

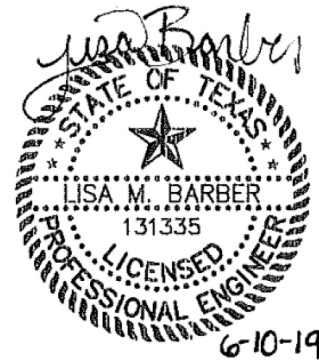
MEMORANDUM

To: Mr. David Wilde
Town of Addison

From: Lisa Barber, P.E.
Kimley-Horn and Associates, Inc.

Date: June 10, 2019

Subject: Sanitary Sewer Flow Analysis for Addison Galaxy FBO Development in Addison, Texas



Kimley-Horn and Associates, Inc. (Kimley-Horn) was contracted by Black Forest Ventures, Inc. (Client) to perform a capacity analysis of the downstream sanitary sewer system serving the Addison Airport. The proposed development is located on the southeast corner of the existing Addison Airport property, across Addison Road from Addison Circle Park, as shown in **Appendix A**. At the time of this memo, the proposed development is under design. The Town of Addison (Town) has requested that flow monitoring be performed downstream of the development as part of their plan review process.

RJN Group was contracted by Kimley-Horn to perform flow monitoring and provide a report summarizing their findings. **Appendix A** shows the existing and proposed sanitary sewer system serving the site. The proposed plans consist of 6-inch and 8-inch sewer lines to serve the new development. An 8-inch line will connect into the Town system at an existing manhole (ADFM-01) on the northwest corner of the Addison Road and Roscoe Turner Drive intersection. The existing sewer system downstream of the proposed development consists of a combination of 8-inch and 12-inch lines. These lines ultimately tie into a 21-inch interceptor which crosses under Dallas North Tollway (DNT) and connects to an existing Dallas meter. The system was evaluated to determine if there is enough capacity in the existing Town system to convey the proposed development flows. Metering locations were selected to determine the remaining capacity of critical pipes in the system. Meter #1 (ADFM-01) was chosen in order to analyze the pipe directly downstream of the tie-in location, while meter #2 (ADFM-02) was selected to verify adequate capacity downstream of the critical interceptor intersection just north of the railroad tracks along DNT. The following assumptions were made while analyzing this system:

1. The study area for this analysis includes the existing sanitary sewer system from the proposed tie-in location to the City of Dallas meter east of DNT. The meter siphon and Dallas mains downstream are assumed to be sized appropriately to be able to handle any additional flow anticipated from the proposed development.
2. All evaluations performed are based on flow metering information provided by RJN Group. No additional sewer basin evaluation was performed.
3. As-built plan and profile drawings of the sewer mains were provided by the Town. These drawings are assumed to be correct.
4. Flows from future developments within the City were not considered.

5. Flow calculations for the proposed development are in accordance with the Town of Addison's *Wastewater System Requirements* manual dated August 2010.
 - a. Average daily demand for the proposed development (Office/Commercial Land Use): 0.1 gallons per SF per day.
 - b. Infiltration shall be 650 gallons per acre per day.
 - c. Peaking factor from the average daily flow to the peak daily flow is 3.

RJN Group provided flow meter readings from April 11th - 27th, 2019. The meters were installed at the designated manholes, as shown in **Appendix B**. The full report provided by RJN can be seen in **Appendix C**. Flow information provided in the report can be summarized as follows:

Meter #1 (ADFM-01):

- Average Daily Flow (Dry Weather): 17 gpm
- Peak Flow (Dry Weather): 45 gpm
- Peak Flow (Wet Weather): 192 gpm

Meter #2 (ADFM-02):

- Average Daily Flow (Dry Weather): 255 gpm
- Peak Flow (Dry Weather): 689 gpm
- Peak Flow (Wet Weather): 793 gpm

The Addison Galaxy FBO development is located on approximately 16 acres and consists of three new hangars and a 12,000 SF FBO building. Applying the assumptions listed above, the flow produced by the proposed development will be as follows:

Projected Development Flow:

- Average Daily Flow: 9 gpm
- Peak Flow: 33 gpm

Flow projection calculations can be seen in **Appendix C**.

Kimley-Horn utilized the as-built drawings provided by the Town to calculate the existing and future capacity of the sanitary sewer system. The results are summarized in **Table 1**.

Table 1: System Capacity Analysis

| Meter | Pipe Relation to Meter | Pipe Dia. (in) | Slope (%) | Full Pipe Capacity (gpm) | Existing Peak Flow (gpm) ¹ | Peak Proposed Flow (gpm) ² | Remaining Capacity (gpm) | % Full |
|---------|------------------------|----------------|-----------|--------------------------|---------------------------------------|---------------------------------------|--------------------------|--------|
| ADFM-01 | Downstream | 12 | 0.24 | 784 | 192 | 224 | 559 | 29 |
| ADFM-02 | Upstream | 12 | 0.50 | 1,131 | 793 | 826 | 306 | 73 |
| | Downstream | 12 | 3.20 | 2,861 | 793 | 826 | 2,036 | 29 |

¹ Peak Existing Flow based on flow meter data from 5/11-5/27 as reported by RJN Group.

