Appendix 3.11-3

Sanitary Sewer Impact Study

DRAFT TECHNICAL MEMORANDUM

TO: City of San Bruno

PREPARED BY: Gisa Ju, Woodard & Curran, PE No. 31823
Katie Howes, Woodard & Curran, EIT No. 159022

REVIEWED BY: Cathy Greenman, Woodard & Curran, PE No. 66157

DATE: August 26, 2019

RE: Sanitary Sewer Impact Study for Bayhill Specific Plan Area

The City of San Bruno is preparing a Draft Environmental Impact Report (EIR) to address the potential impacts of the proposed Bayhill Specific Plan and Phase I of YouTube's 20-year campus expansion plan. The City has requested that Woodard & Curran evaluate the potential sanitary sewer capacity impact of the proposed Specific Plan and Phase I development using the City's sanitary sewer hydraulic model. The model was originally developed for the City's 2014 Sewer Master Plan to guide improvements to the City's sanitary sewer system to accommodate current and future development. This Technical Memorandum (TM) summarizes the results of the evaluation.

1. PROJECT DESCRIPTION

The Bayhill Specific Plan area includes the area bounded by Interstate 280 on the west, Interstate 380 on the north, San Bruno Avenue West on the south, and El Camino Real on the east. The Bayhill Specific Plan area includes the area bounded by Interstate 280 on the west, Interstate 380 on the north, San Bruno Avenue West on the south, and El Camino Real on the east, except the portions that are part of the Transit Corridor Plan. The project area includes 17 large parcels, including the existing Bayhill Shopping Center and multiple parcels and office buildings owned by YouTube, as well as other commercial and office developments.

The first phase of the project is YouTube's campus expansion plan (Phase I development), which also includes the proposed re-alignment of Grundy Lane and replacement of the utilities in that portion of the roadway. The EIR preferred buildout alternative includes up to approximately 2.46 million square feet of new office development, with a housing overlay that allows for the potential for replacing some of that office development with housing and adding residential (mixed use) development in the Bayhill shopping center area. These two scenarios are referred to as the Maximum Office and Maximum Housing scenarios in this TM. The modeling also evaluated two alternate scenarios (Alternate Maximum Office and Alternate Maximum Housing), which are based on the potential for increased building height limits in the area. Table 1 summarizes the development quantities for each scenario.

Table 1: Total Land Use Quantities for Bayhill Specific Plan Development Scenarios

Scenario	Office (sq. ft.)	Retail (sq. ft.)	Residential (DUs)	Hotel (rooms)
Existing	1,557,847	121,846	--	133
Phase I	1,859,323	121,846	--	133
Maximum Office	4,017,694	121,846	--	133
Maximum Housing	3,500,743	121,846	573	133
Alternate Maximum Office	4,017,694	121,846	--	186
Alternate Maximum Housing	3,500,743	121,846	1,070	186

2. EXISTING AND PLANNED WASTEWATER FACILITIES

The Bayhill Specific Plan area is served by local sewers located along Cherry Avenue, Bayhill Drive, and Grundy Lane, and a major (18- to 24-inch) trunk sewer that runs through the area from San Bruno Avenue West along Traeger Avenue, Bayhill Drive, across El Camino Real and I-380 and through the Tanforan Mall to Sneath Lane and then east on Sneath Lane and Tanforan Avenue. This trunk sewer ultimately discharges to the City of South San Francisco's Shaw Road Pump Station located on Shaw Road east of San Mateo Avenue, from where the flow is conveyed to the South San Francisco Water Quality Control Plant (WQCP). In addition to the Bayhill Specific Plan area, the downstream portion of the 24-inch trunk sewer east of El Camino Real conveys flow from the entire portion of the City's sewer service area located west of I-280, and the portion of the trunk sewer running through the Specific Plan area carries flows from about one-third of this area.

The location of the Specific Plan area and the existing sewers within and in the vicinity of the Bayhill Specific Plan area are shown in Figure 1. Figure 2 highlights these sewers and the downstream trunk sewer system to which the Bayhill Specific Plan area is tributary. Note that the figures reflect the proposed Phase I re-alignment of Grundy Lane including installation of a new sewer in that street, as well as a new sewer extension in Grundy Lane flowing west from Elm Avenue to serve future uses. Although the new sewer mains within Grundy Lane were modeled as 8-inch pipes, City standards require sewer mains to have a minimum inner diameter of eight inches within commercial and industrial areas. Therefore, at a minimum, 10-inch HDPE pipes shall be installed for new sewer mains within the Bayhill Specific Plan area.

Figure 1: Modeled Sewers Within and in Vicinity of Bayhill Specific Plan Area

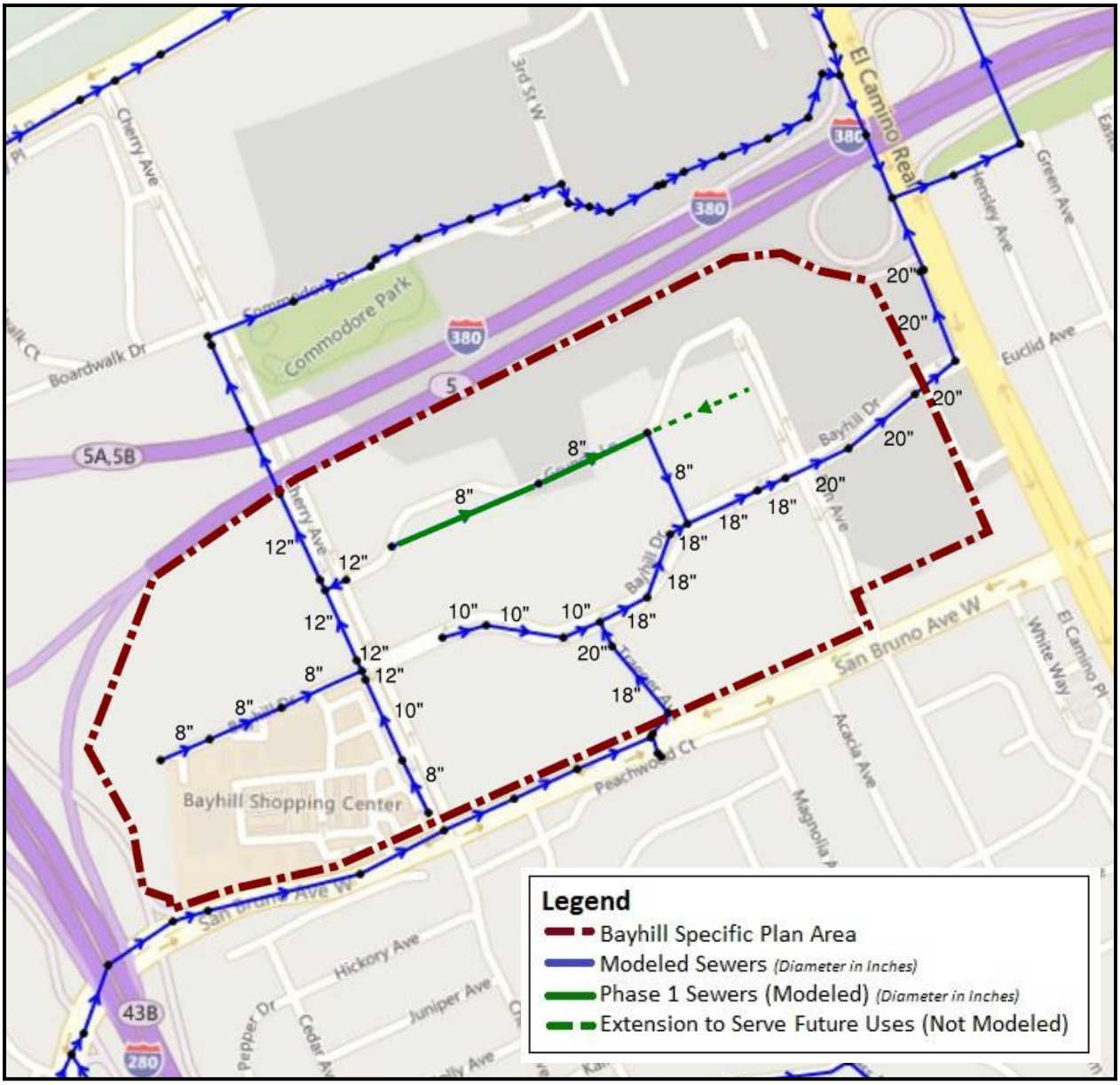
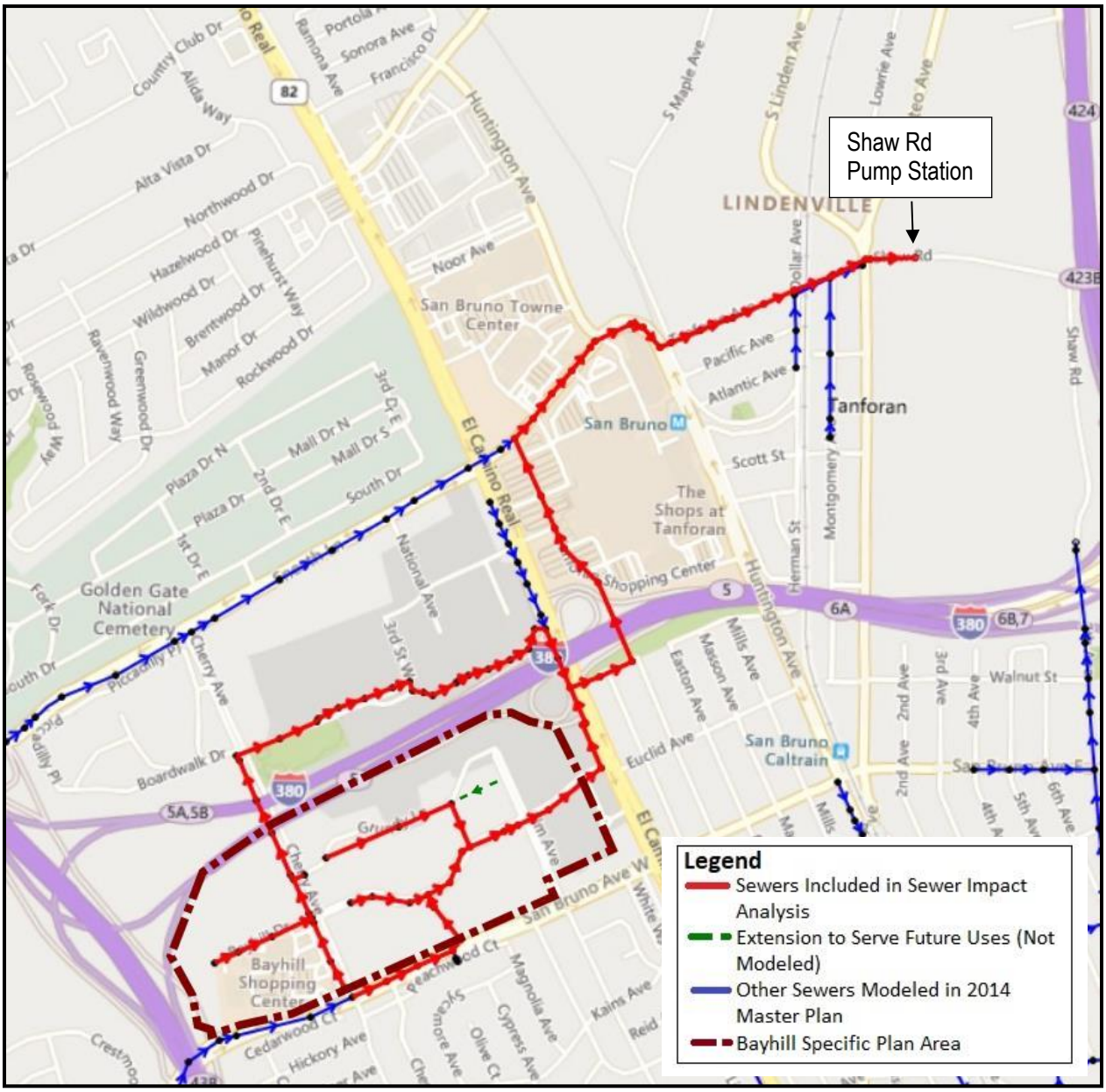


