Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

719 2ND AVENUE, SUITE 200 | SEATTLE, WA 98104 | P 206.394.3700

DRAFT TECHNICAL MEMORANDUM

DATE:	July 29, 2022
TO:	The Nature Conservancy
FROM:	Aaron Miller, EIT Kathleen Bell, PE Paul Fendt, PE
SUBJECT:	Tacoma Mall Stormwater Park Feasibility Study
PROJECT NUMBER:	556-3256-007 WA-C-211213-041
PROJECT NAME:	Healthy Bridges and Roads - Tacoma Mall Stormwater Park Feasibility Study

INTRODUCTION

Parametrix is working with The Nature Conservancy (TNC) and the City of Tacoma (the City) to perform a feasibility study and conceptual design of stormwater treatment facility alternatives in the Tacoma Mall Neighborhood. The Tacoma Mall Neighborhood is a Regional Growth Center located approximately 2.5 miles southwest of downtown Tacoma. The purpose of this feasibility study is to narrow down the draft short list of 13 potential stormwater facility locations provided by the City to 3 final sites for which conceptual designs were created. The overall process for choosing facility locations and creating concept designs is based upon the TNC's Healthy Bridges and Roads Scope of Work Template.

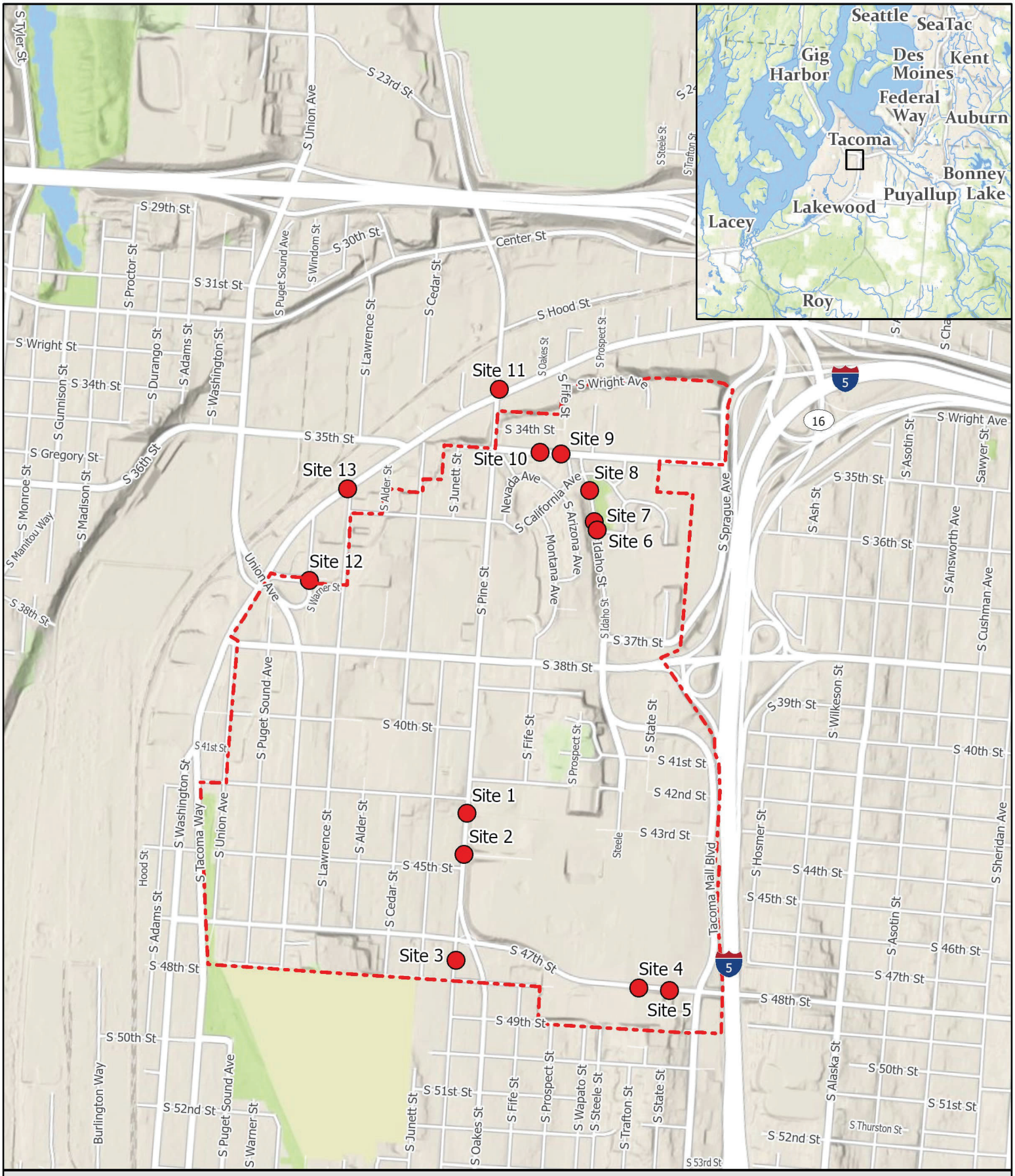
SCREENING PROCESS

Final Short List of Potential Intervention Sites

For this project, the City provided Parametrix the draft short list of 13 potential stormwater facility sites (sites). Each site constitutes a stormwater conveyance structure, typically a maintenance hole, from which stormwater would be diverted for treatment. This draft short list of sites was narrowed down to a final short list of five sites based on a qualitative assessment of hydraulic feasibility, parcel acquisition feasibility, and other preferences from discussions with the City and TNC. The qualitative hydraulic feasibility assessment screened out exceptionally deep facilities (greater than 15 feet deep) with limited adjacent available area and sites that are likely to require pumping. The final short list of five sites was determined during a meeting with the City and TNC on May 31, 2022. These five sites are listed and briefly described below.

