



**AGENDA
PLANNING & ZONING COMMISSION MEETING
CITY OF LEANDER, TEXAS**

Pat Bryson Municipal Hall
201 North Brushy Street - Leander, Texas
Thursday, September 26, 2024
Regular Meeting at 6:00 PM



**Place 1 – Donnie Mahan
Place 2 – John Cosgrove
Place 3 – Ron May
Place 4 – Deirdre Moss**

**Place 5 – James Oliver, Vice Chair
Place 6 – Laura Lantrip, Chair
Place 7 – Scott Calame
Staff Liaison – Robin Griffin**

The meeting will also be live-streamed at the following link: <https://www.leandertx.gov/video>.

REGULAR MEETING

1. Call to Order.
2. Roll Call.
3. Director's report to the Planning & Zoning Commission on action taken by City Council on the September 19, 2024 meeting.
4. Review of meeting protocol.
5. Public comments on items not listed in the agenda.

Public comments on items listed in the agenda will be heard at the time each item is discussed.

[All comments are limited to no more than 3 minutes (6 minutes if translation is needed) per individual.]

CONSENT AGENDA: ACTION

6. Approval of the minutes for meeting held on September 12, 2024

PUBLIC HEARING: ACTION

7. Conduct a Public Hearing and consider action regarding Comprehensive Plan Case CPA-24-0012 to amend the Transportation Master Plan as set forth in the Comprehensive Plan, Leander, Williamson and Travis Counties, Texas.
 - Discuss and consider action regarding Comprehensive Plan Case CPA-24-0012 as described above.
 - a. Staff Presentation
 - b. Open Public Hearing
 - c. Close Public Hearing

- d. Discussion
 - e. Consider Action
8. Conduct a Public Hearing and consider action regarding Comprehensive Plan Case CPA-24-0013 to update the Wastewater Master Plan; Leander, Williamson and Travis Counties, Texas.
- Discuss and consider action regarding Comprehensive Plan Case CPA-24-0013 as described above.
- a. Staff Presentation
 - b. Open Public Hearing
 - c. Close Public Hearing
 - d. Discussion
 - e. Consider Action

REGULAR AGENDA

9. Adjournment

CERTIFICATION

The City of Leander is committed to compliance with the American with Disabilities Act. Reasonable modifications and equal access to communications will be provided upon request. Please call the City Secretary at (512) 528-2743 for information. Hearing impaired or speech disabled persons equipped with telecommunication devices for the deaf may call (512) 528-2800. I certify that the above agenda for this meeting of the Planning and Zoning Commission of the City of Leander, Texas, was posted on the bulletin board at City Hall in Leander, Texas, on the 20th day of September 2024 by 5:00 p.m. pursuant to Chapter 551 of the Texas Government Code.



Ellen Coufal, Secretary



EXECUTIVE SUMMARY
9/26/2024

AGENDA SUBJECT:

Approval of the minutes for meeting held on September 12, 2024

BACKGROUND:

Approval of the minutes for meetings held on September 12, 2024.

HISTORY/TIMELINE:

APPLICANT/AGENT:

RECOMMENDATION:

Staff recommends approval of the minutes

PRESENTER:

Attachments:

1. 9-12-2024 P & Z Minutes



**MINUTES
PLANNING & ZONING COMMISSION MEETING
CITY OF LEANDER, TEXAS**

Pat Bryson Municipal Hall
201 North Brushy Street - Leander, Texas
Thursday, September 12, 2024
Regular Meeting at 6:00 PM



**Place 1 – Donnie Mahan
Place 2 – John Cosgrove
Place 3 – Ron May
Place 4 – Deirdre Moss**

**Place 5 – James Oliver, Vice Chair
Place 6 – Laura Lantrip, Chair
Place 7 – Scott Calame
Staff Liaison – Robin Griffin**

REGULAR MEETING

1. Call to Order.
Meeting was called to order at 6:04 p.m.
2. Roll Call.
All present except Commissioner Mahan, Commissioner Cosgrove, and Commissioner Moss.
3. Director's report to the Planning & Zoning Commission on action taken by City Council on the September 5, 2024 meeting.
4. Review of meeting protocol.
5. Public comments on items not listed in the agenda.

Public comments on items listed in the agenda will be heard at the time each item is discussed.

[All comments are limited to no more than 3 minutes (6 minutes if translation is needed) per individual.]

No one wished to speak.

CONSENT AGENDA: ACTION

Motion to approve Consent Agenda Item # 6.

By: Board Member May

Seconded: Board Member Oliver

Vote: 4 - 0 None

6. Approval of the minutes for meetings held on August 22, 2024 Planning & Zoning meeting and September 5, 2024 Joint Workshop.

PUBLIC HEARING: ACTION

7. Conduct a Public Hearing and consider action regarding Zoning Case Z-24-0123 to amend the Northline Planned Unit Development on several parcels of land approximately 115.7076 acres ± in size, out of the William Mancil Survey, Abstract No. 437, the Talbot Chambers Survey, Abstract No. 125; and generally located south of East San Gabriel Parkway and approximately 200 feet east of US 183, Leander, Williamson County, Texas. *[Postponed by Applicant]*
8. Conduct a Public Hearing and consider action regarding Zoning Case Z-24-0127 to amend the current zoning of Northline Planned Unit Development to adopt the Northline Retail Planned Unit Development with base zoning district of GC-2-A (General Commercial) on eight (8) parcels of land approximately 16.0602 acres ± in size, more particularly described by Williamson Central Appraisal District Parcels R517094, R031604, R646992, R646986, R646987, R646988, R646989, and R646990; and generally located southwest of the intersection of East San Gabriel Parkway and 183A Toll Road, Leander, Williamson County, Texas.

- Discuss and consider action regarding Zoning Case Z-24-0127 as described above.

No one spoke in favor of the request. Marshall Hines, 1801 Montana Court, Leander, TX 78641, submitted via website opposition to the request.

Motion to approve Zoning Case Z-24-0127 contingent on the approval of the Comprehensive Plan Amendment.

By: Board Member Calame
Seconded: Board Member Oliver

Vote: 4 - 0 None

9. Conduct a Public Hearing regarding Ordinance Case OR-24-0017 to amend the Subdivision Ordinance to adopt updates to the Parkland Dedication, Park Improvement, and Parkland Fee-in-Lieu regulations and requirements, and to provide for related matters; Williamson & Travis Counties, Texas. Applicant: City of Leander.

- Discuss and consider action regarding Ordinance Case OR-24-0017 as described above.

Motion to approve Ordinance Case OR-24-0017.

By: Board Member Lantrip
Seconded: Board Member Calame

Vote: 4 - 0 None

REGULAR AGENDA

10. Adjournment
Meeting adjourned at 6:51 p.m.

APPROVED

CHAIR

ATTEST:

STAFF LIAISON

Subject:

RE: Online Form Submission #3608 for Public Comments Request

From: noreply@civicplus.com <noreply@civicplus.com>

Sent: Thursday, September 12, 2024 1:04 PM

To: Dara Crabtree <dcrabtree@leandertx.gov>; Debora Penberg <dpenberg@leandertx.gov>; Stefanie Brown <sbrown@leandertx.gov>

Subject: Online Form Submission #3608 for Public Comments Request

Caution: This is an external email. DO NOT access links or attachments unless you know the sender and contents are safe. When in doubt, please notify IT Department staff.

Public Comments Request

Individuals who want to comment at the next regular meeting of the City Council or the Planning and Zoning Commission (P&Z) may complete the following request form. See [Agendas and Minutes](#) for a list of upcoming meetings.

Comments on agenda items:

- This form only applies to regular Council/P&Z meetings. It does not apply to special meetings, workshops, or other board or commission meetings.
- Comments must pertain to items that appear on the current posted Council/P&Z meeting agendas.
- Written comments will be included in the meeting record.
- Spoken comments will be limited to no more than three minutes (six minutes if translation is needed) per individual.
- This form must be submitted no later than noon on the Wednesday before the posted meeting start time.

Comments on non-agenda items:

Public comments on items not listed in the agenda will be limited to no more than 3 minutes (6 minutes if translation is needed) per individual.

This form must be submitted no later than noon on the Wednesday prior to the posted meeting start time.

(Section Break)

First Name	Marshall
------------	----------

Last Name	Hines
-----------	-------

Do you live within Leander city limits?	Yes
--	-----

Home Address	1801 Montana Court
--------------	--------------------

City	Leander
------	---------

State	TX
-------	----

Zip Code	78641
----------	-------

Phone Number	5128699483
--------------	------------

My comments apply to the following regular meeting:	Planning and Zoning Commission
---	--------------------------------

This form will only be accepted until noon on the Wednesday prior to the next regular meeting in which an agenda has been posted.

Please see [Agendas and Minutes](#) for a list of upcoming meeting dates, times, and agendas.

My comments apply to the following meeting date:	9/12/2024
--	-----------

My agenda item or case number:	Z-24-0127
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My position on the above agenda item or case number:	I am AGAINST this item.
--	-------------------------

I want to include comments at the meeting:

Yes. But I only want my written comments added to the meeting record.

My written comments

Sadly, I am unable to attend this meeting, to voice my position in person but I am writing to voice my strong opposition to item number nine on tonight's agenda, the creation of a new PUD to supplant a portion of land which is currently controlled under the Northline PUD.

This PUD will be pitched, I believe, as a simple adjustment to provide a similar collection of development opportunities that Northline would provide under its existing PUD. This is demonstrably false. This new PUD effectively removes everything that made Northline special – namely creating an urban downtown in Leander centered around a transit station – and replacing it with a suburban strip center focused on auto-oriented traffic with a primary focus on the toll road.

Eventually, the TIRZ board will review whether or not it's appropriate to consider reimbursement of infrastructure under Endeavour's new plan – I have a hard time understanding why allowing for auto-oriented infrastructure should be reimbursed from the TIRZ that was setup to cover infrastructure costs for an urban downtown makes sense. Alas, I digress, as that isn't really the subject of your case tonight.

Ultimately the question before you is whether or not this PUD request comports with the Comprehensive Plan the city has adopted. And I think its quite plain that it doesn't.

This area is squarely within the Future Land Use Category "Leander Central". It is described in the adopted 2020 Comprehensive Plan as below:

The Leander Central future land use category encompasses the City's future urban center, in close proximity to Leander Station. This area is envisioned to be a very walkable area which encourages a "sense of place" and should represent the most dense, urban form Leander will have. This is a highly activated area with first floor storefronts, employment, dense residential, and entertainment.

Land uses are less distinguishable and less regulated in the urban environment, where the focus is more on form than function. Important characteristics in the central location are building relationship with the street and pedestrian movement, signage, street design, and public gathering places.

This area is envisioned to be developed with an urban character, meaning development requires on-street or structured parking and an emphasis on pedestrian walkability. Vehicular circulation occurs along a grid-based network of complete streets with short blocks and focus on the safety and efficient distribution of vehicles, bikes, and pedestrians.

What you see presented by Endeavour is arguably the antithesis of the intent of this Land Use Category. It is effectively a series of strip commercial buildings and pad sites in a sea of parking. These will not be walkable. They will destroy the intended urban grid laid out in the initial Northline street grid, creating yet another characterless commercial space that looks like every other characterless commercial space up and down every highway in Texas.

I encourage you to think seriously about whether or not recommending approval of this case would simply be an action whose interest is primarily about speeding up development. And would that speed come at the expense of quality? I believe so. Do we want to be a place devoid of something special because we want to say we built something quickly?

Thank you for your consideration,
Marshall Hines

I want to upload a file
with this form:

Field not completed.

Email not displaying correctly? [View it in your browser.](#)



EXECUTIVE SUMMARY

9/26/2024

AGENDA SUBJECT:

Conduct a Public Hearing and consider action regarding Comprehensive Plan Case CPA-24-0012 to amend the Transportation Master Plan as set forth in the Comprehensive Plan, Leander, Williamson and Travis Counties, Texas.

- Discuss and consider action regarding Comprehensive Plan Case CPA-24-0012 as described above.

BACKGROUND:

This request is the first step in the Comprehensive Plan amendment process. The Comprehensive Plan was adopted on April 1, 2021 and included goals related to the Transportation Master Plan (TMP). The TMP was updated May 6, 2021 and June 1, 2023, since the adoption of the latest update the City has re-evaluated several roads and is proposing the following changes:

- CR 175 realignment at new RM 2243 intersection
- Raider Way realignment from Torre Street to Hero Way
- CR 267 north of San Gabriel River to Bar W Ranch Blvd removal from the thoroughfare map
- W Broade St and Heritage Grove Rd realignment and change classification to collector
- W Broade Street north of Coba Street removal from the thoroughfare map
- Unnamed collector roads around proposed Home Depot site at 183A realignment

The TMP is intended to be the guidebook for the City of Leander on what the future roadway network looks like and what future investments in the roadway infrastructure should be made. This document evaluates existing conditions to provide an update to the Thoroughfare Plan map that accounts for constrained facilities and prioritizes projects to formulate a strategic Capital Improvements Plan (CIP) for the next 10 years. In addition, the TMP includes tools, frameworks, and recommendations for the following topic areas:

- Sidewalk, Trail, and other Bike Facility planning
- Intersection Control Evaluation processes, decision charts, and project development framework
- Diagnostic of existing policies in Leander to modernize and update for support of transportation systems
- An overview of funding available to help pay for transportation projects

The results of this study and recommendations were combined into the short term and long term CIP - the primary implementation tool for the master plan. Figure E-1 shows all of the planned projects geographically by project type.

HISTORY/TIMELINE:

04/01/2021 Comprehensive Plan Update
05/06/2021 Transportation Master Plan Update
06/01/2023 Transportation Master Plan Update

APPLICANT/AGENT:

City of Leander

RECOMMENDATION:

Staff recommends approval of the Transportation Master Plan.

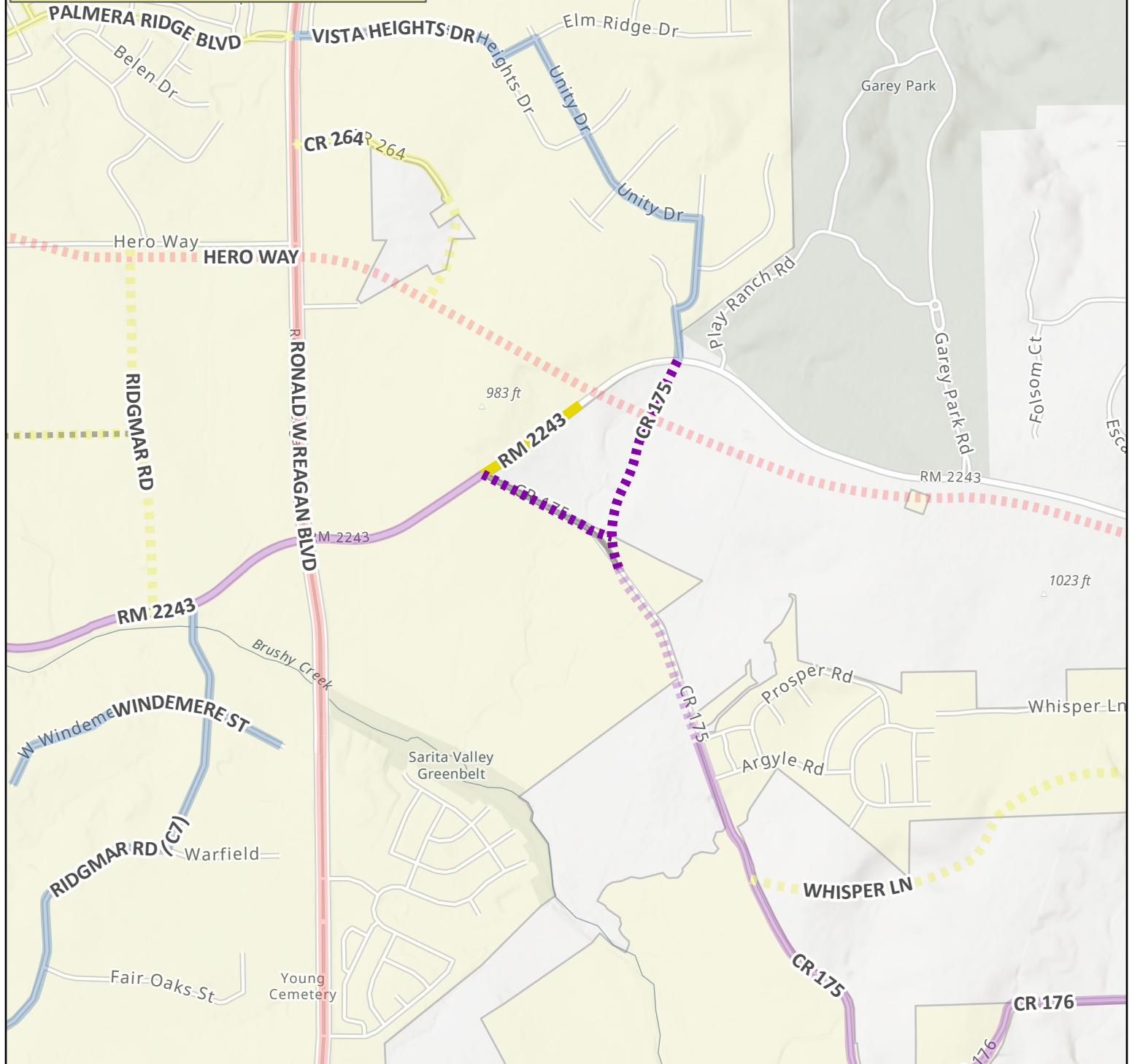
PRESENTER:

Sarvesh Dhakal, PE, CFM, Assistant City Engineer, Floodplain Administrator

Attachments:

1. CPA-24-0012 Att 1 Thoroughfare_Plan_Amendments_2024_09_16

This map has been produced by the City of Leander for informational purposes only. No warranty is made by the City regarding completeness or accuracy, please refer to the appraisal district website for official property data. No responsibility is assumed for damages or other liabilities due to the accuracy, availability, completeness, use or misuse of the information herein provided.

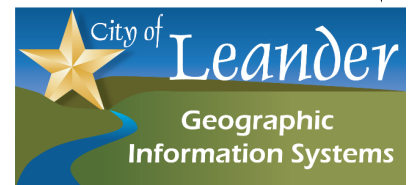
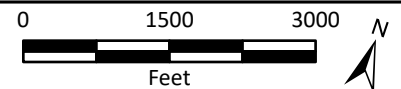


THOROUGHFARE PLAN AMENDMENTS

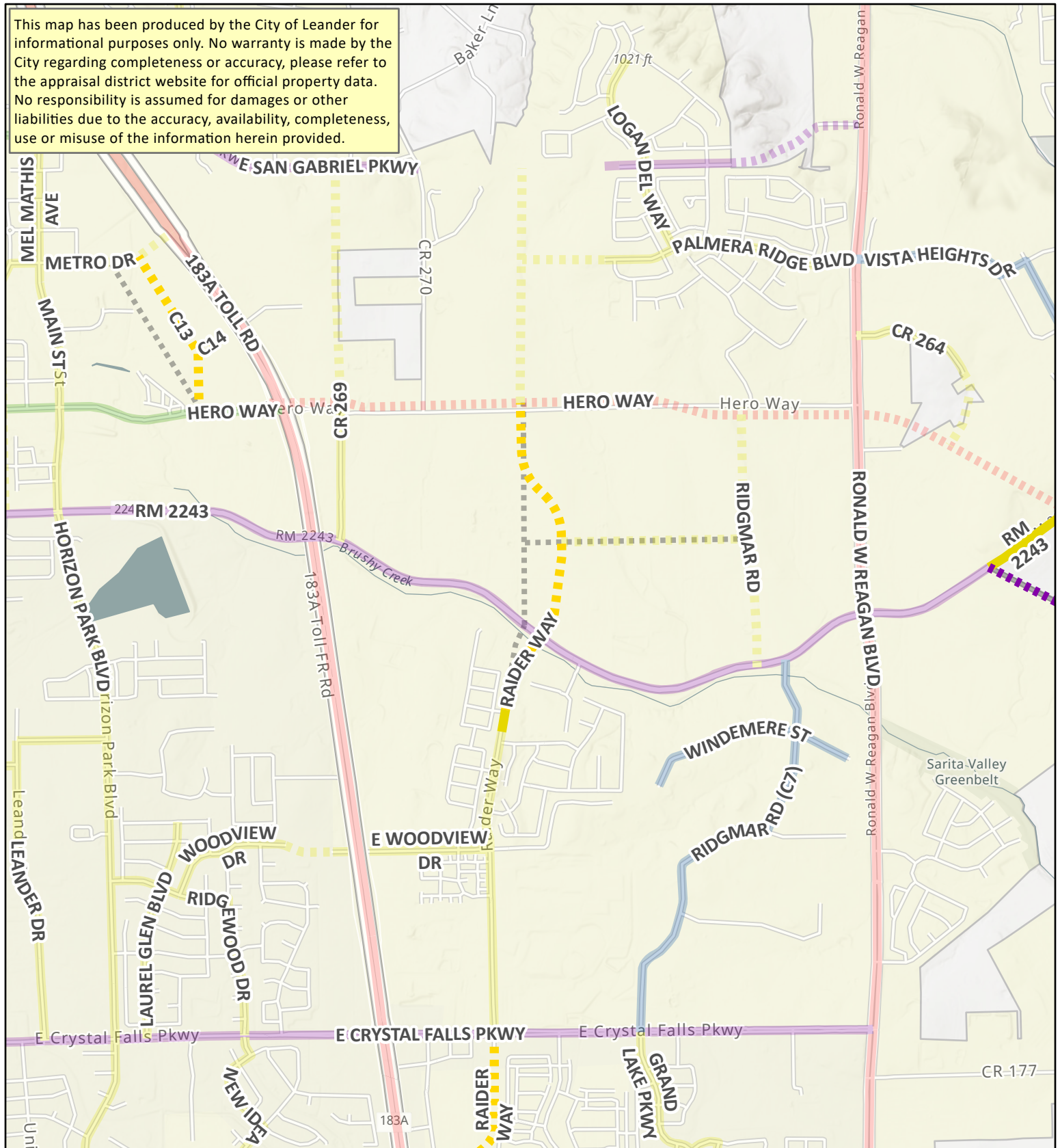
CR 175

Change Description: CR 175 alignment and tie into New 2243 from County.

- Existing Collector
- - - Proposed Arterial 4



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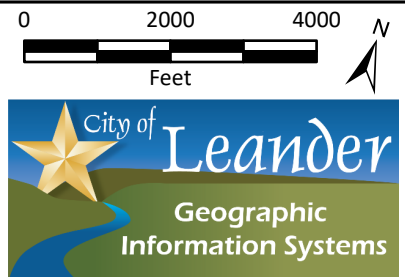


THOROUGHFARE PLAN AMENDMENTS

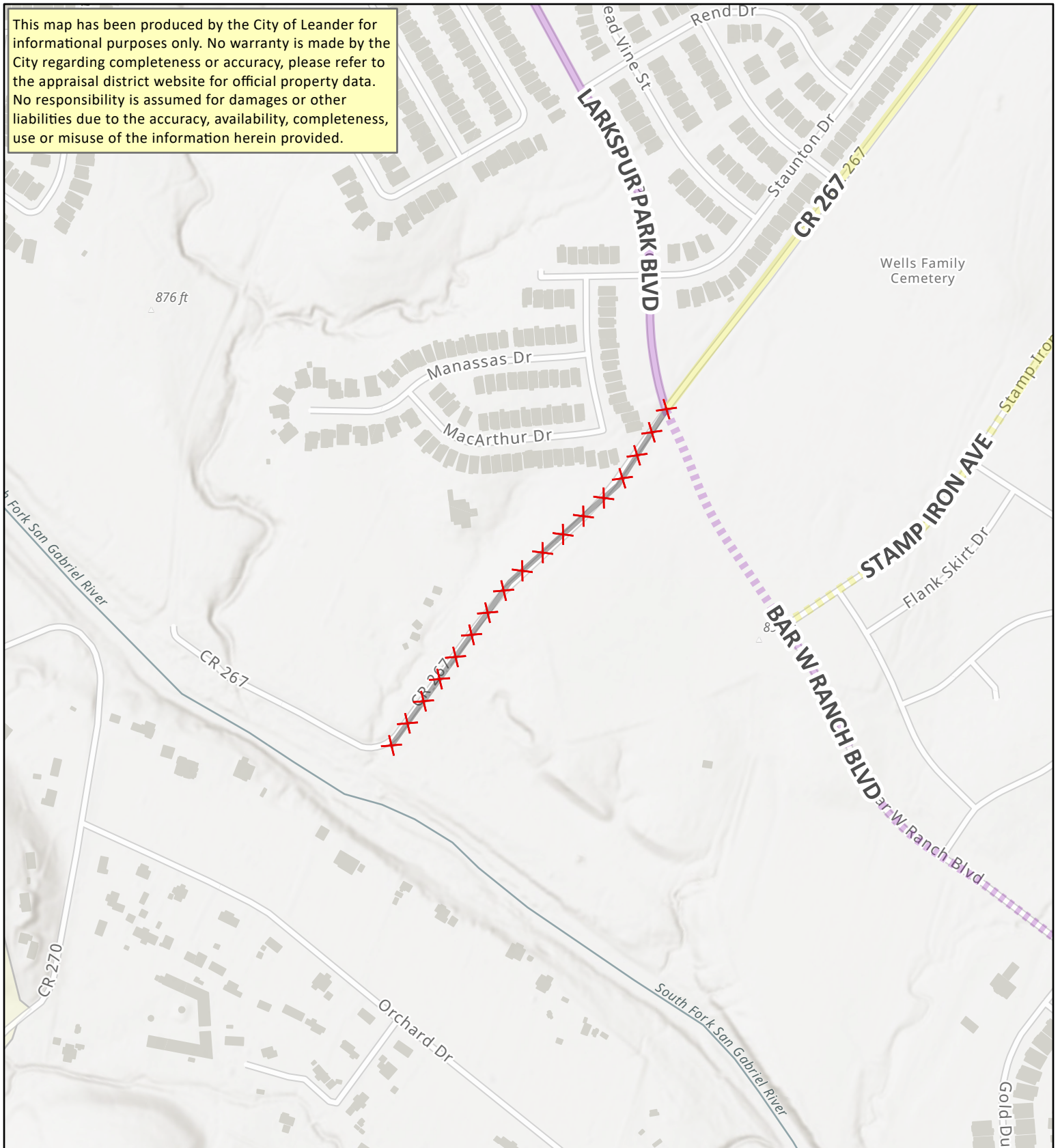
RAIDER WAY

Change Description: Raider Way alignment from Torre to Hero Way from Raider Way Study. (Kimley Horn)

- Existing Collector
- Proposed Arterial 4
- Proposed Collector



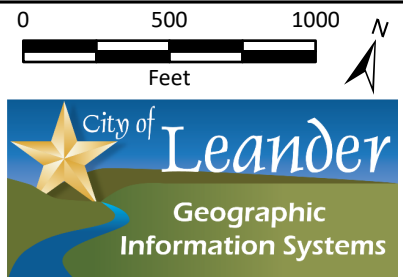
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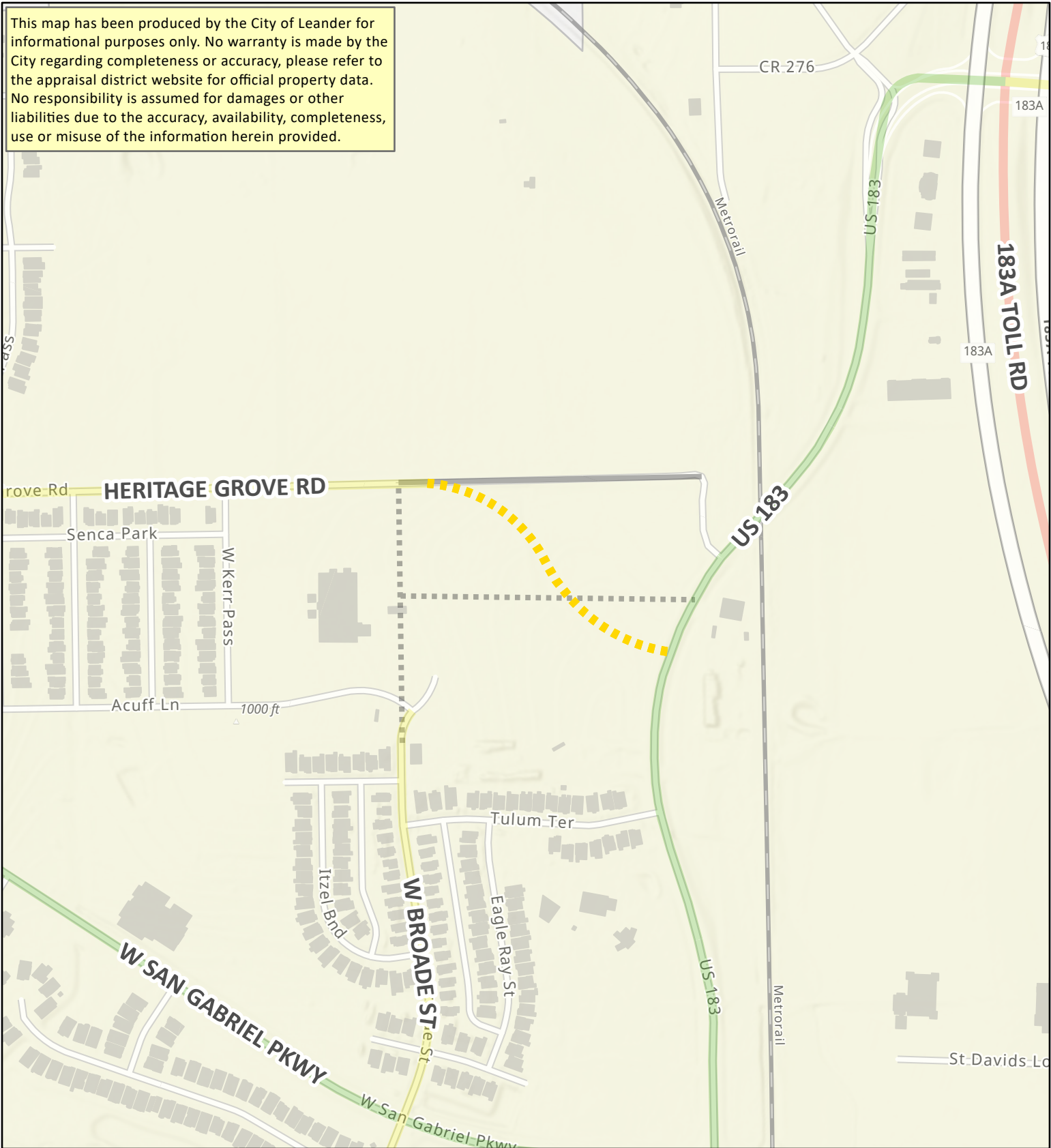
THOROUGHFARE PLAN AMENDMENTS

CR 267

Change Description: CR 267 south of Bar W Ranch Blvd has been vacated and removed from the Thoroughfare Plan.



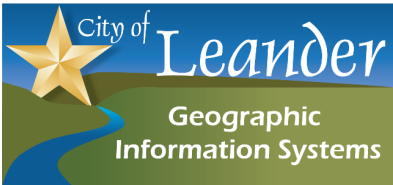
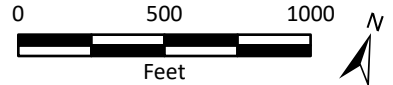
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THOROUGHFARE PLAN AMENDMENTS
HERITAGE GROVE RD & W BROADE ST

Change Description: Heritage Grove Rd realignment from W Broade St to US 183 and W Broade St terminated at the intersection of Acuff Ln.


 Proposed Collector



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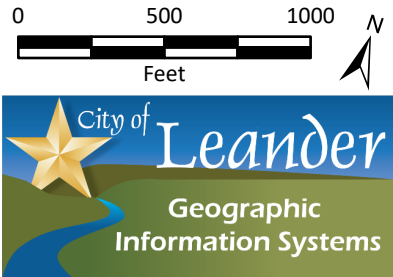


THOROUGHFARE PLAN AMENDMENTS

C13 AND C14

Change Description: Realignment for Collector C13 and additiona of C14 connector to 183A

Proposed Collector





EXECUTIVE SUMMARY
9/26/2024

AGENDA SUBJECT:

Conduct a Public Hearing and consider action regarding Comprehensive Plan Case CPA-24-0013 to update the Wastewater Master Plan; Leander, Williamson and Travis Counties, Texas.

- Discuss and consider action regarding Comprehensive Plan Case CPA-24-0013 as described above.

BACKGROUND:

As part of Wastewater Collection System Masterplan update, George Butler Associates, Inc was tasked in January 2023 to study city's wastewater collection system including data collection, growth projections, system calibration and modelling, and provide list of capital improvement projects as recommendations. The study is conducted to identify city's wastewater infrastructure needs and meet wastewater collection system demands for smooth operations and future growth as part of city's wastewater infrastructure planning. The professional engineering services for this task was executed under task number GBA-007 under solicitation #S20-052. This study is planned to update the existing wastewater masterplan from March 2008 which was restudied in 2017. As a part of city's comprehensive plan, the infrastructure masterplans are updated every five years.

This wastewater collection system masterplan update takes into consideration the most recent growth patterns in the city and recommends capital projects in combination of gravity lines, force mains and lift stations for the immediate, 5-year, 10-year and 20-year time horizons as listed in the final report. Study recommends total of 43 capital wastewater projects with estimated planning level cost of \$266 Million. Out of which, there are 2 immediate projects, 3 projects for 5-year, 15 projects for 10-year and 23 projects for 20-year growth horizons.

HISTORY/TIMELINE:

APPLICANT/AGENT:

City of Leander

RECOMMENDATION:

Staff recommends approval of the Wastewater Master Plan update.

PRESENTER:

Sarvesh Dhakal, PE, CFM, Assistant City Engineer, Floodplain Administrator

Attachments:

1. CPA-24-0013 At 1 Leander Collection System Master Plan



City of
Leander

COLLECTION SYSTEM MASTER PLAN

CITY OF LEANDER, TEXAS

FINAL REPORT

JUNE 2024



TBPE Firm No. 4242
9601 Amberglen Blvd, Ste. 109
Austin, TX 78729
www.gbateam.com

GBA PN 15393.01

City of Leander, Texas
Collection System Master Plan
June 2024

Prepared for:

City of Leander, Texas

Prepared by:

GBA
TBPE Firm No. 4242
9601 Amberglen Blvd, Ste. 109
Austin, TX 78729



GBA PN: 15393.01

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List of Acronyms and Abbreviations

ADDF	Average Daily Dry-Weather Flow
CCI	Construction Cost Index
CCTV	Closed-Circuit Television
CIP	Capital Improvements Program
CIWEM	Chartered Institution of Water and Environmental Management
ENR	Engineering News-Record
ETJ	Extraterritorial Jurisdiction
fps	Feet Per Second
FM	Flow Meter or Force Main
GIS	Geographic Information System
I/I	Inflow and Infiltration
LF	Linear Foot
LS	Lift Station
LUE	Living Unit Equivalent
MG/MGD	Million Gallons/Million Gallons per Day
MUD	Municipal Utility District
O&M	Operations & Maintenance
OPCC	Opinion of Probable Construction Cost
OSSF	On-Site Septic Facilities
PCSWMM	Personal Computer Storm Water Management Model (EPA)
PDWF	Peak Dry Weather Flow
PVC	Polyvinyl Chloride
PWWF	Peak Wet Weather Flow
RDII	Rainfall Dependent Inflow and Infiltration
ROW	Right-of-Way
RM	Ranch-To-Market Road (as in RM2243)
SRTC	Sensitivity-Based Radio Tuning Calibration
SSO	Sanitary Sewer Overflow
TCEQ	Texas Commission on Environmental Quality
UCM	Austin Utilities Criteria Manual
WWTP	Wastewater Treatment Plant

0 EXECUTIVE SUMMARY

The City of Leander (City) retained GBA to prepare a Collection System Master Plan for the next 20-year period. Rapid growth has occurred since the City's most recent wastewater master plan completed in 2017, prompting the need for an updated plan. The purpose of this plan is to guide the City towards a wastewater collection system that supports and serves the City's evolving needs and continued growth. Objectives completed as part of this master planning project include the following:

- Collected manhole data in the field for sewers 12 inches or greater to develop the hydraulic model network and collect asset information.
- Identified growth areas and projected wastewater flows within the study area using City-provided population growth projections and development maps.
- Established planning-level design criteria for existing and future infrastructure.
- Developed a hydraulic model of the existing collection system in PCSWMM calibrated to Fall 2022 flow monitoring data.
- Conducted model simulations for existing conditions, 5-year, 10-year, and 20-year growth conditions to identify necessary improvements to meet established design criteria.
- Conceptualized sewer extensions to accommodate growth in the future service areas and developed estimated costs.
- Developed a list of projects to address existing and future wastewater infrastructure needs, along with estimated costs, for present day, 5-year, 10-year, and 20-year growth conditions.

Population projections provided by the City estimate Leander's population will grow by over 120,000 over the next 20 years. This growth is expected to occur throughout the City's extra-territorial jurisdiction (ETJ), particularly in areas with less existing development. For example, the City anticipates a significant portion of growth will be concentrated in the northwest region of the City (please see Chapter 6.10 for a conceptual plan for that area). To serve the anticipated growth, significant investment in wastewater infrastructure will be required throughout the City.

A 5-year, 6-hour storm event was utilized in the calibrated, hydraulic model to generate peak wet weather flows for existing infrastructure. The 5-year, 6-hour design storm method was selected based on established practices in modeling by the City of Austin and other nearby municipalities and to provide a balance of conservatism and practicality when estimating inflow and infiltration. Design criteria from the Austin Utility Criteria Manual (UCM) was used to estimate design flows for extension projects that would extend City sewer service beyond current service limits.

The hydraulic model developed for this plan was calibrated to Fall 2022 flow monitoring data, which demonstrated higher levels of inflow and infiltration (I/I) in certain basins within the City's existing sewer system. To address condition and capacity concerns in the existing sewers, it is recommended the City continue to engage in I/I mitigation efforts.

It is important to note that these I/I mitigation efforts have the potential to reduce peak wet weather flows in the existing system. If peak wet weather flows are reduced, then relief or upsizing projects may be delayed or avoided. However, the degree of I/I reduction that can be achieved is not certain. To determine if a relief project can be delayed or avoided, targeted pre- and post-rehabilitation flow monitoring will be required to confirm actual flow conditions after I/I reduction projects have been implemented.

Model simulations predict there are interceptors in the Block House Creek and Mason Creek basins not currently sized to adequately convey peak flows during 5-year, 6-hour design storm conditions. It is recommended that the City confirm and corroborate model results before embarking on large-scale relief or replacement projects. Targeted field investigations (e.g., manhole surcharge checks and flow monitoring) would help confirm the necessity and urgency of these relief projects.

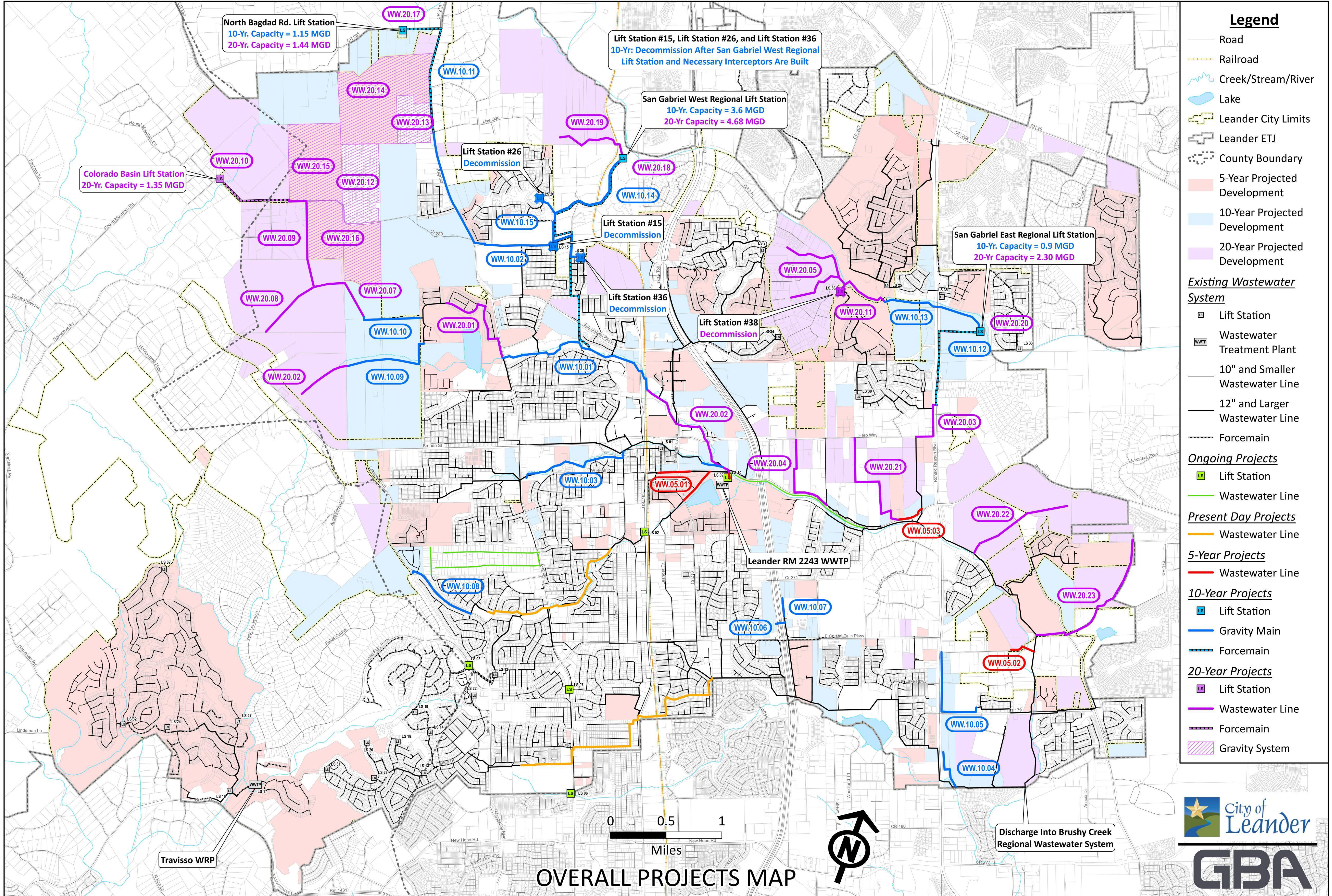
Relief projects were prioritized considering factors such as the projected timeframe of concern, extent of flooding or surcharge predicted by the model, and how existing pipe capacities compared to 20-year flow conditions. Extension projects are primarily growth-driven and will be implemented in concert with development. More details regarding project recommendations can be found in Chapter 6 of the report.

Table ES-1 summarizes the collection system improvements identified from modeling and analysis for present day, 5-year, 10-year, and 20-year growth conditions. A detailed map and list of all identified improvements are provided in Figure ES-1 and Table ES-2, respectively.

Table ES-1: Summary of Recommended Projects

Time Horizon \ Projects	Gravity Sewer		Lift Stations & Force Main		Capital Costs (\$M)
	Relief and Upsizing	Extensions for Growth	Lift Stations, Force Main	Decommission Lift Stations	
Present Day	2 Projects, 22,000 LF	-	-	-	\$28M Relief/Upsizing
5-year	1 Project, 3,700 LF	2 Projects, 2,600 LF	-	-	\$5.6M Relief/Upsizing \$1.2M Extensions (Gravity)
10-year	3 Projects, 20,600 LF	9 Projects, 37,900 LF	3 New LS, 25,500 LF FM	Decommission up to 3 LS	\$29.2M Relief/Upsizing \$69.7M Extensions (Gravity, LS, FM)
20-year	3 Projects, 13,900 LF	16 Projects, 50,400 LF	1 New LS, 2 LS Expansions, 9,300 LF FM	-	\$24.2M Relief/Upsizing \$107.4M Extensions (Gravity, LS, FM)
Total	9 Projects, 60,200 LF	27 Projects, 90,900 LF	4 New LS, 34,800 LF FM	Decommission up to 3 LS	\$267M Over 20 Years

Note: Colors on table correspond to time horizons shown in in Figure ES-1 and Table ES-2.



Leander, TX
Collection System Master Plan
Table ES-2: Overall Project List

Project ID	Infrastructure Type	Time Horizon	FY24 CIP Project ID	Project Name	Type of Improvement	Pipe Diameter (in) ¹	Total Length of Pipe (ft)	Lift Station Flow Rate (mgd)	Planning-Level Construction OPCC without Contingency	Construction Contingency (30%)	Planning-Level Construction OPCC with Contingency	Engineering & Survey (20%)	ROW Acquisition	Planning-Level Capital Cost (OPCC with Contingency + Engr./Survey + ROW Acq.) ²
WW.00.01	Existing/Relief	Present Day	-	Block House Interceptor	Exist. Gravity Relief/Upsizing	21"-24"	13,020	-	\$ 11,327,000	\$ 3,398,000	\$ 14,725,000	\$ 2,945,000	\$ -	\$ 17,670,000
WW.00.02	Existing/Relief	Present Day	-	Mason Creek Interceptor	Exist. Gravity Relief/Upsizing	15"-24"	8,170	-	\$ 6,597,000	\$ 1,979,000	\$ 8,576,000	\$ 1,715,000	\$ -	\$ 10,291,000
WW.05.01	Existing/Relief	5-Year	-	Horizon Lake Interceptor	Exist. Gravity Relief/Upsizing	18"-36"	3,660	-	\$ 3,617,000	\$ 1,085,000	\$ 4,702,000	\$ 940,000	\$ -	\$ 5,642,000
WW.05.02	New/Extension	5-Year	-	Lonestar Landing WW Improvements	New Gravity to Serve Growth	8"	1,225	-	\$ 620,000	\$ 186,000	\$ 806,000	\$ 161,000	\$ 124,000	\$ 1,091,000
WW.05.03	New/Extension	5-Year	-	RM 2243 to Hero Way WW Improvements - East Segment Ph. 1	New Gravity to Serve Growth	12"	1,350	-	\$ 810,000	\$ 243,000	\$ 1,053,000	\$ 211,000	\$ 136,000	\$ 1,400,000
WW.10.01	Existing/Relief	10-Year	WW.41	Benbrook Interceptor (Under Design)	Exist. Gravity Relief/Upsizing	27"	8,460	-	\$ 9,870,000	\$ 2,961,000	\$ 12,831,000	\$ 2,566,000	\$ -	\$ 15,397,000
WW.10.02	Existing/Relief	10-Year	-	Collaborative Way	Exist. Gravity Relief/Upsizing	18"	5,780	-	\$ 4,379,000	\$ 1,314,000	\$ 5,693,000	\$ 1,139,000	\$ -	\$ 6,832,000
WW.10.03	Existing/Relief	10-Year	WW.25	South Brushy Creek Interceptor	Exist. Gravity Relief/Upsizing	15"-24"	6,400	-	\$ 4,493,000	\$ 1,348,000	\$ 5,841,000	\$ 1,168,000	\$ -	\$ 7,009,000
WW.10.04	New/Extension	10-Year	-	South Ronald Reagan Blvd. WW Improvements	New Gravity to Serve Growth	8"	2,000	-	\$ 1,012,000	\$ 304,000	\$ 1,316,000	\$ 263,000	\$ 202,000	\$ 1,781,000
WW.10.05	New/Extension	10-Year	-	Journey Pkwy and Ronald Reagan Blvd WW Improvements	New Gravity to Serve Growth	8"	4,675	-	\$ 2,366,000	\$ 710,000	\$ 3,076,000	\$ 615,000	\$ 472,000	\$ 4,163,000
WW.10.06	New/Extension	10-Year	-	US 183-A WW Improvements Ph. 1	New Gravity to Serve Growth	8"	450	-	\$ 228,000	\$ 68,000	\$ 296,000	\$ 59,000	\$ 45,000	\$ 400,000
WW.10.07	New/Extension	10-Year	-	US 183-A WW Improvements Ph. 2	New Gravity to Serve Growth	8"	875	-	\$ 443,000	\$ 133,000	\$ 576,000	\$ 115,000	\$ 88,000	\$ 779,000
WW.10.08	New/Extension	10-Year	-	Linda Hall WW Improvements	New Gravity to Serve Growth	12"	3,600	-	\$ 2,160,000	\$ 648,000	\$ 2,808,000	\$ 562,000	\$ 363,000	\$ 3,733,000
WW.10.09	New/Extension	10-Year	-	North Fork Brushy Creek WW Interceptor Improvements Ph. 1	New Gravity to Serve Growth	18"	4,630	-	\$ 3,506,000	\$ 1,052,000	\$ 4,558,000	\$ 912,000	\$ 467,000	\$ 5,937,000
WW.10.10	New/Extension	10-Year	-	North Brushy Creek WW Interceptor Improvements	New Gravity to Serve Growth	18"-21"	2,800	-	\$ 2,250,000	\$ 675,000	\$ 2,925,000	\$ 585,000	\$ 282,000	\$ 3,792,000
WW.10.11	New/Extension	10-Year	-	North Bagdad Rd. Lift Station Ph. 1	New Gravity/LS to Serve Growth	18"(G), 10"(F)	10,600(G/F)	1.15	\$ 6,235,000	\$ 1,871,000	\$ 8,106,000	\$ 1,621,000	\$ 756,000	\$ 10,483,000
WW.10.12	New/Extension	10-Year	-	San Gabriel East Regional Lift Station	New LS to Serve Growth	8" (F)	5,500(F)	0.90	\$ 2,593,000	\$ 778,000	\$ 3,371,000	\$ 674,000	\$ 312,000	\$ 4,357,000
WW.10.13	New/Extension	10-Year	-	San Gabriel River WW Interceptor Improvements Ph. 1	New Gravity to Serve Growth	15"-18"	5,140	-	\$ 3,863,000	\$ 1,159,000	\$ 5,022,000	\$ 1,004,000	\$ 518,000	\$ 6,544,000
WW.10.14	New/Extension	10-Year	-	San Gabriel West Regional Lift Station Ph. 1	New Lift Station	16"(F)	13,100(F)	3.60	\$ 8,349,000	\$ 2,505,000	\$ 10,854,000	\$ 2,171,000	\$ 696,000	\$ 13,721,000
WW.10.15	New/Extension	10-Year	-	Lift Station #15, #26, and #36 Decommission	New Gravity to Serve Growth	8"-21"	10,050	-	\$ 8,331,000	\$ 2,499,000	\$ 10,830,000	\$ 2,166,000	\$ 1,014,000	\$ 14,010,000
WW.20.01	Existing/Relief	20-Year	-	Devine Lake	Exist. Gravity Relief/Upsizing	27"	5,240	-	\$ 5,625,000	\$ 1,688,000	\$ 7,313,000	\$ 1,463,000	\$ -	\$ 8,776,000
WW.20.02	Existing/Relief	20-Year	WW.37/38	North Brushy Creek Interceptor	Exist. Gravity Relief/Upsizing	33"-36"	6,150	-	\$ 8,265,000	\$ 2,480,000	\$ 10,745,000	\$ 2,149,000	\$ -	\$ 12,894,000
WW.20.03	Existing/Relief	20-Year	-	North Ronald Reagan	Exist. Gravity Relief/Upsizing	12"-15"	2,500	-	\$ 1,640,000	\$ 492,000	\$ 2,132,000	\$ 426,000	\$ -	\$ 2,558,000
WW.20.04	New/Extension	20-Year	-	RM 2243 to Hero Way WW Improvements - West Segment	New Gravity to Serve Growth	8"-12"	4,340	-	\$ 2,356,000	\$ 707,000	\$ 3,063,000	\$ 613,000	\$ 437,000	\$ 4,113,000
WW.20.05	New/Extension	20-Year	-	San Gabriel River WW Interceptor Improvements Ph. 2	New Gravity to Serve Growth	8"-15"	9,050	-	\$ 5,402,000	\$ 1,621,000	\$ 7,023,000	\$ 1,405,000	\$ 913,000	\$ 9,341,000
WW.20.06	New/Extension	20-Year	-	North Fork Brushy Creek WW Interceptor Improvements Ph. 2	New Gravity to Serve Growth	12"-15"	2,650	-	\$ 1,708,000	\$ 512,000	\$ 2,220,000	\$ 444,000	\$ 268,000	\$ 2,932,000
WW.20.07	New/Extension	20-Year	-	San Gabriel Pkwy. WW Interceptor Ph. 1	New Gravity to Serve Growth	18"	3,350	-	\$ 2,540,000	\$ 762,000	\$ 3,302,000	\$ 660,000	\$ 338,000	\$ 4,300,000
WW.20.08	New/Extension	20-Year	-	San Gabriel Pkwy. WW Interceptor Ph. 2	New Gravity to Serve Growth	12"	3,150	-	\$ 1,890,000	\$ 567,000	\$ 2,457,000	\$ 491,000	\$ 318,000	\$ 3,266,000
WW.20.09	New/Extension	20-Year	-	Lakeline Blvd. WW Improvements	New Gravity to Serve Growth	15"	5,030	-	\$ 3,311,000	\$ 993,000	\$ 4,304,000	\$ 861,000	\$ 507,000	\$ 5,672,000
WW.20.10	New/Extension	20-Year	-	Colorado Basin Lift Station	New LS to Serve Growth	10"(F)	3,750(F)	1.35	\$ 2,782,000	\$ 835,000	\$ 3,617,000	\$ 723,000	\$ 224,000	\$ 4,564,000
WW.20.11	New/Extension	20-Year	-	Lift Station #38 Decommission	New Gravity to Serve Growth	12"	400	-	\$ 540,000	\$ 162,000	\$ 702,000	\$ 140,000	\$ 40,000	\$ 882,000
WW.20.12	New/Extension	20-Year	-	Greatwood WW Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 8,010,000	\$ 2,403,000	\$ 10,413,000	\$ 2,083,000	\$ -	\$ 12,496,000
WW.20.13	New/Extension	20-Year	-	Whitt Ranch Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 2,310,000	\$ 693,000	\$ 3,003,000	\$ 601,000	\$ -	\$ 3,604,000
WW.20.14	New/Extension	20-Year	-	Sullivan Tract Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 9,270,000	\$ 2,781,000	\$ 12,051,000	\$ 2,410,000	\$ -	\$ 14,461,000
WW.20.15	New/Extension	20-Year	-	Leander Estates Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 6,300,000	\$ 1,890,000	\$ 8,190,000	\$ 1,638,000	\$ -	\$ 9,828,000
WW.20.16	New/Extension	20-Year	-	Hilltop Ranch Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 3,150,000	\$ 945,000	\$ 4,095,000	\$ 819,000	\$ -	\$ 4,914,000
WW.20.17	New/Extension	20-Year	-	North Bagdad Rd. Lift Station Ph. 2	New Pumps for Existing LS	-	-	1.44	\$ 245,000	\$ 74,000	\$ 319,000	\$ 64,000	\$ 35,200	\$ 418,000
WW.20.18	New/Extension	20-Year	-	San Gabriel West Regional Lift Station Ph. 2	Proposed LS Expansion	-	-	4.68	\$ 586,000	\$ 176,000	\$ 762,000	\$ 152,000	\$ 35,000	\$ 949,000
WW.20.19	New/Extension	20-Year	-	San Gabriel West WW Improvements	New Gravity to Serve Growth	8"-18"	3,860	-	\$ 2,215,000	\$ 665,000	\$ 2,880,000	\$ 576,000	\$ 389,000	\$ 3,845,000
WW.20.20	New/Extension	20-Year	-	San Gabriel East Regional Lift Station Ph. 2	Proposed LS Expansion	10" (F)	5,500(F)	2.30	\$ 2,539,000	\$ 762,000	\$ 3,301,000	\$ 660,000	\$ 312,000	\$ 4,273,000
WW.20.21	New/Extension	20-Year	-	RM 2243 to Hero Way WW Improvements - East Segment Ph. 2	New Gravity to Serve Growth	8"	5,925	-	\$ 2,998,000	\$ 899,000	\$ 3,897,000	\$ 779,000	\$ 598,000	\$ 5,274,000
WW.20.22	New/Extension	20-Year	-	CR 175 and RM 2243 WW Improvements	New Gravity to Serve Growth	8"-12"	5,160	-	\$ 2,637,000	\$ 791,000	\$ 3,428,000	\$ 686,000	\$ 520,000	\$ 4,634,000
WW.20.23	New/Extension	20-Year	-	CR 175 and CR 176 WW Improvements	New Gravity to Serve Growth	8"-12"	7,500	-	\$ 4,402,000	\$ 1,321,000	\$ 5,723,000	\$ 1,145,000	\$ 757,000	\$ 7,625,000

Notes:

- 1) For pipe diameters and lengths, gravity main is assumed, except where (F) indicates force main, and (G) indicates gravity main.
- 2) For new/extension projects not within the ROW or an existing easement, a unit cost of \$87,900/acre was utilized for easement cost estimates.
- The easement unit cost includes survey, easement acquisiton, engineering fees, condemnation/attorney fees, and ROW agent fees.
- 3) It is recommended that further on-site evaluation and data collection (e.g., checking manholes for evidence of surcharge, targeted flow monitoring) be conducted before initiating any project based on modeling results.

Subtotal, Existing/Relief Projects	\$ 87,069,000
Subtotal, New/Extension Projects ²	\$ 179,582,000
Total, All Projects	\$ 266,651,000

Time Horizon	Capital Cost
Present Day	\$ 27,961,000
5-Year	\$ 8,133,000
10-Year	\$ 98,938,000
20-Year	\$ 131,619,000
Total, All Projects	\$ 266,651,000

1 INTRODUCTION

1.1 Purpose

The purpose of this report is to update the City of Leander's wastewater collection system master plan, providing a guide towards a wastewater system that beneficially supports and serves the City's evolving needs and continued growth. The existing master plan was developed in 2017 and was intended to forecast wastewater collection and treatment system needs for the City for the 20-year period from 2015-2035. However, growth within the City over the intervening period has occurred at a much more rapid rate than anticipated, hence the need to update the existing study and re-project flows for the next 20-year period.

This updated masterplan re-evaluates the demands for the next 20 years and will introduce alternative strategies and timelines for addressing the potential need for system capacity improvements. In addition, this report will provide planning-level estimates of the probable costs for the proposed alternatives. A flow monitoring and inflow and infiltration (I/I) study was performed in the Fall of 2022 as a separate project which culminated in a report titled *Fall 2022 Flow and Rainfall Monitoring Project*. The flow monitoring data and results from that study are used to model and evaluate the existing system's capacities for this master plan study.

1.2 Scope of Work

The scope of the collection system master planning project encompasses field data collection, hydraulic modeling, growth projections, and proposed infrastructure improvements to meet current and future demands. This Master Plan study and its recommendations are focused on sanitary sewers with a diameter of 12 inches or greater. The adequacy of existing sewer lines with diameters less than 12 inches will depend on the specifics of new developments that connect to them and may require analysis on a case-by-case basis.

The study began with a survey of manholes connected to pipes with diameters of 12 inches or greater. The manhole survey data was assembled in GIS and then used to develop a hydraulic model of the collection system using the PCSWMM software. The hydraulic model was used to evaluate both the current capacity of the existing infrastructure as well as options for system improvements. The City of Leander provided maps, reports, and other information necessary to create the new PCSWMM model, including pipe lengths, sizes, and locations. Wastewater models of the existing system and the five, ten, and twenty-year planning horizons were developed. These models were evaluated to determine infrastructure needs required to serve current and future flows. Finally, a list of proposed improvements, including anticipated timing and cost, was created based on the analysis. A summary of major tasks is provided below:

- Collected physical data in the field for sewers 12 inches or greater, with the exception of a few 8" lines specified by the City, to develop the hydraulic model network and collect asset information.
- Developed a hydraulic model of the existing collection system in PCSWMM and calibrated the model to align with actual flow data gathered during the Fall 2022 flow monitoring season.
- Developed growth projections for five, ten, and twenty-year time horizons based on City-provided population and land use projections.

- Performed model simulations for the existing, five, ten, and twenty-year growth conditions to identify needed sewer system improvements.
- With City staff input, selected design criteria consistent with current, local design requirements to be used for planning-level sizing and costing of improvements.
- Developed conceptual projects to both improve the existing system (i.e., relief or replacement sewers) and serve new growth outside the existing system (i.e., extension sewers, lift stations, and force main).
- Developed planning-level opinions of probable construction cost and capital cost for each identified project to assist the City with CIP budget planning.
- Presented a comprehensive report detailing the work completed, analyses, and recommended improvements to the City's sanitary sewer system.

2 PLANNING INFORMATION, DATA COLLECTION AND ASSUMPTIONS

2.1 Wastewater Service Area

The City of Leander is situated along Highway 183, primarily in the western region of Williamson County, while the western side of the City extends into northwest Travis County. The City of Leander wastewater service area, shown in Figure 2-1, is limited to its current Certificate of Convenience and Necessity (CCN) boundaries, which generally includes areas within City limits, approximately 39 square miles, and portions of its Extra-Territorial Jurisdiction (ETJ). The study area generally follows the current sewer CCN boundary (shown in Figure 4-1 on page 24), with the addition of areas north and east of the San Gabriel River that fall within City limits and are served by City-owned collection systems. Per discussions with the City, this report primarily provides recommendations for portions of Leander's sewer CCN where flow monitoring data was collected in the Fall of 2022: south of the San Gabriel River and east of the Colorado River basin.

Most of the wastewater generated in the service area is currently treated at the Leander Wastewater Treatment Plant (WWTP), located on RM 2243 at Brushy Creek (referred to in this report as the RM2243 WWTP). The RM2243 WWTP discharges into Brushy Creek, east of downtown Leander. The plant is currently permitted for an average annual discharge of 2.25 MGD. A wastewater facilities master plan was performed concurrently with the wastewater collection system masterplan and will be delivered as a separate report. The collection system and facilities master plan address overall wastewater system needs over a 20-year planning period.

The areas that are generally located east of the 183A Toll highway and south of Crystal Falls Parkway are served by the Brushy Creek Regional Wastewater System (BCRWWS). The BCRWWS consists of two wastewater treatment plants and approximately 45 miles of regional collection lines, treating flows from the Cities of Round Rock, Cedar Park, Leander and Austin. While the City of Round Rock oversees operations and maintenance of the regional system, the system is owned jointly between the partner cities. The City of Leander owns 4.23 MGD of BCRWWS treatment capacity and leases any excess treatment capacity. The City of Leander is currently sending an average of 2 MGD to the BCRWWS through the Brushy Creek interceptor and is in the process of constructing a diversion line from the RM2243 WWTP to the Brushy Creek interceptor with a maximum capacity of 2 MGD to alleviate demands on the RM2243 WWTP.

The properties on the southwestern portion of the City within the Travisso development are part of the Travis County Municipal Utility District 21 (MUD 21) and are served by the Travisso Water Reclamation Plant (WRP), also referred to as the Crystal Falls West WRP. The Travisso collection system was conceptualized, designed and constructed over the past ten years in concert with the Travisso master-planned community. The City is currently engaged in expanding the Travisso WRP from its current capacity of 0.25 MGD to 0.52 MGD. Because Travisso's collection system was planned for and constructed recently, planning for Travisso's system was not included under the scope of this report.

Flow from the remaining service area north of the San Gabriel River is either pumped to the City of Liberty Hill to the west or sent by gravity to Georgetown to the east (Figure 2-1). Please refer to Section 2.2 for more information regarding the agreements with Liberty Hill and Georgetown.

City of Leander
Williamson County, TX

FIGURE 2-1: EXISTING
WASTEWATER SYSTEM



Legend

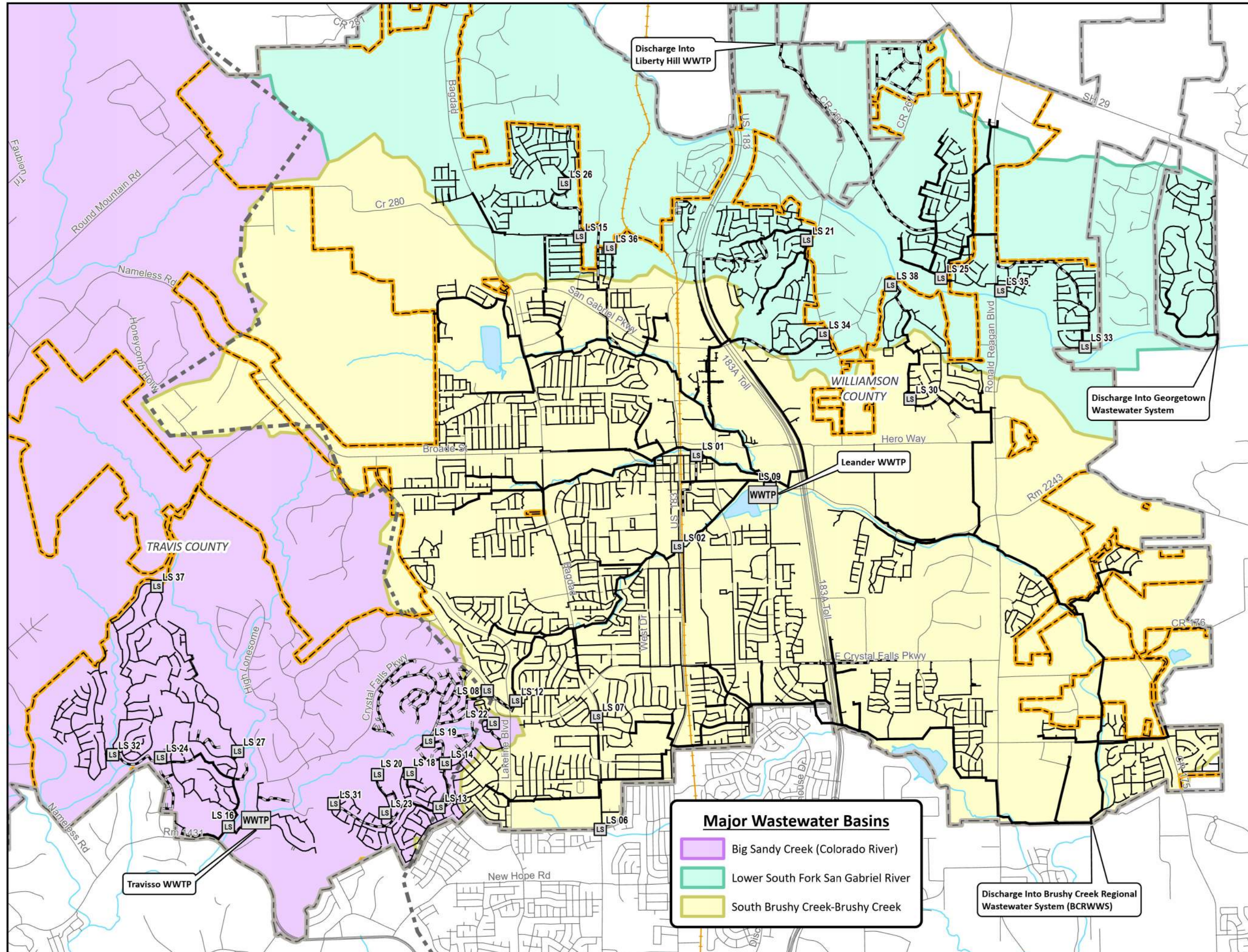
- LS Lift Station
- WWTP Wastewater Treatment Plant
- 10" and Smaller Wastewater Line
- 12" and Larger Wastewater Line
- Forcemain
- Road
- Railroad
- Creek/Stream/River
- Lake
- Leander City Limits
- Leander ETJ
- County Boundary



0 0.75 1.5

Miles

Date: 4/24/2024



Major Wastewater Basins

- Big Sandy Creek (Colorado River)
- Lower South Fork San Gabriel River
- South Brushy Creek-Brushy Creek

2.2 Interlocal and Development Agreements

Due to topographic and jurisdictional constraints, wastewater flows from the City of Leander are conveyed across jurisdictional boundaries. Interlocal agreements govern the exchange of wastewater flows between Leander and neighboring communities. Below are brief descriptions of the primary agreements impacting Leander's collection system and treatment works:

- **Brushy Creek Regional Wastewater System (BCRWWS):** Flows from the Brushy Creek basin (generally east of 183A) and the Block House Creek basin are conveyed to the BCRWWS. The interlocal agreement between the Cities of Austin, Cedar Park, Leander, and Round Rock, dated December 21, 2023, states that Leander owns 4.23 MGD of daily average treatment capacity at the BCRWWS treatment plants. Please refer to Section 2.1 for more information on Leander's involvement in the BCRWWS.
- **City of Georgetown:** The Lively Ranch subdivision collection system in the northeast of Leander's ETJ is maintained by Leander but conveys flow to the City of Georgetown for treatment (Figure 2-1). The interlocal agreement between the City of Georgetown and the City of Leander specifies a maximum sewer connection limit of 1,200 connections for the 437 acre tract. Georgetown is responsible for operating and maintaining their system as well as any necessary improvements to provide the wholesale wastewater service. Leander is responsible for operating and maintaining their collection system to convey flows to the Delivery Point near the southeast corner of the tract. Leander is also responsible for providing monthly reports to Georgetown listing the number of active connections within the Lively Tract.
- **City of Jonestown:** The agreement between City of Jonestown and the City of Leander states that Leander must receive, treat, and dispose of wastewater delivered by Jonestown in an amount up to the Annual Wastewater Entitlement, provided that only 50% (500 Living Unit Equivalents, or LUEs) of the Annual Wastewater Entitlement is available to Jonestown until improvements to the Crystal Falls West Water Reclamation Plant becomes operable. At the completion of Phase II of the WRP improvements, Leander must notify Jonestown of the number of additional LUEs (above 500 LUEs) available to Jonestown. Thereafter, Leander must notify Jonestown upon completion of Phase III and at such time the full Annual Wastewater Entitlement will be available. Jonestown agrees that it will not approve wastewater connections of its customers that would cause it to exceed the number of available LUEs. Jonestown may not deliver wastewater flows more than the Daily Average Flow Limit, a peak flow rate of 750 gpm, or wastewater in an amount that exceeds the Annual Wastewater Entitlement. Jonestown is solely responsible for collecting the wastewater from its customers and conveying the wastewater to the Points of Delivery. Upon completion and acceptance of the Master Meter and improvements, the Master Meter and improvements will be part of the Leander System, and Leander will repair, maintain, and replace the Master Meter and improvements as necessary.

- **City of Liberty Hill:** Wastewater from portions of Leander's ETJ north of the San Gabriel River (namely the Bar W Ranch subdivision) is pumped to Liberty Hill's South San Gabriel WWTP (Figure 2-1). The interlocal agreement establishes a phased wholesale service commitment of up to 8,100 LUEs total provided by the City of Liberty Hill to the City of Leander. The wholesale wastewater service is conveyed by Lift Station 25 to Liberty Hill's South San Gabriel WWTP where it is treated. The flow rate at the Point of Entry (South San Gabriel WWTP) may not exceed an average of 0.65 gpm per LUE served. Additionally, the agreement includes provisions regarding wastewater strength limitations, whereby the total daily Biological Oxygen Demand (BOD) loading may not exceed an average of 0.425 pounds per LUE. Leander is responsible for designing and constructing the internal facilities within their system, the connection point to Liberty Hill's network, and the metering of the wastewater flow. Liberty Hill is responsible for designing and constructing the interceptor lines and any necessary treatment upgrades to accommodate the wholesale wastewater service flows from Leander. Leander must keep the City of Liberty Hill apprised of developing properties and additional wastewater connections that may contribute additional flows to the Liberty Hill WWTP.

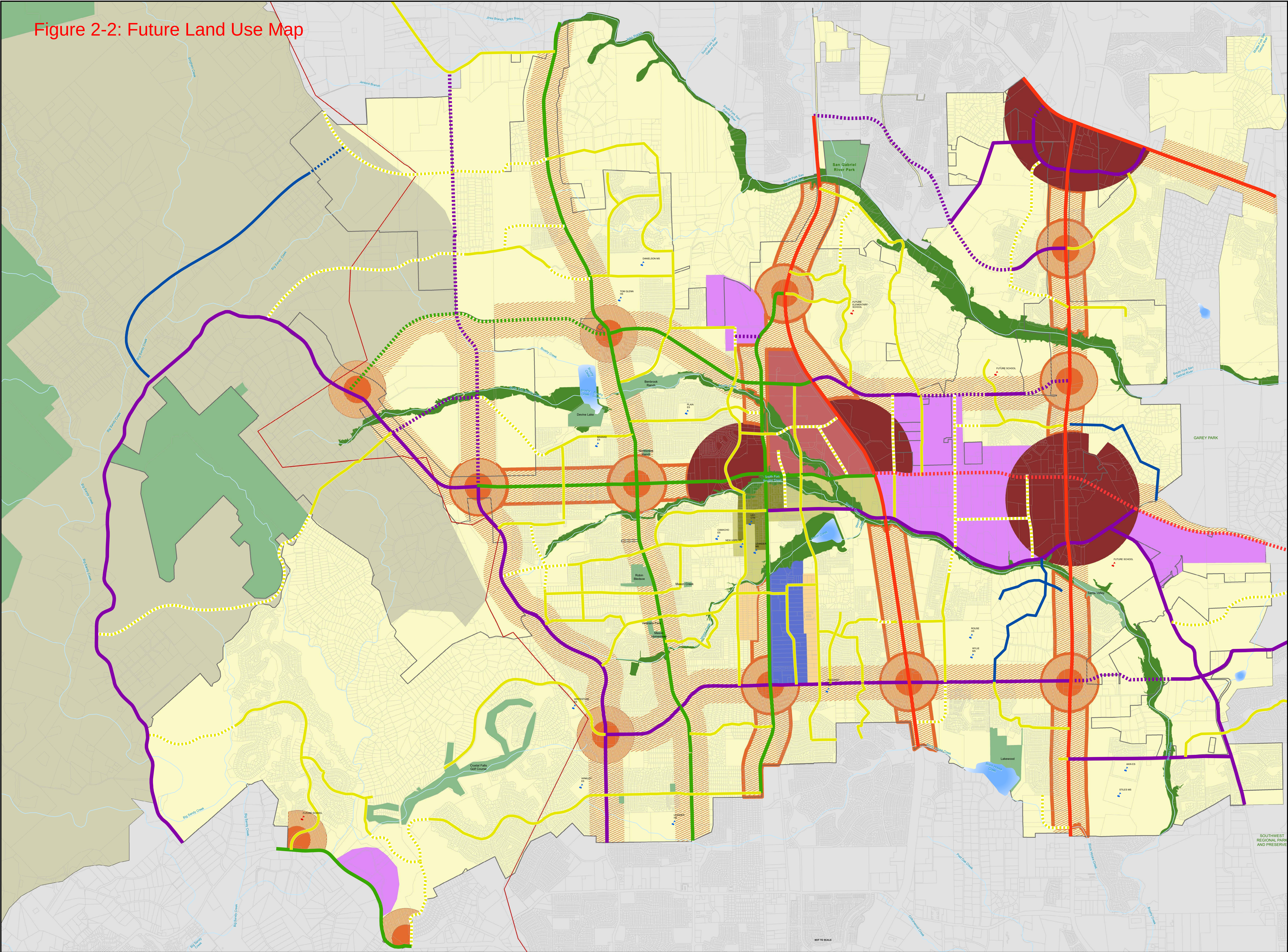
2.3 Future Land Use Assumptions

Future land use assumptions were used to develop projections of future flow contributions in the collection system model. Future land use assumptions were provided by the City in the form of a map shown in Figure 2-2. This map provides approximate locations of various land use types across the City of Leander. These land uses provide information on the types, potential densities, and locations of future development. The City also provided information regarding the planned and in-progress developments in the form of a map, a copy of which is provided in Figure 2-3. This map was used to estimate which parcels were most likely to develop within the 5-year time horizon.

Future land use assumptions are important factors for projecting future wastewater flows and identifying the required infrastructure to serve planned growth. Future land use assumptions do not represent zoning regulations or requirements, and actual future land use may vary from these assumptions. Rather, these land use assumptions are a best approximation of the types of developments and densities the City may support in the future.

Table 2-1 provides the development density assumptions agreed upon with the City, in terms of living unit equivalent (LUE) per acre for each land use type assigned. A LUE is a planning tool that estimates the typical flow of water or wastewater produced by a single-family residence. For the purposes of this study, one (1) LUE was assumed to represent 3 persons (or population equivalents) and produce 200 gallons per day (gpd) of wastewater. The 200 gpd/LUE wastewater production rate is an average rate developed based on flow monitoring. Table 2-1 was utilized to convert future growth areas into an estimated number of LUEs generating wastewater from each growth area.

Figure 2-2: Future Land Use Map

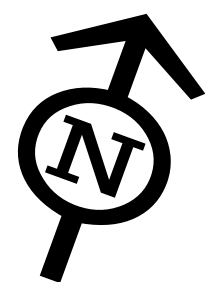
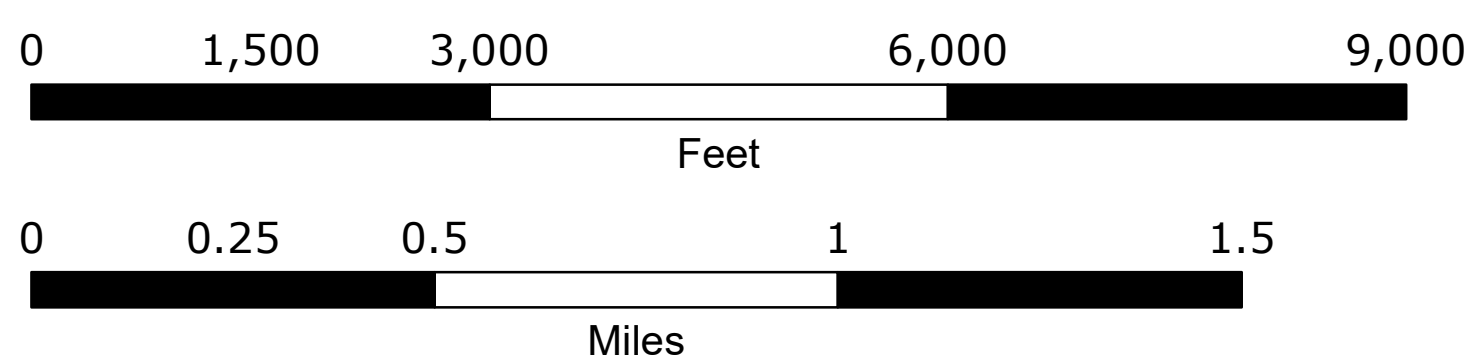


Future Land Use Map

Effective October 12, 2021



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- | | | | |
|-----------------------------|-----------------------------|---|---------------------|
| Access Controlled, Existing | Access Controlled, Proposed | Rural | Activity Center |
| Arterial 6 Lane, Existing | ARTERIAL 6, Proposed | Neighborhood Residential | Employment Center |
| Arterial 4 Lane, Existing | Arterial 4 Lane, Proposed | Transitional | Industrial |
| Collector, Existing | Collector, Proposed | Neighborhood Center - Solid | Old Town |
| Rural, Existing | Rural, Proposed | Neighborhood Center | Urban Mixed Use |
| | Existing School | Multi-Use Corridor | Leander Central |
| | Future School | Multi-Use Corridor - Priority Corridor | Greenway |
| | Lakes and Ponds | Neighborhood Center - Priority Corridor | Parks and Preserves |
| | Streams | | |

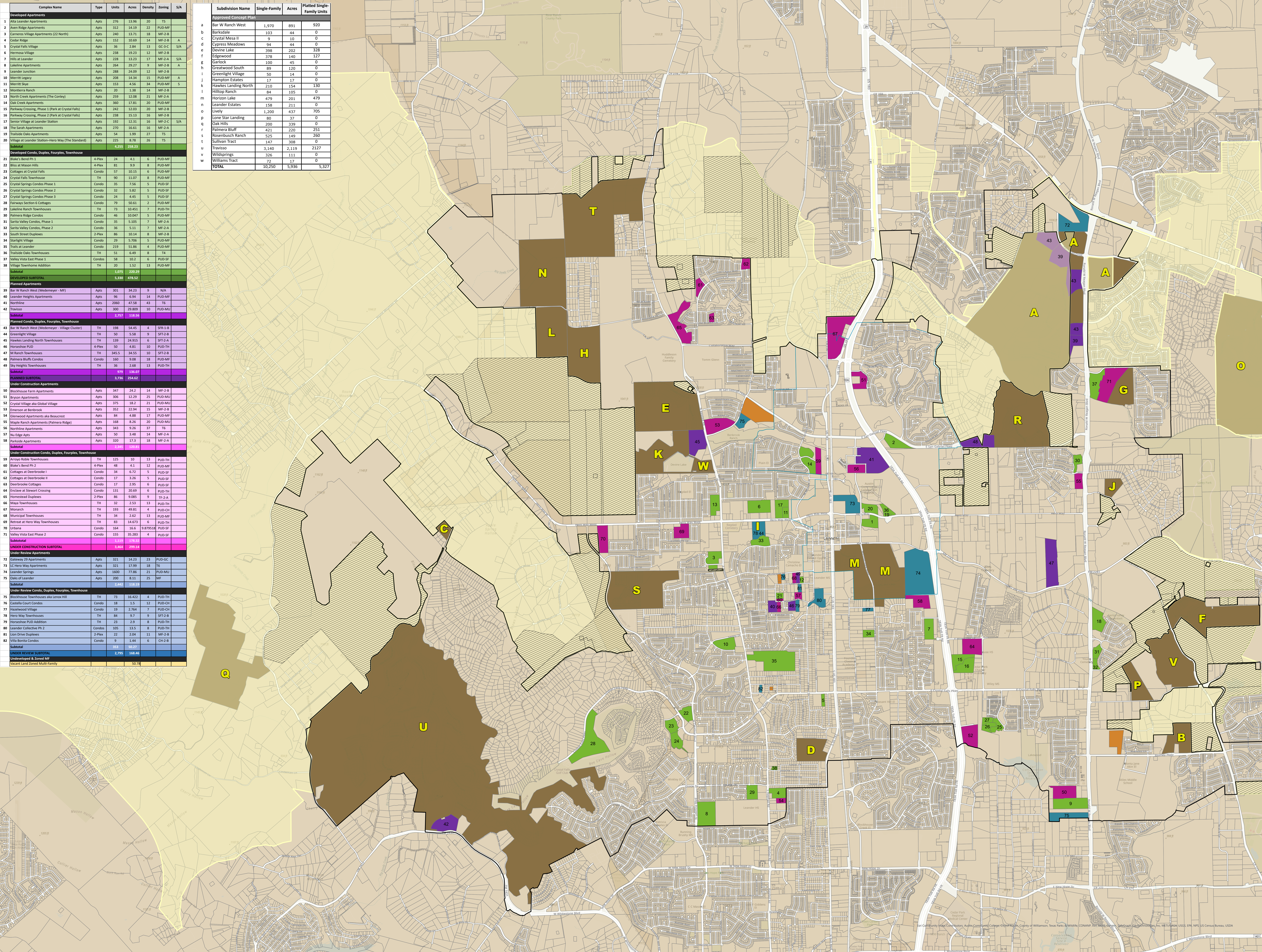
Texas Local Government Code Section 213.005: A comprehensive plan shall not constitute zoning regulations or establish zoning district boundaries.

* Properties added to the ETJ after the adoption of this Future Land Use Map are designated as Neighborhood Residential.

This map has been produced by the City of Leander for formational purposes only. No warranty is made by the City regarding completeness or accuracy, please refer to the official ordinance for zoning verification. This data should not be construed as a legal description or survey instrument. No responsibility is assumed for damages or other liabilities due to the accuracy, availability, completeness, use or misuse of the information herein provided.

	Complex Name	Type	Units	Acres	Density	Zoning	S/A
1	Alta Leander Apartments	Apts	276	13.96	20	T5	
2	Aven Ridge Apartments	Apts	312	14.19	22	PUD-MF	
3	Cameros Village Apartments (22 North)	Apts	240	13.71	18	MF-2-B	A
4	Cedar Ridge	Apts	152	10.69	14	MF-2-B	A
5	Crystal Falls Village	Apts	36	2.84	13	GC-3-C	S/A
6	Hermosa Village	Apts	238	13.23	12	MF-2-B	
7	Hills at Leander	Apts	228	13.23	17	MF-2-A	S/A
8	Lakeline Apartments	Apts	264	29.27	9	MF-2-B	A
9	Leander Junction	Apts	288	24.09	12	MF-2-B	
10	Meritt Legacy	Apts	208	14.34	15	MF-2-B	A
11	North Valley	Apts	153	4.56	34	PUD-MF	5
12	Montana Ranch	Apts	20	1.38	14	MF-2-B	
13	North Creek Apartments (The Conley)	Apts	259	12.08	21	MF-2-A	
14	Oak Creek Apartments	Apts	360	17.81	20	PUD-MF	
15	Parway Crossing, Phase 1 (Park at Crystal Falls)	Apts	242	12.03	20	MF-2-B	
16	Parway Crossing, Phase 2 (Park at Crystal Falls)	Apts	238	15.13	16	MF-2-B	
17	Parway Village at Leander Station	Apts	190	12.31	16	MF-2-C	S/A
18	The Sarah Apartments	Apts	270	16.61	16	MF-2-A	
19	Trailside Oaks Apartments	Apts	54	1.99	27	T5	
20	Village at Leander Station-Hero Way (The Standard)	Apts	225	8.78	26	T5	
Subtotal			4,255	254.23			
Developed Condo Duplex, Fourplex, Townhouse							
21	Blake's Bend Ph 1	4-Plex	24	4.1	6	PUD-MF	
22	Bliss at Mason Hills	4-Plex	81	9.9	8	PUD-MF	
23	Cottages at Crystal Falls	Condo	57	10.15	6	PUD-MF	
24	Crystal Falls Townhouse	TH	90	11.07	8	PUD-MF	
25	Crystal Springs Condos Phase 1	Condo	35	7.56	5	PUD-SF	
26	Crystal Springs Condos Phase 2	Condo	32	5.82	5	PUD-SF	
27	Crystal Springs Condos Phase 3	Condo	24	4.45	5	PUD-SF	
28	Farway Section C Cottages	Condo	79	50.61	2	PUD-MF	
29	Lakeline Ranch Townhouses	TH	73	10.451	7	PUD-TH	
30	Palmera Ridge Condos	Condo	46	10.047	5	PUD-MF	
31	Santa Valley Condos, Phase 1	Condo	35	5.105	7	MF-2-A	
32	Santa Valley Condos, Phase 2	Condo	36	5.11	7	MF-2-A	
33	South Street Duplexes	2-Plex	86	10.14	8	MF-2-B	
34	Starlight Village	Condo	29	5.706	5	PUD-MF	
35	Trails at Leander	Condo	219	51.86	4	PUD-MF	
36	Trailside Oaks Townhouses	TH	51	6.49	8	T4	
37	Valley Vista East Phase 1	Condos	58	10.2	6	PUD-SF	
38	Village Townhome Addition	TH	20	1.50	13	PUD-MF	
Subtotal			3,073	226.29			
DEVELOPED SUBTOTAL			5,328	478.52			
Planned Apartments							
39	Bar W Ranch West (Wedemeyer - MF)	Apts	301	34.23	9	N/A	
40	Leander Heights Apartments	Apts	96	6.94	14	PUD-MF	
41	Northline	Apts	2060	47.58	43	T6	
42	Traverse	Apts	300	29.809	10	PUD-MU	
Subtotal			2,753	118.56			
Planned Condo, Duplex, Fourplex, Townhouse							
43	Bar W Ranch West (Wedemeyer - Village Cluster)	TH	198	54.45	4	SFR-1-B	
44	Greenlight Village	TH	50	5.58	9	SFR-2-B	
45	Hawkes Landing North Townhouses	TH	139	24.915	6	SFR-2-B	
46	Horseshoe PUD	4-Plex	50	4.81	10	PUD-TH	
47	M Ranch Townhouses	TH	345.5	34.55	10	SFR-2-B	
48	Palmera Bluffs Condos	Condo	160	8.08	18	PUD-MF	
49	Sky Heights Townhouses	TH	36	2.68	13	PUD-TH	
Subtotal			975	157.07			
PLANNED SUBTOTAL			3,728	276.62			
Under Construction Apartments							
50	Blockhouse Farm Apartments	Apts	347	24.2	14	MF-2-B	
51	Brison Apartments	Apts	306	12.29	25	PUD-MU	
52	Crystal Village aka Global Village	Apts	375	18.2	21	PUD-MU	
53	Emerson at Birdbrook	Apts	352	22.84	15	MF-2-B	
54	Greenwood Apartments aka Bannock	Apts	84	4.88	17	PUD-MF	
55	Maple Ranch Apartments (Palmera Ridge)	Apts	168	8.26	20	PUD-MU	
56	Northline Apartments	Apts	343	9.26	37	T6	
57	Nu Edge Apts	Apts	50	3.48	14	MF-2-A	
58	Parkside Apartments	Apts	320	17.3	18	MF-2-A	
Subtotal			2,413	119.33			
Under Construction Condo, Duplex, Fourplex, Townhouse							
59	Arroyo Roble Townhouses	TH	125	10	13	PUD-TH	
60	Blake's Bend Ph 2	4-Plex	48	4.1	12	PUD-MF	
61	Cottages at Deerbrooke I	Condo	34	6.72	5	PUD-SF	
62	Cottages at Deerbrooke II	Condo	17	3.26	5	PUD-SF	
63	Deerbrooke Cottages	Condo	17	3.95	6	PUD-SF	
64	Enclave at Stewart Crossing	Condo	131	20.69	6	PUD-TH	
65	Homestead Duplexes	2-Plex	86	9.085	9	TF-2-A	
66	Maya Townhouses	TH	32	2.53	13	PUD-TH	
67	Monarch	TH	193	49.81	4	PUD-CH	
68	Municipal Townhouses	TH	34	2.42	13	PUD-MF	
69	Rever at Hero Way Townhouses	TH	33	14.623	6	PUD-TH	
70	Urbana	Condo	164	16.6	9.879554	PUD-SF	
71	Valley Vista East Phase 2	Condo	155	35.283	4	PUD-SF	
Subtotal			1,618	118.30			
UNDER CONSTRUCTION SUBTOTAL			3,463	299.54			
Under Review Apartments							
72	Greenway 2B Apartments	Apts	321	14.23	23	PUD-GC	
73	LC Hero Way Apartments	Apts	321	17.89	18	T6	
74	Leander Springs	Apts	1600	77.86	21	PUD-MU	
75	Oaks of Leander	Apts	200	8.11	25	MF	
Subtotal			2,443	118.19			
Under Review Condo, Duplex, Fourplex, Townhouse							
76	Blockhouse Townhouses aka Lenox Hill	TH	71	15.422	4	PUD-TH	
77	Castella Court Condos	Condo	18	1.5	12	PUD-CH	
78	Hazelwood Village	Condo	19	2.764	7	PUD-CH	
79	Hero Way Townhouses	TH	84	9.7	9	SFR-2-B	
80	Horseshoe PUD Addition	TH	23	2.9	8	PUD-TH	
81	Leander Collective Ph 2	Condo	205	13.5	8	PUD-TH	
82	Lion Drive Duplexes	2-Plex	22	2.04	11	MF-2-B	
83	Villa Bonita Condos	Condo	9	1.44	6	CH-2-B	
Subtotal			863	50.97			
UNDER REVIEW SUBTOTAL			2,795	168.46			
Not Reviewed & Listed MF							
	Mountain Land Zoned Multi-Family			50.74			

Subdivision Name	Single-Family	Acres	Platted Single-Family Units
a Bar W Ranch West	1,970	891	920
b Barkdale	103	44	0
c Crystal Mesa II	3	10	0
d Cypress Meadows	94	44	0
e Devine Lake	398	202	328
f Edgewood	378	140	127
g Garlock	100	45	0
h Greatwood South	89	120	0
i Greenlight Village	50	14	0
j Hampton Estates	17	17	0
k Hawkes Landing North	210	154	130
l Hilltop Ranch	84	105	0
m Horton Lake	479	201	479
n Leander Estates	158	211	0
o Lively	1,200	437	705
p Lone Star Landing	80	37	0
q Oak Hills	200	339	0
r Palmera Bluff	421	220	251
s Rosenbach Ranch	525	149	260
t Sullivan Tract	147	308	0
u Travisso	3,140	2,119	2127
v Wildsprings	326	111	0
w Williams Tract	72	17	0
TOTAL	10,350	5,536	5,327



Residential Properties

Effective August 17th, 2023



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Legend

- City Limits
- Future Annexation Per DA
- Leander ETJ
- TOD Boundary
- Active Subdivision

Multi-Family Properties

Status

- Developed
- Planned
- Under Construction
- Under Review
- Not Built

Figure 2-3: Residential Properties Map

Table 2-1: Population Density Assumptions for Various Land Use Types

Land Use Category	Population Density Assumptions (LUE/acre)
Neighborhood Residential	4
Neighborhood Center	4
Employment Center	3
Urban Mixed Use	10
Greenway, Parks and Preserves	0

By applying both the LUE/acre density from Table 2-1 and the 200 gpd/LUE flow estimate to a given land area (in acres), an approximate wastewater production was estimated for land uses shown on the future land use map. The estimated wastewater production was then used in the hydraulic model of the collection system. Please refer to Section 4.2 for further discussion of the flow projections and distributions.

2.4 Population Projections

The citywide population projections used to develop wastewater flow projections were provided by the City. These population projections were developed as part of the 20-Year Water Capital Improvements Plan Memorandum, dated July 19, 2023. These projections were derived using annual growth rates which decreased over time and were subsequently converted into an equivalent number of LUEs. Table 2-2 shows the population forecasts for the time horizons considered in this analysis. Please refer to Section 4.2 for flow projections and distributions.

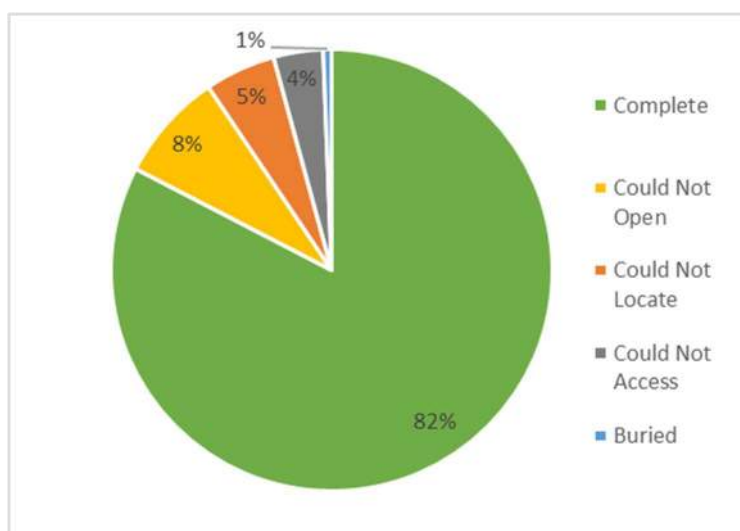
Table 2-2: Population Projections Provided by City

Year	Annual Growth Rate	Population	No. of LUEs
2022	9.7%	86,733	33,687
2027	7.5%	131,746	49,795
2032	3.0%	168,869	63,827
2042	1.0%	207,808	78,545

2.5 Manhole Survey

GBA field staff attempted inspection of 965 City-owned manholes to create a hydraulic model of the existing wastewater collection system. Among these 965 manholes with attempted inspections, 797 were completed successfully, 77 were unable to be opened, 50 manholes could not be located, 35 manholes were not accessible, and 6 manholes were buried (Figure 2-4). Manholes that were located but not able to be opened were considered partially inspected, as location and rim elevation data could still be collected. The data collected during manhole inspections include their X and Y coordinates, rim elevations, depths, and manhole cover sizes, as well as rim-to-invert depths and diameters of incoming and outgoing pipes. The manhole survey maps are provided in **Appendix A** and the GIS data will be provided as a separate submittal to the City.

