



CITY OF NORMAN, OK
AIM NORMAN COMPREHENSIVE PLAN
WATER/WASTEWATER SUB-COMMITTEE
Development Center, Room B, 225 N. Webster Ave., Norman, OK 73069
Friday, April 12, 2024 at 9:00 AM

AGENDA

It is the policy of the City of Norman that no person or groups of persons shall on the grounds of race, color, religion, ancestry, national origin, age, place of birth, sex, sexual orientation, gender identity or expression, familial status, marital status, including marriage to a person of the same sex, disability, relation, or genetic information, be excluded from participation in, be denied the benefits of, or otherwise subjected to discrimination in employment activities or in all programs, services, or activities administered by the City, its recipients, sub-recipients, and contractors. In the event of any comments, complaints, modifications, accommodations, alternative formats, and auxiliary aids and services regarding accessibility or inclusion, please contact the ADA Technician at 405-366-5424, Relay Service: 711. To better serve you, five (5) business days' advance notice is preferred.

All AIM Sub-Committee Meetings are not regular meetings of the AIM Norman Comprehensive Plan Steering Committee, but the Steering Committee will be invited to attend, and this notice is being posted in compliance with the Oklahoma Open Meetings Act in the event of a quorum.

ROLL CALL

MINUTES

1. CONSIDERATION OF APPROVAL, REJECTION, AMENDMENT, AND/OR POSTPONEMENT OF THE MINUTES AS FOLLOWS:

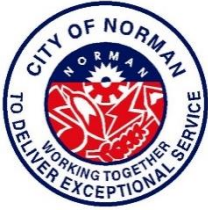
AIM NORMAN COMPREHENSIVE PLAN WATER/WASTEWATER SUB-COMMITTEE MEETING MINUTES OF JANUARY 10, 2024.

DISCUSSION ITEMS

2. GROUNDWATER DISCUSSION BY JOHN HARRINGTON FROM THE ASSOCIATION OF CENTRAL OKLAHOMA GOVERNMENTS.
3. WATER RECLAMATION FACILITY INDIRECT POTABLE REUSE.
4. DISCUSSION OF GENERAL COMMITTEE, OVERALL LAND USE PLAN PROGRESS AND PUBLIC ENGAGEMENT EFFORTS.
5. WATER BASELINE TECHNICAL MEMORANDUM.
6. WASTEWATER BASELINE TECHNICAL MEMORANDUM
7. SCHEDULE OF UPCOMING WORK.

MISCELLANEOUS COMMENTS

ADJOURNMENT



CITY OF NORMAN, OK
AIM NORMAN COMPREHENSIVE PLAN
WATER/WASTEWATER SUB-COMMITTEE
Development Center, Room B, 225 N. Webster Ave., Norman, OK 73069
Wednesday, January 10, 2024 at 9:00 AM

MINUTES

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Chair Dan Bergey called the meeting to order at 9:00 am

ROLL CALL & PROJECT TEAM INTRODUCTIONS

Present

- Dan Bergey, Chair
- Mark Daniels
- Dr. David Sabatini
- Bill Scanlon
- Karen Goodchild
- Hossein Farzaneh
- Kyle Arthur
- Doris Kupfer (Alternate)
- James Chappel (Alternate)

Absent

- Dr. Robert Knox

Guests Present

- Amada Nairn, AIM Steering Committee Member
- Lee Hall, AIM Steering Committee Member

Consultants

- Amy Haase, RDG
- Molly Hanson, RDG

Bailey Aldridge, RDG
 Marty Shukert, RDG
 Cole Niblett, Garver
 Mary Elizabeth Mach, Garver
 Evan Tromble, Garver
 Michael Nguyen, Garver

Staff

Beth Muckala, Assistant City Attorney
 Chris Mattingly, Utilities Director
 Nathan Madenwald, Utilities Engineer
 Gay Webb, Administrative Technician

Chair Dan Bergey welcomed everyone to the meeting. Cole Niblett, Oklahoma Water Team Leader for Garver, introduced himself and asked members and guests to introduce themselves.

WATER & WASTEWATER MASTER PLANNING PROCESS OVERVIEW

A. REVIEW OF PREVIOUS MASTER PLANS/REPORTS

B. REVIEW OF EXISTING SYSTEMS

Cole explained the goal of the meeting is to introduce the Garver team, explain the water and wastewater master planning process and familiarize members with the existing systems and challenges.

Sub-committee members were asked for major interests or priorities as it relates to Norman's water and wastewater infrastructure. Members expressed interest in wastewater reuse, future water security, groundwater management protection, Lake Thunderbird management, infrastructure for development, development affecting natural waterways and how this process links to development and growth from a cost and environmental impact.

Cole provided an overview of the master planning process. Both water and wastewater master plans will be developed using four specific tasks. At the conclusion of each task, the team will provide a summary of major findings to the sub-committee for input, review and feedback.

- Task 1 Baseline Development establishes the demands and areas of new growth to be serviced
- Task 2 Existing System Assessments evaluate the future demands against existing capacities
- Task 3 Alternative Evaluations consider the viable options to meet capacity gaps
- Task 4 Plan Development combines the preferred alternatives into a single plan, with phasing as needed

Cole described Norman's water supply and distribution system. The water supply comes from three main sources: surface water from Lake Thunderbird, groundwater wells and a wholesale water connection from Oklahoma City. Norman's water distribution system extends generally from 48th Ave W to 36th Ave E and consists of the well field, water mains, storage tanks and the Water Treatment Plant. Water discussion included withdrawal rates from and water levels within

the Garber-Wellington Aquifer, Lake Thunderbird design/capacity/firm yield, augmentation at the Norman water well field. Specifically for Lake Thunderbird, the life of the reservoir was also discussed. Kyle Arthur discussed the design of the lake and expected life of the reservoir. Generally, the 50-100 year life is referring to the siltation estimate of the lake. The Bureau of Reclamation estimates how fast the siltation will fill up the dead storage (volume below the intake to the bottom of the lake) when designing a lake. Siltation will occur for every lake and, even when the siltation of the dead storage occurs, the lake will still continue to function though any additional siltation will then begin to proportionately reduce the volume of storage to be used for water supply.

Cole described the existing sewer collection system, which is comprised of numerous sub-basins and lift stations. A ridge divides the sewershed into two main basins, the Little River sewershed to the north and the Canadian River sewershed to the south. This topography feature splits the flow on either side. The Water Reclamation Facility (WRF) was built in the 1940s and began as a set of lagoons. The infrastructure has been rehabbed many times, with the last major sewer plant expansion completed in 2016. The Water Reclamation Facility has been master planned to build toward future potable reuse opportunities as well as future permit changes.

WATER SCOPE REVIEW

A. WATER MODELING CONCEPTS

B. WATER SUPPLY PLAN UPDATES & CONCEPTS

Cole referenced previous reports that will be revisited and noted deliverables expected to be received during this master planning process. The 2060 Strategic Water Supply Plan will be reviewed and updated to include projected growth within the service area and new areas, regulatory and permit changes and how water quality regulations will impact costs for treatment compared to alternate water supplies. Review of the distribution system modeling report will focus on delivery pressure, improvements to southeast portion of the distribution system along 24th Ave SE, pressure plane improvements and expansion of water mains along Robinson and 24th Ave SE.

WASTEWATER SCOPE REVIEW

A. WASTEWATER COLLECTION CONCEPTS

B. WASTEWATER TREATMENT/REUSE CONCEPTS

The wastewater master plan update will include review of several engineering reports as they relate to reuse at the existing facility. The team will also evaluate expansion of the existing facility compared to a new North WRF.

DISCUSS SCHEDULE, DELIVERABLES, AND WORKSHOPS

The group discussed frequency of meetings. Workshops are scheduled for April 12th, July 12th, October 11th with a final presentation December 2024. Members suggested additional meetings may be needed. Amy Haase, RDG, recommended waiting until the next meeting to determine if more meetings should be scheduled. Tasks 1 and 2 information will be discussed at the April 12th meeting. Members are encouraged to reach out to Chris Mattingly, Nathan Madenwald or Garver staff, if they have any questions prior to workshops.

DISCUSS NEXT STEPS

Sub-committee members will receive a copy of the presentation and links to reports referenced. Technical Memos will be sent to members prior to meetings for review. Amy Haase shared that AIM Norman Steering Committee presentations are available on the AIM Norman website, a link will be provided. Mary Elizabeth Mach said members are welcome to attend the AIM Norman Steering committee meetings, which will be held the second Wednesday of each month at 6:00 pm at the Adult Wellness & Education Center. She also encouraged members to complete the water survey on the AIM Norman website.

ADJOURNMENT

The meeting adjourned at 10:55 am.

Passed and approved on this _____ day of 2024.

Dan Bergey, Chair

AIM NORMAN

Area & Infrastructure Master Plan

Water Utility

Baseline Development Technical Memorandum

City of Norman
Norman, Oklahoma



Prepared by:



In Partnership with:



DRAFT
April 2024

Garver Project No.: 22W02320
Norman Project No.: WA0385



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List of Acronyms

City	City of Norman
NUA	Norman Utilities Authority
µg/L	micrograms per liter
ADD	average day demand
AIM Norman	Area & Infrastructure Master Plan
AWWA	American Water Works Association
CIP	capital improvement plan
DBPs	disinfection byproducts
gpcd	gallons per capita per day
gpd	gallons per day
HAA5	haloacetic acid
IFC	International Fire Code
KPI	key performance indicator
LCR	Lead and Copper Rule
LCRI	Lead and Copper Rule Improvements
LRAAs	locational running annual averages
MCLs	maximum contaminant levels
MDD	maximum day demand
mg/L	milligrams per liter
MGD	million gallons per day
NOM	natural organic matter
ODEQ	Oklahoma Department of Environmental Quality
RTCR	Revised Total Coliform Rule
SFE	single-family equivalent
TM	technical memorandum
TTHM	total trihalomethanes
WSA	water service area

1.0 Introduction

The City of Norman (City) and the Norman Utilities Authority (NUA) are developing an Area & Infrastructure Master Plan (AIM Norman) that will cover a wide spectrum of city planning aspects, including land use, transportation, stormwater management, water infrastructure, wastewater infrastructure, parks, and housing. The AIM Norman effort includes updates to related master plans for the City's infrastructure, including transportation, stormwater, water, and wastewater. This technical memorandum (TM) is the first in a series of TMs that will be incorporated into the Water Master Plan Report. The purpose of this TM is to establish a baseline for upcoming water system evaluations that will be used to identify future capital improvements. This TM will cover the following:

- Summary of previous water planning documents
- Analysis of historical water consumption
- Projections of future water demands
- Review of historical water quality data

1.1 Water System Overview

The NUA water system serves the urban area within the city limits. The water system includes two primary components:

- Water Distribution System – The pipes and tanks that convey water from the sources of supply to each customer.
- Sources of Supply – The NUA water system has three sources of supply.
 - Surface water from Lake Thunderbird treated at the Vernon Campbell Water Treatment Plant
 - Groundwater from the Garber-Wellington aquifer supplied from 43 groundwater wells
 - Wholesale treated water purchased from Oklahoma City

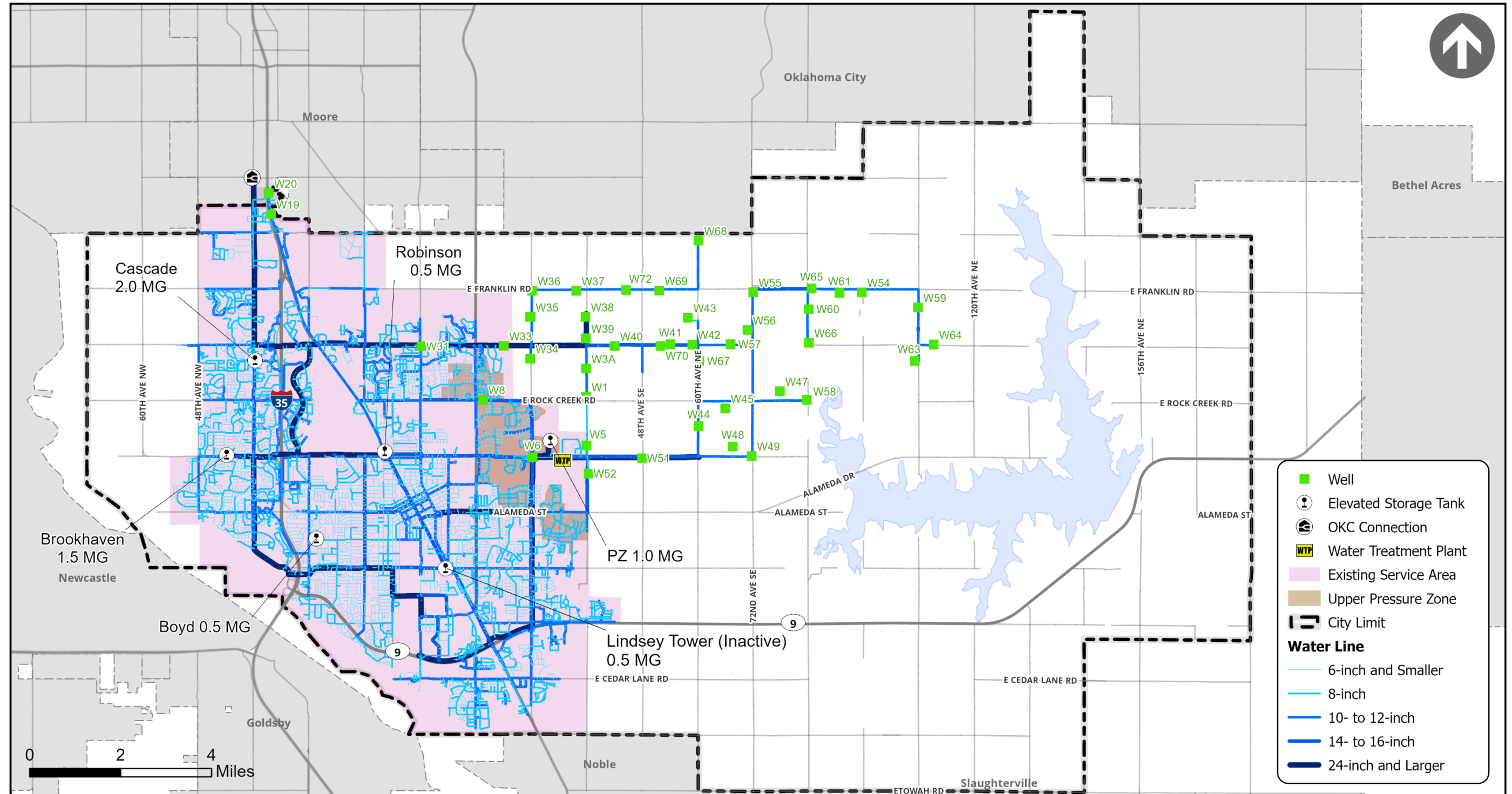
NUA's current water service area (WSA) extends from 48th Avenue West to 36th Avenue East as shown below in Map 1.1. Approximately 90% of the City's population resides within the water service boundary.

1.2 Operations and Management

The NUA is a public trust that oversees policy and financial authorizations as they relate to City-managed utilities. The elected mayor and City Council members also serve as the Board of Trustees for NUA. Three of the Norman Utilities Department Divisions administer and operate the water utility: Administration & Engineering, Water Treatment, and Line Maintenance. The Utilities Department has adopted the following Mission Statement:

Providing environmentally sound, efficient utility service to our customers in a professional, safe manner at sustainable rates through six divisions.

Map 1.1: Water System Overview



1.3 Related Documents

Table 1.1 summarizes the previous work by others that was used in the baseline development. The reference names listed in the table are used throughout this report to refer to each document.

Table 1.1: Related Documents			
Document	Author/Agency	Date	Reference Name
2060 Strategic Water Supply Plan	Carollo	2014	2060 Water Supply Plan
Update Distribution System Modeling	Alan Plummer Associates, Inc.	2018	2018 Modeling Update
AIM Norman Area & Infrastructure Master Plan - Norman Today	RDG	2024	Norman Today

1.4 Historical Data Collection

The following data was provided by NUA for the use in the creation of this baseline development:

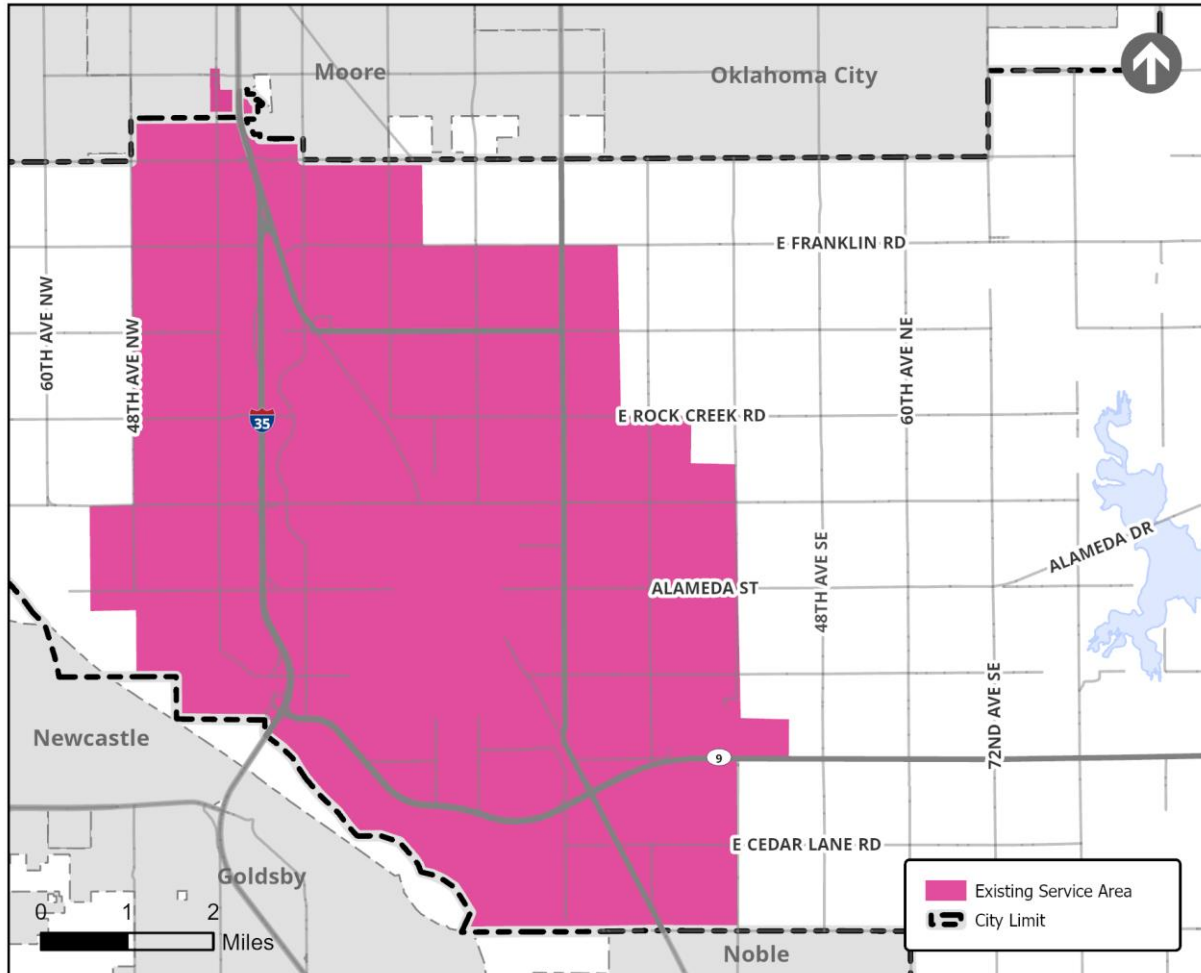
- Customer Meter Data (2019–2023)
- Water Production Data (1990–2023)
- Monthly Operating Reports (2014–2023)
- Water Audit Reports (2019–2023)
- Water Quality Data (2010–2023)
- GIS base files with water infrastructure information

2.0 Water Service Area

2.1 Water Service Area

The existing NUA water distribution system serves a portion of the City. The NUA water service area (WSA) is illustrated in Map 2.1. In general, the current boundary extends from 48th Avenue West to 36th Avenue East as shown below. Future WSA expansion will be based on future urban expansion related to future land use and will be discussed further in the *Norman Tomorrow: Vision & Future Land Use* report.

Map 2.1: Water Service Area Overview

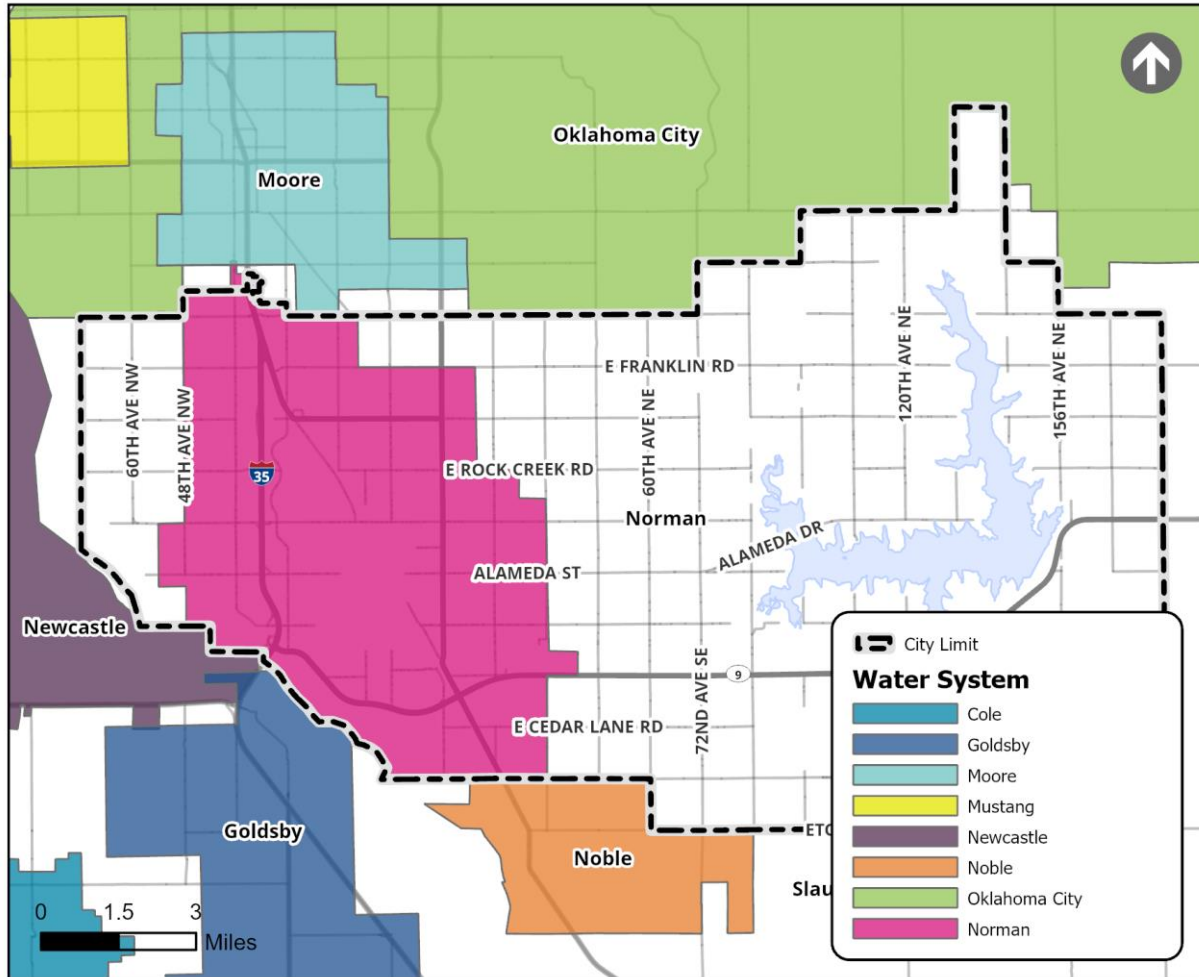


2.2 Adjacent Water Utilities

The water utilities adjacent to the NUA WSA are shown in Map 2.2. Clockwise from the north, NUA's WSA is bounded by the following water utilities:

- Moore
- Oklahoma City
- Noble
- Goldsby
- Newcastle

Map 2.2: Adjacent Water Systems



2.3 Land Use

Existing land use for the purpose of this report was derived from the Norman Today report and was used to predict future development demand rates based on land use classification and historical billing data. Future land use is being developed as part of the *Norman Tomorrow: Vision & Future Land Use* report and will be discussed in a future technical memorandum.

3.0 Historical Population and Water Demands

3.1 Historical Water Production

Three main sources of water are used for water supply including surface water, groundwater, and purchased water from a neighboring utility. Figure 3.1 summarizes the annual water supply by source from 2003-2023.

Since 2000, NUA has had the ability to purchase treated water from Oklahoma City via a connection in the northernmost part of the WSA. In 2015, NUA entered into an agreement with the Oklahoma City Water Utilities Trust to regularly purchase treated water based on a subscribed monthly capacity reservation of approximately 1 million gallons per day (MGD).

A majority of NUA's supply is provided by surface water from Lake Thunderbird. The NUA currently has an annual water rights allocation of 3,084 MG of supply from Lake Thunderbird. However, when the lake's water elevation is in the flood pool, NUA's withdrawals do not count towards the water rights allocation. In recent years, NUA has relied on flood pool water to meet demands. The remaining demand is met by groundwater from the Garber-Wellington aquifer underlying Norman via 43 groundwater wells in the eastern portion of the WSA. Further discussion related to existing water supply challenges will be included in the upcoming Water Supply Plan Review Technical Memorandum.

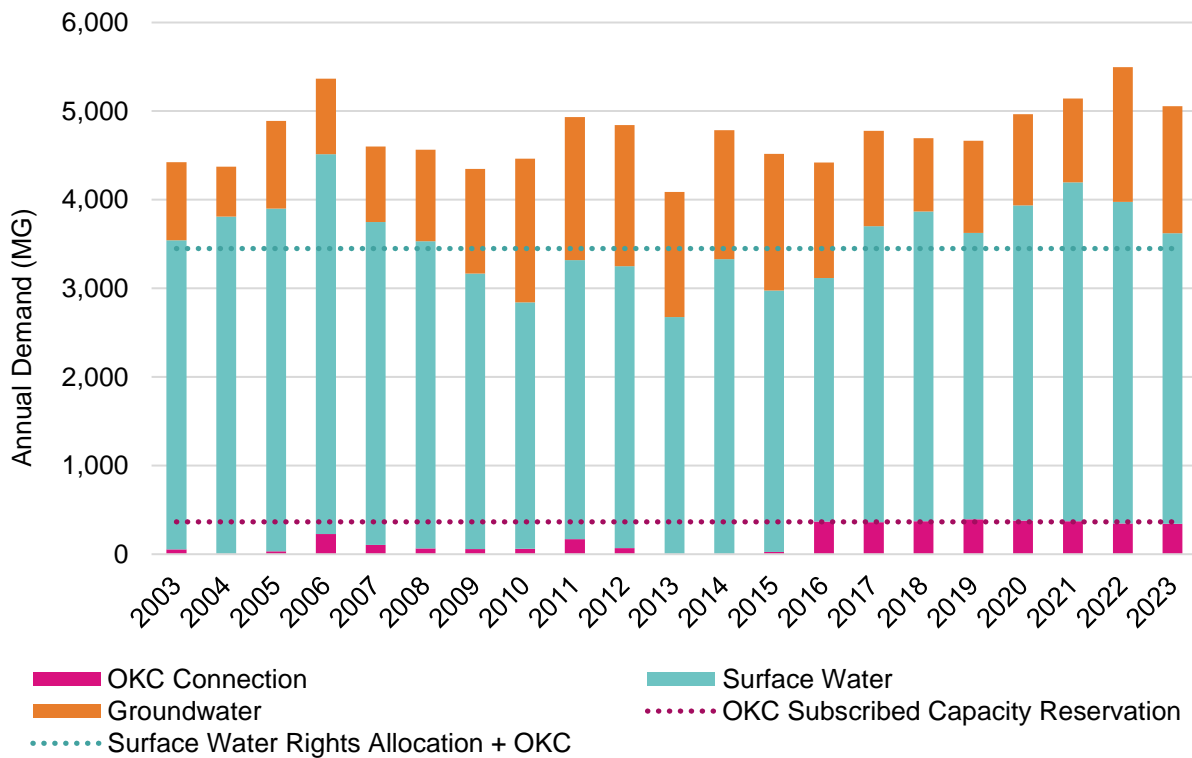


Figure 3.1: Annual Water Production by Source

3.2 Historical Population Growth

Historical population data for both the City and Cleveland County were obtained from the U.S. Census Bureau and are shown in Table 3.1.

Table 3.1: U.S. Census Population Data

Year	Cleveland County Population	City of Norman Population
1990	174,253	80,071
2000	208,016	95,693
2010	255,755	110,925
2020	295,528	128,026

NUA provided historical service population data from 1990–2023, and a summary of the data in five-year intervals is shown in Table 3.2. As of 2022, NUA served a retail population of approximately 113,553 customers via approximately 42,600 meters. Historically, the service population has been approximately 88% of the total City population. The 2060 Water Supply Plan estimated that the NUA service population would be about 90% of the total City population by 2025, and this assumption was used for the purpose of determining the future service population discussed in Section 4.1.

Table 3.2: Historical Water Service Population Data

Year	Service Population	Percent of City of Norman Population
1990	70,462	88%
1995	76,987	88%
2000	84,538	88%
2005	94,398	91%
2010	98,075	88%
2015	104,843	88%
2020	112,151	88%

3.3 Historical Water Demand

NUA provided historical production data from 1990 to 2023. The historical average day demand (ADD) and maximum day demand (MDD), as well as the service population estimates, are shown in Figure 3.2. The figure indicates that the population growth over the last 20 years has generally been linear. However, both the ADD and MDD fluctuated over the period, with the ADD appearing to increase over time, although at a lower rate than the increase in the service population. Local maxima within the data set often correlate to known drought/dry years (2006, 2012, and 2020).

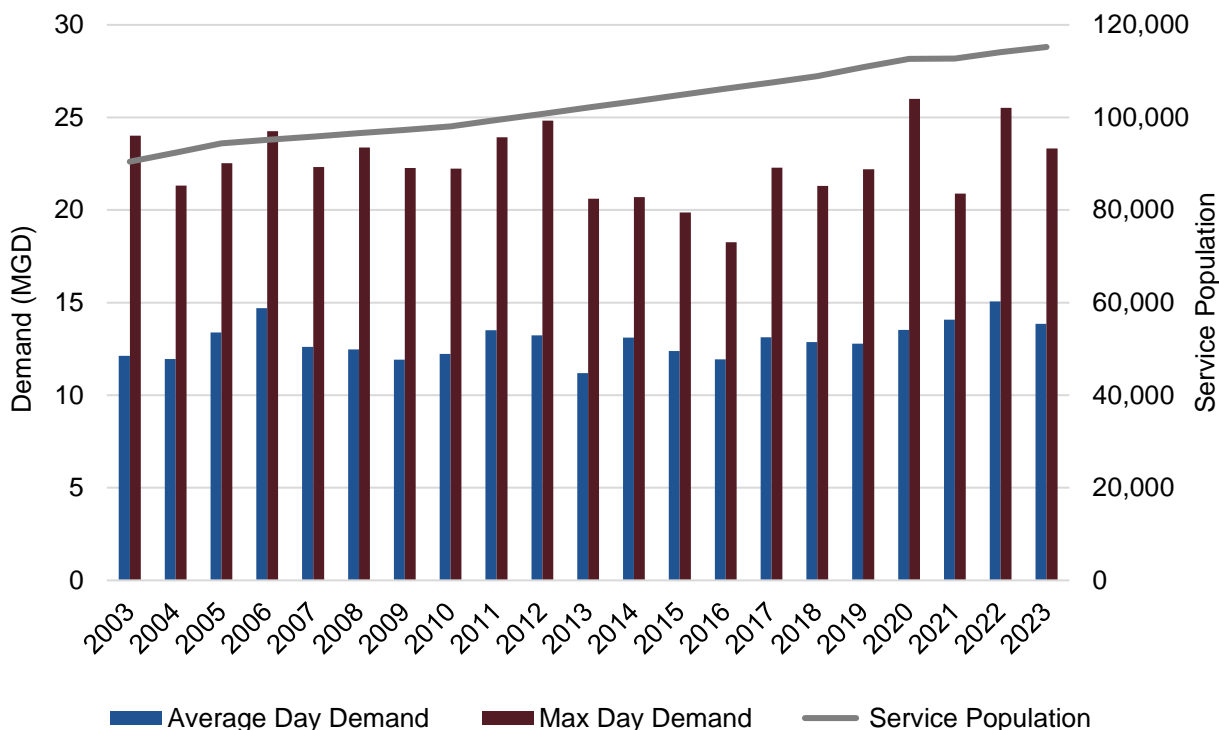


Figure 3.2: Historical Daily Water Demand and Service Population

3.4 Historical Customer Billing Data

Garver categorized consumption into six separate user classes: Residential, Commercial, University of Oklahoma Commercial, Industrial, Municipal, and Public Authority from historical billing data for 2021 and 2022. Figure 3.3 illustrates the percent of the total metered consumption by user class. Residential water use accounts for the highest portion of billed volume at 75.8% of the annual water consumption. The commercial, University of Oklahoma commercial, and industrial account for approximately 13.0%, 5.7%, and 2.9% of the annual water consumption, respectively.

Historical water production and consumption data was used to determine that the ratio of the average day demand to average day consumption has typically been approximately 1.25. This ratio was used for the purposes of adjusting data derived from historical metered consumption to a realistic demand value (Section 3.6 and Section 3.7). Water loss is discussed in more detail in Section 3.8.

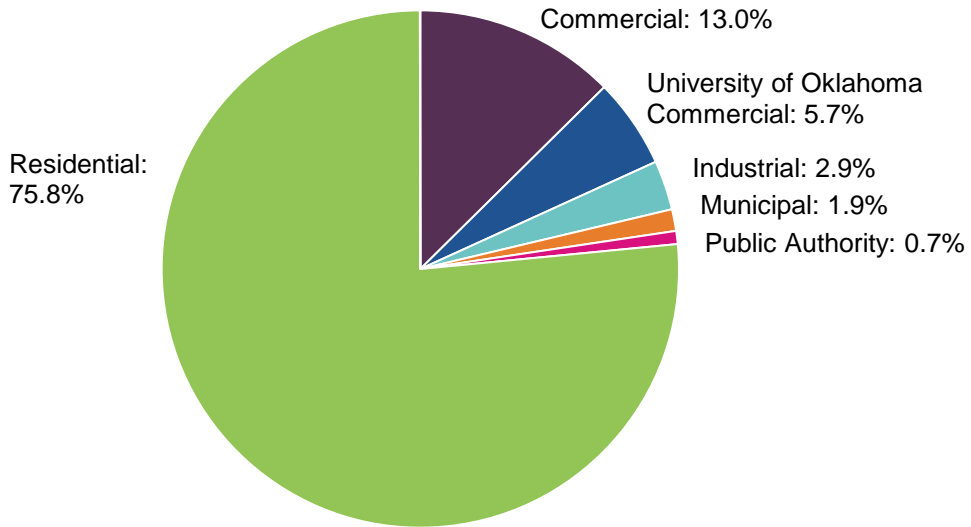


Figure 3.3: Percent Consumption by User Class

3.5 Per Capita Water Demands

Garver evaluated per capita demands using historical service population data and historical water demand data to determine ADD and MDD trends. Figure 3.4 and Figure 3.5 illustrate the per capita demand for ADD and MDD conditions between 2002 and 2022, respectively. The per capita MDD has been steadily decreasing since 2002, while per capita ADD has marginally decreased since 2002.

For the purpose of developing future projections, 136 gallons per capita per day (gpcd) will be used as the ADD baseline with an additional 14 gpcd reserve capacity for a total ADD value of 150 gpcd. A baseline value of 250 gpcd for MDD will be used with an additional reserve capacity of 25 gpcd for a total MDD value of 275 gpcd. These values are shown as dashed horizontal lines on Figure 3.4 and Figure 3.5 for reference. Further discussion of these projections can be found in Section 4.2.

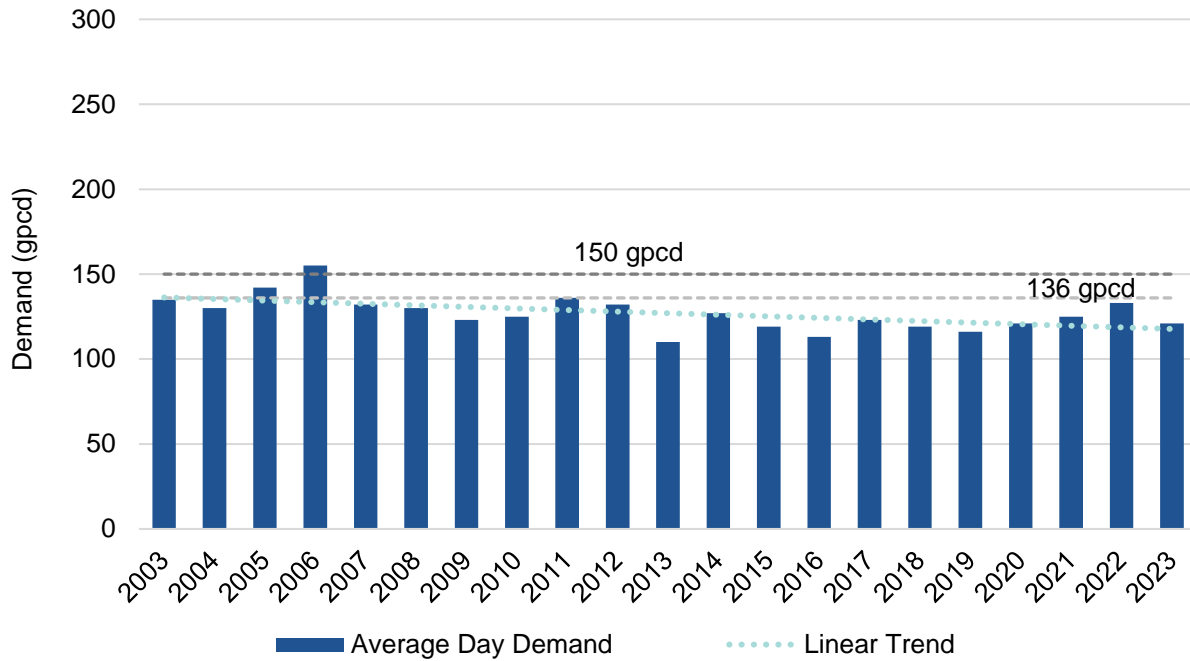


Figure 3.4: Historical Average Day Per Capita Water Demand

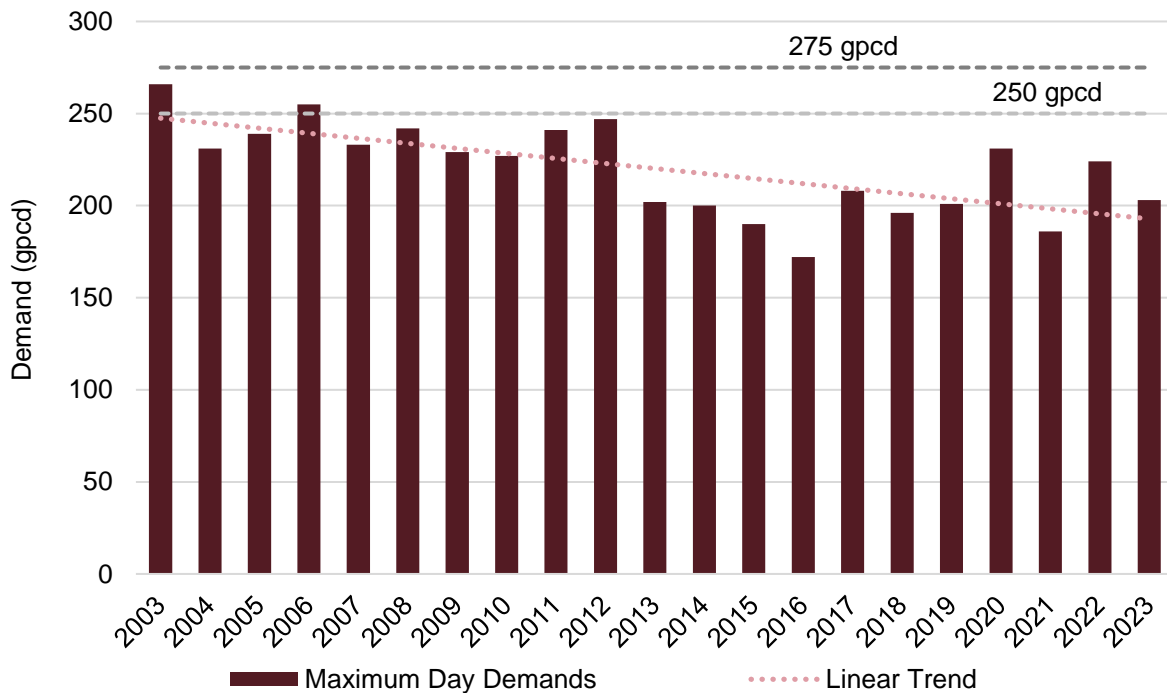


Figure 3.5: Historical Maximum Day Per Capita Water Demand

3.6 Water Demand by Land Use

Garver used historical water consumption data from 2022 and GIS data to determine historical demands associated by existing land use. A GIS analysis was completed to determine the lot size and the existing land use associated with each geolocated meter by extracting data for the nearest parcel. Table 3.3 summarizes the demands by land use category. The projected demand rate values will be used to determine future demand for new developments within the WSA, which will be discussed in more detail in the upcoming Distribution System Hydraulic Model Update Technical Memorandum. For single-family residential developments, the residential area will be assumed to be about 80% of the total development area for high-density developments and 70% for low-density developments to account for the area of streets, detention ponds, and other open spaces.

Table 3.3: Historical and Projected Demands by Customer Class

Customer Class	Customer Sub Class	Total Annual Demand (MG)	Total Area (acre)	Historical Demand (gpd/acre)	Projected Demand Rate (gpd/acre)
Residential	Residential - Multi-Family	6,777	700	2,654	2,700
	Residential - Single Family Attached	1,946	311	1,714	1,800
	Residential - Single Family Detached	30,619	7,575	1,107	See Table 3.4
Industrial	Light Industrial	907	293	848	900
	Heavy Industrial	407	94	1,182	1,200
Commercial	Commercial	5,615	1,745	3,218	3,300
	Office	2,901	403	1,974	2,000

As discussed in Section 3.4, residential users make up over 75% of all consumers within the WSA. A majority of residential users are classified as single-family detached lots. Due to the large percentage of single family detached users, further analysis was completed to determine the varied usage based on lot size. Table 3.4 and Figure 3.6 summarize the differences in usage related to differing lot sizes.

Table 3.4: Single Family Detached Historical Demands by Lot Size

Lot Size (acre)	Total Annual Demand (MG)	Total Area (acre)	Historical Demand (gpd/acre)	Projected Demand Rate (gpd/acre)	Historic Demand (gpd/connection)
<0.14	1,921	358	1,470	1,500	165
0.15 - 0.25	16,372	3,557	1,261	1,300	216
0.26 - 0.50	9,574	1,925	1,363	1,400	361
0.51 - 1.00	1,498	366	1,123	1,200	552
>1.00	1,254	1,041	330	350	577

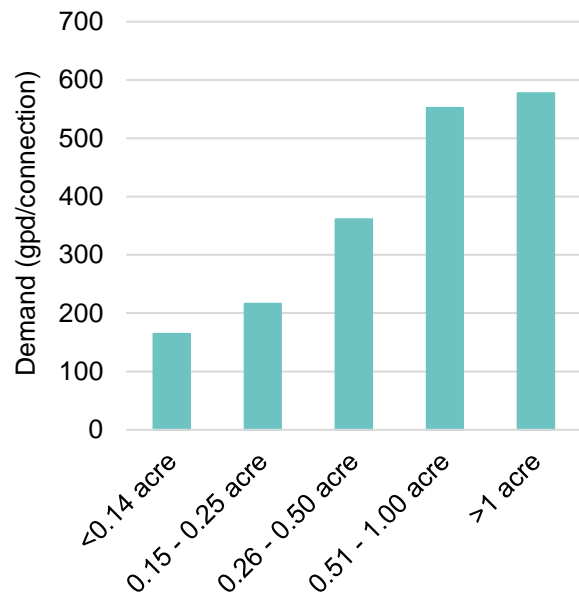
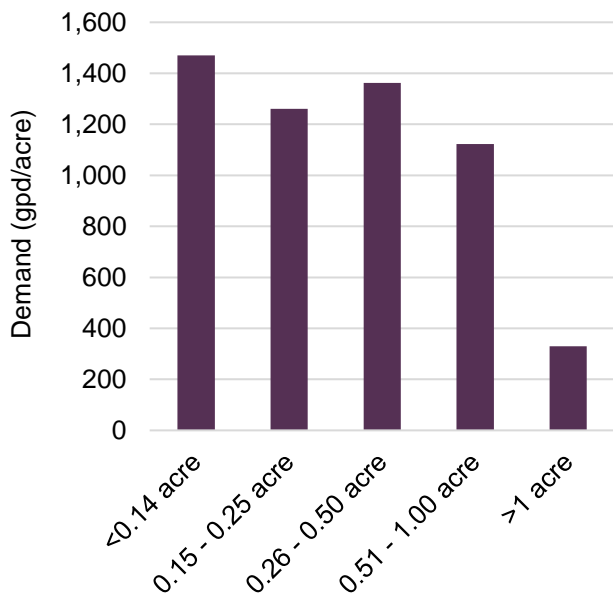


Figure 3.6: Demand by Single Family Detached Lot Sizes

3.7 Single-Family Equivalents

A single-family equivalent (SFE) value was determined using historical billed consumption data provided by NUA. SFE values are used to compare water system demands for other customer classes and the system overall to the demand of a typical single-family detached dwelling. Single family residential demands are often used as the benchmark for demand planning because they tend to represent the majority of system demands and they tend to remain more stable over time compared to other benchmarks. Multi-family, industrial, and commercial demands tend to vary significantly, and changes in these types of demands over time can cause variability in a water system's per capita demands. Once the SFE value has been determined, it can be used to express the system

capacity as the number of single-family customer connections the water system can serve currently or in the future.

