CITY OF OAKLAND

250 FRANK H. OGAWA PLAZA OAKLAND, CALIFORNIA 94612–2033

Oakland Public Works Department (510) 238-7276
Bureau of Design & Construction FAX (510) 238-6333
Watershed & Stormwater Management Division TDD (510) 238-7644

February 26, 2025

Wilfung Martono
Caltrans District 4 (SF Bay Area)
111 Grand Avenue
Oakland, CA 94612

Attention: Mr. Martono

CITY OF OAKLAND TRASH REDUCTION PARTNERSHIP PROJECT REQUEST

City of Oakland (City) Public Works Watershed and Stormwater Management Division (WSMD) staff have engaged in numerous discussions with Kenneth Johansson, Caltrans Statewide Stormwater Program manager, regarding a potential partnership between Caltrans and the City to design and construct three new large full trash capture (FTC) devices in Oakland. This collaboration would help both agencies meet State and Regional stormwater permit trash load reduction requirements and would help stem the flow of trash to the Oakland Estuary and the San Francisco Bay. The City is deeply grateful to Caltrans for funding two recently completed large FTC projects in Oakland.

In 2019, the City identified five large FTC project sites (see attached *Trash Capture Device Hydraulic Analysis* for project information) that, if constructed, would treat approximately 159 acres of stormwater runoff from Caltrans right-of-way (ROW). In 2021 and 2022, Caltrans authorized funding to construct two of the five projects (Mandela Parkway and Cary Avenue), both of which were completed in 2024 and are now removing trash from approximately 57 acres of Caltrans ROW and 1,349 acres of Oakland's urban landscape. The City requests Caltrans funding to construct the remaining three projects, which would treat approximately 102 acres of Caltrans ROW. Additional project details and benefits and estimated construction costs for the three proposed projects are summarized in **Table 1** (also see attached Scope of Work, Cost Estimates, and Tentative Schedule):

Table 1 – Trash Capture Projects Site Summaries

Project Location	Total Area Treated (Acres)	Total Caltrans Area Treated (Acres)	Total Caltrans STGA Treated (Acres)	Device Type	Estimated Construction Cost[1]
45th & San Leandro	1,679	65.7	65.7	DSBB	$6,550,000.00
47th & UPRR	751	29.5	29.5	DSBB	$ 6,550,000.00
G and 85th	802	6.5	6.5	DSBB	$ 6,900,000.00
Total:	3,232	102	102		**$ 20,000,000.00**

The City intends to apply for, and enter into, a Financial Contribution Only (FCO) agreement with Caltrans for the three proposed trash capture device projects. In addition to contributing to Caltrans' and Oakland's trash load reduction regulatory goals, the proposed projects would remove pollutants of concern from stormwater, providing Total Maximum Daily Load (TMDL) compliance and water quality protection benefits.

Should you have any questions about the proposed projects and/or the City's commitment to construct the projects, please contact Tiffany Pham at (510) 238-3397 or by email at TPham@oaklandca.gov. Our office intends to continue working with Caltrans staff to participate in the Caltrans FCO program regarding stormwater quality project funding. Thank you for your consideration.

Yours truly,

Josh Rowan (Feb 27, 2025 17:13 PST)
____
Signature

Josh Rowan
Interim Director

Enclosures:
1. Scope of Work, Cost Estimates, and Tentative Schedule
2. Trash Capture Device Hydraulic Analysis, 2019

Cc: Hardeep Takhar, Chief Environmental Engineer, Caltrans
Kenneth Johansson, Statewide Stormwater Program Manager, Caltrans
Liam Garland, Interim Assistant Director, Oakland Public Works (OPW), Bureau of Design and Construction (BDC), City of Oakland Liam Garland
Liam Garland (Feb 26, 2025 16:29 PST)
Terri Fashing, Watershed and Stormwater Division Manager, OPW BDC, City of Oakland
Tiffany Pham, Civil Engineer, WSMD, OPW BDC, City of Oakland

[1] The City estimates that engineering design, permitting, construction support, project management, and other soft costs would be close to 40% of estimated construction costs for the three projects (approximately $8,000,000).

SCOPE OF WORK, COST ESTIMATES, AND TENTATIVE SCHEDULE

Date: 2/26/25

Full Trash Capture (FTC) Device Projects, City of Oakland – Phase II

Three Locations: 45th Ave & San Leandro Street, 47th Ave & UPRR, and 85th Ave & G Street

(Phase I – Completed FTC Projects at Mandela Parkway and Cary Ave)

1. **<u>Scope of Work</u>**:

- **45th Ave & San Leandro Street**
  Work includes all costs to support the installation of a full large trash capture device to treat approximately 1,679 acres of the City's urban area, which includes approximately 65.7 acres of the area within Caltrans' right-of-way (ROW). This device is proposed to be installed in an existing concrete box culvert (6' high x 14' wide x approximately 12' Deep) that has the capacity to treat 95 cubic feet per second of water quality, meeting the minimum required water quality treatment of a 1-year, 1-hour storm, per the Municipal Regional Stormwater NPDES Permit, Section C.10. Trash Load Reduction, and convey a peak storm flow for a 25-year storm event. The anticipated excavation limit is approximately 100' long x 40' wide x 15' deep.

- **48th Ave & Union Pacific Railroad (UPRR)**
  Work includes all costs to support the installation of a full large trash capture device to treat approximately 751 acres of the City's urban area, which includes approximately 29.5 acres of the treated area within Caltrans' ROW. This device is proposed to be installed in an existing concrete pipe (72" diameter x 15' deep) that has the capacity to treat 38 cubic feet per second of water quality, meeting the minimum required water quality treatment of a 1-year, 1-hour storm, per the Municipal Regional Stormwater NPDES Permit, Section C.10. Trash Load Reduction, and convey a peak storm flow for a 25-year storm event. The anticipated excavation limit is approximately 100' long x 30' wide x 18' deep.

- **85th Ave & G Street**
  Work includes all costs to support the installation of a full large trash capture device to treat approximately 802 acres of the City's urban area, which includes approximately 6.5 acres of the treated area within Caltrans' ROW. This device is proposed to be installed in an existing concrete box culvert (5.5' high x 11.5' x 13' deep) that has the

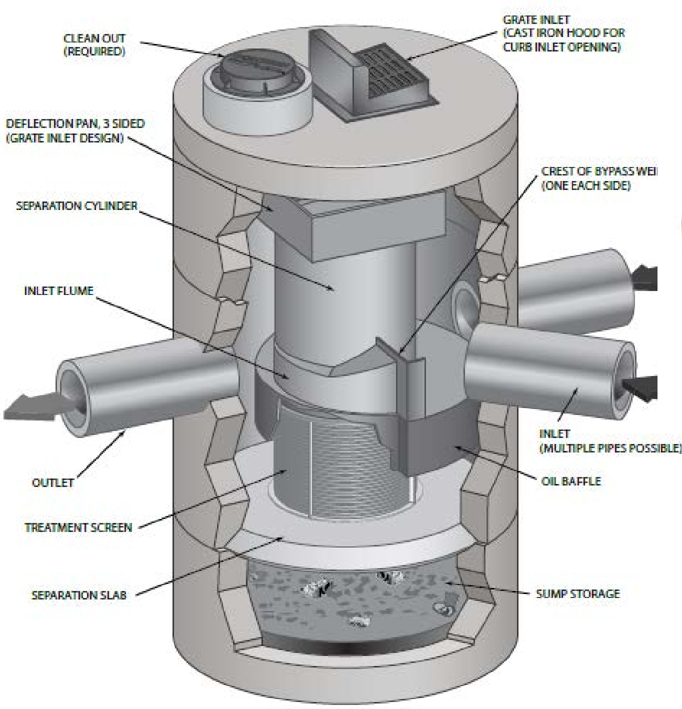
capacity to treat 48 cubic feet per second of water quality, meeting the minimum required water quality treatment of a 1-year, 1-hour storm, per the Municipal Regional Stormwater NPDES Permit, Section C.10. Trash Load Reduction, and convey a peak storm flow for a 25-year storm event. The anticipated excavation limit is approximately 100’ long x 35’ wide x 16’ deep.

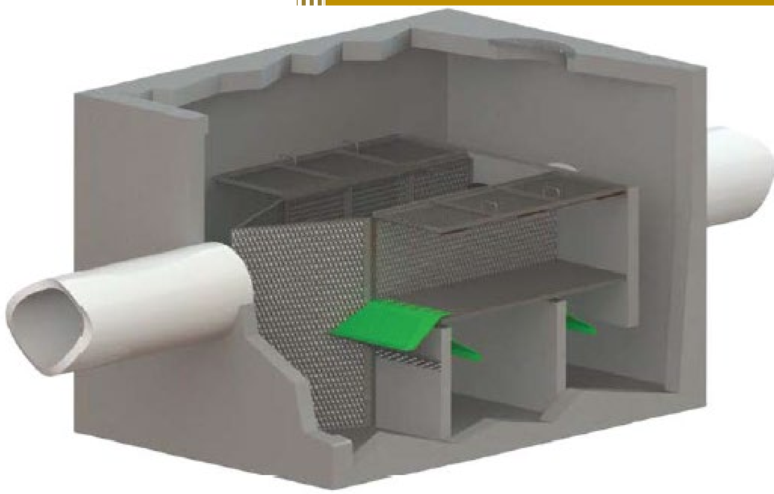
2. Cost Estimates and Tentative Schedule

Project Phase	Estimated Duration	Cost
Design, Project Management, Permitting, and other overhead costs	1 year (30%)	$6,000,000.00
Bid & Award and Outreach	6 months	$0.00
Construction (2 FTCs) - 45th Ave & San Leandro and 47th Ave & UPRR (FY 2027/FY 2028)	9 months	$10,800,000.00
Construction (1 FTC) - 85th Ave & G Street (FY 2028/FY 2029)	9 months	$5,700,000.00
Construction Contingency	21%	$3,500,000.00
Construction Management	15 months (10%)	$2,000,000.00
TOTAL		**$28,000,000.00**

2019

Trash Capture Device Hydraulic Analysis





City of Oakland

Wood Rodgers

6/11/2019

CITY OF OAKLAND

WOOD RODGERS

This page left intentionally blank

CITY OF OAKLAND TRASH CAPTURE DEVICE HYDRAULIC ANALYSIS

CITY OF OAKLAND

WOOD RODGERS

This page left intentionally blank

ACKNOWLEDGEMENTS

CITY:

City of Oakland Department of Public Works, Bureau of Design and Construction

250 Frank H Ogawa Plaza, Ste 4314

Oakland, CA 94612

Jeff Roubos, P.E	Civil Engineer, Watershed and Stormwater Management

CONSULTANT TEAM:

Wood Rodgers Inc.

180 Grand Avenue, Suite 775

Oakland, CA 94612

Dan Matthies, P.E., C.F.M.	Principal Engineer, Consultant Principal-in-Charge
Cheng Soo, P.E., C.F.M.	Associate Engineer, Consultant Project Manager
Camila Correa	Engineer, Civil Engineer

This page left intentionally blank

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

This page left intentionally blank

1 INTRODUCTION

The City of Oakland (City) is required by its Municipal Regional Stormwater NPDES Permit (Permit) with the State of California Regional Water Quality Control Board (RWQCB) to demonstrate compliance with discharge prohibitions through timely implementations of control measures and other actions to reduce trash loads from municipal separate storm sewer systems (MS4). This requirement, under Provision C.10 of the Permit, defines a schedule for implementation that requires 80 percent implementation by July 1, 2019 and 100 percent implementation by July 1, 2022.

The City began developing storm sewer large trash capture designs around 2010. As of 2019, approximately 10 trash capture facilities have been designed and constructed. A few new trash capture facilities are being analyzed in this study and considered for construction in the near future.

The **purpose** of this study is to provide an assessment of the proposed trash capture facilities with respect to hydraulic impacts and to maintenance; and to provide recommendations for improvements to mitigate any adverse impacts for design storms before the existing storm sewer system floods the streets.

2 REFERENCES

The references collected and used for this study are as follows:

1. California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Stormwater NPDES Permit (MRS NPDES), November 19, 2015.
2. City of Oakland, Storm Drainage Design Standards, Updated October 2014
3. Alameda Countywide Clean Water Program, C.3 Stormwater Technical Guidance, October 2017.
4. Ettie Street Pump Station Watershed Storm Water Treatment Feasibility Study, Caltrans District 4 & City of Oakland, June 19, 2017.
5. Laboratory Testing of Gross Solids Removal Facilities, Caltrans, May 2005.
6. San Francisco Bay Tidal Datums and Extreme Tides Study Final Report, February 2016, AECOM

3 CRITERIA

The trash capture facilities will need to meet the minimum performance for trash capture as required in the Permit. Also, due to the obligations of the City of Oakland and Alameda County, the devices will need to installed in a manner that prevents hydraulic impacts to the drainage systems, or to at least minimizes the impacts to a point that still meets the City's and County's drainage system level of service requirements.

3.1 Trash Capture

In order to identify the trash capture performance requirements, the following is taken from the "*California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Stormwater NPDES Permit (MRS NPDES)*", November 19, 2015:

A full capture system is any single device or series of devices that traps all particles retained by a 5 mm mesh screen and has a design treatment capacity of not less than the peak flow rate resulting from a one-year, one-hour, storm in the sub-drainage area or designed to carry at least the same flow as the storm drain connected to the inlet. The device(s) must also have a trash reservoir large enough to contain a reasonable amount of trash safely without overflowing trash into the overflow outlet between maintenance events.

See **Section 7** for more detail.

3.2 Hydraulic Performance

In order to identify the threshold for determining if the hydraulic impacts are acceptable or not, both the City of Oakland and the Alameda County Flood Control & Water Conservation District (District) storm drainage system criteria were investigated.

See **Section 6** from more detail.

This page left intentionally blank

4 STUDY AREAS

There are four watersheds analyzed in this study for proposed large trash capture facilities.

1. Ettie Street
2. Peralta Creek (Line F)
3. Elmhurst Creek (Line M)
4. Stonehurst Creek (Line N)

Five sites were identified within these four watersheds based on the storm sewer network systems.

Table 1 – Trash Capture Areas and Loading

Site	Watershed	Location	Drainage Area (ac)	Loading (cu.ft/year)[1]	Caltrans ROW (ac)[2]
1	Ettie Street	Mandela & 24th	610	3,209	16.8
2	Peralta Creek	45th & San Leandro	1,679	2,647	65.7
3	Peralta Creek	47th & UPRR	751	1,203	29.5
4	Elmhurst Creek	G and 85th	802	3,342	6.5
5	Stonehurst Creek	Stonehurst Outfall	739	2,741	40.7

The Ettie Street Watershed drains to an 800 cfs pump station owned and operated by Alameda County Public Works Agency (ACPWA) while most of the upstream storm sewer systems are owned and operated by the City of Oakland. Site 1 is located at the intersection of Mandela Parkway and 24th Street and has one of the highest trash reduction potential based on the high loading volume per year estimate in the table above and has relatively low Caltrans's right-of-way (ROW) areas within its drainage area.

The Peralta Creek (Line F) Watershed is subject to tidal influence with Mean Higher High Water (MHHW) at 6.6 feet, NAVD88 and has large, networked (looped) storm sewer systems upstream that collect smaller drainage areas from Courtland Creek (Line G), 54th Avenue Creek (Line H) and Seminary Avenue Drain (Line I). Site 2 is located at the intersection of 45th Avenue and San Leandro Street along Peralta Creek storm sewer system, and Site 3 is located at the intersection of 47th Avenue and UPRR along Courtland Creek storm sewer system. The upstream storm sewer systems at these two locations are owned and operated by both ACPWA and the City of Oakland with ACPWA owns most of the larger (greater than 36") systems. Site 2 has relatively low trash reduction potential based on the loading volume per year estimate in the table above but has the

[1] EOA Inc. estimate on May 8, 2019

[2] EOA Inc. estimate on May 8, 2019

highest Caltrans's ROW areas within its drainage area. Site 3 has the lowest trash reduction potential based on the loading volume per year estimate in the table above and has relatively low Caltrans's ROW areas within its drainage area.

The Elmhurst Creek (Line M) Watershed is subject to tidal influence with MHHW at 6.7 feet, NAVD88 and it has shallow and relatively flat storm sewer systems. Site 4 is located at the intersection of G and 85th Street on a shallow City storm sewer system. The City's system connects to an ACPWA storm sewer system at the downstream before discharging to Elmhurst Creek. Site 4 has the highest trash reduction potential based on the loading volume per year estimate in the table above but has the lowest Caltrans's ROW areas within its drainage area.

The Stonehurst Creek (Line N) Watershed is above tidal influence. Site 5 is located at the downstream end of ACPWA's storm sewer system discharging into Stonehurst Creek. Site 5 has relatively high trash reduction potential based on the loading volume per year estimate in the table above and has relatively high Caltrans's ROW areas within its drainage area.

The figure below shows the 5 site locations and their corresponding watershed areas. The green storm sewers belong to the City and the orange storm sewers belong to ACPWA.

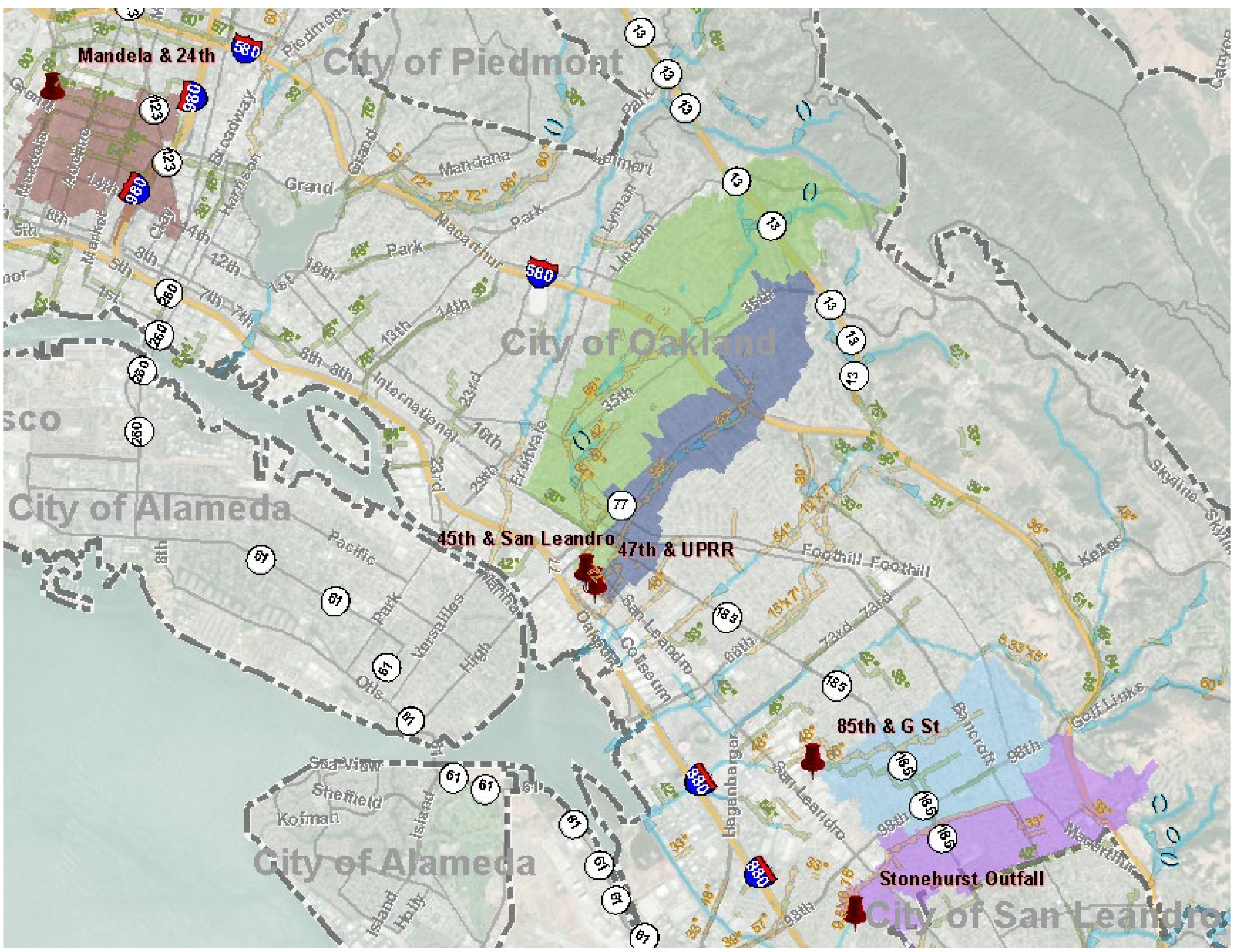


Figure 1 – Site Locations and Drainage Areas (City Pipe=Green, ACPWA Pipe=Orange)

This page left intentionally blank

5 DATA COLLECTION, SITE RECONNAISANCE & SITE SELECTION

Data collected and used to size the trash capture facilities in this study are from ACPWA, the City, CDS trash capture manufacturer Contech, DSBB trash capture manufacturer BioClean, and Storm Flo Screen trash capture manufacturer Roscoe Moss.

Site reconnaissance was performed at the four sites to:

1. Confirm tidal influence
2. Inspect and assess sediment and trash conditions
3. Confirm structure integrity and dimensions

Some sites were inaccessible because of missing manholes or access hatches and the next closest available manholes or access hatches were inspected. A camera was lowered from the street level with an extension pole to photograph the storm sewer interior conditions. Storm sewer inverts and dimensions were verified with tape measurements relative to the street level.

With the collected data and information above, a trash capture location was selected and optimized for each site. The locations were optimized based on the following criteria:

1. Minimize tidal influence
2. Minimize hydraulic impacts
3. Stay within City or County easement/ ROW
4. Avoid Caltrans's or Union Pacific Railroad (UPRR) easement/ ROW (need encroachment permits and maintenance agreement)
5. Avoid major utility conflicts from PG&E and EBMUD
6. No in-channel facility except at pipe outfall or significant open channel upstream (Regional Board)

Trash capture facilities should be away from tidal influence above the Mean Higher High Water (MHHW) elevation to meet the Regional Board's requirement of passing water quality flows at all times. Designing a facility below MHHW will risk not fulfilling the Regional Board's requirement because the facility will not pass water quality flow effectively when storms coincide with MHHW. Tides higher than MHHW will flood the facility and create maintenance nuisances by flushing trash away from the facility and upstream to the storm sewer system.

Trash capture facilities should be placed at storm sewer systems with moderate to steep hydraulic grade line slopes (HGL slope) to minimize hydraulic impacts to the upstream systems. Trash capture facilities located at systems with mild HGL slopes will propagate head loss farther upstream than those systems with moderate to steep HGL slopes and result in reduced pipe capacity.

