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City of Gresham Stormwater Retrofit Master Plan

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City of Gresham
Stormwater Retrofit Master Plan

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A research project report submitted in partial fulfillment of the requirement for the degree of

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Abstract

The Stormwater Retrofit Master Plan identifies more than 50 stormwater retrofit project opportunities across three watersheds in the City of Gresham. The retrofit projects are prioritized in a scoring system to evaluate the costs and benefits of diverse project sizes and types. Project types range from bioswales and planters in city parking lots and along arterial roads, to regional end-of-pipe facilities and retrofits of existing detention ponds. Top projects will move forward for further assessment, design and construction, helping the city achieve its water quality improvement goals. The scoring system may be used to evaluate additional projects in the future.

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Introduction

This stormwater retrofit master plan was developed to provide a prioritized list of projects to design and construct using the City of Gresham's (COG) Low Impact Development (LID) Practices Retrofit Program Capital Improvement Program budget. It builds upon the retrofit opportunities identified in Gresham's 2015 TMDL Benchmarks report (City of Gresham, 2014) to Oregon Department of Environmental Quality (DEQ). This retrofit master plan identifies the "low-hanging fruit" projects that could be tackled first to achieve significant water quality and hydrologic benefits with limited funds. In addition to identifying and ranking projects that the City can currently consider, the plan also establishing a ranking tool that can be used to evaluate any future project that is identified and the City might consider implementing in the future.

Potential retrofit opportunities were identified across three watersheds and a scoring system was developed to compare their costs and benefits. Retrofit design concepts and ballpark cost estimates were developed for each project. The process required desktop data from the city's GIS records including stormwater pipe networks, outfalls, land use types, street functional classes, census data, soil type, and the location of natural water bodies. Site visits were essential for determining suitability of potential retrofit sites. The city will further investigate the highest ranking projects for design and construction. The scoring system developed for this retrofit master plan can be used to assess additional projects in the future.

This master plan builds on existing related COG reports, including:

- Natural Resources Management Plan (2010)
- Stormwater Management Plan (2015)
- Kelly Creek Stormwater Master Plan (2006)
- Johnson Creek Stormwater Master Plan (2005)
- Fairview Creek Stormwater Master Plan (2003)
- West Gresham Stormwater Master Plan (2005)
- Springwater Stormwater Master Plan (2006)
- Stormwater Retrofit Strategy (2014)

Gresham Watersheds and Water Quality Goals

The City of Gresham has three major watershed areas: Fairview Creek/Columbia Slough, Johnson Creek, and Kelly/Burlingame/Beaver Creek. Each of these watersheds has Clean Water Act listings, and COG has Total Maximum Daily Load (TMDL) waste load allocations they are working to meet as part of their municipal stormwater permit. The TMDLs vary by watershed (Table 1).

Table 1: City of Gresham watersheds and associated Total Maximum Daily Load (TMDL) and 303(d) listed pollutants

Basin	Stream	TMDL	303(d)
Willamette	(all)	Mercury	None
	Columbia Slough	Bacteria, phosphorus, lead, DDT/DDE, Dieldrin, dioxins, PCB, chlorophyll-a, dissolved oxygen, pH, temperature*	Cat 5 (TMDL needed): Iron biological criteria Cat 3 (insufficient data): antimony,, barium, beryllium, cadmium, chromium, copper, nickel, thallium, zinc, flow modification Cat 3B (potential concern): ammonia
	Johnson Creek	Bacteria, DDT Dieldrin, temperature*	Cat 5 (TMDL needed): PCB, PAHs, DDE, Endosulfan, Endrin aldehyde, lead, biological criteria Cat 3 (insufficient data): chlorinated benzenes, chlorophyll-a, halogenated pesticides, flow modification, nutrients Cat 3B (potential concern): chlordane, DDD, Dioxins/Furans, Endrin, Heptachlor, Methoxychlor, iron, manganese, phosphorus
	Fairview Creek	Bacteria, pH, temperature*	None

Sandy	Kelly/Burlingame/Beaver	Bacteriatemperature*	Cat 5 (TMDL needed): Lead, , biological criteria Cat 3 (insufficient data): nutrients, sedimentation, ammonia, chloride, chlorophyll a, dissolved oxygen, pH, flow modification

*DEQ does not consider stormwater to be a temperature contributor, but it is included for completeness.

The Retrofit Assessment Process

The Center for Watershed Protection identifies eight steps in the stormwater retrofitting process (Fig. 1) This master plan completes steps one through five.

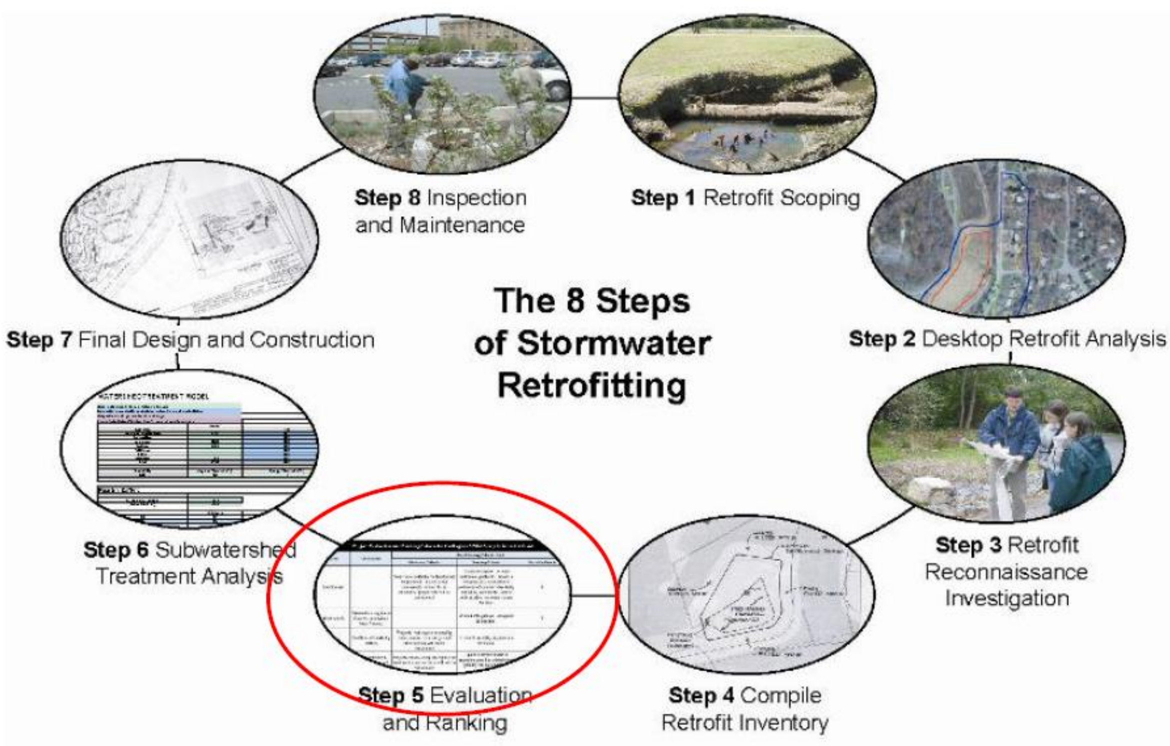

Figure 1. The eight steps of the stormwater retrofitting process (Schueler et al., 2007)

Step 1. Retrofit Scoping

The City has already identified its retrofit objectives:

1) Project implementation within untreated areas over the next 20 plus years
2) Reduction of TMDL and 303(d) Listed Pollutants
3) Volume reduction that will help reduce stormwater hydromodification impacts on streams
4) Minimize long-term maintenance costs
5) Maximize cost/benefit ratio of retrofit program
6) Maximize aesthetic benefits/improve the city's streetscape
7) Enhance pedestrian and bicycle access and safety
8) Educate the public about the connection of the retrofits to water quality
9) Leverage budgets for retrofits by connecting to multiple objective projects

The retrofit project ranking process was designed to meet these objectives. The City has set aside capital improvement funding for LID retrofits. This effort focuses on city-owned properties.

Step 2. Desktop Retrofit Analysis

The City's GIS maps of the existing stormwater system were used to identify potential locations for retrofits. In some cases, the maps needed to be updated and groundtruthed to clarify which pipes drained to which outfalls, and those corrections were made to the GIS records. Existing stormwater ponds were reviewed based on their history of maintenance problems and the size and makeup of their pipesheds. City staff were invited to share suggestions for retrofit opportunities and problem areas. Past watershed plans were reviewed to follow up on earlier recommendations.

Step 3. Retrofit Reconnaissance Investigation

The feasibility of potential retrofit sites was investigated in the field, and rough retrofit design concepts were developed. Some potential sites were abandoned after field investigation.

Step 4. Compile Retrofit Inventory

Retrofit concepts were tracked in a spreadsheet, and project sizing, pipeshed area, and cost estimates were calculated.

Step 5. Retrofit Evaluation and Ranking

A scoring and ranking system was developed based on the city's retrofit objectives. The scoring system was refined based on feedback from multiple staff working in Gresham's environmental science, stormwater engineering, and operations & maintenance programs. Once the ranking system was finalized, projects that passed the field investigation stage were scored and ranked to identify top projects for design and construction.

Step 6. Subwatershed Treatment Analysis

COG is not including this step in its retrofit master plan at this time. COG aims to implement cost-effective stormwater retrofits in multiple watersheds throughout the city, rather than focusing them in one subwatershed.

Step 7. Final Design and Construction
This step will need to be executed by COG or its contractors for the top ranking projects.

Step 8. Inspection, Maintenance & Evaluation
New retrofit projects will join the City's existing stormwater facility inspection, maintenance and evaluation system.

Retrofit Project Types

Potential retrofit projects were identified in parts of the city that currently have little to no stormwater treatment. This effort focused primarily on properties owned or maintained by the City of Gresham, which will be easier to access for retrofit than privately owned properties. Retrofits project types included end of pipe treatment at outfalls, retrofitting existing stormwater ponds, adding rain gardens to city-owned parking lots and arterial roads, installing drywells, converting ditches to swales, downspout disconnection, and depaving excess asphalt.