Figure 2: Bayhill Specific Plan Sewers and Downstream Trunks Included in Sewer Impact Analysis



3. MODEL INPUT

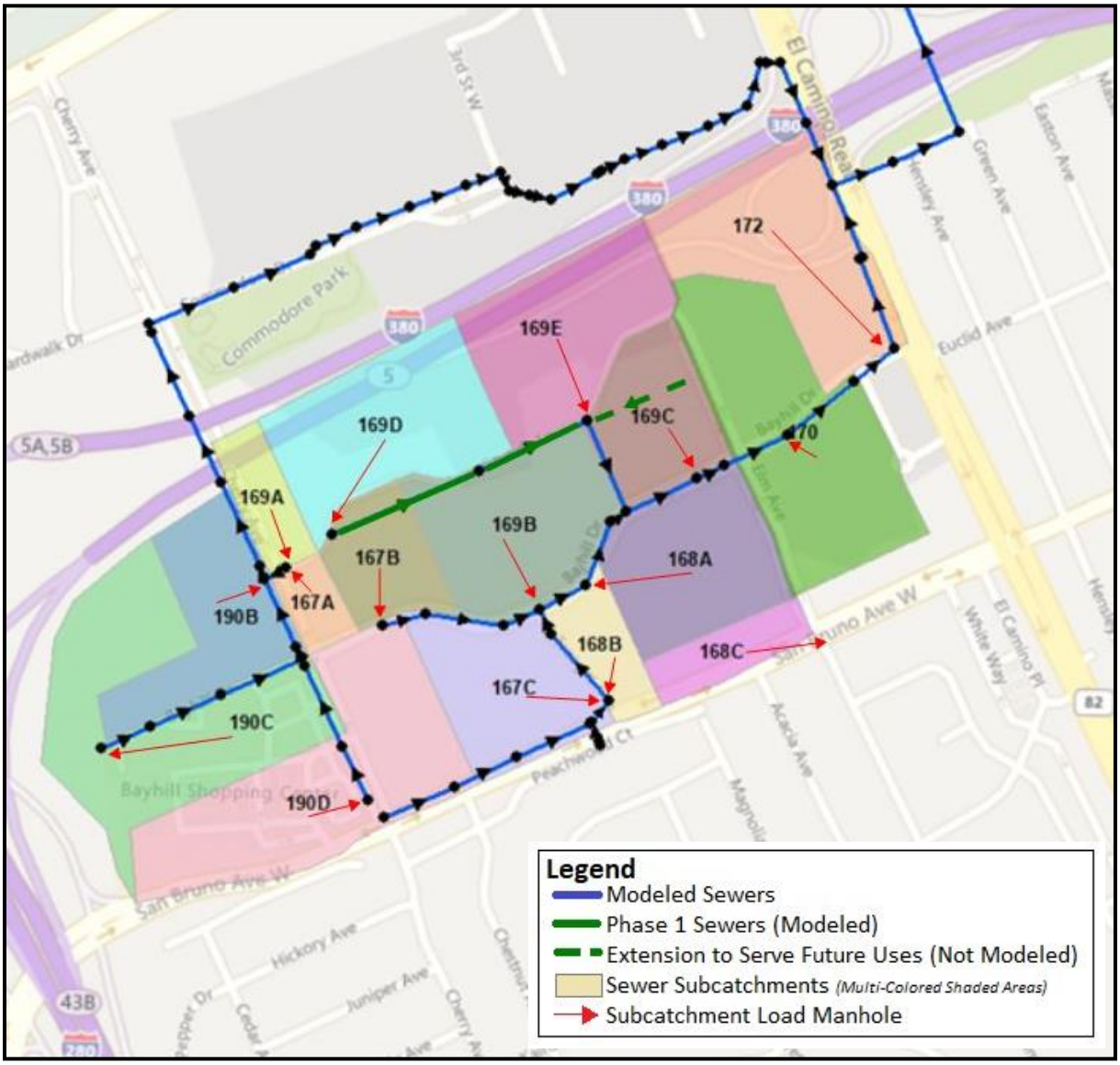
The model developed for the 2014 Master Plan was used to evaluate the sanitary sewer capacity within and downstream of the Bayhill Specific Plan area with the addition of the proposed development. The estimated flows in the original model were based on 2010 census information, winter water consumption and flow monitoring data from the 2010/2011 period, and projections of future development available at that time. The model was created in InfoWorks™ CS and was recently converted to InfoWorks ICM, the current version of the InfoWorks modeling software. Updates to the model were made for this analysis, as described below.

3.1 Sewer Network

This analysis used the City's trunk system network that was developed for the 2014 Master Plan, which included primarily 10-inch and larger pipes and selected smaller diameter pipes that effectively serve as "trunk" sewers. For this analysis, additional small diameter pipe segments within the Bayhill Specific Plan area were added to the network, as well as the alignment of the proposed new sewer along Grundy Lane, as proposed by YouTube to be constructed as part of the Phase I development. The model network data for these additions, as well as the entire previously modeled trunk sewers within and downstream of the Bayhill Specific Plan area as highlighted in Figure 2, were updated for this study. The update included manhole locations and IDs based on the City's current geographic information system (GIS) sewer layers, and associated ground elevations and pipe lengths, sizes, and invert elevations based on a combination of latest GIS data, manhole rim and invert elevations shown on AutoCAD sewer mapping developed by the City in 2003, and as-built sewer drawings where available. No updates to the model were made for portions of the City's system beyond the sewershed of the Bayhill Specific Plan area and downstream trunk sewers.

In addition to updates to the model pipe network, the sewer "subcatchments", or areas of the system discharging to the modeled system, were further subdivided in order to establish the model "loads" to each pipe with the Specific Plan area. Figure 3 shows the updated sewer subcatchments.

Figure 3: Bayhill Specific Plan Sewer Subcatchments



3.2 Sewer Loads

In order to update the model to current conditions, the existing model loads (representing the sanitary sewer flow contributions, or base wastewater flow (BWF), from residential and non-residential customers) were updated based on recent water consumption data. The City provided water meter readings by water account for winter months (January through April), which can be assumed to be representative of primarily indoor water use and corresponding wastewater flows. The water usage data for the 2017/18 winter period were linked to address points in GIS and associated with the relevant sewer subcatchments based on geographical location. For the Bayhill Specific Plan area, an alternate estimate of existing sewer loads was also calculated by applying design unit flow factors (discussed below) to the square footage of existing building floor space, as provided by the EIR project team. This was done because there appeared to be some buildings within the Specific Plan area that were not included in the initial download of the water account data.