Trash capture facilities should be constructed and maintained by within the City or ACPWA easement or ROW. The facilities located within the City's properties should have higher priority than those within ACPWA's properties. The City will need to develop a memorandum of understanding (MOU) with ACPWA to assume responsibility to maintain the facilities if they were constructed within the ACPWA properties.

Caltrans's or Union Pacific Railroad (UPRR) easement/ ROW are to be avoided for trash capture facilities because these locations typically need encroachment permits and maintenance agreements which can be a lengthy process to get approval.

Major utility conflicts from PG&E and EBMUD should be avoided in trash capture facility selection process because these conflicts will take at least one year to relocate the utilities and often time delay the construction schedule.

The collected data, site reconnaissance findings, and site selection criteria considered are described for each site in the following sections.

5.1 Site 1 –Mandela Parkway and 24th St

A site (No. 1 in the figure) was investigated and proposed at the intersection of Mandela Parkway and Grand Avenue prior to this study. We reanalyzed the location and determined that it is not suitable for a trash capture facility because of frequent flooding issues due to limited pipe capacity (less than 5-year design storm). Installing a trash capture facility at the location will further exacerbate the existing flooding and create maintenance issues when the flood water brings the collected debris/ trash to the ground surface. The original proposed location also has a smaller contributing watershed of 385 acres, and has no access from the ground to inspect the condition of the system.

Another location (No. 2 in the figure) was considered further downstream at the intersection of Mandela Parkway and 24th Street to minimize the hydraulic impact as discussed further in **Section 6**, to increase the contributing watershed to 610 acres, and with verified sound pipe structural integrity.

See the preliminary 5-year floodplain map and site relocation in the figure below.

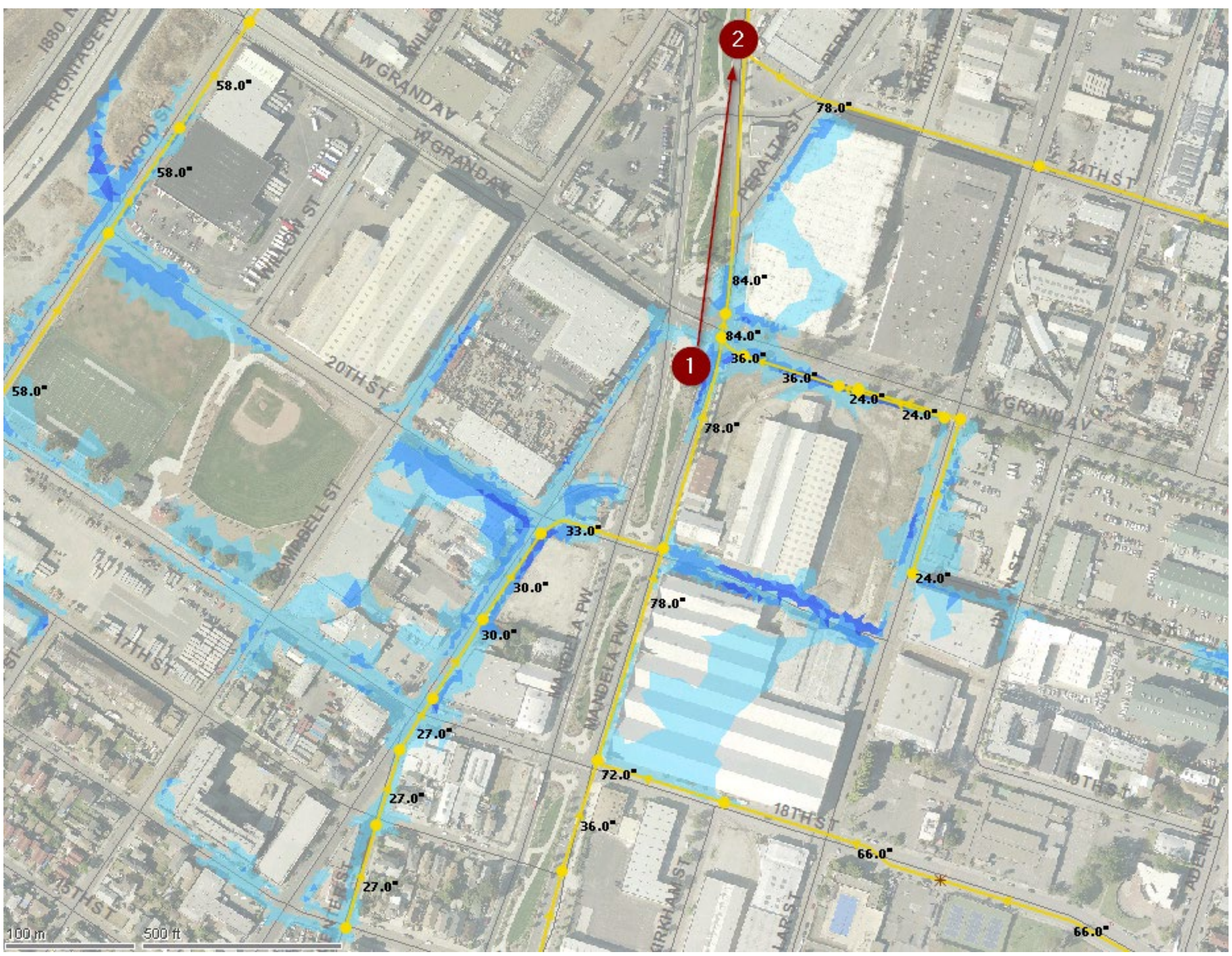


Figure 2 - Mandela and 24th EBMUD Water Utility Map

The following data were collected for site selection and hydraulic impact analysis.

1. 2011 Parcels and ACPWA's Easements
2. ACPWA's 2016 LiDAR DEM
3. ACPWA's hydrologic and hydraulic models
4. City's Sewer Map (storm drains and sanitary sewer pipes)
5. EBMUD and PG& E utilities maps
6. Contech's CDS design

The proposed site was observed with shallow, slow-flowing water, structurally sound pipes and access structure, and a sediment/debris free condition.

Figure 3 - Mandela and 24th Access Structure and Pipe Inside Photos

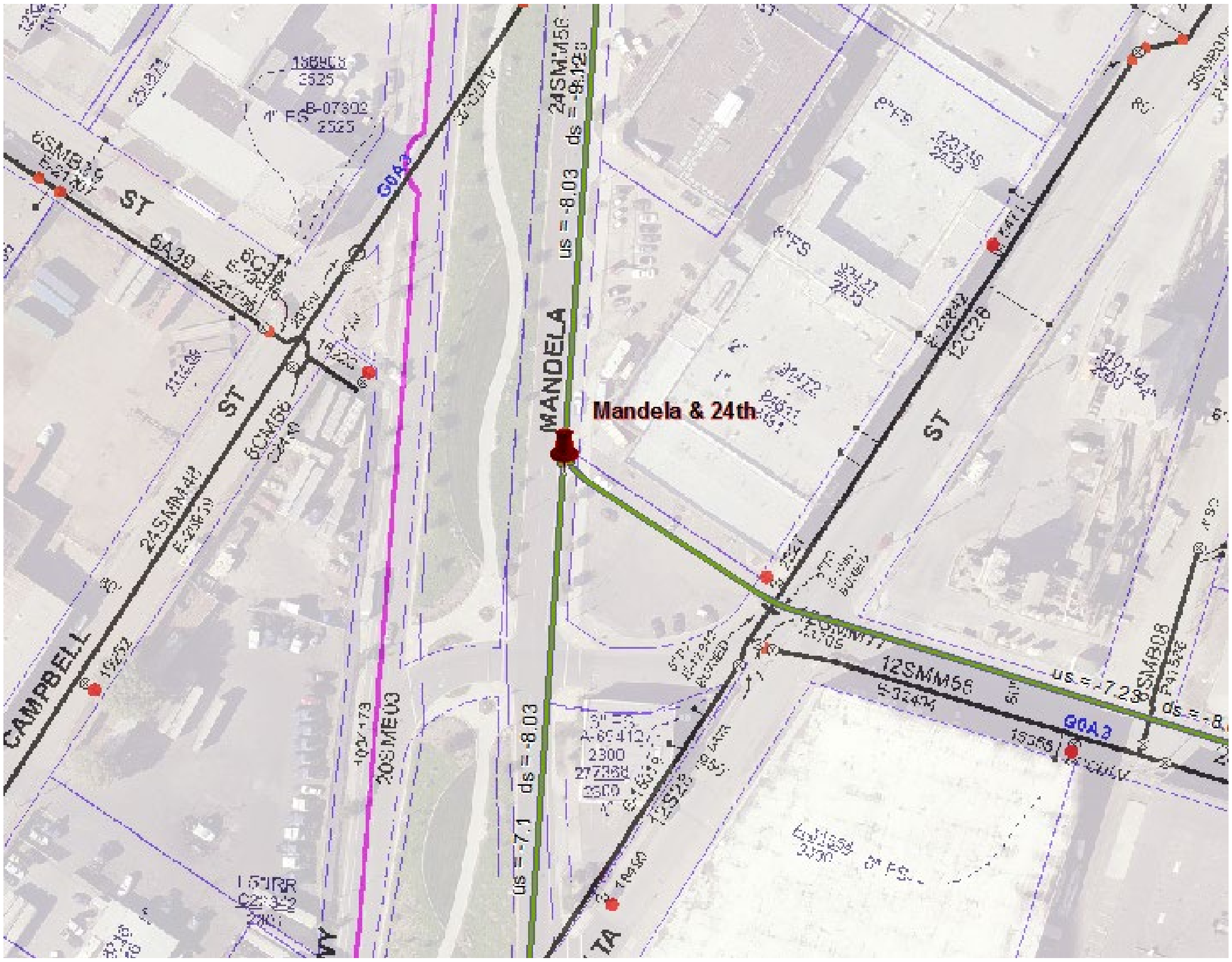


Figure 4 - Mandela and 24th EBMUD Water Utility Map

Based on the EBMUD water utility map provided by the City, there are no potable water distribution (black) or recycled distribution systems (magenta) within the site location.

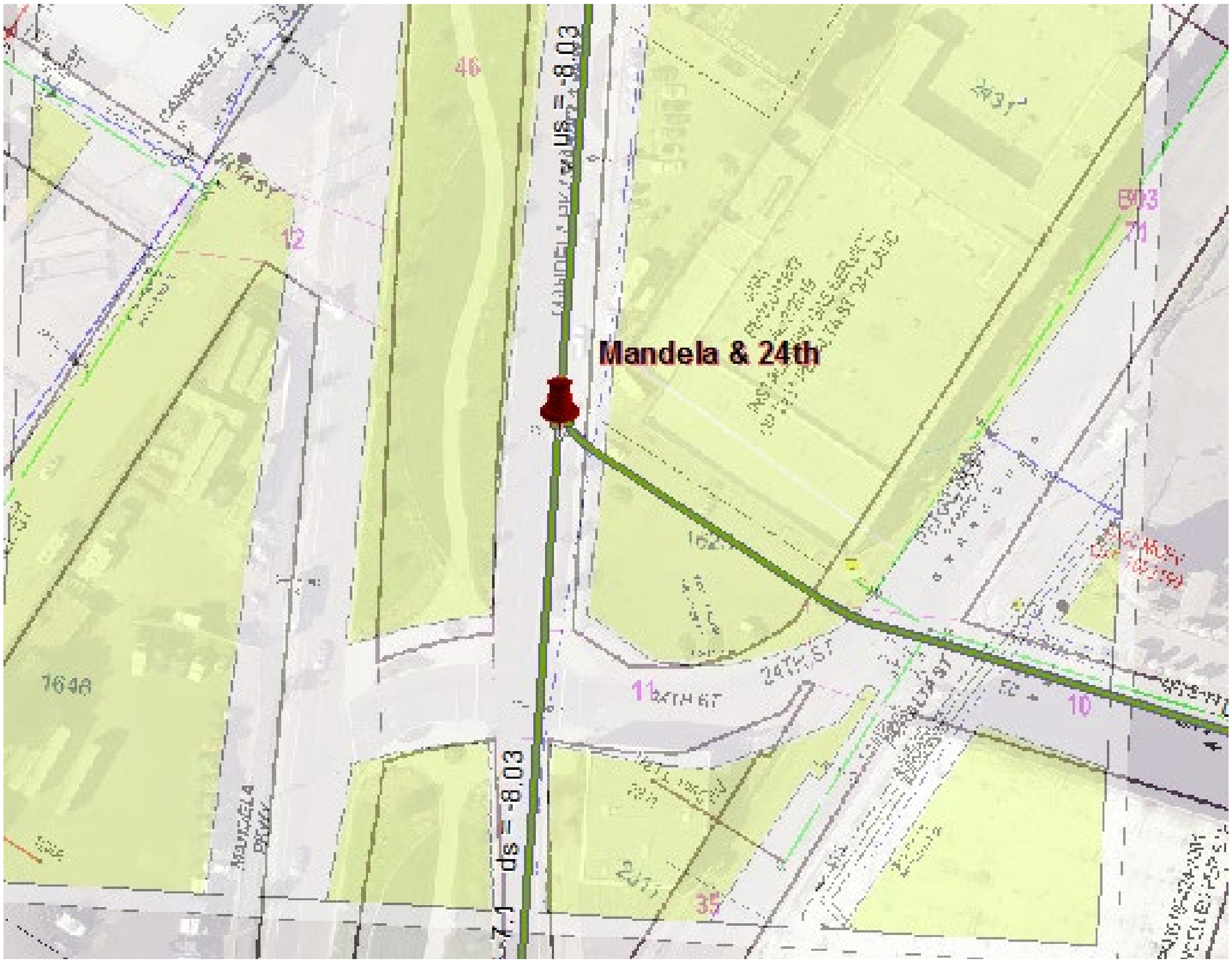


Figure 5 – Mandela and 24th Gas and Electric Utility Map

Based on the PG&E gas and electric utilities map provided by the City, there are no service lines, distribution mains and transmission mains (green, blue, magenta, yellow, red) within the site location.

5.2 Site 2 – 45th Avenue & San Leandro Street

The following data were collected for site selection and hydraulic impact analysis.

1. 2011 Parcels and ACPWA's Easements
2. ACPWA's 2016 LiDAR DEM
3. ACPWA's hydrologic and hydraulic models
4. ACPWA's storm sewer as-builts (CB-362)
5. City's Sewer Map (storm sewer and sanitary sewer pipes)

No EBMUD or PG&E utility maps were obtained for Site 2.

No site reconnaissance was performed at Site 2.

ACPWA's storm sewer 1974 as-builts (CB-362) was georeferenced (rubber sheeted) to aerial imagery for preliminary utility conflict screening. No utility conflicts were identified.

Figure 6 – Site 2 As-Built Plan (CB-362)

5.3 Site 3 – 47th Avenue & UPRR

The following data were collected for site selection and hydraulic impact analysis.

6. 2011 Parcels and ACPWA's Easements
7. ACPWA's 2016 LiDAR DEM
8. ACPWA's hydrologic and hydraulic models
9. ACPWA's storm sewer as-builts (CB-333)
10. City's Sewer Map (storm sewer and sanitary sewer pipes)

No EBMUD or PG&E utility maps were obtained for Site 3.

No site reconnaissance was performed at Site 3. ACPWA's storm sewer 1971 as-builts (CB-333) was georeferenced (rubber sheeted) to aerial imagery for preliminary utility conflict screening. A 6-inch sanitary sewer pipe and 6-inch water pipe were found in the vicinity of the site location.

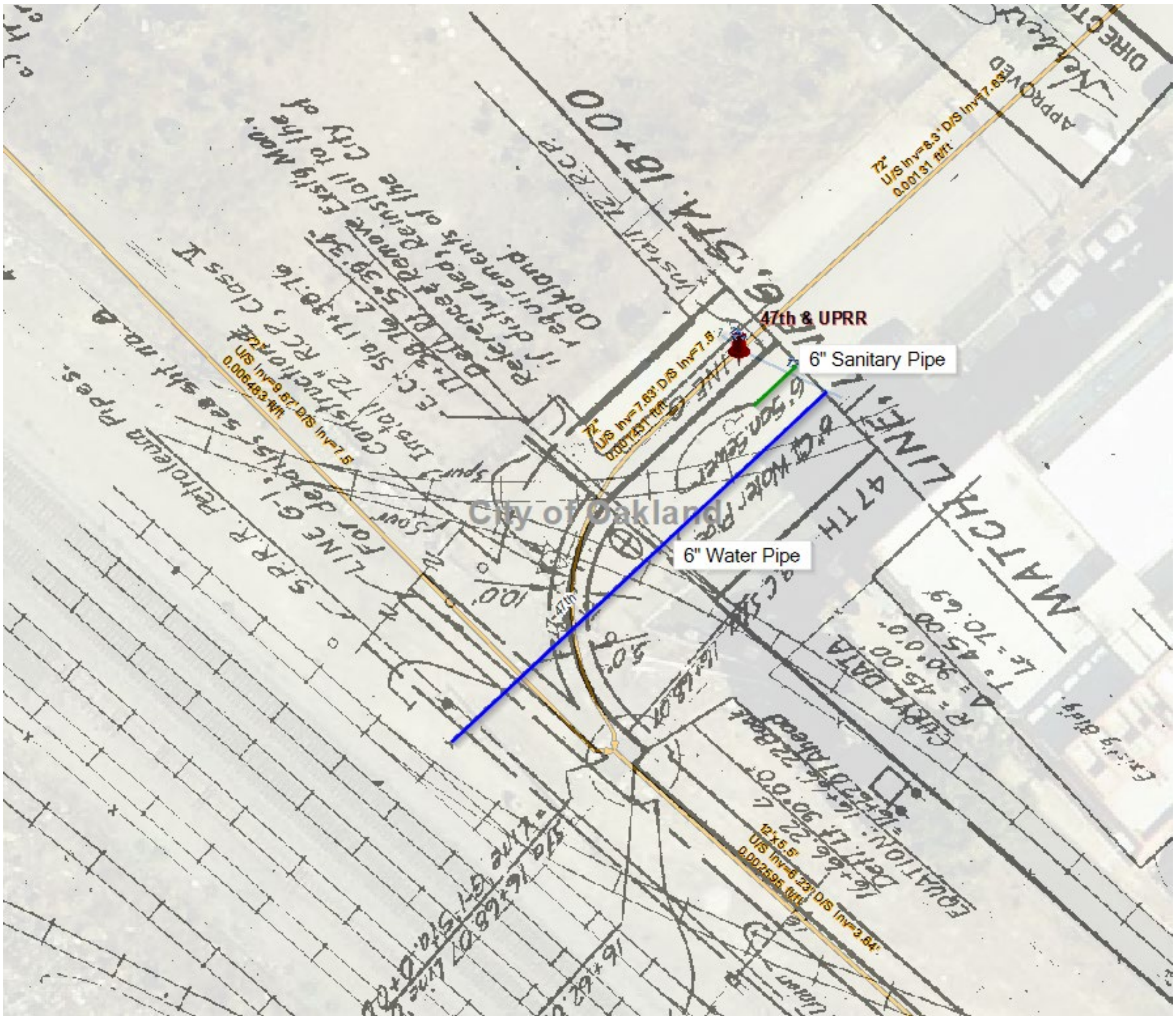


Figure 7 – Site 3 As-Built Plan (CB-333)

5.4 Site 4 – 85th Avenue and G Street

The following data were collected for site selection and hydraulic impact analysis.

1. 2011 Parcels and ACPWA's Easements
2. ACPWA's 2016 LiDAR DEM
3. ACPWA's hydrologic and hydraulic models
4. ACPWA's storm sewer 1946 as-builts (UC-2421)
5. City's Sewer Map (storm sewer and sanitary sewer pipes)
6. Contech's CDS design

7. PG&E and EBMUD 2019 utilities map

ACPWA's storm sewer 1946 as-builts (UC-2421) was georeferenced (rubber sheeted) to aerial imagery for preliminary utility conflict screening.

