Appendix F

Wastewater Capacity Analysis

City of Folsom
Rezone Project Wastewater Capacity Analysis Technical Memorandum for Ascent Environmental - DRAFT

Date: February 2, 2024
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Table of Contents

1 Background and Objective 3
1.1 Folsom Plan Area Model Background 3
1.2 North Model Background 4
1.3 System Discharge Locations 5
1.4 Objective 5
2 Analysis Approach 6
2.1 Folsom Plan Area Model 6
2.2 North Model 8
3 Results 9
3.1 Folsom Plan Area Model 9
3.2 North Model 10
3.2.1 FE3 Shed 10
3.2.2 33” Shed 10
3.2.3 27” Shed 11
4 Recommendations 12
4.1 Folsom Plan Area 12
4.2 North of Highway 50 12
4.2.1 FE3 Shed 12
4.2.2 33” Shed 12
4.2.3 27” Shed 13
5 Appendices 15
Appendix 0: Ascent FPASP Proposed Changes Exhibit 16
Appendix 0.1: FPA Model Max d/D Results Figure 17
Appendix 0.2: FPA Model Max Velocity Results Figure 18
Appendix 1: North of 50 Buildout Exhibit 19
Appendix 2: North Model FE3 Shed Results 20
Appendix 2.1: FE3 Shed with Pipe Size Theming 21
Appendix 2.2: FE3 Shed Base UBO Scenario with Surcharge and Freeboard Theming 22
Appendix 2.3: FE3 Shed Rezone Scenario with Surcharge and Freeboard Theming 23
Appendix 2.4: FE3 24” Main Profile Comparison 24
Appendix 3: North Model 33” Shed Results 25
Appendix 3.1: 33” Shed with Pipe Size Theming 26

Appendix 3.2: 33" Shed Base UBO Scenario with Surcharge and Freeboard Theming 27
Appendix 3.3: 33" Shed Rezone Scenario with Surcharge and Freeboard Theming 28
Appendix 3.4: 33" Shed Main Profile Comparison 29
Appendix 3.5: 33" Shed College District Extent Base UBO Scenario with Surcharge and Freeboard Theming 30
Appendix 3.6: 33" Shed College District Extent Rezone Scenario with Surcharge and Freeboard Theming 31
Appendix 3.7: 33" Shed IP-1 Extent Base UBO Scenario with Surcharge and Freeboard Theming 32
Appendix 3.8: 33" Shed IP-1 Extent Rezone Scenario with Surcharge and Freeboard Theming 33
Appendix 4: North Model 27" Shed Results 34
Appendix 4.1: 27" Shed with Pipe Size Theming 35
Appendix 4.2: 27" Shed Base UBO Scenario with Surcharge and Freeboard Theming 36
Appendix 4.3: 27" Shed Rezone Scenario with Surcharge and Freeboard Theming 37
Appendix 4.4: 27" Shed Main Profile Comparison 38

List of Tables

Table 1 – FPASP Revised Allocations Summary 8

List of Figures

Figure 1 – City Wastewater Collection System Model Extents 3
Figure 2 – FPA Wastewater Infrastructure Plan 4
Figure 3 – North Model Wastewater Collection System 5
Figure 4 – Peaking Factor Graph 7
Figure 5 – 33" Shed Sewer Improvements 13
Figure 6 – 27" Shed Sewer Improvements 14

1 Background and Objective

The City of Folsom (City) is bisected by U.S. Route 50 effectively creating two hydraulically distinct wastewater collection systems. Thus, the City maintains two separate hydraulic models. For this analysis, the portion of the system south of the highway has been termed the "Folsom Plan Area" model (FPA model) and the northern portion simply named "North of Highway 50" model (North model) shown in Figure 1 below.

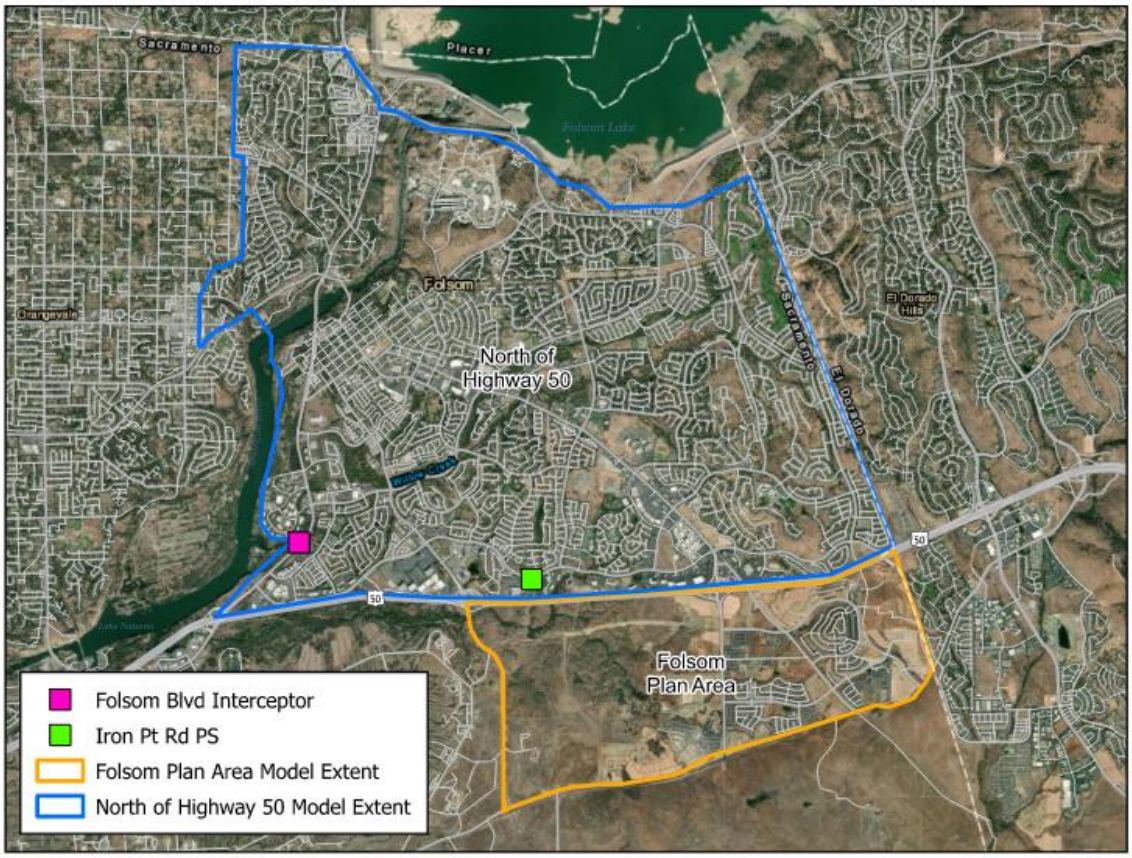


Figure 1 – City Wastewater Collection System Model Extents

1.1 Folsom Plan Area Model Background

The FPA model was developed by Water Works Engineers (Water Works) in 2014 and was based on the most recently approved Folsom Plan Area Specific Plan (FPASP) and Wastewater Infrastructure Plan (WWIP) prepared by MacKay & Somps Civil Engineers, Inc. at the time. The general layout of the FPA wastewater system is shown in Figure 2 below (from the WWIP).

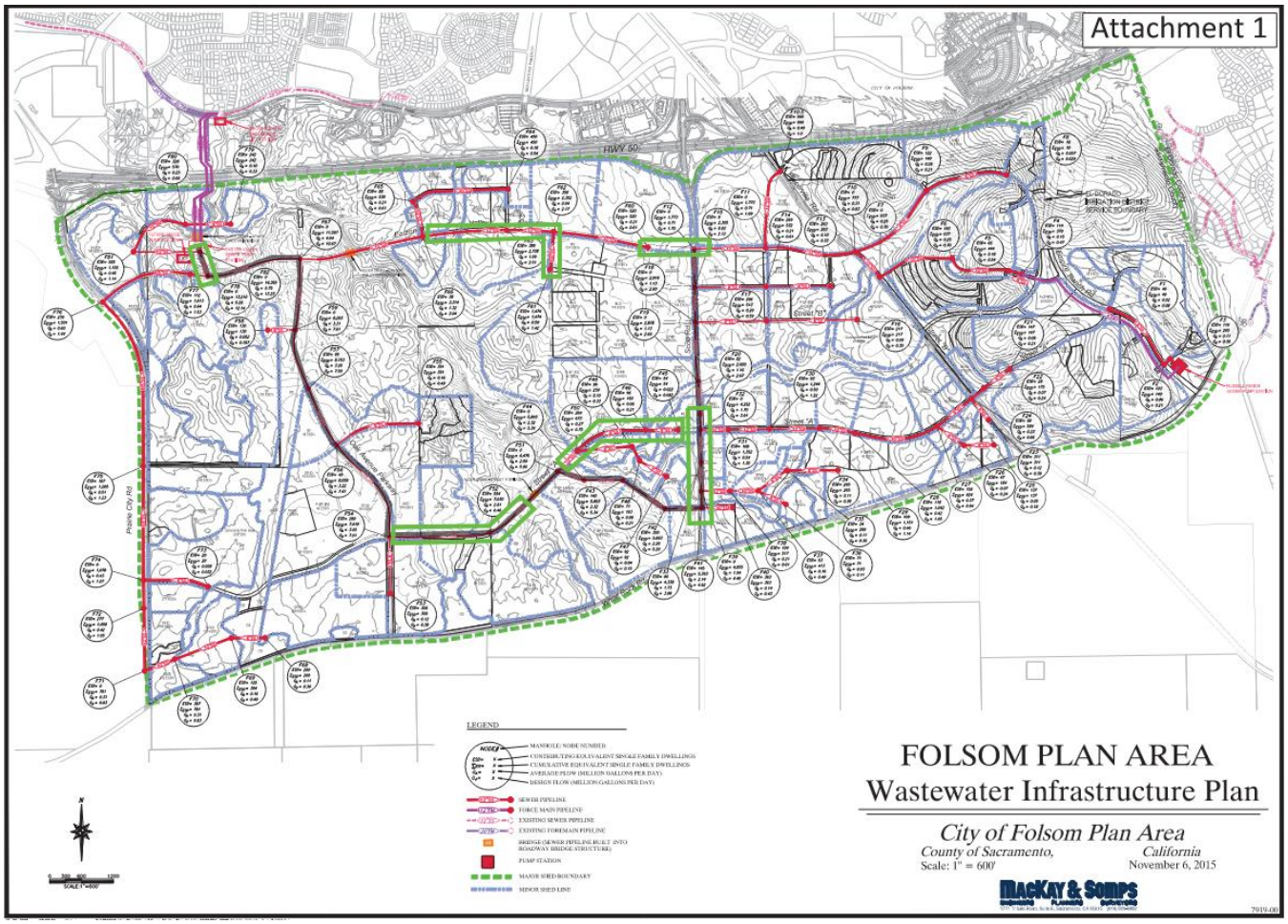


Figure 2 – FPA Wastewater Infrastructure Plan

The design criteria, hydraulic modeling, and sewer system improvements necessary to meet the sewage collection and conveyance demands of the approved FPASP Land Use is summarized in Water Works' City of Folsom Plan Area Wastewater Master Plan Update (WWMPU) dated September 2014. Subsequent to completion of the WWMPU, further refinement to the WWIP for the FPA was made to better support actual development phasing. The updated WWIP included changes to the collection system alignment, land use designations for the parcels within the FPA, and wastewater flow projections. Water Works completed hydraulic modeling of these changes to confirm the proposed FPA wastewater collection system has sufficient capacity to convey these flows while meeting the required design criteria. Water Works' City of Folsom Plan Area Sewer System Master Plan Technical Memorandum (SSMPTM), dated February 16th, 2016, summarizes the findings of the FPA model update. This was the last time the FPA model was updated until the land use changes described herein were applied for this technical memorandum's analysis.

1.2 North Model Background

The north model is further delineated into 3 sewer sheds governed by topography and natural features that dictate how the wastewater flows by gravity. As such, the 3 sheds largely operate independently of each other

and any changes in wastewater loading has to be analyzed for each shed. The 3 sewer sheds are further broken down into 18 distinct basins similarly governed by topography and natural features but further delineated by sewer system assets. The sewer sheds and basins are shown in Figure 3 below.

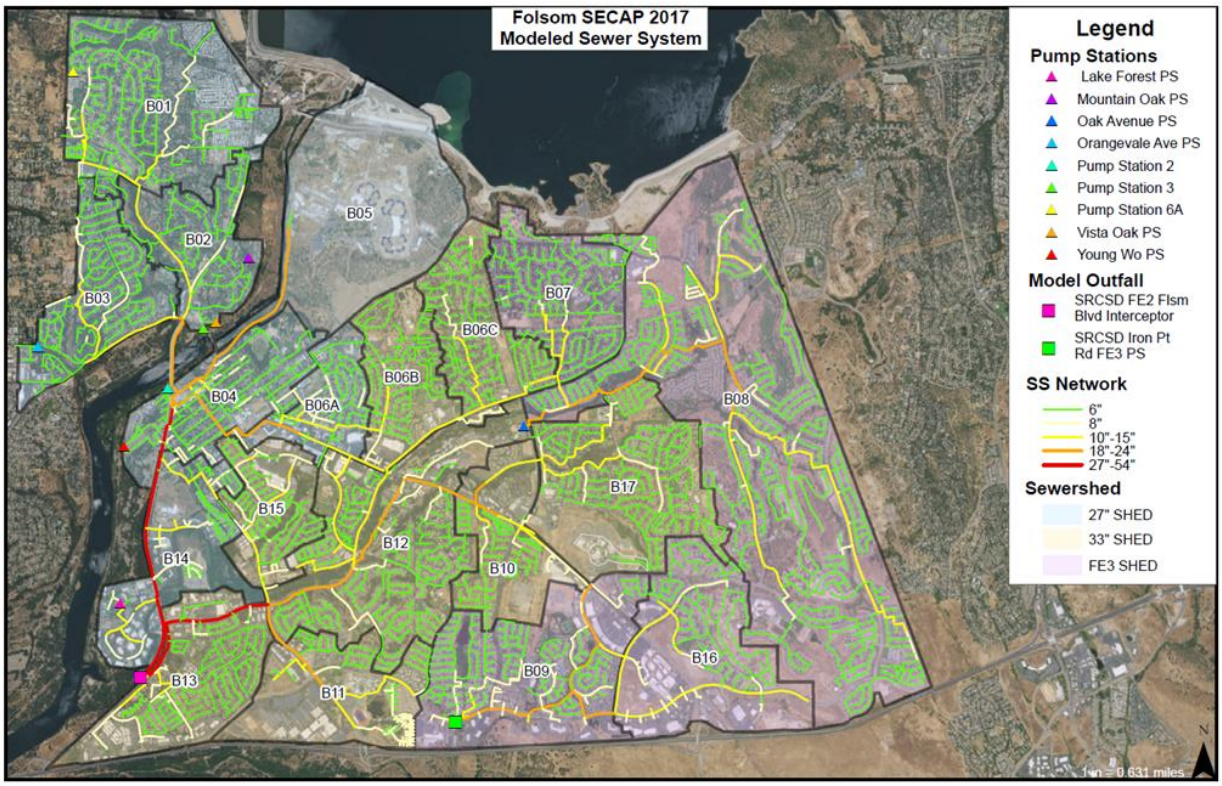


Figure 3 – North Model Wastewater Collection System

1.3 System Discharge Locations

The City does not own and operate a wastewater treatment facility. Instead, the City's collection system is transferred at two locations into Sacramento Regional County Sanitation District (Regional San) interceptor system shown on Figure 1. The first location is the Iron Point Road pump station which is the terminus point for the FE3 shed. Additionally, the FPA system is routed such that it crosses U.S. Route 50 and connects immediately upstream of the Iron Point Rd PS. The second location is the Folsom boulevard interceptor which acts as the terminus for the 27" shed and the 33" shed (refer to Figure 3). It is important to note that these terminus points act as the outfall boundaries for the hydraulic models. As such, changes to wastewater flow characteristics, most notably increases, and their impacts on the downstream Regional San interceptor system are not considered in this analysis.

1.4 Objective

The City's general plan governs the goals, policies, and programs of land use within the City which is periodically amended to respond to trends and to meet state mandates for zoning, residential density, and housing. To this end, the City contracted with Ascent Environmental to provide professional environmental services including analysis and selection of opportunity sites within the city to increase residential capacity.

