Appendix E

Capital Improvement Project Summary Descriptions and Cost Estimates

701 Pike Street, Suite 1200
Seattle, Washington 98101

T: 206.624.0100
F: 206.749.2200

Technical Memorandum

Prepared for: City of Mukilteo

Project Title: Stormwater Management Plan

Project No.: 145357.003

Technical Memorandum

Subject: Capital Improvement Project Summary Descriptions and Cost Estimates

Date: March 5, 2015

To: Jennifer Adams

From: Colleen O. Doten

Prepared by: Margaret Ales, E.I.T.

Reviewed by: Colleen O. Doten, P.E.

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This memorandum presents written summaries and cost estimates for eight planning-level capital improvement projects (CIPs) that were developed in support of the City of Mukilteo (City) Comprehensive Surface Water Management Plan update. The CIPs were selected in a prioritization process conducted by City staff, with input from a Citizen Advisory Committee. Project descriptions are organized into summaries containing the following information:

- **Project number:** Project ranking as provided by the City.
- **Project name:** A short, descriptive name was provided by the City.
- **Location:** A simple description of the project location, such as the cross streets, is provided.
- **Schedule:** Project implementation year is dependent on funding.
- **Problem summary:** A brief description of the observed problem is presented along with a summary of the analysis conducted to characterize the problem and evaluate alternatives for mitigation, preliminary hydrologic and hydraulic analysis.
- **Description:** A description of the proposed project is provided, including major project elements and sizes.
- **Level of service:** The level of service addressed by the project is provided.
- **Recommended predesign refinements or considerations:** In some cases, pre-project data collection and analysis is proposed to confirm GIS data used in the development of the project and the condition of existing stormwater infrastructure to be incorporated into the project.
- **Planning-level cost estimate:** A list of estimated costs is provided including construction costs, construction management and inspections, engineering, administrative, and public outreach costs, operation and maintenance, taxes, and contingency costs. Cost estimating assumptions are included as Attachment A: Cost Estimate Details.
- **Project area**: A figure showing the conceptual design and location of project elements is provided.

The CIPs cost estimates are summarized in Table 1. Hydrologic and hydraulic methods, parameters, and assumptions used to develop the CIP are outlined in Table 2. Hydrologic model inputs and results used to develop pipe sizes are included as Attachment B: Hydrologic Modeling and Pipe Sizing Summary.

Table 1. CIP Cost Summary

CIP Rank No.	Project name	Total CIP cost
1	Chennault Beach Drive Drainage Improvements	$3,811,000
2	Mukilteo Lane Drainage Improvements	$6,591,000
3	84th Street SW (West) Storm Drainage Improvements	$1,240,000
4 and 5	64th Place W Street Drainage Improvements 66th Place W Street Drainage Improvements	$1,202,000 $1,425,000
6	Central Drive Storm Drainage Improvements for Big Gulch Basin	$5,267,000
7	62nd Place W/Canyon Drive Storm Drainage Improvements	$2,852,000
8	10th Street and Loveland Avenue Storm Drainage Improvements	$794,000

<table>
<tr><th colspan="2">Table 2. Hydrologic and Hydraulic Information</th></tr>
<tr><th>Hydrology</th><th>Method, parameter values, and assumptions</th></tr>
<tr><td>Methodology</td><td>Urban Hydrology for Small Watersheds TR-55, U.S. Department of Agriculture (USDA), 1986 (TR-55)</td></tr>
<tr><td>Model</td><td>HEC-HMS, version 4</td></tr>
<tr><td>Design storm</td><td>25-year and 100-year, 24-hour design storm Type 1A (National Oceanic and Atmospheric Administration [NOAA] Atlas 2, 1973), per Mukilteo Municipal Code</td></tr>
<tr><td>Subbasin delineation</td><td>Developed based on geographic information system (GIS) data including existing subbasin delineations, 2-foot contours, roadway extents, and drainage infrastructure</td></tr>
<tr><td>Subbasin characteristics (slope, soil, land cover and land use)</td><td>Derived by Environmental Science Associates (ESA) with GIS data
Slope: average subbasin slope based on derived slope classes, using 6 foot digital elevation model (DEM) based on LiDAR data obtained from the Puget Sound LiDAR Consortium.
Soil: Natural Resources Conservation Service (NRCS) soil hydrologic groups
Land cover/land use: City of Mukilteo zoning, NOAA Coastal Change Analysis Program Regional Land Cover, 2011 aerial photography, City right-of-way GIS</td></tr>
<tr><td>Soil Conservation Service (SCS) curve number (CN)</td><td>Composite CN per subbasin for five land cover/land use types (roads, residential, commercial, grass, forested) and for three hydrologic soil types
<table>
<tr><th rowspan="2">Land use or Land cover</th><th colspan="3">NRCS Soil Type</th><th rowspan="7">n/a = not applicable as this land cover & soil combination is not present in the CIP subbasins</th></tr>
<tr><th>A</th><th>C</th><th>D</th></tr>
<tr><td>Roads</td><td>98</td><td>98</td><td>98</td></tr>
<tr><td>Grass</td><td>n/a</td><td>74</td><td>n/a</td></tr>
<tr><td>Forested</td><td>n/a</td><td>70</td><td>n/a</td></tr>
<tr><td>Commercial</td><td>89</td><td>94</td><td>95</td></tr>
<tr><td>Residential</td><td>61</td><td>83</td><td>87</td></tr>
</table></td></tr>
<tr><td>Lag time</td><td>Method outlined in NRCS 1997 Engineering Handbook, part 630 Hydrology</td></tr>
<tr><td>Initial abstraction</td><td>Methods outlined in TR-55</td></tr>
<tr><th>Hydraulics</th><th>Method, parameter values, and assumptions</th></tr>
<tr><td>Methodology</td><td>Manning’s n equations</td></tr>
<tr><td>Pipe roughness</td><td>0.013</td></tr>
<tr><td>Pipe slope</td><td>Estimated from pipe invert elevations in GIS where available. When pipe invert elevations were not available, assigned CIP pipe slope to ground surface slope (based on 2-foot contour data) with a minimum slope of 0.005 ft/ft.</td></tr>
<tr><td>Sizing criteria</td><td>Closed systems that are considered part of a major stream were designed to convey flows from a 100-year recurrence storm event. All other closed drainage systems were designed to convey flows from a 25-year recurrence storm event, with a 12-inch minimum diameter.</td></tr>
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<tr><th>Project number</th><th>CIP Rank 1</th></tr>
<tr><td>Project name</td><td>Chennault Beach Drive Drainage Improvements</td></tr>
<tr><td>Location</td><td>Chennault Beach Drive from 60th Street and Marine View Drive</td></tr>
<tr><td>Schedule</td><td>Dependent on funding; currently unfunded
Project should be implemented prior to upstream project, 62nd Place W/Canyon Drive Storm Drainage Improvements (CIP Rank 7)</td></tr>
<tr><td>Problem summary</td><td>Drainage from the Chennault Beach Drive roadway is conveyed in an under-developed ditch-and-culvert system as well as intermittent piping between 60th Avenue W and Marine View Drive. The piped portions of the system are located where the system outfalls to Upper Chennault Beach Creek at four locations: 60th Avenue W, McArthur Lane, 64th Place W, and west of Marine View Drive.
During high flows, roadway flooding occurs because of a lack of ditch capacity, debris blocking driveway culverts and inlets, and misplaced inlets. High flows scour landscaping material (typically small rocks) located in the right-of-way (ROW), providing a debris source. Soil and vegetation on steep slopes adjacent to ditches slough into the ditches, reducing ditch capacity and providing another debris source. Some inlets are located outside of the drainage pathway. Flows bypass the inlets and contribute to the roadway flooding by concentrating flow in under-capacity ditches. In addition, the City does not have an easement to perform maintenance on their outfall near 64th Place W.</td></tr>
<tr><td>Description</td><td>This project provides a new drainage system along Chennault Beach Drive, where the existing drainage system is under-developed, under-capacity, or bypassed. See Figure 1. Flows currently routed to the existing Upper Chennault Creek outfall east of McArthur Lane will be routed through the new drainage system to the existing Upper Chennault Creek outfall east of 64th Place W. Existing inlets that are not currently collecting surface water will either be repositioned and connected to the new system or removed. Existing functional inlets may be connected to the new system. New inlets and laterals will be installed as needed.
The project consists of four areas of drainage improvements:
• Improvements to the north ROW shoulder of Chennault Beach Drive between 60th Avenue W and McArthur Lane consisting of paving and re-grading of the shoulder and installing asphalt curbing to channel water to the existing stormwater inlets.
• A 12-inch-diameter drainage system located in the alignment of the existing ditch-and-culvert system located on the south side of Chennault Beach Drive between west of 60th Place W and west of 62nd Place W.
• An 18-inch-diameter drainage system located in the alignment of the existing ditch-and-culvert system located on the south side of Chennault Beach Drive between west of 62nd Place W and 64th Place W. A proposed drainage system from 62nd Place W will tie into this new system on Chennault Beach Drive (see 62nd Place W/Canyon Drive Storm Drainage Improvements project, CIP Rank 7). The new 18-inch-diameter drainage system discharges to the existing outfall to Upper Chennault Creek east of 64th Place W. A maintenance easement will be obtained along the extent of the existing outfall pipe.
• A 12-inch-diameter drainage system located in the alignment of the existing ditch-and-culvert system on the north side of Chennault Beach Drive between 64th Place W and W Marine View Drive. This new drainage system will tie into the existing drainage system on Marine View Drive.</td></tr>
<tr><td>Level of service</td><td>Closed drainage systems shall be designed to convey flows from a 25-year recurrence storm event.</td></tr>
<tr><td>Recommended predesign considerations</td><td>• Conduct a pipe condition assessment to confirm the existing pipe in the proposed CIP, as shown in Figure 1, is in good condition.
• Conduct a geotechnical investigation to determine if special construction requirements are necessary or replacement of retaining walls. Cost estimate assumes no special measures or replacement are necessary.</td></tr>
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Cost estimate	Gravity storm drain: install 1,400 feet of 12-inch-diameter pipe in ROW	$943,000
	Gravity storm drain: install 730 feet of 18-inch-diameter pipe in ROW	$519,000
	Gravity storm drain: install 170 feet of 18-inch-diameter outfall pipe	$75,000
	Improve 270 feet of shoulder ROW	$57,000
	Maintenance easement	$45,000
	Subtotal line-item costs..	*$1,639,000*
	Contractor overhead, profit, and mobilization (18% of subtotal of line-item costs)......................	$295,000
	Construction contingency (20% of all above construction costs)...	$387,000
	Washington State and Snohomish County sales tax (9.5% of all above construction costs).......	$220,000
	Subtotal construction costs..	*$2,541,000*
	Construction management and inspections (15% of construction costs)	$381,000
	Administration, engineering design, public outreach, and permitting (35% of construction costs)...	$889,000
	CIP 1 project cost	$3,811,000
	Annual O&M costs	$750

