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Natural Gas System

Baseline Model Report

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BACKGROUND

The City of Castroville operates a natural gas distribution system which has not previously been modeled. In addition, the City of Castroville's natural gas system has been operated by CPS Energy since August 2008. The legacy contractual agreement between CPS Energy and the City did not adequately reimburse CPS Energy for their costs due to increased operations necessary to maintain regulatory compliance; therefore, the City has taken over the operation responsibility. As a result, the City is interested in better understanding their system performance and capacity such that the City can safely operate their natural gas system in compliance with the Texas Railroad Commission (TxRRC) as well as grow to serve more customers effectively. The development of a baseline model of the natural gas system is essential for understanding the natural gas distribution system. The objective of this model is to better understand and predict the natural gas system performance in extreme cases as well as to strategically use this model to size future improvements and/or replacements. This objective is to be rendered in the most cost-effective manner by relying on the existing information the City has on hand.

APPROACH

Engineered Utility Solutions, Inc. (EUSI) was authorized to generate a preliminary baseline model of the City's natural gas system. This work was performed in two phases and consisted of the following tasks:

- Phase 1: Data Compilation— in this phase, EUSI obtained and reviewed the City's system information to streamline Phase II. This consisted of the following City records/information:
    - Existing paper maps
        - February 1962 system map by Frank T Drought (5 page black and white set referred to as block maps)
        - July 9, 2007 Castroville Gas Service Area map (single page block map referred to as color map)
    - GIS database (static files received on April 15, 2024)
    - Gas supply parameters
        - delivery pressures and volumes received at the City Gate from 2021-2024

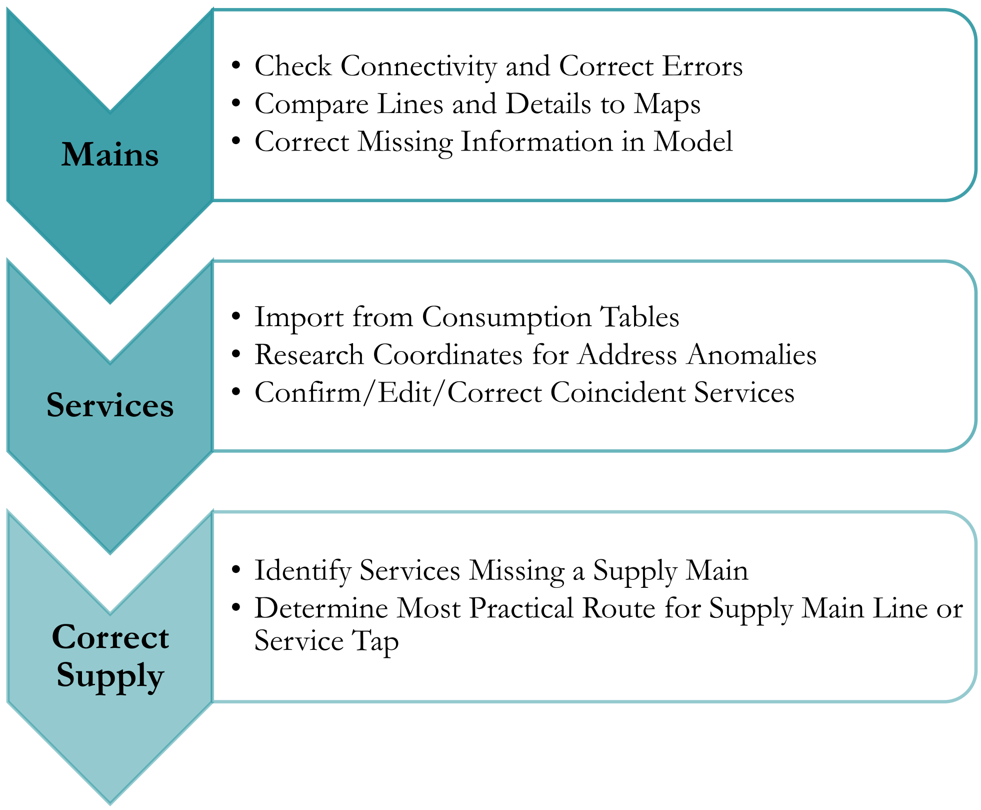
        - gas quality/chemistry from natural gas supplier
    - Gas consumption parameters
        - customer address and volume of gas consumed 2021-2023
    - Compliance Information
        - Regulator inspection reports by CPS Energy for 2023
            - City Gate Station
            - District Regulator Station- Pear Tree
            - CR 5711 & Cornfield
            - Medina Valley High School
            - FM 471 & PR 4784
        - Relief Valve Inspection Reports by CPS Energy for 2021-2023
            - 8449 FM 471 S La Coste (Medina Valley Football Field)
            - 1150 US Highway 90E
        - Control Valve Inspection Reports by CPS Energy for 2018-2023
            - City Gate Station
            - District Regulator Station-Pear Tree
            - Medina Valley High School
            - CR 5711 & Cornfield (west of CR 483)
            - FM 471 & PR 4784
        - Distribution Integrity Management Program Version 3.1.5
        - List of Castroville Projects dated 03-26-2024 (citing work from 09/20/2016 through 09/21/2023)
        - PHMSA Annual Report for Calendar Year 2022

The goal of this phase was to compile and evaluate the completeness of the data to ensure a seamless integration of this information into the GASWorkS™ modeling software. The following documents our approach in evaluating and assessing the information provided:

- Paper Maps and GIS--our team encountered unforeseen challenges since the GIS was only intended to be a digital replica of the block map and color map; therefore, it did not contain any service lines nor complete pipe data such as material, diameter, etc. for all mains. At this stage, our team was at a crossroads; we could either update the static version of the GIS to include all missing information or we could import the GIS data into our modeling software then update all missing information. In the interest of time, our team opted to proceed with the modeling software to stay on course with our project goals.

  - Gas Supply—the information provided to our team regarding gas quality was adequate for inputting into the modeling tool to calculate gas flow properties. Pipeline delivery loads and pressures were transferred to spreadsheets so that we could efficiently analyze the operating conditions through charts and calculations. This allowed us to determine the top 3 peak days the system has experienced.
  - Gas Consumption—the customer data received was also transferred to spreadsheets to allow for more efficient refinement of the information. We identified the highest consumption per customer and set that as the load requirement for each address.
  - Compliance Information—the information provided for regulators, relief valves and control valves helped our team note the presence of more stations in the Castroville system than was reported in our scope discussions. These facilities are important to note and incorporate in the modeling especially since neither the maps nor the GIS show the presence of more stations other than the City Gate and Pear Tree DRS. Regarding the DIMP, projects list and PHMSA portions in this category, those documents contain valuable information for reference rather than for direct incorporation into the model.

- Phase II: Hydraulic Model Development—in this phase, we integrated the data collected in Phase I into a steady-state network model based on a singular load profile. This means we are taking a conservative approach and modeling the system based on the highest peak the system has experienced in the real world; therefore, we set the model to the pressure and load parameters reported for the City Gate on the highest peak day. With this in mind, we first started with the actual model development before establishing the model parameters. The construction of the model began with extracting all standard pipe elements such as diameter, material and length as well as regulators, valves, and fittings from the GIS database into the model and proceeding through the following steps:



Once the GIS data was imported into our modeling software, our team ran a system trace to ensure that gas flowed through the network. The first trace attempt resulted in gas flow starting at the City Gate but not flowing through the first lateral at CR 5711. There were several lines that did not have gas flow due to the way the lines were "connected" in GIS. After all connectivity errors were corrected, the system traced completely to all system end points. Our team documented gross errors that we felt were important to correct in the GIS; refer to Appendix A for graphical illustrations of our findings. Next, our team checked every line against the paper and color maps to confirm pipe size and material since most mains did not have a material identified in GIS and a majority were missing pipe size. Where we discovered discrepancies between the maps and GIS, we used the information from the maps since the GIS appeared to be a quick attempt to digitize the paper and color maps. An example of the types of map discrepancies found and corrected can be seen in Figures 91-93 in Appendix D. Locations where mains were shown that were not on either paper or color map were sent to the City for determination if our assumed diameter and material was acceptable or if the City preferred to field verify. Refer to Appendix B for graphical illustrations of these locations. Upon completion of this task, our team then proceeded to services. The spreadsheet our team developed was imported into the model by relying on Google addresses to link the customer address to a location. While this is an automated batch process, a significant number of services did not import into the City or dropped into the center of town. Those services that were not within the City came in elsewhere due to the street name listing. For example, customers with an address on Paris St showed up in Paris, Texas.; this was due to the street name missing "St". Once we revised the street name from "Paris" to "Paris St" the service imported into the correct location. Several customers have business names only in place of a physical address. For those locations, we researched the business and input coordinates for the business location. For those customers that still georeferenced to the center of town, our team researched each address as well and input coordinates for each customer respectively. This then narrowed down branch locations; therefore, for services that appeared to coincide, our team confirmed via Google Street view if the location had multiple meters. At this stage, we did not worry about accurately depicting all meter manifolds, but did ensure that the correct number of meters that could be verified using street view were tapping the main within the approximate service tap location. At the end of this operation, we now had green dots representing meter locations. Our team used another automated tool from the modeling software to assign supply mains to the meters by defining a radius of 200 linear feet. The software assigned the service line to the main closest to the meter within +/- 200 linear feet radially. This yielded quite a number of meters without a main within 200 linear feet of the service. At those locations, our team took the following approach:

We used general industry standards for determining the most likely placement of a service or main, whichever was being added. Appendix C contains a graphical representation of the mains that were added. Our team did not index service line assumptions since all services has been placed by assumptions. Additionally, our team performed a thorough check of every service to ensure the same general industry standards used for manually adding a service line or main line were consistently applied to the service lines placed by the automatic tool. The biggest correction to the automated tool was to ensure a service line did not cross a lot line. For an example of this concern, refer to Figure 90 in Appendix D.

At this stage, we now have a system map containing all mains and services believed to be an active part of the City system. We then proceeded with inputting all system parameters. The information from the pipeline supplier was used to calculate the natural gas characteristics which govern the flow results. Additionally, we added the regulators at the City Gate station and Pear Tree DRS. This yielded a system map consisting of a network of mains, services and regulators that represent the entirety of the City's natural gas system. The overall map was quality checked one final time before the modeling was ready to begin. In this final, thorough quality check, we discovered that the pipe lengths which were imported with the mains from the GIS data did not match the physical lengths based on where these lines exist in the real world. Further research revealed that the GIS data contained two sets of length values and in most instances neither length was correct. Therefore, our team had to manually edit all hydraulic lengths to be used in the modeling calculations to equal the physical length of the facility in question.

Once these final quality checks were completed, we were finally at a stage where we could run the model to simulate gas follow. This model can be manipulated to simulate the existing condition as well as the addition of new loads, pipes, changes in regulator set points, and opening or closing of valves on the system. This model will serve as the foundation for future investigations related to new customers, load increases, and system constraints. It can also be used to assist with master planning capital improvement projects to help determine the most cost-effective solutions to system needs.

It should be noted that we typically include a calibration process which involves comparing the model results at locations where SCADA information is available. This fine-tunes the results of the model to within a reasonable percentage error so that predictions made from the model are better aligned with real world experiences. In the absence of SCADA, we can identify low points and other key locations based on the model to take pressure readings to use in calibrating the model. This is typically an iterative process that we discuss with your operations personnel to confirm the model behaves like the real-world system. For this system, we discussed the settings experienced on a particular day at the City Gate as well as at Pear Tree.

Typically, the development of a natural gas distribution system model would not include an actual capacity assessment to determine feasibility of adding a new gas load (i.e., customer). However, our model generation duration required more effort than typical and exceeded the target completion timeframe. Therefore, as a gesture of customer service, our team incorporated the evaluation of 3 potential loads to help the City's make an informed decision regarding accepting these loads which was the City's intent behind the decision to engage our firm.

EVALUATION DETAILS

The following delineates key details of the model

- Historical Consumption Information

Highest Load

02.14.2021
714 Mcfh
30 Mcfh

01.15.2024
705 Mcfh
29 Mcfd

12.23.2022
663 Mcfh
2 Mcfd

Average Load

116 Mcfh
5 Mcfh

Smallest Load

07.11.2022
51.2 Mcfh
2 Mcfd

07.1.2024
52.4 Mcfh
2 Mcfd

07.04.2024
52.61 Mcfh
2 Mcfh

- Flow Equation used to calculate pipe flow is IGT-Improved which is valid for pressures ranging from 1-500psig.
- Compressibility was calculated based on AGA 8 Gross Method #1, 1992.
- Model Details
    - Color Coding
        - Color was used to differentiate mains derived from the GIS and maps (black) versus assumed mains required due to service meters (orange). We also applied a blue color to the high-pressure portion of the system. Refer to Figure 1 for an illustration of the final model exhibit.

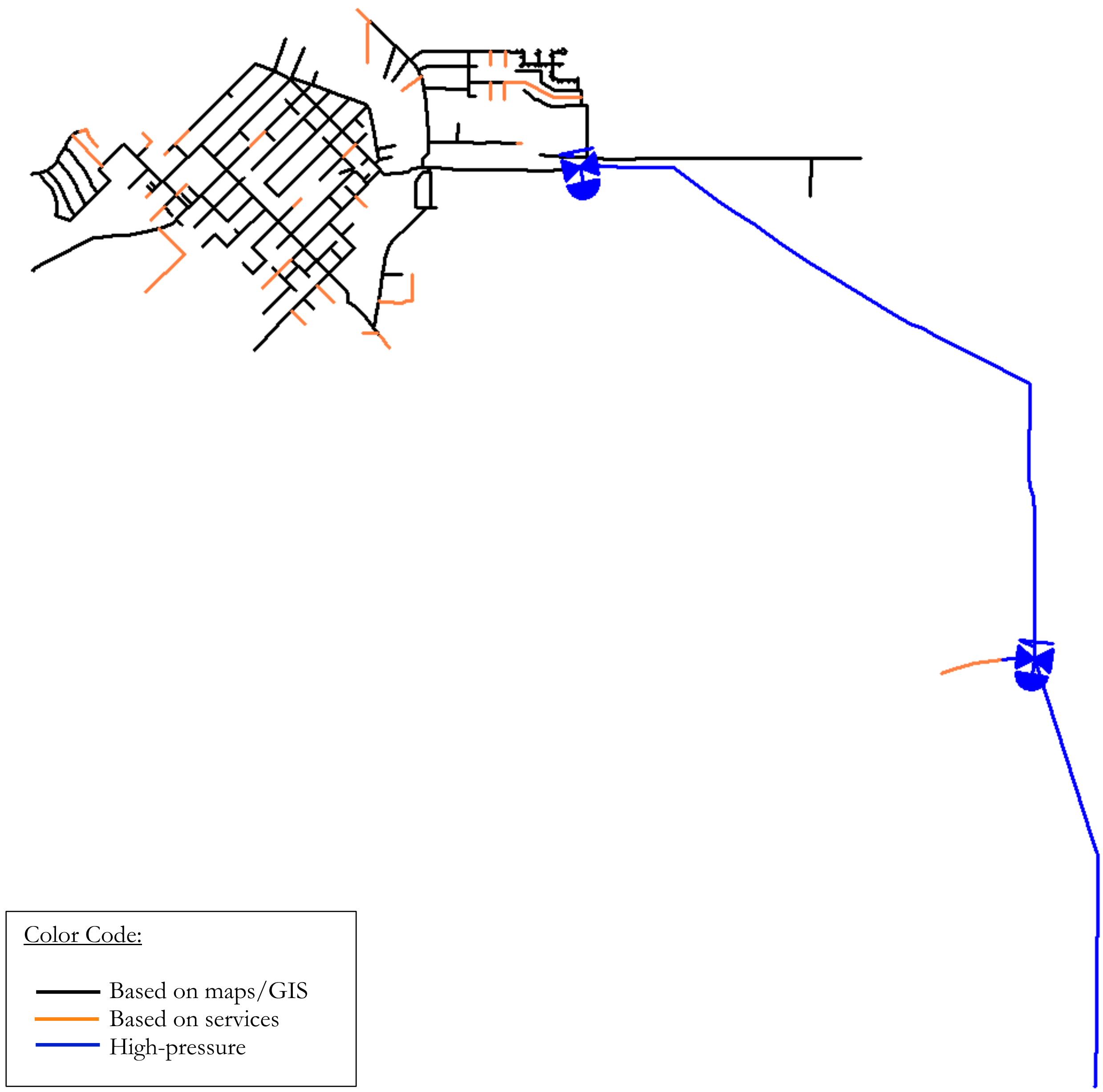


Figure 1: Existing System Model

The model consists of 361 lines totaling 159,570 linear feet broken down as follows on the next page. The orange lines represent unmapped added mains; there are 30 lines that have been added to account for services that were missing a supply main. Refer to Appendix C for these details. In the model, main line end points, angles and connections are represented by a solid circle referred to as a node. The connectivity issues described in our Approach were essentially locations where a node was needed at locations where two mains intersect or connect. The model we generated contains 341 nodes. We also added regulators to the model; however, without further on-site investigations, we were unable to confidently locate what we suspect to be farm tap services utilizing a regulator due to the supply main being the high-pressure line bringing gas into the city system. Currently, the model accounts for the regulator at the City Gate, Pear Tree DRS and what we, together with the City, believe to be the DRS at CR 5711 and Cornfield.

Size/Type Code	Inside Diameter, Inches	Pipe Count	Length, Feet
1S	1.049	2	384
1/2P CTS	0.445	56	1,933
2P	1.917	149	49,906
2S	2.067	116	57,120
3S	3.068	9	4,620
4S	4.026	23	42,568
4S-.156	4.188	6	3,039
Total Quantities		361	159,570

Figure 2: Breakdown of Pipe Segments

EVALUATION RESULTS

Three scenarios were modeled to establish a preliminary baseline model performance. The results from these 3 scenarios can be used to calibrate the model when the system is experiencing the applicable load condition. The following delineates each load scenario:

- Scenario A: Low Demand Condition (2 Mcfh) —demand comes the lowest system load experienced since 2021which occurred on July 11, 2022 based on the volumes delivered at the City Gate.
- Scenario B: Average Demand Condition (5 Mcfh)—demand is the average volume delivered at the City Gate from Jan 2021 through September 30, 2024.
- Scenario C: Peak Demand Condition (30 Mcfh)—this represents the system's critical load; at this demand level, the system begins to experience pressures below 10 psig.
- Scenario D: Average Load plus Growth Condition (5 Mcfh)—this represents the average system demand plus assumes two additional services at their peak demand. This is meant to be the typical result the City can expect after adding the two perspective customer loads.
- Scenario E: Peak Load plus Growth Condition (30 Mcfh)—this represents the peak system demand plus assumes two additional services. This is meant to be a worst-case scenario of adding the two perspective customer loads.

SCENARIO A: LOW DEMAND CONDITION (2 Mcfh)

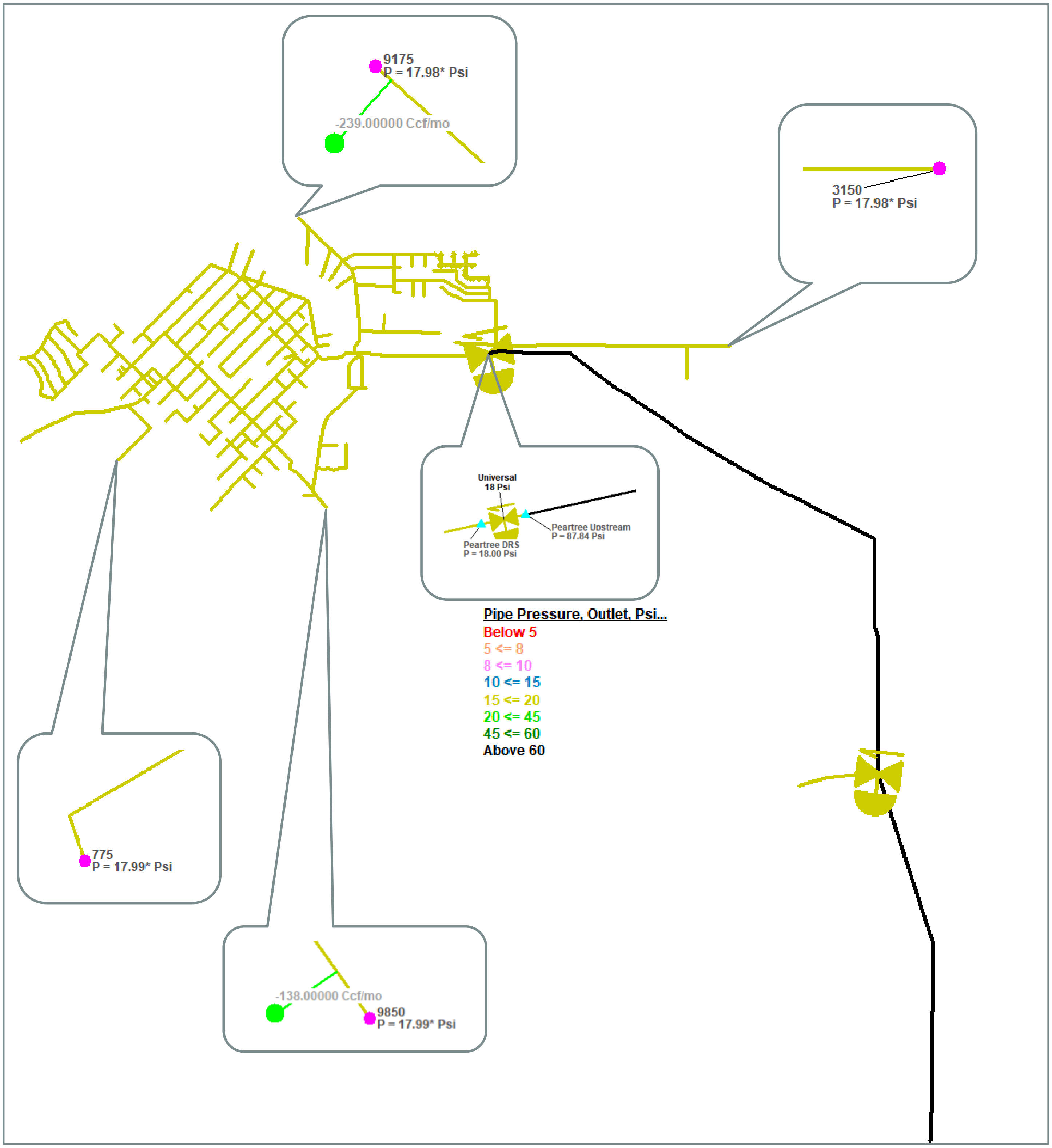


Figure 3: Low Demand Condition

SCENARIO B: AVERAGE DEMAND CONDITION (5 Mcfh)

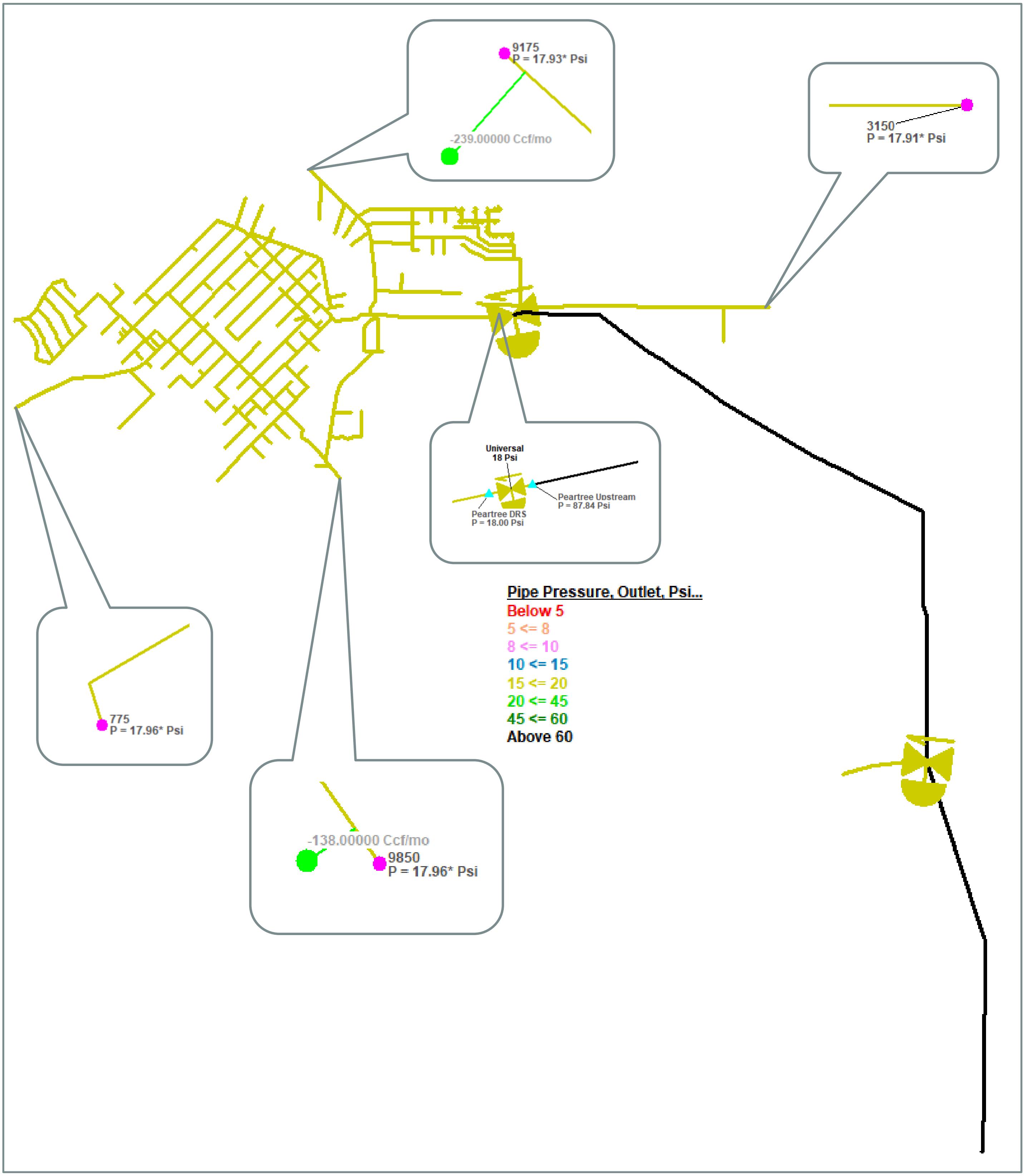


Figure 4: Average Demand Condition

SCENARIO C: PEAK DEMAND CONDITION (30 Mcfh)

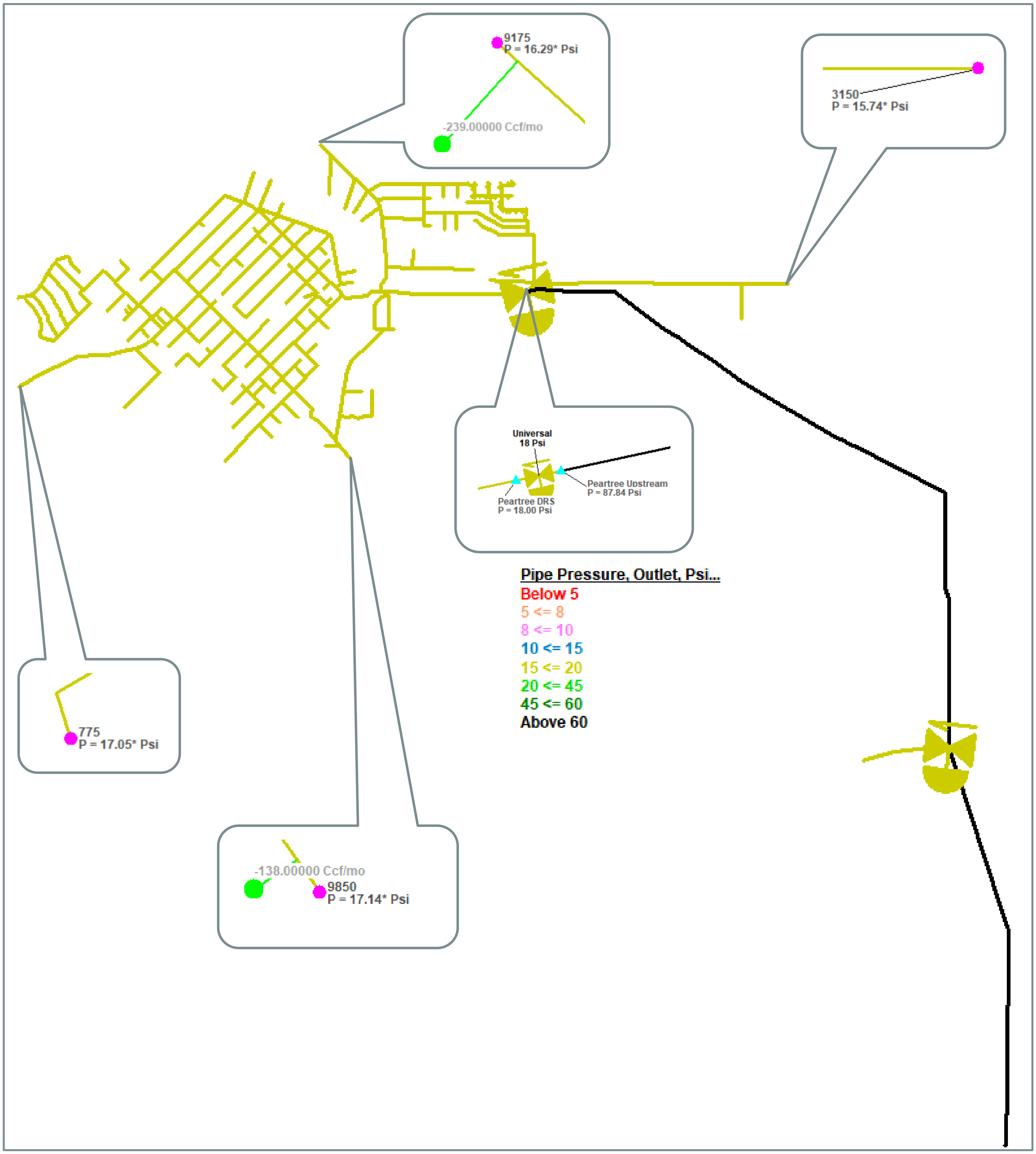


Figure 5: Peak Demand Condition

SCENARIO D: AVERAGE LOAD PLUS GROWTH CONDITION (5 Mcfh)