A key component of this analysis is how increased residential density affects the capacity of the City's utilities, specifically its wastewater collection system. Increased residential density results in increased wastewater flows potentially triggering infrastructure upgrades that the City must plan and budget for in order to mitigate spill risk in compliance with the sewer system management plan. Ascent contracted with Water Works to conduct a wastewater capacity analysis of the proposed zoning changes using the City's hydraulic models. The wastewater capacity analysis, results, and recommendations are the subject of this report.

2 Analysis Approach

2.1 Folsom Plan Area Model

The City's FPA model is currently implemented on Innovyze's InfoSewer modeling software. Geographic information system datasets were created, land use data was analyzed, and flows for each parcel were calculated and assigned to the appropriate nodes (manholes). In depth discussion on the hydraulic model development process can be found in WWMPU dated September 2014.

While the WWMPU analyzed multiple simulation scenarios, Water Works used the "Build-Out Design Flow" scenario for this technical memorandum's analysis. The design flow (DF), or peak wet weather flow (PWWF), for the FPA collection system is calculated in a multi-step process. The first step involves calculating each parcel's average flow (AF). Each parcel within the FPA is allocated a certain number of Equivalent Single Family Dwelling Units (ESDs), which are then multiplied by the flow factor of 400 gallons per day per ESD as set forth in the City's Design and Procedures Manual (DPM). To calculate the AF from each parcel, the following equation is used:

Equation 1

AF (gpd) = DU (ESDs) x FF (gpd/ESD)

Where:

AF = Average Flow

DU = Dwelling Units [determined in the FPASP]

FF = Flow Factor = 400 gpd/ESD

The next step involves multiplying each parcel's AF by the applicable Peaking Factor (PF) chosen from Figure 4 below. The following equation is used:

Equation 2

PAF (gpd) = AF (gpd) x PF (unitless)

Where:

PAF = Peaked Average Flow

AF = Average Flow

PF = Peaking Factor (Figure 4)

The next step involves applying a groundwater infiltration rate of 50 gpd per inch diameter per mile to the collection system as prescribed in the DPM. Within the InfoSewer model, infiltration can be assigned to all pipelines using the Group Editing on Domain function in the InfoSewer Edit Network toolbar. The Infiltration Type to be used for this model would be Pipe Diameter-Length. After this infiltration rate has been applied to the

collection system, the DF scenario run can be simulated. It should be noted that the particular manhole that each parcel (or collection of parcels) discharges wastewater flows into within the hydraulic model has remained unchanged for this analysis.

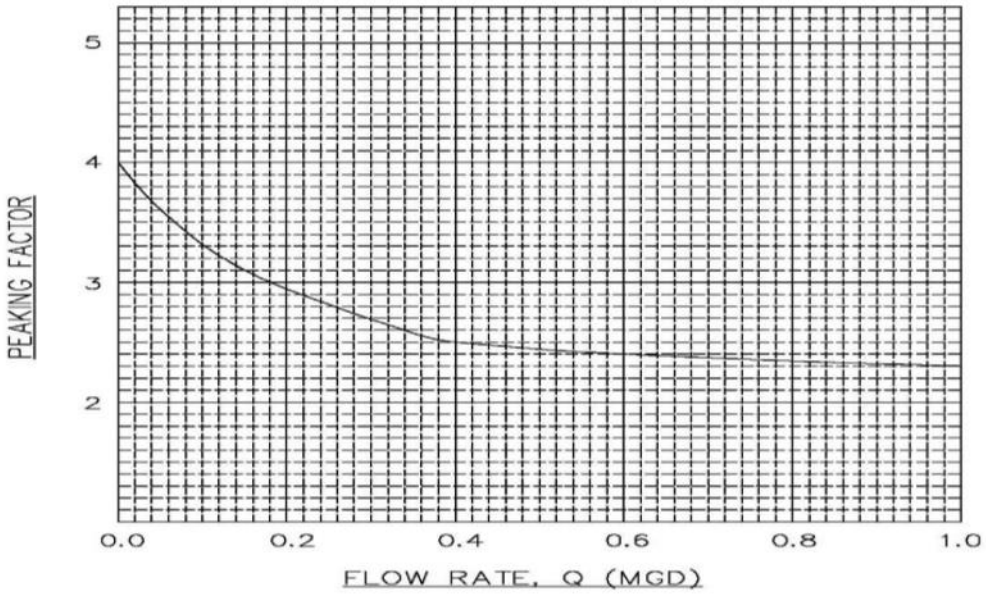


Figure 4 – Peaking Factor Graph

The depth-to-diameter (d/D) ratio for each pipe segment is calculated every 15 minutes over the model simulation. As stated in the SSMPTM (dated February 16th, 2016), it is the desire of the City to maintain a maximum d/D ratio of 0.8 or less under Design Flow conditions for the FPA wastewater collection system. Manholes are assessed to eliminate the risk of surcharge and ensure no sanitary sewer overflows (SSO) occur over a 24-hour period. The unfilled depth was calculated for each manhole every 15 minutes over the model simulation. Upon completion of the model run, each time step is analyzed to determine whether any manhole experienced any surcharging. As a final step in the model simulation review process to ensure compliance with design criteria, the velocity in each pipe segment is reviewed to ensure operation between two and ten feet per second (fps).

For the FPA model, Ascent provided Water Works with a list of parcels with revised dwelling unit allocations for incorporation into updated model simulations and analysis of the associated results (refer to Appendix 0: Ascent FPASP Proposed Changes Exhibit). Appendix 0: Ascent FPASP Proposed Changes Exhibit's FPASP Proposed Changes

Exhibit (dated June 29th, 2023) details the specific parcels with revised allocations of number of units (i.e. ESD's) and thereby wastewater flow contributions to the collection system utilizing the flow calculations discussed above. Table 1 below shows the parcels that were updated as a part of this analysis.

Table 1 – FPASP Revised Allocations Summary

"FPASP_RevisedAllocations.6.29.23" PDF								
Original Allocation			Revised Allocation			FPA Model		
Parcel ID	Land Use Designation	Housing Unit Capacity	Land Use Designation	Housing Unit Capacity	Change in Residential Capacity	Original Model ESD's	ESD's in Updated FPA Model	Discharge MH
2	IND/OP	0	MHD	400	+400	236	400	H3.0
11	MMD	155	MMD	160	+5	202	160	H6.01
15	CC	0	CC	320	+320	277	320	H5.04
16	MHD	246	MHD	240	-6	185	240	H6.01
60	MHD	192	MHD	270	+78	145	270	C6.2
63	MLD	70	MLD	225	+47	70	225	C6.05
64	MHD	108	MHD			81		C6.05
68	MMD	176	MMD	160	-16	87	160	C6.1
74	MU	57	MU	366	+309	215	366	C7.02
76	MLD	119	MLD	230	+111	119	230	C7.02
144	MMD	109	MMD	130	+21	82	130	M8.01
156	MLD	57	MLD	225	+23	57	225	C7.02
157	MHD	145	MHD			109		C7.02
158	MU	72	MU	349	+277	237	349	C7.02
160A	MHD	145	MHD	192	+47	109	192	C7.02
160B	MLD	97	MLD	113	+16	97	113	C7.02
233	GC	0	MU	250	+250	0	250	1046

Refer to Appendix 0: Ascent FPASP Proposed Changes Exhibit for the map showing the listed parcels.

2.2 North Model

The City's North Model network is currently implemented on the modeling software InfoWorks ICM. The model is a digital twin of the collection system, having distinct elements for gravity and pressure sewer mains, manholes, and pump stations as well as parcels. However, the model only encompasses city pipes and does not account for parcel only piping and private sewer systems. Wastewater flow rates are assigned by parcel and determined by the land use type and other factors such as flowmeter data. The associated flows for each parcel are then loaded onto the collection system in a simulation that accounts for diurnal flow curves and storm events over a fixed period.

The results of a simulation are used to analyze the capacity of the wastewater collection system. The City utilizes several simulations for planning purposes related to forecasted population demographics and storm events. For this analysis, Water Works utilized the ultimate buildout scenario (UBO) based on assumptions in the draft 2035 General Plan with peak wet weather flow (PWWF) from a 10-year, 6-hour storm event developed in 2017. This simulation is the ultimate capacity stress test for the North wastewater collection system and is the City's basis for long-term planning of wastewater capacity.

Wastewater system capacity can be directly gauged in the model by assessing the pipe surcharge and manhole (MH) freeboard state data metrics. As more flow enters the system, gravity sewer pipes begin to fill. By measuring the depth of water over the height of the pipe, or "d/D" ratio, Water Works can assess the pipe surcharge state. Typically, gravity mains are sized to operate in open channel flow, i.e. not completely full. As an example, a d/D ratio less than 0.7 is a common threshold to design a new pipeline with adequate capacity. If the gravity sewer main fills beyond the pipe's full capacity, the flow will start to fill the manholes. The height of the airspace left in the manhole as the wastewater rises is called freeboard and thresholds can be set to indicate spill risk, such as one foot of freeboard.

For the North model, Ascent provided Water Works with a list of site overlays considered for redevelopment and are attached for reference in Appendix 1: North of 50 Buildout Exhibit. The overlays outline a target number of new residential units for portions of parcels, entire parcels, or multiple parcels throughout the extent of the North model. Thus, Water Works developed a framework to apply new wastewater loads. General assumptions made for the loading framework are as follows:

- Additional residential units from redevelopment were assumed Multiple Residential for average flow determination per City design standards for sanitary sewer with the following modifications:
    - In addition to residential units identified in the site overlay for the Kaiser site North and South, 104 equivalent single family dwelling units were added to the Kaiser site to capture additional developments made since the model scenario was last updated.
- For opportunity site overlays with multiple parcels, Water Works selected parcels to closely match the redevelopment square footage outlined in the list Ascent provided and overwrote the parcels' existing flow. This process more significantly affected how the CC-1 opportunity site's flows were allocated, whereby the selection of parcels not only dictated whether the flows end up in the 27" or 33" shed, but also affected the local smaller diameter sewer. More detailed discussion can be found in the Results section below.
- All previous UBO loads in the model were removed and overwritten with the flow calculated from the additional residential units with the following exceptions where redevelopment flow was added to previous UBO flow:
    - Kaiser Site North and South (CB-3A and CB-3B)
    - College District (CB-2)

Water Works created a scenario with the new redevelopment flow characteristics loaded and ran a simulation for analysis.

3 Results

3.1 Folsom Plan Area Model

The results of the revised ESD allocations within the FPA can be found in Appendices Appendix 0.1: FPA Model Max d/D Results Figure and Appendix 0.2: FPA Model Max Velocity Results Figure ("Hydraulic Model Design Flow Results Maximum Depth to Diameter Ratio" and "Hydraulic Model Design Flow Results Maximum Velocity", respectively). When comparing these updated results to the results figures found in the February 16th, 2016

SSMPTM, the results remain the same with one exception: the pipe segment directly downstream of manhole C7.02 experienced a maximum d/D ratio in between the values of 0.8 and 0.9 (an increase from the original maximum d/D ratio of less than 0.7) in the updated model simulation. When assessing the total additional number of ESD's effectively being modeled as a point load to manhole C7.02 (as is shown in Table 1 above), it becomes clear this significant increase in ESD's causes the increase in modeled maximum d/D for that pipe segment. The impact on the pipe segment's maximum d/D ratio stemming from this increase in wastewater flows is exaggerated within the hydraulic model due to the direct discharge into manhole C7.02. In reality, the flows from these parcels will likely be discharged to smaller tributary pipe segments prior to reaching manhole C7.02, thereby lessening the negative impact on the maximum d/D ratio seen in the pertinent pipe segment. The maximum velocity results (depicted in Appendix 0.2: FPA Model Max Velocity Results Figure) do not change from the previously accepted results shown in the SSMPTM (dated February 16th, 2016).

3.2 North Model

The results of the rezone simulation can be analyzed independently by each of the 3 sewer sheds previously mentioned.

3.2.1 FE3 Shed

Site Overlays in the FE3 shed include:

- CB-3A
- CB-3B
- CB-4

For the FE3 shed, a 24" main line starting on East Bidwell and terminating at the Iron Point Road pump station represents the major trunk of this shed. Compared to smaller diameter lines, the capacity of the 24" trunk is the centerpiece to the capacity of the shed and is the focus of the analysis. The 24" line is exemplified in Appendix 2.1: FE3 Shed with Pipe Size Theming, which themes the FE3 shed collection system based on pipe diameter. If the major trunk of a collection shed is at capacity then that incurs significant infrastructure upgrades to provide additional capacity.

A comparison of surcharge states with and without the rezone site overlays is included in Appendix 2.2: FE3 Shed Base UBO Scenario with Surcharge and Freeboard Theming and Appendix 2.3: FE3 Shed Rezone Scenario with Surcharge and Freeboard Theming, respectively. Additionally, Appendix 2.4: FE3 24" Main Profile Comparison shows a profile comparison of the 24" line with and without the rezone site overlays, allowing analysis of each segment's flow rate and surcharge state. Pipe surcharge state and MH freeboard at peak conditions indicated that the FE3 shed and the 24" main have capacity to accommodate the increased flows from the site rezoning without any capacity upgrades required.

3.2.2 33" Shed

Site Overlays in the 33" shed include:

- Portions of CC-1
- CD-1
- CD-2
- CD-3
- CD-4
- CD-5

- CB-1
- CB-2

Site overlay CC-1 straddles both the 27" and 33" shed. Water Works intentionally loaded all the redevelopment flow to the 33" side, as it is understood that the 27" shed has been near capacity since Water Works' preparation of the 2017 system evaluation and capacity assessment plan (SECAP). A discussion of possible recommendations for the 27" shed, should development occur in CC-1, is included later in this report.

For the 33" shed, a 33" main line along Blue Ravine Road represents the major trunk. The 33" line is exemplified in Appendix 3.1: 33" Shed with Pipe Size Theming, which themes the 33" shed collection system based on pipe diameter.

A comparison of surcharge states with and without the rezone site overlays is included in Appendix Appendix 3.2: 33" Shed Base UBO Scenario with Surcharge and Freeboard Theming and Appendix 3.3: 33" Shed Rezone Scenario with Surcharge and Freeboard Theming, respectively. Pipe surcharge state and MH freeboard at peak conditions indicate that overall, the 33" main has capacity for the increased flow. Additionally, Appendix 3.4: 33" Shed Main Profile Comparison shows a profile comparison of the 33" line with and without the rezone site overlays, allowing analysis of each segment's flow rate and surcharge state. Despite the 33" main line on Blue Ravine having sufficient capacity, Water Works identified 3 areas affected by the increase: portions of Sibley, Riley, and Glenn Roads shown in Appendix 3.3: 33" Shed Rezone Scenario with Surcharge and Freeboard Theming. However, it is difficult to determine exactly which areas will be impacted when they are redeveloped since the CC-1 overlay covers such a large extent of parcels. Generally, these affected areas will likely require localized sewer improvements (i.e. upsizing) to smaller diameter lines. The costs associated with these improvements are discussed further in the Recommendations section below.

For site overlay CB-2 located at the Folsom Lake College, Water Works assumed that any redevelopment would connect to the sewer system on East Bidwell rather than the smaller local sewer on Silberhorn shown in Appendix Appendix 3.5: 33" Shed College District Extent Base UBO Scenario with Surcharge and Freeboard Theming and Appendix 3.6: 33" Shed College District Extent Rezone Scenario with Surcharge and Freeboard Theming.

For site overlay IP-1, while technically in the 33" shed, it connects directly upstream of the Regional San's Folsom Boulevard interceptor. This is isolated from the 33" main line on Blue Ravine and does not impact its capacity. However, small local improvements will need to be made as shown in Appendix Appendix 3.7: 33" Shed IP-1 Extent Base UBO Scenario with Surcharge and Freeboard Theming and Appendix 3.8: 33" Shed IP-1 Extent Rezone Scenario with Surcharge and Freeboard Theming which compares the Base UBO scenario with the Rezone Scenario themed for pipe surcharge and manhole freeboard at peak conditions. These improvements will be discussed further in the Recommendations section below.

3.2.3 27" Shed

Site Overlays in the 27" shed include:

- Portions of CC-1
- GS-1
- GS-2
- GS-3
- GS-4
- GS-5

For the 27" shed, a 27" main line along Folsom Boulevard represents the major trunk. The 27" line is exemplified in Appendix 4.1: 27" Shed with Pipe Size Theming, which themes the 27" shed collection system based on pipe diameter. When Water Works prepared the 2017 SECAP report for the City, analysis showed that the 27" main line was at capacity. Since then, the City has undertaken the installation of a 21" parallel main line intended to be a "high line" which gives the 27" additional capacity during increased flow events such as storms but does not increase the dry weather capacity of the 27". A comparison of surcharge states with and without the rezone site overlays is included in Appendix 4.2: 27" Shed Base UBO Scenario with Surcharge and Freeboard Theming and Appendix 4.3: 27" Shed Rezone Scenario with Surcharge and Freeboard Theming, respectively, which shows that the 27" is at/near capacity and the rezone sites only exacerbate the capacity issue. Additionally, Appendix 4.4: 27" Shed Main Profile Comparison shows a profile comparison of the 27" line with and without the rezone site overlays, allowing analysis of each segment's flow rate and surcharge state. Improvements to address the capacity constraints are discussed in more detail in the Recommendations section below.