² Peak Future Flow: Peak Existing Flow + Peak Flow from proposed development

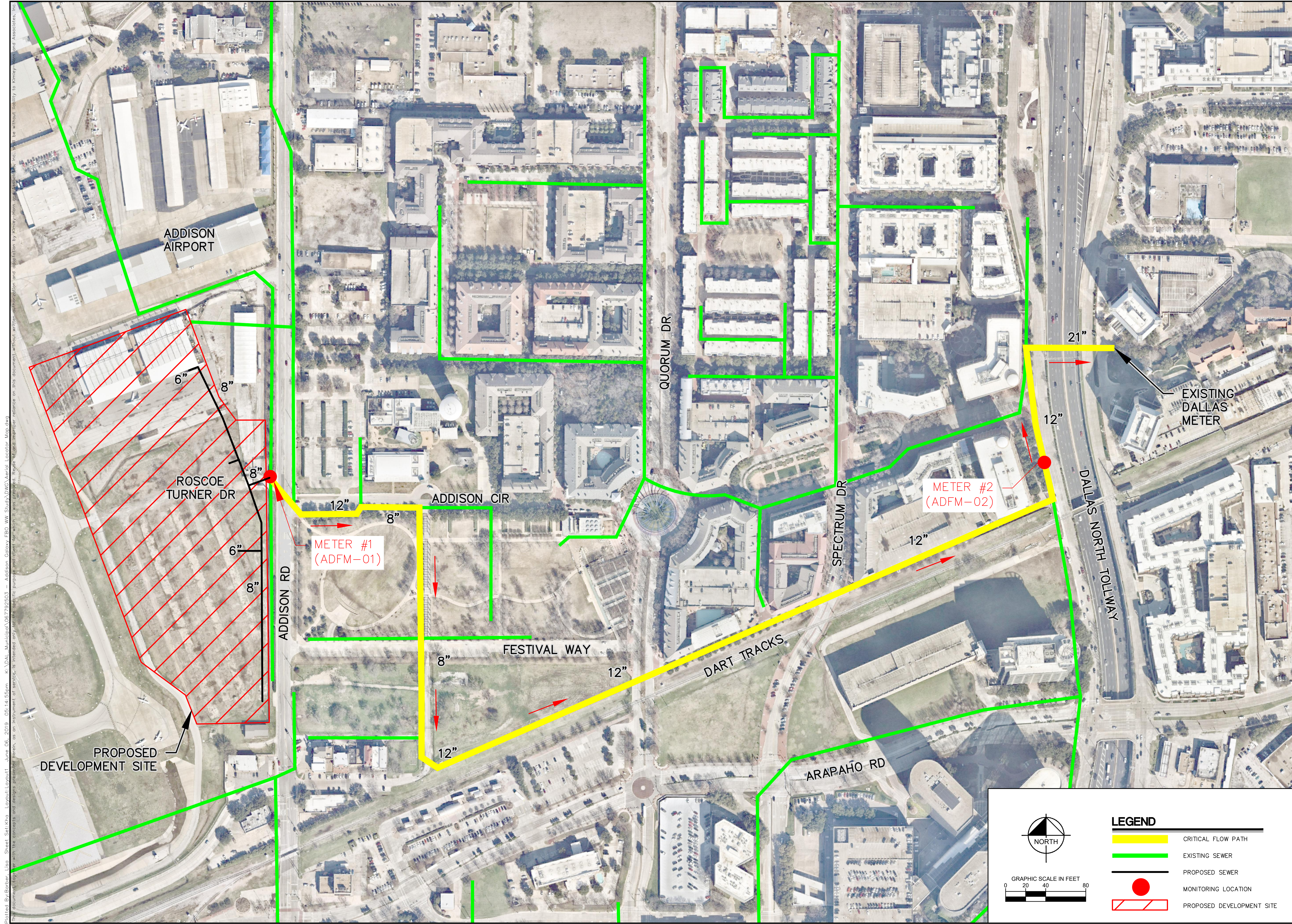
The previous table indicates that the system has enough capacity to accommodate the additional flow produced by the proposed development.

APPENDICES

Appendix A: Flow Monitoring Location Map

Appendix B: RJN Flow Monitoring Report

Appendix C: Development Flow Projections



Plotted By: Barber, Lisa. Sheet Set: kha. Layout: Layout1. June 06, 2019 05:14:55pm. K:\DAL\Municipal\067792503 - Addison Galaxy FBO WW Study\DWG\Aerial Locator Map.dwg
 This document, together with the concepts and designs presented herein, is intended only for the specific purpose and client for which it was prepared. Review of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.

NORTH

GRAPHIC SCALE IN FEET

LEGEND

- CRITICAL FLOW PATH
- EXISTING SEWER
- PROPOSED SEWER
- MONITORING LOCATION
- PROPOSED DEVELOPMENT SITE

| | |
|---|---|
| ADDISON GALAXY FBO PREPARED FOR BLACK FOREST VENTURES, INC. | ADDISON, TEXAS |
| SHEET NUMBER A | DATE 6/7/2019 |
| ADDISON GALAXY FBO PREPARED FOR BLACK FOREST VENTURES, INC. | Kimley»Horn <small>© 2015 KIMLEY-HORN AND ASSOCIATES, INC. 1400 WOODLOCH FOREST DRIVE, SUITE 225 THE WOODLANDS, TEXAS 77380 PHONE: 281-754-2880 TBPE FIRM REGISTRATION F-928 WWW.KIMLEY-HORN.COM</small> |
| FLOW MONITORING LOCATOR MAP | KHA PROJECT 067792503 |
| SCALE AS SHOWN DESIGNED BY LMB DRAWN BY JUC CHECKED BY JEB | REVISIONS No. DATE BY |

June 2019

Addison Airport Wastewater Flow Monitoring in Addison, Texas Deliverables

prepared for
Kimley-Horn & Associates, Inc.

prepared by
RJN Group, Inc.
14755 Preston Rd, Suite 710
Dallas, Texas 75254
972.437.4300



June 3, 2019

Ms. Lisa Barber, PE
Kimley-Horn Associates, Inc.
13455 Noel Road
Two Galleria Office Tower, Suite 700
Dallas, TX 75240

Subject: Flow Monitoring Services for Addison Airport in Addison, TX

Dear Ms. Barber:

According to the April 2019 Engineering Agreement, RJN is pleased to present the final project deliverables for the above referenced project.

Per the agreement, project activities included 14-day flow monitoring of two flow metering sites in the Addison Airport area, flow data processing, and basic hydraulic analysis of the collected data. A total of 17 days is included with this deliverable.

The project deliverables consist of a compiled PDF file organized by Appendices. Also included is a zipped file of all the final processed flow data files for Kimley-Horn's use in further hydraulic analyses of the project site wastewater system.

The following were observed during the flow monitoring period:

- On May 11th, 18th, and 21st, rain events were observed that significantly influenced the system.
- Meter site ADFM-01 experienced slow or even stagnant flows on multiple occasions and typically occurred between the hours of 7 pm to 7 am. This anomaly could be due to sewer flow backup likely caused by a sag upstream of the meter location during periods of low flow. Further investigations using CCTV are recommended to verify this observed flow anomaly.

