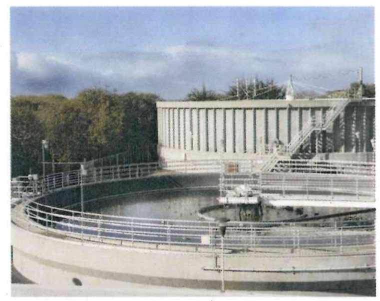
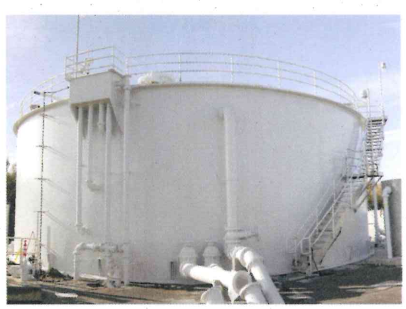
South San Luis Obispo County Sanitation District

Inflow and Infiltration Study

Final Report








Prepared by Wallace Group
August 3, 2011

REGISTERED PROFESSIONAL ENGINEER
AARON P. YONKER
No. 77914
Exp. 06-30-13
CIVIL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
VALERIE G. HUFF
No. 72426
Exp. 06-30-12
CIVIL
STATE OF CALIFORNIA

Executive Summary

The District Inflow and Infiltration study was initiated upon discovery of elevated sewer flows at the District treatment plant during the significant rain event of December 18-19, 2010 which resulted in severe localized flooding across much of the Oceano Community, including the plant grounds and ultimately led to the temporary failure of the influent pumping plant. Preliminary review of historical plant throughput records for similar, prior significant rain events also indicated elevated sewer flows during and immediately after precipitation events.

The study consisted of the following primary components:

- Flow monitoring
- Rainfall data review
- Historical in-plant flow review
- Field investigation
- Future recommendations

The purpose of the I/I study was to identify general locations along the District Trunk Sewer, broken down by Member Agency tributary areas, which indicate excessive ground and storm water entry into the District treatment works. To perform this task, wastewater flow monitoring devices were placed at strategic locations throughout the District trunk sewer. Data gathered from the flow monitoring devices was utilized to generate representative dry and wet weather diurnal wastewater flow patterns for the period monitored. Evaluation of the wet-weather flow patterns against representative dry-weather patterns from the same period provided an indication of wastewater flow increases attributed to the influence of precipitation activities relative to the sewer tributaries.

Rain data collected from local area rain gauges provided a datum to which sewer flow variation and response could be evaluated. The timeframe between observed precipitation and increased wastewater flow relative to the representative dry-weather flow patterns provided indication as to the source type of water entering the collection system as a result of the precipitation activities.

Inflow, extraneous water that enters the system primarily through surface inputs and illegal services connections, was identified by an observed rapid flow increase and a quick return to prior flow conditions. Infiltration, extraneous water that enters the system from the ground, primarily through system defects and cracks, was identified by the rather long time that it took the elevated flows to return to prior flow conditions.

Historical plant flow records were assessed in a similar fashion and field investigations were performed to evaluate manholes indicating a high likelihood of contributing ground and storm water to the collections system.

Report Conclusions are as follows:

<u>Arroyo Grande Basin</u>

The Arroyo Grande basin contributed the largest volume of I/I during the flow monitoring period. This basin warrants a more detailed flow monitoring study to locate sources of I/I. The flow monitor located in manhole C18 recorded the highest volume of I/I in the system, and data is indicative of both infiltration and inflow. This flow monitor is located downstream from the

Arroyo Grande creek, indicating that the siphon crossing under the Arroyo Grande Creek may be contributing I/I flow to the District Trunk System.

<u>Grover Beach Basin</u>
This basin has minimal I/I for the majority of storm events, and exhibits inflow only during larger storm events. Additional flow monitoring is not warranted at this time. The potential for inflow may be further studied by conducting field investigations to locate manholes in obvious paths of surface flow.

<u>Oceano Basin</u>
Monitoring data exhibits both infiltration and inflow in the Oceano basin. This basin warrants a more detailed study to locate sources of I/I. The area of west Oceano and the portion of the collection system that flows to the lift station exhibit the most likely indications of infiltration. The field investigation identified a few potential locations of both infiltration and inflow.

Based on the conclusions acquired as part of this study the following recommendations are made:

1. Provide additional future flow monitoring studies within the Arroyo Grande Basin during the 2011-12 rainy season, and more specifically:
    - Develop a flow monitoring location plan aimed at reducing the overall basin into smaller more manageable basins that could identify areas which show a high prevalence of I/I and exclude areas which due not warrant additional subsequent field testing;
    - Implement techniques that provide information relative to on-trunk and off-trunk (i.e. Arroyo Grande Collection System) source locations;
    - Isolate flow contributions that may be originating from the Arroyo Grande Creek between Manhole C20 and C20a;
    - Coordinate with City staff to review dry weather flow monitoring data currently being implemented as part of the City's 2011 Waste Water Master Plan update and 2011 sewer flow model update;
    - Coordinate with City staff to utilize City sewer lift station data in conjunction with future flow monitoring data to more thoroughly identify I/I source locations.

2. Provide additional future flow monitoring studies within the Oceano Community Services District Basin during the 2011-12 rainy season, and more specifically:
    - Develop a flow monitoring location plan aimed at reducing the overall basin into smaller more manageable basins that identify areas which could identify areas which show a high prevalence of I/I and exclude areas which due not warrant additional subsequent field testing;
    - Implement techniques that provide information relative to on-trunk and off-trunk (i.e. OCSD Collection System) source locations;
    - Evaluate per-capita municipal water usage against per-capita sewer contributions to determine if elevated per-capita sewer contributions observed in this study are repeatable and if so, evaluate likelihood of potential long-term groundwater infiltration currently being recognized as base sewer flow;
    - Coordinate with OCSD staff to initiate manhole inspections in areas where inflow was observed during field investigation efforts (OCSD Manhole A1-D, A3-A and others);

3. Exclude the Grover Beach Basin from future wet weather flow monitoring studies based on relatively minor I/I contributions observed.

4. Initiate calibration of both the influent and effluent flow meters at the District treatment plant to confirm or deny the minor discrepancies noted between flow variations occurring during this study, understanding that effluent flow values should be slightly greater than influent flow values due to process return flow re-entering the head works structure downstream of the influent flow meter and due to onsite drainage entering the head works structure downstream of the influent flow meter.
   - If calibration of influent and effluent flow meters indicate that each are recording properly, evaluate likelihood of I/I contributions to the subgrade onsite treatment works process piping subjected to known elevated water tables.

Section 1: Purpose

The purpose of this report is to provide a summary of the initial Inflow and Infiltration (I/I) analysis performed on the District trunk sewer. The study was initiated upon discovery of elevated sewer flows at the District treatment plant during the significant rain event of December 18-19, 2010 which resulted in severe localized flooding across portions of the Oceano Community, including the plant grounds, ultimately leading to the temporary failure of the influent pumping plant. Preliminary review of historical plant throughput records for similar recent significant rain events also indicated elevated sewer flows during and immediately after these precipitation events.

This initial Inflow and Infiltration analysis study consisted of the following components:

- Trunk Sewer Flow monitoring
- Rainfall data review
- Historical in-plant flow review
- Field investigation

Specifically, the purpose of this study was to:

- Identify areas broken down by sewer basin along the District trunk sewer where ground and/or storm water are contributing to extraneous sewer flows to the District treatment plant;
- Evaluate diurnal wastewater trends for dry vs. wet-weather flow for current and historic timeframes;
- Assess wet-weather wastewater flow patterns relative to available rainfall data (intensity and duration);
- Develop current and historic daily and weekly average dry-weather and wet-weather flow patterns for use in determining the influence of precipitation and groundwater on observed wastewater flows;
- Develop Inflow and Infiltration (I/I) percentage increases and associated volumes over average daily and weekly dry-weather flows per sewer basin relative to rainfall totals.
- Evaluate the presence of Inflow vs. Infiltration on the system.

Section 2: Approach

Seven Flo-Dar brand non-contact flow measuring devices were placed within the District trunk sewer to capture flow variations relative to observed precipitation contributions. Placement of the flow measuring devices at strategically assigned locations (Section 6) delineated the District trunk sewer into three smaller sewer basins, defined specifically by Member Agency contributions. Data collected from the flow monitoring devices was utilized to generate daily and weekly average flow patterns during non-precipitation events. The daily and weekly average flow patterns developed were then evaluated against flow patterns occurring during precipitation events (Section 10). Historical diurnal flow patterns developed from prior District treatment plant throughput records over the past three years were generated and provided the basis for historic dry-weather vs. wet-weather system flows (Section 8). In each case, relevant rain data was acquired and formed the basis for sewer response time and quantity assessment.

The time between observed precipitation and increased wet-weather wastewater flow relative to dry-weather flow patterns provided important indicators as to the I/I sources. Inflow to the trunk sewer caused an observed rapid (one or two hour) flow increase to the sewered area and a quick return to the antecedent flow condition. Infiltration to the sewered area on the other hand caused a much slower response to the monitored flow, most notable by the rather long time of elevated flow recession.

The primary component of this I/I study was sewer flow monitoring. Consistent with standard approaches, the flow monitoring applied a “broad brush” I/I discovery method aimed at reducing large collection systems into smaller more manageable sewer basins to more readily identify the effects of I/I on the system. By breaking down the trunk sewer into smaller more manageable sewer basins, the study was able identify those basins which showed a high prevalence of Inflow and/or Infiltration as well as exclude those that do not warrant additional study at this time.

Overall conclusions and recommendations for preferred “next steps” are provided in Sections 12 and 13 of this report.

Section 3: Inflow and Infiltration Background

For the purposes of this study, the following definitions are provided:

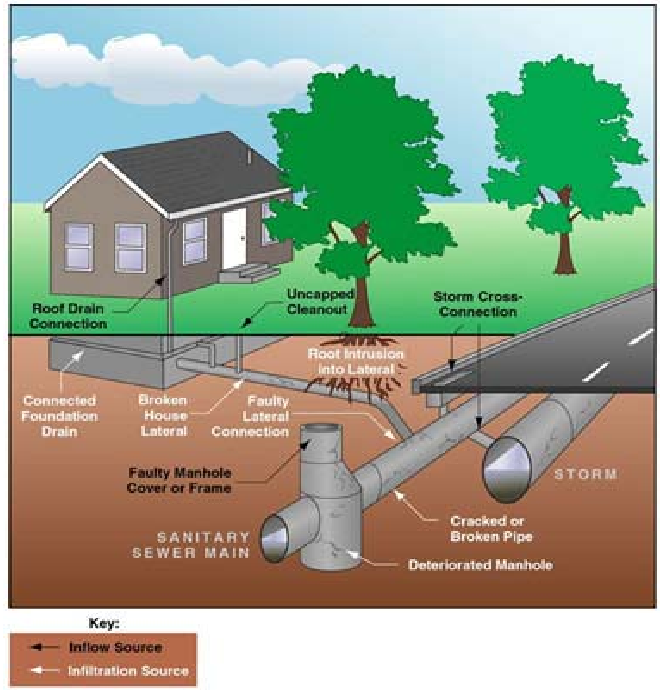
Inflow: Inflow is defined as the portion of wastewater which is extraneous water that flows into a sewer system from sources such as gaps around manhole covers, catch basins, cross-connections with storm drains, sump pumps, roof downspouts, surface drains, drains from springs and swampy areas, and other inlets. Inflow is largely the result of rain day (stormwater) influences on the sewer system. Inflow differs from infiltration in that it is the result of direct connections of extraneous sources into the collection system and, generally, is not linked to fluctuations in the groundwater table.

Infiltration: Infiltration is defined as the component of wastewater that is extraneous water entering the sewer system from underground through sources such as defective sewer pipes and laterals, sewer pipe joints, connections, and manhole walls. Some quantity of infiltration is generally expected to be present in wastewater flow throughout the year. Because infiltration is directly influenced by groundwater fluctuations, the volume of infiltration entering a sewer system is generally expected to fluctuate from season to season with typically larger volumes anticipated in the winter and spring and smaller volumes anticipated in the summer and fall.

General Characterization of the Dominant Sources of Inflow and Infiltration

The dominant sources of Inflow and Infiltration to a municipal collection system include:

- Faulty manhole cover or frame
- Deteriorated manholes
- Cracked or broken pipes
- Storm drain cross connects
- Faulty lateral connections
- Broken service laterals
- Root intrusion into main and laterals
- Uncapped cleanout
- Roof drain connection
- Connected foundation drain



Graphic courtesy King County Department of Natural Resources and Parks, Wastewater Treatment Division, Regional Infiltration and Inflow Control Program.

The graphic to the right provides examples of how Inflow and Infiltration may enter a municipal sewer line. Locations shown in black text represent common sources of Inflow. Locations shown in white text represent common sources of Infiltration.

Most common forms of Inflow to a system include faulty manhole covers or frames, and illegal sewer connections within homes or businesses. A single sump pump operating at 5 gallons per minute can discharge over 7000 gallons of water into a collection system in a single day.

Most common forms of Infiltration to a system include entry through cracks or leaks in sewer pipes or manholes caused by age-related deterioration, loose joints, poor design, installation or maintenance errors, damage, or root infiltration. Ground and/or storm water can enter these cracks wherever sewer systems lie beneath water tables or rain induced saturated soil. Sewer pipes installed beneath creeks or streams are particularly susceptible to infiltration when they crack or break. Average sewer pipes are designed to last between 20-50 years, depending on the material used[1] However with proper installation and maintenance they can last significantly longer than that.

A well-planned and implemented I/I study must consider cost-effective approaches to identifying and subsequently removing I/I from the sewer collection system. This process usually consists of increasingly focused, successive tests; each providing additional, supporting information and leading closer to the I/I source(s).

[1] http://www.globalw.com/support/inflow.html

The usual sequence of field tests is as follows:

1. Flow Monitoring
2. Smoke Testing
3. Dye Testing
4. Closed Circuit Television Inspection
5. Building Inspections
6. Foundation Drain Testing

The first four tests are used to address I/I sources within publicly owned collection systems. Tests five and six are implemented to address Inflow and Infiltration on private property. A well-planned study might include all of the steps listed above, but the overall magnitude of the effort for each step will depend on the findings of the prior steps. The purpose of proceeding sequentially is to undertake the program in the most economical way.

The phase which is often considered to be of the greatest importance is flow monitoring. Flow monitoring typically implements a “broad brush” discovery approach aimed at reducing the overall collection system into smaller more manageable basins through the strategic placement of flow monitoring devices. For example, dividing a collection system into five equally sized basins may eliminate one or two of the areas from further investigation, thereby reducing expenditures associated with subsequent field testing. The purpose of this study was to identify basins showing a high prevalence of I/I and make recommendations to the District Board to pursue subsequent, cost-effective field tests aimed at reducing potential I/I sources in the District trunk sewer.

Section 4: District Background

South San Luis Obispo County Sanitation District

The South San Luis Obispo County Sanitation District owns and operates a secondary treatment facility (treatment plant or WWTP) and ocean disposal facility located at 1600 Aloha Place in Oceano, CA. The design average flow capacity at the treatment plant is 4.2 million gallons per day (mgd). The design peak-day wet-weather flow is 8.4 mgd and the design instantaneous wet-weather flow rate is 10.0 mgd.

Treatment is provided through the following process elements:

- Head Works – Flow Meter and Raw Wastewater Pump Station
- Primary Clarification
- Secondary Treatment Utilizing a Biological Fixed Film Reactor
- Secondary Clarification
- Disinfection and Dechlorination
- Gravity Ocean Outfall (shared with the City of Pismo Beach)

Hydraulically, the treatment plant is operating at approximately 53% hydraulic capacity (2.63 mgd)[2]. Treatment plant capacity is not established by contract and therefore is not apportioned amongst the varying Member Agencies. The District’s geographic service area is approximately

[2] District Flow Records, 2010 Annual Report

16.5 square miles, extending across much of the City of Arroyo Grande, the City of Grover Beach, and the Oceano Community Services District.

Member Agencies

The South San Luis Obispo County Sanitation District provides services to the three District Member Agencies. The three Member Agencies are comprised of the City of Arroyo Grande, the City of Grover Beach, and the Oceano Community Services District.

Each agency resides within the District's geographical service area, but each agency retains ownership and direct responsibility for wastewater collections within their own respective community boundaries. The South San Luis Obispo County Sanitation District provides interceptor sewers (trunk sewers) that are connected to each of the Member Agencies respective collection systems for transport of the wastewater collected by the Member Agencies to the District's treatment plant.

The District's trunk sewer is the primary focus of this study but it is also understood that I/I documented as part of this study may be originating within the collection systems of the respective Member Agencies. It is therefore recommended that additional, future I/I efforts include the involvement of the Member Agencies, where warranted.

SSLOCSD District Trunk Sewer

The District's trunk sewer was designed and constructed in 1966 to transport wastewater collected by the three Member Agencies to the District treatment plant. The system is approximately 9 miles in length and comprised of segmented sewer pipe. Pipe diameter within the District trunk sewer varies between 15 and 30 inches. The composition of the pipe material is primarily vitrified clay pipe (VCP) and asbestos cement concrete (ACP) with the majority of the VCP located on the Grover Beach trunk segment (GB designation and in the trunk system above Manhole C-50 in Arroyo Grande), as indicated on the attached sewer map. VCP pipe segments are primarily 3-5 feet in length and ACP segments are primarily 20 feet in length.

Typically, shorter sewer pipe segments represent a greater potential for infiltration within aged and/or poorly constructed collection systems due to a greater number of possible input locations.

Trunk capacity within the District trunk lines is not established by contract and therefore is not apportioned amongst the varying Member Agencies. Additional information relating to trunk sewer capacity can be found within the District's 2006 Trunk Sewer System Capacity Study.

Flow Model Calibration

The South San Luis Obispo County Sanitation District maintains an up to date electronic system hydraulic model of the District Trunk Sewer. Utilizing the model allows the District to assess flow conditions under existing and future build-out conditions and also provides for additional specialized assessment such as characterization of alternative flow patterns (i.e. Inflow and Infiltration).

The District Trunk System Model was created using the computer program MWHSoft InfoSWMM, and contains both the SSLOCSD District Trunks and the Oceano Community Services District Collection System. The model flows and spatial data were created from multiple sources. The flow information in the model is based on data prepared under the District's 2006 Trunk Sewer System Capacity Study, which evaluated the existing wastewater trunk sewers flows under current and build out conditions, and on information contained in the

2009 Oceano Community Services District Collection System Study. The model has not been calibrated against metered sewer flow.

Data collected during the flow monitoring phase of this project is available for future calibration of the District's hydraulic model. Calibrating the District's hydraulic model based on the information obtained during this study is recommended to ensure that the model accurately reflects current and future build-out conditions and to ensure that characterization of alternative flow patterns is representative of anticipated flows.

<u>December 19, 2010 Sewage Spill</u>
A significant rain event occurred on December 18th and December 19th with a total rainfall accumulation of 5.14 inches across much of the area surrounding the District's treatment plant. This rain event caused storm water runoff to raise the Oceano Lagoon to a level that inundated the streets and homes in the residential neighborhood to the immediate west of the WWTP and contributed to significant ponding within the WWTP, eventually leading to the plant influent pump failure on Sunday, December 19th.

Based on influent flow rates during the rain event, the District treatment plant took on a significant amount of I/I from the District trunk sewer and/or the Member Agency collection systems. When compared to influent flow records for the Sunday prior to the storm event (Dec 12th, no rain), the Dec 19th storm event increased peak flow to the plant by an additional 3.6 MGD (2,500 gpm). The source of the storm water entering the collection was not identified. The excess I/I entering the trunk sewer contributed to the extent and duration of the influent pump failure and recovery operations. Subsequent review of historic plant flow indicated that the treatment plant is subjected to periods of elevated flow during precipitation events, although not to the level seen on 12/19/2010. This I/I study was implemented as a result of the current and historic I/I observed.

