



RESOLUTION
(49 - 2016)

**A RESOLUTION OF CITY COUNCIL FOR THE CITY OF FAIRVIEW, OREGON
ADOPTING THE 2016 UPDATE TO THE CONSOLIDATED STORMWATER
MASTER PLAN**

WHEREAS, the City of Fairview has numerous capital improvement plans, permits, permit required documents relating to stormwater quantity and quality, and

WHEREAS, it is the City's ongoing desire to consolidate these numerous documents into one "Consolidated Stormwater Master Plan" that can be used by staff to prioritize projects and review rates and system development charges, and

WHEREAS, the City of Fairview contracted with Brown and Caldwell to update the 2007 Consolidated Stormwater Master Plan, and

WHEREAS, Brown and Caldwell has completed the work including reviewing the existing documents, interviewing City staff, working with staff to prioritize and rank selected projects, and providing cost estimates for the selected projects, and

WHEREAS, all these findings are included in the final document developed by Brown and Caldwell titled "Consolidated Stormwater Master Plan Update 2016" dated August 2016.

NOW, THEREFORE, BE IT RESOLVED BY THE FAIRVIEW CITY COUNCIL AS FOLLOWS:

Section 1 The Fairview City Council adopts the Consolidated Stormwater Master Plan Update 2016.

Section 2 This resolution is and shall be effective from and after its passage by the City Council.

Resolution adopted by the City Council of the City of Fairview, this 16th day of November, 2016.

Mayor, City of Fairview
Ted Tosterud

ATTEST

City Recorder, City of Fairview
Devree Leymaster

11-28-2016

Date

Consolidated Stormwater Master Plan Update

Prepared for
City of Fairview, Oregon
August 9, 2016



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List of Abbreviations

BC	Brown and Caldwell
CIP	capital improvement program
City	City of Fairview
County	Multnomah County
CP	capital project
CSMP	Consolidated Stormwater Master Plan
DEQ	(Oregon) Department of Environmental Quality
ft	foot/feet
FV	Fairview Creek Subbasin (projects)
GN	general/programmatic (projects)
GW	groundwater (projects)
ID	identifier
LF	linear foot/feet
MS4	municipal separate storm sewer system
NN	No Name Creek Subbasin (projects)
NPDES	National Pollutant Discharge Elimination System
OS	Osborn Creek Subbasin (projects)
RT	Raintree Creek Subbasin (projects)
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
UIC	underground injection control
UPRR	Union Pacific Railroad

Foreword

This document is an update to the City of Fairview's (City) 2007 Consolidated Stormwater Master Plan (CSMP) (BC 2007). This update documents the stormwater capital projects (CPs) completed since 2007 and outlines the project priorities for the next 5 to 10 years. This CSMP update includes refinement of select existing and unconstructed CPs and the addition of new CPs per City objectives. Additional analysis has been included to add asset management elements, specifically routine system inspections and replacement of aging infrastructure, to the City's stormwater program planning. Updated costs and project prioritization and scheduling are also included.

This CSMP update should be used in conjunction with the 2007 CSMP, which includes detailed information regarding project background, hydrologic and hydraulic modeling, and initial CP development.

Section 1

Introduction

The City of Fairview, Oregon, includes 3.1 square miles of urbanized area situated around Fairview Lake in northeast Multnomah County. The area includes many historical developments as well as recent developments and regional recreational areas. As a heavily urbanized area, the City of Fairview (City) must manage stormwater runoff to protect public safety and maintain water quality. This Consolidated Stormwater Master Plan (CSMP) update provides an opportunity for the City to improve public safety, water quality, and aesthetic benefits while addressing storm drain capacity in several flood-prone areas.

The City has a combination of aging infrastructure from earlier developments as well as new pipe systems and stormwater management ponds that have been installed with recent developments. Stormwater runoff from the city is managed through a municipal separate storm sewer system (MS4) that discharges to the natural drainage systems of Fairview Creek, Osborne Creek, No Name Creek, and Fairview Lake. The city is experiencing increasing development activity, both within city limits and upstream in areas of Wood Village and Gresham. Stormwater master planning provides one mechanism through which to anticipate and address infrastructure needs in conjunction with development and expansion. This CSMP update includes prioritized stormwater capital projects (CPs) that, along with the City's ongoing stormwater program, which includes development standards and operational maintenance, will serve as tools to proactively address stormwater management.

1.1 Objectives and Approach

The City's stormwater program has previously been guided by a 2007 CSMP (BC 2007) that prioritized 21 stormwater-related CPs. Over the last 10 years, the City's stormwater program has successfully implemented projects from the 2007 CSMP. The City needs an updated stormwater project priority list to guide stormwater program priorities over the next planning period.

The objectives of this CSMP update are:

- Review current stormwater-related problem areas and completed projects
- Update the stormwater CPs list to reflect current and projected needs
- Update cost estimates based on 2016 construction prices and refined project descriptions
- Prioritize projects to outline an implementation plan for the next 5 to 10 years

The result is an updated capital improvement program (CIP) that should guide City staff in implementing stormwater-related projects to address City watershed goals. The project cost estimates should inform development of the City's stormwater utility and fee rate structure and can be used to seek additional funding sources, such as grants and loans, where appropriate.

1.2 Approach

The development of this CSMP update is based extensively on the work completed to develop the 2007 CSMP. No additional data collection or modeling was performed. Brown and Caldwell (BC) conducted a thorough review of the 2007 CSMP as well as the related documents outlined in Section 1.4.

Based on existing information, a project review workshop was conducted with City staff to identify current and projected problem areas and review the projects from the 2007 CSMP. Based on the outcome from that workshop (see Section 2.1), a project summary matrix was developed to guide the development of the updated CPs list. Limited field investigations were performed to verify proposed projects and visually investigate design alternatives. Following the field investigations, detailed project fact sheets were developed for each proposed CP, along with updated cost estimates.

Similar to the 2007 CSMP, project priorities were established based on pre-selected prioritization criteria, as described in Section 3.

1.3 Recommendations

This CSMP update prioritizes 14 CPs and 2 asset management initiatives to support successful implementation of the City's stormwater program. Figure 1-1 shows the locations of proposed CPs. Asset management and general/programmatic CPs are conducted on a citywide basis and not depicted geographically on the map.

The CPs in this CSMP update include replacement projects to maintain existing infrastructure, capacity improvements and storage projects to address flooding along Fairview Creek and No Name Creek, and stormwater facility retrofits and green street installations to improve water quality treatment. Private property planting projects from the 2007 CSMP have been removed from the CSMP update, so that the current CPs list is focused on projects that can be completed on public property.

Most projects prioritized in this CSMP update were included in the 2007 CSMP, though some projects have been modified or redefined to address new or multiple objectives. New projects have been added to incorporate asset management elements into the City's stormwater program. Such elements include ongoing system inspections, updated hydraulic modeling, and replacements of aging infrastructure.

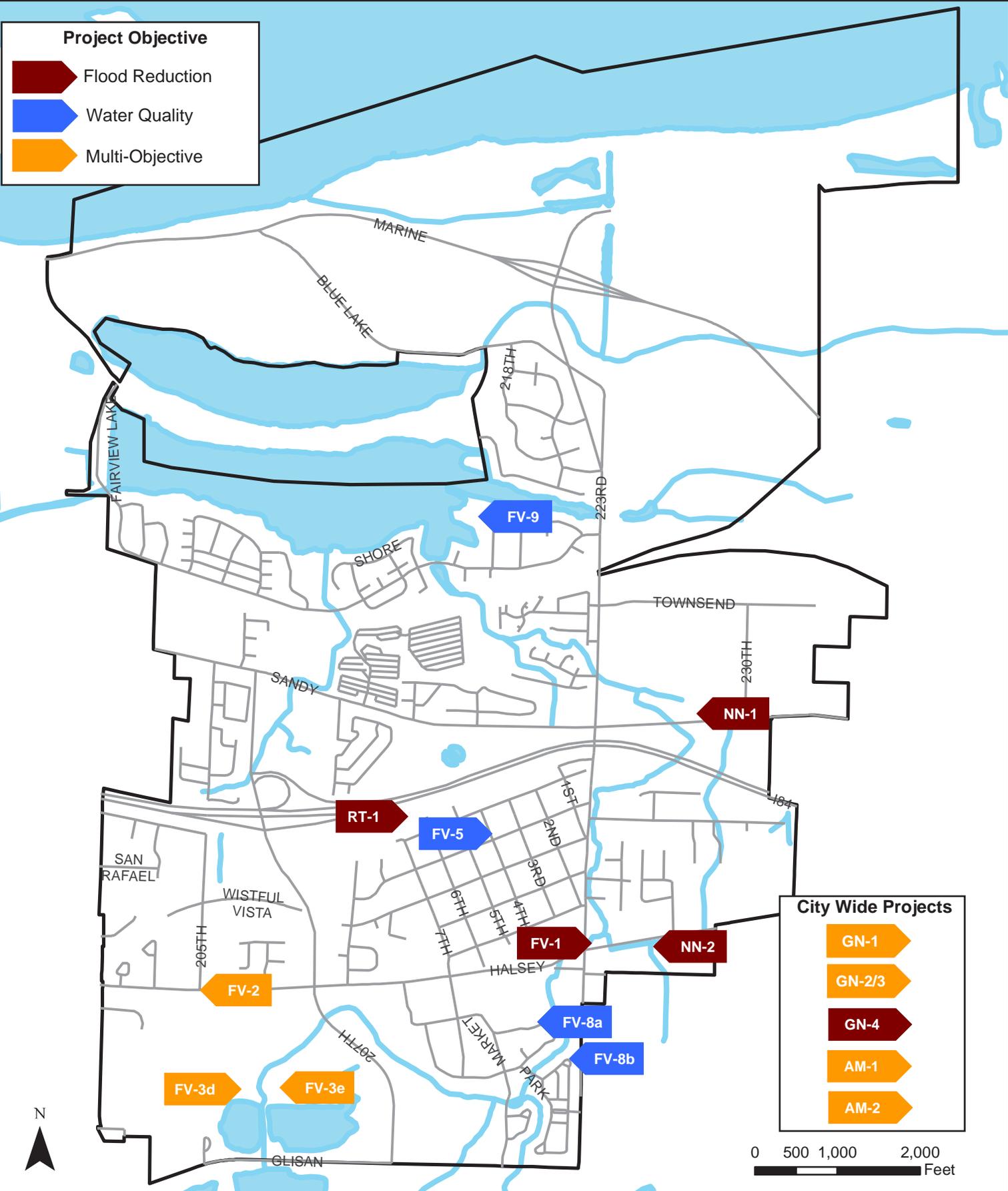
1.4 Related Reports

The CP and capital improvement program (CIP) recommendations in this CSMP update form the framework for the City's stormwater management program. However, the City is under additional regulatory obligations that influence program priorities and decision making. Namely, the City is operating under a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer (MS4) permit issued by the Oregon Department of Environmental Quality (DEQ) and is subject to total maximum daily load (TMDL) wasteload allocations issued by DEQ through the Willamette Basin TMDL (2006) and the Columbia Slough TMDL (1998).

Obligations related to the NPDES MS4 Phase I Permit are outlined in the City's Stormwater Management Plan (2011). As part of the NPDES MS4 permit compliance activities, the City has developed a stormwater quality retrofit strategy (BC 2014b) and a hydromodification assessment (Cardno 2014). The stormwater retrofit strategy points to the need for a CSMP update to refine project needs and clarify preliminary designs and costs. The hydromodification assessment does not identify specific project recommendations. Rather, the study points to the use of low-impact development approaches for development and redevelopment and use of flow duration matching for flow control design as strategies to prevent further hydromodification in the city's stream channels. The project recommendations in this CSMP update are consistent with the recommendations in the retrofit strategy and hydromodification assessment.

Project Objective

-  Flood Reduction
-  Water Quality
-  Multi-Objective



**CITY OF FAIRVIEW
CSMP UPDATE**

Figure 1-1

Capital Project Overview



Obligations related to TMDL compliance are outlined in the City's TMDL Implementation Plan (BC 2014a). Management strategies related to instream temperature control are highlighted and include riparian planting and revegetation, the enforcement of riparian buffers, and promotion of infiltration through stormwater design standards. The TMDL Implementation Plan also references the CSMP update as one method of implementation (BC 2014a). Although this CSMP update omits planting projects on private property because of the limited ability of the City to obtain authorization and manage activities on private property, select CPs continue to include a planting and vegetation element to address objectives of the TMDL Implementation Plan.

Section 2

Project and Program Recommendations

The primary objective of stormwater master plan development is to establish a current list of stormwater-related projects and activities that can be prioritized for implementation. The resulting project list should reflect current and projected needs and address known flooding and water quality problem areas.

As a result of the CP and program evaluation conducted for the City of Fairview, this CSMP update includes 14 stormwater CPs and 2 asset management initiatives to support successful implementation of the City's stormwater program. The projects address flow control, flood storage, water quality, maintenance, and asset management objectives. On occasion, a single project meets multiple objectives.

Projects have been developed or redefined based on comprehensive evaluation of past work, including the 2007 CSMP and other related reports and studies. The project team also conducted limited site visits to visually verify proposed projects and evaluate potential design alternatives. No additional hydrologic or hydraulic modeling or detailed field data collection was performed to support development of the proposed CPs.

Section 3 provides implementation guidance related to prioritization and scheduling of the projects over the next 5 to 10 years.

2.1 2007 CSMP Project Review

The 2007 CSMP included an extensive evaluation of stormwater-related problem areas based on City staff knowledge, past complaints, and hydraulic modeling to evaluate the capacity of the existing stormwater infrastructure. The hydraulic capacity analysis evaluated both existing flow conditions and the future "buildout" scenario assuming that all contributing drainage basins were developed to full density as allowed under the current zoning. The resulting list of stormwater CPs considered long-term development scenarios in identifying project needs.

One objective of this (2016) CSMP update was to use staff knowledge to evaluate the projects from the 2007 CSMP with respect to flooding incidents over the last 10 years. In particular, project needs were compared to the level of flooding experienced during the December 6–8, 2015, storm events, which regional rain gauge records and flood reports identified as roughly equivalent to a 10-year storm event. City staff also considered nuisance flooding problems—areas that frequently have low-level drainage challenges that may impact roads, parking lots, or private property.

A project review workshop was held on February 16, 2016. BC facilitated the workshop and attendees included City staff from the engineering and maintenance groups. In preparing for the workshop, City staff completed a survey of known stormwater problem areas and project needs. BC conducted an extensive review of the 2007 CSMP project list and prepared maps to document project locations and status. BC also reviewed existing documents, such as the City's stormwater retrofit strategy and the TMDL Implementation Plan (described in Section 1.4), to identify additional project commitments.

During the workshop, each project from the 2007 CSMP was reviewed with respect to known flooding problems, water quality treatment opportunities, and operational needs. Completed projects were verified with City staff and removed from further consideration for this CSMP update. Immediate and long-term continued project needs were identified from the 2007 CSMP project list. Some projects from the 2007 CSMP were merged into more comprehensive solutions and others were divided into phases or smaller projects. One additional project area was also identified. The result from the workshop was a preliminary list of projects for use in developing the 2016 CSMP update.

Table 2-1 below is a project summary showing the status of each project and recommendations from the project review workshop.

Figure 2-1 shows project locations and status for projects from the 2007 CSMP and this 2016 CSMP update.