If you have any questions regarding this submittal or you require additional information, please do not hesitate to call us.



KAR/3437
Enclosure

Sincerely,
RJN GROUP, INC.

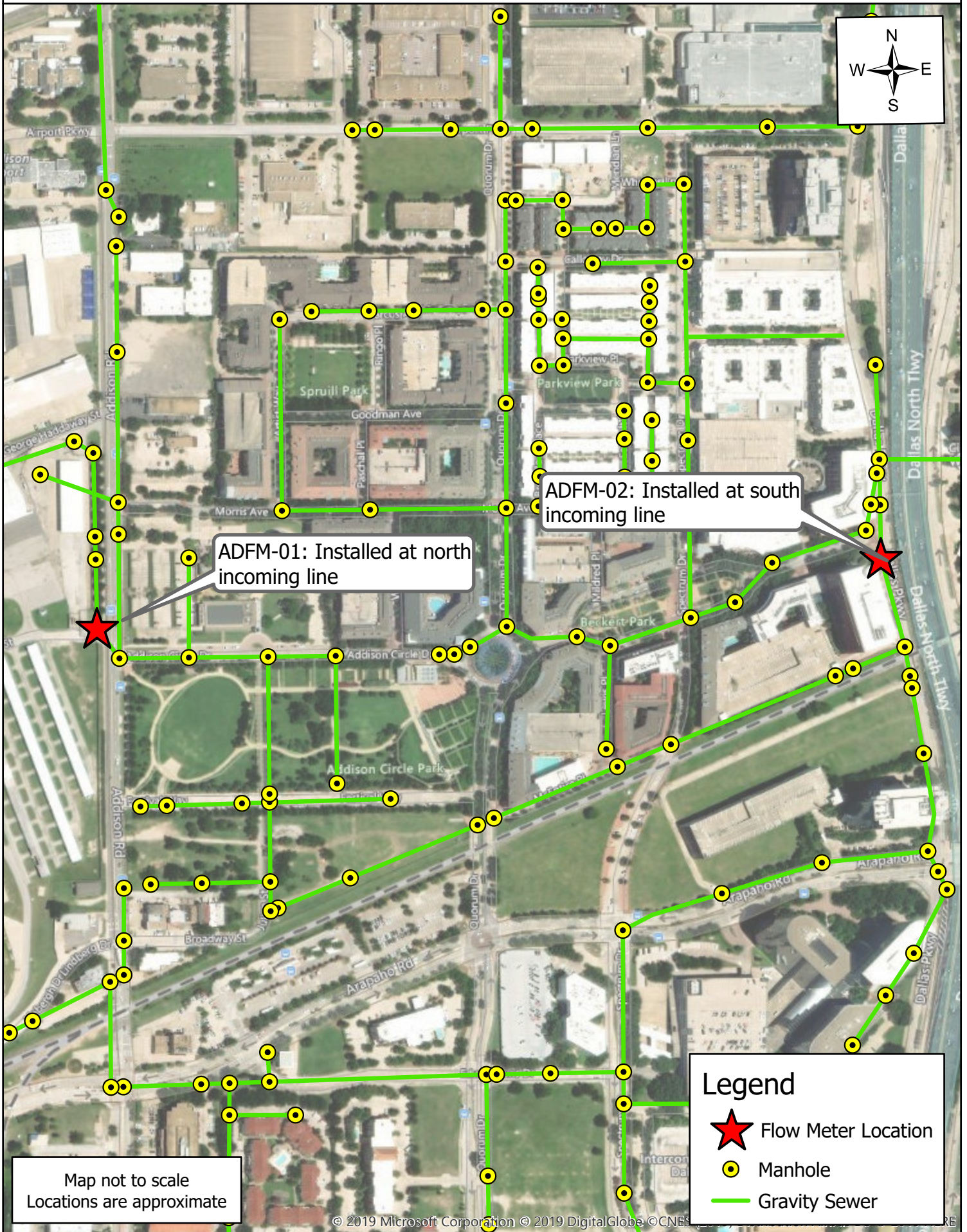
A handwritten signature in cursive script, appearing to read 'Karen A. Rico'.

Karen A. Rico, P.E.
Project Manager

EXHIBIT


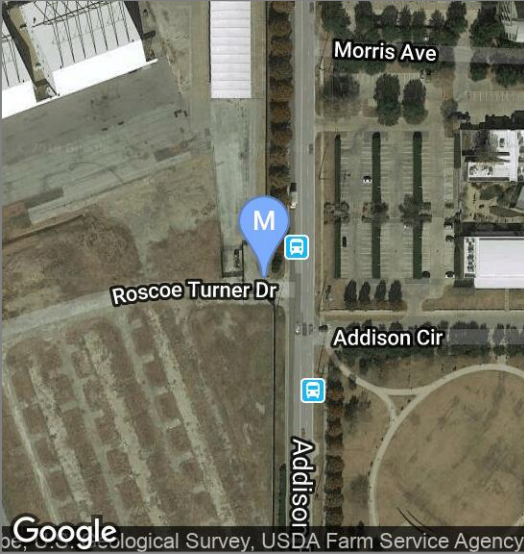




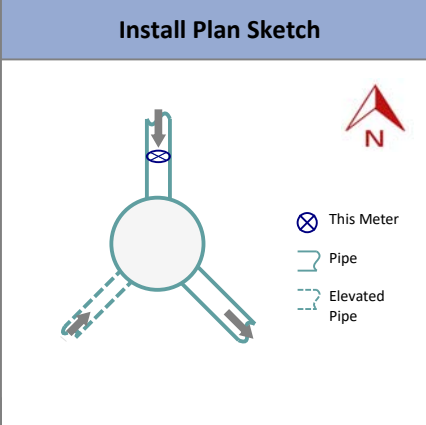
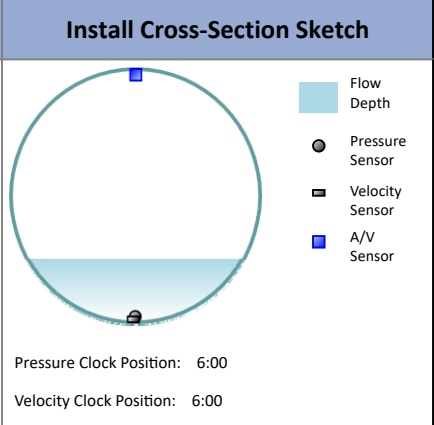
FLOW MONITORING LOCATION