Garver used historical consumption data to determine the SFE value for the distribution system. The 2022 single-family water demand was determined using the annual consumption of all meters classified as single-family with a diameter of 1-inch or less. The total demand was then divided by the total number of single-family meters within the system, for an estimated value of 250 gallons per day (gpd)/connection. These values are summarized in Table 3.5.

Table 3.5: Single-Family Equivalent Projection

Total Single-Family Demand		Number of Meters	ADD SFE Value (gpd/SFE)
(MG/year)	(MGD)		
3,067	8.4	33,641	250

3.8 Water Loss

Garver reviewed water loss audits prepared by NUA for fiscal years 2019-2023. The audits were prepared by NUA using the American Water Works Association (AWWA) Free Water Audit Software.

Figure 3.7 summarizes the normalized total water losses for fiscal years 2019-2023. Total water losses are the sum of real losses (system leakage) and apparent losses (customer meter inaccuracies, unauthorized consumption, and data handling errors). Dividing the total losses by a measure of a water system’s size (e.g., number of connections) provides a normalized key performance indicator (KPI) for tracking losses over time and comparing losses to reference data. Urban water systems typically use total or real losses per connection as their primary normalized KPI.

Figure 3.7 also shows the 25th percentile, median, and 75th percentile from the AWWA reference data included in the audit software. NUA's unit total water losses were between the median and the 75th percentile of the AWWA reference data for each fiscal year. During the 2023 fiscal year, NUA's unit total water losses were near the median compared to other systems. Higher losses near the 75th percentile in earlier years may be partially attributed to the impact of apparent losses caused by customer meter inaccuracies. NUA is currently implementing advanced water metering infrastructure to improve customer meter accuracy.

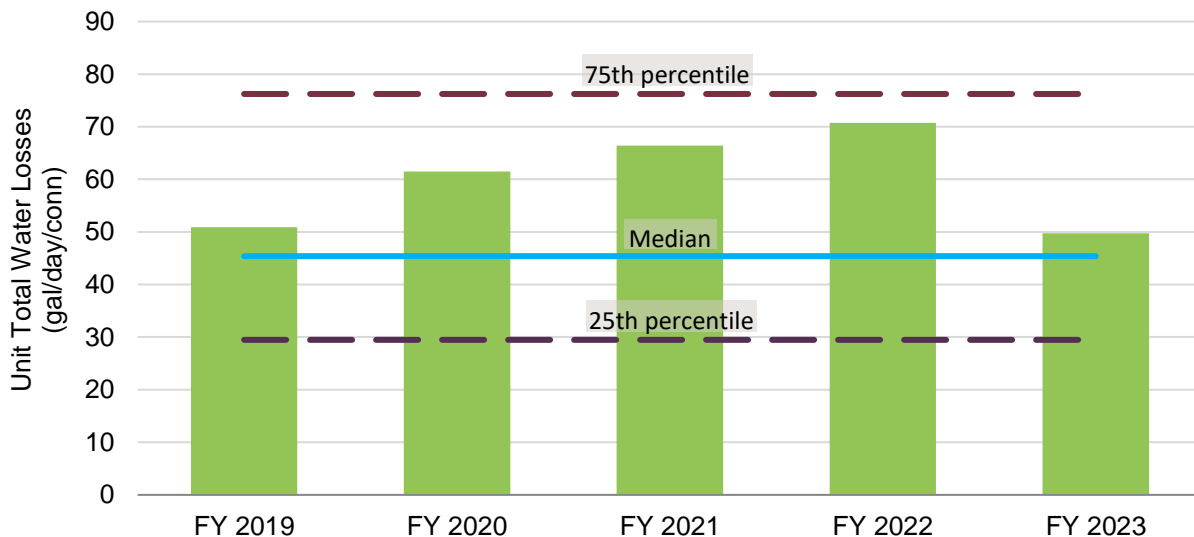


Figure 3.7: Total Unit Water Loss for 2019–2023

4.0 Population and Water Demand Projections

4.1 Population Projections

Garver used the 1.5% annual growth rate projection included in the Norman Today report as the basis of the city population projections through the year 2045 and is presented in Figure 4.1. It was assumed that the service population would be approximately 90% of the city's population, and the growth rate percentage was applied independently to both the city population and the service population.

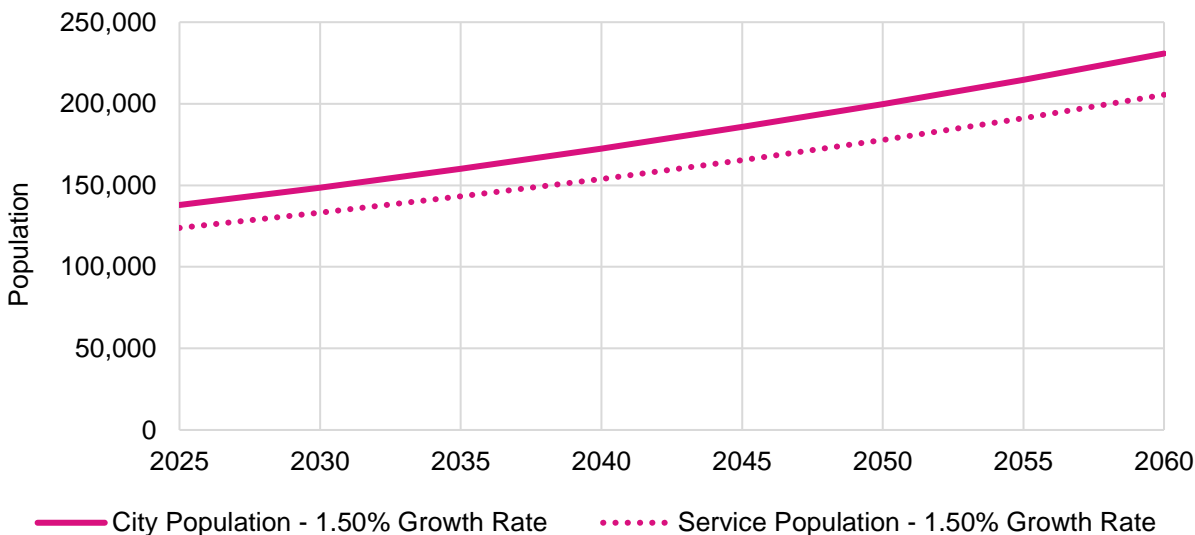


Figure 4.1: City and Service Area Population Projections

Figure 4.2 compares the population projection that was included in the 2060 Water Supply Plan. The population projection completed as part of this baseline development closely aligns with the previous population projection included in the 2060 Water Supply Plan.

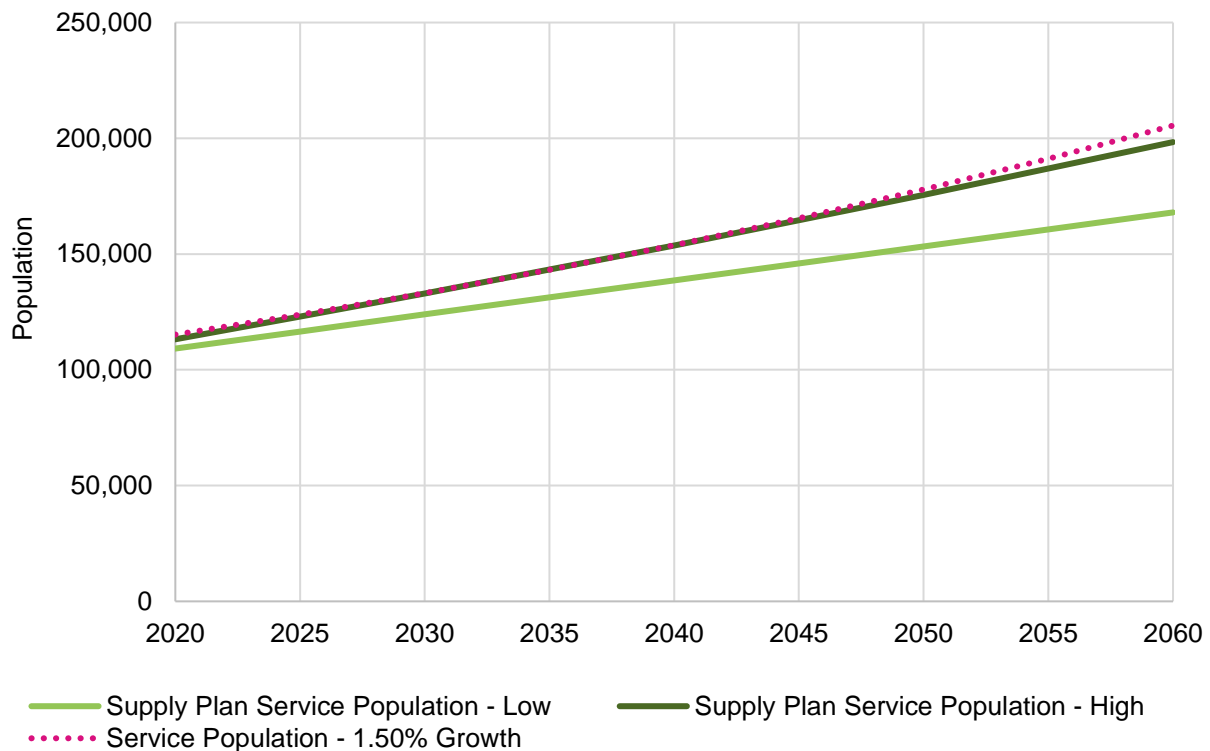


Figure 4.2: Population Projection

4.2 Water Demand Projections

As discussed in Section 3.3 and Section 3.5, the historical service population was used to determine the ADD and MDD per capita values of 136 gpcd and 250 gpcd, respectively. Production data was provided for the years 1990-2022. For the purpose of determining the ADD and MDD per capita demands for the system, only data after 2008 was considered to capture values that more closely reflect current usage. In addition to the values discussed above, a reserve capacity of 10% was included for both the ADD and MDD projections to remain consistent with the 2060 Water Supply Plan. Garver recommends the inclusion of a reserve capacity to mitigate any potential changes to per capita demand as a result of a new large user, unanticipated growth, or severe droughts. The projected ADD and MDD at the projected population discussed in Section 4.1 is shown below in Table 4.1.

Garver determined that the ADD per capita was around 136 gpcd. The value was derived comparing maximum ADD data over the noted period. An additional 10% (14 gpcd) was applied to account for reserve capacity for a total ADD per capita demand of 150 gpcd. This value is within the range of 144–160 gpcd used in the 2060 Water



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Supply Plan. Per capita demand varied in the 2060 Water Supply Plan projection due to the inclusion of passive conservation savings. The comparison between Garver's projections and the 2060 Water Supply Plan projections will be discussed in greater detail in the upcoming Water Supply Plan Review Technical Memorandum.

The projected MDD was derived using the MDD over the past 15 years which correlated to a value of 250 gpcd. An additional 10% (25 gpcd) was added to account for reserve capacity for a total MDD of 275 gpcd. This value is within the range of 274–304 gpcd used in the 2060 Water Supply Plan. The 2060 Water Supply Plan values were derived by applying the maximum historical peaking factor between 1990–2012 of 1.9 to the ADD demand discussed above. Garver used the historical daily production data that was provided to determine historical MDD per capita instead of using a peaking factor. The comparison between Garver's projections and the 2060 Water Supply Plan projections will be discussed in greater detail in the upcoming Water Supply Plan Review Technical Memorandum.

Table 4.1: Projected Water Demands

Year	Service Population	ADD (MGD)	ADD Reserve Capacity (MGD)	ADD Total (MGD)	MDD (MGD)	MDD Reserve Capacity (MGD)	MDD Total (MGD)	SFE ¹
2025	123,865	16.8	1.7	18.5	31.0	3.1	34.1	74,904
2030	133,155	18.1	1.8	19.9	33.3	3.3	36.6	81,355
2035	143,142	19.5	1.9	21.4	35.8	3.6	39.4	88,341
2040	153,877	20.9	2.1	23.0	38.5	3.8	42.3	95,906
2045	165,418	22.5	2.2	24.7	41.4	4.1	45.5	104,098

Notes:

¹Based on projected ADD with reserve capacity and a value of 250 gpd/SFE as discussed in Section 3.7

Figure 4.3 and Figure 4.4 show the historical consumption and the projected ADD and MDD through 2045. Projections through the year 2045 will be used for the purpose of the capital improvement plan (CIP) development. The projections through buildout will be determined based off the land use capacity of the service area and will be used to determine sizing.

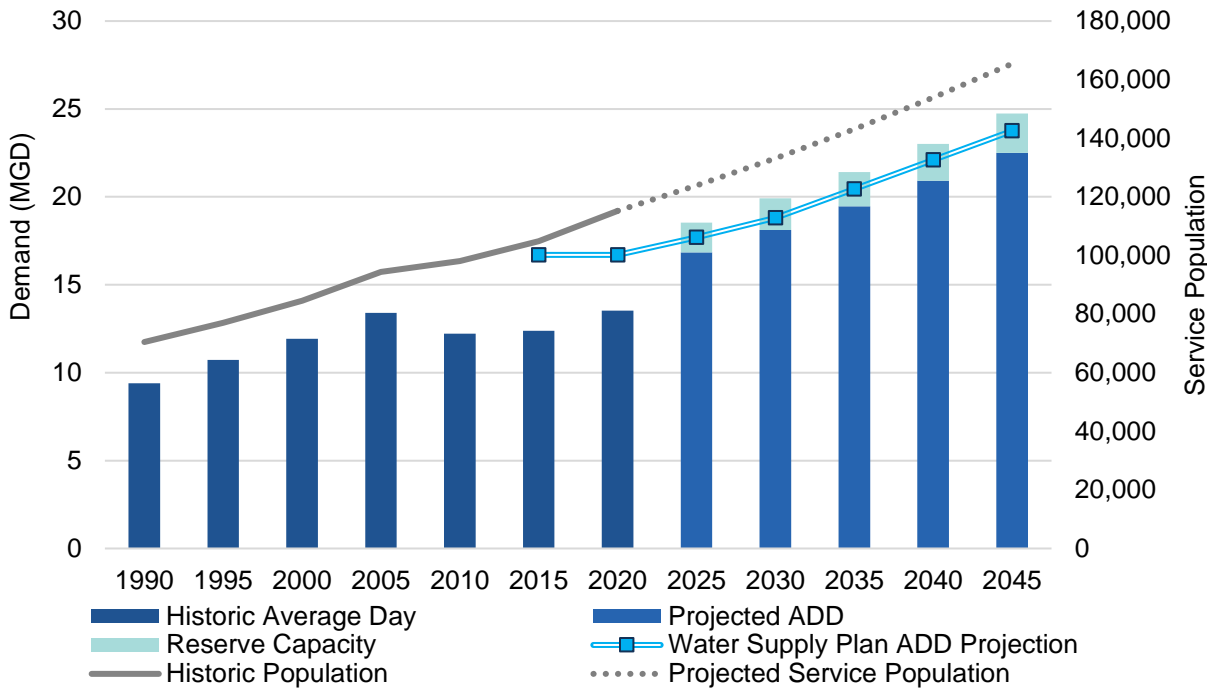


Figure 4.3: Historical and Projected Average Day Demand

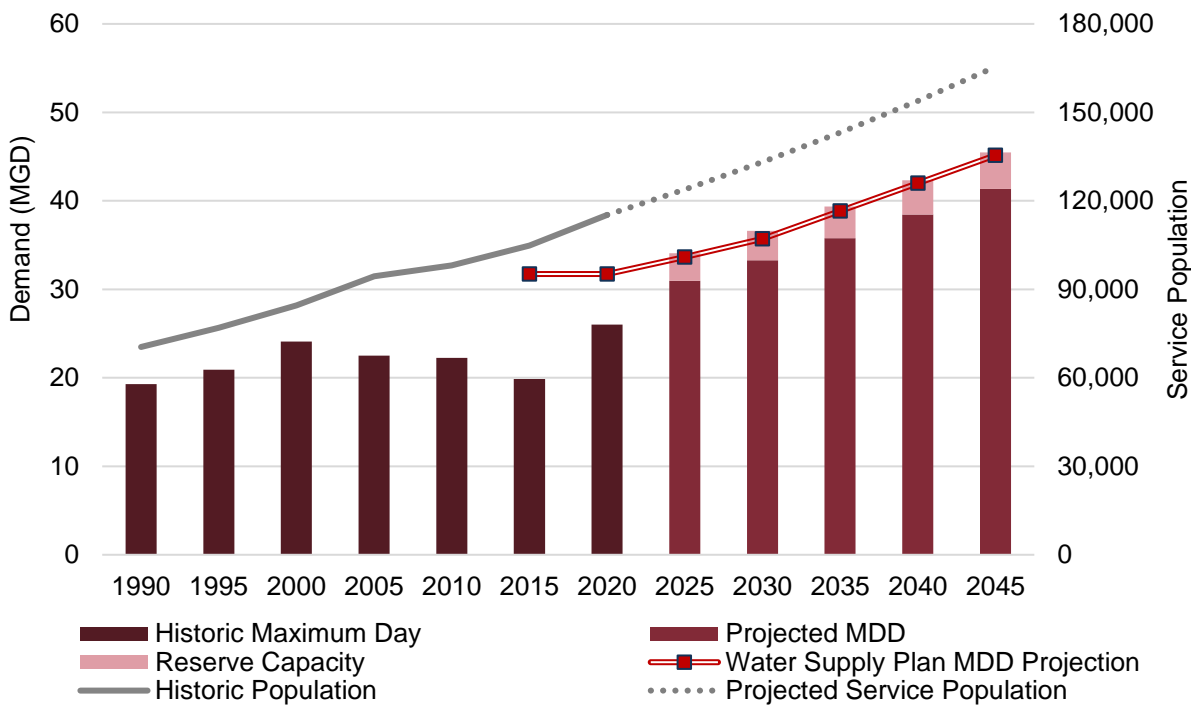


Figure 4.4: Historical and Projected Maximum Day Demand

5.0 Water Quality

Garver reviewed the following historical water quality data provided by NUA and downloaded from the Oklahoma Drinking Water Watch database to gain a better understanding of the current system and identify current system challenges:

- Disinfectant Residual
- Bacteriological
- Nitrite
- Disinfection Byproducts (DBPs)
- Lead and Copper

5.1 Disinfectant Residual

Disinfectant residuals serve as a surrogate for the potential for or presence of microbial activity. Disinfectant residuals are measured as total chlorine in chloraminated systems and are typically lowest in areas with high water age or with sediment, corrosion products, biofilm, or other sources of disinfectant demand, or where undisinfected groundwater enters the distribution system. Figure 5.1 summarizes disinfectant residual data provided by NUA from the regulatory compliance sampling conducted from 2021 to 2023. Average total chlorine residuals for the entire system, denoted by “x” symbols, ranged from 1.1 to 2.9 milligrams per liter (mg/L).

Oklahoma Department of Environmental Quality (ODEQ) regulations require a minimum total chlorine residual of 1.0 mg/L throughout the water distribution system. The regulatory minimum total chlorine residual is shown as a dashed red line on Figure 5.1. Several total chlorine residual samples, denoted by “o” symbols, were below 1.0 mg/L in the data provided. Finished water leaving the Vernon Campbell Water Treatment Plant typically has a total chlorine residual of at least 3.0 mg/L. However, undisinfected groundwater is pumped directly into the distribution system at multiple well sites, which is likely contributing to low total chlorine residuals at some locations. A new centralized groundwater blending and disinfection facility that will address this issue is currently in the design phase. Because nitrification can also contribute to low disinfectant residuals, the total chlorine residuals will be evaluated in comparison to hydraulic model results (source trace) as part of the upcoming Distribution System Hydraulic Model Update Technical Memorandum to identify any low residuals unlikely to have been associated with groundwater.

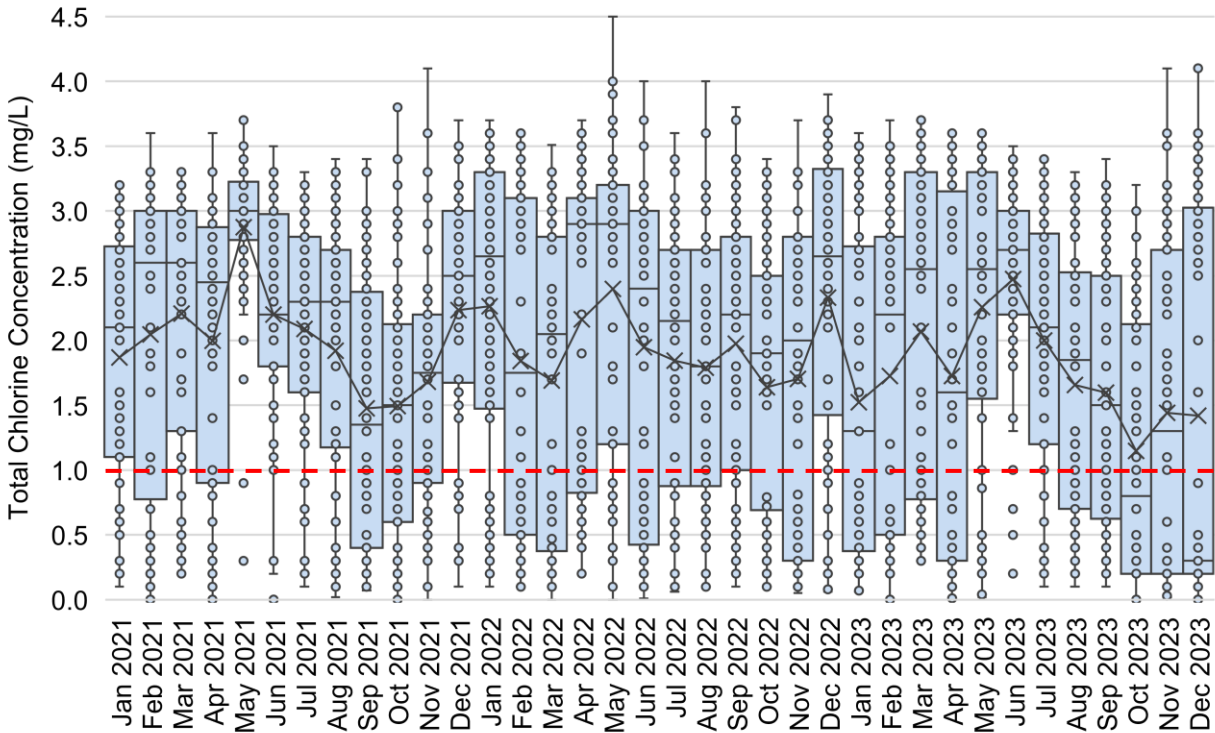


Figure 5.1: Total Chlorine Residual Box Plots by Month for 2021–2023

5.2 Total Coliform and *E. coli*

The Revised Total Coliform Rule (RTCR) requires monitoring of total coliform and *E. coli* according to a sample siting plan and schedule specific to each water system. According to the Oklahoma Drinking Water Watch database, NUA is currently required to sample 100 sites per month. A Level 1 Assessment to find sanitary defects is triggered when 5% of routine/repeat samples in the same month are total coliform-positive.

Bacteriological sample results were obtained from the Oklahoma Drinking Water Watch database for 2020 through 2023. According to these sample results, 5% of the samples during the months of October 2023 and May 2022 were total coliform-positive. No samples from 2020 through 2023 tested positive for *E. coli*.

5.3 Nitrification

Nitrification is the microbial process by which ammonia is oxidized to nitrite and nitrate. It occurs in chloraminated systems due to the presence of free ammonia from the decay of chloramines, excess ammonia addition during the formation of chloramines, or possibly from source water. Nitrification typically begins in areas with low disinfectant residuals and can lead to additional disinfectant residual loss, excessive microbial activity, and a drop in pH which can lead to corrosion. Nitrification is typically identified based on total chlorine, monochloramine, free ammonia, nitrite, and nitrate measurements.

NUA currently collects two samples daily to monitor nitrite in the water distribution system, rotating through 14 different sampling locations throughout the system. Figure 5.2 summarizes nitrite data provided by NUA for 2021 to 2023. Average nitrite for the entire system, denoted by “x” symbols, increased during the last summer months of each year, reaching as high as 0.3 mg/L-N in 2021. The locations with high nitrite concentrations will be evaluated in comparison to hydraulic model results as part of the upcoming Distribution System Hydraulic Model Update Technical Memorandum.

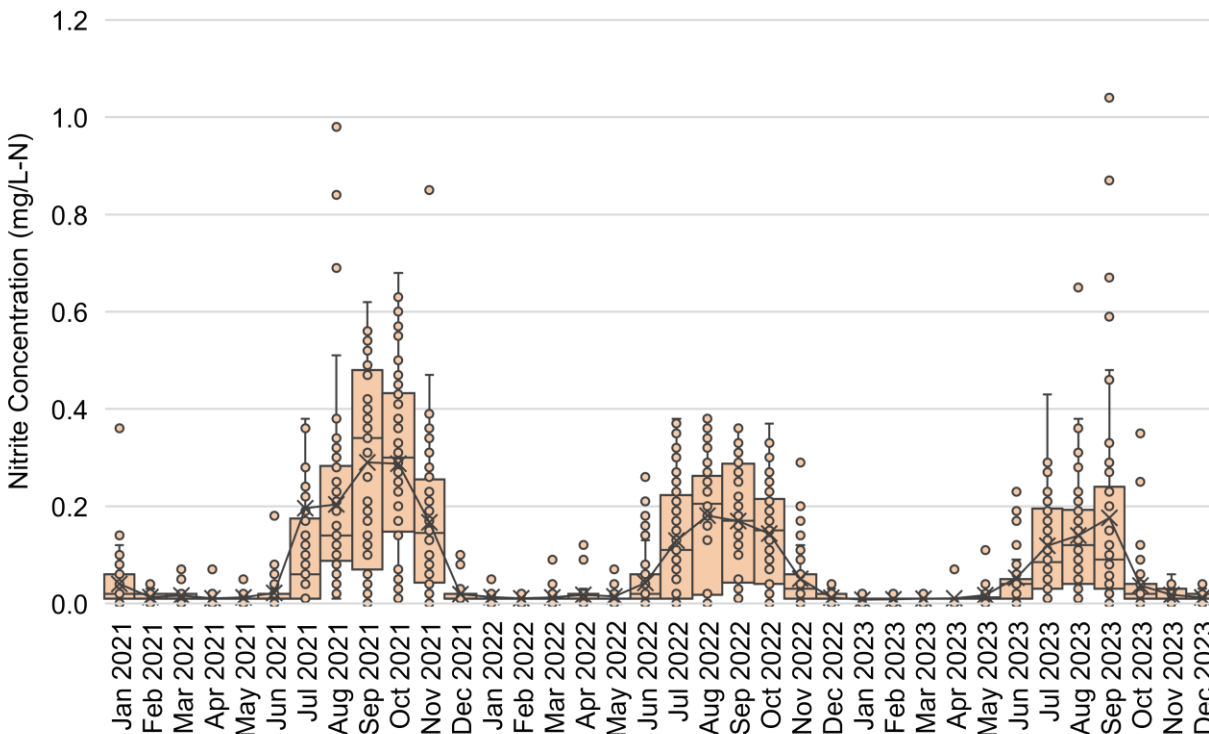


Figure 5.2: Nitrite Box Plots by Month for 2021–2023

5.4 Disinfection Byproducts

Disinfection byproducts (DBPs) can form when a disinfectant reacts with natural organic matter (NOM). Some DBPs are associated with negative impacts on human health and have maximum contaminant levels (MCLs) based on locational running annual averages (LRAAs) under the Stage 2 Disinfectants/DBP Rule. Two groups of regulated DBPs are measured in NUA's distribution system:

- Haloacetic acid (HAA5), with an MCL of 60 micrograms per liter (µg/L)
- Total trihalomethanes (TTHM), with an MCL of 80 µg/L

NUA provided quarterly sampling results for HAA5 and TTHM at four sampling locations for 2021 through 2023. All individual HAA5 and TTHM samples were below 60 µg/L and 80 µg/L, respectively. The maximum HAA5 and TTHM detected concentrations for 2023 were 10.1 µg/L and 14.9 µg/L, respectively.



5.5 Lead and Copper

Lead and copper typically enter drinking water via release from service line and premise plumbing materials. Lead is associated with negative human health outcomes even at low levels. Copper is primarily associated with aesthetic complaints but could have health impacts at high levels.

The Lead and Copper Rule (LCR) sets action levels for copper and lead at 1.3 milligrams per liter (mg/L) and 0.015 mg/L, respectively, based on the 90th percentile tap sample collected during each monitoring period. If the 90th percentile sample exceeds an action level, the water system must take steps to reduce lead or copper release, such as service line replacement or optimization of corrosion control treatment.

NUA provided lead and copper sample results from tap sampling in the distribution system from 2010 to 2023. Table 5.1. summarizes lead and copper data for 2010–2023. The 90th percentile samples for both copper and lead are well below their action levels. No individual samples have been above the copper action level since at least 2010 and only one sample has been above the lead action level since 2010.

The proposed Lead and Copper Rule Improvements (LCRI), which is expected to be finalized in 2024 and have a compliance date in 2027, will require water systems to revise their sampling sites to preferentially sample from sites with known lead service lines or lead premise plumbing. At present, NUA collects lead and copper samples that are known or expected to have lead service lines or lead premise plumbing. NUA will need to confirm the service line and/or premise plumbing materials at sites that are currently only expected to have lead.

The LCRI also will require water systems to revise their sampling sites to preferentially sample from sites with known lead service lines or lead premise plumbing. At present, NUA collects lead and copper samples that are known or expected to have lead service lines or lead premise plumbing. NUA will need to confirm the service line and/or premise plumbing materials at sites that are currently only expected to have lead. Should new sites be needed, it is possible that the measured lead levels will increase.

Table 5.1: 90th Percentile Lead and Copper Concentrations for 2010–2023

Monitoring Period	Copper			Lead	
	90 th Percentile Concentration (mg/L)	Number of Samples Exceeding 1.3 mg/L Action Level	90 th Percentile Concentration (mg/L)	Number of Samples Exceeding 0.015 mg/L Current Action Level	Number of Samples Exceeding 0.010 mg/L Future Action Level
07/01/2010 - 12/31/2010	0.0259	0	0	1	1
01/01/2011 - 06/30/2011	0.0224	0	0	0	0
01/01/2012 - 06/30/2012	0.0167	0	0	0	0
07/01/2012 - 12/31/2012	0.0144	0	0	0	0
01/01/2013 - 12/31/2013	0.0922	0	0.000634	0	0
01/01/2018 - 12/31/2018	0.078	0	0	0	0
01/01/2019 - 12/31/2019	0.07	0	0	0	0
01/01/2020 - 06/30/2020	0.109	0	0	0	1
07/01/2020 - 12/31/2020	0.086	0	0	0	0
01/01/2021 - 12/31/2021	0.066	0	0	0	0
01/01/2022 - 12/31/2022	0.177	0	0.000365	0	0
01/01/2023 - 12/31/2023	0.155	0	0.00072	0	0

6.0 Water System Evaluation Criteria

Design criteria and regulatory requirements from a variety of sources were assembled to develop the evaluation criteria for analysis of the distribution system. Specifically, documents from the following sources were reviewed:

- Oklahoma Department of Environmental Quality (ODEQ)
- International Fire Code (IFC)

- City of Norman 2023 Engineering Design Criteria and Standard Specifications (Norman EDC)
- American Water Works Association (AWWA) Manuals

Table 6.1 summarizes the evaluation criteria that will be used to evaluate the water system's performance and identify potential capital improvement projects.

Table 6.1: Water System Evaluation Criteria

Criteria	Limiting Source	Description
Supply	ODEQ	ODEQ requires documentation demonstrating an adequate quantity of water will be available and that water will meet or exceed current drinking water standards.
Water Lines	Norman EDC	All water lines along section lines and arterial streets must be at least 12-inch diameter. All water lines along half-section lines and all collector streets should be a minimum of 8-inch diameter. All other lines shall be minimum 6-inch diameter
Pumping	ODEQ	All pumping stations shall have a minimum of two pumping units. With any pump out of service the remaining pump(s) shall be capable of providing the maximum pumping demand of the system.
Storage	ODEQ	System must be able to maintain sufficient storage capacity to meet domestic demands and fire flow demands over a 24-hour period while maintaining 25 psi throughout distribution system.
Minimum Pressure	ODEQ	A minimum pressure of 25 pounds per square inch (psi) shall be maintained, including during fire flow events. .
	NUA target level of service (2018 Modeling Update Report)	A minimum pressure of 40 pounds per square inch shall be maintained if possible.
Fire Flow	IFC	The City enforces the International Fire Code (IFC), 2018 edition. A system-wide minimum pressure criteria of 25 psi is used to determine available fire flow.
	NUA target level of service (2018 Modeling Update Report)	A minimum available fire flow of 1,500 gpm at 25 psi residual pressure, if possible.
Maximum Flow Velocity	AWWA (guideline)	Water distribution lines should not experience a maximum flow velocity of 6 ft/s. (Note: Guideline is not a regulatory requirement and will be used to identify water lines for potential replacement)
Maximum Head Loss Gradient	AWWA (guideline)	The maximum head loss gradient for smaller pipes (diameter < 16 inches) should not exceed 7 ft/1,000 ft. The maximum head loss gradient for larger pipes (diameter ≥ 16 inches) should not exceed 3 ft/1,000 ft. (Note: Guideline is not a regulatory requirement and will be used to identify water lines for potential replacement)

7.0 Future Work

The City's population projections and future land use plan are being developed in parallel with the baseline development for the water system. Once the future land use plan is finalized, Garver will update the water baseline development presented in this TM and move forward with the following future water system evaluations:

- Distribution System Hydraulic Model Update
- Hydraulic Model Evaluation
- Water Supply Plan Review
- Capital Improvement Program

Each evaluation will be documented in an upcoming TM that will be incorporated in the Water Master Plan Report.

AIM NORMAN

Area & Infrastructure Master Plan

Wastewater Utility

Baseline Development Technical Memorandum

City of Norman
Norman, Oklahoma



Prepared by:



In Partnership with:



DRAFT
April 2024

Garver Project No.: 22W02320
Norman Project No.: WW0179



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List of Acronyms

ADF	average daily flows
ADWF	average dry weather flows
AIM Norman	Area & Infrastructure Master Plan
CIP	Capital Improvement Plan
City	City of Norman
DMR	discharge monitoring reports
GARR	gauge-adjusted radar rainfall
gpcd	gallons per capita per day
IPR	indirect potable reuse
MGD	million gallons per day
MOR	monthly operating reports
NOAA	National Oceanic and Atmospheric Administration
NUA	Norman Utilities Authority
OAC	Oklahoma Administrative Code
ODEQ	Oklahoma Department of Environmental Quality
OPDES	Oklahoma Pollutant Discharge Elimination System
OU	University of Oklahoma
RDII	rainfall-derived infiltration and inflow
SFE	single-family equivalent
TM	technical memorandum
WEF	Water Environment Federation
WRF	Water Reclamation Facility
WWSA	wastewater service area

1.0 Introduction

The City of Norman (City) and the Norman Utilities Authority (NUA) are developing an Area & Infrastructure Master Plan (AIM Norman) that will cover a wide spectrum of city planning aspects including land use, transportation, stormwater management, water infrastructure, wastewater infrastructure, parks, and housing. The AIM Norman effort includes updates to related master plans for the City's infrastructure including transportation, stormwater, water, and wastewater. This technical memorandum (TM) is the first in a series of TMs that will be incorporated into the Wastewater Master Plan Report. The purpose of this TM is to establish a baseline for upcoming wastewater system evaluations that will be used to identify future capital improvements. This TM will cover the following:

- Summary of previous wastewater planning documents
- Analysis of recent wastewater collection system flow monitoring data
- Analysis of historical wastewater flows
- Projections of future wastewater flows

1.1 Wastewater System Overview

The NUA wastewater system serves the urban area within the city limits. The wastewater system includes two primary components:

- Wastewater Collection System – The gravity sewers, lift stations, and force mains that collect sewage from each customer and convey it to the treatment facility.
- Water Reclamation Facility (WRF) – The treatment facility that treats sewage received from the collection system and returns highly-treated water to the Canadian River.

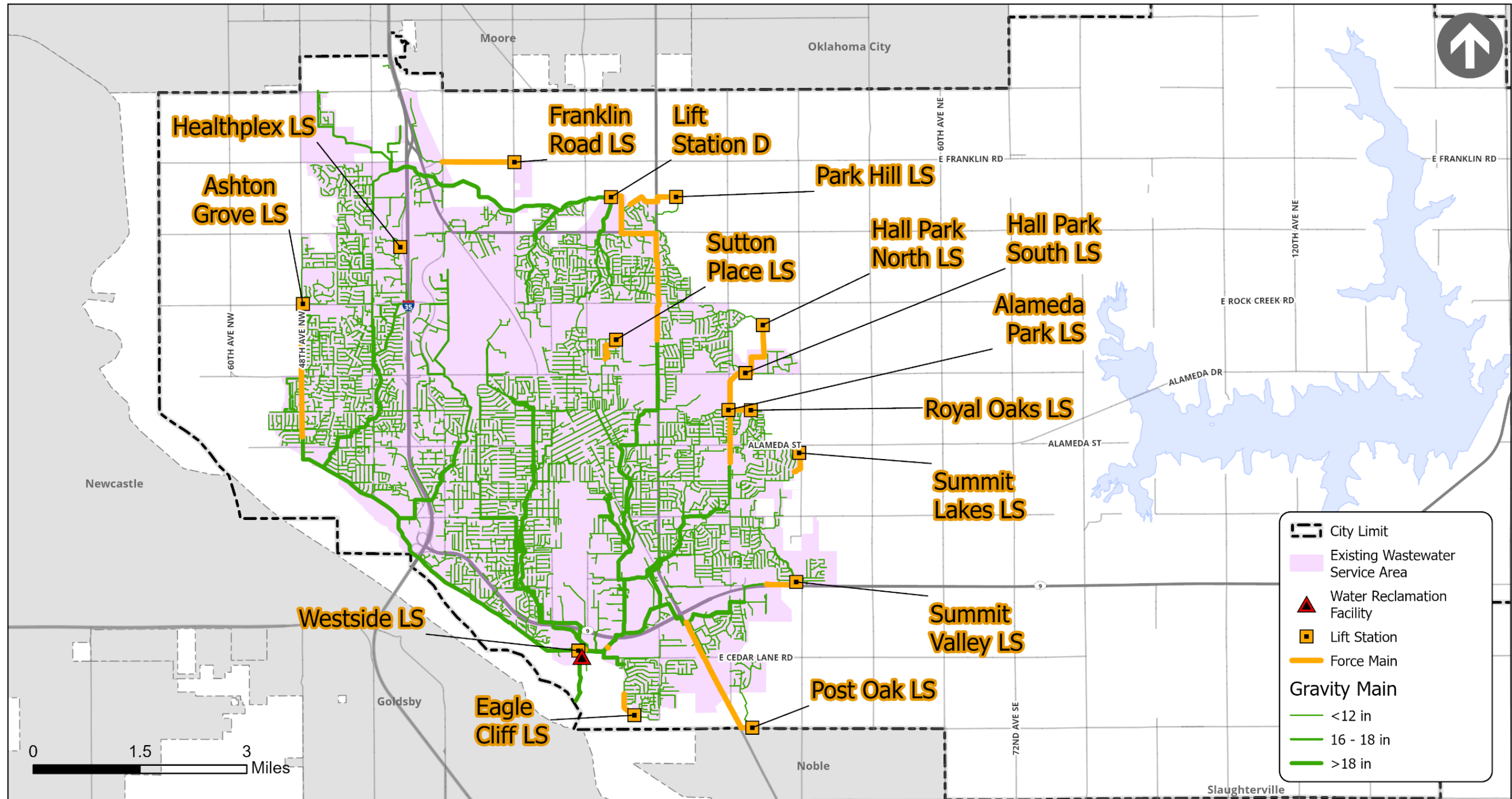
NUA's current wastewater service area (WWSA) extends from 48th Avenue West to 36th Avenue East as shown below in Map 1.1.

1.2 Operations and Management

The NUA is a public trust that oversees policy and financial authorizations as they relate to City-managed utilities. The elected mayor and City Council members also serve as the Board of Trustees for NUA. Three of the Norman Utilities Department Divisions administer and operate the water utility: Administration & Engineering, Water Treatment, and Line Maintenance. The Utilities Department has adopted the following Mission Statement:

Providing environmentally sound, efficient utility service to our customers in a professional, safe manner at sustainable rates through six divisions.

Map 1.1: Wastewater System Overview Map





1.3 Related Documents

Table 1.1 summarizes the previous work by others that used in this baseline development. The reference names listed in the table are used throughout this report to refer to each document.

Table 1.1: Related Documents

Document	Author/Agency	Date	Reference Name
Wastewater Systems Master Plan	CDM Smith	2001	2001 WWMP
WRF Phase II Improvements Engineering Report	Garver, Carollo	2011	WRF Phase 2 ER
Wastewater Flow Monitoring & Modeling Report	HDR	2013	2013 WW Modeling Report
Wastewater Flow Monitoring & Modeling Report	HDR	2018	2018 WW Modeling Report
North Water Reclamation Facility Engineering Report	HDR	2018	2018 North WRF ER
AIM Norman Area & Infrastructure Master Plan - Norman Today	RDG	2024	Norman Today

1.4 Historical Data Collection

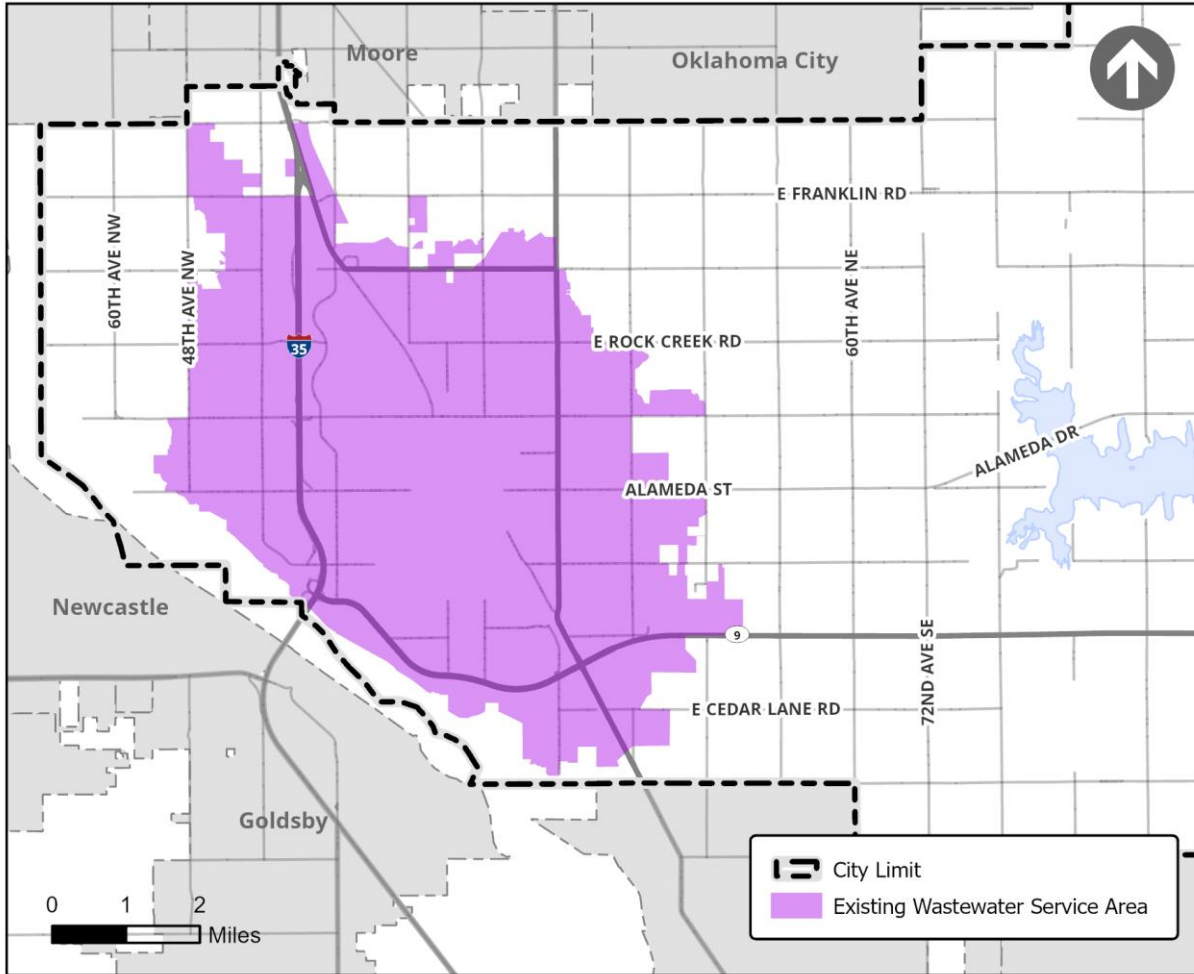
The following data was provided by NUA for use in the creation of this baseline development:

- WRF monthly operating reports (MOR) (2015–January 2024)
- Discharge monitoring reports (DMR) (2021–2023)
- GIS files with wastewater infrastructure information
- Rain and flow metering data from April 2023 to August 2023

2.0 Wastewater Service Area

The existing NUA wastewater collection system serves the urban portion of the area within the city limits. Slightly less than 90% of the City's population resides within the WWSA. Residents outside the WWSA boundary are served by private septic systems. The WWSA is illustrated in Map 2.1. The current boundary extends from 48th Avenue West to 36th Avenue East as shown below. Future WWSA expansion will be based on future urban expansion related to future land use and will be discussed further in the *Norman Tomorrow: Vision & Future Land Use* report.

