SANITARY SEWER ANALYSIS

TTM No. 22-01
City of Seal Beach Sewer Atlas Map S-004-A and S-005-A

Prepared for:
Lampson Park Place, LLC
27702 Crown Valley Parkway D4-197
Ladera Ranch, CA 92694

Property:
TTM No. 22-01
APN 130-012-35
4665 Lampson Ave.
Los Alamitos, California

Prepared by:
C&V Consulting, Inc.
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Irvine, CA 92618
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Philip C Malcomson R.C.E. 67819

September 2022

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Appendices

INTRODUCTION

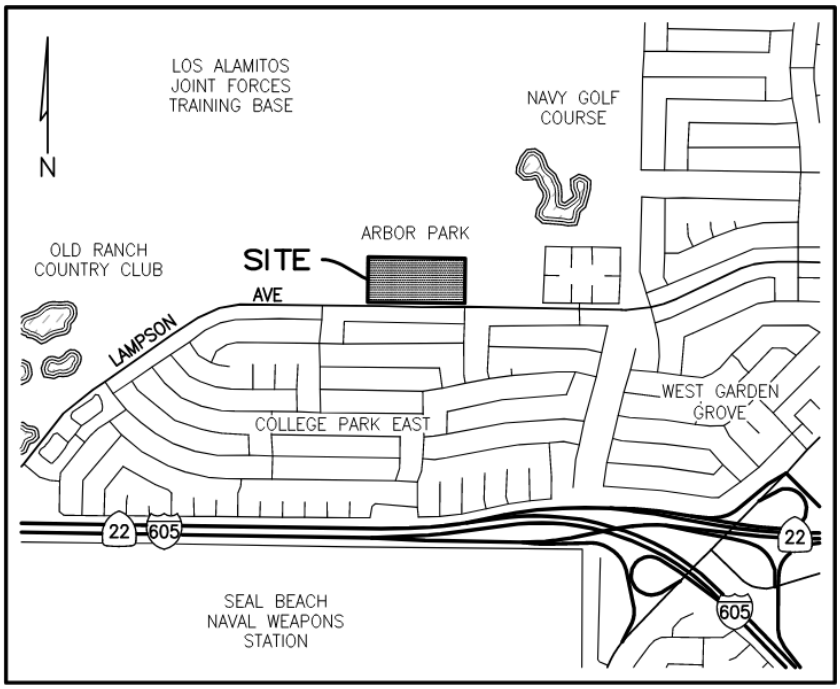
The following study has been prepared by C&V Consulting, Inc. to determine and illustrate:

- ***A.*** The capacity of the existing sewer segments from the proposed development site to the City of Seal Beach maintained 8" sewer main in the Aster Street and Basswood Street intersection.
- ***B.*** The capacity of the existing sewer segments from the proposed development site to the City of Seal Beach maintained 8" sewer main in the Aster Street and Candleberry Avenue intersection.
- ***C.*** The capacity of the existing sewer segments from the proposed development site to the City of Seal Beach maintained 8" sewer main in Elder Avenue.
- ***D.*** If the existing sewer facilities will adequately service the proposed development.

Although the project site is in the City of Los Alamitos, sanitary sewer will be served by the City of Seal Beach. Per the City of Seal Beach Sewer Master Plan 2018, the City provides sewer service throughout the City in a service area that collects and conveys wastewater from the service area for treatment by the Orange County Sanitation District (OCSD). This study utilizes a sewer monitoring method to determine the result. The existing sewer system was analyzed to determine the sewer capacity and its ability to adequately service the proposed development. The analysis includes all existing tributary flows to the sewer system and future flow from the proposed development to the existing system, located in the Aster Street and Basswood Street intersection. Additionally, this report will include an analysis of the sewer segment located in the Aster Street and Candleberry Avenue intersection and a third manhole in Elder Avenue. This report will analyze the existing capacity and how the future flow from the proposed development will impact the sewer system at these three manholes.

SITE DESCRIPTION

The project site comprises a gross total of 12.367 acres and is located at 4665 Lampson Ave., at the northwest corner of Rose Street and Lampson Avenue, in the City of Los Alamitos, California (APN: 130-012-35). The site is bounded by Lampson Avenue to the south, Arbor Park to the north and east, and undeveloped land to the west.



PROJECT DESCRIPTION

The development proposes the construction of 246 total units (77 affordable apartment units, 55 detached SFD units, and 114 townhouse units) with private garages, private drive aisles, sidewalks, guest parking areas, and common landscaped areas.

Project Site	**Size (ac)**
Total Project Area (APN: 130-012-35)	12.367

METHODOLOGY/EXISTING CONDITIONS

The study will investigate the sewerage discharge route from the proposed development (TTM No. 22-01) to the existing sewer mains of the three manholes that were monitored.

Please note that the sewer main sizes in the sewer atlas map and the ADS report do not match. ADS confirmed the reported sizes are correct so the report and calculations will reflect these reported sewer main sizes.

Sewer Monitoring Method

Basswood Street and Aster Street Intersection

As part of this study for the sewer monitoring analysis, the project was conditioned to flow monitor the existing conditions at northern inlet of Manhole A-16 of the 15" local main, located in the Basswood Street and Aster Street Intersection by ADS. The flow monitoring took place from 8/23/22 to 9/5/22. The existing project site peak flow was subtracted from the projected proposed project site flow. This delta flow was then added to the existing monitored peak flows to obtain the proposed development conditions.

Candleberry Avenue and Aster Street Intersection

As part of this study for the sewer monitoring analysis, the project was conditioned to flow monitor the existing conditions at northern inlet of Manhole A-21 of the 17.88" xx 17" (H x W) elliptical local main, located in the Candleberry Avenue and Aster Street Intersection by ADS. The flow monitoring took place from 8/23/22 to 9/5/22. The existing project site peak flow was subtracted from the projected proposed project site flow. This delta flow was then added to the existing monitored peak flows to obtain the proposed development conditions.

Elder Avenue

As part of this study for the sewer monitoring analysis, the project was conditioned to flow monitor the existing conditions at northern inlet of Manhole A-25 of the 12" local main, located in Elder Avenue by ADS. The existing project site peak flow was subtracted from the projected proposed project site flow. This delta flow was then added to the existing monitored peak flows to obtain the proposed development conditions.

SEWER PIPE CAPACITY ANALYSIS

Sewer Monitoring Method

Basswood Street and Aster Street (Manhole A-16)

The existing sewer pipes were analyzed per City of Seal Beach Sewer Master Plan 2018 Table ES-1, for a maximum design depth at half-full for pipe sized at 15" or under. Based on the monitoring data collected by ADS, existing peak flow for Manhole A-16 at the northern inlet was measured at 0.391 MGD (0.6050 cfs), with a max peak depth flow of 4.52 inches (d/D = 0.3013). The data shows that the 15" sewer pipe system capacity is capable of maintaining an adequate flow well below 50% of its flow depth capacity with the additional flow from the proposed development. Refer to the field data enclosed in Appendix B.

The "Unit Flow Factors" Table 3-1 per the City of Seal Beach Sewer Master Plan 2018 was utilized for this method to obtain the peak flow generated from the proposed residential project site. It was determined from the architectural plans for the 246 residential unit (20.33 DU/AC) project has a proposed zoning of Adopted R-3 Ordinance. It is assumed that this zoning is equivalent to the "Residential High Density" Land Use from the "Unit Flow Factors." The project is estimated to be a total peak flow output of 49468 GPD (0.0765 cfs) of effluent. After applying peak dry and wet weather factors, it was determined there would be 0.2348 cfs of effluent from the project site.

The same calculations were made to determine the flow produced from the existing site.

To approximate the real-world conditions of the pipe, a new Manning's n-value was calculated based on the existing max flow rate and depth of flow observed. This new Manning's n-value was used to calculate the depth of flow for the combined proposed flow rate and the existing flow rate.

The project site will contribute an additional 0.0824 cfs to the trunk main. This will increase the d/D to become 0.3216, which is below the d/D=0.50 criteria and indicates that the proposed development will not have a significant impact on the existing condition of its' capacity. Refer to the Sewer Monitoring Study Table in Appendix A for calculation details.

Candleberry Avenue and Aster Street (Manhole A-21)

The existing sewer pipes were analyzed per City of Seal Beach Sewer Master Plan 2018 Table ES-1, for a maximum design depth at half-full for pipe sized at 15" or under and pipes measured 18" or over with a d/D of 0.64. Since this is an elliptical sewer main sized at 17.88" x 17" (H x W), it was treated with the design criteria of d/D=0.5 (half full). Based on the monitoring data collected by ADS, existing peak flow for Manhole A-21 at the northern inlet was measured at 0.377 MGD (0.5833 cfs), with a max peak depth flow of 5.84 inches (d/D = 0.3266). The data shows that the sewer pipe system capacity is capable of maintaining an adequate flow well below 50% of its flow depth capacity with the additional flow from the proposed development. Refer to the field data enclosed in Appendix B.

The "Unit Flow Factors" Table 3-1 per the City of Seal Beach Sewer Master Plan 2018 was utilized for this method to obtain the peak flow generated from the proposed residential project site. It was determined from the architectural plans for the 246 residential unit (20.33 DU/AC) project has a proposed zoning of Adopted R-3 Ordinance. It is assumed that this zoning is equivalent to the "Residential High Density" Land Use from the "Unit Flow Factors." The project is estimated to be a total peak flow output of 49468 GPD (0.0765 cfs) of effluent. After applying peak dry and wet weather factors, it was determined there would be 0.2348 cfs of effluent from the project site.

The same calculations were made to determine the flow produced from the existing site.

To approximate the real-world conditions of the pipe, a new Manning's n-value was calculated based on the existing max flow rate and depth of flow observed. This new Manning's n-value was used to calculate the depth of flow for the combined proposed flow rate and the existing flow rate.

The project site will contribute an additional 0.0824 cfs to the trunk main. This will increase the d/D to become 0.3684, which is below the d/D=0.50 criteria and indicates that the proposed development will not have a significant impact on the existing condition of its' capacity. Refer to the Sewer Monitoring Study Table in Appendix A for calculation details.

Elder Avenue (Manhole A-25)

The existing sewer pipes were analyzed per City of Seal Beach Sewer Master Plan 2018 Table ES-1, for a maximum design depth at half-full for pipe sized at 15" or under. Based on the monitoring data collected by ADS, existing peak flow for Manhole A-25 at the northern inlet was measured at 0.249 MGD (0.3853 cfs), with a max peak depth flow of 4.75 inches (d/D = 0.3958). The data shows that the 12" sewer pipe system capacity is capable of maintaining an adequate flow well below 50% of its flow depth capacity with the additional flow from the proposed development. Refer to the field data enclosed in Appendix C.

