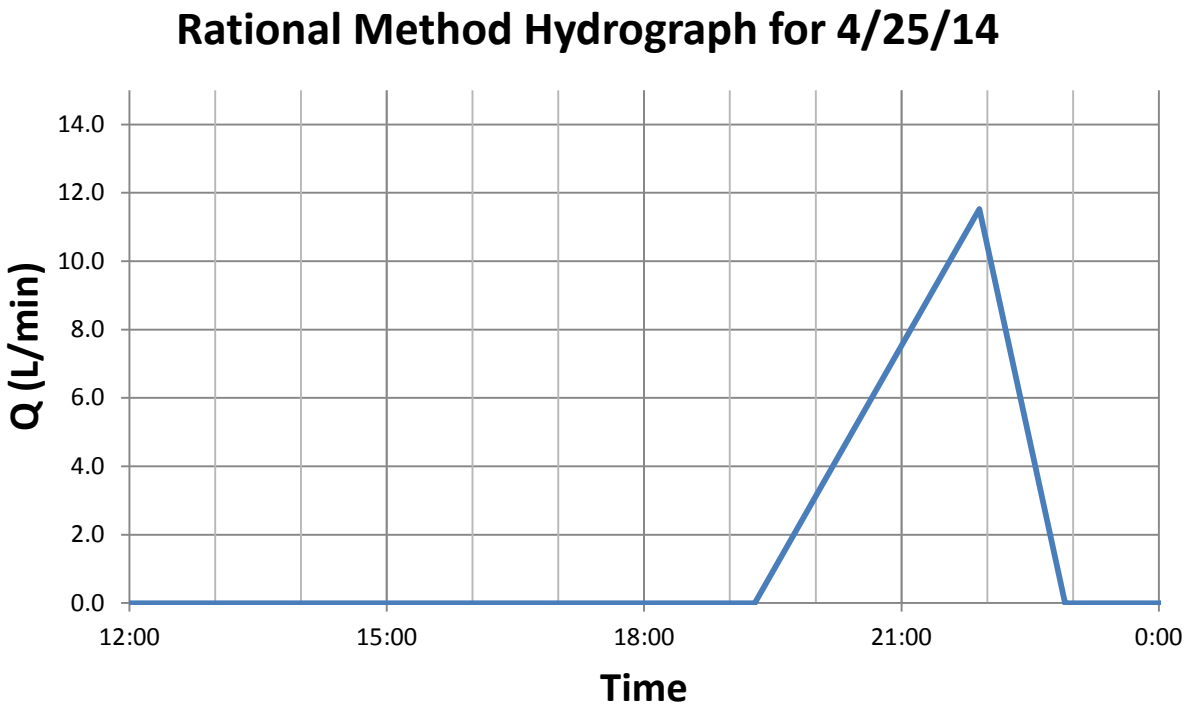
Rational Method Hydrograph for 3/25/14 - 3/26/14

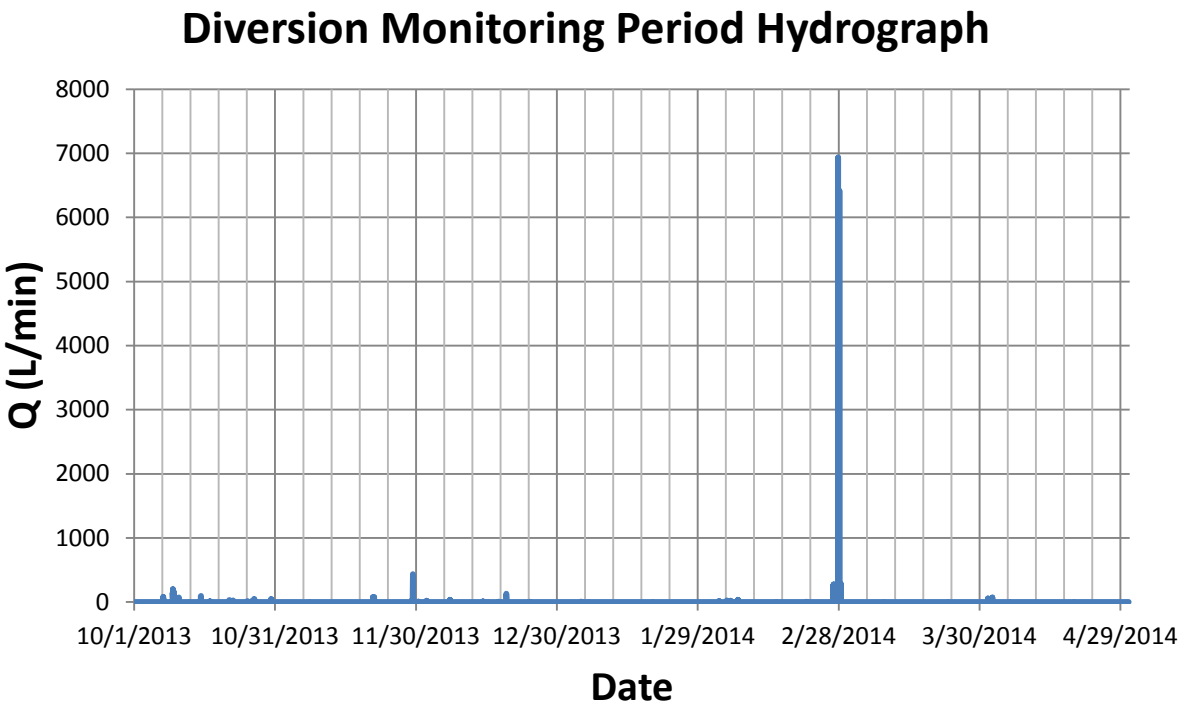


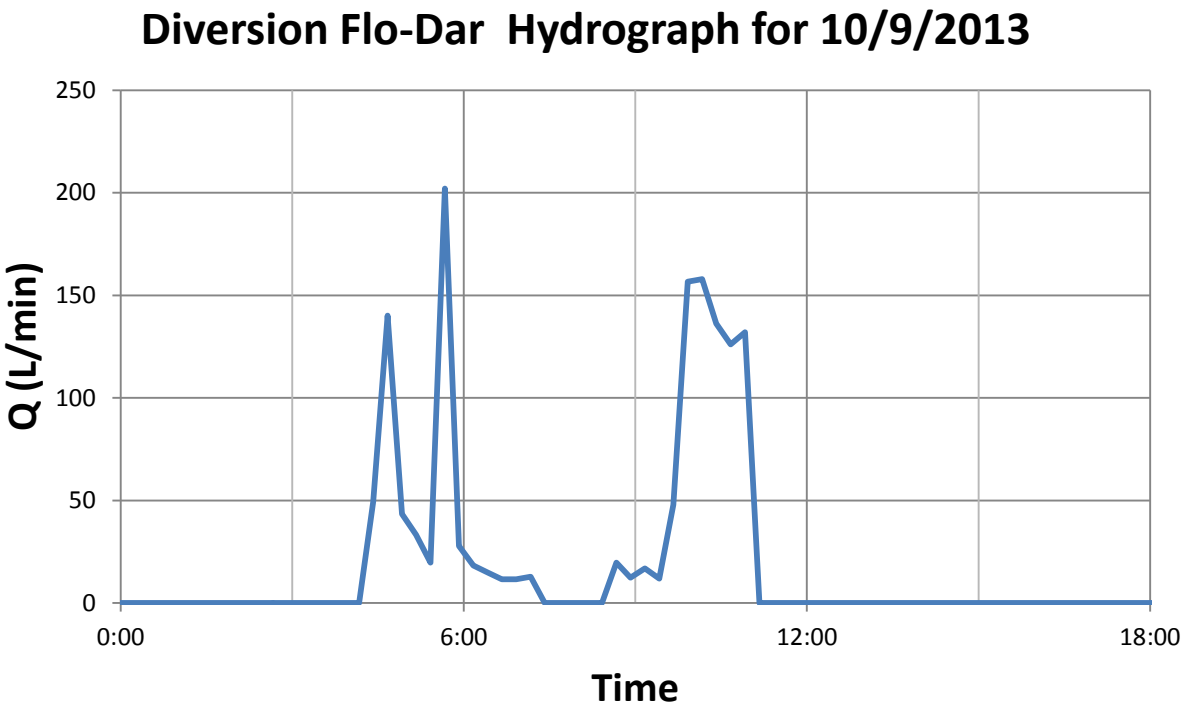
Rational Method Hydrograph for 3/31/14 - 4/1/14



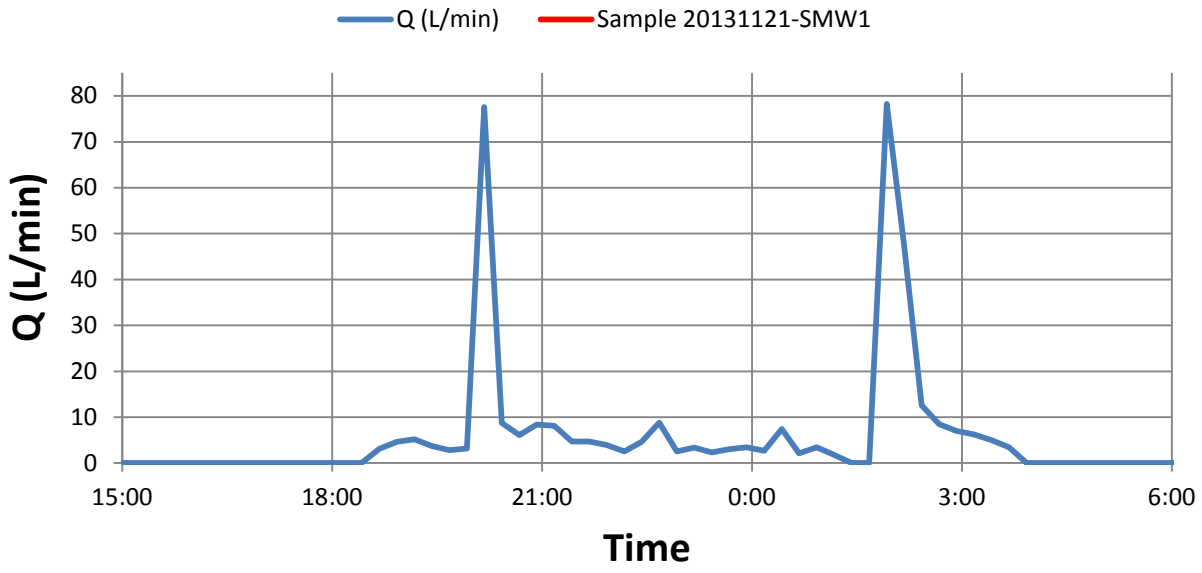

Rational Method Hydrograph for 4/1/14 - 4/2/14
3000
2500
2000
1500
1000
500
0
Q (L/min)
21:00
0:00
3:00
6:00
Time


Rational Method Hydrograph for 4/25/14
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Q (L/min)
12:00
15:00
18:00
21:00
0:00
Time

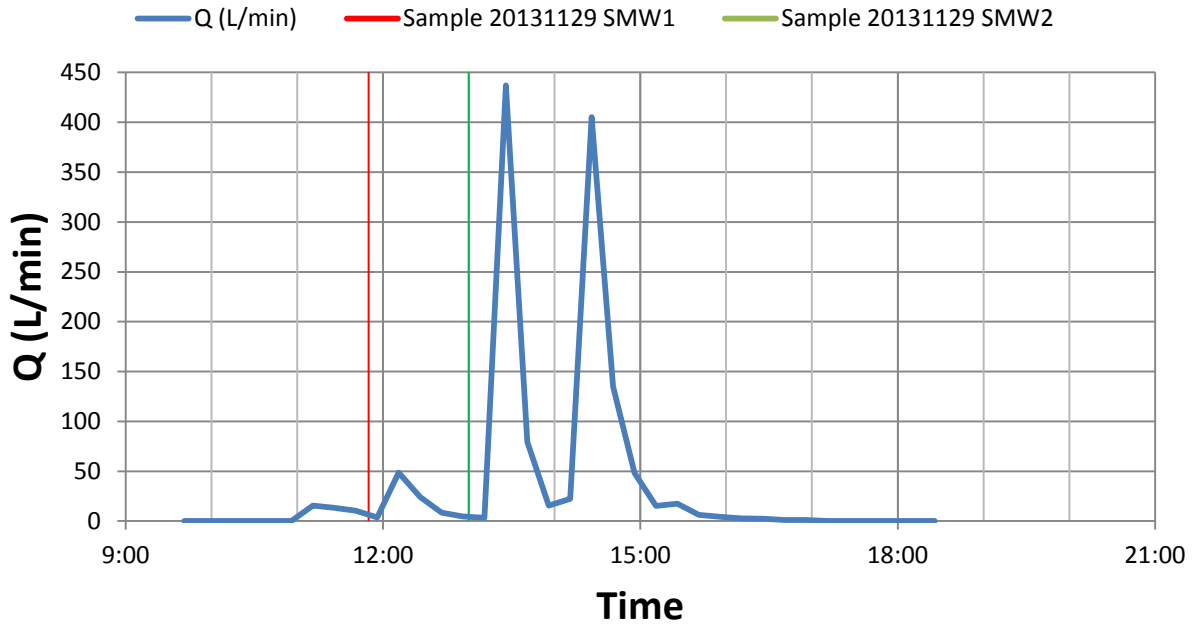

Diversion Monitoring Period Hydrograph
8000
7000
6000
5000
4000
3000
2000
1000
0
Q (L/min)
10/1/2013
10/31/2013
11/30/2013
12/30/2013
1/29/2014
2/28/2014
3/30/2014
4/29/2014
Date