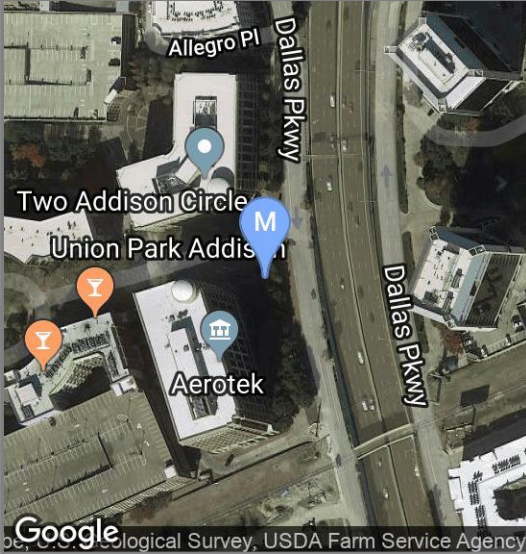




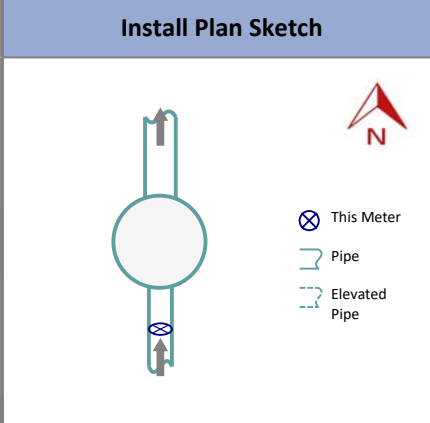
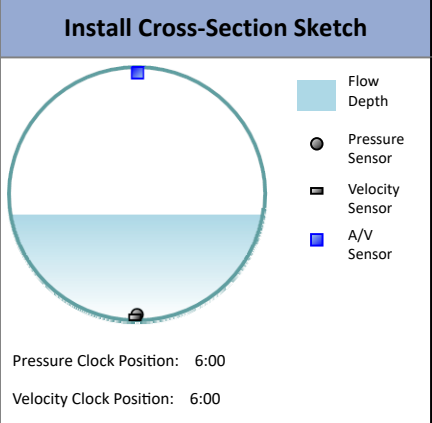
Flow Monitoring Location Exhibit



APPENDIX A

FLOW METER SITE REPORTS

| | | | |
|---|--|---|---|
|  | Kimley-Horn Addison Flow Monitoring | | Site Name ADFM-01 |
| | Inspected By fporchia | Project No. 18-3437-00 | Site Code T |
| Inspected Date/Time 5/10/2019 9:40 AM | System Information | | Area Location Map |
| Target Pipe Dia. (in) 12.0 Municipality Addison District Assigned Rain Gauge Client Manhole # E74 U/S Connecting MH I.D E73 System Characteristics: Residential - <input type="checkbox"/> Commercial - <input checked="" type="checkbox"/> Industrial - <input type="checkbox"/> P/S Influence No WWTP Influence No |  | |  |
| Location Information |  | | Top View Picture |
| Site Address Addison @ Roscoe Turner - S - NS Addison Site Access Other Longitude -96.83010000 Latitude 32.96170000 MH Type Poured Concrete Manhole Depth (ft) 10.90 Manhole Width (ft) 4.0 Elevated MH Yes Height Elevated (ft) 0.7 Structural Integrity Safe | Access Notes Entrance of Addison Airport | | |
| Site Information | Investigation Photo | Installation Photo | |
| Pipe Height (in) 11.94 Pipe Width (in) 11.68 Pipe Type Polyvinyl Chloride Pipe Shape Elliptical O2 20.9 LEL % 0.0 H2S 0.0 CO 0.0 |  |  | |
| Hydraulic Information | Hydraulic Characteristics Slow moving velocity | Installation Notes | |
| Flow Depth (in) 3.00 Instant Velocity (fps) 0.29 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 | Install Plan Sketch | Install Cross-Section Sketch | |
| Installation Notes |  |  | |
| Location in Pipe (ft) 1.0 Location from Manhole Sensors Antenna Surface Non-Paved Surface Signal Strength 75 | Post Installation Notes | | |
| Post Installation Notes | Approvals | | |
| Meter Type ADS Triton+ Telemetry Type ADS Installation Date 5/10/2019 | Recommended by FSP | | Client Approval |

| | | | | | |
|--|--|--|--|---|--|
|  | | Kimley-Horn Addison Flow Monitoring | | Site Name ADFM-02 | |
| Inspected By fporchia | | Project No. 18-3437-00 | | Site Code D-1 | |
| Inspected Date/Time 5/10/2019 11:17 AM | | 18-3437-00 | | D-1 | |
| System Information | | Area Location Map | | Area View Picture | |
| Target Pipe Dia. (in) 12.0 Municipality Addison District Assigned Rain Gauge Client Manhole # Unknown U/S Connecting MH I.D E2 System Characteristics: Residential - <input type="checkbox"/> Commercial - <input checked="" type="checkbox"/> Industrial - <input type="checkbox"/> P/S Influence No WWTP Influence No | |  | |  | |
| Location Information | |  | | Top View Picture | |
| Site Address 15601 Dallas Pkwy Site Access Sidewalk Longitude -96.82200000 Latitude 32.96220000 MH Type Precast Concrete Manhole Depth (ft) 21.90 Manhole Width (ft) 4.0 Elevated MH No Height Elevated (ft) Structural Integrity Safe | | Access Notes | | | |
| Site Information | | Investigation Photo | | Installation Photo | |
| Pipe Height (in) 11.75 Pipe Width (in) 11.88 Pipe Type Polyvinyl Chloride Pipe Shape Circular O2 20.9 LEL % 0.0 H2S 0.0 CO 0.0 | |  | |  | |
| Hydraulic Information | | Hydraulic Characteristics | | Installation Notes | |
| Flow Depth (in) 4.88 Instant Velocity (fps) 2.01 Surge Evidence (ft) Silt Type None Silt Depth (in) 0.00 Needs Cleaning No Backwater No Flow Path Straight Drop Inlet No Hydraulic Rating Fair | | Install Plan Sketch | | Install Cross-Section Sketch | |
| Installation Notes | |  | |  | |
| Location in Pipe (ft) 1.0 Location from Manhole Sensors Antenna Surface Paved Surface Signal Strength 75 | | Pressure Clock Position: 6:00 Velocity Clock Position: 6:00 | | | |
| Post Installation Notes | | Approvals | | | |
| Meter Type ADS Triton+ Telemetry Type ADS Installation Date 5/10/2019 | | Recommended by FSP | | Client Approval | |