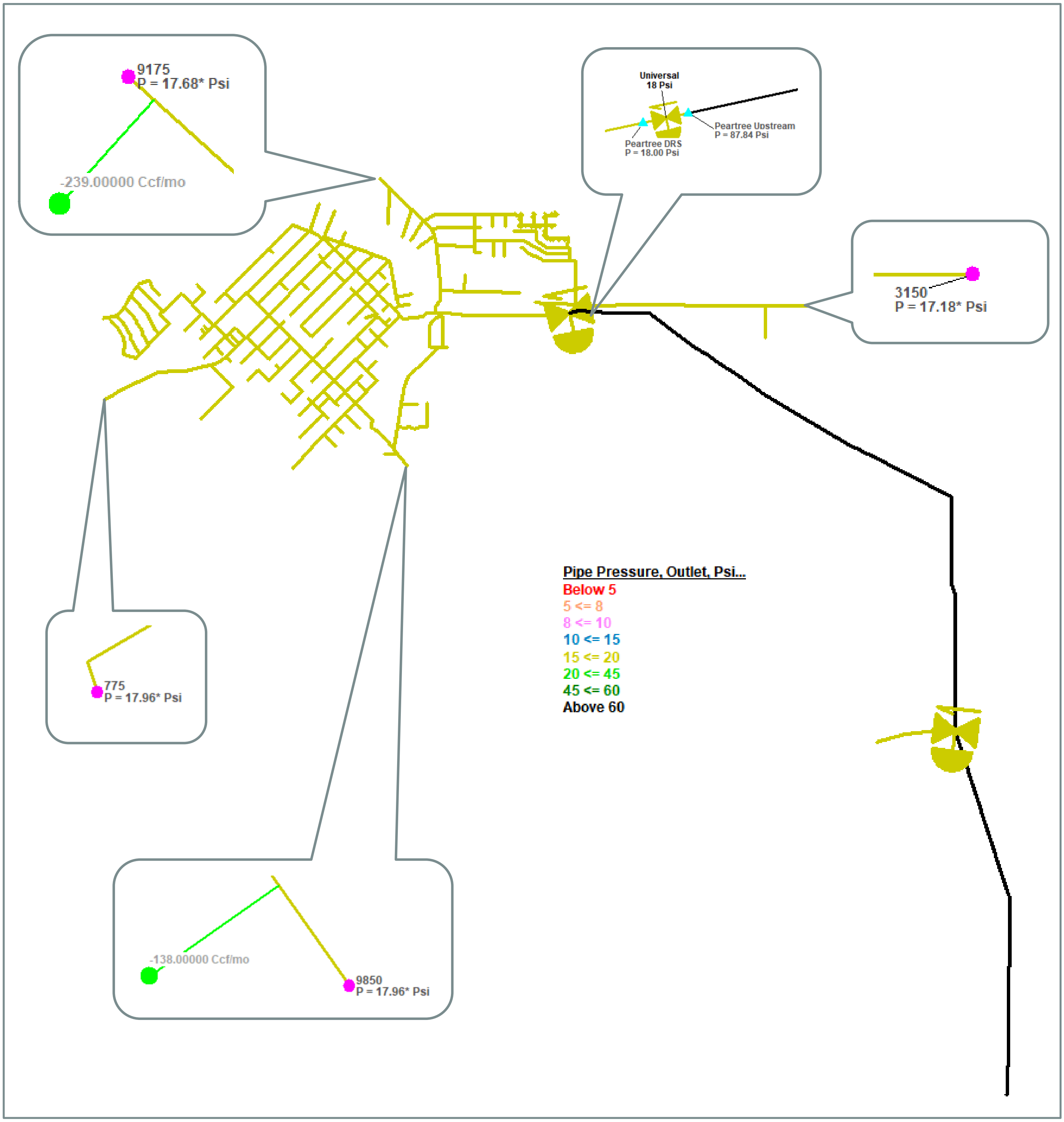


Figure 6: Average Load Plus Growth Condition

SCENARIO E PEAK LOAD PLUS GROWTH CONDITION (30 Mcfh)

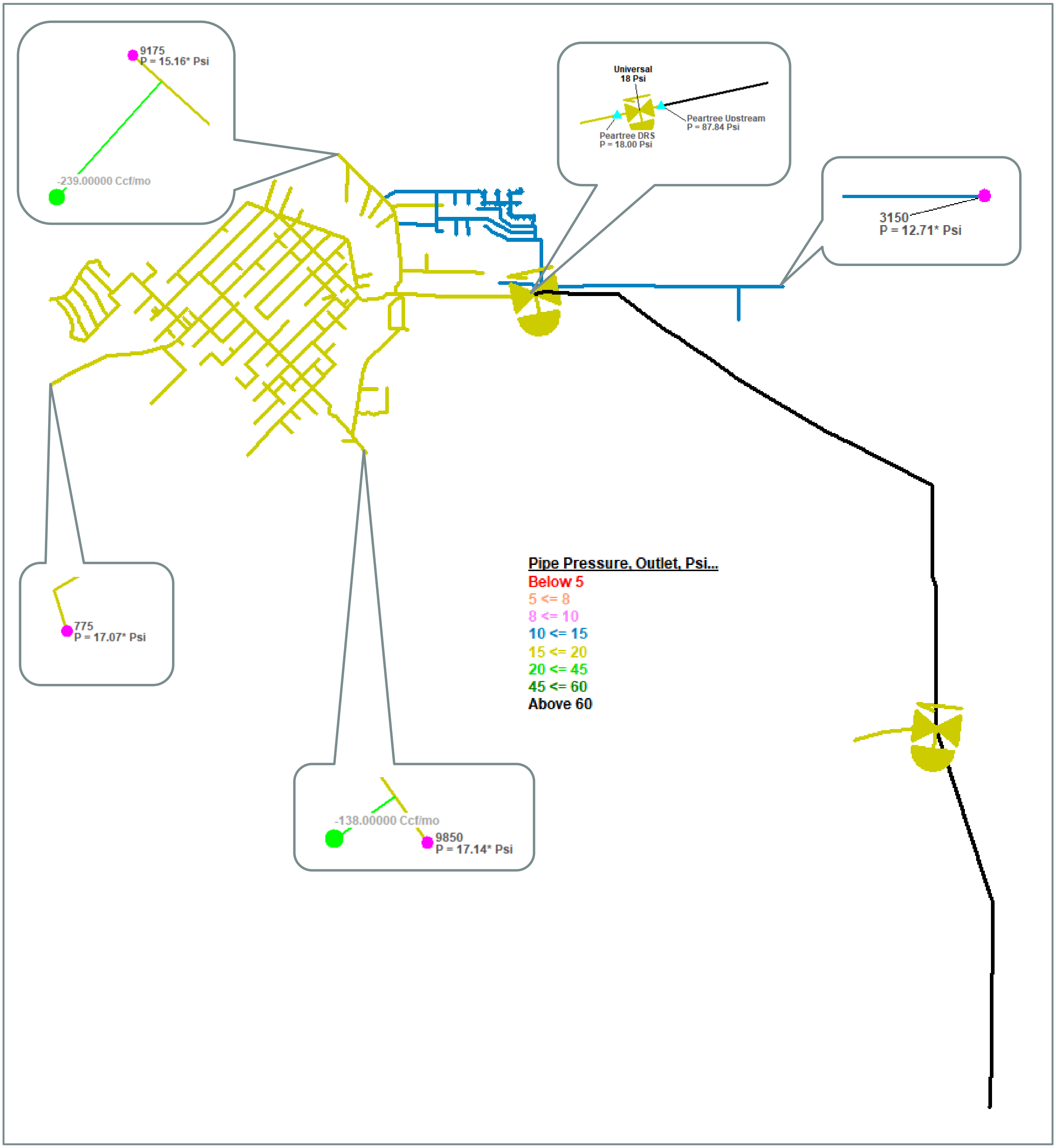


Figure 7: Peak Load Plus Growth Demand Condition

The various scenarios illustrate the system operation when subjected to certain load conditions. For scenarios D and E, we accounted for two perspective customers with the flowing load parameters:

- Town East Crossing Retail—3250 cfh at 2 psig
- Flat Creek Subdivision 65 lots estimated at 110 ccf/month

It should be noted that the assumed load for Flat Creek Subdivision is based on the average usage for Castroville in the Village Path/Sunnyland Dr neighborhood. Our team evaluated the impact of adding these two perspective loads and had provided preliminary results previously outside of this report. However, those results reported a bigger impact because we used a higher assumed consumption per lot. The earlier results used the largest load in the reference neighborhood. Upon further consideration, we decided the more appropriate representation would be the average load since the developer was not able to provide any information regarding estimated natural gas load nor did they include information regarding lot or building size for our team to estimate load based on planned home sizes.

Our team conducted a site visit to evaluate our model results and verify the system layout. There are a number of discrepancies between the real-world system and the maps; therefore, we used industry standards as a basis for our assumptions. During our site visit, we were able to confirm and/or update some of our assumptions for missing mains or service feeds. This provided confidence in our assumptions since we were not able to fully field verify all assumptions in our single site visit. The high-pressure portion of the system in the model matches the real-world pressures at the high-pressure side (upstream) of the Pear Tree DRS. This also gives us confidence in the model.

During our site visit, we confirmed that the area along FM471 from Pear Tree DRS to FM 483 is not adequately captured in the City's maps and may not be correctly reported or patrolled in regard to regulatory compliance and industry best practices. This is in the high-pressure portion of the system; however, that line has considerable capacity.

Furthermore, we discovered the presence of an unknown station west of the station we believe to be the CR 5711 and Cornfield DRS. Out visit to the site did not provide enough time and resources to further investigate this station to verify the upstream main supplying the station nor the downstream man exiting the station.

In addition, our site visit helped clarify some locations where we assumed mains or service feeds.

RECOMMENDATIONS

We recommend a second phase to further refine the hydraulic model in order to increase the reliability of the model. This future phase should include the following items:

- Toning and locating all lines along FM 471 from Pear Tree DRS to FM 483 to map out all mains, services, farm taps and any stations present in this region. Field verification of any facilities not accounted for in the City's maps or GIS may be necessary to properly understand the system. This should be performed by natural gas subject matter experts (SMEs) together with the City. The SME is needed to provide guidance to the City regarding any compliance obligations to ensure the safe and reliable operation of any unknown portion of the system.
- Toning and locating all lines along CR 5711 to map out all mains, services, farm taps and any stations present in this region. Field verification of any facilities not accounted for in the City's maps or GIS may be necessary to properly understand the system. This should be performed by natural gas subject matter experts (SMEs) together with the City. The SME is needed to provide guidance to the City regarding any compliance obligations to ensure the safe and reliable operation of any unknown portion of the system.
- Conduct a site visit to all high-volume customer meters to document delivery pressure requirements to ensure those are accounted for in the model. The site visit can be performed by the City and results reported back to our team for a Phase II refinement.
- Field verify the assumed main limits and material specifications so that all maps and records can be updated together with the model to properly reflect the real-world system.
- Monitor and record pressures at key system end points (i.e., those noted in the model scenarios) during peak events (both high and low). It is common practice in the industry to monitor low points as well as key large loads so that the system operations are routinely calibrated in a hydraulic model. The City could opt to install remote monitoring devices at these locations for the sole purpose of establishing these check points not only for calibrating this model, but also for monitoring the system in general, especially during peak events. The alternative to installing devices at these end points is to check pressures at nearby customer meters. Regardless of how this data is collected, the temperature, date and time of the pressure reading should be recorded. If

our team is to assist with a Phase II scope, we will work with the City throughout this year and any Phase II scope year to obtain readings as they are acquired or as a peak weather event is anticipated.

- Similarly, we recommend adding remote monitoring at the City Gate, Pear Tree DRS, CR 5711 and Cornfield DRS (and any other stations discovered in the next phase). Again, this is in line with industry standards and provides the City with a more efficient monitoring system when compared to physical patrolling.
- Research the following for possible grant opportunities:
    - Natural Gas Distribution Infrastructure Safety and Modernization (NGDISM) Grant Program offered by the US Department of Transporation's Pipeline and Hazardous Materials Safety Administration (PHSMA) for installing remote monitoring systems and/or replacing or adding a DRS.
    - Pipeline Emergency Response Grant (PERG) offered by the US Department of Transporation's Pipeline and Hazardous Materials Safety Administration (PHSMA) for training City personnel and/or for the purchase of equipment that was previously provided by CPS Energy.
    - Community Development Block Grant Program offered by the U.S. Department of Housing and Urban Development for the construction of public improvements such as replacing mains or stations.
    - Community Facilities Direct Loan & Grant Program in Texas offered by the USDA Rural Development to determine grant eligibility for the purchase of new equipment or for the construction of public improvements.
    - Texas Community Development Block Grant Program (TxCDBG) offered by the Texas Department of Agriculture for utility infrastructure improvements.
    - Public Works and Economic Adjustment Assistance Program offered by the U.S. Department of Commerce to possibly fund construction projects, equipment purchases or personnel training.
- We recommend the acceptance of the two new natural gas loads we analyzed (Town East Crossing and Flat Creek Subdivision); however, we recommend increasing the outlet pressure at Pear Tree DRS from 18 psi to 25 psi to rebalance the system pressure ranges into a more acceptable range during peak load conditions. Typically, this type of recommendation would be part of a Master Plan scope of work or would

be presented more generally encouraging the City to simply increase pressure. Again, due to the delayed completion of the model generation, our team performed additional scope at no additional cost to ensure the City received their target benefits from this model. Refer to the following illustration of the model scenario that illustrates the system improvements resulting from this recommendation.

SCENARIO F PEAK LOAD PLUS GROWTH CONDITION WITH SYSTEM IMPROVEMENT (30 Mcfh)

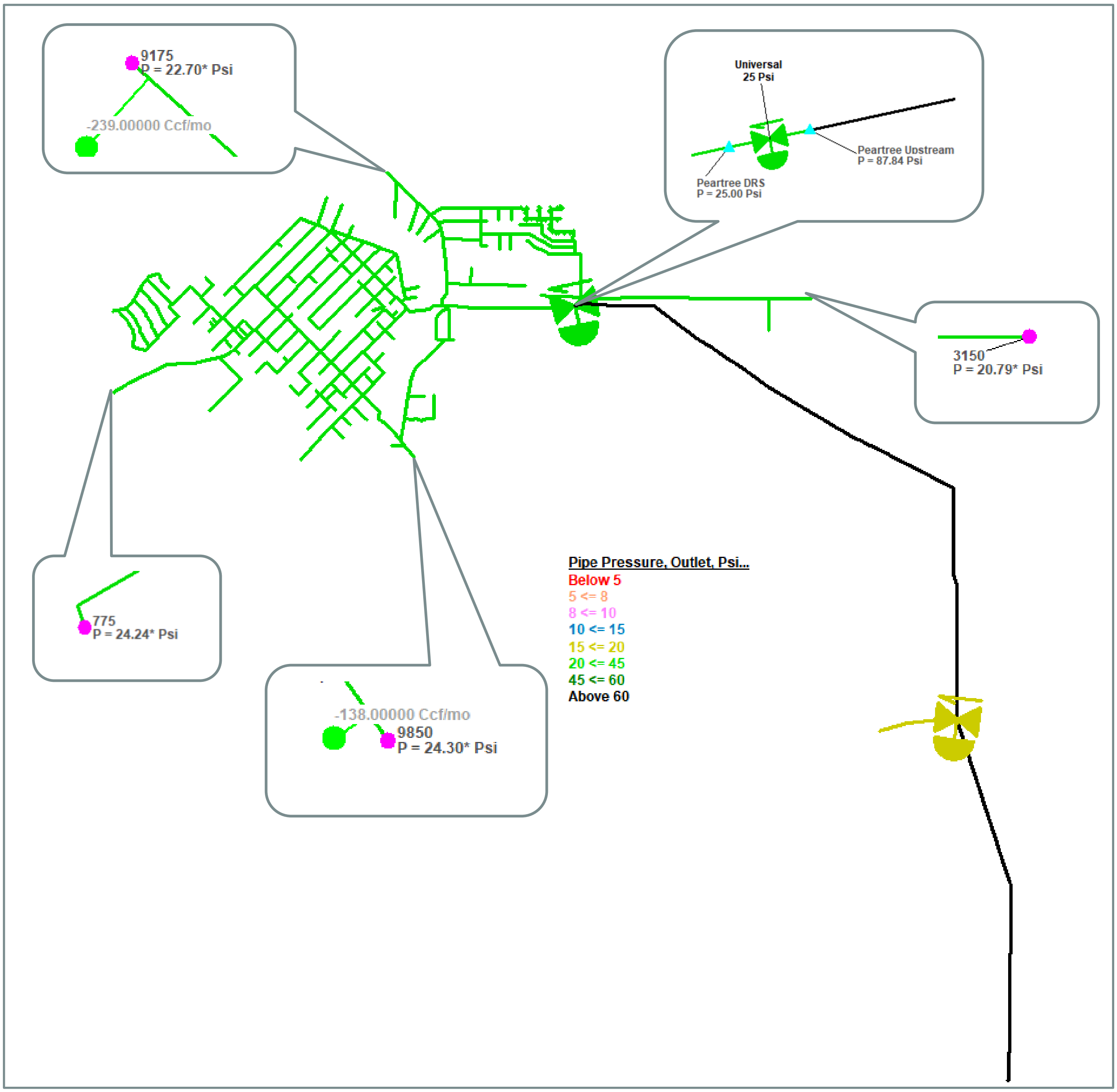


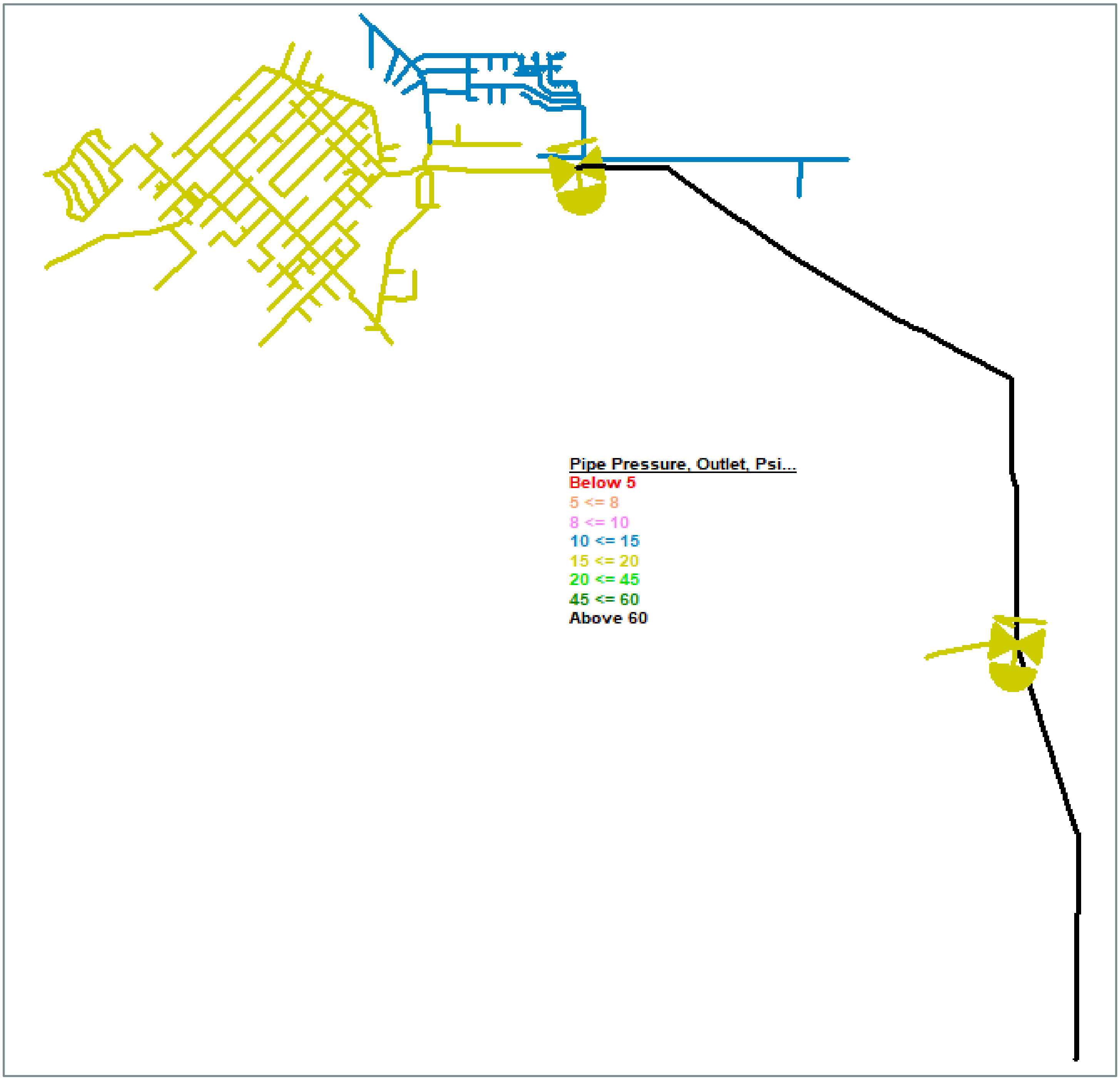
Figure 8: Peak Load plus Growth Conditions with System Improvement

This recommendation includes the use of a natural gas SME to guide the City regarding Maximum Allowable Operating Pressure (MAOP) concerns. At the very least, during peak weather conditions, the City should monitor the portion of the system impacted by the new loads to determine if a temporary increase in outlet pressure is warranted to ensure the continued delivery of natural gas service to all customers.

- These recommendations are made assuming that the City elects to approve a change order to capitalize on our ability to provide the City with an updated shape file for use in updating the City's current GIS maps for the natural gas system. If the City chooses to not authorize the additional Phase I scope we previously submitted, then we suggest updating the GIS whenever those assumed assets are field verified.
- Last, we believe the model provides an invaluable resource that should be used together with your leak management, DIMP assessments and master planning for capital improvement projects.

As noted in our conversations, our team is available to answer any questions and assist with the development of any of our recommendations. Refer to Appendix F where we have summarized our list of assumptions and recommendations.

SCENARIO G: 25% GROWTH CAPACITY WITH SYSTEM IMPROVEMENT (37.5 MCFH)