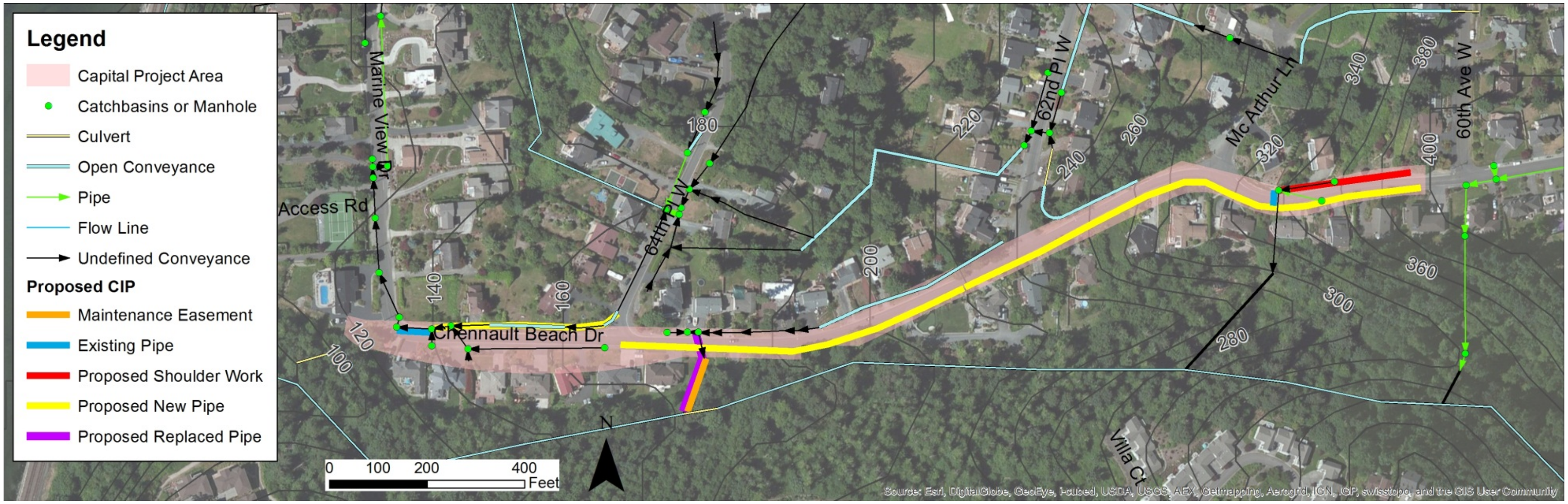

Figure 1. CIP Rank 1, Chennault Beach Drive Drainage Improvements

Project number	CIP Rank 2
Project name	Mukilteo Lane Drainage Improvements
Location	Mukilteo Lane between W Mukilteo Boulevard and Park Avenue
Schedule	Dependent on funding; currently unfunded
Problem summary	Drainage along Mukilteo Lane has three discharge locations. The drainage features and problems descriptions below are split up into three sections (eastern, middle and western), based on the discharge location. **Eastern Mukilteo Lane:** Drainage along the eastern portion of Mukilteo Lane (between W Mukilteo Boulevard and the rail line crossing) is conveyed along unimproved roadside shoulders, curb and gutter, ditches, and inlets and pipe, and discharges to Japanese Gulch. Flooding occurs during high flows when debris blocks driveway culverts and inlets. The debris is reported to be rock from unimproved right-of-way (ROW). Although not represented in the City's geographic information system (GIS), City staff report 8-inch-diameter pipes in the Eastern Mukilteo Lane section. City conveyance standards require minimum 12-inch-diameter pipe for storm sewers and culverts. Roadway drainage between the rail line and Japanese Gulch is conveyed in a shallow ditch along the shoulder of the road. This ditch is under capacity and floods the roadway. This area experiences roadside ponding year round. **Middle Mukilteo Lane:** Drainage along Mukilteo Lane from the rail line crossing and west to Loveland Avenue is collected in roadside ditches and conveyed to the north, where City GIS data show that flows discharge through an 18-inch-diameter pipe onto Burlington Northern Santa Fe (BNSF) property. Ditches along this middle section of Mukilteo Lane have low slope, but flooding has not been reported in this section of Mukilteo Lane. **Western Mukilteo Lane:** Drainage along the western section of Mukilteo Lane from Loveland Avenue to Park Avenue is the most downstream section of the conveyance of a 113-acre portion of the Brewery Creek drainage basin. This 400-foot section of conveyance is relatively flat compared to the steep slopes of the contributing basin. Modeling results show that the conveyance along the western portion of Mukilteo Lane is capacity-limited. Also, high sediment loads are conveyed from upstream sources and deposited along Mukilteo Lane, resulting in significant sediment accumulation in the pipes and ditches. Approximately 60 cubic yards of sediment are removed annually from the drainage system along Mukilteo Lane between Park and Loveland Avenues. The continual sediment accumulation further reduces the system capacity.
Description	This project consists of three areas of drainage improvements. See Figure 2. • For the eastern portion of Mukilteo Lane, this project provides a 12-inch-diameter storm drain from Mukilteo Boulevard to the rail line crossing. While the CIP assumes the existing piped system immediately east of Japanese Gulch will be replaced, some portions of the existing system with 12-inch-diameter pipe may remain and be connected to the new system. The new drainage system will discharge to Japanese Gulch. • For the middle portion of Mukilteo Lane (from the rail line crossing to Loveland Avenue), it is recommended that a 12-inch-diameter storm drain replace the ditch and culvert system to improve the drainage along this low sloped section as well as reduce ditch maintenance efforts. The new drainage system will tie into the existing 18-inch-diameter pipe that outfalls to the north onto BNSF property. • For the western portion of Mukilteo Lane, this project includes replacing the 24-inch-diameter pipe discharging from the south at Mukilteo Lane to a 36-inch-diameter pipe, installing an inline sediment collection vault in an existing City-owned ROW that will discharge to new a 36-inch-diameter pipe on the north side of Mukilteo Lane, and replacing the existing 24-inch-diameter Brewery Creek outfall crossing the BNSF rail yard at Park Avenue to 36-inch diameter.
Level of service	The conveyance in the Western Mukilteo Lane portion of the project is considered part of a major stream and shall be designed to convey flows from a 100-year recurrence storm event. Closed drainage systems in the middle and eastern portions of the project shall be designed to convey flows from a 25-year recurrence storm event.
Recommended predesign refinements	Detailed design should consider planning and development efforts outlined in the City of Mukilteo Downtown Waterfront Master Plan.

Cost estimate	Gravity line: install 2,100 feet of pipe with 12-inch-diameter pipe in ROW	$906,000
	Gravity line: replace 1,260 feet of pipe with 12-inch-diameter pipe in ROW	$507,000
	Gravity line: install 320 feet of 36-inch-diameter pipe in ROW	$196,000
	Gravity line: replace 640 feet of pipe with 36-inch-diameter pipe in ROW	$410,000
	Gravity line: replace 110 feet of pipe with 36-inch-diameter pipe by jack and bore	$363,000
	Contaminated soil remediation	$162,000
	Install a 130 by 12 by 10 sediment collection vault in ROW	$290,000
	Subtotal line-item costs	*$2,834,000*
	Contractor overhead, profit, and mobilization (18% of subtotal of line-item costs)	$510,000
	Construction contingency (20% of all above construction costs)	$669,000
	Washington State and Snohomish County sales tax (9.5% of all above construction costs)	$381,000
	Subtotal construction costs	*$4,394,000*
	Construction management and inspections (15% of construction costs)	$659,000
	Administration, engineering design, public outreach, cultural resources, and permitting, including railroad crossing permitting (35% of construction costs)	$1,538,000
	CIP 2 project cost	$6,591,000
	Annual O&M costs	$700

Figure 2. CIP Rank 2, Mukilteo Lane Drainage Improvements

Project number	CIP Rank 3	
Project name	84th Street SW (West) Storm Drainage Improvements	
Location	84th Street SW from Mukilteo Speedway and 53rd Avenue W	
Schedule	Dependent on funding; currently unfunded	
Problem summary	Drainage along the 84th Street SW roadway is conveyed in an under-developed ditch-and-culvert system as well as in intermittent piping between State Route 525/Mukilteo Speedway and 53rd Avenue W. The downstream section of ditch near the intersection of 84th Street SW and 53rd Avenue SW is shallow and gravel-lined. The inlet at the northeast corner of 84th Street SW and 53rd Avenue W is easily clogged with gravel (from the right-of-way [ROW] and upstream ditch) and results in flooding at the intersection. Also, the inlet is located in the ROW outside of the direct drainage path and flows that bypass this inlet are likely to contribute to intersection flooding.	
Description	This project provides a new drainage system along 84th Street SW and consists of a 12-inch-diameter pipe located in the existing 84th Street SW ROW, replacing the 36-inch diameter pipe that crosses 53rd Avenue SW at 84th Street SW, and replacing the pipe on 53rd Avenue SW that discharges into the 84th Street system. See Figure 3. The new system will have the same discharge location as the previous system an open channel, at the west end of 84th Street SW, flowing to the Naketa Beach outfall. Existing inlets that are not currently collecting surface water will either be repositioned and connected to the new system or removed. Existing functional inlets may be connected to the new system. New inlets will be installed as needed. Open ditch segments will be covered and the ROW shoulder will be restored in kind. (Some [currently unfunded] sidewalk projects are proposed in this area. If funding sources align for these projects, the ROW shoulder could be restored to a different standard.)	
Level of service	Closed drainage systems shall be designed to convey flows from a 25-year recurrence storm event.	
Recommended predesign refinements	None.	
Cost estimate	Gravity storm drain: install 1,080 feet of 12-inch-diameter pipe in ROW....................................	$514,000
	Gravity storm drain: install 60 feet of 36-inch-diameter pipe in ROW..	$38,000
	Subtotal line-item costs..	*$552,000*
	Contractor overhead, profit, and mobilization (18% of subtotal of line-item costs).....................	$99,000
	Construction contingency (20% of all above construction costs)..	$130,000
	Washington State and Snohomish County sales tax (9.5% of all above construction costs).......	$74,000
	Subtotal construction costs...	*$855,000*
	Construction management and inspections (15% of construction costs)....................................	$128,000
	Administration, engineering design, public outreach, and permitting (30% of construction costs)	$257,000
	CIP 3 project cost	$1,240,000
	Annual O&M costs	$200