- Site 5: Facility located at the SE corner of the Tacoma Mall parking lot
- Site 6: Facility located at the south end of Lincoln Heights Park
- Site 9: Facility located at vacant parcels at 2602 S 35th Street
- Site 12: Facility located at the S Tacoma Way Clover Leaf
- Site 13: Facility located within the BNSF Railway right-of-way near S Tacoma Way

The locations of all 13 draft short list sites are shown on Figure 1. See Attachment 1 – Initial Site List and Data Inventory for the information collected and used to narrow down the initial 13 sites to the final 5 sites on the short list.



Date: 7/28/2022
Sources: King County, City of Tacoma
Disclaimer: This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes.

Site Location

Expanded Neighborhood Subarea

0 430 860 1,720 Feet

Figure 1 - Vicinity Map
Tacoma Mall Stormwater Park
Feasibility Study

Tacoma, WA

Site Scale Analysis

A site scale analysis was performed on the five final short-list sites to narrow them down to three final sites. The first steps in the site scale analysis were to delineate contributing areas, perform landcover analysis, and create basic hydrologic models to determine water quality treatment flow rates. These analyses provided the necessary information to assess the pollutant removal potential and hydraulic feasibility for each site.

The results of the site scale analysis were then used to assign a final score to each of the sites using six different scoring categories: 1) Pollutant Removal Potential, 2) Hydraulic Feasibility, 3) Existing Water Quality Treatment, 4) Property Acquisition Feasibility, 5) Public Use Potential, and 6) Alignment with Existing Plans. For each category, each site receives a score from 1 to 5, 5 being the best. Each category has a percent weight that reflects the relative importance of that category. The three sites with the highest weighted average scores are the final sites for which conceptual designs were created. See Attachment 2 – Site Scoring Matrix for the results of the site scale analysis and for the detailed criteria on how each score was assigned.

Hydrology

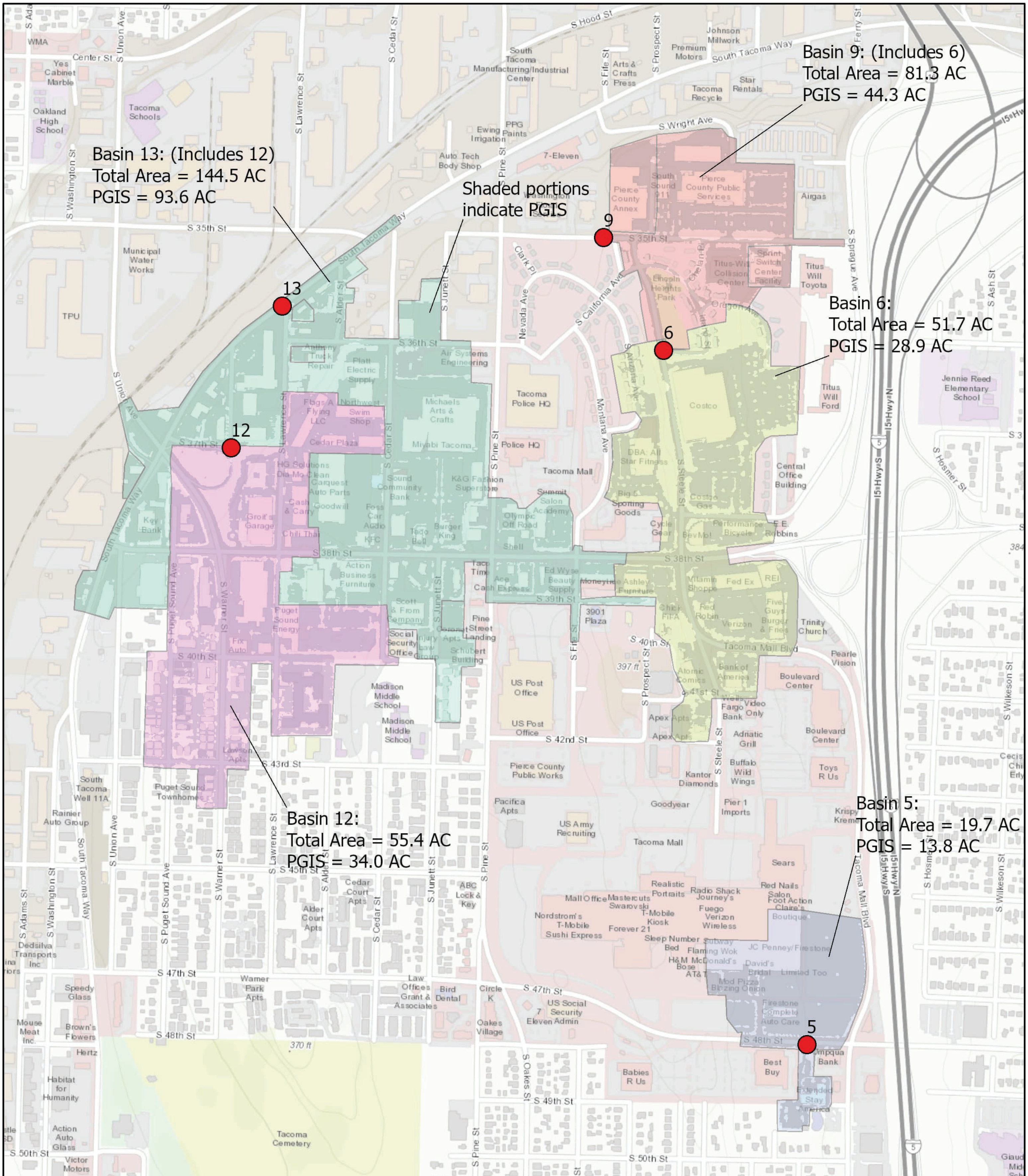
Drainage basins (basins) for each of the five final short list sites site were delineated in a geographic information system (GIS) using stormwater conveyance system data, contour data, and parcel boundaries (Figure 2). Contours were created based on 2017 LiDAR data taken from the Washington DNR LiDAR Portal (WA DNR 2017). In the case of the Tacoma Mall facility, additional tributary area when compared to the existing drainage basin was added to the facility since it is feasible to reroute currently untreated flows from elsewhere in the Tacoma Mall area to the proposed bioretention facility.

