SEWER CAPACITY STUDY
for
WAREHOUSE/COMMERCIAL DEVELOPMENT
NW CORNER OF HOSKINGS AND SOUTH 'H' STREET

County of Kern
City of Bakersfield
APN: 515-020-05, 07, 08, 09, 30, 44, 45 & 47

October 15, 2021

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CORNERSTONE ENGINEERING, INC

10/15/2021

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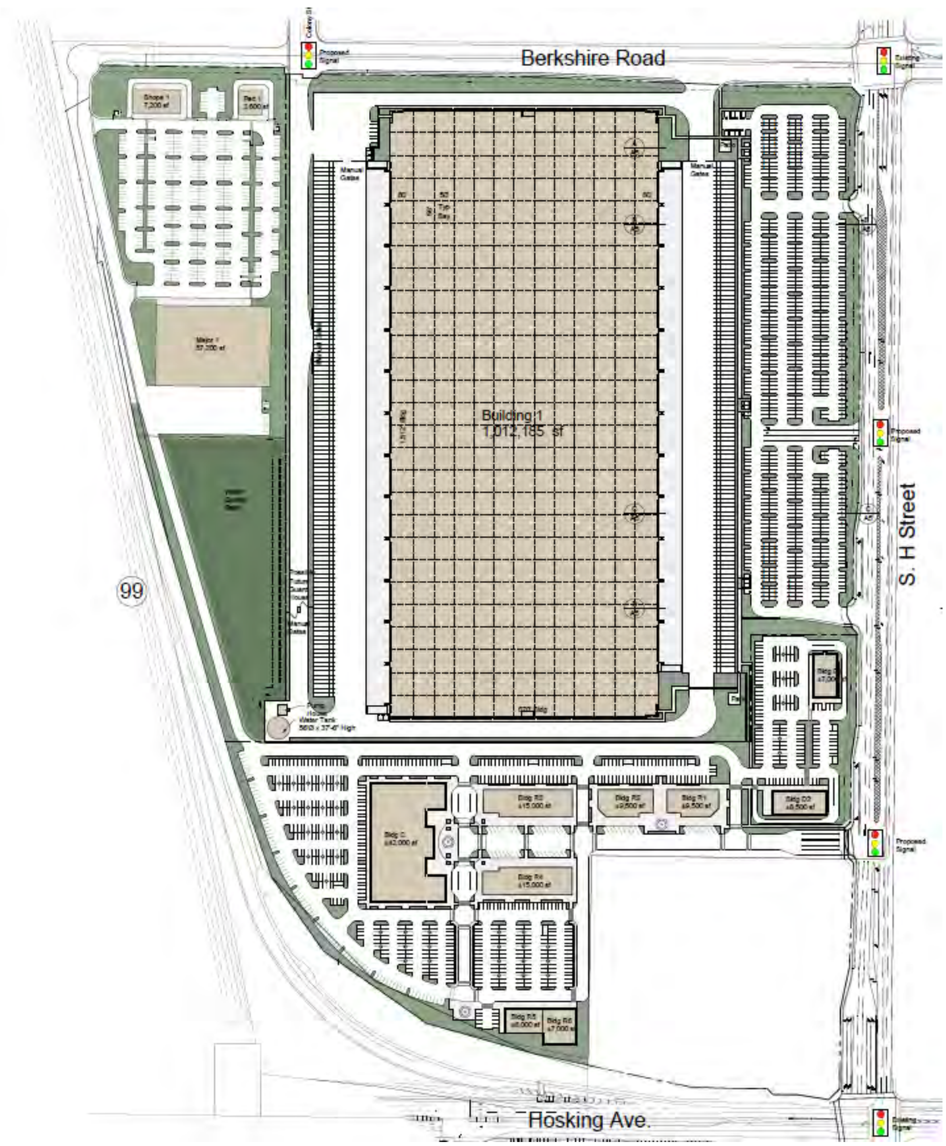
PURPOSE

Majestic Realty proposes to develop a 90.7 gross acre (84.8-acre net) project at the NW corner of Hoskings and H street. The project will consist of a 1,012,185 square foot distribution warehouse on a 56.9 gross acre (52.4-acre net) parcel with the balance of the project being developed as General Commercial consisting of eleven commercial buildings totaling 187,500 square feet on 29.8 gross acres (27.99 net acres). The proposed project is referred to as the "Majestic Hosking Project" and it's stormwater basin will occupy 4.4 acres and will not contribute to the sewer system. This study will demonstrate the feasibility of the city of Bakersfield serving this project with sewer capacity in the collection system.



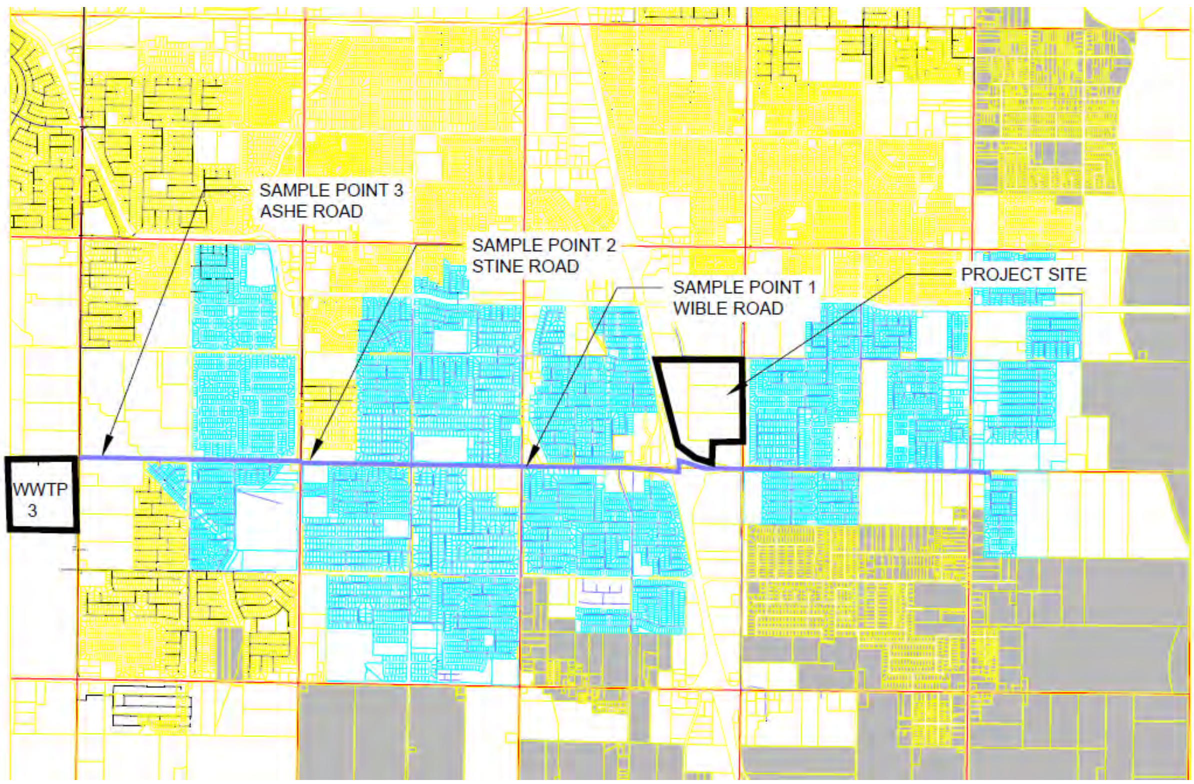
MAJESTIC REALTY

HOSKINGS
PROJECT
N.T.S.

HISTORY AND NEED

Wastewater generated at the proposed Majestic Hosking Project, located along Highway 99 between Berkshire Road and Hosking Avenue, would be transported to the City's Wastewater Treatment Plant #3 via existing trunklines located along Hosking Avenue between South Union and Ashe Road. See **Figure 1** for a schematic of the existing sewer collection system layout in the vicinity of the Majestic Hosking Project.

In 2006, The City of Bakersfield commissioned a service area study for the City Wastewater Treatment Plant #3 which was prepared by Parsons Infrastructure. Technical Memo No. 9 (attached in Appendices) concluded that portions of the sewer trunk line along Hosking Avenue might be undersized for the ultimate development throughout that trunk line's service area. For example, the 2006 evaluation concluded that at ultimate buildout, the 36" trunk line in Hosking Avenue between Stine and Ashe would see a peak flow of 19.2 cfs and the trunk line had a peak capacity of 14.9 cfs. It is this observation from 2006 in particular that prompts this updated evaluation of sewer trunkline capacity in the context of providing sewer service to the proposed Majestic Hosking Project.



HOSKING PROJECT VICINITY MAP
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PROJECT EFFLUENT ANALYSIS

The proposed Majestic Hosking Project consists of a warehouse adjacent to a proposed commercial development. Wastewater flow generated from this proposed land use is examined here.

For the warehouse, a daily workforce of 1200 working over three shifts is anticipated. The best estimate for effluent from this facility would be based upon table 201.1(4) of the California Plumbing code. See below and excerpt from this code table:

EXCERPTS FROM
TABLE H 201.1(2)
ESTIMATED WASTE/SEWAGE FLOW RATES
TYPE OF OCCUPANCY
GALLONS PER DAY

7.Factories no showers... 25 per employee
with showers .... 35 per employee
Cafeteria, add .... 5 per employee

13.Offices .... 20 per employee

Of the categories noted above for estimated daily wastewater flow per employee, the category that best suits the proposed Majestic Hosking Project is "Offices" due to the fact that a warehouse for the sorting and distribution of goods has a different function that a factory and using a factory flow rate would overstate wastewater generated. Actual effluent rates from similar warehouses that are in operation are reportedly on the order of 10 gallons per day per employee,[1] but since the Plumbing Code is an accredited source, we base the analysis on the Plumbing Code duty factor stated above. Therefore, the warehouse with a staff of 1200 is estimated to produce 24,000 GPD daily average. Bakersfield City's peaking factor for Industrial uses is 2.0 so the peak daily flow from this facility is estimated at 48,000 GPD.

Estimating wastewater flow from the commercial portion of the development is based on the City's general land use criteria. The effluent factor of 0.0056 cfs/gross acre with a 1.8 peak factor is used per the City Design Manual. The commercial portion of the site is 29.8 Gross acres so the average daily flow rate is 0.17 cfs and the peak daily rate is 0.30 cfs. This works out to 108,000 gpd average and 195,000 GPD peak flow for the commercial portion of the proposed project.

Project Effluent			CFS units	
Land Use	Average Daily	Peak Daily	Average Daily	Peak Daily
Warehouse Commercial	24,000 GPD 108,000 GPD	48,000 GPD 195,000 GPD	0.037 CFS 0.17 CFS	0.074 CFS 0.30 CFS
Project total	**132,000 GPD**	**243,000 GPD**	**0.20 CFS**	**0.37 CFS**

Based on this project effluent analysis, the proposed Majestic Hosking Project is expected to generate 132,000 GPD on average and 243,000 GPD at peak flow into the City wastewater collection and treatment system.

PRE 2014 ANALYSIS

The acreage proposed for the Majestic Hosking Project was the subject of a prior development proposal dated 2015 that was not put into operation. Studies for the previous "Gateway Project" are mentioned here for comparison.

For example, the subject acreage prior to 2014 was zoned R-1 and had a General Plan land use designation of LR (low density residential) LMR (low medium residential) and HMR (high medium

[1] Developer has stated that 10 gallons per day is typical for this facility at other locations but we have no documentation for this value so the Plumbing Code is used herein.

residential)[2]. The R-1 zoning that was in place in 2014/15 would have supported at least 4.0 dwelling units per gross acre. So, prior to 2014, and presumably at the time of the sewer Technical Memo No. 9 mentioned previously, this land was zoned to support at least 360 single family dwelling units. The following table shows the sewage effluent that would be produced by 360 single family homes:

Flow per home = 250 GPD with a peaking factor of 3.23

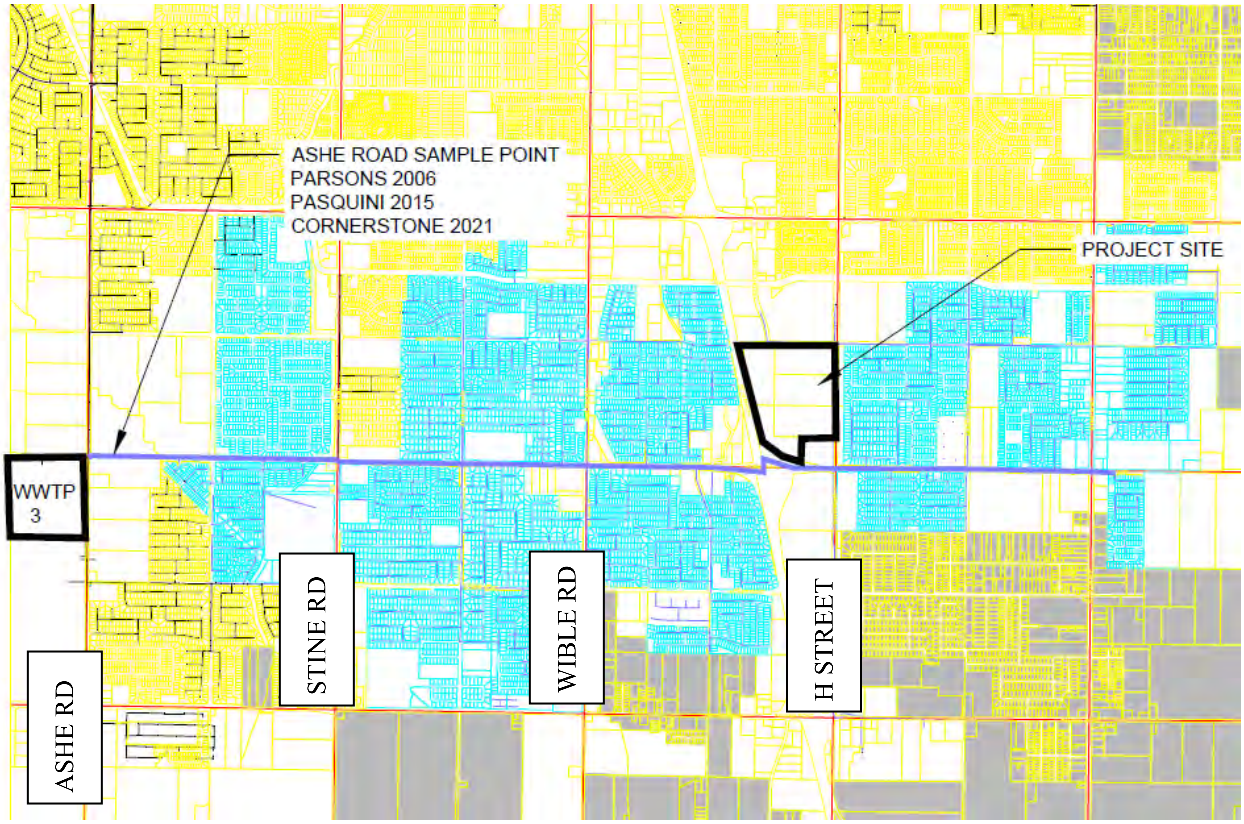
Land Use	Average Daily	Peak Daily	Average Daily	Peak Daily
R-1	90,000 GPD	290,700 GPD	0.14 CFS	0.45 CFS

Conclusion #1: The proposed Majestic Hosking Project will discharge an estimated 0.37 CFS peak effluent flow to the sewer collection system. This is 18% less flow than the project site was expected to discharge considering the zoning that was in effect prior to 2014. In other words, the proposed Majestic Hosking Project will discharge less sewer effluent than was stated in the 2006 Technical Memo 9.

[2] "SR 99/Hosking Commercial Center Project" Draft Environmental Impact Report dated June 2015, aka "the Gateway Project"

FIELD MONITORING

There have been several monitoring studies done on the Hosking Avenue trunk line that provide good indication of the actual rates of flow experienced along this trunkline. In addition to this data, the influent is measured daily into the headworks at WWTP #3. This section will summarize the available data.



HISTORIC SAMPLING
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2006 Technical Memo 9 – For this previous evaluation, the Hosking Avenue trunk line was monitored by flow monitoring radar at the sewer manhole (SMH) located about 1/4 mile east of Ashe Road. The flow monitoring data was listed as follows:

		Depth	Velocity	Flow
Average Depth and Velocity:	36" Main	15.05"	3.16 FPS	(8.93 cfs)
Max Depth and Velocity:		19.43"	3.66 FPS	(13.7 cfs)

It should be noted that the flow monitoring company, ADS, noted that this trunk line was a 36" pipe but the 2006 Technical Memo 9 refers to it as a 33" pipe size. There was a 33" trunk line in this segment years ago but it was abandoned and replaced in 1991 with a 36" pipe. This error in pipe sizing possibly explains the 2006 observation of inadequate trunkline capacity.

Pasquini Engineering 2015 – In 2015 Pasquini Engineering did a sewer study in support of a GPA/ZC for APN 404-010-46. The study included monitoring the flow in the Hosking Avenue trunk line (36") east of Ashe Road at the intersection of Hosking and Breccia. This manhole is about ¼ mile east of Ashe Road. The flow monitoring data is listed as follows:

		Depth	Velocity	Flow
Max Depth and Velocity:	36" main	21.87"	2.75 FPS	(12.85 cfs)

Note: The velocity noted in the 2015 evaluation is too low to match the slope of pipe installation. For monitoring on the same section of pipe, the 2006 Technical Memo 9 velocity was 3.7 fps and this evaluation indicates 3.9 fps. A Manning's calculation for this depth yields a velocity of 3.4 fps and a max flow rate of 15.3 cfs. For this study we will use this corrected flow rate attributed to the 2015 Pasquini study.

Cornerstone Engineering 2021 – In 2021 Cornerstone monitored 3 SMH locations along the Hosking Avenue trunk line. Going from east to west these monitoring locations were:

a) Hoskings and Wible Road
b) Hoskings just east of Stine Road and
c) Hosking just east of Ash Road.

The locations and data are listed as follows:

		Max Depth	Max Vel.	Max Flow	Max Capacity
Hosking at Wible	27" Main	11.21"	1.81 FPS	2.80 cfs	8.0 cfs (1)
Hosking at Stine	24" Main	14.27"	1.90 FPS	3.81 cfs	9.86 cfs (2)
Hosking East of Ashe	36" Main	21.07"	3.88 fps	16.66 cfs	23.7 cfs (3)

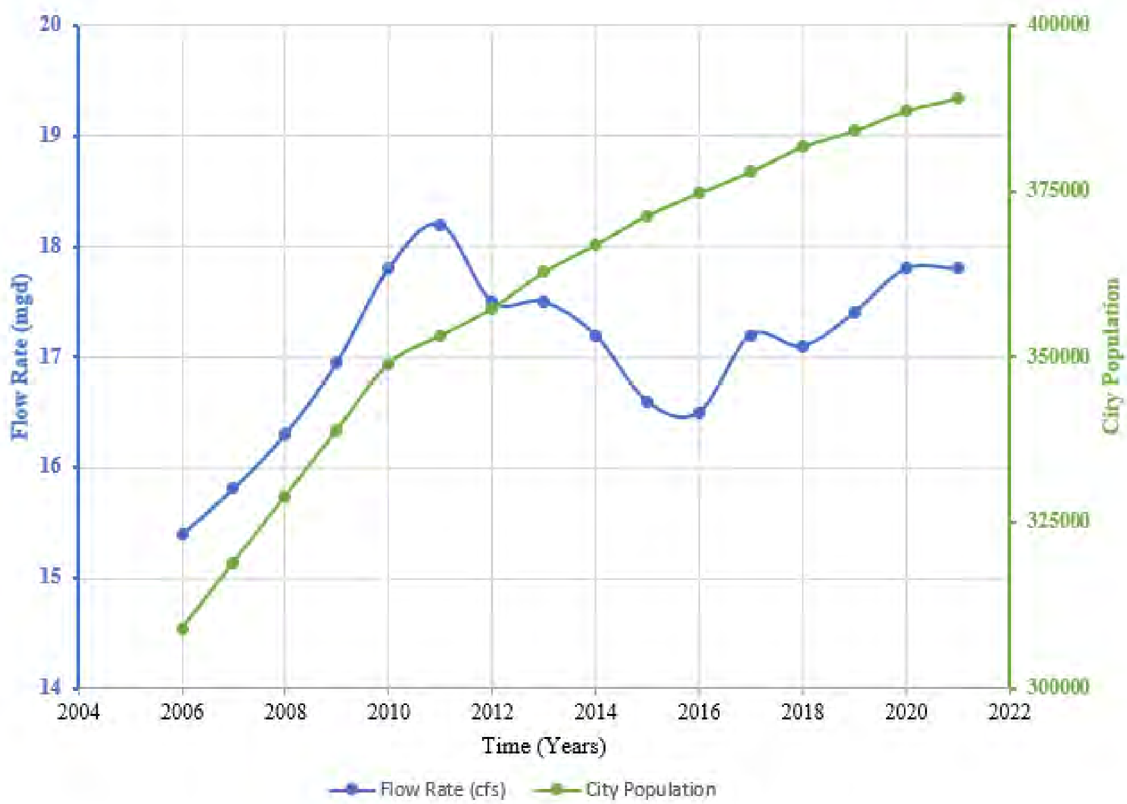
Note:
(1) Max flow in the data set was on 5/31/2021. Max capacity based on as-built showing 27" pipe run at 0.06% Manning's Calc.
(2) Max flow in the data set was on 5/31/2021. As-built data indicates a 24" main installed at 0.165% with a max calculated capacity of 9.86 cfs Manning's Calc.
(3) Max flow in the data used on 6/6/2021. As-built data indicates a 36" PVC main installed at 0.08% with a max calculated capacity of 23.7 cfs using Manning's Calc.

Key Data to Note: The Hosking Avenue trunk line just east of Ashe Road has been the subject of three monitoring events since 2006. The data from these events indicates that the flow in this trunk line has been trending upward over the last 16 years. This should be expected since there has been significant housing growth in the corridor along the Hosking trunk line to the east.

Comparing Actual Flow Measurements - 36" Hosking Trunk Line East of Ashe road:

2006 Technical Memo 9 max daily:	13.7 cfs
2015 Pasquini max daily:	15.3 cfs
2021 Cornerstone max daily:	16.7 cfs

Wastewater Treatment Plant 3 Data: The data summary above indicates that the flow in the sewer system has been relatively flat over the last 6 years even as the population of the tributary area has been increasing. In order to confirm this, recent annual flow data from measurements taken at the headworks of WWTP #3, the Ashe Road Sewer Plant was retrieved for analysis. The flow data was pulled from the annual reports that are filed with the State and was provided by City Staff. This data is shown in the chart below:



As shown above, the population of the Bakersfield City Area has grown from 309,000 to 389,000 over the last 15 years. This is a 26% increase above the 2006 base line. Over this same period, the flow rate to Plant 3 went from 15.4 mgd up to 17.8 mgd, an increase of 16%. Of particular note is the declining trend since 2011 which has been -2%. This is an indicator that water conservation and low flow water fixtures are reducing sewer flow to the collection system even as the population of Bakersfield is growing.

Conclusion #2: The sewer effluent flow to the collection system has remained flat over the last 10 years even as the city population has grown 10% over the same time period. This differs from the projections included in the Technical Memo 9 and suggests again that there is more available capacity in the City's sewer system in the vicinity of the Majestic Hosking Project than analyzes in 2006.

TRIBUTARY AREA ANALYSIS

Stine Road

The sewer tributary area to the Hosking Road trunk line can be broken down into two major branch lines, the Stine Road trunk line and the Hoskingstrunk line. Stine Road drains about 9 square miles of older, more mature parts of Bakersfield. Additional growth for this area may occur in the future with population densification, but this will also be offset by the increased use of low flow fixtures in older homes and buildings.

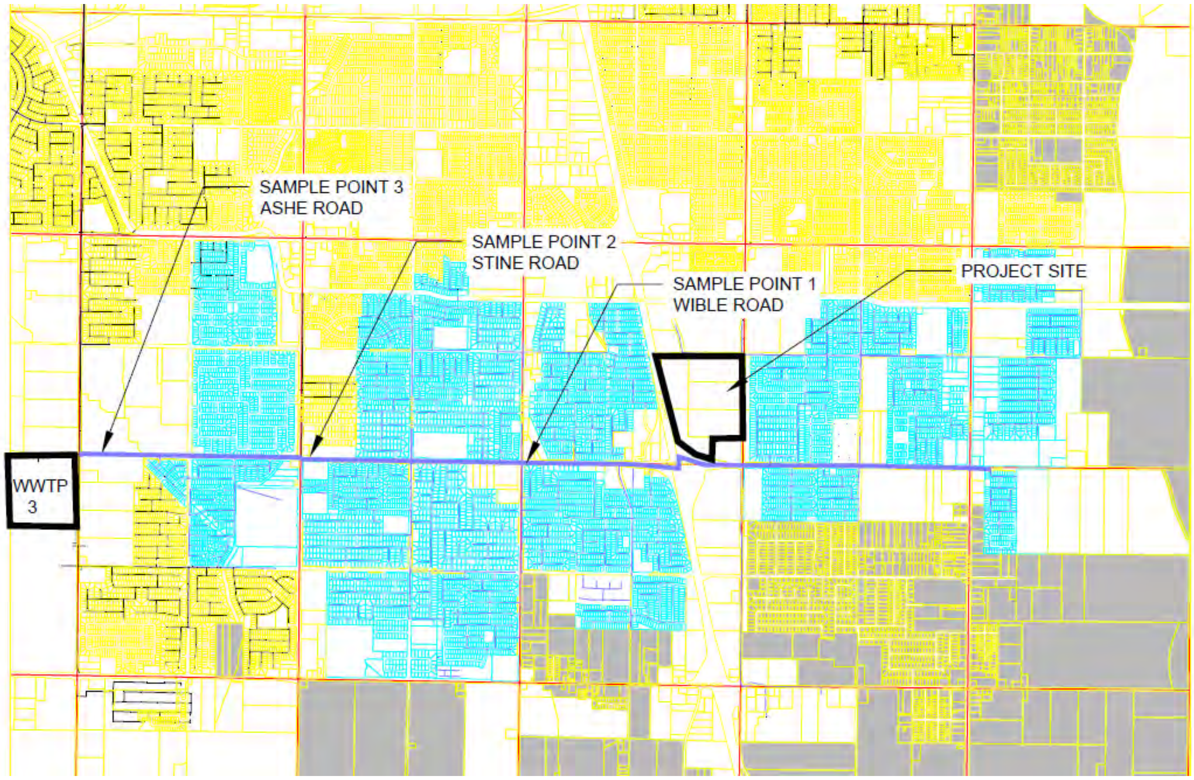
The Stine Road trunk line, just north of Hosking is indicated to be a 30" HDPE pipe installed at 0.106% slope (City records). A Mannings calculation would indicate that this line has a peak capacity of 14.6 cfs. This line has had extended flow monitoring done twice in the last 6 years, Paquini Engineering in 2015 and Mcintosh in 2017. Following is a summary of these measurements:

Pasquini 2015	11.3 cfs max daily flow rate
McIntosh 2017	11.2 cfs max daily flow rate.

The focus of this study is on the capacity of the Hosking trunk line and we don't intend to study the character of the Stine Road line. However, since the Stine Road line flows into the Hosking Line, for the purpose of this study we will assume that the Stine Road trunk line has a max daily outflow of 11.5 cfs and the flow rate is stable. The Stine Road trunk line just north of Hosking is a 30" and is currently operating at about 78% of capacity.

Hosking Sewer main

As noted above, the purpose of this study is to establish whether the trunk line capacity is a concern for the proposed Majestic Hosking Project. Cornerstone has analyzed the existing development in the tributary area to the Hosking trunk line using the peak flow estimating procedures and methods in the City Design Manual. We wanted to compare the actual flow as monitored in the Hosking trunk line against the predicted flow rate as estimated by the City Design Manual procedures. Cornerstone counted each residential house, each developed commercial and industrial parcel, and calculated the estimated flow for each section of land within the developed sewer area.



