Appendix D: Capital Project Fact Sheets

BC-1: Library Pond Retrofit
BC-2: Ash Meadows Flow Mitigation
BC-3: Wiedemann Ditch and Canyon Creek Park Retrofit, Phase 1 & 2
BC-4: Boeckman Creek Stabilization at Colvin Lane
BC-5: Memorial Park Swale Retrofit
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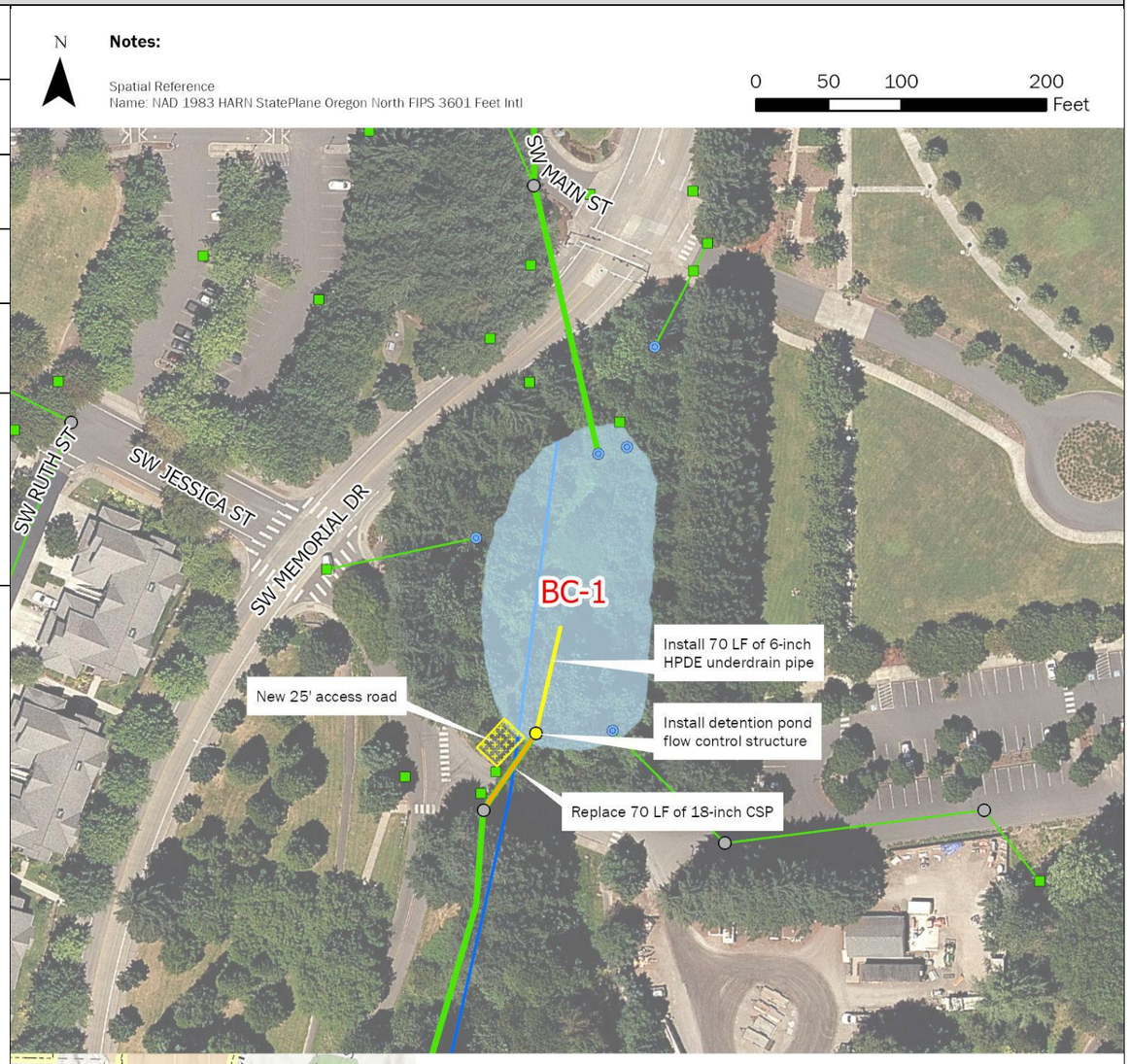
BC-1	Library Pond Retrofit		
Project Objective(s)	Capacity (Mitigation) Water Quality		
Project Opportunity ID	4		
Contributing Drainage Area	132 acres		
Estimated Existing Impervious Area (%)	47%	**Estimated Future Impervious Area (%)**	53%
Project Location	The project site is located adjacent to Memorial Park, north of the Wilsonville Public Library parking lot and east of SW Memorial Drive.		
Statement of Need	The current configuration of Library Pond does not support routine maintenance activities (ongoing challenges are reported related to debris removal at the existing outlet structure), nor does it have a flow control/orifice structure or emergency overflow to provide downstream flow mitigation. Retrofit of the Library Pond is proposed to provide regional water quality treatment and flow control for the Town Center redevelopment, as part of the fee-in-lieu program.		
Project Description	This project retrofits the existing Library Pond to meet current City Standards and accommodate future condition flows associated with the Town Center Development Plan, which anticipates full build out in the next 20+ years. Project details are as follows: • Install a pond outlet structure in compliance with current design standards. • Install 70 LF of 6-inch HDPE underdrain pipe. • Clear, regrade, and replant the 0.7-acre detention pond, including amending the pond bottom to include the 3 feet of required rocks and media. • Install 15-ft wide, 25-feet long access road for maintenance access. • Replace 70 LF of 18" CSP pipe (SD5213) at new design depth, approx. 15 feet deep.		



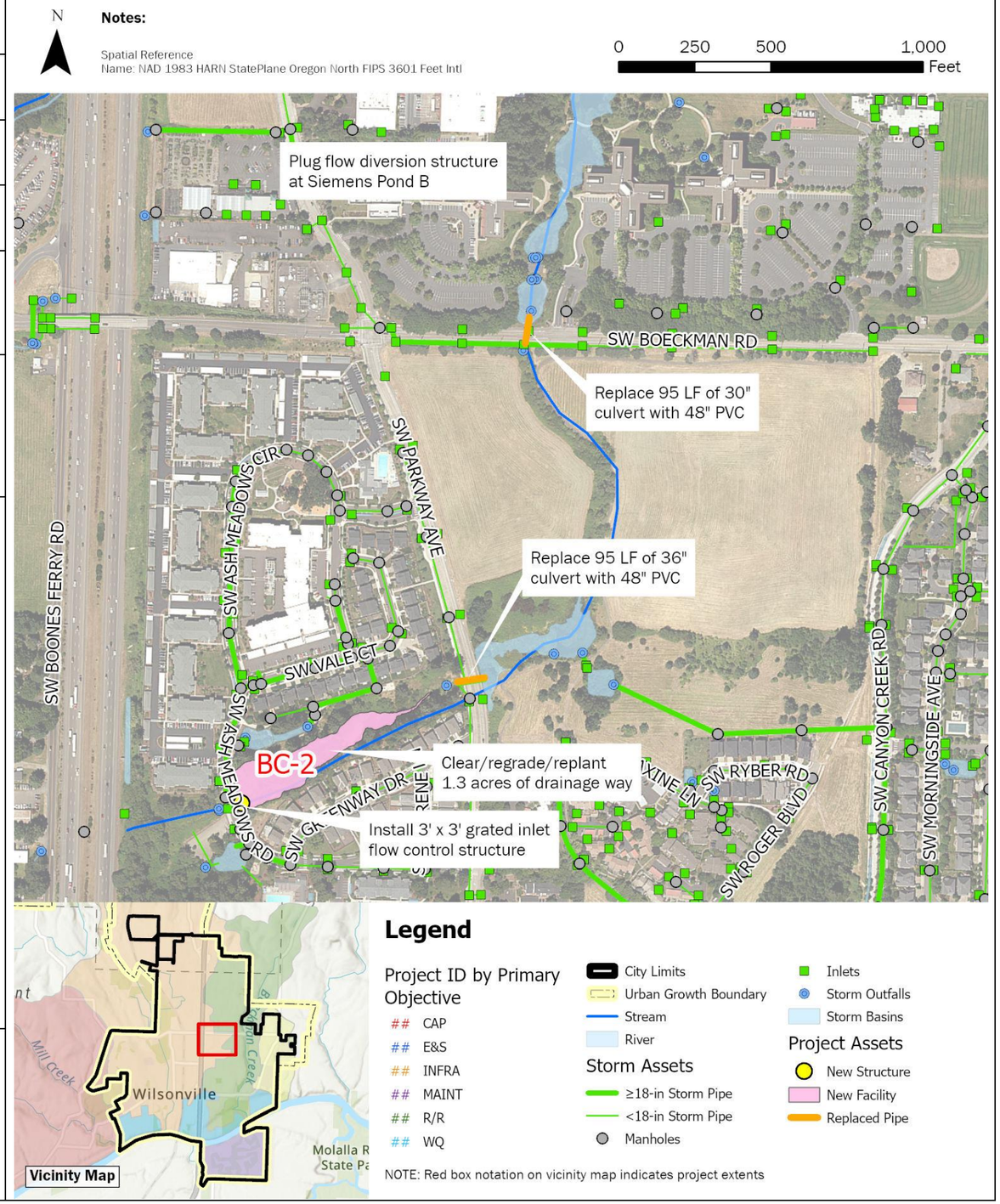
BC-1	Library Pond Retrofit	
Design Considerations / Assumptions	• The existing pond footprint remains unchanged due to roadway and development constraints. Interior side slopes are assumed to be 3H:1V. • Facility sizing is based on adherence to the City's 2015 PWS Section 3 requiring flow matching to pre-development conditions (classified as Oak Savanna). Sizing utilizes the BMP Sizing Tool. • To size the pond in accordance with PWS design standards, approximately 48 acres (50% of total new and redeveloped impervious area associated with the Town Center redevelopment) require onsite treatment and flow control prior to discharge into Library Pond detention facility. • Total pond depth includes drain rock (15-inches), separation layer (3-inches), and growing media (18-inches), in accordance with the PWS Section 3, Appendix A landscape and soil media requirements. • Upstream (SD5053) and downstream (SD5213) pipe sizes are anticipated to remain unchanged. • Inlet structure into the pond (CARTE ID: 27) to remain unchanged. • Outlet structure (standard drawing ST-6110) assumes an additional field inlet for the 100-year overflow event. • Assuming bottom of the pond shape is roughly 70' x 100' - placing underdrain through 2/3 of the of the pond (based on ST-6060), approx. 70 LF.	
Estimated Project Cost	Capital Expense Total	$1,407,000
	Design / Construction Admin. (13.5%)	$190,000
	Engineering & Permitting (20%)	$281,000
	Total Cost	**$1,880,000**
Project Cost Notes	• Cost is for the Library Pond retrofit only. It does not include any additional LID BMPs that are needed to offset some of the contributing drainage area. • Assumes upstream inlet pipe (SD5053) and inlet structure to Library Pond (no ENG ID available) can remain unaltered. • Limited traffic control/utility relocation and surveying will be required, as the site is already developed and has access and staging areas.	

Additional Figures

Overview of the detention pond from maintenance entrance to Memorial Park near the intersection of SW Memorial Drive and SW Jessica Street (Jan 2023)

Outlet of pond that functions as the ditch inlet (Sep 2021)

BC-2	Ash Meadows Flow Mitigation		
Project Objective(s)	Capacity (Mitigation) Water Quality		
Project Opportunity ID	25 and 26		
Contributing Drainage Area	295 acres		
Estimated Existing Impervious Area (%)	37.6%	**Estimated Future Impervious Area (%)**	51.6%
Project Location	This project is in a residential area near the Ash Meadows apartment complex. The area is bounded to the west by Interstate-5, SW Vale Court to the north, SW Parkway Avenue to the east, and SW Greenway Drive to the south.		
Statement of Need	The Boeckman Road Corridor Project requires mitigation of increased flow in Boeckman Creek due to the planned removal of the flow control structure at Boeckman Road. This project reestablishes historic flow patterns to Coffee Lake Creek by rerouting high flows from the Siemens Pond B (Opp. ID 25) and Boeckman Creek back to the Coffee Lake Creek basin.		
Project Description	This project mitigates flow to Boeckman Creek by plugging the diversion structure that currently routes high flows from the Siemens Pond B (Opp. ID 25) east to Boeckman Creek. Rerouted flows will be conveyed through the culvert under Boeckman Road and down the natural drainage path toward Coffee Lake Creek. To mitigate the rerouted high flows, in-line storage will be enhanced between Ash Meadows Lane and Parkway Ave (Opp. ID 26). Project details are as follows: • Plug the flow diversion structure at Siemens Pond B. • Upsize 95 LF of 30-inch culvert at Boeckman Road to 48-inch diameter PVC. • Upsize 80 LF of 36-inch culvert at Parkway Ave (main barrel) to 48-inch diameter PVC. • Install a 3-foot x 3-foot grated inlet to serve as a flow control structure at SW Ash Meadows Circle. • Clear, regrade, and replant 1.3-acres of drainage way and embankment to ensure a low-flow drainage path and healthy vegetation.		

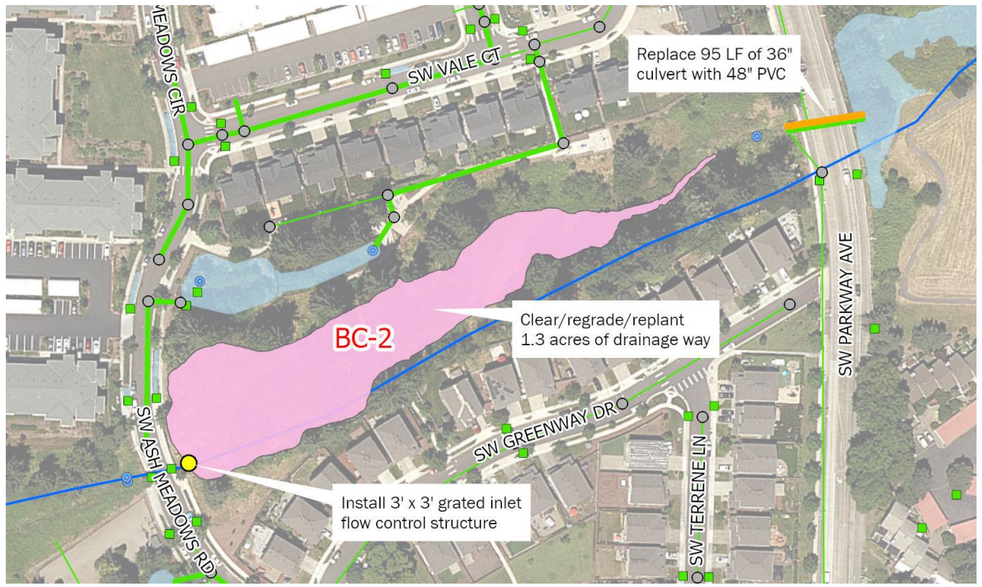


BC-2	Ash Meadows Flow Mitigation		
Design Considerations / Assumptions	• This project is predicted to mitigate 75% of the increased peak flow to Boeckman Creek resulting from the removal of the Boeckman Creek flow control structure during the 25-year storm, under existing hydrological conditions. • This project and cost estimate do not include any modification of the area east of SW Parkway Avenue and south of Boeckman Road. • Existing topography at the Ash Meadows site ranges between 182 -190 feet in elevation, with an estimated storage potential of 181,000 cubic feet. • This project is intended to mitigate additional flow to the culvert under I-5, approximately 300 feet downstream of the Ash Meadows site, and mimic existing flow conditions. • The flow control structure will store 25-year peak flows at a maximum water surface elevation (WSE) of 190 feet. This max WSE will maintain 2 feet of freeboard to neighboring residential properties. Final design will include confirmation of flow control structure sizing.		
Estimated Project Cost	Capital Expense Total	$1,737,000	
	Design / Construction Admin. (13.5%)	$234,000	
	Engineering & Permitting (50%)	$869,000	
	Geotechnical	$100,000	
	Total Cost	**$2,940,000**	
Project Cost Notes	• The Ash Meadows site is approximately 55,000 square feet. Earthwork estimates assume 1.5-feet of excavation and 6-inches of amended soils over the site area. • Clearing and plant restoration is necessary for entire area to 190 ft elevation. • Project concept and cost estimates developed in conjunction with the Boeckman Road Corridor Project. • A 50% Engineering and Permitting multiplier was applied based on design cost estimate. • A 15% Traffic Control/Utility Relocation multiplier was applied based on design cost estimate. • A 20% Surveying multiplier was applied based on design cost estimate. • A $100,000 lump sum cost was included for Geotechnical work based on design cost estimate.		

Additional Figures

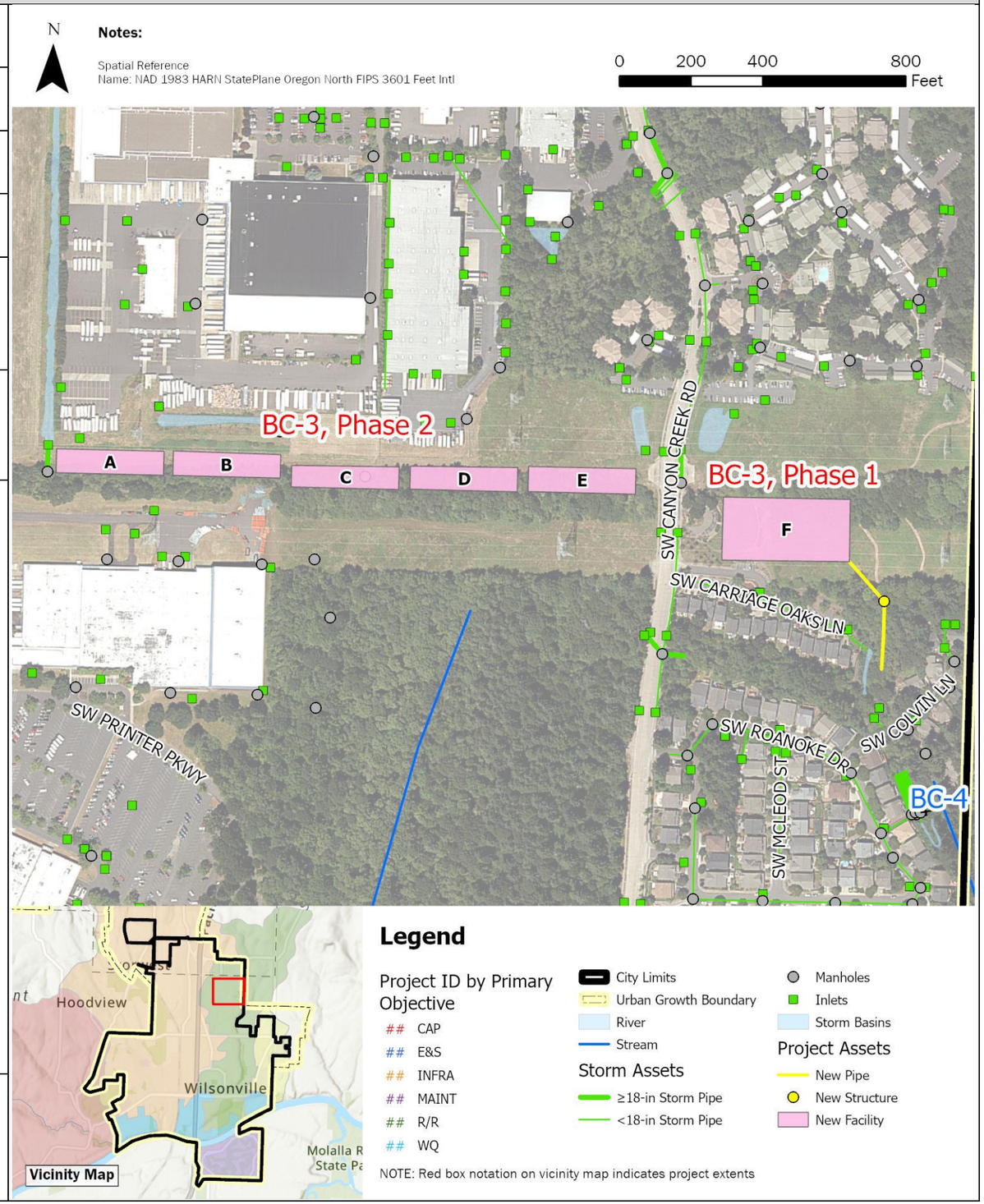
Ash Meadows Drainage Way (Jan 2023)

Siemens Pond Diversion (Nov 2021)



Area map showing zoomed in view of Ash Meadows drainage way.

BC-3	Wiedemann Ditch and Canyon Creek Park Retrofit		
Project Objective(s)	Capacity (Mitigation) Water Quality		
Project Opportunity ID	24		
Contributing Drainage Area	295 acres		
Estimated Existing Impervious Area (%)	38.1%	**Estimated Future Impervious Area (%)**	47.0%
Project Location	This project is located east and west of SW Canyon Creek Road along the existing BPA easement. Phase 1 is located at Canyon Creek Park, north of SW Carriage Oaks Lane. Phase 2 extends west to east along the existing Wiedemann Ditch alignment, south of the Sysco property.		
Statement of Need	The Boeckman Road Corridor Project requires mitigation of increased flow in Boeckman Creek due to the planned removal of the flow control structure at Boeckman Road. This project provides additional floodplain storage through enhancement of the existing Wiedemann Ditch alignment and installation of a storage facility at Canyon Creek Park.		
Project Description	This project mitigates flow to Boeckman Creek through the creation of a series of linear wetland complexes along the existing Wiedemann Ditch within the BPA easement (Facilities A-E). Discharge from the linear wetland complexes will be routed through the existing 48-inch culvert underneath Canyon Creek Rd. prior to entering the proposed vegetated storage facility (Facility F) within available, undeveloped space at Canyon Creek Park. Due to project complexity and size, this project is costed as two phases and numbered based on recommended sequencing. Project details by phase are as follows: Phase 1 (Canyon Creek Park) • Clear, regrade, and replant approximately the 1.6-acre proposed vegetated storage facility. • Install a flow control/outlet structure with emergency overflow at the storage facility. • Install 350 LF of 36-inch diameter PVC to discharge from the southeast corner of the site towards Boeckman Creek. • Install one new manhole at bend in new 36-inch pipe. Phase 2 (Wiedemann Ditch) • Clear, regrade, and replant approximately 2.1-acres along the existing ditch alignment to install five, tiered wetland complexes. • Install a 12-foot wide, 1,500-foot-long access road west of Canyon Creek Road.		



BC-3	Wiedemann Ditch and Canyon Creek Park Retrofit

Design Considerations / Assumptions

- This project is predicted to mitigate 98% of the increased peak flow to Boeckman Creek resulting from the removal of the Boeckman Creek flow control structure during the 25-year storm, under existing hydrological conditions.
- Coordination with both Sysco and BPA is necessary prior to design and construction.
- The Canyon Creek Park facility (Phase 1) is to be designed per the City's surface water requirements with an assumed active storage depth of four feet and 3:1 side slope. Sizing is based on the desire to maximize the flow mitigation potential of the site. If less flow mitigation is needed, the pond footprint and/or depth may be reduced.
- The Wiedemann Ditch alignment (Phase 2) receives drainage from the existing north-south Sysco ditch on Sysco property. Sysco has identified this location as a potential mitigation site for their planned facility expansion.
- The linear wetlands (Phase 2) will be hydraulically connected, using weirs to provide a storage depth of two feet within each cell.

Estimated Project Cost

	Phase 1	*Phase 2*
Capital Expense Total	$3,491,000	$5,253,000
Design / Construction Admin. (3.5% + $200K)	$322,000	$384,000
Engineering & Permitting (30%)	$1,047,000	$1,576,000
Total Cost	**$4,860,000**	**$7,210,000**

Project Cost Notes

- The Canyon Creek Park site (Phase 1) is approximately 69,000 sf. Earthwork estimates assume 1.5-feet of excavation over the site area and the 6-inches of amended soil, per City Standards.
- Final design will include confirmation of weir sizing and layout.
- Final design will include confirmation of vegetated facility plantings and structure sizing.
- Project concept and cost estimates were initially developed in conjunction with the Boeckman Road Corridor Project. A modified construction administration multiplier was applied per direction from the City. No cap on engineering and permitting was applied, given potential design and permitting complexity of the project.

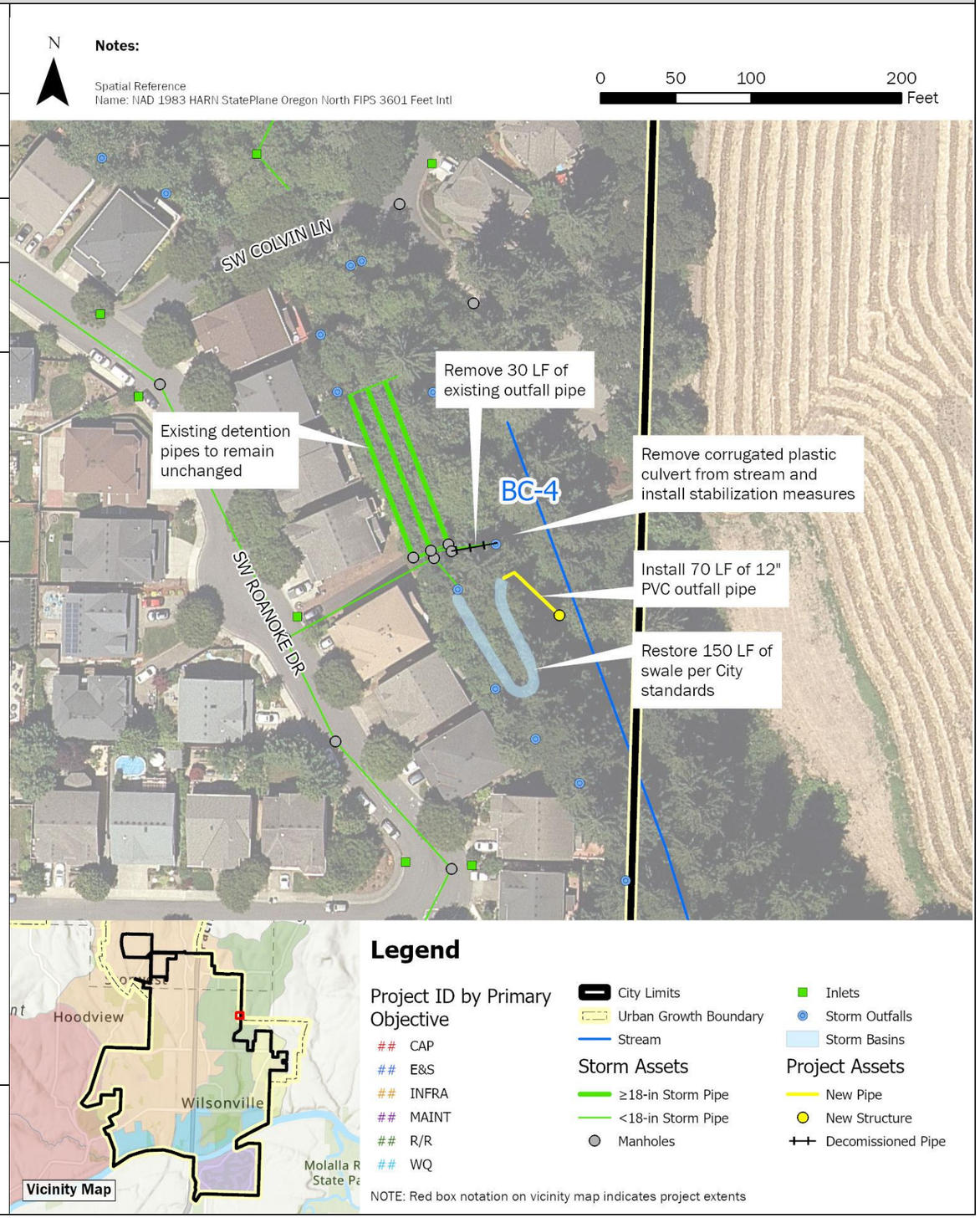
Additional Figures

Canyon Creek channel (Jan 2023)

Canyon Creek channel (Jan 2023)

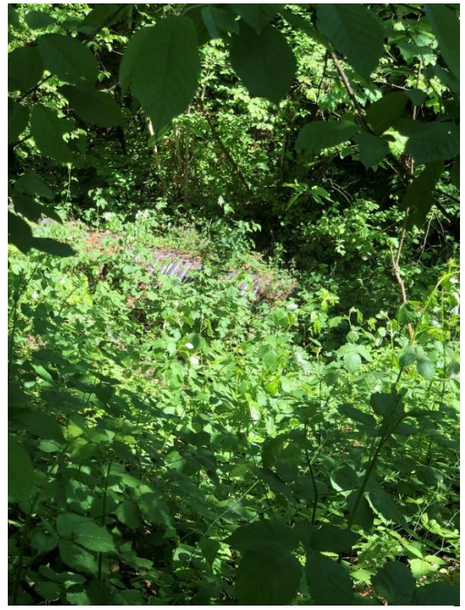
Wiedemann Ditch alignment (Sep 2021)

BC-4	Boeckman Creek Stabilization at Colvin Lane		
Project Objective(s)	Erosion/Sediment Control Repair/Replace Maintenance		
Project Opportunity ID	15		
Contributing Drainage Area	358 acres		
Estimated Existing Impervious Area (%)	36.7%	**Estimated Future Impervious Area (%)**	45.3%
Project Location	This project is located along the Boeckman Creek corridor, adjacent to a residential neighborhood (Canyon Creek Estates) and bounded to the west by SW Roanoke Drive. SW Colvin Lane is directly north of the project location.		
Statement of Need	Streambank erosion and channel migration have been observed in the Boeckman Creek tributary segment, which discharges to Boeckman Creek downstream of SW Colvin Lane. The 2012 Master Plan identified this location as a project need (BC-8), and subsequent site visits and conversations with City staff confirmed the need. Corrugated plastic piping installed by a resident with the intention of mitigating erosion was not approved by the City. Trees have fallen and additional tree loss may occur due to streambank loss.		
Project Description	This project includes riparian and in-channel bank stabilization measures to address resident concerns and stabilize the section of the tributary channel bank. This project also includes restoration of the existing water quality swale. Project details are as follows: • Removal of approx. 30 LF of existing outfall pipe. • Installation of approx.70 LF of 12-inch PVC to serve as a new outfall. • Install planting and bioengineered restoration/stabilization measures along approx. 600 LF of stream corridor. • Reconstruction of approx. 150 LF of vegetated swale in accordance with the City's Public Works Standards (PWS).		



BC-4	Boeckman Creek Stabilization at Colvin Lane	
Design Considerations / Assumptions	• The pipe system upstream of the outfall, including detention pipes in the City easement adjacent to 7590 Roanoke Drive N. will be preserved. Issues have not been reported and these pipes are assumed to be functioning as intended. • Assumes that access to the outfall stabilization area can be attained via the City easement between 7590 and 7598 Roanoke Drive N. • Exact stabilization measures to be determined during project design. Stabilization measures may include targeted planting, bio-engineered solutions such as live stakes or fascines, and gabion walls if necessary. • Swale reconstruction to be confirmed with final design.	
Estimated Project Cost	Capital Expense Total	$282,000
	Design / Construction Admin. (13.5%)	$38,000
	Engineering & Permitting (30%)	$85,000
	Total Cost	**$410,000**
Project Cost Notes	• Assumes clearing/grubbing including stump removal and removal of existing corrugated pipe. • No costs included for access. Assumes access can be attained through an existing temporary City easement.	

Additional Figures

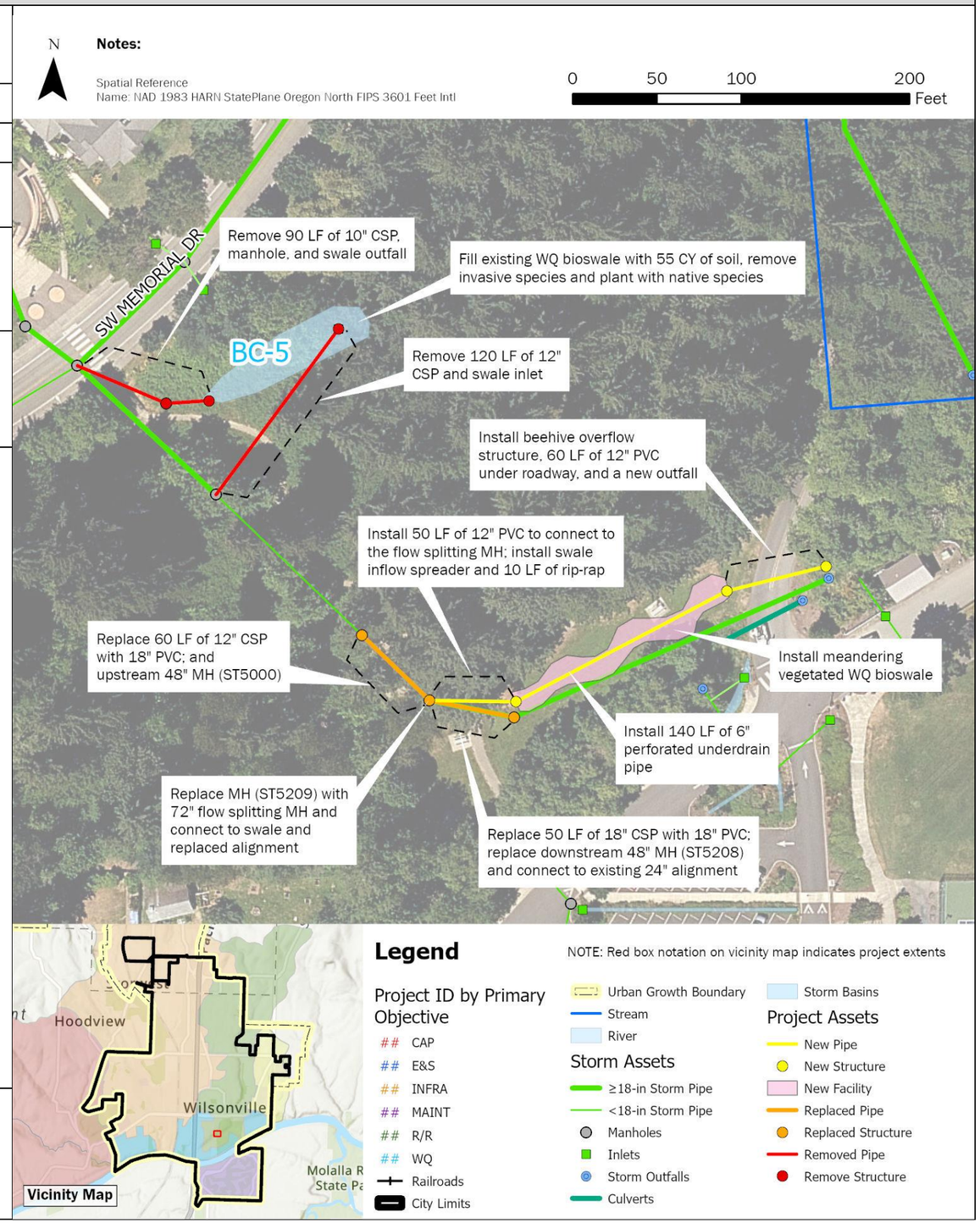


Streambank with resident-installed corrugated plastic pipe (May 2023)

City-owned outfall pipe (May 2023)

Upstream detention pipes location (May 2023)

BC-5	Memorial Park Swale Retrofit		
Project Objective(s)	Water Quality Erosion/ Sediment Control Maintenance		
Project Opportunity ID	21		
Contributing Drainage Area	33 acres		
Estimated Existing Impervious Area (%)	56.3%	**Estimated Future Impervious Area (%)**	57.7%
Project Location	This project site is located in the southeast portion of the City within the Boeckman Creek watershed. The project is bounded by SW Memorial Drive to the north, the Memorial Park parking lot/baseball fields to the south, and forested area within Memorial Park to the east and west.		
Statement of Need	The water quality bioswale at SW Memorial Drive is eroded, not draining properly, and not providing a water quality benefit. Modeling evaluation indicates that the pipe system after the convergence point at SW Memorial Drive has a constriction resulting in backwater and upstream system flooding.		
Project Description	This project includes removal and relocation of an existing water quality bioswale off SW Memorial Drive and installation of a new water quality bioswale and associated infrastructure at the downslope near the Memorial Park parking lot. Project details are as follows: • Remove existing water quality swale (ENG IDs provided in parentheses when applicable, CARTE ID provided when ENG ID is not available): ○ Remove 90 LF of 10-inch CSP (SD5041 and SD5042). ○ Remove 120 LF of 12-inch CSP (SD5044). ○ Remove manhole (ST5098). ○ Remove swale inlet structure (CARTE ID 568). ○ Remove swale outfall structure (CARTE ID 19). ○ Fill existing swale and revegetate area. • Replace two 48-inch manholes (ST5000 and ST5208). • Replace 60 LF of 12-inch CSP with 18-inch PVC pipe (SD5046). • Replace 50 LF of 18-inch CSP with 18-inch PVC pipe (SD5206). • Install a new meandering water quality swale near the Memorial Park parking lot: ○ Replace manhole ST5209 with a 72-inch flow splitting/WQ manhole. ○ Install 50 LF of 12-inch PVC pipe. ○ Install 140 LF of 6-inch perforated HDPE underdrain pipe. ○ Install swale inflow spreader. ○ Install 10 ft x 4 ft rip-rap pad in front of inflow spreader. ○ Install beehive overflow structure. ○ Install new outfall into the creek. ○ Install vegetated swale with required 1 foot of drain rock and 1.5 feet of amended soil.		



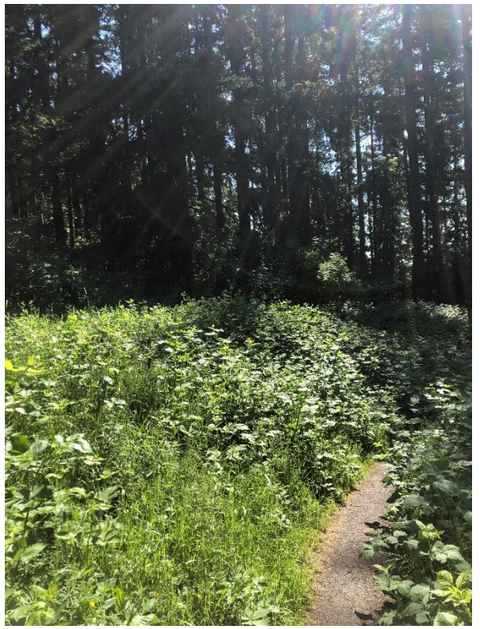
BC-5	Memorial Park Swale Retrofit	

Design Considerations / Assumptions	• Installation of the water quality bioswale is a water quality retrofit project, as the site is space constrained limiting the use of the BMP Sizing Tool for required facility sizing. Approx. size of the facility is 200 ft x 12 ft = 2,400 SF.
	  ○ Existing swale (to be removed) is estimated to be approx. 1,500 SF.
	• Soil infiltration rates are anticipated to be very low (0.02-0.07 in/hr based on USDA NRCS survey).
	• The maximum width of the swale is 12 feet.
	• Maximum side slopes of the swale are 3H:1V with a 2-foot minimum width flat bottom.
	• The maximum depth from growing media to overflow elevation is 1 foot.
	• Three feet of required media (12-inches of drain rock, 3-inches of open graded aggregate, and 18-inches of growing media minimum).
	  ○ Table 3.11 of the PWS notes that by increasing the growing media by 12 inches or more the facility surface area can be reduced by 25 percent.
	• A small portion of the facility resides within the FEMA 100-year floodplain. As this is not an infiltration site it does not require additional seasonal high groundwater testing.
	• Upsizing the 12-inch CSP (SD5046) with 18-inch PVC reduces the duration of modeled flooding at ST5000. Given the significant amount of vegetation and steep slopes in the area, full replacement of the alignment is not proposed.
	• Installation of a diversion manhole upstream of the swale may result in periodic surcharge of the swale that will overflow into the nearby creek.
	Standard Detail references:
	• Vegetated swale – filtration reference ST-6045.
	• Swale inflow spreader reference S-2225.
	• Planter, Rain Garden, Swale Flow Control Structure reference ST-6105.	

Estimated Project Cost	Capital Expense Total	$631,000
	Design / Construction Admin. (13.5%)	$85,000
	Engineering & Permitting (30%)	$189,000
	Total Cost	**$910,000**
Project Cost Notes	• Onsite fill from excavation of new swale to be stockpiled and used to fill existing swale footprint. • All existing conveyance piping and manholes to remain in place except for those identified for removal from the existing swale and replacement from manholes ST5000 to ST5208. • Project cost estimate assumes a single meandering, vegetated swale. Parallel vegetated swales may also be considered to increase capacity of the facility at this site. • Engineering and permitting estimate reflect in water work required for outfall installation.	

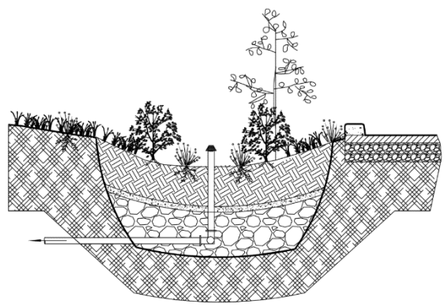
Additional Figures

Current water quality swale near SW Memorial Drive (Jan 2023)



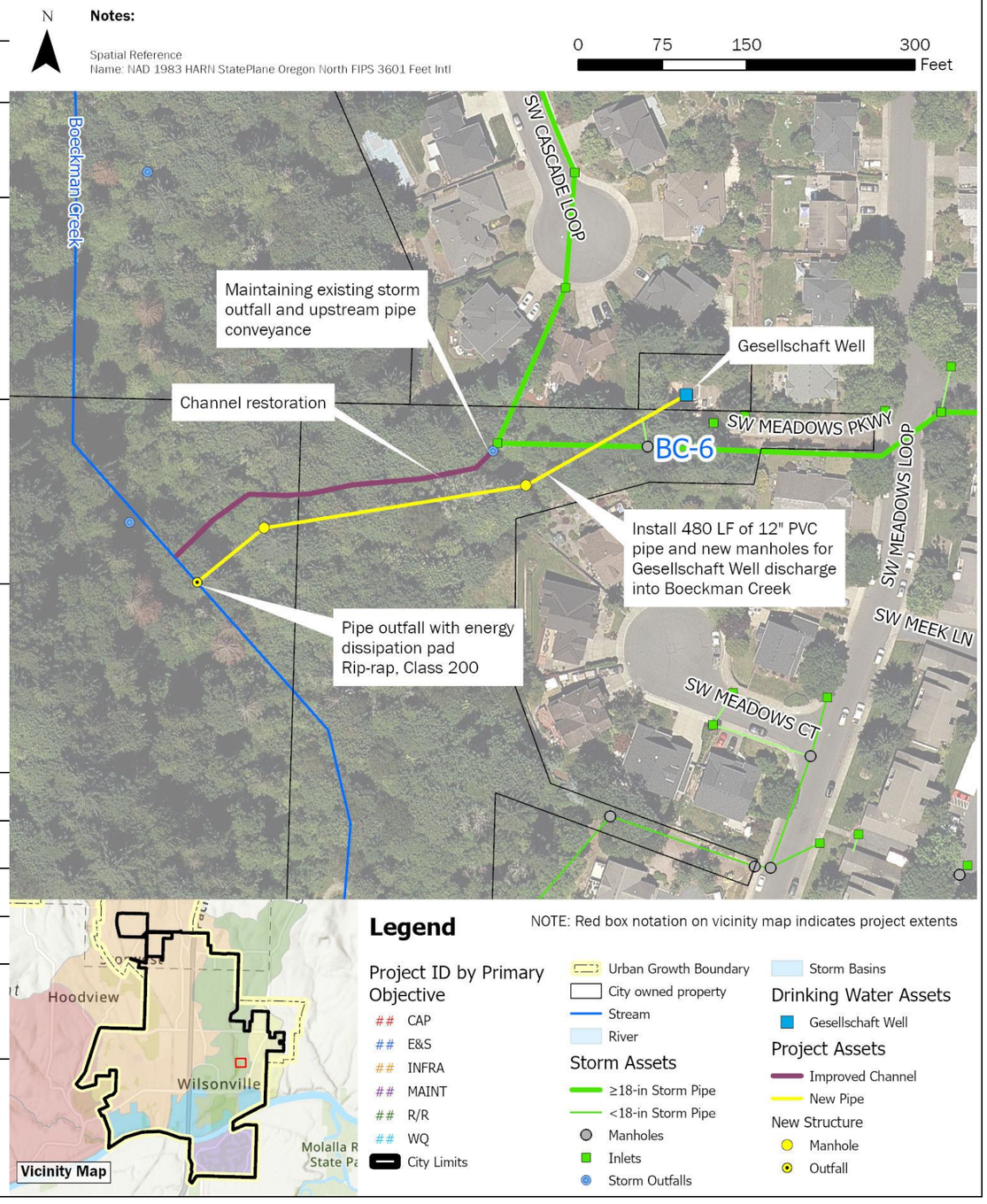
Water quality swale in the spring overgrown with invasive species (May 2023)

Open area along the creek to relocate the Memorial Park Swale (May 2023)

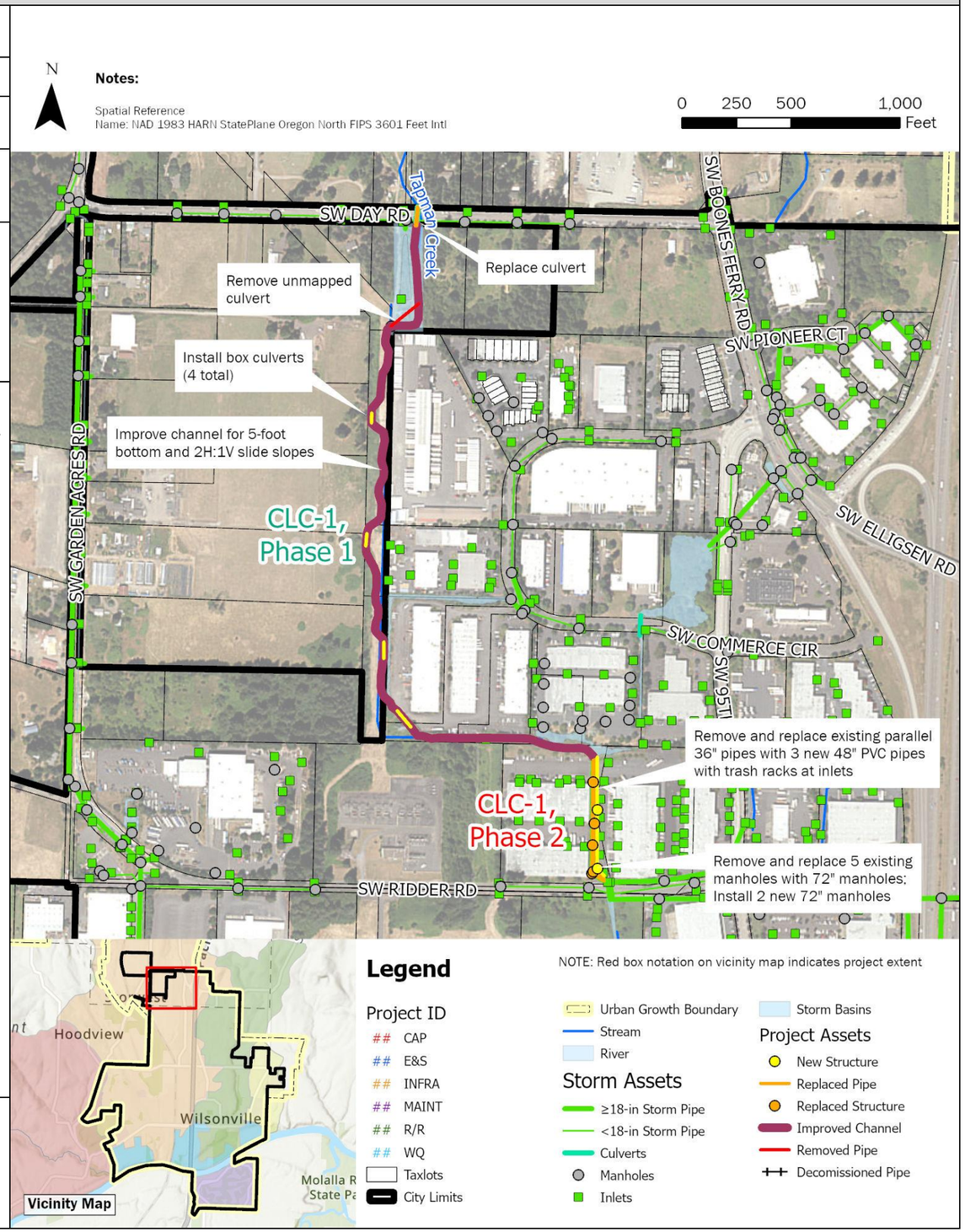


Vegetated Swale – Filtration (ST-6045)

BC-6	Gesellschaft Water Well Channel Restoration		
Project Objective(s)	Erosion/Sediment Control Maintenance		
Project Opportunity ID	41	**Contributing Drainage Area (acres)**	25 acres
Estimated Existing Impervious Area (%)	39.7%	**Estimated Future Impervious Area (%)**	39.9%
Project Location	This project is in the Boeckman Creek riparian area, near Wilsonville High School, at the Gesellschaft Well site (29001 SW Meadows Parkway). The area is directly west of SW Meadows Loop and bounded to the west by Boeckman Creek and SW Meadows Parkway to the north.		
Statement of Need	Weekly potable discharge from the Gesellschaft drinking water well and contributing stormwater runoff have caused severe erosion of the existing drainage channel to Boeckman Creek. The Gesellschaft well provides backup water supply and the City exercises the water well weekly to maintain quality and regulatory compliance. Under Capital Project #7054 (Fiscal Year 2015-2017) the City installed an asphalt apron and gabion boxes in three locations, but they have been undermined and are no longer effective at dissipating energy. The area is currently overgrown with blackberry brambles and inaccessible to conduct routine maintenance.		
Project Description	Project details are as follows: • Install approximately 480 LF of 12" PVC with 2 new MHs top pipe the weekly discharge from the well to the bottom of the slope into Boeckman Creek and bypass the existing drainage channel. • Install outfall and energy dissipation pad with Class 200 riprap. • Restore the eroded discharge channel (approximately 310 LF) through the installation of coir log check dams, coir matting, and re-vegetating with native trees and shrubs.		
Design Considerations / Assumptions	• Project need was identified in the 2012 SMP (BC-4). • Existing outfall (STD3008) and upstream stormwater pipes can remain as is for the contributing 25-acre drainage area. • The weekly discharge rate from the drinking water well is unknown. The pipe is sized based on the City's PWS and the smallest acceptable diameter for the public system. ODWR well logs were reviewed to verify pipe sizing. • Water discharge conveyance designed to comply with stormwater conveyance standards.		
Estimated Project Cost	Capital Expense Total	$279,000	
	Design / Construction Admin. (13.5%)	$38,000	
	Engineering & Permitting (30%)	$84,000	
	Total Cost	**$400,000**	
Project Cost Notes	• Connection to the well discharge point unknown and not included in cost estimate. • Channel restoration estimates are based on 2012 SMP and City staff feedback; the site was inaccessible during site visits.		