Land cover and soil data for each basin were used to create MGSFlood models. Landcover data was provided by the City of Tacoma, and surface soil data was taken from the Soil Survey Geographic Database (SSURGO) (USDA 2022). The MGSFlood model then calculates the water quality flow rates used to size the stormwater treatment facility. Off-line water quality flow rates were used since all proposed facilities will divert water from existing stormwater mainlines to off-line treatment facilities. These off-line water quality flow rates provide the required flow rate to treat 91 percent of the total runoff volume in a year. This meets Washington State Department of Ecology (Ecology) runoff treatment standards (MGSFlood 2022). No flow control is required since the basins analyzed all flow directly or in a controlled system to Puget Sound, which is a flow-control exempt waterbody (Ecology 2019).

Facility Footprint

Stormwater facility footprints were estimated for the calculated treatment flow rates. Facility footprints are used to evaluate the feasibility of locating a treatment facility within the site vicinity. Facility footprints were calculated using a Ecology approved proprietary enhanced treatment system, the BioPod system from Oldcastle Infrastructure Inc. The BioPod system has a treatment flow rate of 1.6 gallons per minute per square foot (153 inches per hour). This flow rate is the Ecology General Use Level Designation (GULD)-approved treatment rate (OCI 2018). Once required treatment areas were calculated based on water quality flow rates, additional area was added to account for pretreatment and maintenance requirements. The total facility area includes an additional 10 percent for pretreatment and an additional 50 percent for maintenance.

With the hydrologic and facility footprint calculations complete, the site scale analysis and final site scoring was performed.



Date: 7/28/2022
Sources: King County, City of Tacoma
Disclaimer: This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes.

0 250 500 1,000 Feet

● Site Location

Drainage Basins
- 5
- 6
- 9
- 12
- 13

Figure 2 - Drainage Basins
Tacoma Mall Stormwater Park
Feasibility Study

Tacoma, WA

1. Pollutant Removal Potential

Potential pollutant removal that may result from the project was estimated using WSDOT Method 1, as approved in the 2020 Environmental Manual (WSDOT 2020) and outlined in the Quantitative Procedures for Surface Water Impact Assessments (WSDOT 2009). This method was developed based on Federal Highway Administration guidance to provide a rough estimate of pollutant loads from roads and highways. This method calculated estimated pollutant loads based on the total amount of pollution generating impervious surfaces (PGIS) within a given basin. Pollutant removal percentages are based on empirical data gathered by WSDOT for several different types of treatment best management practices (BMPs) and is a rough estimate of the pollutant removal potential of the proposed stormwater facilities. PGIS was calculated by determining the total amount of impervious area in the City of Tacoma Landcover layer minus impervious area from buildings. Estimates of the potential pollutant removal are shown in Table 1. The final pollutant removal potential scoring was based on total PGIS within each basin. Pollutant removal was given a 25 percent weight in determining the final site score.

Table 1. Potential Pollutant Removal

	Potential Amount Removed (lbs/year)					
Pollutant of Concern	**Site 5**	**Site 6**	**Site 9**	**Site 12**	**Site 13**	**Percent Removed**
Total Suspended Solids	9420	19690	30150	23180	63760	89%
Total Copper	1.7	3.5	5.3	4.1	11.2	75%
Dissolved Copper	0.14	0.29	0.44	0.34	0.94	25%
Total Zinc	10.6	22.3	34.1	26.2	72.1	79%
Dissolved Zinc	2.4	4.9	7.5	5.8	15.9	55%

2. Hydraulic Feasibility

Hydraulic feasibly of each site was evaluated based on the rim and invert elevations of the pipes and structures at the upstream and downstream ends of the facility. These structures are the connection points between the proposed stormwater treatment facility and the existing stormwater conveyance system. This data was then used to calculate two values used to evaluate hydraulic feasibility: 1) the depth of the bottom of the facility relative to the existing grade and 2) hydraulic drop across the facility.

Sites with low hydraulic feasibility scores are sites that have deep pipes (greater than 10 feet from grade) and less than 3 feet of hydraulic drop between the inlet and outlet pipes. These sites would need to be constructed relatively deep which makes maintenance more difficult, requires additional space for sloped facility embankments, and makes structural retaining walls necessary where sloped embankments aren't feasible. Low hydraulic drop makes it more likely that a pumping system, backwater weirs within the upstream flow diversion structure, or other hydraulic modifications are required. Sites with good hydraulic feasibility have shallower pipes (less than 8 feet from grade) and have greater than 4 feet of hydraulic drop. These sites are less hydraulically constrained and can easily be designed to operate as a gravity flow facility. Hydraulic feasibility was given a 20 percent weight in determining the final site score.

3. Existing Water Quality

The percentage of PGIS with existing water quality treatment was calculated for each site. Sites with smaller percentages of PGIS with existing water quality treatment were given higher scores than sites with more existing water quality treatment. This helps prioritize basins with little to no existing water quality treatment over basins that already have stormwater best management practices (BMPs) in place. Existing water quality was given a 5 percent weight in determining the final site score.

4. Property Acquisition Feasibility

Sites were assigned property acquisitions feasibility scores primarily based on whether the parcel was publicly or privately owned. Privately owned parcels whose owners seem unlikely to sell their land or partner with the City to construct a stormwater facility were given low scores. Land owned by public entities or by the City of Tacoma were given higher acquisition feasibility scores. Property acquisition feasibility was given a 25 percent weight in determining the final site score.

5. Public Use and Education Opportunities

Sites were also evaluated based on their potential to provide usable public green spaces and educational opportunities. This was evaluated using several qualitative metrics. The existing use of the parcel is considered; if the parcel is already a public facility or adjacent to one, then public use is likely to be strong. Additionally, if the facility is located next to any of the pedestrian streets identified in the Tacoma Mall Subarea Plan (Figure UF-7), then placement of a stormwater park facility next to one of these streets would indicate potential public use. Finally, facilities located near existing or planned trails were also given a strong public use score. Public use and educational opportunity was given a 20 percent weight in determining the final site score.