A. End of pipe treatment
Where there is space at or near a stormwater outfall pipe, a facility can be added to treat stormwater quality and reduce stormwater volume. These retrofits manage runoff from throughout the pipeshed, including multiple properties and land uses, so they can also be called regional facilities. In many cases, the area available for treatment is very small in comparison to the large catchment area, so only a small portion of the runoff volume can be treated. The design of the facility depends on local site conditions, and facility types can include bioretention, filters, ponds or wetlands, and regenerative stormwater conveyance. Regenerative stormwater conveyance is an open-channel filtering system that uses a series of shallow pools and riffle weirs, with native vegetation and carbon-rich sand to treat, infiltrate, detain and convey stormwater flows (Brown et al., 2010). It combines the features and benefits of swales, infiltration, filtering and wetlands.

B. Retrofitting existing stormwater ponds
The City of Gresham owns more than 30 stormwater ponds that were built between 1992 and 2007. Most were designed primarily for detention and they provide little volume reduction or water quality benefit. Vegetation typically consists of grasses, cattails, or no vegetation, and they often have been colonized by alder trees and/or Himalayan blackberries, which in some cases have been removed by maintenance crews in the last three years. The ponds treat mostly residential neighborhoods, and some receive runoff from arterial streets as well. Ponds were prioritized for retrofit investigation if their treatment area is ten acres or larger, they have a history of maintenance problems such as high sedimentation, and their treatment area includes an arterial street or commercial area. The Kitsap County Stormwater Pond Retrofit Manual (Herrera, 2012) was used as a guide to assess ponds and identify potential retrofit possibilities.

C. Green streets
The City's 2014 Stormwater Retrofit Strategy and Plan (City of Gresham, 2014) identifies high traffic streets as the highest retrofit priority due to their high amount of impervious surface and high pollutant loads generated by vehicles. Arterials with space in the right of way for rain gardens along the roadside

or in the median were identified. Some residential streets were also explored, but they were assumed to produce lower pollutant loads than arterials. Site visits were essential to understanding how the road is crowned and which direction runoff flows. In addition to the typical stormwater planters, street-side retrofits could include street trees or tree trenches, a practice in which structural soils are used to provide additional room for tree roots to grow under streets or sidewalks while also storing and infiltrating runoff.

D. City-owned parking lots

The City owns several public surface parking lots in the downtown commercial district. These heavily trafficked, highly visible, publicly owned properties are excellent retrofit opportunities for stormwater planters or rain gardens. Each lot was visited and retrofit opportunities were identified. In addition, the City's operations yard was also assessed for retrofits.

E. Mt. Hood Community College

The City is currently working with the Sandy River Basin Watershed Council and other partners to investigate stormwater retrofit opportunities at Mt. Hood Community College. The top projects identified by that group (Herrera, 2016) are included in this retrofit plan. Most of them are parking lot retrofits. These projects are grouped together because they are not on COG property and they have unique opportunities for collaboration.

F. Underground Injection Controls (UICs)

UICs (drywells) can be installed to infiltrate stormwater in areas with high soil infiltration rates and adequate separation distance between the surface and groundwater levels. UICs were considered as a way to infiltrate stormwater and decrease runoff volumes in areas that have MS4 pipes but are adjacent to areas where UICs are currently used.

G. Ditch to swale conversion

While conventional swales are designed primarily to convey stormwater, LID swales have check dams to promote infiltration and allow for more contact time with soil and plants to improve water quality. The City has numerous ditches that could possibly be converted to LID swales to improve water quality and reduce stormwater volume. However, many existing ditches are on streets where the city will likely add curbs and sidewalks in the next 10 years. Attention was focused on locations that are less likely to be redeveloped in the near term. Swales manage runoff from the upstream contributing drainage area, including multiple properties and land uses. For ditch to swale retrofit design options, consult the Kitsap County Roadside Ditch and Shoulder Water Quality Enhancement Plan (Otak, 2012).

H. Downspout disconnects

Downspout disconnects reduce runoff volumes from rooftops. The water they treat typically has relatively low pollutant loads. COG already has a residential downspout disconnection program that prioritizes neighborhoods with soils that infiltrate well. It has a separate funding source, so the LID Retrofit CIP will not need to be used for downspout disconnects. A few were included in this strategy to see how they compare with other projects based on the scoring criteria.

I. Fire station wash pad retrofits

Some of the city's fire stations wash their fire engines and trucks in a location that drains to the stormwater system. The City needs to retrofit these areas with some form of treatment to prevent vehicle washing waste from entering the stormwater system. Site visits found storm drains full of sudsy water. At the locations that scored highest in the ranking system, rain gardens could be installed to treat stormwater and wastewater before it enters the storm drain. At other locations there was not space to add a rain garden, so a valve would need to be installed to switch the drain to a wastewater connection when vehicles are being washed. Communication with CONTECH confirmed that their proprietary filters, which COG uses in some parts of the city, are not designed to treat soap suds.

J. Sedimentation manhole

A sedimentation manhole was included in the ranking matrix to see how it would compare with other practices. Sedimentation manholes settle out course solids and are often used as pretreatment before a UIC or other facility. On their own they do not reduce runoff volume and they provide incomplete water quality treatment.

K. Depave

Removing pavement is a step in the retrofit construction process for many project types, such as green streets and parking lots. One larger depaving project was also considered, in which most of a remnant street section that is currently used as a bicycle and pedestrian path would be removed.

L. Repairs

While investigating stormwater retrofit opportunities, a few existing stormwater facilities in need of repair were identified. This includes a number of stormwater planters that were installed with an inadequate depression at the inlet, so most runoff is currently bypassing the entire planter. These repairs could be funded by the LID Retrofit CIP, or with another funding source.

Scoring System for Prioritizing Retrofit Projects

A scoring system consisting of 15 criteria was developed for prioritizing potential retrofit projects. Each criterion has a maximum score of 10 and minimum score of zero. Multiplicative weighting factors of between 0.1 and 2 were given to each criterion. The criteria fall into three categories: environmental, cost, and multiple objectives. Weighting factors were allocated so the environmental criteria make up 60% of the total score, cost 28%, and multiple objectives 12%. For details on how each criterion is scored, please see Appendix A.

Environmental criteria

1. **Land use**: Higher scores are given when the drainage area includes commercial or industrial land uses, because they generate higher pollutant loads, based on monitoring conducted by multiple municipalities (Oregon ACWA, 1997). Lower scores are given for purely residential drainage areas.
2. **Arterial streets:** Since high traffic streets generate the highest pollutant loads in stormwater runoff, higher scores are given for treatment areas that include arterials. This criterion also

includes a score for projects that treat parking lots or other 100% paved areas that are not arterials.

3. **Existing treatment:** The highest score is given for drainage areas that currently receive no stormwater treatment and have "self-cleaning" catch basins. These catch basins are designed so sediment is flushed out of them into the stormwater system. Their presence can be identified in the City's GIS mapping system. Lower scores are given for drainage areas that already have some stormwater treatment, such as an existing pond.
4. **Volume reduction:** For each project, an area ratio is calculated dividing the surface area of the proposed stormwater facility by the area that drains into it. In some cases this required making improvements to the City's GIS records to confirm which pipes connect to which outfalls. A large area ratio indicates a higher likelihood of infiltrating stormwater into the ground in the facility, thus reducing runoff volume. Soil type was not factored into this score.
5. **Water quality improvement:** This score is based primarily on the type of proposed best management practice (BMP) and its ability to improve water quality of runoff (Table 2).
   - UICs and porous pavement score a 10 because they produce no surface runoff. Bioretention and filters also score a 10.
   - However, if the facility is vastly undersized (with an area ratio less than 0.5%), the score is reduced to 7.5 since the BMP will be unable to fully treat the water quality design storm.
   - Conveyance swales without check dams, downspout disconnects, and detention ponds score a 5.
   - Sedimentation manholes score 2.5.

Table 2. Pollutant removal abilities of stormwater best management practices (BMPs).

BMP	Volume Reduction	TSS	Phosphorus	Bacteria	Metals
Rain garden	High	High	High	High	High
Swale	Moderate	Moderate	Moderate	Low	Moderate
Dry pond	Moderate	Moderate	Low	Low	Low
Engineered wetland	Low	Moderate	Moderate	Moderate	Moderate
UIC	High	High	High	High	High
Pervious pavement	High	High	High	High	High
Downspout disconnect	High	High	High	High	High
Sedimentation manhole	None	Moderate	Low	Low	Moderate
Manufactured filter device	None	Moderate	Moderate	Low	Moderate

Adapted from ACWA (2014).

6. **Impact:** This score assesses the size of the project. Higher scores are given for large projects that can have a significant impact on the watershed, versus small projects that treat less than an acre.

Cost Criteria

7. **Cost per acre of area treated:** Ballpark project cost is divided by acreage of the drainage area. A lower cost per acre of area treated receives a higher score.
8. **Total project cost**: A lower project cost receives a higher score. Given limited funds, there is some advantage to doing multiple, smaller projects versus one large project. Ballpark cost estimates were developed for each project based on its size and project components (Appendix B). An effort was made to use cost estimates that are localized to the City of Gresham whenever possible.
9. **Maintenance cost**: Long term maintenance of stormwater facilities is important to consider in a cost evaluation. The maintenance score is based on the type of proposed BMP, with low scores given for high maintenance costs (filter cartridges), a moderate score for bioretention facilities, and a high score for ponds, UICs and sediment manholes. The highest score is given for projects that create no increased maintenance (such as repairs of existing facilities).
10. **Coordinate/leverage**: If there are known or expected opportunities to partner with other agencies or receive grant funding, that is reflected in this score.
11. **Property ownership**: While this plan focused primarily on publicly-owned land, there are some projects on privately owned properties. Projects on city-owned land received the highest score, because they will be more straightforward to construct and maintain with city resources.

