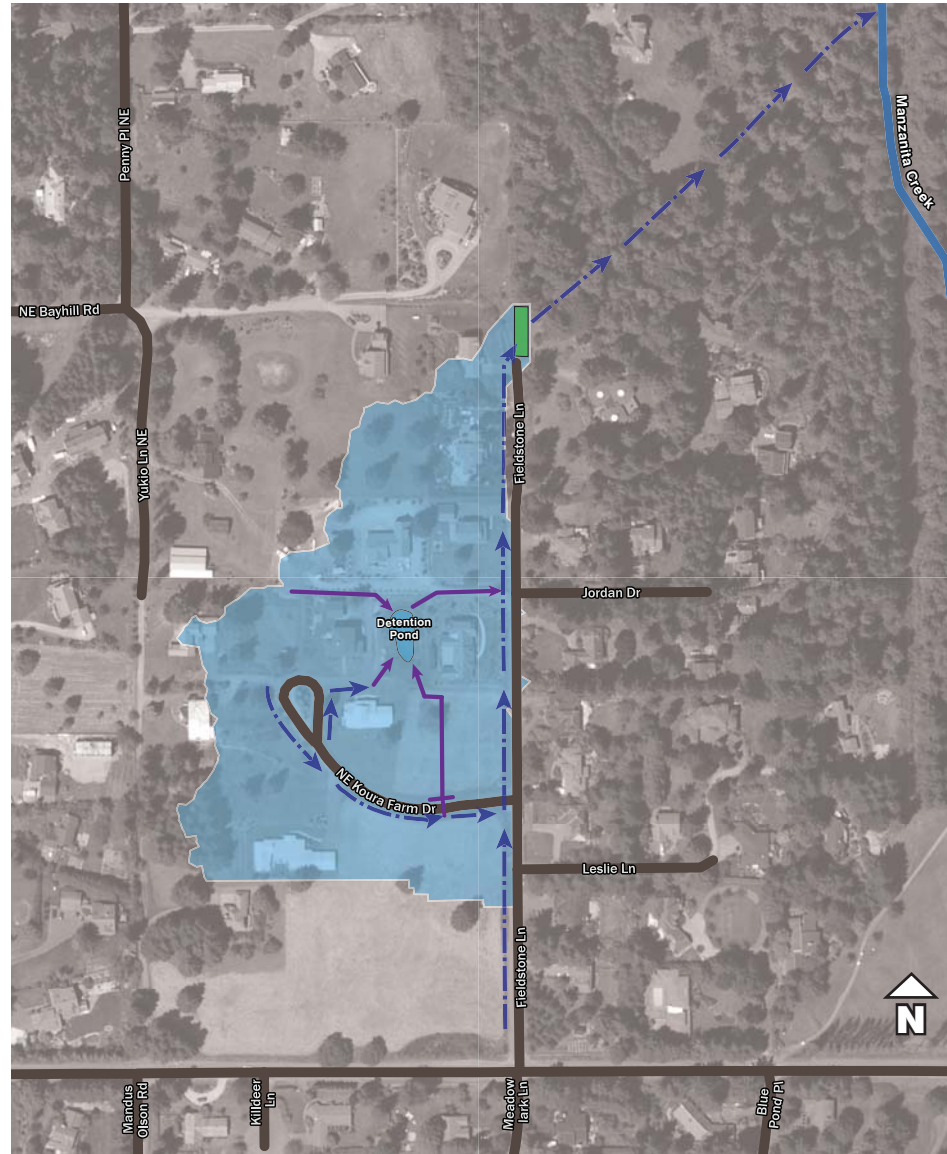
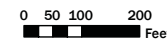