4 Recommendations

4.1 Folsom Plan Area

Based on the updated model simulation conducted, the FPA wastewater collection system has capacity for the revised allocations previously described and no additional sewer improvements/changes are required to handle the increased flows.

4.2 North of Highway 50

4.2.1 FE3 Shed

Based on the model runs conducted, the FE3 shed has capacity for the proposed site overlays and no additional sewer improvements are required to handle the additional flow.

4.2.2 33" Shed

Based on the model runs conducted, the 33" shed has capacity for the proposed site overlays. However, localized sewer improvements will likely be required to convey the additional flow at the CC-1 and IP-1 site overlays. These areas are shown in Appendix Appendix 3.3: 33" Shed Rezone Scenario with Surcharge and Freeboard Theming and Appendix 3.8: 33" Shed IP-1 Extent Rezone Scenario with Surcharge and Freeboard Theming. Shown in Figure 5 below is a conceptual cost estimate for the work. Water Works estimates that $5.923 million in sewer improvements will be required for the 33" shed. This is based on two assumptions:

1. All CC-1 redevelopment is on the 33" shed portions of the site overlay, necessitated by the lack of capacity on the 27" shed
2. The IP-1 redevelopment utilizes the existing sewer line that connects into the Regional San Folsom Boulevard interceptor. Water Works did not explore the option of connecting to the Regional San infrastructure closer to the site overlay thereby saving cost of sewer improvements.

Figure 5 – 33" Shed Sewer Improvements

WATERWORKS ENGINEERS

City of Folsom SACOG Rezone Modeling
Conceptual Opinion of Probable Construction Cost
33" Shed Sewer Improvements
1/18/2024

Prepared: Brett Husa, PE
Checked: Tim Lewis, PE
Mike Fisher, PE

Item No.	Description	Unit	Estimated Quantity	Eng. Est. Unit Price	Eng. Est. Construction Cost
1	Upsizing small diameter sewer due to CC-1 Overlay (8" to 10") Appendix 3.3	LF	3028	$ 450	$ 1,362,600
2	Upsizing small diameter sewer due to IP-1 Overlay (8" to 10") Appendix 3.8	LF	3400	$ 450	$ 1,530,000
5	Bypass Pumping	LS	1	$ 289,260	$ 289,260
6	Traffic Control	LS	1	$ 289,260	$ 289,260
				Subtotal	**$ 3,471,120**
7	Mob/Demob (5% of subtotal)				$ 173,556
				Estimated Construction Cost Subtotal	**$ 3,644,676**
8	Construction Contingency (30% of Construction subtotal)				$ 1,093,403
				Conceptual OPCC	**$ 4,738,079**
9	Engineering, Administration, Legal (25% of OPCC)				$ 1,184,520
				Total Project Cost[1]	**$ 5,923,000**

(1) Rounded to nearest $10,000

4.2.3 27" Shed

As mentioned in the Results section, the 27" shed is at capacity in the UBO scenario. Any additional flow from rezone development will only exacerbate the issue. Any attempt to add additional capacity along Folsom Boulevard, such as the construction of a large diameter parallel sewer, would be prohibitively expensive. In regard to diversion projects, the City has feasible options. One such option would be the installation of a pump station near the intersection of Riley Street and East Bidwell Street as shown on Appendix 4.3: 27" Shed Rezone Scenario with Surcharge and Freeboard Theming. This pump station would take flow from portions of basin 6 and the CC-1 overlay and transfer it to the 33" shed, effectively diverting the flow away from the 27" shed. If planned correctly, this recommendation could be combined with the recommendations for the 33" shed to resolve two issues at once: capacity constraints in the 27" shed and localized sewer improvements due to the CC-1 overlay. Shown in Figure 6 below is a conceptual cost estimate for the work.

Figure 6 – 27" Shed Sewer Improvements

City of Folsom SACOG Rezone Modeling
Conceptual Opinion of Probable Construction Cost
27" Shed Sewer Improvements
1/19/2024

Prepared: Brett Husa, PE
Checked: Tim Lewis, PE
Mike Fisher, PE

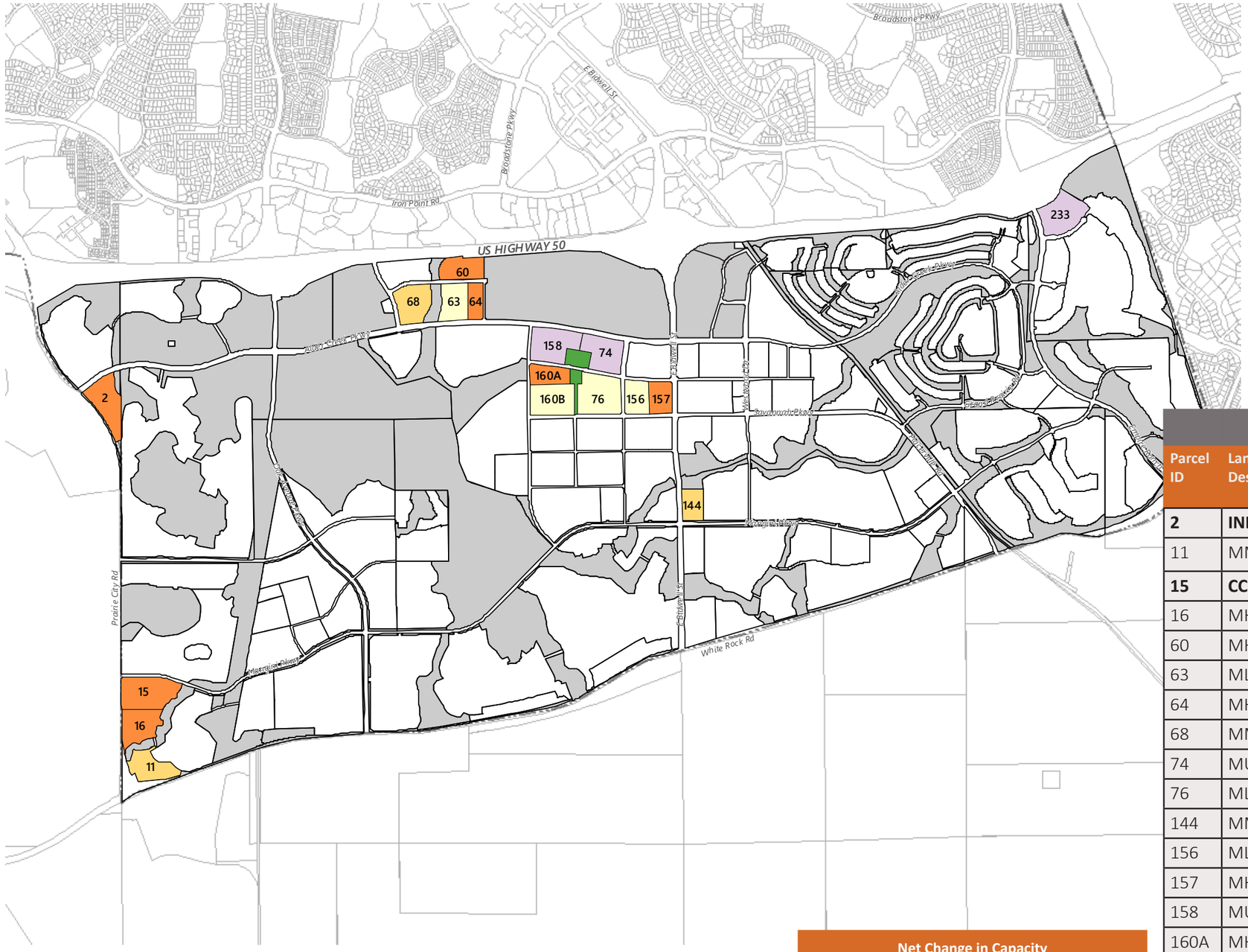
Item No.	Description	Unit	Estimated Quantity	Eng. Est. Unit Price	Eng. Est. Construction Cost
1	2MGD Pump Station at Riley and Bidwell Appendix 4.3	LS	1	$ 5,000,000	$ 5,000,000
2	8" Forcemain from pump station to high point at Glenn and Sibley Appendix 4.3	LF	2200	$ 240	$ 528,000
3	Upsize small diameter sewer on Glenn and Sibley to convey additional flow from PS (8" to 12") Appendix 4.3	LF	6200	$ 540	$ 3,348,000
4	Bypass Pumping	LS	1	$ 887,600	$ 887,600
5	Traffic Control	LS	1	$ 887,600	$ 887,600
				Subtotal	**$ 10,651,200**
6	Mob/Demob (5% of subtotal)				$ 532,560
				Estimated Construction Cost Subtotal	**$ 11,183,760**
7	Construction Contingency (30% of Construction subtotal)				$ 3,355,128
				Conceptual OPCC	**$ 14,538,888**
8	Engineering, Administration, Legal (25% of OPCC)				$ 3,634,722
				Total Project Cost[1]	**$ 18,174,000**

(1) Rounded to nearest $10,000

5 Appendices

Appendix 0: Ascent FPASP Proposed Changes Exhibit

CITY OF FOLSOM HOUSING ELEMENT IMPLEMENTATION – FPASP Proposed Changes *(Rev. 6/29/2023)*



Source: data downloaded from City of Folsom in 2020 and Sacramento County in 2018 **Not to Scale.**

Net Change in Capacity	
Residential (units)	**1,882**
Non-Residential (square feet)	**-228,833**

	Original Allocation			Revised Allocation			
Parcel ID	**Land Use Designation**	**Units**	**Comm. Sq. Ft.**	**Land Use Designation**	**Units**	**Change in Units**	**Comm. Sq. Ft.**
2	**IND/OP**	**0**	**137,214**	**MHD**	**400**	***+400***	**-**
11	MMD	155	-	MMD	160	*+5*	-
15	**CC**	**0**	**142,659**	**MHD**	**320**	***+320***	**-**
16	MHD	246	-	MHD	240	*-6*	-
60	MHD	192		MHD	270	*+78*	
63	MLD	70	-	MLD	225	*+47*	-
64	MHD	108	-	MHD			
68	MMD	176		MMD	160	*-16*	
74	MU	57	38,333	MU	366	*+309*	60,000
76	MLD	119	-	MLD	230	*+111*	-
144	MMD	109	-	MMD	130	*+21*	-
156	MLD	57	-	MLD	225	*+23*	-
157	MHD	145	-	MHD			
158	MU	72	43,560	MU	349	*+277*	50,500
160A	MHD	145	-	MHD	192	*+47*	-
160B	MLD	97	-	MLD	113	*+16*	-
233	**GC**	**0**	**125,235**	**MU**	**250**	***+250***	**125,235**

Appendix 0.1: FPA Model Max d/D Results Figure

Updated FPA Model

MH C6.1
MH C6.2
MH C6.05
MH C7.0
MH C7.02
MH H3.0
MH 1046
MH M8.01
MH H5.04
MH H6.01

60
68
63
64
158
74
160A
160B
76
156
157
233
2
144
15
16
11

Legend

Manhole

Unfilled Depth [ft]

- SSO
- 0 to 1
- 1 to 3
- 3 to 6
- > 6

Pipe

Max d/D

- < 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1
- >1

Parcels

- # Parcel ID

N

0 200 400 800
Feet

HYDRAULIC MODEL DESIGN FLOW RESULTS
MAXIMUM DEPTH TO DIAMETER RATIO

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Appendix 0.2: FPA Model Max Velocity Results Figure

Updated FPA Model

MH C6.1
MH C6.2
MH C6.05
MH C7.0
MH C7.02
MH H3.0
MH H5.04
MH H6.01
MH M8.01
MH 1046

60
68
63
64
158
74
160A
160B
76
156
157
233
144
2
15
16
11

Legend

Manhole

Unfilled Depth [ft]

- SSO
- 0 to 1
- 1 to 3
- 3 to 6
- > 6

Pipe

Max Velocity [fps]

- < 1
- 1 to 2
- 2 to 10
- > 10

Parcels

\# Parcel ID

N

0 200 400 800
Feet

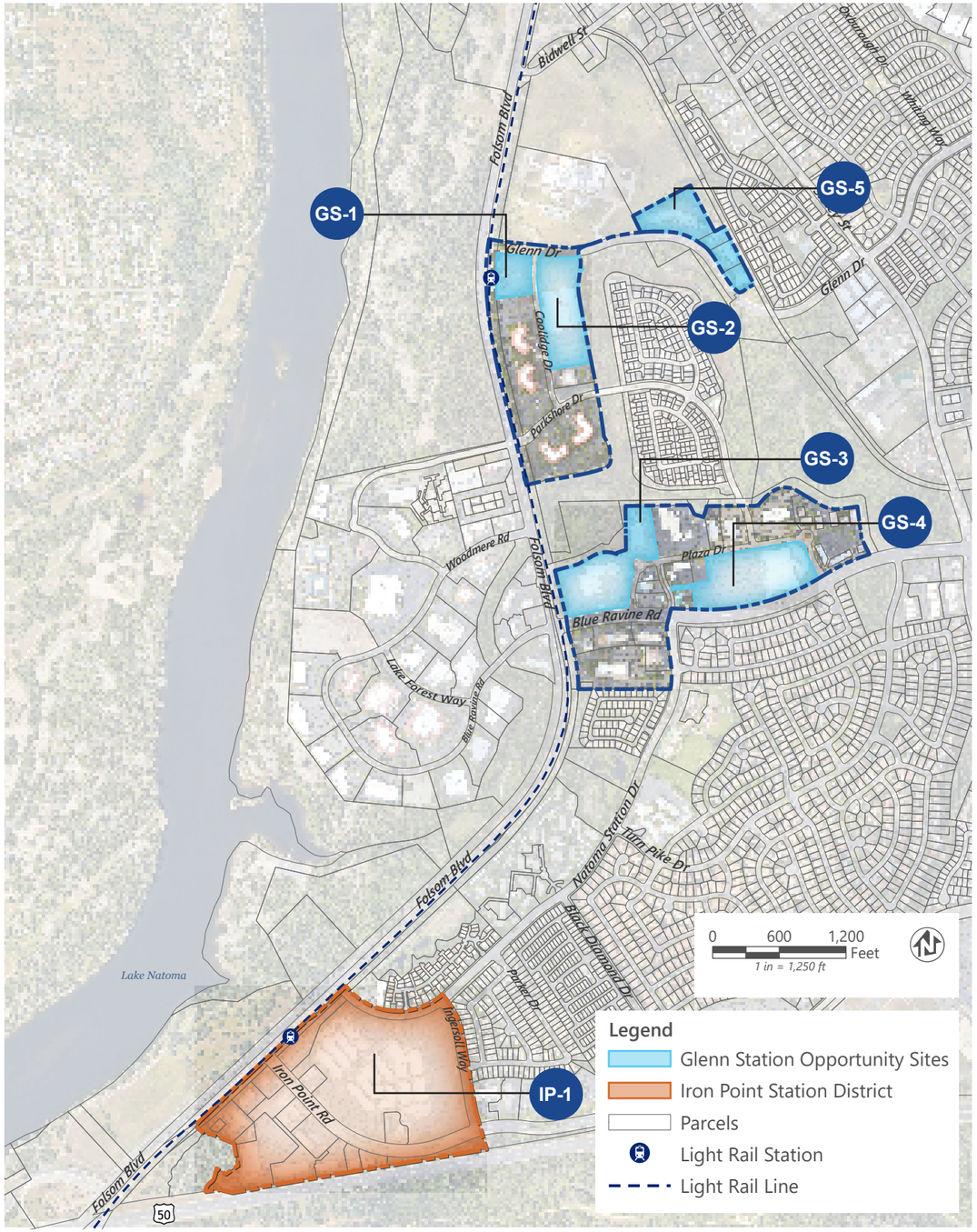
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