Multiple Objectives

12. **Education visibility, signage:** Projects in highly visible locations that are well-suited to signage receive a higher score for the public education opportunity they provide. Other projects, such as drywells, are not visible at all.
13. **Equity:** The equity score considers whether the project benefits a low-income community or a community of color. In general, Gresham has higher diversity and poverty rates than the Portland regional average. The city only has four census tracts with lower poverty rates than the regional average and lower percentage populations of color than the regional average (Table 3). Projects in these neighborhoods receive a lower score than those in the rest of the city.

Table 3. Gresham census tracts with rates of poverty and diversity that are lower than the regional average (Coalition for a Livable Future, 2013).

Census Tract	**Location**
09903	South of Binford Lake, West of Towle Ave.
09904	South of Powell Blvd., North of Springwater Trail, West of Eastman Pkwy.
09905	South of Springwater Trail, North of Binford Lake, West of Towle Ave.
09906	Buttes area South of Springwater Trail, East of Towle Ave.

14. **Address flooding, infrastructure capacity, or safety:** If projects will help address local flooding or other infrastructure capacity issues, they receive a higher score. These issues were identified by Gresham staff and by reviewing watershed stormwater master plans. A list of local problem areas was compiled and used to assess this project score (Appendix C). Creating a GIS layer for these problem areas would streamline the process and help the city plan future projects.

15. **Community benefits:** Stormwater retrofits can provide additional benefits beyond stormwater management, such as improving the pedestrian environment, adding wildlife habitat, and beautifying neighborhoods. Projects that provide more community benefits receive a higher score.

Results

A total of 52 potential stormwater retrofit projects were identified and scored. Descriptions of the top 35 projects are provided in Appendix E. Project scores ranged from 39 to 71.75, out of 100 possible points. Top ranking projects occur in each of the three watersheds (Table 4). The top ten ranked projects include fire station retrofits, Mt. Hood Community College, green streets, a parking lot retrofit, and a UIC. Within each project type, there is typically a range of scores. A complete list of projects grouped by project type is provided in Appendix D. The scoring system is designed to differentiate between individual projects as well as between project types (Figure 2). The projects with the lowest cost per treated acre are not necessarily the highest scoring projects (Figure 3), since there are multiple scoring criteria.

Comparing average scores of each project type, fire stations scored highest, followed by UICs, ditch to swale, Mt. Hood Community College, and green streets (Table 5). Sedimentation manholes and downspout disconnects received the lowest scores because sedimentation manholes only provide small water quality improvement and do not reduce runoff volume, and because downspout disconnects treat rooftop water that is less contaminated than runoff from streets and parking lots. It should be noted that while there is a significant difference between projects at the top of the list and those at the bottom of the list, projects whose scores differ by only a few points should be considered comparable. The scored projects have a standard deviation of 6.36 and standard error of 0.88.

Table 4. Top Ranking Retrofit Projects

Rank	Project Type	Score	Cost Estimate	Cost Per Acre Treated	Project Description	Watershed
1	Fire station	71.75	$26,000	$94,380	1520 NE 192nd Ave. Fire station plus training area.	Fairview/ Columbia
2	Fire station	70.5	$14,000	$93,822	2301 SW Pleasant View Dr. Fire station vehicle wash drain: bioretention	Johnson
3	MHCC	70.25	$476,000	$85,000	Parking lots Q,R,S,T,U restriping, bioretention, and grass pave. Not in Metro grant proposal.	Kelly
4	MHCC	69.75	$773,000	$198,205	Parking lots E,F,G,H restriping, bioretention and permeable pavement	Kelly
5	Green street	67.5	$19,600	$89,091	Burnside & Division Triangle (Rotary Club)	Kelly
6	MHCC	67.25	$154,000	$77,000	Parking lot A restriping and bioretention retrofit	Kelly
6	Parking lot retrofit	67.25	$2,000	$937	Operations - raise drain grate in existing swale	Johnson
8	UIC	67	$200,000	$100,000	UIC Implementation Ph 2 Pkg 2 Stark & 202nd	Fairview/ Columbia
8	Green street	67	$79,800	$178,995	Halsey at 186th. Use ROW and add sidewalk in unfinished section on N side	Fairview/ Columbia
10	Green street	65.75	$33,600	$134,400	1572 NE Burnside Triangle	Kelly
11	Ditch to swale	65.25	$21,200	$21,414	Hogan Rd ditch to swale - middle	Johnson
12	Ditch to swale	65	$4,500	$28,125	Hogan Rd ditch to swale - South	Johnson
13	Green street	64.5	$315,000	$123,217	Stark St. Hogan to Kane (in front of legacy)	Fairview/ Columbia
14	End of pipe	64.25	$405,000	$2,049	Thompson Creek: regenerative flow in isolated stream reach	Johnson
15	UIC	64	$194,825	$194,825	UIC CIP 902800, SE 182nd Ave at SW 5th Dr	Fairview/ Columbia
15	End of pipe	64	$225,000	$3,000	Hogan Dr & Hogan Pl	Kelly
15	Pond retrofit	64	$52,550	$2,628	Springwater Hills South. Excavate swale section and add plants.	Kelly

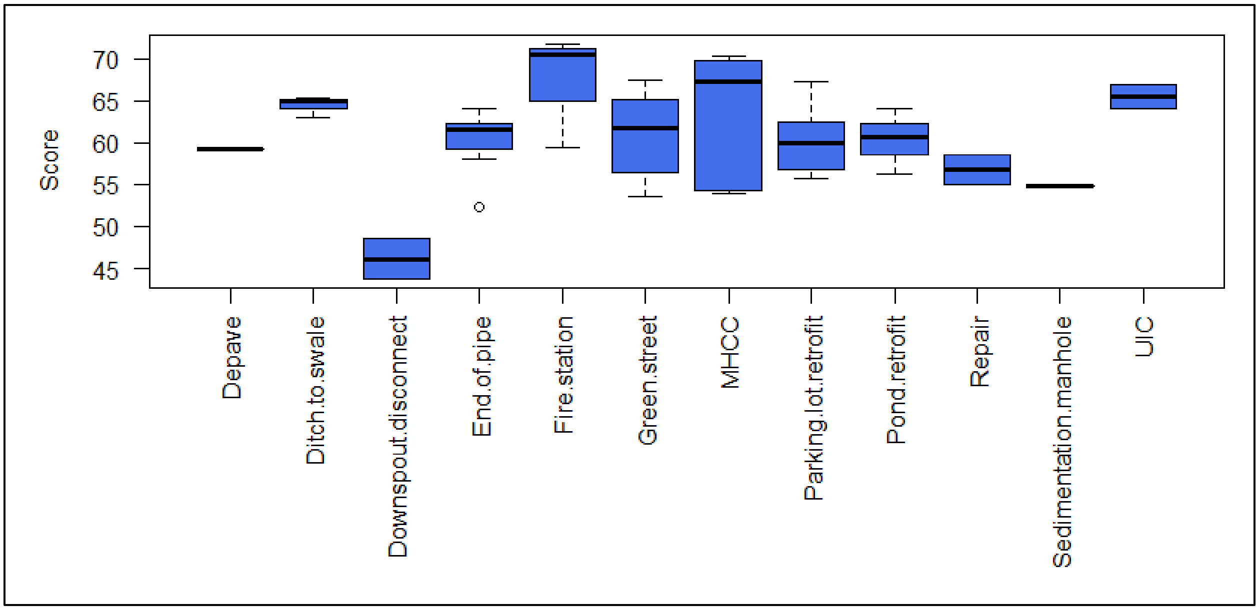

Figure 2. Box plot comparing scores for each project type.

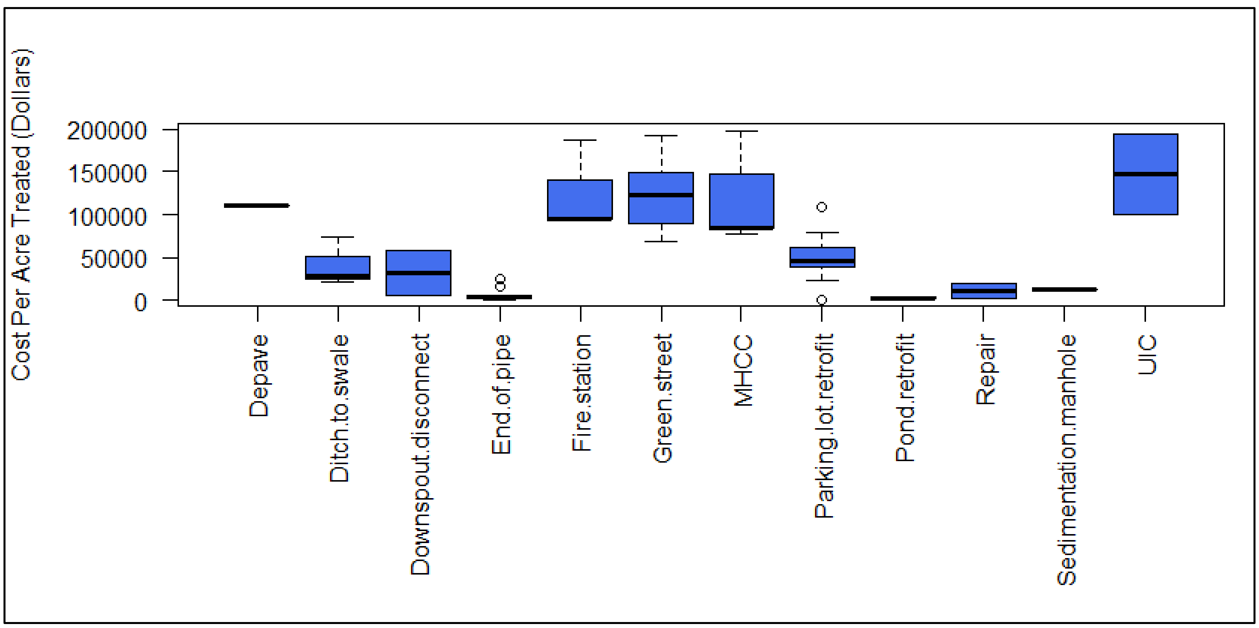

Figure 3. Box plot comparing cost per acre treated for each project type.