The "Unit Flow Factors" Table 3-1 per the City of Seal Beach Sewer Master Plan 2018 was utilized for this method to obtain the peak flow generated from the proposed residential project site. It was determined from the architectural plans for the 246 residential unit (20.33 DU/AC) project has a proposed zoning of Adopted R-3 Ordinance. It is assumed that this zoning is equivalent to the "Residential High Density" Land Use from the "Unit Flow Factors." The project is estimated to be a total peak flow output of 49468 GPD (0.0765 cfs) of effluent. After applying peak dry and wet weather factors, it was determined there would be 0.2348 cfs of effluent from the project site.

The same calculations were made to determine the flow produced from the existing site.

To approximate the real-world conditions of the pipe, a new Manning's n-value was calculated based on the existing max flow rate and depth of flow observed. This new Manning's n-value was used to calculate the depth of flow for the combined proposed flow rate and the existing flow rate.

The project site will contribute an additional 0.0824 cfs to the trunk main. This will increase the d/D to become 0.441, which is below the d/D=0.50 criteria and indicates that the proposed development will not have a significant impact on the existing condition of its' capacity. Refer to the Sewer Monitoring Study Table in Appendix A for calculation details.

CONCLUSION

The results from this study using methods provided by the ADS and Manning's equation demonstrate that the proposed flows, in addition to the observed flows, create a proposed depth of flow that does not impact the existing surrounding sanitary sewer systems. Based on sewer monitoring data collected by ADS, the sewer systems in all three locations indicated good flow, along with hydraulics and relatively low depths. Refer to Appendix A for calculations and tabulated results.

All three sewer mains at the monitored locations will have d/D levels under 0.5.

MH A-16 (Basswood Street and Aster Street Intersection)

Existing d/D: 0.3013

Future d/D: 0.3216

d/D % Increase: 6.30%

MH A-21 (Candleberry Avenue and Aster Street Intersection)

Existing d/D: 0.3266

Future d/D: 0.3684

d/D % Increase: 11.34%

MH A-25 (Elder Avenue)

Existing d/D: 0.3958

Future d/D: 0.441

d/D % Increase: 10.24%

Based on the analysis above, we conclude that effluent volumes produced by the proposed development should not significantly impact or exceed the existing sewer capacity in the public system, and that the existing sewer system has adequate capacity for the proposed development.

Appendix A

SEWER MONITORING STUDY TABLE & DEPTH OF FLOW CALCULATIONS

Sewer Monitoring Study Table

TTM 22-01

Basswood Street & Aster Street (Manhole A-16)

Upstream Pipeline Size*	15	in
Upstream Pipeline Slope	0.0016	ft/ft
Metered Ex. Peak Flow	0.391	MGD
Ex. Peak Flow	0.6050	cfs
Metered Ex. Peak Flow Depth	4.52	in
d/D	0.3013	
Calculated Manning's n	0.01096	

*The observed pipe size does not match the sewer atlas. The observed pipe size is used as this information is more recent

Project Projected Flows

High Density Residential**	4000	GPD/Acre
Project Site Area	12.367	Acres
Average Dry Weather Flow (Q_{adw})	49468	GPD
Average Dry Weather Flow (Q_{adw})	0.0765	cfs
Peak Dry Weather Flow (Q_{pdw})***	0.1739	cfs
Peak Wet Weather Flow (Q_{pww})*****	0.2348	cfs

Existing Site Flow

Commerical****	2500	Acres
Project Site Area	12.367	Acres
Average Dry Weather Flow (Q_{adw})	30917.5	GPD
Average Dry Weather Flow (Q_{adw})	0.0478	cfs
Peak Dry Weather Flow (Q_{pdw})***	0.1129	cfs
Peak Wet Weather Flow (Q_{pww})*****	0.1524	cfs

**per City of Seal Beach Sewer System Master Plan 2018 - Table 3-2 Unit Flow Factors

***per City of Seal Beach Sewer System Master Plan 2018 - Section 3-3 Q_{pqd} = Peaking Factor x $Q_{adw}^{0.92}$ (Peaking value 1.85)

****Existing Project Site zone is "Community Facilities" per City of Los Alamitos zoning map. It's assumed to have unit flow factors of Commercial (C) per City of Seal Beach Sewer System Master Plan Update - Table 4-2 Unit Flow Factors

*****per City of Seal Beach Sewer System Master Plan 2018 - Section 3-3 $Q_{pww} = 1.35 \times Q_{pdw}$

Delta Flow (cfs) = Project Wet Peak Flows (cfs) - Existing Wet Peak Site Flow (cfs)= 0.0824 cfs

Future Flow (cfs) = Metered Ex. Peak Flow (cfs) + Delta Flow (cfs)= 0.6874 cfs

Calculated Future Depth	4.824	in
Future d/D	0.3216	
d/D % Increase	6.30%	

Sewer Monitoring Study Table

TTM 22-01

Candleberry Street & Aster Street (Manhole A-21)

Upstream Pipeline Size (Height)*	17.88	in
Upstream Pipeline Size (Width)*	17	in
Upstream Pipeline Slope	0.0018	ft/ft
Metered Ex. Peak Flow	0.377	MGD
Ex. Peak Flow	0.5833	cfs
Metered Ex. Peak Flow Depth	5.84	in
d/D	0.3266	
Calculated Manning's n	0.02111439	

*The observed pipe size does not match the sewer atlas. The observed pipe size is used as this information is more recent

Project Projected Flows

High Density Residential**	4000	GPD/Acre
Project Site Area	12.367	Acres
Average Dry Weather Flow (Q_{adw})	49468	GPD
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*****per City of Seal Beach Sewer System Master Plan 2018 - Section 3-3 Q_{pww} = 1.35 x Q_{pdw}

Delta Flow (cfs) = Project Wet Peak Flows (cfs) - Existing Wet Peak Site Flow (cfs)= 0.0824 cfs

Future Flow (cfs) = Metered Ex. Peak Flow (cfs) + Delta Flow (cfs)= 0.6657 cfs

Calculated Future Depth	6.263	in
Future d/D	0.3684	
d/D % Increase	11.34%	

Sewer Monitoring Study Table

TTM 22-01

Elder Avenue (Manhole A-25)

Upstream Pipeline Size*	12	in
Upstream Pipeline Slope	0.002	ft/ft
Metered Ex. Peak Flow	0.249	MGD
Ex. Peak Flow	0.3853	cfs
Metered Ex. Peak Flow Depth	4.75	in
d/D	0.3958	
Calculated Manning's n	0.0178	

*The observed pipe size does not match the sewer atlas. The observed pipe size is used as this information is more recent

Project Projected Flows

High Density Residential**	4000	GPD/Acre
Project Site Area	12.367	Acres
Average Dry Weather Flow (Q_{adw})	49468	GPD
Average Dry Weather Flow (Q_{adw})	0.0765	cfs
Peak Dry Weather Flow (Q_{pdw})***	0.1739	cfs
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Existing Site Flow

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*****per City of Seal Beach Sewer System Master Plan 2018 - Section 3-3 $Q_{pww} = 1.35 \times Q_{pdw}$

Delta Flow (cfs) = Project Wet Peak Flows (cfs) - Existing Wet Peak Site Flow (cfs)= 0.0824 cfs

Future Flow (cfs) = Metered Ex. Peak Flow (cfs) + Delta Flow (cfs)= 0.4677 cfs

Calculated Future Depth	5.292	in
Future d/D	0.441	
d/D % Increase	10.24%	

Appendix B

FLOW MONITORING DATA

4665 Lampson Ave Sewer Study

Final Report Submitted to **SealBeach.KHR.TFM.CA22**
September 21, 2022

ADS ENVIRONMENTAL SERVICES

September 21, 2022

James H. Kawamura, P.E.
KHR Associates
17530 Von Karman Avenue – Suite 200
Irvine, CA 92614

SUBJECT: 4665 Lampson Ave Sewer Study

Dear Mr. Kawamura,

ADS is pleased to submit the report for the 4665 Lampson Ave Sewer Study completed on behalf of KHR Associates. The metering was conducted at three (3) locations. The study was conducted during the period of Tuesday, 23 August 2022 to Monday, 05 September 2022.

The report contains depth, velocity, and quantity hydrographs as well as daily long tables for the metering period. An Excel file containing depth, quantity, and velocity entities for the monitoring location in 5-minute format has been provided.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Shay Koerber at (619) 520-9168.

It has been our pleasure to be of service to you in the performance of this project. Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,
ADS ENVIRONMENTAL SERVICES

Justin Hatch
Data Analyst
562-488-7346

4665 Lampson Ave Sewer Study

Prepared For:

James H. Kawamura, P.E.
KHR Associates
17530 Von Karman Avenue – Suite 200
Irvine, CA 92614

Prepared By:

ADS, LLC
15201 Springdale St
Huntington Beach, CA 92649

Scope and Methodology

Introduction

KHR Associates entered into an agreement with ADS Environmental Services to conduct flow monitoring at (3) three locations in the Seal Beach Sanitary Collection System. The study was scheduled for a period of (14) fourteen days. Once in place, the flow monitoring equipment was used to measure depth, velocity, and to quantify flows. Data obtained from the study will be used to determine existing sewer flow rates and capacity to support development of a new residential redevelopment project tributary to these locations.

Project Scope

The scope of this study involved using a flow monitor to quantify wastewater flow at the designated locations for the 14-day time period. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring sites for adequate hydraulic conditions
- Flow monitor installations
- Flow monitor confirmations and data collections
- Flow data analysis

Equipment installation was completed on August 22, 2022. The monitoring began on August 23, 2022 and was completed on September 5, 2022. Upon completion of the study, equipment was removed from the system.

Flow Monitoring Equipment

The ***ADS Trinton+*** monitor was selected for this project. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Triton+ monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The Triton+ monitor features cross-checking using multiple technologies in each sensor for continuous running of comparisons and tolerances. The Triton+ monitor can support two (2) sets of sensors. The sensor option used for this project was:

The Peak Combo Sensor installed at the bottom of the pipe includes three types of data acquisition technologies.

The ***up looking ultrasonic depth*** uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by

sensor to calculate depth.

The ***pressure depth*** is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

To obtain ***peak velocity*****,** the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed.

In pipes up to 42 inches in diameter, the sensors were mounted on expandable stainless steel rings, inserted at least a foot upstream into influent pipes and tightened against the inside walls of the pipes. Influent pipe installations reduce the influences of turbulence and backwater often caused by changes in channel geometry in manholes.

Data Collection, Confirmation, and Quality Assurance

Data collection was done remotely via wireless connect on a weekly basis via ADS Field Representatives. During the monitoring period, field crews visit each monitoring location to verify proper monitor operation and document field conditions. The following quality assurance steps are taken to assure the integrity of the collected data:

Measure power supplies: monitors were powered by dry cell battery packs. Voltages were recorded and battery packs replaced, as necessary. Separate batteries provided back-up power to memory allowing primary batteries to be replaced without loss of data.

Clock synchronization: Field crews synchronized monitor clocks to master clocks.

Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare them meter readings to confirm that they agreed. They also measured silt levels, if any, in the inverts of the pipes. Silt areas were subtracted from flow areas to compute true areas of flow.

Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measure peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

Upload and Review Data: Data collected from the monitors were uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow patterns, which indicate system anomalies or equipment failure.

Flow Quantification Methods

There are two main equations used to measure open channel flow: the ***Continuity Equation*** and the ***Manning Equation.*** The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

Q = A * V

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the ultrasonic depth, (2) the peak velocity and (3) the pressure depth. The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which depth sensor entity will be used to calculate the final depth information. Silt and/or debris are often present in sewer lines. When present, silt levels are measured at each site visit. They are reviewed by the data analyst and representative silt levels established. Silt reduces the cross sectional area of the flow where as debris causes depth to become deeper and slower. Calculated flow should remain consistent in both hydraulic conditions. Debris may result in reduced line capacity.

Occasionally the velocity sensor's performance may be compromised resulting in invalid readings sporadically during the monitoring period. This is generally caused by excessive debris (silt) blocking the sensor's crystals, shallow flows (~< 1") that may drop below the top of the sensor or very clear flows lacking the particles needed to measure rate. In order to use the Continuity equation to quantify the flow during these periods, a Data Analyst and/or Engineer will use the site's historical pipe curve (depth vs. velocity) data along with valid field confirmations to reconstitute and replace the false velocity recordings with expected velocity readings for a given historical depth along the curve.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs. Hydrographs are based on 5 minute averaging. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the tables and hydrographs.

DFINAL - Final calculated depth measurement (in inches)

QFINAL - Final calculated flow rate (in MGD)

VFINAL - Final calculated flow velocity (in feet per second)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

Bass01

Site Commentary

SITE INFORMATION

Pipe	Round (15 in H)
Silt	0.00 (in)

OBSERVATIONS

Average flow depth, velocity, and quantity data observed during **Tuesday, 23 August 2022 to Monday, 05 September 2022**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.48	1.45	0.215
Minimum	2.09	0.79	0.055
Maximum	4.52	1.94	0.391
Min Time	08/30/2022 05:05:00	09/03/2022 05:20:00	08/30/2022 05:15:00
Max Time	08/29/2022 21:20:00	08/29/2022 21:15:00	08/29/2022 21:15:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the five minutes average.

DATA UPTIME

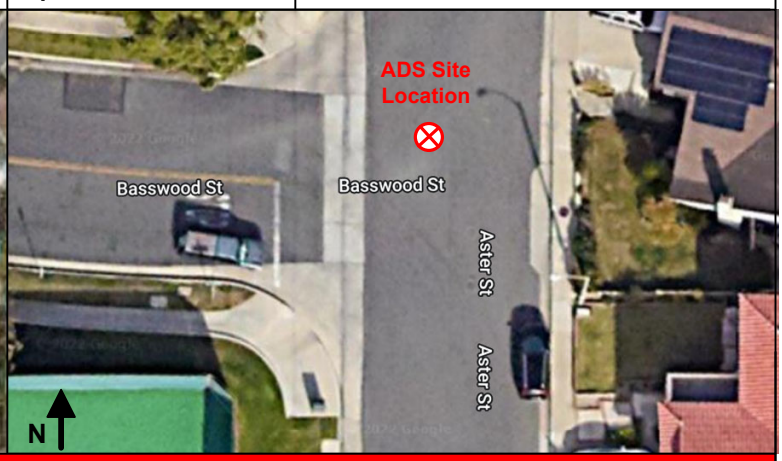
Data uptime observed during **Tuesday, 23 August 2022 to Monday, 05 September 2022** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name:	SealBeach.KHR.TFM.CA22	**City:** Seal Beach	**Agency:** KHR		**FM Initials:** VM
Site Name:	Bass01	**Install Date:**	8/22/22	**Monitor Type**	Peak Doppler
Address/Location:	3580 Aster St.			**Monitor Model**	Triton +
				Data Acquisition	Manual/Wireless Collect
				Manhole ID	A-16
Access:	Drive	**Type of System:**	Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	15 "
				Pipe Width:	15 "



Investigation Information:

Date/Time of Investigation:	3/4/22 @ 8:22 AM
Site Hydraulics:	Good straight through flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	3.88 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.89 fps
Silt:	0 Inches

Manhole Information:

Manhole Depth:	12'-3"
Manhole Material / Condition	Precast/Good
Pipe Material / Condition:	VCP/Good

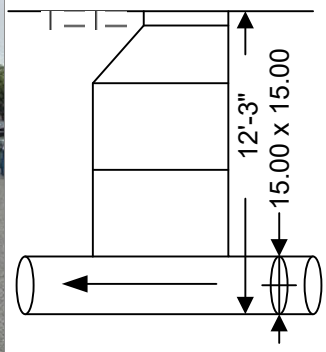
Land Use:	Residential	Commercial	Industrial	Other
	[x]	[ ]	[ ]	[ ]

Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0

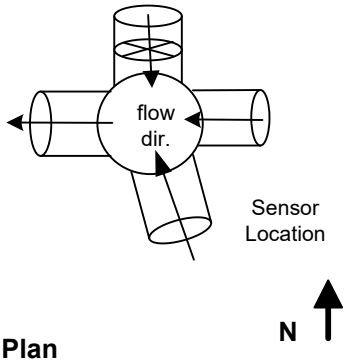
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[x]	[ ]	
WWTP	[ ]	[x]	[ ]	
Other	[ ]	[x]	[ ]	

Additional Site Information / Comments:

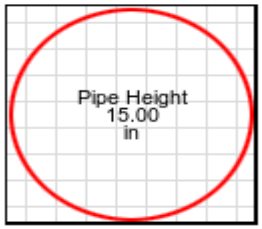
Standard Traffic Control with No Safety Concerns