Figure 2-4: Manhole Survey Summary



2.6 Planning-Level Design Criteria

To model, size, and plan for new wastewater infrastructure, planning-level design criteria were established for this study with input from City staff. It is important to note that all sizing of improvements for this study are conceptual only; actual designs may vary from the conceptual designs presented in this report. Table 2-3 provides a summary of the criteria used to guide this study. This table is broken into three sections:

- (1) Existing Infrastructure Flow Calculations (Modeled System),
- (2) Future Infrastructure Flow Calculations (Extensions to Serve Growth Areas), and
- (3) Conceptual Sizing of New Infrastructure (Relief, Replacement or Extensions).

2.6.1 Flow Calculations

The PCSWMM design storm model of the existing system was primarily used to identify necessary capacity improvements for the City's *existing sewers*, at the present, 5-year, 10-year and 20-year time horizons. In contrast, Austin Utilities Criteria Manual (UCM) guidance and GIS analysis were primarily used to conceptually size the *future sewer extensions* needed to serve growth areas outside of City limits, at the 5-year, 10-year and 20-year time horizons. Therefore, flow calculations for the existing infrastructure (interceptors and lift stations) modeled in PCSWMM differed from flow calculations for future infrastructure (sewer extensions), which were not modeled in PCSWMM.

Flows from future growth were still plugged into the PCSWMM model of the existing system for future growth scenario modeling in order to demonstrate impacts of growth on the existing sewers. To represent peak wet weather flows from future growth in the PCSWMM model, the synthetic unit hydrograph for flow meter basin 2 was assigned to future growth model nodes. Basin 2 was chosen as a representative basin for new growth areas because it demonstrated an average level of I/I for Leander's collection system.

2.6.2 Design Storm

The 5-year, 6-hour design storm was chosen because there is precedence for its use in modeling by the City of Austin and other cities in the metropolitan area. It also represents a moderately conservative storm event to plan for, particularly for systems demonstrating higher levels of I/I. Storm events with higher recurrence intervals (such as 10-year, 25-year, or 50-year) may be overly burdensome to ratepayers of systems with high I/I levels, but storms with lower recurrence intervals (such as 1-year or 2-year) may be insufficient for predicting areas at higher risk of sanitary overflows and backups.

2.6.3 Critical Surge

The calibrated PCSWMM model was used to identify locations in the existing system with potential for surge under design storm conditions. Not all surge of existing sewers requires immediate mitigation, however. To identify high risk surge, critical surge criteria were developed to help identify the need for capacity improvement projects. The two-part criteria used during this study is stated in terms of surge above the crown of pipe and in terms of minimum “freeboard” (or, the distance between maximum surge level and manhole rim). This criteria is based on similar criteria used by the Environmental Protection Agency (EPA) in recent sewer consent decrees. It is important to note that this is a criteria for judging the severity of surge, not a pipe sizing tool. New gravity sewers (relief, replacement, or extensions) will not be designed to surge under design flow conditions.

Surge of a sewer is typically defined as the situation in which the sewer entrance and exit are submerged, and the pipe is flowing full and under pressure. Levels of surge predicted by the hydraulic model will vary widely across the system and depend on factors such as design storm intensity, existing pipe capacities, projected upstream flows and infiltration and inflow (I/I), and downstream bottlenecks. Some sewer agencies allow surge in their systems to specified levels (e.g., “surge up to 100% of pipe diameter over the crown of pipes”), while other agencies do not allow any surge in their systems.

Surge may not be acceptable at locations where sewers are relatively shallow (e.g., less than 10 vertical feet from the surface) because of the increased risk of overflow. Surge may be more acceptable in locations with particularly deep sewers (e.g., 20 feet or more below the surface) because of the lower risk of overflow. Therefore, it is pragmatic to allow some surge in the existing system before relief sewers are deemed necessary. However, all new or relief sewers should be designed for no resulting surge during design flow conditions.

2.6.4 Conceptual Pipe Sizing

The Austin UCM Q65/Q85 method of pipe sizing requires pipes be sized to either reach a maximum of 65% of their full capacity during peak dry weather flows (PDWF), or 85% of their capacity during peak wet weather flows (PWWF). This method of sizing provides an adequate safety factor to account for higher than anticipated I/I during a storm event.

During peak wet weather storms, Austin UCM requires that pipes be designed such that the peak wet weather flow (PWWF) shall not exceed 85% of the capacity of the pipe flowing full for all pipes 15 inches in diameter and below, and 80% of the capacity for all pipes 18 inches and above.

This excess 15%-20% capacity helps to reduce risk of excessive surcharging and overflow. Designing the system with additional capacity provides flexibility for accommodating increased wastewater flows associated with population growth and denser development.

The City of Leander does not currently have a pipe sizing standard. Options were discussed with City engineering staff. Many cities size pipes to reach full flow (Q_{full}) capacity during peak wet weather events, but this is a less conservative method that will accommodate design flows without providing as much safety factor for growth or increased I/I. Allowing pipes to reach full capacity during the design flow reduces costs by requiring smaller pipe sizes but leaves less room for accommodating future growth and expansion. Backup and surcharging are a greater risk to a system sized using this method. Because of Leander's rapid growth and presence of I/I, the more conservative Austin UCM Q65/Q85 approach was preferred by the City for use during this study.

Table 2-3. Planning-Level Design Criteria

Criteria	Value or Range
Existing Infrastructure Flow Calculations (Modeled System)	
Average Daily Dry Weather Flow (ADDF)	Model Calibrated to Flow Meter Data
Peak Dry Weather Flows (PDWF)	Model Calibrated to Flow Meter Data
Modeled I/I for Existing System ⁽¹⁾	RTK Unit Hydrograph Calibrated to Respective Flow Meter Basin
Modeled I/I for Growth ⁽²⁾	RTK Unit Hydrograph Calibrated to Flow Meter Basin 2 (representative of average I/I)
Peak Wet Weather Flows (PWWF)	Design Storm Model (PDWF + I/I)
Design Storm ⁽³⁾	5-year, 6-hour Event (4.1 inches)
Critical Surge Criteria ⁽⁴⁾	Flow Depths > 24" above crown of pipe Flow Depths ≤ 36" below manhole rim
Future Infrastructure Flow Calculations (Extensions to Serve Growth Areas)	
Average Daily Dry Weather Flow (ADDF) ⁽⁵⁾	200 gpd/LUE (1 LUE ≈ 3 people)
Peak Dry Weather Flows (PDWF) ⁽⁶⁾	$Q = \left[\frac{(18 + (0.0206 * ADDF)^{0.5})}{(4 + 0.0206 * ADDF)^{0.5}} \right] * ADDF$
Peak Wet Weather Flows (PWWF) ⁽⁶⁾	Q = PDWF + 750 gpd/acre
Conceptual Sizing of New Infrastructure (Relief, Replacement or Extensions)	
Peak Flow Conveyance Criteria ⁽⁷⁾	Austin UCM Q65/Q85
Gravity Pipe Capacity	Manning's Equation
Manning's Coefficient (n)	0.013
Gravity Pipe Velocity ⁽⁸⁾	2-10 fps
Lift Station Capacity	Maximum 2-hr Peak Flow from Model
Force Main Velocity	3-6 fps

Notes:

- 1) Inflow and Infiltration (I/I) in the existing system was estimated using synthetic unit hydrographs (calibrated using the RTK method) for each flow meter basin.
- 2) Flows from new growth areas were plugged into the existing system during growth scenario modeling. To represent flows from growth in the model, flow meter basin 2's synthetic unit hydrograph was used. Basin 2 was chosen because it is considered to have average rates of I/I relative to other parts of Leander.
- 3) Precipitation frequency estimates for design storm provided by NOAA Atlas 14.
- 4) Based on criteria used in recent EPA Consent Decrees. This criterion defines high risk (critical) surcharge levels in the existing sewer system and was used to define the necessity of capacity improvement projects for existing gravity sewers. It is important to note that new gravity sewers (relief, replacement or extensions) will NOT be designed to surcharge under design flow conditions.
- 5) Estimated from wastewater flow monitoring data.
- 6) Sourced from Austin Utilities Criteria Manual (UCM), which is commonly used and accepted throughout the Austin metropolitan area.
- 7) Sourced from Austin Utilities Criteria Manual (UCM). All gravity sewer projects were conceptually sized to reach a maximum of 80 to 85% of their capacity during peak wet weather flows (PWWF), depending on pipe diameter.
- 8) Texas Commission on Environmental Quality (TCEQ) design standards.

2.7 Cost Data

Planning level cost equations and tables were developed using past wastewater project data from the Austin metropolitan area and other commonly referenced guidance documents, such as those developed by the EPA. Costs should be considered planning-level only and may not reflect costs of actual construction. ENR Construction Cost Index (CCI) data were used for the Dallas metropolitan area (the closest metropolitan area to Leander with CCI indices) to adjust historical cost data for inflation to better reflect present-day costs. All referenced cost equations were adjusted to account for inflation using the February 2024 CCI for Dallas (CCI = 7824. Please see [enr.com/economics/historical_indices](https://www.enr.com/economics/historical_indices) for more information regarding ENR CCI values.)

The following cost equations were developed to estimate lump sum construction costs for most improvement projects and may not be representative of more unique situations. For example, the gravity sewer cost equation generally accounts for costs related to construction of new gravity sewer, such as excavation, pipe, ditch checks, manholes, erosion control, restoration and mobilization. The cost equations are representative of construction costs and do not include other soft costs or contingencies. To estimate a capital cost for each project, a 30% factor was applied to the construction cost to account for soft costs such as engineering design and survey, and then another 20% contingency factor was applied to account for unanticipated costs and scope changes. A summary of the cost equations is presented in Table 2-4 below.

Table 2-4: Planning-Level Construction Cost Equations

Project Type	General Cost Equation	Units
Gravity Sewer	$y = 322 * 1.038^x$	y is \$/LF, x is diameter (in)
Steel Encasement	$y = 50x$	y is \$/LF, x is casing diam. (in)
Force Main	$y = 18x$	y is \$/LF, x is diameter (in)
Lift Station	$y = 1,500,000 * (x^{0.62})$	y is \$, x is capacity (MGD)

3 EXISTING COLLECTION SYSTEM

3.1 Current Capacities and Projections

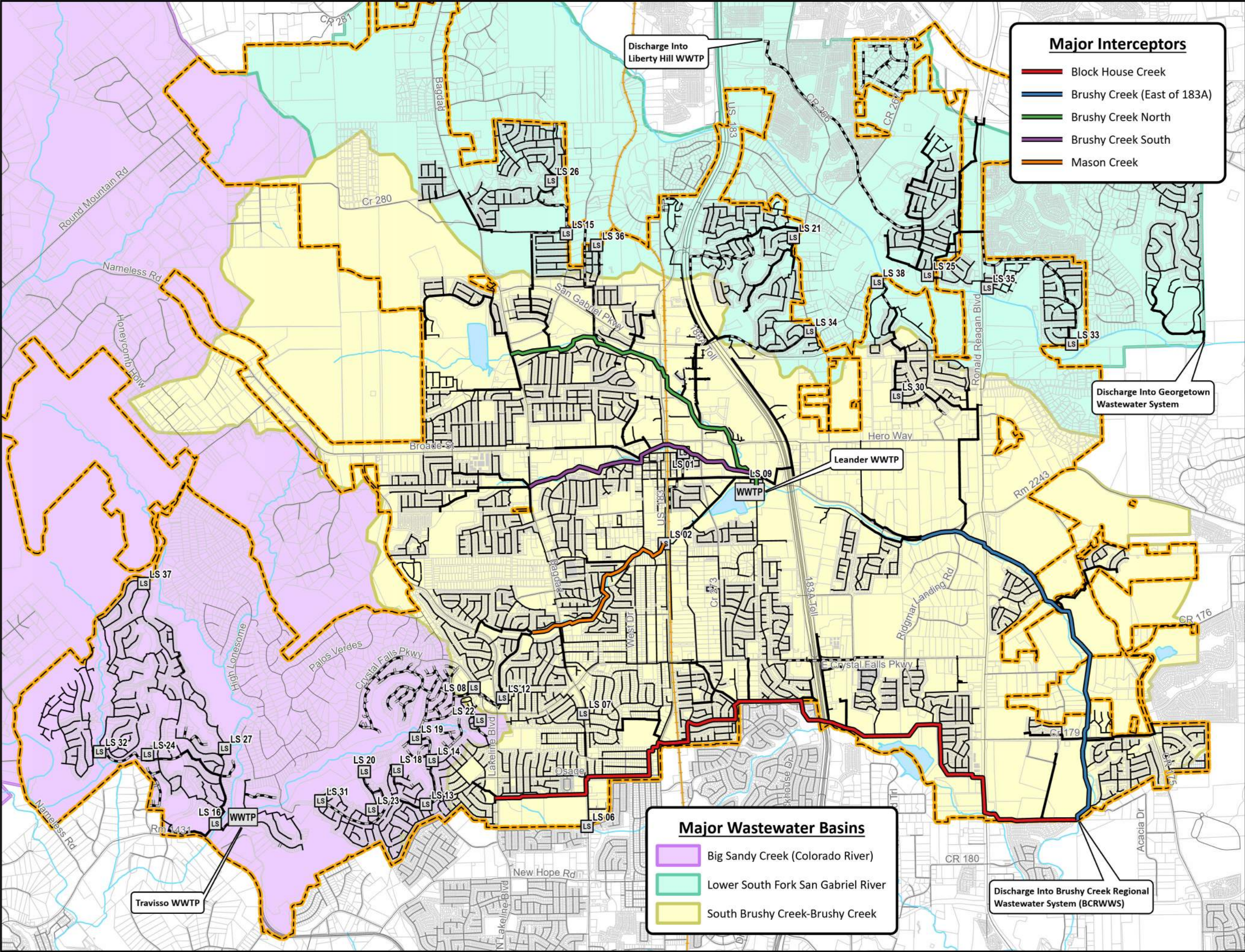
The Leander WWTP, located on RM 2243 at Brushy Creek, has a current treatment capacity of 2.25 MGD and treats most of the wastewater generated within the City. Leander's RM2243 WWTP is permitted to expand its ultimate treatment capacity to discharge 5.25 MGD. Additionally, the City possesses 4.23 MGD of treatment capacity at the BCRWWS, with no intentions to procure additional capacity in the future. Table 3-1 describes each main interceptor serving Leander and Table 3-2 provides all known information about the major lift stations in Leander. This table also contains information for lift stations that are included in the model. The major interceptors and lift stations are provided in Figure 3-1.

Table 3-1. Description of Major Interceptors

Interceptor	Pipe Diameter Range	Length (ft)	Description
Mason Creek	15"-18"	8,500	The existing Mason Creek Interceptor runs from Bagdad Road to Lift Station 2 along the alignment of Mason Creek, which pumps through a 12-inch force main to a 21-inch gravity main and finally to the RM2243 WWTP.
Block House Creek	12"-30"	34,100	The existing Block House Creek interceptor runs along Block House Creek from just south of the intersection between Lakeline Boulevard and Crystal Falls Parkway and ties into the Brushy Creek Interceptor at the interconnect with the BCRWWS.
Brushy Creek North	12"-27"	15,000	The existing Brushy Creek North Interceptor runs along the North Fork of Brushy Creek from Bagdad Road to the RM2243 WWTP.
Brushy Creek South	12"-18"	10,900	The existing Brushy Creek South Interceptor runs along the South Fork of Brushy Creek from Bagdad Road until it ties into the Brushy Creek North Interceptor.
Brushy Creek (East of 183A)	12"-36"	17,800	The existing Brushy Creek Interceptor runs along the main branch of Brushy Creek from the intersection of Ronald Regan Blvd and RM 2243 to the interconnect with the BCRWWS in the southeast portion of the City's ETJ.

Table 3-2. Lift Station Descriptions

Lift Station	No. of Pumps	Firm Capacity (gpm)	Force Main Diameter (in)	Force Main Length (ft)	Description
LS 1	2	-	6	1,140	Planned to be decommissioned as part of the East Street Project in FY2024 (CIP WW.49).
LS 2	3	3,600	18	3,050	Serves an area of Mason Creek, west of US 183.
LS 9	2	2,600	16	700	Serves as the main lift station feeding the RM2243 WWTP. This lift station is planned to be decommissioned and replaced with a master lift station to serve the ultimate WWTP buildout (CIP. WW.43).
LS 10	3	1,200	16	700	Serves as a secondary lift station feeding the RM2243 WWTP. This lift station is planned to be decommissioned and replaced with a master lift station to serve the ultimate WWTP buildout (CIP. WW.43).
LS 13	2	825	8	650	Serves as the main lift station for the Bluffs.
LS 14	2	190	4	1,740	Serves several neighborhoods in southwest Leander, including Gann Ranch and The Fairways at Crystal Falls.
LS 15	2	400	6	1,990	Primarily serves the Savannah Ranch subdivision.
LS 20	2	125	4	2,520	Serves the Bluffs at Crystal Falls.
LS 21	2	1,200	12	7,420	Serves the Bryson subdivision.
LS 23	2	265	6	780	Serves the Bluffs at Crystal Falls.
LS 25	4	5,785	10 & 18	29,000	Located at Bar W Ranch, outside of City limits but within City ETJ. In Spring 2024, received two new 2,400 gpm pumps in addition to the two original 985 gpm pumps. The 10" and 18" force mains run parallel from LS25 to Liberty Hill's WWTP.
LS 26	2	960	8	10,640	Serves the Deerbrooke neighborhood.
LS 30	2	565	8	1,690	Serves Palmera Ridge.
LS 31	2	135	4	3,430	Serves the Bluffs at Crystal Falls.
LS 33	2	204	6	8,710	Serves the Bluffview subdivision.
LS 34	2	700	8	4,020	Serves the Bryson subdivision.



Major Interceptors

- Block House Creek
- Brushy Creek (East of 183A)
- Brushy Creek North
- Brushy Creek South
- Mason Creek

Major Wastewater Basins

- Big Sandy Creek (Colorado River)
- Lower South Fork San Gabriel River
- South Brushy Creek-Brushy Creek



**City of Leander
Williamson County, TX**

**FIGURE 3-1:
WASTEWATER INTERCEPTORS**



Legend

- LS Lift Station
- WWTP Wastewater Treatment Plant
- 10" and Smaller Wastewater Line
- 12" and Larger Wastewater Line
- Forcemain
- Road
- Railroad
- Creek/Stream/River
- Lake
- Leander City Limits

0 0.75 1.5
Miles
Date: 4/26/2024



3.2 Flow Characteristics

To better understand the City's wastewater system a flow analysis was performed under the 2022 Flow Monitoring Project. The system was separated into a total of 14 interconnected drainage basins with a total length of gravity wastewater pipes of approximately 1,096,000 linear feet. Flow meters were strategically located to measure flows generated by these basins (Figure 3-2). The pipe sizes throughout the project area range from six (6) inches to thirty-six (36) inches with most of the pipes being poly-vinyl chloride (PVC).

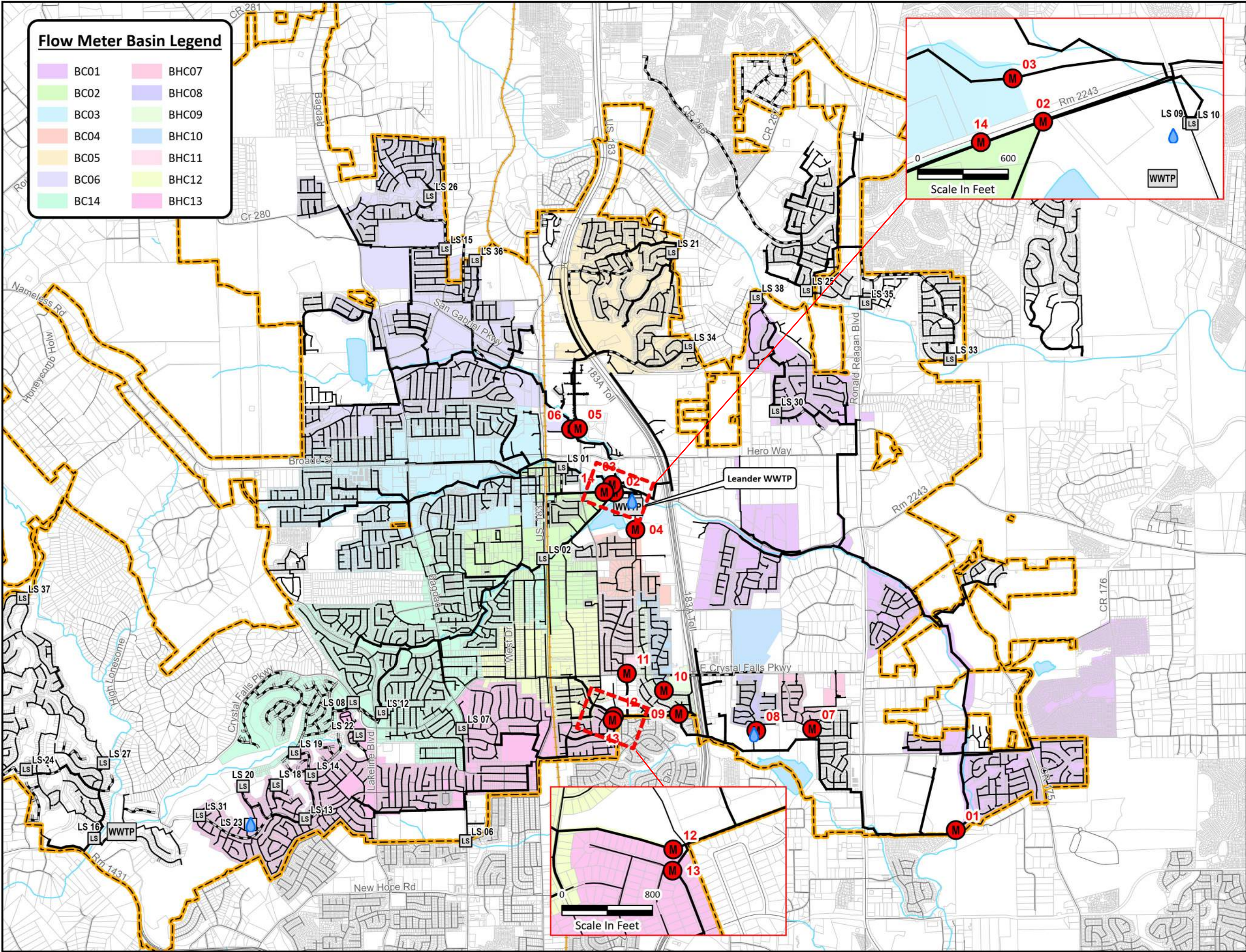
The flow monitoring period experienced overall rainfall that was slightly below historical averages, with only three out of the eight total storm events exceeding 1 inch of total rainfall. Surge issues were observed at Site 3 due to downstream restrictions, while Site 8 encountered nine dry weather surcharges, indicating potential under sizing of the servicing line or abnormal upstream discharges. Excessive infiltration was identified at Site 4, while excessive inflow was noted at Sites 1, 2, 3, 9, 13, and 14. Recommendations included CCTV inspections and smoke testing in Basins 1, 2, 3, 4, 9, 13, and 14 to address inflow and infiltration issues. Additionally, a lateral inspection program was recommended to address private sources of infiltration, particularly in Basin 4. A hydraulic capacity analysis was also recommended for potentially undersized lines, such as the 8-inch line serving Site 8 (Table 3-3).

The flow meter data and analysis results were used to assist in the calibration of the model developed for this project. The flow monitoring results of the City's sanitary sewer system provided useful data in respect to infiltration and inflow (I&I). The flow meter reactions were varied for the rainfall events, however all meters reacted to some of the rain events with increased flows indicating I&I. Since nearly half of the metering sites showed evidence of excessive inflow, but only one site had excessive infiltration, direct inflow sources are suspected to be a more significant problem than sources such as cracks or joint separations. The flow monitoring sites also provided insight into the capacity limitations of the system.

As will be noted in later chapters of the report, the two most urgent relief projects identified during modeling, the Block House Creek and Mason Creek Interceptor projects, are situated in Basins 13 and 14, respectively.

Table 3-3: Fall 2022 Flow Monitoring Results and Recommendations Summary

Basin ID	Excessive Infiltration?	Excessive Inflow?	Recommendations
1	-	Yes	CCTV and Smoke Testing
2	-	Yes	CCTV and Smoke Testing
3	-	Yes	CCTV and Smoke Testing
4	Yes	-	CCTV, Smoke Testing, and Lateral Inspections
5	-	-	-
6	-	-	-
7	-	-	-
8	-	-	Hydraulic Capacity Analysis
9	-	Yes	CCTV and Smoke Testing
10	-	-	-
11	-	-	-
12	-	-	-
13	-	Yes	CCTV and Smoke Testing
14	-	Yes	CCTV and Smoke Testing



Flow Meter Basin Legend

BC01	BHC07
BC02	BHC08
BC03	BHC09
BC04	BHC10
BC05	BHC11
BC06	BHC12
BC14	BHC13



**City of Leander
Williamson County, TX**

**FIGURE 3-2: FALL 2022
FLOW MONITORING MAP**



Legend

- Rain Gauge
- Flow Meter
- Lift Station
- Wastewater Treatment Plant
- 10" and Smaller Wastewater Line
- 12" and Larger Wastewater Line
- Forcemain
- Road
- Railroad
- Creek/Stream/River
- Lake
- Leander City Limits



0 0.75 1.5

Miles

Date: 4/26/2024



3.3 Review of Current Infrastructure Projects

Table 3-4 lists and describes all wastewater capital improvement projects (CIP) listed under the most recent FY2024 CIP document provided by the City. These projects were taken into consideration when analyzing the design storm model runs and identifying necessary projects.

Table 3-4. Wastewater Capital Improvement Projects from FY2024 CIP

Project Name	CIP #	Description	Status
Eagles Way, Mica Lane, Topaz Lane Wastewater Service	WW. 16	Provides wastewater service to residences in the area.	Complete
Wastewater Treatment Plant Sludge Processing and Aeration Improvements – Phase 2	WW.17, WW.18	Sludge processing and aeration upgrades to help the WWTP process waste more efficiently.	Complete
Falcon Oaks Wastewater Collection System	WW.20	Replace the onsite sanitary sewage facilities within the subdivision with direct connections to a wastewater collection system.	Under Construction
South Brushy Creek Wastewater Interceptor Improvements	WW.25	Increase capacity of interceptor to send the correct volumetric flow to RM2243 WWTP to comply with TCEQ.	Pending
North Brushy Creek Wastewater Interceptor Improvements – Segment 2	WW.37	Increase capacity of interceptor to improve flow conditions and conveyance to RM2243 WWTP.	Pending
North Brushy Creek Wastewater Interceptor Improvements – Segment 3	WW.38	Increase capacity of interceptor to improve flow conditions and conveyance to RM2243 WWTP.	Pending
North Brushy Creek Wastewater Interceptor Improvements – Benbrook Section	WW.41	Increase capacity of interceptor to improve flow conditions and conveyance to RM2243 WWTP.	Under Design
RM 2243 Wastewater Treatment Plant Lift Station and Gravity Relief Main	WW.43	Replacement of two existing lift stations with a new master lift station to serve ultimate WWTP build-out, including diversion facilities to convey flows up to 2.0 MGD to the Brushy Creek Interceptor to be ultimately treated by the BCRWWS.	Under Construction
Wastewater Lift Station Rehabilitations	WW.44	Improvements of six existing wastewater lift stations (LS 2, 6, 7, 8, 13, and 14).	Under Construction

Table 3-4 Continued:

Project Name	CIP #	Description	Status
Reclaimed Water System to Northline	WW.46	Install a phased reclaimed water system at RM2243 WWTP to supply reclaimed water for construction and other authorized uses.	Under Construction
Inflow and Infiltration Study	WW.47	Establish comprehensive plan to address inflow and infiltration (I/I) removal from the sanitary sewer collection system.	Initial Study Complete
East Street Utilities	WW.49	Add water and wastewater lines and eliminate an old wastewater lift station (LS01) to modernize East Street.	Pending

4 MODEL DEVELOPMENT

4.1 Introduction

A hydraulic model of the City's sanitary sewer network was developed using the PCSWMM modeling software by Computational Hydraulics International (CHI). The developed model was used to determine current needs within and impacts of growth on the existing sanitary sewer network. The future growth scenarios evaluated in this project were 5, 10, and 20-year time horizons. Section 4.2 provides further detail on the population growth projections for each time horizon that was utilized in the model.

As part of the scope of this study, copies of PCSWMM model scenarios of the existing conditions, 5-year, 10-year, and 20-year growth conditions will be provided to the City. It is recommended that regular model maintenance and re-calibration be performed to keep the model current and useful for analysis. It is generally recommended that sanitary sewer models be re-calibrated with new flow monitoring data at least once every five years. GBA can assist the City with model maintenance and re-calibration when needed.

4.2 Flow Projections

The overall goal for developing flow projections was to spatially assign growth across the City in a logical manner to align with the population projections provided by the City for the 5, 10, and 20-year time horizons (Table 2-1). As previously mentioned, growth projections were developed based on the residential development and future land use map supplied by the City (Figure 2-2 and Figure 2-3). The 5-year growth projections were developed assuming that all residential properties from the residential development map are to be constructed and populated by the end of 2027. The 10 and 20-year growth projections were established using the future land use map in conjunction with input from the City's planning department (Figure 4-1). It is important to note that a significant portion of the anticipated growth in Leander is projected to take place in the northwest region of the City. Overall, GBA's population projections are in alignment with the City-provided projections and were used to estimate wastewater generation from the future growth areas to be incorporated in the hydraulic model (Table 4-1). The acres and LUEs associated with the future growth areas for each land use type and time horizon are summarized in Table 4-2.



**City of Leander
Williamson County, TX**

FIGURE 4-1:
GROWTH AREA MAP



Legend

-
- Legend:
- 5-Year Projected Development
 - 10-Year Projected Development
 - 20-Year Projected Development
 - Road
 - Railroad
 - Creek/Stream/River
 - Lake
 - Leander City Limits
 - Leander ETJ
 - Leander Sewer CCN
 - County Boundary



0 0.5 1 2

Miles

Date: 4/24/2024

GBA

Table 4-1: GBA Population and LUE Projections

Year	City		GBA	
	No. of LUEs	Population	No. of LUEs	Population
2022	33,687	86,733	-	-
2027	49,795	131,746	49,965	132,407
2032	63,827	168,869	64,035	169,692
2042	78,545	207,808	78,832	208,904

Table 4-2: Future Growth Areas Summary Table

Future Growth Summary Table			
5-year Growth			
<i>Property Type</i>	<i>LUE/unit</i>	<i>Units (Acreage)</i>	<i>LUEs ⁽¹⁾</i>
Single-Family	1	8,381 (5,790)	8,381
2-Plex	2	108 (30)	216
4-Plex	0.7	144 (8)	101
Condo	0.5	902 (134)	451
Apartments	0.5	7,448 (335)	3,724
Townhome	1	1,393 (234)	1,393
<i>Property Type</i>	<i>LUE/acre</i>	<i>Acreage</i>	<i>LUEs</i>
Employment Center	3	112	336
Commercial	4	267	1,082
School	10	59	594
5-yr Growth Total	-	6,790 Ac 18,376 Units	16,278 LUEs
10-year Growth			
<i>Property Type</i>	<i>LUE/unit</i>	<i>Acreage</i>	<i>LUEs</i>
Neighborhood	4	1,694	6,786
Commercial	4	1,175	4,725
Community Mixed Use	10	211	2,116
Employment	3	147	443
10-yr Growth Total	-	3,227 Ac	14,070 LUEs
20-year Growth			
<i>Property Type</i>	<i>LUE/unit</i>	<i>Acreage</i>	<i>LUEs</i>
Neighborhood	4	2,505	10,029
Commercial	4	731	2,938
Employment	3	607	1,830
Parks/Open Space	0	71	0
20-yr Growth Total	-	3,914 Ac	14,797 LUEs
Growth Total (Cumulative)	-	73,930 Ac	45,145 LUEs

(1) A LUE is a planning tool that estimates the typical flow of water or wastewater produced by a single-family residence. For the purposes of this study, one (1) LUE was assumed to represent 3 persons (or population equivalents) and produce 200 gallons per day (gpd) of wastewater. The 200 gpd/LUE wastewater production rate is an average rate developed based on flow monitoring. (See section 2.3).

4.3 Existing System Model Network Development and Flow Assignment

The model was developed using the data collected from survey, GIS data from the City, and the 2022 flow monitoring project. In cases of missing data, values were retrieved from City-provided GIS data, record drawings, or interpolated between known data points. Only pipes 12 inches or greater in diameter were included in this model, except for several 8-inch lines that were specified by the City during scoping. A map of the modeled system can be found in Figure 4-2.

The fourteen flow meter locations from the 2022 I/I Reduction project were imported into the appropriate manholes in the model, as well as their respective basins. Parcels encompassed in the flow metering basins were imported into the model as subcatchments. Every parcel was assigned a receiving manhole and a living unit equivalent (LUE) count, resulting in each receiving manhole being assigned a total LUE count. The LUE count was utilized to account for variations in wastewater generation from single-family homes, apartments, schools, restaurants, retail properties, and other property types. The sewershed areas for each flow meter basin were distributed among the manholes based on a weighted system, accounting for the number of LUEs assigned to each manhole.

In summary, the model network included 960 manholes, 261,740 linear feet of gravity sewer, 78,830 linear feet of force main, and 16 lift stations (Figure 4-2). The lengths of gravity sewers are summarized according to diameter and corresponding flow metering basin in Table 4-3.

**City of Leander
Williamson County, TX**

**FIGURE 4-2: MODELED
WASTEWATER SYSTEM**



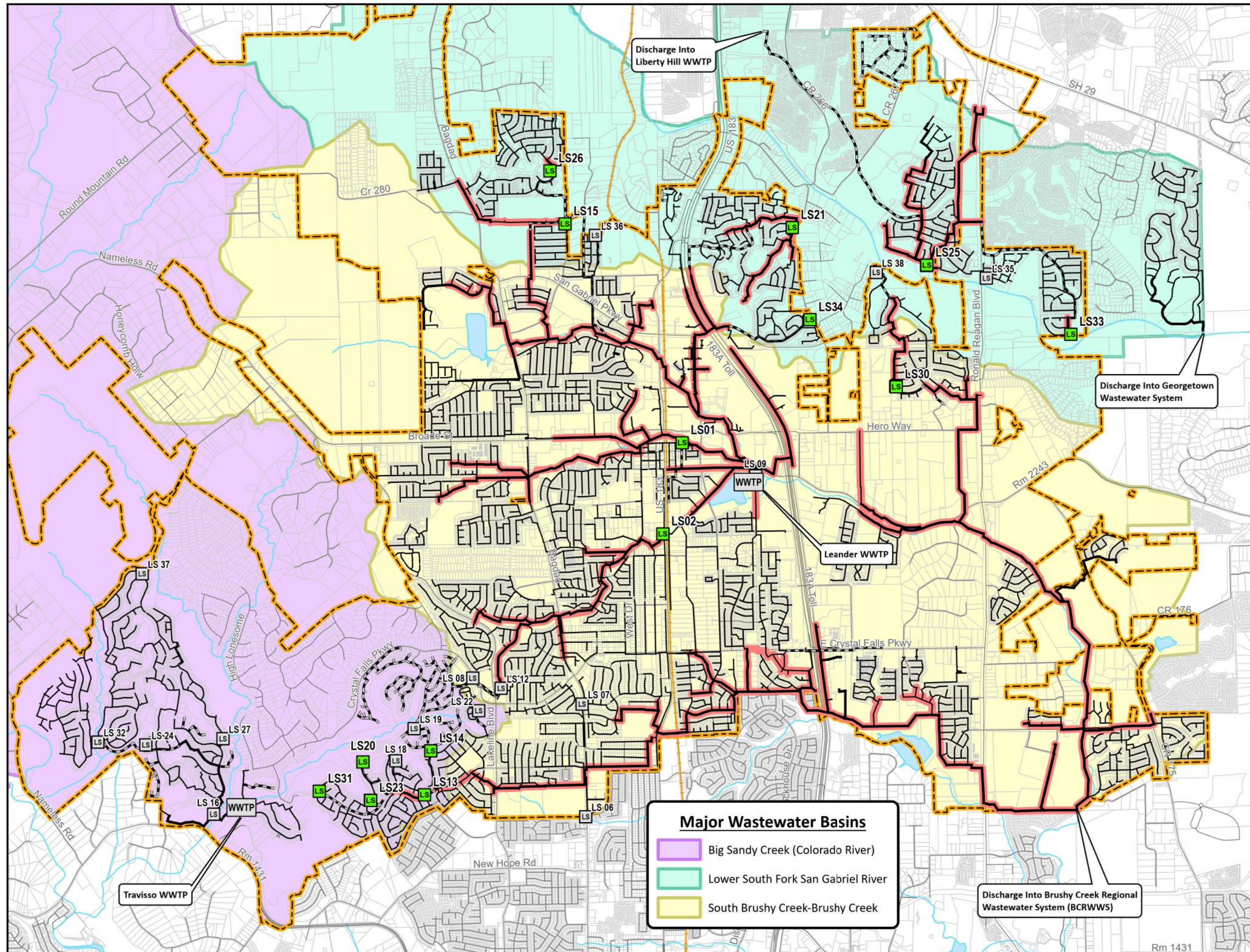
Legend

- Modeled Lift Station
- LS Lift Station
- WWTP Wastewater Treatment Plant
- Modeled Wastewater Line
- 10" and Smaller Wastewater Line
- 12" and Larger Wastewater Line
- Forcemain
- Leander City Limits
- Road
- Railroad
- ~ Creek/Stream/River
- Lake



0 0.75 1.5
Miles

Date: 4/25/2024



Major Wastewater Basins

- Big Sandy Creek (Colorado River)
- Lower South Fork San Gabriel River
- South Brushy Creek-Brushy Creek

Table 4-3: Summary of Modeled Pipes by Diameter

Flow Meter Basin ID	Gravity Main									Force Main						
	<12"	12"	15"	18"	21"	24"	30"	36"	Totals	4"	6"	8"	10"	12"	18"	Totals
1	3385	16947	2998	7280		1745	5537	10983	48875					1690		1690
2	1830	3456							5286							
3		22656		4516					27172							
4	502								502							
5		13525	7456						20981			4100		7637		11737
6	4386	11720	6557		10236				32899		1988		10711			12699
7	2050								2050							
8	477								477							
9	3861	746	152	627					5386							
10	429								429							
11																
12		288	3666		302				4256							
13	426	8621	10186	4007					23240	8204	1293	669		83		10249
14		9123	5244	2279	4657				21303		1628			3100		4728
Liberty Hill ⁽¹⁾		9850	7668	239	2409	199			20365				14508	8707	14515	37730
Other ⁽²⁾	2376	11773	5777	3277	6879	13513	4392	532	48519							
Totals	19722	108705	49704	22225	24483	15457	9929	11515	<u>261740</u>	8204	4909	4769	25219	21217	14515	<u>78833</u>

* - All units in linear feet

(1) - Includes piping north of the South Fork San Gabriel River and East of Highway 183A going to Liberty Hill WWTP

(2) - Includes all piping that is downstream of a flow meter (Areas going to RM2243 WWTP and Brushy Creek Interceptor)

4.4 Model Calibration

4.4.1 Dry Weather Calibration

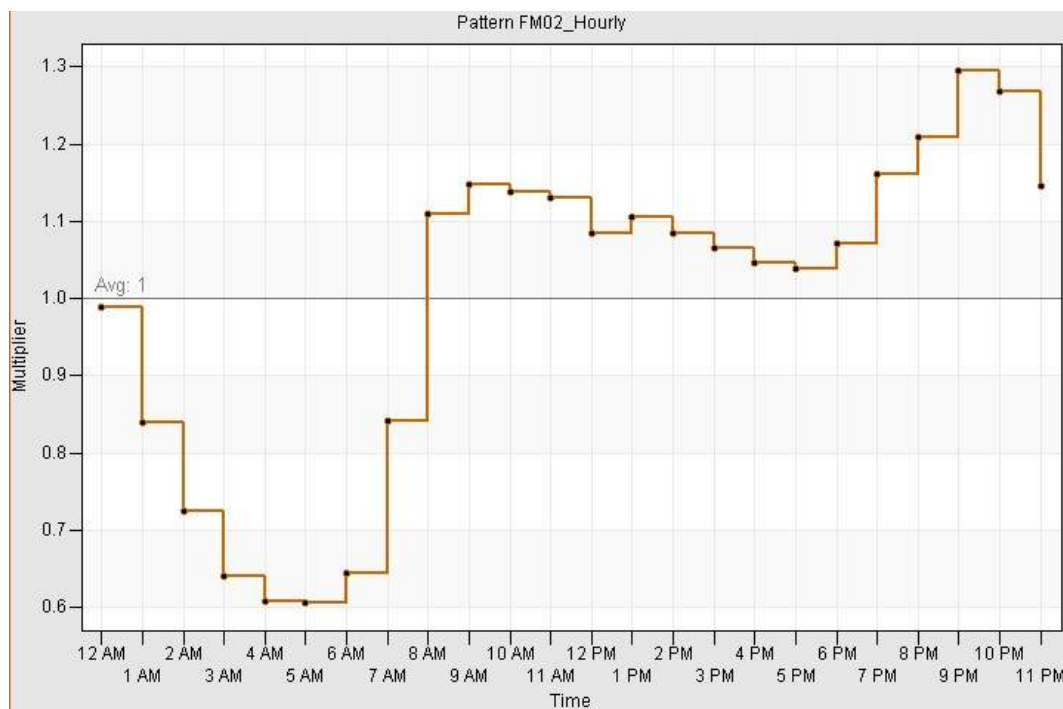
Average daily dry weather flow (ADDF) for each flow monitoring basin was retrieved from the 2022 Flow Monitoring Report by averaging the flows from Sep 29, 2022 - Oct 15, 2022, which was the driest, two-week period of the flow monitoring duration (See Figure 3-2 for flow meter locations). The ADDF was then normalized by dividing by the total number of Living Unit Equivalents (LUEs) within each respective basin, yielding a unit flow per LUE value for each flow metering basin (Table 4-4). To distribute flows throughout the system, the average flow entering each manhole was determined by multiplying the unit flow per LUE by the number of estimated LUEs served by that particular manhole.

Table 4-4: Unit Flow per LUE

Flow Metering Basin	Estimated No. of LUEs Upstream of Meter	Avg. Daily Dry Weather Flow (MGD)	Estimated ADDF/LUE (gpd/LUE)
1	2148	0.846	394
2	371	0.219	590
3	3350	0.890	266
4	272	0.098	342
5	1117	0.178	159
6	4428	0.365	82
7	248	0.059	238
8	426	0.056	130
9	337	0.327	970
10	334	0.054	162
11	500	0.149	298
12	821	0.168	205
13	2641	0.929	352
14	3424	0.491	143

Time patterns were created by using the Time Pattern Creator tool in PCSWMM. Hourly and weekend time patterns were generated based off the dry weather period used for calibration. The outputs of the time pattern creator are hourly multipliers, in which the hourly time pattern has hourly multipliers that are applied to weekdays, while the weekend time pattern has hourly multipliers which are utilized on the weekend. Figure 4-3 shows an example of an hourly time pattern created by PCSWMM. The hourly and weekend time patterns were created for each flow metering basin and assigned to the manholes within their respective flow metering basins.

Figure 4-3: Example Hourly Time Pattern



The model was run after inputting the average flows and time patterns to the manholes, and the model results were compared to the flow meter data. ADDF retrieved from the flow meter data was compared against the ADDF the model calculated, as well as the total volumes for the dry weather period (Table 4-5). The hydrographs showing modeled versus metered flow for the dry weather period for each flow meter are provided in **Appendix B: Dry Weather Calibration**.

Table 4-5: Dry Weather Calibration Results

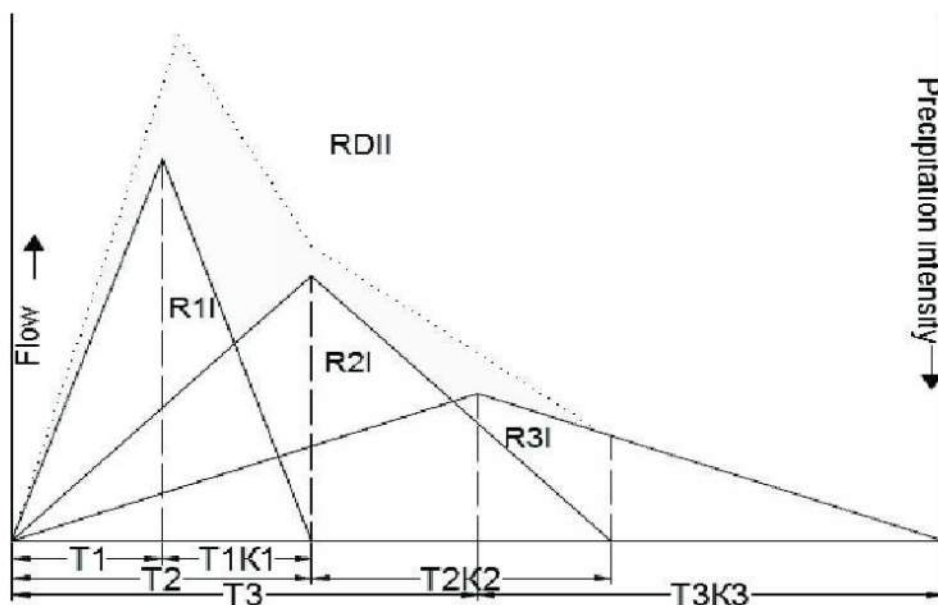
FM	Metered ADDF (MGD)	Modeled ADDF (MGD)	Difference (MGD)	% Difference	Metered Total Volume (MG)	Modeled Total Volume (MG)	Difference (MG)	% Difference
1	0.983	0.982	-0.001	-0.1%	15.750	16.700	0.950	6.0%
2	0.255	0.255	0.000	0.1%	4.097	4.340	0.243	5.9%
3	0.919	0.929	0.011	1.2%	14.450	15.8	1.350	9.3%
4	0.090	0.090	0.000	-0.2%	1.442	1.530	0.088	6.1%
5	0.197	0.187	-0.010	-5.2%	3.087	3.180	0.093	3.0%
6	0.365	0.357	-0.009	-2.4%	5.838	6.060	0.222	3.8%
7	0.078	0.077	-0.001	-0.9%	1.230	1.310	0.080	6.5%
8	0.049	0.049	-0.001	-1.0%	0.794	0.828	0.034	4.3%
9	0.406	0.409	0.004	1.0%	6.486	6.960	0.474	7.3%
10	0.064	0.065	0.001	1.7%	1.065	1.100	0.035	3.3%
11 ¹	0.165	0.222	0.058	35.1% ⁽¹⁾	2.620	3.780	1.160	44.3%
12	0.193	0.189	-0.003	-1.7%	3.100	3.220	0.120	3.9%
13	1.061	1.065	0.004	0.4%	16.890	18.100	1.210	7.2%
14	0.548	0.549	0.001	0.1%	8.678	9.330	0.652	7.5%
Total/ Avg.	5.371	5.426	0.065	1.02%	85.527	92.238	6.711	7.85%

Note 1) Dry weather flows for the FM11 basin were increased in the model to improve FM09 dry weather calibration, since FM09 is downstream of FM11. Because FM11 is a small basin and there are no interceptors modeled upstream of the FM11 meter location, the dry weather calibration was considered acceptable and conservative for the purposes of this analysis.

4.4.2 Wet Weather Calibration

The RTK Hydrograph method was chosen to model rainfall dependent inflow and infiltration (RDII) in PCSWMM. RDII is produced as groundwater and stormwater enter through defects in the sanitary network. A RTK unit hydrograph was used to define the proportion of rainfall falling on the basin that enters the sewer system as RDII and the timeframe this rainfall enters the system during and after the storm event. The RTK unit hydrograph is a combination of three separate unit hydrograph triangles which represent slow, medium, and fast responses of flow entering a sanitary network (Figure 4-4). Each response represents RDII that enters a system during and after a rainfall event. The R value symbolizes the fraction of rainfall that is entering the system, which is shown in the figure as the magnitude of the peak, T is the time to peak, and K is the falling limb ratio, which predicts how long the system will respond to a storm event. The slow response can be associated with slow infiltration, which occurs immediately following a rain event and can persist for several hours or even days. The medium response is associated with moderate infiltration that occurs during and soon after an event, when soil surrounding a pipe becomes saturated and starts infiltrating. The fast response time is associated with rapid inflow that enters the system through more direct connections and pathways (such as cracks or holes in manhole frames and covers).

Figure 4-4: RTK Hydrograph Schematic



A unit hydrograph was developed for each flow monitoring basin, featuring unique sets of short-, medium-, and long-term R, T, and K values, along with an assigned rain gage. The City of Leander has a total of three rain gages, as illustrated in Figure 3-2. The Thiessen polygon method was utilized to establish an estimate of rainfall for each flow monitoring basin during the calibration period, determined by the proximity of the basin to the nearest rain gages.

The Sensitivity-based Radio Tuning Calibration (SRTC) tool in PCSWMM was applied to calibrate modeled data with observed flow meter data. The SRTC tool establishes sensitivity gradients for short, medium, and long-term R, T, K values, allowing for simultaneous

observation of effects across multiple wet weather events. Initial unit hydrographs were generated by estimating R, T, K values based on computed and observed data from the dry weather calibrated model results. Subsequently, an iterative approach was adopted, adjusting R, T, and K values for each flow meter until the weighted averages of the peaks and total volumes for all the observed wet weather responses were within the ranges suggested by the Chartered Institution of Water and Environmental Management (CIWEM): -15% to +25% for peak flow, and -10% to +20% for total volume (Table 4-6). In addition, 45-degree plots were prepared to visually depict how the modeled flows align with metered flow data (Appendix C: Wet Weather Calibration).

Table 4-6: Wet Weather Calibration Results

FM	Basin Area (Acres)	No. of Storm Events with Observable I/I Responses	Weighted Avg. % Difference, Volume	Weighted Avg. % Difference, Peak Flow
1	1638	7	10%	-1%
2	452	8	7%	-1%
3	1301	9	5%	1%
4	140	7	9%	-4%
5	747	6	17%	8%
6	1561	7	9%	14%
7	98	9	-4%	13%
8	87	7	3%	-1%
9	418	6	8%	-1%
10	197	7	8%	7%
11	125	9	19%	7%
12	410	11	-3%	13%
13	1285	9	16%	12%
14	1569	5	6%	14%
Acceptable Range (CIWEM), % Difference			-10% to +20%	-15% to +25%

4.5 Future Growth Model Development

The future growth projections were incorporated into the model by importing the number of LUEs and the sewershed area into the nearest downstream, modeled manhole. The nearest downstream manhole was determined by the future growth area's location and topography. Future interceptor lines were drafted and included in the final plan as future interceptor projects to serve new growth and tie into the existing infrastructure. The exhibits in **Appendix D: Future Growth Exhibits** illustrate the estimated number of LUEs and sewershed area (acres) tying into the system for each location at each time horizon. The locations where future growth is anticipated to connect are indicated by blue triangles in the design storm modeling results (**Appendix E: Design Storm Modeling Results**). The future growth models did not factor in any planned or anticipated improvements; however, all known improvements were considered when developing recommendations.

5 MODEL RESULTS ANALYSIS

5.1 Overview of Modeling Results

The existing model and future growth models (5, 10, and 20-year time horizons) were simulated with the 5-year, 6-hour design storm (see Section 2.6 for more information regarding the design storm). This chapter provides an analysis of the outcomes derived from these simulations. Figure 5-1 provides a summary map of design storm results. In this figure, the colored circles denote manholes experiencing flooding during the simulation period. While the model might indicate flooding, it does not imply that the system will actually flood. It is recommended that further on-site evaluation and data collection (e.g., checking manholes for evidence of surcharge, targeted flow monitoring) be conducted before initiating any project based on modeling results.

A more detailed set of maps showing model results from PCSWMM is provided in Appendix E. In those maps, orange symbolizes pipes undergoing surcharge due to backup, indicative of downstream bottlenecks such as undersized pipes or lift stations. Pipes appearing as red are representing pipes experiencing surcharge due to capacity limitations, indicative of undersized pipes. These pipes can be considered bottlenecks to flow in the collection system. When evaluating projects, pipes surcharging due to backup are generally of lesser concern compared to those surcharging due to capacity limitations.

5.2 Existing System Design Storm Model Results

The analysis of the existing system under 5-year design storm conditions reveals two primary areas of concern:

- **Block House Interceptor**, which is situated in southwest Leander near Leander High School and flows northeast from west of Lakeline Blvd to Highway 183. The design storm model predicts that this section of pipe may currently be experiencing excessive surcharging and potential flood loss under 5-year storm conditions.
- **Mason Creek Interceptor**, located in central west Leander and flowing northeastward towards Lift Station 2, is predicted to experience excessive surcharge with some minimal flood loss according to the existing system model.

Other areas of lesser concern include a pipe segment in southeast Leander, near Lakewood Park, which is forecasted to experience surcharge due to capacity limitations. However, the level of surcharge is not considered critical. Manholes downstream of Lift Station 2 appear as flooded in the existing system modeling results. However, there are recent and ongoing upgrades at LS02 and its force main, and modeling of this area may be fine-tuned once upgrades are complete. There are also no known SSO issues in this vicinity; therefore, this area is not considered an area of concern for the present-day time horizon (Figure 5-1).

5.3 5-year Growth Design Storm Model Results

The results from the 5-year growth model simulation conducted with the design storm are presented in Figure 5-1. The previously identified areas of concern (Block House and Mason Creek Interceptors) exhibit exacerbated surcharge and flooding. In addition, it is anticipated that the **pipes near the RM2243 WWTP** and along the Horizon Park Interceptor will surcharge under 5-year growth conditions during the design storm. The **Horizon Park Interceptor** is an

older 12-inch line (circa 1986) with new developments recently tying into it, which is likely exacerbating the predicted surcharge conditions.

5.4 10-year Growth Design Storm Model Results

Like the 5-year growth model findings, the previously identified areas of concern show worsened surcharging and flooding. With the integration of the 10-year growth projection into the model, excessive surcharge and flooding is anticipated in the following locations (please also refer to Figure 5-1):

- **Benbrook Interceptor**, where there is a project currently listed in the City's Capital Improvement Plan (CIP) under WW.41 and is under design by GBA. Although this interceptor is not expected to become a concern until the 10-year time horizon, the City is taking proactive measures to address this interceptor.
- **Collaborative Way** sewers are another area of concern. Located in northwest Leander, these sewers flow southeast along Bagdad Rd and Collaborative Way, upstream of LS15. Growth was assumed to tie into these sewers upstream of Collaborative Way, although the actual tie-in locations may differ in the future. A conceptual plan of this area is presented in Section 6.10.
- **South Brushy Creek Interceptor**, which is situated in central west Leander, is projected to experience surcharge in the design storm simulation of the 10-year growth model.

5.5 20-year Growth Design Storm Model Results

The integration of the 20-year growth projection into the model, caused excessive surcharge and flooding is anticipated in the following locations (please also refer to Figure 5-1):

- Sewers near **Devine Lake**, upstream of the Benbrook Interceptor are forecasted to undergo significant flooding and surcharging. Although this pipe is relatively newly constructed, most of the growth expected in the northwest area of town is anticipated to connect to this stretch of pipe.
- The sewers flowing south along **N Ronald Reagan Blvd**, at the near the intersection of Hero Way, are projected to experience flooding and surcharging under the conditions of 20-year growth and a 5-year design storm event.

FIGURE 5-1: DESIGN STORM
MODELING RESULTS



Legend

- LS Lift Station
- WWTP Wastewater Treatment Plant
- 10" and Smaller Wastewater Line
- 12" and Larger Wastewater Line
- Forcemain
- Road
- Railroad
- Creek/Stream/River
- Lake
- Leander City Limits
- Leander ETJ
- County Boundary



0 0.75 1.5

Miles

Date: 4/26/2024

Modeling Results

Existing Condition Results

- Flooded Manholes
- Surcharging Conduits

5-Year Results

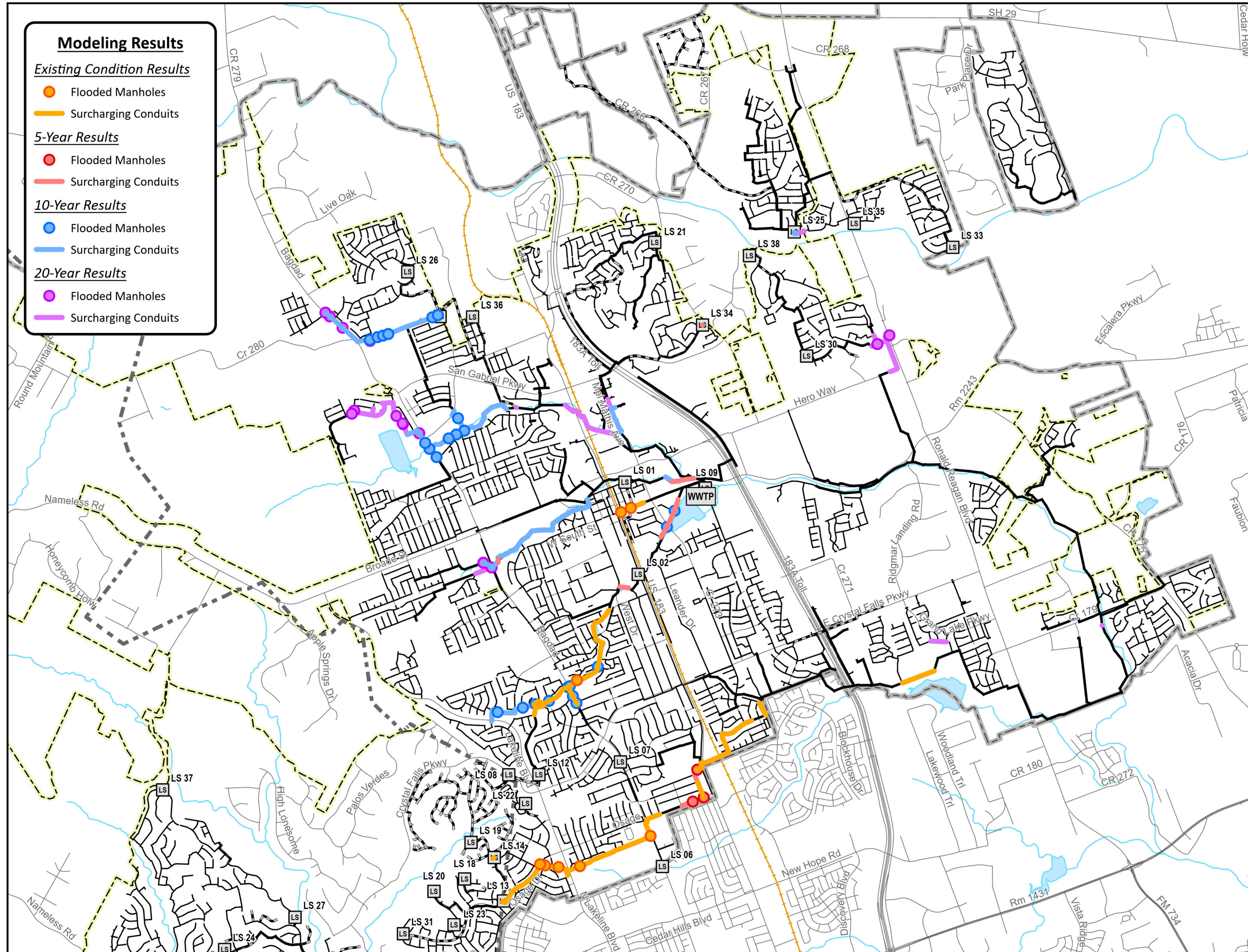
- Flooded Manholes
- Surcharging Conduits

10-Year Results

- Flooded Manholes
- Surcharging Conduits

20-Year Results

- Flooded Manholes
- Surcharging Conduits



5.6 Free Flow Model Results

A free flow model scenario was developed for the 20-year growth conditions whereby pipe capacities were increased until no surcharging or flooding was predicted in the model under 5-year, 6-hour design storm conditions. In the previous non-free flow design storm models, flood loss and surcharging diminish peak flows progressing downstream of any bottlenecks. The free flow analysis assumes that any flow entering the system will flow through the system and to the outfall without encountering restrictions or flood loss. This model scenario enables a comparison between a) the maximum 20-year free flow peaks that could be experienced without upstream flow restrictions and b) the existing full flow capacity of every modeled pipe. Additionally, this analysis facilitates the identification of capacity concerns not highlighted in the non-free flow design storm models, either due to flood loss, surcharging, or other flow restrictions upstream.

The findings from the free flow analysis significantly influence the identification and delineation of necessary projects and their extents. Figure 5-2 denotes pipes (shown in red) where the maximum 20-year free flow peak exceeds the existing pipe's full flow capacity. The pipe segments which are under capacity for the 20-yr free flow conditions generally align with the areas of concern previously identified from the design storm modeling results, with the addition of a few areas in southeast Leander at the downstream end of the Block House Creek interceptors (Figure 5-2). After further modeling of the recommended improvements, these pipes in southeast Leander, while still slightly under-sized for the 20-year free flow peak, do not flood or meet critical surcharge criteria when upstream flow restrictions are removed. Therefore, these pipes at the downstream end of the Block House Creek interceptors east of 183A (including the Lakewood Park area) are not of concern and likely do not require a project within the 20-year planning window.

Modeling Results
20-Yr Free Flow Peak Greater Than Existing Capacity



**City of Leander
Williamson County, TX**

FIGURE 5-2: 20-YEAR FREE FLOW MODELING RESULTS



Legend

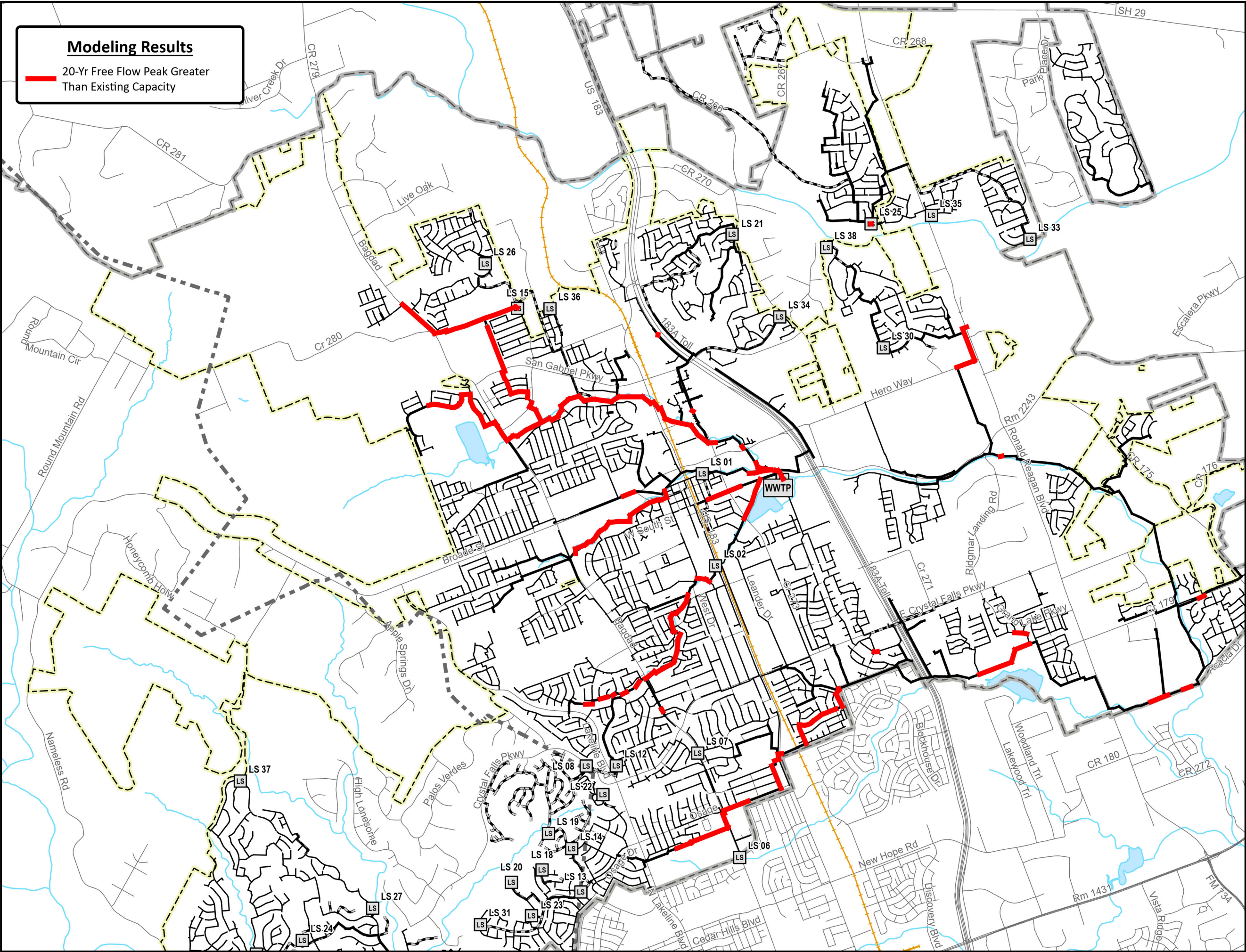
- LS Lift Station
- WWTP Wastewater Treatment Plant
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- Forcemain
- Road
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- Creek/Stream/River
- Lake
- Leander City Limits
- Leander ETJ
- County Boundary



0 0.75 1.5

Miles

Date: 4/26/2024



5.7 Lift Station Modeling

Lift stations were modeled in PCSWMM with the information available during model development. Several modeled lift stations were missing information regarding pump curves, capacities, start up and shut off depths, and wet well dimensions. Where information was missing or model calibration required it, an “ideal” pump assumption was used. Lift stations missing current pump curves (Lift Stations 01, 26, and 31) were modeled as “ideal” pumps, whereby outgoing flows are assumed to be equivalent to incoming flows. Other lift stations were better represented by ideal pumps during dry weather flow calibration (Lift Stations 02, 21, and 34). Further investigation, such as draw down testing, is recommended for fine-tuning of lift station modeling. However, conclusions can still be drawn regarding several crucial lift stations.

Table 5-1 summarizes the modeled flows reaching those lift stations with significant growth anticipated upstream over the next 20 years. Only modeled lift stations with anticipated upstream growth are included in Table 5-1 because smaller lift stations with limited growth upstream should primarily require O&M rather than significant capacity upgrade projects. Free flow peaks reaching each lift station at each time horizon are provided, along with the lift station’s estimated firm capacity and maximum (or emergency) capacity. As discussed previously, free flow peaks represent a conservative estimate of maximum peak flows that could be experienced, assuming all upstream flow restrictions are removed.

Cells shaded yellow indicate a flow rate that exceeds the lift station’s firm capacity, and cells shaded red indicate a flow rate that exceeds the lift station’s maximum capacity. LS02 and LS15 indicate need for capacity upgrades by the 10-year time horizon. However, as described in the next chapter, LS15 may be decommissioned if flows are sent to a new regional LS instead.

Table 5-1: Modeled Lift Stations With Growth Anticipated Upstream

Lift Station	Existing Sys. Free Flow Peak (MGD)	5-year Free Flow Peak (MGD)	10-year Free Flow Peak (MGD)	20-year Free Flow Peak (MGD)	Existing LS Firm Capacity (MGD) ¹	Existing LS Max Capacity (MGD) ²	Ideal Pump in Model ³ ?
LS 02	6.8	6.6	8.0	8.0	5.2	7.8	Yes
LS 15	0.4	0.4	2.1	3.4	0.6	1.2	No
LS 21	1.3	1.9	1.9	1.9	1.7	3.5	Yes
LS 25	1.2	1.2	1.5	1.8	8.3	9.7	No ⁴
LS 26	0.5	1.0	1.2	1.2	1.4	2.8	Yes
LS 30	0.4	0.8	0.8	0.8	0.8	1.6	No
Notes: 1) Firm capacity represents the capacity of the lift station assuming one pump is not running. 2) Max. capacity represents the capacity of the lift station assuming all available pumps are running. 3) Lift stations were modeled as “ideal” pumps ($Q_{in}=Q_{out}$) when pump curves were unavailable. It is advised that further investigations be conducted on these lift stations before considering improvements. 4) LS25 (Bar W Ranch) received two new 2,400 gpm pumps in Spring 2024 which tie into the 18" force main, in addition to the existing two 985 gpm pumps that tie into the 10" force main. During model development, only the two 985 gpm pumps were present, and this is how LS25 is represented in the model. Yellow shading indicates free-flow peak exceeds firm capacity of lift station (one pump not running). Red shading indicates free-flow peak exceeds maximum capacity of lift station (all pumps running).							

6 PROJECT RECOMMENDATIONS AND COSTS

This section outlines the conceptual projects identified from modeling, as well as the planning-level costs estimated for each identified project. Refer to Appendix H for additional recommendations on model maintenance and lessons learned.

6.1 Development of Planning-Level Costs

All planning-level costs of projects are in February 2024 dollars and include the opinion of probable construction cost (OPCC), along with a 20% construction contingency, a 30% factor for engineering and other soft costs (survey, public coordination, permitting, etc.), and an additional 10% contingency for projects involving railroad crossings. The inclusion of the railroad crossing contingency is due to additional engineering costs for obtaining permits and additional construction costs due to longer bores.

The estimated unit cost for acquiring easements for new infrastructure projects outside of existing right-of-way (ROW) or pre-existing easements was approximately \$88,000 per acre. This unit cost was determined by averaging the expenses of recent utility infrastructure easements in Central Texas for both developed and undeveloped areas and includes easement survey costs, engineering, ROW agent, condemnation, attorney fees, and easement acquisition costs.

All OPCCs are considered planning-level, and actual costs may vary significantly depending on final design, project scope and bidding environment. Planning-level construction cost estimates for both new and existing infrastructure projects were estimated based on the following assumptions:

- Gravity Lines: Gravity pipe construction costs generally cover excavation, pipe, ditch checks, manholes, extra depth, erosion control, restoration, and mobilization. The gravity pipe construction estimates also assume that 10% of gravity line length will be encased with a steel casing to account for roadway and stream crossings.
- Lift Stations: The cost for lift station construction generally covers erosion control, site work, wet well, pumps, site piping, electrical work, controls, jib crane, hoist, fencing, access road, restoration, and appurtenances. The lift station unit costs were calculated based on averaging construction costs from past lift station projects.
- Force Mains: Force main construction costs generally cover excavation, pipe, erosion control, and restoration. The force main construction estimates also assume that 10% of force main length will be encased with a steel casing to account for roadway and stream crossings.
- Conversion of On-Site Septic Facilities: A unit cost of \$30,000/acre was estimated for future projects providing wastewater service to existing on-site septic facilities (OSSF) and includes infrastructure necessary to connect septic areas to City sewer. The unit cost is sourced from an average cost of converting OSSF to City sewer service in the Falcon Oaks subdivision.

6.2 Field Investigations Prior to Design

In order to confirm a relief project's urgency and necessity, field investigations and targeted flow metering are recommended before initiating design and construction. The hydraulic model is most accurate nearest the meter locations used for model calibration. Locations in the model that are relatively far upstream or downstream from a meter location are more likely to be imprecise in terms of flow predictions. Many site-specific factors in the collection system can impact flow conditions at a particular location that may not be readily apparent from flow data collected far downstream of that location (such as branching interceptors or diversions). Also, timing and scale of future growth may vary from growth projections assumed in this report, which may drastically change the necessity of projects listed below under future time horizons. Therefore, it is in the City's best interest to confirm and corroborate model results and project necessity before embarking on a costly relief or replacement project.

Table 6-1 describes the primary benefits and costs of performing targeted field investigations and flow monitoring prior to relief project implementation. Overall, these investigations are highly recommended and can help confirm the necessity and urgency of a project identified from modeling.

Table 6-1: Benefits and Costs of Targeted Investigations Prior to Relief Design

Benefits	Costs
+ Verify site-specific flow conditions necessitate a project at all, potentially saving City budget if a project is eliminated, postponed, or reduced in scope + Determine level of risk of postponing a project if flow conditions are not as concerning as originally predicted/modeled + Verify presence or absence of surcharge evidence (rags, high water marks, high water levels) + Verify site-specific hydraulics for fine-tuned modeling, such as diameters or pipe inverts that could not be collected during initial manhole inspections	- Additional costs of performing field investigations, flow monitoring and any supplementary modeling - Delays timeline toward project completion if project is essential

6.3 Project Summary

Table 6-2 and Figure 6-1 present a summary of all projects identified as part of the collection system master planning project. Further description of the recommended projects are provided in the sections below. IDs for each project (e.g., "WW.00.01") are formatted such that the middle two digits represent the time horizon by which the project becomes necessary ("00" for present day, "05" for 5-year growth conditions, etc.), and the second two digits represent a unique project number for that time horizon. Though parts of the existing system are overloaded and need relief prior to the 20 year growth horizon, all sizing recommendations are based on the 20 year future growth flows.

Leander, TX
Collection System Master Plan
Table 6-2: Overall Project List

Project ID	Infrastructure Type	Time Horizon	FY24 CIP Project ID	Project Name	Type of Improvement	Pipe Diameter (in) ¹	Total Length of Pipe (ft)	Lift Station Flow Rate (mgd)	Planning-Level Construction OPCC without Contingency	Construction Contingency (30%)	Planning-Level Construction OPCC with Contingency	Engineering & Survey (20%)	ROW Acquisition	Planning-Level Capital Cost (OPCC with Contingency + Engr./Survey + ROW Acq.) ²
WW.00.01	Existing/Relief	Present Day	-	Block House Interceptor	Exist. Gravity Relief/Upsizing	21"-24"	13,020	-	\$ 11,327,000	\$ 3,398,000	\$ 14,725,000	\$ 2,945,000	\$ -	\$ 17,670,000
WW.00.02	Existing/Relief	Present Day	-	Mason Creek Interceptor	Exist. Gravity Relief/Upsizing	15"-24"	8,170	-	\$ 6,597,000	\$ 1,979,000	\$ 8,576,000	\$ 1,715,000	\$ -	\$ 10,291,000
WW.05.01	Existing/Relief	5-Year	-	Horizon Lake Interceptor	Exist. Gravity Relief/Upsizing	18"-36"	3,660	-	\$ 3,617,000	\$ 1,085,000	\$ 4,702,000	\$ 940,000	\$ -	\$ 5,642,000
WW.05.02	New/Extension	5-Year	-	Lonestar Landing WW Improvements	New Gravity to Serve Growth	8"	1,225	-	\$ 620,000	\$ 186,000	\$ 806,000	\$ 161,000	\$ 124,000	\$ 1,091,000
WW.05.03	New/Extension	5-Year	-	RM 2243 to Hero Way WW Improvements - East Segment Ph. 1	New Gravity to Serve Growth	12"	1,350	-	\$ 810,000	\$ 243,000	\$ 1,053,000	\$ 211,000	\$ 136,000	\$ 1,400,000
WW.10.01	Existing/Relief	10-Year	WW.41	Benbrook Interceptor (Under Design)	Exist. Gravity Relief/Upsizing	27"	8,460	-	\$ 9,870,000	\$ 2,961,000	\$ 12,831,000	\$ 2,566,000	\$ -	\$ 15,397,000
WW.10.02	Existing/Relief	10-Year	-	Collaborative Way	Exist. Gravity Relief/Upsizing	18"	5,780	-	\$ 4,379,000	\$ 1,314,000	\$ 5,693,000	\$ 1,139,000	\$ -	\$ 6,832,000
WW.10.03	Existing/Relief	10-Year	WW.25	South Brushy Creek Interceptor	Exist. Gravity Relief/Upsizing	15"-24"	6,400	-	\$ 4,493,000	\$ 1,348,000	\$ 5,841,000	\$ 1,168,000	\$ -	\$ 7,009,000
WW.10.04	New/Extension	10-Year	-	South Ronald Reagan Blvd. WW Improvements	New Gravity to Serve Growth	8"	2,000	-	\$ 1,012,000	\$ 304,000	\$ 1,316,000	\$ 263,000	\$ 202,000	\$ 1,781,000
WW.10.05	New/Extension	10-Year	-	Journey Pkwy and Ronald Reagan Blvd WW Improvements	New Gravity to Serve Growth	8"	4,675	-	\$ 2,366,000	\$ 710,000	\$ 3,076,000	\$ 615,000	\$ 472,000	\$ 4,163,000
WW.10.06	New/Extension	10-Year	-	US 183-A WW Improvements Ph. 1	New Gravity to Serve Growth	8"	450	-	\$ 228,000	\$ 68,000	\$ 296,000	\$ 59,000	\$ 45,000	\$ 400,000
WW.10.07	New/Extension	10-Year	-	US 183-A WW Improvements Ph. 2	New Gravity to Serve Growth	8"	875	-	\$ 443,000	\$ 133,000	\$ 576,000	\$ 115,000	\$ 88,000	\$ 779,000
WW.10.08	New/Extension	10-Year	-	Linda Hall WW Improvements	New Gravity to Serve Growth	12"	3,600	-	\$ 2,160,000	\$ 648,000	\$ 2,808,000	\$ 562,000	\$ 363,000	\$ 3,733,000
WW.10.09	New/Extension	10-Year	-	North Fork Brushy Creek WW Interceptor Improvements Ph. 1	New Gravity to Serve Growth	18"	4,630	-	\$ 3,506,000	\$ 1,052,000	\$ 4,558,000	\$ 912,000	\$ 467,000	\$ 5,937,000
WW.10.10	New/Extension	10-Year	-	North Brushy Creek WW Interceptor Improvements	New Gravity to Serve Growth	18"-21"	2,800	-	\$ 2,250,000	\$ 675,000	\$ 2,925,000	\$ 585,000	\$ 282,000	\$ 3,792,000
WW.10.11	New/Extension	10-Year	-	North Bagdad Rd. Lift Station Ph. 1	New Gravity/LS to Serve Growth	18"(G), 10"(F)	10,600(G/F)	1.15	\$ 6,235,000	\$ 1,871,000	\$ 8,106,000	\$ 1,621,000	\$ 756,000	\$ 10,483,000
WW.10.12	New/Extension	10-Year	-	San Gabriel East Regional Lift Station	New LS to Serve Growth	8" (F)	5,500(F)	0.90	\$ 2,593,000	\$ 778,000	\$ 3,371,000	\$ 674,000	\$ 312,000	\$ 4,357,000
WW.10.13	New/Extension	10-Year	-	San Gabriel River WW Interceptor Improvements Ph. 1	New Gravity to Serve Growth	15"-18"	5,140	-	\$ 3,863,000	\$ 1,159,000	\$ 5,022,000	\$ 1,004,000	\$ 518,000	\$ 6,544,000
WW.10.14	New/Extension	10-Year	-	San Gabriel West Regional Lift Station Ph. 1	New Lift Station	16"(F)	13100	3.60	\$ 8,349,000	\$ 2,505,000	\$ 10,854,000	\$ 2,171,000	\$ 696,000	\$ 13,721,000
WW.10.15	New/Extension	10-Year	-	Lift Station #15, #26, and #36 Decommission	New Gravity to Serve Growth	8"-21"	10,050	-	\$ 8,331,000	\$ 2,499,000	\$ 10,830,000	\$ 2,166,000	\$ 1,014,000	\$ 14,010,000
WW.20.01	Existing/Relief	20-Year	-	Devine Lake	Exist. Gravity Relief/Upsizing	27"	5,240	-	\$ 5,625,000	\$ 1,688,000	\$ 7,313,000	\$ 1,463,000	\$ -	\$ 8,776,000
WW.20.02	Existing/Relief	20-Year	WW.37/.38	North Brushy Creek Interceptor	Exist. Gravity Relief/Upsizing	33"-36"	6,150	-	\$ 8,265,000	\$ 2,480,000	\$ 10,745,000	\$ 2,149,000	\$ -	\$ 12,894,000
WW.20.03	Existing/Relief	20-Year	-	North Ronald Reagan	Exist. Gravity Relief/Upsizing	12"-15"	2,500	-	\$ 1,640,000	\$ 492,000	\$ 2,132,000	\$ 426,000	\$ -	\$ 2,558,000
WW.20.04	New/Extension	20-Year	-	RM 2243 to Hero Way WW Improvements - West Segment	New Gravity to Serve Growth	8"-12"	4,340	-	\$ 2,356,000	\$ 707,000	\$ 3,063,000	\$ 613,000	\$ 437,000	\$ 4,113,000
WW.20.05	New/Extension	20-Year	-	San Gabriel River WW Interceptor Improvements Ph. 2	New Gravity to Serve Growth	8"-15"	9,050	-	\$ 5,402,000	\$ 1,621,000	\$ 7,023,000	\$ 1,405,000	\$ 913,000	\$ 9,341,000
WW.20.06	New/Extension	20-Year	-	North Fork Brushy Creek WW Interceptor Improvements Ph. 2	New Gravity to Serve Growth	12"-15"	2,650	-	\$ 1,708,000	\$ 512,000	\$ 2,220,000	\$ 444,000	\$ 268,000	\$ 2,932,000
WW.20.07	New/Extension	20-Year	-	San Gabriel Pkwy. WW Interceptor Ph. 1	New Gravity to Serve Growth	18"	3,350	-	\$ 2,540,000	\$ 762,000	\$ 3,302,000	\$ 660,000	\$ 338,000	\$ 4,300,000
WW.20.08	New/Extension	20-Year	-	San Gabriel Pkwy. WW Interceptor Ph. 2	New Gravity to Serve Growth	12"	3,150	-	\$ 1,890,000	\$ 567,000	\$ 2,457,000	\$ 491,000	\$ 318,000	\$ 3,266,000
WW.20.09	New/Extension	20-Year	-	Lakeline Blvd. WW Improvements	New Gravity to Serve Growth	15"	5,030	-	\$ 3,311,000	\$ 993,000	\$ 4,304,000	\$ 861,000	\$ 507,000	\$ 5,672,000
WW.20.10	New/Extension	20-Year	-	Colorado Basin Lift Station	New LS to Serve Growth	10"(F)	3,750	1.35	\$ 2,782,000	\$ 835,000	\$ 3,617,000	\$ 723,000	\$ 224,000	\$ 4,564,000
WW.20.11	New/Extension	20-Year	-	Lift Station #38 Decommission	New Gravity to Serve Growth	12"	400	-	\$ 540,000	\$ 162,000	\$ 702,000	\$ 140,000	\$ 40,000	\$ 882,000
WW.20.12	New/Extension	20-Year	-	Greatwood WW Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 8,010,000	\$ 2,403,000	\$ 10,413,000	\$ 2,083,000	\$ -	\$ 12,496,000
WW.20.13	New/Extension	20-Year	-	Whitt Ranch Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 2,310,000	\$ 693,000	\$ 3,003,000	\$ 601,000	\$ -	\$ 3,604,000
WW.20.14	New/Extension	20-Year	-	Sullivan Tract Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 9,270,000	\$ 2,781,000	\$ 12,051,000	\$ 2,410,000	\$ -	\$ 14,461,000
WW.20.15	New/Extension	20-Year	-	Leander Estates Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 6,300,000	\$ 1,890,000	\$ 8,190,000	\$ 1,638,000	\$ -	\$ 9,828,000
WW.20.16	New/Extension	20-Year	-	Hilltop Ranch Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 3,150,000	\$ 945,000	\$ 4,095,000	\$ 819,000	\$ -	\$ 4,914,000
WW.20.17	New/Extension	20-Year	-	North Bagdad Rd. Lift Station Ph. 2	New Pumps for Existing LS	-	-	1.44	\$ 245,000	\$ 74,000	\$ 319,000	\$ 64,000	\$ 35,200	\$ 418,000
WW.20.18	New/Extension	20-Year	-	San Gabriel West Regional Lift Station Ph. 2	Proposed LS Expansion	-	-	4.68	\$ 586,000	\$ 176,000	\$ 762,000	\$ 152,000	\$ 35,000	\$ 949,000
WW.20.19	New/Extension	20-Year	-	San Gabriel West WW Improvements	New Gravity to Serve Growth	8"-18"	3,860	-	\$ 2,215,000	\$ 665,000	\$ 2,880,000	\$ 576,000	\$ 389,000	\$ 3,845,000
WW.20.20	New/Extension	20-Year	-	San Gabriel East Regional Lift Station Ph. 2	Proposed LS Expansion	10" (F)	5,500	2.30	\$ 2,539,000	\$ 762,000	\$ 3,301,000	\$ 660,000	\$ 312,000	\$ 4,273,000
WW.20.21	New/Extension	20-Year	-	RM 2243 to Hero Way WW Improvements - East Segment Ph. 2	New Gravity to Serve Growth	8"	5,925	-	\$ 2,998,000	\$ 899,000	\$ 3,897,000	\$ 779,000	\$ 598,000	\$ 5,274,000
WW.20.22	New/Extension	20-Year	-	CR 175 and RM 2243 WW Improvements	New Gravity to Serve Growth	8"-12"	5,160	-	\$ 2,637,000	\$ 791,000	\$ 3,428,000	\$ 686,000	\$ 520,000	\$ 4,634,000
WW.20.23	New/Extension	20-Year	-	CR 175 and CR 176 WW Improvements	New Gravity to Serve Growth	8"-12"	7,500	-	\$ 4,402,000	\$ 1,321,000	\$ 5,723,000	\$ 1,145,000	\$ 757,000	\$ 7,625,000

Notes:

1) For pipe diameters and lengths, gravity main is assumed, except where (F) indicates force main, and (G) indicates gravity main.

2) For new/extension projects not within the ROW or an existing easement, a unit cost of \$87,900/acre was utilized for easement cost estimates.

The easement unit cost includes survey, easement acquisiton, engineering fees, condemnation/attorney fees, and ROW agent fees.

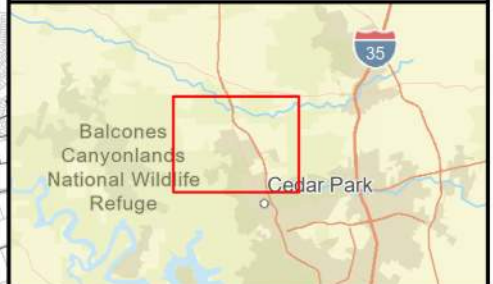
3) It is recommended that further on-site evaluation and data collection (e.g., checking manholes for evidence of surcharge, targeted flow monitoring) be conducted before initiating any project based on modeling results.

Subtotal, Existing/Relief Projects	\$ 87,069,000
Subtotal, New/Extension Projects ²	\$ 179,582,000
Total, All Projects	\$ 266,651,000

Time Horizon	Capital Cost
Present Day	\$ 27,961,000
5-Year	\$ 8,133,000
10-Year	\$ 98,938,000
20-Year	\$ 131,619,000
Total, All Projects	\$ 266,651,000

**City of Leander
Williamson County, TX**

**FIGURE 6-1:
OVERALL PROJECTS**



Legend

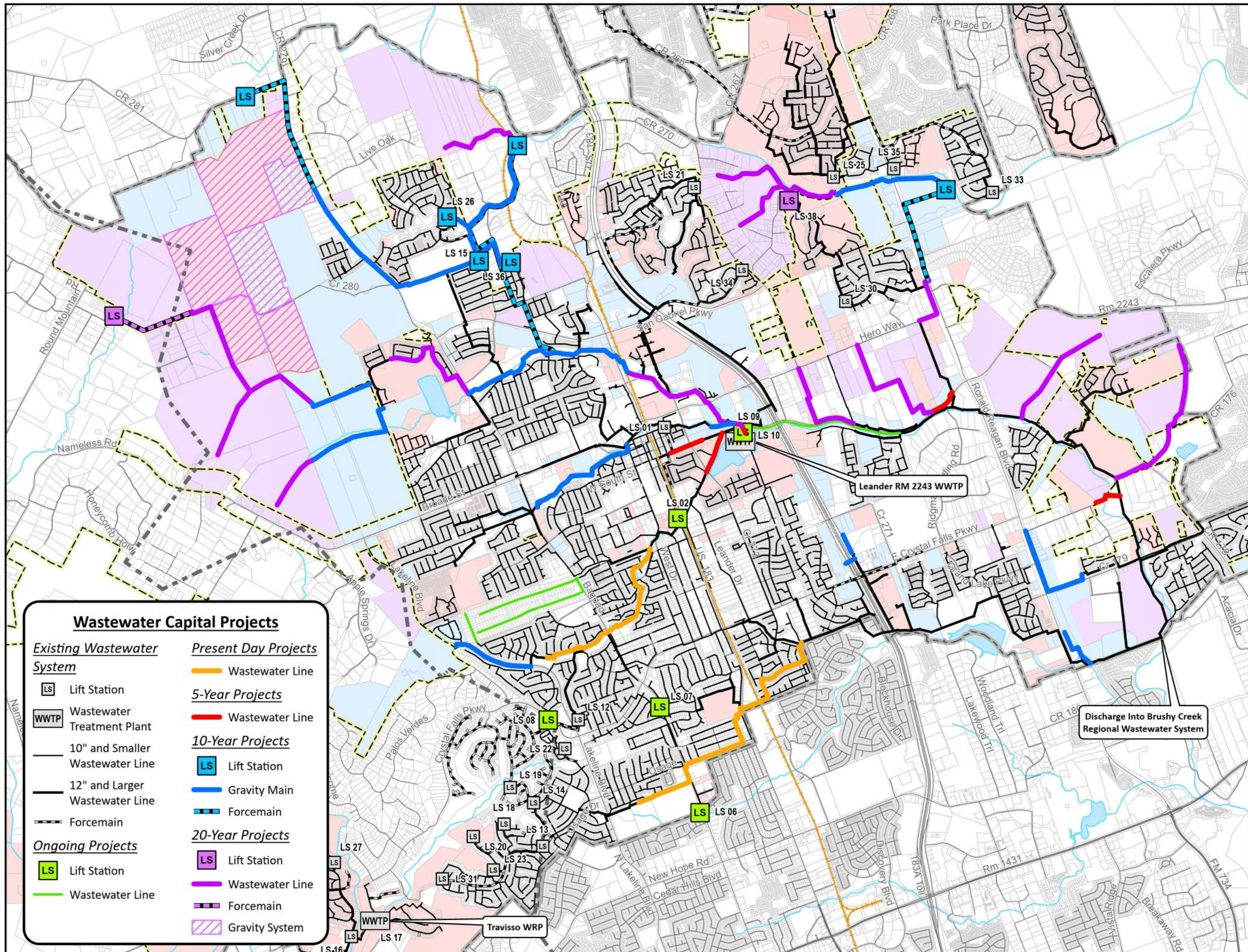
-  Road
-  Railroad
-  Creek/Stream/River
-  Lake
-  Leander City Limits
-  Leander ETJ
-  County Boundary
-  5-Year Projected Development
-  10-Year Projected Development
-  20-Year Projected Development



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Miles

Date: 6/12/2024



Wastewater Capital Projects

Existing Wastewater System

-  Lift Station
-  Wastewater Treatment Plant
-  10" and Smaller Wastewater Line
-  12" and Larger Wastewater Line
-  Forcemain

Ongoing Projects

-  Lift Station
-  Wastewater Line

Present Day Projects

-  Wastewater Line

5-Year Projects

-  Wastewater Line

10-Year Projects

-  Lift Station
-  Gravity Main
-  Forcemain

20-Year Projects

-  Lift Station
-  Wastewater Line
-  Forcemain
-  Gravity System

6.4 Present Day (Existing Conditions) Projects

Present day projects (those requiring attention under existing conditions) are presented in Figure 6-2, along with projects from the 5-year time horizon. Further description of projects is provided below.

Block House Interceptor (WW.00.01)

The western section of the Block House Interceptor, spanning from Leander High School to Highway 183, was predicted to have flooding and excessive surcharging under the existing system model conditions and was in turn recommended as the top priority project in the project recommendations list (Refer to Section 6.8 for more information outlining the methodology in prioritizing projects). Modeling results show that upon upsizing this upstream section, the downstream section of the Block House Interceptor, spanning from Highway 183 to Fall Creek Dr., is then predicted to undergo flooding and surcharging (Figure 6-2). Therefore, both segments of the Block House Interceptor are proposed to be upsized from pipes ranging from 8"-18" in diameter currently up to 21"-24" pipes.

The Block House Interceptor is downstream of several lift stations (including Lift Station 13) and approximately 9,000 feet of total force main serving the Bluffs subdivision. During model calibration, LS13 generated significant flow peaks when its provided pump curve was used. These peaks led to surcharging in the gravity sewer segment upstream of the Block House Interceptor project extents when utilizing the provided pump curve. However, this issue was resolved when the pump was set to an ideal pump configuration. The ideal pump configuration also allowed for a more consistent dry weather calibration. Therefore, it was believed that these anomalous peaks did not represent reality based on downstream flow monitoring data, and an ideal pump configuration was retained at LS13.

The tributary flows to the lift stations upstream of the Block House Creek interceptors also significantly impact the maximum flow downstream. Further investigation such as flow monitoring and analysis of lift station performance during wet weather events is recommended for the Block House Interceptor. Flow monitoring for the Block House Interceptor is recommended directly downstream of Lift Station 13, west of Lakeline Blvd, to confirm flow conditions created by the lift stations. Further investigation should confirm design flows and relief sewer sizing.

Mason Creek Interceptor (WW.00.02)

The Mason Creek Interceptor was predicted to experience surcharging and minimal flooding during the existing system model. The stretch of pipe that is proposed to be improved is approximately 8,200 ft in length and ranges from the intersection of Sonny Dr. and Lakeline Blvd. flowing northeast until it approaches West Dr (Figure 6-2). The existing pipe segment has diameters ranging from 12"-18" and is proposed to be upsized to pipe diameters ranging from 15"-24". Once again, further investigation such as flow monitoring and field checks are recommended before design initiation.

The Block House Creek and Mason Creek Interceptor projects are situated in Flow Meter Basins 13 and 14, respectively. These two basins were shown to have excessive inflow during wet weather. Therefore, it should be noted that peak wet weather flows in these basins could potentially be reduced by I/I mitigation efforts, thus reducing capacity concerns along these interceptors. However, the extent of I/I reduction that is possible is unknown.

6.5 5-year Projects

5-year projects (those projects requiring attention under 5-year growth conditions) are presented in Figure 6-2, along with projects from the present day time horizon. Further description of projects is provided below.

Horizon Lake Interceptor (WW.05.01)

The Horizon Lake Interceptor project includes three distinct segments of pipe located upstream of the RM2243 WWTP (Figure 6-2). Analysis based on the five-year growth model identified these pipes as meeting critical surcharge criteria, while the free flow analysis revealed their undersized capacity for serving 20-year free flow capacities. The total length of pipes selected to be upsized is roughly 1,850 ft and the existing pipe diameters are 12", 15", and 21". It is proposed to upgrade the existing 12" and 15" segments to 18", while the 21" pipe segments are recommended to be upsized to a diameter of 36".

5-year Extension Projects Summary

Two subdivisions are anticipated to undergo development and necessitate wastewater service by the five-year time horizon, projected for 2027. The Lonestar Landing subdivision is planned for the southeast area of Leander, with a proposed 8" line intended to connect the subdivision to the Brushy Creek Interceptor (WW.05.02). Similarly, the M Ranch Townhouses, also situated in southeast Leander, are slated to be served by a proposed 12" gravity line extension running on the north side of RM2243 to connect to the Brushy Creek Interceptor (WW.05.03, Figure 6-2). For further information on 5-year extension projects, refer to Table 6-4.

