CAPITOL HWY. CORRIDOR

STORMWATER CONCEPT DESIGN

MARCH 2016

ENVIRONMENTAL SERVICES
CITY OF PORTLAND

GREENWORKS

kpff

ACKNOWLEDGEMENTS

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City of Portland Bureau of Environmental Services

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1.0 PROJECT SUMMARY

1.1 INTRODUCTION AND BACKGROUND

In January of 1996, the Portland City Council adopted the ***Capitol Highway Plan***, identifying a conceptual multi-modal street design for over four miles of SW Capitol Highway. The plan was divided into seven segments, from the Terwilliger segment at the north end, to the Markham segment at the south end (see Figure 1 at right). This plan was adopted in order to address the need for pedestrian, bicycle and transit infrastructure in the corridor.

In 2011, the ***SW Capitol Highway Plan Refinement Report*** provided refined conceptual streetscape design for the Garden Home segment of SW Capitol Highway. This plan developed a design for multi-modal transportation improvements that included bike lanes and sidewalks on both sides of SW Capitol Highway. The 2011 Plan also included stormwater improvements with green street facilities on both sides of SW Capitol Highway. The preliminary cost estimate for the Garden Home segment was approximately $19 million, which exceeded available funding and caused the project to be put on hold.

1.2 PROJECT GOALS AND OBJECTIVES

This project, called the ***Capitol Highway Corridor Stormwater Concept Design***, builds upon the 2011 Refinement Report by incorporating the latest information on the corridor and investigating alternative concepts for stormwater management. Like the 2011 plan, the study area for this project includes the Garden Home segment of the corridor, extending almost a mile from SW Garden Home Road on the north end to SW Taylors Ferry Road on the south end. Existing stormwater infrastructure along this segment is insufficient to support proposed transportation improvements. Three different concepts are identified and explored in detail as part of this project. For each of the concepts, a preliminary cost estimate has been developed for evaluation and comparison of the concepts.

The goal of this project is to identify concepts that mix standard and new stormwater management approaches, and that are potentially more cost effective than those in the 2011 Plan. Building upon the work done in 2011, new work done by the Portland Bureau of Transportation (PBOT) on

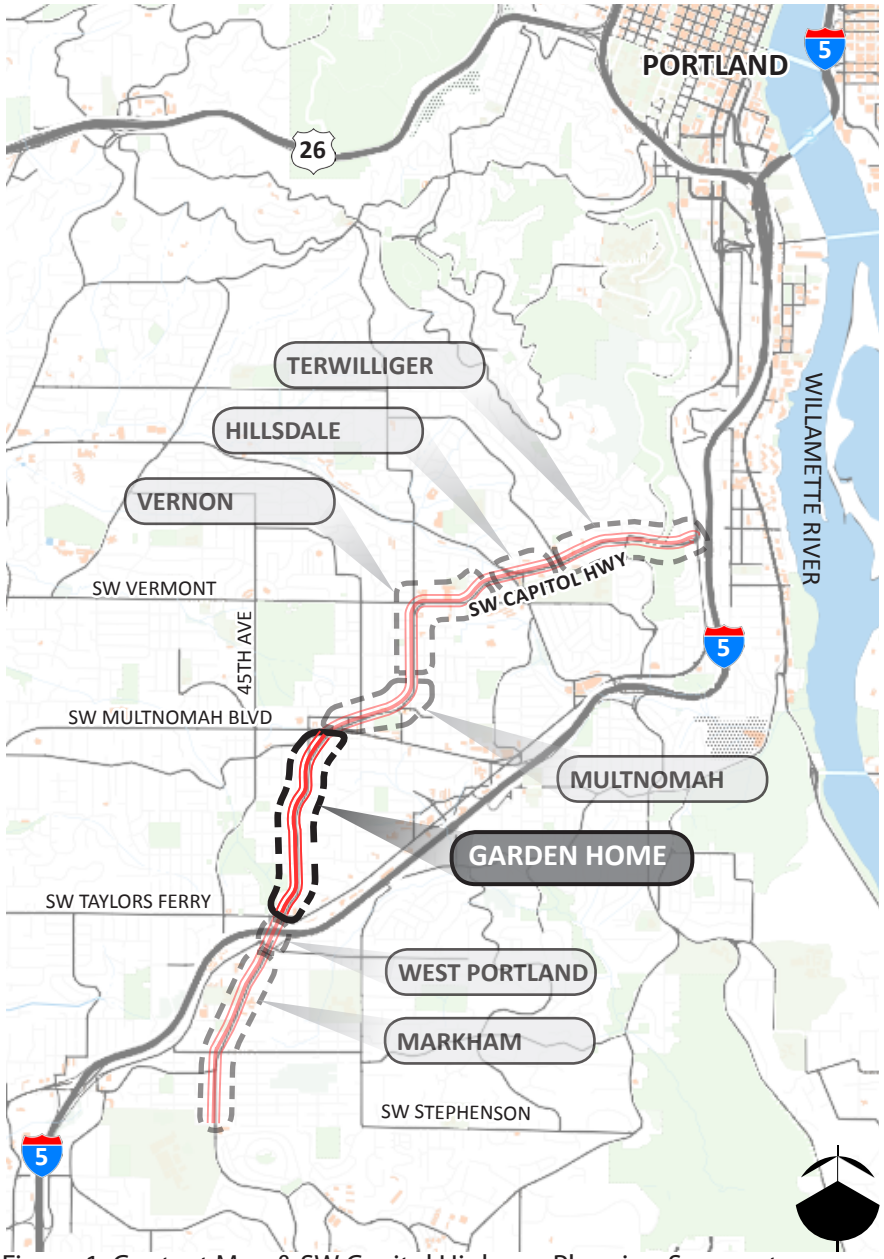


Figure 1: Context Map & SW Capitol Highway Planning Segments

alternative street design, the joint ***PBOT-BES Tryon-Stephens Headwaters Neighborhood Street Plan***, and the initial work done at BES on the Stormwater System Plan, all provide potential ways to look at stormwater management in the corridor.

Stormwater concepts developed as part of this project will help determine the most appropriate stormwater system to move forward to design for this segment of Capitol Highway. This work is necessary to allow PBOT to move forward with proposed transportation improvements along this corridor, and it may also inform future right-of-way stormwater management projects throughout Portland.

1.3 PROJECT TEAM WORKSHOP MEETING

On July 8th, 2015 a three hour workshop was held at BES that included staff from BES, PBOT, Portland Water bureau in addition to the project design team of GreenWorks and KPFF. The goal of this meeting was to include PBOT and City staff early in the project to discuss parameters for the project and brainstorm potential stormwater concepts.

Much of the conversation centered on establishing what the modified roadway cross section will look like that PBOT anticipates from the full build out on both sides of Capitol Highway that the 2011 Plan used. The conclusion from this meeting was for stormwater concepts to use two different cross sections. One that includes development of bike lanes on both sides and a sidewalk on the west side only. Favorable conditions and topography on the east side has led to the formation of informal pedestrian paths that PBOT would like to preserve if possible if no sidewalk on the east side is developed. The second cross section discussed combines pedestrian and bike facilities into a multi-use path on the west side with no development on the east side.

The first cross section, bike lanes on both sides and sidewalk on the west side only, are included in stormwater concepts for Concepts 1 & 2 in this report. The second cross section with multi-use path and no east side development is incorporated into Concept 3. A third cross section with multi-use path on the west side and separated bike lane on the east side was added later as a part of Concept 4 in this report. Complete notes from this meeting are included in Appendix E on page 84 of this report.

Garden Home Segment
Capitol Highway Corridor Overview

2.0 PROJECT STUDY AREA AND EXISTING CONDITIONS

2.1 CORRIDOR EXISTING CONDITIONS

This segment of Capitol Highway consists primarily of a 60-foot wide right-of-way with a 24-foot wide two-lane asphalt roadway. Wider asphalt or gravel shoulders in some areas provide informal vehicular parking. Pedestrian, bicycling and parking amenities are lacking along the corridor. The bus stops are generally unimproved and walking to them involves negotiating narrow roadway shoulders or unimproved paths in close proximity to vehicle traffic. Residential development is consistent along the length of the corridor segment with commercial nodes located at the north and south ends. Most parcels appear to be developed with some residences located in close proximity to the right-of-way property line. Existing conditions maps and photos are provided on pages 6-11 of this report.

This segment of SW Capitol highway is located on a ridge that separates the Fanno Creek (west) and Tryon Creek (east) watersheds. Slopes to the east and west are varied and steep in some locations. Cascade silt loam is the predominant soil type found throughout this area, which has characteristically poor infiltration. Geotechnical services performed in 2010 for the 2011 Plan included infiltration testing of four borings along the corridor. These tests showed 'extremely low' infiltration rates at all four locations. No further geotechnical investigation was done as part of this project, and it was assumed that infiltration facilities are not likely to be feasible.

Steep slopes adjacent to the corridor, in some places in close proximity to the roadway, will require the construction of retaining walls and require areas of cut and fill in order to expand improvements beyond the current roadway footprint. The existing pavement is in good condition, and generally consists of two travel lanes with a total width of 24 feet. There are numerous encroachments along the shoulders between the existing pavement and the right-of-way boundary, including trees, smaller vegetation, and fences. Any expansion of the current street section will have significant impacts on those encroachments. The right-of-way width, adjacent slopes and proximity to adjacent development will all be significant design constraints to consider in designing improvements for Capitol Highway.

The existing stormwater infrastructure in the corridor is minimal, mainly consisting of roadside ditches and culverts with some scattered, shallow storm pipes and inlets. The existing infrastructure is insufficient to support any expansion of the existing transportation system. The absence of stormwater treatment and detention facilities on this segment of the corridor allows rapid flows and pollutants to degrade Fanno and Tryon Creeks. The Oregon Department of State Lands has identified both of these creeks as essential salmonid habitat.

2.2 EXISTING STORMWATER BASINS

The Garden Home segment of Capitol Highway consists of four stormwater drainage basins, each draining to the tributaries of either Fanno Creek or Tryon Creek, and ultimately to the Willamette River (See Fig. 2, p. 4). Refer to the existing conditions maps included in the report on pages 6-11 for more detailed corridor information. Key features shown in these maps include existing tees, utility poles, water and storm lines, catch basins, slopes, bus stops and driveways. Opportunity areas indicated are areas that have the potential for larger regional type facilities. Photos provided along the corridor provide views of typical conditions along the corridor. A more complete analysis of the study area drainage can be found in the document called *Capitol Highway Drainage Analysis Technical Memorandum*, completed March 4, 2009 by BES. The following basin descriptions and analysis is summarized from this document.

2.2.1 Basin 1: Falling Creek (Outfall ADG 677)

Stormwater runoff from 600 lineal feet of SW Capitol Highway from SW Taylors Ferry Road to SW Brugger Street drains into Basin 1. Drainage from eastern half is directed by curbs and sidewalks to storm inlets. Drainage from western half collects and flows along the roadway.

2.2.2 Basin 2: Woods Creek (Outfall DTF092)

Stormwater runoff drains from the western half of SW Capitol Highway from SW Brugger Street north to SW Alice Street, approximately 1,000 lineal feet along the roadway. There is no public stormwater infrastructure along this segment and runoff drains to a gravel shoulder and onto adjacent properties to the west.

2.2.3 Basin 3: Tryon Creek (Outfall ACW 912)

Stormwater runoff from the eastern half of Capitol Highway from SW Brugger Street north to SW Alice Street, and all of SW Capitol Highway from SW Alice Street north to SW Freeman Street, drains along approximately 2,500 lineal feet of roadway. No stormwater infrastructure is located on the east side of SW Capitol Highway from SW Brugger Street to SW Alice Street; stormwater currently flows north along road edge to inlet at SW Alice Street. Stormwater from SW Capitol Highway drains north approximately 1,200 lineal feet to SW Dolph Court through roadside ditches, inlets, culverts and 8-inch to 12-inch storm pipes. Stormwater from SW Freeman Street south to SW Dolph Court is collected in a storm inlet on the west side of SW Capitol Highway directly west of SW Dolph Court.

Stormwater is conveyed east on SW Dolph Court for 300 feet through a series of ditches, storm pipes and culverts where it discharges north to a short open drainage between private properties. Some private property drainage complaints are referred to in the ***SW Capitol Highway Refinement Plan Stormwater Disposal Drainage Assessment Technical Memorandum*** (2010) done in support of the 2011 Refinement Report.

2.2.4 Basin 4: Vermont Creek (Outfall ACW 898)

Stormwater runoff drains approximately 1,800 lineal feet along SW Capitol Highway from SW Freeman Street northeast to SW Garden Home Road. Runoff from the east side of SW Capitol Highway flows along the road edge through ditch segments and along the roadside and enters an inlet 130 feet south of SW Garden Home Road and then is conveyed west under SW Capitol Highway in a 12-inch storm sewer culvert along SW Garden Home Road. Stormwater runoff flows from the west side of SW Capitol highway from SW Freeman Street north approximately 350 lineal feet to SW Carson Street along roadway edge with no ditches and flows west onto SW Carson Street. From SW Carson Street stormwater flows north approximately 420 lineal feet to the intersection of SW 40th Avenue where it sheet flows to the east onto the adjacent private properties. A portion of this flow may be picked up by drainage ditches that flow along SW 40th Avenue. From SW 40th Avenue north approximately 67 lineal feet to SW Garden Home Road, stormwater from the west side of SW Capitol Highway flows along the roadway (no ditches) and flows west to an inlet on the south side of SW Garden home Road.

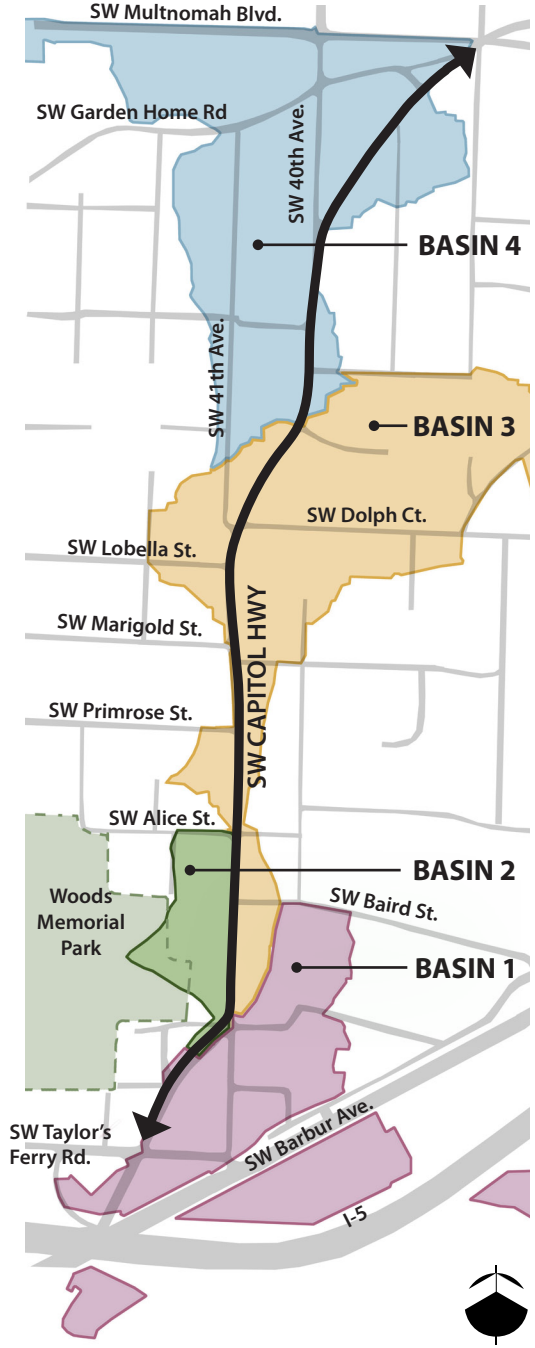
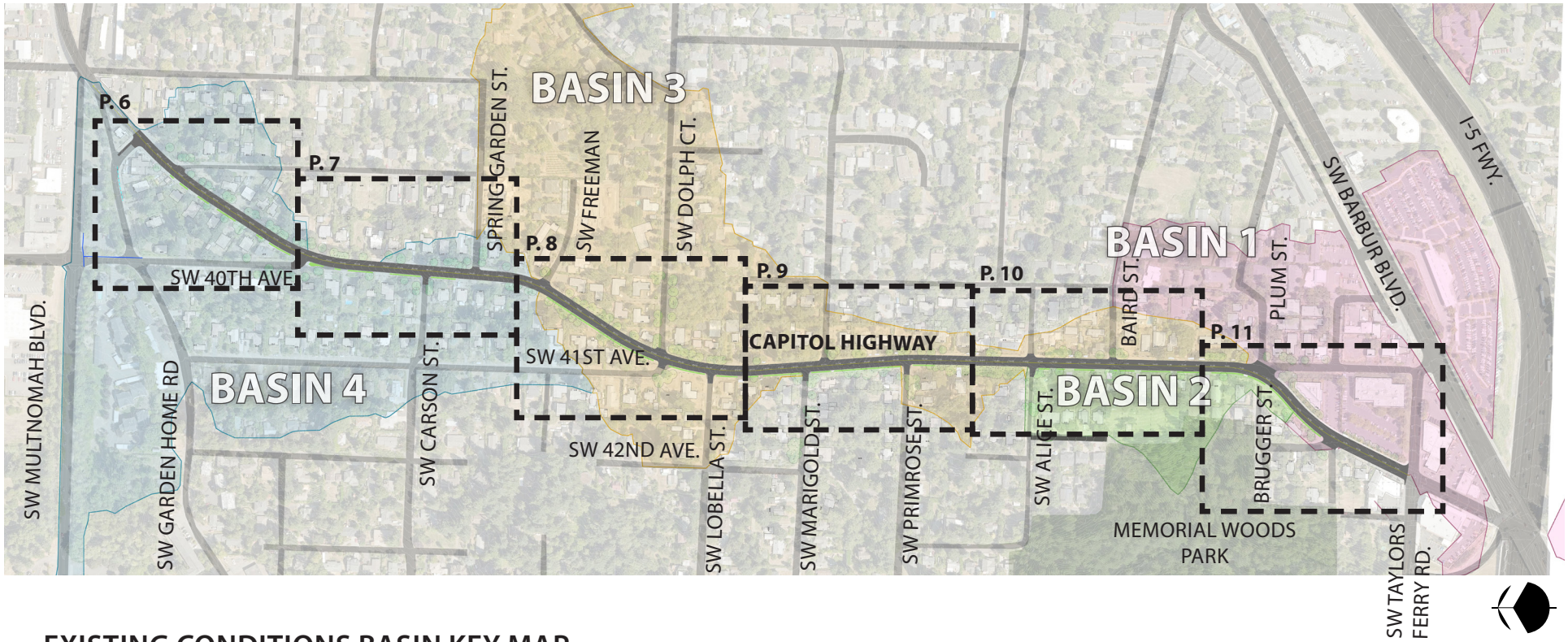


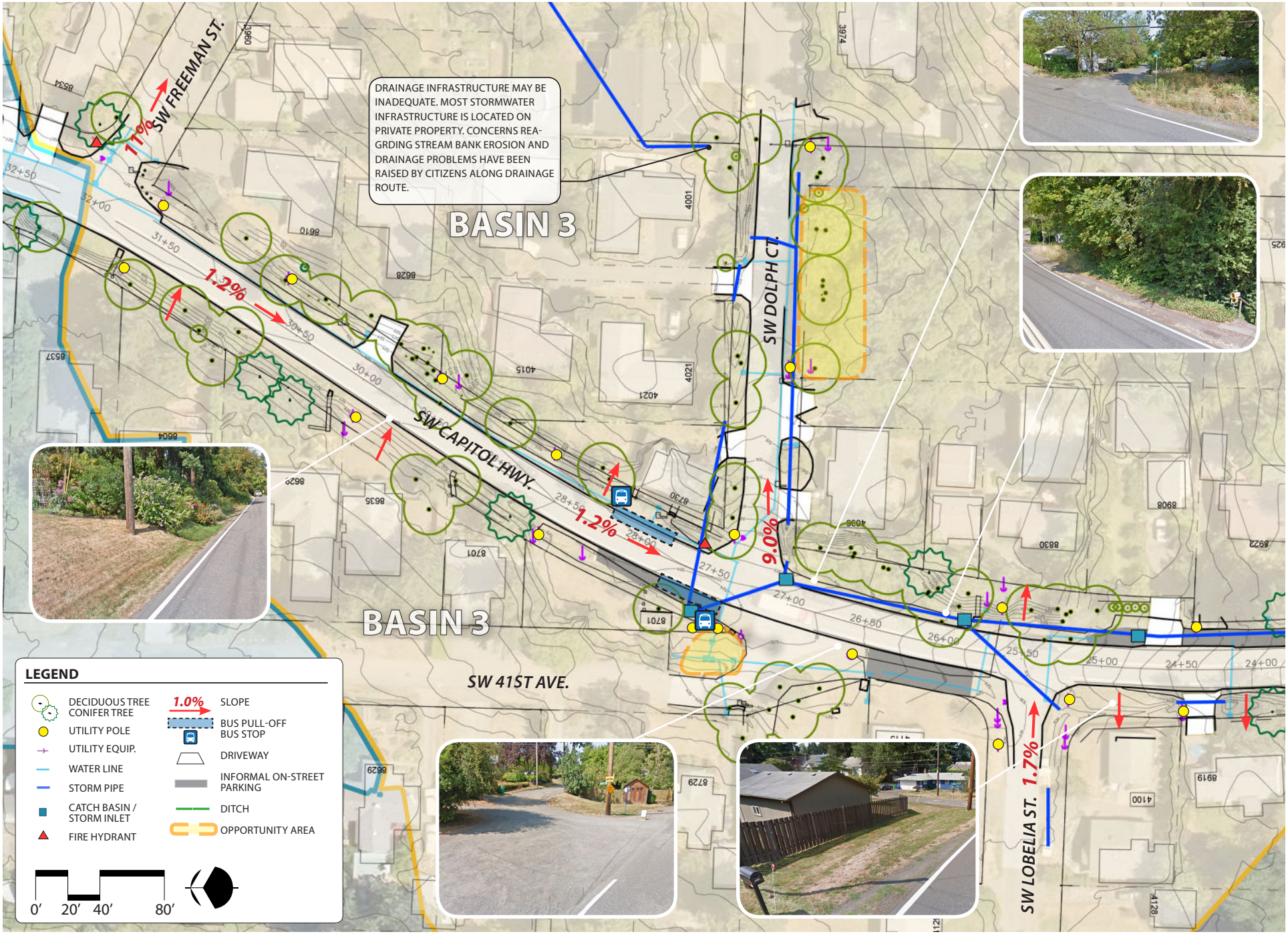
Figure 2: Existing Basins

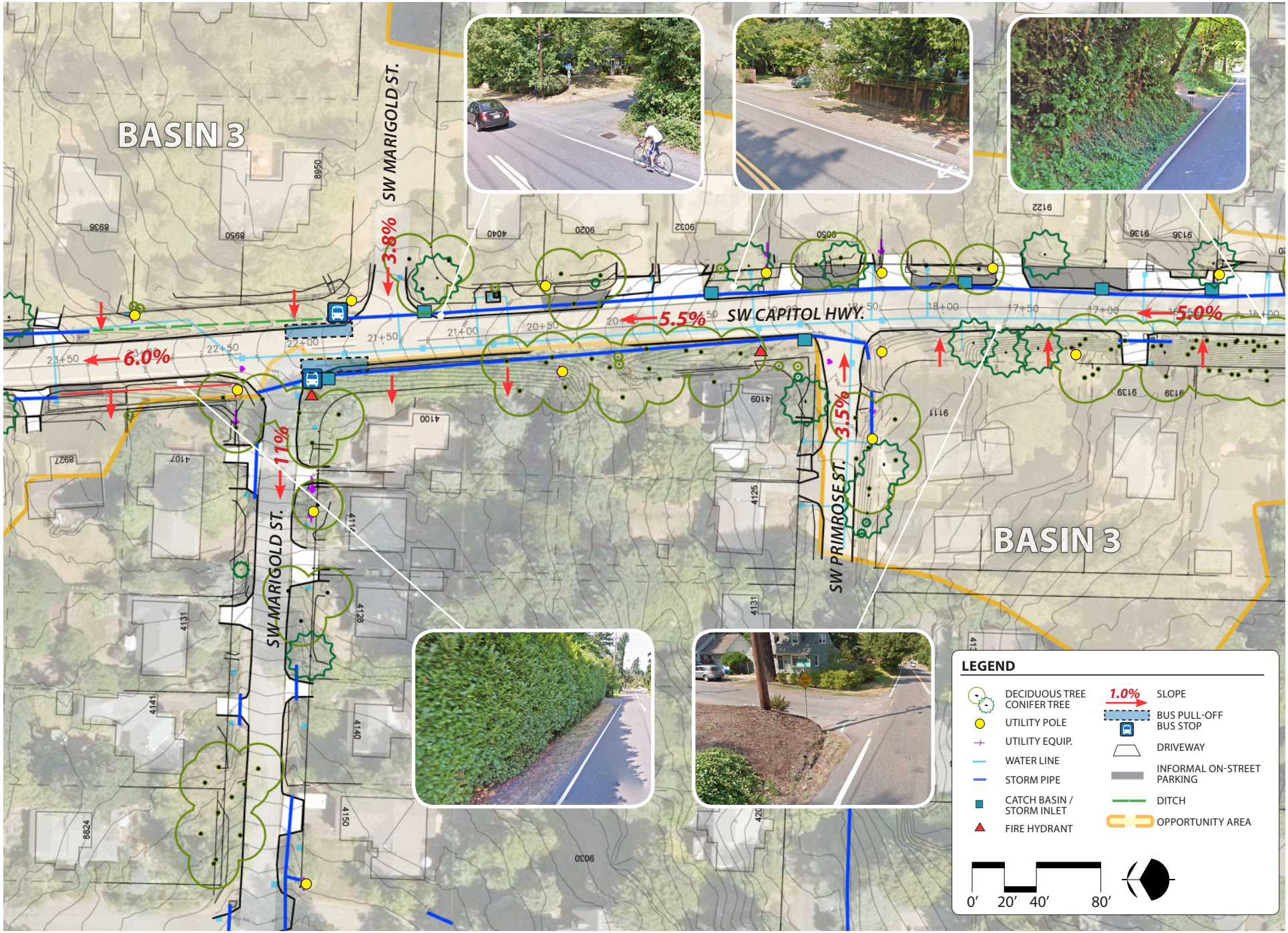


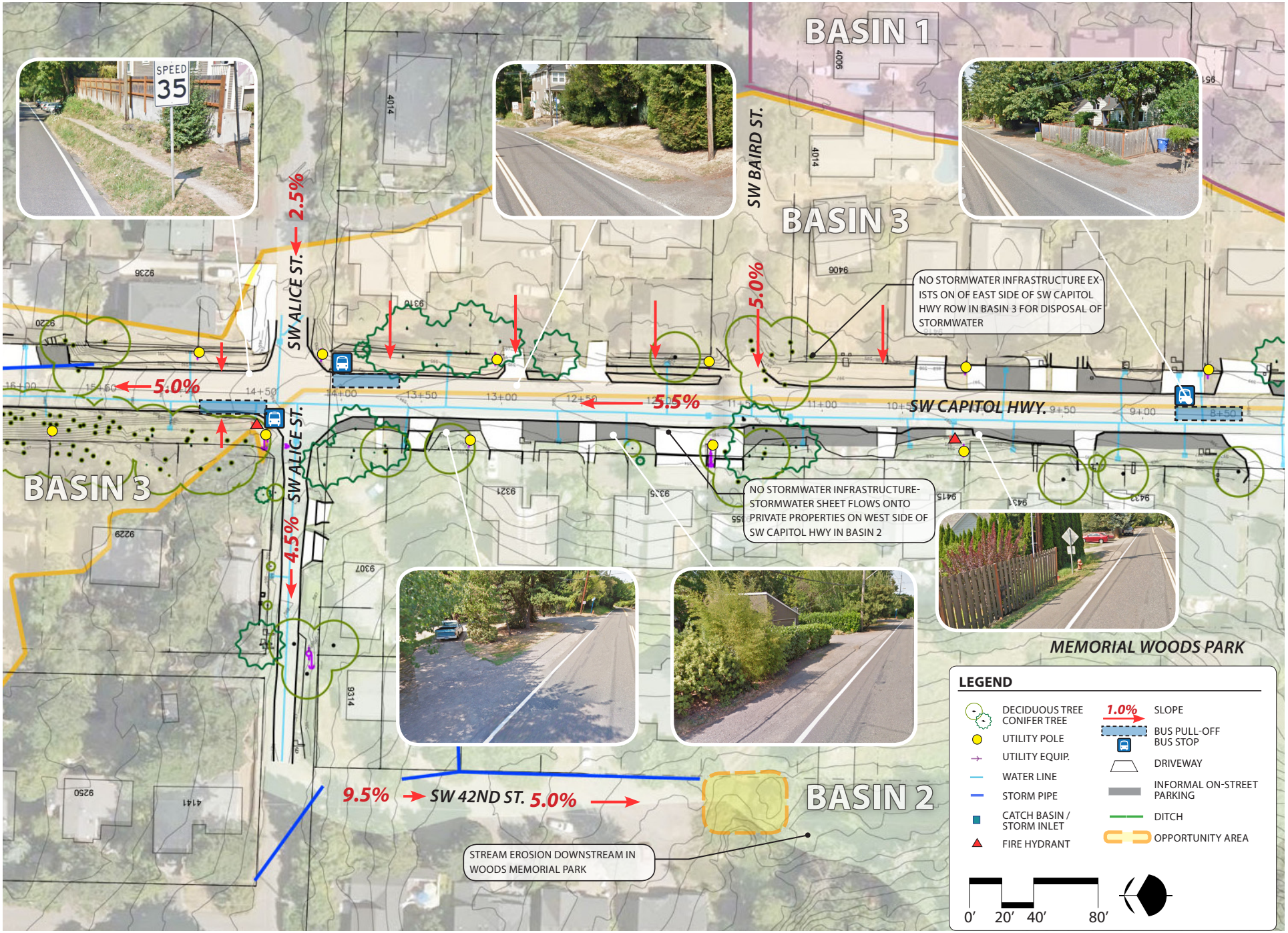
EXISTING CONDITIONS BASIN KEY MAP


SW GARDEN HOME DRIVE
SW 39TH AVE.
SW CAPITOL HWY.
SW 40TH AVE.
BASIN 4
10.4%
5.0%
4.0%
6.3%
LEGEND
DECIDUOUS TREE
CONIFER TREE
UTILITY POLE
UTILITY EQUIP.
WATER LINE
STORM PIPE
CATCH BASIN / STORM INLET
FIRE HYDRANT
1.0%
SLOPE
BUS PULL-OFF
BUS STOP
DRIVEWAY
INFORMAL ON-STREET PARKING
DITCH
OPPORTUNITY AREA
0′ 20′ 40′ 80′


BASIN 3
BASIN 4
SW CAPITOL HWY.
SW SPRING GARDEN ST.
SW CARSON ST.
5.7%
8.0%
6.0%
DRAINAGE ISSUE: MAN HOLE LOCATED IN ROAD-SIDE DRAINAGEWAY IN FRONT OF PROPERTY 8409 ALLOWS STORWATER TO FLOW INTO SANITARY SYSTEM.
DRAINAGE ISSUE: DRAINAGE FLOWING FROM SW CAPITOL HWY & SW CARSON ST.
LEGEND
DECIDUOUS TREE
CONIFER TREE
UTILITY POLE
UTILITY EQUIP.
WATER LINE
STORM PIPE
CATCH BASIN / STORM INLET
FIRE HYDRANT
1.0% SLOPE
BUS PULL-OFF
BUS STOP
DRIVEWAY
INFORMAL ON-STREET PARKING
DITCH
OPPORTUNITY AREA
0' 20' 40' 80'


DRAINAGE INFRASTRUCTURE MAY BE INADEQUATE. MOST STORMWATER INFRASTRUCTURE IS LOCATED ON PRIVATE PROPERTY. CONCERNS REA-GRDING STREAM BANK EROSION AND DRAINAGE PROBLEMS HAVE BEEN RAISED BY CITIZENS ALONG DRAINAGE ROUTE.
BASIN 3
BASIN 3
SW FREEMAN ST.
SW CAPITOL HWY.
SW DOLPH CT.
SW 41ST AVE.
SW LOBELIA ST.
11.0%
1.2%
1.2%
9.0%
1.7%
LEGEND
DECIDUOUS TREE
CONIFER TREE
UTILITY POLE
UTILITY EQUIP.
WATER LINE
STORM PIPE
CATCH BASIN / STORM INLET
FIRE HYDRANT
1.0% SLOPE
BUS PULL-OFF BUS STOP
DRIVEWAY
INFORMAL ON-STREET PARKING
DITCH
OPPORTUNITY AREA
0′ 20′ 40′ 80′


BASIN 3
SW MARIGOLD ST.
3.8%
SW CAPITOL HWY.
5.5%
5.0%
6.0%
11%
3.5%
SW PRIMROSE ST.
BASIN 3
LEGEND
DECIDUOUS TREE
CONIFER TREE
UTILITY POLE
UTILITY EQUIP.
WATER LINE
STORM PIPE
CATCH BASIN / STORM INLET
FIRE HYDRANT
1.0% SLOPE
BUS PULL-OFF
BUS STOP
DRIVEWAY
INFORMAL ON-STREET PARKING
DITCH
OPPORTUNITY AREA
0′ 20′ 40′ 80′



EXISTING CONDITIONS MAPS

CAPITOL HWY. CORRIDOR STORMWATER CONCEPTS

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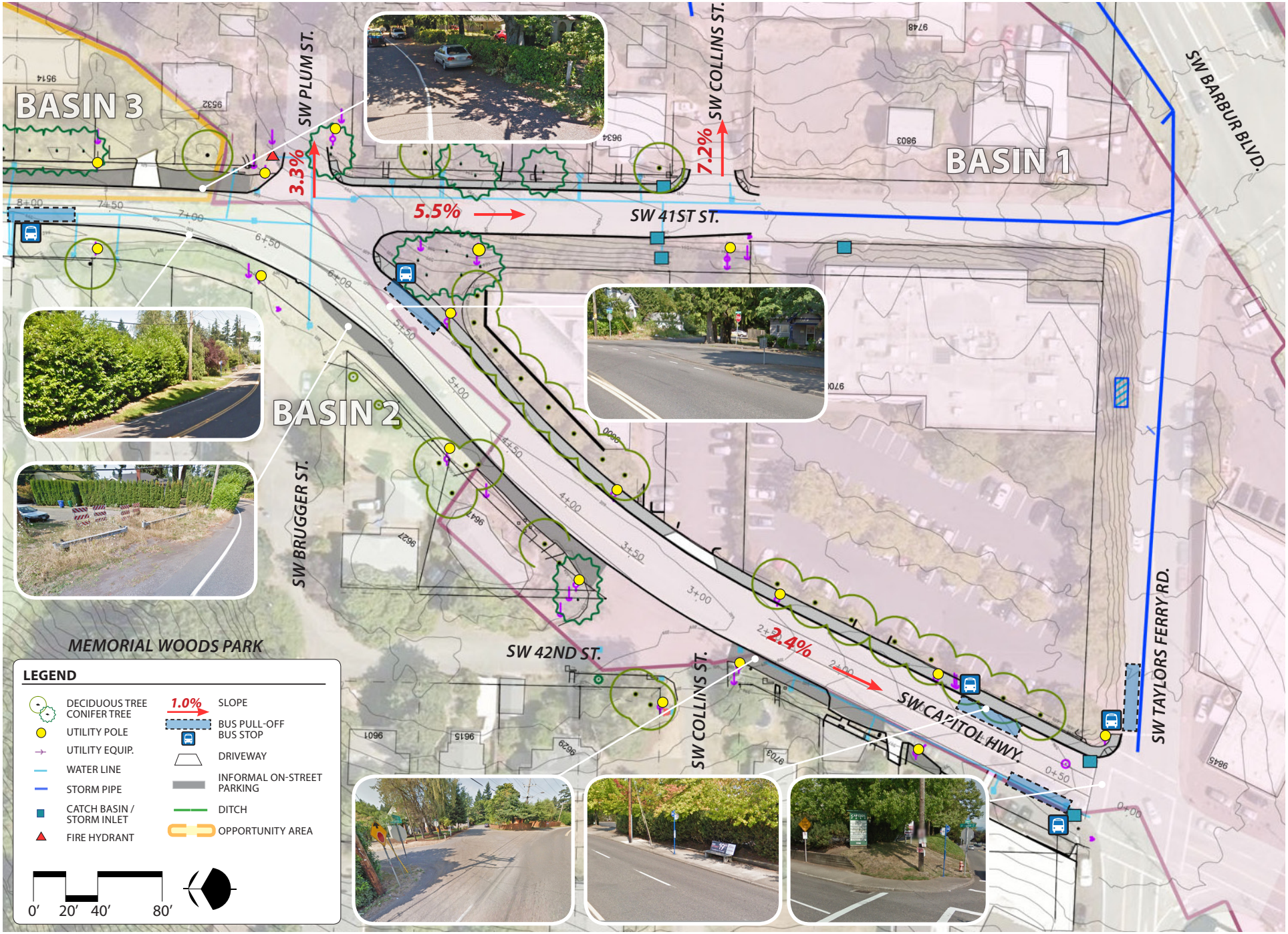

BASIN 3
BASIN 2
BASIN 1
SW PLUM ST.
SW COLLINS ST.
SW BARBUR BLVD.
SW 41ST ST.
SW BRUGGER ST.
SW 42ND ST.
SW CAPITOL HWY.
SW TAYLORS FERRY RD.
MEMORIAL WOODS PARK
3.3%
7.2%
5.5%
2.4%
LEGEND
DECIDUOUS TREE
CONIFER TREE
UTILITY POLE
UTILITY EQUIP.
WATER LINE
STORM PIPE
CATCH BASIN / STORM INLET
FIRE HYDRANT
1.0%
SLOPE
BUS PULL-OFF
BUS STOP
DRIVEWAY
INFORMAL ON-STREET PARKING
DITCH
OPPORTUNITY AREA
0'
20'
40'
80'

3.0 CONCEPT DESIGN ALTERNATIVES

3.1 STORMWATER MANAGEMENT REQUIREMENTS

Projects that develop or redevelop over 500 square feet of impervious surface area are required to comply with the flow control and pollution reduction requirements described in the Portland Stormwater Management Manual. A summary of these requirements are as follows:

3.1.1 Flow control

Discharge to a surface water body or storm-only system that discharges to surface water must detain:

- 2-year post-development peak runoff rate to one-half of the 2-year predevelopment rate.
- 5-year post-development peak runoff rate to 5-year pre-development peak rate.
- 10-year post-development peak runoff rate to 10-year pre-development peak rate.
- 25-year post-development peak runoff rate to 25-year pre-development peak rate.