Table 2-1. Project Summary Matrix from Project Review Workshop

2007 CSMP ID	Project name	Project type	2007 project description summary	Water quality elements and benefits	Ownership	2016 evaluation	Recommendation(s)
GN-1	Closed-Circuit Television Inspection	Multi-objective	Video inspection of all pipes known to be older than 25 years (12,000 LF) and pipes with unknown age (1,100 LF).		Public (City)	<ul style="list-style-type: none"> Video inspection is still needed. Older pipes are the priority, but all City systems would benefit from a visual inspection. Cleaning should be conducted in conjunction with inspection. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as GN-1 with revised project cost to include pipe cleaning. Include an ongoing inspection program as AM-2.
GN-2	Pipe, Manhole, and Catch Basin Rehabilitation	Multi-objective	Programmatic CP to replace metal pipe and aging concrete or plastic pipe at rate of 150 LF per year.		Public (City)	<ul style="list-style-type: none"> This work is still needed. The 2007 CSMP recommended a 15-year program to replace 2,300 LF of aging metal pipe and pipe of unknown age. Implementation of an annual program (150 LF of pipe per year) is too small for effective project implementation. Project should be converted to an individual CP, not an ongoing program. Consider merging GN-2 and GN-3 to create a single infrastructure replacement project. Consider separate asset management project for ongoing replacement of aging infrastructure after high-needs areas are addressed. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as merged GN-2/3 with revised project cost. Include an ongoing replacement program as AM-1.
GN-3	Catch Basin Retrofit Program	Water quality	Programmatic CP to replace existing self-cleaning catch basins with sumped catch basins.	Adding sumps to 48 un-sumped catch basins to collect sediment and other pollutants upstream in the system.	Public (City)	<ul style="list-style-type: none"> Project was included in the 2014 Stormwater Retrofit Strategy and Plan. Project should be converted to an individual CP, not an ongoing program. Consider merging GN-2 and GN-3 to create a single infrastructure replacement project. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as merged GN-2/3 with revised project cost.
GW-1	Drywell Registration	Water quality	Drywell registration and evaluation for retrofit needs.		Public (City)	<ul style="list-style-type: none"> Project is complete. Drywells have been registered and no additional retrofits were identified. 	<ul style="list-style-type: none"> Delete from CSMP project list.
GW-2	Drywell Pretreatment	Water quality	Adding pretreatment at three drywells.	Adding drywell pretreatment—sumped catch basins, spill control structures, and swales—supports reductions in TSS and nutrients (TP and TN).	Public (City)	<ul style="list-style-type: none"> Drywell retrofit projects were completed from 2009 to 2011. Sediment manholes were installed upstream of two drywells in Broadway Court and one drywell at 205th. 	<ul style="list-style-type: none"> Delete from CSMP project list.
FV-1	Fairview Creek between Halsey Street and I-84	Flood reduction	High-flow bypass pipe (48") along 223rd/Fairview Road to reduce flows in Fairview Creek between Halsey and Bridge Street.		Public (City)	<ul style="list-style-type: none"> Bypass was the preferred alternative out of four considered with the 2007 CSMP. Upstream detention was not shown to provide significant relief for downstream flooding. Design should consider impacts from potential bypass of water from No Name Creek to Fairview Creek. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as FV-1 with revised project cost. Add hydraulic modeling project to evaluate design flows for multiple project solutions as GN-4.
FV-2	Flooding on Halsey Street by Fieldstone Apartments	Multi-objective	Remove existing pipes through berms in the two detention ponds on the south side of the apartments to limit overflow from Fairview Creek to the property. Create a weir on southwest pond to increase flood storage. Conduct infiltration test of downstream UIC. (Future phase not budgeted: remove pipe and create weir on northeast pond to increase flood storage.)		Public (City and County)	<ul style="list-style-type: none"> 2007 CSMP project was focused on flooding and conveyance solutions for private-property areas adjacent to existing wetland. Shift project focus to flooding of public roadway system. Infiltration swale on NE Halsey Street provided initial relief to roadway flooding, but the swales are not draining well and do not have overflow options. Coordination with Multnomah County is needed because Halsey is a County road. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as FV-2 with revised project scope and cost.
FV-3a	South of Halsey Street/West of 207th: North of Salish Ponds	Planting	Riparian planting on City property near Salish ponds adjacent to Fairview Creek: approximately 0.8 acre.	0.8-acre riparian planting would increase shading for temperature reduction.	Public (City)	<ul style="list-style-type: none"> Planting project as described in 2007 CSMP is complete. 	<ul style="list-style-type: none"> Delete from CSMP project list.
FV-3b	South of Halsey Street/West of 207th: Riparian Vegetation	Planting	Riparian planting on City property near 207th adjacent to Fairview Creek: approximately 0.6 acres	600 LF of riparian buffer (40 ft wide each side of creek) would increase shading for temperature reduction.	Public (City)	<ul style="list-style-type: none"> Planting project as described in 2007 CSMP is complete. 	<ul style="list-style-type: none"> Delete from CSMP project list.
FV-3c	South of Halsey St/West of 207th: Riparian Vegetation	Planting	Riparian planting on private property north of Salish Ponds; adjacent to Fairview Creek – approximately 1.0 acres	520 LF of riparian buffer (40 ft wide each side of creek)	Private	<ul style="list-style-type: none"> Planting project on private property should be referred to non-profit or other community group. 	<ul style="list-style-type: none"> Delete from CSMP project list.
FV-3d	South of Halsey St/West of 207th: Floodplain Banking	Multi-objective	Grading and wetland planting on City property north of the West Salish Pond to provide additional off-channel floodplain storage to address flooding problems downstream in Fairview Creek.	3 acres of floodplain storage and planting on City property could support reductions in nutrients (TP and TN), bacteria, and TSS.	Public (City)	<ul style="list-style-type: none"> Project was included in the 2014 Stormwater Retrofit Strategy and Plan. The addition of storage provides minor flow reduction for Fairview Creek. Greater benefit may be achieved as a water quality treatment retrofit. Opportunities to enhance public access as a wetland park. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as FV-3d with revised project cost.
FV-3e	South of Halsey St/West of 207th: Floodplain Banking	Multi-objective	Grading and wetland planting on private property north of the East Salish Pond to provide additional off-channel floodplain storage to address flooding problems downstream in Fairview Creek.	5 acres of floodplain storage and planting on private property could support reductions in nutrients (TP and TN), bacteria, and TSS.	Private	<ul style="list-style-type: none"> Project is similar to FV-3d, but on privately owned land. Project would not move forward without the transfer of property to public ownership. Project was included in the 2014 Stormwater Retrofit Strategy and Plan. The addition of storage provides minor flow reduction for Fairview Creek. Greater benefit may be achieved as a water quality treatment retrofit. Opportunities to enhance public access as a wetland park. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as FV-3e with revised project cost.

Table 2-1. Project Summary Matrix from Project Review Workshop

2007 CSMP ID	Project name	Project type	2007 project description summary	Water quality elements and benefits	Ownership	2016 evaluation	Recommendation(s)
FV-5	Old Town Green Streets Opportunities	Water Quality	Construct swales, stormwater planters, and other green streets elements in conjunction with re-paving and sidewalk projects.	Adding bioretention sites in untreated areas would support reductions in nutrients (TP and TN), bacteria, and TSS. Adding infiltration for stormwater may help address the temperature TMDL.	Public (City)	<ul style="list-style-type: none"> City has completed 5 phases of work to date to add stormwater planters and rain gardens to Old Town Fairview in conjunction with sidewalk projects. Projects are typically implemented every two years. There is an ongoing need to for continued retrofit. Project was included in the 2014 Stormwater Retrofit Strategy and Plan. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as FV-5 with revised project scope and cost.
FV-6a	Heron Point Restoration: Riparian Planting	Planting	Large riparian planting at Heron Point, adjacent to Fairview Creek - approximately 4.4 acres	4.4 acres riparian planting along 2400 LF of Fairview Creek and Tributary would increase shading for temperature reduction.	Private	<ul style="list-style-type: none"> Planting project as described in 2007 CSMP is complete. 	<ul style="list-style-type: none"> Delete from CSMP project list.
FV-6b	Heron Point Restoration: 3 ac WQ Facility	Water Quality	Grading of 3 acre site to create off-channel, high-flow water quality treatment facility.	3 acre floodplain storage and creation of forested wetland for treatment and storage could support reductions in nutrients (TP and TN), TSS and bacteria (if designed to minimize waterfowl use).	Private	<ul style="list-style-type: none"> Associated planting (FV-6a) has been completed. There is not a significant need for additional flood storage in close proximity to Fairview Lake. Project was included in the 2014 Stormwater Retrofit Strategy and Plan. Private property ownership makes implementation a challenge. 	<ul style="list-style-type: none"> Delete from CSMP project list.
FV-7	McDonald Brothers Restoration	Water Quality	Riparian planting on private property that does not have street access - approximately 0.5 acres	0.5 acres riparian planting along 250 LF of Fairview Creek would increase shading for temperature reduction.	Private	<ul style="list-style-type: none"> Private property has been slated for different development purpose. Planting opportunity is no longer available. 	<ul style="list-style-type: none"> Delete from CSMP project list.
FV-8	Fairview Village Detention Ponds	Water Quality	Retrofit of existing Market Drive Detention Pond with rock weirs to create meandering swale with longer residence time for water quality treatment. Planting of Multnomah Pond - approximately 0.2 acres	Potential to add/enhance WQ treatment to support reductions in nutrients (TP and TN), bacteria, and TSS.	Public (City)	<ul style="list-style-type: none"> Three ponds should be considered: Chinook, Market, Multnomah. 2007 budget assumed pond maintenance with limited design and no modeling or analysis. Existing ponds provide opportunity to enhance water quality treatment and/or flow control through more significant pond retrofit that considers amended soils, perforated pipes, and possibly reconfiguration of control structures. Three existing ponds should be considered separately. Project was included in the 2014 Stormwater Retrofit Strategy and Plan. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as new FV-8a and FV-8b with new project scope and costs.
NN-1a	Undersized Culvert at Sandy Blvd	Flood Reduction	Alternative A: Replace existing pair of 30" CMPs with single 48" culvert to alleviate flooding of Sandy Blvd.		Public (City and County)	<ul style="list-style-type: none"> Culvert replacement project was intended to occur as part of widening of NE Sandy Boulevard, which has not occurred. This culvert showed minor flooding (several hours) during December 2015 storm event. This is not a significant flooding issue, though downstream properties continue to experience flooding. Project design should consider opportunities for upstream flow control in the No Name Creek basin, as well as joint basin solutions with FV-1 and NN-2. 	<ul style="list-style-type: none"> Remove this alternative from 2016 CSMP update and replace with new project NN-1 per NN-1b description.
NN-1b	Undersized Culvert at Sandy Blvd Bypass	Flood Reduction	Alternative B: Construct diversion on south side of Sandy Blvd (upstream) to divert flow from No Name Creek to Fairview Creek.		Public (City and County)	<ul style="list-style-type: none"> 2007 analysis showed that this diversion would not free up enough capacity at NE Sandy Boulevard to eliminate need to replace the existing culverts (NN-1a). However, the December 2015 storm event showed that peak flows may not be at the level identified in the 2007 analysis. This bypass option may be a viable solution to address flooding of property downstream of NE Sandy Boulevard. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as NN-1. Add hydraulic modeling project to evaluate design flows for multiple project solutions as GN-4.
NN-2	Flooding of Church parking lot on Halsey Street from No Name Creek	Planting	Riparian planting on private property - approximately 0.8 acres. Private property flooding (Ukrainian Church) also identified but not addressed in the scope of the project.	Shading for instream temperature control.	Private and Public (City)	<ul style="list-style-type: none"> Limited planting was completed as part of redevelopment of the church parking lot. Ongoing flooding concerns remain along NE Halsey Street during peak flow events. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as NN-2 with revised project scope and cost. Add hydraulic modeling to evaluate multiple project solutions as GN-4.
NN-3	Revegetation behind Fairview Oaks Apartments	Planting	Riparian planting on private property - approximately 0.3 acres	0.3 acres riparian planting along 600 LF of No Name Creek would increase shading for temperature reduction.	Private	<ul style="list-style-type: none"> Planting project on private property should be referred to non-profit or other community group. 	<ul style="list-style-type: none"> Delete from CSMP project list.

Table 2-1. Project Summary Matrix from Project Review Workshop

2007 CSMP ID	Project name	Project type	2007 project description summary	Water quality elements and benefits	Ownership	2016 evaluation	Recommendation(s)
RT-1	Raintree Creek Culvert under Railroad	Flood Rreduction	Negotiate access easement and install trash rack to reduce culvert clogging.		UPRR	<ul style="list-style-type: none"> Trash rack was not installed as part of Park Cleone project (RT-2a and RT-2b). Project is still needed. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as RT-1 with new project costs.
RT-2a	Park Cleone Detention Pond Retrofit: Pond and Swale	Water quality	Retrofit of Park Cleone detention facility for water quality treatment.	Adding water quality elements to Park Cleone detention facility would support reductions in nutrients (TP and TN), bacteria, and TSS.	Public	<ul style="list-style-type: none"> Project was completed in 2014. 	<ul style="list-style-type: none"> Delete from CSMP project list.
RT-2b	Park Cleone Creek Daylight	Water quality	Replace 200 LF pipe upstream of Park Cleone detention facility with swale and planting.	Replace 200 LF pipe with vegetated swale would support reductions in nutrients (TP and TN), bacteria, and TSS.	Public (City)	<ul style="list-style-type: none"> Project was completed in 2014. 	<ul style="list-style-type: none"> Delete from CSMP project list.
RT-3	7th Street: from Main North to Railroad Ditch	Flood reduction	New storm sewer pipe on 7th Street.		Public (City)	<ul style="list-style-type: none"> Project was completed in 2014. 	<ul style="list-style-type: none"> Include in 2016 CSMP update as part of FV-5.
RT-4	Pipe Replacement at 6th and Harrison	Flood reduction	Pipe replacement concurrent with street repairs.		Public (City)	<ul style="list-style-type: none"> Project was completed in 2009-10. 	<ul style="list-style-type: none"> Delete from CSMP project list.
FV-4	Salish Ponds and Wetlands	Water quality Flood reduction	Shoreline restoration; created public access locations; install pet waste stations.	Shoreline restoration, designated public access locations, and adding pet waste stations should reduce TSS and bacteria.	Public (City)	<ul style="list-style-type: none"> Project was completed in 2012. 	<ul style="list-style-type: none"> Delete from CSMP project list.
OS-1	Thompson Street Stormwater Improvements	Flood reduction	Address localized flooding at Thompson and 205th.		Public (City)	<ul style="list-style-type: none"> Project was completed in 2009-10. 	<ul style="list-style-type: none"> Delete from CSMP project list.

FV = Fairview Creek projects.

GN = general/programmatic projects.

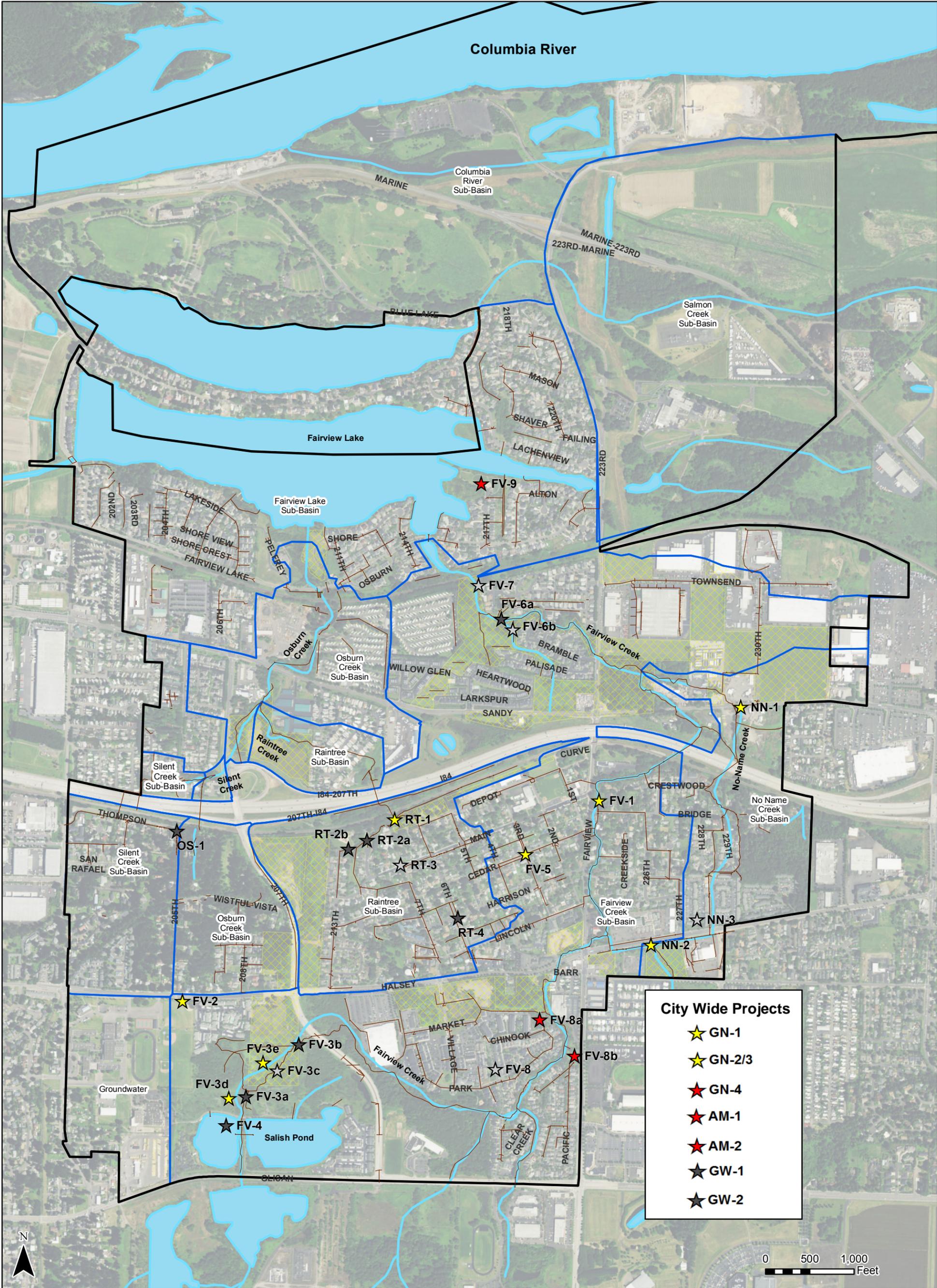
GW = groundwater projects.