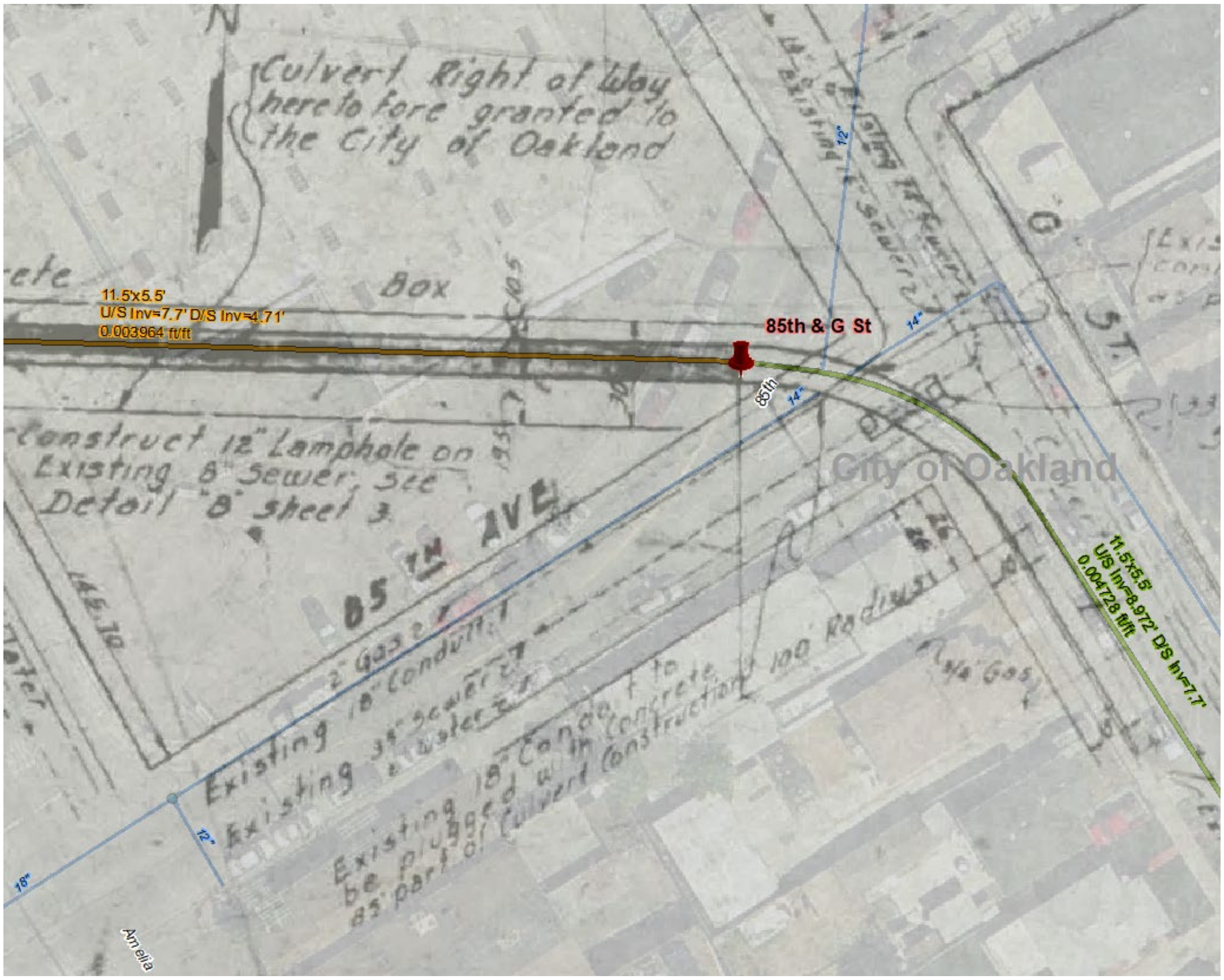


Figure 8 – Site 3 As-Built Plan (UC-2421)

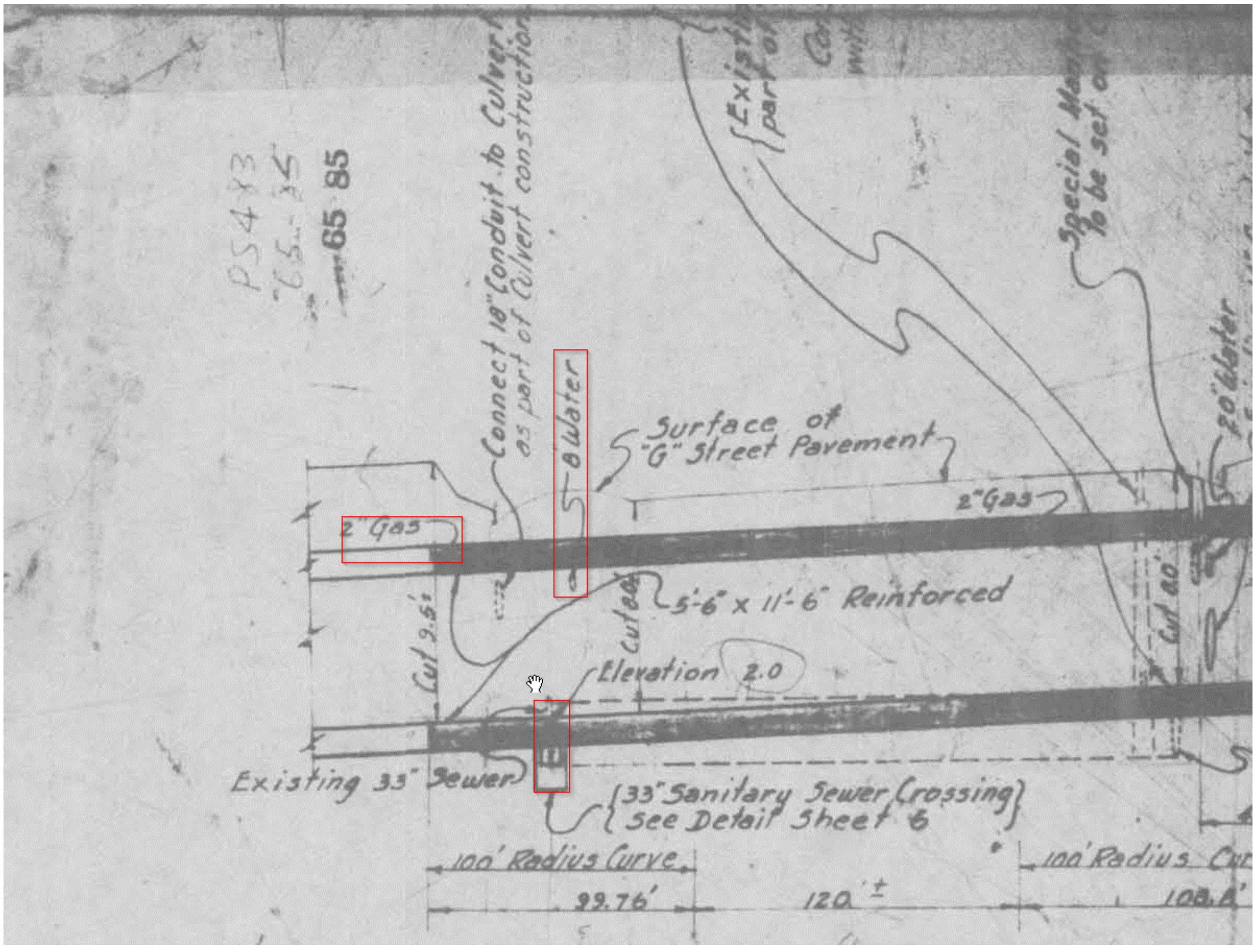


Figure 9 – Site 3 As-Built Section (UC-2421)

A 2" gas line, 8" water line, and 33" sanitary sewer crossing were identified from the as-built plans crossing the 11.5' x 5.5' RCB. The 2" gas and 8" water lines were further investigated with 2019 PG&E and EBMUD utility maps and found no records of the utilities crossing the RCB near the proposed trash capture site, see Figure 11 and Figure 12 . The sanitary sewer line was confirmed in our site reconnaissance by inspecting the access hatch to the northeast of the RCB.

There was no access hatch or manhole found around the proposed site location and we inspected the access hatch further upstream at the intersection of 85th Avenue and G Street. The proposed site was observed with relatively fast-moving shallow water, structurally sound pipes and access structure, and a sediment/debris free condition.

Figure 10 - 85th Avenue and G Street Access Structure and Pipe Inside Photos

Figure 11 – 85th and G Electric Utility Map

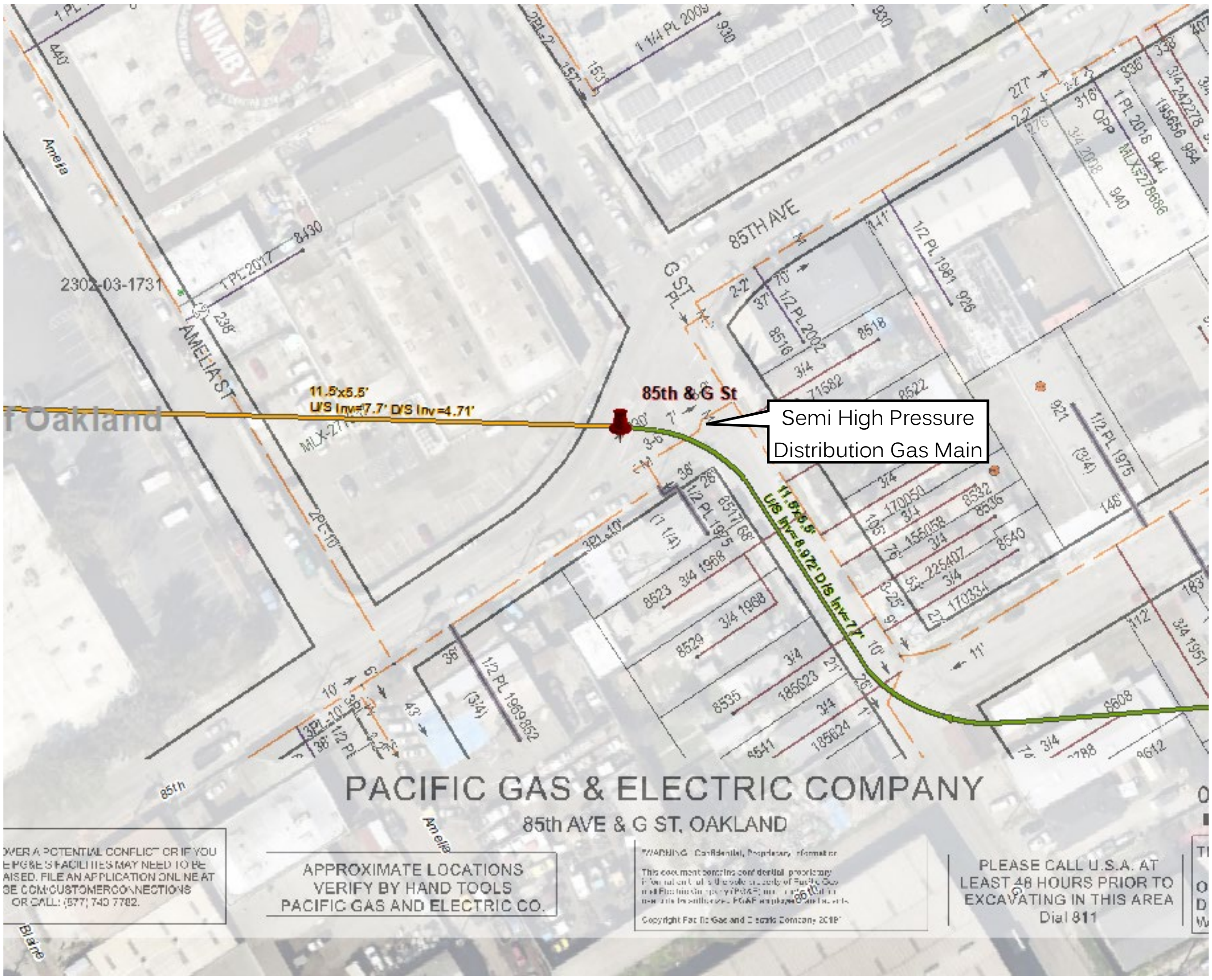


Figure 12 – 85th and G Gas Utility Map

Based on the PG&E gas and electric utilities map provided by the City, there are no service lines, distribution mains and transmission mains (green, blue, magenta, yellow, red) within the site location.

Figure 13 - 85th and G EBMUD Water Utility Map

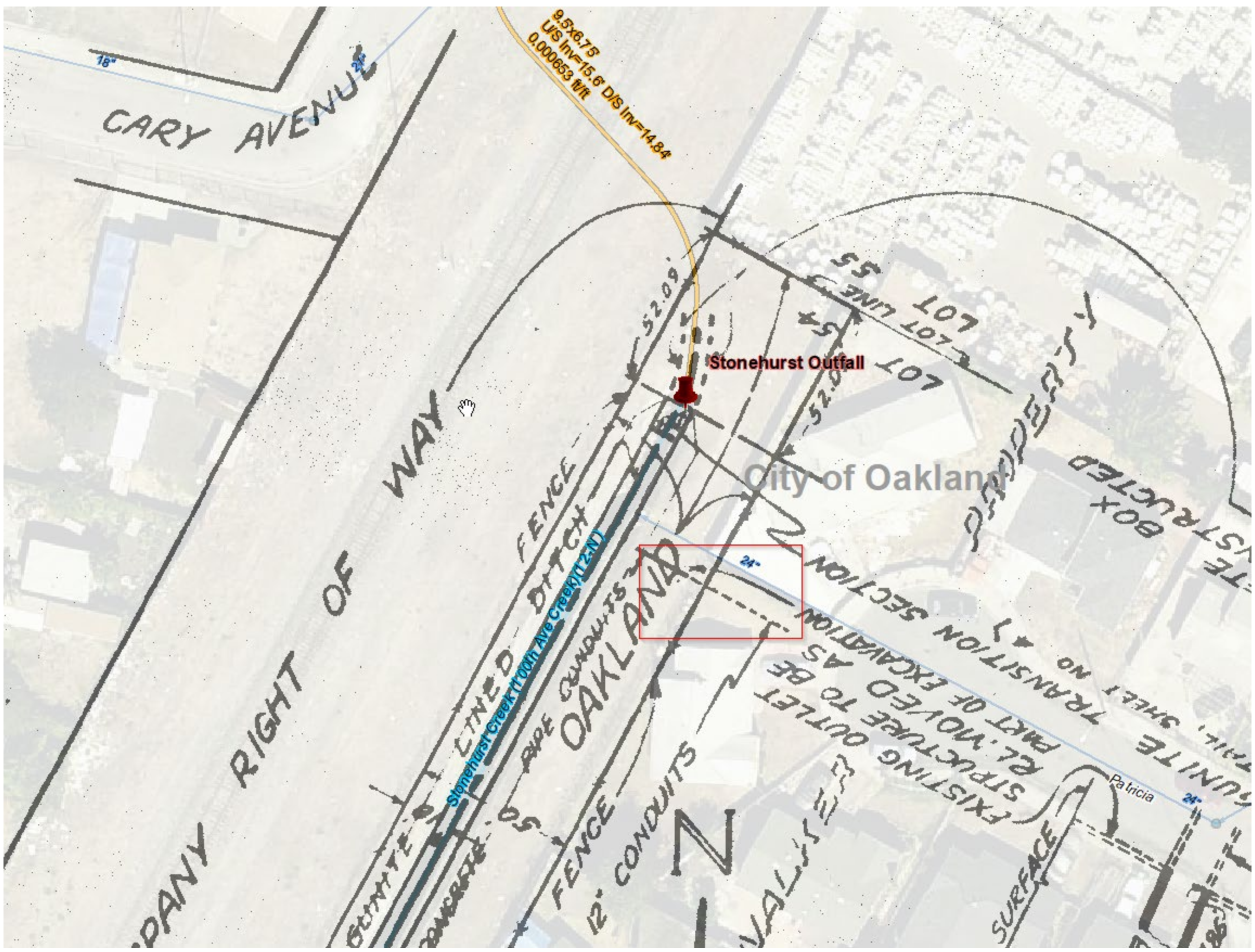
Based on the EBMUD water utility map provided by the City, there are no potable water distribution (black) or recycled distribution systems (magenta) within the site location.

5.5 Site 5 – Stonehurst Outfall

The following data were collected for site selection and hydraulic impact analysis.

1. 2011 Parcels and ACPWA's Easements
2. ACPWA's 2016 LiDAR DEM
3. ACPWA's hydrologic and hydraulic models
4. ACPWA's channel 1947 as-builts (UD-153)
5. City's Sewer Map (storm sewer and sanitary sewer pipes)
6. PG&E and EBMUD 2019 utilities map

ACPWA's channel 1947 as-builts (UD-153) was georeferenced (rubber sheeted) to aerial imagery



for preliminary utility conflict screening.

A 12" RCP was found about 40' downstream of the outfall structure based on the as-built and the latest APCWA GIS database indicates another 24" RCP lateral storm sewer. Both storm sewers were verified in our site reconnaissance.

The proposed site was observed with relatively fast-moving shallow water, structurally sound pipes and concrete channel, and a moderate to heavy sediment/debris condition.

Figure 14 – Stonehurst Creek Outfall Pipe and Channel Photos

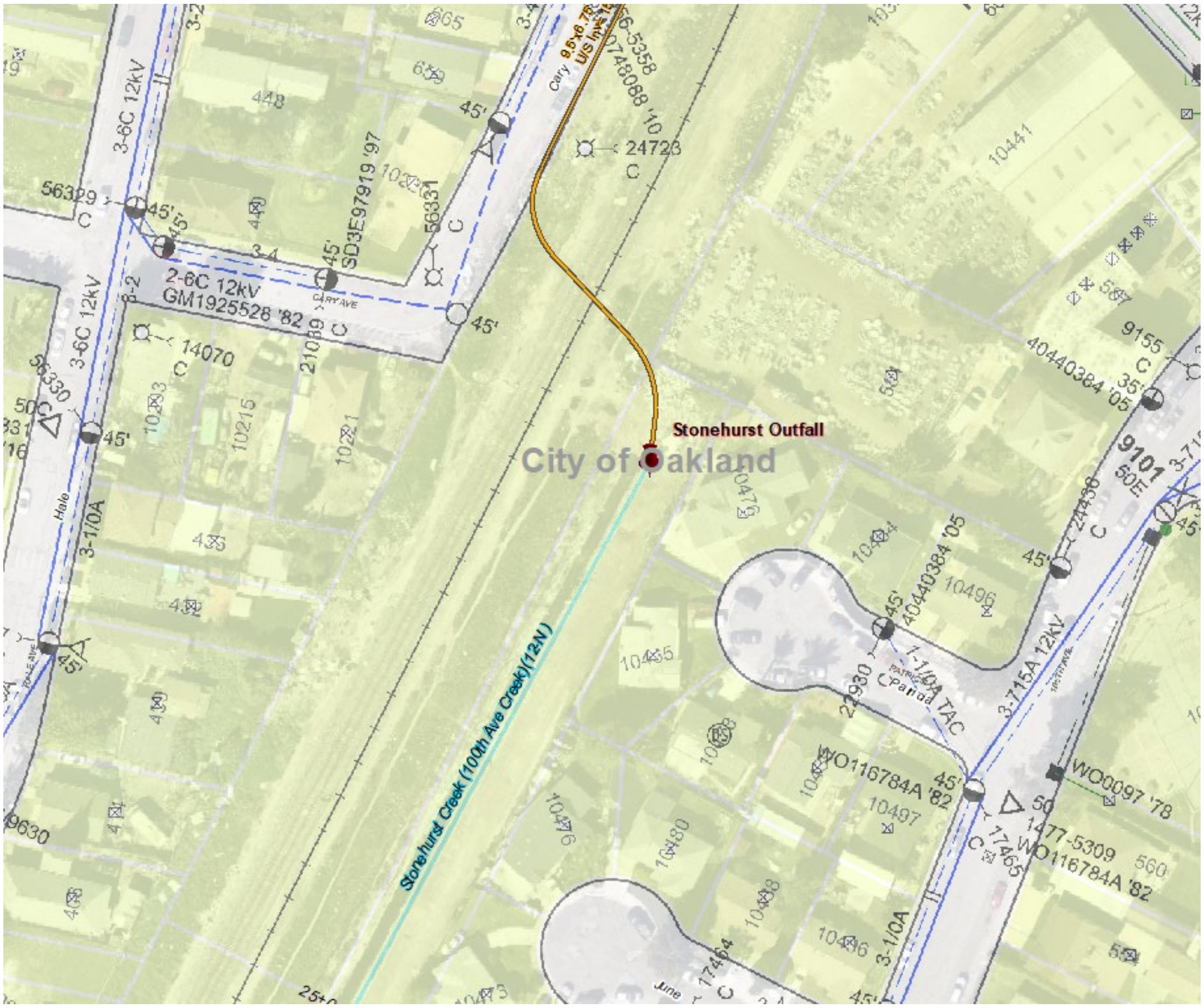


Figure 15– Stonehurst Electric Utility Map

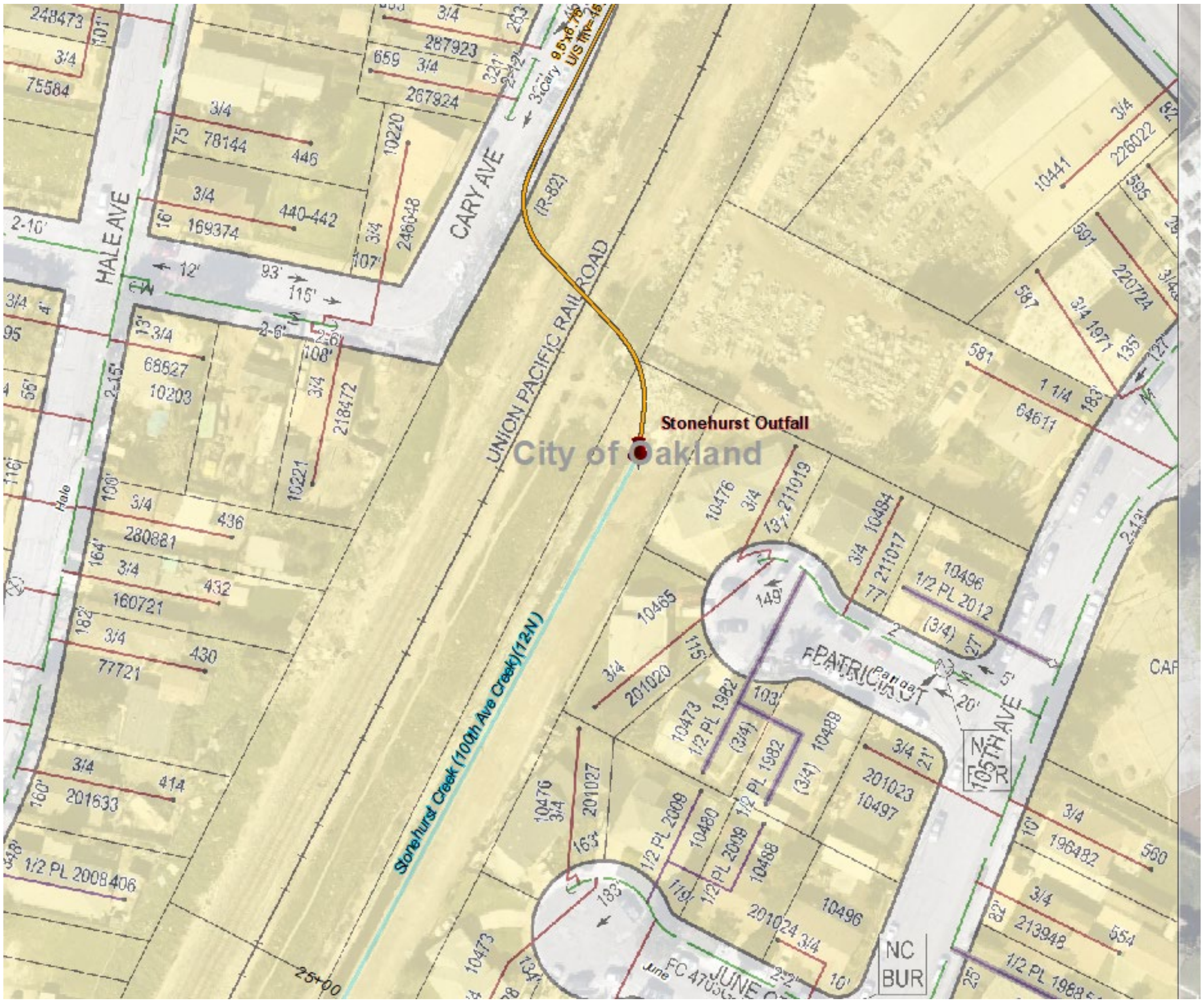


Figure 16 – Stonehurst Gas Utility Map

Based on the PG&E gas and electric utilities map provided by the City, there are no service lines, distribution mains and transmission mains (green, blue, magenta, yellow, red) within the site location.

Figure 17 - Stonehurst EBMUD Water Utility Map

Based on the EBMUD water utility map provided by the City, there are no potable water distribution (black) or recycled distribution systems (magenta) within the site location.

6 HYDRAULIC IMPACT ANALYSIS

A hydraulic impact analysis was conducted in order to determine the effects of the proposed trash capture system on the main function of the storm sewers. Because each of the possible trash capture facilities can meet the trash capture requirements, aside from space considerations, the hydraulic impact analysis was the most instrumental factor in selecting the trash capture device.

6.1 Trash Capture Devices

Three trash capture devices: 1) Contech's Continuous Deflective Separation (CDS), 2) BioClean's Debris Separating Baffle Box (DSBB), and 3) Roscoe Moss's Storm Flo Screen trash capture facilities were considered and analyzed for each site for hydraulic performance, mainly head loss.