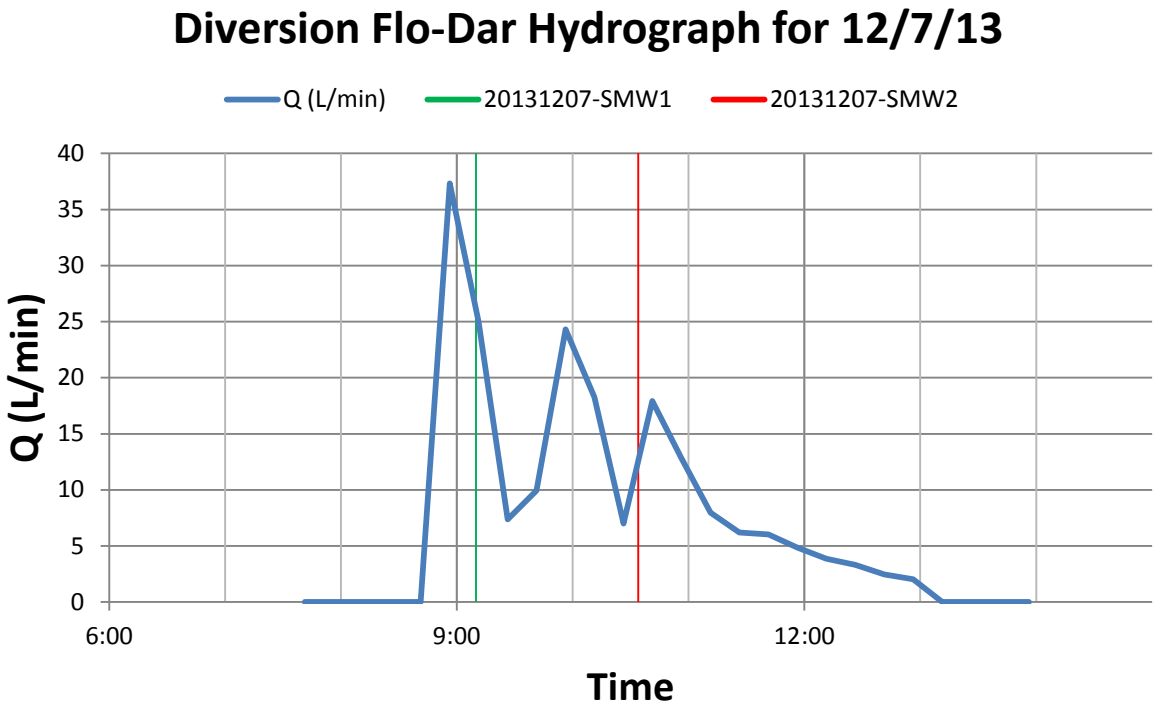

Diversion Flo-Dar Hydrograph for 10/9/2013
250
200
150
100
50
0
Q (L/min)
0:00
6:00
12:00
18:00
Time

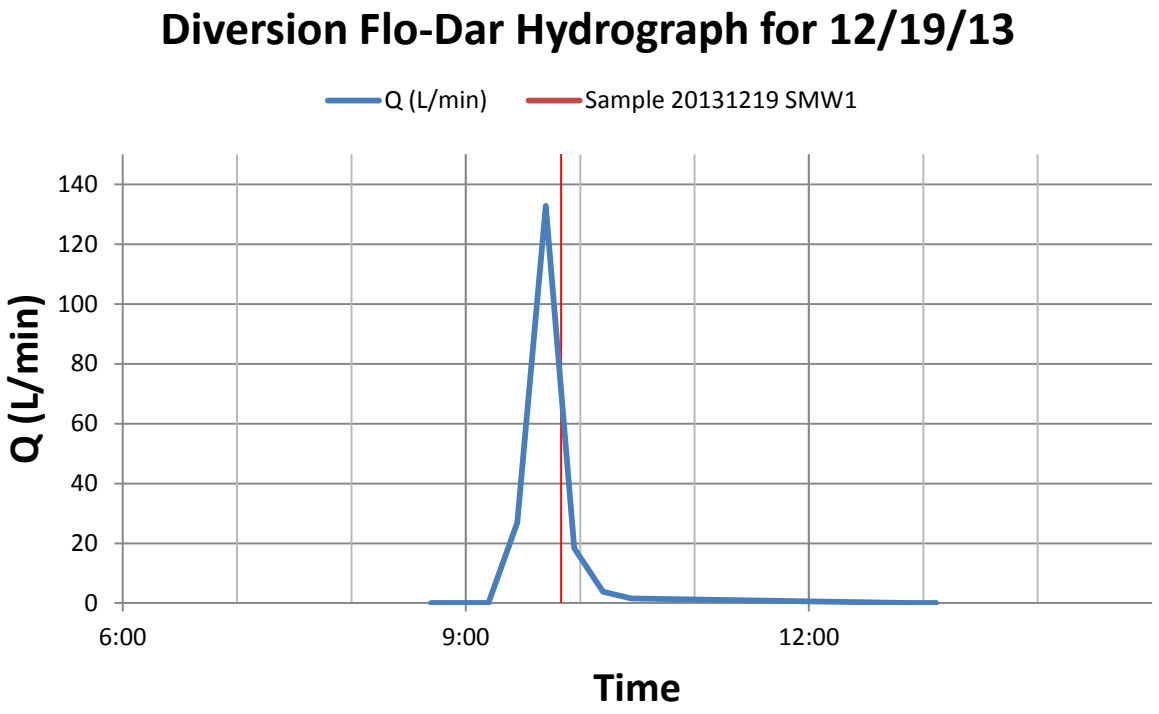
Diversion Flo-Dar Hydrograph for 11/20/2013 - 11/21/2013

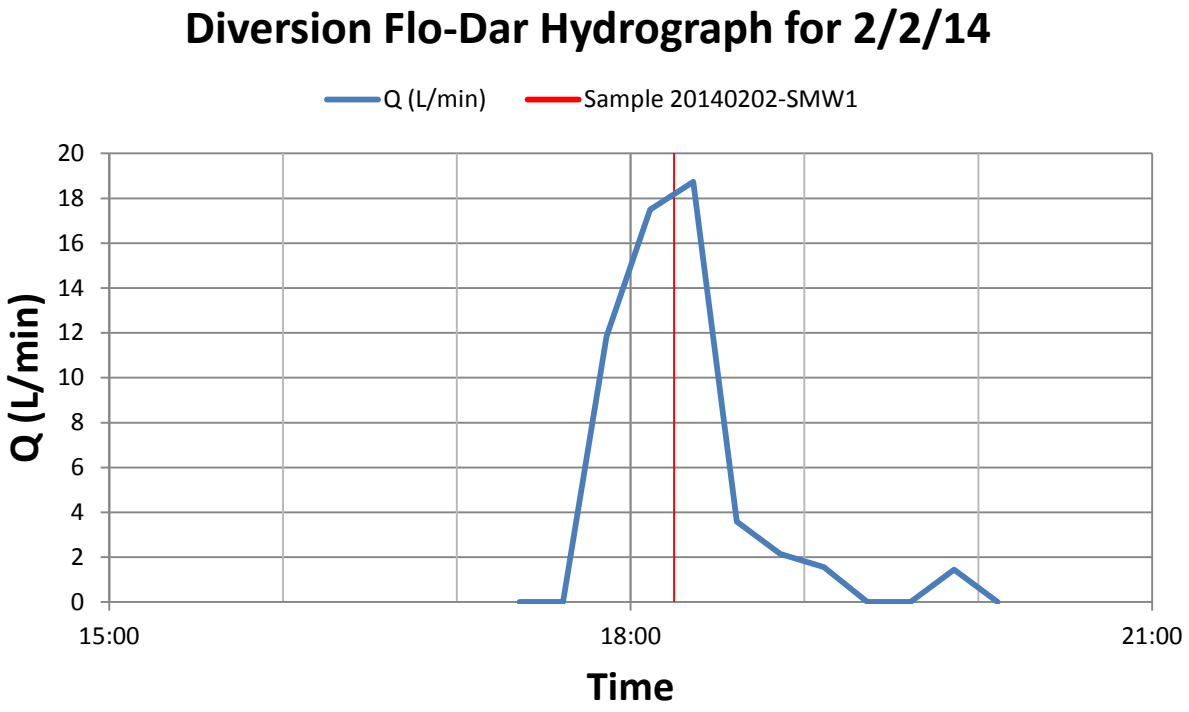


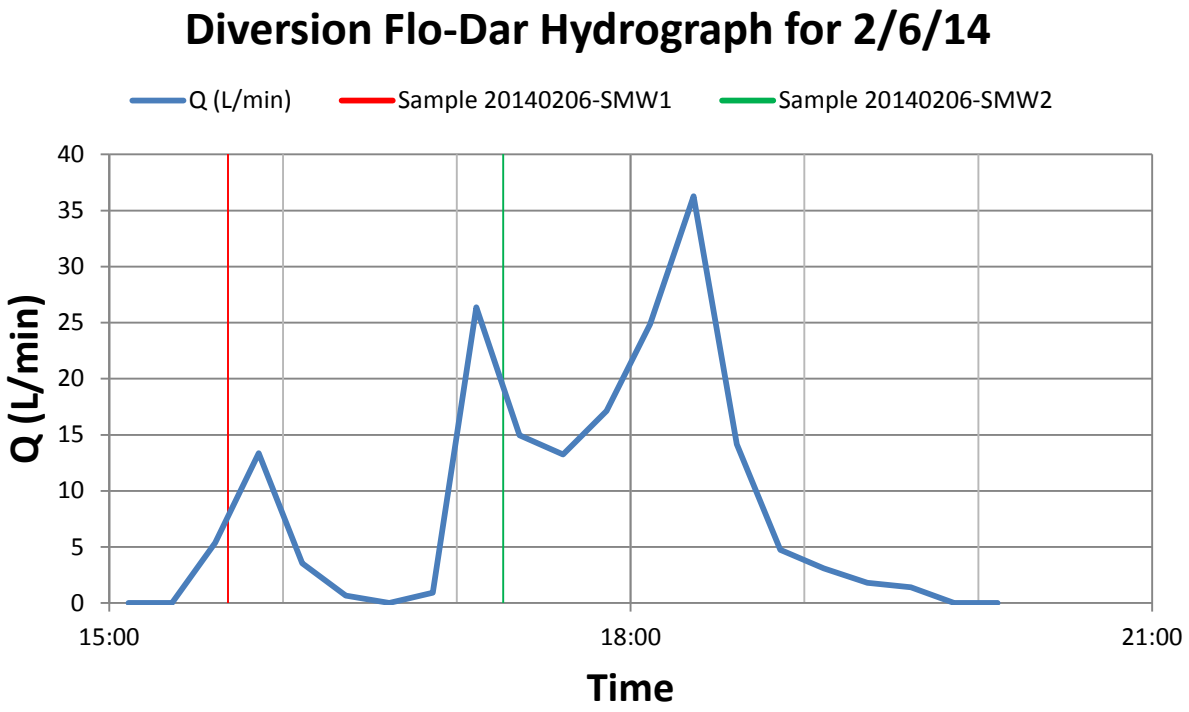
Diversion Flo-Dar Hydrograph for 11/29/13