NN = No Name Creek projects.

OS = Osborn Creek Sub-basin projects.

RT = Raintree Sub-basin projects.

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CITY OF FAIRVIEW
CSMP UPDATE
Figure 2-1
CSMP PROJECT STATUS

JUNE 2016

Legend

- CITY LIMITS
- SUBBASINS
- VACANT LAND
- STREAMS AND WATER BODIES
- STORMWATER PIPES (2007)
- ★ 2007 CIP PROJECTS (COMPLETED)
- ☆ 2007 CIP PROJECTS (NOT NEEDED)
- ★ 2007 CIP PROJECTS (MODIFIED)
- ★ 2007 CIP PROJECTS (NEW)

2.2 2016 Project Identification

For this CSMP update, concept-level CPs were developed and/or redefined based on the outcome from the project review workshop and review of existing technical reports and documents. Limited field investigations were performed to verify proposed projects and visually investigate design alternatives. For consistency, the project identification abbreviations and numbers were retained from the 2007 CSMP.

The field investigation, which was conducted on March 24, 2016, focused on evaluating project areas with proposed project modifications from the 2007 CSMP. This included projects FV-2, FV-8, NN-1, and NN-2. As a result of the investigations, project FV-8 was divided into two separate projects (FV-8a and FV-8b) to reflect retrofit of two existing stormwater ponds to improve water quality treatment and flow control. Projects where the scope remained the same from the 2007 CSMP were generally not reviewed during the field investigations. Instead, the original project descriptions and elements were carried forward from the 2007 CSMP.

No additional hydrologic or hydraulic modeling was performed for this 2016 CSMP update. However, the 2007 XPSWMM model was reviewed to evaluate pipe elevations, sizes, and peak flow assumptions. The model information was used to validate proposed project concepts, particularly with respect to FV-1, NN-1, and NN-2. The model review revealed a level of complexity and connectivity with these three projects, resulting in the recommendation to establish a new CP (GN-4) specifically to conduct the hydraulic modeling needed to support FV-1, NN-1, and NN-2.

One new project area was identified during the project review workshop. The City is planning a project to install bank stabilization and vegetation at Lakeshore City Park, along the banks of Fairview Lake. Bank stabilization will help to reduce sediment contributions to Fairview Lake, and planting could increase shade for temperature reduction. As a result, project FV-9 was added to this CSMP CP list.

The 14 stormwater CP recommendations are summarized in Table 2-2. Project fact sheets with location maps, background information, and project descriptions are included in Appendix A.

Project ID	Project name	Project objectives	Project description
GN-1	Closed-Circuit Television Inspection	<ul style="list-style-type: none"> Flood reduction/maintenance Asset management/maintenance 	Video inspection and cleaning of aging infrastructure areas.
GN-2/3	Targeted Infrastructure Upgrades	<ul style="list-style-type: none"> Flood reduction Water quality Asset management/maintenance 	Replacement of metal pipe, deteriorated pipe, and self-cleaning catch basins.
GN-4	System Hydraulic Modeling	<ul style="list-style-type: none"> Flood reduction 	Hydraulic modeling to evaluate connectivity and define solutions for FV-1, NN-1, and NN-2.
FV-1	Fairview Creek High-Flow Bypass	<ul style="list-style-type: none"> Flood reduction 	High-flow bypass along NE 223rd to reduce flows in Fairview Creek between NE Halsey Street and Bridge Street.
FV-2	Halsey Street Swale Retrofit	<ul style="list-style-type: none"> Flood reduction Water quality 	Retrofit of existing swales on NE Halsey Street.
FV-3d	Fairview Creek Off-Channel Storage	<ul style="list-style-type: none"> Flood reduction Water quality 	Grading and wetland planting to provide off-channel floodplain storage.

Table 2-2. 2016 Stormwater Capital Projects

Project ID	Project name	Project objectives	Project description
FV-3e	Fairview Creek Off-Channel Storage, Future	<ul style="list-style-type: none"> Flood reduction Water quality 	Grading and wetland planting to provide off-channel floodplain storage.
FV-5	Old Town Green Streets Opportunities	<ul style="list-style-type: none"> Water quality 	Constructing green street elements in Old Town neighborhoods.
FV-8a	Chinook Pond Retrofit	<ul style="list-style-type: none"> Water quality 	Pond retrofit and reconstruction to maximize storage and water quality treatment.
FV-8b	Multnomah Pond Retrofit	<ul style="list-style-type: none"> Water quality 	Pond retrofit and reconstruction to maximize storage and water quality treatment.
FV-9	Fairview Lake Bank Stabilization	<ul style="list-style-type: none"> Water quality 	Bank stabilization measures and planting to address erosion of bank at Lakeshore City Park.
NN-1	No-Name Creek Flow Bypass	<ul style="list-style-type: none"> Flood reduction 	Flow diversion at NE Sandy Boulevard to divert high flows from No Name Creek to Fairview Creek.
NN-2	No-Name Creek Capacity Improvement	<ul style="list-style-type: none"> Flood reduction 	Modification of flow split between No Name Creek and Fairview Creek at NE Halsey Street.
RT-1	Raintree Creek Culvert Debris Barrier	<ul style="list-style-type: none"> Flood reduction/maintenance 	Install trash rack at culvert under railroad to reduce clogging and allow for debris removal at railroad culvert.

2.3 Asset Management Initiatives

Asset management initiatives are new stormwater program recommendations related to ongoing infrastructure maintenance as well as asset management. The following two asset management initiatives are included in the CSMP recommendations:

- AM-1 Stormwater Infrastructure Asset Replacement:** Establish a long-term program to set aside funds to replace aging stormwater infrastructure. While high-priority replacements are included in project GN-2/3, this would be an ongoing program to establish funds for future and ongoing replacements as additional areas of the city reach the end of infrastructure stability.
- AM-2 Stormwater Infrastructure Inspection and Cleaning:** Establish an ongoing schedule to conduct video inspections and cleaning of all publicly owned stormwater pipes. As of 2016, the City has documented approximately 70,000 linear feet (LF) of public stormwater pipe. Regular inspection of existing infrastructure will allow the City to prioritize maintenance areas and to identify deteriorated infrastructure that needs replacement (as part of AM-1).

These initiatives are intended to be funded on an annual basis in accordance with assumptions and descriptions outlined in the project fact sheets in Appendix A. Because of the ongoing nature of these initiatives, they are not reflected in the prioritization and implementation schedule in Section 3.

2.4 Cost Estimates

Planning-level cost estimates were developed for each of the proposed CPs and asset management initiatives.

Unit costs for structural elements were compiled from a variety of sources. These included recent stormwater master plans for the cities of Milwaukie, Newberg, Fairview, and Gladstone along with bid tabulations from local construction projects in Gresham and Portland. Dates on these projects ranged from 2007 to 2016 and thus were adjusted to 2016 costs using the RS Means Historical

Cost Index. Once the data were compiled and adjusted to reflect 2016 costs, a comparison was made and best engineering judgment was used to determine final unit costs. In cases where conflicting data existed, especially for structure installation, the RS Means construction cost data were used to provide an additional point of reference.

For each project, standard cost percentages were added to the structural elements for mobilization/demobilization, traffic control/utility relocation, and erosion control. A 30 percent construction contingency was added to the construction subtotal to establish the total capital expense. Each project was then assigned costs for engineering and permitting (15 to 35 percent) to cover additional investigations and design fees and construction and general administration (5 percent) to cover construction management and internal project implementation.

Appendix B includes a table of unit costs and standard planning-level costs percentages. Appendix B also includes the detailed cost estimates for each CP and asset management initiative presented in Sections 2.3 and 2.4.

Section 3

Prioritization and Implementation

The City will use this CSMP update to proactively address stormwater management with prioritized stormwater CPs and asset management initiatives. These CPs and initiatives provide an opportunity for the City to improve public safety, water quality, and aesthetic benefits, while addressing storm drain capacity in several flood-prone areas.

With these goals in mind, the CPs have been prioritized and scheduled for implementation using a collaborative process between City maintenance and engineering staff. It should be noted that specific implementation timelines are dependent on the City's budget and other funding mechanisms as described in Section 3.2.

As described in Section 2.3, the asset management initiatives are intended to be funded on an annual basis and thus are not reflected with an individual project priority ranking and scheduling. Additionally, CP FV-5 is also an annual budget item to be implemented in conjunction with other transportation projects and not included in the project prioritization and scheduling.

3.1 Prioritization Criteria

The prioritization criteria used for this CSMP update are modified from the criteria used in 2007, as the City has a greater understanding of community priorities as well as regulatory obligations. The prioritization criteria are also based on criteria established for the 2014 Stormwater Retrofit Strategy and Plan and other input from the City.

Seven criteria in total were defined to aid in the project prioritization. Because many projects are consistent with the 2007 CSMP and are already incorporated into the City's current stormwater budget, detailed project scoring and accompanying ranking was not conducted for this CSMP update. Instead, an overall project prioritization and schedule was developed by City engineering and maintenance staff. Staff collectively reviewed the updated (redefined) or new project descriptions in conjunction with the defined prioritization criteria. Project priority was discussed in conjunction with the project rating definitions for each prioritization criterion described in Table 3-1. Higher-priority projects tended toward the higher-priority project ratings for multiple criteria. Lower-priority projects tended toward the lower-priority project ratings for multiple criteria. Criterion and project rating definitions were established to ensure consistency among staff when participating.

Cost was not included as a specific prioritization criterion, but was considered in the context of establishing an implementation schedule (see Section 3.2). Table 3-1 lists the prioritization criteria and provides the project rating definition. The results from the evaluation and proposed project priority are shown in Table 3-2.

Table 3-1. Capital Project Rating Criteria

Prioritization criterion	Criterion importance	Project rating definition	
		Higher priority	Lower priority
1 Safety/liability	High	<ul style="list-style-type: none"> Project alleviates a potential safety hazard Project minimizes liability issues associated with system flooding 	<ul style="list-style-type: none"> No safety or liability issues associated with project
2 Concurrence	High	<ul style="list-style-type: none"> Project is a prerequisite or preliminary project for other CPs 	<ul style="list-style-type: none"> Project scheduling would not impact or be impacted by other stormwater or infrastructure projects
3 Environmental benefit	High	<ul style="list-style-type: none"> Project significantly improves water quality and wildlife habitat 	<ul style="list-style-type: none"> Project does not provide water quality or wildlife benefit
4 Ownership	High	<ul style="list-style-type: none"> Project is located entirely on public property and does not require coordination from other agencies/jurisdictions 	<ul style="list-style-type: none"> Project requires support, assistance, or funds from other agencies/jurisdictions
5 Long-term maintenance	Medium	<ul style="list-style-type: none"> Project will reduce or eliminate ongoing maintenance needs 	<ul style="list-style-type: none"> Project could increase City's maintenance activities
6 Complexity	Medium	<ul style="list-style-type: none"> Project may be completed by a small crew in less than a month's time 	<ul style="list-style-type: none"> Project requires significant design effort, stakeholder coordination, complex construction, and/or permitting
7 Sustainability/Livability	Medium	<ul style="list-style-type: none"> Project is a long-term solution that will be sustained for multiple generations 	<ul style="list-style-type: none"> Project is a short-term solution that may require additional projects down the road

Criterion definitions:

- | | |
|-----------------------------|--|
| 1 Safety/liability | What potential safety and/or liability issues are involved? |
| 2 Concurrence | Will overall project scheduling be impacted by this project? |
| 3 Environmental benefit | Are there direct environmental benefits associated with the projects? |
| 4 Ownership | Is third-party involvement required to implement the project? |
| 5 Long-term maintenance | Will this alleviate or result in additional maintenance obligations? |
| 6 Complexity | How quickly can the solution be implemented and with what level of effort? |
| 7 Sustainability/livability | Will the project improve the quality of life? Is this what our grandchildren would want? |



Table 3-2. Capital Project Evaluation and Prioritization

Project		Project evaluation						Project prioritization (rank 1–13)
		Safety/liability	Concurrence	Environmental benefit	Ownership	Long-term maintenance	Complexity	
GN 1	Closed-Circuit Television Inspection	✓	✓	✓	✓	✓	✓	1
GN 2/3	Targeted Infrastructure Upgrades	✓			✓	✓	✓	4
GN 4	System Hydraulic Modeling	✓	✓		✓	✓	✓	2
FV 1	Fairview Creek High-Flow Bypass	✓			✓	✓		8
FV 2	Halsey Street Swale Retrofit	✓		✓		✓		11
FV 3d	Fairview Creek Off-Channel Storage, Public			✓	✓		✓	9
FV 3e	Fairview Creek Off-Channel Storage, Private			✓			✓	13
FV 8a	Chinook Pond Retrofit			✓	✓		✓	3
FV 8b	Multnomah Pond Retrofit			✓	✓		✓	5
FV 9	Fairview Lake Bank Stabilization			✓	✓		✓	6
NN 1	No Name Creek Flow Bypass	✓				✓		10
NN 2	No Name Creek Capacity Improvement	✓	✓			✓		7
RT 1	Raintree Creek Culvert Debris Barrier			✓		✓		12
FV 5	Old Town Green Street Opportunities (Annual Cost)	Annual cost: not reflected in project prioritization						
AM 1	Stormwater Infrastructure Asset Replacement (Annual Cost)	Annual cost: not reflected in project prioritization						
AM 2	Stormwater Infrastructure Video and Cleaning (Annual Cost)	Annual cost: not reflected in project prioritization						



3.2 Implementation Schedule

The City's implementation schedule is dependent on the stormwater program budget, as well as capital funds available through grants, system development charges, and other sources. The total stormwater CP cost estimate is approximately \$5.4 million. Annual costs associated with the asset management initiatives and CP FV-5 are estimated at \$270,000. Under current funding levels, the City anticipates completing the highest-priority CPs (GN-1 and GN-4) in the upcoming year, as results of these CPs will help to inform future project implementation.

Generally, project scheduling is anticipated to follow the project prioritization, with the exception of FV-1, which is the highest-cost CP currently proposed. Funding for FV-1 may need to be staggered throughout the overall implementation period. FV-8b is a higher-priority project for the City, but because it is a standalone and single-objective (water quality) project, its funding may be shifted to the second half of the implementation period. The final CP prioritization and scheduling is reflected in Table 3-3.

The City is planning to conduct a rate study to set near-term stormwater utility rates, which will dictate the speed in which the stormwater projects and program activities can be completed.