City of Leander
Williamson County, TX

FIGURE 6-2: PRESENT DAY
& 5-YEAR PROJECTS



Legend

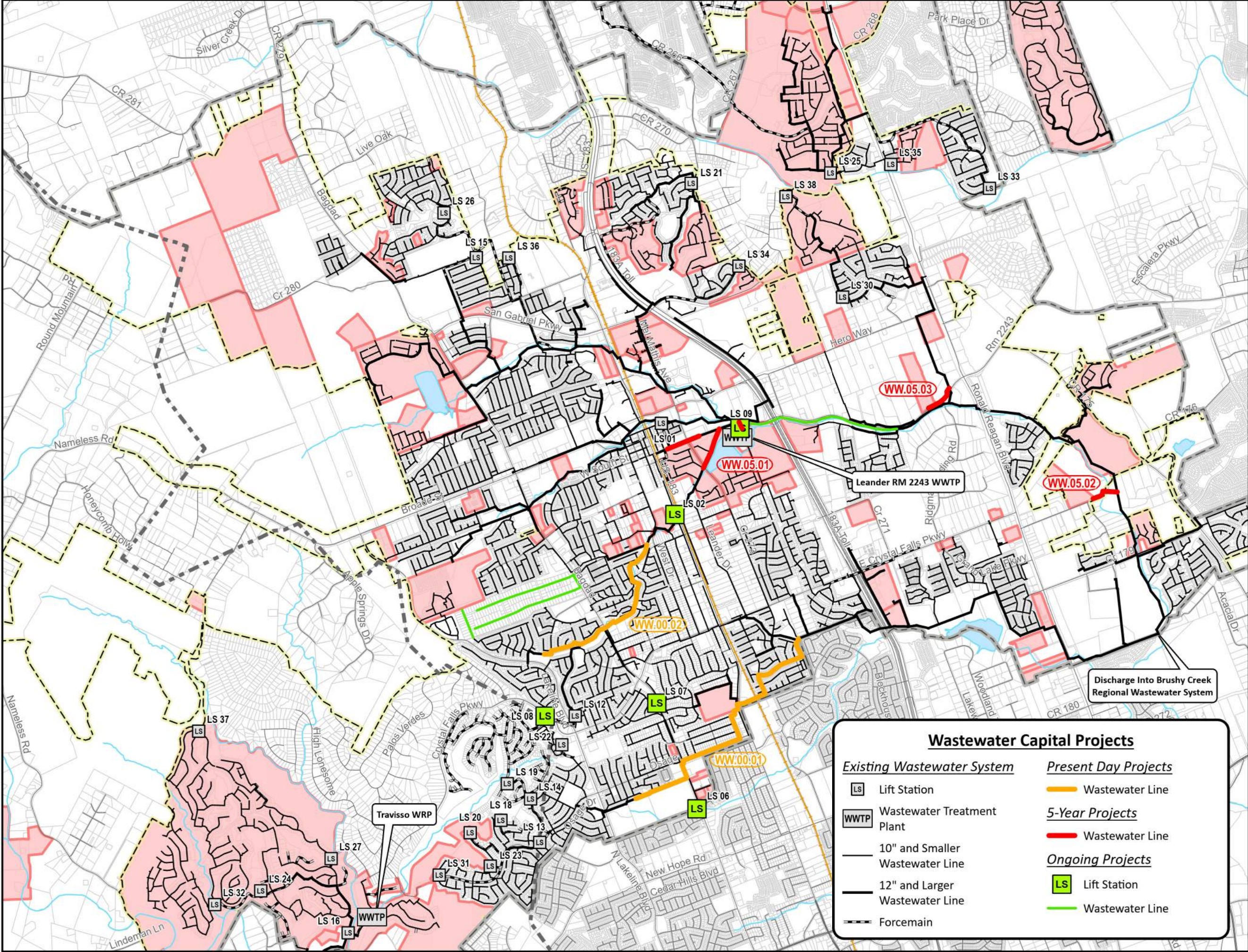
- Road
- Railroad
- Creek/Stream/River
- Lake
- Leander City Limits
- Leander ETJ
- County Boundary
- 5-Year Projected Development



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Miles

Date: 4/26/2024



Wastewater Capital Projects

Existing Wastewater System

- LS Lift Station
- WWTP Wastewater Treatment Plant
- 10" and Smaller Wastewater Line
- 12" and Larger Wastewater Line
- Forcemain

Present Day Projects

- Wastewater Line

5-Year Projects

- Wastewater Line

Ongoing Projects

- LS Lift Station
- Wastewater Line

6.6 10-year Projects

10-year projects (those projects requiring attention under 10-year growth conditions) are presented in Figure 6-3. Further description of key 10-year projects is provided below.

Benbrook Interceptor (WW.10.01)

The Benbrook Interceptor line is a segment of the North Brushy Creek Interceptor that is approximately 8,500 ft in length and is located in northwest Leander, from Bagdad Rd to the east of Highway 183 and the railroad tracks. This project is already identified as a CIP project in Leander's FY2024 CIP as WW.41. This interceptor is predicted to experience flooding and surcharging in the 10-year growth model, due to heavily concentrated growth anticipated in the northwest area of Leander by that time horizon. This region of Leander anticipates significant growth over the next 20 years, with development extending upstream of the Benbrook Interceptor. A portion of this growth is conservatively estimating that on-site septic facilities (OSSF) will be integrated into the City's service network over the next 20 years. The interceptor currently has 15" and 21" lines, and it is recommended to upsize to a pipe diameter range of 27"-33".

Collaborative Way (WW.10.02) and N Bagdad Rd Lift Station (WW.10.11)

In the northwest area of Leander, there are anticipated 10- and 20-year growth areas, located west of N Bagdad Rd. The proposed N Bagdad Lift Station is intended to accommodate this future growth and convey flow through a force main running south along Bagdad Road to connect to the existing line flowing east along Collaborative Way (Figure 6-3). The section of existing gravity pipe extending to Lift Station 15 along Collaborative Way is proposed to be upsized from 8-12" pipes to 18" pipe. The true timing and necessity of these projects will heavily depend on actual growth to the north and west of Collaborative Way and N Bagdad Rd.

San Gabriel West Regional Lift Station Ph 1 (WW.10.14) and Decommissioning of Lift Station #15, #26, #36 (WW.10.15)

Lift stations #15, #26, and #36 are recommended for decommissioning, and their flow redirected by gravity to the proposed San Gabriel West Regional Lift Station. This regional lift station is designed to accommodate the anticipated growth over both 10 and 20 years, with an estimated maximum two-hour peak flow of 1.15 MGD. An 8-inch force main would be necessary to meet the force main velocity requirements outlined by the Texas Commission on Environmental Quality (TCEQ). Twenty-year growth is also expected to be served by the LS and would therefore require pump upgrades and force-main upsizing in the 20-yr time horizon.

South Brushy Creek Interceptor (WW.10.03)

The South Brushy Creek Interceptor is located in central Leander and flows to the east along the Brushy Creek south of Hero Way and north of South St. A segment of the South Brushy Creek Interceptor met critical surcharge criteria in the 10-year design storm results

and worsened to flooding by the 20-yr design storm. The segment of pipe proposed to be upsized to 15"-24" pipe begins to the east of Bagdad Rd and ends when it reaches Broade St.

10-year Extension Projects Summary

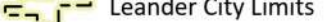
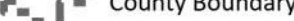
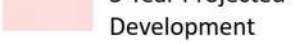
Growth is expected throughout Leander by the 10-year time horizon, and several 8" gravity lines are proposed to tie future growth into the system (WW.10.04 -WW.10.07). A 12" gravity extension is proposed to service new growth in southwest Leander near the Mason Hills neighborhood (WW.10.08). Due to the heavily concentrated growth anticipated in northwest Leander, 18"-21" gravity extensions were proposed to cater to that growth (WW.10.09 & WW.10.10). In northeast Leander, the San Gabriel East Regional Lift Station and the associated gravity line and force main are proposed to serve 10-year growth (WW.10.12 & WW.10.13). For further information on extension projects, refer to Table 6-4.

City of Leander
Williamson County, TX

FIGURE 6-3:
10-YEAR PROJECTS



Legend

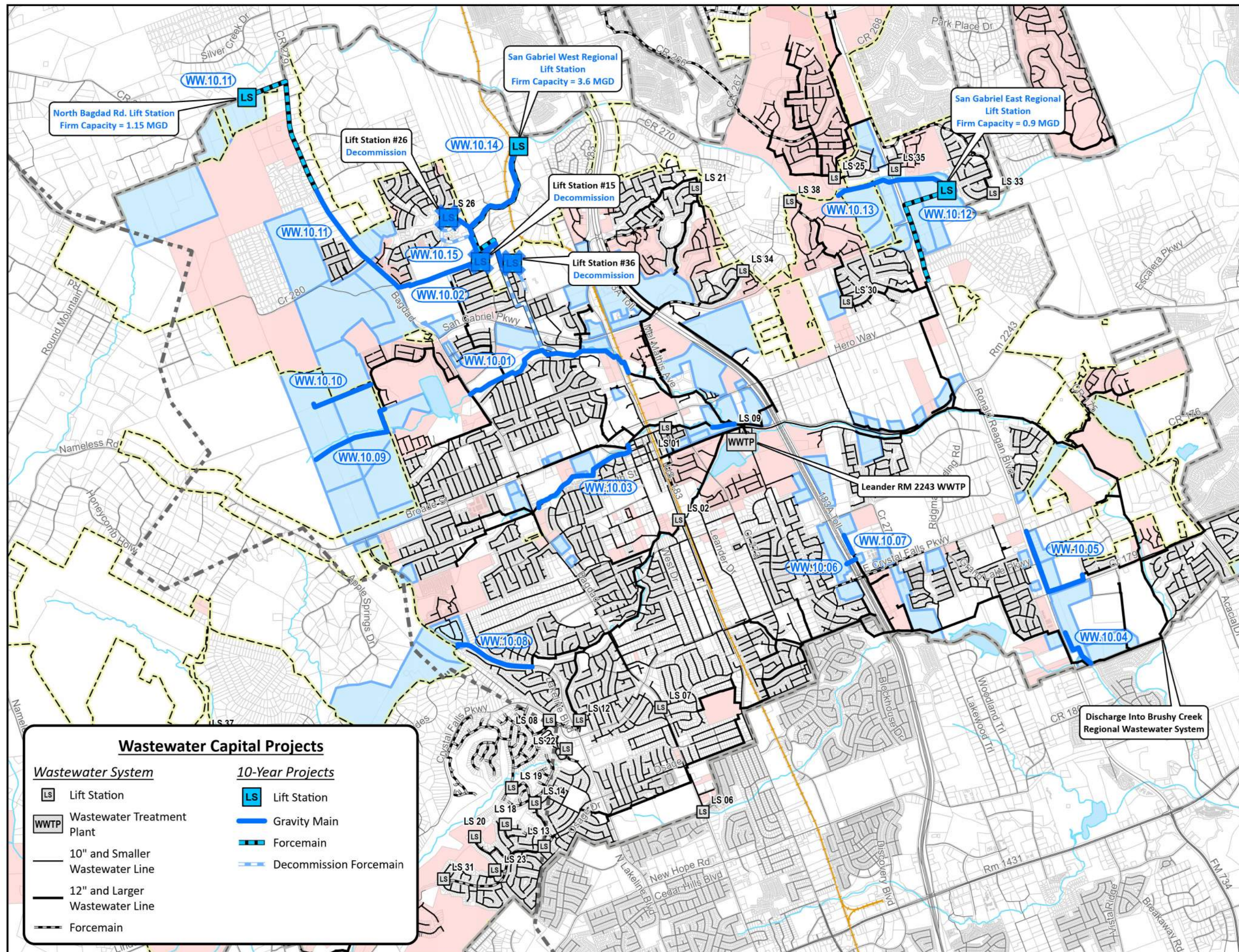
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-  Railroad
-  Creek/Stream/River
-  Lake
-  Leander City Limits
-  Leander ETJ
-  County Boundary
-  5-Year Projected Development
-  10-Year Projected Development



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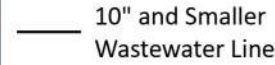
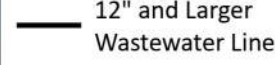
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Wastewater Capital Projects

Wastewater System

-  Lift Station
-  Wastewater Treatment Plant
-  10" and Smaller Wastewater Line
-  12" and Larger Wastewater Line
-  Force main

10-Year Projects

-  Lift Station
-  Gravity Main
-  Force main
-  Decommission Force main

6.7 20-year Projects

20-year projects (those projects requiring attention under 20-year growth conditions) are presented in Figure 6-4. Further description of these projects is provided below.

Devine Lake (WW.20.01)

The Devine Lake project proposes upgrading the pipe segment preceding the Benbrook Interceptor from 18 inches to 27 inches in diameter. This stretch of pipe was predicted to undergo flooding and excessive surcharging in the 20-year time horizon (Table 6-3) due to high rates of upstream growth and relatively flat slopes along this section of sewer. It is advised to analyze the actual extent of upstream growth during the design phase to verify project necessity and to confirm that the unmodeled upstream pipes can adequately fulfill capacity requirements.

North Brushy Creek Interceptor (WW.20.02)

The segment of the North Brushy Creek Interceptor downstream of the Benbrook Interceptor, extending all the way to the RM2243 WWTP, is proposed to be upsized within the 20-year timeframe. Currently, this 6,000 ft pipe segment has diameters ranging from 21" - 30", and it is recommended to increase sizes to 33" - 36". Although this pipe segment was not initially identified as a concern area in the growth model, it has been selected for upgrade due to the existing pipes' inability to handle the anticipated 20-year free flow peaks. This implies that upon completion of the upstream projects such as the Devine Lake, Benbrook Interceptor and other future extension projects in northwest Leander, a greater volume of flow will be directed to the North Brushy Creek Interceptor. It is recommended that targeted flow metering be performed closer to this time horizon to confirm necessity of this project.

North Ronald Reagan (WW.20.03)

Flooding and surcharging in northeast Leander, particularly near the intersection of Ronald Reagan Blvd and Hero Way, resulted during the 20-year growth model run. The N Ronald Reagan project will address these concerns and will span from directly downstream of the proposed San Gabriel East Regional Lift Station force main to the point where the interceptor crosses Hero Way. This 2,500 ft pipe segment currently ranges from 8" to 12" in diameter and is recommended to be upgraded to a diameter of 12" to 15".

20-year Extension Projects Summary

The 20-year extension projects mainly consist of gravity line extensions to serve future growth in northwest and northeast Leander, where a majority of 20-year growth is anticipated. Refer to Table 6-4 for further description of the 20-year extension projects. In northeast Leander, Lift Station #38 is proposed to be decommissioned to flow by gravity to the proposed San Gabriel East Regional LS (WW.20.13). There are several on-site septic facilities (OSSF) in northwest Leander that are conservatively assumed to be serviced by City sewer by the 20-year time horizon.

City of Leander
Williamson County, TX

FIGURE 6-4:
20-YEAR PROJECTS



Legend

- Road
- Railroad
- Creek/Stream/River
- Lake
- Leander City Limits
- Leander ETJ
- County Boundary
- 5-Year Projected Development
- 10-Year Projected Development
- 20-Year Projected Development

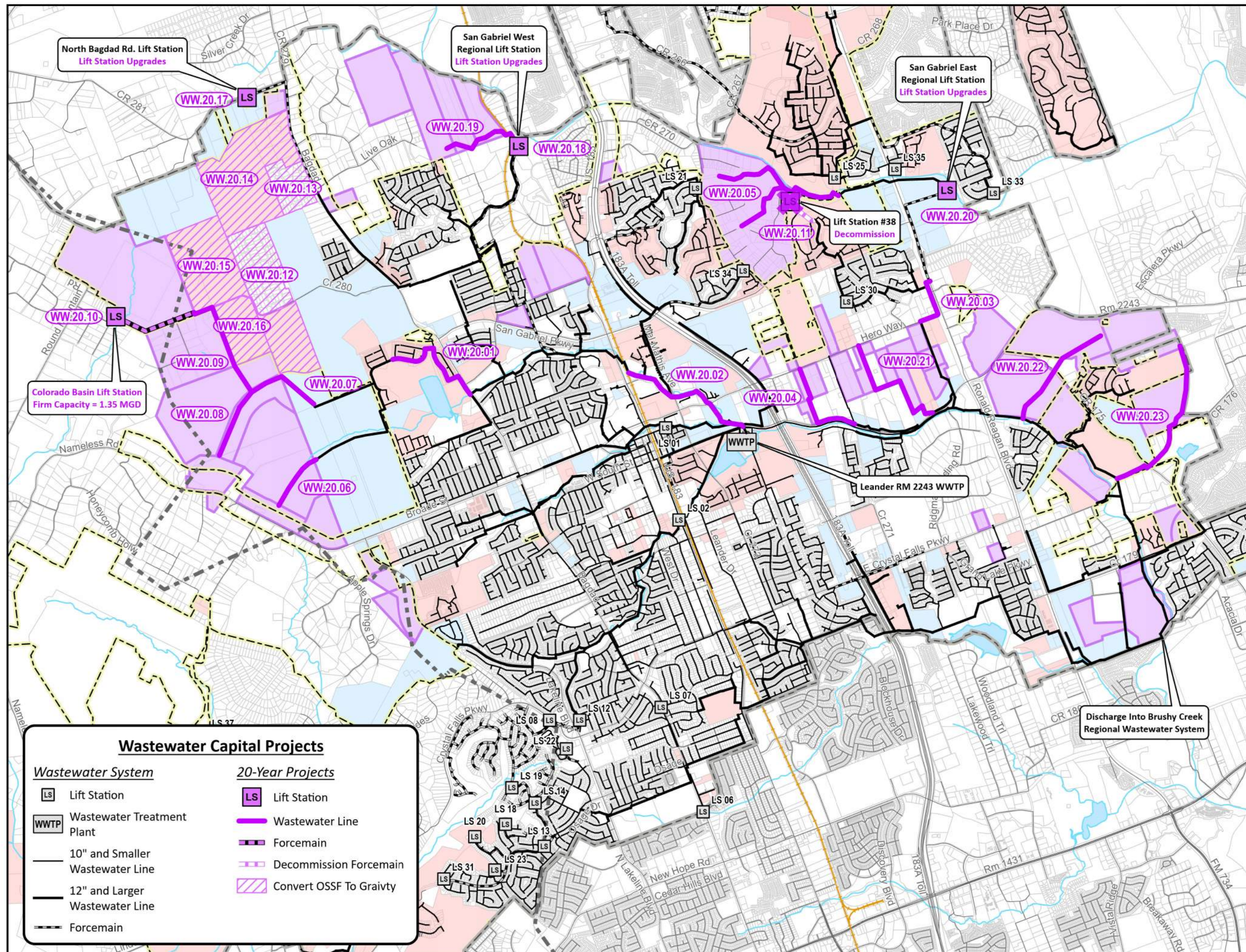


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Date: 6/11/2024

GBA



Wastewater Capital Projects

Wastewater System

- LS Lift Station
- WWTP Wastewater Treatment Plant
- 10" and Smaller Wastewater Line
- 12" and Larger Wastewater Line
- Forcemain

20-Year Projects

- LS Lift Station
- Wastewater Line
- Forcemain
- Decommission Forcemain
- Convert OSSF To Gravity

6.8 Relief Project Prioritization

Relief-type projects for existing interceptors were prioritized based on various factors, such as the number of manholes meeting critical surcharge criteria, total flood loss, and the maximum ratio of 20-year free flow capacity to the existing pipe's full flow capacity. Table 6-3 presents these factors for each relief-type project, which were then ranked within each time horizon.

Future extension projects were not prioritized in this way because they were not modeled and are heavily driven by development demands. Relief-type projects are more dependent on modeling results and the condition and capacity of existing interceptors. Extension-type projects should proceed as development requires them, while relief-type projects should proceed after modeling and monitoring confirm increasing capacity risks in the existing sewers.

Table 6-3: Relief Project Prioritization

Project ID	Project Name	Time Horizon	No. of MHs Exceeding Surcharge Criteria ¹	Total Flood Volume ¹ (MG)	Max. Ratio 20-yr Free Flow Peak: Exist. Capacity	Relief Project Priority Rank
WW.00.01	Block House Interceptor Ph. 1	Present Day	38	0.44	9.45	1
WW.00.02	Mason Creek Interceptor	Present Day	14	0.01	2.01	2
WW.05.01	Horizon Lake Interceptor	5-yr	3	0	3.27	3
WW.10.01	Benbrook Interceptor	10-yr	20	0.24	4.77	4
WW.10.02	Collaborative Way	10-yr	20	0.12	4.23	5
WW.10.03	South Brushy Creek Interceptor	10-yr	7	0	1.97	6
WW.20.01	Devine Lake	20-yr	33	1.36	9.55	7
WW.20.02	North Brushy Creek Interceptor	20-yr	N/A	N/A	2.37	8
WW.20.03	North Ronald Reagan	20-yr	5	0.01	1.23	9

1) Data presented is derived from the model corresponding to the designated time horizon for each project.

6.9 Extension Projects Summary

Table 6-4 provides further description of all extension-type projects conceptualized for the plan. Extension-type projects are those that extend City sewer service out beyond current service limits with new interceptors, lift stations, and force main. The projects are primarily development and growth-driven.

Leander, TX Collection System Master Plan
Table 6-4: Extension Projects Summary

Project Name	Project ID	Time Horizon	Project Description
Lonestar Landing WW Improvements	WW.05.02	5-year	This project provides wastewater service to the Lonestar Landing subdivision which includes an 8" Gravity Main extension that connects to the Brushy Creek Interceptor.
RM 2243 to Hero Way WW Improvements - East Segment Ph. 1	WW.05.03	5-year	This project provides wastewater service to the M Ranch Townhouses along with future developments. It will include a 12" Gravity Main extension on the north ROW side of RM 2243 that will connect to the Brushy Creek Interceptor.
South Ronald Reagan Blvd. WW Improvements	WW.10.04	10-year	This project provides wastewater service to Multi-Use Corridor developments. It will include an 8" Gravity Main extension on the east ROW side of Ronald Reagan Blvd. that will connect to the Block House Creek Interceptor.
Journey Pkwy and Ronald Reagan Blvd WW Improvements	WW.10.05	10-year	This project includes a 8" Gravity Main extension on the north ROW side of Journey Pkwy. and along the east ROW side of Ronald Reagan Blvd that will connect to the Catalina Ranch subdivision wastewater system.
US 183-A WW Improvements Ph. 1	WW.10.06	10-year	This project provides wastewater service to Multi-Use Corridor developments. It will include an 8" Gravity Main extension that will be bored under US 183-A.
US 183-A WW Improvements Ph. 2	WW.10.07	10-year	This project provides wastewater service to Multi-Use Corridor developments. It will include an 8" Gravity Main extension along the east ROW side of US 183-A.
Linda Hall WW Improvements	WW.10.08	10-year	This project provides wastewater service to the Linda Hall subdivision in western Leander which includes a 12" Gravity Main connecting to the Mason Creek Interceptor.
North Fork Brushy Creek WW Interceptor Improvements Ph. 1	WW.10.09	10-year	This project provides wastewater service to Neighborhood Residential developments in the western part of town. This interceptor includes a 18" Gravity Main that will connect to the North Brushy Creek Wastewater Interceptor.
North Brushy Creek WW Interceptor Improvements	WW.10.10	10-year	This project provides wastewater service to Neighborhood Residential developments in the western part of town. This interceptor includes a 18" Gravity Main that will connect to the North Brushy Creek Wastewater Interceptor.
North Bagdad Rd. Lift Station Ph. 1	WW.10.11	10-year	This project includes a 1.15 MGD Lift Station, a 10" Force main and 18" Gravity Main that will serve Neighborhood Residential developments on the north side of town along with future septic system slated to be converted to conventional wastewater systems in the future. The new Lift Station and Force main will pump to the proposed Gravity Main. Pumps will need to be replaced to accommodate 1.44 MGD by the 20-Year Time Horizon.
San Gabriel East Regional Lift Station	WW.10.12	10-year	This project includes a 0.9 MGD Lift Station and an 8" Force main that will serve Neighborhood Center and Residential developments on the north side of town. The new Lift Station and Force main will pump to the Brushy Creek Interceptor. Pumps will need to be replaced to accommodate 2.3 MGD by the 20-Year Time Horizon.
San Gabriel River WW Interceptor Improvements Ph. 1	WW.10.13	10-year	This project provides wastewater service to Neighborhood Center and Residential developments in the northern part of town. This interceptor includes a 15" and 18" Gravity Main that will connect to the proposed Ronald Reagan Blvd. Lift Station.
San Gabriel West Regional Lift Station Ph. 1	WW.10.14	10-year	This project includes a 1.15 MGD Lift Station and an 8" Force main that will serve Neighborhood Residential developments on the north side of town. The new Lift station and Force main will pump to the North Brushy Creek Wastewater Interceptor.
Lift Station #15, #26, and #36 Decommission	WW.10.15	10-year	This project includes the decommissioning of Lift Station #15, #26, #36, and 8", 12", and 21" Gravity Mains connecting to the proposed San Gabriel Creek West Lift Station.
RM 2243 to Hero Way WW Improvements - West Segment	WW.20.04	20-year	This project provides wastewater service to Employment Center developments north of RM 2243 up to Hero Way. It will include a 8"-12" Gravity Main extension on the north ROW side of RM 2243 that will connect to the Brushy Creek Interceptor.
San Gabriel River WW Interceptor Improvements Ph. 2	WW.20.05	20-year	This project provides wastewater service to Neighborhood Residential developments in the northern part of town. This interceptor includes a 15" Gravity Main that will connect to the San Gabriel River Wastewater Interceptor, along with two branches to serve residential areas west of Palmera Ridge.
North Fork Brushy Creek WW Interceptor Improvements Ph. 2	WW.20.06	20-year	This project provides wastewater service to Multi-Use Corridor and Neighborhood Residential developments in the western part of town. This interceptor includes a 12" and 15" Gravity Main that will connect to the North Fork Brushy Creek Wastewater Interceptor.
San Gabriel Pkwy. WW Interceptor Ph. 1	WW.20.07	20-year	This project provides wastewater service to Multi-Use Corridor and Neighborhood Center developments in the western part of town. This interceptor includes a 18" Gravity Main that will connect to the North Brushy Creek Wastewater Interceptor.
San Gabriel Pkwy. WW Interceptor Ph. 2	WW.20.08	20-year	This project provides wastewater service to Multi-Use Corridor and Neighborhood Center developments in the western part of town. This interceptor includes a 12" Gravity Main that will connect to the San Gabriel Pkwy. Wastewater Interceptor Phase 1.
Lakeline Blvd. WW Improvements	WW.20.09	20-year	This project provides wastewater service to Neighborhood Residential developments in the western part of town. This interceptor includes a 15" Gravity Main that will connect to the San Gabriel Pkwy Wastewater Interceptor Phase 1.
Colorado Basin Lift Station	WW.20.10	20-year	This project includes a 1.35 MGD Lift Station and a 10" Force main that will serve Neighborhood Residential developments on the north side of town. The new Lift station and Force main will pump to the proposed Lakeline Blvd. Wastewater Interceptor.
Lift Station #38 Decommission	WW.20.11	20-year	This project includes the decommissioning of Lift Station #38 and a 12" Gravity Main connecting to the proposed San Gabriel Creek Wastewater Interceptor.
Greatwood WW Collection System Improvements	WW.20.12	20-year	Design and installation of wastewater gravity sewer lines, manholes, and stub-outs to each lot within the Greatwood subdivision.
Whitt Ranch Collection System Improvements	WW.20.13	20-year	Design and installation of wastewater gravity sewer lines, manholes, and stub-outs to each lot within the Whitt Ranch subdivision.
Sullivan Tract Collection System Improvements	WW.20.14	20-year	Design and installation of wastewater gravity sewer lines, manholes, and stub-outs to each lot within the Sullivan Tract subdivision.
Leander Estates Collection System Improvements	WW.20.15	20-year	Design and installation of wastewater gravity sewer lines, manholes, and stub-outs to each lot within the Leander Estates subdivision.
Hilltop Ranch Collection System Improvements	WW.20.16	20-year	Design and installation of wastewater gravity sewer lines, manholes, and stub-outs to each lot within the Hilltop Ranch subdivision.
North Bagdad Rd. Lift Station Ph. 2	WW.20.17	20-year	This project includes two replacements pumps to meet the 20-year capacity of 1.44 MGD.
San Gabriel West Regional Lift Station Ph. 2	WW.20.18	20-year	This project includes lift station upgrades to accommodate 4.68 MGD.
San Gabriel West WW Improvements	WW.20.19	20-year	This project provides wastewater service to Neighborhood Residential developments in the northern part of town. This interceptor includes a 8" and 18" Gravity Main that will connect to the San Gabriel West Regional Lift Station.
San Gabriel East Regional Lift Station Ph. 2	WW.20.20	20-year	This project includes lift station upgrades and 10" Force main to accommodate 2.30 MGD.
RM 2243 to Hero Way WW Improvements - East Segment Ph. 2	WW.20.21	20-year	This project provides wastewater service to Employment Center developments north of RM 2243 up to Hero Way. It will include a 8"-12" Gravity Main extension on the north ROW side of RM 2243 that will connect to the RM 2243 to Hero Way WW Improvements - East Segment Phase 1.
CR 175 and RM 2243 WW Improvements	WW.20.22	20-year	This project provides wastewater service to neighborhood residential, employment center, and activity center developments north of Brushy Creek in the vicinity of the intersection of County Road 175 and RM 2243. It will include a 8"-12" Gravity Main extension north of Brushy Creek that will connect to the existing Brushy Creek interceptor.
CR 175 and CR 176 WW Improvements	WW.20.23	20-year	This project provides wastewater service to neighborhood residential and employment center developments north of Brushy Creek in the vicinity of the intersection of County Road 175 and County Road 176. It will include a 8"-12" Gravity Main extension north of Brushy Creek that will connect to the existing Brushy Creek interceptor.

6.10 Conceptual Plan for the Northwest Region of Leander

A conceptual plan was developed for the northwest region of Leander due to significant growth being anticipated for this region. The varied terrain and topography of this region necessitates the construction of several lift stations and interceptors to facilitate City wastewater service.

The conceptual plan is summarized in Figure 6-5 below. As part of the conceptual plan, three existing lift stations (LS 15, 26, and 36) are slated for decommissioning, allowing for gravity flow to a new regional lift station, the San Gabriel West Regional Lift Station. The decommissioning of lift stations helps reduce the City's long-term operation and maintenance costs. The timing and necessity of the San Gabriel West Regional LS will depend on several factors, including:

- 1) *Development interest west of N Bagdad Rd:* If there is increasing development interest in this area, then improvements along Collaborative Way and LS15 become more necessary. If improvements along Collaborative Way are necessary, it may be in the City's best interest to build a regional lift station at that time to avoid costly upgrades at LS15, which could then be decommissioned. But if demands for sewer service west of N Bagdad Rd are lower than projected for this report, then upgrades along Collaborative Way may not be necessary for a long time.
- 2) *Development interest west of the San Gabriel West Regional LS:* This area north/northeast of the Deerbrooke development (served by LS26) may or may not be served by City sewers, especially if any parcels are developed to be served by OSSF. If those properties are served by OSSF, it may be a long time until they wish to convert to City sewer service.

As part of the conceptual plan, another Regional LS and set of interceptors were conceptualized that would likely be needed beyond the 20-year planning horizon. Although this infrastructure was not included in the 20-year project list provided in this chapter, some capital costs were estimated. This infrastructure is represented by green lines in Figure 6-5 below, and planning-level costs are summarized in Table 6-5. These conceptual projects that fall outside the 20-year planning window offer the City a flexible plan in case growth is more than anticipated in this area and these projects are needed sooner than 20 years from now.

Table 6-5: Northwest Region Conceptual Project Costs Beyond 20-year Planning Window

Element	Pipe Size	Pipe Length (ft)	Lift Station Capacity	Estimated Capital Cost
Gravity Sewer	8"-18"	26,345		\$27,751,000
Regional Lift Station	-	-	2.3 MGD	\$3,957,000
Force Main	12"	1,150	-	\$446,000
Total		27,495		\$32,154,000

Wastewater Capital Projects

Projects Beyond 20-Year

Time Horizon

- LS** Lift Station
- Wastewater Line**
- Forcemain**
- Decommission Forcemain**

Existing Wastewater System

- LS** Lift Station
- WWTP** Wastewater Treatment Plant

Existing Wastewater System

- 10" and Smaller Wastewater Line
- 12" and Larger Wastewater Line
- Forcemain

10-Year Projects

- LS** Lift Station
- Gravity Main
- Forcemain

20-Year Projects

- LS** Lift Station
- Gravity Main
- Forcemain



City of Leander Williamson County, TX

FIGURE 6-5:
NORTHWEST CONCEPT PLAN



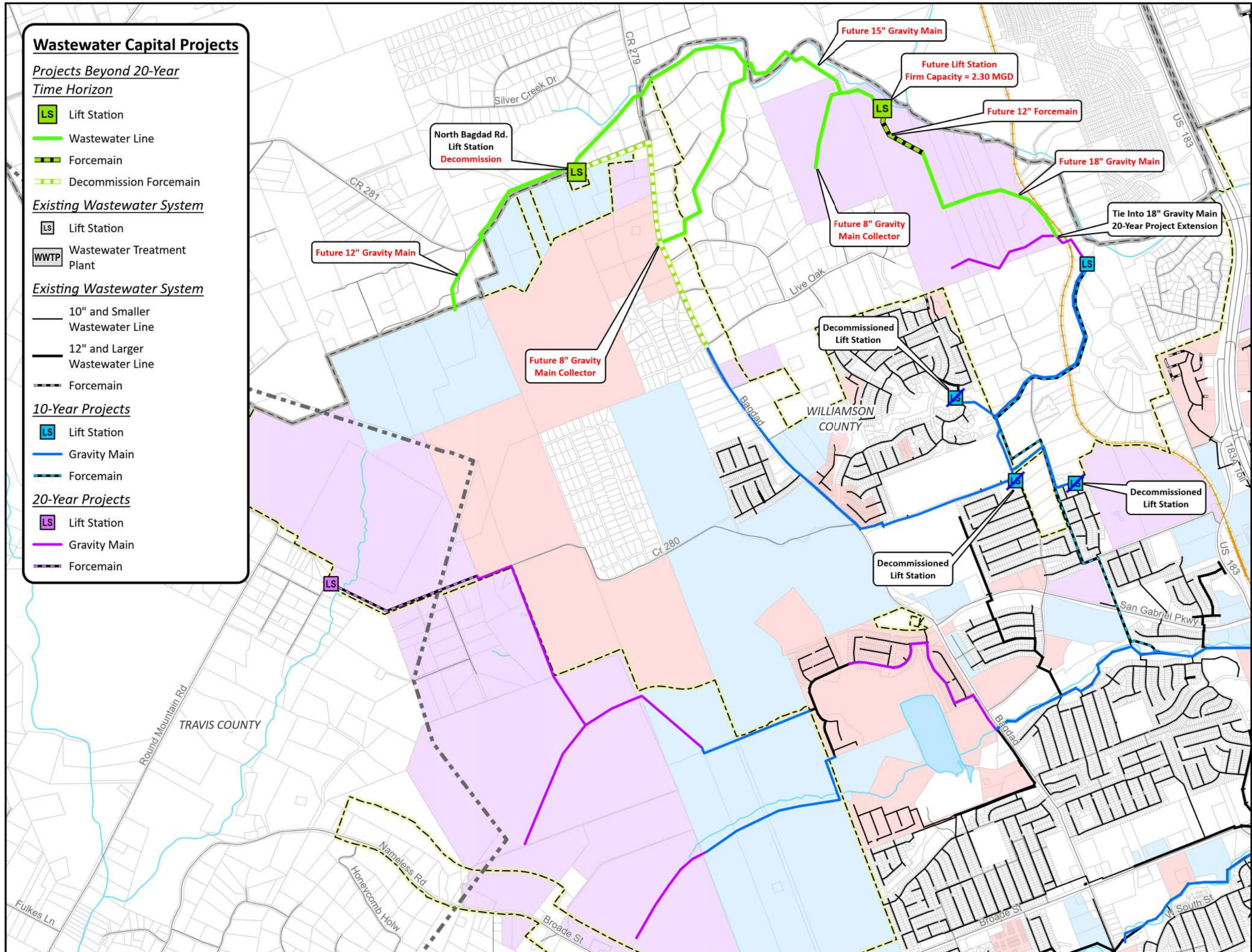
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- Railroad
- Creek/Stream/River
- Lake
- Leander City Limits
- Leander ETJ
- County Boundary
- 5-Year Projected Development
- 10-Year Projected Development
- 20-Year Projected Development

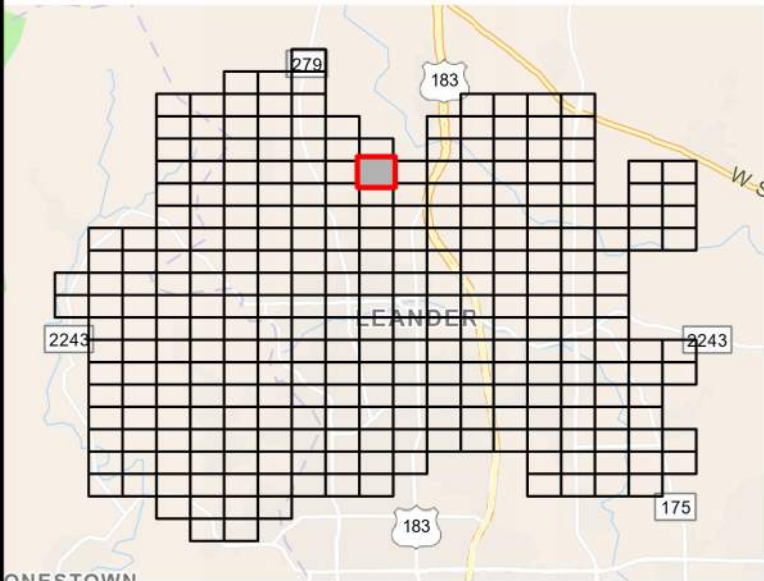
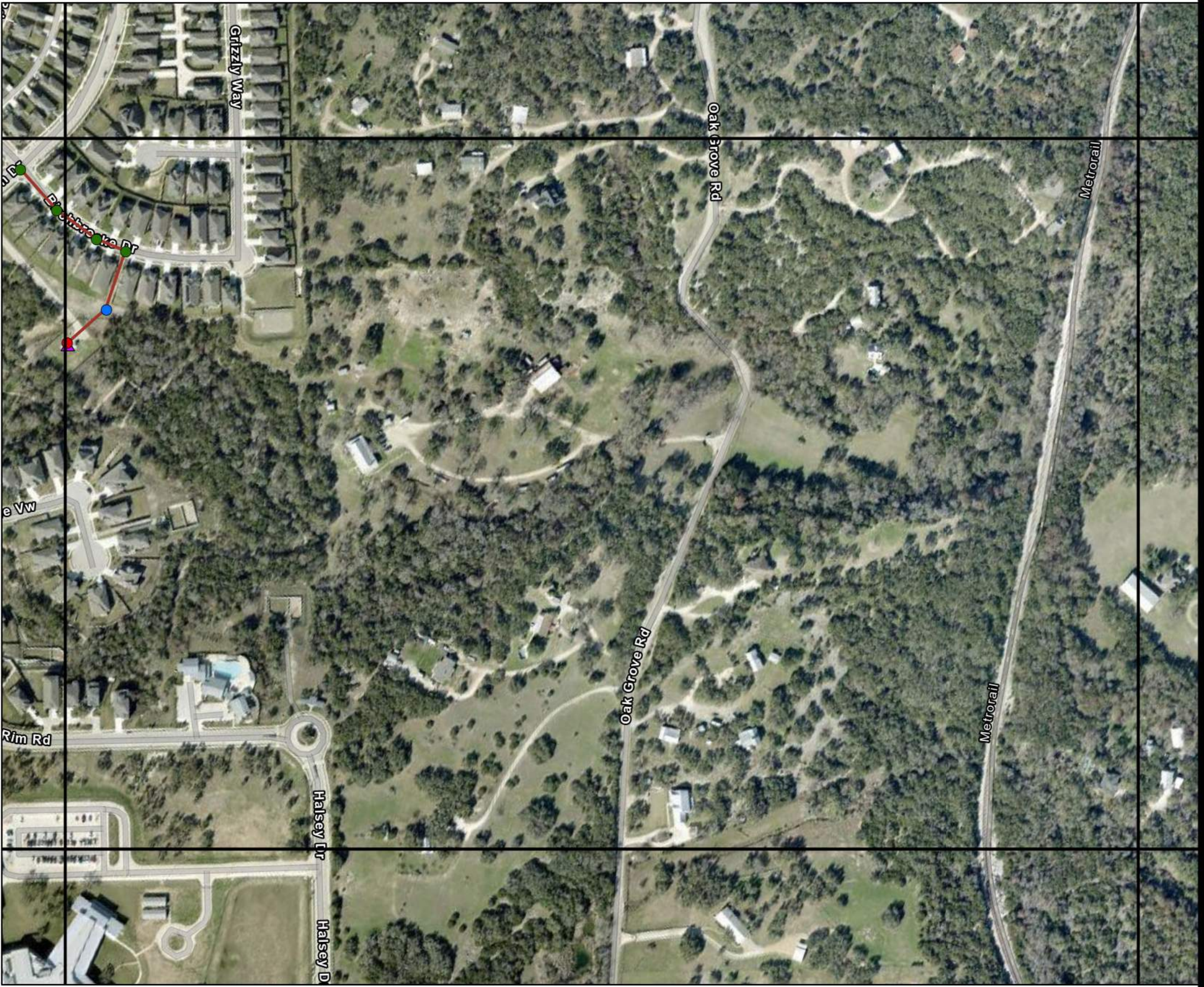


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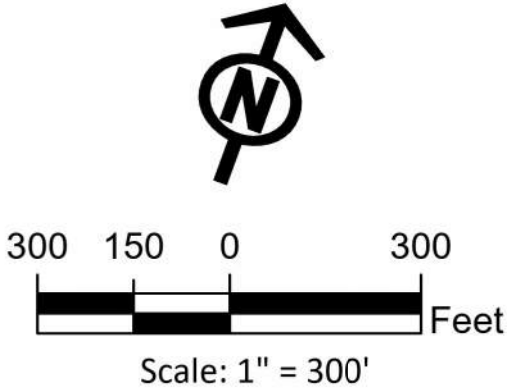
Appendix A: Manhole Survey Summary Maps



**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: F-12**

Legend

- | | |
|--------------|------------------------------|
| Lift Station | Manhole Survey Status |
| Outfall | Buried |
| Sewer Main | Could Not Access |
| | Could Not Locate |
| | Could Not Open |
| | Complete |

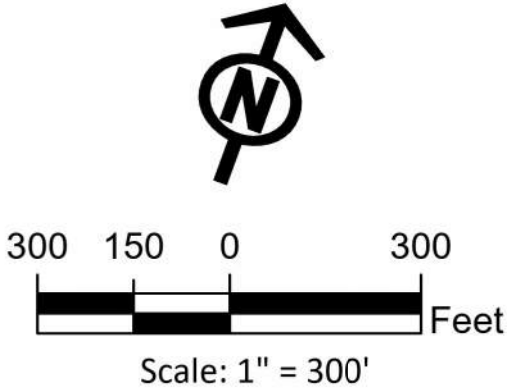


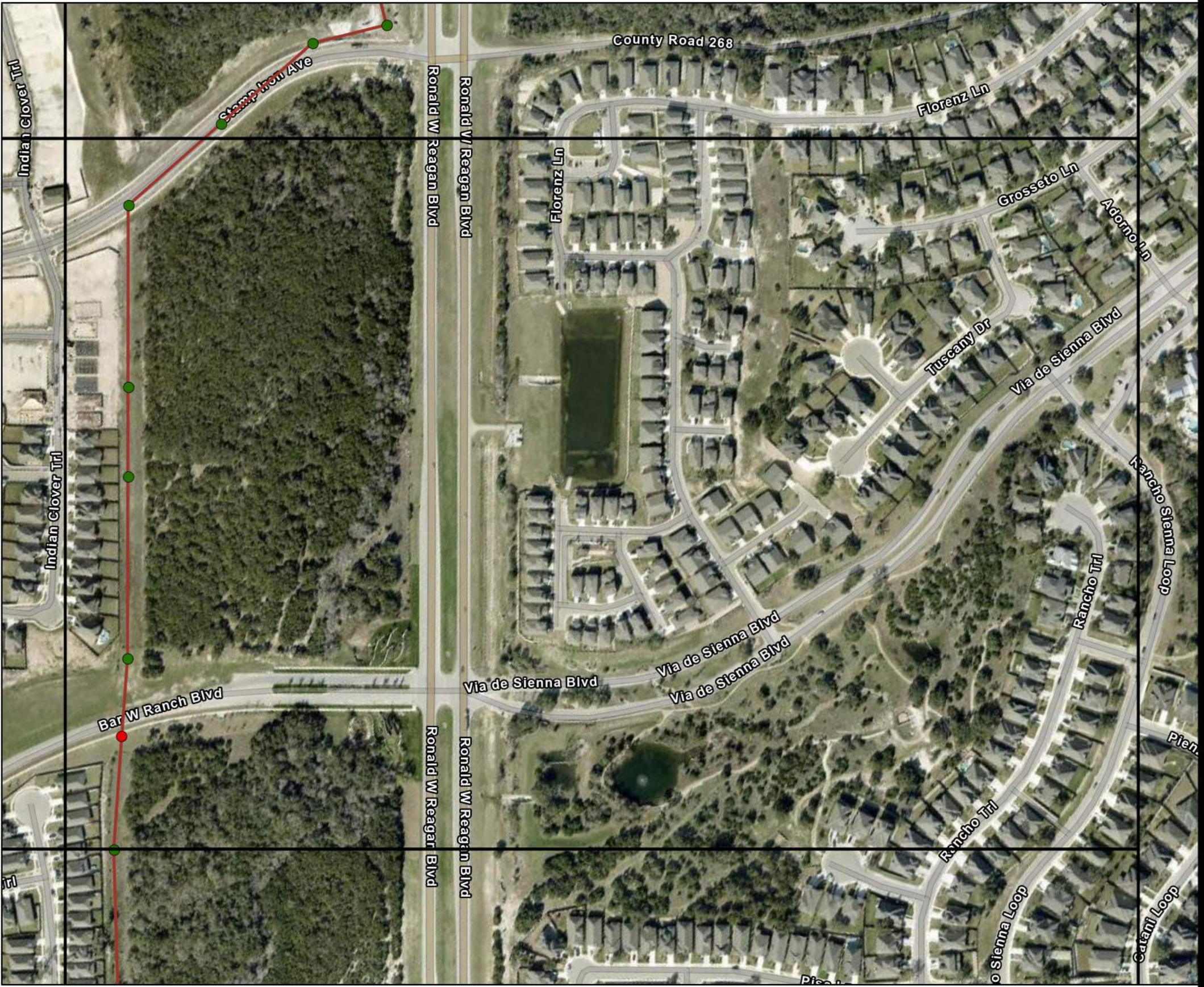


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: F-17**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

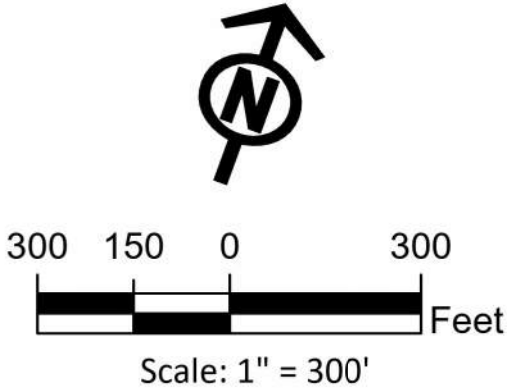


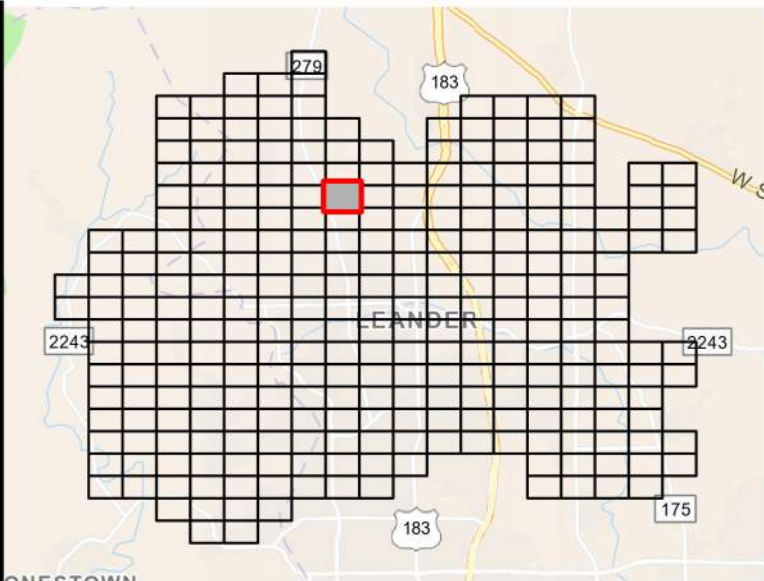


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: F-18**

Legend

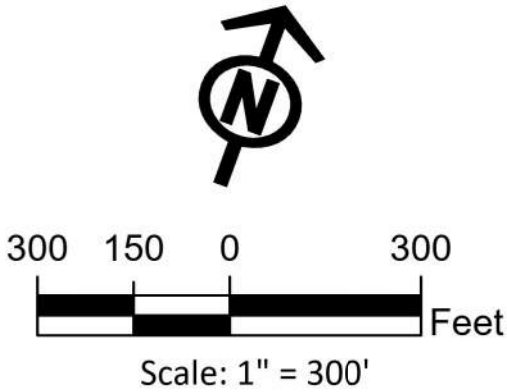
- | | |
|--------------|------------------------------|
| Lift Station | Manhole Survey Status |
| Outfall | Buried |
| Sewer Main | Could Not Access |
| | Could Not Locate |
| | Could Not Open |
| | Complete |

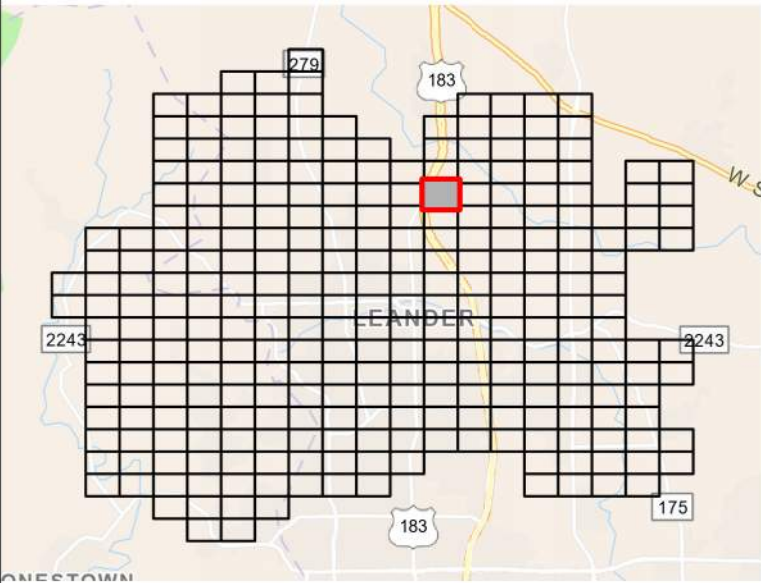
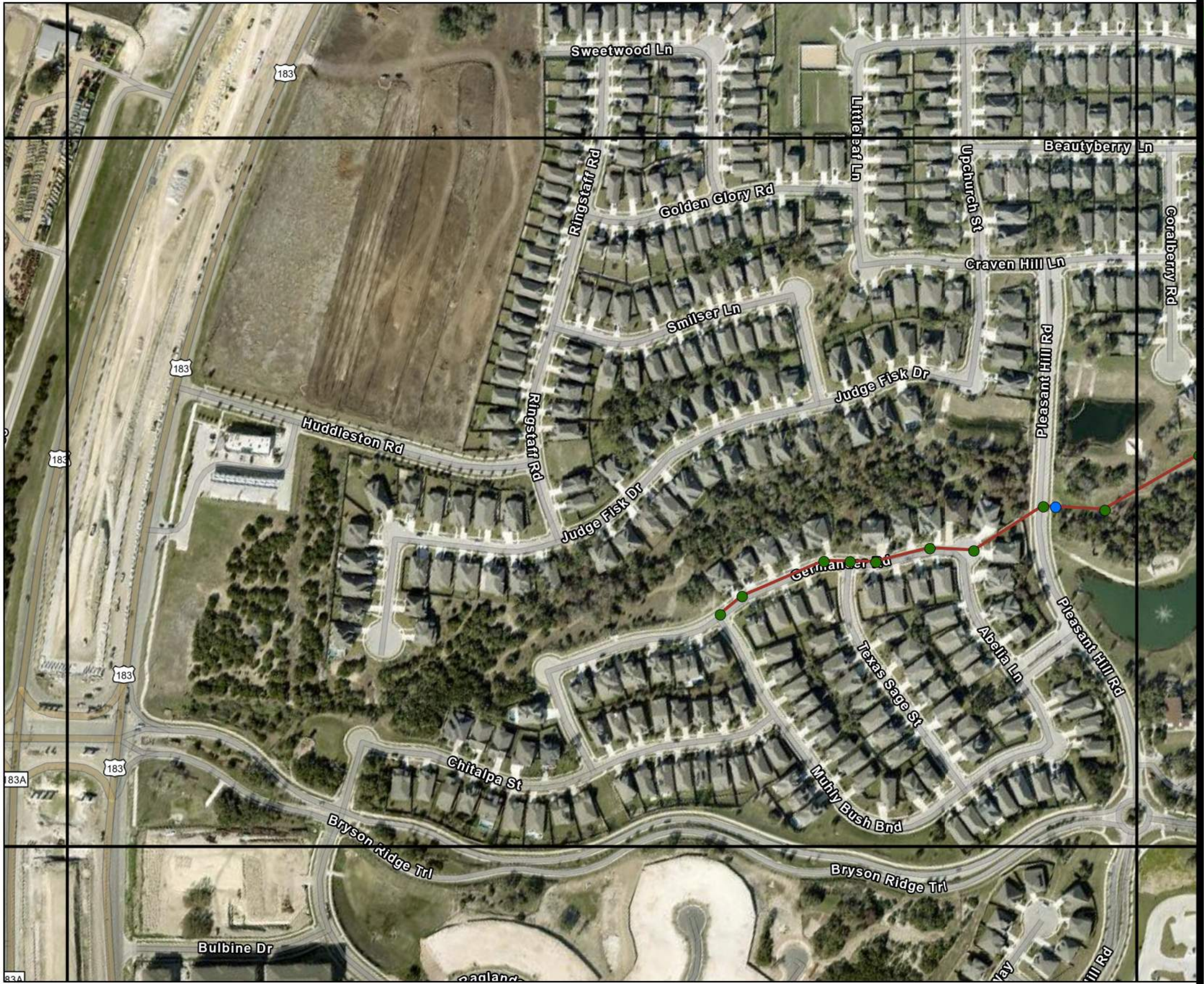




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: G-11**

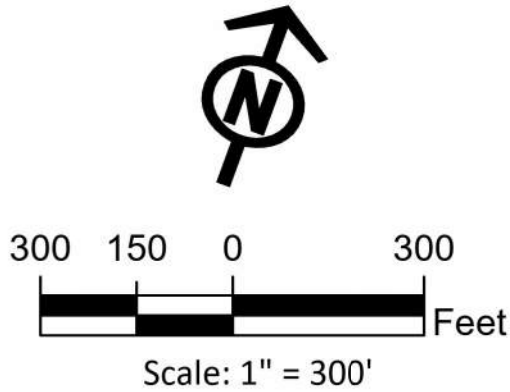
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

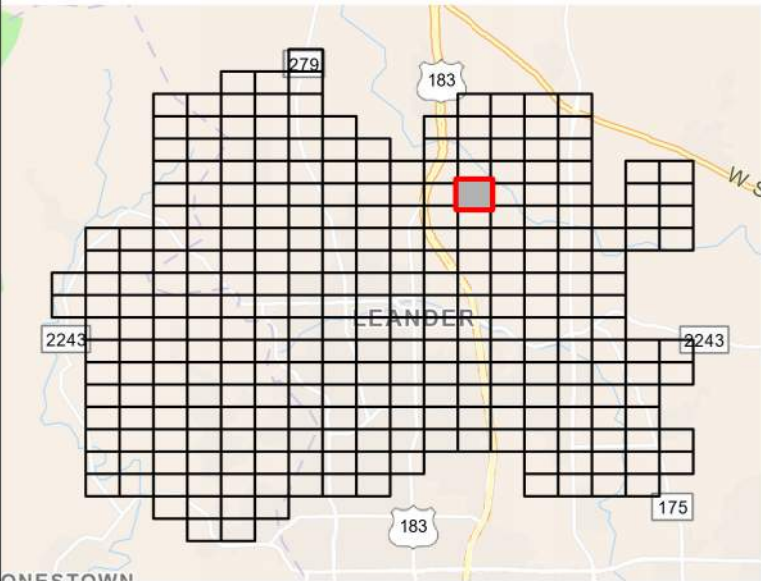
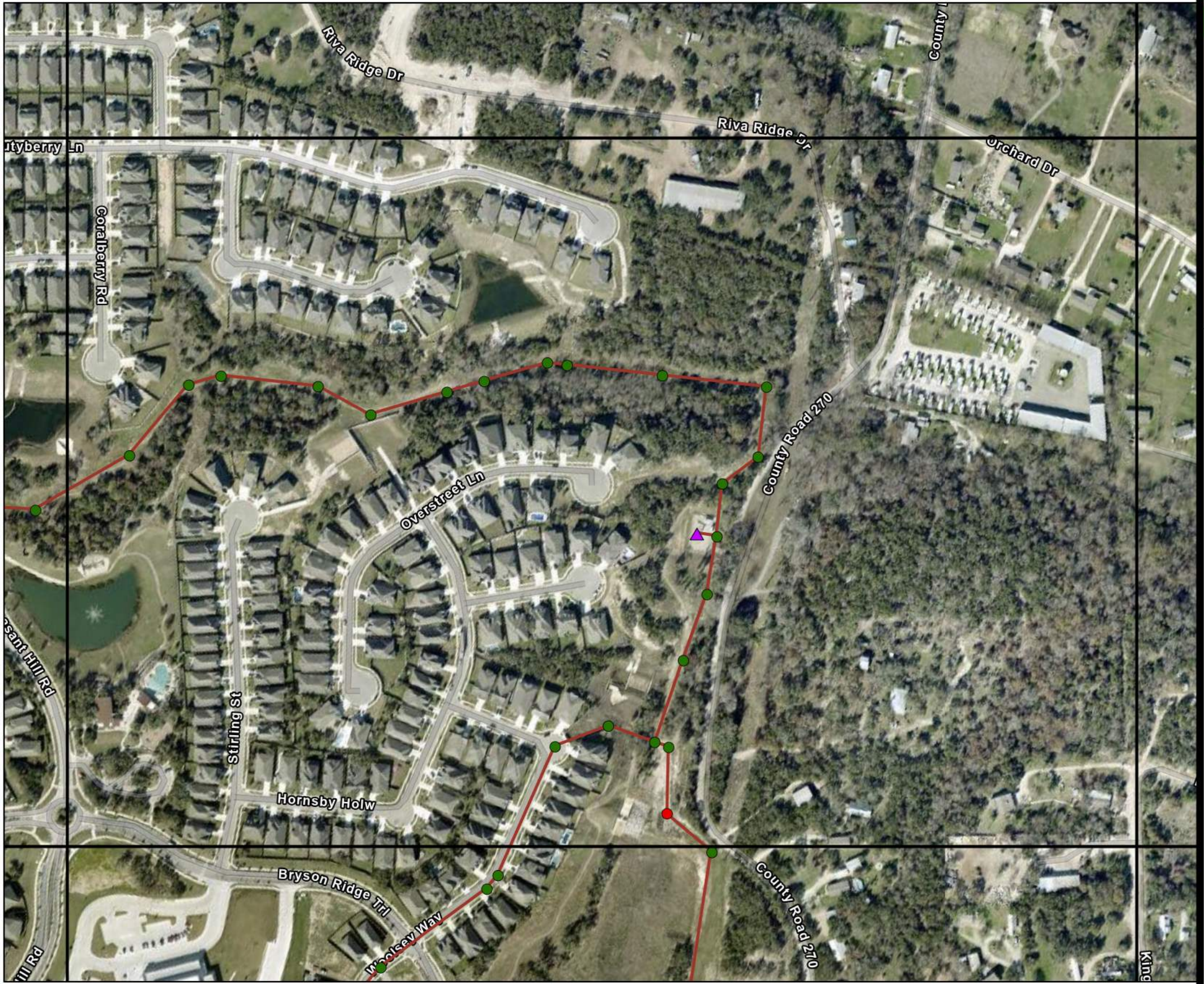




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: G-14**

- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

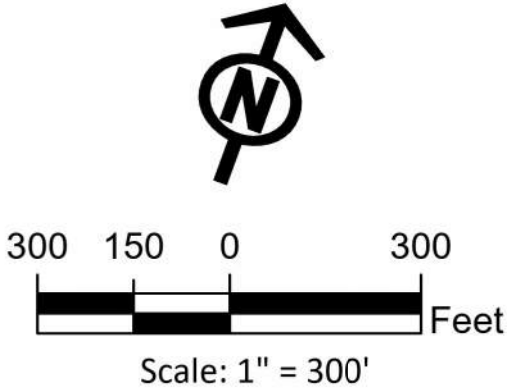


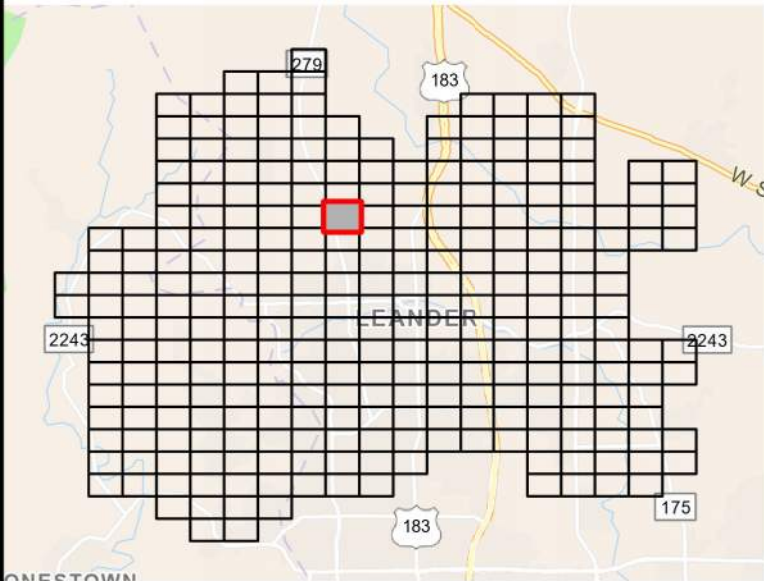
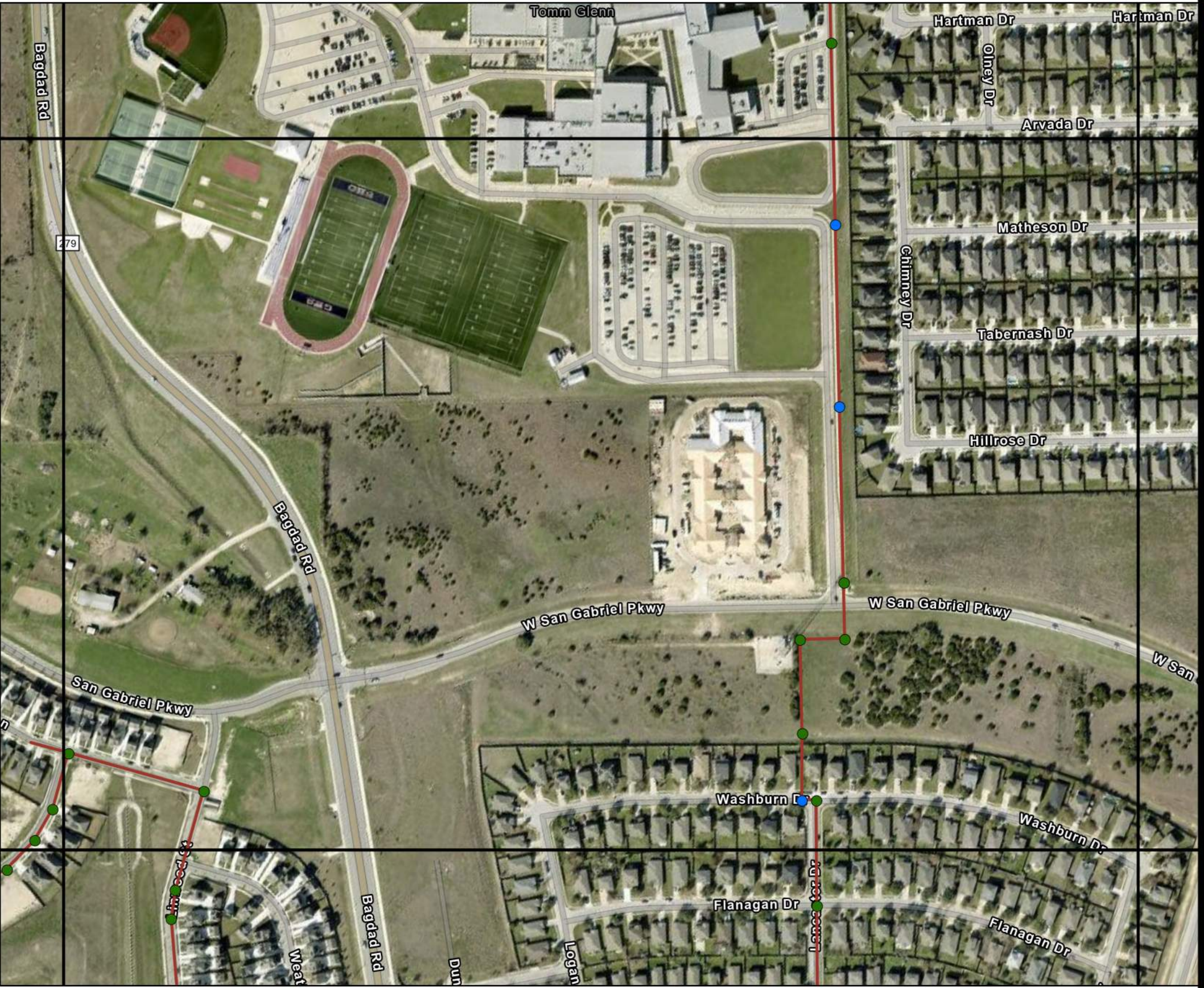


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: G-15**

Legend

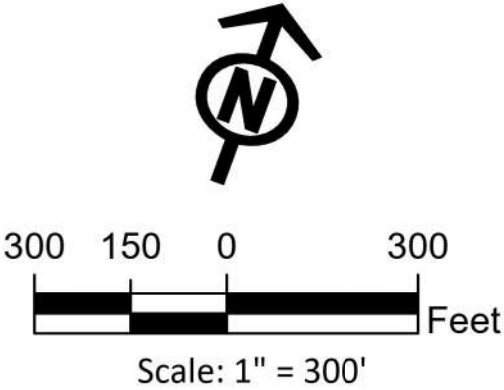
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

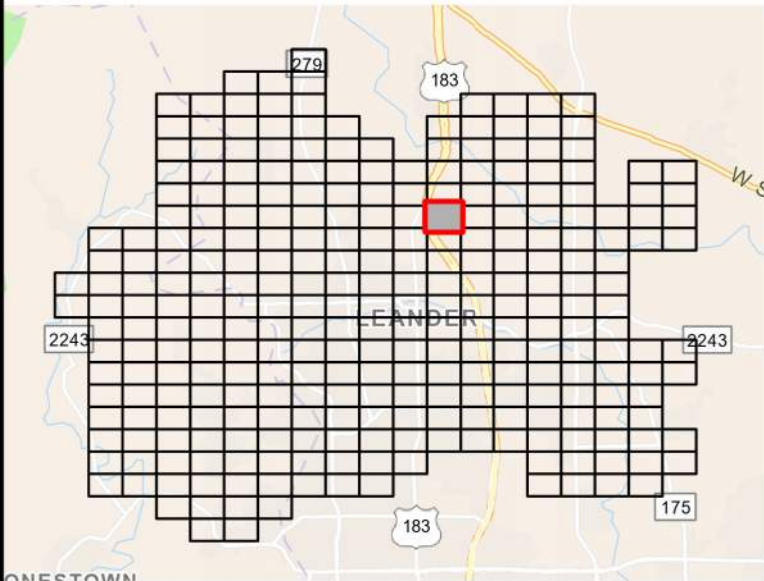
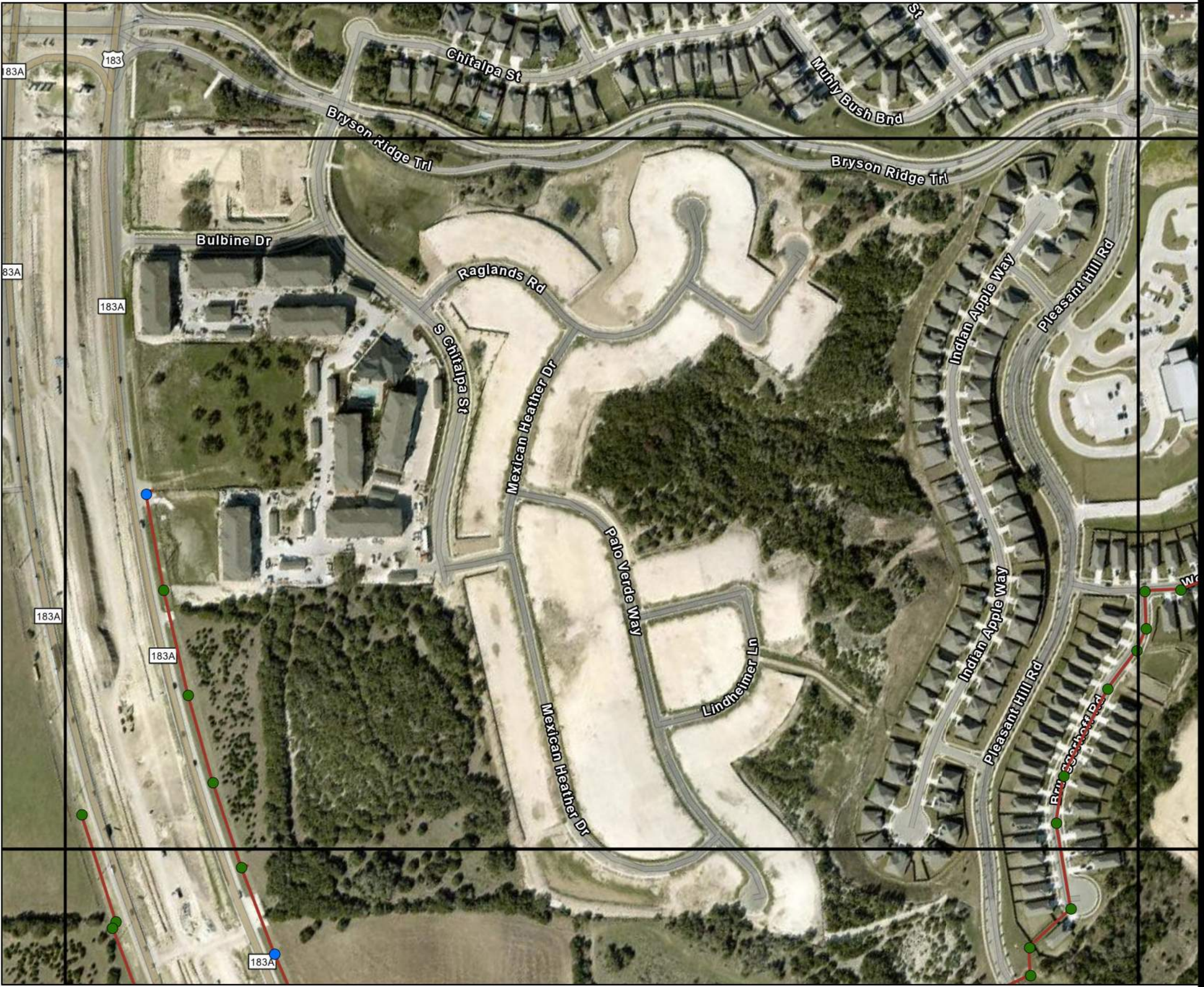




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: H-11**

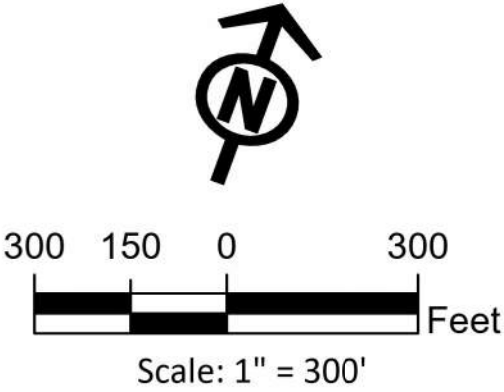
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

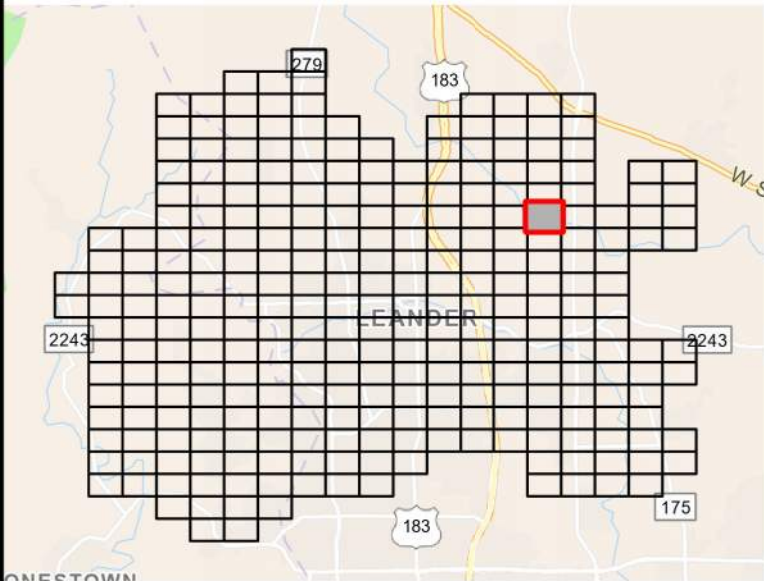
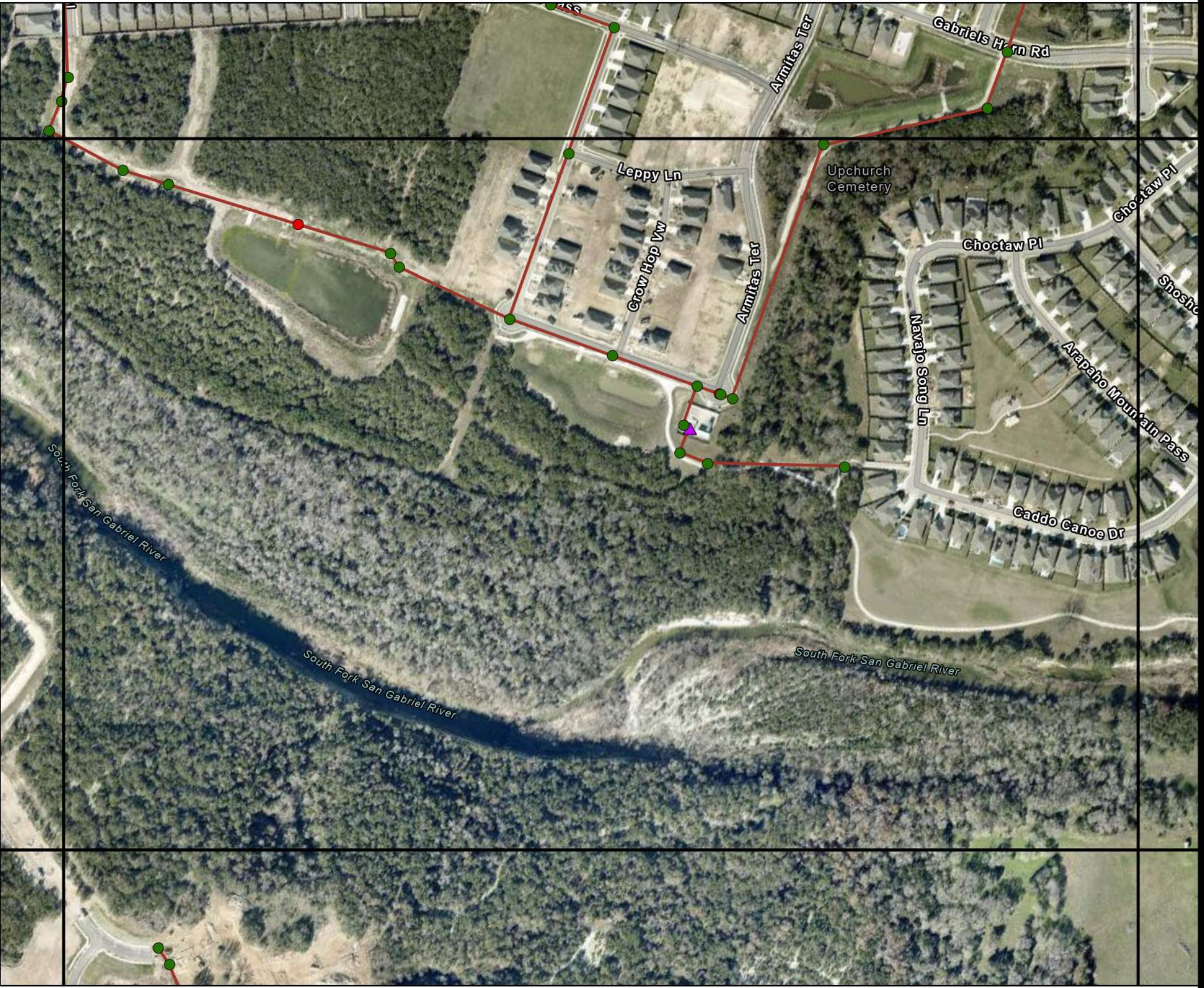




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: H-14**

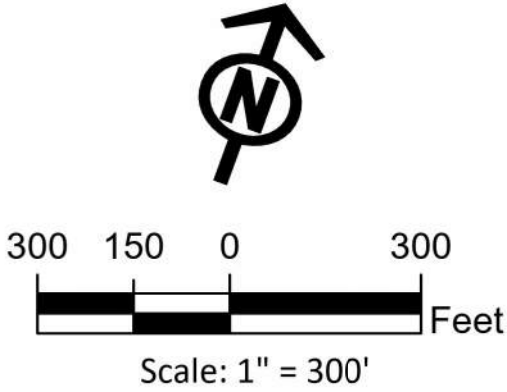
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

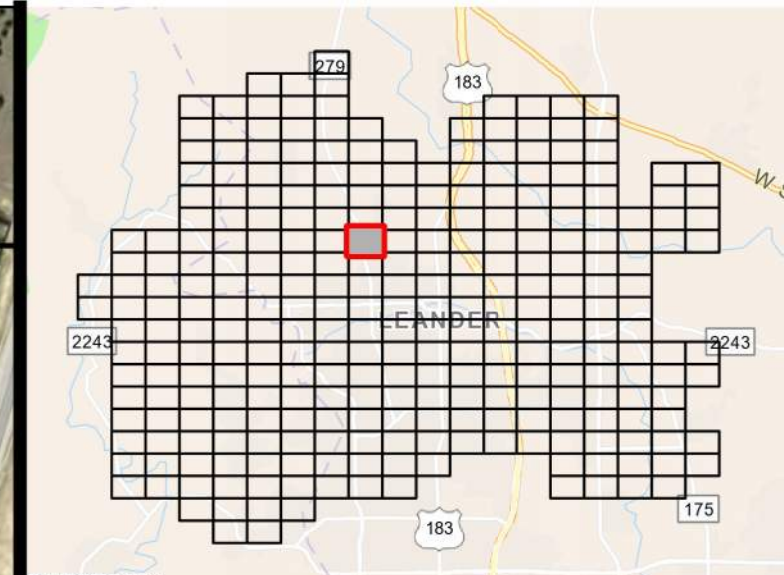
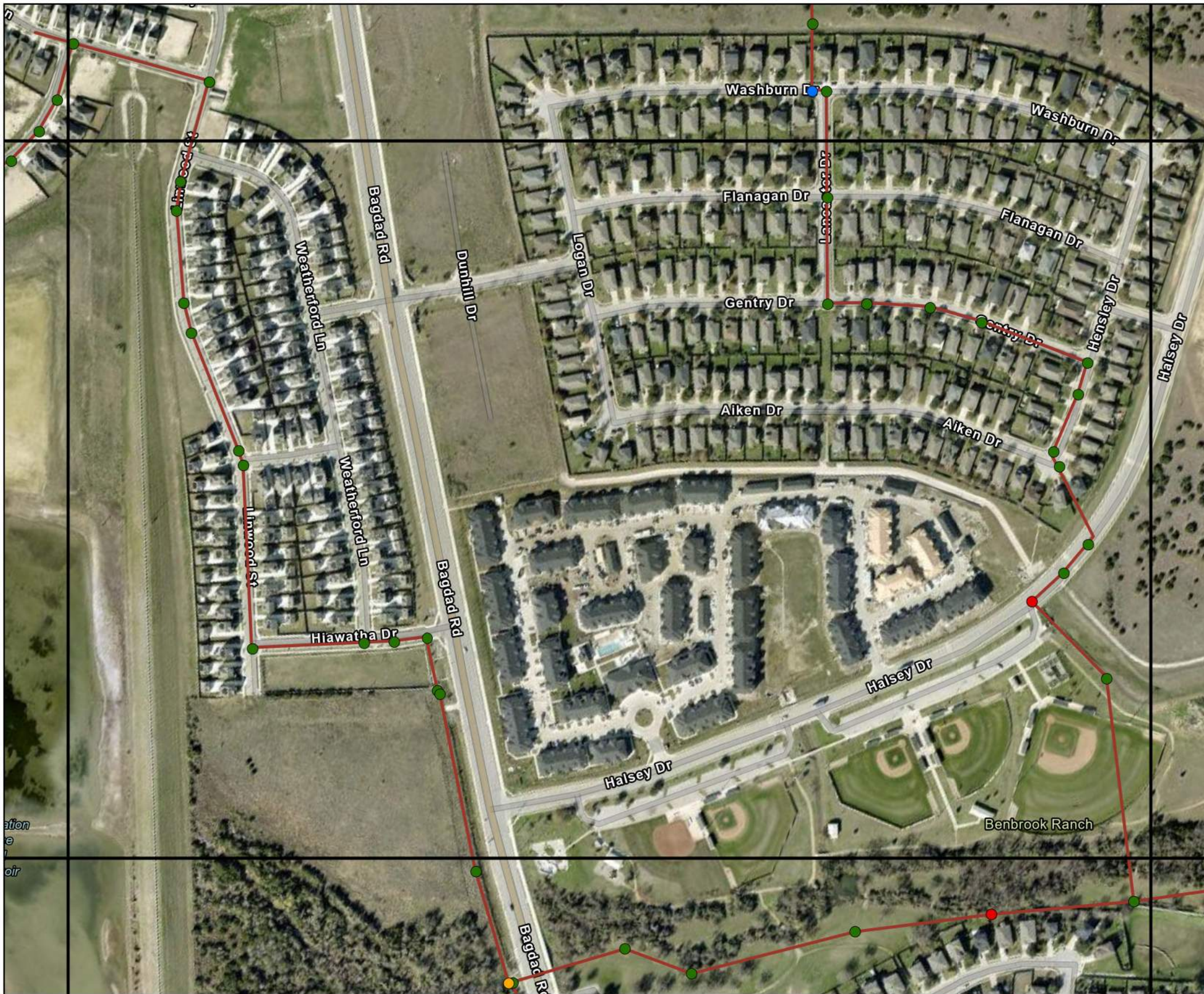




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: H-17**

- Legend**
- | | |
|--------------|------------------------------|
| Lift Station | Manhole Survey Status |
| Outfall | Buried |
| Sewer Main | Could Not Access |
| | Could Not Locate |
| | Could Not Open |
| | Complete |

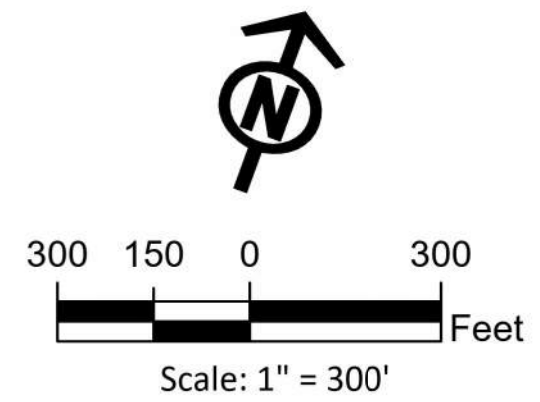


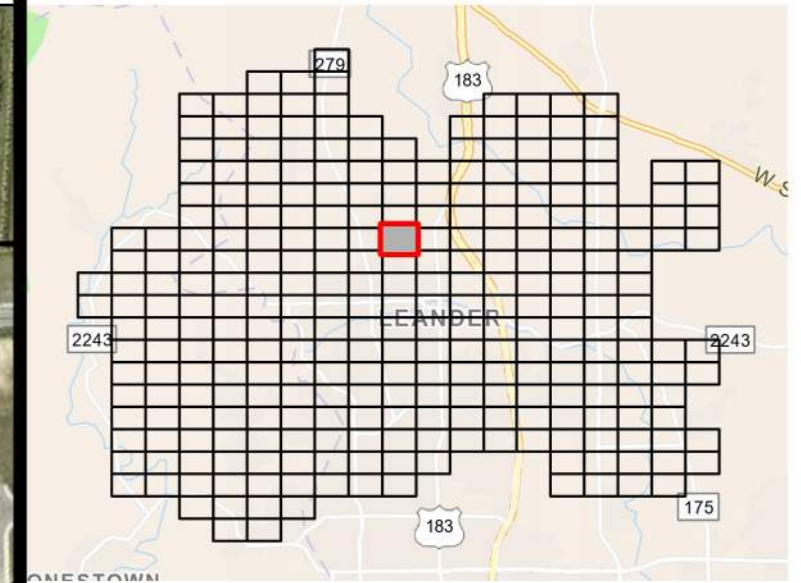
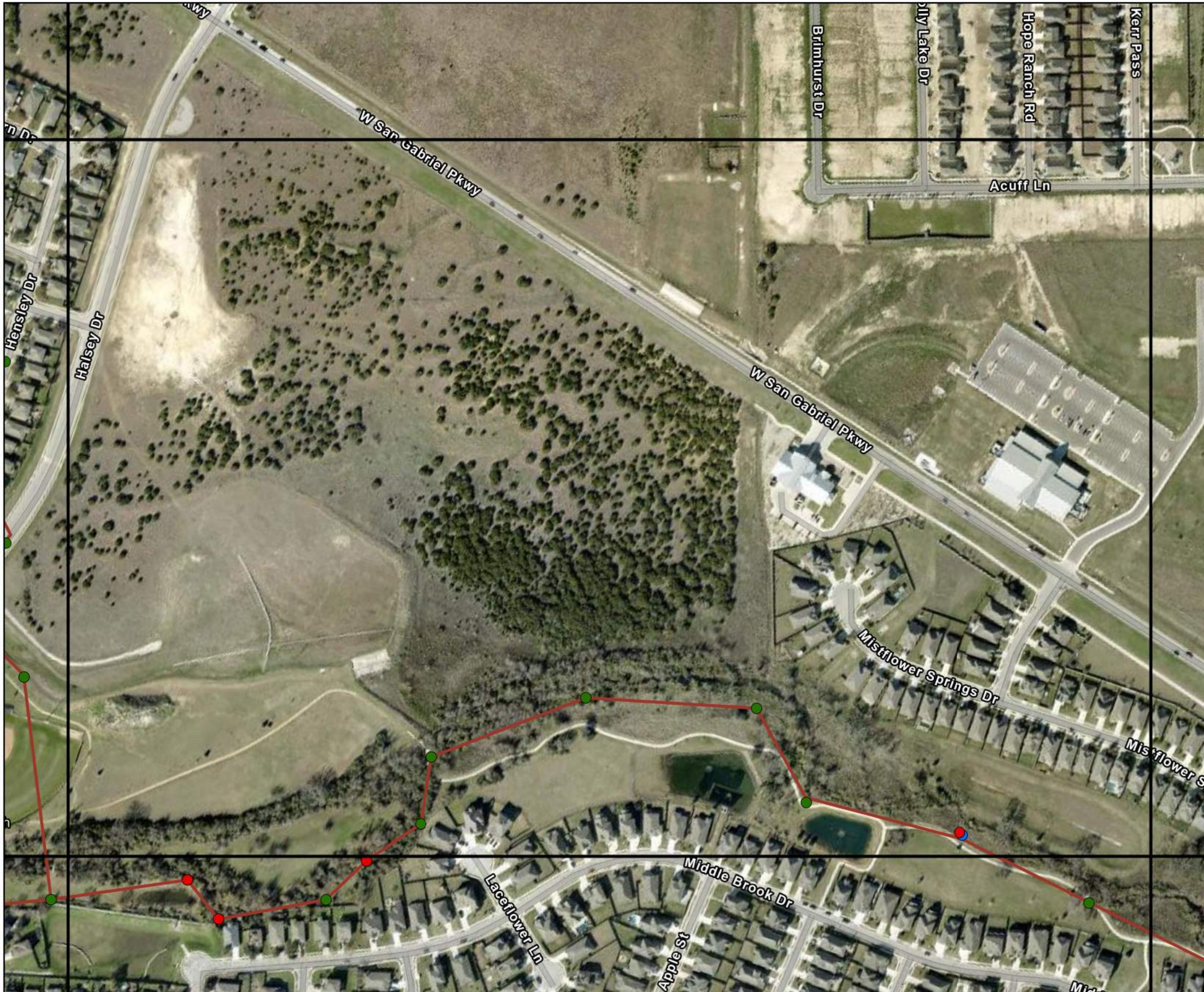


LEANDER MANHOLE SURVEY STATUS MAP GRID NO.: I-11

Legend

- | | |
|--------------|------------------------------|
| Lift Station | Manhole Survey Status |
| Outfall | Buried |
| Sewer Main | Could Not Access |
| | Could Not Locate |
| | Could Not Open |
| | Complete |

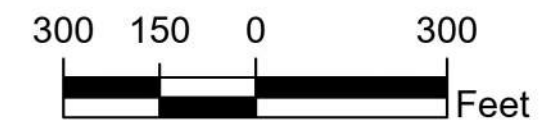




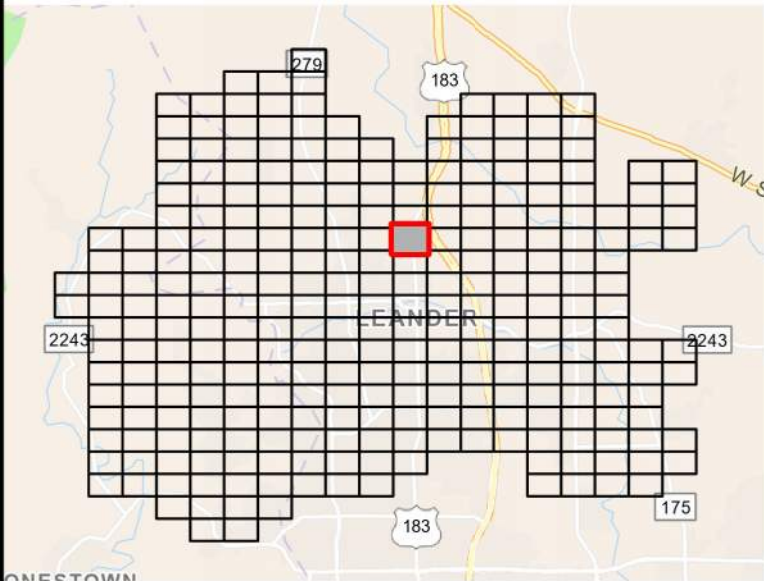
LEANDER MANHOLE SURVEY STATUS MAP GRID NO.: I-12

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |



Scale: 1" = 300'

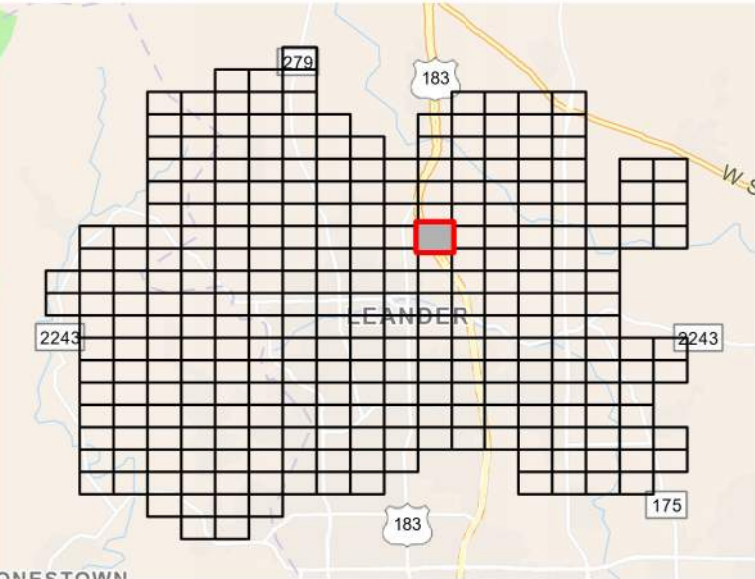
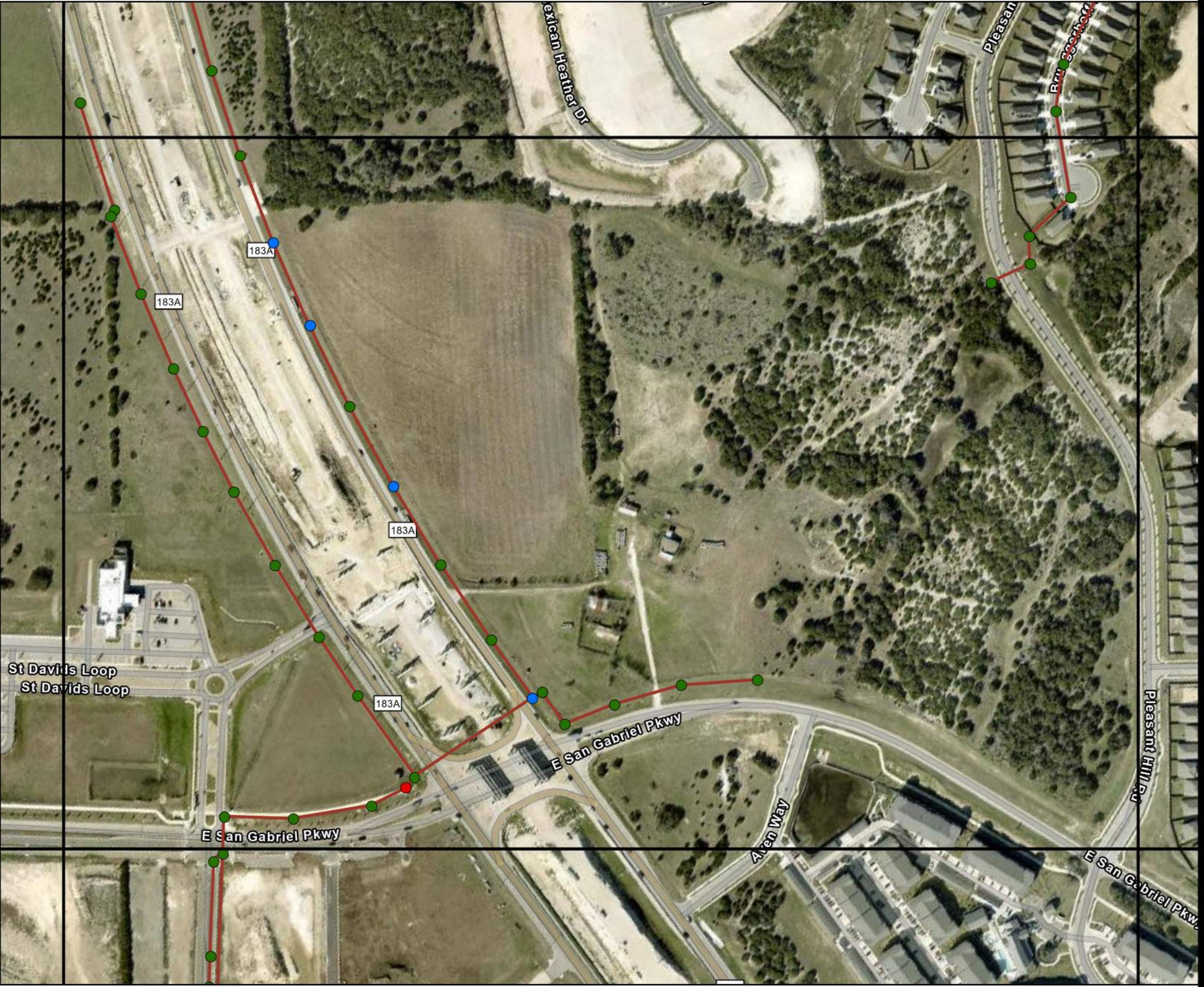