Table 5. Average score and cost per-acre-treated for each project type

Project Type	Number of Projects	Average Score	Average Cost Per Acre Treated
Fire station	3	67.25	$125,234
UIC	2	65.50	$147,413
Ditch to swale	3	64.42	$41,204
MHCC	5	63.10	$118,430
Green street	11	61.05	$121,913
End of pipe	9	60.75	$6,980
Pond retrofit	3	60.33	$2,773
Parking lot retrofit	9	60.11	$50,317
Depave	1	59.25	$111,111
Repair	2	56.75	$11,656
Sedimentation manhole	1	54.75	$12,000
Downspout disconnect	2	46.13	$31,849

Conclusions and Recommendations

This stormwater retrofit master plan identifies many more projects than the City of Gresham is currently able to fund. The ranking results should help COG identify top projects to move forward for design and construction, maximizing public benefits from retrofit investments. While the project list is long, it is by no means exhaustive. If COG identifies additional projects, the scoring matrix can be used to evaluate their costs and benefits. The scoring criteria and their weighting can easily be modified if the City's goals and priorities change. In addition, if additional information is acquired about any of the projects, their scores can be adjusted.

Some of the Mt. Hood Community College projects are high on the ranking list, and numerous partners are working to fund and implement them. Because MHCC is not COG property, the City's capital improvement budget may not be the appropriate funding source. If the City develops a new funding source to support the MHCC projects, it should be designed such that it could be used to fund retrofits on additional school properties, not just MHCC. Gresham School District properties were not investigated for this retrofit plan, and if funding were available for them they would likely score similarly to MHCC projects or parking lot retrofits. In other jurisdictions such as the City of Portland, stormwater retrofits at public schools have been very successful at providing educational opportunities in addition to managing runoff and improving neighborhood livability.

Another type of project location that may be considered in the future is the I-84 corridor. Freeway runoff is highly polluted, and the City may be able to partner with the Oregon Department of Transportation to implement stormwater retrofits along the freeway within COG.

This master plan process did not include the Center for Watershed Protection's step 6, which consists of analyzing the collective impact of stormwater retrofits on meeting water quality goals in a subwatershed. A watershed approach could benefit COG in the future. COG could identify priority subwatersheds where numerous stormwater retrofits would be implemented in concert with stream restoration projects upstream in the subwatershed. Repairing urban hydrology and improving water quality can address the root causes of stream degradation, enabling creek restoration projects to produce a long-lasting improvement in watershed health.

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Appendix A. Scoring Criteria

Criterion	Score	Weight	Total	10	7.5	5	2.5	0
Land Use Score	10	1	10	80% or greater commercial or industrial	50 - 79% commercial or industrial	10 - 49% commercial, industrial	< 10% commercial, industrial; but has some roads or parking	No commercial, industrial, or roads
Arterial Streets	10	1.1	11	>80% arterial street (arterial green street project)	Project has at least 50 linear feet or 50% arterials in treatment area. Or vehicle wash area.	Project has little or no arterials, but does have at least 50 linear feet or 50% collector streets in its treatment area, OR >80% lower traffic pavement (non-arterial green street or parking lot project)	No arterials or collector roads in treatment area (only local streets), and <80% pavement	No streets or parking lots in treatment area
Existing Treatment	10	0.6	6	No stormwater treatment plus >50% of catch basins are self-cleaning	No stormwater treatment; < 50 % of catch basins are self-cleaning	Minimal treatment, e.g. sedimentation manhole	Existing pond or other treatment for some stormwater.	Existing volume reduction and water quality treatment
Volume Reduction	10	1	10	Area ratio 10% or greater	Area ratio 5 - 9.9%	Area ratio 1 - 4.9%	Area ratio < 1%	No volume reduction
Water Quality Improvement	10	1.1	11	BMP has high ability to remove pollutants (or 100% volume reduction): porous pavement, bioretention, UICs, filter	BMP has high ability to remove pollutants but is vastly undersized for treatment area (area ratio <0.5%)	BMP has moderate ability to remove pollutants: conveyance swale without check dams, downspout disconnect, detention pond, lined bioretention.	BMP has little ability to remove pollutants: sedimentation manhole	BMP does not remove pollutants
Impact	10	1.2	12	Has effects region-wide, with significant downstream and/or upstream impacts. Or treats >30 acres	Treats 10 - 29.9 acres	Affects small sub-basin. Or treats 5-9.9 acres.	Treats 1-4.9 acres	Affects only one or two individual properties. Or treats <1 acre
Environment Subtotal			60					
Cost per acre of area treated	10	0.7	7	Low: < $5,000	$5,000 - $9,999	Medium: $10,000 - $49,999	$50,000 - $99,999	High: $100,000 or greater
Total project cost	10	0.7	7	Low: < $15,000	$15,000 - $99,999	$100,000 - $499,999	$500,000 - 999,999	High: $1 Million or greater
Maintenance cost	10	0.7	7	No additional maintenance for City of Gresham	Low: ponds, UICs, SMHs	Moderate: bioretention facilities	High: proprietary filters	
Coordinate/Leverage	10	0.4	4	High opportunity for grants or other funding, or concurrence with other projects		Small potential for grants or other funding, or concurrence with other projects.		No anticipated opportunity for grants or other funding sources, or concurrence with other projects
Property Ownership	10	0.3	3	City-owned land or right-of-way		Schools; private land with easement or permission	Undevelopable privately owned land	Developable privately owned land
Cost Subtotal			28					
Education visibility, signage opportunity	10	0.2	2	High visibility: Located at park, school, or community building, or high traffic area		Moderate: Above ground in location with some foot traffic		Low: underground facility or location with little foot traffic or signage opportunity
Equity	10	0.2	2	Project is in a census tract with higher than regional average percentage households below poverty level and percentage populations of color (Most Tracts)		Project is in a census tract with higher than average populations of color and lower than average households below poverty level (Tracts 10200 & 10002)		Project is in a census tract with below regional average populations of color and percentage households below poverty level (Tracts 09903, 09904, 09905, 09906)
Address flooding/ infrastructure capacity / safety	10	0.6	6	Project significantly addresses existing problem such as flooding, limited system capacity (10-yr storm surcharge problem), safety hazard		Project makes small contribution to resolving existing problem such as flooding, limited system capacity, safety hazard		Project does not address existing problems such as flooding, limited system capacity, safety hazard
Community benefits	10	0.2	2	Project provides four or more of the following: greenspaces, sidewalks, bike lanes, street trees, wildlife habitat, beautification or other social or environmental benefits.	Project provides three social or environmental benefits.	Project provides two social or environmental benefits.	Project provides one social or environmental benefit.	Project does not provide additional social or environmental benefits
Multiple objectives Subtotal			12					

Appendix B. Project Cost Elements

BMP	Cost	Units	Source
Vegetated planters with curbs	$35.00	square foot	COG Transportation Division
End of pipe, regional pond or wetland	$20.00	square foot	same as curbless rain garden
Rain garden without curbs	$20.00	square foot	less than with curb
Downspout disconnect	$0.13	square foot	COG downspout disconnect program: $100/800 sf roof (2 downspouts)
New UIC	$190,000.00	per acre	Average from COG UIC bid tabs
PROJECT COMPONENTS			
Excavation	$25.00	cubic yard	COG UIC Bid Tab
Amended Topsoil	$35.00	cubic yard	COG UIC Bid Tab
Concrete curb or rain garden wall	$40.00	linear foot	COG UIC Bid Tab
Perforated Pipe	$200.00	linear foot	COG UIC Bid Tab
Sediment Manhole	$6,000.00	each	COG UIC Bid Tab
Curb Opening	$500.00	each	COG UIC Bid Tab
Trees (2-in caliper)	$225.00	each	COG UIC Bid Tab
Tree removal	$350.00	each	COG UIC Bid Tab
Clear & grub	$0.50	square foot	COG UIC Bid Tab
Asphalt removal	$1.00	square foot	Eric Rosewall, Depave
Saw cutting cement	$6.00	square foot	COG UIC Bid Tab

Appendix C. Existing Flooding or Infrastructure Problems

ID	Location	Watershed	Problem	Source
3354-J-670	Outfall to one block of open channel on 6th between Elliott & Linden	Johnson	Water has nowhere to go. High flows cause flooding on 6th	David Lashbaugh
3051-F-601	Stark St. between 205th & 210th (pipes begin around 217th)	Fairview	Major stacking of water in the pipe system because the outfall is below the creek ordinary water level of flow. Catch basins and pipe systems full of water all winter long. The Mobile home park at 21016 had multiple flooding issues.	David Lashbaugh
3354-K-049	1301 SE 8th: Channel between Division & 8th, Burnside & Cleveland. (Behind Gresham Outlook)	Kelly	Outfall to a channel that has nowhere to go. Every year, very high flows, last year the channel breeched and flowed thru the buildings at along Division st. Major property damage, also flooded out several apartments on the south side of the channel. There is an inlet to pipes on Cleveland, but it is not shown on GIS.	David Lashbaugh
	Numerous locations in Fujitsu Ponds area	Fairview	50-yr overbank open channel flooding, channel erosion	Fairview Creek Stormwater Master Plan
3154-F-017	On 25th, in Red Sunset Park area	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3154-F-021	Manhole above Red Sunset Park inlet	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3154-F-003	Liberty & 22nd	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3154-F-042	22nd E of Elliott	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3253-F-030	E of 18th & Roberts	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3154-F-064	22nd & Elliott	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3251-F-003	14th E of Riverview	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3251-F-504	S of 14th & Orchard	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3251-F-501	S of 15th & Towle	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3353-F-001	10th & Hood	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
3353-F-004	8th & Kelly	Fairview	Storm drain flooding in 10-yr storm	Fairview Creek Stormwater Master Plan
	Birdsdale East: Area east of Birdsdale Road and south of Burnside	Fairview	Highest total load of contaminants to Fairview Cr.	Fairview Creek Stormwater Master Plan
	Glisan St: Glisan Street and area south	Fairview	Second highest total load of contaminants to Fairview Cr.	Fairview Creek Stormwater Master Plan
	Stark East: Stark Street east of Fairview Creek	Fairview	Third highest total load of contaminants to Fairview Cr.	Fairview Creek Stormwater Master Plan
	NE Division Street and NE Hogan Drive	Kelly	Storm drain surcharging	Kelly Creek Stormwater Master Plan, 2007