Project		Estimated project cost	Project prioritization (rank 1–13)	Project schedule	
				Implementation year 1–5	Implementation year 6+
FV 5	Old Town Green Street Opportunities (Annual Cost)	\$51,000	Annual cost and project	✓	✓
AM 1	Stormwater Infrastructure Asset Replacement (Annual Cost)	\$164,000	Annual cost and project	✓	✓
AM 2	Stormwater Infrastructure Video and Cleaning (Annual Cost)	\$55,000	Annual cost and project	✓	✓
GN 1	Closed-Circuit Television Inspection	\$51,000	1	✓	
GN 4	System Hydraulic Modeling	\$100,000	2	✓	
FV 8a	Chinook Pond Retrofit	\$249,000	3	✓	
GN 2/3	Targeted Infrastructure Upgrades	\$163,000	4	✓	
FV 8b	Multnomah Pond Retrofit	\$120,000	5		✓
FV 9	Fairview Lake Bank Stabilization	\$52,000	6	✓	
NN 2	No Name Creek Capacity Improvement	\$237,000	7	✓	
FV 1	Fairview Creek High-Flow Bypass	\$1,995,000	8	✓	✓
FV 3d	Fairview Creek Off-Channel Storage, Public	\$766,000	9		✓
NN 1	No Name Creek Flow Bypass	\$525,000	10		✓
FV 2	Halsey Street Swale Retrofit	\$163,000	11		✓
RT 1	Raintree Creek Culvert Debris Barrier	\$83,000	12		✓
FV 3e	Fairview Creek Off-Channel Storage, Private	\$924,000	13		✓

Section 4

Limitations

This document was prepared solely for the City of Fairview in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Fairview and Brown and Caldwell dated April 2, 2015. This document is governed by the specific scope of work authorized by the City of Fairview; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Fairview and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Further, Brown and Caldwell makes no warranties, express or implied, with respect to this document, except for those, if any, contained in the agreement pursuant to which the document was prepared. All data, drawings, documents, or information contained in this report have been prepared exclusively for the person or entity to whom it was addressed and may not be relied upon by any other person or entity without the prior written consent of Brown and Caldwell unless otherwise provided by the Agreement pursuant to which these services were provided.

Section 5

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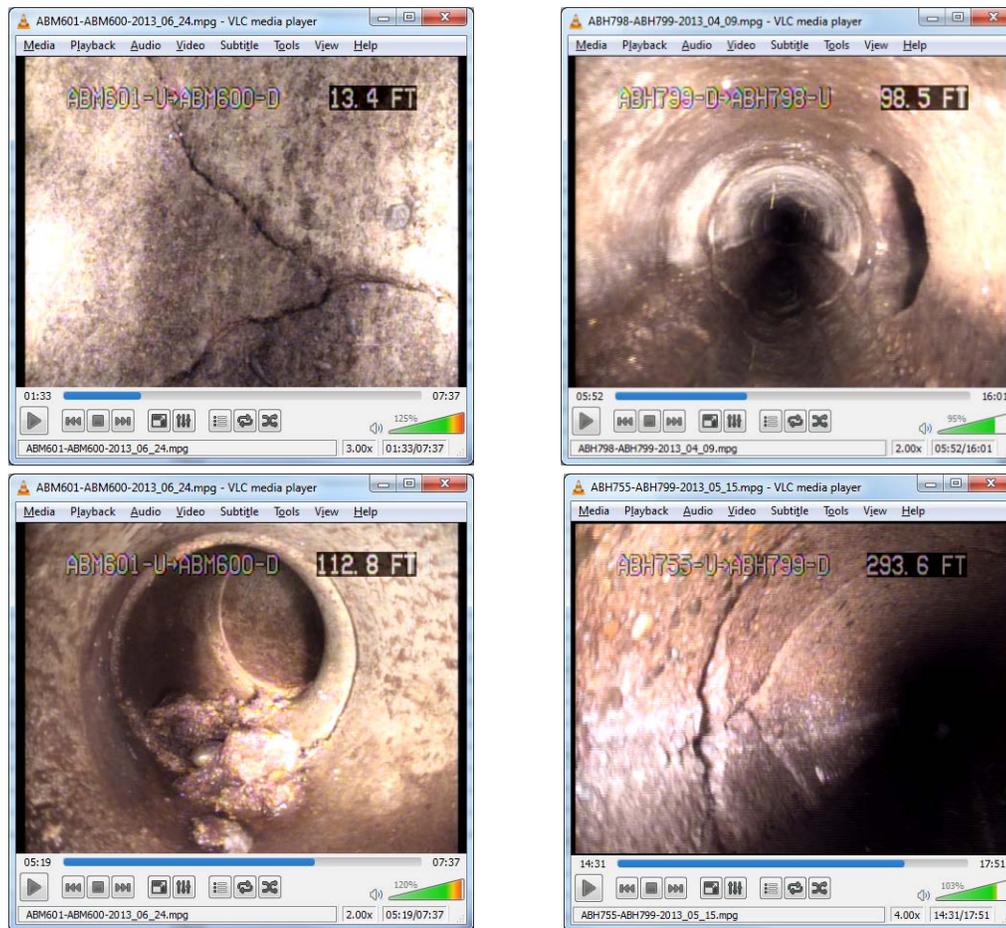
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Appendix A: Capital Project Fact Sheets





Project Name	GN-1: CCTV Inspection
Detailed Location	Entire city of Fairview
Ownership	Public (City of Fairview)
Objective(s) Addressed	Flood Reduction, Asset Management

Project Background

This project was originally proposed in the 2007 CSMP, and cost assumptions have been updated to reflect pipe cleaning in addition to video inspection. This project is critical for ongoing asset management.

Project Description

Video inspection and cleaning of all pipes known to be older than 25 years (12,000 LF) and pipes with unknown age (1,100 LF). Locations of aging pipe are documented in the City’s GIS or maintenance logs. Refer to the 2007 CSMP for additional background related to identification of pipes for inspection.

Design Considerations

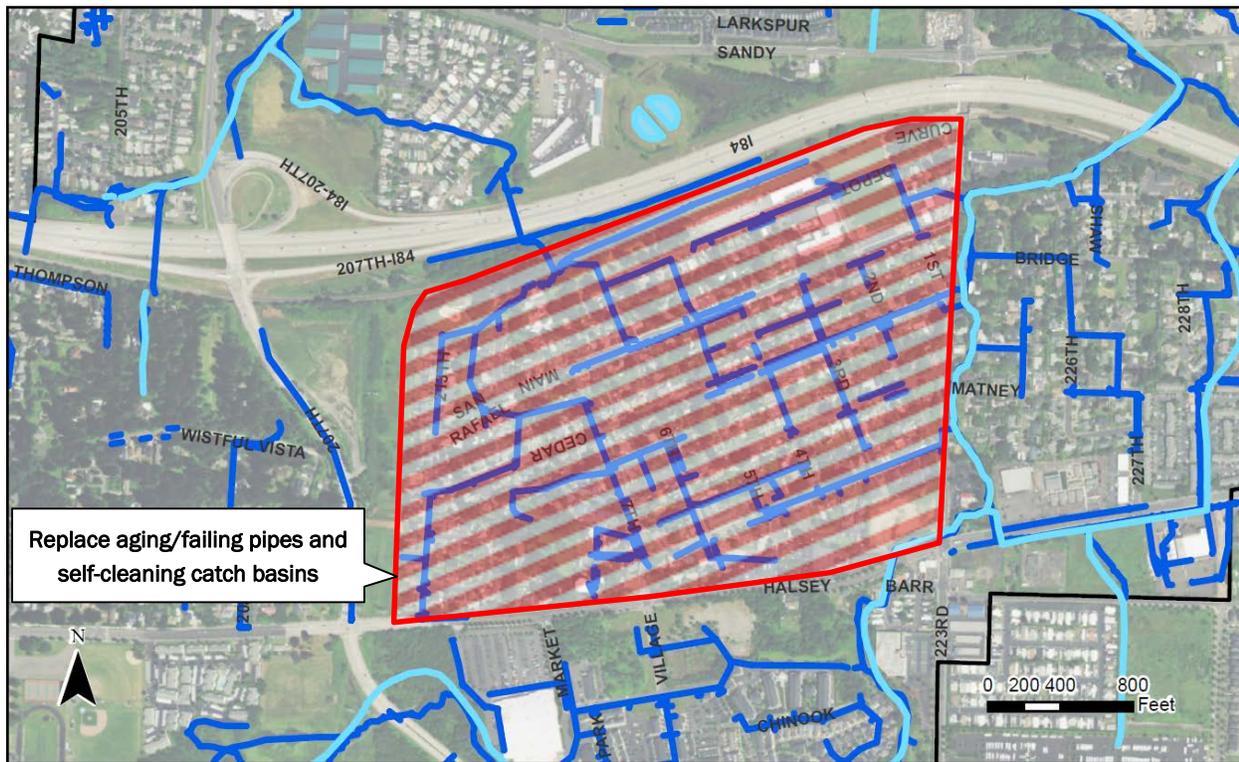
Video inspection should be used to help identify pipes that are currently failing or reaching the end of useful life. Failing pipes should be identified for replacement under GN-2/3. This effort is intended to occur prior to activities scheduled under AM-2.

Video inspections may also help the City identify sanitary cross connections in conjunction with its illicit discharge detection and elimination system program.

The cost estimate assumes that approximately 40 hours of engineering staff time would be required to review the videos and document results.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$43,000
Engineering and permitting (15%)	\$6,000
Construction administration (5%)	\$2,000
Capital project implementation cost (Total)	\$51,000



Project Name	GN-2/3: Targeted Infrastructure Upgrades
Detailed Location	Entire city of Fairview
Ownership	Public (City of Fairview)
Objective(s) Addressed	Flood Reduction, Water Quality, Asset Management

Project Background

This capital project has been redefined from the 2007 CSMP.

In the 2007 CSMP, project GN-2 estimated that the City owns 1,800 LF of metal pipe (CMP or steel) that is more than 25 years old and approximately 500 LF of pipe with an unknown age. The 2007 CSMP identified an annual budget allocation for replacement of the aged metal pipe and pipe with an unknown age over a 15-year period.

In the 2007 CSMP, project GN-3 identified 48 self-cleaning catch basins in need of replacement to provide sumps for sediment collection. Given difficulties in implementing these replacement programs on an annual basis, this project merges both replacement projects and identifies a total cost for targeted infrastructure upgrades.

Project Description

A programmatic CP to replace metal pipe, aging concrete pipe, failing pipes, and pipes at risk of reaching the end of life within the next 5 to 10 years. The quantities and specific locations of pipe replacement areas should be identified and prioritized through the video inspections conducted under GN-1. The Old Town portion of Fairview was preliminarily identified as the targeted area with the greatest likelihood for aged pipe. The project also includes replacement of 48 self-cleaning catch basins with sumped catch basins that provide sediment collection. Specific structures were identified prior to the 2007 CSMP and documented in the City's GIS or maintenance logs.

Design Considerations

CP GN-1 must be completed prior to GN-2/3.

The preliminary cost estimate is based on replacing 3,000 LF of existing pipe with plastic pipe and installing 48 sumped catch basins to replace existing structures. The replacement cost assumes 12-inch-diameter HDPE.

This project could be constructed as a single project or in multiple phases as part of an ongoing program over the next 5 to 10 years.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$523,000
Engineering and permitting (15%)	\$79,000
Construction administration (5%)	\$26,000
Capital project implementation cost (Total)	\$628,000

Project Name	GN-4: System Hydraulic Modeling
Detailed Location	Fairview Creek and No Name Creek Basins
Ownership/Funding Source	Public (City of Fairview)
Objective(s) Addressed	Flood Reduction

Project Background

CPs FV-1, NN-1, and NN-2 are interconnected, and flows associated with each CP contribute to or are impacted by the other project areas. Designing these CPs requires refinement of the City’s XP-SWMM model to evaluate alternatives for these three connected projects. The results from the updated XP-SWMM hydraulic model will be used to guide the CP designs to convey existing and future contributing flows without having adverse impacts on downstream or neighboring properties.

All three projects are impacted by the flow split between No Name Creek and Fairview Creek that occurs at NE Halsey Street. Upstream flow control and/or adjustments to the flow split (NN-2) are needed to address flooding downstream of NE Halsey Street. In addition, the flows to Fairview Creek from the flow split (NN-2) contribute to the design of the Fairview Creek high-flow bypass (FV-1). Flows that remain in No Name Creek will impact the design of NN-1.

For this CSMP update, the City’s XP-SWMM model was reviewed to confirm projected flows and evaluate design elevations. During the model review, inconsistencies were observed in the modeling of offsite areas that contribute flow to No Name Creek upstream of NE Halsey Street (location of NN-2), and also to No Name Creek upstream of NE Sandy Boulevard (location of NN-1). Inconsistencies were also observed between the model and hydraulic result tables in the CSMP. A comprehensive model update is needed to verify offsite flow contributions and to evaluate design options for the combined projects of FV-1, NN-1, and NN-2.

Project Description

Update the City’s current XP-SWMM model based on information obtained from the following activities:

- Refine subbasin delineations and update hydrologic calculations for areas outside the City limits
- Conduct field investigations to identify locations where offsite flows contribute to the City’s system and areas where offsite flows are diverted or controlled prior to entering the City’s system
- Review and update the model per as-built information for stormwater systems in developments adjacent to the City’s planned capital projects (i.e., Walmart commercial area along SE Sandy Boulevard and NE 238th Drive)
- Conduct a limited field survey to confirm existing system information

The updated XP-SWMM model should then be used to evaluate design alternatives for the combined projects of FV-1, NN-1 and NN-2. Adjustments to the flow split for No Name Creek at NE Halsey Street (NN-2) will dictate the flow patterns in Fairview Creek for FV-1 and No Name Creek for NN-1. The updated modeling would be used to verify the bypass design for FV-1 and to determine whether full or partial bypass of No Name Creek is possible at NE Sandy Boulevard in NN-1.

Modeling results and design recommendations should be documented to support the development of detailed engineering plans for FV-1, NN-1, and NN-2.

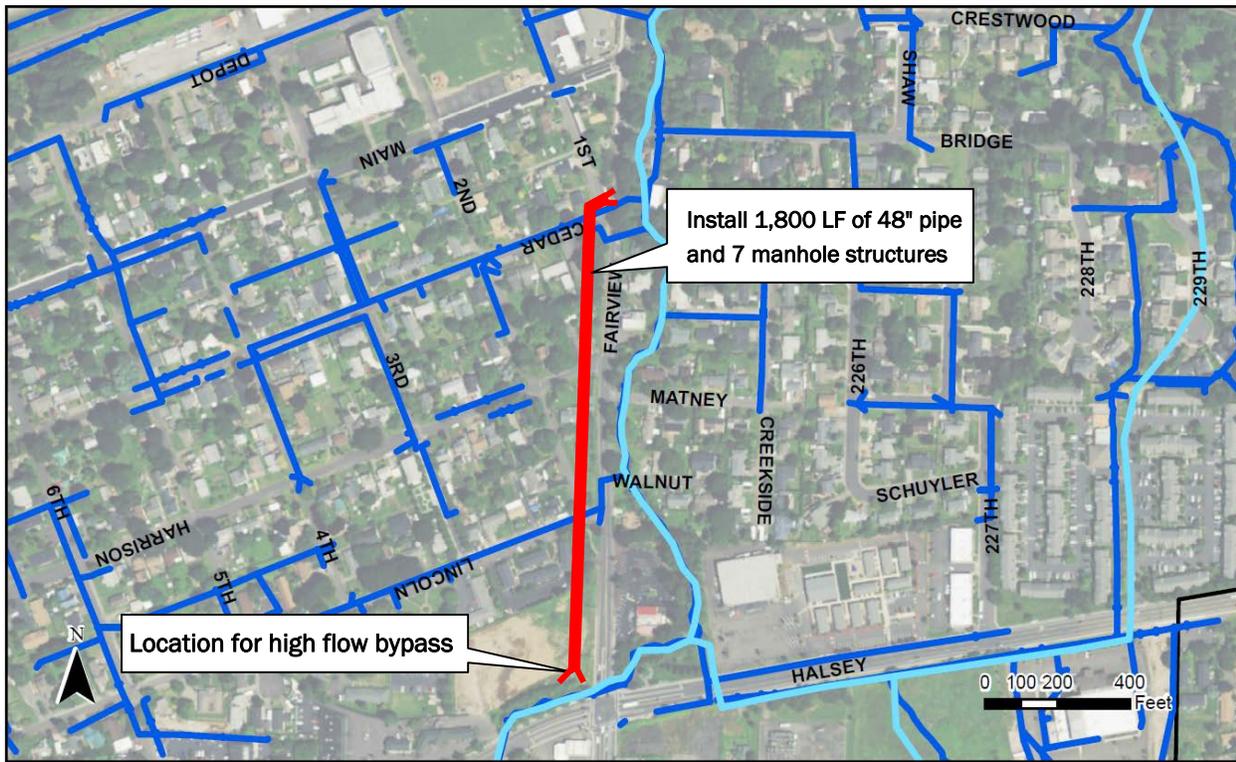
Design Considerations

This project should be completed prior to detailed design of CPs FV-1, NN-1, and NN-2.