HYDRAULIC MODEL DESIGN FLOW RESULTS
MAXIMUM VELOCITY

Appendix 1: North of 50 Buildout Exhibit

CITY OF FOLSOM SACOG INCREASING RESIDENTIAL DENSITIES IMPLEMENTATION (REAP) *- June 29, 2023*

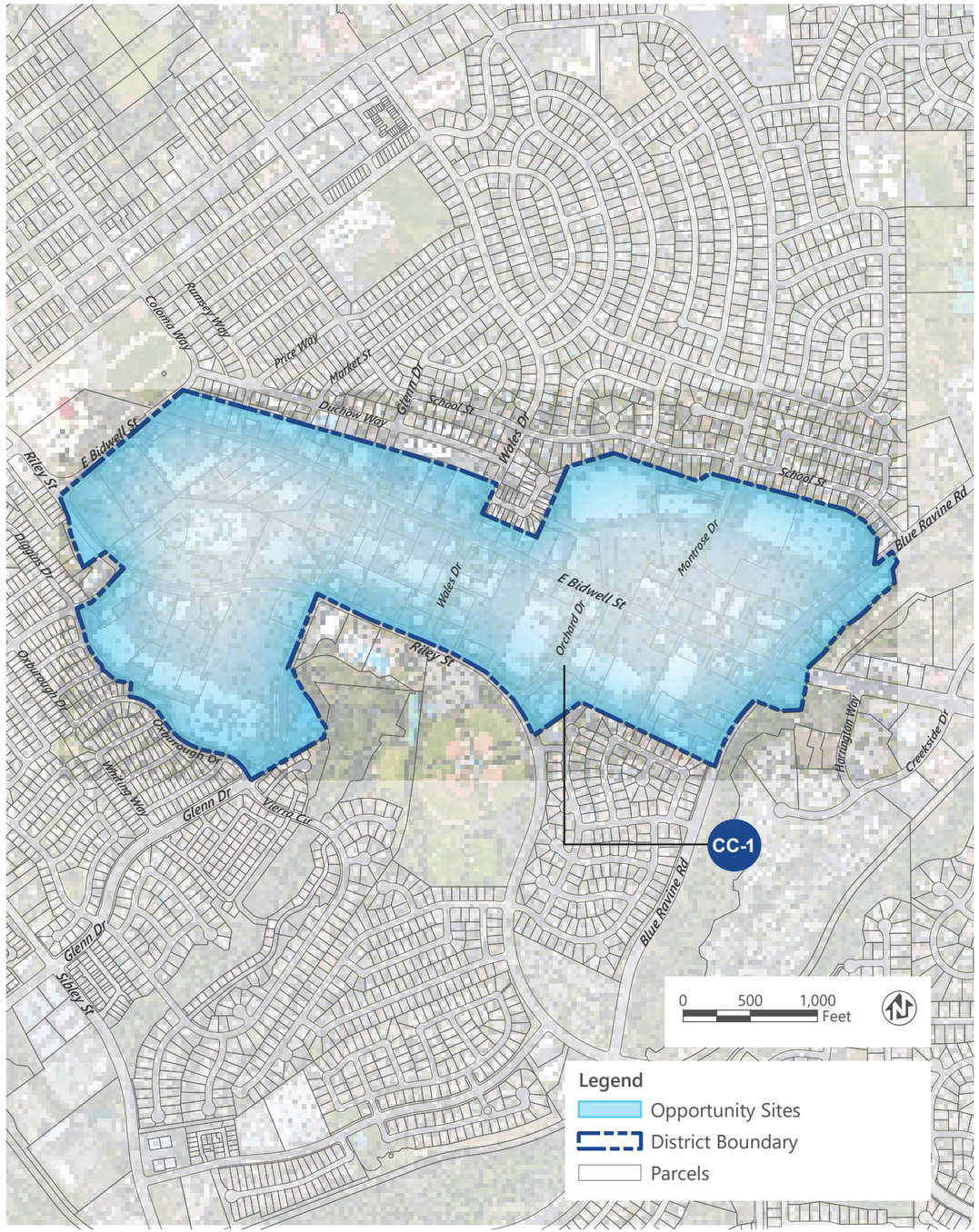
Folsom Boulevard Transit-Oriented Development Areas



Site ID	Site Description	Parcel Acreage	Potential Redevelopment (% of site)	Redevelopment Square Footage	Max FAR	Target Residential FAR	Residential Units	Non-Res GSF
Glenn Station District								
GS-1	Glenn Park & Ride	2.73	100%	118,919	3.00	2.00	238	0
GS-2	Maximus	8.5	25%	92,565	3.00	2.00	185	0
GS-3	Blue Ravine/ Folsom Car Dealership	9.75	25%	106,178	3.00	2.00	212	0
GS-4	Winco Foods Site	10.92	25%	118,919	3.00	2.00	238	0
GS-5	Glenn Drive Technology Park	7.39	25%	80,477	3.00	2.00	161	0
District Sub-total:		**39.29**		**517,057**			**1,034**	**0**
Iron Point Station District								
IP-1	Entire District Boundary	57.22	15%	373,875	3.00	2.00	748	0
District Sub-total:		**57.22**		**373,875**			**748**	**0**
TOD Area Total:		**97**		**890,933**			**1,782**	**0**

CITY OF FOLSOM SACOG INCREASING RESIDENTIAL DENSITIES IMPLEMENTATION (REAP) *- June 29, 2023*

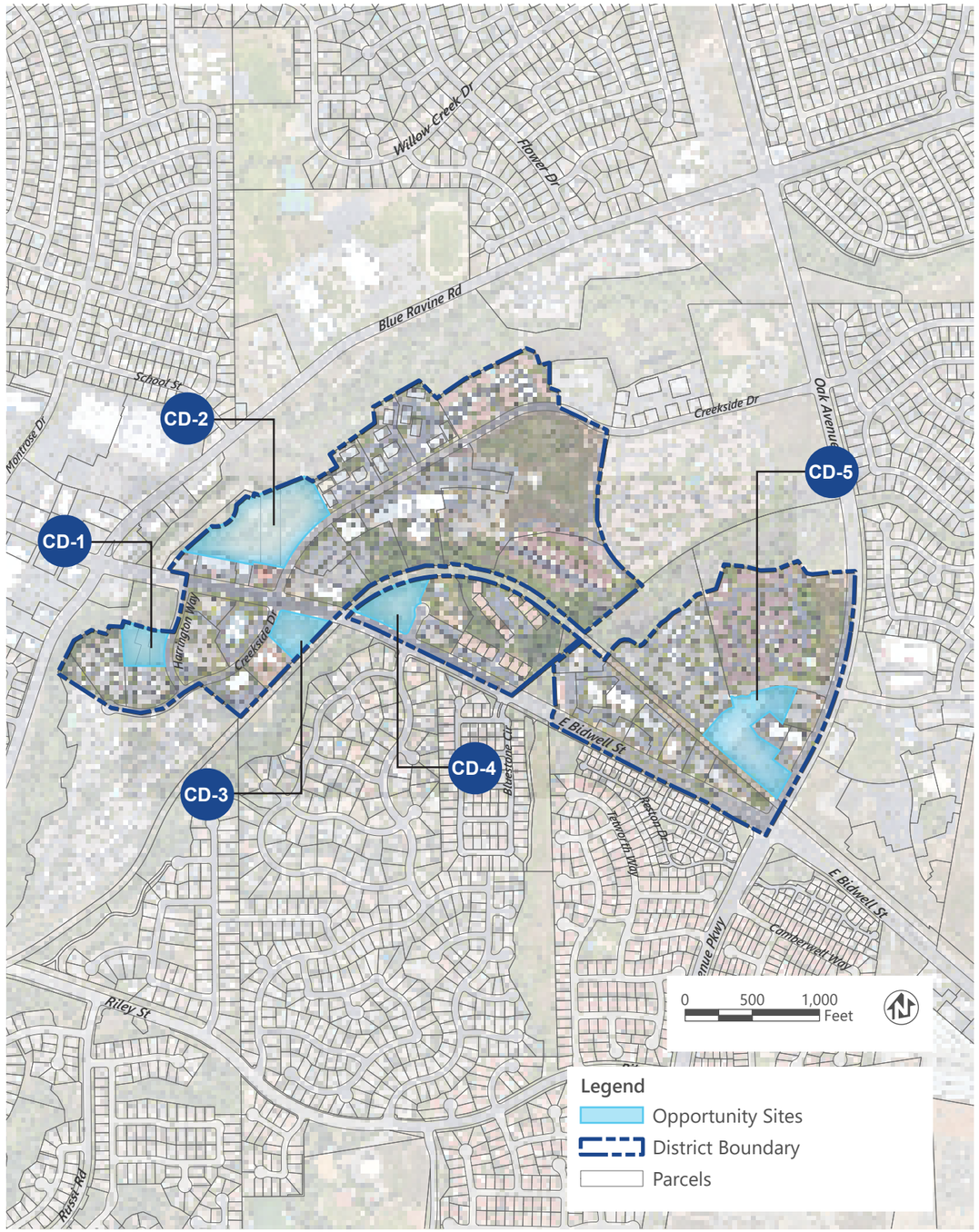
East Bidwell Corridor Mixed-Use Overlay Zone – Central Commercial District



Site ID	Site Description	Parcel Acreage	Potential Redevelopment (% of site)	Redevelopment Square Footage	Max FAR	Target Residential FAR	Residential Units	Non-Res GSF
Central Commercial District								
CC-1	Entire Boundary	190.53	15%	1,244,923	2.50	1.50	1,867	0
District Sub-total:		**190.53**		**1,244,923**			**1,867**	**0**

CITY OF FOLSOM SACOG INCREASING RESIDENTIAL DENSITIES IMPLEMENTATION (REAP) *- June 29, 2023*

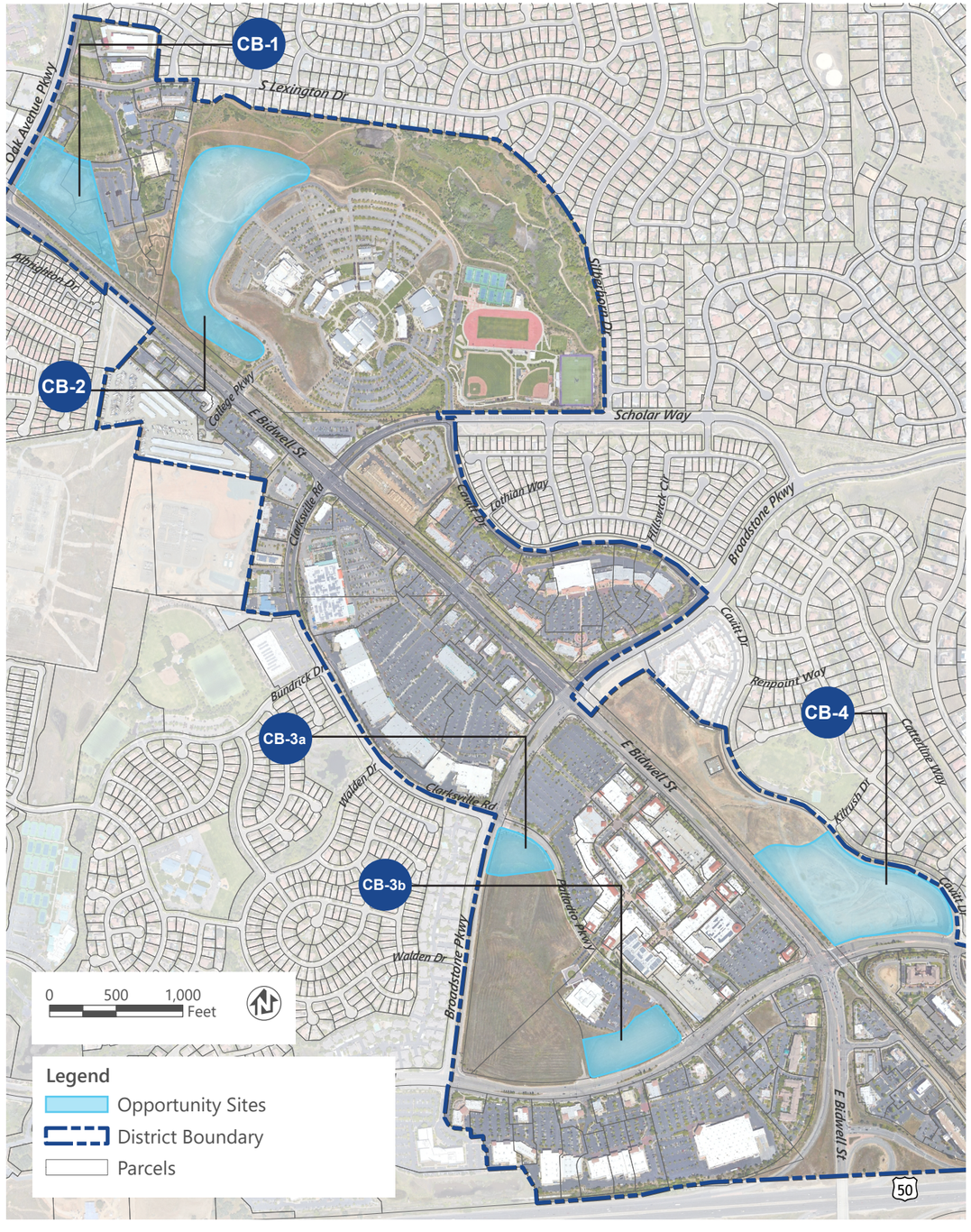
East Bidwell Corridor Mixed-Use Overlay Zone – Creekside District



Site ID	Site Description	Parcel Acreage	Potential Redevelopment (% of site)	Redevelopment Square Footage	Max FAR	Target Residential FAR	Residential Units	Non-Res GSF
Creekside District								
CD-1	(3) Harrington Way Parcels	1.95	75%	63,707	2.50	1.50	96	0
CD-2	(3) Creekside Parcels	8.2	55%	196,456	2.50	1.00	196	0
CD-3	Creekside Dr parking lot	1.9	25%	20,691	2.50	1.00	21	0
CD-4	Corner Parcel w/ of Woodsmoke, N of Bidwell	2.53	25%	27,552	2.50	1.50	41	0
CD-5	California Family Fitness Site	5.65	25%	61,529	2.50	1.50	92	0
District Sub-total:		**20.23**		**369,933**			**446**	**0**

CITY OF FOLSOM SACOG INCREASING RESIDENTIAL DENSITIES IMPLEMENTATION (REAP) *- June 29, 2023*

East Bidwell Corridor Mixed-Use Overlay Zone – College/Broadstone District



Site ID	Site Description	Parcel Acreage	Potential Redevelopment (% of site)	Redevelopment Square Footage	Max FAR	Target Residential FAR	Residential Units	Non-Res GSF
College/Broadstone District								
CB-1	Oak Ave Pkwy Triangle (3 parcels)	7.37	25%	80,259	2.50	1.50	120	0
CB-2	College District	15.5	25%	168,795	2.50	1.50	253	0
CB-3a	Kaiser Site - North	2.5	75%	81,675	2.50	1.50	123	0
CB-3b	Kaiser Site - South	6.12	50%	133,294	2.50	1.50	200	0
CB-4	Bidwell St site north of Palladio	20.5	25%	223,245	2.50	1.50	335	0
District Sub-total:		**51.99**		**687,268**			**1,031**	**0**