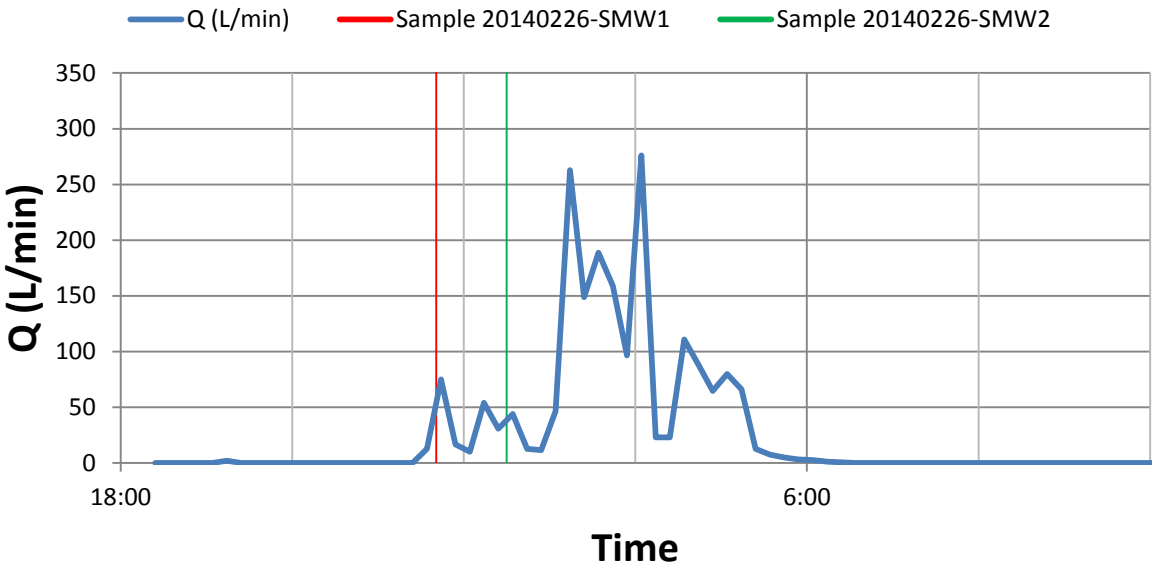

Diversion Flo-Dar Hydrograph for 12/7/13
Q (L/min)
20131207-SMW1
20131207-SMW2
40
35
30
25
20
15
10
5
0
Q (L/min)
6:00
9:00
12:00
Time


Diversion Flo-Dar Hydrograph for 12/19/13
Q (L/min)
Sample 20131219 SMW1
140
120
100
80
60
40
20
0
Q (L/min)
6:00
9:00
12:00
Time

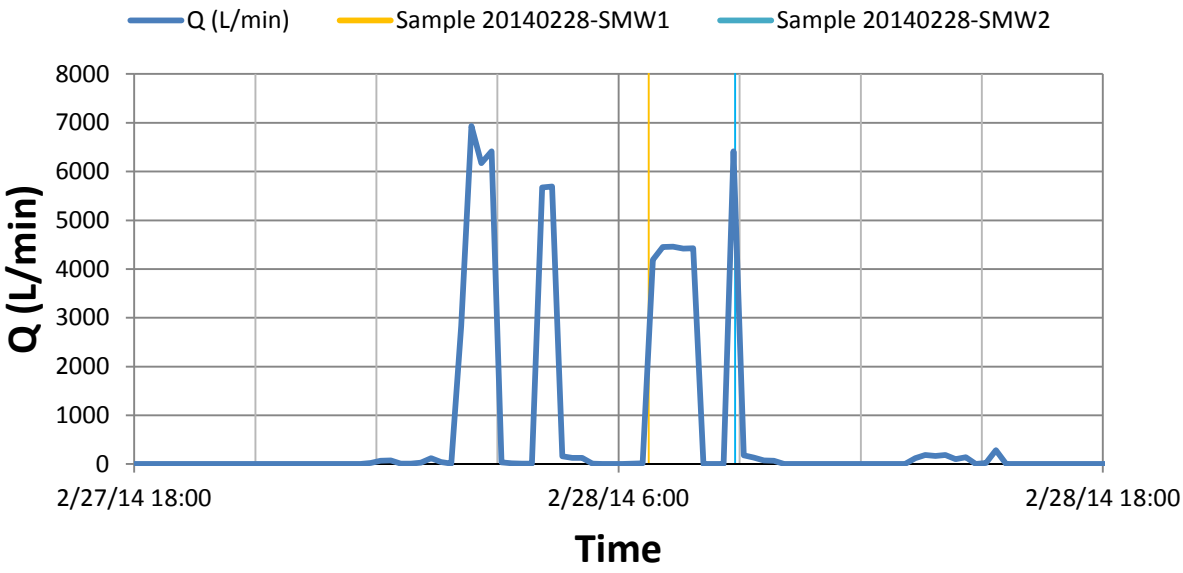

Diversion Flo-Dar Hydrograph for 2/2/14
Q (L/min)
Sample 20140202-SMW1
20
18
16
14
12
10
8
6
4
2
0
Q (L/min)
15:00
18:00
21:00
Time

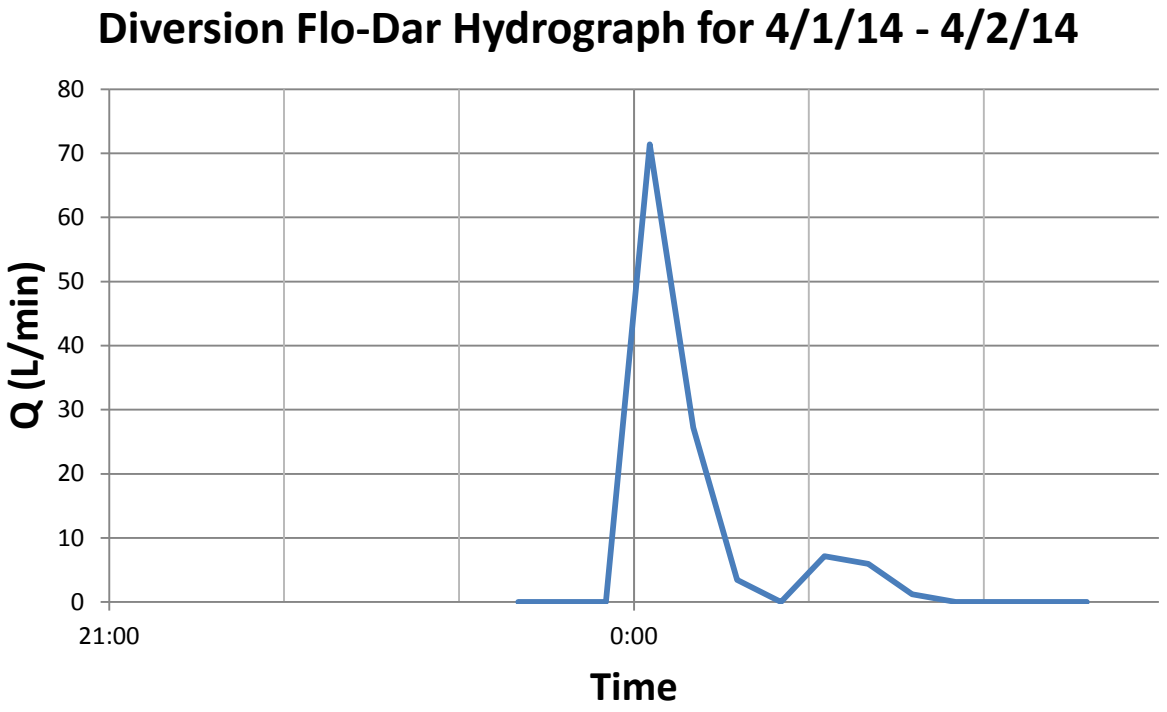

Diversion Flo-Dar Hydrograph for 2/6/14
Q (L/min)
Sample 20140206-SMW1
Sample 20140206-SMW2
40
35
30
25
20
15
10
5
0
Q (L/min)
15:00
18:00
21:00
Time

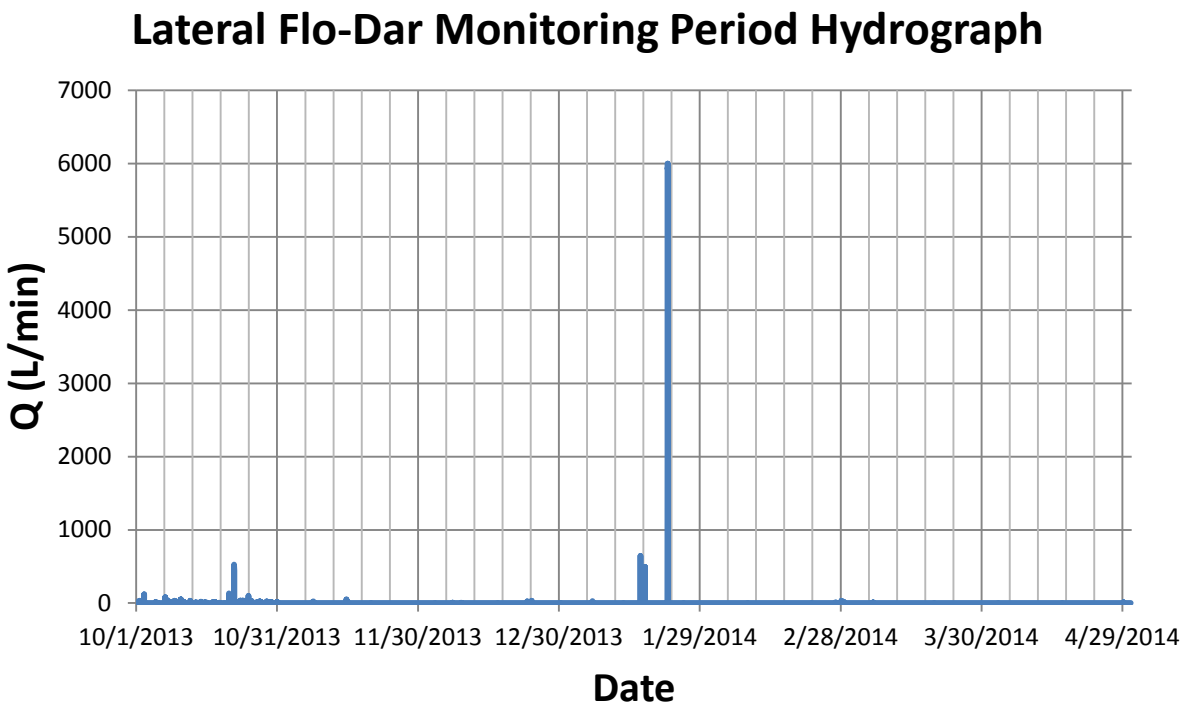
Diversion Flo-Dar Hydrograph for 2/26/14 - 2/27/14



Diversion Flo-Dar Hydrograph for 2/26/14 - 3/1/14




Diversion Flo-Dar Hydrograph for 4/1/14 - 4/2/14
Q (L/min)
80
70
60
50
40
30
20
10
0
21:00
0:00
Time


Lateral Flo-Dar Monitoring Period Hydrograph
Q (L/min)
7000
6000
5000
4000
3000
2000
1000
0
10/1/2013
10/31/2013
11/30/2013
12/30/2013
1/29/2014
2/28/2014
3/30/2014
4/29/2014
Date