Hydrograph Report

Bass01

Flow Monitor

Bass01



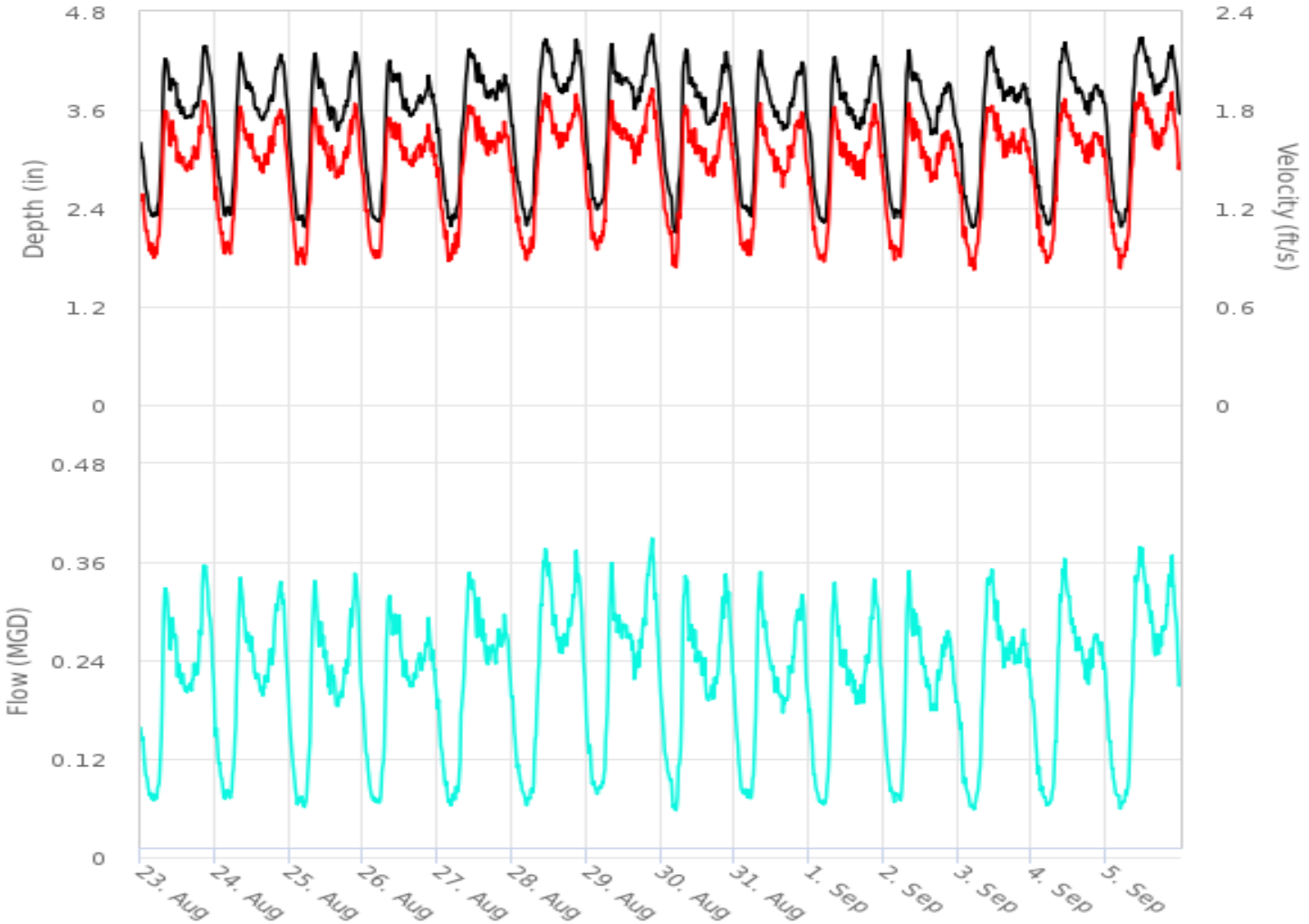
Report Period

08/23/2022
To
09/05/2022

Legend

- DFINAL
- QFINAL
- VFINAL

ADS ENVIRONMENTAL SERVICES

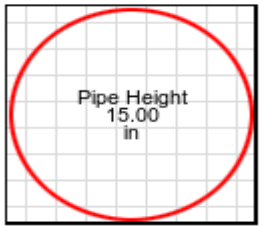


Scattergraph Report

Bass01

Flow Monitor

Bass01



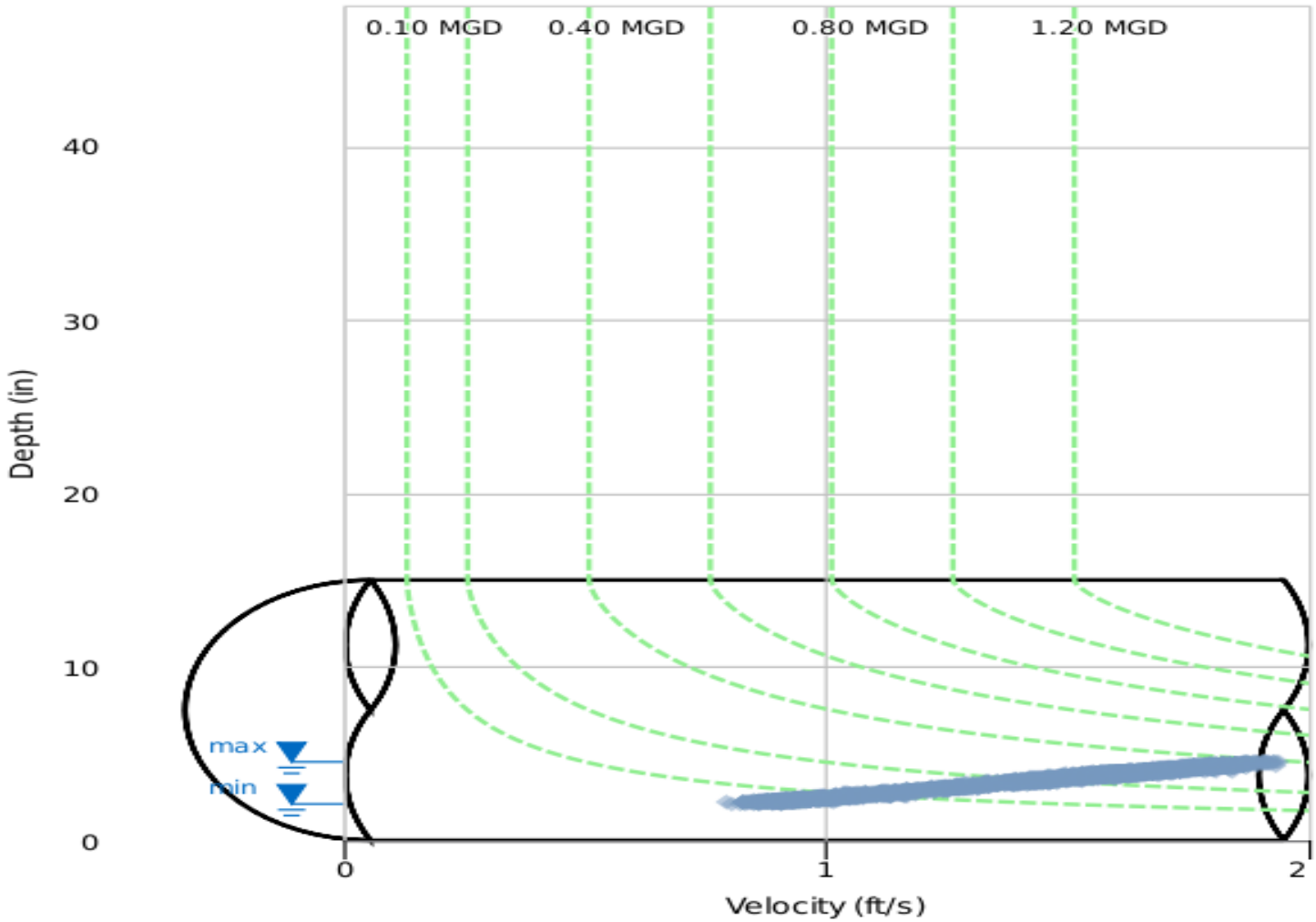
Report Period

08/23/2022
To
09/05/2022

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth

ADS ENVIRONMENTAL SERVICES



Daily Tabular Report

08/23/2022 00:00 - 09/05/2022 23:59
Bass01Pipe: Round (15 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)					
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total
08/23/2022	04:20	2.28	21:05	4.38	3.47	04:20	0.88	20:10	1.88	1.45	04:20	0.067	20:30	0.361	0.212	0.212
08/24/2022	03:35	2.30	08:20	4.30	3.49	03:30	0.90	21:15	1.85	1.46	03:30	0.070	08:20	0.346	0.215	0.215
08/25/2022	05:10	2.17	21:25	4.31	3.42	02:50	0.83	21:25	1.84	1.42	05:00	0.060	21:25	0.348	0.205	0.205
08/26/2022	05:15	2.22	08:30	4.23	3.42	05:10	0.87	10:10	1.81	1.43	05:10	0.063	08:35	0.325	0.204	0.204
08/27/2022	04:25	2.17	10:10	4.37	3.48	03:40	0.86	10:55	1.85	1.45	04:20	0.062	10:15	0.350	0.216	0.216
08/28/2022	04:55	2.18	10:55	4.47	3.57	05:00	0.86	20:55	1.93	1.49	05:00	0.061	20:55	0.382	0.231	0.231
08/29/2022	03:35	2.38	21:20	4.52	3.63	03:35	0.93	21:15	1.94	1.52	03:35	0.075	21:15	0.391	0.237	0.237
08/30/2022	05:05	2.09	08:10	4.37	3.50	05:15	0.81	08:05	1.86	1.46	05:15	0.055	08:10	0.351	0.215	0.215
08/31/2022	05:15	2.30	08:25	4.37	3.44	04:05	0.88	08:25	1.86	1.43	04:05	0.070	08:25	0.356	0.207	0.207
09/01/2022	04:50	2.22	21:15	4.26	3.42	04:50	0.86	21:00	1.85	1.43	04:50	0.063	21:00	0.341	0.205	0.205
09/02/2022	05:40	2.26	08:20	4.33	3.40	03:35	0.87	08:20	1.84	1.41	03:35	0.066	08:20	0.350	0.201	0.201
09/03/2022	04:40	2.17	11:00	4.37	3.45	05:20	0.79	11:10	1.85	1.44	05:20	0.056	11:10	0.355	0.212	0.212
09/04/2022	05:25	2.19	10:45	4.44	3.46	04:55	0.86	10:35	1.89	1.45	04:55	0.063	10:35	0.371	0.213	0.213
09/05/2022	04:45	2.16	11:30	4.49	3.57	04:40	0.83	21:25	1.93	1.49	04:40	0.058	11:35	0.384	0.232	0.231

08/23/2022 00:00 - 09/05/2022 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			3.003
Average	3.48	1.45	0.215

Cand02

Site Commentary

SITE INFORMATION

Pipe	Elliptical (17.88 in H x 17 in W)
Silt	0.00 (in)

OBSERVATIONS

Average flow depth, velocity, and quantity data observed during **Tuesday, 23 August 2022 to Monday, 05 September 2022**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	4.67	0.89	0.207
Minimum	3.06	0.46	0.060
Maximum	5.84	1.25	0.377
Min Time	08/30/2022 04:55:00	08/30/2022 04:25:00	08/30/2022 04:25:00
Max Time	09/05/2022 10:45:00	09/05/2022 11:25:00	09/05/2022 11:25:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the five minutes average.

DATA UPTIME

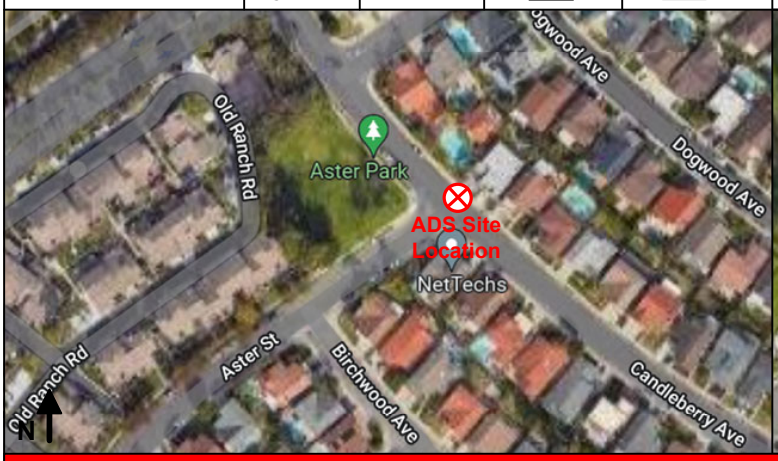
Data uptime observed during **Tuesday, 23 August 2022 to Monday, 05 September 2022** is provided in the following table:

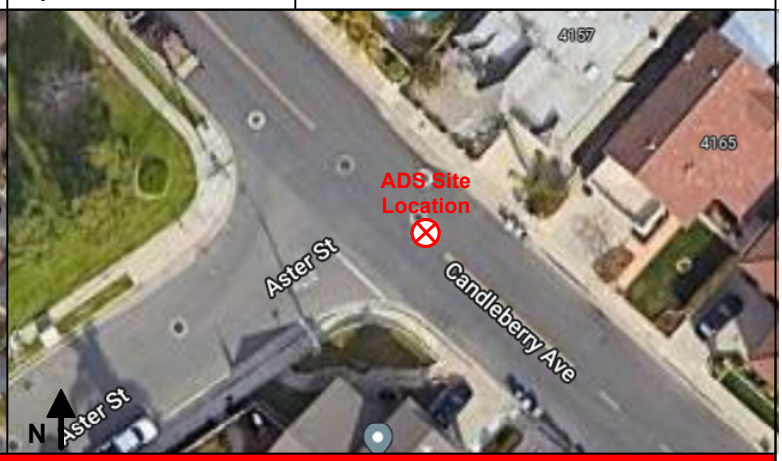
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name:	SealBeach.KHR.TFM.CA22	**City:** Seal Beach	**Agency:** KHR	**FM Initials:** VM	
Site Name:	Cand02	**Install Date:**	8/22/22	**Monitor Type**	Peak Doppler
Address/Location:	4156 Candleberry Ave			**Monitor Model**	Triton +
				Data Acquisition	Manual/Wireless Collect
				Manhole ID	A-21
Access:	Drive	**Type of System:**	Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	17.88 "
				Pipe Width:	17.00 "





Investigation Information:

Date/Time of Investigation:	3/4/22 @ 10:30 AM
Site Hydraulics:	Good straight through flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	5.00 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.13 fps
Silt:	0 Inches

Manhole Information:

Manhole Depth:	9'-7"
Manhole Material / Condition	Precast/Good
Pipe Material / Condition:	PVC/Good

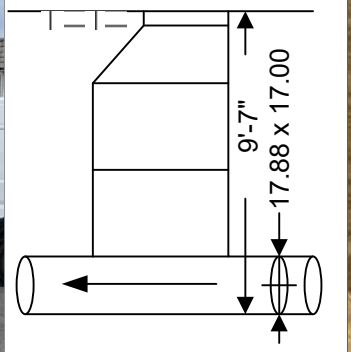
Land Use:	Residential	Commercial	Industrial	Other
	[x]	[ ]	[ ]	[ ]

Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0

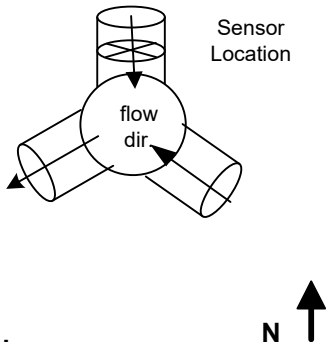
Safety Notes:

2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section



Plan

Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	[ ]	[x]	[ ]	
Sensors Devices:	Ultrasonic/Velocity/Pressure	Lift / Pump Station	[ ]	[x]	[ ]	
Surcharge Height:	0	WWTP	[ ]	[x]	[ ]	
Rain Gauge Zone:		Other	[ ]	[x]	[ ]	

Additional Site Information / Comments:

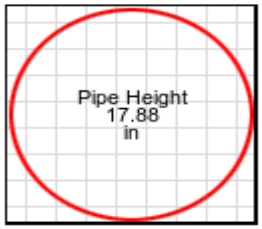
Standard Traffic Control with No Safety Concerns

Hydrograph Report

Cand02

Flow Monitor

Cand02

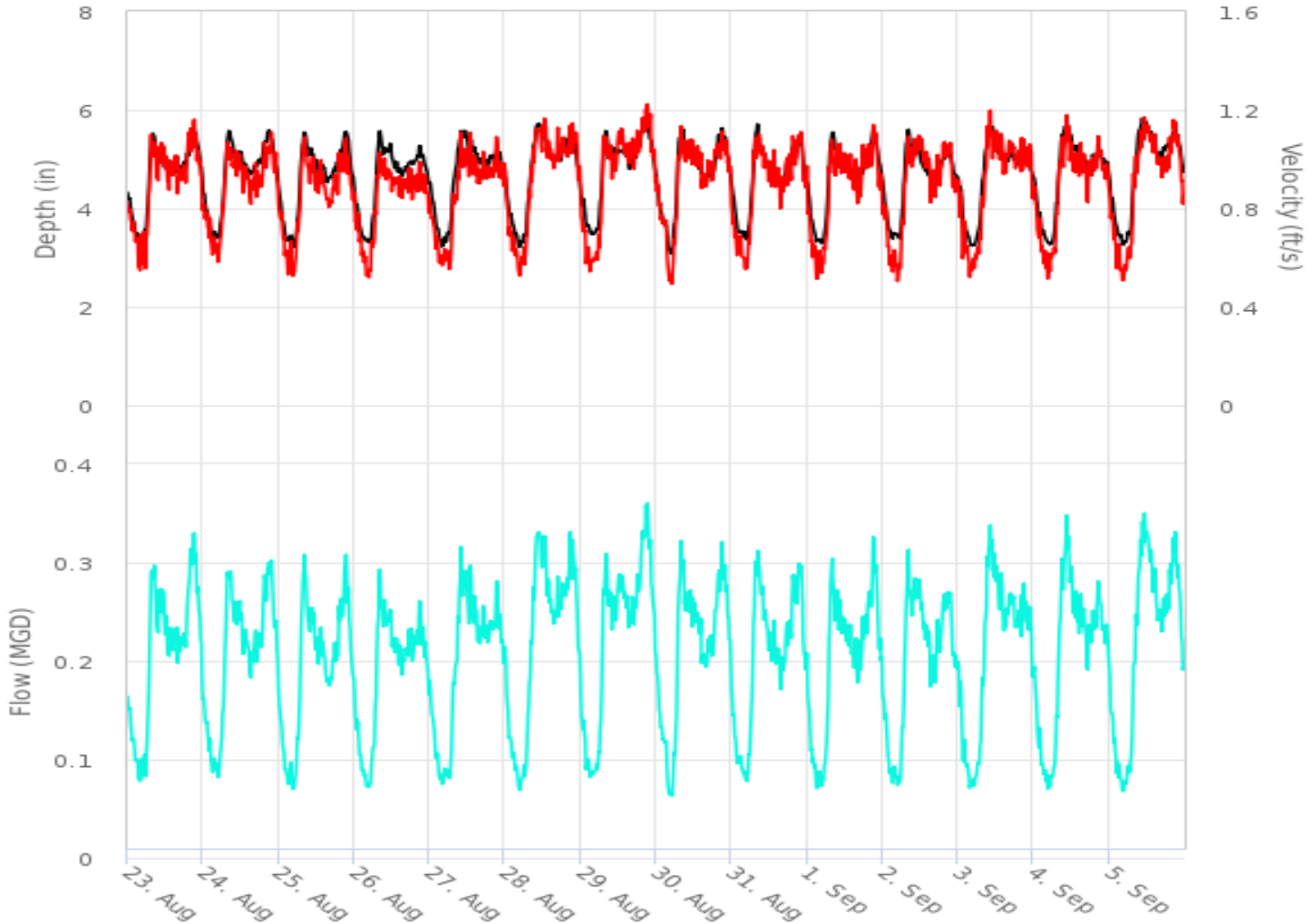


Report Period

08/23/2022
To
09/05/2022

Legend

- DFINAL
- QFINAL
- VFINAL

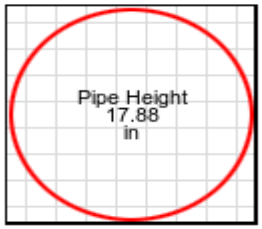


Scattergraph Report

Cand02

Flow Monitor

Cand02



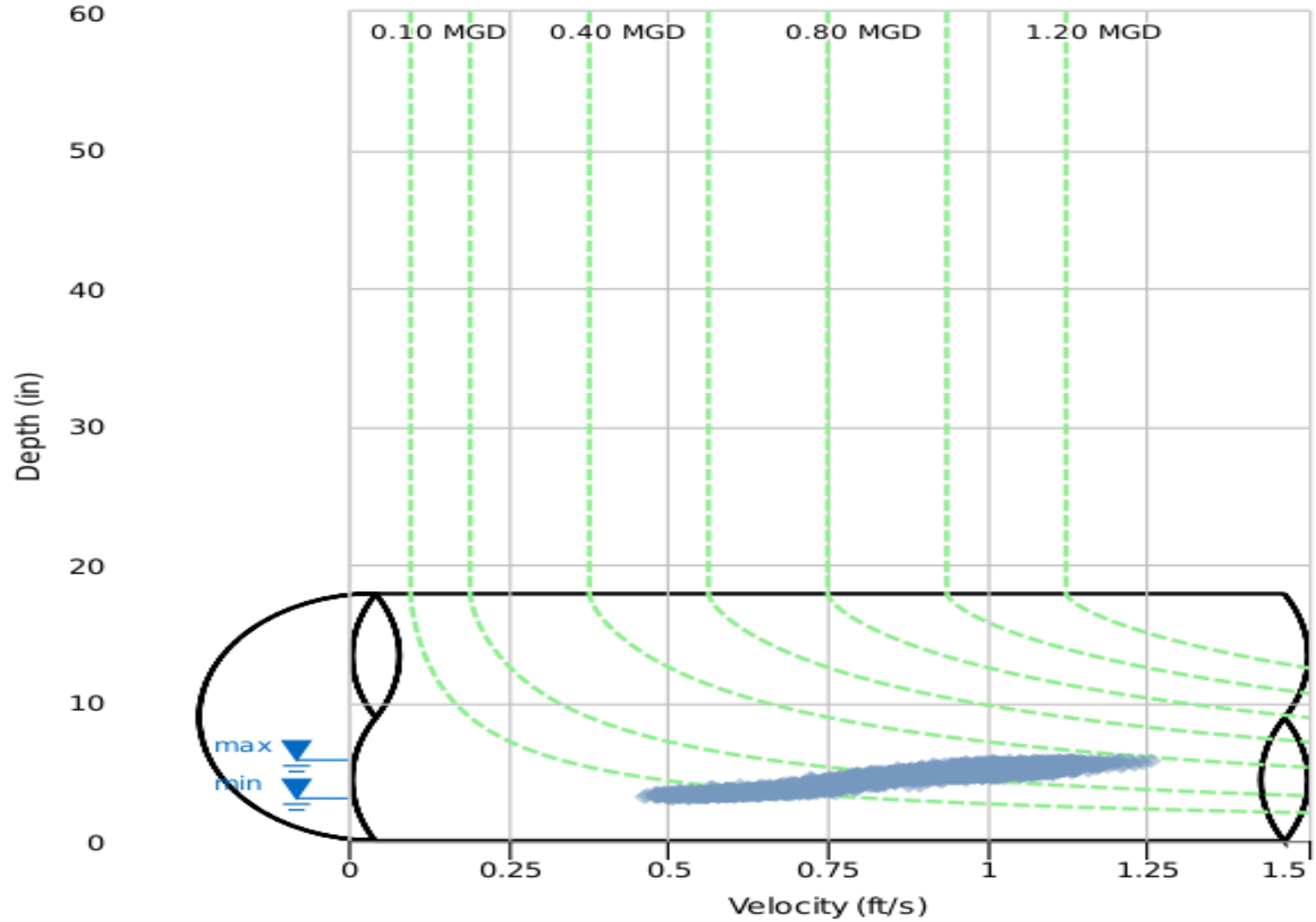
Report Period

08/23/2022
To
09/05/2022

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth

ADS ENVIRONMENTAL SERVICES



Daily Tabular Report

08/23/2022 00:00 - 09/05/2022 23:59
Cand02Pipe: Elliptical (17.88 in H x 17 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)					
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total
08/23/2022	05:10	3.39	20:25	5.65	4.67	04:05	0.48	21:15	1.17	0.91	04:05	0.068	21:15	0.334	0.209	0.209
08/24/2022	04:50	3.39	21:10	5.61	4.70	04:50	0.57	21:55	1.13	0.89	04:50	0.081	20:30	0.312	0.207	0.207
08/25/2022	05:00	3.21	21:15	5.57	4.60	04:30	0.48	08:25	1.13	0.85	04:30	0.064	08:25	0.321	0.194	0.194
08/26/2022	05:05	3.31	08:25	5.61	4.60	04:15	0.48	08:25	1.07	0.84	04:15	0.066	08:25	0.307	0.189	0.189
08/27/2022	04:10	3.21	10:00	5.60	4.65	06:25	0.50	10:10	1.14	0.86	04:05	0.073	10:10	0.322	0.200	0.200
08/28/2022	04:50	3.20	10:50	5.73	4.74	04:45	0.50	12:40	1.19	0.93	04:45	0.065	10:30	0.343	0.222	0.222
08/29/2022	04:10	3.46	21:10	5.80	4.80	03:00	0.51	21:20	1.24	0.94	03:00	0.079	21:15	0.368	0.228	0.228
08/30/2022	04:55	3.06	21:00	5.63	4.67	04:25	0.46	21:05	1.15	0.92	04:25	0.060	21:05	0.332	0.212	0.212
08/31/2022	05:05	3.35	08:20	5.73	4.63	04:40	0.51	19:25	1.14	0.89	04:40	0.073	08:25	0.325	0.204	0.204
09/01/2022	04:40	3.28	21:10	5.60	4.61	03:20	0.48	21:00	1.16	0.88	03:20	0.067	21:00	0.330	0.201	0.201
09/02/2022	03:25	3.37	08:10	5.62	4.59	04:55	0.49	08:15	1.13	0.89	04:55	0.072	08:15	0.325	0.201	0.201
09/03/2022	04:30	3.23	10:55	5.67	4.65	03:50	0.49	10:20	1.23	0.90	03:50	0.066	10:20	0.346	0.210	0.210
09/04/2022	05:15	3.26	10:40	5.73	4.66	05:15	0.48	10:35	1.20	0.89	05:15	0.064	10:35	0.355	0.206	0.206
09/05/2022	04:30	3.24	10:45	5.84	4.79	04:30	0.47	11:25	1.25	0.91	04:30	0.062	11:25	0.377	0.222	0.221

08/23/2022 00:00 - 09/05/2022 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			2.904
Average	4.67	0.89	0.207

Elder03

Site Commentary

SITE INFORMATION

Pipe	Round (12 in H)
Silt	0.00 (in)

OBSERVATIONS

Average flow depth, velocity, and quantity data observed during **Tuesday, 23 August 2022 to Monday, 05 September 2022**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.59	0.96	0.129
Minimum	2.18	0.45	0.030
Maximum	4.75	1.35	0.249
Min Time	08/30/2022 04:35:00	09/03/2022 03:55:00	08/25/2022 04:40:00
Max Time	08/29/2022 20:45:00	08/29/2022 20:35:00	08/29/2022 20:50:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the Observed Flow Conditions and data on the graphical reports are based on the five minutes average.