APPENDIX A: CONNECTIVITY

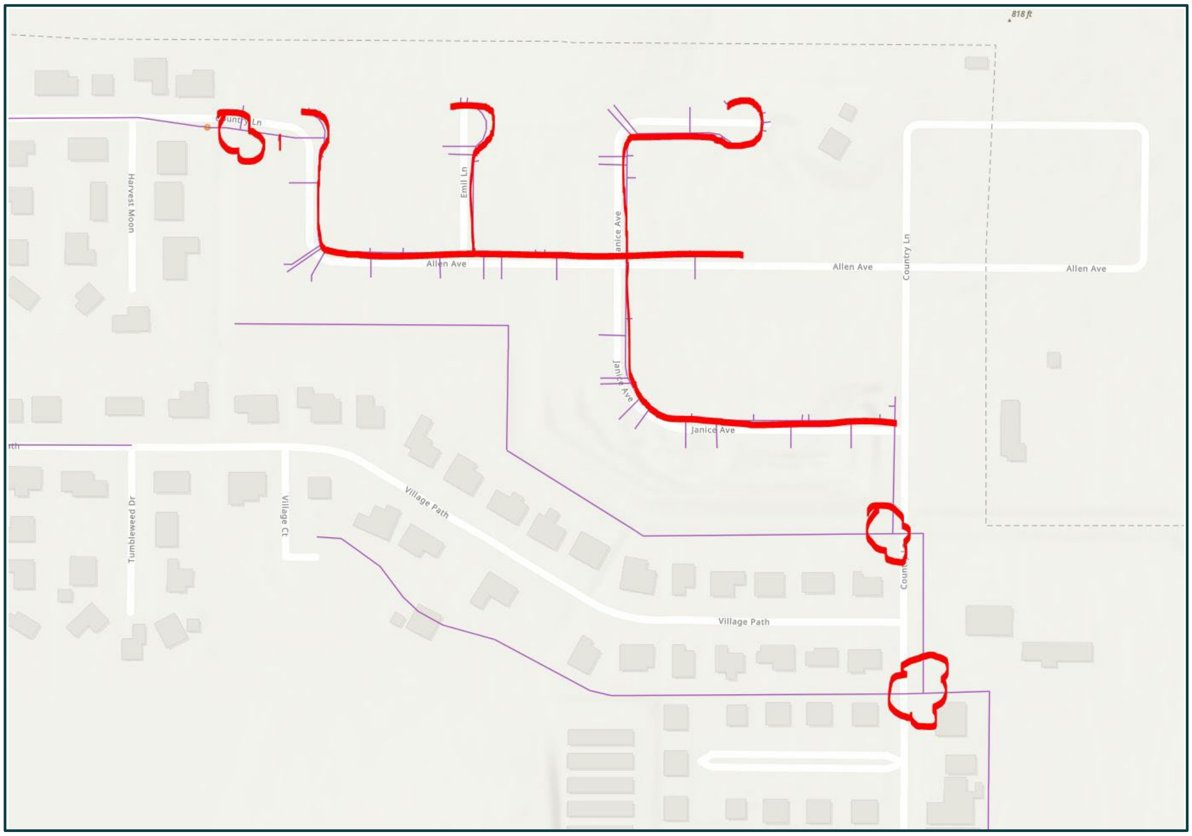


Figure 9: Neighborhood off Country Ln-Janice Ave-Allen Ave

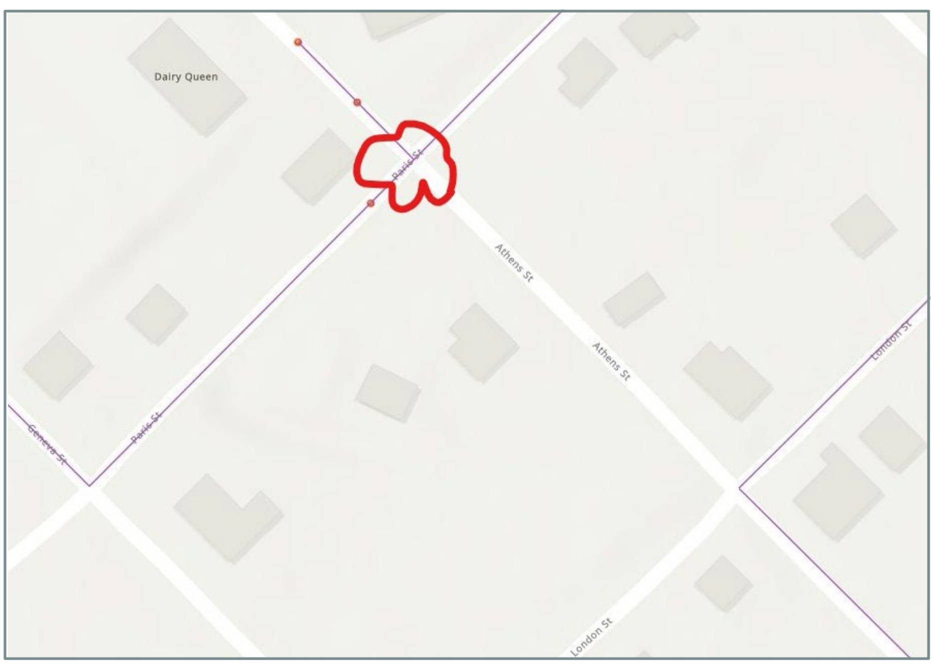


Figure 10: Athens St at Paris St

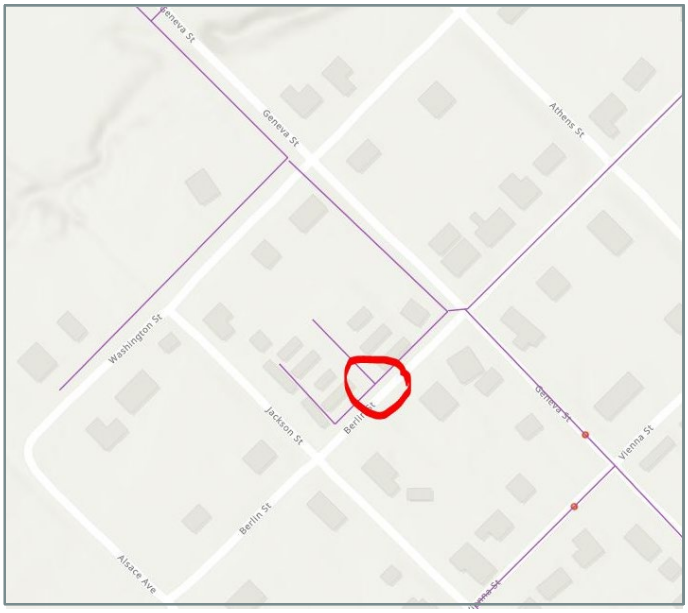


Figure 11: Berlin between Geneva St and Jackson St

Figure 12: Constantinople St at Berlin St

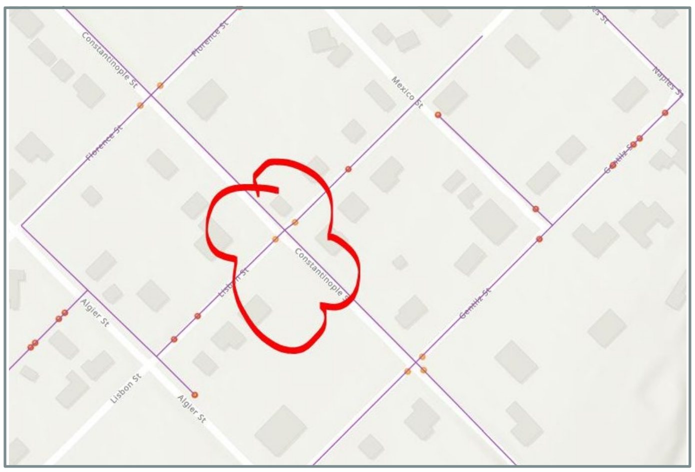


Figure 13: Constantinople St at Lisbon St

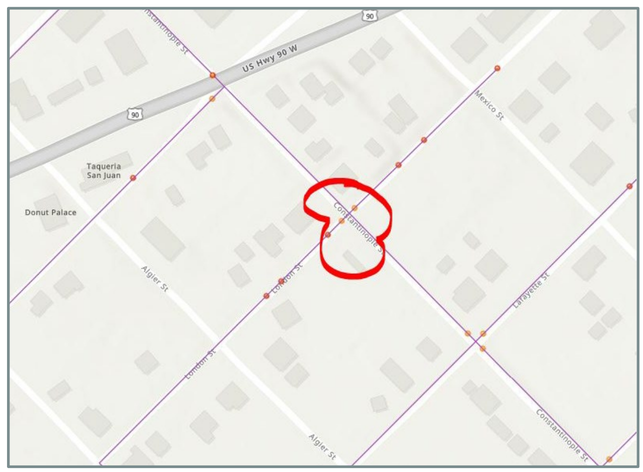


Figure 14: Constantinople St at London St

Figure 15: CF 471 at Brieden St

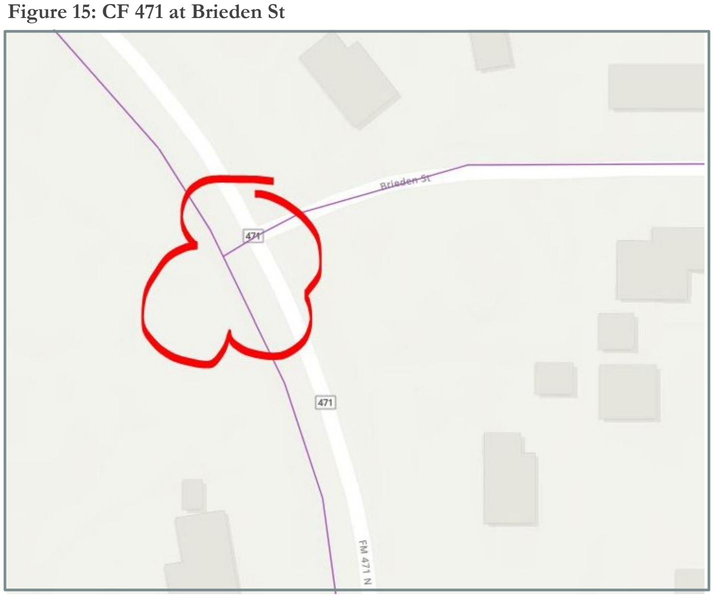


Figure 16: FM 471 at May St

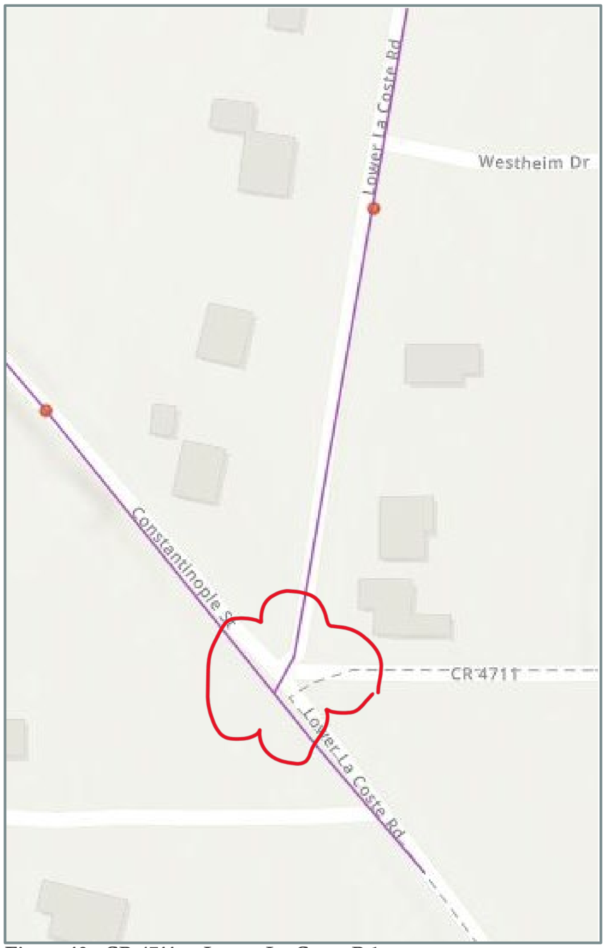


Figure 18: CR 4711 at Lower La Coste Rd

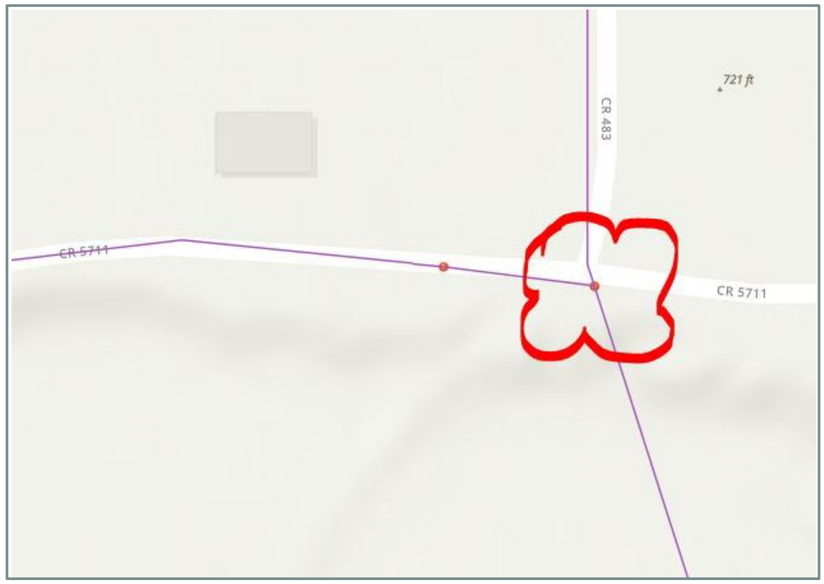


Figure 17: CR 5711 at CR 483

Figure 19: Easement between CR 471 and School St

Figure 20: Easement East of Country Ln and North of US 90

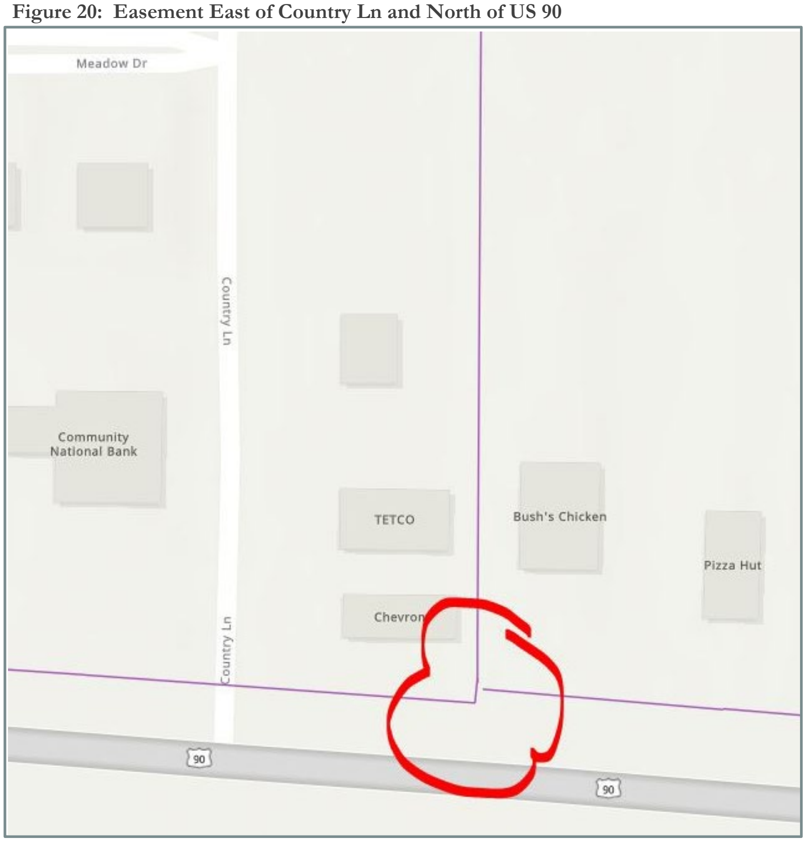


Figure 21: Easement bound by Algier St-Lisbon St-Florence St-Athens St

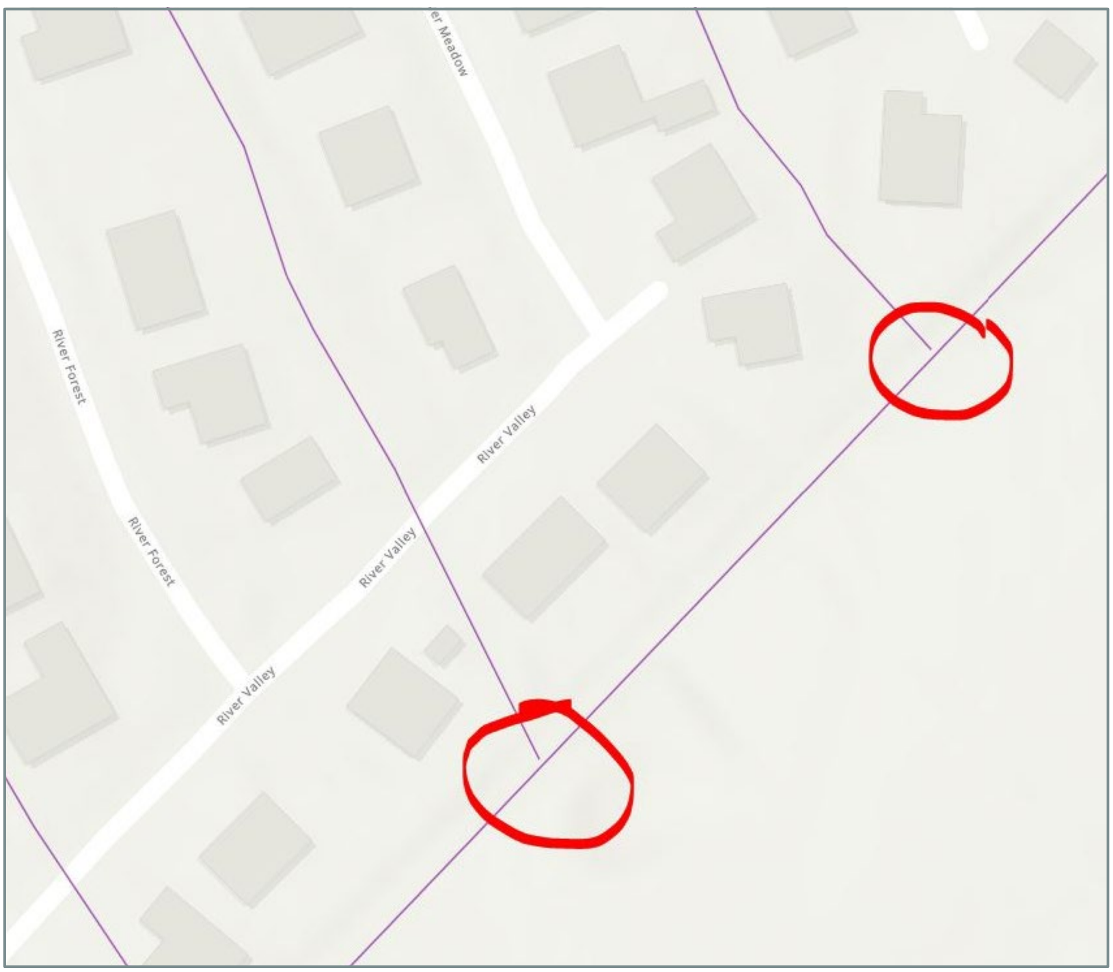


Figure 22: Easement South of River Valley from River Bluff to River Knoll

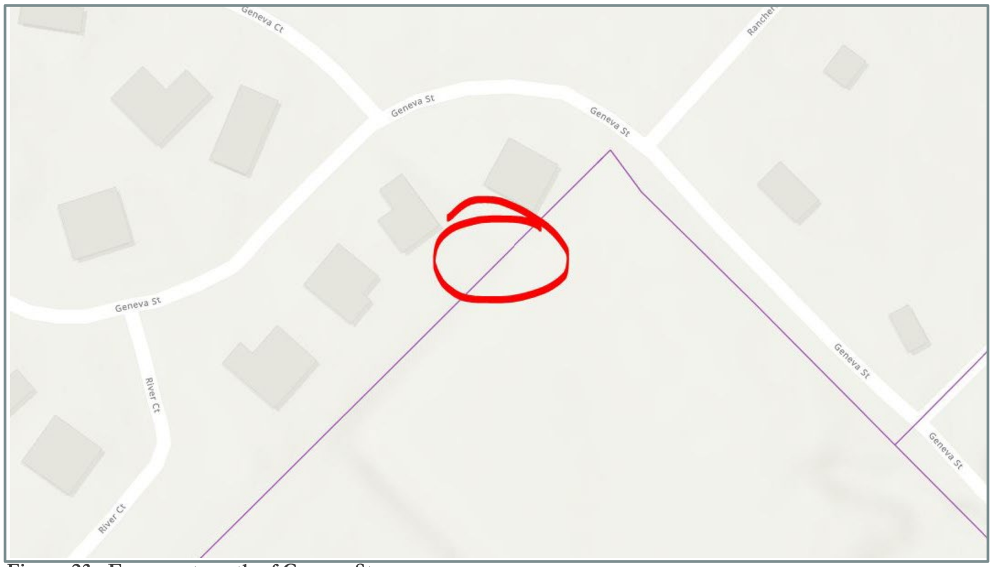


Figure 23: Easement south of Geneva St

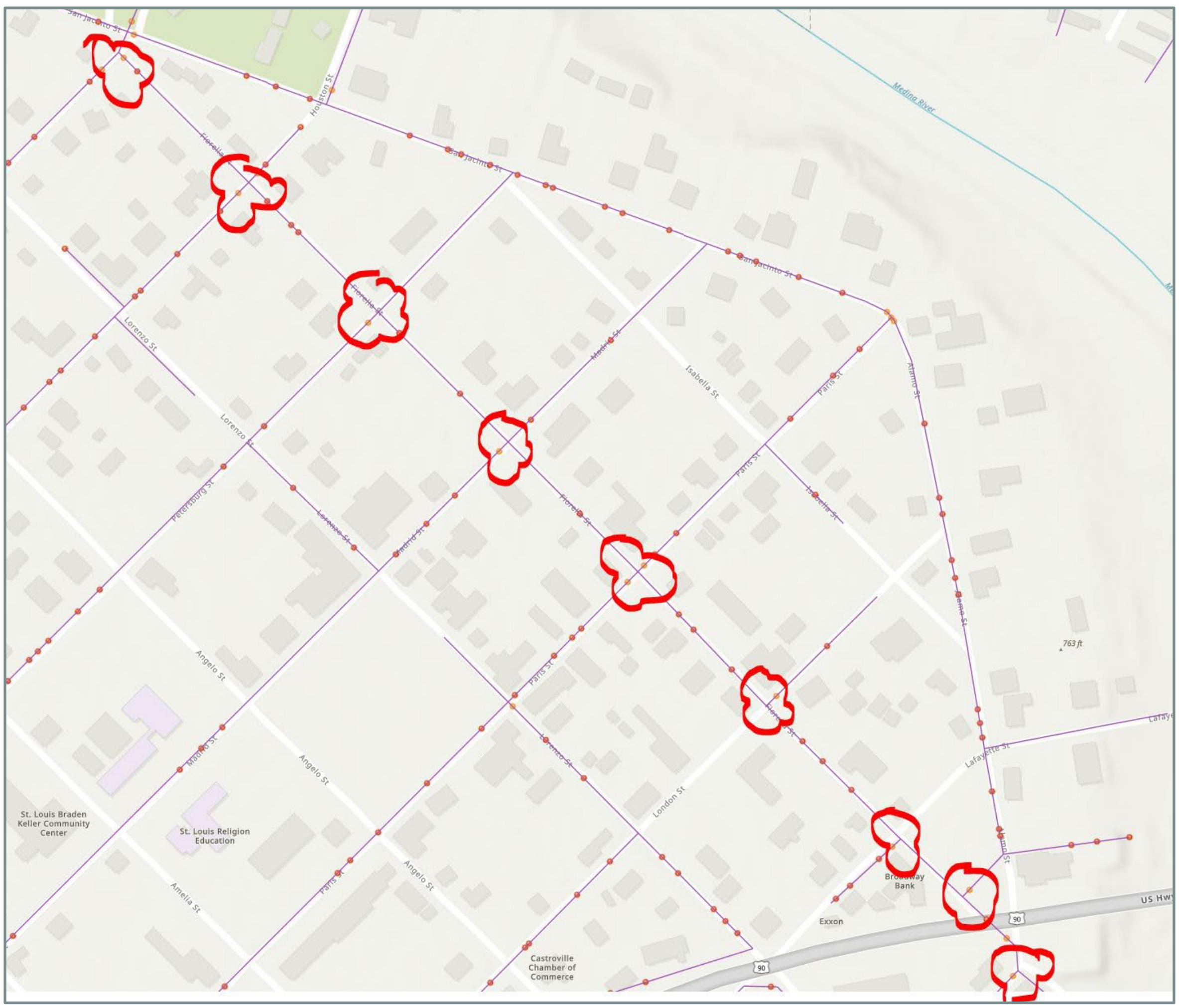


Figure 24: Fiorella St from Petersburg St to US 90