Appendix E

Monitoring Results

Table A-1 Dry-Weather Results Summary															
				20131028-SMD	20131106-SMD	20131113-SMD	20131204-SMD	20131219-SMD	20140130-SMD	20140131-SMD	20140206-SMD	20140217-SMD	20140326-SMD	20140331-SMD	20140430-SMD
				10/28/13	11/06/13	11/13/13	12/04/13	12/19/13	01/30/14	01/31/14	02/06/14	02/17/14	03/26/14	03/31/14	04/30/14
Analyte	**Units**	**DL**	**RL**	**10:30:00**	**08:40:00**	**07:20:00**	**07:01:00**	**08:30:00**	**08:10:00**	**07:03:00**	**13:46:00**	**06:56:00**	**07:23:00**	**07:43:00**	**07:05:00**
Bacteria															
Total Coliform	MPN/100ml			280000	300000	160000	300000	90000	17000000	3000000	90000000	80000	900000	170000	280000
Fecal Coliform	MPN/100ml			3000	13000	7000	300000	5000	130000	500000	140000	700	240000	50000	2300
Enterococcus	MPN/100ml			50000	90000	13000	30000	17000	28000	9000	1600000	1600	300000	>16000	1300000
General															
Total Suspended Solids	mg/L	2.7	5	130	22	118	808	34	200	1460	758	26	217	112	325
Total Phosphorous as P	mg/L	0.01	0.02	3.52	1.88	0.48	4.46	0.42	2.96	0.55	79.8	1.16	14.3	0.58	1.54
BOD	mg/L	1.5	3	NA	12	21	7	11	1070	526	544	6	295	17	62
Nitrate, as Nitrogen	mg/L	0.06	0.1	3.51	0.70	0.75	1.82	0.87	1.17	ND	2.44	1.27	2.57	0.78	0.77
Nitrite, as Nitrogen	mg/L	0.018-0.9	0.1-0.5	0.31	0.23	0.16	0.32	ND	0.12	0.13	ND	0.12	1.33	ND	ND
Total Oil and Grease	mg/L	1.7	5	ND	2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals															
Arsenic	ug/L	0.12	2	NA	NA	NA	0.91	0.52	3.29	2.47	9.11	1.34 J	4.3	0.52	0.670 J
Cadmium	ug/L	0.1	1	0.3 J	0.12	0.092	0.23	0.26	0.4 J	0.3 J	1.40	ND	0.75	0.13	0.366 J
Calcium	ug/L	9.1	100	NA	NA	NA	NA	29	54300	67600	128000	36700	48400	35800	45500
Chromium	ug/L	0.18	2	11.2	1.4	0.81	2.2	0.95	13.0	6.22	23.7	3.02	7.1	1.3	3.25
Copper	ug/L	0.13	3	44.2	25	15	83	29	125	52.1	111	27.3	110	39	57.0
Lead	ug/L	0.08	5	9.28	3.2	1.4	4.7	3.7	14.2	6.66	33.4	1.29 J	26	3.0	11.2
Nickel	ug/L	0.32	5	9.14	3.5	2.4	63	1.5	21.3	13.1	49.8	4.17 J	19	5.0	8.65
Silver	ug/L	0.1	5	ND	0.060	0.068	0.040	0.020	0.2 J	ND	0.4 J	ND	0.14	0.065	NA
Zinc	ug/L	0.36	10	265	190	24	140	54	504	248	659	38.5	460	75	183
Polynuclear Aromatic Hydrocarbons (PAH)															
1-Methylnapthalene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnapthalene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ug/L	0.1	0.5	NA	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table A-2 Wet-Weather Results Summary										
				20131121-SMW1	20131129 SMW1	20131129 SMW2	20131207-SMW1	20131207-SMW2	20131219 SMW1	20140202-SMW1
				11/21/13	11/29/13	11/29/13	12/07/13	12/07/13	12/19/13	02/02/14
Analyte	**Units**	**DL**	**RL**	**12:53:00**	**11:50:00**	**13:00:00**	**09:10:00**	**10:34:00**	**09:50:00**	**18:15:00**
Bacteria										
Coliform, Total	MPN/100ml			7000	500000	500000	70000	80000	90000	130000
Coliform, Fecal	MPN/100ml			500	170000	130000	2200	22000	30000	80000
Enterococcus	MPN/100ml			30000	110000	160000	50000	170000	16000	30000
General										
Total Suspended Solids	mg/L	2.7	5	69	28	105	399	55	1400	51
Total Phosphorous as P	mg/L	0.01	0.02	1.24	0.86	0.75	15.5	5.14	4.00	8.22
BOD	mg/L	1.5	3	23	7	5	244	84	355	262
Nitrate, as Nitrogen	mg/L	0.06	0.1	5.08	0.65	0.48	1.32	0.99	2.33	5.08
Nitrite, as Nitrogen	mg/L	0.018-0.9	0.1-0.5	0.73	0.09 J	0.05 J	0.23	0.11	0.15	0.13
Total Oil and Grease	mg/L	1.7	5	ND	ND	ND	ND	ND	6	ND
Metals										
Arsenic	ug/L	0.12	2	NA	NA	NA	NA	NA	3.6	2.24
Cadmium	ug/L	0.1	1	0.43	0.39	0.30	0.32	0.090	0.87	0.4 J
Calcium	ug/L	9.1	100	NA	NA	NA	NA	NA	36	28800
Chromium	ug/L	0.18	2	10	2.2	4.2	5.8	1.4	12	5.875
Copper	ug/L	0.13	3	75	26	30	48	25	75	99.1
Lead	ug/L	0.08	5	12	4.5	9.5	6.3	2.8	21	8.35
Nickel	ug/L	0.32	5	12	7.1	8.0	20	6.7	34	25.9
Silver	ug/L	0.1	5	ND	0.085	0.11	0.12	0.10	0.17	ND
Zinc	ug/L	0.36	10	240	88	130	220	87	460	398
Polynuclear Aromatic Hydrocarbons (PAH)										
1-Methylnapthalene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
2-Methylnapthalene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Anthracene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Chrysene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Fluorene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
Pyrene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND
2-Fluorobiphenyl (SUR)	ug/L	NA	NA	1.33	1.04	1.26	1.305	1.510	1.4	1.76
Nitrobenzene-d5 (SUR)	ug/L	NA	NA	1.14	1.17	1.08	1.366	1.673	1.7	2.16
Terphenyl-d14 (SUR)	ug/L	NA	NA	1.77	1.62	1.77	1.718	2.267	1.89	2.02

Table A-2 Wet-Weather Results Summary											
				20140206-SMW1	20140206-SMW2	20140226-SMW1	20140226-SMW2	20140228-SMW1	20140228-SMW2	20140401-SMW1	20140401-SMW2
				02/06/14	02/06/14	02/26/14	02/27/14	02/28/14	02/28/14	04/01/14	04/01/14
ANALYTE	UNITS	DL	RL	15:41:00	17:16:00	23:31:00	00:45:00	06:45:00	08:58:00	13:30:00	13:45:00
Bacteria											
Coliform, Total	MPN/100ml			50000	14000	9000	30000	90000	30000	5000	24000
Coliform, Fecal	MPN/100ml			17000	5000	5000	13000	90000	30000	50	2200
Enterococcus	MPN/100ml			22000	28000	300000	6	>16000	11000	16000	2100
General											
Total Suspended Solids	mg/L	2.7	5	752	166	806	29	12	22	348	48
Total Phosphorous as P	mg/L	0.01	0.02	5.29	3.79	0.38	1.93	0.86	0.85	2.96	2.17
BOD	mg/L	1.5	3	92	44	84	14.8	12	17	39	102
Nitrate, as Nitrogen	mg/L	0.06	0.1	3.00	2.59	2.87	1.52	0.10	ND	1.35	2.22
Nitrite, as Nitrogen	mg/L	0.018-0.9	0.1-0.5	0.33 J	0.14 J	0.20	0.08 J	ND	ND	ND	ND
Total Oil and Grease	mg/L	1.7	5	ND	ND	ND	ND	7	7	ND	ND
Metals											
Arsenic	ug/L	0.12	2	3.63	1.68 J	4.05	1.06 J	0.8 J	1.09 J	3.6	1.4
Cadmium	ug/L	0.1	1	0.7 J	0.3 J	0.8 J	ND	ND	ND	1.1	0.28
Calcium	ug/L	9.1	100	24100	14200	14800	6310	5010	4540	19000	16600
Chromium	ug/L	0.18	2	15.7	9.43	19.5	5.77	2.11	2.64	18	3.0
Copper	ug/L	0.13	3	98.4	54.0	77.2	28.9	9.25	12.1	110	60
Lead	ug/L	0.08	5	23.5	6.87	34.8	3.00 J	0.6 J	2.10 J	32	5.9
Nickel	ug/L	0.32	5	32.8	15.6	26.5	8.02	2.96 J	2.70 J	40	15
Silver	ug/L	0.1	5	0.3 J	0.4 J	1.20 J	ND	ND	ND	0.49	0.12
Zinc	ug/L	0.36	10	341	187	447	192	43.4	58.4	690	390
Polynuclear Aromatic Hydrocarbons (PAH)											
1-Methylnapthalene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnapthalene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(a,h)anthracene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ug/L	0.1	0.5	ND	ND	ND	ND	ND	ND	ND	ND
2-Fluorobiphenyl (SUR)	ug/L	NA	NA	1.26	1.32	1.657	1.218	1.33	1.40	1.35	1.41
Nitrobenzene-d5 (SUR)	ug/L	NA	NA	1.65	1.81	1.922	1.508	1.81	1.86	1.75	1.66
Terphenyl-d14 (SUR)	ug/L	NA	NA	1.79	2.05	2.089	1.810	1.97	2.01	1.70	1.94

Appendix F

CEDEN SCCWRP Data Load Success Reports

CEDEN SCCWRP RDC Stations Load Success

Your Stations data has been successfully loaded into the Southern California Regional Data Center.

This is your data upload receipt. Please print this and save it.

Print This Page

Troubleshooting

Stations

Description	DataValue
Message:	Your Stations data was loaded into the Southern California Regional Data Center
User Name:	rjen@cwecorp.com
Submitted File Name:	StationsStagingCWE4448
Date Submitted:	06/11/14
Time:	12:07:17
Table loaded:	n/a
Number of records added:	8
Production Load ID	1296

For assistance please contact Shelly Moore at 714-755-3207

Troubleshooting

Southern California Regional Data Center Chemistry Results and Lab Batch Load Success

Your data has been successfully loaded into the Southern California Regional Data Center.

This is your data upload receipt. Please print this and save it.

Print This Page

Troubleshooting

Chemistry Results

Description	DataValue
Message:	Chemistry Results data for AgencyCWE and rjen@cwecorp.com was loaded into the Southern California Re
User Name:	rjen@cwecorp.com
Submitted File Name:	ChemResultsStagingCWE4500
Date Submitted:	06/16/14
Time:	11:13:22
Table loaded:	tblChemistryResults
Number of records added:	972
Production Load ID	1310

Lab Batch

Description	DataValue
Message:	Your Lab Batch data AgencyCWE and rjen@cwecorp.com was loaded into the Southern California Regional
User Name:	rjen@cwecorp.com
Submitted File Name:	ChemLabBatchStagingCWE4500
Date Submitted:	06/16/14
Time:	11:13:22
Table loaded:	tblChemLabBatch
Number of records added:	19
Production Load ID	1311

For assistance please contact Shelly Moore at 714-755-3207

Troubleshooting

Appendix G

Photos

In-Line Catch Basin – Nebraska St. Construction, west side, parkway installation of infiltration zone.

In-Line Catch Basin – Nebraska Construction, west side parkway installation completed

In-Line Catch Basin – Nebraska Construction, east side, completed Maxwell infiltration system (with manhole cover)

In-Line Storm Drain – Hill St. Construction, storm drain diversion section

In-Line Storm Drain, Hill St. Construction, augering one of Maxwell infiltration systems.

In-Line Storm Drain – Hill Street, infiltration zone nearly completion

In-Line Storm Drain – Hill Street, diversion pipe (foreground) and infiltration zone (background) completed.

Completed project view, diversion from storm drain (right manhole cover) to infiltration zone (left side) .

Appendix H

Soil Percolation Data

Percolation Testing

KOURY GEOTECHNICAL SERVICES, INC.