<u>Regulatory Requirements for Inflow and Infiltration Assessment</u>
Section 35.2120 of the Code of Federal Regulations (CFR 40) places specific requirements upon applicants to demonstrate to the Regional Administrator's satisfaction that "*each sewer system discharging into the proposed treatment works is not or will not be subject to excessive infiltration/inflow."*

Requirements specific to CFR 40 - Section 35.2120 include (among other items):

<u>Inflow</u>: *If the rainfall induced peak inflow rate results or will result in chronic operational problems during storm events, or the rainfall-induced flow rate <u>exceeds 275 gpcd</u> during storm events, the applicant shall perform a study of the sewer system to determine the quantity of excess inflow and to propose a rehabilitation program to eliminate excessive inflow.*

<u>Infiltration</u>: *(1) If the flow rate at the existing treatment plant is <u>120 gallons per capita per day or less</u> during periods of high groundwater, the applicant shall build the project including sufficient capacity to transport and treat any existing infiltration. However if the applicant believes that any specific portion of its sewer system is subject to excessive infiltration, the applicant may confirm its belief in a cost-effectiveness analysis and propose to eliminate that specific excessive infiltration. (2) If the flow rate at the existing treatment facility is <u>more than 120 gallons per capita per day</u> during periods of high groundwater, the applicant shall either (i) Perform a study of the sewer system to determine the quantity of excessive infiltration and to propose*

a sewer rehabilitation program to eliminate the excessive infiltration; or (ii) If the flow rate is not more than 120 gallons per capita per day, request the Regional Administrator to determine that he may proceed without further study.

The treatment plant does not currently experience flows that exceed 275 gpcd (approx. 11MGD) during storm events or flows that approach and/or exceed 120 gpcd (approx. 4.8 MGD) during periods of high groundwater. Through implementing this study, the District is demonstrating due diligence to identify and remove extraneous sources of water from the treatment works and is working towards satisfying the requirements contained in Section 35.2120 of the Code of Federal Regulations (CFR 40).

Section 5: Data Summary and Purpose

Rainfall Data

Rainfall data was used in conjunction with flow monitoring data to assess the source type of I/I entering the system. For the purposes of this study, the following rain gauges were utilized for the assessment.

- Station KCAARROY15 located on Centurion Estates, Arroyo Grande CA
- Station KCAGROVE3 located on Ramona Avenue, Grover Beach, CA
- Station KDYCAOCE2 located at Halcyon and HWY 1, Oceano, CA

Rainfall records were accessed through www.wunderground.com.

Historical Plant Flow

Historical flow data was obtained from the influent and effluent metering stations located at the District treatment plant for specific dates over the prior 3 year period. Historical data was reviewed and summarized for comparison against the flow monitoring data to evaluate flow monitoring data for accuracy relative to prior recorded flow, and to evaluate estimated contribution from dry day infiltration. Tabular and graphical results of this comparison are provided within Section 7 of this report.

Oceano Lift Station

The Oceano Community Services District (OCSD) maintains a sewer lift station on Pier Ave. The tributary area for the lift station is bound between Air Park Drive and Strand Way to the east and west, and Pier Ave. and Laguna Drive to the north and south. For the purposes of this study, data obtained from this lift station was viewed as unique due to the fact that lift station sewer flows discharged directly into the District trunk sewer between two of the flow monitoring locations (GB2 and GB18). Variations in lift station pump runtimes during significant rain events could therefore indicate a presence of I/I within the area specific to the lift station basin, as opposed to the overall basin defined by the sewer flow monitors located at Manhole GB2 and GB18.

As a result, daily pump run time hours for the lift station were obtained from OCSD Staff for the period March 15 – April 16, 2011 (trunk sewer monitoring period) and for the period leading up to and following the December 19, 2010 sewage spill. Runtime hours were plotted against dry and wet-weather flow durations to develop trends and to identify the likelihood of I/I within the lift station tributary area. Information relating to the lift station data acquired and the results obtained is provided in Section 9 of this report.

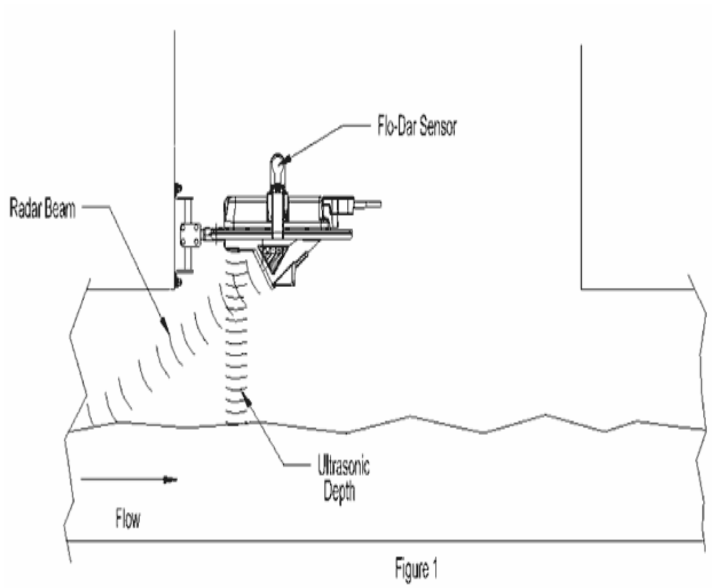
Section 6: Flow Meter Information

Flow Meters

Flow monitoring was performed by Utility Systems, Science and Software, Inc. of Santa Ana, CA, under the direction of District Staff. Flow meters utilized for this study were Flo-Dar® brand non-contact measuring devices. Flo-Dar® measuring devices consist of a Doppler radar based velocity measurement system and an ultrasonic pulse echo depth measurement system which mounts to the interior of the manholes above the sewer flow-line. This equipment has a reported accuracy of +/- 5%. In this configuration, velocity measurements are obtained in a manner similar to that of a radar gun measuring the velocity of a baseball or an automobile. Site-specific pipe characteristics (pipe diameter, pipe shape, velocity profile) were inputted to each device allowing for automated flow based conversion according to respective velocity/depth profiles.

Mounting the metering devices above flow line eliminates the potential for fouling of the metering sensors by suspended debris typically found within municipal wastewater.

Typical flow meter installation into a manhole utilizing Flo-Dar® measuring devices is shown in the following sketch.



Typical Flo-Dar® Flow Meter Installation

Flow data was recorded at 5-minute recurring intervals. Data obtained from the study provided the basis for the diurnal flow curves generated. Comparison of dry vs. wet-weather flows from the representative basins identified the presence of ground and stormwater contributions (inflow and influent). A narrative of this approach and the results obtained is provided in Section 7 of this report.

As sewer flow monitoring is limited to interval flow recording only, and cannot provide continuous data collection, the results obtained represent an estimate of total wastewater volume generated by the respective sewer basins. Periodic slug flows which may have occurred between recording intervals would not be recorded, however the probability of having a slug flow occur entirely witin a recording interval is highly unlikely. Data obtained at the 5-

minute recording intervals however, is more than adequate for generating flow trends from within the respective sewer flow contributions.

<u>Sewer Flow Monitoring Locations and Dates</u>
Sewer flow monitoring devices were installed at seven locations throughout the District Trunk Sewer between March 15, 2011 and April 16, 2011. The following monitoring locations were designated for this project.

Table 1. Flow Monitoring Device Locations

Manhole	Location of Monitoring Device	Location of Representative Sewer Basin
A1a*	Aloha Place Oceano, CA (Treatment Plant)	Oceano
A6*	Delta Street Oceano, CA (RV Storage Yard)	Oceano
B1a	17th Street Oceano, CA	Oceano
B11a	Tamara Drive Oceano, CA	Arroyo Grande
C18	S. Halcyon Road Arroyo Grande, CA	Arroyo Grande
GB2*	Aloha Place Oceano, CA (Treatment Plant)	Oceano
GB18	Highway 1 Grover Beach, CA	Grover Beach

* *These meters provide influent flows at the treatment plant head works from the three individual trunk sewer segments and also provide the basis for determining flow contributions within the Oceano sewer basin as described below.*

Utilizing G.I.S. mapping of the District trunk sewer, individual sewer basins were created to identify flow contributions from each of the three Member Agency boundaries. The seven monitoring locations identified above were chosen to 1) provide representative flow contributions from each of the designated Member Agency basins, and 2) record representative flow volumes and patterns within each of the three District Trunk Sewer branches extending to the Member Agencies. In some instances (Grover Beach Basin Area), individual monitoring stations provided comprehensive flow data for the entire basin. In other instances (Arroyo Grande Basin Area) cumulative totals were required to represent an entire basin. Still, in other instances (Oceano Basin Area) a cumulative/subtractive approach was necessary to represent the entire collection area.

The three representative sewer basins are defined by their flow monitors as follows:

<u>Grover Beach Sewer Basin</u>: GB18

<u>Arroyo Grande Sewer Basin</u>: (B11a + C18)

<u>Oceano Sewer Basin</u>: (GB1+ A1a + A6) – (GB18 + B11 + C18)

For the purposes of this study, it is understood that inflow and infiltration contributions within the designated sewer basins identified above may originate at any one of many input locations. Those locations may reside either on the District trunk sewer itself or any one of the three collection systems of a respective Member Agency. The designation “*Member Agency*” basin is not intended to imply that the inflow and infiltration contributions identified are the direct result of defects located specifically within any one Member Agency’s collection system. The designation rather, is intended to properly delineate areas by sewer flow source (i.e. Member Agency), understanding that the sources of the inflow and infiltration may be located either on the District trunk sewer, within the respective Member Agency’s collection system, or both. In doing so, the District becomes better prepared to initiate subsequent, more detailed investigations and solicit the assistance of those Member Agencies whose areas identify significant inflow and infiltration trends. Additional, subsequent investigative efforts aimed at specifically locating actual I/I input locations after the general basins have been defined through flow monitoring efforts are identified in Section 9 of this study.

As identified within Section 1 of this study, the purpose of this study is to identify the presence of inflow and infiltration sources occurring within generally broad sewer basins and to rank them according to those that warrant further District study and subsequent repair and those that do not warrant further study and which would not benefit substantially from repair investment at this time.

Section 8: Historical Flow Data

Historical flow data was reviewed and summarized for comparison to the flow monitoring results and to evaluate estimated contribution from dry day infiltration. The District operates and maintains a Parshall Flume flow meter at the headworks facility. This flow meter reads the influent wastewater flow and prints it on a chart recorder. The District also operates and maintains an effluent flow meter upstream from the chlorine contact chamber. This meter reads the effluent flow rate every 5 minutes as the treated wastewater flows through the chlorine contact chamber and then into the ocean outfall line. Historical wastewater flow data from these meters was reviewed for dry and rain day flows for select dates throughout the past 3 years.

For the purpose of this study, weather conditions are defined as follows:

> **Dry Season**: The period of time between the last rainfall in spring/summer, and the first rain in fall of the same year. Typically June through October.
>
> **Wet Season**: The period of time between the first rain of the fall, and the last rain in spring/summer the following year. Typically November through May.
>
> **Dry Day**: No recorded rainfall, or rainfall less than 0.10 inch.
>
> **Rain Day**: Recorded rainfall equal to or greater than 0.10 inch.

Member Agency Flow

The following information regarding Member Agency wastewater flow was reported in the *2006 SSLOCSD Trunk Sewer System Capacity Study*.

"Flow meters were installed in 2001 at the two District trunk mains that convey wastewater from the City of Arroyo Grande. An analysis of data from the Arroyo Grande Wastewater Master Plan shows that during dry weather periods, Arroyo Grande contributes approximately 44% of the total raw wastewater flow to the District. This result was consistent with the Arroyo Grande population at that time, which represents approximately 44% of the total District population. It was a reasonable assumption then, that the City of Grover Beach and the Oceano Community Services District would also contribute proportionate flows based on their population ratios."

Table 2 summarizes existing wastewater flows as provided in the 2006 Capacity Study.

Table 2. Average Annual Flow by Member Agency (2006 Capacity Study)

City or District	Existing Population	Percentage of District Population	Total Average Annual Flow (million gallons/day)
Arroyo Grande	16,115	44%	1.26
Grover Beach	13,067	36%	1.03
Oceano Community Services District	7,260	20%	0.59
SSLOCSD TOTAL	**36,802**	**N/A**	**2.88**[3]

Notes:

1. These values were based on the values used in the Arroyo Grande Wastewater Master Plan adopted November 2001.
2. Existing population is based on the 2000 census.
3. The Annual Average Flow for the District in year 2000 was 2.88 MGD.

As stated previously, historically the contributions from member agencies were assumed to be proportional to member agency population. This historical member agency data is pertinent for comparison to flow monitoring results because it has been used in multiple prior studies and was also used as the basis for the District's sewer model and associated capacity evaluations.

Dry Day Flow

The purpose of reviewing historical dry day flow is to determine anticipated infiltration flow on dry days. The difference between dry season and wet season flow for dry days is assumed to be equal to long-term infiltration flow from groundwater. Dry season flows were evaluated to serve as a basis for the infiltration calculation. Dates were chosen to correspond with the end of the dry season, when groundwater levels are anticipated to be lowest. Table 3 provides a summary of dry day wastewater influent flow for the District in units of million gallons per day (mgd), as measured through the Parshall Flume. A comprehensive list of the historical influent data evaluated is included in Attachment 2..

Table 3. Historical Dry Day Wastewater Flow

	Average Flow (mgd)	**Peak Flow (mgd)**
Dry Season	2.5	3.8
Wet Season	2.7	4.1

The difference between dry season and wet season flows is between 0.20 mgd for average flow and 0.30 mgd for peak flow. Therefore, based on the data reviewed in Table 3, average dry day infiltration for the District is approximately 0.25 mgd.

Rain Day Flow

The purpose of reviewing historical rain day flow is to develop an initial understanding of the collection system's response to rain events, to be able to better evaluate the collected flow monitoring data for validity. Table 4 provides a summary of historical rain-day wastewater flow for the District. Graphs illustrating wastewater flow and rainfall distribution for these rain days are included in Attachment 1. The approximate flow increase due to I/I was estimated based on visual review of the graphed data.

Table 4. Historical Rain Day Wastewater Flow

Date	Rainfall (inches)	Average Influent Flow (mgd)	Approximate I/I Flow Increase (mgd)	Notes	Reference
12/14/2008 – 12/15/2008	1.38 (48 hours)	2.8	1.0 to 1.5	First rain of season	Exhibit 1
10/13/2009	0.71 (24 hours)	2.6	0.5 to 0.75	First rain of season	Exhibit 2
12/29/2010	1.18 (24 hours)	3.7	1.5 to 2.0	12.4 inches rainfall to-date	Exhibit 3

The following conclusions were developed based on the data reviewed:

- I/I contribution from historical storm events evaluated in this study varied from 0.5 to 2.0 million gallons per day (mgd), in terms of peak instantaneous flow
- Flow at the plant typically increases quickly as the result of a rain event.
- Magnitude of inflow varies based on intensity and total depth of rainfall.

Historical Flow Data Conclusions

Based on our review of historical flow data, the District wastewater collection system receives both infiltration and surface inflow during storm events. During the wet season, infiltration is on the order of 0.25 mgd for dry days. During rain events, flow rates rise quickly in relation to rainfall intensity, indicating that surface inflow may be the dominant source of I/I volume. The flow increase due to I/I varies based on intensity and total rainfall accumulation for a specific storm.

Section 9: Oceano Lift Station Data

Pumping records for the Oceano lift station were evaluated as another data set for comparison to the flow monitors due to the lift station contribution location between meters GB2 and GB18. Daily pumping hours are recorded for the lift station by OCSD. This data was provided by OCSD for the flow monitoring time period, and also for the time period leading up to the December 19th flood event. Based on our review of the lift station data, the lift station exhibits increased pump run time in relation to rainfall. Table 5 provides a summary of the lift station data evaluated. The data is illustrated in graphical format in Attachment 1, and the complete data set is included in Attachment 2.

Table 5. Oceano Lift Station Summary

Condition	Total Pumping Hours
Weekday average	4.4
Weekend average	4.9
Rain day average	5.3
Rain day maximum	7.4

The lift station pump run hours increased in relation to rainfall, and remained higher than average following storm events. The pump run hours are a direct correlation to volume of flow pumped from the station. Therefore, increased pump run time during and following storm events is an indication that both inflow and infiltration may be contributing flow to the lift station.

Section 10: Flow Monitoring Data

The flow monitoring period covered both dry days and rain days. For this study, the purpose of collecting dry day flow information is for comparison to the rain days. Seven rain days were captured by the flow monitoring, with a total rainfall of approximately 4.4 inches. Results of the flow monitoring are described below. A complete summary table of the monitoring data collected is included in Attachment 2.

Treatment Plant Flow

Total flow to the treatment plant is equal to the sum of the metered flow from locations GB1, A1a and A6. Table 6 provides a summary of the daily flow totals recorded by the flow monitors.

Table 6. Total Plant Flow by Flow Monitoring

Parameter	Daily Flow (mgd)
Dry Day Weekday	2.60
Dry Day Weekend	2.75
Dry Day Average	2.67
Rain Day Average	3.00
Rain Day Maximum Day	3.73

The average daily flows recorded by the monitors correlate well to the historical plant data reviewed. In addition, plant flow as recorded through the flow monitoring was compared with the effluent flow meter readings as a check for monitoring accuracy (Refer to Exhibit 8 in Attachment 1). The monitored flow trends correlated closely with the effluent meter, with the exception of a 4 day period between March 25th and March 28th. Typically the flow monitor readings were lower than the effluent flow meter, which could be attributed to process water or drainage water entering the system through the treatment plant works, downstream from the flow monitoring locations. However, during the 4 day period between March 25th and March 28th the flow monitors read approximately 0.125 mgd higher than the effluent meter. The flow monitoring data did not exhibit any unusual trends during this 4-day time period and appears to be valid. It is unknown why the discrepancy between the flow monitors and effluent meter occurred for these 4 days, but it did not skew results of this study.

Flow Monitoring Basins

Dry day flow data was compiled for each of the three flow monitoring basins to serve as a baseline for comparison to rain days captured by the flow monitors. Table 7 provides a summary of the dry day flow data collected, broken down by monitoring basin.

Table 7. Dry Day Flow Summary, (MGD)

Flow Condition	Arroyo Grande Basin	Grover Beach Basin	Oceano Basin
Weekday Flow	1.102	0.543	0.961
Weekend Flow	1.132	0.601	1.019
Average Daily Flow	1.117	0.557	0.996

Historically, total flow to the plant was assumed to be contributed by the member agencies in direct proportion to population, but this had not been corroborated by flow monitoring with the exception of the Arroyo Grande collection system. Compared to population of the member agencies, the flow monitoring results on a per capita basis are low for Grover Beach and high for Oceano. Table 8 provides a comparison of the flow monitoring results to population of each member agency. Population values are based on the 2010 census.

Table 8. Population and Daily Flow by Flow Monitoring Basin

	2010 Census population	Percent Population	Monitored Average Daily Flow [mgd]	Percent of Total Flow	Flow per Capita [gpd]
Oceano	7,286	19%	1.00	37%	137
Arroyo Grande	17,252	46%	1.12	42%	65
Grover Beach	13,156	35%	0.56	21%	42
Total	37,694	100%	2.67	100%	---

There are a number of reasons why the daily flows found through the flow monitoring could vary from population for Grover Beach and Oceano, including the following:

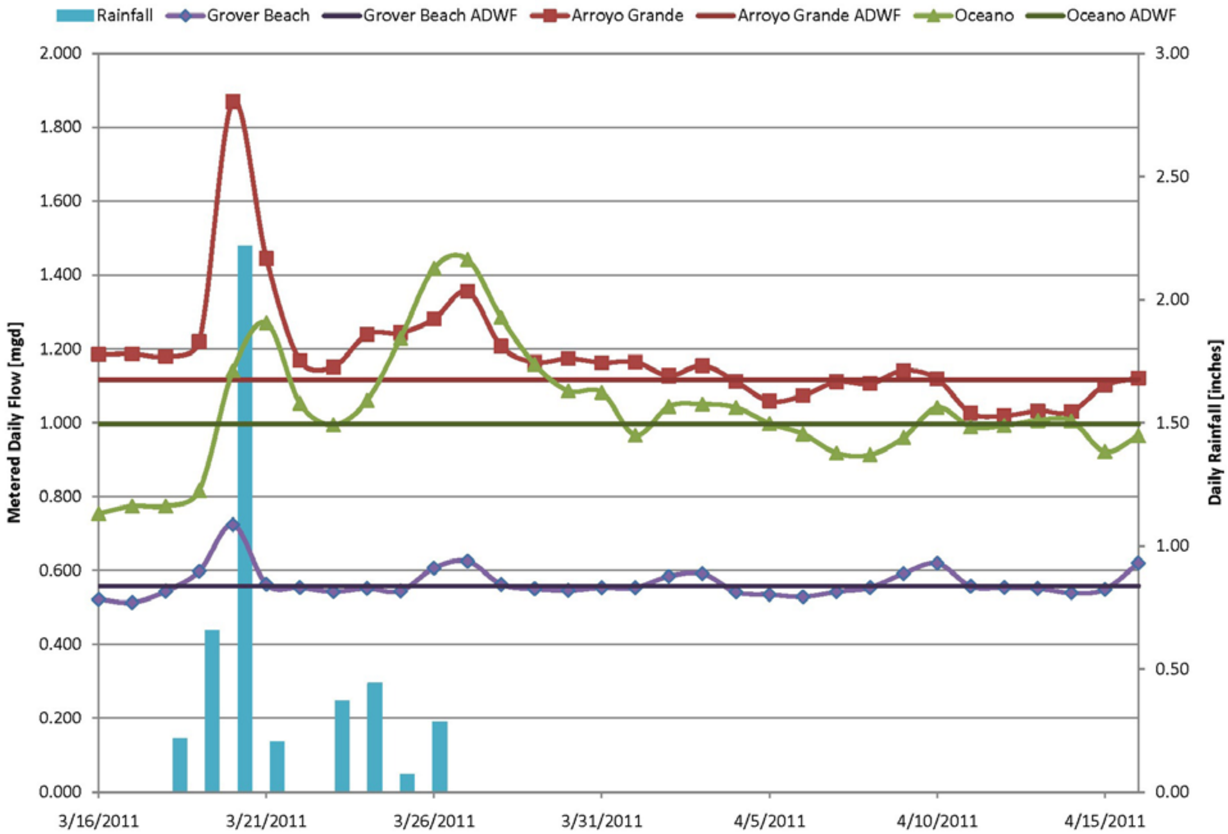
- The residents of Oceano may be using more water on a per capita basis.
- The flow monitors could be reading high or low, within the expected accuracy of the meters. Flows for the Oceano basin were calculated based on adding and subtracting results from multiple meters which could compound accuracy issues.
- The flow contribution in Oceano from sources other than population, including the food processing industry, could result in higher than expected flows.
- The dry day infiltration component could be higher in the Oceano basin compared to the other two basins.
- The Grover Beach Basin was monitored through a single meter (GB18). This meter could be reading only a portion of flow contribution from Grover Beach if the atlas mapping used to define the Grover Beach basin was incorrect or out of date. Though we believe the basin delineation to be accurate, a review of the basin delineation by Grover Beach staff could further verify that GB18 captured all of the flow from Grover Beach. Alternatively, if this meter was reading low, then the resultant flows calculated for the Oceano basin would be high. The data recorded at this monitoring location does not exhibit any apparent discrepancies or indication of inaccurate readings.