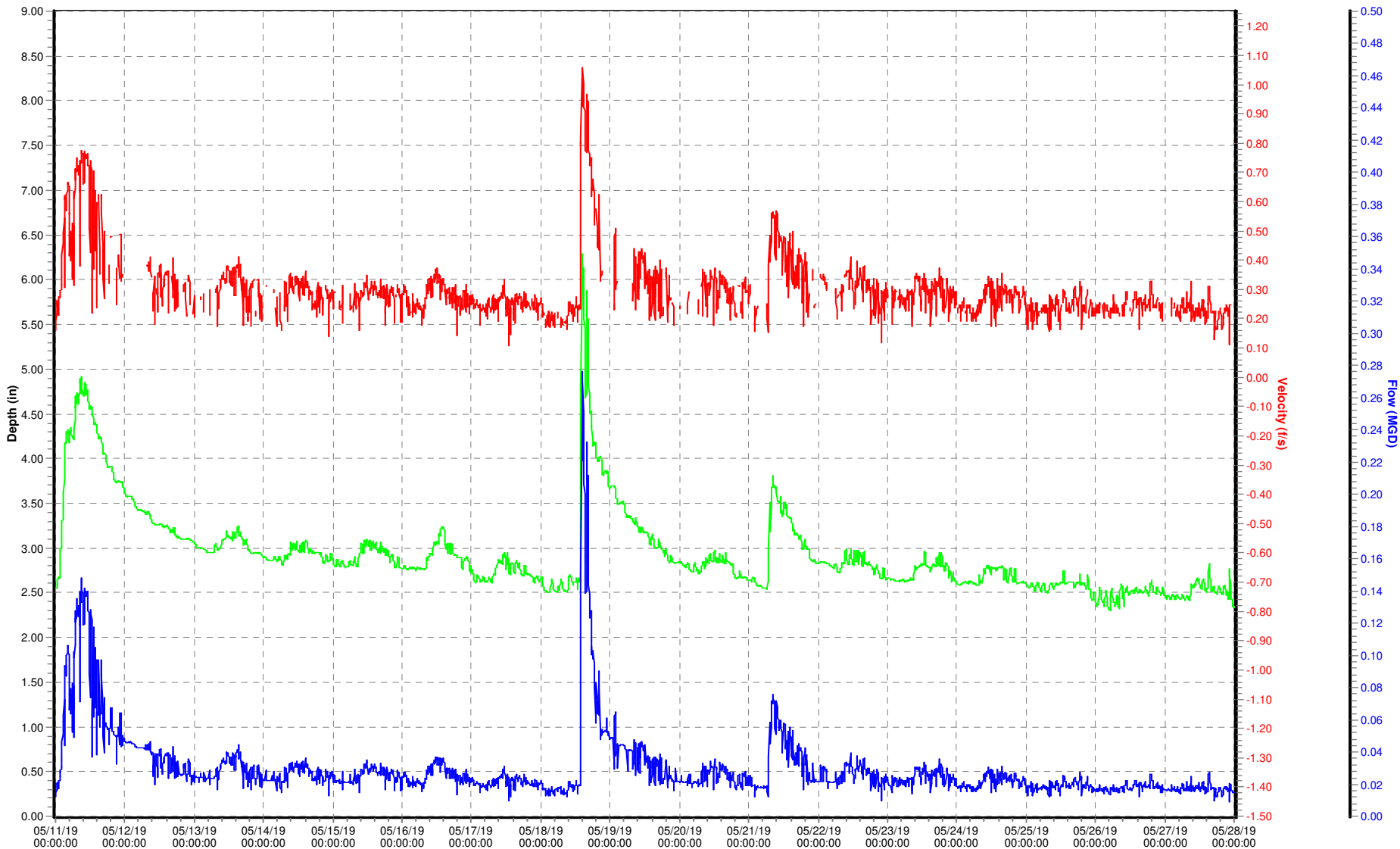
APPENDIX B

HYDROGRAPHS

ADFM-01 (05/11/19 to 05/28/19) Pipe Dia: 11.94 x 11.68 in

DVQ

05 Dprocessed (in) 06 Vprocessed (f/s) 12 Qfinal (MGD)

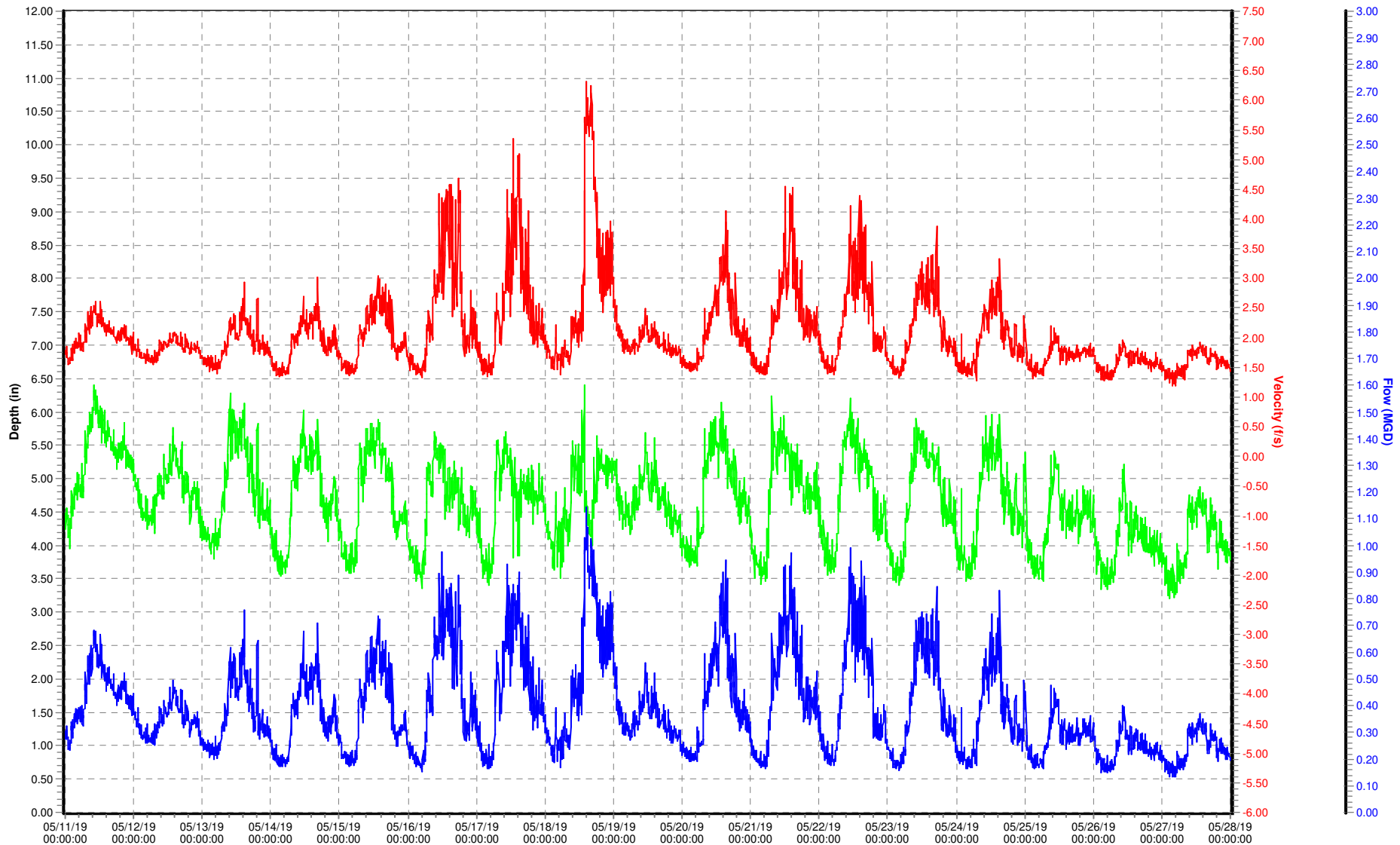


Print Date: 06/03/19 09:12:26

ADFM-02 (05/11/19 to 05/28/19) Pipe Dia: 11.82 in

DVQ

05 Dprocessed (in) 06 Vprocessed (f/s) 12 Qfinal (MGD)



Print Date: 06/03/19 09:12:21

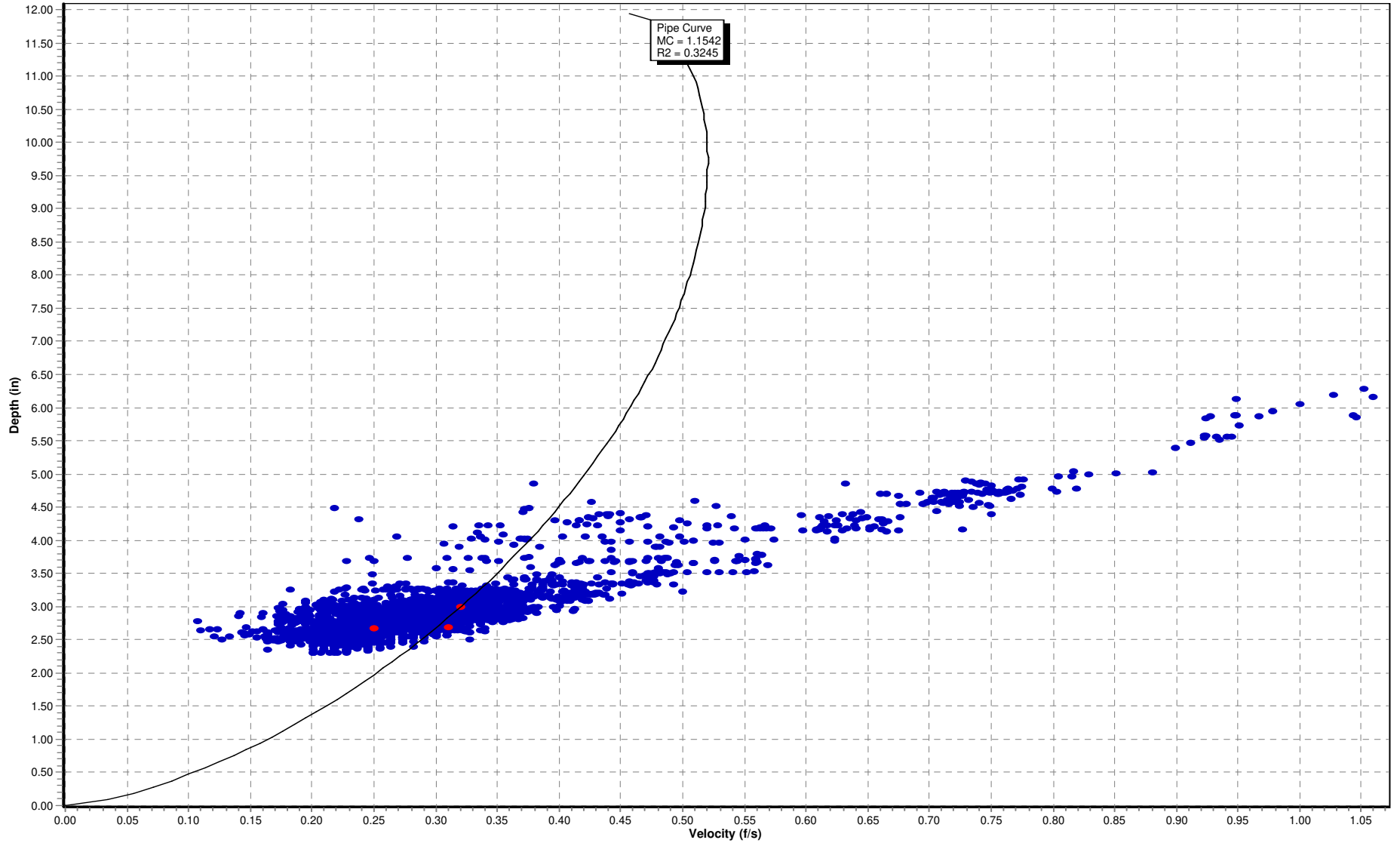
APPENDIX C

SCATTERGRAPHS

ADFM-01 (05/11/19 to 05/28/19) Pipe Dia: 11.94 x 11.68 in

Scattergraph

05 Dprocessed (in) Pipe Curve

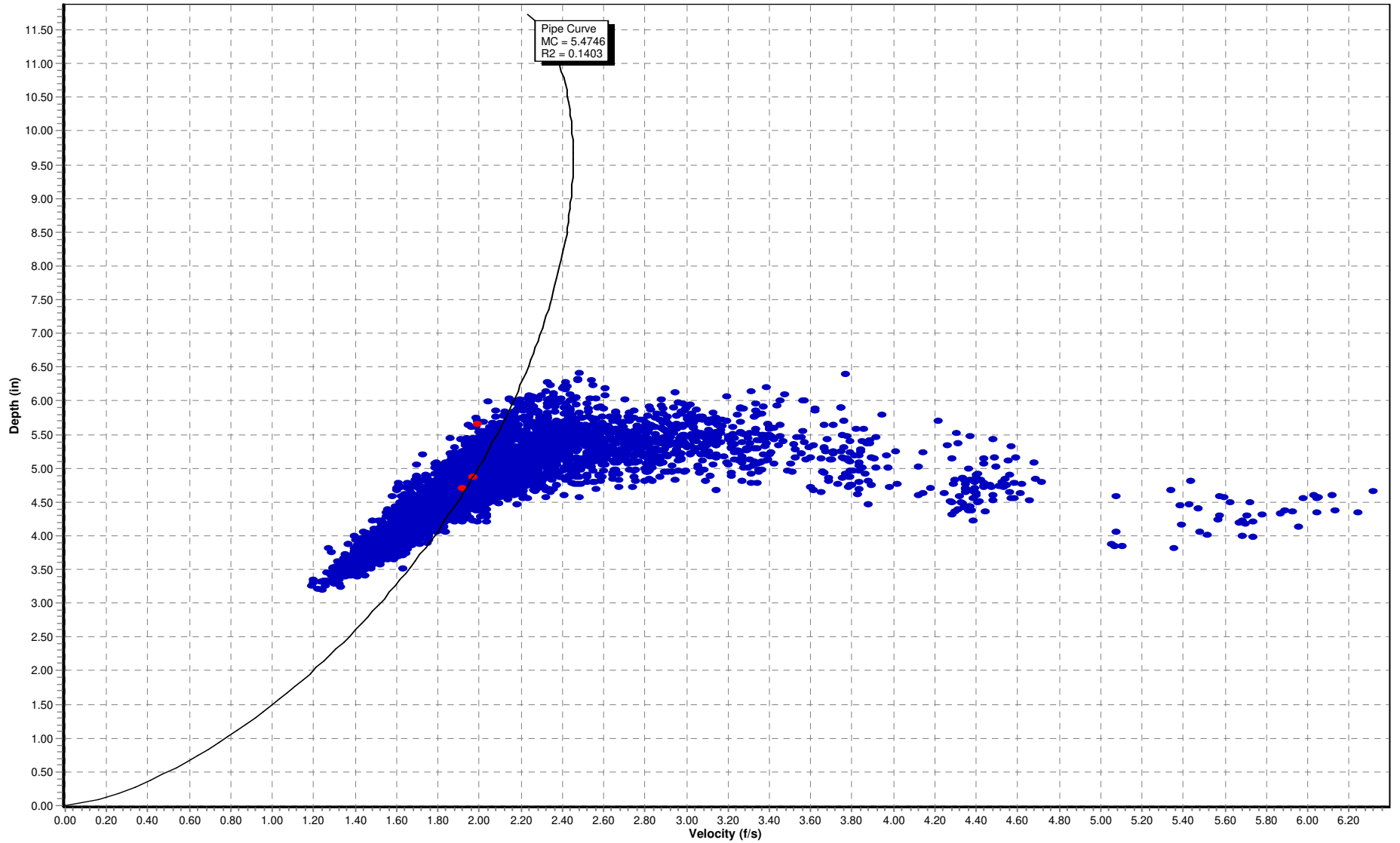


Print Date: 06/03/19 09:12:38

ADFM-02 (05/11/19 to 05/28/19) Pipe Dia: 11.82 in

Scattergraph

05 Dprocessed (in) Pipe Curve



Print Date: 06/03/19 09:12:32

APPENDIX D