Job Name: City Wide Percolation Testing

Job No.: 12-0147

Test Location: Franklin St., N of Nebraska, in front of 1760 Franklin, west side of street

Water Table Depth (ft): 35 Relatively Impervious Layer Depth (ft): 2 feet below test

Test Date: 7-5 to 7-6/2012

Test No.: 16

Depth of Hole (db): 114 in

Diameter of Hole (D): 6 in

Test Performer: MN

Trial No.	Time of Testing			Water Level Measurement		Water Level Calculations				Percolation Rate Calculations		
	Initial Time T_1 (min)	Final Time T_2 (min)	Time Interval $\Delta T = T_2 - T_1$ (min)	Initial Depth to Water d_1 (in)	Final Depth to Water d_2 (in)	Initial Height of Water Column $d_{i1} = d_b - d_1$ (in)	Final Height of Water Column $d_{i2} = d_b - d_2$ (in)	Drop in Height $\Delta d_i = d_{i1} - d_{i2}$ (in)	Average Height of Water Column $d_{avg} = (d_{i1}+d_{i2})/2$ (in)	Measured Percolation $K_i = \Delta d_i / \Delta T$ (in/hr)	Reduction Factor $R_f = ((2d_{i1} - \Delta d_i) / D) + 1$	Adjusted Percolation Rate $K = K_i / R_f$ (in/hr)
1	0	30	30	81 8/16	84 10/16	32.50	29.38	3.13	30.9	6.3	11.31	0.55
2	0	30	30	84 10/16	87 11/16	29.38	26.31	3.06	27.8	6.1	10.28	0.60
3	0	30	30	87 11/16	90 10/16	26.31	23.38	2.94	24.8	5.9	9.28	0.63

Note:

1. Reduction Factor, $R_f = ((2d_{i1} - \Delta d_i) / D) + 1$
2. Long Term Percolation Rate = Short Term Percolation Rate / Correction Factor for Siltation and Other Factors

Correction Factor Range Normally used to account for Long Term Moderate Siltation, Test Scale Limitations and Other Factors = 2 to 20

Lowest Short Term Percolation Rate = 0.55 in/hr

Adjusted Long Term Percolation Rate = _____ in/hr

Reference: Los Angeles County Administrative Manual - Low Impact Development Best Management Practice Guideline for Design, Investigation, and Reporting, dated 06/01/11

East / West Franklin & Nebraska Percolation Rate = 0.55 in / hr

Percolation Testing

KOURY GEOTECHNICAL SERVICES, INC.

Job Name: City Wide Percolation Testing

Job No.: 12-0147

Test Location: N/W corner of Hill St and 17th St, Santa Monica

Water Table Depth (ft): _____ Relatively Impervious Layer Depth (ft): _____

Test Date: 7-11 to 7-15/2013

Test No.: 29

Depth of Hole (db): 108 in

Diameter of Hole (D): 6 in

Test Performer: MN

Trial No.	Time of Testing			Water Level Measurement		Water Level Calculations				Percolation Rate Calculations		
	Initial Time T_1 (min)	Final Time T_2 (min)	Time Interval $\Delta T = T_2 - T_1$ (min)	Initial Depth to Water d_i (in)	Final Depth to Water d_f (in)	Initial Height of Water Column $d_{hi} = d_b - d_i$ (in)	Final Height of Water Column $d_{hf} = d_b - d_f$ (in)	Drop in Height $\Delta d_h = d_{hi} - d_{hf}$ (in)	Average Height of Water Column $\bar{d}_{ha} = (d_{hi}+d_{hf})/2$ (in)	Measured Percolation $R_i = \Delta d_h / \Delta T$ (in/hr)	Reduction Factor $R_r = ((2\bar{d}_{ha} - \Delta d_h) / D) + 1$	Adjusted Percolation Rate $R_a = R_i / R_r$ (in/hr)
1	0	6	6	82	94	27.00	15.00	12.00	21.0	120.0	8.00	15.00
2	0	6	6	82 4/8	94 4/8	26.50	14.50	12.00	20.5	120.0	7.83	15.32
3	0	7	7	83	96	26.00	12.00	13.00	19.5	111.4	7.50	14.86
4	0	7	7	87	98 8/16	22.00	10.50	11.50	16.3	98.6	6.42	15.36
5	0	7	7	85 4/8	97 4/8	23.50	11.50	12.00	17.5	102.9	6.83	15.05
6	0	8	8	85	97	24.00	12.00	12.00	18.0	90.0	7.00	12.86
7	0	8	8	86 4/8	98 4/8	22.50	10.50	12.00	16.5	90.0	6.50	13.85
8	0	8	8	85 6/8	97 6/8	23.25	11.25	12.00	17.3	90.0	6.75	13.33

Note:

1. Reduction Factor, $R_r = ((2\bar{d}_{ha} - \Delta d_h) / D) + 1$
2. Long Term Percolation Rate = Short Term Percolation Rate / Correction Factor for Siltation and Other Factors

Correction Factor Range Normally used to account for Long Term Moderate Siltation, Test Scale Limitations and Other Factors = 2 to 20

Lowest Short Term Percolation Rate = 12.86 in/hr

Adjusted Long Term Percolation Rate = 2.4 in/hr

Reference: Los Angeles County Administrative Manual - Low Impact Development Best Management Practice Guideline for Design, Investigation, and Reporting, dated 06/05/11

Location near Hill and 11th Court Percolation Rate = 2.4 in/hr

Appendix I

Rain Gauge Data

Date/Time	Raw Count	Amount (in)	Accumulated (in)
2013-10-01 19:09:28.0	0	0.00	0.00
2013-10-02 07:09:29.0	0	0.00	0.00
2013-10-02 19:09:30.0	0	0.00	0.00
2013-10-03 07:09:31.0	0	0.00	0.00
2013-10-03 19:09:33.0	0	0.00	0.00
2013-10-04 07:09:33.0	0	0.00	0.00
2013-10-04 19:09:34.0	0	0.00	0.00
2013-10-05 07:09:36.0	0	0.00	0.00
2013-10-05 19:09:37.0	0	0.00	0.00
2013-10-06 07:09:37.0	0	0.00	0.00
2013-10-06 19:09:38.0	0	0.00	0.00
2013-10-07 07:09:39.0	0	0.00	0.00
2013-10-07 19:09:40.0	0	0.00	0.00
2013-10-08 07:09:41.0	0	0.00	0.00
2013-10-08 19:09:42.0	0	0.00	0.00
2013-10-09 07:09:44.0	0	0.00	0.00
2013-10-09 10:41:40.0	1	0.01	0.01
2013-10-09 10:42:53.0	2	0.01	0.02
2013-10-09 10:44:35.0	3	0.01	0.03
2013-10-09 10:47:42.0	4	0.01	0.04
2013-10-09 11:00:52.0	5	0.01	0.05
2013-10-09 11:06:36.0	6	0.01	0.06
2013-10-09 11:57:11.0	7	0.01	0.07
2013-10-09 19:09:44.0	7	0.00	0.07
2013-10-10 07:09:46.0	7	0.00	0.07
2013-10-10 19:09:47.0	7	0.00	0.07
2013-10-11 07:09:48.0	7	0.00	0.07
2013-10-11 19:09:49.0	7	0.00	0.07
2013-10-12 07:09:50.0	7	0.00	0.07
2013-10-12 19:09:51.0	7	0.00	0.07
2013-10-13 07:09:52.0	7	0.00	0.07
2013-10-13 19:09:54.0	7	0.00	0.07
2013-10-14 07:09:54.0	7	0.00	0.07
2013-10-14 19:09:55.0	7	0.00	0.07
2013-10-15 07:09:56.0	7	0.00	0.07
2013-10-15 19:09:58.0	7	0.00	0.07
2013-10-16 07:09:59.0	7	0.00	0.07
2013-10-16 19:10:00.0	7	0.00	0.07
2013-10-17 07:10:01.0	7	0.00	0.07
2013-10-17 19:10:01.0	7	0.00	0.07

2013-10-18 07:10:03.0	7	0.00	0.07
2013-10-18 19:10:04.0	7	0.00	0.07
2013-10-19 07:10:05.0	7	0.00	0.07
2013-10-19 19:10:06.0	7	0.00	0.07
2013-10-20 07:10:07.0	7	0.00	0.07
2013-10-20 19:10:07.0	7	0.00	0.07
2013-10-21 07:10:09.0	7	0.00	0.07
2013-10-21 19:10:11.0	7	0.00	0.07
2013-10-22 07:10:12.0	7	0.00	0.07
2013-10-22 19:10:13.0	7	0.00	0.07
2013-10-23 07:10:14.0	7	0.00	0.07
2013-10-23 19:10:14.0	7	0.00	0.07
2013-10-24 07:10:16.0	7	0.00	0.07
2013-10-24 19:10:16.0	7	0.00	0.07
2013-10-25 07:10:17.0	7	0.00	0.07
2013-10-25 19:10:18.0	7	0.00	0.07
2013-10-26 07:10:19.0	7	0.00	0.07
2013-10-26 19:10:20.0	7	0.00	0.07
2013-10-27 07:10:22.0	7	0.00	0.07
2013-10-27 19:10:23.0	7	0.00	0.07
2013-10-28 07:10:24.0	7	0.00	0.07
2013-10-28 19:10:26.0	7	0.00	0.07
2013-10-29 07:10:27.0	7	0.00	0.07
2013-10-29 19:10:27.0	7	0.00	0.07
2013-10-30 07:10:29.0	7	0.00	0.07
2013-10-30 19:10:30.0	7	0.00	0.07
2013-10-31 07:10:31.0	7	0.00	0.07
2013-10-31 19:10:32.0	7	0.00	0.07
2013-11-01 07:10:33.0	7	0.00	0.07
2013-11-01 19:10:34.0	7	0.00	0.07
2013-11-02 07:10:36.0	7	0.00	0.07
2013-11-02 19:10:36.0	7	0.00	0.07
2013-11-03 06:10:38.0	7	0.00	0.07
2013-11-03 18:10:39.0	7	0.00	0.07
2013-11-04 06:10:40.0	7	0.00	0.07
2013-11-04 18:10:41.0	7	0.00	0.07
2013-11-05 06:10:42.0	7	0.00	0.07
2013-11-05 18:10:43.0	7	0.00	0.07
2013-11-06 06:10:44.0	7	0.00	0.07
2013-11-06 18:10:46.0	7	0.00	0.07
2013-11-07 06:10:46.0	7	0.00	0.07
2013-11-07 18:10:47.0	7	0.00	0.07
2013-11-08 06:10:48.0	7	0.00	0.07
2013-11-08 18:10:49.0	7	0.00	0.07
2013-11-09 06:10:50.0	7	0.00	0.07
2013-11-09 18:10:51.0	7	0.00	0.07
2013-11-10 06:10:53.0	7	0.00	0.07
2013-11-10 18:10:54.0	7	0.00	0.07

2013-11-11 06:10:55.0	7	0.00	0.07
2013-11-11 18:10:56.0	7	0.00	0.07
2013-11-12 06:10:57.0	7	0.00	0.07
2013-11-12 18:10:58.0	7	0.00	0.07
2013-11-13 06:11:00.0	7	0.00	0.07
2013-11-13 18:11:01.0	7	0.00	0.07
2013-11-14 06:11:01.0	7	0.00	0.07
2013-11-14 18:11:02.0	7	0.00	0.07
2013-11-15 06:11:04.0	7	0.00	0.07
2013-11-15 18:11:05.0	7	0.00	0.07
2013-11-16 06:11:06.0	7	0.00	0.07
2013-11-16 18:11:07.0	7	0.00	0.07
2013-11-17 06:11:08.0	7	0.00	0.07
2013-11-17 18:11:09.0	7	0.00	0.07
2013-11-18 06:11:10.0	7	0.00	0.07
2013-11-18 18:11:11.0	7	0.00	0.07
2013-11-19 06:11:13.0	7	0.00	0.07
2013-11-19 18:11:14.0	7	0.00	0.07
2013-11-20 18:11:16.0	7	0.00	0.07
2013-11-20 20:02:46.0	8	0.01	0.08
2013-11-20 20:40:12.0	9	0.01	0.09
2013-11-20 21:08:19.0	10	0.01	0.10
2013-11-20 22:20:46.0	12	0.02	0.12
2013-11-20 22:34:02.0	13	0.01	0.13
2013-11-20 22:43:41.0	14	0.01	0.14
2013-11-20 23:30:52.0	17	0.03	0.17
2013-11-20 23:48:27.0	18	0.01	0.18
2013-11-20 23:51:20.0	19	0.01	0.19
2013-11-20 23:54:47.0	20	0.01	0.20
2013-11-21 00:03:52.0	21	0.01	0.21
2013-11-21 00:16:50.0	22	0.01	0.22
2013-11-21 00:26:53.0	23	0.01	0.23
2013-11-21 00:44:30.0	25	0.02	0.25
2013-11-21 00:50:42.0	26	0.01	0.26
2013-11-21 00:59:42.0	27	0.01	0.27
2013-11-21 01:29:15.0	28	0.01	0.28
2013-11-21 02:51:43.0	29	0.01	0.29
2013-11-21 03:45:04.0	30	0.01	0.30
2013-11-21 03:53:50.0	31	0.01	0.31
2013-11-21 06:11:17.0	33	0.02	0.32
2013-11-21 08:51:51.0	34	0.01	0.33
2013-11-21 18:11:19.0	34	0.00	0.33
2013-11-22 06:11:20.0	34	0.00	0.33
2013-11-22 18:11:20.0	34	0.00	0.33
2013-11-23 06:11:22.0	34	0.00	0.33
2013-11-23 18:11:22.0	34	0.00	0.33
2013-11-24 06:11:24.0	34	0.00	0.33
2013-11-24 18:11:25.0	34	0.00	0.33