Appendix 2: North Model FE3 Shed Results

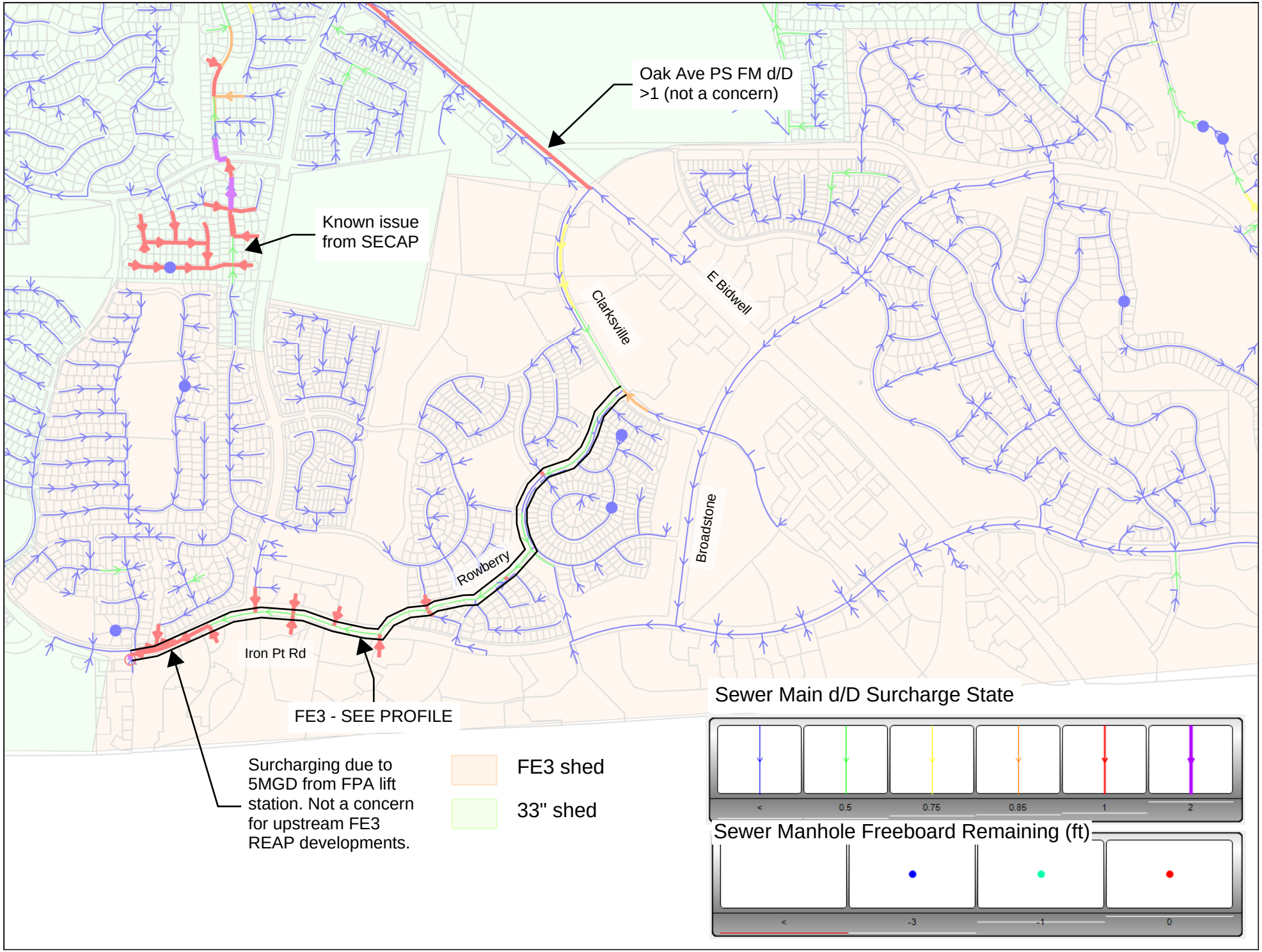
Appendix 2.1: FE3 Shed with Pipe Size Theming

FE3 24" Shed Pipe Size Map



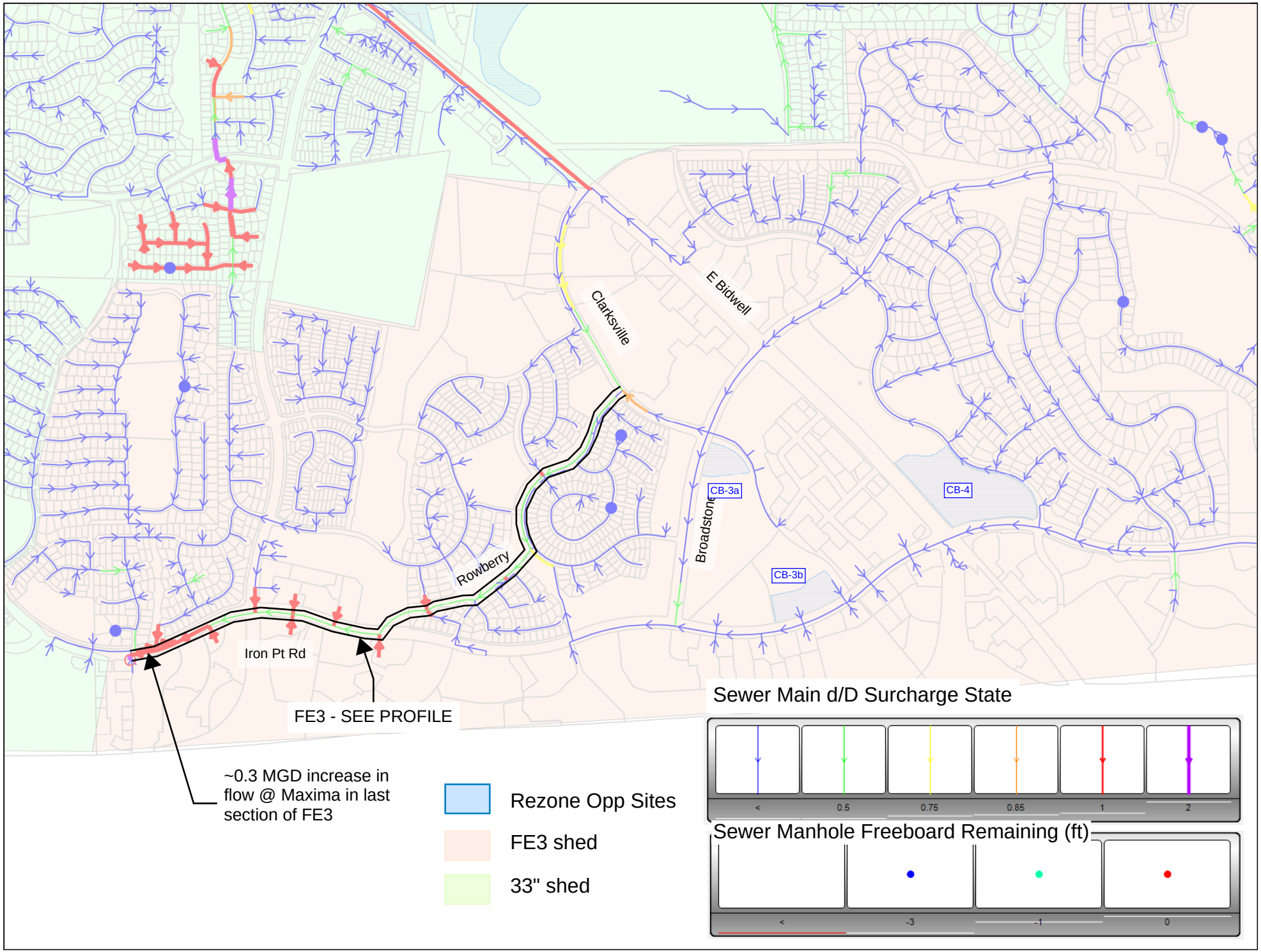
Appendix 2.2: FE3 Shed Base UBO Scenario with Surcharge and Freeboard Theming

Base UBO scenario, PWWF 10yr6hr storm - ORIGINAL

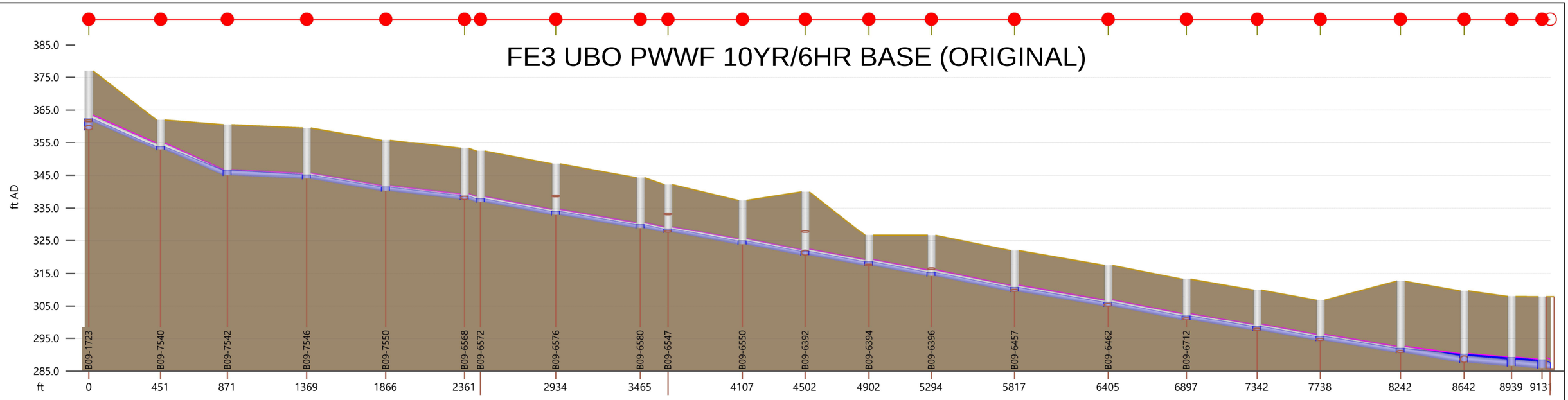


Appendix 2.3: FE3 Shed Rezone Scenario with Surcharge and Freeboard Theming

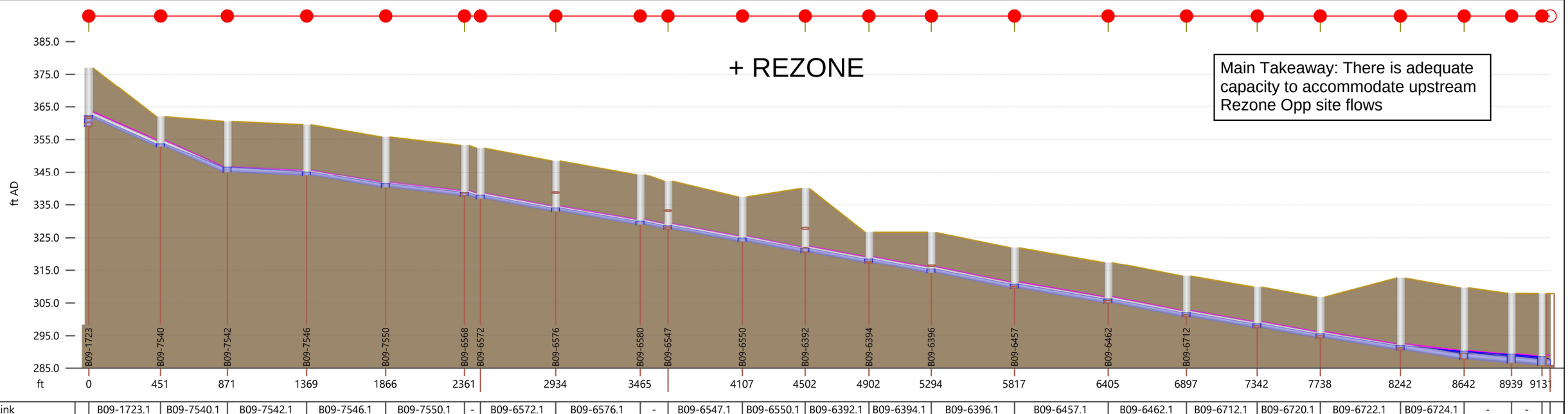
Base UBO scenario, PWWF 10yr6hr storm, with SACOG REAP Opp Sites



Appendix 2.4: FE3 24" Main Profile Comparison



Link	B09-1723.1	B09-7540.1	B09-7542.1	B09-7546.1	B09-7550.1	-	B09-6572.1	B09-6576.1	-	B09-6547.1	B09-6550.1	B09-6392.1	B09-6394.1	B09-6396.1	B09-6457.1	B09-6462.1	B09-6712.1	B09-6720.1	B09-6722.1	B09-6724.1	-	-
height (in)	24.0	24.0	24.0	24.0	24.0	-	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
grad (%)	1.909	1.865	0.201	0.755	0.515	-	0.820	0.758	-	0.804	0.831	0.800	0.811	0.897	0.765	0.854	0.754	0.780	0.732	0.747	0.363	0.366
surc	0.40	0.77	0.76	0.57	0.56	-	0.51	0.51	0.50	0.50	0.55	0.55	0.55	0.57	0.56	0.58	0.57	0.59	0.60	1.00	1.00	1.00
DS flow (MGD)	6.7627	6.7645	6.7799	6.8226	6.8231	-	6.9099	6.9475	-	7.0249	7.0255	8.1748	8.1870	8.2043	8.3704	8.4200	8.4504	8.4817	8.5666	8.5954	9.0793	-
Node	-	B09-7540	B09-7542	B09-7546	B09-7550	-	-	B09-6576	-	-	B09-6550	B09-6392	B09-6394	B09-6396	B09-6457	B09-6462	B09-6712	B09-6720	B09-6722	B09-6724	-	-	-

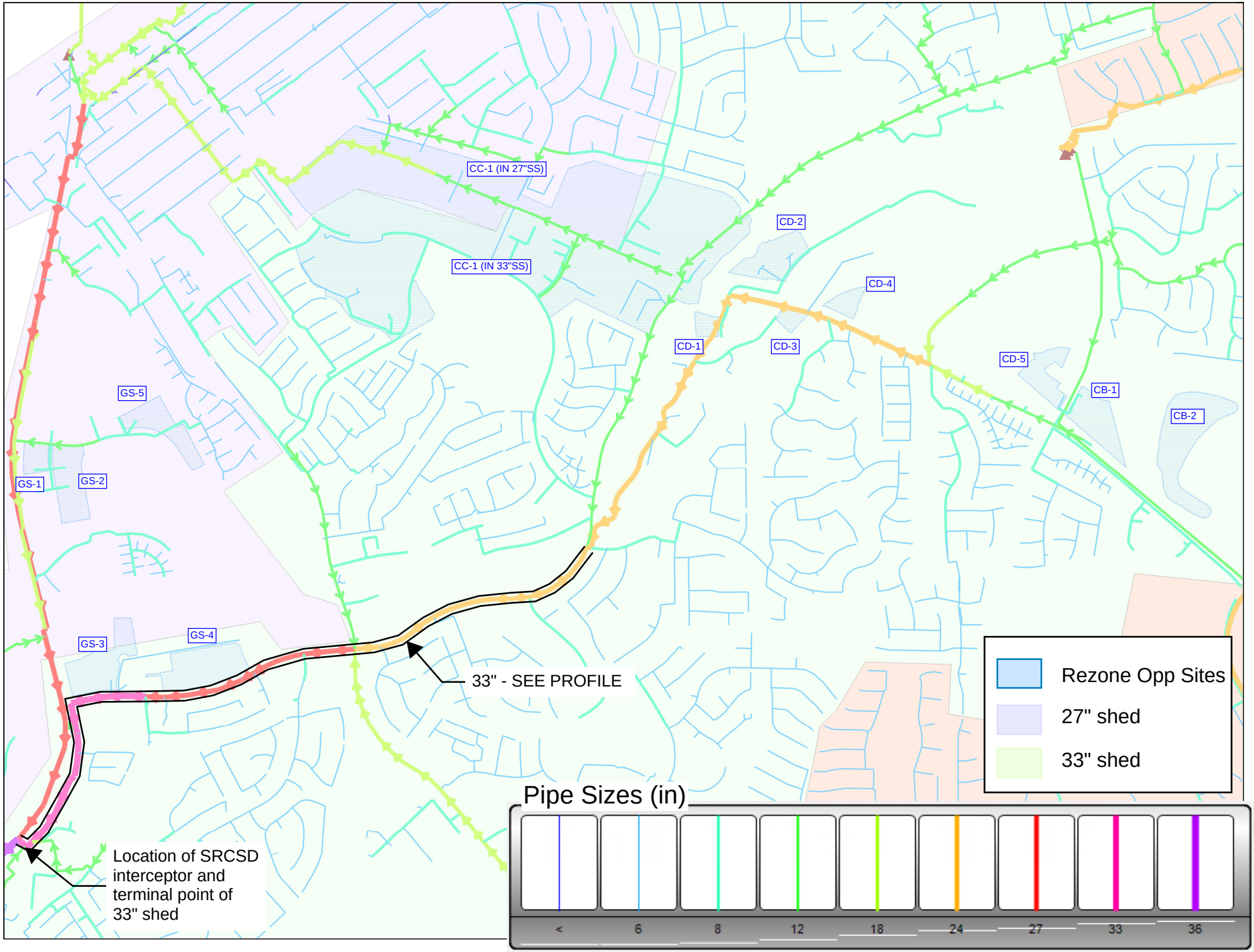


Link	B09-1723.1	B09-7540.1	B09-7542.1	B09-7546.1	B09-7550.1	-	B09-6572.1	B09-6576.1	-	B09-6547.1	B09-6550.1	B09-6392.1	B09-6394.1	B09-6396.1	B09-6457.1	B09-6462.1	B09-6712.1	B09-6720.1	B09-6722.1	B09-6724.1	-	-
height (in)	24.0	24.0	24.0	24.0	24.0	-	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
grad (%)	1.909	1.865	0.201	0.755	0.515	-	0.820	0.758	-	0.804	0.831	0.800	0.811	0.897	0.765	0.854	0.754	0.780	0.732	0.747	0.363	0.366
surc	0.40	0.77	0.76	0.57	0.56	-	0.51	0.51	0.51	0.50	0.57	0.56	0.56	0.58	0.58	0.59	0.58	0.60	0.63	1.00	1.00	1.00
DS flow (MGD)	6.7627	6.7645	6.7799	6.8226	6.8231	-	6.9753	7.0129	-	7.0903	7.0910	8.4637	8.4760	8.4932	8.6591	8.7086	8.7391	8.7703	8.8539	8.8821	9.3638	-
Node	-	B09-7540	B09-7542	B09-7546	B09-7550	-	-	B09-6576	-	-	B09-6550	B09-6392	B09-6394	B09-6396	B09-6457	B09-6462	B09-6712	B09-6720	B09-6722	B09-6724	-	-	-