Note that the updated total existing (2018) average BWF in the system is lower than that estimated in the 2014 Sewer Master Plan based on 2010/2011 water consumption and sewer flow monitoring data. This is consistent with the findings of many Bay Area cities and wastewater agencies, which have experienced decreases in wastewater flows due to recent drought years and water conservation measures.

To estimate the model loads from future development in the Specific Plan area, the City's EIR team provided a detailed tabulation of the existing and proposed building square footage, residential dwelling units, and hotel rooms by parcel for the proposed development for each of the Specific Plan planning scenarios. The future loads from these developments were assigned to their associated model subcatchments. In addition, the City's planning staff provided listings with details of other proposed development projects within the City ("related projects") in order to estimate cumulative impacts for the EIR. Attachment A provides a list of the related projects included in the buildout scenarios. Note that most of these related projects are not tributary to the trunk sewers that serve the Bayhill Specific Plan area.

Future flows were calculated based on the design unit flow factors shown in Table 2 below. Note that for consistency with the water system impact analysis, the unit flow factors for residential and commercial development were based on indoor water use factors developed for the City's Water Master Plan, which differ somewhat from those that were used to estimate future development flows for the Sewer Master Plan. In general, the commercial factors from the Water Master Plan are somewhat higher (more conservative), and the residential factors are slightly lower than the Sewer Master Plan factors.

Table 2: New Development Unit Flow Factors

Type of Development	Design Unit Flow Factor (average daily flow)
Single Family Residential	160 gpd/DU
Multi-Family Residential	120 gpd/DU
Commercial Office	0.13 gpd/sf
Commercial Retail	0.19 gpd/sf
Hotel	150 gpd/room

gpd = gallons per day
DU = dwelling unit
sf = square feet of building floor space

The same BWF diurnal curves for residential flows and non-residential flows, as well as the same infiltration/inflow (I/I) rates as applied in the 2014 Master Plan, were used for this analysis. Note than no additional I/I was added due to the future development. This is consistent with the 2014 Sewer Master Plan, which assumed that any increase in I/I due to deterioration of existing sewers will be offset by a decrease due to the City's ongoing sewer rehabilitation and replacement efforts, and that new sewers and building laterals will be constructed of watertight materials and contribute minimal I/I flows.

3.3 Design Flow Parameters and Capacity Deficiency Criteria

System capacity was evaluated based on the ability of the sanitary sewer system to convey future peak dry weather flow (PDWF) and future design storm peak wet weather flow (PWWF). This analysis used the same 10-year return period design storm as the 2014 Master Plan. In the 2014 Sewer Master Plan, sewers were considered deficient and in need of capacity upgrades if PDWF resulted in surcharge in the sewer pipes (water level above the crown of the pipes) or if PWWF resulted in surcharge to within four feet of the ground. For this study, however, any significant surcharge under PWWF was also identified as a potential impact from the proposed development.

4. MODEL RESULTS

The model was evaluated under the existing, Phase I, and buildout development scenarios as defined by the EIR team. For this study, the sewer impact analysis was limited to only those sewers within and downstream of the Bayhill Specific Plan area, as highlighted in Figure 2, and does not address other areas of the system. Furthermore, this study did not include analysis of the potential impacts on City of South San Francisco facilities that convey flows from San Bruno to the South San Francisco WQCP. However, the total flows from the City of San Bruno system, as predicted by the model, were tabulated and are presented in this TM.

Note that a small portion of the Bayhill Specific Plan area (identified in Figure 3 as Subcatchment 168C) that fronts on San Bruno Avenue West east of Traeger Avenue (and includes part of the housing overlay) would likely discharge to the existing 6-inch sewer in San Bruno Avenue that then flows east and south through other 6-inch pipes and connects to a modeled 10-inch sewer in Kains Avenue at El Camino Real. The Kains Avenue sewer from Hensley Avenue downstream was replaced in 2014 with a 14-inch pipe (not included in the current model) so is assumed to have adequate capacity for future flows. Because this part of the Bayhill Specific Plan area is very small, any capacity improvements, if needed, could be evaluated at a future date once the specific location of any new office or housing at this location is more accurately identified.

4.1 Model Results for Peak Dry Weather Flow Conditions

The modeling indicated that all sewers within and downstream of the Bayhill Specific Plan area would have adequate capacity to convey PDWF without surcharge under all development scenarios. The major trunk sewers would flow between roughly 1/3 and 1/2 full under PDWF conditions.

4.2 Model Results for Peak Wet Weather Flow Conditions

The model indicated that all sewers within the Bayhill Specific Plan area, including the 18- to 24-inch trunk sewer from San Bruno Avenue West at Traeger Avenue extending downstream to Sneath Lane, would have adequate capacity to convey the design storm PWWF without surcharge under all development scenarios. However, a small amount of surcharge under PWWF due to a "throttle" condition (peak flow exceeding full pipe capacity) could occur at two locations in the downstream portion of the 24-inch trunk sewer: in Sneath Lane downstream of El Camino Real (manhole 1350) and in Tanforan Avenue at Herman Street (manhole 5370). The surcharge at manhole 1350 would range from 0.6 feet over the pipe crown under existing conditions to a maximum of 1.3 feet under the most critical scenario (Alternate Maximum Housing); however, there would still be substantial freeboard (over 12 feet at this location

and over 8 feet in the nearby downstream manholes). At manhole 5370, the surcharge would range from 0.7 feet under existing conditions to 0.9 feet under the most critical scenario with a freeboard of about 5 feet. However, neither of these conditions would be considered a capacity deficiency warranting an improvement project.

Attachment B to this TM includes model hydraulic profiles of the downstream portion of the 24-inch trunk sewer under the existing, Phase I, Maximum Housing and Alternate Maximum Housing PWWF scenarios. Attachment C includes profiles of the other sewers within and downstream of the Bayhill Specific Plan area under the Maximum Housing PWWF scenario (the most critical EIR preferred scenario). Note that in all cases, the Maximum Housing scenarios generate higher flows than the Maximum Office scenarios so are considered the worst case scenarios with respect to potential impact on the sanitary sewer system.

It is expected that the locations of new office space within the Bayhill Specific Plan area may ultimately differ somewhat from the currently envisioned plan, that is, less development may occur on some parcels and more on others. However, the total development quantities would not change. Relatively small shifts in parcel development (e.g. ±20 percent) will not impact the flows in the system enough to result in need for any additional capacity improvements.

4.3 Total System Flows

Table 2 summarizes the total average dry weather flow (ADWF), PDWF, and PWWF for each of the scenarios at the two major "outfalls" (discharge points into the South San Francisco system) from the San Bruno sewer system: Tanforan Avenue (which includes the Bayhill Specific Plan area) and 7th Avenue. Note that since the model does not include recent or proposed capacity improvements in other parts of the City's sewer system, the peak wet weather flows do not reflect the total flow that could reach the South San Francisco system if upstream capacity deficiencies in the system were relieved. Furthermore, the buildout peak flows do not include other potential future development projects that have not yet been specifically identified as related development projects for this study.

Table 3: Summary of Total System Flows

Scenario	Outfall at Tanforan Avenue			Outfall at 7th Avenue		
	ADWF[a] (mgd)	PDWF (mgd)	PWWF[b] (mgd)	ADWF[a] (mgd)	PDWF (mgd)	PWWF[b] (mgd)
Existing	1.91	3.11	12.1	0.98	1.60	8.2
Future: Phase I	1.96	3.20	12.1	0.98	1.60	8.2
Future: Max Office	2.24	3.66	12.4	1.08	1.78	8.2
Future: Max Housing	2.24	3.66	12.4	1.08	1.78	8.2
Future: Alternate Max Office	2.24	3.67	12.4	1.08	1.78	8.2
Future: Alternate Max Housing	2.31	3.79	12.5	1.08	1.78	8.2

a. ADWF includes wintertime groundwater infiltration.
b. PWWF reaching system outfalls reflects upstream capacity deficiencies in the system that could result in flow backup and potential overflows during design storm conditions, including areas that may have already been relieved by improvement projects constructed by the City in the past five years. PWWF at the outfalls would be higher if upstream capacity constrictions were relieved.