CLC-1	Day Road Stormwater Improvements		
Project Objective(s)	Repair and Replacement Capacity		
Project Opportunity ID	9	**Contributing Drainage Area**	944 acres
Estimated Existing Impervious Area (%)	30.4%	**Estimated Future Impervious Area (%)**	49.1%
Project Location	This project is in an industrial area south of Day Road and north of Ridder Road. The project extents run along the Bonneville Power Authority (BPA) easement before crossing the parking lot of industrial Tax Lot 500.		
Statement of Need	Stormwater conveyance between Day Road and Ridder Road includes a series of culverts and open channels and is limited in capacity and storage potential. Portions of the channel have a negative slope. Flooding is routinely observed at adjacent properties. Development in the Tapman Creek basin may increase the frequency and severity of flooding. In 2019, AKS prepared a facility siting alternatives report, which included design concepts to alleviate existing flooding, but future development conditions were not evaluated.		
Project Description	This project includes a phased approach to mitigate flooding of adjacent industrial properties. Phase 1 includes construction of the channel improvements and culvert installation consistent with AKS' Alt A-3 per the 2019 report. Phase 2 includes upsizing the two existing 36-inch parallel pipes to 48-inch beneath the parking lot of Tax Lot 500 and installing a third, parallel 48-inch pipe to reduce modeled flooding expected in the future development condition. Project details are as follows: Phase 1 - refer to Alt A-3 of the AKS report for full details. • Regrade and reconstruct approx. 4,500 feet of open channel to eliminate negative slope. The resulting channel shall be approximately 5-foot wide (bottom width) ranging from 1-foot to 6-feet deep. The channel widens at elevation 223.0 to create a floodplain. Side slopes are designed at 2H:1V. • Construct a structural earth wall at bends in the channel and along the east-west portion of the alignment, as specified in the AKS report. • Install 200 LF of open-bottom or box culverts (4 culverts total) to provide access to the existing BPA utility poles while also maximizing conveyance. • Remove the unmapped, 50-foot existing culvert at the northwest corner of the northernmost industrial property south of Day Road. • Install approx. 190 LF of two barrel, 36-inch diameter PVC culverts at Day Road. Phase 2 • Remove and replace the two existing, approx. 600 LF, 36-inch parallel storm pipes located beneath the parking lot of Tax Lot 500 with approx. 600 LF, 48-inch PVC parallel storm pipes. • Remove and replace five existing manholes along existing pipes with 72-inch manholes. • Install a third 600 LF of 48-inch PVC storm pipe parallel to the upsized pipes. • Construct two new 72-inch manholes on the new 48" pipe alignment. • Construct trash racks at the inlet at each of the three new pipes.		



CLC-1	Day Road Stormwater Improvements

Design Considerations / Assumptions

- The AKS project concept was modeled and incorporated into the updated InfoSWMM model for this SMP, which reflects updated hydrology.
- Model results indicate that the proposed concept alleviates flooding in the existing land use condition. Future land use conditions assume unmitigated flow from new/ redevelopment. Modeled flooding is still predicted in the future land use condition, but adherence to PWS requiring onsite retention should reduce future flows to this area.
- Assessment of flooding during the 100-year storm was based on maximum WSE in relation to the elevation of adjacent structures.
- PWS design criteria for culverts (using the 100-year storm) is met at both Day Road and Ridder Road. The criteria are not met under future (unmitigated) land use condition.
- The catchment area draining to this project includes areas outside of City limits within the City of Tualatin. Application of local design standards in Tualatin may impact future flow conditions to this location.
- Access to BPA alignment, towers, and overhead power lines must be maintained.
- The small pond at inlet of culverts across Ridder Road is assumed landscape features, not detention and were not modeled - it is assumed that there is adequate space for outlets of the three proposed 48" pipes to this pond.

Estimated Project Cost

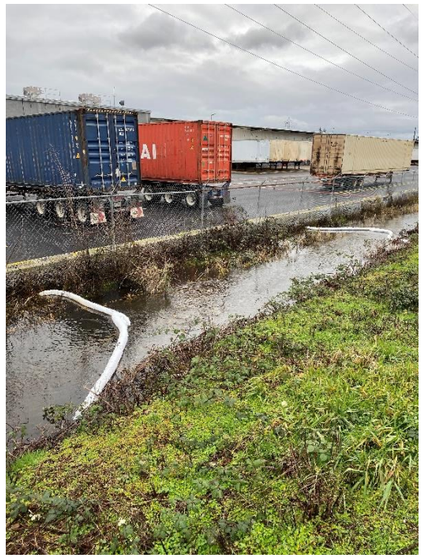
	Phase 1	*Phase 2*
Capital Expense Total	$5,860,000	$2,738,000
Design / Construction Admin. Phase 1: 3.5% + $200K Phase 2: 13.5%	$405,000	$370,000
Engineering & Permitting (30%)	$1,758,000	$821,000
Total Cost	**$8,020,000**	**$3,930,000**

Project Cost Notes

- Where possible, quantities for project components listed in the 2019 AKS report were verified and maintained. Costs are calculated based on the unit costs developed for this SMP. Unit costs for items derived directly from the 2019 AKS report were escalated to 2023 based on ENR CCI.
- Multipliers were applied as consistent with other capital projects. Lump sum costs used in the AKS estimate were not carried over.
- The AKS cost estimate did not include costs for Design/Construction Admin or Engineering/Permitting. These multipliers have been included for consistency with other capital project estimates. A modified construction administration multiplier was applied per direction from the City. No cap on engineering and permitting was applied, given potential design and permitting complexity of the project.

Additional Figures

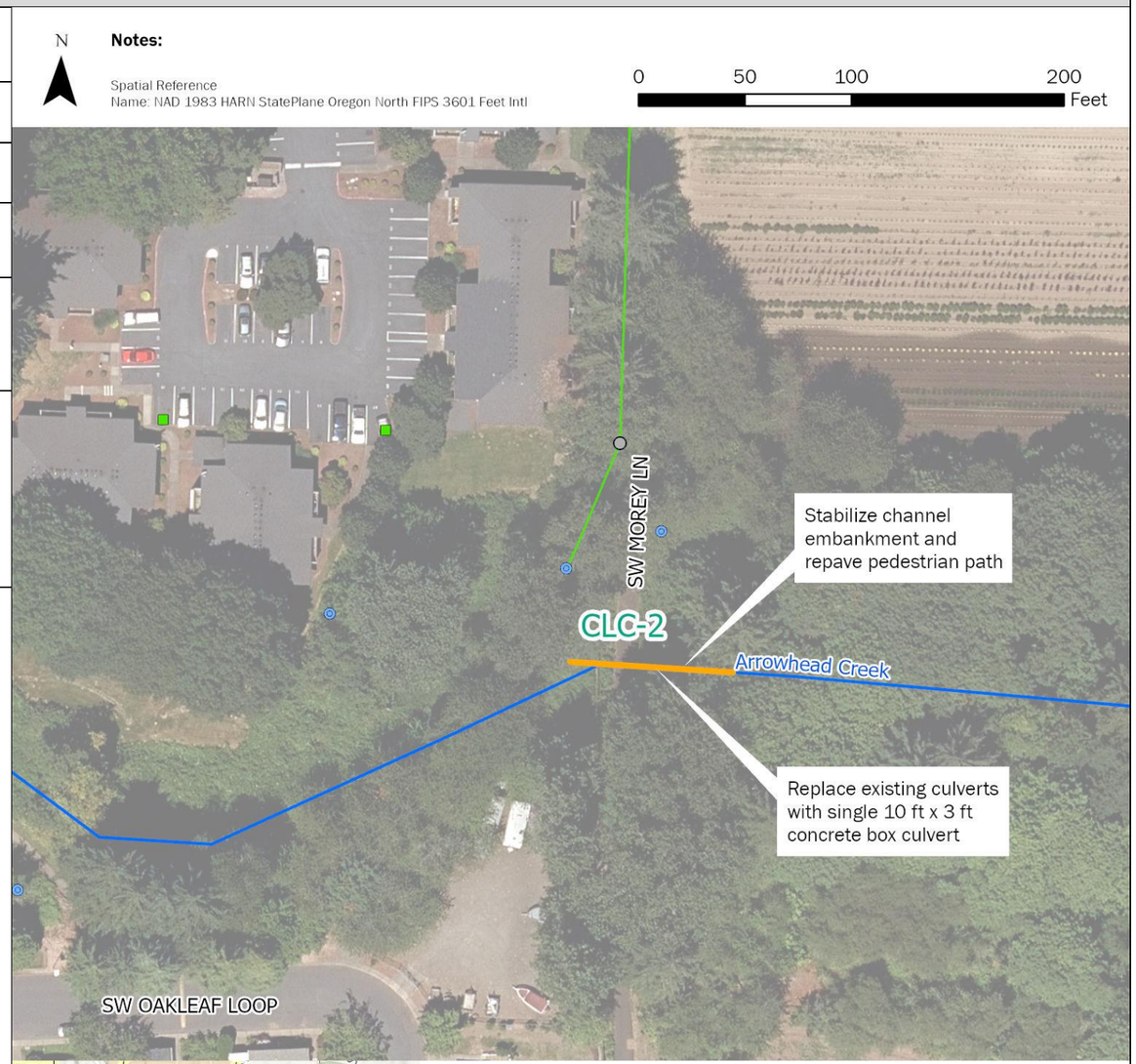
Ponding north of Day Road (Jan 2022)



Conveyance channel south of Day Road (Jan 2022)

Conveyance channel and impoundment south of Day Road after storm (Jan 2022)

CLC-2	Arrowhead Creek Culvert Replacement at Arrowhead Creek Trail		
Project Objective(s)	Repair/Replacement Maintenance		
Project Opportunity ID	14		
Contributing Drainage Area	421 acres		
Estimated Existing Impervious Area (%)	35.25	**Estimated Future Impervious Area (%)**	37.29
Project Location	This project is located at the Arrowhead Creek culvert crossings under the Arrowhead Creek Trail. SW Oakleaf Loop is directly to the south of the project location.		
Statement of Need	The two existing, parallel 5-foot x 5-foot concrete box culverts that convey Arrowhead Creek under the pedestrian path are failing and in need of replacement. The 2012 Stormwater Master Plan identified this location as a project need (CLC-9), and subsequent site visits, results and findings of the 2022 stream assessment conducted for this SMP, and conversations with City staff confirmed the need.		
Project Description	This project includes replacement of the existing parallel 5-foot x 5-foot concrete box culverts with new 10-foot by 3-foot concrete box culverts to address the failing culverts and stabilize the Arrowhead Creek channel and pedestrian trail's creek crossing. Project details are as follows: • Remove and replace approx. 70 LF existing double 5 ft x 5 ft concrete box culverts with a 10 ft x 3 ft concrete box culvert. • Install planting and bioengineered restoration/stabilization measures after replacement of the culvert to stabilize an area approximately 20 feet along the pedestrian path length and approximately 50 feet upstream and downstream of the crossing. • Repave approx. 30 LF of the approx. 20-foot-wide pedestrian path after culvert replacement.		



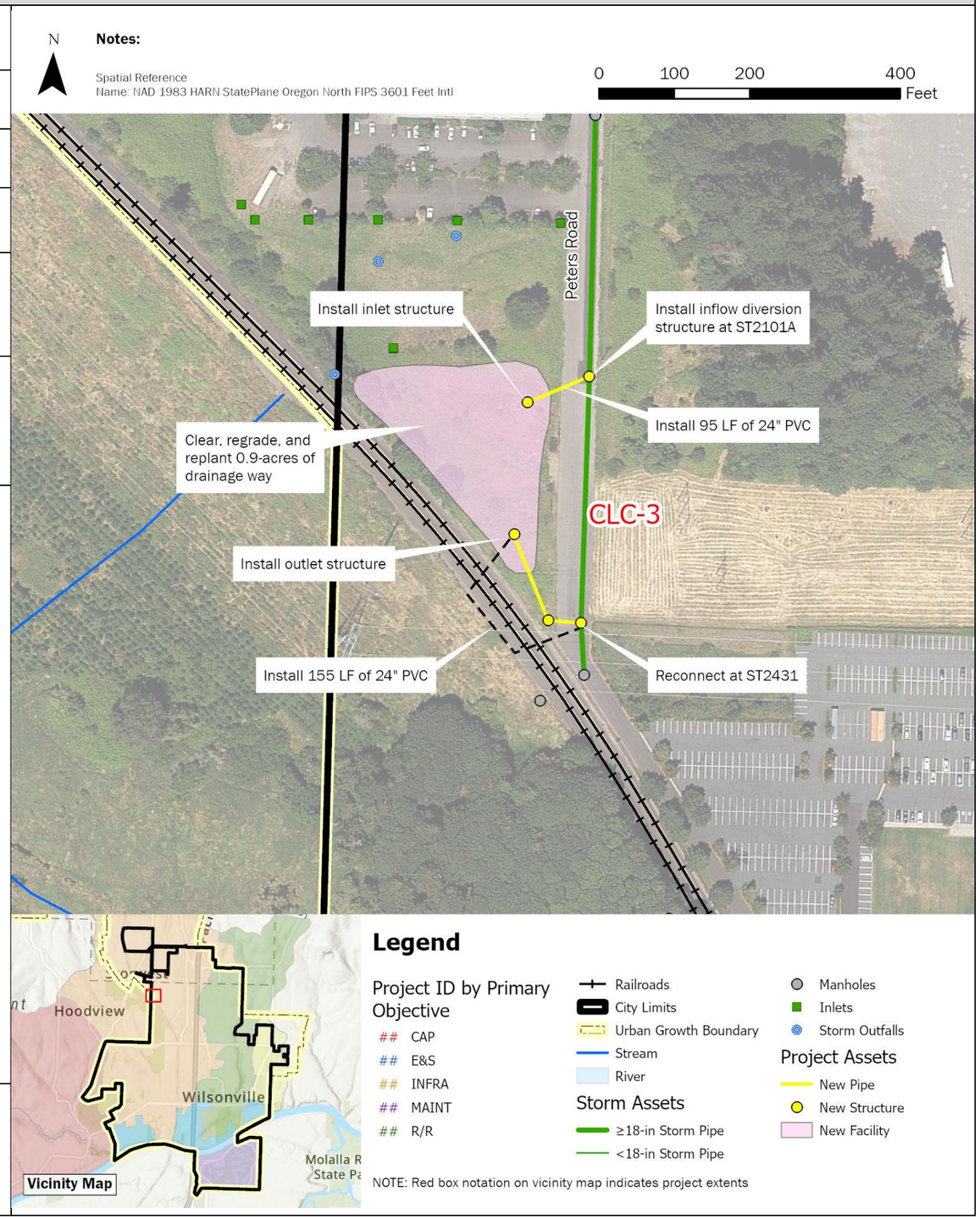
CLC-2	Arrowhead Creek Culvert Replacement at Arrowhead Creek Trail	
Design Considerations / Assumptions	• Model results indicate that a 10-foot x 3-foot concrete box culvert has sufficient capacity to convey the 100-year design storm flow in Arrowhead Creek without decreasing freeboard when compared to the current twin 5-foot x 5-foot culverts. • Culvert sizing to be confirmed with final design. • Assumes that access to the site for construction equipment can be obtained via the pedestrian path at Arrowhead Creek Lane. • Exact stabilization measures to be determined during project design. Stabilization measures may include targeted planting, bio-engineered solutions such as live stakes or fascines, and gabion walls if necessary. • Note that the City's GIS includes a 48" diameter culvert at this location, which is inconsistent with field observations from Stream Assessment conducted May 2022.	
Estimated Project Cost	Capital Expense Total	$179,000
	Design / Construction Admin. (Cap)	$35,000
	Engineering & Permitting (Cap)	$75,000
	Total Cost	**$290,000**
Project Cost Notes	• Assumes clearing/grubbing with stump removal in immediate areas as necessary for construction. • No costs included for access - assumed access can be attained through pedestrian path. • A minimum cap on Design/ Construction Admin and Engineering & Permitting was applied at the direction of the City.	

Additional Figures

Failing twin 5 ft x 5 ft culverts under pedestrian crossing looking upstream

(Source: Geomorphic Stream Assessment, Waterways Consulting, May 2022)

CLC-3	Garden Acres Pond Retrofit		
Project Objective(s)	Capacity (Mitigation) Water Quality		
Project Opportunity ID	32		
Contributing Drainage Area	231 acres		
Estimated Existing Impervious Area (%)	34.1%	**Estimated Future Impervious Area (%)**	52.8%
Project Location	This project is located at an existing public pond in an industrial area along Peters Road. The area is bounded to the west by SW Graham's Ferry Rd, SW Day Road to the north, SW 95th Ave to the east, and the Coffee Lake Wetlands to the south.		
Statement of Need	The stormwater collection system along Peters Road is undersized with several pipe constrictions limiting flow upstream of the railroad crossing. Future development is anticipated to increase runoff to the system. Options to upsize the collection system at the railroad crossing are limited due to required coordination with the railroad and METRO.		
Project Description	This project entails the retrofit of an existing public pond, located in a greenfield east of Peters Road, to provide additional storage of stormwater during high flow events. Retrofit of the pond includes increasing its current storage capacity from 13,200 to 39,200 cubic feet. Stormwater will be diverted towards the pond to reduce flow through undersized storm piping along Peters Road. Rerouted flow from the pond will reconnect to the main network prior to discharge in Coffee Lake Wetlands. Project details are as follows: • Install a flow diversion structure at Peters Road (ST2101A). • Install 95 LF of 24-inch PVC pipe from Peters Road to the inlet of the detention pond. • Increase existing detention pond capacity by 26,000 cubic feet and lower pond bottom invert to an elevation of 196-ft. • Clear, regrade, and replant 0.9-acres of pond footprint area. • Install an outlet control structure within the detention pond. • Install 155 LF of 24-inch diameter PVC pipe from the detention pond to the stormwater conveyance system on Peters Road (ST2431). • Install 50 LF of 6-inch HDPE underdrain pipe. • Install pond underdrain media in accordance with the 2015 PSW Section 3, Appendix A landscape and soil media requirements. Including 15" of drain rock, a 3" separation layer, and 18" of growing media.		



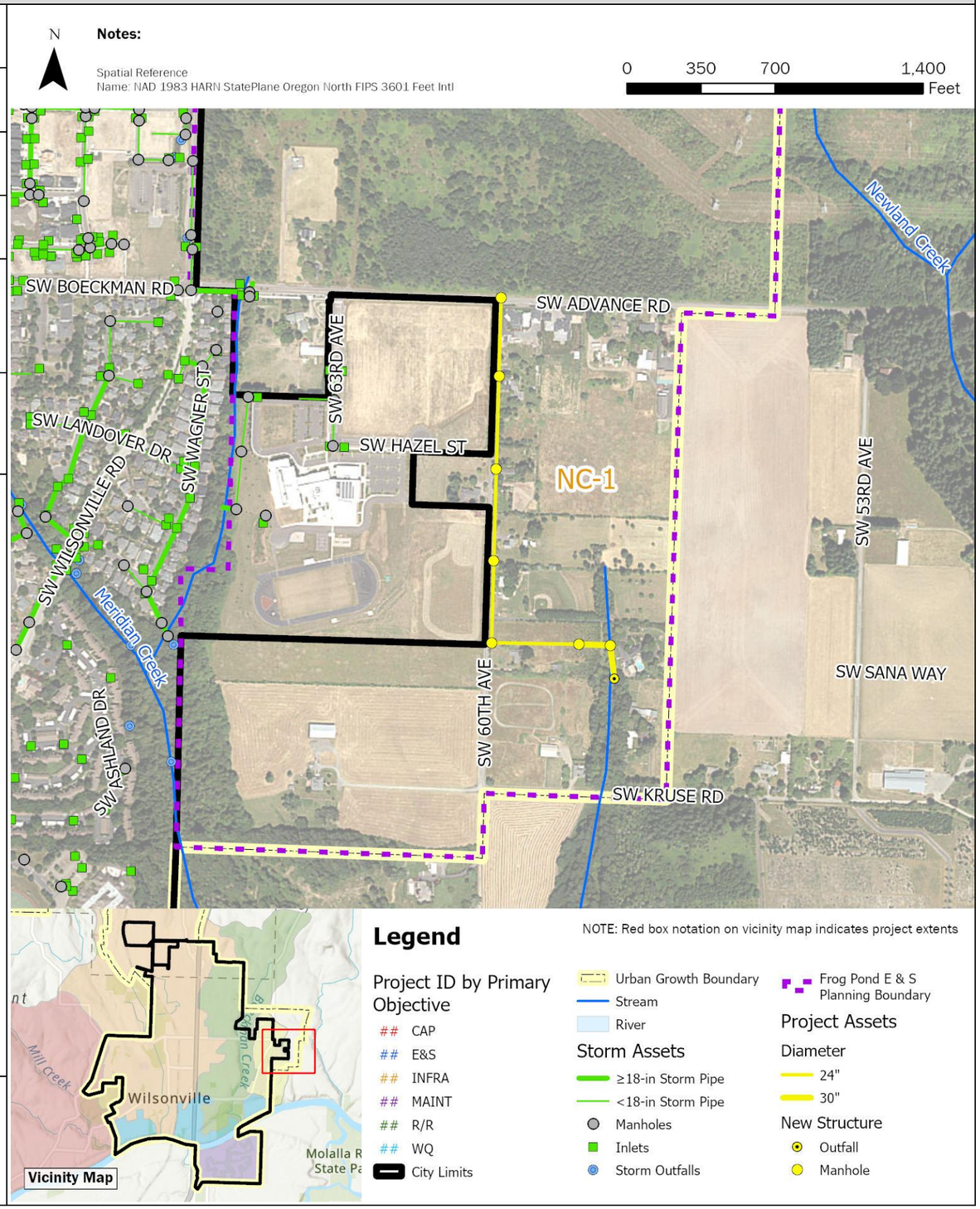
CLC-3	Garden Acres Pond Retrofit	
Design Considerations / Assumptions	• As-builts were received for the existing public pond and existing storage volume estimated from the as-builts. • All proposed improvements are within the public pond boundaries. Property lines to be verified by survey. • This project is intended to alleviate modeled flooding of the Peters Road system under current land use conditions; however, future development conditions may still result in flooding along Peters Road and SW Garden Acres Road. Future development will be required to adhere to current stormwater design standards and retain/mitigate flow to pre-development conditions. • H/H modeling was used to confirm the flow diversion structure configuration and pond operation up to the 25-year storm event. The proposed design incorporates an emergency spillway to the railroad ditch for higher storm events.	
Estimated Project Cost	Capital Expense Total	$2,897,000
	Design / Construction Admin. (3.5% + $200K)	$301,000
	Engineering & Permitting (20%)	$579,000
	Total Cost	**$3,780,000**
Project Cost Notes	• The proposed detention facility footprint is approximately 39,200 square feet. Earthwork estimates assume additional excavation of 25,600 cubic feet to provide the required storage. • Final design will include confirmation of vegetation enhancement and structure sizing. • A modified construction administration multiplier was applied per direction from the City. No cap on engineering and permitting was applied, given potential design and permitting complexity of the project.	

Additional Figures

Garden Acres Pond Existing Inflow Pipe (May 2023)

Garden Acres Detention Pond (May 2023)

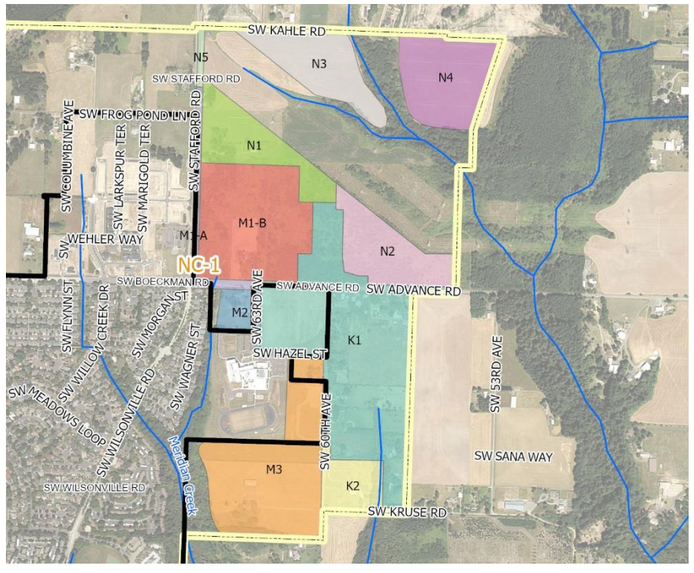
NC-1	Frog Pond East and South Conveyance Piping (Basin K1 only)		
Project Objective(s)	Infrastructure Need (New Development)		
Project Opportunity ID	44		
Contributing Drainage Area (acres)	61 acres		
Estimated Existing Impervious Area (%)	12.1%	**Estimated Future Impervious Area (%)**	57.0%
Project Location	This project is located east of Stafford Road and the Frog Pond West development area in Wilsonville, outside of the current city limits and UGB. This future planning area is bounded to the west by SW Stafford Road and bisected into east and south by SW Advance Road.		
Statement of Need	The Frog Pond East and South Master Plan (2022) identified stormwater improvements required for development of the Frog Pond East and South neighborhoods.		
Project Description	The full 2022 Frog Pond East and South Master Plan stormwater conveyance layout has been simplified for this CP to only include the storm main and outfall along SW 60th Ave to outfall near unnamed tributary (under SW Kruse Rd). This drainage basin is referred to in the Master Plan as K1 (encompassing approx. 61 acres). Project details are as follows: • Install 2,050 LF of 24-inch PVC pipe. • Install 310 LF of 30-inch PVC pipe. • Install seven 60-inch manholes. • Install 1 outfall.		



NC-1	Frog Pond E and S Conveyance Piping	
Design Considerations / Assumptions	• Infrastructure sizing is based on recommendations in the Frog Pond East and South Master Plan (Dec 2022). No additional modeling was performed using InfoSWMM per this SMP for this area. • The Frog Pond East and South Master Plan divides the planning area into 11 basins. The breakdown of proposed infrastructure by basin is detailed below: ○ **K1**: install 1,200 LF of 18-inch PVC pipe, 2,050 LF of 24-inch PVC pipe, and 310 LF of 30-inch PVC pipe; 3- 48-inch manholes, 7-60-inch manholes and 1 outfall. ○ **K2**: install 220 LF of 12-inch PVC pipe, 2- 48-inch manholes, and 1 outfall. ○ **M1-A**: install 2,630 LF of 12-inch PVC pipe, 8- 48-inch manholes, and 1 outfall. ○ **M1-B**: install 1,050 LF of 24-inch PVC pipe, 5- 60-inch manholes, and 1 outfall. ○ **M2**: install 400 LF of 12-inch PVC pipe, 2- 48-inch manholes, and 1 outfall. ○ **M3**: install 1,160 LF of 24-inch PVC pipe, 5- 60-inch manholes, and 1 outfall. ○ **N1**: install 670 LF of 18-inch PVC pipe, 2- 48-inch manholes, and 1 outfall. ○ **N2**: install 7,670 LF of 18-inch PVC pipe, 3- 48-inch manholes, and 1 outfall. ○ **N3**: install 670 LF of 18-inch PVC pipe, 2- 48-inch manholes, and 1 outfall. ○ **N4**: install 1,150 LF of 18-inch PVC pipe, 5- 48-inch manholes, and 1 outfall. ○ **N5**: install 730 LF of 12-inch PVC pipe, 3- 48-inch, and 1 outfall. • Proposed public LID and water quality treatment facilities have not been costed as part of this project, given development-driven installation needs. • Future stream assessments in conjunction with planning-related capital projects will be conducted in the area to evaluate natural system prior to and during development activities.	
Estimated Project Cost	Capital Expense Total	$3,064,000
	Design / Construction Admin. (13.5%)	$414,000
	Engineering & Permitting (20%)	$613,000
	Total Cost	**$4,090,000**
Project Cost Notes	• Cost estimates assume use of PVC for all new pipe materials. • Project cost assumes pipe installation will occur in roadways. Pavement restoration and trenching are assumed in the pipe unit costs. • No earthwork beyond trenchwork is included. • Only the main stormwater pipes along SW 60th Ave towards the outfall (24-inch and 30-inch in diameter) are included in the project estimate, per City direction. • Regional stormwater storage facilities and low impact development (LID) facilities are not included in this project estimate.	

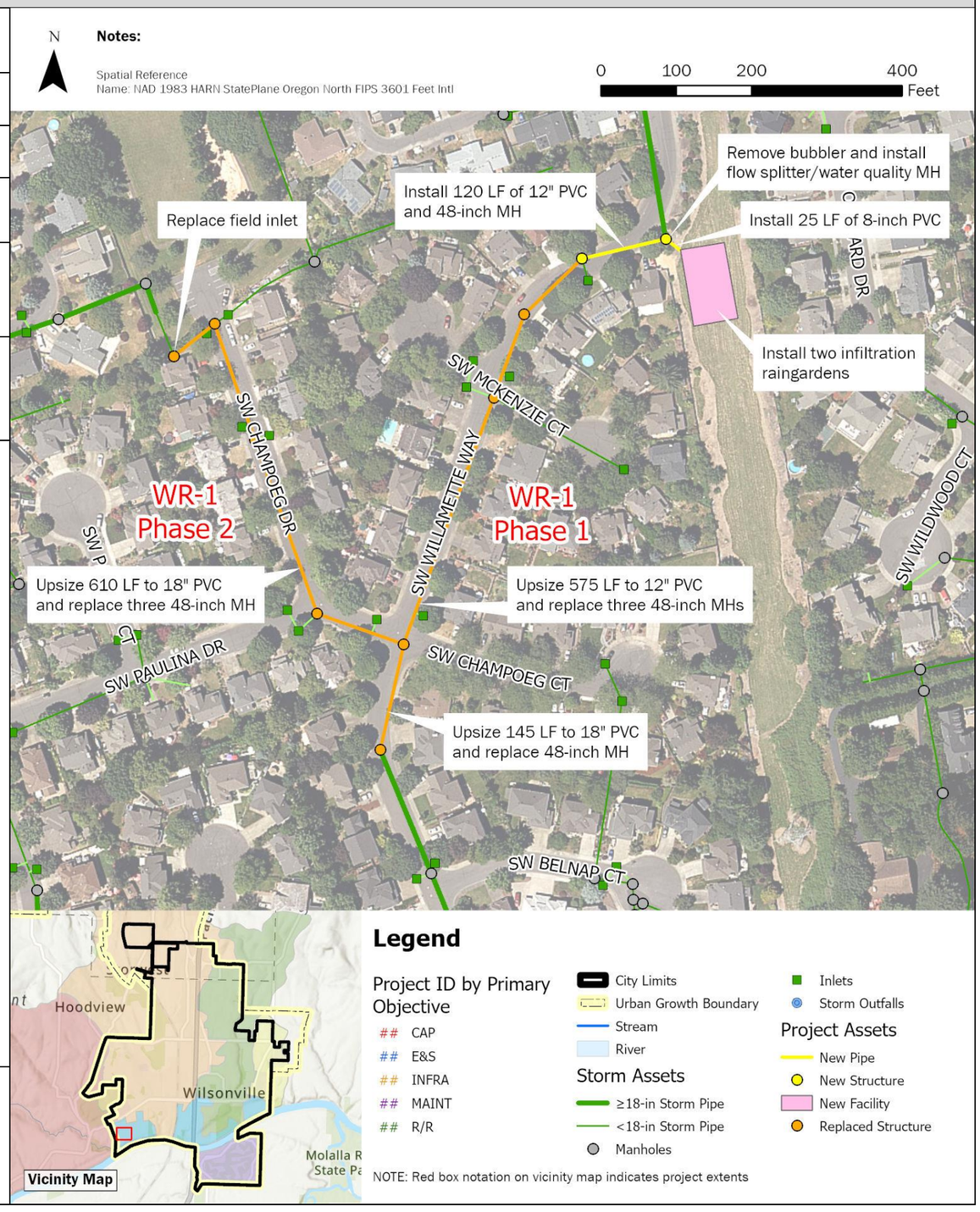
Additional Figures

Frog Pond East & South Master Plan Areas from Master Plan (Dec 2022)



Frog Pond East & South Basins from Master Plan (Dec 2022)

WR-1	SW Willamette Way / Morey's Landing Stormwater Improvements		
Project Objective(s)	Capacity (Mitigation) Water Quality		
Project Opportunity ID	1		
Contributing Drainage Area	46 acres		
Estimated Existing Impervious Area (%)	45.4%	**Estimated Future Impervious Area (%)**	46.3%
Project Location	This project is in a residential area near the Willamette River. The project area is located along SW Willamette Way and SW Champoeg Dr, approximately 1,200 feet north of the Belknap Outfall to the Willamette River.		
Statement of Need	The Morey's Landing Bubbler at SW Willamette Way results in local flooding and impacts to neighboring residential property during large rainfall events. Downstream capacity deficiencies were identified by H/H modeling, and current public storm drainage pipe sizes do not adhere to the City's PWS.		
Project Description	This project mitigates flooding by removing the existing bubbler structure (STD6604) and reroutes the water quality (1-inch/24 hr storm) flows to a nearby Bonneville Power Administration (BPA) easement, utilizing the Belknap Court Outfall to bypass high flow events. Water quality events will drain to two proposed infiltration raingardens constructed within the adjacent BPA easement. High flows will bypass to new 12-inch and 18-inch PVC pipes along SW Willamette Way, upstream of the Belknap Court Outfall. Additional capacity deficiencies will be addressed by upsizing pipes along SW Willamette Way and SW Champoeg Ct. Due to project complexity and size, this project is costed as two phases and numbered based on recommended sequencing. Project details by phase are as follows: Phase 1 (Morey's Landing Bubbler): • Remove existing Morey's Landing Bubbler (STD6604). • Clear, grade, and replant 0.12-acres to create two infiltration raingardens within the BPA easement. • Install a flow control diversion structure and 25 LF of 8-inch PVC to route water quality events (low flow) to new raingardens and high flow events to the Belknap Court outfall. • Install 120 LF of 12-inch PVC for flow exceeding the water quality event. • Upsize 575 LF of 10-inch CPS to 12-inch PVC (SD6629, SD6630, SD6632). • Upsize 145 LF of 10-inch CSP to 18-inch PVC (SD6638). • Install one 48-inch manhole and replace four 48-inch manholes (ST6618, ST6619, ST6606, and ST6605). Phase 2 (SW Champoeg Ct): • Upsize 610 LF of 12-inch CSP to 18-inch PVC on SW Champoeg Dr E (SD6634 – SD6637). • Replace three 48-inch manholes (ST6607, ST6608, and ST6609) and field inlet (6647).		



WR-1	SW Willamette Way / Morey's Landing Stormwater Improvements

Design Considerations / Assumptions

- This project is intended to mitigate stormwater overflow from an existing bubbler and increase capacity of downstream piped infrastructure to the Belknap Court outfall.
- The raingarden facilities (Phase 1) were sized as a water quality, filtration raingarden using the BMP Sizing Tool. Due to design constraints and lack of feasible outlet, this BMP may be constructed as an infiltration facility, pending infiltration testing.
- Pipe replacement/upsizing along SW Willamette Way is proposed to adhere to the minimize pipe size required for public infrastructure.
- The conveyance along SW Champoeg Ct (Phase 2) is identified as under capacity and will be upsized from existing 12-inch to 18-inch.
- H/H modeling was used to confirm the flow diversion structure configuration, which uses an 8-inch low flow pipe and weir to divert the water quality event to the raingarden and bypass high flows to the piped collection system.
- Coordination with BPA will be required to obtain easement for the raingarden facilities.

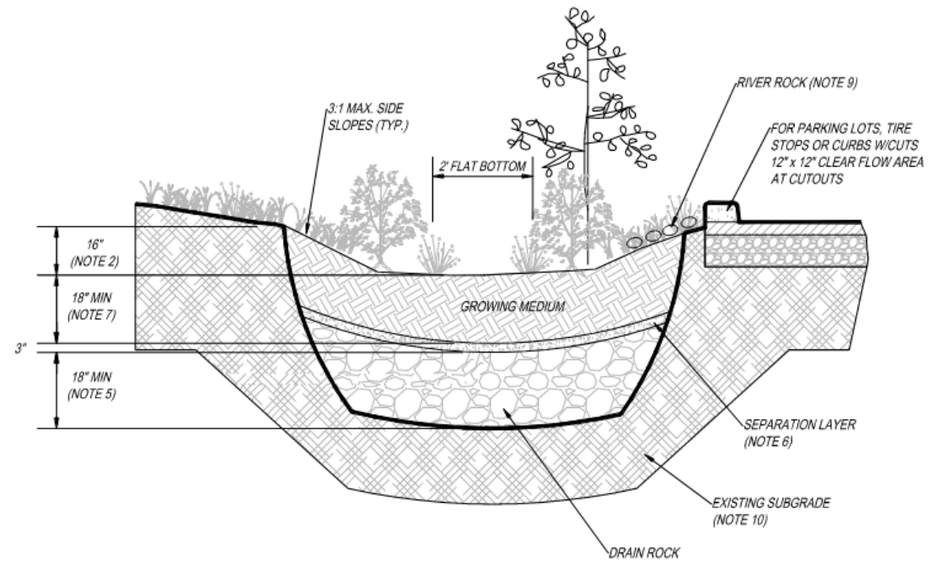
Estimated Project Cost

	Phase 1	*Phase 2*
Capital Expense Total	$ 1,729,000	$811,000
Design / Construction Admin. (13.5%)	$233,000	$109,000
Engineering & Permitting (20%)	$ 346,000	$162,000
Total Cost	**$2,310,000**	**$1,080,000**

Project Cost Notes

- The required raingarden facility footprint is approximately 5,800 square feet. Earthwork estimates assume 5 feet of over excavation to an elevation of 163-ft to accommodate the low flow pipe grade.
- Final design will include confirmation of vegetated facility plantings and structure sizing.

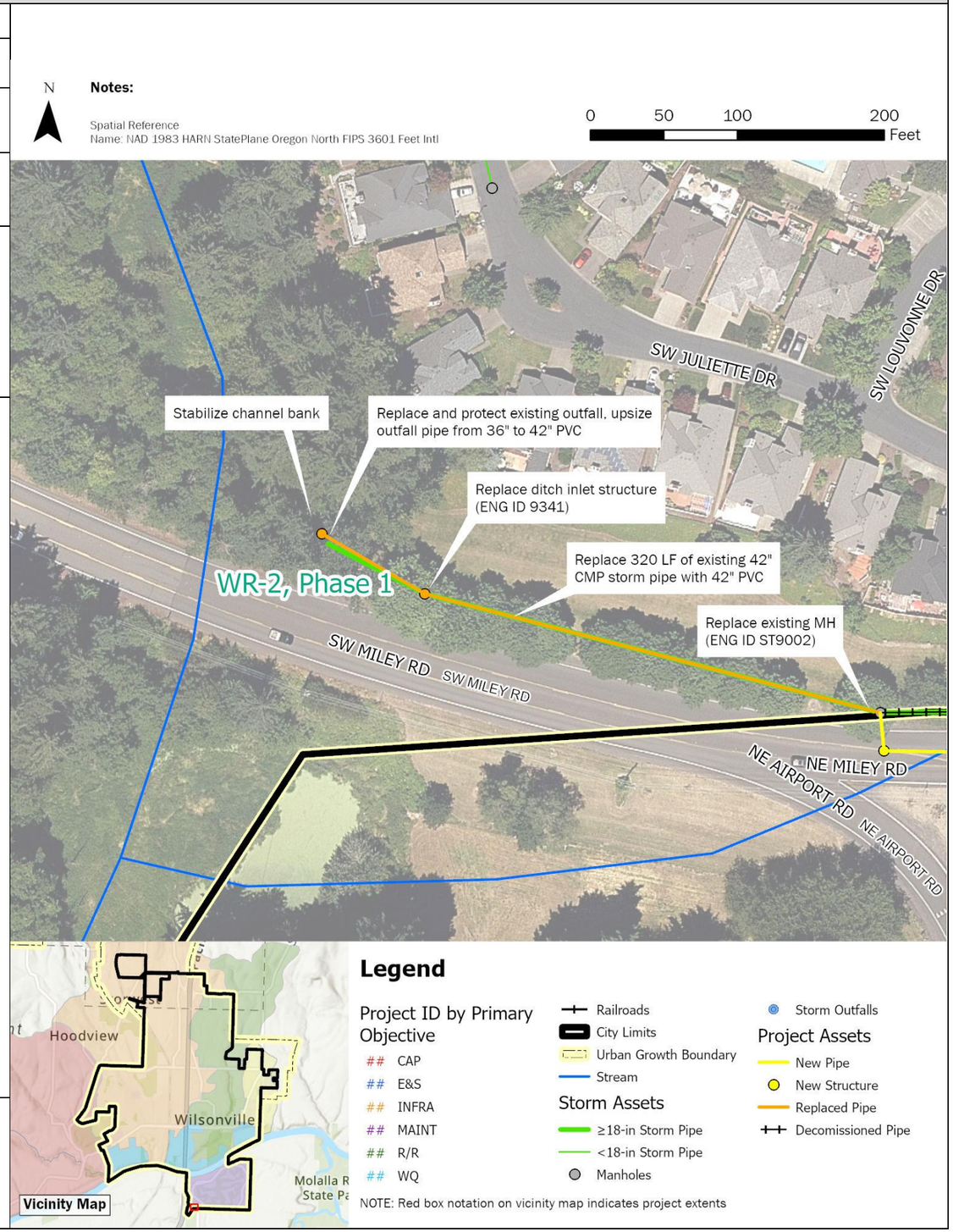
Additional Figures



BMP Sizing Tool Standard Detail – Infiltration Raingarden

Existing Bubbler Structure (May 2023)

WR-2	Miley Road Stormwater Improvements		
Project Objective(s)	Repair/Replace, Erosion/Sediment Control, Maintenance		
Project Opportunity ID	5	**Contributing Drainage Area**	138.0 acres
Estimated Existing Impervious Area (%)	46.1%	**Estimated Future Impervious Area (%)**	46.1%
Project Location	This project is located along Miley Road, from the outfall just north of SW Miley Road east approximately 1,200 feet from the corner of NE Miley Road and NE Eilers Road. Phase 1 of the project is located outside of the ROW. Phase 2 is located within the NE Miley Road ROW.		
Statement of Need	The Miley Road outfall is in poor condition with overgrown vegetation and difficult access. The outfall is causing scouring into the adjacent jurisdictional wetland. Further upstream, the existing storm main that runs parallel with Miley Road has collapsed due to age, pipe corrosion, and potential settling of a private brick wall installed along a portion of the alignment. The pipe failure has caused a sinkhole at the upstream (eastern) edge of the pipe alignment. Upstream capacity deficiencies were identified by H/H modeling. This location was identified in the 2012 SMP as CIP SD9000 to SD9069.		
Project Description	This project includes a phased approach to improve the stormwater system along Miley Road, which serves a significant portion of the Charbonneau development. Phase 1 includes replacement of the outfall and approximately 400 LF of pipe outside of the ROW. Phase 2 includes construction of a new pipe alignment in the Miley Road ROW to replace the failing storm pipe, and extension of the existing main connections to the new alignment. This new alignment includes upsizing of 650 LF of pipe from 24-inches to 36-inches to address capacity deficiencies in this area. Project details are as follows: Phase 1 • Upsize 80 LF of 36-inch CMP to 42inch PCV from area drain (ENG ID 9341) to outfall. • Restore approx. 30 ft of channel bank on either side of new outfall. • Replace area drain (ENG ID 9341). • Replace 320 LF of existing storm pipe with same diameter 42-inch PVC between area drain (ENG ID 9341) and manhole (ST9002). • Replace and lower invert of manhole (ST9002) to ensure 3 ft cover requirement is met for incoming pipe. Maintain 0.2 ft drop within MH. Phase 2 • Install 530 LF of 42-inch PVC from replaced manhole (ST9002) to new manhole at the near intersection with SW French Prairie Road. • Install three 72-inch manholes for the above 42-inch line, the most upstream of which is at the SW French Prairie Road. • Install ten 60-inch manholes and 3,015 LF of 36-inch PVC along NE Miley Road from SW French Prairie Road to new manhole adjacent to manhole ST9011. • Install two 48-inch manholes and 650 LF of 24-inch PVC from the new manhole adjacent to manhole ST9011 to the new manhole at upstream most lateral. • Extend six total existing main connections to the new pipe alignment (approx. 40 LF each, varying diameters). Note that these points of connection run under the existing brick wall. • Reconnect all existing curb inlets (approx. 13) along new NE Miley Road alignment.		