Facility Drainage Area



Legend

- Project Site
- Catchment Area
- Channelized Flow

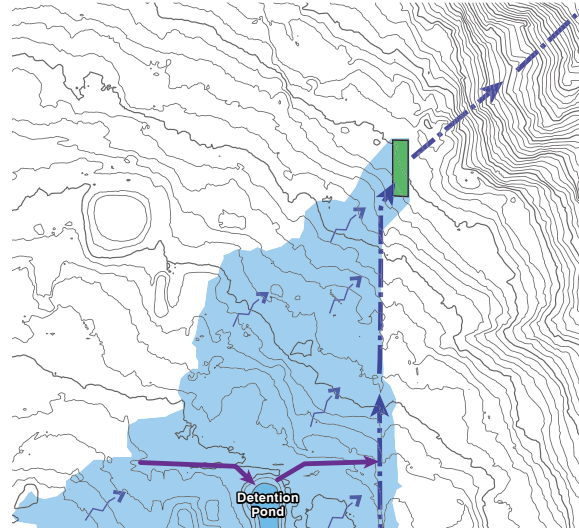


Existing Conditions Photo



Looking north from Fieldstone Lane (taken 10/14/2021). The project site is between the path on the left (west) and the yellow vegetation and wood fence on the right (east). The right of way line is along the right (east) side of the gravel path.

Key Prioritization Criteria



Catchment Area and Drainage Patterns

- Large catchment area: 9 Acres
- High stream connectivity: 900 feet from Manzanita Creek

Project Background

Through multiple studies, the City identified the Manzanita watershed as a priority for stormwater retrofits, identified multiple project opportunities, and prioritized them. This project was selected as one of the two highest priority projects. More information can be found online - Bainbridgewa.gov/WAM

Design Considerations

- Facility footprint is constrained to existing right of way (30 ft x 90 ft)
- Potential utility conflicts: water supply line, underground electrical distribution line and vault
- Shallow infiltration is infeasible (AESI, 2022)



Land Ownership and Maintenance Access

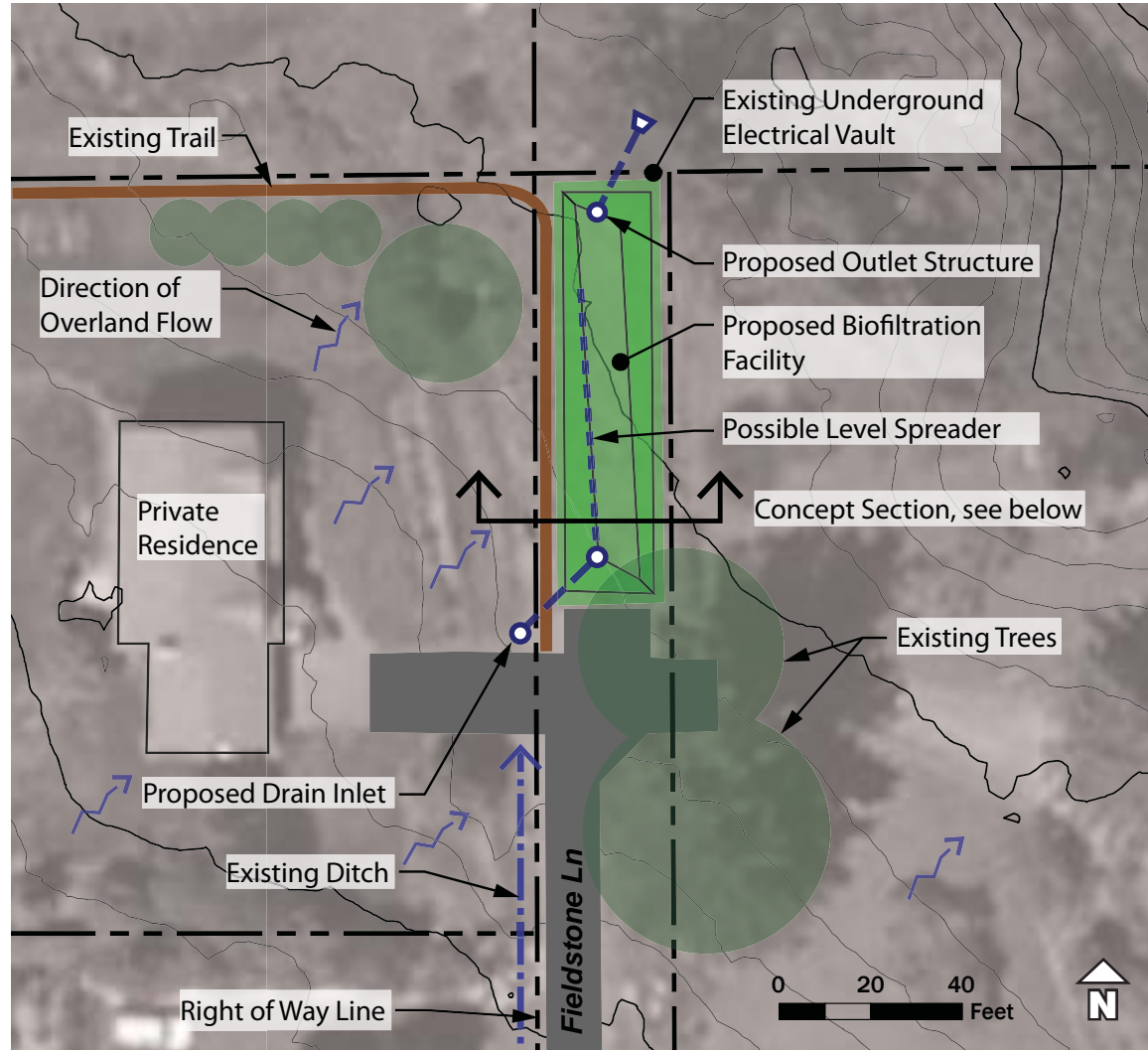
- Public ownership: site is within public street right of way
- Maintenance access directly from Fieldstone Lane