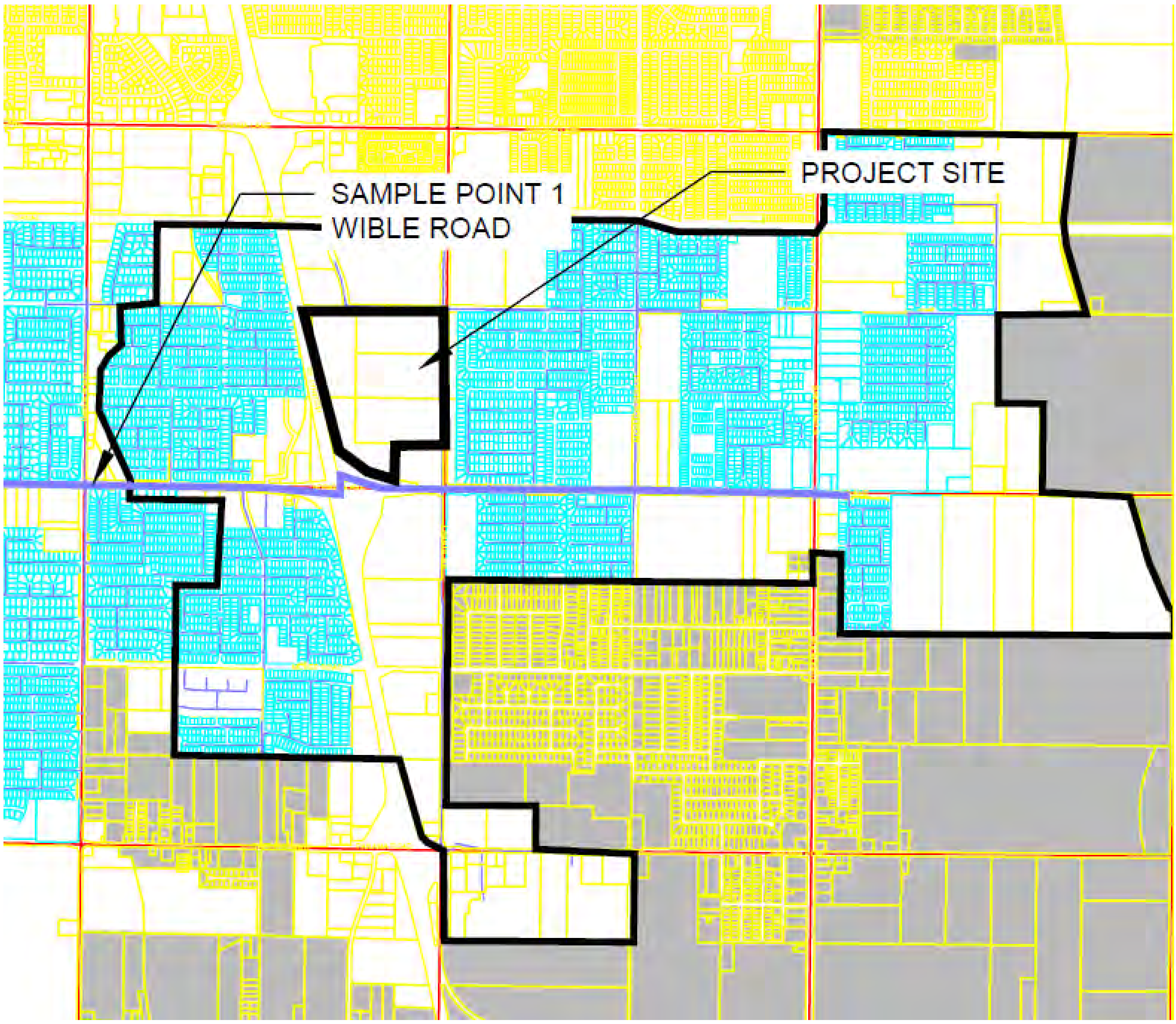
HOSKING PROJECT VICINITY MAP
nts

<u>Segment 1- Hoskings Trunk line East of Wible</u>

The first segment of the Hosking trunk line to be evaluated is the portion east of Wible Road. Currently the sewer main east of Wible drains a 2,200-acre area within the city limits. Based upon our analysis of this tributary area, the design peak flow for existing uses is 5.9 cfs.

From 5/19/21 to 6/7/21 US3 performed SMH monitoring on the 27” sewer main flowing into the SMH at Wible and Hoskings from the east. Velocity and depth of flow measurements were made for an extended period of time. The peak flow rate measured with 2.82 CFS.

Hosking at Wible Tributary area:



The city design manual peak flow estimates were 5.9 cfs while the actual peak flow data was only 2.8 cfs. We note that the average peak factor for residential flow was about 2.5 in our spreadsheet while that actual peak factor seen in the field was about 1.7.

The Hosking sewer main at Wible Road is a 27" main that was installed at 0.06% gradient. A Manning's calculation for this pipe would indicate that it has a peak capacity (90% depth) of 9.6 cfs. So, the current utilization rate for this pipe segment is 29% of capacity and the current tributary area seems to be better than 50% developed based upon the Google Earth image below:

Based upon these measurements, we can conclude that the Hosking sewer main and collection system east of Wible road has ample reserve capacity to serve the proposed project flow of 0.37 cfs.

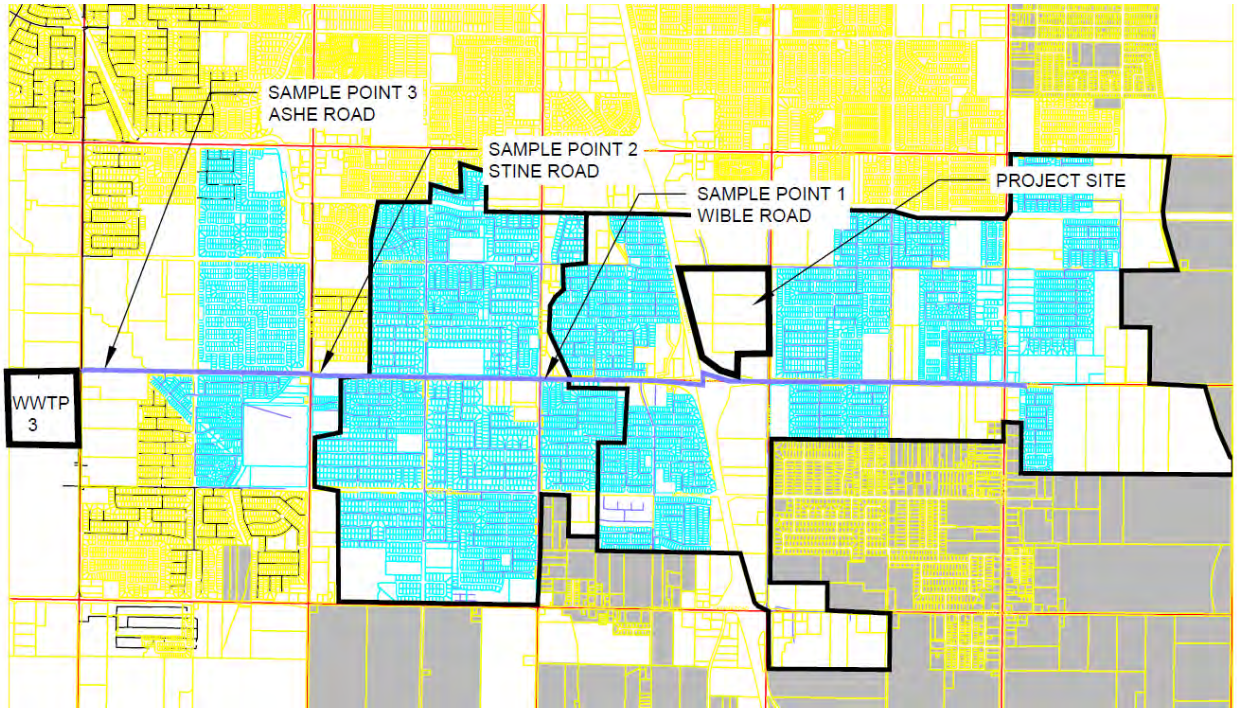
<u>Segment 2 - Hosking at Stine Road</u>

The sewer main in Hosking between Akers and Stine is a 24" PVC pipe installed at a 0.168% grade. This pipe segment is one of the lines flagged in the 2006 Technical Memo 9 as possibly being undersized. In 2021 US3 performed extended flow monitoring on this line in a SMH located to the east of the intersection of Stine and Hosking. The area draining to this sewer main includes all of the last Hosking segment plus an additional 1,100 acres of city parcels. The area includes over 2200 single family homes and is well developed.

US3 measured a peak flow rate of 3.81 cfs and an average flow rate of 2.4 cfs for this sewer main. This yields a peaking factor of about 1.6. The peak flow rate calculated using the City design manual was estimated at 8.26 cfs which would indicate that the city peaking factors are higher than actual. The pipe has a peak flow capacity of 9.86 cfs and is presently flowing at 39% of peak capacity.

The future peak flow rate, assuming full buildout of the tributary area upstream of this point of measurement was estimated to be 13.8 cfs. The City design manual overestimated the predicted present day flow rate by a factor of 340%. Applying this as a correction factor to the future flow rate, it would bring 13.8 cfs down to a rate of about 4.0 cfs. This is still less that 50% of the peak capacity of the sewer main. There is ample excess capacity for the addition project flow of 0.37 cfs.

Hoskings Tributary area between Wible Road and Stine Road:



Segment 3 – Hoskings Sewer Main east of Ashe Road.

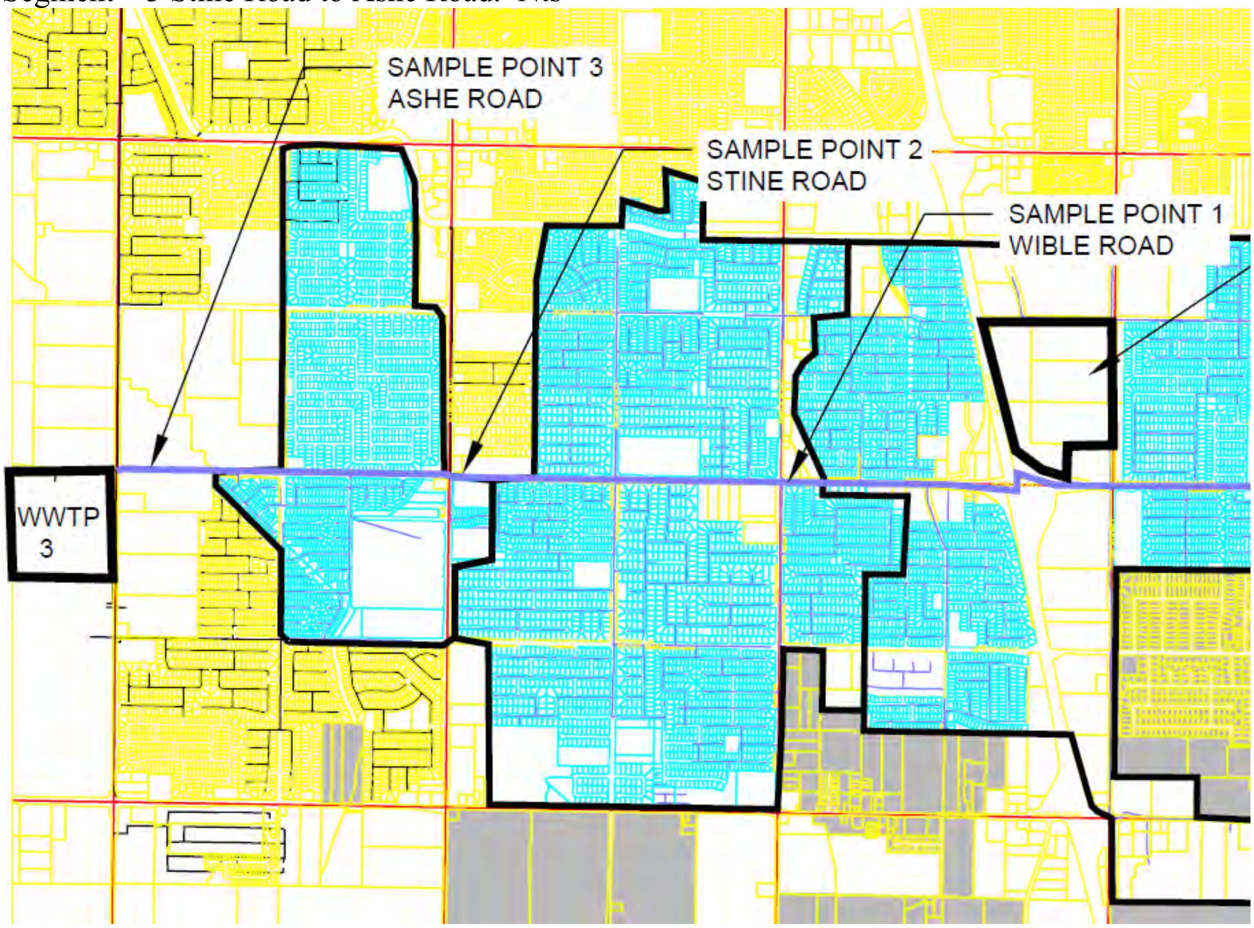
The last mile of sewer main between Stine Road and Ashe is a 36" HDPE pipe laid at a 0.08% grade. Parsons identified this line as being undersized for future flow in their 2006 report. As stated above, this line has had extended flow monitoring performed on it three times since 2006:

Comparing 36" Hosking Trunk Line East of Ashe Road:

2006 Parsons max daily:	13.8 cfs
2015 Pasquini max daily:	15.3 cfs
2021 Cornerstone max daily:	16.7 cfs

This sewer line has a peak capacity of 23.8 cfs based upon Mannings. As also discussed above, the flow rate in this line has grown moderately in the last 6 years. The additional flow to the trunk line comes from the Stine Road sewer trunk (11.5 cfs) and additional flow from 490 acres of land between Stine Road and Ashe. This area is well developed and is comprised mostly of single-family residential parcels.

Segment – 3 Stine Road to Ashe Road. Nts



US3 performed continuous flow monitoring on a SMH in Hosing just east of Ashe Road. The peak flow rate for at this location was 16.7 cfs and the daily average was 8.6 cfs. This derives to a peaking factor of 1.94 which is closer to the city standard then the prior measuring locations.

The city design manual analysis estimated a design peak flow rate of 21.5 cfs while the actual peak flow rate was measured at 16.7 cfs. This would indicate that the city calculation method overestimates the flow by a factor of 1.28. The estimated flow for future buildout of the entire Hosking area was calculated to be 27.4 cfs which when corrected downward by a factor of 1/1.28 would indicate that the future peak flow rate at full buildout will be about 21.4 cfs. The sewer pipe in Hoskings between Stine road and Ashe Road has a peak capacity of 23.8 based upon Manning's. The capacity of the Hosking trunk line at between Ashe and Stine is currently at 70% of peak capacity and even at full buildout should have available capacity for the 0.37 cfs needed to serve this project.

A note about 2006 Technical Memo 9 Table 9-3 of this report shows under-designed trunks at peak (wet weather) flow conditions. This table appears on page 9-18 of the TM-9 report and is shown below:

Table 9-3: Under Designed Trunks at Peak (Wet Weather) flow Conditions

Under designed Trunk	From	To	Capacity at Full Flow (cfs)	Actual Peaked Flow (cfs)
Hosking Road	Stine Road	Ashe Road	14.90	19.24
Ashe Road	District Blvd	Harris Road	8.31	10.53
Ashe Road	Panama Lane	McCutchen Road	11.78	12.41
Stine Road	Summertree Lane	Wilson Road	3.32	3.71
White Lane	Lily Drive	Ashe Road	3.89	3.92
Lily Drive	Olympia Drive	White Lane	2.58	3.21
Trunk discharging to headwork	McCutchen Road	Headwork	24.83	49.97

This table indicates that the existing capacity of the Hosking Trunk sewer line from Stine Road to Ashe Road is undersized. But, the Ashe Road sewer is a 36" HDPE sewer main running at 0.08% grade. Based upon Mannings equation, this pipe has a peak flow capacity of 23.7 cfs verses the Table 9-3 value of 14.90 cfs above. The trunk line is not under-designed but rather will be at about 80% capacity at full buildout.

Conclusion 3: Based upon our analysis of the current flow conditions and predicted future flow, all trunk lines along Hosking Road east of Ashe Road have available capacity to serve the Majestic Hosking Project.

SUMMARY

The proposed Majestic Hosking Project as described in the application materials submitted to City of Bakersfield in May 2021 is forecasted to discharge approximately 0.37 cfs, peak flow to the city sewer system.

Three segments of sewer line were analyzed for available capacity between the proposed project site and discharge to the headworks at WWTP #3. All three segments analysis show that there is excess capacity available to serve the proposed project under current and future tributary buildout conditions.

APPENDICES

Parsons TM-9
Appendix to TM-9
US3 flow monitoring data sheets
Tributary Area Spreadsheets

PARSONS TM-9

CITY OF BAKERSFIELD
TECHNICAL MEMORANDUM 9
PLANT 3 SERVICE AREA SEWER MODEL

9.1 INTRODUCTION

A "backbone" sewer model for Plant 3 Service Area under existing (current) and build-out conditions is developed and presented in this Technical Memorandum (TM). The model is then used to evaluate the hydraulic capacity of the existing sewage collection system and identify sewers with inadequate capacity. The model is a tool for the City to use in defining and optimizing sewer improvements for servicing future growth.

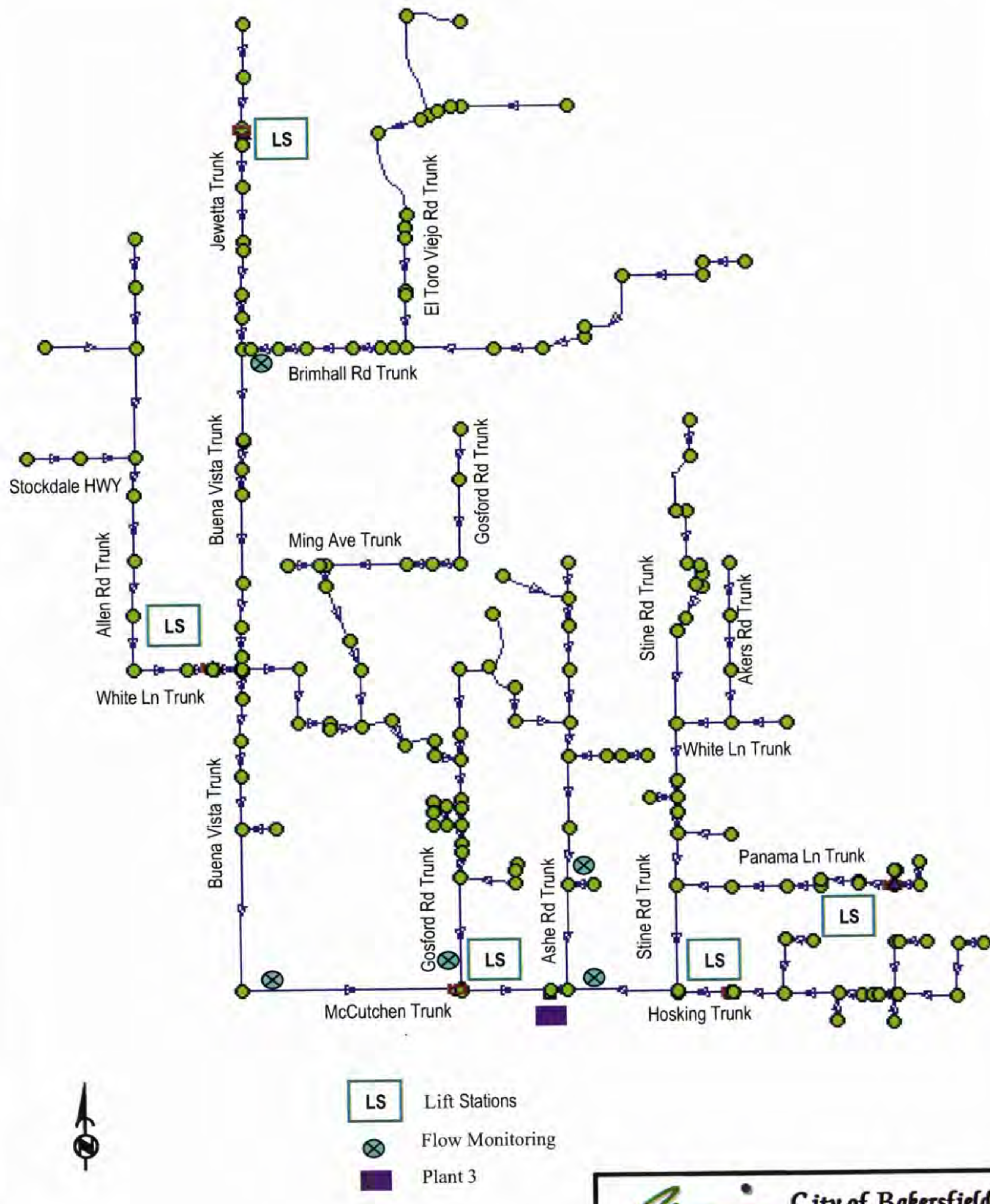
The "backbone" model addresses sewer sizes 15-inches and larger. The sewer model is based on information from as-build drawings provide by the City. For existing conditions, the average daily wastewater flow is estimated based on flow monitoring of selected trunks. The average daily wastewater flow for the build-out condition is based on the land use data provided by the City. The flow conditions under existing and build-out system are evaluated in terms of the City's design and operational criteria, which are presented in TM-1 of this study. In addition, recommendations are made based on model output results.

9.2 SEWER SYSTEM MODEL DESCRIPTION

The backbone sewer model for existing Plant 3 Service Area was prepared using H_2OMAP Sewer Suite 7.0, a widely used sewer system modeling program. Sewer sizes 15-inches and larger are included in the model. Selected manholes are included in the model, when there are changes in sewer diameters or when the slopes of the upstream and downstream sewers differ by more than ten percent. 193 manholes are included in the model and these are defined as "loading" manholes in the model.

The geometry and attribute data used in this study were obtained from as-build drawings. For selected manholes, northing and easting and invert elevations were provided by the City based on "County" Datum, which is in the NAD83 coordinate system. For other manholes, the northing and easting and invert elevations (from as-build drawings) were adjusted using the data provided by the City as benchmarks. Accordingly, the sewer model for Plant 3 Service Area is created based on "County" Datum, which is in the NAD83 coordinate system.

For gravity sewers and force mains, Manning's roughness coefficient "n" and Hazen-William's roughness coefficient 'C" values of 0.013 and 100 were used, respectively.



City of Bakersfield

Plant 3 Service Area Analysis and Plant 4 Feasibility Study at Build-out

Figure 9-1 Plant 3 Service Area Sewer Layout

PARSONS

Figure 9-1 shows the sewer layout and manholes included in the model. The model has 193 "loading" manholes, one outlet at Plant 3 headworks, 195 sewers, and five lift stations. According to the model, a lift station consists of a pump, a wet well, and a chamber (dry well). There are other lift stations in the existing Plant 3 Service Area not included in the model, because these lift stations pump to sewers smaller than 15-inches, which is the smallest sewer size include in the model.

9.3 SEWER MODEL FOR EXISTING CONDITIONS

9.3.1 FLOW MONITORING

The land use data obtained from the City was for the ultimate build-out condition. No information was available on percent build-out or number of sewer connections for existing condition precluding estimation of flows based on land use or sewer connected population. The average daily wastewater flows were estimated for existing conditions by monitoring selected trunks and distributing measured flows over the 193 loading manholes.

Flow monitoring was conducted by ADS Environmental Services, at four locations along the major sewer trunks, namely:

- Ashe Road trunk at an intersection with a canal at Harris Road,
- McCutchen Road trunk just to the east of Ashe Road,
- Gosford Road trunk just to the north of McCutchen Road, and
- Brimhall Road trunk just to the east of Jewetta Road.

Flow monitoring data conducted for RBF Consulting by ADS on McCutchen Road just to the east of Buena Vista Road was also utilized in this study. Flow monitoring locations are shown in Figure 9-1.

The flow monitoring data on Brimhall Road trunk was used to develop a standard 24-hour flow variation curve. The model then uses this curve to load the "average daily flows" into the loading manholes. The Brimhall Road monitoring data was used for the diurnal flow peaking curve since there are no upstream lift stations that could influence the measured flow rates. This developed curve can be used to evaluate flow variation in the collection system over extended period, for example, over 24 hours period. The diurnal flow peaking curve is presented in TM-1 of this study.

At the selected sewer trunks, continuous flow data was collected for duration of one week, September 5-11, 2005. Preceding or during the flow monitoring period no rainfall occurred. Thus, the flow monitoring data represents dry weather conditions that include infiltration but not inflow. Infiltration is water (typically groundwater or perched groundwater) entering the sewer underground through cracks or openings in joints. Inflow is water (typically storm water or surface runoff) that enters the sewer from grates or unsealed manholes exposed to the surface. The average daily flows were calculated from the measured hydrographs. Then, the average daily flows were distributed uniformly to the loading manholes located upstream of the flow monitoring location. Table 9-1, summaries the flow monitoring data. The flow monitoring report prepared by ADS is presented in Appendix 9-1.

Table 9-1: Flow Monitoring Summary

Flow Monitoring Location	Trunk Diameter (inches)	Dry Weather Wastewater Flow [a] (cfs)		
		Average	Peak	Minimum
Ashe Road @ Harris Road	30	5.59	8.92	2.21
McCutchen Road @ Ashe Road	33	9.05	13.85	3.61
Gosford Road @ McCutchen Road	42	5.57	8.50	1.78
Brimhall Road @ Jewetta Road	42	2.43	4.15	0.79
Buena Vista Road @ McCutchen Road	48	5.33	8.86	1.78

[a] includes infiltration

9.3.2 FLOW PEAKING CURVES

Figure 9-2, illustrates the City's normalized design peaking curve and selected flow monitoring data. The peaking curve is based on City's design peaking equation presented in TM-1 of this study. The peaking factor is used to define the maximum sewer design flow based on the average flow. In the figure, the maximum and minimum dry weather peaking factors obtained from flow monitoring data are represented by solid squares and circles, respectively. The dashed lines indicate the trend in maximum and minimum dry weather peaking factors as average daily flow varies. The City's peaking curve is greater than the dry weather peaks and is assumed to include inflow due to rainfall runoff and represents wet weather peak flow conditions. Therefore, the City's peaking curve can be used to evaluate sewer capacity under peak flow conditions.

As expected, the City's wet weather peaking curve lies above the measured dry weather peak conditions. The solid triangle (red) in Figure 9-2 is the peaking factor measured at Plant 3 during wet weather flow. It is lower than the design curve indicating that the City's peaking equation appears adequate for wet weather flow conditions. It is recommended that the City continue to use its peaking equation.