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: I-13**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |





**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: I-14**

Legend

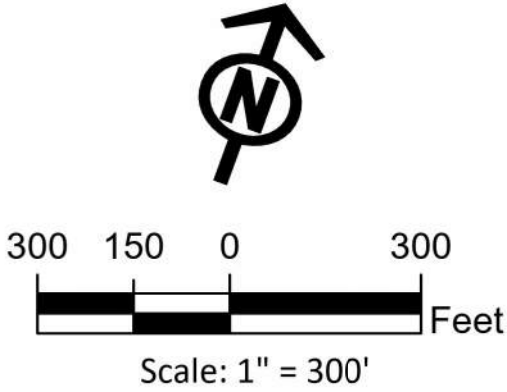
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

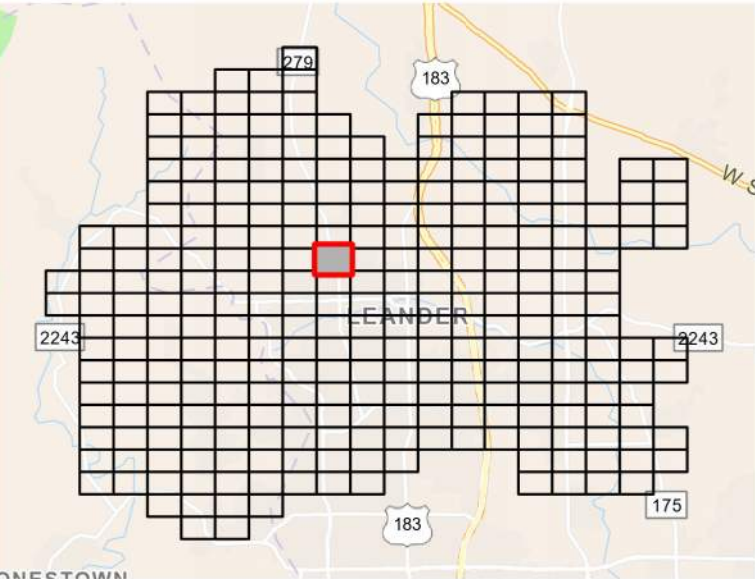
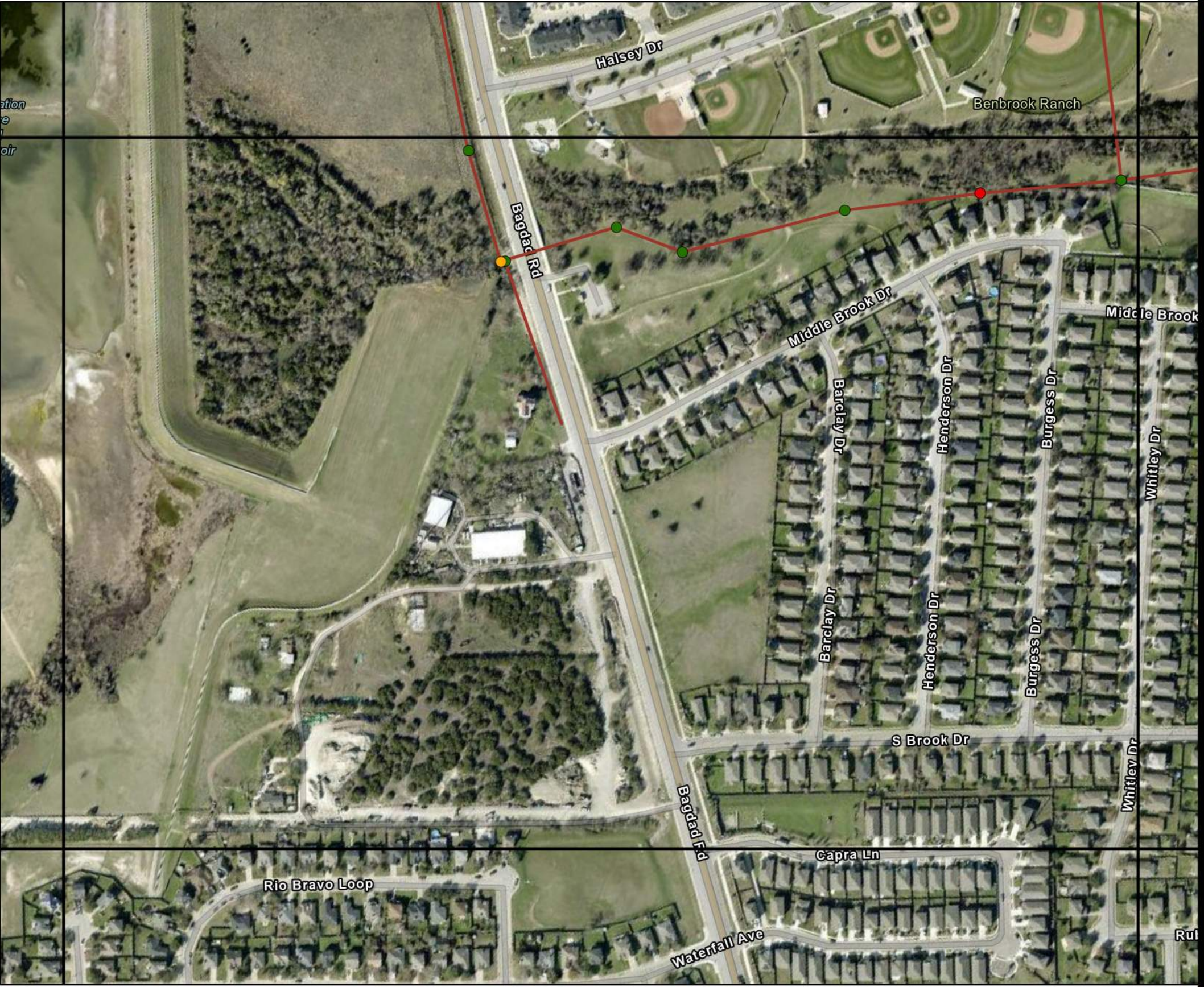




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: I-19**

- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ● Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

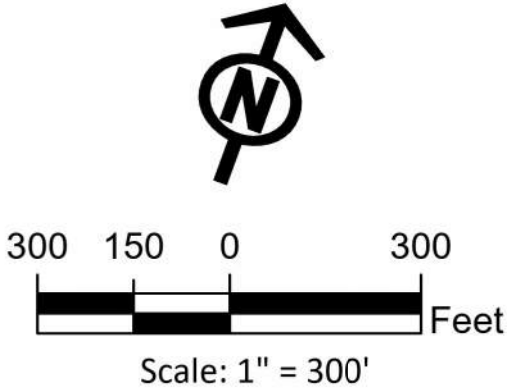


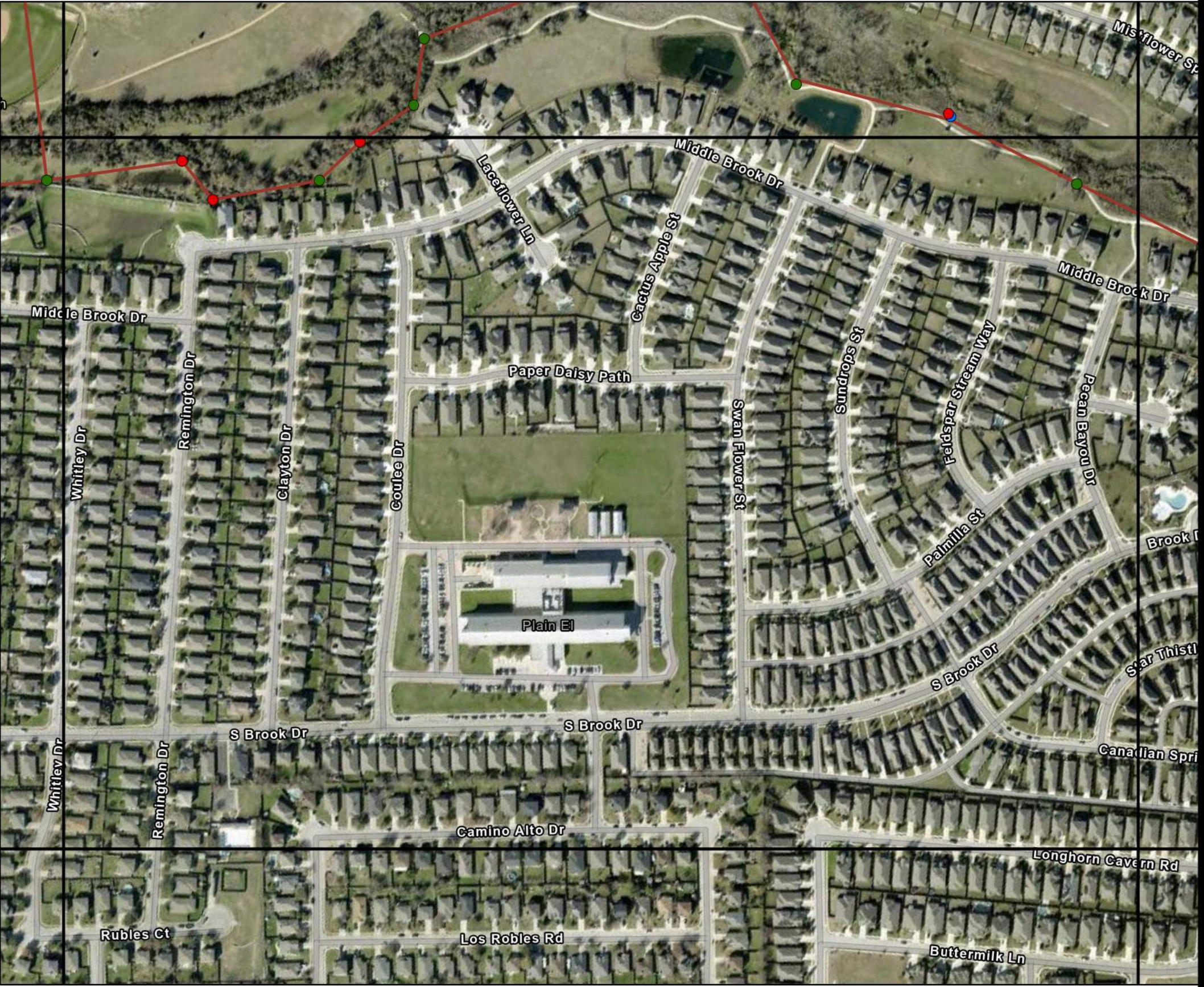


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: J-11**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

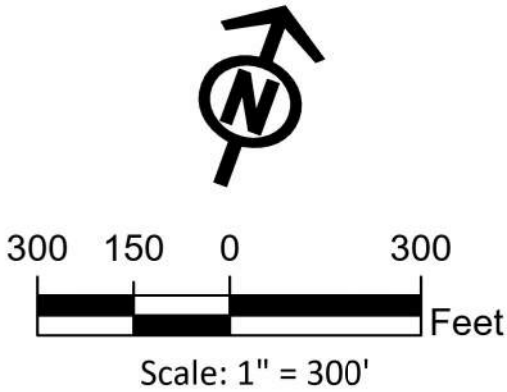


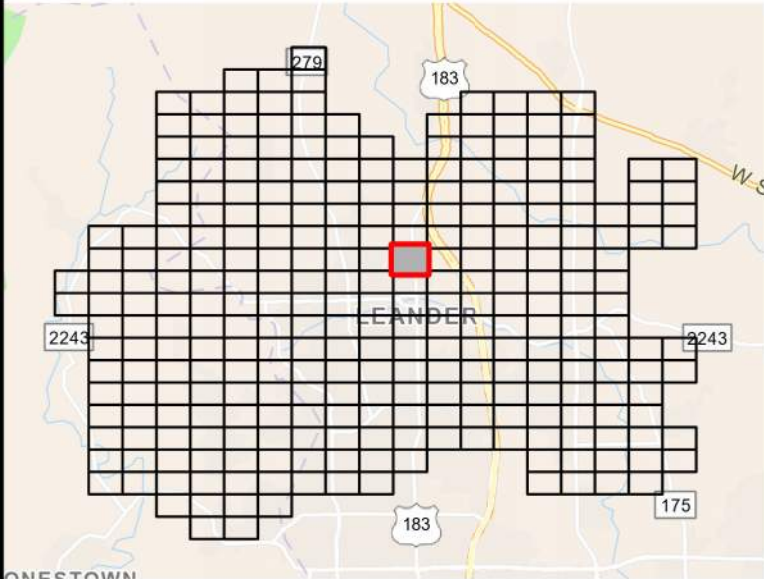
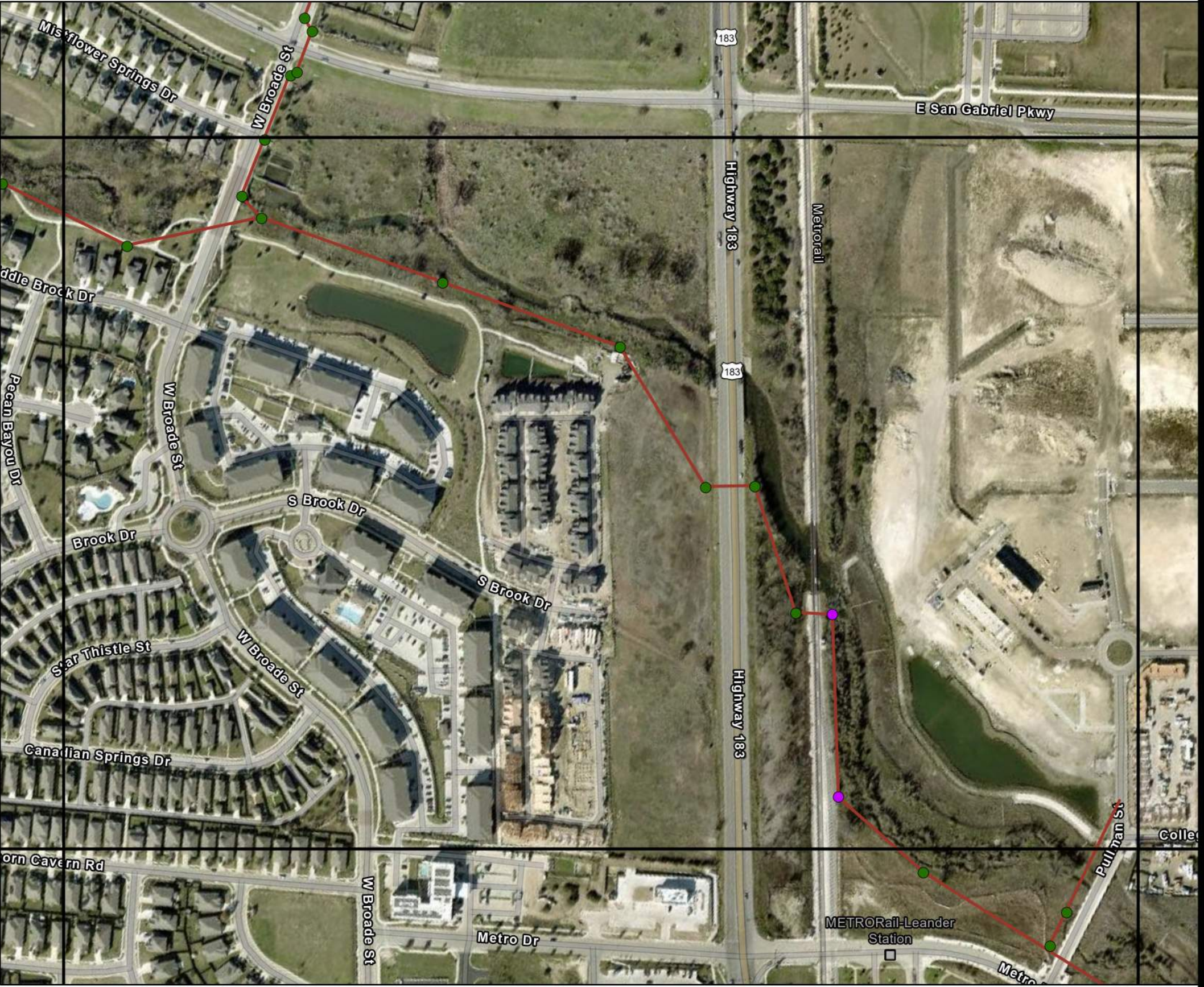


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: J-12**

Legend

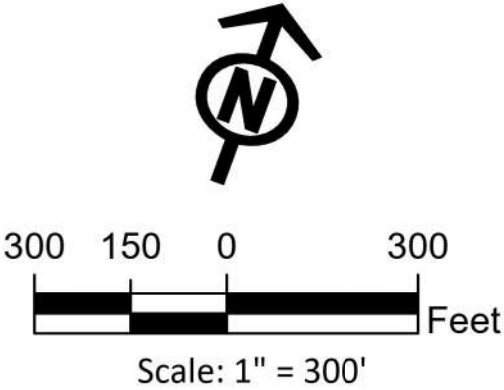
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

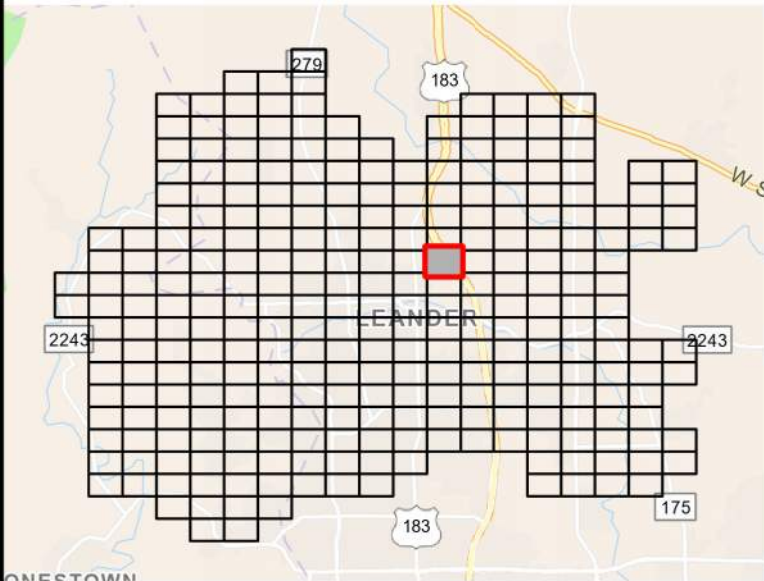
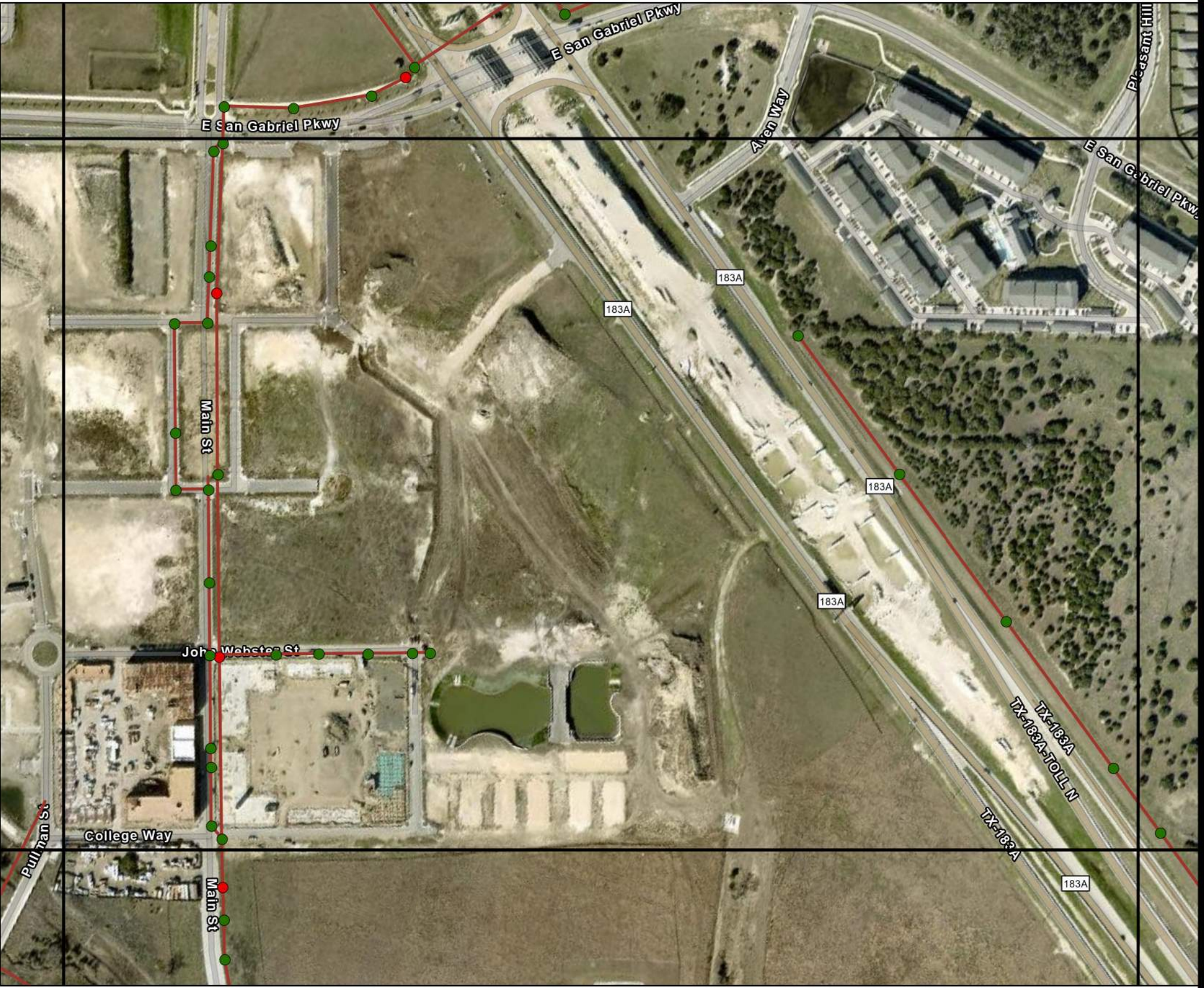




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: J-13**

- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

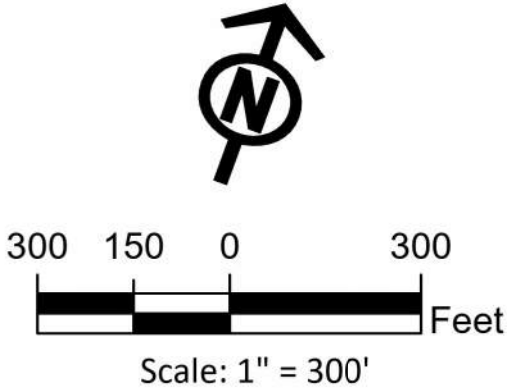


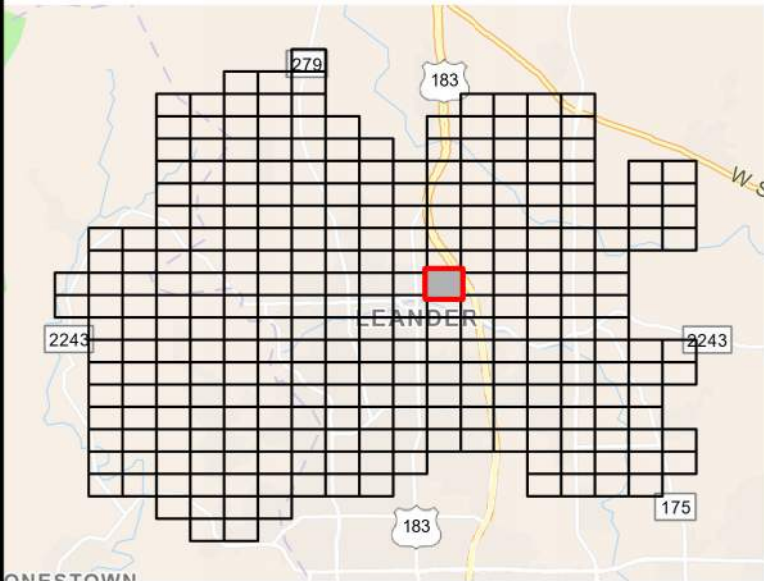
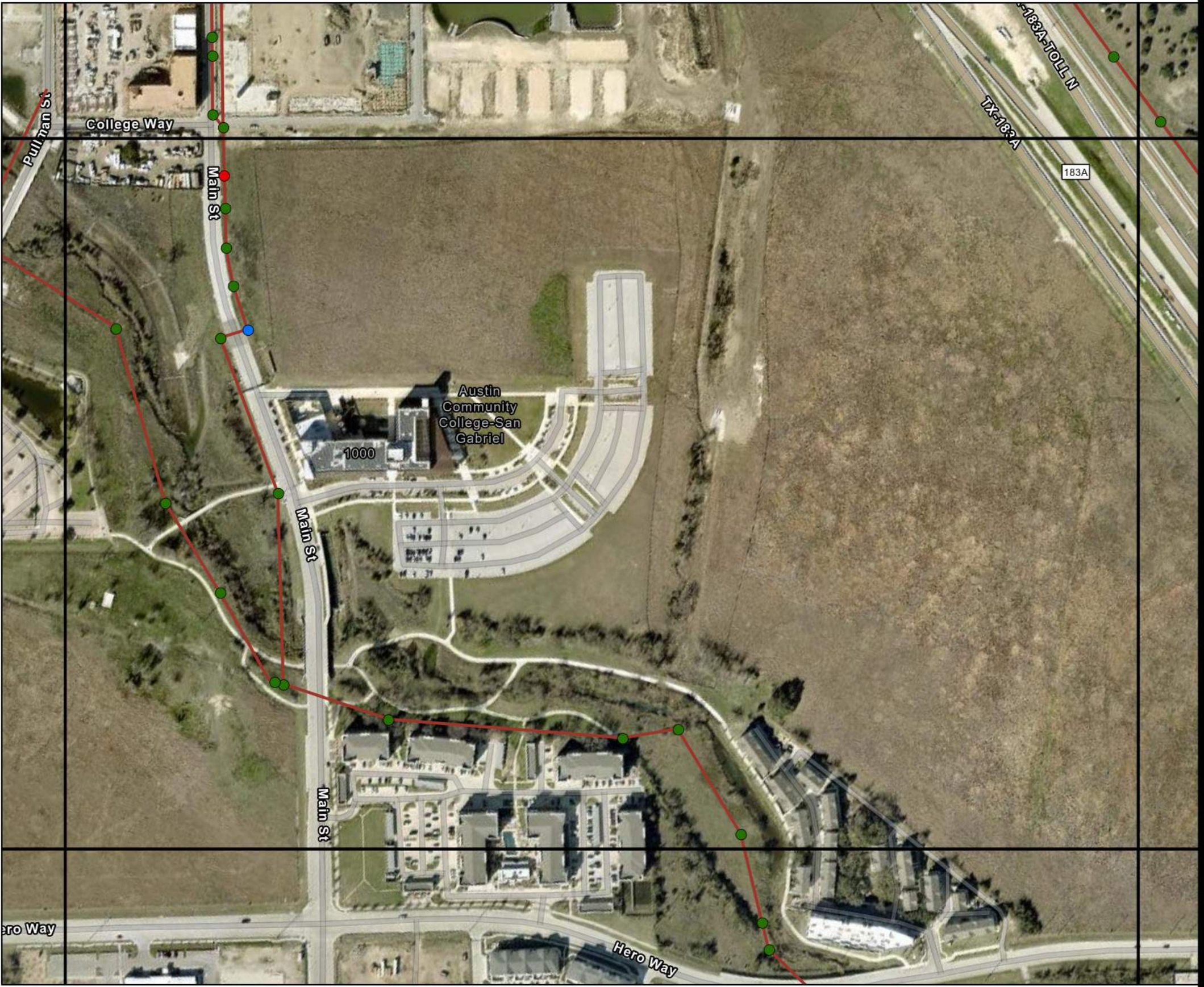


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: J-14**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

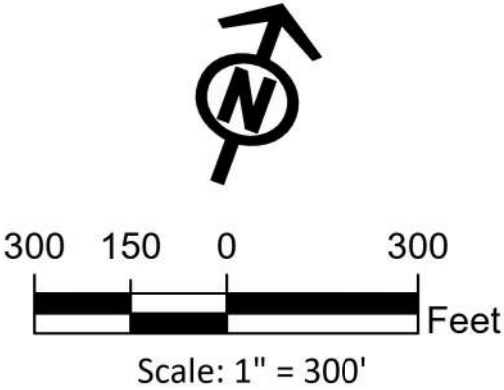


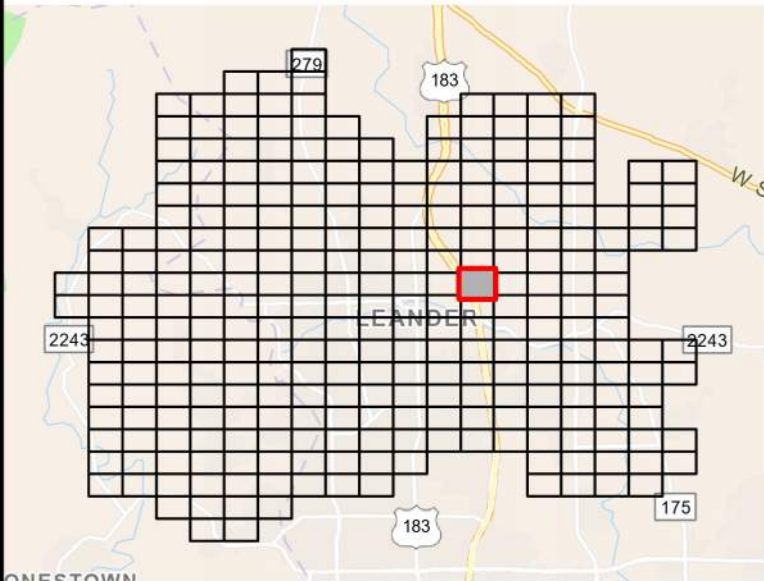
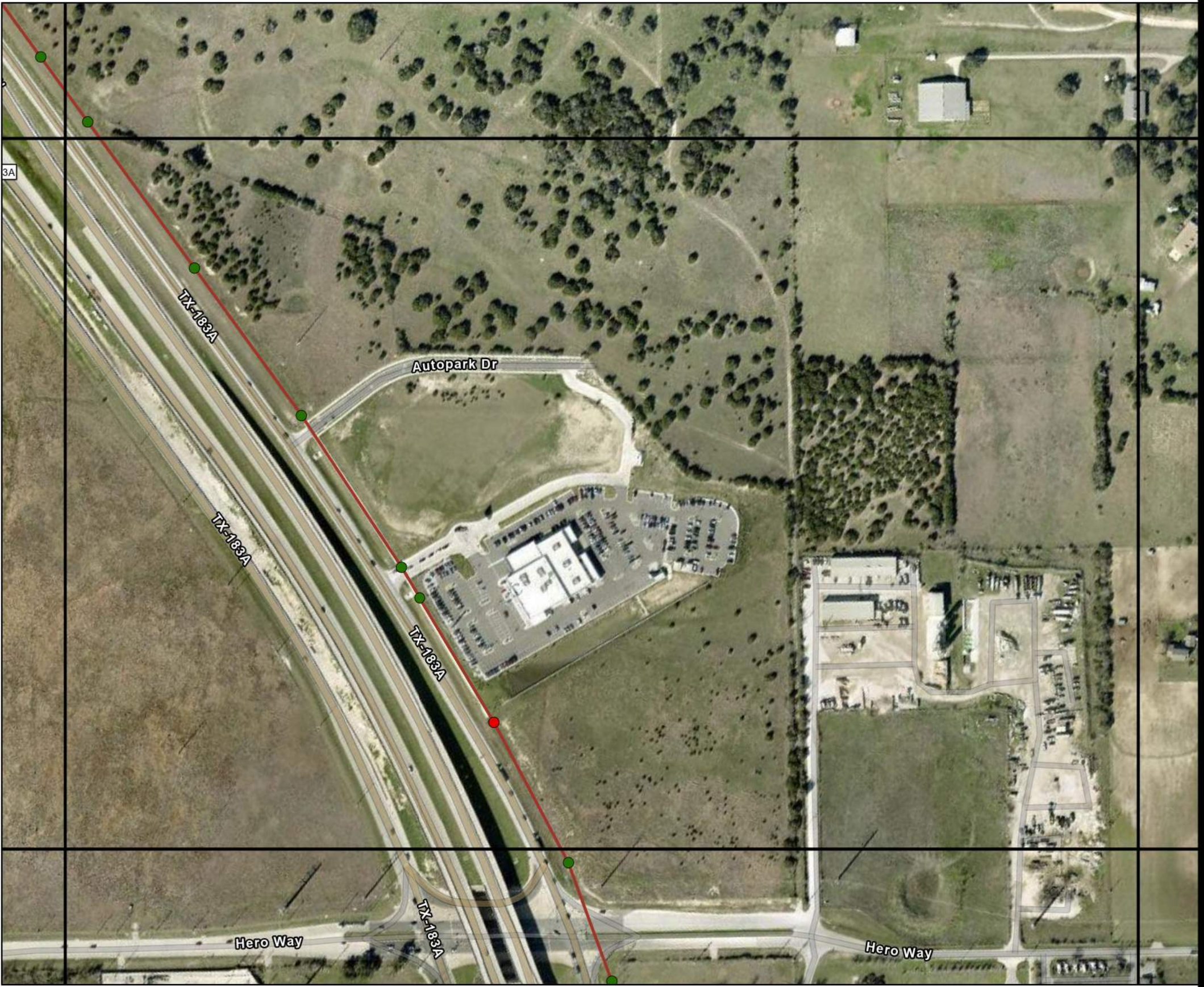


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: K-14**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

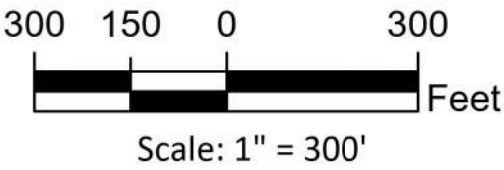


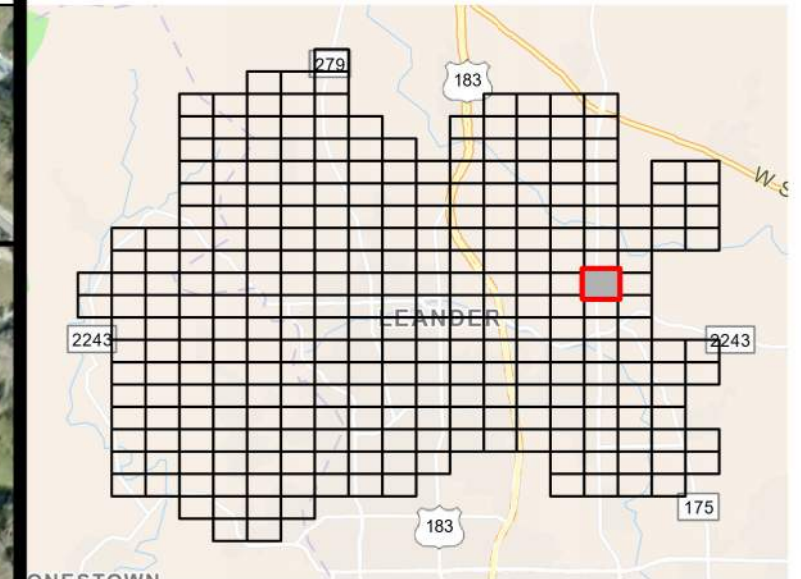
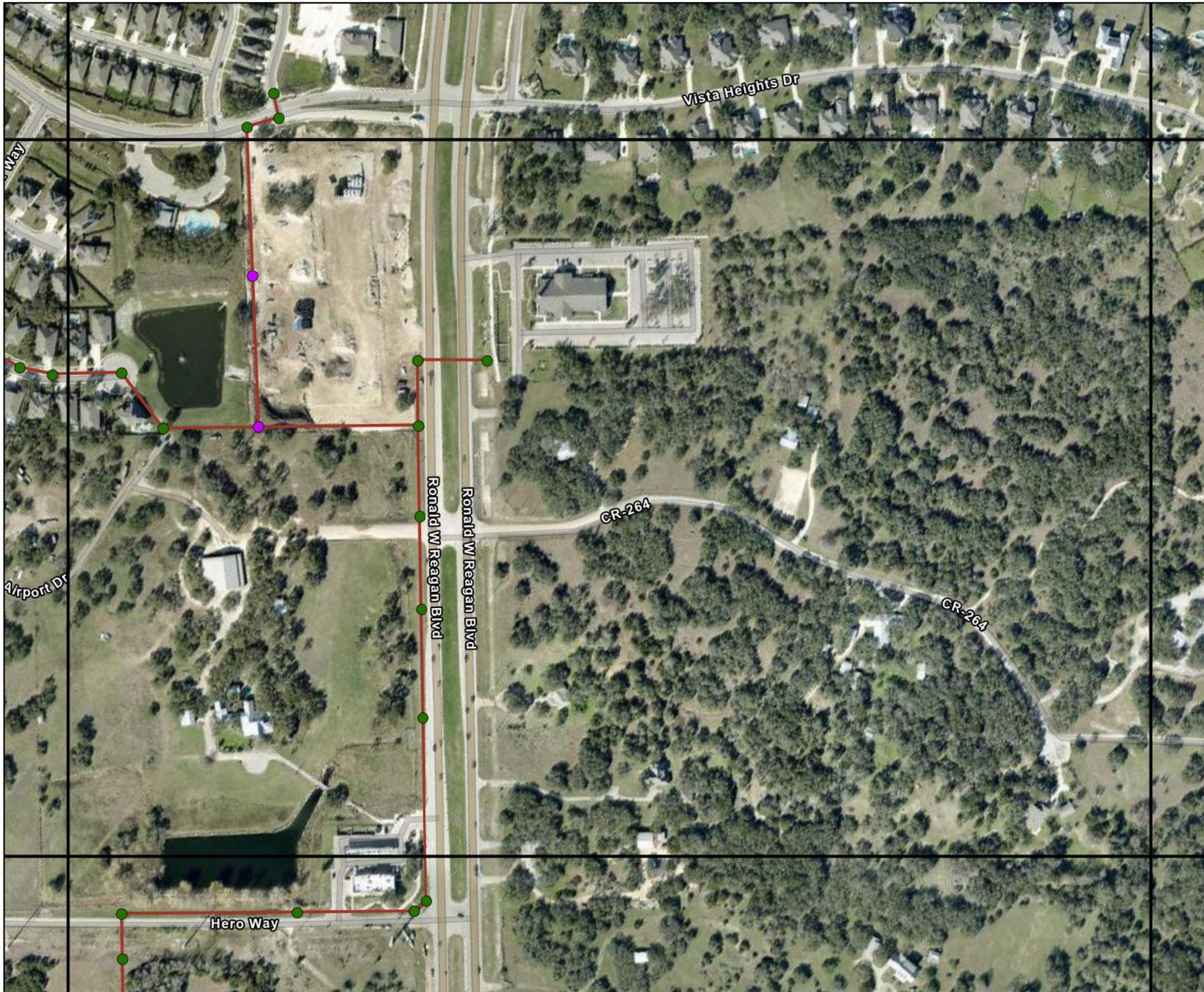


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: K-15**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

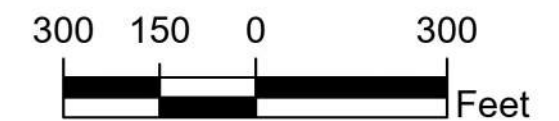




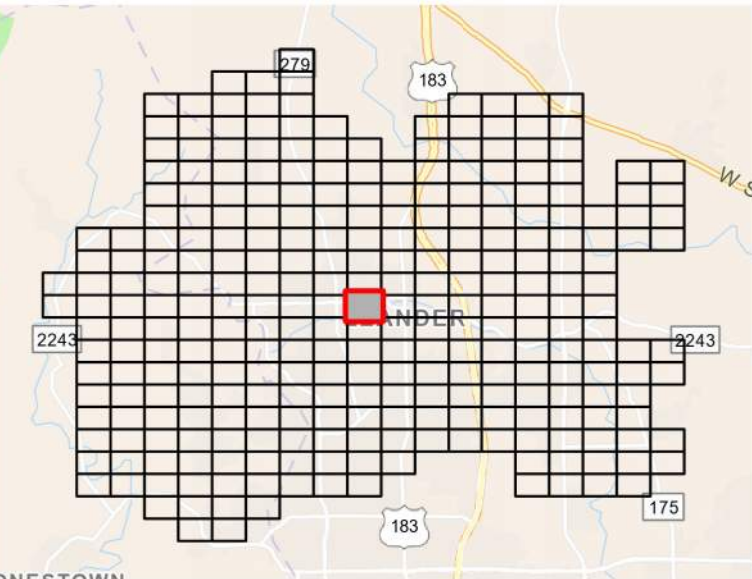
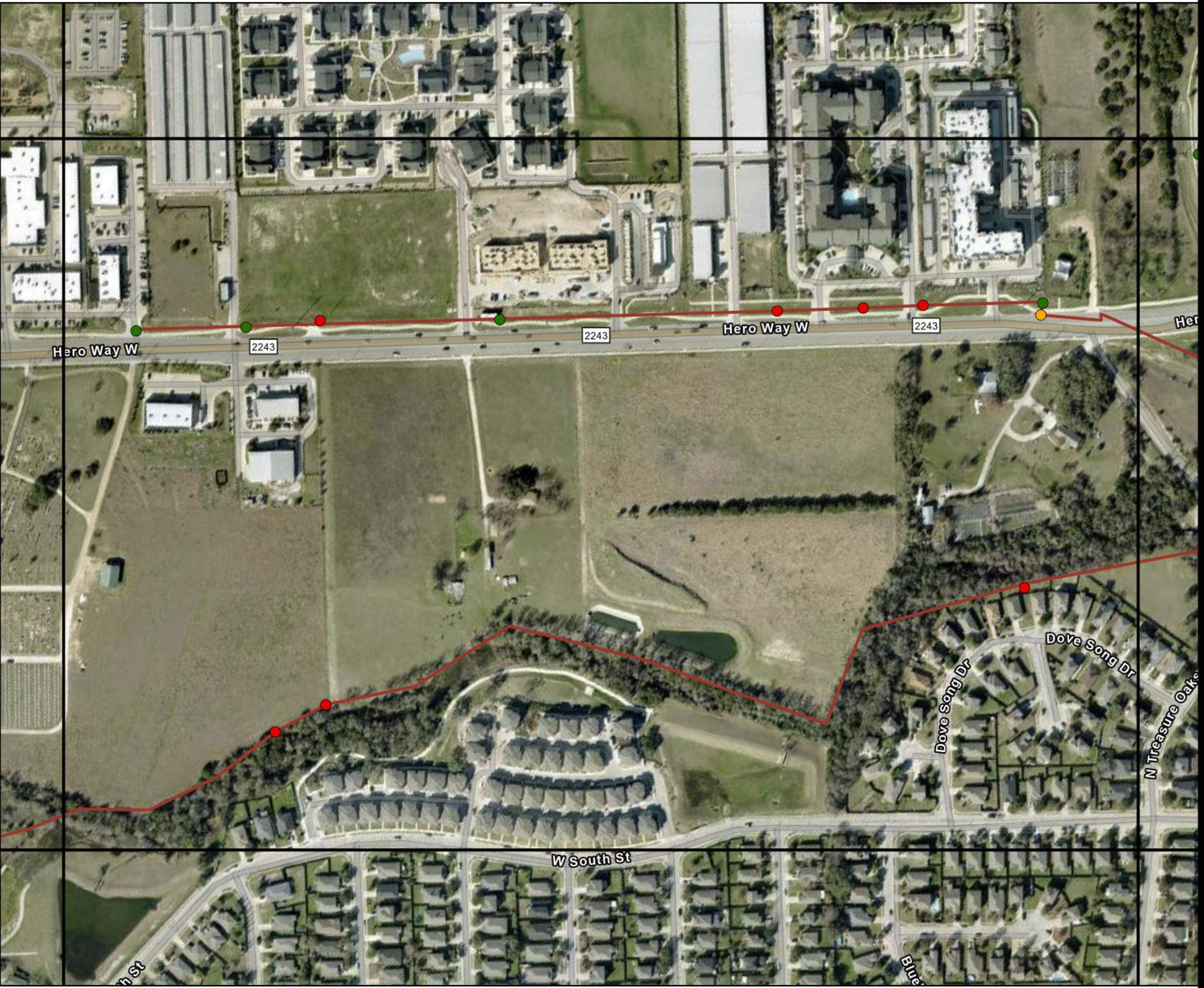
LEANDER MANHOLE SURVEY STATUS MAP GRID NO.: K-18

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |



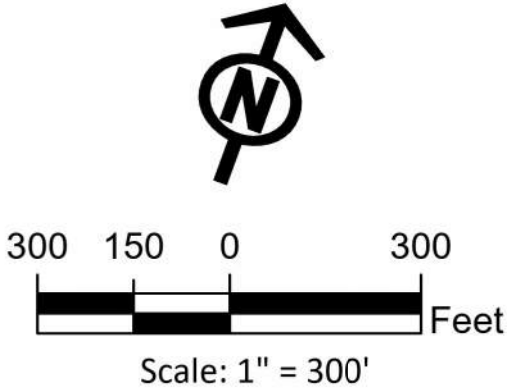
Scale: 1" = 300'

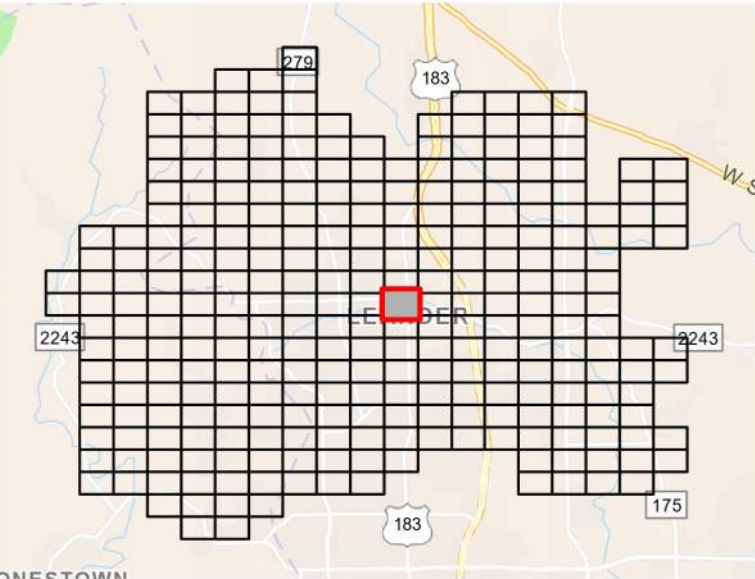


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: L-12**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |



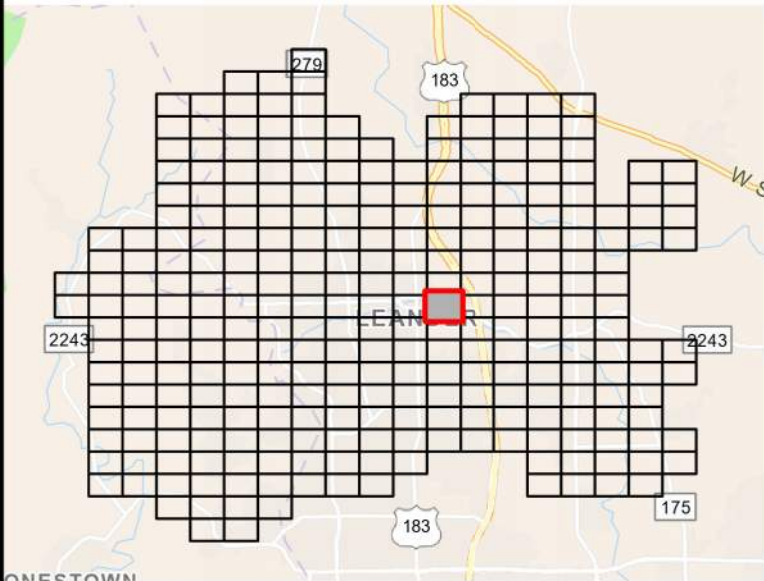
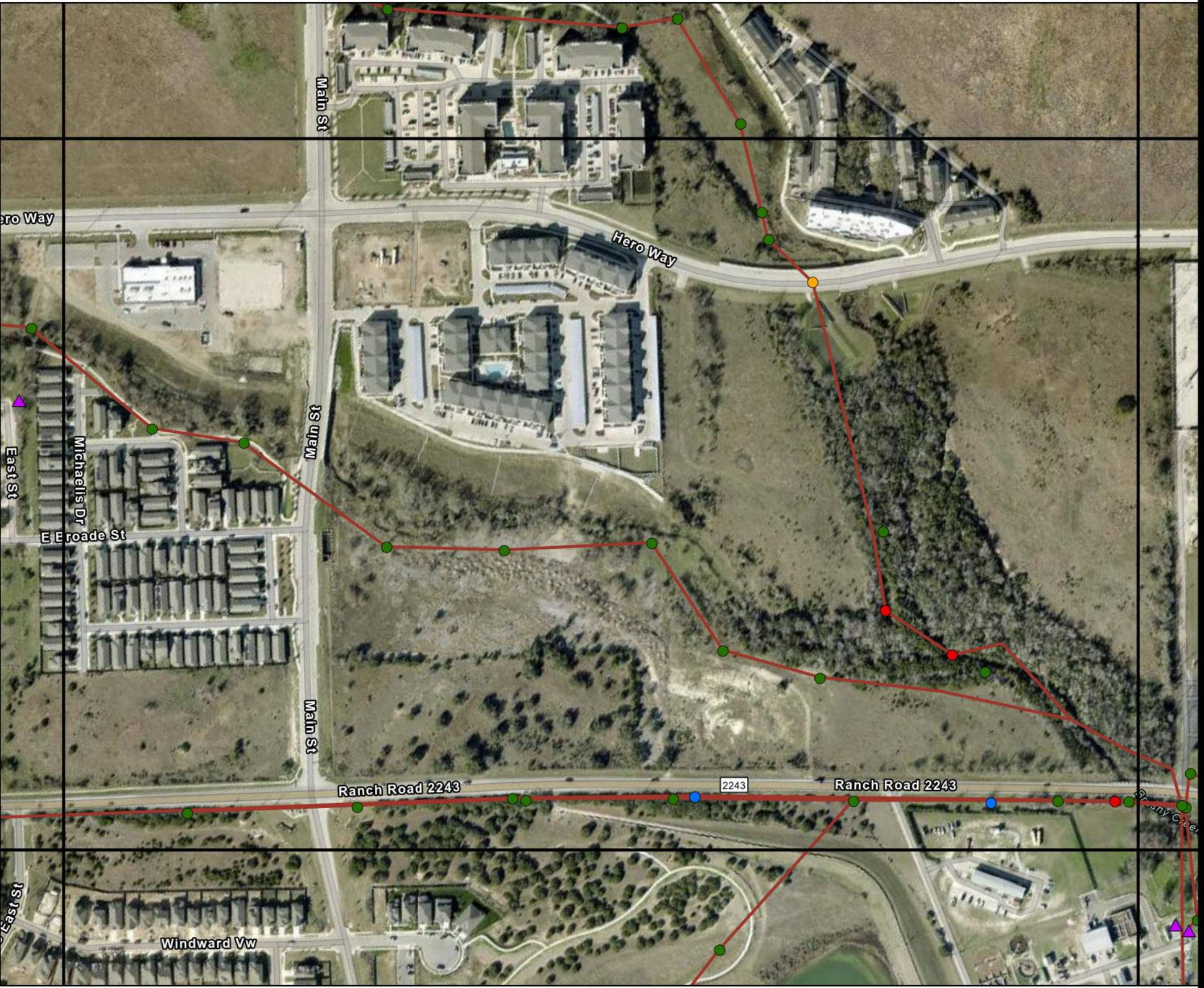


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: L-13**

Legend

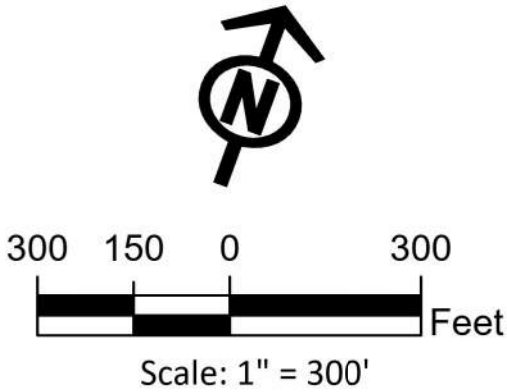
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ● Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

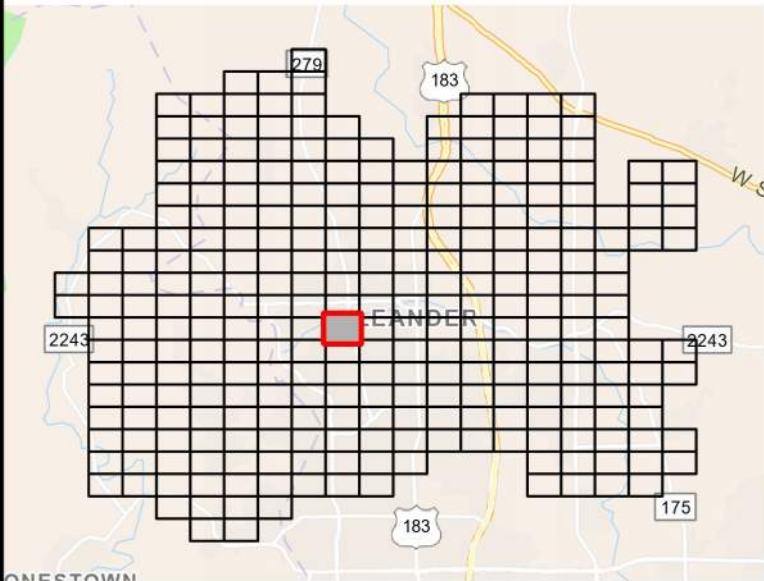
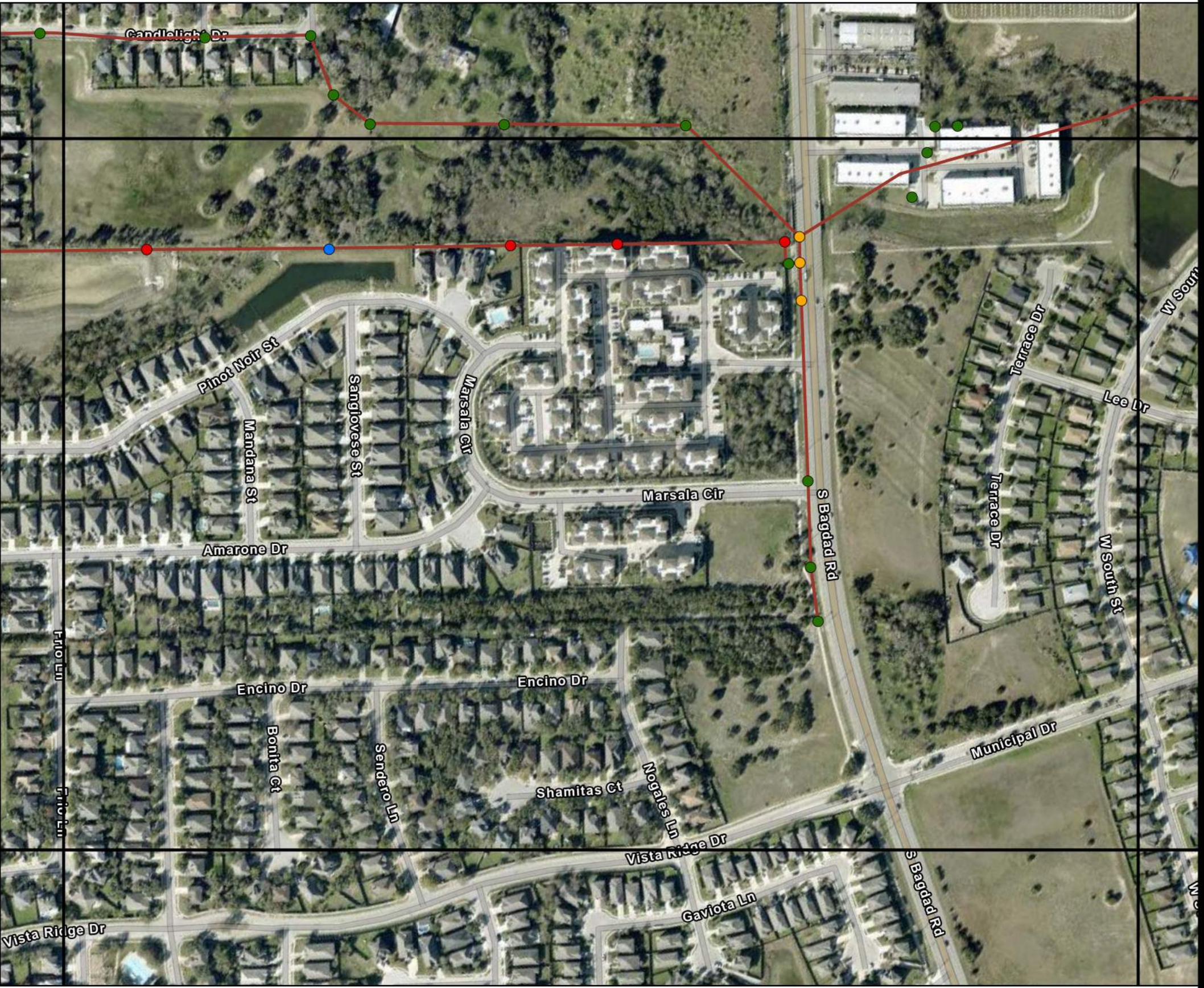




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: L-14**

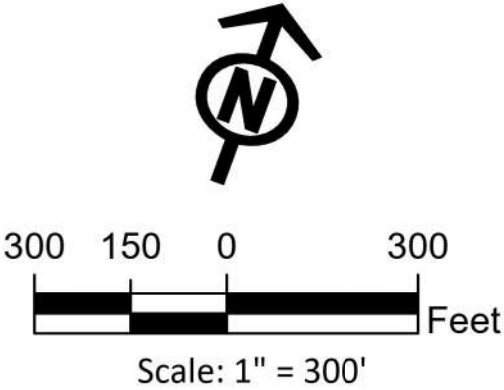
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

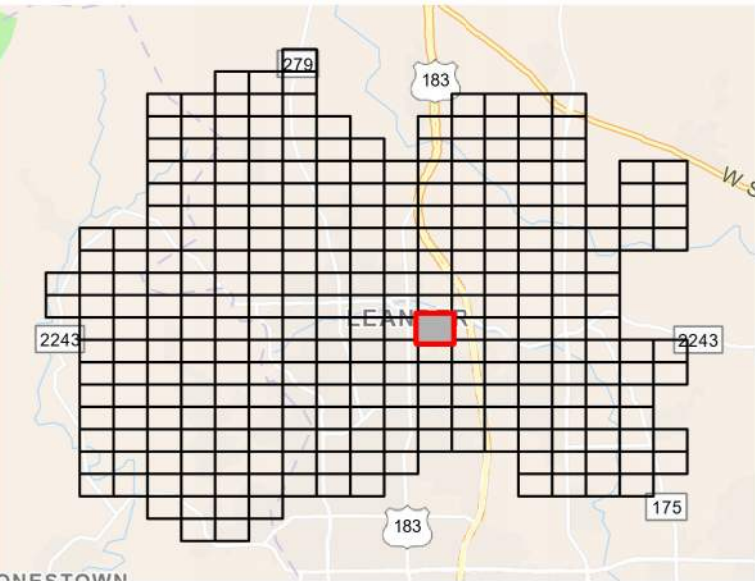




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: M-11**

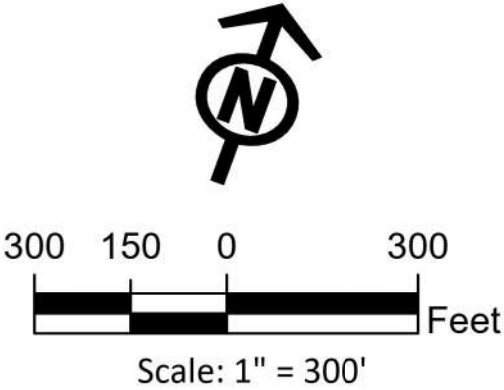
- Legend**
- ▲ Lift Station
 - ⬠ Outfall
 - Sewer Main
- Manhole Survey Status**
- Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete

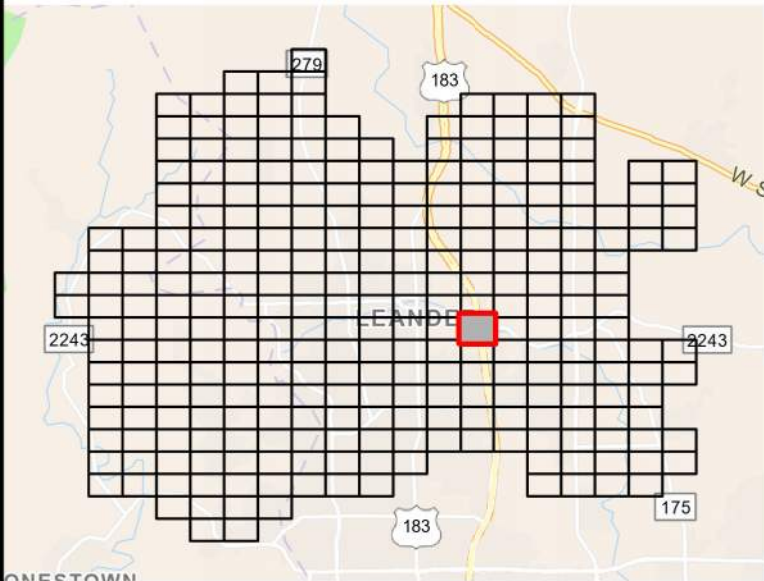




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: M-14**

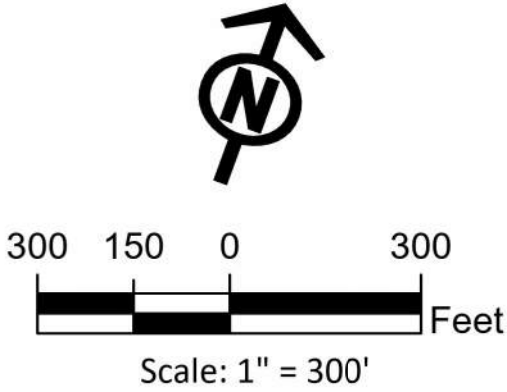
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬠ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

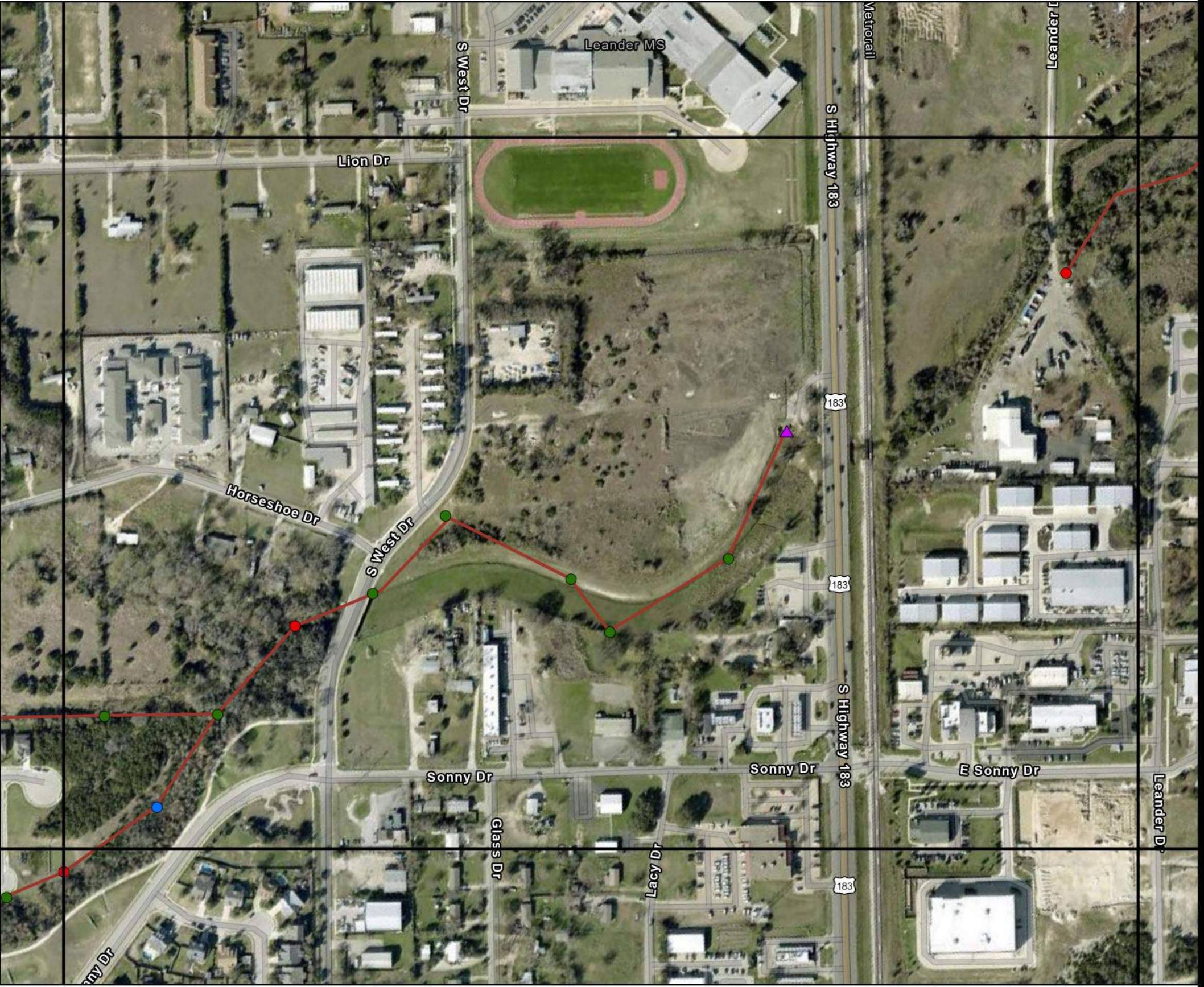




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: M-15**

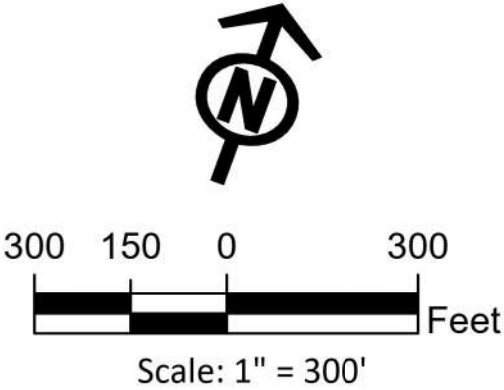
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◻ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

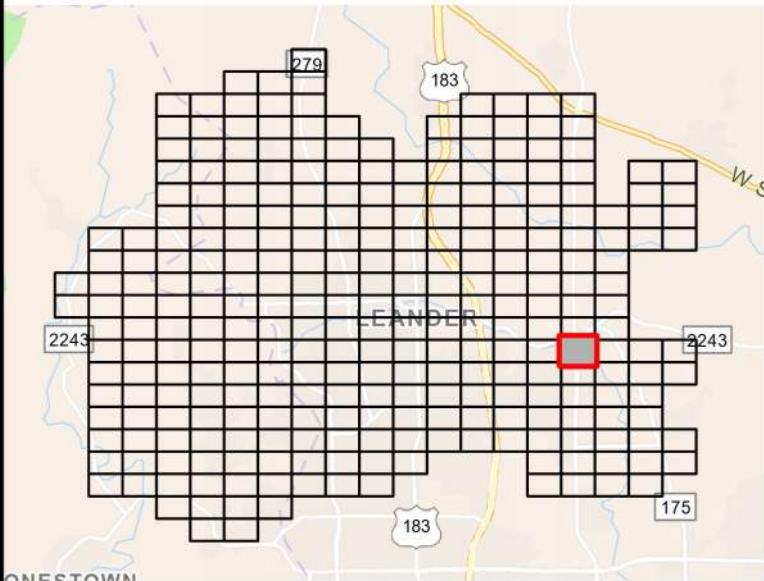
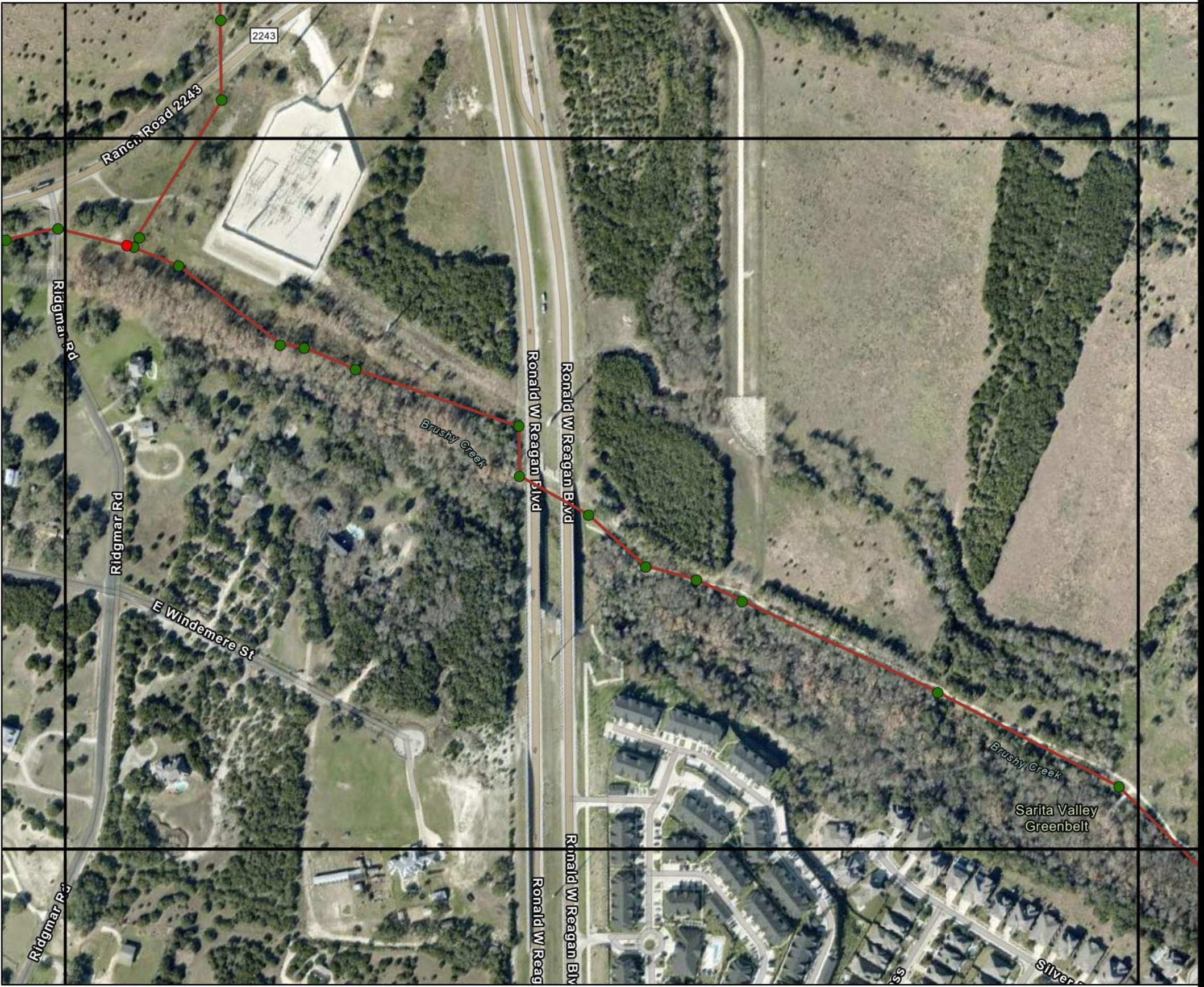




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: N-13**

- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |



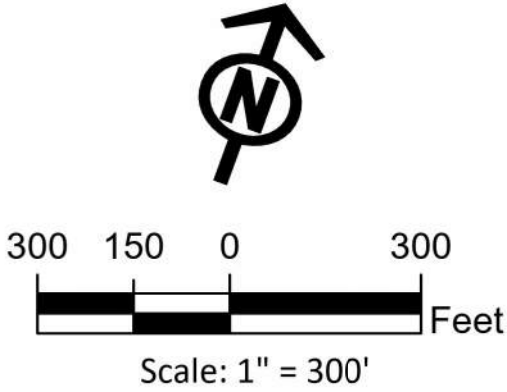


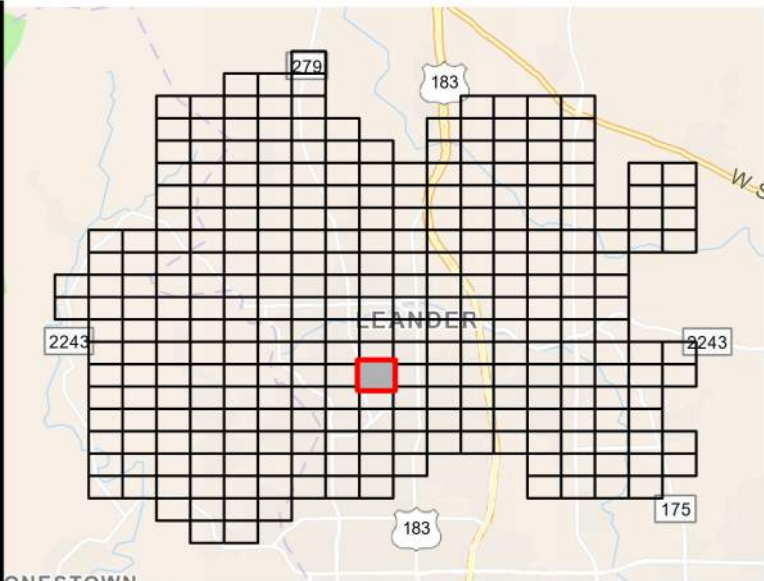
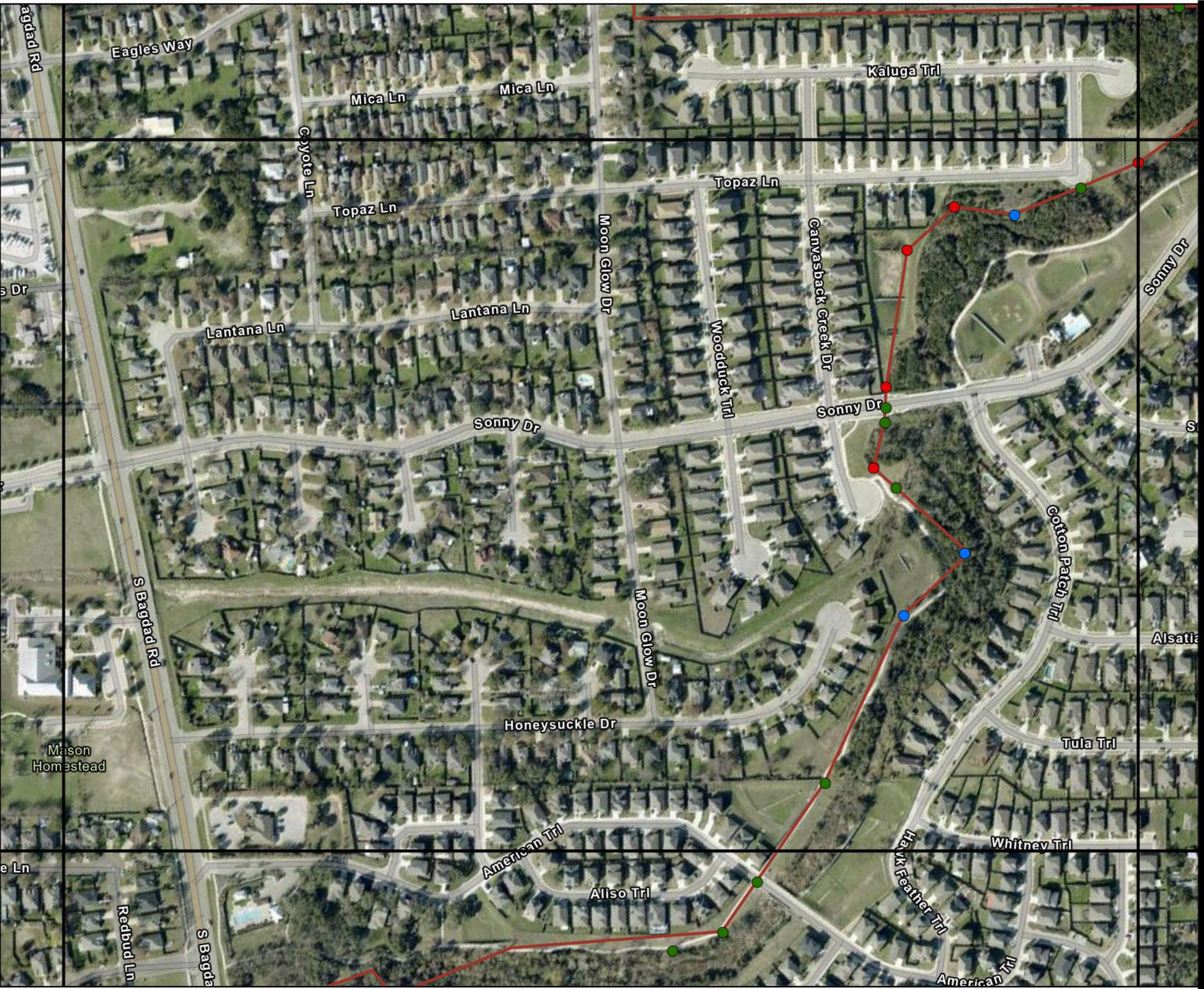
**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: N-18**

- Legend**

 - ▲ Lift Station
 - ◊ Outfall
 - Sewer Main
- Manhole Survey Status**

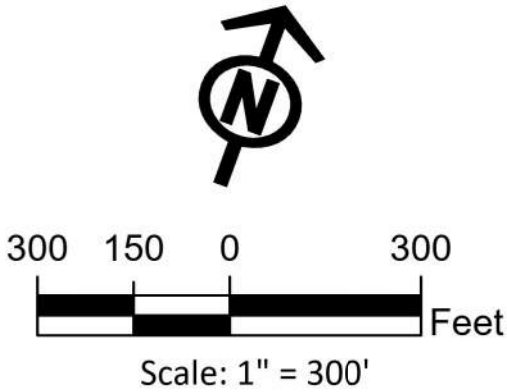
 - Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete

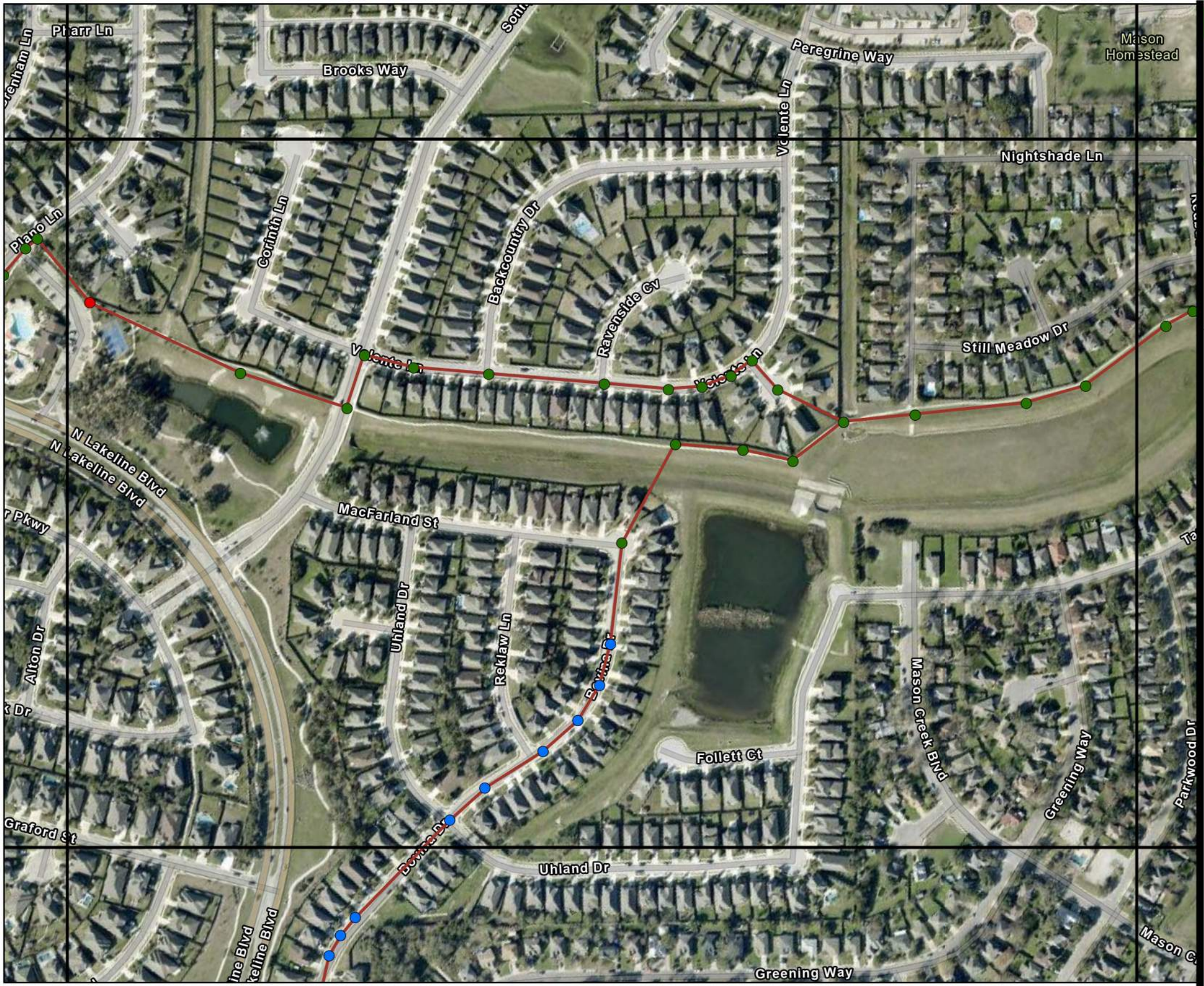




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: O-12**

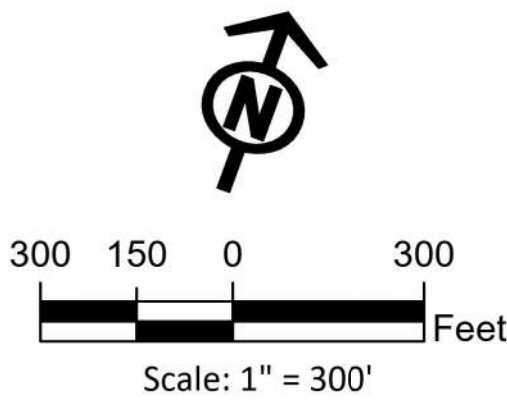
- Legend**
- ▲ Lift Station
 - ◆ Outfall
 - Sewer Main
- Manhole Survey Status**
- Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete

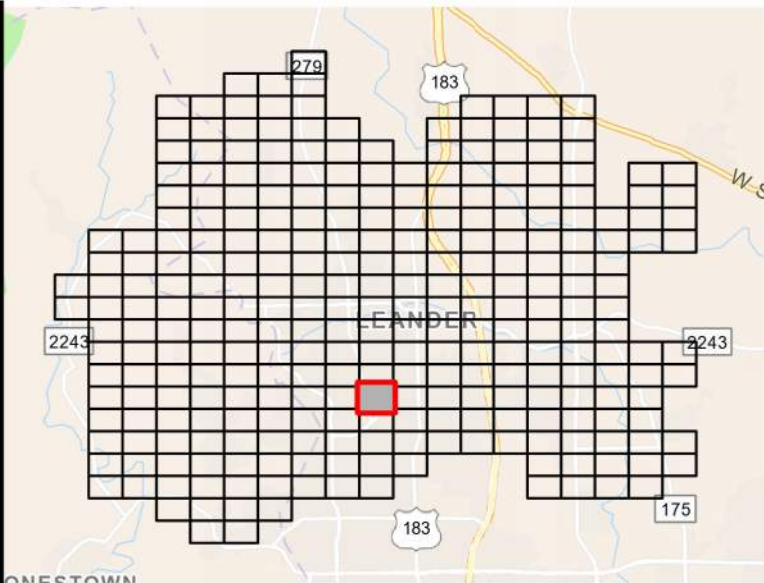
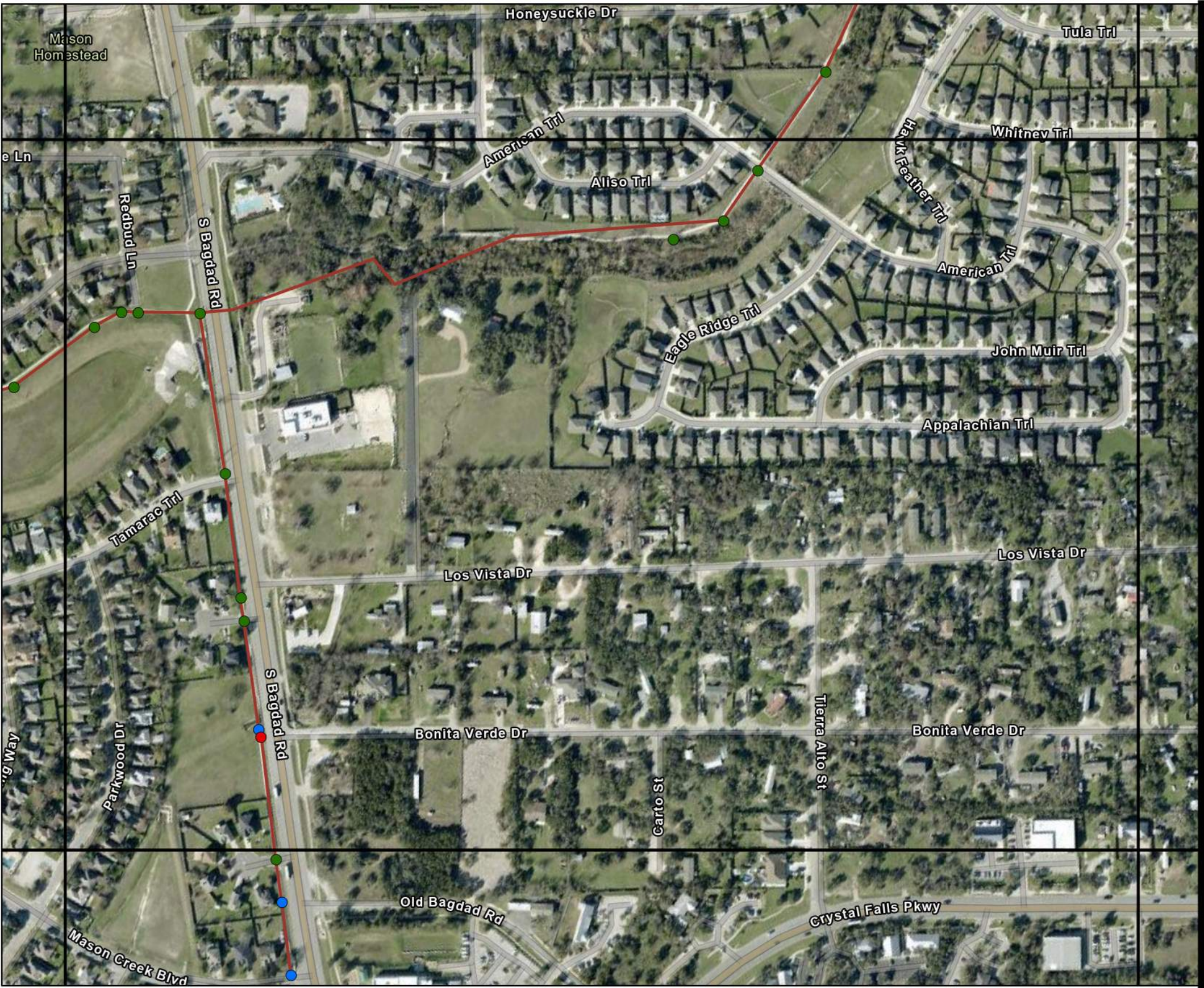




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: P-11**

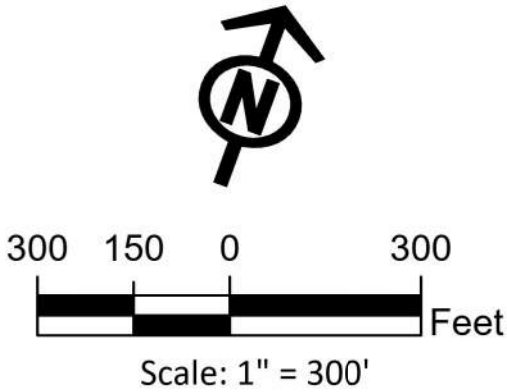
- Legend**
- | | |
|--------------|------------------|
| Lift Station | Buried |
| Outfall | Could Not Access |
| Sewer Main | Could Not Locate |
| | Could Not Open |
| | Complete |

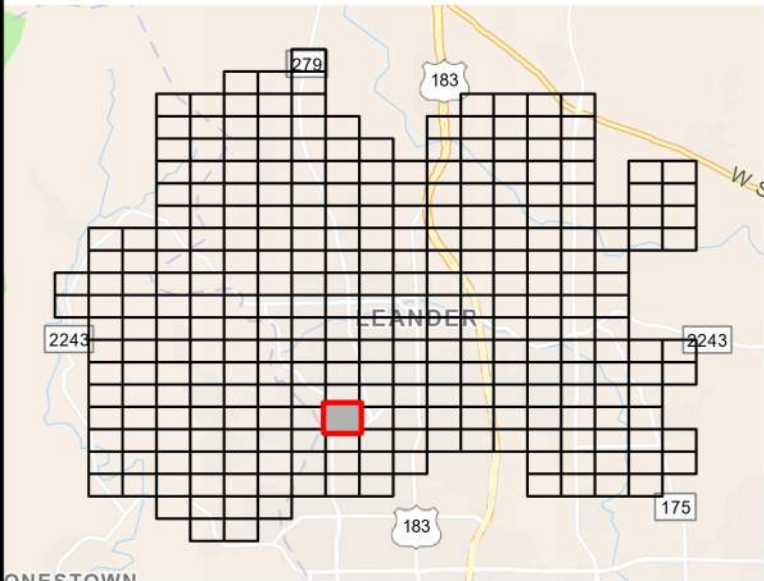
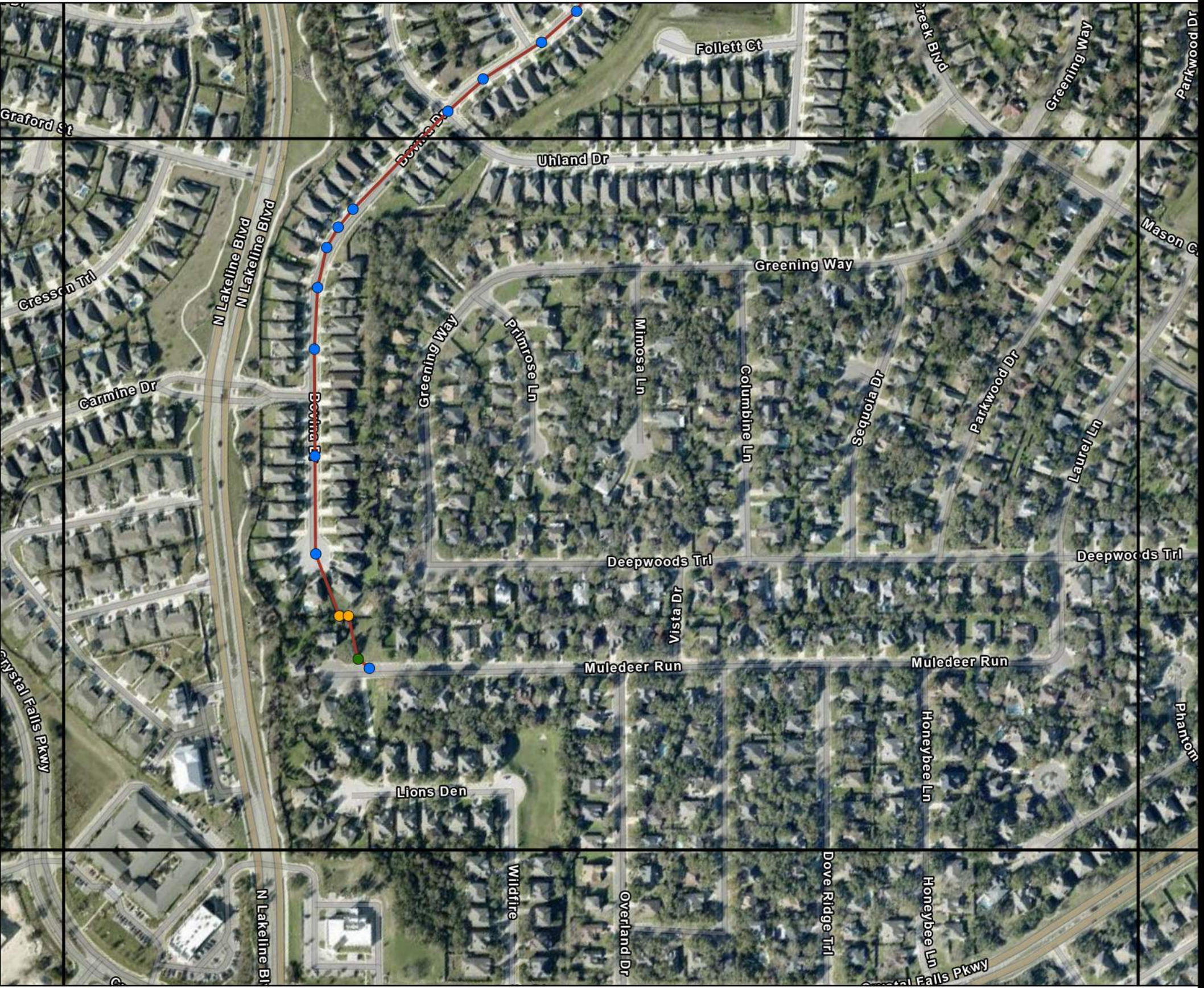