Additional analysis including dry weather flow monitoring would be required to determine why the flow monitoring results do not correlate well to population for the Grover Beach and Oceano basin. However, the purpose of this study is to compare dry day and rain day flows for the same flow meter, and therefore, the percentage I/I from each meter is considered to be relevant and accurate.

Rain Day Flow

Rain day flow monitoring data was evaluated in both graphical and tabular formats. Figure 1 illustrates the trending observed for the three flow monitoring basins, and flow response during rain events. Refer to Exhibit 10 in Attachment 1 for the full size graph.

Figure 1: Flow Monitoring Summary by Monitoring Basin



ADWF: Average dry weather flow observed during the flow monitoring period, also referred to as dry day baseline flow

Table 9 provides a summary of the rain-day data collected by the flow monitors, broken down by flow monitoring basin. I/I parameters were calculated based on the following equations:

I/I Volume = Monitored Flow – Dry Day Baseline Flow
Percent I/I = I/I Volume ÷ Dry Day Baseline Flow

Table 9: Rain Day Flow Summary (MGD)

		Arroyo Grande Basin	Grover Beach Basin	Oceano Basin	Rainfall (inches)
Dry Day Baseline	Weekday Flow	1.10	0.54	0.96	---
	Weekend Flow	1.13	0.60	1.02	
	Daily Flow	1.12	0.56	1.00	
Friday	Monitored Flow	1.18	0.54	0.77	0.22

		Arroyo Grande Basin	Grover Beach Basin	Oceano Basin	Rainfall (inches)
03/18/2011	I/I Volume	0.08	0.00	-0.19	
	Percent I/I	6%	0%	-24%	
Saturday 03/19/2011	Monitored Flow	1.22	0.60	0.82	0.66
	I/I Volume	0.09	0.00	-0.20	
	Percent I/I	8%	0%	-20%	
Sunday 03/20/2011	Monitored Flow	1.87	0.72	1.14	2.22
	I/I Volume	0.74	0.12	0.12	
	Percent I/I	65%	20%	12%	
Monday 03/21/2011	Monitored Flow	1.44	0.56	1.27	0.20
	I/I Volume	0.34	0.02	0.31	
	Percent I/I	31%	4%	32%	
Wednesday 03/23/2011	Monitored Flow	1.15	0.54	0.99	0.37
	I/I Volume	0.05	0.00	0.03	
	Percent I/I	4%	0%	3%	
Thursday 03/24/2011	Monitored Flow	1.24	0.55	1.06	0.44
	I/I Volume	0.14	0.01	0.10	
	Percent I/I	12%	2%	10%	
Friday 03/25/2011	Monitored Flow	1.24	0.54	1.23	0.07
	I/I Volume	0.14	0.00	0.27	
	Percent I/I	13%	0%	28%	
Saturday 03/26/2011	Monitored Flow	1.21	0.56	1.28	0.28
	I/I Volume	0.03	0.02	0.51	
	Percent I/I	2%	3%	50%	

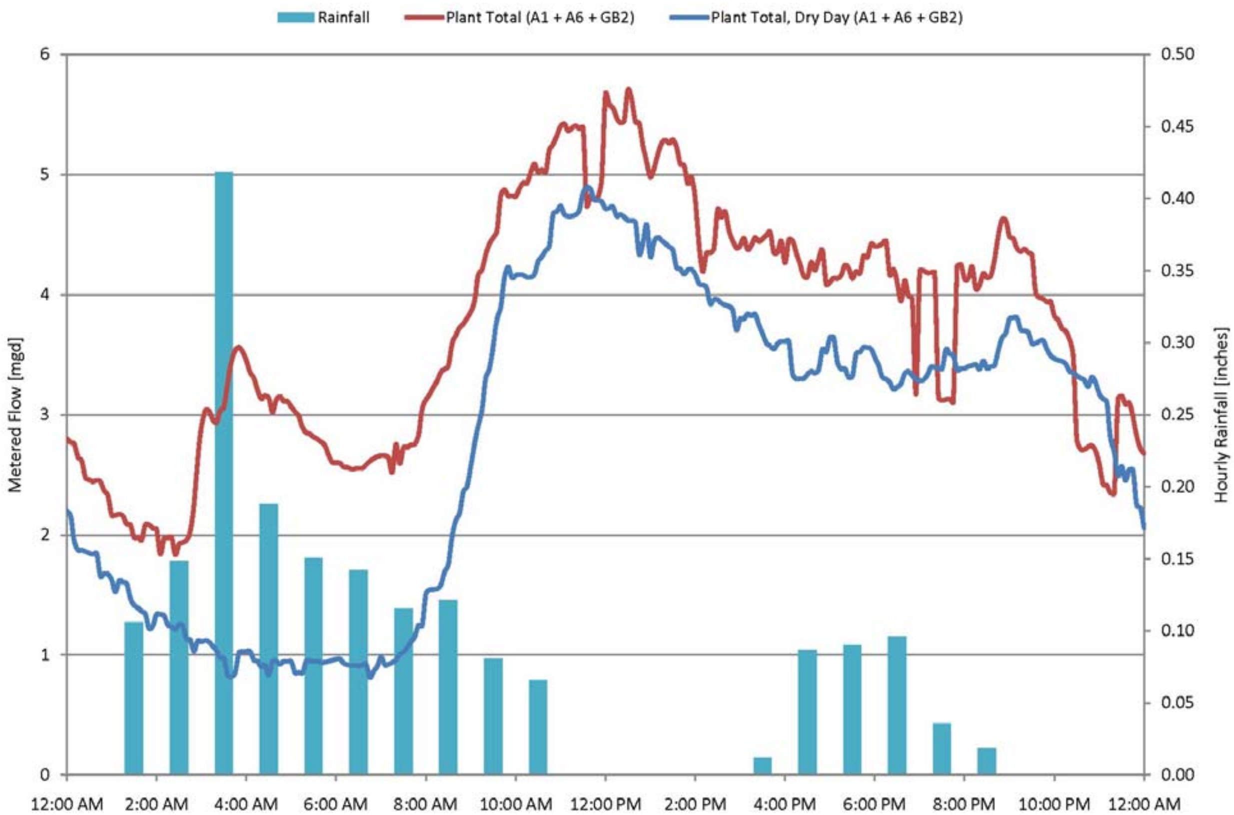
The calculated I/I was evaluated further based on a graphical review of the rain day data compared to dry day data. Compiled graphs illustrating data collected from the largest storm event recorded are included in Attachment 1, illustrating Sunday March 20th with a total rainfall of 2.2 inches (Refer to Exhibits 11 through 18). The following is a summary of results by monitoring basin, based on the results in Table 9 and graphical review:

- Arroyo Grande Basin: This monitoring basin exhibited I/I for all storm events, and has the highest I/I volume of the three basins. The majority of the I/I contribution was recorded in manhole C-18, which is just downstream from the Arroyo Grande Creek crossing. This indicates the siphon crossing under the Arroyo Grande Creek may be contributing I/I flow to the District Trunk System. Also, C-18 flow remained high after rain subsided, which is an indication of infiltration in addition to inflow.
- Grover Beach Basin: This monitoring basin exhibited negligible I/I, except for the largest 2.2 inch storm event. The I/I occurred rapidly with respect to rainfall then dropped down to dry day levels, indicating the volume is likely due to inflow rather than infiltration.
- Oceano Basin: This monitoring basin recorded lower than average flows during the first two rain days. Therefore, the I/I as calculated based on comparison to average flows is a negative number (not realistic). However, the graphical review indicates both infiltration and inflow present, with flows rising with rainfall and also remaining high after

rainfall subsided. It is unknown why the first two rain days had lower than average flows. Also, I/I volume appeared to increase during the latter monitored rain days. This is an indication of additional infiltration occurring due to saturation of soils following the rain events.

Total plant flow on the Sunday March 20th, 2011 rain day is illustrated in Figure 2. The rain day is compared to a dry day, Sunday April 3rd 2011. As stated previously, total rainfall on this day was 2.2 inches, and represented the worst case rain event captured by the flow monitors. Observed instantaneous peak flow increase from I/I is approximately 2.5 mgd.

Figure 2: Total Plant Flow, March 20th 2011 compared to April 3rd 2011



One important thing to note in evaluating flow monitoring data for I/I response to rain events is that a linear trend between rainfall depth and I/I volume or I/I flow is not expected. I/I will vary based on additional factors such as rainfall intensity, groundwater table conditions, and antecedent ground moisture condition. Typically a full rain season worth of flow monitoring data is required to accurately analyze these types of factors, and therefore rainfall intensity and antecedent moisture condition were not evaluated in detail in this study.

Section 11: Field Investigation

A field investigation was conducted on March 24th 2011 to look for visual indications of I/I at likely I/I locations in close proximity to the flow monitoring locations and the treatment plant. The following is a summary of the manholes with suspected I/I contributions. A complete documentation of the field investigation is included in Attachment 3.

- Oceano Manhole A1-D. This manhole is located in a low-lying area north of the Oceano Airport and west of Fountain Avenue. At the time of the field investigation, the manhole was surrounded by ponded water at the manhole rim elevation. Stormwater likely flows to this location during rain events then flows into the manhole. Water staining was observed along the interior of the manhole. The downstream flow monitor, located in manhole A-1a, exhibited a high percentage of I/I during rain events.

- Oceano Manhole A1-C. This manhole is located in Fountain Avenue. Water staining was observed between the manhole cone and base. Infiltration is suspected.
- Oceano Manhole A6-A. This manhole is located on Ocean Street just north of the Oceano Airport. Significant root intrusion was observed, and infiltration is suspected.
- Oceano Manhole A3-A. This manhole is located in a drainage area between Highway 1 and 4th Street, adjacent to the railroad tracks. There is potential during larger storm events that stormwater may inundate the manhole. Water staining was observed along the interior of the manhole, and both inflow and infiltration are suspected.

Section 12: Conclusions

As stated under Section 1 of this report, the primary purpose of this study was to identify general locations broken down by sewer basins along the District trunk sewer where ground and/or storm water is contributing to extraneous sewer flows to the District treatment works.

This task was accomplished by 1) strategically locating seven sewer flow monitoring devices throughout the District trunk sewer and evaluating the data obtained against rainfall data to determine sewer flow variations relative to precipitation volumes and duration, 2) evaluation of current and historic diurnal wastewater trends for dry vs. rain day flow values, 3) development I/I percentage increases and total volumes over average daily and weekly dry-weather flows for each of the three sewer basins assigned.

Based on this approach the following conclusions were developed:

<u>Overall Collection System Flow</u>
The total treatment plant flow recorded by the flow monitors correlates well with the historical data reviewed as a part of this analysis. When broken down by flow monitoring basin, the flow monitor results do not correlate to population for the Oceano and Grover Beach basin. Additional analysis would be required to determine why recorded dry day flow does not correspond to population in these regions. However, results are acceptable for the purpose of this study because dry day and rain day flows are compared for the same meter, therefore percentage I/I is considered relevant and accurate regardless of flow volume measured.

<u>Arroyo Grande Basin</u>
The Arroyo Grande basin contributed the largest volume of I/I during the flow monitoring period. This basin warrants a more detailed flow monitoring study to locate sources of I/I. The flow monitor located in manhole C18 recorded the highest volume of I/I in the system, and data is indicative of both infiltration and inflow. This flow monitor is located downstream from the Arroyo Grande creek, indicating that the siphon crossing under the Arroyo Grande Creek may be contributing I/I flow to the District Trunk System.

<u>Grover Beach Basin</u>
This basin has minimal I/I for the majority of storm events, and exhibits inflow only during larger storm events. Additional flow monitoring is not warranted at this time. The potential for inflow may be further studied by conducting field investigations to locate manholes in obvious paths of surface flow.

Oceano Basin

Monitoring data exhibits both infiltration and inflow in the Oceano basin. This basin warrants a more detailed study to locate sources of I/I. The area of west Oceano and the portion of the collection system that flows to the lift station exhibit the most likely indications of infiltration. The field investigation identified a few potential locations of both infiltration and inflow.

Section 13: Recommendations

Based on the conclusions acquired as part of this study the following recommendations are made:

1. Provide additional future flow monitoring studies within the Arroyo Grande Basin during the 2011-12 rainy season, and more specifically:
    - Develop a flow monitoring location plan aimed at reducing the Arroyo Grande basin into smaller more manageable basins that could identify areas which show a high prevalence of I/I and exclude areas which due not warrant additional subsequent field testing;
    - Implement techniques that provide information relative to on-trunk and off-trunk (i.e. Arroyo Grande Collection System) source locations;
    - Isolate flow contributions that may be originating from the Arroyo Grande Creek between Manhole C20 and C20a;
    - Coordinate with City staff to review dry weather flow monitoring data currently being implemented as part of the City's 2011 Waste Water Master Plan update and 2011 sewer flow model update;
    - Coordinate with City staff to utilize City sewer lift station data in conjunction with future flow monitoring data to more thoroughly identify I/I source locations.

2. Provide additional future flow monitoring studies within the Oceano Community Services District Basin during the 2011-12 rainy season, and more specifically:
    - Develop a flow monitoring location plan aimed at reducing the Oceano basin into smaller more manageable basins that identify areas which could identify areas which show a high prevalence of I/I and exclude areas which due not warrant additional subsequent field testing;
    - Implement techniques that provide information relative to on-trunk and off-trunk (i.e. OCSD Collection System) source locations;
    - Evaluate per-capita municipal water usage against per-capita sewer contributions to determine if elevated per-capita sewer contributions observed in this study are repeatable and if so, evaluate likelihood of potential long-term groundwater infiltration currently being recognized as base sewer flow;
    - Coordinate with OCSD staff to initiate manhole inspections in areas where inflow was observed during field investigation efforts (OCSD Manhole A1-D, A3-A and others);

3. Exclude the Grover Beach Basin from future wet weather flow monitoring studies based on relatively minor I/I contributions observed.

4. Confirm calibration of the influent and effluent flow meters at the District treatment plant relative to the minor discrepancies noted between flow variations occurring during this study, understanding that effluent flow values should be slightly greater

than influent flow values due to process return flow re-entering the head works structure downstream of the influent flow meter and due to onsite drainage entering the head works structure downstream of the influent flow meter.

- If calibration of influent and effluent flow meters indicate that each are recording properly, evaluate likelihood of I/I contributions to the subgrade onsite treatment works process piping subjected to known elevated water tables.

As discussed previously in this report, a well-planned and implemented Inflow and Infiltration study must consider cost-effective approaches to identifying and subsequently removing I/I from the sewer collection system. This process usually consists of several increasingly task-specific, successive phases; each providing additional, supporting information and leading the study closer to the I/I source(s) in a cost effective, systematic approach, and focused on excluding those sections of the trunk sewer which do not warrant additional subsequent field testing and expenditure.

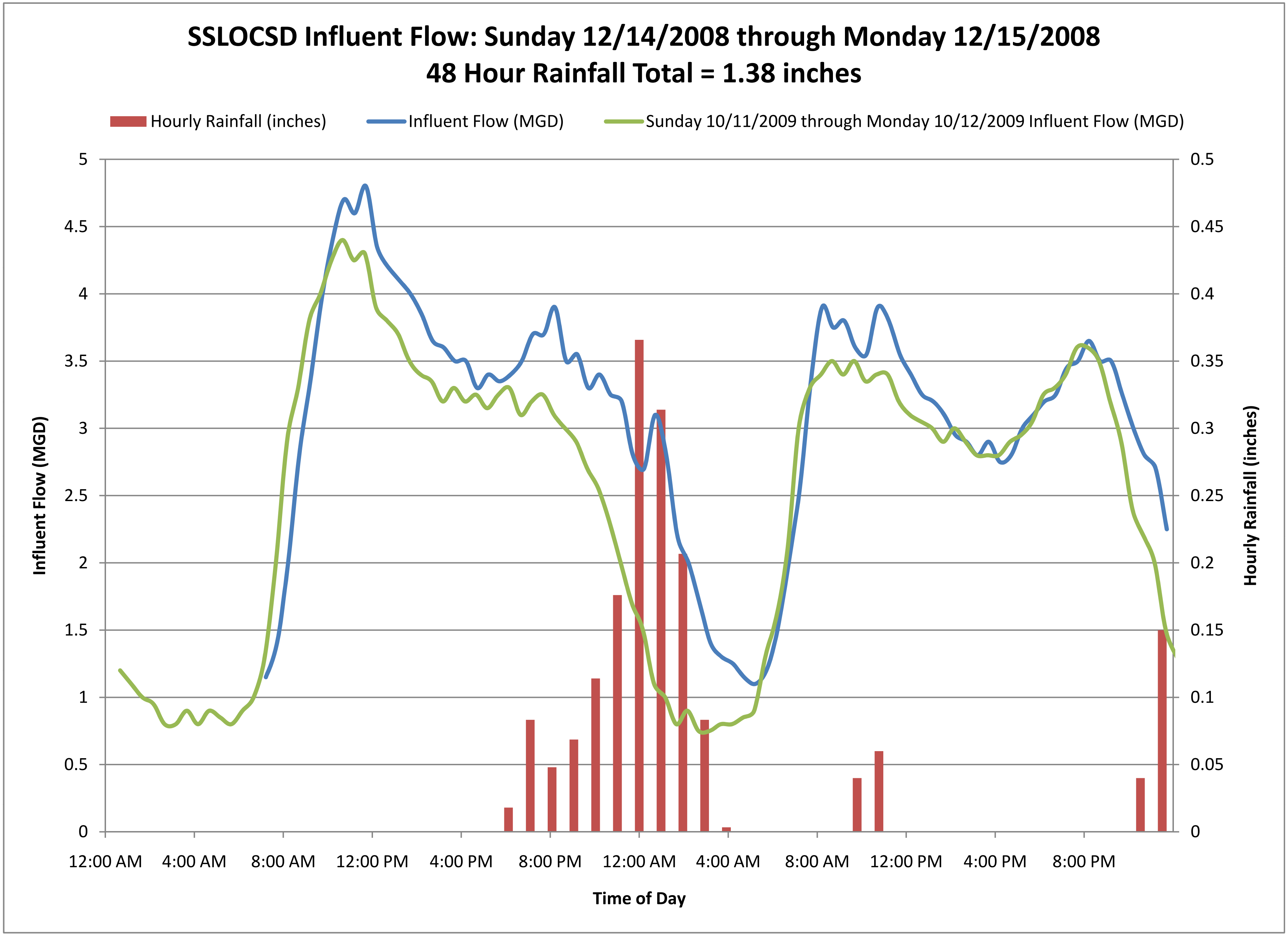
The usual sequence of field tests is as follows:

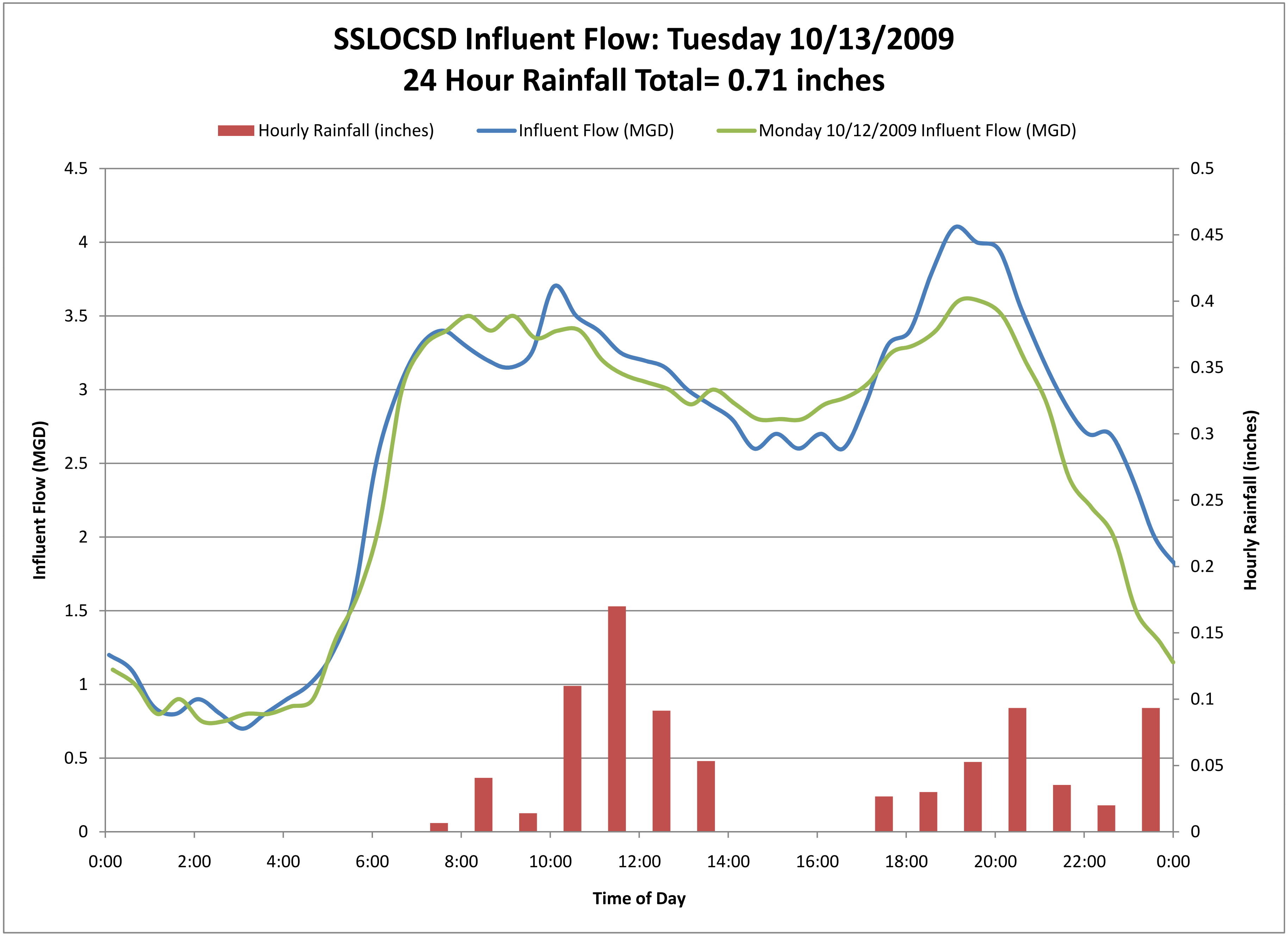
1. Flow Monitoring
2. Smoke Testing
3. Dye Water Flooding
4. Closed Circuit Television Inspection
5. Building Inspections
6. Foundation Drain Testing

It is recommended at this time that the next round of study focus efforts on determining whether I/I flow contributions are originating within the District trunk sewer or within a respective Member Agency collections system. If the former, it is recommended that the District evaluate the short-term costs of rehabilitating the system defects contributing to the extraneous flow vs. the long-term costs of providing unnecessary treatment to the extraneous flow.

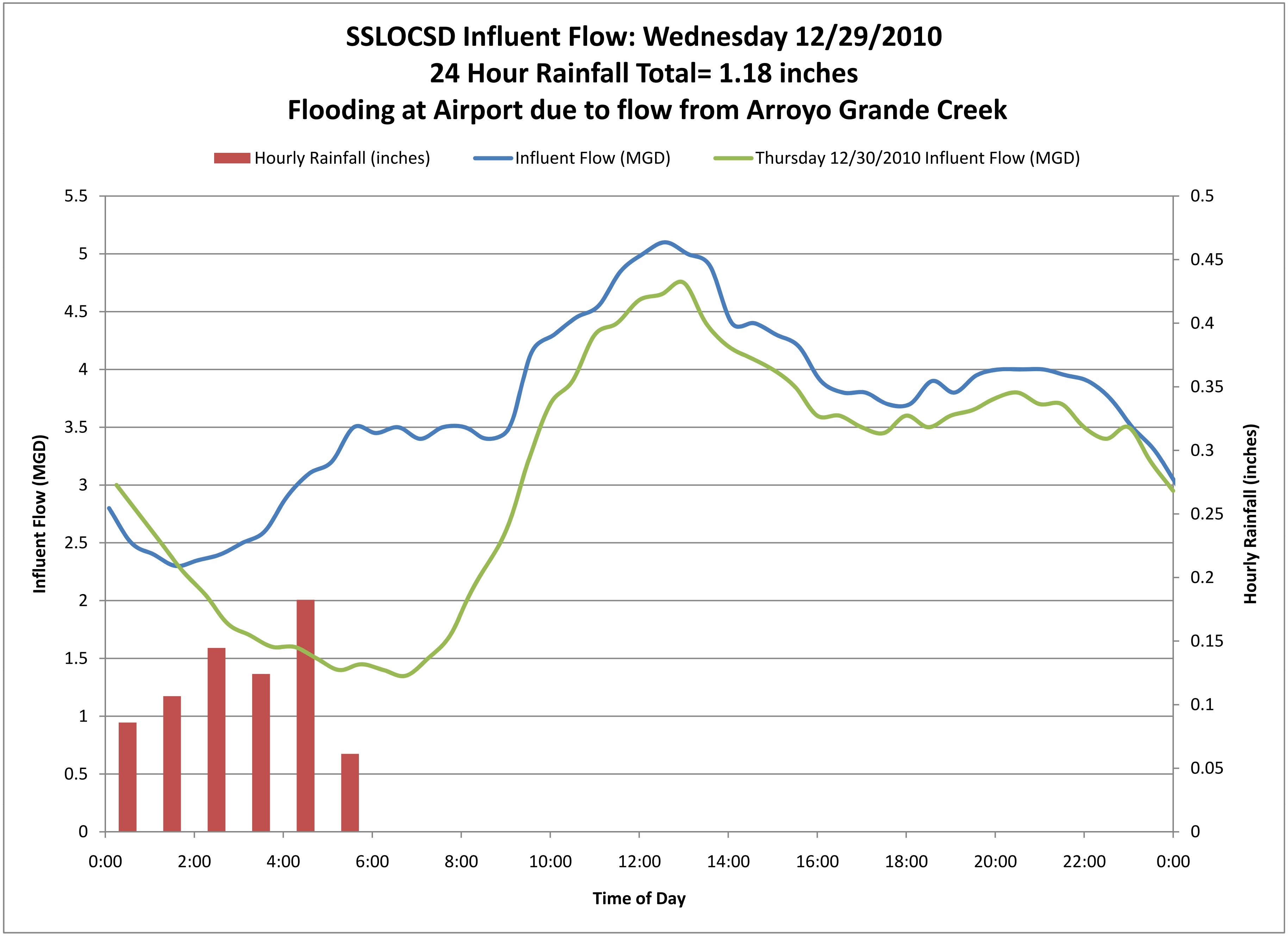
South San Luis Obispo County Sanitation District

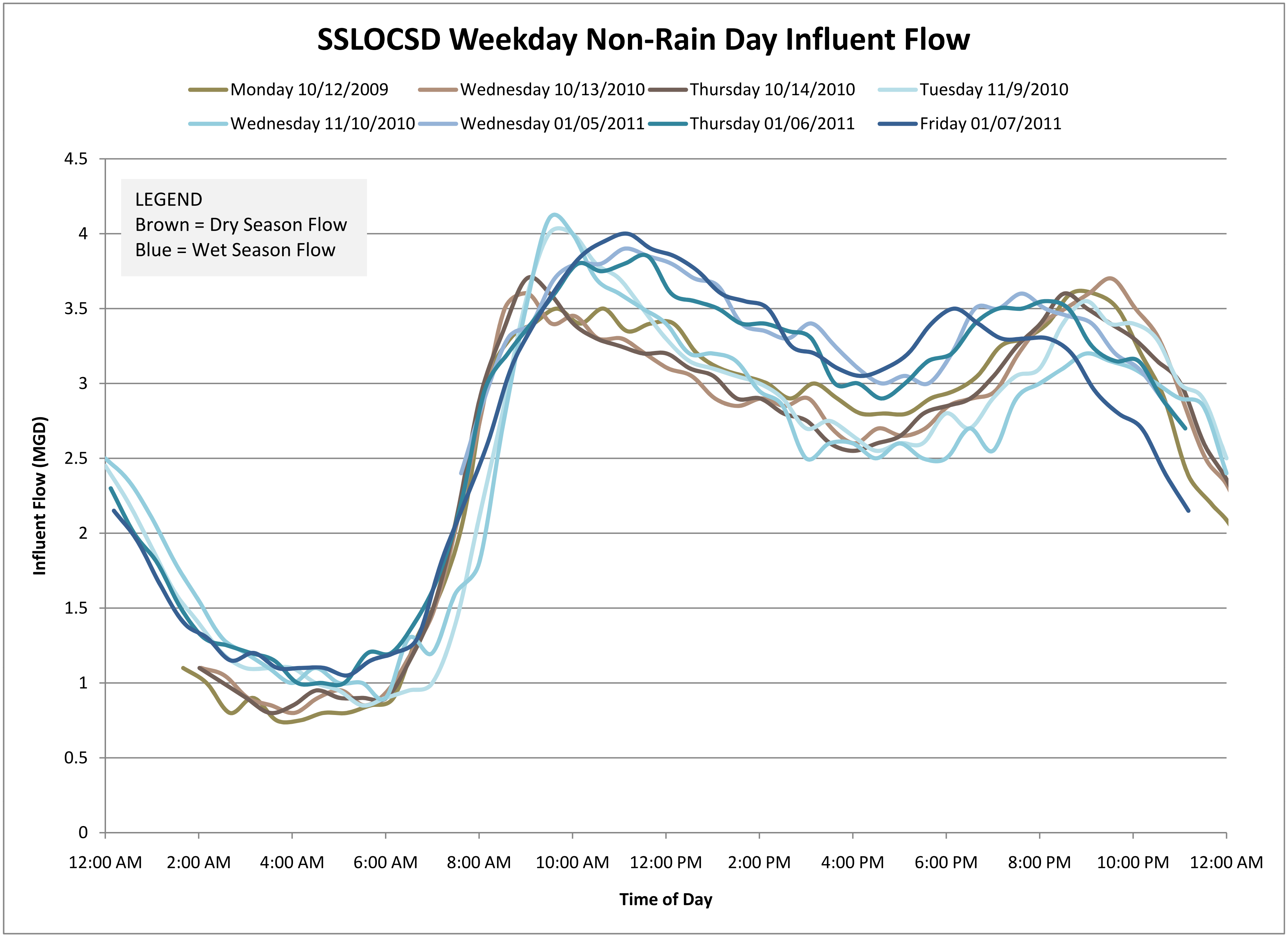
Attachment 1- Graphs


SSLOCSD Influent Flow: Sunday 12/14/2008 through Monday 12/15/2008
48 Hour Rainfall Total = 1.38 inches
Hourly Rainfall (inches)
Influent Flow (MGD)
Sunday 10/11/2009 through Monday 10/12/2009 Influent Flow (MGD)
Influent Flow (MGD)
Hourly Rainfall (inches)
Time of Day
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM

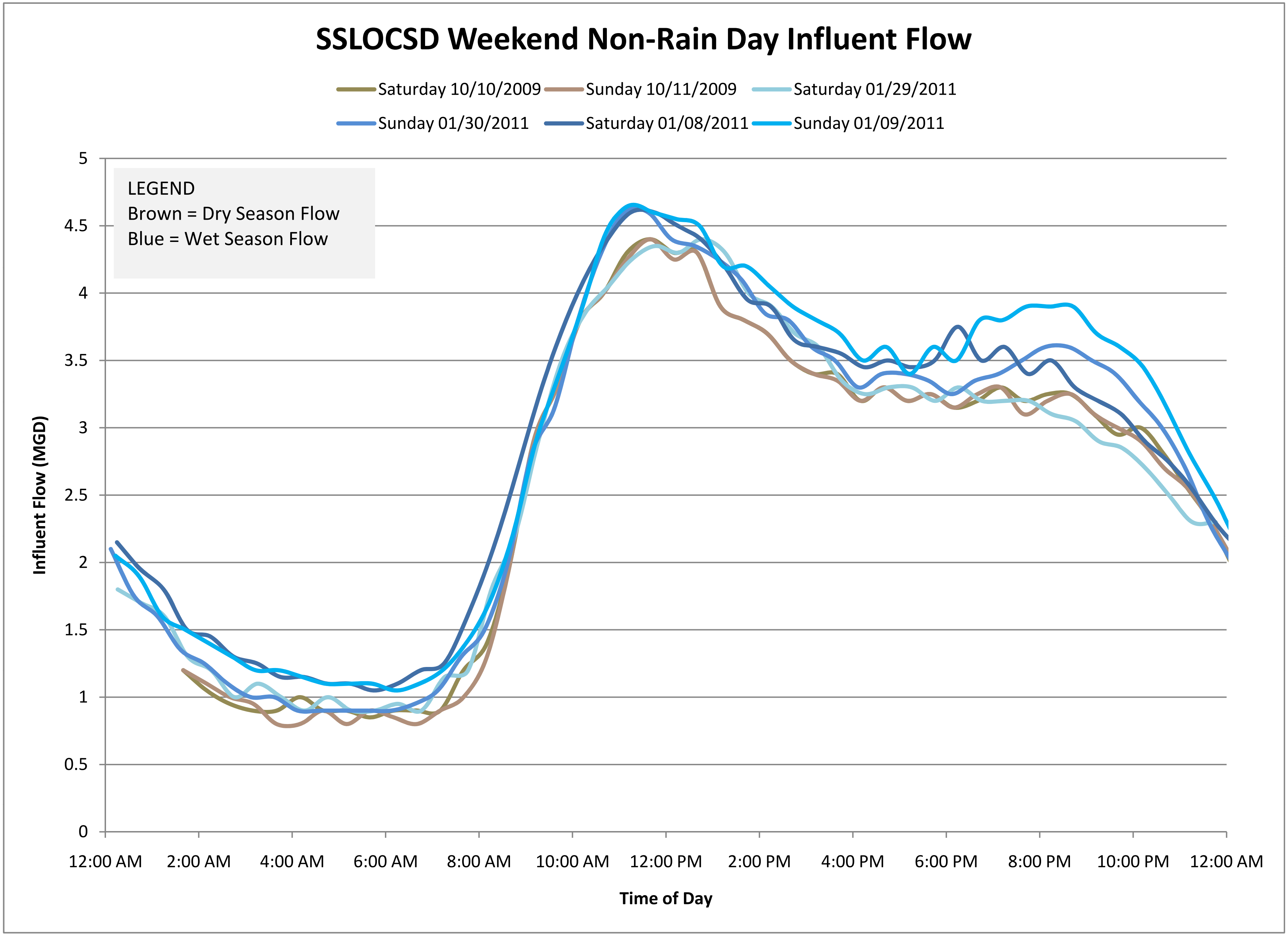


SSLOCSD Influent Flow: Tuesday 10/13/2009
24 Hour Rainfall Total= 0.71 inches
Hourly Rainfall (inches)
Influent Flow (MGD)
Monday 10/12/2009 Influent Flow (MGD)
Influent Flow (MGD)
Hourly Rainfall (inches)
Time of Day
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00


SSLOCSD Influent Flow: Wednesday 12/29/2010
24 Hour Rainfall Total= 1.18 inches
Flooding at Airport due to flow from Arroyo Grande Creek
Hourly Rainfall (inches)
Influent Flow (MGD)
Thursday 12/30/2010 Influent Flow (MGD)
Influent Flow (MGD)
Hourly Rainfall (inches)
Time of Day
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00



SSLOCSD Weekday Non-Rain Day Influent Flow
Monday 10/12/2009
Wednesday 10/13/2010
Thursday 10/14/2010
Tuesday 11/9/2010
Wednesday 11/10/2010
Wednesday 01/05/2011
Thursday 01/06/2011
Friday 01/07/2011
LEGEND
Brown = Dry Season Flow
Blue = Wet Season Flow
Influent Flow (MGD)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM
Time of Day