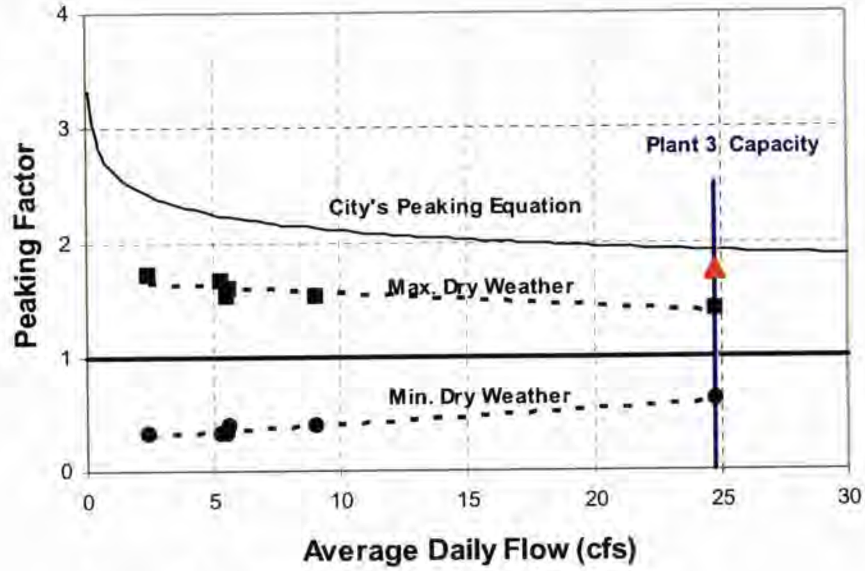


Figure 9-2: Flow Peaking Curves

9.3.3 MODEL CALIBRATION

As mentioned above, flow monitoring was conducted for selected trunk sewers during the week of September 5-11, 2005. This flow data was then input to the model which was then used to predict the total flow to Plant 3. Comparison of the model's predicted flow entering Plant 3 with the actual Plant 3 influent flow measured during the same period confirmed model calibration. Plant 3 influent is measured continuously and is independent of the flow monitoring.

Specifically, the model estimated an average daily flow of 26.13 cfs (16.86 mgd) at Plant 3 headworks which agrees well with actual average influent of 24.60 cfs (15.87 mgd) monitored at Plant 3. The model projected Plant 3 flow is within 6% of the measured Plant 3 flow.

9.3.4 DRY WEATHER FLOW SIMULATION

In this section, the variation of dry weather flow over 24 hours period is simulated for the entire Plant 3 collection system. The average dry weather flow along with the diurnal flow peaking curve developed in TM-1 of this is used. As mentioned in section 9.3.1, the diurnal peaking curve is developed from flow monitoring data on Brimhall Road trunk.

Based on average dry weather flow and flow peaking curve, the projected variation in dry weather flow in Plant 3 Service Area is shown in Figure 9-3. The result indicates that flow generated in Plant 3 Service Area reaches its highest value of 35.14 cfs (23.42 mgd) at 22:30 (10.30 pm). The flows generated at 12:15 (12:15 pm) and 13:45 (1:45 pm) are close to the highest value. The lowest value of flow generated in Plant 3 Service Area is 9.72 cfs (6.27 mgd) at 6 am.

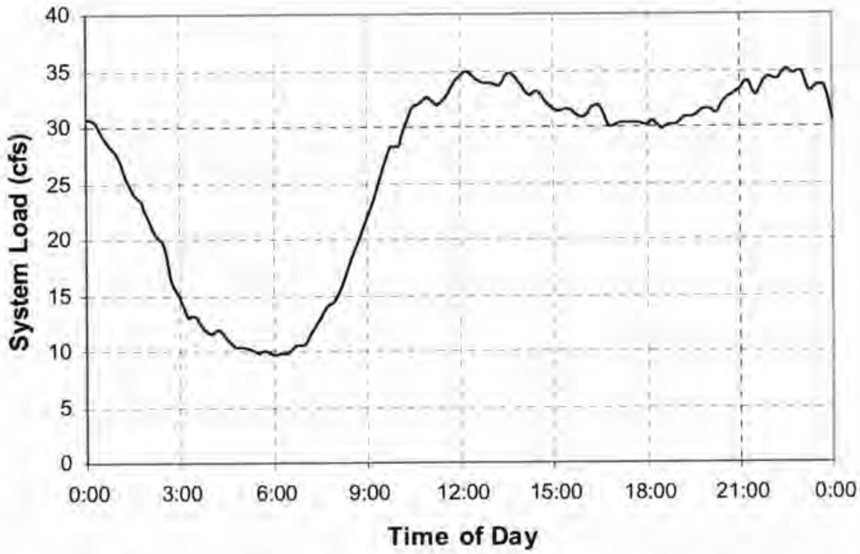


Figure 9-3: Projected Dry Weather Flow Variation for Plant 3 Service Area

9.3.5 MINIMUM AND MAXIMUM DRY WEATHER FLOWS

Based on the design and operational criteria presented in TM-1 of this study, the minimum velocity required to prevent deposition of solids in a sewer pipe should be checked under minimum flow conditions, while the maximum flow depths and maximum velocities should be checked under maximum flow conditions. Based on Figure 9-3, the minimum velocities in the collection system were evaluated at 6 am, while the flow depths and maximum velocities were evaluated at 10:30 pm.

Figure 9-4, presents the flow velocities at 6 am with different colors for different flow velocity magnitudes. Green represents sewers with flow velocities equal to or greater than 2 feet per second (fps), which is the minimum velocity specified by the City's Subdivision Design Manual to prevent deposition of solids in a sewer. Sewers in red color indicate where the flow velocities are less than 2 fps. The result indicates that majority of the sewers in the collection system have flow velocities below 2 fps.

The velocities in the collection system at maximum flows are presented in Figure 9-5. The red color represents sewers with flow velocities less 2 fps, the green represents sewers with flow velocities between 2 and 10 fps and blue represents flow velocities greater than 10 fps, which is the maximum velocity stated in the City's Subdivision Design Manual. The results indicate that most of the sewers in the collection system still exhibited flow velocities below the minimum 2 fps value even under maximum flow conditions. A sewer running north south connecting Hosking Road trunk with McCutchen Road trunk exhibits a flow velocity that exceeds the maximum value of

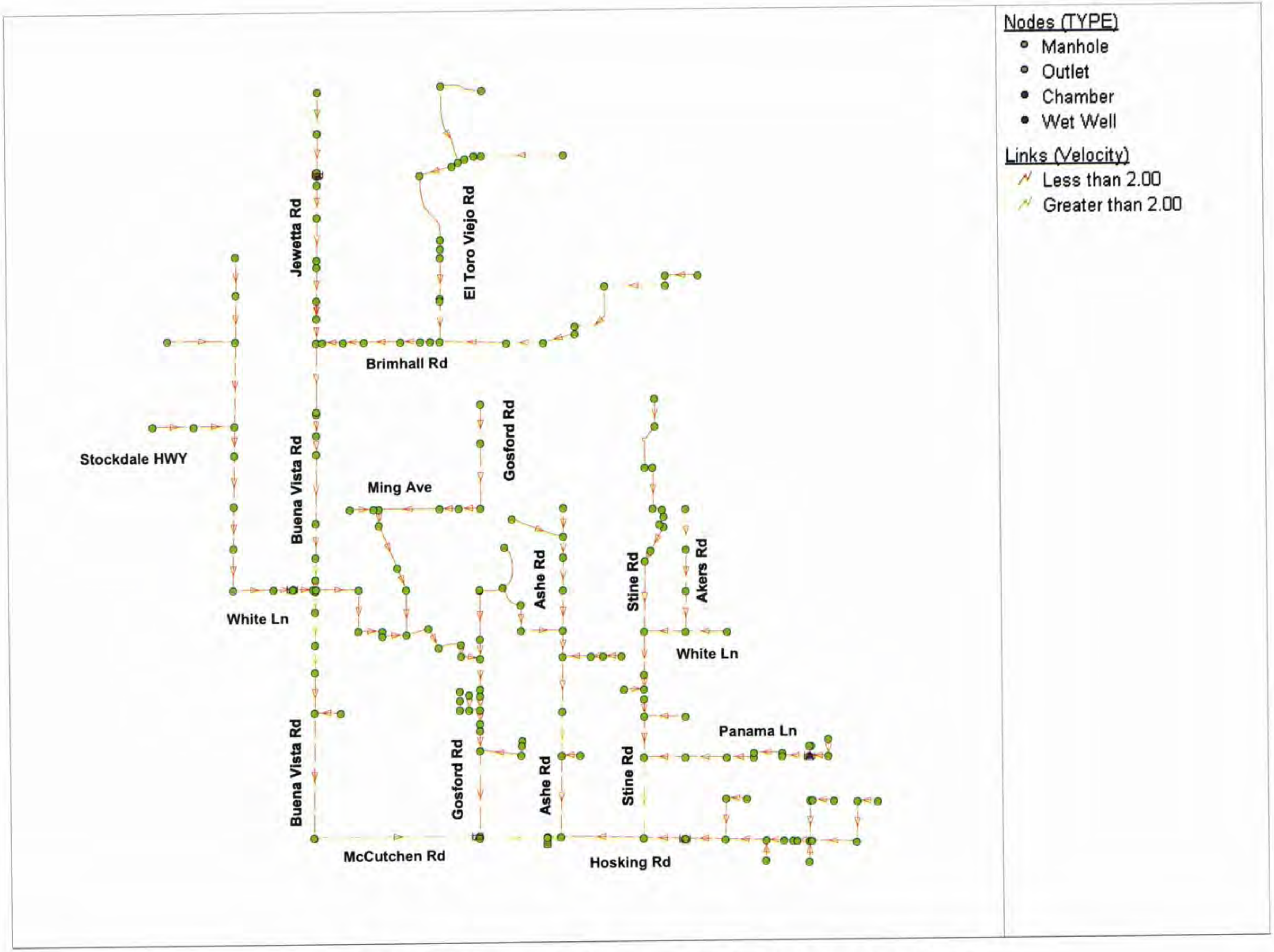


Figure 9-4: Velocities under Minimum Dry Weather Flow Conditions

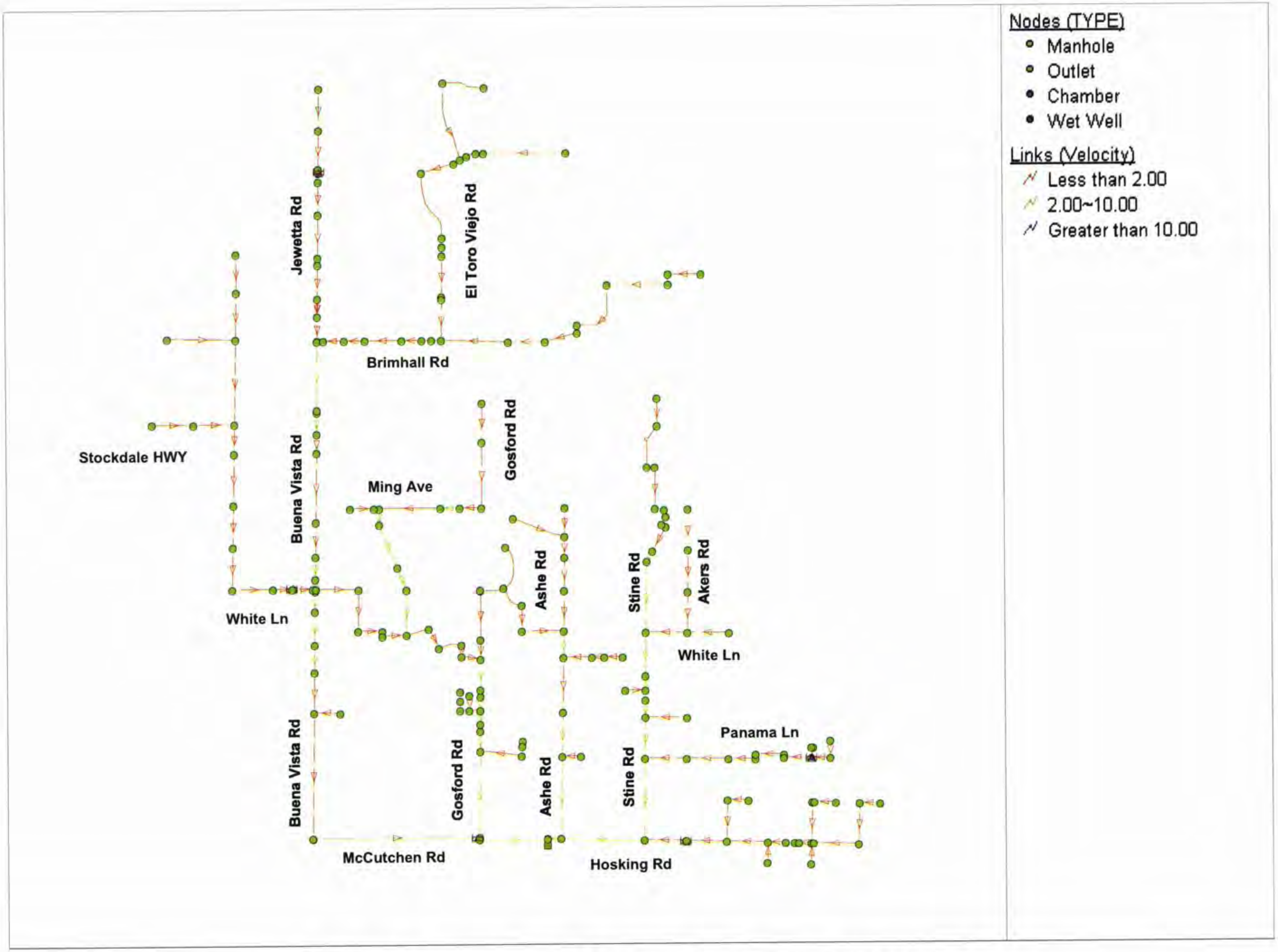


Figure 9-5: Velocities under Maximum Dry Weather Flow Conditions

10 fps. The sewer is not visible on Figure 9-5 due its smaller length relative to the map scale. The flow depths (d/D) at maximum flow condition are presented in Figure 9-6. "d" is the projected flow depth and "D" is the sewer diameter. The green, blue, and red colors represent sewers with d/D ratios less than 0.50, between 0.50 and 1.0, and 1.0 (flowing full, possibly surcharged), respectively. The results indicate that the majority of the sewers exhibited d/D ratios less than 0.50, a few sewers have d/D ratios between 0.50 and 1.0, and the sewer discharging to the headwork at the treatment plant is flowing full (the sewer is not visible in Figure 9-6 due to the short length of the sewer relative to the map scale).

9.3.6 WET WEATHER FLOWS

In this section, the capacities of sewer pipes under peak (wet weather) flow conditions are projected and compared with the design criteria. The peak flow is computed based on the City's peaking equation, which is assumed to consider wet weather flow conditions. In Figure 9-7, sewer capacities under peak flow conditions are presented. The green, blue, and red colors represent sewers with q/Q ratios less than 0.75, between 0.75 and 1.0, and greater than 1.0, respectively. Q represents the sewer capacity at full flow, while q is the model project peak flow. As indicated in the figure, most of the sewers exhibited q/Q ratio less than 0.75 and few sewers have q/Q ratio between 0.75 and 1.0. The following sewer trunks exhibited $q/Q > 1.0$, i.e., pressurized flow (surcharged) for the peak flow conditions:

- Ashe Road
- Husking Road
- Stine Road
- While Lane
- Lily Drive
- The trunk discharging to the headwork (not visible in Figure 9-7).

9.4 SEWER MODEL FOR BUILT-OUT CONDITIONS

The maximum wastewater flow will occur when the City is fully built-out in the future and all dwellings in the service area are connected to the sewer system. The City's Master Plan is the roadmap for building out City and provides the future land use that is used to estimate future water demands and wastewater generation.

9.4.1 LAND USE AND FLOW GENERATION RATES

The average daily flows for the build-out conditions were estimated based on land use data obtained from the City and by using H_2OMAP Sewer's Load Allocator. Parcel polygons were created around each manhole using the Thiessen polygon feature available in H_2OMAP Sewer. Figure 9-8 shows the parcel polygons created along with the model layout. The parcel polygons were intersected with the land use and the Load Allocator automatically generates and assigns the flow to each manhole.

The land use data obtained from the City was in the NAD27 coordinate system; however, the sewer model for Plant 3 Service Area was created in the NAD83 coordinate system. To utilize the load allocation capability of H_2OMAP sewer, the sewer model and the land use data must be in the same coordinate system. In this study, the sewer model was transformed to the NAD27 coordinate system, and then the land use and parcel polygons (see discussion above) were intersected to obtain the average daily flow.

In Figure 9-9 presents the City's General Plan for the existing Plant 3 Service Area. The City's General Plan shows that Plant 3 Service Area consist of a mixture of residential, commercial, and industrial developments as well as public facilities. The existing Plant 3 Service Area outlined with a dashed line covers approximately 70 square miles.

For each land use, unit wastewater flow generation rates (load factors) were applied. In discussion with the City, flow contribution rate of 280 gallons per day (gpd) per equivalent dwelling unit (EDU) is appropriate for residential land use types. For high-density areas, the mid-range density flow generation rate was used, as high-density areas are relatively small.

The average wastewater generation rates for commercial developments normally range from 800 to 1,500 gpd per acre (Metcalf and Eddy, 1991). In this study a flow generation rate of 1,000 gpd per acre is used.

Typical design values for estimating industrial areas wastewater flows are 1,000 to 1,500 gpd per acre for light industrial developments and 1,500 to 3,000 gpd per acre for medium industrial developments (Metcalf and Eddy, 1991). In this study, flow generation rates of 1,000, 1,500, and 3,000 gpd per acre were used for light industrial, service industrial, and heavy industrial developments, respectively.

Based on City of Los Angeles draft California Environmental Quality Act (CEQA) threshold guide, a public facility wastewater generation rate of 50 gpd/ per 1,000 square feet, which is equivalent to 2,178 gpd per acre, was used.

Table 9-2 summarizes the flow generation rates used in this study for the various land use types.

Additional wastewater may enter the sewer system from infiltration occurring in gravity sewers. The amount of flow that can enter a sewer may range from 100 to 10,000 gal/d in-mi (Metcalf and Eddy, 1991). In this study a value of 1,000 gal/d in-mi, which is equivalent to 2.93×10^{-7} cfs/in-ft, is used. This value was assigned as an infiltration rate to each sewer by using H_2OMAP Sewer. The model applies peaking factors to the calculated average wastewater generation rates. There is no peaking of the infiltration.

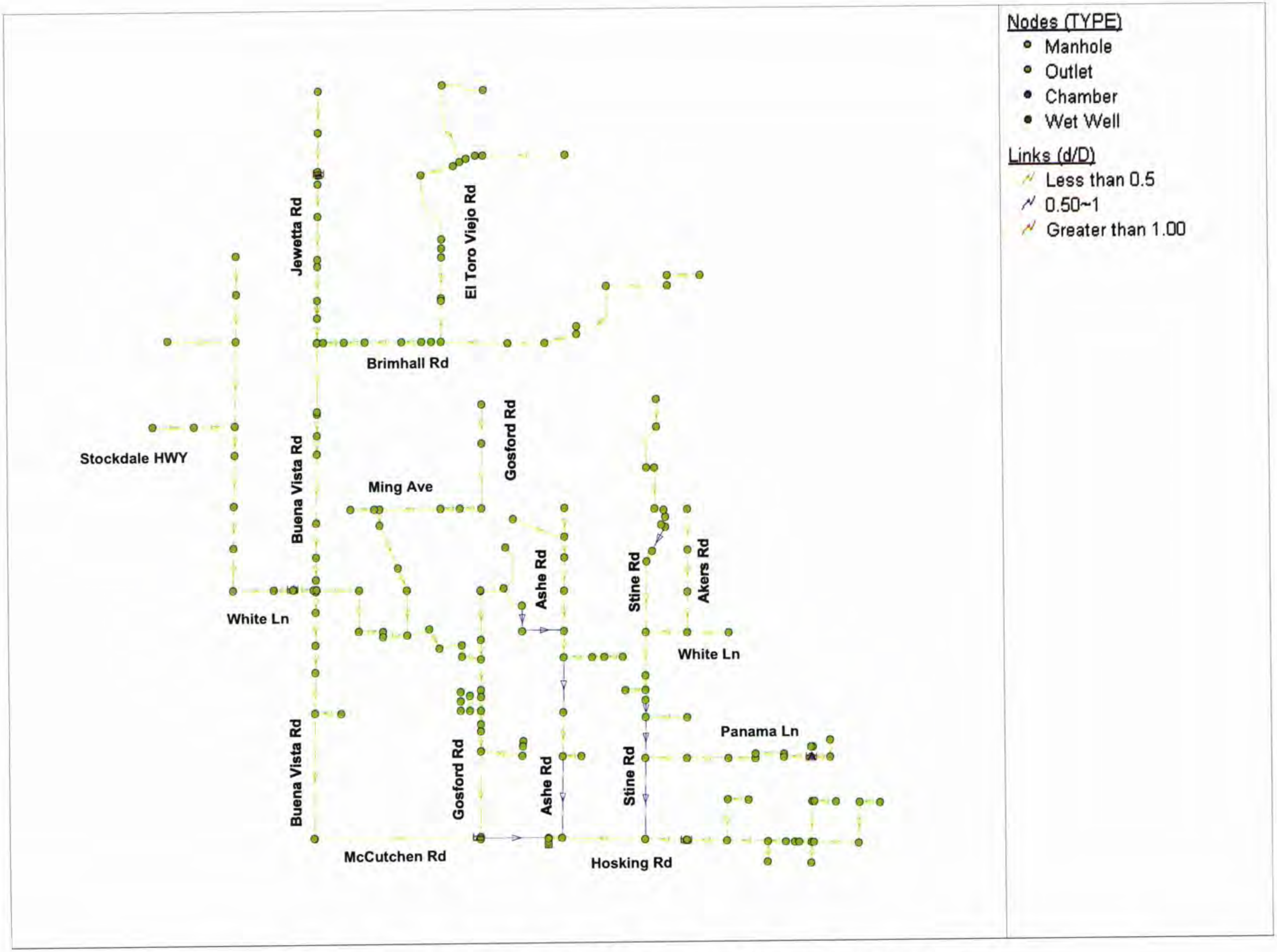


Figure 9-6: Flow Depths under Maximum Dry Weather Flow Conditions

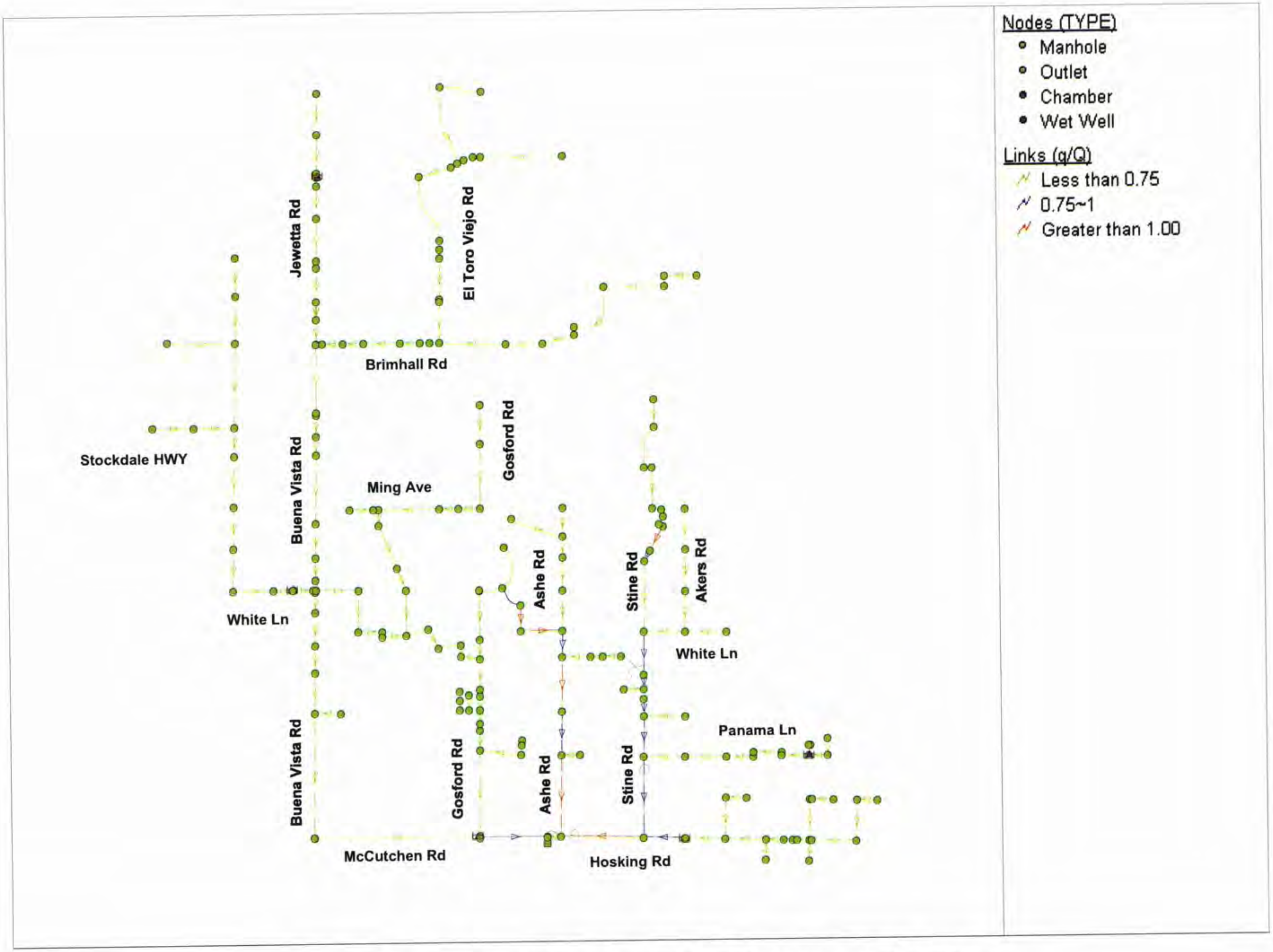
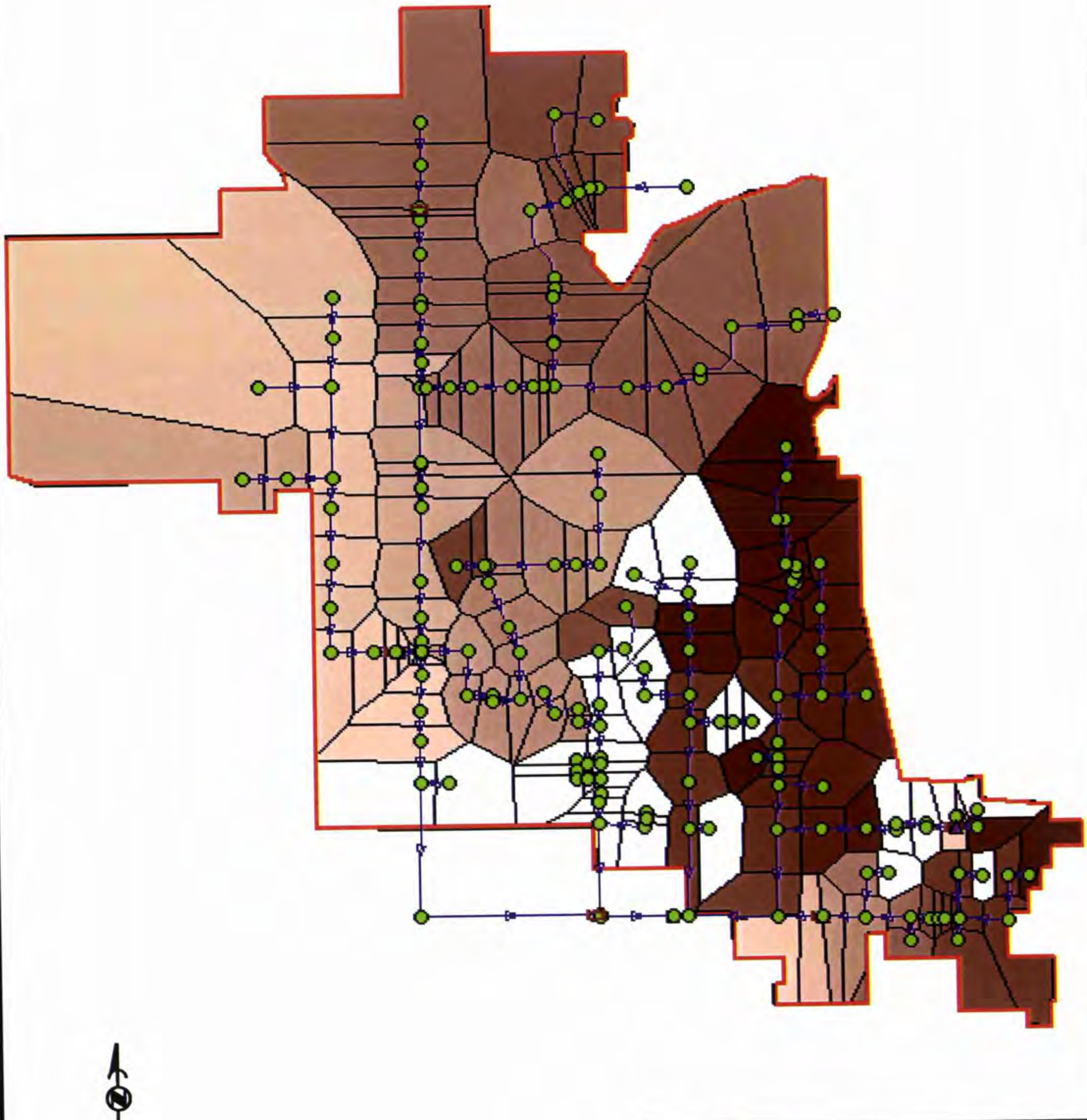


Figure 9-7: Sewer Capacities under Peak (Wet Weather) Flow Conditions



City of Bakersfield

Plant 3 Service Area Analysis and Plant 4 Feasibility Study at Build-out

Figure 9-8 Thiessen Polygon

PARSONS

Table 9-2: Land Use Type and Wastewater Flow Generation Rate

Land Use Type	Categories	Wastewater Flow Generation Rate (Average Daily Flow Rates)		
		EDU/Acre	gpd/Acre	cfs/Acre
Residential (a)	Rural Residential (RR)	0.4	112	1.733×10^{-4}
	Estate Residential (ER)	1	280	4.332×10^{-4}
	Urban Estate Residential (UER)	2	560	8.664×10^{-4}
	Suburban Residential (SR)	4	1120	1.733×10^{-3}
	SR/LR	4	1120	1.733×10^{-3}
	Low Density Residential (LR)	4	1120	1.733×10^{-3}
	LMR/LR	4	1120	1.733×10^{-3}
	Low Medium Density Residential (LMR)	10	2800	4.332×10^{-3}
	HMR/LMR	10	2800	4.332×10^{-3}
	High Medium Density Residential (HMR)	10	2800	4.332×10^{-3}
	High Density Residential (HR)	10	2800	4.332×10^{-3}
Commercial (b)	Highway Commercial (HC) General Commercial (GC) Office Commercial (OC) Major Commercial (MC) Mixed Use Commercial (MUC)	NA	1000	1.547×10^{-3}
Industrial (b)	Light Industrial (LI)	NA	1000	1.547×10^{-3}
	Service Industrial (SI)	NA	1500	2.321×10^{-3}
	Heavy Industrial (HI)	NA	3000	4.642×10^{-3}
Public Facilities (c)	Public Utilities (P) Public and Private Schools (PS) Public Transportation Corridor (PT) Solid Waste facility sites (P-SW) Low Density Residential/Public and Private Schools (LR/PS)	NA	2178	3.370×10^{-3}

(a) Based on 280 gpd/acre (b) Metcalf and Eddy, 1991 (c) Based on 50 gpd/ per 1,000 square feet

9.4.2 AVERAGE DAILY FLOW

A total average daily flow of 39.8 mgd (61.8 cfs) was obtained from existing Plant 3 Service Area for the build-out condition using land use plans, the unit generation rates in Table 9-2 and the H_2OMAP Load Allocator. This flow represents the average daily dry weather flow including infiltration of 1,000 gallons per day per diameter inch mile. For the backbone system modeled, the total infiltration is approximately 1 cfs or 0.7 mgd.