Attachment A
Related Development Projects

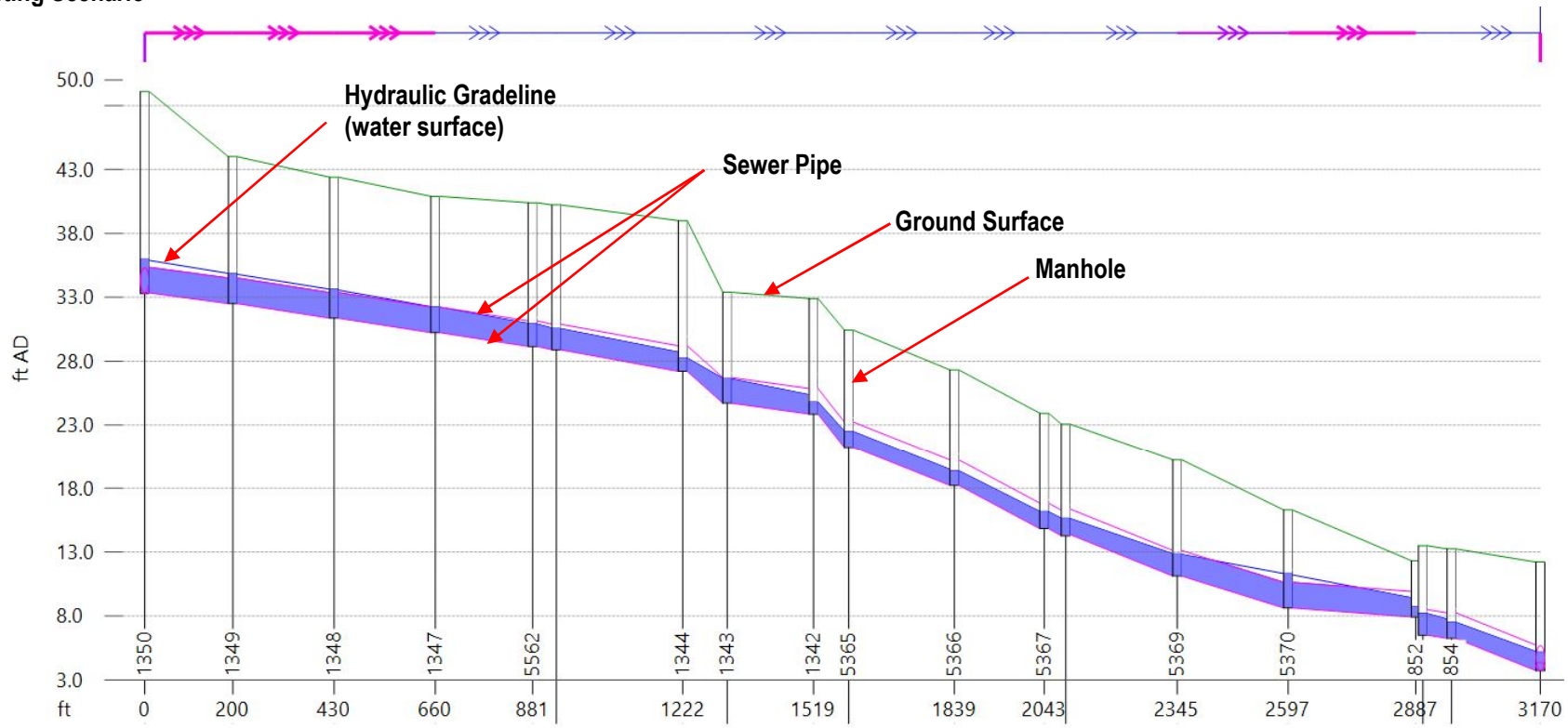
Development Name	Type	Single Family (DUs)	Multi-Family (DUs)	Office (sq. ft.)	Commerical (sq. ft.)	Hotel (rooms)
406 San Mateo Ave	Mixed Use		83		6,975	
841 San Bruno Ave	Medical office			15,223		
Skyline College Housing	Residential	40	30			
271 El Camino Real	Residential		24			
111 San Bruno Ave	Mixed Use		62		7,600	
Mills Park Plaza[1]	Mixed Use		425		54,200	
500 Sylvan Ave	Residential		9			
160 El Camino Real	Hotel					34
Glenview Terrace	Residential	29				
APN 020-012-160[2]	Office			287,000		

1. The Mills Park Plaza project is still subject to a final decision by the San Bruno City Council. The project description reflects the most recent development application on file at the time of the Draft EIR analysis. The project is still included in this sewer impact study for reference; however, it is not tributary to the main Bayhill sewershed.

2. This project could be constructed under an existing, fully entitled develpoment agreement or, if the development agreement expires, as part of buildout under the Bayhill Specific Plan project. Therefore, it is conservatively evaluated as both a component of the Specific Plan and a related project. As stipulated in the Specific Plan, if the project is developed under the existing development agreement, the maximum permitted density for this parcel in the Specific Plan would be reduced from 287,000 to zero square feet.

Attachment B
Model Hydraulic Profiles of 24" trunk sewer in Sneath Lane and Tanforan Avenue under Design PWWF

Existing Scenario

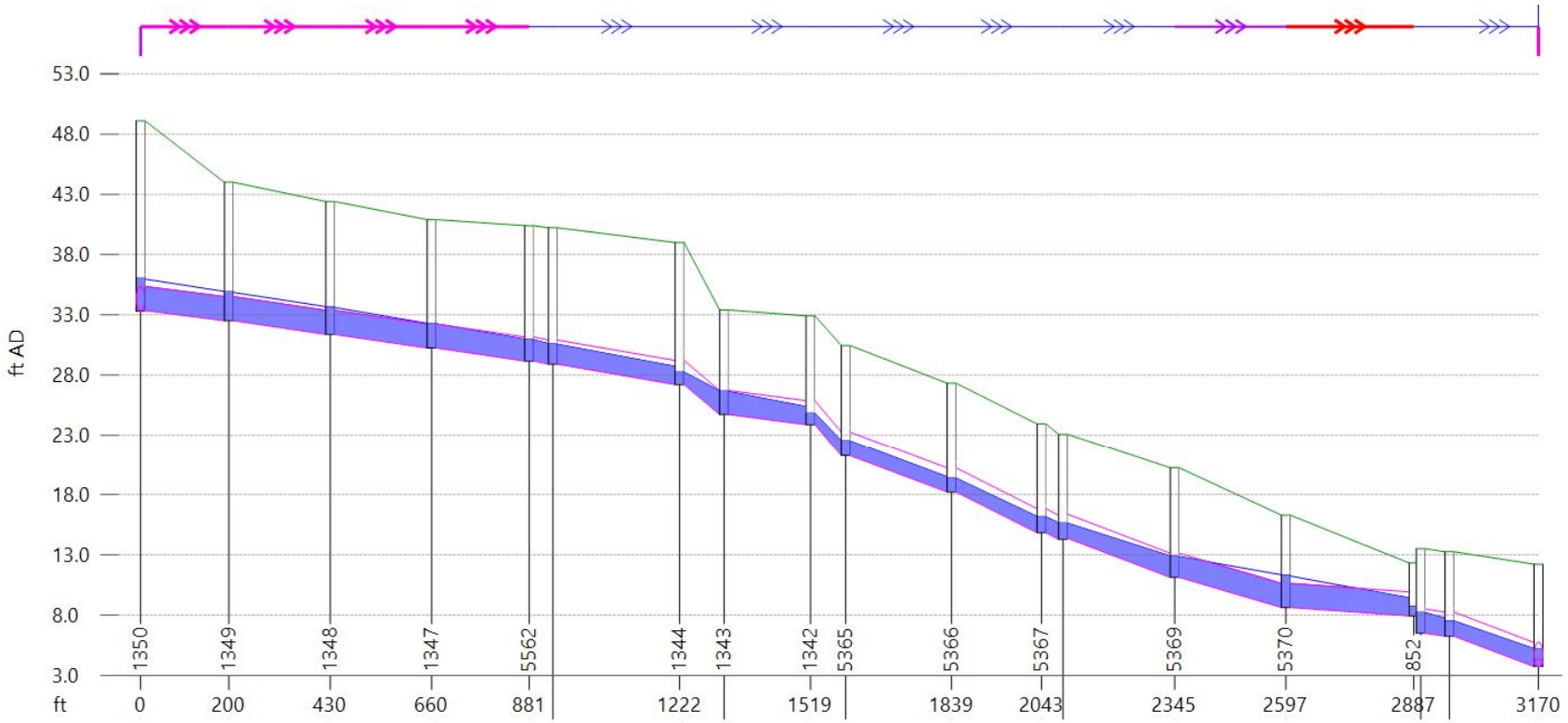


Link	1350.1	1349.1	1348.1	1347.1	-	1345.1	-	1343.1	-	5365.1	5366.1	-	5368.1	5369.1	5370.1	-	854.1
width (in)	24.0	24.0	24.0	24.0	-	24.0	24.0	24.0	-	24.0	24.0	-	24.0	24.0	24.0	-	24.0
surc	2.00	2.00	2.00	0.99	-	0.82	0.97	0.94	-	0.62	0.67	-	0.86	1.00	2.00	-	0.74
DS flow (MGD)	10.3790	10.3794	10.9398	10.9396	-	11.1200	-	11.1197	-	11.1197	11.1196	-	11.1182	11.1178	11.1177	-	11.1177
Node	-	1349	1348	1347	-	1345	1344	1343	-	5365	5366	-	5368	5369	5370	852	854	-