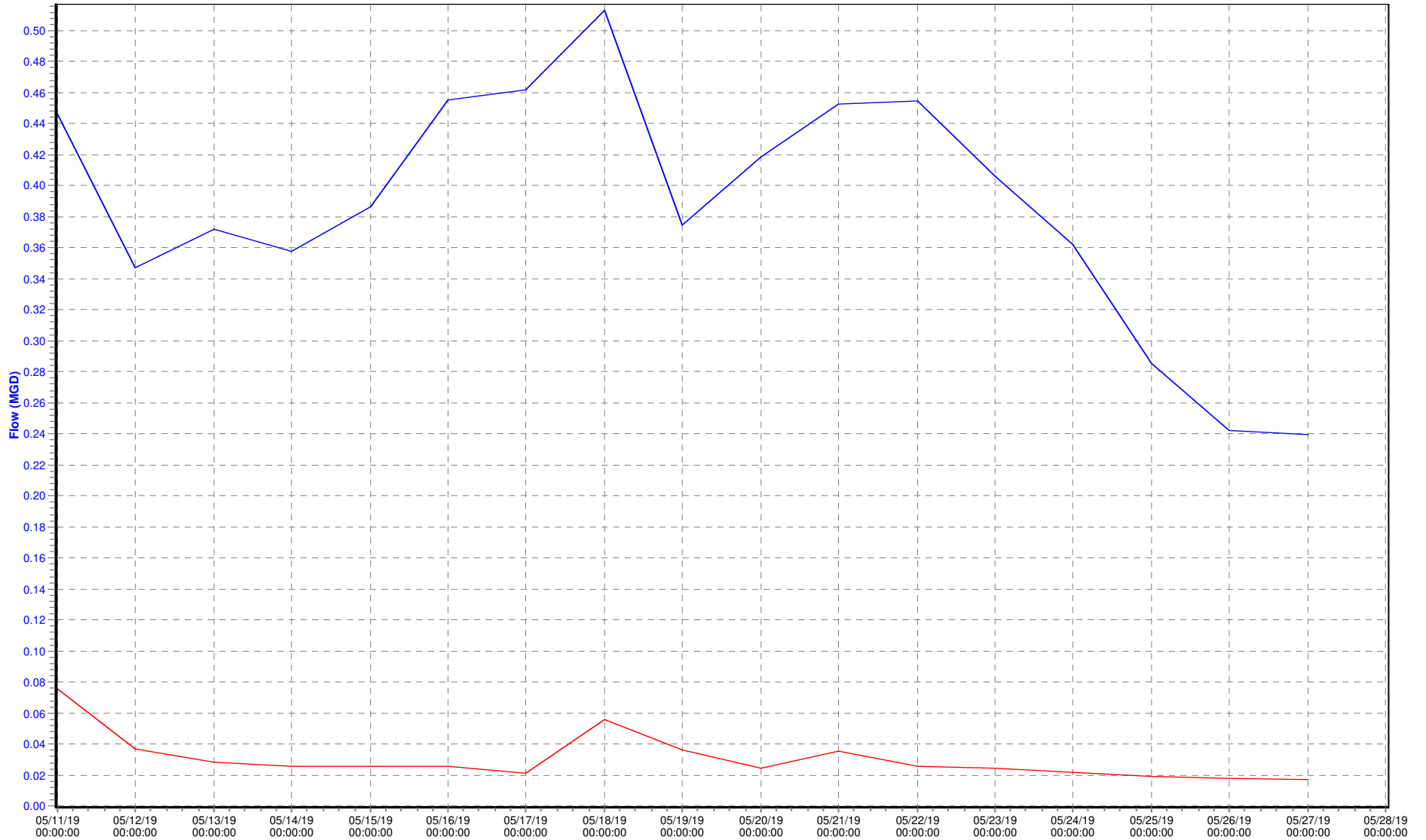
FLOW BALANCE



ADFM-02 (05/11/19 to 05/28/19)

Flow Balance from ADFM-01

12 Qfinal (MGD) FB_ADFM01 (MGD)



Printed: 06/03/19 15:21:37

Appendix C: Development Flow Projections
Per Addison's 2010 Wastewater System Requirements Manual

| | | | | | | | | | |
|------|--|------------------------------|---------------------|--------------|--------------|--------------|--------------|--------|-----------------|
| a) | Buildings | Area | Total building area | 122,000 sf | | | | | |
| | FBO | 12,000 sf | | | | | | | |
| | Hangar I | 40,000 sf | | | | | | | |
| | Hangar II | 40,000 sf | | | | | | | |
| | Hangar III | 30,000 sf | | | | | | | |
| b) | Site area | 15.68 | acres | | | | | | |
| c) | Commercial Design Flows: Office/Commerical design flow rate Table 1b | 0.1 gallons per sf per day | | | | | | | |