	SE Barnes Road	Kelly	Storm drain surcharging and flooding	Kelly Creek Stormwater Master Plan, 2007
	Gresham Golf Course	Kelly	Channel flooding	Kelly Creek Stormwater Master Plan, 2007
	Immediate vicinity of SE Palmquist Road	Kelly	Channel flooding	Kelly Creek Stormwater Master Plan, 2007
	Sheryl Lynn Estates	Kelly	Channel flooding	Kelly Creek Stormwater Master Plan, 2007
	NE Scott Drive	Kelly	Outfall	Kelly Creek Stormwater Master Plan, 2007
	SE Laura Avenue	Kelly	Outfall	Kelly Creek Stormwater Master Plan, 2007
	SE Condor Place	Kelly	Outfall	Kelly Creek Stormwater Master Plan, 2007
	Upper Kelly Creek (east of SE 282nd Avenue)	Kelly	Water Quality	Kelly Creek Stormwater Master Plan, 2007
	the Highway 26 Corridor	Kelly	Water Quality	Kelly Creek Stormwater Master Plan, 2007
	the Burnside Corridor	Kelly	Water Quality	Kelly Creek Stormwater Master Plan, 2007
	North of Gresham Golf Course	Kelly	Water Quality	Kelly Creek Stormwater Master Plan, 2007
	Downstream from SE Chase Rd	Kelly	Water quality (nursery sediment)	Kelly Creek Stormwater Master Plan, 2007
	Between NE Cleveland & NE Burnside Rd	Kelly	Water quality (residential lawn chemicals in Burlingame Cr.)	Kelly Creek Stormwater Master Plan, 2007
	Along 181st St. starting approximately one block north of NE Pacific Ct. and extending one block south of Halsey St.	Columbia Slough	Flooding during 10-year storm	West Gresham Stormwater Master Plan, 2005
	Along Halsey St. starting just east of the intersection with 183rd and continuing approximately one block east of 186th St.	Columbia Slough	Flooding during 10-year storm	West Gresham Stormwater Master Plan, 2005
AVG-1	NW Ava Ave, from 1st to Powell	Johnson	Flooding during 10-year storm	Johnson Creek Stormwater Master Plan, 2005
MEG-1	SW 5th St., E from Walters (S of Forest Lawn Cemetery). Project called "Miller Court"	Johnson	Flooding during 10-year storm	Johnson Creek Stormwater Master Plan, 2005

Appendix D. Retrofit Projects Sorted By Type

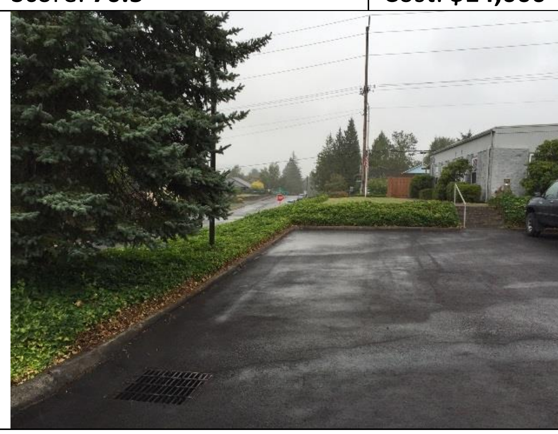
Project Type	Score	Average Type Score	Cost Estimate	Cost Per Acre Treated	Project Description
Fire station	71.75	67.25	$26,000	$94,380	1520 NE 192nd Ave. Fire station plus training area.
Fire station	70.5	67.25	$14,000	$93,822	2301 SW Pleasant View Dr. Fire station vehicle wash drain: bioretention
Fire station	59.5	67.25	$15,000	$187,500	500 NE Kane Dr. Fire station vehicle wash drain: Actuated valve to send wash water to wastewater system. Plus contech filter.
UIC	67	65.50	$200,000	$100,000	UIC Implementation Ph 2 Pkg 2 Stark & 202nd
UIC	64	65.50	$194,825	$194,825	UIC CIP 902800, SE 182nd Ave at SW 5th Dr
Ditch to swale	65.25	64.42	$21,200	$21,414	Hogan Rd ditch to swale - middle
Ditch to swale	65	64.42	$4,500	$28,125	Hogan Rd ditch to swale - South
Ditch to swale	63	64.42	$40,000	$74,074	Hogan Rd ditch to swale - North
MHCC	70.25	63.10	$476,000	$85,000	Parking lots Q,R,S,T,U restriping, bioretention, and grass pave. Not in Metro grant.
MHCC	69.75	63.10	$773,000	$198,205	Parking lots E,F,G,H restriping, bioretention and permeable pavement
MHCC	67.25	62.00	$154,000	$77,000	Parking lot A restriping and bioretention retrofit
MHCC	54.25	63.10	$101,000	$84,167	Building 22 open space: replace lawn with bioretention to treat nearby buildings, road and parking lots.
MHCC	54	63.10	$133,000	$147,778	Courtyard 15 demonstration projects: bioretention planters, roof runoff cisterns, naturescaping
Green street	67.5	61.05	$19,600	$89,091	Burnside & Division Triangle (Rotary Club)
Green street	67	61.05	$79,800	$178,995	Halsey at 186th. Use ROW and add sidewalk in unfinished section on N side
Green street	65.75	61.05	$33,600	$134,400	1572 NE Burnside Triangle

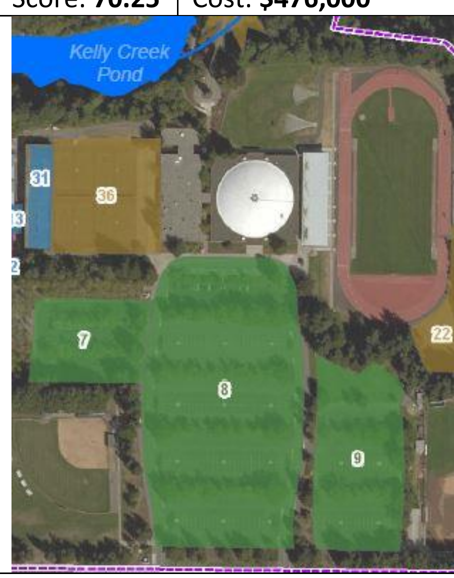
Green street	64.5	61.05	$315,000	$123,217	Stark St. Hogan to Kane (in front of legacy)
Green street	62.75	61.05	$25,200	$100,800	Eastman & Burnside Kmart Triangle
Green street	61.75	61.05	$231,000	$68,920	Division St. Eastman to Kelly. Use brick-covered tree planters.
Green street	61	61.05	$192,500	$162,066	Hogan Rd S of 2nd, to 1240. Planters in extra ROW on E side
Green street	57.75	61.05	$61,500	$192,188	223rd & Fairview local option (surface). No curbs
Green street	55.25	61.05	$266,000	$76,000	Division St. Wallula to Eastman. Use brick-covered tree planters.
Green street	54.75	61.05	$14,200	$88,750	Willowbrook local option: street flow in existing bulb-outs. Map K3
Green street	53.5	61.05	$107,625	$126,618	223rd & Fairview neighborhood option (include pipe). No curbs
End of pipe	64.25	60.75	$405,000	$2,049	Thompson Creek: regenerative flow in isolated stream reach
End of pipe	64	60.75	$225,000	$2,500	Hogan Dr & Hogan Pl
End of pipe	62.75	60.75	$312,000	$6,360	Bauman Condo Outfall to area N of Springwater Trail at Eastman/Towle.
End of pipe	61.75	60.75	$570,000	$3,149	Shimmering Pines / Holly Ridge/Mawcrest. Regenerative flow
End of pipe	61.75	60.75	$52,500	$1,400	Willowbrook regional option: include pipes.
End of pipe	61.5	60.75	$147,000	$871	W Gresham Elementary Outfall.
End of pipe	60.5	60.75	$400,000	$5,642	Powell Loop
End of pipe	58	60.75	$360,000	$24,259	Hunters Highland. Huge PGE vacant property on hillside.
End of pipe	52.25	60.75	$14,000	$16,092	Nancy Ct (Residential outfall S of Paesano).
Pond retrofit	64	60.33	$52,550	$2,628	Excavate swale section and add plants.
Pond retrofit	60.75	60.33	$20,620	$1,650	Square, cattail filled pond. Add sediment forebay, elevation variation, wetland plants. Add treatment to little creek as well?
Pond retrofit	56.25	60.33	$101,020	$4,041	Pond is not bad now. Fix flow splitter, plant swale, add sediment settling forebay.
Parking lot retrofit	67.25	60.11	$2,000	$937	Operations - raise drain grate in existing swale
Parking lot retrofit	63	60.11	$55,400	$51,345	City lots 9-14

Parking lot retrofit	62.5	60.11	$12,600	$78,408	City lots 1,2
Parking lot retrofit	60	60.11	$10,000	$43,560	City lots 3-6
Parking lot retrofit	60	60.11	$10,600	$38,478	City lots 7,8
Parking lot retrofit	59.75	60.11	$40,000	$108,900	City lots 20-24
Parking lot retrofit	56.75	60.11	$10,000	$62,112	Operations - secure lot abutting Brick Creek
Parking lot retrofit	56	60.11	$18,800	$24,072	Operations - dumptruck parking area
Parking lot retrofit	55.75	60.11	$30,000	$45,045	Operations - public lot abutting springwater
Depave	59.25	59.25	$150,000	$111,111	Gresham-Fairview Trail at Springwater.
Repair	58.5	56.75		$2,500	Grind down cement inlets in 36 Phase 2 Brookside rain gardens (648 lf to grind)
Repair	55	56.75	$45,500	$20,313	Repair existing swale at Hogan Rd S of Johnson Creek. Has ditch-like trench through it.
Sedimentation Manhole	54.75	54.75	$6,000	$12,000	Sed manhole as pretreatment to UIC in commercial arterial
Downspout disconnect	48.5	46.13	$6,000	$58,252	Operations - downspout disconnect
Downspout disconnect	43.75	46.13	$200	$5,445	Residential downspout disconnect in Tract 10001

Appendix E. Retrofit Project Descriptions

Station 74	Rank: **1**	Score: **71.75**	Cost: **$26,000**
1520 NE 192nd Ave This location includes a fire station and training area. While the asphalt training area does not present any simple opportunities for LID retrofits, the parking lot at the station does. The bark chipped area with unused raised garden beds at the downhill end of the lot could be retrofit with a rain garden. Fire trucks would need to be washed in this lot (not the training area) so the soapy runoff would enter the rain garden instead of the storm drain system.			