WR-2	Miley Road Stormwater Improvements

Design Considerations / Assumptions

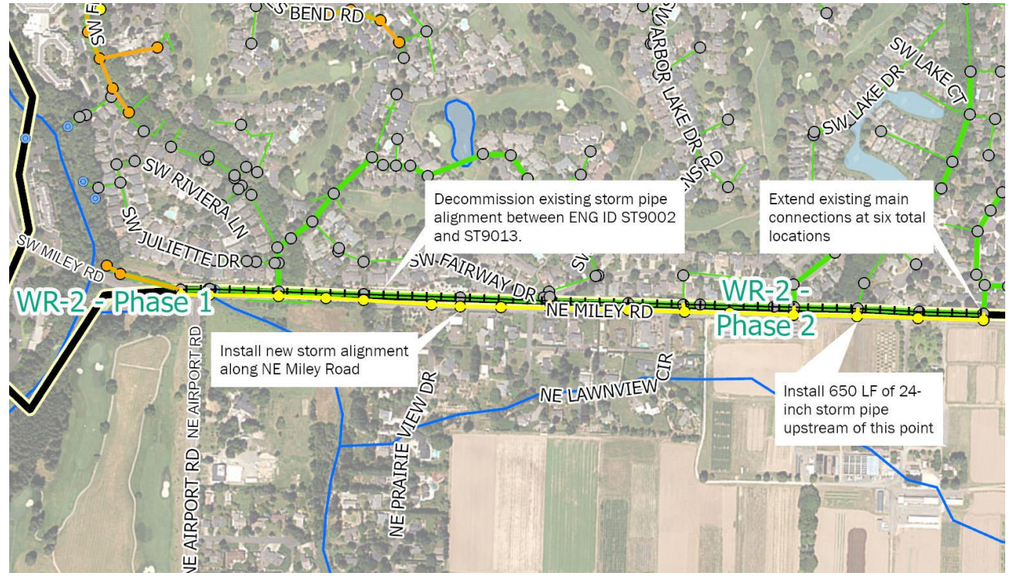
- Access to the outfall is assumed to be feasible without significant permitting requirements.
- Pipe sizing for the new alignment was conducted using changes to the existing pipe alignment, including the existing inverts, to confirm capacity. As such, capacity using inverts for the new pipe alignment should be confirmed during project design.
- Extending the connections to the existing alignment may require work underneath the private brick wall that stands on top of much of the existing alignment. Constructability considerations and trenchless methods should be investigated during design.
- Miley Road lies outside of Wilsonville City limits. Clackamas County requirements and permitting should be reviewed during project design.

Estimated Project Cost

	Phase 1	*Phase 2*
Capital Expense Total	$574,000	$7,720,000
Design / Construction Admin. Phase 1: 13.5% Phase 2: 3.5% + $200K	$77,000	$470,000
Engineering & Permitting (30%)	$172,000	$2,316,000
Total Cost	**$820,000**	**$10,510,000**

Project Cost Notes

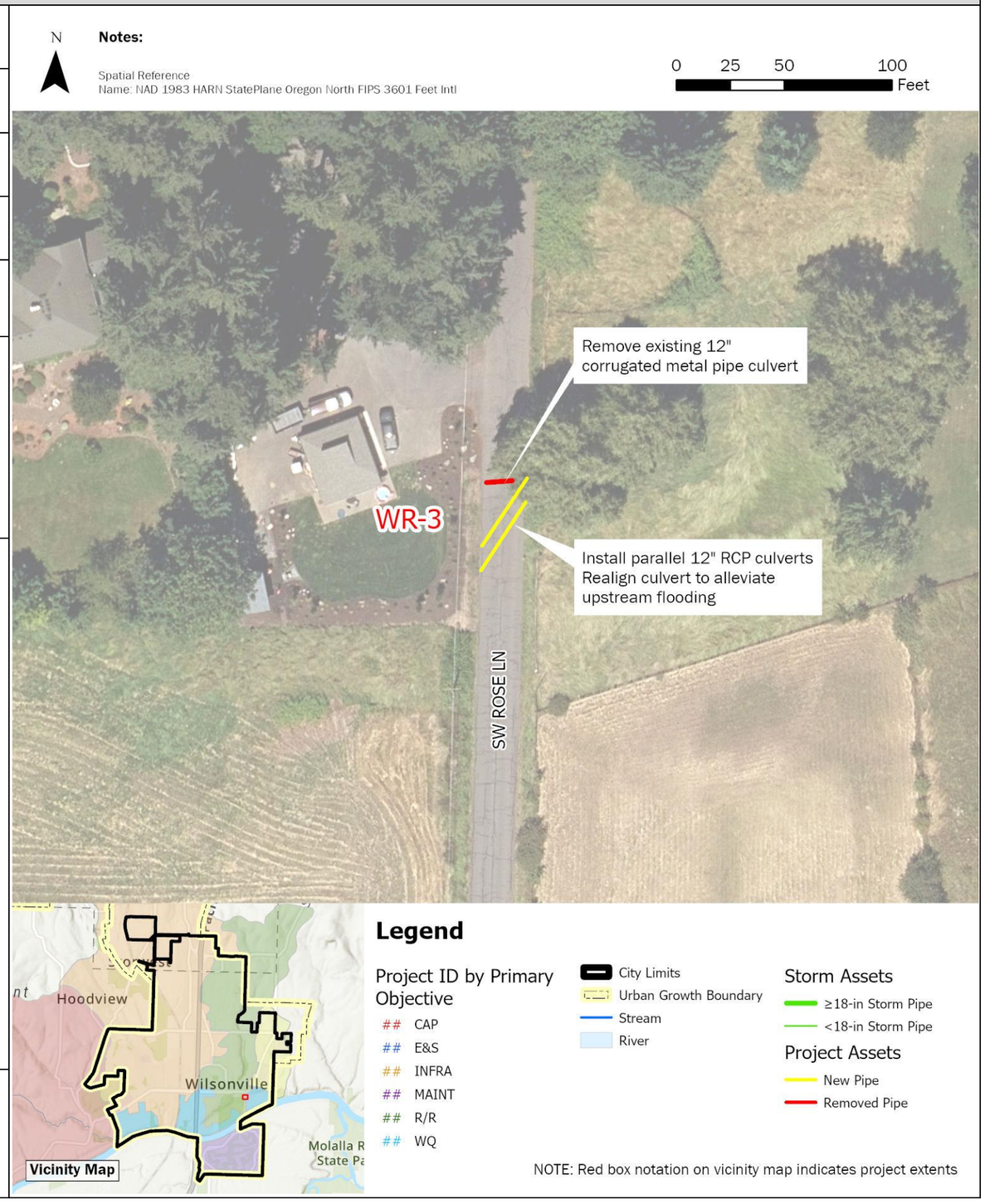
- Costs have not been included for access requirements.
- Costs for connections to existing system under brick wall have been assumed based on the existing number of connections and associated pipe length only.
- Costs assume that existing pipe alignment (where not replaced, where moved to ROW) will be abandoned and filled with grout at key connection points.
- Replacement of inlets and laterals along Miley Road is not accounted for.
- Miley Road lies outside of Wilsonville City limits. An 8.83% multiplier has been applied to the project cost to account for Clackamas County permitting costs.
- A modified construction administration multiplier was applied per direction from the City. No cap on engineering and permitting was applied, given potential design and permitting complexity of the project.



Sinkhole observed at upstream end of Miley Road alignment

Temporary construction work on sinkhole

WR-3	Rose Lane Culvert Replacement		
Project Objective(s)	Capacity Maintenance		
Project Opportunity ID	7		
Contributing Drainage Area	Approx. 14 acres (estimated as a portion of subbasin 5200)		
Estimated Existing Impervious Area (%)	21.6%	**Estimated Future Impervious Area (%)**	23.9%
Project Location	This project is located in the Boeckman Creek watershed, along SW Rose Lane between SW Wilsonville Road and SW Montgomery Way near tax lot 31W24A 03900.		
Statement of Need	The culvert under SW Rose Lane appears to be undersized, causing flooding on the road and neighboring private property on upstream side. This area is very flat with undefined drainage patterns. The existing culvert alignment is perpendicular to the upstream open channel alignment, which limits the ability to route/divert flow east. In addition, the roadway and associated culvert are located at a lower elevation than surrounding upstream or downstream property, causing water to collect and flood over the roadway. This project was originally identified as WD-2 in the 2012 SMP.		
Project Description	This project replaces an existing 12-inch corrugated metal pipe culvert under Rose Lane with realigned dual 12-inch RCP culverts to adequately convey flows. Project details are as follows: • Remove the existing 25 LF of 12-inch culvert (CARTE ID: 24370, ENG ID not available). • Install approximately 40 LF of parallel 12-inch RCP culverts. • Realign the existing culvert at a diagonal across the road so that the culvert outlet location remains the same, but the culvert inlet is at least 30 feet to the south (away from the residential structure). This will also help soften the hard bends in the system. • Reinforce stormwater conveyance around property near culvert to move water into ditch and avoid overland sheet flow and potential flooding.		

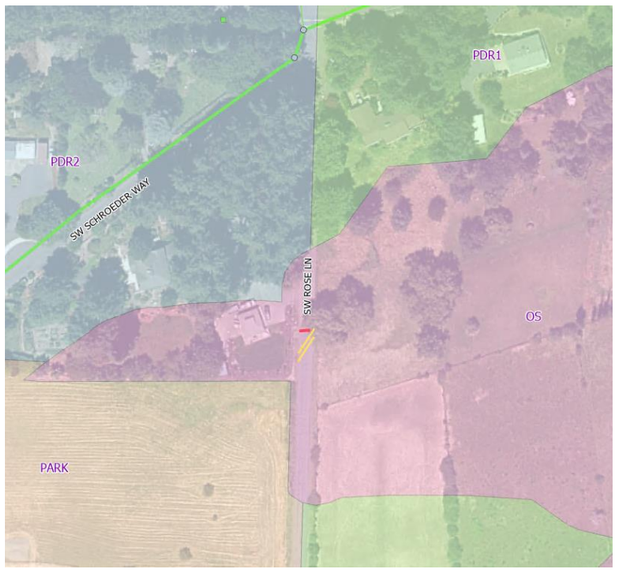


WR-3	Rose Lane Culvert Replacement	
Design Considerations / Assumptions	• Project was identified in the 2012 SMP (WD-2) with a proposed culvert sizing of 36-inches and roadway modifications. To avoid raising the roadway this project utilizes parallel 12-inch RCP culverts to convey flows under Rose Lane with the required amount of pipe cover. • Minimum 12-inch cover on top of culvert. • Surveying is required for this project as available topography displayed minor changes in elevation that may require additional grading of both the ditch and roadway. • Maximum allowable depth for roadside ditches is 2-feet. • Minimum separation distance between parallel storm sewers and other utilities is 5-feet measured from the edge of each pipe. • Waterbody is a seasonal stream with open marsh/wetlands on upstream and downstream sides. This channel and the culvert were not surveyed or reflected in the H/H modeling associated with this SMP. • Most future land use for the contributing area to this project location is designated as Parks and Open Space/Natural Area. However, some surrounding areas are anticipated to develop as Planned Development Residential (PDR1 and PDR2) that may influence stormwater runoff patterns to this project location in the future.	
Estimated Project Cost	Capital Expense Total	$86,000
	Design / Construction Admin. (Cap)	$35,000
	Engineering & Permitting (Cap)	$75,000
	Total Cost	**$200,000**
Project Cost Notes	• Modifications to the roadway beyond trenching were not developed as part of the cost estimate. • Surveying is required. • Clearing and grubbing 1,000 SF of vegetation on both sides of the road is included. • A minimum cap on Design/ Construction Admin and Engineering & Permitting was applied at the direction of the City.	

Additional Figures

Upstream ditch along west side of Rose Lane (May 2023)

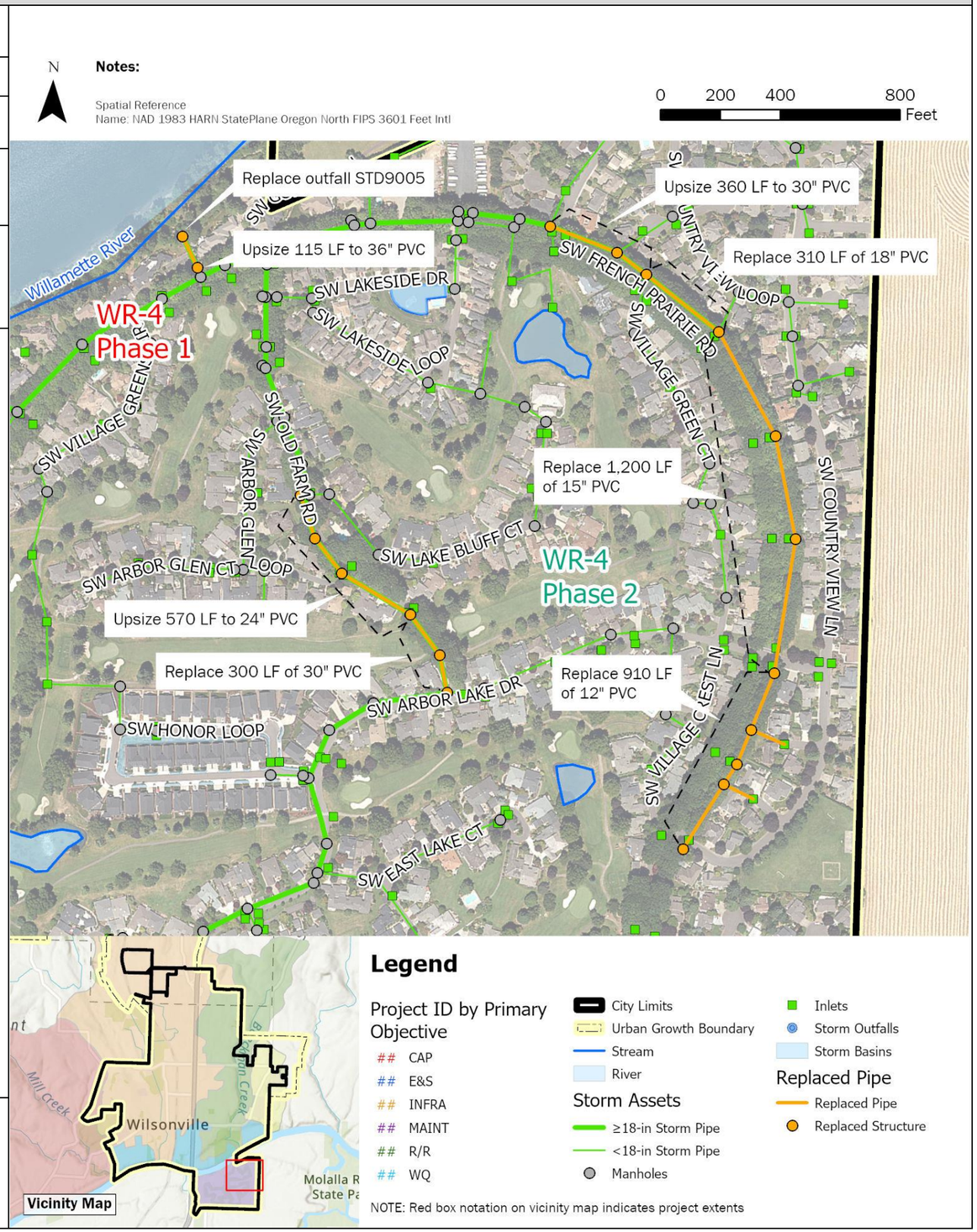
Culvert inlet under Rose Lane (May 2023)



Future Land Use Zoning around project area

Downstream of culvert, east side of Rose Lane (May 2023)

WR-4	Charbonneau East Stormwater Improvements		
Project Objective(s)	Capacity Repair and Replacement		
Project Opportunity ID	30	**Contributing Drainage Area**	159 acres
Estimated Existing Impervious Area (%)	43.1%	**Estimated Future Impervious Area (%)**	43.1%
Project Location	This project is located in the Charbonneau residential area near the Willamette River. The area is bounded to the west by Village Green Circle, the Willamette River to the north, SW Country View Lane to the east, and the SW Lake Drive to the south.		
Statement of Need	Charbonneau East reflects replacement and select upsizing of stormwater pipe and associated structures along SW French Prairie Rd and SW Old Farm Road. System upsizing and replacement was reflected in the 2012 SMP as well as the Charbonneau Consolidated Improvement Plan (2014).		
Project Description	This project mitigates modeled flooding along SW French Prairie Rd and/or SW Old Farm Rd by increasing the diameter of the outfall pipe discharging to the Willamette River (Phase 1). Select pipe upsizing (per modeled capacity limitations) and replacement (due to reported system condition issues) along SW French Prairie Rd and SW Old Farm Rd are reflected as Phase 2 of the project, subject to flow monitoring results. Due to project complexity and size, this project is costed as two phases and numbered based on recommended sequencing. Project details by phase are as follows: Phase 1 (Charbonneau East Outfall): • Replace existing Charbonneau East Outfall (STD9005). • Replace one 72-inch manhole (ST9014). • Upsize 115 LF of 30-inch pipe to 36-inch diameter PVC discharging to Willamette River (STD9005 to ST9014). Phase 2 (Storm Sewer Replacement): • Replace 230 LF of 10-inch pipe with 12-inch PVC on SW French Prairie Rd (ST9087 to end, and ST9088 to end). • Replace 680 LF of 12-inch pipe with 12-inch PVC on SW French Prairie Rd (ST9023 to ST9242). • Replace 1,200 LF of 15-inch pipe with 15-inch PVC on SW French Prairie Rd (ST9023 to ST9020). • Replace 310 LF of 18-inch pipe with 18-inch PVC on SW French Prairie Rd (ST9020 to ST9019). • Upsize 360 LF of 21-inch pipe to 30-inch PVC on SW French Prairie Rd (ST9019 to ST9017). • Replace 570 LF of 24-inch pipe with 24-inch PVC on Old Farm Rd (ST9030 to ST9027). • Replace 300 LF of 30-inch pipe with 30-inch PVC on Old Farm Rd (ST9031 to ST9030). • Replace eight 48-inch manholes (ST9020 to ST9242). • Replace nine 60inch manholes (ST9017 to ST9019, and ST9027 to ST9031).		



WR-4	Charbonneau East Stormwater Improvements

Design Considerations / Assumptions

- This project mitigates projected flooding along SW French Prairie Rd and/or SW Old Farm Rd by increasing the diameter of the outfall pipe discharging to the Willamette River (Phase 1). Due to space limitations, above ground detention cannot be used to provide flow control. Additional configurations, including various inline detention along SW French Prairie Rd and/or SW Old Farm Rd, were explored as part of CIP development. Flow monitoring and model calibration in this area are recommended to confirm simulated flooding results and pipe upsizing needs.
- Portions of the stormwater conveyance along Old Farm Road and SW Prairie Road have been replaced in conjunction with the Charbonneau Consolidated Improvement Plan. These pipe segments include ST003 to ST9017 along SW French Prairie Road and ST9369 to ST9027 along Old Farm Road.
- Pipes indicated as upsizing needs (Phase 2) do not include replacement of recently replaced piping per modeled capacity needs. Pipes indicated as replacement are identified due to condition.
- Design and construction of CIP SD9030-9037 (Edgewater Drive E and French Prairie Road) per the 2012 SMP is in progress and not reflected in this project.
- Phase 2 sizing and overall need may be influenced by system conditions following implementation of Phase 1 of each project. Ongoing monitoring of site conditions should be considered prior to initiating work on Phase 2.

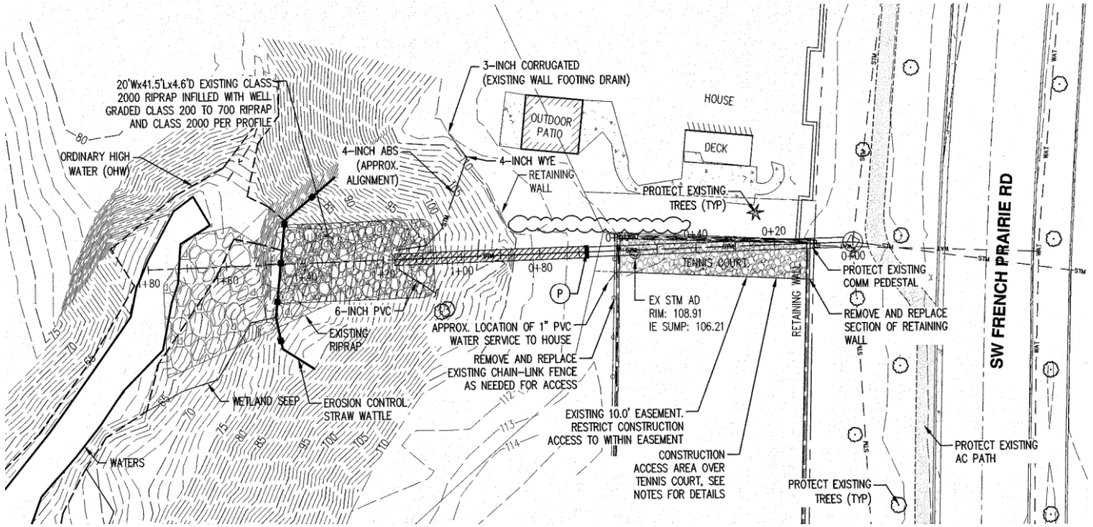
Estimated Project Cost

	Phase 1	*Phase 2*
Capital Expense Total	$201,000	$3,325,000
Design / Construction Admin. Phase 1: 25% Phase 2: 13.5%	$50,000	$449,000
Engineering & Permitting Phase 1: 50% Phase 2: 20%	$101,000	$665,000
Outreach Coordination (Flat Rate - Phase 1 only)	$250,000	N/A
Total Cost	**$600,000**	**$4,400,000**

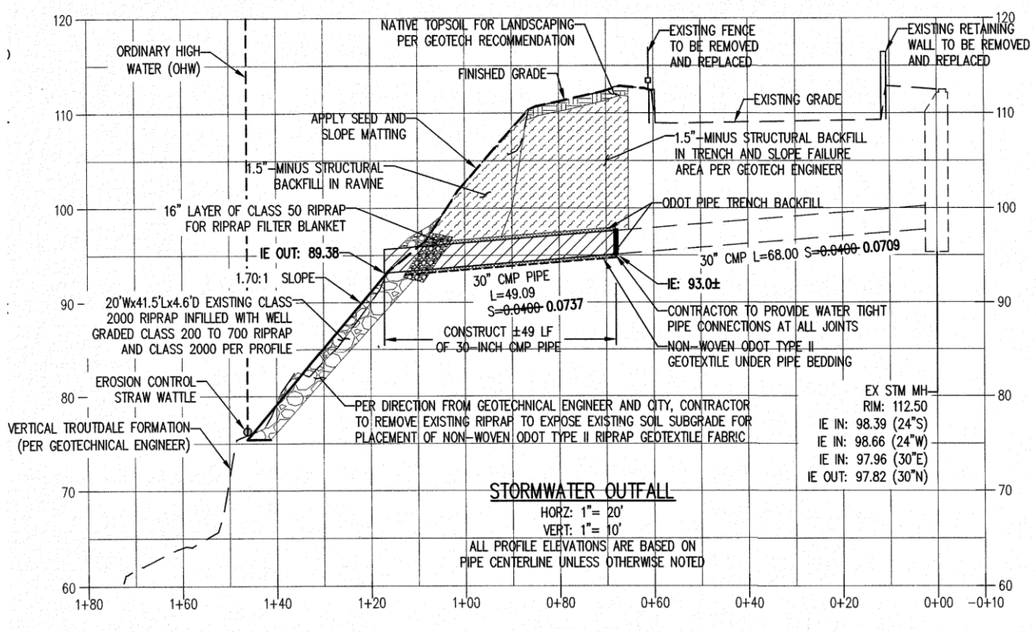
Project Cost Notes

- Due to in-water work and private property constraints, Phase 1 engineering and permitting multiplier was set to 50%. Design/Construction Administration multiplier was set to 25% per direction from the City.
- Cost estimates use PVC for all new and replacement pipe materials.
- Project contingency increased to 50% for Phase 1 due to private property constraints.

Additional Figures



Outfall to Willamette River Emergency Replacement As-builts (Plan View, 2019)



Outfall to Willamette River Emergency Replacement As-builts (Profile View, 2019)

WR-5	Charbonneau West Stormwater Improvements		
Project Objective(s)	Repair and Replacement, Maintenance		
Project Opportunity ID	28	**Contributing Drainage Area (acres)**	54 acres
Estimated Existing Impervious Area (%)	46.5%	**Estimated Future Impervious Area (%)**	46.5%
Project Location	This project is located in the Charbonneau residential area near the Willamette River. The area is bounded to the west by Interstate 5, the Willamette River to the north, Charbonneau Golf Club to the east, and NE Miley Road to the south.		
Statement of Need	Charbonneau West reflects replacement of stormwater pipe and associated structures along SW French Prairie Rd. SW Curry Dr., and SW Boones Bend Rd. System replacement needs were reflected in the 2012 SMP as well as the Charbonneau Consolidated Improvement Plan (2014).		

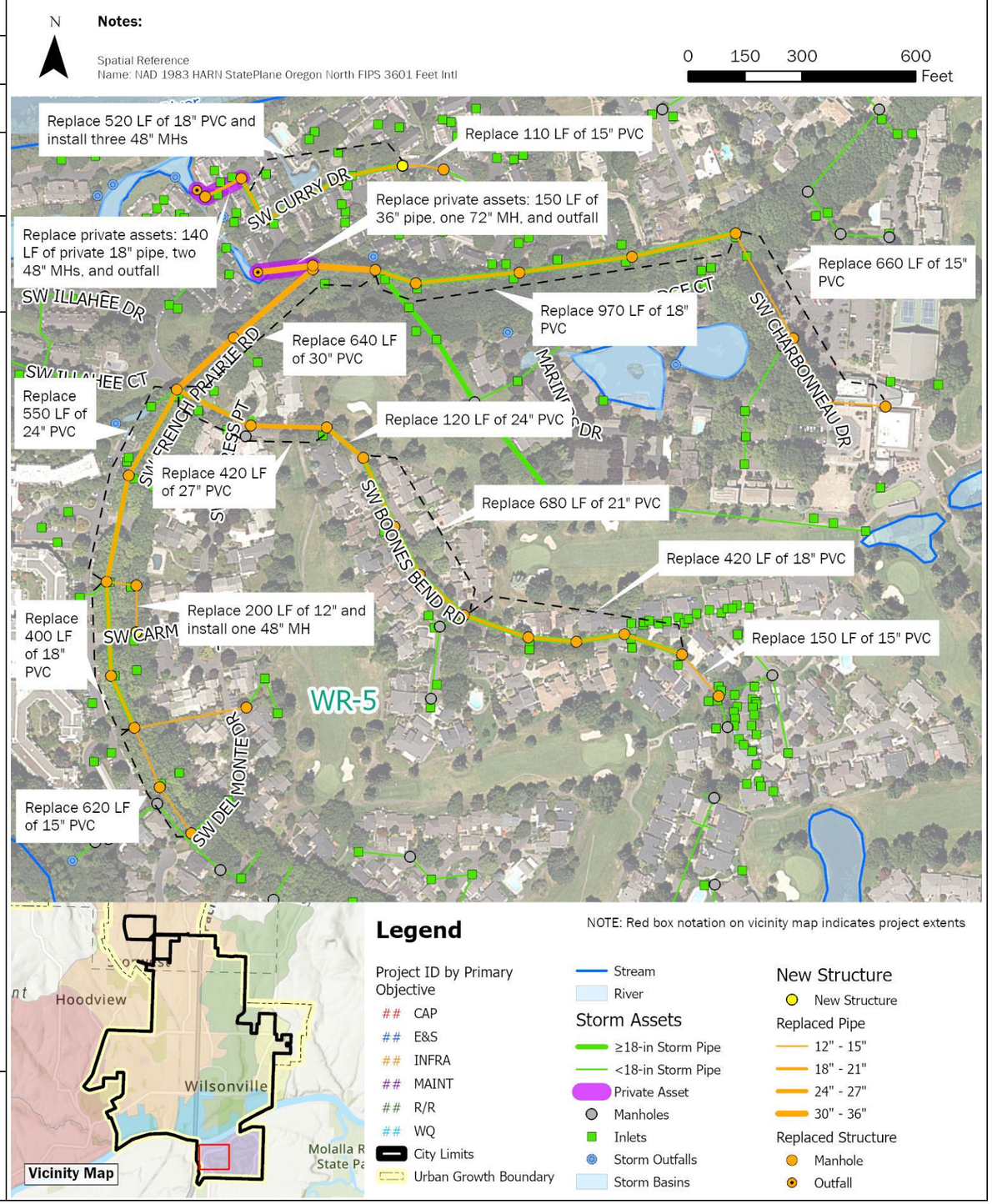
Project Description

This project replaces select public and private stormwater infrastructure throughout the Charbonneau West area, as identified in the Charbonneau Consolidated Improvement Plan. Private system improvements are specifically referenced on the figures and project details as identified per the City's GIS mapping.

Project details are as follows (ENG IDs provided in parentheses when applicable, CARTE ID provided when ENG ID is not available):

- Pipe replacement along SW Curry Drive:
  - Replace 110 LF of 15-in pipe with PVC (PST9012 to new manhole).
  - Replace 520 LF of 18-in pipe with PVC (new manhole to private manhole CARTE ID: 1892).
  - Replace 140 LF of 18-in private pipe with PVC (private manhole CARTE ID: 1892 to private outfall CARTE ID: 15).
  - Replace private outfall (CARTE ID: 15).
  - Replace two private 48-in manholes (CARTE ID 1892 and 1383).
  - Install three 48-inch manholes.
- Pipe replacement along SW French Prairie Road:
  - Replace 200 LF of 12-in pipe with PVC (ST9331 to ST9044)
  - Replace 1,280 LF of 15-in pipe with PVC (ST9048 to ST9046; ST9269 to ST9046; and ST9281 to ST9043).
  - Replace 1,370 LF of 18-in pipe with PVC (ST9046 to ST9044 and ST9043 to CARTE ID: 1859 – ENG ID unknown)
  - Replace 550 LF of 24-in pipe with PVC (ST9044 to ST9040).
  - Replace 640 LF of 30-in pipe with PVC (ST9040 to ST9067, ST9041 to ST9067, and unknown to ST9041).
  - Replace 20 LF of 36-in pipe with PVC (unknown to ST9067).
  - Replace 150 LF of private 36-in PVC pipe (ST9041 to private outfall – ID unknown).
  - Replace private outfall; install one 48-in manholes and replace 14 48-in manholes; replace four 60-in manholes; and replace two 72-in manholes.

Continued on page 2.



WR-5	Charbonneau West Stormwater Improvements	

Project Description (*continued*)	• Pipe replacement along SW Boone's Bend Road:
	  ○ Replace 150 LF of 15-in pipe with PVC (ST9059 to ST9058).
	  ○ Replace 420 LF of 18-in pipe with PVC (ST9058 to ST9055).
	  ○ Replace 680 LF of 21-in pipe with PVC (ST9055 to ST9051).
	  ○ Replace 120 LF of 24-in pipe with PVC (ST9051 to ST9050).
	  ○ Replace 420 LF of 27-in pipe with PVC (ST9050 to ST9040).
	  ○ Replace eight 48-in manholes; and replace three 60-in manholes.	

Design Considerations / Assumptions	• This project is summarized in conjunction with the Charbonneau Consolidated Improvement Plan 2014. Pipe segments greater than 12 inches in diameter and identified as Priority 1 or 2 in the Charbonneau Consolidated Improvement Plan were incorporated.
	• Pipes with unknown diameters were assumed to have the same diameter as the adjoined downstream pipe.
	• Manholes with unknown diameters were sized based on incoming and outgoing pipe diameters.
	• The following manholes (ENG IDs) are anticipated to be replaced in conjunction with pipe replacement:
	  ○ Twenty-five 48-in: ST9281 to ST9066, unknown (CARTE ID 1859), ST9059 to ST9052, ST9278 to ST9045, ST9269, ST9165, PST9012, two private manholes (CARTE ID 1383 and 1892).
	  ○ Seven 60-in: ST9051, ST9050, ST9049, ST9044, ST9042, ST9040, and ST9041.
	  ○ Two 72-in: ST9067 and ST9041	

Estimated Project Cost	Capital Expense Total	$8,235,000
	Design / Construction Admin. (3.5% + $200K)	$488,000
	Engineering & Permitting (20%)	$1,647,000
	Total Cost	**$10,370,000**
Project Cost Notes	• A modified Design/Construction Administration multiplier was applied per direction from the City. • All assumed as PVC replacement. • Private pipe and outfall replacement are included in cost estimate to maintain consistency with the Charbonneau Consolidated Improvement Plan 2014. • Connections to existing public stormwater mains greater than 12-inches in diameter are included in the cost estimate. • Connections to laterals not included in cost estimate.	

Additional Figures

Stormwater replacement prioritization from Charbonneau Consolidated Improvement Plan (2014)

Appendix E: Capital Project Cost Estimates

Unit Cost Table			
Item	**Unit**	**Proposed Unit Cost Mar 2023**	**Notes, Unit Cost Mar 2023**
Earthwork			
General Earthwork/Excavation	CY	78	City of Wilsonville, provided by Zach Weigel December 2023
Excavation, to onsite stockpile	CY	20	For site grading (not structural). Source: BC Assembly using RSMeans pricing.
Fill, imported clean	CY	115	For site grading (not structural), includes compaction. Source: BC Assembly using RSMeans pricing.
Fill, from onsite stockpile	CY	60	For site grading (not structural), includes compaction. Source: BC Assembly using RSMeans pricing.
Embankment	CY	35	City of Wilsonville, provided by Zach Weigel December 2023
Structural Earth Wall	SF	50	City of Wilsonville, provided by Zach Weigel December 2023
Clear and Grub brush including stumps	AC	22,000	Source: ODOT 2022Q4, Item 0320-010000R, avg award + 10%. This item INCLUDES stump removal
Clearing and Grubbing	AC		ODOT does not have a bid item without stump removal.
Amended Soils and Mulch	CY	165	Source: ODOT 2022Q3, Item 1040-0194000K (Compost mulch), avg award + 10%
Jute Matting, Biodegradeable	SY	8	Source: ODOT 2022Avg, Item 0280-0105010,20,30,40 avg, avg award + 10%
Tree removal	EA	1,200	City of Wilsonville, provided by Zach Weigel December 2023
Geotextile	SY	7	Source: ODOT 2022Q4, Item 0350-010000J (drainage geotex Type 1), avg award + 10%
Energy dissapation pad - Rip-Rap, Class 50	CY	161	Source: ODOT 2022Avg, Item 0390-010500K, avg award + 10% - **ANDREW SAID NOT TO USE THIS ONE**
Energy dissapation pad - Rip-Rap, Class 100	CY	124	Source: ODOT 2022Avg, Item 0390-010800K, avg award + 10%
Energy dissapation pad - Rip-Rap, Class 200	CY	81	Source: ODOT 2022Avg, Item 0390-011000K, avg award + 10%
Dewatering (pipeline construction)	DAY	550	Recommend $550/day minimum for pipeline construction
Dewatering (other)	LS	5,000 - 50,000	Select as needed based on project needs (T. Suesser April 2023)
Drain Rock	CY	110	City of Wilsonville, provided by Zach Weigel December 2023
Streambed Cobble	TON	120	City of Wilsonville, provided by Zach Weigel December 2023
Water Quality Facility Installation			
Outflow Control Structure	EA	20,000	City of Wilsonville, provided by Zach Weigel December 2023
Swale Flow Spreader	EA	20,000	Unique facility (ditch inlet + outflow control) - City spec S-2225
Facility Inlet Structure	EA	10,000	Same as Outflow Control Structure
Water Quality Facility Plantings with Trees	SF	40	City of Wilsonville, provided by Zach Weigel January 2024
Rain Garden/ Swale	SF	130	City of Wilsonville, provided by Zach Weigel December 2023
Stormwater Planter	SF	180	City of Wilsonville, provided by Zach Weigel December 2023
Gravel Access Road	SF	5	2023RSMeans, for 9" thick gravel with geotextile
Beehive Overflow	EA	6,100	City of Wilsonville, provided by Zach Weigel December 2023
Structure Installation			
Field Ditch Inlet	EA	5,600	City of Wilsonville, provided by Zach Weigel December 2023
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	City of Wilsonville, provided by Zach Weigel December 2023
Precast Concrete Manhole (48", 9-12' deep)	EA	15,000	City of Wilsonville, provided by Zach Weigel December 2023
Precast Concrete Manhole (48", 13-20' deep)	EA	18,000	City of Wilsonville, provided by Zach Weigel December 2023
Precast Concrete Manhole (60", 0-8' deep)	EA	14,000	City of Wilsonville, provided by Zach Weigel December 2023
Precast Concrete Manhole (60", 9-12' deep)	EA	18,000	City of Wilsonville, provided by Zach Weigel December 2023
Precast Concrete Manhole (60", 13-20' deep)	EA	22,000	City of Wilsonville, provided by Zach Weigel December 2023
Precast Concrete Manhole (72", 0-8' deep)	EA	18,000	City of Wilsonville, provided by Zach Weigel December 2023
Precast Concrete Manhole (72", 9-12' deep)	EA	23,000	City of Wilsonville, provided by Zach Weigel December 2023
8'x8'x10' Concrete Vault	EA		
Precast Concrete Manhole (72", >12' deep)	EA	28,000	City of Wilsonville, provided by Zach Weigel December 2023
Flow Splitter/WQ Manhole (72", all depths)	EA	28,000	City of Wilsonville, provided by Zach Weigel December 2023
Contech CDS (Model CDS3025, 72")	EA		
StormFilter (2-cartridge catch basin unit, 18" cartridges)	EA		
Drywell (48", 20-25' deep)	EA	14,100	Source: BC Assembly using RSMeans pricing
Curb Inlet	EA	8,300	Source: ODOT 2022Q4, Item 0470-0304000E (Concrete inlet, Type CG-1), avg award + 10%
ADA Ramp	EA	10,000	City of Wilsonville, provided by Zach Weigel December 2023
Catch Basin, all types	EA	8,300	Same as Curb Inlet
Concrete Fill - UIC Decomissioning	EA		
Connection to Existing Lateral	EA	6,000	City of Wilsonville, provided by Zach Weigel December 2023
Connection to Existing Structure, standard	EA	10,000	City of Wilsonville, provided by Zach Weigel December 2023
Abandon Existing Pipe, no excavation (12")	FT		Use pipe plugs priced below or fill with grout item
Abandon Existing Pipe, no excavation (15"-18")	FT		Use pipe plugs priced below or fill with grout item
Abandon Existing Pipe, no excavation (21"-24")	FT		Use pipe plugs priced below or fill with grout item
Abandon Existing Pipe, no excavation (27"-36")	FT		Use pipe plugs priced below or fill with grout item
Abandon Existing Pipe, fill with grout	CF	8	Source: BC Assembly using previous bid pricing
Abandon Existing Structure	EA	3,400	Source: ODOT 2022Q4, Item 0490-0117000E (filling abandoned structures), avg award + 10%
Demo pipe	LF	30	Assumes 12" RCP pipe. Does not include excavation. Source: BC Assembly using RSMeans pricing
Remove existing pavement	SY	120	City of Wilsonville, provided by Zach Weigel January 2024
Remove structure	EA	1,700	Source: ODOT 2022Q4, Item 0310-0105000E (removal of manholes), avg award + 10%
Plug Existing Pipe, up to 18" dia, at manhole	EA	1,800	Source: BC Assembly using RSMeans pricing.
Plug Existing Pipe, up to 36" dia, at manhole	EA	2,300	Source: BC Assembly using RSMeans pricing.
Retrofit diversion structure	EA	50,000	Conservative estimate to retrofit diversion structure on seimens property. Options include raising invert elevation, plugging altogether, etc.
Check dams	EA	570	Aggregate Type 1 (Erosion Control) check dam. Source: ODOT 2022Q4, Item 0280-0106010E, avg award + 10%
Stem wall check dam	LF	600	Assume similar to retaining wall, 4' wide footing x 1' deep (buried 1' deep) with 4' tall wall x 12" th. Includes excavation/backfill. Source: BC Assembly using RSMeans pricing.
Headwall with wingwalls, larger than 48" pipe	EA	35,000	Assume approx 8' tall x 15' long. Includes excavation/backfill. Source: BC Assembly using RSMeans pricing.
Headwall with wingwalls, up to 48" pipe	EA	25,000	Assume approx 5' tall x 15' long. Includes excavation/backfill. Source: BC Assembly using RSMeans pricing.
Headwall with wingwalls, up to 48" pipe	EA		
Outfall Improvements	EA		
Restoration/Resurfacing			
Non-Water Quality Facility Landscaping	AC	27,000	City of Wilsonville, provided by Zach Weigel December 2023
Riparian/Wetland Planting (Non-irrigated)	AC	36,000	City of Wilsonville, provided by Zach Weigel December 2023
Riparian/Wetland Planting (w/temporary irrigation)	AC	60,000	City of Wilsonville, provided by Zach Weigel December 2023
Planting and Bioengineered Restoration	SY	60	City of Wilsonville, provided by Zach Weigel December 2023
4-foot Chain Link Fence	LF	60	City of Wilsonville, provided by Zach Weigel December 2023
Split Rail Fence	LF	60	City of Wilsonville, provided by Zach Weigel December 2023
Hydroseed, large quantities	AC	22,000	Source: ODOT 2022Avg, Item 1030-0110000R (Perm seeding, mix No. 2), avg award + 10%
Seeding, small quantities (< 5,000 sf)	SF	0.68	Source: ODOT 2022Q4, Item 1030-0138000J (lawn seeding), avg award + 10%
Sidewalk Installation	SF	17	Source: ODOT 2022Avg, Item 0759-0128000J (concrete walks), avg award + 10%
Trench resurfacing, Permanent ACP, 6-Inch Depth	SY	144	Source: ODOT 2022Avg, Item 0495-0100000J, avg award + 10%

Unit Cost Table			
Item	Unit	Proposed Unit Cost Mar 2023	Notes, Unit Cost Mar 2023
Permeable Paver Installation	SF	46	Source: ODOT 2022Avg, Item 0760-010000J (Unit pavers), avg award + 10%
Porous Asphalt Paving	SF	5	Source: 2023RSMeans, Item 32-12-16.13, 0600 (1" porous friction course over 3" bit course) adjusted to include hauling
Concrete Curbs	FT	74	Source: ODOT 2022Avg, Item 0759-0103000F (conc curb & gutter), avg award + 10%
Retaining wall, block	SF	119	Source: ODOT 2022Avg, Item 0596-B002000A (Retaining wall, prefab modular gravity), avg award + 10%
Retaining wall, CIP concrete	SF	250	City of Wilsonville
Retaining wall, sheet pile	SF	190	Up to 20' high exposed face. Source: BC Assembly using RSMeans pricing.
Retaining wall, soldier pile	SF	210	Up to 20' high exposed face. Source: BC Assembly using RSMeans pricing.
Root wad	EA	61	Source: Oregon, OH bid tab 2019 escalated
Trash rack	EA	5,600	Same as Field Ditch Inlet. City of Wilsonville, provided by Zach Weigel December 2023
Pipe Unit Cost			
Underdrain Pipe, 4"	LF	55	City of Wilsonville
Underdrain, 6" perforated HDPE	LF	60	City of Wilsonville
HDPE, 12", 10' to invert, not in road	FT	171	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
HDPE, 12", 15' to invert, not in road	FT	179	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
HDPE, 12", 10' to invert, in road	FT	470	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
HDPE, 12", 15' to invert, in road	FT	567	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
HDPE, 24", 10' to invert, not in road	FT	298	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
HDPE, 24", 15' to invert, not in road	FT	310	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
HDPE, 24", 10' to invert, in road	FT	649	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
HDPE, 24", 15' to invert, in road	FT	778	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 8", 10' to invert, not in road	FT	136	Interpolated
PVC, 12", 10' to invert, not in road	FT	206	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 18", 10' to invert, not in road	FT	293	Interpolated from equivalants at 12" and 24" diam, SG 6/20/23
PVC, 12", 15' to invert, not in road	FT	215	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 18", 15' to invert, not in road	FT	304	Interpolated from equivalants at 12" and 24" diam, SG 6/20/23
PVC, 12", 10' to invert, in road	FT	506	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 12", 15' to invert, in road	FT	602	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 15", 10' to invert, in road	FT	535	Interpolated from equivalants at 12" and 18" diam, MT 7/7/24
PVC, 15", 15' to invert, in road	FT	666	Interpolated from equivalants at 12" and 18" diam, SG 1/23/24
PVC, 15", 10' to invert, not in road	FT	249	Interpolated from equivalants at 12" and 18" diam, SG 1/23/24
PVC, 15", 15' to invert, not in road	FT	259	Interpolated from equivalants at 12" and 18" diam, SG 1/23/25
PVC, 18", 10' to invert, in road	FT	563	Interpolated from equivalants at 12" and 24" diam, MT 6/22/23
PVC, 18", 15' to invert, in road	FT	731	Interpolated from equivalants at 12" and 24" diam, MT 6/22/23
PVC, 24", 10' to invert, not in road	FT	381	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 24", 15' to invert, not in road	FT	393	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 21", 10' to invert, in road	FT	647	Interpolated from equivalants at 18" and 24" diam, MT 7/7/23
PVC, 21", 15' to invert, in road	FT	796	Interpolated from equivalants at 18" and 24" diam, SG 1/23/24
PVC, 21", 15' to invert, not in road	FT	348	Interpolated from equivalants at 18" and 24" diam, SG 1/23/25
PVC, 24", 10' to invert, in road	FT	732	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 24", 15' to invert, in road	FT	860	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 27", 10' to invert, in road	FT	805	Interpolated from equivalants at 24" and 30" diam, MT 7/7/23
PVC, 30", 10' to invert, not in road	FT	477	Interpolated from equivalants at 24" and 36" diam, MT 6/29/23
PVC, 30", 10' to invert, in road	FT	879	Interpolated from equivalants at 24" and 36" diam, MT 6/29/24
PVC, 36", 10' to invert, not in road	FT	573	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 36", 15' to invert, not in road	FT	591	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 36", 10' to invert, in road	FT	1,027	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 36", 15' to invert, in road	FT	1,220	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 42", 10' to invert, not in road	FT	703	Interpolated from equivalants at 36" and 48" diam, T. Suesser 6/14/23
PVC, 42", 10' to invert, in road	FT	1,169	Interpolated from equivalants at 36" and 48" diam, T. Suesser 6/14/23
PVC, 48", 10' to invert, not in road	FT	834	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 48", 15' to invert, not in road	FT	855	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 48", 10' to invert, in road	FT	1,310	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
PVC, 48", 15' to invert, in road	FT	1,536	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 12", 10' to invert, not in road	FT	198	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 12", 15' to invert, not in road	FT	207	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 12", 10' to invert, in road	FT	498	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 12", 15' to invert, in road	FT	594	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 15", 15' to invert, in road	FT	326	Interpolated from equivalants at 12" and 24" diam, MT 6/30/23
RCP, 18", 15' to invert, in road	FT	391	Interpolated from equivalants at 12" and 24" diam, MT 6/30/23
RCP, 24", 10' to invert, not in road	FT	303	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 24", 15' to invert, not in road	FT	315	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 24", 10' to invert, in road	FT	653	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 24", 15' to invert, in road	FT	782	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 27", 15' to invert, in road	FT	766	Interpolated from equivalants at 24" and 36" diam, MT 7/06/23
RCP, 30", 10' to invert, in road	FT	866	Interpolated from equivalants at 24" and 36" diam, MT 6/30/23
RCP, 36", 10' to invert, not in road	FT	625	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 36", 15' to invert, not in road	FT	642	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 36", 10' to invert, in road	FT	1,079	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 36", 15' to invert, in road	FT	1,272	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 48", 10' to invert, not in road	FT	877	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 48", 15' to invert, not in road	FT	898	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 48", 10' to invert, in road	FT	1,353	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 48", 15' to invert, in road	FT	1,579	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 72", 10' to invert, not in road	FT	1,375	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 72", 15' to invert, not in road	FT	1,401	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 72", 10' to invert, in road	FT	1,861	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
RCP, 72", 15' to invert, in road	FT	2,151	See PipeCostBasis tab Notes, increase by 10% per City of Wilsonville
Box Culvert (8' x 3')	FT	705	Source: 2023RSMeans, Item 33-42-11.60, 0200, excavation/backfill not included
Box Culvert (10' x 3')	FT	950	Source: 2023RSMeans, Item 33-42-11.60, 0300, excavation/backfill not included
Box Culvert (12' x 3')	FT	2070	Source: 2023RSMeans, Item 33-42-11.60, 0400, excavation/backfill not included
Contingencies and Multipliers			
Mobilization/Demobilization	LS	10%	
Erosion and Sediment Control	LS	3%	
Contingency	LS	40%	Updated per City of Wilsonville
Traffic Control/Utility Relocation	LS	5-10%	Dependent on work in ROW
Surveying	LS	5%	
Clackamas County Permitting	LS	8.83%	Applicable to Miley Road, added 6/22/23 per Kerry's instructions
Capital Expense Total (including contingency)			

Unit Cost Table			
Item	Unit	Proposed Unit Cost Mar 2023	Notes, Unit Cost Mar 2023
Design/Construction Administration (%)	LS	13.5%	Reflects City staff technical and administrative needs to execute the project. Per City of Wilsonville, assume minimum of $35,000.
Engineering and Permitting (%)	LS	20-30%	In-water dependent and capped on a case-by-case basis at $500,000 per City of Wilsonville. Per City of Wilsonville, minimum of $75,000.