Link	741.1
width (in)	18.0
surc	0.31
DS flow (MGD)	1.8523
Node	741

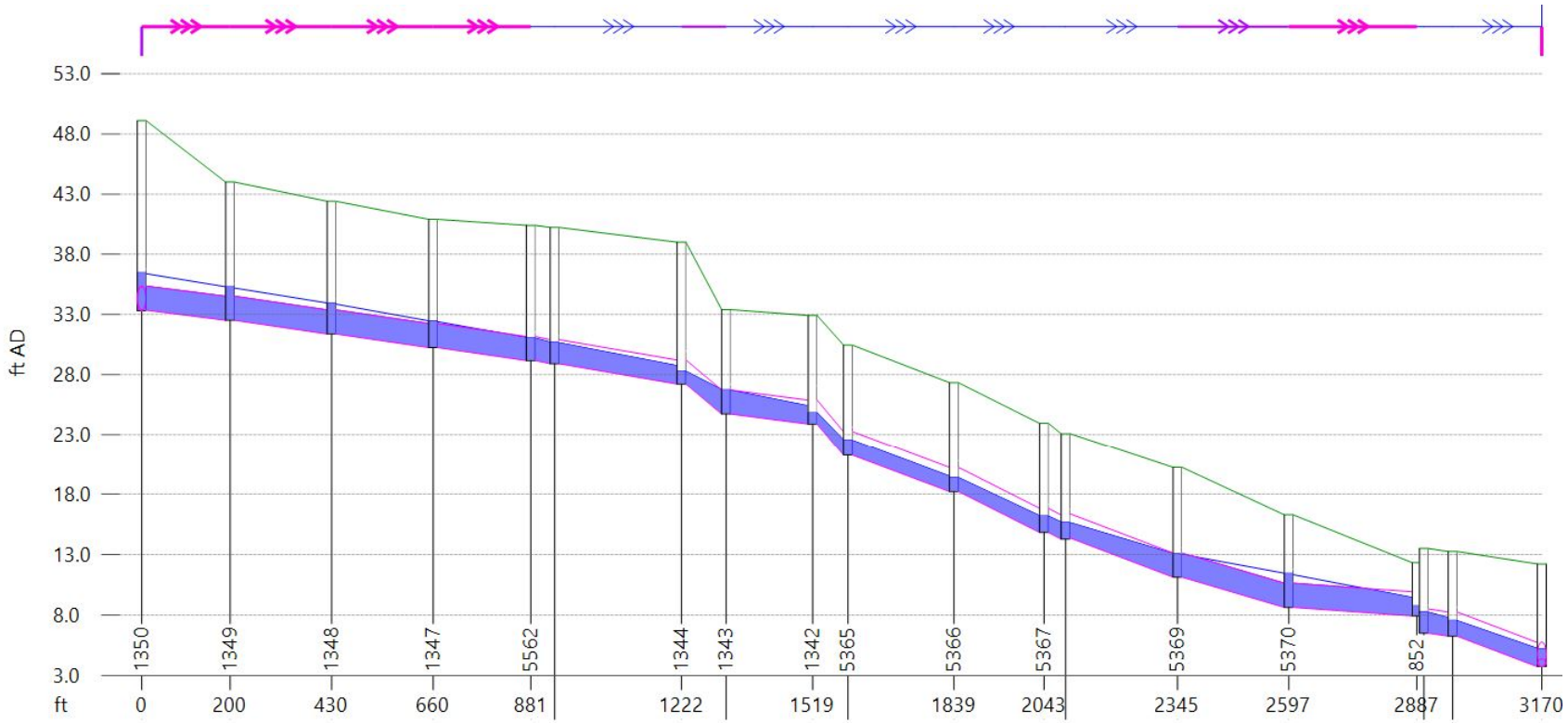
Model Pipe ID
Pipe diameter
d/D (1.00 – surcharged due to backwater, 2.00 – surcharged due to peak flow > full pipe capacity)
Peak flow
Manhole ID

Phase I Scenario



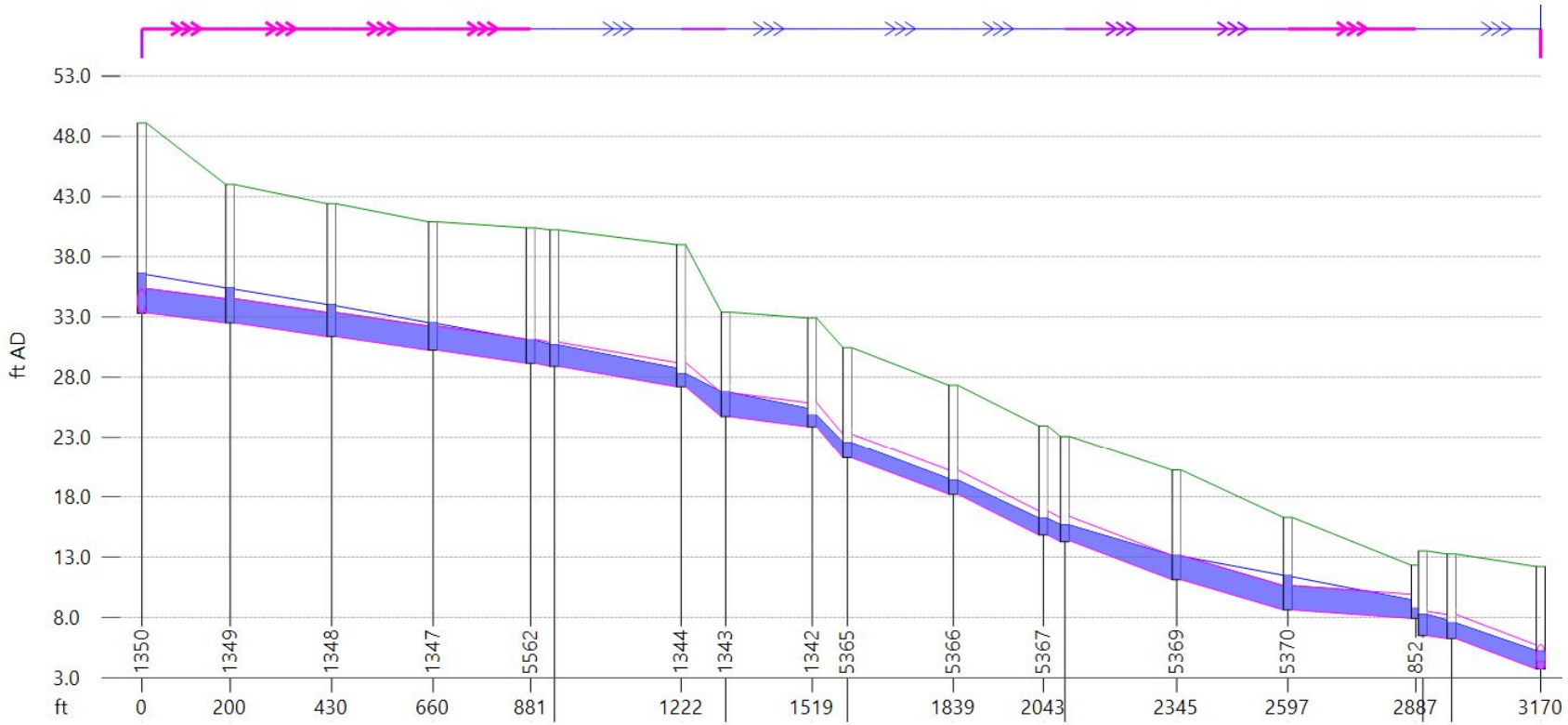
Link		1350.1	1349.1	1348.1	1347.1	-	1345.1	-	1343.1	-	5365.1	5366.1	-	5368.1	5369.1	5370.1	-	854.1
width (in)		24.0	24.0	24.0	24.0	-	24.0	24.0	24.0	-	24.0	24.0	-	24.0	24.0	24.0	-	24.0
surc		2.00	2.00	2.00	2.00	-	0.82	0.98	0.95	-	0.62	0.67	-	0.88	1.00	2.00	-	0.74
DS flow (MGD)		10.4335	10.4337	10.9927	10.9926	-	11.1728	-	11.1726	-	11.1724	11.1724	-	11.1713	11.1710	11.1709	-	11.1709
Node	-	1349	1348	1347	-	1345	1344	1343	-	5365	5366	-	5368	5369	5370	852	854	-

Maximum Housing Scenario



Link		1350.1	1349.1	1348.1	1347.1	-	1345.1	-	1343.1	-	5365.1	5366.1	-	5368.1	5369.1	5370.1	-	854.1
width (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
surc		2.00	2.00	2.00	2.00	-	0.87	1.00	0.99	-	0.63	0.69	-	0.97	1.00	2.00	-	0.75
DS flow (MGD)		10.7336	10.7339	11.2832	11.2832	-	11.4607	-	11.4606	-	11.4606	11.4605	-	11.4595	11.4594	11.4594	-	11.4595
Node	-	1349	1348	1347	-	1345	1344	1343	-	5365	5366	-	5368	5369	5370	852	854	-