In TM-2 of this study, 30.0 mgd was calculated as the ultimate (build-out) sewer flow from existing Plant 3 Service Area based on land use. The discrepancy between the two approaches appears due to TM-2 assuming a typical net density of 4 EDU per acre for all residential categories. This is lower than the density used in this TM where the number of EDU's per acre varies based on the type of residential category, i.e., low-, medium-, and high-density, as shown in Table 9-2. In addition, the projections in TM-2 did not include infiltration.

9.4.3 WET WEATHER FLOW ANALYSIS

The sewer flow rates for peak wet weather flows (includes both inflow and infiltration) for the ultimate (build-out) conditions were projected and compared with existing sewer capacities. The peak flow is obtained based on the peaking equation provided in the City's Subdivision Design Manual, which was presented in TM-1 of this study. In Figure 9-10, the capacities under peak flow conditions are presented. The green, blue, and red colors represent sewers with q/Q ratios less than 0.75, between 0.75 and 1.0, and greater than 1.0, respectively. Q represents the sewer capacity at full flow, while q is the projected peaked flow. As indicated in the figure, a number of trunks exhibited q/Q ratio greater than 1.0, i.e., pressurized flow. Obviously, many parts of the existing sewer system were not designed for build-out and will be overloaded with a doubling of the existing wastewater flow.

9.5 SUMMARY AND RECOMMENDATIONS

9.5.1 GENERAL

The "backbone" model developed in this study contains sewer sizes 15-inches and larger and selected manholes. For manholes included in the model, the existing average daily flows were estimated based on flow monitoring of selected trunks during the week of September 5-11, 2005. The model calibration was confirmed based on flow measurements of Plant 3 influent for the same period.

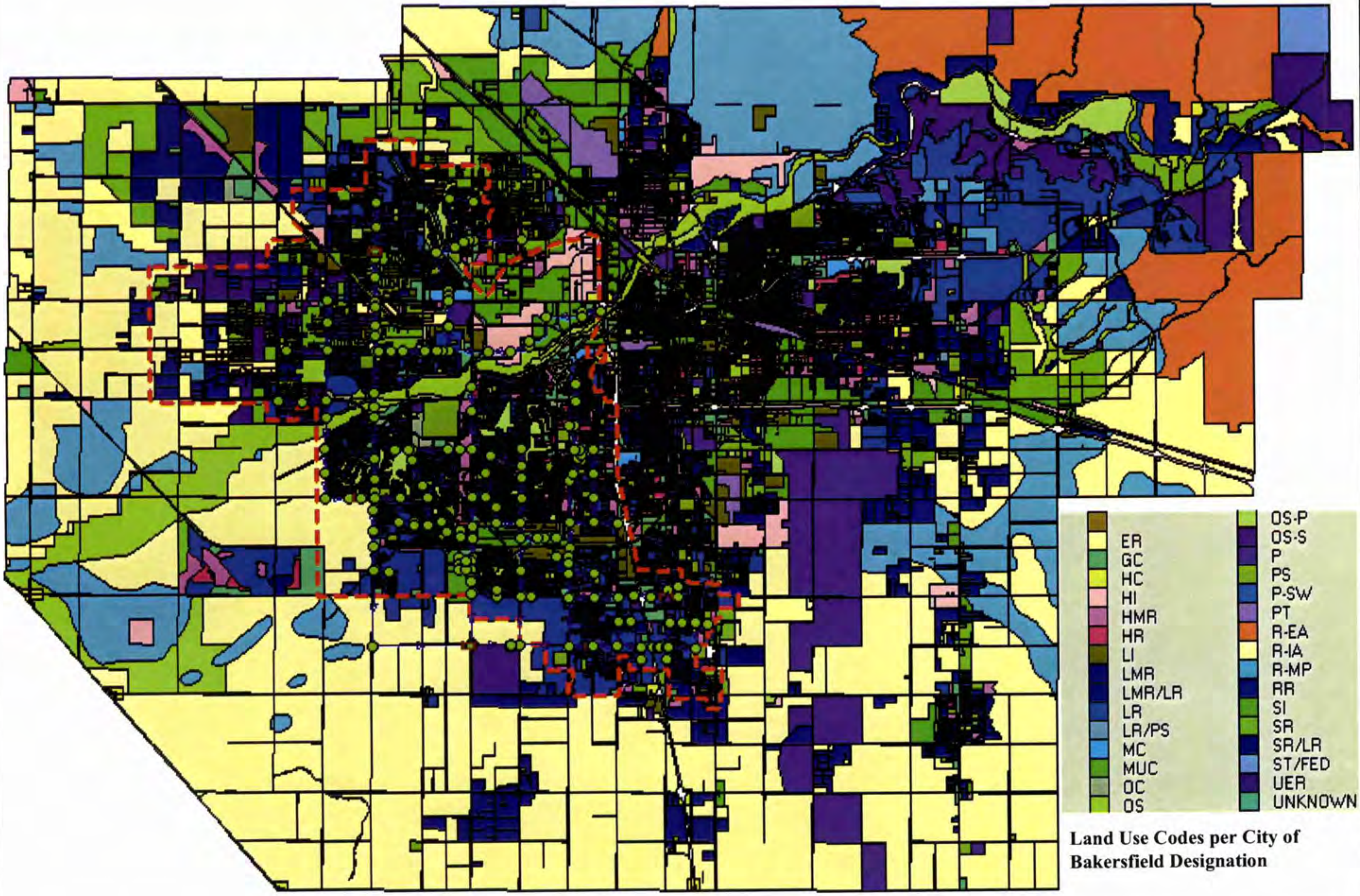
Overall, if properly maintained and updated, the model can be used to:

- Perform capacity analysis.
- Identify hydraulic deficiencies in the collection system.
- Develop sewer upgrade plans and needs.
- Evaluate the impact of new development on existing system.

The model was developed and calibrated based on limited number of flow monitoring data. The accuracy and value of the model can be improved by conducting more flow monitoring in the future. Furthermore, as additional developments take place within Plant 3 Service Area, the model can be used to assess the capacities of sewers affected by the development.

9.5.2 RECOMMENDATIONS - EXISTING CONDITIONS

Based on the model output, most of the sewers in the collection system violate the minimum velocity specified in the City's Subdivision Design Manual. Therefore, it is recommended the City periodically inspect for solid deposition in selected sewers and jet-wash the accumulated deposits as needed.



City of Bakersfield

Plant 3 Service Area Analysis and Plant 4 Feasibility Study at Build-out

Figure 9-9 Plant 3 Service Area

Figure 9-10: Sewer Capacities under Peak Flow Conditions at Built-Out

The flow velocity in the 48-in sewer connecting Husking Road trunk with McCutchen Road trunk exceeds 10 feet per second under all flow conditions and may experience erosion. It is recommended that this sewer be inspected and appropriate erosion protection measure installed as needed.

Under peak (wet weather) flow conditions, the sewer trunks on Ashe Road, Husking Road, Stine Road, While Lane, Lily Drive, and the trunk discharging to the headwork exceed their capacities. It is recommended that these overload conditions be confirmed through field observations and, if necessary, relieved with parallel sewers or replaced with larger diameter sewers to accommodate peak flows. Table 9-3 summarizes the undersized sewers under peak flow (wet weather) conditions.

Table 9-3: Under Designed Trunks at Peak (Wet Weather) flow Conditions

Under designed Trunk	From	To	Capacity at Full Flow (cfs)	Actual Peaked Flow (cfs)
Hosking Road	Stine Road	Ashe Road	14.90	19.24
Ashe Road	District Blvd	Harris Road	8.31	10.53
Ashe Road	Panama Lane	McCutchen Road	11.78	12.41
Stine Road	Summertree Lane	Wilson Road	3.32	3.71
White Lane	Lily Drive	Ashe Road	3.89	3.92
Lily Drive	Olympia Drive	White Lane	2.58	3.21
Trunk discharging to headwork	McCutchen Road	Headwork	24.83	49.97

9.5.3 RECOMMENDATIONS - BUILD-OUT CONDITIONS

Based on the land use plan, many of the existing sewers will be overloaded at build-out. Additional sewers or relief sewers will be required. No specific recommendations can be provided for the built-out system without defining rates of development, the locations of development and the specific characteristics of the development.

It is recommended that the City use a five year "look ahead" approach along with the build-out requirements. The build-out sewer sizes are the maxima anticipated. The five year look ahead can be maintained based on the latest plans of developers. The City can then identify developer required improvements recognizing the ultimate capacity needs of the system.

APPENDIX TO TM-9

FLOWVIEW™

INTELLIGENCE YOU CAN COUNT ON.

City of Bakersfield, CA

Temporary Flow Monitoring Study

Prepared for:

Parsons

Sep. 5, 2005 - Sep. 11, 2005

ADS ENVIRONMENTAL SERVICES®

TABLE OF CONTENTS

CHAPTER 1 Introduction

1.1 Background

Parsons entered into agreement with ADS Environmental Services to conduct flow monitoring at four (4) locations in the City of Bakersfield, CA sanitary sewer system. The objective of this study was to measure depth and velocity and to quantify flows.

1.2 Project Scope

The scope of this study involved using temporary flow monitors to quantify wastewater flow at four (4) locations. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring site for adequate hydraulic conditions.
- Flow monitor installation.
- Flow monitor confirmations and data collections.
- Flow data analysis.

Equipment installation was accomplished on September 3, 2005. The monitoring period began on September 5, 2005 and was completed on September 11, 2005.

CHAPTER 2 Equipment and Methodology

2.1 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. Most modern flow monitoring equipment, including the ADS Models, measure both depth and velocity and therefore use the Continuity Equation to calculate flow quantities.

2.2 Flow Monitoring Equipment

The monitor selected for this project was the ADS Model 1500-flow monitor. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Model 1500-flow 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 15-minute intervals. A laptop computer was used in the field to retrieve and store data from the monitor.

Three types of data acquisition sensors are available for Model 1500 flow monitor. The primary depth measurement device is the ADS quad-redundant ultrasonic level sensor. This sensor uses four independent ultrasonic transceivers in pairs to measure the distance from the face of the transceiver housing to the water surface (air range) with up to four transceiver pairs, of the available one, active at one time. The elapsed time between transmitting and receiving the ultrasonic waves is used to calculate the air range between the sensor and flow surface based on the speed of sound in air. Sensors in the transceiver housing measure temperature, which is used to compensate the ultrasonic signal travel time. The speed of sound will vary with temperature. Since the ultrasonic level sensor is mounted out of the flow, it creates no disturbance to normal flow patterns and does not affect site hydraulics.

Redundant flow depth data can be provided by a pressure depth sensor, and is independent from the ultrasonic level sensor. This sensor uses 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. Pressure depth sensors are typically used in larger size channels and applications where surcharging is anticipated. Its streamlined shape minimizes flow distortion.

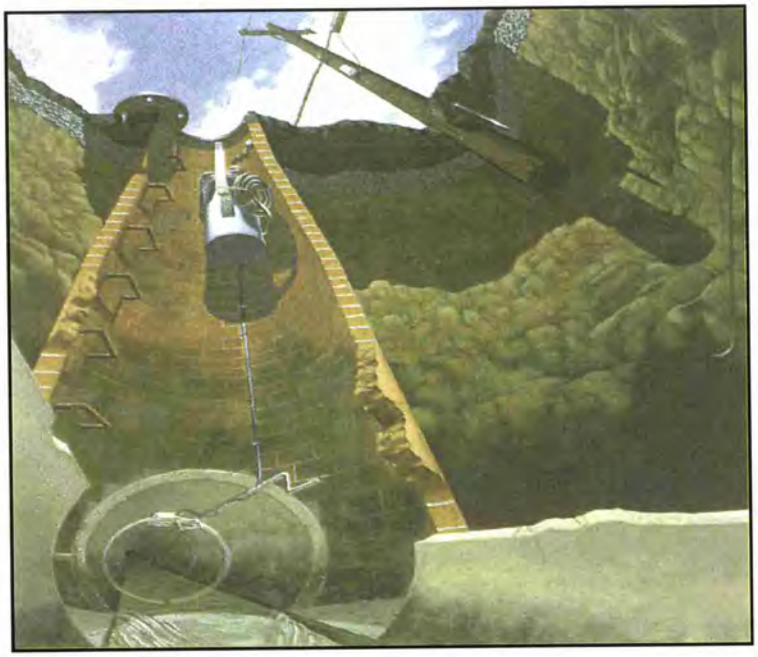
Velocity is measured using the ADS V-3 digital Doppler velocity sensor. This sensor measures velocity in the cross-sectional area of flow. An ultrasonic carrier is transmitted upstream into the flow, and is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional 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. Collected peak velocity information is filtered and processed using field confirmation information and proprietary software to determine the average velocity, which is used to calculate flow quantities. The sensor's small profile, measuring 1.5 inches by 1.15 inches by 0.50 inches thick, minimizes the affects on flow patterns and site hydraulics.

2.3 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. A typical flow monitor installation is shown in Figure 2.1.

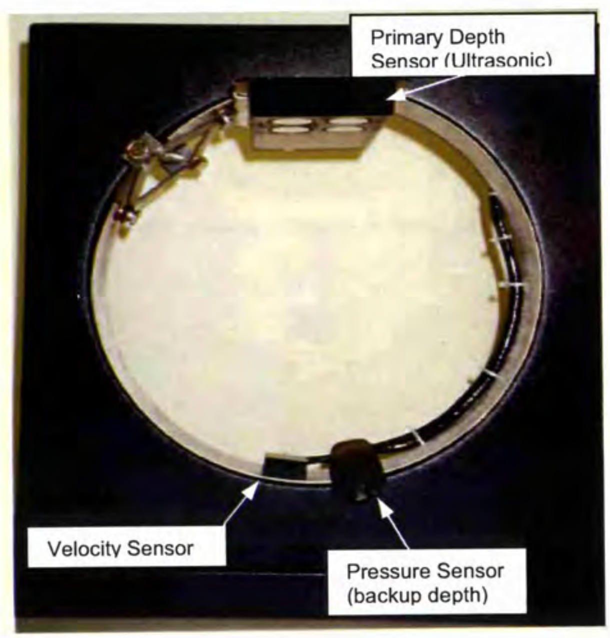
The installations depicted in Figures 2.1 are typical for circular or oval pipes up to approximately 104-inches in diameter or height. In installations into pipes 42-inches or less in diameter, depth and velocity sensors are mounted on an expandable stainless steel ring and installed one to two pipe diameters upstream of the pipe/manhole connection in the incoming sewer pipe. This reduces the affects of turbulence and backwater caused by the connection. In pipes larger than 42 inches in diameter, a special installation is made using two sections of the ring installed one to two feet upstream of the pipe/manhole connection; one bolted to the crown of the pipe for the depth sensor, and the other bolted to the bottom of the pipe (bolts usually placed just above the water line) to hold the velocity sensor.

Figure 2.1 Typical Installation



Large Pipe (>42" Diameter)

Small Pipe (8" to 42" Diameter)



2.4 Data Collection, Confirmation, and Quality Assurance

During the monitoring period, field crews visit each monitoring location to retrieve data, verify proper monitor operation, and document field conditions. The following quality assurance steps are taken to assure the integrity of the data collected:

- **Measure Power Supply:** The monitor is powered by a dry cell battery pack. Power levels are recorded and battery packs replaced, if necessary. A separate battery provides back-up power to memory, which allows the primary battery to be replaced without the loss of data.

- **Perform Pipe Line Confirmations and Confirm Depth and Velocity:** Once equipment and sensor installation is accomplished, a member of the field crew descends into the manhole to perform a field measurement of flow rate, depth and velocity to confirm they are in agreement with the monitor. Since the ADS V-3 velocity sensor measures peak velocity in the wetted cross-sectional area of flow, velocity profiles are also taken to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

- **Measure Silt Level:** During site confirmation, a member of the field crew descends into the manhole and measures and records the depth of silt at the bottom of the pipe. This data is used to compute the true area of flow.

- **Confirm Monitor Synchronization:** The field crew checks the flow monitor's clock for accuracy.

- **Upload and Review Data:** Data collected by the monitor is uploaded and reviewed for comparison with previous data. All readings are checked for consistency and screened for deviations in the flow patterns, which indicate system anomalies or equipment failure.

CHAPTER 3 Data Analysis and Presentation

3.1 Data Analysis

A flow monitor is programmed to collect data at either 5-minute or 15-minute intervals throughout the monitoring period depending on site hydraulics. The monitor stores raw data consisting of (1) the air range (distance from sensor to top of flow) for each active ultrasonic depth sensor pair and (2) the peak velocity. If the monitor is equipped with a pressure sensor, then a depth reading from this sensor may also be stored. When the field personnel collect the data, the air range is converted to depth data based on the pipe height and physical offset (distance from the top of the pipe to the surface of the ultrasonic sensor). 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 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 ultrasonic pairs and/or depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

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.

3.2 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. Tables are provided in daily and 15-minute averages. 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)

MAX FLOW--The maximum observed flow rate during the reporting period (in MGD)

MIN FLOW -- The minimum observed flow rate during the reporting period (in MGD)

QFINAL -- Final calculated flow rate (in MGD)

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

TOT FLOW -- Total volume of flow recorded for the indicated time period (in MG)

Overview

A review of the hydrograph data indicates a repeatable diurnal pattern on weekdays and on weekends from Monday, September 05, 2005 through Sunday, September 11, 2005.

Observations

Average flow depth, velocity, and quantity observed during the study period, along with minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	15.05	3.16	5.831
Minimum	9.60	2.33	2.331
Maximum	19.43	3.66	8.935

Please note the minimum and maximum flow rate recorded in this table may vary from those recorded on the daily and weekly tabular data. The minimum and maximum rates recorded on the daily and weekly tabular data are absolute verses average fifteen minute data.

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.

Data Quality

Data uptime observed during the monitoring period is provided in the table below.

Percent Uptime	
Depth	100.00%
Velocity	99.85%
Quantity	99.85%

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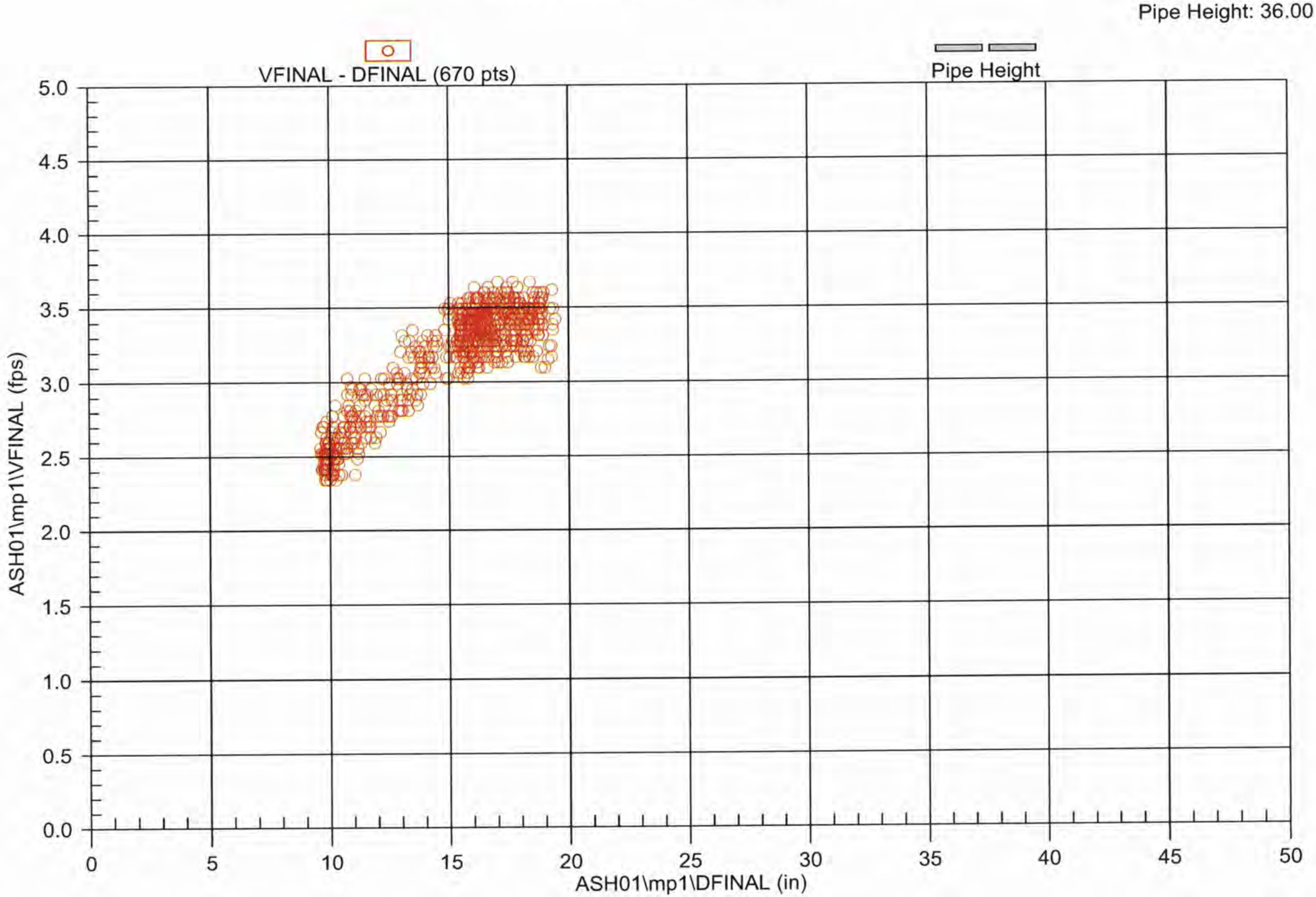
9/5/2005 00:00:00 - 9/11/2005 23:59:59



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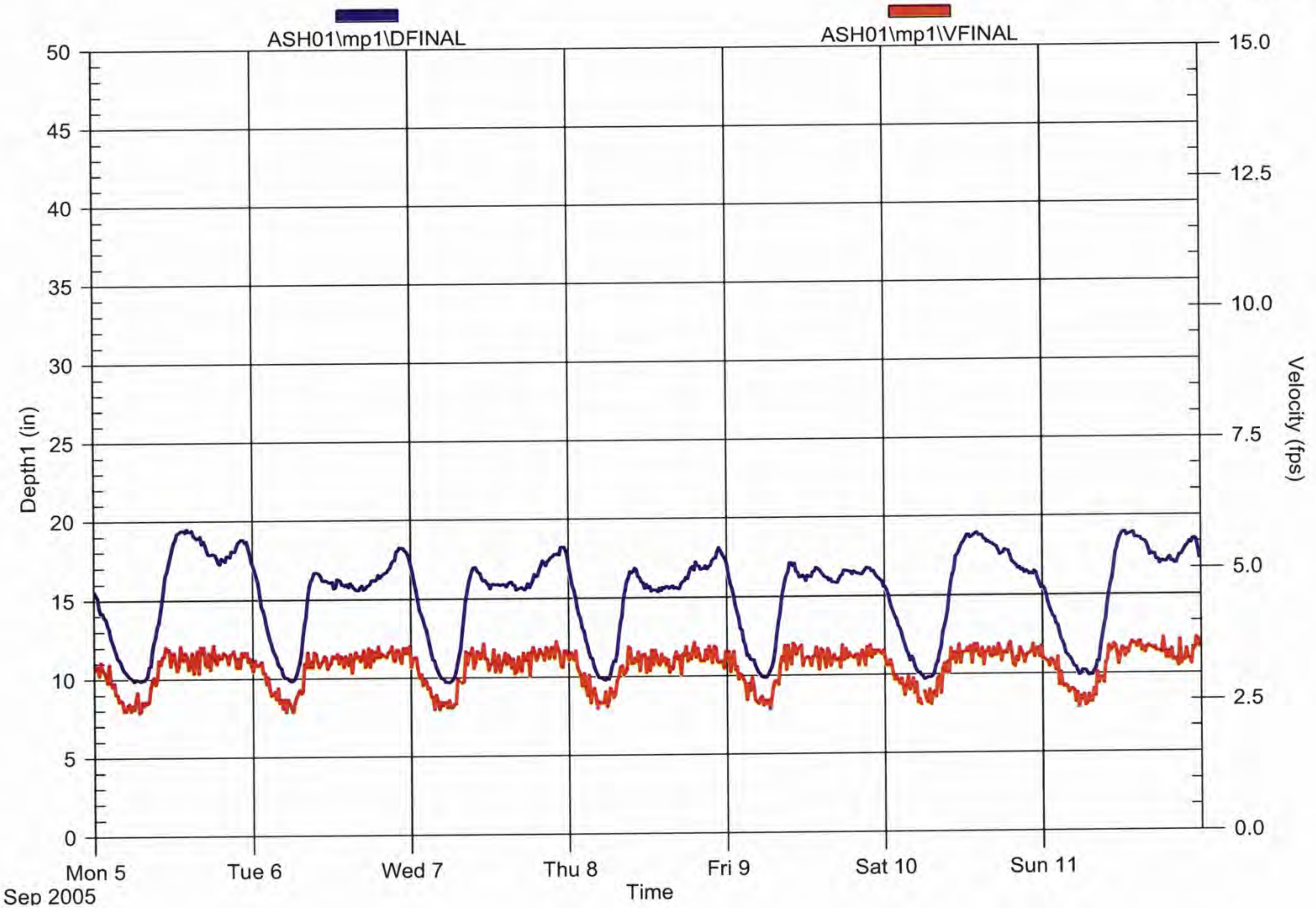
Pipe Height: 36.00