BC-1: Library Pond

Key Project Elements

- Retrofit the existing Library Pond stormwater detention facility to meet current City PWS and accommodate future condition flows associated with the Town Center Development Plan, which anticipates full build out in the next 20+ years.
- Install a pond outlet structure in compliance of current design standards.
- Clear, regrade, and replant the 0.7-acre detention pond, including amending the pond bottom to include the 3 feet of required rocks and media.
- Install 15-ft wide, 25-ft long access road for maintenance access. Assume existing gate can be maintained.
- Remove and replace 70 LF of 18" CSP pipe at new design depth, approx. 15' deep.

Design Assumptions

- The existing pond footprint remains unchanged due to roadway and development constraints. Interior side slopes are assumed to be 3H:1V.
- Facility sizing is based on adherence to the City's Public Works Standards (PWS), Chapter 3 requiring flow matching to pre-development conditions (classified as Oak Savanna). Sizing utilizes the BMP Sizing Tool.
- To size the pond in accordance with PWS design standards, approximately 48 acres require onsite treatment and flow control prior to discharge into Library Pond detention facility.
- Total pond depth includes drain rock (15"), separation layer (3"), and growing media (18"), in accordance with the 2015 PWS Section 3, Appendix A landscape and soil media requirements.
- Inlet and outlet pipe sizes are anticipated to remain unchanged. The outlet structure (standard drawing ST-6110) assumes an additional field inlet for 100-year overflow event.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
Excavation, to onsite stockpile	CY	20	2,350	$47,000
Fill, from onsite stockpile	CY	60	1,289	$77,340
Clear and Grub brush including stumps	AC	22,000	0.70	$15,400
Amended Soils and Mulch	CY	165	389	$64,167
Drain Rock	CY	110	324	$35,648
Water Quality Facility Installation				
Outflow Control Structure	EA	20,000	1	$20,000
Gravel Access Road	SF	5	375	$1,875
Water Quality Facility Plantings with Trees	SF	40	13,550	$542,000
Structure Installation				
Field Ditch Inlet	EA	5,600	1	$5,600
Demo pipe	LF	30	70	$2,100
Remove existing pavement	SY	120	210	$25,200
Remove structure	EA	1,700	1	$1,700
Pipe Unit Cost				
Underdrain, 6" perforated HDPE	LF	60	70	$4,200
PVC, 18", 15' to invert, not in road	FT	304	70	$21,252
Project Sub-Total				$863,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$86,300
Erosion and Sediment Control	LS	3%		$25,890
Contingency	LS	40%		$345,200
Traffic Control/Utility Relocation	LS	5%		$43,150
Surveying	LS	5%		$43,150
Capital Expense Total (including contingency)				$1,407,000
Design/Construction Administration (%)	LS	13.5%		$190,000
Engineering and Permitting (%)	LS	20%		$281,000
			TOTAL	$1,880,000

BC-2: Ash Meadows Flow Mitigation

Key Project Elements

- Plug flow diversion structure at Siemens Pond B.
- Upsize culvert under Boeckman Road from 30" to 48" PVC.
- Upsize culvert under SW Parkway Ave. from 36" to 48" PVC.
- Construct flow control structure at upstream end of culverts under Ash Meadows Road.
- Regrade and restore drainage way between Ash Meadows Road and Parkway Avenue.

Design Assumptions

- Excavate 18" depth for amended soils for entire 55,000 sq ft footprint area, per City Standards.
- Final design will include confirmation of flow control structure sizing.
- Cost estimates were developed directly with the City, without input or review by the TSJV, the Design-Builder.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	3,056	$238,368
Clear and Grub brush including stumps	AC	22,000	1.3	$28,600
Amended Soils and Mulch	CY	165	1,019	$168,135
Tree removal	EA	1,200	30	$36,000
Energy dissapation pad - Rip-Rap, Class 200	CY	81	40	$3,240
Dewatering (other)	LS	50,000	1	$50,000
Water Quality Facility Installation				
Outflow Control Structure	EA	20,000	1	$20,000
Structure Installation				
Demo pipe	LF	30	175	$5,250
Retrofit diversion structure	EA	50,000	1	$50,000
Restoration/Resurfacing				
Riparian/Wetland Planting (w/temporary irrigation)	AC	60,000	1.3	$78,000
Trash rack	EA	5,600	3	$16,800
Pipe Unit Cost				
PVC, 48", 10' to invert, in road	FT	1,310	175	$229,268
Project Sub-Total				$924,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$92,400
Erosion and Sediment Control	LS	3%		$27,720
Contingency	LS	40%		$369,600
Traffic Control/Utility Relocation	LS	15%		$138,600
Surveying	LS	20%		$184,800
Capital Expense Total (including contingency)				$1,737,000
Design/Construction Administration (%)	LS	13.5%		$234,000
Engineering and Permitting (%)	LS	50%		$869,000
Geotechnical	LS	Flat Rate		$100,000
			TOTAL	$2,940,000

BC-3: Wiedemann Ditch and Canyon Creek Park Retrofit, Phase 1

Key Project Elements

- Construct a detention pond at Canyon Creek Park that would receive drainage from the wetland complexes described under Phase 2.

Design Assumptions

- Canyon Creek (phase 1) work includes only the installation of a vegetated facility at Canyon Creek Park and necessary conveyance.
- Excavate 18" depth for amended soils for entire vegetated facility footprint area, per City Standards.
- Final design will include confirmation of vegetated facility plantings and structure sizing.
- Cost estimates were developed directly with the City, without input or review by the TSJV, the Design-Builder.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	13,900	$1,084,200
Clear and Grub brush including stumps	AC	22,000	1.6	$34,470
Amended Soils and Mulch	CY	165	3,792	$625,625
Energy dissapation pad - Rip-Rap, Class 200	CY	81	20	$1,620
Water Quality Facility Installation				
Outflow Control Structure	EA	20,000	1	$20,000
Structure Installation				
Precast Concrete Manhole (60", 0-8' deep)	EA	14,000	1	$14,000
Restoration/Resurfacing				
Riparian/Wetland Planting (w/temporary irrigation)	AC	60,000	1.6	$94,008
4-foot Chain Link Fence	LF	60	1,130	$67,800
Pipe Unit Cost				
PVC, 36", 10' to invert, not in road	FT	573	350	$200,585
Project Sub-Total				$2,142,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$214,200
Erosion and Sediment Control	LS	3%		$64,260
Contingency	LS	40%		$856,800
Traffic Control/Utility Relocation	LS	5%		$107,100
Surveying	LS	5%		$107,100
Capital Expense Total (including contingency)				$3,491,000
Design/Construction Administration (%)	LS	3.5% + $200K		$322,000
Engineering and Permitting (%)	LS	30%		$1,047,000
			TOTAL	$4,860,000

BC-3: Wiedemann Ditch and Canyon Creek Park Retrofit, Phase 2

Key Project Elements

• Construct a series of linear wetland complexes to replace the existing Wiedemann ditch. Existing ditch would be enhanced to provide additional floodplain storage and mitigate flows received from Sysco ditch.

Design Assumptions

• Excavate 18" depth for amended soils for entire vegetated facility footprint area, per City Standards.
• Final design will include confirmation of weir sizing and layout.
• Final design will include confirmation of vegetated facility plantings and structure sizing.
• Cost estimates were developed directly with the City, without input or review by the TSJV, the Design-Builder.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	25,600	$1,996,800
Clear and Grub brush including stumps	AC	22,000	3.6	$79,924
Amended Soils and Mulch	CY	165	3,792	$625,625
Energy dissapation pad - Rip-Rap, Class 200	CY	81	20	$1,620
Water Quality Facility Installation				
Facility Inlet Structure	EA	10,000	1	$10,000
Structure Installation				
Gravel Access Road	SF	5	18,000	$90,000
Restoration/Resurfacing				
Riparian/Wetland Planting (w/temporary irrigation)	AC	60,000	3.6	$217,975
Pipe Unit Cost				
PVC, 36", 10' to invert, not in road	FT	573	350	$200,585
Project Sub-Total				$3,223,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$322,300
Erosion and Sediment Control	LS	3%		$96,690
Contingency	LS	40%		$1,289,200
Traffic Control/Utility Relocation	LS	5%		$161,150
Surveying	LS	5%		$161,150
Capital Expense Total (including contingency)				$5,253,000
Design/Construction Administration (%)	LS	3.5% + $200K		$384,000
Engineering and Permitting (%)	LS	30%		$1,576,000
			TOTAL	$7,210,000

BC-4: Boeckman Creek Stabilization at Colvin Lane

Key Project Elements

- Remove existing outfall pipe.
- Install approx. 70 LF of new outfall pipe with angle closer to parallel with creek channel.
- Install bioengineered plantings to stabilize streambank.
- Remove corrugated plastic pipe in existing channel bottom.

Design Assumptions

- Assumes that access to the outfall stabilization area can be attained via the City easement between 7590 and 7598 Roanoke Drive N. No cost included for access.
- Exact stabilization measures to be determined during project design.
- Assumes clearing/grubbing including stumps can include removal of existing corrugated pipe.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	194	$15,132
Clear and Grub brush including stumps	AC	22,000	0.20	$4,400
Jute Matting, Biodegradeable	SY	8	90	$720
Embankment	CY	35	50	$1,750
Amended Soils and Mulch	CY	165	83	$13,695
Tree removal	EA	1,200	5	$6,000
Energy dissapation pad - Rip-Rap, Class 100	CY	124	10	$1,240
Drain Rock	CY	110	56	$6,160
Water Quality Facility Installation				
Water Quality Facility Plantings with Trees	SF	40	1,500	$60,000
Structure Installation				
Demo pipe	LF	30	30	$900
Restoration/Resurfacing				
Planting and Bioengineered Restoration	SY	60	360	$21,600
Pipe Unit Cost				
HDPE, 12", 15' to invert, not in road	FT	179	150	$26,895
PVC, 12", 10' to invert, not in road	FT	206	70	$14,399
Project Sub-Total				$173,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$17,300
Erosion and Sediment Control	LS	3%		$5,190
Contingency	LS	40%		$69,200
Traffic Control/Utility Relocation	LS	5%		$8,650
Surveying	LS	5%		$8,650
Capital Expense Total (including contingency)				$282,000
Design/Construction Administration (%)	LS	13.5%		$38,000
Engineering and Permitting (%)	LS	30%		$85,000
			TOTAL	$410,000

BC-5 Memorial Park Swale Retrofit

Key Project Elements

- Remove the existing WQ swale and relocate it at the bottom of the hill.
- Only designing for the WQ storm event (treatment only in the BMP Sizing Tool).
- Swale design is based on a retrofit approach. Facility sizing per PWS is not possible within available space. Design of swale with variance from design criteria (top width maximum) may allow for optimization of available space.
- Ideally keep swale outside of the 100-yr floodplain, but not a permit issue if within since it is not infiltration based.

Design Assumptions

- Remove 90 LF of 10-inch corrugated steel pipe (SD5041 and SD5042).
- Remove 120 LF of 12-inch corrugated steel pipe (SD5044).
- Remove: manhole (ST5098); inlet structure (CARTE ID 568); and outfall structure (CARTE ID 19).
- Fill existing swale and revegetate area.
- Replace 60 LF of 12" CSP with 18" PVC (SD5046); replace 2 48" MHs (ST5200 and ST5208).
- Replace 50 LF of 18-inch CSP with 18-inch PVC pipe (SD5206).
- Replace manhole ST5209 with a 72-inch flow splitting/WQ manhole.
- Install 50 LF of 12-inch PVC.
- Install 140 LF of 6-inch perforated HDPE underdrain pipe.
- Install inflow spreader with rip-rap pad, beehive overflow structure, and outfall to the creek.
- Install a new meandering water quality swale with 1 ft of drain rock and 1.5 ft of amended soil.
- Install split rail fence along pedestrian path north of the swale.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
Excavation, to onsite stockpile	CY	20	55	$1,100
Fill, from onsite stockpile	CY	60	55	$3,300
General Earthwork/Excavation	CY	78	265	$20,670
Energy dissapation pad - Rip-Rap, Class 200	CY	81	2.2	$178
Drain Rock	CY	110	90	$9,900
Amended Soils and Mulch	CY	165	135	$22,275
Water Quality Facility Installation				
Beehive Overflow	EA	6,100	1	$6,100
Swale Flow Spreader	EA	20,000	1	$20,000
Facility Inlet Structure	EA	10,000	1	$10,000
Water Quality Facility Plantings with Trees	SF	40	2,400	$96,000
Structure Installation				
Demo pipe	LF	30	210	$6,300
Remove structure	EA	1,700	3	$5,100
Connection to Existing Structure, standard	EA	10,000	2	$20,000
Flow Splitter/WQ Manhole (72", all depths)	EA	28,000	1	$28,000
Outfall Improvements	EA	10,000	1	$10,000
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	2	$24,000
Restoration/Resurfacing				
Non-Water Quality Facility Landscaping	AC	27,000	0.5	$13,500
Split Rail Fence	LF	60	160	$9,600
Pipe Unit Cost				
Underdrain, 6" perforated HDPE	LF	60	140	$8,400
PVC, 12", 10' to invert, not in road	FT	206	50	$10,285
PVC, 12", 10' to invert, in road	FT	506	60	$30,360
PVC, 18", 10' to invert, not in road	FT	293	110	$32,247
Project Sub-Total				$387,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$38,700
Erosion and Sediment Control	LS	3%		$11,610
Contingency	LS	40%		$154,800
Traffic Control/Utility Relocation	LS	5%		$19,350
Surveying	LS	5%		$19,350
Capital Expense Total (including contingency)				$631,000
Design/Construction Administration (%)	LS	13.5%		$85,000
Engineering and Permitting (%)	LS	30%		$189,000
			TOTAL	$910,000

BC-6 - Gesellschaft Water Well Channel Restoration

Key Project Elements

- Existing outfall (STD3008) and upstream stormwater pipes can remain unchanged for the contributing 25 acres.
- Bypass the channel entirely by piping the weekly discharge from the well to the bottom of the slope into Boeckman Creek.
- Pipe is sized using PWS, smallest diameter (12-inch) to convey the flows.
- Weekly discharge of well volume is unknown, ODWR well logs were reviewed to verify that pipe size works with likely flows.
- Water discharge conveyance designed to comply with stormwater conveyance standards.

Design Assumptions

- Install approx. 480 LF of 12-inch PVC.
- Install 2 MHs along the new pipe alignment.
- Intall outfall and energy dissipation pad with Class 200 riprap.
- Restore the eroded discharge channel (approx. 310 LF) through the installation of coir log check dams, coir matting, and re-vegetating with native trees and shrubs.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	214	$16,692
Energy dissapation pad - Rip-Rap, Class 200	CY	81	8	$648
Structure Installation				
Outfall Improvements	LS	10,000	1	$10,000
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	2	$24,000
Restoration/Resurfacing				
Planting and Bioengineered Restoration	SY	60	345	$20,700
Pipe Unit Cost				
PVC, 12", 10' to invert, not in road	FT	206	480	$98,736
Project Sub-Total				$171,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$17,100
Erosion and Sediment Control	LS	3%		$5,130
Contingency	LS	40%		$68,400
Traffic Control/Utility Relocation	LS	5%		$8,550
Surveying	LS	5%		$8,550
Capital Expense Total (including contingency)				$279,000
Design/Construction Administration (%)	LS	13.5%		$38,000
Engineering and Permitting (%)	LS	30%		$84,000
			TOTAL	$400,000

CLC-1: Day Road Stormwater Improvements, Phase 1

Key Project Elements

- Replace the double-barrel 36-inch culverts that cross Day Road.
- Construct the channel improvements and culvert installations proposed by AKS in 2019 report (concept A-3).

Design/ Cost Assumptions

- The AKS concept was modeled and incorporated into BC's updated InfoSWMM model, which included updated hydrology.
- Assessment of flooding during the 100-year storm was based on maximum WSE in relation to the elevation of adjacent structures.
- The catchment area draining to this project includes areas outside of City limits.
- Access to BPA alignment, towers, and overhead power lines must be maintained.
- Where possible, quantities listed in the 2019 AKS report for Alt A-3 were used and costs recalculated using City-reviwed unit costs of similar items developed for this SMP.
- Unit costs for project elements not reflected in this SMP's unit cost list were derived directly from the 2019 AKS report were escalated to 2023 based on ENR CCI.
- Contingency multipliers such as Mobilization were applied as consistent with other capital projects. Lump sum costs for these items used in the AKS estimate were not carried over.
- The AKS cost estimate did not include costs for Design/Construction Admin or Engineering/Permitting. These multipliers were maintained in this estimate for consistency with other capital project estimates.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	26,500	$2,067,000
Structural Earth Wall	SF	50	16,900	$845,000
Clear and Grub brush including stumps	AC	22,000	3	$66,000
Jute Matting, Biodegradeable	SY	8	4,950	$39,600
Energy dissapation pad - Rip-Rap, Class 100	CY	124	125	$15,500
Streambed Cobble	TON	120	900	$108,000
Water Quality Facility Installation				
Gravel Access Road	SF	5	15,000	$75,000
Structure Installation				
Demo pipe	LF	30	50	$1,500
Restoration/Resurfacing				
Riparian/Wetland Planting (w/temporary irrigation)	AC	60,000	3.2	$192,000
Pipe Unit Cost				
PVC, 36", 10' to invert, in road	FT	1,027	180	$184,932
Box Culvert (10' x 3')	FT	950	200	$190,000
Project Sub-Total				$3,595,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$359,500
Erosion and Sediment Control	LS	3%		$107,850
Contingency	LS	40%		$1,438,000
Traffic Control/Utility Relocation	LS	5%		$179,750
Surveying	LS	5%		$179,750
Capital Expense Total (including contingency)				$5,860,000
Design/Construction Administration (%)	LS	3.5% + $200K		$405,000
Engineering and Permitting (%)	LS	30%		$1,758,000
			TOTAL	$8,020,000

CLC-1: Day Road Stormwater Improvements, Phase 2

Key Project Elements

- Upsize the two existing parallel storm pipes located beneath the parking lot of Tax Lot 500, from 36-inch to 48-inch.
- Install a third, parallel 48-inch storm pipe.

Design/ Cost Assumptions

- Assessment of flooding during the 100-year storm was based on maximum WSE in relation to the elevation of adjacent structures.
- The catchment area draining to this project includes areas outside of City limits. The establishment of similar onsite retention standards for Tualatin discharge may mitigate future flooding of this area.
- The small ponds at inlet of culverts across Ridder was not modeled - it is assumed that there is adequate space for outlets of the three proposed 48" pipes to this pond.
- Where possible, quantities listed in the 2019 AKS report for Alt A-3 were used and costs recalculated using City-reviwed unit costs of similar items developed for this SMP.
- Unit costs for project elements not reflected in this SMP's unit cost list were derived directly from the 2019 AKS report were escalated to 2023 based on ENR CCI.
- Contingency multipliers such as Mobilization were applied as consistent with other capital projects. Lump sum costs for these items used in the AKS estimate were not carried over.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Structure Installation				
Precast Concrete Manhole (72", 0-8' deep)	EA	18,000	7	$126,000
Demo pipe	LF	30	1,200	$36,000
Restoration/Resurfacing				
Trash rack	EA	5,600	3	$16,800
Pipe Unit Cost				
PVC, 48", 10' to invert, not in road	FT	834	1,800	$1,500,840
Project Sub-Total				$1,680,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$168,000
Erosion and Sediment Control	LS	3%		$50,400
Contingency	LS	40%		$672,000
Traffic Control/Utility Relocation	LS	5%		$84,000
Surveying	LS	5%		$84,000
Capital Expense Total (including contingency)				$2,738,000
Design/Construction Administration (%)	LS	13.5%		$370,000
Engineering and Permitting (%)	LS	30%		$821,000
			TOTAL	$3,930,000

CLC-2: Arrowhead Creek Culvert Replacement at Arrowhead Creek Trail

Key Project Elements

- Remove and replace approx. 70 LF existing double 5 ft x 5 ft concrete box culverts with a 10 ft x 3 ft concrete box culvert.
- Stabilize and restore embankment and channel after culvert replacement.
- Repave pedestrian path after culvert replacement.

Design Assumptions

- Assumes clearing/grubbing with stump removal in immediate areas as necessary for construction.
- No costs included for access - assumed access can be attained through pedestrian path.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	45	$3,510
Fill, imported clean	CY	115	45	$5,175
Embankment	CY	35	90	$3,150
Clear and Grub brush including stumps	AC	22,000	0.10	$2,200
Energy dissapation pad - Rip-Rap, Class 200	CY	81	10	$810
Structure Installation				
Demo pipe	LF	30	70	$2,100
Restoration/Resurfacing				
Planting and Bioengineered Restoration	SY	60	270	$16,200
Trench resurfacing, Permanent ACP, 6-Inch Depth	SY	144	70	$10,080
Pipe Unit Cost				
Box Culvert (10' x 3')	FT	950	70	$66,500
Project Sub-Total				$110,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$11,000
Erosion and Sediment Control	LS	3%		$3,300
Contingency	LS	40%		$44,000
Traffic Control/Utility Relocation	LS	5%		$5,500
Surveying	LS	5%		$5,500
Capital Expense Total (including contingency)				$179,000
Design/Construction Administration (%)	LS	13.5%		$35,000
Engineering and Permitting (%)	LS	30%		$75,000
			TOTAL	$290,000

CLC-3: Garden Acres Pond Retrofit

Key Project Elements

• Retrofit existing detention pond to increase storage capacity and water quality treatment along Peters Road and provide detention during high flow events.

Design Assumptions

• Install an inflow diversion structure at Peters Road (ST2101A).
• Install 95 LF of 24-inch PVC culvert at inlet of upsized detention pond.
• Increase existing detention pond capacity by 25,600 ft3 and lower pond invert to 196-ft elevation.
• Clear, regrade, and replant 0.9-acres of drainage way to ensure a low-flow drainage path and healthy vegetation.
• Install 155 LF of 24-inch PVC culvert at outlet of upsized detention pond.
• Install an outlet control structure at Peters Road (ST2431).
• Install pond underdrain in accordance with the 2015 PSW Section 3, Appendix A landscape and soil media requirements. Including 15" of drain rock, a 3" separation layer, and 18" of growing media.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	3,220	$251,160
Clear and Grub brush including stumps	AC	22,000	0.9	$19,800
Amended Soils and Mulch	CY	165	1,240	$204,600
Drain Rock	CY	110	1,030	$113,300
Water Quality Facility Installation				
Water Quality Facility Plantings with Trees	SF	40	22,310	$892,400
Outflow Control Structure	EA	20,000	1	$20,000
Structure Installation				
Flow Splitter/WQ Manhole (72", all depths)	EA	28,000	1	$28,000
Precast Concrete Manhole (60", 0-8' deep)	EA	14,000	1	$14,000
Precast Concrete Manhole (72", 0-8' deep)	EA	18,000	1	$18,000
Restoration/Resurfacing				
4-foot Chain Link Fence	LF	60	980	$58,800
Pipe Unit Cost				
Field Ditch Inlet	EA	5,600	1	$5,600
Connection to Existing Structure, standard	EA	10,000	4	$40,000
PVC, 24", 10' to invert, not in road	FT	381	205	$78,023
PVC, 24", 10' to invert, in road	FT	732	45	$32,918
Project Sub-Total				$1,777,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$177,700
Erosion and Sediment Control	LS	3%		$53,310
Contingency	LS	40%		$710,800
Traffic Control/Utility Relocation	LS	5%		$88,850
Surveying	LS	5%		$88,850
Capital Expense Total (including contingency)				$2,897,000
Design/Construction Administration (%)	LS	3.5% + $200K		$301,000
Engineering and Permitting (%)	LS	20%		$579,000
			TOTAL	$3,780,000

NC-1: Frog Pond E and S Conveyance Pipe Installation

Key Project Elements

- Install stormwater collection system for main alignments in basin K1 identified in the Frog Pond East and South Master Plan.

Design Assumptions

- Pipe sizes and alignment was taken directly from the Frog Pond E and S Master Plan. This area was not included in the InfoSWMM modeling effort for this SMP.
- Install 2,050 LF of 24-inch PVC pipe.
- Install 310 LF of 30-inch PVC pipe.
- Install seven 60-inch manholes.
- Install 1 outfall.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Structure Installation				
Precast Concrete Manhole (60", 0-8' deep)	EA	14,000	7	$98,000
Outfall Improvements	EA	10,000	1	$10,000
Pipe Unit Cost				
PVC, 24", 10' to invert, in road	FT	732	2,050	$1,499,575
PVC, 30", 10' to invert, in road	FT	879	310	$272,630
Project Sub-Total				$1,880,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$188,000
Erosion and Sediment Control	LS	3%		$56,400
Contingency	LS	40%		$752,000
Traffic Control/Utility Relocation	LS	5%		$94,000
Surveying	LS	5%		$94,000
Capital Expense Total (including contingency)				$3,064,000
Design/Construction Administration (%)	LS	13.5%		$414,000
Engineering and Permitting (%)	LS	20%		$613,000
			TOTAL	$4,090,000

WR-1: Willamette Way East/ Morey's LandingStormwater Improvements - Phase 1

Key Project Elements

- Remove existing Morey's Landing Bubbler (STD6604).
- Clear, grade, and replant 0.12-acres to create two infiltration raingardens within the BPA easement.
- Install a flow control diversion structure and low flow pipe at Willamette Way E to route water quality events to new raingardens and high flow events to the stormwater collection system along SW Willamette Way.
- Install a flow control diversion structure and 25 LF of 8-inch PVC to route water quality events (low flow) to new raingardens and high flow events to the Belknap Court outfall.
- Install 120 LF of 12-inch PVC on SW Willamette Way for flow exceeding the water quality event.
- Upsize 575 LF of 10-inch CPS to 12-inch PVC on SW Willamette Way (SD6629, SD6630, SD6632).
- Upsize 145 LF of 10-inch CSP to 18-inch PVC on Willamette Way (SD6638).
- Install one 48-inch manhole and replace four 48-inch manholes (ST6618, ST6619, ST6606, and ST6605).

Design Assumptions

- The raingardens (Phase 1) were sized as a filtration facility using the BMP Sizing Tool. Due to design constraints and lack of feasible outlet, this BMP will be constructed as an infiltration facility, pending infiltration testing. It is to be designed per the City's standard details for the selected BMP structure and used to treat the 1" water quality event.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
Excavation, to onsite stockpile	CY	20	2,055	$41,100
Fill, from onsite stockpile	CY	60	1,289	$77,340
Amended Soils and Mulch	CY	165	389	$64,167
Drain Rock	CY	110	376	$41,360
Water Quality Facility Installation				
Rain Garden/ Swale	SF	130	120	$15,600
Geotextile	SY	7	2.5	$18
Energy dissapation pad - Rip-Rap, Class 100	CY	124	1	$124
Water Quality Facility Plantings with Trees	SF	40	5,782	$231,280
Restoration/Resurfacing				
4-foot Chain Link Fence	LF	60	305	$18,300
Flow Splitter/WQ Manhole (72", all depths)	EA	28,000	1	$28,000
Structure Installation				
Remove structure	EA	1,700	6	$10,200
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	5	$60,000
Pipe Unit Cost				
PVC, 8", 10' to invert, not in road	FT	136	25	$3,394
PVC, 12", 15' to invert, not in road	FT	215	120	$25,740
PVC, 12", 10' to invert, in road	FT	506	575	$290,950
PVC, 18", 10' to invert, in road	FT	563	145	$81,635
Connection to Existing Structure, standard	EA	10,000	4	$40,000
Project Sub-Total				$1,029,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$102,900
Erosion and Sediment Control	LS	3%		$30,870
Contingency	LS	40%		$411,600
Traffic Control/Utility Relocation	LS	10%		$102,900
Surveying	LS	5%		$51,450
Capital Expense Total (including contingency)				$1,729,000
Design/Construction Administration (%)	LS	13.5%		$233,000
Engineering and Permitting (%)	LS	20%		$346,000
			TOTAL	$2,310,000

WR-1: Willamette Way East/ Morey's LandingStormwater Improvements - Phase 2

Key Project Elements

- Upsize 610 LF of 12-inch CSP to 18-inch PVC on SW Champoeg Dr E (SD6634 – SD6637).
- Replace three 48-inch manholes (ST6607, ST6608, and ST6609) and field inlet (6647).

Design Assumptions

- Flows over the water quality event will be routed to the Belknap Court outfall (part of Phase 2 network).
- The conveyance along SW Champoeg Ct (Phase 2) is identified as under capacity and will be upsized from existing 12-inch to 18-inch.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Structure Installation				
Demo pipe	LF	30	610	$18,300
Field Ditch Inlet	EA	5,600	1	$5,600
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	3	$36,000
Pipe Unit Cost				
PVC, 18", 10' to invert, in road	FT	563	610	$343,430
Connection to Existing Structure, standard	EA	10,000	8	$80,000
Project Sub-Total				$483,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$48,300
Erosion and Sediment Control	LS	3%		$14,490
Contingency	LS	40%		$193,200
Traffic Control/Utility Relocation	LS	10%		$48,300
Surveying	LS	5%		$24,150
Capital Expense Total (including contingency)				$811,000
Design/Construction Administration (%)	LS	13.5%		$109,000
Engineering and Permitting (%)	LS	20%		$162,000
			TOTAL	$1,080,000

WR-2: Miley Road Stormwater Improvements - Phase 1

Key Project Elements

- Upsize 80 LF of 36-inch CMP to 42inch PCV from area drain (ENG ID 9341) to outfall.
- Restore approx. 30 ft of channel bank on either side of new outfall.
- Replace area drain (ENG ID 9341).
- Replace 320 LF of existing storm pipe with same diameter 42-inch PVC between area drain (ENG ID 9341) and manhole (ST9002).
- Replace and lower invert of manhole (ST9002) to ensure 3 ft cover requirement is met for incoming pipe. Maintain 0.2 ft drop within MH.

Design Assumptions

- Access to outfall for removal and replacement is assumed feasible - costs have not been included for access requirements

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
General Earthwork/Excavation	CY	78	100	$7,800
Embankment	CY	35	100	$3,500
Clear and Grub brush including stumps	AC	22,000	0.1	$2,200
Jute Matting, Biodegradeable	SY	8	100	$800
Energy dissapation pad - Rip-Rap, Class 200	CY	81	50	$4,050
Structure Installation				
Field Ditch Inlet	EA	5,600	1	$5,600
Precast Concrete Manhole (72", 0-8' deep)	EA	18,000	1	$18,000
Demo pipe	LF	30	400	$12,000
Outfall Improvements	EA	10,000	1	$10,000
Remove structure	EA	1,700	2	$3,400
Restoration/Resurfacing				
Planting and Bioengineered Restoration	SY	60	55	$3,300
Pipe Unit Cost				
PVC, 42", 10' to invert, not in road	FT	703	400	$281,380
Project Sub-Total				$352,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$35,200
Erosion and Sediment Control	LS	3%		$10,560
Contingency	LS	40%		$140,800
Traffic Control/Utility Relocation	LS	5%		$17,600
Surveying	LS	5%		$17,600
Capital Expense Total (including contingency)				$574,000
Design/Construction Administration (%)	LS	13.5%		$77,000
Engineering and Permitting (%)	LS	30%		$172,000
			TOTAL	$820,000

WR-2: Miley Road Stormwater Improvements - Phase 2

Key Project Elements

- Install 530 LF of 42-inch PVC from replaced manhole (ST9002) to new manhole at the near intersection with SW French Prairie Road.
- Install three 72-inch manholes for the above 42-inch line, the most upstream of which is at the SW French Prairie Road.
- Install ten 60-inch manholes and 3,015 LF of 36-inch PVC along NE Miley Road from SW French Prairie Road to new manhole adjacent to manhole ST9011.
- Install two 48-inch manholes and 650 LF of 24-inch PVC from the new manhole adjacent to manhole ST9011 to the new manhole at upstream most lateral.
- Extend six total existing main connections to the new pipe alignment (approx. 40 LF each, varying diameters). Note that these points of connection run under the existing brick wall.
- Reconnect all existing curb inlets (approx. 13) along new NE Miley Road alignment.

Design Assumptions

- Costs for connections to existing system under brick wall have been assumed for connections and pipe length only. Constructability to be verified during detailed design.
- Costs assume that existing pipe alingment (where not replaced, where moved to ROW) will be abandoned and filled with grout at key connection points.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Structure Installation				
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	2	$24,000
Precast Concrete Manhole (60", 0-8' deep)	EA	14,000	10	$140,000
Precast Concrete Manhole (72", 0-8' deep)	EA	18,000	3	$54,000
Connection to Existing Lateral	EA	6,000	19	$114,000
Abandon Existing Pipe, fill with grout	CF	8	3705	$29,640
Pipe Unit Cost				
PVC, 12", 15' to invert, in road	FT	602	80	$48,136
PVC, 18", 15' to invert, in road	FT	731	80	$58,476
PVC, 24", 10' to invert, in road	FT	732	650	$475,475
PVC, 24", 15' to invert, in road	FT	860	40	$34,408
PVC, 36", 10' to invert, in road	FT	1,027	3055	$3,138,707
PVC, 42", 10' to invert, in road	FT	1,169	530	$619,438
Project Sub-Total				$4,736,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$473,600
Erosion and Sediment Control	LS	3%		$142,080
Contingency	LS	40%		$1,894,400
Traffic Control/Utility Relocation	LS	5%		$236,800
Surveying	LS	5%		$236,800
Clackamas County Permitting	LS	8.83%		$418,189
Capital Expense Total (including contingency)				$7,720,000
Design/Construction Administration (%)	LS	3.5% + $200K		$470,000
Engineering and Permitting (%)	LS	30%		$2,316,000
			TOTAL	$10,510,000

WR 3 - Rose Lane Culvert Replacement

Key Project Elements

- Remove the existing 25 LF of 12-inch culvert (CARTE ID: 24370, ENG ID not available).
- Install approximately 40 LF of parallel 12-inch RCP culverts.
- Reconfiguring culvert diagonally across roadway to move it away from the residental building (garage) and remove hard bends.
- Maintain 12-inch pipe cover in roadway (minimum amount).

Design Assumptions

- Assuming recommended culvert sizing is sufficent to convey H/H flows. Unable to easily model due to lack of stream information (seasonal stream in wetland).
- Survey required.
- Roadwork beyond trenching not evaluated.
- Waterbody is a seasonal stream with open marsh/wetlands on upstream and downstream sides.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Earthwork				
Clear and Grub brush including stumps	AC	22,000	0.05	$1,100
Structure Installation				
Demo pipe	LF	30	25	$750
Field Ditch Inlet	EA	5,600	2	$11,200
Pipe Unit Cost				
RCP, 12", 10' to invert, in road	FT	498	80	$39,864
Project Sub-Total				$53,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$5,300
Erosion and Sediment Control	LS	3%		$1,590
Contingency	LS	40%		$21,200
Traffic Control/Utility Relocation	LS	5%		$2,650
Surveying	LS	5%		$2,650
Capital Expense Total (including contingency)				$86,000
Design/Construction Administration (%)	LS	13.5%		$35,000
Engineering and Permitting (%)	LS	30%		$75,000
			TOTAL	$200,000

WR-4: Charbonneau East Stormwater Improvements, Phase 1

Key Project Elements

- Upsize and replace the existing stormwater outfall (serving Charbonneau development) along the Willamette River.

Design Assumptions

- Remove and replace existing Charbonneau East Outfall.
- Upsize 115 LF of 30-inch pipe discharging to Willamette River to 36-inch diameter PVC.
- Replace 72-inch manhole (ST9014).

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Structure Installation				
Precast Concrete Manhole (72", 0-8' deep)	EA	18,000	1	$18,000
Connection to Existing Structure, standard	EA	10,000	1	$10,000
Energy dissapation pad - Rip-Rap, Class 200	CY	81	145	$11,745
Restoration/Resurfacing				
Trench resurfacing, Permanent ACP, 6-Inch Depth	SY	144	70	$10,080
Pipe Unit Cost				
PVC, 36", 10' to invert, not in road	FT	573	115	$65,907
Project Sub-Total				$116,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$11,600
Erosion and Sediment Control	LS	3%		$3,480
Contingency	LS	50%		$58,000
Traffic Control/Utility Relocation	LS	5%		$5,800
Surveying	LS	5%		$5,800
Capital Expense Total (including contingency)				$201,000
Design/Construction Administration (%)	LS	25.0%		$50,000
Engineering and Permitting (%)	LS	50%		$101,000
Outreach Coordination	LS	Flat Rate		$250,000
			TOTAL	$600,000

WR-4: Charbonneau East Stormwater Improvements, Phase 2

Key Project Elements

- Upsize and replace stormwater network along SW French Prairie Rd or SW Old Farm Rd.

Design Assumptions

- Replace 230 LF of 10-inch pipe with 12-inch PVC on SW French Prairie Rd (ST9087 to end, and ST9088 to end).
- Replace 680 LF of 12-inch pipe with 12-inch PVC on SW French Prairie Rd (ST9023 to ST9242).
- Replace 1,200 LF of 15-inch pipe with 15-inch PVC on SW French Prairie Rd (ST9023 to ST9020).
- Replace 310 LF of 18-inch pipe with 18-inch PVC on SW French Prairie Rd (ST9020 to ST9019).
- Upsize 360 LF of 21-inch pipe to 30-inch PVC on SW French Prairie Rd (ST9019 to ST9017).
- Replace 570 LF of 24-inch pipe with 24-inch PVC on Old Farm Rd (ST9030 to ST9027).
- Replace 300 LF of 30-inch pipe with 30-inch PVC on Old Farm Rd (ST9031 to ST9030).
- Replace eight 48-inch manholes.
- Replace nine 60-inch manholes.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Structure Installation				
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	4	$48,000
Precast Concrete Manhole (48", 9-12' deep)	EA	15,000	4	$60,000
Precast Concrete Manhole (60", 0-8' deep)	EA	14,000	5	$70,000
Precast Concrete Manhole (60", 13-20' deep)	EA	22,000	4	$88,000
Connection to Existing Structure, standard	EA	10,000	12	$120,000
Pipe Unit Cost				
PVC, 12", 10' to invert, in road	FT	506	910	$460,460
PVC, 15", 10' to invert, in road	FT	535	1,200	$641,400
PVC, 18", 10' to invert, in road	FT	563	310	$174,530
PVC, 30", 10' to invert, in road	FT	879	360	$316,602
PVC, 24", 10' to invert, in road	FT	732	570	$416,955
PVC, 30", 10' to invert, in road	FT	879	300	$263,835
Project Sub-Total				$1,979,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$197,900
Erosion and Sediment Control	LS	3%		$59,370
Contingency	LS	40%		$791,600
Traffic Control/Utility Relocation	LS	10%		$197,900
Surveying	LS	5%		$98,950
Capital Expense Total (including contingency)				$3,325,000
Design/Construction Administration (%)	LS	13.5%		$449,000
Engineering and Permitting (%)	LS	20%		$665,000
			TOTAL	$4,440,000

WR-4: Charbonneau West Stormwater Improvements

Key Project Elements

- Replace stormwater network along SW French Prairie Road, SW Curry Drive, SW Boones Bend Road

Design Assumptions

- Replace 200 LF of 12-inch pipe along SW French Prairie Road with PVC (ENG ID: ST9048 to ST9281)
- Replace a total of 1,540 LF of 15-inch pipe along SW Curry Drive, SW French Prairie Road, and SW Boones Bend Rd with PVC.
- Replace a total of 2,450 LF of 18-inch pipe along SW Curry Drive, SW French Prairie Road, and SW Boones Bend Rd with PVC.
- Replace 680 LF of 21-inch pipe along SW Boones Bend Road with PVC.
- Replace 670 LF of 24-inch pipe along SW French Prairie Road and SW Boones Bend Road with PVC.
- Replace 420 LF of 27-inch pipe along SW Boones Bend Road with PVC.
- Replace 640 LF of 30-inch pipe along SW Boones Bend Road with PVC.
- Replace 170 LF of 36-inch pipe along SW Boones Bend Road with PVC.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Structure Installation				
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	29	$348,000
Precast Concrete Manhole (60", 0-8' deep)	EA	14,000	7	$98,000
Precast Concrete Manhole (72", 0-8' deep)	EA	18,000	2	$36,000
Connection to Existing Lateral	EA	6,000	15	$90,000
Outfall Improvements	EA	10,000	2	$20,000
Pipe Unit Cost				
PVC, 12", 10' to invert, in road	FT	506	200	$101,200
PVC, 15", 10' to invert, in road	FT	535	1,540	$823,130
PVC, 18", 10' to invert, in road	FT	563	2,450	$1,379,350
PVC, 21", 10' to invert, in road	FT	647	680	$440,130
PVC, 24", 10' to invert, in road	FT	732	670	$490,105
PVC, 27", 10' to invert, in road	FT	805	420	$338,300
PVC, 30", 10' to invert, in road	FT	879	640	$562,848
PVC, 36", 10' to invert, in road	FT	1,027	170	$174,658
Project Sub-Total				$4,902,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$490,200
Erosion and Sediment Control	LS	3%		$147,060
Contingency	LS	40%		$1,960,800
Traffic Control/Utility Relocation	LS	10%		$490,200
Surveying	LS	5%		$245,100
Capital Expense Total (including contingency)				$8,235,000
Design/Construction Administration (%)	LS	3.5% + $200K		$488,000
Engineering and Permitting (%)	LS	20%		$1,647,000
			TOTAL	$10,370,000

Charbonneau R&R Program

Key Project Elements

- Replace pipe in Charbonneau District that isn't being replaced by another CIP or hasn't been recently replaced. Recently replaced pipe was designated by the City as anything replaced between 2015-2022.
- Assume minimum pipe size of 12-inch. Assume all other pipe is replace-in-place.
- Assume replacements of all manholes (except those excluded from above mentioned projects).

Design Assumptions

- Replace 19,460 LF of 12-inch diameter PVC pipe.
- Replace 4,590 LF of 15-inch diameter PVC pipe.
- Replace 3,620 LF of 18-inch diameter PVC pipe.
- Replace 1,210 LF of 21-inch diameter PVC pipe.
- Replace 750 LF of 24-inch diameter PVC pipe.
- Replace 180 LF of 27-inch diameter PVC pipe.
- Replace 340 LF of 30-inch diameter PVC pipe.
- Replace 470 LF of 36-inch diameter PVC pipe.

Item	Unit	Unit Cost (2023)	Quantity	Total Cost
Structure Installation				
Precast Concrete Manhole (48", 0-8' deep)	EA	12,000	120	$1,440,000
Precast Concrete Manhole (48", 9-12' deep)	EA	15,000	13	$195,000
Precast Concrete Manhole (48", 13-20' deep)	EA	18,000	3	$54,000
Precast Concrete Manhole (60", 0-8' deep)	EA	14,000	15	$210,000
Precast Concrete Manhole (72", 9-12' deep)	EA	23,000	2	$46,000
Pipe Unit Cost				
PVC, 12", 10' to invert, in road	FT	506	13,470	$6,815,820
PVC, 12", 15' to invert, in road	FT	602	2,500	$1,504,250
PVC, 12", 10' to invert, not in road	FT	206	3,210	$660,297
PVC, 12", 15' to invert, not in road	FT	215	280	$60,060
PVC, 15", 10' to invert, in road	FT	535	2,220	$1,186,590
PVC, 15", 15' to invert, in road	FT	666	570	$379,805
PVC, 15", 10' to invert, not in road	FT	249	1,680	$419,034
PVC, 15", 15' to invert, not in road	FT	259	120	$31,086
PVC, 18", 10' to invert, in road	FT	563	1,870	$1,052,810
PVC, 18", 15' to invert, in road	FT	731	880	$643,236
PVC, 18", 10' to invert, not in road	FT	293	630	$184,685
PVC, 18", 15' to invert, not in road	FT	304	240	$72,864
PVC, 21", 10' to invert, in road	FT	647	670	$433,658
PVC, 21", 15' to invert, in road	FT	796	520	$413,699
PVC, 21", 15' to invert, not in road	FT	348	20	$6,963
PVC, 24", 10' to invert, in road	FT	732	410	$299,915
PVC, 24", 10' to invert, not in road	FT	381	340	$129,404
PVC, 27", 10' to invert, in road	FT	805	180	$144,986
PVC, 30", 10' to invert, in road	FT	879	340	$299,013
PVC, 36", 10' to invert, not in road	FT	573	240	$137,544
PVC, 36", 15' to invert, in road	FT	1,220	230	$280,577
Project Sub-Total				$17,101,000
Contingencies and Multipliers				
Mobilization/Demobilization	LS	10%		$1,710,100
Erosion and Sediment Control	LS	3%		$513,030
Contingency	LS	40%		$6,840,400
Traffic Control/Utility Relocation	LS	10%		$1,710,100
Surveying	LS	5%		$855,050
Capital Expense Total (including contingency)				$28,730,000
Design/Construction Administration (%)	LS	13.5%		$3,879,000
Engineering and Permitting (%)	LS	20%		$5,746,000
			TOTAL	$38,360,000

Appendix F: Library Pond Analysis

Brown AND Caldwell

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Technical Memorandum

Prepared for: City of Wilsonville

Project Title: Wilsonville Stormwater Master Plan Update

Project No.: 156157

Technical Memorandum

Subject: Library Pond Evaluation

Date: June 14, 2023

To: Kerry Rappold, City of Wilsonville

From: Brown and Caldwell

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Executive Summary

This Technical Memorandum (TM) describes a sizing evaluation conducted on the Library Pond stormwater detention facility (also referred to as the Memorial Park Pond). This evaluation was conducted as part of the City's 2023 Stormwater Master Plan (SMP) Update to determine capital project needs (specific to retrofit of the Library Pond), as well as policy recommendations (to be documented in the SMP) related to redevelopment of the Wilsonville Town Center, which contributes stormwater to the Library Pond.

This evaluation utilized the City of Wilsonville's BMP Sizing Tool, which is intended for use in conjunction with the *2015 Stormwater & Surface Water Design & Construction Standards,* as well as historic as-built drawings, results from the InfoSWMM model, Geographic Information System (GIS) data, and the *2019 Wilsonville Town Center Plan* to analyze pond sizing and ability to effectively mitigate stormwater flows under three development scenarios. The development scenarios reflect unique land cover and impervious conditions specific to pre-development (Oak Savanna) land use conditions, existing (current) land use conditions, and future (Town Center build-out) land use conditions.

Section 1: Background

The Library Pond Stormwater Detention Facility (Library Pond) was originally constructed in the 1980s. Modifications were made to the pond in 1992 as part of the Memorial Park site improvements. These improvements include enlarging the pond, installing new stormwater piping, an outfall, and inlet, as well as enclosing the pond with a chain-link fence.