A lump sum of \$100,000 was estimated to update the XP-SWMM model, evaluate alternatives, and document model results for use in the detailed design of CPs.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital cost total	N/A
Engineering and permitting (LS)	\$100,000
Construction administration (0%)	N/A
Capital project implementation cost (Total)	\$100,000



Project Name	FV-1: Fairview Creek High Flow Bypass
Detailed Location	NE 223rd/NE Fairview Road south of I-84
Ownership	Public (City of Fairview)
Objective(s) Addressed	Flood Reduction

Project Background

This project was originally proposed in the 2007 CSMP. No changes are proposed to the previously identified project. This segment of Fairview Creek was studied in the *Assessment of Fairview Creek Flow Control Options* developed by CH2M Hill in July 2000. Areas along Fairview Creek between NE Halsey Street and I-84 report localized flooding, which is consistent with FEMA analyses indicating risk of flooding during the 100-year storm. The CH2M Hill report recommended constructing levees to control flow. The 2007 CSMP evaluated four alternatives, which included increasing reach conveyance, constructing upstream detention, providing a high-flow bypass, and constructing levees. The high-flow bypass pipe was selected to mitigate flooding. See the 2007 CSMP for additional project background, including projected flows.

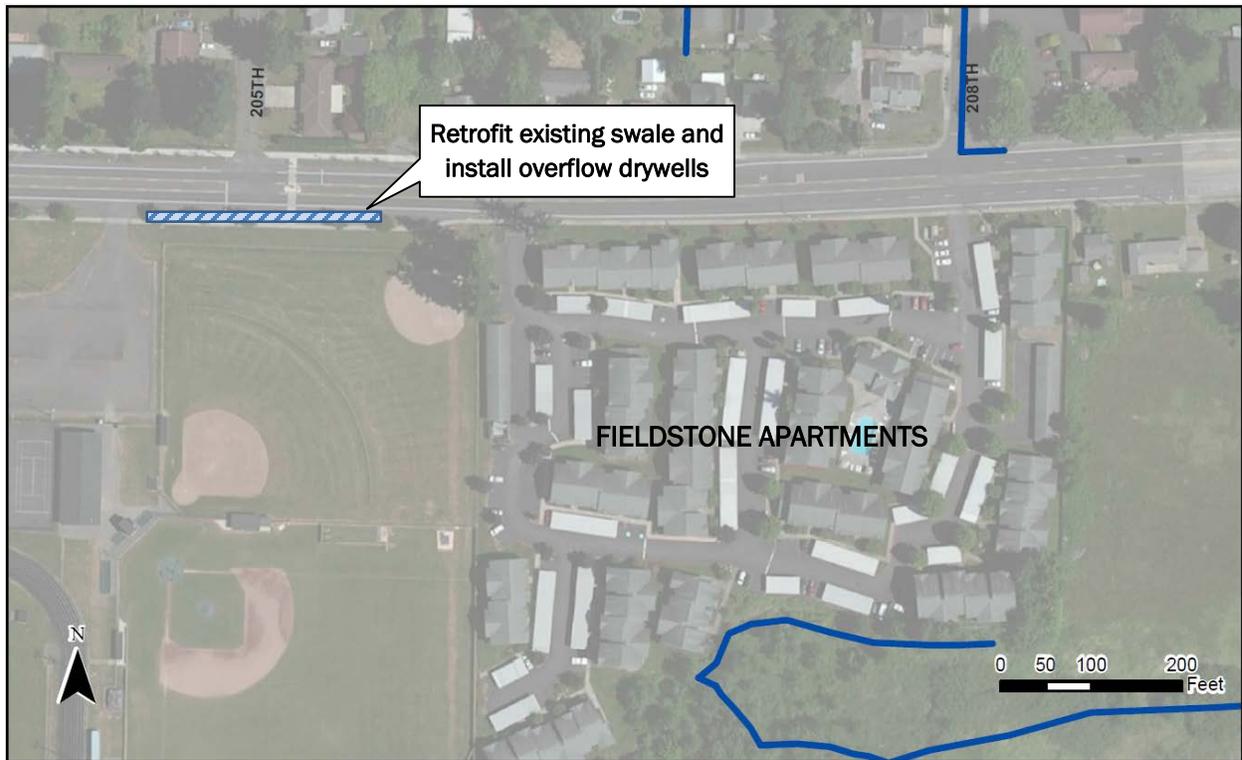
Project Description

Install high-flow bypass pipe (48 inches diameter) along 223rd/Fairview Road to reduce flows in Fairview Creek between NE Halsey Street and Bridge Street. The project assumes a 48-inch-diameter bypass pipe for 1,800 LF with an outfall to return flow to Fairview Creek near Cedar Street.

Design Considerations

The engineering evaluation should use the updated XP-SWMM model developed under GN-4 to evaluate proposed bypass alignment and flow capacity. The detailed engineering evaluation shall determine the appropriate location for the flow diversion. Potential options include the west side of NE 223rd prior to the NE 223rd culvert crossing or on the east side of NE 223rd in Marilyn’s Park. A preliminary cost estimate assumes one manhole at the upstream end of the bypass and one manhole for every 300 feet of pipe.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)	
Capital expense total (including contingency)	\$1,535,000
Engineering and permitting (25%)	\$384,000
Construction administration (5%)	\$77,000
Capital project implementation cost (Total)	\$1,995,000



Project Name	FV-2: Halsey Street Swale Retrofit
Detailed Location	NE Halsey Street and Fairview Parkway
Ownership	Public (City of Fairview and Multnomah County)
Objective(s) Addressed	Flood Reduction, Water Quality

Project Background

This project has been redefined from the 2007 CSMP, which recommended onsite and phased improvements to the Fieldstone Apartment property to manage flows discharged into NE Halsey Street. Private property improvements have presented implementation difficulties.

During larger storm events, stormwater runoff and offsite flow from wetlands south of the property discharge to the north and cause flooding in NE Halsey Street. Installation of infiltration swales along NE Halsey Street west of the Fieldstone Apartment property has alleviated much of the roadway flooding, but the swales reach capacity during small events.

Project Description

Retrofit of two existing swales on the south side of NE Halsey Street, west of the Fieldstone Apartments to increase collection and infiltration capacity and reduce overflows to street and private property. Reconstruction of the existing swales shall include installation of drain rock, amended soils, planting, an underdrain system, and an overflow. The underdrain system and overflow will connect to drywells to promote full infiltration.

Design Considerations

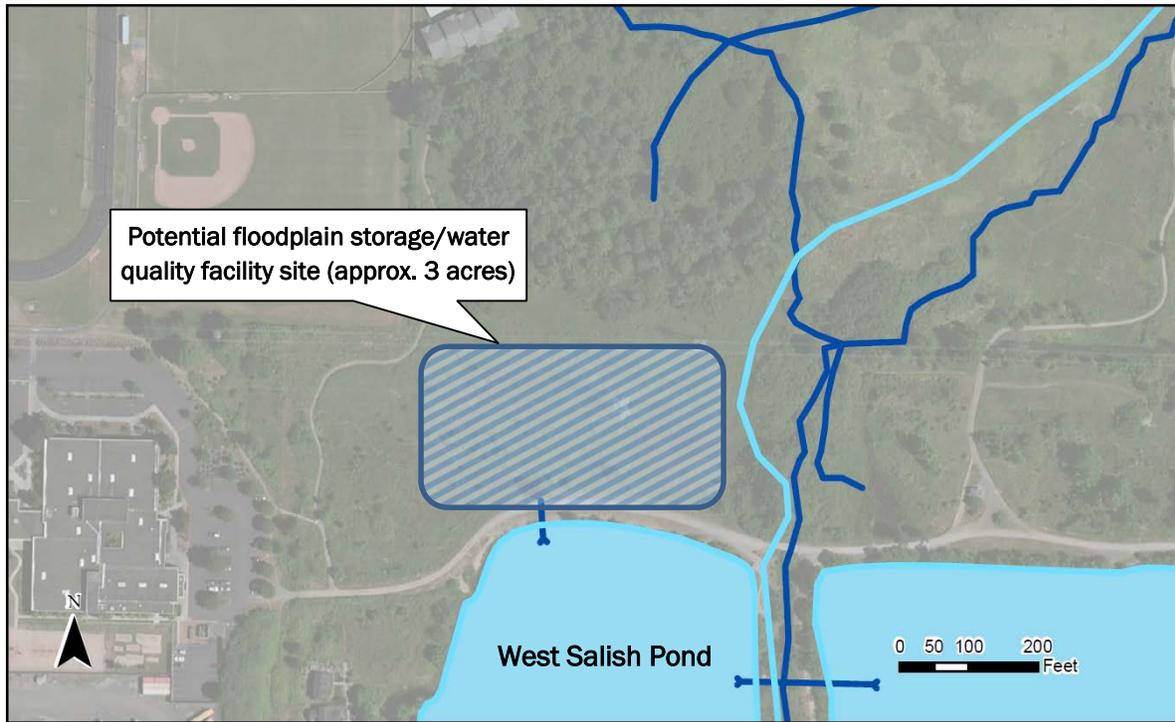
Installation of two overflow drywells requires infiltration testing. The drywells must penetrate below the existing clay layer to reach infiltrating soils.

Design and construction should consider that NE Halsey Street is a County-maintained roadway.

The cost estimate assumes retrofit of two swales, with each swale approximately 150 feet long and 6 feet wide.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$136,000
Engineering and permitting (15%)	\$20,000
Construction administration (5%)	\$7,000
Capital project implementation cost (Total)	\$163,000



Project Name	FV-3d: Fairview Creek Off-Channel Storage
Detailed Location	South of NE Halsey Street/West of 207th
Ownership	Public (City of Fairview)
Objective(s) Addressed	Flood Reduction, Water Quality

Project Background

This project is consistent with the project scope defined in the 2007 CSMP.

This project was originally proposed in the 2007 CSMP as an opportunity to construct floodplain storage on land owned by the City. The project meets multiple objectives and is referenced in the City's *Stormwater Retrofit Strategy and Retrofit Plan*, published in 2014.

Project Description

Regrade 3 acres of City-owned property north of the West Salish Pond to provide additional, off-channel floodplain storage to address flooding problems downstream in Fairview Creek. Enhance water quality treatment by planting native wetland and upland vegetation.

Design Considerations

Design should consider opportunities to incorporate public access in or around the storage area.

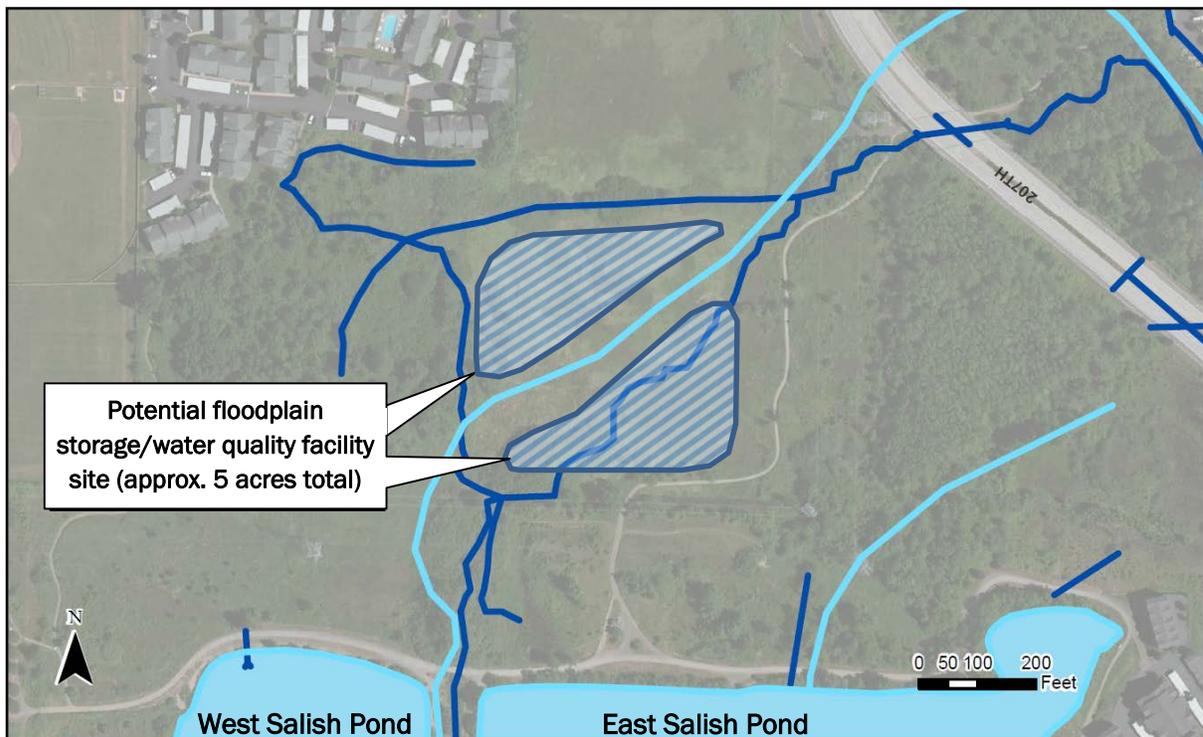
The detailed engineering evaluation should consider impacts to Salish ponds as well as connections to Fairview Creek during different-level storm events.

Earthwork and excavation costs assume regrading the site from an average elevation of 199.0 to 195.7 feet, assuming an average of 2.5 feet of excavation across the 3.0-acre site.

The 2007 CSMP identified that limited downstream flow mitigation (approximately 10 cfs) may be provided from construction of additional floodplain storage. Depending on Fairview's need, the scope of this project may be limited to the planting activities.

A Section 404 wetland permit may be required to regrade existing natural wetland areas. Such effort was accounted for in the cost estimate.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)	
Capital expense total (including contingency)	\$551,000
Engineering and permitting (25%)	\$138,000
Section 404 wetland permit (possible cost)	\$50,000
Construction administration (5%)	\$26,000
Capital project implementation cost (Total)	\$766,000



Project Name	FV-3e: Fairview Creek Off-Channel Storage, Future
Detailed Location	South of NE Halsey Street/West of 207th
Ownership	Private
Objective(s) Addressed	Flood Reduction, Water Quality

Project Background

This project is consistent with the project scope defined in the 2007 CSMP.

This project was originally proposed in the 2007 CSMP as an opportunity to construct floodplain storage on land that could come under City ownership in the future. The project meets multiple objectives and is referenced in the City's *Stormwater Retrofit Strategy And Retrofit Plan* published in 2014.

Project Description

Regrade 5 acres of private property north of the East Salish Pond to provide additional, off-channel floodplain storage to address flooding problems downstream in Fairview Creek. This area will also enhance water quality treatment with native wetland and upland vegetation.

Design Considerations

This project is opportunity-based, and contingent on property availability. Design should consider opportunities to incorporate public access in or around the storage area.

The earthwork and excavation costs assume regrading the site from an average elevation of 195.5 to 194.0 feet, assuming an average of 1.5 feet of excavation across the 5.0-acre site.