6. Alignment with Existing Plans

Facilities that align with future development plans were given a higher score than projects that do not align with development plans. Facilities located in areas designated as potential stormwater retrofit locations or located near stormwater improvements areas as identified in the Tacoma Mall Subarea Plan (see Figure E-1) received higher scores for this category. Alignment with existing plans was given a 5 percent weight in determining the final site score.

Final Site Selection

The results of the Site Scale Analysis are shown in Table 2 – Site Scoring Matrix. The Site Scoring Matrix, along with the specific criteria used to score each category, are provided in Attachment 2 – Site Scoring Matrix and Scoring Criteria.

Based on the results of the Site Scoring Matrix, Sites 9 and 13 were removed from consideration for concept design. These sites had the greatest pollutant removal potential but were removed from consideration largely because the parcels are privately owned, among other factors. Sites 5, 6, and 12 were the highest scoring sites; therefore, conceptual designs were developed for these sites.

Table 2. Site Scoring Matrix

Site #	Site Description or Address	Pollutant Removal Potential	Hydraulic Feasibility	Existing WQ	Property Acquisition Feasibility	Public Use	Alignment w/Existing Plans	Overall Score
	% Weight	25%	20%	5%	25%	20%	5%	
5	SW Corner Tacoma Mall	1	5	5	3	3	3	**3.0**
6	Lincoln Heights Park	2	2	5	4	5	3	**3.3**
9	2602 S 35th St	3	3	4	1	3	5	2.7
12	S Tacoma Way Clover Leaf	2	3	1	5	3	5	**3.3**
13	S Tacoma Way Railroad Parcel	5	1	5	1	1	1	2.2

CONCEPTUAL DESIGN OF SELECTED SITES

With the Site Scale Analysis complete, conceptual designs for each of the three final sites were created. The first major decision in designing each BMP is determining what type of stormwater BMP is best suited for the site. According to the Tacoma Mall Subarea Plan, infiltration of stormwater into underlying soils is desired to help increase contributions to the South Tacoma Aquifer (City of Tacoma 2018). Infiltrating stormwater also reduces contributions to the closed stormwater conveyance systems, which are particularly stressed along S Tacoma Way according to the Tacoma Mall Subarea Plan Urban Modeling Report (City of Tacoma 2016).

Subsurface Infiltration Data

The City of Tacoma hired Robinson and Noble to perform a subsurface infiltration study (infiltration study) for the Tacoma Mall Neighborhood, which was completed in February of 2016. This study performed a desktop review of available surficial soil data, reviewed previous subsurface studies in the vicinity, reviewed publicly available boring information, and performed several new geotechnical borings. Parametrix reviewed this study to assess infiltration feasibility at the three final concept design locations.

Site 5, the Tacoma Mall site, is located within the Vashon recessional outwash (Qvr) geologic unit, which is a moderate- to high-permeability unit (Robinson and Noble 2016). Table 5 from the infiltration study gives this geologic unit an area-wide average hydraulic conductivity (K) of 24.9 feet per day based on permeameter testing performed during the study. Robinson and Noble did not perform any subsurface investigations near this site, but Figure 3 from the infiltration study shows an existing boring log, Boring 154, close to the proposed Site 5. This boring record was retrieved from the Ecology database, and the boring was performed in 2001. It suggests high permeability and a surficial layer thickness of 60 feet. The thickness and permeability of this layer suggests high potential for surface infiltration at this site.

Site 6, the Lincoln Heights Park site, is also located within the Qvr geologic unit, which has moderate- to high-permeability. Robinson and Noble performed a geologic boring (Boring 10) very near the proposed site at the southwest corner of the park and determined that the Qvr layer is 24 feet thick in this area. The Qvr layer is locally perched atop Vashon till (Qvt), which is highly impermeable. During the boring, groundwater was encountered at 17 feet below ground, higher than anywhere else in the study area. According to the infiltration

study, the borings were performed after a particularly dry year, and Boring 10 was one of the few where groundwater was encountered. It is possible that high seasonal groundwater at the site could impact infiltration feasibility. The current concept design still proposes infiltration at this site since the Qvr layer is still relatively thick and highly permeable, but additional groundwater-level monitoring data and subsurface investigation would be required to confirm infiltration feasibility.

Site 12, the S Tacoma Way Cloverleaf site, is located within a Steilacoom gravel (Qvs) geologic unit, which is a high-permeability geologic unit. Robinson and Noble performed a geologic boring (Boring 6) approximately 300 feet south of the proposed site. Boring results revealed that the surface gravel layer is 10 feet thick, followed by 10 feet of silt and till-like deposits, underlain by another 10 feet of gravel and sand. Table 5 from the infiltration study gives this geologic unit an average hydraulic conductivity (K) of 274 feet per day based on permeameter testing performed during the study. The thickness and permeability of this layer suggests high potential for surface infiltration at this site.

Bioretention Facility Design

Conceptual stormwater bioretention facilities were designed in MGSFlood. These bioretention facilities provide water quality treatment by filtering runoff through a vegetated bioretention soil mix. Runoff then infiltrates into underlying soils or reenters the closed conveyance system via an outlet riser structure or an underdrain.

MGSFlood uses Massmann equations to calculate stormwater-facility infiltration rates based on soil hydraulic conductivity and depth to groundwater. Geotechnical explorations performed during the infiltration study recorded the depths to groundwater, but the overall results regarding groundwater levels were inconclusive. The City of Tacoma Stormwater Management Manual states that the bottom of an infiltration facility should be at least 5 feet from the seasonal high-water mark, bedrock, or other low-permeability layer (City of Tacoma 2021). This minimum 5-foot facility separation was used as the depth to groundwater for all proposed facilities for additional conservatism in facility sizing. Using this depth to groundwater and the average hydraulic conductivity for each geologic unit, Massmann equations give an infiltration rate of 0.3 inches per hour for Site 5 and 6, and 4.0 inches per hour for Site 12.