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: P-12**

- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |



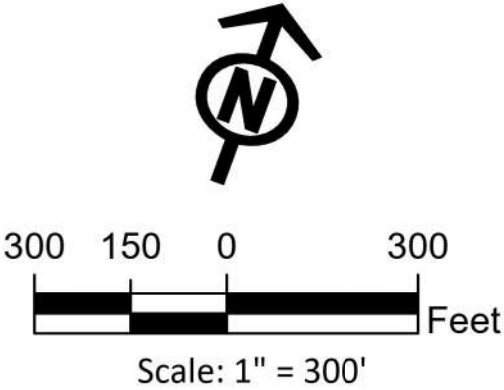


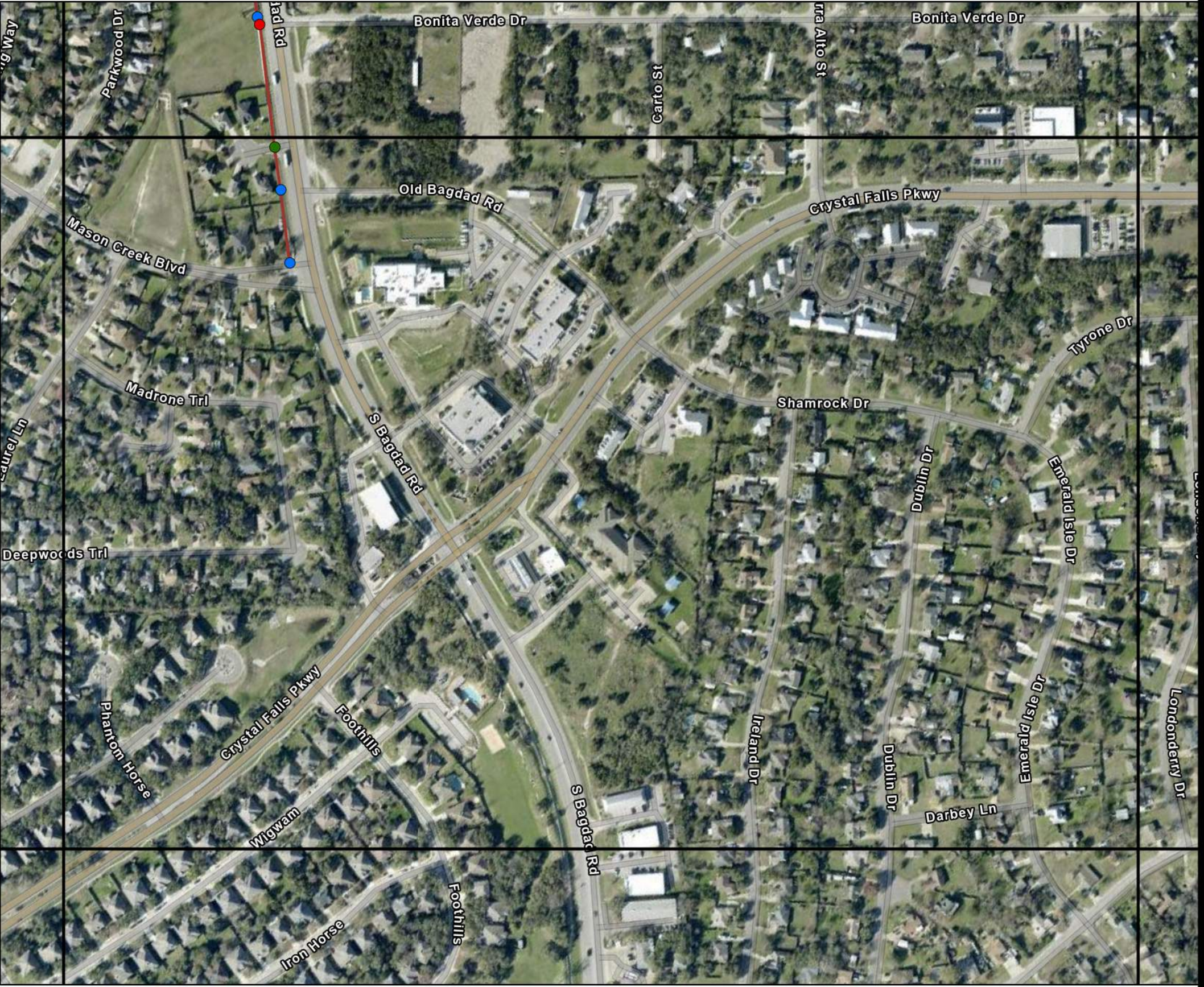
**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: Q-11**

- Legend**

 - ▲ Lift Station
 - ◆ Outfall
 - Sewer Main
- Manhole Survey Status**

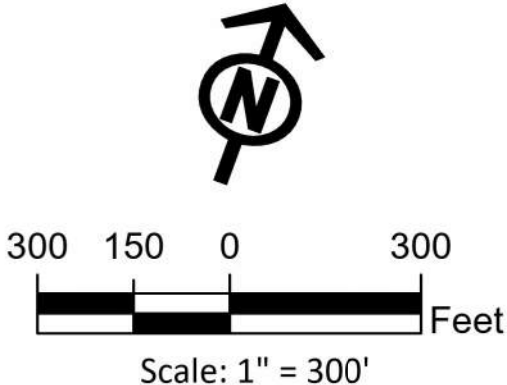
 - Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete





**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: Q-12**

- Legend**
- | | |
|--------------|------------------------------|
| Lift Station | Manhole Survey Status |
| Outfall | Buried |
| Sewer Main | Could Not Access |
| | Could Not Locate |
| | Could Not Open |
| | Complete |

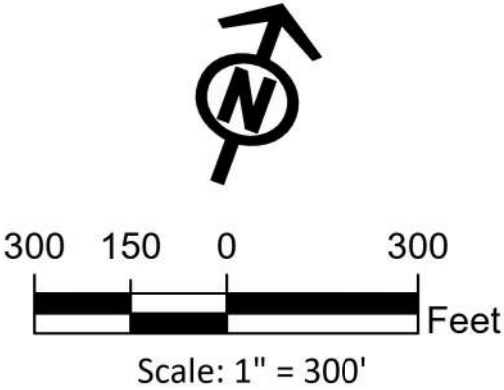


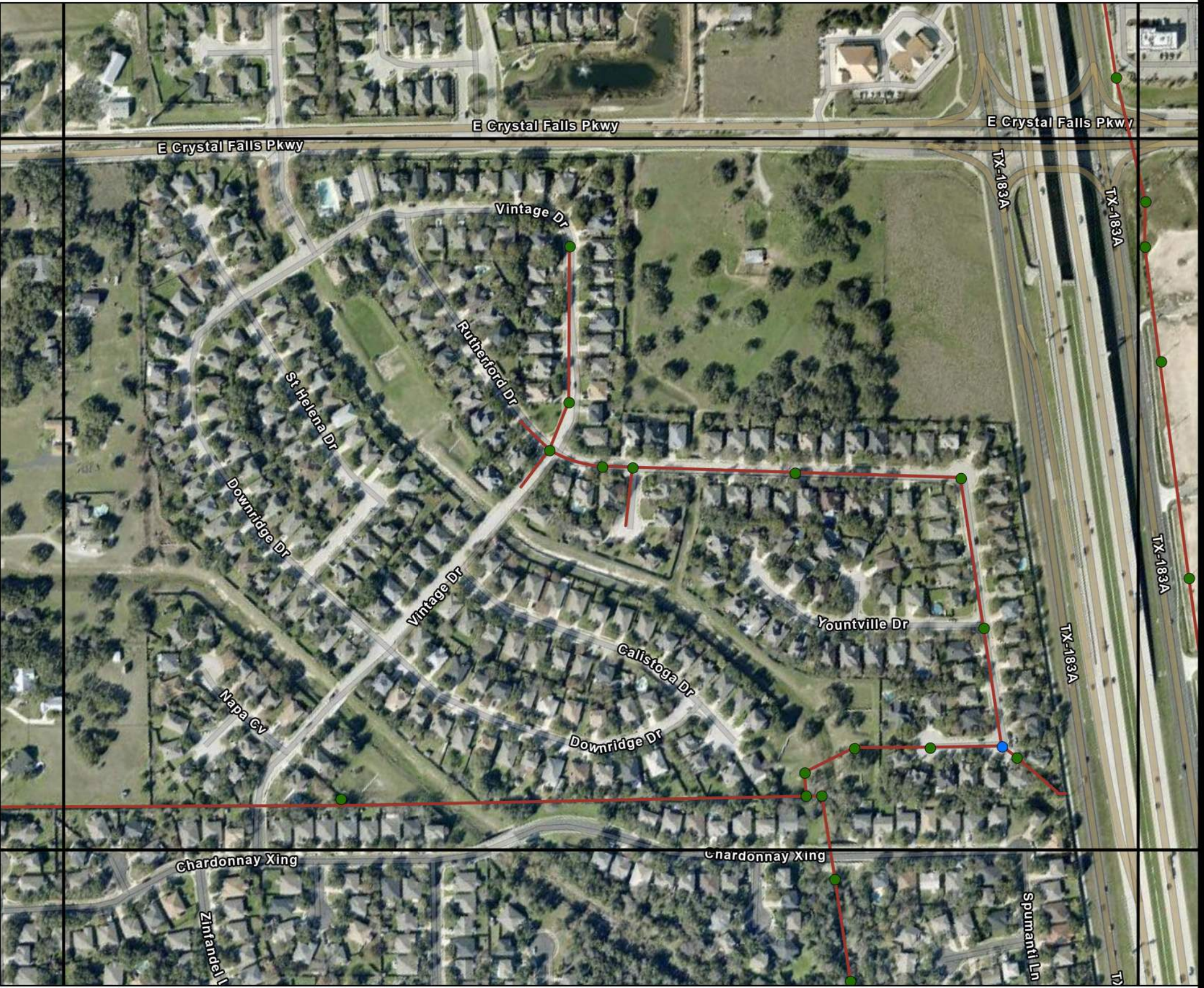


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: Q-14**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬠ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

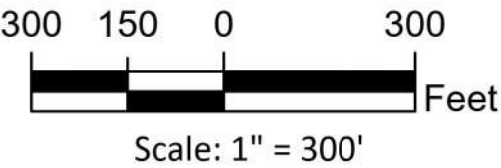


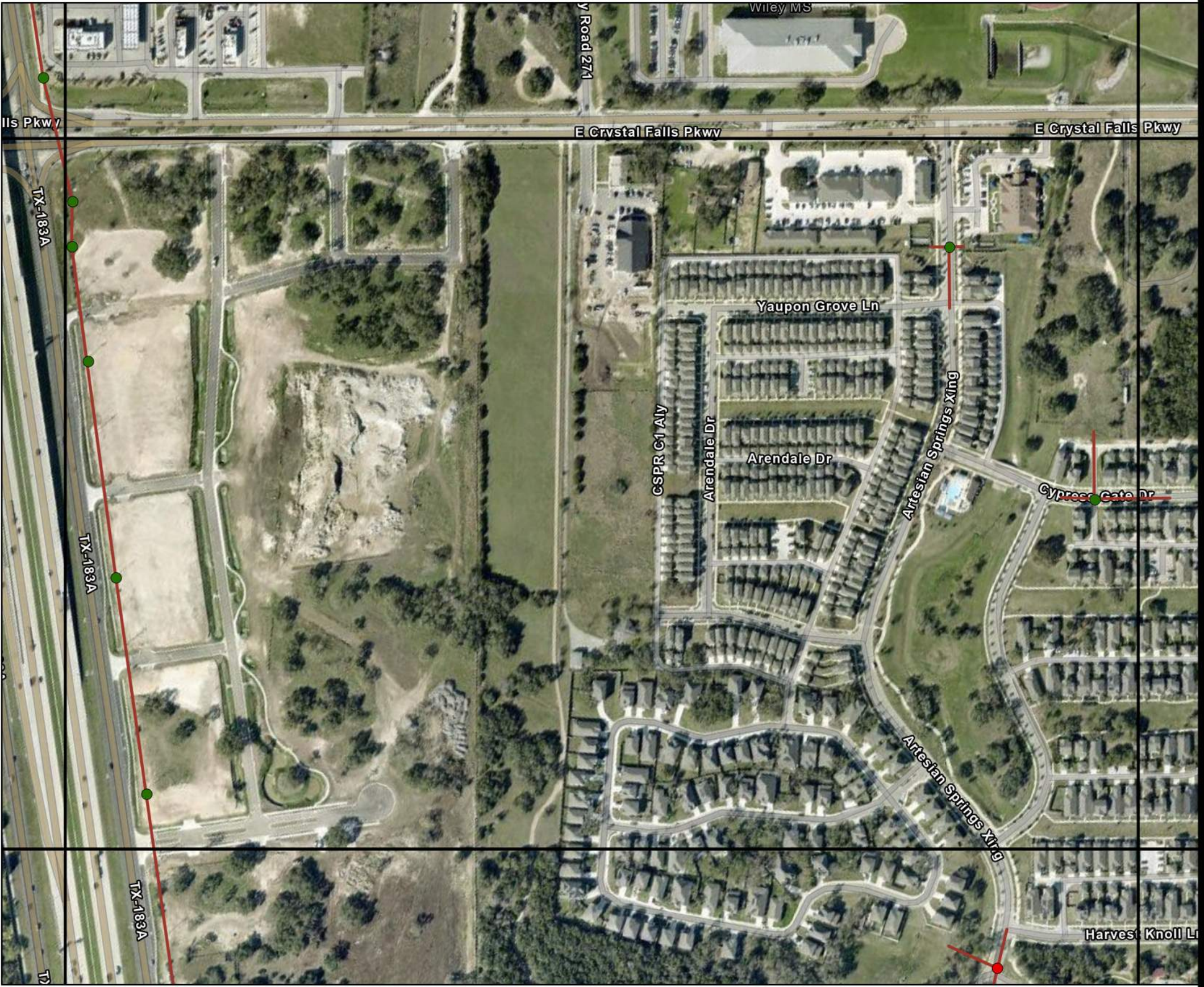


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: Q-15**

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |



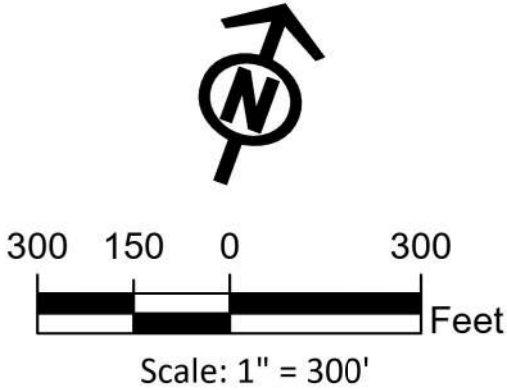


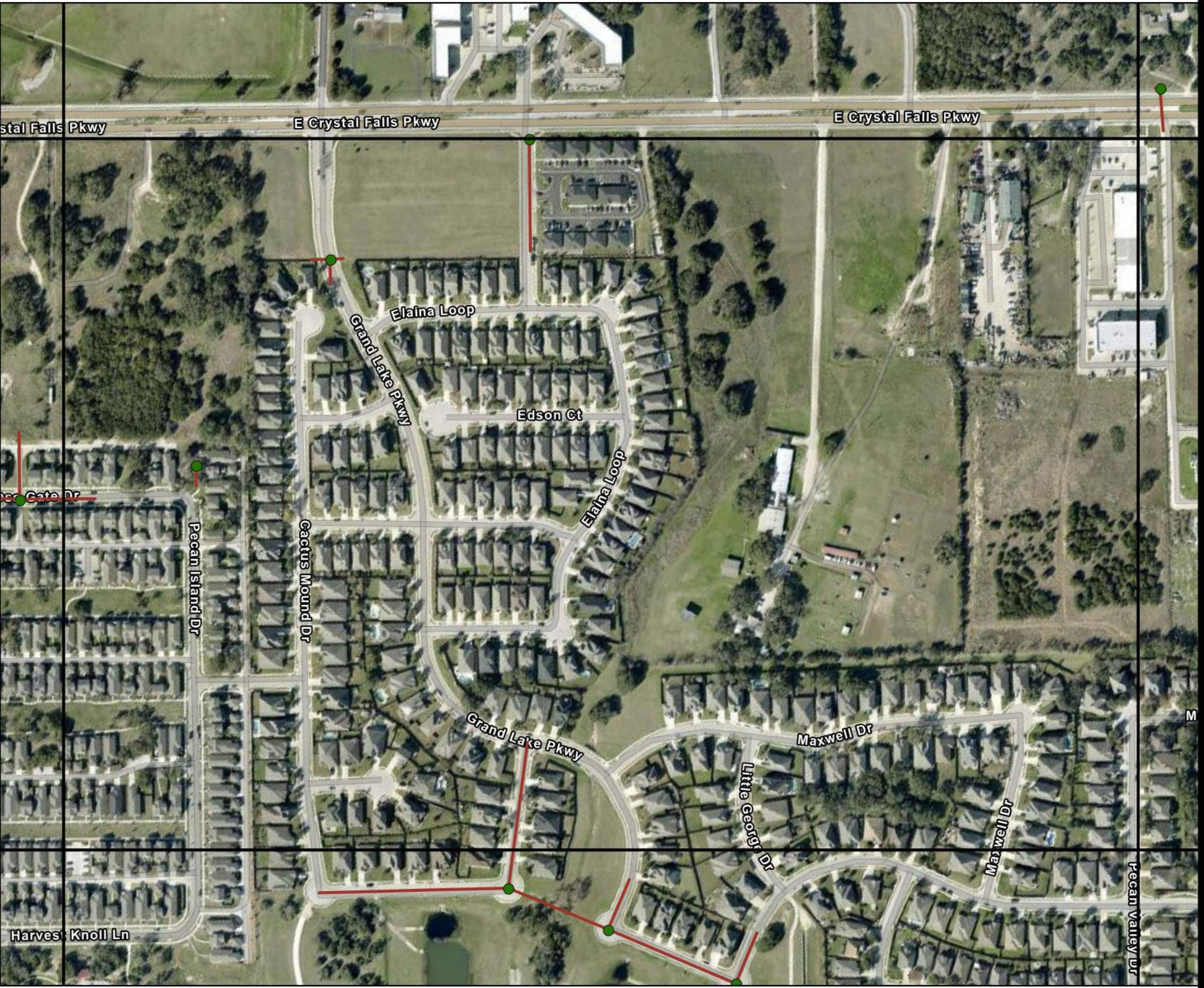
**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: Q-16**

- Legend**

 - ▲ Lift Station
 - ◊ Outfall
 - Sewer Main
- Manhole Survey Status**

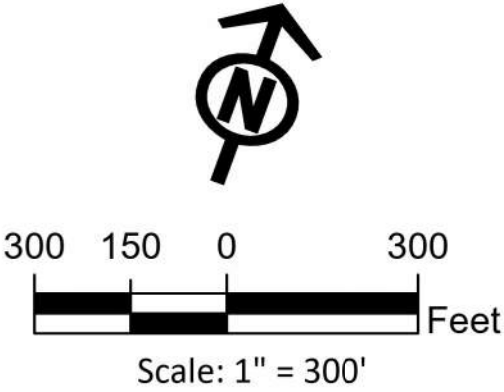
 - Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete

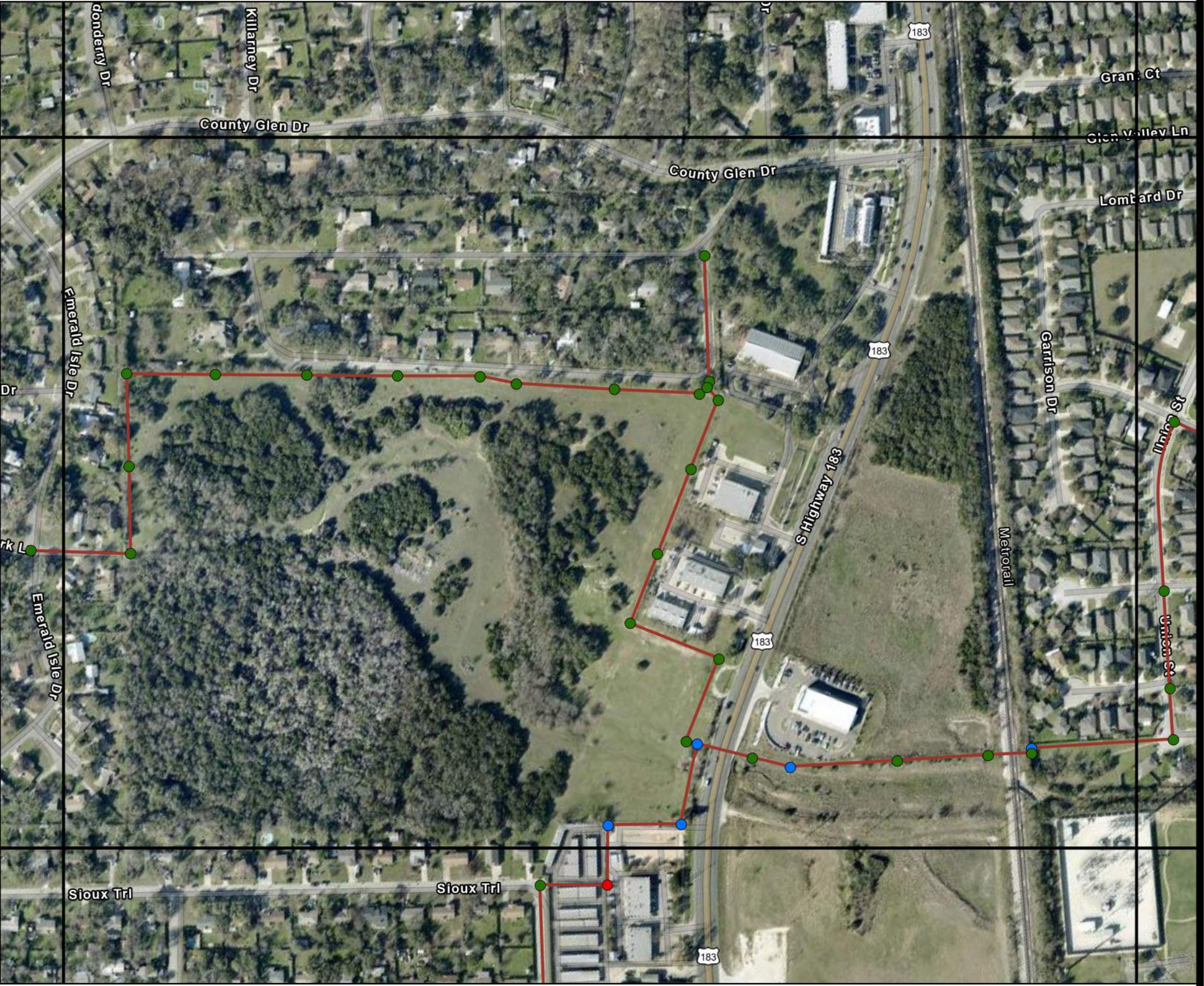




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: Q-17**

- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

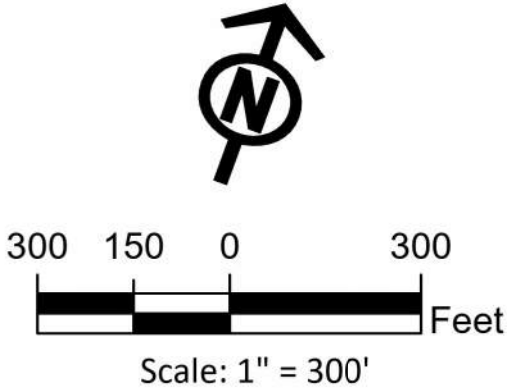


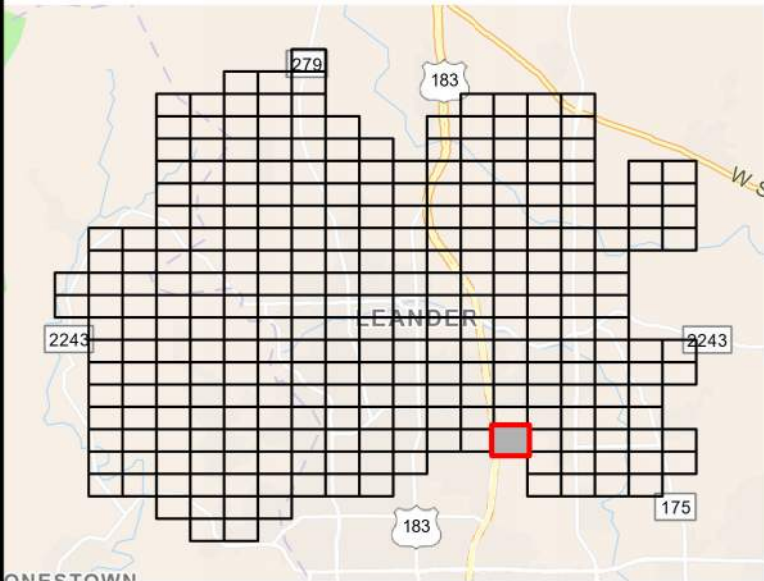


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: R-13**

Legend

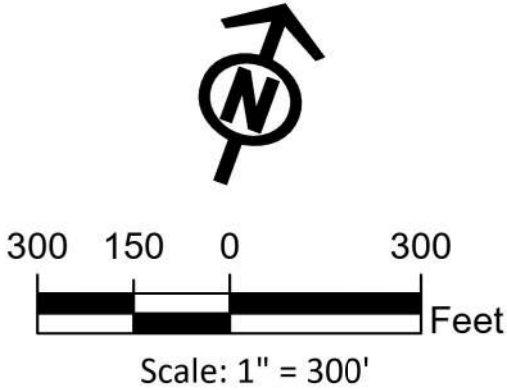
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

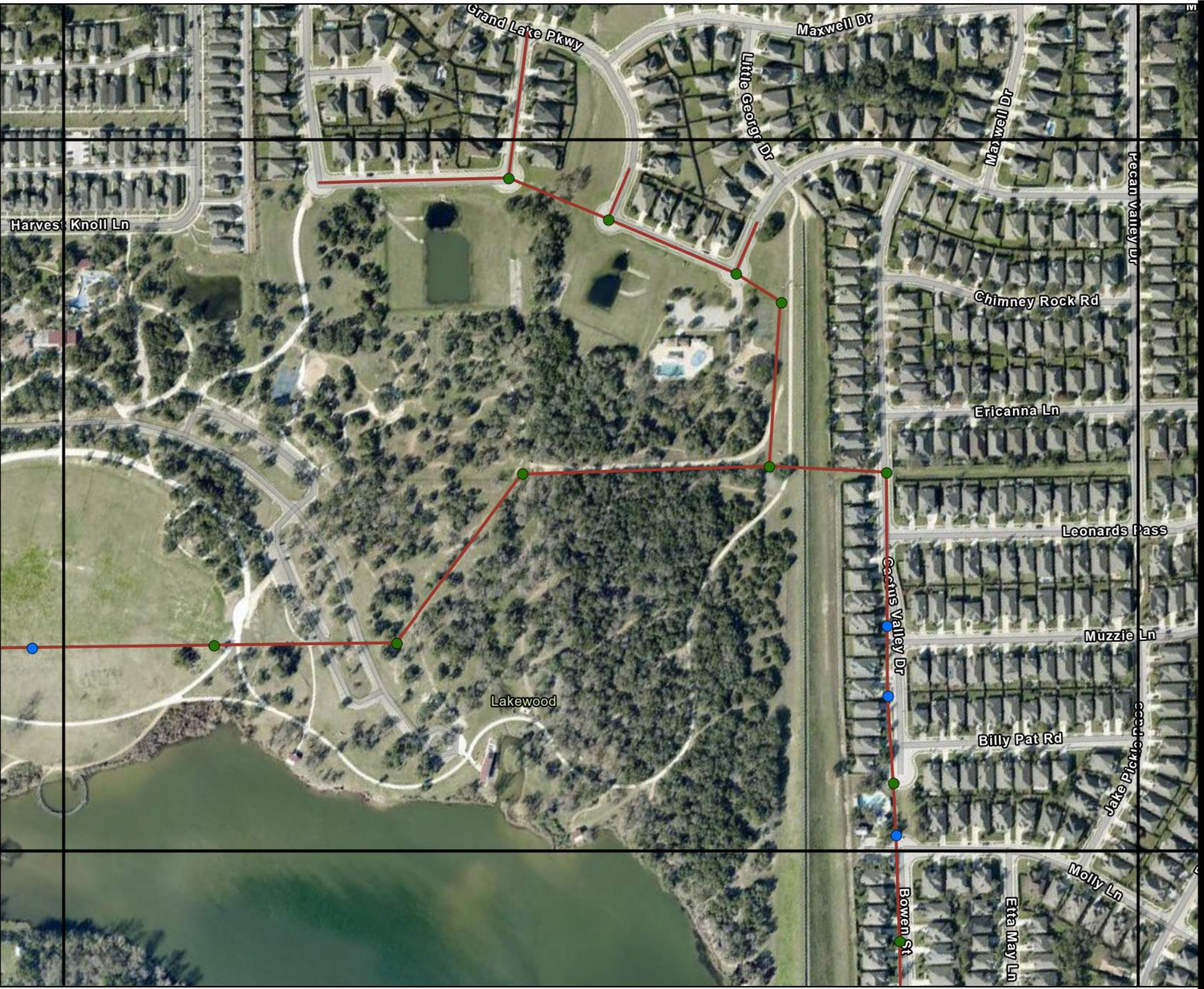




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: R-16**

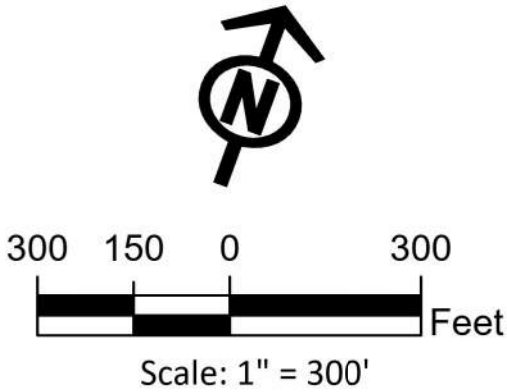
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◆ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

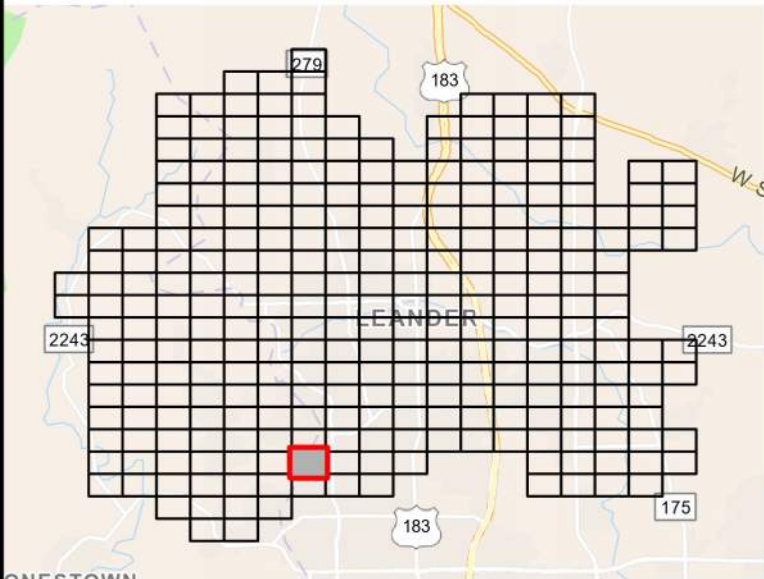
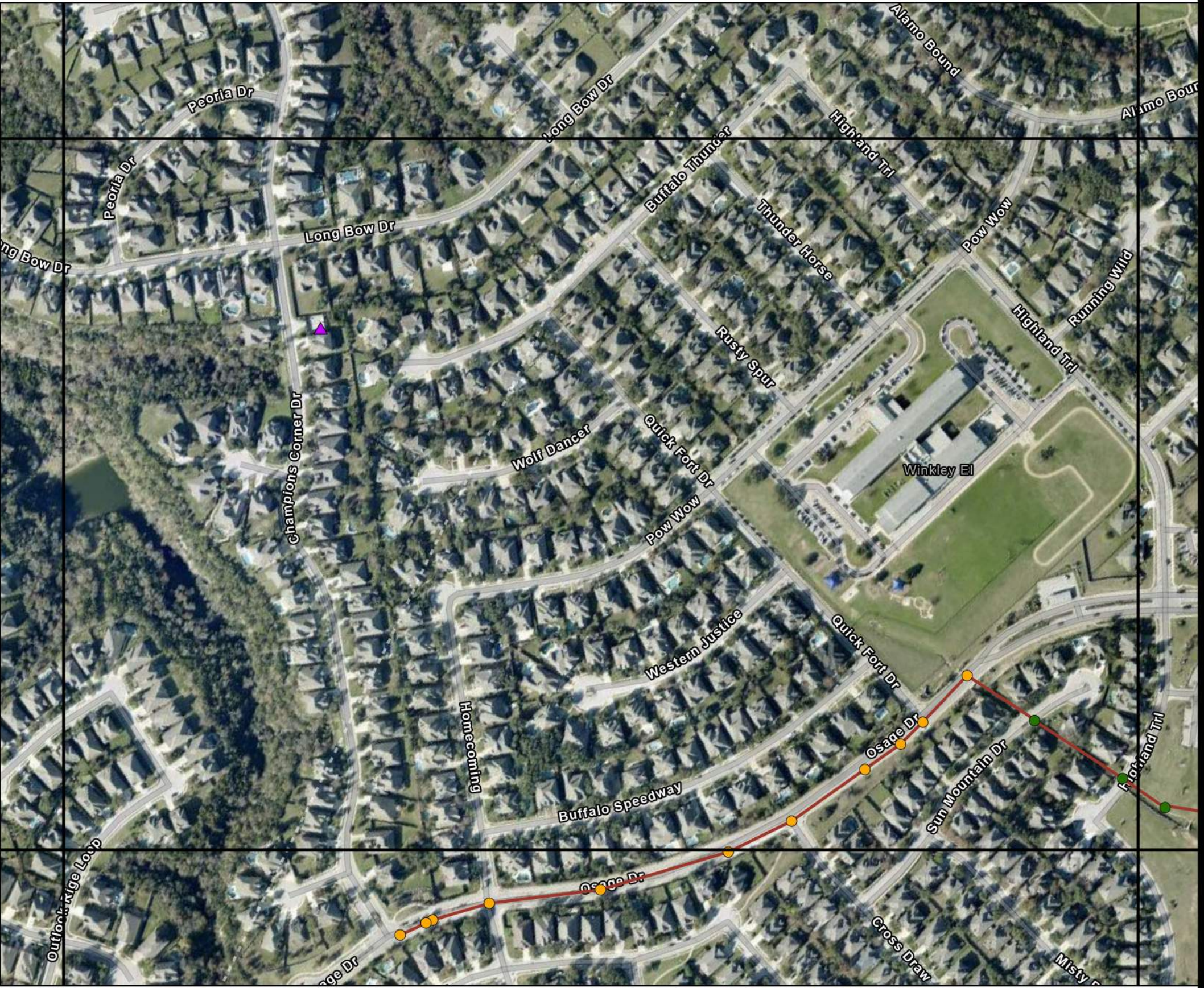




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: R-17**

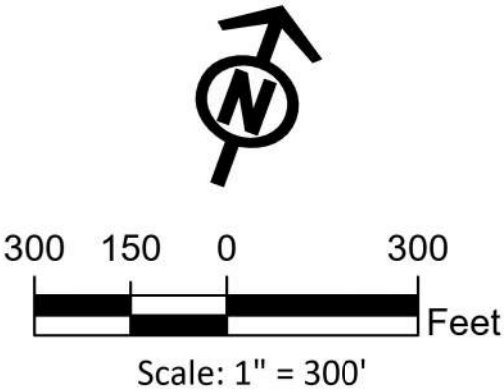
- Legend**
- ▲ Lift Station
 - ◆ Outfall
 - Sewer Main
- Manhole Survey Status**
- Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete

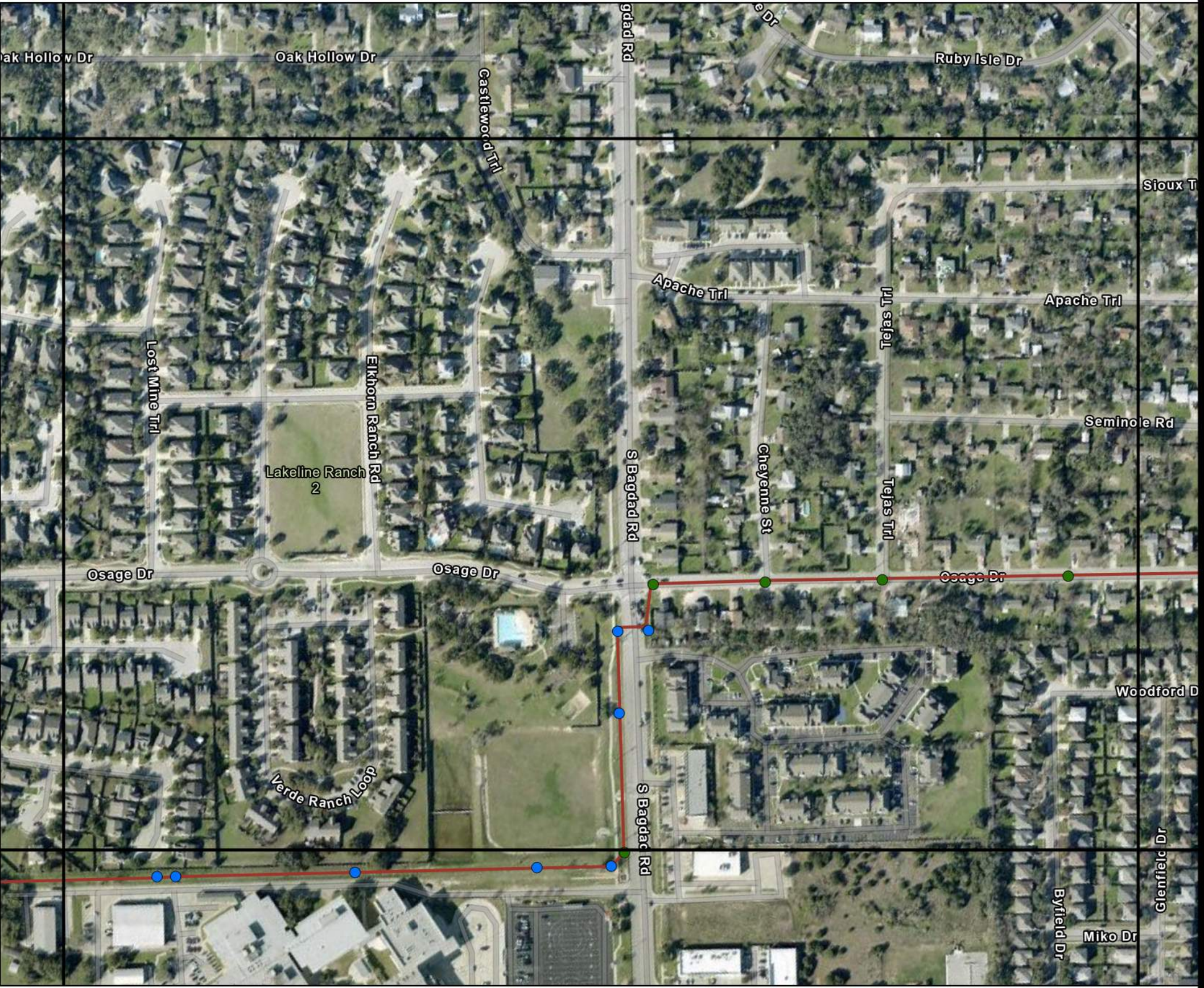




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: S-10**

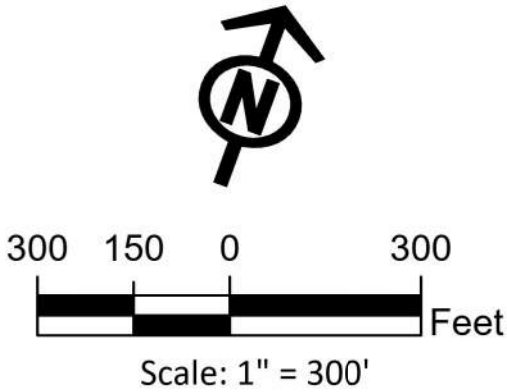
- Legend**
- | | |
|--------------|------------------------------|
| Lift Station | Manhole Survey Status |
| Outfall | Buried |
| Sewer Main | Could Not Access |
| | Could Not Locate |
| | Could Not Open |
| | Complete |

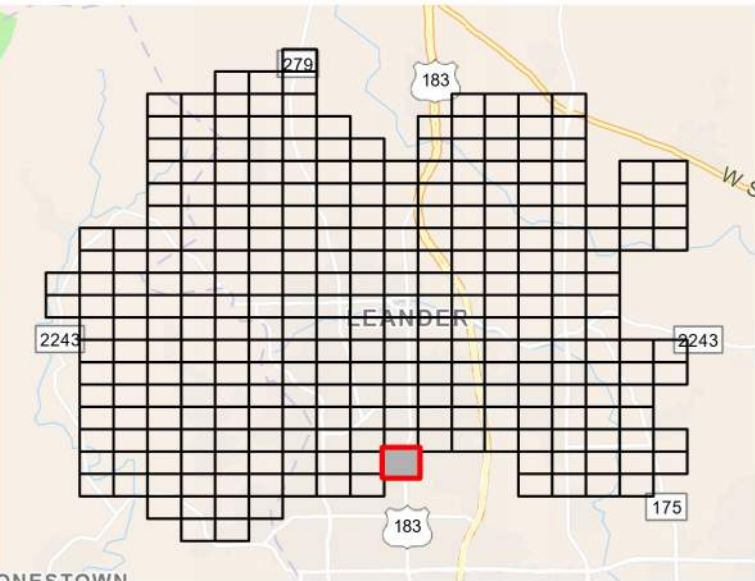
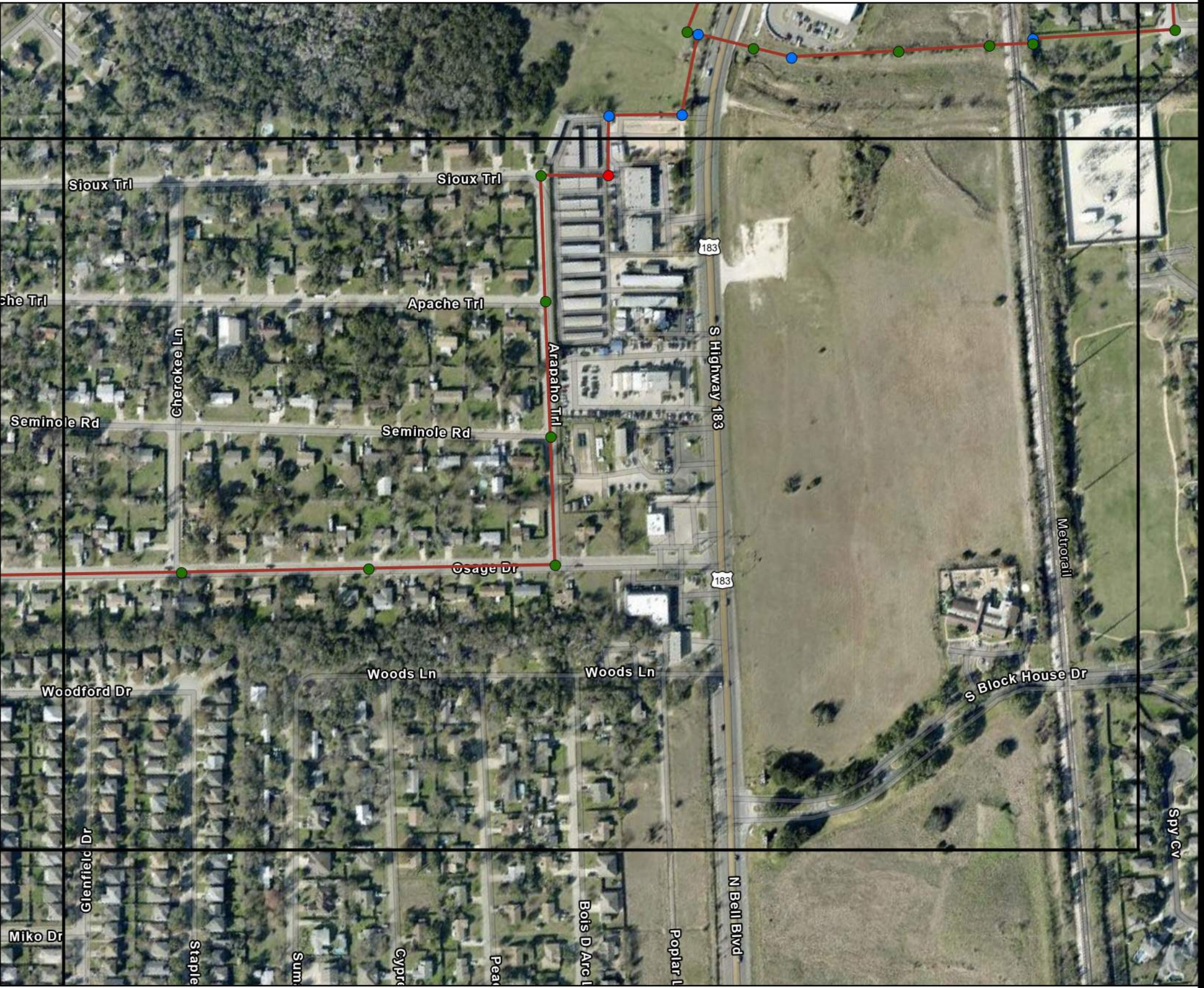




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: S-12**

- Legend**
- ▲ Lift Station
 - ◆ Outfall
 - Sewer Main
- Manhole Survey Status**
- Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete

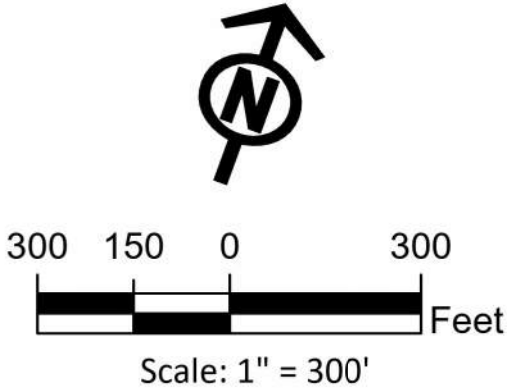


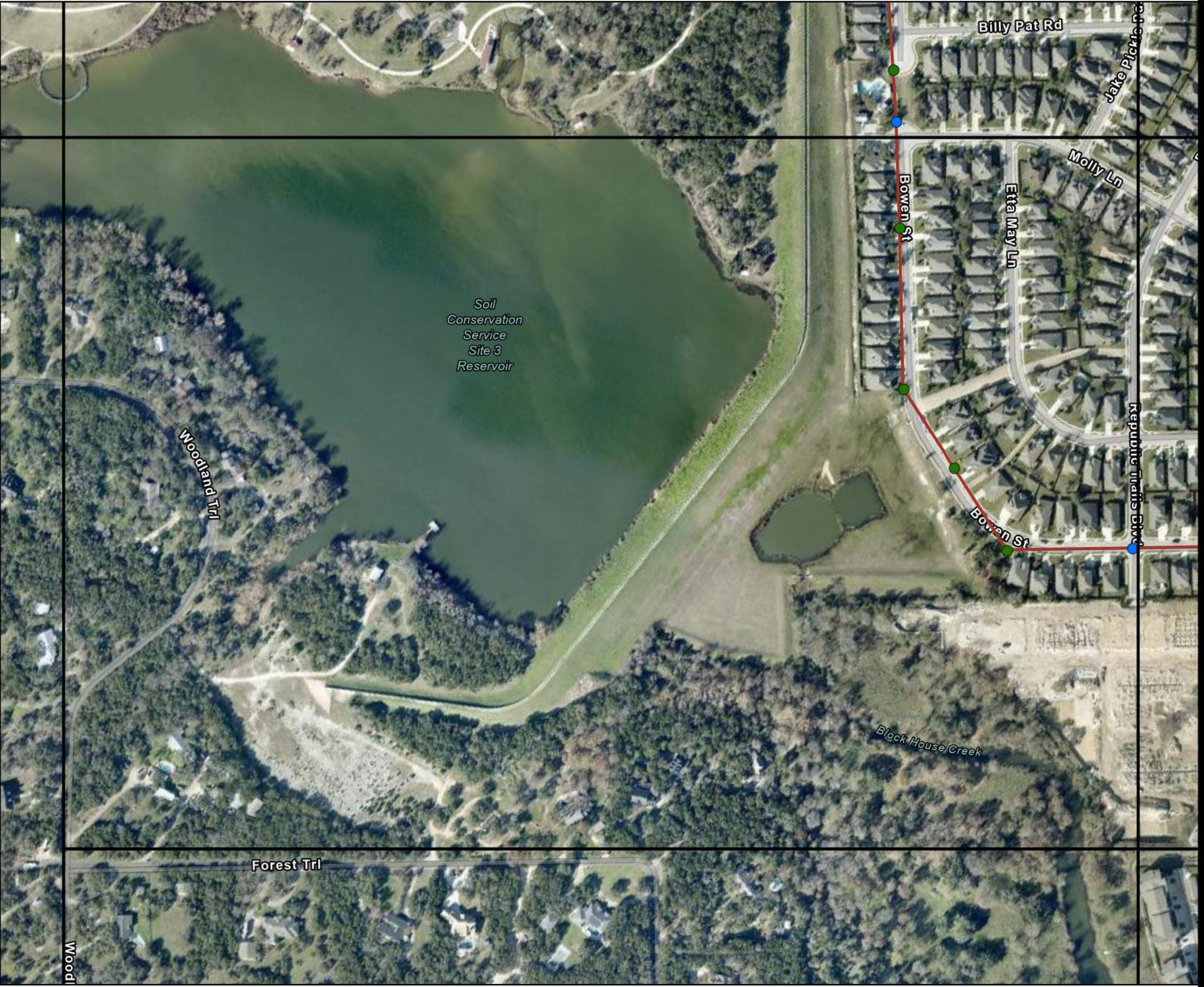


**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: S-13**

Legend

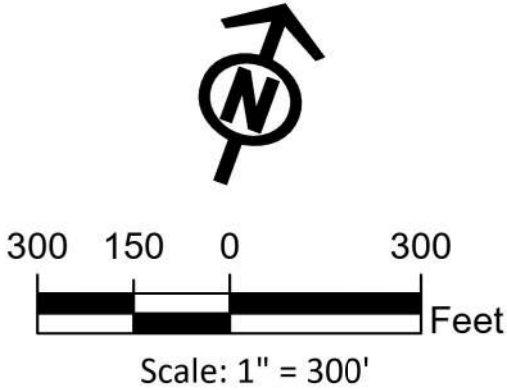
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

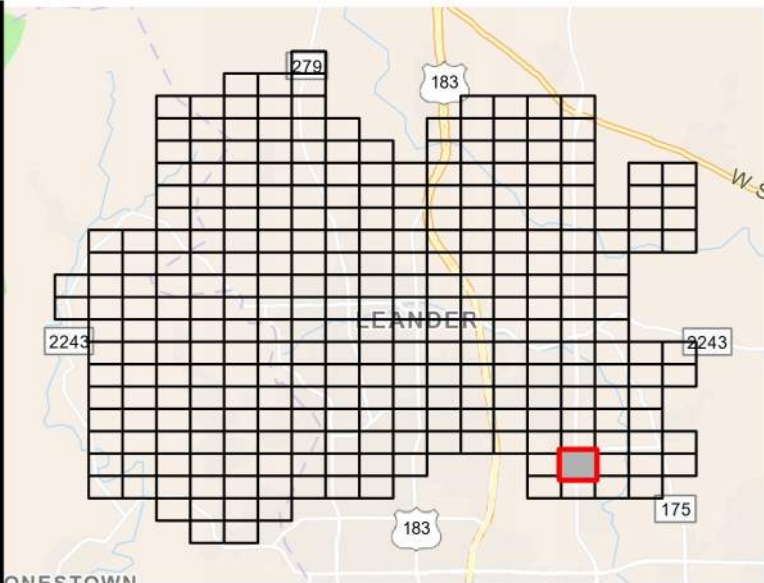
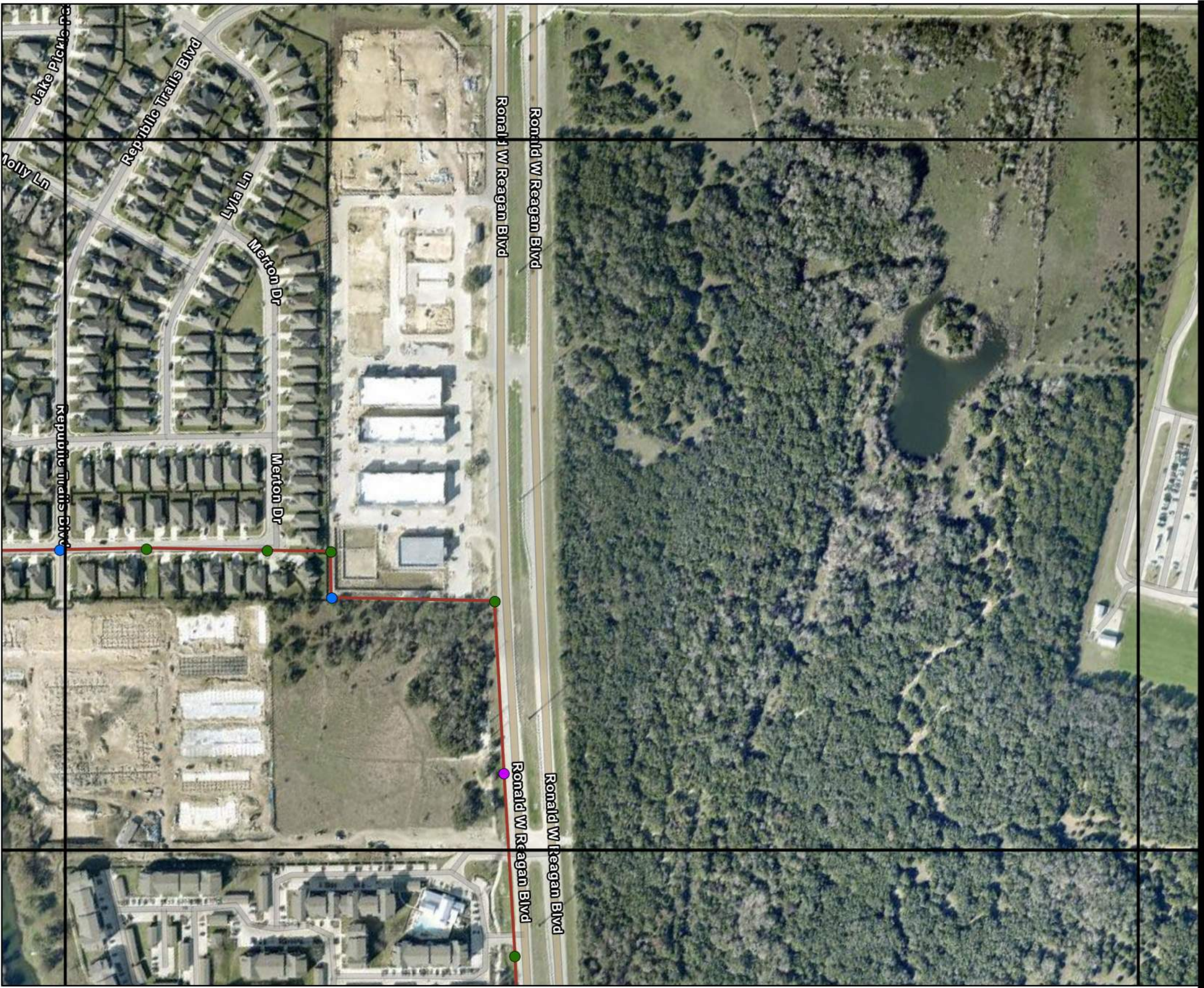




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: S-17**

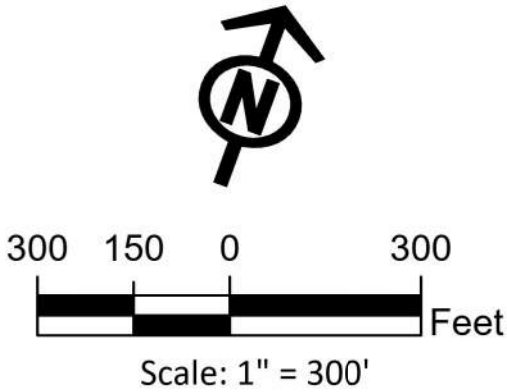
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

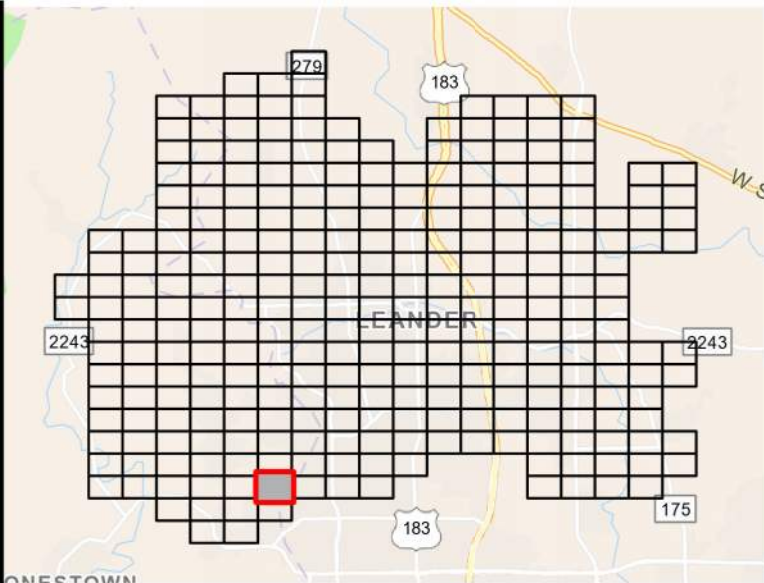
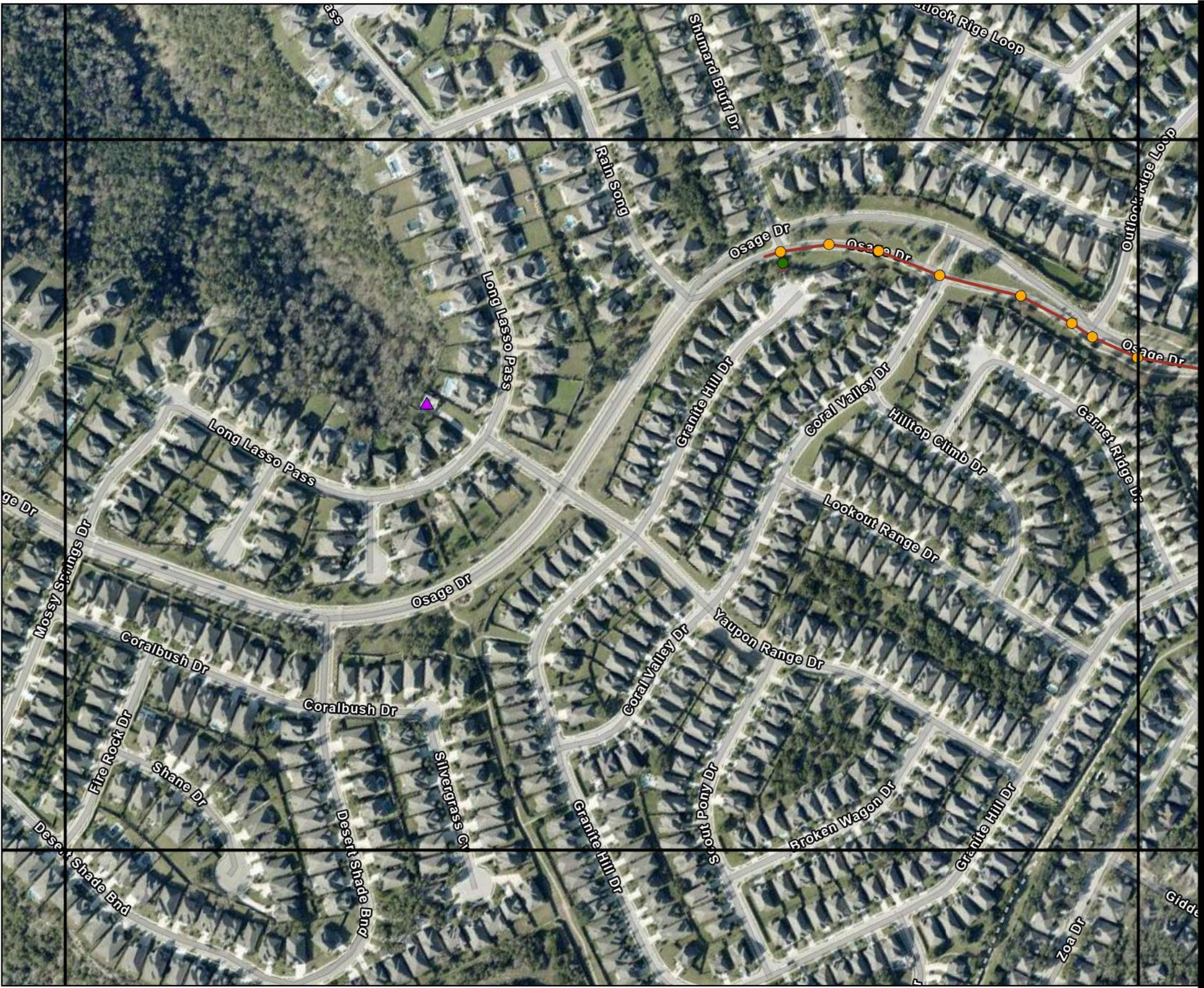




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: S-18**

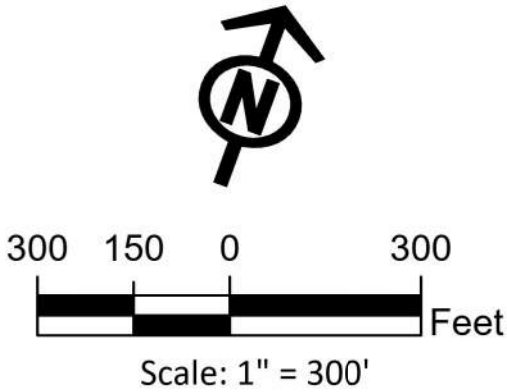
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

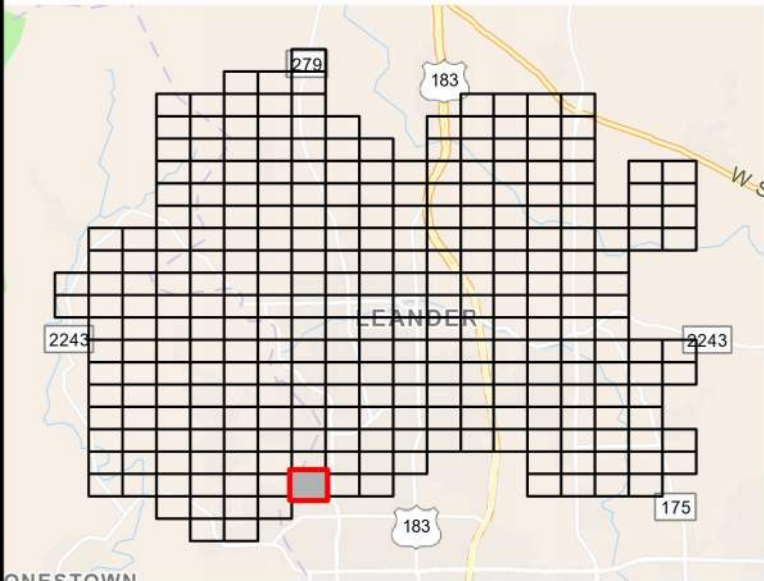
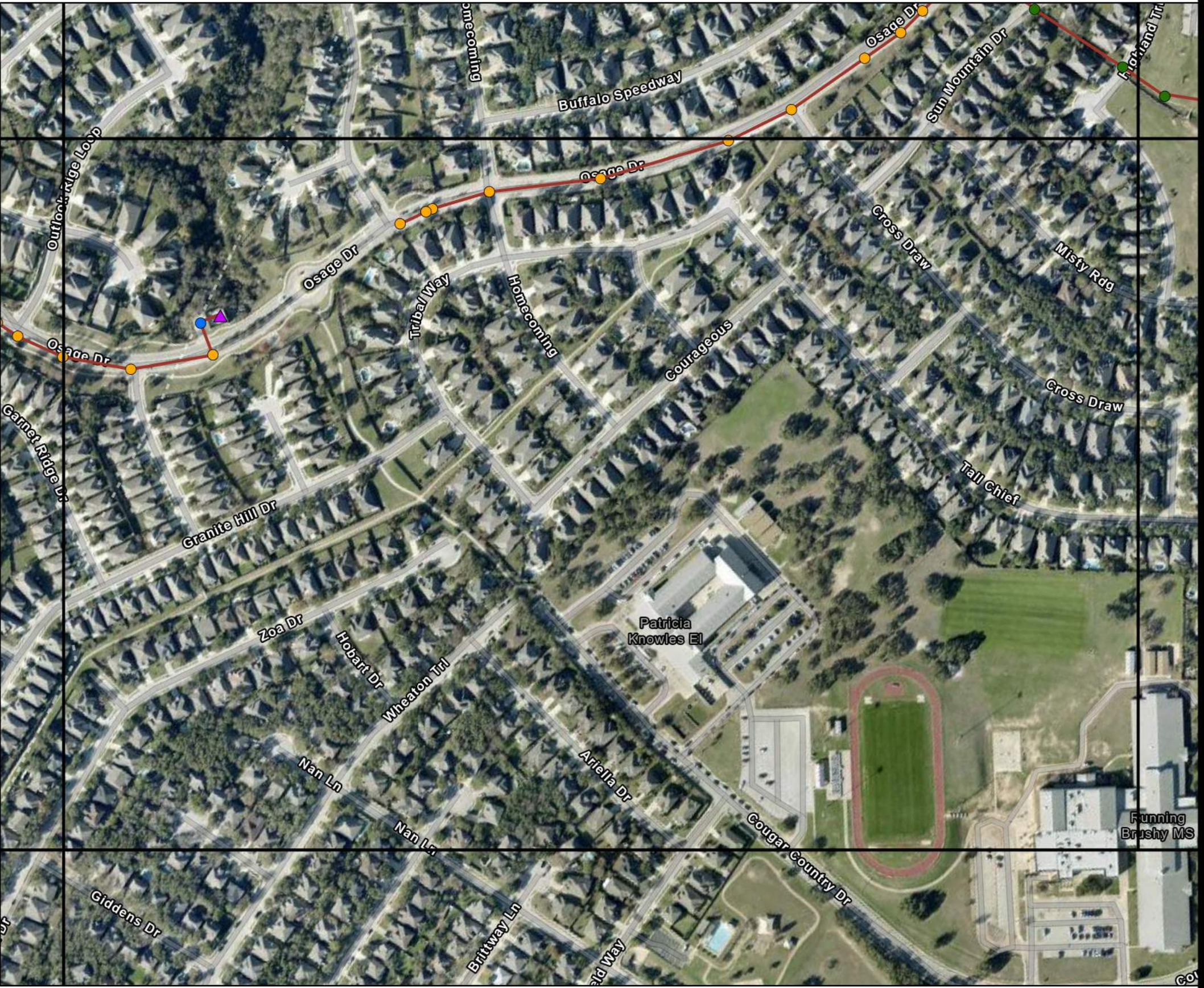




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: T-09**

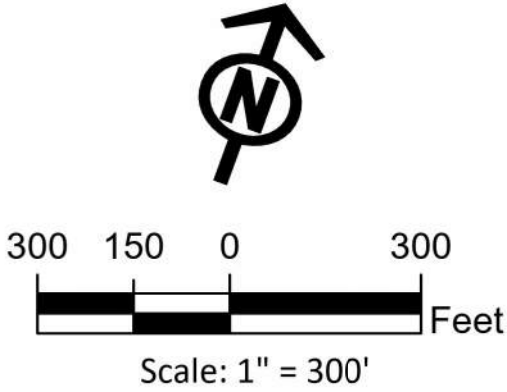
- Legend**
- | | |
|--------------|------------------------------|
| Lift Station | Manhole Survey Status |
| Outfall | Buried |
| Sewer Main | Could Not Access |
| | Could Not Locate |
| | Could Not Open |
| | Complete |

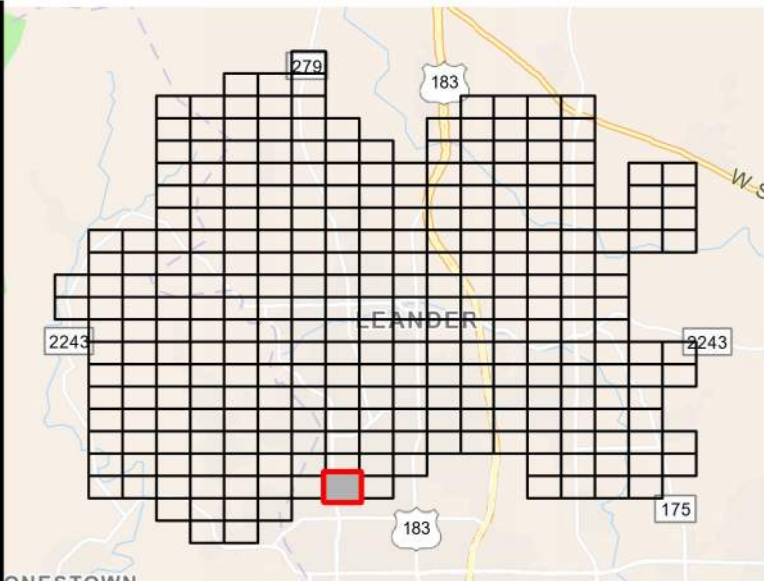
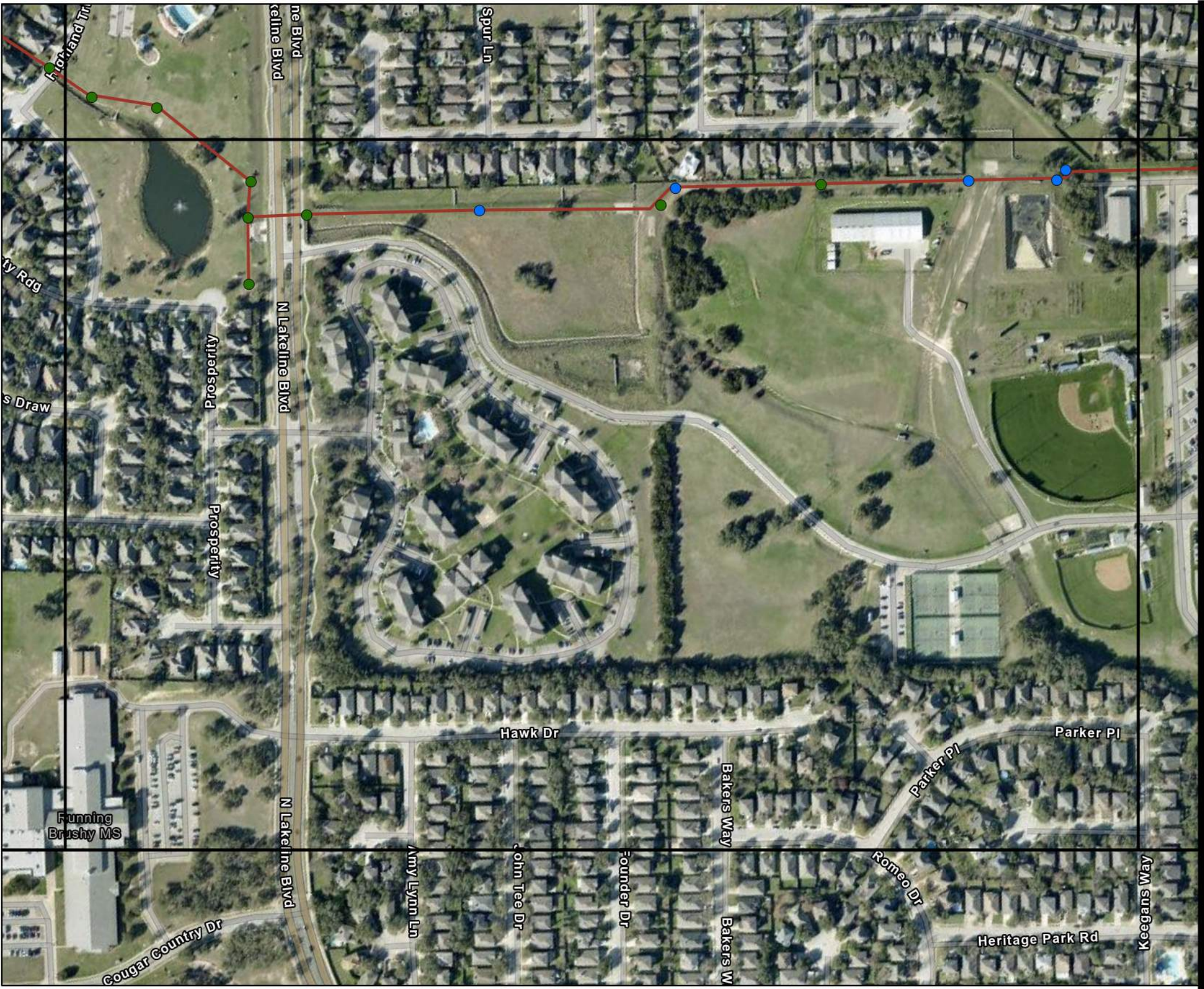




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: T-10**

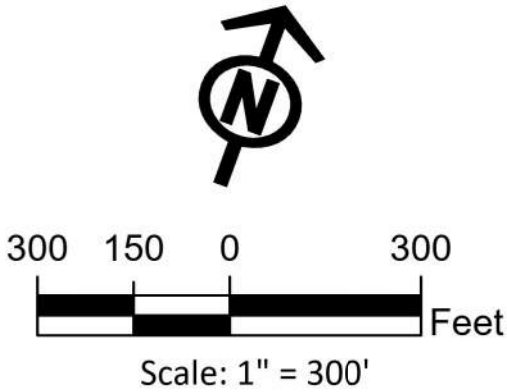
- Legend**
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ● Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

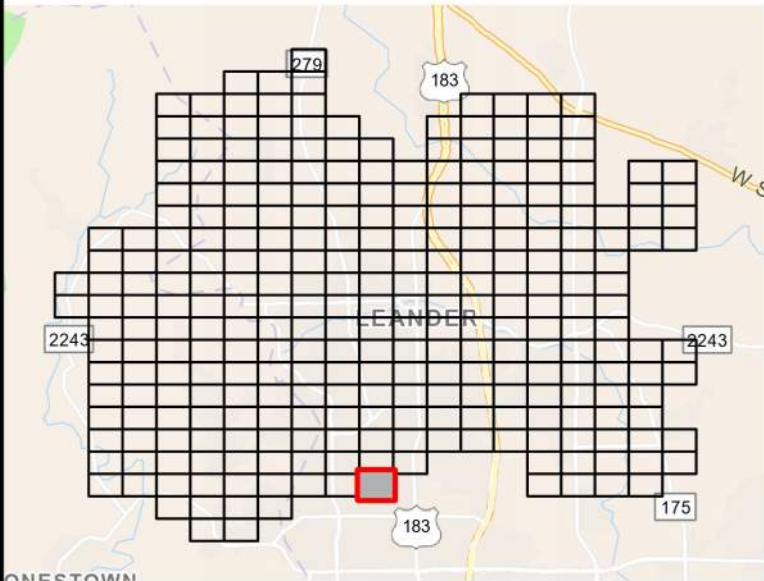




**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: T-11**

- Legend**
- ▲ Lift Station
 - ◆ Outfall
 - Sewer Main
- Manhole Survey Status**
- Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete



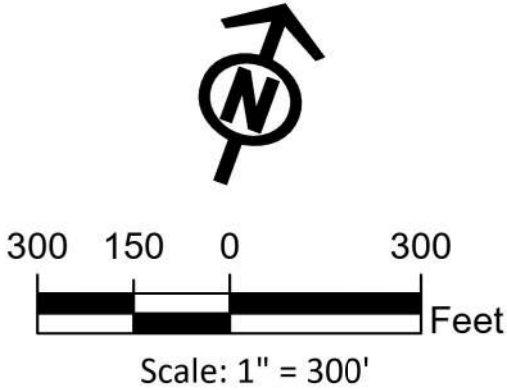


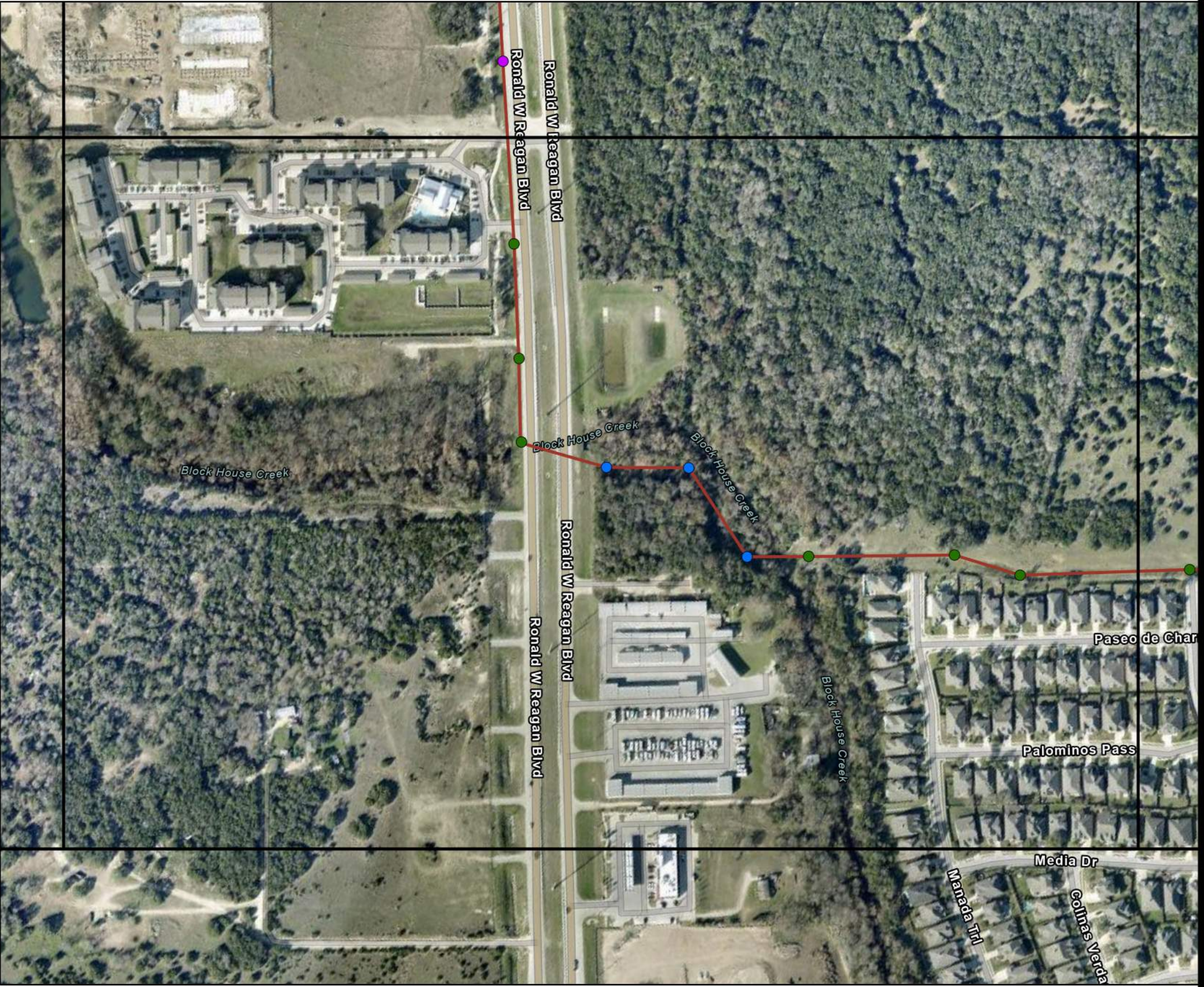
**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: T-12**

- Legend**

 - ▲ Lift Station
 - ◊ Outfall
 - Sewer Main
- Manhole Survey Status**

 - Buried
 - Could Not Access
 - Could Not Locate
 - Could Not Open
 - Complete



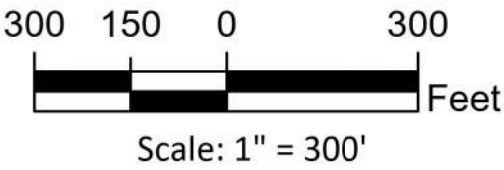


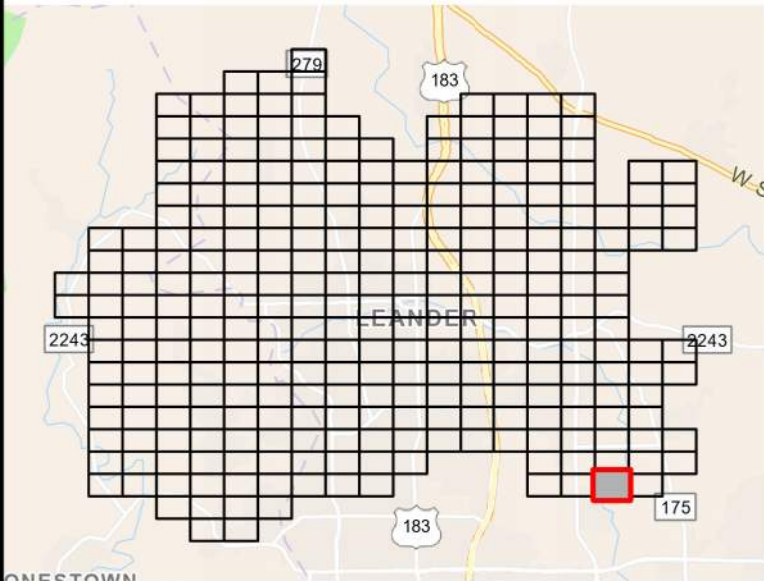
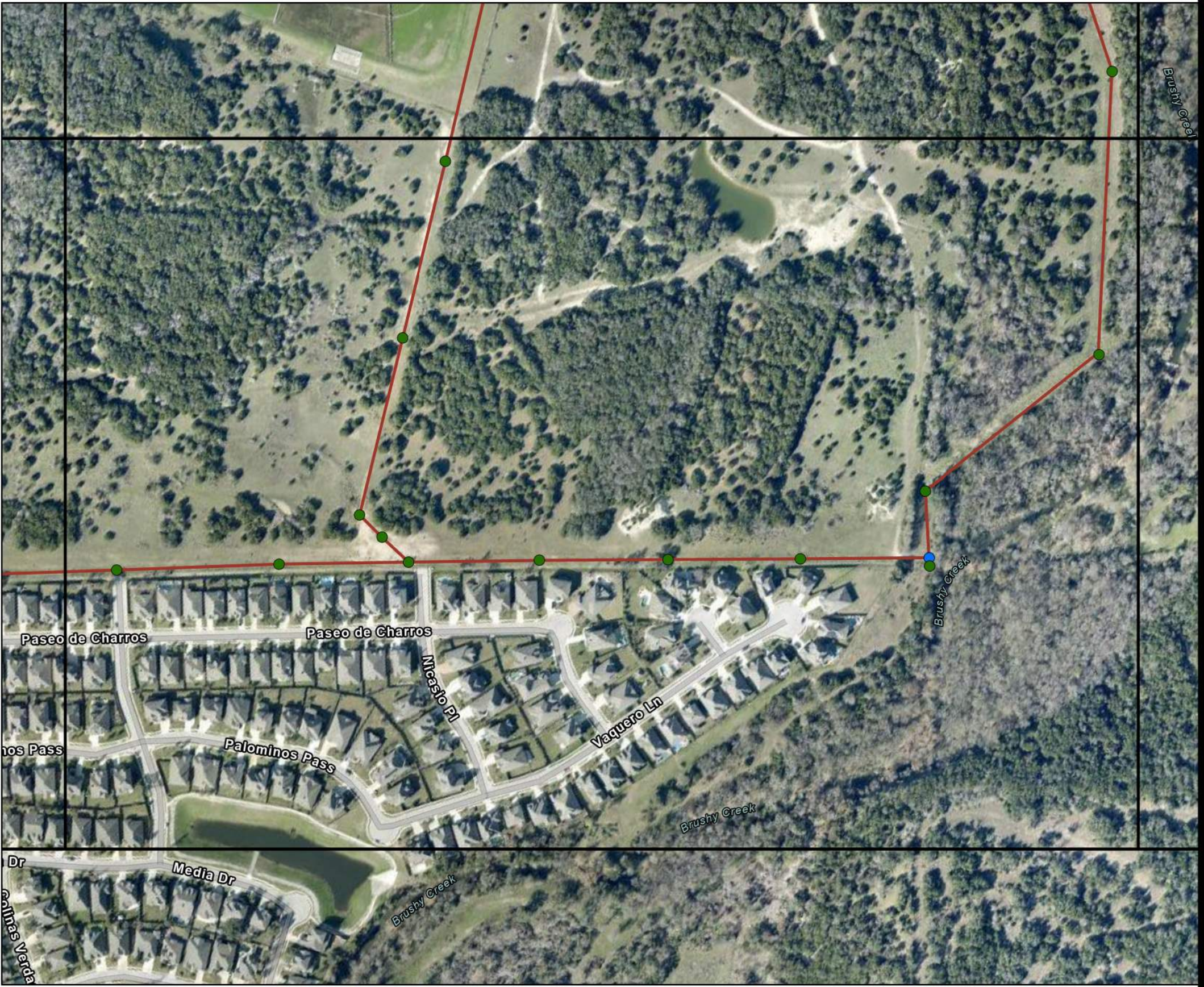
LEANDER MANHOLE SURVEY STATUS MAP

GRID NO.: T-18

Legend

- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ◊ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |





**LEANDER MANHOLE
SURVEY STATUS MAP
GRID NO.: T-19**

Legend

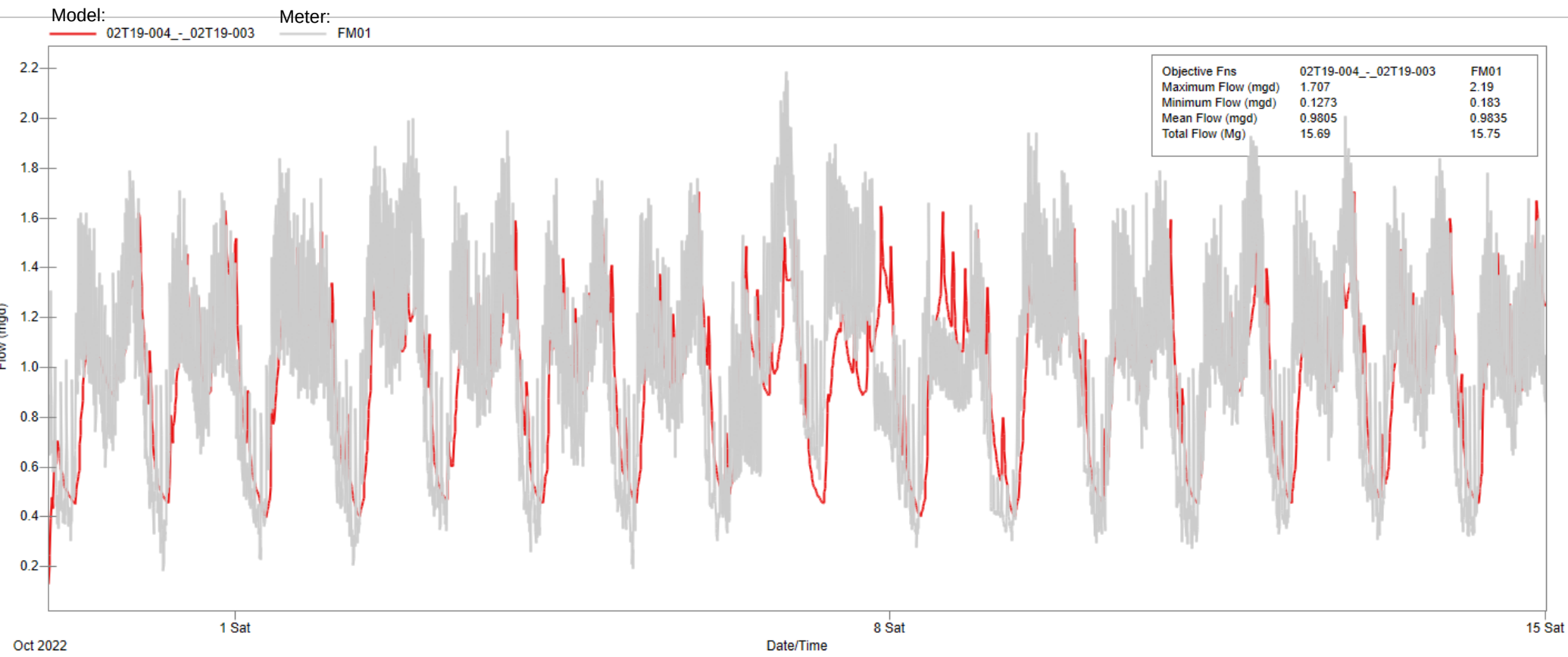
- | | |
|----------------|--------------------|
| ▲ Lift Station | ● Buried |
| ⬡ Outfall | ● Could Not Access |
| — Sewer Main | ● Could Not Locate |
| | ● Could Not Open |
| | ● Complete |

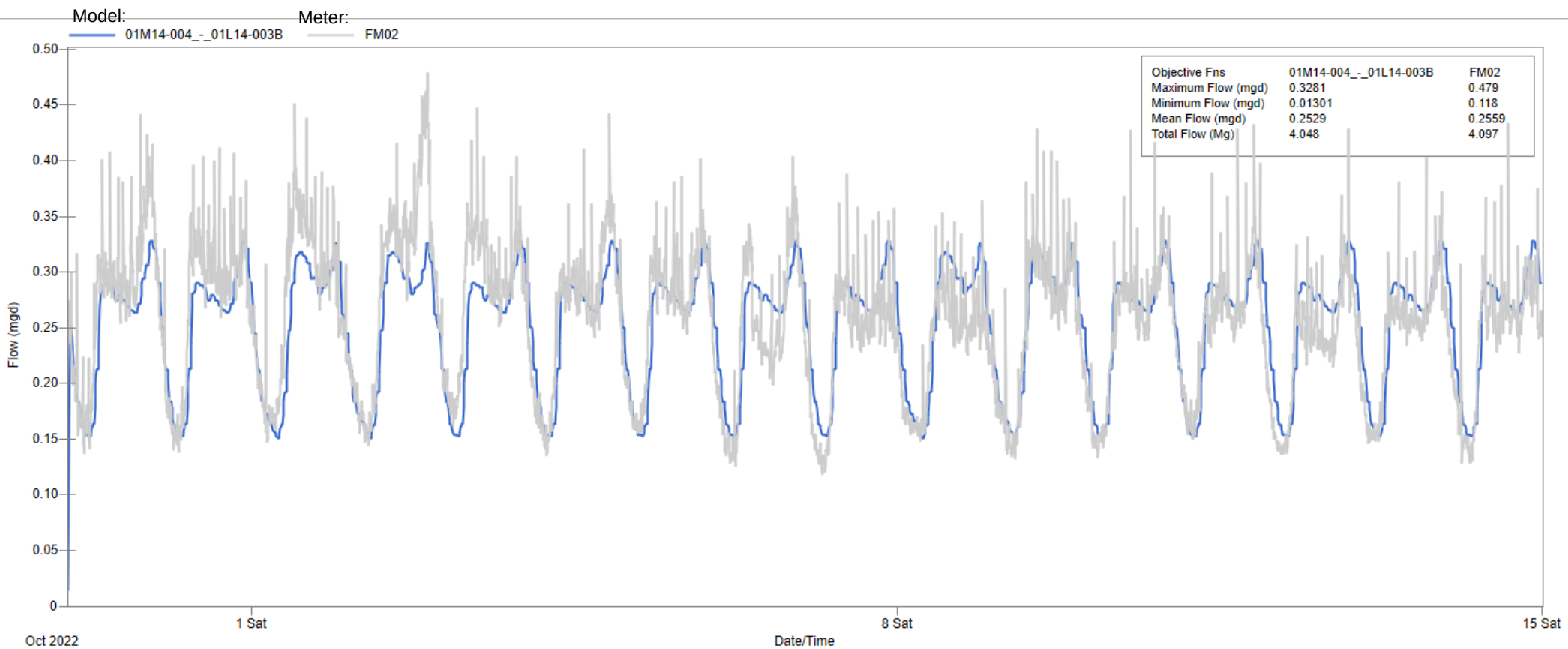


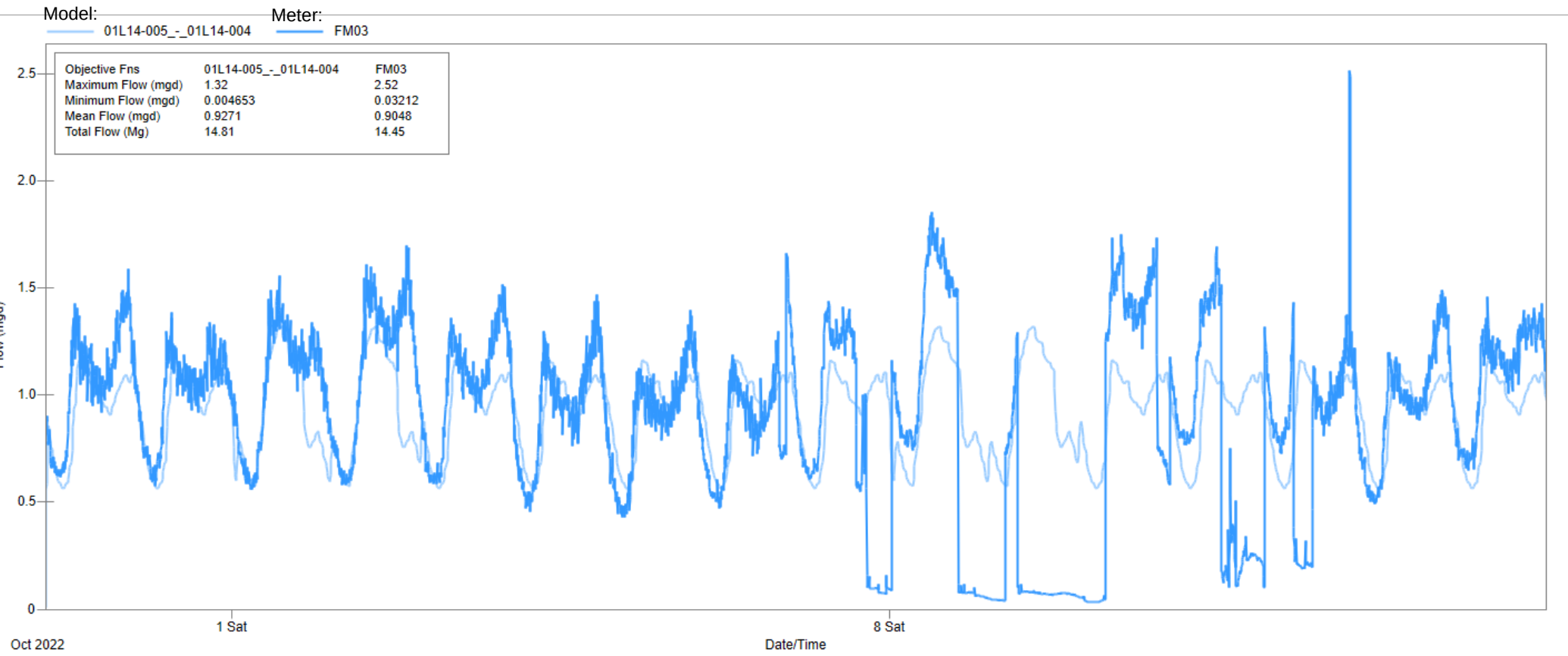
Scale: 1" = 300'