The Library Pond receives drainage from approximately 180 acres of commercial property in the southeastern portion of Wilsonville, east of Interstate 5 and adjacent to Wilsonville Road. The Library Pond discharges to a piped collection system, which outfalls to an unnamed tributary to Boeckman Creek approximately 750 feet downstream of the Library Pond. Boeckman Creek is a tributary to the Willamette River. Water quality monitoring has been conducted at the Library Pond since the late 1990's in accordance with the City's National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer (MS4) permit. Although operating as a regional stormwater facility, there are several notable characteristics of the pond that may contribute to observed capacity and water quality issues:

- There is no flow control/orifice structure or emergency overflow type structure, thus providing limited detention benefit.
- Vegetation is overgrown with invasive species and sediment has accumulated along the pond bottom, limiting pond capacity and water quality function.
- As shown in the as-builts and verified on-site, the facility has very steep side slopes (estimated to be 2H:1V), limiting facility access and maintenance.
- City staff have experienced ongoing challenges with debris removal at existing ditch inlet, which serves as the outlet from the pond so impounded trash can quickly result in a flooding issue.

Hydraulic analysis of the Library Pond conducted for the SMP in 2022 indicates that flooding occurs during the 25-year future development condition. This finding is confirmed by City staff who have observed flooding of the Wilsonville Public Library parking lot and Memorial Drive near the entrance to Memorial Park. The contributing drainage area to the Library Pond is subject to redevelopment in both the near term and long term as part of the Wilsonville Town Center Plan (adopted May 6, 2019).

The three phases of the Willamette Town Center Plan include:

- Phase I - infill and redevelopment of vacant and/or underutilized land over the next 10 years (approx. 2019-2029). This will focus on areas where landowners can develop new buildings on vacant or underused parking without impacting existing businesses. The mostly likely type of redevelopment occurring will be existing retail and commercial buildings, multifamily residential, and some mixed-use development.
- Phase 2 - redevelopment, multiuse, and parking garage integration in the next 10-20 years (approx. 2029-2039). This phase includes office and mixed-use development with attached structured parking leading to the redevelopment of surface lots, redesign of the street grid because of development, and streetscape management.
- Phase 3 – the full build out will include high-density, mixed-use buildings, completion of pedestrian networks and vehicle roadways, and reallocation of parking facilities behind or integrated into buildings. This phase is anticipated to occur in the next 20+ years (approx. 2039-TBD).

The City anticipates using the Library Pond as a regional stormwater facility to mitigate stormwater treatment and flow control requirements associated with private redevelopment and public improvements in the Town Center Plan area. Design and construction of the Library Pond retrofit may be funded exclusively through system development charges (SDCs) applied to Town Center redevelopment, allowing the City to charge Town Center development a fee-in-lieu.

Section 2: City of Wilsonville Stormwater Design Standards

Over the past decade, stormwater management practices in Oregon have evolved to require consideration of hydromodification as well as more traditional water quality and peak flow (detention) requirements. Hydromodification is the change in runoff patterns caused by land use and impervious area changes that result in the degradation of stream channels and water quality (i.e., stream erosion from the extended duration of peak flows). Traditional stormwater treatment and detention design practices typically analyze pre- and post-development peak flows associated with a standard (i.e., 24-hour) synthetic design storm. A hydromodification standard requires continuous simulation flow modeling to evaluate both peak flow but also the duration of flows exceeding a specific recurrence interval. Adherence to a hydromodification standard assumes that peak flow and flow duration for the post-development condition does not exceed the pre-developed condition for a range of geomorphically significant flows—those capable of moving sediment and eroding streambanks. For the City of Wilsonville, the range of geomorphically significant flows is established as 42 percent of the 2-year flow to the 10-year flow.

Given the complexity of evaluating stormwater controls to adhere to a hydromodification standard, municipalities that have adopted a hydromodification standard have also developed tools to aid developers with design.

2.1 Design Standards

The City's Public Works Design Standards (PWS) (i.e., *City of Wilsonville's 2015 Stormwater & Surface Water Design & Construction Standards, Section 3*) were updated in December 2015 to emphasize low-impact development (LID) facilities that incorporate infiltration to address both pollutant reduction and flow control as well as develop facility sizing to address hydromodification impacts.

2.2 BMP Sizing Tool

The cities of Wilsonville and Oregon City, together with Clackamas Water Environment Services (WES) developed a custom tool, referred to as the BMP Sizing Tool, to help size stormwater facilities for hydromodification-based standards. The BMP Sizing Tool (last updated in 2017) is used in conjunction with the City's PWS and by developers and engineers to automate some of the required calculations to support sizing and design for a specific set of stormwater management facility types based on long-term rainfall records, soils, and land use cover data. The BMP sizing tool can be used to calculate the following BMP types:

- Rain Garden - Filtration and Infiltration
- Stormwater Planter - Filtration and Infiltration
- Vegetated Swale - Filtration and Infiltration
- Infiltrator
- Detention Pond

The BMP Sizing Tools offers two design options: (1) treatment and flow control, or (2) treatment only. The BMP types that are available for each design option depend on the native soil infiltration rate at the location of the BMP facility. The tool was developed based on local conditions (rainfall, soil characteristics, etc.) for Clackamas County, Oregon. The distinction between infiltration and filtration is based on the facility soil subgroup. Groups A1 – B3 include infiltration rates greater than 0.50 in/hr and are considered acceptable for use with infiltration facilities. Groups C1 – D1 reflect infiltration rates from 0.02 – 0.49 in/hr and are considered acceptable for use with filtration facilities. Infiltration facilities use only infiltration to manage runoff. Filtration facilities include piped underdrain systems and orifice controls.

The following table is an excerpt from the *User's Guide for the BMP Sizing Tool* which shows the BMP sizing dimension for each facility type. The focus for this analysis will be on the capabilities of the Detention Pond for treatment and flow control settings in the tool.

Table 4. BMP Dimensions Required for the Sizing Tool to Apply

Facility	Drain Rock, min. in.	Separation Layer, in.	Growing Media, min. in.	Ponding Depth, in.	Freeboard, min. in.	Side Slope, ratio	Bottom Width, min. in.	Liner
Stormwater Planter - Filtration	12	3	18	12	4	0	18	If required
Stormwater Planter - Infiltration	28	3	18	12	4	0	30	No
Rain Garden - Filtration	18	3	18	12	4	3:1 max	24	If required
Rain Garden - Infiltration	18	3	18	16	N/A	3:1 max	24	No
Vegetated Swale - Filtration	12	3	18	12	4	3:1 max	24	If required
Vegetated Swale - Infiltration	18	3	18	12	N/A	3:1 max	24n	No
Detention Pond	15	3	18	Per sizing model (12 in. min.)	12[a]	3:1 max	N/A	If required

a. The surface area of the detention pond, the filtration rain garden and the filtration swale sized by the tool does not take freeboard into account. In addition, see Note 12 on the Detention Pond detail regarding an emergency spillway.

Although the table states a side slope ratio of 3H:1V max for detention ponds, the 2015 PWS section 301.4.09 states a General Facility Design Requirement that stormwater management facilities shall not exceed 4H:1V up to the maximum design water elevation. The initial analyses used 4H:1V sizing requirements. After review by the City, the scenarios were refined to optimize pond sizing and incorporated a 3H:1V side slope to maximize potential storage at Library Pond.

For detention ponds, the tool can be used to either calculate a simple geometry or a custom geometry. A simple geometry uses a known surface area or depth and entered slope to calculate the bottom area and depth or surface area (whichever was initially an unknown variable). While the custom geometry relies on known depth, area, and flow values. For each configuration option, the BMP Sizing Tool routes the post-development flow through the pond, performs statistical analyses for flow duration and peak flow criteria, and reports if the pond is sized adequately.

For ponds sized using simple geometry, the required outlet dimensions for the pond will be calculated. This includes inverts and dimensions of lower orifice, upper orifice, and overflow weir which correspond to the provided facility schematic (see Figure 1). Figure 1 depicts the main features of the outlet structure with the locations of their inverts. The overflow weir is at 1 foot below the 10-year pond water surface elevation. It is assumed that the pond will need to include additional freeboard (typically 1 foot) above the 10-year water surface elevation.

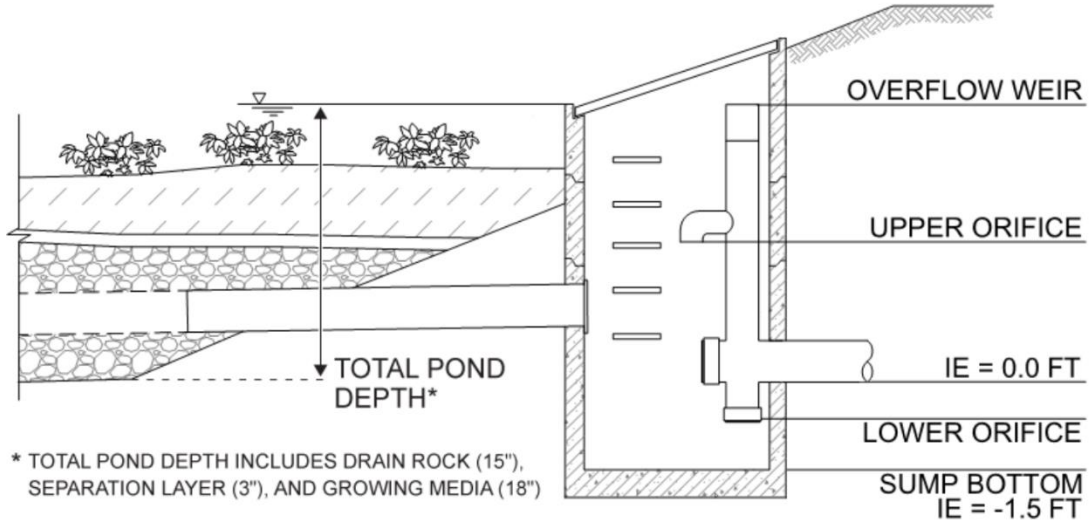


Figure 1. Detention pond facility schematic

The BMP Sizing Tool also calculates flow duration and peak flow frequency curves to compare pre-development to post-project flows. The curves represent the flow and duration over the range of geomorphically significant flows (i.e., lower threshold of 42 percent of the 2-yr storm and an upper threshold of the 10-yr storm). When a pond is adequately sized the mitigated post-development curve (blue per the BMP Sizing Tool output) falls below the pre-development curve (red per the BMP Sizing Tool output). It will also be sized to ensure treatment of 80 percent of the average annual runoff.

Section 3: Evaluation and Methodology

With the 2015 updates to the PWS, the Library Pond as it exists today does not meet the City's current stormwater design and construction specifications. This TM documents the evaluation of the existing pond location and footprint against several pre- and post- development scenarios. The process used for this evaluation of the facility includes:

1. Utilize facility as-builts, the InfoSWMM model, and the Town Center Plan to determine the current pond facility size, contributing drainage area and land use, and the pond's stage storage curve;
2. Determine if the current pond storage volume and outlet structure address current flows reflective of existing development conditions and pre-development flows reflective of historic land use conditions, as required in the 2015 PWS;
3. Use the BMP Sizing Tool to compare pond sizing and outlet adjustments, assuming existing development conditions and historic land use conditions, to meet the minimum criteria in the City's design standards;
4. Locate potential impervious areas within the Town Center redevelopment for upstream, low impact development (LID) planter facilities to meet the City's water quality treatment and flow control requirements associated with the City's established hydromodification standard;
5. Use the BMP Sizing Tool to iterate and optimize pond sizing and outlet configurations in conjunction with LID sizing/placement to meet the City's design standards in conjunction with future development of the Town Center and associated site constraints, and
6. Document LID placement needs associated with future development to determine fee-in-lieu policy implications.

To evaluate Library Pond sizing in conjunction with the above-mentioned process, the 11 subbasins (delineated as part of the SMP) that drain into the Library Pond were subdivided based on various land cover and impervious conditions reflective of pre-development, existing, and future development conditions. Under future development conditions, the Town Center development plans include demolition of existing stormwater infrastructure and installation of new pipes to convey stormwater drainage in conjunction with the proposed roadway configuration.

Because the existing footprint of the pond, approximately 0.7 acres, is constrained by limitations (roadways, trees, etc.), simple pond sizing was employed by holding the pond surface area constant and allowing the BMP Sizing Tool to calculate a required pond depth and bottom surface area.

3.1 Discharge Management Areas

The BMP Sizing Tool requires users to first delineate Discharge Management Areas (DMAs), also referred to as subcatchments, which are used to define a contributing drainage area to each planned BMP facility on a site. The BMP Sizing Tool has limitations on the size of individual DMAs to individual LID facilities. In addition, to facilitate iteration of scenarios related to BMP sizing, flexibility had to be incorporated into the DMAs. Therefore, the contributing drainage area to the Library Pond had to be categorized and subdivided.

The DMAs were initially developed by subdividing each of the 11 subbasins (totaling 179.8 acres) into their respective Hydrologic Soil Groups (HSGs) - either B, C, or D (note: soils that fell into a dual-HSG category are reflected by the less infiltrating soil. For example, a soil in group C/D was calculated as HSG D). The total area of analysis was found to be 35% HSG B, 42% HSG C, and 23% HSG D, with the actual site of Library Pond in HSG B soils.

The areas were then further subdivided by land cover to separate existing roadways/Right-of-ways (ROWs) from private property. Existing ROW areas were confirmed against the future Town Center Plan to ensure the area would remain roadways in the future development condition. Similarly, building (rooftop) area and pavement areas were also designated and digitized to inform the delineation of DMAs. An example of how this hierarchy was implemented is shown in Figure 2.

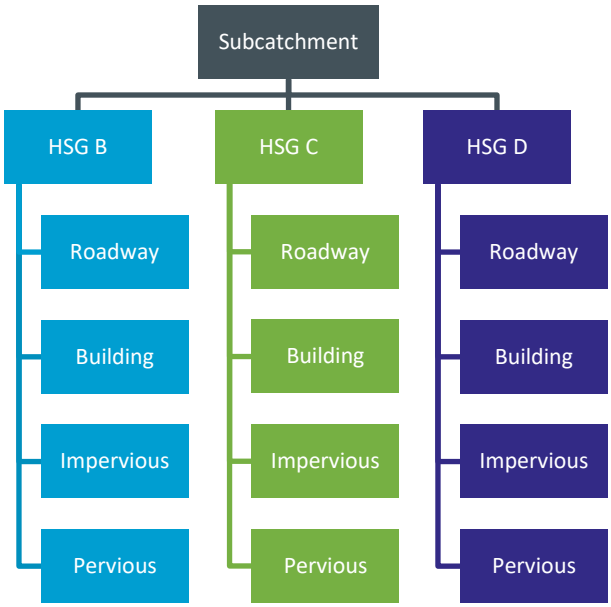


Figure 2. Example hierarchy of how the subcatchments were divided into DMAs

The DMAs were set-up to meet each of the three (3) initial scenarios for evaluation:

1. Pre-development (Oak Savanna) to existing conditions (today)
2. Pre-development (Oak Savanna) to future conditions (Town Center build out)
3. Existing conditions (today) to future conditions (Town Center build out)

To accommodate each of these scenarios, a total of 98 individual DMAs were established to represent the soil characteristics and development types over the 11 subcatchments. Each of the DMAs has a unique pre-development and post-development surface types associated with a specific soil type.

A database and specific naming convention was used to track DMAs and associated information. DMAs were named by subcatchment number, HSG letter, the existing development type, and the future development type. For example, a DMA from scenario 3 may read as 3414_D_Ex_Perv_Fu_Imp with an area of 3,995 square feet. This naming convention indicates that this DMA is currently a pervious surface (noted as Grass in the tool) but is anticipated to become an impervious surface (Conventional Concrete or Asphalt) under the full Town Center development.

3.2 Best Management Practices

Although the BMP Sizing Tool has eight (8) available facility types to develop sizing, this analysis focused on the Detention Pond with treatment and flow control to represent the Library Pond. Since the Library Pond is located in HGL B soils, the more conservative group B value (called B3 in the tool) with an infiltration rate of 0.50-0.99 in/hr was used to represent these soils. This range was verified against data from the United States Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS) soil survey database which identified the soil in this area to be primarily Willamette silt loam with a saturated hydraulic conductivity (Ksat) between 0.57-1.98 in/hr.

The pond was modeled using both custom and simple geometry in the tool in order to compare existing pond sizing as well as determine sizing and outlet control adjustments. The custom geometry was used in the BMP Sizing Tool to represent the existing facility under current and future conditions to confirm if it meets design standards. For the custom sizing, the geometry data was extracted from the InfoSWMM model (based on the 1992 as-built data) to determine the depth in feet (ft), area in square feet (sq ft), and flow in cubic feet per second (cfs) based on modeled stage storage for the 10-year storm event. The stage storage information extracted from InfoSWMM is listed in Table 1.

Table 1. Library Pond Stage Storage

Depth (ft)	Area (sq ft)	Flow (cfs)
0	0	0
1	10,018	9.4
2	17,859	14.3
5	23,522	19.7
9	32,670	Not reached in 10-year storm
10	34,848	Not reached in 10-year storm

It is assumed that usable storage within the pond must remain below the elevation of the chain link fence at its lowest position (near the outlet structure where it passes under the road). This elevation contour of 147 ft is considered the upper limit of the pond with a calculated surface area of 30,130 sq ft. The lowest full elevation contour of the pond was calculated to be 137 ft with a surface area of 17,800 sq ft. It was assumed that the existing footprint of the pond is a hard constraint, and the surface area of the pond could not be expanded.

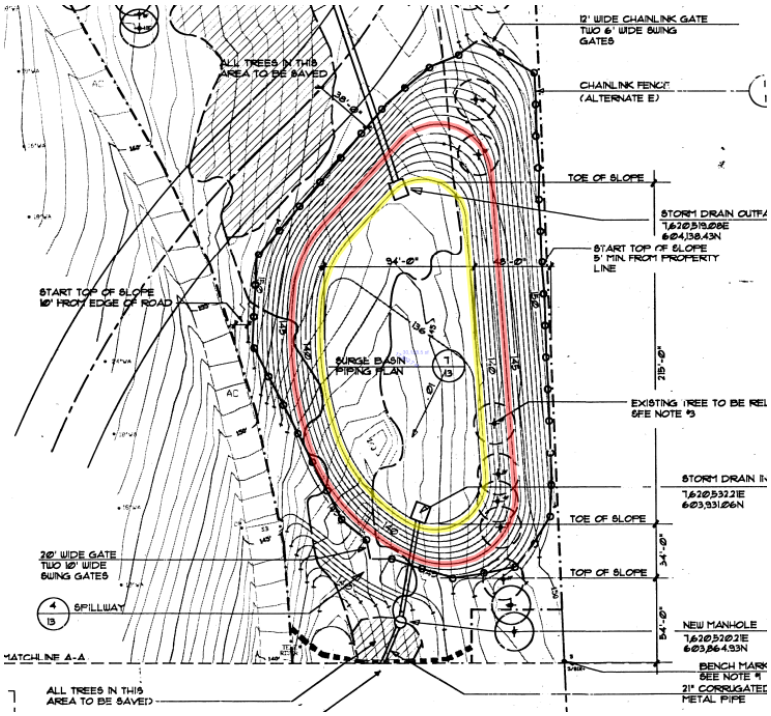


Figure 3. Library Pond 1992 as-builts, upper 147 ft contour (red) and lower 137 ft contour (yellow)

Alternatively, the simple geometry calculation was used to confirm modifications needed to retrofit the pond to current PWS design standards, based on each of the scenarios. The simple geometry could be run with either a known pond surface area, a known depth, or both. If one variable is unknown the tool calculates it based on the provided information for the surface area and/or depth and slope (H:V), as well as calculated the bottom area of the pond. Values for the surface area and slope were rounded to the nearest whole number for calculations.

Since the detention pond is being evaluated to meet both the water quality and flow control criteria, the BMP Sizing Tool was used to evaluate and size the pond facility to address peak flow duration matching for flows ranging from 42 percent of the 2-year peak flow to the 10-year peak flow as well as ensure treatment of 80 percent of the average annual runoff.

Section 4: Scenarios

The following three (3) scenarios were established to compare past, present, and future conditions of the Town Center Development area and associated sizing of the Library Pond. Each scenario was input into the BMP Sizing Tool to see how the system (pond) would respond under the varying development assumptions, with accompanying scenarios evaluated to confirm what level of retrofit or policy change regulating upstream LID installations are needed to meet the City's design standards.

4.1 Scenario 1: Pre-development to Existing Conditions

This scenario simulated pre-development conditions, referred to as Oak Savanna in the 2015 PWS, and existing development conditions to confirm whether the existing Library Pond sizing is adequate to meet design standards. The contributing drainage area under existing conditions is 47 percent impervious. In comparison, Oak Savanna is considered 100 percent pervious, with all DMAs identified as 'Grass' for the pre-development surface type.

Simply comparing the aerial photography from 1992 (which is not representative of Oak Savanna but represents the oldest web accessible archived image) to aerial imagery from 2022, it is evident that this area has experienced a large amount of development over the past 30 years.

Figure 4. Aerial images of site and surrounding area

Left: after retrofit in June 1994

Right: July 2022, representative of existing condition.

4.1.1 Pond Sizing Evaluation

Simulation of the Library Pond configuration in the BMP Sizing Tool indicates that the existing pond does not meet the current stormwater design standards per the 2015 PWS. The existing pond geometry was entered into the tool using stage storage information from the 1992 as-builts and SMP InfoSWMM model. As seen in Figure 5, the blue line represents the discharge occurring from the pond and it is consistently higher than the red, pre-development (Oak Savannah) flow frequency and flow duration curves. Library Pond in its current configuration does not adequately match the pre-development curves and additional pond storage is needed.

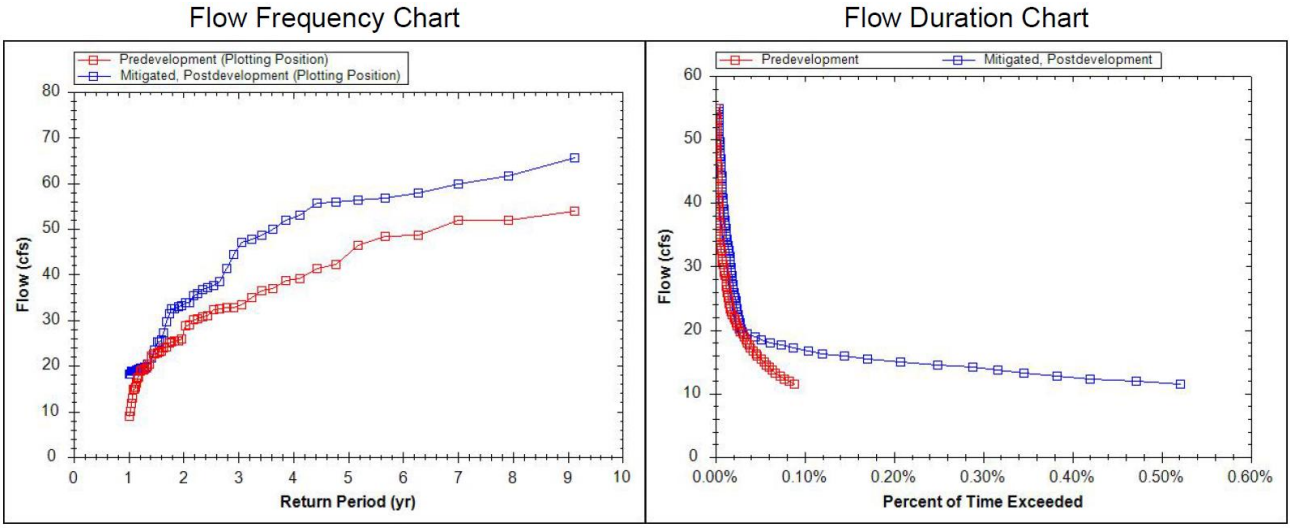


Figure 5. Curves based on existing stage storage information from as-builts

Pre-development shown in red. Mitigated, Post-Development shown in blue.

4.1.2 Pond Retrofit Evaluation

The BMP Sizing Tool was used to simulate additional scenarios associated with the pond configuration and size, as outlined in Table 2, to calculate pond retrofits required to meet current design standards. The BMP Sizing Tool calculations show that significant design modifications are required to ensure the pond is adequately sized; specifically the pond would need to be retrofit to have 1H:1V side slopes with a depth of nearly 24 feet (Figure 6) to adhere to the City's hydromodification standard (see Attachment A, Scenario 1A). This design fails to meet the design criteria for detention ponds having 3H:1V slopes and results in an excessively deep detention facility. Retrofit of the pond to meet City design standards based on existing development conditions is considered infeasible.

Table 2. Scenario 1 Iterations

Geometry Type	Slope (H:V)	Sizing Mode	Depth (ft)	Bottom Area (sq ft)	Does it Pass the Tool?
Custom Geometry	Stage Storage Information per as-builts				No, not large enough
Simple Geometry	4:1	Auto calculate depth	Cannot be calculated, bottom reaches zero before depth is reached		No, geometry doesn't work
	3:1	Auto calculate depth	Cannot be calculated, bottom reaches zero before depth is reached		No, geometry doesn't work
	2:1	Auto calculate depth	43.39	0	No, geometry doesn't work
	1:1	Auto calculate depth	23.98	15,780	Yes, sized adequately

Note: there is some variation between calculated depths with the same slope based on the tool and the outset structure sizing/configuration.

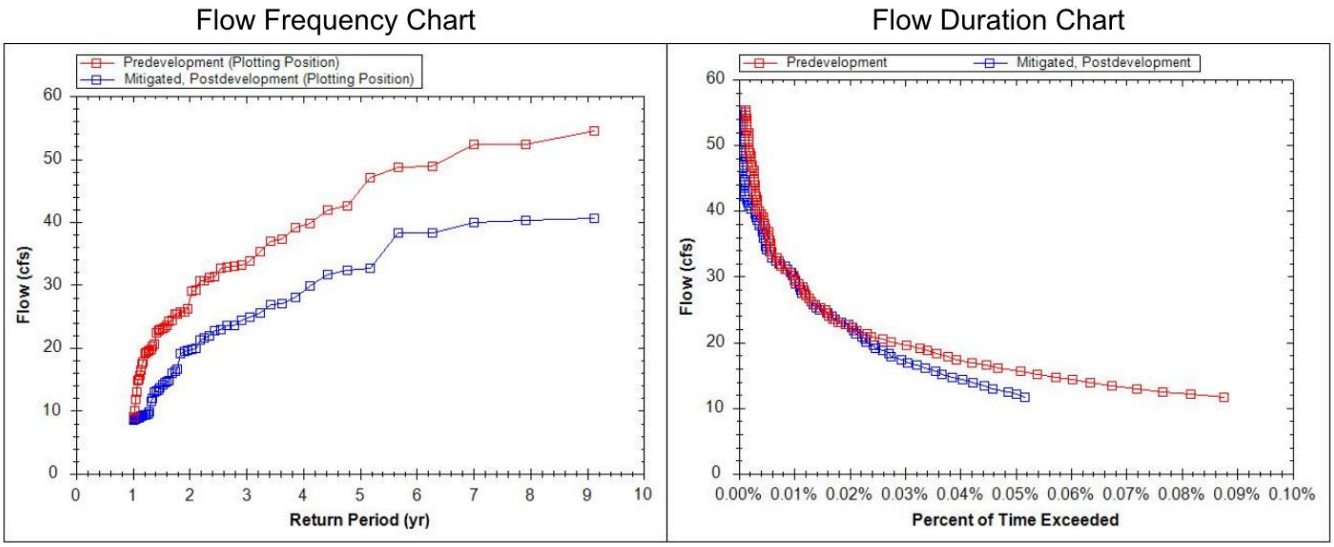


Figure 6. Flow frequency and duration curves if retrofit is to have 1H:1V side slopes and a depth of nearly 24 feet

Pre-development (red) to Existing condition (blue)

4.1.3 Onsite Flow Mitigation Evaluation

An additional, theoretical investigation was conducted to see how much of the current contributing drainage area to Library Pond would need to be managed onsite (i.e., routed to onsite LID) for the pond to meet current design standards.

To evaluate, the BMP Sizing Tool was used to automatically size the detention pond, maintaining the existing pond surface area of 30,130 sq. ft., and adjusting the side slopes to meet the PWS of 3H:1V. The automatic sizing mode to calculate the depth and bottom area of the pond. DMAs were then selectively removed from contributing area to the detention pond with the assumption that removed DMAs would require onsite stormwater management (retention) and use of LID such as planters or raingardens.

By removing approximately 20 percent of the existing total drainage area (roughly 36 acres of impervious surface or 43% of the contributing impervious area) to Library Pond, the BMP Sizing Tool was able to size the pond to meet PWS requirements. This reduces the total drainage area to the Library Pond to 143.3 acres. The resulting pond sizing requires deepening the Library Pond to 15.08 feet (including the 3 feet of media at the bottom) and maintaining a bottom area of 6,906 sq. ft. See Attachment A, Scenario 1B.

The pond schematic and structure sizing reflecting the reduced contributing drainage area, a depth of 15.08 feet and 3H:1V side slopes is as follows in Figures Figure 7 and Figure 8.

Structure	Size
Lower Orifice Diameter	9.9 in
Lower Orifice Invert	0.0 in
Upper Orifice Diameter	25.2 in
Upper Orifice Invert	9.8 ft
Weir Length	6.3 ft
Weir Invert	13.6 ft

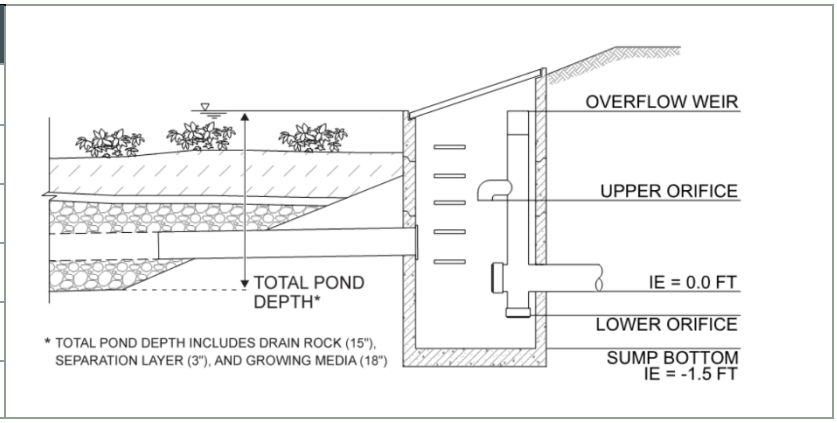


Figure 7. Scenario 1 outfall structure sizing and schematic for reduced contributing drainage area and 3H:1V sides slopes

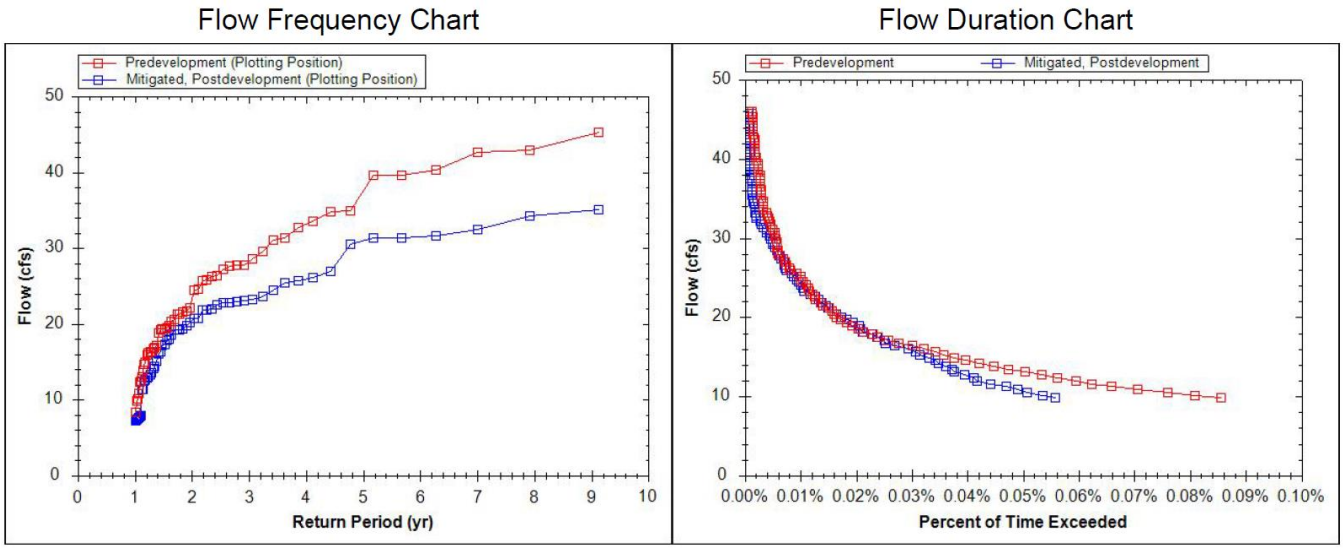


Figure 8. Reduced contributing drainage area for flow frequency and duration curves with a 3H:1V pond

Pre-development (red) to existing condition (blue)

4.2 Scenario 2: Pre-development to Future Conditions

The second scenario was simulated in the BMP Sizing Tool, comparing pre-development conditions, referred to as "Oak Savanna" in the 2015 PWS, to the future development conditions outlined in the Town Center Plan at full build out (20+ year planning horizon) to confirm sizing needs for the Library Pond. The contributing drainage area under future conditions is 53 percent impervious. In comparison, Oak Savanna is 100 percent pervious, with all DMAs identified as 'Grass' for the pre-development surface type. Like Scenario 1, expansion of the existing footprint of the pond, approximately 0.7 acres, is not possible due to constraining site limitations (roadways, trees, etc.).

4.2.1 Pond Sizing and Retrofit Evaluation

Based on Scenario 1 findings, it is assumed that the existing pond sizing would not meet the City's design standards as is in conjunction with future redevelopment of the Town Center area (Figure 9). Since the existing pond configuration does not meet the City's design standards for existing development conditions, it was not expected that the pond is adequately sized for future development conditions either.

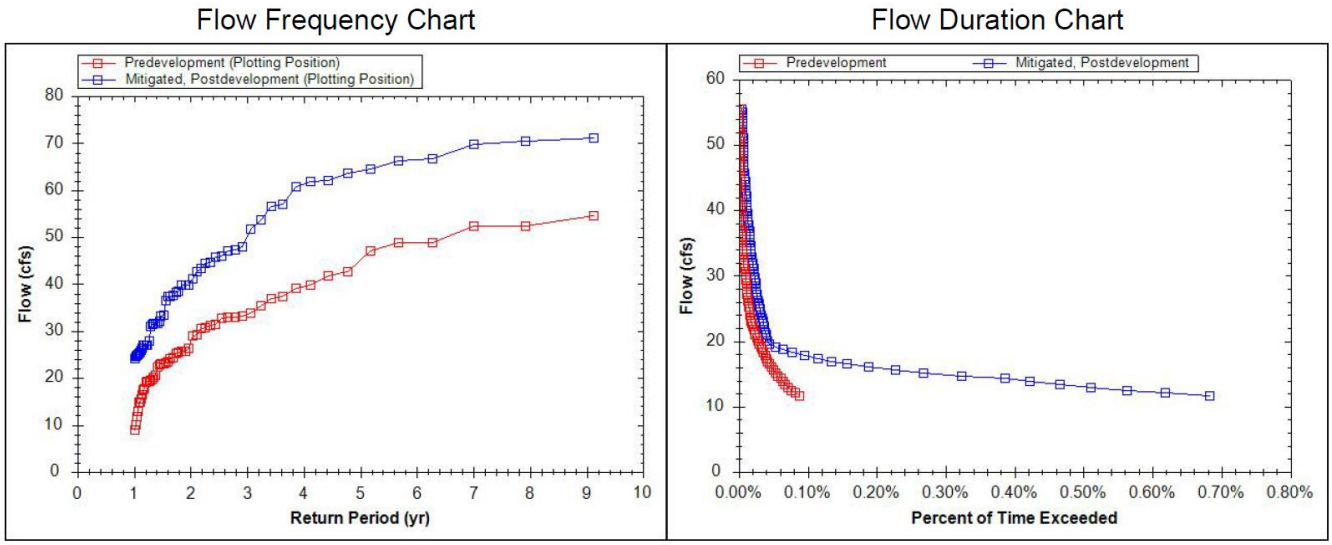


Figure 9. Flow frequency and duration curves based on existing stage storage information from as-builts

Pre-development shown in red and future development conditions shown in blue.

The BMP Sizing Tool was simulated for the additional scenarios outlined in Table 3 to calculate the required pond sizing and retrofit needs. As shown in Table 3 and Figure 10, like with the previous scenario, the BMP Sizing Tool calculated that the pond would have to be retrofit to have 1H:1V side slopes with a depth of approximately 30.4 feet and a bottom geometry of over just over 12,700 sq. ft to meet current design standards (see Attachment A, Scenario 2A). However, these detention pond design criteria do not meet the 2015 PWS requirements.

Table 3. Scenario 2 Iterations

Geometry Type	Slope (H:V)	Sizing Mode	Depth (ft)	Bottom Area (sq ft)	Does it Pass the Tool?
Custom Geometry	Stage Storage Information				No, not large enough
Simple Geometry	4:1	Auto calculate depth	Cannot be calculated, bottom reaches zero before depth is reached		No, geometry doesn't work
	3:1	Auto calculate depth	Cannot be calculated, bottom reaches zero before depth is reached		No, geometry doesn't work
	2:1	Auto calculate depth	43.39	0	No, not large enough
	1:1	Auto calculate depth	30.40	12,719	Yes, sized adequately

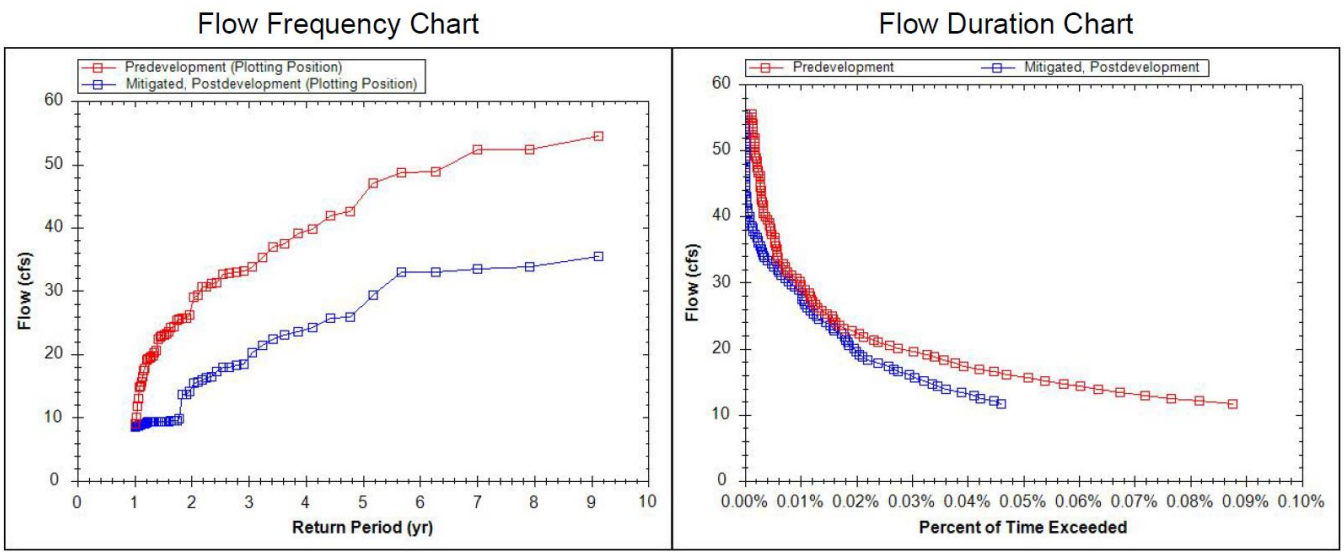


Figure 10. Flow and durations curves if retrofit was to have 1H:1V side slopes with a depth of over 30 feet.

Pre-development (red) to future development conditions (blue).

4.2.2 Onsite Flow Mitigation Evaluation

Based on these findings, a secondary analysis for Scenario 2 was developed. Similar to Scenario 1, this analysis removed select DMAs from contributing to the pond, assuming that these areas could be treated by additional LID facilities, to determine how much of Town Center property would require onsite stormwater management in order for Library Pond to meet City design standards.

Again, to evaluate the reduction in DMAs, the BMP Sizing Tool maintained the existing surface area of 30,130 sq. ft., set the slope to meet the City directed use of the PWS maximum of 3H:1V, and used the automatic sizing mode to calculate the depth and bottom area of the pond.

By removing approximately 27 percent of the total contributing drainage area (approximately 48 acres impervious area) to Library Pond, the BMP Sizing Tool was able to size the pond to meet PWS requirements. All 48 acres of removed DMAs were impervious surfaces and represents all roadways (approximately 27 acres) plus an additional 21 acres of impervious area. **The removed impervious surfaces to be redirected constitutes 50 percent of the total new or redeveloped impervious surfaces contributing to the pond.** This removed area was assumed rerouted to infiltration planters onsite and modeled in the BMP Sizing Tool through a series of Stormwater Water Planter BMPs that connect to Library Pond as upstream LIDs. Although site-specific infiltration testing would be needed to confirm whether an infiltration or filtration-based LID is needed, for integration into the BMP Sizing Tool an infiltration planter that provides treatment and flow control was selected. Since the facility infiltration rate at Library Pond is associated with HSG B3 (0.50-0.99 in/hr), for purposes of this initial analysis the same infiltration rate was assumed as a representative of the soils for the LID facilities. With a portion of contributing drainage area removed, the total drainage area to Library Pond to 131.8 acres. The resulting pond sizing requires deepening the Library Pond to 15.04 feet (including the 3 feet of media at the bottom) and maintaining a bottom area of 6,946 sq. ft. See Attachment A, Scenario 2B.

The pond schematic and structure sizing reflecting the reduced contributing drainage area, a depth of 15.04 feet and 3H:1V side slopes is as follows in Figure 11 and Figure 12.

Structure	Size
Lower Orifice Diameter	10.6 in
Lower Orifice Invert	0.0 in
Upper Orifice Diameter	27.4 in
Upper Orifice Invert	10.1 ft
Weir Length	6.3 ft
Weir Invert	14.0 ft

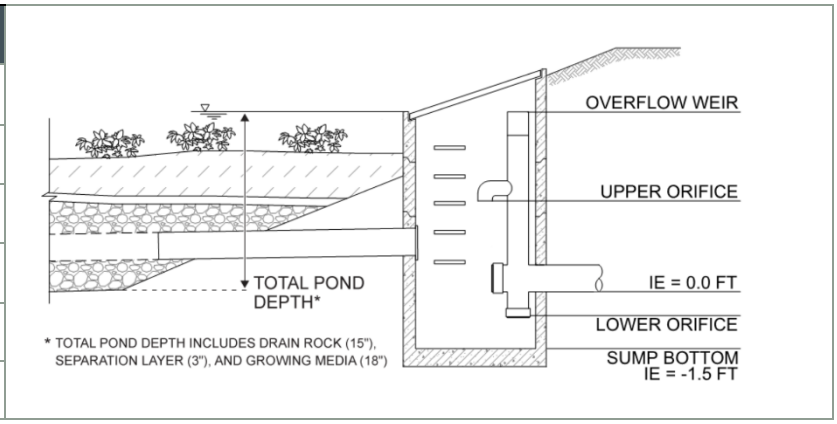


Figure 11. Scenario 2 outfall structure sizing and schematic for reduced contributing drainage area and 3H:1V sides slopes

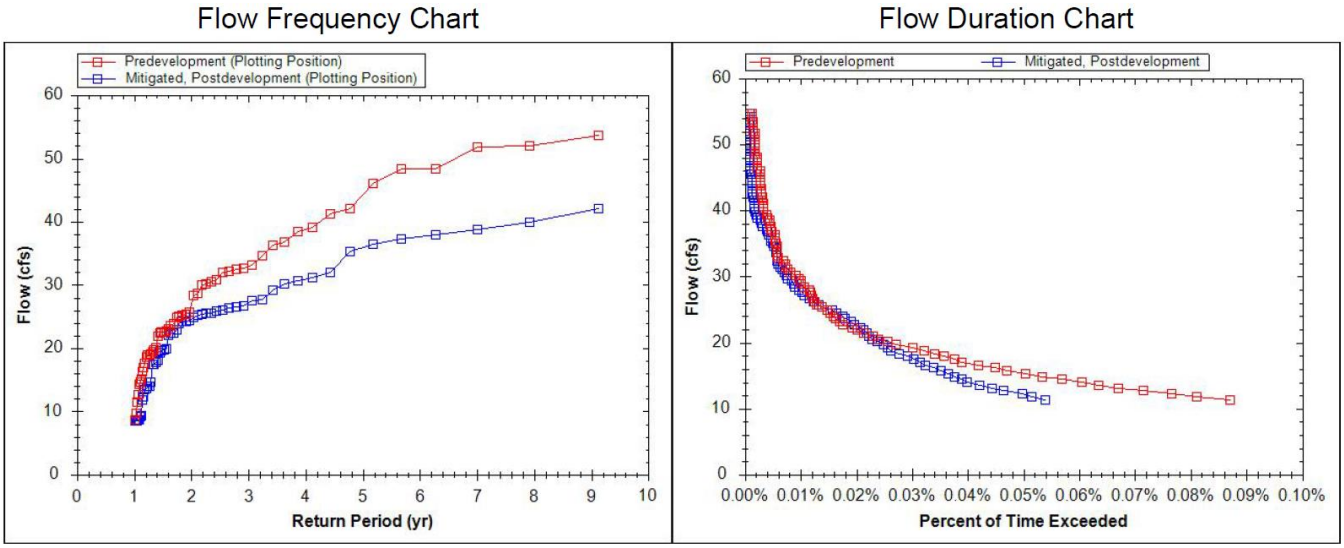


Figure 12. Reduced contributing drainage area for flow frequency and duration curves with a 3H:1V pond

Pre-development (red) to future development condition (blue).

4.3 Scenario 3: Existing to Future Conditions

The last scenario assumes that adherence to the City's design standards could be accomplished by allowing redevelopment of Town Center to adhere to predevelopment flows reflecting existing land use conditions as opposed to historic (Oak Savannah) land cover conditions. The contributing drainage area under existing conditions is 47 percent impervious and under future conditions increases to 53 percent impervious through both redevelopment and the addition of approximately 10 acres of impervious surface. As seen in Figure 13, the Town Center development plans anticipate redevelopment of many currently developed and impervious areas, which is why the amount of impervious area only increases by about 7 percent. However, all redevelopment area is subject to the City's design standards including utilization of Green Infrastructure and Low Impact Development (GI/LID) strategies to mitigate stormwater.