Conceptual Cost Estimate

A cost range was estimated for each site based on a detailed cost estimate for a bioretention and infiltration facility recently created by Parametrix for a different project. This facility was designed to treat 0.5 acres of impervious area. For that project, facility size, quantities, and cost were evaluated for a low infiltration rate (0.3 inches per hour) and a high infiltration rate (1.0 inches per hour). To treat 0.5 acres of impervious area, the cost was $42,498 for a high infiltration rate bioretention site and $75,797 for a low infiltration rate site. These costs per 0.5 acre of impervious area were used to calculate cost-range estimates based on the total impervious area contributing to each site.

Future Design Considerations

As design progresses for any of these conceptual designs, additional groundwater monitoring data and subsurface investigation are recommended to determine the feasibility of infiltration BMPs. This is especially true for Site 6 at Lincoln Heights Park since the permeable recessional outwash layers are perched on top of a till layer, and there is potential for seasonal-high groundwater impacts. Additional subsurface investigation and groundwater-level monitoring would be required for the final design of any infiltration BMP per Ecology stormwater design guidelines.

Tacoma Mall Neighborhood Stormwater Park Feasibility Study

Site 5: Tacoma Mall Parking Lot Bioretention Facility

SE Corner of the Tacoma Mall Parking Lot

RETROFIT TYPE
Bioretention and Infiltration Facility
LOCATION
S 48th St and Tacoma Mall Blvd
EXISTING USE
Tacoma Mall Parking Lot
TRIBUTARY DRAINAGE AREA
19.7 acres 18.2 acres impervious 13.8 acres PGIS
SITING NOTES
Parcel is owned by Tacoma Mall
FACILITY AREA
33,000 square feet
TREATMENT FLOW RATE
1.66 cubic feet per second (cfs)
COST RANGE
$1,550,000 - $2,767,000

Description

A stormwater treatment facility is proposed at the southeast corner of the Tacoma Mall parking lot. Available subsurface data suggests that underlying soils are highly permeable in this area; therefore, it is proposed that this facility would be a combination bioretention and infiltration facility.

This facility would treat runoff from the Tacoma Mall parking lot, mall buildings, and S 48th Street. Impervious area from the northeast section of the lot that doesn't flow to Site 5 in the existing condition was included in the Site 5 basin since existing catch basins could be rerouted to flow to the proposed facility. Additional area from Tacoma Mall Blvd and other parts of the Tacoma Mall could be rerouted to the site as well. Being near to the Tacoma Mall, this facility would be designed as a dual-purpose facility, providing stormwater treatment and a green space for public enjoyment. See Figure 3.

Site Benefits

- Strong public use and educational potential
- Construction of the facility would directly remove parking lot PGIS
- Good hydraulic feasibility
- Tacoma Mall could qualify for surface water rate reductions by implementing this low-impact development BMP

Site Constraints/Difficulties

- Coordination with Tacoma Mall required – privately owned property
- In the City's experience, Tacoma Mall does not like reducing the number of parking spaces
- This site would treat a relatively small amount of PGIS compared to other sites

Date: 7/28/2022
Sources: King County, City of Tacoma
Disclaimer: This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes.

0 50 100 200 Feet

- Site Location
- Facility Footprint
- Bioretention Facility Bottom
- Proposed Pipe
- Existing Manhole
- Existing Inlet

Existing Stormwater Pipe

- 4-in
- 6-in
- 8-in
- 10-in
- 12-in
- 15-in
- 18-in
- 21-in
- 24-in
- 60-in
- Unknown

Figure 3 - Site 5
Tacoma Mall Stormwater Park
Feasibility Study

Tacoma, WA

The Nature Conservancy Parametrix

Tacoma Mall Neighborhood Stormwater Park Feasibility Study

Site 6: Lincoln Heights Park Bioretention Facility

South End of Lincoln Heights Park

RETROFIT TYPE
Bioretention and Infiltration Facility
LOCATION
3591 S Steele St
EXISTING USE
Park – Open Grass Area
TRIBUTARY DRAINAGE AREA
51.7 acres 38.1 acres impervious 28.9 acres PGIS
SITING NOTES
Parcel is owned by Tacoma Metro Parks
FACILITY AREA
150,000 square feet
TREATMENT FLOW RATE
3.472 cfs
COST RANGE
$3,240,000 - $5,790,000

Description

A stormwater treatment facility is proposed at the south end of the Lincoln Heights Park. Available subsurface data suggests that underlying outwash soils are highly permeable in this area but are underlain by an impermeable till layer. At this time, a combination bioretention and infiltration facility is proposed, but additional subsurface investigation is recommended to ensure infiltration is feasible.

This facility would treat runoff from the residential, commercial, and roadway runoff from S Steele Street and adjacent areas to the south. Since this site is in a public park, this facility would be designed as a dual-purpose stormwater treatment and green space for public enjoyment. See Figure 4.

Site Benefits

- Uses a relatively unused section of the park
- Strong public use and educational potential
- Parcel is publicly owned, currently by Metro Parks Tacoma
- Sufficient space is available to accommodate a deep facility

Site Constraints/Difficulties

- Potential hydraulic feasibility challenges: there is limited hydraulic drop available, and the facility will be deep relative to the surrounding area
- Site is underlain by an impermeable till layer, additional subsurface investigation is recommended

Date: 7/28/2022
Sources: King County, City of Tacoma
Disclaimer: This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes.

0 50 100 200 Feet

- Site Location
- Facility Footprint
- Bioretention Facility Bottom
- Proposed Pipe
- Existing Manhole
- Existing Inlet

Existing Stormwater Pipe

- 4-in
- 6-in
- 8-in
- 10-in
- 12-in
- 15-in
- 18-in
- 21-in
- 24-in
- 60-in
- Unknown

Figure 4 - Site 6
Tacoma Mall Stormwater Park
Feasibility Study

Tacoma, WA

The Nature Conservancy Parametrix

Tacoma Mall Neighborhood Stormwater Park Feasibility Study

Site 12: S Tacoma Way Cloverleaf Bioretention

S Tacoma Way Cloverleaf

RETROFIT TYPE
Bioretention and Infiltration Facility
LOCATION
S Tacoma Way and Union Ave
EXISTING USE
None - Open Grassy Area
TRIBUTARY DRAINAGE AREA
55.4 acres 43.8 acres impervious 34.0 acres PGIS
SITING NOTES
Parcel is owned by City of Tacoma
FACILITY AREA
23,000 square feet
TREATMENT FLOW RATE
3.998 cfs
COST RANGE
$3,730,000 - $6,654,000

Description

A stormwater treatment facility is proposed within the grassy clover leaf area along the on-ramp from S Tacoma Way to Union Ave. Available subsurface data suggests that underlying Steilacoom Gravels are highly permeable.; therefore, it is proposed that this facility would be a combination bioretention and infiltration facility.