Appendix 3: North Model 33" Shed Results

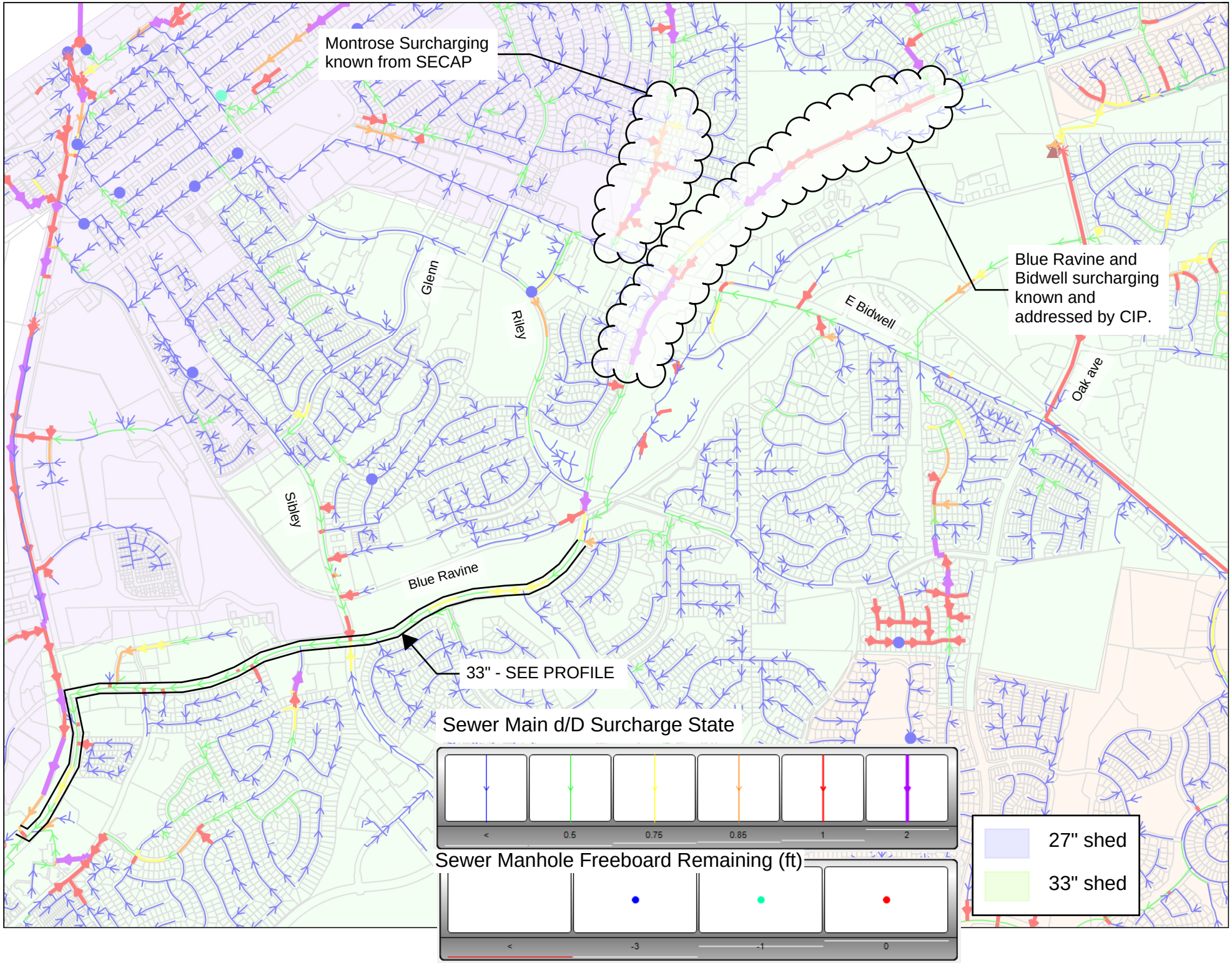
Appendix 3.1: 33” Shed with Pipe Size Theming

Folsom East 33" Shed Pipe Size Map



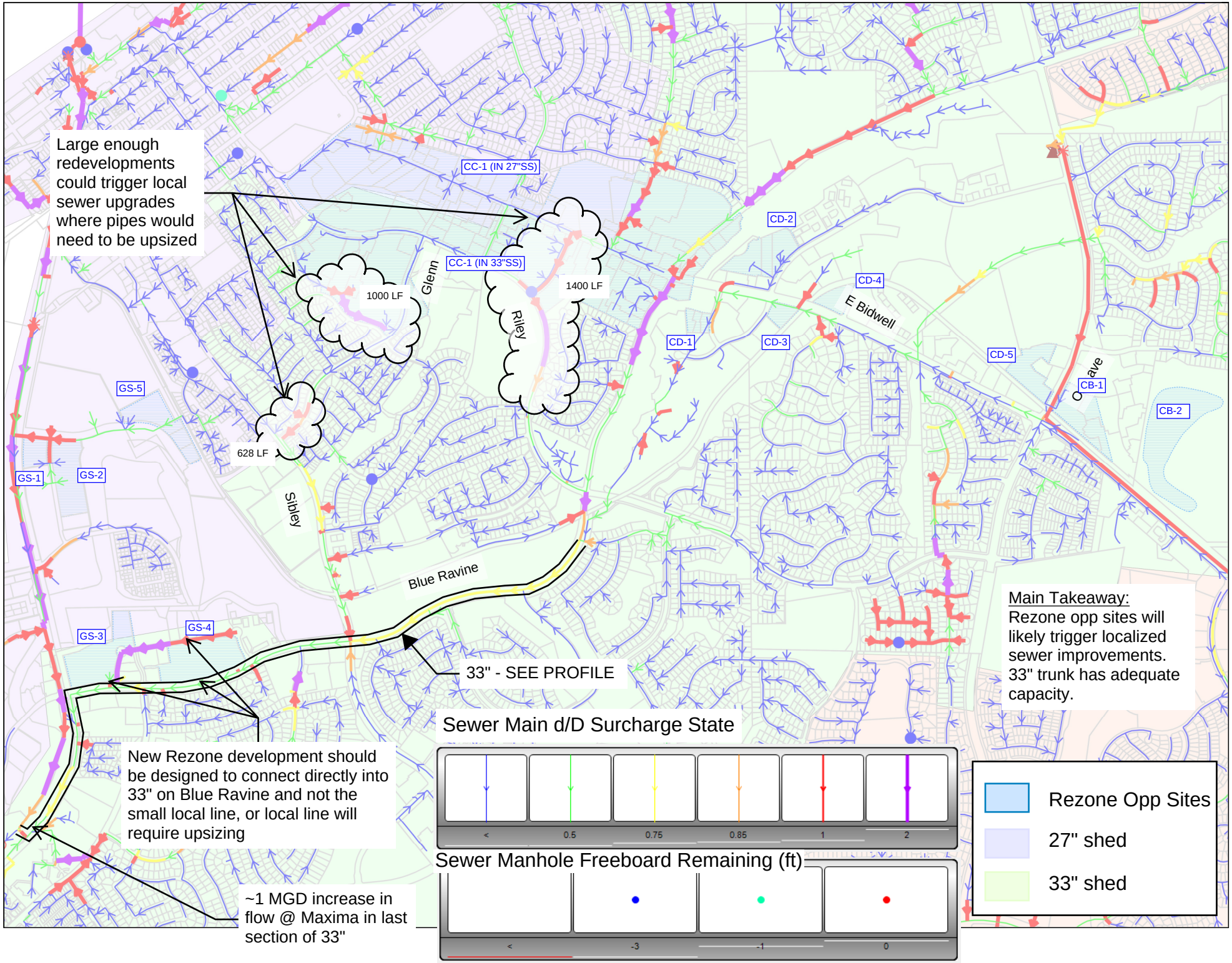
Appendix 3.2: 33” Shed Base UBO Scenario with Surcharge and Freeboard Theming

Base UBO scenario, PWWF 10yr6hr storm (ORIGINAL)

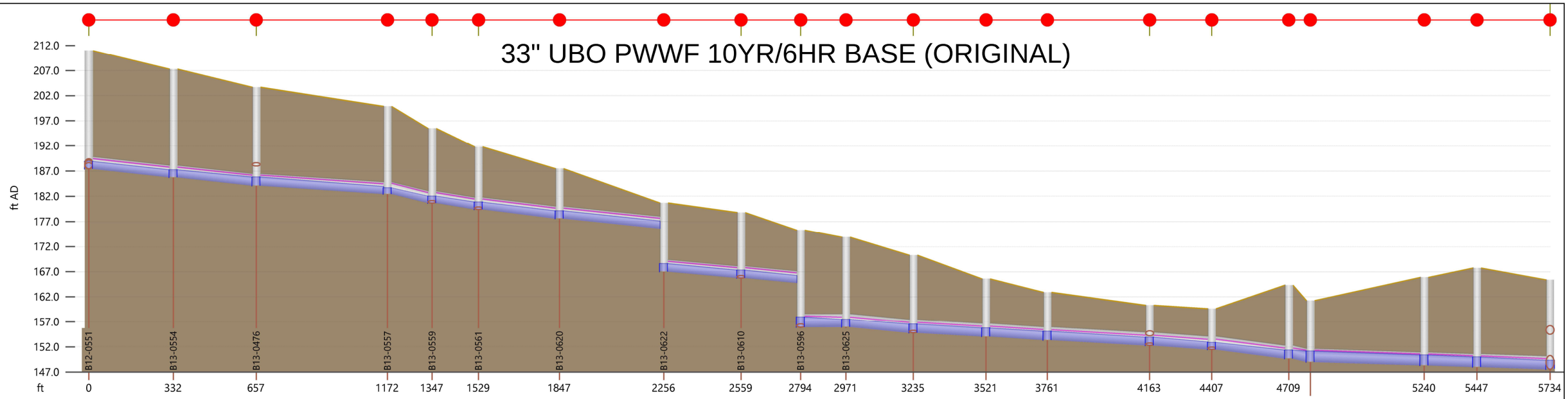


Appendix 3.3: 33” Shed Rezone Scenario with Surcharge and Freeboard Theming

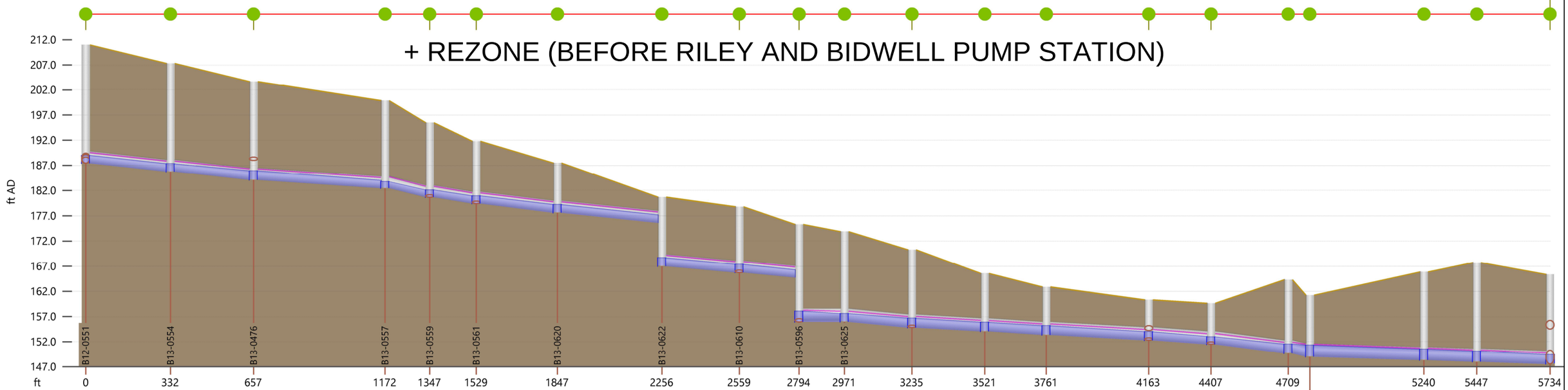
Base UBO scenario, PWWF 10yr6hr storm, with SACOG REAP Opp Sites



Appendix 3.4: 33” Shed Main Profile Comparison



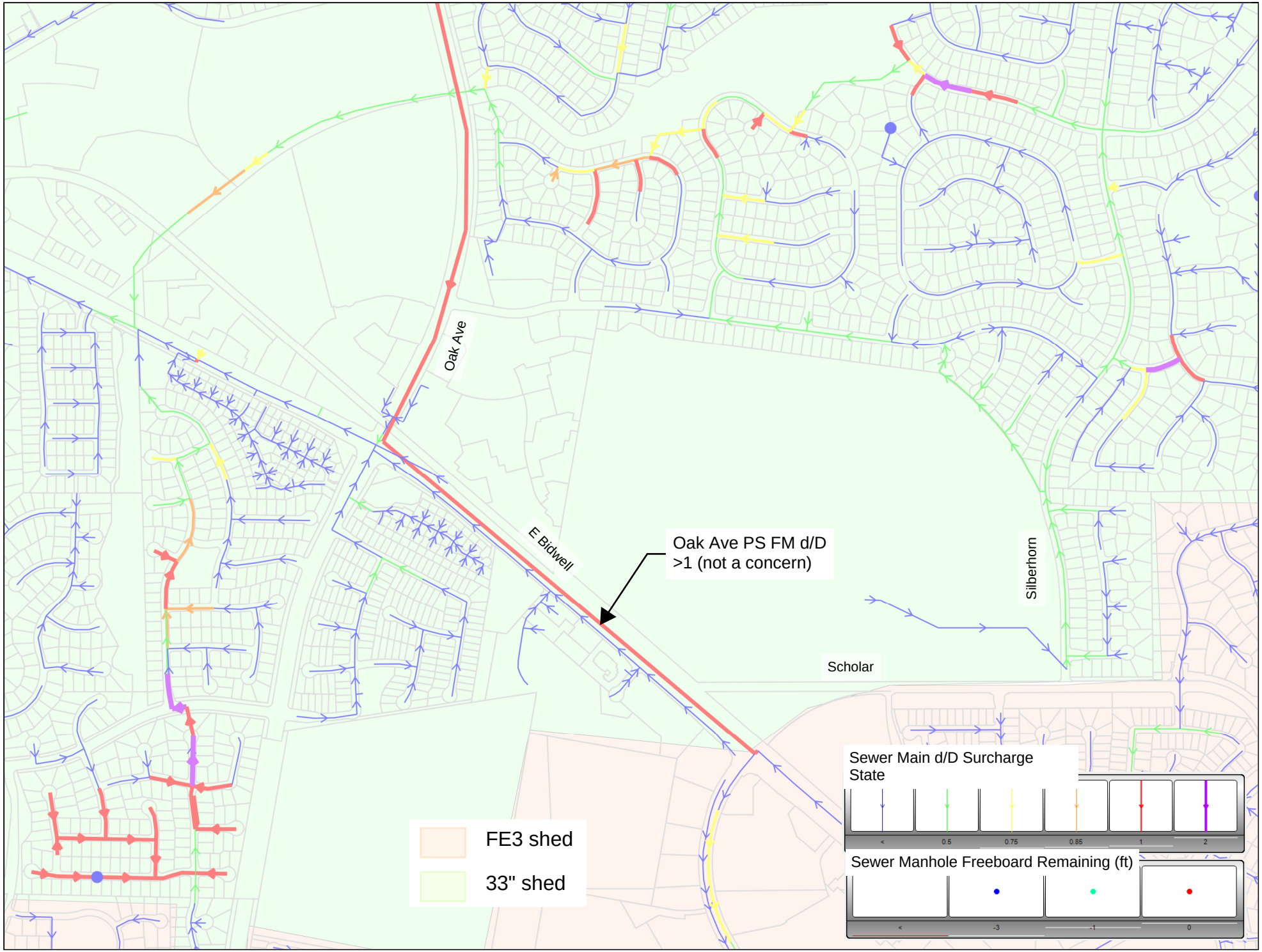
Link	B12-0551.1	B13-0554.1	B13-0476.1	-	-	B13-0561.1	B13-0620.1	B13-0622.1	B13-0610.1	-	B13-0625.1	B13-0628.1	B13-0630.1	B13-9933.1	B13-0633.1	B13-0670.1	-	B13-0678.1	-	B13-0680.1
height (in)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	-	33.0	33.0	33.0
grad (%)	0.509	0.507	0.321	1.018	0.685	0.563	0.489	0.412	0.431	-0.028	0.439	0.270	0.295	0.262	0.328	0.599	-	0.157	0.155	0.153
surc	0.58	0.68	0.67	0.54	0.57	0.59	0.59	0.62	0.61	0.73	0.62	0.62	0.63	0.62	0.57	0.60	-	0.76	0.74	0.71
DS flow (MGD)	11.6795	11.6871	11.9329	11.9380	11.9550	11.9548	11.9586	11.9585	11.9933	12.1633	12.1636	12.4831	12.4898	12.4894	12.5369	12.6337	-	12.6495	12.6493	12.6500
Node	-	B13-0554	B13-0476	B13-0557	-	B13-0561	B13-0620	B13-0622	B13-0610	-	-	B13-0628	B13-0630	B13-9933	B13-0633	B13-0670	-	B13-0678	B13-0682	B13-0680	-