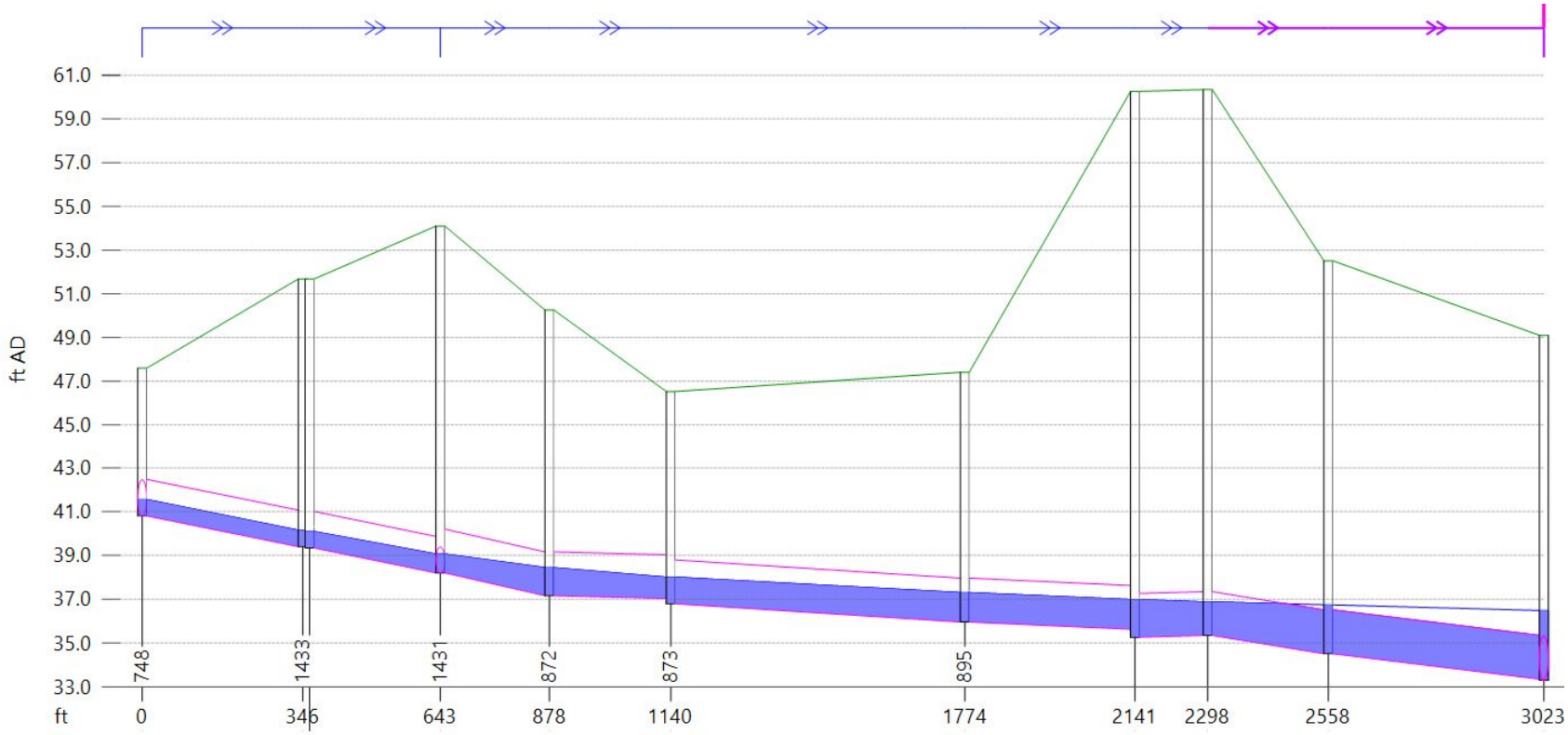
Alternate Maximum Housing



Link		1350.1	1349.1	1348.1	1347.1	-	1345.1	-	1343.1	-	5365.1	5366.1	-	5368.1	5369.1	5370.1	-	854.1					
width (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					
surc		2.00	2.00	2.00	2.00	-	0.88	1.00	1.00	-	0.64	0.69	-	1.00	1.00	2.00	-	0.76					
DS flow (MGD)		10.8248	10.8249	11.3734	11.3735	-	11.5501	-	11.5500	-	11.5500	11.5500	-	11.5494	11.5493	11.5493	-	11.5493					
Node	-	1349	1348	1347	-	1345	1344	1343	-	5365	5366	-	5368	5369	5370	852		854	-				

Attachment C
Model Hydraulic Profiles of Other Sewers under Maximum Housing Scenario Design PWWF

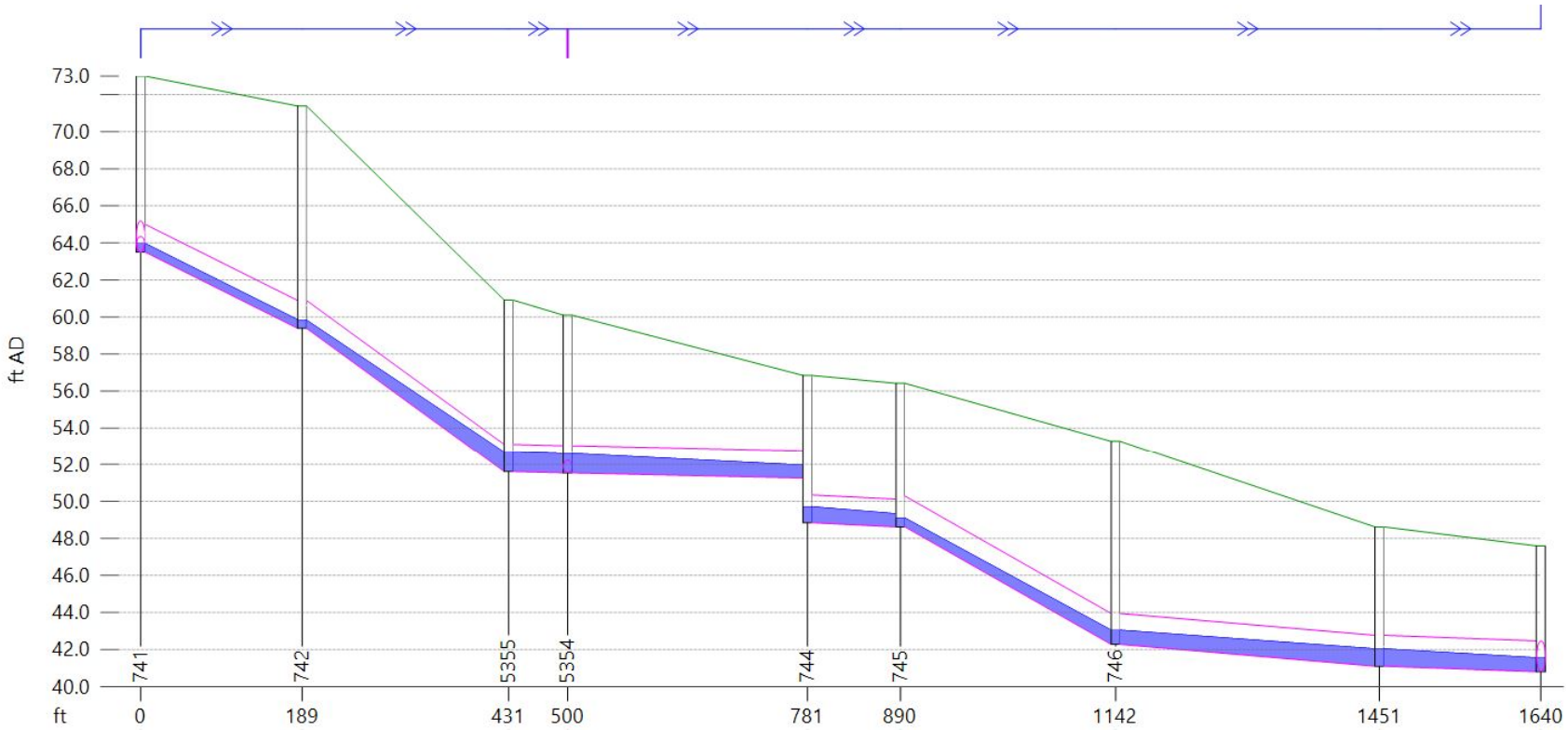
El Camino Real, Bayhill Dr. to Sneath Lane



Link	748.1	1432.1	1431.1	872.1	873.1	895.1	1833.1	1834.1	1835.1
width (in)	20.0	20.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
surc	0.45	0.52	0.64	0.64	0.67	0.68	0.86	1.00	1.00
DS flow (MGD)	2.3625	2.3628	3.5413	3.5390	3.5203	3.4969	3.4843	3.4580	3.4697