Station 73	Rank: **2**	Score: **70.5**	Cost: **$14,000**
2301 SW Pleasant View Dr			
Fire trucks are regularly washed in the station parking lot, and the soapy water goes to this storm drain, in violation if the city's stormwater permit. Water could be diverted to a rain garden in the sloped, ivy-covered area.			

MHCC 8: Lots Q,R,S,T,U	Rank: **3**	Score: **70.25**	Cost: **$476,000**
The Herrera Mt Hood Community College Clean Water Retrofit Plan notes that parking spaces and driving lanes are oversized and asphalt is in poor condition. Flooding occurs at the northern end of the lot. They recommend restriping for one-way traffic to reduce impervious area and installing bioretention retrofits at flooding catch basins. While this project was ranked #3 by Herrera, it was not included in the Metro grant application because it has lower visibility than others.			

MHCC 4: Lots E,F,G,H	Rank: **4**	Score: **69.75**	Cost: **$26,000**
The Herrera Mt Hood Community College Clean Water Retrofit Plan describes oversized parking spaces and driving lanes, and some unutilized impervious and vegetated areas around and within the parking lots. They recommend restriping, improving wayfinding, and installing bioretention along the center strip and/or around edges of the parking lot, plus permeable pavement in open areas that are not directly under tree canopy.			

Burnside & Division Triangle	Rank: **5**	Score: **67.5**	Cost: **$19,600**
This landscaped triangle could become a stormwater planter to treat arterial runoff. It would require an under-sidewalk drain grate. Rotary club installed the current landscaping: perhaps they could be involved in installing or maintaining the stormwater plants. Pedestrian space at the corner is tight. As part of the project, the front edge of the planter could be pulled back about one foot to improve the pedestrian experience at this busy intersection.			

MHCC 1: Lot A	Rank: **6**	Score: **67.25**	Cost: **$26,000**
Parking spaces and driving lanes are oversized, and erosion occurs at SE corner of parking lot due to overwhelmed catch basin. Recommend restriping to create space for bioretention along edge or corner of lot.			

Operations Lot: Raise drain grate in existing swale	Rank: **6**	Score: **67.25**	Cost: **$2,000**

2123 SE Hogan Dr

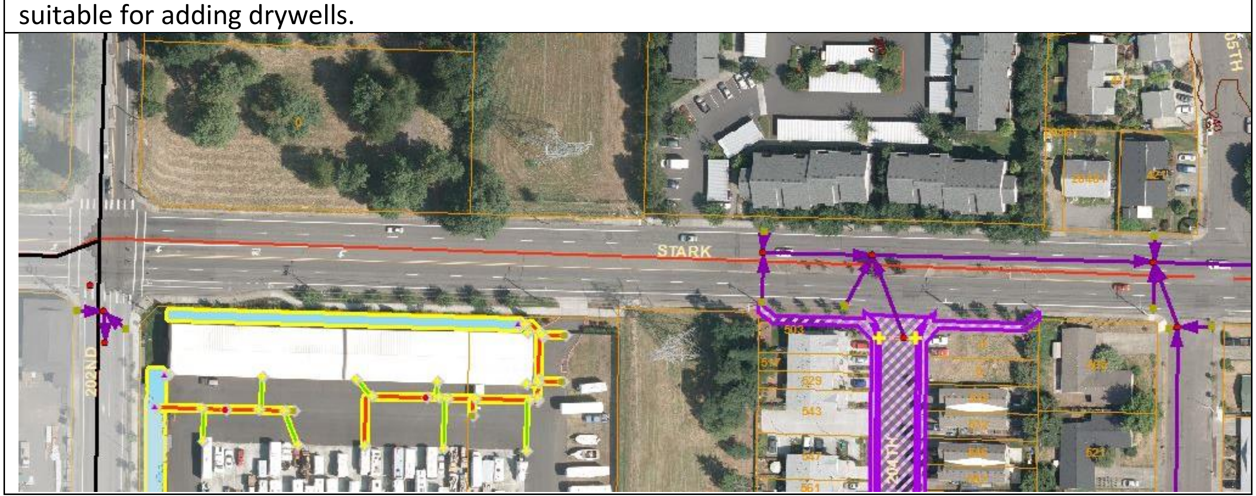
This large, deep swale in the back of the City's operations property receives runoff from much of the asphalt lot. The swale has a drain grate in the center at the bottom elevation. Raising the grate by a few inches would allow for some ponding and increased infiltration – an inexpensive retrofit for this existing swale. The swale is not shown as a water quality facility on the City's stormwater GIS maps.

Halsey at 186th	Rank: **8**	Score: **67**	Cost: **$79,800**

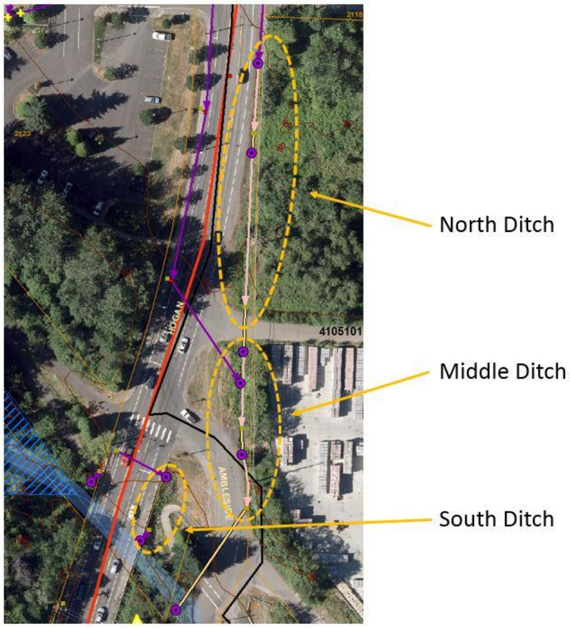
The north side of Halsey currently has no sidewalk along this block. Stormwater planters could be installed and sidewalk added at the same time.

New UICs Stark St & 202nd	Rank: **8**	Score: **67**	Cost: **$200,000**

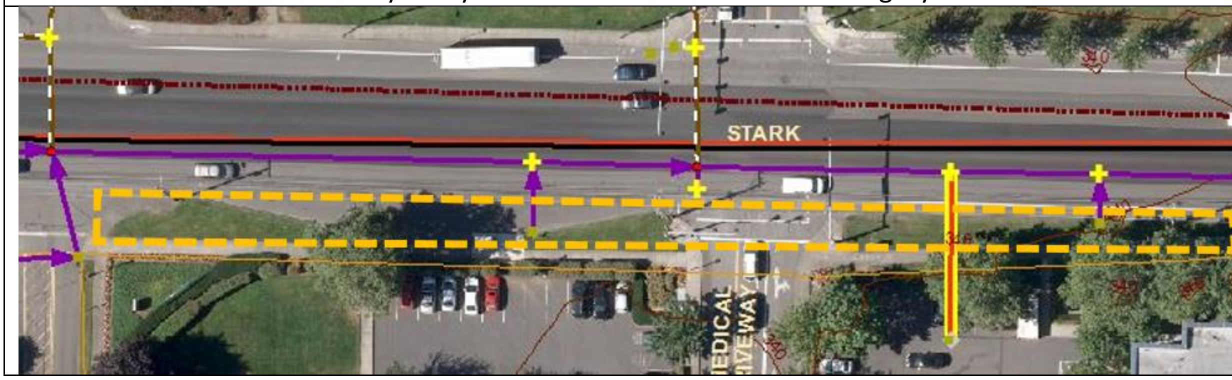
202nd Ave is the edge of the area currently served by UICs (shown in light grey overlay below). This area should have good infiltration rates and separation from the groundwater table, making it suitable for adding drywells.



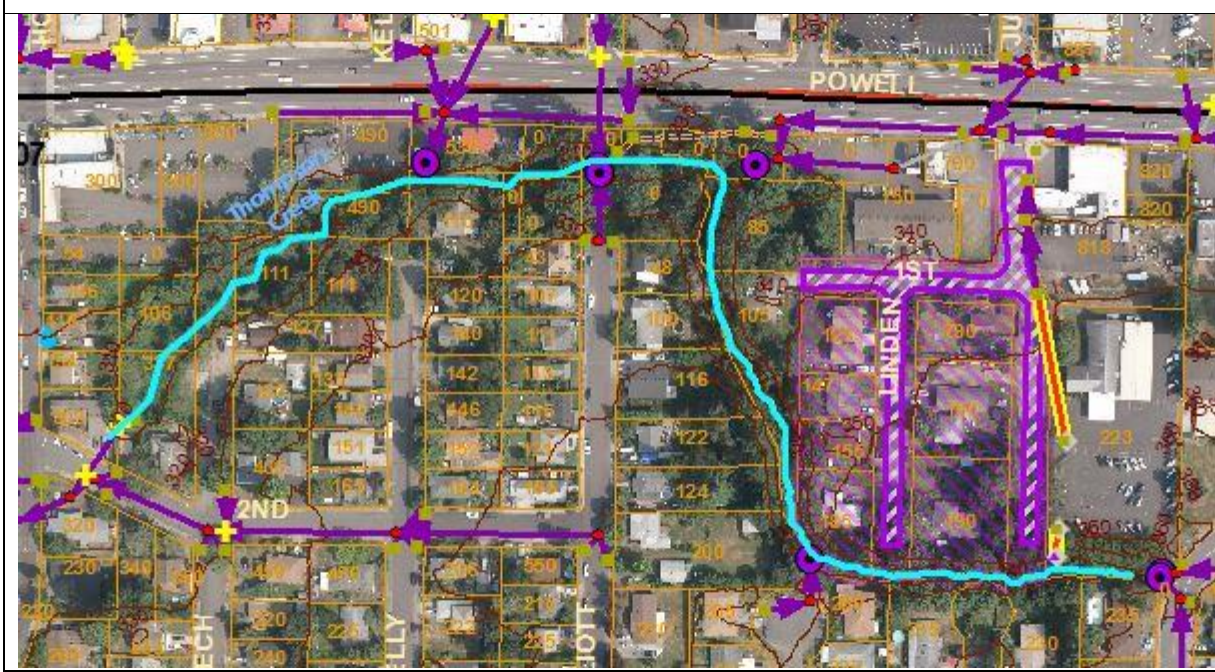
1572 NE Burnside Triangle	Rank: **10**	Score: **65.75**	Cost: **$33,600**
There is a triangle of public right-of way here where the sidewalk jogs. It currently has grass and neglected shrubs. It is located next to a fenced-off private stormwater facility. This land could be used to treat runoff from Burnside. It could either remain separate from the neighboring facility, or they could be combined, which would be more complex logistically and legally but could result in a more attractive and beneficial outcome.			