3.1.2 Pollution reduction

Must achieve 70 percent total suspended solids (TSS) removal from 90 percent of the average annual stormwater runoff.

However, because federal funding will likely help pay for improvements to SW Capitol Highway, the project will trigger SLOPES V (Standard Local Operating Procedures for Endangered Species) requirements. This means that the detention and pollution reduction facilities will also need to meet those requirements. Through sample modeling it was shown that designing facilities using Portland's requirements and sizing methods can yield facilities that meet or exceed the SLOPES V requirements for detention and pollution reduction. Therefore the basis of design for these conceptual solutions only utilized Portland's requirements.

Stormwater Management Requirements are summarized in the 2009 ***Capitol Highway Drainage Analysis Technical Memorandum***.

3.2 FACILITY SIZING CALCULATIONS

To quickly size the numerous stormwater facilities for the four concept alternatives it was necessary to determine an approximate sizing ratio for the pollution reduction and detention facilities based on the impervious area draining to them.

For the pollution reduction facilities, which consisted of green street planters or swales, the Stormwater Management Manual's Presumptive Approach Calculator was used to run a series of scenarios using different street running slopes. Flatter streets yield smaller facilities. A single sizing ratio of 3.0% was selected to be used on all pollution reductions green street facilities since as it represented the high end of street slopes in the corridor making the sizing generally conservative.

For the detention facilities, an extensive series of flow-control calculations were performed to determine the minimum storage needed to meet the detention requirements. The results showed a very consistent ratio of storage volume to drainage area, despite a variable range of drainage areas, storage depths and shapes. A Universal Detention Volume (UDV) sizing ratio of 12% was adopted, and the required storage volume in cubic feet is calculated by multiplying the UDV ratio by the square feet of impervious area draining to it. The detention facility footprint is then determined based on the depth and shape appropriate for each location. This method was used to determine the sizes of both surface and sub-surface detention facilities used in the concepts.

3.3 CONCEPT DESIGN ALTERNATIVES

PBOT has reconsidered the roadway needs since completion of the 2011 Plan and anticipates bike and pedestrian improvements to be reduced from the 2011 design. The sections on pages 16 & 17 show the cross sections of the development that has been assumed for each of the stormwater concepts proposed as part of this project. Neighborhood side streets were investigated as part of this project for potential areas for treatment, detention and conveyance. The stormwater management approach in the 2011 Plan did not consider neighborhood side streets or adjacent property acquisitions. The 2011 stormwater plan also proposed large pipes under SW Capitol Highway to handle detention, which added significant cost by burying large pipes in the roadway that would require reconstruction of parts of the road as wells as significant traffic impacts.

All four concepts proposed in this project have the following in common:

- Replace the existing storm inlet at the north west corner of Capitol Hwy and Taylors Ferry with a single StormFilter® catch basin to provide stormwater management for Basin 1. Basin 1 is mostly built out and will have limited stormwater management requirements. It also has very limited space available for above ground stormwater improvements. Refer to text on page 45 for a more detailed explanation of Basin 1 design
- Merge the southern portion of Basin 2 south of SW Alice Street and convey stormwater in a proposed storm pipe to the south end of SW 42nd Avenue and discharge into Woods Memorial Park drainage way. This strategy helps reduce Basin 3 which is desirable to alleviate issues with the capacity of the existing drainage system at the low point of this basin (refer to Fig. 3&4 on the following page).
- Improve SW 42nd Avenue from gravel to a 16’ wide paved roadway since it will have a new storm main installed under it. These improvements also require they meet pollution-reduction and detention requirements for each concept.

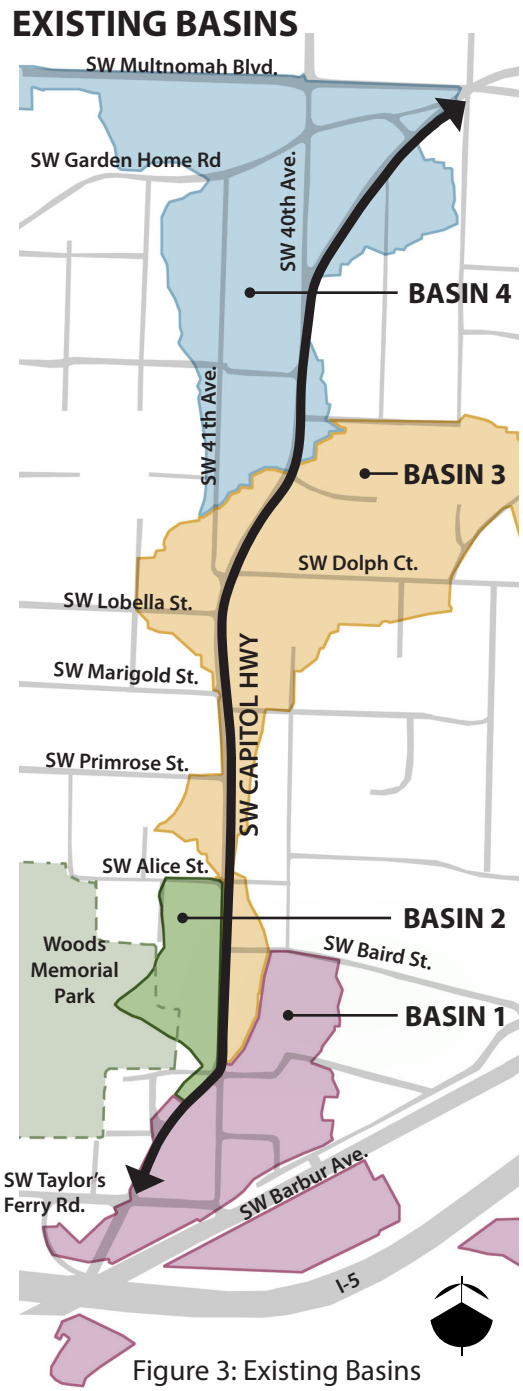


Figure 3: Existing Basins

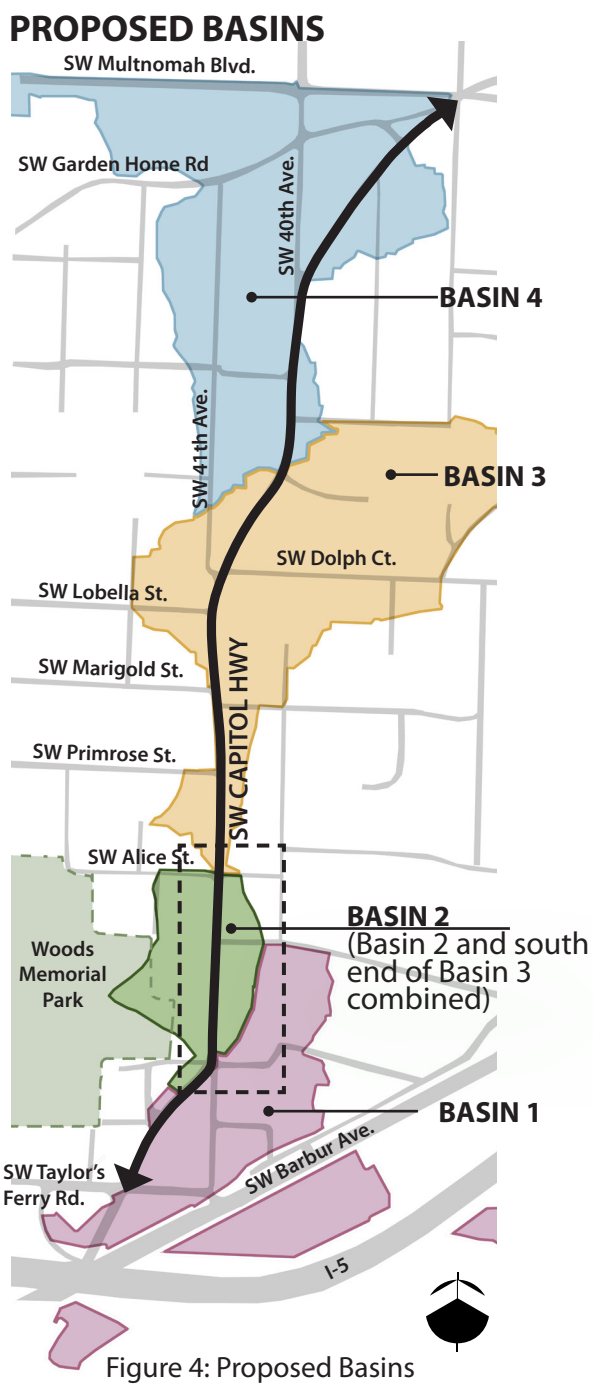
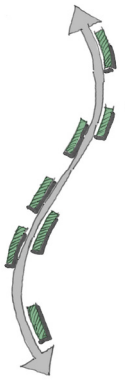


Figure 4: Proposed Basins

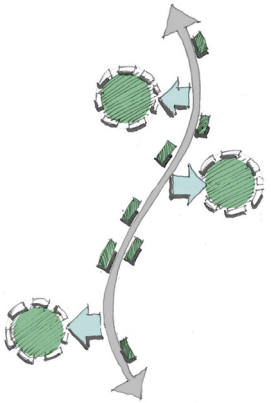


Concept 1

Storm Strategy:
Dispersed Treatment, Dispersed Detention

Street Section:
Separated sidewalk on west side, bike lanes both sides.

1. **Water quality** pollution-reduction in green street facilities on both sides of street.
2. **Detention** in Capitol Hwy ROW on both sides of street using sub-surface storage system.
3. **Conveyance**: Gutter and shallow "ODOT" style storm piping for conveyance on each side under gutter.

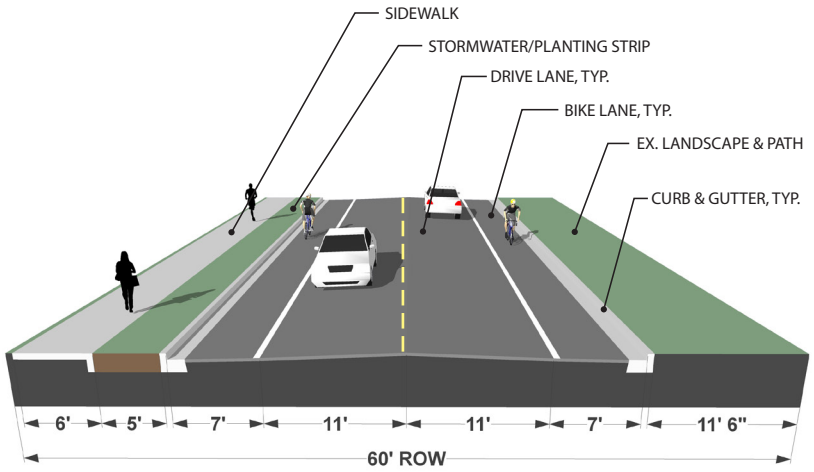


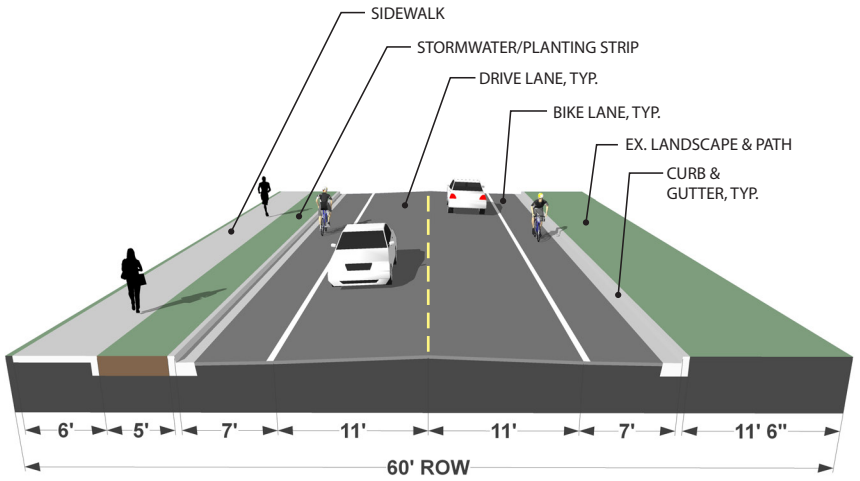
Concept 2

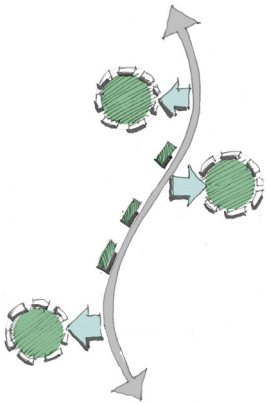
Storm Strategy:
Dispersed Treatment, Centralized Detention

Street Section:
Separated sidewalk on west side, bike lanes both sides.

1. **Water quality** pollution-reduction in green street facilities on both sides of street.
2. **Detention** in regional/neighborhood facilities located on side streets.
3. **Conveyance:** Gutter and shallow "ODOT" style storm piping for conveyance on west side under gutter and lateral connection to east side.





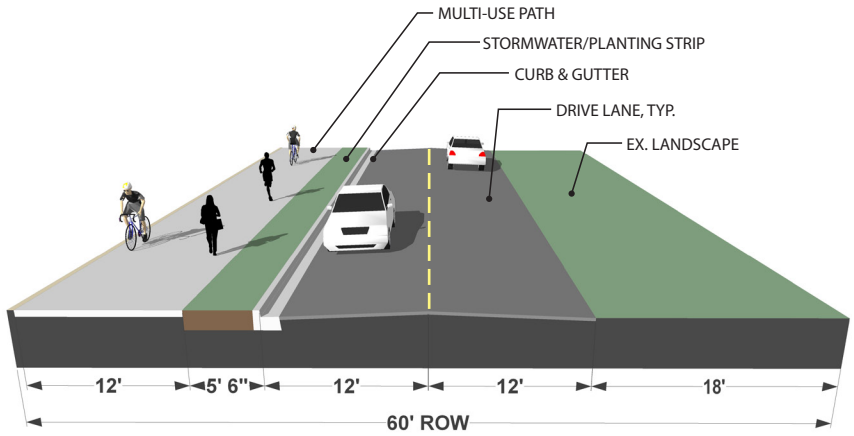


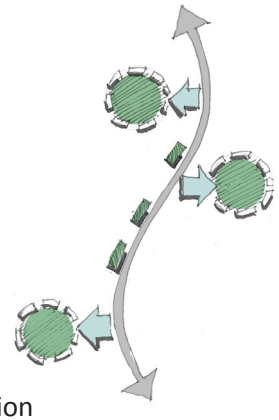
Concept 3

Storm Strategy:
Dispersed Treatment, Centralized Detention

Street Section:
Multi-use Path on west side, no primary improvements on east side

1. **Water quality** pollution-reduction in green street facilities on west side of street only.
2. **Detention** in regional/neighborhood facilities located on side streets.
3. **Conveyance:** Gutter and shallow "ODOT" style storm piping for conveyance on west side under gutter. Existing conveyance on east side unchanged.
4. Multi-use path on west side constructed of pervious concrete for impervious area reduction. No improvements on east side.



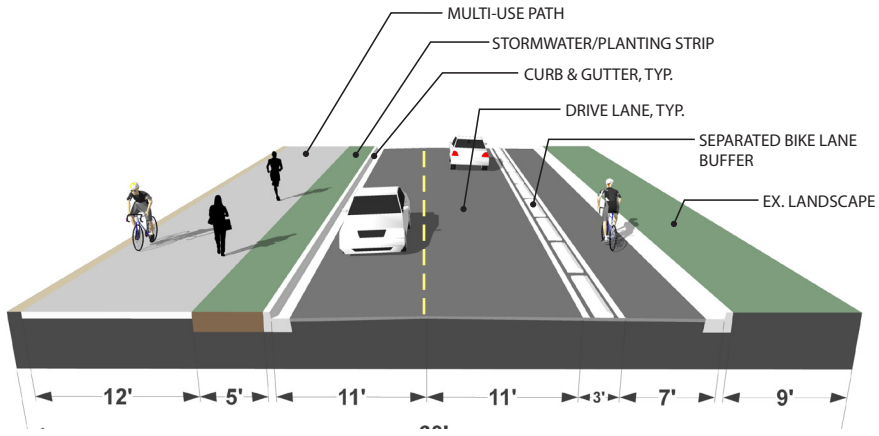


Concept 4

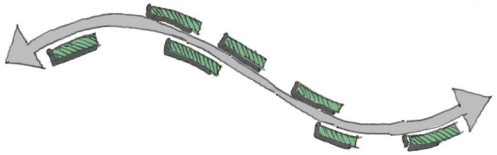
Storm Strategy:
West Side: Dispersed Treatment, Centralized Detention
East Side: Centralized Treatment & Detention

Street Section:
Multi-use Path on west side, separated bike lane on east side

1. **Water quality** pollution-reduction in green street facilities on west side of street. East side pollution-reduction at regional/neighborhood facilties.
2. **Detention** in regional/neighborhood facilities located on side streets.
3. **Conveyance:** Gutter and shallow "ODOT" style storm piping for conveyance on west and east side.
4. Multi-use path on west side constructed of pervious concrete for impervious area reduction.



CONCEPT 1:



Storm Strategy: Dispersed Treatment, Dispersed Detention
Street Section: Separated sidewalk on west side, bike lanes both sides

Development for this concept assumes development of 7-foot bike lanes on both sides of SW Capitol Highway and a 6-foot sidewalk on the west side only, separated by a 5-foot wide planting strip. Refer to the concept section/ perspective illustration on opposite page.

Pollution-reduction is managed using de-centralized green street facilities within the SW Capitol Highway right-of-way. On the west side the green street facilities are 4.5-foot wide stormwater flow-through planters and on the east side are 6-foot wide swales. Each planter or swale is separated by an average of 200 lineal feet. Spacing varies based on avoiding conflicts with driveways, utilities or other existing features.

Detention is accomplished beneath the sidewalk and landscaping area through the use of a 3.5-foot tall proprietary stacking storage systems such as R-Tank™, EcoRain™, CUDO® other high void (> 95%) space detention product to maximize the storage volume in the smallest footprint possible.

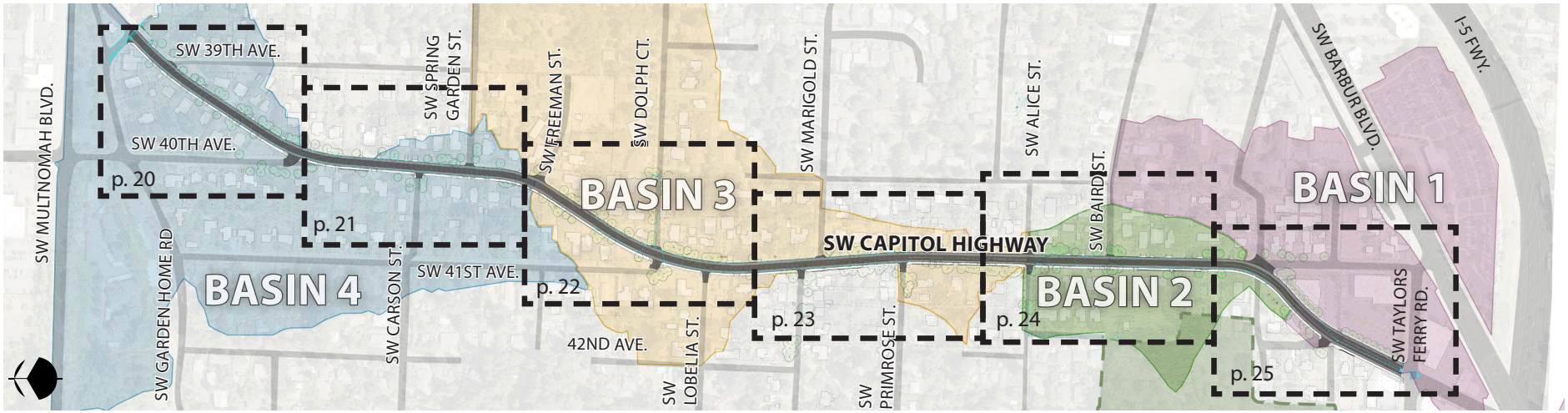
The filtered stormwater from the upstream green street facilities flows into a small sediment trapping vault that also contains a smaller version of a typical flow-control riser with an orifice on the bottom that is used in standard flow-control manholes. This conceptual design is further illustrated in the preliminary details provided in Appendix C on page 74. For this type of small detention facility to work, it requires contributing road lengths between 500-1100 lineal feet. Segments shorter than that would require the flow-control orifice to be too small (<0.5-inch diameter) and longer segments make it exceptionally difficult to find relatively level and available space between the curb and right-of-way line to install the system.

While orifice control systems with diameters less than 2-inches have been used on private property, it is a new approach for the public right-of-way. Additional discussions are required regarding susceptibility to clogging and frequency of maintenance prior to any expansive use of this design. Other regional agencies are also looking at small diameter orifice controls to meet their own flow control requirements.

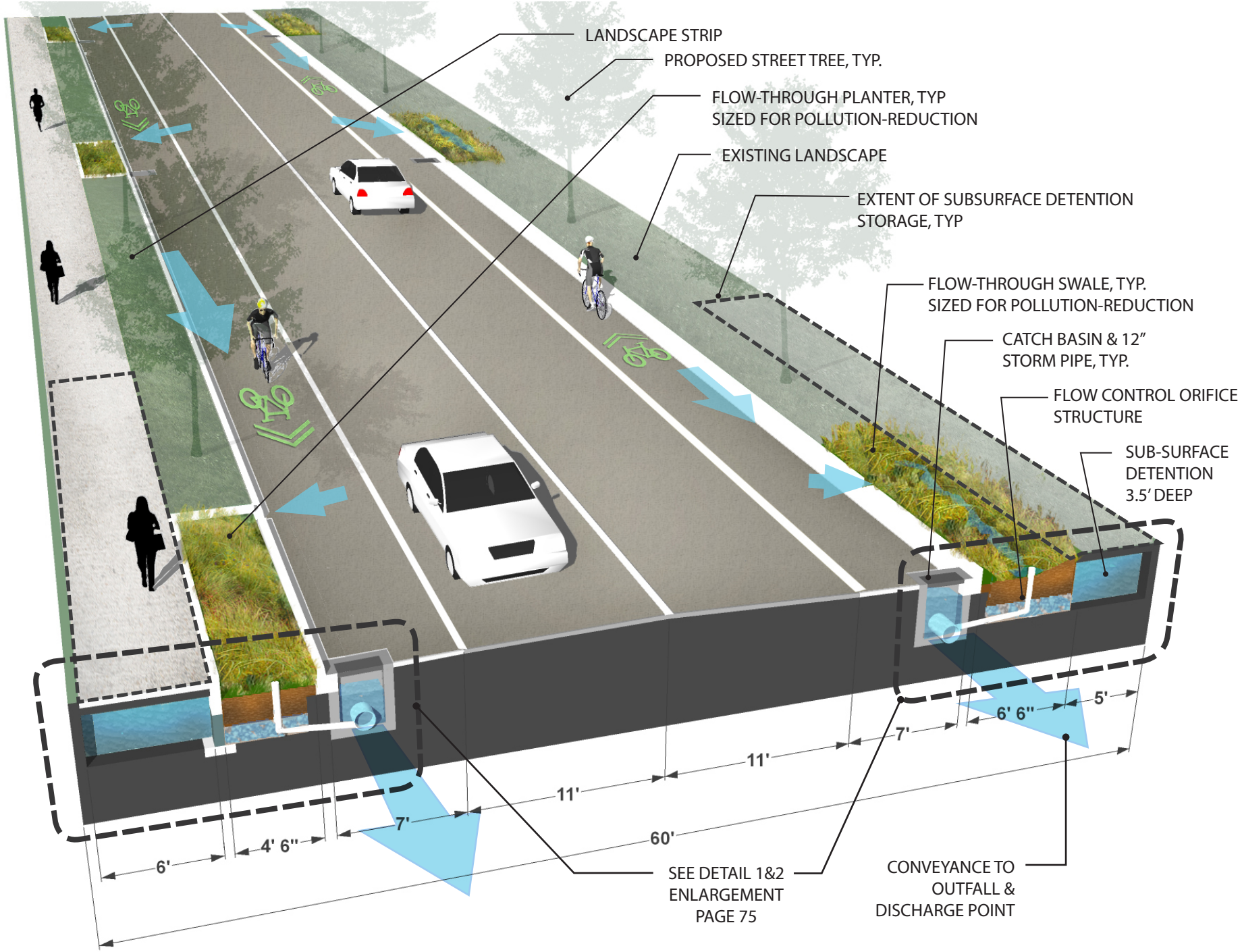
This concept also proposes shallow (3 to 4-foot deep) dual storm pipe lines on both sides of SW Capitol Highway in order for the proposed sub-surface detention facilities to remain shallow enough to function properly and fit in the spaces available.

All green street facilities have been located to avoid bus stops, driveways, water mains and water service lines.

CONCEPT PLAN KEY MAP



CONCEPT 1 : DISPERSED TREATMENT & DISPERSED DETENTION



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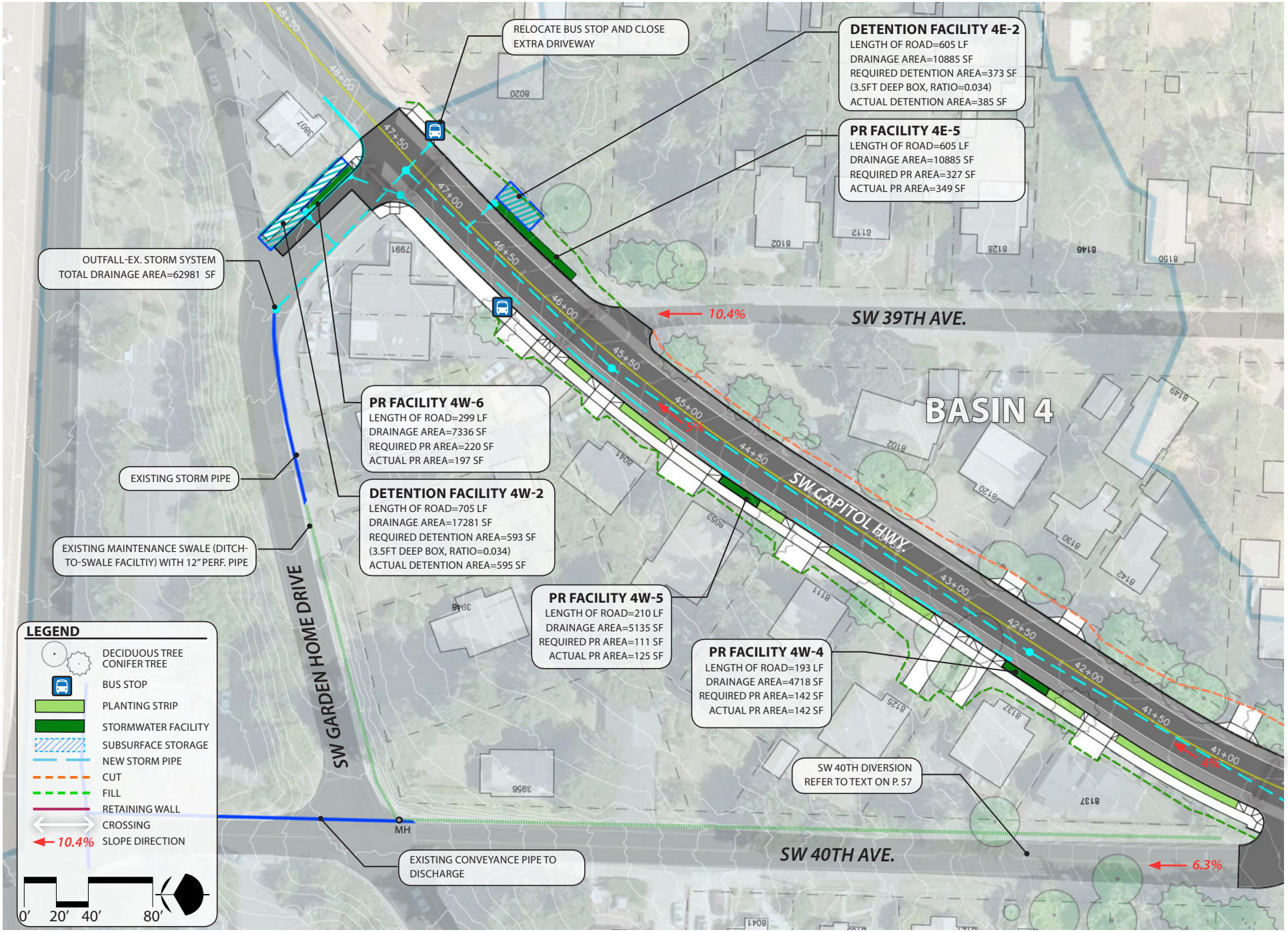
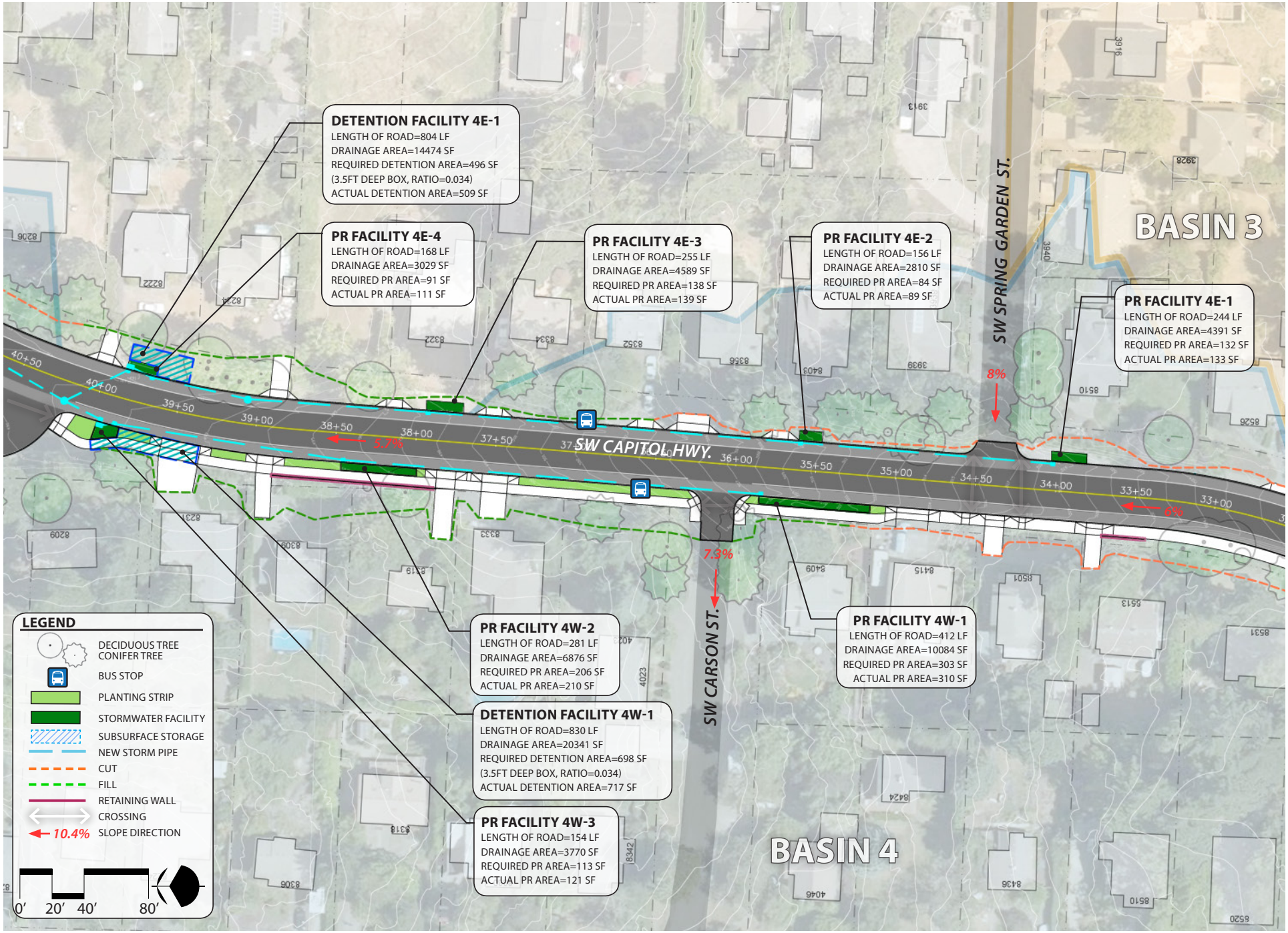