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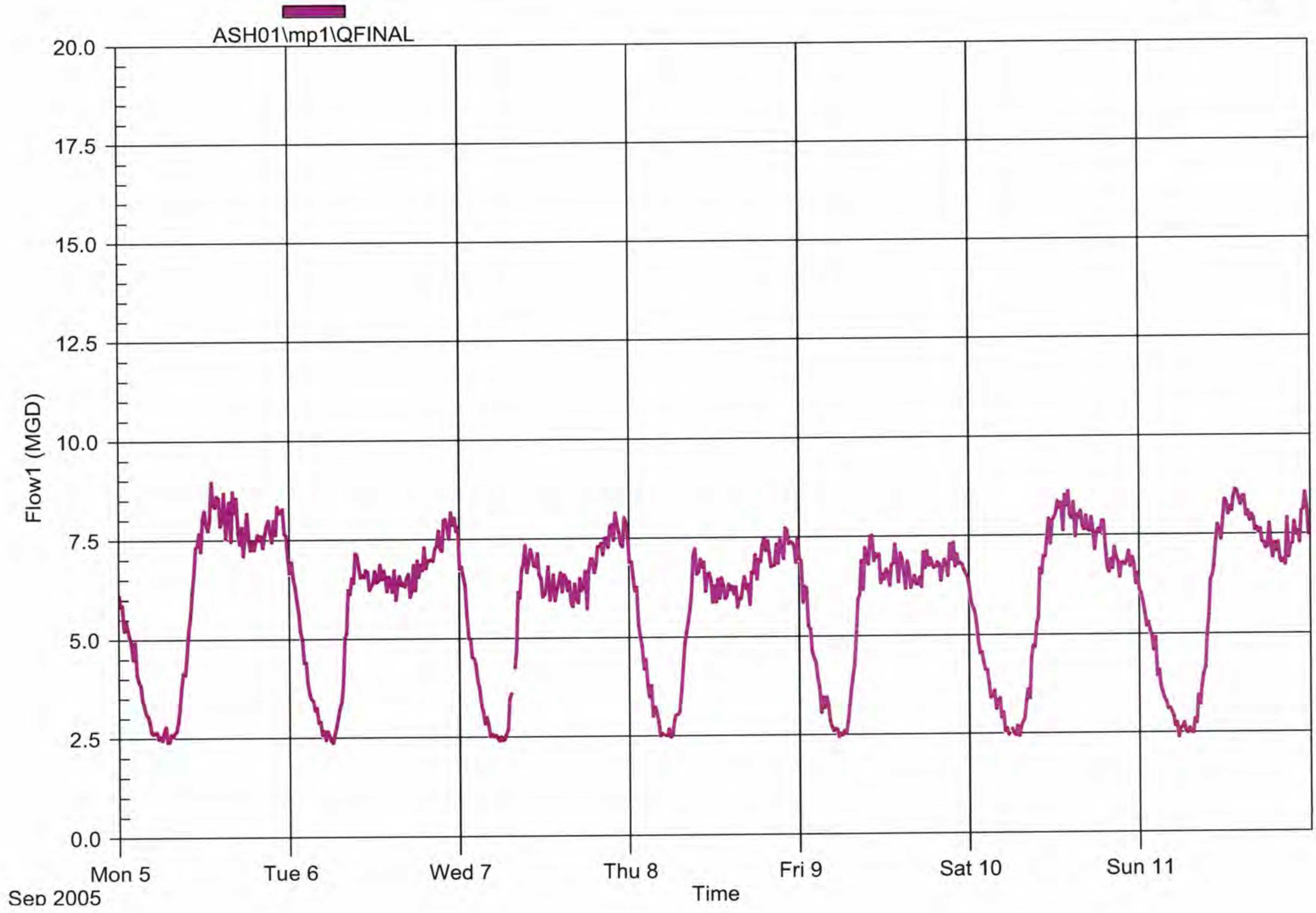
Pipe Height: 36.00



ADS Environmental Services

Pipe Height: 36.00

	ASH01\mp1\DFINAL (inches)					ASH01\mp1\VFINAL (feet/sec)					ASH01\mp1\QFINAL (MGD - Total MG)					
Date	Time	Min.	Time	Max.	Average	Time	Min.	Time	Max.	Average	Time	Min.	Time	Max.	Average	Total
9/5/2005	07:00	9.8	14:00	19.4	15.5	06:45	2.3	18:00	3.6	3.1	06:45	2.358	13:00	8.935	6.027	6.027
9/6/2005	05:45	9.7	22:15	18.2	14.9	05:00	2.3	19:00	3.6	3.2	06:00	2.331	22:45	8.145	5.799	5.799
9/7/2005	05:45	9.6	23:15	18.1	14.9	03:30	2.4	22:00	3.7	3.1	05:30	2.354	22:00	8.108	5.725	5.725
9/8/2005	05:30	9.7	22:45	18.0	14.8	04:15	2.4	19:00	3.6	3.2	05:45	2.425	22:00	7.704	5.675	5.675
9/9/2005	05:45	9.8	09:45	17.0	14.8	06:30	2.3	10:00	3.6	3.2	05:30	2.408	10:15	7.496	5.725	5.725
9/10/2005	06:00	9.6	14:00	18.9	15.1	05:30	2.4	19:00	3.6	3.1	07:00	2.396	14:00	8.578	5.876	5.876
9/11/2005	07:00	9.8	12:30	18.9	15.3	05:30	2.3	18:15	3.7	3.2	05:30	2.350	13:30	8.617	5.993	5.993
ReportAvg					15.0					3.2					5.831	
ReportTotal																40.82

ADS Environmental Services

ASH01\mp1\DFINAL (inches):Dep

ASH01\mp1\VFINAL (feet/sec):Vel

ASH01\mp1\QFINAL (MGD - Total MG):Flow

Pipe Height: 36.00

	Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday		
	9/5/2005			9/6/2005			9/7/2005			9/8/2005			9/9/2005			9/10/2005			9/11/2005		
	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow
00:00	15.5	3.3	6.092	17.1	3.1	6.620	16.9	3.2	6.708	16.8	3.3	6.850	16.9	3.3	6.901	15.5	3.3	6.170	15.4	3.3	6.078
00:15	15.3	3.2	5.789	16.8	3.3	6.908	16.5	3.3	6.774	16.3	3.4	6.873	16.3	3.4	6.867	15.3	3.2	5.812	15.3	3.3	6.010
00:30	15.1	3.2	5.833	16.4	3.2	6.489	15.9	3.4	6.534	15.7	3.4	6.487	15.7	3.1	5.818	15.0	3.2	5.664	15.0	3.2	5.787
00:45	14.4	3.1	5.183	16.0	3.2	6.282	15.5	3.4	6.296	15.4	3.3	6.141	15.5	3.3	6.228	14.5	3.3	5.587	14.5	3.2	5.514
01:00	14.1	3.3	5.437	15.1	3.3	5.920	14.9	3.2	5.598	15.0	3.5	6.237	15.0	3.4	6.184	14.2	3.2	5.238	14.1	3.1	5.166
01:15	14.1	3.2	5.212	14.4	3.3	5.619	14.2	3.0	4.961	14.3	3.2	5.304	14.4	3.1	5.220	13.9	3.0	4.812	13.9	3.3	5.278
01:30	13.8	3.1	5.021	14.2	3.1	5.158	13.9	3.1	4.946	13.8	3.1	4.966	14.0	3.2	5.149	13.6	2.9	4.505	13.6	3.2	5.072
01:45	13.8	3.1	4.864	13.8	3.1	4.941	13.7	2.8	4.485	13.6	3.0	4.744	13.7	2.9	4.588	13.5	2.9	4.555	13.5	3.2	4.921
02:00	13.4	2.9	4.455	13.3	2.9	4.359	13.3	2.9	4.461	13.0	2.8	4.152	12.9	3.0	4.417	13.0	2.9	4.253	13.1	3.1	4.565
02:15	13.1	3.3	4.899	12.8	3.0	4.382	13.0	2.9	4.300	12.8	3.1	4.415	12.8	3.0	4.322	12.9	2.8	4.082	13.0	3.3	4.892
02:30	12.6	2.9	4.097	12.4	2.8	3.837	12.5	2.8	3.880	12.2	2.8	3.754	12.1	2.9	3.909	12.6	2.9	4.095	12.6	2.8	3.908
02:45	12.3	2.8	3.879	12.1	2.7	3.561	12.0	2.8	3.720	11.9	2.6	3.441	11.9	2.8	3.700	12.1	2.8	3.715	12.2	3.0	4.063
03:00	11.9	2.9	3.826	11.7	2.7	3.441	11.5	2.6	3.273	11.5	3.0	3.749	11.2	2.5	3.026	11.9	2.6	3.375	12.0	2.8	3.652
03:15	11.6	2.7	3.417	11.5	2.7	3.412	11.1	2.6	3.110	11.1	2.5	2.959	11.2	2.8	3.434	11.5	2.8	3.438	11.7	2.7	3.481
03:30	11.3	2.7	3.275	11.3	2.6	3.152	11.0	2.4	2.795	11.1	2.7	3.203	11.0	2.7	3.149	11.2	2.9	3.562	11.2	2.8	3.339
03:45	11.2	2.5	3.059	10.9	2.8	3.229	10.6	2.7	2.972	10.6	2.8	3.075	10.9	2.9	3.430	10.8	2.7	3.094	11.1	2.7	3.251
04:00	11.0	2.6	3.035	10.7	2.5	2.838	10.4	2.5	2.755	10.3	2.6	2.817	10.9	2.8	3.224	11.1	2.8	3.321	11.0	2.6	3.074
04:15	10.7	2.5	2.873	10.6	2.6	2.882	10.1	2.4	2.471	10.1	2.4	2.463	10.6	2.5	2.802	10.9	2.9	3.373	10.8	2.7	3.101
04:30	10.5	2.4	2.603	10.2	2.4	2.533	9.9	2.5	2.550	9.9	2.5	2.540	10.3	2.5	2.670	10.5	2.6	2.868	10.6	2.7	3.005
04:45	10.4	2.4	2.564	10.0	2.6	2.646	9.9	2.4	2.465	9.9	2.5	2.495	10.1	2.4	2.560	10.2	2.8	3.008	10.4	2.7	2.885
05:00	10.2	2.5	2.623	10.0	2.3	2.402	9.8	2.5	2.516	9.8	2.5	2.485	10.0	2.5	2.630	10.0	2.4	2.523	10.4	2.4	2.639
05:15	10.1	2.5	2.617	9.9	2.6	2.638	9.6	2.5	2.452	9.8	2.5	2.463	9.9	2.6	2.603	10.1	2.5	2.611	10.1	2.6	2.732
05:30	10.0	2.4	2.439	9.8	2.5	2.522	9.7	2.4	2.354	9.7	2.7	2.650	9.8	2.4	2.408	9.9	2.4	2.432	9.9	2.3	2.350
05:45	9.9	2.5	2.524	9.7	2.4	2.386	9.6	2.5	2.477	9.9	2.4	2.425	9.8	2.5	2.511	9.8			9.9	2.5	2.594
06:00	9.8	2.4	2.405	9.8	2.3	2.331	9.7	2.4	2.364	9.8	2.5	2.496	9.8	2.4	2.449	9.6	2.7	2.594	10.2	2.5	2.606
06:15	9.9	2.6	2.633	9.9	2.5	2.548	9.8	2.4	2.394	10.1	2.8	2.882	10.0	2.5	2.577	9.7	2.5	2.472	10.2	2.6	2.719
06:30	9.9	2.7	2.754	10.2	2.6	2.759	10.0	2.5	2.531	10.6	2.7	3.006	10.2	2.3	2.483	9.8	2.4	2.424	10.1	2.4	2.486
06:45	9.9	2.3	2.358	10.6	2.7	2.987	10.3	2.5	2.661	10.9	2.6	3.003	10.4	2.5	2.787	9.7	2.7	2.672	9.9	2.4	2.456
07:00	9.8	2.4	2.369	10.9	2.8	3.214	10.9	3.0	3.434	10.9	2.7	3.080	10.9	2.8	3.189	9.8	2.4	2.396	9.8	2.6	2.591
07:15	9.9	2.5	2.568	11.5	2.7	3.363	11.3	2.9	3.565	11.4	2.9	3.609	11.5	2.9	3.577	9.9	2.6	2.641	9.9	2.4	2.483
07:30	9.9	2.5	2.498	12.5	2.7	3.805	11.8			12.5	3.0	4.161	12.4	2.9	3.975	10.1	2.7	2.755	9.8	2.4	2.455
07:45	10.0	2.5	2.611	13.3	3.3	4.995	12.9	2.9	4.211	13.3	3.2	4.814	13.3	2.8	4.261	10.6	2.5	2.837	10.1	2.7	2.817
08:00	10.1	2.5	2.630	13.8	3.2	5.110	13.8	2.9	4.650	13.7	3.2	5.078	13.8	3.2	5.062	10.7	2.9	3.302	10.2	2.5	2.709
08:15	10.7	2.5	2.883	15.0	3.5	6.204	14.8	3.5	6.132	14.9	3.0	5.335	14.8	3.3	5.873	11.3	2.9	3.584	10.7	3.0	3.421
08:30	10.8	2.8	3.242	15.7	3.2	6.089	15.4	3.2	5.975	15.4	3.1	5.645	15.3	3.3	6.018	11.7	2.6	3.353	10.7	2.8	3.176
08:45	11.7	2.9	3.779	16.1	3.3	6.491	15.9	3.4	6.683	15.9	3.1	6.052	15.9	3.6	6.859	12.6	3.1	4.390	11.6	2.9	3.660
09:00	12.3	3.0	4.118	16.3	3.2	6.368	16.3	3.4	6.807	16.1	3.6	7.000	16.2	3.1	6.134	13.0	3.2	4.705	12.2	2.9	3.960
09:15	12.6	2.9	4.063	16.6	3.5	7.117	16.7	3.6	7.302	16.6	3.5	7.184	16.4	3.6	7.178	13.4	3.0	4.651	13.0	2.8	4.119
09:30	13.2	3.0	4.500	16.6	3.4	7.059	16.9	3.2	6.604	16.5	3.2	6.540	17.0	3.3	6.983	14.0	3.2	5.270	13.4	3.2	4.926
09:45	13.5	3.3	5.172	16.6	3.3	6.756	16.9	3.3	6.839	16.6	3.2	6.595	17.0	3.2	6.759	15.0	3.0	5.374	14.3	3.2	5.445
10:00	14.3	3.3	5.481	16.6	3.2	6.508	16.7	3.5	7.195	16.8	3.3	6.926	16.8	3.6	7.478	15.7	3.5	6.628	15.1	3.5	6.324
10:15	15.0	3.4	6.095	16.4	3.3	6.574	16.6	3.4	7.031	16.7	3.3	6.713	17.0	3.6	7.496	16.3	3.3	6.497	15.6	3.4	6.437
10:30	15.8	3.4	6.510	16.1	3.3	6.505	16.5	3.3	6.781	16.2	3.4	6.850	16.5	3.4	6.844	16.6	3.4	6.948	16.0	3.4	6.692
10:45	16.5	3.6	7.276	16.1	3.4	6.700	16.2	3.4	6.753	16.2	3.1	6.108	16.4	3.5	7.030	17.4	3.2	6.931	16.7	3.6	7.328
11:00	16.8	3.5	7.297	16.1	3.4	6.645	16.1	3.6	7.094	15.9	3.4	6.537	16.1	3.5	6.930	17.5	3.4	7.386	17.5	3.5	7.719
11:15	17.3	3.6	7.646	16.1	3.2	6.191	16.1	3.3	6.550	15.9	3.4	6.575	16.2	3.6	7.019	17.7	3.6	7.885	17.9	3.4	7.588
11:30	17.7	3.2	7.166	16.0	3.2	6.293	15.9	3.3	6.466	15.5	3.4	6.384	16.3	3.2	6.287	18.0	3.2	7.246	18.3	3.2	7.339
11:45	18.1	3.5	7.975	16.0	3.3	6.359	15.8	3.1	6.000	15.8	3.1	5.834	16.2	3.3	6.520	18.2	3.4	7.851	18.6	3.3	7.885

ASH01\mp1\DFINAL (inches):Dep

ASH01\mp1\VFINAL (feet/sec):Vel

ASH01\mp1\QFINAL (MGD - Total MG):Flow

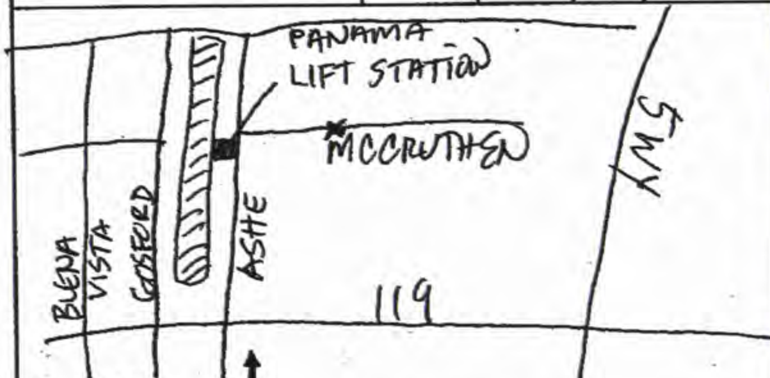
	Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday		
	9/5/2005			9/6/2005			9/7/2005			9/8/2005			9/9/2005			9/10/2005			9/11/2005		
	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow	Dep	Vel	Flow
12:00	18.5	3.5	8.204	16.0	3.4	6.670	15.6	3.2	6.067	15.5	3.3	6.257	15.9	3.3	6.389	18.3	3.4	7.916	18.8	3.5	8.359
12:15	18.7	3.3	7.874	15.6	3.4	6.379	15.8	3.3	6.268	15.6	3.1	5.840	16.3	3.3	6.640	18.5	3.4	8.029	18.9	3.4	8.294
12:30	19.1	3.1	7.697	15.7	3.4	6.413	15.9	3.5	6.771	15.3	3.5	6.419	16.2	3.3	6.541	18.8	3.5	8.325	18.9	3.3	7.974
12:45	19.2	3.2	7.939	16.2	3.4	6.832	15.8	3.1	5.918	15.4	3.2	5.933	16.1	3.2	6.228	18.8	3.4	8.151	18.7	3.4	8.181
13:00	19.3	3.6	8.935	16.2	3.3	6.455	15.8	3.2	6.195	15.4	3.5	6.456	16.5	3.3	6.750	18.6	3.5	8.296	18.7	3.4	8.058
13:15	19.3	3.4	8.369	16.1	3.4	6.695	15.8	3.4	6.556	15.4	3.4	6.255	16.5	3.3	6.772	18.7	3.2	7.583	18.8	3.5	8.413
13:30	19.3	3.3	8.288	15.8	3.4	6.492	15.8	3.1	5.903	15.3	3.2	5.925	16.7	3.5	7.271	18.8	3.6	8.493	18.8	3.6	8.617
13:45	19.2	3.5	8.576	15.9	3.2	6.156	15.8	3.2	6.199	15.5	3.2	5.991	16.7	3.3	6.797	18.8	3.4	8.197	18.9	3.6	8.557
14:00	19.4	3.4	8.518	15.8	3.4	6.529	15.8	3.3	6.346	15.4	3.4	6.299	16.6	3.1	6.308	18.9	3.6	8.578	18.5	3.6	8.368
14:15	19.3	3.2	7.813	15.9	3.3	6.370	15.8	3.4	6.609	15.6	3.3	6.147	16.5	3.5	7.041	18.7	3.3	7.958	18.5	3.5	8.207
14:30	19.3	3.2	7.986	15.7	3.2	6.138	15.7	3.2	6.123	15.5	3.3	6.243	16.3	3.4	6.894	18.7	3.3	7.887	18.5	3.6	8.438
14:45	19.3	3.5	8.650	16.0	3.4	6.689	15.8	3.4	6.563	15.6	3.2	6.039	16.2	3.3	6.531	18.7	3.5	8.305	18.5	3.6	8.438
15:00	19.0	3.1	7.497	15.8	3.1	5.937	16.0	3.3	6.486	15.6	3.3	6.233	16.1	3.1	6.147	18.5	3.2	7.425	18.4	3.4	7.934
15:15	18.9	3.4	8.152	15.7	3.3	6.332	16.0	3.2	6.150	15.5	3.1	5.702	16.1	3.5	6.847	18.5	3.4	7.996	18.3	3.5	8.061
15:30	18.8	3.5	8.429	15.6	3.5	6.546	15.8	3.3	6.395	15.6	3.2	5.958	15.9	3.4	6.606	18.3	3.4	7.888	18.3	3.4	7.806
15:45	18.8	3.1	7.419	15.5	3.4	6.306	15.8	3.1	5.834	15.7	3.1	5.921	16.0	3.2	6.163	18.3	3.5	8.088	18.1	3.5	7.974
16:00	18.9	3.6	8.691	15.5	3.4	6.378	15.5	3.1	5.750	15.5	3.3	6.239	15.8	3.3	6.337	18.2	3.3	7.687	17.8	3.5	7.890
16:15	18.5	3.5	8.158	15.7	3.3	6.273	15.5	3.4	6.331	15.6	3.4	6.485	15.8	3.4	6.476	18.2	3.3	7.600	17.4	3.5	7.570
16:30	18.7	3.6	8.527	15.8	3.4	6.473	15.6	3.2	5.938	15.5	3.3	6.172	15.8	3.3	6.255	18.1	3.5	7.959	17.5	3.5	7.639
16:45	18.4	3.3	7.621	15.5	3.5	6.597	15.6	3.1	5.842	15.5	3.4	6.284	15.8	3.3	6.251	18.0	3.3	7.599	17.4	3.4	7.511
17:00	18.0	3.2	7.350	15.6	3.2	6.015	15.6	3.4	6.469	15.8	3.0	5.768	16.0	3.3	6.433	18.0	3.3	7.568	17.5	3.5	7.604
17:15	17.8	3.5	7.787	15.8	3.2	6.174	15.5	3.3	6.158	15.9	3.4	6.592	16.2	3.1	6.179	17.8	3.6	7.923	17.1	3.4	7.260
17:30	17.8	3.2	7.055	15.8	3.6	6.818	15.6	3.3	6.224	16.0	3.4	6.557	16.2	3.6	7.064	17.5	3.4	7.539	17.1	3.4	7.267
17:45	17.8	3.4	7.625	15.9	3.2	6.174	15.9	3.4	6.645	16.2	3.6	7.029	16.6	3.3	6.656	17.6	3.2	7.099	16.9	3.4	7.110
18:00	17.9	3.6	8.141	16.1	3.5	6.926	15.6	3.0	5.690	16.1	3.3	6.407	16.6	3.5	7.093	17.6	3.4	7.524	17.0	3.4	7.132
18:15	17.8	3.3	7.452	16.1	3.3	6.510	15.8	3.4	6.614	16.5	3.4	6.911	16.5	3.3	6.713	17.8	3.4	7.626	17.0	3.7	7.740
18:30	17.6	3.3	7.196	16.1	3.5	6.832	16.0	3.6	6.950	16.8	3.3	6.843	16.5	3.4	6.908	17.7	3.4	7.516	17.0	3.4	7.179
18:45	17.3	3.4	7.414	16.2	3.4	6.675	16.4	3.4	6.955	16.9	3.5	7.260	16.5	3.3	6.762	17.7	3.5	7.823	17.0	3.3	6.874
19:00	17.2	3.4	7.206	16.5	3.6	7.260	16.3	3.3	6.593	16.6	3.6	7.429	16.3	3.3	6.662	17.5	3.6	7.829	17.1	3.4	7.257
19:15	17.6	3.4	7.416	16.3	3.4	6.722	16.3	3.4	6.761	17.1	3.3	7.117	16.5	3.3	6.693	17.1	3.4	7.162	17.3	3.3	7.030
19:30	17.5	3.5	7.605	16.4	3.4	6.935	16.7	3.5	7.267	16.9	3.5	7.376	16.4	3.4	6.808	17.0	3.2	6.655	17.0	3.4	7.268
19:45	17.3	3.4	7.457	16.5	3.4	6.910	17.0	3.4	7.262	16.9	3.4	7.058	16.4	3.4	6.764	16.9	3.1	6.528	17.0	3.2	6.825
20:00	17.7	3.4	7.572	16.6	3.4	6.963	17.3	3.4	7.349	16.7	3.3	6.713	16.4	3.2	6.337	16.8	3.3	6.855	16.9	3.2	6.751
20:15	17.7	3.3	7.257	16.6	3.4	6.907	17.2	3.3	7.045	16.7	3.3	6.743	16.3	3.3	6.671	16.6	3.2	6.614	16.9	3.3	6.836
20:30	17.6	3.4	7.612	16.8	3.5	7.225	17.0	3.6	7.480	16.7	3.3	6.742	16.3	3.4	6.870	16.7	3.5	7.167	17.2	3.1	6.687
20:45	18.0	3.4	7.829	16.9	3.5	7.283	17.2	3.5	7.477	16.9	3.5	7.294	16.5	3.3	6.748	16.5	3.4	6.913	17.4	3.6	7.880
21:00	18.0	3.5	7.961	17.2	3.6	7.681	17.3	3.3	7.222	16.7	3.3	6.798	16.6	3.2	6.457	16.6	3.3	6.802	17.4	3.2	6.876
21:15	18.0	3.4	7.640	17.3	3.3	7.220	17.5	3.6	7.774	16.9	3.6	7.409	16.7	3.5	7.268	16.3	3.2	6.399	17.6	3.3	7.201
21:30	18.3	3.2	7.402	17.4	3.3	7.155	17.6	3.6	7.807	16.9	3.4	7.226	16.7	3.3	6.869	16.5	3.3	6.755	17.8	3.2	7.224
21:45	18.5	3.4	7.948	17.9	3.5	7.944	17.7	3.3	7.412	17.2	3.2	6.916	16.7	3.6	7.304	16.4	3.4	6.777	17.9	3.4	7.791
22:00	18.7	3.2	7.586	18.0	3.5	7.973	17.7	3.7	8.108	17.4	3.6	7.704	16.5	3.3	6.689	16.3	3.4	6.711	18.1	3.3	7.447
22:15	18.7	3.5	8.315	18.2	3.4	7.752	17.7	3.5	7.835	17.4	3.5	7.630	16.5	3.4	7.001	16.3	3.4	6.813	18.3	3.3	7.548
22:30	18.7	3.4	8.130	18.1	3.3	7.470	17.6	3.4	7.624	17.8	3.3	7.286	16.3	3.4	6.753	16.2	3.6	7.057	18.2	3.2	7.253
22:45	18.5	3.5	8.195	18.1	3.6	8.145	18.1	3.2	7.313	18.0	3.2	7.348	16.1	3.4	6.793	16.4	3.3	6.665	18.4	3.4	8.049
23:00	18.6	3.5	8.249	18.0	3.4	7.821	18.1	3.2	7.239	17.8	3.3	7.322	16.1	3.4	6.743	16.3	3.4	6.903	18.5	3.4	8.082
23:15	18.2	3.3	7.612	17.9	3.6	8.002	18.1	3.5	7.981	17.6	3.3	7.214	15.9	3.4	6.612	15.9	3.5	6.756	18.4	3.7	8.524
23:30	17.9	3.4	7.586	17.7	3.4	7.667	17.9	3.5	7.863	17.5	3.1	6.811	15.9	3.4	6.505	15.6	3.3	6.235	17.9	3.6	8.146
23:45	17.3	3.2	6.984	17.4	3.6	7.778	17.5	3.4	7.485	17.3	3.4	7.419	15.5	3.4	6.448	15.4	3.5	6.512	17.2	3.5	7.455
Total			6.027			5.799			5.725			5.675			5.725			5.876			5.993
Average	15.5	3.1	6.027	14.9	3.2	5.799	14.9	3.1	5.725	14.8	3.2	5.675	14.8	3.2	5.725	15.1	3.1	5.876	15.3	3.2	5.993
Min Time	07:00	06:45	06:45	05:45	05:00	06:00	05:45	03:30	05:30	05:30	04:15	05:45	05:45	06:30	05:30	06:00	05:30	07:00	07:00	05:30	05:30
Min Value	9.8	2.3	2.358	9.7	2.3	2.331	9.6	2.4	2.354	9.7	2.4	2.425	9.8	2.3	2.408	9.6	2.4	2.396	9.8	2.3	2.350
Max Time	14:00	18:00	13:00	22:15	19:00	22:45	23:15	22:00	22:00	22:45	19:00	22:00	09:45	10:00	10:15	14:00	19:00	14:00	12:30	18:15	13:30
Max Value	19.4	3.6	8.935	18.2	3.6	8.145	18.1	3.7	8.108	18.0	3.6	7.704	17.0	3.6	7.496	18.9	3.6	8.578	18.9	3.7	8.617
Week Avg																			15.0	3.2	5.831
WeekTotal																					40.82