SSLOCSD Weekend Non-Rain Day Influent Flow
Saturday 10/10/2009
Sunday 10/11/2009
Saturday 01/29/2011
Sunday 01/30/2011
Saturday 01/08/2011
Sunday 01/09/2011
LEGEND
Brown = Dry Season Flow
Blue = Wet Season Flow
Influent Flow (MGD)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
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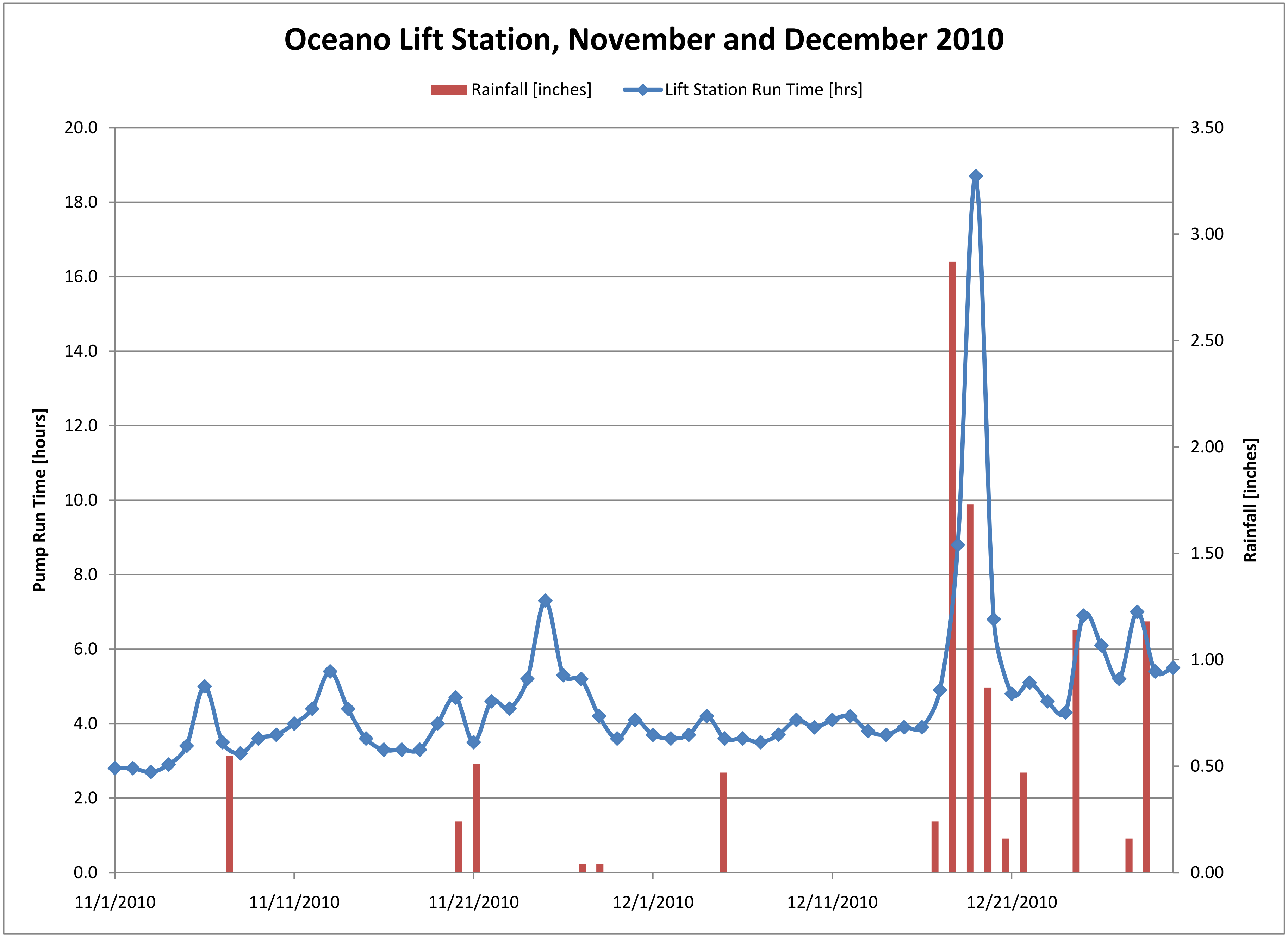
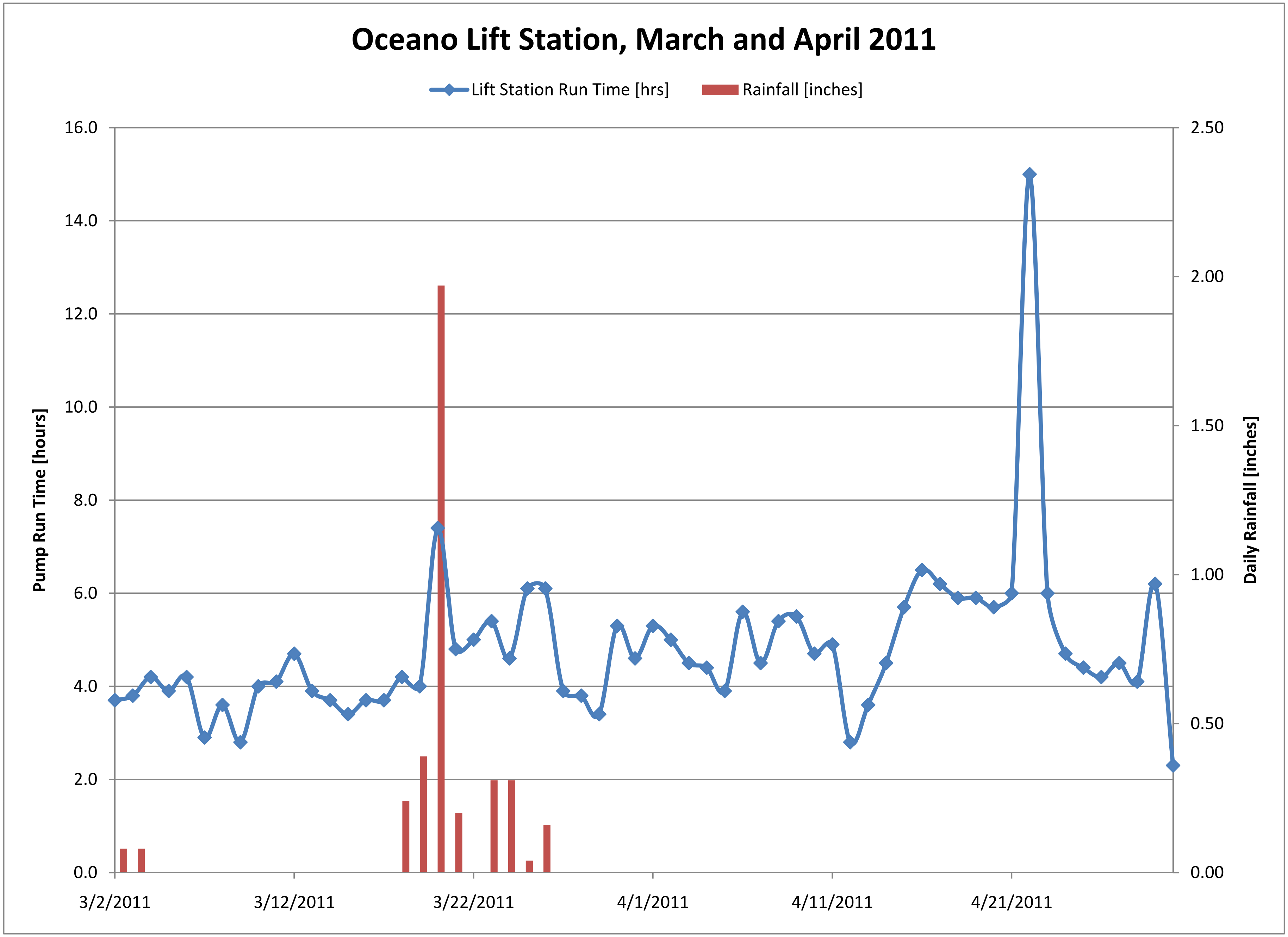
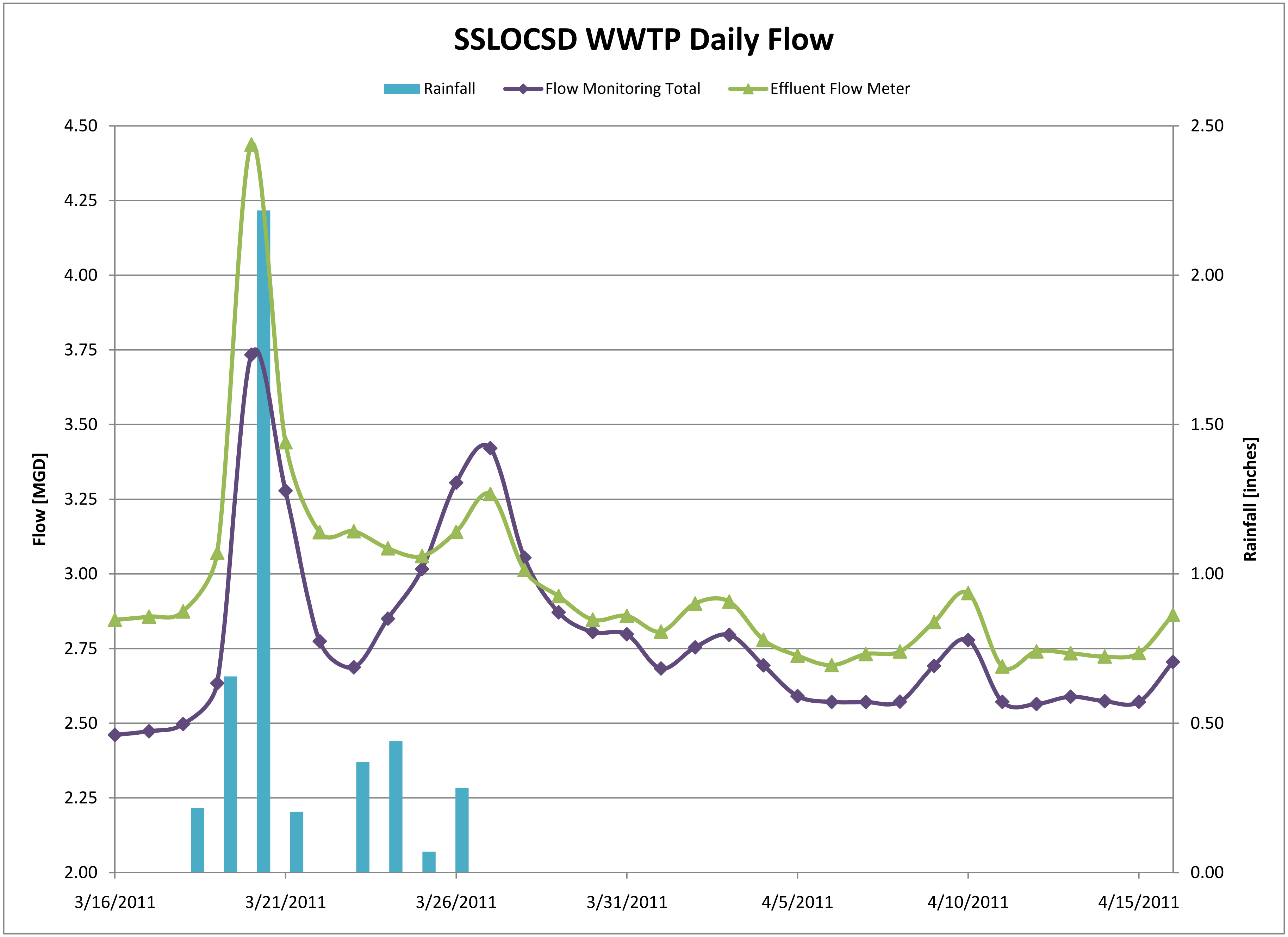
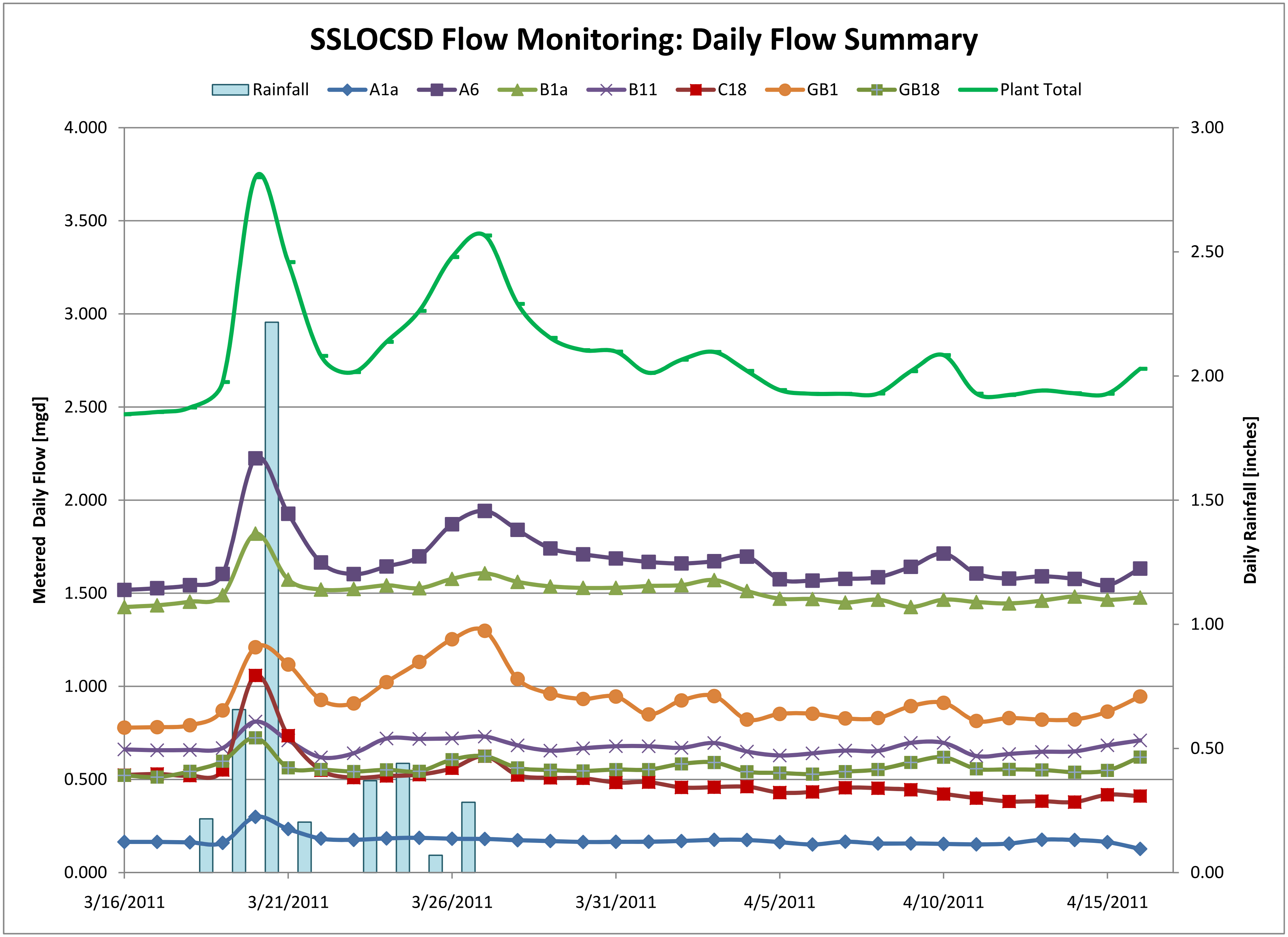
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM
Time of Day

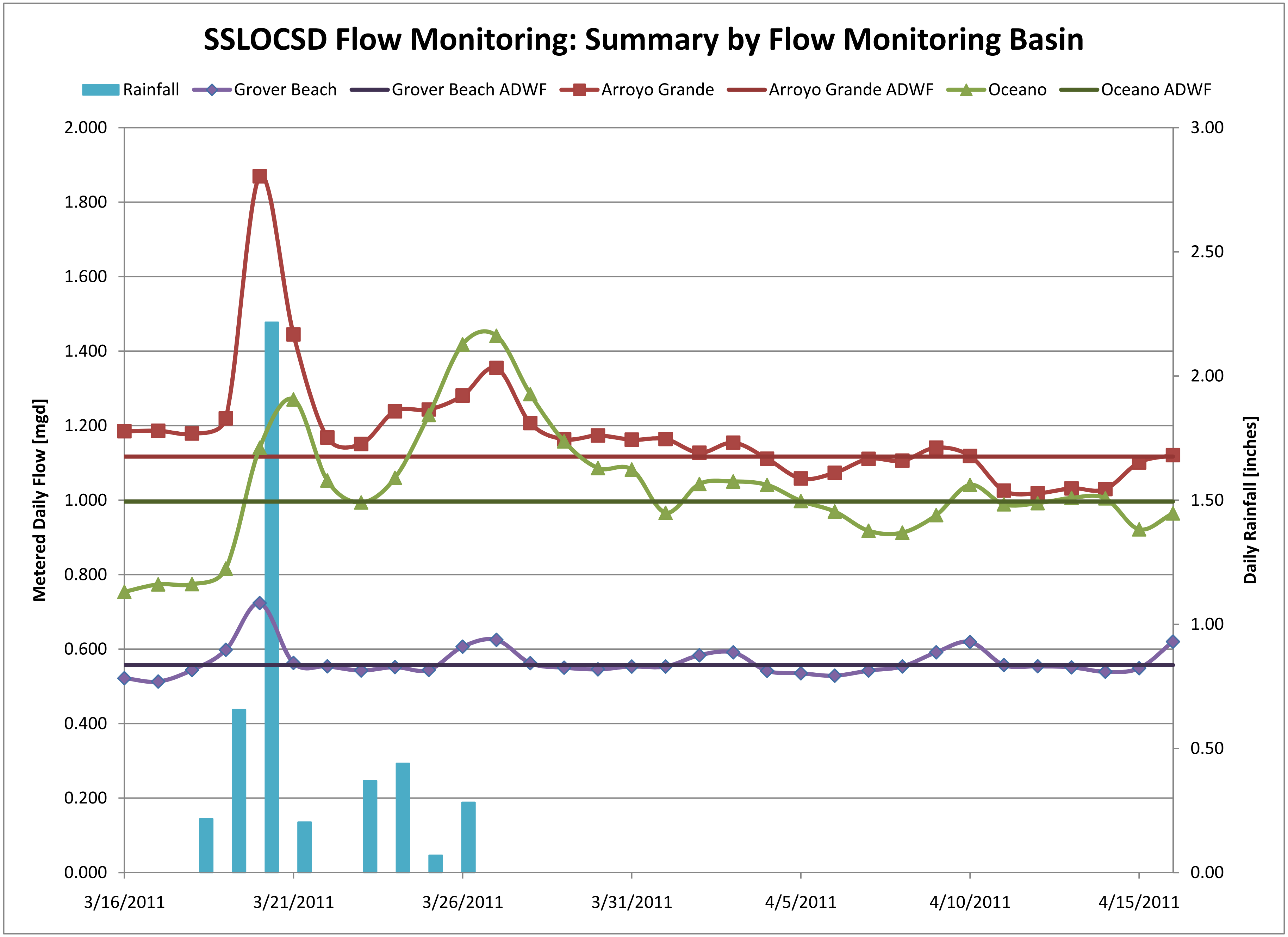

Oceano Lift Station, November and December 2010
Rainfall [inches]
Lift Station Run Time [hrs]
Pump Run Time [hours]
Rainfall [inches]
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
11/1/2010
11/11/2010
11/21/2010
12/1/2010
12/11/2010
12/21/2010

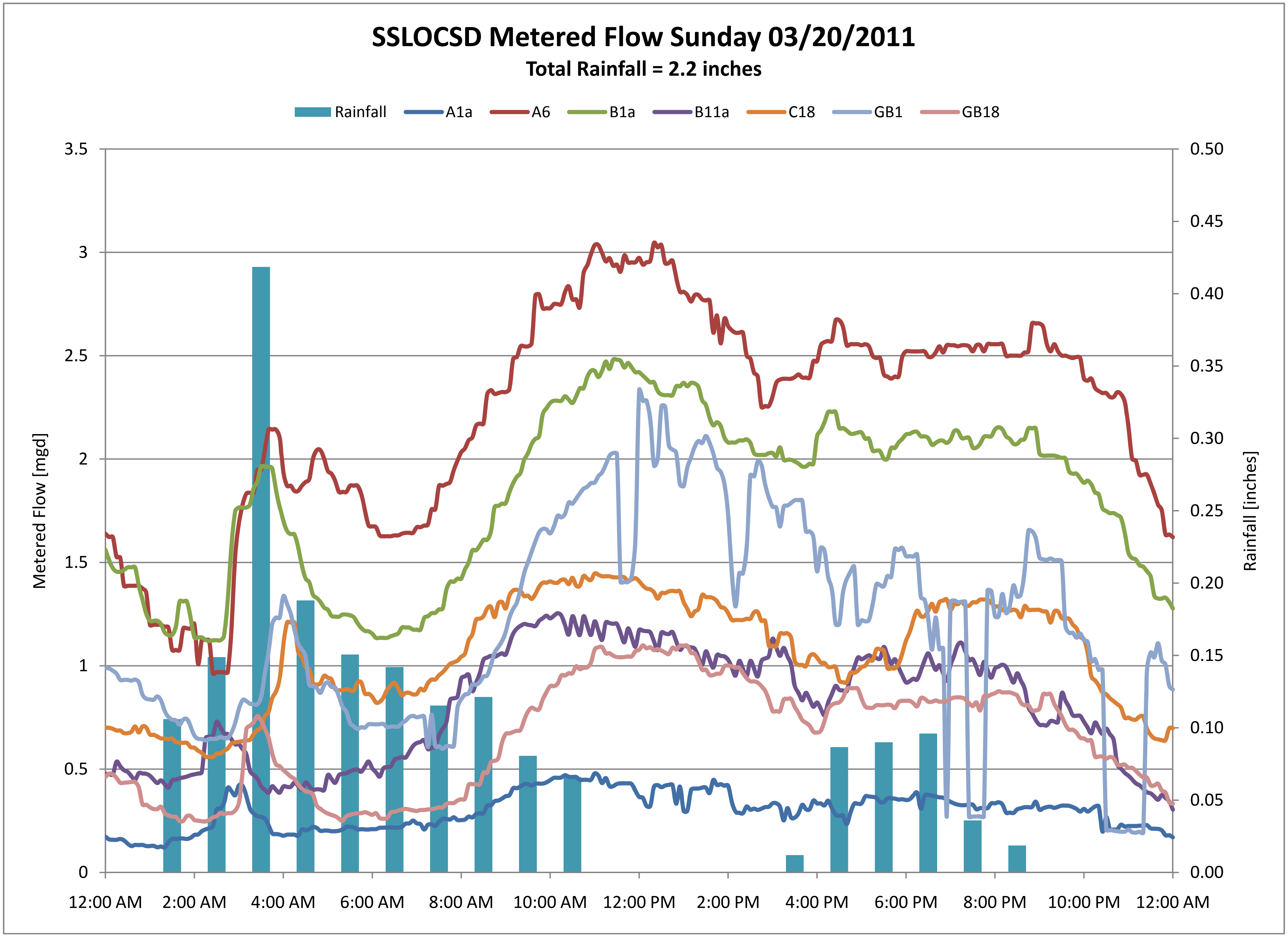


Oceano Lift Station, March and April 2011
Lift Station Run Time [hrs]
Rainfall [inches]
Pump Run Time [hours]
Daily Rainfall [inches]
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2.50
2.00
1.50
1.00
0.50
0.00
3/2/2011
3/12/2011
3/22/2011
4/1/2011
4/11/2011
4/21/2011