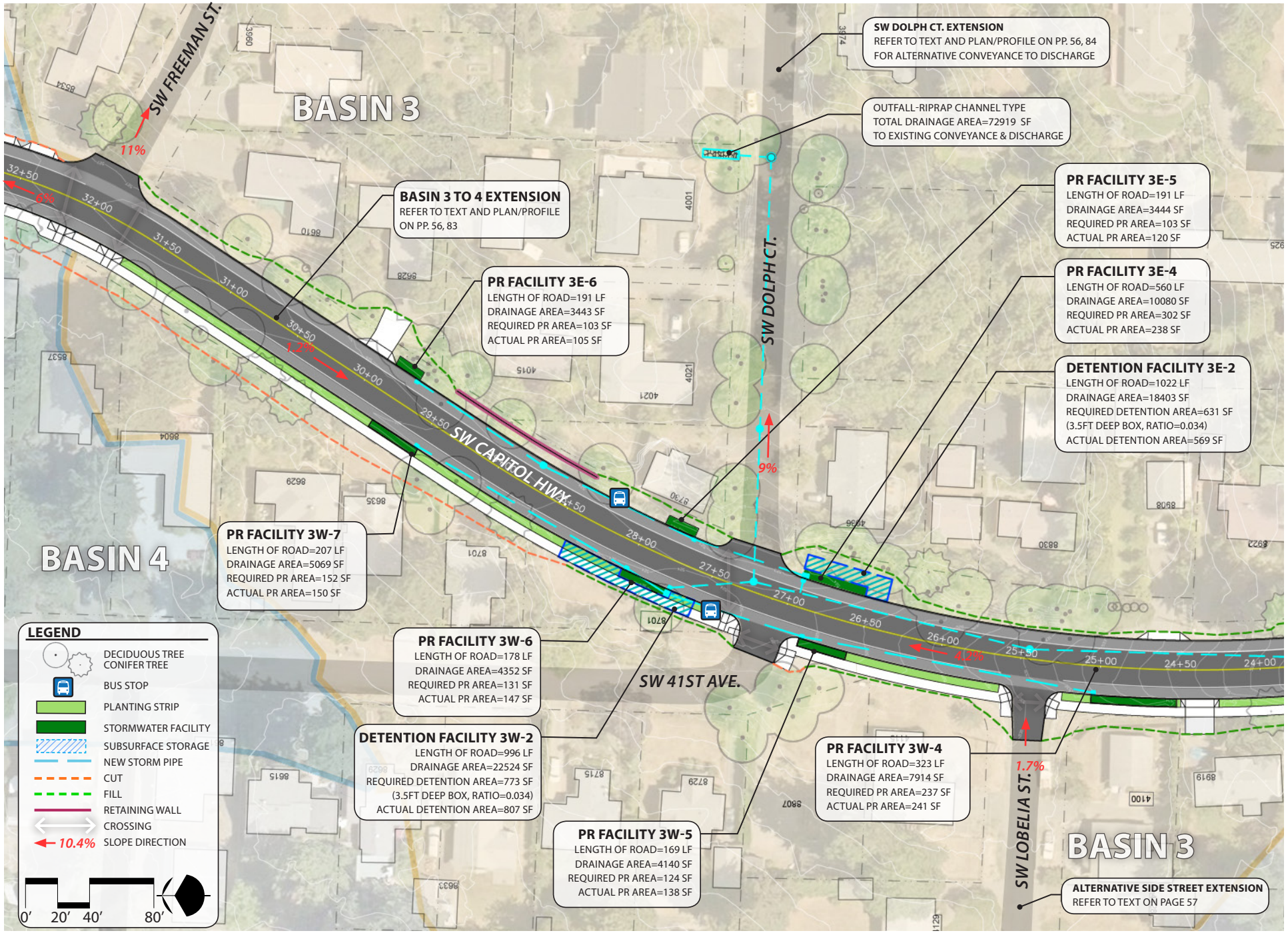
CONCEPT 1 : DISPERSED TREATMENT & DISPERSED DETENTION

CAPITOL HWY. CORRIDOR STORMWATER CONCEPTS

ENVIRONMENTAL SERVICES CITY OF PORTLAND GREENWORKS kpff



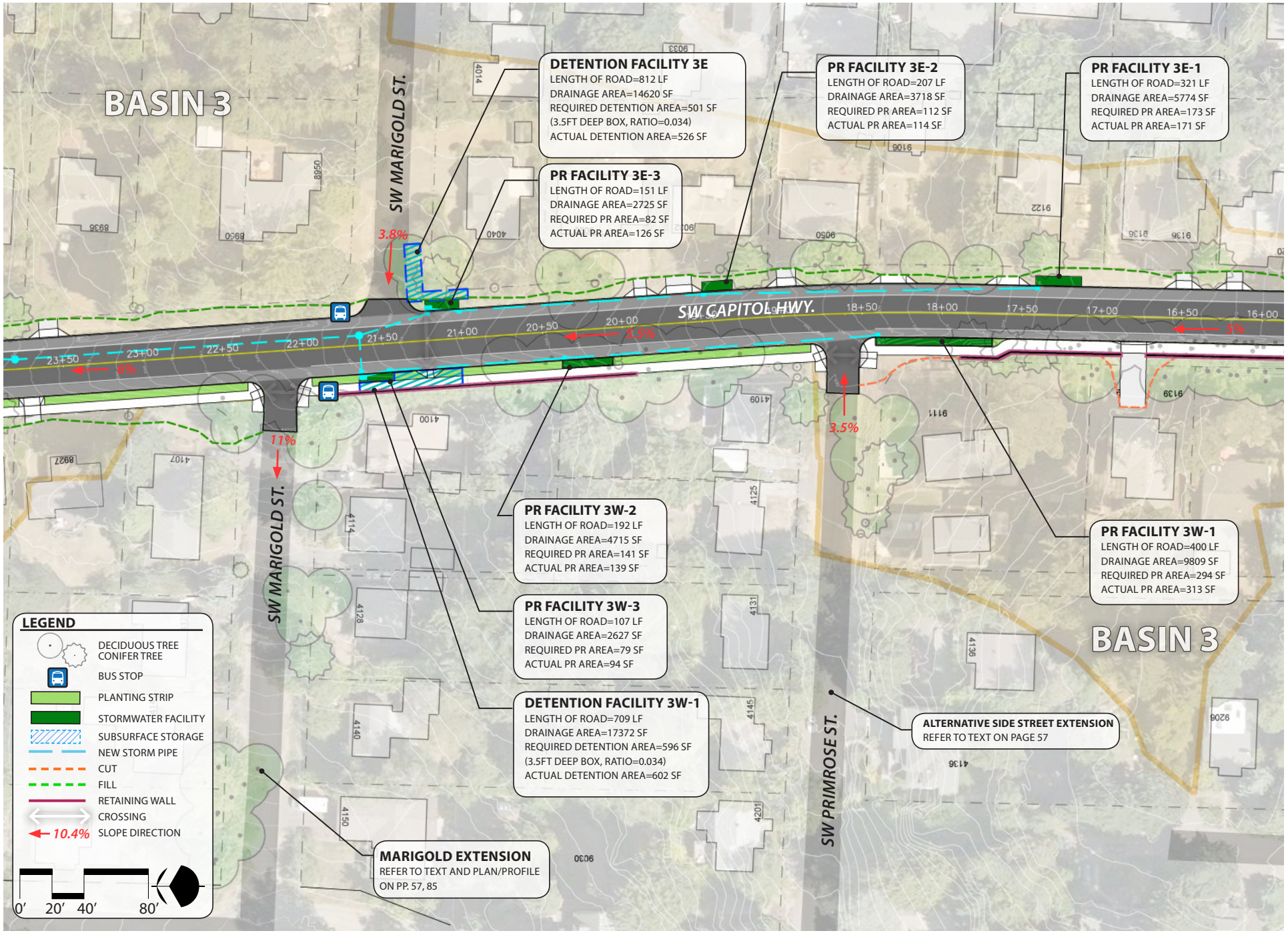
CONCEPT 1 : DISPERSED TREATMENT & DISPERSED DETENTION



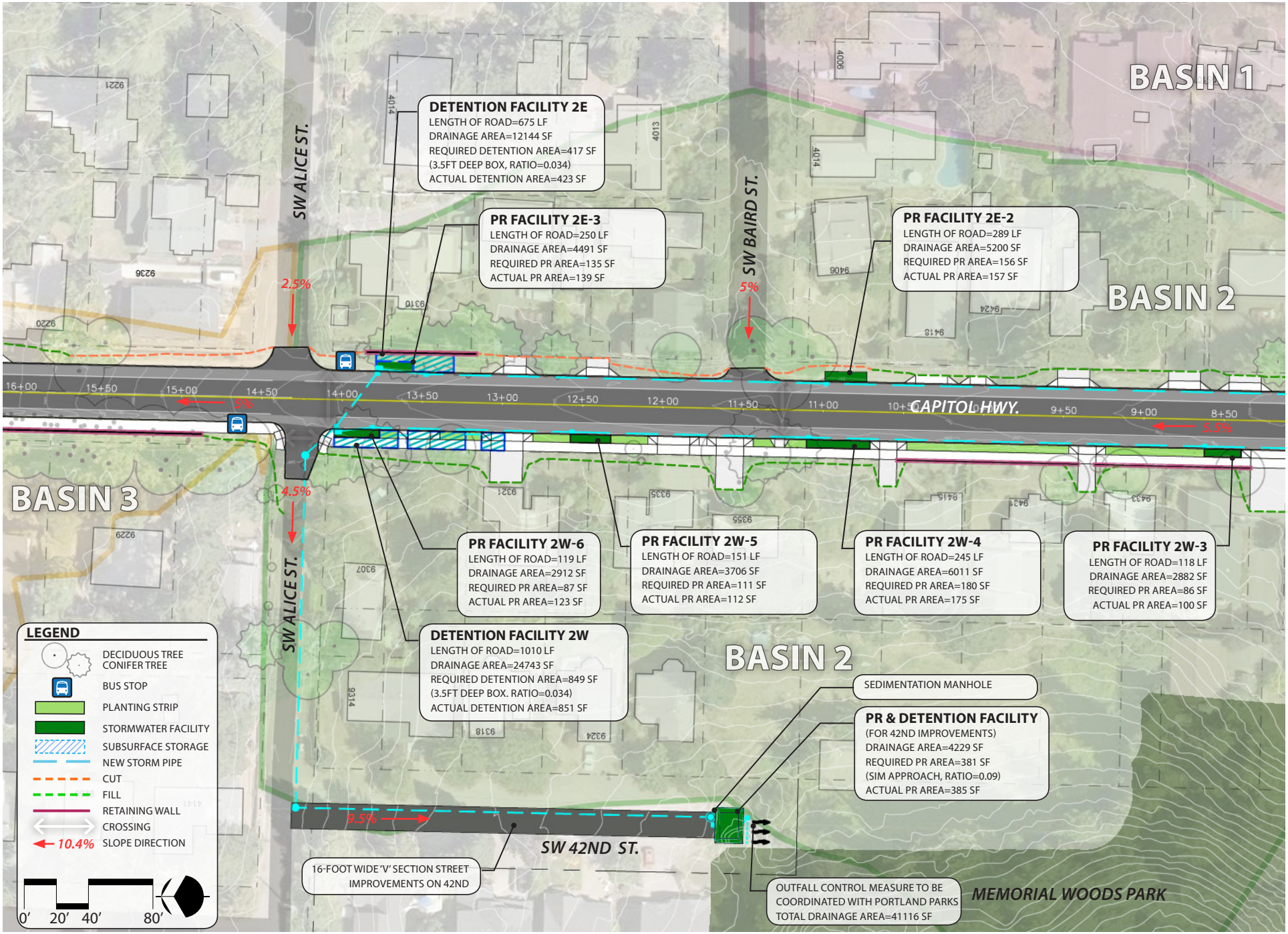
CONCEPT 1 : DISPERSED TREATMENT & DISPERSED DETENTION

CAPITOL HWY. CORRIDOR STORMWATER CONCEPTS

ENVIRONMENTAL SERVICES CITY OF PORTLAND GREENWORKS kpff



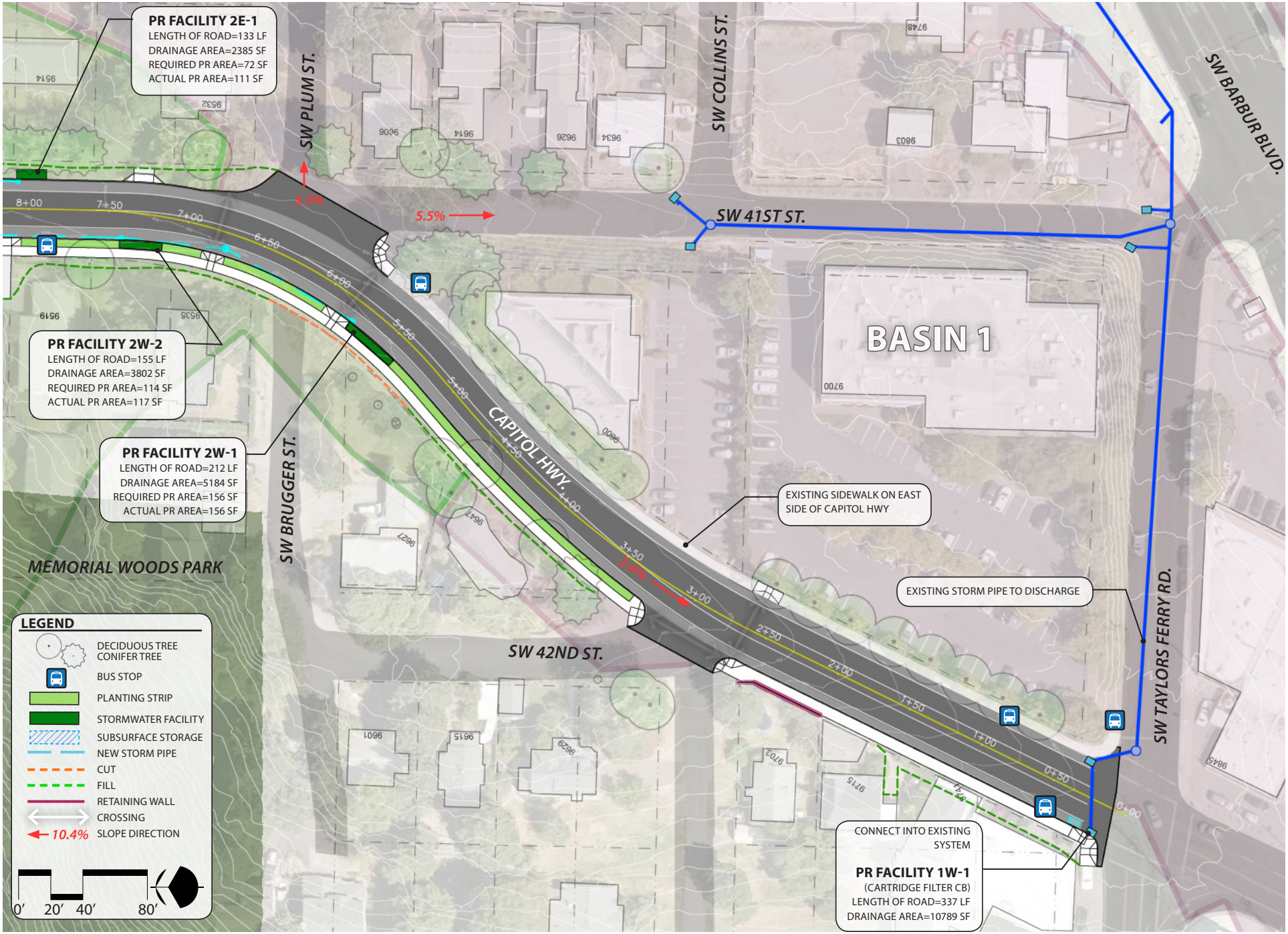
CONCEPT 1 : DISPERSED TREATMENT & DISPERSED DETENTION



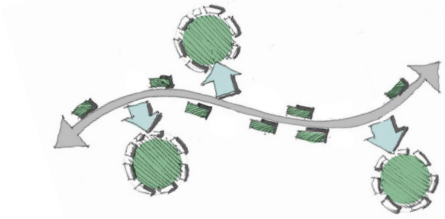
CONCEPT 1 : DISPERSED TREATMENT & DISPERSED DETENTION

CAPITOL HWY. CORRIDOR STORMWATER CONCEPTS

ENVIRONMENTAL SERVICES CITY OF PORTLAND GREENWORKS kpff



CONCEPT 1 : DISPERSED TREATMENT & DISPERSED DETENTION



CONCEPT 2:

Storm Strategy: Dispersed Treatment, Centralized Detention
Street Section: Separated sidewalk on west side, bike lanes both sides

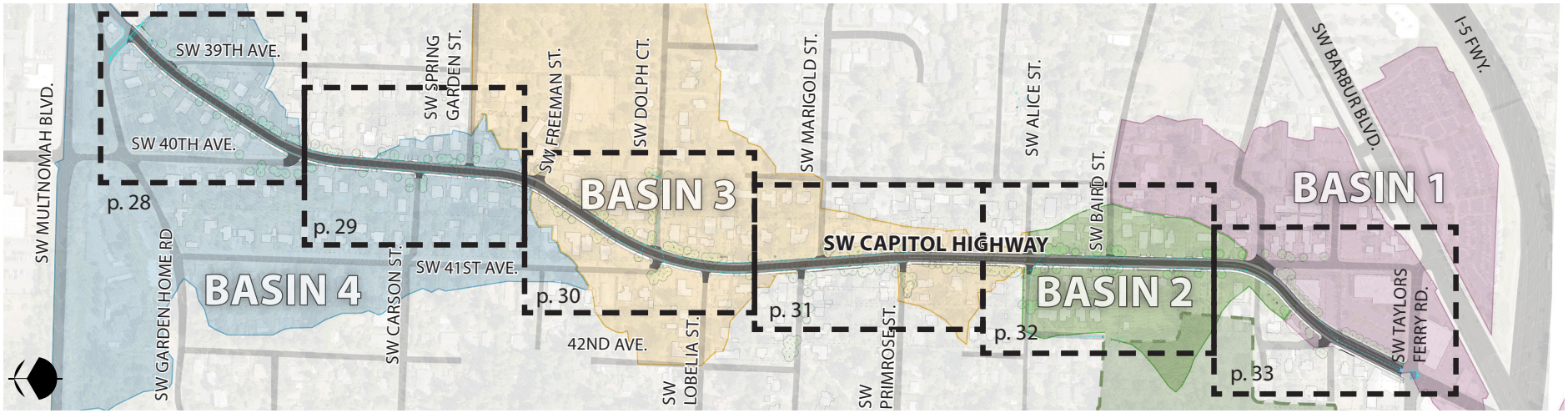
Concept 2 assumes the same development scenario as Concept 1 to provide an 'apples to apples' comparison of the cost estimates for each concept. Pollution-reduction is also managed using de-centralized green street facilities within the SW Capitol Highway right-of-way configured the same as in Concept 1. Refer to the concept section/perspective illustration on opposite page.

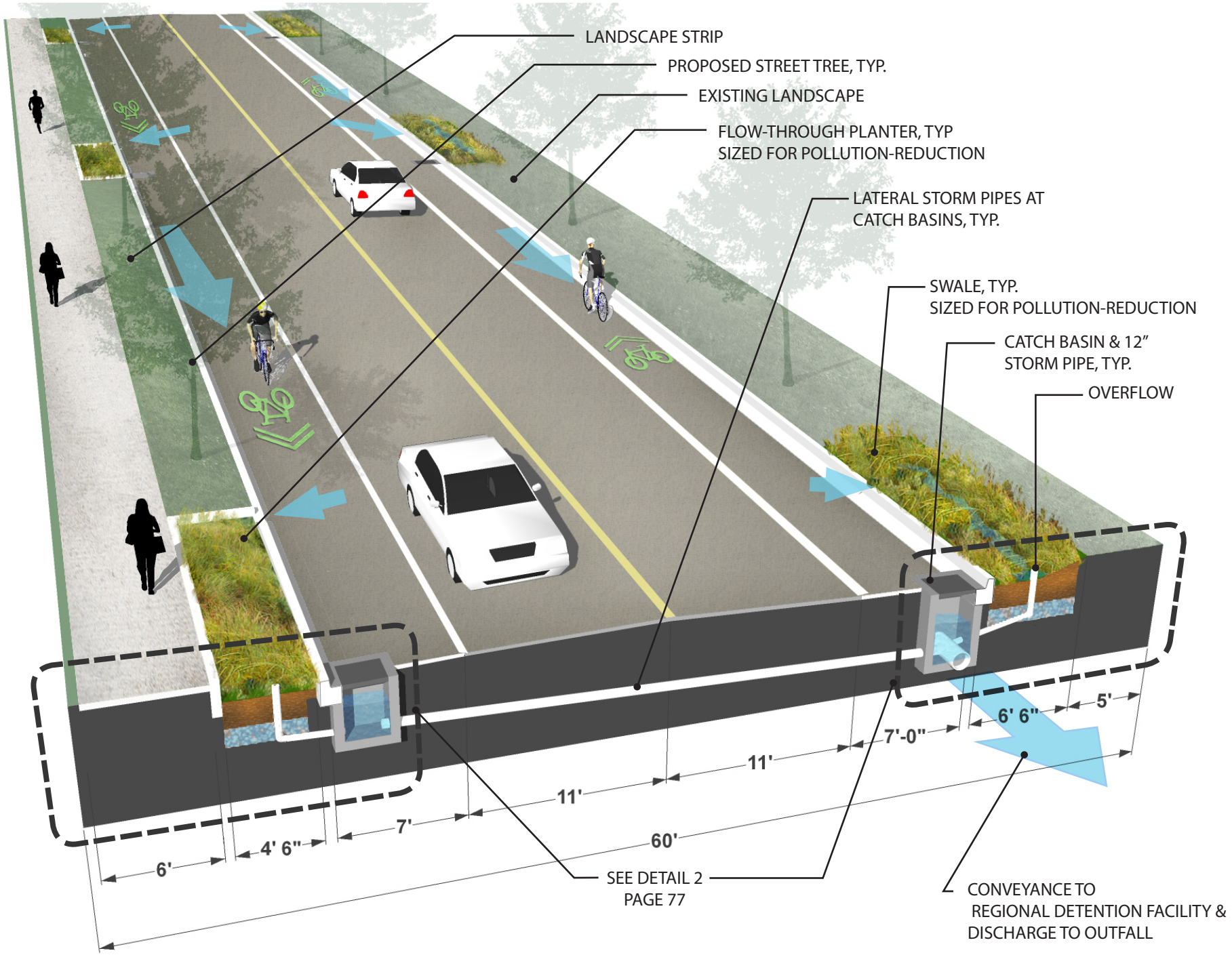
Detention facilities are located in larger centralized facilities at the low point of the basin prior to conveyance to a discharge point. This concept proposes three detention facilities. They are located at the south end of SW 42nd Avenue south of SW Alice Street; approximately 140-feet east of SW Capitol Highway on the south side of SW Dolph Court; and at the intersection of SW Garden Home Road with SW Capitol Highway on the east side of the road. The right-of-way at SW 42nd extends far enough south that property acquisition is not required at this location. Both of the other detention facilities would require property acquisition in order to implement this concept in Basins 3 and 4.

The detention facilities that have been sized and shown in the concept are surface facilities that are three-feet deep with 3:1 side-slopes. To ensure that they readily drain out after each storm event they are proposed to contain an underdrain layer with a perforated pipe to drain the sub-grade to the flow-control manhole. By providing an overflow ditch inlet 6-inches above the bottom, they function as flow-through stormwater basins.

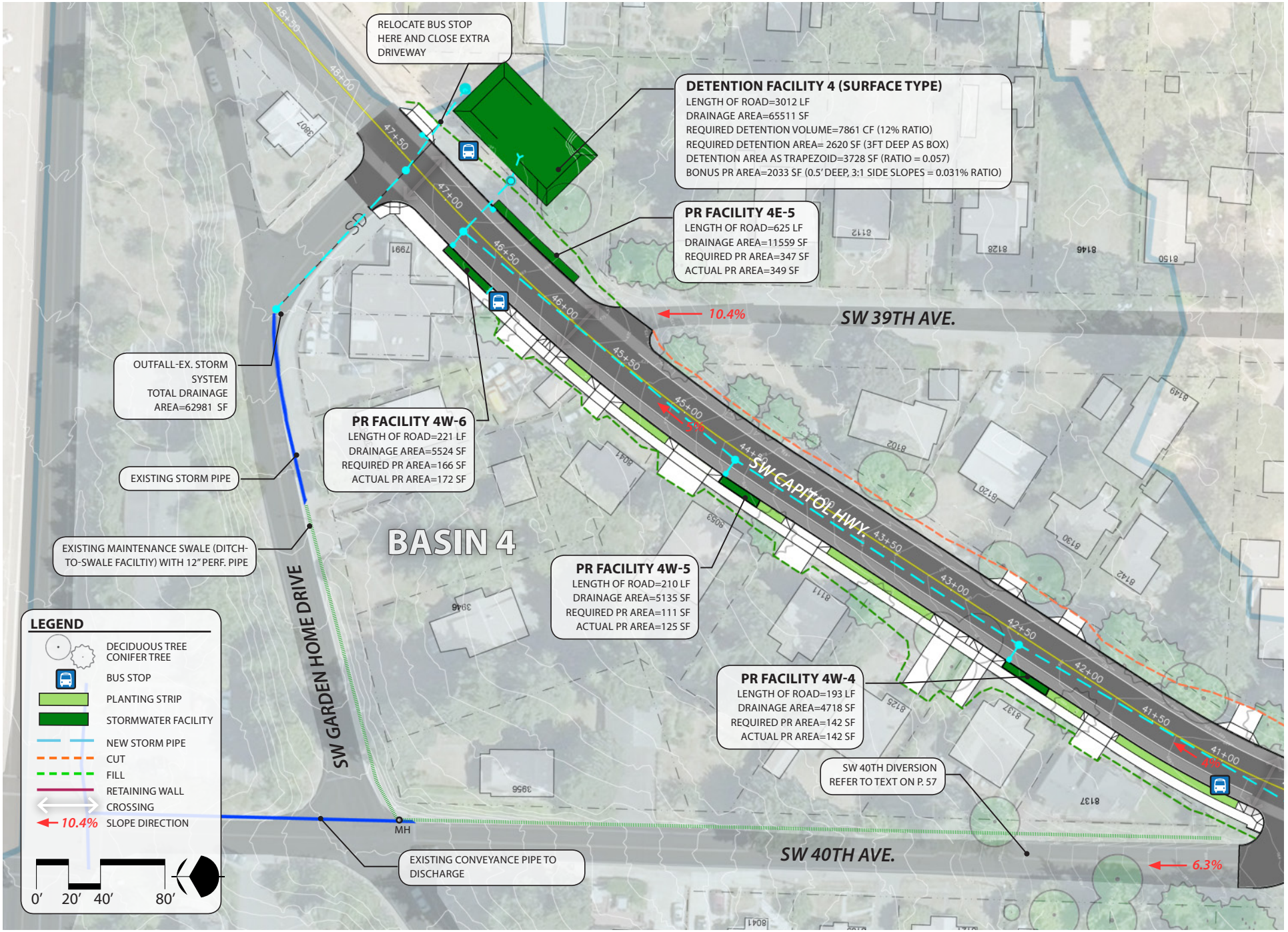
This concept proposes 10-inches diameter lateral storm pipes across SW Capitol Highway to the new storm trunk main. The 12-inch diameter storm trunk main is generally 5 to 7-foot deep and alternates to either the east side or the west side of SW Capitol Highway depending on which direction stormwater is being conveyed towards the discharge point.

The shape of the detention facilities have not been designed, and are shown as rectangles for simplicity at this stage of design. During design, the facility footprint should be carefully considered to fit with the context of the site. All green street facilities have been located to avoid bus stops, driveways, water mains and water service lines.