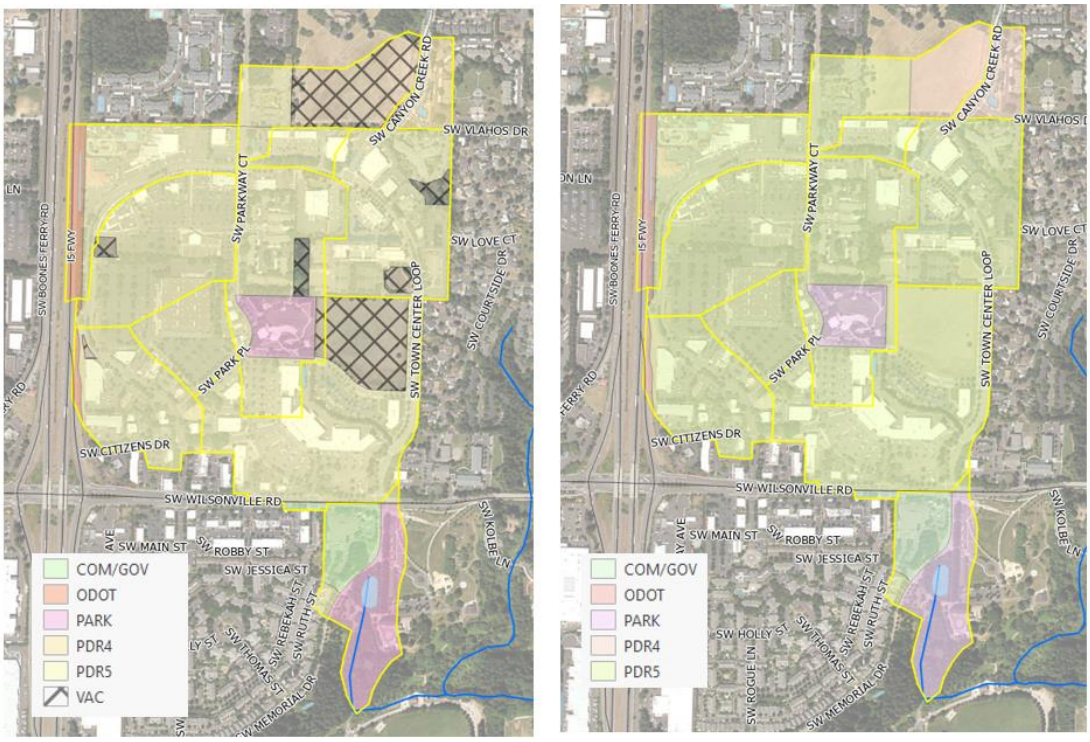


Figure 13. Existing land use at 47% impervious (left); future land use at 53% impervious (right)

The BMP Sizing Tool was run through the following scenarios outlined in Table 4 to calculate how the existing pond may handle future flows as well as design modifications that would be required.

Assuming pre-development conditions reflect existing land use, the pond as-is does not adequately meet City design standards for sizing. Some modifications to Library Pond are required, specifically the pond needs to be deepened to approximately 7.1 feet, which includes 3 feet of media at the bottom of the facility and adjustment of side slopes to 4:1 is required. Utilizing this comparison methodology, this approach requires a policy change since for the City since it redefines "pre-development" from historic (Oak Savanna) land coverage to current land use conditions.

Table 4. Scenario 3 Iterations

Geometry Type	Slope (H:V)	Sizing Mode	Depth (ft)	Bottom Area (sq ft)	Does it Pass the Tool?
Custom Geometry	Stage Storage Information				No, not large enough
Simple Geometry	4:1	Auto calculate depth	7.09	13,656	Yes, sized adequately
	3:1	Auto calculate depth	6.24	18,534	Yes, sized adequately

Note: Additional analysis of slopes 2H:1V and 1H:1V were not recorded as the 4H:1V and 3H:1V slope design standard slope meets sizing requirements.

The pond schematic and structure sizing reflect a depth of 7.09 feet and 4H:1V side slopes is as follows in Figure 14 and Figure 15.

Structure	Size
Lower Orifice Diameter	16.9 in
Lower Orifice Invert	0.0 in
Upper Orifice Diameter	40.9 in
Upper Orifice Invert	4.8 ft
Weir Length	6.3 ft
Weir Invert	6.1 ft

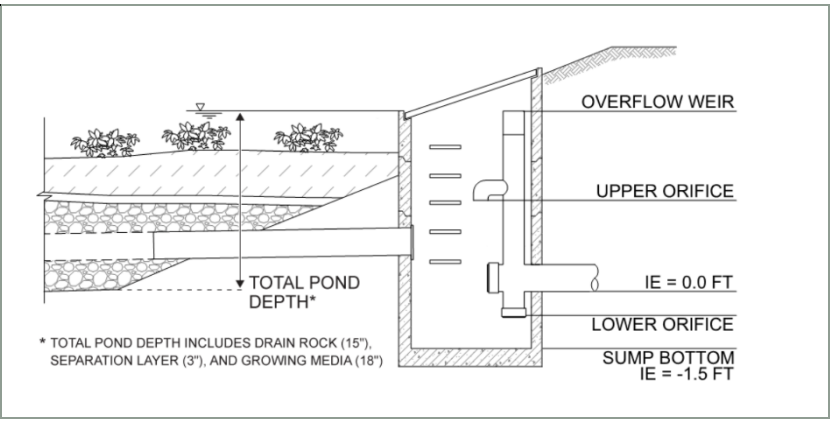


Figure 14. Scenario 3 outfall structure sizing and schematic for reduced contributing drainage area and 4H:1V sides slopes

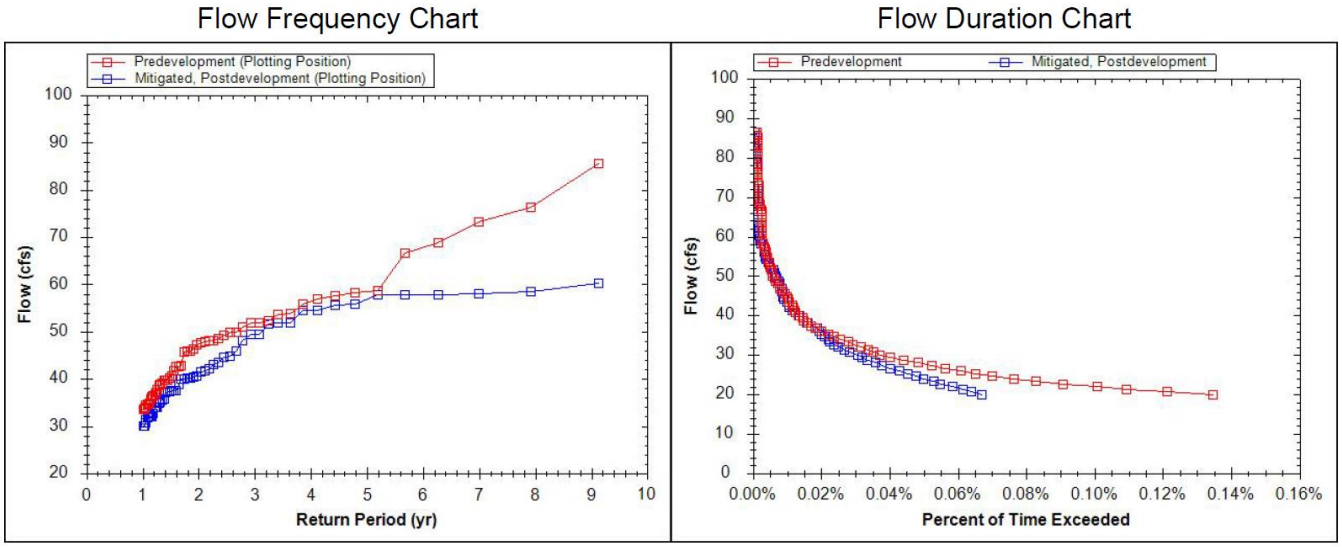


Figure 15. Flow and durations curves show adequate sizing for 4H:1V side slopes at 7.09 feet deep

Existing development conditions (red) to future development conditions (blue).

Section 5: Conclusions

Scenarios simulated using the BMP Sizing Tool for Library Pond indicate there are limited options to retrofit the pond to meet the existing stormwater design standards. Table 5 summarizes the scenarios iterated and the resulting design adjustments (retrofit) required for Library Pond based on assumptions discussed in Section 4.

Table 5. Scenario Summary							
Scenario No.	Scenario Description and Land Cover Conditions	Total Contributing Area (acres)	Meets Hydraulic Requirements?	Pond Retrofit Requirements		Meets Pond Design Criteria?	Notes
				Slope (H:V)	Depth (feet)		
1.A	Pre-Development Land Cover to Existing Land Cover	179.8	Yes	1:1	21.33	No	Pond sides are too steep and pond is too deep
1.B	Pre-Development Land Cover to Existing Land Cover	143.3	Yes	3:1	15.08	Yes	Requires onsite mitigation (retention) for 36 acres of existing impervious area
2.A	Pre-Development Land Cover to Future Land Cover	179.8	Yes	1:1	32.01	No	Pond sides are too steep, and pond is too deep
2.B	Pre-Development Land Cover to Future Land Cover	131.8	Yes	3:1	15.04	Yes	Requires onsite mitigation (retention) for 48 acres of existing impervious area
3	Existing Land Cover to Future Land Cover	179.8	Yes	4:1	7.09	Yes	Requires an established policy adjusting the definition of pre-developed land cover for Town Center redevelopment.

As seen in Table 5, Scenarios 1A and 2A are unable to meet the 2015 PWS stormwater design standards for ponds, specific to side slope (both are 1H:1V and the standard is 3H:1V) and depth. Only if onsite retention occurs for a portion of the upstream contributing drainage area will pond retrofit be able to meet the City's design standards. Only Scenario 3 allows for the entire upstream contributing drainage area to be managed by Library Pond and the pond adhere to design criteria outlined in the PWS. This pond retrofit can be designed with a more gradual 4H:1V slope, and results in a reasonable pond depth of 7.09 feet deep, which is shallower than the existing Library Pond with the 3 feet of required media in the bottom.

However, Scenario 3 mandates a policy change to adjust pre-development land cover from historic Oak Savanna to current land use conditions. This consideration will need to be evaluated by the City.

If a policy change related to the pre-development condition associated with Town Center is not possible, Scenarios 1B and 2B reflect the percentage and acreage of impervious area that would need to be retained or managed onsite using GI/LID BMP facilities and no longer routed to Library Pond. The following assumptions were made to estimate the amount of onsite infiltration planters required to offset 48 acres of impervious surfaces in the future condition (or 50% of the total new or redeveloped impervious area to Library Pond).

- Pre-development conditions are grass cover per PWS Oak Savanna designation with soil conditions reflective of the associated HSG;
- Soil and infiltration characteristics for the LID facilities are similar to that of the Library Pond, characterized as B3 (0.5-0.99 in/hr infiltration), which prompts use of an infiltration facility;
- Per Appendix B of the BMP Sizing Tool User Manual, onsite LID sizing would equate to a sizing factor of approximately 7.4, based on an area weighted average of sizing factors and soil characteristics for area removed from the Library Pond drainage area.

Using the above assumptions, onsite retention of 48 acres of impervious surface is possible using approximately 154,725 sq. ft. (3.6 acres) of infiltration planters located throughout the Town Center development. It should be noted that site-specific infiltration testing may result in adjustment of the LID sizing and/or need for a filtration-based facility to be used instead.

Retrofit of the Library Pond would require regrading and structural improvements, resulting in a 3:1 side slope and depth of 15.04 feet. This is a conservative design approach and conservative design assumptions based on onsite management of approximately 48 acres of the contributing drainage area to Library Pond onsite. Pond sizing may vary depending on the use and characteristics of upstream LID.

References

Stormwater & Surface Water Design & Construction Standards, Section 3, "Public Works Standards," City of Wilsonville, 2015, pp.1-104.

User's Guide for the BMP Sizing Tool, City of Wilsonville and City of Oregon City, 2017, pp. 1-23.

Wilsonville Town Center Plan, City of Wilsonville, 2019, pp. 1-104.

Attachment A: BMP Sizing Tool Scenario Reports

1. Scenario 1 – Stage Storage Report
2. Scenario 1A – Automatically Calculated Depth Report
3. Scenario 1B – Automatically Calculated Depth Report – Reduced Area
4. Scenario 2 – Stage Storage Report
5. Scenario 2A – Automatically Calculated Depth Report
6. Scenario 2B – Automatically Calculated Depth Report – Reduced Area
7. Scenario 3 – Stage Storage Report
8. Scenario 3A – Automatically Calculated Depth Report

WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Library Pond_Predevelopment (Oak Savanna) to Existing
Project Type	Planning
Location	
Stormwater Management Area	30130
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
3218_D_Bdg	22,140	Grass	Roofs	D	Library Pond_Existing
3218_D_Imp	53,626	Grass	ConventionalConcrete	D	Library Pond_Existing
3218_D_Perv1	201,064	Grass	Grass	D	Library Pond_Existing
3218_D_Perv2	304,657	Grass	Grass	D	Library Pond_Existing
3218_D_Rd	47,500	Grass	ConventionalConcrete	D	Library Pond_Existing
3402_B_Bdg	188,724	Grass	Roofs	B	Library Pond_Existing
3402_B_Imp	141,471	Grass	ConventionalConcrete	B	Library Pond_Existing
3402_B_Perv	385,991	Grass	Grass	B	Library Pond_Existing
3402_B_Rd	128,278	Grass	ConventionalConcrete	B	Library Pond_Existing
3402_C_Bdg	98,396	Grass	Roofs	C	Library Pond_Existing
3402_C_Imp	42,160	Grass	ConventionalConcrete	C	Library Pond_Existing
3402_C_Perv	429,486	Grass	Grass	C	Library Pond_Existing
3402_C_Rd	105,818	Grass	ConventionalConcrete	C	Library Pond_Existing

3414_B_Bdg	58,379	Grass	Roofs	B	Library Pond_Existing
3414_B_Imp	63,926	Grass	ConventionalConcrete	B	Library Pond_Existing
3414_B_Perv	209,761	Grass	Grass	B	Library Pond_Existing
3414_B_Rd	49,096	Grass	ConventionalConcrete	B	Library Pond_Existing
3414_C_Bdg	126,069	Grass	Roofs	C	Library Pond_Existing
3414_C_Imp	82,826	Grass	ConventionalConcrete	C	Library Pond_Existing
3414_C_Perv	308,800	Grass	Grass	C	Library Pond_Existing
3414_C_Rd	25,301	Grass	ConventionalConcrete	C	Library Pond_Existing
3414_D_Bdg	14,315	Grass	Roofs	D	Library Pond_Existing
3414_D_Imp	49,279	Grass	ConventionalConcrete	D	Library Pond_Existing
3414_D_Perv	109,766	Grass	Grass	D	Library Pond_Existing
3414_D_Rd	22,834	Grass	ConventionalConcrete	D	Library Pond_Existing
3417_D_Bdg	28,358	Grass	Roofs	D	Library Pond_Existing
3417_D_Imp	26,856	Grass	ConventionalConcrete	D	Library Pond_Existing
3417_D_Perv	74,227	Grass	Grass	D	Library Pond_Existing
3417_D_Rd	33,919	Grass	ConventionalConcrete	D	Library Pond_Existing
3418A_B_Bdg	104,425	Grass	Roofs	B	Library Pond_Existing
3418A_B_Imp	86,889	Grass	ConventionalConcrete	B	Library Pond_Existing
3418A_B_Perv	312,748	Grass	Grass	B	Library Pond_Existing
3418A_B_Rd	148,903	Grass	ConventionalConcrete	B	Library Pond_Existing
3418B_B_Bdg	88,068	Grass	Roofs	B	Library Pond_Existing
3418B_B_Imp	139,481	Grass	ConventionalConcrete	B	Library Pond_Existing
3418B_B_Perv	100,636	Grass	Grass	B	Library Pond_Existing

3418B_B_Rd	28,000	Grass	ConventionalConcrete	B	Library Pond_Existing
3420_B_Imp	23,265	Grass	ConventionalConcrete	B	Library Pond_Existing
3420_B_Perv	39,389	Grass	Grass	B	Library Pond_Existing
3420_B_Rd	32,226	Grass	ConventionalConcrete	B	Library Pond_Existing
3420_C_Bdg	109,273	Grass	Roofs	C	Library Pond_Existing
3420_C_Imp	275,853	Grass	ConventionalConcrete	C	Library Pond_Existing
3420_C_Perv	386,959	Grass	Grass	C	Library Pond_Existing
3420_C_Rd	9,675	Grass	ConventionalConcrete	C	Library Pond_Existing
3425_C_Bdg	68,156	Grass	Roofs	C	Library Pond_Existing
3425_C_Imp	68,156	Grass	ConventionalConcrete	C	Library Pond_Existing
3425_C_Perv	202,555	Grass	Grass	C	Library Pond_Existing
3425_C_Rd	259,711	Grass	ConventionalConcrete	C	Library Pond_Existing
3425_D_Bdg	11,387	Grass	Roofs	D	Library Pond_Existing
3425_D_Imp	31,398	Grass	ConventionalConcrete	D	Library Pond_Existing
3425_D_Perv	40,770	Grass	Grass	D	Library Pond_Existing
3436_C_Bdg	88,720	Grass	Roofs	C	Library Pond_Existing
3436_C_Imp	80,765	Grass	ConventionalConcrete	C	Library Pond_Existing
3436_C_Perv	238,917	Grass	Grass	C	Library Pond_Existing
3436_C_Rd	47,127	Grass	ConventionalConcrete	C	Library Pond_Existing
3436_D_Bdg	96,205	Grass	Roofs	D	Library Pond_Existing
3436_D_Imp	75,308	Grass	ConventionalConcrete	D	Library Pond_Existing
3436_D_Perv	257,884	Grass	Grass	D	Library Pond_Existing
3436_D_Rd	76,800	Grass	ConventionalConcrete	D	Library Pond_Existing

3443_D_Bdg	27,464	Grass	Roofs	D	Library Pond_Existing
3443_D_Imp	5,664	Grass	ConventionalConcrete	D	Library Pond_Existing
3443_D_Perv	99,259	Grass	Grass	D	Library Pond_Existing
3443_D_Rd	72,345	Grass	ConventionalConcrete	D	Library Pond_Existing
5038_B_Bdg	35,902	Grass	Roofs	B	Library Pond_Existing
5038_B_Imp	71,437	Grass	ConventionalConcrete	B	Library Pond_Existing
5038_B_Perv	305,799	Grass	Grass	B	Library Pond_Existing
5038_B_Rd	64,436	Grass	ConventionalConcrete	B	Library Pond_Existing
5038_C_Bdg	46,318	Grass	Roofs	C	Library Pond_Existing
5038_C_Imp	18,733	Grass	ConventionalConcrete	C	Library Pond_Existing
5038_C_Perv	105,053	Grass	Grass	C	Library Pond_Existing
5038_C_Rd	16,137	Grass	ConventionalConcrete	C	Library Pond_Existing

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Library Pond_Existing	FCWQT	B3	5.00	30,130.0	0	150,650.0	96,416.0	No

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

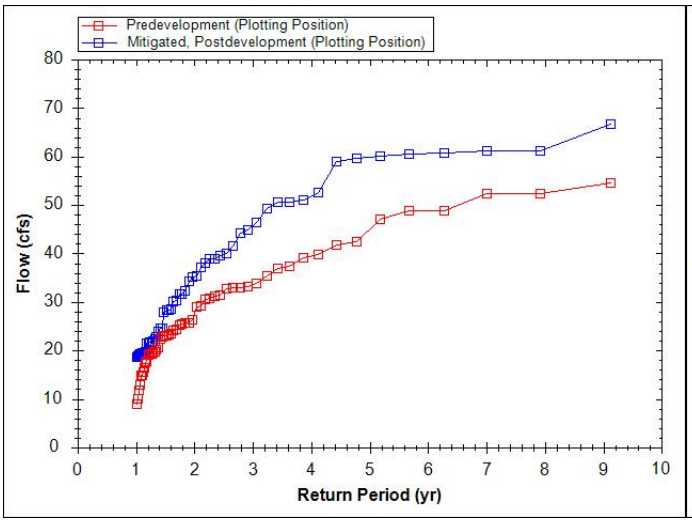
Custom Pond Geometry Configuration

Pond ID: Library Pond_Existing
Design: FlowControlAndTreatment

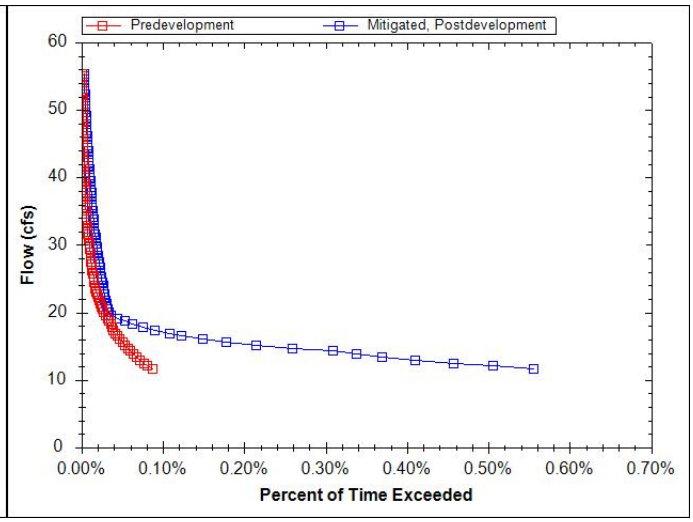
Shape Curve

Depth (ft)	Area (sq ft)	Discharge (cfs)
.0	.0	.0
1.0	10,018.0	9.4
2.0	17,859.0	14.3
5.0	23,522.0	19.7

Flow Frequency Chart



Flow Duration Chart



WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

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5038_B_Perv	305,799	Grass	Grass	B	Library Pond_Existing
5038_B_Rd	64,436	Grass	ConventionalConcrete	B	Library Pond_Existing
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5038_C_Perv	105,053	Grass	Grass	C	Library Pond_Existing
5038_C_Rd	16,137	Grass	ConventionalConcrete	C	Library Pond_Existing

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Library Pond_Existing	FCWQT	B3	23.98	30,130.0	1	541,267.4	511,485.0	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Simple Pond Geometry Configuration

Pond ID: Library Pond_Existing
Design: FlowControlAndTreatment

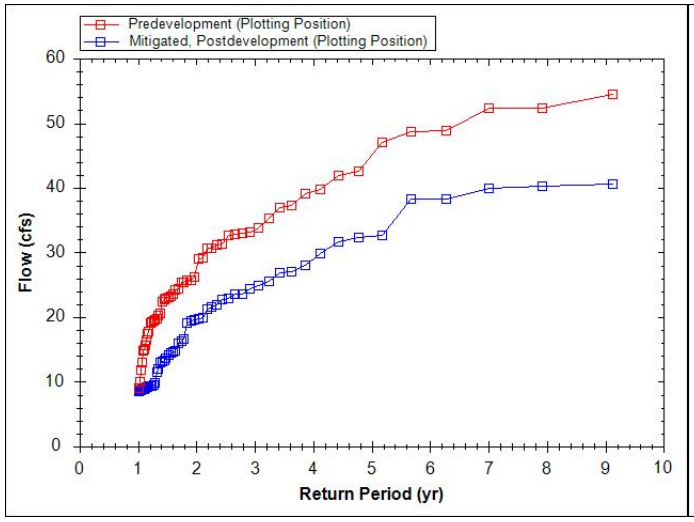
Shape Curve

Depth (ft)	Area (sq ft)
24.0	30,130.0

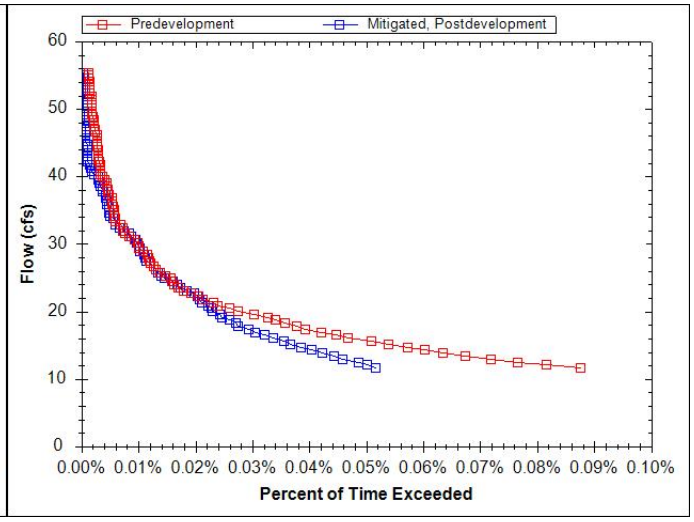
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	9.5
Upper Orifice Invert(ft)	16.1
Upper Orifice Dia (in)	24.5
Overflow Weir Invert(ft)	23.0
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Library Pond_Predevelopment (Oak Savanna) to Existing
Project Type	Planning
Location	
Stormwater Management Area	30130
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
3218_D_Bdg	22,140	Grass	Roofs	D	Library Pond_Existing
3218_D_Imp	53,626	Grass	ConventionalConcrete	D	NA
3218_D_Perv1	201,064	Grass	Grass	D	Library Pond_Existing
3218_D_Perv2	304,657	Grass	Grass	D	Library Pond_Existing
3218_D_Rd	47,500	Grass	ConventionalConcrete	D	NA
3402_B_Bdg	188,724	Grass	Roofs	B	Library Pond_Existing
3402_B_Imp	141,471	Grass	ConventionalConcrete	B	NA
3402_B_Perv	385,991	Grass	Grass	B	Library Pond_Existing
3402_B_Rd	128,278	Grass	ConventionalConcrete	B	NA
3402_C_Bdg	98,396	Grass	Roofs	C	Library Pond_Existing
3402_C_Imp	42,160	Grass	ConventionalConcrete	C	Library Pond_Existing
3402_C_Perv	429,486	Grass	Grass	C	Library Pond_Existing
3402_C_Rd	105,818	Grass	ConventionalConcrete	C	NA

3414_B_Bdg	58,379	Grass	Roofs	B	Library Pond_Existing
3414_B_Imp	63,926	Grass	ConventionalConcrete	B	Library Pond_Existing
3414_B_Perv	209,761	Grass	Grass	B	Library Pond_Existing
3414_B_Rd	49,096	Grass	ConventionalConcrete	B	NA
3414_C_Bdg	126,069	Grass	Roofs	C	Library Pond_Existing
3414_C_Imp	82,826	Grass	ConventionalConcrete	C	Library Pond_Existing
3414_C_Perv	308,800	Grass	Grass	C	Library Pond_Existing
3414_C_Rd	25,301	Grass	ConventionalConcrete	C	NA
3414_D_Bdg	14,315	Grass	Roofs	D	Library Pond_Existing
3414_D_Imp	49,279	Grass	ConventionalConcrete	D	Library Pond_Existing
3414_D_Perv	109,766	Grass	Grass	D	Library Pond_Existing
3414_D_Rd	22,834	Grass	ConventionalConcrete	D	NA
3417_D_Bdg	28,358	Grass	Roofs	D	Library Pond_Existing
3417_D_Imp	26,856	Grass	ConventionalConcrete	D	Library Pond_Existing
3417_D_Perv	74,227	Grass	Grass	D	Library Pond_Existing
3417_D_Rd	33,919	Grass	ConventionalConcrete	D	NA
3418A_B_Bdg	104,425	Grass	Roofs	B	Library Pond_Existing
3418A_B_Imp	86,889	Grass	ConventionalConcrete	B	NA
3418A_B_Perv	312,748	Grass	Grass	B	Library Pond_Existing
3418A_B_Rd	148,903	Grass	ConventionalConcrete	B	NA
3418B_B_Bdg	88,068	Grass	Roofs	B	Library Pond_Existing
3418B_B_Imp	139,481	Grass	ConventionalConcrete	B	NA
3418B_B_Perv	100,636	Grass	Grass	B	Library Pond_Existing

3418B_B_Rd	28,000	Grass	ConventionalConcrete	B	NA
3420_B_Imp	23,265	Grass	ConventionalConcrete	B	Library Pond_Existing
3420_B_Perv	39,389	Grass	Grass	B	Library Pond_Existing
3420_B_Rd	32,226	Grass	ConventionalConcrete	B	NA
3420_C_Bdg	109,273	Grass	Roofs	C	Library Pond_Existing
3420_C_Imp	275,853	Grass	ConventionalConcrete	C	Library Pond_Existing
3420_C_Perv	386,959	Grass	Grass	C	Library Pond_Existing
3420_C_Rd	9,675	Grass	ConventionalConcrete	C	NA
3425_C_Bdg	68,156	Grass	Roofs	C	Library Pond_Existing
3425_C_Imp	68,156	Grass	ConventionalConcrete	C	Library Pond_Existing
3425_C_Perv	202,555	Grass	Grass	C	Library Pond_Existing
3425_C_Rd	259,711	Grass	ConventionalConcrete	C	NA
3425_D_Bdg	11,387	Grass	Roofs	D	Library Pond_Existing
3425_D_Imp	31,398	Grass	ConventionalConcrete	D	Library Pond_Existing
3425_D_Perv	40,770	Grass	Grass	D	Library Pond_Existing
3436_C_Bdg	88,720	Grass	Roofs	C	Library Pond_Existing
3436_C_Imp	80,765	Grass	ConventionalConcrete	C	Library Pond_Existing
3436_C_Perv	238,917	Grass	Grass	C	Library Pond_Existing
3436_C_Rd	47,127	Grass	ConventionalConcrete	C	NA
3436_D_Bdg	96,205	Grass	Roofs	D	Library Pond_Existing
3436_D_Imp	75,308	Grass	ConventionalConcrete	D	Library Pond_Existing
3436_D_Perv	257,884	Grass	Grass	D	Library Pond_Existing
3436_D_Rd	76,800	Grass	ConventionalConcrete	D	NA

3443_D_Bdg	27,464	Grass	Roofs	D	Library Pond_Existing
3443_D_Imp	5,664	Grass	ConventionalConcrete	D	Library Pond_Existing
3443_D_Perv	99,259	Grass	Grass	D	Library Pond_Existing
3443_D_Rd	72,345	Grass	ConventionalConcrete	D	NA
5038_B_Bdg	35,902	Grass	Roofs	B	Library Pond_Existing
5038_B_Imp	71,437	Grass	ConventionalConcrete	B	Library Pond_Existing
5038_B_Perv	305,799	Grass	Grass	B	Library Pond_Existing
5038_B_Rd	64,436	Grass	ConventionalConcrete	B	NA
5038_C_Bdg	46,318	Grass	Roofs	C	Library Pond_Existing
5038_C_Imp	18,733	Grass	ConventionalConcrete	C	Library Pond_Existing
5038_C_Perv	105,053	Grass	Grass	C	Library Pond_Existing
5038_C_Rd	16,137	Grass	ConventionalConcrete	C	NA

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Library Pond_Existing	FCWQT	B3	15.08	30,130.0	3	258,676.8	243,359.2	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Simple Pond Geometry Configuration

Pond ID: Library Pond_Existing
Design: FlowControlAndTreatment

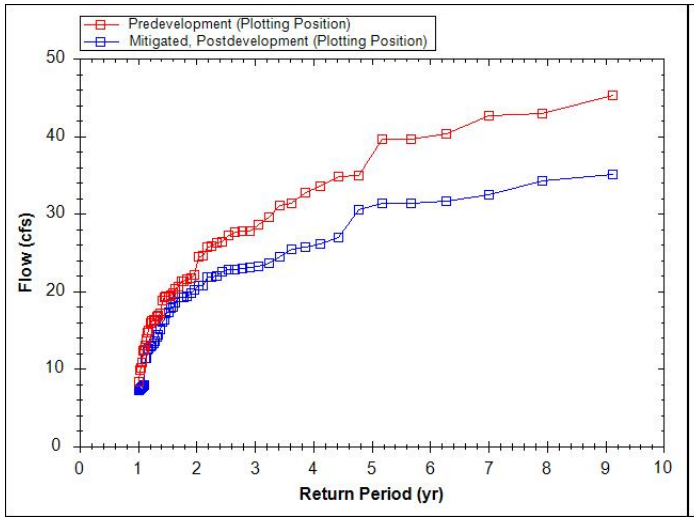
Shape Curve

Depth (ft)	Area (sq ft)
15.1	30,130.0

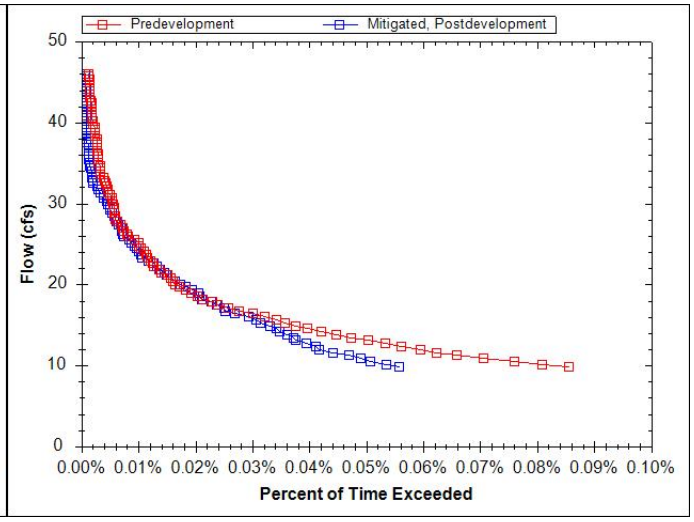
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	9.9
Upper Orifice Invert(ft)	9.8
Upper Orifice Dia (in)	25.2
Overflow Weir Invert(ft)	13.6
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Library Pond_Oak Savanna to Future
Project Type	Planning
Location	Wilsonville Public Library, 8200 SW Wilsonville Rd, Wilsonville, OR 97070
Stormwater Management Area	30130
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
5038_C_Perv	105,053	Grass	Grass	C	Library Pond_Future
5038_C_Rd	16,137	Grass	ConventionalConcrete	C	Library Pond_Future
5038_C_Bdg	50,147	Grass	Roofs	C	Library Pond_Future
5038_B_Perv	268,537	Grass	Grass	B	Library Pond_Future
5038_B_Rd	64,436	Grass	ConventionalConcrete	B	Library Pond_Future
5038_B_Bdg	36,815	Grass	Roofs	B	Library Pond_Future
5038_B_Imp	122,689	Grass	ConventionalConcrete	B	Library Pond_Future
3443_D_Perv	99,259	Grass	Grass	D	Library Pond_Future
3443_D_Rd	72,345	Grass	ConventionalConcrete	D	Library Pond_Future
3443_D_Bdg	27,464	Grass	Roofs	D	Library Pond_Future
3443_D_Imp	5,664	Grass	ConventionalConcrete	D	Library Pond_Future
3436_D_Perv	245,470	Grass	Grass	D	Library Pond_Future
3436_D_Rd	76,800	Grass	ConventionalCo	D	Library

			ncrete		Pond_Future
3436_D_Bdg	122,187	Grass	Roofs	D	Library Pond_Future
3436_D_Imp	61,740	Grass	ConventionalConcrete	D	Library Pond_Future
3436_C_Perv	213,971	Grass	Grass	C	Library Pond_Future
3436_C_Rd	47,127	Grass	ConventionalConcrete	C	Library Pond_Future
3436_C_Bdg	120,495	Grass	Roofs	C	Library Pond_Future
3436_C_Imp	73,935	Grass	ConventionalConcrete	C	Library Pond_Future
3425_D_Perv	40,770	Grass	Grass	D	Library Pond_Future
3425_D_Bdg	22,979	Grass	Roofs	D	Library Pond_Future
3425_D_Imp	19,807	Grass	ConventionalConcrete	D	Library Pond_Future
3425_C_Perv	202,555	Grass	Grass	C	Library Pond_Future
3425_C_Rd	259,711	Grass	ConventionalConcrete	C	Library Pond_Future
3425_C_Bdg	68,156	Grass	Roofs	C	Library Pond_Future
3425_C_Imp	68,156	Grass	ConventionalConcrete	C	Library Pond_Future
3420_C_Perv	379,853	Grass	Grass	C	Library Pond_Future
3420_C_Rd	9,675	Grass	ConventionalConcrete	C	Library Pond_Future
3420_C_Bdg	290,343	Grass	Roofs	C	Library Pond_Future
3420_C_Imp	101,889	Grass	ConventionalConcrete	C	Library Pond_Future
3420_B_Perv	39,389	Grass	Grass	B	Library Pond_Future
3420_B_Rd	32,226	Grass	ConventionalConcrete	B	Library Pond_Future
3420_B_Bdg	13,450	Grass	Roofs	B	Library Pond_Future
3420_B_Imp	9,815	Grass	ConventionalConcrete	B	Library Pond_Future
3418B_B_Perv	100,636	Grass	Grass	B	Library Pond_Future
3418B_B_Rd	28,000	Grass	ConventionalCo	B	Library

			ncrete		Pond_Future
3418B_B_Bdg	158,586	Grass	Roofs	B	Library Pond_Future
3418B_B_Imp	68,963	Grass	ConventionalConcrete	B	Library Pond_Future
3418A_B_Perv	312,748	Grass	Grass	B	Library Pond_Future
3418A_B_Rd	148,903	Grass	ConventionalConcrete	B	Library Pond_Future
3418A_B_Bdg	174,556	Grass	Roofs	B	Library Pond_Future
3418A_B_Imp	16,758	Grass	ConventionalConcrete	B	Library Pond_Future
3417_D_Perv	74,227	Grass	Grass	D	Library Pond_Future
3417_D_Rd	33,919	Grass	ConventionalConcrete	D	Library Pond_Future
3417_D_Bdg	55,214	Grass	Roofs	D	Library Pond_Future
3414_D_Perv	105,771	Grass	Grass	D	Library Pond_Future
3414_D_Rd	22,834	Grass	ConventionalConcrete	B	Library Pond_Future
3414_D_Bdg	52,414	Grass	Roofs	D	Library Pond_Future
3414_D_Imp	15,175	Grass	ConventionalConcrete	D	Library Pond_Future
3414_C_Perv	280,831	Grass	Grass	C	Library Pond_Future
3414_C_Rd	25,301	Grass	ConventionalConcrete	C	Library Pond_Future
3414_C_Bdg	236,864	Grass	Roofs	C	Library Pond_Future
3414_B_Perv	209,761	Grass	Grass	B	Library Pond_Future
3414_B_Rd	49,096	Grass	ConventionalConcrete	B	Library Pond_Future
3414_B_Bdg	88,565	Grass	Roofs	B	Library Pond_Future
3414_B_Imp	33,740	Grass	ConventionalConcrete	B	Library Pond_Future
3402_C_Perv	319,104	Grass	Grass	C	Library Pond_Future
3402_C_Rd	105,818	Grass	ConventionalConcrete	C	Library Pond_Future
3402_C_Bdg	250,938	Grass	Roofs	C	Library

					Pond_Future
3402_B_Perv	385,991	Grass	Grass	B	Library Pond_Future
3402_B_Rd	128,278	Grass	ConventionalConcrete	B	Library Pond_Future
3402_B_Bdg	330,195	Grass	Roofs	B	Library Pond_Future
3218_D_Perv	304,657	Grass	Grass	D	Library Pond_Future
3218_D_Rd	47,500	Grass	Grass	B	Library Pond_Future
3218_D_Bdg	22,140	Grass	Roofs	D	Library Pond_Future
3218_D_Imp	254,690	Grass	ConventionalConcrete	D	Library Pond_Future

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Library Pond_Future	FCWQT	B3	30.40	30,130.0	1	632,574.3	608,440.5	No

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

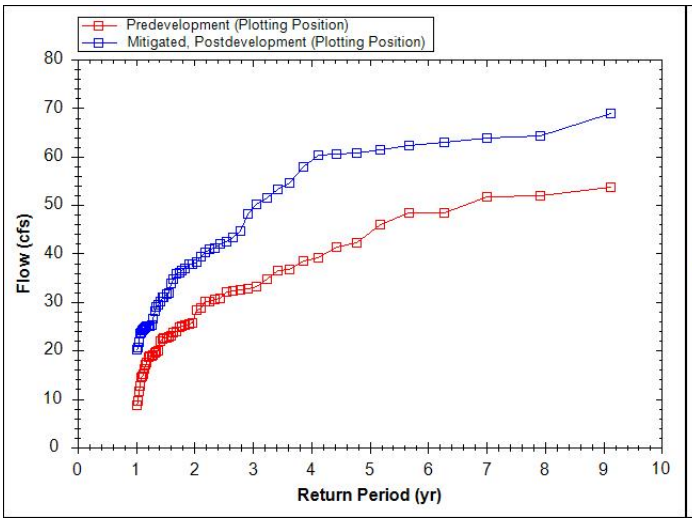
Custom Pond Geometry Configuration

Pond ID: Library Pond_Future
Design: FlowControlAndTreatment

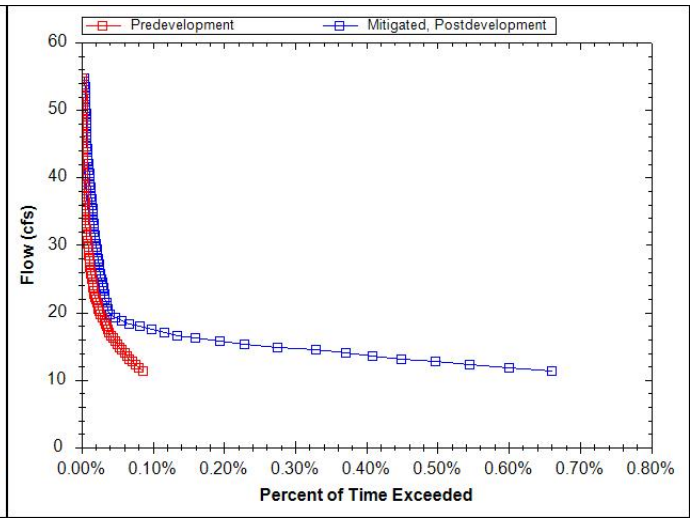
Shape Curve

Depth (ft)	Area (sq ft)	Discharge (cfs)
.0	.0	.0
1.0	10,018.0	9.4
2.0	17,859.0	14.3
5.0	23,522.0	19.7

Flow Frequency Chart



Flow Duration Chart



WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Library Pond_Oak Savanna to Future
Project Type	Planning
Location	Wilsonville Public Library, 8200 SW Wilsonville Rd, Wilsonville, OR 97070
Stormwater Management Area	30130
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
5038_C_Perv	105,053	Grass	Grass	C	Library Pond_Future
5038_C_Rd	16,137	Grass	ConventionalConcrete	C	Library Pond_Future
5038_C_Bdg	50,147	Grass	Roofs	C	Library Pond_Future
5038_B_Perv	268,537	Grass	Grass	B	Library Pond_Future
5038_B_Rd	64,436	Grass	ConventionalConcrete	B	Library Pond_Future
5038_B_Bdg	36,815	Grass	Roofs	B	Library Pond_Future
5038_B_Imp	122,689	Grass	ConventionalConcrete	B	Library Pond_Future
3443_D_Perv	99,259	Grass	Grass	D	Library Pond_Future
3443_D_Rd	72,345	Grass	ConventionalConcrete	D	Library Pond_Future
3443_D_Bdg	27,464	Grass	Roofs	D	Library Pond_Future
3443_D_Imp	5,664	Grass	ConventionalConcrete	D	Library Pond_Future
3436_D_Perv	245,470	Grass	Grass	D	Library Pond_Future
3436_D_Rd	76,800	Grass	ConventionalCo	D	Library

			ncrete		Pond_Future
3436_D_Bdg	122,187	Grass	Roofs	D	Library Pond_Future
3436_D_Imp	61,740	Grass	ConventionalConcrete	D	Library Pond_Future
3436_C_Perv	213,971	Grass	Grass	C	Library Pond_Future
3436_C_Rd	47,127	Grass	ConventionalConcrete	C	Library Pond_Future
3436_C_Bdg	120,495	Grass	Roofs	C	Library Pond_Future
3436_C_Imp	73,935	Grass	ConventionalConcrete	C	Library Pond_Future
3425_D_Perv	40,770	Grass	Grass	D	Library Pond_Future
3425_D_Bdg	22,979	Grass	Roofs	D	Library Pond_Future
3425_D_Imp	19,807	Grass	ConventionalConcrete	D	Library Pond_Future
3425_C_Perv	202,555	Grass	Grass	C	Library Pond_Future
3425_C_Rd	259,711	Grass	ConventionalConcrete	C	Library Pond_Future
3425_C_Bdg	68,156	Grass	Roofs	C	Library Pond_Future
3425_C_Imp	68,156	Grass	ConventionalConcrete	C	Library Pond_Future
3420_C_Perv	379,853	Grass	Grass	C	Library Pond_Future
3420_C_Rd	9,675	Grass	ConventionalConcrete	C	Library Pond_Future
3420_C_Bdg	290,343	Grass	Roofs	C	Library Pond_Future
3420_C_Imp	101,889	Grass	ConventionalConcrete	C	Library Pond_Future
3420_B_Perv	39,389	Grass	Grass	B	Library Pond_Future
3420_B_Rd	32,226	Grass	ConventionalConcrete	B	Library Pond_Future
3420_B_Bdg	13,450	Grass	Roofs	B	Library Pond_Future
3420_B_Imp	9,815	Grass	ConventionalConcrete	B	Library Pond_Future
3418B_B_Perv	100,636	Grass	Grass	B	Library Pond_Future
3418B_B_Rd	28,000	Grass	ConventionalCo	B	Library

			ncrete		Pond_Future
3418B_B_Bdg	158,586	Grass	Roofs	B	Library Pond_Future
3418B_B_Imp	68,963	Grass	ConventionalConcrete	B	Library Pond_Future
3418A_B_Perv	312,748	Grass	Grass	B	Library Pond_Future
3418A_B_Rd	148,903	Grass	ConventionalConcrete	B	Library Pond_Future
3418A_B_Bdg	174,556	Grass	Roofs	B	Library Pond_Future
3418A_B_Imp	16,758	Grass	ConventionalConcrete	B	Library Pond_Future
3417_D_Perv	74,227	Grass	Grass	D	Library Pond_Future
3417_D_Rd	33,919	Grass	ConventionalConcrete	D	Library Pond_Future
3417_D_Bdg	55,214	Grass	Roofs	D	Library Pond_Future
3414_D_Perv	105,771	Grass	Grass	D	Library Pond_Future
3414_D_Rd	22,834	Grass	ConventionalConcrete	B	Library Pond_Future
3414_D_Bdg	52,414	Grass	Roofs	D	Library Pond_Future
3414_D_Imp	15,175	Grass	ConventionalConcrete	D	Library Pond_Future
3414_C_Perv	280,831	Grass	Grass	C	Library Pond_Future
3414_C_Rd	25,301	Grass	ConventionalConcrete	C	Library Pond_Future
3414_C_Bdg	236,864	Grass	Roofs	C	Library Pond_Future
3414_B_Perv	209,761	Grass	Grass	B	Library Pond_Future
3414_B_Rd	49,096	Grass	ConventionalConcrete	B	Library Pond_Future
3414_B_Bdg	88,565	Grass	Roofs	B	Library Pond_Future
3414_B_Imp	33,740	Grass	ConventionalConcrete	B	Library Pond_Future
3402_C_Perv	319,104	Grass	Grass	C	Library Pond_Future
3402_C_Rd	105,818	Grass	ConventionalConcrete	C	Library Pond_Future
3402_C_Bdg	250,938	Grass	Roofs	C	Library

					Pond_Future
3402_B_Perv	385,991	Grass	Grass	B	Library Pond_Future
3402_B_Rd	128,278	Grass	ConventionalConcrete	B	Library Pond_Future
3402_B_Bdg	330,195	Grass	Roofs	B	Library Pond_Future
3218_D_Perv	304,657	Grass	Grass	D	Library Pond_Future
3218_D_Rd	47,500	Grass	Grass	B	Library Pond_Future
3218_D_Bdg	22,140	Grass	Roofs	D	Library Pond_Future
3218_D_Imp	254,690	Grass	ConventionalConcrete	D	Library Pond_Future

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Library Pond_Future	FCWQT	B3	30.40	30,130.0	1	632,574.3	608,440.5	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Simple Pond Geometry Configuration