2013-11-25 06:11:27.0	34	0.00	0.33
2013-11-25 18:11:27.0	34	0.00	0.33
2013-11-26 06:11:29.0	34	0.00	0.33
2013-11-26 18:11:30.0	34	0.00	0.33
2013-11-27 06:11:31.0	34	0.00	0.33
2013-11-27 18:11:32.0	34	0.00	0.33
2013-11-28 06:11:34.0	34	0.00	0.33
2013-11-28 18:11:35.0	34	0.00	0.33
2013-11-29 06:11:36.0	34	0.00	0.33
2013-11-29 07:51:59.0	35	0.01	0.34
2013-11-29 08:39:45.0	36	0.01	0.35
2013-11-29 08:50:23.0	37	0.01	0.36
2013-11-29 09:45:32.0	38	0.01	0.37
2013-11-29 09:50:16.0	39	0.01	0.38
2013-11-29 09:53:41.0	40	0.01	0.39
2013-11-29 09:57:03.0	41	0.01	0.40
2013-11-29 10:01:23.0	42	0.01	0.41
2013-11-29 10:57:20.0	43	0.01	0.42
2013-11-29 11:03:21.0	45	0.02	0.44
2013-11-29 11:11:31.0	46	0.01	0.45
2013-11-29 11:20:12.0	47	0.01	0.46
2013-11-29 11:38:55.0	48	0.01	0.47
2013-11-29 11:53:59.0	49	0.01	0.48
2013-11-29 12:10:26.0	50	0.01	0.49
2013-11-29 12:20:32.0	51	0.01	0.50
2013-11-29 12:30:59.0	52	0.01	0.51
2013-11-29 12:34:24.0	53	0.01	0.52
2013-11-29 12:38:20.0	54	0.01	0.53
2013-11-29 12:42:42.0	55	0.01	0.54
2013-11-29 12:55:50.0	56	0.01	0.55
2013-11-29 18:11:37.0	56	0.00	0.55
2013-11-30 06:11:38.0	56	0.00	0.55
2013-11-30 18:11:39.0	56	0.00	0.55
2013-12-01 06:11:40.0	56	0.00	0.55
2013-12-01 18:11:41.0	56	0.00	0.55
2013-12-02 06:11:42.0	56	0.00	0.55
2013-12-02 18:11:44.0	56	0.00	0.55
2013-12-03 06:11:45.0	56	0.00	0.55
2013-12-03 18:11:46.0	56	0.00	0.55
2013-12-04 06:11:47.0	56	0.00	0.55
2013-12-04 18:11:49.0	56	0.00	0.55
2013-12-05 06:11:50.0	56	0.00	0.55
2013-12-05 18:11:51.0	56	0.00	0.55
2013-12-06 06:11:52.0	56	0.00	0.55
2013-12-06 18:11:54.0	56	0.00	0.55
2013-12-07 06:11:55.0	56	0.00	0.55
2013-12-07 08:20:56.0	57	0.01	0.56
2013-12-07 08:40:59.0	58	0.01	0.57

2013-12-07 08:44:48.0	59	0.01	0.58
2013-12-07 09:13:30.0	61	0.02	0.60
2013-12-07 09:16:20.0	62	0.01	0.61
2013-12-07 09:21:39.0	63	0.01	0.62
2013-12-07 09:28:43.0	64	0.01	0.63
2013-12-07 09:34:44.0	65	0.01	0.64
2013-12-07 09:50:06.0	66	0.01	0.65
2013-12-07 09:53:18.0	67	0.01	0.66
2013-12-07 09:57:12.0	68	0.01	0.67
2013-12-07 09:58:39.0	69	0.01	0.68
2013-12-07 09:59:54.0	70	0.01	0.69
2013-12-07 10:01:19.0	71	0.01	0.70
2013-12-07 10:10:20.0	72	0.01	0.71
2013-12-07 11:11:13.0	74	0.02	0.73
2013-12-07 11:14:54.0	75	0.01	0.74
2013-12-07 11:23:55.0	76	0.01	0.75
2013-12-07 18:11:56.0	76	0.00	0.75
2013-12-08 06:11:57.0	76	0.00	0.75
2013-12-08 18:11:59.0	76	0.00	0.75
2013-12-09 06:12:00.0	76	0.00	0.75
2013-12-09 18:12:01.0	76	0.00	0.75
2013-12-10 06:12:02.0	76	0.00	0.75
2013-12-10 18:12:03.0	76	0.00	0.75
2013-12-11 06:12:05.0	76	0.00	0.75
2013-12-11 18:12:06.0	76	0.00	0.75
2013-12-12 06:12:08.0	76	0.00	0.75
2013-12-12 18:12:09.0	76	0.00	0.75
2013-12-13 06:12:10.0	76	0.00	0.75
2013-12-13 18:12:11.0	76	0.00	0.75
2013-12-14 06:12:12.0	76	0.00	0.75
2013-12-14 18:12:13.0	76	0.00	0.75
2013-12-15 06:12:15.0	76	0.00	0.75
2013-12-15 18:12:17.0	76	0.00	0.75
2013-12-16 06:12:17.0	76	0.00	0.75
2013-12-16 18:12:18.0	76	0.00	0.75
2013-12-17 06:12:20.0	76	0.00	0.75
2013-12-17 18:12:21.0	76	0.00	0.75
2013-12-18 06:12:22.0	76	0.00	0.75
2013-12-18 18:12:23.0	76	0.00	0.75
2013-12-19 06:12:24.0	76	0.00	0.75
2013-12-19 09:26:53.0	77	0.01	0.76
2013-12-19 09:29:52.0	78	0.01	0.77
2013-12-19 09:36:50.0	79	0.01	0.78
2013-12-19 09:43:31.0	80	0.01	0.79
2013-12-19 10:12:21.0	81	0.01	0.80
2013-12-19 18:12:25.0	81	0.00	0.80
2013-12-20 06:12:27.0	81	0.00	0.80
2013-12-20 18:12:28.0	81	0.00	0.80

2013-12-21 06:12:29.0	81	0.00	0.80
2013-12-21 18:12:30.0	81	0.00	0.80
2013-12-22 06:12:32.0	81	0.00	0.80
2013-12-22 18:12:33.0	81	0.00	0.80
2013-12-23 06:12:35.0	81	0.00	0.80
2013-12-23 18:12:35.0	81	0.00	0.80
2013-12-24 06:12:36.0	81	0.00	0.80
2013-12-24 18:12:38.0	81	0.00	0.80
2013-12-25 06:12:39.0	81	0.00	0.80
2013-12-25 18:12:40.0	81	0.00	0.80
2013-12-26 06:12:41.0	81	0.00	0.80
2013-12-26 18:12:42.0	81	0.00	0.80
2013-12-27 06:12:43.0	81	0.00	0.80
2013-12-27 18:12:45.0	81	0.00	0.80
2013-12-28 06:12:46.0	81	0.00	0.80
2013-12-28 18:12:47.0	81	0.00	0.80
2013-12-29 06:12:48.0	81	0.00	0.80
2013-12-30 18:12:53.0	81	0.00	0.80
2013-12-31 06:12:54.0	81	0.00	0.80
2013-12-31 18:12:55.0	81	0.00	0.80
2014-01-01 06:12:56.0	81	0.00	0.80
2014-01-01 18:12:58.0	81	0.00	0.80
2014-01-02 06:12:59.0	81	0.00	0.80
2014-01-02 18:13:00.0	81	0.00	0.80
2014-01-03 06:13:00.0	81	0.00	0.80
2014-01-03 18:13:02.0	81	0.00	0.80
2014-01-04 06:13:03.0	81	0.00	0.80
2014-01-04 18:13:05.0	81	0.00	0.80
2014-01-05 06:13:06.0	81	0.00	0.80
2014-01-05 18:13:07.0	81	0.00	0.80
2014-01-06 06:13:08.0	81	0.00	0.80
2014-01-06 18:13:09.0	81	0.00	0.80
2014-01-07 06:13:11.0	81	0.00	0.80
2014-01-07 18:13:12.0	81	0.00	0.80
2014-01-08 06:13:13.0	81	0.00	0.80
2014-01-08 18:13:14.0	81	0.00	0.80
2014-01-09 06:13:16.0	81	0.00	0.80
2014-01-09 18:13:17.0	81	0.00	0.80
2014-01-10 06:13:18.0	81	0.00	0.80
2014-01-10 18:13:20.0	81	0.00	0.80
2014-01-11 06:13:21.0	81	0.00	0.80
2014-01-11 18:13:22.0	81	0.00	0.80
2014-01-12 06:13:24.0	81	0.00	0.80
2014-01-12 18:13:25.0	81	0.00	0.80
2014-01-13 06:13:25.0	81	0.00	0.80
2014-01-13 18:13:27.0	81	0.00	0.80
2014-01-14 06:13:29.0	81	0.00	0.80
2014-01-14 18:13:29.0	81	0.00	0.80

2014-01-15 06:13:30.0	81	0.00	0.80
2014-01-15 18:13:31.0	81	0.00	0.80
2014-01-16 06:13:32.0	81	0.00	0.80
2014-01-16 18:13:34.0	81	0.00	0.80
2014-01-17 06:13:35.0	81	0.00	0.80
2014-01-17 18:13:36.0	81	0.00	0.80
2014-01-18 06:13:37.0	81	0.00	0.80
2014-01-18 18:13:38.0	81	0.00	0.80
2014-01-19 06:13:40.0	81	0.00	0.80
2014-01-19 18:13:41.0	81	0.00	0.80
2014-01-20 06:13:42.0	81	0.00	0.80
2014-01-20 18:13:43.0	81	0.00	0.80
2014-01-21 06:13:45.0	81	0.00	0.80
2014-01-21 18:13:45.0	81	0.00	0.80
2014-01-22 06:13:46.0	81	0.00	0.80
2014-01-22 18:13:48.0	81	0.00	0.80
2014-01-23 06:13:50.0	81	0.00	0.80
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2014-01-24 06:13:51.0	81	0.00	0.80
2014-01-24 18:13:53.0	81	0.00	0.80
2014-01-25 06:13:54.0	81	0.00	0.80
2014-01-25 18:13:55.0	81	0.00	0.80
2014-01-26 06:13:56.0	81	0.00	0.80
2014-01-26 18:13:57.0	81	0.00	0.80
2014-01-27 06:13:59.0	81	0.00	0.80
2014-01-27 18:14:00.0	81	0.00	0.80
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2014-01-28 18:14:02.0	81	0.00	0.80
2014-01-29 06:14:03.0	81	0.00	0.80
2014-01-29 18:14:05.0	81	0.00	0.80
2014-01-30 06:14:06.0	81	0.00	0.80
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2014-01-31 06:14:08.0	81	0.00	0.80
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2014-02-01 06:14:11.0	81	0.00	0.80
2014-02-01 18:14:12.0	81	0.00	0.80
2014-02-02 06:14:12.0	81	0.00	0.80
2014-02-02 18:14:14.0	81	0.00	0.80
2014-02-02 18:59:46.0	82	0.01	0.81
2014-02-02 19:10:27.0	83	0.01	0.82
2014-02-02 19:26:51.0	84	0.01	0.83
2014-02-02 19:53:36.0	85	0.01	0.84
2014-02-02 20:16:05.0	86	0.01	0.85
2014-02-03 06:14:15.0	86	0.00	0.85
2014-02-03 18:14:17.0	86	0.00	0.85
2014-02-04 06:14:18.0	86	0.00	0.85
2014-02-04 18:14:20.0	86	0.00	0.85
2014-02-05 06:14:20.0	86	0.00	0.85