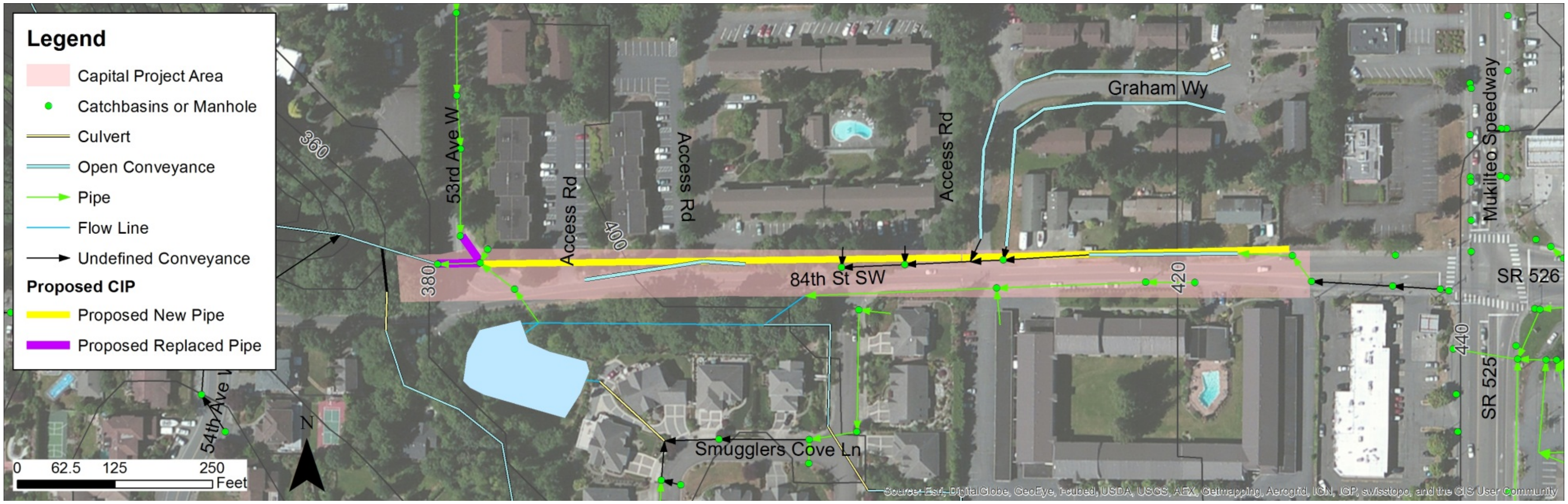

Figure 3. CIP Rank 3, 84th Street SW (West) Drainage Improvements

Project number	CIPs Rank 4 and Rank 5 (described jointly)	
Project name	64th Place W and 66th Place W Street Drainage Improvements	
Location	64th Place W from south of Central Drive to 66th Place W 66th Place W from 64th Place W to Marine View Drive	
Schedule	Dependent on funding; currently unfunded CIP Rank 5 should be implemented prior to, or concurrently with CIP Rank 4	
Problem summary	Drainage along the 64th Place W and 66th Place W roadways is conveyed in an under-developed ditch-and-culvert system as well as intermittent piping. Some culvert inlets are located in the gravel shoulder and erosion of the shoulder provides debris into the inlets and downstream ditches. Driveway culverts and open ditches and driveway culverts clog easily, resulting in flooding at driveways and the roadway.	
Description	This project provides a new drainage system along 64th Place W and 66th Place W and consists of a 12-inch-diameter pipe located in the existing right-of-way (ROW). See Figure 4. The new system will tie into the existing system on 66th Place W east of Marine View Drive. Existing inlets that are not currently collecting surface water will either be repositioned and connected to the new system or removed. Existing functional inlets may be connected to the new pipe. New inlets will be installed on both sides of the roads as needed. Open ditch segments will be covered and the ROW shoulder will be restored with in-kind landscaping. These projects were originally scoped and ranked separately. However, during problem analysis it was determined that the two projects are part of one drainage system and should be constructed together or phased from downstream to upstream to ensure there is adequate downstream conveyance capacity for upstream improvements. Because flows collected along 64th Place W (CIP Rank 4 project location) discharge to the ditch-and-culvert system on 66th Place W (CIP Rank 5 project location), CIP Rank 5 project should be constructed before CIP Rank 4 project.	
Recommended predesign considerations	CIP Rank 5 ties into an existing private drainage system (see existing pipe on Figure 4). Inspect the private system to confirm it is in good condition.	
Cost estimate Project 4	Gravity storm drain: install 750 feet of 12-inch-diameter pipe in ROW	$535,000
	Subtotal line-item costs	*$535,000*
	Contractor overhead, profit, and mobilization (18% of subtotal of line-item costs)	$96,000
	Construction contingency (20% of all above construction costs)	$126,000
	Washington State and Snohomish County sales tax (9.5% of all above construction costs)	$72,000
	Subtotal construction costs	*$829,000*
	Construction management and inspections (15% of construction costs)	*$124,000*
	Administration, engineering design, public outreach, and permitting (30% of construction costs)	$249,000
	CIP 4 project cost	$1,202,000
	Annual O&M costs	$250
Cost estimate Project 5	Gravity storm drain: install 880 feet of 12-inch-diameter pipe in ROW	$634,000
	Subtotal line-item costs	*$634,000*
	Contractor overhead, profit, and mobilization (18% of subtotal of line-item costs)	$114,000
	Construction contingency (20% of all above construction costs)	$150,000
	Washington State and Snohomish County sales tax (9.5% of all above construction costs)	$85,000
	Subtotal construction costs	*$983,000*
	Construction management and inspections (15% of construction costs)	*$147,000*
	Administration, engineering design, public outreach, and permitting (30% of construction costs)	$295,000
	CIP 5 project cost	$1,425,000
	Annual O&M costs	$300
	Total CIP 4 and 5 project cost	$2,627,000
	Total annual O&M costs	$550

Figure 4. CIP Rank 4 and 5, 64th Place W and 66th Place W Street Drainage Improvements

Project number	CIP Rank 6
Project name	Central Drive Storm Drainage Improvements for Big Gulch Basin
Location	Central Drive near 103rd Place SW to 63rd Place W, and 63rd Place W from Central Drive to Webster Way
Schedule	Dependent on funding; currently unfunded
Problem summary	Drainage along the Central Drive and 63rd Place W roadways is conveyed in an under-developed ditch-and-culvert system as well as intermittent piping. Some inlets are located in the gravel shoulder and erosion of the shoulder provides debris into the inlets and downstream ditches. Open ditches and driveway culverts are under-capacity and clog easily, resulting in flooding at driveways and onto roadway and private property. A portion of the runoff is conveyed through an open channel and piped system through a wetland area in the backyards of properties on the west side of 63rd Pl W. The City does not have an easement to perform maintenance for this portion of the system.
Description	This project provides a new drainage system along Central Drive and 63rd Place W. Existing inlets that are not currently collecting surface water will either be repositioned and connected to the new system or removed. Existing functional inlets may be connected to the new pipe. New inlets and laterals will be installed as needed. See Figure 5. The project consists of seven areas of drainage improvements: • A 12-inch-diameter drainage pipe located in the alignment of the existing ditch-and-culvert system located on the east side of Central Drive in the vicinity of 103rd Place SW to convey stormwater to across Central Drive to the new 12-inch-diameter pipe on the west side of Central Drive. • A 12-inch-diameter drainage pipe located in the alignment of the existing ditch-and-culvert system located on the south side of Central Drive between 103rd Place SW and 63rd Place W to convey storm-water to the west side of 63rd Place W. Inlets on the north side of Central Drive with laterals to the south piped system. The existing ditch-and-culvert system on the north side of Central Drive will remain. • A 12-inch-diameter drainage pipe located in the alignment of the existing ditch-and-culvert system and pipe-and-inlet system located on the east side of 63rd Place W between Central Drive and Webster Way, and in the alignment of the pipe crossing 63rd Place W (at its north end) to the open channel west of 63rd Place W. • A 12-inch-diameter drainage pipe located in the alignment of the existing ditch-and-culvert system located on the west side of 63rd Place W north of Central Drive to convey stormwater to the west side of 63rd Place W. • Replace the existing culvert crossing 63rd Place W north of Central Drive with an 18-inch-diameter pipe. • Replace the existing 12-inch-diameter wetland outfall pipe near the north end of west of 63rd Place W with an 18-inch-diameter pipe. • Obtain a maintenance easement for the piped portion of the conveyance system through the wetland area along properties on the west side of 63rd Place W.
Level of service	Closed drainage systems shall be designed to convey flows from a 25-year recurrence storm event.
Recommended predesign refinements	Conduct a field study and analysis of the open channel, pipe and wetland area, between 64th Place W and 63rd Place W north of Central Drive, to assess the condition of the system and function of the wetland.

Cost estimate	Gravity storm drain: replace 320 feet of pipe with 18-inch-diameter pipe in ROW	$269,000
	Gravity storm drain: install 2,650 feet of 12-inch-diameter pipe in ROW	$1,824,000
	Maintenance easement	$171,000
	Subtotal line-item costs...	*$2,264,000*
	Contractor overhead, profit, and mobilization (18% of subtotal of line-item costs)......................	$408,000
	Construction contingency (20% of all above construction costs)...	$534,000
	Washington State and Snohomish County sales tax (9.5% of all above construction costs)........	$305,000
	Subtotal construction costs...	*$3,511,000*
	Construction management and inspections (15% of construction costs)......................................	$527,000
	Administration, engineering design, public outreach, and permitting (35% of construction costs)	$1,229,000
	CIP 6 project cost	$5,267,000
	Annual O&M costs	$1,050

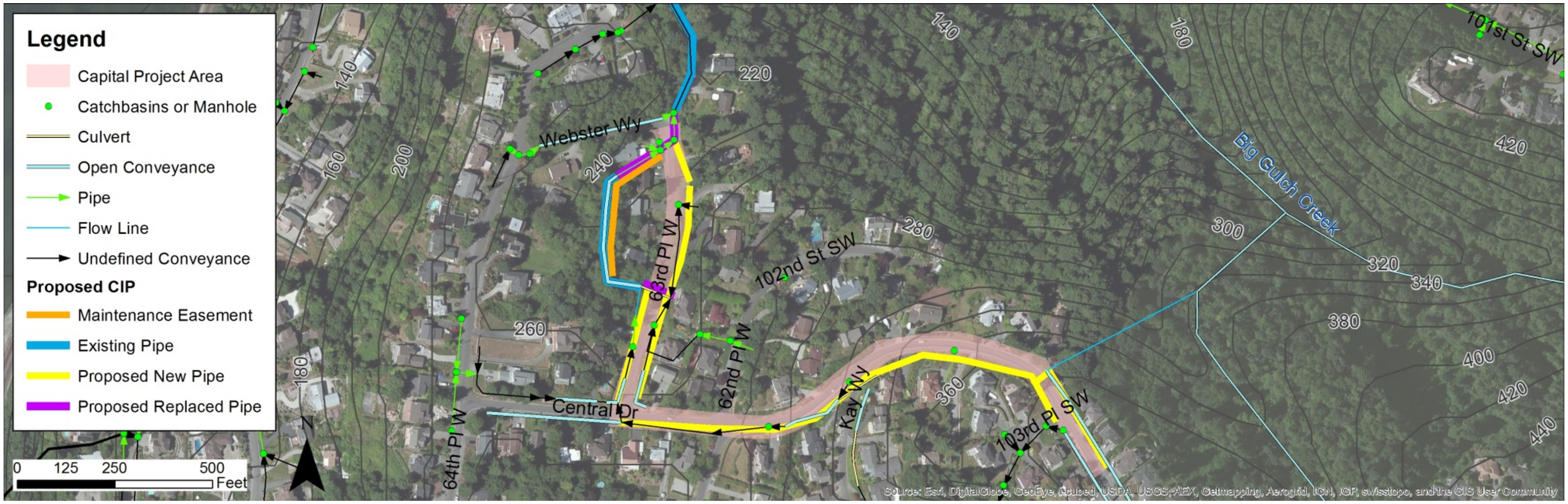

Figure 5. CIP Rank 6, Central Drive Storm Drainage Improvements for Big Gulch

<table>
<tr><th>Project number</th><th colspan="2">CIP Rank 7</th></tr>
<tr><td>Project name</td><td colspan="2">62nd Place W/Canyon Drive Storm Drainage Improvements</td></tr>
<tr><td>Location</td><td colspan="2">Along 62nd Place W and Canyon Drive</td></tr>
<tr><td>Schedule</td><td colspan="2">Dependent on funding; currently unfunded
Project should be implemented after downstream project, Chennault Beach Drive Drainage Improvements (CIP Rank 1)</td></tr>
<tr><td>Problem summary</td><td colspan="2">Drainage from Canyon Drive is conveyed in a ditch-and-culvert system as well as intermittent piping. The west side of 62nd Place W does not contain a conveyance system. As a result, roadway surface water flows onto private property west of 62nd Place W.
During high flows, roadway flooding occurs because of a lack of conveyance system and debris blockage of driveway culverts and inlets. Also some inlets are located in the far extent of the right-of-way (ROW) and flows bypass the inlets contributing to the roadway flooding.</td></tr>
<tr><td>Description</td><td colspan="2">This project provides a new drainage system, along 62nd Place W and Canyon Drive, that ties into the proposed piped drainage system in the Chennault Beach Drive Drainage Improvements project (CIP Rank 1). Existing inlets that are not currently collecting surface water will either be repositioned and connected to the new system or removed. Existing functional inlets may be connected to the new pipe. New inlets will be installed in both sides of Canyon Drive and 62nd Place W as needed. See Figure 6.
The project consists of three areas of drainage improvements:
• A 12-inch-diameter drainage pipe located in the alignment of the existing ditch-and-culvert system on the north side of Canyon Drive, from west of Kay Way to 62nd Place W, and that crosses 62nd Place W at Canyon Drive.
• A 12-inch-diameter drainage pipe located in the west ROW shoulder of 62nd Place W, from the northern project extent to where the existing pipes from the east ROW cross over 62nd Place W.
• An 18-inch-diameter drainage pipe located in the west ROW shoulder of 62nd Place W (from where the existing pipes from the east ROW cross over 62nd Place W north) and in the north ROW shoulder of Chennault Beach Drive crossing over Chennault Beach Drive and tying into the proposed piped system on the south side of Chennault Beach Drive as described in Chennault Beach Drive Drainage Improvements project (CIP Rank 1).</td></tr>
<tr><td>Level of service</td><td colspan="2">Closed drainage systems shall be designed to convey flows from a 25-year recurrence storm event.</td></tr>
<tr><td>Recommended predesign refinements</td><td colspan="2">Conduct a pipe condition assessment to confirm the existing pipe in the proposed CIP, as shown in Figure 6, is in good condition.</td></tr>
<tr><td rowspan="9">Cost estimate</td><td>Gravity storm drain: install 1,270 feet of 12-inch-diameter pipe in ROW</td><td>$891,000</td></tr>
<tr><td>Gravity storm drain: install 390 feet of 18-inch-diameter pipe (deep trench) in ROW</td><td>$378,000</td></tr>
<tr><td>Subtotal line-item costs</td><td>$1,269,000</td></tr>
<tr><td>Contractor overhead, profit, and mobilization (18% of subtotal of line-item costs)</td><td>$228,000</td></tr>
<tr><td>Construction contingency (20% of all above construction costs)</td><td>$299,000</td></tr>
<tr><td>Washington State and Snohomish County sales tax (9.5% of all above construction costs)</td><td>$171,000</td></tr>
<tr><td>Subtotal construction costs</td><td>$1,967,000</td></tr>
<tr><td>Construction management and inspection (15% of construction costs)</td><td>$295,000</td></tr>
<tr><td>Administration, engineering design, public outreach, and permitting (30% of construction costs...</td><td>$590,000</td></tr>
<tr><td colspan="2" align="right">CIP 7 project cost</td><td>$2,852,000</td></tr>
<tr><td colspan="2" align="right">Annual O&M costs</td><td>$600</td></tr>
</table>