Map 2.1: Wastewater Service Area Overview



2.1 Land Use

Existing land use for the purpose of this report was derived from the Norman Today report and was used to predict future development loading rates based on land use classification and historical billing data. Future land use is being developed as part of the *Norman Tomorrow: Vision & Future Land Use* report and will be discussed in a future TM.

3.0 Historical Population and Wastewater Flow

3.1 Historical Wastewater Service Population

Historically, the water service population has been approximately 88% of the City's total population. As discussed in the *Water Utility Baseline Development Technical Memorandum*, previous population projections have been



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based on the assumption that the NUA service population will be about 90% of the City's total population by 2025. Based on recent GIS data, approximately 450 properties with water connections do not have connections to the City's wastewater collection system. The majority of these properties are residential. Assuming an average of 2.3 persons per household per the 2020 US Census, the wastewater system currently serves approximately 1,000 fewer people than the water system, which is equivalent to nearly 1% less of the City's total population. For the purposes of this analysis, Garver will use a historical wastewater service population of 87% of the City's total population, which will be assumed to increase to 89% of the City's total population by 2025. The historical estimated WWSA service population is summarized in Table 3.1.

Table 3.1: Historical Wastewater Service Population Estimates

Year	Service Population	Percent of Total City Population
2015	104,042	87%
2016	105,426	87%
2017	106,810	87%
2018	108,194	87%
2019	109,579	87%
2020	111,383	87%
2021	111,444	87%
2022	112,775	87%

3.2 Historical Water Reclamation Facility Flows

Figure 3.1 illustrates the historical influent flow to the Norman WRF spanning from January 2015 to January 2024. The figure includes daily data points along with lines representing the annual and monthly averages. Rolling averages are taken on a 30-day (monthly) and a 365-day (annual) basis for the influent flow data. Peaking factors are calculated according to the equation below. Here, the monthly average influent flow is divided by the annual average influent flow at a specific date to calculate the peaking factor. A peaking factor represents a peak month condition when the facility receives maximum flow and potentially maximum contaminant loadings over the course of a consecutive 30-day period. The identified peaking factor(s) can be utilized in establishing the proper maximum month conditions when the facility receives maximum levels of loadings over a month.

$$\text{Peaking Factor (Date)} = \frac{\text{30-day Average Flow (Date)}}{\text{365-day Average Flow (Date)}}$$

Figure 3.2 shows the historical minimum monthly average and the annual average influent flows to the WRF by year for 2015–2023. The minimum monthly flows during dry-weather periods gradually increased over this period, while the annual average has fluctuated due to the variability in storm events.

The data from 2015 indicates a period of elevated flows, with daily rates reaching up to 36 million gallons per day (MGD). However, the subsequent timeframe demonstrates a more consistent flow pattern. May 2015 experienced record rainfall (23.4-inches), leading to exceptionally high flows. While the methodology employed does not allow for an exact calculation of the mid-2015 annual average flow, it is estimated that the peak flow observed in 2015 had a peaking factor of nearly 2. This peak significantly exceeds the peaking factors recorded in subsequent years

and surpasses the typical peaking factors for a municipal treatment facility of comparable size. Figure 3.3 summarizes the historical rainfall from 2002 to 2024 and showcases the level of intensity of the May 2015 rainfall relative to other years.

Between 2016 and January 2024, monthly average peaks fluctuated within an estimated range of 13.0 to 16.6 MGD. Although there has been a slight increase in the annual average flow since 2018, it has remained relatively stable, hovering around 11 to 12 MGD. A peaking factor of 1.4 is recommended to be used for treatment capacity planning purposes within this project. It must be noted that the assessment of the treatment capacity requirement at the existing and potential future Norman WRF(s) will also be considering maximum month contaminant loadings which will be documented in the upcoming Treatment and Reuse TM.

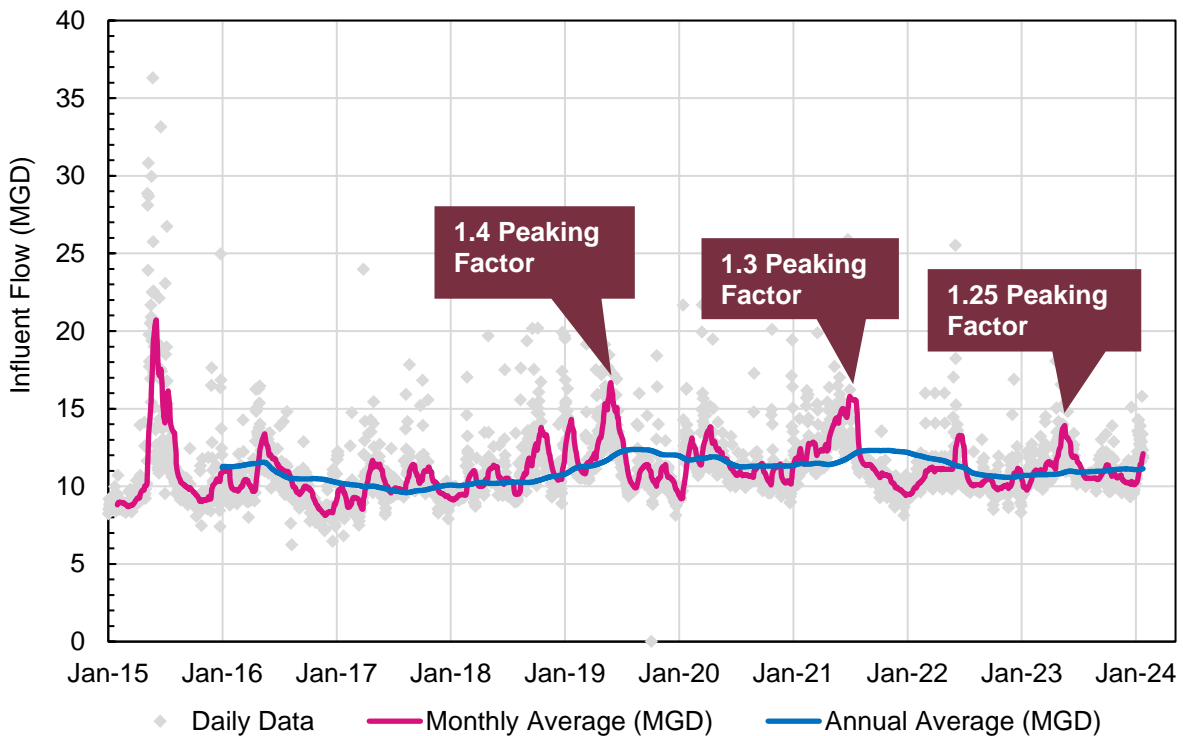


Figure 3.1: Historical Influent Flows to WRF for January 2015 to January 2024

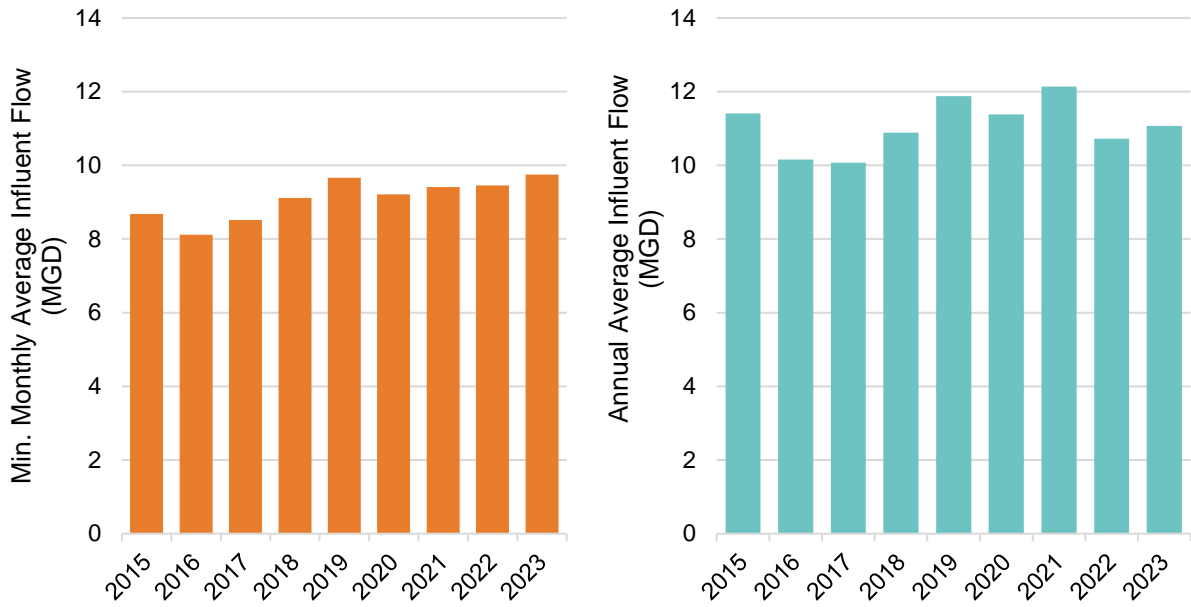


Figure 3.2: Historical Minimum Monthly Average (left) and Annual Average (right) Influent Flows to WRF by year for 2015–2023

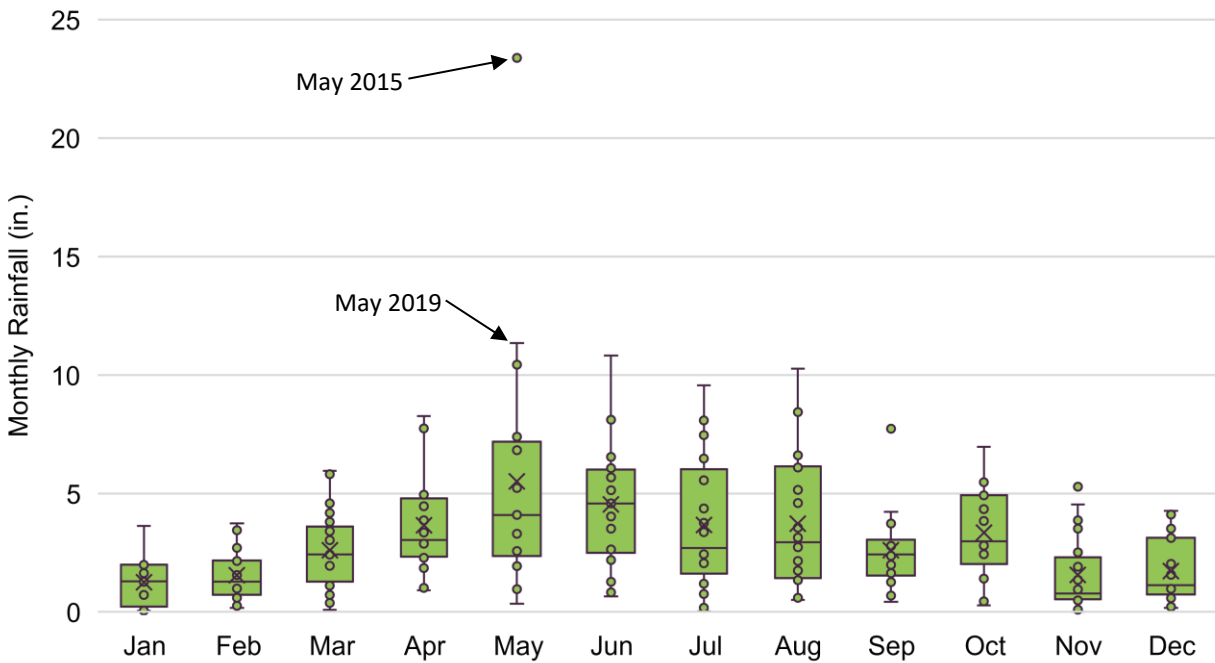


Figure 3.3: Historical Monthly Rainfall July 2002 to February 2024



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3.3 Per Capita Wastewater Flows

Garver evaluated per capita average daily flows (ADF) using historical service population data and annual average WRF flows. Table 3.2 summarizes the historical ADF per capita. A value of 100 gallons per capita per day (gpcd) will be used to project future flows based on population projections. This value is slightly higher than recent ADF per capita and aligns with the Oklahoma Department of Environmental Quality (ODEQ) ADF design requirement of 100 gpcd.

Table 3.2: Historic ADF Per Capita

Year	Service Population	ADF (MGD)	ADF Per Capita (gpcd)
2015	104,042	11.20	94
2016	105,426	10.16	84
2017	106,810	10.08	82
2018	108,194	10.88	88
2019	109,579	11.88	94
2020	111,383	11.38	89
2021	111,444	12.16	95
2022	112,775	10.72	83

3.4 Single-Family Equivalents

A single-family equivalent (SFE) value was determined using historical billed water consumption data provided by NUA. SFE values are used to compare water system demands for other customer classes and the system overall to the flows for a typical single-family detached dwelling. Single family residential flows are often used as the benchmark for flow planning because they tend to represent the majority of system flows, and remain more stable over time compared to other benchmarks. Multi-family, industrial, and commercial flows tend to vary significantly, and changes in these types of flows over time can cause variability in a collection system's per capita flows. Once the SFE value is determined, it can be used to express the system capacity as the number of single-family customer connections the collection system can serve currently or in the future.

Garver used historical consumption data to determine the SFE value for the wastewater collection system. The 2022 single-family water demand was determined using the total consumption from November to February for all meters classified as single-family with a diameter of 1-inch or less. The total demand was then divided by the total number of single-family meters within the system. Historically, the winter water demands have been approximately equal to the wastewater ADF. A summary of the data used to determine the SFE value is presented in Table 3.3.



Table 3.3: Single-Family Equivalent Projection

Total Single-Family Winter Water Demand		Number of Meters	ADF SFE Value (gpd/SFE)
(MG)	(MGD)		
828.1	6.9	33,641	205

3.5 Wastewater Flows by Land Use

Garver used historical water consumption data from November 2022 to February 2023 and GIS data to determine historical land use loading rates. A GIS analysis was completed to determine the lot size and the existing land use associated with each geolocated meter by extracting data for the nearest parcel. Table 3.4 summarizes the loading rate by land use category. The projected loading rate values will be used to determine future wastewater flows for new developments, which will be discussed in more detail in the upcoming Collection System Modeling and Evaluation TM. For single-family residential developments, the residential area will be assumed to be about 80% of the total development area for high-density developments and 70% for low-density developments to account for the area of streets, detention ponds, and other open spaces. The actual development area will be used to determine loading rates for the new developments.

Table 3.4: Historical Loading Rates by Customer Class

Customer Class	Customer Sub Class	Winter Water Demand (MG)	Total Area (acre)	Historical Loading Rate (gpd/acre)	Projected Loading Rate (gpd/acre)
Residential	Residential - Multi-Family	2,155	700	2,567	2,600
	Residential - Single Family Attached	621	311	1,664	1,700
	Residential - Single Family Detached	7,576	7,575	833	See Table 3.5
Industrial	Light Industrial	270	293	768	800
	Heavy Industrial	117	94	1,035	1,100
Commercial	Commercial	1,622	1,745	775	800
	Office	870	403	1,802	1,800

Residential users make up a large percentage of users with a majority of residential users being classified as single family detached. Due to the large percentage of single family detached users, further analysis was completed to determine the varied flows based on lot size. An analysis was completed to determine the correlation between lot size and flows to better predict future loading rates for new subdivision developments. Table 3.5 and Figure 3.4 summarize the differences in flows related to differing lot sizes.

Table 3.5: Single Family Detached Historical and Projected Loading Rates by Lot Size

Lot Size (acre)	Winter Water Demand (MG)	Total Area (acre)	Historical Loading (gpd/acre)	Projected Loading Rate (gpd/acre)	Historical Loading (gpd/connection)
<0.14	560	358	1,304	1,300	146
0.15 - 0.25	4,301	3,557	1,008	1,000	173
0.26 - 0.50	2,114	1,925	915	900	243
0.51 - 1.00	331	366	754	800	371
>1.00	270	1,041	216	250	379

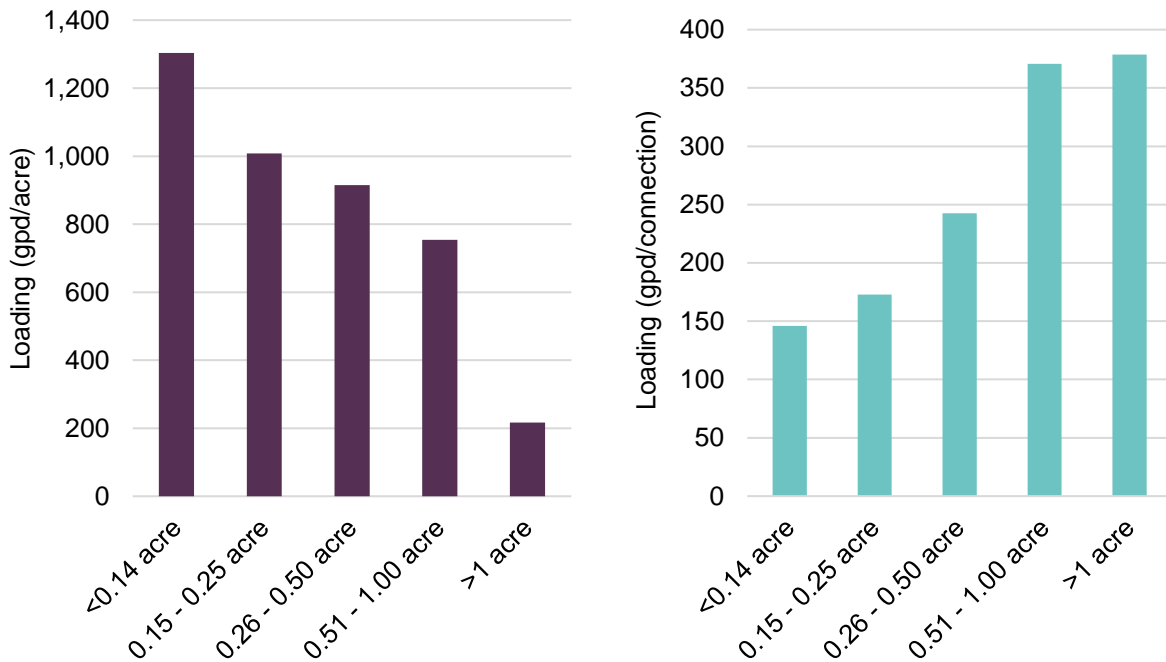
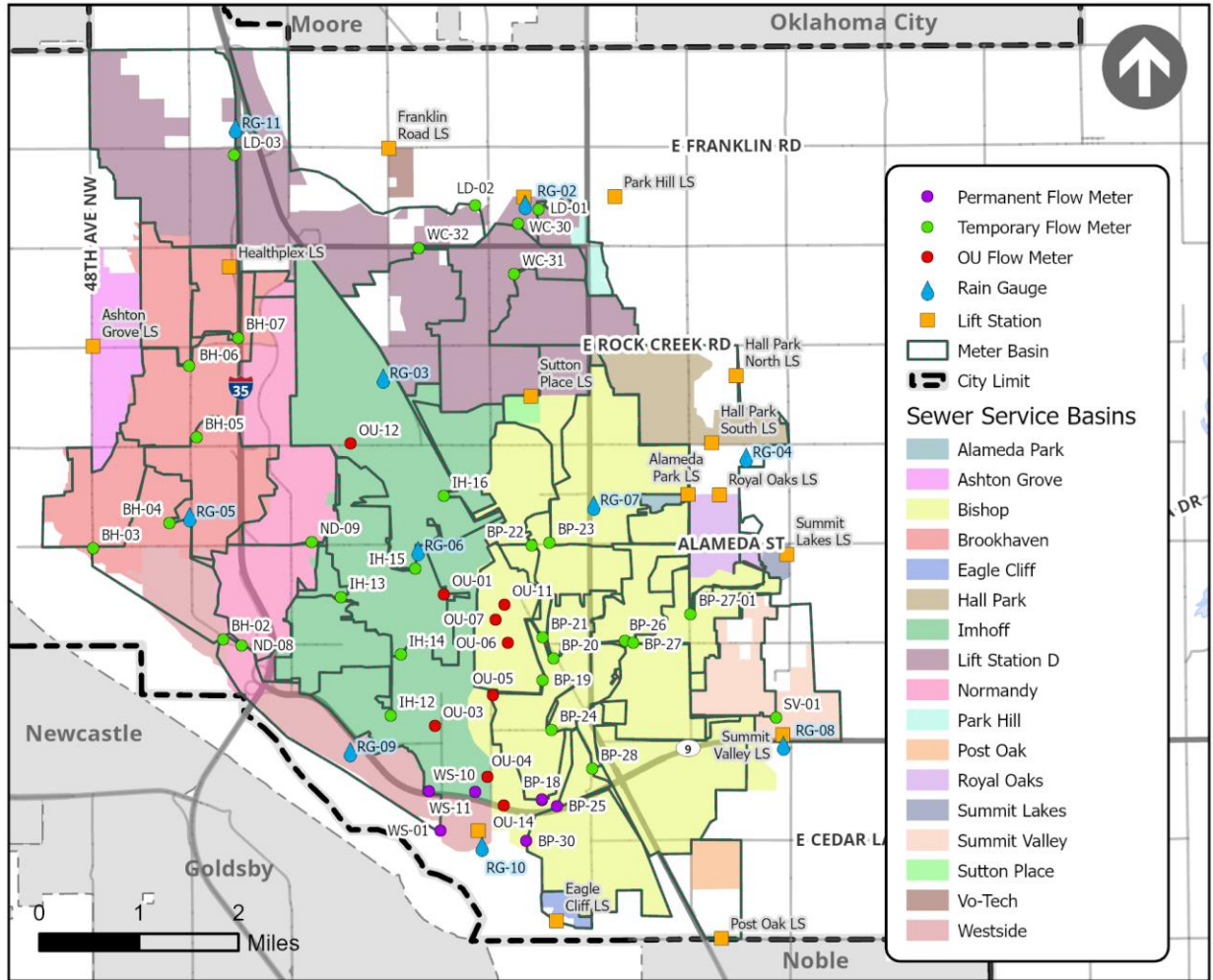


Figure 3.4: Historical Single Family Detached Loading Rates by Lot Size

4.0 Flow Metering Data Analysis

Flow meter data was collected to assess existing dry- and wet-weather flows in the collection system. Thirty-one temporary flow meters and ten temporary rain gauges were installed throughout the collection system. Temporary flow metering data was supplemented by six permanent flow meters that are installed just upstream of the WRF. A map of the flow metering basins is shown in Map 4.1. Flow metering and rainfall data were collected on 5- to 15-minute increments between April 20, 2023 and August 1, 2023. Site sheets showing detailed location and hydraulic information for the flow meter and rain gauge sites are provided in Appendix A. The flow monitoring hydrographs are included in Appendix B.

Map 4.1: Flow Monitoring Basin Map



Note: The OU flow meters included in the above figure were not used for the purpose of the flow metering data analysis.

Flow meter analysis involved determination of average dry-weather flows (ADWF) and diurnal patterns, as well as rainfall-derived infiltration and inflow (RDII) during wet-weather events. Figure 4.1 shows a schematic of the flow network of all the metered basins.

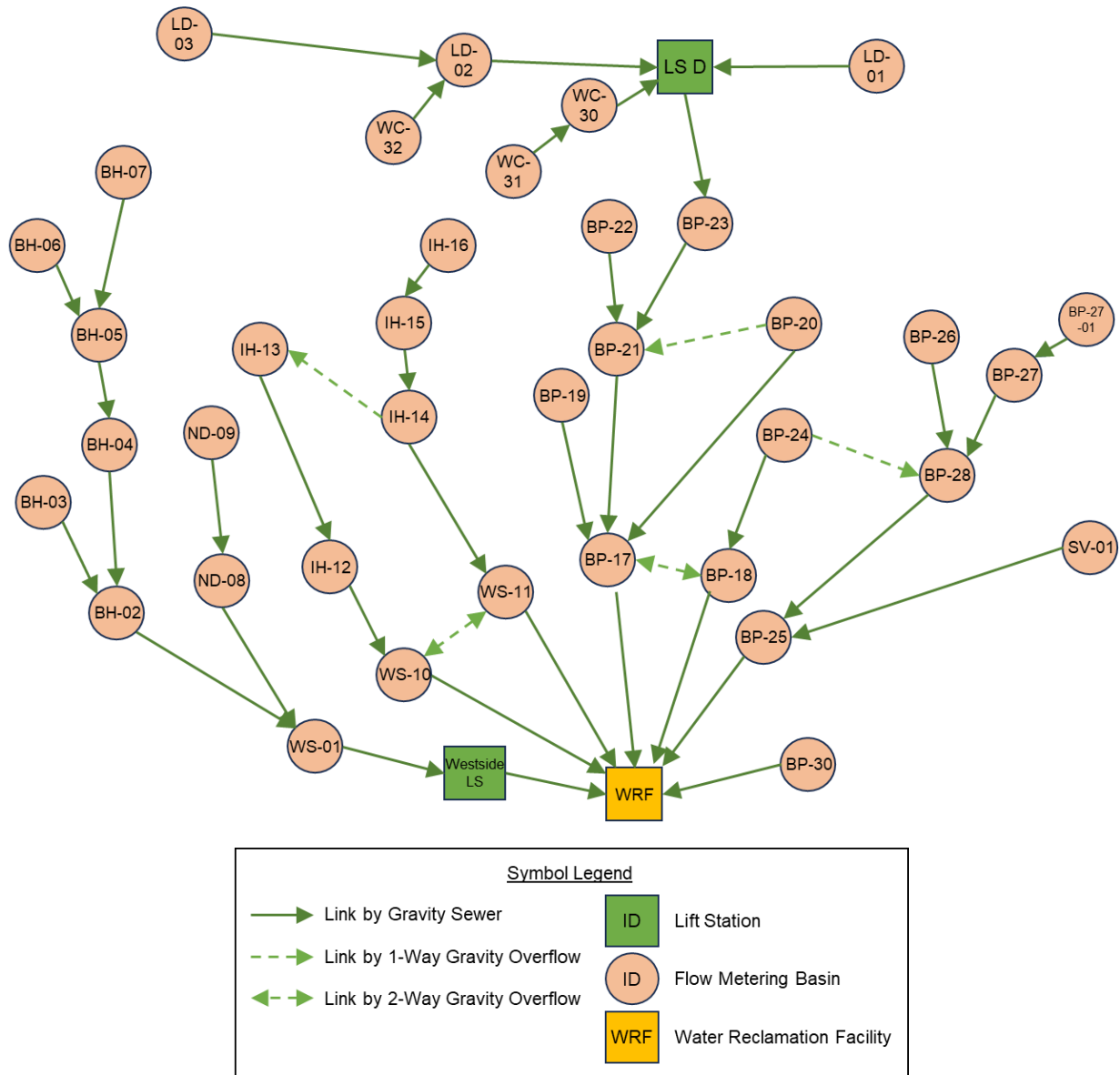


Figure 4.1: Flow Meter Schematic

Dry-weather flow days were used for calculation of ADWF and diurnal patterns. A dry-weather flow day was considered to be any day in the flow metering period that had five or more days without rainfall preceding it.

Depending on the rain gauge associated with the metered basin, as many as 18 to 30 dry-weather days were used to determine dry-weather flow conditions. Table 4.1 shows the ADWF and the dry-weather flow peaking factor for each basin. The values shown are for the total metered flow at each flow meter, without upstream flows subtracted out. The dry-weather flow peaking factor is the ratio of the peak hour dry-weather flow to the ADWF. The dry-weather flow peaking factors range from 1.16 to 1.5, and the average dry-weather peaking factor is 1.29 as shown in Figure 4.2.

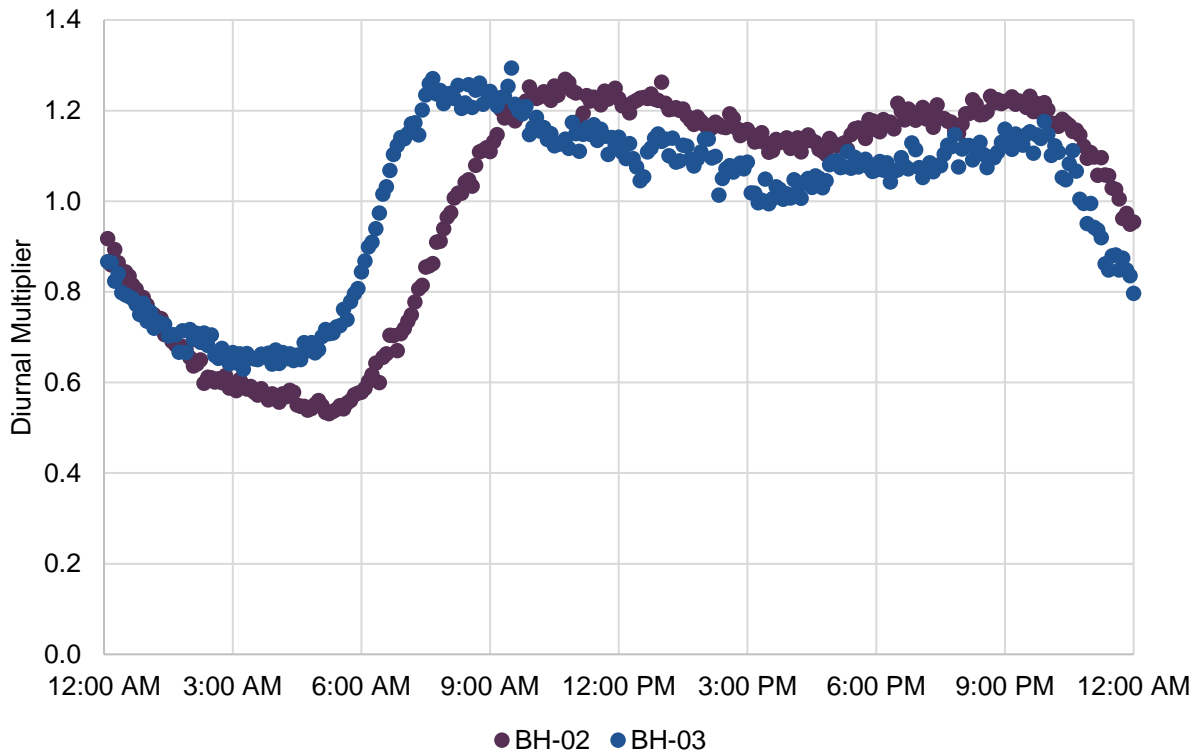


Figure 4.2: Example Dry-Weather Diurnal Patterns



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Table 4.1: Dry-Weather Flows

Flow Meter	Average Dry-Weather Flow (MGD)	Peak Hour Dry-Weather Flow (MGD)	Dry-Weather Flow Peaking Factor
BH-02	1.85	2.37	1.28
BH-03	0.39	0.51	1.30
BH-04	1.39	1.72	1.24
BH-05	0.81	1.06	1.32
BH-06	0.23	0.30	1.29
BH-07	0.19	0.27	1.45
BP-17	3.47	4.01	1.16
BP-18	0.41	0.49	1.20
BP-19	0.55	0.66	1.20
BP-20	0.16	0.21	1.32
BP-21	2.70	3.28	1.21
BP-22	0.34	0.42	1.22
BP-23	2.45	2.92	1.19
BP-24	0.30	0.39	1.32
BP-25	2.09	2.62	1.25
BP-26	0.62	0.80	1.28
BP-27	0.57	0.76	1.33
BP-27-01	0.46	0.69	1.50
BP-28	0.69	0.89	1.29
BP-30	0.28	0.42	1.48
IH-13	0.24	0.30	1.28
IH-14	1.14	1.50	1.31
IH-15	0.60	0.74	1.22
IH-16	0.39	0.46	1.18
LD-02	0.81	1.01	1.25
LD-03	0.25	0.33	1.30
ND-08	0.70	0.92	1.31
ND-09	0.65	0.84	1.29
SV-01	0.10	0.15	1.43
WC-30	0.69	0.90	1.31
WC-31	0.28	0.38	1.35
WC-32	0.20	0.29	1.44
WS-01	2.70	3.42	1.27
WS-10	0.64	0.81	1.27
WS-11	1.25	1.52	1.21

Each flow meter is associated to the nearest rain gauge in the rainfall monitoring network. Wet-weather events were determined for each rain gauge, and the wet-weather events were used as analysis periods for wet weather flows. Wet-weather events were considered to be rainfall events in which 24-hour rainfall totals exceed 0.9 inches. This 24-hour rainfall total was selected so that multiple qualifying wet-weather events could be evaluated at each flow meter, while ensuring that only significant rainfall events were analyzed. Several rain gauges did not have multiple events that met this criteria, in which case the wet-weather event criteria was lowered to 0.5 inches of



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rainfall in a 24-hour period. A summary of the rainfall experienced at each of the rain gauges during the monitoring period is shown in Table 4.2. This table also shows an estimate of the maximum 24-hour and 1-hour frequency storms experienced during the monitoring period (according to the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation frequency-duration curves).

Table 4.2: Wet-Weather Events

Rain Gauge	Associated Flow Meters	Number of Wet-Weather Events	Maximum 24-hour Rainfall (in)	Equivalent 24-hour Frequency Storm	Maximum 1-hour Rainfall (in)	Equivalent 1-hour Frequency Storm
RG-02	LD-02, WC-30, WC-31, WC-32	4	2.36	< 1-year	0.78	< 1-year
RG-04	BP-18, BP-22, BP-23, BP-26, BP-27-01, BP-28, IH-14	4	3.91	2-year	2.90	10-year
RG-05	BH-02, BH-03, BH-04, BH-05, BH-06, BH-07, ND-08	4	3.77	2-year	2.57	10-year
RG-06	IH-13, IH-15, IH-16, ND-09	3	3.50	1-year	2.36	5-year
RG-07	BP-19, BP-20, BP-21, BP-24, BP-27	3	5.41	5-year	3.52	25-year
RG-08	SV-01	4	4.08	2-year	2.99	10-year
RG-09	WS-10	4	1.04	<1-year	0.62	<1-year
RG-10	BP-25, BP-30, WS-01, WS-11, BP-17	2	3.83	2-year	2.73	10-year
RG-11	LD-03	3	2.36	<1-year	0.78	<1-year

The RDII was calculated at each basin for each wet-weather event. RDII was calculated as the difference between the wet-weather event flow and the typical dry-weather flow of the basin. Figure 4.3 shows an example of the wet-weather (combined dry-weather and RDII flow), RDII, and dry-weather flow for flow meter basin BH-03.

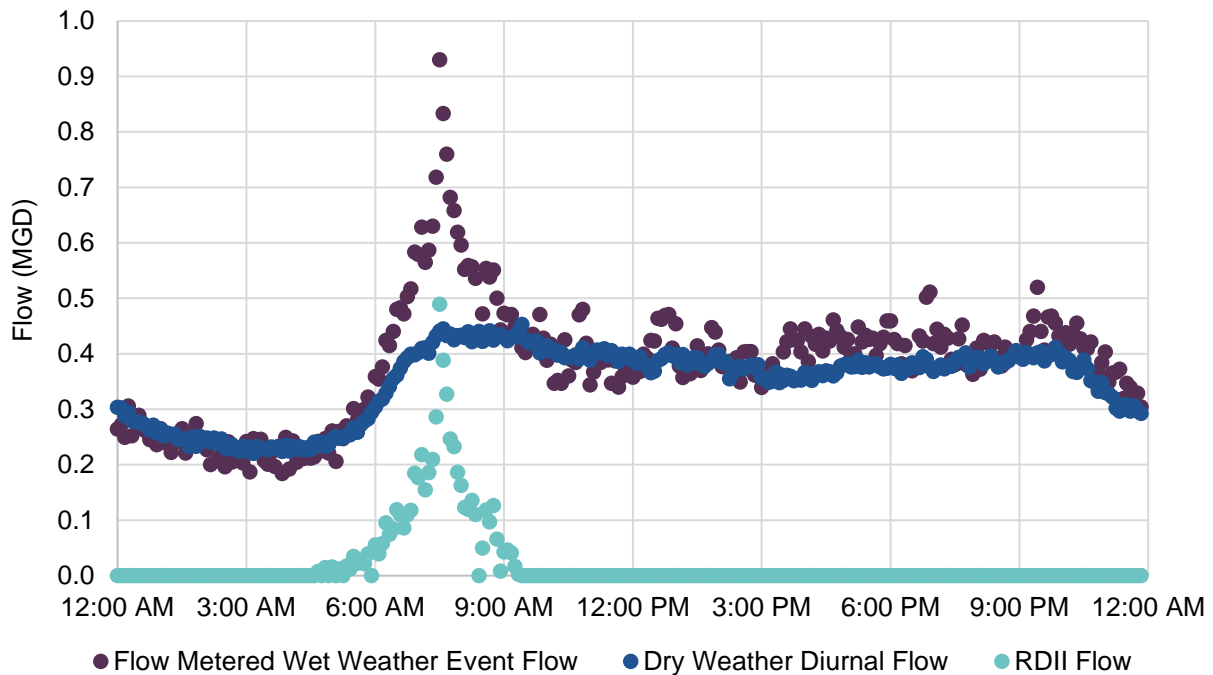


Figure 4.3: Example RDII Flow

For each wet-weather event, the RDII flow was modeled using the RTK method. The RTK method is a parameterization of RDII flow that estimates flow by defining three separate unit hydrographs (the hypothetical flow response to a unit of rainfall). The three hydrographs represent inflow, short-term infiltration, and long-term infiltration of rainwater into the wastewater system after a rainfall event. The RTK parameters were generated with a genetic algorithm that selects parameters with the goal of minimizing average peak flows and volume errors for each wet-weather event in the monitoring period. The RTK parameters are then used to simulate wet-weather flows for the 2-year, 5-year, and 10-year 24-hour design storms. The design storm volumes were taken from the NOAA Atlas 14 precipitation frequency-duration tables. The design storm volumes were distributed over 24-hours using the SCS Type II rainfall distribution. The rain volumes and the maximum 1-hour rainfall intensities used for the design storms are shown in Table 4.3.

Table 4.3: Design Storm Rain Volume

Design Storm	Rain Volume (inch)	Maximum 1-hour Intensity (inch/hour)
2-year	3.77	1.71
5-year	4.67	2.12
10-year	5.53	2.51



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Table 4.4 shows the resulting peaking factors and design peak flows. This table also shows the average peak flow error the selected RTK parameters result in for the monitored wet-weather events. Figure 4.4 shows a graphical representation of the 5-year wet-weather peaking factor and the RTK calibration peak flow errors. The peak flow error represents the average overestimation (positive error) or underestimation (negative error) of RDII peak flow for each wet-weather event. There are several basins that have high peak flow errors. This is typically caused by inconsistent wet-weather responses in the flow metering data, often as a result of the influence of lift station pumping on the flow patterns or due to high geospatial variability in the rainfall data. The calibration of these basins can be revisited with more sophisticated methods, including the use of gauge-adjusted radar rainfall (GARR) for more precise definition of wet-weather events. Additionally, basins with large amounts of pumped flow can be further calibrated during hydraulic model development. The wet-weather analysis in this report was conducted on total flows at each flow meter, without upstream flows subtracted out. Discrete dry- and wet-weather flows will be assessed during model development and calibration and discussed in the Collection System Modeling and Evaluation TM.

Table 4.4: Temporary Flow Meters Wet-Weather Flows

Flow Meter	Peaking Factors			Design Storm Peak Flows (MGD)			Average Event Flow Error (%)
	2 Year Storm	5 Year Storm	10 Year Storm	2 Year Storm	5 Year Storm	10 Year Storm	
BH-02	9.33	11.25	13.06	17.28	20.83	24.19	7%
BH-03	8.60	10.33	11.97	3.35	4.02	4.66	0%
BH-04	4.88	5.75	6.57	6.79	8.00	9.14	0%
BH-05	11.80	14.30	16.65	9.54	11.55	13.46	13%
BH-06	9.66	11.65	13.54	2.23	2.69	3.12	0%
BH-07	8.28	9.91	11.45	1.56	1.87	2.16	10%
BP-19	10.28	12.44	14.48	5.65	6.84	7.96	48%
BP-20	8.68	10.44	12.09	1.39	1.68	1.94	-3%
BP-21	4.68	5.51	6.29	12.64	14.87	16.97	1%
BP-22	10.44	12.63	14.70	3.58	4.33	5.04	-3%
BP-23	6.55	7.82	9.03	16.06	19.19	22.14	111%
BP-24	9.33	11.24	13.04	2.79	3.36	3.89	8%
BP-26	15.15	18.45	21.57	9.46	11.52	13.47	50%
BP-27	5.17	6.08	6.95	2.94	3.46	3.95	0%
BP-27-01	18.55	22.61	26.45	8.58	10.45	12.23	1%
BP-28	6.03	7.16	8.22	4.16	4.94	5.67	-3%
IH-13	5.83	6.91	7.94	1.37	1.63	1.87	-4%
IH-14	5.12	6.02	6.88	5.83	6.86	7.84	-5%
IH-15	12.75	15.49	18.09	7.66	9.31	10.86	15%
IH-16	9.04	10.91	12.68	3.49	4.22	4.90	2%
LD-02	15.77	19.23	22.50	12.76	15.56	18.20	10%
LD-03	8.49	10.20	11.82	2.12	2.55	2.95	9%
ND-08	5.68	6.72	7.71	3.98	4.71	5.40	15%
ND-09	5.67	6.71	7.69	3.68	4.36	5.00	1%
SV-01	12.67	15.34	17.87	1.28	1.55	1.81	12%
WC-30	11.59	14.04	16.35	8.00	9.69	11.28	12%

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Flow Meter	Peaking Factors			Design Storm Peak Flows (MGD)			Average Event Peak Flow Error (%)
	2 Year Storm	5 Year Storm	10 Year Storm	2 Year Storm	5 Year Storm	10 Year Storm	
WC-31	8.87	10.66	12.35	2.50	3.01	3.48	-9%
WC-32	15.23	18.52	21.62	3.09	3.76	4.39	19%

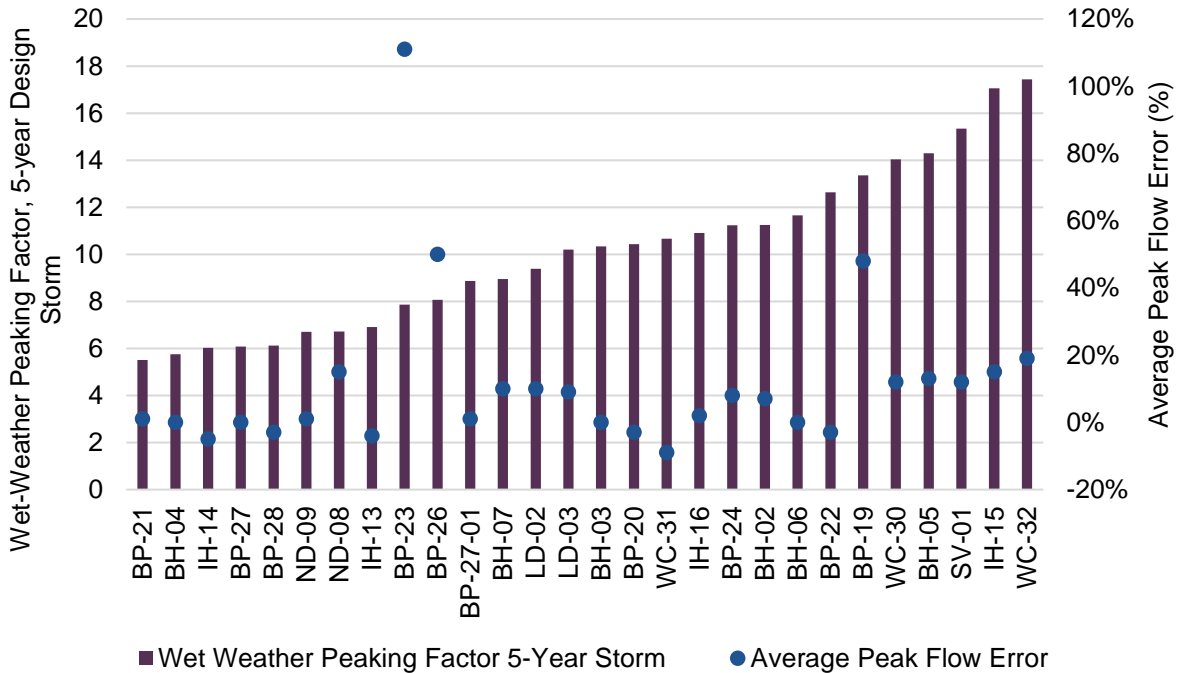


Figure 4.4: 5-Year Storm Peaking Factors and Peak Flow Calibration Errors

Table 4.5 shows the statistics of the basin peaking factors for the 2-year, 5-year, and 10-year design storms. The median peaking factor for the 2-year storm is 8.5. The median peaking factor for the 5-year storm is 10.3, and the median peaking factor for the 10-year storm is 11.9. These peaking factors represent the impact of RDII on collection system flows. Actual peak flows experienced at the WRF and at other locations in the system will depend on travel time, flow attenuation, and storage as water is conveyed through the collection system. The peak influent flows to the WRF will be evaluated in hydraulic modeling scenarios.