2014-02-05 18:14:21.0	86	0.00	0.85
2014-02-06 04:43:41.0	87	0.01	0.86
2014-02-06 06:14:23.0	87	0.00	0.86
2014-02-06 15:31:41.0	88	0.01	0.87
2014-02-06 16:03:30.0	91	0.03	0.90
2014-02-06 16:45:28.0	92	0.01	0.91
2014-02-06 16:57:03.0	93	0.01	0.92
2014-02-06 17:01:55.0	94	0.01	0.93
2014-02-06 17:05:05.0	95	0.01	0.94
2014-02-06 17:12:08.0	96	0.01	0.94
2014-02-06 17:19:48.0	97	0.01	0.95
2014-02-06 17:27:03.0	98	0.01	0.96
2014-02-06 17:39:03.0	99	0.01	0.97
2014-02-06 17:48:11.0	100	0.01	0.98
2014-02-06 17:56:00.0	101	0.01	0.99
2014-02-06 18:04:09.0	102	0.01	1.00
2014-02-06 18:09:32.0	103	0.01	1.01
2014-02-06 18:13:21.0	104	0.01	1.02
2014-02-06 18:14:23.0	104	0.00	1.02
2014-02-06 18:15:28.0	105	0.01	1.03
2014-02-06 18:17:54.0	106	0.01	1.04
2014-02-06 18:21:28.0	107	0.01	1.05
2014-02-06 18:27:29.0	108	0.01	1.06
2014-02-06 18:35:03.0	109	0.01	1.07
2014-02-06 18:43:18.0	110	0.01	1.08
2014-02-06 19:08:03.0	111	0.01	1.09
2014-02-07 06:14:25.0	111	0.00	1.09
2014-02-07 18:14:26.0	111	0.00	1.09
2014-02-08 06:14:28.0	111	0.00	1.09
2014-02-08 18:14:29.0	111	0.00	1.09
2014-02-09 06:14:30.0	111	0.00	1.09
2014-02-09 18:14:31.0	111	0.00	1.09
2014-02-10 06:14:32.0	111	0.00	1.09
2014-02-10 18:14:34.0	111	0.00	1.09
2014-02-11 06:14:34.0	111	0.00	1.09
2014-02-11 18:14:35.0	111	0.00	1.09
2014-02-12 06:14:37.0	111	0.00	1.09
2014-02-12 18:14:38.0	111	0.00	1.09
2014-02-13 06:14:39.0	111	0.00	1.09
2014-02-13 18:14:40.0	111	0.00	1.09
2014-02-14 06:14:41.0	111	0.00	1.09
2014-02-14 18:14:43.0	111	0.00	1.09
2014-02-15 06:14:44.0	111	0.00	1.09
2014-02-15 18:14:45.0	111	0.00	1.09
2014-02-16 06:14:46.0	111	0.00	1.09
2014-02-16 18:14:47.0	111	0.00	1.09
2014-02-17 06:14:49.0	111	0.00	1.09
2014-02-17 18:14:50.0	111	0.00	1.09

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2014-02-18 18:14:51.0	111	0.00	1.09
2014-02-19 06:14:53.0	111	0.00	1.09
2014-02-19 18:14:55.0	111	0.00	1.09
2014-02-20 06:14:55.0	111	0.00	1.09
2014-02-20 18:14:56.0	111	0.00	1.09
2014-02-21 06:14:58.0	111	0.00	1.09
2014-02-21 18:14:58.0	111	0.00	1.09
2014-02-22 06:15:00.0	111	0.00	1.09
2014-02-22 18:15:02.0	111	0.00	1.09
2014-02-23 06:15:02.0	111	0.00	1.09
2014-02-23 18:15:03.0	111	0.00	1.09
2014-02-24 06:15:04.0	111	0.00	1.09
2014-02-24 18:15:06.0	111	0.00	1.09
2014-02-25 06:15:07.0	111	0.00	1.09
2014-02-25 18:15:09.0	111	0.00	1.09
2014-02-26 06:15:09.0	111	0.00	1.09
2014-02-26 18:15:11.0	111	0.00	1.09
2014-02-26 19:46:17.0	112	0.01	1.10
2014-02-26 23:24:15.0	113	0.01	1.11
2014-02-26 23:27:16.0	114	0.01	1.12
2014-02-26 23:29:03.0	115	0.01	1.13
2014-02-26 23:30:35.0	116	0.01	1.14
2014-02-26 23:31:54.0	117	0.01	1.15
2014-02-26 23:33:24.0	118	0.01	1.16
2014-02-26 23:34:37.0	119	0.01	1.17
2014-02-26 23:37:45.0	120	0.01	1.18
2014-02-26 23:44:00.0	122	0.02	1.20
2014-02-26 23:47:13.0	123	0.01	1.21
2014-02-27 00:02:22.0	124	0.01	1.22
2014-02-27 00:15:46.0	125	0.01	1.23
2014-02-27 00:21:26.0	126	0.01	1.24
2014-02-27 00:25:11.0	127	0.01	1.25
2014-02-27 00:27:50.0	128	0.01	1.26
2014-02-27 00:32:45.0	129	0.01	1.27
2014-02-27 00:39:17.0	130	0.01	1.28
2014-02-27 00:39:59.0	131	0.01	1.29
2014-02-27 00:40:31.0	132	0.01	1.30
2014-02-27 00:41:42.0	134	0.02	1.32
2014-02-27 00:50:37.0	137	0.03	1.35
2014-02-27 00:51:57.0	138	0.01	1.36
2014-02-27 00:52:57.0	139	0.01	1.37
2014-02-27 00:53:52.0	140	0.01	1.38
2014-02-27 01:21:46.0	143	0.03	1.41
2014-02-27 01:29:44.0	144	0.01	1.42
2014-02-27 01:39:22.0	145	0.01	1.43
2014-02-27 01:43:33.0	146	0.01	1.44
2014-02-27 01:48:53.0	148	0.02	1.46

2014-02-27 01:55:15.0	150	0.02	1.48
2014-02-27 01:58:30.0	152	0.02	1.50
2014-02-27 02:04:17.0	154	0.02	1.52
2014-02-27 02:05:27.0	155	0.01	1.53
2014-02-27 02:08:34.0	156	0.01	1.54
2014-02-27 02:10:51.0	157	0.01	1.55
2014-02-27 02:13:22.0	158	0.01	1.56
2014-02-27 02:15:49.0	159	0.01	1.56
2014-02-27 02:20:14.0	161	0.02	1.58
2014-02-27 02:26:06.0	163	0.02	1.60
2014-02-27 02:29:52.0	164	0.01	1.61
2014-02-27 02:36:23.0	166	0.02	1.63
2014-02-27 02:45:09.0	168	0.02	1.65
2014-02-27 02:52:14.0	169	0.01	1.66
2014-02-27 03:07:39.0	171	0.02	1.68
2014-02-27 03:11:39.0	172	0.01	1.69
2014-02-27 03:17:02.0	174	0.02	1.71
2014-02-27 03:18:59.0	175	0.01	1.72
2014-02-27 03:21:52.0	176	0.01	1.73
2014-02-27 03:27:29.0	177	0.01	1.74
2014-02-27 03:37:27.0	179	0.02	1.76
2014-02-27 03:40:02.0	180	0.01	1.77
2014-02-27 03:46:28.0	181	0.01	1.78
2014-02-27 03:59:54.0	182	0.01	1.79
2014-02-27 04:16:29.0	184	0.02	1.81
2014-02-27 04:27:42.0	185	0.01	1.82
2014-02-27 04:39:09.0	186	0.01	1.83
2014-02-27 04:44:52.0	187	0.01	1.84
2014-02-27 04:54:51.0	188	0.01	1.85
2014-02-27 04:56:11.0	189	0.01	1.86
2014-02-27 04:57:28.0	190	0.01	1.87
2014-02-27 05:03:16.0	191	0.01	1.88
2014-02-27 06:15:11.0	191	0.00	1.88
2014-02-27 06:20:19.0	192	0.01	1.89
2014-02-27 18:15:13.0	192	0.00	1.89
2014-02-27 23:15:04.0	193	0.01	1.90
2014-02-27 23:46:38.0	195	0.02	1.92
2014-02-27 23:50:43.0	196	0.01	1.93
2014-02-27 23:53:41.0	197	0.01	1.94
2014-02-27 23:57:24.0	198	0.01	1.95
2014-02-28 00:02:00.0	199	0.01	1.96
2014-02-28 00:07:53.0	200	0.01	1.97
2014-02-28 00:14:50.0	201	0.01	1.98
2014-02-28 00:24:50.0	202	0.01	1.99
2014-02-28 00:47:08.0	203	0.01	2.00
2014-02-28 01:03:42.0	204	0.01	2.01
2014-02-28 01:12:18.0	205	0.01	2.02
2014-02-28 01:17:18.0	206	0.01	2.03

2014-02-28 01:24:04.0	207	0.01	2.04
2014-02-28 01:33:46.0	208	0.01	2.05
2014-02-28 01:42:18.0	209	0.01	2.06
2014-02-28 01:56:21.0	210	0.01	2.07
2014-02-28 02:00:45.0	211	0.01	2.08
2014-02-28 02:09:54.0	212	0.01	2.09
2014-02-28 02:15:27.0	213	0.01	2.10
2014-02-28 02:18:10.0	215	0.02	2.12
2014-02-28 02:19:34.0	216	0.01	2.13
2014-02-28 02:21:05.0	217	0.01	2.14
2014-02-28 02:23:05.0	218	0.01	2.15
2014-02-28 02:25:34.0	219	0.01	2.16
2014-02-28 02:30:41.0	222	0.03	2.19
2014-02-28 02:36:02.0	224	0.02	2.20
2014-02-28 02:37:38.0	225	0.01	2.21
2014-02-28 02:39:16.0	226	0.01	2.22
2014-02-28 02:41:21.0	227	0.01	2.23
2014-02-28 02:44:33.0	228	0.01	2.24
2014-02-28 02:46:19.0	229	0.01	2.25
2014-02-28 02:48:57.0	231	0.02	2.27
2014-02-28 02:50:25.0	232	0.01	2.28
2014-02-28 02:53:15.0	234	0.02	2.30
2014-02-28 02:55:17.0	235	0.01	2.31
2014-02-28 02:59:33.0	236	0.01	2.32
2014-02-28 03:58:27.0	239	0.03	2.35
2014-02-28 04:03:27.0	240	0.01	2.36
2014-02-28 04:05:00.0	241	0.01	2.37
2014-02-28 04:08:43.0	244	0.03	2.40
2014-02-28 04:10:11.0	245	0.01	2.41
2014-02-28 04:18:16.0	252	0.01	2.42
2014-02-28 04:20:09.0	254	0.02	2.44
2014-02-28 04:21:58.0	255	0.01	2.45
2014-02-28 04:27:02.0	257	0.02	2.47
2014-02-28 04:39:23.0	259	0.02	2.49
2014-02-28 05:01:25.0	263	0.04	2.53
2014-02-28 06:15:13.0	264	0.01	2.54
2014-02-28 06:41:46.0	265	0.01	2.55
2014-02-28 06:46:55.0	266	0.01	2.56
2014-02-28 06:58:18.0	269	0.03	2.59
2014-02-28 06:59:10.0	272	0.03	2.62
2014-02-28 07:02:46.0	275	0.03	2.65
2014-02-28 07:05:43.0	276	0.01	2.66
2014-02-28 07:06:48.0	277	0.01	2.67
2014-02-28 07:29:16.0	295	0.05	2.72
2014-02-28 07:31:01.0	296	0.01	2.73
2014-02-28 07:33:45.0	297	0.01	2.74
2014-02-28 07:45:33.0	300	0.03	2.77
2014-02-28 07:48:19.0	302	0.02	2.79