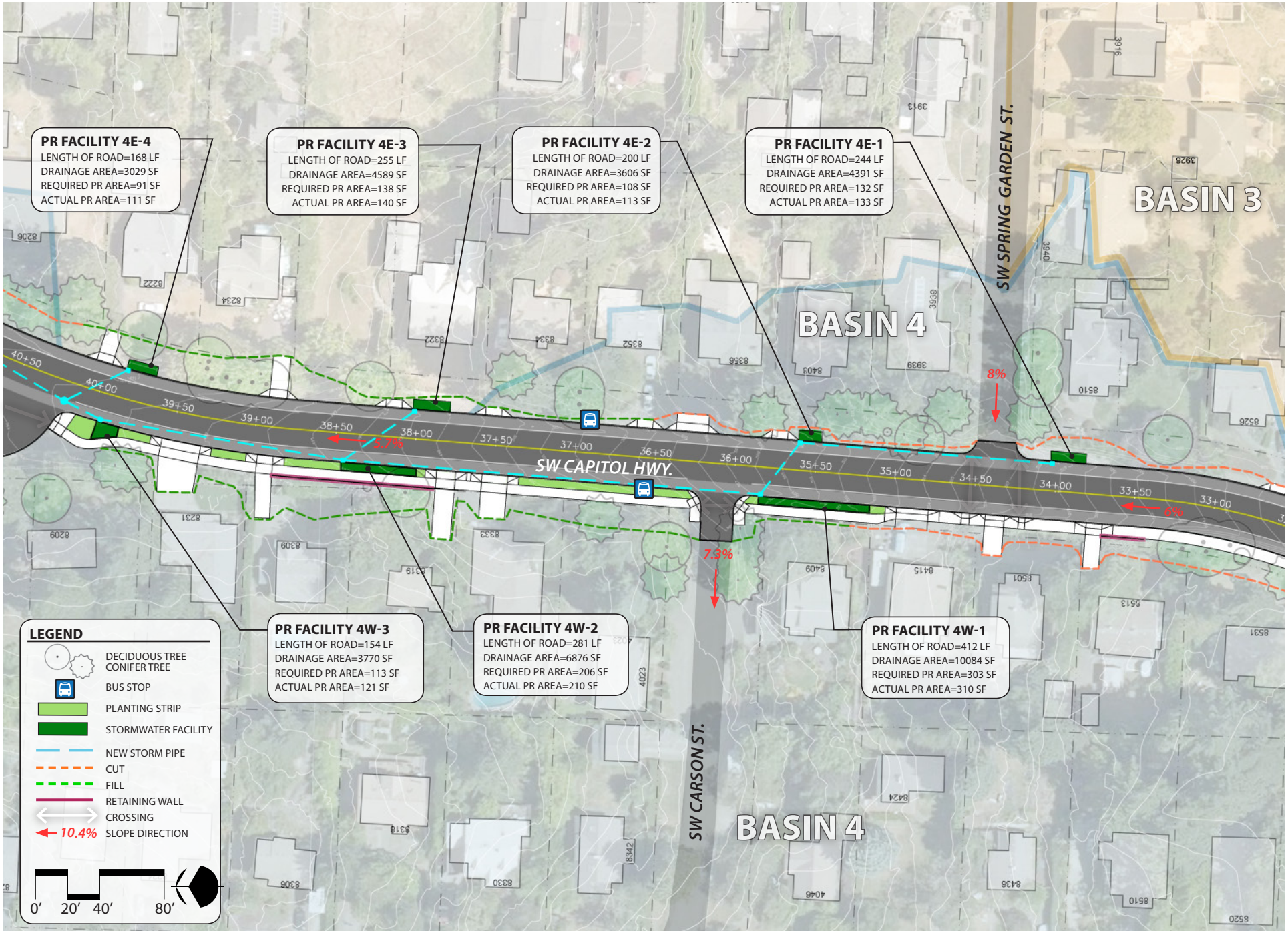
CONCEPT 2: DISPERSED TREATMENT, CENTRALIZED DETENTION



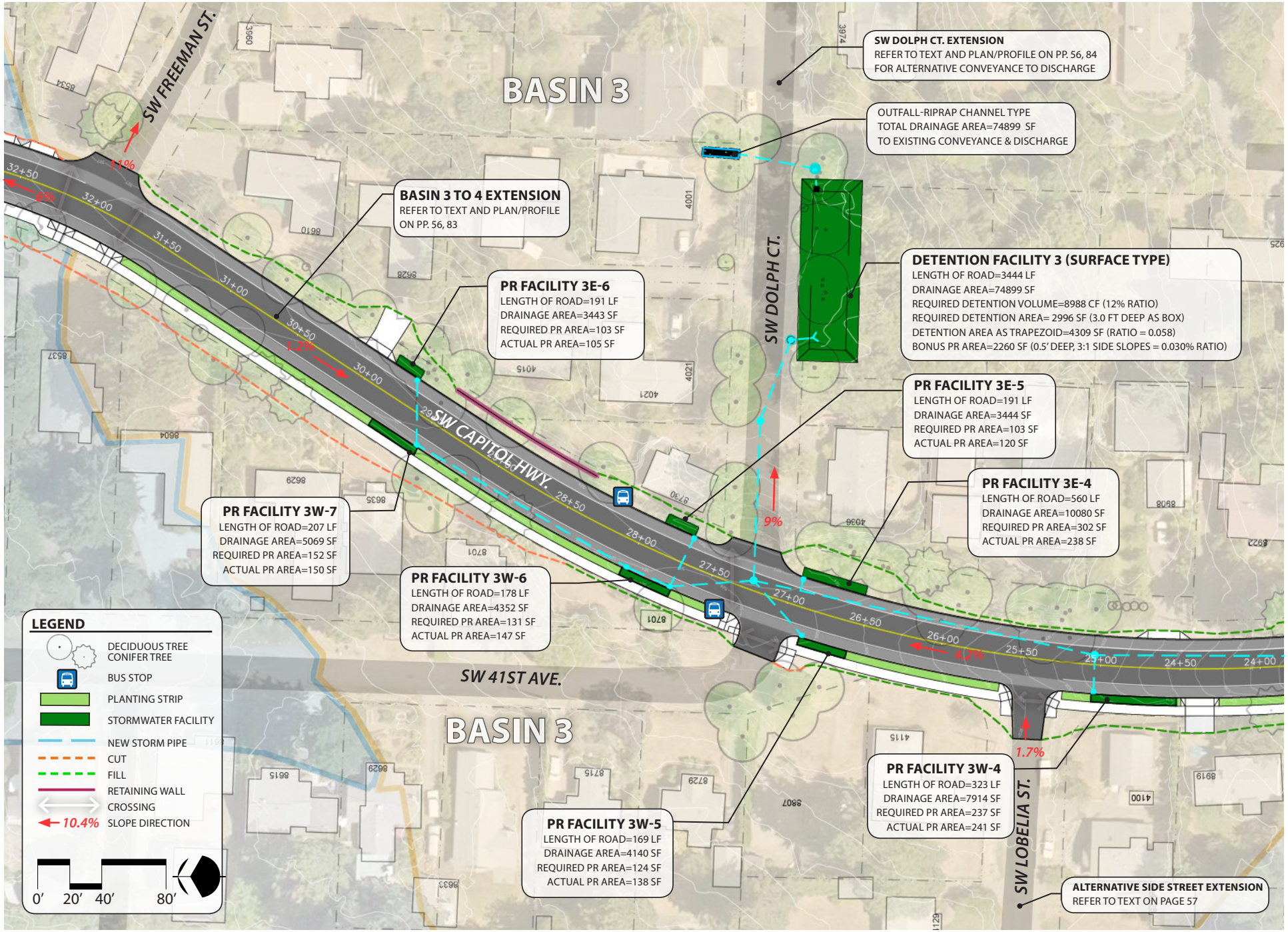
CONCEPT 2: DISPERSED TREATMENT, CENTRALIZED DETENTION

CAPITOL HWY. CORRIDOR STORMWATER CONCEPTS

ENVIRONMENTAL SERVICES CITY OF PORTLAND GREENWORKS kpff



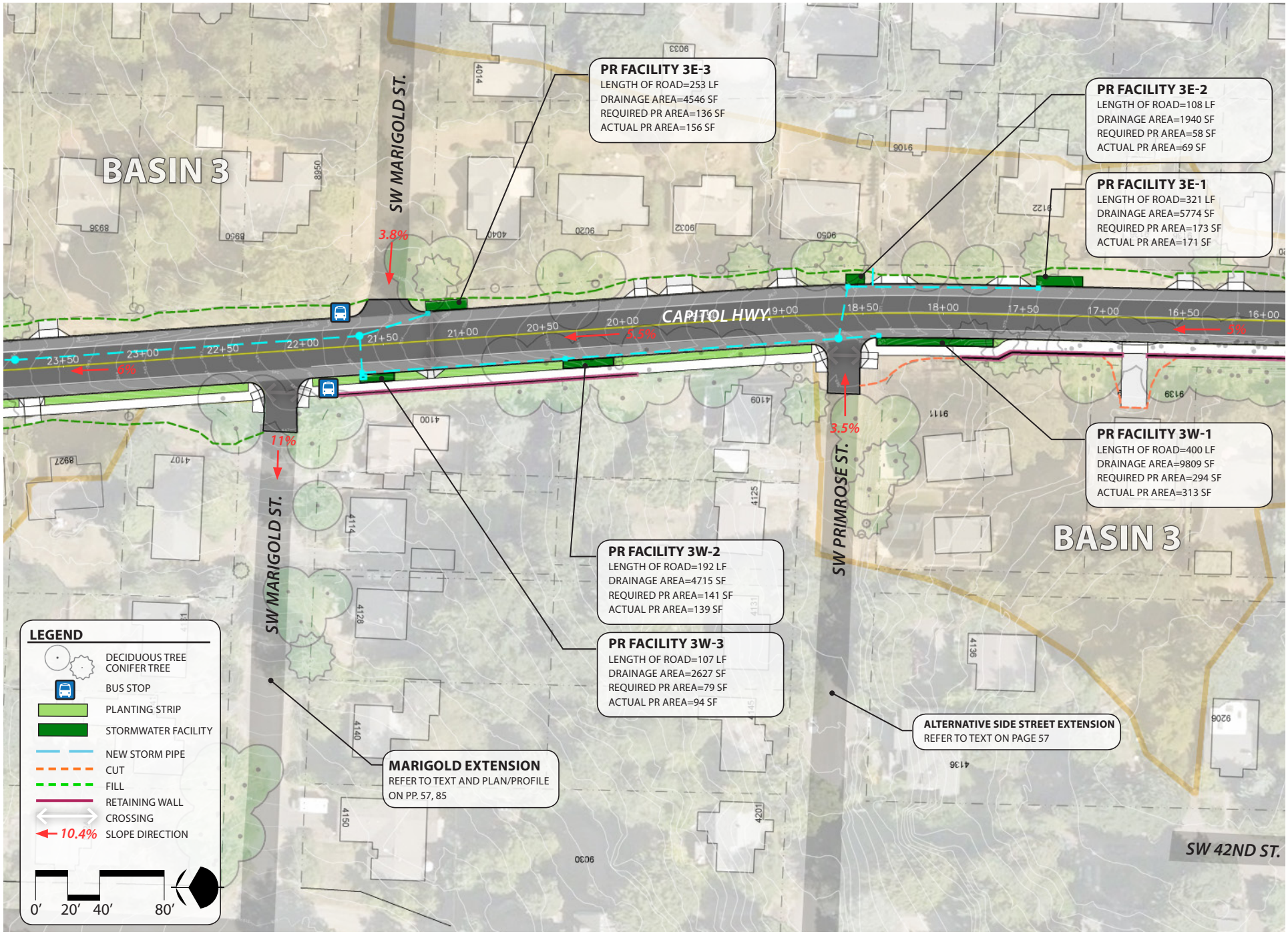
CONCEPT 2: DISPERSED TREATMENT, CENTRALIZED DETENTION



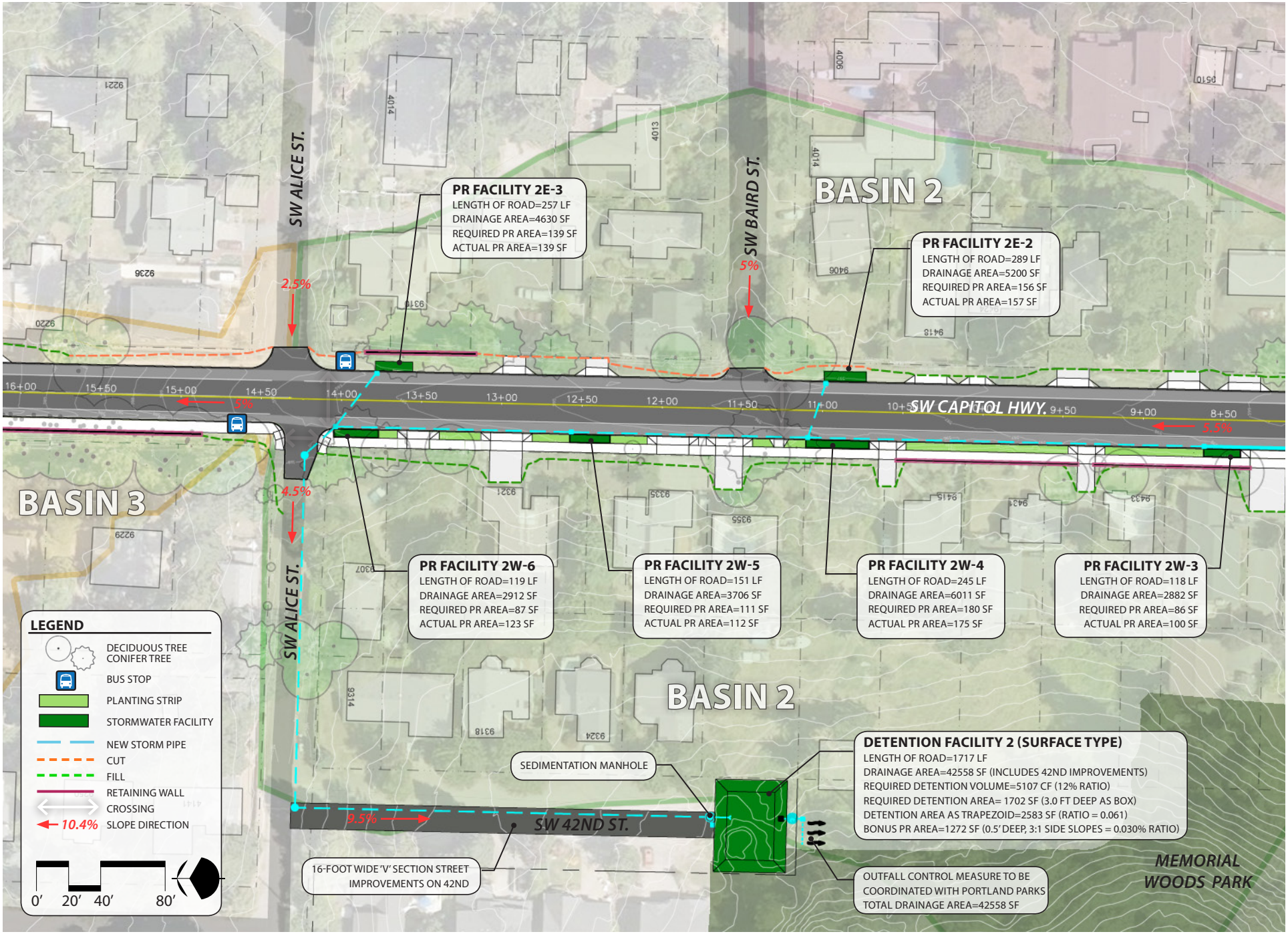
CONCEPT 2: DISPERSED TREATMENT, CENTRALIZED DETENTION

CAPITOL HWY. CORRIDOR STORMWATER CONCEPTS

ENVIRONMENTAL SERVICES CITY OF PORTLAND GREENWORKS kpff



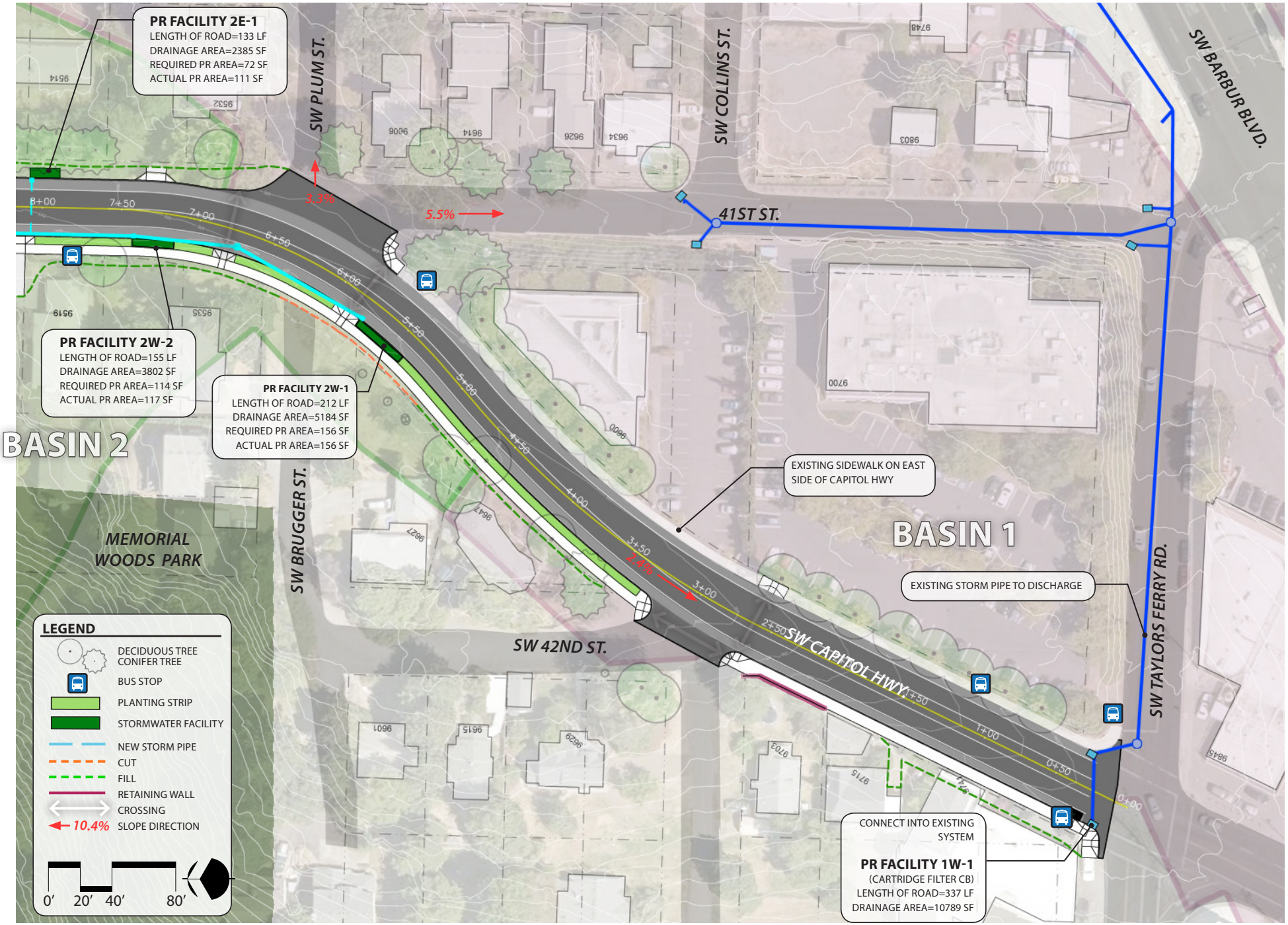
CONCEPT 2: DISPERSED TREATMENT, CENTRALIZED DETENTION



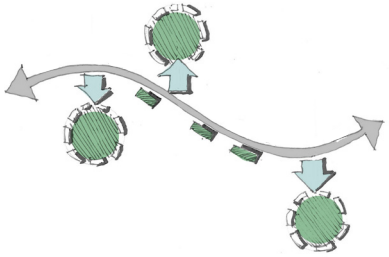
CONCEPT 2: DISPERSED TREATMENT, CENTRALIZED DETENTION

CAPITOL HWY. CORRIDOR STORMWATER CONCEPTS

ENVIRONMENTAL SERVICES CITY OF PORTLAND GREENWORKS kpff



CONCEPT 2: DISPERSED TREATMENT, CENTRALIZED DETENTION



CONCEPT 3:

Storm Strategy: Dispersed Treatment, Centralized Detention
Street Section: Multi-use Path on west side, no primary improvements on east side

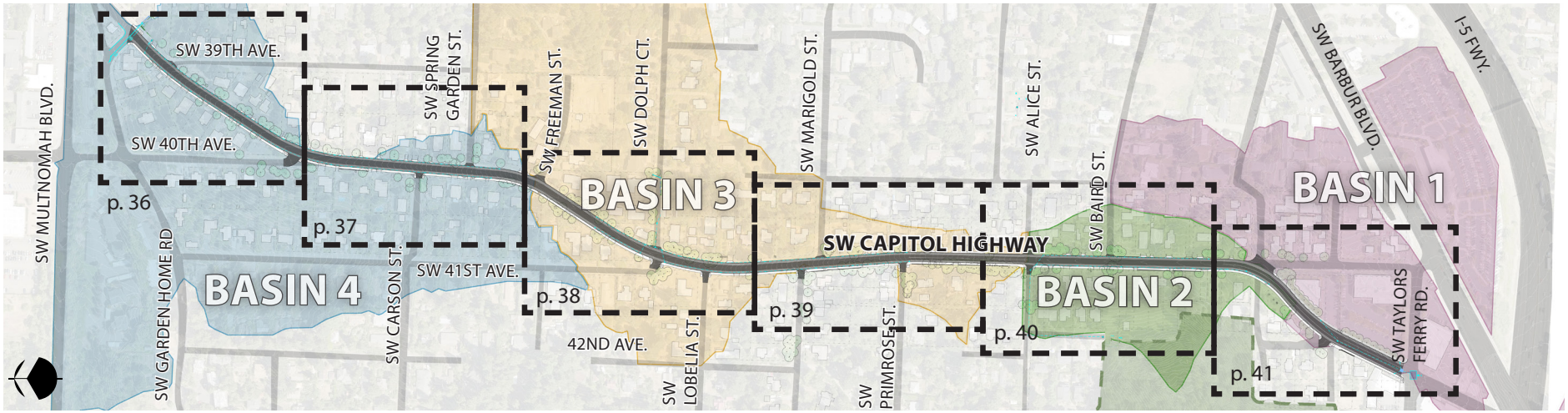
The stormwater management approach for this concept is the same as Concept 2- a hybrid approach with de-centralized pollution-reduction green street facilities located within the SW Capitol Highway right-of-way and detention facilities located in centralized facilities at the same locations as shown in Concept 2. This concept also has the same property acquisition requirements as Concept 2. Refer to the concept section/perspective illustration on opposite page.

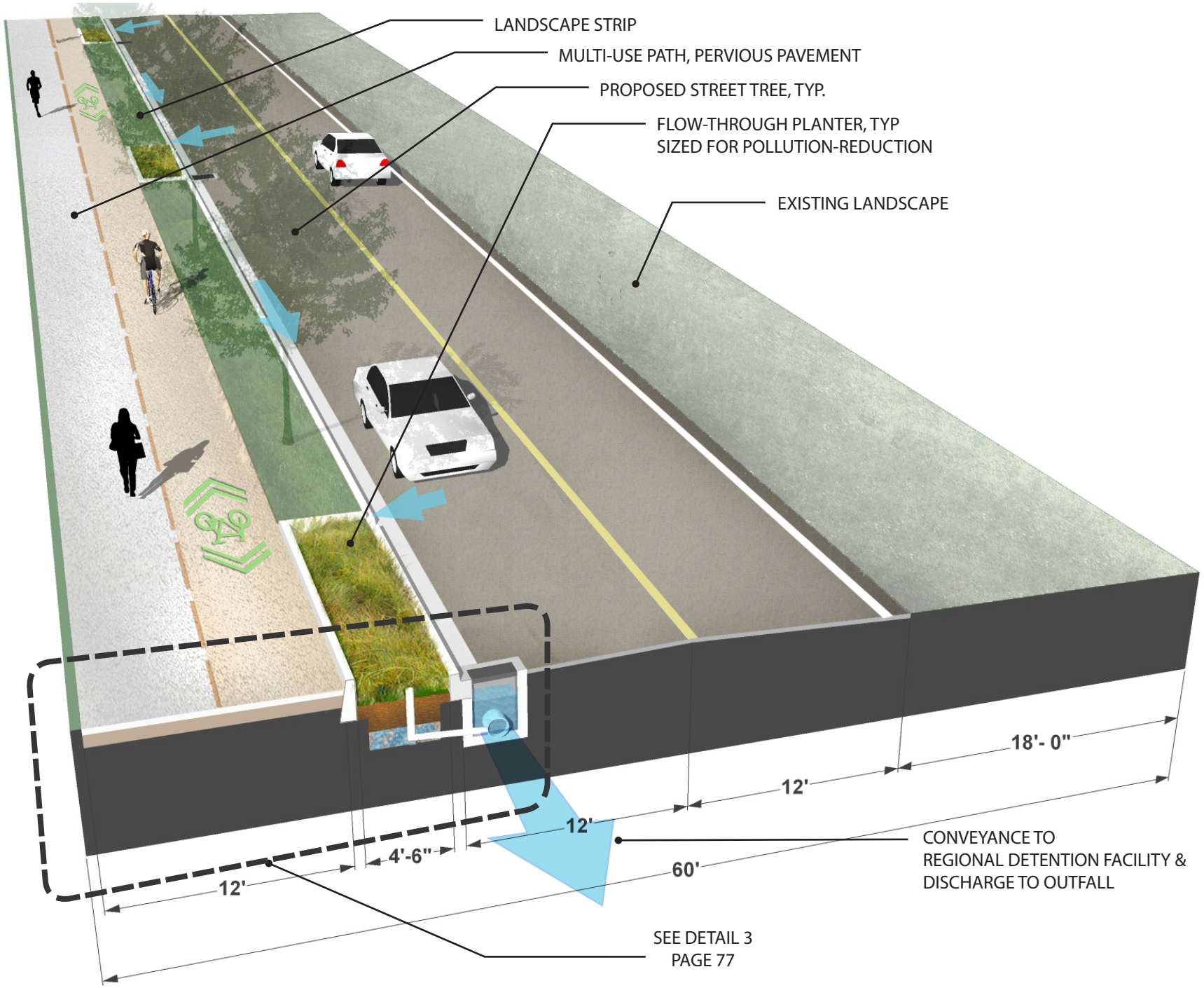
Instead of bike lanes on both sides, this concept proposes that bike and pedestrian facilities be combined into a single 12-foot wide multi-use path on the west side constructed of pervious concrete. Because there are no improvements proposed for the east side of SW Capitol Highway, there are no green street facilities proposed there either. However, centralized detention facilities in this concept are sized to accept east side drainage via new ditch inlets located to intercept drainage from the existing ditches. All green street facilities have been located to avoid bus stops, driveways, water mains and water service lines.

The multi-use path in this concept is proposed to be constructed of permeable concrete because the reduction of impermeable area is significant, which makes it more worth the additional cost to help reduce the sizes of the green street and detention facilities. PBOT supports the use of permeable paving for impermeable area reduction, as long as it is not placed directly adjacent to unimproved streets because of clogging concerns. Because infiltration of existing soils is poor, perforated drain pipes and connection to the storm pipe are proposed in the concept and included in the cost estimate.

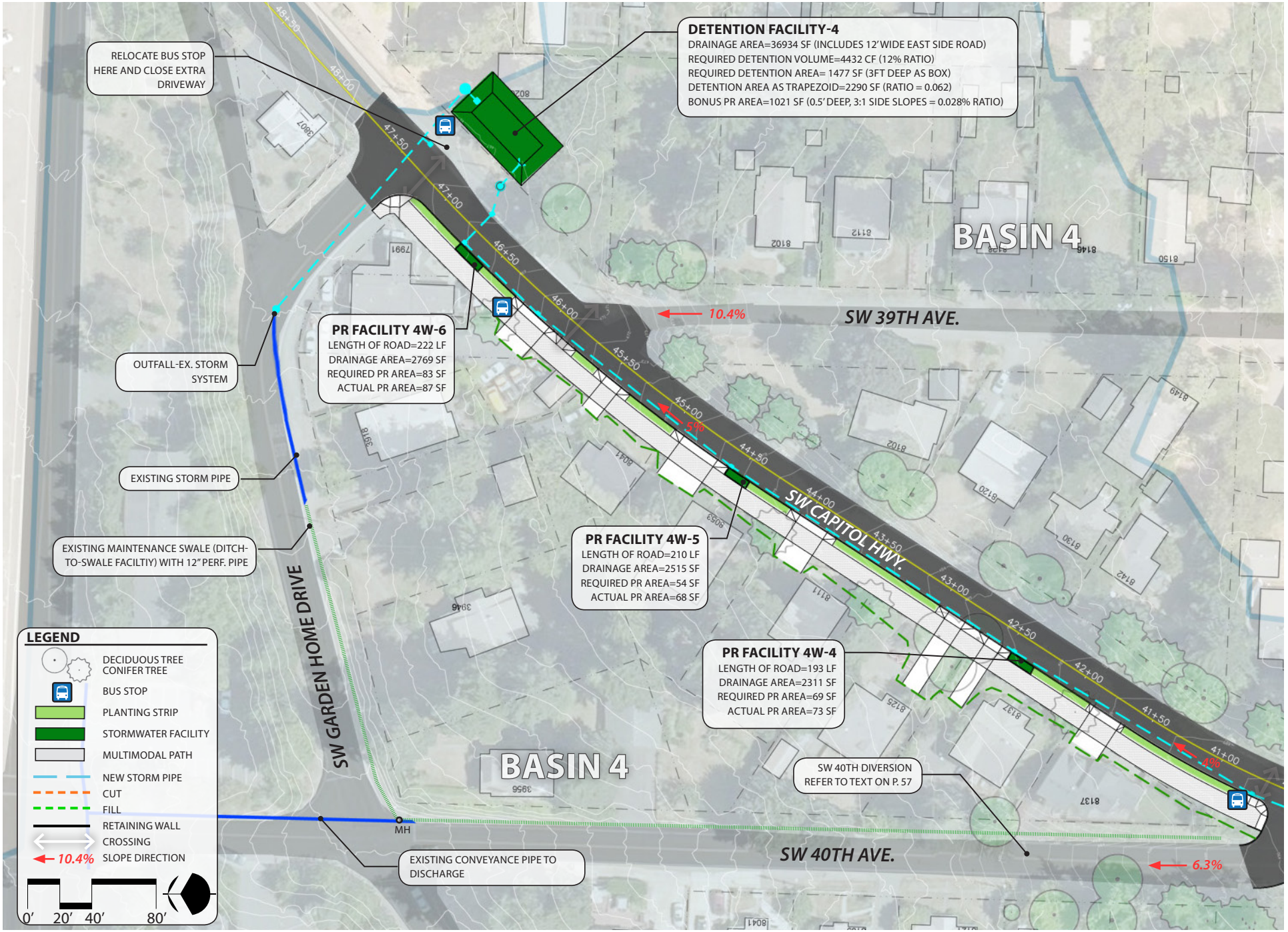
This conceptual design assumes that pervious pavements contribute no runoff to the storm system so they are not accounted for in the detention sizing. Higher level designs that incorporate pervious pavements should include additional infiltration testing to determine if the pervious pavement sub-grade can be designed to fully infiltrate the 10-year event or discharge excess sub-grade stormwater to the storm system and account for that excess flow in the detention facility sizing.

Permeable paving is not proposed for use in sidewalks in Concepts 1 & 2 because the amount of paved area with six foot wide sidewalks is unlikely to warrant the added complexity and cost of the permeable concrete. However, this remains a potential option for future consideration.

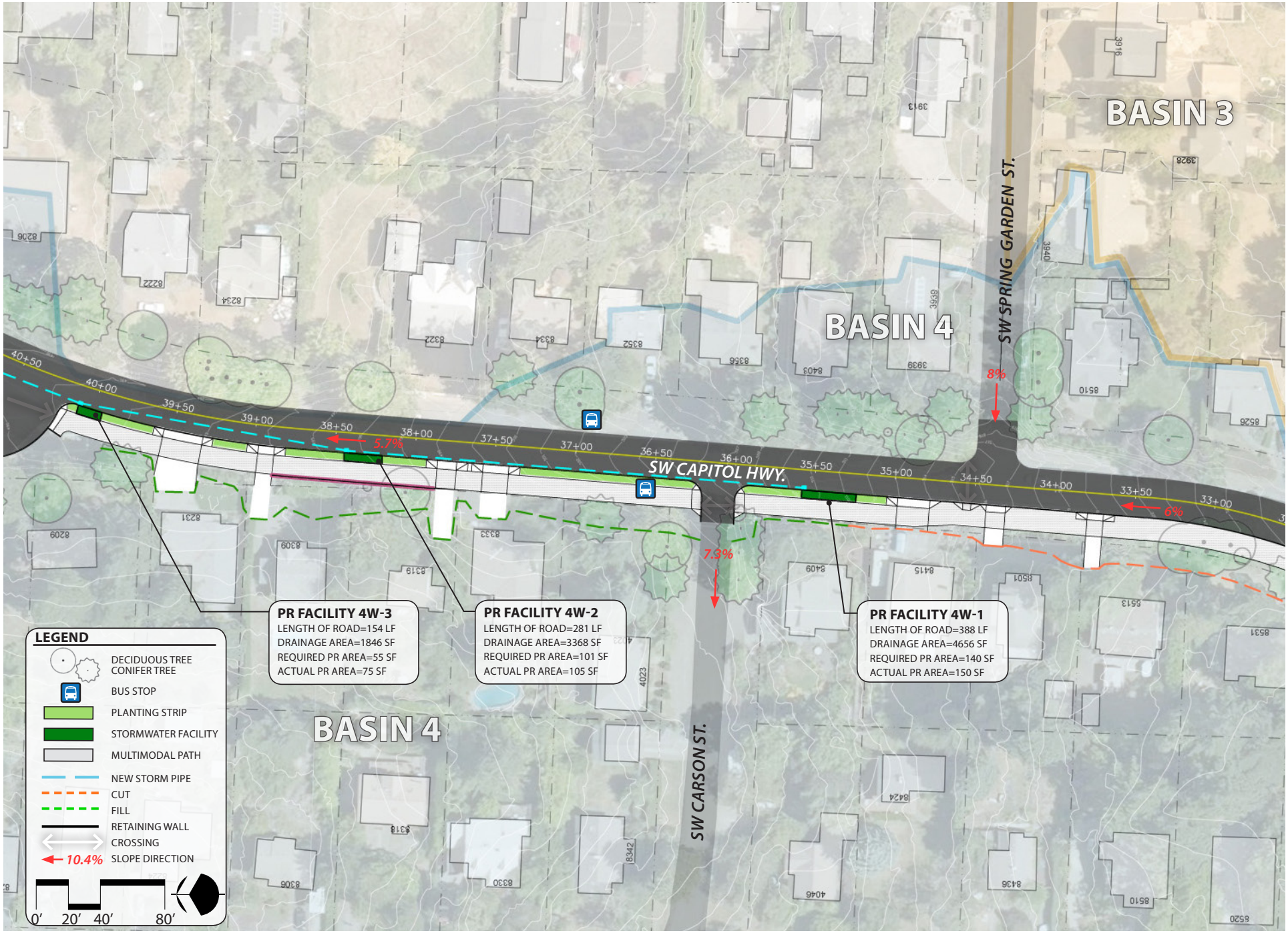




CONCEPT 3: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



CONCEPT 3: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



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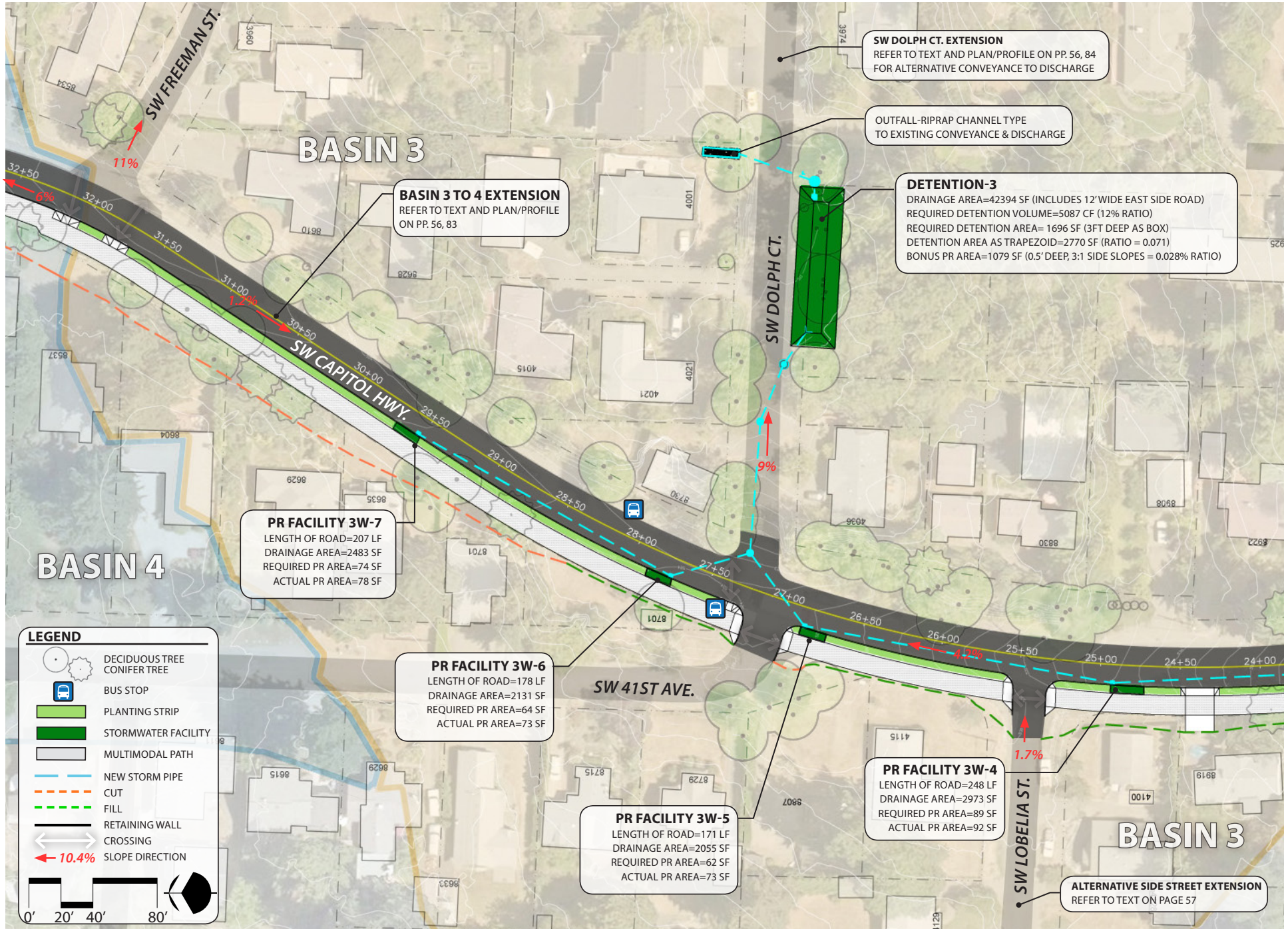
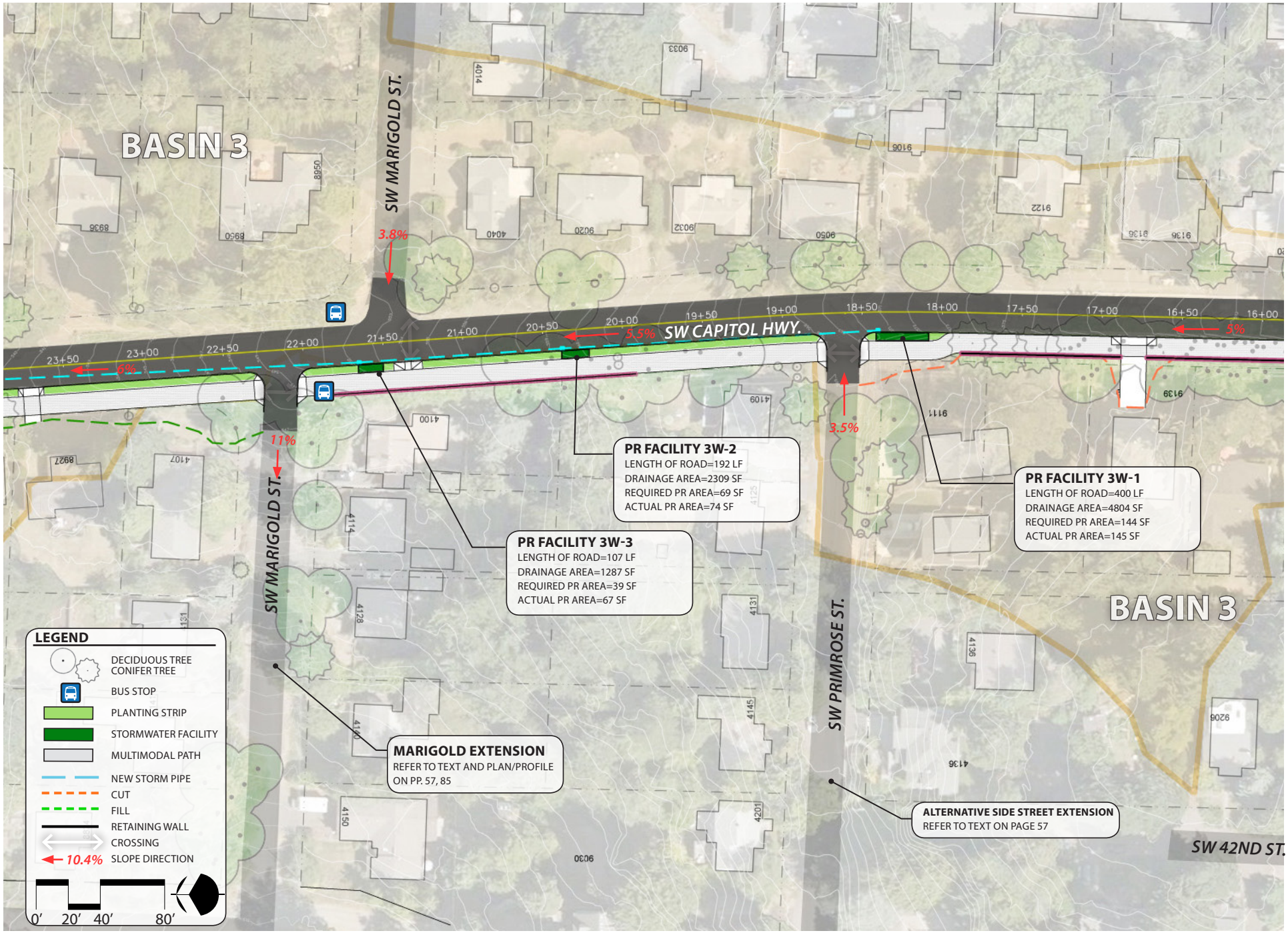
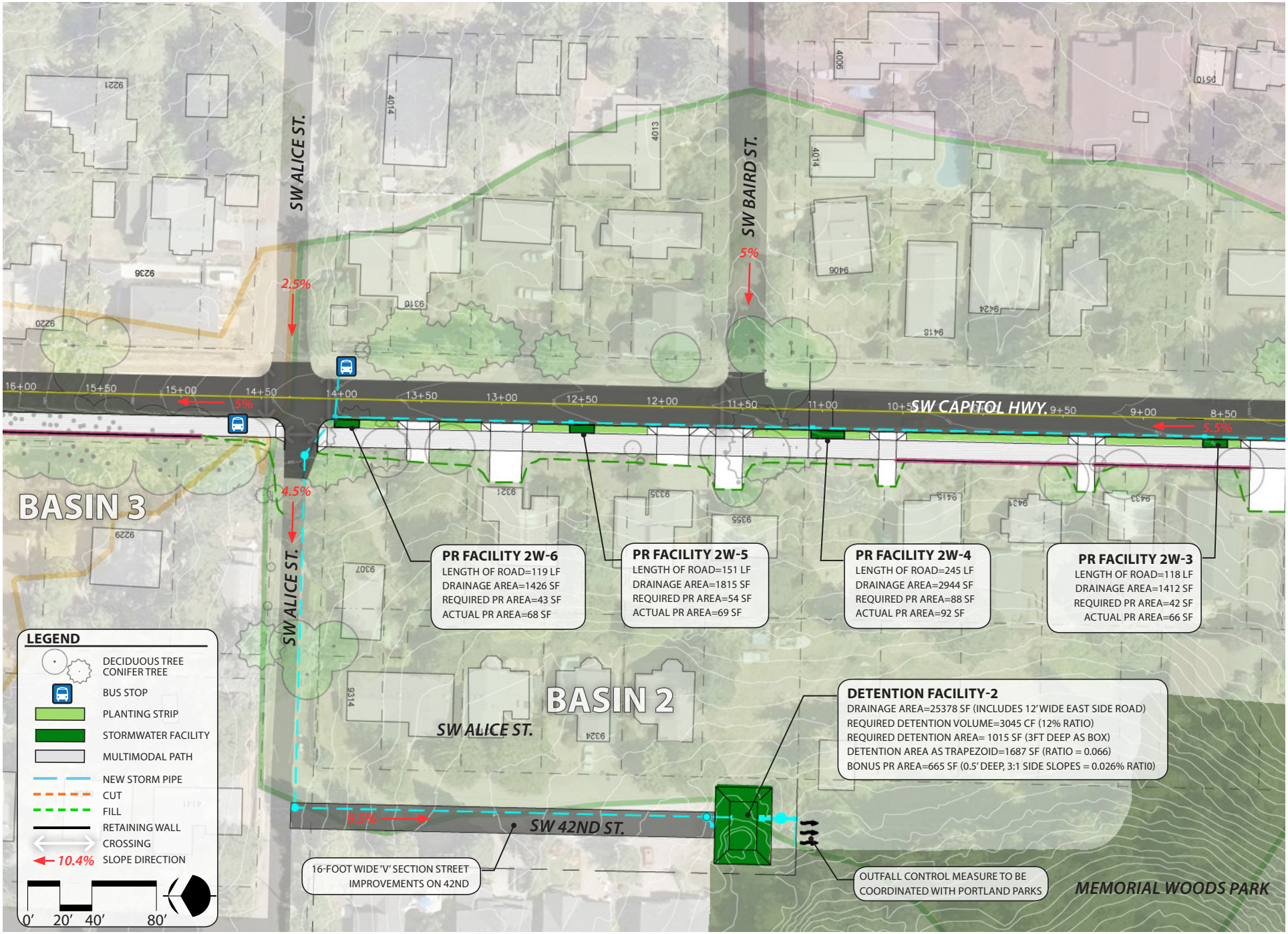


CONCEPT 3: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



CONCEPT 3: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



CONCEPT 3: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH

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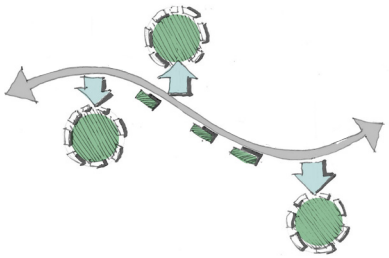


CONCEPT 4:

Storm Strategy: Dispersed Treatment, Centralized Detention West Side
Centralized Treatment and Detention East Side
Street Section: Multi-use Path on West side, Separated Bike Lane East Side

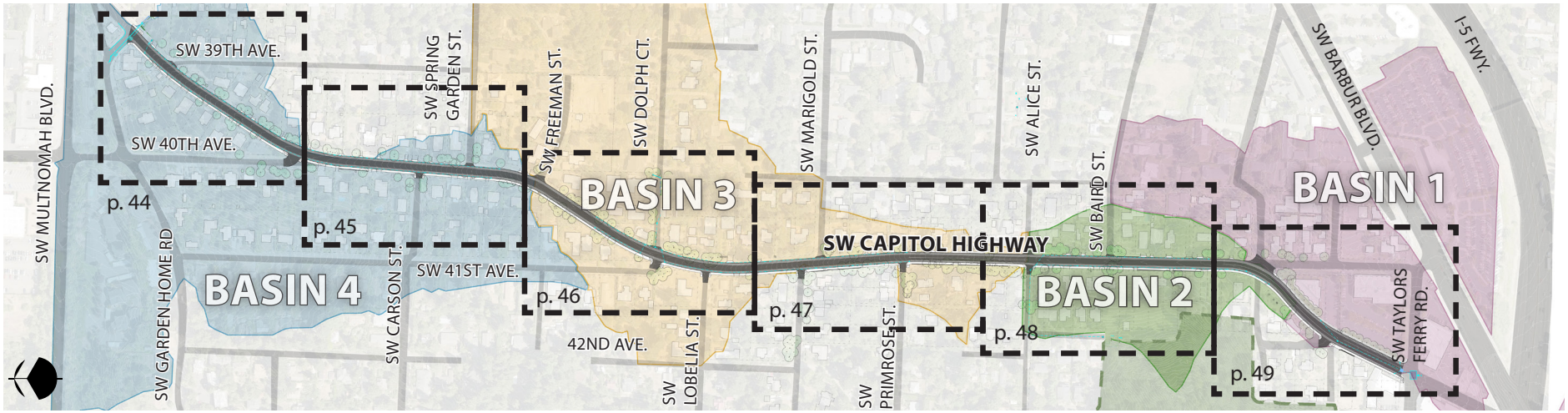
The stormwater management approach for this concept is the same as Concepts 2 and 3 on the west side of the road- a hybrid approach with de-centralized pollution-reduction green street facilities and new storm mains to convey the filtered water to centralized surface detention facilities. On the east side, pollution-reduction is not provided along the corridor, but instead stormwater is collected and conveyed via the same storm mains as the west side to the centralized detention facilities which are also sized to meet the pollution-reduction storm events. Refer to the concept section/perspective illustration on opposite page.