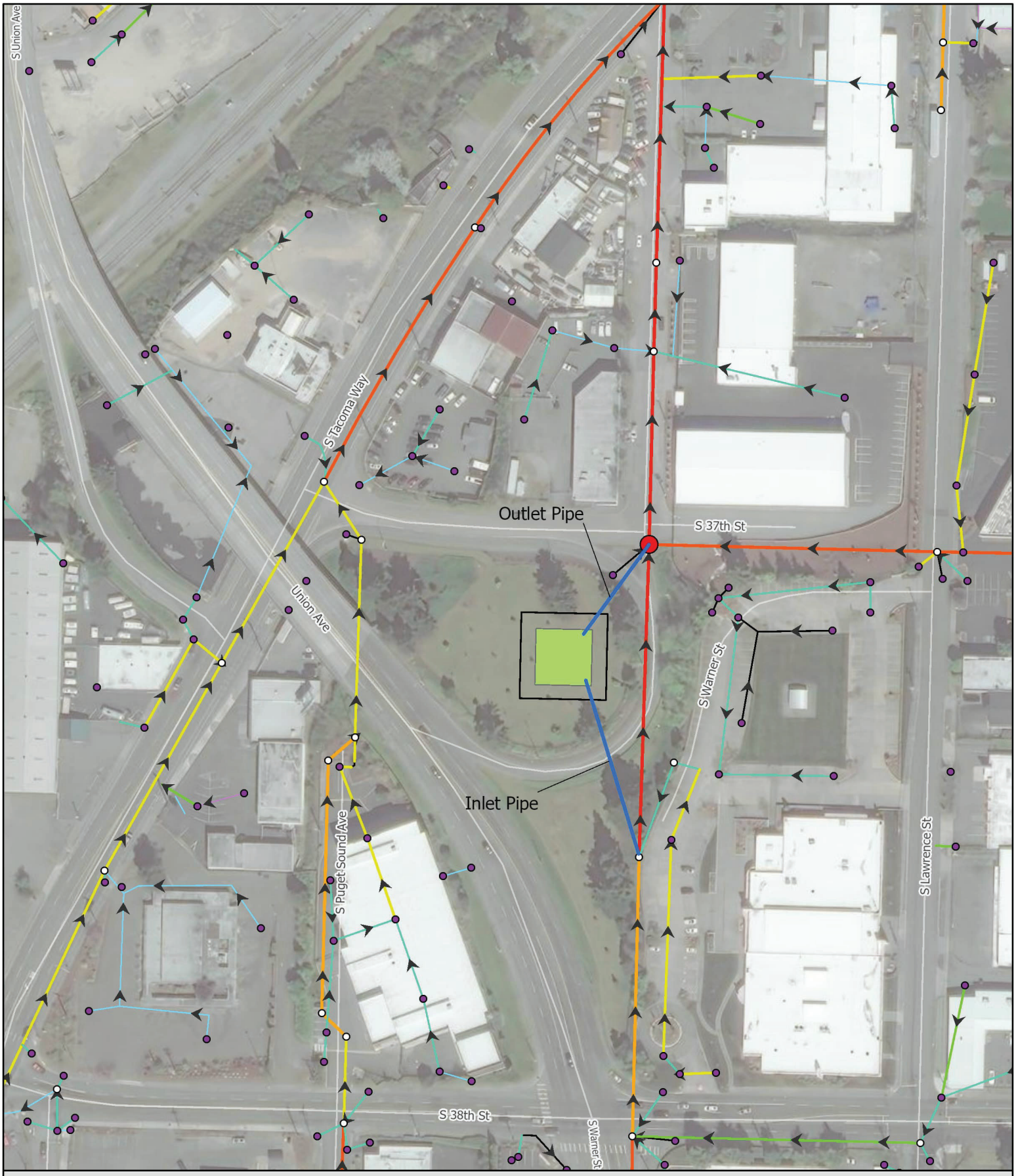
This facility would treat runoff from the residential, commercial, and roadway runoff from adjacent streets to the east and south. See Figure 5.

Site Benefits

- Utilizes a relatively unused piece of public land
- Future sections of the Water Flume Line Trail will be near the facility
- Sufficient space available for the proposed facility
- Infiltration of stormwater may help alleviate flooding issues
- Underlying Steilacoom Gravel has very high infiltration capacity

Site Constraints/Difficulties

- 33 Percent of the PGIS treated by this site has existing water quality treatment
- The sloped site makes construction slightly more challenging; the facility may need to be constructed in stepped bioretention cells or require additional supporting structure



Date: 7/28/2022
Sources: King County, City of Tacoma
Disclaimer: This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes.

0 50 100 200 Feet

- Site Location
- Facility Footprint
- Bioretention Facility Bottom
- Proposed Pipe
- Existing Manhole
- Existing Inlet

Existing Stormwater Pipe

- 4-in
- 6-in
- 8-in
- 10-in
- 12-in
- 15-in
- 18-in
- 21-in
- 24-in
- 60-in
- Unknown

Figure 5 - Site 12
Tacoma Mall Stormwater Park
Feasibility Study

Tacoma, WA

RECOMMENDATION

Parametrix has prepared three conceptual design alternatives that each provide substantial water quality benefit, high public use potential, and feasibility in terms of hydraulics and property acquisition. It is regrettable that Sites 9 and 13 were ultimately eliminated based on their private ownership because they are the two sites with the highest potential for pollutant removal. If slightly more importance were added to pollutant removal potential score, Site 9 would be a primary contender.