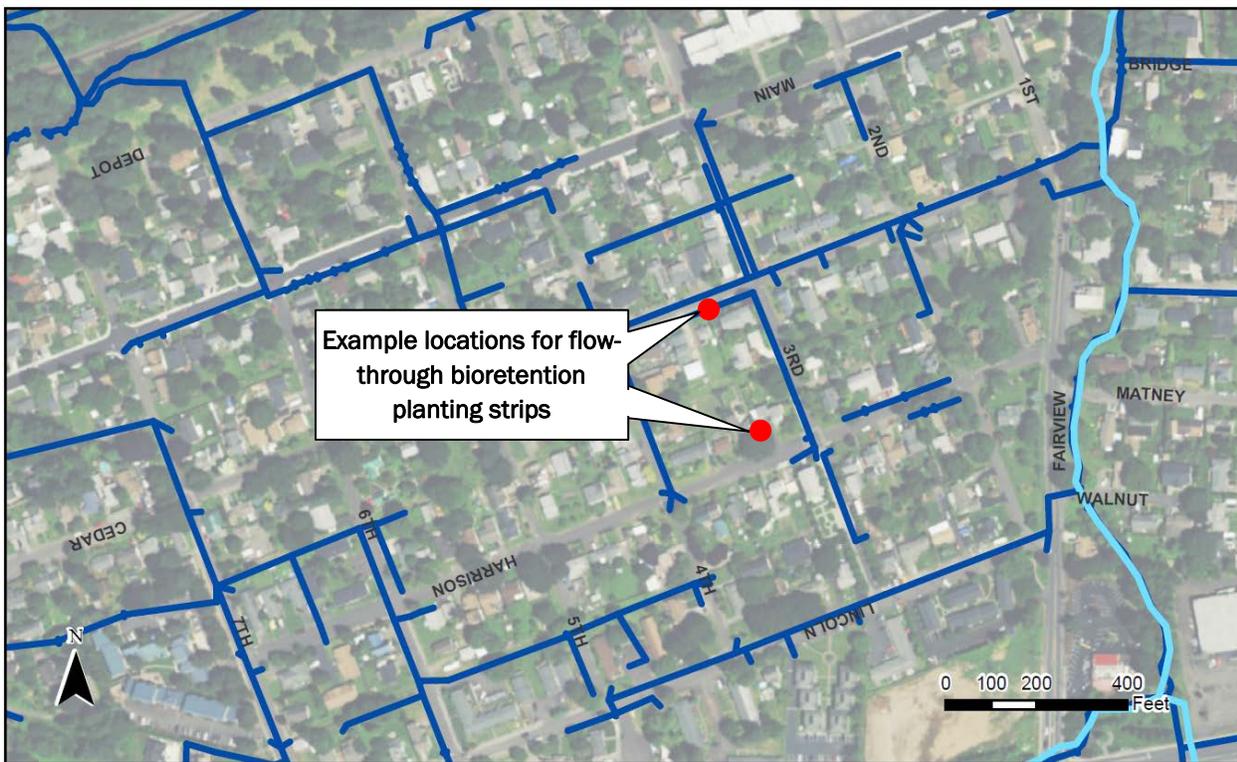
The detailed engineering evaluation should consider hydraulic connections and changes to flow patters based on completion of CP FV-3d.

The 2007 CSMP identified that limited downstream flow mitigation (approximately 10 cfs) may be provided from construction of additional floodplain storage. Depending on Fairview's need, the scope of this project may be limited to the planting activities.

A Section 404 wetland permit may be required to regrade existing natural wetland areas. Such effort was accounted for in the cost estimate.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$672,000
Engineering and permitting (25%)	\$168,000
Section 404 wetland permit (possible cost)	\$50,000
Construction administration (5%)	\$34,000
Capital project implementation cost (Total)	\$924,000



Project Name	FV-5: Old Town Green Streets Opportunities
Detailed Location	Across city of Fairview
Ownership	Public (City of Fairview)
Objective(s) Addressed	Water Quality
Funding	Annual

Project Background

This project was originally proposed in the 2007 CSMP, and design and cost assumptions have been updated to reflect current implementation strategies. Installation of green streets continues to be an ongoing aspect of the City’s long-term retrofit strategy. The project is referenced in the City’s *Stormwater Retrofit Strategy And Retrofit Plan* published in 2014.

Project Description

Construct swales, stormwater planters, and other green streets elements in Old Town neighborhoods in conjunction with re-paving and sidewalk projects. The 2007 CSMP estimated that approximately 38 viable planting strip sites existed in the 28 blocks of Old Town. The City identified sites for stormwater planter installation in conjunction with related transportation and pedestrian improvement projects. Stormwater planters aid in soil infiltration of stormwater, street shading, and addressing TMDLs including reductions in nutrients (TP and TN), bacteria, and TSS.

Design Considerations

This project is intended to be an ongoing project conducted in conjunction with related transportation or pedestrian improvement projects.

The cost estimate assumes annual installation of 600 sf of stormwater planters. This size is based on treatment of 10,000 sf of new or redeveloped impervious area using a 6 percent impervious sizing factor.

The cost estimate assumes installation of infiltration rain gardens for water quality only, and it does not include costs for an overflow or a piped connection to the stormwater conveyance system.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)	
Capital expense total (including contingency)	\$37,000
Engineering and permitting (35%)	\$13,000
Construction administration (5%)	\$2,000
Capital project implementation cost total (Annual)	\$51,000



Project Name	FV-8a: Chinook Pond Retrofit
Detailed Location	NE Chinook Way
Ownership	Public (City of Fairview)
Objective(s) Addressed	Water Quality

Project Background

This project has been added since development of the 2007 CSMP. The 2007 CSMP recommended maintenance for Chinook Pond, including periodic mowing of blackberry bushes. Recent review of the Chinook Pond site shows potential for modifying the pond grading and function to improve water quality treatment and flow control.

Project Description

Retrofit Chinook Pond in the Fairview Village development to maximize storage and water quality treatment. The project will involve over-excavation of accumulated sediment to expose the pond bottom and remove compacted soil layers. Re-construction should include installation of a new layer of drain rock to promote below-ground storage and infiltration. Soil amendments and stormwater facility planting will be added to enhance water quality treatment.

Design Considerations

The engineering evaluation could include review of the pond flow control structure to consider adjustments to match the City's flow control standards. Potential adjustments include installation of a smaller low-flow orifice to manage a wider range of flows to Fairview Creek.

Construction is likely to require a flow bypass system to convey stormwater runoff to Fairview Creek during construction.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$208,000
Engineering and permitting (15%)	\$31,000
Construction administration (5%)	\$10,000
Capital project implementation cost (Total)	\$249,000



Project Name	FV-8b: Multnomah Pond Retrofit
Detailed Location	NE Multnomah Drive
Ownership	Public (City of Fairview)
Objective(s) Addressed	Water Quality

Project Background

This project has been added since the development of the 2007 CSMP. The 2007 CSMP recommended maintenance for Multnomah Pond, including periodic mowing of blackberry bushes. Recent review of the Multnomah Pond site shows potential for modifying the site grading to improve water quality treatment and flow control.

Project Description

Retrofit Multnomah Pond to maximize storage and water quality treatment. The project will involve excavation and re-grading of the existing site to create a meandering swale from existing inlets to existing outlet. Reconstruction should include installation of drain rock to promote storage and infiltration along meandering path and the addition of soil amendment and stormwater facility plantings to the remainder of the facility for enhanced water quality treatment.

Design Considerations

Design should consider opportunities to adjust ground elevations to better accommodate sediment collection at inlet pipes.

The cost estimate assumes the existing inlet and outlet configuration will be maintained.

Erosion control should consider whether flow bypass is required during construction.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$86,000
Engineering and permitting (35%)	\$30,000
Construction administration (5%)	\$4,000
Capital project implementation cost (Total)	\$120,000



Project Name	FV-9: Fairview Lake Bank Stabilization
Detailed Location	Fairview Lake
Ownership/Funding Source	Public (City of Fairview)
Objective(s) Addressed	Water Quality (erosion prevention)

Project Background

This project has been added since development of the 2007 CSMP. Nearby property owners to Lakeshore City Park have expressed concerns over the rapid rate of erosion along the southern and western edges of Lakeshore City Park along Fairview Lake. Erosion has resulted in turbidity and algal blooms. The City is currently investigating bank restoration activities in conjunction with overall park improvements.

Project Description

Conduct bank stabilization along 500 feet of shoreline to address bank erosion at Lakeshore City Park. The project includes removal of decayed bank vegetation, installation of jute matting, installation of riprap along the lower bank areas, and revegetation and plantings along the upland portion of the bank.

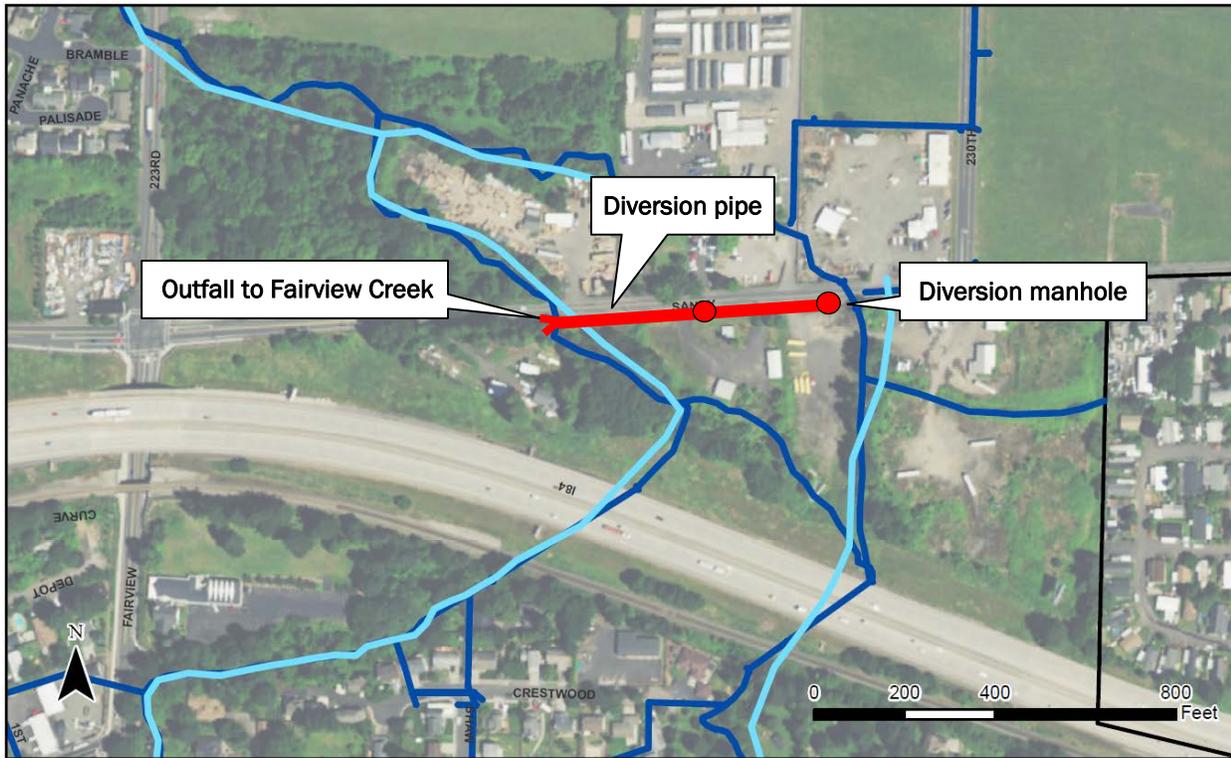
Design Assumptions

The preliminary project definition from City staff identified 500 feet of shoreline requiring restoration. Cost estimates are based on a total of 5,000 sf of restoration area including both upland and in-water areas.

Project implementation may be conducted concurrently with proposed park improvements.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$37,000
Engineering and permitting (35%)	\$13,000
Construction administration (5%)	\$2,000
Capital project implementation cost (Total)	\$52,000



Project Name	NN-1: No-Name Creek Capacity Improvement
Detailed Location	NE Sandy Blvd and NE 230th Ave
Ownership	Public (City of Fairview and Multnomah County)
Objective(s) Addressed	Flood Reduction

Project Background

This project has been redefined from CP NN-1a and NN-1b in the 2007 CSMP.

Varying solutions to localized flooding of NE Sandy Boulevard near NE 230th Avenue have been included in multiple drainage master plans and engineering documents. The original Oakley Engineering report published April 1993 originally recommended a flow bypass along the south side of NE Sandy Boulevard to reduce flows crossing NE Sandy Boulevard and reduce flooding of downstream properties.

The 2007 CSMP modeled projected flows from both No Name Creek and a major drainage basin originating outside of the city limits to the east (in Wood Village) and determined that a flow diversion would not be sufficient to reduce flooding of NE Sandy Boulevard. However, flooding reports since 2007 indicate that peak flows are generally conveyed through the NE Sandy Boulevard culvert with minimal flooding.

Review of the 2007 XP-SWMM model shows major flow contributions from east of the city of Fairview that do not appear consistent with observed drainage patterns, so the peak flows at NE Sandy Boulevard may be manageable through a flow bypass.

Project Description

Construct a flow diversion structure on the south side of NE Sandy Boulevard to bypass flows from No Name Creek to Fairview Creek. The project objectives are to reduce flooding on NE Sandy Boulevard and surrounding properties during peak storm events. This would also increase redevelopment potential for properties downstream (north) of NE Sandy Boulevard. Utilize the existing ditch alignment along the south side of NE Sandy Boulevard. Modeled invert elevations at No Name Creek (elevation 38.0 feet) and Fairview Creek (elevation 31.9 feet) would allow for a positive slope alignment of approximately 0.9 percent.

The preliminary design assumes a 36-inch-diameter pipe with manholes every 300 feet. Detailed design efforts should include system modeling to determine whether the bypass pipe is sufficient to convey all flow from No Name Creek, eliminating the need for a conveyance system through private property downstream of NE Sandy Boulevard.

Design Considerations

The engineering evaluation should use the updated XP-SWMM model developed under GN-4 to verify flow contributions from outside the city limits (i.e., Wood Village), account for upstream development and flow diversions (i.e., CP NN-2), and verify size of the bypass pipe.

Design evaluation should consider whether full bypass of No Name Creek is possible to remove drainage impacts to properties on the North side of NE Sandy Boulevard.

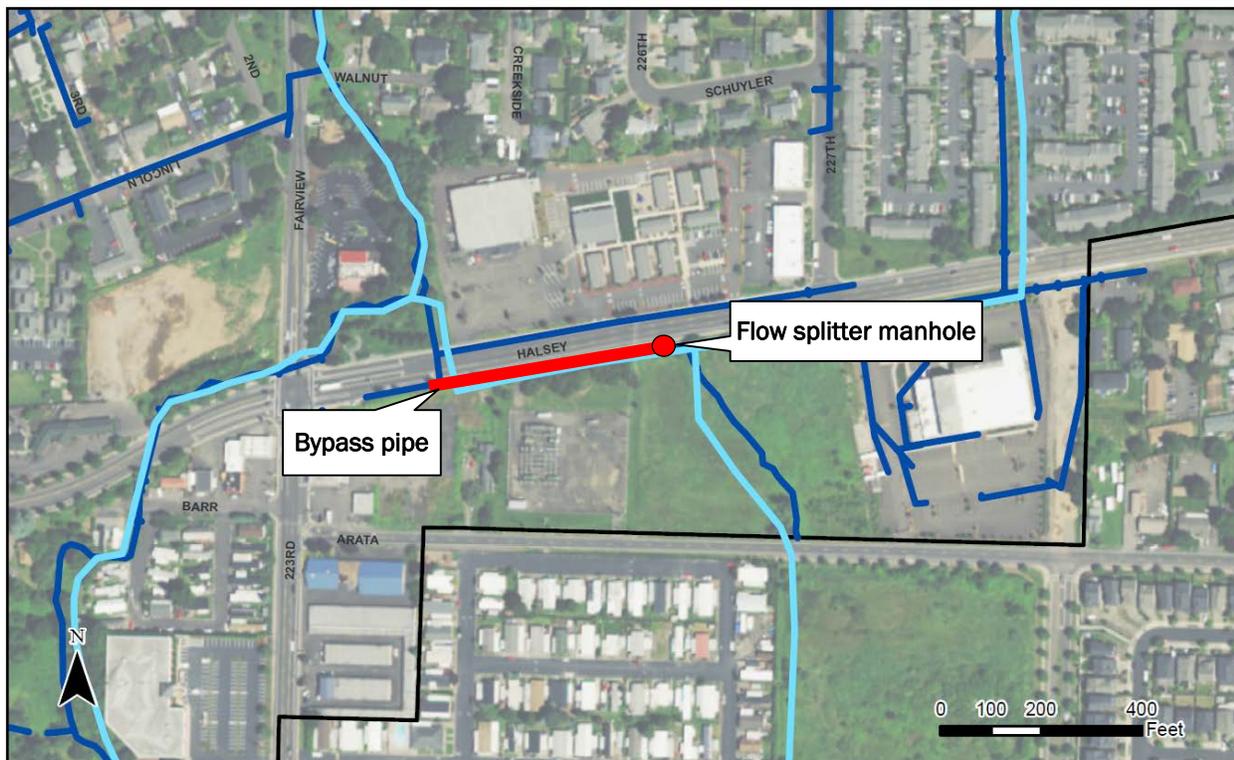
The bypass pipe would be located in the location of the existing drainage ditch along the south side of NE Sandy Boulevard. Consider impacts to existing utilities.

The project could be constructed in conjunction with transportation or pedestrian improvements along NE Sandy Boulevard.