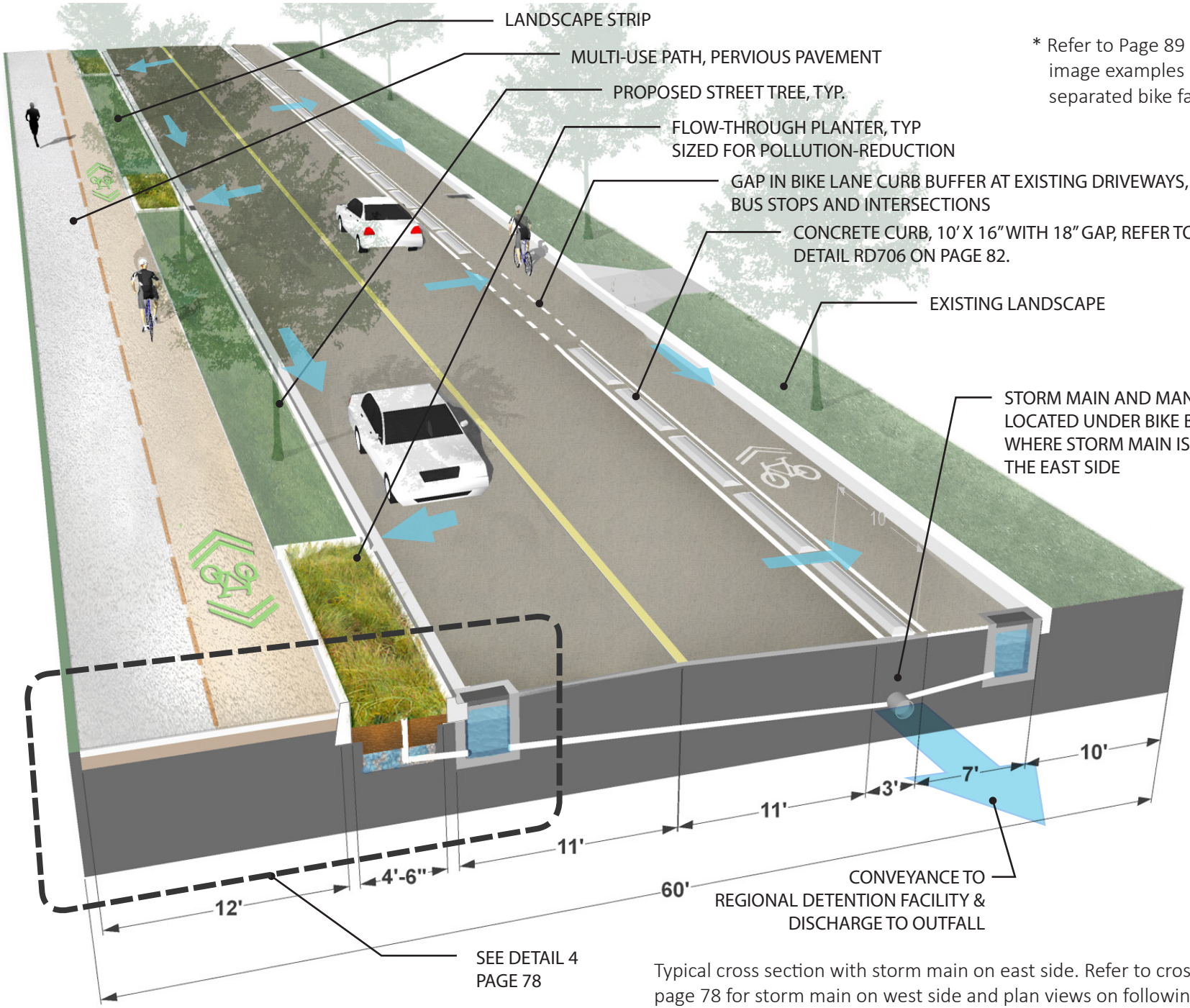
Like Concept 3, this concept proposes a 12-foot wide multi-use path on the west side of the corridor, constructed of pervious concrete to reduce total impervious area. On the east side of the travel lanes, a 3-foot wide buffer zone separates a 7-foot wide bike lane. Centered in the 3-foot buffer zone are 10-foot long, 16-inch wide raised concrete curbs. Separations of 18-inches between the curb segments allow drainage to pass to the gutter on the opposite side of the bike lane. The concrete curb is modeled after ODOT standard detail RD706, shown on page 82. Constructing the curb as precast concrete units is likely the most efficient method of construction of the roadway and curb. The concrete curb is eliminated at driveways, bus stops and intersections, and the solid painted lines on either side of the curb change to dashed lines at these locations.

An important consideration of this separated bike lane design is that stormwater facilities can be added adjacent to it because it allows non-concentrated stormwater to easily flow through the buffer and across the bike lane. A grade separated bike lane adjacent to travel lanes poses a challenge as to how to convey water to storm facilities.

Left over landscape area on the east side in this concept is wide enough to allow for green street swale facilities as shown in Concepts 1 & 2 if a de-centralized drainage approach is preferred. However, only about 2'-6" of ROW would be left between the edge of facilities and property line. This would most likely eliminate the informal walking path in many places and increase the amount of retaining walls required. Additionally, adding sidewalks in the future would incur added cost to retrofit the swale facilities to planters.

Sizing of the storm main and centralized pollution-reduction & detention facilities would need to account for anticipated future development on the east side of the road.

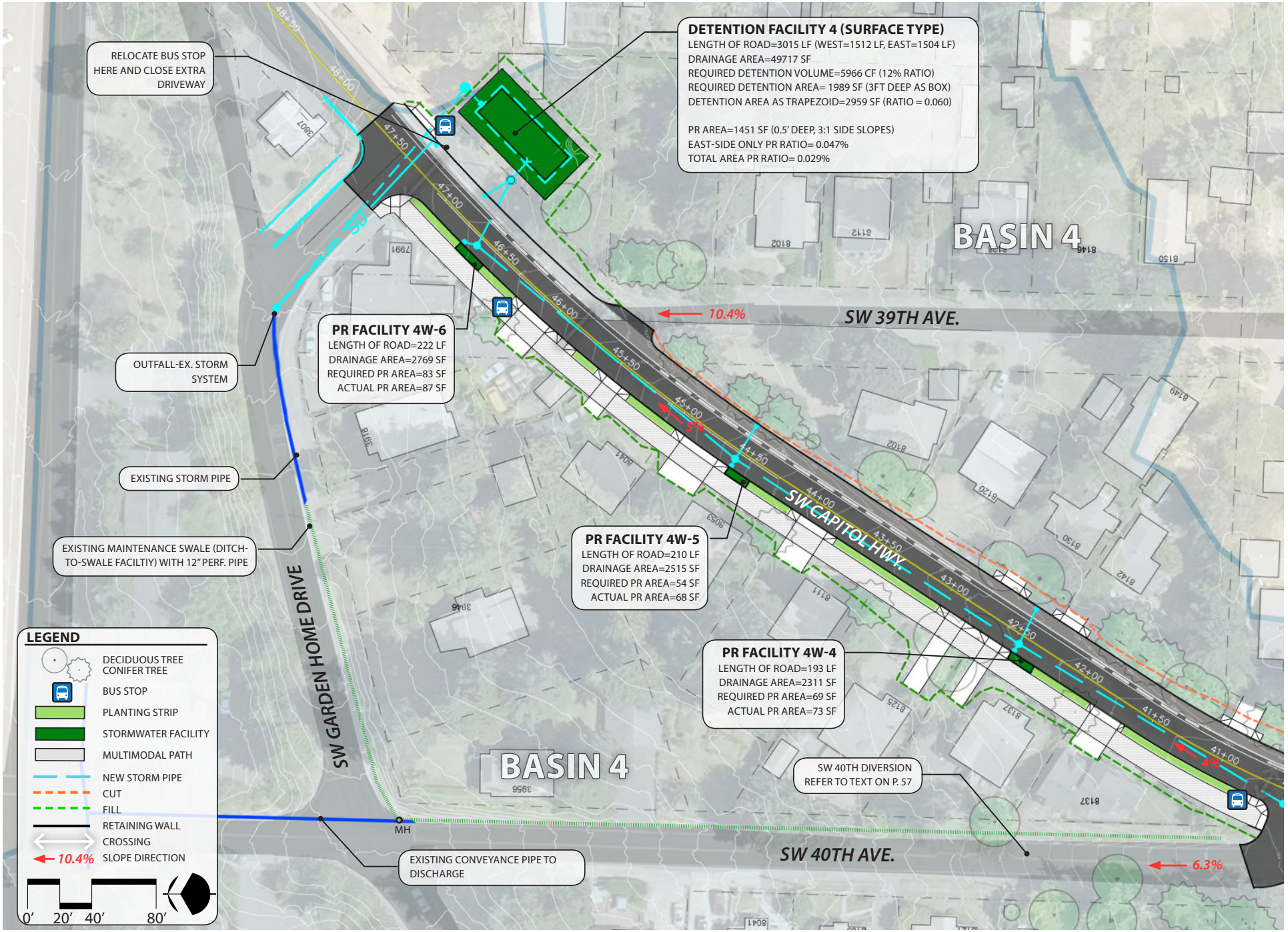




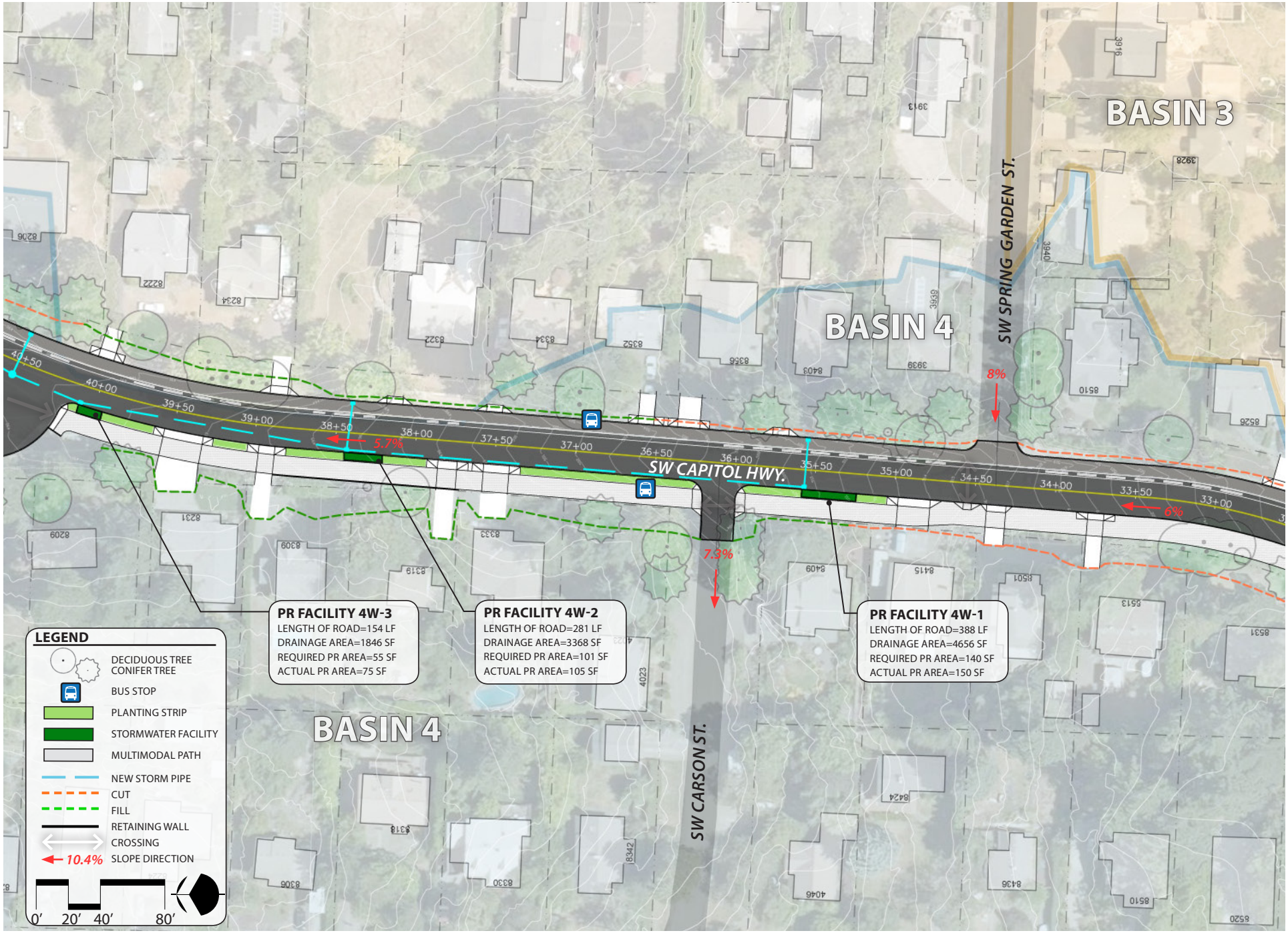
* Refer to Page 89 for precedent image examples of raised and separated bike facilities.

Typical cross section with storm main on east side. Refer to cross section on page 78 for storm main on west side and plan views on following pages for where these specific conditions occur.

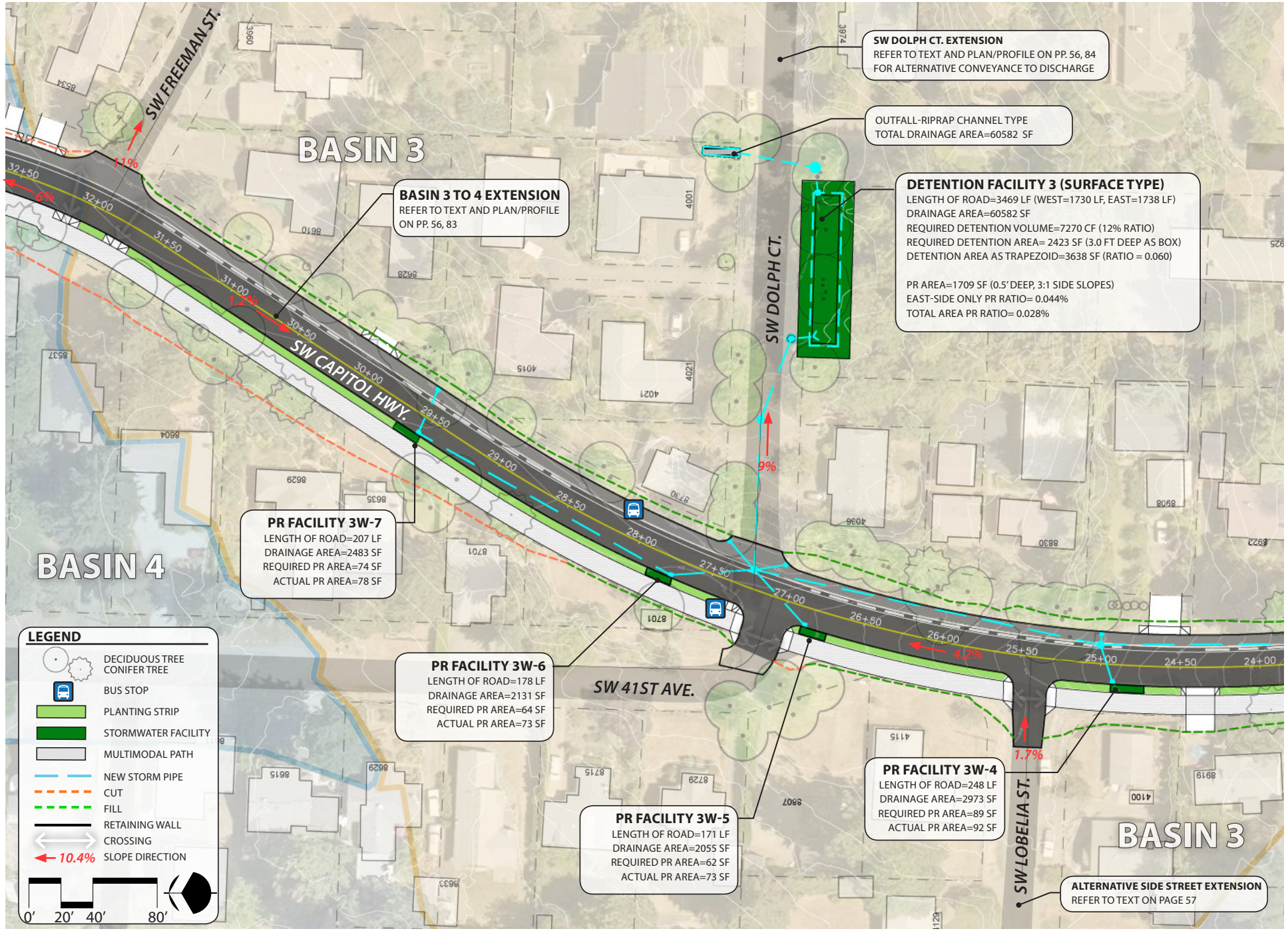
CONCEPT 4: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



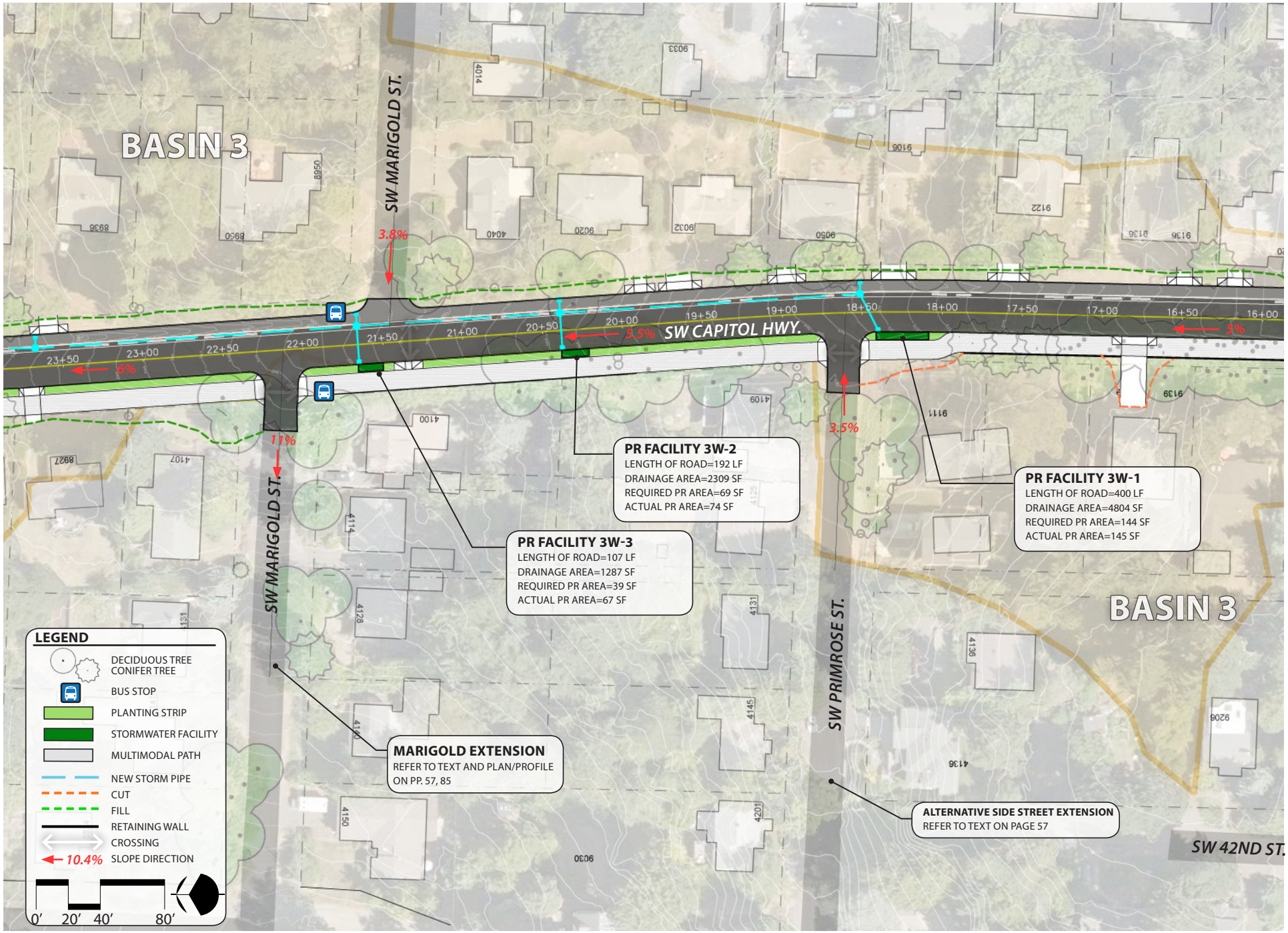
CONCEPT 4: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



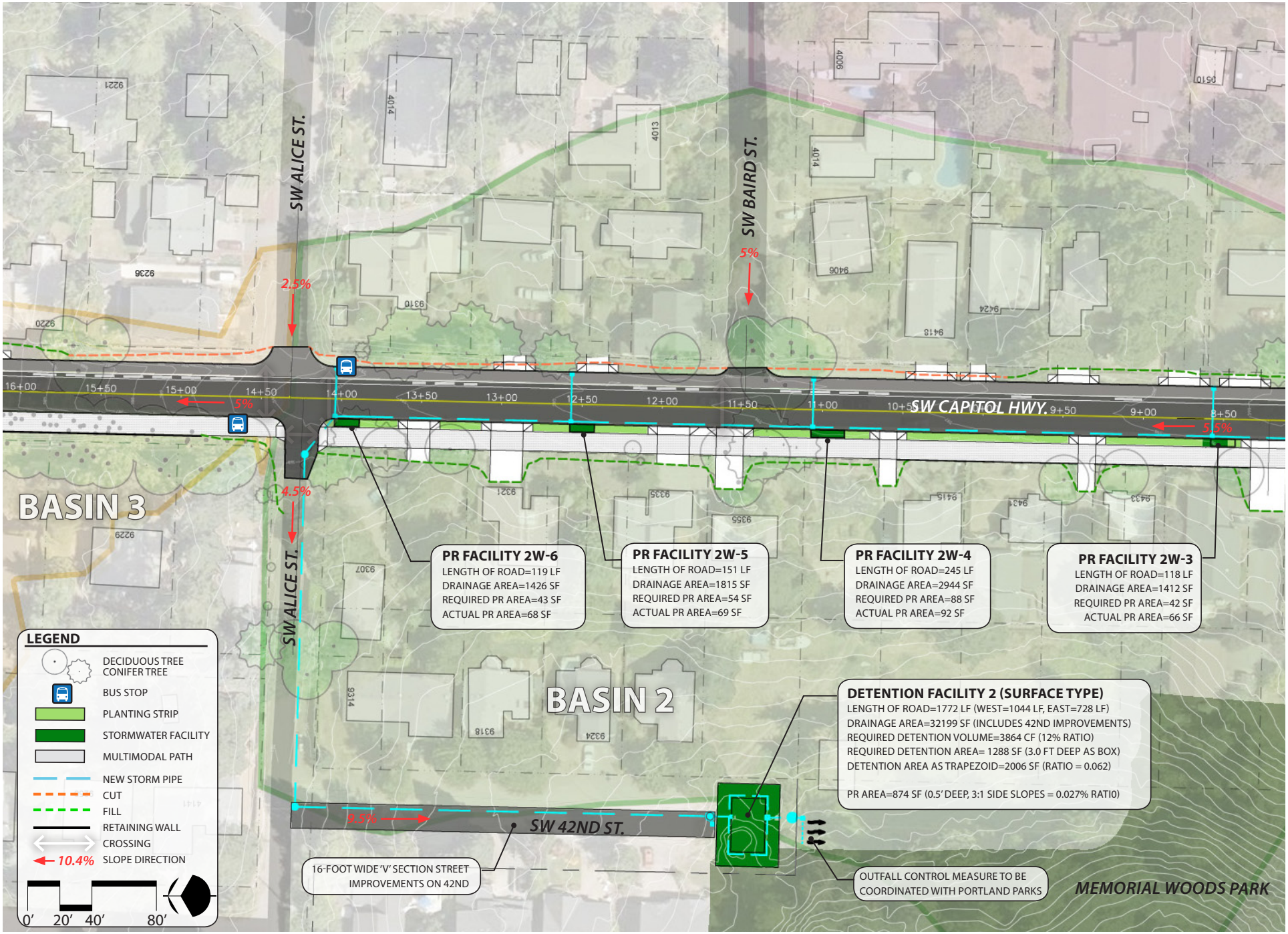
CONCEPT 4: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



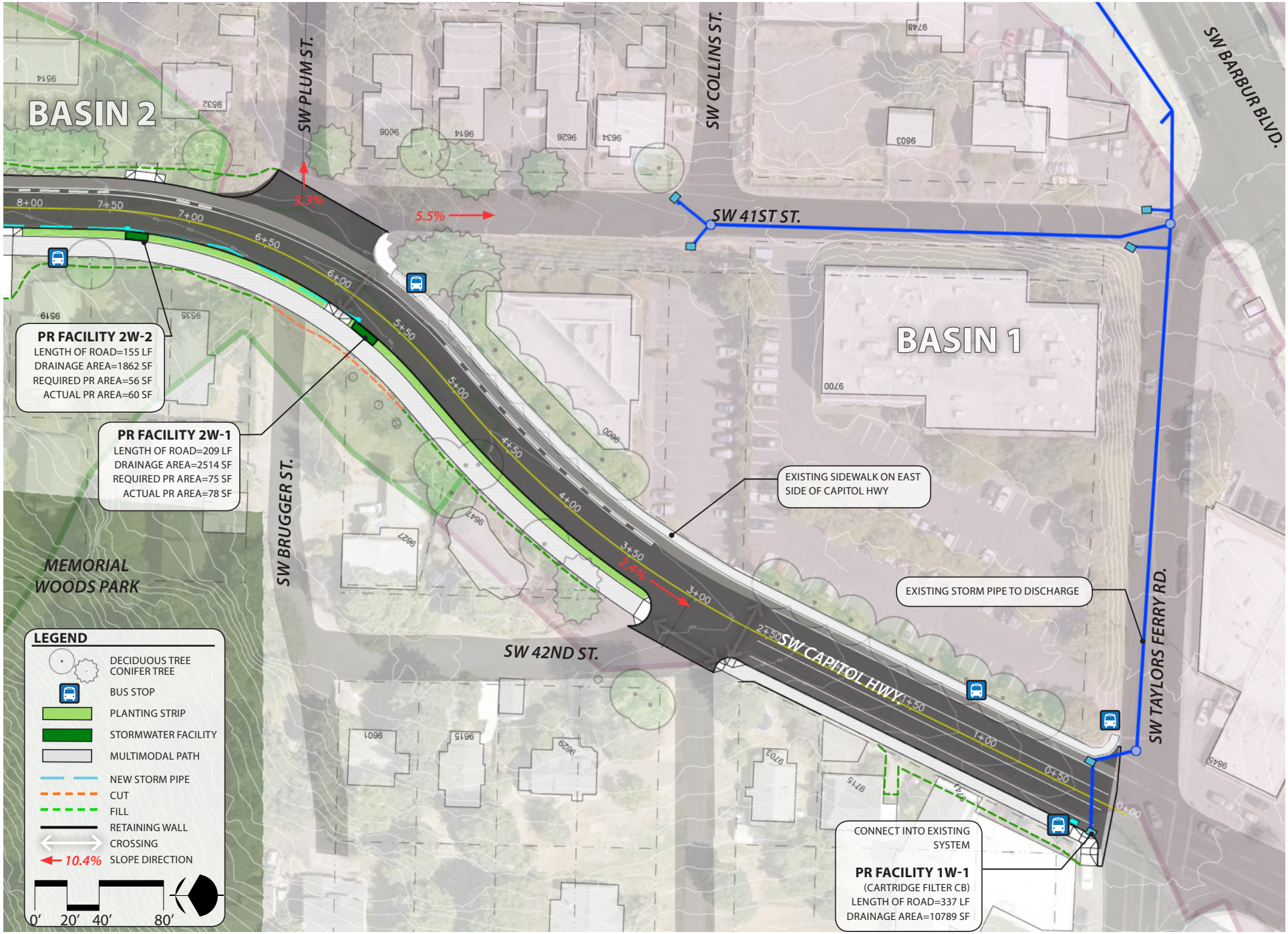
CONCEPT 4: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



CONCEPT 4: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



CONCEPT 4: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH



CONCEPT 4: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH

3.4 CONCEPT COST ESTIMATES

Preliminary cost estimates have been provided for each of the concepts with the items that are specifically related to the stormwater improvements separated into its own section. Costs were also broken out by basin so each concept could be merged together in different combinations as needed to address future alternatives.

It should be noted that the intent of these estimates is focused on the stormwater system and the street section improvements. Other estimate line items, such as temporary features, signage replacement, street trees, striping, and mailboxes, borrow heavily from the quantities used in the 2011 estimate. Refer to Appendix Section B on page 65 for Cost Estimate Summary and Concept Estimates.

3.5 DOWNSTREAM DRAINAGE ISSUES

Though runoff will be treated and detained by various stormwater management techniques, conveying stormwater from the expanded and modified right-of-way could still result in increased flows downstream in the storm sewer system and creeks. Once more refined decisions are made on the roadway section, a downstream drainage analysis will be required that may indicate that improvements are needed outside the primary project area to accommodate those increases.

Necessary downstream Improvements could include adding new conveyance in the form of storm sewers or surface drainage channels, upsizing or improving existing storm sewer pipes and surface drainage channels, and installing erosion and velocity control measures.

An estimate of $2M was included in the 2011 Refinement Plan to cover potential improvements ($2.2M in 2015 dollars). Given the real possibility that some additional improvements will be a required part of the project, the downstream improvements placeholder is retained. However, this was an estimate based on the street section considered at the time, and all the conceptual street sections used for this analysis are significantly different. Some of the potential improvements cited in 2011 have been incorporated into one or more of the concepts, and there are substantial differences between the concepts, such as the amount of improved right-of-way and the extent of drainage improvements.

To accommodate all the differences, a variable placeholder value was developed for each concept. The value and rationale are detailed in the table below.

Concept	ROW width / Effective Impervious Area Managed	Downstream Impacts	Placeholder Estimate
1	48 feet wide 222,000 sq feet	Similar stormwater management approach to the 2011 Refinement Plan, but the street section width is reduced and localized detention may be more effective. The footprint of the ROW improvements has been reduced by 16%, so the placeholder is reduced by the same amount.	$1.9M
2	48 feet wide 222,000 sq feet	Development footprint is the same as Concept 1, but the regional detention approach incorporates the conveyance improvements down SW Alice and SW 42nd (est.-$360,000).	$1.5M
3	42 feet wide 130,000 sq feet+	Much smaller development footprint than Concepts 1 & 2 (41% reduction), and uses the same regional detention approach as Concept 2.	$0.9M
4	50 feet wide 173,000 sq feet+	Smaller development footprint than Concepts 1 & 2 (22% reduction), and uses a modified regional detention approach.	$1.35M

Table 1: Downstream Drainage Impacts

3.6 ADDITIONAL CONSIDERATIONS

3.6.1 Property Acquisition

Concepts 2, 3, & 4 will depend on property acquisition to enable the construction of regional neighborhood facilities. Two specific facility locations are used in all regional concepts and would need to be acquired.

The first property is 3972 SW Dolph Ct, is zoned residential and totals 21,900 square feet. There are currently no structures on the lot, which is in a wooded condition. The lot does not have any environmental restrictions according to information gathered from Portland Maps online.

The second property is located at the north end of the corridor where SW Garden Home Road intersects at 8020 SW Capitol Hwy, on the east side of the intersection. It is a triangular lot that is zoned commercial and is 9,937 square feet. It currently has a structure on it that was built in 1960. It appears that it could have been a service station or mechanic shop at one point, but now appears to be used for storage. Portland Maps does not indicate underground tanks on the site, but does indicate a septic tank.

The cost estimates provided with each of the concepts include property acquisition as part of the total construction cost. On top of the market value of the property, an additional 50% has been added to account for potential market fluctuations. Research of assessed values of comparable empty lots within a mile of the SW Dolph Ct. property was used to determine an average value per square foot. However, the shape, use and location of the 'Garden Home' lot make the use of comparable properties difficult.

3.6.2 Operation and Maintenance

All stormwater infrastructure requires ongoing maintenance to ensure continued functionality. For a project to be successful in the long-term, these features need to be as simple and cost effective as possible.

Each of the proposed concepts has incorporated sediment/debris collection features to provide specific locations to concentrate maintenance to make the periodic cleaning as efficient as possible.

- **Green Street Planters and Swales**

  All green street facilities are proposed to include a sedimentation forebay beneath the curb inlet spillways that help trap the sediment and debris coming off the road. The design is conceptual, but is based on prototypes currently being field tested by BES. It is designed to trap a significant amount of the sediment and debris within the forebay so it could be easily scooped up with a flat shovel. Additionally, the inclusion of a grated lid on a hinge that covered the area could help obscure from view the accumulated debris and sediment. This item is included in the cost estimate.

- **Flow-control Detention Facilities**

All the concepts propose designs where stormwater is filtered from the pollution reduction event prior to entering the detention facility. However it is possible that significant amounts of sediment and debris will bypass the pollution reduction facilities on occasion. Therefore, all the detention facilities are designed to include sediment and debris trapping structures prior to the detention storage and flow-control. The flow-control structure is especially susceptible since it contains a small orifice that could easily clog if too much to debris or sediment migrated to that part of the system. These trapping structures are included in the cost estimate.

Concept 1 detention storage is proposed beneath the sidewalk directly adjacent to a storm planter. To prevent siltation of the storage and clogging of the orifice a sediment trap is built into a small vault in the corner of the planter. Flows from the upstream system enter the vault on one side of a plate baffle that bisects the vault, while the other side of the vault contains the orifice structure and the piped connection to the detention storage. The baffle extends from the top to at least 6 inches below the dead water storage level which should trap floatables and force sediment to settle to the bottom. Additional baffles could be added as well if it was determined that the system needed further protection. The maintenance would consist of periodic inspections to confirm that the orifice is clear and that accumulated sediment and debris is vacuumed out with a vactor truck when the depth exceeds 12 inches.