The Storm Flo Screen was not selected or modeled at Sites 1 to 4 because of its large footprint requirement within street ROW makes construction of the facility infeasible, and it is not effective at locations subject to tidal influence or high backwater effects (like Sites 1 to 4). CDS and DSBB were not selected or modeled at Site 5 because they generally have higher head loss than Storm Flo Screen, and the site has sufficient space being at the pipe outfall to Stonehurst Creek. Sites 1 to 4 were analyzed with CDS and DSBB for hydraulic impacts.

6.2 Design Flows

6.2.1 Trash Capture

Section C10.a.iii of the MRS NPDES Permit states that the LTC facilities must have a "design treatment capacity of not less than the peak flow rates resulting from a one-year, one-hour, storm in the sub-drainage area".

The Alameda Countywide Clean Water Program, C.3 Stormwater Technical Guidance further describes the design storm requirement – "*The permit also allows the use of 0.2 inches/hour as one of the three alternative methods regardless of the results from calculating values from local rainfall depths*".

Dynamic hydrologic and hydraulic models from ACPWA were used to develop the water quality one-year, one-hour flow for large trash capture device sizing. The models were calibrated to the Dec 2014 historical storm and used the latest ACPWA Design Manual standards. The dynamic models provide more realistic and accurate hydraulic performance of the facility than simplified hand calculations or Rational Method by accounting for pipe storage, flow routing, backwater effects, and pipe diversion.

6.2.2 Hydraulic Impacts

The existing storm sewer systems within the study areas have 2- to 10-year conveyance capacity and, hence, 2-year 24-hour, 5-year 24-hour, and 10-year 24-hour design storms were used to analyze the proposed trash capture system hydraulic impacts for storm drainage. The 25-year 24-hour City design storm was not analyzed because most of the existing systems within the study areas have less than 25-year capacity. In addition, a 100-year 24-hour design storm was used to analyze channel hydraulic performance at Site 5.

The design storm that produces flows just before (below) where the system starts flooding the streets was used as the target for analysis. Additional improvements will be proposed to mitigate post-trash capture system hydraulic impacts to the existing condition as described in the next section.

The design flows in the table below are the results from the dynamic models.

Table 2 – Trash Capture Areas and Design Flows

Site	Location	Drainage Area (ac)	Water Quality Flow (cfs)	Peak Flow, cfs (Design Storm)
1	Mandela & 24th	610	80	345 (2-year)
2	45th & San Leandro	1,679	95	750 (2 year)
3	47th & UPRR	751	38	220 (2 year)
4	G and 85th	802	48	490 (5-year)
5	Stonehurst Outfall	739	51	630 (100-year)

6.3 Hydraulic Models

The pre- and post-trash capture conditions at each site were analyzed using an InfoWorks ICM one- and two-dimensional model to assess the hydraulic impact of the facility. Detailed hydraulic features within each type of the facilities were modeled explicitly to account for the limitation and true performance in both low and high flow conditions.

6.3.1 CDS

The internal head loss coefficient for the CDS unit was requested from Contech but it is not available because it was considered proprietary information. We made an assumption that the head loss coefficient, K factor, was 5 times the inlet orifice velocity for the passing water quality flow. DSBB head losses were based on standard hydraulic coefficients from the calculation provided by BioClean. Storm Flo Screen head loss and performance were based on the Caltrans's laboratory testing data, see **Reference 4**.

A schematic diagram of the post CDS trash capture ICM model is shown in the following figure. The major components of a CDS facility are a diversion weir, CDS unit with screen, and inlet/outlet flumes, and they were modeled explicitly using ICM Weir, Pipe, and Orifice Objects respectively. During low flows (up to the 1-year design water quality flow), storm water is routed through the

CDS unit. A short ICM Pipe Object was used and its downstream discharge coefficient was set to a factor of 5 to represent the inlet flume and CDS unit performance. When the flow exceeds the capacity of the CDS unit, storm water will overtop the overspill weir bisecting the diversion box. The overspill weir was modeled with an ICM Weir Object and the weir length was optimized to reduce the head loss to the existing condition for the target storm before the storm sewer system flooded the streets. The incoming pipe exit coefficient and outgoing pipe entrance coefficient were set to 0.5 and 0.25 respectively. A standard incoming pipe exit coefficient of 1.0 and outgoing pipe entrance coefficient of 0.5 are for water transition in and out of stagnant water body, and they are considered too conservative for this application where design high flow is flowing through the facility with reduced but yet a relatively high velocity.

The input parameters for the ICM objects were translated from the plans as shown in the following figure. The plan is from a design drawing for a similar size CDS facility and markups in red were provided for determining the overtopping weir length, weir elevation, and orifice attributes.

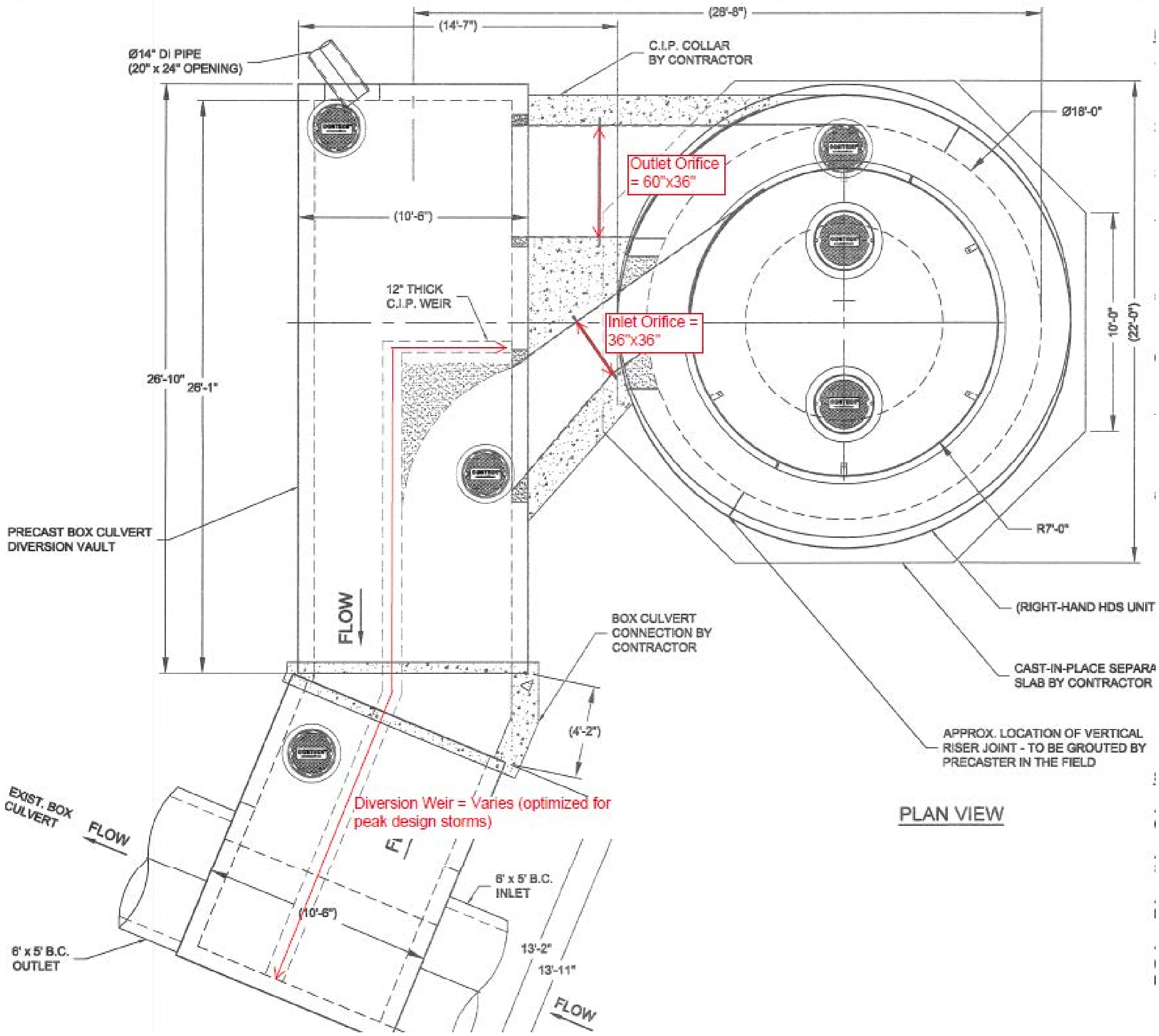


Figure 18 – CDS Trash Capture ICM Schematic (in red)

6.3.2 DSBB

A schematic diagram of the post DSBB trash capture ICM model is shown in the following figure. The major components of a DSBB facility are a screen, overtop weir, and wall bottom opening, and they were modeled explicitly using an ICM Screen, Weir, and Gate Objects respectively. During low flow up to the 1-year design water quality flow, storm water is routed through the screen and go through the wall bottom opening. When the flow exceeds the capacity of the screen, storm water will overtop the screen in addition to the through screen flow and exit through the wall bottom opening and the overtop weir at the downstream side of the facility. The overtop weir height was optimized to reduce the head loss to the existing condition for the target storm before the storm sewer system flooded the streets. The incoming pipe exit coefficient and outgoing pipe entrance coefficient were set to 0.5 and 0.25 respectively to be conservative.

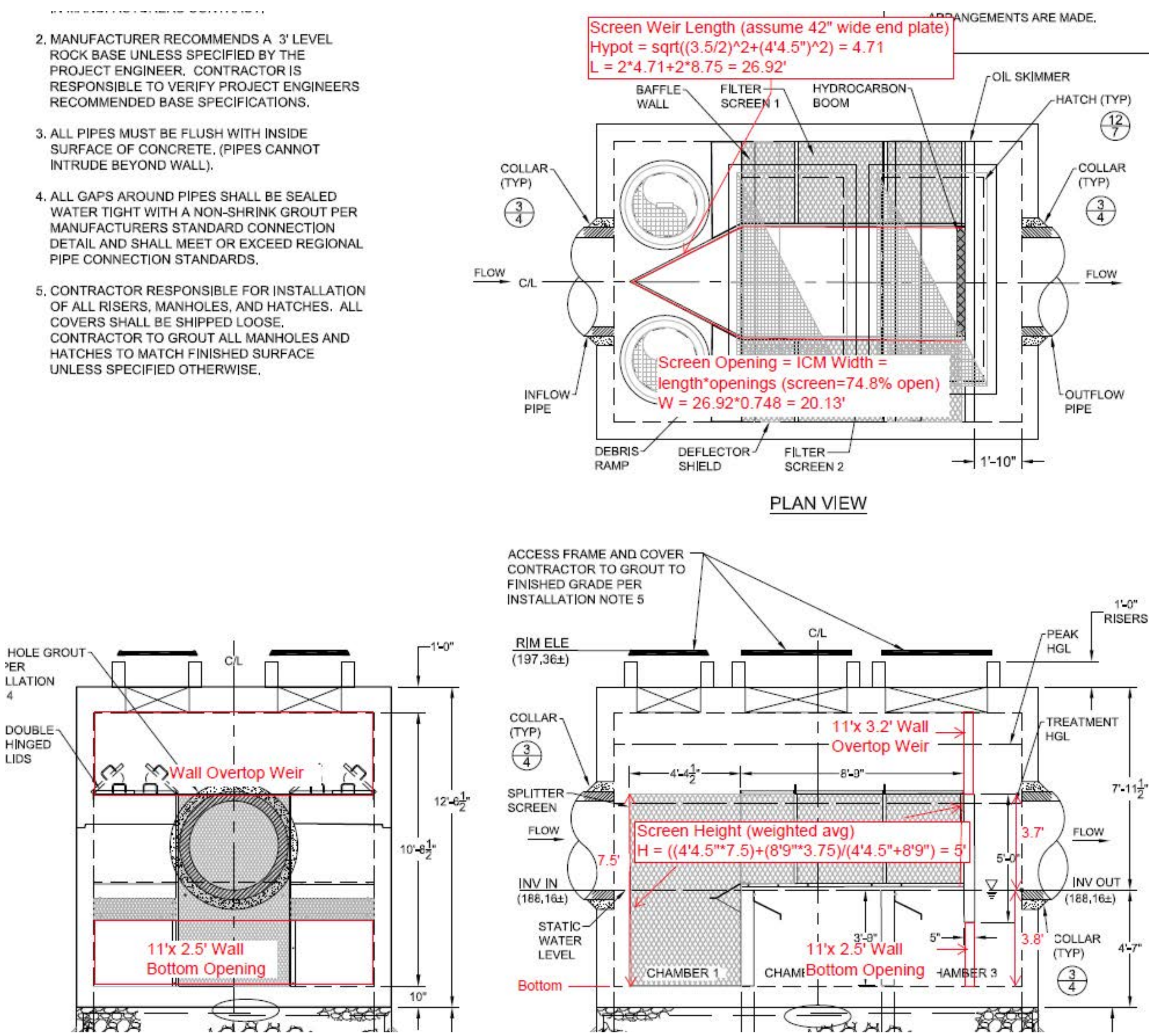


Figure 19 –DSBB Trash Capture ICM Schematic (in red)

6.3.3 Storm Flow

A schematic diagram of the post Storm Flow Screen trash capture ICM model is shown in the following figure. The major components of a Storm Flow Screen facility are a screened (perforated) pipe, and overtop weir, and they were modeled explicitly using an ICM Pipe, and Weir Objects respectively. During low flow up to the 1-year design water quality flow, storm water is routed through the screened pipe. When the flow exceeds the capacity of the screened pipe, storm water will overtop the weir and exit through the downstream drainage facility. The overtop weir height and screened pipe size were optimized to reduce the head loss to the existing condition for the target storm before the storm sewer system flooded the streets. The incoming pipe exit coefficient was set to 0.5.

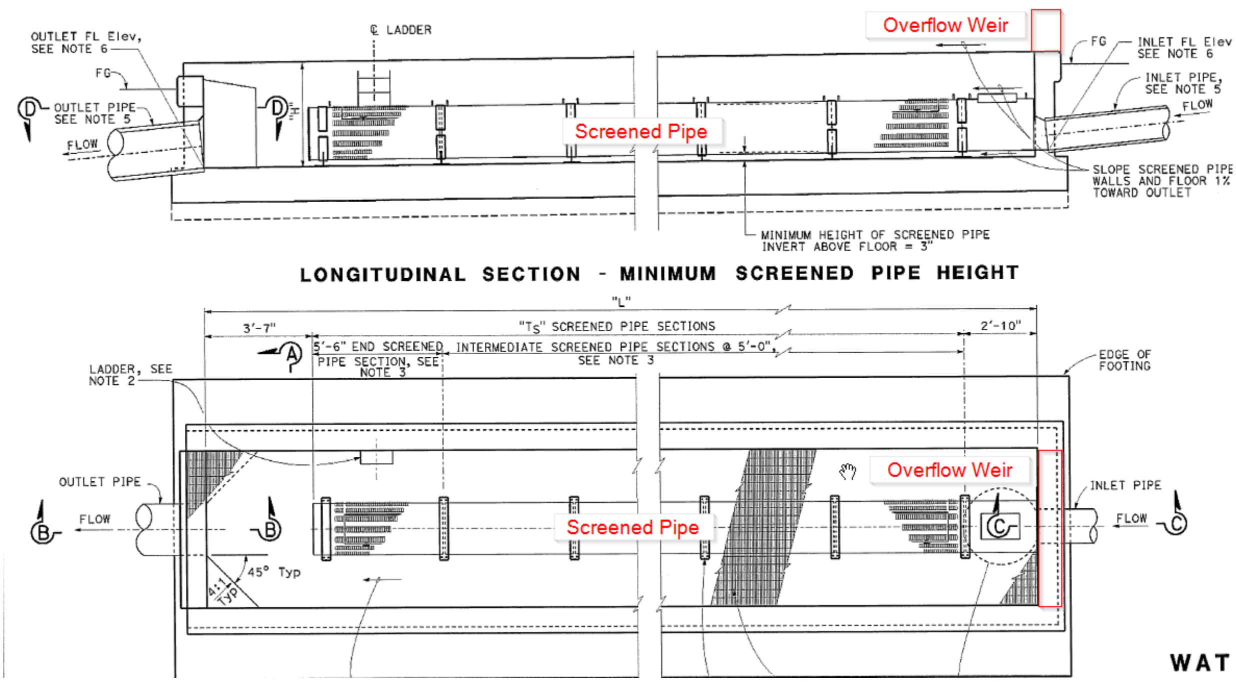


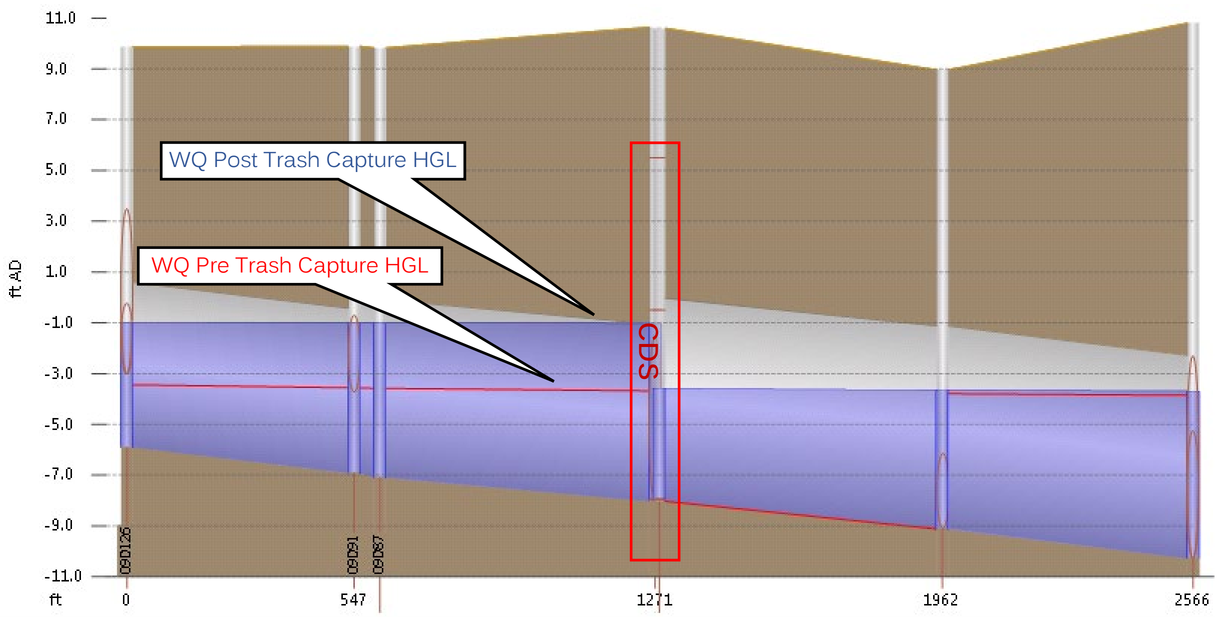
Figure 20 – Storm Flow Screen Trash Capture ICM Schematic (in red)

6.4 Results & Recommended Device

6.4.1 Results

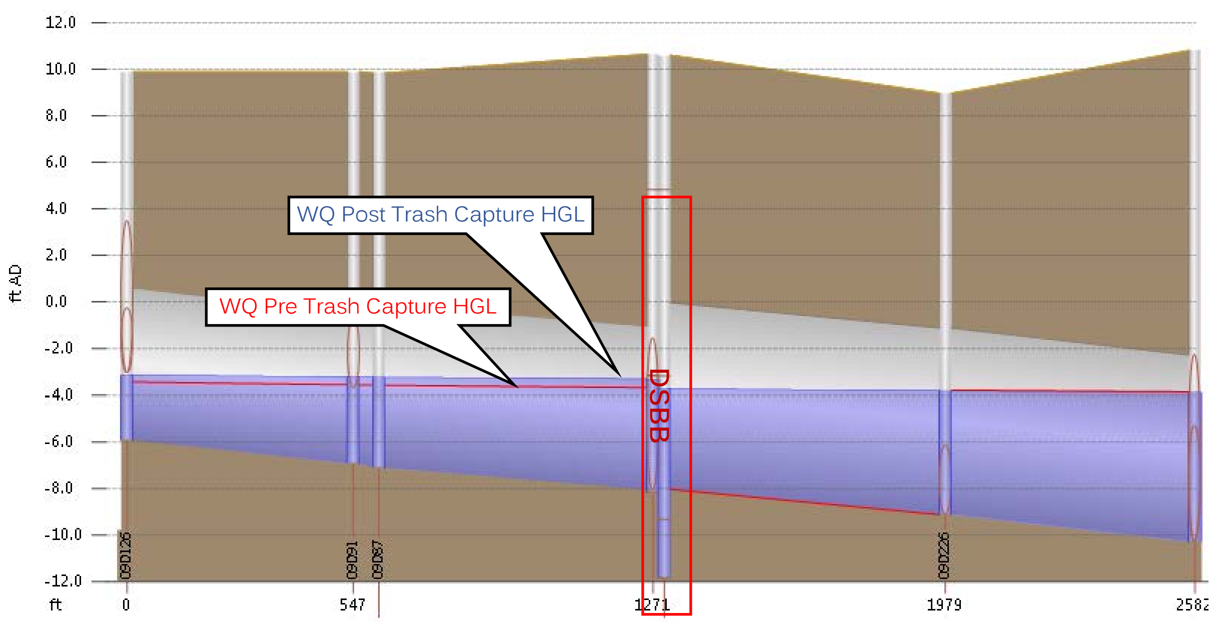
As described in the **Hydraulic Model** section, ICM models were run for pre- and post-trash capture conditions (clean condition), and facilities were then further optimized to mitigate the clogged condition for the target peak design storms (typically 5-year or smaller events). The resulting profiles at the five sites for the water quality flow and peak design storm flow are shown in the figures below.

The red line along the pipe profile shows the hydraulic grade line (HGL) for pre-trash capture condition, and the blue line along the pipe profile shows the HGL for post-trash capture condition. The ground profile is shown in brown.