Table 4.5: Basin Peaking Factor Summary for 2-Year, 5-Year, and 10-Year Design Storms

Design Storm	Minimum Peaking Factor	Median Peaking Factor	Maximum Peaking Factor
2-year	4.7	8.5	14.4
5-year	5.5	10.3	17.4
10-year	6.3	11.9	20.3

Note: Peaking factors shown represent 5-minute peak flows divided by ADWF to be used for collection system infrastructure capacity evaluations.



The six permanent flow meters were not included in the wet-weather analysis. These flow meters are located on interceptors at the downstream end of the collection system, just upstream of the outfall to the WRF. These meters were not included in the evaluation because they are located on interceptors that are designed to surcharge, store water, and attenuate peak flow rates through diversions to other interceptors. The wet weather response of these basins will be investigated during wet-weather calibration for the upcoming Collection System Modeling and Evaluation TM. The permanent flow meters and their maximum observed flows reported during the flow metering period are shown in Table 4.6.

Table 4.6: Permanent Flow Meters Wet-Weather Flows

Flow Meter	Maximum Observed Flow (MGD)
BP-17	11.15
BP-18	9.02
BP-25	7.55
BP-30	1.32
WS-01	12.57
WS-10	2.00
WS-11	12.74

5.0 Wastewater Flow Projections

As discussed in Section 3.3, the wastewater flow rate projections are calculated based on the anticipated service population and an ADF per capita of 100 gpcd. Garver used the 1.5% annual growth rate projection included in the Norman Today report as the basis of the population projections through the year 2045. It was assumed that the service population would be approximately 90% of the city's population, and the growth rate percentage was applied independently to both the city population and the service population. The projected service population and ADF are shown below in Table 5.1 and Figure 5.1 for the WWSA throughout the planning period. Projections through the year 2045 will be used for the purpose of the capital improvement plan (CIP) development. The projections through buildout will be determined based off the land use capacity of the service area and will be used to determine the sizing of proposed wastewater infrastructure.

In addition to the flow calculated based on population growth, a reserve capacity of 10% was included to remain consistent with the reserve capacity projected for the water system. Garver recommends the inclusion of a reserve capacity to mitigate any potential changes to per capita flows as a result of new industrial flows, unanticipated growth, or severe weather events.

Previous wastewater flow projection efforts have focused on buildout flows based on the future WWSA anticipated at the time of their development. The 2001 WWMP predicted that the buildout ADF would be 20.5 MGD and the ADF plus planning capacity would be 21.5 MGD. The 2013 WW Modeling Report buildout projections, which is also referenced in the 2018 WW Modeling Report, predicted that the ADF would be 17.1 MGD and the ADF plus planning capacity would be 18.0 MGD.

Table 5.1: Projected Wastewater Flows

Year	Service Population	ADF (MGD)	ADF Reserve Capacity (MGD)	ADF Total (MGD)	SFE ¹
2025	119,990	12.00	1.20	13.20	58,532
2030	129,264	12.93	1.29	14.22	63,055
2035	139,254	13.93	1.39	15.32	67,929
2040	150,016	15.00	1.50	16.50	73,178
2045	161,610	16.16	1.62	17.78	78,834

Notes:

¹Based on projected ADF with reserve capacity and value of 205 gpd/SFE discussed in Section 3.4.

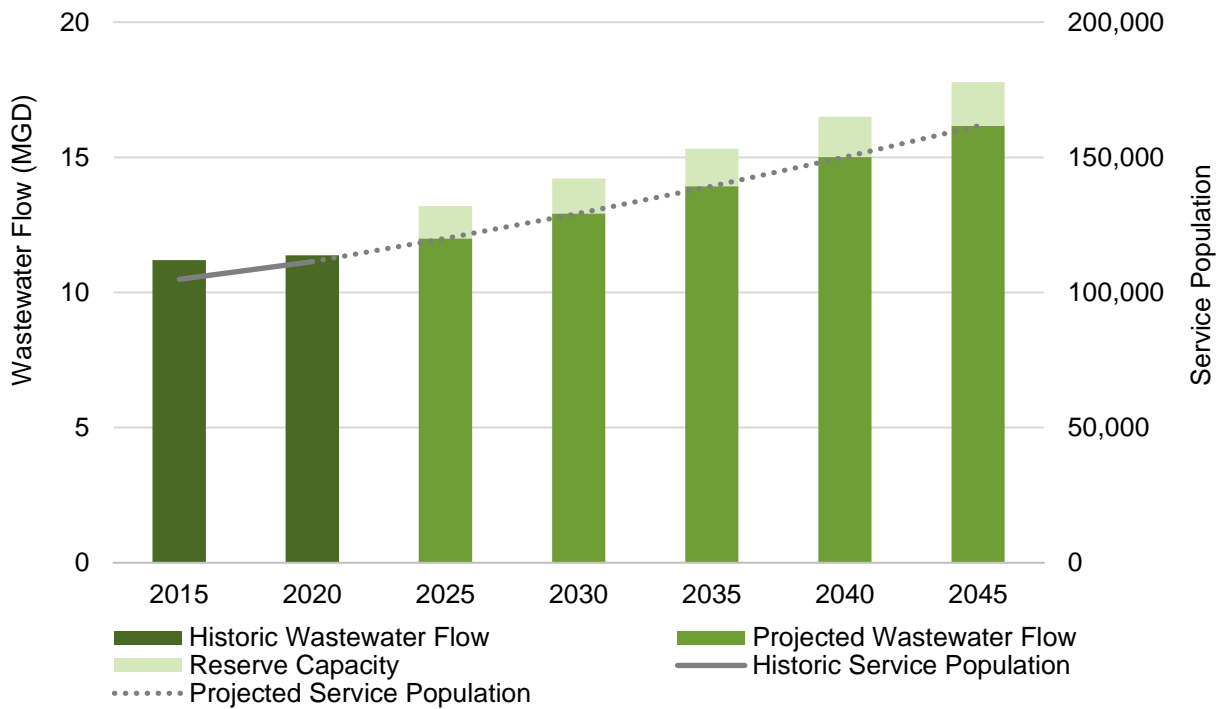


Figure 5.1: Projected Wastewater Flows

6.0 Wastewater System Evaluation Criteria

Design criteria and regulatory requirements from a variety of sources were assembled to develop the evaluation criteria for analysis of the wastewater system. Specifically, documents from the following sources were reviewed:

- Oklahoma Department of Environmental Quality (ODEQ)



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- City of Norman 2023 Engineering Design Criteria and Standard Specifications (Norman EDC)
- Water Environment Federation's Manual of Practice (WEF MOP 8)

Table 6.1 summarizes the evaluation criteria that will be used to evaluate the wastewater system's performance and identify potential capital improvement projects. The table also includes NUA system-specific goals/criteria recommended by Garver for evaluating the existing collection system.

Table 6.1: Wastewater System Evaluation Criteria

Criteria	Limiting Source	Description
Treatment Plant Design Life	ODEQ	Design sewage treatment plants for an estimated 20-year population projection. Construction may occur in phases.
Gravity Sewer Sizing	Norman EDC	No public gravity sewer should be less than 8 inches in diameter.
Gravity Pipe Velocity	ODEQ	Gravity pipes should obtain a velocity of 2 ft/s.
Minimum Gravity Pipe Slope	Norman EDC	Minimum pipe grade by diameter as presented in the 2023 Norman EDC.
Gravity Sewer Hydraulic Capacity	Industry Standard	A "d/D" ratio of 0.75 will be used to determine the sizing of future infrastructure. The d/D ratio is defined as the depth of water in the gravity main during peak flow conditions divided by the inside diameter.
Maximum Surge	NUA system performance target	Existing gravity mains should surcharge no more than 1 foot above the crown of pipe.
Minimum Freeboard	NUA system performance criteria	Existing gravity mains should surcharge to no more than 3 feet below the manhole rim elevation.
Lift Station Capacity	ODEQ	All lift stations shall have a minimum of two pumping units. With any pump out of service the remaining pump(s) shall be capable of providing the maximum sewage flows of the system.
Force Main Velocity	ODEQ	Force mains should obtain a velocity of 2 ft/s.
Force Main Maximum Flow Velocity	Industry Standard	Force mains should not experience a maximum flow velocity of 6 ft/s. (Note: Guideline is not a regulatory requirement)

6.1 Wastewater Treatment Evaluations and Planning

The assessment of the wastewater treatment system will be conducted in accordance with the Oklahoma Department of Environmental Quality (ODEQ) standards for the design of water pollution control facilities,





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alongside the treatment specifications required by the Norman WRF to comply with the facility's Oklahoma Pollutant Discharge Elimination System (OPDES) permit limits. Additionally, the industry-recommended practices outlined in the Water Environment Federation's Manual of Practice (WEF MOP 8) for municipal water reclamation facilities will also be taken into consideration. This assessment of the existing wastewater treatment system and further discussion of the WRF will be detailed in the upcoming Treatment and Reuse TM.

The CIP improvements for the Norman WRF will be designed based on a 20-year planning horizon, extending to the year 2045. These CIP enhancements aim to provide sufficient capacity to manage and treat this average wastewater flow rate. However, the implementation of CIP improvements can adopt a trigger-based approach, meaning they will only be executed once the projected wastewater flows are observed in the future.

If all or a portion of the treated effluent from the existing WRF or a potential greenfield WRF is planned to be discharged to Lake Thunderbird, the findings of the 2022 Indirect Potable Reuse (IPR) Pilot Study together with the Oklahoma Administrative Code § 252:628 (OAC) Requirements for IPR in a Reservoir will be used to determine the scope of improvements required to reach the treatment limits established for IPR.

Regarding capacity expansions, Garver's approach assumes that once the facility reaches 75% of its rated capacity, planning, and design phases for the next phase of capacity expansion must begin. This 75% capacity level acts as the trigger for initiating the planning and design process. Additionally, when the facility hits 90% of its rated capacity, construction to implement the designed improvements must be initiated. Anticipated construction timelines will be evaluated and considered in development of final triggers for recommended projects.

7.0 Future Work

The City's population projections and future land use plan are being developed in parallel with the baseline development for the wastewater system. Once the future land use plan is finalized, Garver will update the wastewater baseline development presented in this TM and move forward with the following future wastewater system evaluations:

- Collection System Modeling and Evaluation
- Treatment and Reuse Evaluation
- Capital Improvement Plan

Each evaluation will be documented in an upcoming TM that will be incorporated in the Wastewater Master Plan Report.



Appendix A: Flow Meter and Rain Gauge Site Sheets



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BH-02

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 9:24 AM

30-3984-00

T

System Information

Target Pipe Dia. (in) 43.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 253006
 U/S Connecting MH I.D 253005
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 600-672 36th Ave SW
 Site Access Off-Road
 Longitude -97.48880000
 Latitude 35.20480000
 MH Type Precast Concrete
 Manhole Depth (ft) 13.90
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Access Notes

Site Information

Pipe Height (in) 42.50
 Pipe Width (in) 42.50
 Pipe Type Other
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



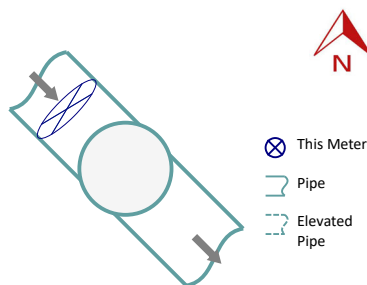
Hydraulic Information

Flow Depth (in) 12.00
 Instant Velocity (fps) 1.84
 Surge Evidence (ft) 13.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

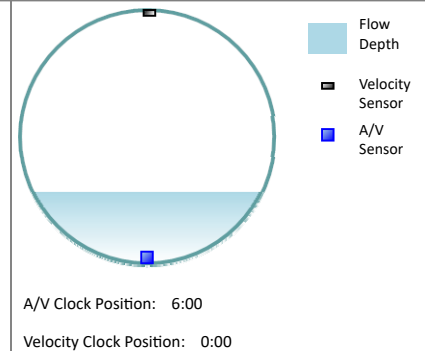
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BH-03

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 7:15 PM

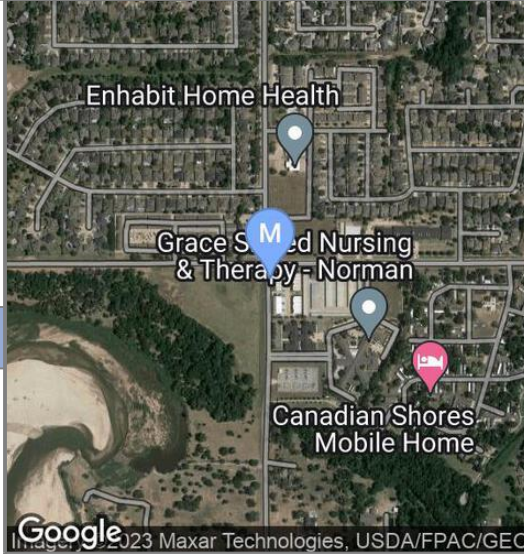
30-3984-00

T

System Information

Target Pipe Dia. (in) 22.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 235001
 U/S Connecting MH I.D 204039
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 4746 W Main St
 Site Access Sidewalk
 Longitude -97.51180000
 Latitude 35.21810000
 MH Type Precast Concrete
 Manhole Depth (ft) 10.00
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 22.00
 Pipe Width (in) 22.00
 Pipe Type Other
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

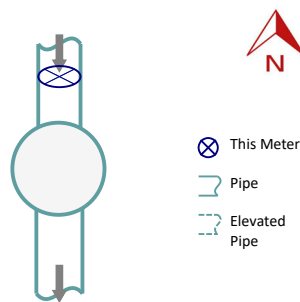
Hydraulic Characteristics

Installation Notes

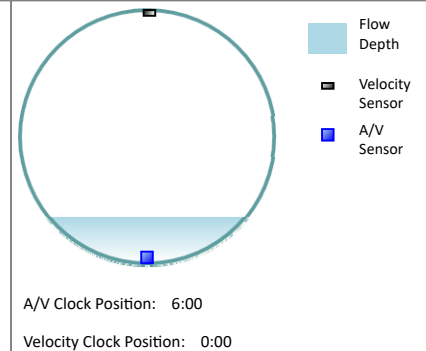
Hydraulic Information

Flow Depth (in) 4.00
 Instant Velocity (fps) 2.02
 Surge Evidence (ft) 5.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BH-04

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 6:41 PM

30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 205071
 U/S Connecting MH I.D 205063
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 3837 Cedar Ridge Dr
 Site Access Off-Road
 Longitude -97.49820000
 Latitude 35.22180000
 MH Type Precast Concrete
 Manhole Depth (ft) 25.00
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.0
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 23.00
 Pipe Width (in) 23.00
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



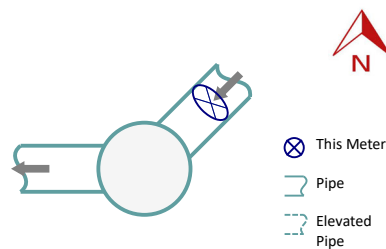
Hydraulic Information

Flow Depth (in) 10.00
 Instant Velocity (fps) 1.78
 Surge Evidence (ft) 13.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Fair

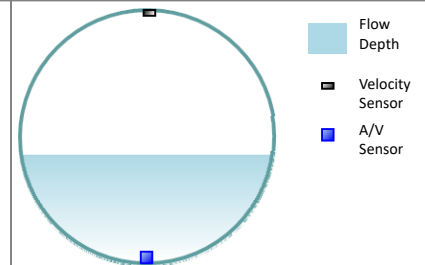
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/27/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BH-05

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 6:12 PM

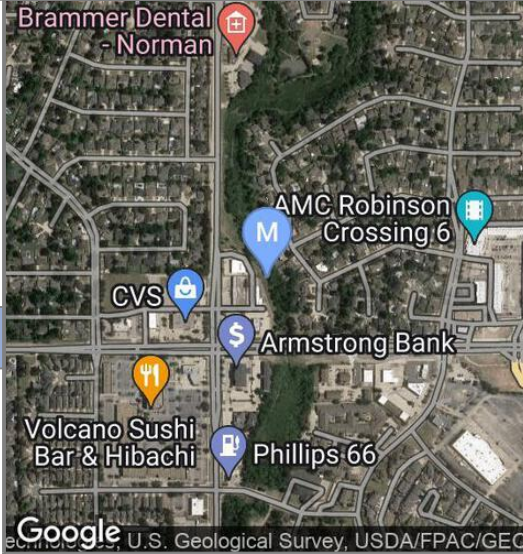
30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 158106
 U/S Connecting MH I.D 158105
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 1219 36th Ave NW
 Site Access Off-Road
 Longitude -97.49330000
 Latitude 35.23420000
 MH Type Precast Concrete
 Manhole Depth (ft) 15.50
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.0
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 23.00
 Pipe Width (in) 23.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



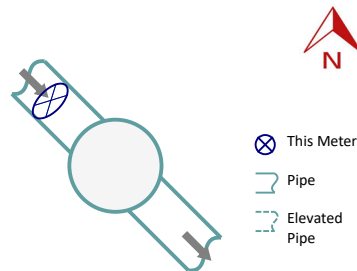
Hydraulic Information

Flow Depth (in) 7.50
 Instant Velocity (fps) 2.24
 Surge Evidence (ft) 10.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

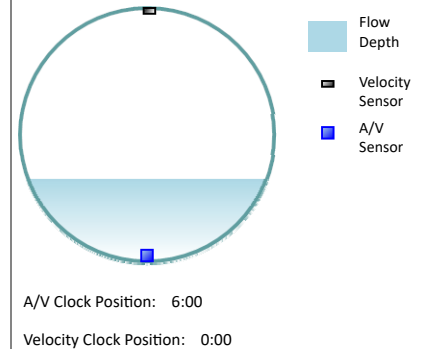
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/19/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BH-06

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:49 PM

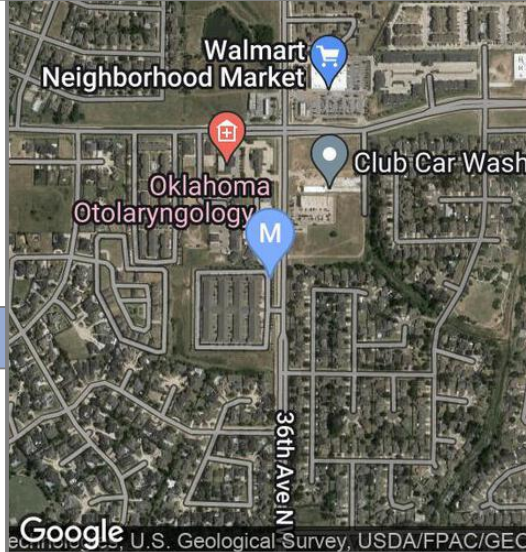
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 143107
 U/S Connecting MH I.D 143106
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

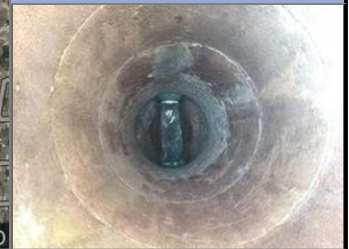
Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2252 36th Ave NW
 Site Access Off-Road
 Longitude -97.49460000
 Latitude 35.24470000
 MH Type Precast Concrete
 Manhole Depth (ft) 18.80
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Access Notes

Site Information

Pipe Height (in) 17.50
 Pipe Width (in) 17.50
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



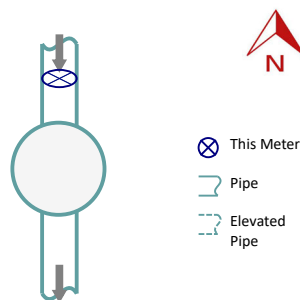
Hydraulic Information

Flow Depth (in) 3.50
 Instant Velocity (fps) 2.31
 Surge Evidence (ft) 8.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

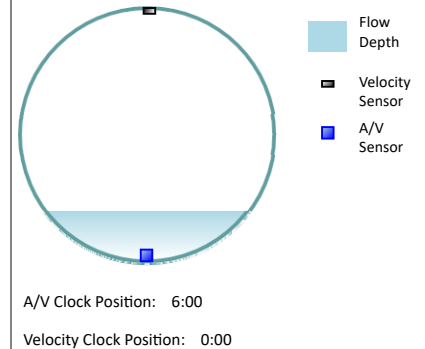
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/19/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BH-07

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 4/4/2023 3:18 PM

30-3984-00

T

System Information

Target Pipe Dia. (in)

Municipality Norman

District

Assigned Rain Gauge

Client Manhole # 113038

U/S Connecting MH I.D 113036

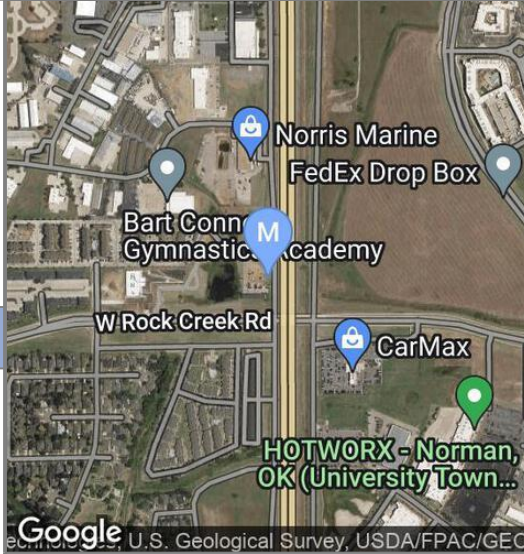
System Characteristics:

Residential - Commercial - Industrial -

P/S Influence No

WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3050 Yarbrough Way

Site Access Off-Road

Longitude -97.48590000

Latitude 35.24870000

MH Type Precast Concrete

Manhole Depth (ft) 12.30

Manhole Width (ft) 4.0

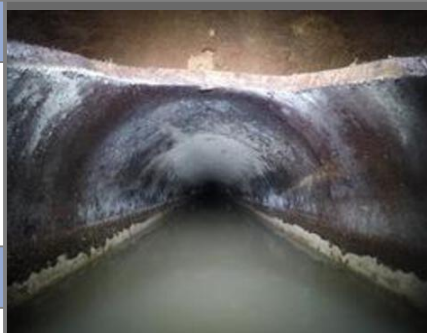
Elevated MH No

Height Elevated (ft)

Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 16.50

Pipe Width (in) 16.50

Pipe Type Polyvinyl Chloride

Pipe Shape Circular

O2 20.9 LEL % 0.0

H2S 0.0 CO 0.0

Hydraulic Characteristics

Installation Notes

Hydraulic Information

Flow Depth (in) 6.00

Instant Velocity (fps) 0.40

Surcharge Evidence (ft) 1.00

Silt Type Fine

Silt Depth (in) 2.00

Needs Cleaning No

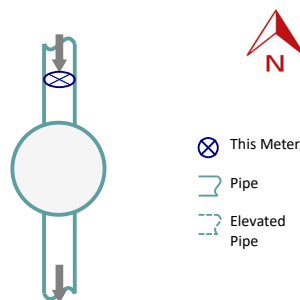
Backwater No

Flow Path Straight

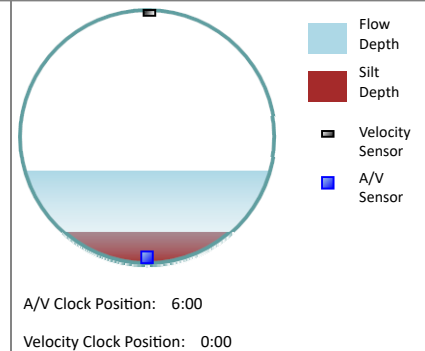
Drop Inlet No

Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0

Location from Manhole

Sensors Pressure, Velocity, and Ultra

Antenna Surface Non-Paved Surface

Signal Strength

Post Installation Notes

Meter Type -

Telemetry Type

Installation Date 4/25/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK
Norman Utilities Authority

Site Name Item 6.

BP-17

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 12/10/2014 12:48 PM

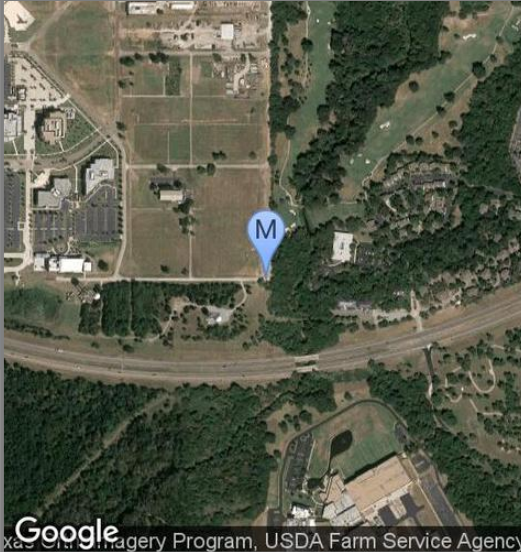
30-3884-00

T

System Information

Target Pipe Dia. (in) 33.5
 Municipality Norman
 District Norman
 Assigned Rain Gauge RG-04
 Client Manhole # 329011
 U/S Connecting MH I.D 329012
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 500 E Constellation St
 Site Access Off-Road
 Longitude -97.43244600
 Latitude 35.18106800
 MH Type Poured Concrete
 Manhole Depth (ft) 17.60
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.3
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 32.94
 Pipe Width (in) 33.98
 Pipe Type Concrete
 Pipe Shape Elliptical
 O2 LEL %
 H2S CO

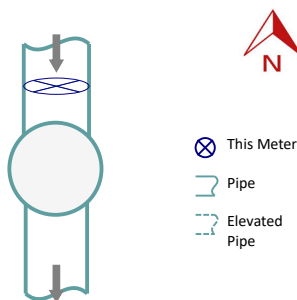
Hydraulic Information

Flow Depth (in) 20.00
 Instant Velocity (fps) 2.74
 Surge Evidence (ft)
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

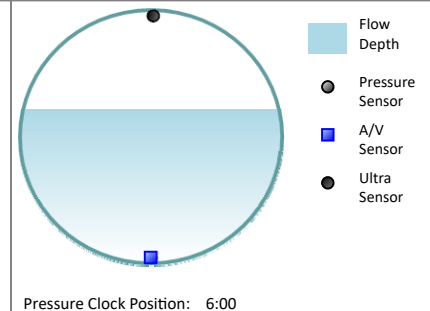
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole Upstream
 Sensors
 Antenna Surface Non-Paved Surface
 Signal Strength 75

Post Installation Notes

Meter Type
 Telemetry Type
 Installation Date 1/8/2015

Approvals

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK
Norman Utilities Authority

Site Name Item 6.

BP-18

Inspected By RJNGROUP\Kgarrett

Project No.

Site Code

Inspected Date/Time 6/17/2014 5:23 PM

30-3884-00

T

System Information

Target Pipe Dia. (in) 36.0
 Municipality Norman
 District Norman
 Assigned Rain Gauge RG-04
 Client Manhole # 329010
 U/S Connecting MH I.D 329002
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 500 E Constellation St
 Site Access Off-Road
 Longitude -97.43236400
 Latitude 35.18122300
 MH Type Precast Concrete
 Manhole Depth (ft) 16.50
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 36.88
 Pipe Width (in) 36.88
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 LEL %
 H2S CO

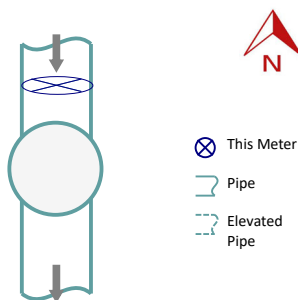
Hydraulic Characteristics

Installation Notes

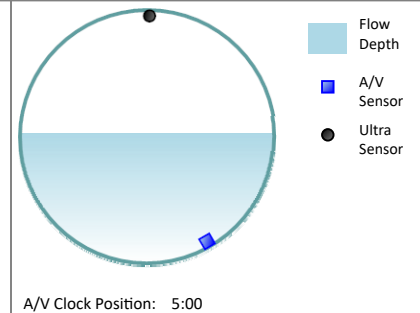
Hydraulic Information

Flow Depth (in) 19.00
 Instant Velocity (fps) 0.60
 Surge Evidence (ft)
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole Upstream
 Sensors
 Antenna Surface Non-Paved Surface
 Signal Strength 100

Post Installation Notes

Meter Type
 Telemetry Type
 Installation Date 5/7/2015

Approvals

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-19

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:04 PM

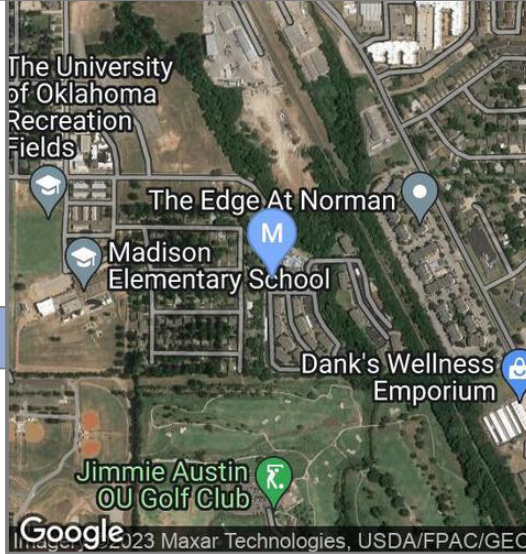
30-3984-00

T

System Information

Target Pipe Dia. (in) 30.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 286085
 U/S Connecting MH I.D 286084
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 730 Stinson St
 Site Access Sidewalk
 Longitude -97.43220000
 Latitude 35.19860000
 MH Type Precast Concrete
 Manhole Depth (ft) 12.50
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Site Information

Pipe Height (in) 29.50
 Pipe Width (in) 29.50
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



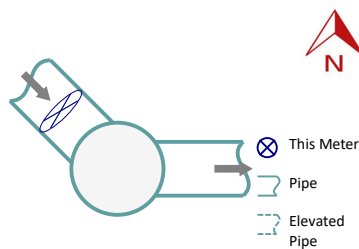
Hydraulic Information

Flow Depth (in) 8.40
 Instant Velocity (fps) 1.30
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

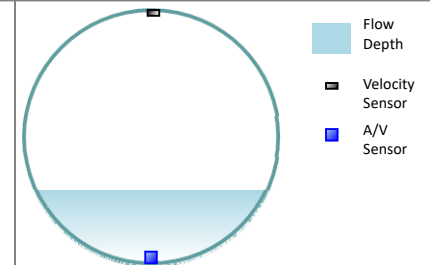
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/26/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-20

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:25 PM

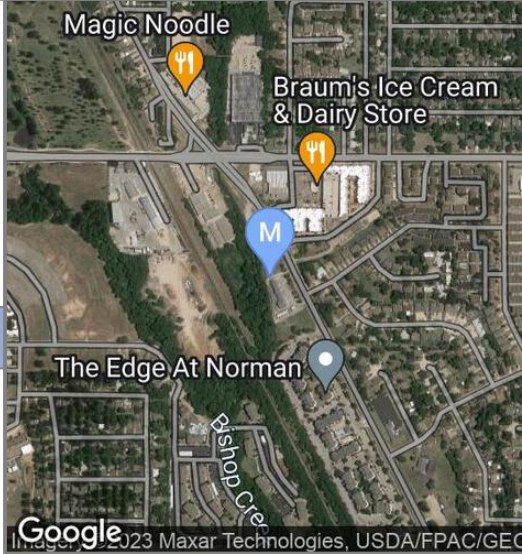
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 286013
 U/S Connecting MH I.D 286012
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2100 Classen Blvd
 Site Access Other
 Longitude -97.43020000
 Latitude 35.20170000
 MH Type Brick
 Manhole Depth (ft) 6.20
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes Parking lot of carwash

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 18.50
 Pipe Width (in) 18.50
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

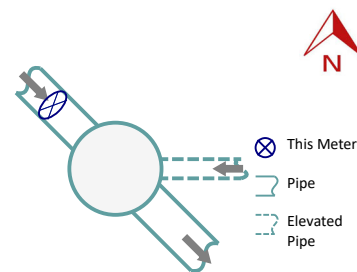
Hydraulic Characteristics

Installation Notes

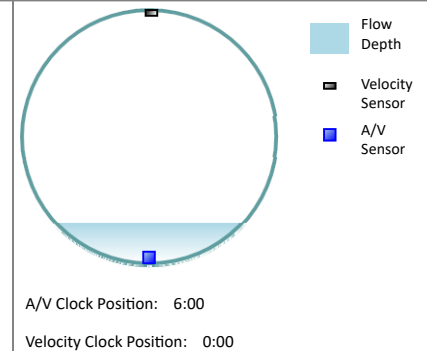
Hydraulic Information

Flow Depth (in) 3.00
 Instant Velocity (fps) 0.75
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/26/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-21

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:44 PM

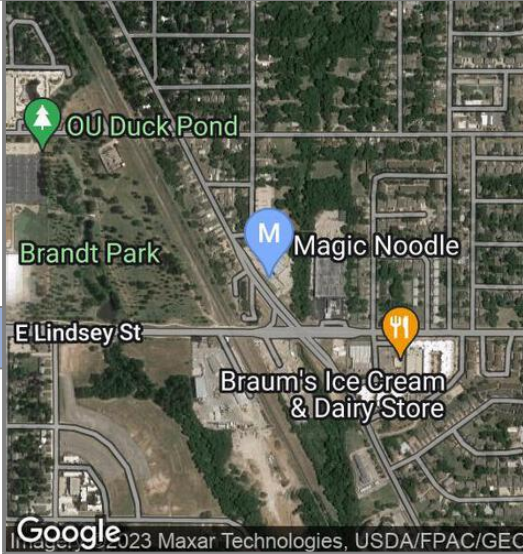
30-3984-00

T

System Information

Target Pipe Dia. (in) 30.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 260116
 U/S Connecting MH I.D 260117
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address Suite 115 1915
 Site Access Off-Road
 Longitude -97.43210000
 Latitude 35.20480000
 MH Type Precast Concrete
 Manhole Depth (ft) 10.30
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 29.75
 Pipe Width (in) 28.75
 Pipe Type Concrete
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

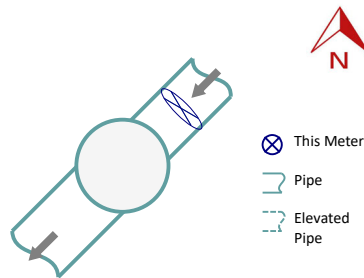
Hydraulic Characteristics

Installation Notes

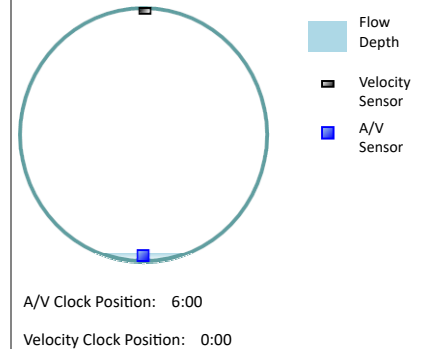
Hydraulic Information

Flow Depth (in) 1.00
 Instant Velocity (fps) 1.50
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-22

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/22/2023 9:23 AM

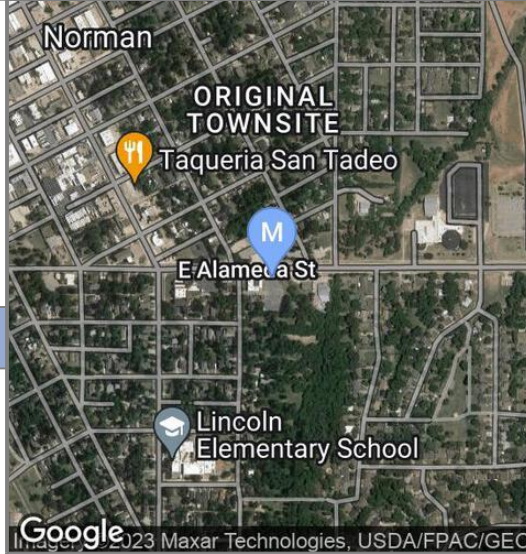
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 243054
 U/S Connecting MH I.D 212067
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 500 E Alameda St
 Site Access Sidewalk
 Longitude -97.43390000
 Latitude 35.21820000
 MH Type Precast Concrete
 Manhole Depth (ft) 14.70
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 16.50
 Pipe Width (in) 17.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



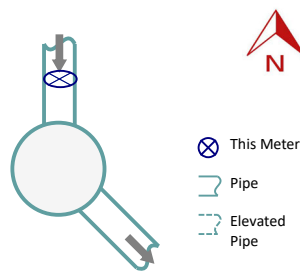
Hydraulic Information

Flow Depth (in) 4.80
 Instant Velocity (fps) 0.75
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

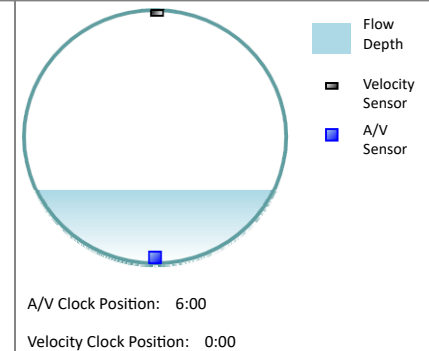
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/26/2023

Approvals

Recommended by FSP

Client Approval



Norman, OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-23

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 6:01 PM

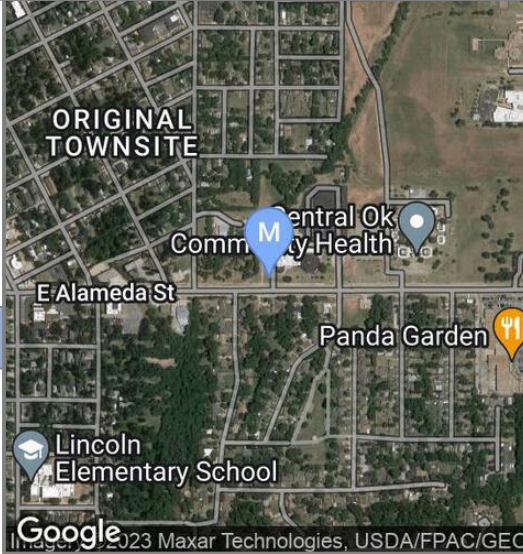
30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 213051
 U/S Connecting MH I.D 213035
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 801 E Alameda St
 Site Access Sidewalk
 Longitude -97.43080000
 Latitude 35.21860000
 MH Type Poured Concrete
 Manhole Depth (ft) 12.10
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 23.50
 Pipe Width (in) 25.00
 Pipe Type Concrete
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

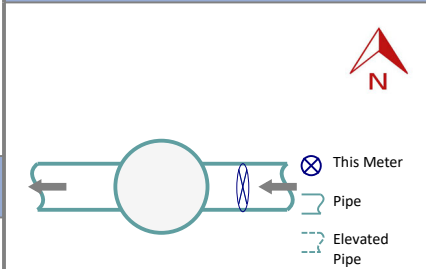
Hydraulic Characteristics

Installation Notes

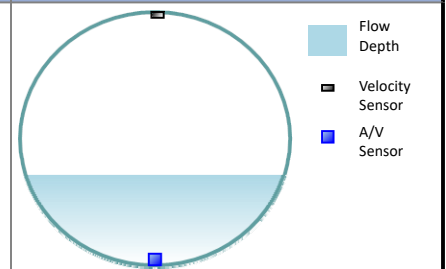
Hydraulic Information

Flow Depth (in) 8.40
 Instant Velocity (fps) 2.40
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/26/2023

Approvals

Recommended by FSP

Client Approval



Norman, OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-24

Inspected By zanders

Project No.

Site Code

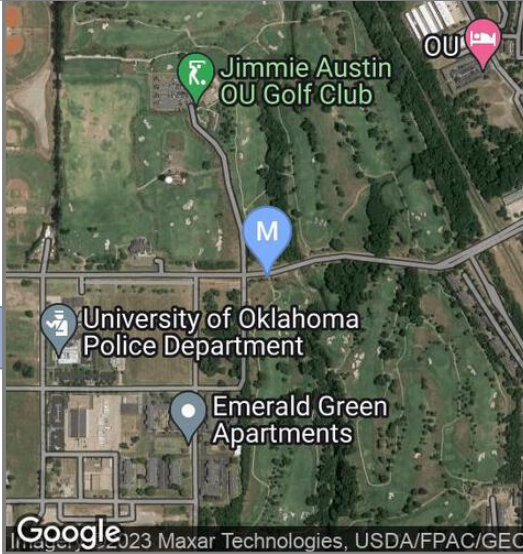
Inspected Date/Time 3/21/2023 3:35 PM

30-3984-00

System Information

Target Pipe Dia. (in) 19.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 297022
 U/S Connecting MH I.D 297099
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 720 E Constitution St
 Site Access Off-Road
 Longitude -97.43060000
 Latitude 35.19130000
 MH Type Brick
 Manhole Depth (ft) 17.60
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 3.0
 Structural Integrity Safe

Access Notes Need 9 foot tripod

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 19.00
 Pipe Width (in) 18.50
 Pipe Type Lined
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

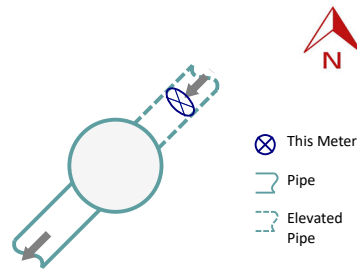
Hydraulic Characteristics

Installation Notes

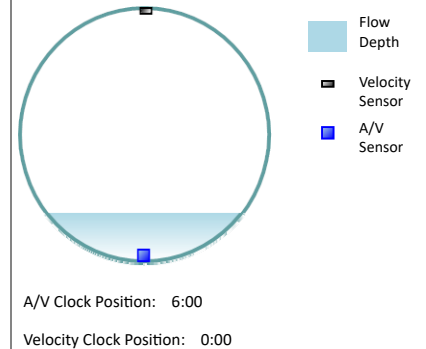
Hydraulic Information

Flow Depth (in) 3.60
 Instant Velocity (fps) 2.10
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/27/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK
Norman Utilities Authority

Site Name Item 6.