Link	B12-0551.1	B13-0554.1	B13-0476.1	-	-	B13-0561.1	B13-0620.1	B13-0622.1	B13-0610.1	-	B13-0625.1	B13-0628.1	B13-0630.1	B13-9933.1	B13-0633.1	B13-0670.1	-	B13-0678.1	-	B13-0680.1
height (in)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	-	33.0	33.0	33.0
grad (%)	0.509	0.507	0.321	1.018	0.685	0.563	0.489	0.412	0.431	-0.028	0.439	0.270	0.295	0.262	0.328	0.599	-	0.157	0.155	0.153
surc	0.62	0.72	0.71	0.56	0.60	0.62	0.62	0.65	0.64	0.76	0.66	0.66	0.66	0.66	0.60	0.66	-	0.82	0.78	0.75
DS flow (MGD)	12.5796	12.5872	12.8322	12.8374	12.8542	12.8541	12.8578	12.8577	12.8924	13.0616	13.0614	13.5511	13.5578	13.5575	13.6047	13.7001	-	13.7153	13.7154	13.7161
Node	-	B13-0554	B13-0476	B13-0557	-	B13-0561	B13-0620	B13-0622	B13-0610	-	-	B13-0628	B13-0630	B13-9933	B13-0633	B13-0670	-	B13-0678	B13-0682	B13-0680	-

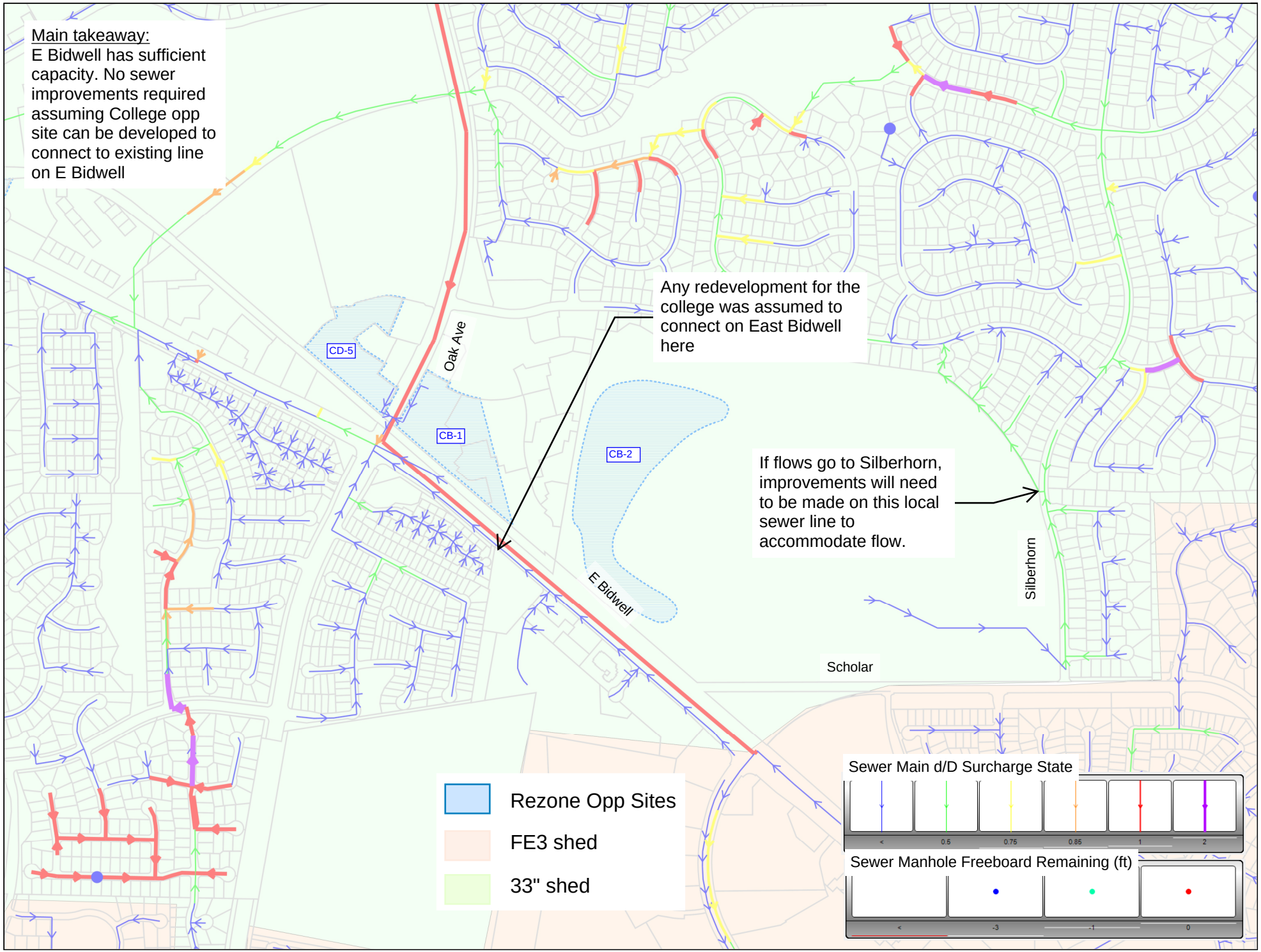
Appendix 3.5: 33” Shed College District Extent Base UBO Scenario with Surcharge and Freeboard Theming

Base UBO scenario, PWWF 10yr6hr storm



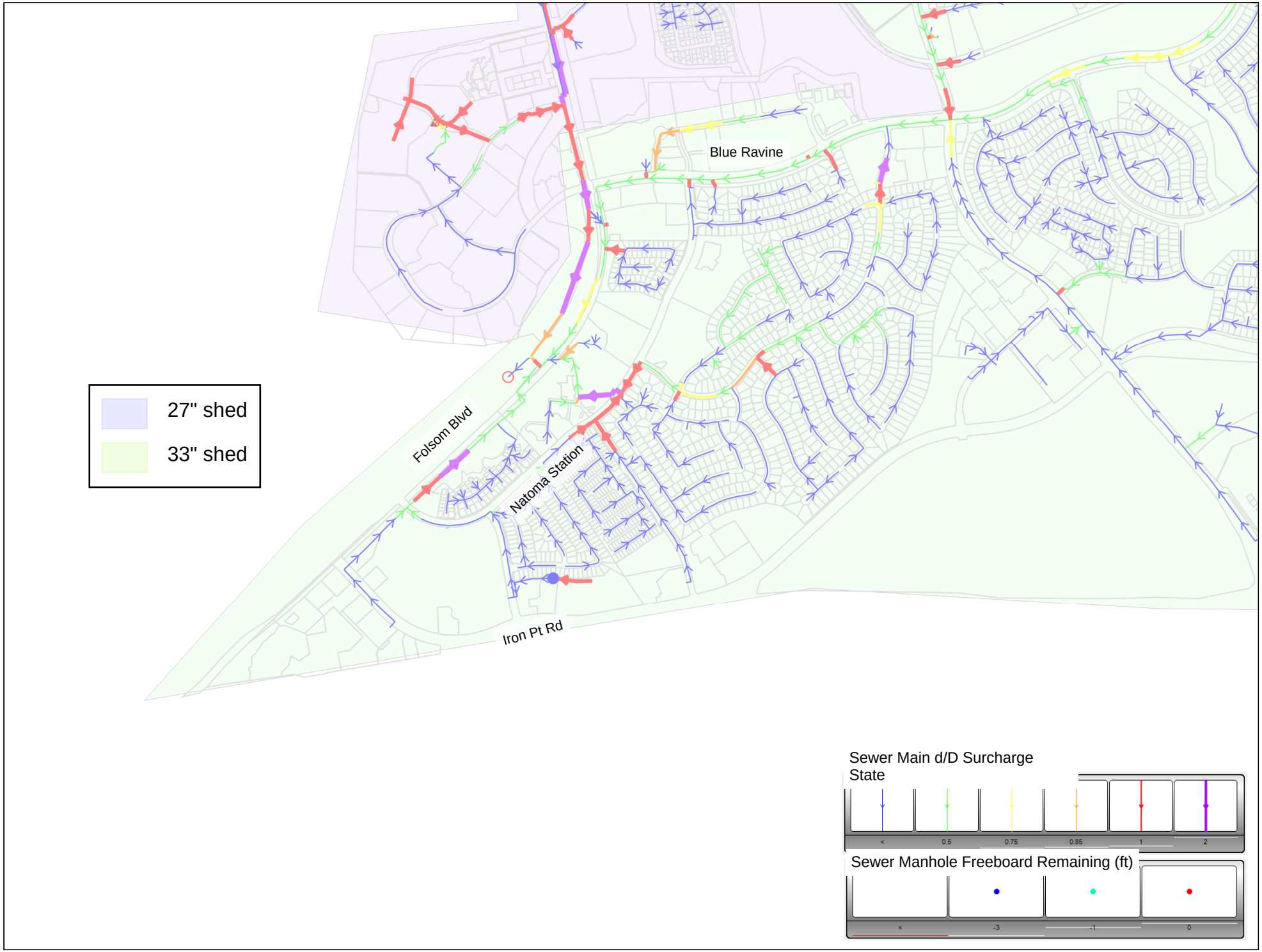
Appendix 3.6: 33" Shed College District Extent Rezone Scenario with Surcharge and Freeboard Theming

Base UBO scenario, PWWF 10yr6hr storm, with SACOG REAP Opp Sites



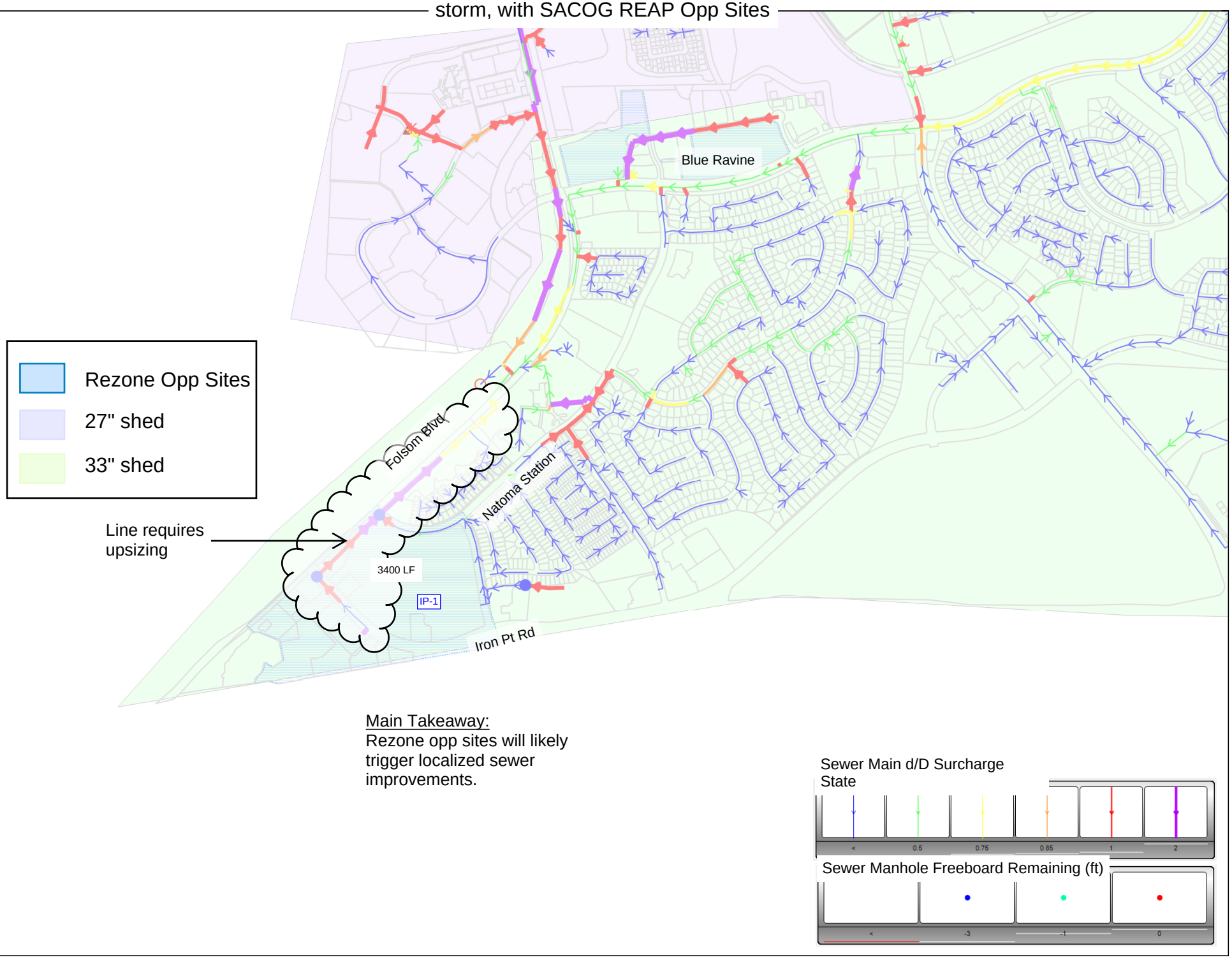
Appendix 3.7: 33” Shed IP-1 Extent Base UBO Scenario with Surcharge and Freeboard Theming

Base UBO scenario, PWWF 10yr6hr storm



Appendix 3.8: 33" Shed IP-1 Extent Rezone Scenario with Surcharge and Freeboard Theming

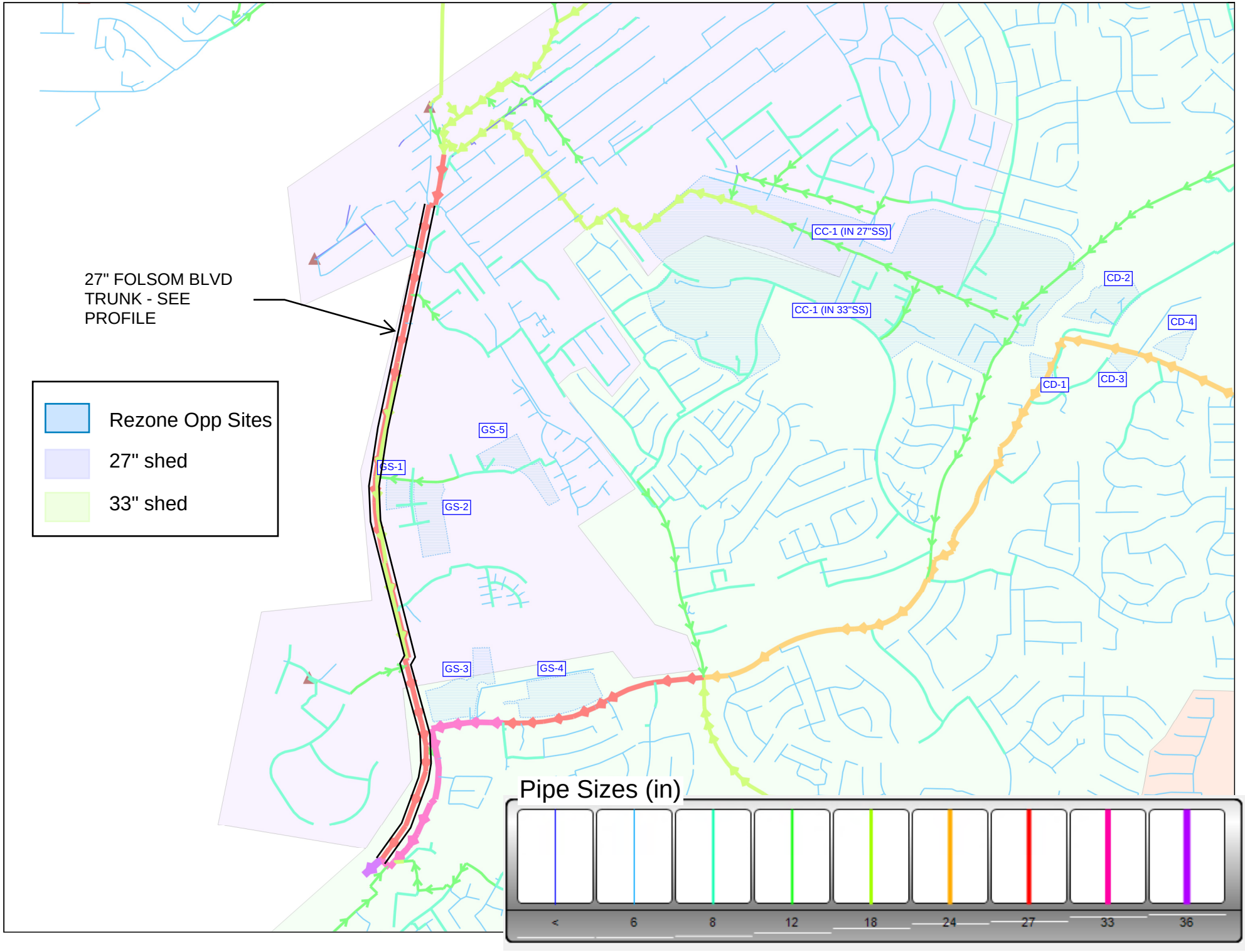
Base UBO scenario, PWWF 10yr6hr storm, with SACOG REAP Opp Sites