2014-02-28 07:50:33.0	304	0.02	2.81
2014-02-28 07:52:57.0	306	0.02	2.82
2014-02-28 08:41:56.0	307	0.01	2.83
2014-02-28 09:06:29.0	308	0.01	2.84
2014-02-28 09:08:26.0	309	0.01	2.85
2014-02-28 09:11:34.0	311	0.02	2.87
2014-02-28 09:14:01.0	314	0.03	2.90
2014-02-28 09:23:21.0	318	0.04	2.94
2014-02-28 09:28:41.0	320	0.02	2.96
2014-02-28 09:42:39.0	323	0.03	2.99
2014-02-28 13:23:38.0	325	0.02	3.01
2014-02-28 13:30:12.0	326	0.01	3.02
2014-02-28 13:35:15.0	329	0.03	3.05
2014-02-28 13:44:11.0	331	0.02	3.07
2014-02-28 13:49:16.0	335	0.04	3.11
2014-02-28 13:50:46.0	337	0.02	3.13
2014-02-28 13:51:15.0	338	0.01	3.14
2014-02-28 13:51:40.0	340	0.02	3.16
2014-02-28 13:52:05.0	341	0.01	3.17
2014-02-28 13:52:38.0	342	0.01	3.18
2014-02-28 13:54:05.0	343	0.01	3.19
2014-02-28 14:04:15.0	346	0.03	3.22
2014-02-28 14:35:27.0	348	0.02	3.24
2014-02-28 15:08:21.0	350	0.02	3.26
2014-02-28 15:14:32.0	351	0.01	3.27
2014-02-28 18:15:15.0	351	0.00	3.27
2014-02-28 18:30:07.0	352	0.01	3.28
2014-02-28 18:32:34.0	353	0.01	3.29
2014-02-28 18:32:46.0	355	0.02	3.31
2014-02-28 18:32:57.0	357	0.02	3.33
2014-02-28 18:33:10.0	359	0.02	3.35
2014-02-28 18:33:22.0	361	0.02	3.37
2014-02-28 18:33:33.0	363	0.02	3.39
2014-02-28 18:33:43.0	365	0.02	3.41
2014-02-28 18:33:57.0	367	0.02	3.43
2014-02-28 18:34:25.0	368	0.01	3.44
2014-02-28 18:34:46.0	370	0.02	3.45
2014-02-28 18:35:15.0	371	0.01	3.46
2014-02-28 18:35:45.0	372	0.01	3.47
2014-02-28 18:36:15.0	373	0.01	3.48
2014-02-28 18:37:34.0	374	0.01	3.49
2014-02-28 18:38:30.0	375	0.01	3.50
2014-02-28 18:40:32.0	378	0.03	3.53
2014-02-28 18:41:35.0	380	0.02	3.55
2014-02-28 18:41:48.0	382	0.02	3.57
2014-02-28 18:42:03.0	384	0.02	3.59
2014-02-28 18:42:32.0	388	0.04	3.63
2014-02-28 18:43:16.0	392	0.04	3.67

2014-02-28 18:43:45.0	393	0.01	3.68
2014-02-28 18:44:02.0	395	0.02	3.70
2014-02-28 18:44:25.0	396	0.01	3.71
2014-02-28 18:44:43.0	398	0.02	3.73
2014-02-28 18:45:03.0	400	0.02	3.75
2014-02-28 18:45:26.0	401	0.01	3.76
2014-02-28 18:46:05.0	404	0.03	3.79
2014-02-28 18:46:20.0	406	0.02	3.81
2014-02-28 18:47:45.0	409	0.03	3.84
2014-02-28 18:49:06.0	410	0.01	3.85
2014-02-28 18:50:57.0	411	0.01	3.86
2014-02-28 18:54:05.0	414	0.03	3.89
2014-02-28 18:55:29.0	418	0.04	3.93
2014-02-28 18:56:35.0	422	0.04	3.97
2014-02-28 18:56:54.0	424	0.02	3.99
2014-02-28 18:57:25.0	425	0.01	4.00
2014-02-28 18:57:57.0	426	0.01	4.01
2014-02-28 19:03:55.0	427	0.01	4.02
2014-03-01 06:15:16.0	427	0.00	4.02
2014-03-01 18:05:53.0	428	0.01	4.03
2014-03-01 18:15:17.0	428	0.00	4.03
2014-03-02 18:15:19.0	428	0.00	4.03
2014-03-03 06:15:21.0	428	0.00	4.03
2014-03-03 18:15:22.0	428	0.00	4.03
2014-03-04 06:15:23.0	428	0.00	4.03
2014-03-04 18:15:24.0	428	0.00	4.03
2014-03-05 06:15:25.0	428	0.00	4.03
2014-03-05 18:15:27.0	428	0.00	4.03
2014-03-06 06:15:27.0	428	0.00	4.03
2014-03-07 06:15:29.0	428	0.00	4.03
2014-03-07 18:15:31.0	428	0.00	4.03
2014-03-08 06:15:32.0	428	0.00	4.03
2014-03-08 18:15:33.0	428	0.00	4.03
2014-03-09 07:15:34.0	428	0.00	4.03
2014-03-09 19:15:35.0	428	0.00	4.03
2014-03-10 07:15:37.0	428	0.00	4.03
2014-03-10 19:15:37.0	428	0.00	4.03
2014-03-11 07:15:38.0	428	0.00	4.03
2014-03-11 19:15:40.0	428	0.00	4.03
2014-03-12 07:15:41.0	428	0.00	4.03
2014-03-12 19:15:42.0	428	0.00	4.03
2014-03-13 07:15:43.0	428	0.00	4.03
2014-03-13 19:15:44.0	428	0.00	4.03
2014-03-14 07:15:45.0	428	0.00	4.03
2014-03-14 19:15:46.0	428	0.00	4.03
2014-03-15 07:15:48.0	428	0.00	4.03
2014-03-15 19:15:49.0	428	0.00	4.03
2014-03-16 07:15:50.0	428	0.00	4.03

2014-03-16 19:15:51.0	428	0.00	4.03
2014-03-17 07:15:51.0	428	0.00	4.03
2014-03-17 19:15:53.0	428	0.00	4.03
2014-03-18 07:15:53.0	428	0.00	4.03
2014-03-18 19:15:55.0	428	0.00	4.03
2014-03-19 07:15:56.0	428	0.00	4.03
2014-03-19 19:15:57.0	428	0.00	4.03
2014-03-20 07:15:59.0	428	0.00	4.03
2014-03-20 19:16:00.0	428	0.00	4.03
2014-03-21 07:16:00.0	428	0.00	4.03
2014-03-21 19:16:01.0	428	0.00	4.03
2014-03-22 07:16:03.0	428	0.00	4.03
2014-03-22 19:16:04.0	428	0.00	4.03
2014-03-23 07:16:05.0	428	0.00	4.03
2014-03-23 19:16:06.0	428	0.00	4.03
2014-03-24 07:16:08.0	428	0.00	4.03
2014-03-24 19:16:09.0	428	0.00	4.03
2014-03-25 07:16:09.0	428	0.00	4.03
2014-03-25 19:16:10.0	428	0.00	4.03
2014-03-26 01:40:42.0	429	0.01	4.04
2014-03-26 01:55:03.0	430	0.01	4.05
2014-03-26 07:16:12.0	430	0.00	4.05
2014-03-27 07:16:13.0	430	0.00	4.05
2014-03-27 19:16:15.0	430	0.00	4.05
2014-03-28 07:16:16.0	430	0.00	4.05
2014-03-28 19:16:17.0	430	0.00	4.05
2014-03-29 07:16:18.0	430	0.00	4.05
2014-03-29 19:16:19.0	430	0.00	4.05
2014-03-30 07:16:21.0	430	0.00	4.05
2014-03-30 19:16:22.0	430	0.00	4.05
2014-03-31 07:16:23.0	430	0.00	4.05
2014-03-31 19:16:24.0	430	0.00	4.05
2014-04-01 01:39:43.0	433	0.03	4.07
2014-04-01 07:16:25.0	433	0.00	4.07
2014-04-01 19:16:26.0	433	0.00	4.07
2014-04-01 23:58:27.0	434	0.01	4.08
2014-04-02 00:00:53.0	435	0.01	4.09
2014-04-02 00:02:14.0	436	0.01	4.10
2014-04-02 00:03:18.0	437	0.01	4.11
2014-04-02 00:03:57.0	438	0.01	4.12
2014-04-02 00:04:28.0	439	0.01	4.13
2014-04-02 00:04:57.0	440	0.01	4.14
2014-04-02 00:05:27.0	441	0.01	4.15
2014-04-02 00:06:27.0	443	0.02	4.17
2014-04-02 00:07:40.0	444	0.01	4.18
2014-04-02 00:09:04.0	445	0.01	4.19
2014-04-02 00:09:27.0	446	0.01	4.20
2014-04-02 00:09:57.0	447	0.01	4.21

2014-04-02 00:10:26.0	448	0.01	4.22
2014-04-02 00:11:26.0	450	0.02	4.24
2014-04-02 00:13:30.0	451	0.01	4.25
2014-04-02 00:19:40.0	453	0.02	4.27
2014-04-02 00:47:51.0	454	0.01	4.28
2014-04-02 01:09:24.0	455	0.01	4.29
2014-04-02 01:11:28.0	456	0.01	4.30
2014-04-02 04:01:34.0	458	0.02	4.32
2014-04-02 07:16:27.0	458	0.00	4.32
2014-04-02 19:16:29.0	458	0.00	4.32
2014-04-03 07:16:30.0	458	0.00	4.32
2014-04-03 19:16:31.0	458	0.00	4.32
2014-04-04 07:16:32.0	458	0.00	4.32
2014-04-04 19:16:33.0	458	0.00	4.32
2014-04-05 07:16:34.0	458	0.00	4.32
2014-04-05 19:16:36.0	458	0.00	4.32
2014-04-06 07:16:37.0	458	0.00	4.32
2014-04-06 19:16:37.0	458	0.00	4.32
2014-04-07 07:16:39.0	458	0.00	4.32
2014-04-07 19:16:39.0	458	0.00	4.32
2014-04-08 07:16:40.0	458	0.00	4.32
2014-04-08 19:16:42.0	458	0.00	4.32
2014-04-09 07:16:43.0	458	0.00	4.32
2014-04-09 19:16:44.0	458	0.00	4.32
2014-04-10 07:16:45.0	458	0.00	4.32
2014-04-10 19:16:46.0	458	0.00	4.32
2014-04-11 07:16:47.0	458	0.00	4.32
2014-04-11 19:16:48.0	458	0.00	4.32
2014-04-12 07:16:50.0	458	0.00	4.32
2014-04-12 19:16:50.0	458	0.00	4.32
2014-04-13 07:16:52.0	458	0.00	4.32
2014-04-14 07:16:54.0	458	0.00	4.32
2014-04-14 19:16:55.0	458	0.00	4.32
2014-04-15 07:16:55.0	458	0.00	4.32
2014-04-15 19:16:57.0	458	0.00	4.32
2014-04-16 07:16:58.0	458	0.00	4.32
2014-04-16 19:16:59.0	458	0.00	4.32
2014-04-17 07:17:00.0	458	0.00	4.32
2014-04-17 19:17:01.0	458	0.00	4.32
2014-04-18 07:17:02.0	458	0.00	4.32
2014-04-18 19:17:03.0	458	0.00	4.32
2014-04-19 07:17:05.0	458	0.00	4.32
2014-04-19 19:17:05.0	458	0.00	4.32
2014-04-20 07:17:06.0	458	0.00	4.32
2014-04-20 19:17:07.0	458	0.00	4.32
2014-04-21 07:17:09.0	458	0.00	4.32
2014-04-21 19:17:10.0	458	0.00	4.32
2014-04-22 07:17:11.0	458	0.00	4.32

2014-04-22 19:17:12.0	458	0.00	4.32
2014-04-23 07:17:13.0	458	0.00	4.32
2014-04-23 19:17:14.0	458	0.00	4.32
2014-04-24 07:17:16.0	458	0.00	4.32
2014-04-24 19:17:16.0	458	0.00	4.32
2014-04-25 07:17:18.0	458	0.00	4.32
2014-04-25 19:17:19.0	458	0.00	4.32
2014-04-25 21:54:27.0	460	0.02	4.34
2014-04-26 19:17:21.0	460	0.00	4.34
2014-04-27 07:17:22.0	460	0.00	4.34
2014-04-27 19:17:23.0	460	0.00	4.34
2014-04-28 07:17:25.0	460	0.00	4.34
2014-04-28 19:17:25.0	460	0.00	4.34
2014-04-29 07:17:27.0	460	0.00	4.34
2014-04-29 19:17:28.0	460	0.00	4.34
2014-04-30 07:17:28.0	460	0.00	4.34
2014-04-30 19:17:29.0	460	0.00	4.34