BP-25

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 1/7/2015 10:38 AM

30-3884-00

T

System Information

Target Pipe Dia. (in) 36.0
 Municipality Norman
 District Norman
 Assigned Rain Gauge RG-04
 Client Manhole # 330006
 U/S Connecting MH I.D 330030
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3240 Marshall Ave
 Site Access Other
 Longitude -97.42970000
 Latitude 35.18020000
 MH Type Poured Concrete
 Manhole Depth (ft) 8.57
 Manhole Width (ft) 5.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes In island

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 35.75
 Pipe Width (in) 35.75
 Pipe Type Concrete
 Pipe Shape Circular
 O2 LEL %
 H2S CO

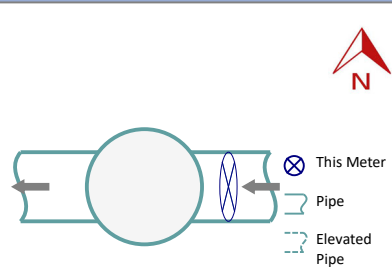
Hydraulic Characteristics

Installation Notes

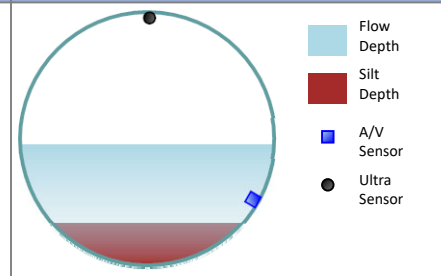
Hydraulic Information

Flow Depth (in) 17.06
 Instant Velocity (fps) 1.41
 Surge Evidence (ft)
 Silt Type Fine
 Silt Depth (in) 6.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole Upstream
 Sensors
 Antenna Surface Non-Paved Surface
 Signal Strength 75

Post Installation Notes

Meter Type
 Telemetry Type
 Installation Date 11/5/2014

Approvals

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-26

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:04 PM

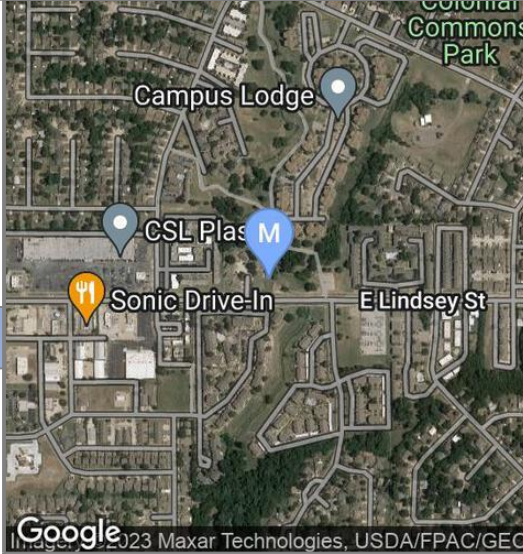
30-3984-00

T

System Information

Target Pipe Dia. (in) 15.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 261088
 U/S Connecting MH I.D 261058
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 1531 E Lindsey St
 Site Access Other
 Longitude -97.41750000
 Latitude 35.20420000
 MH Type Precast Concrete
 Manhole Depth (ft) 15.50
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 2.0
 Structural Integrity Safe

Top View Picture



Access Notes Park, inside drop influenced by water park

Site Information

Pipe Height (in) 14.50
 Pipe Width (in) 15.62
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



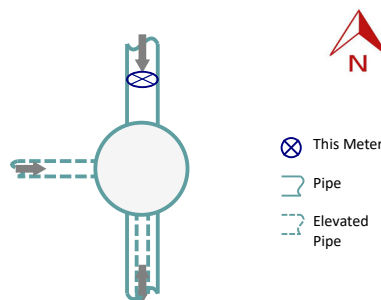
Hydraulic Information

Flow Depth (in) 7.20
 Instant Velocity (fps) 0.80
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet Yes
 Hydraulic Rating Good

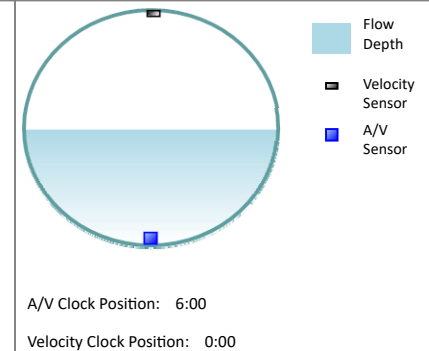
Hydraulic Characteristics

Installation Notes Flow picked up as we were finishing, may be a pump near by, heights and flow speed both increases

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-27

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:21 PM

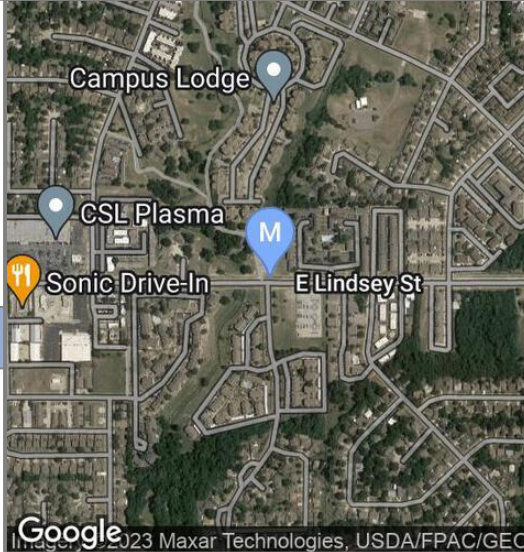
30-3984-00

T

System Information

Target Pipe Dia. (in) 21.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 261092
 U/S Connecting MH I.D 262109
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 1699 E Lindsey St
 Site Access Sidewalk
 Longitude -97.41610000
 Latitude 35.20390000
 MH Type Brick
 Manhole Depth (ft) 10.90
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 20.25
 Pipe Width (in) 20.25
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



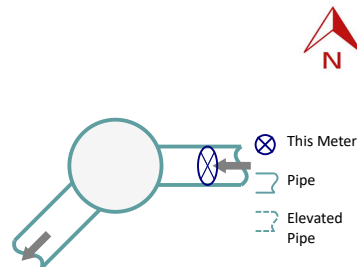
Hydraulic Information

Flow Depth (in) 6.00
 Instant Velocity (fps) 1.10
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

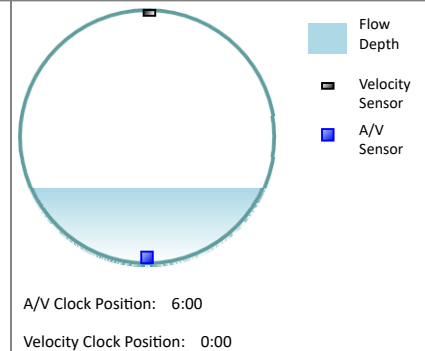
Hydraulic Characteristics

Installation Notes Flow rates vary up and down from 6 to 9 inches

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-27-01

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:41 PM

30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 263060
 U/S Connecting MH I.D 263059
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence Yes
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 769 24th Ave SE
 Site Access Off-Road
 Longitude -97.40580000
 Latitude 35.20810000
 MH Type Precast Concrete
 Manhole Depth (ft) 13.90
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 16.94
 Pipe Width (in) 17.25
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Hydraulic Characteristics

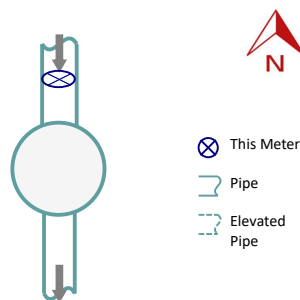
Installation Notes

Flow fluctuates from 1.5 to 4.5 inches, when flow is at its lowest, the av sensor is no longer submerged.

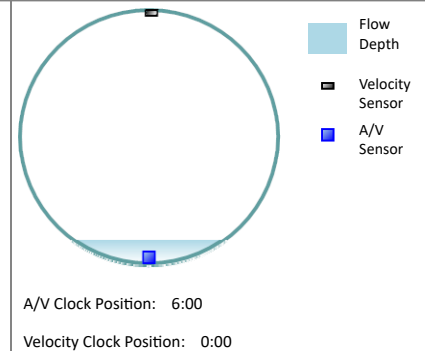
Hydraulic Information

Flow Depth (in) 1.50
 Instant Velocity (fps) 0.60
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

BP-28

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 2:51 PM

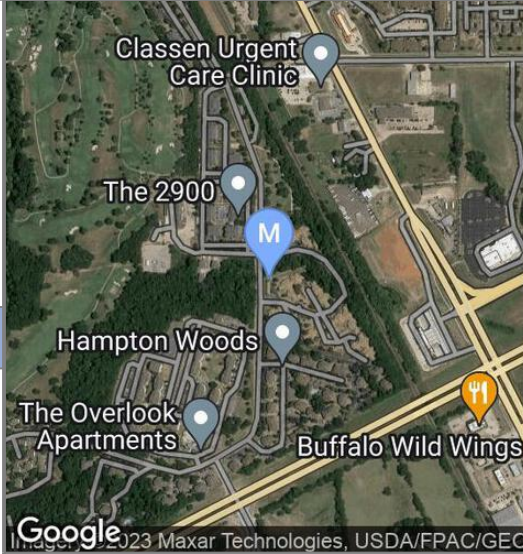
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 322001
 U/S Connecting MH I.D 322070
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 700 Oak Tree Ave
 Site Access Off-Road
 Longitude -97.42340000
 Latitude 35.18560000
 MH Type Precast Concrete
 Manhole Depth (ft) 14.30
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes Gate was open during investigation, #1590 gate code

Site Information

Pipe Height (in) 23.50
 Pipe Width (in) 23.81
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



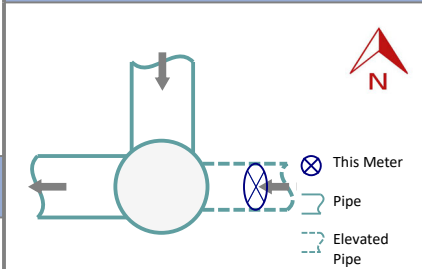
Hydraulic Information

Flow Depth (in) 3.70
 Instant Velocity (fps) 2.00
 Surge Evidence (ft) 9.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

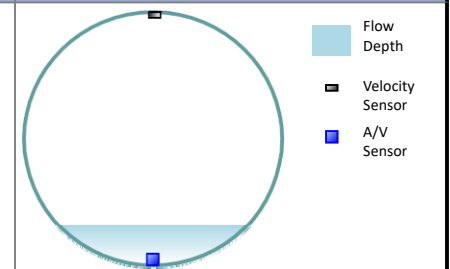
Hydraulic Characteristics

Installation Notes Flow changes from 4.5 to 6 inches variably

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

A/V Clock Position: 6:00

Velocity Clock Position: 0:00

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



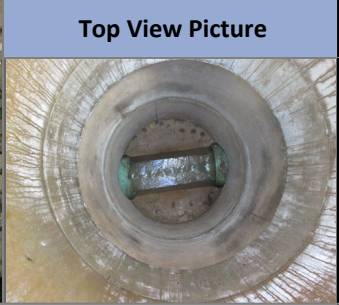
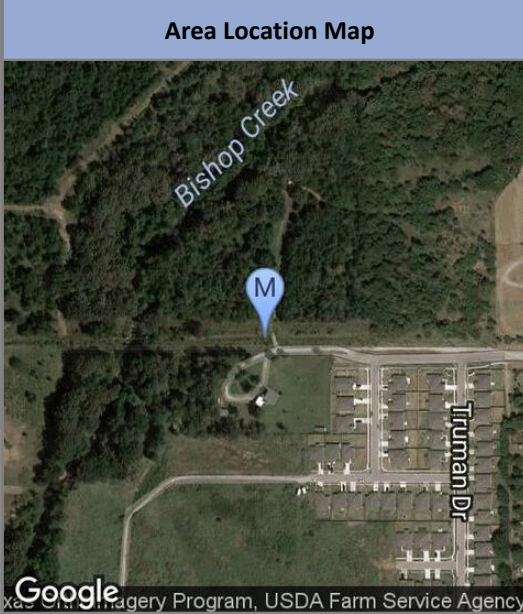
Norman,OK
Norman Utilities Authority

Site Name Item 6.

BP-30

Inspected By	r_bass	Project No.	Site Code
Inspected Date/Time	10/7/2014 3:07 PM	30-3884-00	

System Information	
Target Pipe Dia. (in)	24.0
Municipality	Norman
District	Norman
Assigned Rain Gauge	RG-10
Client Manhole #	329087
U/S Connecting MH I.D	329051
System Characteristics:	
Residential - <input checked="" type="checkbox"/>	Commercial - <input checked="" type="checkbox"/> Industrial - <input type="checkbox"/>
P/S Influence	No
WWTP Influence	No



Location Information	
Site Address	400 East Cedar Ln
Site Access	Fenced In
Longitude	-97.43520000
Latitude	35.17520000
MH Type	Precast Concrete
Manhole Depth (ft)	14.48
Manhole Width (ft)	5.0
Elevated MH	Yes
Height Elevated (ft)	1.7
Structural Integrity	Safe

Access Notes Enter through red gate at end of East Cedar Lane, (RJN owned lock on gate) Follow fence line to the west, pass black iron gate...MH located next to gate

Site Information	
Pipe Height (in)	23.06
Pipe Width (in)	23.31
Pipe Type	Polyvinyl Chloride
Pipe Shape	Circular
O2	LEL %
H2S	CO

Investigation Photo



Installation Photo



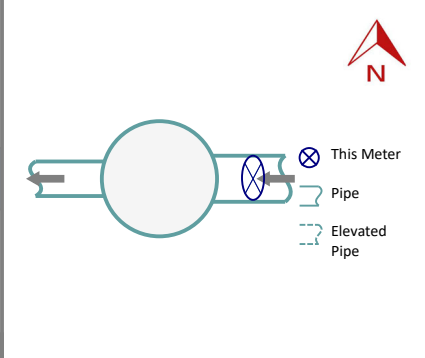
Hydraulic Information	
Flow Depth (in)	3.50
Instant Velocity (fps)	0.70
Surcharge Evidence (ft)	
Silt Type	None
Silt Depth (in)	0.00
Needs Cleaning	No
Backwater	No
Flow Path	Straight
Drop Inlet	No
Hydraulic Rating	No Flow

Hydraulic Characteristics

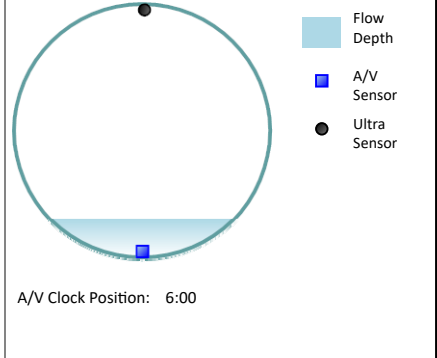
Installation Notes

Installation Notes	
Location in Pipe (ft)	1.0
Location from Manhole	Upstream
Sensors	
Antenna Surface	Non-Paved Surface
Signal Strength	75

Install Plan Sketch



Install Cross-Section Sketch



Post Installation Notes

Approvals

Meter Type	Recommended by FSP	Client Approval
Telemetry Type	Yes	Yes
Installation Date	11/7/2014	



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

IH-12

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:51 AM

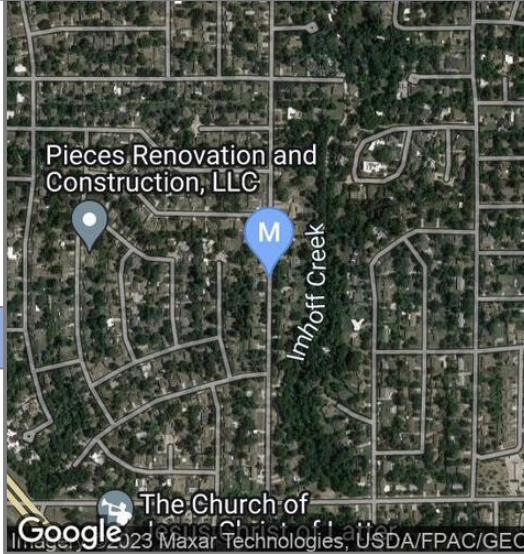
30-3984-00

T

System Information

Target Pipe Dia. (in) 21.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 293010
 U/S Connecting MH I.D 293009
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

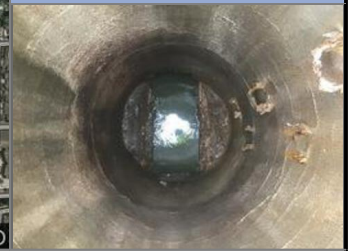
Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2522 S Berry Rd
 Site Access Roadway, Low Traffic
 Longitude -97.45910000
 Latitude 35.19350000
 MH Type Precast Concrete
 Manhole Depth (ft) 11.70
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 22.12
 Pipe Width (in) 22.25
 Pipe Type Concrete
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

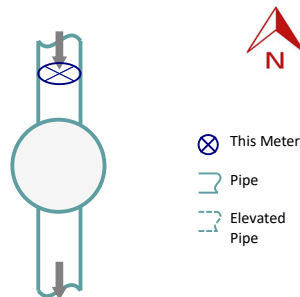
Hydraulic Characteristics

Installation Notes

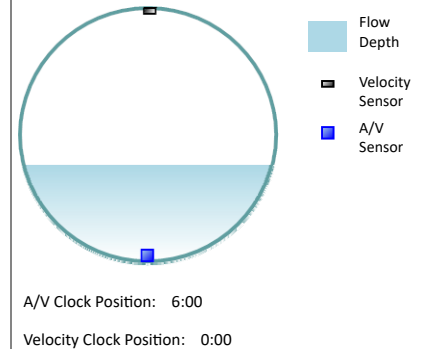
Hydraulic Information

Flow Depth (in) 8.40
 Instant Velocity (fps) 0.50
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/21/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

IH-13

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:22 AM

30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 255052
 U/S Connecting MH I.D 239129
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 708 McGee Dr
 Site Access Roadway, Low Traffic
 Longitude -97.46780000
 Latitude 35.21080000
 MH Type Brick
 Manhole Depth (ft) 16.80
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 18.00
 Pipe Width (in) 18.00
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

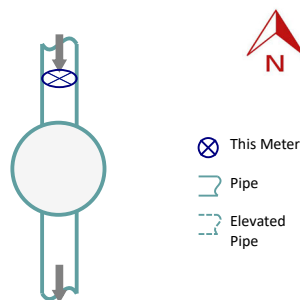
Hydraulic Characteristics

Installation Notes

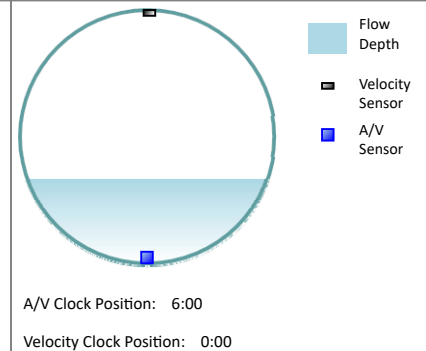
Hydraulic Information

Flow Depth (in) 6.00
 Instant Velocity (fps) 0.88
 Surge Evidence (ft) 11.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

IH-14

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:44 AM

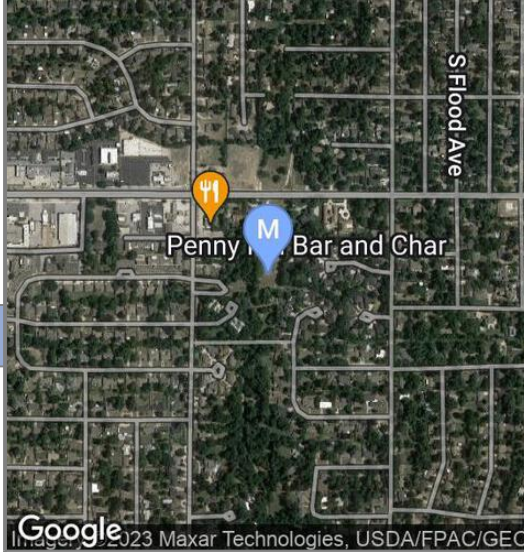
30-3984-00

T

System Information

Target Pipe Dia. (in) 36.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 283007
 U/S Connecting MH I.D 283003
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 1101 Cherrystone Cir
 Site Access Off-Road
 Longitude -97.45730000
 Latitude 35.20240000
 MH Type Precast Concrete
 Manhole Depth (ft) 15.60
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 34.00
 Pipe Width (in) 35.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



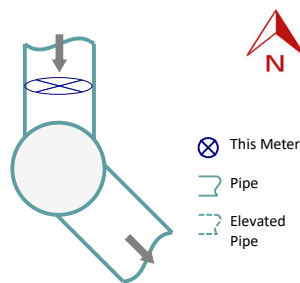
Hydraulic Information

Flow Depth (in) 7.50
 Instant Velocity (fps) 1.98
 Surge Evidence (ft) 11.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

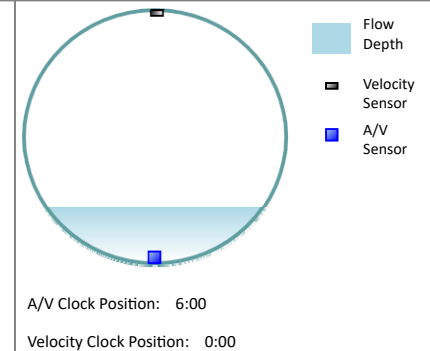
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

IH-15

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:24 AM

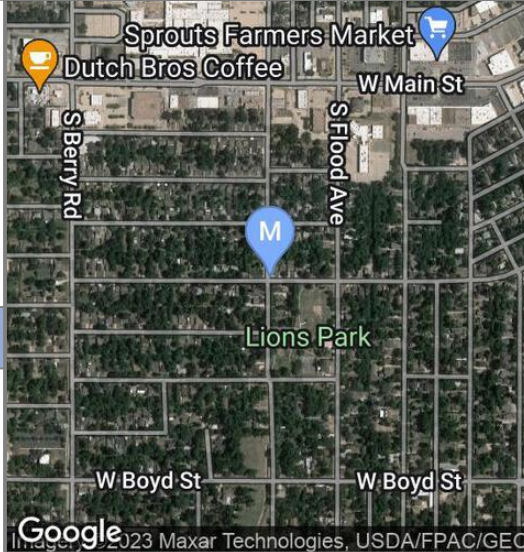
30-3984-00

T

System Information

Target Pipe Dia. (in) 30.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 241027
 U/S Connecting MH I.D 241020
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 949 W Symmes St
 Site Access Sidewalk
 Longitude -97.45460000
 Latitude 35.21490000
 MH Type Precast Concrete
 Manhole Depth (ft) 12.80
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

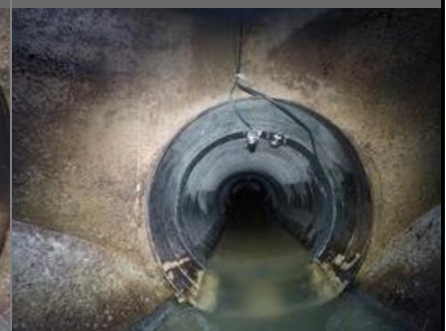
Site Information

Pipe Height (in) 29.00
 Pipe Width (in) 30.25
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



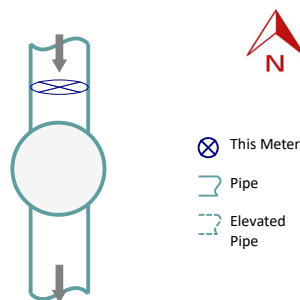
Hydraulic Information

Flow Depth (in) 3.60
 Instant Velocity (fps) 1.80
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

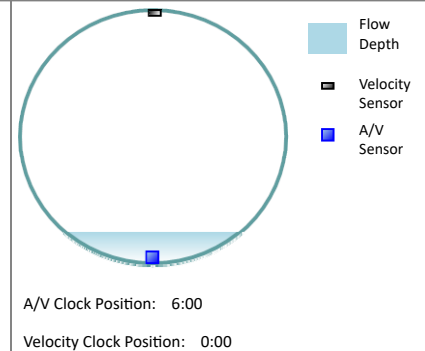
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/21/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

IH-16

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/22/2023 9:47 AM

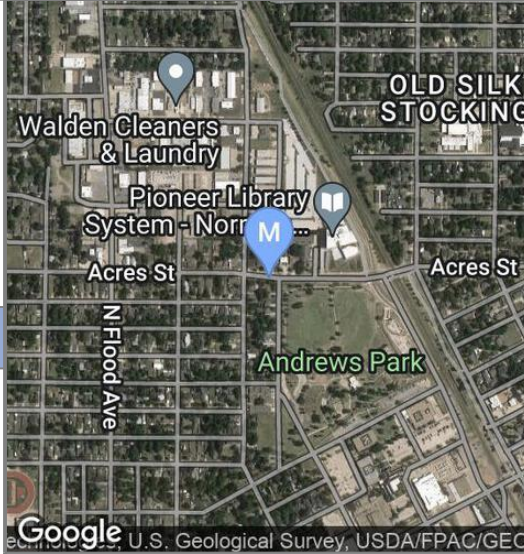
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 211076
 U/S Connecting MH I.D 211077
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 301 W Acres St
 Site Access Roadway, Low Traffic
 Longitude -97.44950000
 Latitude 35.22550000
 MH Type Precast Concrete
 Manhole Depth (ft) 17.20
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 17.44
 Pipe Width (in) 17.44
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



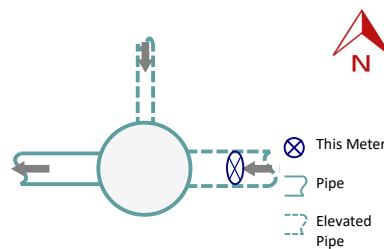
Hydraulic Information

Flow Depth (in) 3.00
 Instant Velocity (fps) 1.70
 Surge Evidence (ft) 1.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

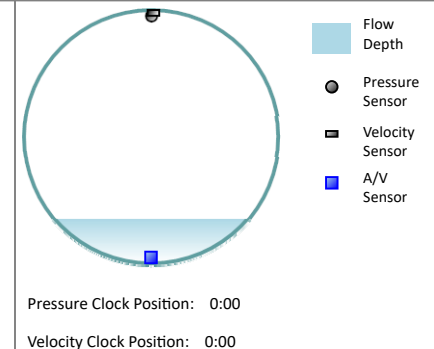
Hydraulic Characteristics

Installation Notes Flow fluctuates between 3 and 4 inches during calibration, speed also 2 to 3 fcs

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/21/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

LD-01

Inspected By mjaurez

Project No.

Site Code

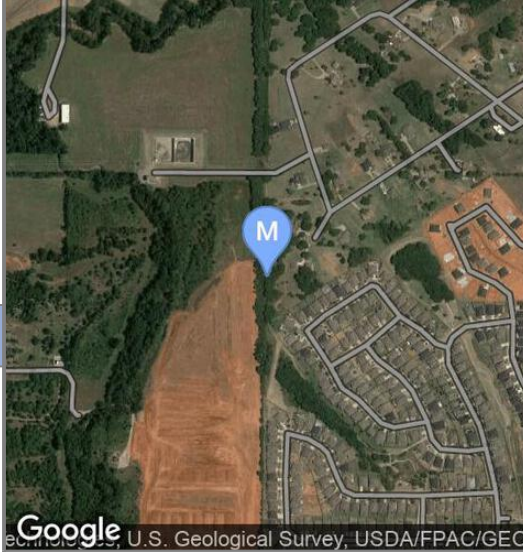
Inspected Date/Time 3/21/2023 3:16 PM

30-3984-00

System Information

Target Pipe Dia. (in) 10.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 79023
 U/S Connecting MH I.D 79022
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 4011 8th Ave Cir NE
 Site Access Off-Road
 Longitude -97.43240000
 Latitude 35.26720000
 MH Type Poured Concrete
 Manhole Depth (ft) 3.80
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.5
 Structural Integrity Safe

Top View Picture



Access Notes

Through drainage ditch off of road that goes to the treatment plant. Drive through the easement.

Site Information

Pipe Height (in) 9.75
 Pipe Width (in) 9.75
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



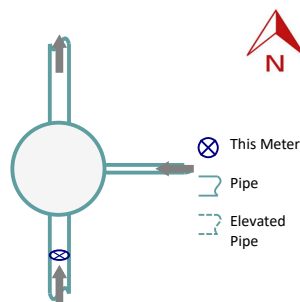
Hydraulic Information

Flow Depth (in) 1.00
 Instant Velocity (fps) 2.13
 Surge Evidence (ft) 3.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

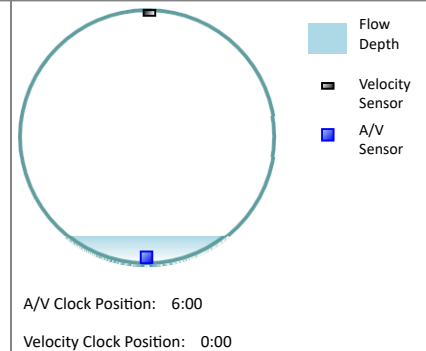
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/25/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

LD-02

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 2:30 PM

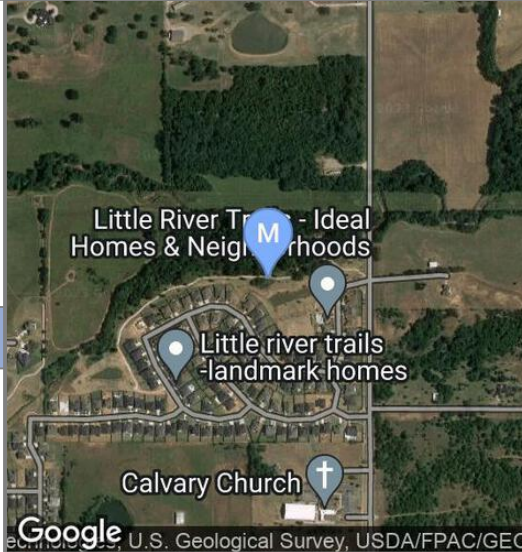
30-3984-00

T

System Information

Target Pipe Dia. (in) 36.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 78009
 U/S Connecting MH I.D 78008
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

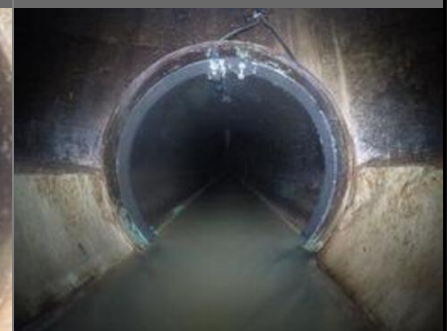
Site Address 301 Sonora Ln
 Site Access Off-Road
 Longitude -97.44360000
 Latitude 35.26790000
 MH Type Lined
 Manhole Depth (ft) 16.70
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Access Notes Access On walking trail off of N porter and Bandera Trail.

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 35.50
 Pipe Width (in) 36.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

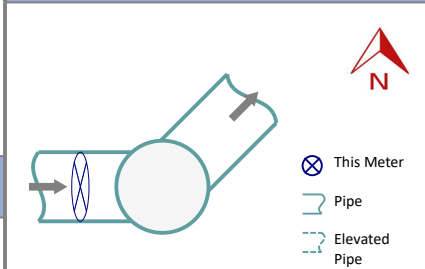
Hydraulic Characteristics

Installation Notes

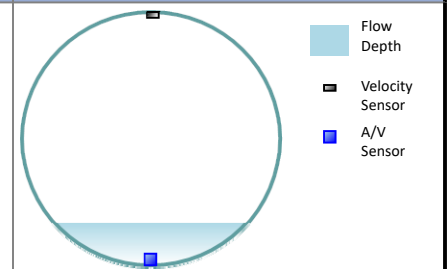
Hydraulic Information

Flow Depth (in) 6.00
 Instant Velocity (fps) 1.25
 Surge Evidence (ft) 9.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

A/V Clock Position: 6:00
Velocity Clock Position: 0:00

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/24/2023

Approvals

Recommended by FSP Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

LD-03

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 12:29 PM

30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 69012
 U/S Connecting MH I.D 69011
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 7GG7+5F Norman
 Site Access Off-Road
 Longitude -97.48640000
 Latitude 35.27540000
 MH Type Lined
 Manhole Depth (ft) 12.60
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 22.00
 Pipe Width (in) 23.50
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



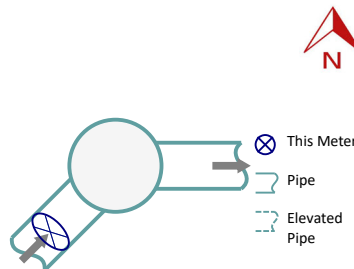
Hydraulic Information

Flow Depth (in) 4.00
 Instant Velocity (fps) 0.76
 Surge Evidence (ft) 7.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

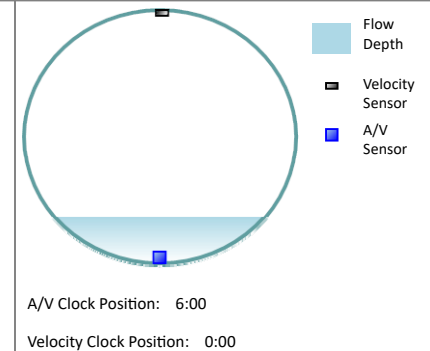
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/19/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

ND-08

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 9:41 AM

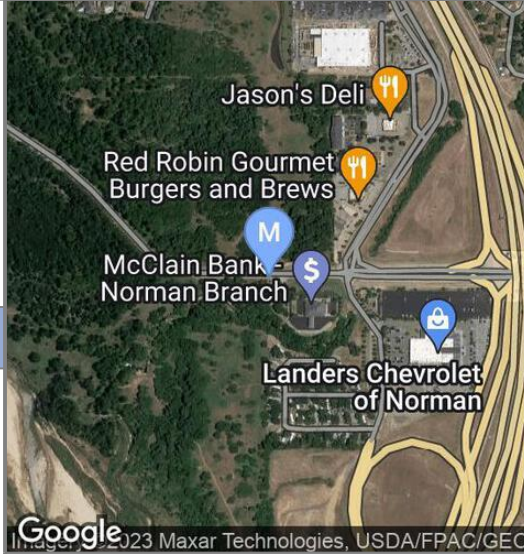
30-3984-00

T

System Information

Target Pipe Dia. (in) 24.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 279003
 U/S Connecting MH I.D 254073
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2900 W Lindsey St
 Site Access Off-Road
 Longitude -97.48550000
 Latitude 35.20390000
 MH Type Poured Concrete
 Manhole Depth (ft) 12.50
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 2.0
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 24.00
 Pipe Width (in) 24.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

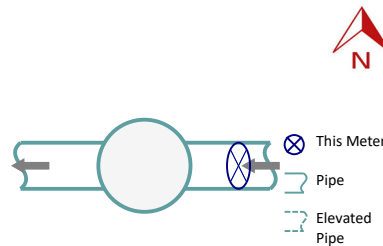
Hydraulic Characteristics

Installation Notes

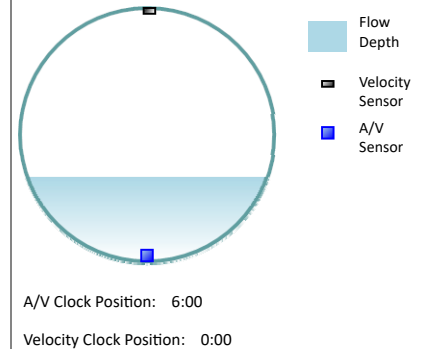
Hydraulic Information

Flow Depth (in) 8.00
 Instant Velocity (fps) 1.43
 Surge Evidence (ft) 5.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

ND-09

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/22/2023 10:00 AM

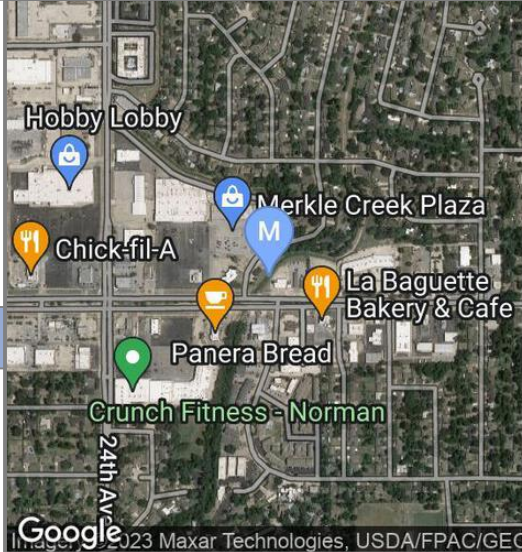
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 208122
 U/S Connecting MH I.D 208121
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 2121 W Main St
 Site Access Off-Road
 Longitude -97.47300000
 Latitude 35.21890000
 MH Type Poured Concrete
 Manhole Depth (ft) 14.30
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 0.5
 Structural Integrity Questionable

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 17.00
 Pipe Width (in) 17.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

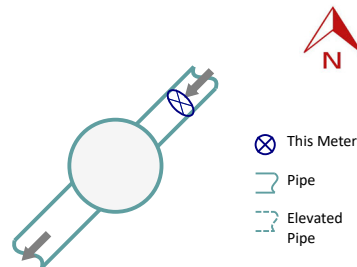
Hydraulic Characteristics

Installation Notes

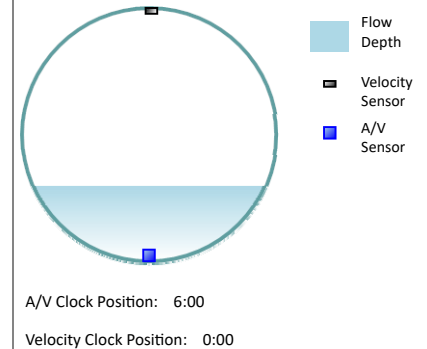
Hydraulic Information

Flow Depth (in) 5.00
 Instant Velocity (fps) 2.14
 Surge Evidence (ft) 8.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/20/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

SV-01

Inspected By zanders

Project No.

Site Code

Inspected Date/Time 3/21/2023 2:22 PM

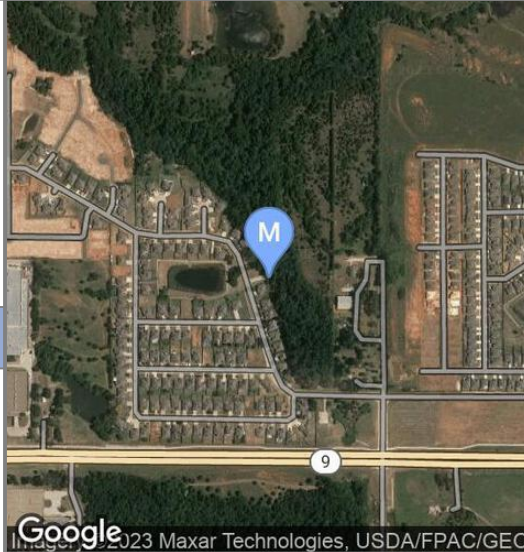
30-3984-00

T

System Information

Target Pipe Dia. (in) 8.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 301022
 U/S Connecting MH I.D 301038
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3301 Wood Valley Rd
 Site Access Off-Road
 Longitude -97.39080000
 Latitude 35.19290000
 MH Type Precast Concrete
 Manhole Depth (ft) 7.30
 Manhole Width (ft) 4.0
 Elevated MH No
 Height Elevated (ft)
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 14.50
 Pipe Width (in) 14.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

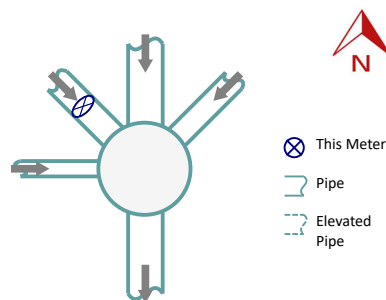
Hydraulic Characteristics

Installation Notes

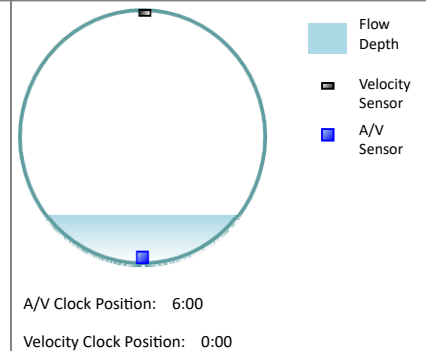
Hydraulic Information

Flow Depth (in) 2.75
 Instant Velocity (fps) 1.00
 Surge Evidence (ft) 1.50
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/19/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

WC-30

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 4:58 PM

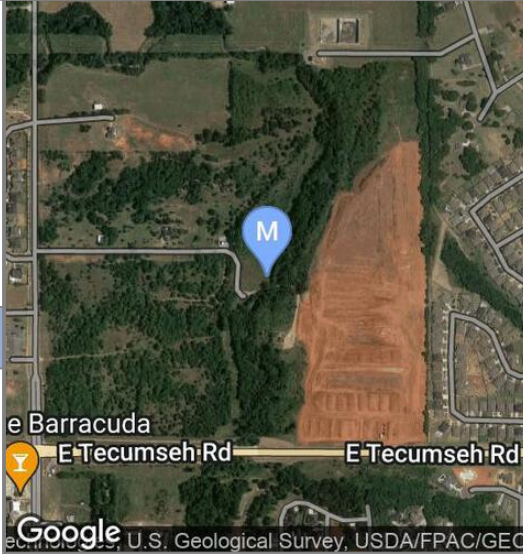
30-3984-00

T

System Information

Target Pipe Dia. (in) 18.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 79037
 U/S Connecting MH I.D 79036
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 7H87+2H Norman
 Site Access Off-Road
 Longitude -97.43610000
 Latitude 35.26510000
 MH Type Precast Concrete
 Manhole Depth (ft) 10.90
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Access Notes

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 23.00
 Pipe Width (in) 23.00
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

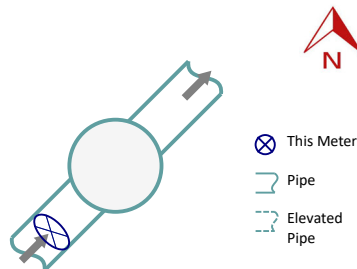
Hydraulic Characteristics

Installation Notes

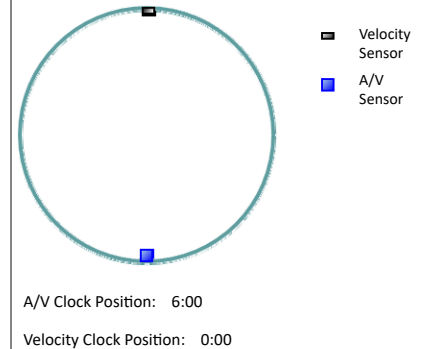
Hydraulic Information

Flow Depth (in)
 Instant Velocity (fps) 2.12
 Surge Evidence (ft) 2.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/27/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

WC-31

Inspected By mjaurez

Project No.

Site Code

Inspected Date/Time 3/21/2023 5:13 PM

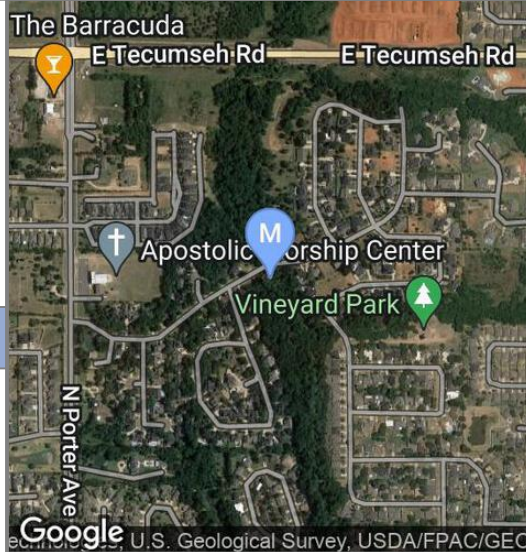
30-3984-00

T

System Information

Target Pipe Dia. (in) 15.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 105128
 U/S Connecting MH I.D 105025
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 400 Nantucket Blvd
 Site Access Off-Road
 Longitude -97.43680000
 Latitude 35.25780000
 MH Type Precast Concrete
 Manhole Depth (ft) 15.00
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 1.5
 Structural Integrity Safe

Top View Picture



Access Notes

Site Information

Pipe Height (in) 14.50
 Pipe Width (in) 15.00
 Pipe Type Iron
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



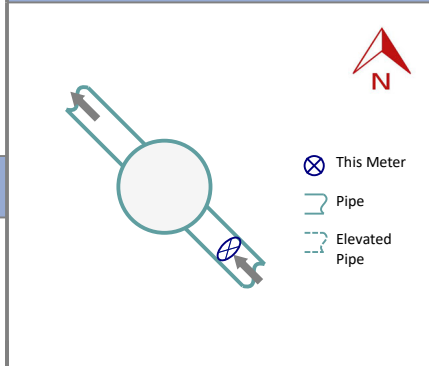
Hydraulic Information

Flow Depth (in) 4.50
 Instant Velocity (fps) 1.39
 Surge Evidence (ft)
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

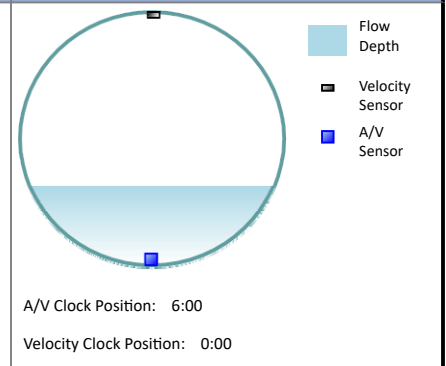
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/21/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK

Site Name

Item 6.

2023 Norman Temporary Flow Monitoring

WC-32

Inspected By

mjaurez

Project No.

Site Code

Inspected Date/Time

3/21/2023 4:26 PM

30-3984-00

T

System Information

Target Pipe Dia. (in) 21.0
 Municipality Norman
 District
 Assigned Rain Gauge
 Client Manhole # 103013
 U/S Connecting MH I.D 103012
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence

Area Location Map



Area View Picture



Location Information

Site Address 796 W Tecumseh Rd
 Site Access Off-Road
 Longitude -97.45370000
 Latitude 35.26170000
 MH Type Precast Concrete
 Manhole Depth (ft) 18.30
 Manhole Width (ft) 4.0
 Elevated MH Yes
 Height Elevated (ft) 2.0
 Structural Integrity Safe

Top View Picture



Access Notes

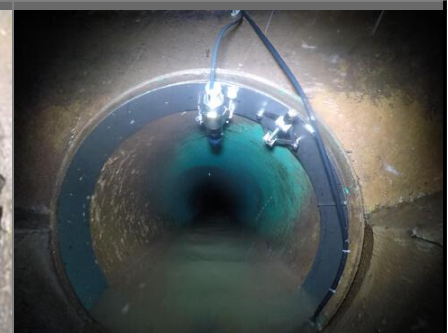
Site Information

Pipe Height (in) 20.50
 Pipe Width (in) 20.50
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 20.9 LEL % 0.0
 H2S 0.0 CO 0.0

Investigation Photo



Installation Photo



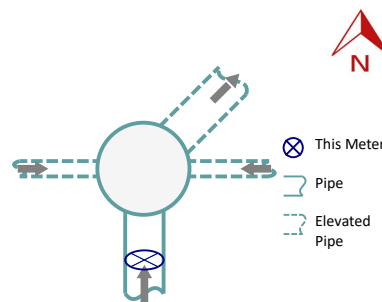
Hydraulic Information

Flow Depth (in) 3.00
 Instant Velocity (fps) 1.02
 Surge Evidence (ft) 16.00
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Slight Bend
 Drop Inlet No
 Hydraulic Rating Good

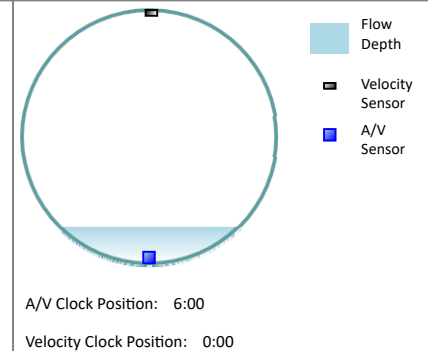
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole
 Sensors Pressure, Velocity, and Ultra
 Antenna Surface Non-Paved Surface
 Signal Strength

Post Installation Notes

Meter Type -
 Telemetry Type
 Installation Date 4/25/2023

Approvals

Recommended by FSP

Client Approval



Norman,OK
Norman Utilities Authority

Site Name Item 6.