Pond ID: Library Pond_Future
Design: FlowControlAndTreatment

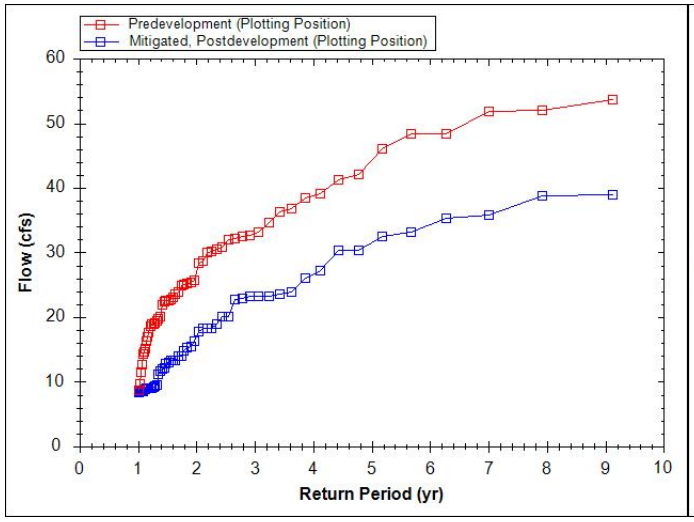
Shape Curve

Depth (ft)	Area (sq ft)
30.4	30,130.0

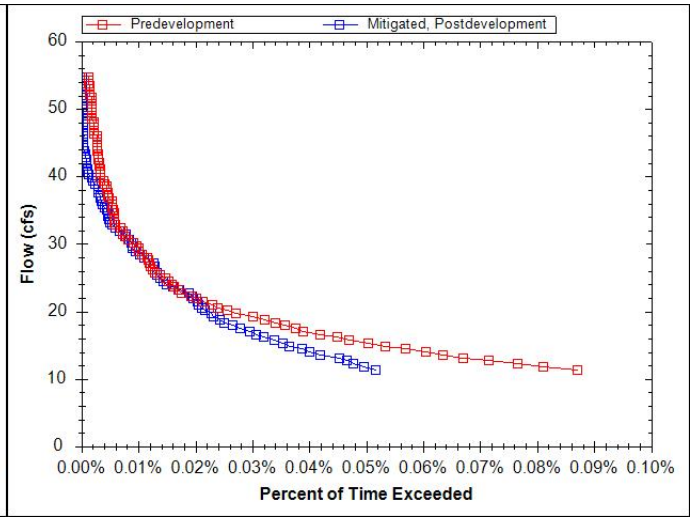
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	7.5
Upper Orifice Invert(ft)	38.8
Upper Orifice Dia (in)	19.5
Overflow Weir Invert(ft)	56.9
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Library Pond_Oak Savanna to Future
Project Type	Planning
Location	Wilsonville Public Library, 8200 SW Wilsonville Rd, Wilsonville, OR 97070
Stormwater Management Area	30130
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
5038_C_Perv	105,053	Grass	Grass	C	Library Pond_Future
5038_C_Rd	16,137	Grass	ConventionalConcrete	C	Planter 2
5038_C_Bdg	50,147	Grass	Roofs	C	Library Pond_Future
5038_B_Perv	268,537	Grass	Grass	B	Library Pond_Future
5038_B_Rd	64,436	Grass	ConventionalConcrete	B	Planter 2
5038_B_Bdg	36,815	Grass	Roofs	B	Library Pond_Future
5038_B_Imp	122,689	Grass	ConventionalConcrete	B	Library Pond_Future
3443_D_Perv	99,259	Grass	Grass	D	Library Pond_Future
3443_D_Rd	72,345	Grass	ConventionalConcrete	D	Planter 3
3443_D_Bdg	27,464	Grass	Roofs	D	Library Pond_Future
3443_D_Imp	5,664	Grass	ConventionalConcrete	D	Library Pond_Future
3436_D_Perv	245,470	Grass	Grass	D	Library Pond_Future
3436_D_Rd	76,800	Grass	ConventionalCo	D	Planter 2

			ncrete		
3436_D_Bdg	122,187	Grass	Roofs	D	Library Pond_Future
3436_D_Imp	61,740	Grass	ConventionalConcrete	D	Planter 4
3436_C_Perv	213,971	Grass	Grass	C	Library Pond_Future
3436_C_Rd	47,127	Grass	ConventionalConcrete	C	Planter 3
3436_C_Bdg	120,495	Grass	Roofs	C	Library Pond_Future
3436_C_Imp	73,935	Grass	ConventionalConcrete	C	Library Pond_Future
3425_D_Perv	40,770	Grass	Grass	D	Library Pond_Future
3425_D_Bdg	22,979	Grass	Roofs	D	Library Pond_Future
3425_D_Imp	19,807	Grass	ConventionalConcrete	D	Library Pond_Future
3425_C_Perv	202,555	Grass	Grass	C	Library Pond_Future
3425_C_Rd	259,711	Grass	ConventionalConcrete	C	Planter 1
3425_C_Bdg	68,156	Grass	Roofs	C	Library Pond_Future
3425_C_Imp	68,156	Grass	ConventionalConcrete	C	Library Pond_Future
3420_C_Perv	379,853	Grass	Grass	C	Library Pond_Future
3420_C_Rd	9,675	Grass	ConventionalConcrete	C	Planter 3
3420_C_Bdg	290,343	Grass	Roofs	C	Library Pond_Future
3420_C_Imp	101,889	Grass	ConventionalConcrete	C	Library Pond_Future
3420_B_Perv	39,389	Grass	Grass	B	Library Pond_Future
3420_B_Rd	32,226	Grass	ConventionalConcrete	B	Planter 3
3420_B_Bdg	13,450	Grass	Roofs	B	Planter 6
3420_B_Imp	9,815	Grass	ConventionalConcrete	B	Planter 4
3418B_B_Perv	100,636	Grass	Grass	B	Library Pond_Future
3418B_B_Rd	28,000	Grass	ConventionalConcrete	B	Planter 3

3418B_B_Bdg	158,586	Grass	Roofs	B	Library Pond_Future
3418B_B_Imp	68,963	Grass	ConventionalConcrete	B	Library Pond_Future
3418A_B_Perv	312,748	Grass	Grass	B	Library Pond_Future
3418A_B_Rd	148,903	Grass	ConventionalConcrete	B	Planter 2
3418A_B_Bdg	174,556	Grass	Roofs	B	Library Pond_Future
3418A_B_Imp	16,758	Grass	ConventionalConcrete	B	Library Pond_Future
3417_D_Perv	74,227	Grass	Grass	D	Library Pond_Future
3417_D_Rd	33,919	Grass	ConventionalConcrete	D	Planter 3
3417_D_Bdg	55,214	Grass	Roofs	D	Library Pond_Future
3414_D_Perv	105,771	Grass	Grass	D	Library Pond_Future
3414_D_Rd	22,834	Grass	ConventionalConcrete	B	Planter 2
3414_D_Bdg	52,414	Grass	Roofs	D	Library Pond_Future
3414_D_Imp	15,175	Grass	ConventionalConcrete	D	Library Pond_Future
3414_C_Perv	280,831	Grass	Grass	C	Library Pond_Future
3414_C_Rd	25,301	Grass	ConventionalConcrete	C	Planter 3
3414_C_Bdg	236,864	Grass	Roofs	C	Library Pond_Future
3414_B_Perv	209,761	Grass	Grass	B	Library Pond_Future
3414_B_Rd	49,096	Grass	ConventionalConcrete	B	Planter 3
3414_B_Bdg	88,565	Grass	Roofs	B	Library Pond_Future
3414_B_Imp	33,740	Grass	ConventionalConcrete	B	Library Pond_Future
3402_C_Perv	319,104	Grass	Grass	C	Library Pond_Future
3402_C_Rd	105,818	Grass	ConventionalConcrete	C	Planter 2
3402_C_Bdg	250,938	Grass	Roofs	C	Planter 6
3402_B_Perv	385,991	Grass	Grass	B	Library

					Pond_Future
3402_B_Rd	128,278	Grass	ConventionalConcrete	B	Planter 1
3402_B_Bdg	330,195	Grass	Roofs	B	Planter 5
3218_D_Perv	304,657	Grass	Grass	D	Library Pond_Future
3218_D_Rd	47,500	Grass	Grass	B	Planter 1
3218_D_Bdg	22,140	Grass	Roofs	D	Library Pond_Future
3218_D_Imp	254,690	Grass	ConventionalConcrete	D	Planter 4

LID Facility Sizing Details

LID ID	Design Criteria	BMP Type	Facility Soil Type	Minimum Area (sq-ft)	Planned Areas (sq-ft)	Orifice Diameter (in)
Planter 1	FlowControlAndTreatment	Stormwater Planter - Infiltration	B3	31,696.4	31,697.0	0.0
Planter 2	FlowControlAndTreatment	Stormwater Planter - Infiltration	B3	43,376.2	43,377.0	0.0
Planter 3	FlowControlAndTreatment	Stormwater Planter - Infiltration	B3	23,933.0	23,933.0	0.0
Planter 4	FlowControlAndTreatment	Stormwater Planter - Infiltration	B3	14,129.5	14,357.0	0.0
Planter 5	FlowControlAndTreatment	Stormwater Planter - Infiltration	B3	49,529.3	54,273.0	0.0
Planter 6	FlowControlAndTreatment	Stormwater Planter - Infiltration	B3	12,055.0	12,247.0	0.0

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Library Pond_Future	FCWQT	B3	15.04	30,130.0	3	258,400.3	243,002.9	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Simple Pond Geometry Configuration

Pond ID: Library Pond_Future
Design: FlowControlAndTreatment

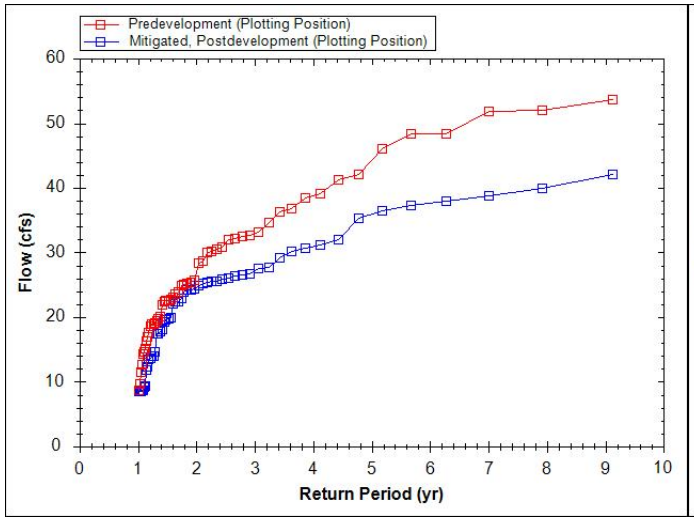
Shape Curve

Depth (ft)	Area (sq ft)
15.0	30,130.0

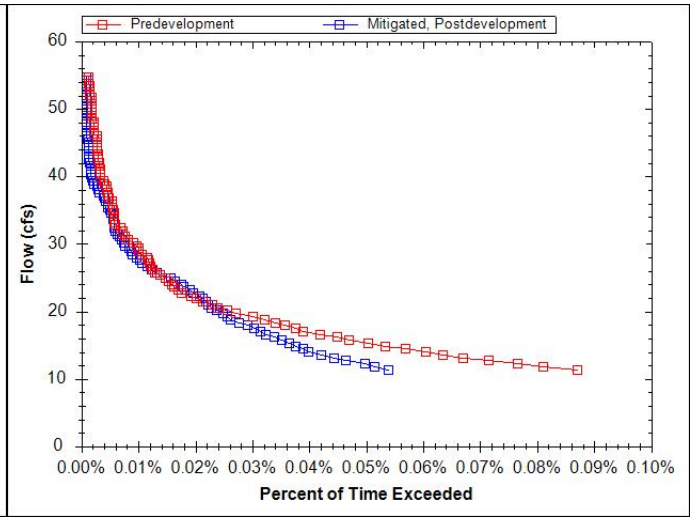
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	10.6
Upper Orifice Invert(ft)	10.1
Upper Orifice Dia (in)	27.4
Overflow Weir Invert(ft)	14.0
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Library Pond_Existing to Future
Project Type	Planning
Location	Wilsonville Public Library, 8200 SW Wilsonville Rd, Wilsonville, OR 97070
Stormwater Management Area	30130
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
3417_D_Ex_Imp_Fu_Bdg	26,856	Impervious	Roofs	D	Library Pond_existing to future
5038_C_Ex_Perv_Fu_Perv	105,053	Grass	Grass	C	Library Pond_existing to future
5038_C_Ex_Rd_Fu_Rd	16,137	Impervious	ConventionalConcrete	C	Library Pond_existing to future
5038_C_Ex_Bdg_Fu_Bdg	46,318	Impervious	Roofs	C	Library Pond_existing to future
5038_C_Ex_Imp_Fu_Bdg	3,829	Impervious	Roofs	C	Library Pond_existing to future
5038_C_Ex_Imp_Fu_Imp	14,903	Impervious	ConventionalConcrete	C	Library Pond_existing to future
5038_B_Ex_Perv_Fu_Imp	37,262	Grass	ConventionalConcrete	B	Library Pond_existing to future
5038_B_Ex_Perv_Fu_Perv	268,537	Grass	Grass	B	Library Pond_existing to future
5038_B_Ex_Rd_Fu_Rd	64,436	Impervious	ConventionalConcrete	B	Library Pond_existing to future

5038_B_Ex_Bdg_Fu_Bdg	35,902	Impervious	Roofs	B	Library Pond_existing to future
5038_B_Ex_Imp_Fu_Bdg	913	Impervious	Roofs	B	Library Pond_existing to future
5038_B_Ex_Imp_Fu_Imp	70,524	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3436_D_Ex_Perv_Fu_Imp	12,414	Grass	ConventionalConcrete	D	Library Pond_existing to future
3436_D_Ex_Perv_Fu_Perv	245,470	Grass	Grass	D	Library Pond_existing to future
3436_D_Ex_Rd_Fu_Rd	76,800	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3436_D_Ex_Bdg_Fu_Bdg	96,205	Impervious	Roofs	D	Library Pond_existing to future
3436_D_Ex_Imp_Fu_Bdg	25,982	Impervious	Roofs	D	Library Pond_existing to future
3436_D_Ex_Imp_Fu_Imp	49,326	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3436_C_Ex_Perv_Fu_Bgd	12,532	Grass	Roofs	C	Library Pond_existing to future
3436_C_Ex_Perv_Fu_Imp	12,414	Grass	ConventionalConcrete	C	Library Pond_existing to future
3436_C_Ex_Perv_Fu_Perv	213,971	Grass	Grass	C	Library Pond_existing to future
3436_C_Ex_Rd_Fu_Rd	47,127	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3436_C_Ex_Bdg_Fu_Bdg	88,720	Impervious	Roofs	C	Library Pond_existing to future
3436_C_Ex_Imp_Fu_Bdg	19,243	Impervious	Roofs	C	Library Pond_existing to future
3436_C_Ex_Imp_Fu_Imp	61,521	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3425_D_Ex_Pe	40,770	Grass	Grass	D	Library

rv_Fu_Perv					Pond_existing to future
3425_D_Ex_Bdg_Fu_Bdg	11,387	Impervious	Roofs	D	Library Pond_existing to future
3425_D_Ex_Imp_Fu_Bdg3425_D_Ex_Imp_Fu_Bdg	11,592	Impervious	Roofs	D	Library Pond_existing to future
3425_D_Ex_Imp_Fu_Imp	19,807	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3425_C_Ex_Perv_Fu_Perv	202,555	Grass	Grass	C	Library Pond_existing to future
3425_C_Ex_Rd_Fu_Rd	259,711	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3425_C_Ex_Bdg_Fu_Bdg	68,156	Impervious	Roofs	C	Library Pond_existing to future
3425_C_Ex_Imp_Fu_Imp	68,156	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3420_C_Ex_Perv_Fu_Bgd	7,106	Grass	Roofs	C	Library Pond_existing to future
3420_C_Ex_Perv_Fu_Perv	379,853	Grass	Grass	C	Library Pond_existing to future
3420_C_Ex_Rd_Fu_Rd	9,675	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3420_C_Ex_Bdg_Fu_Bdg	109,273	Impervious	Roofs	C	Library Pond_existing to future
3420_C_Ex_Imp_Fu_Bdg	173,964	Impervious	Roofs	C	Library Pond_existing to future
3420_C_Ex_Imp_Fu_Imp	101,889	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3420_B_Ex_Perv_Fu_Perv	39,389	Grass	Grass	B	Library Pond_existing to future
3420_B_Ex_Rd_Fu_Rd	32,226	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3420_B_Ex_Im	13,450	Impervious	Roofs	B	Library

p_Fu_Bdg					Pond_existing to future
3420_B_Ex_Imp_Fu_Imp	9,815	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3418B_B_Ex_Perv_Fu_Perv	100,636	Grass	Grass	B	Library Pond_existing to future
3418B_B_Ex_Rd_Fu_Rd	28,000	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3418B_B_Ex_Bdg_Fu_Bdg	88,068	Impervious	Roofs	B	Library Pond_existing to future
3418B_B_Ex_Imp_Fu_Bdg	70,518	Impervious	Roofs	B	Library Pond_existing to future
3418B_B_Ex_Imp_Fu_Imp	68,963	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3418A_B_Ex_Perv_Fu_Perv	312,748	Grass	Grass	B	Library Pond_existing to future
3418A_B_Ex_Rd_Fu_Rd	148,903	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3418A_B_Ex_Bdg_Fu_Bdg	104,425	Impervious	Roofs	B	Library Pond_existing to future
3418A_B_Ex_Imp_Fu_Bdg	70,131	Impervious	Roofs	B	Library Pond_existing to future
3418A_B_Ex_Imp_Fu_Imp	16,758	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3443_D_Ex_Perv_Fu_Perv	99,259	Grass	Grass	D	Library Pond_existing to future
3443_D_Ex_Rd_Fu_Rd	72,345	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3443_D_Ex_Bdg_Fu_Bdg	27,464	Impervious	Roofs	D	Library Pond_existing to future
3443_D_Ex_Imp_Fu_Imp	5,664	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3402_C_Ex_Perv_Fu_Bgd	110,382	Grass	Roofs	C	Library Pond_existing

					to future
3402_C_Ex_Perv_Fu_Perv	319,104	Grass	Grass	C	Library Pond_existing to future
3402_C_Ex_Rd_Fu_Rd	105,818	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3402_C_Ex_Bdg_Fu_Bdg	98,396	Impervious	Roofs	C	Library Pond_existing to future
3402_C_Ex_Imp_Fu_Bdg	42,160	Impervious	Roofs	C	Library Pond_existing to future
3402_B_Ex_Perv_Fu_Perv	385,992	Grass	Grass	B	Library Pond_existing to future
3402_B_Ex_Rd_Fu_Rd	128,278	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3402_B_Ex_Bdg_Fu_Bdg	188,724	Impervious	Roofs	B	Library Pond_existing to future
3402_B_Ex_Imp_Fu_Bdg	141,471	Impervious	Roofs	B	Library Pond_existing to future
3218_D_Ex_Perv_Fu_Imp	201,064	Grass	ConventionalConcrete	D	Library Pond_existing to future
3218_D_Ex_Perv_Fu_Perv	304,657	Grass	Grass	D	Library Pond_existing to future
3218_D_Ex_Rd_Fu_Rd	47,500	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3218_D_Ex_Bdg_Fu_Bdg	22,140	Impervious	Roofs	D	Library Pond_existing to future
3218_D_Ex_Imp_Fu_Imp	53,626	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3417_D_Ex_Bdg_Fu_Bdg	28,358	Impervious	Roofs	D	Library Pond_existing to future
3417_D_Ex_Rd_Fu_Rd	33,919	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3417_D_Ex_Perv_Fu_Perv	74,227	Grass	Grass	D	Library Pond_existing to future

3414_B_Ex_Imp_Fu_Imp	33,740	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3414_B_Ex_Imp_Fu_Bdg	30,186	Impervious	Roofs	B	Library Pond_existing to future
3414_B_Ex_Bdg_Fu_Bdg	58,379	Impervious	Roofs	B	Library Pond_existing to future
3414_B_Ex_Rd_Fu_Rd	49,096	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3414_B_Ex_Perv_Fu_Perv	209,761	Grass	Grass	B	Library Pond_existing to future
3414_C_Ex_Imp_Fu_Bdg	82,826	Impervious	Roofs	C	Library Pond_existing to future
3414_C_Ex_Bdg_Fu_Bdg	126,069	Impervious	Roofs	C	Library Pond_existing to future
3414_C_Ex_Rd_Fu_Rd	25,301	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3414_C_Ex_Perv_Fu_Perv	280,831	Grass	Grass	C	Library Pond_existing to future
3414_C_Ex_Perv_Fu_Bgd	27,969	Grass	Roofs	C	Library Pond_existing to future
3414_D_Ex_Imp_Fu_Imp	11,180	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3414_D_Ex_Imp_Fu_Bdg	38,099	Impervious	Roofs	D	Library Pond_existing to future
3414_D_Ex_Bdg_Fu_Bdg	14,315	Impervious	Roofs	D	Library Pond_existing to future
3414_D_Ex_Rd_Fu_Rd	22,834	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3414_D_Ex_Perv_Fu_Perv	105,771	Grass	Grass	D	Library Pond_existing to future
3414_D_Ex_Perv_Fu_Imp	3,995	Grass	ConventionalConcrete	D	Library Pond_existing to future

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Library Pond_existing to future	FCWQT	B3	7.09	30,130.0	4	151,419.6	121,444.8	No

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

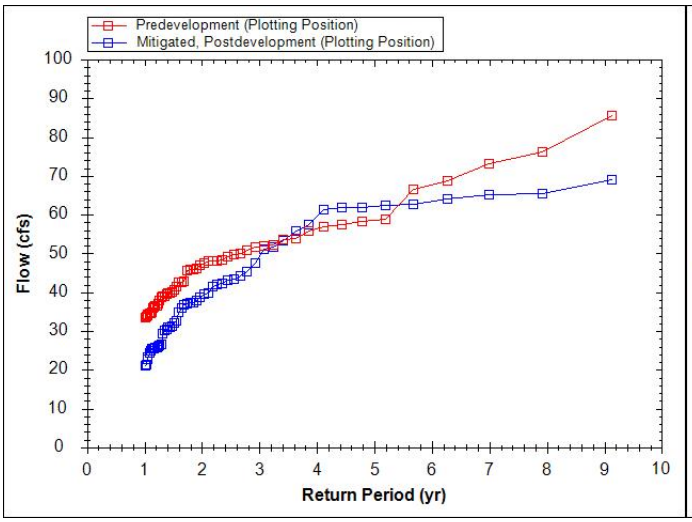
Custom Pond Geometry Configuration

Pond ID: Library Pond_existing to future
Design: FlowControlAndTreatment

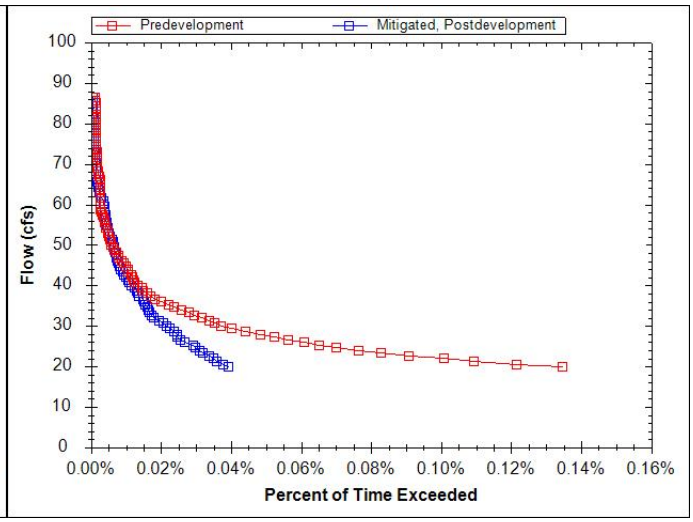
Shape Curve

Depth (ft)	Area (sq ft)	Discharge (cfs)
.0	.0	.0
1.0	10,018.0	9.4
2.0	17,859.0	14.3
5.0	23,522.0	19.7

Flow Frequency Chart



Flow Duration Chart



WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Library Pond_Existing to Future
Project Type	Planning
Location	Wilsonville Public Library, 8200 SW Wilsonville Rd, Wilsonville, OR 97070
Stormwater Management Area	30130
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
3417_D_Ex_Imp_Fu_Bdg	26,856	Impervious	Roofs	D	Library Pond_existing to future
5038_C_Ex_Perv_Fu_Perv	105,053	Grass	Grass	C	Library Pond_existing to future
5038_C_Ex_Rd_Fu_Rd	16,137	Impervious	ConventionalConcrete	C	Library Pond_existing to future
5038_C_Ex_Bdg_Fu_Bdg	46,318	Impervious	Roofs	C	Library Pond_existing to future
5038_C_Ex_Imp_Fu_Bdg	3,829	Impervious	Roofs	C	Library Pond_existing to future
5038_C_Ex_Imp_Fu_Imp	14,903	Impervious	ConventionalConcrete	C	Library Pond_existing to future
5038_B_Ex_Perv_Fu_Imp	37,262	Grass	ConventionalConcrete	B	Library Pond_existing to future
5038_B_Ex_Perv_Fu_Perv	268,537	Grass	Grass	B	Library Pond_existing to future
5038_B_Ex_Rd_Fu_Rd	64,436	Impervious	ConventionalConcrete	B	Library Pond_existing to future

5038_B_Ex_Bdg_Fu_Bdg	35,902	Impervious	Roofs	B	Library Pond_existing to future
5038_B_Ex_Imp_Fu_Bdg	913	Impervious	Roofs	B	Library Pond_existing to future
5038_B_Ex_Imp_Fu_Imp	70,524	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3436_D_Ex_Perv_Fu_Imp	12,414	Grass	ConventionalConcrete	D	Library Pond_existing to future
3436_D_Ex_Perv_Fu_Perv	245,470	Grass	Grass	D	Library Pond_existing to future
3436_D_Ex_Rd_Fu_Rd	76,800	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3436_D_Ex_Bdg_Fu_Bdg	96,205	Impervious	Roofs	D	Library Pond_existing to future
3436_D_Ex_Imp_Fu_Bdg	25,982	Impervious	Roofs	D	Library Pond_existing to future
3436_D_Ex_Imp_Fu_Imp	49,326	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3436_C_Ex_Perv_Fu_Bgd	12,532	Grass	Roofs	C	Library Pond_existing to future
3436_C_Ex_Perv_Fu_Imp	12,414	Grass	ConventionalConcrete	C	Library Pond_existing to future
3436_C_Ex_Perv_Fu_Perv	213,971	Grass	Grass	C	Library Pond_existing to future
3436_C_Ex_Rd_Fu_Rd	47,127	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3436_C_Ex_Bdg_Fu_Bdg	88,720	Impervious	Roofs	C	Library Pond_existing to future
3436_C_Ex_Imp_Fu_Bdg	19,243	Impervious	Roofs	C	Library Pond_existing to future
3436_C_Ex_Imp_Fu_Imp	61,521	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3425_D_Ex_Pe	40,770	Grass	Grass	D	Library

rv_Fu_Perv					Pond_existing to future
3425_D_Ex_Bdg_Fu_Bdg	11,387	Impervious	Roofs	D	Library Pond_existing to future
3425_D_Ex_Imp_Fu_Bdg3425_D_Ex_Imp_Fu_Bdg	11,592	Impervious	Roofs	D	Library Pond_existing to future
3425_D_Ex_Imp_Fu_Imp	19,807	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3425_C_Ex_Perv_Fu_Perv	202,555	Grass	Grass	C	Library Pond_existing to future
3425_C_Ex_Rd_Fu_Rd	259,711	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3425_C_Ex_Bdg_Fu_Bdg	68,156	Impervious	Roofs	C	Library Pond_existing to future
3425_C_Ex_Imp_Fu_Imp	68,156	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3420_C_Ex_Perv_Fu_Bgd	7,106	Grass	Roofs	C	Library Pond_existing to future
3420_C_Ex_Perv_Fu_Perv	379,853	Grass	Grass	C	Library Pond_existing to future
3420_C_Ex_Rd_Fu_Rd	9,675	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3420_C_Ex_Bdg_Fu_Bdg	109,273	Impervious	Roofs	C	Library Pond_existing to future
3420_C_Ex_Imp_Fu_Bdg	173,964	Impervious	Roofs	C	Library Pond_existing to future
3420_C_Ex_Imp_Fu_Imp	101,889	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3420_B_Ex_Perv_Fu_Perv	39,389	Grass	Grass	B	Library Pond_existing to future
3420_B_Ex_Rd_Fu_Rd	32,226	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3420_B_Ex_Im	13,450	Impervious	Roofs	B	Library

p_Fu_Bdg					Pond_existing to future
3420_B_Ex_Imp_Fu_Imp	9,815	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3418B_B_Ex_Perv_Fu_Perv	100,636	Grass	Grass	B	Library Pond_existing to future
3418B_B_Ex_Rd_Fu_Rd	28,000	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3418B_B_Ex_Bdg_Fu_Bdg	88,068	Impervious	Roofs	B	Library Pond_existing to future
3418B_B_Ex_Imp_Fu_Bdg	70,518	Impervious	Roofs	B	Library Pond_existing to future
3418B_B_Ex_Imp_Fu_Imp	68,963	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3418A_B_Ex_Perv_Fu_Perv	312,748	Grass	Grass	B	Library Pond_existing to future
3418A_B_Ex_Rd_Fu_Rd	148,903	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3418A_B_Ex_Bdg_Fu_Bdg	104,425	Impervious	Roofs	B	Library Pond_existing to future
3418A_B_Ex_Imp_Fu_Bdg	70,131	Impervious	Roofs	B	Library Pond_existing to future
3418A_B_Ex_Imp_Fu_Imp	16,758	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3443_D_Ex_Perv_Fu_Perv	99,259	Grass	Grass	D	Library Pond_existing to future
3443_D_Ex_Rd_Fu_Rd	72,345	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3443_D_Ex_Bdg_Fu_Bdg	27,464	Impervious	Roofs	D	Library Pond_existing to future
3443_D_Ex_Imp_Fu_Imp	5,664	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3402_C_Ex_Perv_Fu_Bgd	110,382	Grass	Roofs	C	Library Pond_existing

					to future
3402_C_Ex_Perv_Fu_Perv	319,104	Grass	Grass	C	Library Pond_existing to future
3402_C_Ex_Rd_Fu_Rd	105,818	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3402_C_Ex_Bdg_Fu_Bdg	98,396	Impervious	Roofs	C	Library Pond_existing to future
3402_C_Ex_Imp_Fu_Bdg	42,160	Impervious	Roofs	C	Library Pond_existing to future
3402_B_Ex_Perv_Fu_Perv	385,992	Grass	Grass	B	Library Pond_existing to future
3402_B_Ex_Rd_Fu_Rd	128,278	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3402_B_Ex_Bdg_Fu_Bdg	188,724	Impervious	Roofs	B	Library Pond_existing to future
3402_B_Ex_Imp_Fu_Bdg	141,471	Impervious	Roofs	B	Library Pond_existing to future
3218_D_Ex_Perv_Fu_Imp	201,064	Grass	ConventionalConcrete	D	Library Pond_existing to future
3218_D_Ex_Perv_Fu_Perv	304,657	Grass	Grass	D	Library Pond_existing to future
3218_D_Ex_Rd_Fu_Rd	47,500	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3218_D_Ex_Bdg_Fu_Bdg	22,140	Impervious	Roofs	D	Library Pond_existing to future
3218_D_Ex_Imp_Fu_Imp	53,626	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3417_D_Ex_Bdg_Fu_Bdg	28,358	Impervious	Roofs	D	Library Pond_existing to future
3417_D_Ex_Rd_Fu_Rd	33,919	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3417_D_Ex_Perv_Fu_Perv	74,227	Grass	Grass	D	Library Pond_existing to future

3414_B_Ex_Imp_Fu_Imp	33,740	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3414_B_Ex_Imp_Fu_Bdg	30,186	Impervious	Roofs	B	Library Pond_existing to future
3414_B_Ex_Bdg_Fu_Bdg	58,379	Impervious	Roofs	B	Library Pond_existing to future
3414_B_Ex_Rd_Fu_Rd	49,096	Impervious	ConventionalConcrete	B	Library Pond_existing to future
3414_B_Ex_Perv_Fu_Perv	209,761	Grass	Grass	B	Library Pond_existing to future
3414_C_Ex_Imp_Fu_Bdg	82,826	Impervious	Roofs	C	Library Pond_existing to future
3414_C_Ex_Bdg_Fu_Bdg	126,069	Impervious	Roofs	C	Library Pond_existing to future
3414_C_Ex_Rd_Fu_Rd	25,301	Impervious	ConventionalConcrete	C	Library Pond_existing to future
3414_C_Ex_Perv_Fu_Perv	280,831	Grass	Grass	C	Library Pond_existing to future
3414_C_Ex_Perv_Fu_Bgd	27,969	Grass	Roofs	C	Library Pond_existing to future
3414_D_Ex_Imp_Fu_Imp	11,180	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3414_D_Ex_Imp_Fu_Bdg	38,099	Impervious	Roofs	D	Library Pond_existing to future
3414_D_Ex_Bdg_Fu_Bdg	14,315	Impervious	Roofs	D	Library Pond_existing to future
3414_D_Ex_Rd_Fu_Rd	22,834	Impervious	ConventionalConcrete	D	Library Pond_existing to future
3414_D_Ex_Perv_Fu_Perv	105,771	Grass	Grass	D	Library Pond_existing to future
3414_D_Ex_Perv_Fu_Imp	3,995	Grass	ConventionalConcrete	D	Library Pond_existing to future

LID Facility Sizing Details

Pond Sizing Details

Pond ID	Design Criteria(1)	Facility Soil Type	Max Depth (ft)(2)	Top Area (sq-ft)	Side Slope (1:H)	Facility Vol. (cu-ft)(3)	Water Storage Vol. (cu-ft)(4)	Adequate Size?
Library Pond_existing to future	FCWQT	B3	7.09	30,130.0	4	151,419.6	121,444.8	Yes

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Simple Pond Geometry Configuration

Pond ID: Library Pond_existing to future
Design: FlowControlAndTreatment

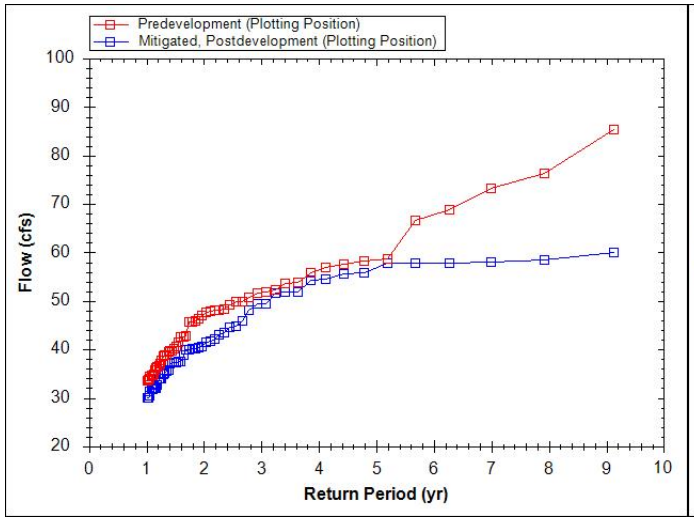
Shape Curve

Depth (ft)	Area (sq ft)
7.1	30,130.0

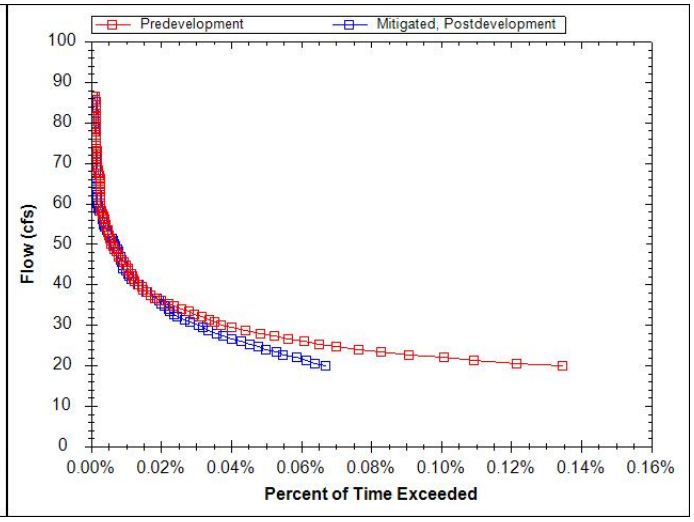
Outlet Structure Details

Lower Orifice Invert (ft)	0.0
Lower Orifice Dia (in)	16.9
Upper Orifice Invert(ft)	4.8
Upper Orifice Dia (in)	40.9
Overflow Weir Invert(ft)	6.1
Overflow Weir Length (ft)	6.3

Flow Frequency Chart



Flow Duration Chart



Appendix G: Staffing Evaluation

6500 S Macadam Avenue, Suite 200
Portland, OR 97239-3552

T: 503.244.7005

Prepared for: City of Wilsonville

Project Title: Wilsonville Stormwater Master Plan

Project No.: 156157.002.001

Staff Analysis Tables

Subject: Stormwater Staffing Analysis

Date: January 24, 2024

To: Kerry Rappold, City of Wilsonville

From: Angela Wieland, Brown and Caldwell

Prepared by: Shelby Gilmartin, EIT

Reviewed by: Angela Wieland, PE

Table of Contents

List of Abbreviations

BMP	Best Management Practice
CCTV	Closed-circuit Television
City	City of Wilsonville
CP	Capital Project
CREST	Center for Research in Environmental Sciences & Technologies
DEI	Diversity, Equity, and Inclusion
EC	Construction Site Runoff Control
Ft	Feet
FTE	Full-Time Employee
FY	Fiscal Year
Hr	Hour
HPSE	High Pollutant Source Facilities
ILL	Illicit Discharge Detection and Elimination
IND	Industrial and Commercial Facilities
IPM	Integrated Pest Management
LF	Linear Feet
NPDES	National Pollution Discharge Elimination System
OM	Pollution Prevention and Good Housekeeping for Municipal Operations
OSHA	Occupational Safety and Health Administration
PC	Post-Construction Site Runoff for New Development and Redevelopment
PEO	Public Education and Outreach
PI	Public Involvement
SF	Square Feet
SMP	Stormwater Master Plan
SWMP	Stormwater Management Program
SWPPP	Stormwater Pollution Prevention Plan
TBD	To Be Determined
TM	Technical Memorandum (Tech Memo)
WERK	Wilsonville Environmental Resource Keepers

Assumptions

A. This staffing analysis assumes that existing City staff is able to implement the current stormwater program (pre-2022 conditions). Additional activities not previously conducted by the City under current staffing were used to create the estimates of additional staff resource needs. Additional activities include those associated with the reissued NPDES MS4 permit (2021) and implementation of the proposed Capital Projects (CP) in the Stormwater Master Plan (2023).

B. One (1) FTE represents 1,650 hrs (after deducting estimated annual leaves, training, and other non-task replaced hours); 0.02 FTE represents 40 hrs. For purposes of calculating an equivalent FTE cost estimate, an annual FTE labor cost was assumed at $200,000/year.

C. Assume that 100 percent of Engineering and Permitting Costs are for use of a consultant, and 100 percent of Design/Construction Administration Costs are required for internal City staff.

D. The NPDES program costs are based on an implementation schedule covering a 5-year permit term (Oct. 1, 2021 – Sept. 30, 2026) – reported in tables as Fiscal Years (FY) 2023-2027, with an anticipated administrative extension after FY 2027.

E. Stormwater Master Plan (SMP) implementation is projected on an annual basis and assumes a 20-year CP implementation schedule from 2024-2043, with higher project projects occurring sooner:
    - High Priority (2024-2028); Medium Priority (2029-2033); and Low Priority (2034-2043).
    - Capital Projects costs are averaged over the 20-year implementation period and shown as a standard annual value. While in practice there will be cycles of more and less staff time demands based on which projects are in construction/constructed.

Where applicable the following asset assumptions are divided between 1) those needed to maintain existing assets and commitments under the Stormwater Management Program (SWMP) BMPs and meet the requirements of the NPDES MS4 permit and 2) those for future assets constructed as part of the SMP Capital Projects. If not distinguished, the assumption applies to newly constructed assets.

F. **Piped Conveyance System**
    - *For SWMP BMPs*: CCTV and cleaning activities were evaluated as part of the maintenance evaluation in SMP TM#1 and this program requires an additional 0.5 FTE to meet current maintenance needs.
    - *For SMP CPs*: 250 ft of pipe cleaning can be accomplished per hour, and 200 ft of closed-circuit television inspections (CCTV) can be accomplished per hour. Inspection and maintenance to occur on at least 15 percent of City pipes annually (assuming cleaning/inspection will occur four times over 20-year CP cycle).
        - Perforated pipe does not require regular cleaning and inspection and is anticipated to only occur if needed.
        - Pipe connections/laterals are not included in the annual maintenance estimate.
        - Pipe inspection and maintenance activities require a 2-person crew.

G. **Manholes**
    - *For SWMP BMPs:* Cleaning activities associated with pollution control manholes and catch basins were evaluated as part of the maintenance evaluation in SMP TM#1, and this program requires an additional 0.25 FTE due to deferred maintenance.
    - For *SMP CPs:* 0.5 hr/facility/year is needed for maintenance of a standard manhole. 1.0 hr/facility/year is needed for inspection and maintenance of a water quality manhole.
        - Manhole inspection and maintenance activities require a 2-person crew.

H. **Catch Basins**
   - *For SWMP BMPs:* Cleaning activities associated with pollution control manholes and catch basins were evaluated as part of the maintenance evaluation in SMP TM#1, and this program requires an additional 0.25 FTE due to deferred maintenance.
   - *For SMP CPs:* 0.5 hr/facility/year is needed for maintenance.
     - Catch basin maintenance requires a 2-person crew.

I. **Vegetated Systems (swales, rain gardens, planters, etc.):**
   - *For SWMP BMPs:* Maintenance activities associated with vegetated system were evaluated as part of the maintenance evaluation in SMP TM#1, and this program requires an additional 1.25 FTE to meet maintenance needs.
   - *For SMP CPs:* 8 hr/facility/year for inspection and maintenance for public systems.
     - Vegetated system inspections and maintenance requires a 2-person crew.

J. **Ditches**: 20 ft of ditch maintenance can be accomplished per hour.
   - Maintenance is required once every 5 years.
   - Ditch maintenance requires a 2-person crew.

K. **Outfalls**: 0.5 hr/facility/year is needed for inspection and maintenance of outfalls.
   - Outfall inspection and maintenance requires a 2-person crew.

L. **Inlets/Outlets**: 0.5 hr/facility/year is needed for inspection and maintenance of inlets/outlets.
   - Inlet/outlet inspection and maintenance requires a 2-person crew.

M. **Detention Pond**: 16 hrs/facility/year is needed for inspection and maintenance of detention ponds.
   - Detention pond inspection and maintenance requires a 2-person crew.

N. **Culverts:** 2 hr/facility/year is needed for culvert cleaning and inspection.
   - Culvert inspection and cleaning requires a 2-person crew.

O. **Private Water Quality Facilities:** 4 hr/facility/year is required for inspections.
   - The City holds *Stormwater Maintenance and Access Easement Agreements* with private water quality facilities owners to actively maintain facilities in conformance with City of Wilsonville's Public Work Standards and annually inspect and report on the facility.
   - Private water quality facility inspections require a 1-person crew.

P. **Restoration/Stabilization:** Planting and bioengineered restoration/stabilization is a single installation and does not require annual maintenance.

Q. **Replacement or Removal:** Replacement or removal of assets does not require continued maintenance and is not accounted for as additional annual maintenance activity.

R. **Driveways/Pathways:** Addition of, or modifications to driveways, accessways, or paths does not require annual maintenance. These facilities will be maintained only when identified as needed.

S. **Street Sweeping:** 165 hr/year is needed for street sweeping of all curbed areas. This work is completed by a contractor.

T. **Training:** Assume general training includes 3 staff and industrial/commercial training includes 1 staff.

NOTE: Recommended Programs developed for the SMP (P-1 to P-3, and P-5 to P-6) are outlined in the SMP Table 7-1 as an annual cost only and not staff hours which is why it was removed from the Public Works/Maintenance Staffing and Community Development/Engineering Staffing sections. Program P-4 is included in *SMP Implementation - Community Development/Engineering Staffing Assessment* analysis.

NPDES MS4 Permit Driven Activities (per 2022 SWMP)

Public Works/Maintenance Staffing Assessment

NPDES MS4 Permit Driven Activities - Public Works/Maintenance Staffing Assessment														
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Public Works/Maintenance Staff Schedule (Hours and FTE)					
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
PEO-2	Staff Training	Staff training includes educational activities for City staff and crews on erosion control measures, proper spill response procedures, safe work practices, and record keeping.	Y	Trainings in addition to pre-2022 BMP activities: Annually: • City's inspection checklist training (assume 1-hr). • Review Dry Weather Screening SOP (assume 1-hr). Once per permit term: • IDDE SOP review training (assume 1-hr). • IDDE training modules (assume 1-hr). • Review ESC plan review check list and update as necessary (assume 1-hr). • Training on City's site inspection SOP (assume 1-hr). • Training on City's SOP and schedule for MS4 maintenance (assume 1-hr). • Training on the City's Industrial and Commercial Facilities Strategy (assume 1-hr).	3	2 hrs/yr 6 hrs/permit term	N	• 40 hr HAZWOPER and 8-hr annual refresher trainings. • Licensed pesticide training continuing education training (40-hr over 5 years requirement). • Training on City's IPM. • CESCL training (assume 8-hrs) every 3 years. • Internal training after the adoption of new or updated design standards. • Joint agency workshop or professional group presentation. • Training on City's municipal pollution prevention plan or SOPs. • Training on the City's SWPPP.	7.2 hrs (0.004 FTE)	7.2 hrs (0.004 FTE)	7.2 hrs (0.004 FTE)	7.2 hrs (0.004 FTE)	7.2 hrs (0.004 FTE)	7.2 hrs (0.004 FTE)
		Staff attend local trainings and conferences to improve skills related to stormwater controls and surface water quality.	N	No change.			Y – conference registration (as applicable)	Staff attended 4 conferences and trainings related to stormwater management during the 2021-22 reporting year.						
PI-2	Public Stewardship Opportunities	Continue to conduct/support a variety of stewardship events to increase public involvement and participation in stormwater-related programs.	N	• Annually, the City sponsors the Wilsonville Environmental Resource Keepers (WERK) day event, the Adopt-a-Road Program for trash and invasive species removal, Friends of Trees, and the Backyard Habitat Certification Program. Sponsorship generally includes staff time and associated City resources such as equipment. • City provides community workshops on IPM and native planting. • Collaboration with CREST.			Y – program/ equipment costs	• Organizing public outreach programs such as Adopt-a-Road and WERK Day. • Participate in the Backyard Habitat Certification Program and CREST to support workshops and environmental programs. • Support the planting of urban trees through partnering with Friends of Trees and providing native trees through the Tree Coupon program. • Promote stewardship- related events on the City's website and social media.						

NPDES MS4 Permit Driven Activities - Public Works/Maintenance Staffing Assessment														
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Public Works/Maintenance Staff Schedule (Hours and FTE)					
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
ILL-1	Illicit Discharge Detection and Elimination	The City prohibits illicit discharges into their MS4 system and conducts response and enforcement as needed.	N	No Change.			N	• Implement the City's IDDE Program as outlined in the IDDE SOP. • For identified illicit discharges, conduct appropriate actions to remove the discharge. Track enforcement activities related to investigation.						
ILL-2	Spill Prevention, Training, and Response	24-hr emergency response hotline and online reporting for illicit spills or activities contaminating stormwater.	N	No Change.			N	• Spill response within the public right-of-way is handled by the City's Public Works staff or the Tualatin Valley Fire and Rescue Hazardous Materials Team. • Select City staff are trained to the OSHA First Responder Operations level and can respond to spills with releases or potential releases of hazardous substances. Annual refresher courses are provided to City staff to maintain OSHA certifications. • Maintain a record of all spills both reported and responded to and follow up/mitigation measures.						
ILL-4	Dry Weather Field Screening	Conduct illicit discharge inspections, monitoring, and investigations annually during dry-weather conditions at 6 high priority field screening locations.	N	No Change.			N	• Track dry weather field screening locations inspected annually and any additional outfalls inspected during routine maintenance. • Summarize dry weather inspection results and indicate locations requiring monitoring (i.e., sampling) and/or investigations. • Indicate the outcome and resolution of any dry weather investigation activities conducted.						
EC-1	Erosion Control and Construction Site Management	The City implements an ESC program in accordance with City Code and Public Works Standards for proposed construction applications.	N	No Change.			N	• Track the number of approved erosion and sediment control plans for new and redevelopment >500 SF. • Track the number of 1200-CN and 1200-C permits issued. • Track the number and frequency of erosion control inspections conducted. • Track the number and type of enforcement actions taken by the City or DEQ.						