Turtle

ADS ENVIRONMENTAL SERVICES

ADS Site Report ① Quality Form

Project Name: BAKERSFIELD – PARSONS	City/State: BAKERSFIELD / CA			FM Initials:	KW
Site Name: BKFIELD_ASH01	Monitor Series: 3600	Monitor S/N:	~~2895~~ 2749		
Address / Location:		Manhole #:			
		Map Page #:			
Access:	Type of System: Sanitary ☐ Storm ☐ Combined ☐	Pipe Height:	36.00		
		Pipe Width:	35.75		
		Phone Number:	.241		



Access Map N ↑

Site Map N ↑

Investigation Information:		Manhole Information:	
Date/ Time of Investigation:	08-26-05 / 14:30	Manhole Depth:	12' Feet
Site Hydraulics:	Fair	Manhole Material / Condition:	Precast
Upstream Input: (L/S, P/S)		Pipe Material / Condition:	Concrete – fair
Upstream Manhole:		Mini System Character:	Residential ☐ Commercial ☐ Industrial ☐ Other ✕
Downstream Manhole:		Telephone Information:	
Depth of Flow (Wet Dof):	+/-	Access Pole #:	
Range (Air Dof):	+/-	Distance From Manhole:	Feet
Peak Velocity:	fps	Road Cut Length:	Feet
Silt:	Inches	Trench Length:	Feet

Other Information

Cross Section N ↑

Planar N ↑

Installation Information		Backup	Yes	No	?	Distance
Installation Type:	Standard	Trunk	☐	☑		
Sensors/Devices:	Ultra – Velocity – Pressure	Lift/Pump Station	☑	☐		1/4 mile
Surcharge Height:	Feet	WWTP	☐	☑		
Rain Gauge Zone:		Other	☐	☑		

Additional Site Information/Comments:

US3 FLOW MONITORING DATA SHEETS

Site Report 6/08/2021

Confidential Proprietary Information

Cornerstone Engineering

MH at ~4798 Hosking Av
Bakersfield, CA 93313
MH # unknown

2021.05 Wible Rd MH

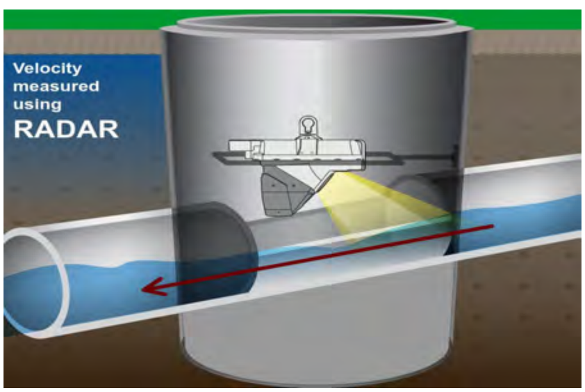
Access:
MH in WB lane of Hosking Av within intersection with Wible Rd

System Type: Sanitary [X] Storm [ ]

Install Date: 5/18/2021

Map

Technology



Sewer Plan

Flow Meter			
Meter Depth: 246"			
MH Coordinates: 35.281371, -119.038931			
Moderate open channel hydraulics in US E line, turbulence DS due to inflow from laterals.			
Avg Velocity	Avg Measured Level		Multiplier
1.5 fps	8.9"		1.0

Gas			
O2	H2S	CO	LEL
20.9	0	0	0

Notes

Three inlets from east, north & south; monitored US mainline as it provided the best hydraulics.

Traffic Safety

No formal TCP required; used arrow board, cones & signs in accord w/site-specific CA MUTCD TC requirements.

Land Use			
Residential	Commercial	Industrial	Trunk
X			

Manhole Depth	279"
Monitored Pipe Size	27"
Inner Pipe Size (In/Out)	27"/27"
Pipe Shape	Round
Pipe Condition	Good
Manhole Material	Concrete
Silt	None observed
Velocity Profile Data	Passed
Velocity Profile Taken	0.4 2-D
Sensor Offset	33.1"
Sensor Dist. to Crown	6.1"
Sensor Direction	Upstream
Flow Heading	West

Meter Site Document

2021.05 Wible Rd MH

MH at ~4798 Hosking Av

Bakersfield, CA 93313

Site

Manhole Before Install

Installation Process

Installed

Upstream

Monitored Pipe Size

Temporary Flow Study

Cornerstone Engineering

2021.05 Wible Rd MH

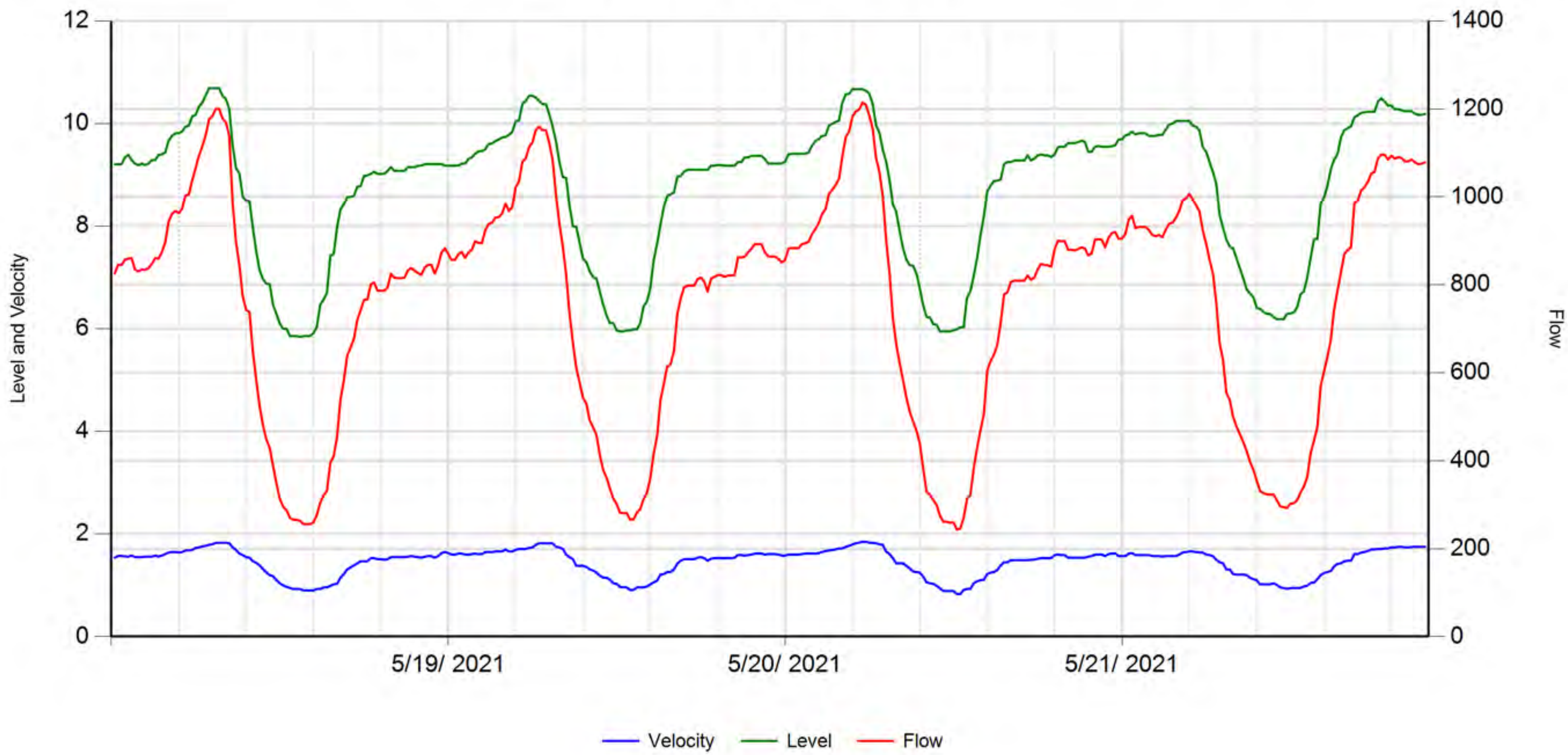
Meter Start Date		From	5/18/2021
Meter Stop Date		To	6/7/2021
Velocity (fps)		Level (in)	Flow (mgd)
Average	1.454	8.905	1.119
Maximum	1.850	11.210	1.824
Minimum	0.830	5.840	0.351
Pipe Size		27.000	
Estimated Capacity (mgd)		Not Calculated	
Capacity Used		Not Calculated	
Sensor Type		Hach - Flodar	

Utility Systems, Science and Software

9314 Bond Av, Suite A
El Cajon, CA 92021

601 N. Parkcenter Dr, Suite 209
Santa Ana, CA 92705

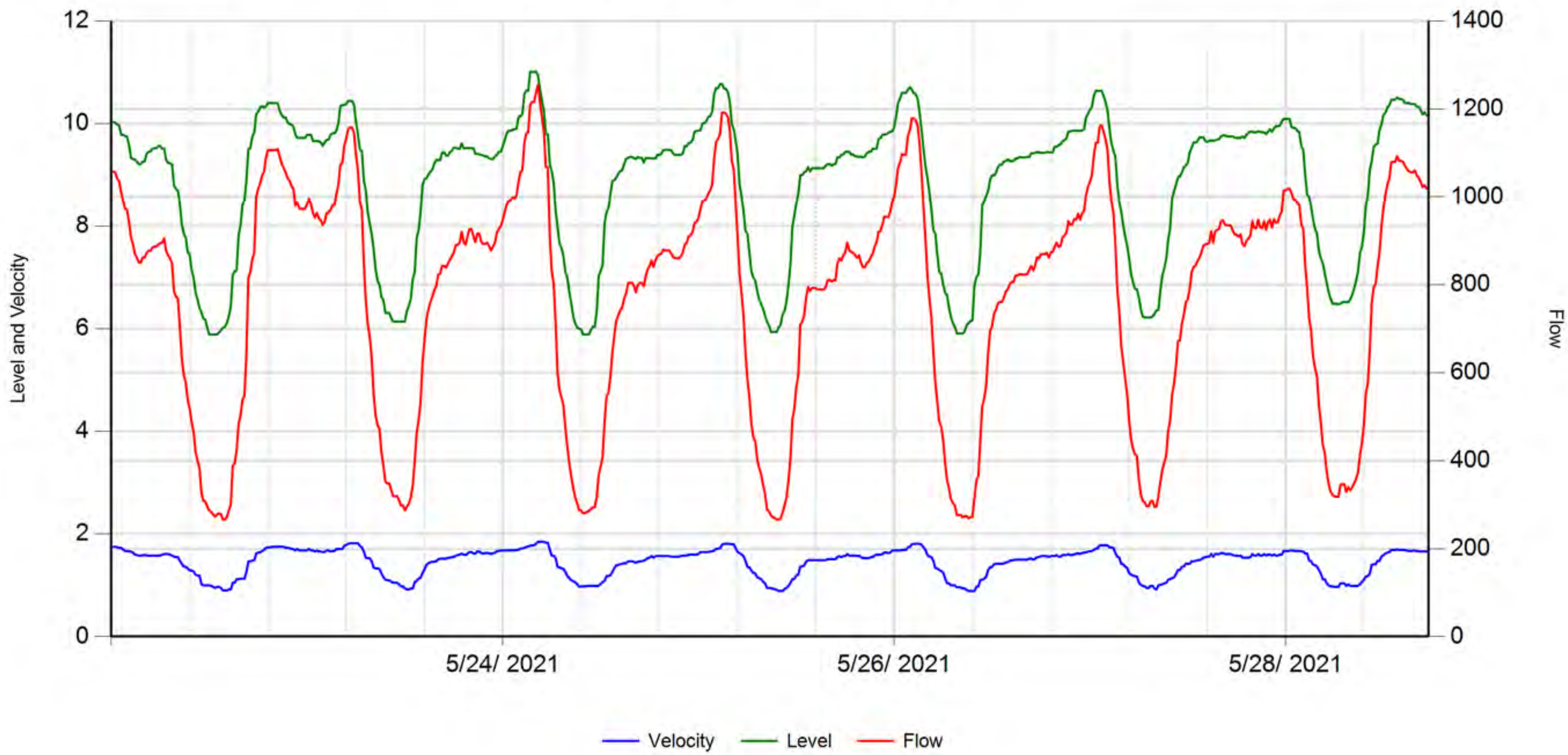
2021.05 Wible Rd MH



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	1.454	8.751	759.400	**RainFall**	Inches
Maximum	1.850	10.690	1214.350		
Minimum	0.830	5.840	243.460		

6/08/2021

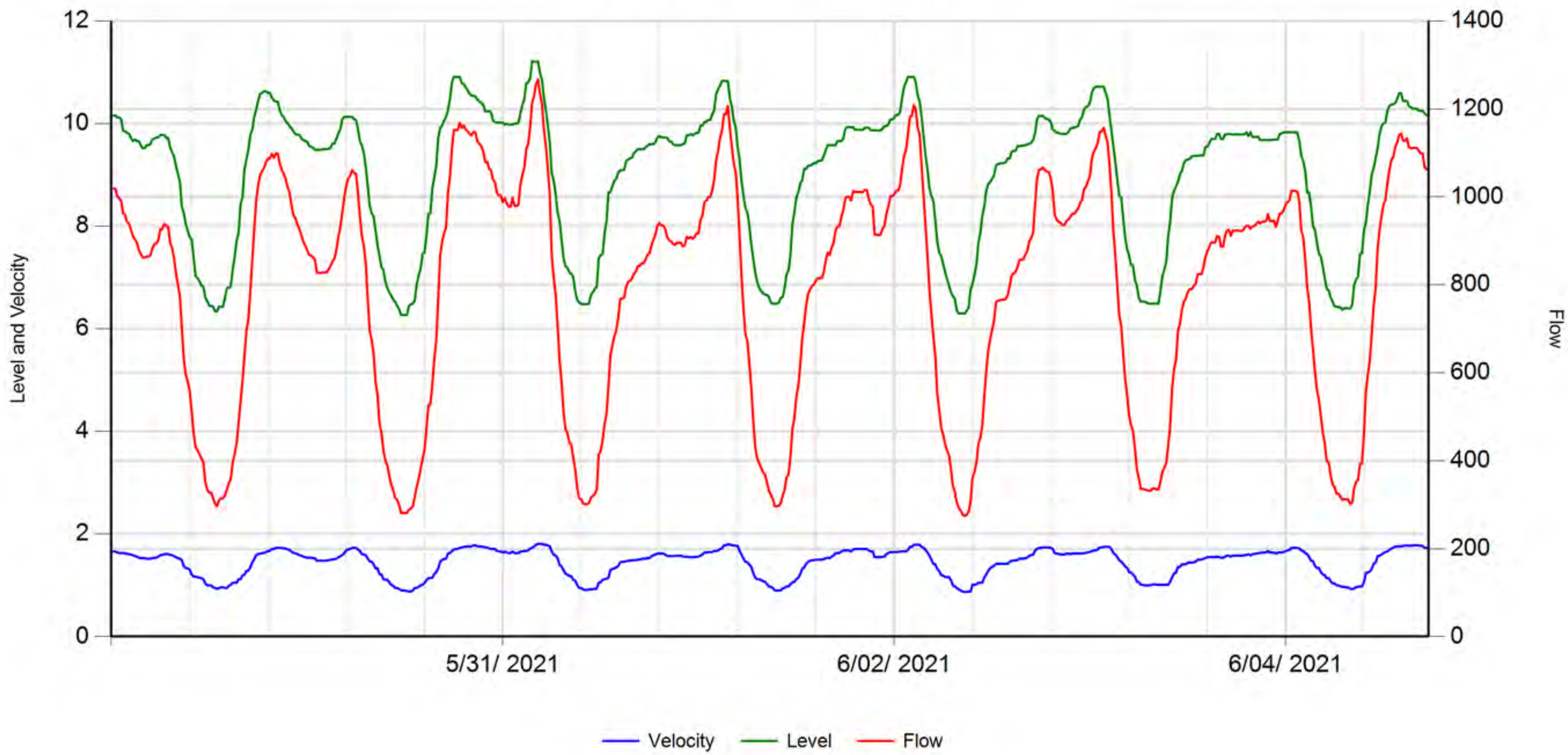
2021.05 Wible Rd MH



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	1.451	8.836	767.522	**RainFall**	Inches
Maximum	1.850	11.010	1253.990		
Minimum	0.890	5.890	265.740		

6/08/2021

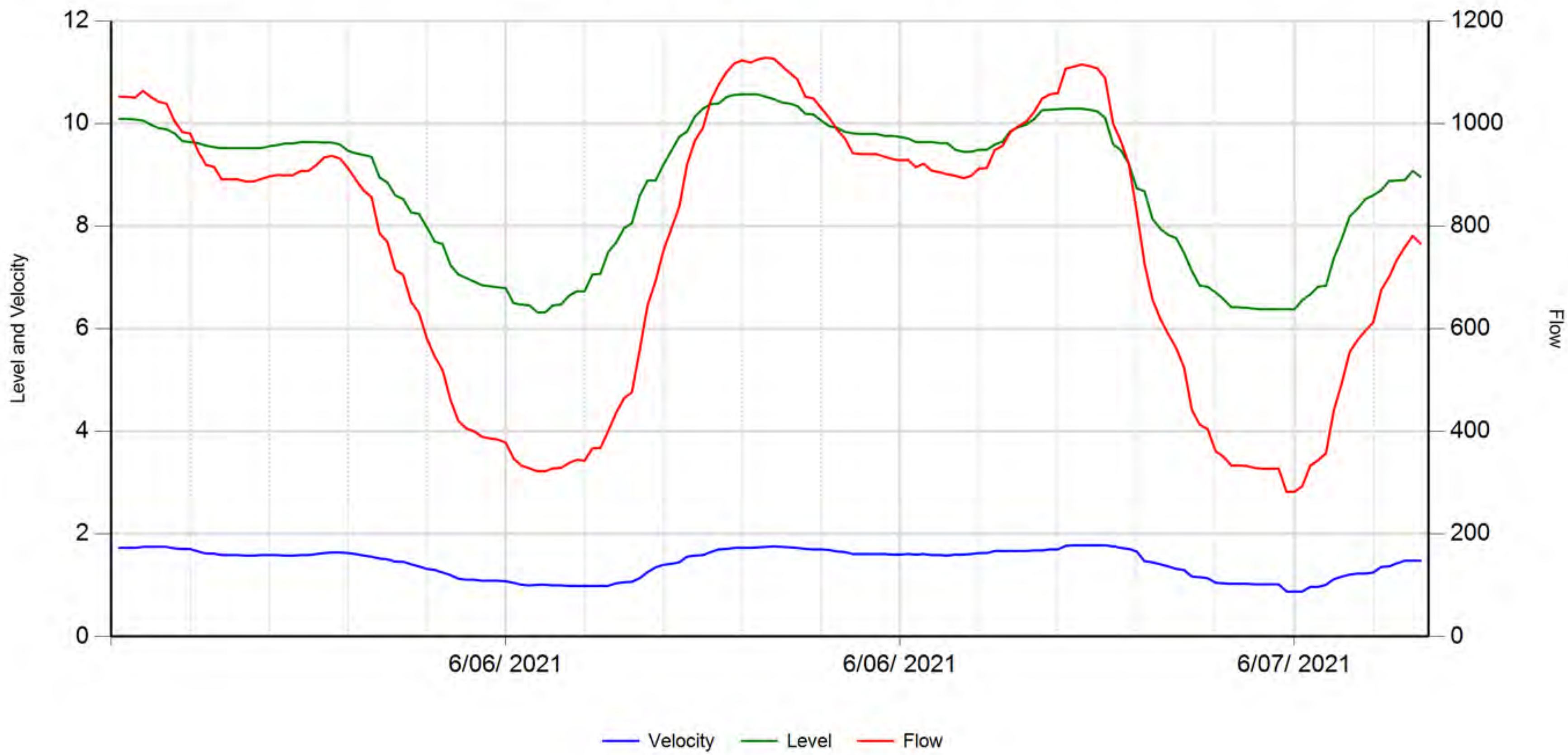
2021.05 Wible Rd MH



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	1.448	9.016	786.624	**RainFall**	Inches
Maximum	1.810	11.210	1266.790		
Minimum	0.870	6.270	274.560		

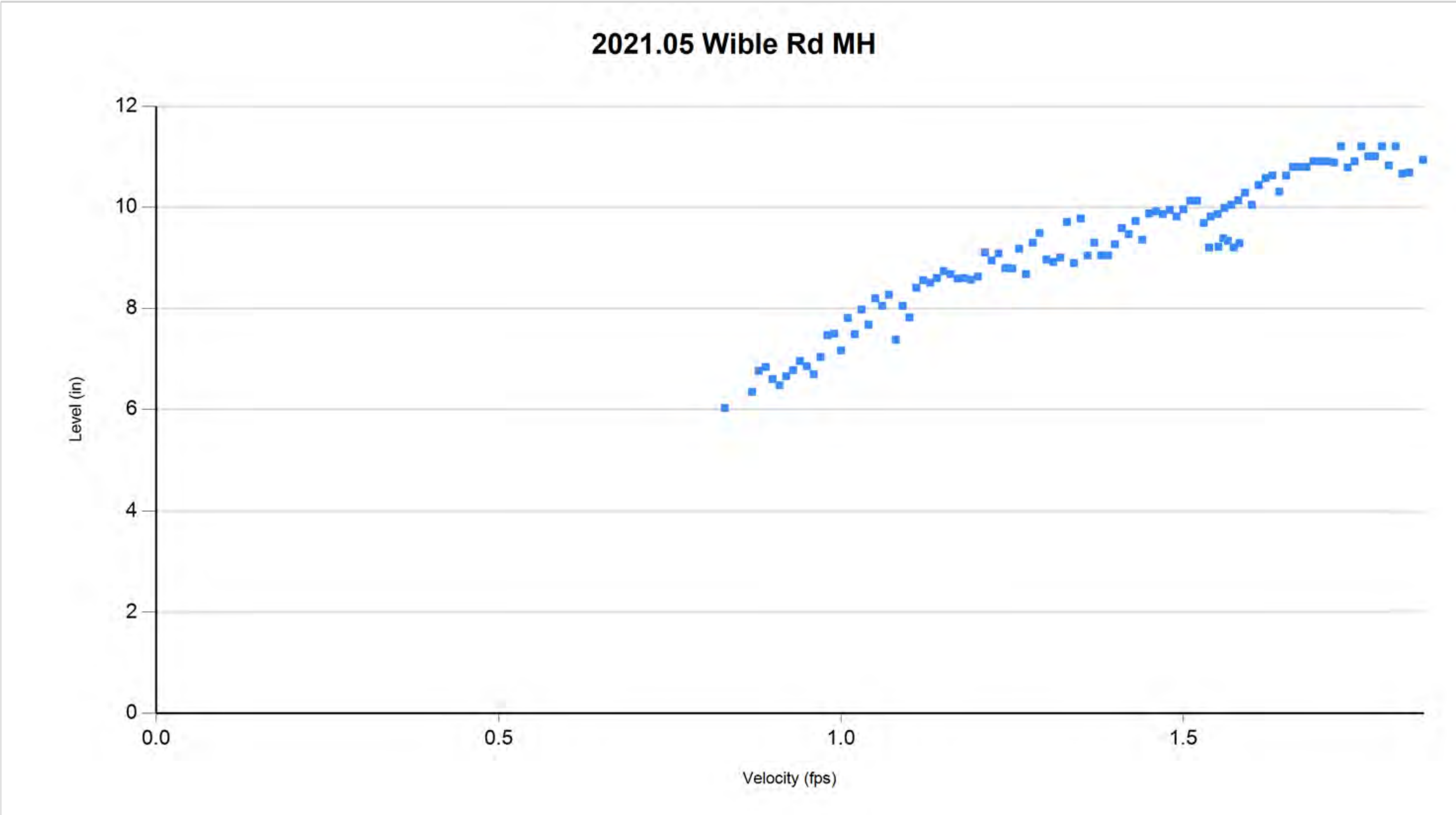
6/08/2021

2021.05 Wible Rd MH



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	1.442	8.802	759.944	**RainFall**	Inches
Maximum	1.780	10.570	1128.370		
Minimum	0.880	6.320	282.450		

6/08/2021



5/18/2021 thru 6/07/2021

6/8/2021 3:37:54 PM

Site Report 6/08/2021

Confidential Proprietary Information

Cornerstone Engineering

MH at ~4830 Hosking Av,
Bakersfield, CA 93313
MH # unknown

2021.05 Hosking FM MH

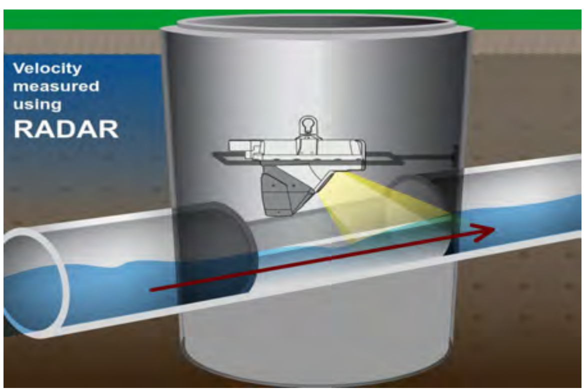
Access:
MH in WB lane of Hosking Av on E side of intersection with Stine Rd

System Type:
Sanitary [X] Storm [ ]

Install Date: 5/18/2021

Map

Technology



Sewer Plan

Flow Meter			
Meter Depth: 152"			
MH Coordinates: 35.281433, -119.056532			
Moderate open channel hydraulics with little affect from inflow from lateral			
Avg Velocity	Avg Measured Level		Multiplier
1.7 fps	10.8"		1.0

Gas			
O2	H2S	CO	LEL
20.9	0	0	0

Notes

Two inlets from east & south; monitored downstream line to get total flow.