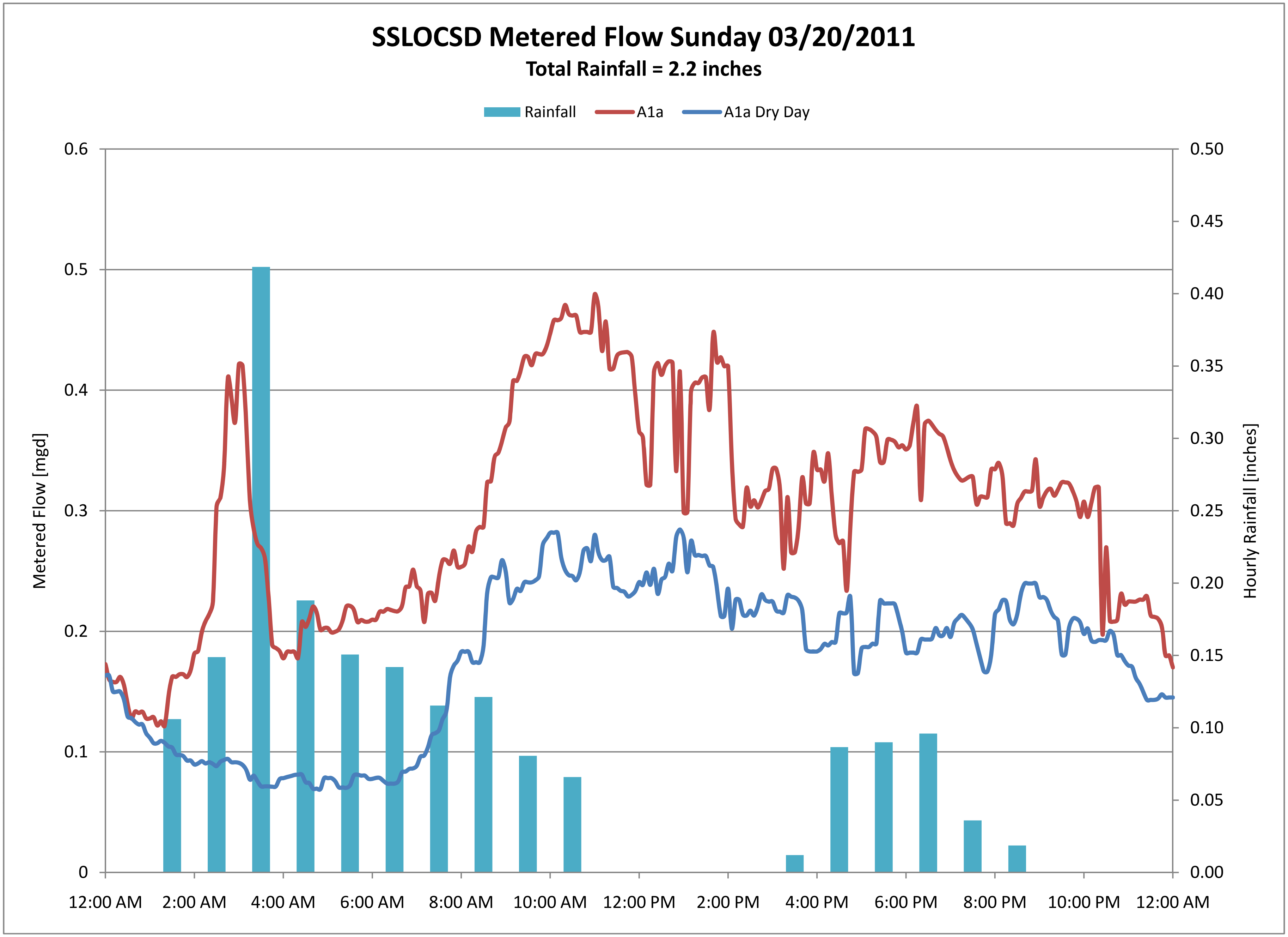

SSLOCSD WWTP Daily Flow
Rainfall
Flow Monitoring Total
Effluent Flow Meter
Flow [MGD]
Rainfall [inches]
4.50
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
2.50
2.00
1.50
1.00
0.50
0.00
3/16/2011
3/21/2011
3/26/2011
3/31/2011
4/5/2011
4/10/2011
4/15/2011


SSLOCSD Flow Monitoring: Daily Flow Summary
Rainfall
A1a
A6
B1a
B11
C18
GB1
GB18
Plant Total
Metered Daily Flow [mgd]
Daily Rainfall [inches]
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
3.00
2.50
2.00
1.50
1.00
0.50
0.00
3/16/2011
3/21/2011
3/26/2011
3/31/2011
4/5/2011
4/10/2011
4/15/2011

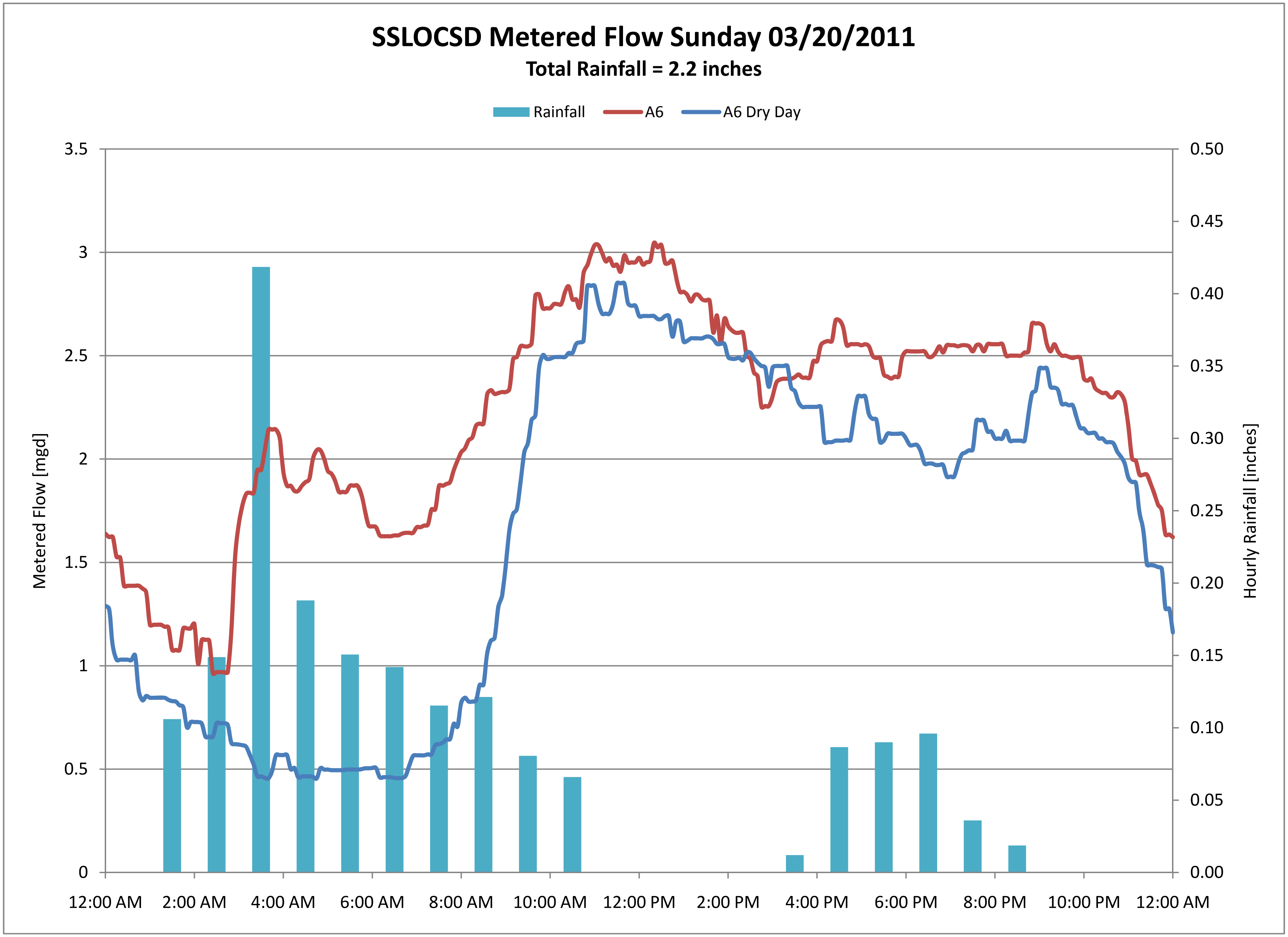

SSLOCSD Flow Monitoring: Summary by Flow Monitoring Basin
Rainfall
Grover Beach
Grover Beach ADWF
Arroyo Grande
Arroyo Grande ADWF
Oceano
Oceano ADWF
Metered Daily Flow [mgd]
Daily Rainfall [inches]
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
3.00
2.50
2.00
1.50
1.00
0.50
0.00
3/16/2011
3/21/2011
3/26/2011
3/31/2011
4/5/2011
4/10/2011
4/15/2011

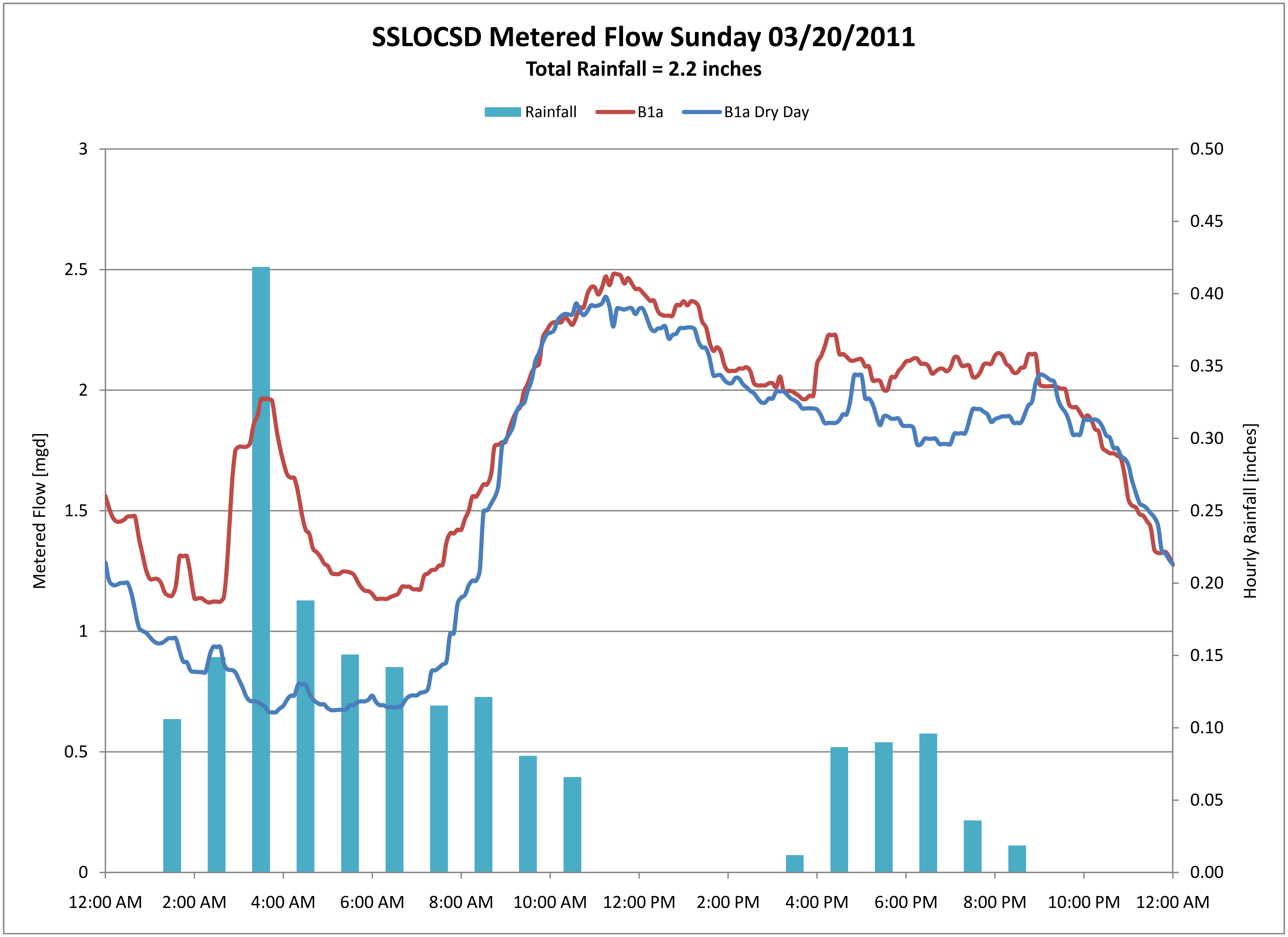


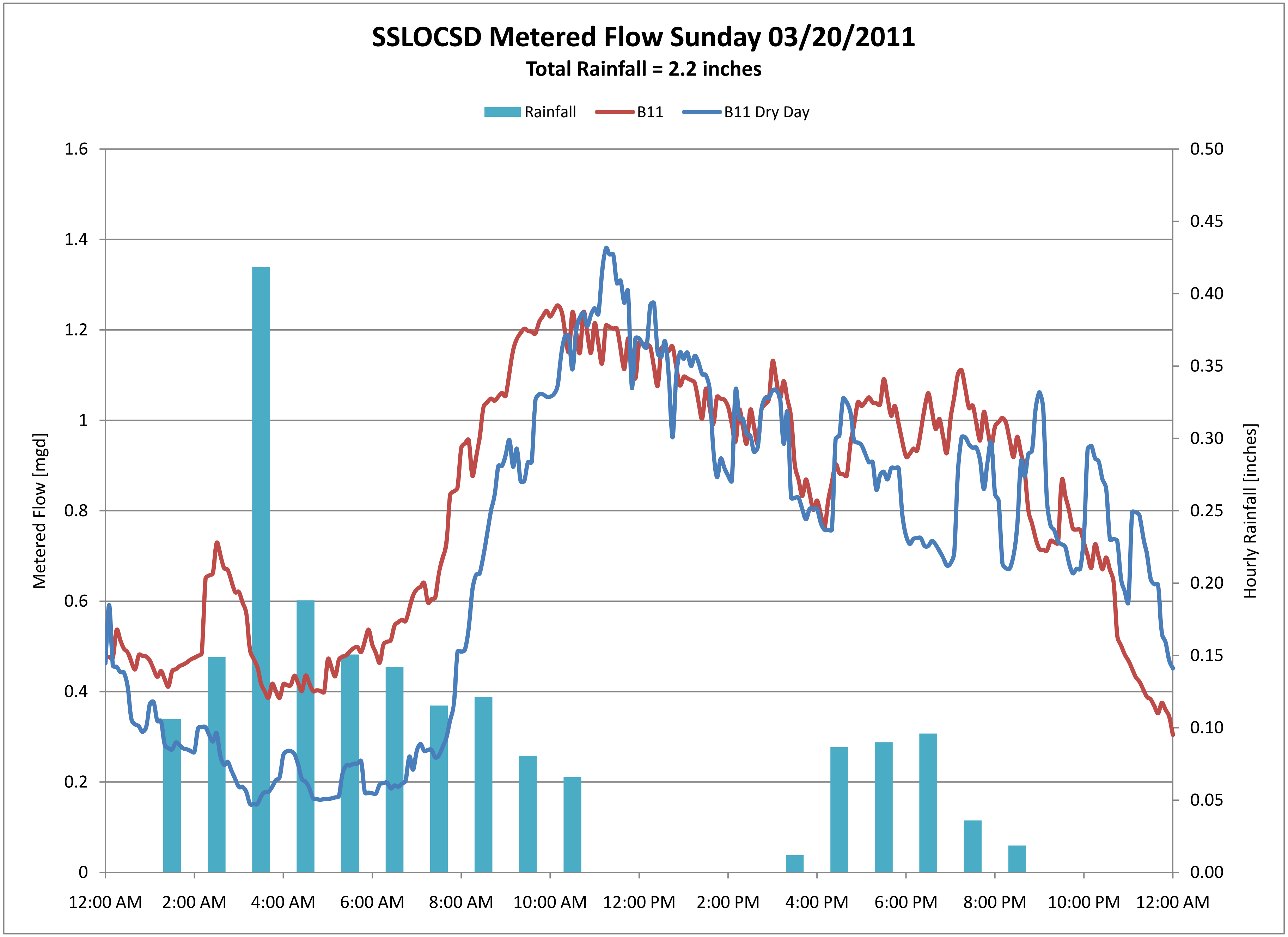
SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
A1a
A6
B1a
B11a
C18
GB1
GB18
Metered Flow [mgd]
Rainfall [inches]
3.5
3
2.5
2
1.5
1
0.5
0
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM

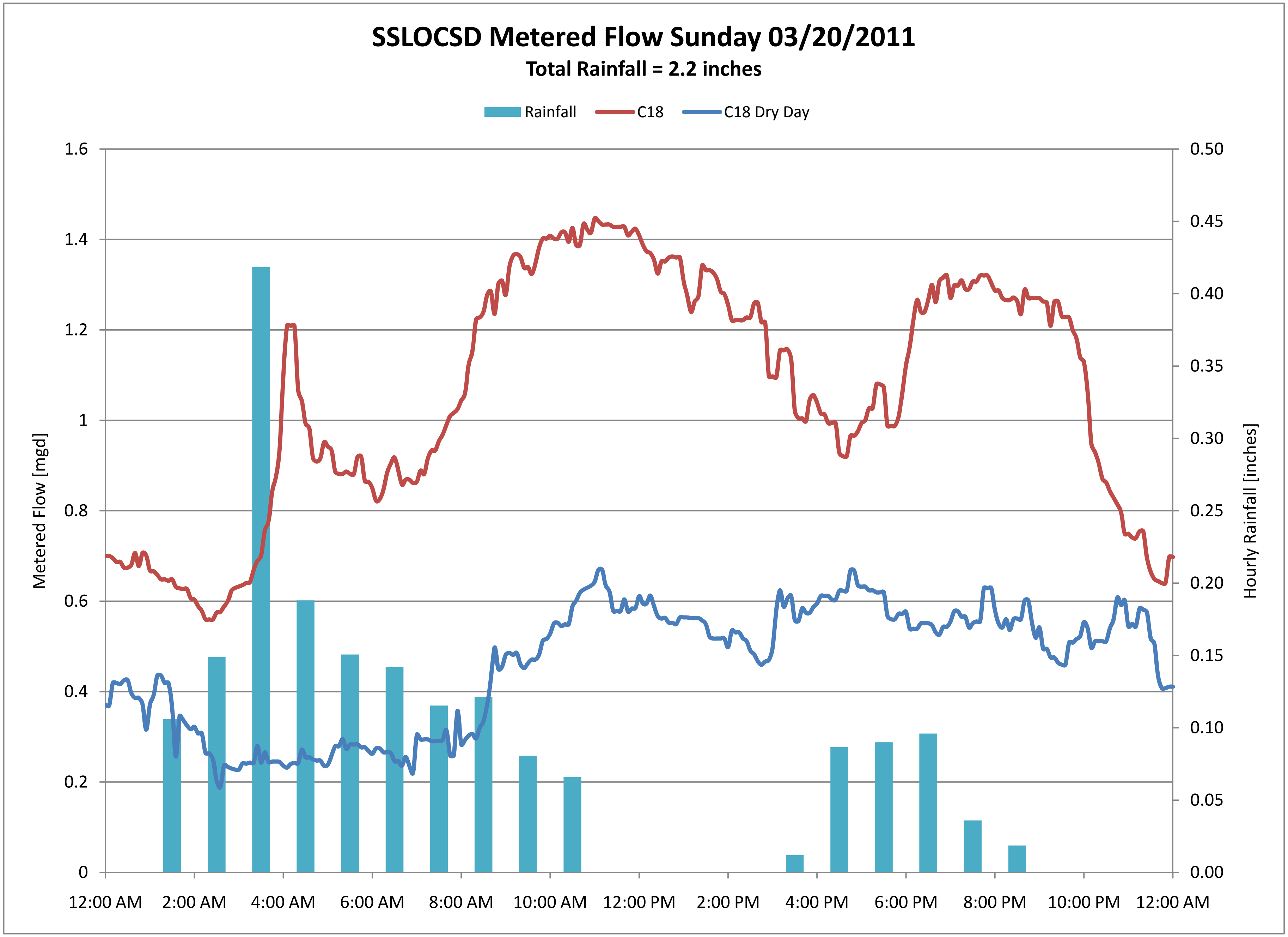


SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
A1a
A1a Dry Day
0.6
0.5
0.4
0.3
0.2
0.1
0
Metered Flow [mgd]
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Hourly Rainfall [inches]
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM