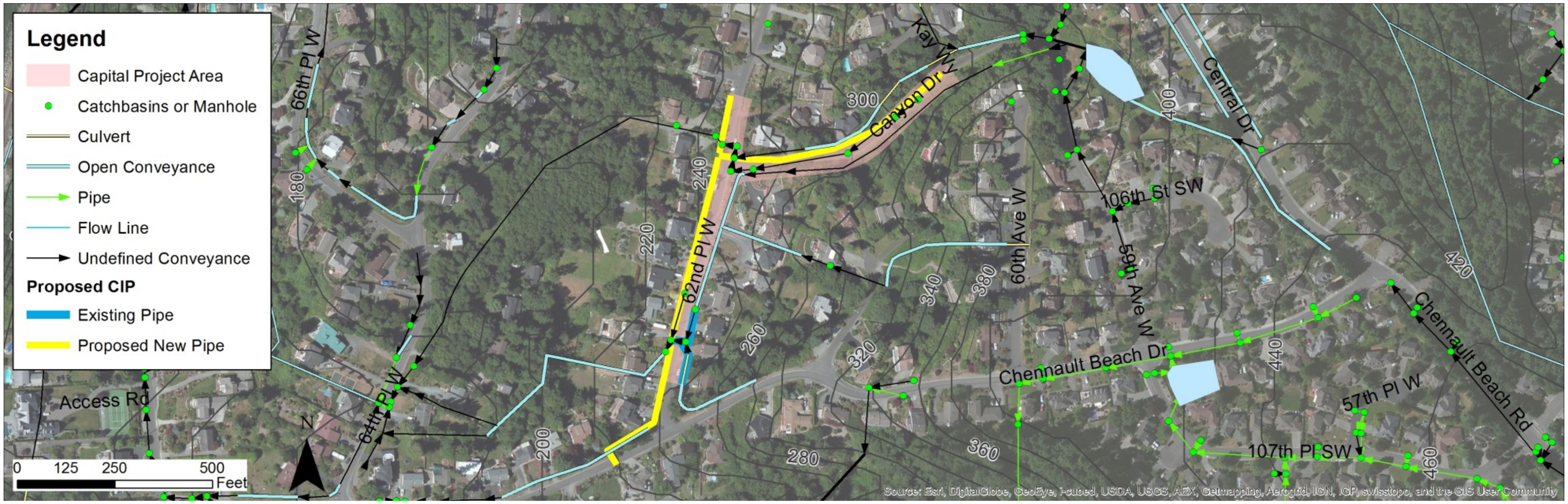

Figure 6. CIP Rank 7, 62nd Place W/Canyon Drive Storm Drainage Improvements

Project number	CIP Rank 8	
Project name	10th Street and Loveland Avenue Storm Drainage Improvements	
Location	Along 10th Street from Campbell Avenue to Park Avenue and along Park Avenue from 10th Street to 9th Street	
Schedule	Dependent on funding; currently unfunded	
Problem summary	Drainage along the 10th Street and Park Avenue roadways is conveyed in an under-developed ditch-and-culvert system. Between Campbell and Loveland Avenues along 10th Street, intermittent and under-capacity infrastructure results in private property flooding during heavy rainfall. Also roadway runoff is not directed to inlets resulting in surface water flowing on to private property instead of into the conveyance system. Between Loveland and Park avenues, the under-capacity ditch overflow to private property and stormwater enters homes.	
Description	This project provides drainage improvements along 10th Street and Park Avenue in five areas: • West of Loveland Avenue, the project consists of installing inlets and laterals along the north side of 10th Street to Park Avenue. The laterals will discharge to an existing ditch along the south side of 10th Street. • Also west of Loveland Avenue, a 12-inch diameter pipe will replace a 10-inch diameter pipe that discharges to the west. • For a third area west of Loveland Avenue, a 12-inch-diameter pipe will replace a section of open channel on the east side of Park Avenue between 9th and 10th streets. • East of Loveland Avenue, a 12-inch-diameter pipe will replace a section of open channel on the south side of 10th Street. • Also east of Loveland Avenue, this project includes installing additional inlets and laterals along the north shoulder of 10th Street at the intersection of Campbell Avenue. Existing laterals on the north side of 10th Street, west of Campbell Avenue, would be replaced to improve conveyance capacity. Shoulder work, such as re-grading and installation of asphalt berms or curbs, to direct flows to inlets would be completed. All laterals will discharge to the existing and proposed pipe on the south side of 10th Street.	
Level of service	Closed drainage systems shall be designed to convey flows from a 25-year recurrence storm event.	
Recommended predesign refinements	Although City staff confirmed the diameter of the existing pipe connecting to proposed pipes, a pipe condition assessment is recommended for the existing pipe in the proposed CIP as shown in Figure 7.	
Cost estimate	Gravity storm drain: install 400 feet of 12-inch-diameter pipe in ROW	$159,000
	Gravity storm drain: replace 180 feet of pipe with 12-inch-diameter pipe in ROW	$78,000
	Install 6 inlets and associated laterals that tie into existing system	$86,000
	Improve feet of ROW shoulder	$30,000
	Subtotal line-item costs	*$353,000*
	Contractor overhead, profit, and mobilization (18% of subtotal of line-item costs)	$64,000
	Construction contingency (20% of all above construction costs)	$83,000
	Washington State and Snohomish County sales tax (9.5% of all above construction costs)	$48,000
	Subtotal construction costs	*$548,000*
	Construction management and inspection (15% of construction costs)	$82,000
	Administration, engineering design, public outreach, and permitting (30% of construction costs)	$164,000
	CIP 8 project cost	$794,000
	Annual O&M costs	$200

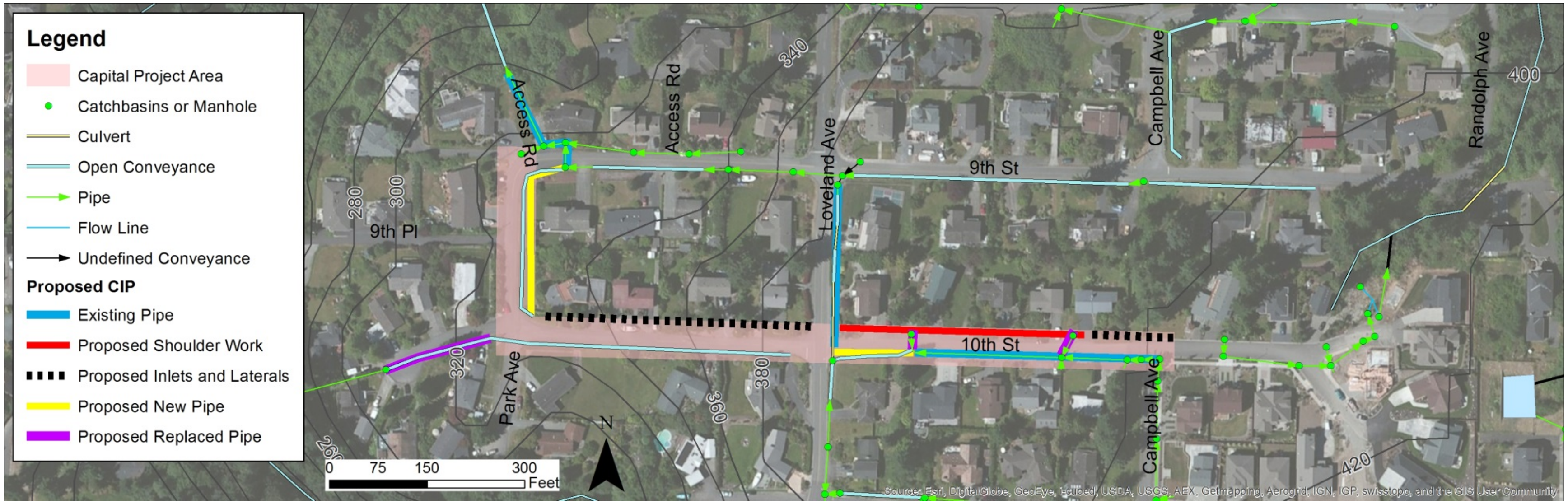

Figure 7. CIP Rank 8, 10th Street and Loveland Storm Drainage Improvement

Attachment A: Cost Estimate Details

Capital Improvement Project Summary Descriptions and Cost Estimates

Project: 145357 Mukilteo Stormwater Retrofit Predesign   Prepared By: CBoyle   Date: 3/3/2015
Task : 003 Tech Support, Capital Improvement Projects   ecked By: RWJacobsen

1 Unit Cost: Install SW piping

Construction Costs						
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost with Installation (1)**	**Source:**	**Notes:**
12" pipe - Light Traffic	LF	1	$ 360	$ 360	Unit Cost from Tabula	see other assumptions below
12" pipe - Heavy Traffic	LF	1	$ 360	$ 360	Unit Cost from Tabula	see other assumptions below
18" pipe - Light Traffic	LF	1	$ 400	$ 400	Unit Cost from Tabula	see other assumptions below
18" pipe - Heavy Traffic	LF	1	$ 410	$ 410	Unit Cost from Tabula	see other assumptions below
18" pipe - 14' Deep	LF	1	$ 600	$ 600	Unit Cost from Tabula	see other assumptions below
36" pipe - Light Traffic	LF	1	$ 600	$ 600	Unit Cost from Tabula	see other assumptions below
36" pipe - Heavy Traffic	LF	1	$ 610	$ 610	Unit Cost from Tabula	see other assumptions below
36" pipe - Jack and Bore	LF	1	$ 3,300	$ 3,300	Unit Cost from Tabula	see other assumptions below

2 Unit Cost: Improve ROW conditions - Curb and Gutter

Construction Costs						
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost with Installation (1)**	**Source:**	**Notes**
Mobilization	LS	1	$ 24	$ 24		10%
Erosion/Water Pollution Control	LS	1	$ 24	$ 24		10%
Project Temporary Traffic Control	LS	1	$ 24	$ 24		10%
SPCC Plan	LS	1	$ 24	$ 24		10%
Clearing and Grubbing	LF	1	$ 1	$ 2	SPU	
Remove existing paving	LF	0.20	$ 30	$ 9	WSDOT	
Regrade	CY	0.33	$ 50	$ 25		CB estimate, assume 1/3 CY total for needed regrading of each lf
Pave ROW	SY	1	$ 20	$ 30		CB estimate
Install asphalt curb and gutter	LF	1	$ 30	$ 30	WSDOT	concrete curb cost
Restoration	LF	1	$ 10	$ 10		CB estimate
TOTAL	**LF**	**1**		**$ 210**		

3 Unit Cost: Improve ROW conditions - Curb and Gutter

Construction Costs						
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost with Installation (1)**	**Source:**	**Notes**
Mobilization	LS	1	$ 5	$ 5		10%
Erosion/Water Pollution Control	LS	1	$ 5	$ 5		10%
Project Temporary Traffic Control	LS	1	$ 5	$ 5		10%
SPCC Plan	LS	1	$ 5	$ 5		10%
Clearing and Grubbing	LF	1	$ 1	$ 2	SPU	
Install berms	LF	1	$ 20	$ 20		CB estimate, assume 2/3 of curb cost
Restoration	LF	1	$ 10	$ 10		CB estimate
TOTAL	**LF**	**1**		**$ 60**		

4 Miscellaneous Unit Costs

Construction Costs						
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost with Installation (1)**	**Source:**	**Notes**
Remove culvert; includes excavation and haul	LF	1	$ 28	$ 42		
Remove CB	LS	1	$ 287	$ 430	SPU	
Remove culvert	LF	1	$ 14	$ 21	SPU	
Remove Pipe	LF	1	$ 19	$ 29		
Install CB and lateral - same side as pipe	LS	1	$ 7,100	$ 10,650	WSDOT, Tabula	assume CB cost from SPU and 10' 12" pipe from Tabula
Install CB and lateral - opposite side of pipe	LS	1	$ 21,500	$ 32,250	WSDOT, Tabula	assume CB cost from SPU and 50' 12" pipe from Tabula
Extensive Landscaping - incl trees and retaining wall	LF	1	$ 20	$ 30		assume 7 mature trees and 500' low retaining wall

(1) For items in this table where material costs were only available, 150% of unit cost was assumed to include installation cost

SPU - Seattle Public Utilities
Tabula is a computer program developed for use by King County staff and consultants to provide conveyance cost estimatesat the planning level.
WSDOT- Washington State Department of Transportation
SPCC- Spill Prevention, Control and Countermeasures

Cost Calculations for Pipe: **12" SW Pipe**

Printed date : 02/24/2015

Project year: 2015

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

- Construction Year: 2015
- Length: 1000 ft
- Conduit Type: Gravity
- Depth of Cover: 5 ft
- Trench Backfill Type: Imported
- Disposal Type: No Disposal Cost
- Manhole Spacing: None
- Existing Utilities: Average
- Dewatering: Significant
- Pavement Restoration: Half Width - Collector Street (18 ft)
- Traffic: Light
- Land Acquisition: None
- Required Easements: None
- Land Adjustment Factor: King County Average
- Trench Safety: Standard
- Pipe Diameter: 12 in.