NPDES MS4 Permit Driven Activities - Public Works/Maintenance Staffing Assessment														
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Public Works/Maintenance Staff Schedule (Hours and FTE)					
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
EC-2	Erosion Control Inspections and Enforcement	Implement, inspection, and maintain ESC prevention measures during and following construction.	N	• Conduct a minimum of 3 erosion control inspections on all construction sites issued an ECS Permit. • As necessary, enforce appropriate erosion and sediment control in conjunction with the progressive enforcement procedures as outlined in the City Code.			N	• Track the number of erosion and sediment control plans approved. • Track the number of 1200- CN and 1200-C permits issued. • Track the number and frequency of erosion control inspections conducted. • Track the number and type of enforcement actions taken by the City or DEQ.						
OM-1	Municipal Stormwater Pollution Prevention	Implement activities to promote stormwater pollution prevention per SWPPP.	N	No Change.			N	Implement BMPs outlined in the City's SWPPS on an ongoing basis.						
OM-2	Routine Road Maintenance	Conduct street sweeping, maintenance, and winter weather protocols.	N	No Change.			N	• Sweep all curbed City streets monthly. • Schedule and conduct street maintenance activities during dry weather conditions. • Continue to sponsor the Adopt-a-Road program, Bulky Waste Day, and Fall Leaf Collection Day.						
			Y	Implement Winter Weather Response Plan (2021) – including snow removal, sanding, chemical application, and proper management of materials. Staff time is winter conditions dependent, assume additional 40-hrs for additional tracking of materials and activities per year.	1	40 hrs/yr	N	N/A – New requirement.	40 hrs (0.02 FTE)	40 hrs (0.02 FTE)	40 hrs (0.02 FTE)	40 hrs (0.02 FTE)	40 hrs (0.02 FTE)	40 hrs (0.02 FTE)
OM-3	Pest Management	Follow the IPM Plan (2018) principles for public landscape maintenance.	N	No Change.			N	• Track the amount of pesticides and fertilizers applied to public property and general areas of application. • Estimate number and area of sites where the planting of native vegetation was incorporated into the maintenance activities.						
			Y	Publish annual IPM activity on City website (assume 1-hr/year).	1	1 hr/yr	N	N/A – New requirement.	1 hr (0.0006 FTE)	1 hr (0.0006 FTE)	1 hr (0.0006 FTE)	1 hr (0.0006 FTE)	1 hr (0.0006 FTE)	1 hr (0.0006 FTE)
OM-4	Conveyance System Cleaning	Maintain and repair public stormwater conveyance system components including the storm sewer pipes,	Y	• Conduct CCTV inspection of approximately 15% of the public stormwater conveyance system (>6-inch pipe) annually. • Inspect other public conveyance systems as required.	Analysis in SMP TM#1		N	• Inspect public conveyance system annually for maintenance needs. • Maintain and repair public conveyance system as needed based on inspections.	825 hrs (0.5 FTE)	825 hrs (0.5 FTE)	825 hrs (0.5 FTE)	825 hrs (0.5 FTE)	825 hrs (0.5 FTE)	825 hrs (0.5 FTE)

NPDES MS4 Permit Driven Activities - Public Works/Maintenance Staffing Assessment													
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Public Works/Maintenance Staff Schedule (Hours and FTE)				
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
		manholes, outfalls, culverts, and swales.	Y	Refine the internal inspection guidelines annually to help facilitate ongoing inspection efforts (assume 40-hr for refinement, review and periodic update).	1	40 hr/permit term	N	N/A	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)
OM-5	Catch Basin Cleaning	Inspect, maintain, and repair public stormwater catch basins annually during dry season.	N	No Change.	Analysis in SMP TM#1		N	• Clean all high-priority public catch basins annually and remaining public catch basins over a 4-year period. • Inspect catch basins for maintenance and repair needs during catch basin cleaning activities. Schedule repair activities as needed, based on inspections.	412.5 hrs (0.25 FTE)	412.5 hrs (0.25 FTE)	412.5 hrs (0.25 FTE)	412.5 hrs (0.25 FTE)	412.5 hrs (0.25 FTE)	412.5 hrs (0.25 FTE)
			Y	Refine the internal inspection guidelines to help facilitate ongoing inspection efforts (assume 40-hr for refinement, review and periodic update).	1	40 hrs/ permit term	N	N/A	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)
			Y	Update tracking database during each maintenance cycle (assume 10-hr/year).	1	10 hrs/yr	N	N/A	10 hrs (0.006 FTE)	10 hrs (0.006 FTE)	10 hrs (0.006 FTE)	10 hrs (0.006 FTE)	10 hrs (0.006 FTE)	10 hrs (0.006 FTE)
OM-6	Public Structural Facility Operation and Maintenance	Tracks, inspect, maintain, and repairs City-owned structural control components of the stormwater system, specifically, water quality manholes, swales, proprietary treatment systems, raingardens, planters, and detention ponds.	N	No Change.	Analysis in SMP TM#1		N	• Inspect public structural controls annually; maintain and repair as needed. • Maintain GIS “atlas” for both public and private.	2,062.5 hrs (1.25 FTE)	2,062.5 hrs (1.25 FTE)	2,062.5 hrs (1.25 FTE)	2,062.5 hrs (1.25 FTE)	2,062.5 hrs (1.25 FTE)	2,062.5 hrs (1.25 FTE)
			Y	In conjunction with post-construction standards updates, by Dec. 1, 2024, update the City’s internal inspection guidelines and Vegetated Stormwater Facility SOP to include all active stormwater facilities (including proprietary controls) used in the City (assume 40-hr for refinement, review and periodic update).	1	40 hrs by Dec. 2024	N	N/A	20 hrs (0.012 FTE)	20 hrs (0.012 FTE)	--	--	--	8 hrs (0.005 FTE)
IND-1	Industrial and Commercial Inspection Program	Maintain and annually update a database of identified potential high pollutant source facilities (HPSF).	N	No Change.			N	• Annually conduct windshield surveys of identified HPSF. • Annually conduct formal site inspections on up to 5 HPSF. • During permit term, review business license applications to see if NPDES permit is required.						

NPDES MS4 Permit Driven Activities - Public Works/Maintenance Staffing Assessment													
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Public Works/Maintenance Staff Schedule (Hours and FTE)				
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
		Industrial and Commercial Facilities staff training.	Y	• Training once in permit term. Internal training based on the Industrial and Commercial Facilities Strategy, and joint agency workshop. • Assume 1 training meeting (2 hrs) and 1 joint agency workshop (4 hrs) annually over the permit term.	1	6 hrs/permit term	N	N/A	1.2 hrs (0.0006 FTE)	1.2 hrs (0.0006 FTE)	1.2 hrs (0.0006 FTE)	1.2 hrs (0.0006 FTE)	1.2 hrs (0.0006 FTE)	1.2 hrs (0.0006 FTE)
NPDES MS4 Driven Activities Subtotal of Public Works/Maintenance Staff Cost								Annual Staff Time (Hours)	3,395.4	3,395.4	3,375.4	3,375.4	3,375.4	3,383.4
								Annual Staff Time (FTE)	2.06	2.06	2.05	2.05	2.05	2.05
								Staffing contingency (FTE) (estimated at 20% to account for unscheduled maintenance and response)	0.41	0.41	0.41	0.41	0.41	0.41
								NPDES MS4 Public Works/Maintenance Activities Sub-Total staff cost (FTE)	2.47	2.47	2.46	2.46	2.46	2.46

Community Development/Engineering Staffing Assessment

NPDES MS4 Permit Driven Activities - Community Development/Engineering Staffing Assessment														
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Community Development/Engineering Staff Cost Schedule (Hours and FTE)					
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
PEO-1	Public Education Participation	• Promote public awareness through City newsletters, doorhangers, social media, and website. • Annually publish 2 articles/year in the Wilsonville Business Newsletter and 3 articles/year educating the public on stormwater issues.	N	No change.			Y – printing	During the 2021-22 reporting year, 5 educational/informational articles were published in the City newsletter and 4 were posted to the City's social media pages.						
		Engage the City's DEI Committee to identify additional language translations needs of the public, if necessary.	Y	Twice over permit term engage with the DEI Committee to verify that materials are translated into representative languages for the public. Assume two 1-hour meetings.	1	2 hrs/ permit term	N	N/A – Committee was formed in 2021.	--	1 hr (0.001 FTE)	--	1 hr (0.001 FTE)	--	0.4 hrs (0.001 FTE)
		Support regional public education campaigns and programs.	N	No change (varies by year).			Y - financial support	• Financially support regional public education campaigns and programs. • During the 2021-22 reporting year, the City contributed $15,000 to Friends of Trees.						
PEO-2	Staff Training	Staff training includes educational activities for City staff and crews on erosion control measures, proper spill response procedures, safe work practices, and record keeping.	Y	Trainings in addition to pre-2022 BMP activities: Annually: • City's inspection checklist training (assume 1-hr). • Review Dry Weather Screening SOP (assume 1-hr). Once per permit term: • IDDE SOP review training (assume 1-hr). • IDDE training modules (assume 1-hr). • Review ESC plan review check list and update as necessary (assume 1-hr). • Training on City's site inspection SOP (assume 1-hr). • Training on City's SOP and schedule for MS4 maintenance (assume 1-hr). • Training on the City's Industrial and Commercial Facilities Strategy (assume 1-hr). Assume 40-hr/yr to develop trainings.	2	40 hrs/yr	N	• 40 hr HAZWOPER and 8-hr annual refresher trainings. • Licensed pesticide training continuing education training (40-hr over 5 years requirement). • Training on City's IPM. • CESCL training (assume 8-hrs) every 3 years. • Internal training after the adoption of new or updated design standards. • Joint agency workshop or professional group presentation. • Training on City's municipal pollution prevention plan or SOPs. • Training on the City's SWPPP.	80 hrs (0.048 FTE)	80 hrs (0.048 FTE)	80 hrs (0.048 FTE)	80 hrs (0.048 FTE)	80 hrs (0.048 FTE)	80 hrs (0.048 FTE)
		Staff attend local trainings and conferences to improve skills related to stormwater controls and surface water quality.	N	No change.			Y – conference registration (as applicable)	Staff attended 4 conferences and trainings related to stormwater management during the 2021-22 reporting year.						

NPDES MS4 Permit Driven Activities - Community Development/Engineering Staffing Assessment													
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Community Development/Engineering Staff Cost Schedule (Hours and FTE)				
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
		Staff attend Clackamas County co-permittee meetings to engage in collective efforts related to education, monitoring, and NPDES requirements.	N	No change.			Y – Cost sharing (as applicable).	Coordinate with other Clackamas County co-permittees regarding regional water quality efforts through scheduled co-permittee meetings.						
PI-1	Public Involvement and Participation	Provide opportunity for public participation in the development, implementation, and modification of the City's stormwater management program.	Y	• Maintain a publicly accessible website with the SWMP, Monitoring Plan, annual reports, program contact information, educational/reference materials, and reporting requirements for illicit discharges. • Provide a 30-day public comment period, and consider comments received for updates to the Monitoring Plan, the SWMP, and other strategy documents as required. • Maintain MS4 Document Library on website. Assume 8 hr/year for website management.	1	8 hrs/yr	N	N/A – new requirement.	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)
PI-2	Public Stewardship Opportunities	Continue to conduct/support a variety of stewardship events to increase public involvement and participation in stormwater-related programs.	N	• Annually, the City sponsors the Wilsonville Environmental Resource Keepers (WERK) day event, the Adopt-a-Road Program for trash and invasive species removal, Friends of Trees, and the Backyard Habitat Certification Program. Sponsorship generally includes staff time and associated City resources such as equipment. • City provides community workshops on IPM and native planting. • Collaboration with CREST.			Y – program/equipment costs	• Organizing public outreach programs (e.g., Adopt-a-Road and WERK Day). • Participate in the Backyard Habitat Certification Program and CREST to support workshops and environmental programs. • Support the planting of urban trees through partnering with Friends of Trees and providing native trees through the Tree Coupon program. • Promote stewardship- related events on the City's website and social media.						
ILL-1	Illicit Discharge Detection and Elimination	The City prohibits illicit discharges into their MS4 system and conducts response and enforcement as needed.	N	No Change.			N	• Implement the City's IDDE Program as outlined in the IDDE SOP. • For identified illicit discharges, conduct appropriate actions to remove the discharge. Track enforcement activities related to investigation.						
		Review and update the City's IDDE SOP to clarify enforcement procedures and response timeframes in conjunction with the NPDES MS4 permit.	Y	Review and update IDDE SOP by Dec. 1, 2023. Assume 8-hrs to review and update annually. Consult will support 2023 update.	1	8 hr/yr	N	Implement existing IDDE SOP (2012).	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)	8.0 hrs (0.005 FTE)
ILL-2	Spill Prevention, Training, and Response	24-hr emergency response hotline and online reporting for illicit spills or activities contaminating stormwater.	N	No Change.			N	• Spill response within the public right-of-way is handled by the City's Public Works staff or the Tualatin Valley Fire and Rescue Hazardous Materials Team. • Select City staff are trained to the OSHA First Responder Operations level						

NPDES MS4 Permit Driven Activities - Community Development/Engineering Staffing Assessment													
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Community Development/Engineering Staff Cost Schedule (Hours and FTE)				
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
								and can respond to spills with releases or potential releases of hazardous substances. Annual refresher courses are provided to City staff to maintain OSHA certifications. • Maintain a record of all spills both reported and responded to and follow up/mitigation measures.						
ILL-3	MS4 Mapping	Continually maintain the online GIS mapping and digital inventory.	Y	• Continually maintain the online GIS mapping for public viewing. • Add municipal structural stormwater controls within 1 year of receiving the as-builts. • As necessary, create a tracking system for repeat illicit discharges. Assume 24-hr/year for updates.	1	24 hr/yr	N	N/A – new requirement.	24 hrs (0.015 FTE)	24 hrs (0.015 FTE)	24 hrs (0.015 FTE)	24 hrs (0.015 FTE)	24 hrs (0.015 FTE)	24 hrs (0.015 FTE)
ILL-4	Dry Weather Field Screening	Conduct illicit discharge inspections, monitoring, and investigations annually during dry-weather conditions at 6 high priority field screening locations.	Y	By Dec. 1, 2023, review and update high priority locations and criteria, as necessary, based on outcomes from inspections and other public reporting. Update locations on mapping and in the IDDE SOP (assume 10 hours for review).	1	10 hrs by Dec. 2023	N	• Track dry weather field screening locations inspected annually and any additional outfalls inspected during routine maintenance. • Summarize dry weather inspection results and indicate locations requiring monitoring (i.e., sampling) and/or investigations. • Indicate the outcome and resolution of any dry weather investigation activities conducted.	10 hrs (0.006 FTE)	--	--	--	--	2 hrs (0.001 FTE)
EC-1	Erosion Control and Construction Site Management	The City implements an ESC program in accordance with City Code and Public Works Standards for proposed construction applications.	Y	Report any updates or modifications to the 2020 Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual (assume 20 hrs for review).	1	20 hrs by Dec. 2024	N	• Track the number of approved erosion and sediment control plans for new and redevelopment >500 SF. • Track the number of 1200-CN and 1200-C permits issued. • Track the number and frequency of erosion control inspections conducted. • Track the number and type of enforcement actions taken by the City or DEQ.	10 hrs (0.006 FTE)	10 hrs (0.006 FTE)	--	--	--	4 hrs (0.002 FTE)

NPDES MS4 Permit Driven Activities - Community Development/Engineering Staffing Assessment														
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Community Development/Engineering Staff Cost Schedule (Hours and FTE)					
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
EC-2	Erosion Control Inspections and Enforcement	Implement, inspection, and maintain ESC prevention measures during and following construction.	N	• Conduct a minimum of 3 erosion control inspections on all construction sites issued an ECS Permit. • As necessary, enforce appropriate erosion and sediment control in conjunction with the progressive enforcement procedures as outlined in the City Code.			N	• Track the number of erosion and sediment control plans approved. • Track the number of 1200- CN and 1200-C permits issued. • Track the number and frequency of erosion control inspections conducted. • Track the number and type of enforcement actions taken by the City or DEQ.						
		Update enforcement response procedures and escalating enforcement language.	Y	By Dec. 1, 2023, review and, if necessary, update enforcement response procedures and escalating enforcement specific to erosion and sediment control in City Code and Public Works Standards (assume 20-hrs for review). Consultant will support update.	1	20 hrs by Dec. 2023	N	N/A	20 hrs (0.012 FTE)	--	--	--	--	4 hrs (0.002 FTE)
PC-1	Stormwater Planning and Development Review	The City provides land use and planning review to meet goals related to the management of natural resources, transportation, housing, public facilities and services, and open spaces and parks.	N	Continue to require all new and redevelopment projects that add or replace 5,000 SF or more of impervious surface to implement the City's Stormwater and Surface Water Design and Construction Standards Review plans for compliance with stormwater requirements.			N	• Track number of development applications reviewed for compliance with the City's stormwater requirements. • Track new and redeveloped impervious surface in conjunction with annual reporting requirements.						
			Y	By Dec. 1, 2023, as necessary, review and document updates to the City's LID Guidebook and Public Works Standards to refine preferred LID/GI approaches and strategies for development within the ROW (assume 20-hrs for review). Consultant will support update.	1	20 hrs by Dec. 2023	N	N/A	20 hrs (0.012 FTE)	--	--	--	--	4 hrs (0.002 FTE)
			Y	By Dec. 1, 2024, as necessary, update Section 3 of the Public Works Standards to include reference to either the Numeric Stormwater Retention Requirement (NSSR) or Alternative Site Performance Standards (assume 100-hrs for review). Consultant will support update.	2	100 hrs by Dec. 2024	N	N/A	50 hrs (0.03 FTE)	50 hrs (0.03 FTE)	--	--	--	20 hrs (0.012 FTE)
OM-1	Municipal Stormwater Pollution Prevention	Implement activities to promote stormwater pollution prevention per SWPPP.	N	No Change.			N	Implement BMPs outlined in the City's SWPPS on an ongoing basis.						
			Y	Ensure litter control language is included in new event contracts and facility rental agreements (assume 8-hr for language draft and inclusion).	1	8 hrs (immediate update)	N	N/A – New requirement.	8 hrs (0.005 FTE)	--	--	--	--	1.6 hrs (0.001 FTE)
			Y	By Dec. 1, 2024, review and update the SWPPP for consistency with current use, practices, and new facility installations (assume 40-hr for review and 8-hr per year for updates). Consultant will support update.	1	40 hrs by Dec. 2024 + 8 hrs/yr	N	N/A	28 hrs (0.017 FTE)	28 hrs (0.017 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	16 hrs (0.010 FTE)

NPDES MS4 Permit Driven Activities - Community Development/Engineering Staffing Assessment													
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Community Development/Engineering Staff Cost Schedule (Hours and FTE)				
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
OM-6	Public Structural Facility Operation and Maintenance	Tracks, inspect, maintain, and repairs City-owned structural control components of the stormwater system, specifically, water quality manholes, swales, proprietary treatment systems, raingardens, planters, and detention ponds.	N	No Change.			N	• Inspect public structural controls annually and maintain and repair as needed. • Ensure maintenance of new private structural stormwater facilities serving 5,000 square feet of area or greater through the tracking of Stormwater Maintenance and Access Easement agreements. • Maintain GIS “atlas” for both public and private.						
			Y	In conjunction with updates to post-construction standards, by Dec. 1, 2024, update the City’s internal inspection guidelines and Vegetated Stormwater Facility SOP to include all active stormwater facilities (including proprietary controls) being used in the City (assume 120-hr for review).	1	120 hrs by Dec. 2024	N	N/A	60 hrs (0.036 FTE)	60 hrs (0.036 FTE)	--	--	--	24 hrs (0.015 FTE)
OM-7	Private Structural Facility Operation and Maintenance	The City requires maintenance of private structural stormwater controls through implementation of the Stormwater Maintenance and Access Easement agreements and submittal of a Stormwater Operations and Maintenance Plan.	N	No Change.			N	• Track agreements on file for private structural control facilities. • Track number of private annual inspection and maintenance reports received annually. • Maintain GIS database for private structural facilities.						
			N	No change, but as additional development and new facilities are added, additional time will be needed for tracking and inspection documentation (assume 8-hr/year for additional facility tracking).	1	8 hrs/yr	N	• Ensure maintenance of new private structural stormwater facilities serving 5,000 square feet of area or greater through the tracking of Stormwater Maintenance and Access Easement agreements. • Maintain GIS “atlas” for both public and private.	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)	8 hrs (0.005 FTE)
OM-8	Develop Planning Documents in Support of Water Quality	The City assesses flood control, transportation, and other infrastructure projects during planning stages to identify and mitigate potential negative impacts and/or enhance benefits for the water quality of receiving water bodies.	Y	• By Dec. 1, 2023, complete public outreach related to the updated 2023 Stormwater Master Plan (assume 30-hr for outreach).	1	30 hrs by Dec. 2023	N	N/A	30 hrs (0.018 FTE)	--	--	--	--	6 hrs (0.004 FTE)
			Y	• Implement water quality, flood control, and natural resource CIPs in accordance with the effective Stormwater Master Plan. • Track the status of the City’s Stormwater Master Planning efforts. • Track the number of CIP/retrofit projects implemented each year and discuss the added benefit (water quality,	1	40 hrs/yr	N	N/A	40 hrs (0.024 FTE)	40 hrs (0.024 FTE)	40 hrs (0.024 FTE)	40 hrs (0.024 FTE)	40 hrs (0.024 FTE)	40 hrs (0.024 FTE)

NPDES MS4 Permit Driven Activities - Community Development/Engineering Staffing Assessment														
Stormwater program implementation (post-2022)								Pre-2022 activities	Annual Community Development/Engineering Staff Cost Schedule (Hours and FTE)					
BMP Number	BMP name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost assumptions	Implementation Need		Material costs (Y/N)	Activity description	2023	2024	2025	2026	2027	Annual Average
					Number of City Staff	Total Staff Time								
				hydromodification, habitat restoration, etc.) of each. • Map the location and drainage area of water quality CIPs/retrofits as they are constructed. Assume 40-hrs/year for CIP implementation and tracking.										
			Y	By Dec. 1, 2023, document and submit a summary of outcomes the City's 2015 Retrofit Strategy and 2015 Hydromodification Assessment, in accordance with the 2023 Stormwater Master Plan (assume 20-hrs for review).	1	20 hrs by Dec. 2023	N	N/A	20 hrs (0.012 FTE)	--	--	--	--	4 hrs (0.002 FTE)
IND-1	Industrial and Commercial Inspection Program	Maintain and annually update a database of identified potential high pollutant source facilities (HPSF).	N	No Change.			N	• Annually conduct windshield surveys of identified HPSF. • Annually conduct formal site inspections on up to 5 HPSF. • During permit term, review business license applications to see if NPDES permit is required.						
		Industrial and Commercial Facilities staff training.	Y	• Training once in permit term. Internal training based on the Industrial and Commercial Facilities Strategy, and joint agency workshop. • Assume 1 training meeting (2 hrs) and 1 joint agency workshop (4 hrs) over permit term. • Assume 6-hrs annually for engineer.	1	6 hrs/yr	N	N/A	6 hrs (0.004 FTE)	6 hrs (0.004 FTE)	6 hrs (0.004 FTE)	6 hrs (0.004 FTE)	6 hrs (0.004 FTE)	6 hrs (0.004 FTE)
NPDES MS4 Permit Driven Activities Subtotal of Community Development/Engineering Staff Cost								Annual Staff Time (Hours*)	430	322	182	182	182	260
								Annual Staff Time (FTE)	0.26	0.19	0.11	0.11	0.11	0.16

**Summary values rounded to nearest whole hour.*

Note: No staffing contingency includes for Community Development/Engineering NPDES MS4 Permit Driven Activities .

NPDES MS4 Permit Driven Activities (per 2022 SWMP) Summary

NPDES MS4 Permit Driven Activities – Public Works/Maintenance and Community Development/Engineering Staffing Assessment Summary							
		Annual NPDES MS4 Activities Staff Cost Schedule (FTE)					
		2023	2024	2025	2026	2027	Annual Average
Public Works/Maintenance	Public Works/Maintenance Annual Staff Time	2.06	2.06	2.05	2.05	2.05	2.05
	Staffing contingency for Public Works/Maintenance (estimated at 20% to account unscheduled maintenance and response)	0.41	0.41	0.41	0.41	0.41	0.41
	Community Development/Engineering	0.26	0.19	0.11	0.11	0.11	0.16
	Total Staff Time (NPDES MS4 Activities)	2.73	2.66	2.57	2.57	2.57	2.62

Stormwater Master Plan Implementation

Master Plan implementation staffing timing varies based on CP implementation schedule and prioritization. Staffing assessment tables averages projects over 20-year planning period.

Public Works/Maintenance Staffing Assessment

SMP Implementation - Public Works/Maintenance Staffing Assessment										
Stormwater program implementation (post-2022)										
CP No.	CP Name	Description (New and replaced assets)	Increase in effort from pre-2022 activities (Y/N)	Cost Assumptions [E]		Implementation Need		Material costs (Y/N)	Annual Public Works/Maintenance Staff Schedule	
				Assumption Note	Hours/Year	Number of City Staff	Total Hours		Annual Average (hrs)	Annual Average (FTE)
BC-1	Library Pond Retrofit	Clear, regrade, and replant 0.7-acre detention pond.	Y	M	16 .0	2	32.0	Y	33.0	0.02
		Install 1 new outlet structure.		L	0.5	2	1.0			
		Install 70 LF of new perforated pipe.	N	F						
		Replace 70 LF of pipe.		Q						
		Install driveway for maintenance access.		R						
BC-2	Ash Meadows Flow Mitigation	Clear, regrade, and replant 1.3-acres of drainageway.	Y	M	16.0	2	32.0	Y	33.0	0.02
		Install 1 inlet.		L	0.5	2	1.0			
		Replace 175 LF of pipe.		Q						
BC-3	Wiedemann Ditch and Canyon Creek Park Retrofit	Clear, regrade, and replant 1.6-acres of storage facility (detention pond).	Y	M	16.0	2	32.0	Y	115.3	0.07
		Clear, regrade, and replant 2.1-acres along the existing ditch alignment to install 5 swales (tiered wetland complexes).		I	40.0	2	80.0			
		Install 1 new outlet structure.		L	0.5	2	1.0			
		Install 350 LF of pipe.		F	0.6	2	1.3			
		Install 1 new manhole.		G	0.5	2	1.0			
BC-4	Boeckman Creek Stabilization at Colvin Lane	Install 70 LF of new pipe.	Y	F	0.1	2	0.2	Y	16.2	0.01
		Reconstruct 150 LF of vegetated swale.		I	8.0	2	16.0			
		Install planting and bioengineered restoration of 600 LF of stream corridor.	N	P						
		Remove 30 LF of existing outfall pipe.		Q						
BC-5	Memorial Park Swale Retrofit	Install 2,400 SF vegetated water quality swale.	Y	I	8.0	2	16.0	Y	21.2	0.013
		Install 50 LF of new pipe.		F	0.1	2	0.2			
		Install 1 swale inflow spreader.		L	0.5	2	1.0			
		Install 1 overflow structure.		L	0.5	2	1.0			
		Install 1 new outfall.		K	0.5	2	1.0			
		Replace 1 manhole with a flow splitting/WQ manhole.		G	1.0	2	2.0			
		Replace 110 LF of pipe.	N	Q						
		Install 140 LF of perforated pipe.		F						
		Replace 2 manholes.		Q						
		Fill existing 1,500 SF swale and revegetate area.		P						

SMP Implementation - Public Works/Maintenance Staffing Assessment										
Stormwater program implementation (post-2022)										
CP No.	CP Name	Description (New and replaced assets)	Increase in effort from pre-2022 activities (Y/N)	Cost Assumptions [E]		Implementation Need		Material costs (Y/N)	Annual Public Works/Maintenance Staff Schedule	
				Assumption Note	Hours/Year	Number of City Staff	Total Hours		Annual Average (hrs)	Annual Average (FTE)
		Remove 210 LF of existing pipe.		Q						
		Remove 1 manhole.		Q						
		Remove 1 swale inlet structure.		Q						
		Remove 1 outlet structure.		Q						
BC-6	Gesellschaft Water Well Channel Restoration	Install 480 LF of new pipe.	Y	F	0.9	2	1.7	Y	4.7	0.003
		Install 2 new manholes.		G	1.0	2	2.0			
		Install 1 outfall.		K	0.5	2	1.0			
		Restore 310 LF of existing channel and re-vegetating with native trees and shrubs.	N	P						
CLC-1	Day Road Stormwater Improvements	Install 200 LF of open-bottom or box culverts (4 total).	Y	N	8.0	2	16.0	Y	27.1	0.016
		Install 180 LF of culverts (1 total).		N	2.0	2	4.0			
		Install 600 LF of pipe.		F	1.1	2	2.2			
		Install 2 manholes.		G	0.5	2	2.0			
		Install 3 trash racks at pipe inlets.		L	0.5	2	3.0			
		Regrade and reconstruct approx. 4,500 feet of open channel.	N	P						
		Replace 1,800 LF of pipe with 600 LF of pipe.		Q						
		Replace 7 manholes.		Q						
		Remove 50 LF of existing culvert.		Q						
CLC-2	Arrowhead Creek Culvert Replacement at Arrowhead Creek Trail	Replace 70 LF of box culvert.	N	N				Y	0.0	0.0
		Install 70 LF of planting and bioengineered restoration/stabilization measures along path.		P						
		Repave 600 SF of pedestrian path.		R						
CLC-3	Garden Acres Pond Retrofit	Install 1 flow diversion structure.	Y	L	0.5	2	1.0	Y	35.0	0.021
		Install 250 LF of new pipe.		F	0.5	2	1.0			
		Install 1 outlet control structure.		L	0.5	2	1.0			
		Clear, regrade, and replant 0.9-acres of pond.		M	16.0	2	32.0			
		Remove 25,600 CY of fill from existing pond.	N	Q						
		Install 50 LF of perforated pipe.		F						
NC-1	Frog Pond East and South Conveyance Pipe Installation	Install 2,360 LF of new pipe.	Y	F	4.2	2	8.5	Y	10.5	0.006
		Install 1 outfall.		K	0.5	2	1.0			
		Install 7 manholes.		G	0.5	2	1.0			
WR-1	SW Willamette Way/ Morey's Landing Stormwater Improvements	Clear, grade, and replant 0.12-acres of raingarden.	Y	I	8.0	2	16.0	Y	18.4	0.011
		Install 1 flow control diversion structure.		L	0.5	2	1.0			
		Install 120 LF of new pipe.		F	0.2	2	0.4			

SMP Implementation - Public Works/Maintenance Staffing Assessment										
Stormwater program implementation (post-2022)										
CP No.	CP Name	Description (New and replaced assets)	Increase in effort from pre-2022 activities (Y/N)	Cost Assumptions [E]		Implementation Need		Material costs (Y/N)	Annual Public Works/Maintenance Staff Schedule	
				Assumption Note	Hours/Year	Number of City Staff	Total Hours		Annual Average (hrs)	Annual Average (FTE)
		Install 1 manhole.		G	0.5	2	1.0			
		Replace 1,330 LF of pipe.	N	Q						
		Remove existing bubbler.		Q						
		Replace 7 manholes.		Q						
		Replace field inlet.		Q						
WR-2	Miley Road Stormwater Improvements	Install 4,195 of new pipe.	Y	F	7.6	2	15.1	Y	30.1	0.018
		Install 15 manholes.		G	7.5	2	15.0			
		Install 25 LF of planting and bioengineered restoration/stabilization measures after replacement of the culvert.	N	P						
		Replace 400 LF of pipe.		Q						
		Replace 1 manhole.		Q						
		Replace 1 area drain.		Q						
		Extend 240 LF of existing main connections to the new pipe alignment.		F						
		Reconnect 13 existing curb inlets.		F						
WR-3	Rose Lane Culvert Replacement	Install 80 LF of new pipe.	Y	F	0.1	2	0.2	Y	2.2	0.001
		Reinforce 100 LF of stormwater conveyance around property near culvert to move water into ditch.		J	1.0	2	2.0			
		Remove 25 LF of pipe.	N	Q						
WR-4	Charbonneau East Stormwater Improvements	Replace 3,765 LF of pipe.	N	Q				Y	0.0	0.0
		Replace 18 manholes.		Q						
		Replace 1 outfall.		Q						
WR-5	Charbonneau West Stormwater Improvements	Install 4 manholes.	Y	G	2.0	2	4.0	Y	4.0	0.002
		Replace 34 manholes.	N	Q						
		Replace 6,770 LF of pipe.		Q						
		Replace 2 outfalls.		Q						
City-1	Flow Monitoring and Rain Gauge Installation Hydromodification Assessment and Stream Survey	Install 1 rain gauge.	Y	Consultant Support				Y	Consultant Support	
		Install 3+ flow meters.								
City-2	Porous Pavement Pilot Study	Follow-up monitoring related to the 2022 geomorphic assessment, targeting select stream reaches.	Y	Consultant Support				Y	Consultant Support	
City-3	Boeckman Creek Geotechnical Evaluation	Project still being scoped.	Y	Consultant Support				Y	Consultant Support	
City-4	Flow Monitoring and Rain Gauge Installation	Project still being scoped.	Y	Consultant Support				Y	Consultant Support	
						SMP Implementation Subtotal of Public Works/Maintenance Staff Cost		Average Annual Staff Time (hours)	350.7	
								Average Annual Staff Time (FTE)	0.21	

Community Development/Engineering Staffing Assessment

SMP Implementation - Community Development/Engineering Staffing Assessment									
Stormwater program implementation (post-2022)									
CP No.	CP Name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost Calculations		Community Development/Engineering Schedule			
				Total Cost ($)	Design/Construction Administration (13.5% of total cost [A]) ($)	Total Staff Time (FTE)	Annual Average Staff Time (FTE)	Total Staff Time (Hr)	Annual Average Staff Time (Hr)
BC-1	Library Pond Retrofit	• Clear, regrade, and replant 0.7-acre detention pond. • Install 1 new outlet structure. • Install 70 LF of new perforated pipe. • Replace 70 LF of pipe. • Install driveway for maintenance access.	Y	$1,880,000	$190,000	0.95	0.048	1,567.5	78.4
BC-2	Ash Meadows Flow Mitigation	• Clear, regrade, and replant 1.3-acres of drainageway. • Install 1 inlet. • Replace175 LF of pipe.	Y	$2,940,000	$234,000	1.17	0.059	1,930.5	96.5
BC-3	Wiedemann Ditch and Canyon Creek Park Retrofit	• Clear, regrade, and replant 1.6-acres of storage facility (detention pond). • Clear, regrade, and replant 2.1-acres along the existing ditch alignment to install 5 swales (tiered wetland complexes). • Install 1 new outlet structure. • Install 350 LF of pipe. • Install 1 new manhole.	Y	Ph 1: $4,860,000	Ph 1: $322,000	1.61	0.081	2,656.5	132.8
				Ph 2: $7,210,000	Ph 2: $384,000	1.92	0.096	3,168.0	158.4
BC-4	Boeckman Creek Stabilization at Colvin Lane	• Install 70 LF of new pipe. • Reconstruct 150 LF of vegetated swale. • Install planting and bioengineered restoration of 600 LF of stream corridor. • Remove 30 LF of existing outfall pipe.	Y	$410,000	$38,000	0.19	0.010	313.5	15.7
BC-5	Memorial Park Swale Retrofit	• Install 2,400 SF vegetated water quality swale. • Install 50 LF of new pipe. • Install 1 swale inflow spreader, 1 overflow structure and 1 new outfall. • Replace 1 manhole with a flow splitting/WQ manhole. • Replace 110 LF of pipe. • Install 140 LF of perforated pipe. • Replace 2 manholes. • Fill existing 1,500 SF swale and revegetate area. • Remove 210 LF of existing pipe. • Remove 1 manhole, 1 swale inlet structure, and 1 outlet structure.	Y	$910,000	$85,000	0.43	0.021	701.3	35.1
BC-6	Gesellschaft Water Well Channel Restoration	• Install 480 LF of new pipe. • Install 2 new manholes. • Install 1 outfall. • Restore 310 LF of existing channel and re-vegetating with native trees and shrubs.	Y	$400,000	$38,000	0.19	0.010	313.5	15.7

SMP Implementation - Community Development/Engineering Staffing Assessment									
Stormwater program implementation (post-2022)									
CP No.	CP Name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost Calculations		Community Development/Engineering Schedule			
				Total Cost ($)	Design/Construction Administration (13.5% of total cost [A]) ($)	Total Staff Time (FTE)	Annual Average Staff Time (FTE)	Total Staff Time (Hr)	Annual Average Staff Time (Hr)
CLC-1	Day Road Stormwater Improvements	• Install 200 LF of open-bottom or box culverts (4 total). • Install 180 LF of culverts (1 total). • Install 600 LF of pipe. • Install 2 manholes. • Install 3 trash racks at pipe inlets. • Regrade and reconstruct approx. 4,500 feet of open channel. • Replace 1,800 LF of pipe with 600 LF of pipe. • Replace 7 manholes. • Remove 50 LF of existing culvert.	Y	Ph 1: $8,020,000	Ph 1: $405,000	2.03	0.101	3,341.3	167.1
				Ph 2: $3,930,000	Ph 2: $370,000	1.85	0.093	3,052.5	152.6
CLC-2	Arrowhead Creek Culvert Replacement at Arrowhead Creek Trail	• Replace 70 LF of box culvert. • Install 70 LF of planting and bioengineered restoration/stabilization measures along path. • Repave 600 SF of pedestrian path.	Y	$290,000	$35,000	0.18	0.009	288.8	14.4
CLC-3	Garden Acres Pond Retrofit	• Install 1 flow diversion structure. • Install 250 LF of new pipe. • Install 1 outlet control structure. • Install 50 LF of perforated pipe. • Clear, regrade, and replant 0.9-acres of pond. • Remove 26,500 CY of fill from existing pond.	Y	$3,780,000	$302,000	1.51	0.076	2,491.5	124.6
NC-1	Frog Pond East and South Conveyance Pipe Installation	• Install 2,360 LF of new pipe. • Install 1 outfalls. • Install 7 manholes.	Y	$4,090,000	$414,000	2.07	0.104	3,415.5	170.8
WR-1	SW Willamette Way / Morey's Landing Stormwater Improvements	• Clear, grade, and replant 0.12-acres of raingarden. • Install 1 flow control diversion structure. • Install 120 LF of new pipe. • Install 1 manhole. • Replace 1,330 LF of pipe. • Remove existing bubbler. • Replace 7 manholes. • Replace field inlet.	Y	Ph 1: $2,310,000	Ph 1: $233,000	1.17	0.058	1,922.3	96.1
				Ph 2: $1,080,000	Ph 2: $109,000	0.55	0.027	899.3	45.0

SMP Implementation - Community Development/Engineering Staffing Assessment									
Stormwater program implementation (post-2022)									
CP No.	CP Name	Description	Increase in effort from pre-2022 activities (Y/N)	Cost Calculations		Community Development/Engineering Schedule			
				Total Cost ($)	Design/Construction Administration (13.5% of total cost [A]) ($)	Total Staff Time (FTE)	Annual Average Staff Time (FTE)	Total Staff Time (Hr)	Annual Average Staff Time (Hr)
WR-2	Miley Road Stormwater Improvements	• Install 4,195 of new pipe. • Install 15 manholes. • Install 25 LF of planting and bioengineered restoration/stabilization measures after replacement of the culvert. • Replace 400 LF of pipe. • Replace 1 manhole. • Replace 1 area drain. • Extend 240 LF of existing main connections to the new pipe alignment. • Reconnect 13 existing curb inlets.	Y	Ph 1: $820,000	Ph 1: $77,000	0.39	0.019	635.3	31.8
				Ph 2: $10,510,000	Ph 2: $470,000	2.35	0.118	3,877.5	193.9
WR-3	Rose Lane Culvert Replacement	• Install 80 LF of new pipe. • Reinforce 100 LF of stormwater conveyance around property near culvert to move water into ditch. • Remove 25 LF of pipe.	Y	$200,000	$35,000	0.18	0.009	288.8	14.4
WR-4	Charbonneau East Stormwater Improvements	• Replace 3,765 LF of pipe. • Replace 18 manholes. • Replace 1 outfall.	Y	Ph1: $600,000	Ph 1: $50,000	0.25	0.013	412.5	20.6
				Ph 2: $4,440,000	Ph 2: $449,000	2.25	0.112	3,704.3	185.2
WR-5	Charbonneau West Stormwater Improvements	• Install 4 manholes. • Replace 34 manholes. • Replace 6,770 LF of pipe. • Replace 2 outfalls.	Y	$10,370,000	$488,000	2.44	0.122	4,026.0	201.3
P-4[E]	Charbonneau Repair/ Replacement Program	• Replace 30,620 LF of pipe. • Replace 153 manholes.	Y	$38,360,000	$3,879,000	19.40	0.970	32,001.8	1,600.1
City-1	Flow Monitoring and Rain Gauge Installation	• Install 1 rain gauge. • Install 3+ flow meters.	Y	TBD, project will vary		Consultant Support			
City-2	Hydromodification Assessment and Stream Survey	Follow-up monitoring related to the 2022 geomorphic assessment, targeting select stream reaches.	Y	TBD, project will vary		Consultant Support			
City-3	Porous Pavement Pilot Study	Project still being scoped.	Y	TBD, project will vary		Consultant Support			
City-4	Boeckman Creek Geotechnical Evaluation	Project still being scoped.	Y	TBD, project will vary		Consultant Support			
SMP Implementation Subtotal of Community Development/Engineering Staff Cost				Total Staff Time		43.04 FTE / (71,008 hrs)			
				Annual Average Staff Time [B]		2.15 FTE / (3,550 hrs)			
				City Engineering Staff already designated for Capital Project work [C]		*1.0 FTE*			
				Additional Annual Average Community Development/Engineering Staff Time Needed [D]		**1.15 FTE**			

[A] *Most projects use a 13.5% multiplier for Design/Construction Administration, but a select group of projects were designated by the City to use a 3.5% + $200K value instead to better represent anticipated conditions.*

The projects with the adjusted multiplier include BC-3 Phases 1 & 2, CLC-1 Phase 1, CLC-3, WR-2 Phase 2, and WR-5.

WR-4 Phase 1 was designated by the City to use a 25% multiplier for Design/Construction Administration.

[B] *Summary values rounded to nearest whole hour.*

[C] *The City already has 1.0 FTE designated to work on Capital Projects, this amount was subtracted from the total calculated staff time.*

[D] *This value represents the additional annual average Community Development/Engineering staffing need of the City to complete the Capital Projects.*

[E] *Proposed program efforts are generally anticipated to be conducted using existing staffing resources or within allocated annual budgets. The Charbonneau R/R Program (P-4) will require dedicated City Engineering resources to schedule and manage specific contracts to adhere to the anticipated 20-year program duration. As such, Design/ Construction Administration costs were specifically calculated for this program and used to inform the required staffing needs.*

Stormwater Master Plan Staffing Summary

SMP Implementation - Public Works/Maintenance and Community Development/Engineering Staffing Assessment Summary						
	Annual SMP Implementation Staff Cost Schedule (FTE)					
	2023	2024	2025	2026	2027	Annual Average
Public Works/Maintenance	0.21	0.21	0.21	0.21	0.21	0.21
Community Development/Engineering	1.15	1.15	1.15	1.15	1.15	1.15
Total Staff Time	1.36	1.36	1.36	1.36	1.36	1.36

Combined Staffing Assessment Summary

Combined - Public Works/Maintenance and Community Development/Engineering Staffing Assessment Summary							
		Combined Annual Staff Cost Schedule (FTE)					
		2023	2024	2025	2026	2027	Annual Average
Public Works/Maintenance Staff Cost Schedule	NPDES MS4 Permit Driven Activities	2.06	2.06	2.05	2.05	2.05	2.05
	Staffing contingency for NPDES MS4 Driven Activities (estimated at 20% to account unscheduled maintenance and response)	0.41	0.41	0.41	0.41	0.41	0.41
	SMP Implementation	0.21	0.21	0.21	0.21	0.21	0.21
	Public Works/Maintenance Staffing Summary (FTE)	2.68	2.68	2.67	2.67	2.67	2.67
Community Development/Engineering Staff Cost Schedule	NPDES MS4 Permit Driven Activities	0.26	0.19	0.11	0.11	0.11	0.16
	SMP Implementation	1.15	1.15	1.15	1.15	1.15	1.15
	Community Development/Engineering Staffing Summary (FTE)	1.41	1.34	1.26	1.26	1.26	1.31

Appendix H: Comprehensive Plan Review

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Comment Log

Prepared for: City of Wilsonville
Project Title: Stormwater Master Plan
Project No.: 156157
Subject: Review of Wilsonville Comprehensive Plan
Date: December 16, 2021

Comment Log Public Facilities and Services Section				
No.	Reviewer	Page	Section	Comment
1	K. Reininga	C-8	Storm Drainage Plan Paragraph 2, Line 2	Add other parameters here [currently includes temperature and turbidity] like metals, toxics, nutrients…
2	K. Reininga	C-8	Storm Drainage Plan Paragraph 3, Line 2	Remove word 'detention.'
3	K. Reininga	C-8	Storm Drainage Plan Paragraph 4, Line 2	Include mention of water quality.
4	K. Reininga	C-8	Storm Drainage Plan Paragraph 4, Line 3	Add "Prepared in X and updated in X" after Stormwater Master Plan.
5	K. Reininga	C-8	Policy 3.1.7	The need to prioritize green infrastructure and infiltration should be reflected in the policy statement. It may be preferred to keep language general and say compliance with the City's standards is required and then those priorities reside there. Or, an implementation measure could be added to address the new permit requirements for LID and retention. Numbering appears to be incorrect, as this should be Policy 3.1.9.
6	K. Reininga	C-8	Policy 3.1.7 Paragraph 1, Line 6	Add "peak rate" after "volume".
7	K. Reininga	C-9	Implementation Measure 3.1.7.b, Line 3	Add Municipal Separate Storm Sewer System (MS4) before the word permit as there are other types of NPDES permits.
8	K. Reininga	C-9	Implementation Measure 3.1.7.c, Line 9	Remove word 'detention.'
9	K. Reininga	C-9	Implementation Measure 3.1.7.e	City to confirm this implementation measure is still applicable.
10	K. Reininga	C-9	Implementation Measure 3.1.7.f, Line 3	Clarification need. It is not clear what Option A is referring to.
11	K. Reininga	C-10	Implementation Measure 3.1.7.h, Line 3	"Development Review Board" - Is this still the appropriate reference?

Comment Log Public Facilities and Services Section				
No.	Reviewer	Page	Section	Comment
12	K. Reininga	C-10	Implementation Measure 3.1.7.k, Line 5	Has this now been done? Reference: "For that area along Coffee Lake Creek, a hydrology study to establish the 100-year flood elevation will be required prior to development approval."
13	K. Reininga	C-10	Implementation Measure 3.1.7.n, Line 1	Insert word "peak" in single-storm drainage runoff.
14	K. Reininga	C-10	Implementation Measure 3.1.7.n, Line 5	Revise to say stormwater management facilities here instead of detention or retention facilities.
15	K. Reininga	C-11	Implementation Measure 3.1.7.n, Line 7	Has this been done? "The appropriate criteria will be established and implemented through the City's Public Works Standards."
16	K. Reininga	C-11	Implementation Measure 3.1.7.r, Line 3	Replace "detention/retention basin" with the term stormwater management facility.