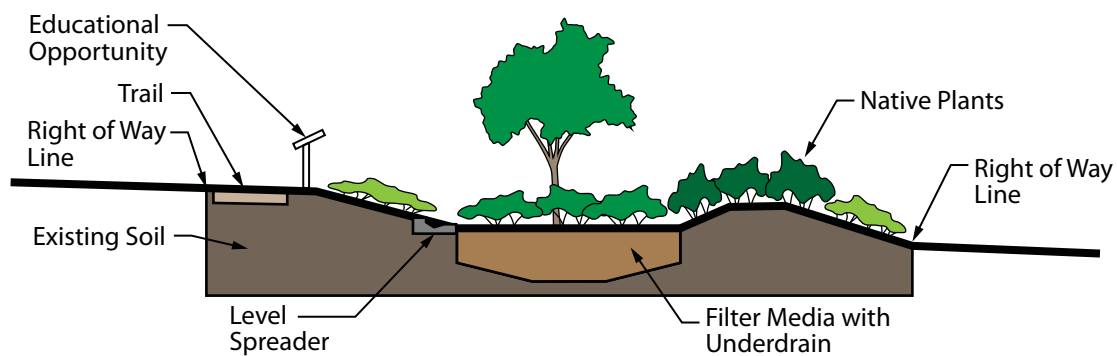
Multi-Benefit Opportunities

- Habitat: convert lawn area to native vegetation and pollinator habitat
- Trails: important connection between NE Bayhill Road and Fieldstone Lane
- Educational: visible and accessible to public with signage

Concept Plan



Concept Section



Project Description

Construct a biofiltration facility to provide water quality treatment for runoff from 9 acres of residential development draining to Manzanita Creek. Include educational signage and improve an existing trail connection. Protect and relocate existing underground utilities

Preliminary modeling indicates that high-performance media, rather than traditional bioretention soil media, may be needed to treat 91 percent of the stormwater runoff volume, so project cost assumes installation of a biopod or similar facility with high treatment flow rates per square foot of facility area.

Estimated Cost

\$200,000 (design, permitting, and construction)

Project Benefits

- Equivalent Impervious Area Managed: 0.7 acres
- Volume of Stormwater Treated Annually: 11.0 acre*ft
- Estimated Annual Pollutant Load Reduction:¹

Pollutant	Annual Reduction (lbs)
Copper Dissolved	0.022
Copper Total	0.040
Total Nitrogen	12.957
Total PCB	0.004
Total Phosphorus	1.115
Total Suspended Solids	361.842
Zinc Dissolved	0.097
Zinc Total	0.227