Geometry

Outer Diameter	1.42 ft
Trench Width	4.34 ft
Excavation Depth	7.42 ft
Complete Surface Rest. Width	6.34 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,190.0	CY	13.00	15,500
Backfill	643.0	CY	34.00	21,900
Complete Pavement Restoration	705.0	SY	86.00	60,600
Overlay Pavement Restoration	1,300.0	SY	28.00	36,300
Trench Safety	14,800.0	SF	0.53	7,860
Spoil Load and Haul	1,190.0	CY	16.00	19,100
Pipe Unit Material Cost	1,000.0	lf	17.00	17,000
Pipe Installation	1,000.0	lf	25.00	25,000
Place Pipe Zone Fill	491.0	CY	34.00	16,700
Existing Utilities	1,000.0	lf	3.00	3,000
Dewatering	1,000.0	lf	80.00	80,000
Traffic Control	1,000.0	lf	8.00	8,000
			Year 2008 Subtotal	$311,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 10386 (2015)	1.18
Effective Multiplier	1.25
Construction Year 2015 Subtotal	$388,000

Tabula estimated cost:	$	388,000
Subtract Mobilization and Contractor Overhead/Profit (18%)	$	69,840
New Total:	$	318,160
Unit Cost:	$	320
Add Unit Disposal Cost ($50/cy)	$	32.15
Adjusted Unit Cost, rounded up:	$	360

Cost Calculations for Pipe: **12" SW Pipe - Heavy Traffic**

Printed date : 03/03/2015

Project year: 2015

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2015
Length: 1000 ft
Conduit Type: Gravity
Depth of Cover: 5 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Collector Street (18 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Standard
Pipe Diameter: 12 in.

Geometry

Outer Diameter	1.42 ft
Trench Width	4.34 ft
Excavation Depth	7.42 ft
Complete Surface Rest. Width	6.34 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,190.0	CY	13.00	15,500
Backfill	643.0	CY	34.00	21,900
Complete Pavement Restoration	705.0	SY	86.00	60,600
Overlay Pavement Restoration	1,300.0	SY	28.00	36,300
Trench Safety	14,800.0	SF	0.53	7,860
Spoil Load and Haul	1,190.0	CY	16.00	19,100
Pipe Unit Material Cost	1,000.0	lf	17.00	17,000
Pipe Installation	1,000.0	lf	25.00	25,000
Place Pipe Zone Fill	491.0	CY	34.00	16,700
Existing Utilities	1,000.0	lf	3.00	3,000
Dewatering	1,000.0	lf	80.00	80,000
Traffic Control	1,000.0	lf	16.00	16,000
			Year 2008 Subtotal	$319,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 10386 (2015)	1.18
Effective Multiplier	1.25
Construction Year 2015 Subtotal	$398,000

Year 2015 Total: $398,000

$	398,000	Tabula estimated cost:
$	71,640	Subtract Mobilization and Contractor Overhead/Profit (18%)
$	326,360	New Total:
$	330	Unit Cost:
$	32	Add Unit Disposal Cost ($50/cy)
$	360	Adjusted Unit Cost, rounded up:

Cost Calculations for Pipe: **18" SW Pipe**

Printed date : 02/24/2015

Project year: 2015

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2015
Length: 1000 ft
Conduit Type: Gravity
Depth of Cover: 5 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Collector Street (18 ft)
Traffic: Light
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.92 ft
Trench Width	4.99 ft
Excavation Depth	7.92 ft
Complete Surface Rest. Width	6.99 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,460.0	CY	13.00	19,000
Backfill	740.0	CY	34.00	25,100
Complete Pavement Restoration	777.0	SY	86.00	66,800
Overlay Pavement Restoration	1,220.0	SY	28.00	34,200
Trench Safety	15,800.0	SF	0.53	8,390
Spoil Load and Haul	1,460.0	CY	16.00	23,400
Pipe Unit Material Cost	1,000.0	lf	24.00	24,000
Pipe Installation	1,000.0	lf	29.00	29,000
Place Pipe Zone Fill	617.0	CY	34.00	21,000
Existing Utilities	1,000.0	lf	3.00	3,000
Dewatering	1,000.0	lf	87.00	87,000
Traffic Control	1,000.0	lf	8.00	8,000
			Year 2008 Subtotal	$349,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 10386 (2015)	1.18
Effective Multiplier	1.25
Construction Year 2015 Subtotal	$436,000

Tabula estimated cost:	$	436,000
Subtract Mobilization and Contractor Overhead/Profit (18%)	$	78,480
New Total:	$	357,520
Unit Cost:	$	360
Add Unit Disposal Cost ($50/cy)	$	37.00
Adjusted Unit Cost, rounded up:	$	400

Cost Calculations for Pipe: **18" SW Pipe Heavy Traffic**

Printed date : 03/03/2015

Project year: 2015

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2015
Length: 1000 ft
Conduit Type: Gravity
Depth of Cover: 5 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Collector Street (18 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.92 ft
Trench Width	4.99 ft
Excavation Depth	7.92 ft
Complete Surface Rest. Width	6.99 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	1,460.0	CY	13.00	19,000
Backfill	740.0	CY	34.00	25,100
Complete Pavement Restoration	777.0	SY	86.00	66,800
Overlay Pavement Restoration	1,220.0	SY	28.00	34,200
Trench Safety	15,800.0	SF	0.53	8,390
Spoil Load and Haul	1,460.0	CY	16.00	23,400
Pipe Unit Material Cost	1,000.0	lf	24.00	24,000
Pipe Installation	1,000.0	lf	29.00	29,000
Place Pipe Zone Fill	617.0	CY	34.00	21,000
Existing Utilities	1,000.0	lf	3.00	3,000
Dewatering	1,000.0	lf	87.00	87,000
Traffic Control	1,000.0	lf	16.00	16,000
			Year 2008 Subtotal	$357,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 10386 (2015)	1.18
Effective Multiplier	1.25
Construction Year 2015 Subtotal	$446,000

Year 2015 Total: $446,000

$	446,000	Tabula estimated cost:
$	80,280	Subtract Mobilization and Contractor Overhead/Profit (18%)
$	365,720	New Total:
$	370	Unit Cost:
$	37.00	Add Unit Disposal Cost ($50/cy)
$	410	Adjusted Unit Cost, rounded up:

Cost Calculations for Pipe: **18" SW Pipe 14' Deep**

Printed date : 03/03/2015

Project year: 2015

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2015
Length: 1000 ft
Conduit Type: Gravity
Depth of Cover: 14 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Collector Street (18 ft)
Traffic: Light
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Standard
Pipe Diameter: 18 in.

Geometry

Outer Diameter	1.92 ft
Trench Width	4.99 ft
Excavation Depth	16.9 ft
Complete Surface Rest. Width	6.99 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	3,130.0	CY	13.00	40,700
Backfill	2,400.0	CY	34.00	81,700
Complete Pavement Restoration	777.0	SY	86.00	66,800
Overlay Pavement Restoration	1,220.0	SY	28.00	34,200
Trench Safety	33,800.0	SF	0.53	17,900
Spoil Load and Haul	3,130.0	CY	16.00	50,000
Pipe Unit Material Cost	1,000.0	lf	24.00	24,000
Pipe Installation	1,000.0	lf	29.00	29,000
Place Pipe Zone Fill	617.0	CY	34.00	21,000
Existing Utilities	1,000.0	lf	3.00	3,000
Dewatering	1,000.0	lf	87.00	87,000
Traffic Control	1,000.0	lf	8.00	8,000
			Year 2008 Subtotal	$463,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 10386 (2015)	1.18
Effective Multiplier	1.25
Construction Year 2015 Subtotal	$579,000

Year 2015 Total: $579,000

Tabula estimated cost:	$	579,000
Subtract Mobilization and Contractor Overhead/Profit (18%)	$	104,220
New Total:	$	474,780
Unit Cost:	$	480
Add Unit Disposal Cost ($50/cy)	$	120
Adjusted Unit Cost, rounded up:	$	600

Cost Calculations for Pipe: **36" SW Pipe**

Printed date : 02/24/2015

Project year: 2015

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2015
Length: 1000 ft
Conduit Type: Gravity
Depth of Cover: 5 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Collector Street (18 ft)
Traffic: Light
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Standard
Pipe Diameter: 36 in.

Geometry

Outer Diameter	3.67 ft
Trench Width	7.27 ft
Excavation Depth	9.67 ft
Complete Surface Rest. Width	9.27 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	2,600.0	CY	13.00	33,800
Backfill	1,080.0	CY	34.00	36,600
Complete Pavement Restoration	1,030.0	SY	86.00	88,500
Overlay Pavement Restoration	970.0	SY	28.00	27,200
Trench Safety	19,300.0	SF	0.53	10,200
Spoil Load and Haul	2,600.0	CY	16.00	41,600
Pipe Unit Material Cost	1,000.0	lf	77.00	77,000
Pipe Installation	1,000.0	lf	45.00	45,000
Place Pipe Zone Fill	1,130.0	CY	34.00	38,600
Existing Utilities	1,000.0	lf	11.00	11,000
Dewatering	1,000.0	lf	107.00	107,000
Traffic Control	1,000.0	lf	12.00	12,000
			Year 2008 Subtotal	$529,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 10386 (2015)	1.18
Effective Multiplier	1.25
Construction Year 2015 Subtotal	$660,000

$	660,000	Tabula estimated cost:
$	118,800	Subtract Mobilization and Contractor Overhead/Profit (18%)
$	541,200	New Total:
$	550	Unit Cost:
$	54.00	Add Unit Disposal Cost ($50/cy)
$	600	Adjusted Unit Cost, rounded up:

Cost Calculations for Pipe: **36" SW Pipe - Heavy Traffic**

Printed date : 03/03/2015

Project year: 2015

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.).

Assumptions

Construction Year: 2015
Length: 1000 ft
Conduit Type: Gravity
Depth of Cover: 5 ft
Trench Backfill Type: Imported
Disposal Type: No Disposal Cost
Manhole Spacing: None
Existing Utilities: Average
Dewatering: Significant
Pavement Restoration: Half Width - Collector Street (18 ft)
Traffic: Heavy
Land Acquisition: None
Required Easements: None
Land Adjustment Factor: King County Average
Trench Safety: Standard
Pipe Diameter: 36 in.

Geometry

Outer Diameter	3.67 ft
Trench Width	7.27 ft
Excavation Depth	9.67 ft
Complete Surface Rest. Width	9.27 ft

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Excavation	2,600.0	CY	13.00	33,800
Backfill	1,080.0	CY	34.00	36,600
Complete Pavement Restoration	1,030.0	SY	86.00	88,500
Overlay Pavement Restoration	970.0	SY	28.00	27,200
Trench Safety	19,300.0	SF	0.53	10,200
Spoil Load and Haul	2,600.0	CY	16.00	41,600
Pipe Unit Material Cost	1,000.0	lf	77.00	77,000
Pipe Installation	1,000.0	lf	45.00	45,000
Place Pipe Zone Fill	1,130.0	CY	34.00	38,600
Existing Utilities	1,000.0	lf	11.00	11,000
Dewatering	1,000.0	lf	107.00	107,000
Traffic Control	1,000.0	lf	24.00	24,000
			Year 2008 Subtotal	$541,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 10386 (2015)	1.18
Effective Multiplier	1.25
Construction Year 2015 Subtotal	$675,000

Year 2015 Total: $675,000

Tabula estimated cost:	$	675,000
Subtract Mobilization and Contractor Overhead/Profit (18%)	$	121,500
New Total:	$	553,500
Unit Cost:	$	560
Add Unit Disposal Cost ($50/cy)	$	54.00
Adjusted Unit Cost, rounded up:	$	610

Cost Calculations for Jack and Bore: **Jack and Bore**

Printed date : 03/03/2015

Project year: 2015

The estimated construction cost below, which includes contractor overhead and profit, is for planning purposes only. The output does NOT include contingency, sales tax, or allied costs (design, permitting, construction management, etc.). Unless added as an Additional Costs item in the estimate, this cost does NOT include land acquisition costs.