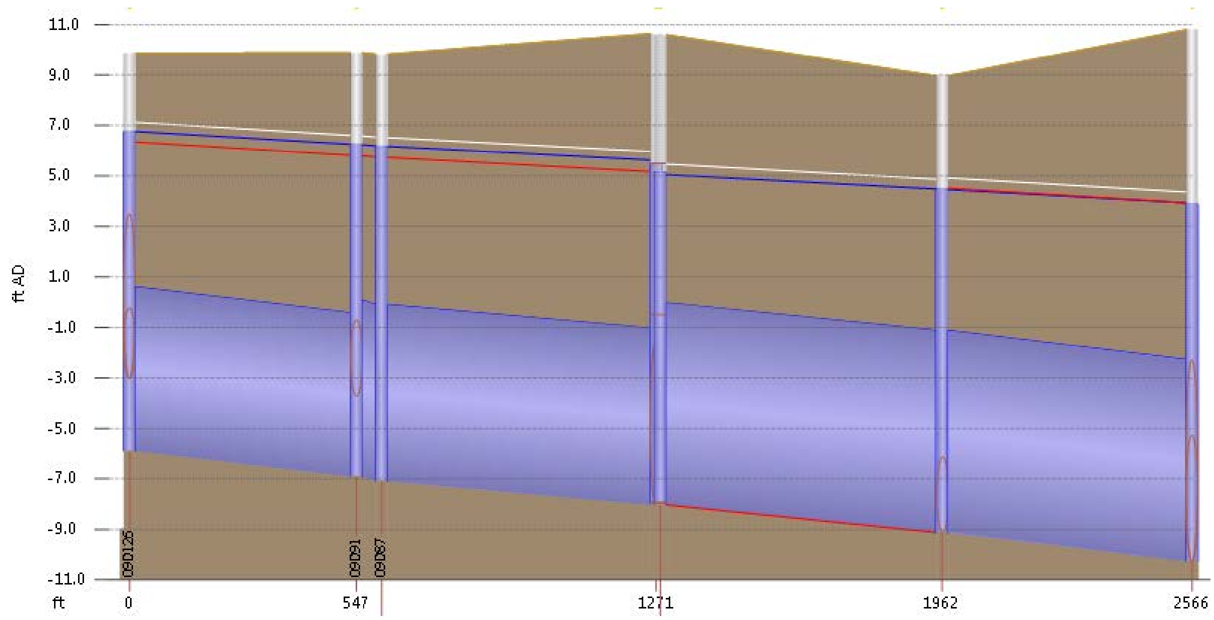
Link	09D126.1	-	09D87.1	LTC_Mandela_DS.1	09D226.1
width (in)	78.0	-	84.0	96.0	96.0
US depth (ft)	4.901	-	6.085	4.421	5.452
US flow (ft3/s)	41.7627	-	43.3134	63.2096	90.0837
US velocity (ft/s)	4.791	-	3.736	4.592	4.682
DS depth (ft)	5.909	-	6.995	5.454	6.574

Figure 21- Site 1 (Mandela & 24th) CDS Water Quality Flow Pipe Profile



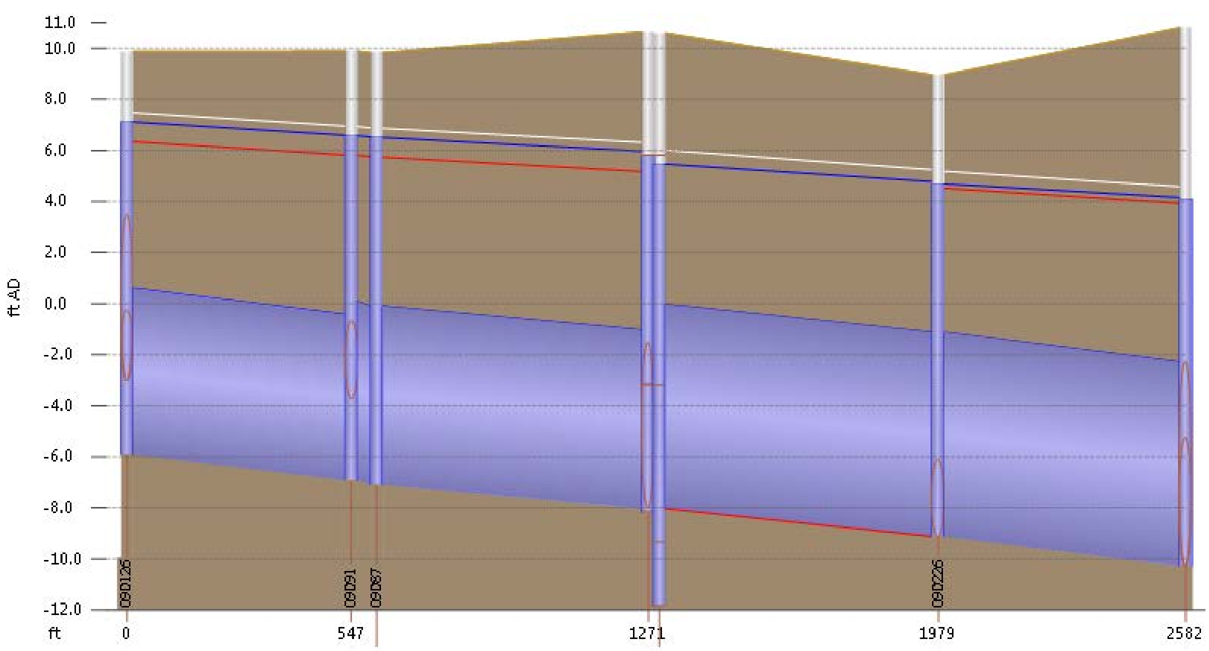
Link	09D126.1	-	09D87.1	LTC_Mandela_DS.1	09D226.1
width (in)	78.0	-	84.0	96.0	96.0
US depth (ft)	2.739	-	3.847	4.281	5.283
US flow (ft3/s)	42.2432	-	49.3695	90.1287	100.7783
US velocity (ft/s)	5.270	-	4.506	5.643	5.800
DS depth (ft)	3.684	-	4.702	5.290	6.388

Figure 22- Site 1 (Mandela & 24th) DSBB Water Quality Flow Pipe Profile



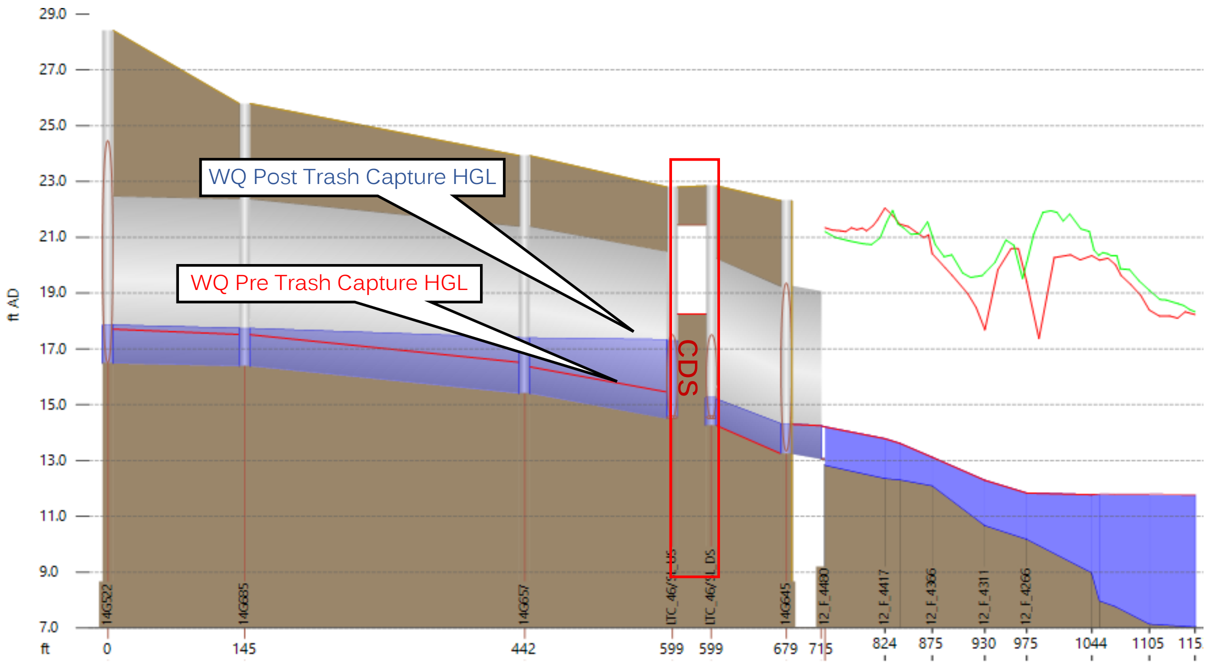
Link	09D126.1	-	09D87.1	LTC_Mandela_DS.1	09D226.1
width (in)	78.0	-	84.0	96.0	96.0
US depth (ft)	12.660	-	13.271	13.079	13.582
US flow (ft3/s)	185.4106	-	210.9918	347.9826	374.3774
US velocity (ft/s)	5.290	-	5.197	6.613	7.110
DS depth (ft)	13.174	-	13.660	13.601	14.214

Figure 23 - Site 1 (Mandela & 24th) CDS 2-year Pipe Profile (Clean Facility)



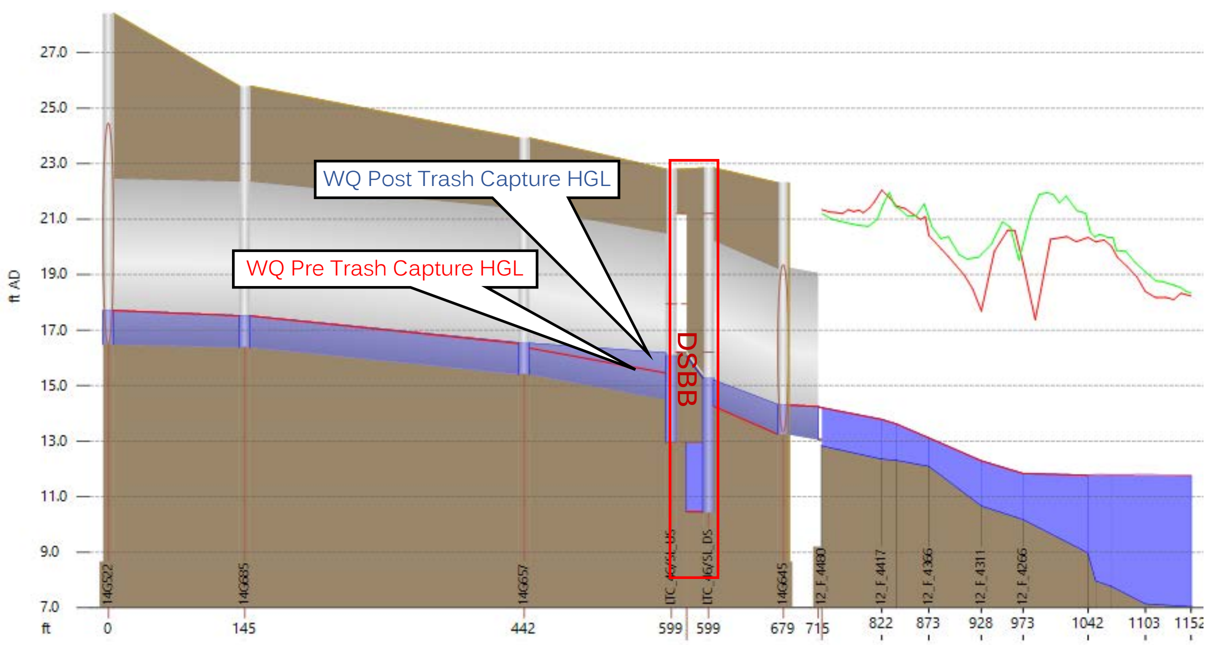
Link	09D126.1	-	09D87.1	LTC_Mandela_DS.1	09D226.1
width (in)	78.0	-	84.0	96.0	96.0
US depth (ft)	13.011	-	13.610	13.496	13.806
US flow (ft3/s)	178.9825	-	203.8550	329.5916	351.8081
US velocity (ft/s)	5.093	-	5.008	6.242	6.658
DS depth (ft)	13.515	-	13.996	13.903	14.437

Figure 24 - Site 1 (Mandela & 24th) DSBB 2-year Pipe Profile (Clean Facility)



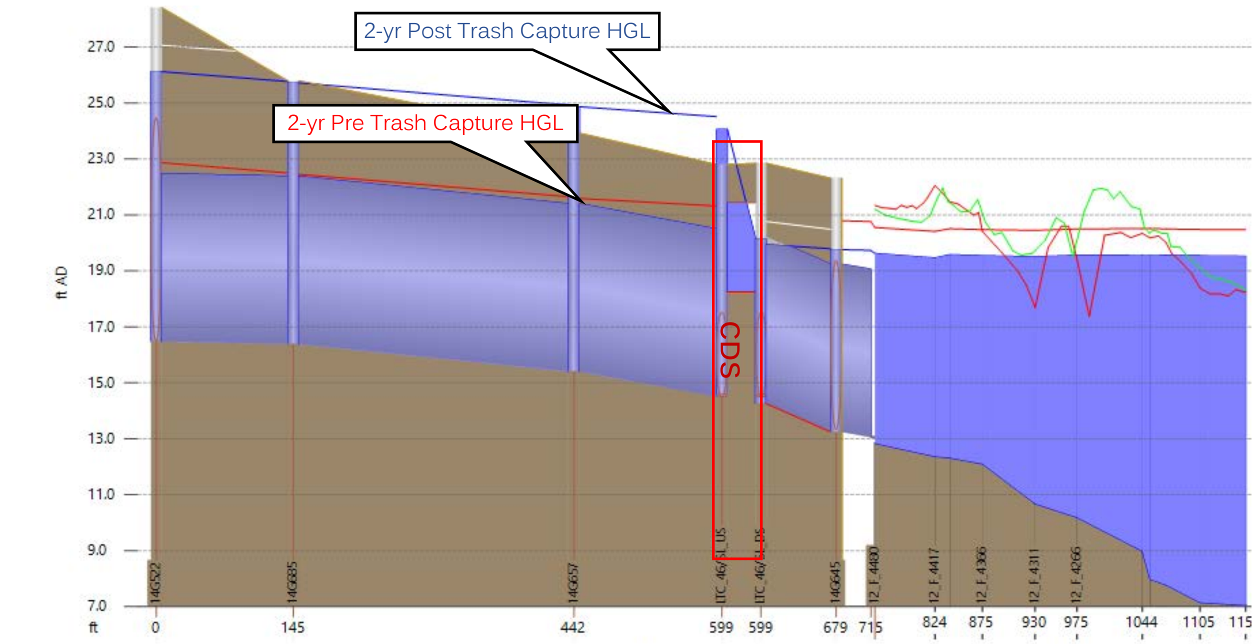
Link		14G522.1	14G685.1	14G657.1	-	-	-	14G784.1
US depth (ft)		1.364	1.347	1.985	-	0.941	-	1.364
US flow (ft3/s)		83.0179	83.0012	83.9359	-	83.9345	-	45.6037
US velocity (ft/s)		2.935	4.455	3.021	-	5.440	-	3.216
DS depth (ft)		1.354	1.992	2.825	-	1.071	-	4.717

Figure 25 – Site 2 (45th & San Leandro) CDS Water Quality Flow Pipe Profile



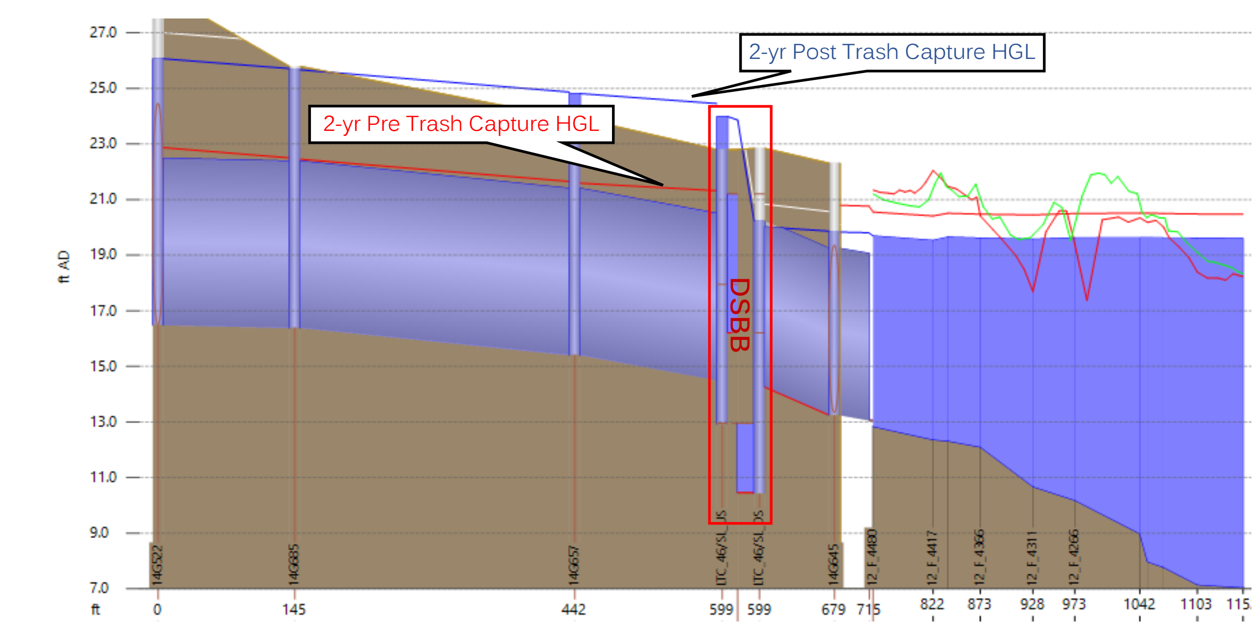
Link		14G522.1	14G685.1	14G657.1	-	-	-	-	14G784.1
US depth (ft)		1.227	1.130	1.120	-	-	0.940	-	1.362
US flow (ft3/s)		83.0098	82.9672	84.6285	-	-	83.7044	-	45.4432
US velocity (ft/s)		3.204	5.251	5.438	-	-	5.430	-	3.212
DS depth (ft)		1.139	1.141	1.673	-	-	1.069	-	4.714

Figure 26 – Site 2 (45th & San Leandro) DSBB Water Quality Flow Pipe Profile



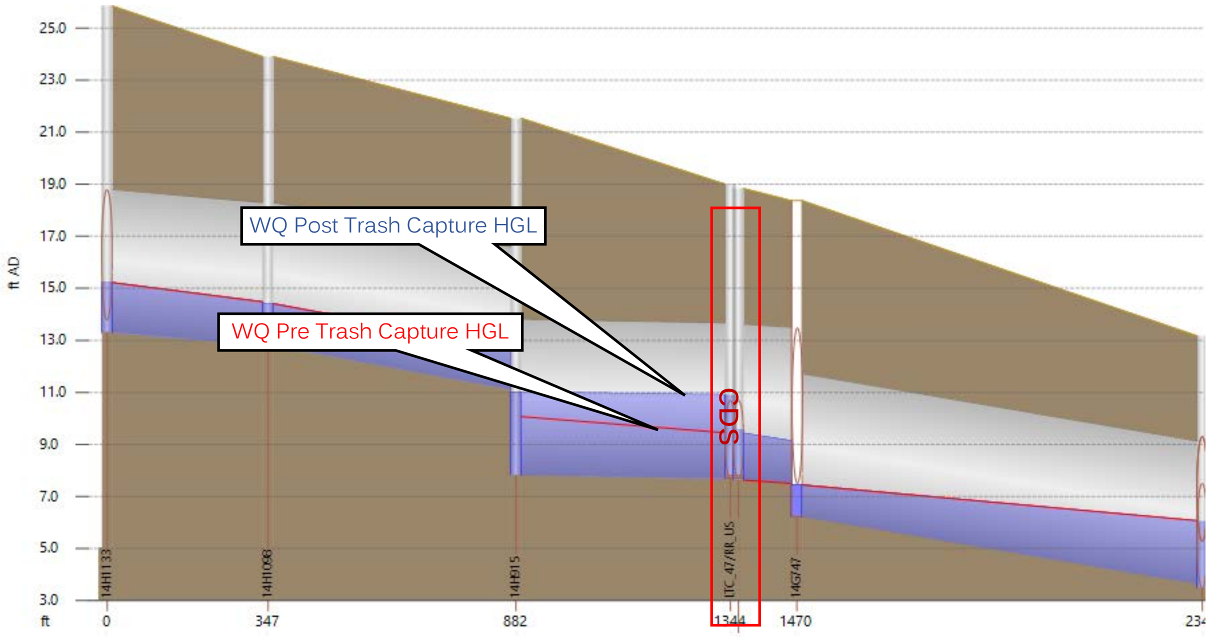
Link	14G522.1	14G685.1	14G657.1	-	-	-	14G784.1
US depth (ft)	9.643	9.342	9.467	-	5.689	-	6.784
US flow (ft3/s)	747.5897	747.5837	681.0099	-	680.3054	-	365.5158
US velocity (ft/s)	7.778	8.874	7.892	-	13.576	-	5.260
DS depth (ft)	9.389	9.523	10.015	-	6.551	-	12.480

Figure 27 – Site 2 (45th & San Leandro) CDS 2-year Pipe Profile (Clean Facility)



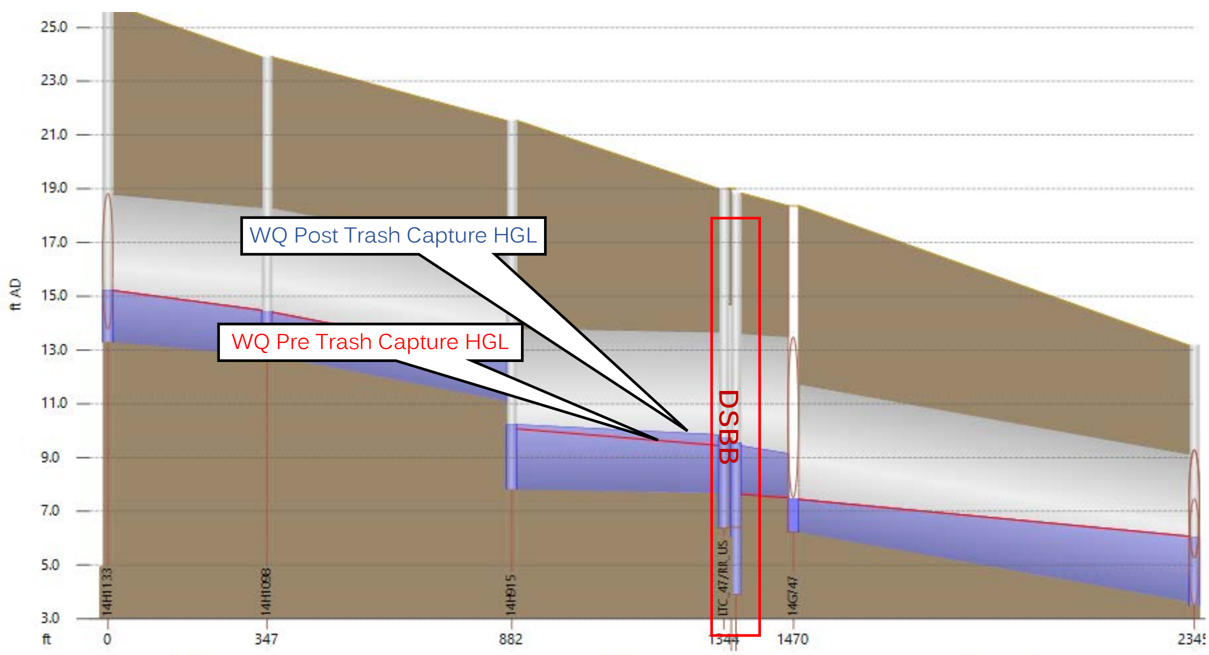
Link	14G522.1	14G685.1	14G657.1			-	-	14G784.1
US depth (ft)	9.585	9.285	9.411	-	-	5.765	-	6.851
US flow (ft3/s)	746.9037	746.9052	685.5505	-	-	685.3792	-	366.2868
US velocity (ft/s)	7.772	8.501	7.801	-	-	12.098	-	5.214
DS depth (ft)	9.332	9.467	9.954	-	-	6.625	-	12.548