1. Pollutant Removal Performance: Herrera. 2020. Draft Water Quality Benefits Evaluation Action Fact Sheet. Phase 1. Prepared by Herrera for King County.
Pollutant Event Mean Concentrations from Low Density Residential: Herrera. 2011. Toxics in Surface Runoff to Puget Sound Phase 3 Data and Load Estimates. Prepared for Washington State Department of Ecology by Herrera Environmental Consultants, Inc. Seattle, Washington.
Hobbs, W., B. Lubliner, N. Kale, and E. Newell. 2015. Western Washington NPDES Phase 1 Stormwater Permit: Final Data Characterization 2009-2013. Washington State Department of Ecology, Olympia, WA. Publication No. 15-03-001.

Design Precedents



High Point Natural Drainage System

Seattle, Washington

- Wide bioretention cell with sloped sides
- Informal plantings with native grasses and wildflowers

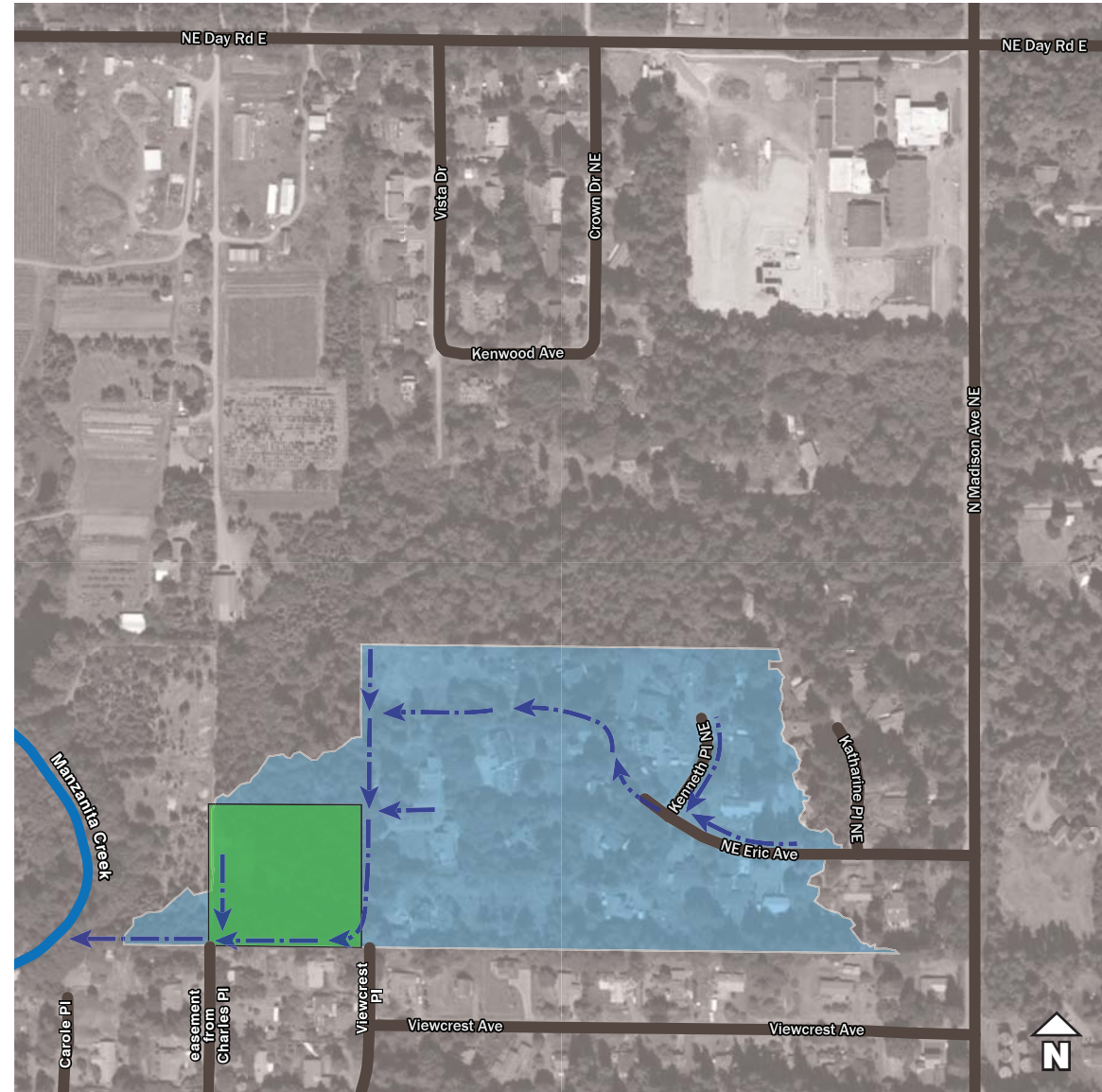


Six Swales Bioretention Systems

Redmond, Washington

- Narrow bioretention cell with vertical sides to maximize treatment volume and preserve adjacent area for a sidewalk
- Education signage next to sidewalk

Facility Drainage Area



Legend

- Project Site