Appendix 4: North Model 27" Shed Results

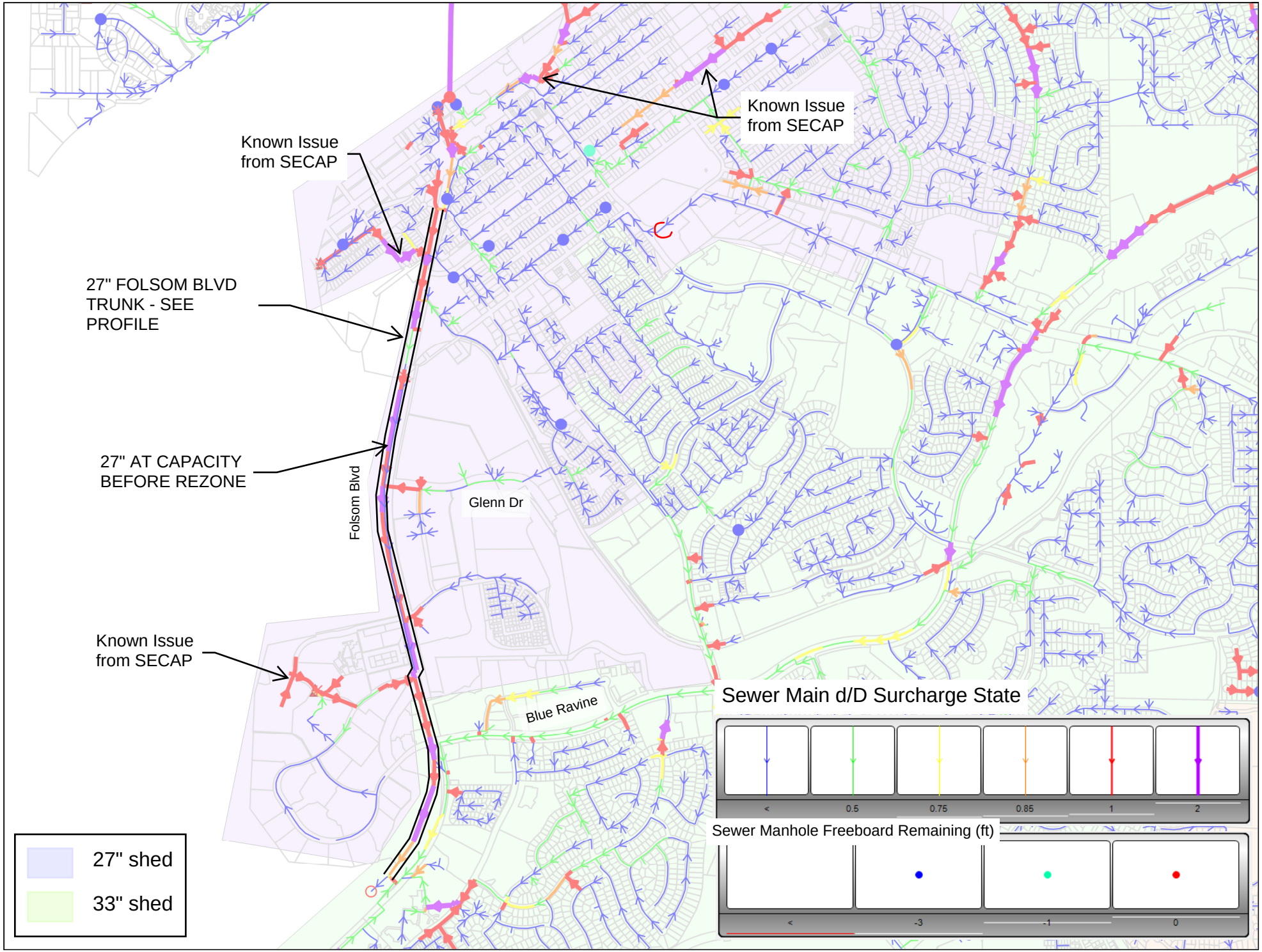
Appendix 4.1: 27” Shed with Pipe Size Theming

Folsom West 27" Shed Size Map



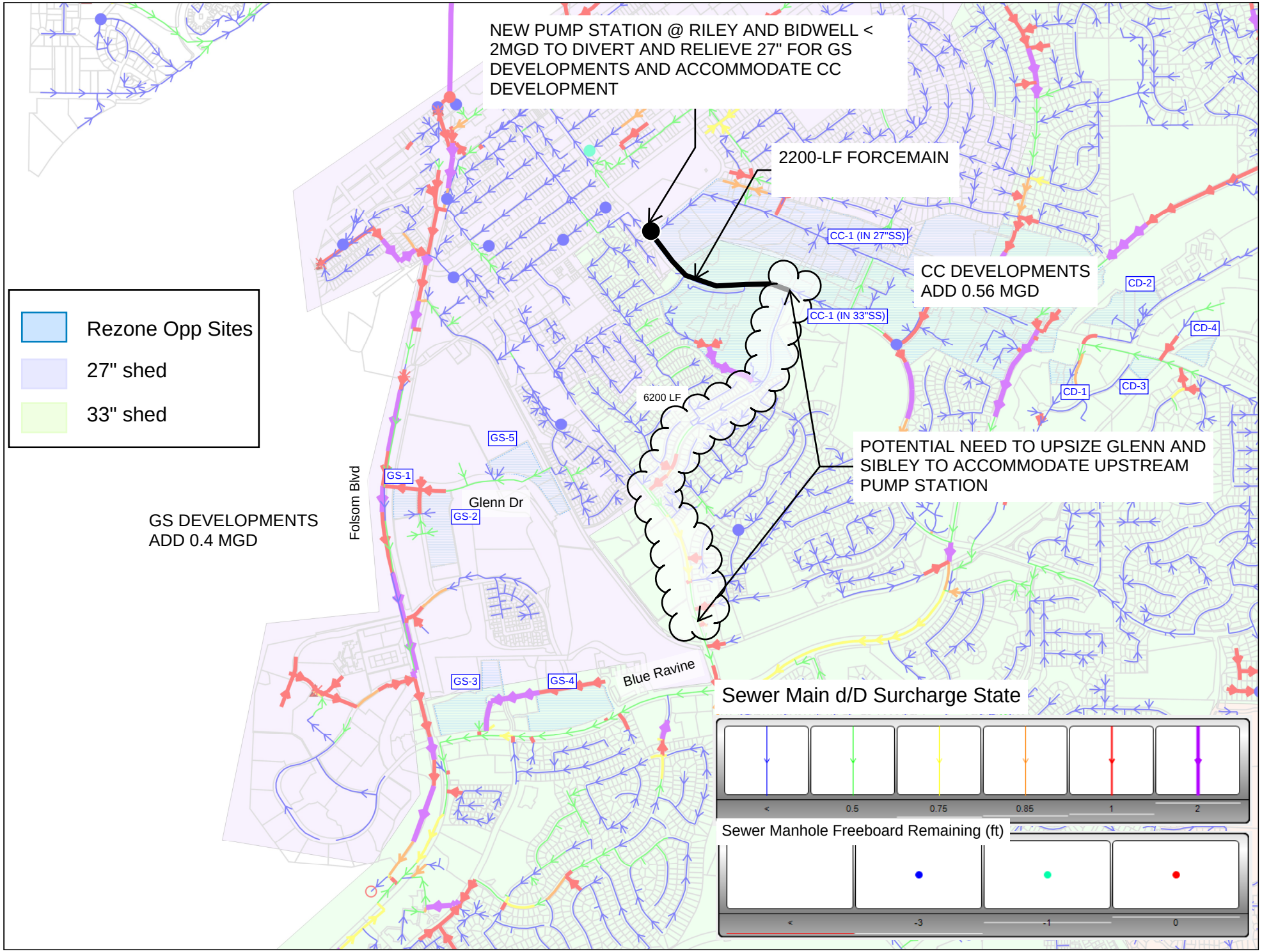
Appendix 4.2: 27” Shed Base UBO Scenario with Surcharge and Freeboard Theming

Base UBO scenario, PWWF 10yr6hr storm

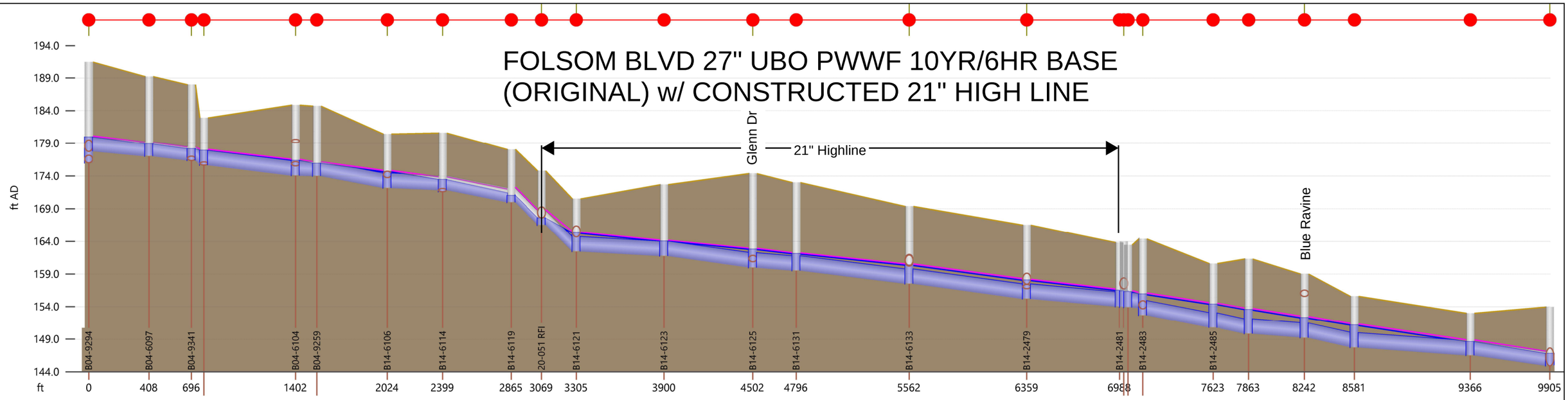


Appendix 4.3: 27” Shed Rezone Scenario with Surcharge and Freeboard Theming

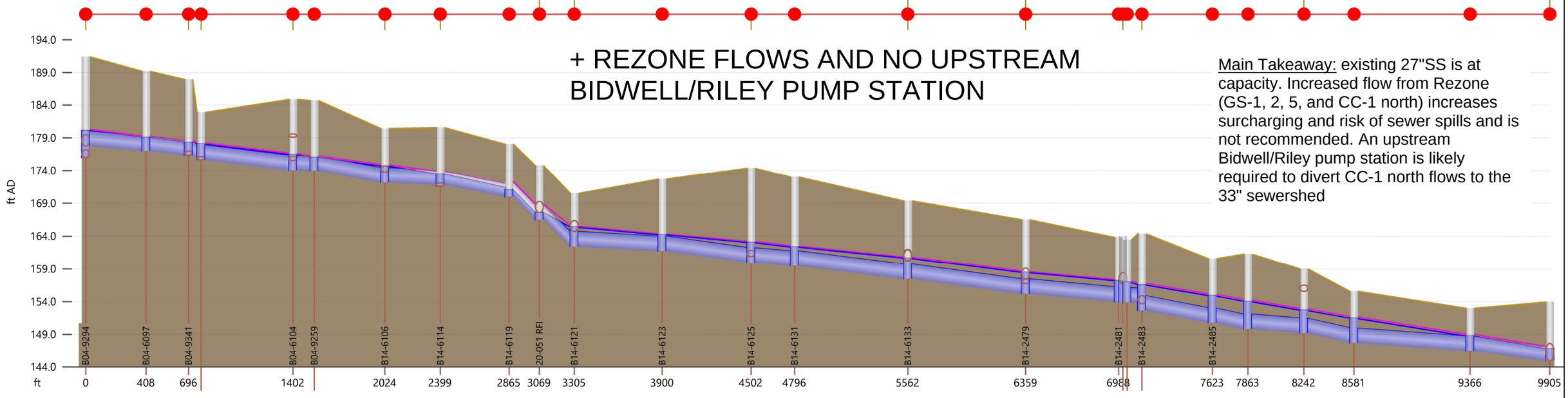
Base UBO scenario, PWWF 10yr6hr storm, with SACOG REAP Opp Sites



Appendix 4.4: 27” Shed Main Profile Comparison



Link	B04-9294.1	-	-	B04-6099.1	-	B04-9259.1	-	B14-6114.1	-	-	B14-6121.1	B14-6123.1	-	B14-6131.1	B14-6133.1	B14-2479.1	-	B14-2483.1	-	-	-	B14-2493.1	B14-9322.1
height (in)	27.0	27.0	-	27.0	-	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	-	27.0	27.0	27.0	27.0	27.0	27.0
grad (%)	0.179	0.233	-	0.256	-	0.378	0.085	0.393	1.677	1.737	0.118	0.288	0.156	0.262	0.288	0.191	-	0.388	0.387	0.153	0.419	0.154	0.295
surc	0.96	0.82	-	1.00	-	1.00	2.00	0.70	0.46	1.00	2.00	1.00	2.00	1.00	1.00	2.00	-	1.00	1.00	2.00	1.00	2.00	0.92
DS flow (MGD)	9.6689	9.6821	-	9.9320	-	10.1308	10.4330	10.4314	-	-	9.5472	9.4758	9.9304	9.7860	10.6640	10.3189	-	11.1288	-	11.1450	11.1428	11.1353	11.1272
Node	-	-	-	-	-	-	B14-6106	B14-6114	-	-	B14-6121	B14-6123	B14-6125	B14-6131	B14-6133	B14-2479	-	-	-	-	-	B14-2493	B14-9322	-



Link	B04-9294.1	-	-	B04-6099.1	-	B04-9259.1	-	B14-6114.1	-	-	B14-6121.1	B14-6123.1	-	B14-6131.1	B14-6133.1	B14-2479.1	-	B14-2483.1	-	-	-	B14-2493.1	B14-9322.1
height (in)	27.0	27.0	-	27.0	-	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	-	27.0	27.0	27.0	27.0	27.0	27.0
grad (%)	0.179	0.233	-	0.256	-	0.378	0.085	0.393	1.677	1.737	0.118	0.288	0.156	0.262	0.288	0.191	-	0.388	0.387	0.153	0.419	0.154	0.295
surc	2.00	0.90	-	1.00	-	1.00	2.00	0.71	0.46	1.00	2.00	1.00	2.00	1.00	2.00	2.00	-	1.00	1.00	2.00	1.00	2.00	0.99
DS flow (MGD)	9.8642	9.8710	-	10.1204	-	10.3248	10.6257	10.6238	-	-	9.4627	9.3835	10.0560	9.8957	10.7835	10.3458	-	11.5569	-	11.5516	11.5509	11.5475	11.5314
Node	-	-	-	-	-	-	B14-6106	B14-6114	-	-	B14-6121	B14-6123	B14-6125	B14-6131	B14-6133	B14-2479	-	-	-	-	-	B14-2493	B14-9322	-