Traffic Safety

No formal TCP required; used arrow board, cones & signs in accord w/site-specific CA MUTCD TC requirements.

Land Use			
Residential	Commercial	Industrial	Trunk
X			

Manhole Depth	182"
Monitored Pipe Size	24"
Inner Pipe Size (In/Out)	24"/24"
Pipe Shape	Round
Pipe Condition	Good
Manhole Material	Concrete
Silt	None observed
Velocity Profile Data	Passed
Velocity Profile Taken	0.4 2-D
Sensor Offset	30.1"
Sensor Dist. to Crown	6.1"
Sensor Direction	Downstream
Flow Heading	West

Meter Site Document

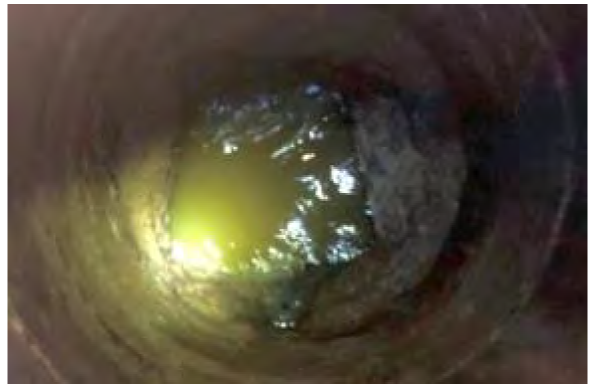
2021.05 Hosking FM MH

MH at ~4830 Hosking Av,

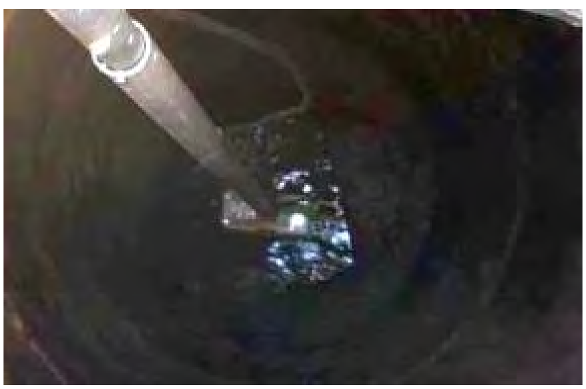
Bakersfield, CA 93313

Site

Manhole Before Install



Installation Process



Installed

Monitored Pipe Size

Downstream

Temporary Flow Study

Cornerstone Engineering

2021.05 Hosking FM MH

Meter Start Date		From	5/18/2021
Meter Stop Date		To	6/7/2021
Velocity (fps)		Level (in)	Flow (mgd)
Average	1.682	10.825	1.521
Maximum	2.140	14.270	2.471
Minimum	0.830	5.650	0.353
Pipe Size		24.000	
Estimated Capacity (mgd)		Not Calculated	
Capacity Used		Not Calculated	
Sensor Type		Hach - Flodar	

Utility Systems, Science and Software

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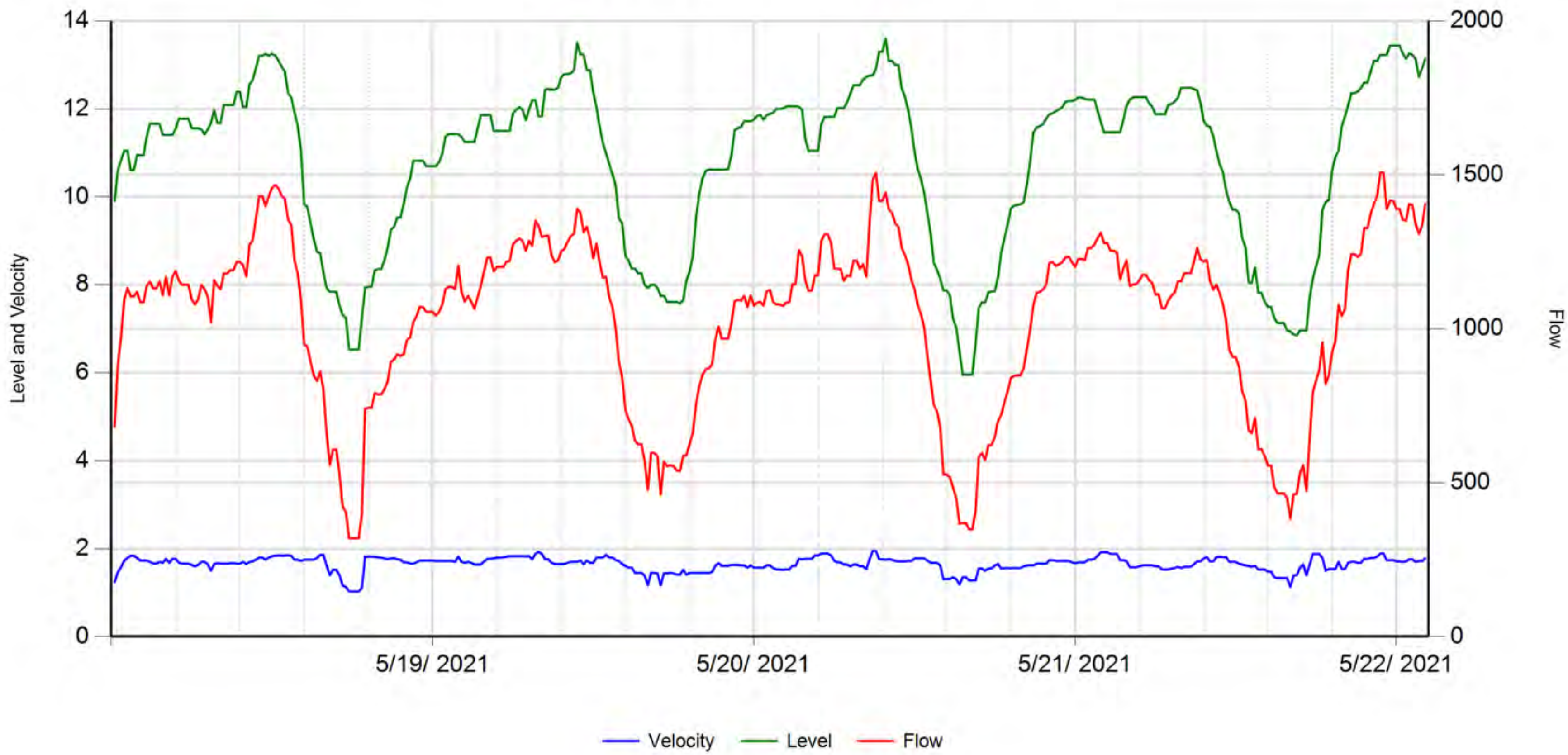
El Cajon, CA 92021

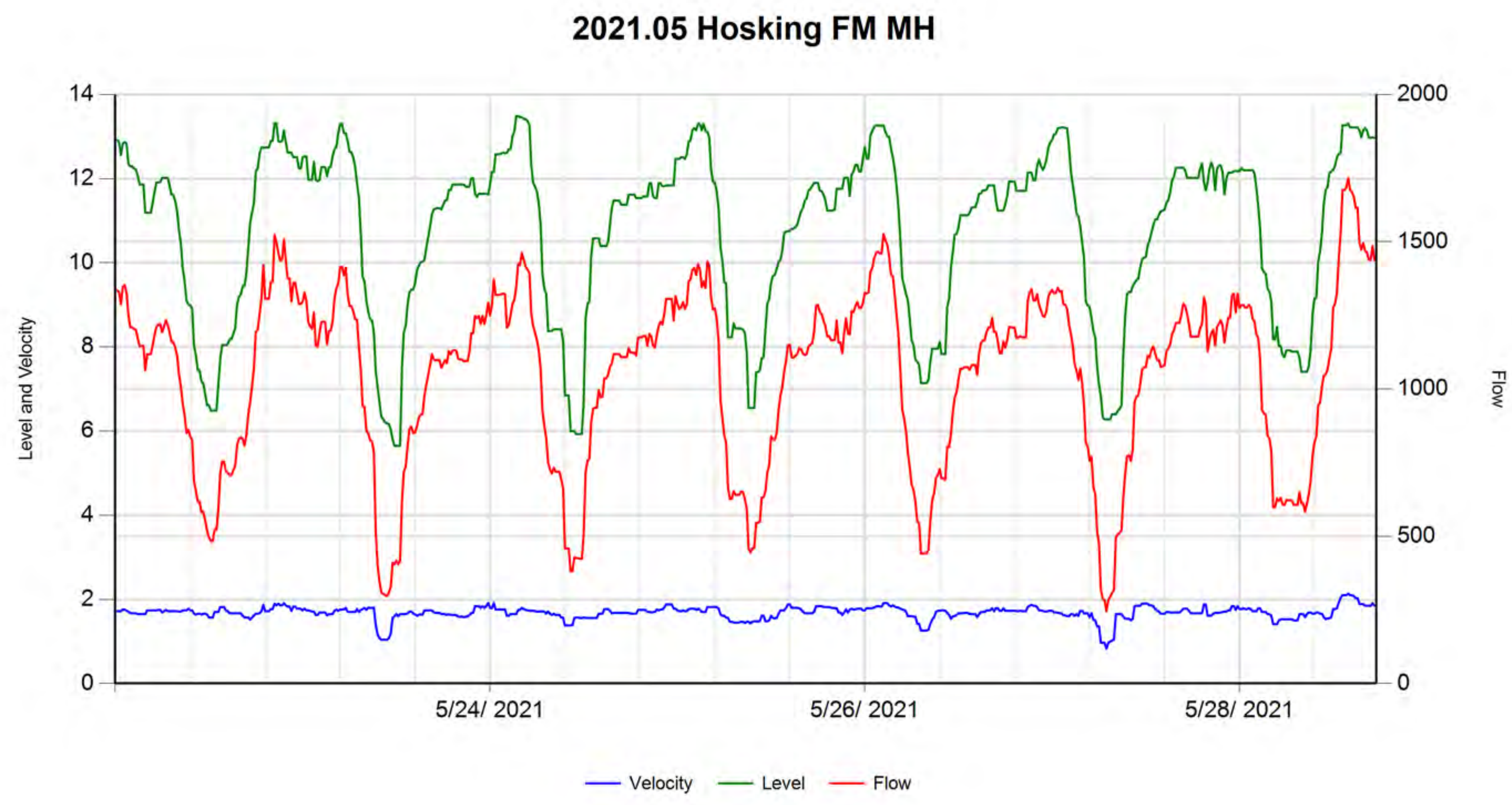
601 N. Parkcenter Dr, Suite 209
Santa Ana, CA 92705

2021.05 Hosking FM MH



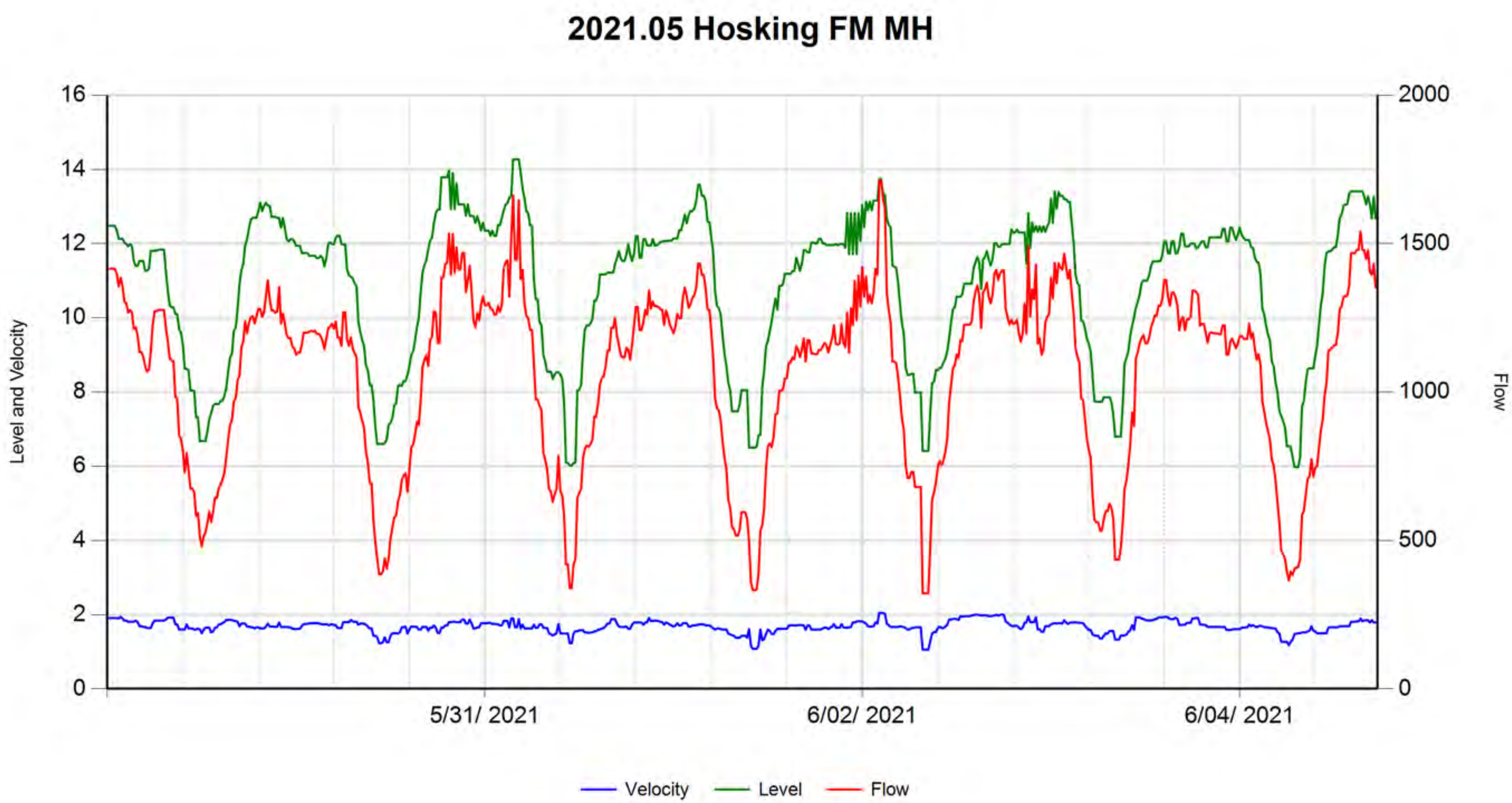
	Velocity (fps)	Level (in)	Flow (gpm)		
Average	1.651	10.787	1031.126	**RainFall**	Inches
Maximum	1.950	13.600	1507.500		
Minimum	1.030	5.960	319.470		

6/08/2021



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	1.683	10.739	1046.573	**RainFall**	Inches
Maximum	2.140	13.490	1715.900		
Minimum	0.830	5.650	244.870		

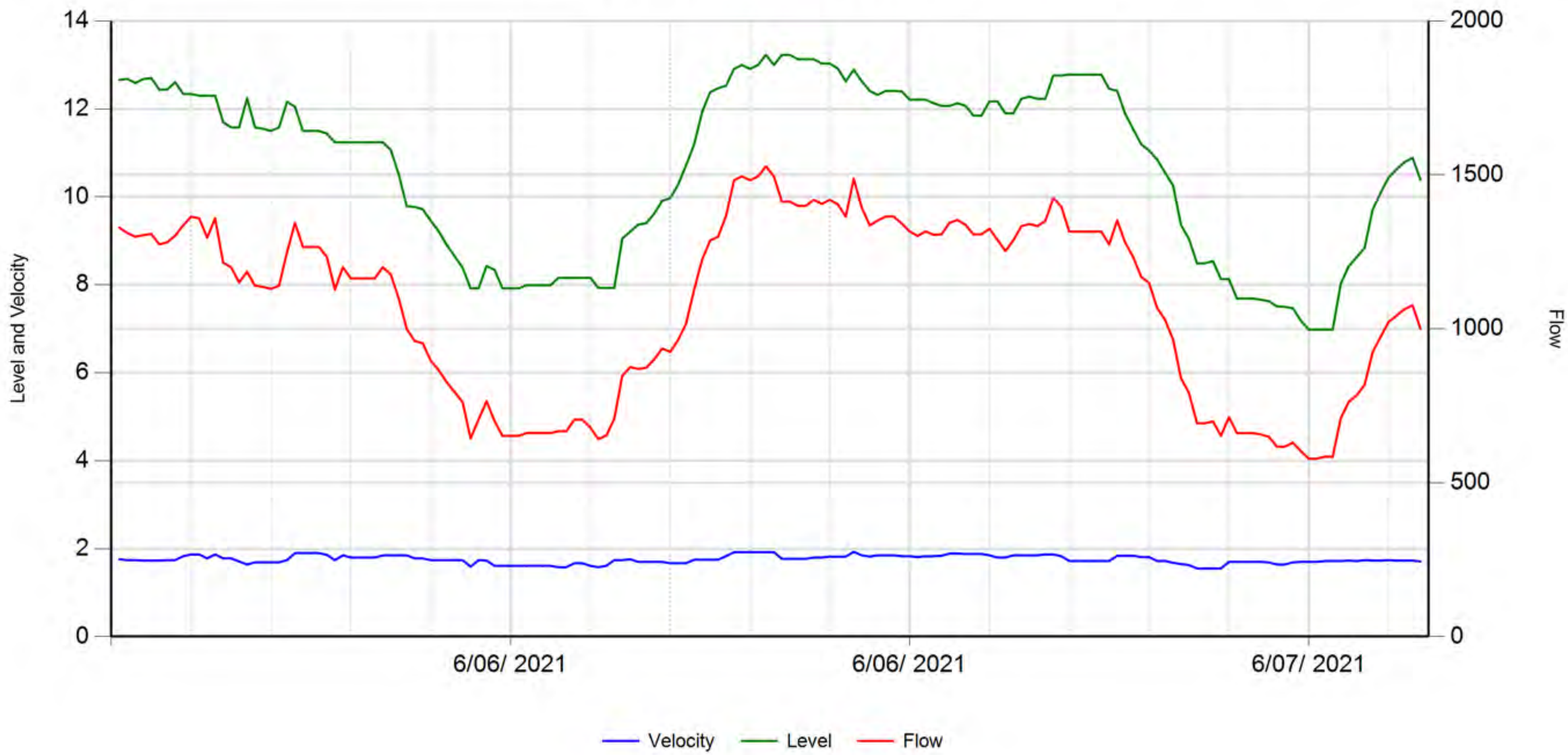
6/08/2021



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	1.683	10.862	1062.069	**RainFall**	Inches
Maximum	2.050	14.270	1712.820		
Minimum	1.060	5.980	322.080		

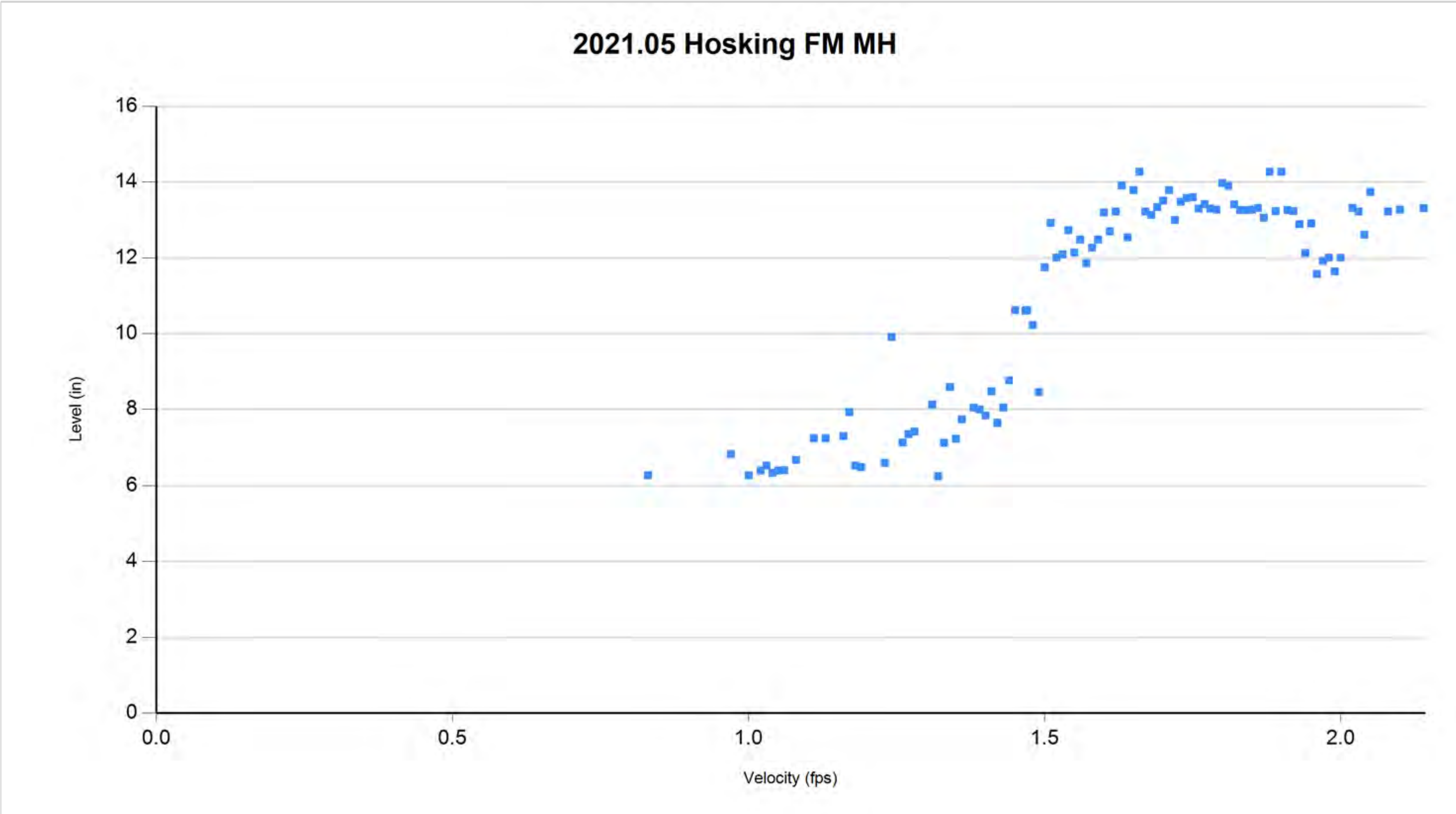
6/08/2021

2021.05 Hosking FM MH



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	1.756	10.710	1080.162	**RainFall**	Inches
Maximum	1.930	13.230	1527.760		
Minimum	1.550	6.980	578.060		

6/08/2021



5/18/2021 thru 6/07/2021

6/8/2021 3:36:08 PM

Site Report 9/02/2021

Confidential Proprietary Information

Cornerstone Engineering

2021.05 Hosking Outfall MH

MH at ~8100 Breccia Way
Bakersfield, CA 93313
MH # unknown

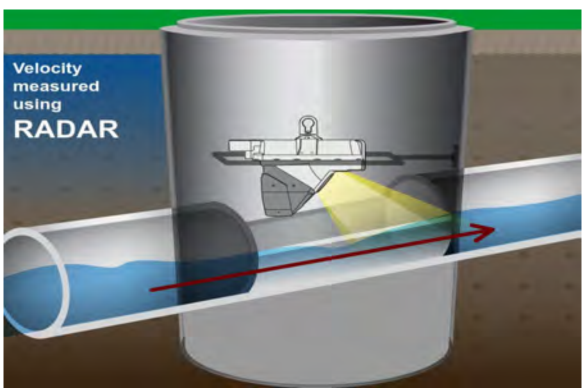
Access:
MH in WB lane, ~540 ft E of Ashe Rd, ~1450 ft W of address

System Type: Sanitary [X] Storm [ ]

Install Date: 5/18/2021

Map

Technology



Sewer Plan

Flow Meter			
Meter Depth: 97"			
MH Coordinates: 35.281661, -119.072595			
Moderate open channel hydraulics with one surcharge event			
Avg Velocity	Avg Measured Level		Multiplier
2.6 fps	16.0"		1.0
Gas			
O2	H2S	CO	LEL
20.9	0	0	0
Notes			
No laterals; monitored the downstream line as it provided the best hydraulics.			
Traffic Safety			
No formal TCP required; used arrow board, cones & signs in accord w/site-specific CA MUTCD TC requirements.			
Land Use			
Residential	Commercial	Industrial	Trunk
			X

Manhole Depth	145"
Monitored Pipe Size	36"
Inner Pipe Size (In/Out)	36"/36"
Pipe Shape	Round
Pipe Condition	Good
Manhole Material	Concrete
Silt	None observed
Velocity Profile Data	Passed
Velocity Profile Taken	0.4 2-D
Sensor Offset	47.8"
Sensor Dist. to Crown	11.8"
Sensor Direction	Downstream
Flow Heading	West