- Catchment Area
- Channelized Flow

Site Photo



Looking northeast from the southwest corner of the site (taken 10/14/2021). The open area of the project site is covered with blackberry bushes. The mature trees in the background are within the site boundaries.

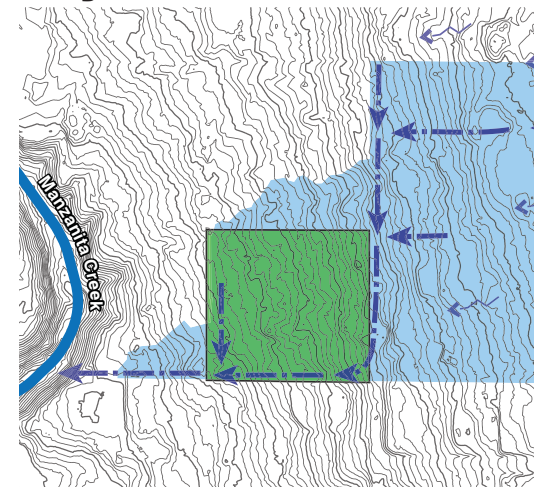
Project Background

Through multiple studies, the City identified the Manzanita watershed as a priority for stormwater retrofits, identified multiple project opportunities, and prioritized them. This project was selected as one of the two highest priority projects. More information can be found online - Bainbridgewa.gov/WAM

Design Considerations

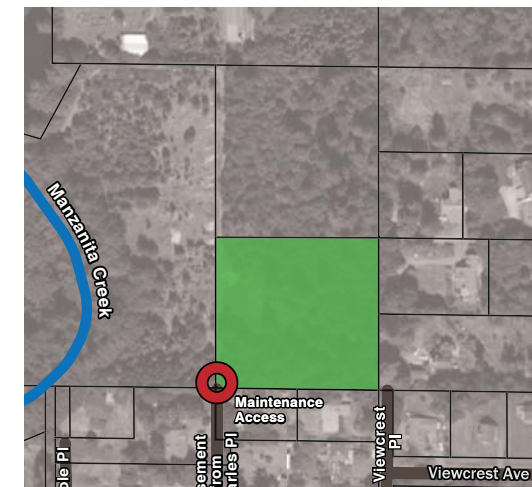
- Preservation of mature trees may limit pond location and layout
- Shallow infiltration may be feasible. Coarse grained sediments were present at 14.5 feet. Planning level infiltration rates are estimated at 0.5 to 2 inches per hour (AESI, 2022)

Key Prioritization Criteria



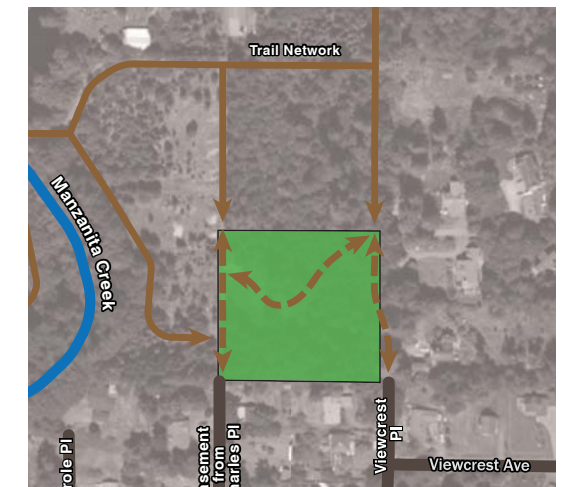
Catchment Area and Drainage Patterns

- Large catchment area: 18 Acres
- High stream connectivity: 300 feet from Manzanita Creek