Concepts 2, 3, & 4 propose detention storage via surface ponds and the flow-control is provided via a traditional flow-control manhole downstream of the ponds. To reduce the amount of sediment and debris entering the ponds, runoff is first routed through a shallow sedimentation manhole. Maintenance would consist of periodic inspections to confirm that the orifice is clear and that accumulated sediment and debris is vacuumed out with a vactor truck from the sedimentation and the flow-control manholes when the depth exceeds 24 inches.

- **Street Sweeping**

  Additionally it is recommended that periodic street sweeping, especially in the fall when the leaves are dropping, should be included in the street O&M plan. This item has not been included in the concept cost estimates.

3.7 BASIN 1 STORMWATER CONCEPT

As noted in Section 3.0 Concept Design Alternatives, all four concepts use an identical storm design for Basin 1. This portion of SW Capitol Hwy is currently almost entirely built out. An approximately 250-ft side sidewalk proposed on the west side is all that would require stormwater management and spatial constraints along this southern end of the corridor do not allow for a green street facility. The storm design shown in the concept plans proposes replacement of an existing storm inlet with a single StormFilter® catch basin to meet the pollution reduction stormwater requirement. It is not practical to provide a detention facility for such a small amount of new impervious area so it was not included in the design.

Alternatively, if full management of all runoff from Basin 1's impervious area is preferred (0.6 acres), a multi-cartridge StormFilter® catch basin located on each side of the road to meet pollution reduction would be required. Given the level of build out and presence of underground utilities, siting such a vault will be difficult. To meet flow-control requirements, a centralized detention facility with a storage volume of approximately 3,400 cu-ft. would be necessary. Given the spatial constraints at this end of the corridor and proximity to the intersection with SW Taylors Ferry Road, there is no room for such a large surface or subsurface facility. Ideally there would be an opportunity for a larger centralized surface detention facility at a point further downstream.

3.8 SUB-SURFACE DETENTION ALTERNATIVE

During concept development, sub-surface detention facilities were also considered. Placing the detention underground, results in a smaller surface footprint but increases the construction depth.

The detention facility plan enlargements located on pages 54 & 55 compare the footprint required for surface detention versus sub-surface detention facilities for Concept 2.

In Concepts 2 & 3, the detention facilities accommodate pollution reduction, so P-R facilities on Capitol Hwy are not necessary with the centralized surface detention facilities. However, if subsurface facilities are constructed as shown in Concept 2, then the pollution reduction facilities on Capitol Hwy would be required.

Facility plan enlargements are included for Concepts 3 & 4 to provide additional detail comparison of the size of the surface detention facilities in each of the concepts. The facilities for Concept 2 are larger because of the greater amount of impervious area compared to Concepts 3 & 4.

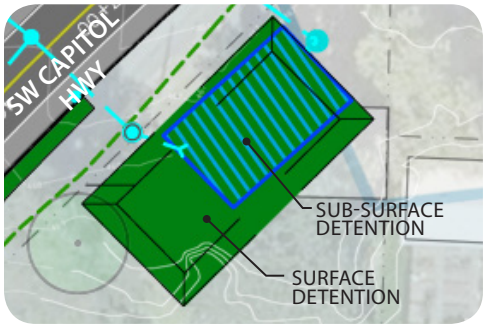
The shape of the facilities shown is diagrammatic and does not represent the shape that would be proposed for final design.

CONCEPT 2

Garden Home Facility

DETENTION FACILITY 4 (SURFACE TYPE)
LENGTH OF ROAD=3012 LF
DRAINAGE AREA=65511 SF
REQUIRED DETENTION VOLUME=7861 CF (12% RATIO)
REQUIRED DETENTION AREA= 2620 SF (3FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=3728 SF (RATIO = 0.057)
BONUS PR AREA=2033 SF (0.5' DEEP, 3:1 SIDE SLOPES = 0.031% RATI0)

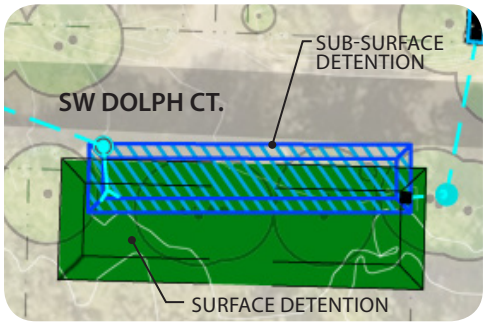
ALTERNATE SUB-SURFACE DETENTION SCENARIO
REQUIRED DETENTION AREA=1572 SF (5FT DEEP)
ACTUAL DETENTION AREA=1573 SF



Dolph Ct. Facility

DETENTION FACILITY 3 (SURFACE TYPE)
LENGTH OF ROAD=3444 LF
DRAINAGE AREA=74899 SF
REQUIRED DETENTION VOLUME=8988 CF (12% RATIO)
REQUIRED DETENTION AREA= 2996 SF (3.0 FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=4309 SF (RATIO = 0.058)
BONUS PR AREA=2260 SF (0.5' DEEP, 3:1 SIDE SLOPES = 0.030% RATI0)

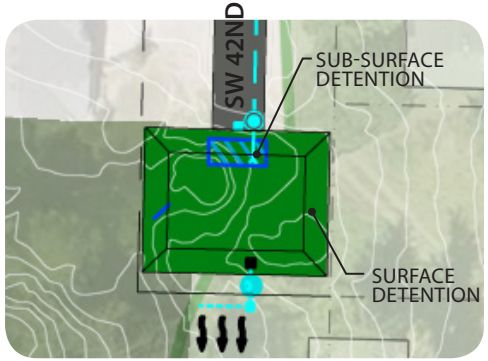
ALTERNATE SUB-SURFACE DETENTION SCENARIO
REQUIRED DETENTION AREA=1798 SF (5FT DEEP)
ACTUAL DETENTION AREA=1799 SF



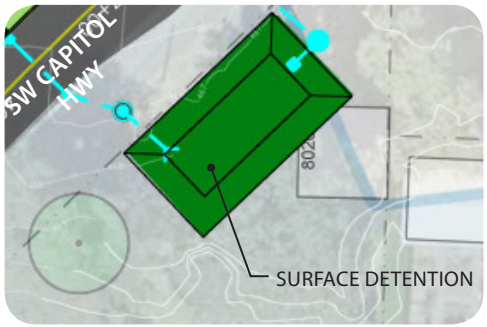
42nd/ Alice Facility

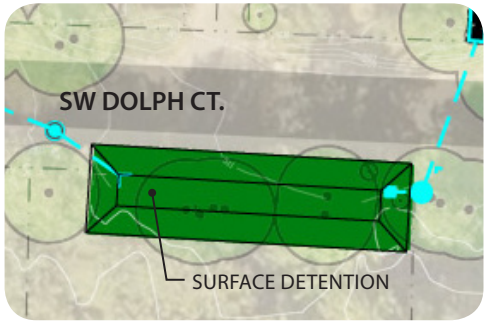
DETENTION FACILITY 2 (SURFACE TYPE)
LENGTH OF ROAD=1717 LF
DRAINAGE AREA=42558 SF (INCLUDES 42ND IMPROVEMENTS)
REQUIRED DETENTION VOLUME=5107 CF (12% RATIO)
REQUIRED DETENTION AREA= 1702 SF (3.0 FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=2583 SF (RATIO = 0.061)
BONUS PR AREA=1272 SF (0.5' DEEP, 3:1 SIDE SLOPES = 0.030% RATI0)

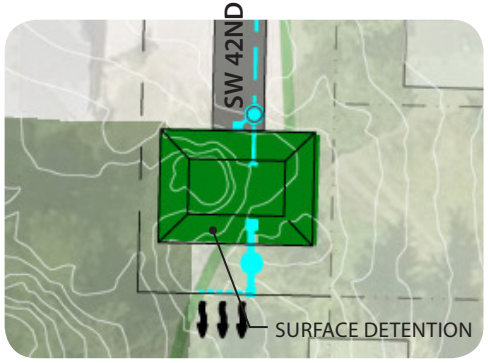
ALTERNATE SUB-SURFACE DETENTION SCENARIO
REQUIRED DETENTION AREA=1021 SF (5FT DEEP)
ACTUAL DETENTION AREA=1063 SF



CONCEPT 3







CONCEPT 3 (facility data)

DETENTION FACILITY 4
DRAINAGE AREA=36934 SF (INCLUDES 12’WIDE EAST SIDE ROAD)
REQUIRED DETENTION VOLUME=4432 CF (12% RATIO)
REQUIRED DETENTION AREA= 1477 SF (3FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=2290 SF (RATIO = 0.062)

BONUS PR AREA=1021 SF (0.5’ DEEP, 3:1 SIDE SLOPES = 0.028% RATI0)

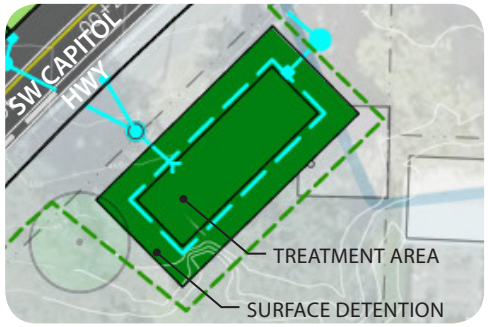
DETENTION FACILITY 3
DRAINAGE AREA=42394 SF (INCLUDES 12’WIDE EAST SIDE ROAD)
REQUIRED DETENTION VOLUME=5087 CF (12% RATIO)
REQUIRED DETENTION AREA= 1696 SF (3FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=2770 SF (RATIO = 0.071)

BONUS PR AREA=1079 SF (0.5’ DEEP, 3:1 SIDE SLOPES = 0.028% RATI0)

DETENTION FACILITY 2
DRAINAGE AREA=25378 SF (INCLUDES 12’WIDE EAST SIDE ROAD)
REQUIRED DETENTION VOLUME=3045 CF (12% RATIO)
REQUIRED DETENTION AREA= 1015 SF (3FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=1687 SF (RATIO = 0.066)

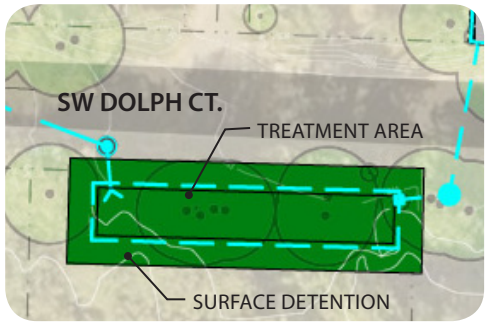
BONUS PR AREA=665 SF (0.5’ DEEP, 3:1 SIDE SLOPES = 0.026% RATI0)

CONCEPT 4



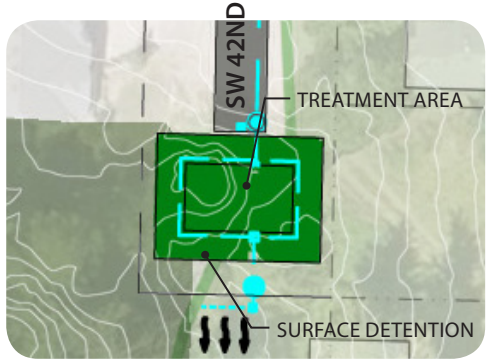
DETENTION FACILITY 4 (SURFACE TYPE)
LENGTH OF ROAD=3015 LF (WEST=1512 LF, EAST=1504 LF)
DRAINAGE AREA=49717 SF
REQUIRED DETENTION VOLUME=5966 CF (12% RATIO)
REQUIRED DETENTION AREA= 1989 SF (3FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=2959 SF (RATIO = 0.060)

PR AREA=1451 SF (0.5’ DEEP, 3:1 SIDE SLOPES)
EAST-SIDE ONLY PR RATIO= 0.047%
TOTAL AREA PR RATIO= 0.029%



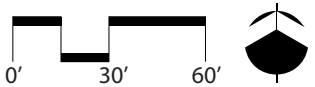
DETENTION FACILITY 3 (SURFACE TYPE)
LENGTH OF ROAD=3469 LF (WEST=1730 LF, EAST=1738 LF)
DRAINAGE AREA=60582 SF
REQUIRED DETENTION VOLUME=7270 CF (12% RATIO)
REQUIRED DETENTION AREA= 2423 SF (3.0 FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=3638 SF (RATIO = 0.060)

PR AREA=1709 SF (0.5’ DEEP, 3:1 SIDE SLOPES)
EAST-SIDE ONLY PR RATIO= 0.044%
TOTAL AREA PR RATIO= 0.028%



DETENTION FACILITY 2 (SURFACE TYPE)
LENGTH OF ROAD=1772 LF (WEST=1044 LF, EAST=728 LF)
DRAINAGE AREA=32199 SF (INCLUDES 42ND IMPROVEMENTS)
REQUIRED DETENTION VOLUME=3864 CF (12% RATIO)
REQUIRED DETENTION AREA= 1288 SF (3.0 FT DEEP AS BOX)
DETENTION AREA AS TRAPEZOID=2006 SF (RATIO = 0.062)

PR AREA=874 SF (0.5’ DEEP, 3:1 SIDE SLOPES = 0.027% RATI0)



4.0 OTHER DESIGN ALTERNATIVES CONSIDERED

Other design concepts and alternatives were considered during the design process, but were not ultimately included in the mixture of approaches used in the four concepts. While not included in a concept, many remain potentially viable approaches and may warrant continued evaluation. Once the street section is chosen, it will be possible to evaluate and compare the specific cost-benefit of each approach.

4.1 FULLY CENTRALIZED STORMWATER CONCEPTS

A purely centralized stormwater concept was developed that was not included in this report. This concept conveyed all stormwater drainage collected for the SW Capitol Highway right-of-way via proposed new curb and gutter, inlets and pipes to off-site neighborhood pollution-reduction and detention facilities. These facilities were located at the same locations as the detention facilities proposed in Concepts 2, 3, & 4.

This stormwater approach is appropriate in basins where site constraints do not allow construction of a planting strip and sidewalks are curb-tight. The cross section assumed with this concept included curb-tight sidewalks that PBOT indicated were very unlikely to be used in the final design.

This concept approach may have merit if it is determined during future design that separated sidewalks are not attainable because of cost and or physical constraints. Concept 2 could be converted to a purely centralized stormwater concept by eliminating all green street pollution reduction facilities from the SW Capitol Highway right-of-way since the detention ponds will also function as pollution reduction flow-through basins.

The detention facilities in Concept 3 & 4 have been sized to meet detention volume requirements, but are also large enough to meet the pollution reduction requirements for all the impervious areas draining to them (east sides and west sides). This means it would be possible to eliminate the west side de-centralized pollution reduction green street facilities shown in Concept 3 & 4 and move to a completely centralized stormwater management approach.

4.2 DIVERSION AND EXTENSION ALTERNATIVES

Options were developed that could alleviate the burden on existing drainageways by extending the existing storm system or diverting flows to other drainage basins. Diversions and extensions may also provide the additional benefit of creating stormwater discharge points for properties in the drainage basins that don't currently have one. However, as discussed in Downstream Drainage Issues at the end of Section 3.0, further detailed hydraulic analysis of downstream impacts and system capacity is essential before any diversion or extension element could be seriously considered.

A number of possibilities were identified that could work with any of the concepts, and a general analysis was done to determine relative effectiveness, difficulty and cost. None of these options were ultimately included in any of the concepts, but they remain potential options for consideration.

4.2.1 Basin 3 to 4 Extension

Runoff from SW Capitol Highway routed down SW Dolph Ct. could be diverted north to Basin 4 through a storm main extension within the SW Capitol Highway right-of-way. This strategy requires approximately 720 lineal feet of 15-inch diameter storm main that would average 9.5-feet deep and be over 13-feet deep at its deepest (see p. 83 in Appendix D). This storm main extension would achieve the goal of protecting the potentially overburdened drainageway off SW Dolph Court and would likely be the least costly alternative due to the shorter pipe run and elimination of impacts outside the SW Capitol Highway corridor. Further study is required to determine whether or not the existing Basin 4 storm system has the capacity to add Basin 3, and what the cost would be the Basin 4 capacity needs to be increased.

4.2.2 SW Dolph Court Extension

Drainage from Basin 3 currently flows east down SW Dolph Court approximately 300 feet and then outfalls to the north into a series of potentially undersized pipes and open drainage ways, much of it on private property.

A storm sewer extension from SW Capitol Highway east within the SW Dolph Court right-of-way could divert flow from the existing outfall to the more substantial drainage ditch located at the intersection with SW 37th

Avenue. This extension would require approximately 720 lineal feet of 12-inch diameter storm main and would average 11-feet deep and be 19-feet deep at its deepest (see p.84 in Appendix D). While this alternative would be a beneficial drainageway improvement (more so than the Marigold Extension discussed below), challenges associated with the depth and length, downstream impacts, and costs must be carefully evaluated if this were to be considered.

4.2.3 Marigold Extension

SW Marigold Street was considered as a potential discharge point west of SW Capitol Highway to reduce the amount of runoff in Basin 3. SW Marigold Street runs west and ends just above Wood Creek, and is the low point of Basin 3. This makes it a preferred side street location for diverting some of the runoff away from the current Basin 3 outlet along SW Dolph Ct. To do this, approximately 1,250 lineal feet of new 12-inch storm main would have to be constructed to a new outfall that provided proper flow-dispersal or flow attenuation to drain into the Woods Memorial Park watershed (see p. 85 in Appendix D). This would also require coordination with Portland Parks & Recreation. Additionally, the lower 250 lineal feet or so of existing gravel road would need to be paved, and that would trigger additional stormwater pollution reduction and detention requirements. The significant off-site impacts and associated costs were deemed too high for the benefit of partially reducing the size of Basin 3.

4.2.4 SW 40th Diversion

SW 40th Avenue is a potential location to divert runoff from the upper portion of Basin 4 where it intersects with SW Capitol Hwy. This strategy is only feasible in Concept 1 since the area available is not large enough to provide a centralized surface detention pond facility.

While Concept 1 currently includes a 675-foot storm extension running down SW Capitol Highway, early versions of Concept 1 utilized the east ditch in SW 40th Avenue as a disposal point for the upper portion of Basin 4. However, that portion of SW 40th is relatively steep (>6%) and the ditch did not appear capable of carrying additional runoff. If the ditch does not have capacity, an approximately 600-foot storm main extension could be provided down SW 40th to the storm main in SW Garden Home Drive.

4.2.5 Other Basin 3 Side Street Extensions

SW Lobelia St. and SW Primrose St. were both considered as potential alternative discharge points to reduce runoff heading through Basin 3. Both of these side streets, like SW Marigold St., would require lengthy extensions to reach a potential discharge point.

Further investigation at the end of SW Lobelia St. is required to determine if there is indeed a suitable discharge point. Grade is not favorable at SW Primrose St., and would require deep trenching for drainage to flow west. SW Primrose St. is south of SW Marigold St., so less stormwater from Basin 3 would be diverted.

5.0 CONCLUSION

The stormwater concept designs in this report are intended to provide a range of potential stormwater alternatives, and there was no intention of choosing a preferred alternative. As PBOT continues their work to determine the appropriate street section moving forward, the concepts presented here can be merged into hybrids that best meet the stormwater management requirements and transportation needs at various points along the corridor.

The concept design process proved valuable by allowing for a range of possibilities to be explored, and for potential issues to be identified before more design work is considered. For BES, it also provides a framework to consider broader regional stormwater management needs.

BES has begun work on its Citywide Stormwater System Plan (SWSP). As this work advances, future concept design projects will become a real-world opportunity to begin incorporating SWSP criteria, such as water quality benefits and creating approvable discharge points. This will allow BES to make better global decisions on project priority and the degree of bureau involvement.

CAPITOL HWY. CORRIDOR STORMWATER CONCEPT DESIGN

APPENDIX

A CONCEPTUAL STORMWATER REPORT

B COST ESTIMATES

C PRELIMINARY ENGINEERING DETAILS

D ALTERNATIVE CONVEYANCE STUDY EXHIBITS

E WORKSHOP MEETING NOTES

F EXAMPLES OF SEPARATED BIKE LANES

G REFERENCE LIST

DATE:	September 25, 2015		
PROJECT:	315018.20-Capitol Highway Corridor	**SUBJECT:**	Conceptual Stormwater Management Plan
TO:	Tim Kurtz Bureau of Environmental Services	**FROM:**	Josh Lighthipe, PE KPFF Consulting Engineers
EMAIL:	Tim.Kurtz@portlandoregon.gov	**EMAIL:**	josh.lighthipe@kpff.com

The purpose of this memorandum is to describe the methodology and sizing of the stormwater management systems for the three concepts for improvements to SW Capitol Highway, in accordance with the requirements of 2014 City of Portland Bureau of Environmental Services (BES) Stormwater Management Manual (SWMM).

The project site encompasses approximately one mile of SW Capitol Highway between SW Garden Home Road and SW Taylors Ferry Road. The existing roadway includes two to three drive lanes in the north and south bound directions, and varying amounts of shoulder. No formal bike lanes or pedestrian paths exist along this corridor. A consist means of stormwater management is also lacking along this stretch of road.

The project has four hydrological basins, identified as basins 1 through 4 from south to north. In basin 1, the right of way is currently fully built out, so proposed changes to this basin were minimal and were proposed to be identical in all 3 concepts. Basins 2, 3 and 4 were analyzed using two types of street sections: 1) with new bike lanes and a west side separated sidewalk; 2) without bike lanes, but a multi-use pervious pavement pathway on the west side and no improvements on the east side. Additionally, two types of stormwater management strategies were used: 1) dispersed pollution-reduction and flow-control facilities within the Capitol Highway right-of-way; 2) dispersed pollution-reduction facilities within the Capitol Highway right-of-way and larger centralized flow-control facilities located on the side streets or in adjacent acquired private properties.

METHODOLOGY

All new or replaced impervious areas within basins 2, 3 and 4 would require pollution-reduction and the flow-control requirements to be met.

Since the project site has unfavorable infiltration rates (much less than 2.0 inches per hour), as identified in the geotechnical report by GeoDesign, Inc. dated October 26, 2010, full onsite infiltration as a means of stormwater disposal was not an option. Therefore, BES stormwater hierarchy categories 1 and 2 were not possible. Category 3 was determined as the appropriate method for stormwater disposal to the existing stormwater conveyance system and eventually local streams.

As encouraged by BES, for all concepts the pollution reduction requirements are proposed to be met using typical green street planters and swales installed within the landscape strips behind the curb of the Capitol Highway roadway every 150-feet to 400-feet.

However, it was determined that using green street facilities to also meet the flow-control requirements was not practical or technically even possible given the requirements of releasing 50% of the 2-year pre-developed peak rate for the 2-year post-developed condition. Basically, assuming a 2-inch per hour infiltration rate through the growing media generally yields rates greater than what is allowed. Additionally, this method is not considered reliable given the variability of soil infiltration rates and the tendency for soil bypassing to occur. For these reasons and the high cost and impacts of extensive use of green street facilities, the flow-control requirements are proposed to be met through more conventional flow-control methods that utilize an orifice with detention storage.

BASIS OF DESIGN

The conceptual green street facilities were sized using the Presumptive Approach from the SWMM which assumes that facilities designed using the Presumptive Approach Calculator (PAC) tool will achieve 70 percent TSS removal from 90 percent of the average annual stormwater runoff. However, because federal funding will likely help pay for improvements to SW Capitol Highway, the project will trigger SLOPES V (Standard Local Operating Procedures for Endangered Species) requirements. This means that the detention and pollution reduction facilities will also need to meet those requirements. Through sample modeling it was shown that designing facilities that utilize less than 59% of surface storage based on Portland's requirements generally yield facilities that exceed the SLOPES V requirements for pollution reduction. Therefore the basis of sizing for pollution reduction facilities only utilized this method.

Similar modeling comparisons using BES' flow-control requirements and the SLOPE V requirements showed similar discharge rates and detention facility sizes. Therefore the flow-control basis of design only utilized BES' flow-control requirements, which are as follows:

> Flow control: discharge to a surface water body or storm-only system that discharges to surface water must detain:
>
> - 2-year post-development peak runoff rate to one-half of the 2-year predevelopment rate.
> - 5-year post-development peak runoff rate to 5-year pre-development peak rate.
> - 10-year post-development peak runoff rate to 10-year pre-development peak rate.
> - 25-year post-development peak runoff rate to 25-year pre-development peak rate.

For this project, as with the 2011 SW Capitol Highway Report, pre-development modeling used a CN of 76 and a time of concentration of 5 minutes. Post-development modeling utilized a CN of 98 for impervious areas and a time of concentration of 5 minutes. Also, it did not include pervious areas in the pollution reduction or flow-control calculations since they were comparatively minimal.

FACILITY SIZING CALCULATIONS

To assist with efficiently laying out the conceptual stormwater designs, a series of modeling scenarios were performed and the results plotted on graphs. These graphs show relationships of: 1) road type and length to impervious area; 2) green street sizing to street slope; 3) large vegetated planter or basins sizing varying depth; 4) detention facility sizing varying shape, depth and drainage area; 5) flow-control orifice size varying depth and drainage area; 6) conveyance in gutter varying street slope and gutter designs. See below for these graphs.

From these modeling results it was possible to select appropriate sizing ratios for the pollution reduction and detention facilities based on the impervious area draining to them. This method is basically a customized "Simplified Approach" sizing percentage for pollution reduction and detention sizing.

For the pollution reduction green street facilities, the modeling showed that flatter street sections yielded smaller facilities and steeper streets yielded larger facilities. To make the conceptual design simpler a constant ratio 3.0% was selected to be used on all pollution reductions green street facilities since it generally allowed for steeper street areas and was generally more conservative across the project.

All the green street facilities modeling assumed a downstream depth of 6-inches. Also, while the width of the planter design and green street swales where different, (4.5-feet versus 5.0-feet) they actually have the same cross-sectional area so the sizing ratios were the same.

For the detention facilities, an extensive series of flow-control modeling calculations were performed to solve for the minimum storage needed to meet the detention requirements. Somewhat surprisingly, the results showed a very consistent ratio of storage volume to contributing drainage area despite variable drainage area, storage depth, and shape of the detention facility. We coined the term Universal Detention Volume (UDV) ratio to describe it. For this project, given the detention requirements and the existing condition CN value of 76, the UDV ratio was 12%. This meant that the required storage volume in cubic-feet could be calculated by multiplying the UDV ratio by the impervious drainage area draining to it. This volume could then translate into a detention footprint, based on the depth and shape of the detention facility. This method was used to determine the sizes of the surface and sub-surface detention facilities used in the concepts.

CONVEYANCE

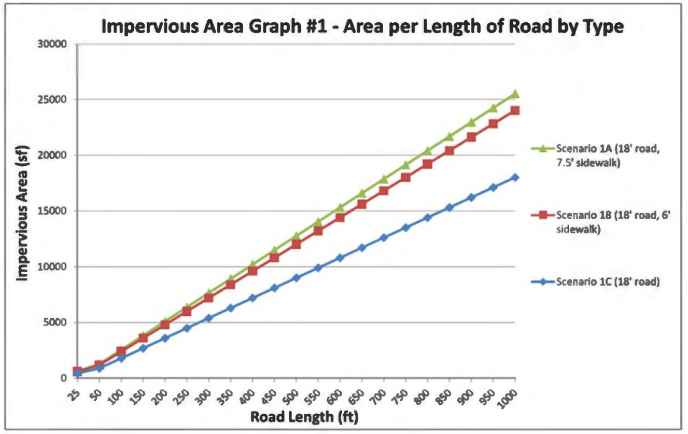
Gutter Flow

As with the facility sizing, multiple modeling scenarios were run to determine how far stormwater could flow down the gutter without flooding too far into the street. This was important since the concepts required periodic pollution reduction facilities that sometimes had to be spaced much farther than the typical 200 lineal foot spacing to avoid conflicts. Since the running slope of the street and design of the gutter effects conveyance capacity multiple scenarios were modeled and plotted on graphs to show the ability for extended spacing to work. See graph #1 below. Generally this modeling proved that extended distances between facilities should not be problematic.

Pipe Flow

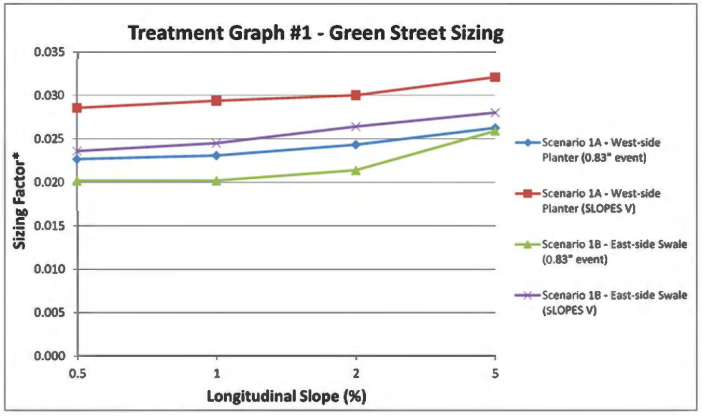
The concept designs assumed all trunk storm mains to be 12-inches minimum, which is the minimum storm main size BES allows. This is generally large enough to fully convey the 10-year event as long as the pipe slopes do not become too flat. As shown in the alternative storm main extension studies, running pipes flatter than 1% may require upsizing to 15-inches given the larger drainage areas contributing to them. Detailed pipe conveyance calculations were not included in this preliminary design.

Graph 1



Assumptions
Crowned roadway, 18' paved each side (7' bike, 11' lane, 11' lane, 7' bike)
Sidewalk on one side, if curb tight 7.5', if separated 6'

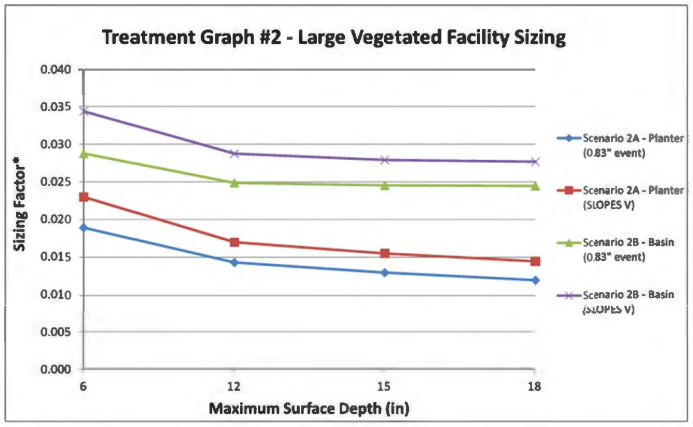
Graph 2



*Sizing Factor = Treatment Area/Drainage Area

Assumptions
Per the SWMM, the Portland pollution reduction event is 0.83"/24-hours.
SLOPES V requires that the facility *"Accept and fully treat the volume of water equal to 50% of the cumulative rainfall from the 2-year, 24-hour storm for that site."*

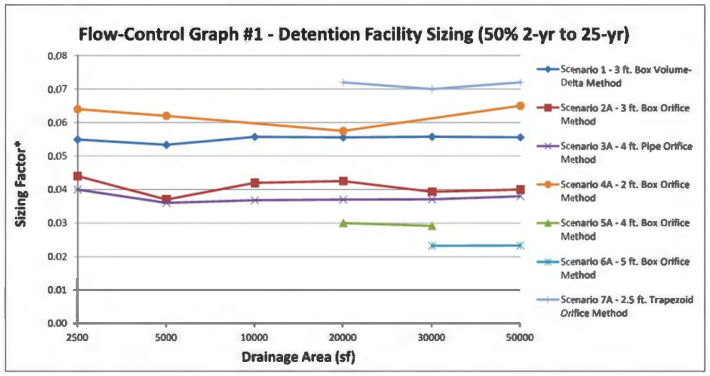
Graph 3



*Sizing Factor = Treatment Area/Drainage Area

Assumptions
Per the SWMM, the Portland pollution reduction event is 0.83"/24-hours.
SLOPES V requires that the facility *"Accept and fully treat the volume of water equal to 50% of the cumulative rainfall from the 2-year, 24-hour storm for that site."*

Graph 4



*Sizing Factor = Detention Facility Area/Drainage Area

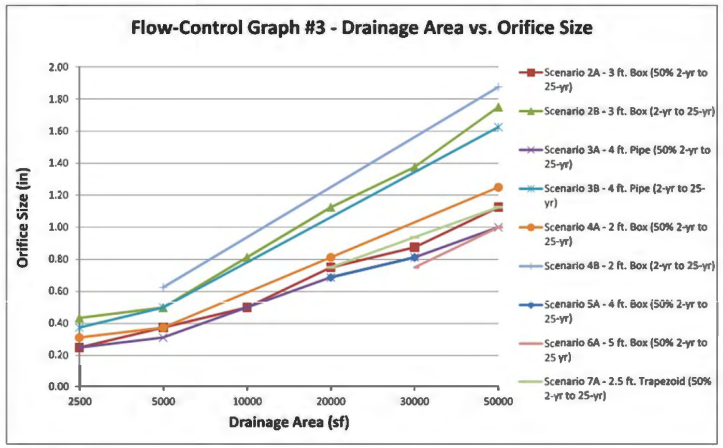
Assumptions
Pre-developed CN = 76, post-developed CN = 98.
Time of concentration = 5 min.

Average Sizing Ratio per Scenario

3 ft. Box (Volume-Delta Method)	0.055
2 ft. Box (Orifice Method)	0.062
3 ft. Box (Orifice Method)	0.041
4 ft. Box (Orifice Method)	0.030
5 ft. Box (Orifice Method)	0.023
4 ft. Pipe (Orifice Method)	0.037
2.5 ft. Trapezoid (Orifice Method)	0.071

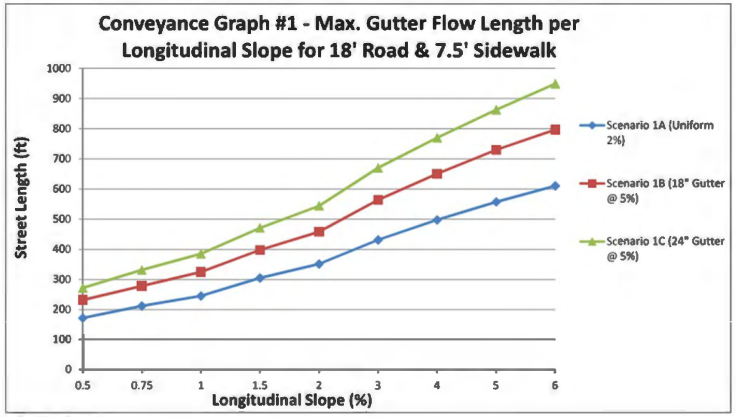
Universal Ratio = 0.12

Graph 5



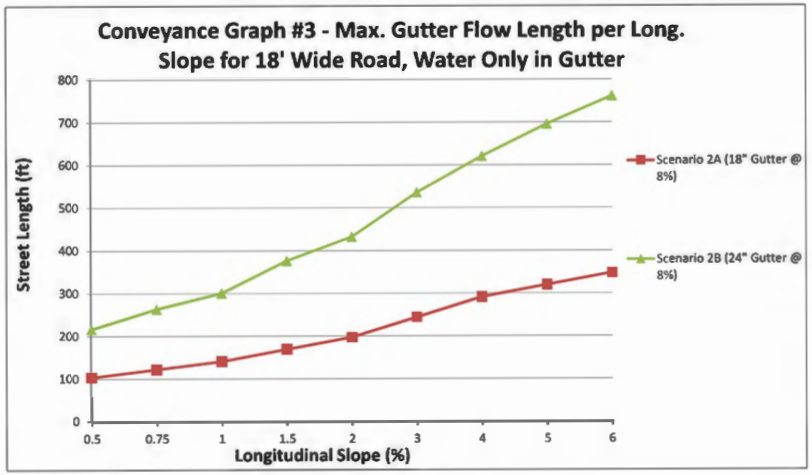
Assumptions
Pre-developed CN = 76, post-developed CN = 98.
Time of concentration = 5 min.