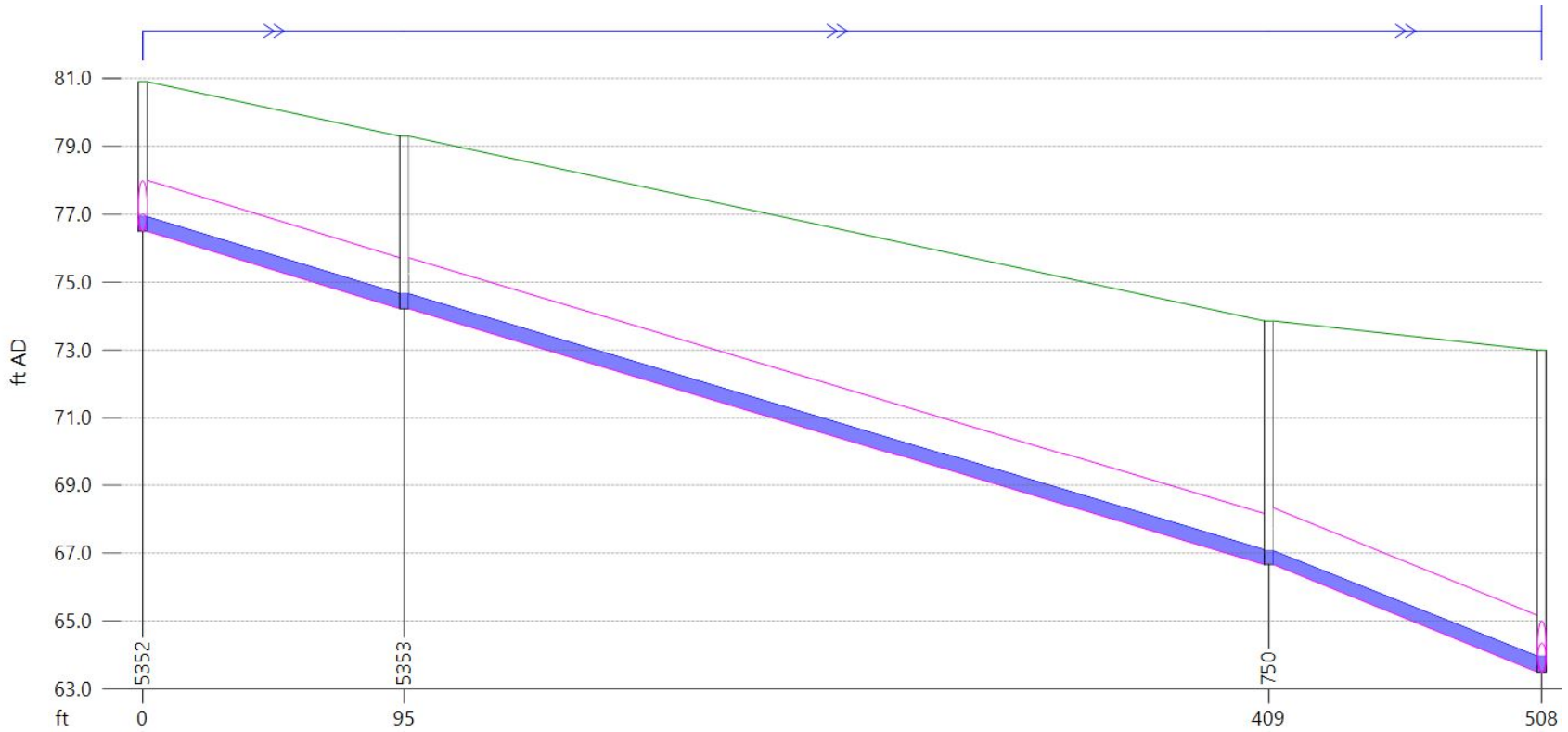
Node	748	1433	1432	1431	872	873	895	1833	1834	1835	1350

Bayhill Drive, Traeger Avenue to El Camino Real



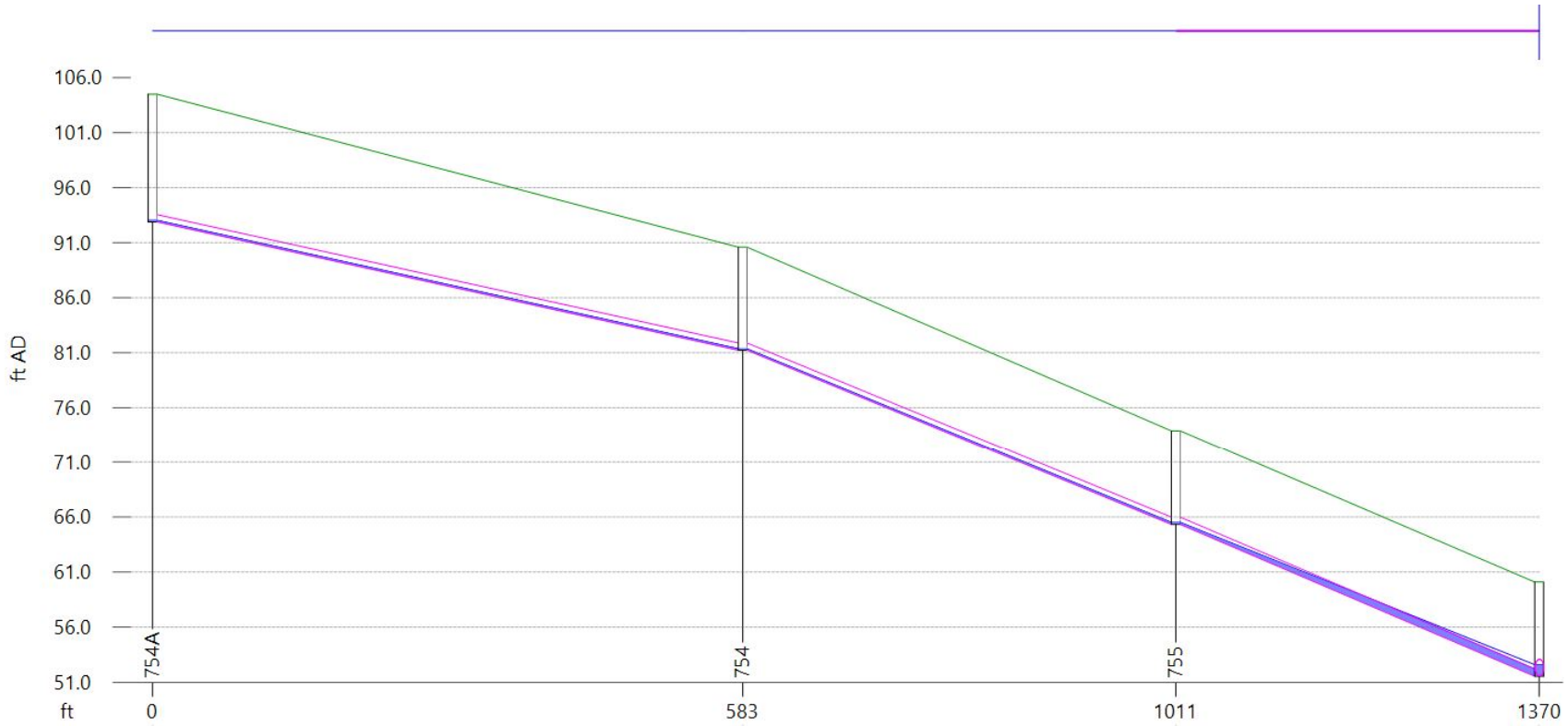
Link	741.1	742.1	-	5354.1	744.1	745.1	746.1	747.1
width (in)	18.0	18.0	18.0	18.0	18.0	20.0	20.0	20.0
surc	0.31	0.71	0.71	0.70	0.57	0.46	0.56	0.56
DS flow (MGD)	1.8523	1.9727	-	2.1283	2.1835	2.1835	2.3357	2.3356
Node	741	742	5355	5354	744	745	746	747	748

Traeger Avenue, San Bruno Avenue W to Bayhill Drive



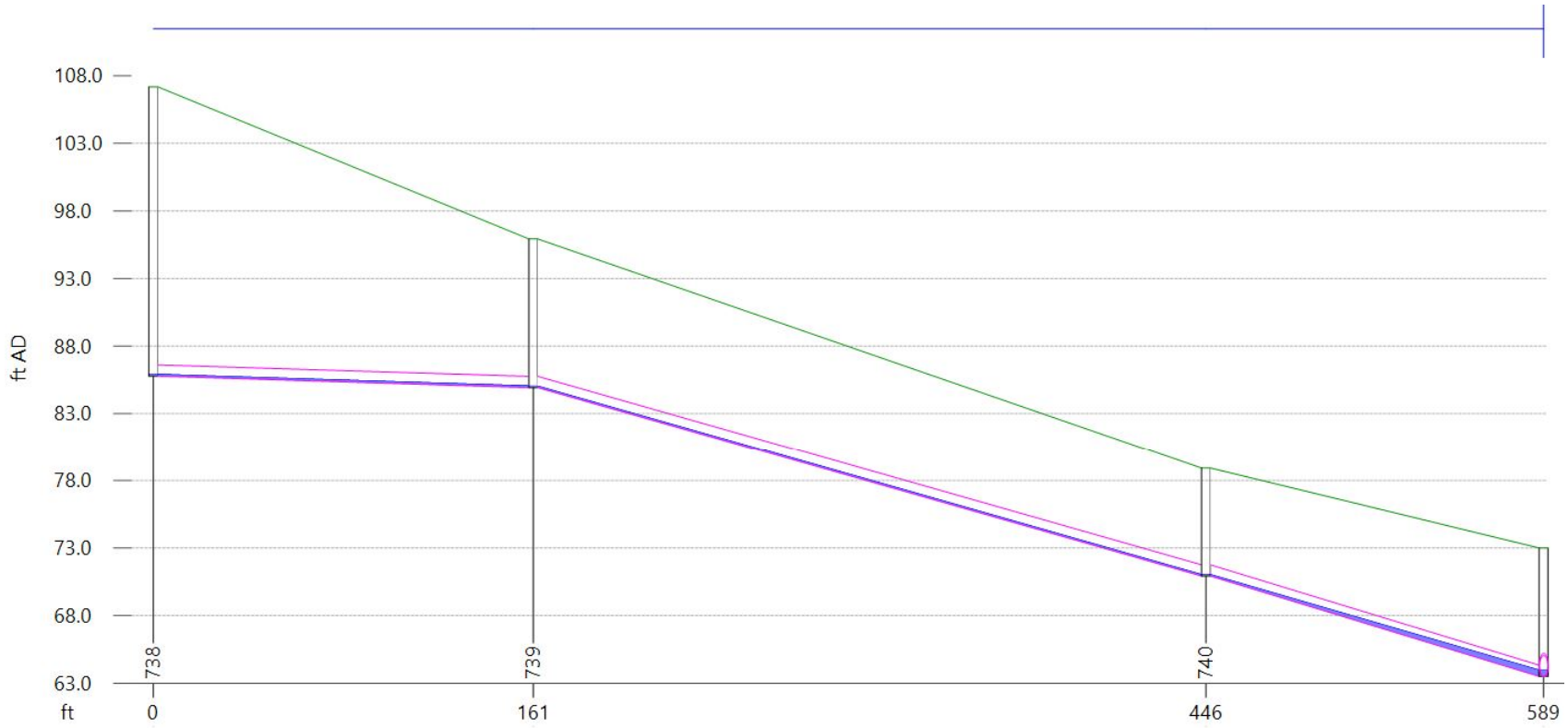
Link	5352.1	5353.1	750.1	
width (in)	18.0	18.0	20.0	
surc	0.29	0.29	0.28	
DS flow (MGD)	1.5759	1.6973	1.6973	
Node	5352	5353	750	741