Land Ownership and Maintenance Access

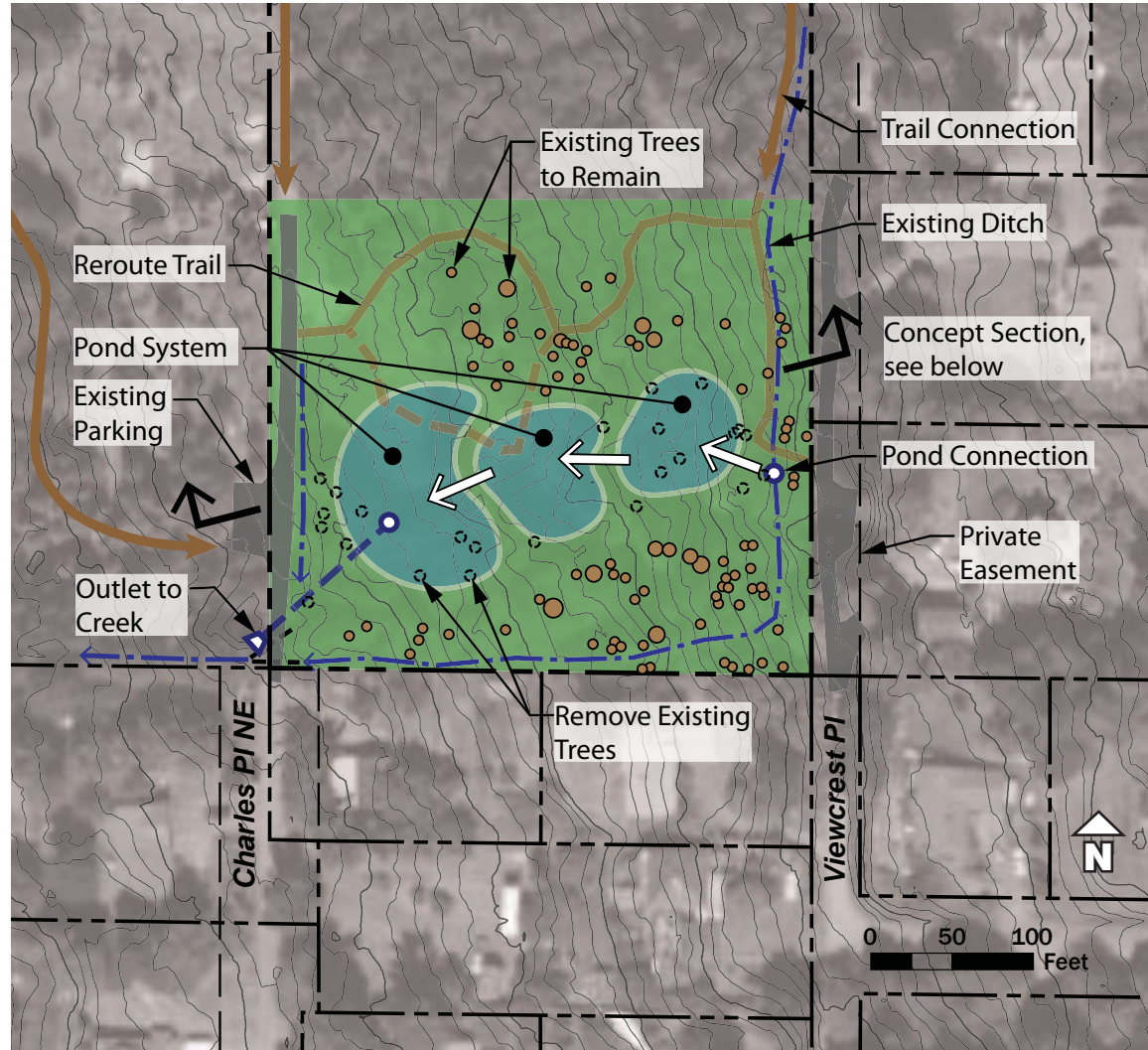
- Public ownership: site is within public farm
- Maintenance access from easement