Graph 6



Assumptions
Gutters have 5% cross-slope, except under uniform scenario.
Street pavement is assumed to have 2% cross-slope.
Water extends into street 5' from face of curb.
Flow is peak of 10-year event using Rational Method (I = 2.86"/hr, C = 0.90)

Graph 7



Assumptions
Gutters have 8% cross-slope.
Street pavement is assumed to have 2% cross-slope.
Water only in gutter.
Flow is peak of 10-year event using Rational Method (I = 2.86"/hr, C = 0.90)

COST ESTIMATE SUMMARY

No	ITEM				ITEM COST CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	2011 ESTIMATE			
1	TOTAL CONSTRUCTION - TEMPORARY FEATURES AND APPURTANCES				$632,768	$386,334	$471,189	$547,154				
2	TOTAL CONSTRUCTION - DEMOLITION AND PREPARATION				$630,716	$464,057	$368,353	$424,882				
3	TOTAL CONSTRUCTION - SURFACE IMPROVEMENTS				$1,565,787	$1,565,787	$1,171,586	$1,636,477				$3,905,201
4	TOTAL CONSTRUCTION - ANTICIPATED ITEMS				$236,000	$236,000	$196,000	$196,000				$994,813
5	TOTAL CONSTRUCTION - STORMWATER IMPROVEMENTS				$1,492,982	$1,346,431	$946,633	$1,009,561				$2,613,939
6	TOTAL CONSTRUCTION - PROPERTY ACQUISITION					$454,200	$454,200	$454,200				
7	TOTAL CONSTRUCTION - CONSTRUCTION CONTINGENCY		5.0%	of Bid Items	$216,113	$199,931	$147,888	$180,904		5.0%	of Bid Items	$325,957
	TOTAL CONSTRUCTION - SUBTOTAL				**$4,774,366**	**$4,652,741**	**$3,755,848**	**$4,449,178**				**$7,839,910**
8	TOTAL PROJECT MANAGEMENT		5.0%	of Bid Items	$216,113	$199,931	$147,888	$180,904		5.0%	of Bid Items	$342,255
9	TOTAL DESIGN ENGINEERING		25.0%	of Bid Items	$1,080,563	$999,653	$739,440	$904,518		25.0%	of Bid Items	$1,711,274
10	TOTAL CONSTRUCTION MANAGEMENT		15.0%	of Bid Items	$648,338	$599,792	$443,664	$542,711		15.0%	of Bid Items	$926,000
11	TOTAL PROJECT ENGINEERING & MANAGEMENT OVERHEAD		80.0%	of PM, Eng, and CM	$1,556,011	$1,439,501	$1,064,794	$1,628,133		80.0%	of PM, Eng, and CM	$2,464,235
	TOTAL PROJECT ENGINEERING & MANAGEMENT				$3,501,025	$3,238,877	$2,395,786	$3,256,266				$5,443,764
	TOTAL PROJECT RIGHT-OF-WAY CONTINGENCY		19.0%	of Land, Improve, and of Land, Improve, and Damages (of Bid Items)	$821,228	$759,736	$561,974	$687,434		19%	of Land, Improve, and of Land, Improve, and Damages (of Bid Items)	$1,250,000
		Years	Inflation						Years	Inflation		
12	TOTAL INFLATION RATE ON CONTRACT	1	4.5%	of Construction	$214,846	$199,554	$148,574	$179,774	6	4.5%	of Construction	$2,369,692
13	TOTAL INFLATION RATE ON PERSONNEL	1	2.0%	of Eng & Mgmt	$70,021	$64,778	$47,916	$58,613	6	2.0%	of Eng & Mgmt	$699,511
14	TOTAL ESTIMATE CONTINGENCY FOR UNDEFINED OR CHANGE IN SCOPE		25.0%	of Const, Eng & Mgmt, and Inflation	$2,140,064	$1,984,438	$1,473,481	$1,791,001		25.0%	of Const, Eng & Mgmt, and Inflation	$4,113,410
	TOTAL PROJECT CONTINGENCY				$2,424,931	$2,248,770	$1,669,971	$2,029,388				$7,182,613
15	DOWNSTREAM DRAINAGE IMPROVEMENTS*				$1,900,000	$1,500,000	$900,000	$1,350,000				$2,200,000
	TOTAL PROJECT ESTIMATE				**$12,600,000**	**$11,640,000**	**$8,722,000**	**$11,085,000**			**	**$23,916,000**
	TOTAL OPERATIONS AND MAINTENANCE (Annually)											
	1 Year Maintenance Total				$16,653	$10,253	$6,668	$6,665				

*See page 50 for explanation of downstream drainage costs.

** The Total Project Estimate in the 2011 SW Capitol Highway Plan Refinement Report is listed at $17,122,244. The 2011 estimate listed in this report increased for the following reasons: percentages used for Project Engineering and Management Overhead are ajdusted to match percentages used for estiamting of the four concepts and the inflation period is increased from 3 years to 6 years. Downstream drainage improvements were not included in the 2011 total project estimate, but are included in the total costs for the concepts in this report, so have been included in the 2011 total cost to provide a direct comparison.

CONCEPT 1: DISPERSED TREATMENT & DETENTION

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4	total	UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	TEMPORARY FEATURES AND APPURTANCES													
1	MOBILIZATION	8.0%	8.0%	8.0%	8.0%	8%	LS		$9,254	$77,617	$124,928	$110,910	$322,708	8% of total
2	TEMPORARY PROTECTION & DIRECTION OF TRAFFIC	3.0%	3.0%	3.0%	3.0%	3%	LS		$3,470	$29,106	$46,848	$41,591	$121,016	3% of total
3	EROSION CONTROL	1.5%	1.5%	1.5%	1.5%	1.5%	LS		$1,735	$14,553	$23,424	$20,796	$60,508	1.5% of total
4	POLLUTION CONTROL PLAN	0.5%	0.5%	0.5%	0.5%	0.5%	LS		$578	$4,851	$7,808	$6,932	$20,169	0.5% of total
5	TEMPORARY SIGNS	38	140	217	204	600	SQFT	$20.00	$766	$2,809	$4,340	$4,085	$12,000	From 2011 Estimate
6	TEMPORARY BARRICADES, TYPE III	1	2	4	3	10	EACH	$115.00	$73	$269	$416	$391	$1,150	From 2011 Estimate
7	TEMPORARY PEDESTRIAN WALKWAYS	5	19	29	27	80	FOOT	$65.00	$332	$1,217	$1,881	$1,770	$5,200	From 2011 Estimate
8	TEMPORARY PLASTIC DRUMS	8	29	45	43	125	EACH	$52.00	$415	$1,521	$2,351	$2,213	$6,500	From 2011 Estimate
9	TEMPORARY FLEXIBLE PAVEMENT MARKERS	64	234	362	340	1000	EACH	$3.00	$191	$702	$1,085	$1,021	$3,000	From 2011 Estimate
10	TEMPORARY STRIPING	606	2223	3436	3234	9500	FOOT	$0.65	$394	$1,445	$2,234	$2,102	$6,175	From 2011 Estimate
11	STRIPING & STRIPE REMOVAL MOBILIZATION	0	1	1	1	3	EACH	$425.00	$81	$298	$461	$434	$1,275	From 2011 Estimate
12	FLAGGERS	77	281	434	409	1200	HOUR	$48.50	$3,715	$13,621	$21,051	$19,813	$58,200	2 x 75 days x 8 hrs/day = 1200
13	SEDIMENT FENCE, UNSUPPORTED	303	1112	1718	1617	4750	FOOT	$2.50	$758	$2,779	$4,295	$4,043	$11,875	From 2011 Estimate
14	INLET PROTECTION	2	8	12	12	34.00	EACH	$88.00	$191	$700	$1,082	$1,019	$2,992	From 2011 Estimate
	SUBTOTAL TEMPORARY FEATURES AND APPURTANCES								$21,955	$151,490	$242,204	$217,120	$632,768	
	DEMOLITION AND PREPARATION													
15	REMOVAL OF STRUCTURES & OBSTRUCTIONS	3.0%	3.0%	3.0%	3.0%	3.0%	LS		$3,274	$27,459	$44,196	$39,237	$114,166	From 2011 Estimate
16	CLEARING AND GRUBBING	3.0%	3.0%	3.0%	3.0%	1.0%	LS		$3,274	$27,459	$44,196	$39,237	$114,166	From 2011 Estimate
17	TREE ROOT REMOVAL	3	9	14	14	40	HOUR	$178.00	$454	$1,666	$2,575	$2,424	$7,120	From 2011 Estimate
18	TREE TRIMMING	3	9	14	14	40	HOUR	$152.00	$388	$1,423	$2,199	$2,070	$6,080	From 2011 Estimate
19	GENERAL EXCAVATION (earthwork, cut or fill)	50	750	2,000	1,500	4,300	CUYD	$35.00	$1,750	$26,250	$70,000	$52,500	$150,500	includes cut/fill at edges of ex. road
20	12 INCH SUBGRADE STABILIZATION	200	1,467	2,267	2,133	6,067	SQYD	$21.90	$4,380	$32,120	$49,640	$46,720	$132,860	assumed under 25% of widened road
21	SUBGRADE GEOTEXTILE	200	1,467	2,267	2,133	6,067	SQYD	$1.25	$251	$1,839	$2,842	$2,675	$7,607	assumed under 25% of widened road
22	VIDEO INSPECTION OF SEWERS, MAINLINE	0	1,988	2,412	2,664	7,064	FOOT	$3.30	$0	$6,560	$7,960	$8,791	$23,311	for all 10" & 12" storm pipe
23	POTHOLE EXCAVATION	1	5	7	7	20	EACH	$548.00	$700	$2,565	$3,964	$3,731	$10,960	assumed needed at crossing with water main
24	COLD PLANE PAVEMENT REMOVAL, 2 INCH DEEP		1,956	4,156	3,911	10,022	SQYD	$3.42	$0	$6,688	$14,212	$13,376	$34,276	for remaining 22' width
25	TREE REMOVAL, 12-INCH		10	22	11	43	EACH	$690.00	$0	$6,900	$15,180	$7,590	$29,670	smaller tree removal not included
	SUBTOTAL SURFACE IMPROVEMENTS - DEMOLITION AND PREPARATION								$14,471	$140,929	$256,965	$218,351	$630,716	
	SURFACE IMPROVEMENTS													
26	RETAINING WALL, CAST-IN-PLACE CONCRETE	171	1,039	3,258	586	5,054	SQFT	$70.00	$11,970	$72,695	$228,060	$41,020	$353,745	heights vary 2' to 7'
27	LEVEL 3, 1/2 INCH DENSE, MWMAC MIXTURE (FULL DEPTH)	65	441	577	562	1,645	TON	$89.50	$5,840	$39,434	$51,627	$50,340	$147,241	only on widened edges
28	LEVEL 3, 1/2 INCH DENSE, MWMAC MIXTURE (2" INLAY)		213	452	425	1,090	TON	$89.50	$0	$19,034	$40,447	$38,067	$97,548	for remaining 22' width
29	AGGREGATE BASE		665	1,190	1,120		TON	$36.90	$0	$24,539	$43,911	$41,328	$109,778	only on widened edges
30	EXTRA FOR ASPHALT APPROACHES		15	20	30	65	EACH	$651.00	$0	$9,765	$13,020	$19,530	$42,315	From 2011 Estimate
31	CONCRETE CURBS, CURB AND GUTTER		1,645	2,884	3,078	7,607	FOOT	$25.50	$0	$41,948	$73,542	$78,489	$193,979	along all storm facilities
32	CONCRETE CURBS, THICKENED CURB AND GUTTER		247	428	349	1,024	FOOT	$37.70	$0	$9,312	$16,136	$13,157	$38,605	all edges except storm facilities
33	CONCRETE DRIVEWAYS	0	2,830	2,032	4,996	9,858	SQFT	$8.40	$0	$23,772	$17,069	$41,966	$82,807	
34	CONCRETE WALKS	128	6,143	10,864	8,179	25,314	SQFT	$7.40	$947	$45,458	$80,394	$60,525	$187,324	
35	MONOLITHIC CURB AND SIDEWALKS	2,016				2,016	SQFT	$11.50	$23,184	$0	$0	$0	$23,184	
36	CONCRETE SIDEWALK RAMPS	8	6	10	13	37	EACH	$1,930.00	$15,440	$11,580	$19,300	$25,090	$71,410	
37	DETECTABLE WARNING SURFACE	64	48	80	104	296	SQFT	$42.30	$2,707	$2,030	$3,384	$4,399	$12,521	
38	THERMOPLASTIC, NON-PROFILE, 120 MILS, EXTRUDED	300	2,300	3,400	3,200	9,200	FOOT	$1.40	$420	$3,220	$4,760	$4,480	$12,880	assumes 1 strip each side
39	PAVEMENT LEGEND, TYPE B: BICYCLE LANE SYMBOLS		5	7	11	23	EACH	$286.00	$0	$1,430	$2,002	$3,146	$6,578	estimate based on half 2011
40	PAVEMENT BAR, TYPE A	17	63	98	92	270	SQFT	$4.50	$78	$284	$439	$414	$1,215	From 2011 Estimate
41	REMOVE & REINSTALL EXISTING SIGNS	2	7	11	10	30	EACH	$167.00	$320	$1,173	$1,812	$1,706	$5,010	From 2011 Estimate
42	TYPE "G" SIGNS IN PLACE	1	4	7	6	18	SQFT	$39.60	$45	$167	$258	$243	$713	From 2011 Estimate
43	TYPE "W1" SIGNS IN PLACE	3	11	17	16	48	SQFT	$19.00	$58	$213	$330	$310	$912	From 2011 Estimate
44	TYPE "W2" SIGNS IN PLACE	2	6	9	8	24	SQFT	$19.90	$30	$112	$173	$163	$478	From 2011 Estimate
45	PERMANENT SEEDING	0.1	0.5	0.7	0.7	2	ACRE	$2,480.00	$317	$1,161	$1,794	$1,689	$4,960	From 2011 Estimate
46	TOPSOIL	4	14	22	20	60	CUYD	$43.60	$167	$612	$946	$891	$2,616	From 2011 Estimate
47	SOIL CONDITIONER	2	7	11	10	30	CUYD	$35.20	$67	$247	$382	$359	$1,056	From 2011 Estimate
48	DECIDUOUS TREES, 2-1/2 INCH CALIPER	8	29	45	43	125	EACH	$822.00	$6,559	$24,048	$37,165	$34,979	$102,750	From 2011 Estimate
49	ADDITIONAL ESTABLISHMENT PERIOD	8	29	45	43	125	YEAR*	$264.00	$2,106	$7,723	$11,936	$11,234	$33,000	From 2011 Estimate
50	CL-4R CHAIN-LINK FENCE WITH VINYL CLAD FABRIC	57	211	326	306	900	FOOT	$27.80	$1,597	$5,856	$9,050	$8,517	$25,020	From 2011 Estimate
51	SINGLE MAILBOX SUPPORTS	1	4	5	5	15	EACH	$207.00	$198	$727	$1,123	$1,057	$3,105	From 2011 Estimate
52	MULTIPLE MAILBOX SUPPORTS	1	2	4	3	10	EACH	$339.00	$216	$793	$1,226	$1,154	$3,390	From 2011 Estimate
53	MAILBOX CONCRETE COLLARS	2	6	9	9	25	EACH	$66.00	$105	$386	$597	$562	$1,650	From 2011 Estimate
	SUBTOTAL SURFACE IMPROVEMENTS								$72,373	$347,719	$660,881	$484,814	$1,565,787	
	ANTICIPATED ITEMS													
54	RELOCATE WATER FACILITIES - FIRE HYDRANT		1	1	2	4	EACH	$20,000	$0	$20,000	$20,000	$40,000	$80,000	
55	RELOCATE WATER FACILITIES - METER	2	7	3	9	21	EACH	$6,000	$12,000	$42,000	$18,000	$54,000	$126,000	
56	NONSTORMWATER PLANTINGS AND PLANT ESTABLISHMENT	191	702	1,085	1,021	3,000	SQFT	$10.00	$1,915	$7,021	$10,851	$10,213	$30,000	From 2011 Estimate
	SUBTOTAL ANTICIPATED ITEMS								$13,915	$69,021	$48,851	$104,213	$236,000	

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4	total	UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	STORMWATER IMPROVEMENTS													
57	TRENCH EXCAVATION, COMMON		736	893	987	2,616	CUYD	$17	$0	$12,296	$14,919	$16,477	$43,692	
58	TRENCH BACKFILL, CLASS B		368	447	493	1,308	CUYD	$33	$0	$12,149	$14,740	$16,280	$43,169	
59	STORMWATER PLANTERS		1,122	1,448	1,105	3,675	SQFT	$50.00	$0	$56,100	$72,400	$55,250	$183,750	on west side
60	STORMWATER SWALES		447	924	859	2,230	SQFT	$35.00	$0	$15,645	$32,340	$30,065	$78,050	on east side
61	GREEN STREET SEDIMENTATION FOREBAY		9	13	11	33	EACH	$600.00	$0	$5,400	$7,800	$6,600	$19,800	1 in each planter/swale, cost rough est.
62	STORMWATER PLANTINGS AND PLANT ESTABLISHMENT		1,569	2,372	1,964	5,905	SQFT	$15.00	$0	$23,535	$35,580	$29,460	$88,575	
63	6 INCH PERFORATED PIPE		247	428	349	1,024	FOOT	$15.00	$0	$3,705	$6,420	$5,235	$15,360	
64	10 INCH PIPE, PVC ASTM D3034 SDR35, BEDDING TYPE: D		90	679	490	1,259	FOOT	$75	$0	$6,750	$50,925	$36,750	$94,425	3 to 4' deep
65	12 INCH PIPE, PVC ASTM D3034 SDR35, BEDDING TYPE: D		1,898	1,733	2,174	5,805	FOOT	$65	$0	$123,370	$112,645	$141,310	$377,325	3 to 4' deep
66	CONCRETE MANHOLES, 48 INCH, 0-8 FT DEPTH		3	6	7	16	EACH	$4,100	$0	$12,300	$24,600	$28,700	$65,600	
67	CONCRETE MANHOLES, SEDIMENTATION		1	1	1	3	EACH	$5,610	$0	$5,610	$5,610	$5,610	$16,830	
68	CONCRETE INLETS, TYPE G-1		12	15	15	42	EACH	$1,940	$0	$23,280	$29,100	$29,100	$81,480	
69	MINOR ADJUSTMENT OF MANHOLES		2	2	2	6	EACH	$642	$0	$1,284	$1,284	$1,284	$3,852	From 2011 Estimate
70	CONCRETE VAULT, SED TRAP & FLOW CONTROL		2	4	4	10	EACH	$5,000	$0	$10,000	$20,000	$20,000	$50,000	
71	STORMWATER FILTER VAULT (CONTECH)	1				0	EACH	$8,000	$8,000	$0	$0	$0	$8,000	
72	TRENCH RESURFACING		14	208	308	530	SQYD	$79.60	$0	$1,141	$16,530	$24,517	$42,188	New pipe under existing roadway
73	STORMWATER OUTFALL			1		1	EACH	$1,000	$0	$0	$1,000	$0	$1,000	
74	STORMWATER LEVEL SPREADER		1			1	EACH	$2,000	$0	$2,000	$0	$0	$2,000	
75	STORMWATER DETENTION GALLERY		5,849	8,845	7,690	22,383	CUFT	$10	$0	$58,485	$88,445	$76,895	$223,825	ECORAIN, per rep. $4.5/cf X 2 FOR INSTALL
76	GENERAL EXCAVATION (earthwork, for detention gallery)		309	468	407	1,184	CUYD	$20.00	$0	$6,189	$9,359	$8,137	$23,685	5' deep excavation
77	IMPERMEABLE LINER FOR DETENTION		5,292	8,002	6,957	20,251	SQFT	$1.50	$0	$7,937	$12,003	$10,436	$30,376	$0.75/sf X 2 FOR INSTALL
	SUBTOTAL STORMWATER IMPROVEMENTS								$8,000	$387,176	$555,700	$542,106	$1,492,982	

SCHEDULE SUMMARY

						BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS
BID ITEMS						$116,798	$1,027,314	$1,715,750	$1,462,390	$4,322,253
CONSTRUCTION CONTINGENCY			5.0%	of Bid Items*		$5,840	$51,366	$85,788	$73,120	$216,113
SUBTOTAL						$122,638	$1,078,680	$1,801,538	$1,535,510	$4,538,366
ANTICIPATED ITEMS						$13,915	$69,021	$48,851	$104,213	$236,000
TOTAL CONSTRUCTION						$136,553	$1,147,701	$1,850,389	$1,639,723	$4,774,366
PROJECT MANAGEMENT			5.0%	of Bid Items		$5,840	$51,366	$85,788	$73,120	$216,113
DESIGN ENGINEERING			25.0%	of Bid Items		$29,199	$256,829	$428,938	$365,598	$1,080,563
CONSTRUCTION MANAGEMENT			15.0%	of Bid Items		$17,520	$154,097	$257,363	$219,359	$648,338
SUBTOTAL						$52,559	$462,292	$772,089	$658,077	$1,945,014
PROJECT ENGINEERING & MANAGEMENT OVERHEAD			80.0%	of PM, Eng, and CM		$42,047	$369,834	$617,671	$526,462	$1,556,011
TOTAL PROJECT ENGINEERING & MANAGEMENT						$94,606	$832,126	$1,389,760	$1,184,539	$3,501,025
RIGHT-OF-WAY CONTINGENCY			19.0%	Land, Improve, and Damages (of Bid Items)		$22,192	$195,190	$325,993	$277,854	$821,228
TOTAL PROJECT RIGHT-OF-WAY						$22,192	$195,190	$325,993	$277,854	$821,228
			Years	Inflation						
INFLATION RATE ON CONTRACT			1	4.5%	of Construction	$6,145	$51,647	$83,268	$73,788	$214,846
INFLATION RATE ON PERSONNEL			1	2.0%	of Eng & Mgmt	$1,892	$16,643	$27,795	$23,691	$70,021
ESTIMATE CONTINGENCY FOR UNDEFINED OR CHANGE IN SCOPE				25.0%	of Const, Eng & Mgmt, and Inflation	$59,799	$512,029	$837,803	$730,435	$2,140,064
TOTAL PROJECT CONTINGENCY						$67,836	$580,319	$948,866	$827,914	$2,424,931
TOTAL PROJECT ESTIMATE						$321,186	$2,755,336	$4,515,008	$3,930,031	$11,521,550

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4	total	UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	OPERATIONS AND MAINTENANCE (Annually)													
1	STORMWATER FILTER VAULT (CONTECH)	1				1	EA	$500.00	$500	$0	$0	$0	$500	Cleaned every year at $500 EA time
2	Vegetated Stormwater Facility maintainance (after 2-year establishment)	0	1569	2372	1964	5905	SF	$1.55	$0	$2,432	$3,677	$3,044	$9,153	$1.55/sf of facility area, per year
3	Flow Control Vault Inspection and cleaning	0	2	4	4	10	EA	$600	$0	$1,200	$2,400	$2,400	$6,000	Triannual Maintenance at $200 EA
4	Flow Control MH Inspection & Cleaning	0	1	2	2	5	EA	$100	$0	$100	$200	$200	$500	Cleaned every 3 year at $300 EA time
5	Sedimentaion MH Insepction & Cleaning	0	1	2	2	5	EA	$100	$0	$100	$200	$200	$500	Cleaned every 3 year at $300 EA time
							1 Year Maintenance Total		**$0**	**$3,832**	**$6,477**	**$5,844**	**$16,653**	

APPENDIX B: COST ESTIMATES

CONCEPT 2: DISPERSED TREATMENT, CENTRALIZED DETENTION

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4		UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	TEMPORARY FEATURES AND APPURTANCES													
1	MOBILIZATION	8.0%	8.0%	8.0%	8.0%	8%	LS		$7,314	$37,873	$71,557	$54,313	$171,057	8% of total
2	TEMPORARY PROTECTION & DIRECTION OF TRAFFIC	3.0%	3.0%	3.0%	3.0%	3%	LS		$2,743	$14,202	$26,834	$20,368	$64,146	3% of total
3	EROSION CONTROL	1.5%	1.5%	1.5%	1.5%	1.5%	LS		$1,371	$7,101	$13,417	$10,184	$32,073	1.5% of total
4	POLLUTION CONTROL PLAN	0.5%	0.5%	0.5%	0.5%	0.5%	LS		$457	$2,367	$4,472	$3,395	$10,691	0.5% of total
5	TEMPORARY SIGNS	38	140	217	204	600	SQFT	$20.00	$766	$2,809	$4,340	$4,085	$12,000	From 2011 Estimate
6	TEMPORARY BARRICADES, TYPE III	1	2	4	3	10	EACH	$115.00	$73	$269	$416	$391	$1,150	From 2011 Estimate
7	TEMPORARY PEDESTRIAN WALKWAYS	5	19	29	27	80	FOOT	$65.00	$332	$1,217	$1,881	$1,770	$5,200	From 2011 Estimate
8	TEMPORARY PLASTIC DRUMS	8	29	45	43	125	EACH	$52.00	$415	$1,521	$2,351	$2,213	$6,500	From 2011 Estimate
9	TEMPORARY FLEXIBLE PAVEMENT MARKERS	64	234	362	340	1000	EACH	$3.00	$191	$702	$1,085	$1,021	$3,000	From 2011 Estimate
10	TEMPORARY STRIPING	606	2223	3436	3234	9500	FOOT	$0.65	$394	$1,445	$2,234	$2,102	$6,175	From 2011 Estimate
11	STRIPING & STRIPE REMOVAL MOBILIZATION	0	1	1	1	3	EACH	$425.00	$81	$298	$461	$434	$1,275	From 2011 Estimate
12	FLAGGERS	77	281	434	409	1200	HOUR	$48.50	$3,715	$13,621	$21,051	$19,813	$58,200	2 x 75 days x 8 hrs/day = 1200
13	SEDIMENT FENCE, UNSUPPORTED	303	1112	1718	1617	4750	FOOT	$2.50	$758	$2,779	$4,295	$4,043	$11,875	From 2011 Estimate
14	INLET PROTECTION	2	8	12	12	34.00	EACH	$88.00	$191	$700	$1,082	$1,019	$2,992	From 2011 Estimate
	SUBTOTAL TEMPORARY FEATURES AND APPURTANCES								$18,802	$86,906	$155,477	$125,150	$386,334	
	DEMOLITION AND PREPARATION													
15	REMOVAL OF STRUCTURES & OBSTRUCTIONS	3.0%	3.0%	3.0%	3.0%	3.0%	LS		$3,269	$26,243	$42,339	$35,475	$107,326	From 2011 Estimate
16	CLEARING AND GRUBBING	1.0%	1.0%	1.0%	1.0%	1.0%	LS		$1,090	$8,748	$14,113	$11,825	$35,775	From 2011 Estimate
17	TREE ROOT REMOVAL	3	9	14	14	40	HOUR	$178.00	$454	$1,666	$2,575	$2,424	$7,120	From 2011 Estimate
18	TREE TRIMMING	3	9	14	14	40	HOUR	$152.00	$388	$1,423	$2,199	$2,070	$6,080	From 2011 Estimate
19	GENERAL EXCAVATION (cut or fill along road)	50	750	2,000	1,500	4,250	CUYD	$35.00	$1,750	$26,250	$70,000	$52,500	$150,500	includes cut/fill at edges of ex. road
20	12 INCH SUBGRADE STABILIZATION	200	733	1,133	1,067	2,933	SQYD	$21.90	$4,380	$16,060	$24,820	$23,360	$68,620	assumed under 25% of widened road
21	SUBGRADE GEOTEXTILE	200	733	1,133	1,067	2,933	SQYD	$1.25	$251	$920	$1,421	$1,338	$3,929	assumed under 25% of widened road
22	VIDEO INSPECTION OF SEWERS, MAINLINE	0	816	952	870	2,638	FOOT	$3.30	$0	$2,693	$3,141	$2,871	$8,705	for all 10" & 12" storm pipe
23	POTHOLE EXCAVATION	1	5	8	8	21	EACH	$548.00	$548	$2,740	$4,384	$4,384	$12,056	assumed needed at crossing with water main
24	COLD PLANE PAVEMENT REMOVAL, 2 INCH DEEP		1,956	4,156	3,911	10,022	SQYD	$3.42	$0	$6,688	$14,212	$13,376	$34,276	for remaining 22' width
25	TREE REMOVAL, 12-INCH		10	22	11	43	EACH	$690.00	$0	$6,900	$15,180	$7,590	$29,670	smaller tree removal not included
	SUBTOTAL SURFACE IMPROVEMENTS - DEMOLITION AND PREPARATION								$12,130	$100,330	$194,384	$157,213	$464,057	
	SURFACE IMPROVEMENTS													
26	RETAINING WALL, CAST-IN-PLACE CONCRETE	171	1,039	3,258	586	5,054	SQFT	$70.00	$11,970	$72,695	$228,060	$41,020	$353,745	heights vary 2' to 7'
27	LEVEL 3, 1/2 INCH DENSE, MWMAC MIXTURE (FULL DEPTH)	65	441	577	562	1,645	TON	$89.50	$5,840	$39,434	$51,627	$50,340	$147,241	only on widened edges
28	LEVEL 3, 1/2 INCH DENSE, MWMAC MIXTURE (2" INLAY)	0	213	452	425	1,090	TON	$89.50	$0	$19,034	$40,447	$38,067	$97,548	for remaining 22' width
29	AGGREGATE BASE	0	665	1,190	1,120	0	TON	$36.90	$0	$24,539	$43,911	$41,328	$109,778	only on widened edges
30	EXTRA FOR ASPHALT APPROACHES	0	15	20	30	65	EACH	$651.00	$0	$9,765	$13,020	$19,530	$42,315	From 2011 Estimate
31	CONCRETE CURBS, CURB AND GUTTER	0	1,645	2,884	3,078	7,607	FOOT	$25.50	$0	$41,948	$73,542	$78,489	$193,979	along all storm facilities
32	CONCRETE CURBS, THICKENED CURB AND GUTTER	0	247	428	349	1,024	FOOT	$37.70	$0	$9,312	$16,136	$13,157	$38,605	all edges except storm facilities
33	CONCRETE DRIVEWAYS	0	2,830	2,032	4,996	9,858	SQFT	$8.40	$0	$23,772	$17,069	$41,966	$82,807	
34	CONCRETE WALKS	128	6,143	10,864	8,179	25,314	SQFT	$7.40	$947	$45,458	$80,394	$60,525	$187,324	
35	MONOLITHIC CURB AND SIDEWALKS	2,016	0	0	0	2,016	SQFT	$11.50	$23,184	$0	$0	$0	$23,184	
36	CONCRETE SIDEWALK RAMPS	8	6	10	13	37	EACH	$1,930.00	$15,440	$11,580	$19,300	$25,090	$71,410	
37	DETECTABLE WARNING SURFACE	64	48	80	104	296	SQFT	$42.30	$2,707	$2,030	$3,384	$4,399	$12,521	
38	THERMOPLASTIC, NON-PROFILE, 120 MILS, EXTRUDED	300	2,300	3,400	3,200	9,200	FOOT	$1.40	$420	$3,220	$4,760	$4,480	$12,880	assumes 1 strip each side
39	PAVEMENT LEGEND, TYPE B: BICYCLE LANE SYMBOLS	0	5	7	11	23	EACH	$286.00	$0	$1,430	$2,002	$3,146	$6,578	estimate based on half 2011
40	PAVEMENT BAR, TYPE A	17	63	98	92	270	SQFT	$4.50	$78	$284	$439	$414	$1,215	From 2011 Estimate
41	REMOVE & REINSTALL EXISTING SIGNS	2	7	11	10	30	EACH	$167.00	$320	$1,173	$1,812	$1,706	$5,010	From 2011 Estimate
42	TYPE "G" SIGNS IN PLACE	1	4	7	6	18	SQFT	$39.60	$45	$167	$258	$243	$713	From 2011 Estimate
43	TYPE "W1" SIGNS IN PLACE	3	11	17	16	48	SQFT	$19.00	$58	$213	$330	$310	$912	From 2011 Estimate
44	TYPE "W2" SIGNS IN PLACE	2	6	9	8	24	SQFT	$19.90	$30	$112	$173	$163	$478	From 2011 Estimate
45	PERMANENT SEEDING	0	0	1	1	2	ACRE	$2,480.00	$317	$1,161	$1,794	$1,689	$4,960	From 2011 Estimate
46	TOPSOIL	4	14	22	20	60	CUYD	$43.60	$167	$612	$946	$891	$2,616	From 2011 Estimate
47	SOIL CONDITIONER	2	7	11	10	30	CUYD	$35.20	$67	$247	$382	$359	$1,056	From 2011 Estimate
48	DECIDUOUS TREES, 2-1/2 INCH CALIPER	8	29	45	43	125	EACH	$822.00	$6,559	$24,048	$37,165	$34,979	$102,750	From 2011 Estimate
49	ADDITIONAL ESTABLISHMENT PERIOD	8	29	45	43	125	YEAR*	$264.00	$2,106	$7,723	$11,936	$11,234	$33,000	From 2011 Estimate
50	CL-4R CHAIN-LINK FENCE WITH VINYL CLAD FABRIC	57	211	326	306	900	FOOT	$27.80	$1,597	$5,856	$9,050	$8,517	$25,020	From 2011 Estimate
51	SINGLE MAILBOX SUPPORTS	1	4	5	5	15	EACH	$207.00	$198	$727	$1,123	$1,057	$3,105	From 2011 Estimate
52	MULTIPLE MAILBOX SUPPORTS	1	2	4	3	10	EACH	$339.00	$216	$793	$1,226	$1,154	$3,390	From 2011 Estimate
53	MAILBOX CONCRETE COLLARS	2	6	9	9	25	EACH	$66.00	$105	$386	$597	$562	$1,650	From 2011 Estimate
	SUBTOTAL SURFACE IMPROVEMENTS								$72,373	$347,719	$660,881	$484,814	$1,565,787	
	ANTICIPATED ITEMS													
54	RELOCATE WATER FACILITIES - FIRE HYDRANT	0	1	1	2	4	EACH	$20,000	$0	$20,000	$20,000	$40,000	$80,000	
55	RELOCATE WATER FACILITIES - METER	2	7	3	9	21	EACH	$6,000	$12,000	$42,000	$18,000	$54,000	$126,000	
56	NONSTORMWATER PLANTINGS AND PLANT ESTABLISHMENT	191	702	1,085	1,021	3,000	SQFT	$10.00	$1,915	$7,021	$10,851	$10,213	$30,000	From 2011 Estimate
	SUBTOTAL ANTICIPATED ITEMS								$13,915	$69,021	$48,851	$104,213	$236,000	

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4		UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	STORMWATER IMPROVEMENTS													
57	TRENCH EXCAVATION, COMMON		544	634	580	1,759	CUYD	$17	$0	$9,086	$10,595	$9,686	$29,367	
58	TRENCH BACKFILL, CLASS B		272	317	290	879	CUYD	$33	$0	$8,977	$10,468	$9,570	$29,016	
59	STORMWATER PLANTERS		1,122	1,448	1,105	3,675	SQFT	$50.00	$0	$56,100	$72,400	$55,250	$183,750	on west side
60	STORMWATER SWALES		447	924	859	2,230	SQFT	$35.00	$0	$15,645	$32,340	$30,065	$78,050	on east side
61	GREEN STREET SEDIMENTATION FOREBAY	0	9	13	11	33	EACH	$600.00	$0	$5,400	$7,800	$6,600	$19,800	1 in each planter/swale, cost rough est.
62	STORMWATER PLANTINGS AND PLANT ESTABLISHMENT		1,569	2,372	1,964	5,905	SQFT	$15.00	$0	$23,535	$35,580	$29,460	$88,575	
63	6 INCH PERFORATED PIPE		247	428	349	1,024	FOOT	$17.00	$0	$4,199	$7,276	$5,933	$17,408	
64	10 INCH PIPE, PVC ASTM D3034 SDR35, BEDDING TYPE: D, COMPLETE		203	292	193	688	FOOT	$75	$0	$15,225	$21,900	$14,475	$51,600	5 to 7' deep
65	12 INCH PIPE, PVC ASTM D3034 SDR35, BEDDING TYPE: D, COMPLETE		1,266	1,421	1,373	4,060	FOOT	$65	$0	$82,290	$92,365	$89,245	$263,900	5 to 7' deep
66	CONCRETE MANHOLES, 48 INCH, 0-8 FT DEPTH		4	6	6	16	EACH	$4,100	$0	$16,400	$24,600	$24,600	$65,600	
67	CONCRETE MANHOLES, SEDIMENTATION		1	1	1	3	EACH	$5,610	$0	$5,610	$5,610	$5,610	$16,830	
68	CONCRETE INLETS, TYPE G-1		11	13	11	35	EACH	$1,940	$0	$21,340	$25,220	$21,340	$67,900	
69	MINOR ADJUSTMENT OF MANHOLES		2	2	2	6	EACH	$642.00	$0	$1,284	$1,284	$1,284	$3,852	From 2011 Estimate
70	CONCRETE MANHOLES, FLOW CONTROL		1	1	1	3	EACH	$8,000	$0	$8,000	$8,000	$8,000	$24,000	
71	STORMWATER FILTER VAULT (CONTECH)	1				0	EACH	$8,000	$8,000	$0	$0	$0	$8,000	
72	TRENCH RESURFACING		37	249	99	385	SQYD	$79.60	$0	$2,972	$19,820	$7,880	$30,673	
73	STORMWATER OUTFALL			1		1	EACH	$1,000	$0	$0	$1,000	$0	$1,000	
74	STORMWATER LEVEL SPREADER		1			1	EACH	$2,000	$0	$2,000	$0	$0	$2,000	
75	STORMWATER DETENTION POND		2,591	4,302	3,707	10,600	SQFT	$30.00	$0	$77,730	$129,060	$111,210	$318,000	
76	GENERAL EXCAVATION (earthwork, for detention pond)		576	956	824	2,356	CUYD	$20.00	$0	$11,516	$19,120	$16,476	$47,111	6' deep for footprint of pond
77	IMPERMEABLE LINER FOR DETENTION						SQFT	$1.50	$0	$0	$0	$0	$0	not assumed needed for ponds
	SUBTOTAL STORMWATER IMPROVEMENTS								$8,000	$367,309	$524,439	$446,684	$1,346,431	