WS-01

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 1/7/2015 9:12 AM

30-3884-00

T

System Information

Target Pipe Dia. (in) 42.0
 Municipality Norman
 District Norman
 Assigned Rain Gauge RG-03
 Client Manhole # 327074
 U/S Connecting MH I.D 327075
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence Yes

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3901 Chautauqua Ave, Norman, OK 73072
 Site Access Off-Road
 Longitude -97.45040000
 Latitude 35.17670000
 MH Type Poured Concrete
 Manhole Depth (ft) 13.00
 Manhole Width (ft) 5.8
 Elevated MH Yes
 Height Elevated (ft) 0.8
 Structural Integrity Safe

Access Notes By cattle gate on Chatauqua

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 41.62
 Pipe Width (in) 41.69
 Pipe Type Polyvinyl Chloride
 Pipe Shape Circular
 O2 LEL %
 H2S CO

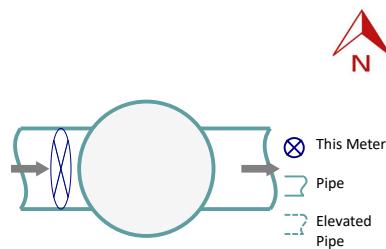
Hydraulic Characteristics

Installation Notes

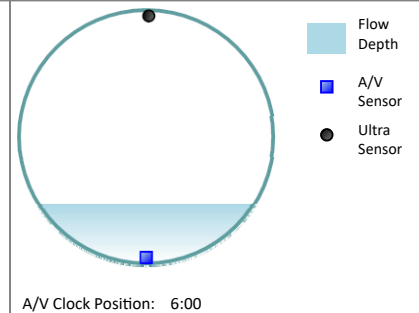
Hydraulic Information

Flow Depth (in) 9.62
 Instant Velocity (fps) 2.13
 Surge Evidence (ft)
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole Upstream
 Sensors
 Antenna Surface Paved Surface
 Signal Strength 75

Post Installation Notes

Meter Type
 Telemetry Type
 Installation Date 3/2/2017

Approvals

Recommended by FSP Yes
Client Approval Yes



Norman,OK
Norman Utilities Authority

Site Name Item 6.

WS-10

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 1/7/2015 9:45 AM

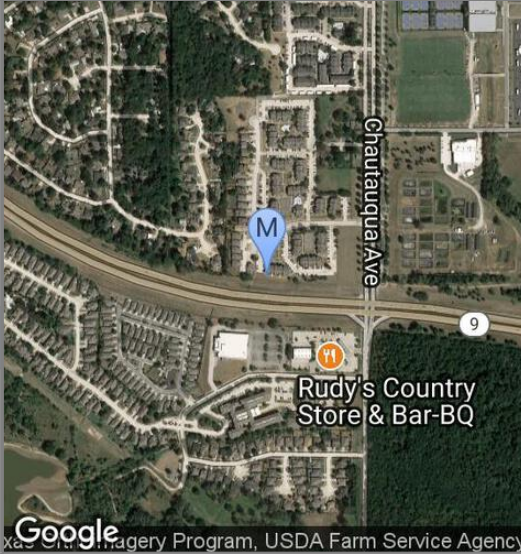
30-3884-00

T

System Information

Target Pipe Dia. (in) 22.0
 Municipality Norman
 District Norman
 Assigned Rain Gauge RG-03
 Client Manhole # 318010
 U/S Connecting MH I.D 318011
 System Characteristics:
 Residential - Commercial - Industrial -
 P/S Influence No
 WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3204 Ridgecrest Cir
 Site Access Off-Road
 Longitude -97.45240000
 Latitude 35.18250000
 MH Type Brick
 Manhole Depth (ft) 8.06
 Manhole Width (ft) 5.0
 Elevated MH Yes
 Height Elevated (ft) 0.3
 Structural Integrity Safe

Access Notes South of Post Oak apartments.

Site Information

Pipe Height (in) 22.62
 Pipe Width (in) 22.88
 Pipe Type Vitrified Clay
 Pipe Shape Circular
 O2 LEL %
 H2S CO

Investigation Photo



Installation Photo



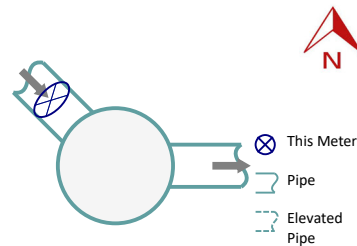
Hydraulic Information

Flow Depth (in) 8.44
 Instant Velocity (fps) 1.62
 Surge Evidence (ft)
 Silt Type None
 Silt Depth (in) 0.00
 Needs Cleaning No
 Backwater No
 Flow Path Straight
 Drop Inlet No
 Hydraulic Rating Good

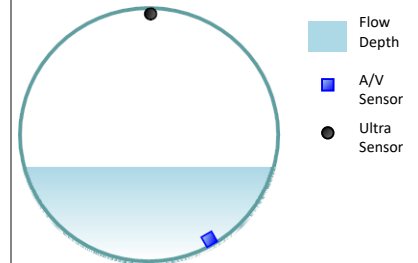
Hydraulic Characteristics

Installation Notes

Install Plan Sketch



Install Cross-Section Sketch



A/V Clock Position: 5:00

Installation Notes

Location in Pipe (ft) 1.0
 Location from Manhole Upstream
 Sensors
 Antenna Surface Non-Paved Surface
 Signal Strength 75

Post Installation Notes

Meter Type
 Telemetry Type
 Installation Date 10/7/2014

Approvals

Recommended by FSP
Yes

Client Approval
Yes



Norman,OK
Norman Utilities Authority

Site Name Item 6.

WS-11

Inspected By r_bass

Project No.

Site Code

Inspected Date/Time 1/8/2015 10:01 AM

30-3884-00

T

System Information

Target Pipe Dia. (in) 42.0
Municipality Norman
District Norman
Assigned Rain Gauge RG-03
Client Manhole # 328046
U/S Connecting MH I.D 328045
System Characteristics:
Residential - Commercial - Industrial -
P/S Influence No
WWTP Influence No

Area Location Map



Area View Picture



Top View Picture



Location Information

Site Address 3428 Jenkins Ave Norman, OK 73072
Site Access Other
Longitude -97.44420000
Latitude 35.18230000
MH Type Poured Concrete
Manhole Depth (ft) 22.60
Manhole Width (ft) 5.0
Elevated MH Yes
Height Elevated (ft) 0.4
Structural Integrity Safe

Access Notes ROTC training ground

Investigation Photo



Installation Photo



Site Information

Pipe Height (in) 41.25
Pipe Width (in) 41.13
Pipe Type Polyvinyl Chloride
Pipe Shape Circular
O2 LEL %
H2S CO

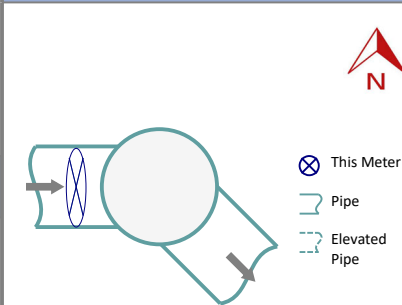
Hydraulic Characteristics

Installation Notes

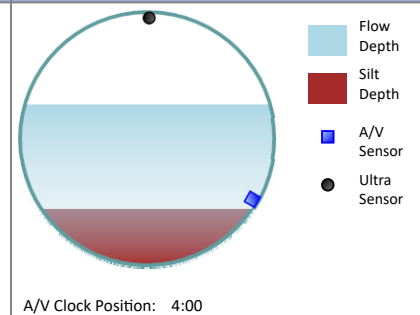
Hydraulic Information

Flow Depth (in) 26.13
Instant Velocity (fps) 0.78
Surcharge Evidence (ft)
Silt Type Fine
Silt Depth (in) 9.00
Needs Cleaning No
Backwater No
Flow Path Straight
Drop Inlet No
Hydraulic Rating Good

Install Plan Sketch



Install Cross-Section Sketch



Installation Notes

Location in Pipe (ft) 1.0
Location from Manhole Upstream
Sensors
Antenna Surface Non-Paved Surface
Signal Strength 75

Post Installation Notes

Approvals

Meter Type
Telemetry Type
Installation Date 6/9/2017

Recommended by FSP
Yes

Client Approval
Yes

Monitor Site

Monitor Site: RG-02

Monitor Location: D Pump station

Metadata

Date	Mar 22 2023 12:10PM
Crew	C. Lyda; M. Juarez
Coordinates	[35.2693105, -97.434748]

Location

Facility Name	D Pump station
Location Description	7H98+MG Norman

Investigation

Arrival Time	Mar 22 2023 11:07AM
Departure Time	Mar 22 2023 11:20AM
Setup Conditions	Standard

Access and Safety

Contact Name	N/A
Phone Number	329-0703
Contact Title	N/A

Review

Recommended for Installation Yes



Location



Area



Area



Area

Monitor Site

Monitor Site: RG-03

Monitor Location: Norman City Yard

Metadata

Date	Jun 4 2021 12:48PM
Creator	Blangdon
Coordinates	[35.244104, -97.460121]

Location

Facility Name	Norman City Yard
Location Description	1301 Da Vinci St

Investigation

Arrival Time	Jun 4 2021 11:46AM
Departure Time	Jun 4 2021 11:53AM
Setup Conditions	Standard

Access and Safety

Contact Name	City
Phone Number	NA
Contact Title	Yard
Access Instructions	Access through South East part of the city building. Use permanent black ladder that is attached to the building, rain gauge is right up on the roof there.

Review

Recommended for Installation Yes



Location



Area

Monitor Site

Monitor Site: RG-04

Monitor Location: Vernon Campbell Water Treatment Plant

Metadata

Date	Sep 11 2015 10:46AM
Creator	mhuska
Coordinates	[35.232275, -97.395774]

Location

Facility Name	Vernon Campbell Water Treatment Plant
Location Description	3000 East robinson St

Investigation

Arrival Time	Sep 11 2015 10:46AM
Setup Conditions	Standard

Access and Safety

Contact Name	Jared Mattern
Phone Number	405-329-0703
Contact Title	Utility Supervisor
Access Instructions	Coordinate with City

Review

Recommended for Installation	Yes
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Location



Monitor Site

Monitor Site: RG-05

Monitor Location: Millenium Medical

Metadata

Date	May 2 2023 3:07PM
Crew	C. Lyda; M. Juarez
Coordinates	[35.22404, -97.494612]

Location

Facility Name	Millenium Medical
Location Description	448 36th Ave NW

Investigation

Arrival Time	May 2 2023 2:05PM
Departure Time	May 2 2023 2:18PM
Setup Conditions	Standard

Access and Safety

Contact Name	Owner
Phone Number	4055739905
Contact Title	Owner
Access Instructions	On top of the NE part of the roof by the front corner of building.

Review

Recommended for Installation Yes



Location



Area

Monitor Site

Monitor Site: RG-06

Monitor Location: Taco Casa

Metadata

Date	May 2 2023 2:02PM
Crew	C. Lyda; M. Juarez
Coordinates	[35.218927, -97.454122]

Location

Facility Name	Taco Casa
Location Description	731 W Main St

Investigation

Arrival Time	May 2 2023 12:57PM
Departure Time	May 2 2023 1:06PM
Setup Conditions	Standard

Access and Safety

Contact Name	Manager
Phone Number	4058014104
Contact Title	Manager
Access Instructions	On top of small NE corner building in the back.

Review

Recommended for Installation Yes



Location



Area

Monitor Site

Monitor Site: RG-07

Monitor Location: Folks Auto Machine

Metadata

Date	May 2 2023 2:15PM
Crew	C. Lyda; M. Juarez
Coordinates	[35.225407, -97.422871]

Location

Facility Name	Folks Auto Machine
Location Description	541 12th Ave NE

Investigation

Arrival Time	May 2 2023 1:14PM
Departure Time	May 2 2023 1:21PM
Setup Conditions	Standard

Access and Safety

Contact Name	Owner
Phone Number	4053292287
Contact Title	Owner
Access Instructions	On top of NE vehicle awning.

Review

Recommended for Installation Yes



Location



Area

Monitor Site

Monitor Site: RG-08

Monitor Location: Summit Valley L/S

Metadata

Date	May 11 2023 9:34AM
Creator	danglemartin
Coordinates	[35.1902413, -97.389453]

Location



Location

Facility Name	Summit Valley L/S
Location Description	Wood Valley Road\n

Investigation

Arrival Time	Apr 25 2023 10:40AM
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Review

Recommended for Installation	Yes
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Monitor Site

Monitor Site: RG-09

Monitor Location: St Michael's Episcopal Church

Metadata

Date	May 11 2023 9:46AM
Creator	danglemartin
Coordinates	[35.1896856, -97.466331]

Location

Location

Facility Name	St Michael's Episcopal Church
Location Description	1601 W Imhoff RD\n



Investigation

Arrival Time	Apr 26 2023 10:30AM
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Review

Recommended for Installation	Yes
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Monitor Site

Monitor Site: RG-10

Monitor Location: City of Norman Water Reclamation Facility

Metadata

Date	Sep 11 2015 10:46AM
Creator	mhuska
Coordinates	[35.1757793, -97.443034]

Location



Location

Facility Name	City of Norman Water Reclamation Facility
Location Description	3500 Jenkins ave

Investigation

Arrival Time	Sep 11 2015 11:46AM
Departure Time	Sep 11 2015 12:46PM
Setup Conditions	Standard

Access and Safety

Contact Name	Jared Mattern
Phone Number	405-329-0703
Contact Title	Utility Supervisor
Access Instructions	Norman waste water treatment plant on top of chlorine building.

Review

Recommended for Installation	Yes
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Monitor Site

Monitor Site: RG-11

Monitor Location: Community Christian School Athletics

Metadata

Date	Mar 22 2023 11:42AM
Crew	S. Gentry; Z. Sanders
Coordinates	[35.280651, -97.486143]

Location

Facility Name	Community Christian School Athleti
Location Description	5336 N Interstate Dr

Investigation

Arrival Time	Mar 22 2023 10:41AM
Departure Time	Mar 22 2023 11:46AM
Setup Conditions	Standard

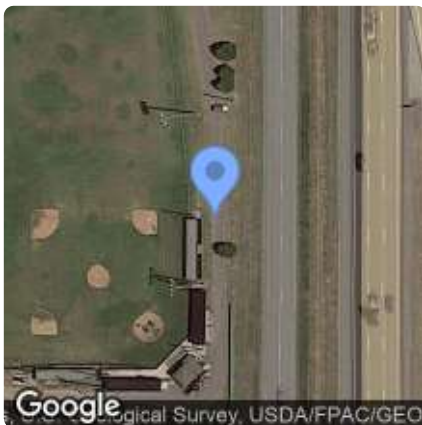
Access and Safety

Contact Name	Kerry Filmore
Phone Number	4056205487
Contact Title	Maintenance

Review

Installation Instructions On the dugout closest to the road, at the field south of the parking lot, or on a bleacher awning

Recommended for Installation Yes



Location



Area



Area



Area

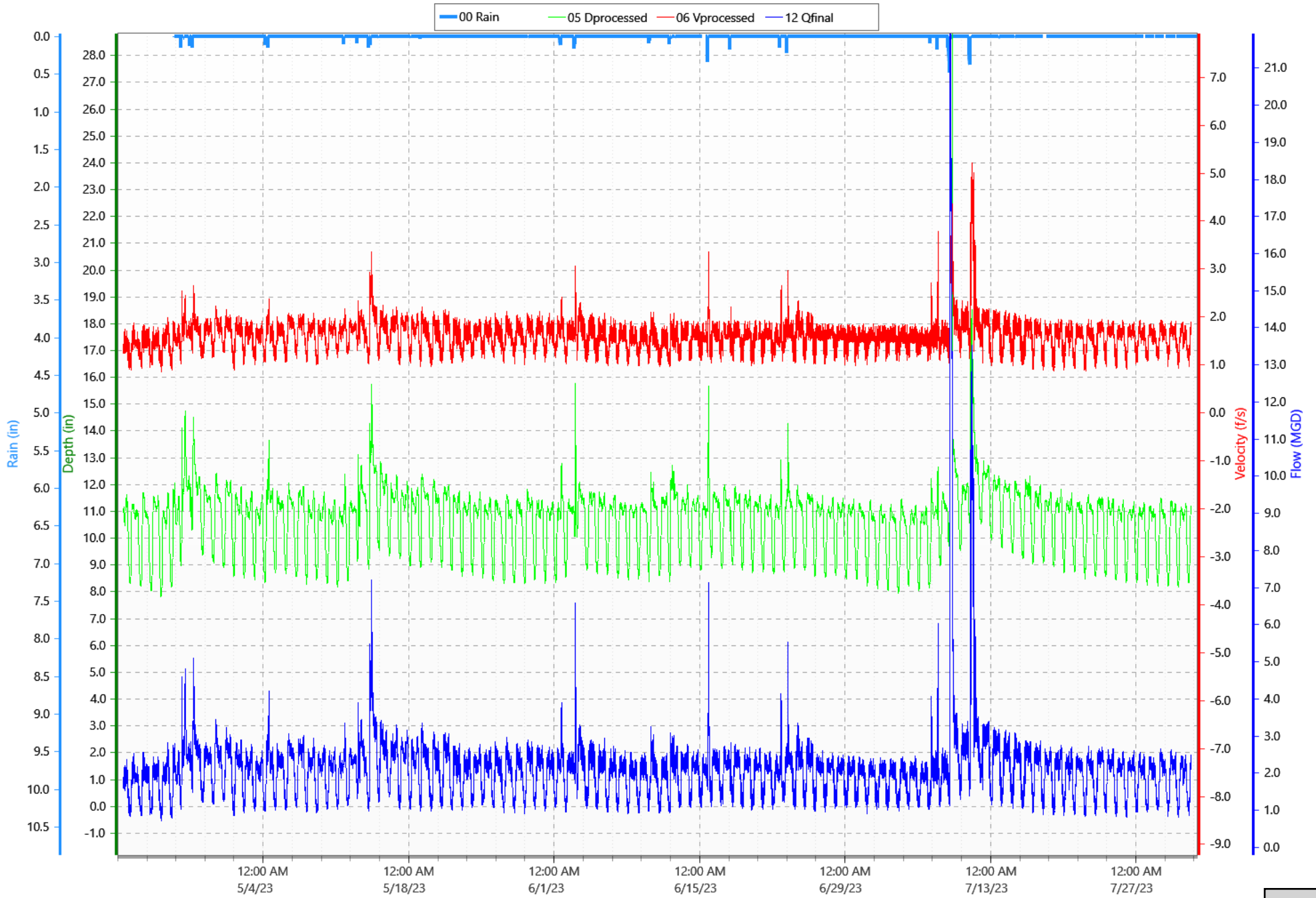


Appendix B: Flow Monitoring Hydrographs

BH-02 (4/20/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 42.50 in.

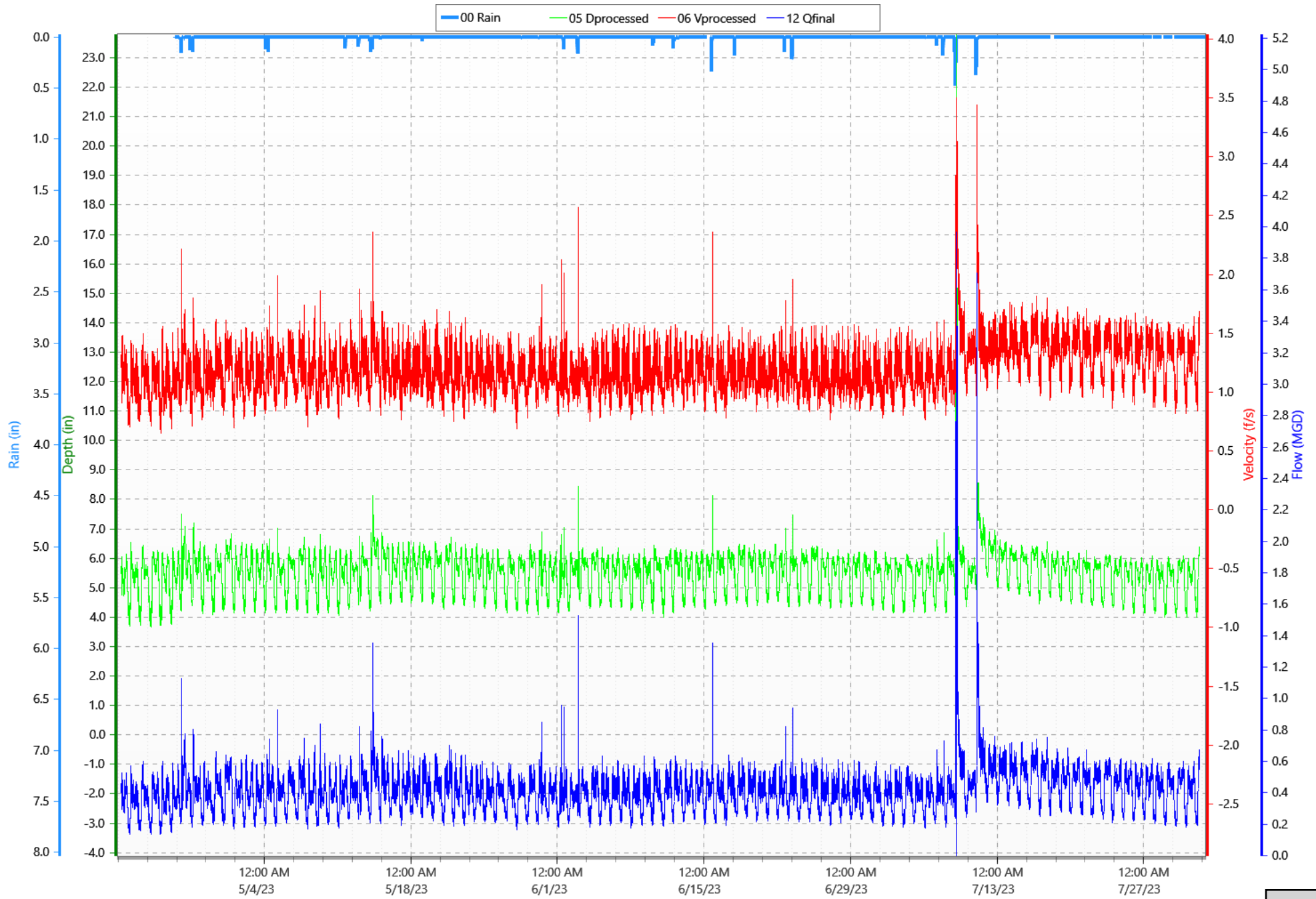


Print Date: 10/12/2023 11:39:15 AM

BH-03 (4/20/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 22.00 in.

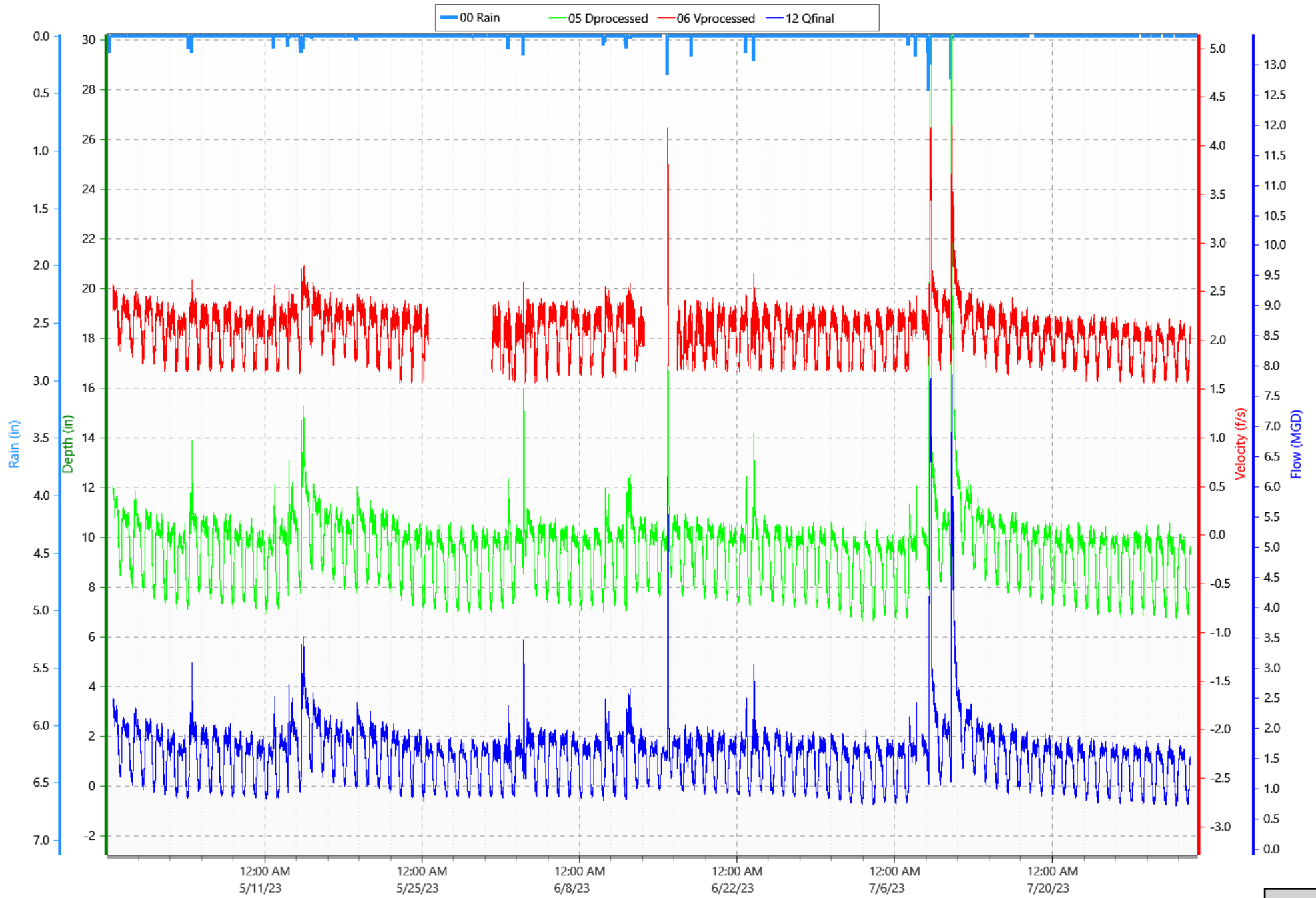


Print Date: 10/12/2023 11:46:53 AM

BH-04 (4/27/2023 to 8/2/2023)

DVQ with Rain - Pipe Dia: 23.00 in.

Item 6.

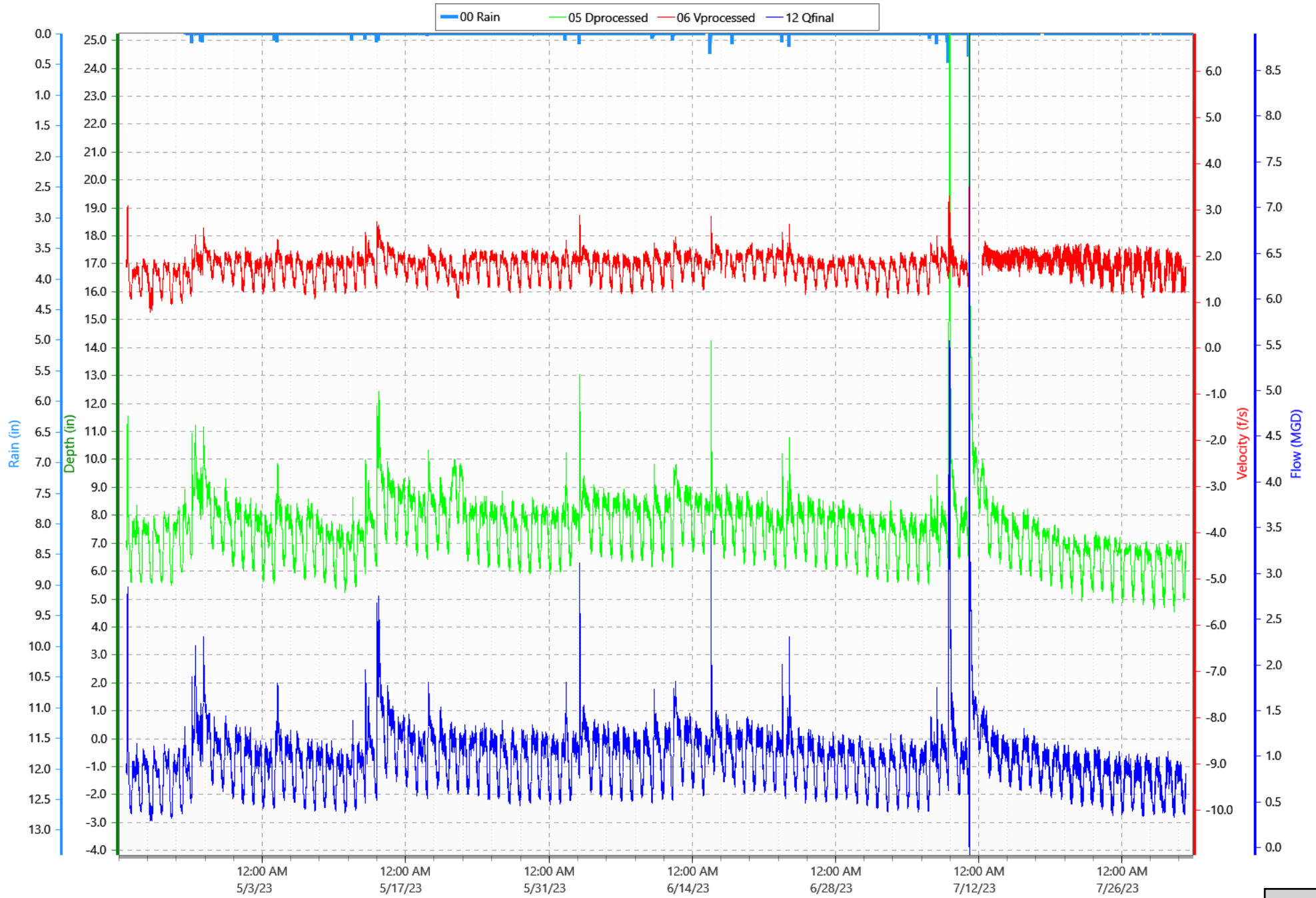


Print Date: 10/12/2023 10:19:30 AM

BH-05 (4/19/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 23.00 in.

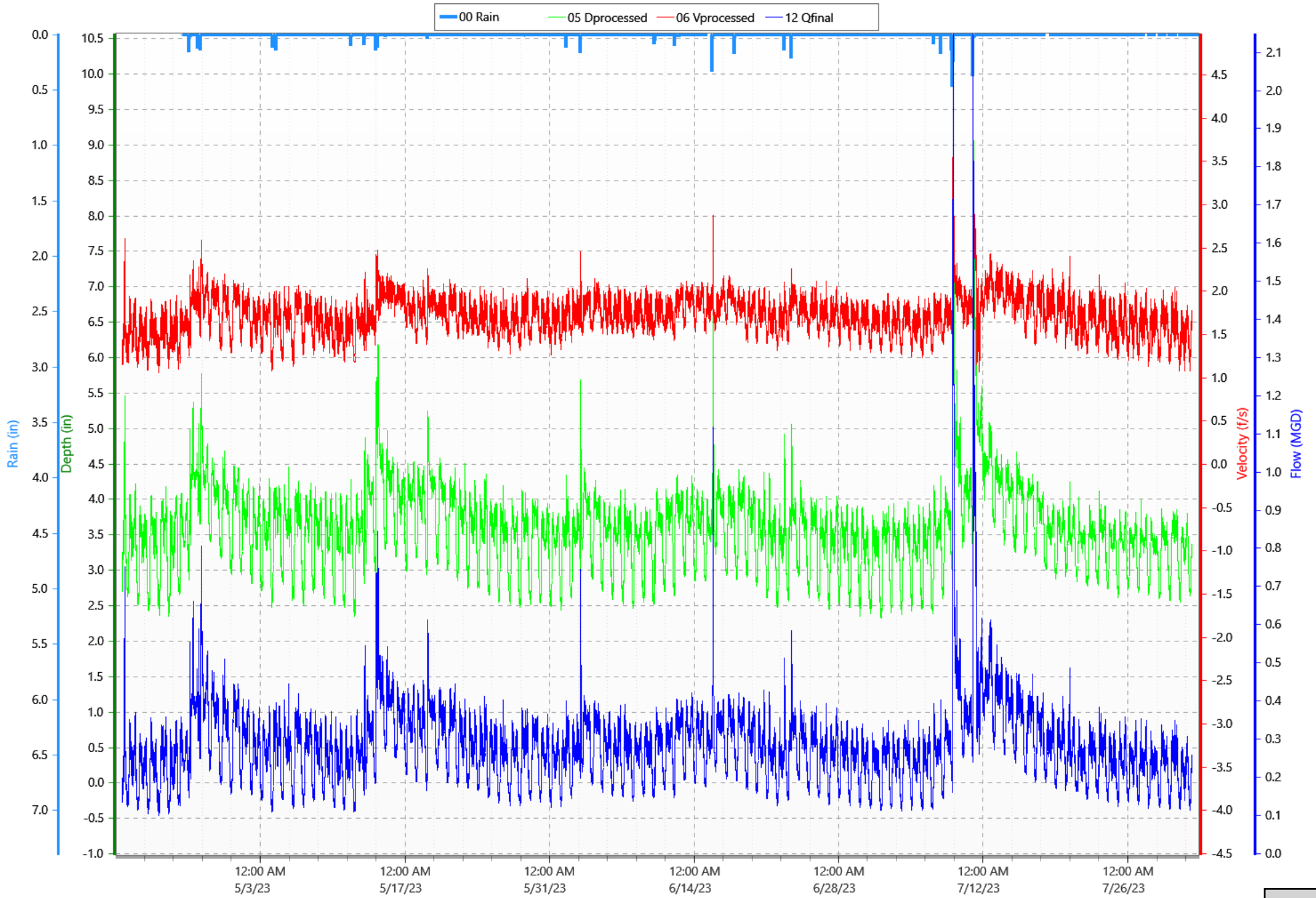


Print Date: 10/12/2023 12:12:58 PM

BH-06 (4/19/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 17.5 in.

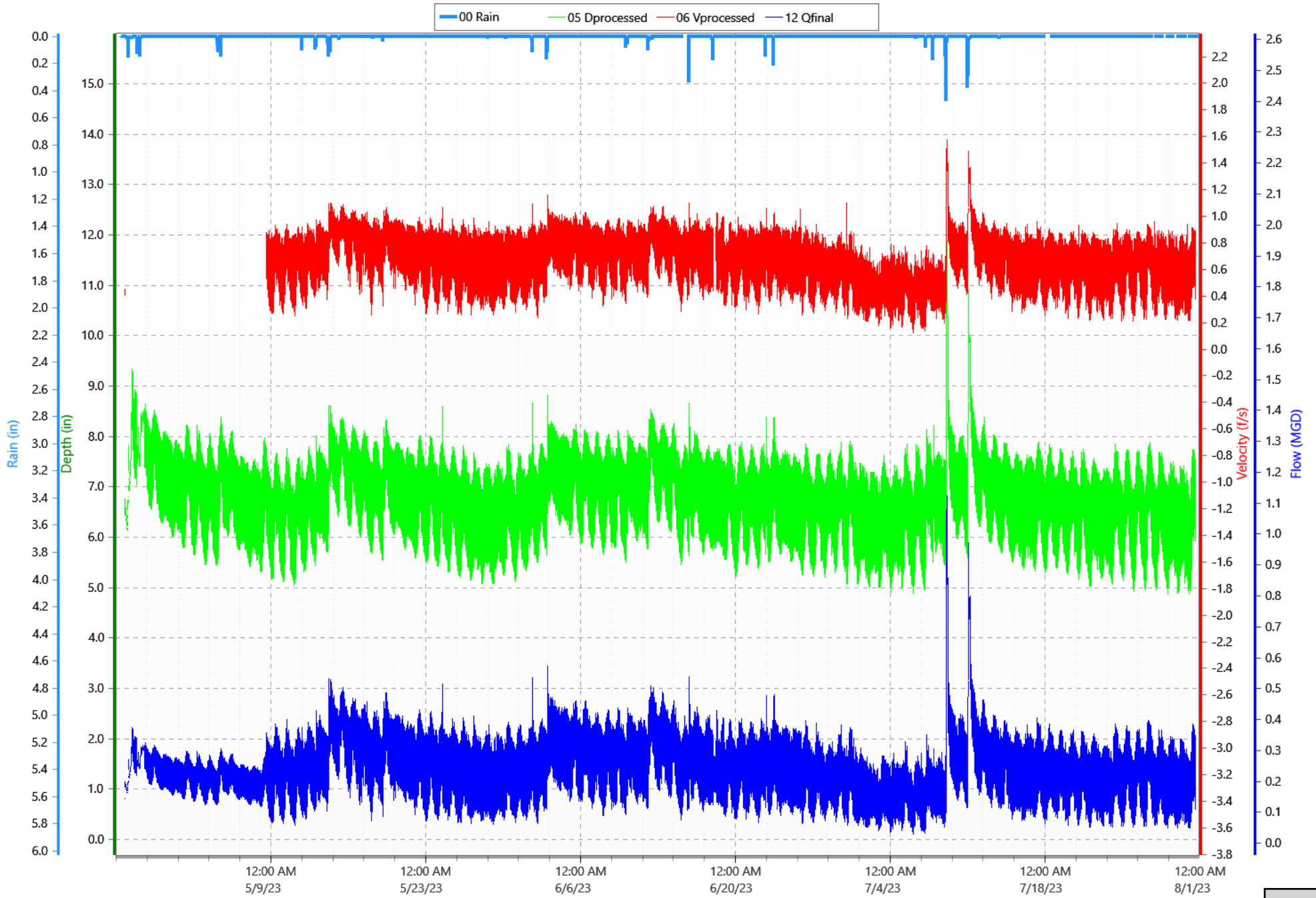


Print Date: 10/12/2023 10:20:57 AM

BH-07 (4/25/2023 to 8/1/2023)

Item 6.

DVQ with Rain - Pipe Dia: 16.50 in.



Print Date: 10/12/2023 10:21:51 AM

BP-17 (4/19/2023 to 8/2/2023)

DVQ with Rain - Pipe Dia: 32.94 x 33.98 in.

Item 6.

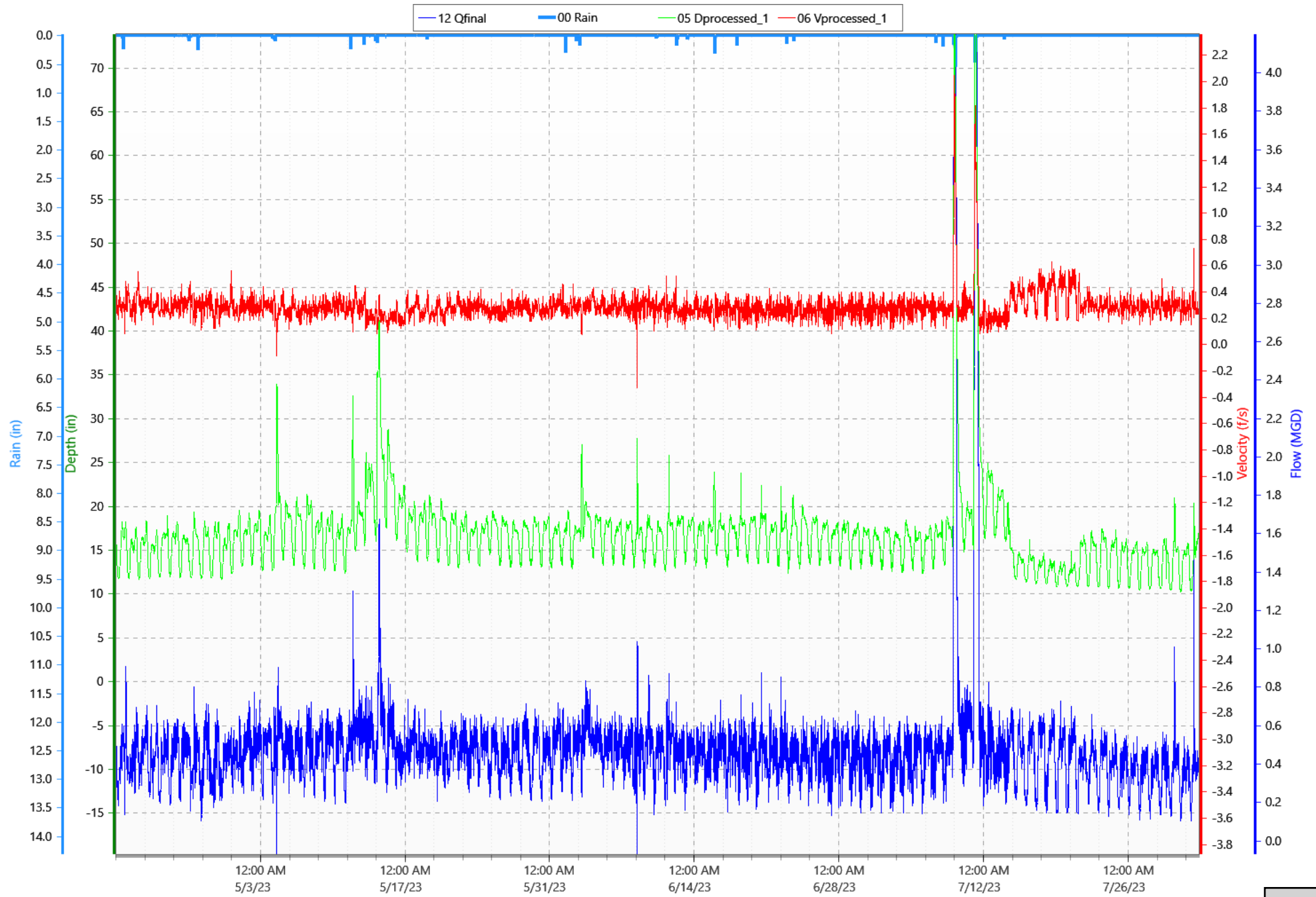


Print Date: 10/12/2023 12:14:56 PM

BP-18 (4/19/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 36.88 in.

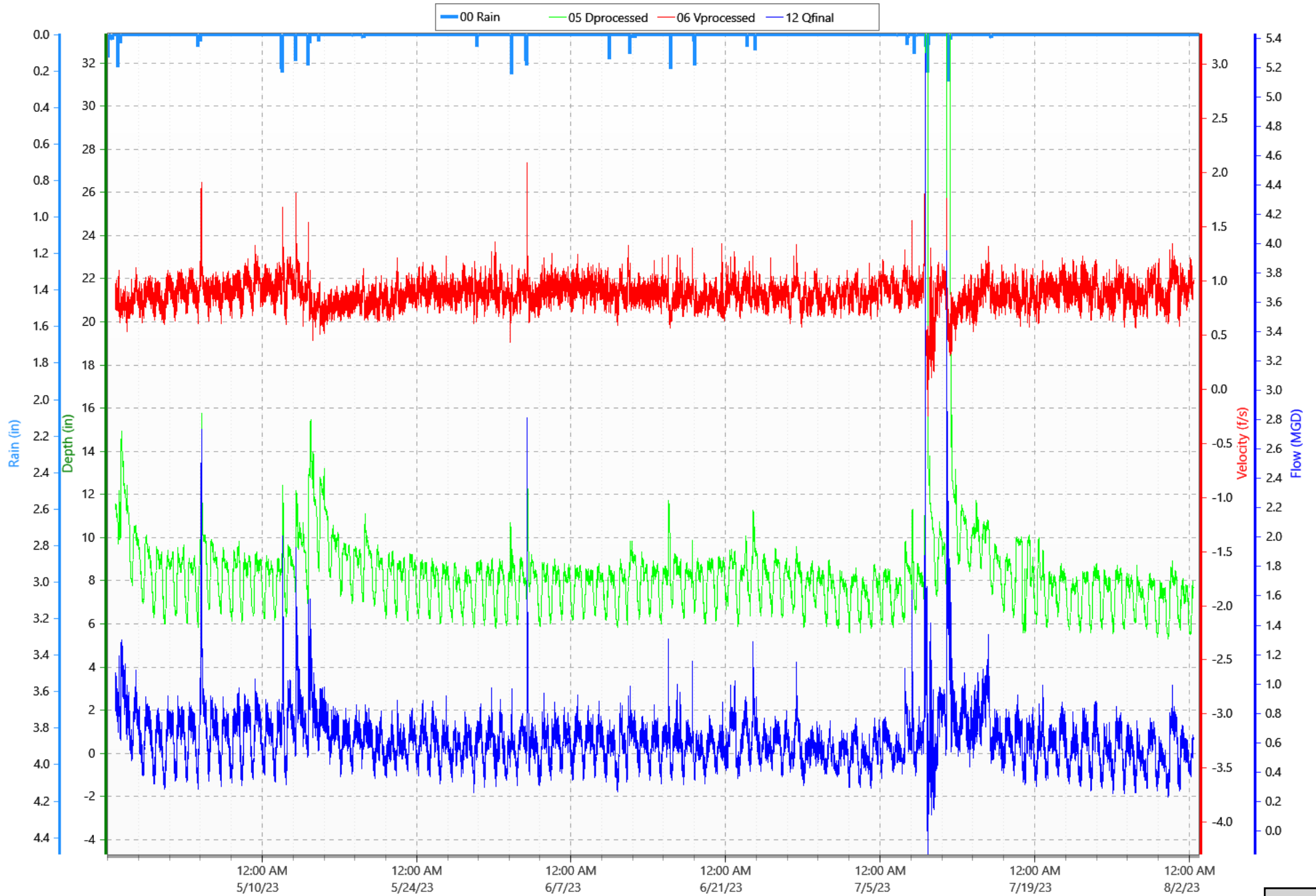


Print Date: 10/12/2023 12:55:37 PM

BP-19 (4/26/2023 to 8/3/2023)

Item 6.

DVQ with Rain - Pipe Dia: 29.50 in.