Site 5 slightly edges out Site 9 as the site with the third highest score. Site 5 has excellent public use and educational potential and has good hydraulic feasibility and infiltration potential. This site, however, treats the least amount of PGIS of all 5 sites analyzed in the Site Scale Analysis. Additionally, coordinating with the Tacoma Mall on acquisition and design of the site may prove challenging.

Sites 6 and 12 are tied for first. Site 12 at the S Tacoma Way Cloverleaf is an excellent overall site for a stormwater infiltration facility. A stormwater facility here would turn an underutilized publicly owned green space into a potential pedestrian attraction adjacent to the planned Water Flume Line Trail. This site could treat up to 34 acres of PGIS, and infiltrated runoff would directly recharge the South Tacoma Aquifer. Site 6 at Lincoln Heights Park is an excellent overall site for a stormwater bioretention and infiltration facility. A regional stormwater treatment facility at this site would provide a significant public use benefit and could treat up to 28.9 acres of PGIS. Additionally, it would repurpose and revitalize a relatively underutilized section of Lincoln Heights Park.

REFERENCES

City of Tacoma. 2016. Tacoma Mall Subarea Plan Urban Modeling Report. October 19, 2016.

City of Tacoma. 2018. Tacoma Mall Neighborhood Subarea Plan. May 15, 2018.

City of Tacoma. 2021. Stormwater Management Manual. City of Tacoma Environmental Services Science and Engineering Division. Tacoma, WA. July 2021. Available at: https://www.cityoftacoma.org/UserFiles/Servers/Server_6/File/cms/Surfacewater/SWMM_2021%20Final/2021%20City%20of%20Tacoma%20SWMM%20-%20FINAL.pdf

Ecology (Washington State Department of Ecology). 2019. Stormwater Management Manual for Western Washington (SWMMWW). Publication 19-10-021. Washington State Department of Ecology. July 2019.

MGS Software LLC. 2022. MGSFlood: A Continuous Hydrological Simulation Model for Stormwater Facility Analysis for Western Washington. Version 4.5.7. Olympia, WA.

OCI (Oldcastle Infrastructure, Inc.). 2018. Washington State Department of Ecology General Use Level Designation for BioPod Biofilter. July 2018. Available at: https://oldcastleinfrastructure.com/wp-content/uploads/2018/10/OIS_BioPod_Submittal-Pkg_LR.pdf.

Robinson and Noble. 2016. Hydrogeologic Conditions Report Tacoma Mall Subarea Infiltration Study. Prepared for the City of Tacoma. Tacoma, Washington. February 2016.

USDA (United States Department of Agriculture). 2022. SSURGO Soils Database. Soils. Available at: https://www.arcgis.com/apps/View/index.html?appid=cdc49bd63ea54dd2977f3f2853e07fff. Accessed: June 12, 2022.

WA DNR (Washington Department of Natural Resources). LiDAR Portal, Division of Geology and Earth Resources. Project: Tacoma, 2017. Available at: https://lidarportal.dnr.wa.gov/#48.72598:-122.40357:11. Date downloaded: June 2022.

WSDOT (Washington State Department of Transportation). 2009. Quantitative Procedures for Surface Water Impact Assessments. Washington State Department of Transportation. Olympia, WA. April 13, 2009.

WSDOT. 2020. Environmental Manual. M 31-11.23. Washington State Department of Transportation, Engineering and Regional Operations Development Division, Environmental Services Office. Olympia, WA. October 2020.