Figure 28 – Site 2 (45th & San Leandro) DSBB 2-year Pipe Profile (Clean Facility)



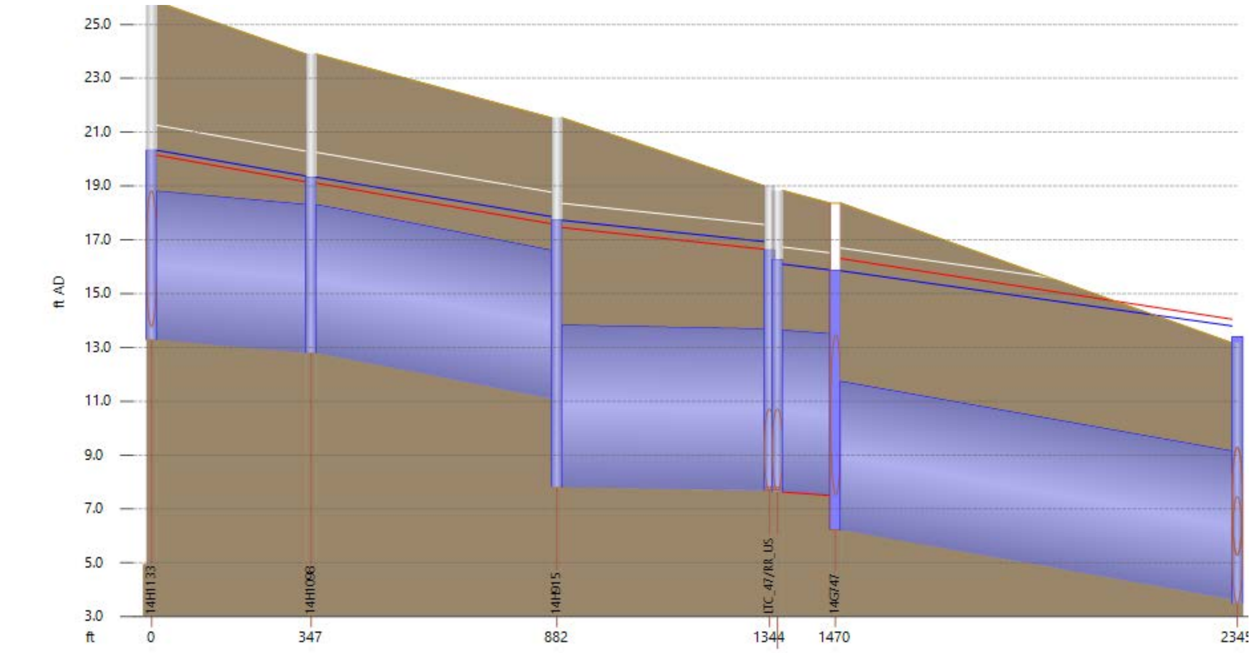
Link	14H1133.1	14H1098.1	14H915.1	-	14G747.1
US depth (ft)	1.915	1.608	3.188	1.796	1.213
US flow (ft3/s)	37.7073	37.7061	37.7034	37.6519	76.7143
US velocity (ft/s)	5.175	6.519	3.529	5.294	5.275
DS depth (ft)	1.678	1.608	3.230	1.636	2.422

Figure 24 – Site 3 (47th & UPRR) CDS Water Quality Flow Pipe Profile



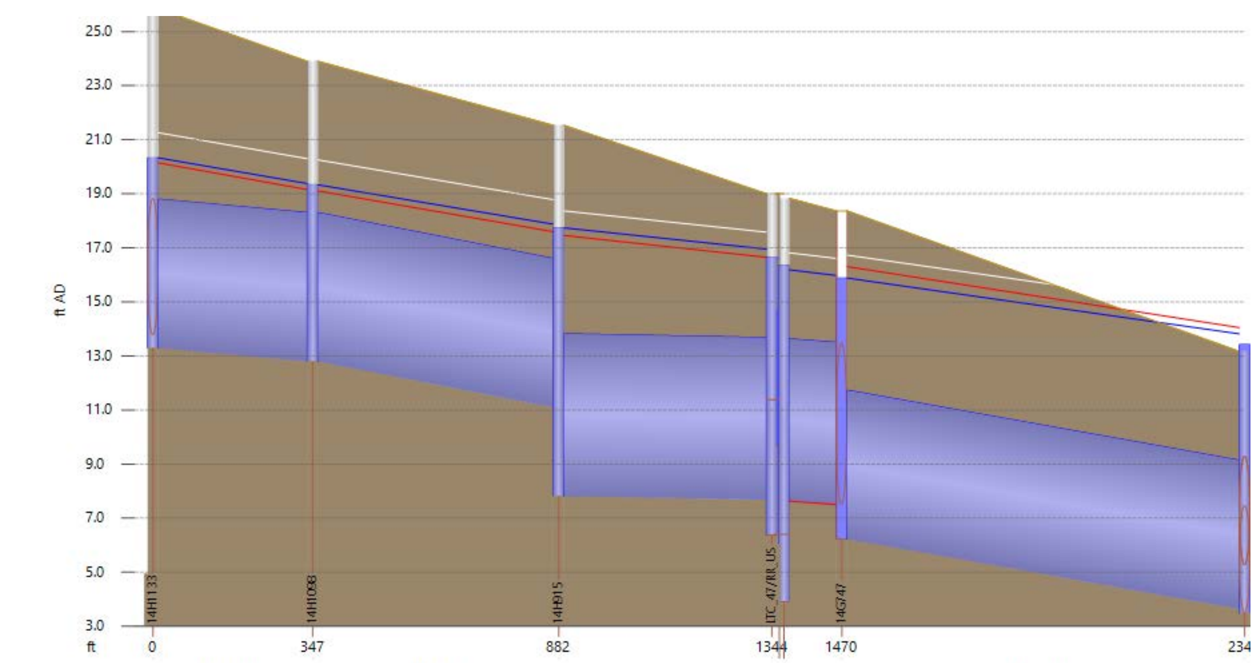
Link	14H1133.1	14H1098.1	14H915.1	-	14G747.1
US depth (ft)	1.915	1.608	2.396	1.797	1.210
US flow (ft3/s)	37.7073	37.7061	37.7048	37.6960	76.3169
US velocity (ft/s)	5.175	6.519	3.998	5.296	5.259
DS depth (ft)	1.678	1.608	2.158	1.637	2.430

Figure 24 – Site 3 (47th & UPRR) DSBB Water Quality Flow Pipe Profile



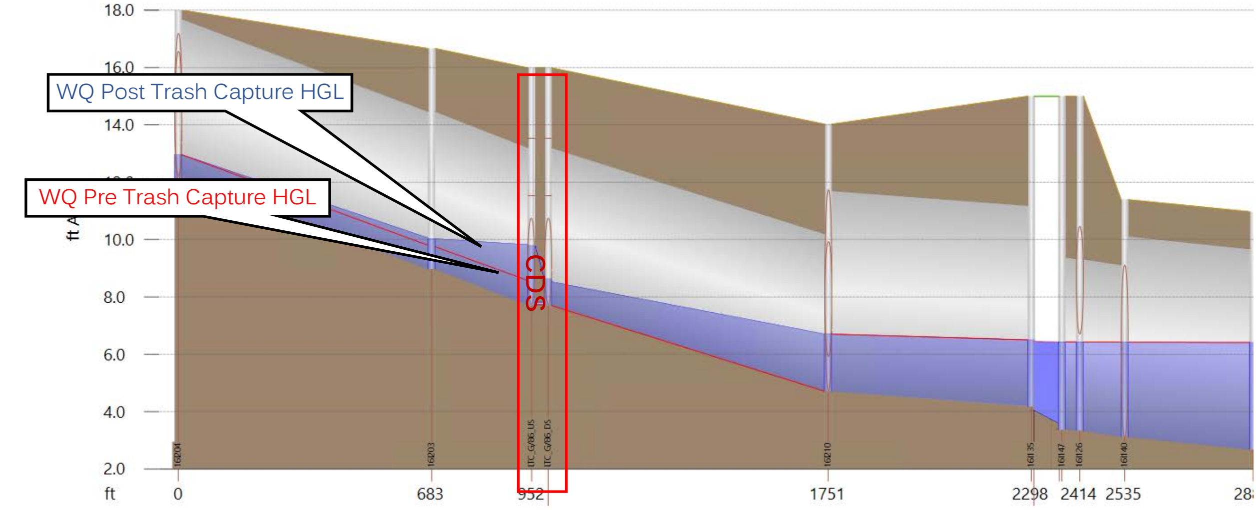
Link	14H1133.1	14H1098.1	14H915.1	-	14G747.1
US depth (ft)	7.028	6.526	9.904	8.465	9.621
US flow (ft3/s)	223.7148	223.0147	222.2702	-	511.5858
US velocity (ft/s)	9.168	10.409	7.554	9.990	8.092
DS depth (ft)	6.572	6.761	9.255	8.383	10.160

Figure 25 – Site 3 (47th & UPRR) CDS 2-year Pipe Profile (Clean Facility)



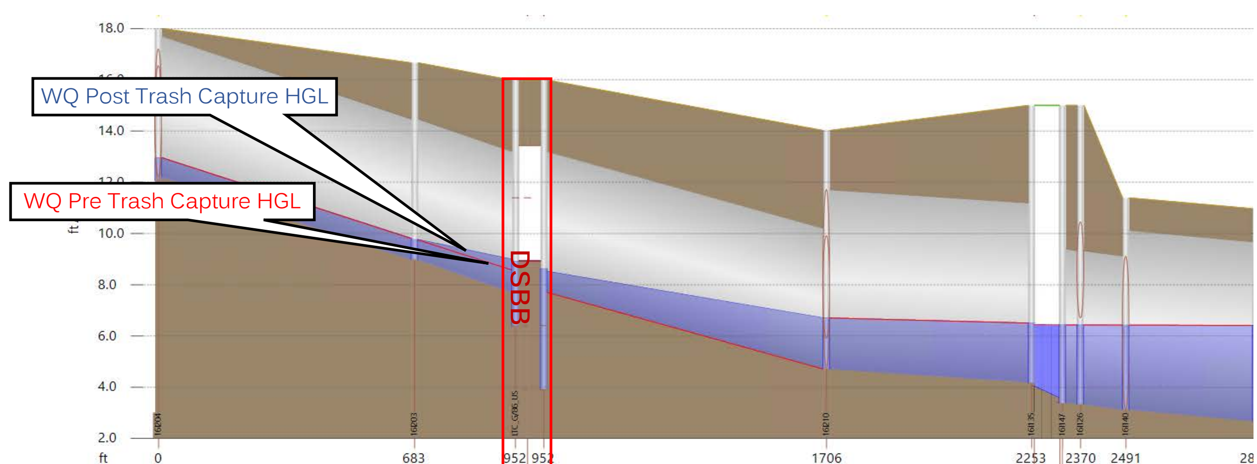
Link	14H1133.1	14H1098.1	14H915.1	-	14G747.1
US depth (ft)	7.030	6.533	9.917	8.558	9.652
US flow (ft3/s)	224.4117	223.7964	222.7153	-	513.0192
US velocity (ft/s)	9.188	10.409	7.578	9.991	8.110
DS depth (ft)	6.578	6.773	9.273	8.477	10.179

Figure 26 – Site 3 (47th & UPRR) DSBB 2-year Pipe Profile (Clean Facility)



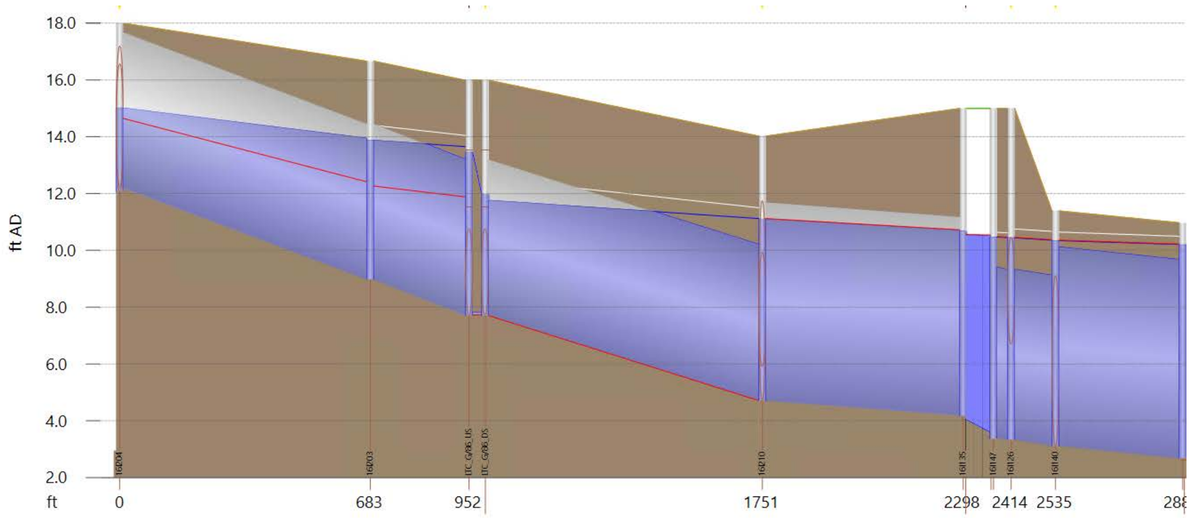
Link	16I204.1	16I203.1	LTC_G/86_DS.1	16I210.1	-	-	16I140.1
US depth (ft)	0.756	1.046	0.818	1.988	-	-	3.296
US flow (ft3/s)	45.7223	48.3491	49.2185	29.7626	-	-	81.9742
US velocity (ft/s)	5.260	4.238	5.234	3.754	-	-	1.788
DS depth (ft)	1.078	2.117	1.991	2.309	-	-	3.724

Figure 27 – Site 4 (85th & G) CDS Water Quality Flow Pipe Profile



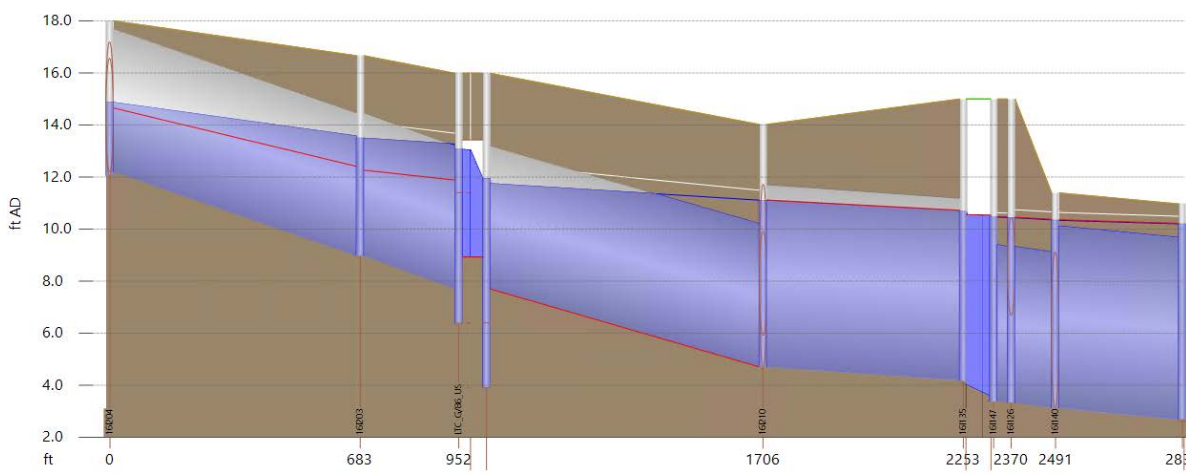
Link	16I204.1	16I203.1	-	LTC_G/86_DS.1	16I210.1	-	-	-	16I140.1
US depth (ft)	0.756	0.790	-	0.819	1.991	-	-	3.098	3.300
US flow (ft3/s)	45.7223	48.3825	-	49.3542	29.8381	-	-	-	82.1616
US velocity (ft/s)	5.260	5.326	-	5.241	3.777	-	-	1.959	1.789
DS depth (ft)	0.842	1.289	-	1.995	2.313	-	-	3.303	3.729

Figure 28 – Site 4 (85th & G) DSBB Water Quality Flow Pipe Profile



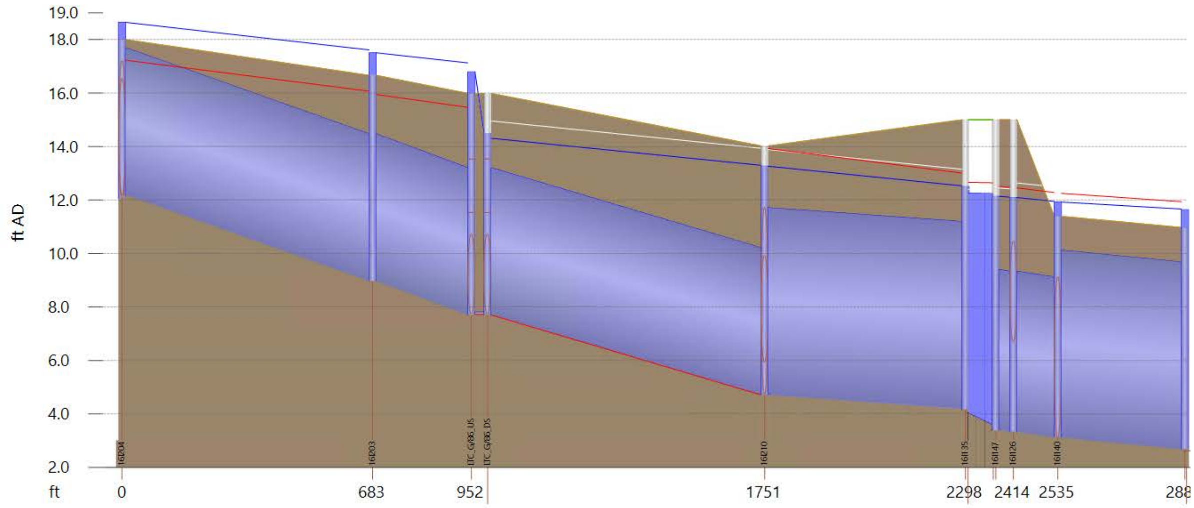
Link	16I204.1	16I203.1	LTC_G/86_DS.1	16I210.1	-	-	16I140.1
US depth (ft)	2.810	4.902	4.059	6.391	-	-	7.223
US flow (ft3/s)	323.3035	330.8954	333.0154	187.5770	-	-	440.3473
US velocity (ft/s)	10.789	7.757	11.084	5.392	-	-	4.478
DS depth (ft)	4.975	5.951	6.410	6.516	-	-	7.527

Figure 29 – Site 4 (85th & G) CDS 2-year Pipe Profile (Clean Facility)



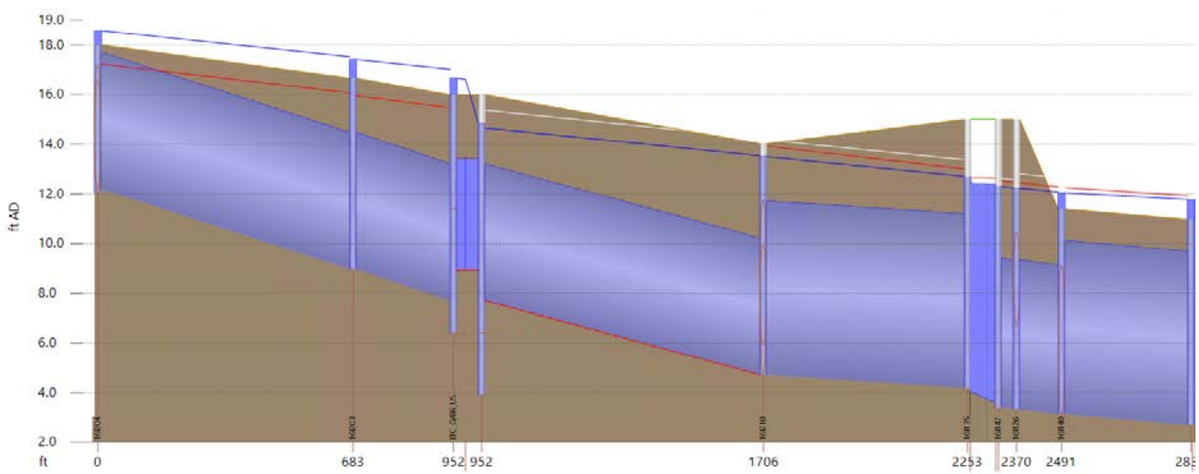
Link	16I204.1	16I203.1	LTC_G/86_DS.1	16I210.1	-	-	16I140.1
US depth (ft)	2.666	4.522	4.051	6.385	-	-	7.219
US flow (ft3/s)	323.6508	329.6667	330.6696	186.9627	-	-	439.2097
US velocity (ft/s)	10.983	7.146	8.672	5.298	-	-	4.463
DS depth (ft)	4.606	5.568	6.404	6.511	-	-	7.524

Figure 30 – Site 4 (85th & G) DSBB 2-year Pipe Profile (Clean Facility)