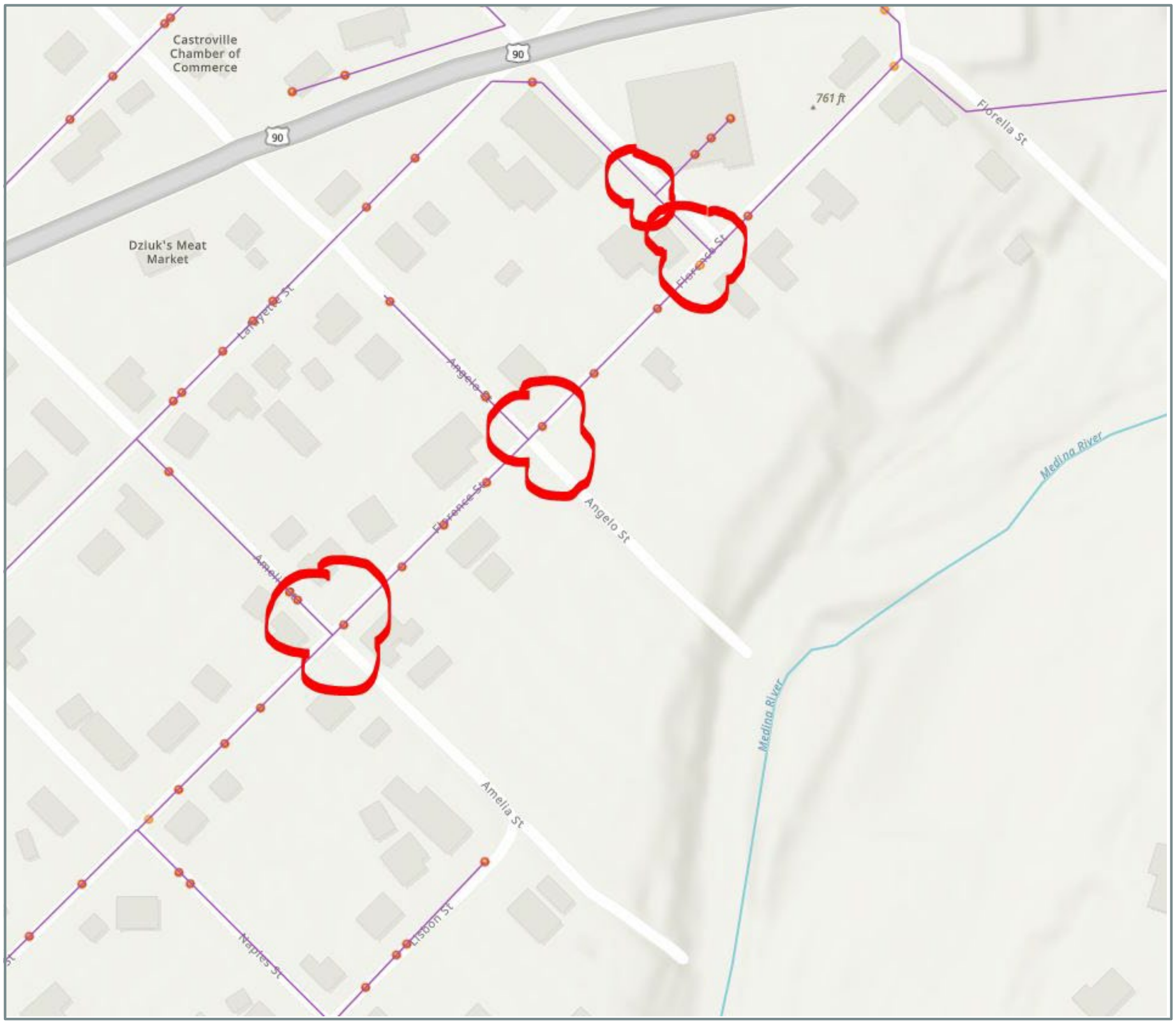


Figure 25: Florence St from Amelia St to US 90

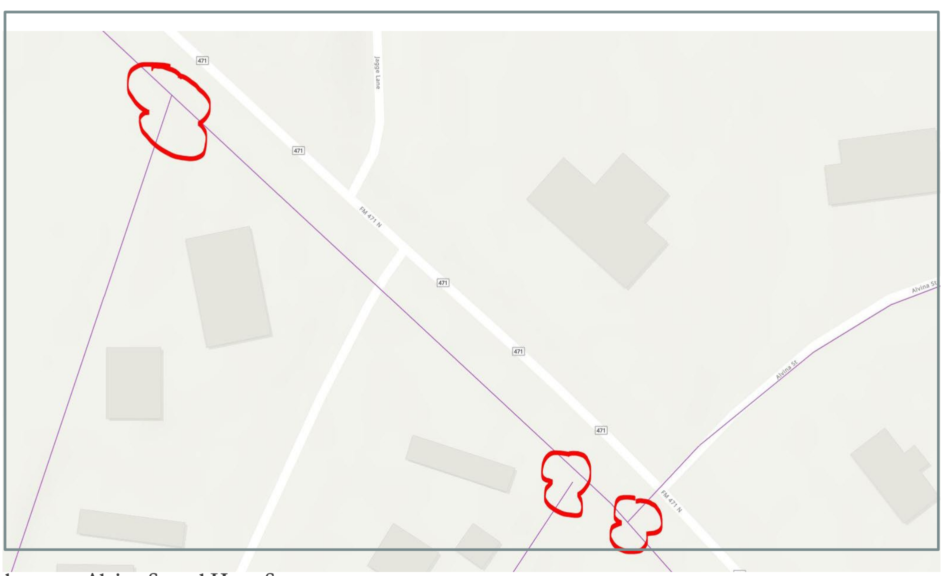


Figure 26: FM 471 between Alvina St and Hans St

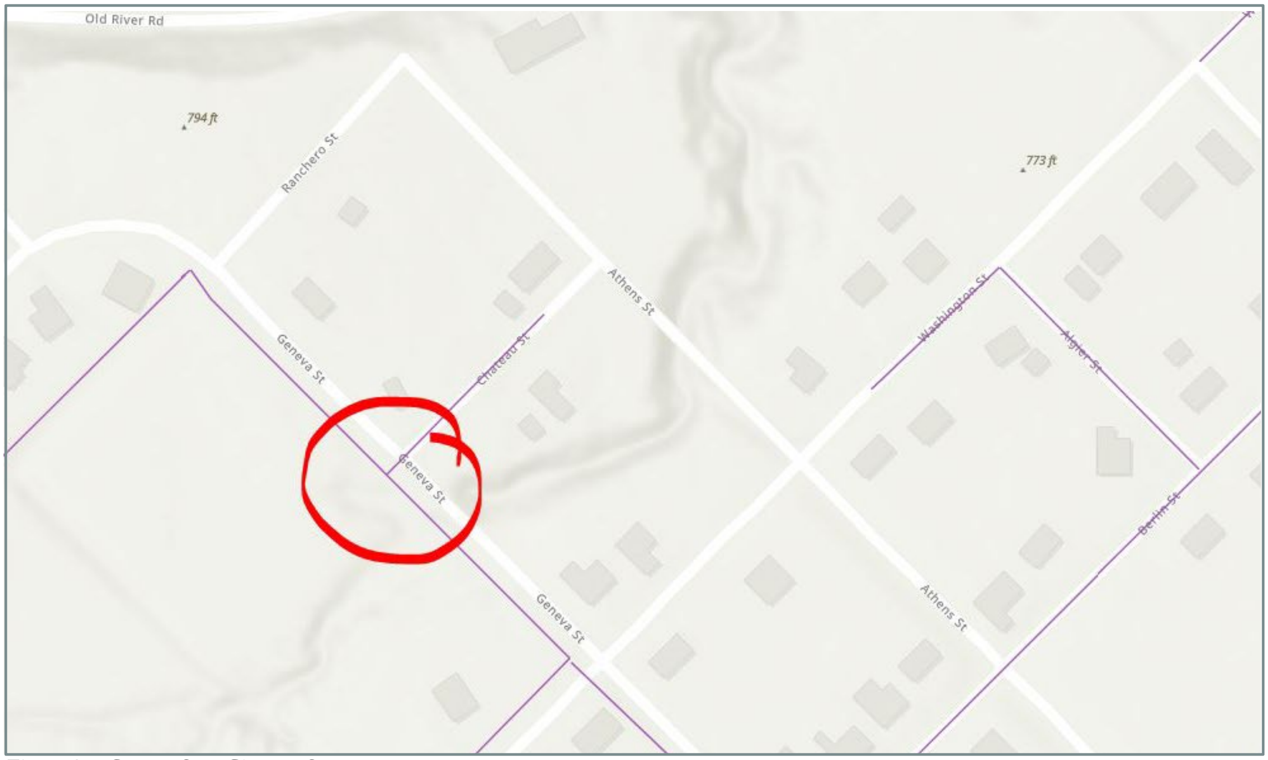


Figure 27: Geneva St at Chateau St

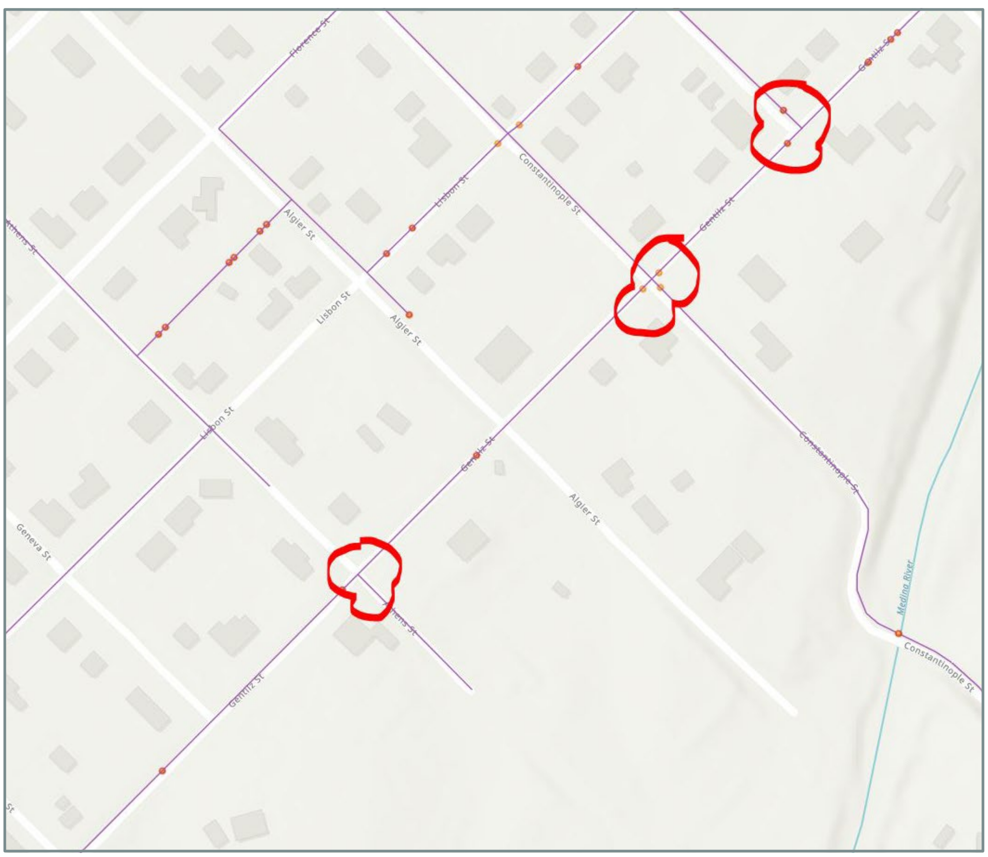


Figure 28: Geneva St between Washington St and Berlin St

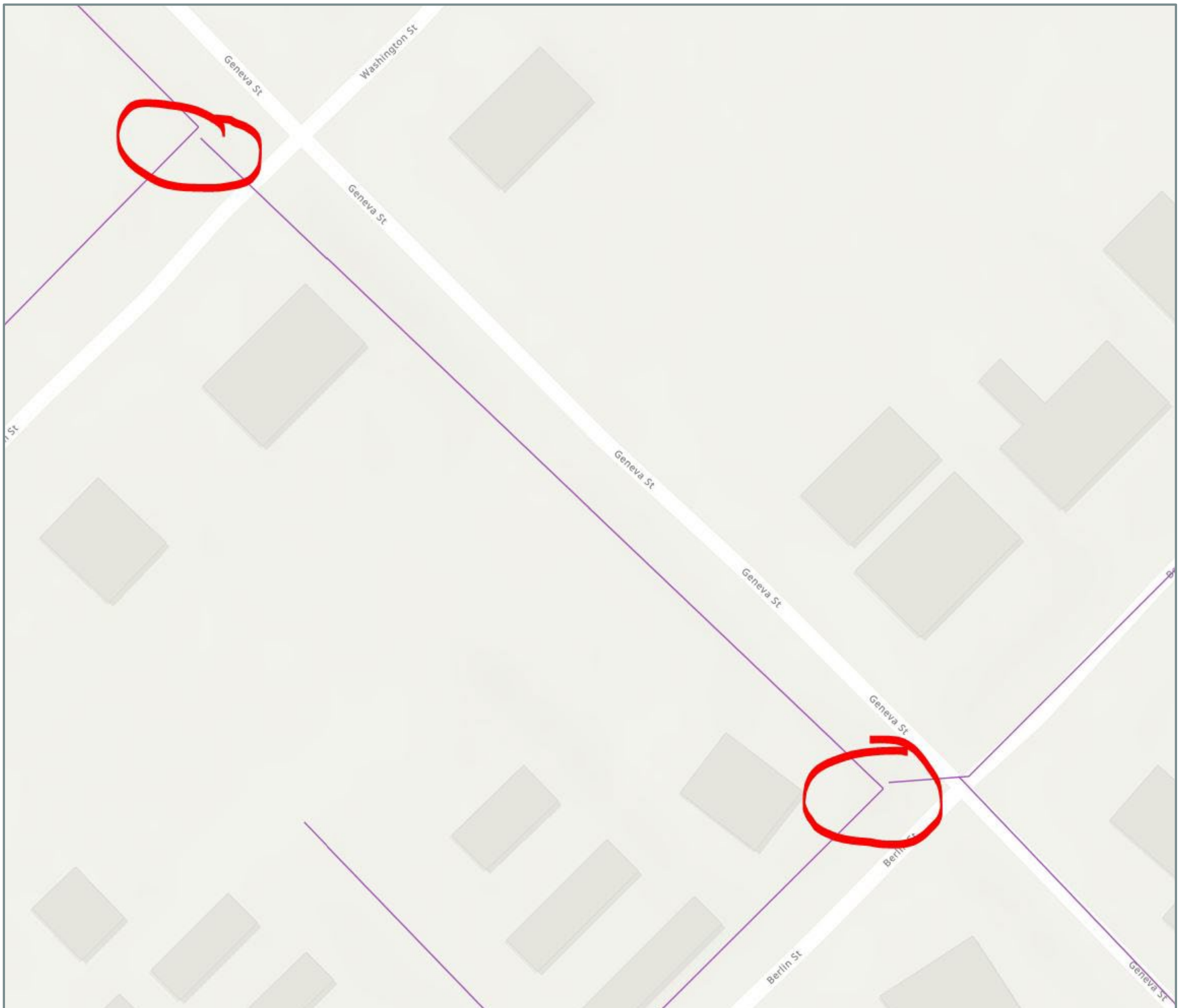


Figure 29: Gentilz St between Alsace Ave and Naples St

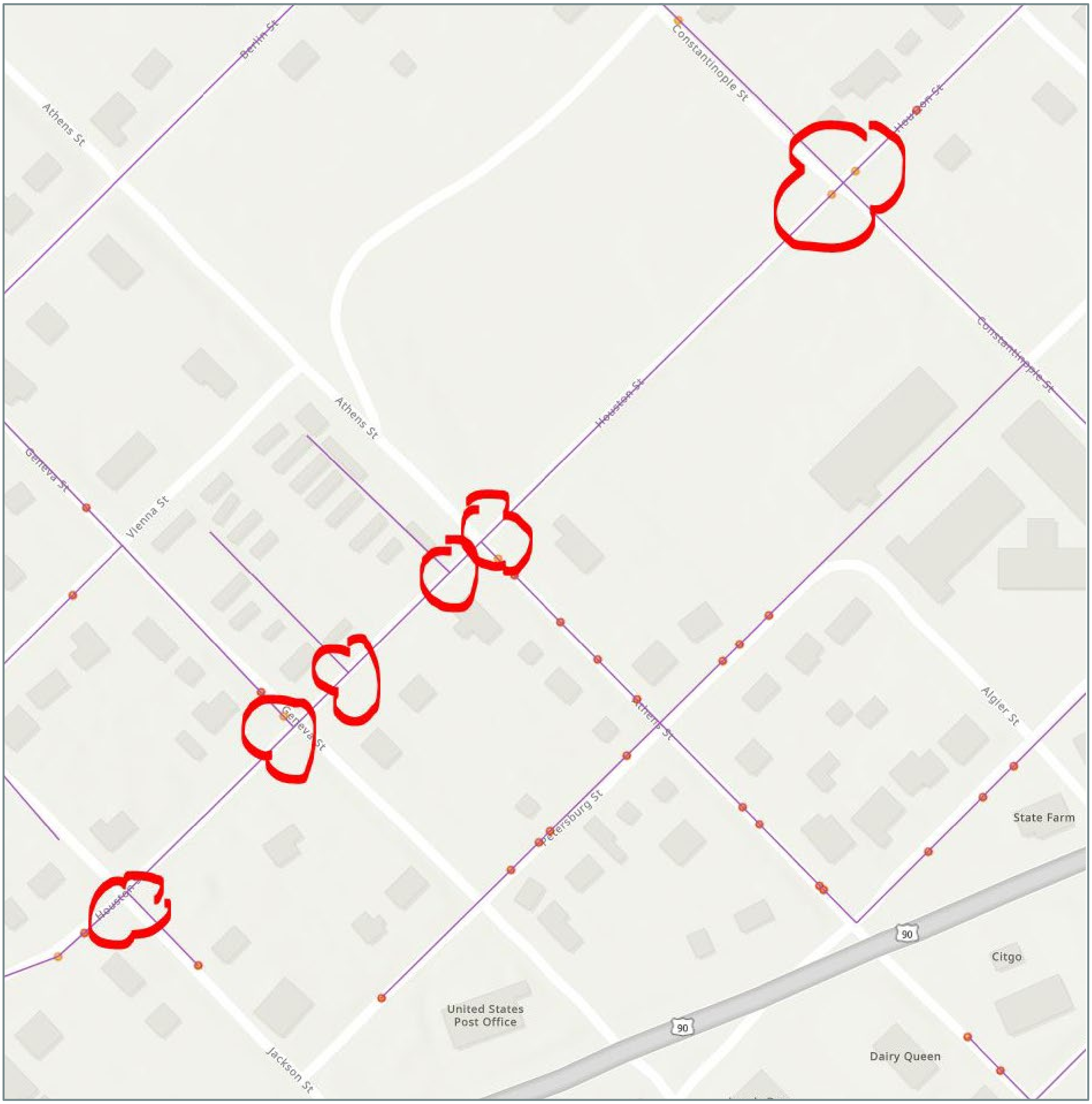


Figure 30: Houston St from Jackson St to Naples St

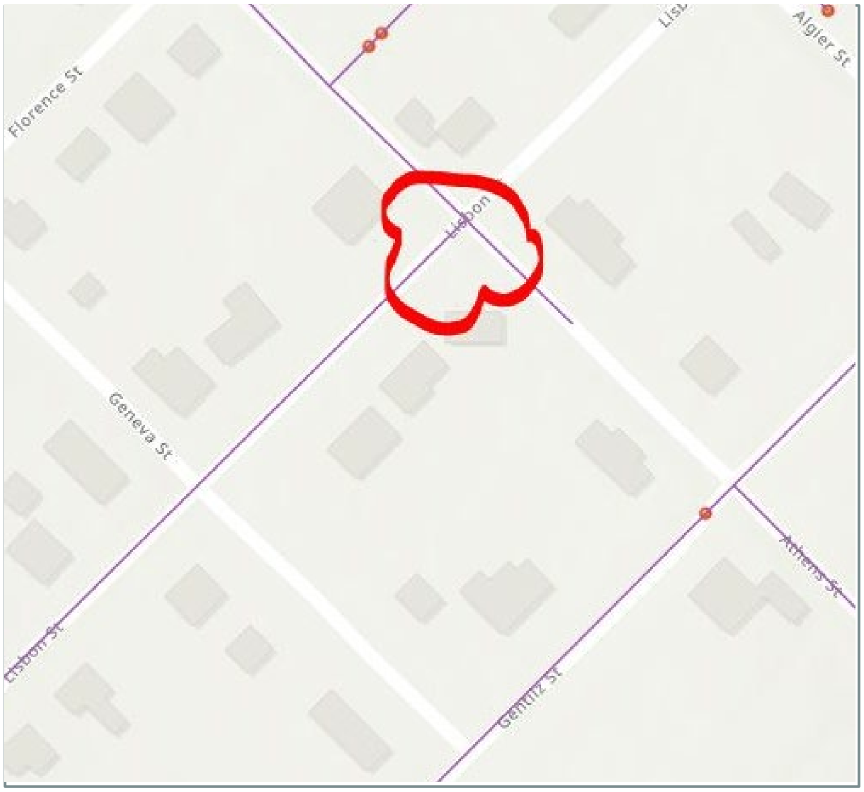


Figure 31: Lisbon St at Athens St

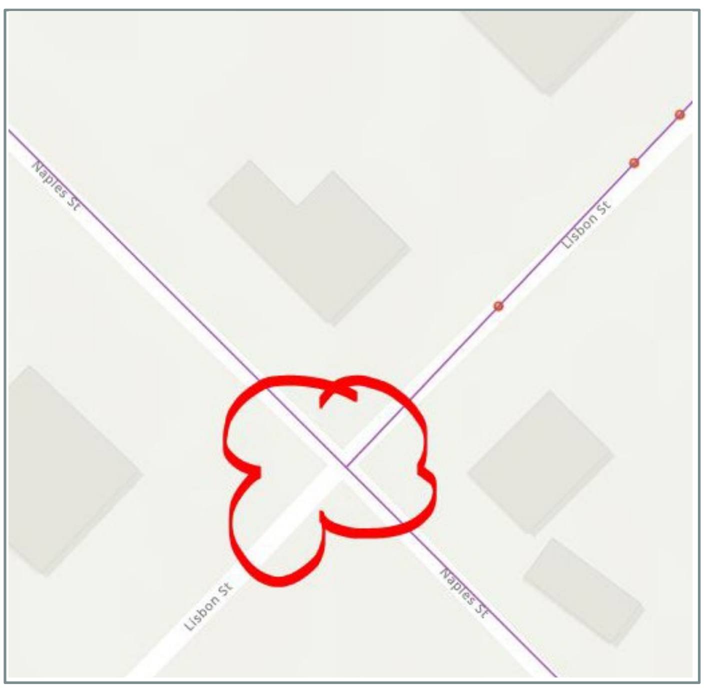


Figure 32: Lisbon St at Naples St

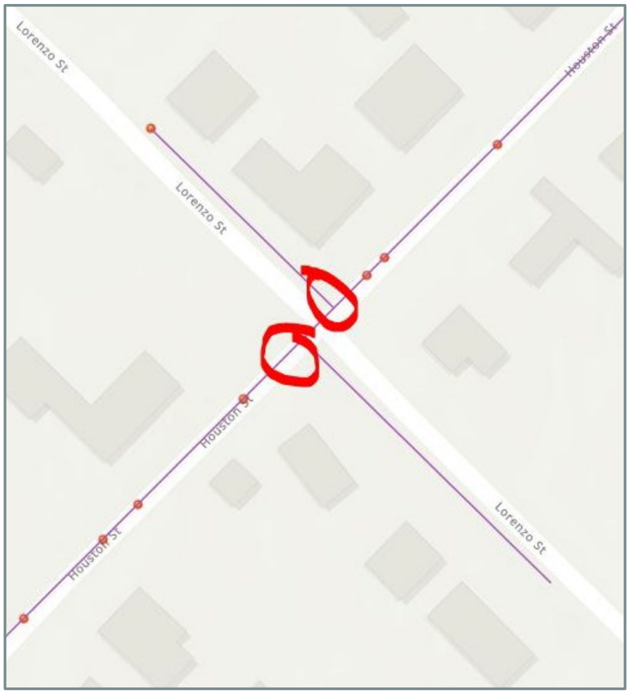


Figure 34: Houston St at Lorenzo St

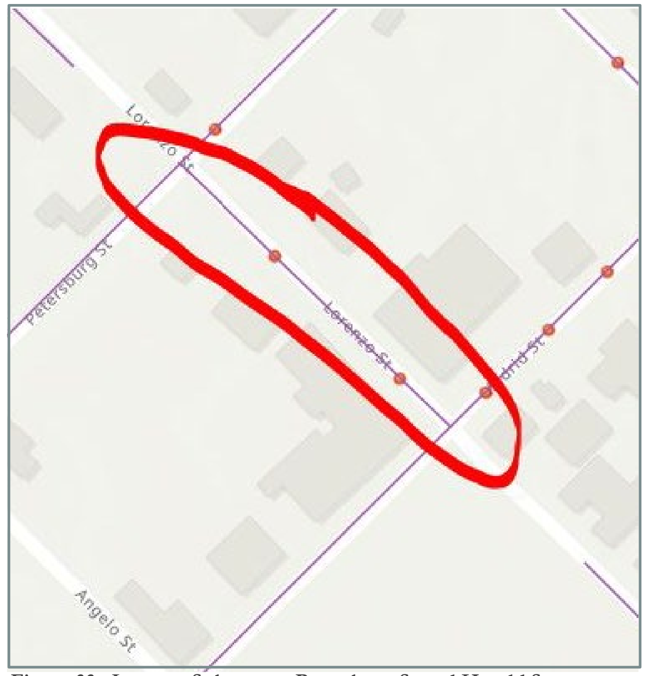


Figure 33: Lorenzo St between Petersburg St and Harold St

Figure 35: Lorenzo St from Paris St to Florence St

Figure 36: Lower La Coste Rd at Paynes Haven Rd

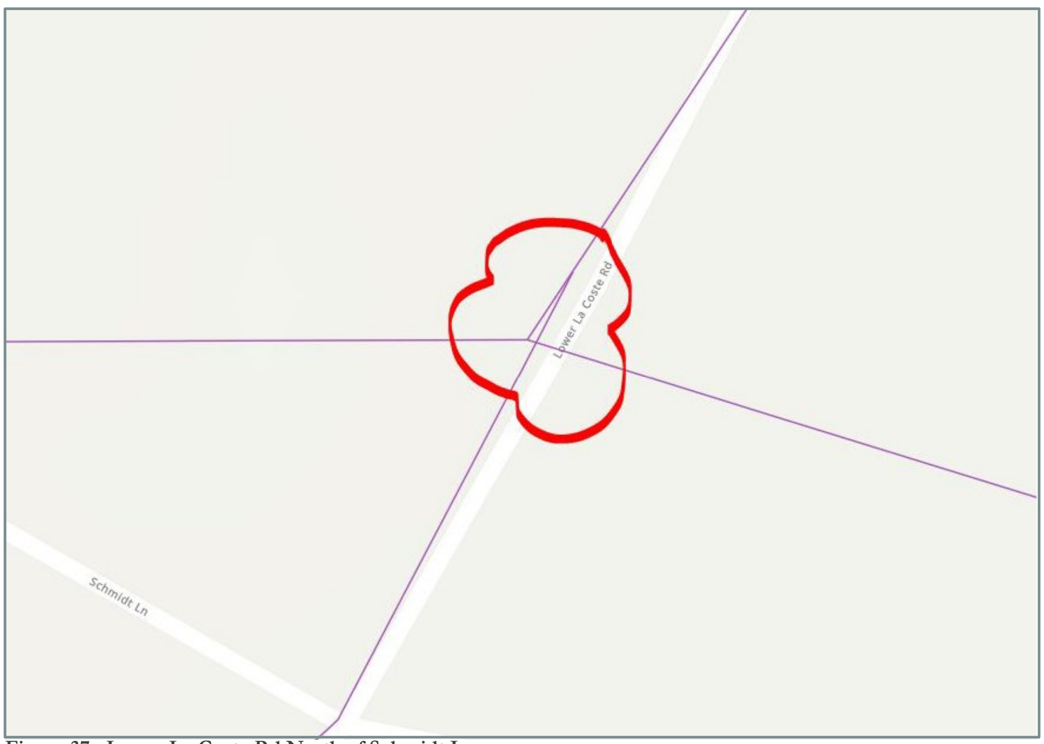


Figure 37: Lower La Coste Rd North of Schmidt Ln

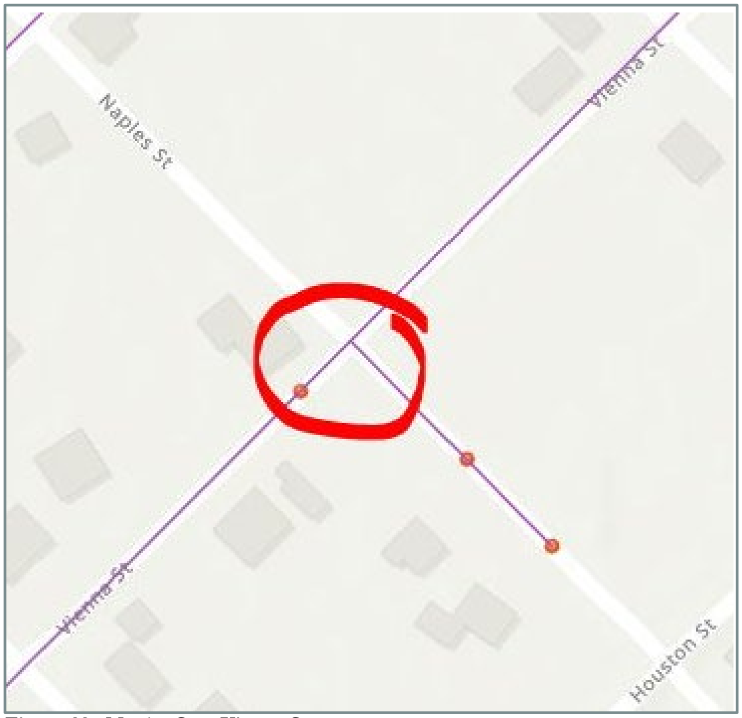


Figure 38: Naples St at Vienna St

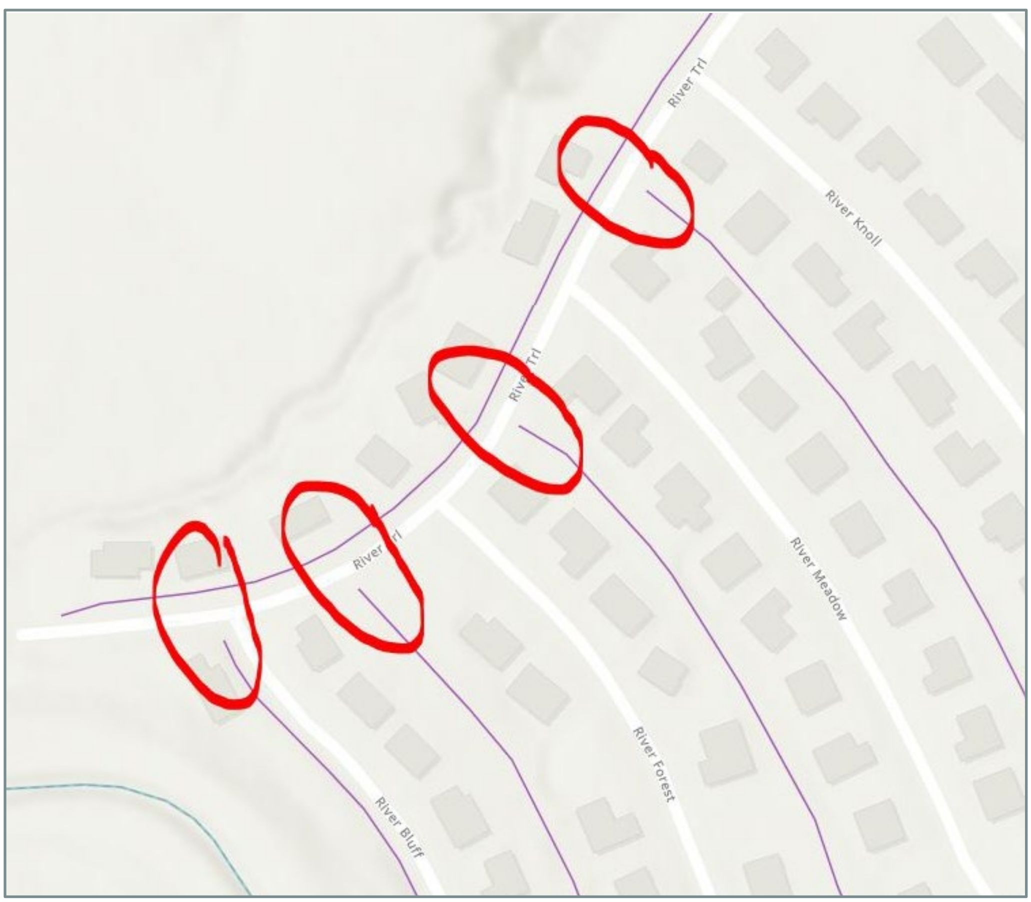


Figure 39: River Trail between River Bluff and River Knoll

Figure 40: San Jacinto St at Berlin St