The project must be coordinated with the County, as NE Sandy Boulevard is a County-maintained roadway.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$404,000
Engineering and permitting (25%)	\$101,000
Construction administration (5%)	\$20,000
Capital project implementation cost (Total)	\$525,000



Project Name	NN-2: No Name Creek Capacity Improvement
Detailed Location	NE Halsey Street and NE 227th Avenue
Ownership	Public (City of Fairview and Multnomah County)
Objective(s) Addressed	Flood Reduction

Project Background

This project has been redefined from the 2007 CSMP to address flooding along NE Halsey Street and on private property along No Name Creek.

Previous reports identified ongoing flooding problems along NE Halsey Street in the vicinity of NE 227th Avenue. Because flooding was isolated to private property, the 2007 CSMP limited NN-2 to the addition of riparian shading along the drainage ditch on the south side of NE Halsey Street that becomes No Name Creek.

In the current configuration, the drainage ditch runs north and bisects private property south of NE Halsey Street. As the drainage ditch approaches the south side of NE Halsey Street, a natural diversion causes the majority of flow to discharge east toward No Name Creek. The culvert under NE Halsey Street to No Name Creek is a 36-inch-diameter culvert. During peak flow events, approximately a quarter of the flow may be diverted west along NE Halsey Street to Fairview Creek. The culvert under NE Halsey Street to Fairview Creek is a 24-inch-diameter culvert.

Project Description

Construct a flow control structure on the south side of NE Halsey Street to manage the flow split between No Name Creek (east) and Fairview Creek (west). The flow split should account for the capacity of existing culverts under NE Halsey Street. The culvert under NE Halsey Street to No Name Creek is a 36-inch-diameter culvert. The culvert under NE Halsey Street to Fairview Creek is a 24-inch-diameter culvert that sits at a slightly higher elevation (less than 1 foot of difference) than the No Name Creek culvert.

The preliminary design assumes a large manhole flow control structure would be installed on the south side of NE Halsey Street to manage the flow split between No Name Creek and Fairview Creek. Approximately 390 feet of 24-inch-diameter pipe and two manholes would be installed along the south side of NE Halsey Street to improve conveyance capacity toward Fairview Creek.

Design Considerations

Upstream and retroactive flow control could eliminate the need for this project if peak flows are managed through detention or infiltration before reaching NE Halsey Street.

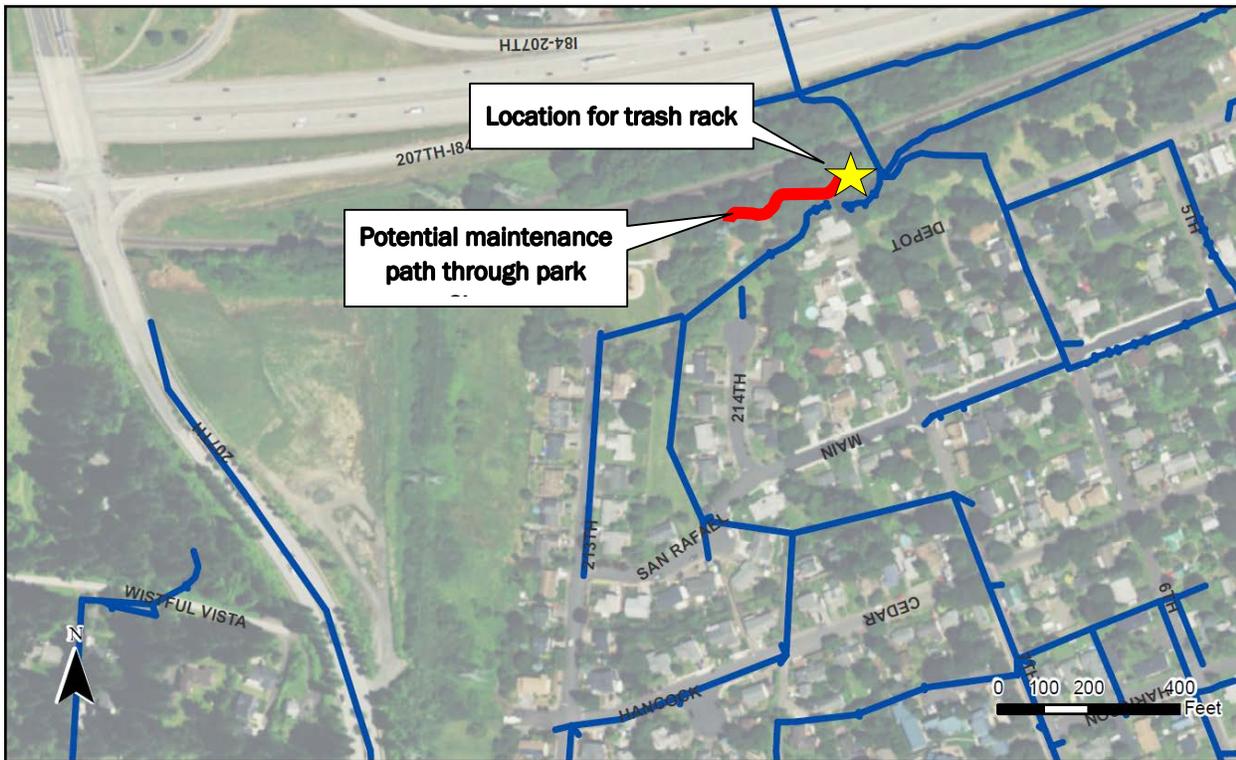
The engineering evaluation should use the updated XP-SWMM model developed under GN-4 to verify flow contributions from outside the city limits (i.e., Wood Village), to account for upstream development potential, and size the flow splitter.

The engineering evaluation for this CP is recommended in conjunction with FV-1 design. Preliminary sizing of FV-1 accounts for contribution from No Name Creek at NE Halsey Street, but sizing may be refined as flows are verified.

The project must be coordinated with the County, as NE Halsey Street is a County-maintained roadway.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$182,000
Engineering and permitting (25%)	\$46,000
Construction administration (5%)	\$9,000
Capital project implementation cost (Total)	\$237,000



Project Name	RT-1: Raintree Creek Culvert Debris Barrier
Detailed Location	Park Cleone City Park
Ownership	Union Pacific (UPRR)
Objective(s) Addressed	Flood Reduction

Project Background

This project was originally proposed in the 2007 CSMP. No changes are proposed to the previously identified project, with the exception of the addition of an access trail (i.e., maintenance path).

Project Description

Install a trash rack at the upstream (south) end of railroad culvert to reduce clogging and allow for debris removal to eliminate potential flooding of the railroad. Construction access may require access through private property and/or through Park Cleone, which provides an opportunity to install an access trail for both construction and maintenance access for ongoing debris removal.

Design Considerations

Design should consider the remote-access location of the railroad culvert and coordination with UPRR. The cost estimate assumes installation of a gravel access road, approximately 300 feet long and 8 feet wide.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$59,000
Engineering and permitting (35%)	\$21,000
Construction administration (5%)	\$3,000
Capital project implementation cost (Total)	\$83,000

Project Name	AM-1: Stormwater Infrastructure Asset Management
Detailed Location	Entire city of Fairview
Ownership/Funding Source	Public (City of Fairview)
Objective(s) Addressed	Flood Reduction, Water Quality, Asset Management
Funding	Annual

Project Background

This project has been added since development of the 2007 CSMP.

City staff have expressed concern regarding the availability of funds to address system maintenance and replacement. In accordance with the City's recent Water System Master Plan, an asset management line item was added based on the anticipated replacement cost and frequency for system-wide assets.

Project Description

Allocate funds annually to establish a stormwater asset replacement fund that would be used to replace existing public infrastructure. Pipes, catch basins, and other stormwater assets should be replaced when materials deteriorate past an acceptable level of service. Specific replacement needs should be identified through routine maintenance visits and planned CCTV inspections (see AM-2).

Design Considerations

System assets were identified based on information currently included in the City's GIS inventory. Public system assets include approximately 70,000 LF of pipe (generally between 12 and 60 inches diameter), manholes, and sumped and unsumped catch basins. Inlet leaders and pipes less than 12 inches diameter are assumed to be 12-inch-diameter pipe for cost-estimating purposes.

Pipe replacement assumes the use of HDPE.

The cost estimate assumes present-day (2016) replacement costs for all assets. The annual cost assumes all identified system assets would be replaced once over a 100-year planning period.

Engineering and permitting costs are not accounted for in this estimate.

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$15,623,000
Engineering and permitting (0%)	N/A
Construction administration (5%)	\$781,000
Asset management allocation (Total)	\$16,404,000
Asset management allocation (Annual)	\$164,000

Project Name	AM-2: Stormwater Infrastructure Video and Cleaning
Detailed Location	Entire city of Fairview
Ownership/Funding Source	Public (City of Fairview)
Objective(s) Addressed	Flood Reduction, Asset Management
Funding	Annual

Project Background

This project has been added since development of the 2007 CSMP.

City staff have expressed concern regarding the availability of funds to address system maintenance and replacement. In accordance with the City's recent Water System Master Plan, an asset management line item was added based on anticipated maintenance needs.

Project Description

Allocate funds annually to implement system-wide CCTV and cleaning of the public stormwater conveyance system. All pipes in the city should be cleaned and inspected on a rotating basis, with the intent to take recordings of 20 percent of the system each year.

Design Considerations

System assets were identified based on information currently included in the City's GIS inventory. Public system assets include approximately 70,000 LF of pipe (generally between 12 and 60 inches diameter).

The annual cost also assumes CCTV and cleaning of 20 percent of the public pipes each year (all pipes inspected over a 5-year period).

Estimated planning-level cost (2016 dollars, rounded to the nearest thousand)

Capital expense total (including contingency)	\$228,000
Engineering and permitting (15%)	\$34,000
Construction administration (5%)	\$11,000
Asset management allocation (Total, every 5 years)	\$274,000
Asset management allocation (Annual)	\$55,000

Appendix B: Cost Estimates

City of Fairview Consolidated Stormwater Master Plan Update
 Brown and Caldwell, 2016
 Unit Cost Summary

Item	Unit	Recommended unit cost
Water Quality Facility Installation		
General Earthwork/ Excavation	CY	20
Clear vegetation including stumps	AC	8,000
Amended Soils and Mulch	CY	45
Jute Matting, Biodegradeable	SY	6
Energy dissipation pad - Rip-Rap, Class 50	CY	65
Drain Rock	CY	100
Pond Outflow Control Structure	EA	6,000
Pond Inlet Structure	EA	4,500
Rain Garden (no walls or underdrain)	SF	27
Stormwater Planter (includes walls and underdrain)	SF	40
Gravel Access Road	SF	5
Beehive Overflow	EA	1,500
Structure Installation		
Precast Concrete Manhole (48", 0-8' deep)	EA	5,500
Precast Concrete Manhole (48", 9-12' deep)	EA	6,500
Precast Concrete Manhole (60", 0-8' deep)	EA	7,500
Precast Concrete Manhole (60", 9-12' deep)	EA	9,500
Precast Concrete Manhole (72", 0-8' deep)	EA	9,500
Precast Concrete Manhole (72", 9-12' deep)	EA	12,000
Drywell (48", 20-25' deep)	EA	12,000
Catch Basin, all types	EA	2,000
Connection to Existing Structure	EA	1,500
Plug Existing Pipe	EA	500
Outfall Energy Dissipator	EA	3,000-10,000 (varies by project)
Restoration/ Resurfacing		
CCTV Inspection	LF	1.50
Pipe Vactor and Cleaning	LF	1.20
Riparian/Wetland Planting (Non-irrigated)	AC	20,000
Riparian/Wetland Planting (w/ temporary irrigation)	AC	32,000
Seeding, small quantities (under 5,000 sf)	SF	6
Pipe Unit Cost		
HDPE Perforated Underdrain (6", 2-5' Deep)	LF	55
HDPE Inlet Lead (12", 2-5' Deep)	LF	90
HDPE Pipeline (12", 5-10' Deep)	LF	110
HDPE Pipeline (12", 10-15' Deep)	LF	130
HDPE Pipeline (18", 5-10' Deep)	LF	170
HDPE Pipeline (24", 5-10' Deep)	LF	225
HDPE Pipeline (36", 5-10' Deep)	LF	350
HDPE Pipeline (48", 5-10' Deep)	LF	500
HDPE Pipeline (60", 5-10' Deep)	LF	720
Contingencies and Multipliers		
Mobilization/Demobilization	LS	10%
Traffic Control/Utility Relocation	LS	5-10% (varies by project)
Erosion Control	LS	2% (varies by project)
Construction Contingency ¹	LS	30%
Engineering and Permitting (%) ²	LS	15-35%
Construction Administration (%)	LS	5%

Notes

- For asset replacement projects, contingency set at 5%
- Engineering and permitting costs vary by project size and scope.
 - Retrofit, maintenance and asset management projects are set at 15%, with the exception of AM-1
 - Projects with construction costs > \$100,000 are set at 25%
 - Projects with construction costs < \$100,000 are set at 35%

City of Fairview Consolidated Stormwater Master Plan Update
 Brown and Caldwell, 2016
 Detailed Cost Summary

CIP Number	CIP Name (Capital Projects)	Total Cost	Total Cost (not rounded)
GN-1	Closed-circuit television inspection	\$ 51,000	\$ 51,251
GN-2/3	Targeted Infrastructure Upgrades	\$ 163,000	\$ 163,082
GN-4	System Hydraulic Modeling	\$ 100,000	\$ 100,000
FV-1	Fairview Creek High Flow Bypass	\$ 1,995,000	\$ 1,995,096
FV-2	Halsey Street Swale Retrofit	\$ 163,000	\$ 163,082
FV-3d	Fairview Creek Off-Channel Storage	\$ 766,000	\$ 765,783
FV-3e	Fairview Creek Off-Channel Storage, Future	\$ 924,000	\$ 923,967
FV-5	Old Town Green Streets Opportunities	\$ 51,000	\$ 51,106
FV-8a	Chinook Pond Retrofit	\$ 249,000	\$ 249,049
FV-8b	Multnomah Pond Retrofit	\$ 120,000	\$ 119,970
FV-9	Fairview Lake Bank Stabilization	\$ 52,000	\$ 52,140
NN-1	No-Name Creek Flow Bypass	\$ 525,000	\$ 524,973
NN-2	No-Name Creek Capacity Improvement	\$ 237,000	\$ 236,782
RT-1	Raintree Creek Culvert Debris Barrier	\$ 83,000	\$ 83,210
CAPITAL PROJECT TOTAL		\$ 5,479,000	\$ 5,479,490
AM-1	Stormwater Infrastructure Asset Replacement	\$ 164,000	\$ 164,044
AM-2	Stormwater Infrastructure Inspection and Cleaning	\$ 55,000	\$ 54,772
ASSET MANAGEMENT TOTAL (Annual)		\$ 219,000	\$ 218,816

City of Fairview Consolidated Stormwater Master Plan Update
 Brown and Caldwell, 2016
 Detailed Cost Estimate

CIP GN-1: Closed-Circuit Television Inspection				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
CCTV Inspection	13,100	LF	1.50 \$	19,650
Pipe Vactor and Cleaning	13,100	LF	1.20 \$	15,720
Capital Expense Sub-Total			\$	35,370
Mobilization/Demobilization	10%	LS	\$	3,537
Traffic Control/Utility Relocation	5%	LS	\$	1,769
Erosion Control	0%	LS	\$	-
Construction Cost Sub-Total			\$	40,676
Construction Contingency	5%	LS	\$	2,034
Capital Expense Total			\$	42,709
<u>Administrative Expenses</u>				
Engineering and Permitting	15%	LS	\$	6,406
Construction & General Administration	5%	LS	\$	2,135
Administrative Expense Total			\$	8,542
Capital Implementation Cost Total			\$	51,251

City of Fairview Consolidated Stormwater Master Plan Update
 Brown and Caldwell, 2016
 Detailed Cost Estimate

CIP GN-2/3: Targeted Infrastructure Upgrades				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
Capital Expenses				
Catch Basin, all types	48	EA	\$ 2,000	\$ 96,000
HDPE Pipeline (12", 5-10' Deep)	3,000	EA	\$ 110	\$ 330,000
Capital Expense Sub-Total				\$ 426,000
Mobilization/Demobilization	10%	LS		\$ 42,600
Traffic Control/Utility Relocation	5%	LS		\$ 21,300
Erosion Control	2%	LS		\$ 8,520
Construction Cost Sub-Total				\$ 498,420
Construction Contingency	5%	LS		\$ 24,921
Capital Expense Total				\$ 523,341
Administrative Expenses				
Engineering and Permitting	15%	LS		\$ 78,501
Construction & General Administration	5%	LS		\$ 26,167
Administrative Expense Total				\$ 104,668
Capital Implementation Cost Total				\$ 628,009

City of Fairview Consolidated Stormwater Master Plan Update
 Brown and Caldwell, 2016
 Detailed Cost Estimate

CIP GN-4: System Hydraulic Modeling				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
		EA	\$	-
		EA	\$	-
Capital Expense Sub-Total			\$	-
Mobilization/Demobilization	10%	LS	\$	-
Traffic Control/Utility Relocation	5%	LS	\$	-
Erosion Control	2%	LS	\$	-
Construction Cost Sub-Total			\$	-
Construction Contingency	0%	LS	\$	-
Capital Expense Total			\$	-
<u>Administrative Expenses</u>				
Engineering and Permitting*	15%	LS	\$	-
Construction & General Administration	5%	LS	\$	-
Administrative Expense Total			\$	-
Capital Implementation Cost Total			\$	100,000

City of Fairview Consolidated Stormwater Master Plan Update
 Brown and Caldwell, 2016
 Detailed Cost Estimate

CIP FV-1: Fairview Creek High Flow Bypass				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
Capital Expenses				
HDPE Pipeline (48", 5-10' Deep)	1,800	LF	\$ 500	\$ 900,000
Precast Concrete Manhole (72", 9-12' deep)	7	EA	\$ 12,000	\$ 84,000
Outfall Energy Dissipator	1	EA	\$ 10,000	\$ 10,000
Rebuilding headwall at Marilyn's City Park	1	EA	\$ 15,000	\$ 15,000
Capital Expense Sub-Total				\$ 1,009,000
Mobilization/Demobilization	10%	LS		\$ 100,900
Traffic Control/Utility Relocation	5%	LS		\$ 50,450
Erosion Control	2%	LS		\$ 20,180
Construction Cost Sub-Total				\$ 1,180,530
Construction Contingency	30%	LS		\$ 354,159
Capital Expense Total				\$ 1,534,689
Administrative Expenses				
Engineering and Permitting ¹	25%	LS		\$ 383,672
Construction & General Administration	5%	LS		\$ 76,734
Administrative Expense Total				\$ 460,407
Capital Implementation Cost Total				\$ 1,995,096

¹Engineering evaluation should utilize the updated XP-SWMM model developed for the Fairview Creek and No Name Creek systems under GN-4.