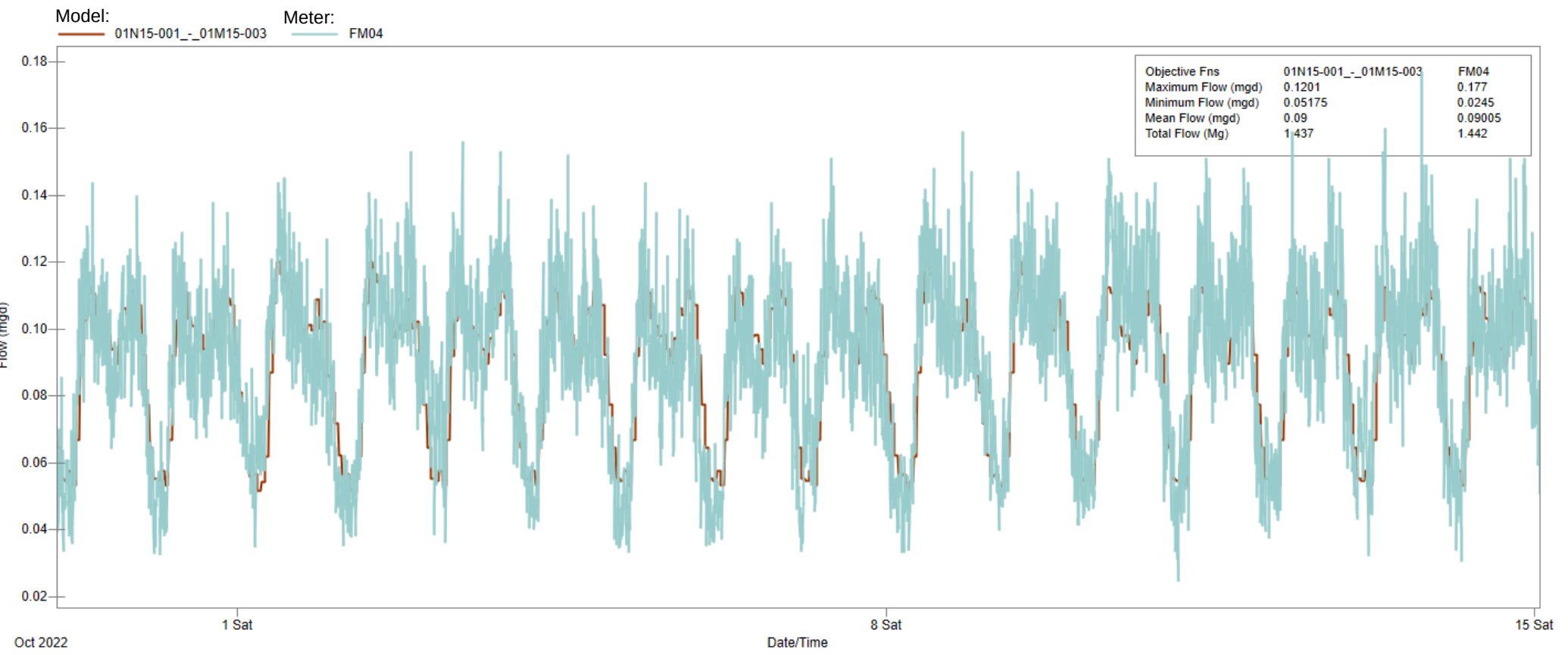
Appendix B: Dry Weather Calibration Summary

FM 01

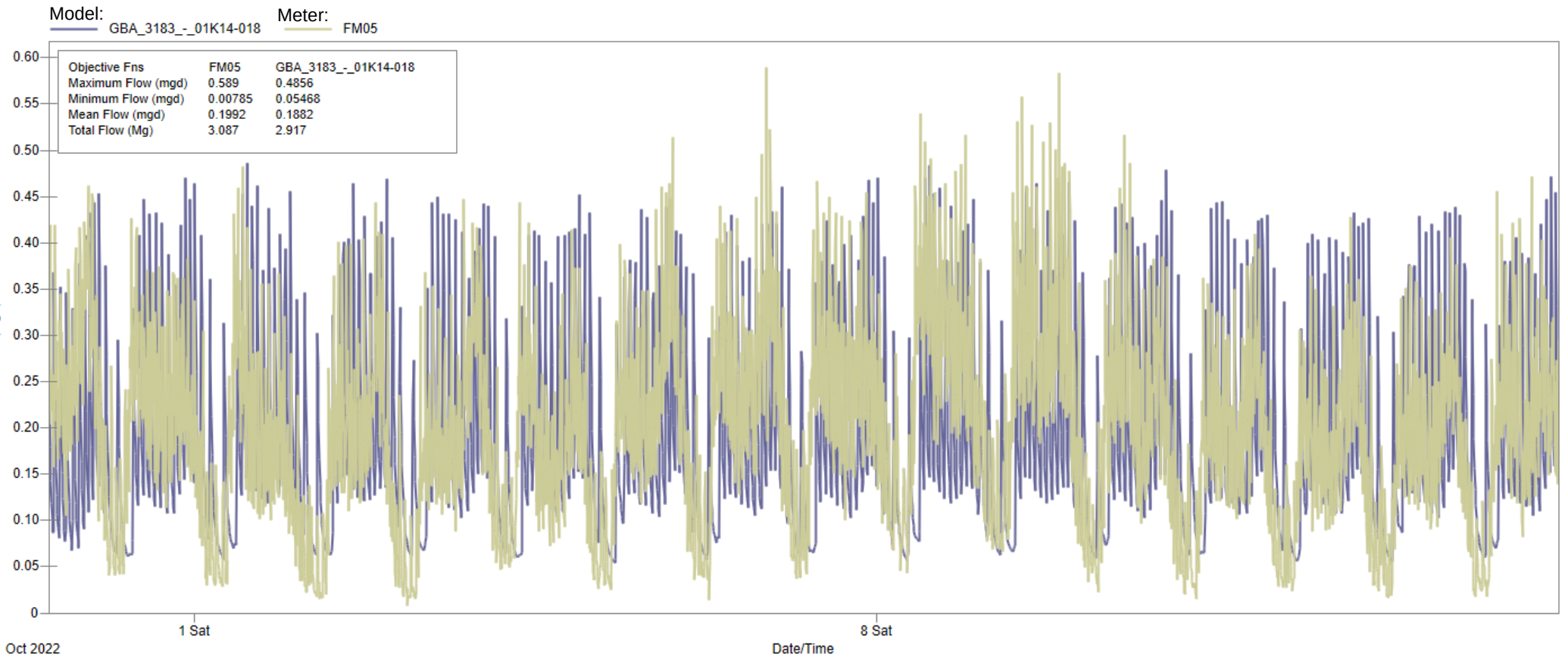


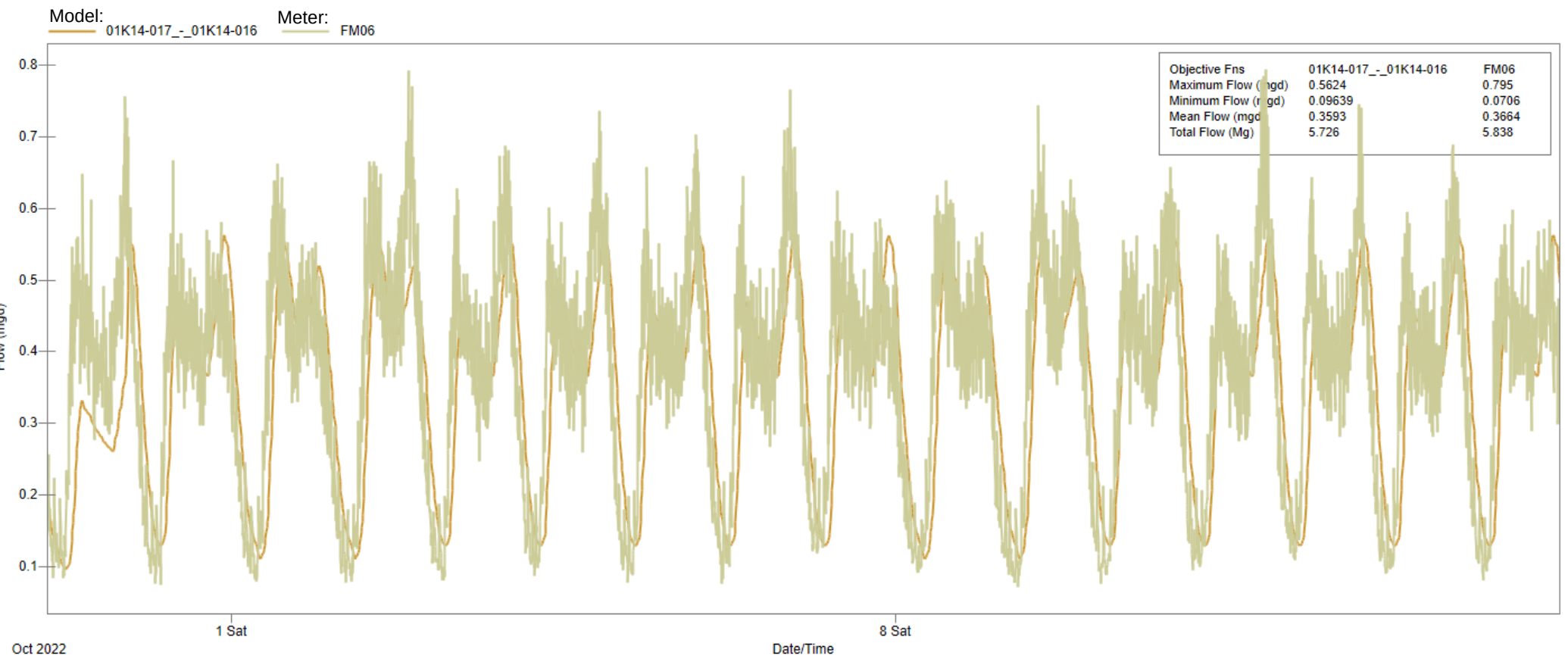


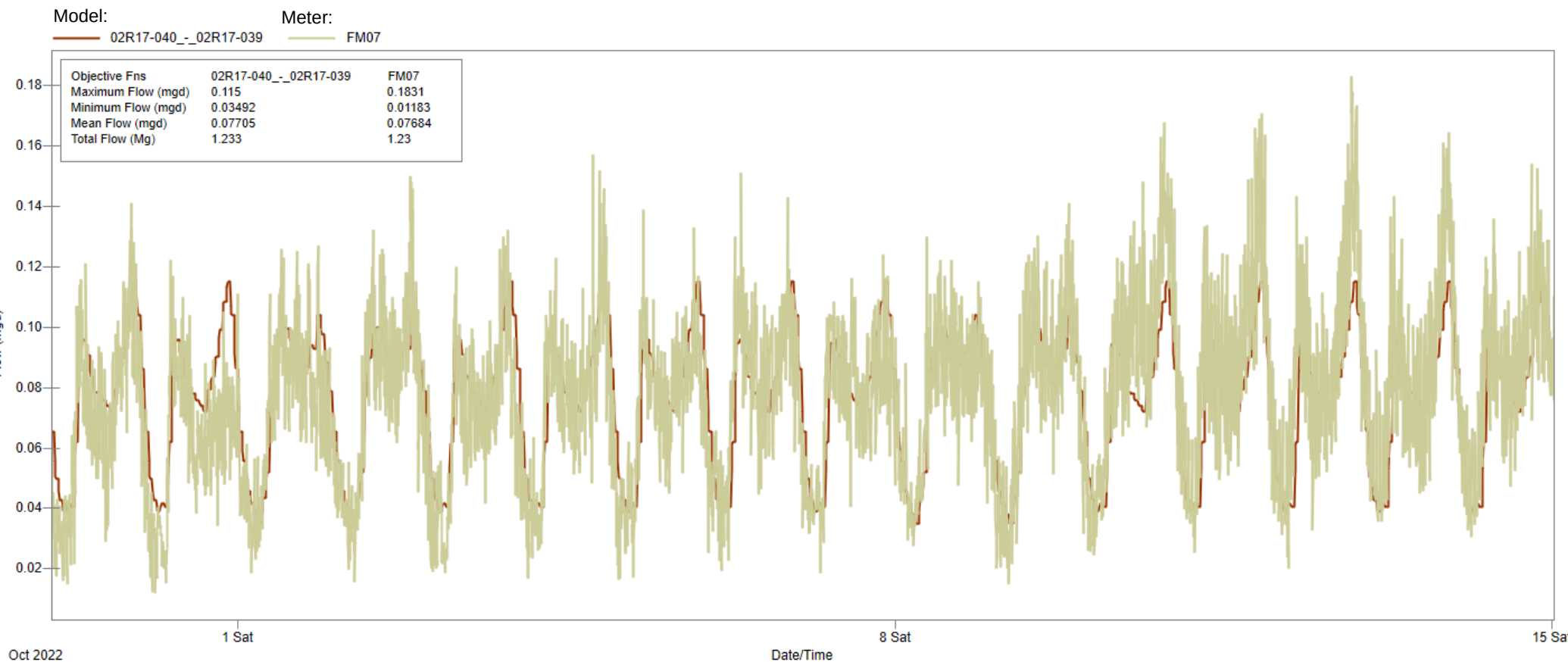


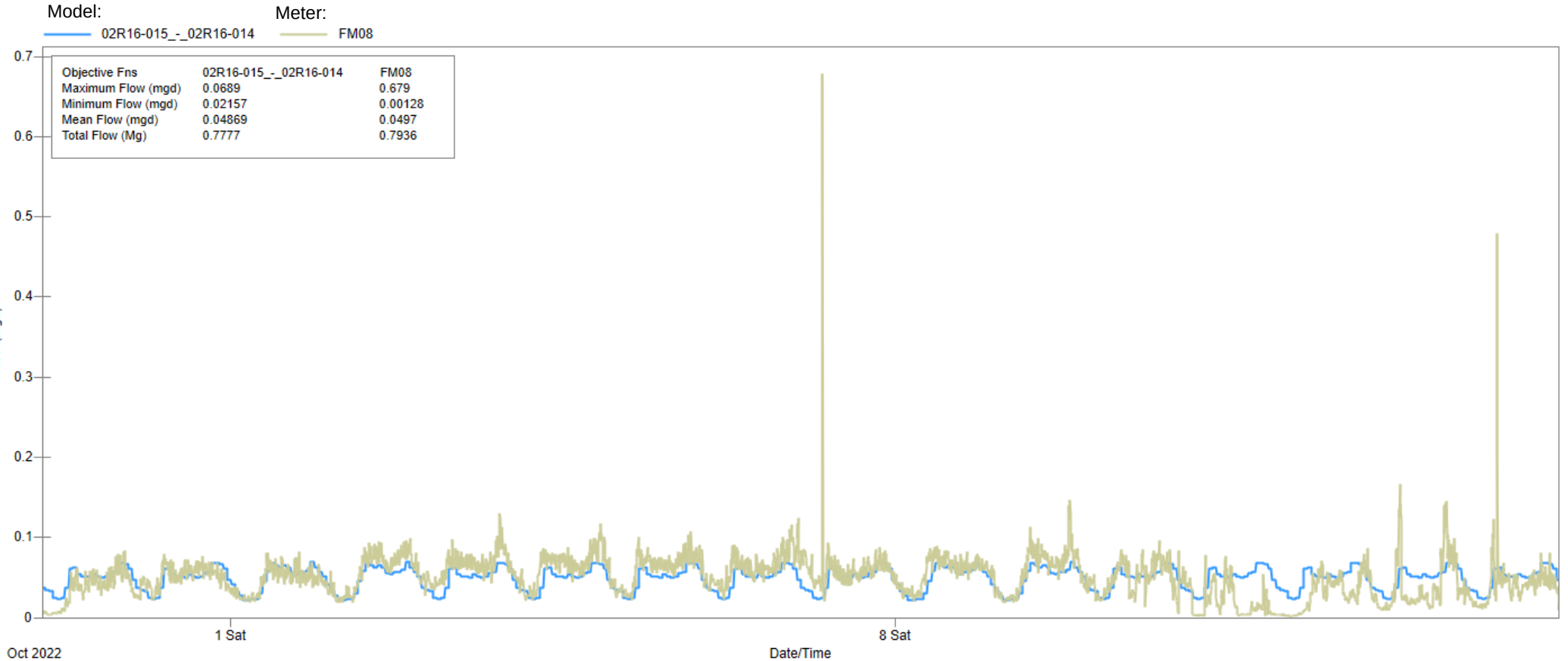


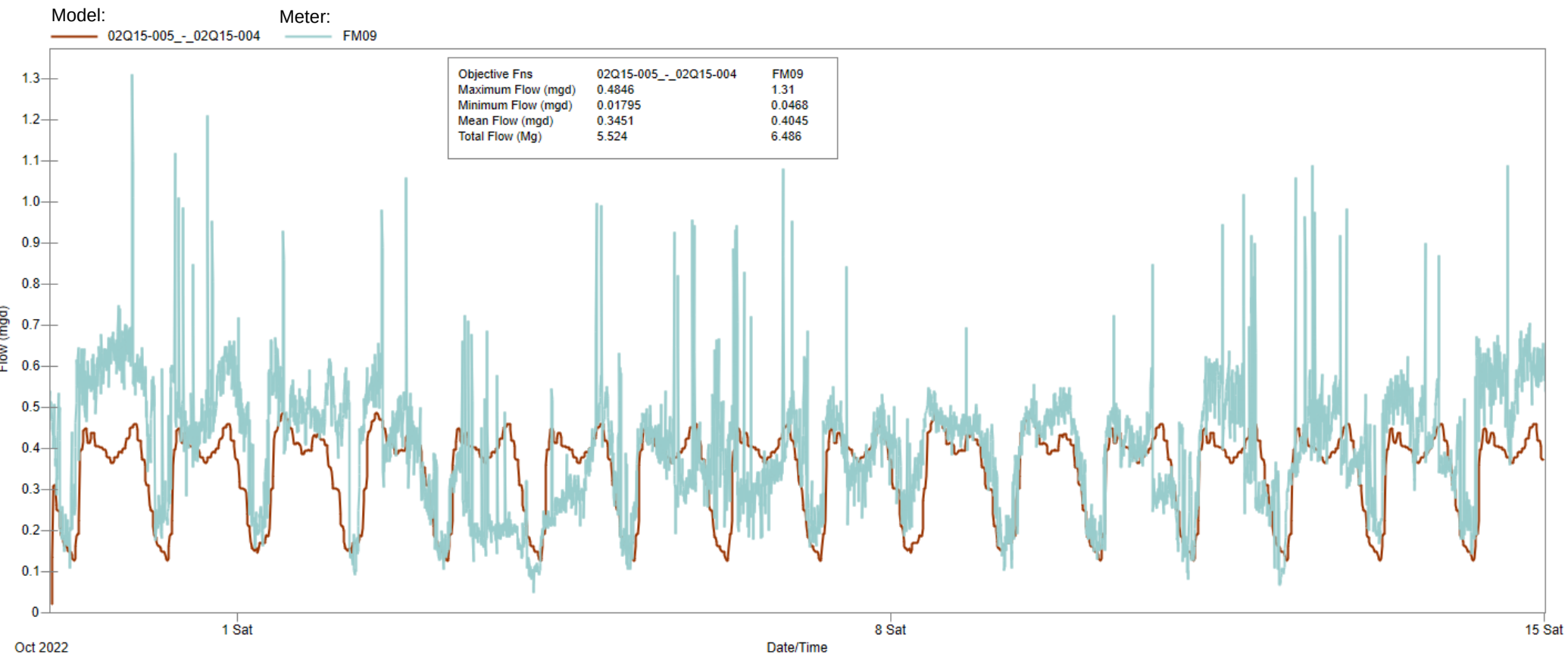
FM 05



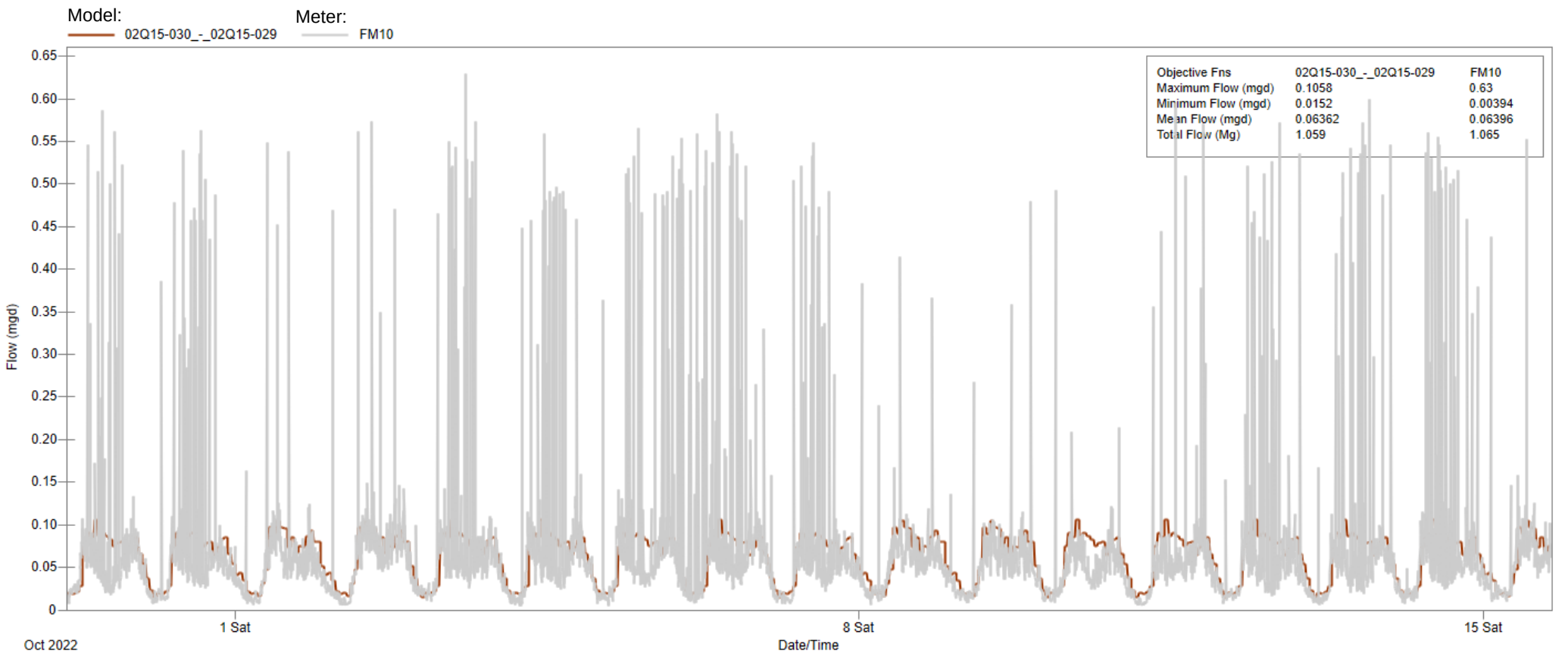


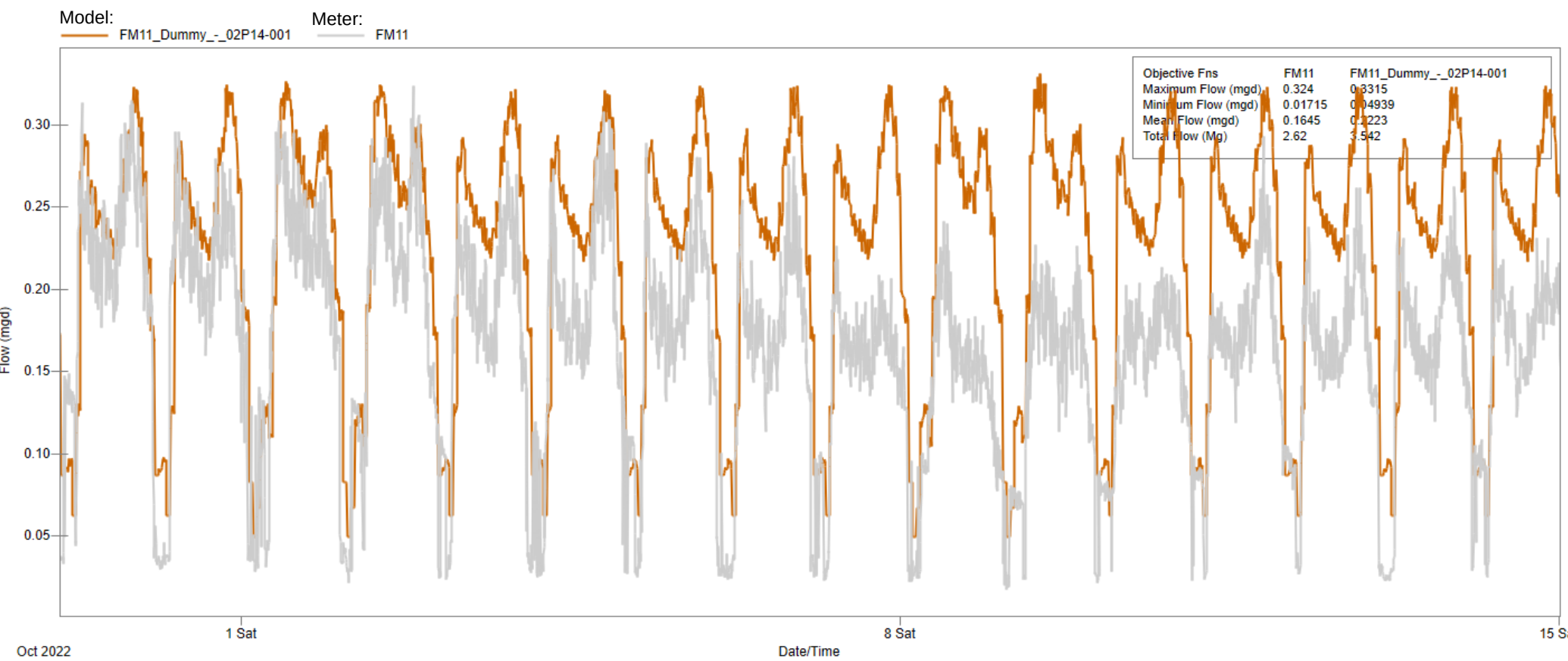


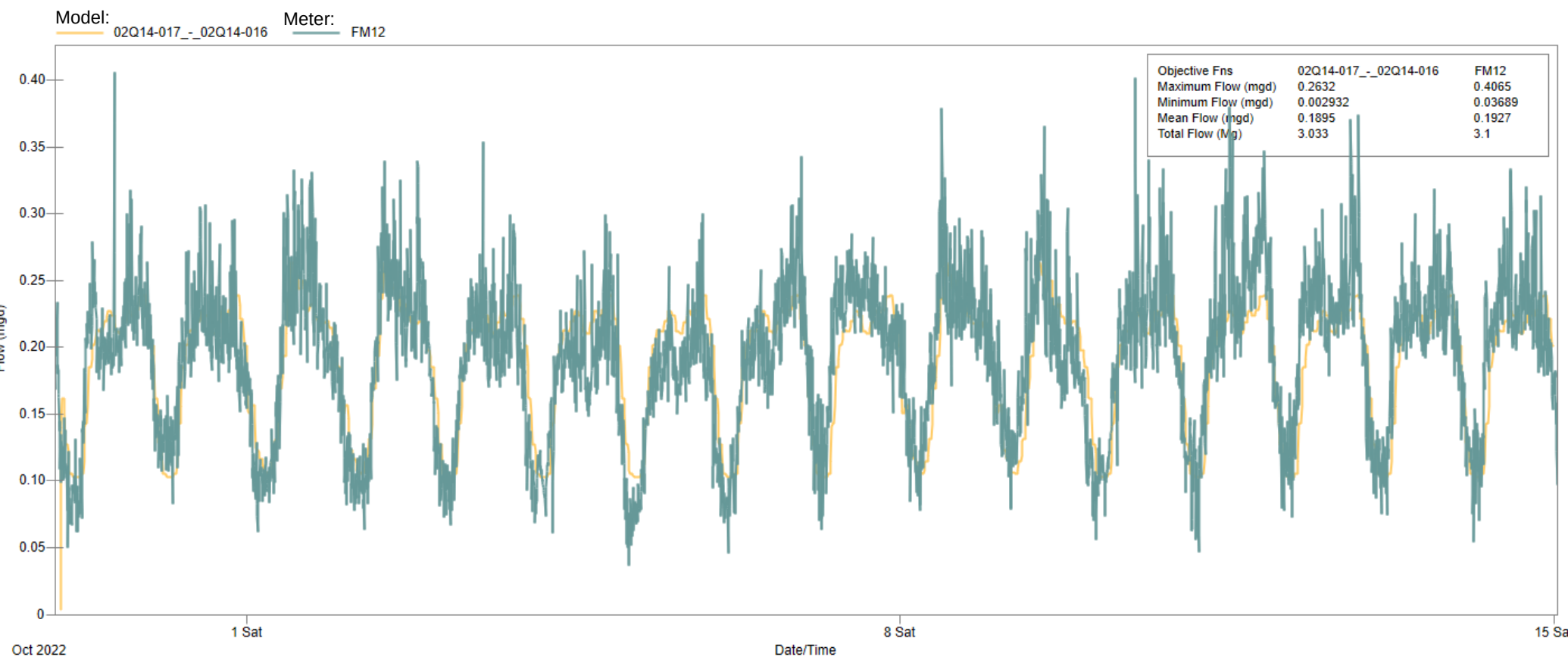


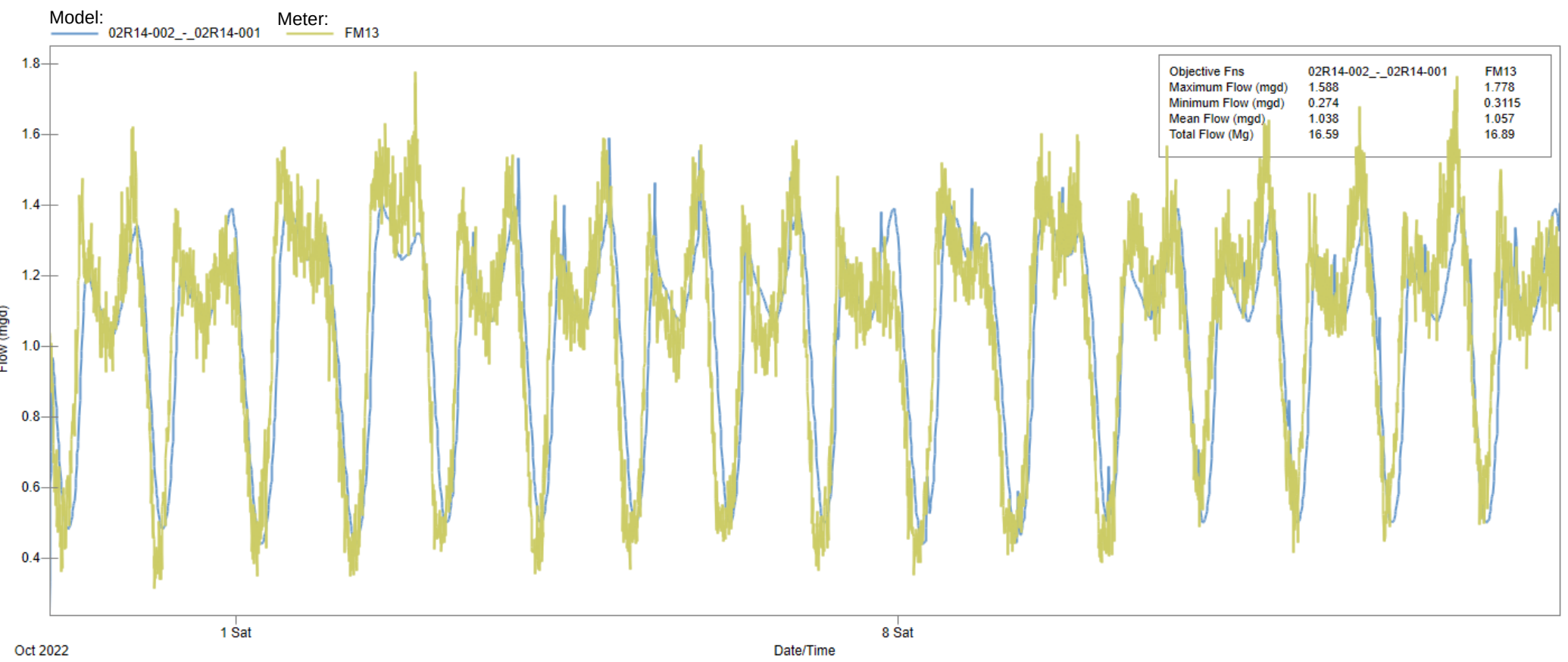


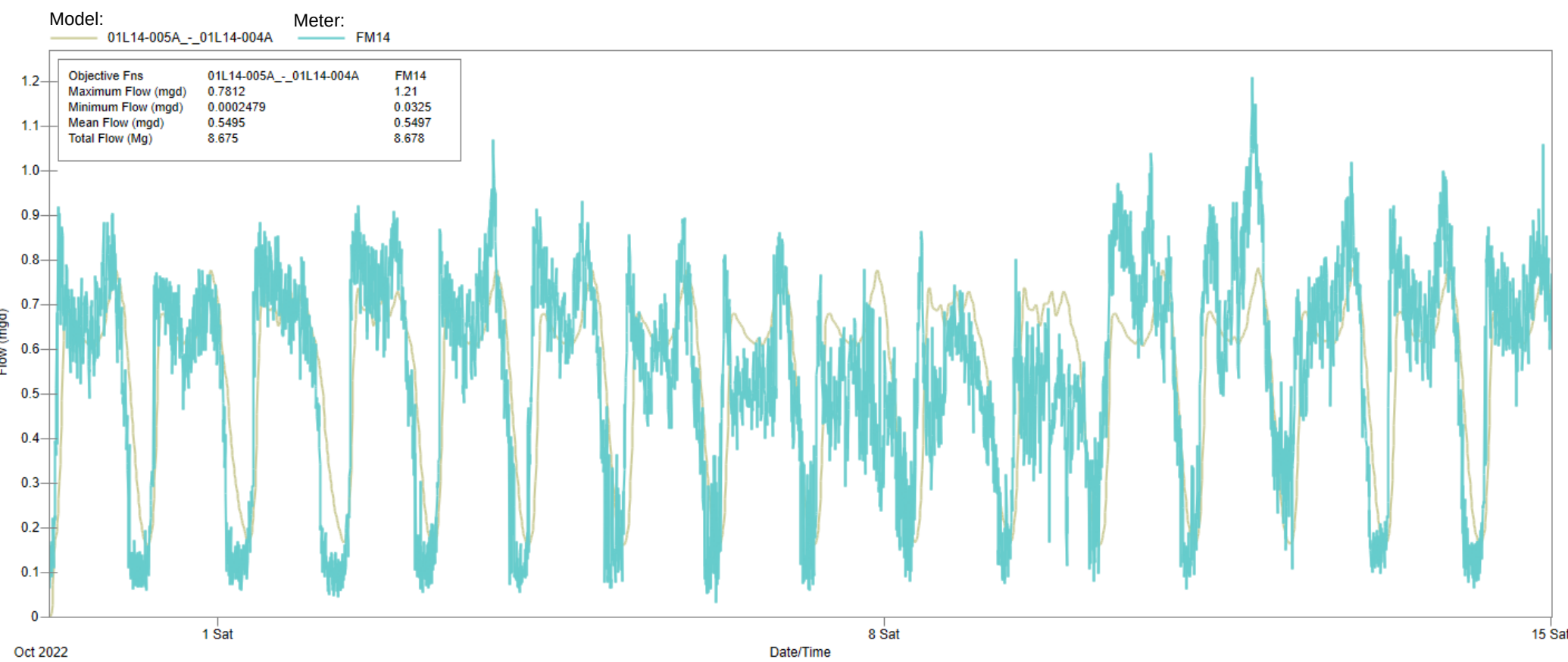
FM 10











Appendix C: Wet Weather Calibration Summary

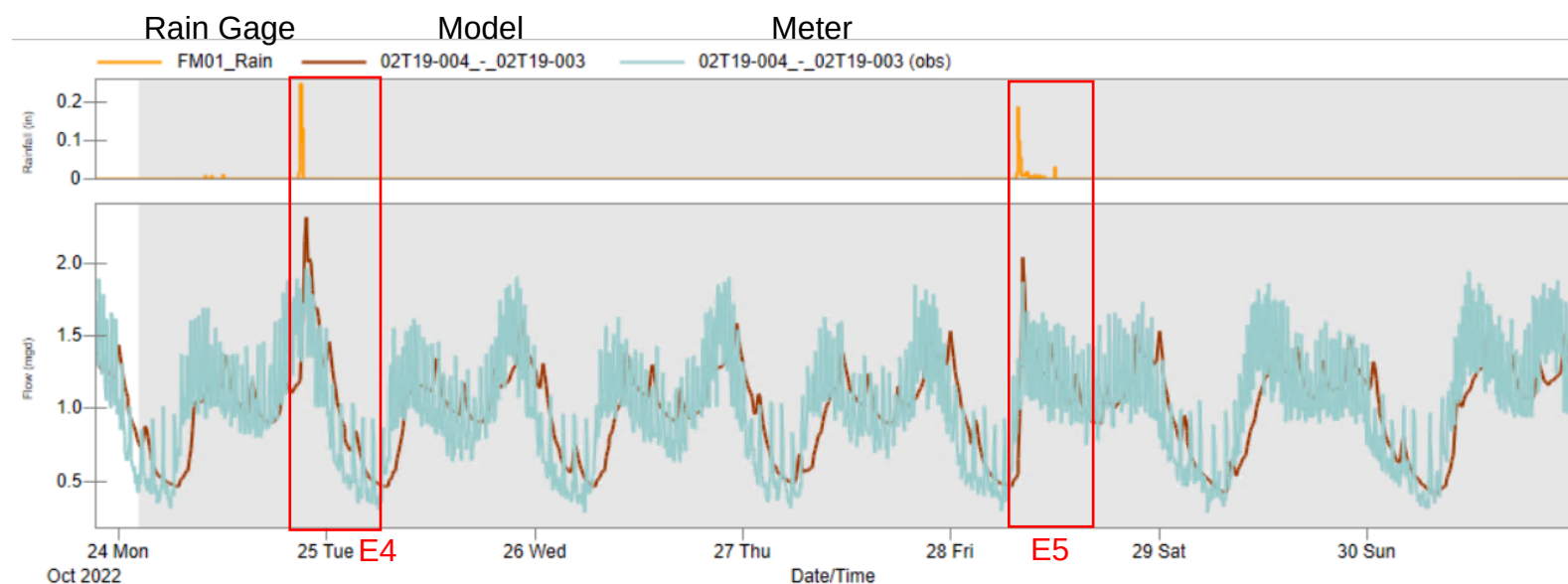
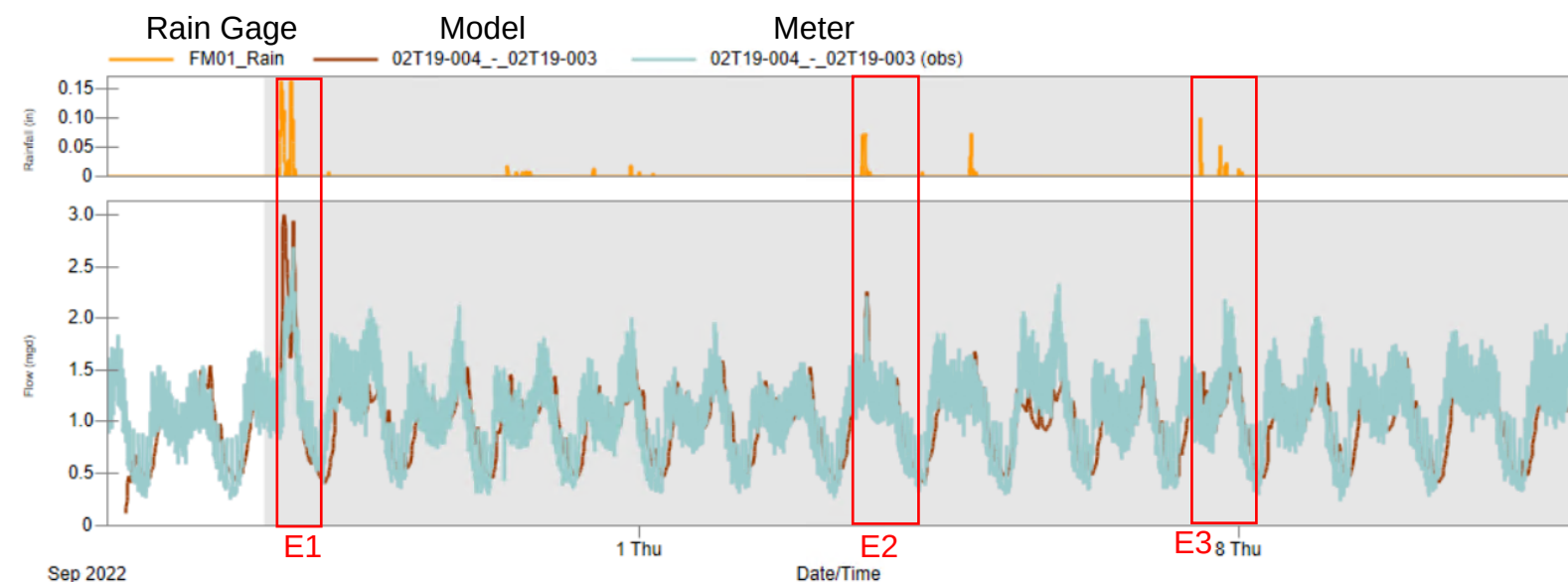
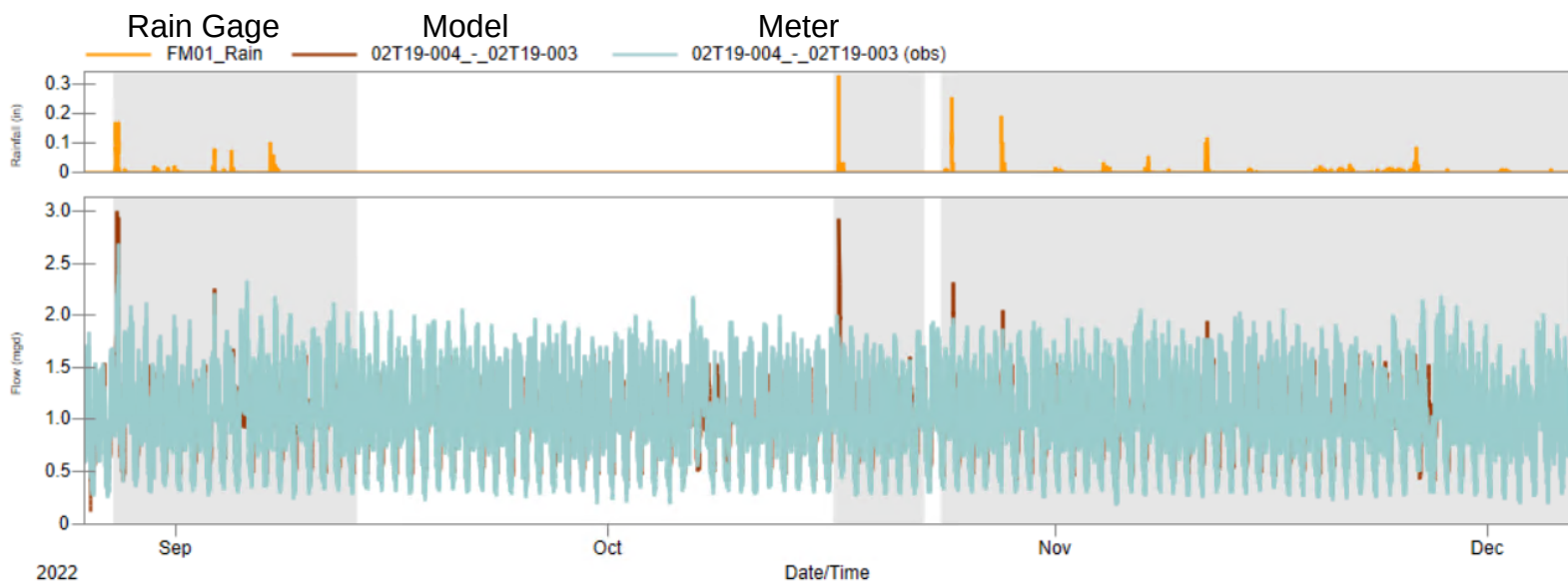
Weighted Averages % Differences

FM Basin	Basin Area (ac)	No. of Storm Events with Responses	Weighted Avg. % Difference, Volume	Weighted Avg. % Difference, Peak Flow
FM01	1638	7	10%	-1%
FM02	452	8	7%	-1%
FM03	1301	9	5%	1%
FM04	140	7	9%	-4%
FM05	747	6	17%	8%
FM06	1561	7	9%	14%
FM07	98	9	-4%	13%
FM08	87	7	3%	-1%
FM09*	418	6	8%	-1%
FM10*	197	7	8%	7%
FM11	125	9	19%	7%
FM12	410	11	-3%	13%
FM13	1285	9	16%	12%
FM14	1569	5	6%	14%
* random peaks in flow meter data not included in peak flow comparisons				

R,T,K Values

	Short Term			Medium Term			Long Term		
	R	T	K	R	T	K	R	T	K
FM01	1.61E-03	0.00	121.68	6.15E-05	7.56	8.25	1.22E-04	46.66	5.59
FM02	6.13E-03	0.18	52.00	1.44E-04	20.88	10.00	9.00E-06	48.00	4.24
FM03	7.42E-03	0.25	30.45	1.00E-05	10.00	10.00	1.00E-05	26.16	2.00
FM04	1.09E-02	0.25	182.00	3.75E-02	12.46	13.44	1.67E-01	96.00	7.89
FM05	1.34E-03	0.03	30.50	4.92E-05	22.40	8.42	7.20E-05	24.00	4.00
FM06	1.46E-03	0.10	37.91	1.61E-05	2.04	3.38	4.36E-04	36.75	15.02
FM07	2.62E-03	0.03	37.12	1.12E-04	31.44	10.00	9.00E-04	45.28	2.00
FM08	5.41E-03	0.06	44.96	5.65E-03	24.38	6.25	5.27E-03	96.00	2.00
FM09	5.03E-02	1.12	33.30	5.05E-03	46.80	1.54	6.50E-04	120.00	2.83
FM10	8.64E-04	0.13	52.00	7.59E-04	53.76	20.00	6.40E-04	24.00	4.00
FM11	5.00E-06	0.05	197.94	2.00E-04	56.27	9.70	1.00E-04	14.52	2.00
FM12	2.87E-03	0.02	54.10	1.81E-04	1.07	10.00	3.63E-04	26.88	4.29
FM13	7.98E-03	0.02	416.00	3.46E-04	15.45	35.40	1.73E-04	96.00	3.09
FM14	4.21E-03	0.03	91.21	8.38E-04	29.74	19.00	6.75E-04	245.76	7.00

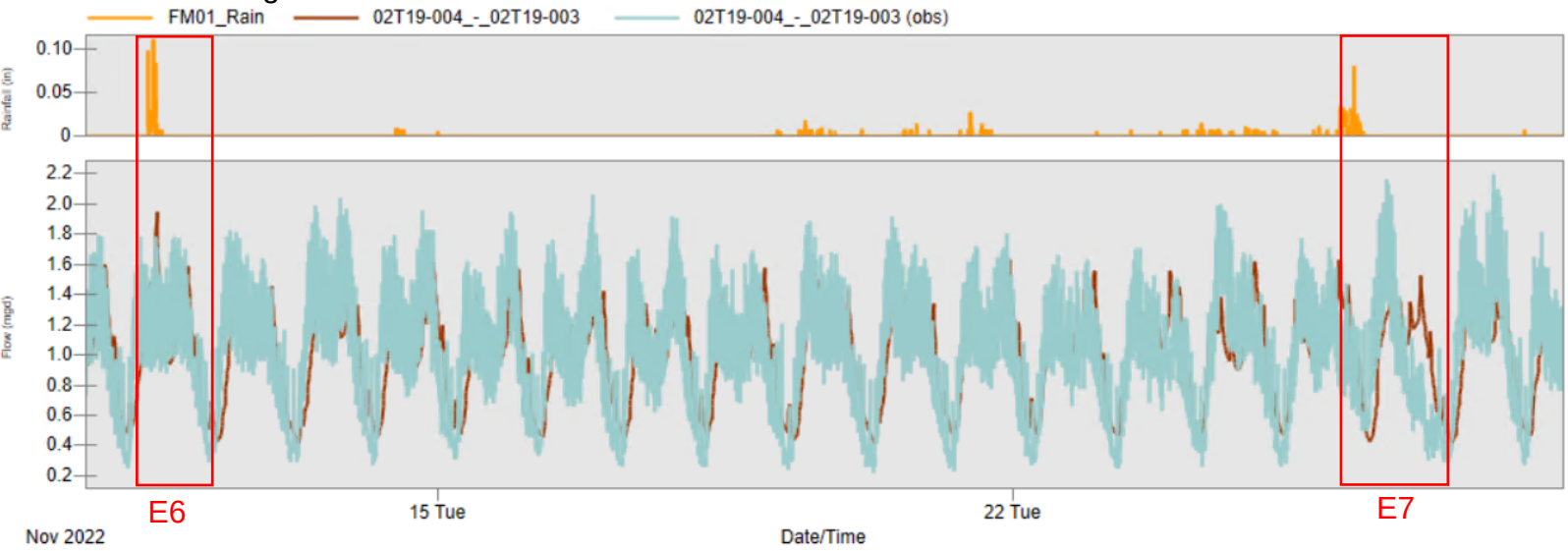
FM01



Rain Gage

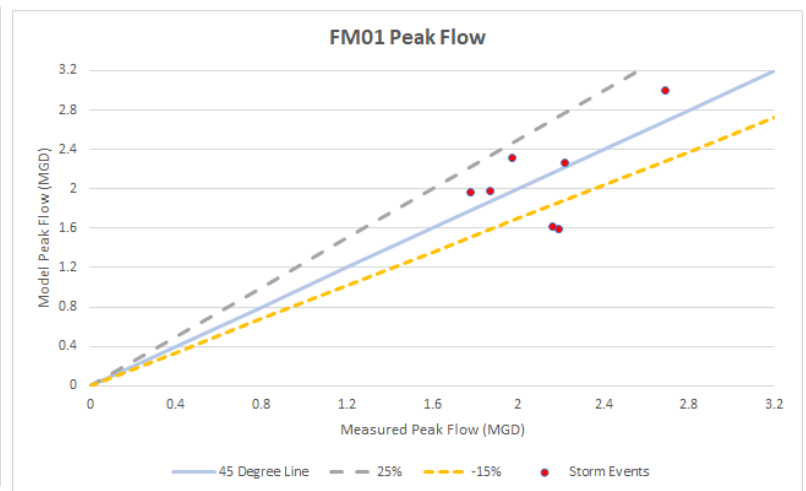
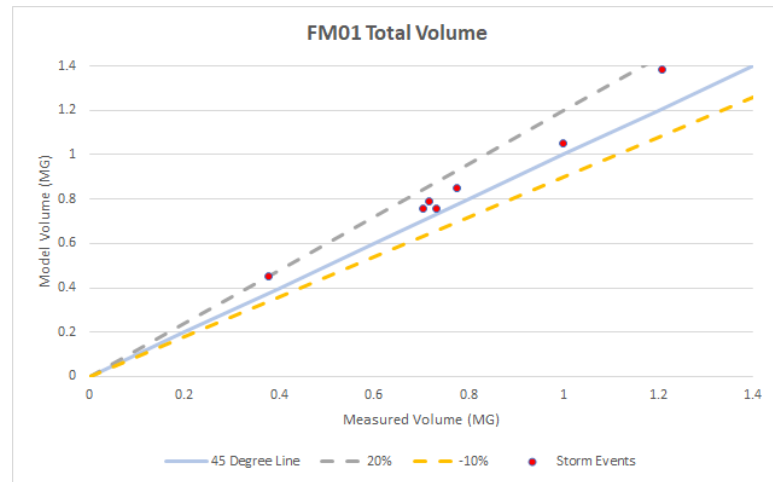
Model

Meter

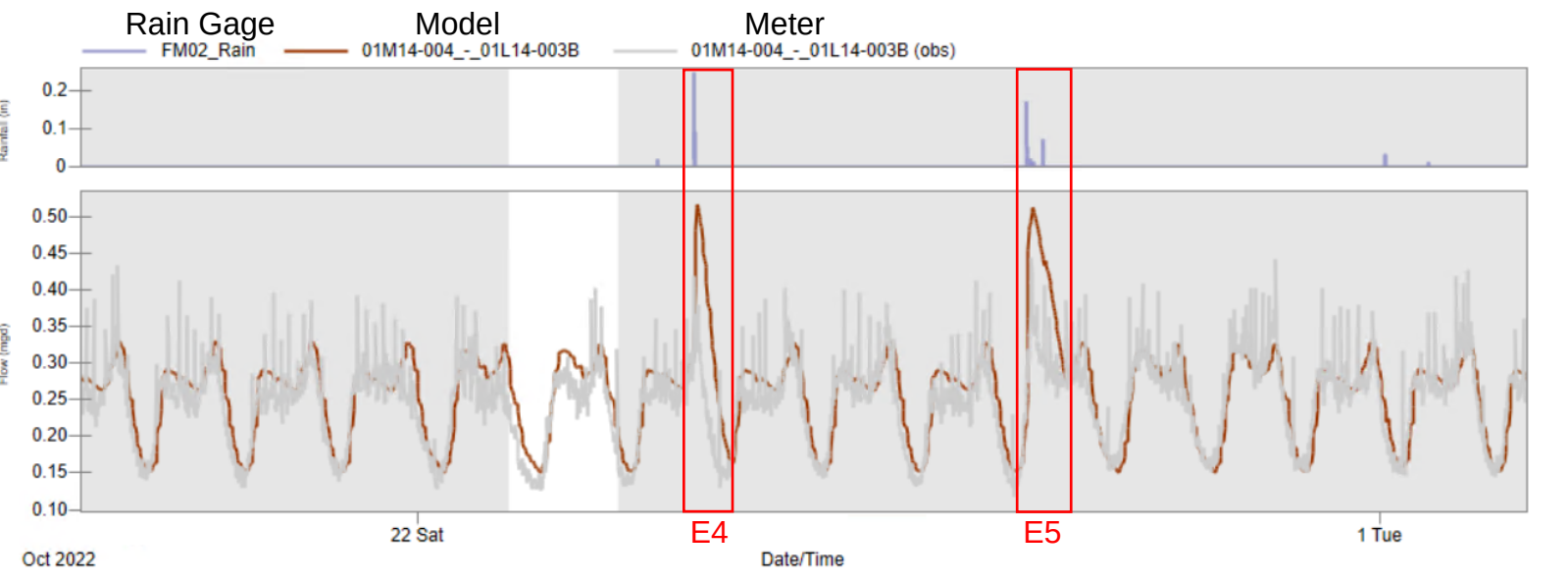
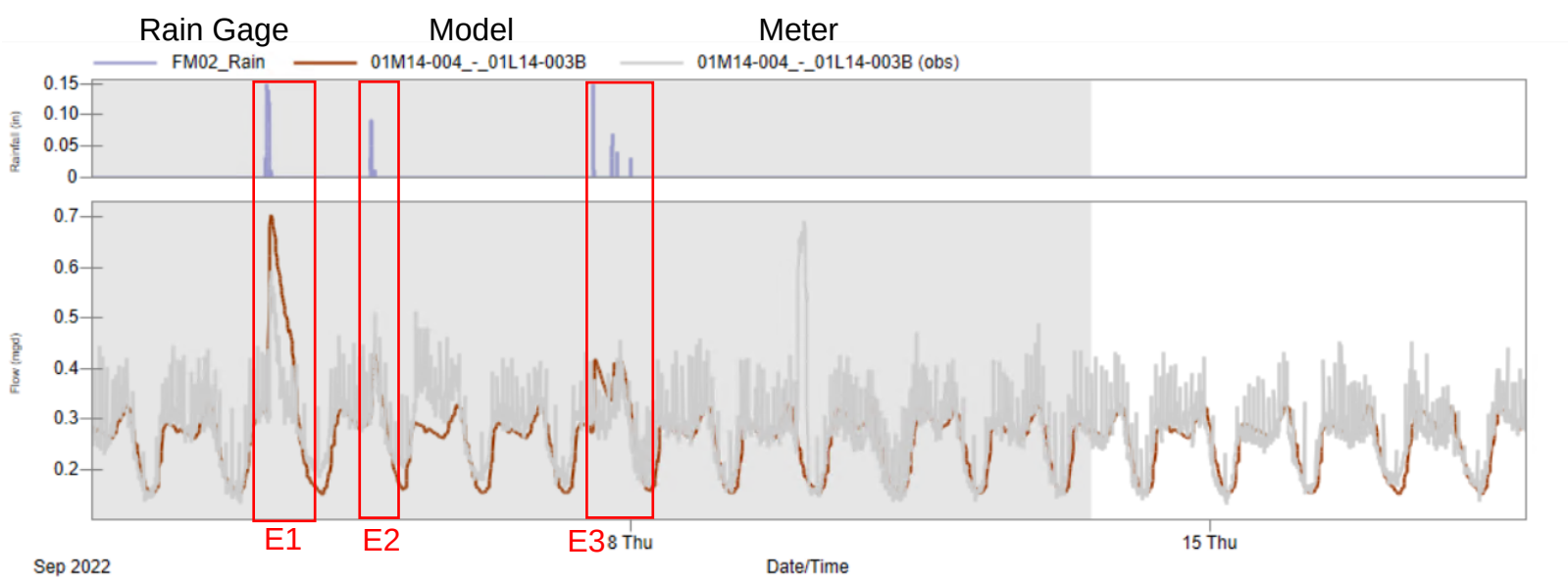
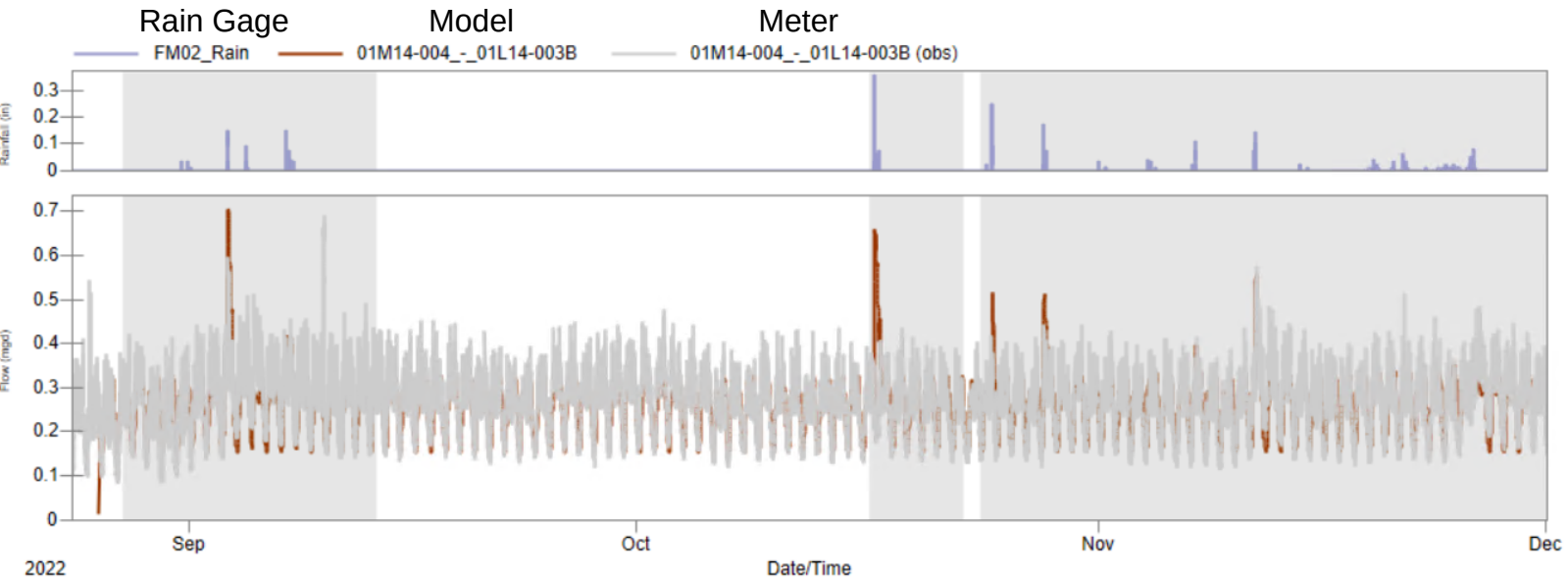


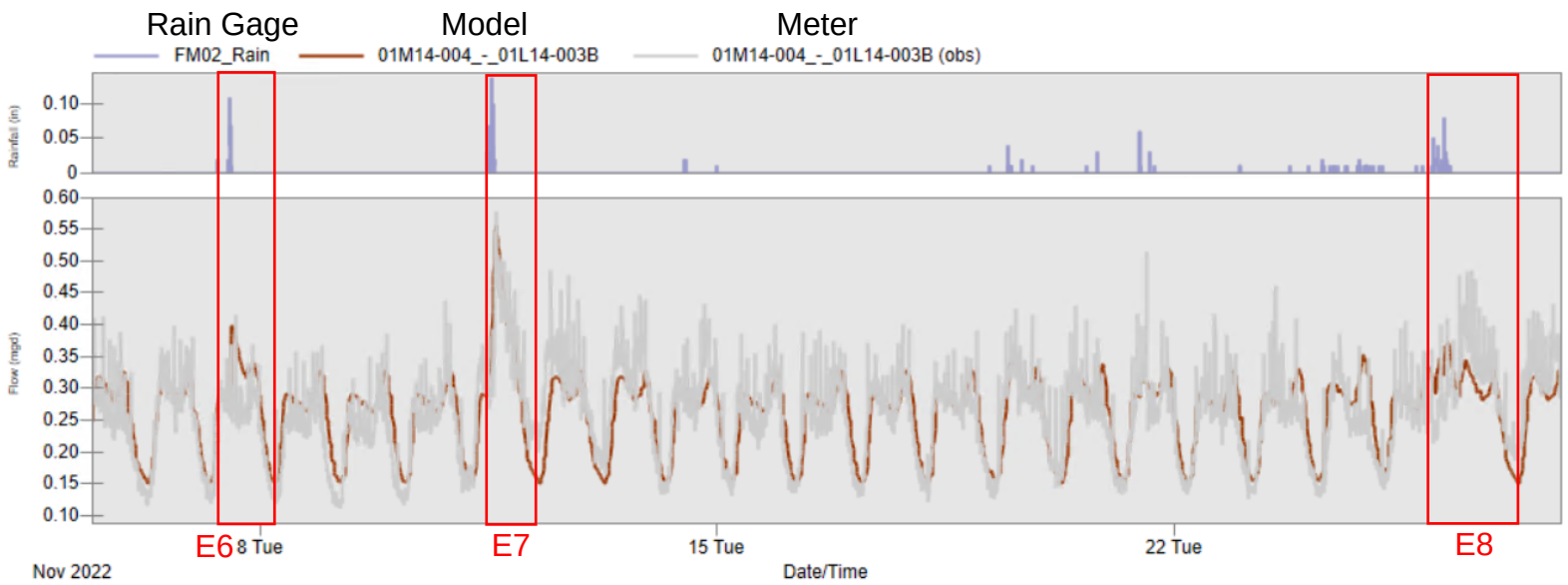
FM01			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.7567	0.7042	7%
2	0.7897	0.7158	10%
3	0.7583	0.7319	4%
4	0.4522	0.3786	19%
5	1.05	0.999	5%
6	0.852	0.7747	10%
7	1.382	1.209	14%

FM01			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	3.001	2.69	12%
2	2.259	2.22	2%
3	1.587	2.19	-28%
4	2.316	1.97	18%
5	1.984	1.87	6%
6	1.962	1.78	10%
7	1.615	2.16	-25%



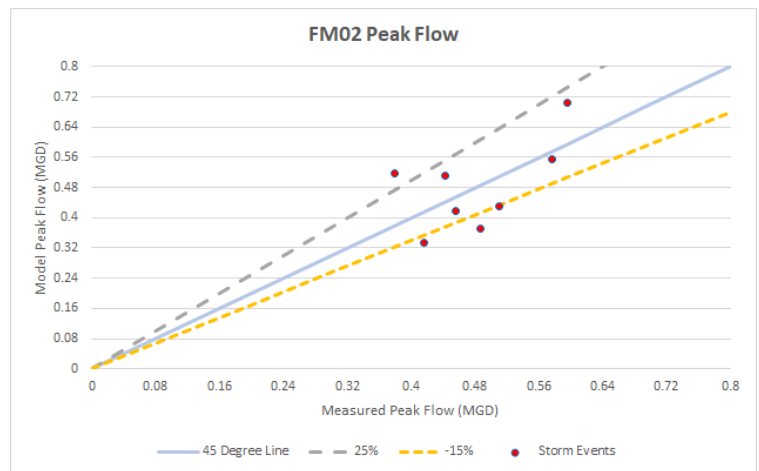
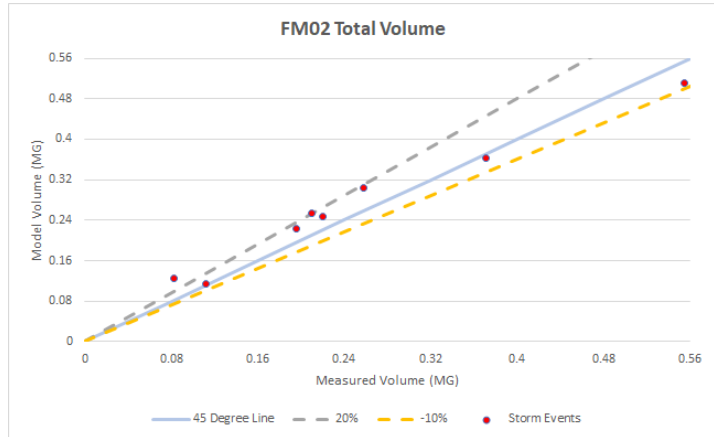
FM02





FM02			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.2543	0.2097	21%
2	0.1131	0.1119	1%
3	0.2227	0.1954	14%
4	0.1254	0.08241	52%
5	0.3031	0.258	17%
6	0.2465	0.2204	12%
7	0.5108	0.555	-8%
8	0.3625	0.3716	-2%

FM02			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.7038	0.595	18%
2	0.4301	0.51	-16%
3	0.4167	0.456	-9%
4	0.5162	0.38	36%
5	0.5115	0.443	15%
6	0.334	0.416	-20%
7	0.5545	0.577	-4%
8	0.3723	0.486	-23%



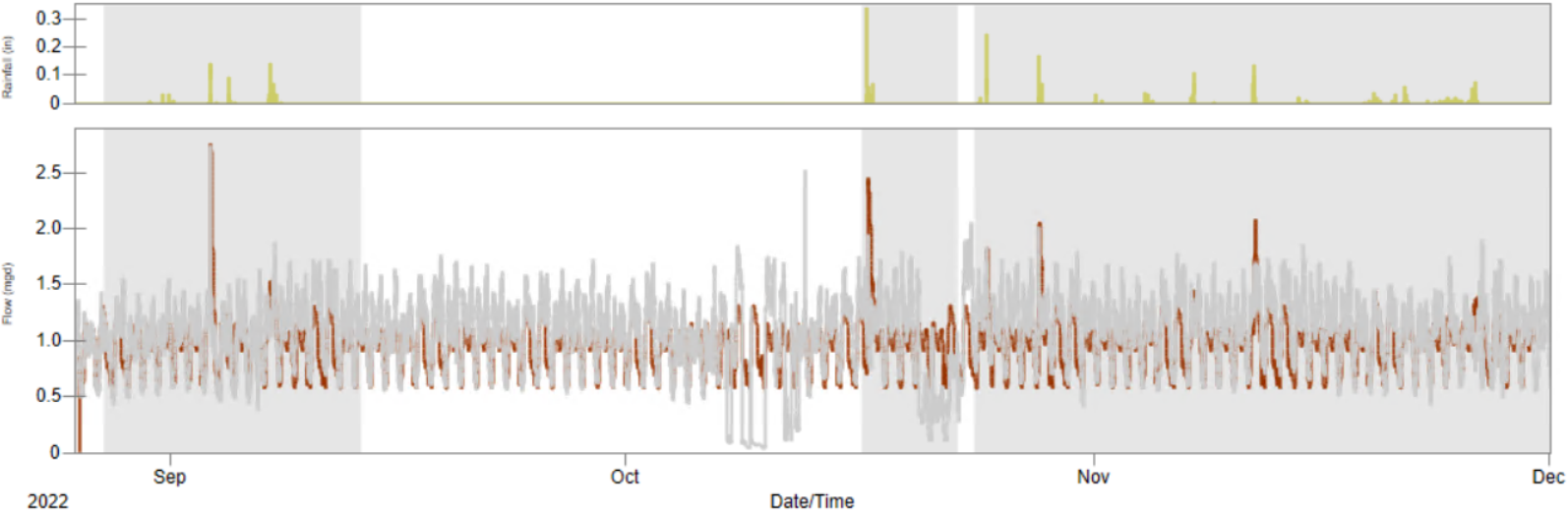
FM03

Rain Gage

Model

Meter

FM03_Rain 01L14-005_-_01L14-004 01L14-005_-_01L14-004 (obs)

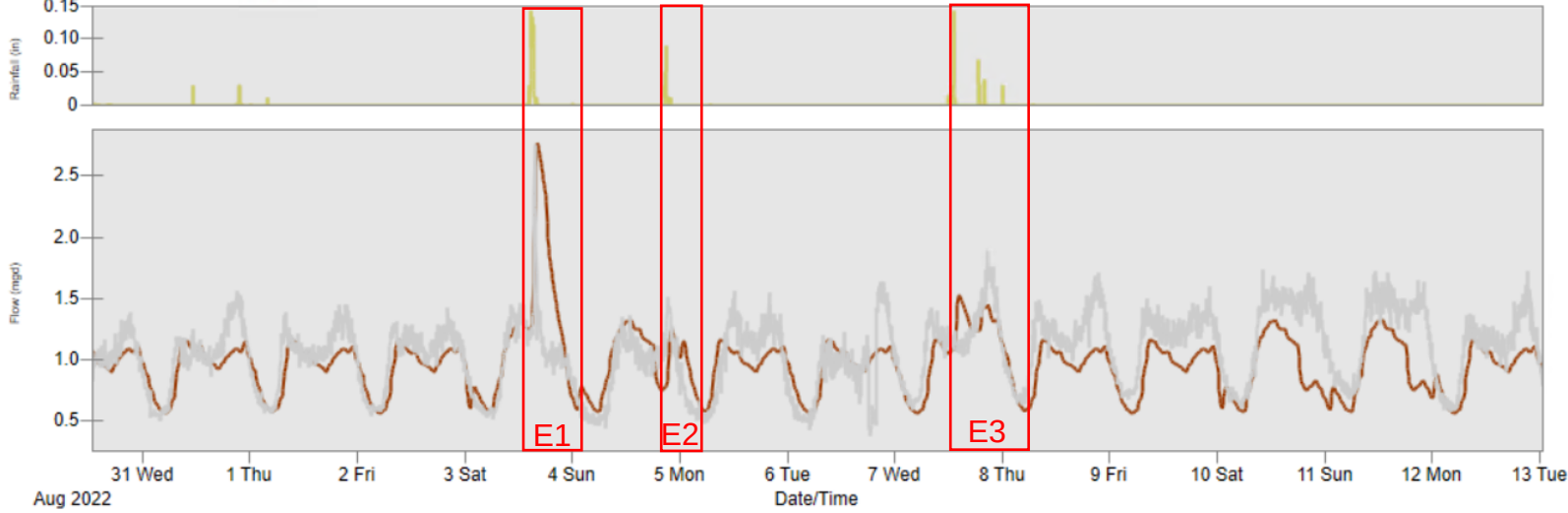


Rain Gage

Model

Meter

FM03_Rain 01L14-005_-_01L14-004 01L14-005_-_01L14-004 (obs)

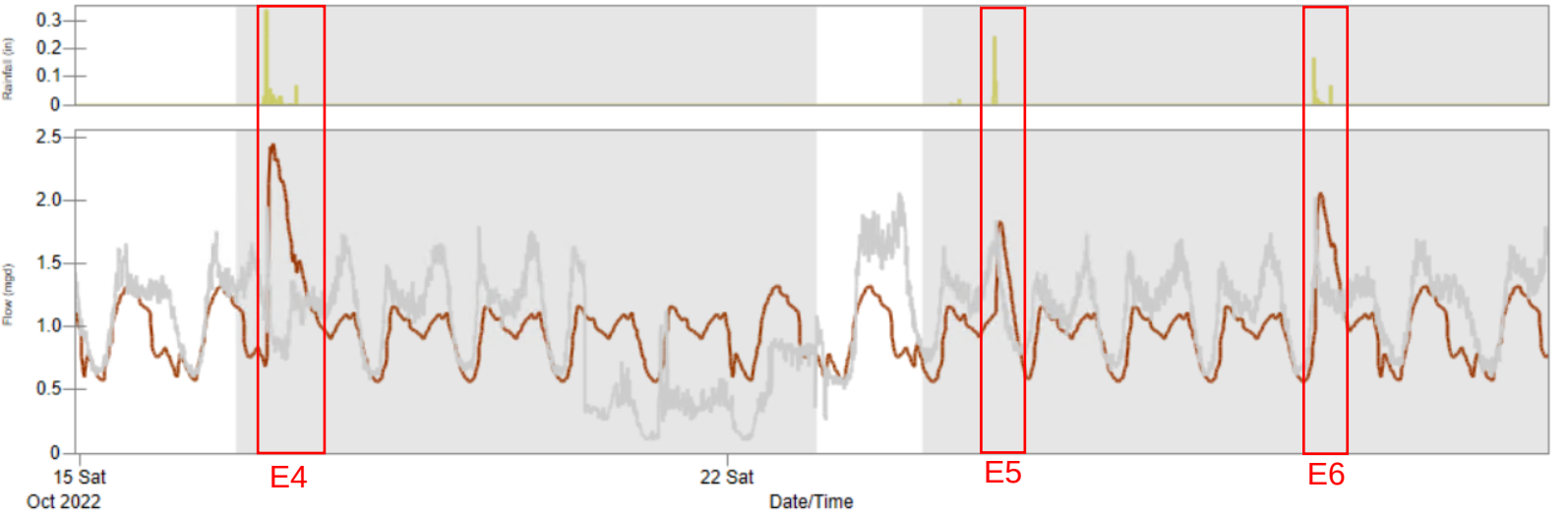


Rain Gage

Model

Meter

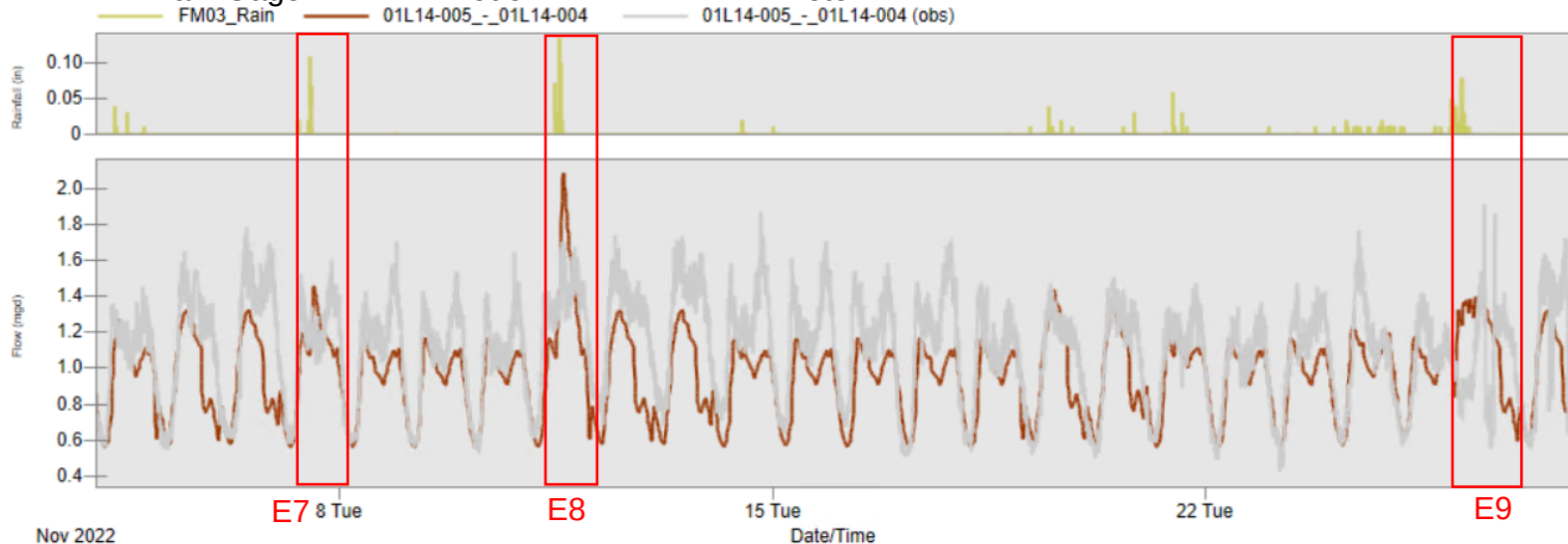
FM03_Rain 01L14-005_-_01L14-004 01L14-005_-_01L14-004 (obs)



Rain Gage

Model

Meter



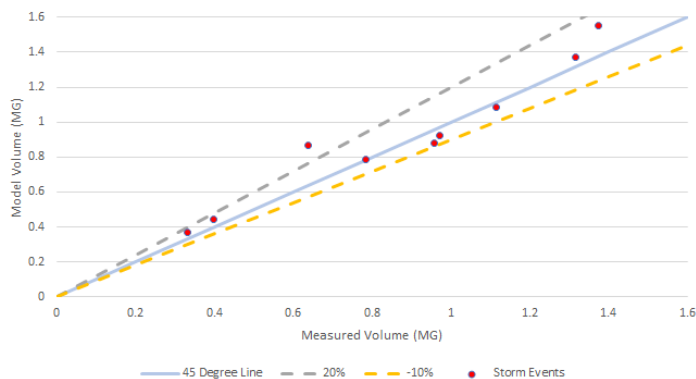
FM03

Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.8659	0.6375	36%
2	0.3679	0.3327	11%
3	0.7862	0.7829	0%
4	1.553	1.374	13%
5	0.4457	0.3977	12%
6	1.086	1.116	-3%
7	0.879	0.9586	-8%
8	0.9229	0.9717	-5%
9	1.372	1.317	4%

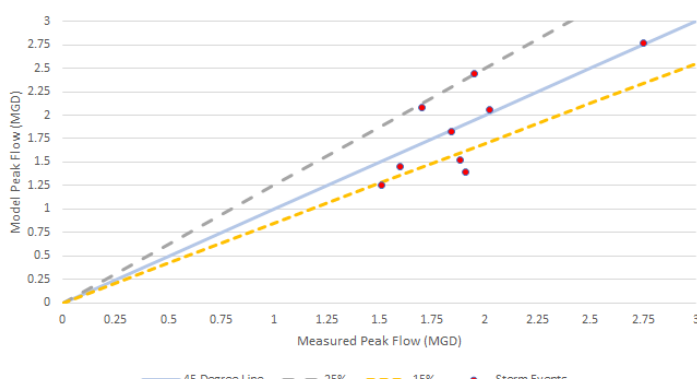
FM03

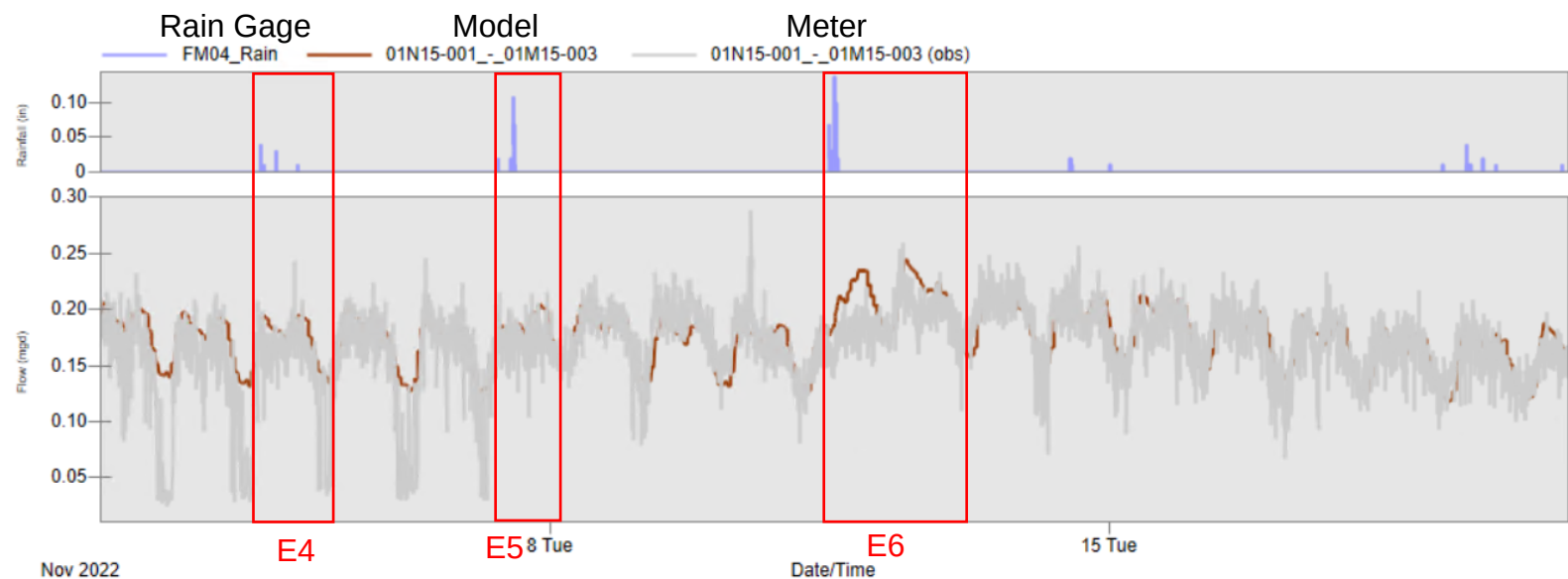
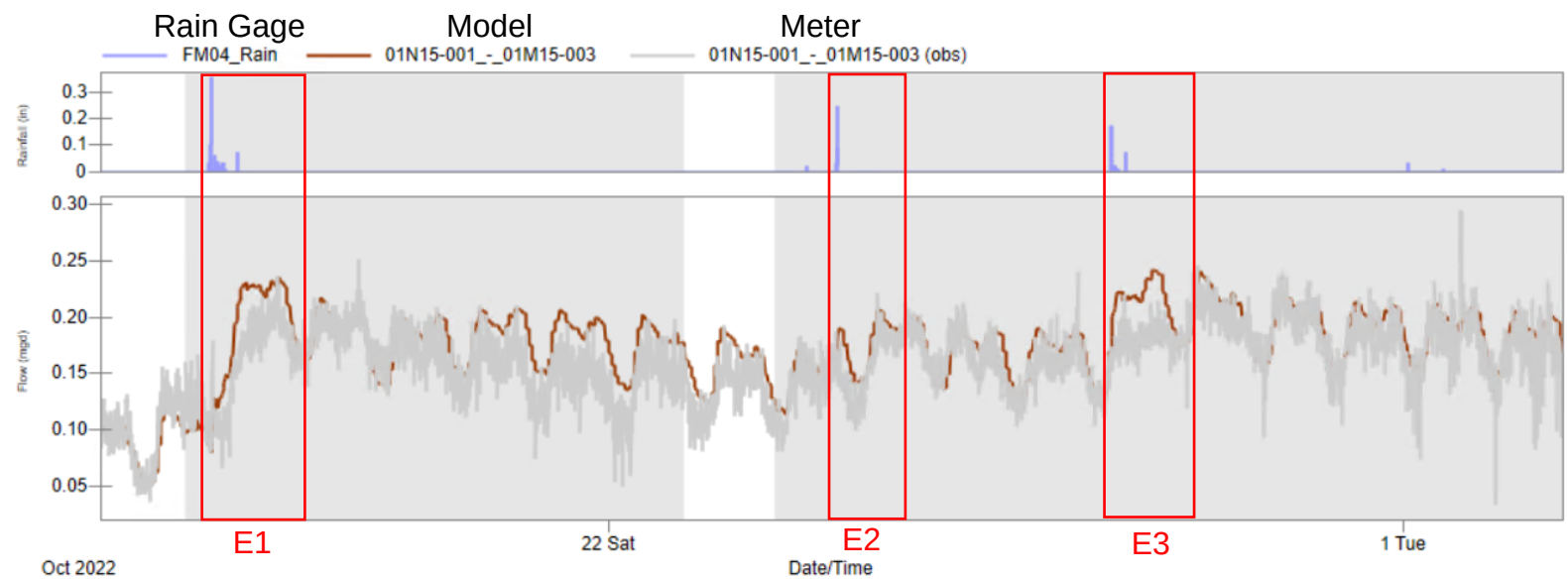
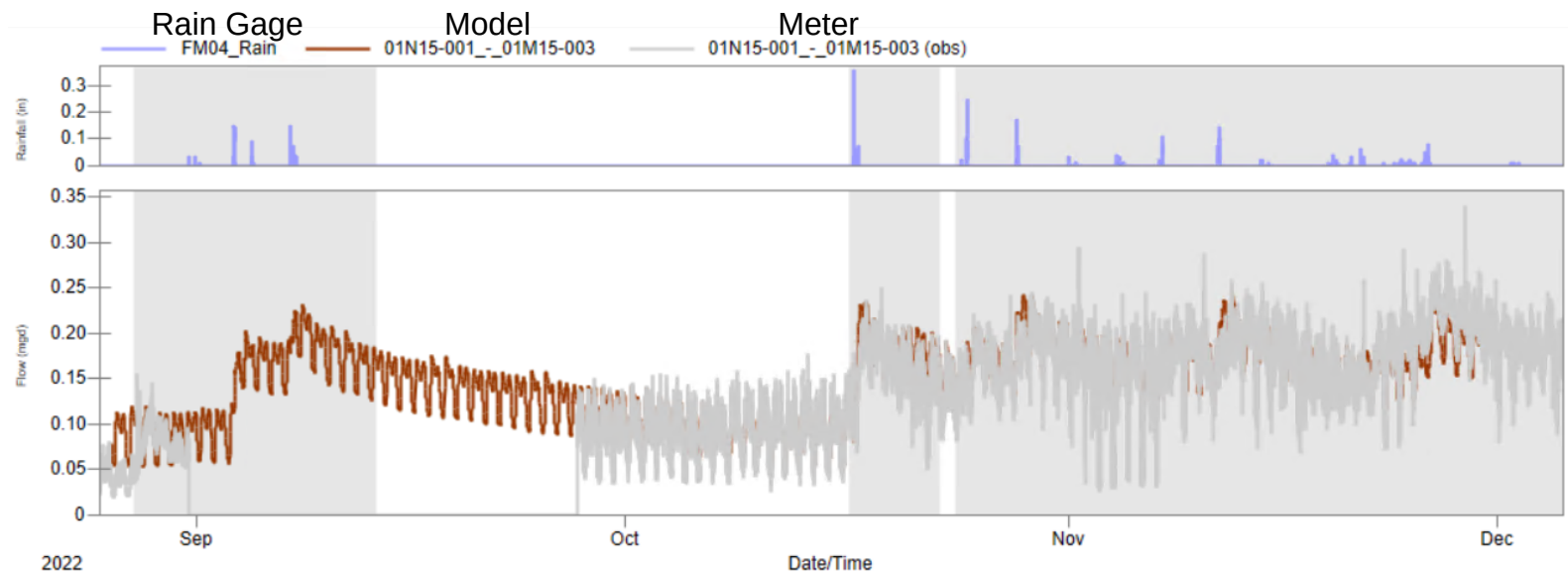
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	2.764	2.75	1%
2	1.251	1.51	-17%
3	1.527	1.88	-19%
4	2.449	1.95	26%
5	1.829	1.84	-1%
6	2.059	2.02	2%
7	1.453	1.6	-9%
8	2.082	1.7	22%
9	1.395	1.91	-27%

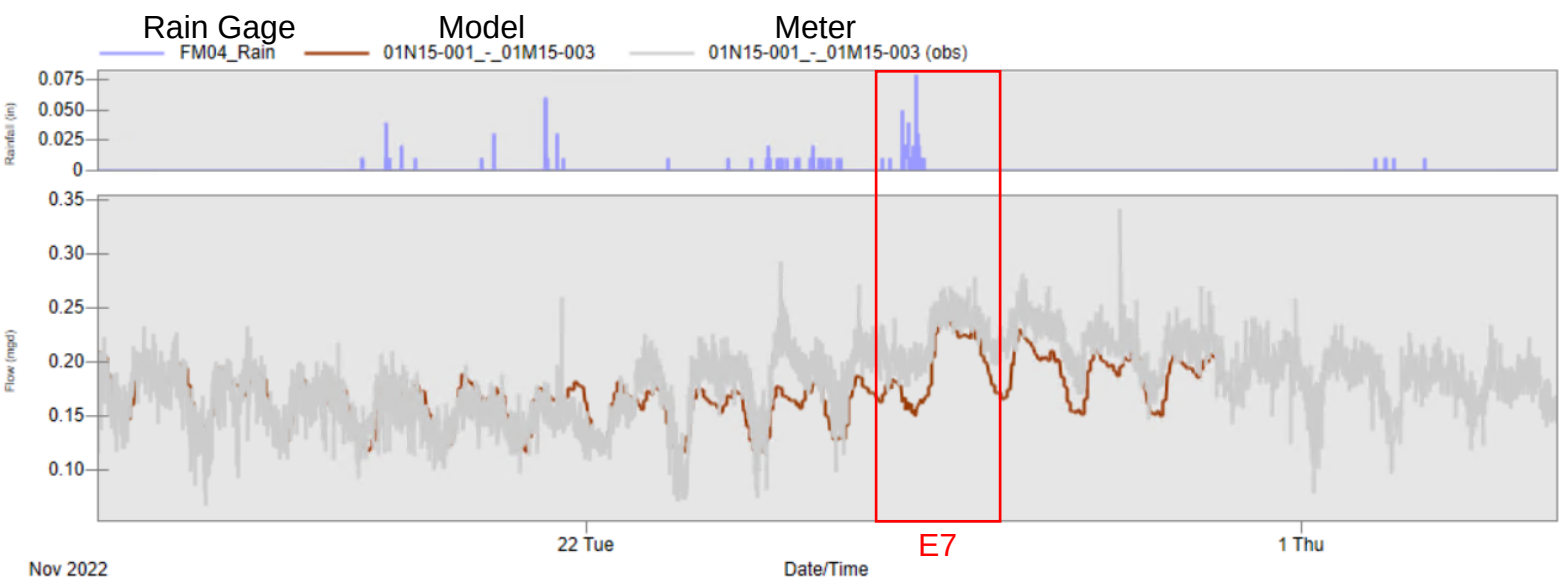
FM03 Total Volume



FM03 Peak Flow

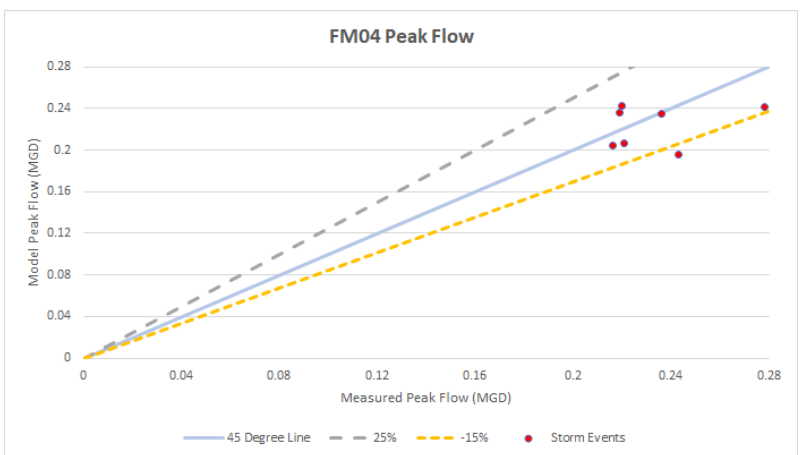
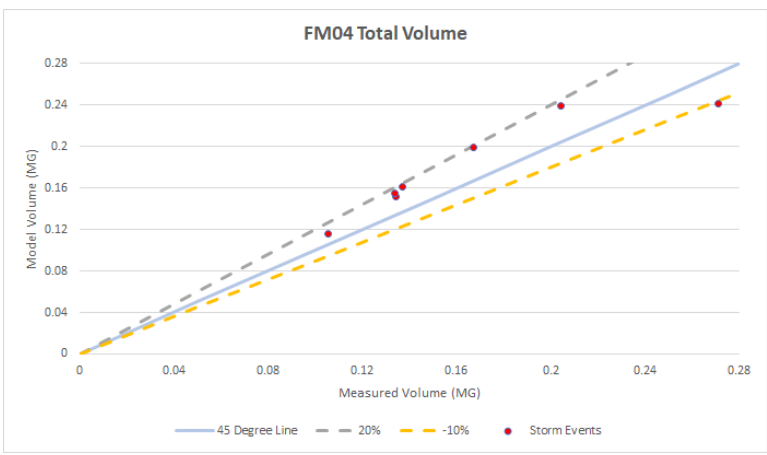