DATA UPTIME

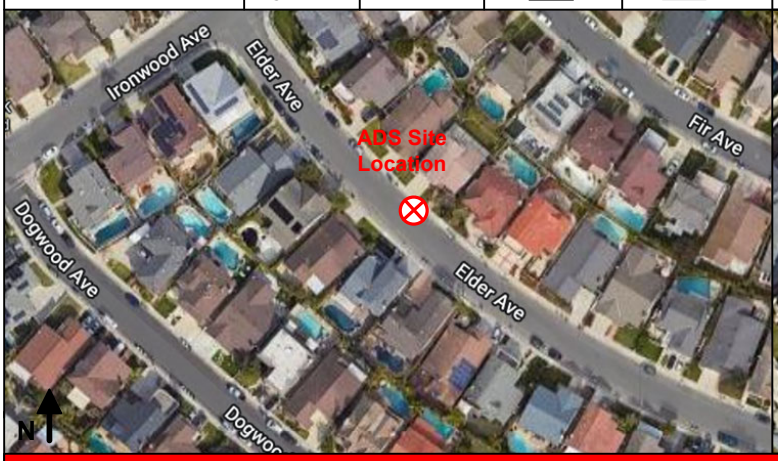
Data uptime observed during **Tuesday, 23 August 2022 to Monday, 05 September 2022** is provided in the following table:

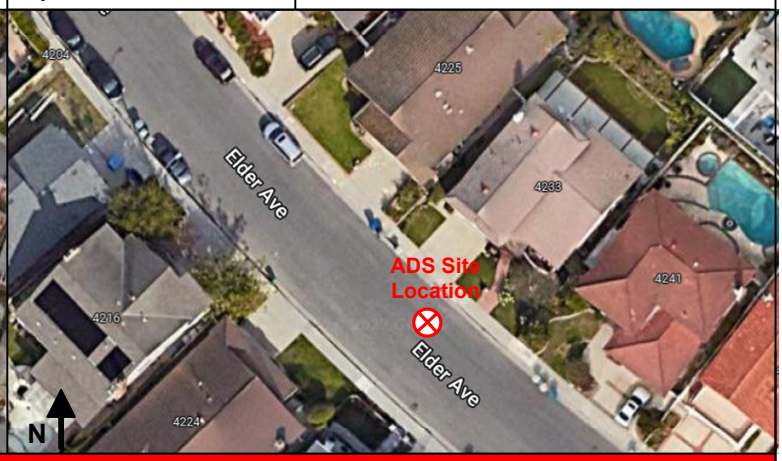
Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

ADS Site Report

Quality Form

Project Name:	SealBeach.KHR.TFM.CA22	**City:** Seal Beach	**Agency:** KHR		**FM Initials:** VM
Site Name:	Elder03	**Install Date:**	8/22/22	**Monitor Type**	Peak Doppler
Address/Location:	4233 Elder Ave			**Monitor Model**	Triton +
				Data Acquisition	Manual/Wireless Collect
				Manhole ID	A-25
Access:	Drive	**Type of System:**	Sanitary [X] Storm [ ] Combined [ ]	**Pipe Height:**	12.00 "
				Pipe Width:	12.00 "





Investigation Information:

Date/Time of Investigation:	3/4/22 @ 12:25 PM
Site Hydraulics:	Good straight through flow
Upstream Input: (L/S, P/S)	--
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not investigated
Depth of Flow:	3.88 " +/- 0.25"
Range (Air DOF):	+/-
Peak Velocity:	1.40 fps
Silt:	0 Inches

Manhole Information:

Manhole Depth:	8'-6"
Manhole Material / Condition	Precast/Good
Pipe Material / Condition:	VCP/Good

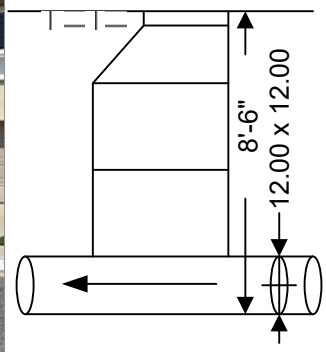
Land Use:	Residential	Commercial	Industrial	Other
	[x]	[ ]	[ ]	[ ]

Oxygen: 20.9	**H2S:** 0	**LEL:** 0	**CO:** 0

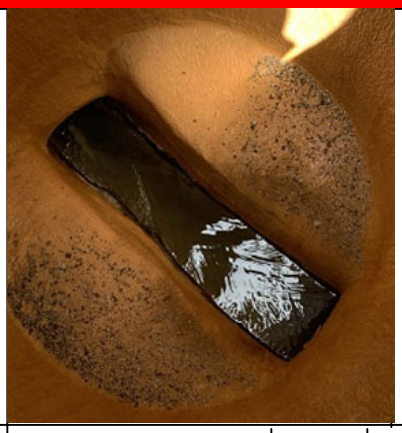
Safety Notes:

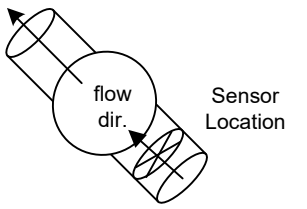
2 man crew required and one blower is to be operated at all times.

Other Information:



Cross Section





Plan

Installation Information	
Installation Type:	Standard
Sensors Devices:	Ultrasonic/Velocity/Pressure
Surcharge Height:	0
Rain Gauge Zone:	

Backup	Yes	No	?	Distance
Trunk	[ ]	[x]	[ ]	
Lift / Pump Station	[ ]	[x]	[ ]	
WWTP	[ ]	[x]	[ ]	
Other	[ ]	[x]	[ ]	

Additional Site Information / Comments:

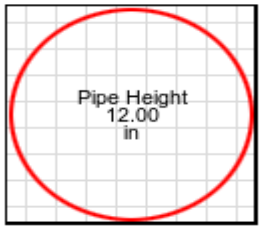
Standard Traffic Control with No Safety Concerns