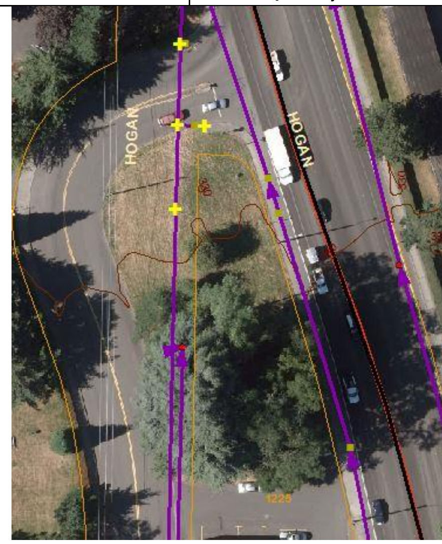
Hogan Road Ditch to Swale	Rank: **11, 12, 18**	Score: **65.25, 65, 63**	Cost: **$21,200, $4,500, $40,000**
2300 SE Hogan Rd For scoring purposes this was considered three projects, the north ditch, middle ditch and south ditch (see image at right). The north and middle ditches are connected to each other. The south ditch is separate. All carry water from Hogan Road. These ditches could be widened and converted to U-shaped vegetated swales with check dams that provide some water quality treatment and infiltration, improving upon their current configuration as ditches that only provide conveyance.	Hogan Rd ditch to swale  		

Stark St. Hogan to Kane	Rank: **13**	Score: **64.5**	Cost: **$315,000**
There is a wide right of way on the south side of Stark Street between Hogan and Kane, where stormwater planters could be added. Portions include grassy areas in front of the sidewalk that could be converted to bioswales fairly easily. Much of this land is in front of Legacy medical center.			



Thompson Creek Regenerative Flow	Rank: **14**	Score: **64.25**	Cost: **$405,000**
530 E Powell			
This nearly 2,000 feet long reach of Thompson Creek is piped both up- and down-stream, making it inaccessible to anadromous fish. Fish passage will likely never be restored to this stream fragment. The canyon is dominated by invasive species and the area has flooding problems. Converting the stream reach to a “regenerative stormwater conveyance” system could improve water quality and stormwater storage and infiltration while removing invasive species and improving wildlife habitat. Portions of the reach are publicly owned and portions are privately owned – several by one local realtor. The pipeshed includes 39% commercial property plus arterials. For sizing purposes the facility is estimated at about seven feet wide.			



<table>
<tr><td>Hogan Dr & Hogan Pl</td><td>Rank: 15</td><td>Score: 64</td><td>Cost: $225,000</td></tr>
<tr><td colspan="2">This vacant land at the intersection of Hogan Drive and Hogan Place is just upstream of where several stormwater pipes enter Burlingame Creek at the Gresham Golf Course. The creek has seasonal flooding problems that could be improved by reducing stormwater discharges. The upstream watershed is huge because it includes a piped section of Burlingame Creek. This lot is partially publicly owned and partially privately owned. It has some large existing trees and there is a natural gas pipeline on the west side. This site was proposed for a regional stormwater facility in the Kelley Creek stormwater management plan. The facility footprint was estimated at 9,000 square feet for scoring purposes.</td><td colspan="2">
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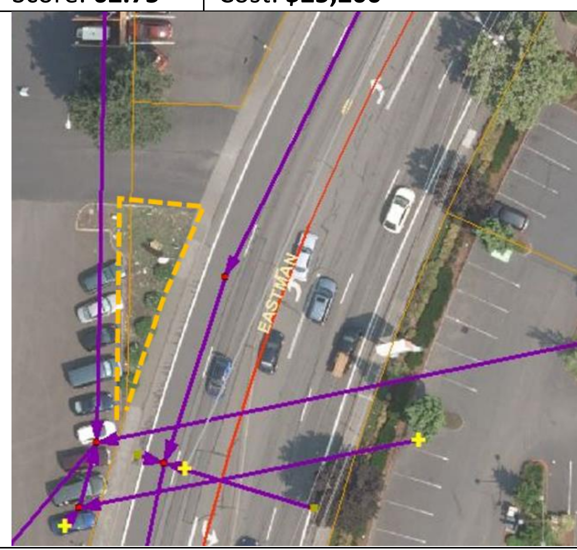
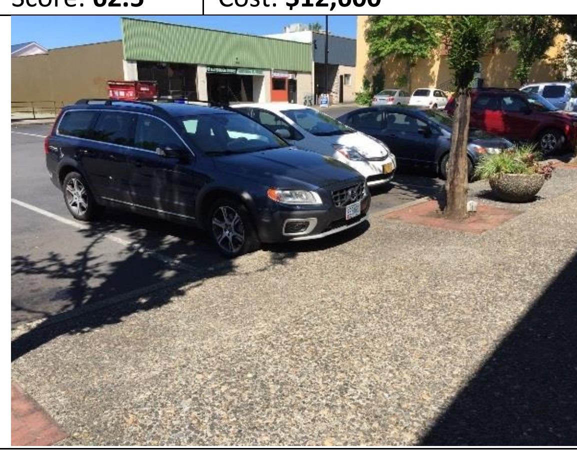
<table>
<tr><td>UIC at SE 182nd & SW 5th</td><td>Rank: 15</td><td>Score: 64</td><td>Cost: $194,825</td></tr>
<tr><td colspan="2">CIP 902800</td><td colspan="2" rowspan="2">
</td></tr>
<tr><td colspan="2">This project would treat approximately one acre of arterial street in an area that is 33% commercial land use and mostly residential. It is near areas that already have UICs.</td></tr>
</table>

Springwater Hills South pond retrofit	Rank: **15**	Score: **64**	Cost: **$52,550**
2836 SE Pheasant Way			
The “Springwater Hills South” pond in the city’s stormwater inventory has old pipes used as flow splitters to send most of the water to this grassy swale on one end, while high flows go to a pond on the other end. This facility has a history of maintenance issues and it receives some runoff from an arterial. The pond needs concrete repairs to the high flow outlet, but otherwise seems to function well. When we visited, the swale had recently been mowed. The base of the swale is becoming uneven, with visible travel paths for water. It could be improved by excavating and smoothing out the bottom elevation, adding check dams and bioretention plants to slow down and soak up the water.			

City lots 9-14	Rank: **18**	Score: **63**	Cost: **$55,400**
NW 2nd & Miller			
This parking lot has landscaped islands and planters that could be converted into bioretention facilities. Many of them have unhealthy looking ornamental pear trees that could be replaced with species suited for bioretention facilities.			

Bauman Condo Outfall	Rank: **20**	Score: **62.75**	Cost: **$312,000**
700 SW Eastman Pkwy			
This stormwater outfall near the Bauman Condos could be diverted to a bioretention facility in the wide vacant area north of the Springwater trail for treatment before reaching Johnson Creek. In addition to providing end-of-pipe stormwater treatment, the facility would be highly visible to people recreating on the trail and it would provide a visible improvement over the existing blackberries.			

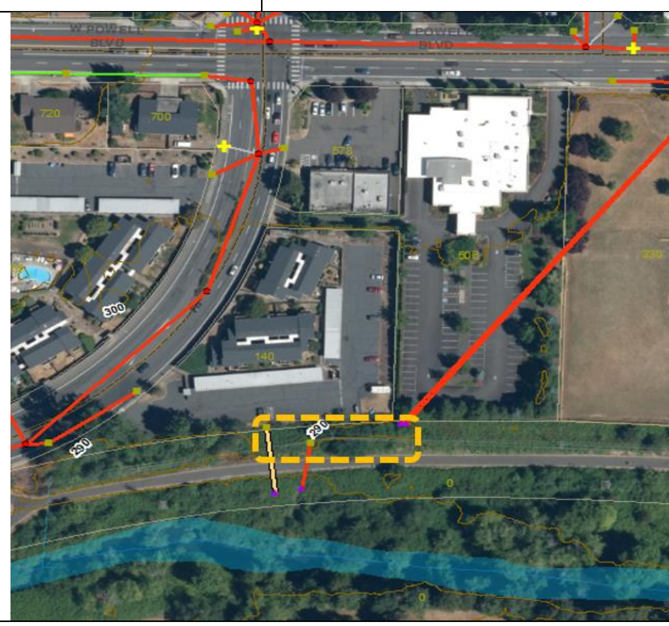
Eastman & Burnside Triangle	Rank: **20**	Score: **62.75**	Cost: **$25,200**
South of 408 NW Burnside			
There is a small triangle of vacant public land on the west side of Eastman Parkway, just south of Burnside and north of Gresham City Hall. The land currently has some hydrangea shrubs. It would be fairly simple to install a bioretention facility here to treat some of the stormwater from Eastman Parkway.			