Assumptions

Construction Year: 2015
Inside Diameter: 36 in.
Length: 110 ft
Dewatering: Minimal
Launch Shaft Existing Utilities: Average
Launch Shaft Excavation Depth: 15 ft
Launch Shaft Surface Restoration: Hydroseed
Retrieval Shaft Excavation Depth: 20 ft
Retrieval Shaft Surface Restoration: Hydroseed
Retrieval Shaft Existing Utilities: Average
Tunnel Easement Length: 0 ft
Easement Type: None
Traffic: Heavy
Casing Required: true
Land Adjustment Factor: King County Average

Tunnel Geometry

Outer Diameter	4.83 ft
Spoils Volume	74.6 CY
Casing Pipe Diameter	48 in

Launch Shaft Geometry

Width	16 ft
Length	27 ft
Footprint	432 SF
Volume	240 CY
Easement Footprint	2,620 SF

Retrieval Shaft Geometry

Width	16 ft
Length	22 ft
Footprint	352 SF
Volume	261 CY
Easement Footprint	2,390 SF

Miscellaneous

Spoils Loads	8 loads

Unit Costs (Basis 2008)

Item	Quantity	Unit	Unit Cost	Item Cost
Spoils Haul	74.6	CY	33.0	2,460
Launch Shaft Excavation/Backfill	240.0	CY	25.0	6,000
Launch Shaft Shoring	1,290.0	SF	37.8	48,700
Launch Shaft Existing Utilities	432.0	SF	6.0	2,590
Launch Shaft Surface Restoration	48.0	SY	3.0	144
Retrieval Shaft Excavation/Backfill	261.0	CY	25.0	6,520
Retrieval Shaft Shoring	1,520.0	SF	47.0	71,400
Retrieval Shaft Existing Utilities	352.0	SF	6.0	2,110
Retrieval Shaft Surface Restoration	39.1	SY	3.0	117
Cased Carrier Pipe Cost	110.0	ft	223.0	24,500
Boring Cost	110.0	ft	1,140.0	126,000
Tunnel Dewatering	1.0	LS	8,500.0	8,500
Traffic Control	2.0	shaft	27,600.0	55,200
			Year 2008 Subtotal	$354,000

Mobilization/Demobilization at 6%	1.06
Multiplier from ENRCCI 8815 (2008) to 10386 (2015)	1.18
Effective Multiplier	1.25
Construction Year 2015 Subtotal	$442,000

Year 2015 Total: $442,000

$	442,000	Tabula estimated cost:
$	79,560	Subtract Mobilization and Contractor Overhead/Profit (18%)
$	362,440	New Total:
$	3,300	Adjusted Unit Cost, rounded up:

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CIP Rank # 1 - Chennault Beach Drive Drainage Improvements

Construction Costs					
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**	**Notes:**
12" Gravity Storm Drain					
Install 1,400 feet of 12-inch-diameter pipe in ROW, heavy traffic	LF	1400	$ 360	$ 504,000	See Item 1 on Unit Costs worksheet
Install CBs and laterals - same side of pipe	EA	10	$ 10,650	$ 106,500	assume 1 CB every 150 ft per Mukilteo design standards
Install CB and lateral - opposite side of pipe	EA	10	$ 32,250	$ 322,500	assume 1 CB every 150 ft per Mukilteo design standards
Remove existing driveway culverts	LS	14	$ 500	$ 7,000	CB estimate, assume 1 driveway every 100 ft
Cement Concrete driveway	CY	14	$ 146	$ 2,046	SPU, assume 1 CY per driveway
TOTAL:				$ 942,046	
18" Gravity Storm Drain					
Install 730 feet of 18-inch-diameter pipe in ROW, heavy traffic	LF	730	$ 410	$ 299,300	See Item 1 on Unit Costs worksheet
Install CBs and laterals - same side of pipe	EA	5	$ 10,650	$ 53,250	assume 1 CB every 150 ft per Mukilteo design standards
Install CB and lateral - opposite side of pipe	EA	5	$ 32,250	$ 161,250	assume 1 CB every 150 ft per Mukilteo design standards
Remove existing driveway culverts	LS	8	$ 500	$ 4,000	CB estimate, assume 1 driveway every 100 ft
Cement Concrete driveway	CY	8	$ 146	$ 1,169	SPU, assume 1 CY per driveway
TOTAL:				$ 518,969	
18" Gravity Storm Outfall Pipe					
Install 170 feet of 18-inch-diameter pipe in ROW, heavy traffic	LF	170	$ 410	$ 69,700	See Item 1 on Unit Costs worksheet
remove exiting outfall	LF	170	$ 29	$ 4,970	See Item 4 on Unit Costs worksheet
TOTAL:				$ 74,670	
Improve 270 feet of shoulder ROW	LF	270	$ 210	$ 56,700	See Item 2 on Unit Costs worksheet
Maintenance Easement	SF	1500	$ 30	$ 45,000	
Annual O&M Cost	EA	15	$ 50	$ 750	assume 1/2 of CBs inspected and cleaned per year

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CIP Rank # 2 - Mukilteo Lane Drainage Improvements

Construction Costs					
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**	**Notes:**
Gravity line: Install 2,100 feet of 12" pipe in ROW, heavy traffic	LS	2100	$ 360	$ 756,000	See Item 1 on Unit Costs worksheet
Install CBs and laterals - same side of pipe	EA	14	$ 10,650	$ 149,100	assume 1 CB every 150 ft per Mukilteo design standards
TOTAL:				$ 905,100	
Gravity Storm Drain					
Replace 1,260 feet of pipe with 12" pipe in ROW, heavy traffic, heavy traffic	LF	1260	$ 360	$ 453,600	See Item 1 on Unit Costs worksheet
Demolition of existing pipe	LF	1260	$ 42	$ 52,920	See Item 4 on Unit Costs worksheet
Install CBs and laterals - same side of pipe	EA	9	$ 10,650	$ 95,850	assume 1 CB every 150 ft per Mukilteo design standards
TOTAL:				$ 506,520	
Gravity line: Install 230 feet of 36" pipe in ROW, heavy traffic	LF	320	$ 610	$195,200	See Item 1 on Unit Costs worksheet
Gravity Storm Drain					
Replace 640 feet of pipe with 36-inch-diameter pipe in ROW, heavy traffic	LF	640	$ 610	$ 390,400	See Item 1 on Unit Costs worksheet
Demolition of existing pipe	LF	640	$ 29	$ 18,711	See Item 4 on Unit Costs worksheet
Install CBs and laterals - same side of pipe	EA	5	$ 10,650	$ 53,250	assume 1 CB every 150 ft per Mukilteo design standards
TOTAL:				$ 409,111	
48-inch jack and bore underneath railroad with 36-inch carrier pipe	LF	110	$ 3,300	$ 363,000	See Item 1 on Unit Costs worksheet
Contaminated Soil Removal	CY	1613	$ 100	$ 161,333	Area is 20' along pipe between 1st Street and Front Street. Unit cost from City of Everett smelter clean up
Install a 130 by 12 by 10 sediment collection vault in ROW	LS	1	$ 289,500	$ 289,500	based on vendor quote, added 50% for installation (earthwork, subgrade prep, etc.)
Annual O&M Cost	EA	14	$ 50	$ 700	assume 1/2 of CBs inspected and cleaned per year

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CIP Rank # 3 - 84th Street SW (West) Storm Drainage Improvements

Construction Costs					
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**	**Notes:**
Gravity Storm Drain					
Install 1,080 feet of 12-inch-diameter pipe in ROW	LF	1080	$ 360	$ 388,800	See Item 1 on Unit Costs worksheet
Install CB and lateral - same side as pipe	EA	8	$ 10,650	$ 85,200	assume 1 CB every 150 ft per Mukilteo design standards
Remove Pipe/culvert	LF	1080	$ 29	$ 31,574	Assume equal to installed pipe length.
Remove CB	EA	3	$ 430	$ 1,290	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	11	$ 500	$ 5,500	assume 1 driveway every 100 ft
Cement Concrete driveway	CY	11	$ 146	$ 1,608	assume 1 CY per driveway
TOTAL:				$ 513,972	
Install 60 feet of 36-inch-diameter pipe in ROW	LF	60	$ 600	$ 36,000	See Item 1 on Unit Costs worksheet
Remove existing pipe	LF	60	$ 29	$ 1,754	See Item 4 on Unit Costs worksheet
TOTAL:				$ 37,754	
Annual O&M Cost	EA	4	$ 50	$ 200	assume 1/2 of CBs inspected and cleaned per year

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CIP Rank # 4 & 5 - 64th Place W and 66th Place W Street Drainage Improvements

Construction Costs					
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**	**Notes:**
Gravity Storm Drain					
Install 750 feet of 12-inch-diameter pipe in ROW	LF	750	$ 360	$ 270,000	See Item 1 on Unit Costs worksheet
Install CB and lateral - same side as pipe	EA	5	$ 10,650	$ 53,250	assume 1 CB every 150 ft per Mukilteo design standards
Install CB and lateral - opposite side of pipe	EA	5	$ 32,250	$ 161,250	assume 1 CB every 150 ft per Mukilteo design standards
Remove Pipe/culvert	LF	750	$ 29	$ 21,926	Assume equal to installed pipe length.
Remove CB	EA	2	$ 430	$ 860	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	8	$ 500	$ 4,000	assume 1 driveway every 100 ft
Cement Concrete driveway	CY	8	$ 97	$ 1,169	assume 1 CY per driveway
Replace extensive landscaping	LF	750	$ 30	$ 22,500	See Item 4 on Unit Costs worksheet
TOTAL:				$ 534,956	
Annual O&M Cost	EA	5	$ 50	$ 250	assume 1/2 of CBs inspected and cleaned per year
Gravity Storm Drain					
Install 880 feet of 12-inch-diameter pipe in ROW	LF	880	$ 360	$ 316,800	See Item 1 on Unit Costs worksheet
Install CB and lateral - same side as pipe	EA	6	$ 10,650	$ 63,900	assume 1 CB every 150 ft per Mukilteo design standards
Install CB and lateral - opposite side of pipe	EA	6	$ 32,250	$ 193,500	assume 1 CB every 150 ft per Mukilteo design standards
Remove Pipe/culvert	LF	880	$ 29	$ 25,727	Assume equal to installed pipe length.
Remove CB	EA	2	$ 430	$ 860	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	9	$ 500	$ 4,500	assume 1 driveway every 100 ft
Cement Concrete driveway	CY	9	$ 146	$ 1,316	assume 1 CY per driveway
Replace extensive landscaping	LF	880	$ 30	$ 26,400	See Item 4 on Unit Costs worksheet
TOTAL:				$ 633,002	
Annual O&M Cost	EA	6	$ 50	$ 300	assume 1/2 of CBs inspected and cleaned per year

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CIP Rank # 6 - Central Drive Storm Drainage Improvements for Big Gulch Basin

Construction Costs					
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**	**Notes:**
Gravity Storm Drain					
Replace 320 feet of 18-inch-diameter pipe in ROW	LF	320	$ 400	$ 128,000	See Item 1 on Unit Costs worksheet
Install CB and lateral - same side as pipe	EA	3	$ 10,650	$ 31,950	assume 1 CB every 150 ft per Mukilteo design standards
Install CB and lateral - opposite side of pipe	EA	3	$ 32,250	$ 96,750	assume 1 CB every 150 ft per Mukilteo design standards
Remove Pipe/culvert	LF	320	$ 29	$ 9,355	Assume equal to installed pipe length.
Remove CB	EA	1	$ 430	$ 430	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	3	$ 500	$ 1,500	assume 1 driveway every 100 ft
Cement Concrete driveway	CY	3	$ 146	$ 439	assume 1 CY per driveway
TOTAL:				$ 268,424	
Gravity Storm Drain					
Install 2,650 feet of 12-inch-diameter pipe in ROW	LF	2650	$ 360	$ 954,000	See Item 1 on Unit Costs worksheet
Install CB and lateral - same side as pipe	EA	18	$ 10,650	$ 191,700	assume 1 CB every 150 ft per Mukilteo design standards
Install CB and lateral - opposite side of pipe	EA	18	$ 32,250	$ 580,500	assume 1 CB every 150 ft per Mukilteo design standards
Remove Pipe/culvert	LF	2650	$ 29	$ 77,473	Assume equal to installed pipe length.
Remove CB	EA	6	$ 430	$ 2,580	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	27	$ 500	$ 13,500	assume 1 driveway every 100 ft
Cement Concrete driveway	CY	27	$ 146	$ 3,947	assume 1 CY per driveway
TOTAL:				$ 1,823,700	
Maintenance Easement	SF	5700	$ 30	$ 171,000	assume 15' wide easement and measured length
Annual O&M Cost	EA	21	$ 50	$ 1,050	assume 1/2 of CBs inspected and cleaned per year