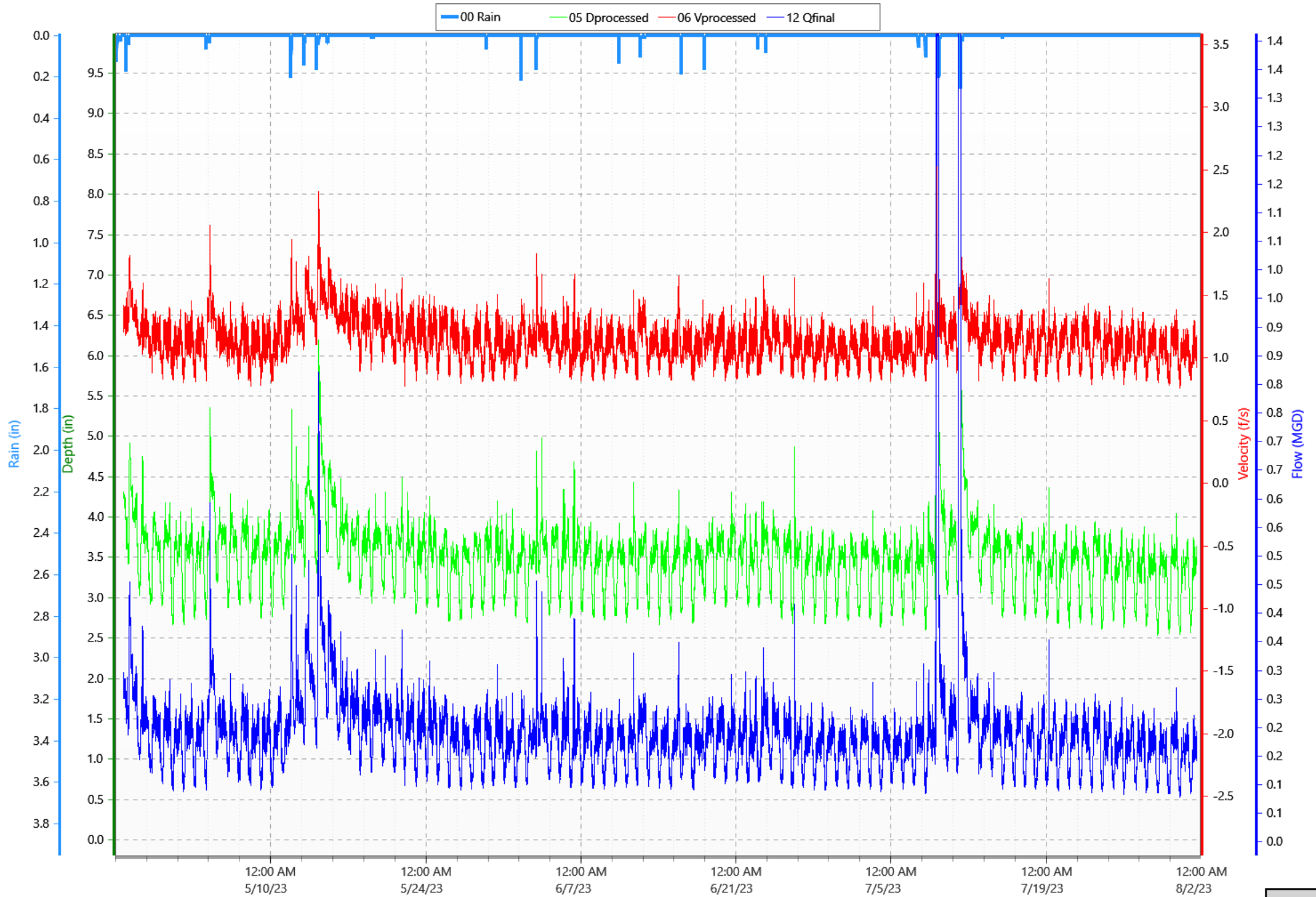


Print Date: 10/12/2023 10:23:18 AM

BP-20 (4/26/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 18.50 in.

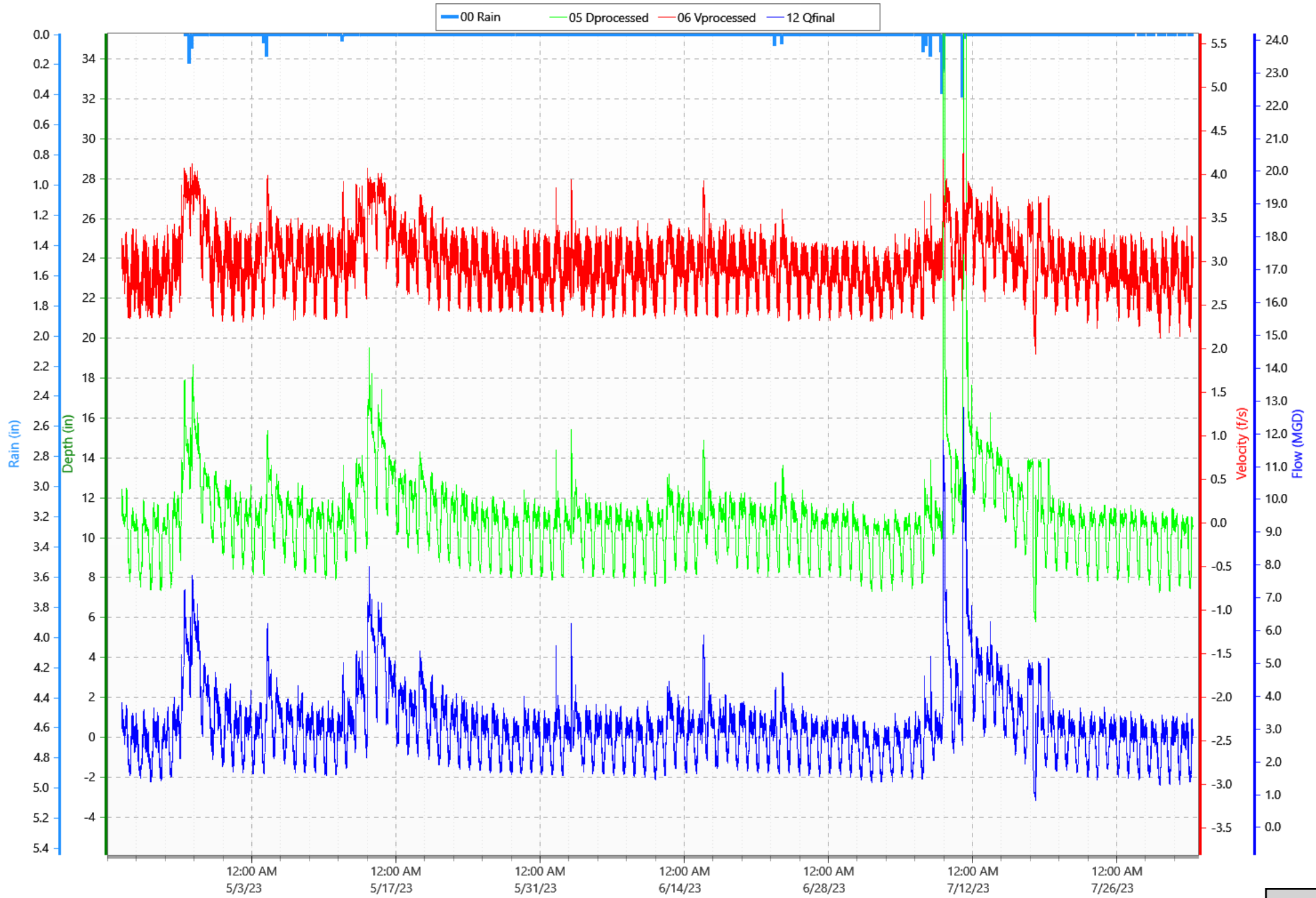


Print Date: 10/12/2023 10:24:11 AM

BP-21 (4/19/2023 to 8/3/2023)

DVQ with Rain - Pipe Dia: 28.75 x 29.75 in.

Item 6.

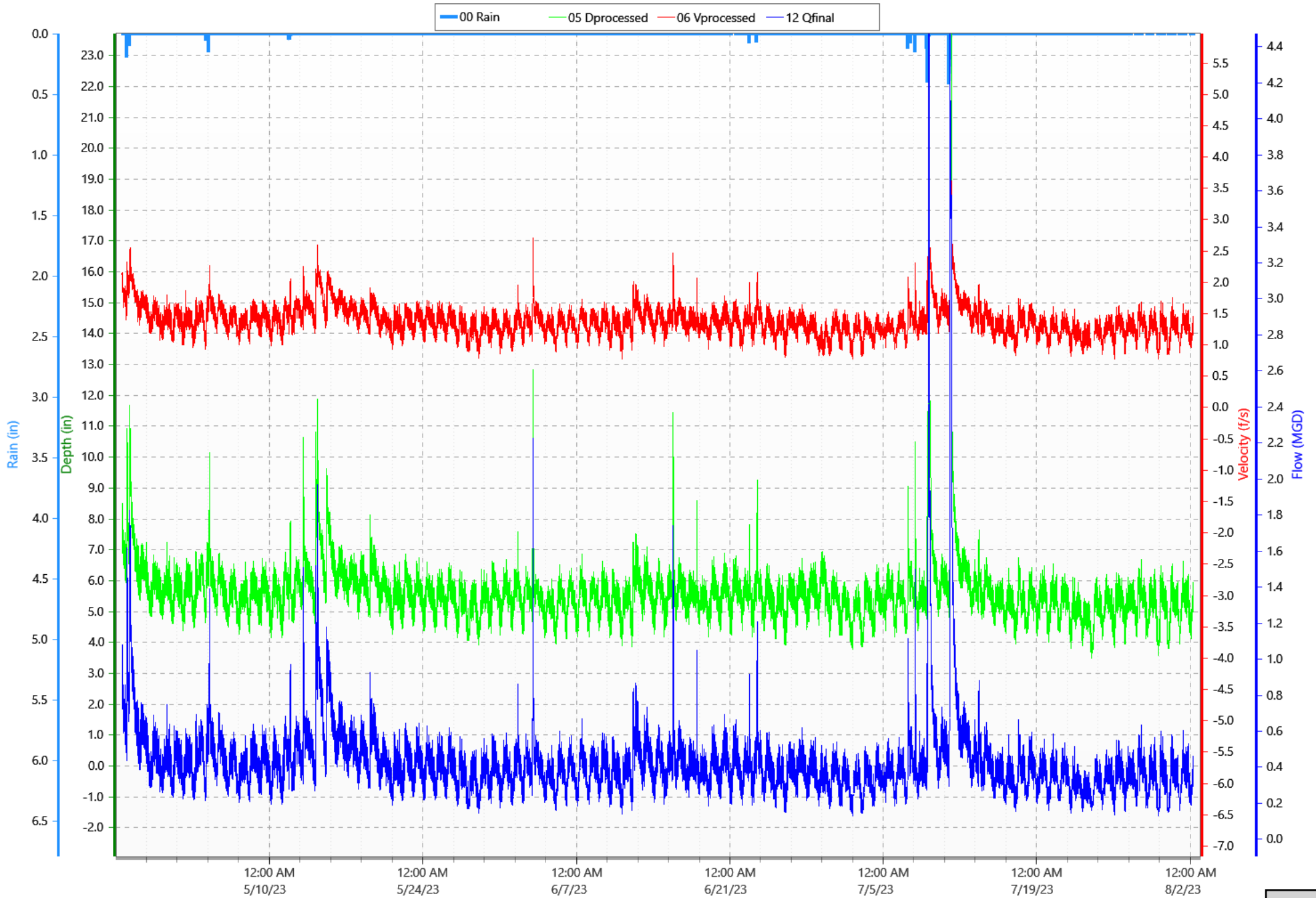


Print Date: 10/12/2023 10:25:35 AM

BP-22 (4/26/2023 to 8/3/2023)

DVQ with Rain - Pipe Dia: 16.50 x 17.00 in.

Item 6.

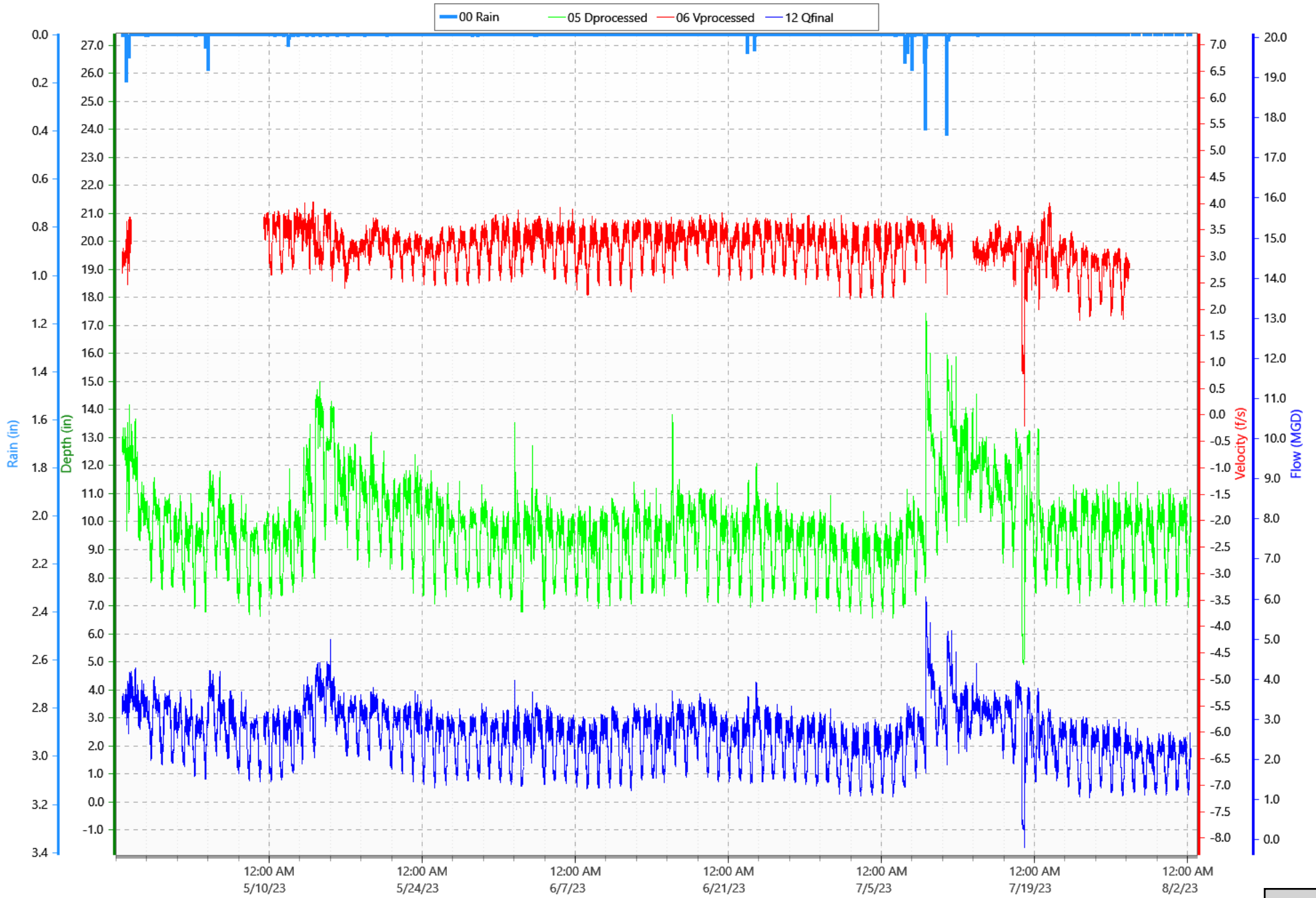


Print Date: 10/12/2023 10:26:26 AM

BP-23 (4/26/2023 to 8/3/2023)

DVQ with Rain - Pipe Dia: 23.50 x 25.00 in.

Item 6.

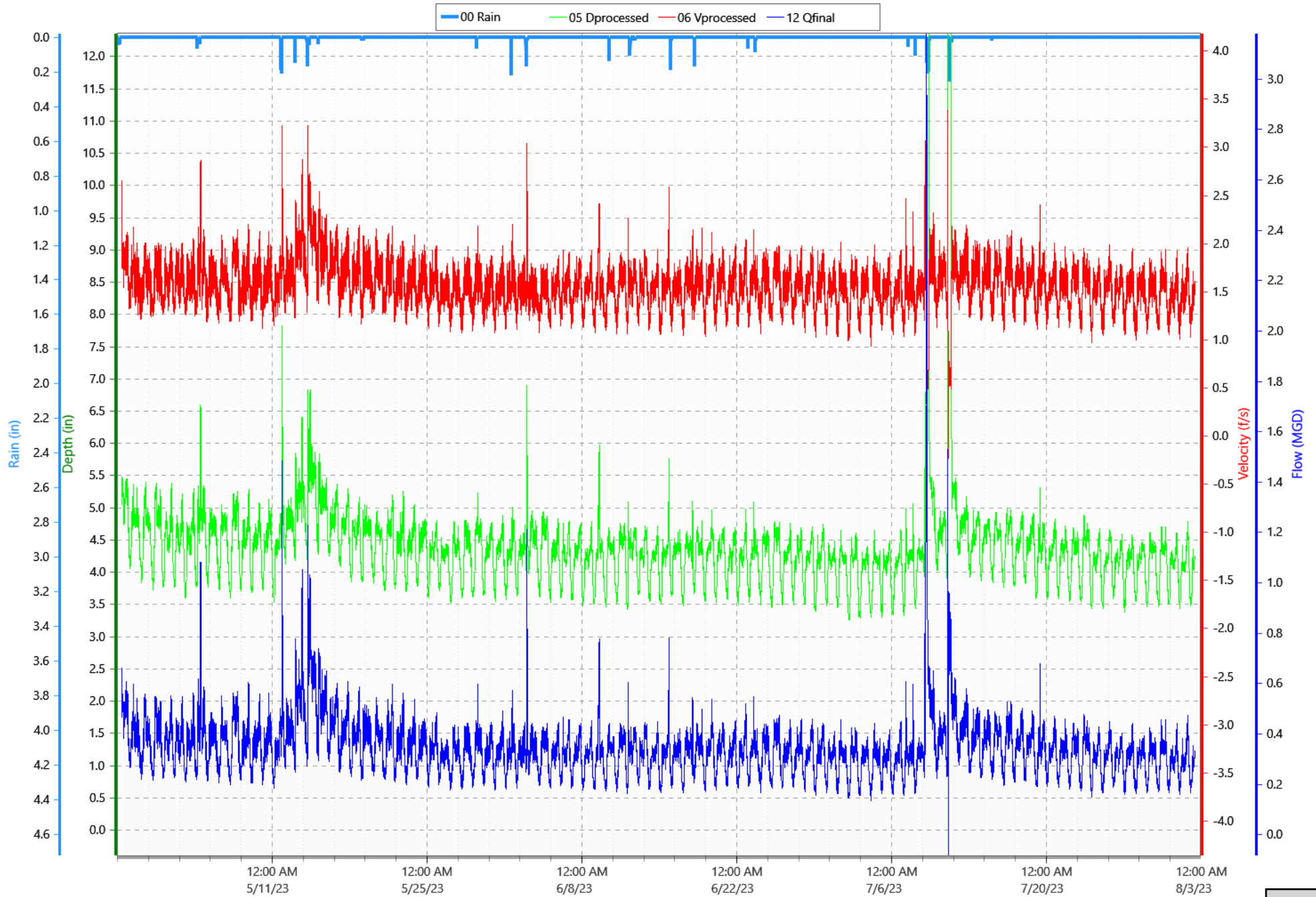


Print Date: 10/12/2023 10:27:24 AM

BP-24 (4/27/2023 to 8/3/2023)

Item 6.

DVQ with Rain - Pipe Dia: 18.50 x 19.00 in.

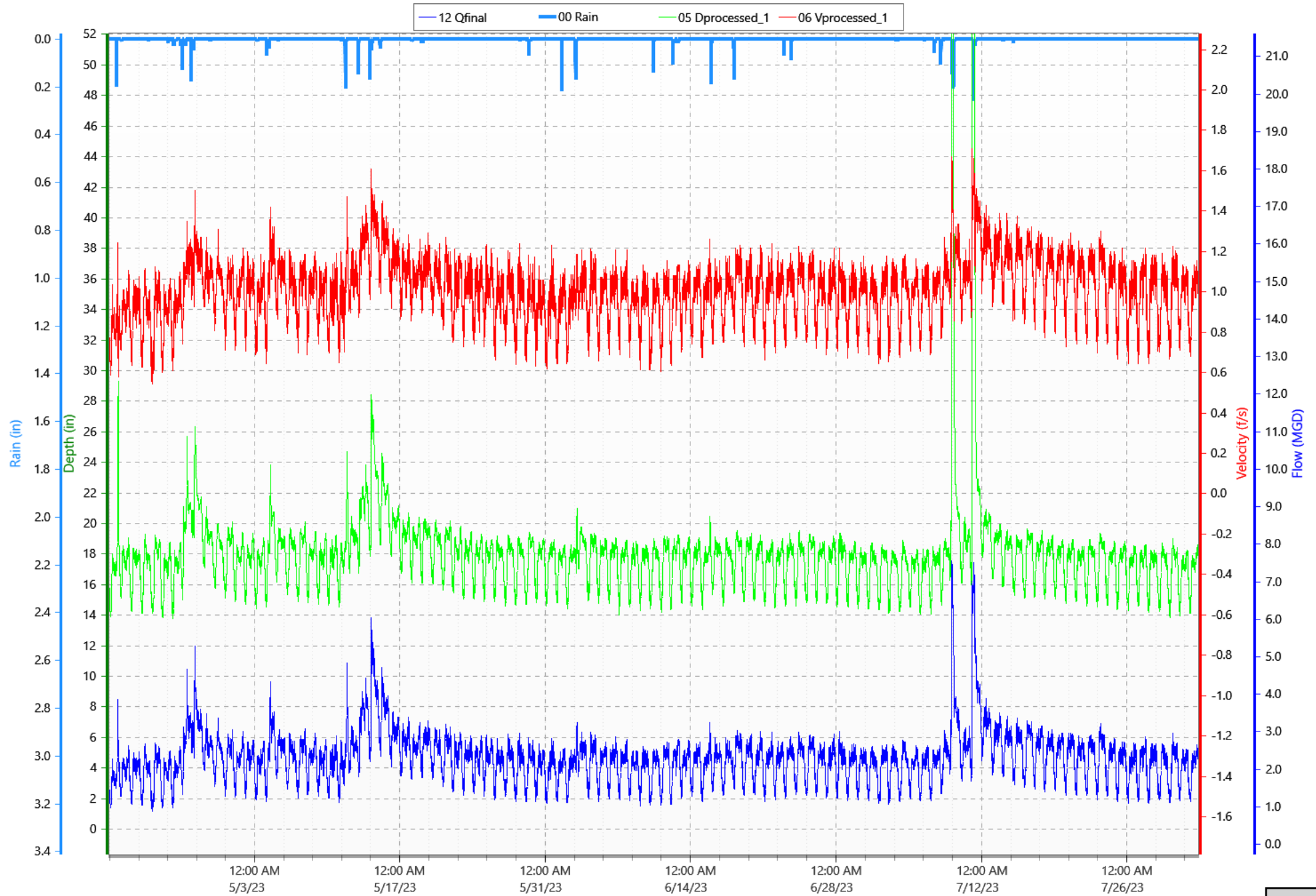


Print Date: 10/12/2023 10:28:03 AM

BP-25 (4/19/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 35.75 in.

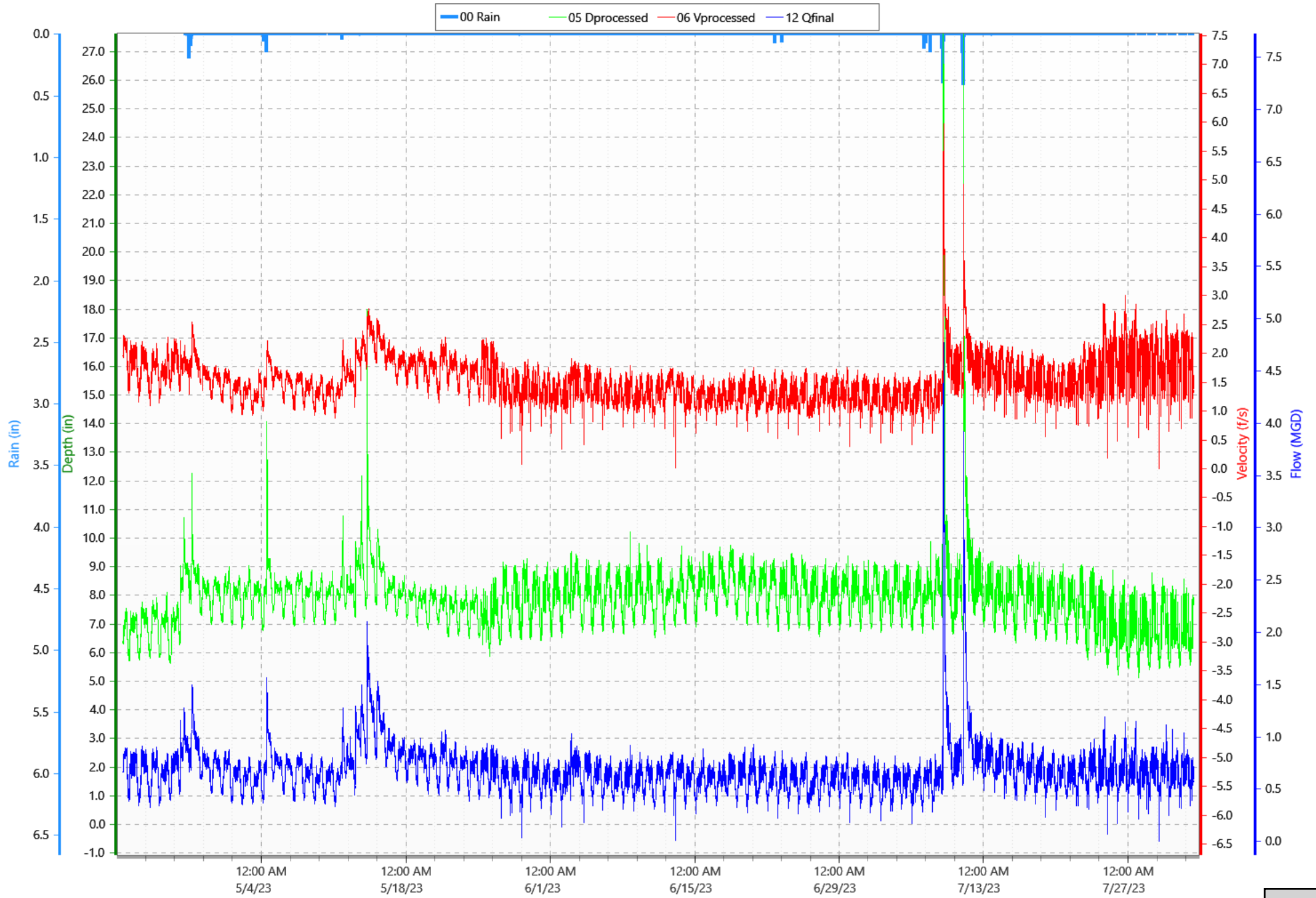


Print Date: 10/12/2023 10:28:27 AM

BP-26 (4/20/2023 to 8/3/2023)

DVQ with Rain - Pipe Dia: 1450 x 15.62 in.

Item 6.

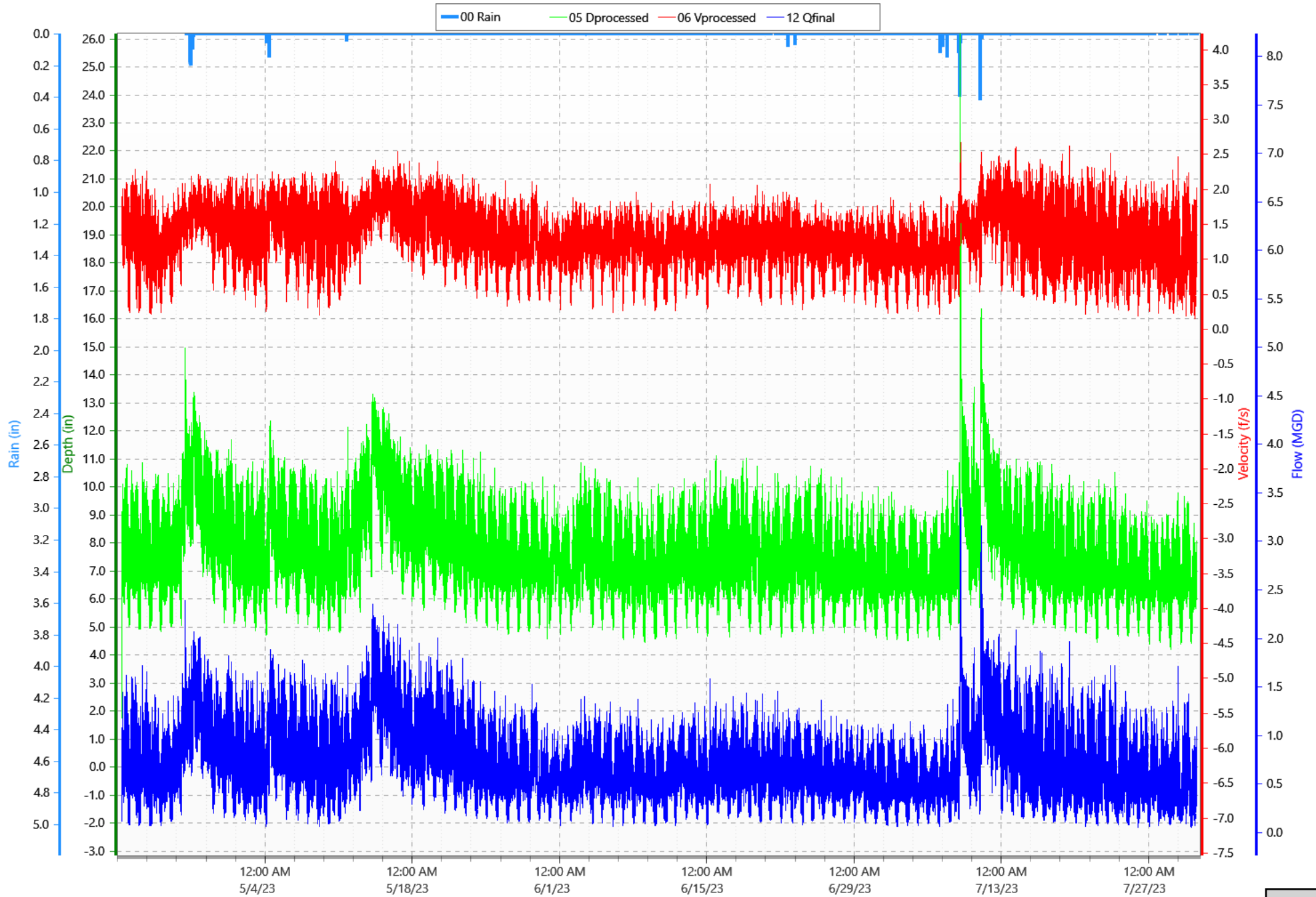


Print Date: 10/12/2023 10:29:19 AM

BP-27 (4/20/2023 to 8/1/2023)

Item 6.

DVQ with Rain - Pipe Dia: 20.25 in.

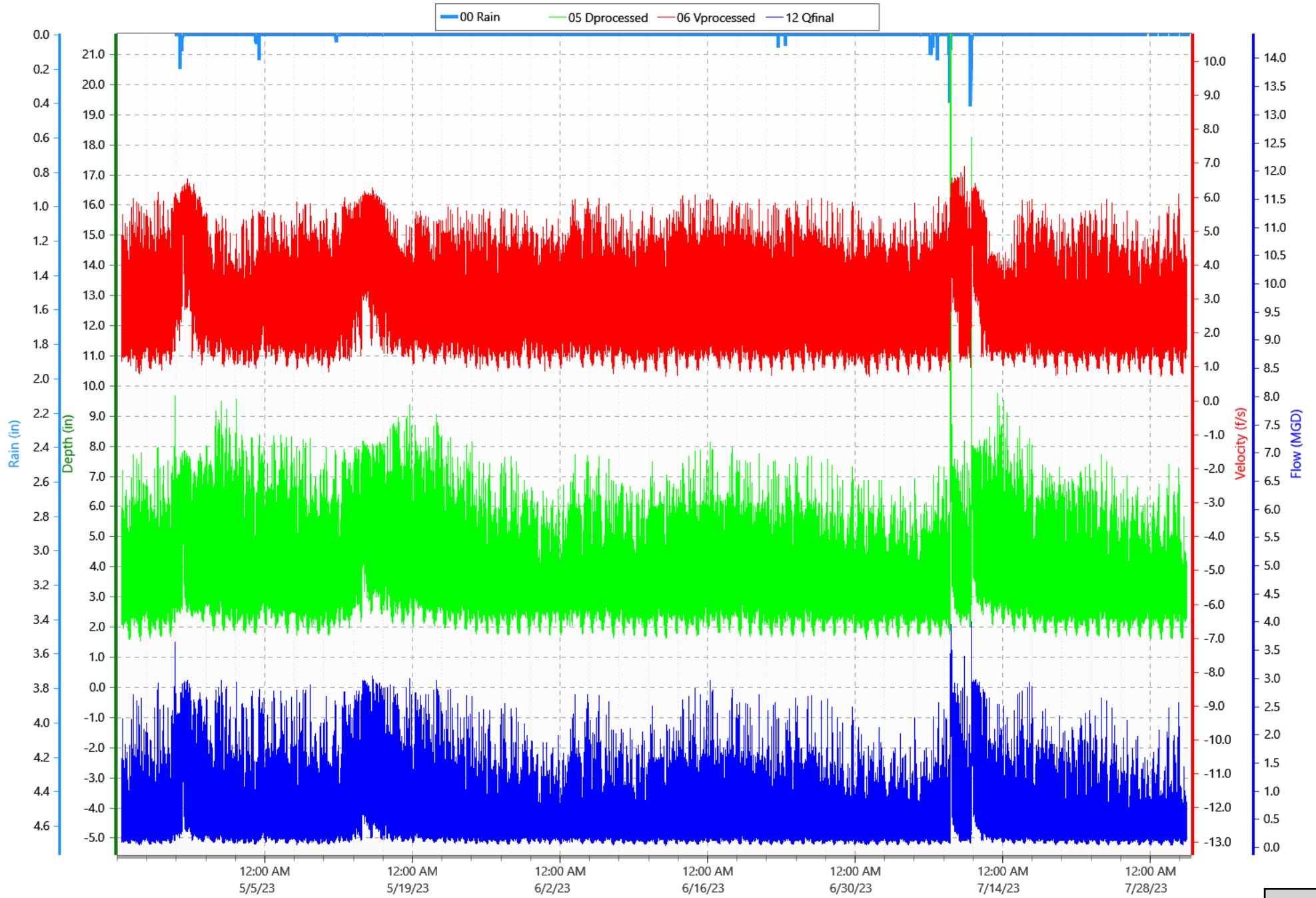


Print Date: 10/12/2023 10:30:05 AM

BP-27-01 (4/21/2023 to 8/1/2023)

Item 6.

DVQ with Rain - Pipe Dia: 17.10 in.

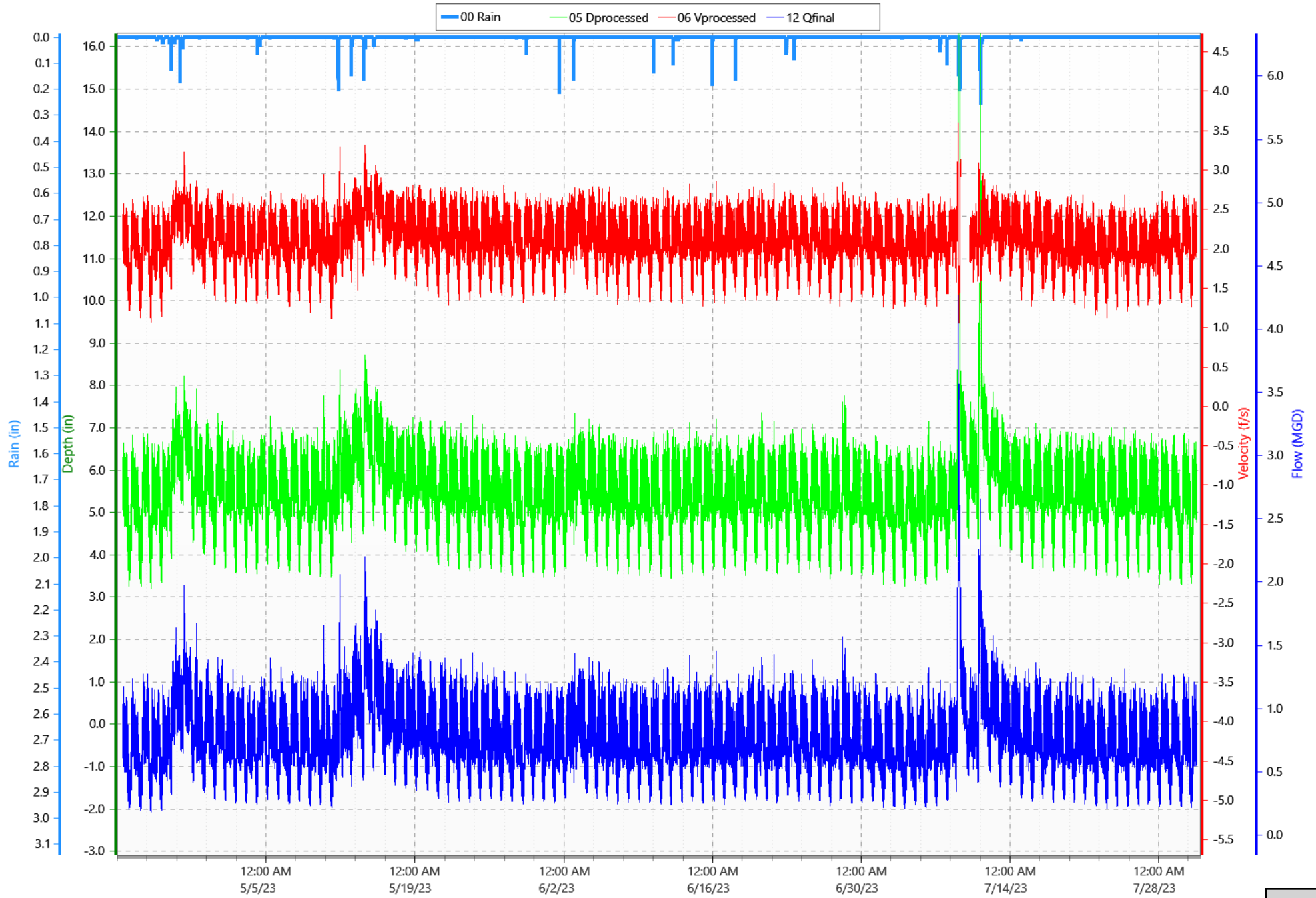


Print Date: 10/12/2023 10:30:54 AM

BP-28 (4/21/2023 to 8/1/2023)

Item 6.

DVQ with Rain - Pipe Dia: 23.70 in.



Print Date: 10/12/2023 10:31:54 AM

BP-30 (4/19/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 23.20 in.

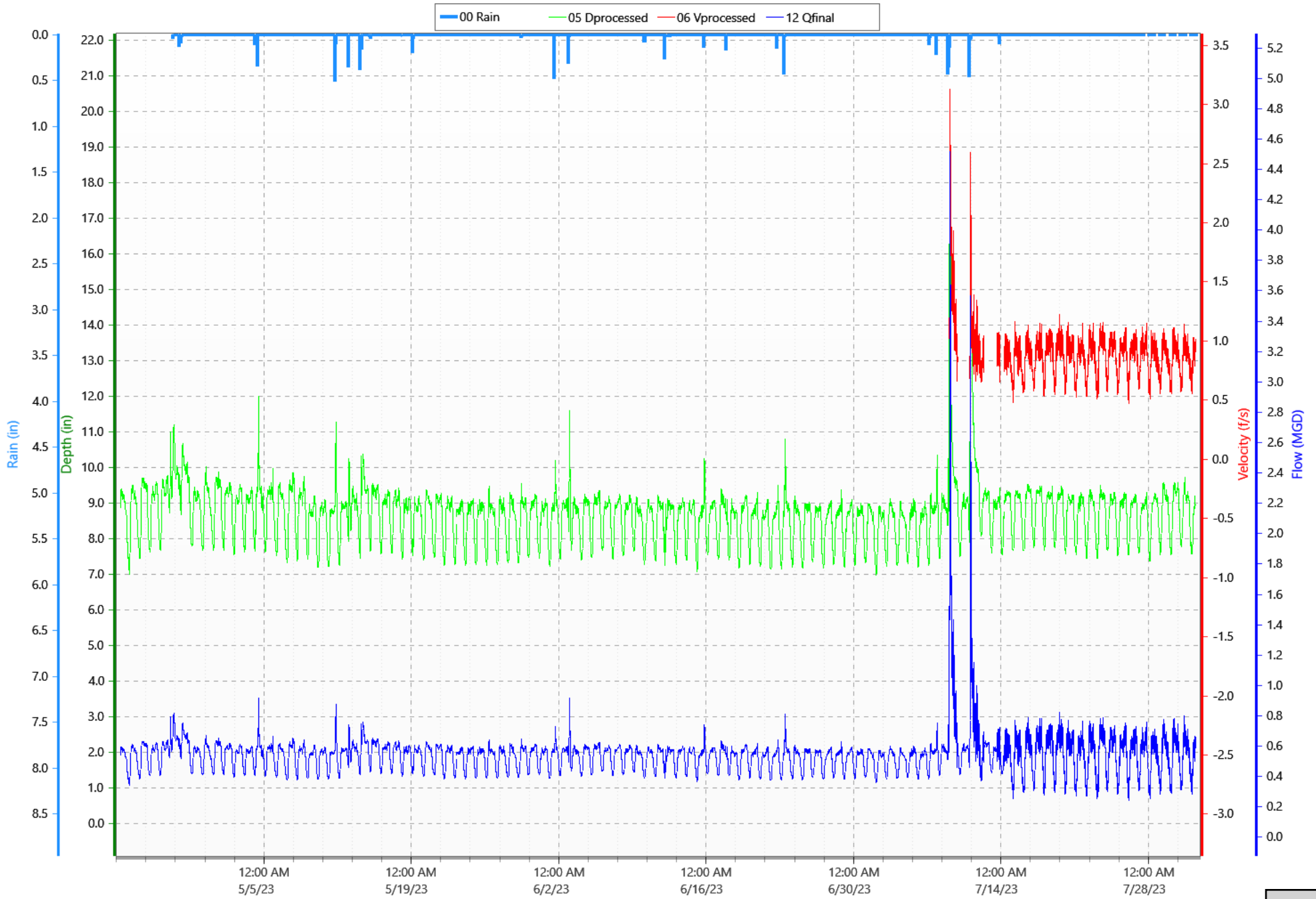


Print Date: 10/12/2023 10:32:32 AM

IH-12 (4/21/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 22.20 in.

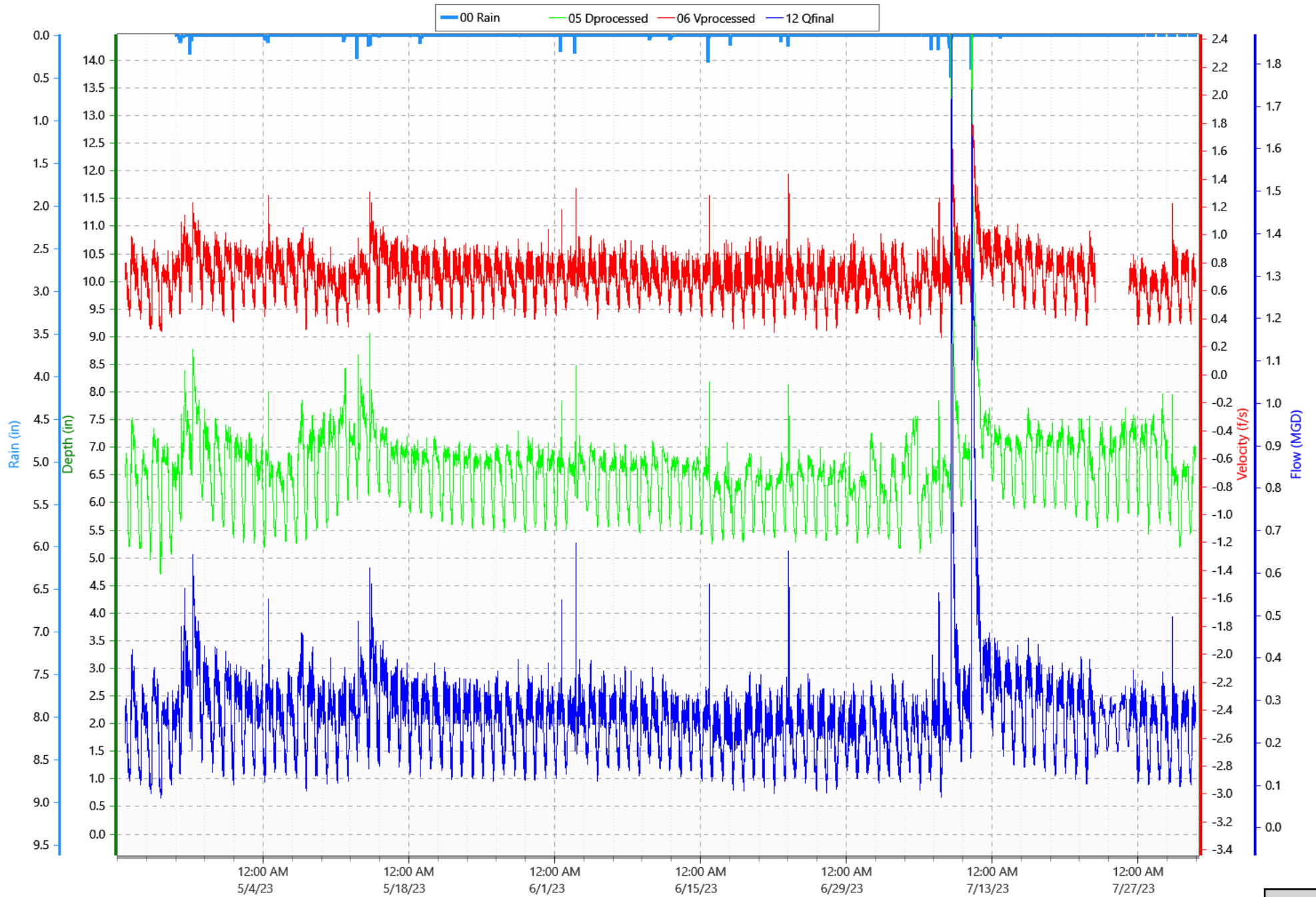


Print Date: 10/12/2023 10:33:31 AM

IH-13 (4/20/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 18.00 in.