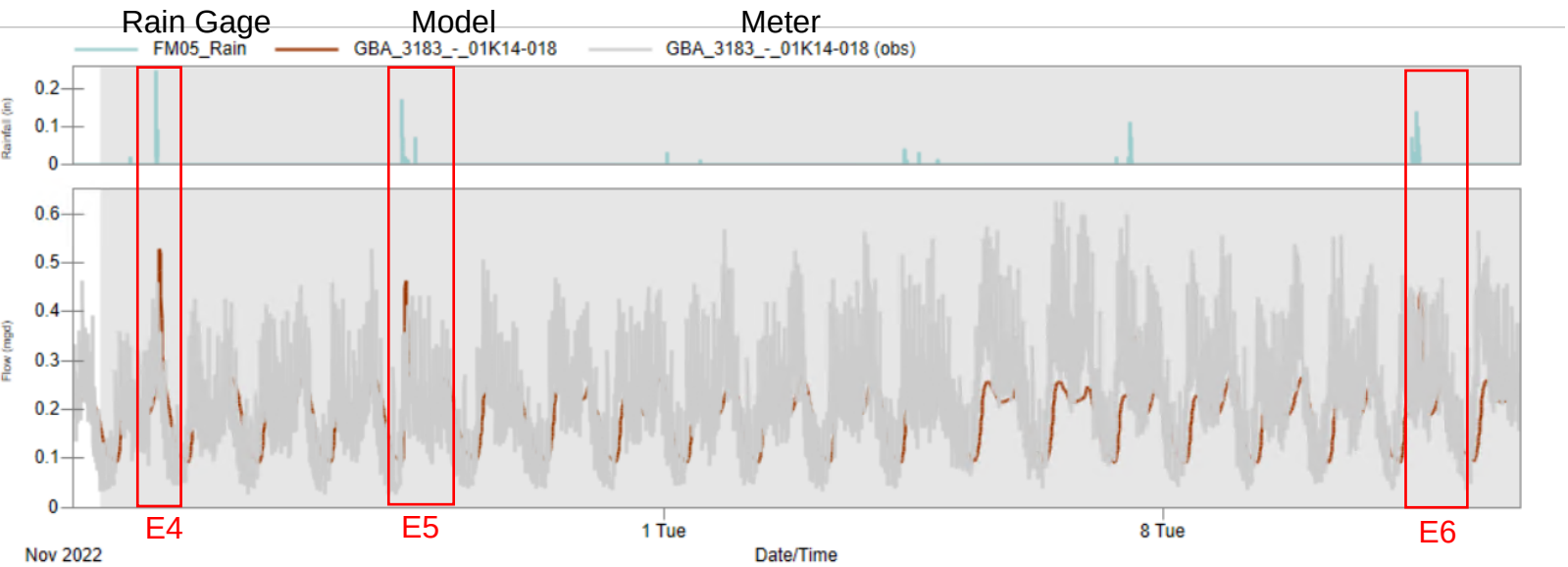
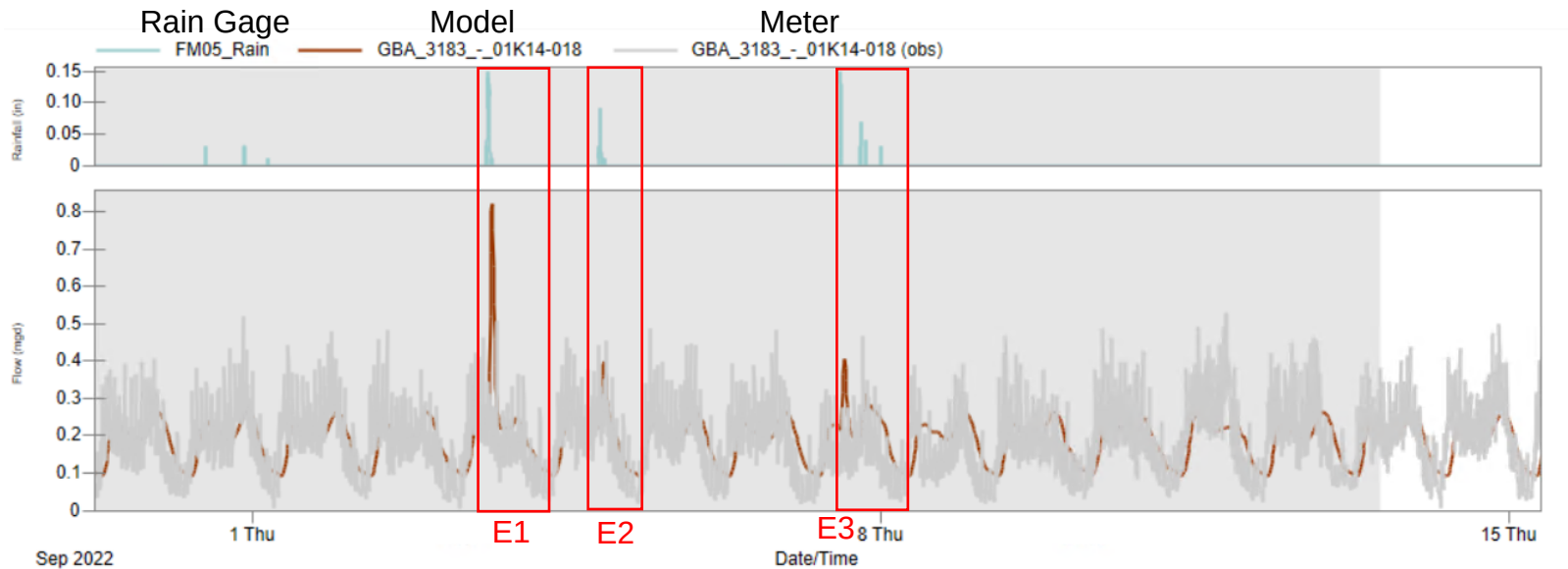
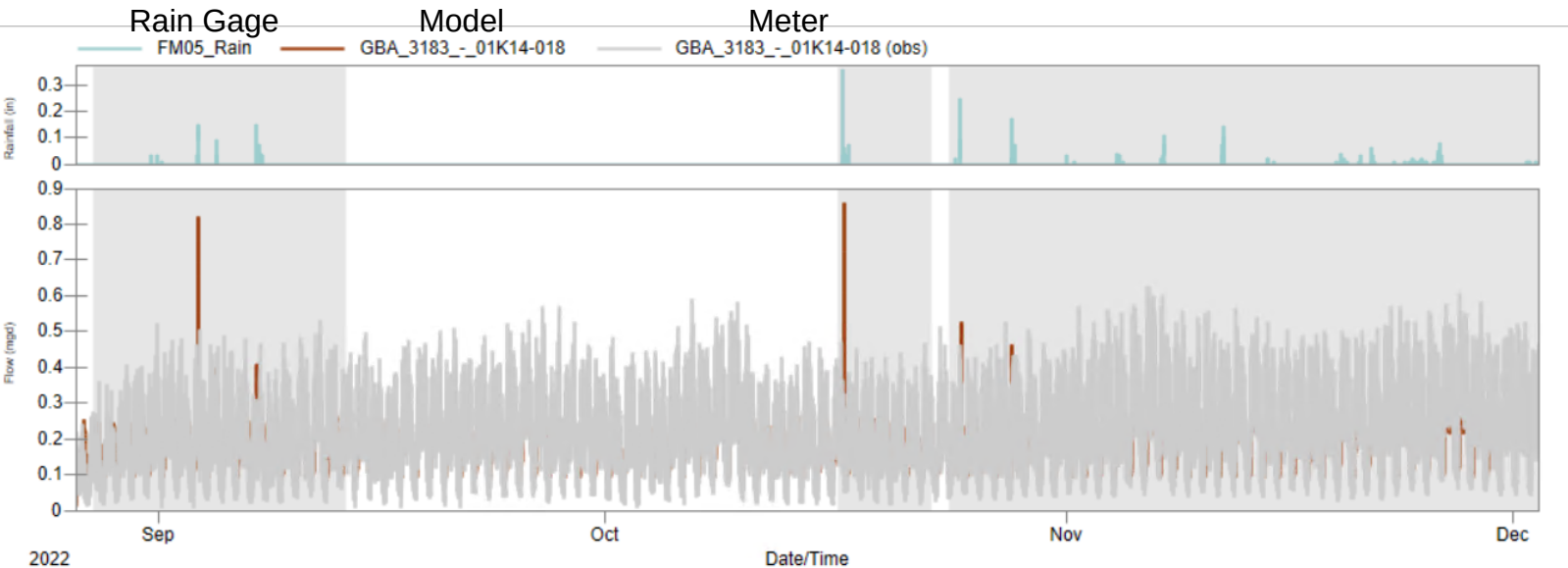


FM04			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.2389	0.2042	17%
2	0.1514	0.1343	13%
3	0.1995	0.1673	19%
4	0.155	0.1336	16%
5	0.1159	0.1056	10%
6	0.1607	0.1372	17%
7	0.2414	0.2711	-11%

FM04			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.2354	0.236	0%
2	0.2069	0.221	-6%
3	0.2425	0.22	10%
4	0.1952	0.243	-20%
5	0.2039	0.216	-6%
6	0.2359	0.219	8%
7	0.241	0.278	-13%

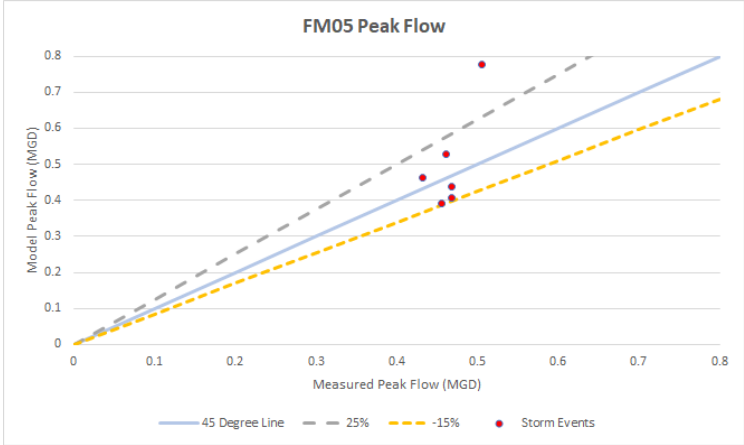
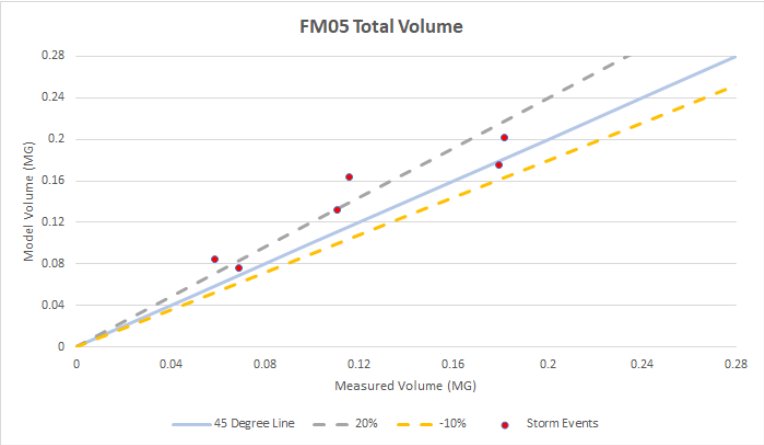


FM05

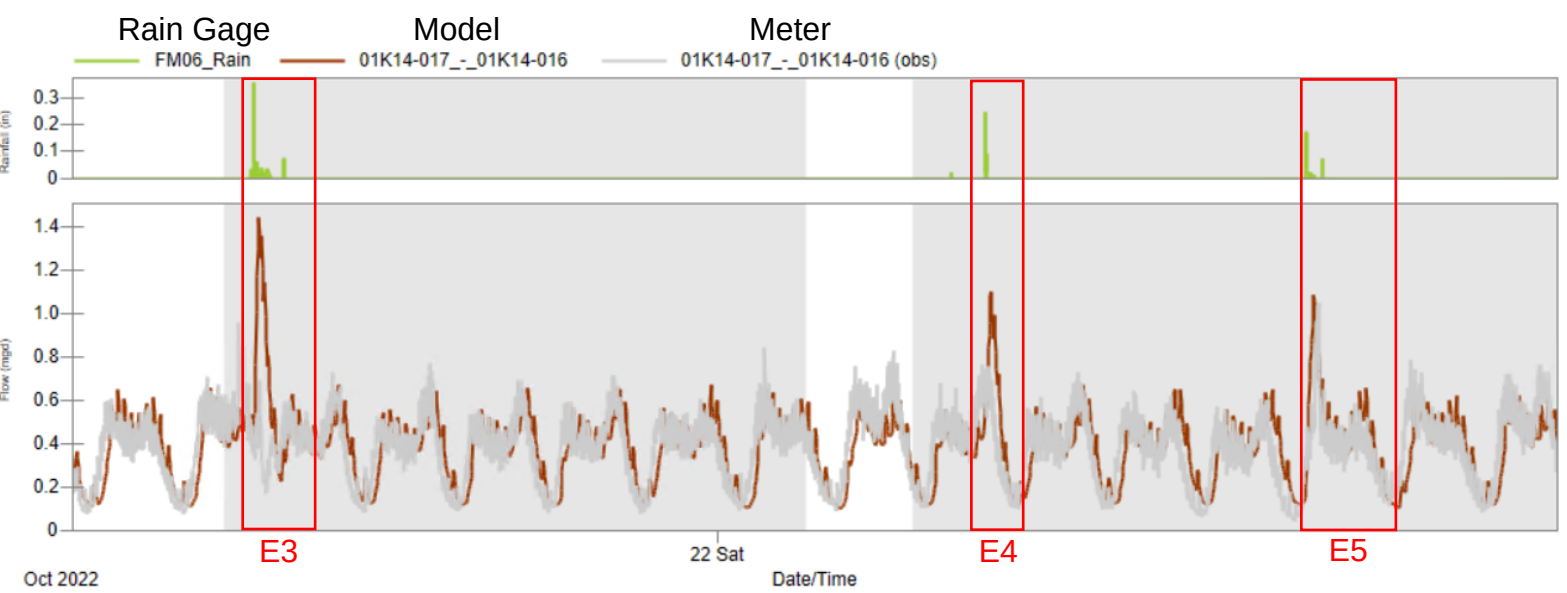
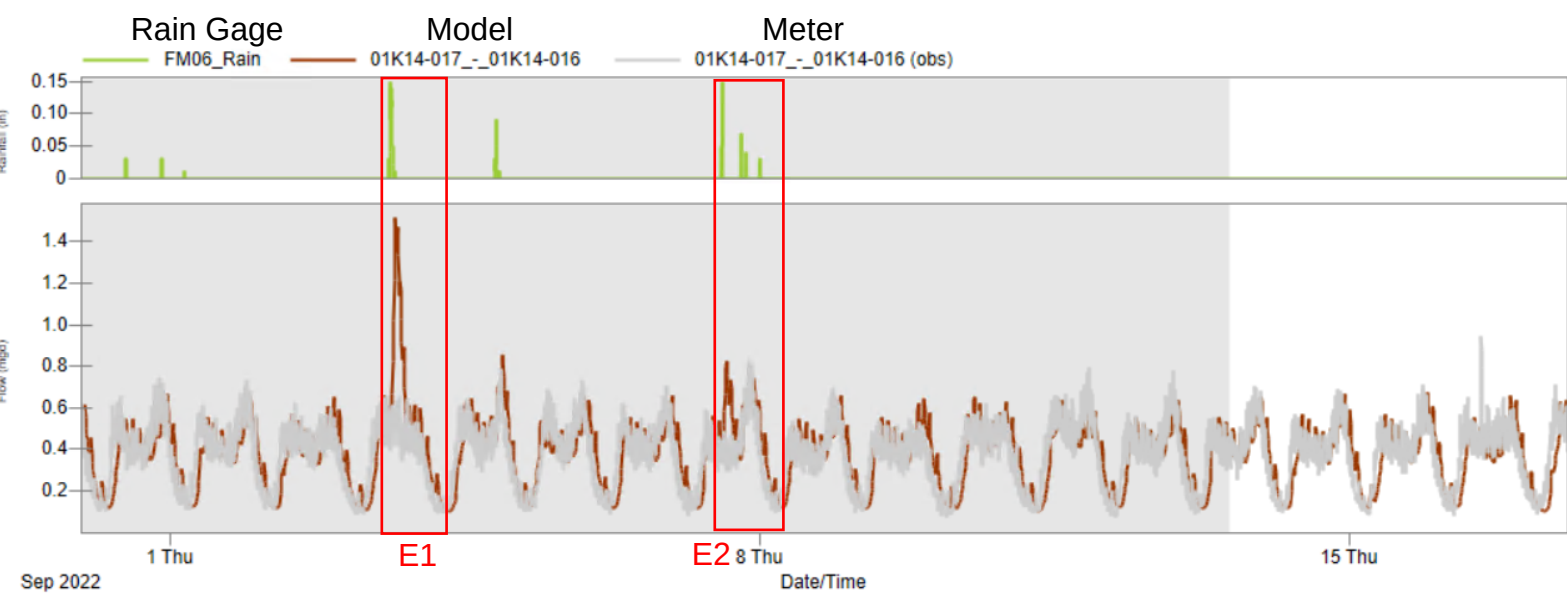
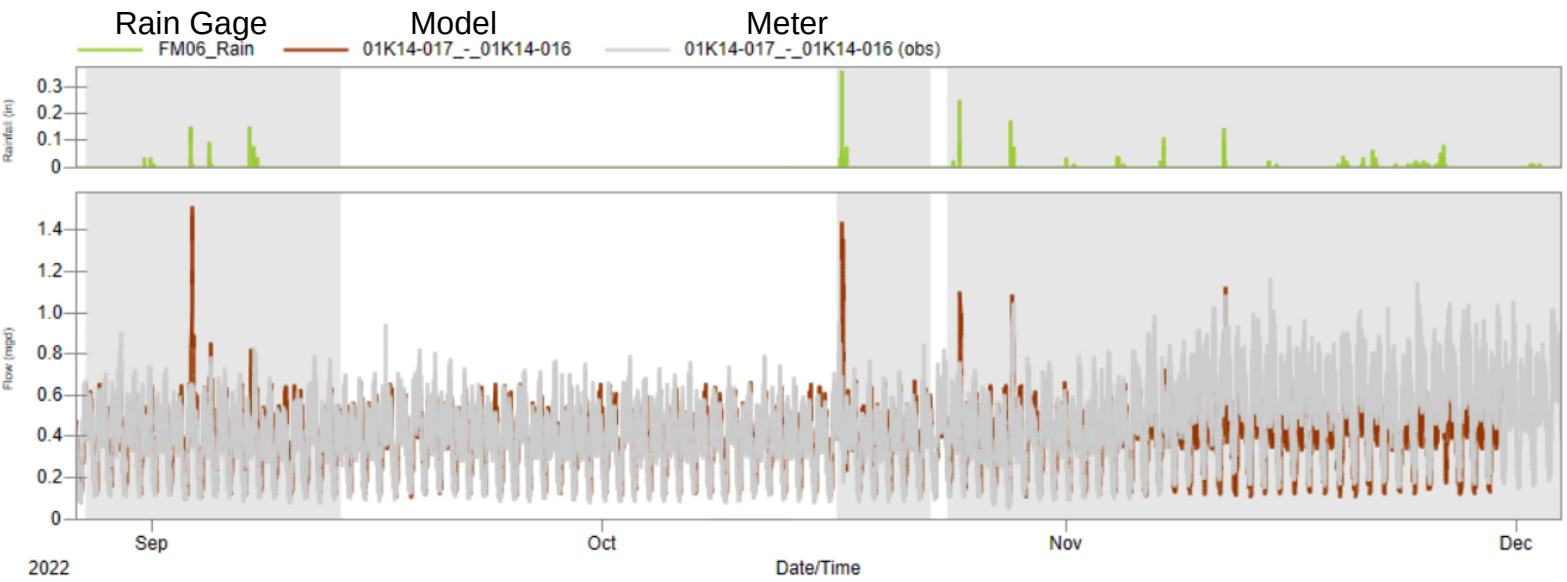


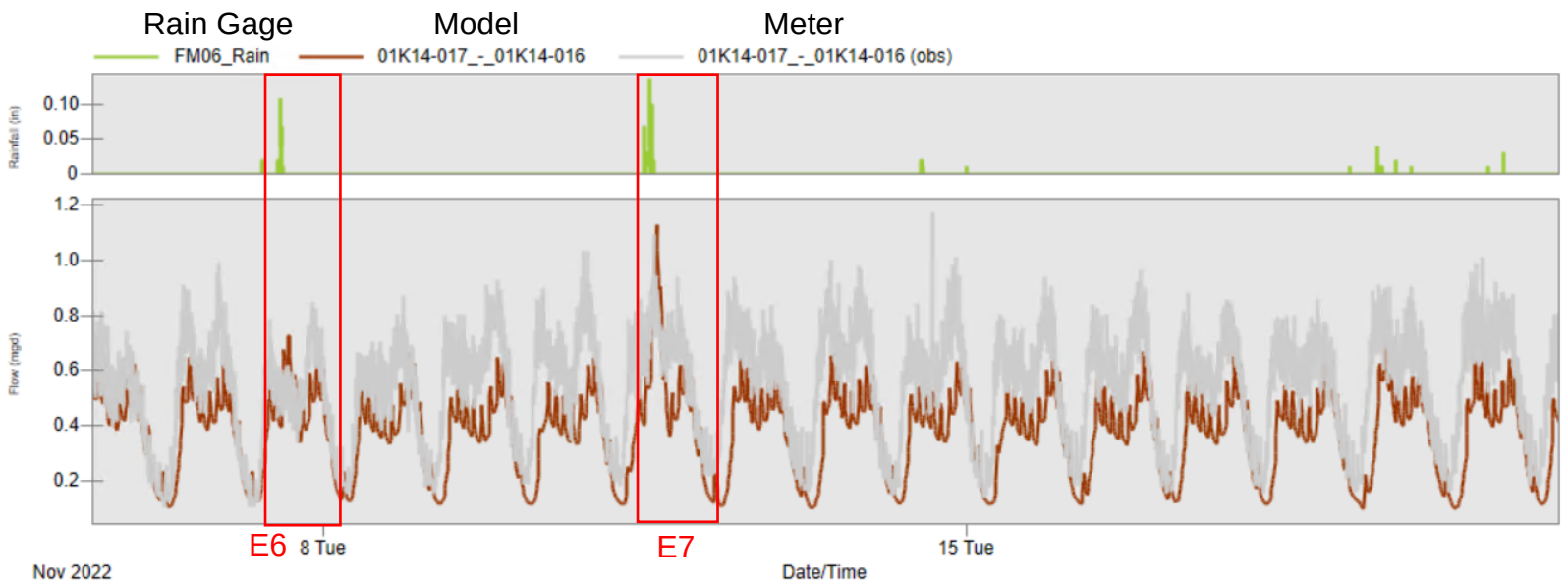
FM05			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.132	0.1108	19%
2	0.07643	0.06878	11%
3	0.1635	0.1159	41%
4	0.0849	0.05876	44%
5	0.2015	0.1816	11%
6	0.1753	0.1794	-2%

FM05			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.7783	0.505	54%
2	0.3904	0.456	-14%
3	0.4059	0.468	-13%
4	0.5281	0.461	15%
5	0.4637	0.432	7%
6	0.439	0.468	-6%



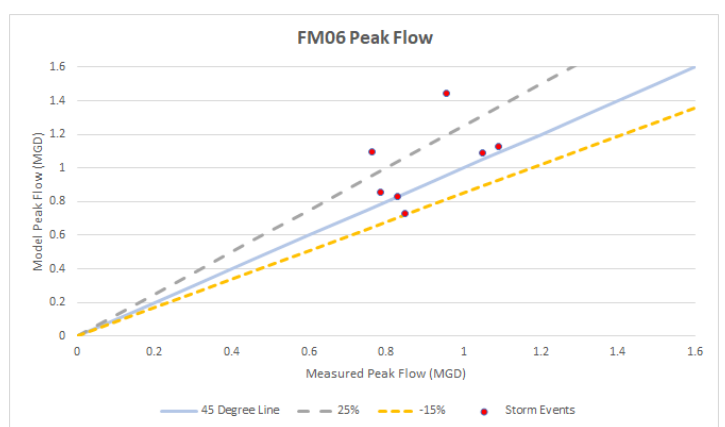
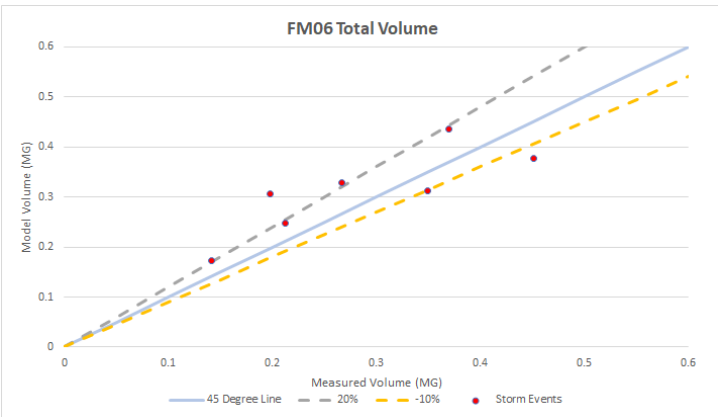
FM06



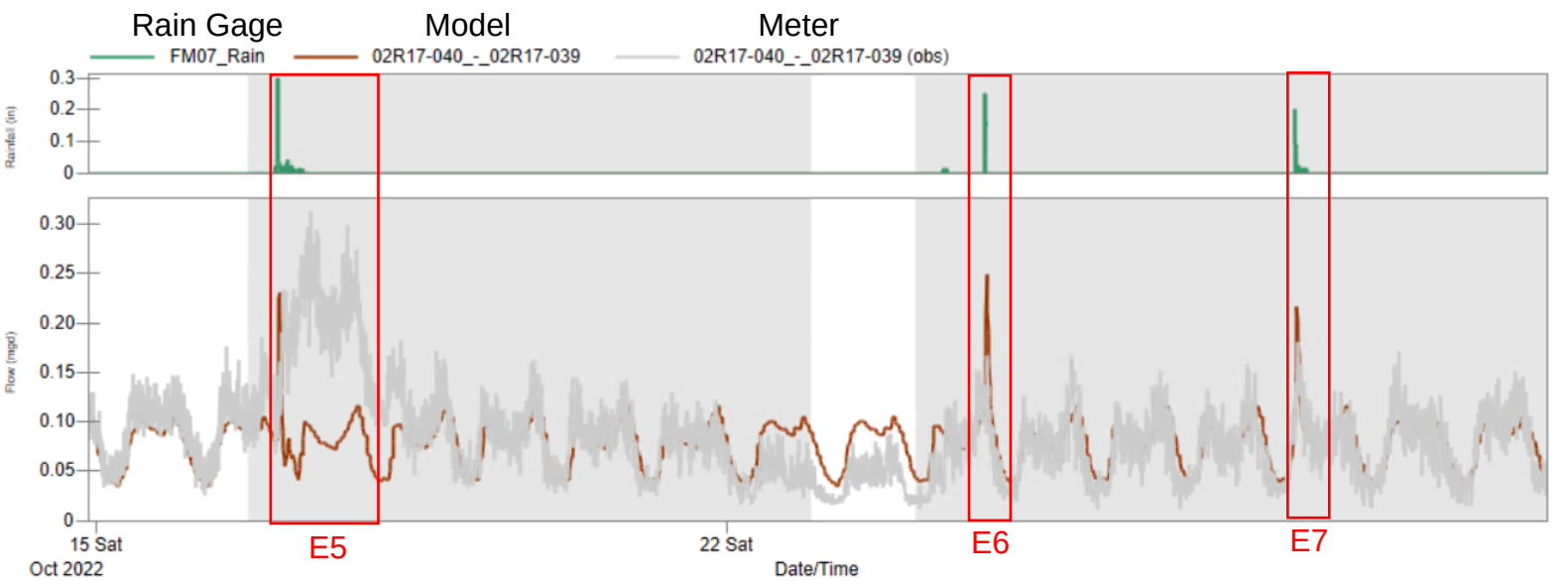
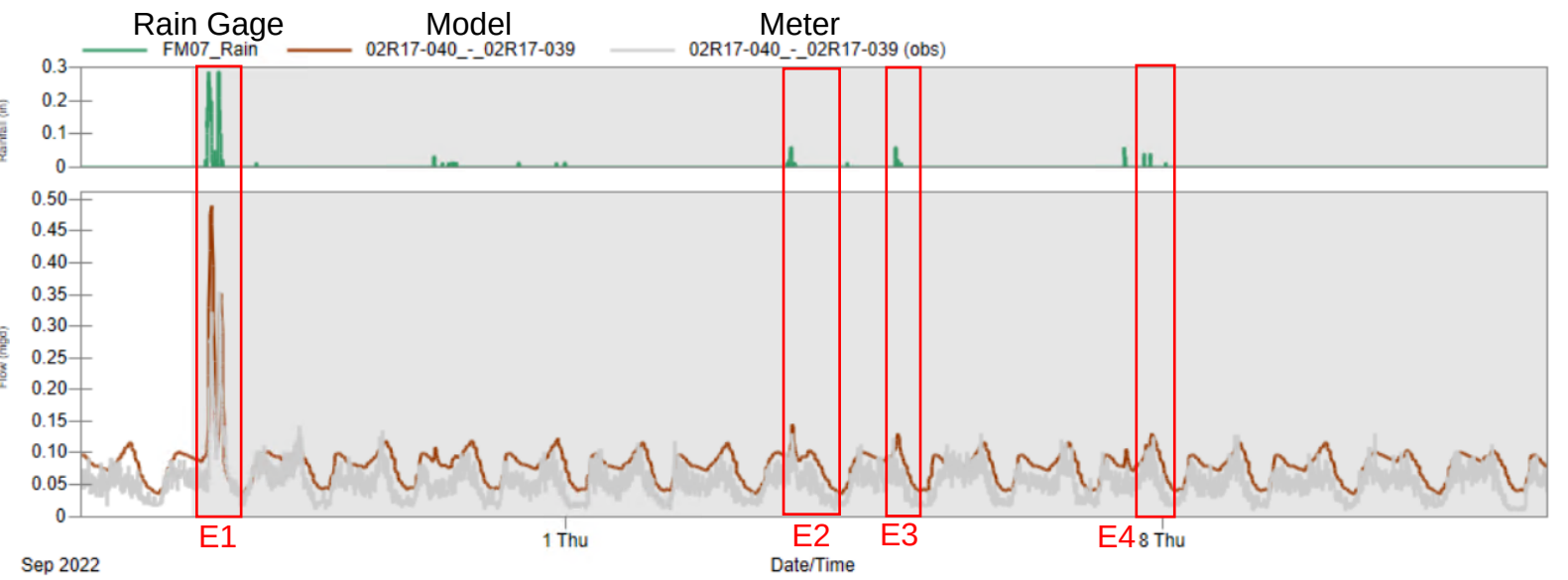
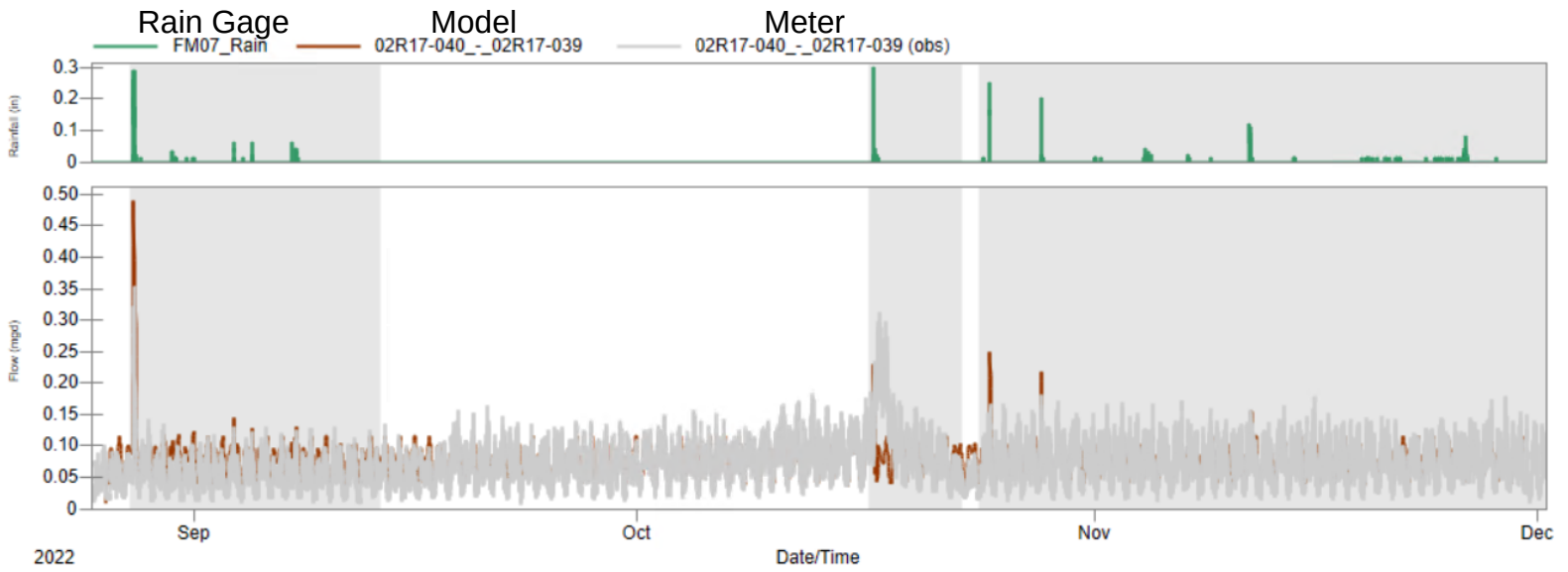


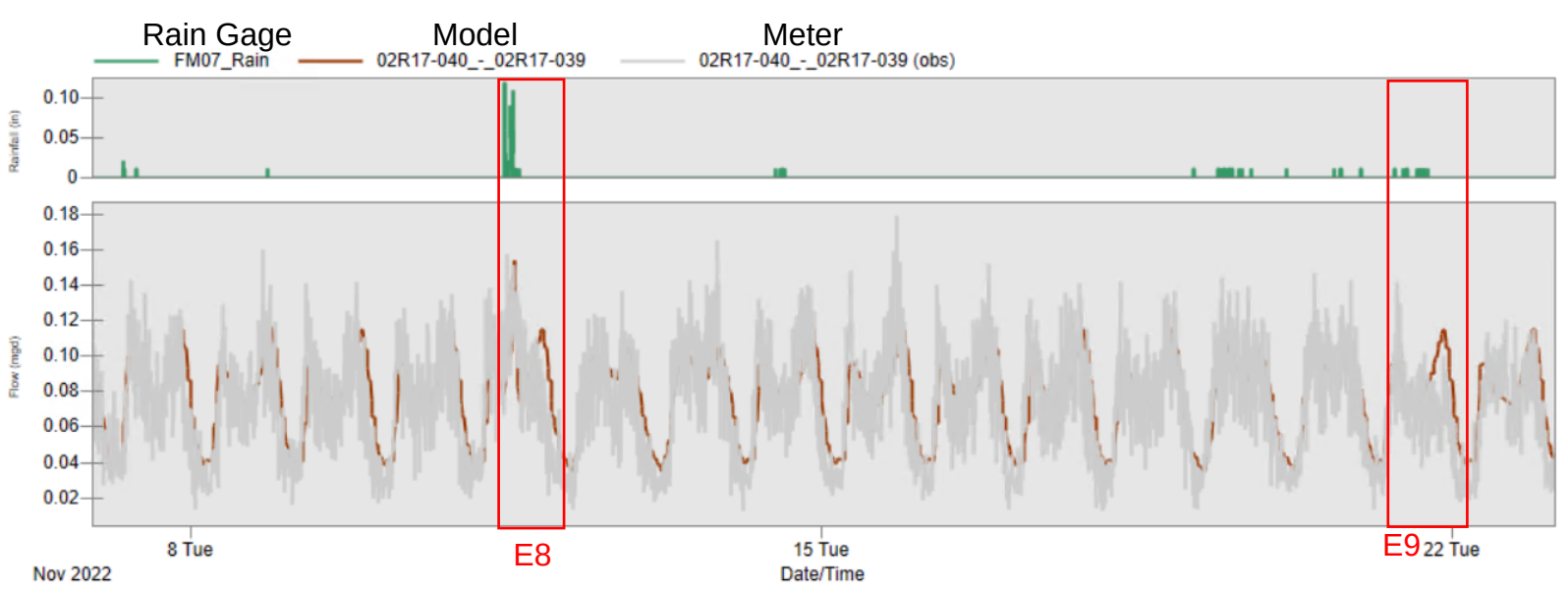
FM06			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.1722	0.1412	22%
2	0.3286	0.267	23%
3	0.3058	0.1981	54%
4	0.2485	0.2127	17%
5	0.4346	0.3696	18%
6	0.3115	0.3492	-11%
7	0.3764	0.4511	-17%

FM06			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.8554	0.785	9%
2	0.8278	0.828	0%
3	1.444	0.955	51%
4	1.098	0.763	44%
5	1.09	1.05	4%
6	0.7307	0.8472	-14%
7	1.127	1.09	3%



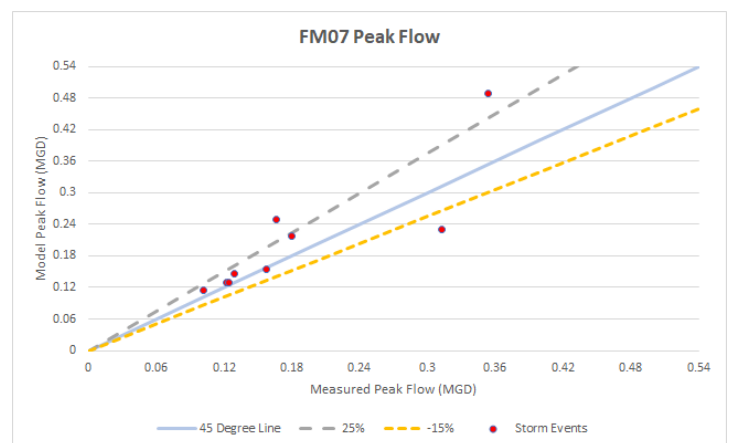
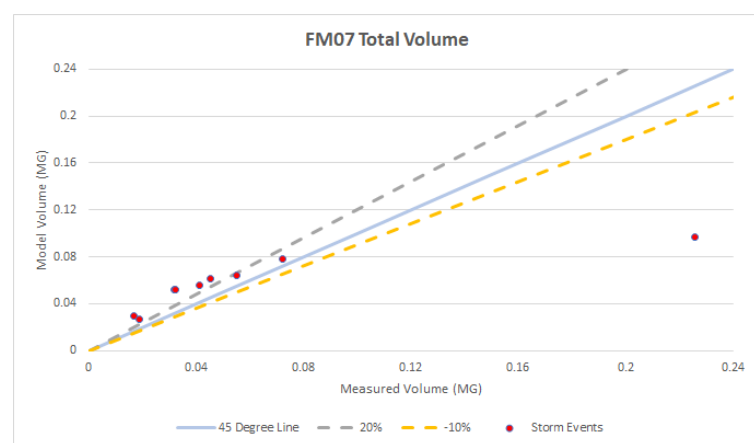
FM07



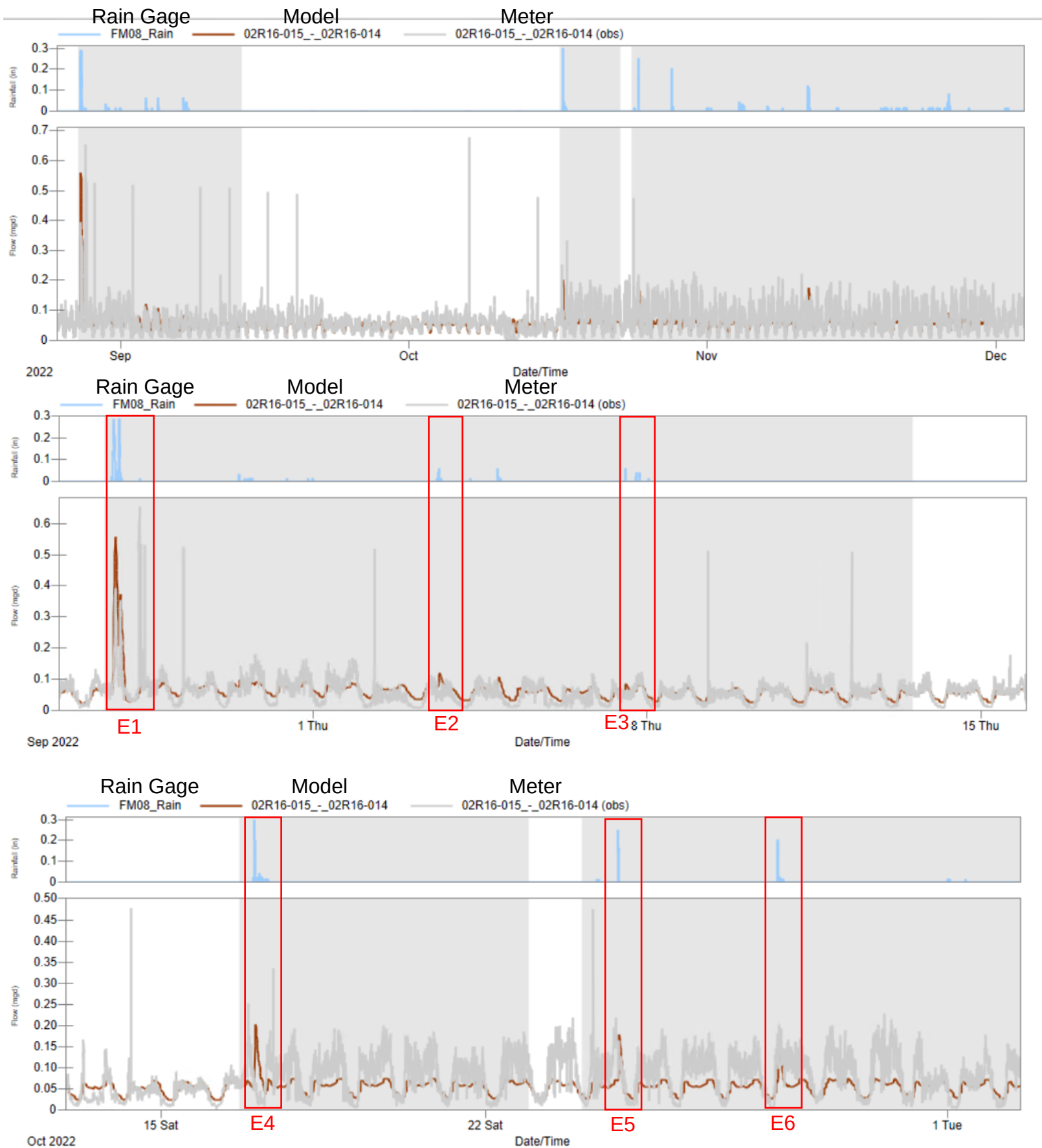


FM07			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.06133	0.04525	36%
2	0.0517	0.03191	62%
3	0.0298	0.01668	79%
4	0.05238	0.03237	62%
5	0.09639	0.2259	-57%
6	0.02633	0.01857	42%
7	0.07848	0.072	9%
8	0.06437	0.05521	17%
9	0.05534	0.04106	35%

FM07			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.4889	0.354	38%
2	0.1457	0.129	13%
3	0.1288	0.122	6%
4	0.1291	0.124	4%
5	0.2303	0.3123	-26%
6	0.2485	0.166	50%
7	0.217	0.18	21%
8	0.1544	0.157	-2%
9	0.1151	0.102	13%



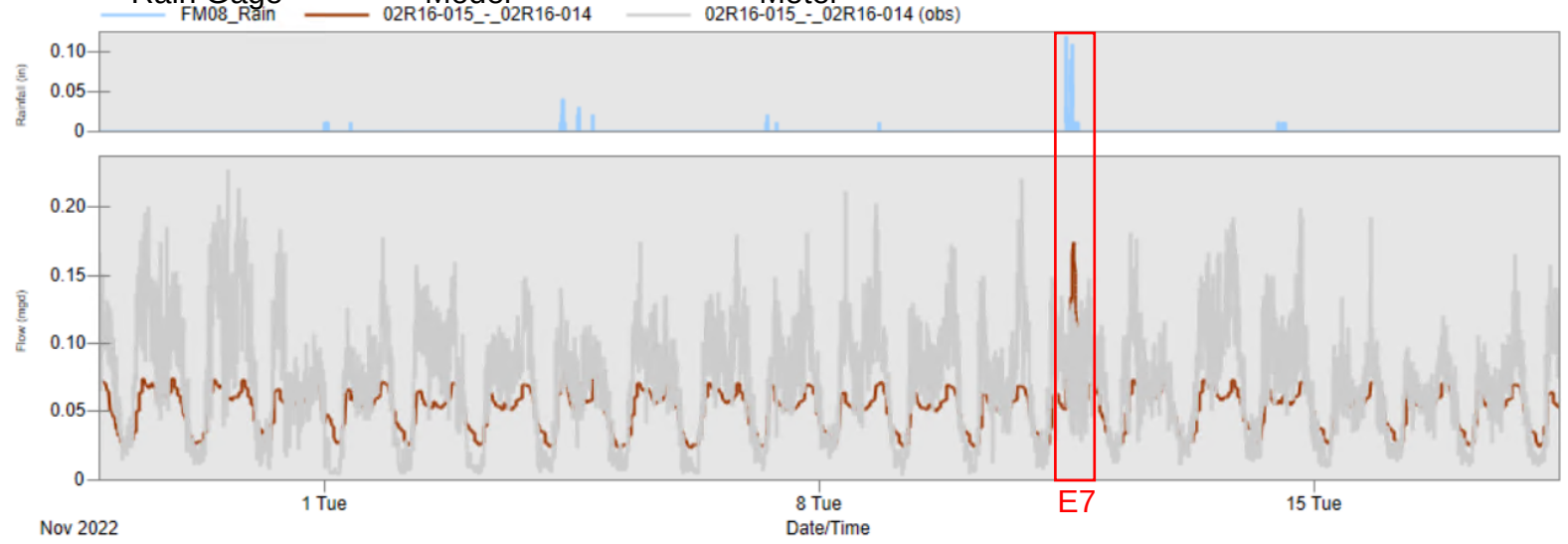
FM08



Rain Gage

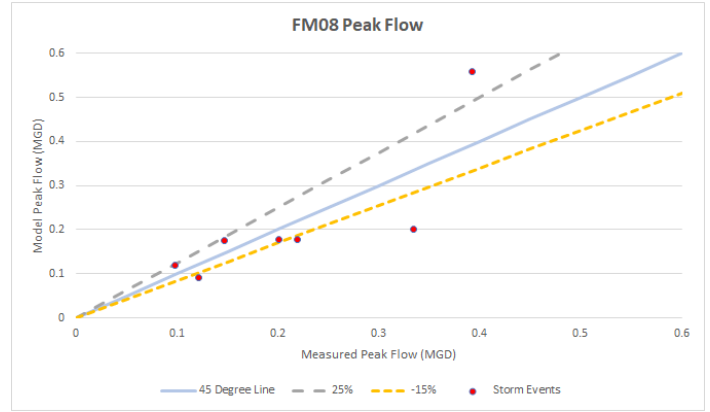
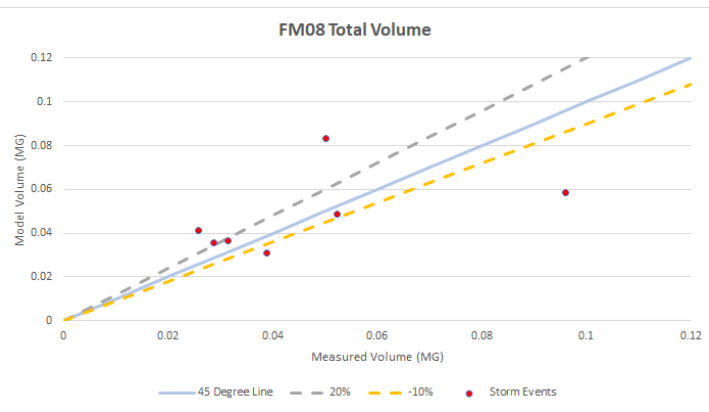
Model

Meter



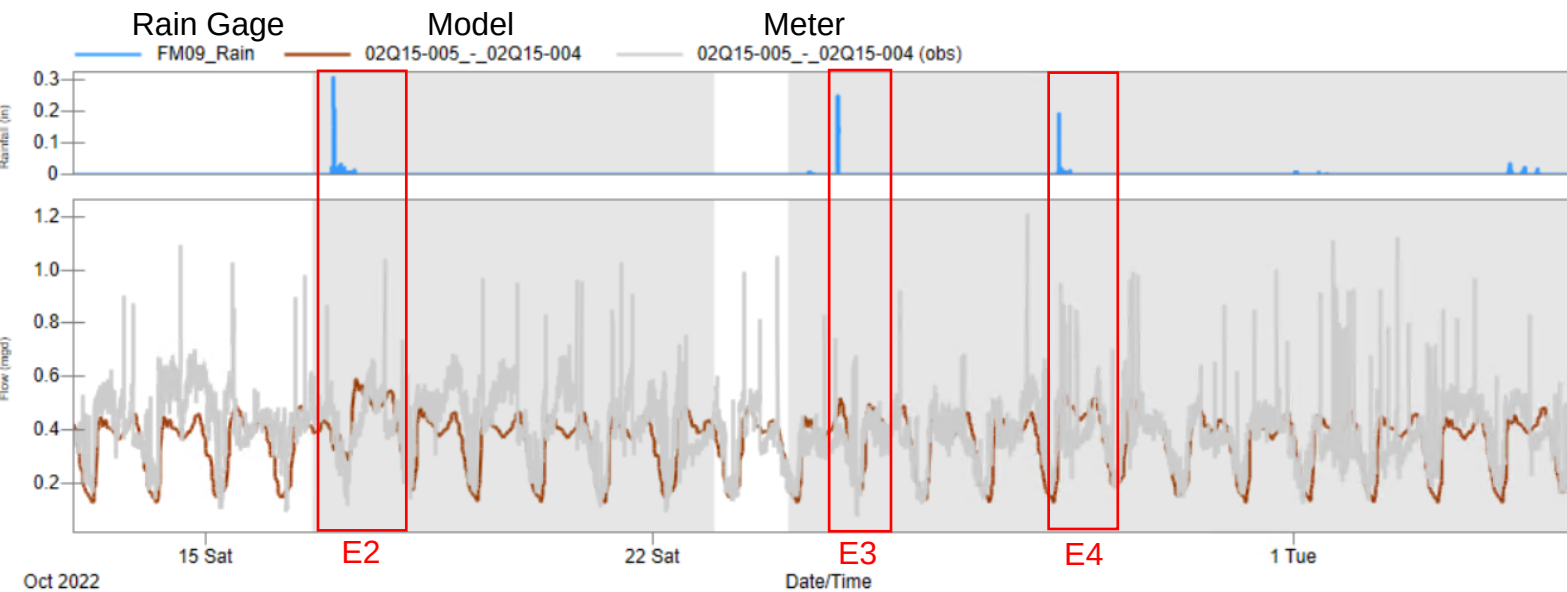
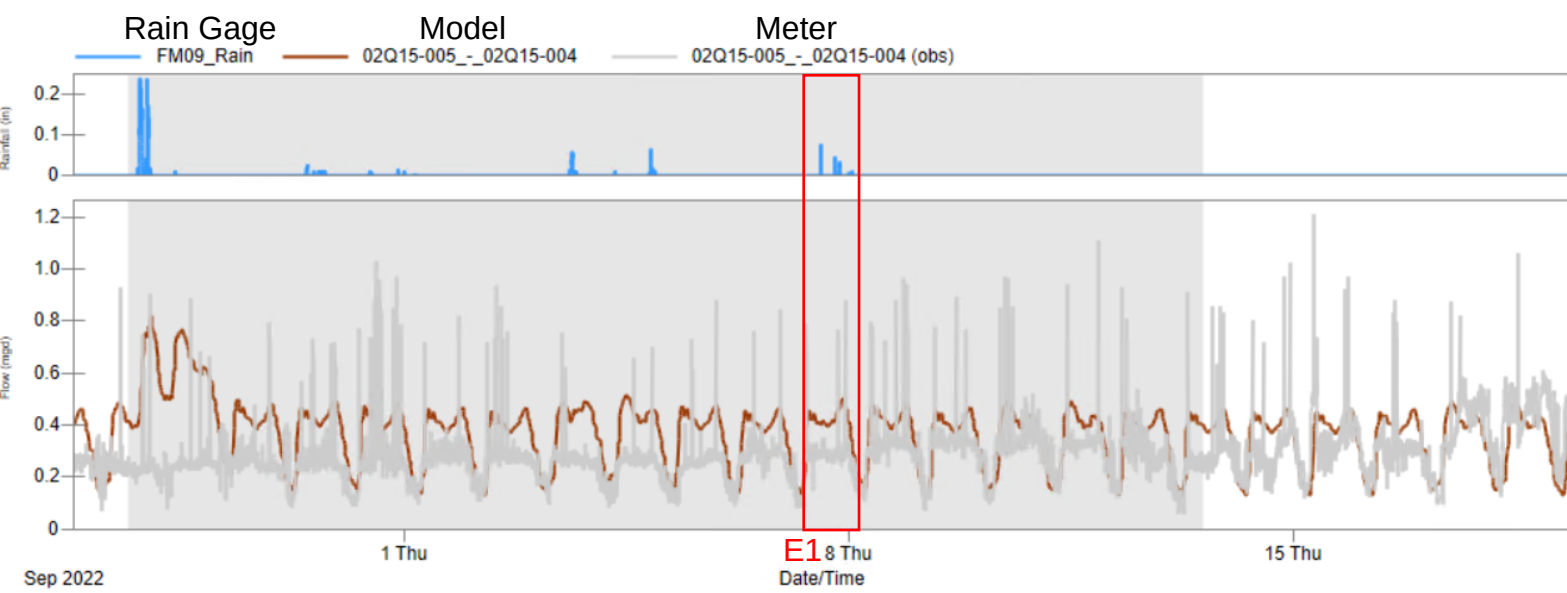
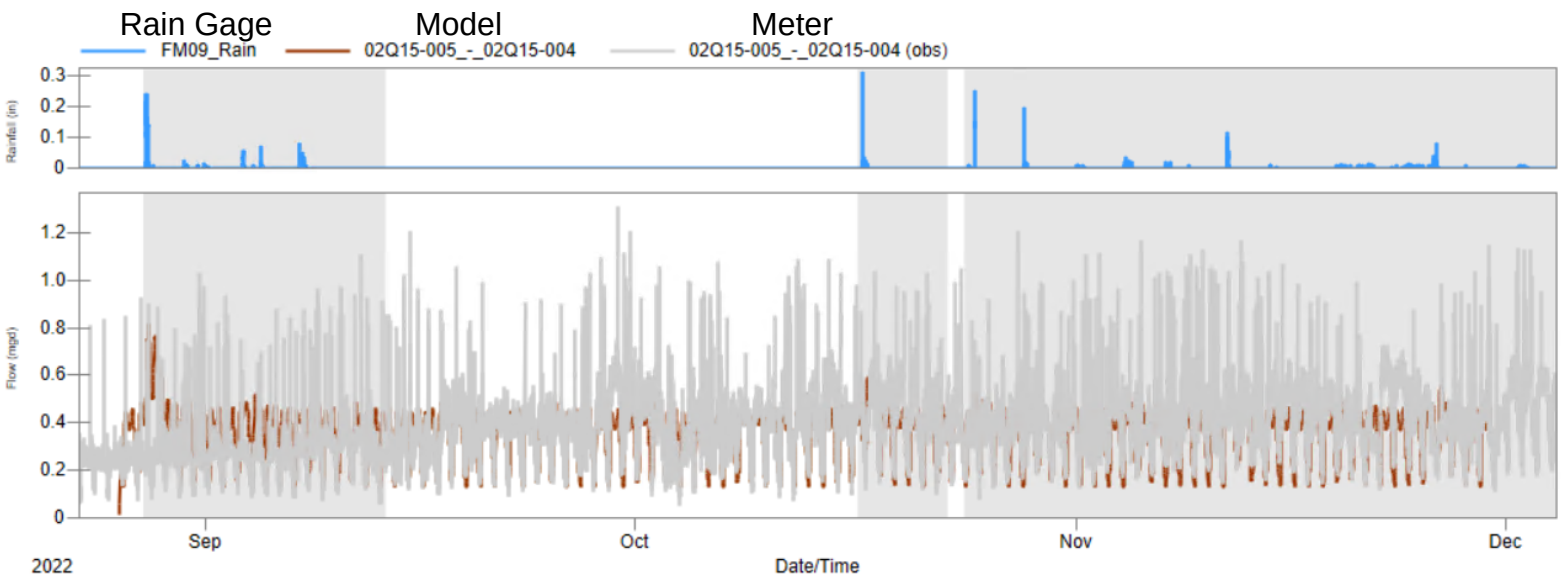
FM08			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.08344	0.05022	66%
2	0.04124	0.02575	60%
3	0.03638	0.03149	16%
4	0.03563	0.02867	24%
5	0.03071	0.03883	-21%
6	0.05835	0.09611	-39%
7	0.04865	0.05227	-7%

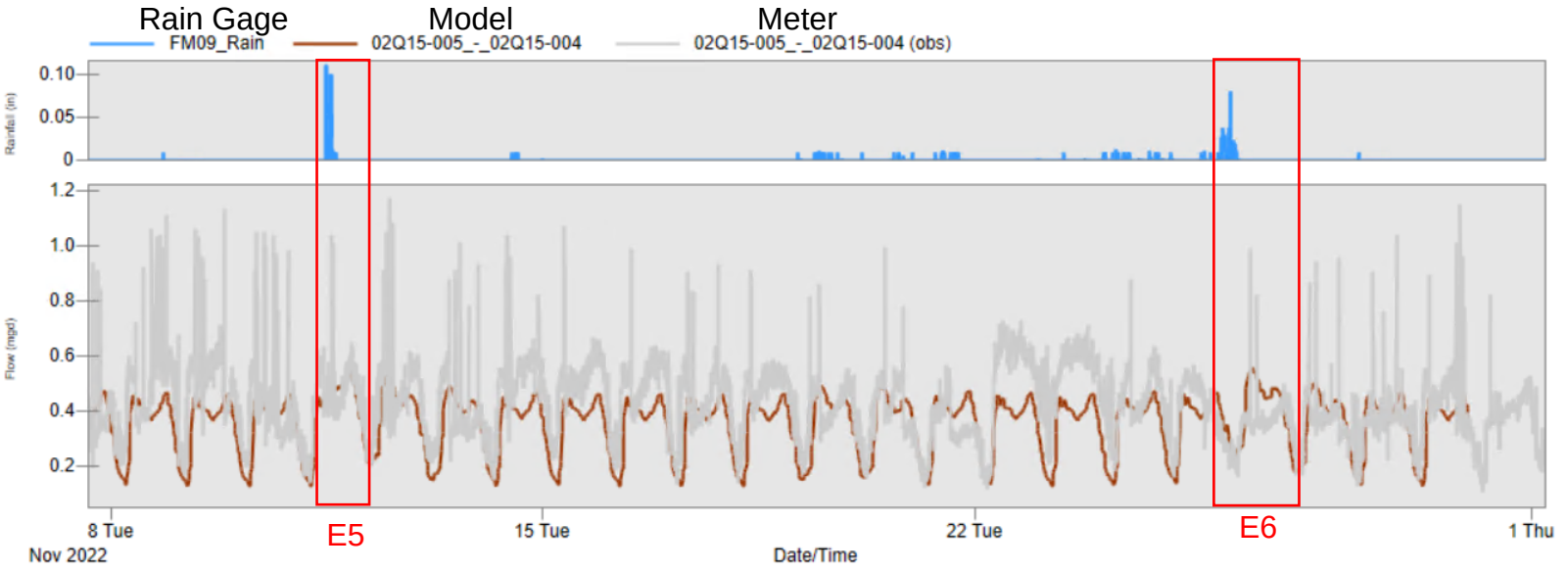
FM08			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.5588	0.392	43%
2	0.119	0.098	21%
3	0.09104	0.121	-25%
4	0.2012	0.3343	-40%
5	0.1772	0.219	-19%
6	0.177	0.201	-12%
7	0.1744	0.147	19%



FM09

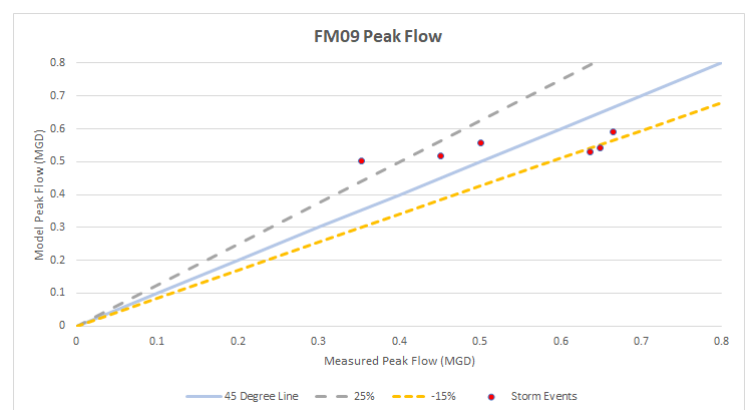
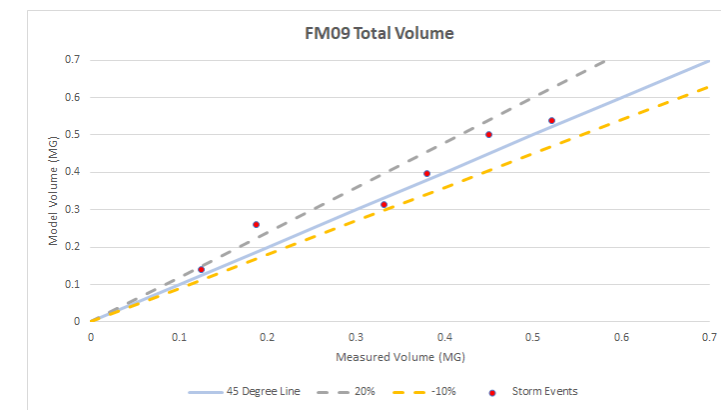
- Random spikes in flow meter data not considered in peak flow comparison between model and meter data





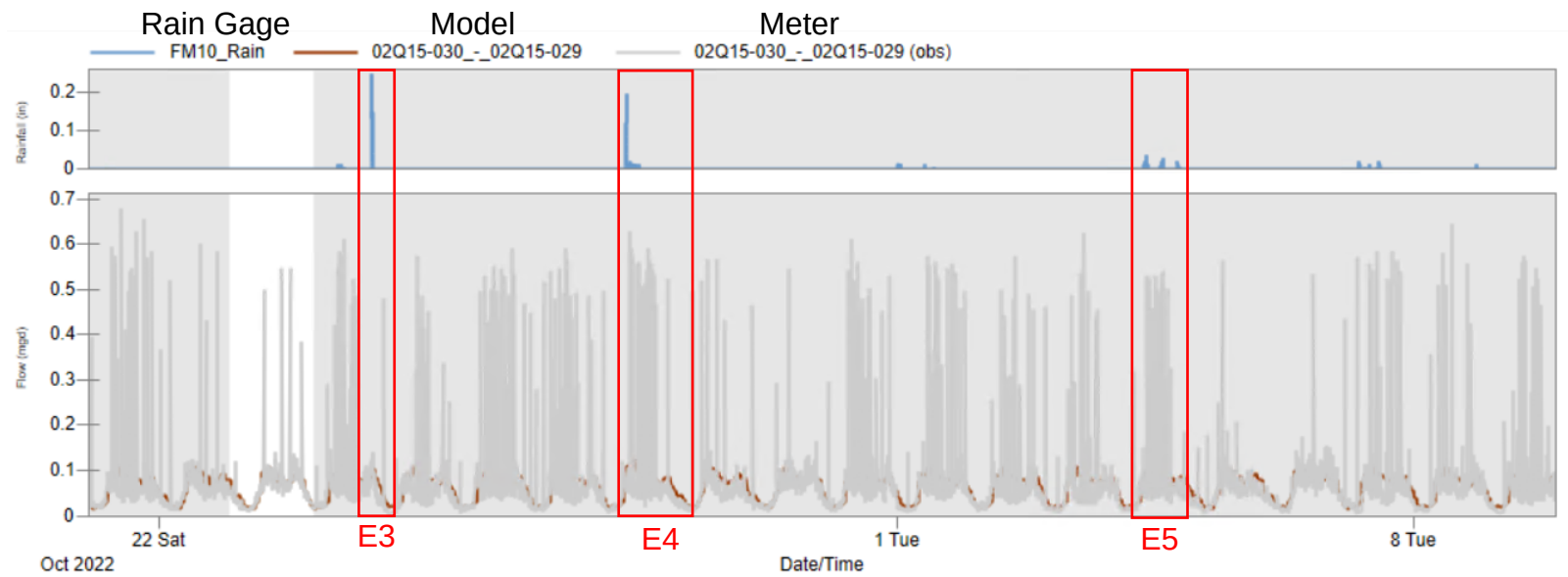
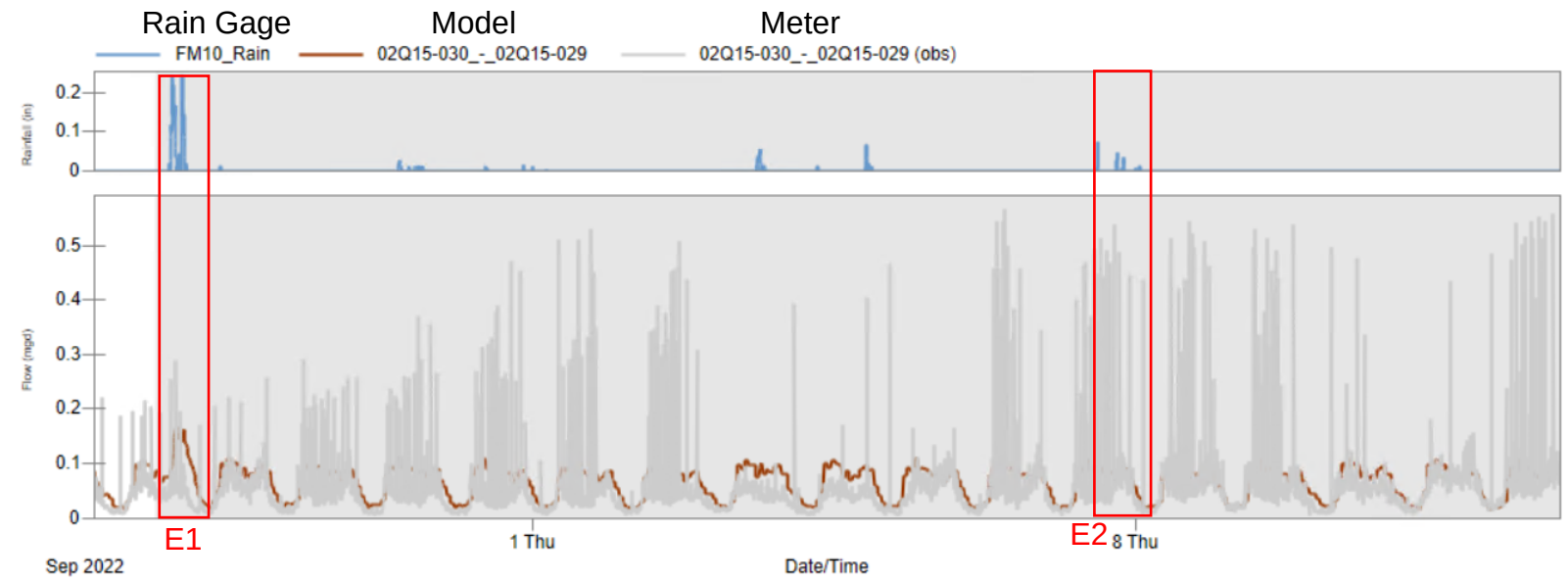
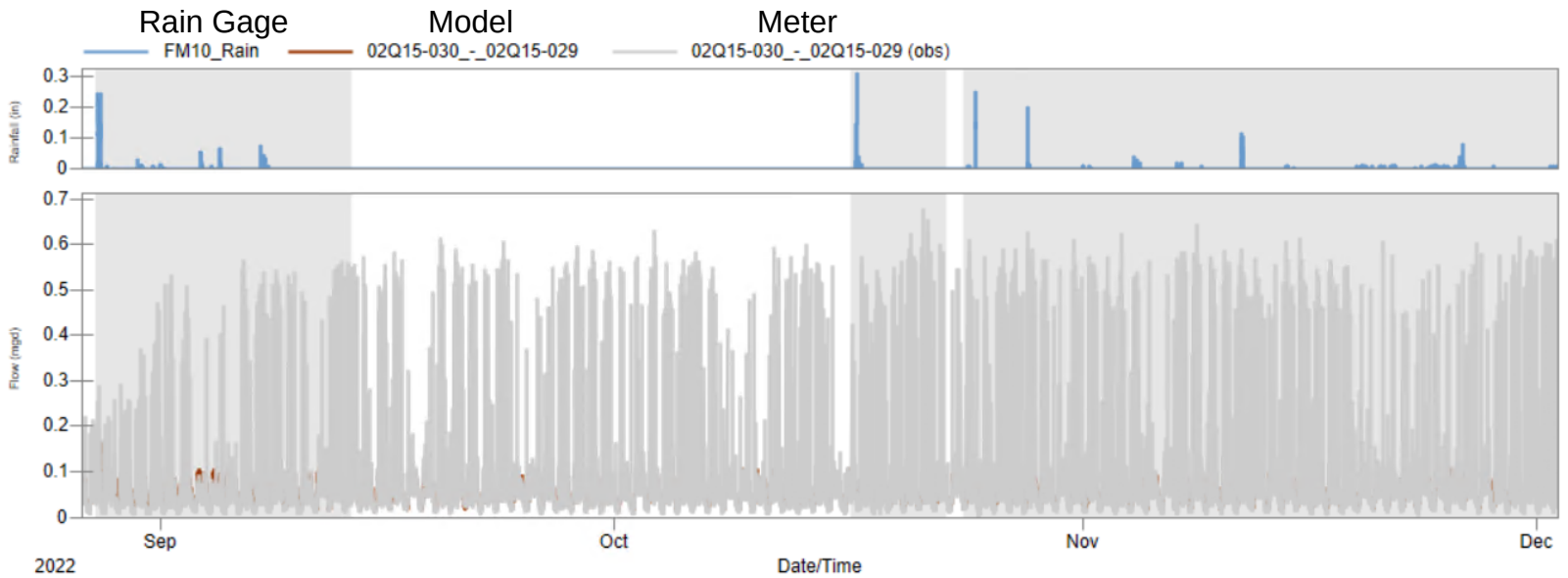
FM09			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.26	0.1867	39%
2	0.5374	0.5217	3%
3	0.1413	0.1244	14%
4	0.396	0.3807	4%
5	0.3153	0.3311	-5%
6	0.5021	0.4506	11%

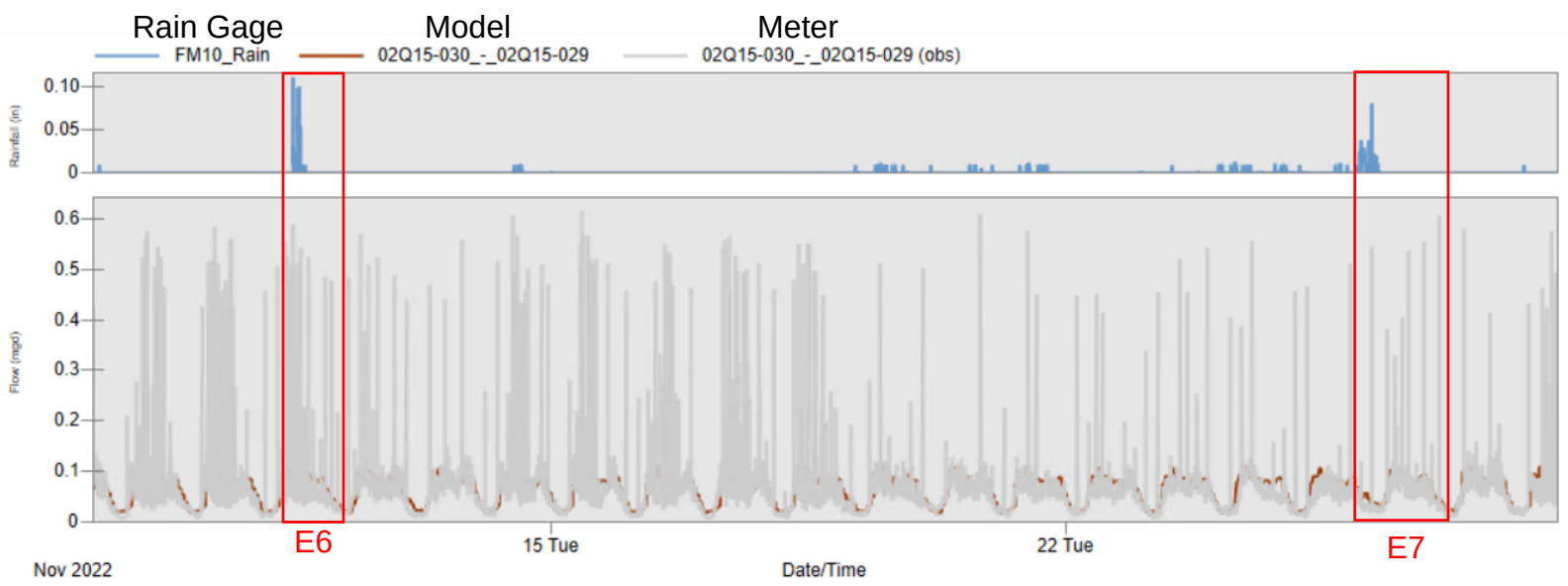
FM09			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.5014	0.353	42%
2	0.5894	0.665	-11%
3	0.517	0.451	15%
4	0.5285	0.636	-17%
5	0.5418	0.649	-17%
6	0.5571	0.501	11%



FM10

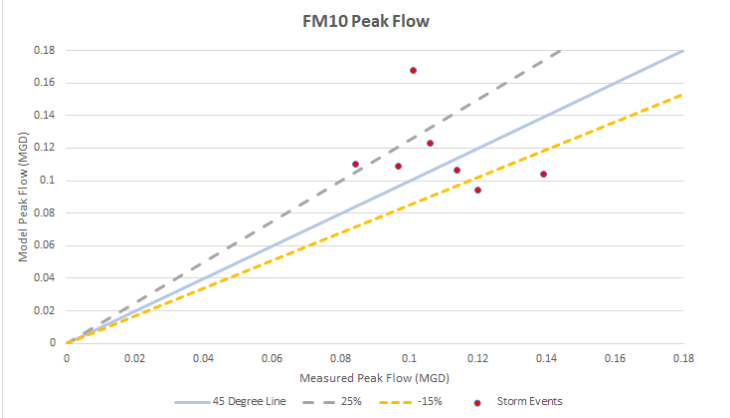
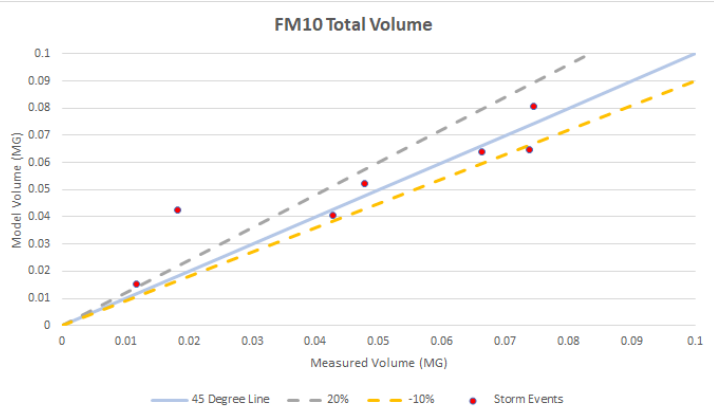
- Random spikes in flow meter data not considered in peak flow comparison between model and meter data



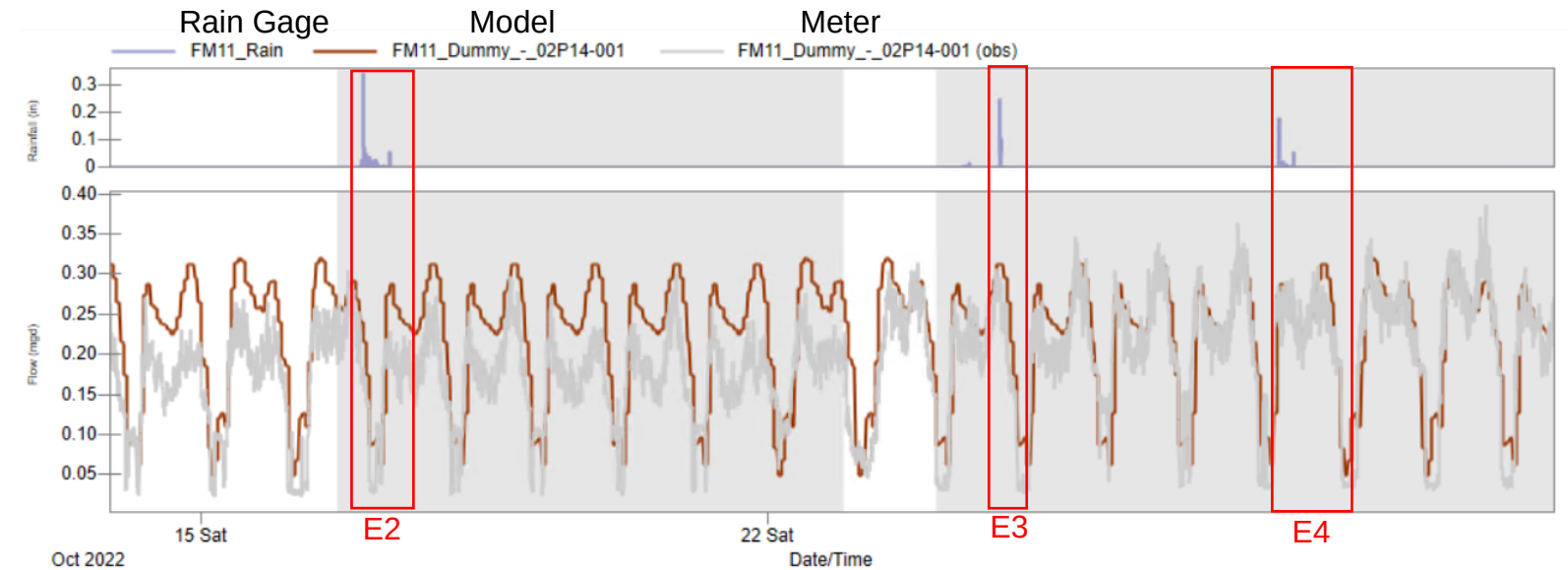
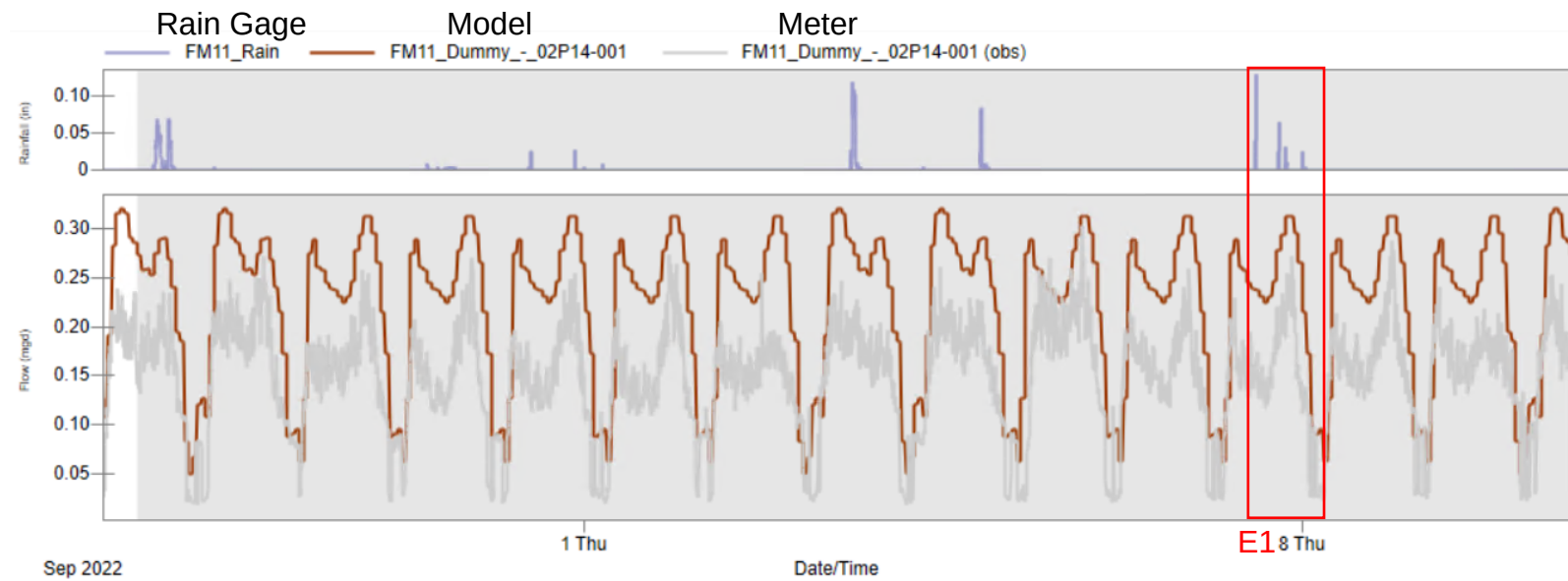
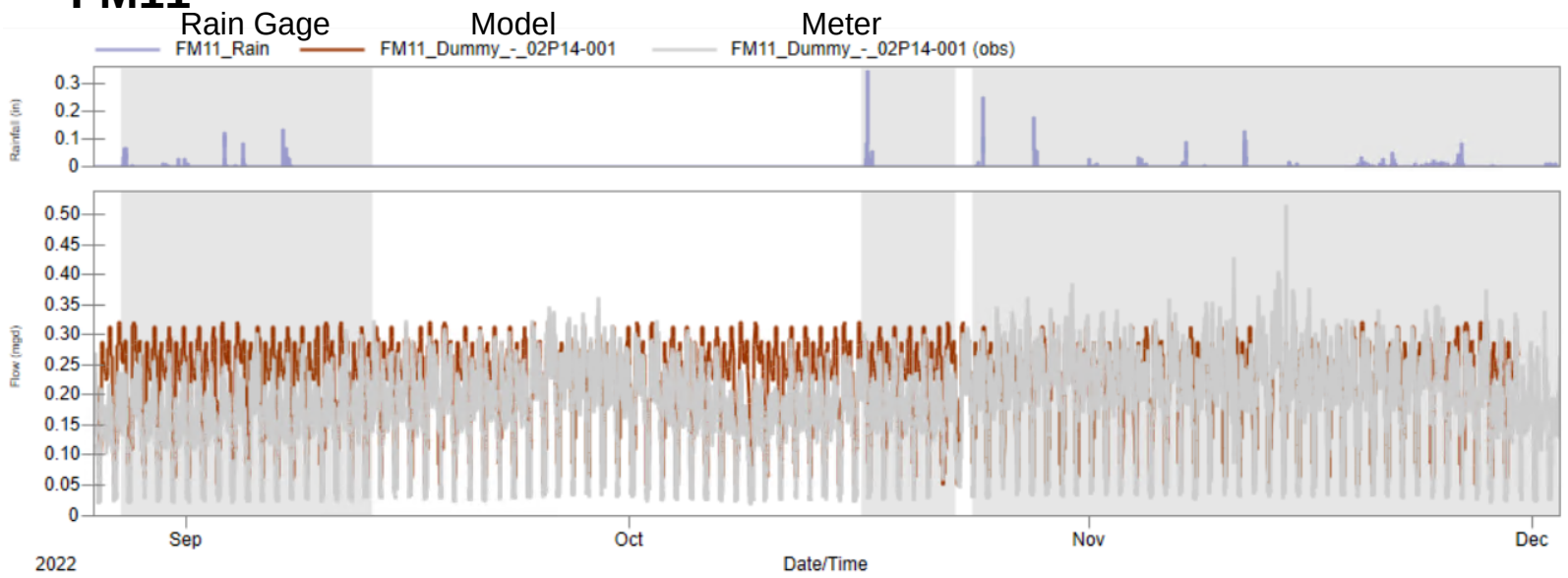


FM10			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.04252	0.01815	134%
2	0.04071	0.0428	-5%
3	0.01523	0.01168	30%
4	0.06486	0.07383	-12%
5	0.0641	0.06629	-3%
6	0.05245	0.04768	10%
7	0.08059	0.07449	8%

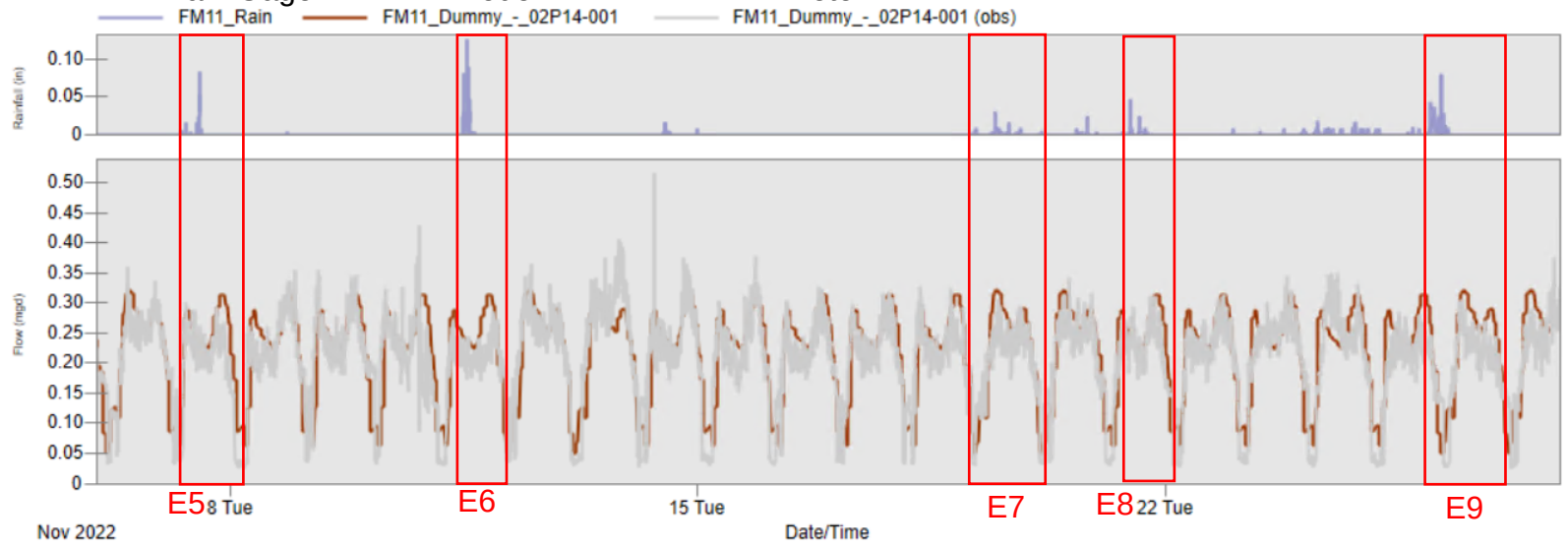
FM10			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.1677	0.101	66%
2	0.09398	0.12	-22%
3	0.1038	0.139	-25%
4	0.1228	0.106	16%
5	0.11	0.0843	30%
6	0.1089	0.0967	13%
7	0.1063	0.114	-7%



FM11

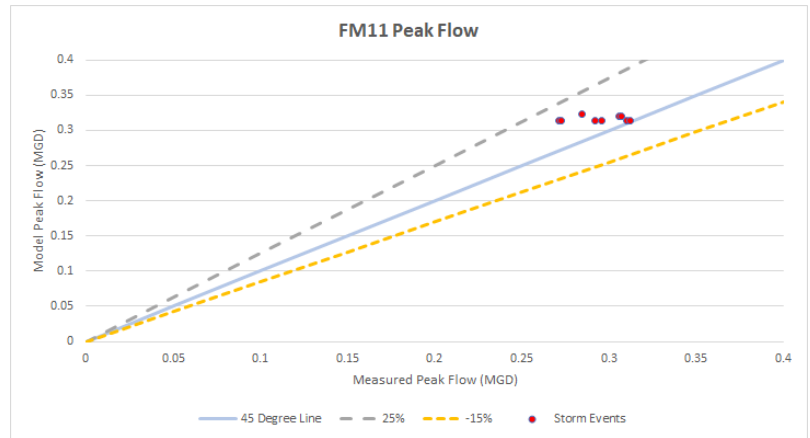
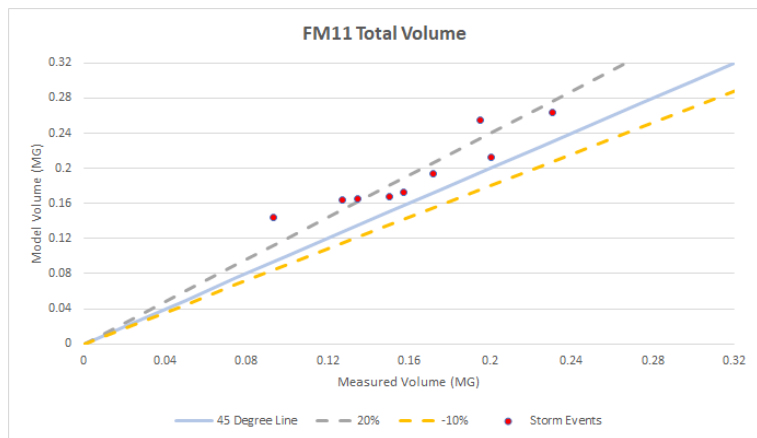


Rain Gage Model Meter



FM11			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.1436	0.09304	54%
2	0.2548	0.195	31%
3	0.1657	0.1346	23%
4	0.2125	0.2002	6%
5	0.1641	0.127	29%
6	0.1681	0.1503	12%
7	0.1939	0.1719	13%
8	0.1724	0.1576	9%
9	0.2631	0.2305	14%

FM11			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.3131	0.2713	15%
2	0.3131	0.2724	15%
3	0.3131	0.296	6%
4	0.3131	0.3104	1%
5	0.3131	0.292	7%
6	0.3231	0.2846	14%
7	0.3202	0.3059	5%
8	0.3131	0.3118	0%
9	0.3202	0.307	4%



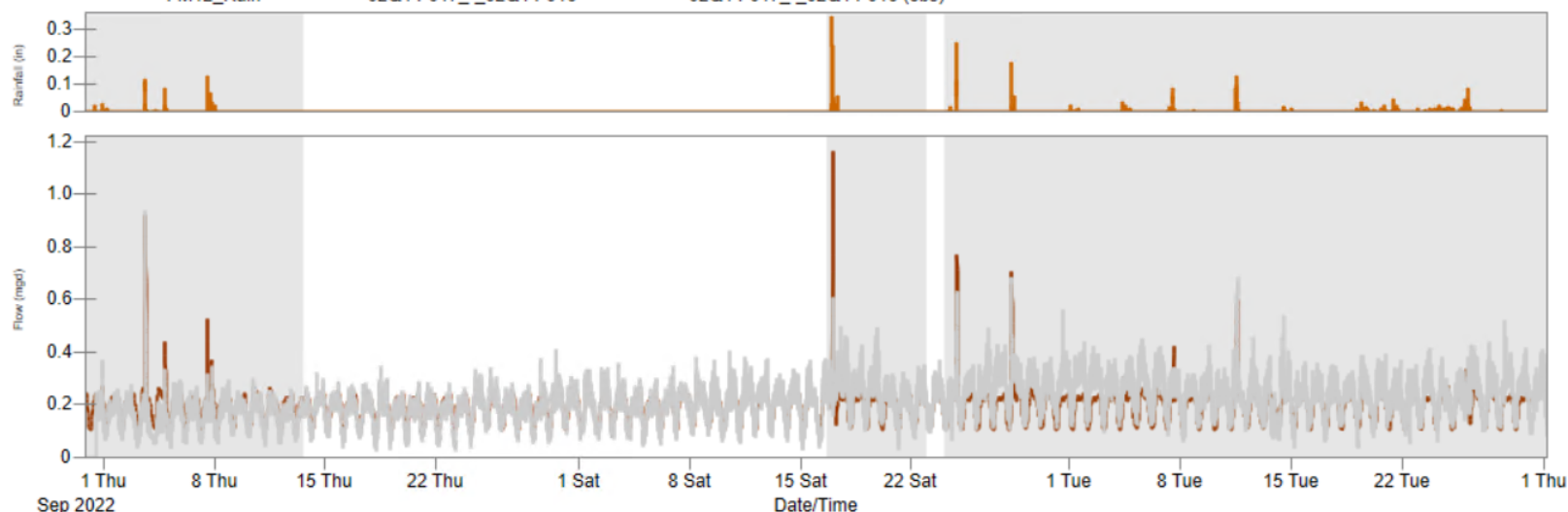
FM12

Rain Gage

Model

Meter

FM12_Rain 02Q14-017_-_02Q14-016 02Q14-017_-_02Q14-016 (obs)

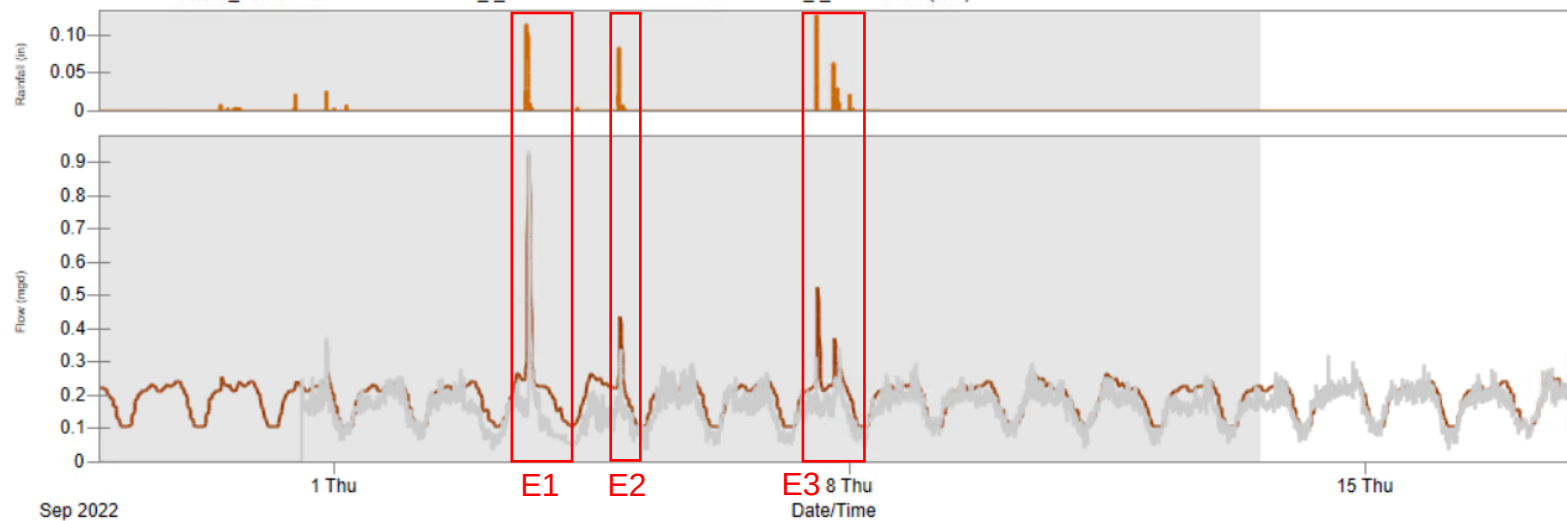


Rain Gage

Model

Meter

FM12_Rain 02Q14-017_-_02Q14-016 02Q14-017_-_02Q14-016 (obs)