Figure 41: San Jacinto St between Houston St and Petersburg St

Figure 42: LaFayette St at Alamo St

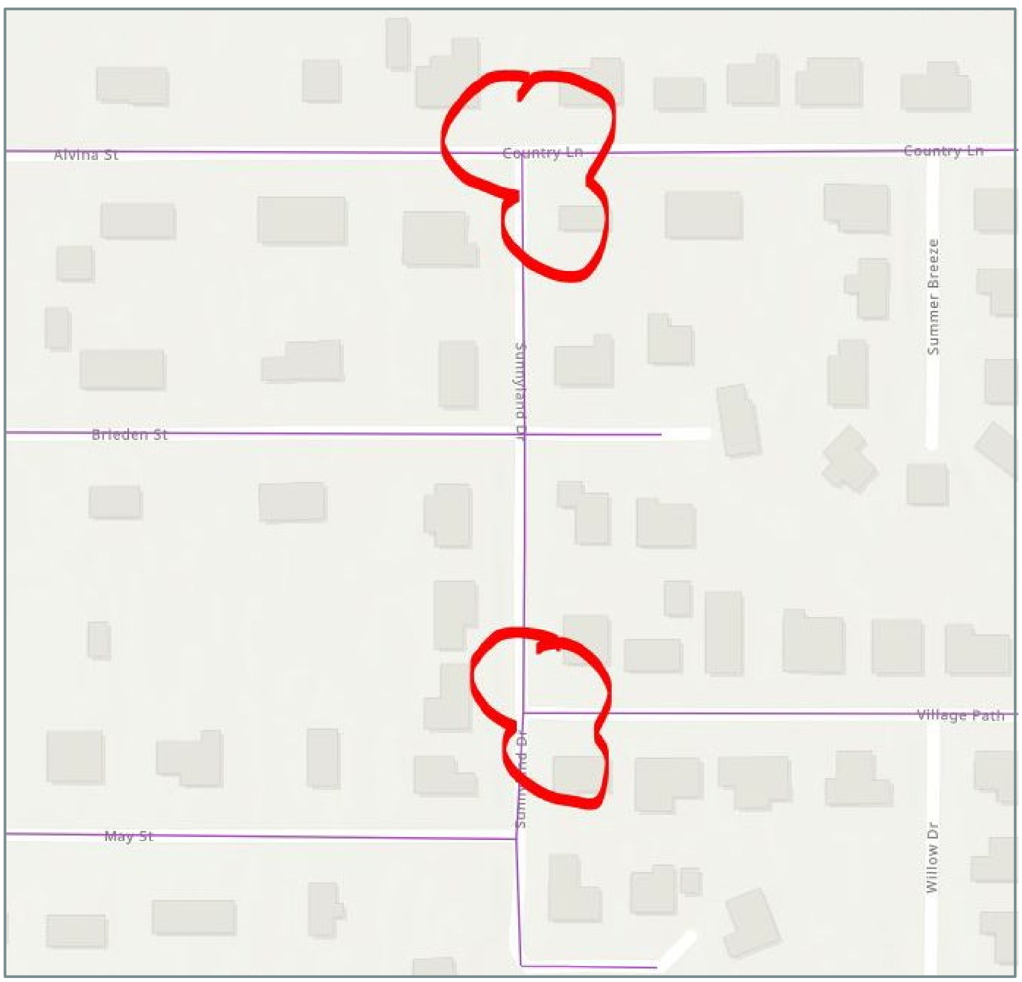


Figure 43: Sunnyland Dr between Country Ln and Village Path

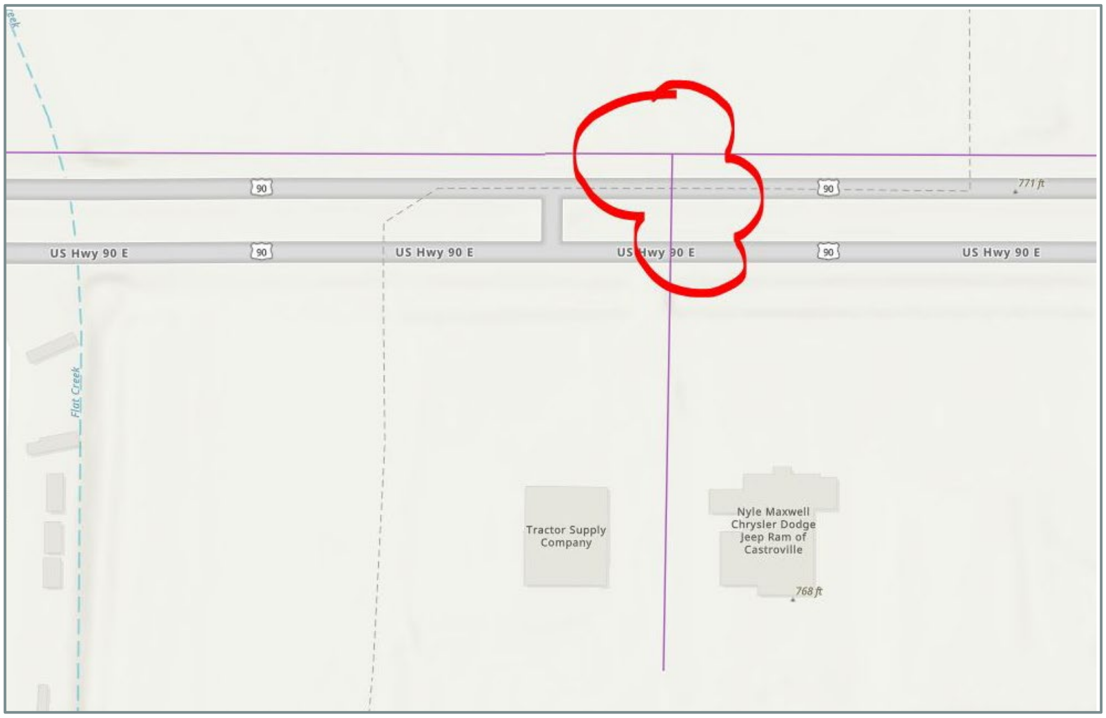


Figure 44: US 90 Tractor Supply Lateral

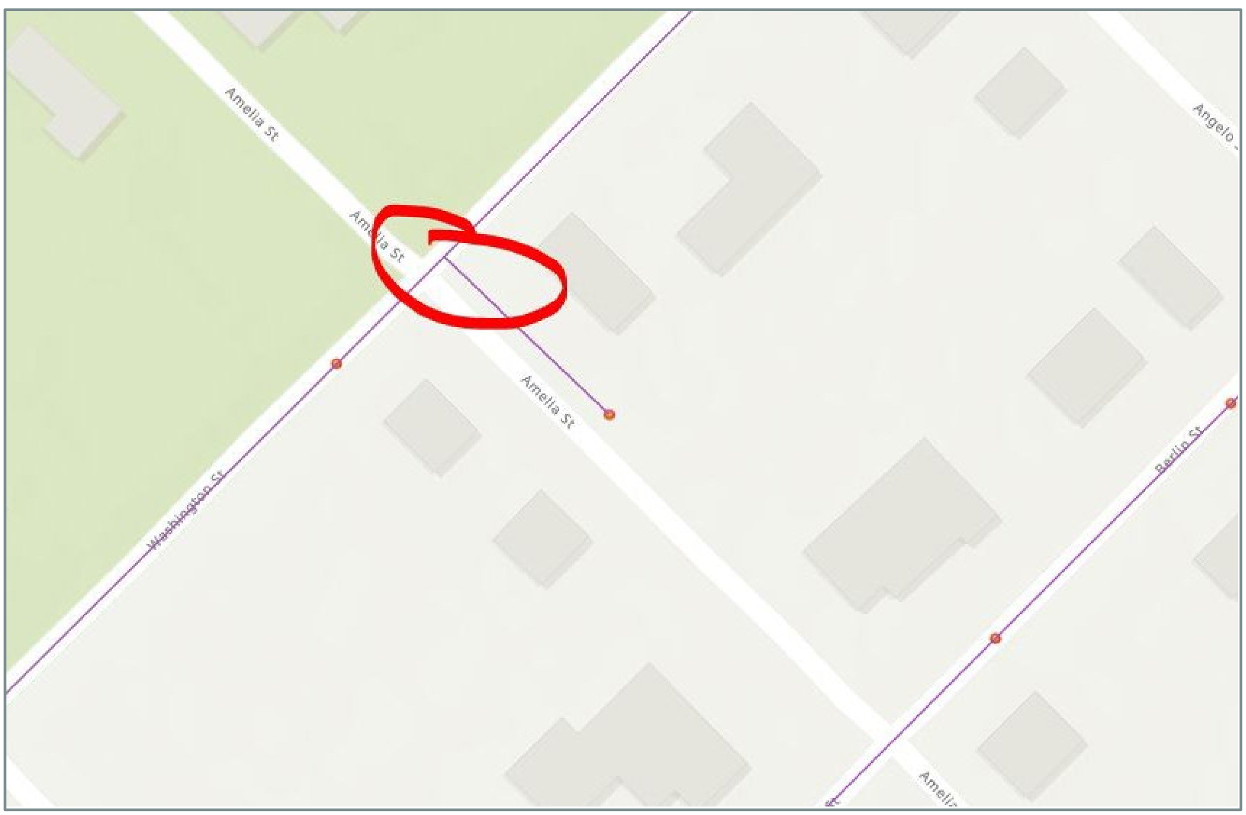


Figure 45: Washington St at Amelia St

APPENDIX B: ASSUMED PIPE SIZE

Figure 46: Athens St South of Gentilz St (assumed as 2" steel)

Figure 47: Lisbon St from West of Jackson St to Athens St (assumed as 2" steel)

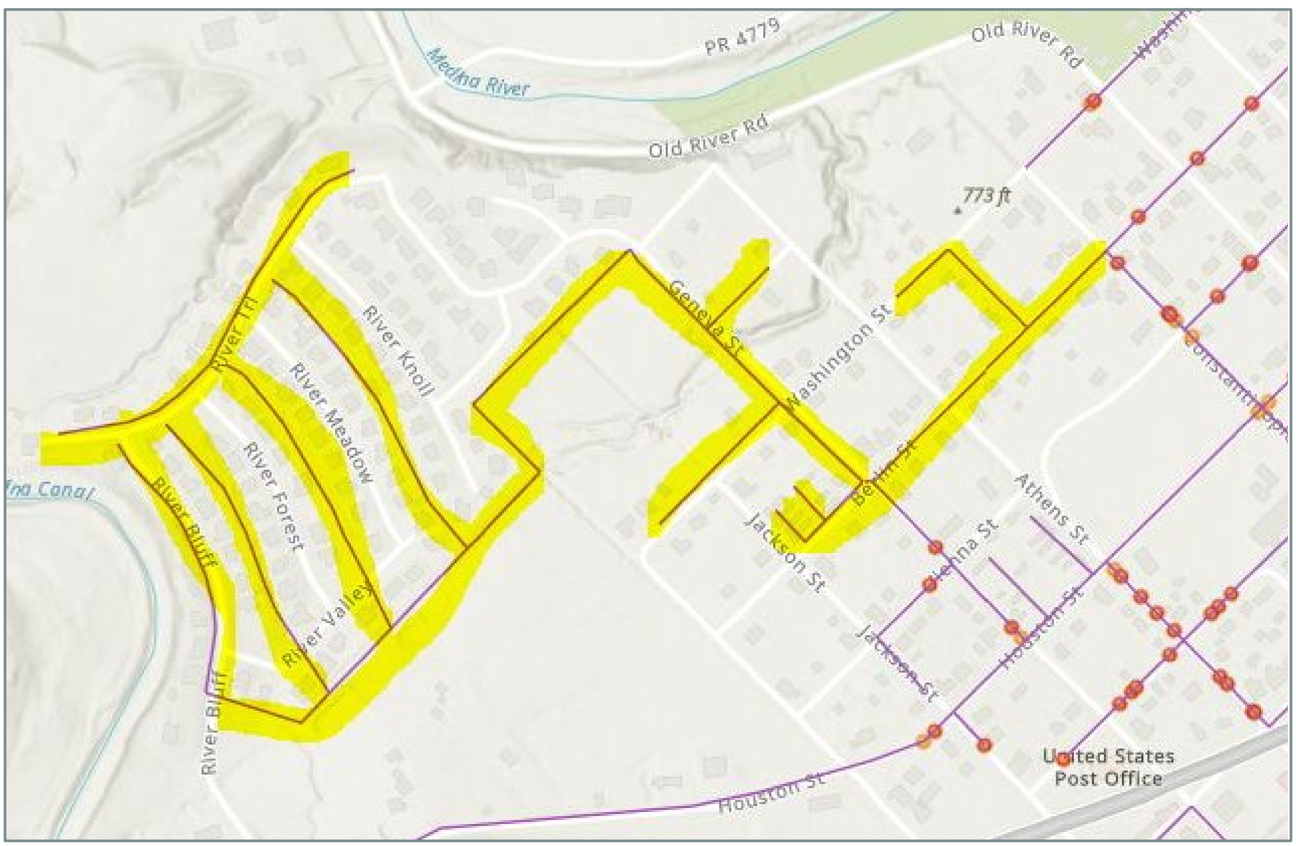


Figure 48: System from Berlin St at Constantinople St to North and West Limits (assumed 2" poly)

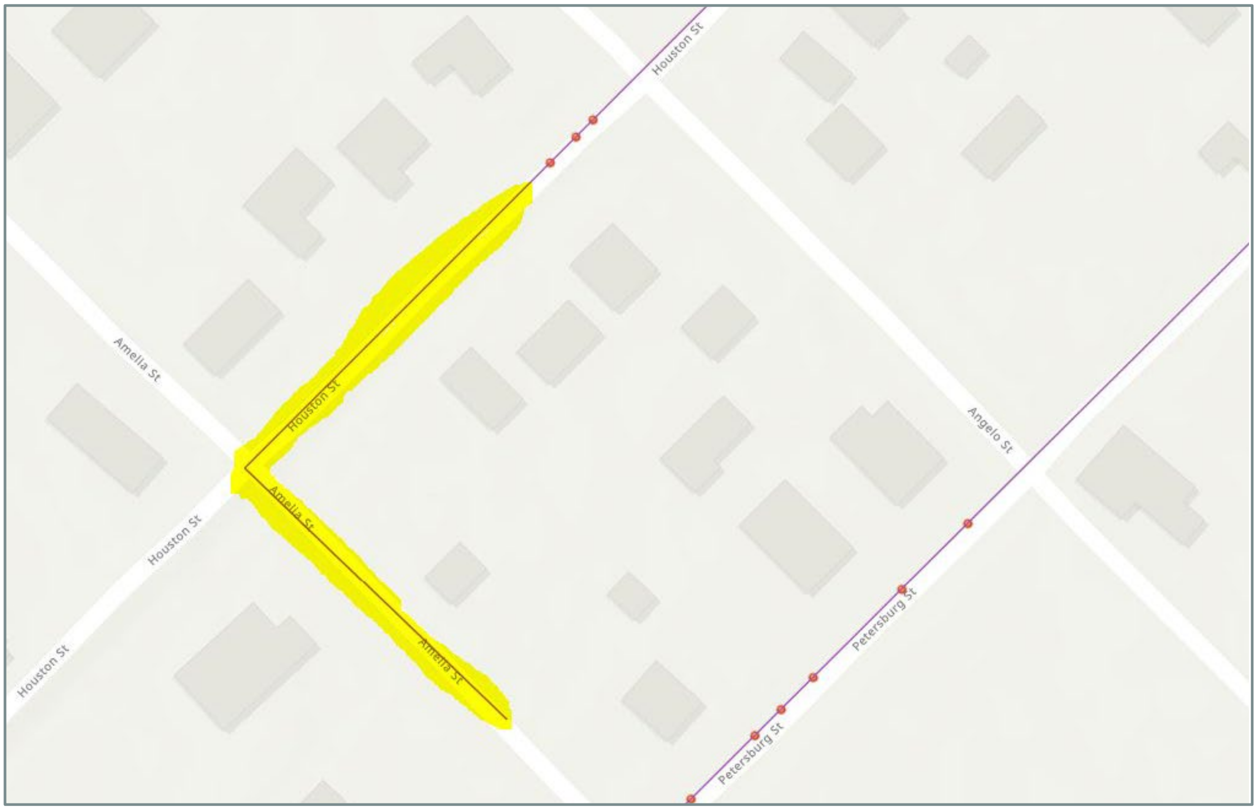


Figure 49: Amelia St and Houston St (assumed as 2" steel)

Figure 50: System off of FM 471 North of Provident Ave (assumed as 2" poly)

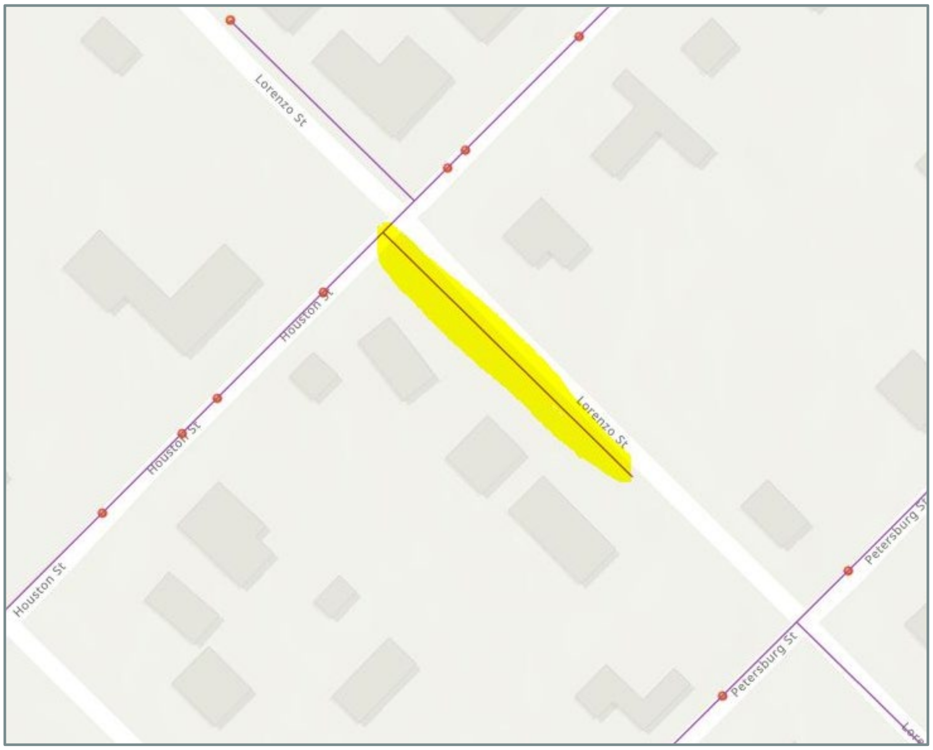


Figure 51: Lorenzo St South of Houston St (assumed as 2" steel)

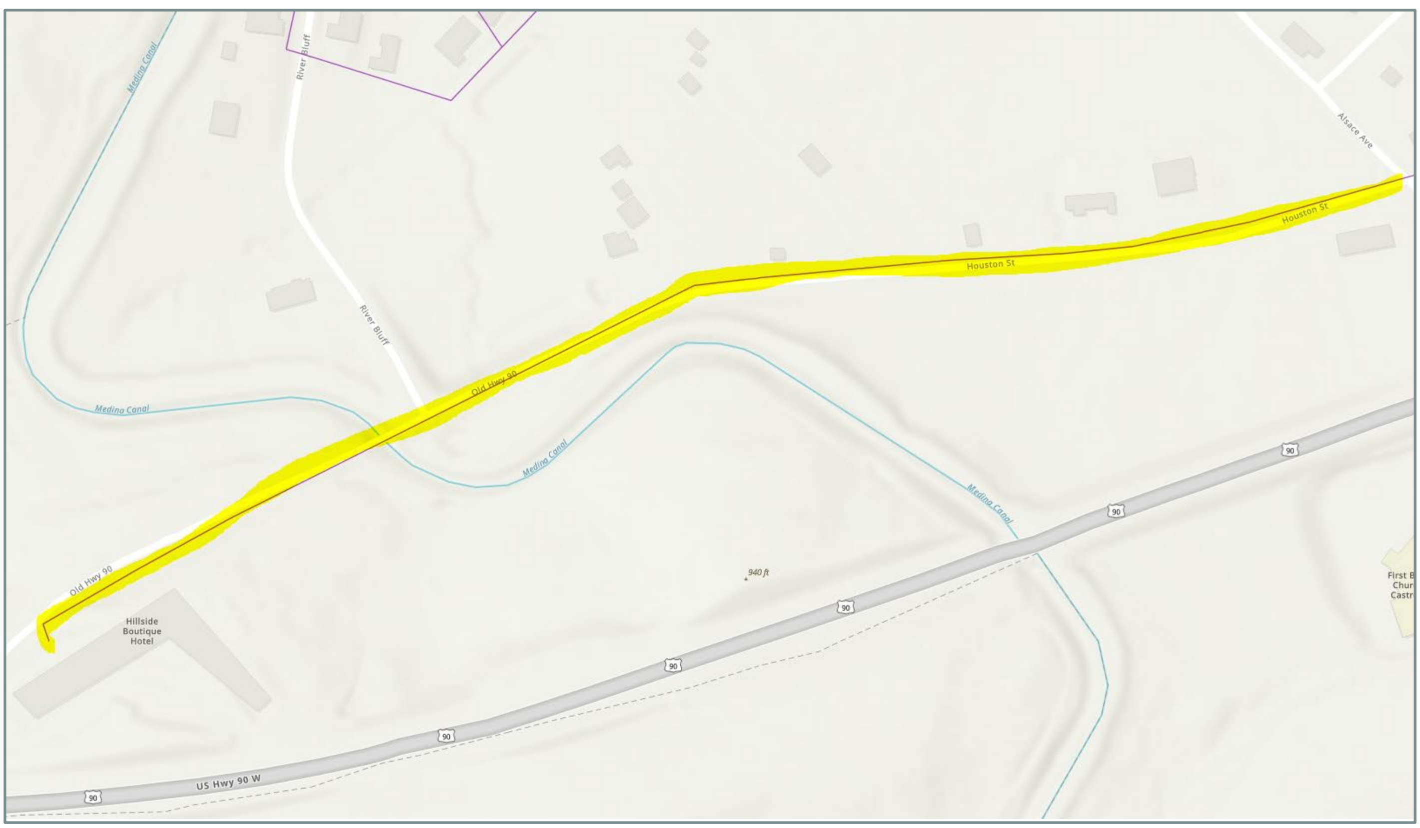


Figure 52: Old Hwy 90 West of Alsace Ave (field verified as 2" plastic)

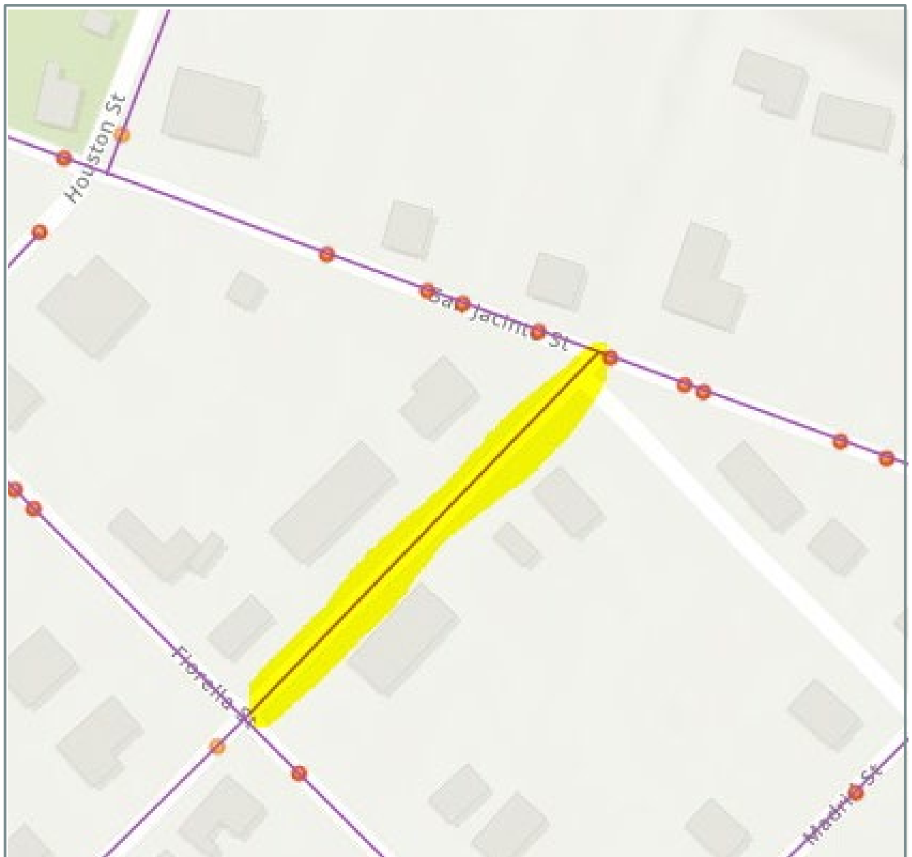


Figure 53: Petersburg St between Fiorella St and San Jacinto St (field verified as 1" steel)

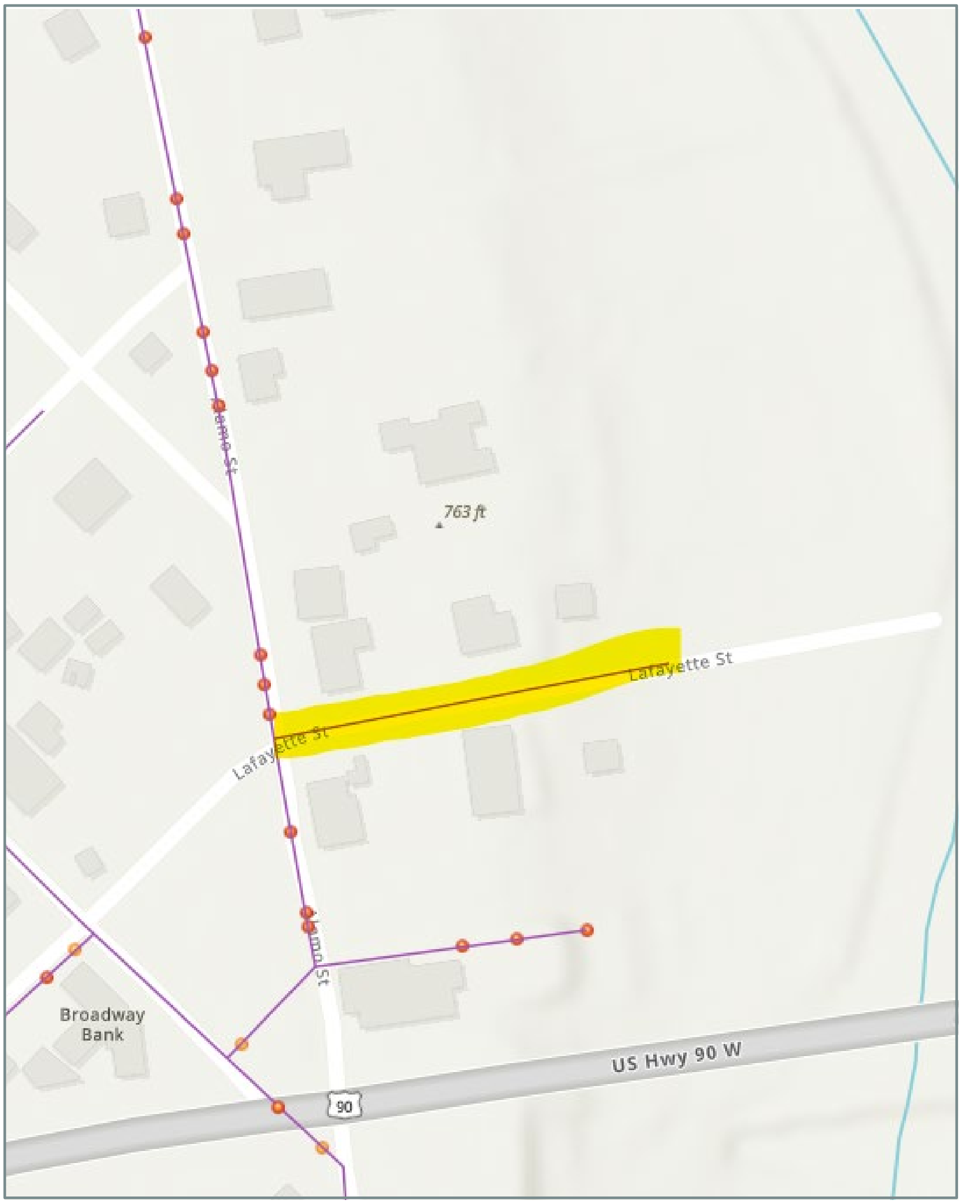


Figure 54: LaFayette St East of Alamo St (assumed 2" poly)