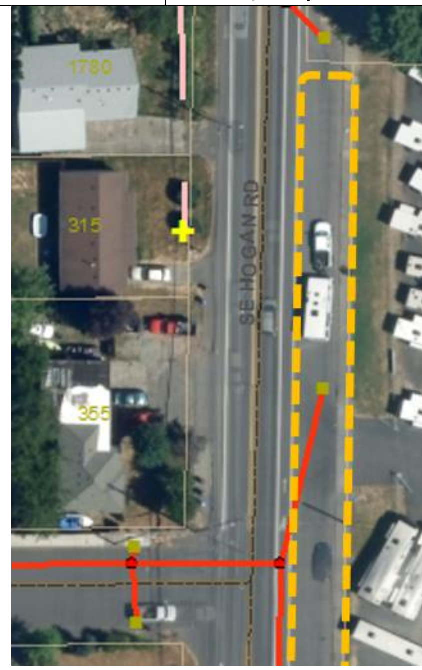
City lots 1-2	Rank: **22**	Score: **62.5**	Cost: **$12,600**
N. Main & Powell			
The downhill end of the parking lot has a wide concrete sidewalk and tree wells. A strip of concrete about the width of the tree wells would need to be removed to install stormwater planters. This could also be a good location to try using structural soils to create bioretention tree wells.			

Mawcrest Outfall	Rank: **23**	Score: **61.75**	Cost: **$570,000**
957 SW Mawcrest Pl There are two areas where sizeable stormwater treatment could be added at this major outfall. North of the Springwater Trail there is a wide, deep area that could be converted into a swale, and there are existing pipes under the trail to bring the water back toward the creek. Where the outfall is currently piped under the trail, it runs in a ditch toward the creek. This area could be retrofit as a swale or it could be an appropriate location to test out regenerative stormwater conveyance.			

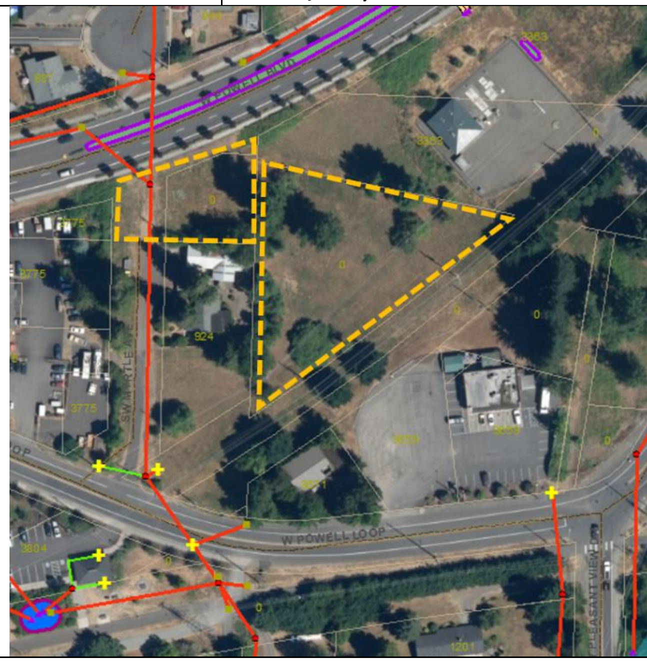
Division St. **Eastman to Kelly**	Rank: **23**	Score: **61.75**	Cost: **$231,000**
Much of Division Street is center-crowned, with planting strips on the street-side of the sidewalk. The planters currently contain trees and pavers. This area could be converted into a stormwater planter. This may also be a good location for testing out a tree vault stormwater system, which would likely support larger trees than the existing ones.			

Willowbrook regional option	Rank: **23**	Score: **61.75**	Cost: **$52,500**
1933 SW Willow Parkway			
The grassy vacant lot and existing curb extensions could be converted into stormwater facilities. Two options were scored: a local option treating just the runoff from the streets, and a regional option that also treats the piped water. The regional option scored higher. Note that the corner of the back fence at 1797 SW Willow Pkwy is on public property according to GIS records.			

West Gresham Elementary Outfall	Rank: **26**	Score: **61.75**	Cost: **$147,000**
Behind 330 W Powell Blvd			
The contributing area to this outfall behind West Gresham Elementary is 22% commercial and includes parts of Powell Blvd. It daylights north of the Springwater Trail and travels aboveground in an area covered with blackberries before it is piped under the trail to the creek. A bioretention facility could be built in this area north of the trail.			

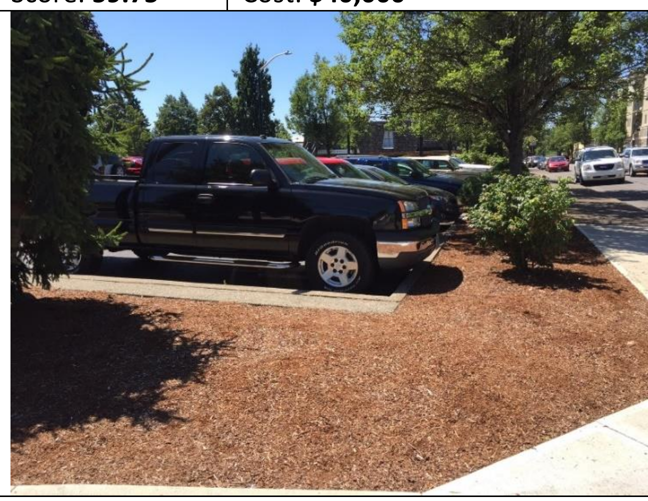
<table>
<tr><td>Hogan Rd South of 2nd</td><td>Rank: 27</td><td>Score: 61</td><td>Cost: $192,500</td></tr>
<tr><td colspan="2">The width of the right of way jogs back and forth along Hogan Drive south of 2nd Ave down to Palmquist Rd. There are multiple locations like the photo at right where the ROW is wide. It is used sparsely for on-street parking and the neighboring properties have driveways and parking lots. This space could instead be used for stormwater planters or bioswales.</td><td colspan="2">
</td></tr>
</table>

<table>
<tr><td>Springwater Estates pond retrofit</td><td>Rank: 28</td><td>Score: 60.75</td><td>Cost: $20,620</td></tr>
<tr><td colspan="2">1989 SE Night Heron Pl</td><td colspan="2" rowspan="2"></td></tr>
<tr><td colspan="2">This rectangular pond is filled with cattails and periodically has to be excavated to remove sediment. Its functionality could be improved by adding a sediment forebay that is easily accessible for maintenance, varying the bottom elevation of the pond and adding wetland plants. The varying pond depth will support more diverse plant species.</td></tr>
</table>

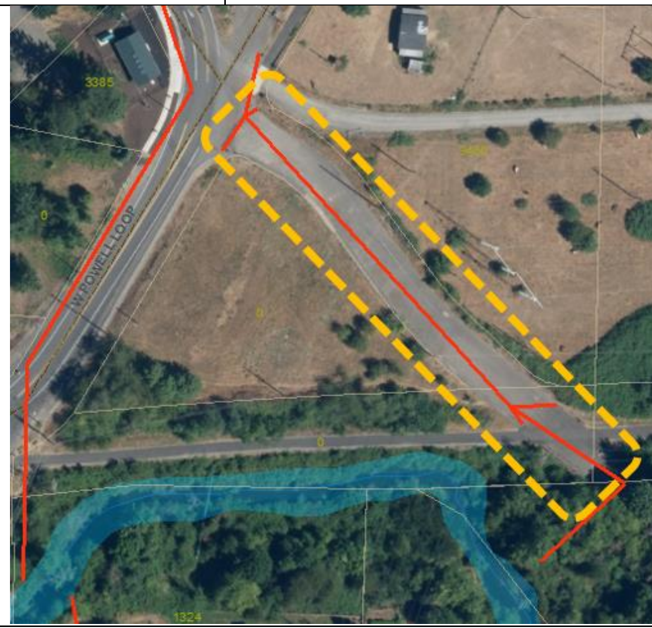
Powell Loop	Rank: **29**	Score: **60.5**	Cost: **$400,000**
924 SW Myrtle Ave			
The vacant lots in the center of Powell Loop are owned by Ionesi Family Trust and the Portland Water Bureau. Stormwater is piped down from Powell Blvd, which is at a higher elevation than this land, to a manhole with a bottom elevation 5 feet below ground level. Water could instead be piped to a regional stormwater facility on one or both of the vacant lots.			

City lots 3-6	Rank: **30**	Score: **60**	Cost: **$10,000**
29 W Powell Blvd			
Converting the empty planter in this parking lot to a stormwater facility would require installing a waterproof liner to protect the building foundation.			

City lots 7-8	Rank: **30**	Score: **60**	Cost: **$10,600**
NW 1st & Miller			
The existing planters at the corner of 1st & Miller could be converted to stormwater planters. One section is already missing a curb.			

City lots 20-24	Rank: **30**	Score: **59.75**	Cost: **$40,000**
NE 3rd & Hood			
Much of the parking lot can be treated by converting the existing islands and planters. Some stormwater will still go to the storm drain in the center of the lot. There are some small ornamental pear trees that could be removed or replaced. The three large maples should be protected. The stormwater planters could be designed to relate aesthetically to the corner planters on Hood.			

Station 72 actuated valve	Rank: **33**	Score: **59.5**	Cost: **$15,000**
500 NE Kane Rd.			

Gresham-Fairview Trail at Springwater: Depave	Rank: **34**	Score: **59.25**	Cost: **$150,000**
There is an abandoned section of road near the intersection of Powell Loop and the Springwater Trail that is now used as the start of the Gresham-Fairview Trail. Most of this asphalt could be removed, leaving only the width needed for a bike/ped trail and making the stormwater pipes unnecessary. It may be more cost-effective to install bioretention facilities near the stormwater inlets rather than depaving the whole area.			

Brookside rain garden inlet repair	Rank: **35**	Score: **58.5**	Cost: **$10,000**
The newly constructed Brookside Phase 2 neighborhood has 36 rain gardens that are being fully or partially bypassed because their inlets were not installed to specifications. The inlets need to be ground down one or more inches so water can enter without being blocked by minor sediment deposits.