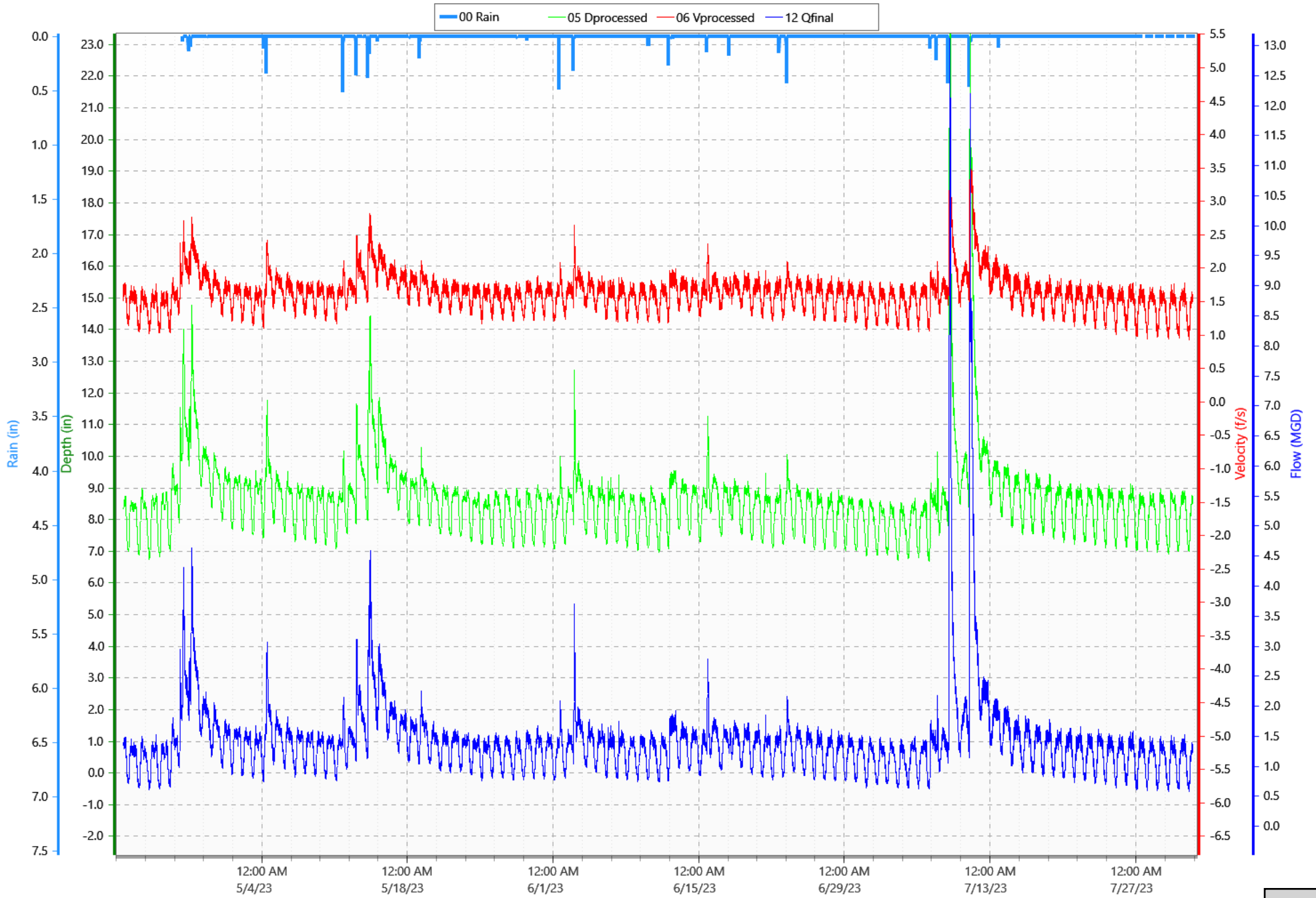


Print Date: 10/12/2023 10:34:23 AM

IH-14 (4/20/2023 to 8/2/2023)

DVQ with Rain - Pipe Dia: 34.00 x 35.00 in.

Item 6.

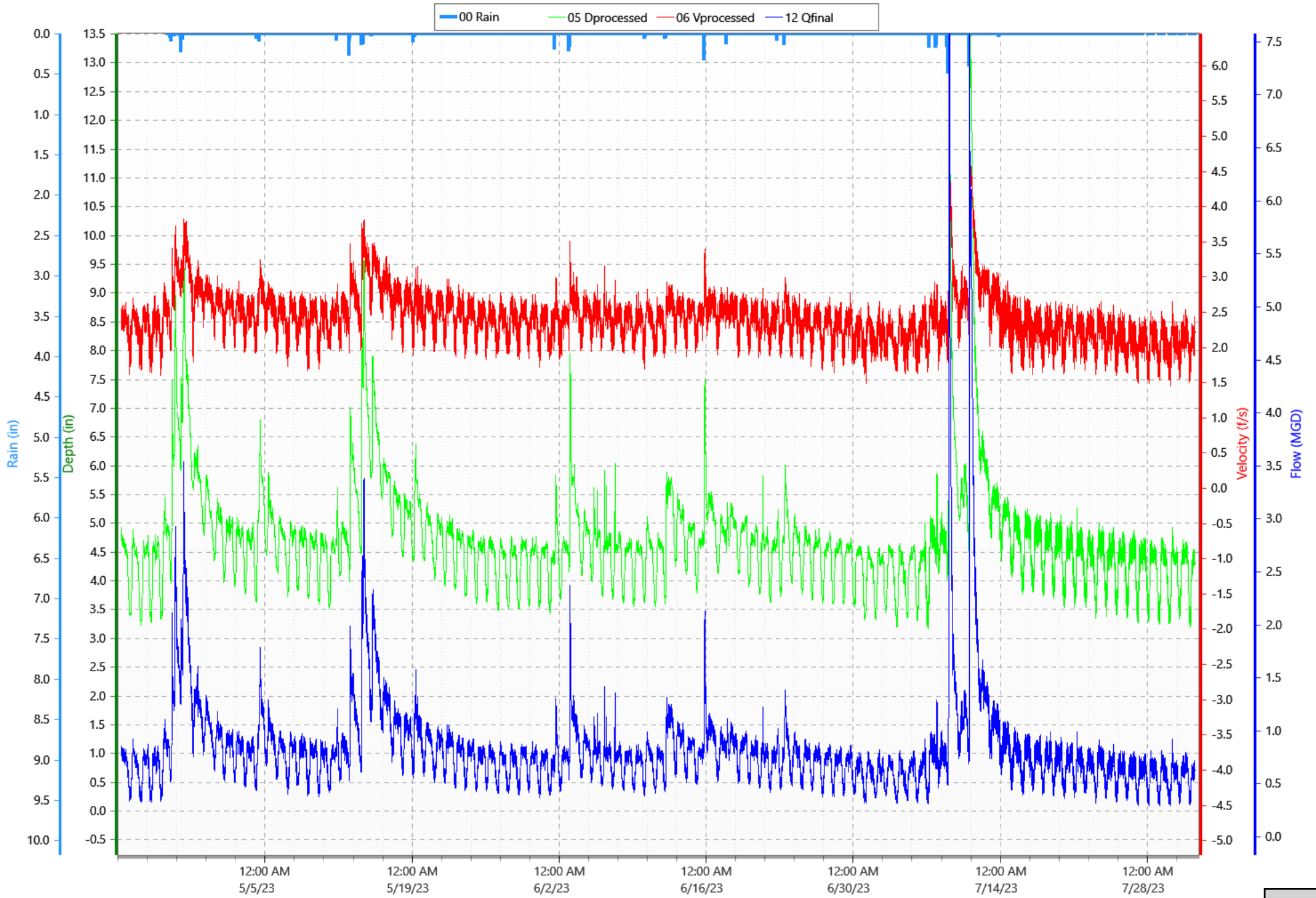


Print Date: 10/12/2023 10:35:11 AM

IH-15 (4/21/2023 to 8/2/2023)

DVQ with Rain - Pipe Dia: 29.00 x 30.25 in.

Item 6.

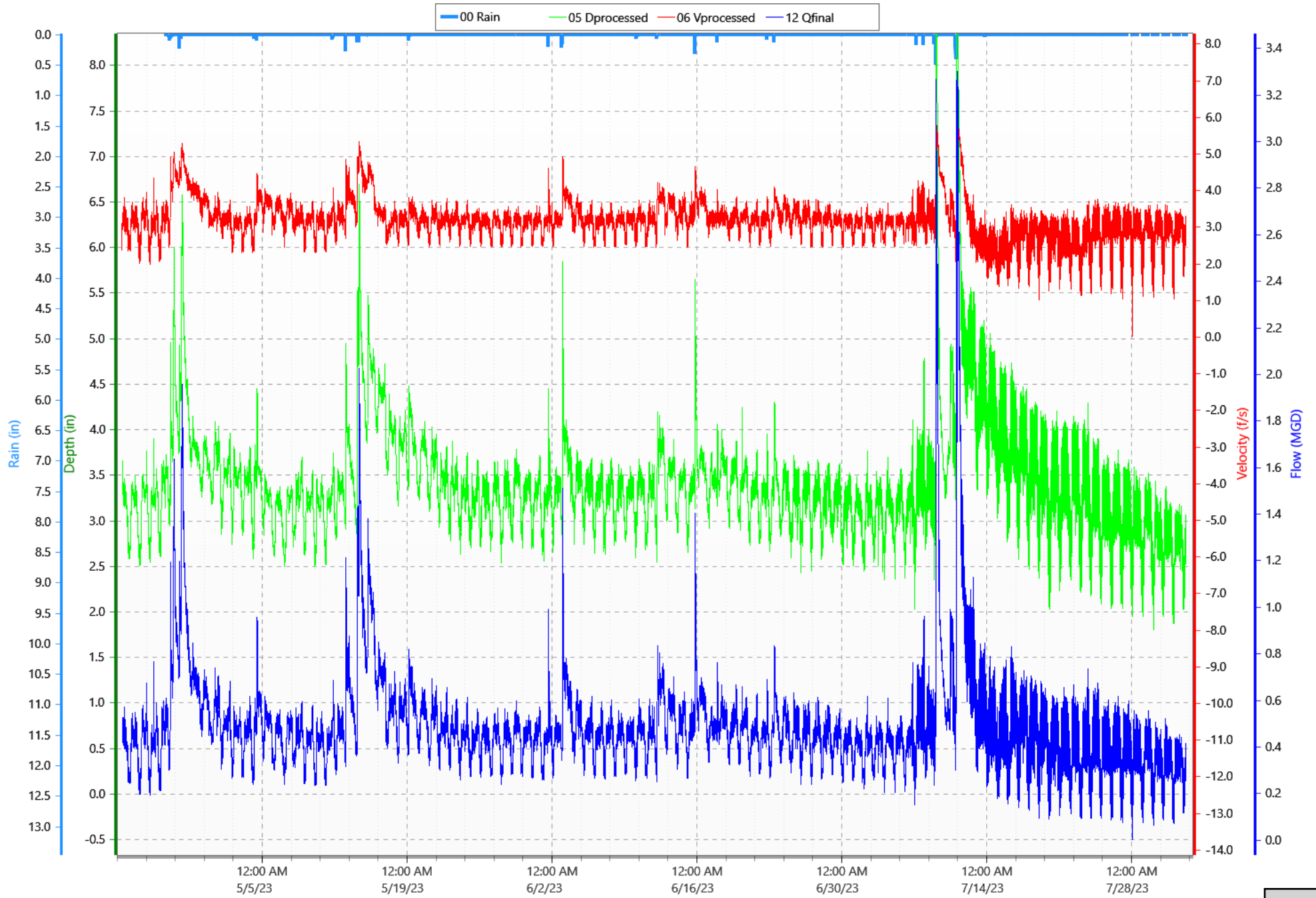


Print Date: 10/12/2023 10:35:58 AM

IH-16 (4/21/2023 to 8/3/2023)

Item 6.

DVQ with Rain - Pipe Dia: 17.44 in.

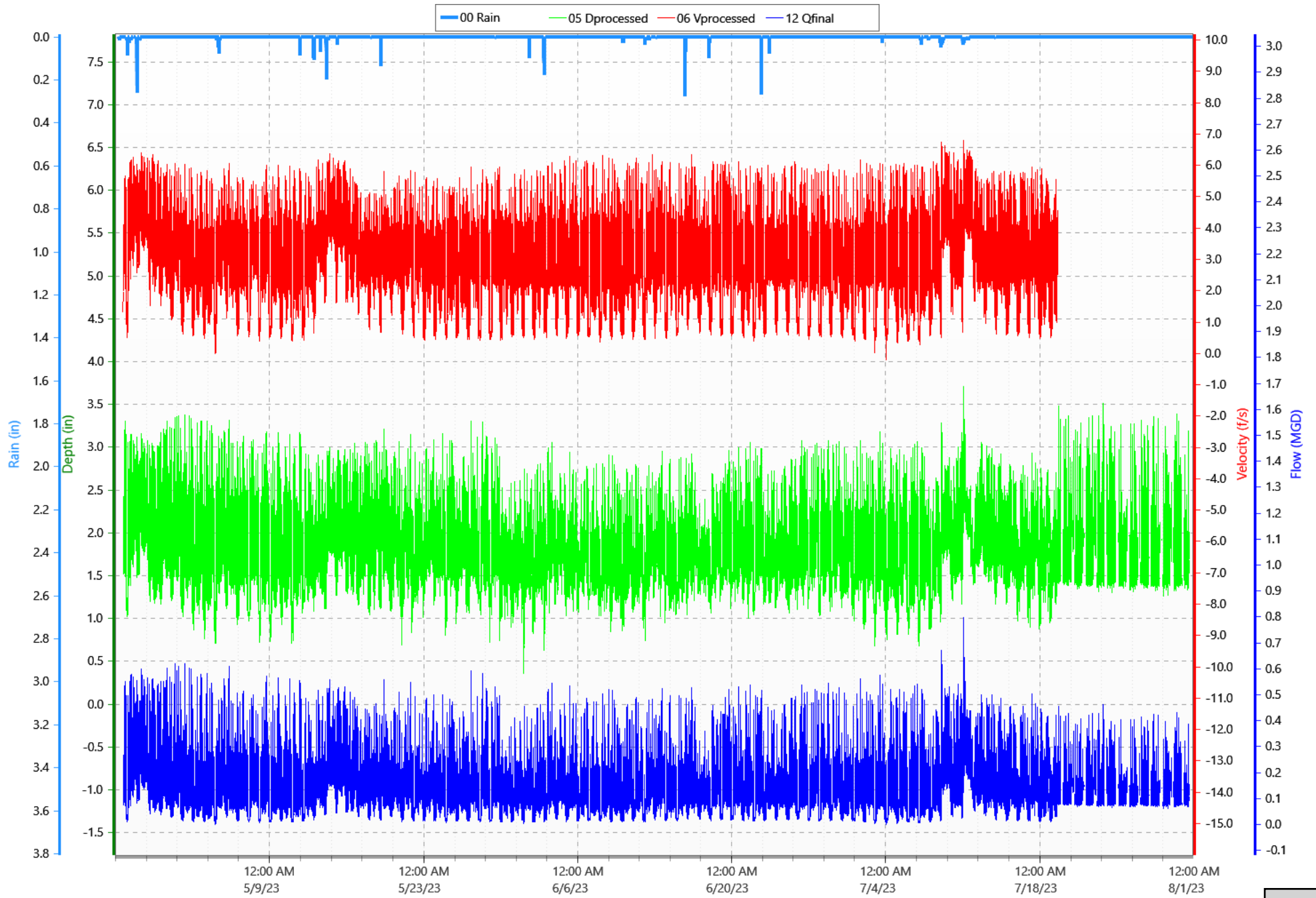


Print Date: 10/12/2023 12:22:24 PM

LD-01 (4/25/2023 to 8/1/2023)

DVQ with Rain - Pipe Dia: 9.75 in.

Item 6.

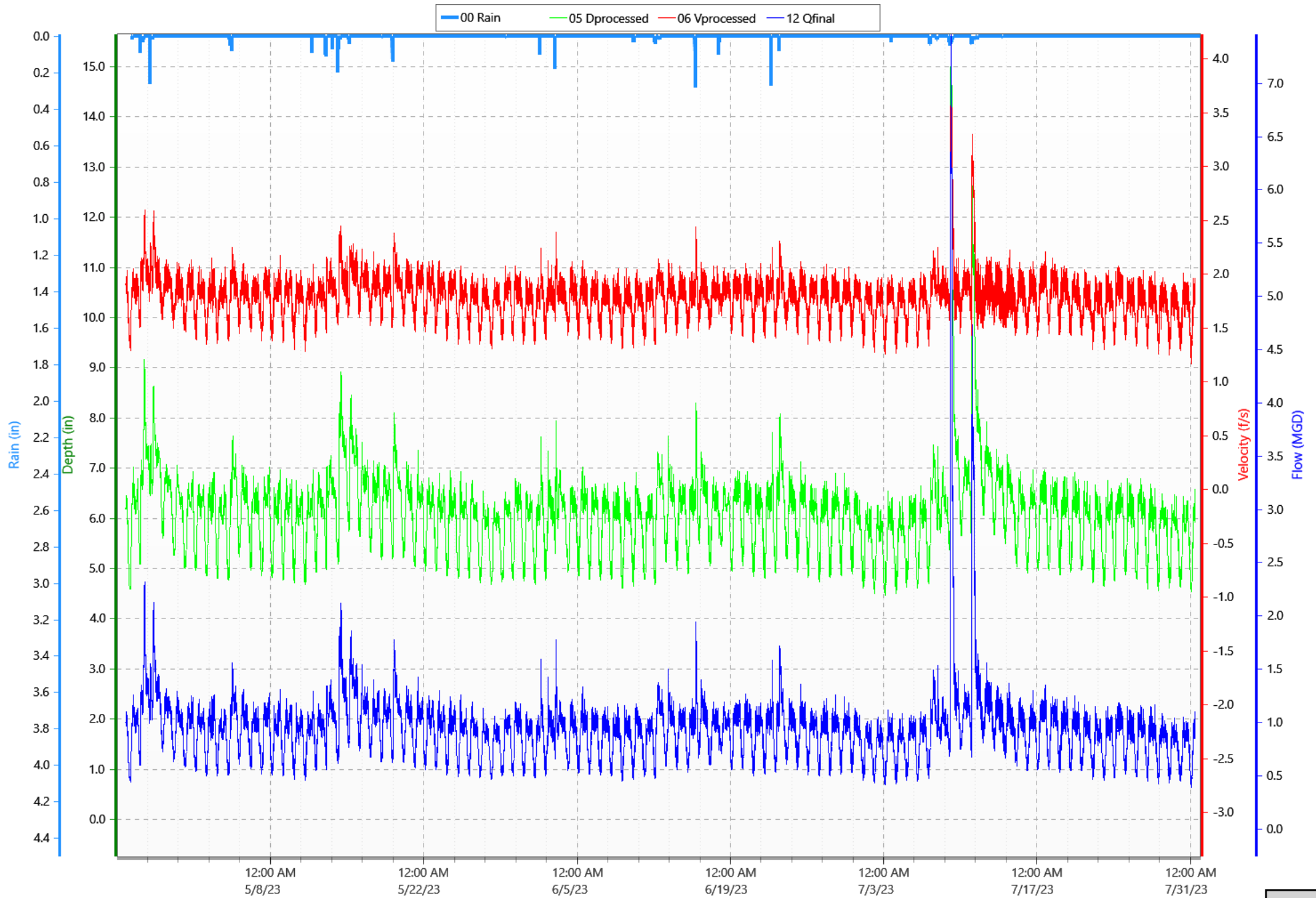


Print Date: 10/12/2023 10:37:23 AM

LD-02 (4/24/2023 to 8/1/2023)

DVQ with Rain - Pipe Dia: 35.50 x 36.00 in.

Item 6.

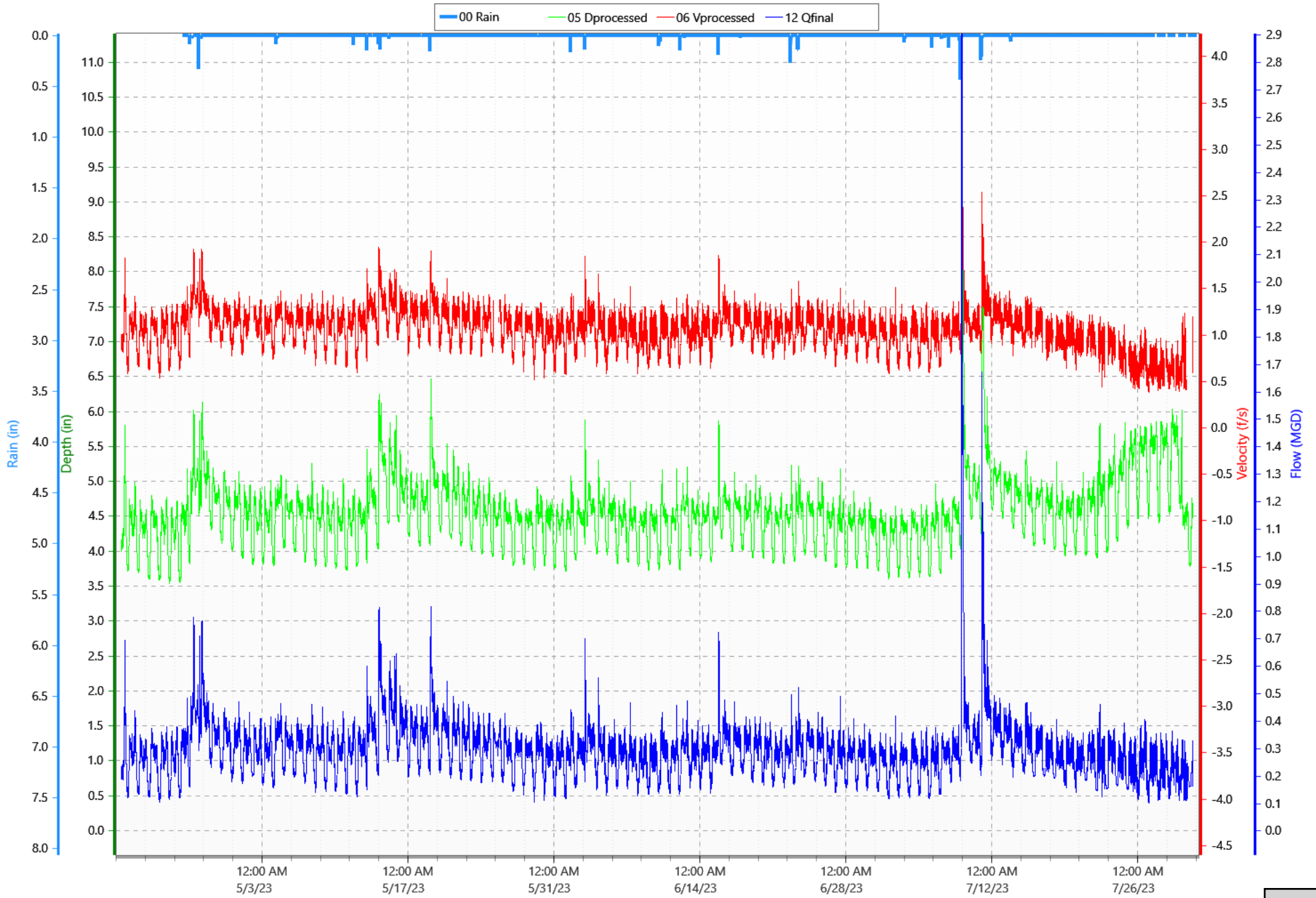


Print Date: 10/12/2023 10:37:59 AM

LD-03 (4/19/2023 to 8/1/2023)

DVQ with Rain - Pipe Dia: 22.00 x 23.50 in.

Item 6.

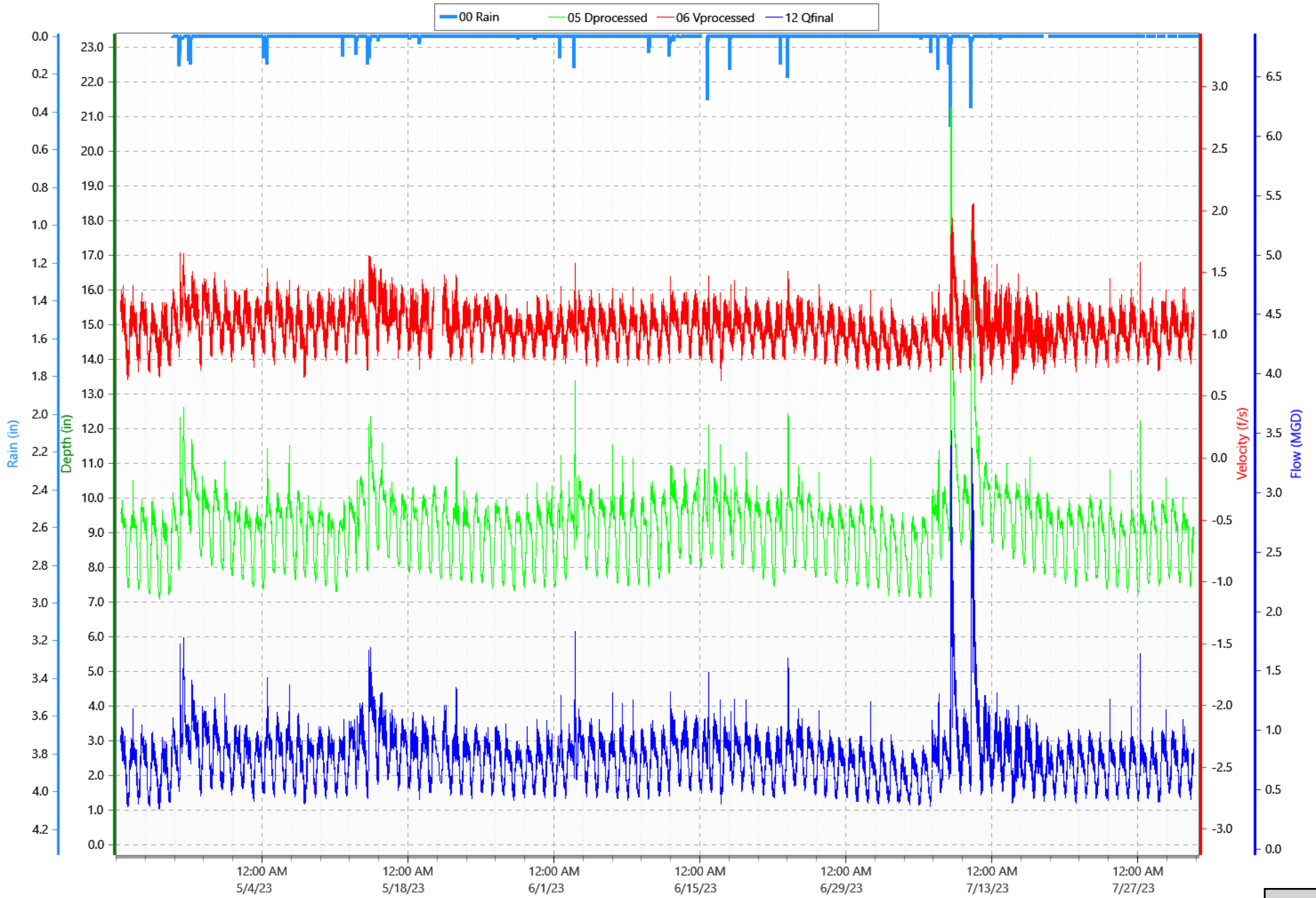


Print Date: 10/12/2023 10:38:36 AM

ND-08 (4/20/2023 to 8/2/2023)

Item 6.

DVQ with Rain - Pipe Dia: 24.00 in.



Print Date: 10/12/2023 10:39:03 AM

ND-09 (4/20/2023 to 8/3/2023)

Item 6.

DVQ with Rain - Pipe Dia: 17.00 in.

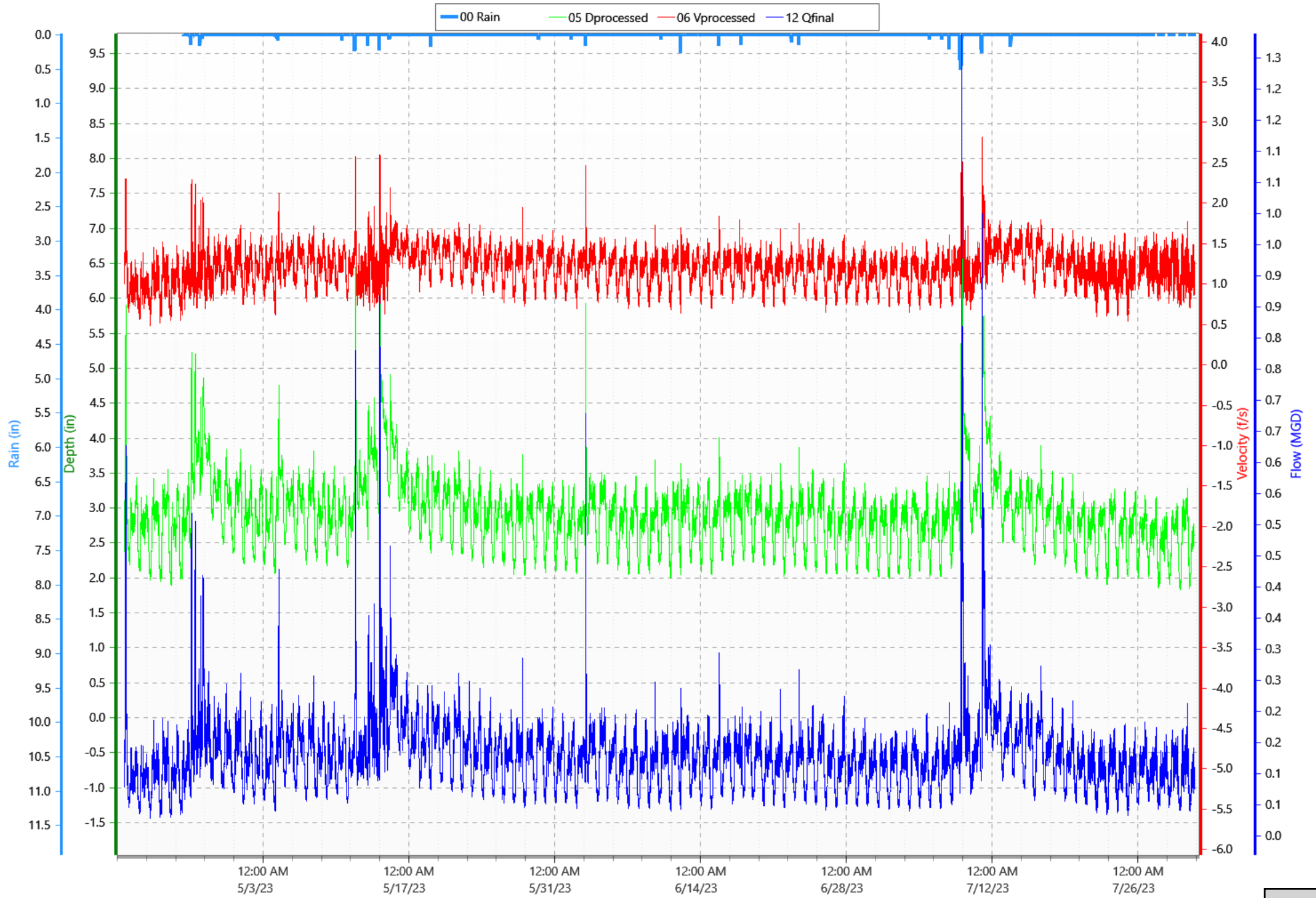


Print Date: 10/12/2023 10:39:21 AM

SV-01 (4/19/2023 to 8/1/2023)

Item 6.

DVQ with Rain - Pipe Dia: 14.00 x 14.50 in.

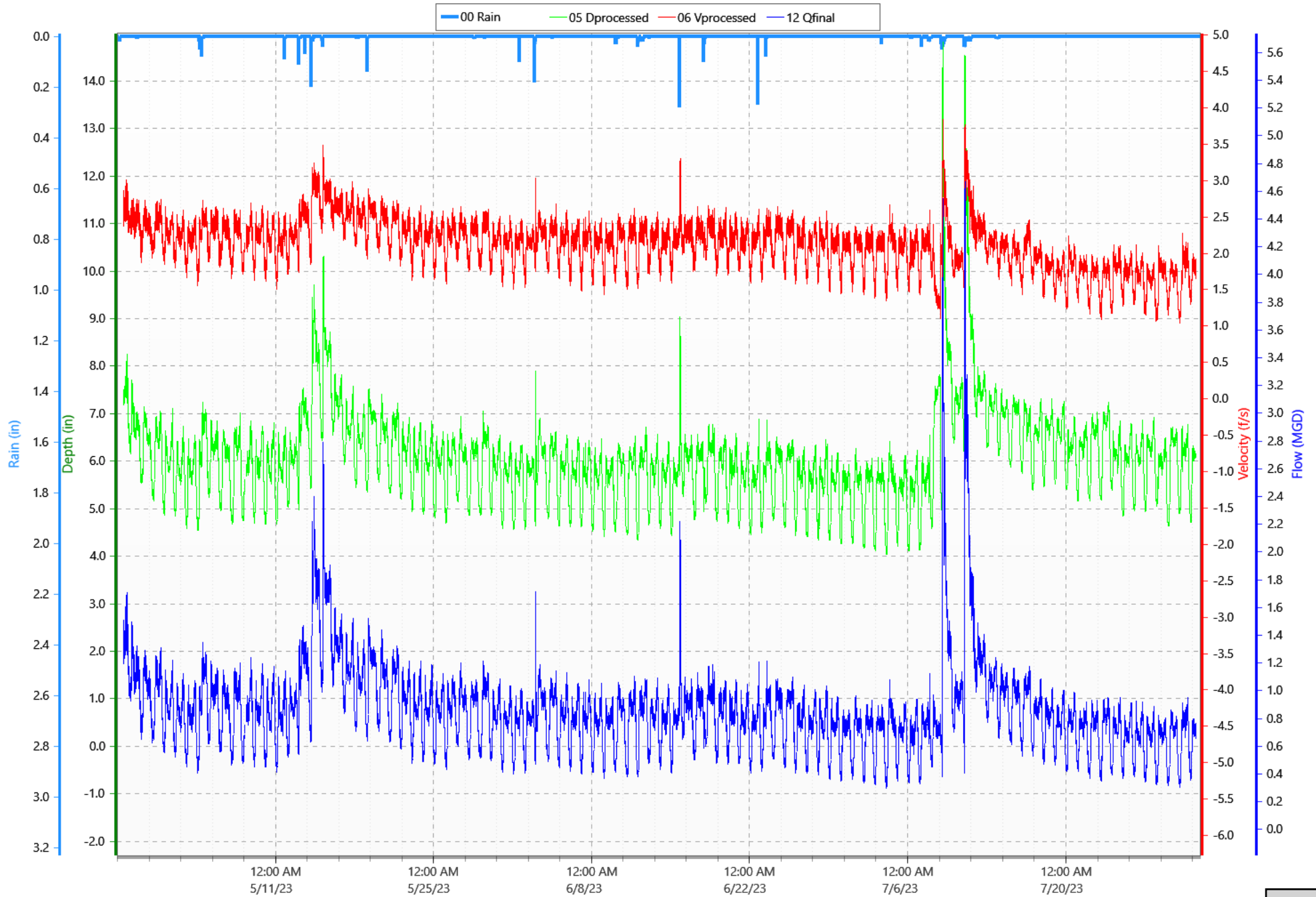


Print Date: 10/12/2023 12:40:35 PM

WC-30 (4/27/2023 to 8/1/2023)

Item 6.

DVQ with Rain - Pipe Dia: 23.00 in.



Print Date: 10/12/2023 10:39:58 AM

WC-31 (4/21/2023 to 8/1/2023)

Item 6.

DVQ with Rain - Pipe Dia: 15.00 in.



Print Date: 10/12/2023 10:40:15 AM

WC-32 (4/25/2023 to 8/1/2023)

Item 6.

DVQ with Rain - Pipe Dia: 20.50 in.



Print Date: 10/12/2023 10:40:40 AM

WS-01 (4/19/2023 to 8/2/2023)

DVQ with Rain - Pipe Dia: 41.66 in.

Item 6.

— 12 Qfinal — 00 Rain — 05 Dprocessed_1 — 06 Vprocessed_1



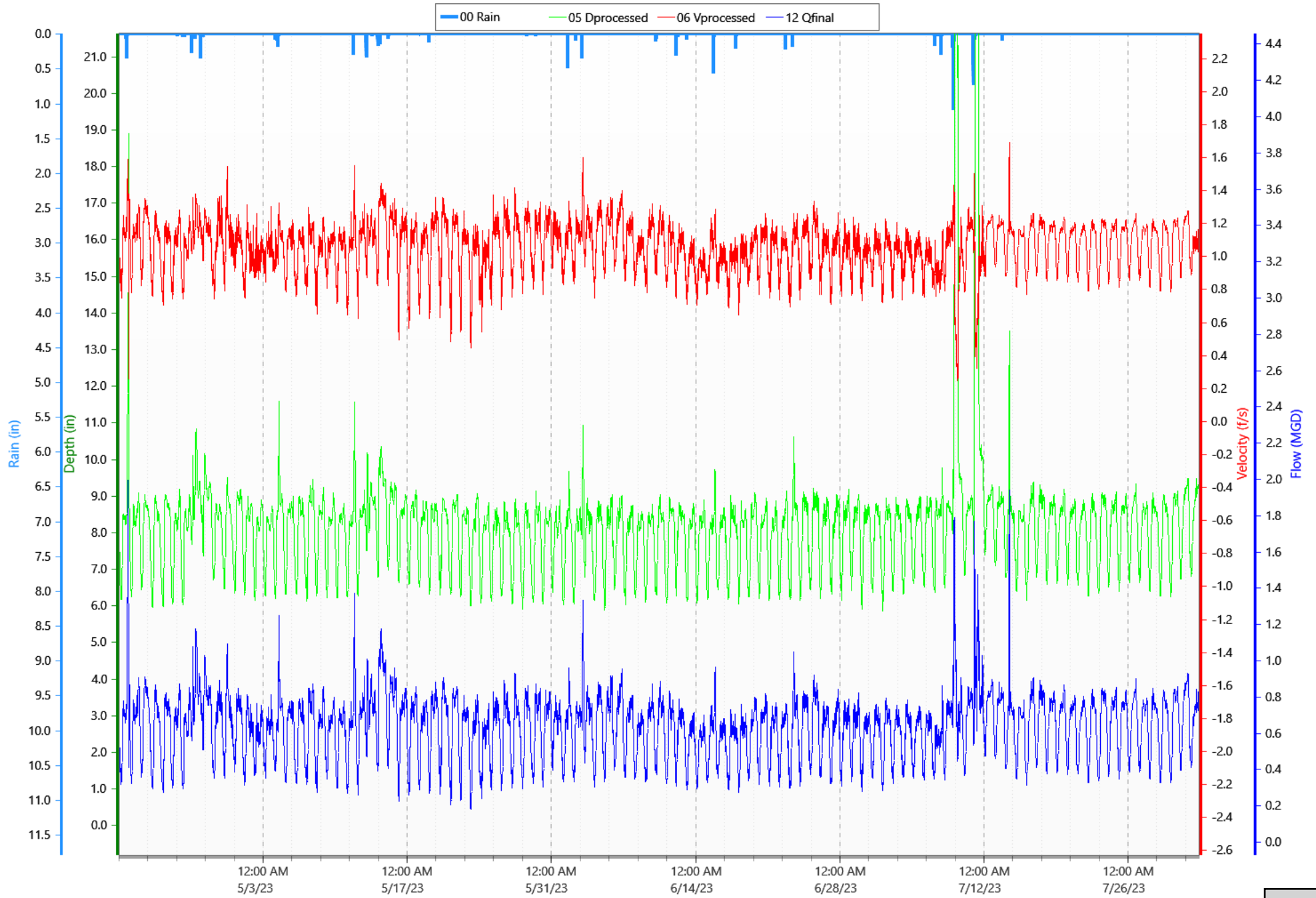
Print Date: 10/12/2023 10:40:52 AM

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WS-10 (4/19/2023 to 8/2/2023)

Item 6.

DVQ - Pipe Dia: 23.25 in.

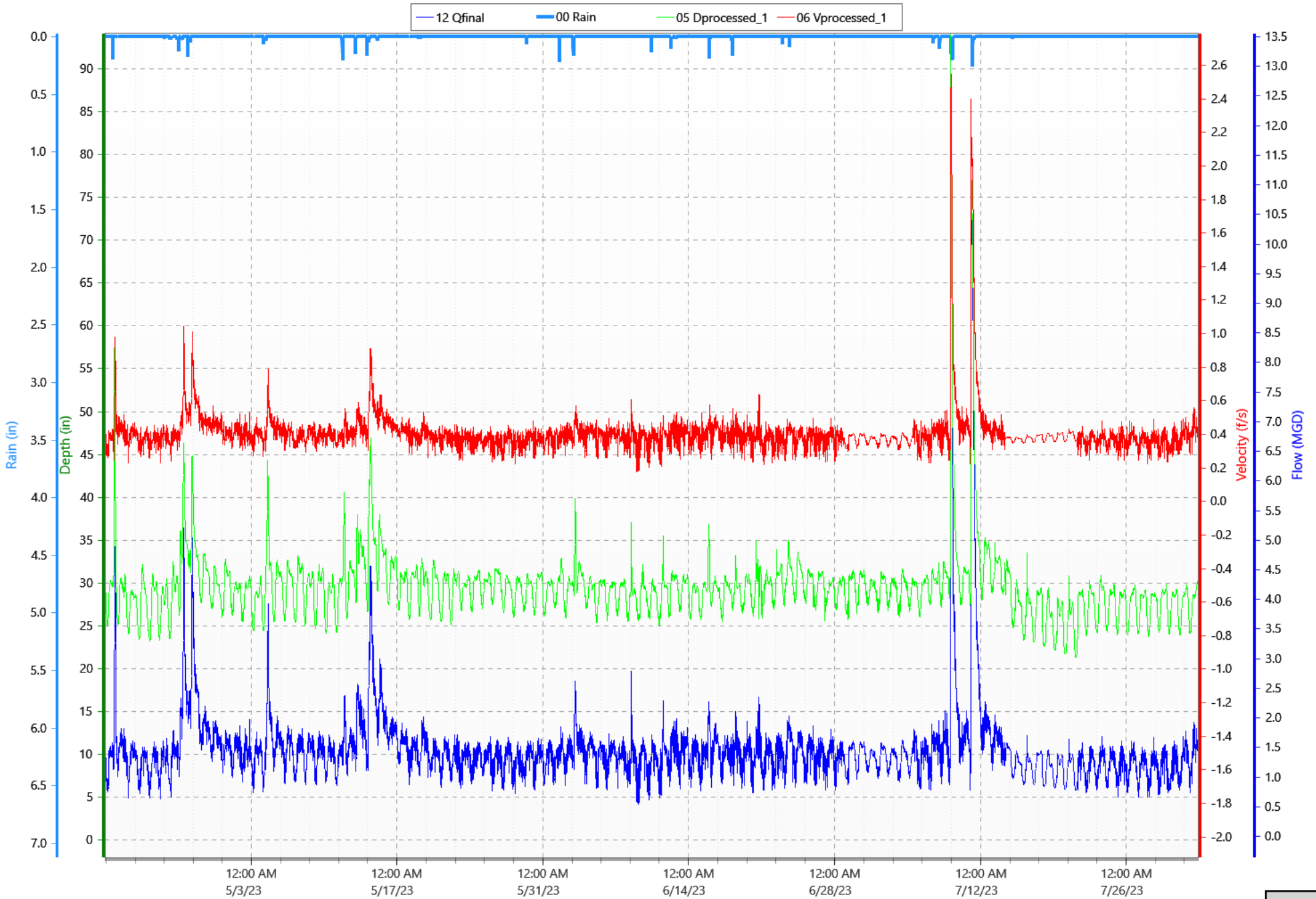


Print Date: 10/12/2023 10:26:03 AM

WS-11 (4/19/2023 to 8/2/2023)

DVQ with Rain - Pipe Dia: 41.20 in.

Item 6.



Print Date: 10/12/2023 10:41:21 AM