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CIP Rank # 7 - 62nd Place W/Canyon Drive Storm Drainage Improvements

Construction Costs					
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**	**Notes:**
Gravity Storm Drain					
Install 1,270 feet of 12-inch-diameter pipe in ROW	LF	1270	$ 360	$ 457,200	See Item 1 on Unit Costs worksheet
Install CB and lateral - same side as pipe	EA	9	$ 10,650	$ 95,850	assume 1 CB every 150 ft per Mukilteo design standards
Install CB and lateral - opposite side of pipe	EA	9	$ 32,250	$ 290,250	assume 1 CB every 150 ft per Mukilteo design standards
Remove Pipe/culvert	LF	1270	$ 29	$ 37,129	Assume equal to installed pipe length.
Remove CB	EA	3	$ 430	$ 1,290	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	13	$ 500	$ 6,500	CB estimate, assume 1 driveway every 100 ft
Cement Concrete driveway	CY	13	$ 146	$ 1,900	SPU, assume 1 CY per driveway
TOTAL:				$ 890,119	
Gravity Storm Drain					
Install 390 feet of 18-inch-diameter pipe in ROW, 14 feet deep	LF	390	$ 600	$ 234,000	See Item 1 on Unit Costs worksheet
Install CB and lateral - same side as pipe	EA	3	$ 10,650	$ 31,950	assume 1 CB every 150 ft per Mukilteo design standards
Install CB and lateral - opposite side of pipe	EA	3	$ 32,250	$ 96,750	assume 1 CB every 150 ft per Mukilteo design standards
Remove Pipe/culvert	LF	390	$ 29	$ 11,402	Assume equal to installed pipe length.
Remove CB	EA	1	$ 430	$ 430	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	4	$ 500	$ 2,000	CB estimate, assume 1 driveway every 100 ft
Cement Concrete driveway	CY	4	$ 146	$ 584.70	SPU, assume 1 CY per driveway
TOTAL:				$ 377,116	
Annual O&M Cost	EA	12	$ 50	$ 600	assume 1/2 of CBs inspected and cleaned per year

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CIP Rank # 8 - 10th Street and Loveland Avenue Storm Drainage Improvements

Construction Costs					
Item	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**	**Notes:**
Gravity Storm Drain					
Install 400 feet of 12-inch-diameter pipe in ROW	LF	400	$ 360	$ 144,000	See Item 1 on Unit Costs worksheet
Remove Pipe/culvert	LF	400	$ 29	$ 11,694	Assume equal to installed pipe length.
Remove CB	EA	1	$ 430	$ 430	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	4	$ 500	$ 2,000	CB estimate, assume 1 driveway every 100 ft
Cement Concrete driveway	CY	4	$ 97	$ 585	SPU, assume 1 CY per driveway
TOTAL:				$ 158,709	
Gravity Storm Drain					
Replace 180 feet of 12-inch-diameter pipe in ROW	LF	180	$ 360	$ 64,800	See Item 1 on Unit Costs worksheet
Remove Pipe/culvert	LF	180	$ 29	$ 5,262	Assume equal to installed pipe length.
Remove CB	EA	1	$ 430	$ 430	assume remove 1 CB every 500 ft
Remove existing driveway culverts	LS	2	$ 500	$ 1,000	CB estimate, assume 1 driveway every 100 ft
Cement Concrete driveway	CY	2	$ 146	$ 292.35	SPU, assume 1 CY per driveway
Demolition of existing pipe	LF	180	$ 29	$ 5,262	See Item 4 on Unit Costs worksheet
TOTAL:				$ 77,047	
Install CB and lateral - same side as pipe	EA	8	$ 10,650	$ 85,200	Quantity estimate City instruction
Improve 500 feet of ROW shoulder	LS	500	$ 60	$ 30,000	See Item 3 on Unit Costs worksheet
Annual O&M Cost	EA	4	$ 50	$ 200	assume 1/2 of CBs inspected and cleaned per year

Attachment B: Hydrologic Modeling and Pipe Sizing Summary

HEC-HMS model subbasins and junctions are shown the Figures B-1 through B-3. Subbasin input values are summarized on Table B-1. Design flows and locations of design flows (subbasin or junction) are summarized in Table B-2.

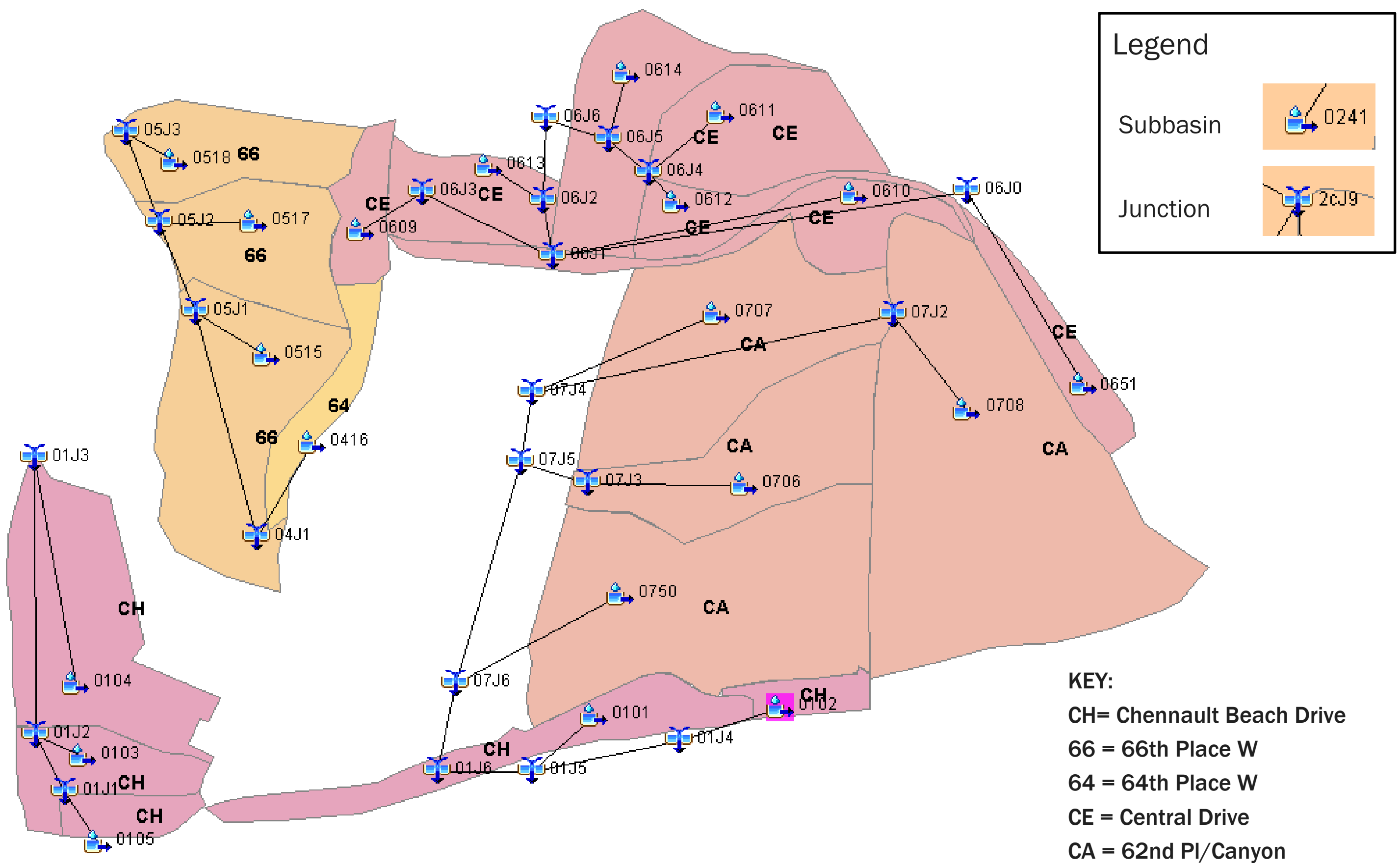

Figure B-1. HEC-HMS Subbasins and Junctions for CIP Rank 1 (Chennault Beach Drive), Rank 4 (64th Place W), Rank 5 (66th Place W), Rank 6 (Central Drive), and Rank 7 (62nd Pl/Canyon).

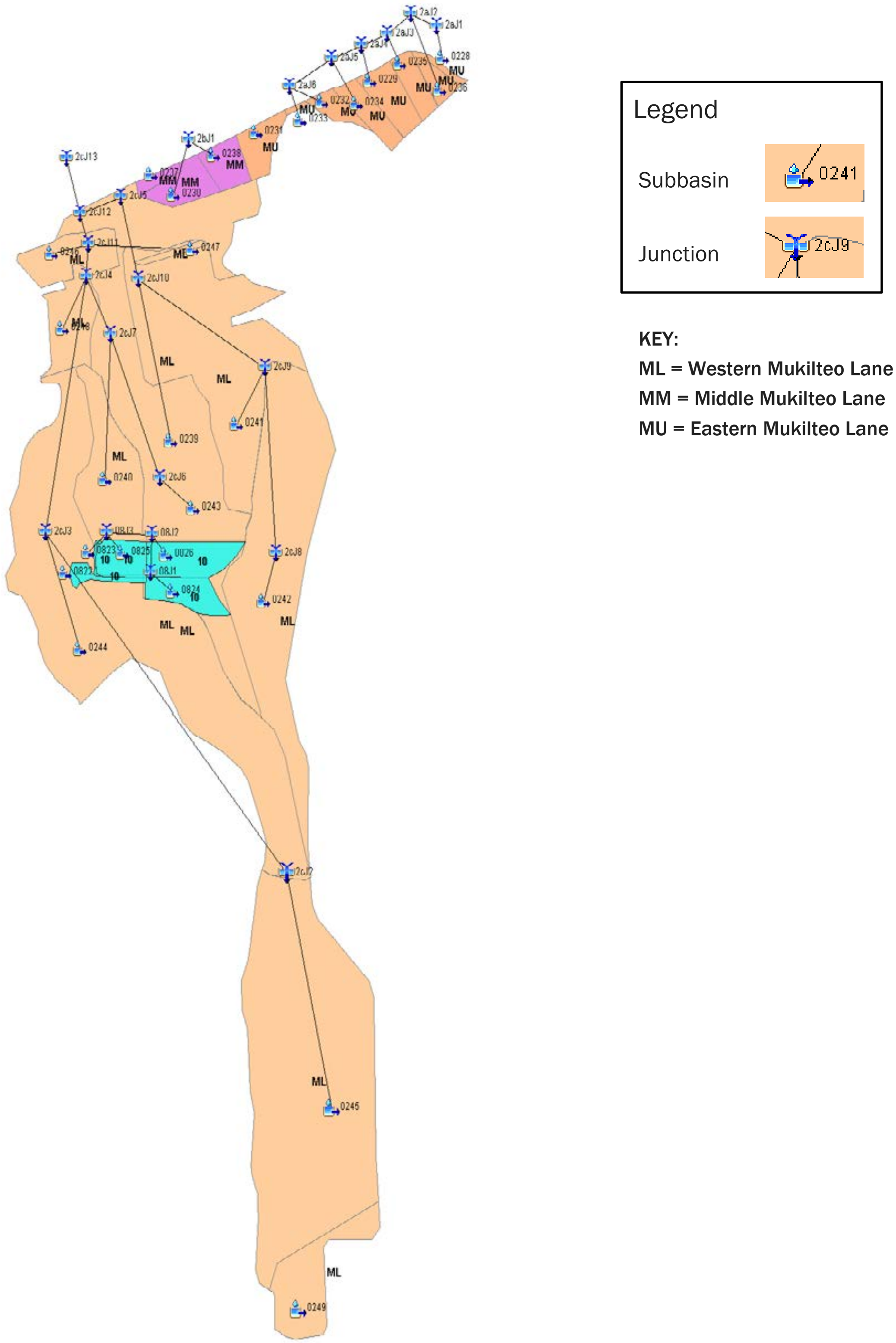

Figure B-2. HEC-HMS Subbasins and Junctions for CIP Rank 2 (Mukilteo Lane)