Hydrograph Report

Elder03

Flow Monitor

Elder03

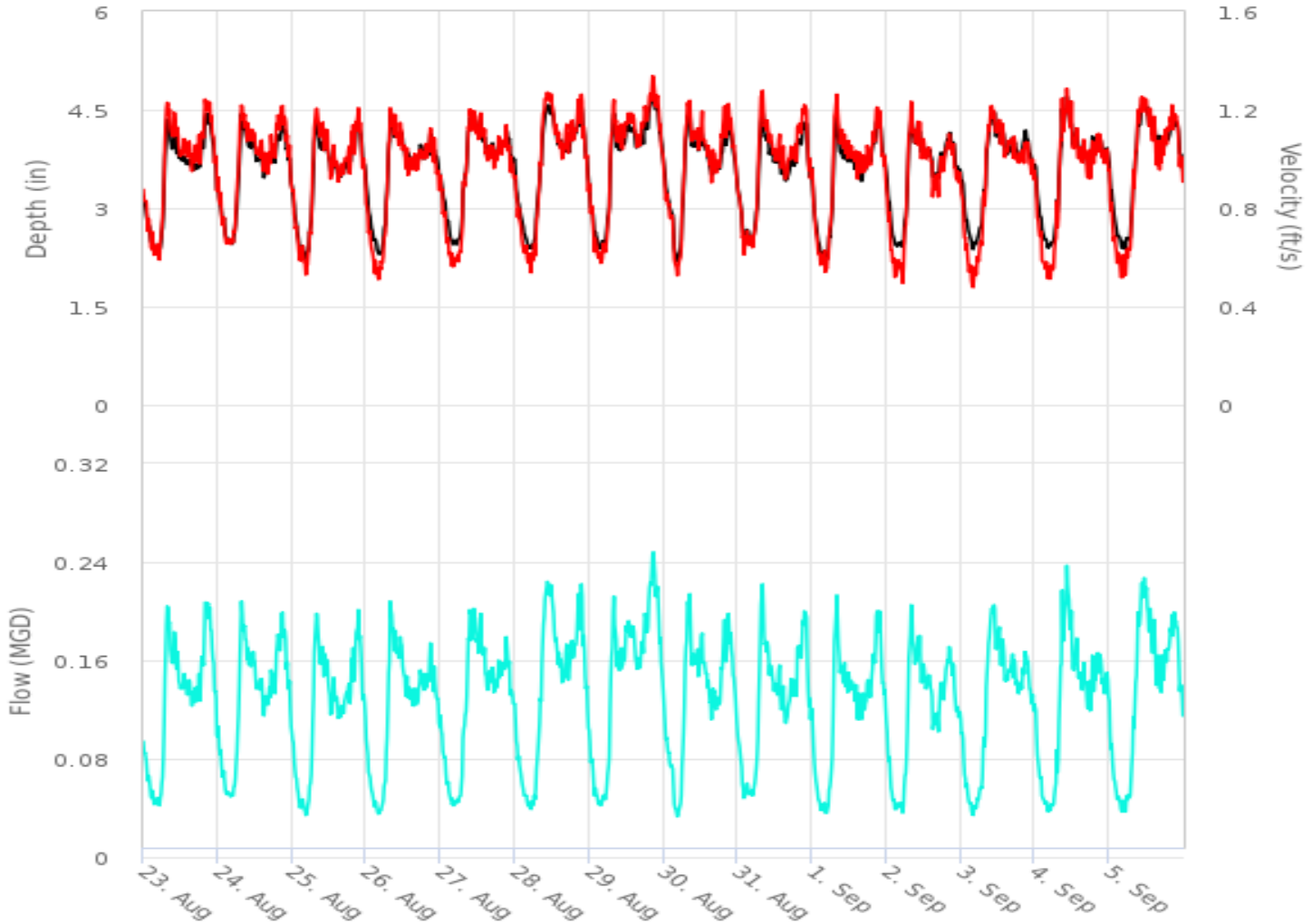


Report Period

08/23/2022
To
09/05/2022

Legend

- DFINAL
- QFINAL
- VFINAL



Scattergraph Report

Elder03

Flow Monitor

Elder03

Pipe Height
12.00
in

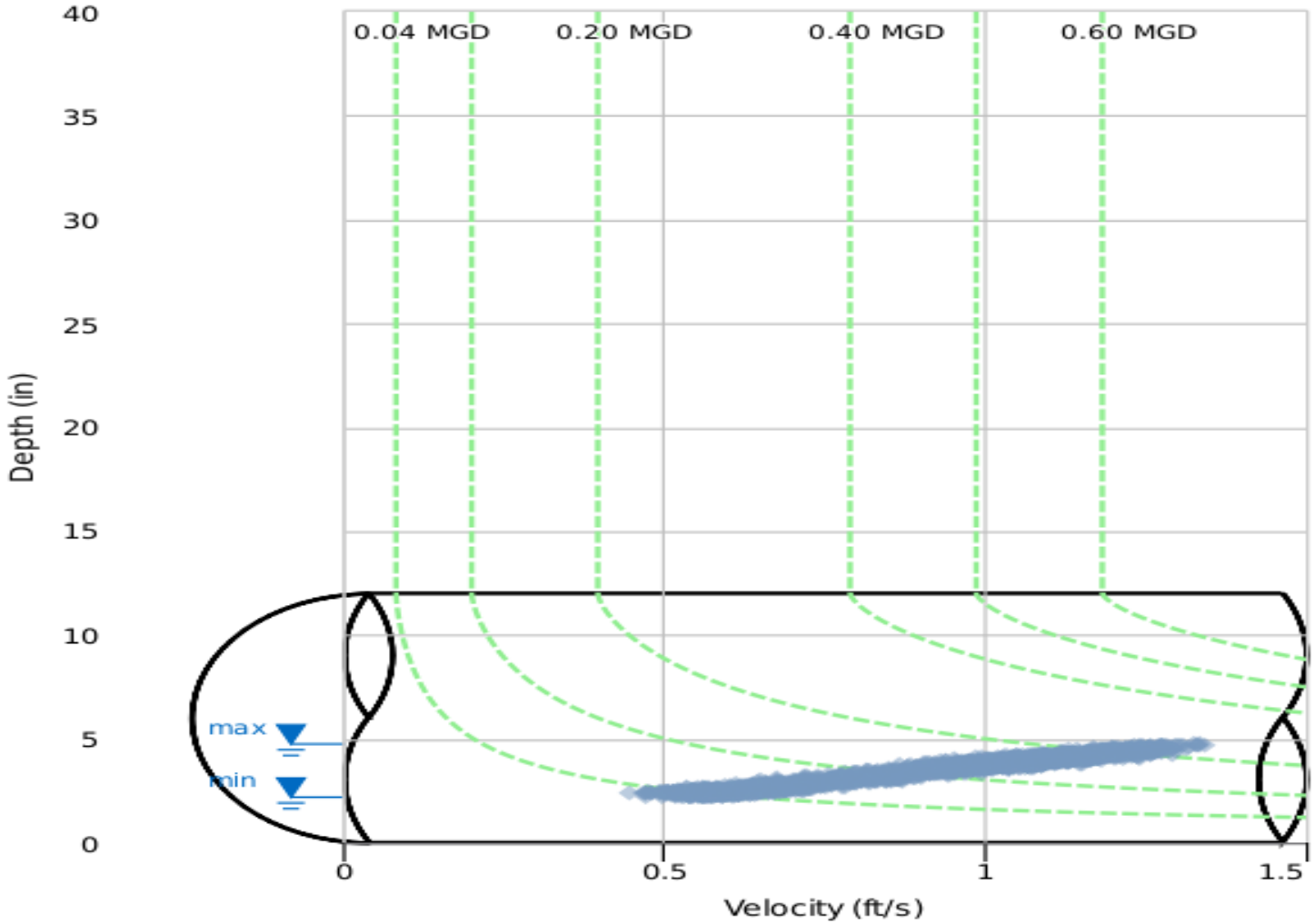
Report Period

08/23/2022
To
09/05/2022

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth

ADS ENVIRONMENTAL SERVICES



Daily Tabular Report

08/23/2022 00:00 - 09/05/2022 23:59
Elder03Pipe: Round (12 in H), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)					
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total
08/23/2022	03:55	2.34	20:55	4.45	3.54	05:25	0.57	21:00	1.27	0.98	05:25	0.040	21:00	0.216	0.129	0.129
08/24/2022	04:45	2.45	07:45	4.44	3.58	03:15	0.62	07:45	1.25	0.98	05:00	0.047	07:45	0.213	0.130	0.130
08/25/2022	04:40	2.22	21:35	4.38	3.48	04:40	0.47	21:40	1.22	0.94	04:40	0.030	21:35	0.204	0.121	0.121
08/26/2022	04:15	2.29	07:55	4.55	3.54	04:10	0.50	07:55	1.27	0.92	04:10	0.034	07:55	0.223	0.121	0.121
08/27/2022	05:15	2.43	10:40	4.44	3.61	03:55	0.51	10:00	1.23	0.94	03:55	0.039	10:00	0.209	0.127	0.127
08/28/2022	05:55	2.37	11:50	4.60	3.68	05:20	0.52	11:55	1.32	0.98	05:20	0.037	11:55	0.236	0.137	0.137
08/29/2022	03:10	2.37	20:45	4.75	3.76	03:50	0.57	20:35	1.35	1.02	03:50	0.041	20:50	0.249	0.147	0.147
08/30/2022	04:35	2.18	08:35	4.50	3.61	04:40	0.50	08:30	1.26	0.98	04:40	0.031	08:30	0.216	0.132	0.132
08/31/2022	04:55	2.50	08:05	4.50	3.55	02:10	0.60	08:05	1.30	0.97	02:10	0.046	08:05	0.225	0.127	0.127
09/01/2022	04:50	2.21	08:00	4.43	3.48	04:20	0.53	08:00	1.29	0.95	04:50	0.035	08:00	0.220	0.122	0.122
09/02/2022	05:20	2.40	08:15	4.42	3.53	02:55	0.48	08:00	1.29	0.91	05:20	0.035	08:00	0.209	0.120	0.120
09/03/2022	04:05	2.37	11:05	4.49	3.59	03:55	0.45	09:55	1.26	0.92	03:55	0.032	10:50	0.208	0.125	0.125
09/04/2022	04:25	2.39	10:20	4.73	3.60	05:00	0.48	10:20	1.31	0.93	05:00	0.035	10:20	0.243	0.126	0.126
09/05/2022	05:25	2.36	11:25	4.68	3.68	04:15	0.47	11:55	1.31	0.96	04:15	0.033	11:30	0.234	0.136	0.135

08/23/2022 00:00 - 09/05/2022 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)
Total			1.801
Average	3.59	0.96	0.129