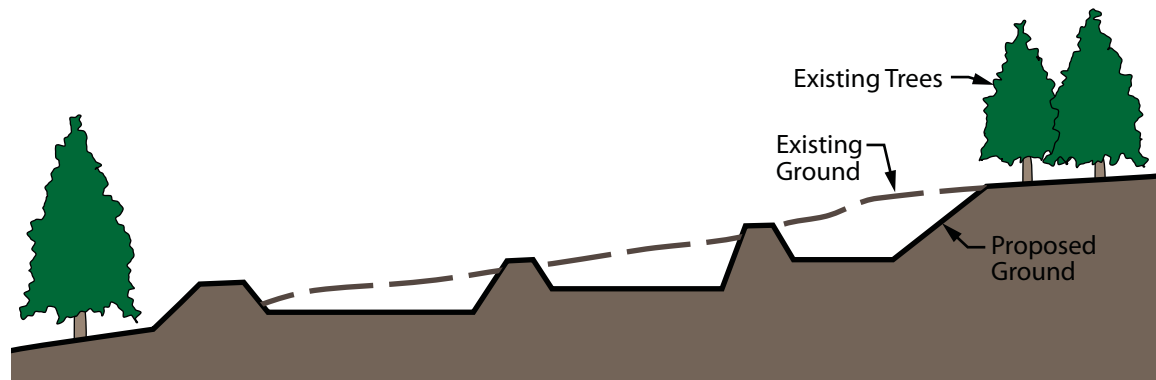
Multi-Benefit Opportunities

- Stormwater Park: natural setting with trails, seating, and other amenities
- Trails: improves important connection within existing trail network
- Educational: visible and accessible to public with signage
- Habitat: for amphibians

Concept Plan



Concept Section



Project Description

Create a stormwater park to provide water quality treatment and flow control for stormwater runoff from 18 acres of residential land. The project would be a partnership between the City's stormwater utility and the Friends of the Farms.

The facility was sized based on the flow duration standard so that the proposed discharge rates are below the pre-developed discharge rates from 50 percent of the 2-year peak flow to the full 50-year peak flow. For this site, pre-developed conditions are assumed to be forested.

Estimated Cost

\$500,000 (Permitting and Construction)

Design Precedents



Eastsound Wetland

- Stormwater treatment that fits within a rural setting
- Mature trees protected and integrated with the design

Project Benefits

- Equivalent Impervious Area Managed for Flow Control: 1.1 acres
- Equivalent Impervious Area Managed for Water Quality: 0.8 acres
- Volume of Stormwater Treated Annually (Infiltrated): 13.3 acre*ft
- Estimated Annual Pollutant Load Reduction:¹

Pollutant	Annual Reduction (lbs)
Copper Dissolved	0.067
Copper Total	0.102
Total Nitrogen	45.694
Total PCB	0.005
Total Phosphorus	3.259
Total Suspended Solids	506.909
Zinc Dissolved	0.217
Zinc Total	0.496

1. Pollutant Removal Performance: Herrera. 2020. Draft Water Quality Benefits Evaluation Action Fact Sheet. Phase 1. Prepared by Herrera for King County. Pollutant Event Mean Concentrations from Low Density Residential: Herrera. 2011. Toxics in Surface Runoff to Puget Sound Phase 3 Data and Load Estimates. Prepared for Washington State Department of Ecology by Herrera Environmental Consultants, Inc. Seattle, Washington. Hobbs, W., B. Lubliner, N. Kale, and E. Newell. 2015. Western Washington NPDES Phase 1 Stormwater Permit: Final Data Characterization 2009-2013. Washington State Department of Ecology, Olympia, WA. Publication No. 15-03-001.



Chambers Lake Stormwater Treatment Facility

- Stormwater park with paths, overlooks, and educational signage
- Natural area with wildlife habitat