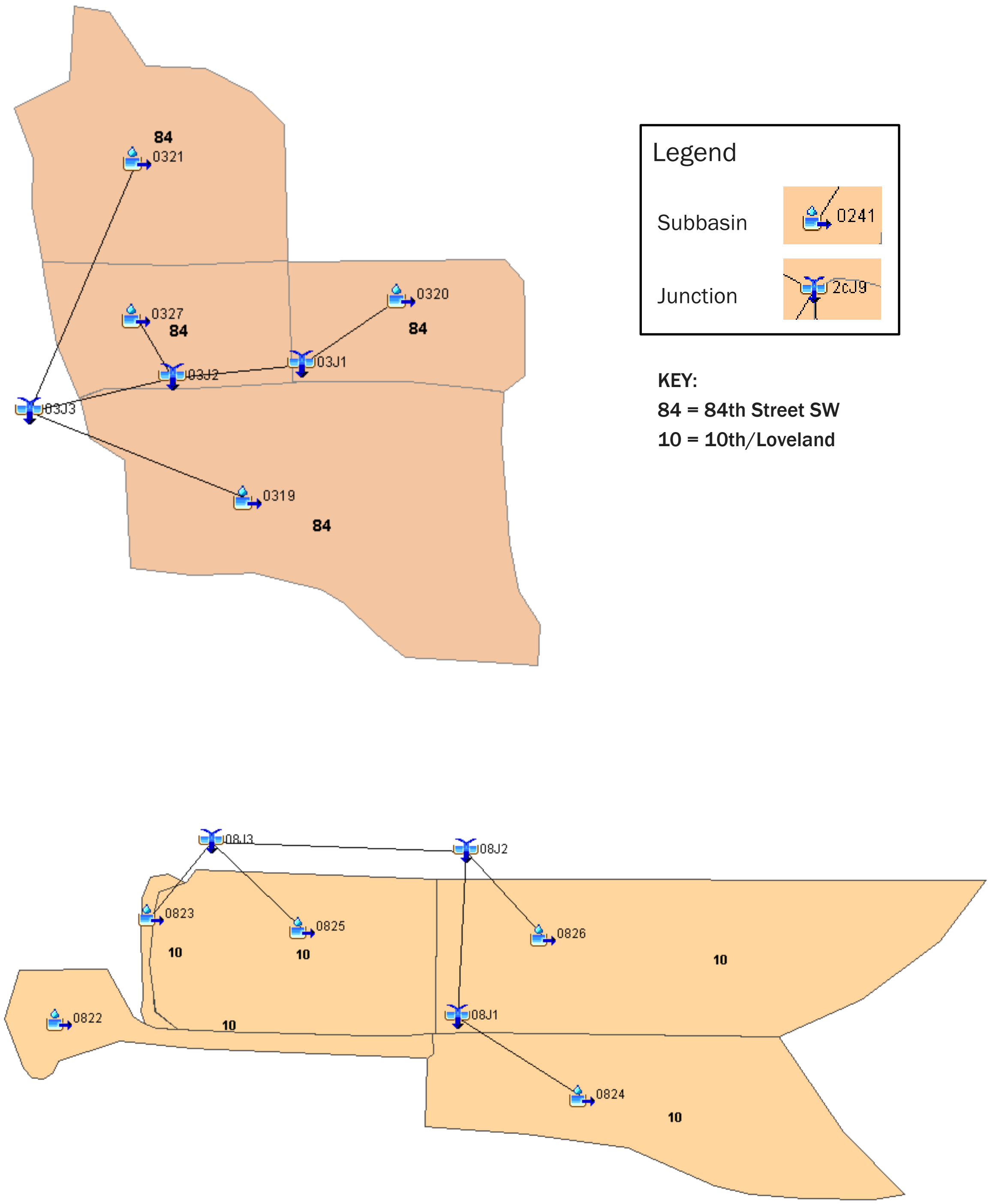

Figure B-3. HEC-HMS Subbasins and Junctions for CIP Rank 3 (84th St SW) and Rank 8 (10th/Loveland)

Table B-1. CIP Hydrologic Modeling Input Values							
CIP Rank No.	Project Short Name	HEC-HMS Subbasin ID	Area (acre)	Composite Curve Number	Average Basin Slope (percent)	Hydraulic Length (feet)	Lag Time [a] (hours)
1	Chennault Beach Drive	101	2.90	83	12.1	1,326	6.2
1	Chennault Beach Drive	102	0.73	83	12.3	393	2.3
1	Chennault Beach Drive	103	1.90	83	8.5	570	3.8
1	Chennault Beach Drive	104	5.39	83	11.8	881	4.5
1	Chennault Beach Drive	105	0.87	83	7.8	374	2.8
2	Mukilteo Lane	228	0.4	83	7.8	722	4.8
2	Mukilteo Lane	229	3.49	85	11.2	830	4.1
2	Mukilteo Lane	230	3.15	79	19.5	804	3.8
2	Mukilteo Lane	231	2.74	82	19.3	805	3.5
2	Mukilteo Lane	232	1.62	86	18.8	686	2.7
2	Mukilteo Lane	233	0.20	75	12.9	208	1.7
2	Mukilteo Lane	234	2.61	86	16.4	806	3.2
2	Mukilteo Lane	235	2.23	83	8.8	638	4.1
2	Mukilteo Lane	236	1.57	83	8.5	483	3.3
2	Mukilteo Lane	237	0.87	86	17.9	511	2.1
2	Mukilteo Lane	238	2.69	76	19.0	373	2.2
2	Mukilteo Lane	239	42.60	74	16.3	3,877	16.6
2	Mukilteo Lane	240	11.59	79	18.2	1,306	5.7
2	Mukilteo Lane	241	34.45	70	13.8	2,967	16.5
2	Mukilteo Lane	242	36.07	78	13.8	3,429	14.5
2	Mukilteo Lane	243	15.02	83	8.8	2,450	12.0
2	Mukilteo Lane	244	60.46	81	16.4	5,141	16.6
2	Mukilteo Lane	245	62.25	74	7.3	3,105	21.2
2	Mukilteo Lane	246	5.66	90	14.7	572	2.2
2	Mukilteo Lane	247	0.64	98	5.6	781	3.1
2	Mukilteo Lane	248	6.20	80	17.0	754	3.6
2	Mukilteo Lane	249	8.56	90	7.9	850	4.2
3	84th Street SW	319	17.5	87	9.7	1,625	7.2
3	84th Street SW	320	5.60	87	11.0	915	4.3
3	84th Street SW	321	9.83	83	7.8	978	6.1
3	84th Street SW	327	5.74	83	10.2	640	3.8
4	64th Place W	416	1.25	83	9.0	706	4.4
5	66th Place W	515	5.64	83	14.0	791	3.8
5	66th Place W	517	3.11	83	16.4	546	2.6

Table B-1. CIP Hydrologic Modeling Input Values							
CIP Rank No.	Project Short Name	HEC-HMS Subbasin ID	Area (acre)	Composite Curve Number	Average Basin Slope (percent)	Hydraulic Length (feet)	Lag Time [a] (hours)
5	66th Place W	518	2.85	83	14.3	693	3.4
6	Central Drive	609	1.21	83	12.4	189	1.3
6	Central Drive	610	2.61	78	12.0	1241	6.9
6	Central Drive	611	3.44	83	10.5	774	4.4
6	Central Drive	612	1.49	83	12.2	1,206	5.8
6	Central Drive	613	2.26	83	11.2	706	3.9
6	Central Drive	614	3.75	83	12.3	652	3.5
6	Central Drive	651	1.45	83	5.3	774	6.1
7	62nd Pl/Canyon	706	4.46	83	14.3	840	4.0
7	62nd Pl/Canyon	707	6.84	83	11.9	921	4.7
7	62nd Pl/Canyon	708	14.14	73	9.3	1,252	9.2
7	62nd Pl/Canyon	750	8.99	83	13.5	1,185	5.4
8	10th/Loveland	822	1.02	83	6.5	659	4.9
8	10th/Loveland	823	0.15	83	4.0	275	3.1
8	10th/Loveland	824	3.29	83	6.9	982	6.5
8	10th/Loveland	825	2.82	83	6.9	605	4.4
8	10th/Loveland	826	4.66	83	8.8	862	5.2

a. *Method outlined n NRCS 1997 Engineering Handbook, Part 630 Hydrology.*

Table B-2. CIP Hydrologic Modeling Results and Pipe Sizing Summary								
CIP Rank No.	Project Short Name	HEC-HMS Subbasin or Junction ID	GIS Pipe ID	HEC-HMS Design Flow [a] (cfs)	Maximum Conveyance Capacity of Proposed Pipe [b] (cfs)	Proposed Pipe Length (feet)	Proposed Pipe Slope [c] (feet/feet)	Proposed Pipe Size (in)
1	Chennault Beach Drive	01J5	C0101	1.6	16.5	999	0.184	12
1	Chennault Beach Drive	01J1	C0125	0.39	11.9	386	0.096	12
1	Chennault Beach Drive	01J6	C0103	9.19	25.1	729	0.049	18
1	Chennault Beach Drive	01J6	C0157	9.19	36.2	167	0.102	18
2	Mukilteo Lane	2aJ6	C0204	3.89	12	785	0.097	12
2	Mukilteo Lane	2aJ6	C0235	3.89	9.4	467	0.060	12
2	Mukilteo Lane	2aJ6	C0238	3.89	8.4	455	0.048	12
2	Mukilteo Lane	2bJ1	C0206	1.18	3	683	0.006	12
2	Mukilteo Lane	2bJ1	C0234	1.18	3	720	0.006	12
2	Mukilteo Lane	0231	C0249	0.71	4.9	246	0.016	12
2	Mukilteo Lane	2cJ5	C0248	26.72	190.3	100	0.070	36
2	Mukilteo Lane	2cJ5	C0208	26.72	82	232	0.013	36
2	Mukilteo Lane	2cJ12	C0263	66.45	88.1	542	0.015	36
3	84th Street SW	03J1	C0309	2.27	8.8	419	0.053	12
3	84th Street SW	03J2	C0327	4.08	9.6	615	0.062	12
3	84th Street SW	0321	C0371	2.84	11.9	42	0.096	12
3	84th Street SW	03J3	C0360	12.7	217	55	0.091	36
4	64th Place W	04J1	C4510	0.5	11.6	748	0.091	12
5	66th Place W	05J3	C4511	3.88	11.3	875	0.087	12
6	Central Drive	06J0	C0653	0.65	7.8	341	0.041	12
6	Central Drive	06J1	C0612	1.98	12.1	1250	0.099	12
6	Central Drive	06J6	C0615	5.73	17.2	84	0.201	12
6	Central Drive	06J2	C0631	2.74	9.9	301	0.066	12
6	Central Drive	06J5	C0629	2.99	3.2	292	0.007	12
6	Central Drive	06J5	C0630	2.99	6.7	271	0.030	12
6	Central Drive	06J6	C0615	5.73	17.2	84	0.201	12
6	Central Drive	06J6	C0654	5.73	14.8	241	0.017	18
7	62nd Pl/Canyon	07J4	C0717	3.54	14.5	637	0.143	12
7	62nd Pl/Canyon	0707	C0718	2.18	2.7	151	0.005	12
7	62nd Pl/Canyon	07J5	C0769	5.14	7.9	480	0.042	12
7	62nd Pl/Canyon	07J6	C0772	7.60	8.8	386	0.006	18

Table B-2. CIP Hydrologic Modeling Results and Pipe Sizing Summary								
CIP Rank No.	Project Short Name	HEC-HMS Subbasin or Junction ID	GIS Pipe ID	HEC-HMS Design Flow [a] (cfs)	Maximum Conveyance Capacity of Proposed Pipe [b] (cfs)	Proposed Pipe Length (feet)	Proposed Pipe Slope [c] (feet/feet)	Proposed Pipe Size (in)
8	10th/Loveland	0823	C0822	0.09	7.8	266	0.041	12
8	10th/Loveland	0824	C0823	1.13	16.3	123	0.179	12
8	10th/Loveland	0822	C0864	0.45	11.6	175	0.091	12

a. *CIP pipes that are part of the Mukilteo Lane project and that convey Brewery Creek (C0248, C0208, C0263) are sized based on 100-year flow. All other CIP pipes are sized to convey the 25-year flow.*

b. *Calculated with Manning's equation assuming proposed pipe is 94% full.*

c. *CIP pipe slope assumed to match the existing pipe slope as estimated from pipe invert elevations in GIS where available. When pipe invert elevations were not available, pipe slope was assumed to match ground surface slope (based on 2-foot contour data) with a minimum slope of 0.005 ft/ft.*