APPENDIX C: ADDED MAINS

Figure 55: Alley bound by Athens St-Lisbon St-Florence St-Geneva St GIS Map

Figure 56: Alley Location Pre-Model Revision

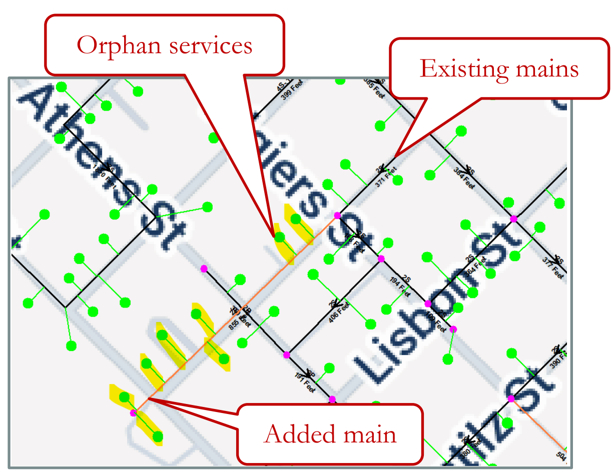


Figure 57: Alley Location Post Model Revision

Figure 58: Berlin toward Alsace Ave GIS Map

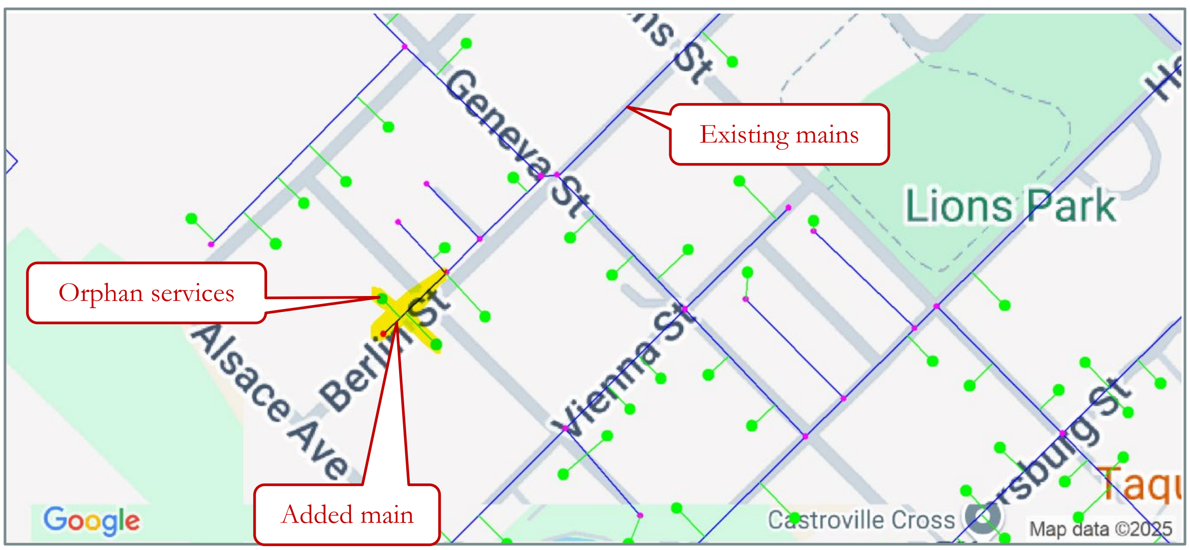


Figure 59: Berline toward Alsace Ave Model Justification

Figure 60: CR 5711 West of CR 483

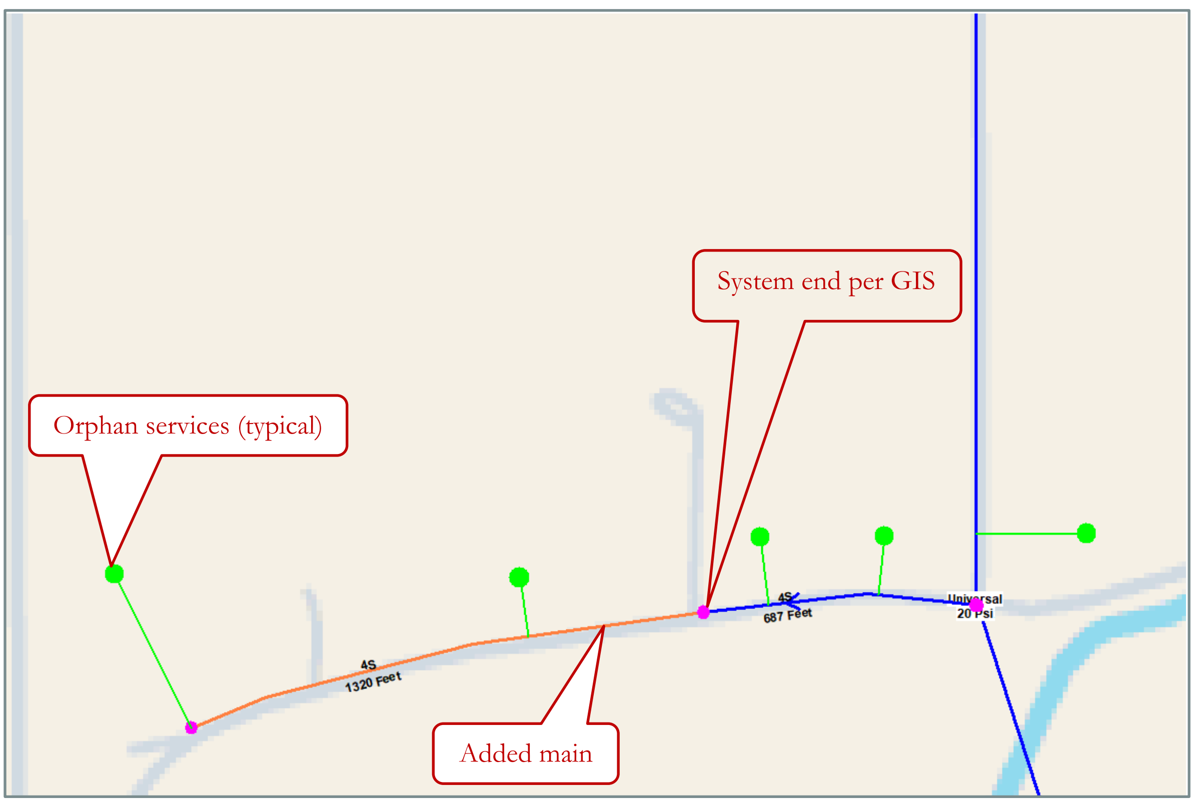


Figure 61: CR 5711 West of CR 483

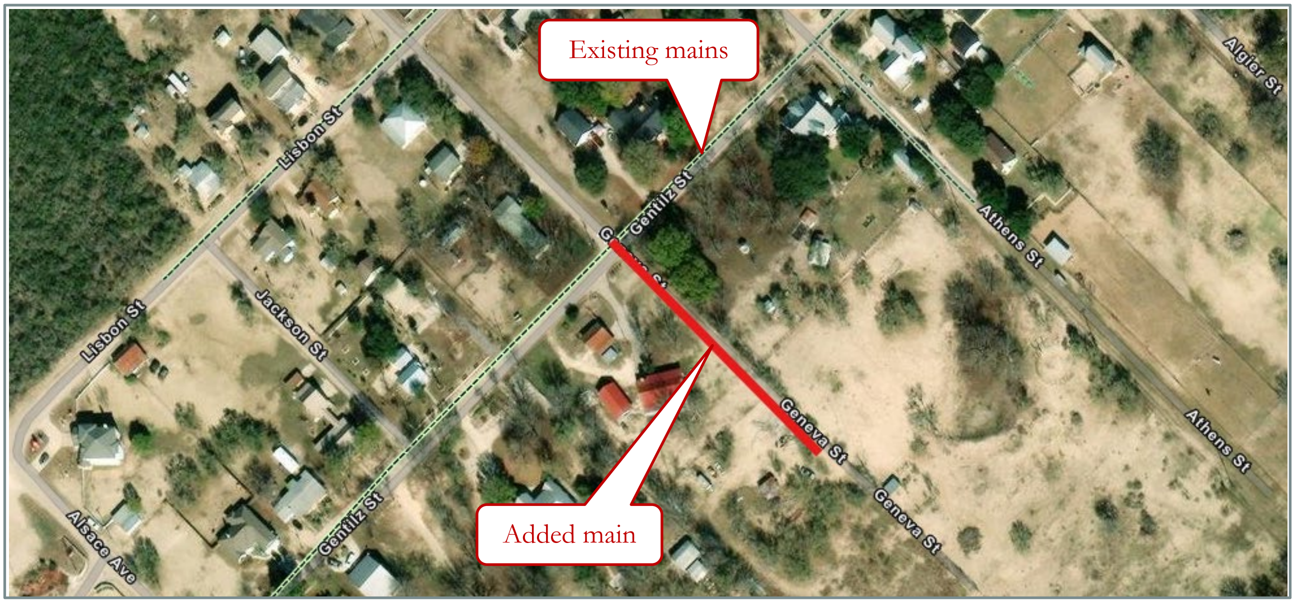


Figure 62: Geneva St South of Gentilz St GIS Map

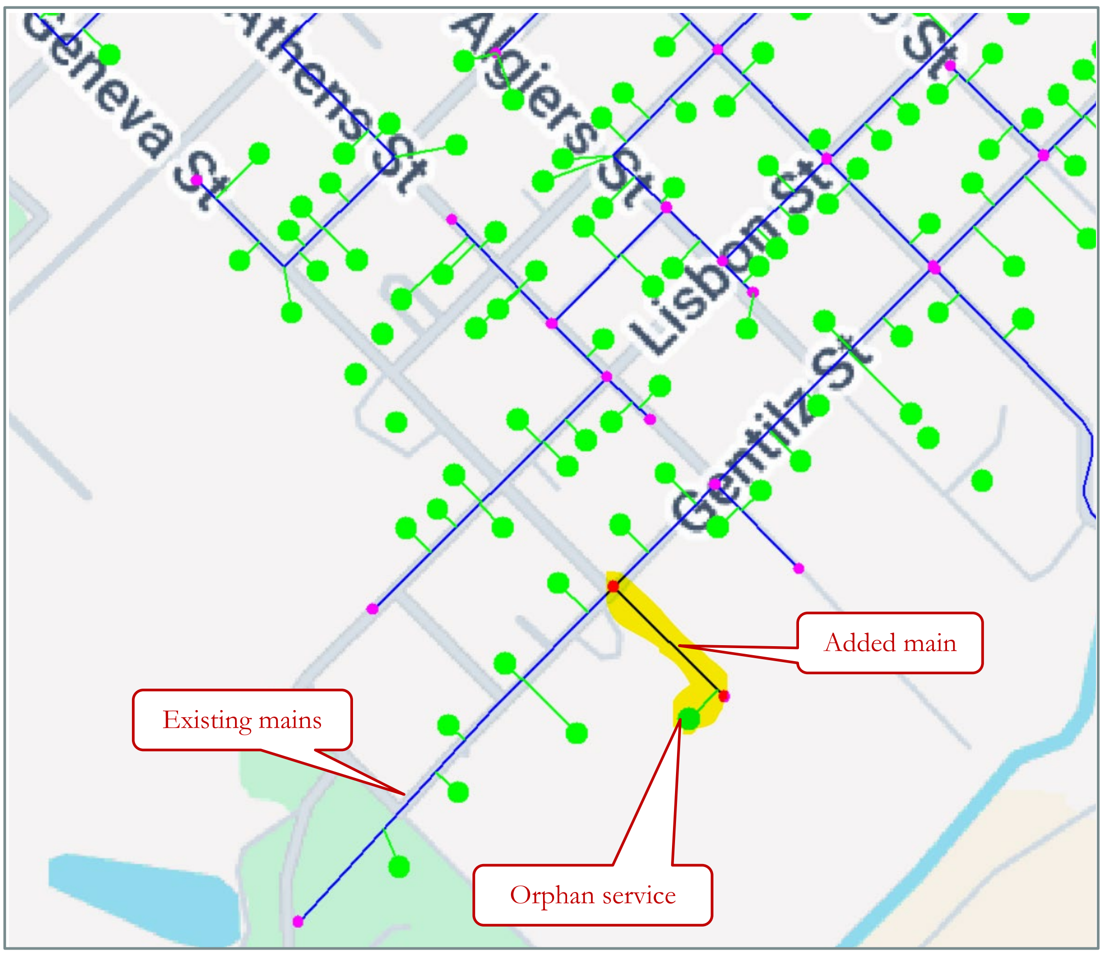


Figure 63: Geneva St South of Gentilz St Model Justification

Figure 64: Lower La Coste at Constantinople GIS Map

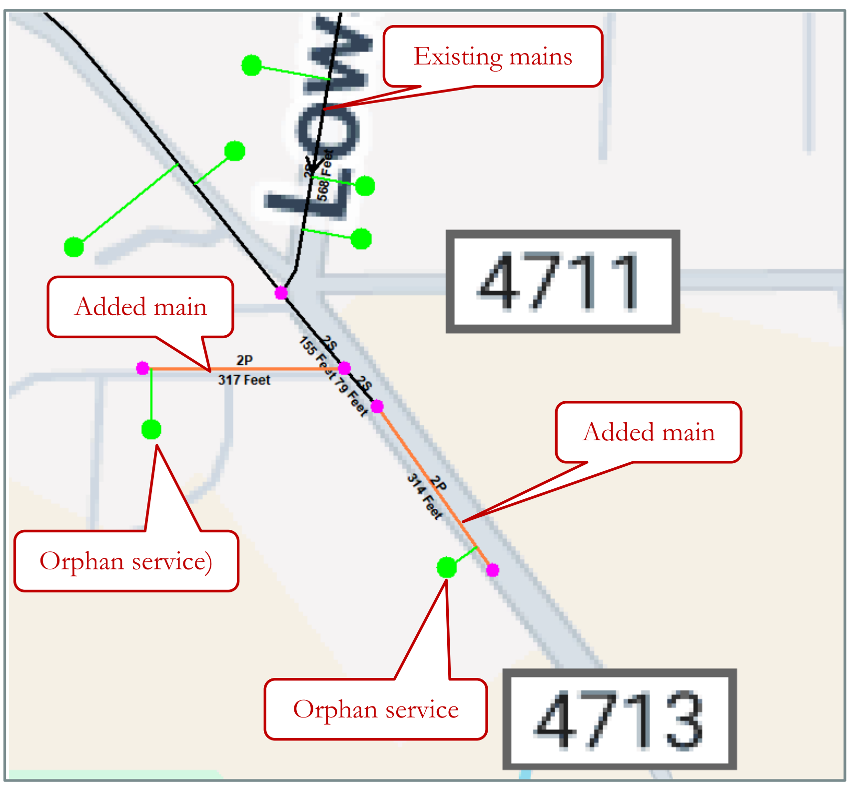


Figure 65: Lower La Coste at Constantinople Model Justification

Figure 66: Houston St between Mexico St and Angelo St GIS Map

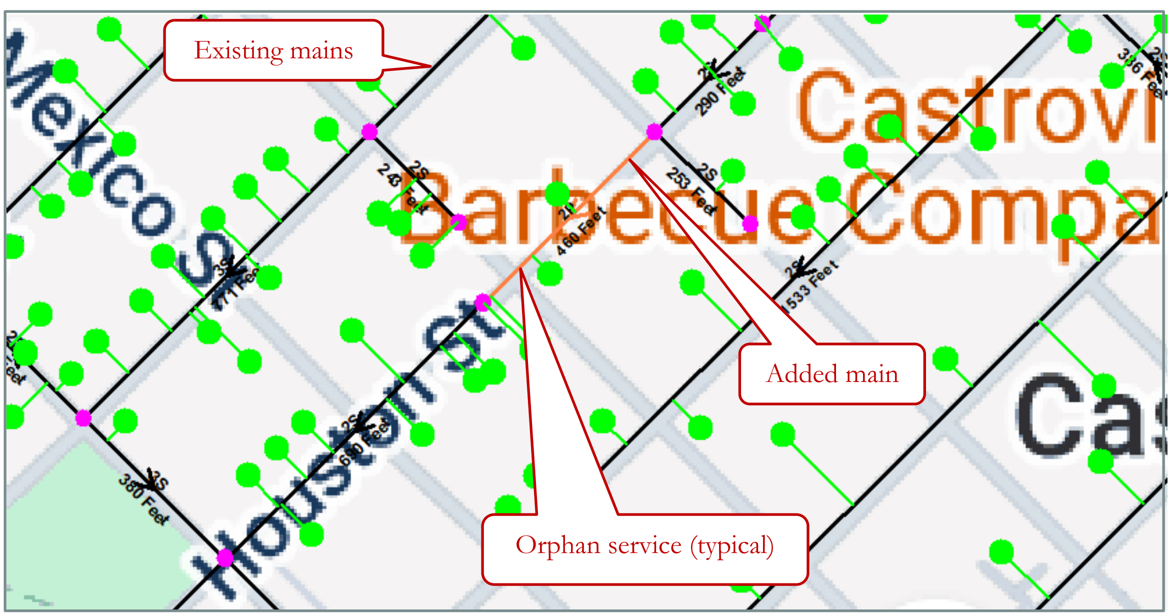


Figure 67: Houston St between Mexico St and Angelo St Model Justification

Figure 68: London St between Mexico St and Naples St GIS Map

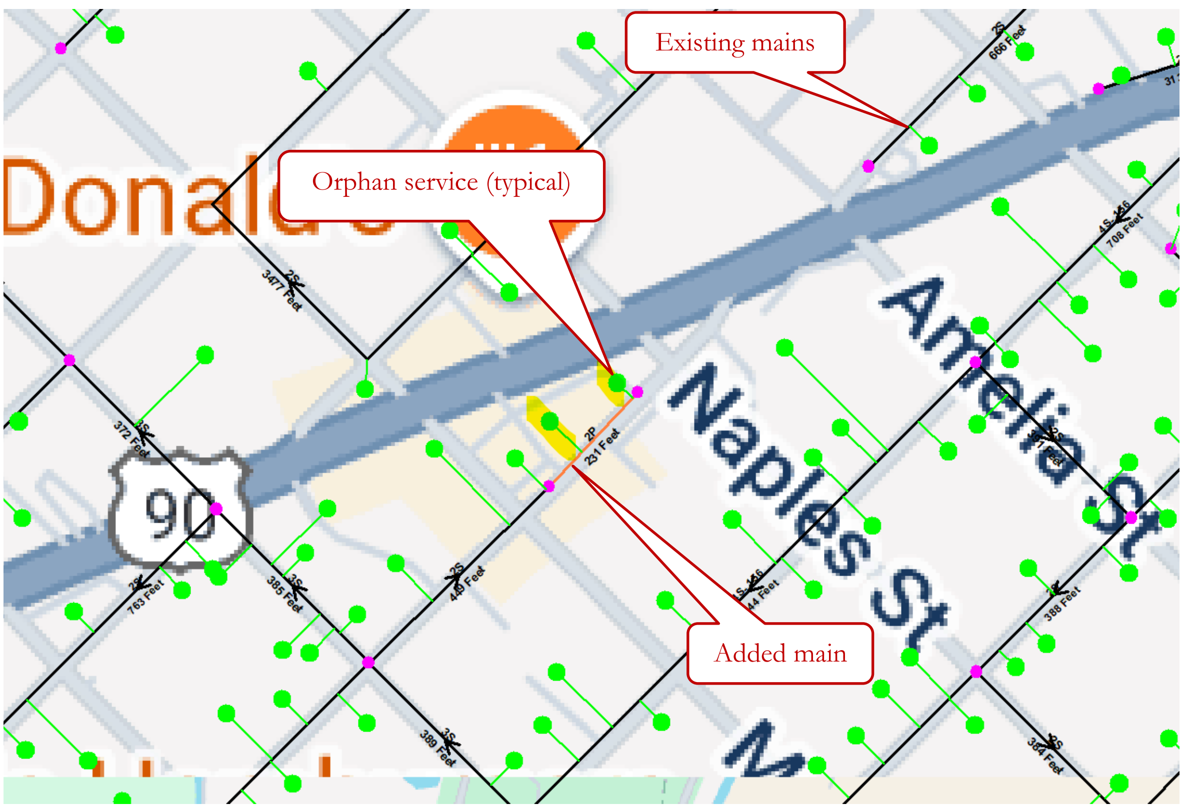


Figure 69: London St between Mexico St and Naples St Model Justification

Figure 70: River Trail and Geneva Area GIS Map

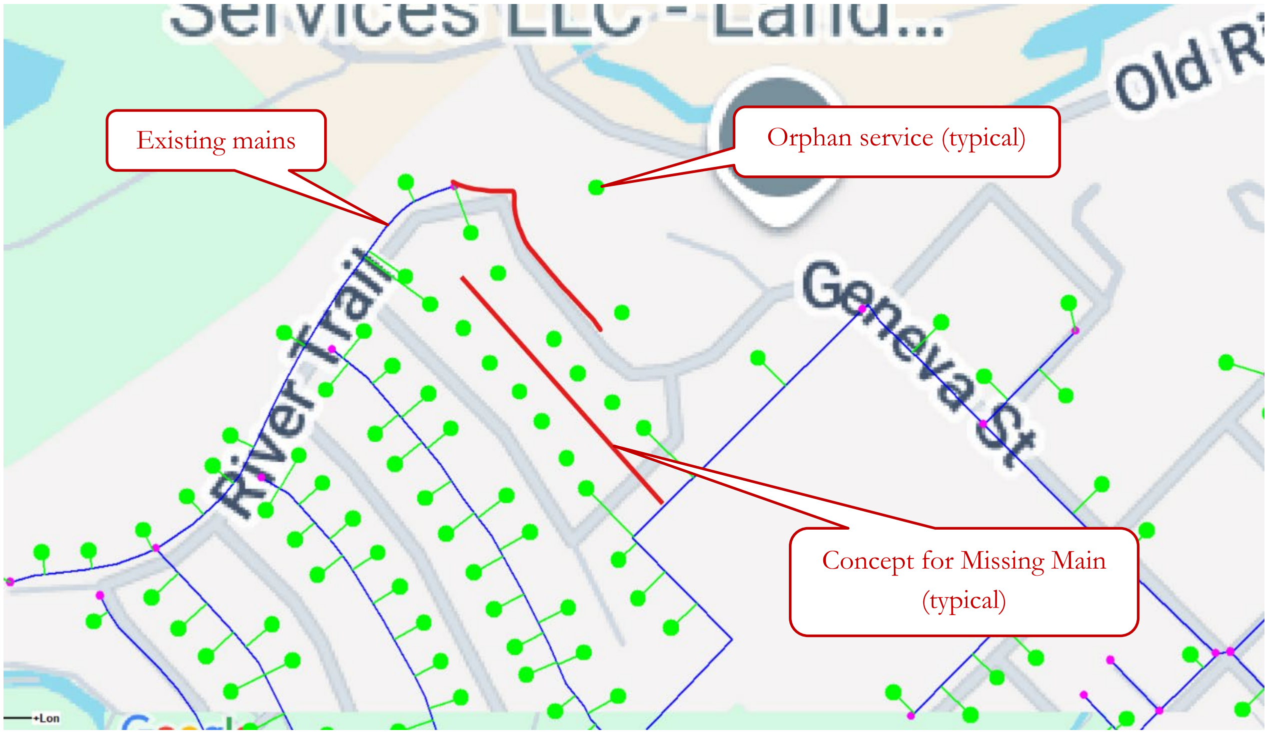


Figure 71: River Trail and Geneva St Area Pre-Model Revisions

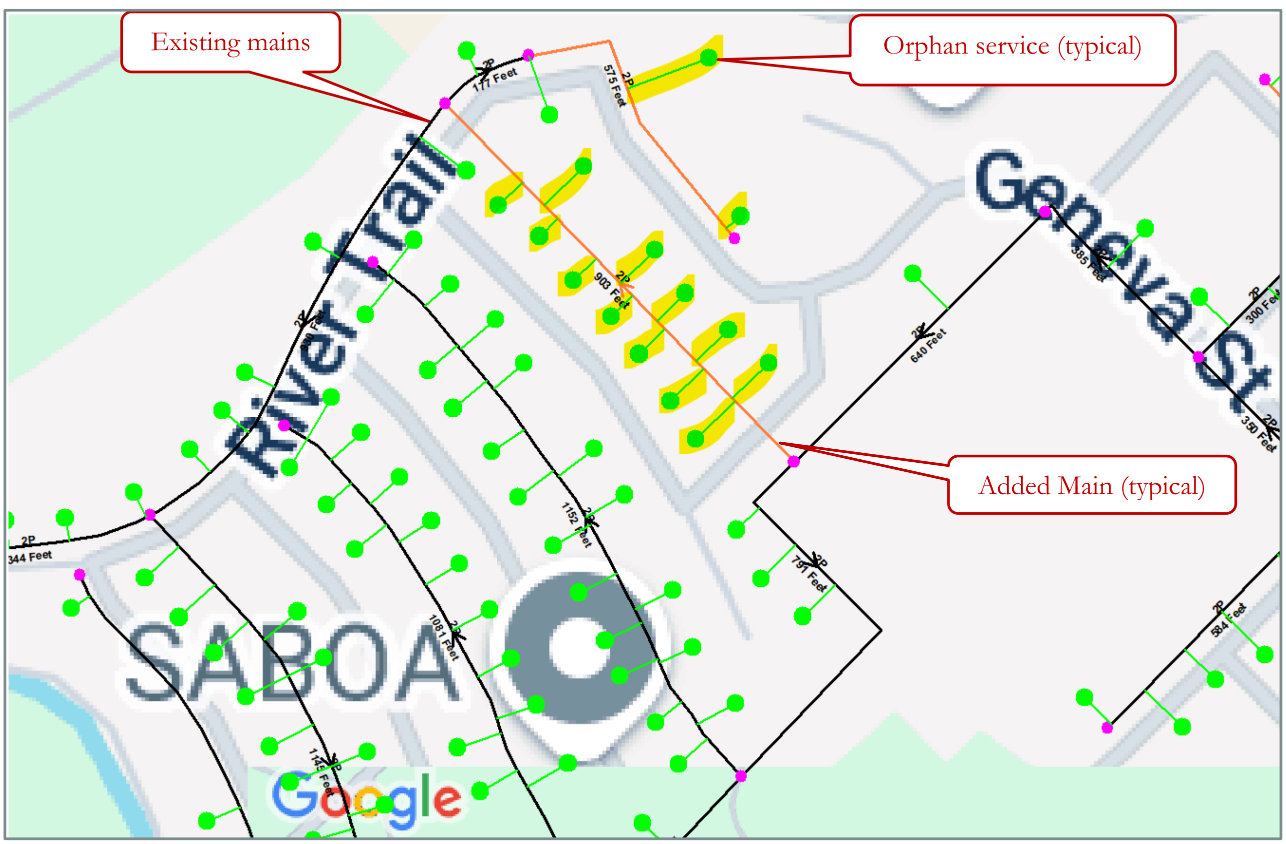


Figure 72: River Trail and Geneva Area Post Model Revisions

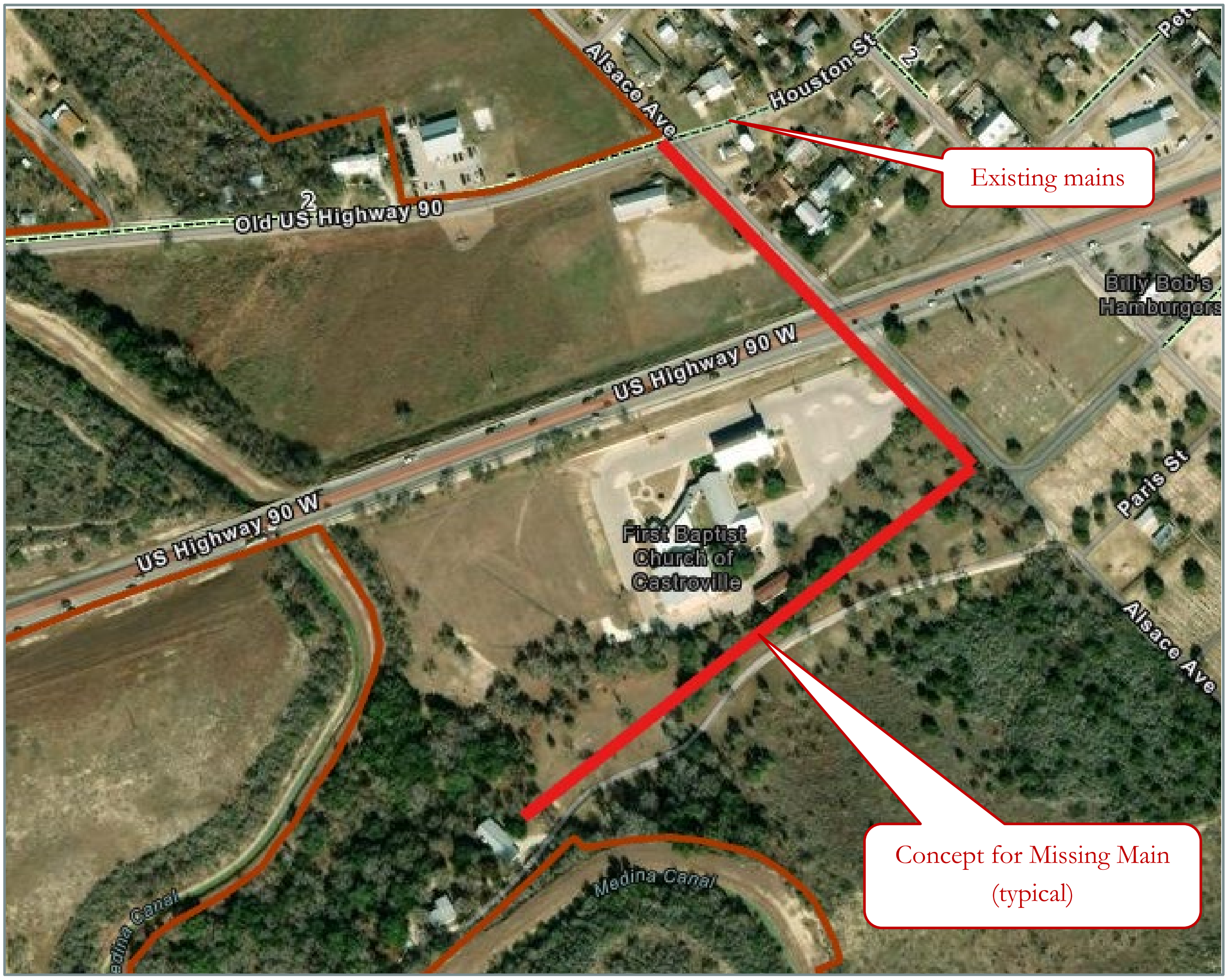


Figure 73: US 90W and Alsace Ave Area GIS Map

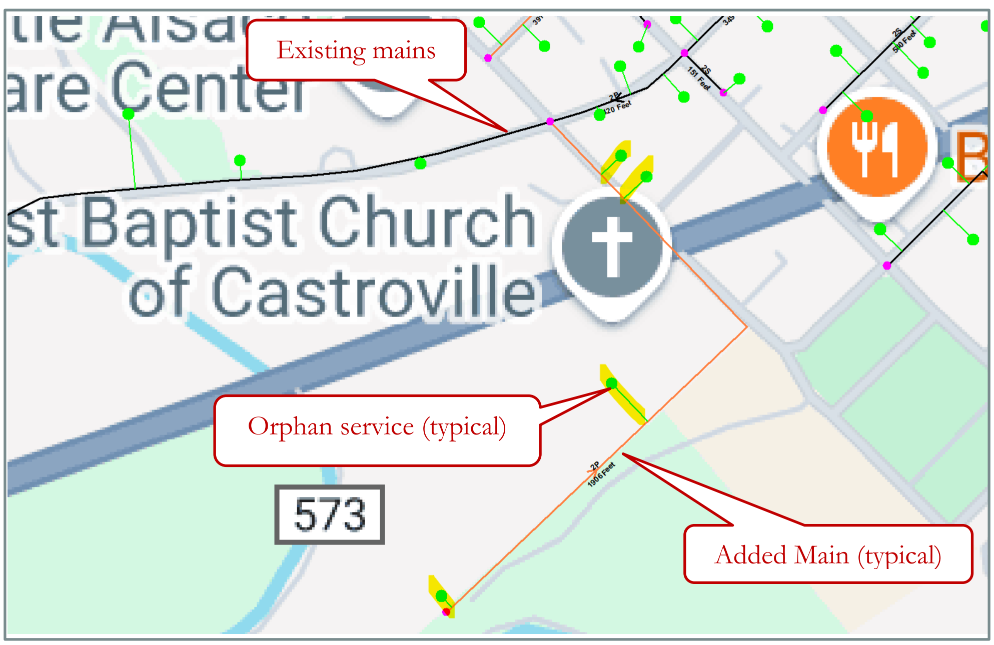


Figure 74: US 90W and Alsace Ave Area Model Justification

Figure 75: Vienna St between Geneva St and Athens St GIS Map

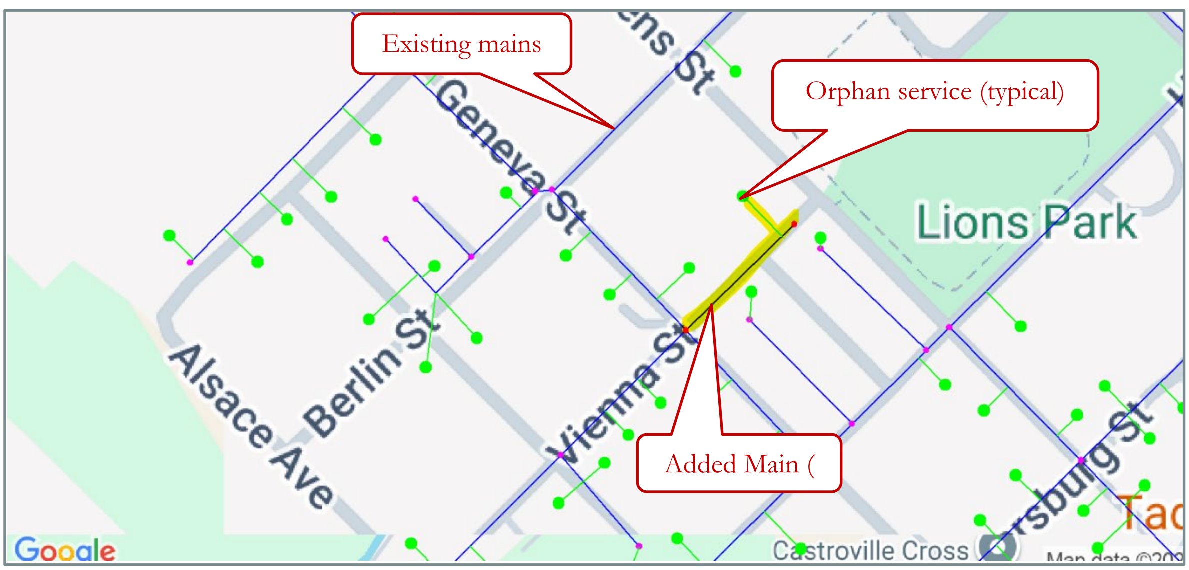


Figure 76: Vienna St between Geneva St and Athens St Model Justification

Figure 77: Washington St from Algiers St to Constantinople St GIS Map

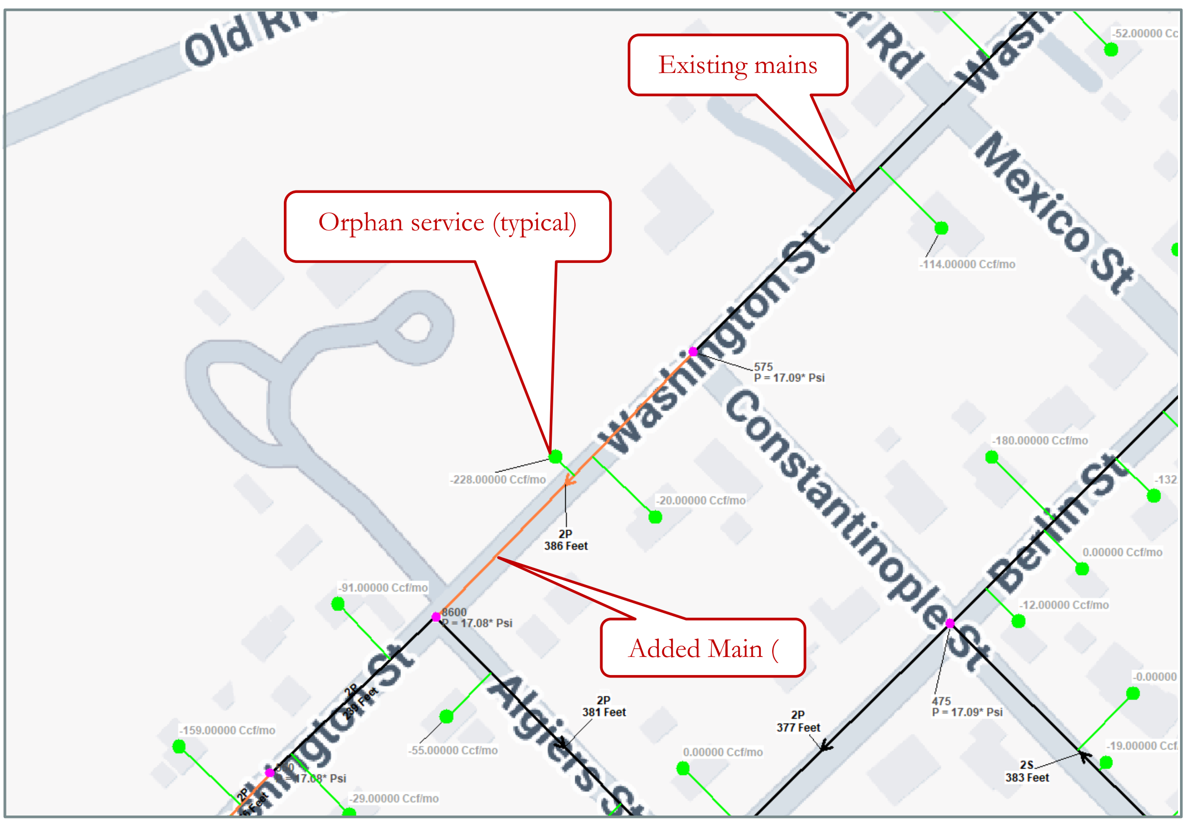


Figure 78: Washington St from Algiers St to Constantinople St Model Justification