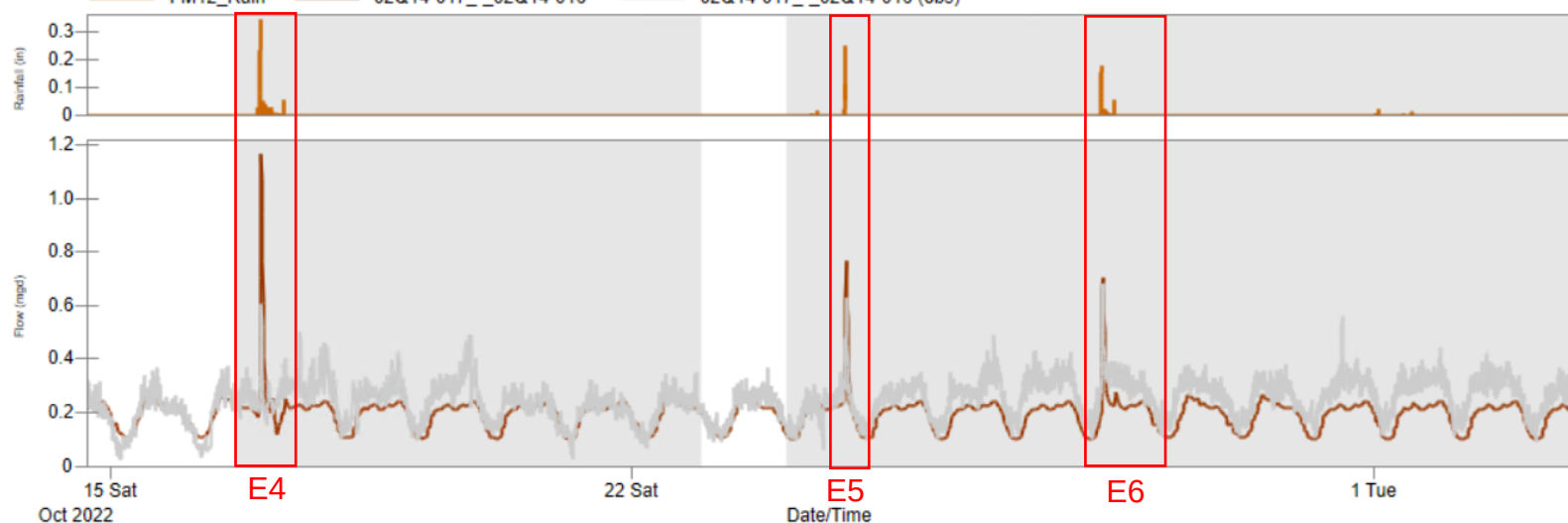


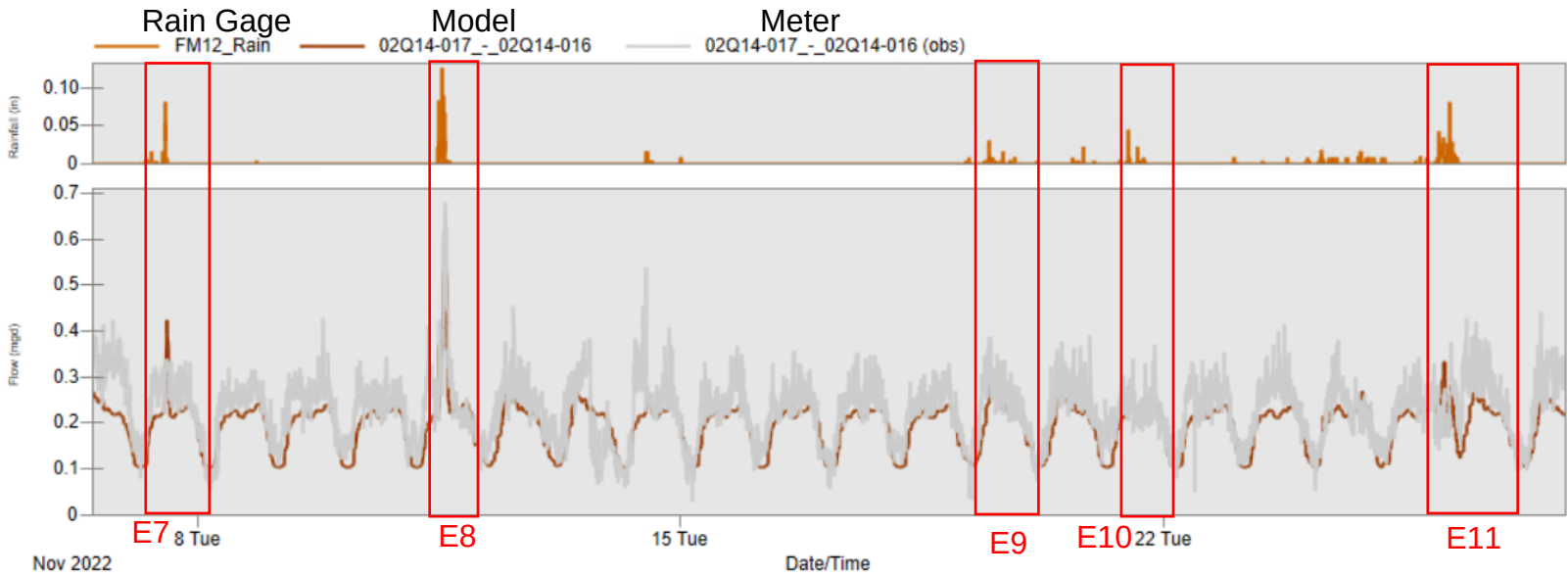
Rain Gage

Model

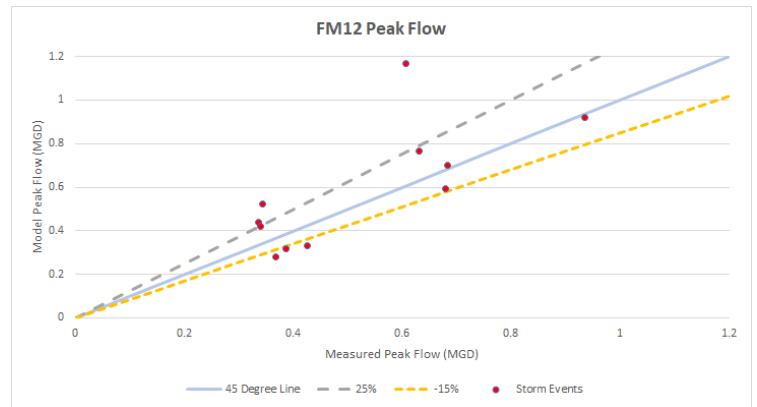
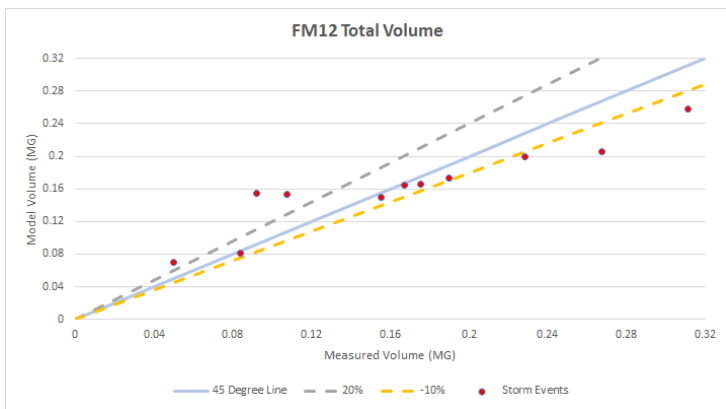
Meter

FM12_Rain 02Q14-017_-_02Q14-016 02Q14-017_-_02Q14-016 (obs)





FM12				FM12			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference	Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	0.154	0.09208	67%	1	0.9183	0.935	-2%
2	0.07048	0.04971	42%	2	0.4369	0.336	30%
3	0.153	0.1074	42%	3	0.5225	0.344	52%
4	0.1652	0.1755	-6%	4	1.166	0.607	92%
5	0.08064	0.08385	-4%	5	0.7663	0.631	21%
6	0.206	0.2675	-23%	6	0.7024	0.683	3%
7	0.1995	0.2285	-13%	7	0.4216	0.3395	24%
8	0.164	0.1671	-2%	8	0.5951	0.679	-12%
9	0.1731	0.1899	-9%	9	0.3186	0.3867	-18%
10	0.1498	0.1555	-4%	10	0.2816	0.3677	-23%
11	0.2585	0.3113	-17%	11	0.3333	0.4252	-22%



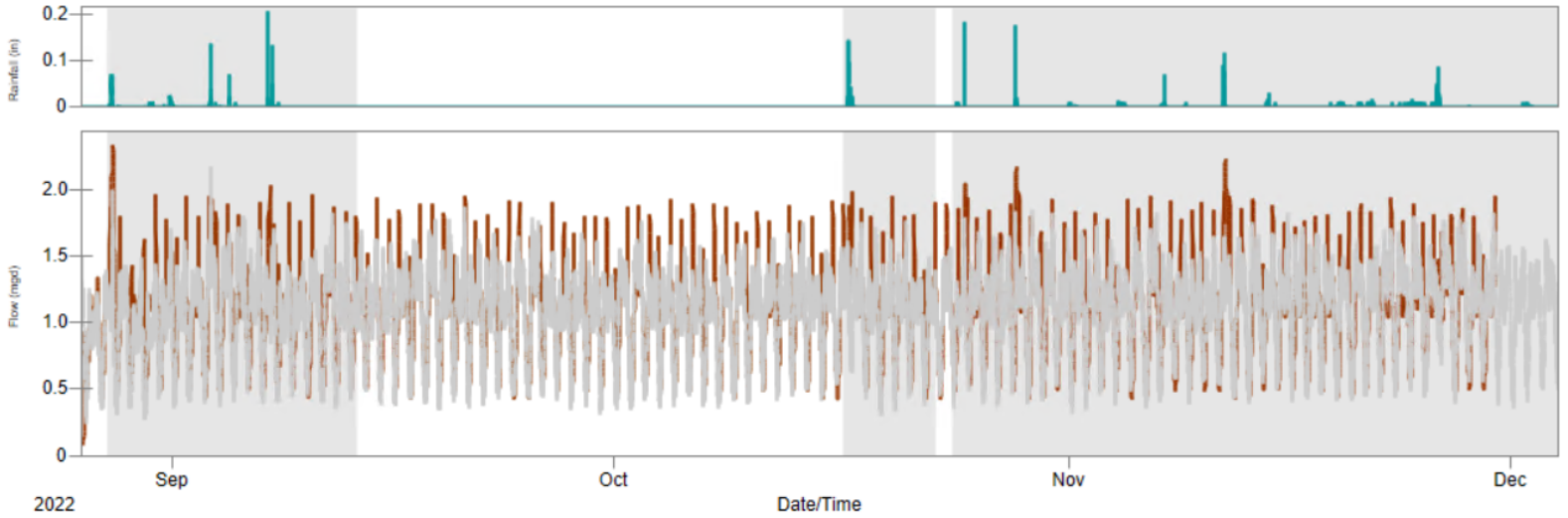
FM13

Rain Gage

Model

Meter

FM13_Rain 02R14-002_-_02R14-001 02R14-002_-_02R14-001 (obs)

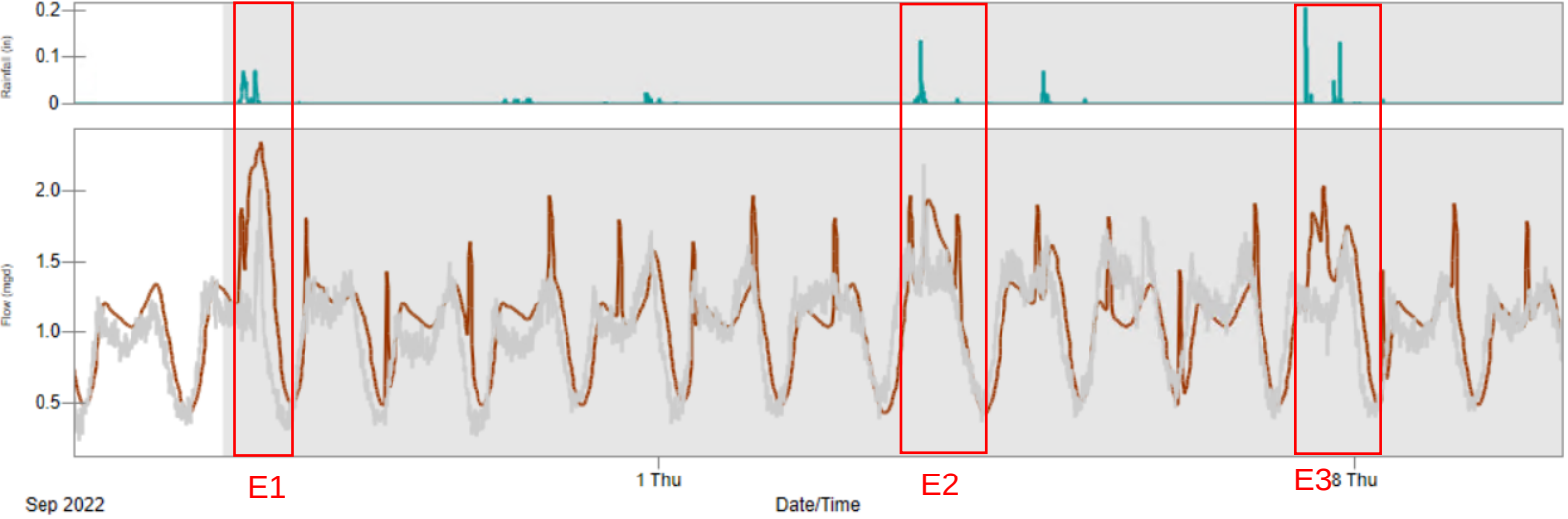


Rain Gage

Model

Meter

FM13_Rain 02R14-002_-_02R14-001 02R14-002_-_02R14-001 (obs)

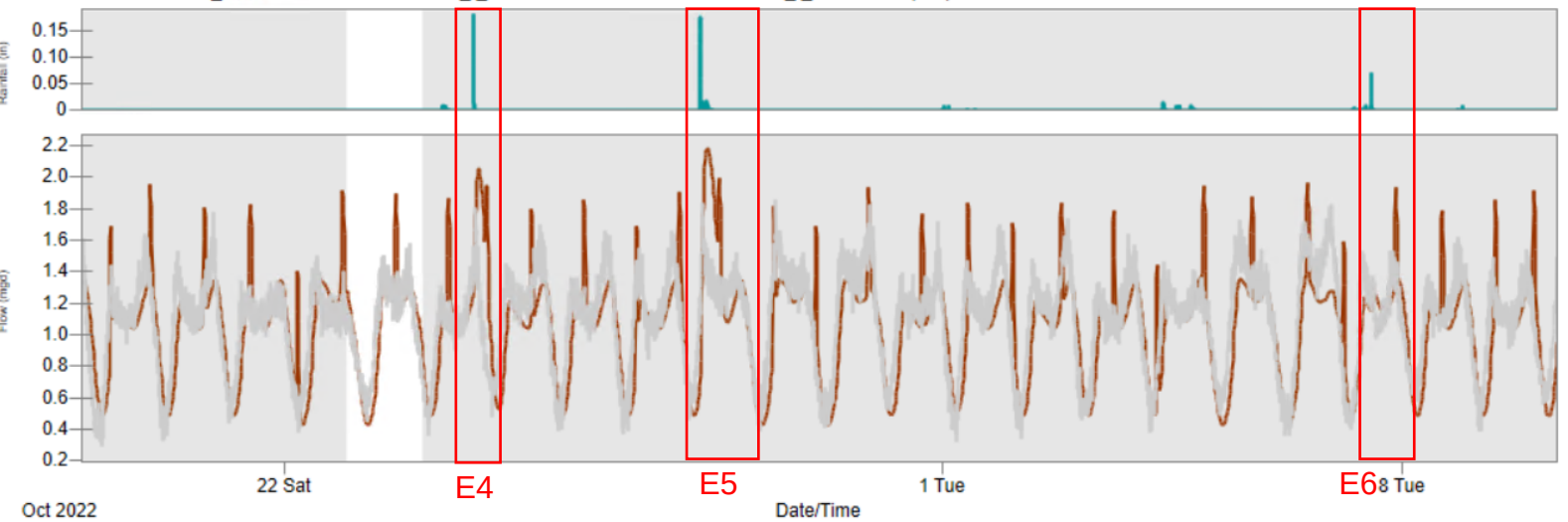


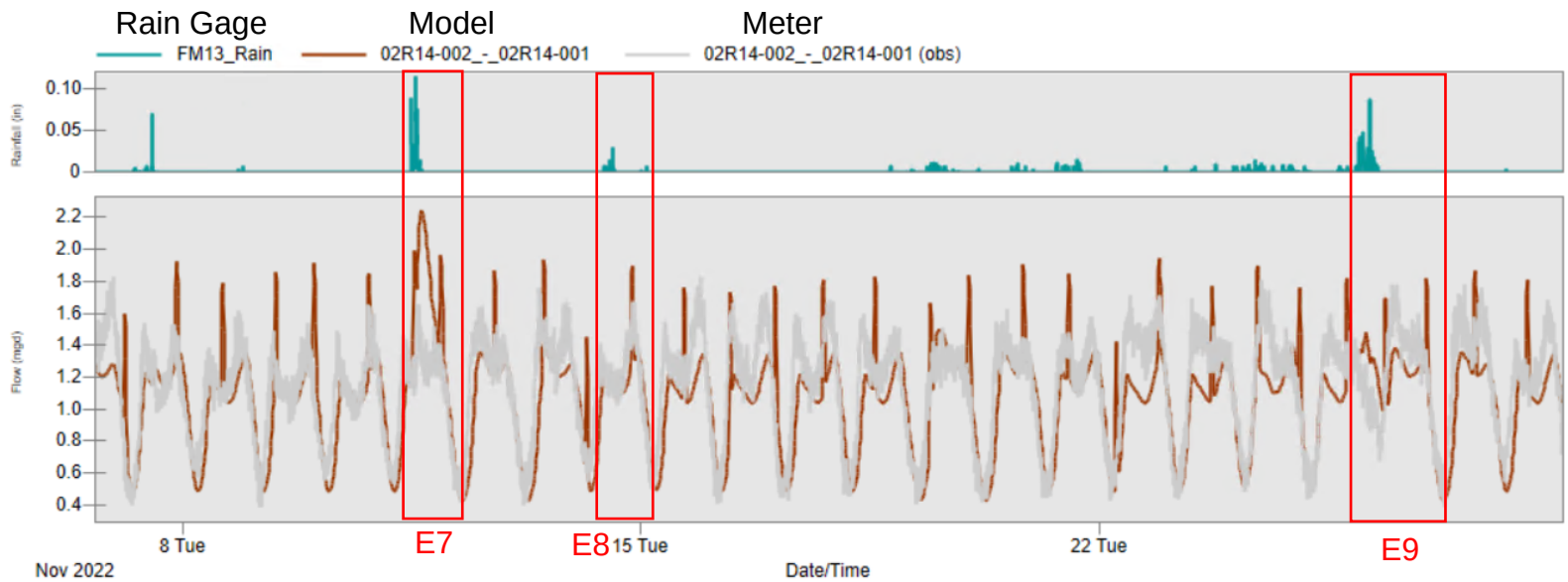
Rain Gage

Model

Meter

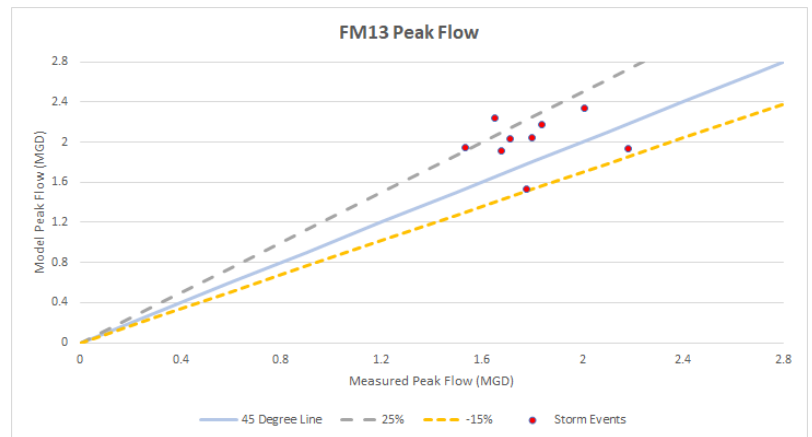
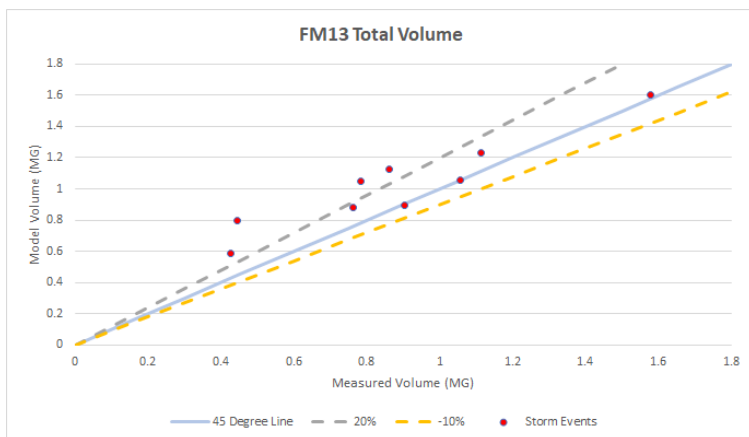
FM13_Rain 02R14-002_-_02R14-001 02R14-002_-_02R14-001 (obs)



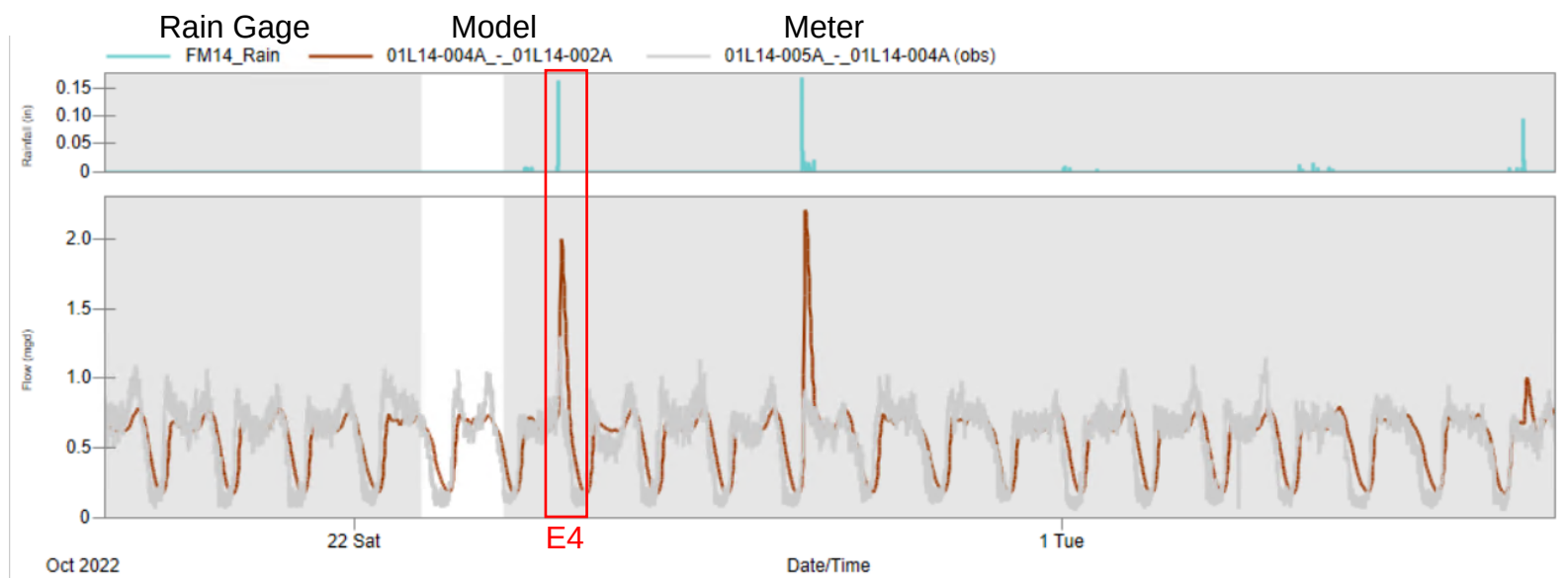
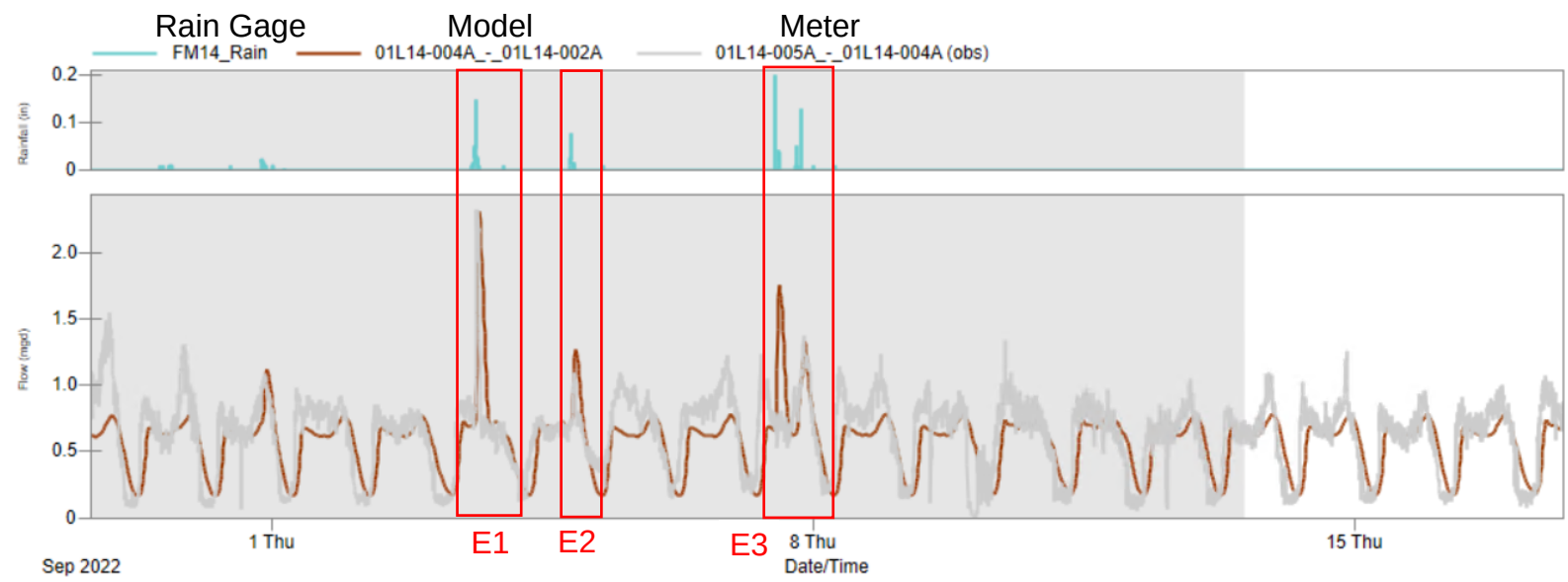
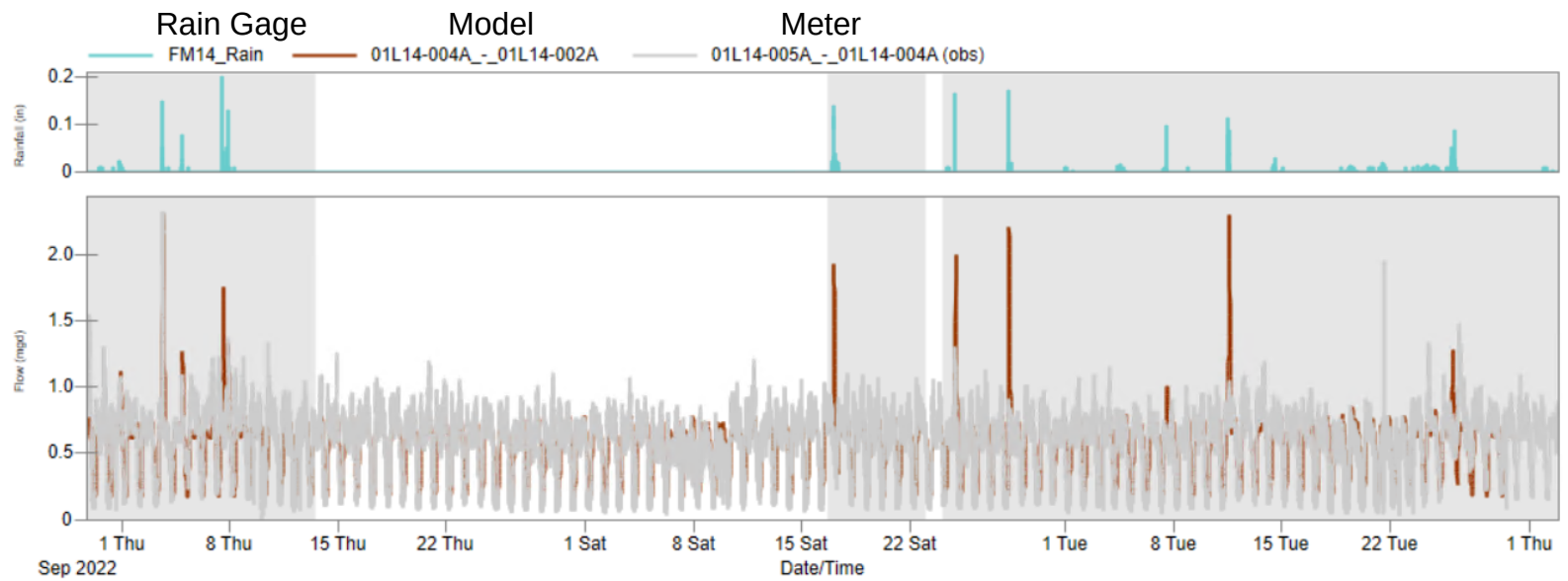


FM13			
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.7951	0.4453	79%
2	0.8826	0.7628	16%
3	1.048	0.7838	34%
4	0.584	0.4258	37%
5	1.231	1.113	11%
6	1.054	1.056	0%
7	1.129	0.8628	31%
8	0.8968	0.9046	-1%
9	1.604	1.58	2%

FM13			
Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	2.34	2.01	16%
2	1.939	2.184	-11%
3	2.037	1.712	19%
4	2.049	1.801	14%
5	2.178	1.837	19%
6	1.949	1.535	27%
7	2.242	1.652	36%
8	1.911	1.676	14%
9	1.532	1.776	-14%



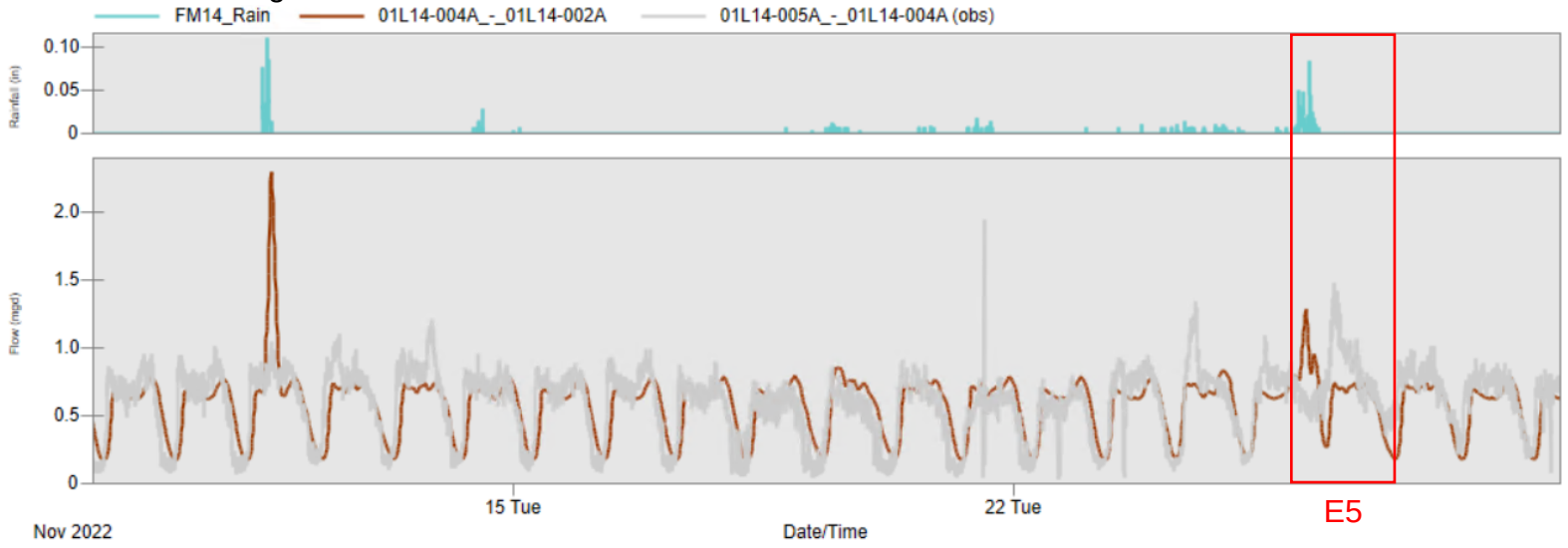
FM14



Rain Gage

Model

Meter

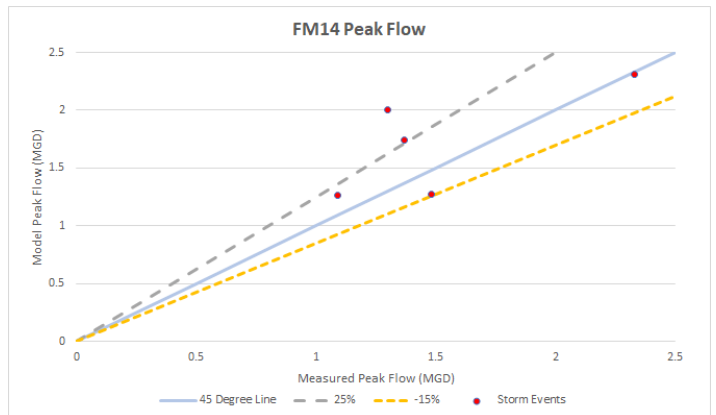
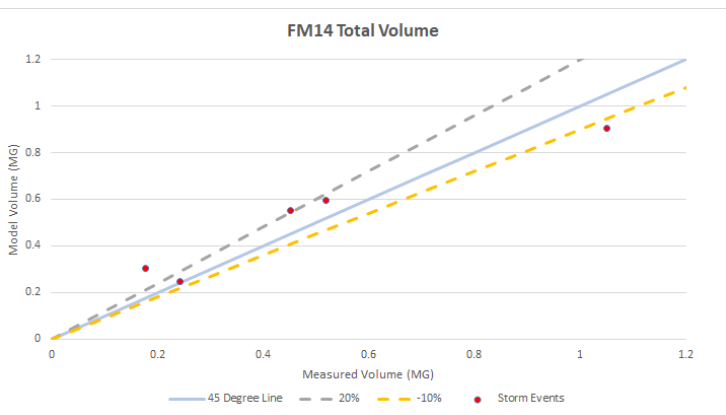


FM14

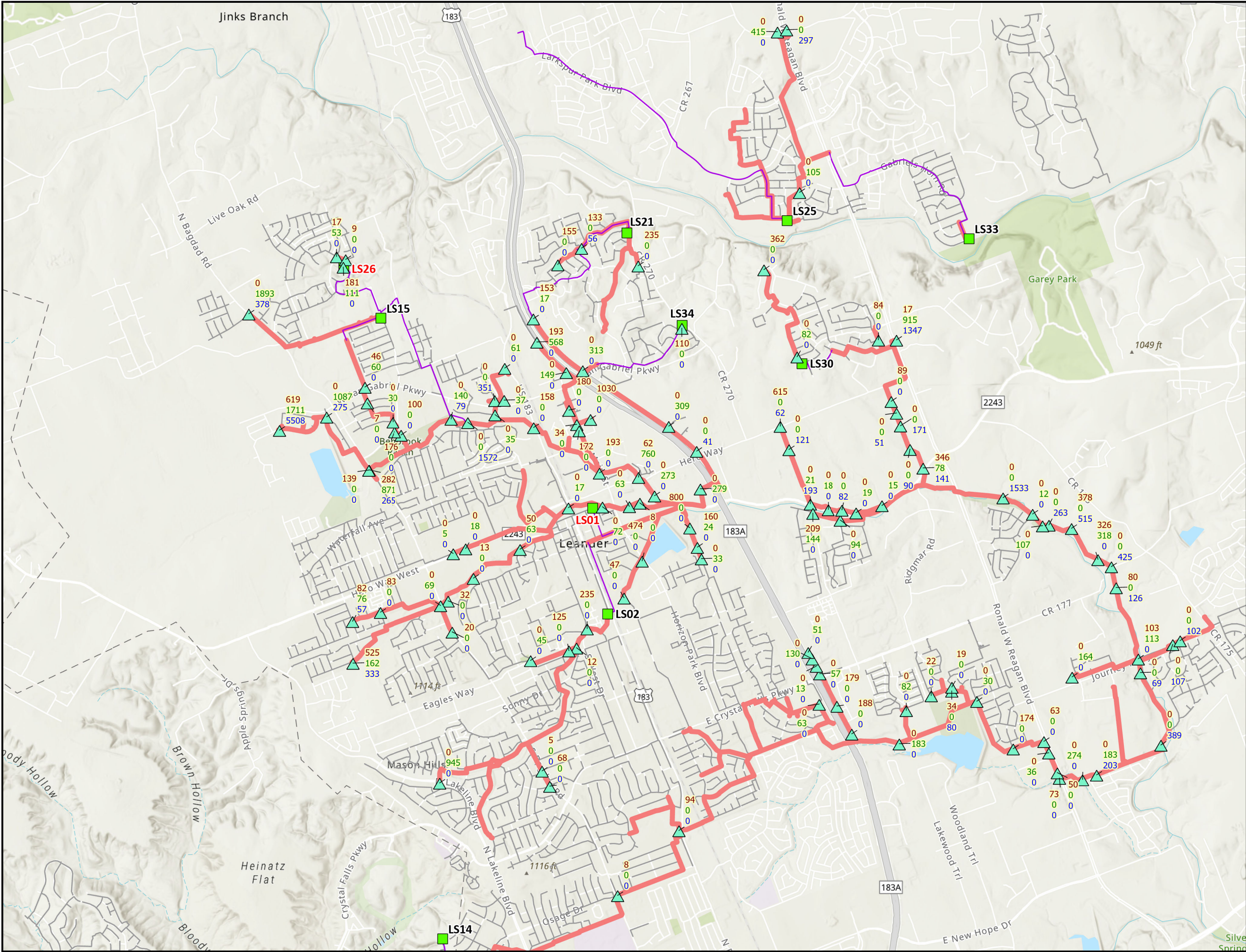
Event	Model Volume (MG)	Meter Volume (MG)	% Difference
1	0.5534	0.4523	22%
2	0.2447	0.2431	1%
3	0.5948	0.5184	15%
4	0.3034	0.1773	71%
5	0.9043	1.051	-14%

FM14

Event	Model Peak Flow (MGD)	Meter Peak Flow (MGD)	% Difference
1	2.31	2.33	-1%
2	1.265	1.09	16%
3	1.747	1.37	28%
4	2.002	1.3	54%
5	1.277	1.48	-14%



Appendix D: Future Growth Exhibits



**City of Leander
Williamson County, TX**

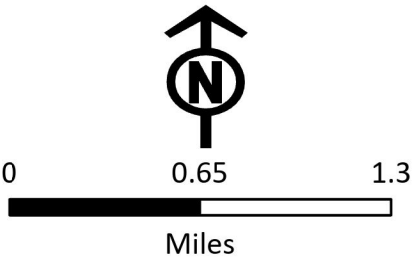
**FUTURE
GROWTH LUE EXHIBIT**



Legend

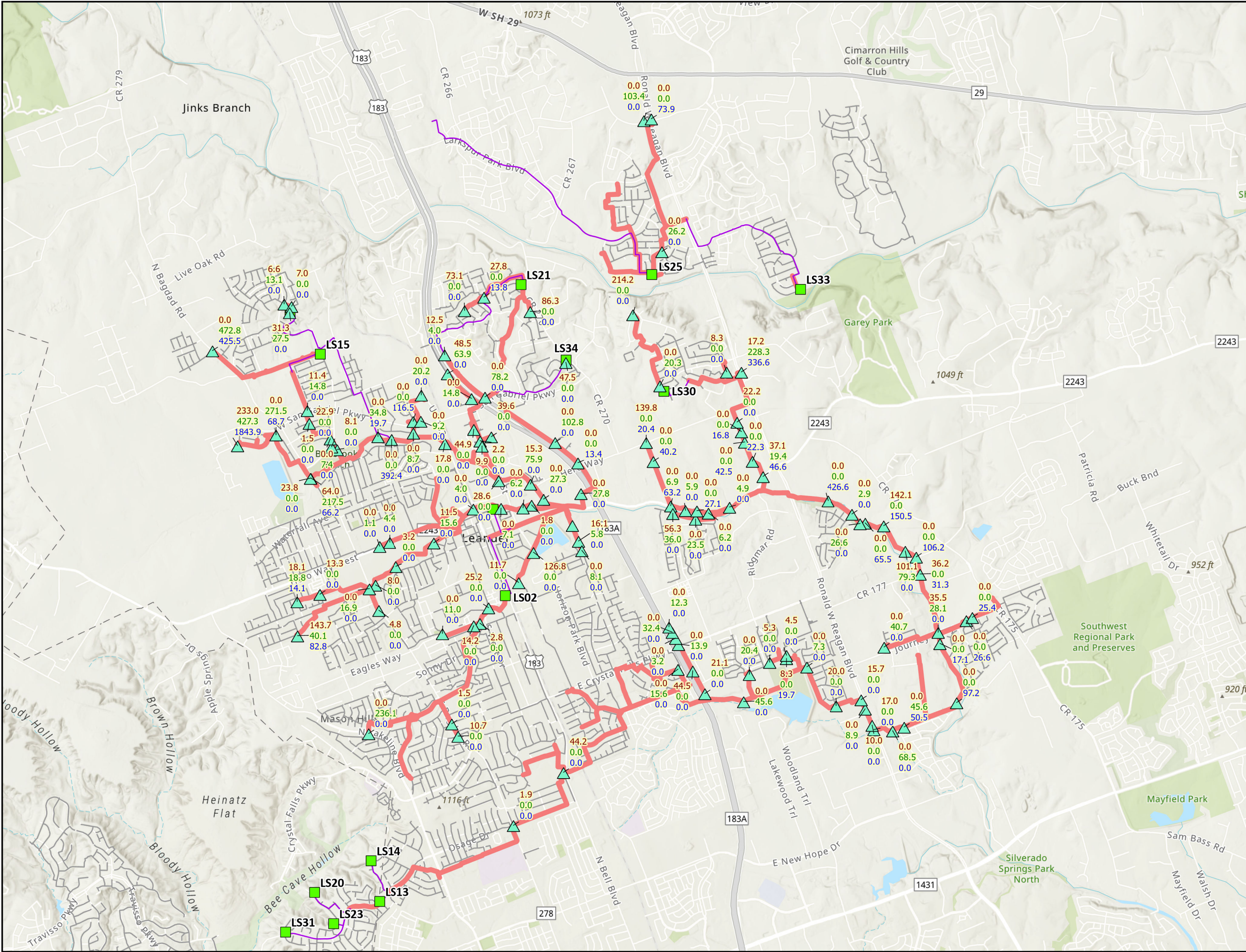
- Modeled Wastewater Line
- Modeled Force Main
- Modeled Lift Station
- Sewer Main
- Future Connections
 - 5-yr LUEs¹
 - 10-yr LUEs¹
 - 20-yr LUEs¹

1 - These values are incremental and represent the increase in Living Unit Equivalents (LUEs) for the 5, 10, and 20-year time horizons



Date: 4/24/2024





**City of Leander
Williamson County, TX**

**FUTURE GROWTH
SEWERSHED AREA EXHIBIT**



Legend

- Modeled Wastewater Line
- Modeled Lift Station
- Modeled Force Main
- Sewer Main
- Future Connections
- 5-yr Sewershed Acreage¹
- 10-yr Sewershed Acreage¹
- 20-yr Sewershed Acreage¹

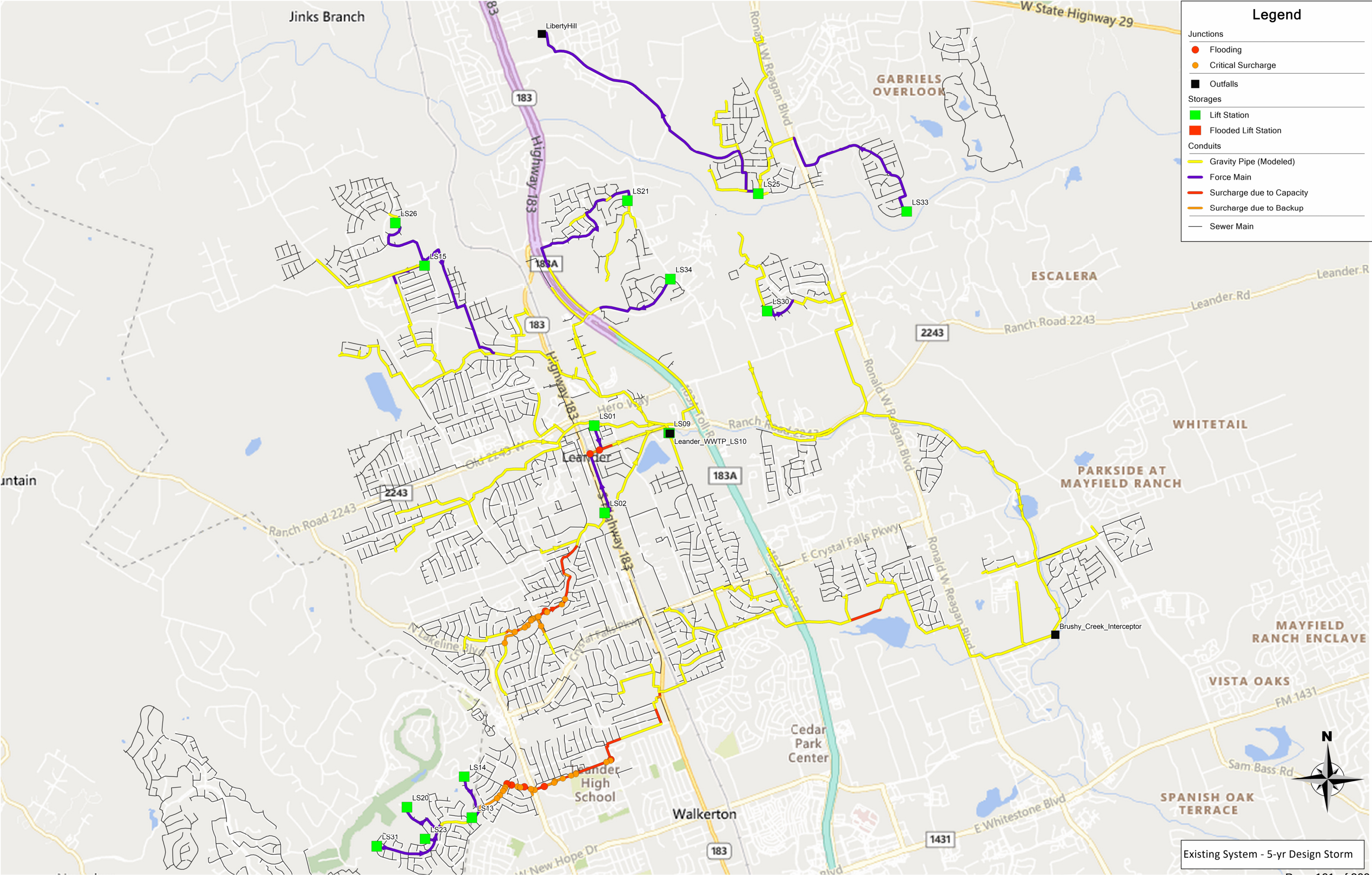
1 - These values are incremental and represent the increase in sewershed area, in acres, for the 5, 10, and 20-year time horizons

Miles

Date: 4/24/2024



Appendix E: Design Storm Modeling Results (PCSWMM)



Legend

Junctions

Flooding

Critical Surge

Outfalls

Storages

Lift Station

Flooded Lift Station

Conduits

Gravity Pipe (Modeled)

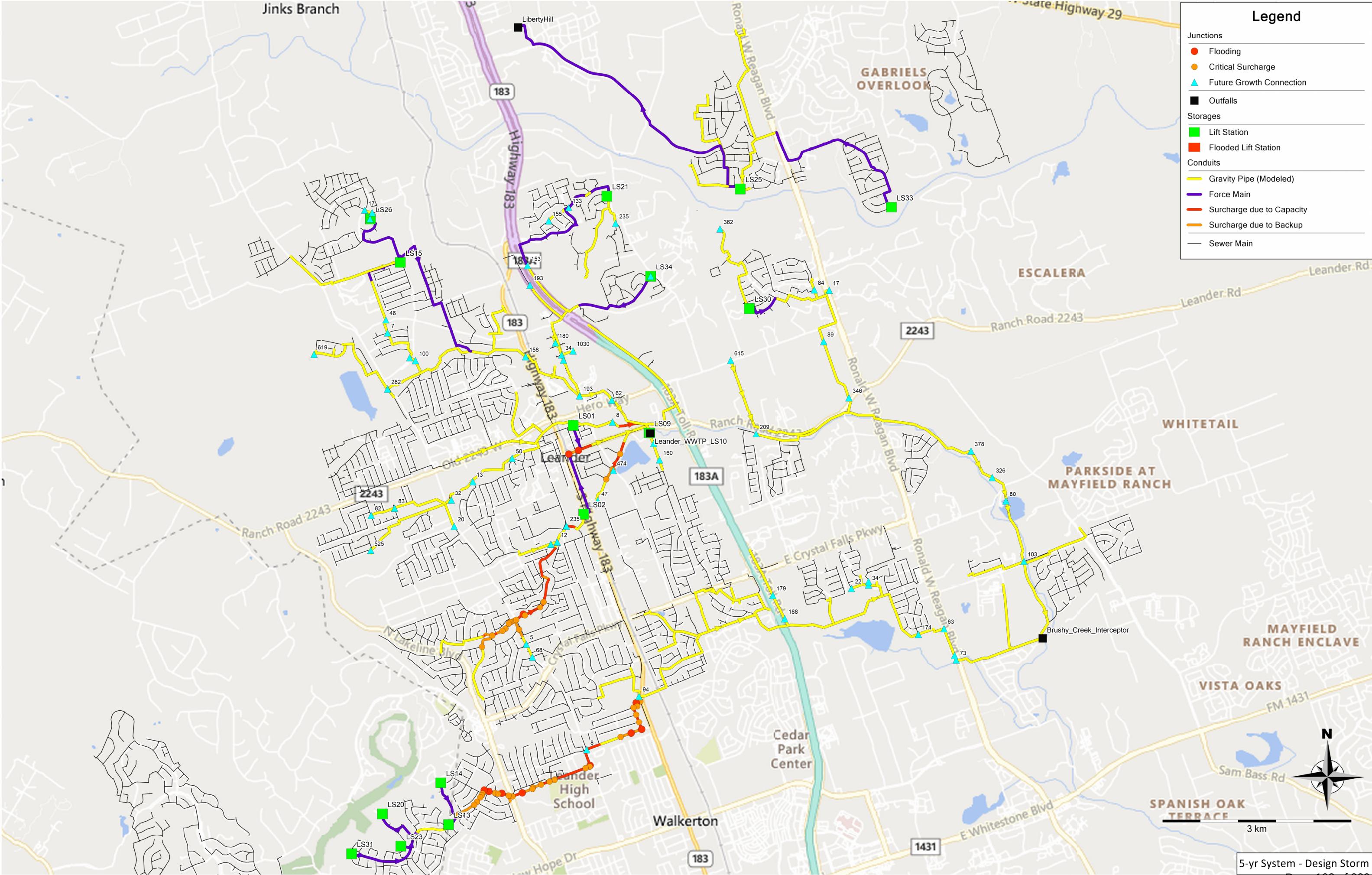
Force Main

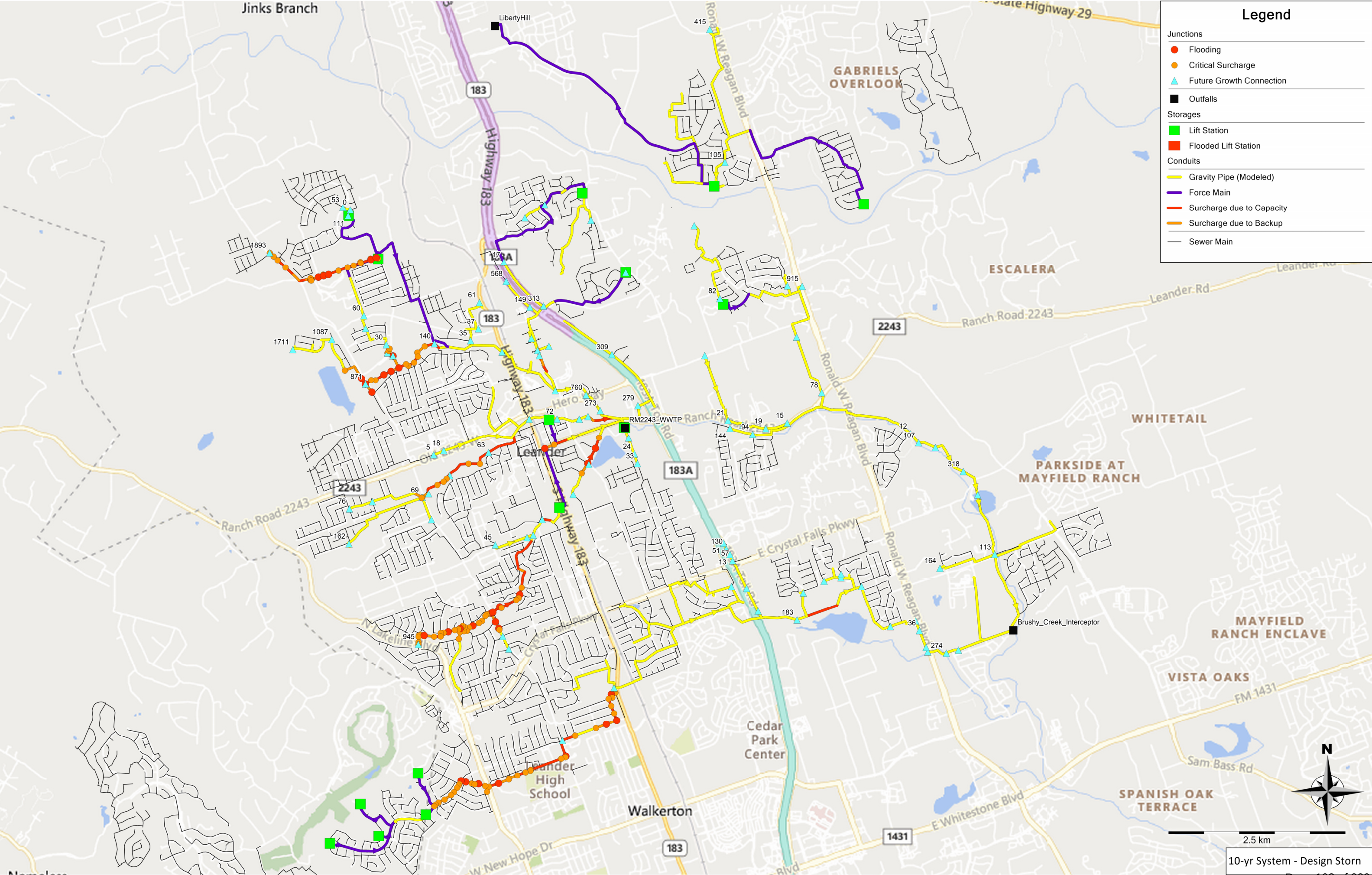
Surcharge due to Capacity

Surcharge due to Backup

Sewer Main

Existing System - 5-yr Design Storm





Legend

Junctions

Flooding

Critical Surge

Future Growth Connection

Outfalls

Storages

Lift Station

Flooded Lift Station

Conduits

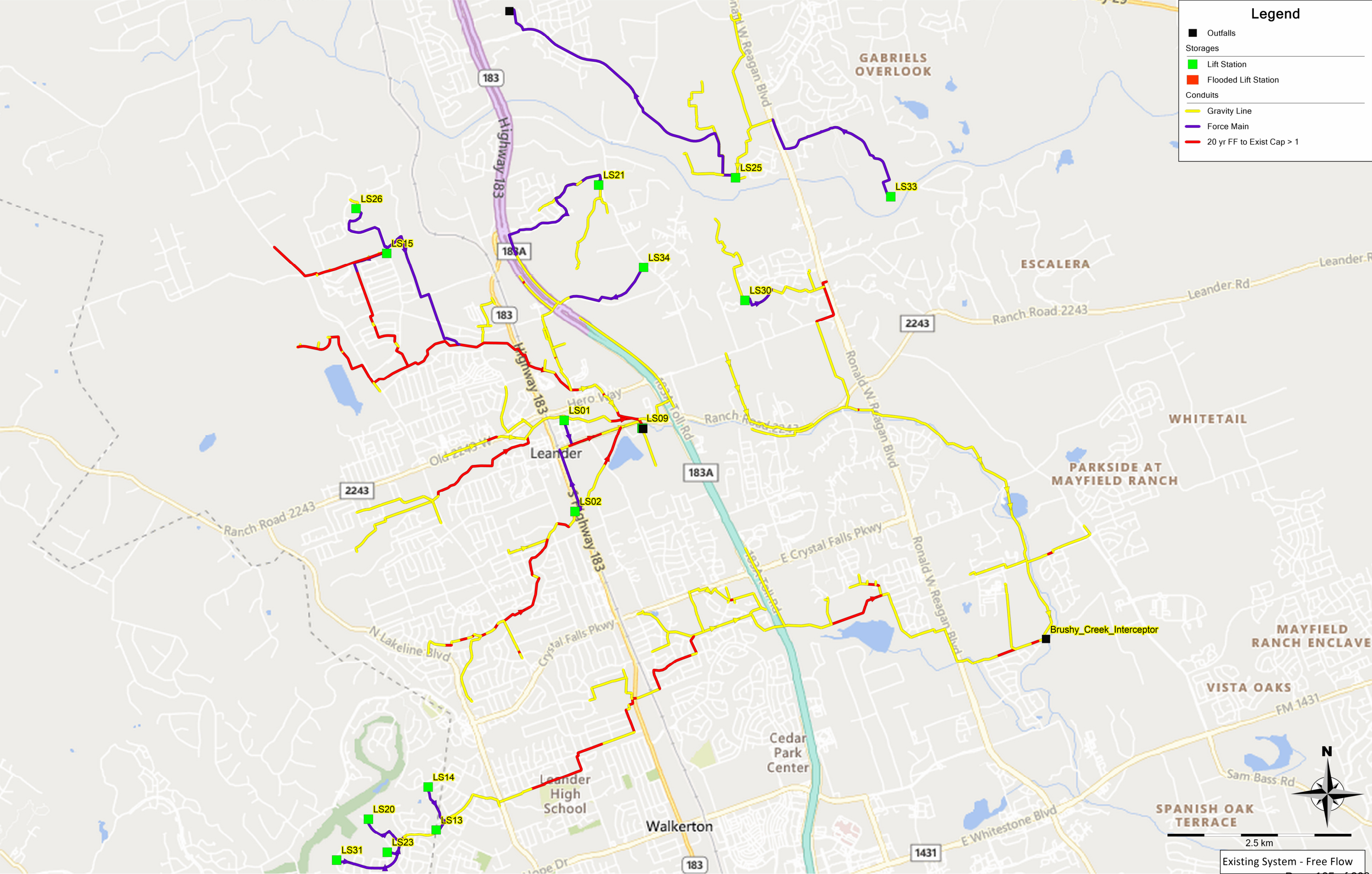
Gravity Pipe (Modeled)

Force Main

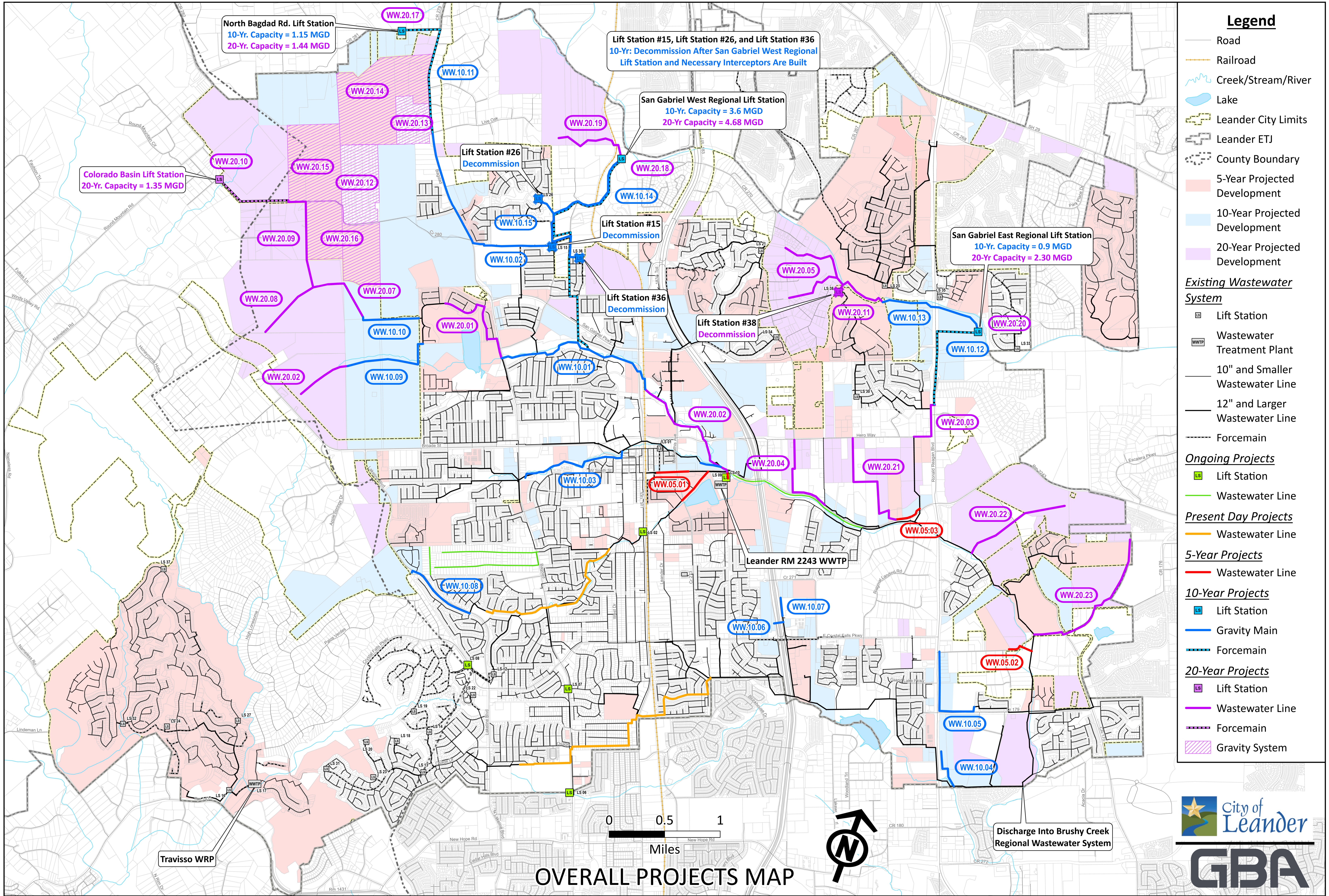
Surcharge due to Capacity

Surcharge due to Backup

Sewer Main



Appendix F: Overall Projects Map (24" x 36")



Appendix G: Overall Project List

Leander, TX
Collection System Master Plan
Table 6-2: Overall Project List

Project ID	Infrastructure Type	Time Horizon	FY24 CIP Project ID	Project Name	Type of Improvement	Pipe Diameter (in) ¹	Total Length of Pipe (ft)	Lift Station Flow Rate (mgd)	Planning-Level Construction OPCC without Contingency	Construction Contingency (30%)	Planning-Level Construction OPCC with Contingency	Engineering & Survey (20%)	ROW Acquisition	Planning-Level Capital Cost (OPCC with Contingency + Engr./Survey + ROW Acq.) ²
WW.00.01	Existing/Relief	Present Day	-	Block House Interceptor	Exist. Gravity Relief/Upsizing	21"-24"	13,020	-	\$ 11,327,000	\$ 3,398,000	\$ 14,725,000	\$ 2,945,000	\$ -	\$ 17,670,000
WW.00.02	Existing/Relief	Present Day	-	Mason Creek Interceptor	Exist. Gravity Relief/Upsizing	15"-24"	8,170	-	\$ 6,597,000	\$ 1,979,000	\$ 8,576,000	\$ 1,715,000	\$ -	\$ 10,291,000
WW.05.01	Existing/Relief	5-Year	-	Horizon Lake Interceptor	Exist. Gravity Relief/Upsizing	18"-36"	3,660	-	\$ 3,617,000	\$ 1,085,000	\$ 4,702,000	\$ 940,000	\$ -	\$ 5,642,000
WW.05.02	New/Extension	5-Year	-	Lonestar Landing WW Improvements	New Gravity to Serve Growth	8"	1,225	-	\$ 620,000	\$ 186,000	\$ 806,000	\$ 161,000	\$ 124,000	\$ 1,091,000
WW.05.03	New/Extension	5-Year	-	RM 2243 to Hero Way WW Improvements - East Segment Ph. 1	New Gravity to Serve Growth	12"	1,350	-	\$ 810,000	\$ 243,000	\$ 1,053,000	\$ 211,000	\$ 136,000	\$ 1,400,000
WW.10.01	Existing/Relief	10-Year	WW.41	Benbrook Interceptor (Under Design)	Exist. Gravity Relief/Upsizing	27"	8,460	-	\$ 9,870,000	\$ 2,961,000	\$ 12,831,000	\$ 2,566,000	\$ -	\$ 15,397,000
WW.10.02	Existing/Relief	10-Year	-	Collaborative Way	Exist. Gravity Relief/Upsizing	18"	5,780	-	\$ 4,379,000	\$ 1,314,000	\$ 5,693,000	\$ 1,139,000	\$ -	\$ 6,832,000
WW.10.03	Existing/Relief	10-Year	WW.25	South Brushy Creek Interceptor	Exist. Gravity Relief/Upsizing	15"-24"	6,400	-	\$ 4,493,000	\$ 1,348,000	\$ 5,841,000	\$ 1,168,000	\$ -	\$ 7,009,000
WW.10.04	New/Extension	10-Year	-	South Ronald Reagan Blvd. WW Improvements	New Gravity to Serve Growth	8"	2,000	-	\$ 1,012,000	\$ 304,000	\$ 1,316,000	\$ 263,000	\$ 202,000	\$ 1,781,000
WW.10.05	New/Extension	10-Year	-	Journey Pkwy and Ronald Reagan Blvd WW Improvements	New Gravity to Serve Growth	8"	4,675	-	\$ 2,366,000	\$ 710,000	\$ 3,076,000	\$ 615,000	\$ 472,000	\$ 4,163,000
WW.10.06	New/Extension	10-Year	-	US 183-A WW Improvements Ph. 1	New Gravity to Serve Growth	8"	450	-	\$ 228,000	\$ 68,000	\$ 296,000	\$ 59,000	\$ 45,000	\$ 400,000
WW.10.07	New/Extension	10-Year	-	US 183-A WW Improvements Ph. 2	New Gravity to Serve Growth	8"	875	-	\$ 443,000	\$ 133,000	\$ 576,000	\$ 115,000	\$ 88,000	\$ 779,000
WW.10.08	New/Extension	10-Year	-	Linda Hall WW Improvements	New Gravity to Serve Growth	12"	3,600	-	\$ 2,160,000	\$ 648,000	\$ 2,808,000	\$ 562,000	\$ 363,000	\$ 3,733,000
WW.10.09	New/Extension	10-Year	-	North Fork Brushy Creek WW Interceptor Improvements Ph. 1	New Gravity to Serve Growth	18"	4,630	-	\$ 3,506,000	\$ 1,052,000	\$ 4,558,000	\$ 912,000	\$ 467,000	\$ 5,937,000
WW.10.10	New/Extension	10-Year	-	North Brushy Creek WW Interceptor Improvements	New Gravity to Serve Growth	18"-21"	2,800	-	\$ 2,250,000	\$ 675,000	\$ 2,925,000	\$ 585,000	\$ 282,000	\$ 3,792,000
WW.10.11	New/Extension	10-Year	-	North Bagdad Rd. Lift Station Ph. 1	New Gravity/LS to Serve Growth	18"(G), 10"(F)	10,600(G/F)	1.15	\$ 6,235,000	\$ 1,871,000	\$ 8,106,000	\$ 1,621,000	\$ 756,000	\$ 10,483,000
WW.10.12	New/Extension	10-Year	-	San Gabriel East Regional Lift Station	New LS to Serve Growth	8" (F)	5,500(F)	0.90	\$ 2,593,000	\$ 778,000	\$ 3,371,000	\$ 674,000	\$ 312,000	\$ 4,357,000
WW.10.13	New/Extension	10-Year	-	San Gabriel River WW Interceptor Improvements Ph. 1	New Gravity to Serve Growth	15"-18"	5,140	-	\$ 3,863,000	\$ 1,159,000	\$ 5,022,000	\$ 1,004,000	\$ 518,000	\$ 6,544,000
WW.10.14	New/Extension	10-Year	-	San Gabriel West Regional Lift Station Ph. 1	New Lift Station	16"(F)	13100	3.60	\$ 8,349,000	\$ 2,505,000	\$ 10,854,000	\$ 2,171,000	\$ 696,000	\$ 13,721,000
WW.10.15	New/Extension	10-Year	-	Lift Station #15, #26, and #36 Decommission	New Gravity to Serve Growth	8"-21"	10,050	-	\$ 8,331,000	\$ 2,499,000	\$ 10,830,000	\$ 2,166,000	\$ 1,014,000	\$ 14,010,000
WW.20.01	Existing/Relief	20-Year	-	Devine Lake	Exist. Gravity Relief/Upsizing	27"	5,240	-	\$ 5,625,000	\$ 1,688,000	\$ 7,313,000	\$ 1,463,000	\$ -	\$ 8,776,000
WW.20.02	Existing/Relief	20-Year	WW.37/.38	North Brushy Creek Interceptor	Exist. Gravity Relief/Upsizing	33"-36"	6,150	-	\$ 8,265,000	\$ 2,480,000	\$ 10,745,000	\$ 2,149,000	\$ -	\$ 12,894,000
WW.20.03	Existing/Relief	20-Year	-	North Ronald Reagan	Exist. Gravity Relief/Upsizing	12"-15"	2,500	-	\$ 1,640,000	\$ 492,000	\$ 2,132,000	\$ 426,000	\$ -	\$ 2,558,000
WW.20.04	New/Extension	20-Year	-	RM 2243 to Hero Way WW Improvements - West Segment	New Gravity to Serve Growth	8"-12"	4,340	-	\$ 2,356,000	\$ 707,000	\$ 3,063,000	\$ 613,000	\$ 437,000	\$ 4,113,000
WW.20.05	New/Extension	20-Year	-	San Gabriel River WW Interceptor Improvements Ph. 2	New Gravity to Serve Growth	8"-15"	9,050	-	\$ 5,402,000	\$ 1,621,000	\$ 7,023,000	\$ 1,405,000	\$ 913,000	\$ 9,341,000
WW.20.06	New/Extension	20-Year	-	North Fork Brushy Creek WW Interceptor Improvements Ph. 2	New Gravity to Serve Growth	12"-15"	2,650	-	\$ 1,708,000	\$ 512,000	\$ 2,220,000	\$ 444,000	\$ 268,000	\$ 2,932,000
WW.20.07	New/Extension	20-Year	-	San Gabriel Pkwy. WW Interceptor Ph. 1	New Gravity to Serve Growth	18"	3,350	-	\$ 2,540,000	\$ 762,000	\$ 3,302,000	\$ 660,000	\$ 338,000	\$ 4,300,000
WW.20.08	New/Extension	20-Year	-	San Gabriel Pkwy. WW Interceptor Ph. 2	New Gravity to Serve Growth	12"	3,150	-	\$ 1,890,000	\$ 567,000	\$ 2,457,000	\$ 491,000	\$ 318,000	\$ 3,266,000
WW.20.09	New/Extension	20-Year	-	Lakeline Blvd. WW Improvements	New Gravity to Serve Growth	15"	5,030	-	\$ 3,311,000	\$ 993,000	\$ 4,304,000	\$ 861,000	\$ 507,000	\$ 5,672,000
WW.20.10	New/Extension	20-Year	-	Colorado Basin Lift Station	New LS to Serve Growth	10"(F)	3,750	1.35	\$ 2,782,000	\$ 835,000	\$ 3,617,000	\$ 723,000	\$ 224,000	\$ 4,564,000
WW.20.11	New/Extension	20-Year	-	Lift Station #38 Decommission	New Gravity to Serve Growth	12"	400	-	\$ 540,000	\$ 162,000	\$ 702,000	\$ 140,000	\$ 40,000	\$ 882,000
WW.20.12	New/Extension	20-Year	-	Greatwood WW Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 8,010,000	\$ 2,403,000	\$ 10,413,000	\$ 2,083,000	\$ -	\$ 12,496,000
WW.20.13	New/Extension	20-Year	-	Whitt Ranch Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 2,310,000	\$ 693,000	\$ 3,003,000	\$ 601,000	\$ -	\$ 3,604,000
WW.20.14	New/Extension	20-Year	-	Sullivan Tract Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 9,270,000	\$ 2,781,000	\$ 12,051,000	\$ 2,410,000	\$ -	\$ 14,461,000
WW.20.15	New/Extension	20-Year	-	Leander Estates Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 6,300,000	\$ 1,890,000	\$ 8,190,000	\$ 1,638,000	\$ -	\$ 9,828,000
WW.20.16	New/Extension	20-Year	-	Hilltop Ranch Collection System Improvements	New Gravity to Serve OSSF	-	-	-	\$ 3,150,000	\$ 945,000	\$ 4,095,000	\$ 819,000	\$ -	\$ 4,914,000
WW.20.17	New/Extension	20-Year	-	North Bagdad Rd. Lift Station Ph. 2	New Pumps for Existing LS	-	-	1.44	\$ 245,000	\$ 74,000	\$ 319,000	\$ 64,000	\$ 35,200	\$ 418,000
WW.20.18	New/Extension	20-Year	-	San Gabriel West Regional Lift Station Ph. 2	Proposed LS Expansion	-	-	4.68	\$ 586,000	\$ 176,000	\$ 762,000	\$ 152,000	\$ 35,000	\$ 949,000
WW.20.19	New/Extension	20-Year	-	San Gabriel West WW Improvements	New Gravity to Serve Growth	8"-18"	3,860	-	\$ 2,215,000	\$ 665,000	\$ 2,880,000	\$ 576,000	\$ 389,000	\$ 3,845,000
WW.20.20	New/Extension	20-Year	-	San Gabriel East Regional Lift Station Ph. 2	Proposed LS Expansion	10" (F)	5,500	2.30	\$ 2,539,000	\$ 762,000	\$ 3,301,000	\$ 660,000	\$ 312,000	\$ 4,273,000
WW.20.21	New/Extension	20-Year	-	RM 2243 to Hero Way WW Improvements - East Segment Ph. 2	New Gravity to Serve Growth	8"	5,925	-	\$ 2,998,000	\$ 899,000	\$ 3,897,000	\$ 779,000	\$ 598,000	\$ 5,274,000
WW.20.22	New/Extension	20-Year	-	CR 175 and RM 2243 WW Improvements	New Gravity to Serve Growth	8"-12"	5,160	-	\$ 2,637,000	\$ 791,000	\$ 3,428,000	\$ 686,000	\$ 520,000	\$ 4,634,000
WW.20.23	New/Extension	20-Year	-	CR 175 and CR 176 WW Improvements	New Gravity to Serve Growth	8"-12"	7,500	-	\$ 4,402,000	\$ 1,321,000	\$ 5,723,000	\$ 1,145,000	\$ 757,000	\$ 7,625,000

Notes:

1) For pipe diameters and lengths, gravity main is assumed, except where (F) indicates force main, and (G) indicates gravity main.

2) For new/extension projects not within the ROW or an existing easement, a unit cost of \$87,900/acre was utilized for easement cost estimates.

The easement unit cost includes survey, easement acquisiton, engineering fees, condemnation/attorney fees, and ROW agent fees.

3) It is recommended that further on-site evaluation and data collection (e.g., checking manholes for evidence of surcharge, targeted flow monitoring) be conducted before initiating any project based on modeling results.

Subtotal, Existing/Relief Projects	\$ 87,069,000
Subtotal, New/Extension Projects ²	\$ 179,582,000
Total, All Projects	\$ 266,651,000

Time Horizon	Capital Cost
Present Day	\$ 27,961,000
5-Year	\$ 8,133,000
10-Year	\$ 98,938,000
20-Year	\$ 131,619,000
Total, All Projects	\$ 266,651,000

Appendix H: Further Recommendations and Lessons Learned



Frank T. Phelan
8/23/2024

Appendix H: Recommendations and Lessons Learned

Introduction and Background:

Computer capacity models provide the means to evaluate your sanitary sewer system in many ways, such as determining system strengths and weaknesses as they relate to system operation, analyzing development inquiries, and future growth master planning. Computer capacity models are generally used for sanitary sewer CIP development to identify strategies including sizing and scheduling of improvements.

This document is to provide recommendations to maintain and utilize the sanitary sewer model developed for the City of Leander's Sanitary Sewer Master Plan. The model was developed utilizing the PCSWMM software. The city Geographical Information Systems (GIS), project records and field data were collected and utilized to input physical attribute data into the model. Because of the complexity of the model and the investment made by the city, this document was created to identify a practical approach to maintain a dynamic hydraulic model of the city's wastewater collection system. The work tasks developed are comprehensive and are recommended knowing that the city may not have the resources in house at least initially to complete. Also, some of the recommendations may differ from the city's current practice for GIS maintenance and record keeping. The model will need to be consistently maintained, however, to gain its full value and needed accuracy.

The model requires consistency in its structure including how network additions and changes are added to the model. Initial development of the model included all gravity sewers 12-inch and larger (with some selected 8-inch lines as well,) pump stations and force mains. Extensive fieldwork was conducted to collect the piping and manhole information on the same elevation datum. Checks, using GIS filters, cross-checks and early model runs were used to identify data gaps and input errors. Drainage areas (basins) were added to manholes to distribute flows into the model. Model calibrations were conducted using recorded rainfall and flow data at various locations (previous flow monitoring sites) throughout the City's system. Future growth planning documents and discussions with City planners was conducted to model future growth for the five, ten, and twenty-year time horizons, up to 2042.

As scoped for the modeling effort, GBA created a GIS layer separate from the city GIS prior to creating the network for the sewer model. The GIS layer was created to provide the data in the optimal format for the model. Also, a copy of this layer was created so that the city GIS would be protected from potential data corruption. This GIS layer included most of the model set-up information needed for the project and provided a basis to create the master plan report exhibits. The GIS layer was primarily built from City GIS data, data added from record drawings and data collected from the field. The GIS layer was used for checks previously discussed. The field survey provided information for approximately 1,000 manholes and 325,000 LF of pipe. City records and interpolation was used to fill in data gaps. Fourteen

of the city's thirty active lift stations were included in the model. Pump station data was provided by the city. The provenance of the attributes (manholes, pipe segments, force mains, pump stations) was recorded in the GIS layer records.

Various model horizons were developed for the project to assist with the Master Plan. These model horizons are listed below and are recommended to be updated concurrently when recalibrations are conducted:

- Current
- 2027 – 5 Year Horizon
- 2032 – 10 Year Horizon
- 2042 – 20 Year Horizon

There are numerous ways to approach maintenance of a sewer model and the activities detailed in this memo are recommended to begin this effort. First, it is recommended that the city maintain information in their GIS as specified below on a consistent annual basis. Also, a complete re-calibration of the model should be conducted at least every 5 years, or at the time of a master plan update. The re-calibration should utilize the best monitoring sessions in the city's repository of ongoing flow monitoring data. Five distinct tasks should be conducted for the modeling, listed and further described below:

1. Sanitary Sewer GIS Network Maintenance - Annual
2. Flow Monitoring Repository - Annual
3. Future Growth Planning – Annual
4. Model Updates - Annual
5. Models Calibration – 5 Year Cycle

1. Sanitary Sewer GIS Network Maintenance - Annually

GIS network maintenance plays a significant role in the maintenance of the hydraulic model. Specific data gaps when filled via field work/investigations need to be consistently and regularly updated in the GIS. There are specific GIS attribute fields that were captured during field investigations and surveys by GBA that are critical to the model input. The attributes shown below will need to be maintained and updated in the city GIS, to ensure efficient and accurate updates to the model. Specific additions and modifications to the GIS database schema are detailed below. Highlighted in yellow are those attributes that the city had historically not captured prior to the sewer modeling project.

Manhole Attributes:	Pipe Attributes:	Lift Station Attributes:
MH ID	Pipe ID	Lift Station ID
MH Rim Elevation	US Manhole ID	Wet Well Area
MH Invert Elevation	DS Manhole ID	Rim Elevation
	Pipe Size	Invert Elevation
	Pipe Material	Pump “On” Depth
	Pipe Length	Pump “Off” Depth
	US Invert Elevation	Pump Curve
	DS Invert Elevation	Record Drawings

Detailed recommendations for maintaining GIS data to ensure efficient integration into the model are outlined below:

- Establish or adopt a GIS database schema that includes all the attributes shown above that are necessary to the upkeep of the hydraulic model;
- Perform a gap analysis to identify areas, features, and attributes missing from the current database as well as those that should be included for modeling activities to consolidate all wastewater data into a single geodatabase;
- Implement the wastewater infrastructure ID system GBA developed from the 2022 Flow Monitoring Study to align with the infrastructure data in the model and to assist Public Works with task efforts;
- Provide developers and consultants with a blank file geodatabase containing the wastewater asset schema and require them to populate the file with all necessary “as-built” data and submit it for review before project closeout;
- Develop a process for integrating/appending newly provided “as-built” GIS data provided by developers/consultants into the city’s master GIS database.

2. Flow Monitoring Data Repository

Flow monitoring is needed to evaluate the adequacy of a system to provide safe services. The following issues can be evaluated by flow monitoring:

- **Does the system have backup issues?** If the line is backing up during storm events, then most likely there is a downstream capacity problem within the system.
- **Does the system have excessive I/I?** Flow monitoring also establishes the leakiness of the system and when strategically located it can isolate I/I issues.
- **Utilize in modeling to calibrate existing system.** Actual base flows and storm events can be used to set and verify model flows at the monitoring sites.
- **Utilize in modeling to project peak design flows.** Once the model is calibrated to flow data it can project peak design flows and simulate system responses.

- **Utilize in modeling to verify locations that have capacity issues.** The model results can be compared to monitoring site flow levels to verify if there is a problem. For example, if the flow monitoring data shows there has been surcharge, the model can be reviewed to verify if it also identifies this problem.

The *Flow Monitoring Data Repository* can be linked to GIS. It is recommended that both the data and the report be kept in the repository to help with evaluations of the data for modeling needs. (i.e., If the meters were in during a dry year, then the meter data for that session should not be used for wet weather calibration). The flow data will also be used to recalibrate the model as recommended on a 5-year basis. An example of a *Flow Monitoring Data Repository* in GIS is shown in Figure 1. It should be noted that flow data can be utilized for many aspects of sanitary sewer surveillance besides modeling and is recommended to be conducted as an independent program.

3. Future Growth Planning - Annual

Documents pertaining to future growth should be compared to the documents utilized in the Master Plan report on an annual basis. Also, as development occurs and sewers are built, the master plan should be annotated accordingly. New planning documents and an updated Master Plan sewer map should be properly stored in a *Future Growth Repository* to be utilized for updating the models and performing model recalibration.

New Development Impacts. The model can be used to evaluate new development impacts. It is recommended that new development impact analyses are conducted when the new development has differed from the city's current plan. Aspects of development to consider are:

- Is the development within the drainage basin? If so, have the flows from the development already been accounted for (i.e., large industries or multi-family projects can add significant daily volumes versus subdivision flows)?
- If not in the watershed, will the sewage be pumped into a basin and does the system have sufficient capacity?
- How will flows be assigned to the new development?
- What is the timing of the development relative to other planned developments and system demands/improvements?

Once the evaluation process has been established, the model is available to determine the impact on the downstream system. A method for modeling new developments should also be established that adheres to city development requirements. The model can predict the available capacity in the sewer segments downstream of the development to evaluate the need for any improvements. There are multiple models on 5- and 10-year time increments to show line capacity projections for the future. The peak flow from the new development can then be added in to determine how much available capacity will be used under

existing and future scenarios. The city can then make decisions about potential upgrades and/or developer cost shares to implement.

4. Model Updates – Annual Checks

The models should be updated annually only when major changes have occurred, and the model is needed for specific development evaluations. Potential updates should be listed and checked to see if model updates are prudent. Detailed scenarios where model updates are necessary and how to perform the updates are outlined below:

- New developments:
 - Assign sewershed area and number of LUEs, or estimated wastewater generation quantities, and flow patterns to the nearest downstream receiving manhole
- New infrastructure:
 - For new gravity lines greater than or equal to 12 inches in diameter, import updated GIS data as shapefiles into the PCSWMM model and ensure connectivity
 - For new lift stations, import updated GIS data into the PCSWMM model including wet well and force main details; manually add pump information (pump curve, start-up, and shut-off depths) to the model
- Changes to existing gravity lines:
 - Update the pipe size, pipe material, and manhole rim and invert elevations
- Changes to existing lift stations:
 - Update wet well area, wet well depth, pump curve, start-up and shut-off depths, force main size, force main material, and force main alignment as applicable

5. Model Calibration

There are two types of calibration situations that are recommended. One is for partial re-calibration and the other is total re-calibration of the model. Partial re-calibrations would be based on significant growth in an isolated area of the system. It is recommended that the system be monitored annually to measure increases in base flow to identify where model changes are needed in the short term. The flow monitoring plan shown in Figure 2 should be used for base flow checks of each basin and re-calibration should be considered for basins that exceed a 20 percent increase in base flow.

Total re-calibration should be conducted on a set schedule and is usually not conducted every year. For the City of Leander, it is recommended that re-calibration of the entire modeled collection system be conducted on a 5-year cycle because of the anticipated fast development of the city's sewer. The model recalibration will utilize the *Flow Data Repository*. The recommended re-calibration method is provided below:

- Partial Re-calibration:
 - When flow meter data varies +/- 20% from 2022 Flow Monitoring Data used for original calibration (See Figure 2)
 - Compare flow metering data for dry weather flow to the modeled average dry weather flow at that location
 - Collect at least 3 months of representative flow metering data capturing both dry and wet weather conditions with flow meters and rain gages appropriately placed
 - Update average daily dry-weather flows (ADDFs) and time patterns for dry weather calibration
 - Recalibrate unit hydrographs for wet weather events
 - Changes to land use
 - If land within a flow meter basin undergoes significant changes impacting wastewater generation, meter flows and recalibrate that specific basin
 - Observed deficiencies (backups, surcharging, etc...)
 - If deficiencies are observed in the field but not predicted in the model, flow meter and recalibrate that specific area
- Total Re-Calibration:
 - On a cycle appropriate for the overall city growth (5 year for Leander).
 - Objective: Update the City Master Plan and re-calibrate the model
 - Add changes to model network – Manholes, pipes, lift stations, etc.
 - Use city GIS that has been updated annually
 - Create new GIS model layer and compare to previous model layer
 - Select most recent year of flow data (use *Flow Data Repository*)
 - Distribute average dry weather flows throughout the system
 - Update time patterns for dry weather conditions
 - Re-calibrate R, T, K hydrographs to selected storms
 - Update future growth models
 - Review plans from *Future Growth Repository*.
 - Analyze model results and establish plan

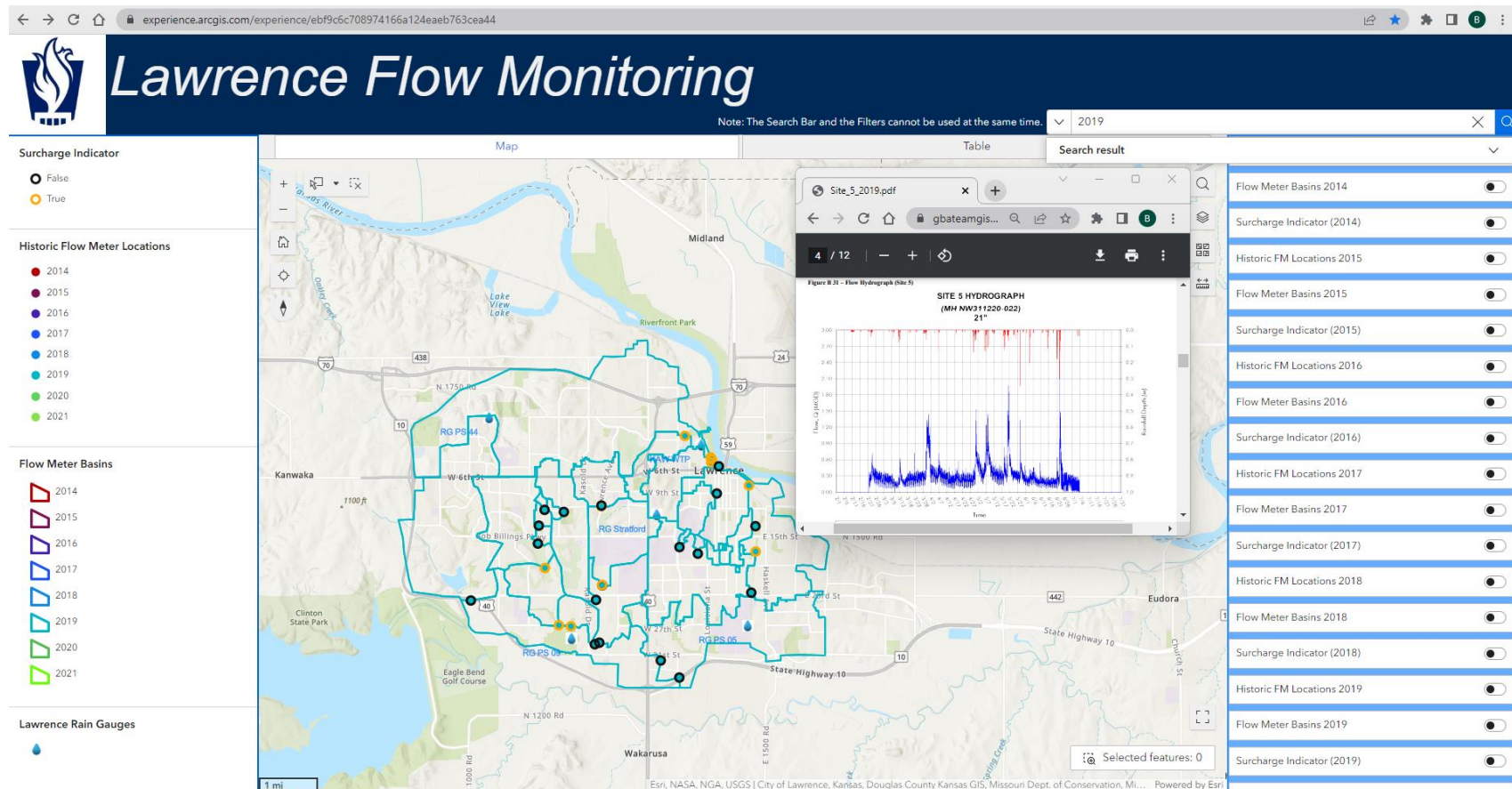


Figure 1: Flow Monitoring Repository Example

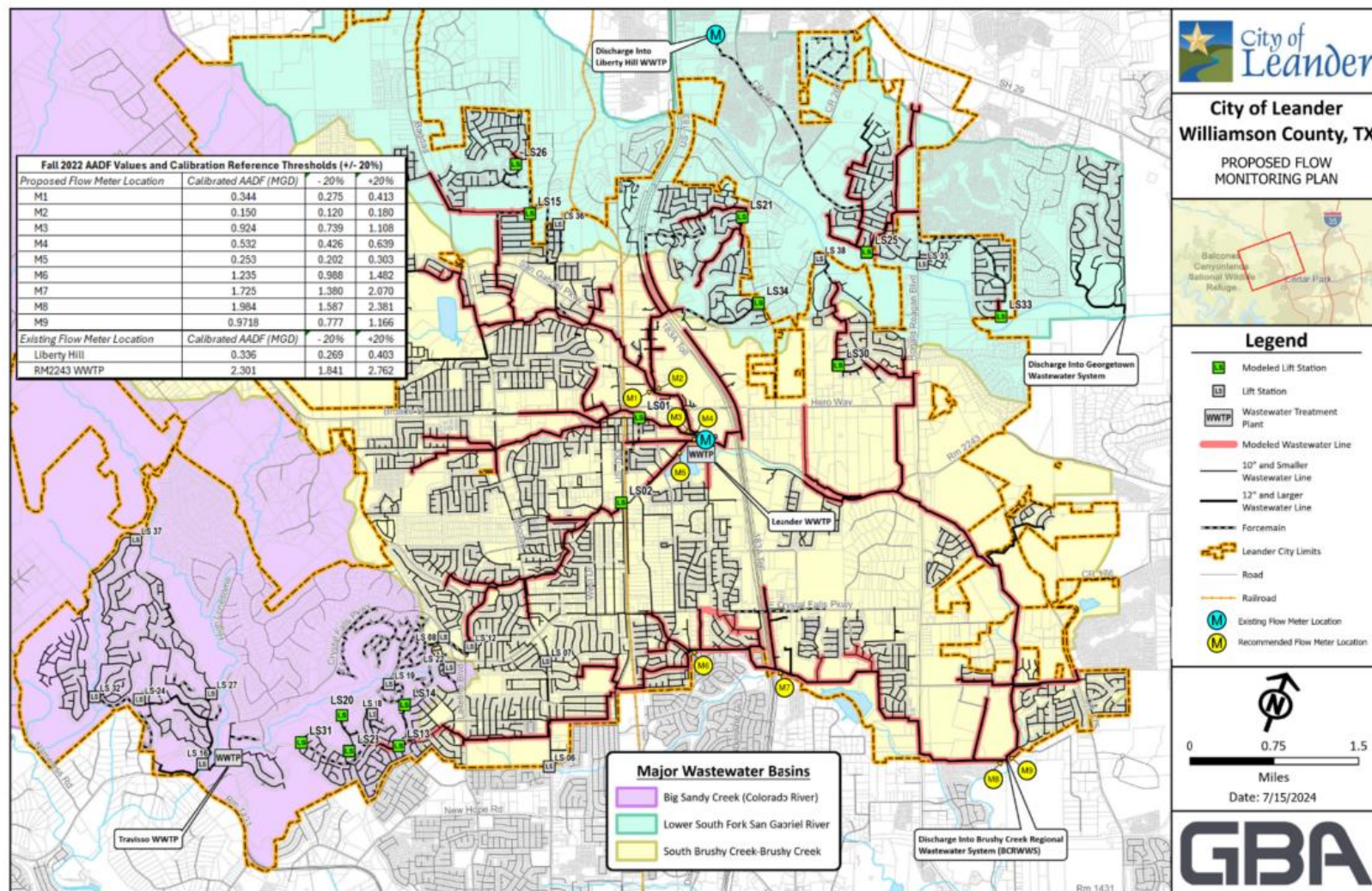


Figure 2: Recommended Flow Monitoring Plan with Calibration Thresholds

Lessons Learned:

In the development of the wastewater master plan, several key lessons were identified through the modeling and data collection processes. Lessons learned are provided to enhance the next efforts for preparing and conducting modeling for the City of Leander's sanitary sewer system.

Ideal Pumps Assumptions

- A few pump curves were unavailable during hydraulic modeling efforts and were modeled as "ideal" pumps, where the flow leaving the lift station is set equal to the flow entering the lift station
- Ideal pump assumptions may not accurately reflect the performance of these lift stations
- Lift station capacities should be obtained and confirmed prior to hydraulic modeling, either by drawdown testing or other means

Manhole Depth Approximations

- Some manholes were inaccessible during survey efforts, therefore those manhole depths were approximated in the hydraulic model.
- Approximated depth assumptions may introduce inaccuracies in the model which can affect capacity assessments
- Future surveys should incorporate contingency plans for accessing difficult manholes, including specialized equipment and/or coordination with city staff to ensure all manholes are accessible.
- GIS database schema modifications should be considered to document data attribute sources (i.e.: As-built records, construction drawing records, surveyed/field measured, assumed/interpolated, etc.) so that accuracy of different sewer data can be assessed.

GIS Data Evaluation

- Considerable pre-processing of GIS data for utilization in computer modeling in PCSWMM needed to be carried out. It would be important to include scope for such projects in the future.
- Future data submissions should undergo validation and quality control.