Grundy Lane (Phase 1 Sewer) and Easement to Bayhill Drive



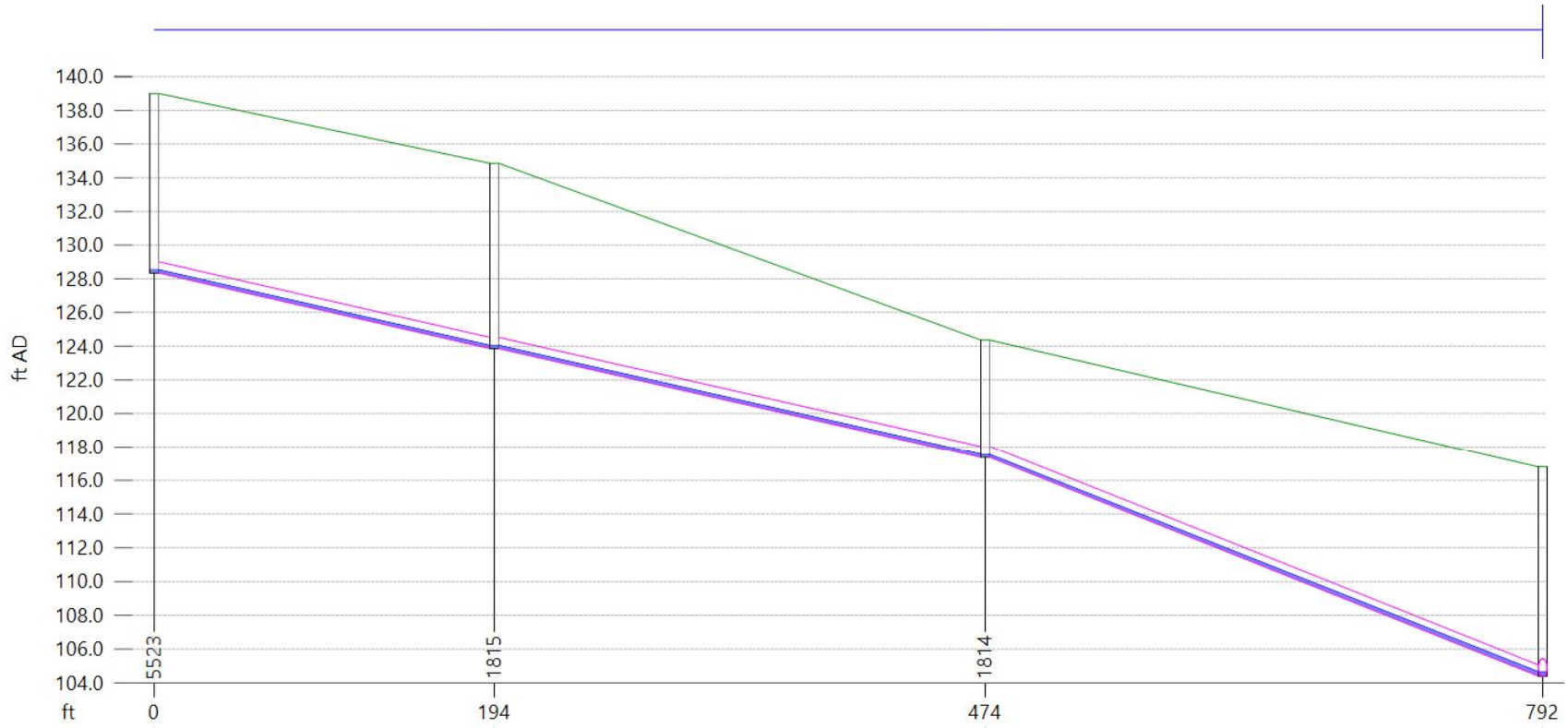
Link	754A.1	754.1	755.1	
width (in)	8.0	8.0	8.0	
surc	0.21	0.26	1.00	
DS flow (MGD)	0.0817	0.0817	0.1935	
Node	754A	754	755	5354

Bayhill Drive west of Traeger Avenue



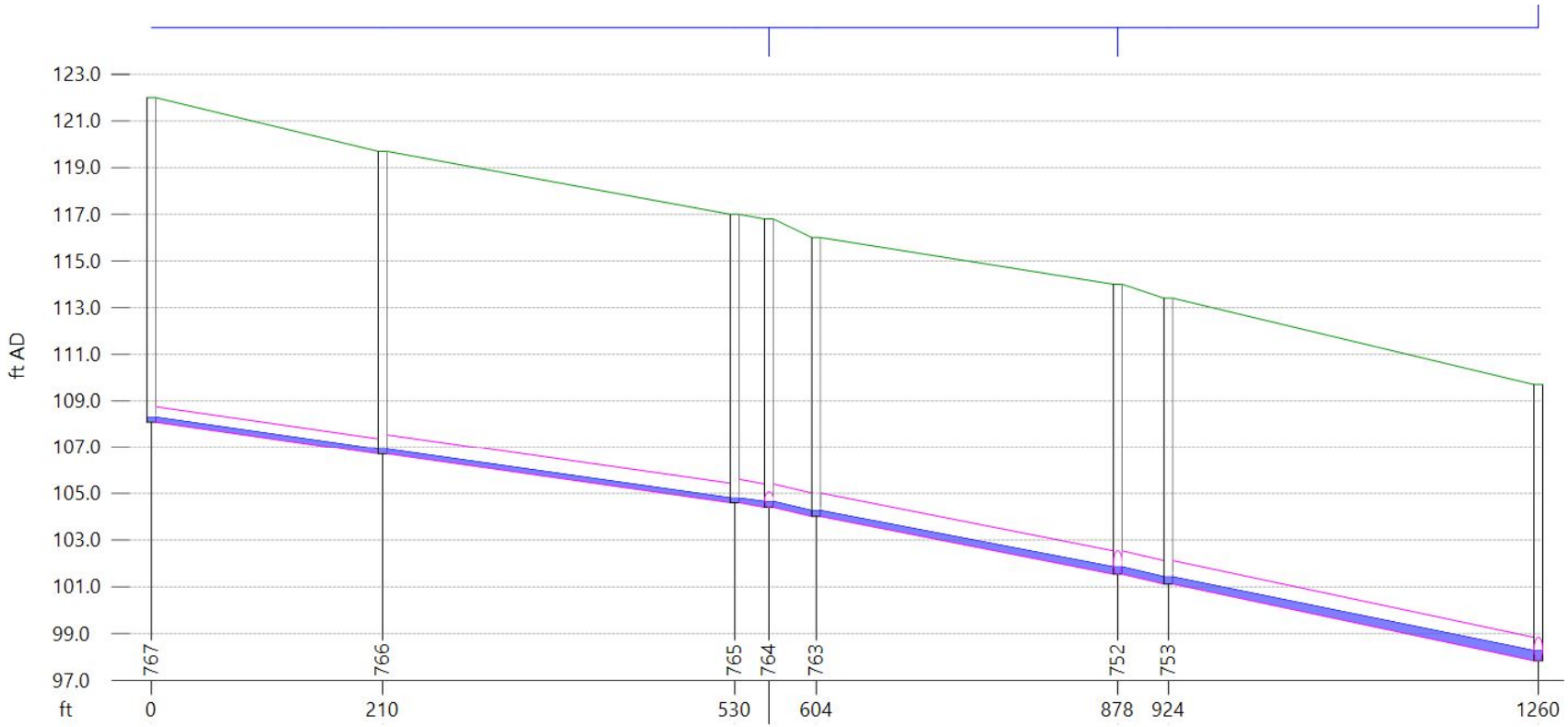
Link		738.1	739.1	740.1
width (in)		10.0	10.0	10.0
surc		0.16	0.13	0.55
DS flow (MGD)		0.0427	0.0427	0.0427
Node	738	739	740	741

Bayhill Drive west of Cherry Avenue



Link	5523.1	1815.1	1814.1	
width (in)	8.0	8.0	8.0	
surc	0.27	0.27	0.37	
DS flow (MGD)	0.1671	0.1671	0.1670	
Node	5523	1815	1814	764

Cherry Avenue, Bayhill Shopping Center to I-380



Link		767.1		766.1	-	-		763.1	-		753.1	
width (in)		8.0		10.0	-	12.0		12.0	12.0		12.0	
surc		0.32		0.24	-	0.25		0.31	0.31		0.43	
DS flow (MGD)		0.1264		0.1264	-	-		0.2718	-		0.4336	
Node	767		766		765	-	763		752	753		762