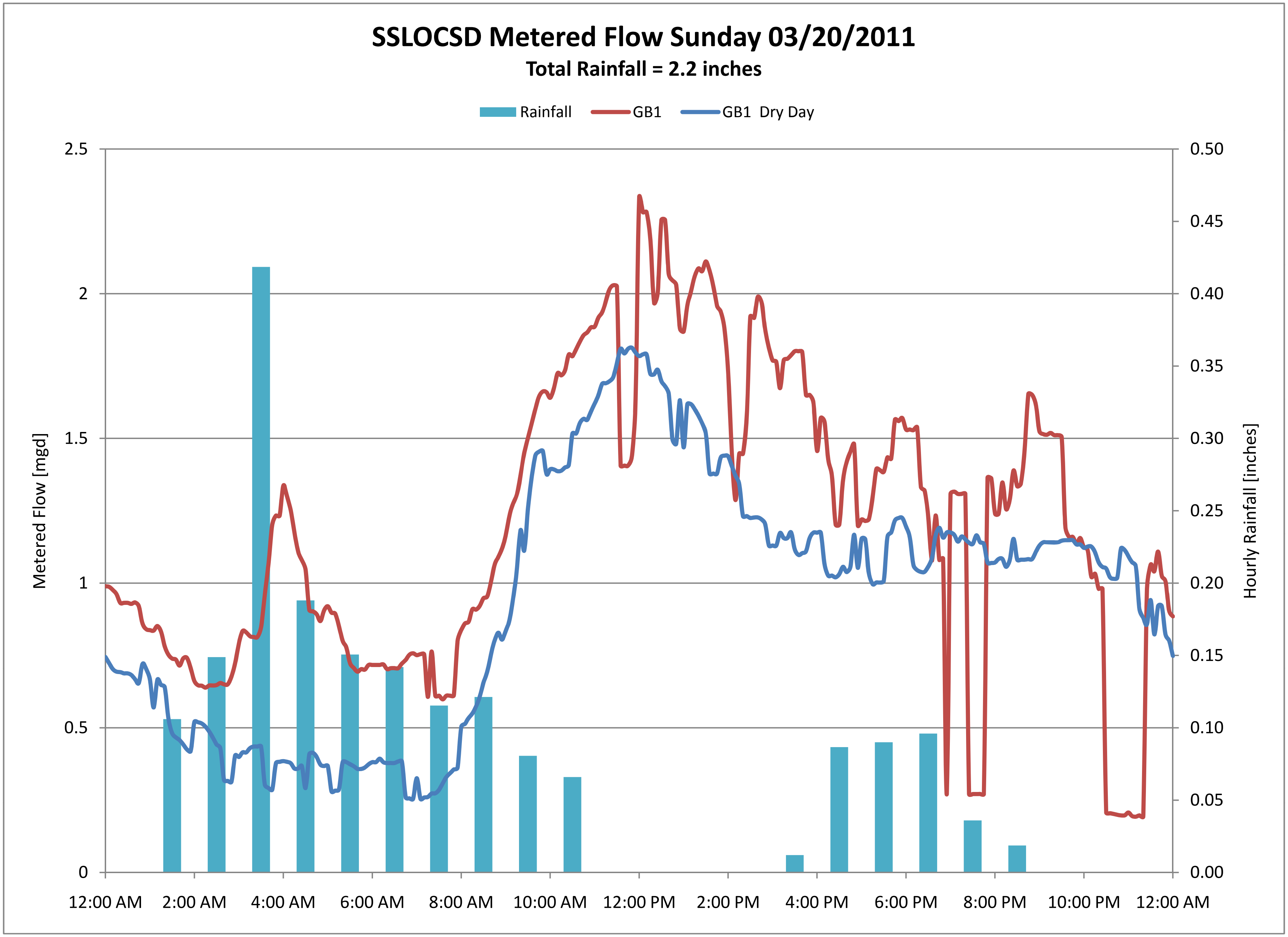

SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
A6
A6 Dry Day
Metered Flow [mgd]
Hourly Rainfall [inches]
3.5
3
2.5
2
1.5
1
0.5
0
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM

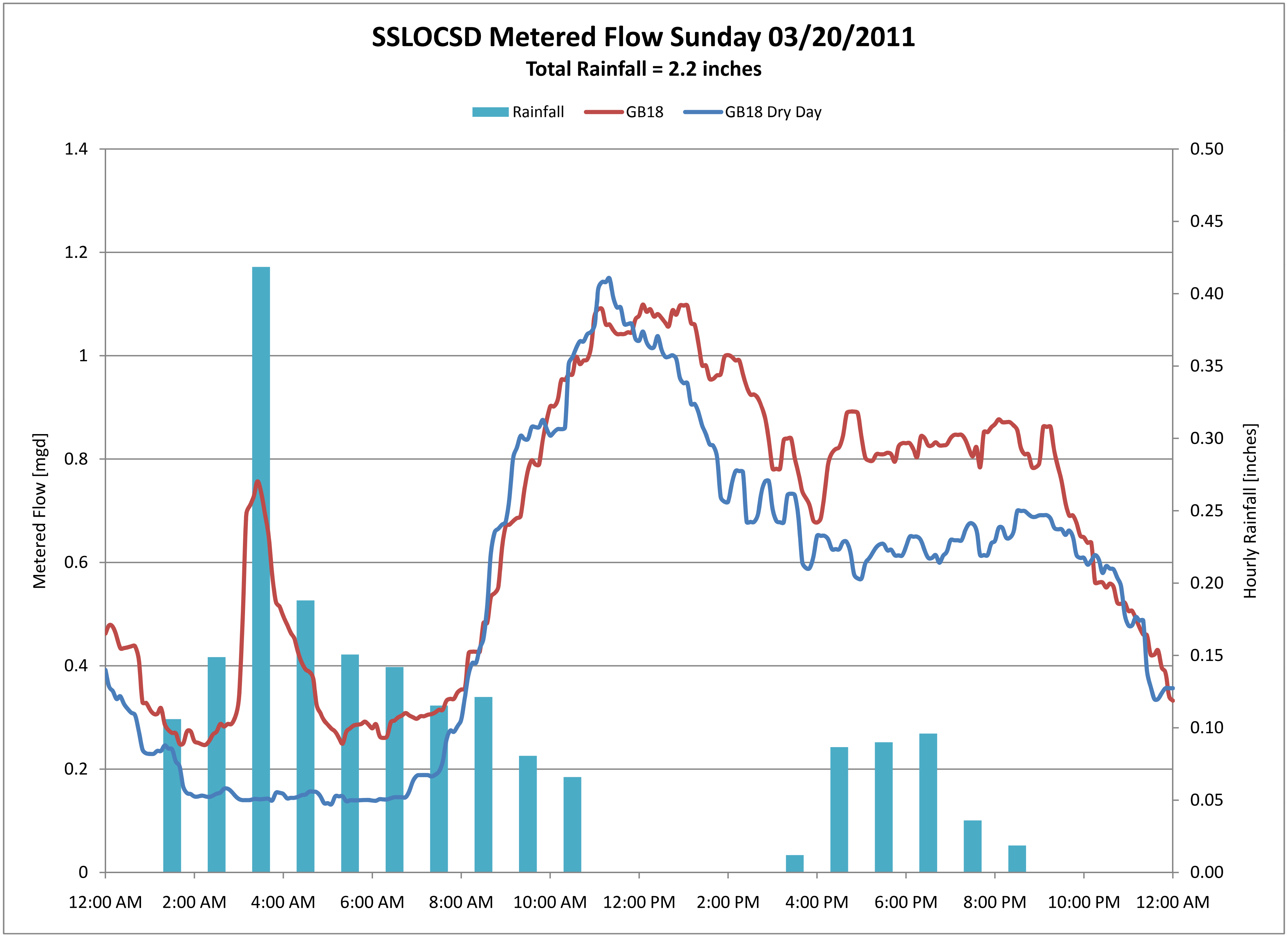

SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
B1a
B1a Dry Day
Metered Flow [mgd]
Hourly Rainfall [inches]
3
2.5
2
1.5
1
0.5
0
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM

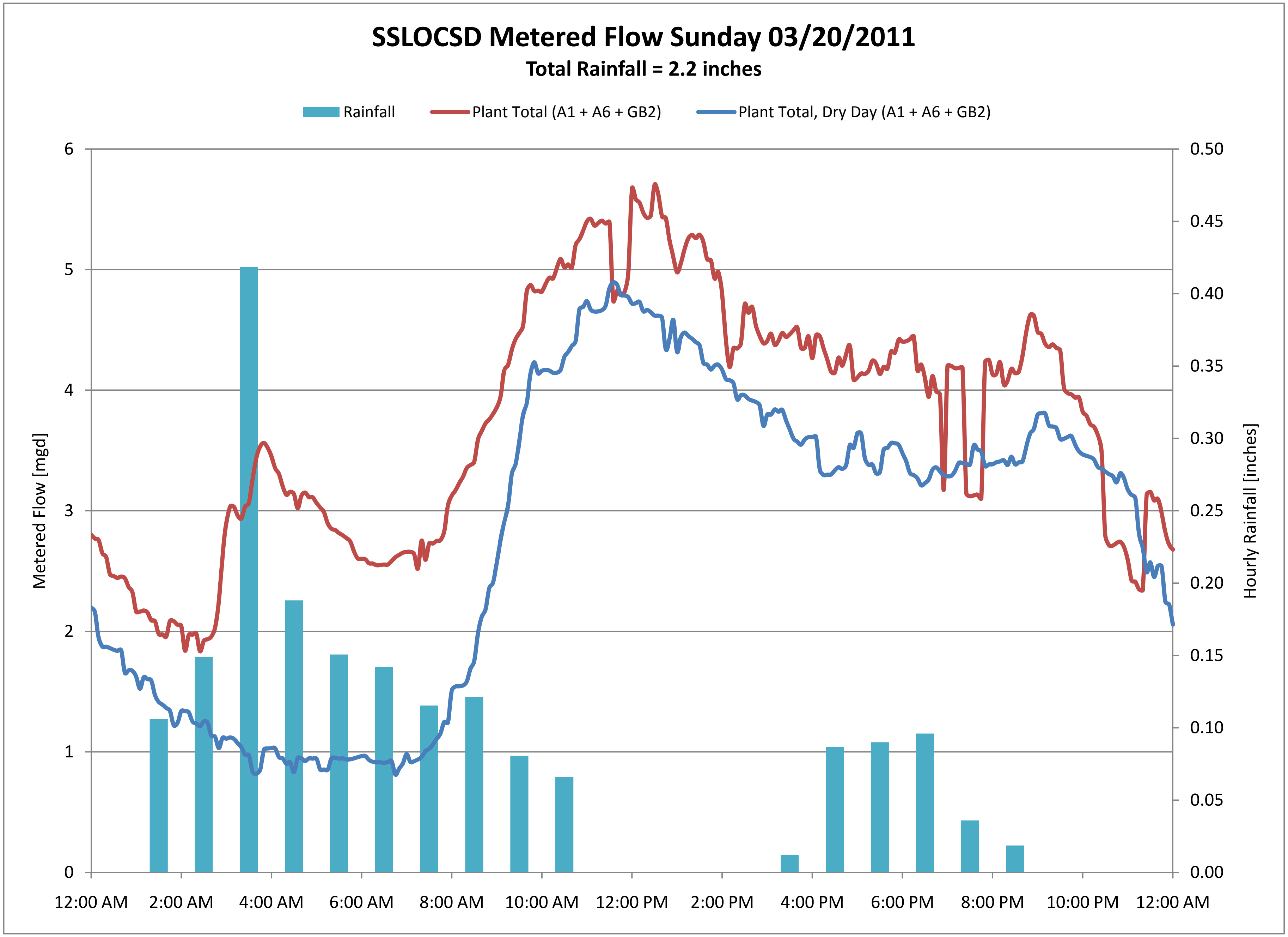

SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
B11
B11 Dry Day
Metered Flow [mgd]
Hourly Rainfall [inches]
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM



SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
C18
C18 Dry Day
Metered Flow [mgd]
Hourly Rainfall [inches]
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM


SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
GB1
GB1 Dry Day
Metered Flow [mgd]
Hourly Rainfall [inches]
2.5
2
1.5
1
0.5
0
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM


SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
GB18
GB18 Dry Day
Metered Flow [mgd]
Hourly Rainfall [inches]
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM


SSLOCSD Metered Flow Sunday 03/20/2011
Total Rainfall = 2.2 inches
Rainfall
Plant Total (A1 + A6 + GB2)
Plant Total, Dry Day (A1 + A6 + GB2)
Metered Flow [mgd]
Hourly Rainfall [inches]
0
1
2
3
4
5
6
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
12:00 PM
2:00 PM
4:00 PM
6:00 PM
8:00 PM
10:00 PM
12:00 AM

South San Luis Obispo County Sanitation District

Attachment 2 -Tables

Flow Monitoring Summary: Rain Day Flow by Meter [mgd]

		A1a	A6	B1a	B11	C18	GB1	GB18	Plant Total	Rainfall (inches)
Dry Weather Baseline	Weekday Flow	0.164	1.601	1.476	0.654	0.448	0.841	0.543	2.606	
	Weekend Flow	0.164	1.664	1.497	0.694	0.439	0.925	0.601	2.752	
	Daily Flow	0.163	1.632	1.487	0.665	0.452	0.875	0.557	2.670	
Friday 03/18/2011	Monitored Flow	0.162	1.544	1.455	0.658	0.521	0.791	0.544	2.497	0.22
	Inflow Volume	-0.002	-0.057	-0.021	0.004	0.072	-0.050	0.001	-0.109	
	Percent I/I	-1%	-4%	-1%	1%	16%	-6%	0%	-4%	
Saturday 03/19/2011	Monitored Flow	0.160	1.604	1.490	0.669	0.551	0.871	0.598	2.634	0.66
	I/I Volume	-0.004	-0.060	-0.007	-0.025	0.112	-0.054	-0.003	-0.118	
	Percent I/I	-3%	-4%	0%	-4%	26%	-6%	0%	-4%	
Sunday 03/20/2011	Monitored Flow	0.299	2.225	1.820	0.811	1.059	1.210	0.724	3.734	2.22
	I/I Volume	0.135	0.561	0.324	0.117	0.620	0.285	0.123	0.981	
	Percent I/I	82%	34%	22%	17%	141%	31%	20%	36%	
Monday 03/21/2011	Monitored Flow	0.234	1.927	1.573	0.710	0.735	1.117	0.563	3.278	0.20
	I/I Volume	0.070	0.326	0.098	0.055	0.287	0.276	0.020	0.672	
	Percent I/I	43%	20%	7%	8%	64%	33%	4%	26%	
Wednesday 03/23/2011	Monitored Flow	0.176	1.603	1.523	0.641	0.510	0.908	0.543	2.687	0.37
	I/I Volume	0.012	0.002	0.048	-0.014	0.062	0.067	0.000	0.081	
	Percent I/I	7%	0%	3%	-2%	14%	8%	0%	3%	
Thursday 03/24/2011	Monitored Flow	0.184	1.644	1.543	0.720	0.519	1.023	0.552	2.850	0.44
	I/I Volume	0.020	0.043	0.067	0.066	0.071	0.181	0.009	0.244	
	Percent I/I	12%	3%	5%	10%	16%	22%	2%	9%	
Friday 03/25/2011	Monitored Flow	0.187	1.698	1.527	0.718	0.526	1.131	0.544	3.016	0.07
	I/I Volume	0.023	0.098	0.052	0.063	0.077	0.290	0.002	0.410	
	Percent I/I	14%	6%	4%	10%	17%	34%	0%	16%	
Saturday 03/26/2011	Monitored Flow	0.174	1.840	1.561	0.683	0.524	1.040	0.562	3.054	0.28
	I/I Volume	0.012	0.297	0.106	0.025	0.003	0.248	0.019	0.557	
	Percent I/I	7%	19%	7%	4%	1%	31%	3%	20%	

Flow Monitoring Summary: Daily Flow [mgd]

	A1a	A6	B1a	B11	C18	GB1	GB18	Plant Total	**Rainfall (in)**	
3/16/2011	0.165	1.518	1.426	0.661	0.524	0.779	0.522	2.461	0.00	Wednesday
3/17/2011	0.165	1.527	1.435	0.657	0.529	0.781	0.513	2.473	0.00	Thursday
3/18/2011	0.162	1.544	1.455	0.658	0.521	0.791	0.544	2.497	0.22	Friday
3/19/2011	0.160	1.604	1.490	0.669	0.551	0.871	0.598	2.634	0.66	Saturday
3/20/2011	0.299	2.225	1.820	0.811	1.059	1.210	0.724	3.734	2.22	Sunday
3/21/2011	0.234	1.927	1.573	0.710	0.735	1.117	0.563	3.278	0.20	Monday
3/22/2011	0.183	1.665	1.520	0.619	0.549	0.927	0.554	2.775	0.00	Tuesday
3/23/2011	0.176	1.603	1.523	0.641	0.510	0.908	0.543	2.687	0.37	Wednesday
3/24/2011	0.184	1.644	1.543	0.720	0.519	1.023	0.552	2.850	0.44	Thursday
3/25/2011	0.187	1.698	1.527	0.718	0.526	1.131	0.544	3.016	0.07	Friday
3/26/2011	0.182	1.871	1.577	0.721	0.560	1.253	0.606	3.305	0.28	Saturday
3/27/2011	0.180	1.942	1.607	0.730	0.625	1.298	0.625	3.421	0.00	Sunday
3/28/2011	0.174	1.840	1.561	0.683	0.524	1.040	0.562	3.054	0.00	Monday
3/29/2011	0.169	1.741	1.537	0.655	0.509	0.961	0.550	2.871	0.00	Tuesday
3/30/2011	0.164	1.709	1.529	0.667	0.506	0.932	0.546	2.805	0.00	Wednesday
3/31/2011	0.165	1.687	1.529	0.679	0.484	0.945	0.553	2.798	0.00	Thursday
4/1/2011	0.166	1.668	1.539	0.678	0.486	0.849	0.553	2.683	0.00	Friday
4/2/2011	0.169	1.660	1.544	0.670	0.457	0.925	0.583	2.754	0.00	Saturday
4/3/2011	0.176	1.672	1.571	0.696	0.459	0.948	0.591	2.796	0.00	Sunday
4/4/2011	0.175	1.697	1.512	0.650	0.461	0.822	0.542	2.694	0.00	Monday
4/5/2011	0.164	1.575	1.471	0.629	0.429	0.852	0.535	2.591	0.00	Tuesday
4/6/2011	0.151	1.568	1.469	0.640	0.433	0.853	0.529	2.571	0.00	Wednesday
4/7/2011	0.166	1.577	1.450	0.655	0.456	0.828	0.542	2.571	0.00	Thursday
4/8/2011	0.156	1.586	1.466	0.653	0.453	0.830	0.553	2.572	0.00	Friday
4/9/2011	0.156	1.642	1.427	0.696	0.445	0.894	0.591	2.692	0.00	Saturday
4/10/2011	0.154	1.713	1.466	0.697	0.422	0.911	0.619	2.779	0.00	Sunday
4/11/2011	0.151	1.606	1.453	0.626	0.400	0.814	0.557	2.572	0.00	Monday
4/12/2011	0.156	1.579	1.445	0.637	0.382	0.830	0.554	2.564	0.00	Tuesday
4/13/2011	0.176	1.591	1.460	0.648	0.383	0.821	0.551	2.588	0.00	Wednesday
4/14/2011	0.175	1.577	1.482	0.651	0.379	0.822	0.539	2.574	0.00	Thursday
4/15/2011	0.164	1.544	1.465	0.683	0.418	0.864	0.549	2.571	0.00	Friday
4/16/2011	0.127	1.632	1.477	0.710	0.411	0.946	0.620	2.705	0.00	Saturday
4/17/2011	---	1.719	1.091	0.551	0.341	0.985	0.398	2.703	0.00	Sunday