City of Fairview Consolidated Stormwater Master Plan Update
 Brown and Caldwell, 2016
 Detailed Cost Estimate

CIP FV-2: Halsey Street Swale Retrofit				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
Drywell (48", 20-25' deep)	2	EA	\$ 12,000	\$ 24,000
Rain Garden (Includes drain rock, amended soil, and planting)	1,800	SF	\$ 27	\$ 48,600
HDPE Perforated Underdrain (6", 2-5' Deep)	150	LF	\$ 55	\$ 8,250
Beehive Overflow	2	EA	\$ 1,500	\$ 3,000
HDPE Pipeline (12", 5-10' Deep)	50	LF	\$ 110	\$ 5,500
Capital Expense Sub-Total				\$ 89,350
Mobilization/Demobilization	10%	LS		\$ 8,935
Traffic Control/Utility Relocation	5%	LS		\$ 4,468
Erosion Control	2%	LS		\$ 1,787
Construction Cost Sub-Total				\$ 104,540
Construction Contingency	30%	LS		\$ 31,362
Capital Expense Total				\$ 135,901
<u>Administrative Expenses</u>				
Engineering and Permitting	15%	LS		\$ 20,385
Construction & General Administration	5%	LS		\$ 6,795
Administrative Expense Total				\$ 27,180
Capital Implementation Cost Total				\$ 163,082

City of Fairview Consolidated Stormwater Master Plan Update
 Brown and Caldwell, 2016
 Detailed Cost Estimate

CIP FV-3d: Fairview Creek Off Channel Storage, Public				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
General Earthwork/ Excavation	12,100	CY	\$ 20	\$ 242,000
Clear vegetation including stumps	3	AC	\$ 8,000	\$ 24,000
Riparian/Wetland Planting (w/ temporary irrigation)	3	AC	\$ 32,000	\$ 96,000
Capital Expense Sub-Total				\$ 362,000
Mobilization/Demobilization	10%	LS		\$ 36,200
Traffic Control/Utility Relocation	5%	LS		\$ 18,100
Erosion Control	2%	LS		\$ 7,240
Construction Cost Sub-Total				\$ 423,540
Construction Contingency	30%	LS		\$ 127,062
Capital Expense Total				\$ 550,602
<u>Administrative Expenses</u>				
Engineering and Permitting	25%	LS		\$ 137,651
404 Wetland Permit (Possible Cost)	1	EA	\$ 50,000	\$ 50,000
Construction & General Administration	5%	LS		\$ 27,530
Administrative Expense Total				\$ 215,181
Capital Implementation Cost Total				\$ 765,783

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CIP FV-3e: Fairview Creek Off Channel Storage, Private				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
General Earthwork/ Excavation	12,100	CY	\$ 20	\$ 242,000
Clear vegetation including stumps	5	AC	\$ 8,000	\$ 40,000
Riparian/Wetland Planting (w/ temporary irrigation)	5	AC	\$ 32,000	\$ 160,000
Capital Expense Sub-Total				\$ 442,000
Mobilization/Demobilization	10%	LS		\$ 44,200
Traffic Control/Utility Relocation	5%	LS		\$ 22,100
Erosion Control	2%	LS		\$ 8,840
Construction Cost Sub-Total				\$ 517,140
Construction Contingency	30%	LS		\$ 155,142
Capital Expense Total				\$ 672,282
<u>Administrative Expenses</u>				
Engineering and Permitting	25%	LS		\$ 168,071
404 Wetland Permit (Possible Cost)	1	EA	\$ 50,000	\$ 50,000
Construction & General Administration	5%	LS		\$ 33,614
Administrative Expense Total				\$ 251,685
Capital Implementation Cost Total				\$ 923,967

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CIP FV-5: Old Town Green Streets Opportunities				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
Stormwater Planter (includes walls, underdrain, drain rock, amended soil, and planting)	600	SF	\$ 40	\$ 24,000
Capital Expense Sub-Total				\$ 24,000
Mobilization/Demobilization	10%	LS		\$ 2,400
Traffic Control/Utility Relocation	5%	LS		\$ 1,200
Erosion Control	2%	LS		\$ 480
Construction Cost Sub-Total				\$ 28,080
Construction Contingency	30%	LS		\$ 8,424
Capital Expense Total				\$ 36,504
<u>Administrative Expenses</u>				
Engineering and Permitting	35%	LS		\$ 12,776
Construction & General Administration	5%	LS		\$ 1,825
Administrative Expense Total				\$ 14,602
Capital Implementation Cost Total¹				\$ 51,106

¹Costs are based on an annual installation of stormwater planters.

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CIP FV-8a: Chinook Pond Retrofit				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
Capital Expenses				
Clear vegetation including stumps	0.4	AC	\$ 8,000	\$ 3,200
General Earthwork/Excavation	1,300	CY	\$ 20	\$ 26,000
Drain Rock	650	CY	\$ 100	\$ 65,000
Amended Soils and Mulch	650	CY	\$ 45	\$ 29,250
Riparian/Wetland Planting (Non-irrigated)	0.4	AC	\$ 20,000	\$ 8,000
Flow bypass during construction	1	LS	\$ 5,000	\$ 5,000
Capital Expense Sub-Total				\$ 136,450
Mobilization/Demobilization	10%	LS		\$ 13,645
Traffic Control/Utility Relocation	5%	LS		\$ 6,823
Erosion Control	2%	LS		\$ 2,729
Construction Cost Sub-Total				\$ 159,647
Construction Contingency	30%	LS		\$ 47,894
Capital Expense Total				\$ 207,540
Administrative Expenses				
Engineering and Permitting	15%	LS		\$ 31,131
Construction & General Administration	5%	LS		\$ 10,377
Administrative Expense Total				\$ 41,508
Capital Implementation Cost Total				\$ 249,049

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CIP FV-8b: Multnomah Pond Retrofit				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
Clear vegetation including stumps	0.13	AC	\$ 8,000	\$ 1,040
General Earthwork/Excavation	815	CY	\$ 20	\$ 16,300
Drain Rock	200	CY	\$ 100	\$ 20,000
Amended Soils and Mulch	200	CY	\$ 45	\$ 9,000
Riparian/Wetland Planting (Non-irrigated)	0.25	AC	\$ 20,000	\$ 5,000
Flow bypass during construction	1	LS	\$ 5,000	\$ 5,000
Capital Expense Sub-Total				\$ 56,340
Mobilization/Demobilization	10%	LS		\$ 5,634
Traffic Control/Utility Relocation	5%	LS		\$ 2,817
Erosion Control	2%	LS		\$ 1,127
Construction Cost Sub-Total				\$ 65,918
Construction Contingency	30%	LS		\$ 19,775
Capital Expense Total				\$ 85,693
<u>Administrative Expenses</u>				
Engineering and Permitting	35%	LS		\$ 29,993
Construction & General Administration	5%	LS		\$ 4,285
Administrative Expense Total				\$ 34,277
Capital Implementation Cost Total				\$ 119,970

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CIP FV-9: Fairview Lake Bank Stabilization				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
Capital Expenses				
Clear vegetation including stumps	0.11	AC	\$ 8,000	\$ 880
Riparian/Wetland Planting (Non-irrigated)	0.11	AC	\$ 20,000	\$ 2,200
Jute Matting, Biodegradeable	556	SY	\$ 6	\$ 3,336
Energy dissipation pad - Rip-Rap, Class 50	278	CY	\$ 65	\$ 18,070
Capital Expense Sub-Total				\$ 24,486
Mobilization/Demobilization	10%	LS		\$ 2,449
Traffic Control/Utility Relocation	5%	LS		\$ 1,224
Erosion Control	2%	LS		\$ 490
Construction Cost Sub-Total				\$ 28,649
Construction Contingency	30%	LS		\$ 8,595
Capital Expense Total				\$ 37,243
Administrative Expenses				
Engineering and Permitting	35%	LS		\$ 13,035
Construction & General Administration	5%	LS		\$ 1,862
Administrative Expense Total				\$ 14,897
Capital Implementation Cost Total				\$ 52,140

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CIP NN-1: No-Name Creek Flow Bypass				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
HDPE Pipeline (36", 5-10' Deep)	650	LF	\$ 350	\$ 227,500
Precast Concrete Manhole (60", 0-8' deep)	2	LF	\$ 7,500	\$ 15,000
Outfall Energy Dissipator	1	EA	\$ 5,000	\$ 5,000
Seeding, small quantities	3,000	SF	\$ 6	\$ 18,000
Capital Expense Sub-Total				\$ 265,500
Mobilization/Demobilization	10%	LS		\$ 26,550
Traffic Control/Utility Relocation	5%	LS		\$ 13,275
Erosion Control	2%	LS		\$ 5,310
Construction Cost Sub-Total				\$ 310,635
Construction Contingency	30%	LS		\$ 93,191
Capital Expense Total				\$ 403,826
<u>Administrative Expenses</u>				
Engineering and Permitting ¹	25%	LS		\$ 100,956
Construction & General Administration	5%	LS		\$ 20,191
Administrative Expense Total				\$ 121,148
Capital Implementation Cost Total				\$ 524,973

¹Engineering evaluation should utilize the updated XP-SWMM model developed for the Fairview Creek and No Name Creek systems under GN-4.

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CIP NN-2: No-Name Creek Capacity Improvement				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
HDPE Pipeline (24", 5-10' Deep)	390	LF	\$ 225	\$ 87,750
Precast Concrete Manhole (60", 0-8' deep)	1	LF	\$ 7,500	\$ 7,500
Precast Concrete Manhole (48", 0-8' deep)	2	EA	\$ 5,500	\$ 11,000
Connection to Existing Structure	1	EA	\$ 1,500	\$ 1,500
Seeding, small quantities	2,000	SF	\$ 6	\$ 12,000
Capital Expense Sub-Total				\$ 119,750
Mobilization/Demobilization	10%	LS		\$ 11,975
Traffic Control/Utility Relocation	5%	LS		\$ 5,988
Erosion Control	2%	LS		\$ 2,395
Construction Cost Sub-Total				\$ 140,108
Construction Contingency	30%	LS		\$ 42,032
Capital Expense Total				\$ 182,140
<u>Administrative Expenses</u>				
Engineering and Permitting ¹	25%	LS		\$ 45,535
Construction & General Administration	5%	LS		\$ 9,107
Administrative Expense Total				\$ 54,642
Capital Implementation Cost Total				\$ 236,782

¹Engineering evaluation should utilize the updated XP-SWMM model developed for the Fairview Creek and No Name Creek systems under GN-4.

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CIP RT-1: Raintree Creek Culvert Debris Barrier				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
Trash Rack	1	LS	\$ 24,000	\$ 24,000
Gravel Access Road	2,400	SF	\$ 5	\$ 12,000
Capital Expense Sub-Total				\$ 36,000
Mobilization/Demobilization	20%	LS		\$ 7,200
Traffic Control/Utility Relocation	5%	LS		\$ 1,800
Erosion Control	2%	LS		\$ 720
Construction Cost Sub-Total				\$ 45,720
Construction Contingency	30%	LS		\$ 13,716
Capital Expense Total				\$ 59,436
<u>Administrative Expenses</u>				
Engineering and Permitting	35%	LS		\$ 20,803
Construction & General Administration	5%	LS		\$ 2,972
Administrative Expense Total				\$ 23,774
Capital Implementation Cost Total				\$ 83,210

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CIP AM-1: Stormwater Infrastructure Asset Replacement				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
Capital Expenses				
HDPE Inlet Lead (12", 2-5' Deep)	16,060	LF	\$ 90	\$ 1,445,400
HDPE Pipeline (12", 5-10' Deep)	28,426	LF	\$ 110	\$ 3,126,860
HDPE Pipeline (18", 5-10' Deep)	15,549	LF	\$ 170	\$ 2,643,330
HDPE Pipeline (24", 5-10' Deep)	6,982	LF	\$ 225	\$ 1,570,950
HDPE Pipeline (36", 5-10' Deep)	2,045	LF	\$ 350	\$ 715,750
HDPE Pipeline (60", 5-10' Deep)	566	LF	\$ 720	\$ 407,520
Precast Concrete Manhole (48", 9-12' deep)	279	EA	\$ 6,500	\$ 1,813,500
Catch Basin, all types	497	EA	\$ 2,000	\$ 994,000
Capital Expense Sub-Total				\$ 12,717,310
Mobilization/Demobilization	10%	LS		\$ 1,271,731
Traffic Control/Utility Relocation	5%	LS		\$ 635,866
Erosion Control	2%	LS		\$ 254,346
Construction Cost Sub-Total				\$ 14,879,253
Construction Contingency	5%	LS		\$ 743,963
Capital Expense Total				\$ 15,623,215
Administrative Expenses				
Engineering and Permitting	0%	LS		\$ -
Construction & General Administration	5%	LS		\$ 781,161
Administrative Expense Total				\$ 781,161
Capital Implementation Cost Total				\$ 16,404,376
Lifespan of Stormwater Infrastructure (Replacement)	100	Years		
Annual Implementation Cost				\$ 164,044

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CIP AM-2: Stormwater Infrastructure Video and Cleaning				
Description	Quantity	Unit	Unit Cost (2016)	2016 Cost
<u>Capital Expenses</u>				
CCTV Inspection	70,000	LF	\$ 1.50	\$ 105,000
Pipe Vactor and Cleaning	70,000	LF	\$ 1.20	\$ 84,000
Capital Expense Sub-Total				\$ 189,000
Mobilization/Demobilization	10%	LS		\$ 18,900
Traffic Control/Utility Relocation	5%	LS		\$ 9,450
Erosion Control	0%	LS		\$ -
Construction Cost Sub-Total				\$ 217,350
Construction Contingency	5%	LS		\$ 10,868
Capital Expense Total				\$ 228,218
<u>Administrative Expenses</u>				
Engineering and Permitting	15%	LS		\$ 34,233
Construction & General Administration	5%	LS		\$ 11,411
Administrative Expense Total				\$ 45,644
Capital Implementation Cost Total (city-wide)				\$ 273,861
System Inspection Cycle	5	Years		
Annual Implementation Cost (20% of City)				\$ 54,772