ATTACHMENTS

Attachment 1 – Initial Site List and Data Inventory

Attachment 2 – Site Scoring Matrix and Scoring Criteria

Attachment 1

Initial Site List and Data Inventory

Site #	Address	Receiving Waterbody	Facility ID	Rim El.	Site Structure Pipe I.E.s	Downstream Receiving Structure Outlet Pipe I.E.	Hydraulic Drop Available (ft)	Existing FC or WQ	Contributing Area (ac)	PGIS Estimate (ac)	% of PGIS with Existing WQ	Project Identified	Facility Feasibility	Recommendation	Property Owner
1	4275 S Pine St	Flett/Leach Creek	6756891	311.62	301.6 East 303.8 North 301.6 South	-	-	NO	-	-	-	No	There does not appear to be a good location near the MH for a treatment facility. Elevations would likely require pumping.	No open parcels are available near the site. Facility would likely be underground treatment vaults within the ROW.	-
2	4275 S Pine St	Flett/Leach Creek	6756985	302.13	293.05 North 292.78 South	-	-	Some - Contech Filters	-	-	-	No	There does not appear to be a good location near the MH for a treatment facility. Elevations would likely require pumping.	No open parcels are available near the site. Facility would likely be underground treatment vaults within the ROW.	-
3	4704 Oakes St	Flett/Leach Creek	6757534	302	289.64 North 289.64 South	-	-	Some - Contech Filters	-	-	-	No	There does not appear to be a good location near the MH for a treatment facility. Elevations would likely require pumping.	No open parcels are available near the site. Facility would likely be underground treatment vaults within the ROW.	-
4	2214 S 48th St	Foss Waterway	6757316	342.78	334.86 North 334.44 East	-	-	Yes, Contech Filters and infiltration	-	-	-	No	There does not appear to be a good location near the MH for a treatment facility. Downstream site 5 is a substantially better site.	No open parcels are available near the site. Facility would likely be underground treatment vaults within the ROW.	-
5	S 48th St and Tacoma Mall Blvd	Foss Waterway	6757326	336.78	329.4 West (In) 329.0 East (Out)	324.95	4.45	Yes, Contech Filters, infiltration, Sand Filters	19.7	13.8	7.4%	Yes	Placement of a facility within the SE corner of the Tacoma Mall Parking lot could work. Facility could be a bioretention facility located within a depression in the corner of the parking lot.	A Bioreterntion and infiltration facility is feasible based on hydraulics and underlying soils.	Tacoma Mall - previously unwilling to give up parking spaces. There is potential to incentivize them using stormwater rate reduction.
6	3591 S Steele St Lincoln Heights Park	Tide Flats	6766290	344.42	329.42 NW (Out) 330.15 East (In) 329.52 South (In)	327.68	2.47	Some - Cosco Detention Tank	51.7	28.9	0.0%	Yes	Placement of a facility in the south end of Lincoln Heights park could work, would need to be about 10ft deep	A Bioreterntion and infiltration facility may be feasible based on underlying soils. There is limited hydraulic drop, installation of a flow backup weir may be necessary to increase hydraulic drop.	Metro Parks Tacoma
7	3591 S Steele St	Tide Flats	6757326	337.19	329.4 West 329.0 East	-	-	Some - Cosco Detention Tank	-	-	-	No	Less feasible than site 6	Less feasible than #6, does not treat significantly more area.	-
8	3591 S Steele St	Tide Flats	6774943	338.98	327.03 South (In) 326.93 North (Out)	-	-	Some - Cosco Detention Tank	-	-	-	No	Less feasible than site 6, site would impact adjacent playground.	Less feasible than #6, does not treat significantly more area.	-
9	2602 S 35th St	Tide Flats	6766400	330.43	321.6 East (In) 321.6 West (Out)	303.16	18.44	Some - Cosco Detention Tank, OWS at Homeland building	81.3	44.3	13.2%	Yes	Parcels 2602, 2610, and 2620 would be good candidates for a treatment facility. Site grading/slopes and pipe elevations are good.	Large open bioretention facility is feasible. Design coordination with the developer likely to be difficult, purchase of the property is likely to be expensive since the developer already has plans, wishes to construct 75+ apartment or condo units.	Property was recently sold to a real estate developer - Brandi Brown is the buyer's broker. brandi@louisrudolphhomes.net 360.685.6059.
10	2610 S 35th St	Tide Flats	6766391	311.92	303.16 East (In) 303.16 West (Out)	-	-	Some - Cosco Detention Tank, OWS at Homeland building	-	-	-	No	Parcels 2602, 2610, and 2620 would be good candidates for a treatment facility; parcels appear to be for sale as of 7/21	Less feasible than #9, does not treat significantly more area.	-
11	2719 S Tacoma Way	Tide Flats	6764767	256.42	244.71 SE (In) 244.71 North (Out)	-	-	Some - Cosco Detention Tank, OWS at Homeland building, Contech stormfilters	-	-	-	No	There does not appear to be a good location near the MH for a treatment facility.	Recommend looking for other site locations along this trunk line with open adjacent parcels.	-
12	S 37th St and S Tacoma Way Cloverleaf	Tide Flats	6765856	304.03	273.76 South (In) 273.76 North (Out)	270.35	3.41	Some - Contech Filters	55.4	34.0	33.2%	Yes	Pipes are quite deep, but there is good elevation drop across the grassy hillside. Could reroute flows from the line to the east and send to the line at the bottom of the hill to the west.	A Bioreterntion and infiltration facility is feasible based on hydraulics and underlying soils.	City of Tacoma
13	13911 Waller Rd E	Tide Flats	6777292	258.47	246.1 South (In) 246.0 North (Out)	239.32	6.78	Some - Contech Filters	144.5	93.6	14.3%	Yes	There does not appear to be a good location near the MH for a treatment facility. Elevations would likely require pumping or a very deep facility	Large proprietary vaults are the most feasible option here, pumping is likely required.	BNSF Railroad

Color Key

- Screened out during initial qualitative screening
- Screened Out during Site Scale Analysis
- Final Site - Conceptual Design Created

Note: No border between rows indicate the sites are located along the same stormwater conveyance trunk line.

Attachment 2

Site Scoring Matrix and Scoring Criteria

Site #	Site Description or Address	Pollutant Removal Potential	Hydraulic Feasibility	Existing WQ	Property Acquisition Feasibility	Public Use	Alignment w/Existing Plans	Overall Score
Percent Weight		25%	20%	5%	25%	20%	5%	
5	SE Corner Tacoma Mall	1	5	5	3	3	3	**3.0**
6	Lincoln Heights Park	2	2	5	4	5	3	**3.3**
9	2602 S 35th St	3	3	4	1	3	5	2.7
12	S Tacoma Way Clover Leaf	2	3	1	5	3	5	**3.3**
13	S Tacoma Way Railroad Parcel	5	1	5	1	1	1	2.2

Score	Pollutant Removal Potential	Hydraulic Feasibility	Existing WQ	Property Acquisition Feasibility	Public Use	Alignment w/Existing Plans
Explanation	Based on PGIS area (acres) within Basin. Site with the lowest PGIS area is 1, highest PGIS is 5. Ranges are below.	See the descriptions below.	Based on the percent of the basin's PGIS with existing water quality treatment. Site with the highest percent is 1, lowest percent is 5. Ranges are below.	See the descriptions below.	*See Figure UF-7 in Tacoma Mall Subarea Plan	See the descriptions below.
1	0 - 13.8	1 - Elevation from MH Rim to Pipe IE >10ft and <3ft Hydraulic Drop. Pumping may be required	33+	1 - Parcel privately owned, confident that owner will not sell it or partner with the City	1 - Parcel is not located near a pedestrian street	1 - No current plans associated with parcel
2	13.9 - 33.8	2 - Elevation from MH Rim to Pipe IE >10ft and <3ft of hydraulic drop. Pumping not required	24.9 - 33	-	-	-
3	33.9 - 52.7	3 - Elevation from MH Rim to Pipe IE > 10ft, >3ft of Hydraulic Drop.	16.6 - 24.8	3 - Privately owned parcel, public/private agreement seems possible	3 - Parcel is located next to a pedestrian street or planned pedestrian trail	3 - Parcel is near stormwater Improvement area or parcel is designated for canopy improvement (Figure E-5)
4	52.8 - 73.7	4 - Elevation from MH Rim to Pipe IE < 10 ft, >4t of Hydraulic drop.	8.4 - 16.5	4 - Publicly Owned	-	-
5	73.8 - 93.6	5 - Elevation from MH Rim to Pipe IE < 8 ft, >4ft of hydraulic drop	0 - 8.3	5 - Owned by the City	5 - Parcel is located next to a core pedestrian street	5 - Parcel is specifically identified for stormwater improvements (Figure E-1)