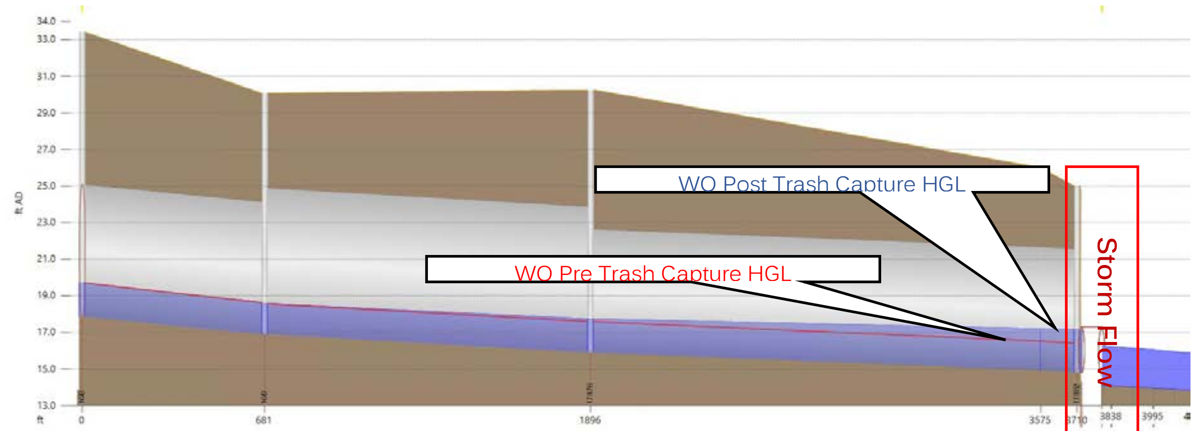
Link	16I204.1	16I203.1	LTC_G/86_DS.1	16I210.1	-	-	16I140.1
US depth (ft)	6.446	8.535	6.608	8.554	-	-	8.802
US flow (ft3/s)	449.9887	437.3319	425.3478	255.4158	-	-	590.7658
US velocity (ft/s)	10.768	7.731	11.311	6.380	-	-	5.797
DS depth (ft)	8.642	9.427	8.586	8.340	-	-	8.982

Figure 31 – Site 4 (85th & G) CDS 5-year Pipe Profile (Clean Facility)



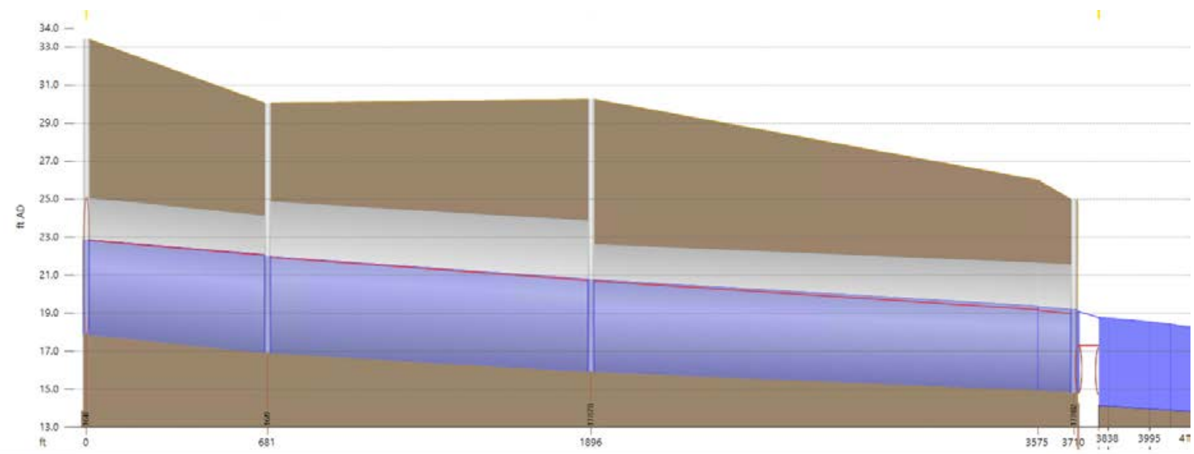
Link	16I204.1	16I203.1	-	LTC_G/86_DS.1	16I210.1	-	-	-	16I140.1
US depth (ft)	6.375	8.442	-	6.956	8.791	-	-	8.897	8.928
US flow (ft3/s)	454.6696	458.9327	-	447.4300	264.4937	-	-	-	607.8176
US velocity (ft/s)	11.084	7.105	-	8.698	6.602	-	-	6.162	5.963
DS depth (ft)	8.552	9.318	-	8.827	8.513	-	-	8.956	9.095

Figure 32 – Site 4 (85th & G) DSBB 5-year Pipe Profile (Clean Facility)



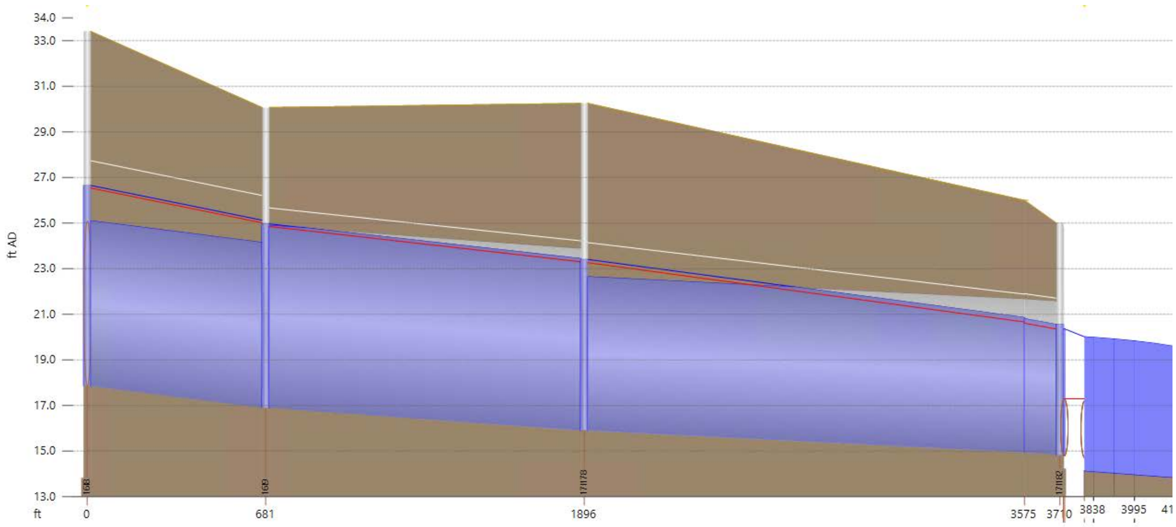
Link	1618.1	1619.1	171178.1	-	-	GSRD_DS.2
US depth (ft)	1.847	1.674	1.827	-	-	2.131
US flow (ft3/s)	39.1061	46.6439	51.3565	-	-	52.9142
US velocity (ft/s)	4.725	3.488	3.069	-	-	3.077
DS depth (ft)	1.735	1.835	2.258	-	-	2.004

Figure 33 – Site 5 (Stonehurst Outfall) Storm Flow Water Quality Flow Pipe Profile



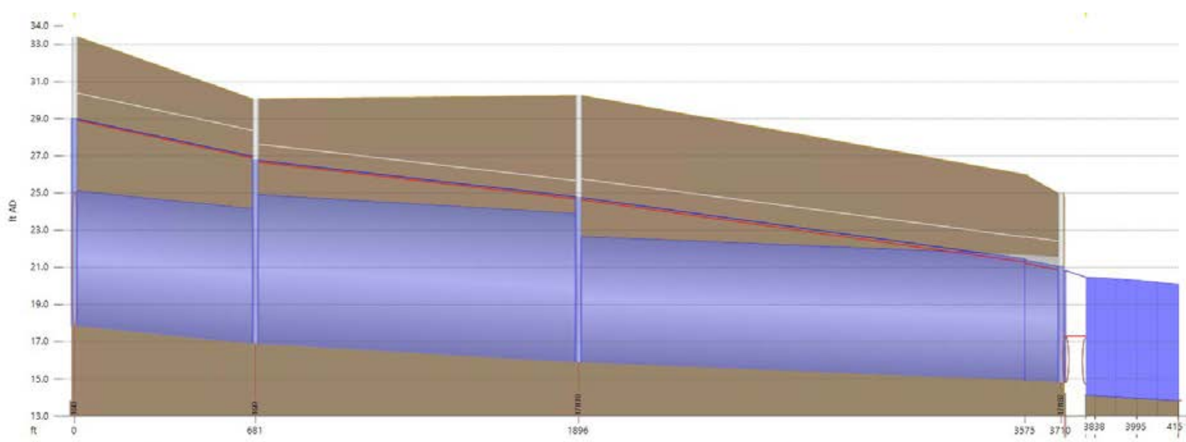
Link	1618.1	1619.1	171178.1	-	-	GSRD_DS.2
US depth (ft)	4.999	5.076	4.861	-	-	4.627
US flow (ft3/s)	216.5966	252.7697	269.3516	-	-	280.3522
US velocity (ft/s)	7.400	6.374	5.881	-	-	5.718
DS depth (ft)	5.184	4.893	4.430	-	-	4.405

Figure 34 – Site 5 (Stonehurst Outfall) 2-year Pipe Profile (Clean Facility)



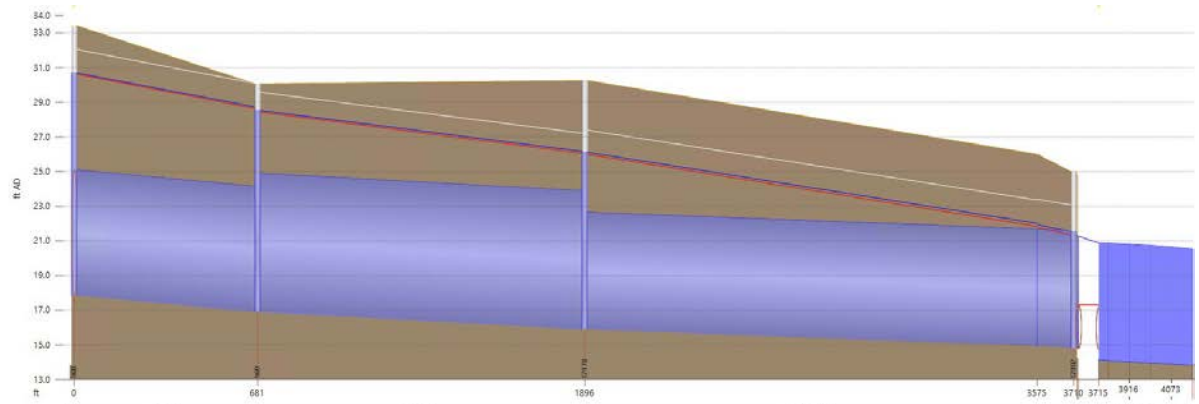
Link	16I8.1	16I9.1	17I178.1	-	-	-
US depth (ft)	8.801	8.065	7.507	-	-	5.877
US flow (ft3/s)	360.8549	430.8893	458.0495	-	-	479.1660
US velocity (ft/s)	8.406	7.293	6.899	-	-	6.981
DS depth (ft)	8.228	7.546	5.922	-	-	5.748

Figure 35 – Site 5 (Stonehurst Outfall) 5-year Pipe Profile (Clean Facility)



Link	16I8.1	16I9.1	17I178.1	-	-	GSRD_DS.2
US depth (ft)	11.128	9.860	8.854	-	-	6.327
US flow (ft3/s)	410.6344	499.1750	537.6448	-	-	565.8502
US velocity (ft/s)	9.490	7.608	8.052	-	-	7.509
DS depth (ft)	10.071	8.898	6.520	-	-	6.241

Figure 36 – Site 5 (Stonehurst Outfall) 10-year Pipe Profile (Clean Facility)



Link		16I8.1	16I9.1	17I178.1	-	-	GSRD_DS.2
US depth (ft)		12.845	11.634	10.216	7.011	-	6.747
US flow (ft3/s)		423.1449	548.9241	608.1356	-	-	650.8582
US velocity (ft/s)		9.797	8.215	9.073	9.698	-	7.809
DS depth (ft)		11.838	10.268	7.078	6.697	-	6.710

Figure 37 – Site 5 (Stonehurst Outfall) 100-year Pipe Profile (Clean Facility)

The hydraulic result summary table below shows the pre- and post-trash capture flows, head losses through the trash capture facilities, upstream hydraulic HGLs, and upstream flooding conditions if any.

Table 3 – Trash Capture Hydraulic Result Summary						
Site	Conditions	Improvement Conditions	Flow (cfs)	Head Loss (ft)	Upstream HGL (ft. NAVD88)	Upstream Flooding
1	1-yr 1-hr WQ	Pre	115	0.0	-3.7	No
		Post-CDS	60	2.6	-1.04	No
		Post-DSBB	90	0.4	-3.3	No
	2-yr 24-hr	Pre	345	0.02	5.2	No
		Post-CDS	350	0.6	5.63	No
		Post-DSBB	330	0.5	6.0	No
2	1-yr 1-hr WQ	Pre	80	0.01	15.2	No
		Post-CDS	80	1.8	17.1	No
		Post-DSBB	80	0.7	15.9	No
	2-yr 24-hr	Pre	750	0.06	21.1	No
		Post-CDS	680	4.3	24.3	Yes
		Post-DSBB	685	4.2	24.2	Yes
3	1-yr 1-hr WQ	Pre	40	0.02	9.5	No
		Post-CDS	40	1.5	10.9	No
		Post-DSBB	40	0.4	9.8	No
	2-yr 24-hr	Pre	220	0.03	16.8	No
		Post-CDS	220	0.8	16.9	No
		Post-DSBB	220	0.8	17.0	No
4	1-yr 1-hr WQ	Pre	50	0.05	8.5	No
		Post-CDS	50	1.3	9.8	No
		Post-DSBB	50	0.5	9.0	No
	2-yr 24-hr	Pre	330	0.1	11.9	No
		Post-CDS	330	1.9	13.6	No
		Post-DSBB	330	1.5	13.3	No
	5-yr 24-hr	Pre	490	0.1	15.5	Yes
		Post-CDS	440	2.8	17.1	Yes
	5-yr 24-hr	Post-DSBB	460	2.4	17.0	Yes
5	1-yr 1-hr WQ	Pre	50	0.1	16.4	No

Table 3 – Trash Capture Hydraulic Result Summary

	Post-StormFlow	50	0.9	17.2	No
2-yr 24-hr	Pre	270	0.2	19.0	No
	Post-StormFlow	270	0.4	19.2	No
5-yr 24-hr	Pre	470	0.3	20.4	No
	Post-StormFlow	470	0.5	20.6	No
10-yr 24-hr	Post-StormFlow	540	0.6	21.1	No
	Pre	540	0.4	20.9	No
100-yr 24-hr	Pre	630			No
	Post-StormFlow	630	0.7	21.6	No

6.4.2 Recommended Devices

The pros and cons of the analyzed trash capture types were summarized based on the hydraulic impacts from the result table above, and the recommended types are bolded for further analysis in the following sections.

Table 4 – Trash Capture Recommendation

Site	Location	Trash Capture Type	Pro	Con
1	Mandela & 24th	**CDS**	• Low design storm head loss	• Higher WQ head loss • CDS unit about 30 ft deep
		DSBB	• Low WQ head loss	• Higher Maintenance with multiple compartments
2	45th & San Leandro	CDS	•	• Higher WQ head loss
		DSBB	• Low WQ head loss • Lower improvement cost to mitigate design storm head loss	• Higher Maintenance with multiple compartments
3	47th & UPRR	CDS	•	• Higher WQ head loss
		DSBB	• Low WQ head loss	• Higher Maintenance with multiple compartments

4	G and 85th	CDS	•	• Higher WQ head loss
		DSBB	• Low WQ head loss • Lower improvement cost to mitigate design storm head loss	• Higher Maintenance with multiple compartments
5	Stonehurst Outfall	**Storm Flow**	• Low head losses for WQ to 100-year flow	• Large footprint

CDS and DSBB have similar performance at Site 1 with insignificant pros and cons, and both types are suitable for the site.

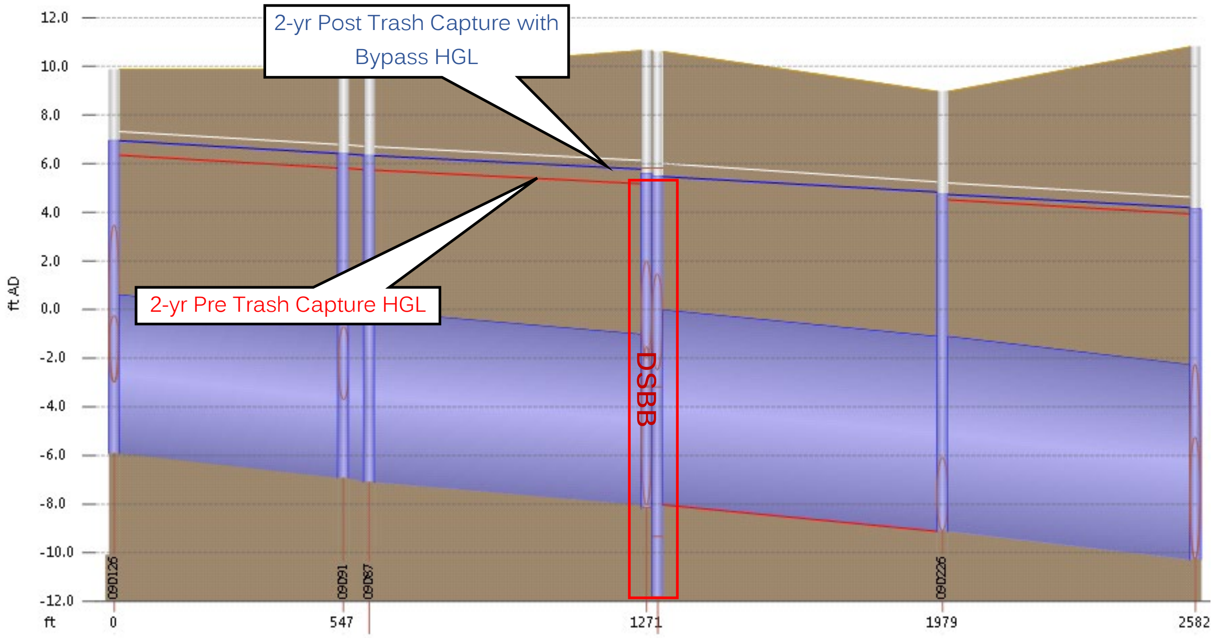
6.5 Additional Improvements

With the recommended trash capture device, the hydraulic impacts to the HGL for each site were mitigated by adding improvements.

These additional improvements are proposed in order to match the existing hydraulic performance as close as possible as summarized in the table below.

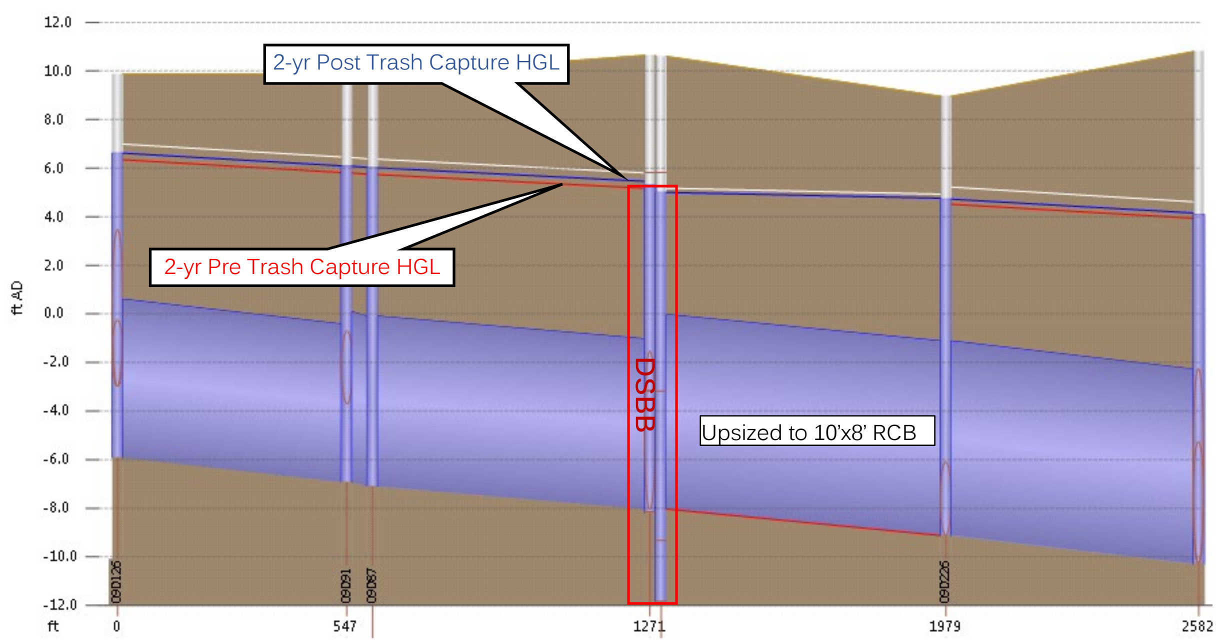
Table 5 – Hydraulic Results with Additional Improvements

Site	Design Peak Flow (Storm Frequency)	Recommended Trash Capture	Additional Improvements	Head Loss (ft)	Upstream HGL (ft. NAVD88)
1	345 cfs (2-year)		(Existing)	0.0	5.2
		DSBB	N/A	0.5	6.0
		DSBB	4'x4' RCB Bypass	0.3	5.8
		DSBB	Upsize 680' downstream 96" RCP to 10'x8' RCB	0.5	5.5
2	750 cfs (2-year)		(Existing)	0.06	21.1
		DSBB	N/A	4.2	24.2
		DSBB	Offline	0.1	21.1
4	490 cfs (5-year)		(Existing)	0.0	15.5
		DSBB	N/A	2.4	17.0
		DSBB	Offline	0.0	15.5