| d) | Average daily flow = (design flow * bld area) | | | | | | | | |
| | <table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">ADF=</td> <td style="padding: 5px;">12,200</td> <td style="padding: 5px;">gallons per day</td> </tr> </table> | | | | | | ADF= | 12,200 | gallons per day |
| ADF= | 12,200 | gallons per day | | | | | | | |
| e) | Infiltration rate | 650 gallons per day per acre | | | | | | | |
| f) | Peak Factor | 3 for 8" to 12" pipes | | | | | | | |
| g) | Minimum N value | 0.013 | | | | | | | |
| h) | Velocity | 2 fps | 10 fps | | | | | | |
| i) | Peak wet weather flow = (design flow * bld area * peak factor) + (Infiltration rate * Site area) | | | | | | | | |
| | <table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">PWF=</td> <td style="padding: 5px;">46,792</td> <td style="padding: 5px;">gallons per day</td> </tr> </table> | | | | | | PWF= | 46,792 | gallons per day |
| PWF= | 46,792 | gallons per day | | | | | | | |
| j) | Conversions | | | | | | | | |
| | 1 gallon = | 0.133681 cubic feet | | | | | | | |
| | 1 day = | 86,400 seconds | | PWF= | 0.07 cfs | ADF= | 0.02 cfs | | |
| | 1 day= | 1440 minutes | | PWF= | 32.49 gpm | ADF= | 8.47 gpm | | |
| k) | Sanitary pipe design values | | | | | | | | |
| | | slope | | Capacity | | Capacity | | | |
| | Pipe (inches) | min (%) | max (%) | min (cfs) | max (cfs) | min (gpm) | max (gpm) | | |
| | 6 | 0.50 | 12.00 | 0.40 | 1.94 | 180 | 871 | | |
| | 8 | 0.33 | 8.40 | 0.69 | 3.50 | 310 | 1571 | | |
| | 10 | 0.25 | 6.23 | 1.10 | 5.47 | 494 | 2455 | | |
| | 12 | 0.20 | 4.88 | 1.59 | 7.78 | 714 | 3492 | | |