Figure 79: Westheim Dr and Strausbourgh GIS Map

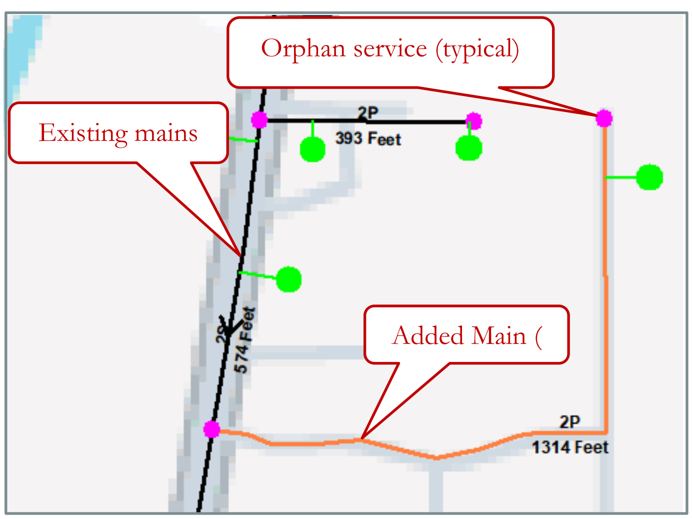


Figure 80: Westheim Dr and Strausbourgh Model Justification

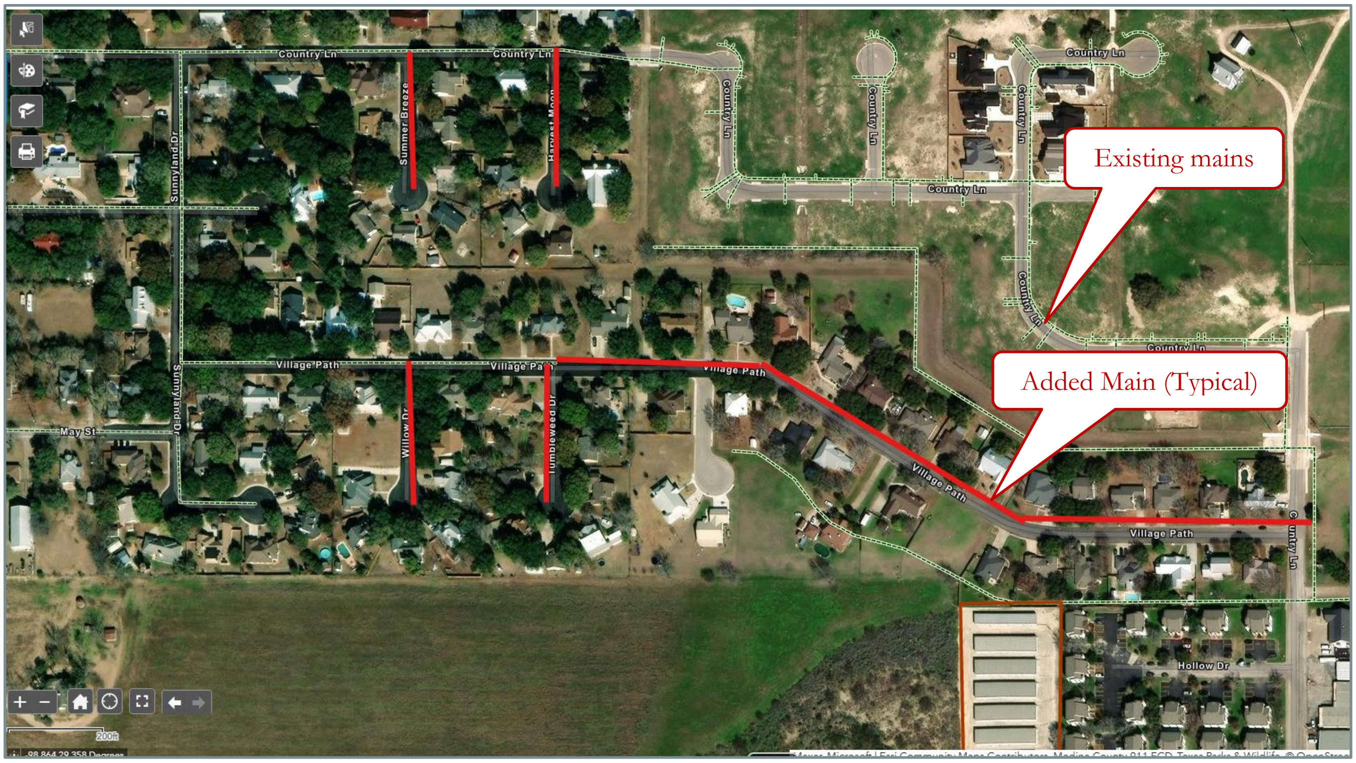


Figure 81: Mains off Village Path and Country Ln GIS Map

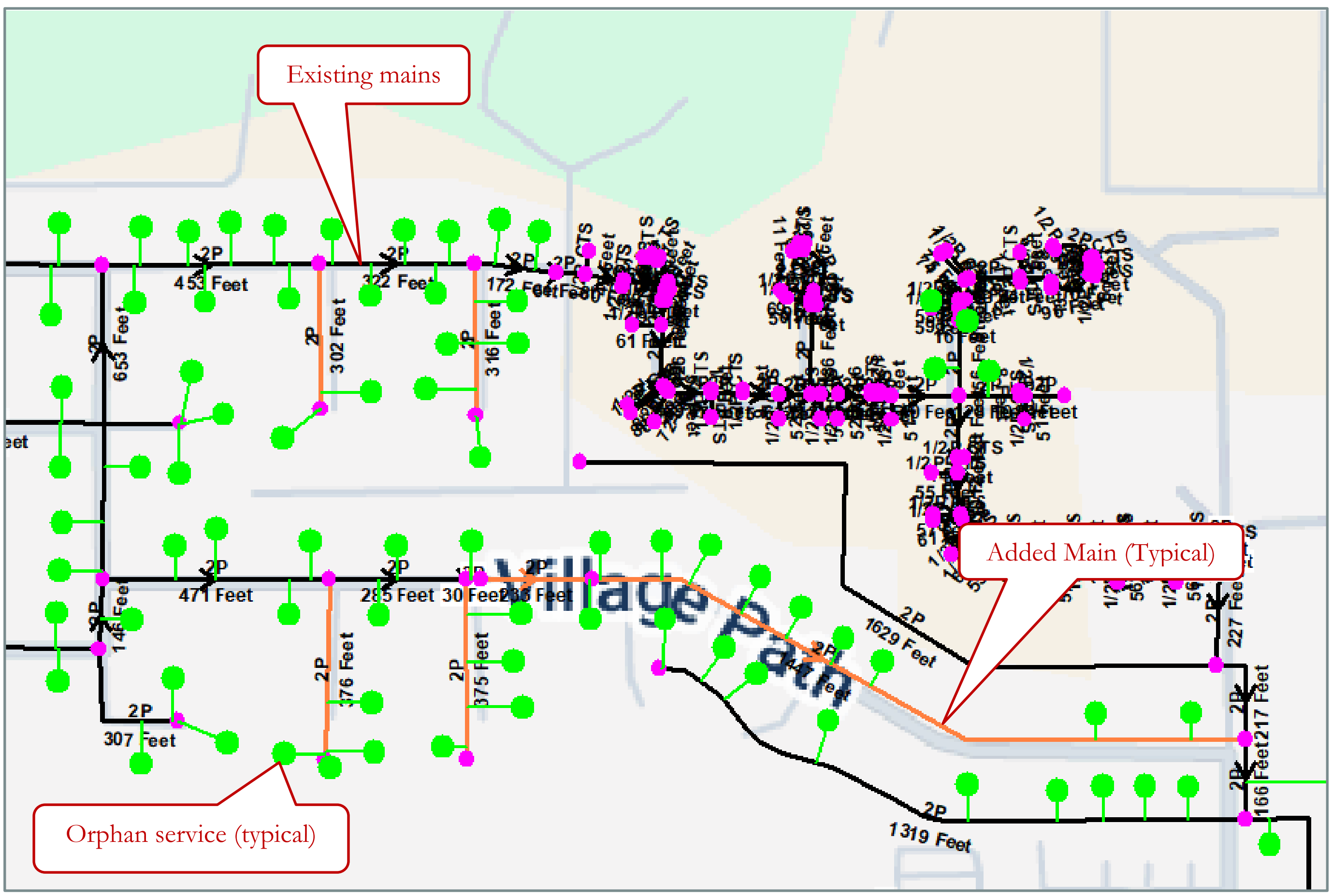


Figure 82: Mains off Village Path and Country Ln Model Justification

Figure 83: Algiers St South of Geneva St GIS Map

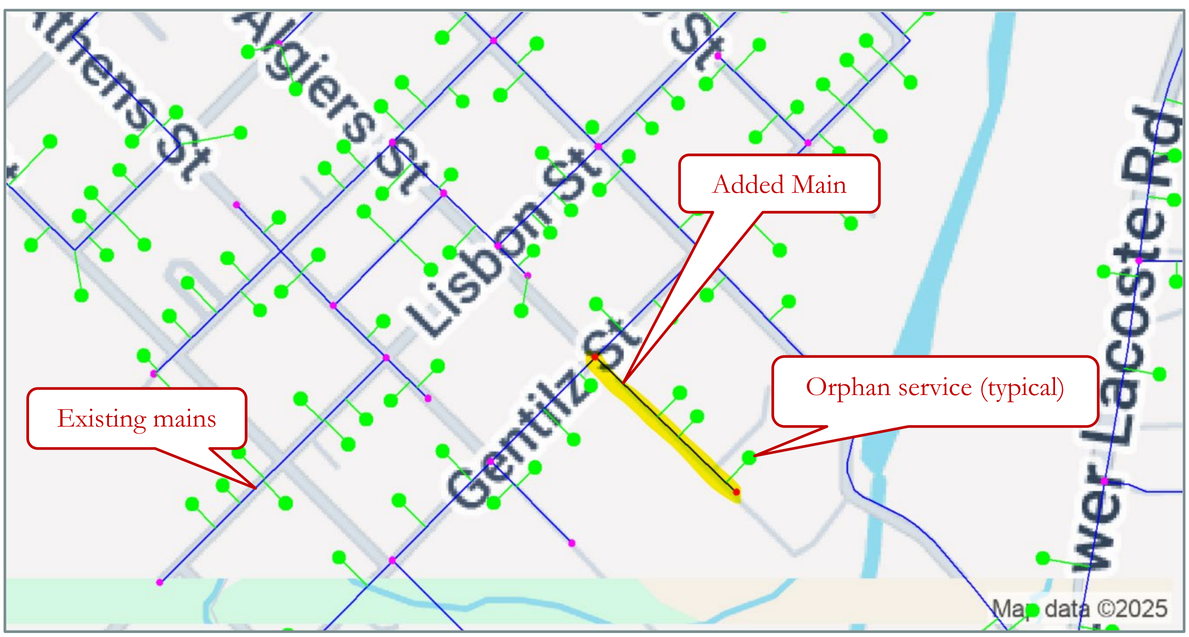


Figure 84: Algiers St South of Geneva St Model Justification

Figure 85: Florence from Algiers St to West of Geneva St GIS Map

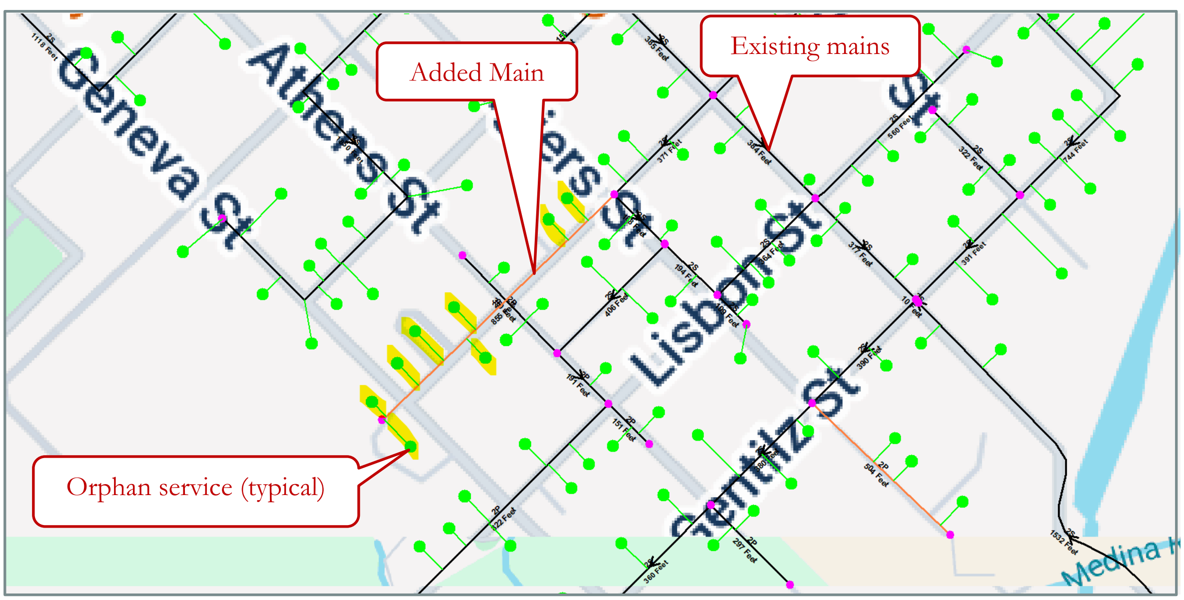


Figure 86: Florence from Algiers St to West of Geneva St Model Justification

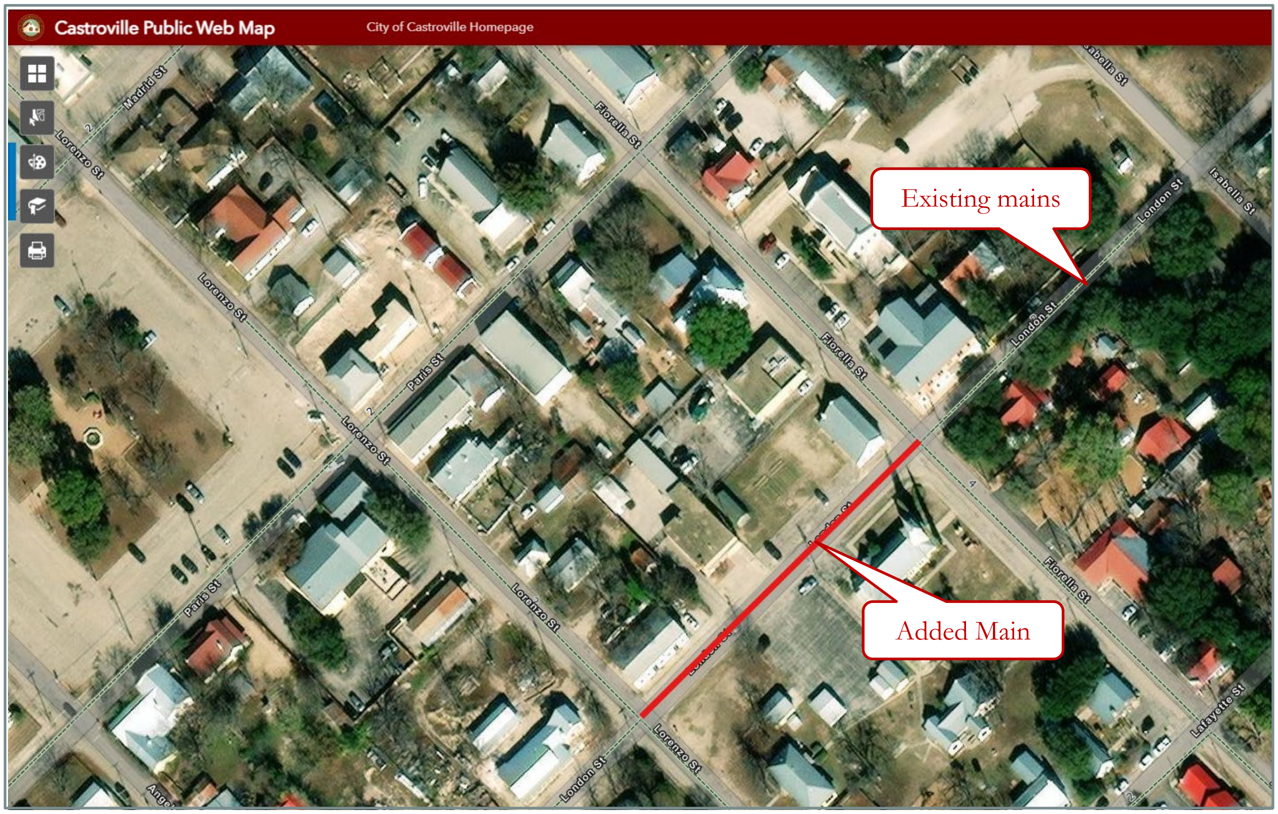


Figure 87: London St between Lorenzo St and Fiorella GIS Map

Figure 88: London St between Lorenzo St and Fiorella St Model Justification

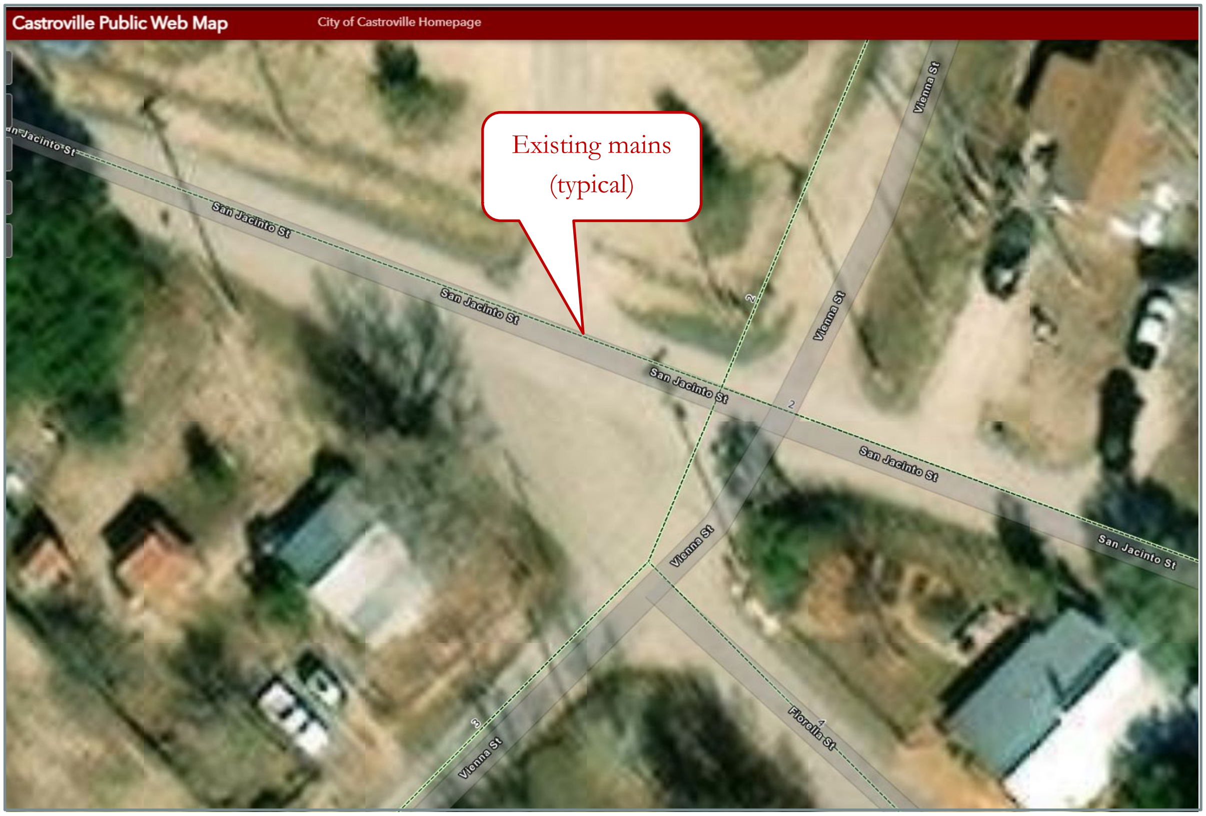


Figure 89: San Jacinto St-Vienna St-Fiorella St Mains GIS Model

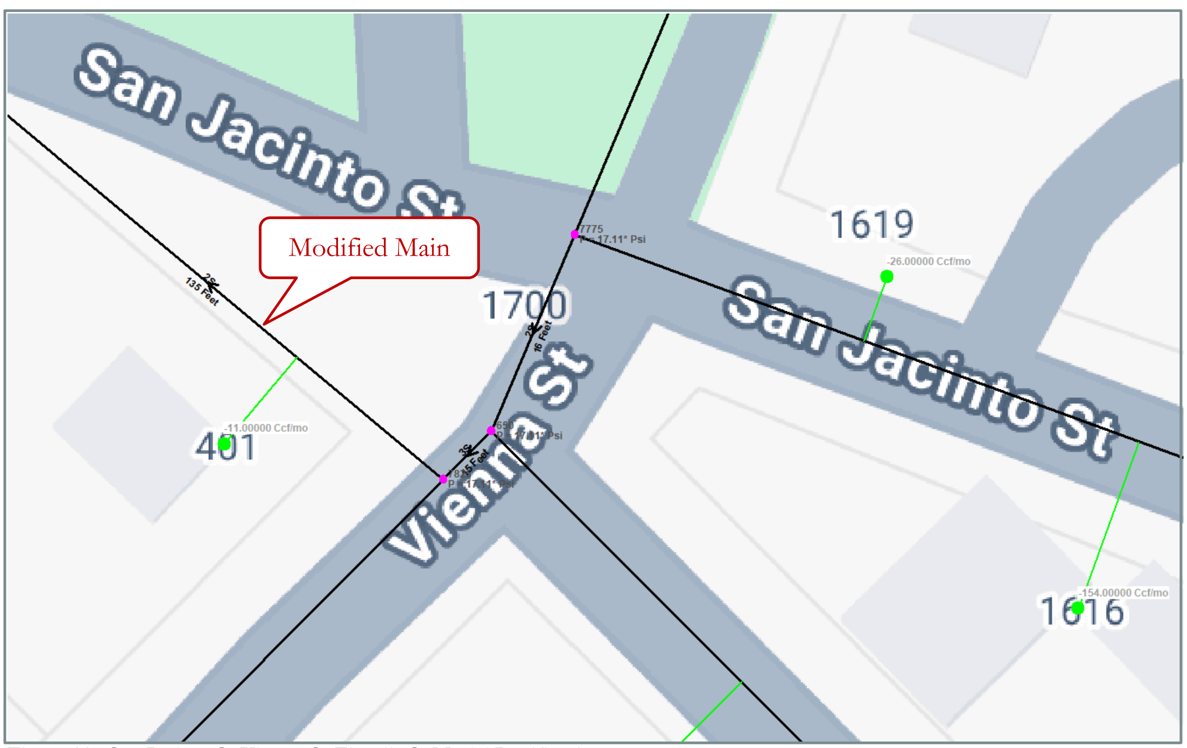


Figure 90: San Jacinto St-Vienna St-Fiorella St Model Justification

APPENDIX D: GIS DISCREPANCIES

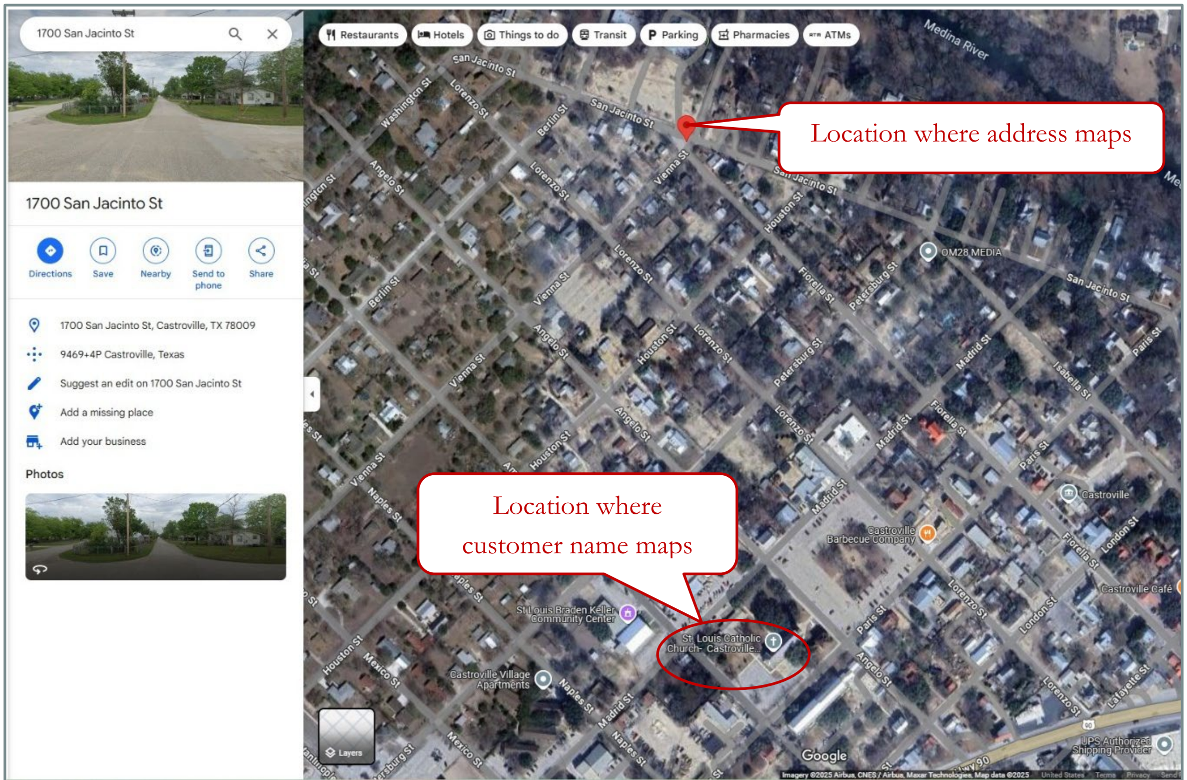


Figure 91: Address Discrepancy for St Louis Catholic Church

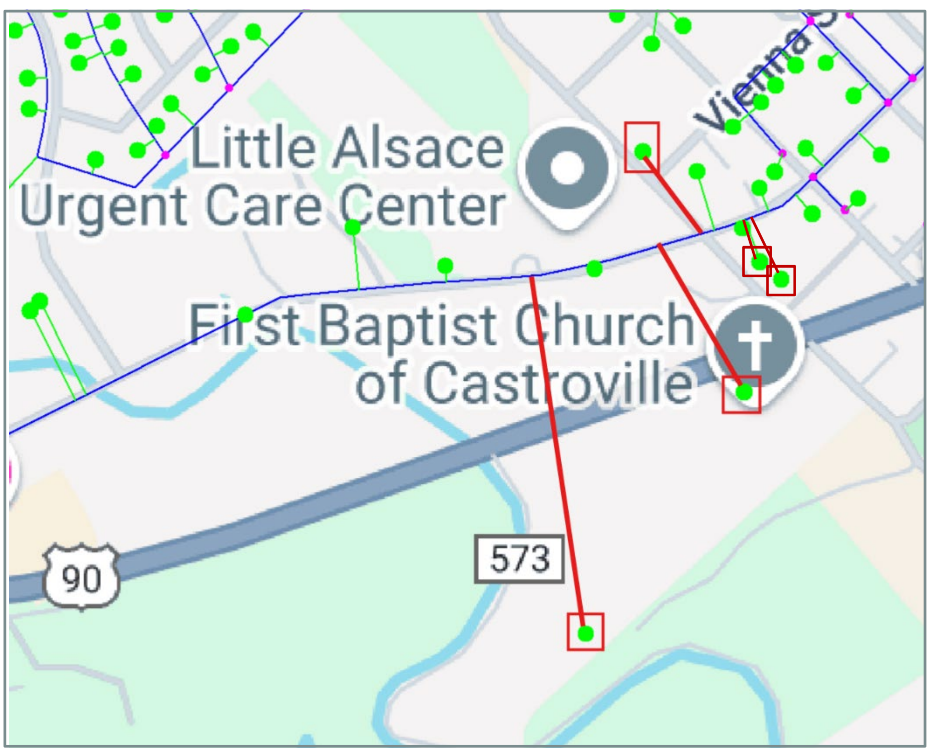


Figure 92: Example of Automated Main Assignments

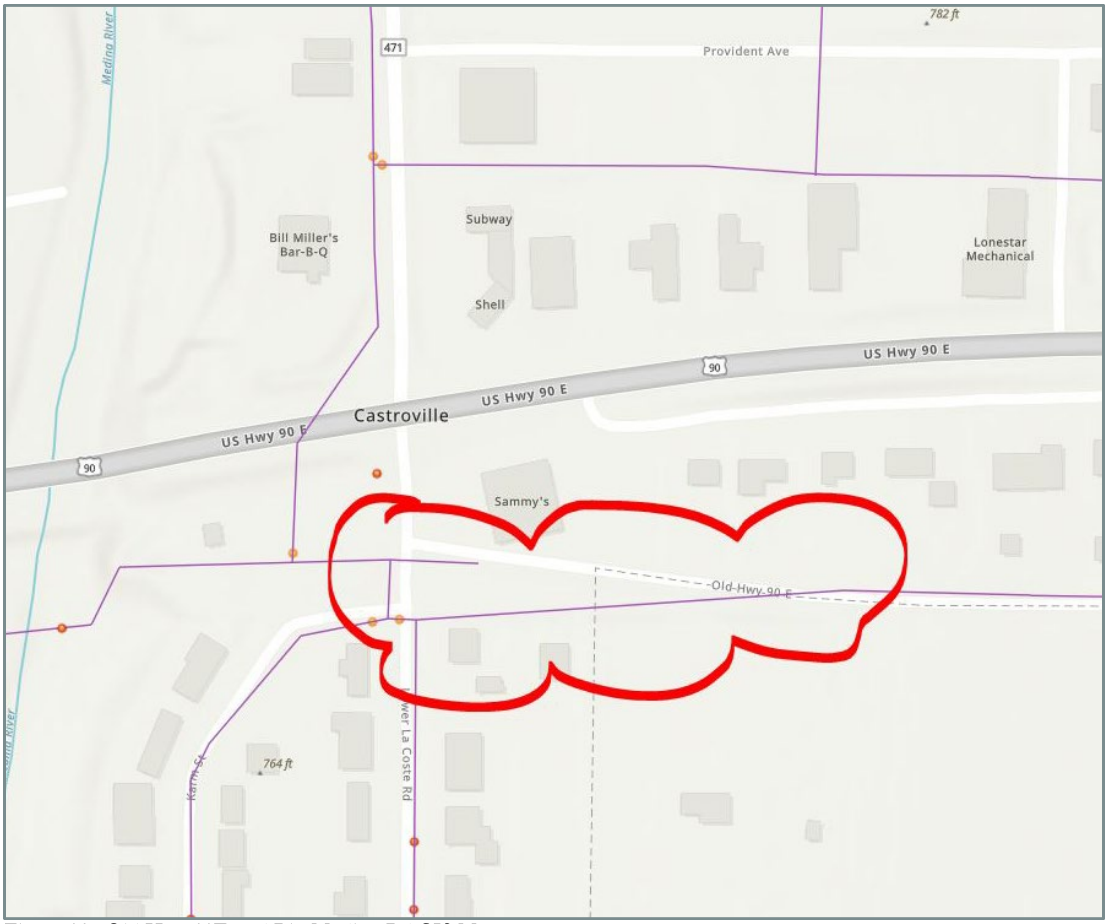


Figure 93: Old Hwy 90E and Rio Medina Rd GIS Map

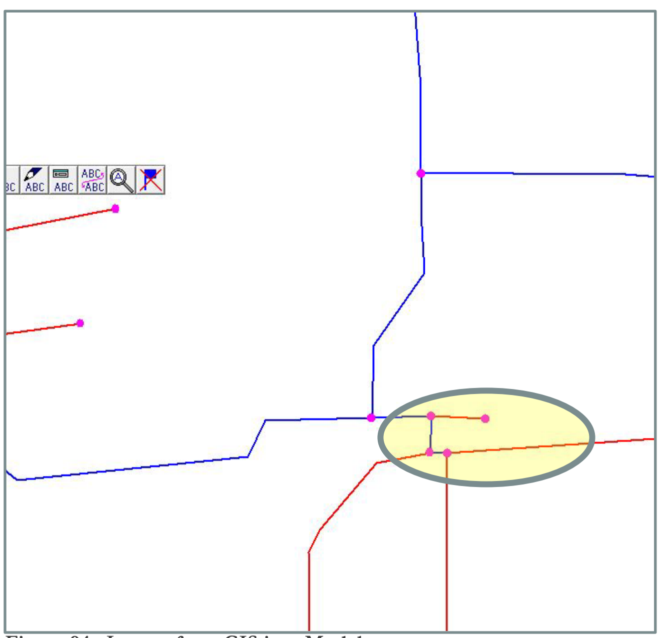


Figure 94: Import from GIS into Model

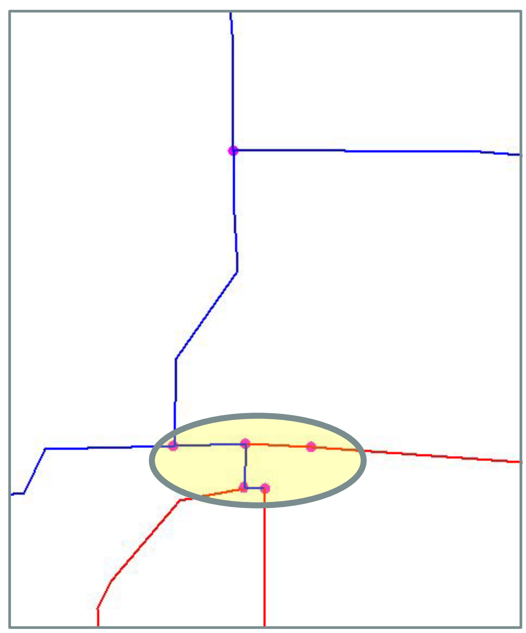


Figure 95: Corrected Model

Figure 96- City Gate looking south along CR583

Figure 97: Unmapped Service to 833 CR 583

Figure 98: DRS located at CR 5711 and CR 483

Figure 99: Pipeline Markers 15 & 16 at CR 5711 and CR 483 DRS

Figure 100: DRS Located along CR 5711 West of CR 483

Figure 101: Marker 18 west side of DRS located along CR 5711 west of CR 483

Figure 102: Marker 18 east side of DRS located along CR 5711 west of CR 483

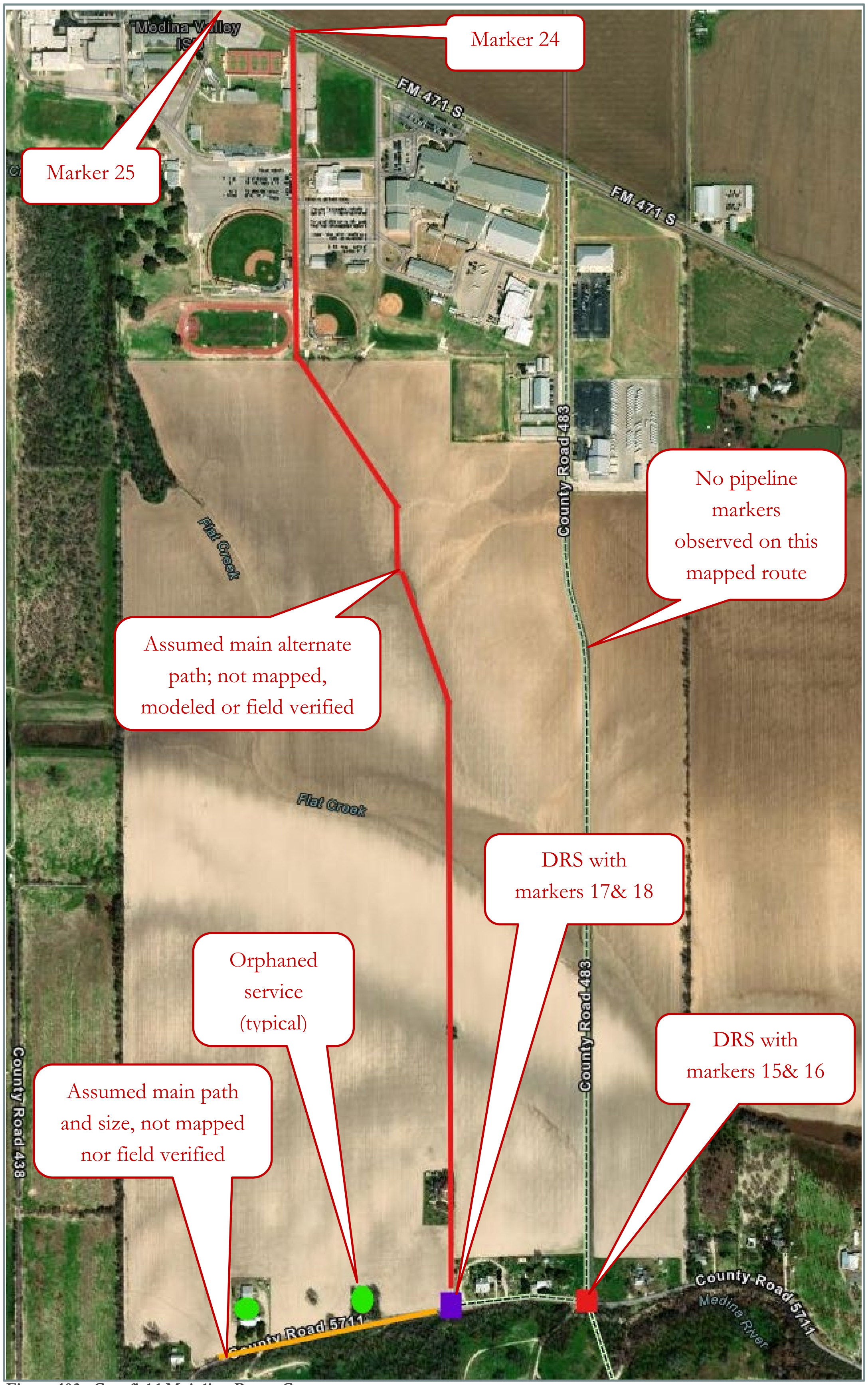


Figure 103: Cornfield Mainline Route Concepts

Figure 104: Pipeline Marker 24


Figure 105: Pipeline Marker 25

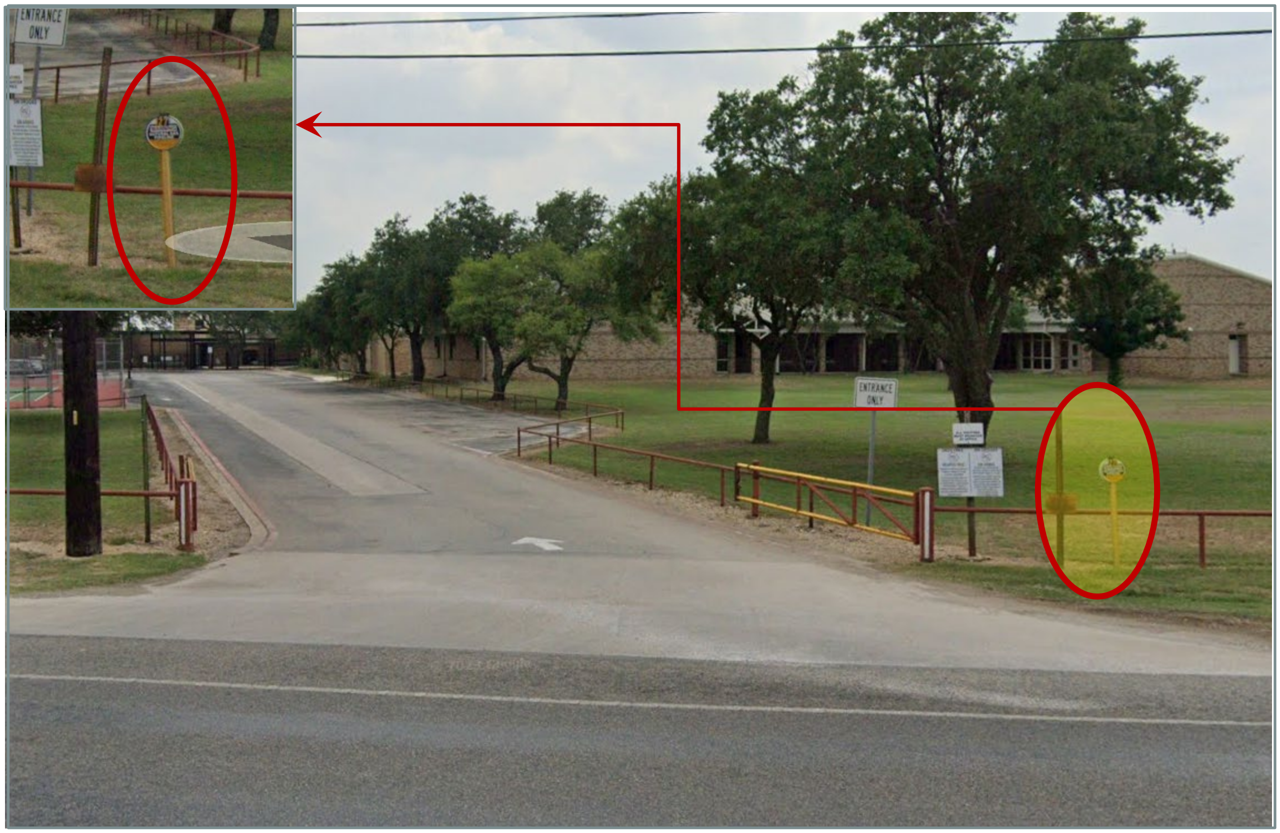


Figure 106: Pipeline Marker 27

Figure 107: Pipeline Marker 28

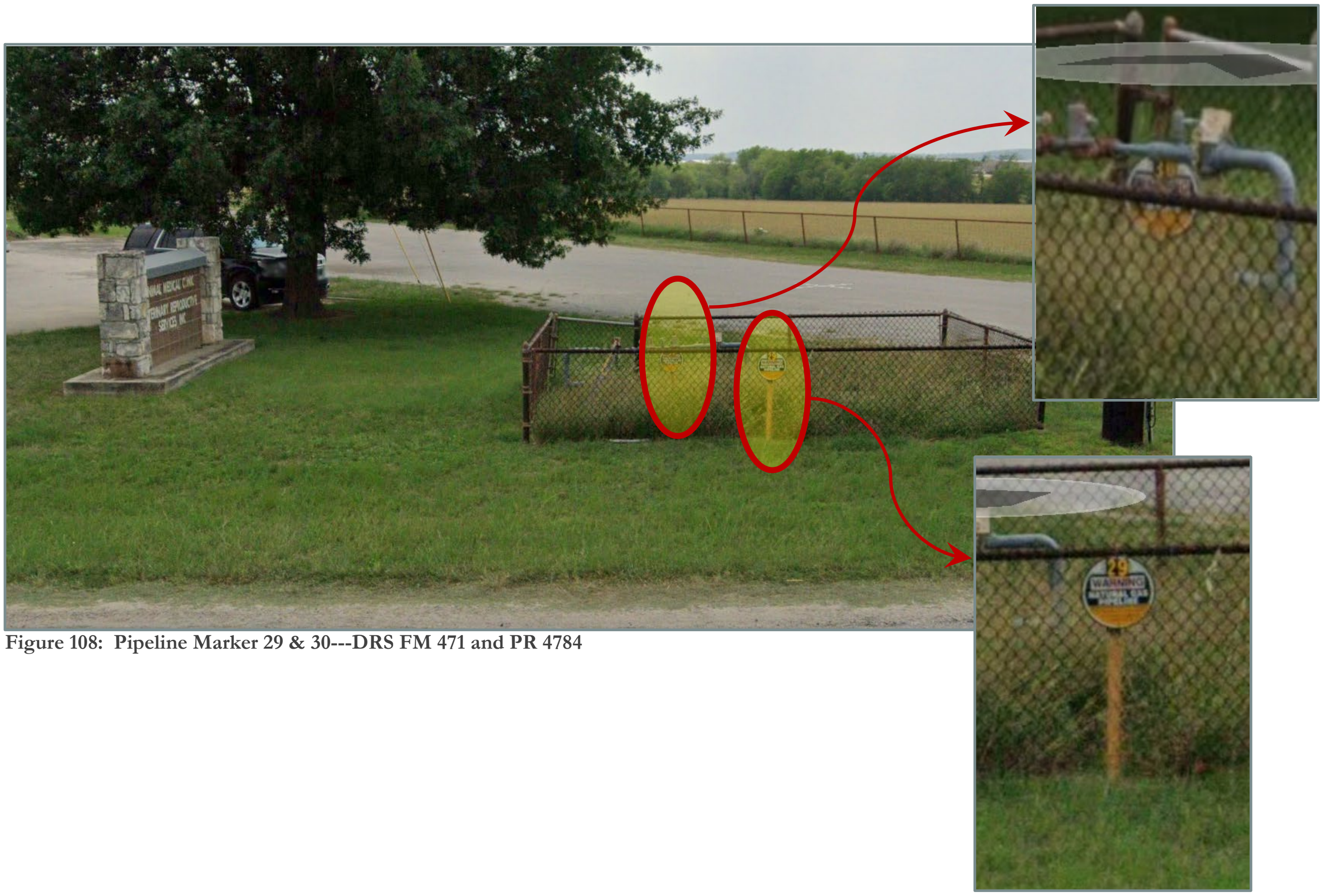


Figure 108: Pipeline Marker 29 & 30---DRS FM 471 and PR 4784


Figure 109: DRS 1130 US 90 (noted as 1150 in records)

APPENDIX F: SUMMARY OF ASSUMPTIONS AND RECOMMENDATIONS

- All pipe from the block map is assumed as steel with the following pipe specifications:

Pipe Diameter	Wall Thickness	Note	Outside Diameter	Inside Diameter	Weight Per Foot	Weight Per mile	Transverse Area	Pipe Volume/Foot Cubic	Surface Area/Foot I.D.	Surface Area/Foot O.D.	Metal Cross Section	Equivalent 3 in.
(in)	(in)		(in)	(in)	(lbs)	(tons)	(sq. in)	Feet	(sq. ft.)	(sq. ft.)	(sq. in.)	factor
0.50	0.109	STD - 40	0.840	0.622	0.85	2.2	0.30	0.002	0.16	0.22	0.25	0.203
0.75	0.113	STD - 40	1.050	0.824	1.13	3.0	0.53	0.004	0.22	0.27	0.33	0.269