Appendix C

SEWER ATLAS

S-0004-A

CANDLEBERRY AVE. & ASTER STREET - A-21

NORTH WESTERN INLET MONITORED

ATLAS LABELED AS 10" SS

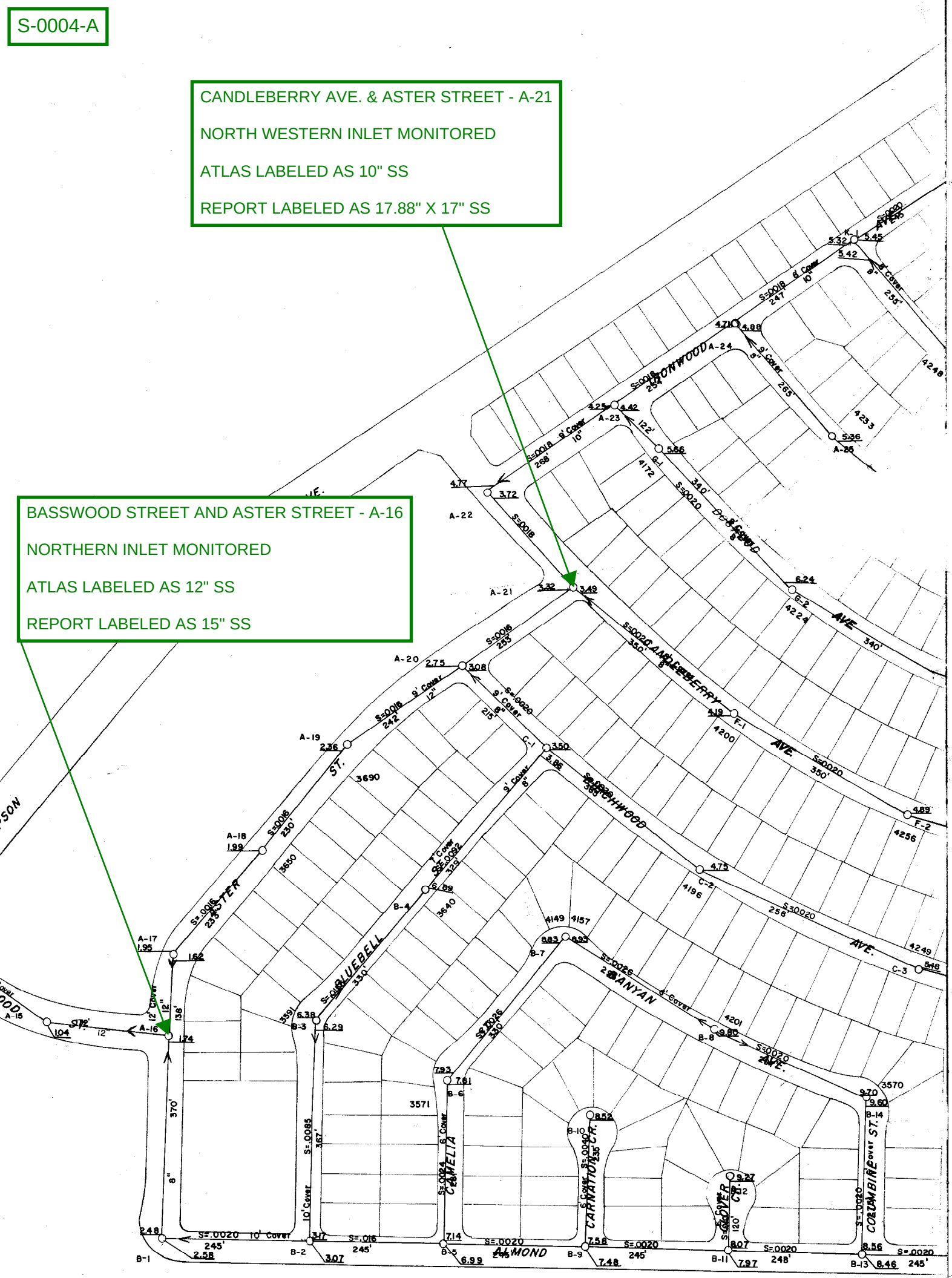
REPORT LABELED AS 17.88" X 17" SS

BASSWOOD STREET AND ASTER STREET - A-16

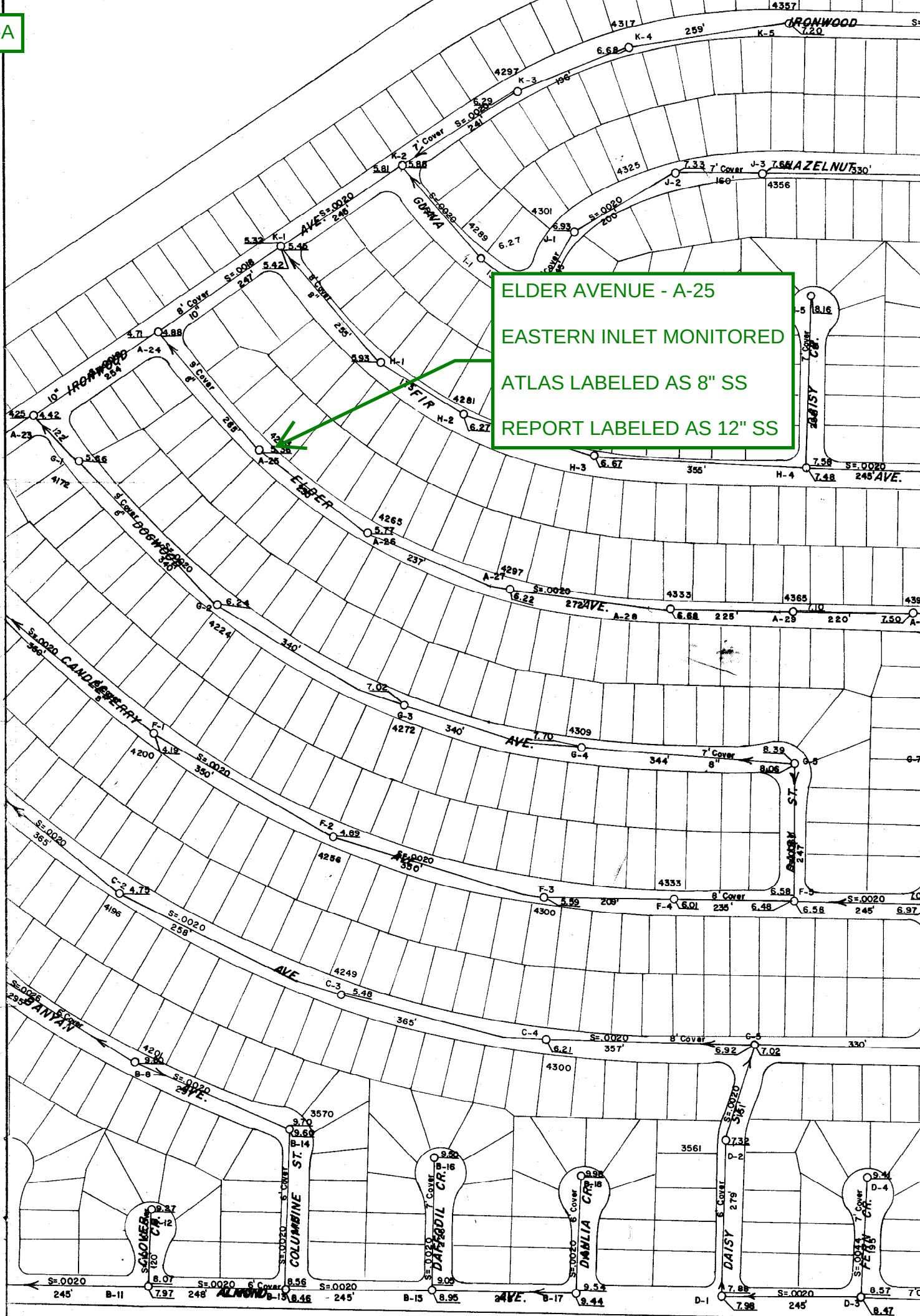
NORTHERN INLET MONITORED

ATLAS LABELED AS 12" SS

REPORT LABELED AS 15" SS



S-0005-A


ELDER AVENUE - A-25
EASTERN INLET MONITORED
ATLAS LABELED AS 8" SS
REPORT LABELED AS 12" SS
IRONWOOD
HAZELNUT
GUINEA
FIR
ELDER
DOGWOOD
CANDLEBERRY
BANYAN
ALMOND
COLUMBINE ST.
DAFFODIL CR.
DAHLIA CR.
DAISY
FERN CR.
CLOVER CR.
AVE.
ST.
CR.

Appendix D

REFERENCES

Sewer system performance evaluation criteria is summarized in Table ES-1.

Table ES-1

Sewer System Performance Evaluation Criteria

Collection System	
Minimum Pipe Size	8-inch
Minimum Velocity	2.0 fps at average flow or;
	3.0 fps at peak flow
Flow Depth to Pipe Diameter Ratio (d/D) with Peak Dry Weather Flows	
15-inch and under	0.50
18-inch and over	0.64
Pump Station	
Pumps	▪ Minimum 2 each sized at peak flow
	▪ Minimum solids handling capacity 3”
Wet Wells	▪ Sized to limit pump cycling to less than 6 times/hr for motor HP up to 20; 4 times/hr up to 50 HP; 3 times/hr up to 75 HP; 2 times/hr 100 HP and above
	▪ Provide 30 minutes of storage at peak flow to allow response to a failure
	▪ Equipment to be maintained must be accessible without entering the structure
Ventilation	▪ 12-air changes/hour minimum in dry well and as required by NFPA 820
Controls	Redundant system. Float operated back-up controls
Emergency Power	Stationary source in locations which cannot provide 30-minute response time without overflowing. Provisions for connection of a portable power source at all other locations
Telemetry	Dialer system at all pump stations to alert personnel in the event of a station failure
Force Mains	▪ Minimum velocity 3.0 ft/sec
	▪ Minimum size 4”
	▪ Air/Vacs installed in vaults

SECTION 3
CRITERIA

3-1 GENERAL

Establishing performance standards is an important part of evaluating the existing wastewater collection system, as it forms the basis for most of the system improvement recommendations. These standards include methodology for estimating wastewater flows, and minimum design standards for the collection system pipes, pump stations and force mains.

Average dry weather wastewater flows can be reasonably estimated from land use and unit flow factors, with the results then compared to measured flows. The components used to estimate design wastewater flows include unit flow factors, peaking factors, and infiltration/inflow allowances.

Collection system design standards include minimum pipe size, minimum flow velocity, and depth of flow to pipe diameter ratio. Pump station criteria includes sizing requirements for pumps, wet wells and forcemains. It also includes provisions for redundancy, emergency storage, emergency power, and remote monitoring and control.

3-2 UNIT FLOW FACTORS

Previous Master Plan studies developed unit flow factors for the various land uses within the City's service area. These unit flow factors, shown in Table 3-1, were developed from flow monitoring data, flow records at Pump Station No. 35, water meter records, and the census data provided in the City's General Plan. The Orange County Sanitation District (OCSD) recommended wastewater flow generation factors were used for manufacturing and public recreation land uses.

For this Master Plan study, the sewage loads utilized in the hydraulic model were based on the average FY 2014-2015 pump flow data at all sewer pump stations. This data was compiled from weekly meter readings recorded by City staff.

Current sewage loads are significantly lower than the previously estimated loads developed using unit flow factors and land use information.

Table 3-1
Unit Flow Factors

Land Use Category		Unit Flow Factor	
Use	Description	gpd/Ac	gpd/du
RHD	Residential High Density	4,000	160
RMD	Residential Medium Density	3,230	190
RLD - CPE, OT	Residential Low Density - College Park East, Old Town	1,825	225
RLD - MH	Residential Low Density - Marina Hill	1,550	225
RLD - HR	Residential Low Density - Hellman Ranch	765	300
C	Commercial	2,500	
R-G	Recreation / Grass	200	
PLU/R	Public Land Use / Recreation	200	
O-E	Oil Extraction	0	
MSSP	Main Street Specific Plan	2,500	
M-1	Light Manufacturing - Pacific Gateway	3,167	

3-3 PEAKING FACTORS

The adequacy of a sewage collection system is based upon its ability to convey peak flows. At any individual point in the system, peak dry weather flow is estimated by converting the total average dry weather flow upstream of the point in question to peak dry weather flow by an empirical relationship.

Based on flow monitoring efforts in 2005, the following empirical relationship between peak dry weather and average dry weather flow was developed for use in the system hydraulic analysis:

$$Q_{pdw} = 1.85 \times Q_{adw}^{0.92} + \text{dry weather infiltration}$$

Where, Q_{pdw} = Peak dry weather flow in cfs

Q_{adw} = Average dry weather flow in cfs

Peak wet weather flow will be determined as follows:

$$Q_{pww} = 1.35 \times Q_{pdw}$$

Where, Q_{pdw} = Peak dry weather flow in cfs

Q_{pww} = Peak wet weather flow in cfs

3-4 INFLOW AND INFILTRATION

Inflow is the surface water that typically gains entry to the sewer system through perforated or unsealed manhole covers during rainfall events. Infiltration is defined as groundwater entering the wastewater collection system through defective pipes, pipe joints, connections, or manhole walls. Together, inflow and infiltration (I/I) can make up a substantial portion of the system loading if not properly managed. The following subsections describe the extent to which the City system is impacted by I/I.

3-4.1 INFLOW

Tests have indicated that leakage through manhole covers can range from 20 to 70 gpm with a depth of 1 inch over the cover (*Clay Pipe Engineering Manual, National Clay Pipe Institute, 1990*). This could lead to a significant volume of water entering the sewer system, resulting in surcharging and increased pumping and treatment costs.

Hydrologic data and sewage flows at Pump Station No.35 during both dry and wet weather were examined during the preparation of the 1999 Master Plan to quantify the amount of inflow entering the City's sewage collection system. The Orange County Resources and Development Management Department provided daily records for rainfall from Station No. 170 (Los Alamitos), located within Seal Beach in the vicinity of Westminster Avenue and the western city boundary. The City provided total daily sewage flow records as well as the daily navy flow records at Pump Station No.35.

The wastewater flow produced by the City was determined by subtracting the US Naval Weapons Station flow from the total flow. An average flow was then calculated for the month under examination. On days in which a rainfall event occurred, inflow was determined by calculating the difference between the measured wastewater flow for that day and the average flow. The inflow was determined for several different rainfall events and plotted versus inches of rainfall per day. The results are displayed in Figure 3-1. Generally, the relationship can be defined as linear and the amount of inflow expected (gpd) is about 250,000 times the amount