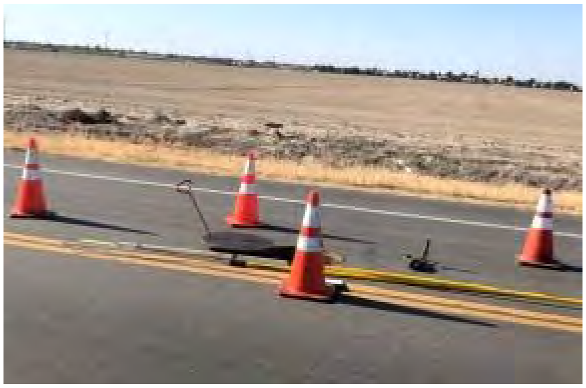
Meter Site Document

2021.05 Hosking Outfall MH

MH at ~8100 Breccia Way

Bakersfield, CA 93313

Site



Manhole Before Install

Installation Process

Installed

Downstream Pipe Size

Downstream

Temporary Flow Study

Cornerstone Engineering

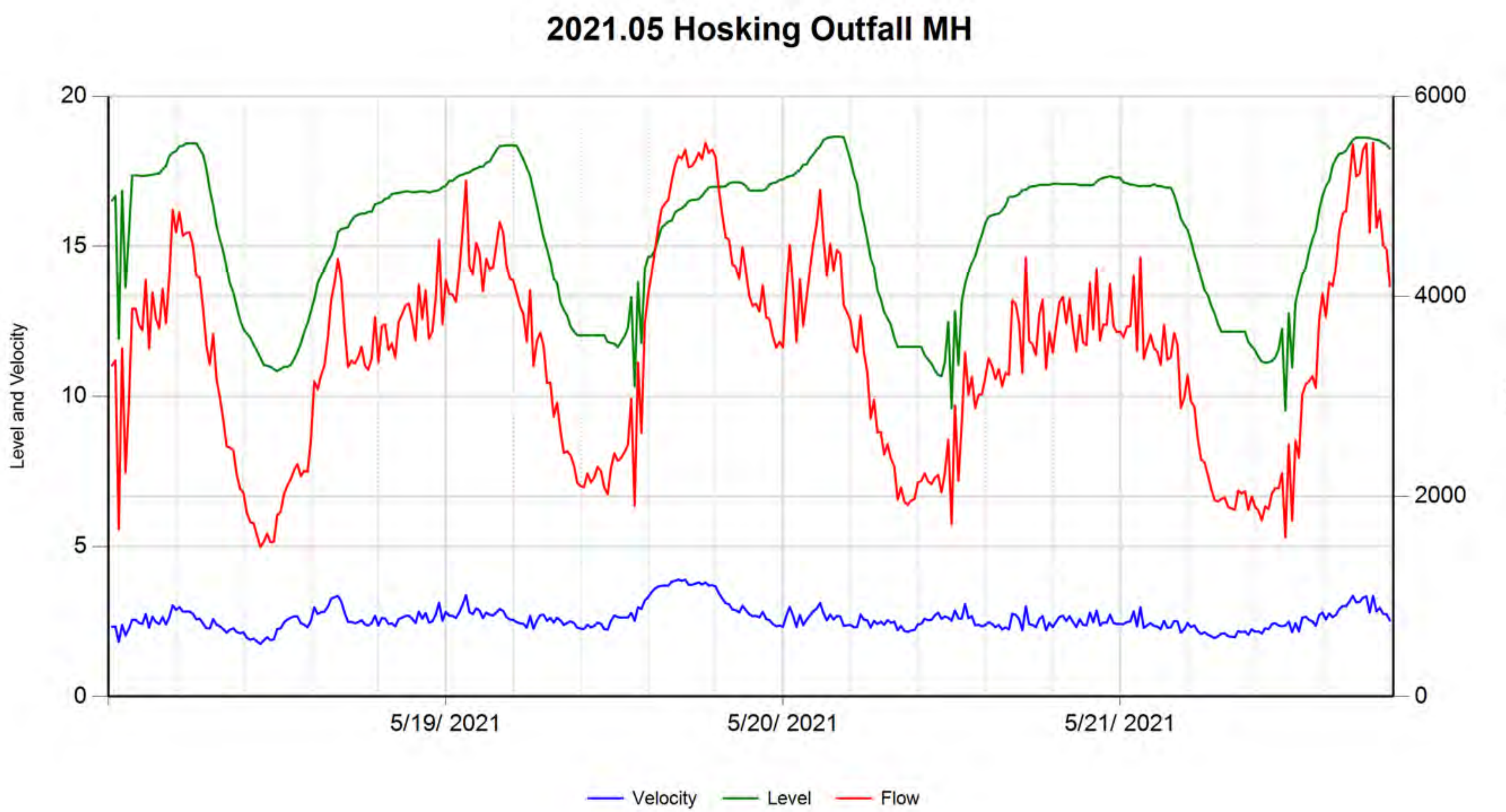
2021.05 Hosking Outfall MH

Meter Start Date		From	5/18/2021
Meter Stop Date		To	6/7/2021
Velocity (fps)		Level (in)	Flow (mgd)
Average	2.613	16.054	5.148
Maximum	3.898	40.883	12.075
Minimum	1.537	8.574	1.938
Pipe Size		36.000	
Estimated Capacity (mgd)		Not Calculated	
Capacity Used		Not Calculated	
Sensor Type		Hach - Flodar	

Utility Systems, Science and Software

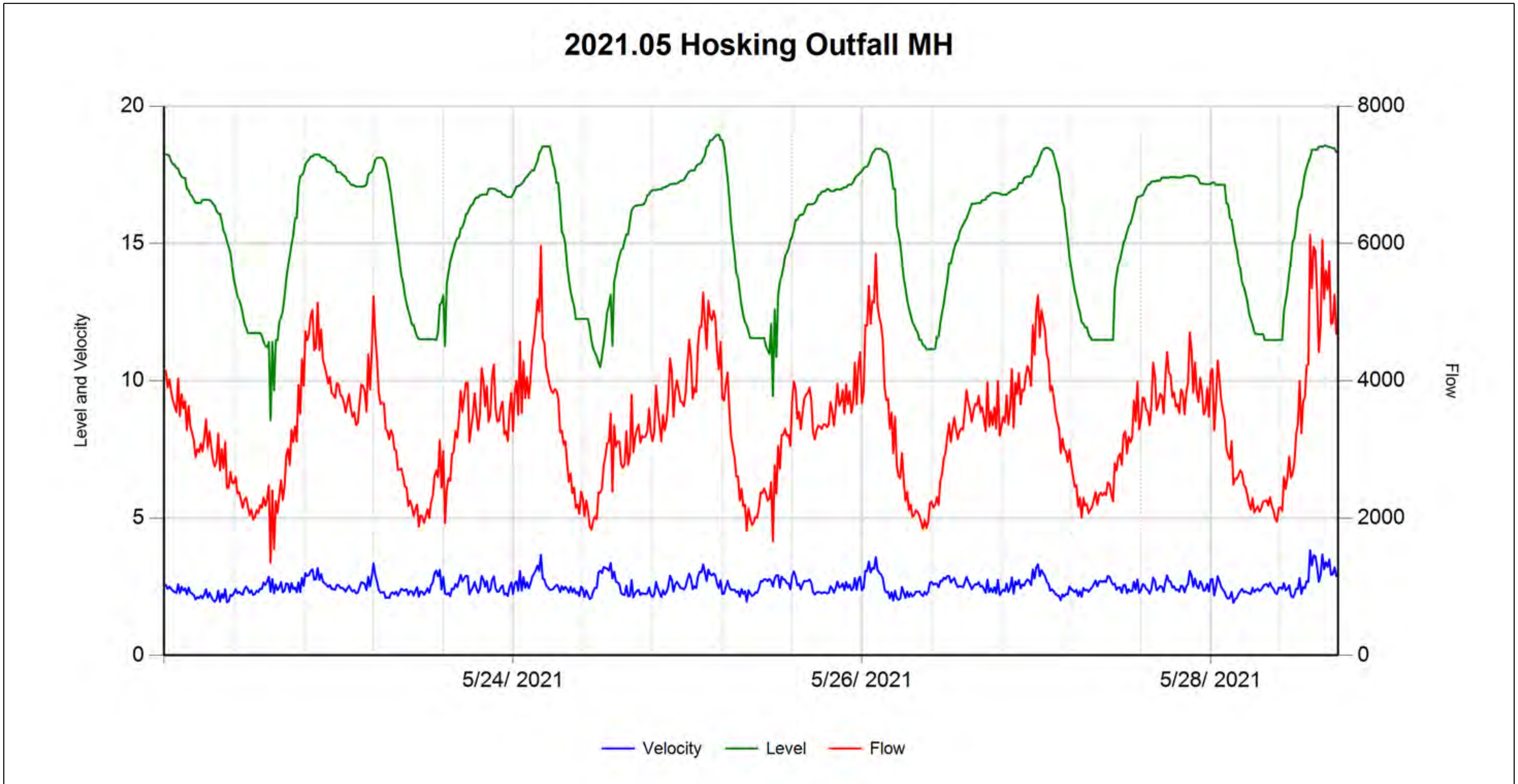
9314 Bond Av, Suite A
El Cajon, CA 92021

601 N. Parkcenter Dr, Suite 209
Santa Ana, CA 92705



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	2.603	15.439	3433.131	**RainFall**	Inches
Maximum	3.898	18.654	5535.690		
Minimum	1.756	9.540	1495.120		

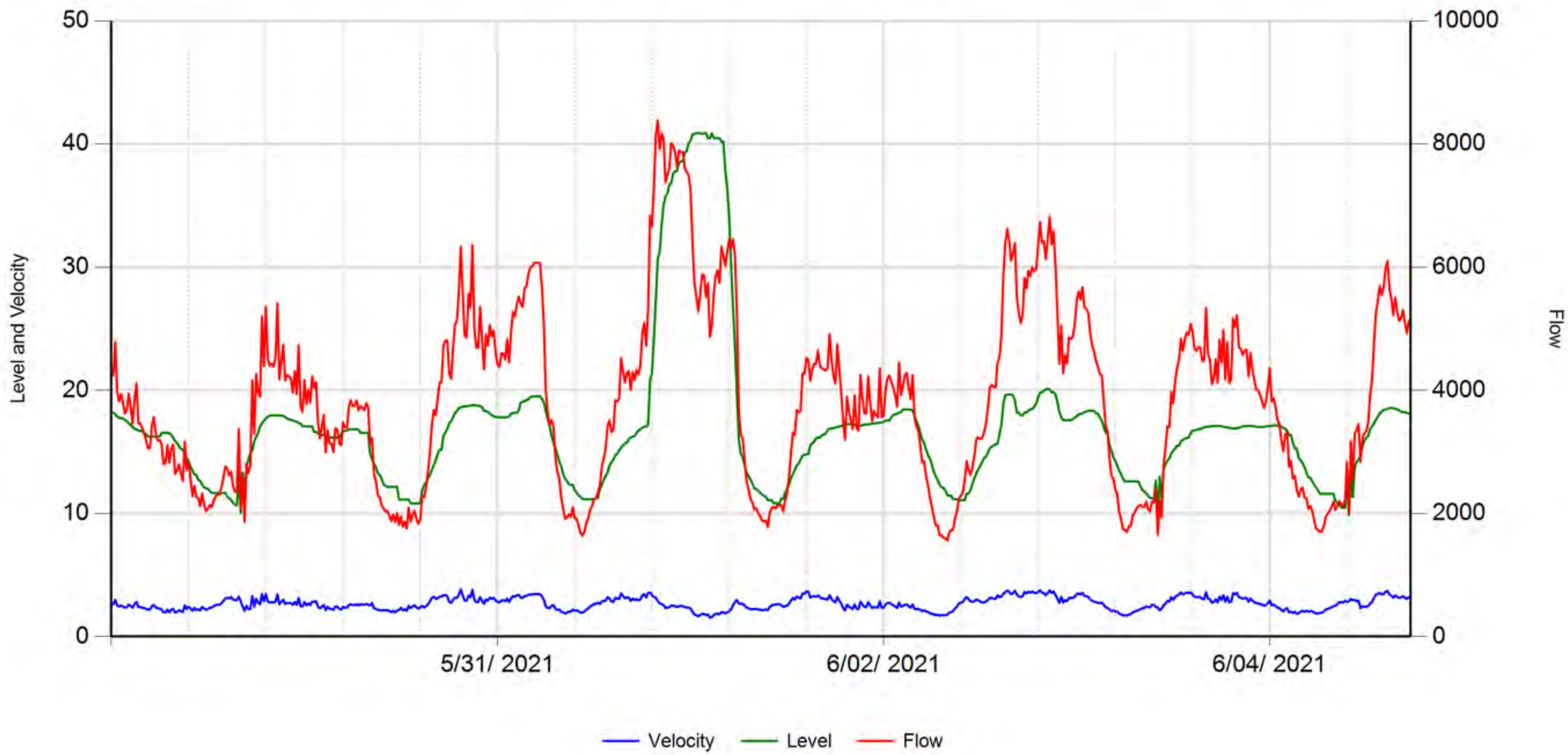
9/02/2021



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	2.523	15.517	3326.589	**RainFall**	Inches
Maximum	3.830	18.964	6126.190		
Minimum	1.915	8.574	1345.840		

9/02/2021

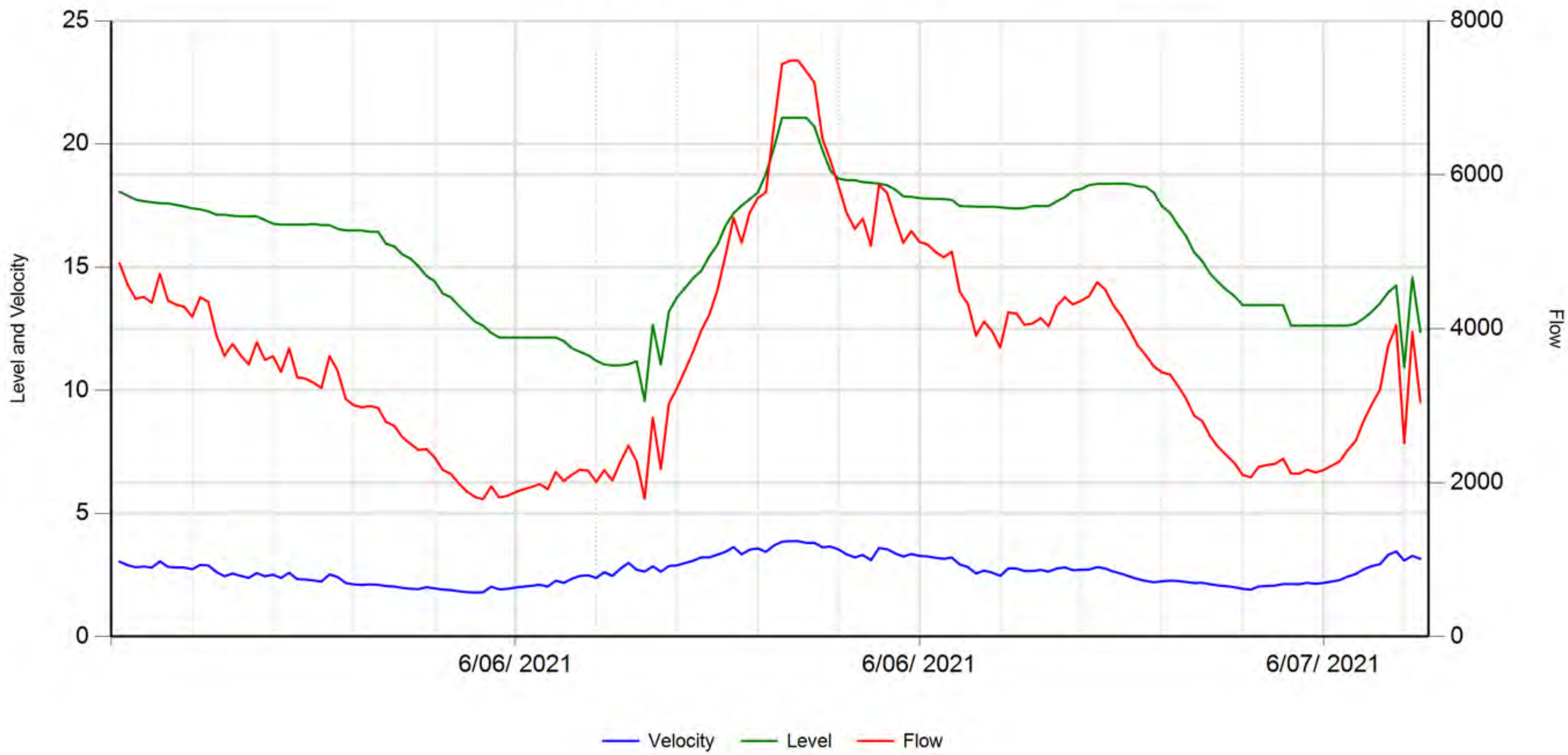
2021.05 Hosking Outfall MH



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	2.688	16.915	3847.538	**RainFall**	Inches
Maximum	3.829	40.883	8385.450		
Minimum	1.537	9.810	1564.140		

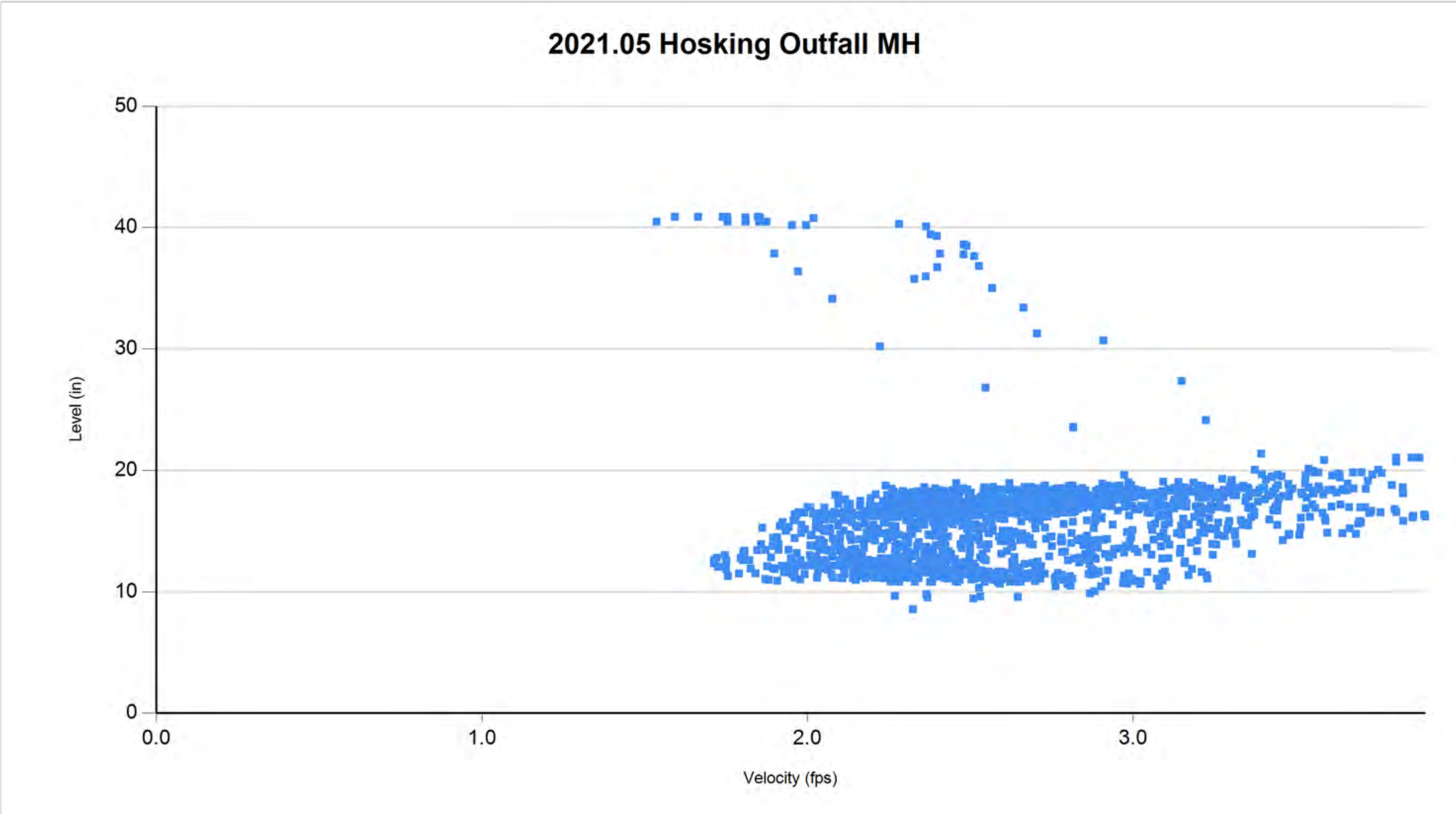
9/02/2021

2021.05 Hosking Outfall MH



	Velocity (fps)	Level (in)	Flow (gpm)		
Average	2.647	15.750	3625.404	**RainFall**	Inches
Maximum	3.880	21.069	7484.840		
Minimum	1.795	9.586	1787.660		

9/02/2021



5/18/2021 thru 6/07/2021

9/2/2021 1:18:15 PM

TRIBUTARY AREA SPREADSHEETS

Per City of Bakersfield Subdivision and Engineering design manual, section 2.2.1.1 the average daily discharge of domestic sewage is calculated as two hundred fifty (250) gallons per day per single-family dwelling unit. R1 zoned residences are calculated as having 4.5 dwelling units per acre with R2 family zone calculated to as 12 dwelling units per acre. For multifamily dwelling units the average daily discharge is 75% of the single-family dwelling units.

SECTION 29

ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FULL BUILDOUT FUTURE AVERAGE FLOW (CFS)	PRESENT DAY PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT PEAK DESIGN FLOW (CFS)	FUTURE PEAK FLOW (CFS)
R1		673			0.168	0.260		2.903		0.756	
C2			0.4			0.00224				0.004	
M-1				2.4		0.018				0.036	
M-2				16.1		0.12075				0.242	
Future R1	155				0.174		0.270		2.728		0.736
Future R2	20.6				0.046		0.072		2.728		0.196
Future E1	12.1				0.0030		0.005		2.728		0.013
TOTAL Average						0.401	0.346				
TOTAL Average SUM							0.748				
TOTAL PEAK										1.04	0.94
TOTAL PEAK SUM										1.04	1.98

SECTION 30

ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FUTURE AVERAGE FLOW (CFS)	PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT PEAK DESIGN FLOW (CFS)	FUTURE PEAK DESIGN FLOW (CFS)
R1		1245			0.311	0.482		2.587		1.246	
R1(Schools as Comm.)	54.1					0.30296				0.541	
R2		73			0.018	0.028		2.587		0.073	
E	2.5				0.001	0.001		2.587		0.003	
C1			5			0.0028				0.05	
C2			3.9			0.02184				0.039	
M-1				0.5		0.00375				0.0075	
M-2				3.8		0.0285				0.057	
Future R1	70				0.079		0.122		2.503		0.305
Future R2	8.9				0.020		0.031		2.503		0.078
TOTAL Average						0.871	0.153				
TOTAL Average SUM						1.272	1.771				
TOTAL PEAK										2.02	0.382
TOTAL PEAK SUM										3.05	4.380

SECTION 32

ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FUTURE AVERAGE FLOW (CFS)	PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT PEAK DESIGN FLOW (CFS)	FUTURE PEAK DESIGN FLOW (CFS)
R1		109			0.027	0.042		2.575		0.109	
C2			3.7			0.02072				0.037	
Future R1	178				0.200		0.310		2.455		0.761
TOTAL Average						0.063	0.310				
TOTAL Average SUM						1.335	2.144				

TOTAL PEAK										0.146	0.761
TOTAL PEAK SUM										3.199	5.287

SECTION 31											
ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FUTURE AVERAGE FLOW (CFS)	PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT PEAK DESIGN FLOW (CFS)	FUTURE PEAK DESIGN FLOW (CFS)
R1		319			0.080	0.123		2.501		0.309	
School (Zoned A calc'd C)	58					0.325				0.580	
Future R2	16.9				0.038		0.059		2.395		0.141
Future E	2.2				0.001		0.001		2.395		0.002
Future C2			17.3				0.09688				0.173
Future M1				1			0.0075				0.015
TOTAL Average						0.448	0.164				
TOTAL Average SUM						1.783	2.756				
TOTAL PEAK										0.889	0.316
TOTAL PEAK SUM										4.1	6.491

SUM OF SECTIONS 29, 30, 31, AND 32:	**FLOW (CFS)**
PRESENT AVERAGE FLOW	1.8
FUTURE AVERAGE FLOW	2.8
PRESENT PEAK FLOW	4.1
FUTURE PEAK FLOW	6.5

SECTION 25 (EXCLUDING ZONES ALONG WILBLE RD)											
ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FUTURE AVERAGE FLOW (CFS)	PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT DAY PEAK DESIGN FLOW (CFS)	FUTURE PEAK DESIGN FLOW (CFS)
R1		795			0.199	0.308		2.450		0.753	
R2		35			0.009	0.014		2.450		0.033	
School (Zoned R1 calc'd C)	15.2					0.08512				0.152	
Future R1					0.000		0.000		2.299		0.000
Future C1			86.7				0.48552				0.867
Future C2/PCD			87.5				0.49				0.875
TOTAL Average						0.406	0.976				
TOTAL Average SUM						2.189	4.138				
TOTAL PEAK										0.94	1.742
TOTAL PEAK SUM										5.0	9.172

SECTION 36 (EXCUDING ZONES ALONG WIBLE RD)											
ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FUTURE AVERAGE FLOW (CFS)	PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT DAY PEAK DESIGN FLOW (CFS)	FUTURE PEAK DESIGN FLOW (CFS)
R1		684			0.171	0.265		2.412		0.638	
R2		22			0.004	0.006		2.412		0.015	
School (Zoned R1 calc'd C)	14.5					0.081				0.145	
C2			4.6			0.026				0.046	
Future R1	66.2				0.074		0.115		2.260		0.2604
Future R2	9.5				0.021		0.033		2.260		0.0747
Future C1			44.3				0.24808				0.443
TOTAL Average						0.378	0.396				
TOTAL Average SUM						2.567	4.912				

TOTAL PEAK										0.844	0.778
TOTAL PEAK SUM										5.870	10.794

EAST OF WIBLE

FIRST MONITORING STATION	FLOW (CFS)
PRESENT AVERAGE FLOW	2.6
FUTURE AVERAGE FLOW	4.9
PRESENT PEAK FLOW	5.9
FUTURE PEAK FLOW	10.8

SECTION 26 (INCLUDING ZONES FROM SECTION 25 ALONG WIBLE RD)

ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FUTURE AVERAGE FLOW (CFS)	PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT DAY PEAK DESIGN FLOW (CFS)	FUTURE PEAK DESIGN FLOW (CFS)
R1		1151			0.288	0.445		2.359		1.050	
R2		0			0.000	0.000		2.359		0.000	
School (Zoned R1 calc'd C)	33.4					0.18704				0.334	
C2	0					0				0.000	
Future R1	9				0.010		0.016		2.229		0.0349
Future R2	5				0.011		0.017		2.229		0.0388
Future C-1	13.3						0.07448				0.133
TOTAL Average						0.632	0.108				
TOTAL Average SUM						3.199	5.652				
TOTAL PEAK										1.384	0.207
TOTAL PEAK SUM										7.255	12.385

SECTION 35 (INCLUDING ZONES FROM SECTION 36 ALONG WIBLE RD and EXCLUDING ZONES FROM SECTION 35 ALONG STINE RD)

ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FUTURE AVERAGE FLOW (CFS)	PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT DAY PEAK DESIGN FLOW (CFS)	FUTURE PEAK DESIGN FLOW (CFS)
R1		1093			0.273	0.423		2.329		0.985	
R2		30			0.006	0.009		2.329		0.020	
Schools and Worship calc'd C	0					0				0.000	
Future R1	25.9				0.029		0.045		2.205		0.0994
Future R2	4.7				0.011		0.016		2.205		0.0361
Future C-2	23.5						0.1316				0.235
TOTAL Average						0.431	0.193				
TOTAL Average SUM						3.631	6.276				
TOTALS										1.005	0.371
TOTAL SUM										8.260	13.761

EAST OF STINE

SECOND MONITORING STATION	FLOW (CFS)
PRESENT AVERAGE FLOW	3.631
FUTURE AVERAGE FLOW	6.276
PRESENT PEAK FLOW	8.260
FUTURE PEAK FLOW	13.761

	Qavg	Qmax	Calculated from Macintosh study
ADD Stine road CFS here	7.82	11.5	

SECTIONS 27 AND 34 (INCLUDING ZONES FROM SECTION 35 ALONG STINE RD)

ZONE	AREA (GROSS ACRES)	NUMBER OF HOUSES	COMMERCIAL AREA (GROSS ACRES)	INDUSTRIAL AREA (GROSS AREA)	AVERAGE FLOW (MGD)	PRESENT DAY AVERAGE FLOW (CFS)	FUTURE AVERAGE FLOW (CFS)	PEAK FACTOR	FUTURE PEAK FACTOR	PRESENT DAY PEAK DESIGN FLOW (CFS)	FUTURE PEAK DESIGN FLOW (CFS)
R1		1472			0.368	0.569		2.061		1.173	
R2		36.7			0.007	0.011		2.061		0.022	
School (Zoned R1 calc'd C)	57.9					0.32424				0.579	
Future R1	66.3				0.075		0.115		1.976		0.2281
Future R2	14.1				0.032		0.049		1.976		0.0970
TOTAL Average						0.904	0.164				
TOTAL Average SUM						12.355	18.796				
TOTALS										1.774	0.325
TOTAL SUM										21.534	27.360

EAST OF ASHE

THIRD MONITORING STATION	FLOW (CFS)
PRESENT AVERAGE FLOW	12.355
FUTURE AVERAGE FLOW	18.796
PRESENT PEAK FLOW	21.534
FUTURE PEAK FLOW	27.360