1.00	0.133	STD - 40	1.315	1.049	1.68	4.4	0.86	0.006	0.27	0.34	0.49	0.342
1.25	0.140	STD - 40	1.660	1.380	2.27	6.0	1.50	0.010	0.36	0.43	0.67	0.450
2.00	0.154	STD - 40	2.375	2.067	3.65	9.6	3.36	0.023	0.54	0.62	1.07	0.674
3.00	0.156		3.500	3.188	5.57	14.7	7.98	0.055	0.83	0.92	1.64	1.039
4.00	0.156		4.500	4.188	7.24	19.1	13.77	0.096	1.10	1.18	2.13	1.365

- Mains that were added in the color map (i.e., not in the block map but present in the color map), are assumed as polyethylene except in the downtown Castroville area where all mains are assumed as steel. For polyethylene pipe specifications, see the following table:

Nominal Size	SDR	Weight	Min Wall	Average OD
(in)		(lb/100 ft)	(in)	(in)
½" CTS	7.0	6.4	0.09	0.625
1	11.0	19	0.12	1.315
2	11.0	63	0.216	2.375
3	11.0	137	0.318	3.5
4	11.5	217	0.391	4.5

- Assumed pipe sizes are detailed in Appendix B, but also summarized in the following table:

Location	Assumed Size	Report Page Number
Athens St South of Gentilz St	2" steel	43
Lisbon St from West of Jackson St to Athens St	2" steel	43
System from Berlin St at Constantinople St to North and West Limits	2" poly	43
Amelia St and Houston St	2" steel	44
System off of FM 471 North of Provident Ave	2" poly	44
Lorenzo St South of Houston St	2" steel	45
LaFayette St East of Alamo St	2" poly	47

- All added mains are assumed as 2" diameter, with mains in the downtown Castroville area assumed as steel and all other locations assumed as polyethylene.
- All service tap locations are assumed. Service lines are assumed to not cross lot lines.
- Recommend updating model with georeferenced meter data, if available, to increase confidence in added mains. Then field verify all mains needed to supply gas to all known customer locations.
- Field verify all map/GIS discrepancies listed in this report.
- Field verify high pressure line route as we suspect it is possible the line does not run along CR 483 but cuts through the cornfield as noted in Figure 103 on report page 70. A key suggestion is to locate pipeline markers 19 through 23 in addition to locating and toning the lines in and out of the stations.
- Field verify all stations and update/create reports as needed to ensure RRC compliance.

- Research all map and documents provided by CPS Energy; consider discussing location concerns with CPS field personnel.
- Increase outlet pressure at Pear Tree DRS if the two new loads evaluated by our team are added.
- Monitor system end points for model refinement.
- Add a monitoring system for all stations.
- Update GIS with our team's findings.
- Develop and maintain a system of routinely updating the GIS and model so that both represent the real-world system.
- Continue to rely on the model for new loads and system improvements to ensure system performance is properly anticipated during system peaks.
- Develop a system master plan for both capital improvement projects as well as maintenance projects.
- Evaluate DIMP processes and incorporate findings in a master plan.