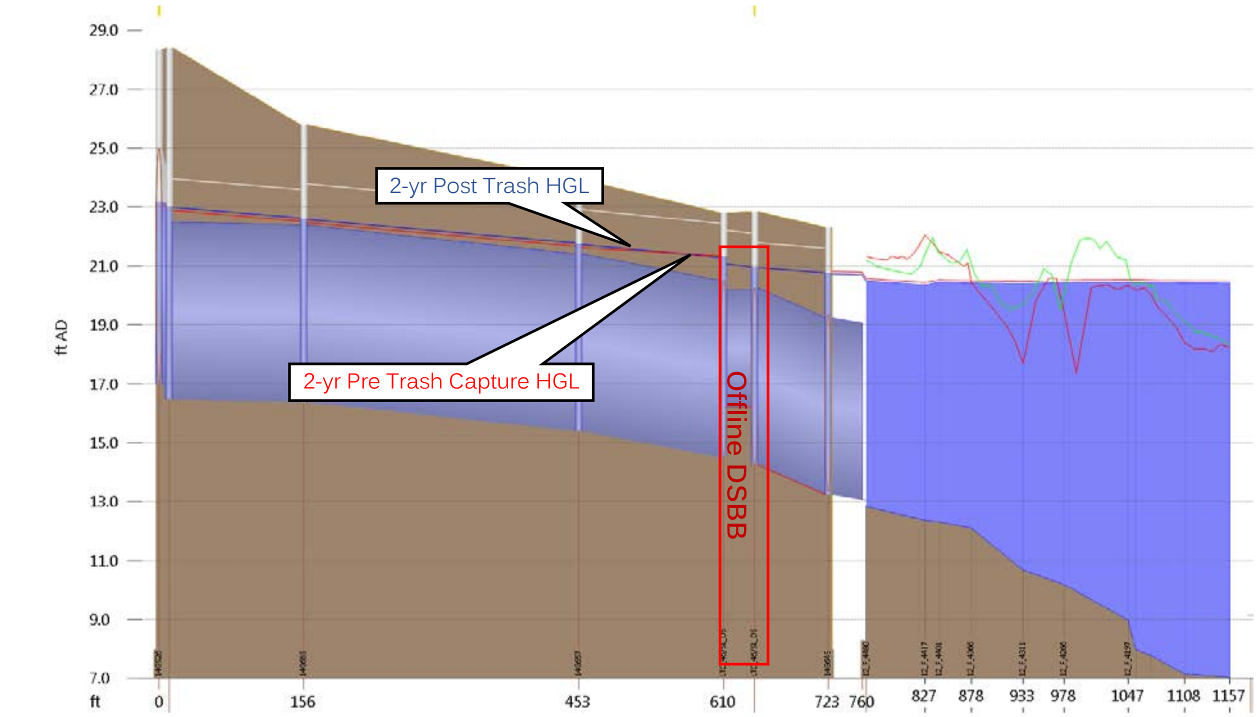
Link	09D126.1	-	09D87.1	LTC_Mandela_DS.1	09D226.1
width (in)	78.0	-	84.0	96.0	96.0
US depth (ft)	12.843	-	13.430	13.496	13.854
US flow (ft3/s)	179.3813	-	204.2551	330.9545	353.1409
US velocity (ft/s)	5.107	-	5.021	6.265	6.681
DS depth (ft)	13.338	-	13.805	13.953	14.475

Figure 38 - Site 1 (Mandela & 24th) DSBB with Bypass 2-year Pipe Profile (Clean Facility)



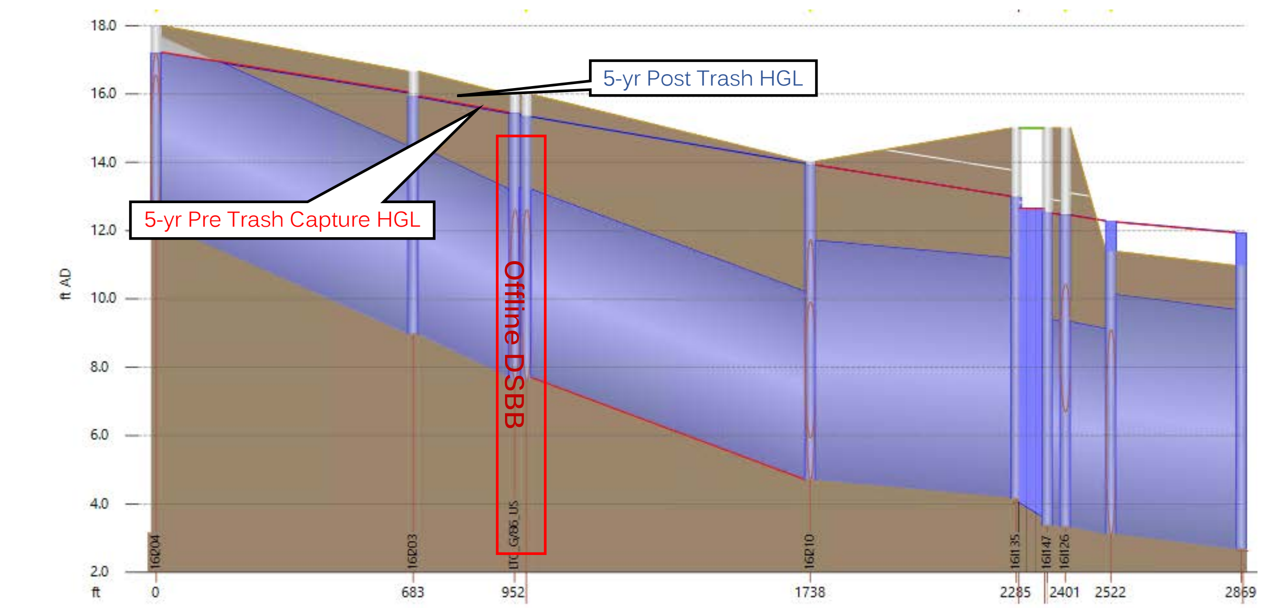
Link	09D126.1	-	09D87.1	LTC_Mandela_DS.1	09D226.1
width (in)	78.0	-	84.0	120.0	96.0
US depth (ft)	12.516	-	13.113	13.031	13.843
US flow (ft3/s)	179.2370	-	204.1369	331.9208	354.1168
US velocity (ft/s)	5.108	-	5.022	3.966	6.699
DS depth (ft)	13.018	-	13.491	13.884	14.435

Figure 29 - Site 1 (Mandela & 24th) DSBB with Downstream Upsized Pipe 2-year Pipe Profile (Clean Facility)



Link	14G522.1	14G685.1	14G657.1	-	-	-	14G784.1
width (in)	264.0	168.0	168.0	-	196.8	-	
US depth (ft)	6.510	6.199	6.323	-	6.696	-	7.653
US flow (ft3/s)	749.7360	749.1262	752.5685	-	751.7678	-	408.1467
US velocity (ft/s)	8.248	11.157	11.030	-	12.195	-	5.272
DS depth (ft)	6.248	6.382	6.795	-	7.530	-	13.360

Figure 40 – Site 2 (45th & San Leandro) Offline DSBB 2-year Pipe Profile



Link	161204.1	161203.1	LTC_G/86_DS.1	161210.1	-	-	-	161140.1
US depth (ft)	4.997	6.943	7.634	9.214	-	-	9.126	9.139
US flow (ft3/s)	476.6858	491.0192	494.8267	282.9653	-	-	-	642.3126
US velocity (ft/s)	12.154	9.824	8.746	7.050	-	-	6.467	6.296
DS depth (ft)	7.065	7.733	9.257	8.815	-	-	9.172	9.273

Node	161204	161203	-	LTC_G/86_DS	161210	161135	-	161140	161215

Figure 41 – Site 4 (85th & G) Offline DSBB 5-year Pipe Profile (Clean Facility)

6.6 Clogging Analysis

A sensitivity analysis was conducted to assess the impacts of maintenance activities to the trash capture facility. The frequency and effectiveness of maintenance activities will determine the trash capture facility clogging condition. The design and analysis should account for the worst-case maintenance scenario for peak design flow to avoid total dependency on maintenance crews for immediate flood response. The worst-case maintenance scenarios were modeled by removing water quality flow discharge features such as CDS units, screens for DSBB and screen pipes for Storm Flow Screen assuming that they are completely clogged. The head loss and upstream HGLs with or without clogging factors are summarized in the table below.

The overspill diversion weir dimensions should be further optimized in the design phase if the City would like to reduce the head loss through the facility and to match the existing condition hydraulic performance.

Table 6 – Trash Capture Clogging and Head Loss					
Site	Design Storm	Trash Capture Type	Additional Improvements	Head Loss- Clean Facility (ft)	Head Loss- 100% Clogged Facility (ft)
1	2-year	DSBB		0.5	0.6
		DSBB	4'x4' RCB Bypass	0.3	0.3
		DSBB	Upsize 680' downstream 96" RCP to 10'x8' RCB	0.5	0.5
2	2-year	DSBB		4.2	4.8
		DSBB	Offline	0.1	0.1
3	2-year	DSBB		0.7	0.8
4	5-year	DSBB		2.4	2.7
		DSBB	Offline	0.7	0.7
5	100-year	Storm Flow Screen		0.7	0.7

7 TRASH CAPTURE SIZING

The recommended trash capture type for each site was further categorized by selecting a model or sizing the extent to capture anticipated trash volume (loading) with a reasonable annual maintenance frequency. The model numbers and Storm Flow Screen length will need to be confirmed by manufactures prior to design.

Table 7 – Trash Capture Loading, Model and Maintenance

Site	Location	Drainage Area (ac)	Loading (cu.ft/year)[3]	Type/Model	Maintenance Frequency (time/year)
1	Mandela & 24th	610	3,209	DSBB/11-24	3-4
2	45th & San Leandro	1,679	2,647	DSBB/11-24	3-4
3	47th & UPRR	751	1,203	DSBB/11-26	2-3
4	G and 85th	802	3,342	DSBB/11-24	3-4
5	Stonehurst Outfall	739	2,741	Storm Flow Screen/30”-220ft	4

[3] EOA Inc. estimate on May 8, 2019

8 ENGINEERING COST ESTIMATE

The engineering cost estimates are based on contractors' bids from *Trash Capture Devices in the Vicinity of Meekland Avenue and Loma Verde Drive, in San Lorenzo, Alameda County, California, 2019*, and *Large Trash Capture Device Installation Project Phase VI, City of San Jose, California, 2018*.

Additional improvements were estimated based on Construction Ebidboard contractor bid history.

Table 8 – Cost Estimate

Site	Recommended Trash Capture	Additional Improvements	Construction Costs	Soft Costs	30% Contingency	Total
1	DSBB	N/A	$1.4M	$0.4M	$0.5M	$2.4M
	DSBB	4'x4' RCB Bypass	$1.6M	$0.5M	$0.6M	$2.7M
	DSBB	Upsize 680' downstream 96" RCP to 10'x8' RCB	$4.2M	$1.3M	$1.6M	$7.1M
2	DSBB	N/A	$0.9M	$0.3M	$0.3M	$1.5M
	DSBB	Offline	$1.0M	$0.3M	$0.4M	$1.7M
3	DSBB		$0.9M	$0.2M	$0.3M	$1.4M
4	DSBB	N/A	$0.9M	$0.2M	$0.3M	$1.4M
	DSBB	Offline	$1.0M	$0.3M	$0.3M	$1.6M
5	Storm Flow Screen		$3.0M	$0.9M	$1.2M	$5.1M

*Notes: Construction Costs = Trash Capture+ Additional Improvements
Soft Costs = Design, Project Management, Construction Management, Traffic Control
Total = Construction Costs + Soft Costs + 30% Contingency

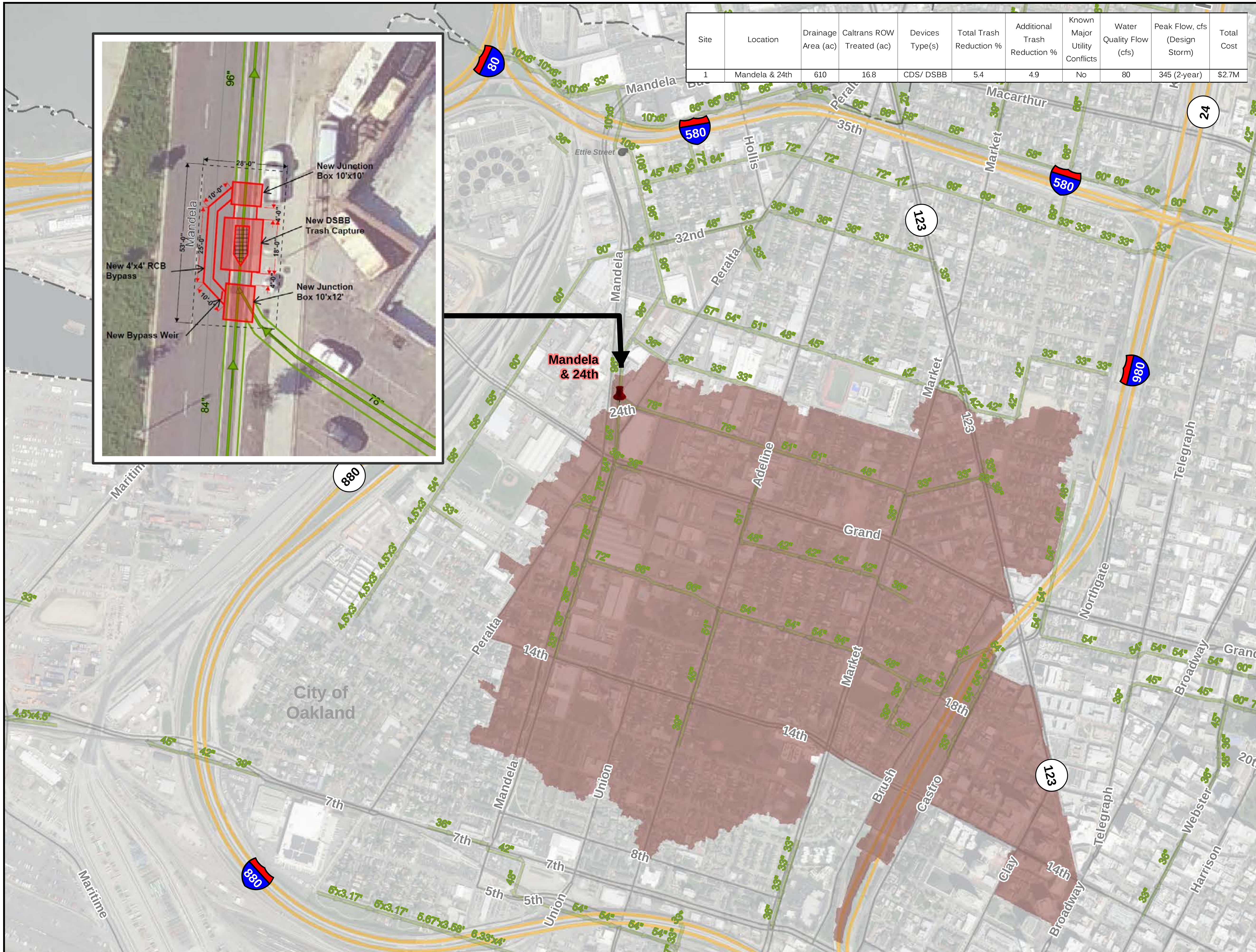
The soft costs and 30% contingency are based on the local construction climate per the City's input.

City of Oakland Large Trash Capture Study

Site 1 Watershed Map

Alameda County, California
June, 2019

Site	Location	Drainage Area (ac)	Caltrans ROW Treated (ac)	Devices Type(s)	Total Trash Reduction %	Additional Trash Reduction %	Known Major Utility Conflicts	Water Quality Flow (cfs)	Peak Flow, cfs (Design Storm)	Total Cost
1	Mandela & 24th	610	16.8	CDS/ DSBB	5.4	4.9	No	80	345 (2-year)	$2.7M

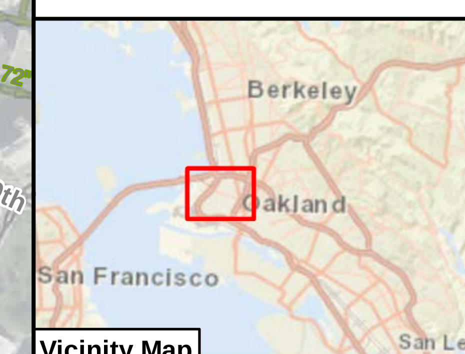


Legend

- Pump Station
- **Gravity Main - Modeled**
- City of Oakland
- Alameda County
- Drainage Area

NORTH

0 1,000 2,000
Feet



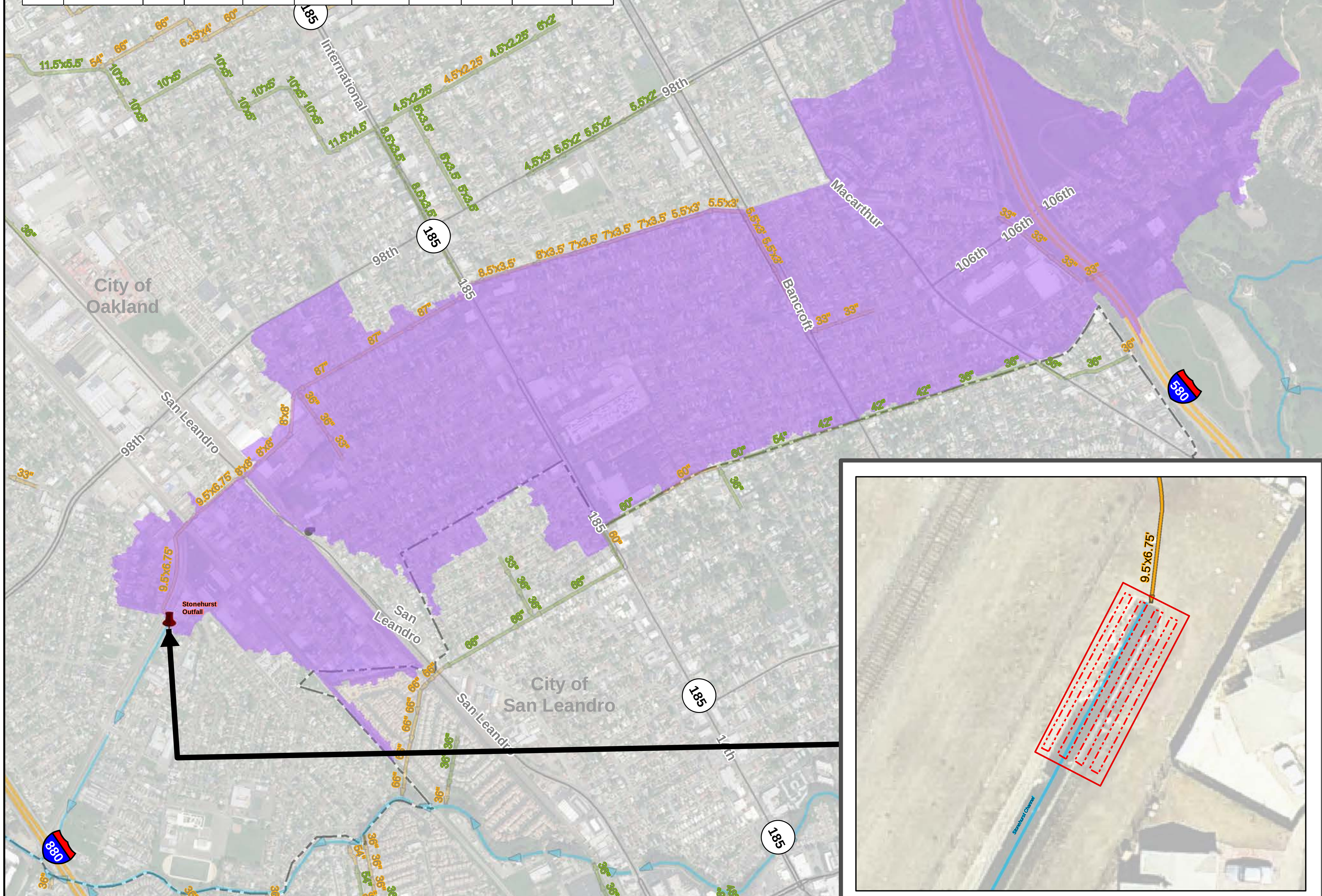
PRELIMINARY

EXHIBIT 1

WOOD RODGERS

\\woodrodgers.loc\ProductionData\Jobs-Oak\Jobs\1986_OaklandTrashCaptureAnalysis\OaklandTrashCaptureAnalysis\GIS\Tasks\Report\Exhibit_Site1.mxd; 6/10/2019; ccorrea

Site	Location	Drainage Area (ac)	Caltrans ROW Treated (ac)	Devices Type(s)	Total Trash Reduction %	Additional Trash Reduction %	Known Major Utility Conflicts	Water Quality Flow (cfs)	Peak Flow, cfs (Design Storm)	Total Cost
5	Stonehurst Outfall	739	40.7	Storm Flow	4.3	4.2	Storm Drains	51	630 (100-year)	$5.1M



City of Oakland Large Trash Capture Study

Site 5 Watershed Map

Alameda County, California
June, 2019

Legend

Pump Station

Gravity Main - Modeled

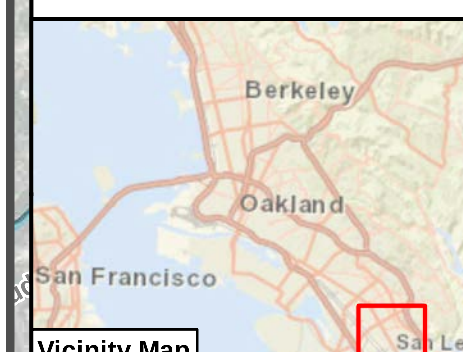
City of Oakland

Alameda County

Drainage Area

NORTH

0 1,000 2,000
Feet



Vicinity Map

PRELIMINARY

EXHIBIT 2

WOOD RODGERS

Oakland - Letter of Intent - 2.26.25_Final with Enclosures

Final Audit Report 2025-02-26

Created:	2025-02-26 (Pacific Standard Time)
By:	Tiffany Pham (TPham@oaklandca.gov)
Status:	Signed
Transaction ID:	CBJCHBCAABAAMTUybXhsaMIJQsNS6FI6tOzbRzc4ay_u

"Oakland - Letter of Intent - 2.26.25_Final with Enclosures" History

Document created by Tiffany Pham (TPham@oaklandca.gov)
2025-02-26 - 4:01:54 PM PST- IP address: 8.44.165.131

Document emailed to Liam Garland (LGarland@oaklandca.gov) for signature
2025-02-26 - 4:04:30 PM PST

Email viewed by Liam Garland (LGarland@oaklandca.gov)
2025-02-26 - 4:08:28 PM PST- IP address: 209.232.103.92

Document e-signed by Liam Garland (LGarland@oaklandca.gov)
Signature Date: 2025-02-26 - 4:29:07 PM PST - Time Source: server- IP address: 209.232.103.92

Agreement completed.
2025-02-26 - 4:29:07 PM PST

TIME SENSITIVE: Oakland - Letter of Intent - 2.26.25_Final with Enclosures - LG Signed_Printed

Final Audit Report 2025-02-27

Created:	2025-02-27 (Pacific Standard Time)
By:	Alejandrina Herrera (AHerrera@oaklandca.gov)
Status:	Signed
Transaction ID:	CBJCHBCAABAAISfq-vnK2XDtDR7tdaVxRu8RmzClfSNm

"TIME SENSITIVE: Oakland - Letter of Intent - 2.26.25_Final with Enclosures - LG Signed_Printed" History

Document created by Alejandrina Herrera (AHerrera@oaklandca.gov)
2025-02-27 - 12:11:10 PM PST- IP address: 209.232.103.93

Document emailed to Josh Rowan (JRowan@oaklandca.gov) for signature
2025-02-27 - 12:12:43 PM PST

Email viewed by Josh Rowan (JRowan@oaklandca.gov)
2025-02-27 - 5:12:46 PM PST- IP address: 24.130.73.188

Document e-signed by Josh Rowan (JRowan@oaklandca.gov)
Signature Date: 2025-02-27 - 5:13:05 PM PST - Time Source: server- IP address: 24.130.73.188

Agreement completed.
2025-02-27 - 5:13:05 PM PST