SSLOCSD HISTORICAL INFLUENT FLOW SUMMARY					
Date	**Day of Week**	**Total Rain (in)**	**Ave Influent Flow (MGD)**	**Max Influent Flow (MGD)**	**Notes**
12/14/2008	Sunday	0.79	---	4.8	First rain of season
10/10/2009	Saturday	0.00	2.6	4.4	Dry weather baseline
10/11/2009	Sunday	0.00	2.5	4.4	Dry weather baseline
1/29/2011	Saturday	0.00	2.6	4.4	13.18 inches rainfall to-date
1/30/2011	Sunday	0.16	2.7	4.6	13.34 inches rainfall to-date
1/8/2011	Saturday	0.00	2.8	4.6	13.34 inches rainfall to-date
1/9/2011	Sunday	0.00	2.9	4.7	13.34 inches rainfall to-date
12/15/2008	Monday	0.59	2.8	3.9	First rain of season
10/12/2009	Monday	0.00	2.5	3.6	Dry weather baseline
10/13/2009	Tuesday	0.71	2.6	4.1	First rain of season
10/13/2010	Wednesday	0.00	2.5	3.7	Dry weather baseline
10/14/2010	Thursday	0.00	2.5	3.7	Dry weather baseline
11/9/2010	Tuesday	0.00	2.5	4.0	1.82 inches rainfall to-date
11/10/2010	Wednesday	0.00	2.5	4.1	1.82 inches rainfall to-date
12/29/2010	Wednesday	1.18	3.7	5.1	12.41 inches rainfall to-date, Airport flooded due to AG Creek flow
12/30/2010	Thursday	0.00	3.1	4.8	12.41 inches rainfall to-date
1/5/2011	Wednesday	0.00	---	3.9	13.14 inches rainfall to-date
1/6/2011	Thursday	0.00	2.7	3.9	13.14 inches rainfall to-date
1/7/2011	Friday	0.00	2.7	4.0	13.14 inches rainfall to-date
		Average Dry Weather Flow [mgd]			
		Dry Season Weekday	2.5	3.7	
		Dry Season Weekend	2.6	3.9	
		Dry Season Average	2.5	3.8	
		Wet Season Weekday	2.8	4.2	
		Wet Season Weekend	2.7	4.0	
		Wet Season Average	2.7	4.1	

Date	Pump 1 Hours	Pump 1 Run Time [hrs]	Pump 2 Hours	Pump 2 Run Time [hrs]	Total Pump Run Time [hrs]	Day of the Week	Rainfall [inches] KDYCAOCE2	Increase Factor
11/1/2010	967.1	1.6	12423.4	1.2	2.8	Monday	0.00	-24%
11/2/2010	968.7	1.6	12424.6	1.2	2.8	Tuesday	0.00	-24%
11/3/2010	970.3	1.5	12425.8	1.2	2.7	Wednesday	0.00	-26%
11/4/2010	971.8	1.6	12427.0	1.3	2.9	Thursday	0.00	-21%
11/5/2010	973.4	1.6	12428.3	1.8	3.4	Friday	0.00	-7%
11/6/2010	975.0	3.0	12430.1	2.0	5.0	Saturday	0.00	10%
11/7/2010	978.0	2.0	12432.1	1.5	3.5	Sunday	0.55	-23%
11/8/2010	980.0	1.8	12433.6	1.4	3.2	Monday	0.00	-13%
11/9/2010	981.8	2.0	12435.0	1.6	3.6	Tuesday	0.00	-2%
11/10/2010	983.8	2.1	12436.6	1.6	3.7	Wednesday	0.00	1%
11/11/2010	985.9	2.2	12438.2	1.8	4.0	Thursday	0.00	9%
11/12/2010	988.1	2.5	12440.0	1.9	4.4	Friday	0.00	20%
11/13/2010	990.6	3.1	12441.9	2.3	5.4	Saturday	0.00	19%
11/14/2010	993.7	2.5	12444.2	1.9	4.4	Sunday	0.00	-3%
11/15/2010	996.2	2.0	12446.1	1.6	3.6	Monday	0.00	-2%
11/16/2010	998.2	1.9	12447.7	1.4	3.3	Tuesday	0.00	-10%
11/17/2010	1000.1	1.8	12449.1	1.5	3.3	Wednesday	0.00	-10%
11/18/2010	1001.9	1.8	12450.6	1.5	3.3	Thursday	0.00	-10%
11/19/2010	1003.7	2.2	12452.1	1.8	4.0	Friday	0.00	9%
11/20/2010	1005.9	2.6	12453.9	2.1	4.7	Saturday	0.24	3%
11/21/2010	1008.5	2.3	12456.0	1.2	3.5	Sunday	0.51	-23%
11/22/2010	1010.8	2.2	12457.2	2.4	4.6	Monday	0.00	25%
11/23/2010	1013.0	2.5	12459.6	1.9	4.4	Tuesday	0.00	20%
11/24/2010	1015.5	3.0	12461.5	2.2	5.2	Wednesday	0.00	42%
11/25/2010	1018.5	4.3	12463.7	3.0	7.3	Thursday	0.00	99%
11/26/2010	1022.8	3.1	12466.7	2.2	5.3	Friday	0.00	45%
11/27/2010	1025.9	2.9	12468.9	2.3	5.2	Saturday	0.04	14%
11/28/2010	1028.8	2.3	12471.2	1.9	4.2	Sunday	0.04	-8%
11/29/2010	1031.1	2.1	12473.1	1.5	3.6	Monday	0.00	-2%
11/30/2010	1033.2	2.3	12474.6	1.8	4.1	Tuesday	0.00	12%
12/1/2010	1035.5	2.1	12476.4	1.6	3.7	Wednesday	0.00	1%
12/2/2010	1037.6	2.0	12478.0	1.6	3.6	Thursday	0.00	-2%
12/3/2010	1039.6	2.1	12479.6	1.6	3.7	Friday	0.00	1%
12/4/2010	1041.7	2.4	12481.2	1.8	4.2	Saturday	0.00	-8%
12/5/2010	1044.1	2.0	12483.0	1.6	3.6	Sunday	0.47	-21%
12/6/2010	1046.1	2.0	12484.6	1.6	3.6	Monday	0.00	-2%
12/7/2010	1048.1	2.0	12486.2	1.5	3.5	Tuesday	0.00	-5%
12/8/2010	1050.1	2.1	12487.7	1.6	3.7	Wednesday	0.00	1%
12/9/2010	1052.2	2.3	12489.3	1.8	4.1	Thursday	0.00	12%
12/10/2010	1054.5	2.2	12491.1	1.7	3.9	Friday	0.00	6%
12/11/2010	1056.7	2.3	12492.8	1.8	4.1	Saturday	0.00	-10%
12/12/2010	1059.0	2.4	12494.6	1.8	4.2	Sunday	0.00	-8%
12/13/2010	1061.4	2.1	12496.4	1.7	3.8	Monday	0.00	4%
12/14/2010	1063.5	2.1	12498.1	1.6	3.7	Tuesday	0.00	1%
12/15/2010	1065.6	2.2	12499.7	1.7	3.9	Wednesday	0.00	6%
12/16/2010	1067.8	2.2	12501.4	1.7	3.9	Thursday	0.00	6%
12/17/2010	1070.0	2.8	12503.1	2.1	4.9	Friday	0.24	34%
12/18/2010	1072.8	5.8	12505.2	3.0	8.8	Saturday	2.87	93%
12/19/2010	1078.6	8.6	12508.2	10.1	18.7	Sunday	1.73	311%
12/20/2010	1087.2	3.5	12518.3	3.3	6.8	Monday	0.87	85%
12/21/2010	1090.7	3.0	12521.6	1.8	4.8	Tuesday	0.16	31%
12/22/2010	1093.7	2.8	12523.4	2.3	5.1	Wednesday	0.47	39%
12/23/2010	1096.5	2.6	12525.7	2.0	4.6	Thursday	0.00	25%
12/24/2010	1099.1	2.4	12527.7	1.9	4.3	Friday	0.00	17%
12/25/2010	1101.5	3.7	12529.6	3.2	6.9	Saturday	1.14	52%
12/26/2010	1105.2	3.4	12532.8	2.7	6.1	Sunday	0.00	34%
12/27/2010	1108.6	3.0	12535.5	2.2	5.2	Monday	0.00	42%
12/28/2010	1111.6	3.7	12537.7	3.3	7.0	Tuesday	0.16	91%
12/29/2010	1115.3	3.4	12541.0	2.0	5.4	Wednesday	1.18	47%
12/30/2010	1118.7	3.1	12543.0	2.4	5.5	Thursday	0.00	50%

Date	Pump 1 Hours	Pump 1 Run Time [hrs]	Pump 2 Hours	Pump 2 Run Time [hrs]	Total Pump Run Time [hrs]	Day of the Week	Rainfall [inches] KDYCAOCE2	Increase Factor
3/1/2011	1262.1	2.1	12648.7	1.5	3.6	Tuesday	0.00	-19%
3/2/2011	1264.2	2.2	12650.2	1.5	3.7	Wednesday	0.08	-17%
3/3/2011	1266.4	2.2	12651.7	1.6	3.8	Thursday	0.08	-14%
3/4/2011	1268.6	2.4	12653.3	1.8	4.2	Friday	0.00	-5%
3/5/2011	1271.0	2.3	12655.1	1.6	3.9	Saturday	0.00	-20%
3/6/2011	1273.3	2.4	12656.7	1.8	4.2	Sunday	0.00	-14%
3/7/2011	1275.7	1.8	12658.5	1.1	2.9	Monday	0.00	-35%
3/8/2011	1277.5	2.0	12659.6	1.6	3.6	Tuesday	0.00	-19%
3/9/2011	1279.5	1.9	12661.2	0.9	2.8	Wednesday	0.00	-37%
3/10/2011	1281.4	2.1	12662.1	1.9	4.0	Thursday	0.00	-10%
3/11/2011	1283.5	2.4	12664.0	1.7	4.1	Friday	0.00	-7%
3/12/2011	1285.9	2.8	12665.7	1.9	4.7	Saturday	0.00	-4%
3/13/2011	1288.7	2.4	12667.6	1.5	3.9	Sunday	0.00	-20%
3/14/2011	1291.1	2.3	12669.1	1.4	3.7	Monday	0.00	-17%
3/15/2011	1293.4	2.1	12670.5	1.3	3.4	Tuesday	0.00	-23%
3/16/2011	1295.5	2.3	12671.8	1.5	3.7	Wednesday	0.00	-17%
3/17/2011		2.3		1.5	3.7	Thursday	0.00	-17%
3/18/2011	1300.0	2.6	12674.7	1.6	4.2	Friday	0.24	-5%
3/19/2011	1302.6	1.8	12676.3	2.2	4.0	Saturday	0.39	-18%
3/20/2011	1304.4	5.4	12678.5	2.0	7.4	Sunday	1.97	51%
3/21/2011	1309.8	3.0	12680.5	1.8	4.8	Monday	0.20	8%
3/22/2011	1312.8	3.0	12682.3	2.0	5.0	Tuesday	0.00	13%
3/23/2011	1315.8	3.0	12684.3	2.4	5.4	Wednesday	0.31	22%
3/24/2011	1318.8	3.3	12686.7	1.3	4.6	Thursday	0.31	4%
3/25/2011	1322.1	3.9	12688.0	2.2	6.1	Friday	0.04	38%
3/26/2011	1326.0	3.7	12690.2	2.4	6.1	Saturday	0.16	25%
3/27/2011	1329.7	2.3	12692.6	1.6	3.9	Sunday	0.00	-20%
3/28/2011	1332.0	2.4	12694.2	1.4	3.8	Monday	0.00	-14%
3/29/2011	1334.4	1.6	12695.6	1.8	3.4	Tuesday	0.00	-23%
3/30/2011	1336.0	3.6	12697.4	1.7	5.3	Wednesday	0.00	20%
3/31/2011	1339.6	2.9	12699.1	1.7	4.6	Thursday	0.00	4%
4/1/2011	1342.5	3.4	12700.8	1.9	5.3	Friday	0.00	20%
4/2/2011	1345.9	3.0	12702.7	2.0	5.0	Saturday	0.00	2%
4/3/2011	1348.9	2.8	12704.7	1.7	4.5	Sunday	0.00	-8%
4/4/2011	1351.7	2.8	12706.4	1.6	4.4	Monday	0.00	-1%
4/5/2011	1354.5	2.9	12708.0	1.0	3.9	Tuesday	0.00	-12%
4/6/2011	1357.4	3.0	12709.0	2.6	5.6	Wednesday	0.00	26%
4/7/2011	1360.4	2.7	12711.6	1.8	4.5	Thursday	0.00	2%
4/8/2011	1363.1	3.3	12713.4	2.1	5.4	Friday	0.00	22%
4/9/2011	1366.4	3.5	12715.5	2.0	5.5	Saturday	0.00	12%
4/10/2011	1369.9	2.8	12717.5	1.9	4.7	Sunday	0.00	-4%
4/11/2011	1372.7	2.9	12719.4	2.0	4.9	Monday	0.00	11%
4/12/2011	1375.6	1.6	12721.4	1.2	2.8	Tuesday	0.00	-37%
4/13/2011	1377.2	2.2	12722.6	1.4	3.6	Wednesday	0.00	-19%
4/14/2011	1379.4	2.5	12724.0	2.0	4.5	Thursday	0.00	2%
4/15/2011	1381.9	3.3	12726.0	2.4	5.7	Friday	0.00	29%
4/16/2011	1385.2	4.2	12728.4	2.3	6.5	Saturday	0.00	33%
4/17/2011	1389.4	3.7	12730.7	2.5	6.2	Sunday	0.00	27%
4/18/2011	1393.1	3.6	12733.2	2.3	5.9	Monday	0.00	33%
4/19/2011	1396.7	3.6	12735.5	2.3	5.9	Tuesday	0.00	33%
4/20/2011	1400.3	3.5	12737.8	2.2	5.7	Wednesday	0.00	29%
4/21/2011	1403.8	3.7	12740.0	2.3	6.0	Thursday	0.00	35%
4/22/2011	1407.5	13.0	12742.3	2.0	15.0	Friday	0.00	238%
4/23/2011	1420.5	3.6	12744.3	2.4	6.0	Saturday	0.00	23%
4/24/2011	1424.1	2.9	12746.7	1.8	4.7	Sunday	0.00	-4%
4/25/2011	1427.0	2.7	12748.5	1.7	4.4	Monday	0.00	-1%
4/26/2011	1429.7	2.6	12750.2	1.6	4.2	Tuesday	0.00	-5%
4/27/2011	1432.3	2.7	12751.8	1.8	4.5	Wednesday	0.00	2%
4/28/2011	1435.0	2.5	12753.6	1.6	4.1	Thursday	0.00	-7%
4/29/2011	1437.5	3.9	12755.2	2.3	6.2	Friday	0.00	40%

South San Luis Obispo County Sanitation District

Attachment 3 – Field Investigation

SSLOCSD I&I Study
Field Investigation – 03/24/2011
Valerie Huff & Aaron Yonker

Manhole G-18: minor infiltration suspected

- Some minor roots
- Soil around manhole rim dry below surface
- Rim elevation 2-3 feet above flowline of Hwy 1 – Hwy 1 would need to flood before surface flow entered manhole

Manhole GB-15: potential inflow during major storm events, minor infiltration suspected

- Shelf and interior of manhole wet, no obvious I/I at time of inspection
- Lagoon level high
- Large puddle at corner of Norswing & Coolidge

Manhole GB-14: surface flow over top of manhole, likely no ponding

- Sediment/debris due to prior surface flow observed
- Appears that puddle would remain below manhole rim

Manhole A1-D: significant inflow suspected, some infiltration likely

- Large ponded area at elevation of manhole rim. Likely pond drained into manhole.
- Significant water staining down the interior of the manhole
- Water observed entering manhole between grade ring and frame

Manhole A1-C: infiltration suspected

- Water staining between cone and manhole base
- Base of manhole flowing full

Manhole A5-A: no I/I suspected

- Manhole in good overall condition
- No apparent water staining or other signs of I/I

Manhole A5-B: minor infiltration suspected

- Some water staining at base of manhole
- Overall manhole in good condition with no roots

Manhole A6-A: infiltration suspected

- Heavy roots in grade rings
- Weeds growing between manhole lid and frame

Cleanout A4-a: potential inflow, could not locate cleanout

- Cleanout potentially buried, could not locate
- Ponding likely at this location
- Velocity much greater in downstream manhole than other adjacent manholes

Manhole A3-A: potential inflow during major storm events, minor infiltration suspected

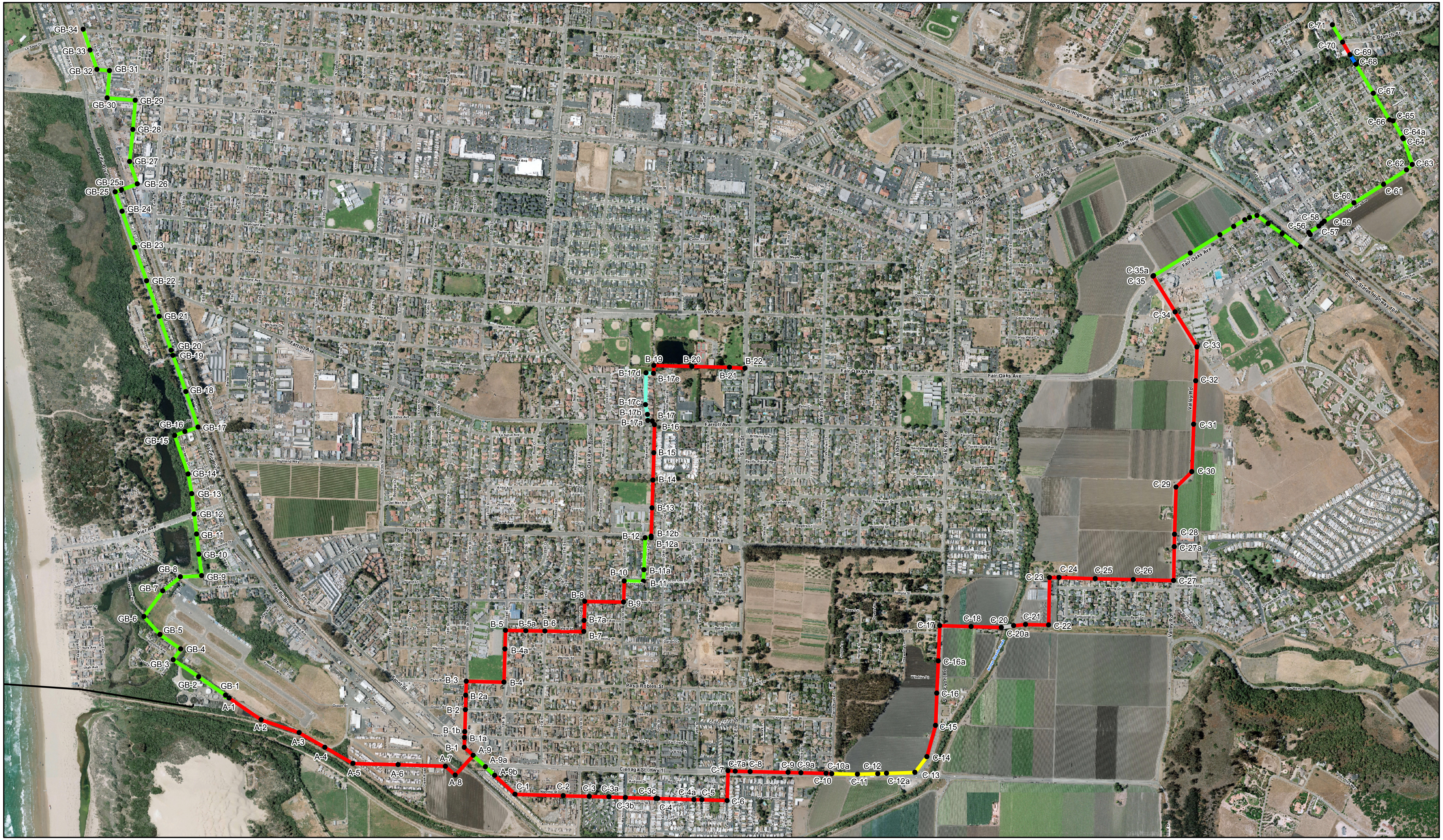
- Located in drainage way, ponding may reach rim elevation during greater storm events
- Heavy weeds and vegetation around manhole, but no root intrusion
- Soil below surface dry

Summary for further field investigation

MH A1-D: Ponding and inflow. Verify ponded area of upstream manhole (A1-E).
MH GB-14: Verify ponding does not reach manhole lid.
MH A6-A: Observe for infiltration through grade rings.
CO A4-a: Locate and verify condition.
MH A3-A: Observe for ponding during significant rain event.

South San Luis Obispo County Sanitation District

Attachment 4 – Trunk Sewer Material Map



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www.wallacegroup.us

WALLACE GROUP

Legend

- Trunk Sewer Manhole
- OTHER
- ACP - EPOXY LINER
- ACP - SPIRO LITE PVC LINER
- PVC
- STEEL
- STEEL - FOLD AND FORM PVC LINER
- VCP

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Geographic Information System

N

MAP PRODUCED:
NOVEMBER 21, 2008