SCHEDULE SUMMARY								
					BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS
BID ITEMS					$125,220	$971,285	$1,584,032	$1,318,074	$3,998,610
CONSTRUCTION CONTINGENCY	5.0%	of Bid Items*			$6,261	$48,564	$79,202	$65,904	$199,931
SUBTOTAL					$131,481	$1,019,849	$1,663,234	$1,383,978	$4,198,541
ANTICIPATED ITEMS					$13,915	$69,021	$48,851	$104,213	$236,000
TOTAL CONSTRUCTION					$145,395	$1,088,870	$1,712,085	$1,488,190	$4,434,541
PROJECT MANAGEMENT	5.0%	of Bid Items			$6,261	$48,564	$79,202	$65,904	$199,931
DESIGN ENGINEERING	25.0%	of Bid Items			$31,305	$242,821	$396,008	$329,518	$999,653
CONSTRUCTION MANAGEMENT	15.0%	of Bid Items			$18,783	$145,693	$237,605	$197,711	$599,792
SUBTOTAL					$56,349	$437,078	$712,815	$593,133	$1,799,376
PROJECT ENGINEERING & MANAGEMENT OVERHEAD	80.0%	of PM, Eng, and CM			$45,079	$349,662	$570,252	$474,506	$1,439,501
TOTAL PROJECT ENGINEERING & MANAGEMENT					$101,428	$786,740	$1,283,067	$1,067,639	$3,238,877
RIGHT-OF-WAY CONTINGENCY	19.0%	Land, Improve, and Damages (of Bid Items)			$23,792	$184,544	$300,966	$250,434	$759,736
TOTAL PROJECT RIGHT-OF-WAY					$23,792	$184,544	$300,966	$250,434	$759,736
			Years	Inflation					
INFLATION RATE ON CONTRACT			1	4.5%	of Construction	$6,543	$48,999	$77,044	$66,969	$199,554
INFLATION RATE ON PERSONNEL			1	2.0%	of Eng & Mgmt of Const, Eng & Mgmt, and Inflation	$2,029	$15,735	$25,661	$21,353	$64,778
ESTIMATE CONTINGENCY FOR UNDEFINED OR CHANGE IN SCOPE	25.0%					$63,849	$485,086	$774,464	$661,038	$1,984,438
TOTAL PROJECT CONTINGENCY						$72,421	$549,820	$877,169	$749,360	$2,248,770
TOTAL PROJECT ESTIMATE						$343,036	$2,609,974	$4,173,288	$3,555,623	$10,681,923

	PROPERTY ACQUISITIONS													
1	GARDEN HOME PROPERTY (8020 SW Capitol Hwy)				1		LS	$141,750	$0	$0	$0	$141,750	$141,750	9,937 SF @ $9.51 = $94,500.87 + 50% add to get owner to sell
2	PROPERTY ACQUISITION (3972 SW Dolph Ct)			1			LS	$312,450	$0	$0	$312,450	$0	$312,450	21,900 SF @ $9.51/SF = $208,269.00 + 50% add to get owner to sell
	SUBTOTAL PROPERTY ACQUISITIONS ITEMS								$0	$0	$312,450	$141,750	$454,200	
	OPERATIONS AND MAINTENANCE													
1	STORMWATER FILTER VAULT (CONTECH)	1				1	EA	$500.00	$500	$0	$0	$0	$500	Cleaned every year at $500 EA time
2	Vegetated Stormwater Facility maintainance (after 2-year establishment)	0	1569	2372	1964	5905	SF	$1.55	$0	$2,432	$3,677	$3,044	$9,153	$1.55/sf of facility area, per year
4	Flow Control MH Inspection & Cleaning	0	1	1	1	3	EA	$100	$0	$100	$100	$100	$300	Cleaned every 3 year at $300 EA time
5	Sedimentaion MH Insepction & Cleaning	0	1	1	1	3	EA	$100	$0	$100	$100	$100	$300	Cleaned every 3 year at $300 EA time
							1 Year Maintenance Total		$500	$2,632	$3,877	$3,244	**$10,253**	

CONCEPT 3: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH MULTI-USE PATH

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4	TOTALS	UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	TEMPORARY FEATURES AND APPURTANCES													
1	MOBILIZATION	8.0%	8.0%	8.0%	8.0%	8%	LS		$9,376	$57,487	$77,974	$78,438	$223,275	8% of total
2	TEMPORARY PROTECTION & DIRECTION OF TRAFFIC	3.0%	3.0%	3.0%	3.0%	3%	LS		$3,516	$21,557	$29,240	$29,414	$83,728	3% of total
3	EROSION CONTROL	1.5%	1.5%	1.5%	1.5%	1.5%	LS		$1,758	$10,779	$14,620	$14,707	$41,864	1.5% of total
4	POLLUTION CONTROL PLAN	0.5%	0.5%	0.5%	0.5%	0.5%	LS		$586	$3,593	$4,873	$4,902	$13,955	0.5% of total
5	TEMPORARY SIGNS	38	140	217	204	600	SQFT	$20.00	$766	$2,809	$4,340	$4,085	$12,000	From 2011 Estimate
6	TEMPORARY BARRICADES, TYPE III	1	2	4	3	10	EACH	$115.00	$73	$269	$416	$391	$1,150	From 2011 Estimate
7	TEMPORARY PEDESTRIAN WALKWAYS	5	19	29	27	80	FOOT	$65.00	$332	$1,217	$1,881	$1,770	$5,200	From 2011 Estimate
8	TEMPORARY PLASTIC DRUMS	8	29	45	43	125	EACH	$52.00	$415	$1,521	$2,351	$2,213	$6,500	From 2011 Estimate
9	TEMPORARY FLEXIBLE PAVEMENT MARKERS	64	234	362	340	1000	EACH	$3.00	$191	$702	$1,085	$1,021	$3,000	From 2011 Estimate
10	TEMPORARY STRIPING	606	2223	3436	3234	9500	FOOT	$0.65	$394	$1,445	$2,234	$2,102	$6,175	From 2011 Estimate
11	STRIPING & STRIPE REMOVAL MOBILIZATION	0	1	1	1	3	EACH	$425.00	$81	$298	$461	$434	$1,275	From 2011 Estimate
12	FLAGGERS	77	281	434	409	1200	HOUR	$48.50	$3,715	$13,621	$21,051	$19,813	$58,200	2 x 75 days x 8 hrs/day = 1200
13	SEDIMENT FENCE, UNSUPPORTED	303	1112	1718	1617	4750	FOOT	$2.50	$758	$2,779	$4,295	$4,043	$11,875	From 2011 Estimate
14	INLET PROTECTION	2	8	12	12	34.00	EACH	$88.00	$191	$700	$1,082	$1,019	$2,992	From 2011 Estimate
	SUBTOTAL TEMPORARY FEATURES AND APPURTANCES								$22,153	$118,778	$165,905	$164,353	$471,189	
	DEMOLITION AND PREPARATION													
15	REMOVAL OF STRUCTURES & OBSTRUCTIONS	3.0%	3.0%	3.0%	3.0%	3.0%	LS		$3,381	$20,728	$28,116	$28,283	$80,508	From 2011 Estimate
16	CLEARING AND GRUBBING	1.0%	1.0%	1.0%	1.0%	1.0%	LS		$1,127	$6,909	$9,372	$9,428	$26,836	From 2011 Estimate
17	TREE ROOT REMOVAL	3	9	14	14	40	HOUR	$178.00	$454	$1,666	$2,575	$2,424	$7,120	From 2011 Estimate
18	TREE TRIMMING	3	9	14	14	40	HOUR	$152.00	$388	$1,423	$2,199	$2,070	$6,080	From 2011 Estimate
19	GENERAL EXCAVATION (earthwork, cut or fill)	50	600	2,000	1,250	3,850	CUYD	$35.00	$1,750	$21,000	$70,000	$43,750	$136,500	includes cut/fill at edges of ex. road
20	12 INCH SUBGRADE STABILIZATION	200	733	1,133	1,067	2,933	SQYD	$21.90	$4,380	$16,060	$24,820	$23,360	$68,620	assumed under 25% of widened road
21	SUBGRADE GEOTEXTILE	200	733	1,133	1,067	2,933	SQYD	$1.25	$251	$920	$1,421	$1,338	$3,929	assumed under 25% of widened road
22	VIDEO INSPECTION OF SEWERS, MAINLINE	0	1,469	1,796	1,566	4,831	FOOT	$3.30	$0	$4,848	$5,927	$5,168	$15,942	for all 10" & 12" storm pipe
23	POTHOLE EXCAVATION	0	2	2	2	6	EACH	$548.00	$210	$1,096	$1,096	$1,096	$3,498	assumed needed at crossing with water main
24	COLD PLANE PAVEMENT REMOVAL, 2 INCH DEEP						SQYD	$3.42	$0	$0	$0	$0	$0	not included in this concept
25	TREE REMOVAL, 12-INCH		7	13	8	28	EACH	$690.00	$0	$4,830	$8,970	$5,520	$19,320	smaller tree removal not included
	SUBTOTAL SURFACE IMPROVEMENTS - DEMOLITION AND PREPARATION								$11,941	$79,480	$154,496	$122,436	$368,353	
	SURFACE IMPROVEMENTS													
26	RETAINING WALL, CAST-IN-PLACE CONCRETE	171	893	3,251	586	4,901	SQFT	$70.00	$11,970	$62,475	$227,570	$41,020	$343,035	heights vary 2' to 7'
27	LEVEL 3, 1/2 INCH DENSE, MWMAC MIXTURE (FULL DEPTH)	44	200	211	177	632	TON	$89.50	$3,893	$17,941	$18,867	$15,843	$56,545	only on widened edges
28	LEVEL 3, 1/2 INCH DENSE, MWMAC MIXTURE (2" INLAY)					0	TON	$89.50	$0	$0	$0	$0	$0	not included in this concept
70	AGGREGATE BASE		482	298	280		TON	$36.90	$0	$17,769	$10,978	$10,332	$39,079	only on widened edges
28	EXTRA FOR ASPHALT APPROACHES		5	10	20	35	EACH	$651.00	$0	$3,255	$6,510	$13,020	$22,785	From 2011 Estimate
29	CONCRETE CURBS, CURB AND GUTTER		1,030	1,506	1,730	4,266	FOOT	$25.50	$0	$26,265	$38,403	$44,115	$108,783	along all storm facilities
30	CONCRETE CURBS, THICKENED CURB AND GUTTER		99	139	127	365	FOOT	$37.70	$0	$3,732	$5,240	$4,788	$13,761	all edges except storm facilities
31	CONCRETE DRIVEWAYS	0	2,710	540	4,842	8,092	SQFT	$8.40	$0	$22,764	$4,536	$40,673	$67,973	
32	CONCRETE WALKS	0	0	0	0	0	SQFT	$7.40	$0	$0	$0	$0	$0	
33	MONOLITHIC CURB AND SIDEWALKS	2,016				2,016	SQFT	$11.50	$23,184	$0	$0	$0	$23,184	
36	CONCRETE SIDEWALK RAMPS	6	4	10	8	28	EACH	$1,930.00	$11,580	$7,720	$19,300	$15,440	$54,040	assumes 1 strip each side
37	DETECTABLE WARNING SURFACE	48	32	80	64	224	SQFT	$42.30	$2,030	$1,354	$3,384	$2,707	$9,475	estimate based on half 2011
38	PERVIOUS CONCRETE PATHWAY	1,990	11,908	19,788	16,432	50,118	SQFT	$9.00	$17,910	$107,172	$178,092	$147,888	$451,062	From 2011 Estimate
39	THERMOPLASTIC, NON-PROFILE, 120 MILS, EXTRUDED	300	1,100	1,700	1,600	4,700	FOOT	$1.40	$420	$1,540	$2,380	$2,240	$6,580	From 2011 Estimate
39b	COLOR CONCRETE - HALF OF MULTI-USE PATH FOR BIKES	995	5,954	9,894	8,216	25,059	SQFT	$5.00	$4,975	$29,770	$49,470	$41,080	$125,295	Per City comments
40	PAVEMENT LEGEND, TYPE B: BICYCLE LANE SYMBOLS	2	5	7	11	25	EACH	$286.00	$572	$1,430	$2,002	$3,146	$7,150	Per City comments
40	PAVEMENT BAR, TYPE A	17	63	98	92	270	SQFT	$4.50	$78	$284	$439	$414	$1,215	From 2011 Estimate
41	REMOVE & REINSTALL EXISTING SIGNS	2	7	11	10	30	EACH	$167.00	$320	$1,173	$1,812	$1,706	$5,010	From 2011 Estimate
42	TYPE "G" SIGNS IN PLACE	1	4	7	6	18	SQFT	$39.60	$45	$167	$258	$243	$713	From 2011 Estimate
43	TYPE "W1" SIGNS IN PLACE	3	11	17	16	48	SQFT	$19.00	$58	$213	$330	$310	$912	From 2011 Estimate
44	TYPE "W2" SIGNS IN PLACE	2	6	9	8	24	SQFT	$19.90	$30	$112	$173	$163	$478	From 2011 Estimate
45	PERMANENT SEEDING	0	0	1	1	2	ACRE	$2,480.00	$317	$1,161	$1,794	$1,689	$4,960	From 2011 Estimate
46	TOPSOIL	4	14	22	20	60	CUYD	$43.60	$167	$612	$946	$891	$2,616	From 2011 Estimate
47	SOIL CONDITIONER	2	7	11	10	30	CUYD	$35.20	$67	$247	$382	$359	$1,056	From 2011 Estimate
48	DECIDUOUS TREES, 2-1/2 INCH CALIPER	4	15	23	21	63	EACH	$822.00	$6,559	$24,048	$37,165	$34,979	$102,750	From 2011 Estimate
49	ADDITIONAL ESTABLISHMENT PERIOD	8	29	45	43	125	YEAR*	$264.00	$2,106	$7,723	$11,936	$11,234	$33,000	From 2011 Estimate
50	CL-4R CHAIN-LINK FENCE WITH VINYL CLAD FABRIC	57	211	326	306	900	FOOT	$27.80	$1,597	$5,856	$9,050	$8,517	$25,020	From 2011 Estimate
51	SINGLE MAILBOX SUPPORTS	1	4	5	5	15	EACH	$207.00	$198	$727	$1,123	$1,057	$3,105	From 2011 Estimate
52	MULTIPLE MAILBOX SUPPORTS	1	2	4	3	10	EACH	$339.00	$216	$793	$1,226	$1,154	$3,390	From 2011 Estimate
53	MAILBOX CONCRETE COLLARS	2	6	9	9	25	EACH	$66.00	$105	$386	$597	$562	$1,650	From 2011 Estimate
	SUBTOTAL SURFACE IMPROVEMENTS								$76,429	$284,215	$406,393	$404,549	$1,171,586	
	ANTICIPATED ITEMS													
54	RELOCATE WATER FACILITIES - FIRE HYDRANT		1	1		2	EACH	$20,000	$0	$20,000	$20,000	$0	$40,000	
55	RELOCATE WATER FACILITIES - METER	2	7	3	9	21	EACH	$6,000	$12,000	$42,000	$18,000	$54,000	$126,000	
56	NONSTORMWATER PLANTINGS AND PLANT ESTABLISHMENT	191	702	1,085	1,021	3,000	SQFT	$10.00	$1,915	$7,021	$10,851	$10,213	$30,000	From 2011 Estimate
	SUBTOTAL ANTICIPATED ITEMS								$13,915	$69,021	$48,851	$64,213	$196,000	

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4	TOTALS	UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	STORMWATER IMPROVEMENTS													
57	TRENCH EXCAVATION, COMMON		544	665	580	1,789	CUYD	$17	$0	$9,086	$11,109	$9,686	$29,881	
58	TRENCH BACKFILL, CLASS B		272	333	290	895	CUYD	$33	$0	$8,977	$10,976	$9,570	$29,523	
59	STORMWATER PLANTERS		517	658	621	1,796	SQFT	$50.00	$0	$25,850	$32,900	$31,050	$89,800	on west side
60	STORMWATER SWALES						SQFT	$35.00	$0	$0	$0	$0	$0	not included in this concept
61	GREEN STREET SEDIMENTATION FOREBAY		6	7	6	19	EACH	$600.00	$0	$3,600	$4,200	$3,600	$11,400	1 in each planter/swale, cost rough est.
62	STORMWATER PLANTINGS AND PLANT ESTABLISHMENT		517	658	621	1,796	SQFT	$15.00	$0	$7,755	$9,870	$9,315	$26,940	
63	6 INCH PERFORATED PIPE		99	139	127	365	FOOT	$17.00	$0	$1,683	$2,363	$2,159	$6,205	
64	10 INCH PIPE, PVC ASTM D3034 SDR35, BEDDING TYPE: D, COMPLETE		126	381	288		FOOT	$75	$0	$9,450	$28,575	$21,600	$59,625	5 to 7' deep
65	12 INCH PIPE, PVC ASTM D3034 SDR35, BEDDING TYPE: D, COMPLETE		1,343	1,415	1,278		FOOT	$65	$0	$87,295	$91,975	$83,070	$262,340	5 to 7' deep
66	CONCRETE MANHOLES, 48 INCH, 0-8 FT DEPTH		3	2	1		EACH	$4,100	$0	$12,300	$8,200	$4,100	$24,600	
67	CONCRETE MANHOLES, SEDIMENTATION		1	1	1		EACH	$5,610	$0	$5,610	$5,610	$5,610	$16,830	
68	CONCRETE INLETS, TYPE G-1		11	8	11		EACH	$1,940	$0	$21,340	$15,520	$21,340	$58,200	
69	MINOR ADJUSTMENT OF MANHOLES						EACH	$642.00	$0	$0	$0	$0	$0	
70	CONCRETE MANHOLES, FLOW CONTROL		1	1	1		EACH	$8,000	$0	$8,000	$8,000	$8,000	$24,000	
71	STORMWATER FILTER VAULT (CONTECH)	1					EACH	$8,000	$8,000	$0	$0	$0	$8,000	
72	TRENCH RESURFACING	0	0	0	196		SQYD	$79.60	$0	$0	$0	$15,602	$15,602	
73	STORMWATER OUTFALL			1			EACH	$1,000	$0	$0	$1,000	$0	$1,000	
74	STORMWATER LEVEL SPREADER		1				EACH	$2,000	$0	$2,000	$0	$0	$2,000	
75	STORMWATER DETENTION POND		1,671	2,771	3,707	8,149	SQFT	$30.00	$0	$50,130	$83,130	$111,210	$244,470	
76	GENERAL EXCAVATION (earthwork, for detention pond)		371	616	824	1,811	CUYD	$20.00	$0	$7,427	$12,316	$16,476	$36,218	6' deep for footprint of pond
77	IMPERMEABLE LINER FOR DETENTION						SQFT	$1.50	$0	$0	$0	$0	$0	not assumed needed for ponds
	SUBTOTAL STORMWATER IMPROVEMENTS								$8,000	$260,503	$325,743	$352,387	$946,633	

SCHEDULE SUMMARY				BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS
BID ITEMS				$118,523	$742,976	$1,052,537	$1,043,724	$2,957,760
CONSTRUCTION CONTINGENCY	5.0%	of Bid Items*		$5,926	$37,149	$52,627	$52,186	$147,888
SUBTOTAL				$124,449	$780,125	$1,105,164	$1,095,910	$3,105,648
ANTICIPATED ITEMS				$13,915	$69,021	$48,851	$64,213	$196,000
TOTAL CONSTRUCTION				$138,364	$849,146	$1,154,015	$1,160,123	$3,301,648
PROJECT MANAGEMENT	5.0%	of Bid Items		$5,926	$37,149	$52,627	$52,186	$147,888
DESIGN ENGINEERING	25.0%	of Bid Items		$29,631	$185,744	$263,134	$260,931	$739,440
CONSTRUCTION MANAGEMENT	15.0%	of Bid Items		$17,778	$111,446	$157,881	$156,559	$443,664
SUBTOTAL				$53,335	$334,339	$473,642	$469,676	$1,330,992
PROJECT ENGINEERING & MANAGEMENT OVERHEAD	80.0%	of PM, Eng, and CM		$42,668	$267,471	$378,914	$375,741	$1,064,794
TOTAL PROJECT ENGINEERING & MANAGEMENT				$96,003	$601,810	$852,556	$845,417	$2,395,786
RIGHT-OF-WAY CONTINGENCY	19.0%	Land, Improve, and Damages (of Bid Items)		$22,519	$141,165	$199,982	$198,308	$561,974
TOTAL PROJECT RIGHT-OF-WAY				$22,519	$141,165	$199,982	$198,308	$561,974
	Years	Inflation						
INFLATION RATE ON CONTRACT	1	4.5%	of Construction	$6,226	$38,212	$51,931	$52,206	$148,574
INFLATION RATE ON PERSONNEL	1	2.0%	of Eng & Mgmt	$1,920	$12,036	$17,051	$16,908	$47,916
ESTIMATE CONTINGENCY FOR UNDEFINED OR CHANGE IN SCOPE		25.0%	of Const, Eng & Mgmt, and Inflation	$60,628	$375,301	$518,888	$518,663	$1,473,481
TOTAL PROJECT CONTINGENCY				$68,774	$425,549	$587,870	$587,777	$1,669,971
TOTAL PROJECT ESTIMATE				$325,661	$2,017,671	$2,794,423	$2,791,625	$7,929,380

	PROPERTY ACQUISITIONS													
1	GARDEN HOME PROPERTY (8020 SW Capitol Hwy)				1		LS	$141,750	$0	$0	$0	$141,750	$141,750	9,937 SF @ $9.51 = $94,500.87 + 50%
2	PROPERTY ACQUISITION (3972 SW Dolph Ct)			1			LS	$312,450	$0	$0	$312,450	$0	$312,450	21,900 SF @ $9.51/SF = $208,269.00 + 50%
	SUBTOTAL PROPERTY ACQUISTIONS ITEMS								$0	$0	$312,450	$141,750	$454,200	
	OPERATIONS AND MAINTENANCE													
1	STORMWATER FILTER VAULT (CONTECH)	1				1	EA	$500.00	$500	$0	$0	$0	$500	Cleaned every year at $500 EA time
2	Vegetated Stormwater Facility maintainance (after 2-year establishment)	0	1034	1316	1242	3592	SF	$1.55	$0	$1,603	$2,040	$1,925	$5,568	$1.55/sf of facility area, per year
3	Flow Control MH Inspection & Cleaning	0	1	1	1	3	EA	$100	$0	$100	$100	$100	$300	Cleaned every 3 year at $300 EA time
4	Sedimentaion MH Insepction & Cleaning	0	1	1	1	3	EA	$100	$0	$100	$100	$100	$300	Cleaned every 3 year at $300 EA time
							1 Year Maintenance Total		$500	$1,803	$2,240	$2,125	**$6,668**	

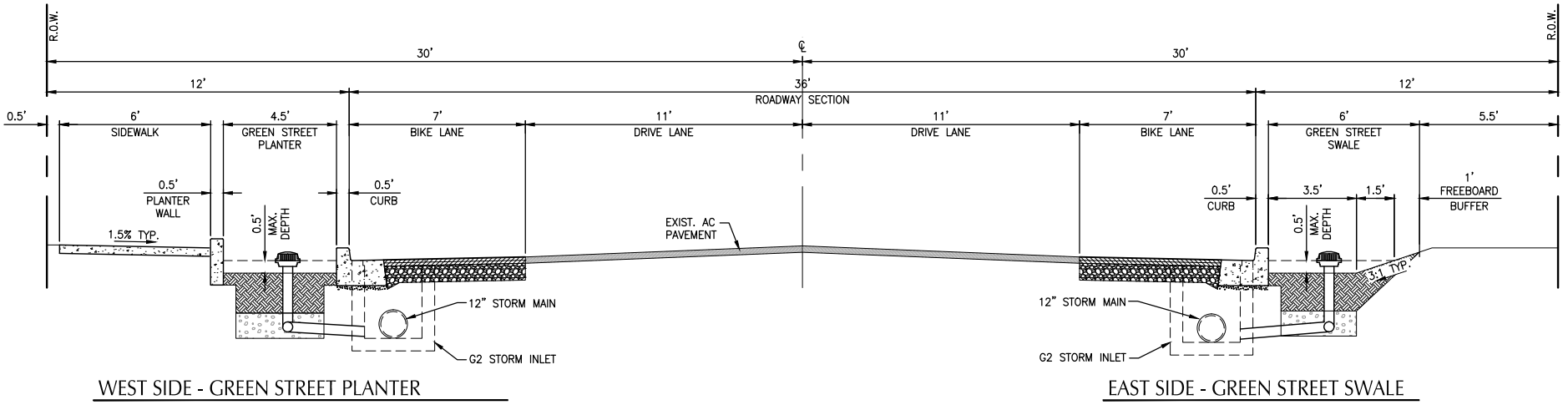
CONCEPT 4: DISPERSED TREATMENT, CENTRALIZED DETENTION WITH WEST SIDE MULTI-USE PATH
CENTRALIZED TREATMENT & DETENTION WITH EAST SIDE SEPARATED BIKE LANE

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4	TOTALS	UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	TEMPORARY FEATURES AND APPURTANCES													
1	MOBILIZATION	8.0%	8.0%	8.0%	8.0%	8%	LS		$10,972	$68,808	$99,436	$90,807	$270,023	8% of total
2	TEMPORARY PROTECTION & DIRECTION OF TRAFFIC	3.0%	3.0%	3.0%	3.0%	3%	LS		$4,114	$25,803	$37,288	$34,053	$101,259	3% of total
3	EROSION CONTROL	1.5%	1.5%	1.5%	1.5%	1.5%	LS		$2,057	$12,902	$18,644	$17,026	$50,629	1.5% of total
4	POLLUTION CONTROL PLAN	0.5%	0.5%	0.5%	0.5%	0.5%	LS		$686	$4,301	$6,215	$5,675	$16,876	0.5% of total
5	TEMPORARY SIGNS	38	140	217	204	600	SQFT	$20.00	$766	$2,809	$4,340	$4,085	$12,000	From 2011 Estimate
6	TEMPORARY BARRICADES, TYPE III	1	2	4	3	10	EACH	$115.00	$73	$269	$416	$391	$1,150	From 2011 Estimate
7	TEMPORARY PEDESTRIAN WALKWAYS	5	19	29	27	80	FOOT	$65.00	$332	$1,217	$1,881	$1,770	$5,200	From 2011 Estimate
8	TEMPORARY PLASTIC DRUMS	8	29	45	43	125	EACH	$52.00	$415	$1,521	$2,351	$2,213	$6,500	From 2011 Estimate
9	TEMPORARY FLEXIBLE PAVEMENT MARKERS	64	234	362	340	1000	EACH	$3.00	$191	$702	$1,085	$1,021	$3,000	From 2011 Estimate
10	TEMPORARY STRIPING	606	2223	3436	3234	9500	FOOT	$0.65	$394	$1,445	$2,234	$2,102	$6,175	From 2011 Estimate
11	STRIPING & STRIPE REMOVAL MOBILIZATION	0	1	1	1	3	EACH	$425.00	$81	$298	$461	$434	$1,275	From 2011 Estimate
12	FLAGGERS	77	281	434	409	1200	HOUR	$48.50	$3,715	$13,621	$21,051	$19,813	$58,200	2 x 75 days x 8 hrs/day = 1200
13	SEDIMENT FENCE, UNSUPPORTED	303	1112	1718	1617	4750	FOOT	$2.50	$758	$2,779	$4,295	$4,043	$11,875	From 2011 Estimate
14	INLET PROTECTION	2	8	12	12	34.00	EACH	$88.00	$191	$700	$1,082	$1,019	$2,992	From 2011 Estimate
	SUBTOTAL TEMPORARY FEATURES AND APPURTANCES								$24,746	$137,176	$200,780	$184,452	$547,154	
	DEMOLITION AND PREPARATION													
15	REMOVAL OF STRUCTURES & OBSTRUCTIONS	3.0%	3.0%	3.0%	3.0%	3.0%	LS		$3,956	$24,811	$35,854	$32,743	$97,364	From 2011 Estimate
16	CLEARING AND GRUBBING	1.0%	1.0%	1.0%	1.0%	1.0%	LS		$1,319	$8,270	$11,951	$10,914	$32,455	From 2011 Estimate
17	TREE ROOT REMOVAL	3	9	14	14	40	HOUR	$178.00	$454	$1,666	$2,575	$2,424	$7,120	From 2011 Estimate
18	TREE TRIMMING	3	9	14	14	40	HOUR	$152.00	$388	$1,423	$2,199	$2,070	$6,080	From 2011 Estimate
19	GENERAL EXCAVATION (earthwork, cut or fill)	50	600	2,000	1,250	3,850	CUYD	$35.00	$1,750	$21,000	$70,000	$43,750	$136,500	includes cut/fill at edges of ex. road
20	12 INCH SUBGRADE STABILIZATION	200	733	1,133	1,067	2,933	SQYD	$21.90	$4,380	$16,060	$24,820	$23,360	$68,620	assumed under 25% of widened road
21	SUBGRADE GEOTEXTILE	200	733	1,133	1,067	2,933	SQYD	$1.25	$251	$920	$1,421	$1,338	$3,929	assumed under 25% of widened road
22	VIDEO INSPECTION OF SEWERS, MAINLINE	0	1,486	1,585	1,556	4,627	FOOT	$3.30	$0	$4,904	$5,231	$5,135	$15,269	for all 10" & 12" storm pipe
23	POTHOLE EXCAVATION	1	3	8	8	19	EACH	$548.00	$548	$1,644	$4,384	$4,384	$10,960	assumed needed at crossing with water main
24	COLD PLANE PAVEMENT REMOVAL, 2 INCH DEEP		1,556	3,306	3,111	7,972	SQYD	$3.42	$0	$5,320	$11,305	$10,640	$27,265	Grind top 2" for remaining 17.5' width of road
25	TREE REMOVAL, 12-INCH		7	13	8	28	EACH	$690.00	$0	$4,830	$8,970	$5,520	$19,320	smaller tree removal not included
	SUBTOTAL SURFACE IMPROVEMENTS - DEMOLITION AND PREPARATION								$13,046	$90,848	$178,711	$142,277	$424,882	
	SURFACE IMPROVEMENTS													
26	RETAINING WALL, CAST-IN-PLACE CONCRETE	171	893	3,251	510	4,825	SQFT	$70.00	$11,970	$62,475	$227,570	$35,700	$337,715	heights vary 2' to 7'
27	LEVEL 3, 1/2 INCH DENSE, MWMAC MIXTURE (FULL DEPTH)	97	475	584	549	1,705	TON	$89.50	$8,643	$42,549	$52,239	$49,154	$152,585	only on widened edges
28	LEVEL 3, 1/2 INCH DENSE, MWMAC MIXTURE (2" INLAY)		169	359	338	867	TON	$89.50	$0	$15,140	$32,173	$30,281	$77,595	Inlay for remaining 17.5' width of road
70	AGGREGATE BASE	146	1,244	1,558	1,466		TON	$36.90	$5,381	$45,904	$57,487	$54,084	$162,856	only on widened edges
28	EXTRA FOR ASPHALT APPROACHES		15	13	25	53	EACH	$651.00	$0	$9,765	$8,463	$16,275	$34,503	at each driveway location
29	CONCRETE CURBS, CURB AND GUTTER	288	1,797	3,423	3,039	8,547	FOOT	$25.50	$7,344	$45,824	$87,287	$77,495	$217,949	along all storm facilities
30	CONCRETE CURBS, THICKENED CURB AND GUTTER		169	73	127	369	FOOT	$37.70	$0	$6,371	$2,752	$4,788	$13,911	all edges except storm facilities
31	CONCRETE DRIVEWAYS	0	2,194	1,640	3,435	7,269	SQFT	$8.40	$0	$18,430	$13,776	$28,854	$61,060	
32	CONCRETE WALKS	0	0	0	0	0	SQFT	$7.40	$0	$0	$0	$0	$0	
33	MONOLITHIC CURB AND SIDEWALKS	2,016	0	0	0	2,016	SQFT	$11.50	$23,184	$0	$0	$0	$23,184	
36	CONCRETE SIDEWALK RAMPS	5	6	11	10	32	EACH	$1,930.00	$9,650	$11,580	$21,230	$19,300	$61,760	assumes 1 strip each side
37	DETECTABLE WARNING SURFACE	40	48	88	80	256	SQFT	$42.30	$1,692	$2,030	$3,722	$3,384	$10,829	estimate based on half 2011
38	PERVIOUS CONCRETE PATHWAY	1,990	11,908	19,790	16,431	50,119	SQFT	$9.00	$17,910	$107,172	$178,110	$147,879	$451,071	From 2011 Estimate
39	THERMOPLASTIC, NON-PROFILE, 120 MILS, EXTRUDED	800	1,100	1,700	1,600	5,200	FOOT	$1.40	$1,120	$1,540	$2,380	$2,240	$7,280	Double Yellow Centerline of Road
39b	COLOR CONCRETE - HALF OF MULTI-USE PATH FOR BIKES	995	5,954	9,895	8,216	25,060	SQFT	$5.00	$4,975	$29,770	$49,475	$41,078	$125,298	Per City comments
39c	BIKE LANE BUFFER - TRAFFIC SEPARATOR	239	342	1,299	1,093	2,974	SQFT	$11.00	$2,633	$3,760	$14,294	$12,026	$32,713	Added with Concept 4 - ODOT Std RD706
39d	BIKE LANE BUFFER - LONGITUDINAL STRIPING	250	2,200	3,400	3,200	9,050	FOOT	$1.20	$300	$2,640	$4,080	$3,840	$10,860	2 stripes parallel Traffic Separator
40	PAVEMENT LEGEND, TYPE B: BICYCLE LANE SYMBOLS	2	5	7	11	25	EACH	$286.00	$572	$1,430	$2,002	$3,146	$7,150	Per City comments
40	PAVEMENT BAR, TYPE A	17	63	98	92	270	SQFT	$4.50	$78	$284	$439	$414	$1,215	From 2011 Estimate
41	REMOVE & REINSTALL EXISTING SIGNS	2	7	11	10	30	EACH	$167.00	$320	$1,173	$1,812	$1,706	$5,010	From 2011 Estimate
42	TYPE "G" SIGNS IN PLACE	1	4	7	6	18	SQFT	$39.60	$45	$167	$258	$243	$713	From 2011 Estimate
43	TYPE "W1" SIGNS IN PLACE	3	11	17	16	48	SQFT	$19.00	$58	$213	$330	$310	$912	From 2011 Estimate
44	TYPE "W2" SIGNS IN PLACE	2	6	9	8	24	SQFT	$19.90	$30	$112	$173	$163	$478	From 2011 Estimate
45	PERMANENT SEEDING	0	0	1	1	2	ACRE	$2,480.00	$317	$1,161	$1,794	$1,689	$4,960	From 2011 Estimate
46	TOPSOIL	4	14	22	20	60	CUYD	$43.60	$167	$612	$946	$891	$2,616	From 2011 Estimate
47	SOIL CONDITIONER	2	7	11	10	30	CUYD	$35.20	$67	$247	$382	$359	$1,056	From 2011 Estimate
48	DECIDUOUS TREES, 2-1/2 INCH CALIPER	4	15	23	21	63	EACH	$822.00	$6,559	$24,048	$37,165	$34,979	$102,750	From 2011 Estimate
49	ADDITIONAL ESTABLISHMENT PERIOD	8	29	45	43	125	YEAR*	$264.00	$2,106	$7,723	$11,936	$11,234	$33,000	From 2011 Estimate
50	CL-4R CHAIN-LINK FENCE WITH VINYL CLAD FABRIC	57	211	326	306	900	FOOT	$27.80	$1,597	$5,856	$9,050	$8,517	$25,020	From 2011 Estimate
51	SINGLE MAILBOX SUPPORTS	1	4	5	5	15	EACH	$207.00	$198	$727	$1,123	$1,057	$3,105	From 2011 Estimate
52	MULTIPLE MAILBOX SUPPORTS	1	2	4	3	10	EACH	$339.00	$216	$793	$1,226	$1,154	$3,390	From 2011 Estimate
53	MAILBOX CONCRETE COLLARS	2	6	9	9	25	EACH	$66.00	$105	$386	$597	$562	$1,650	From 2011 Estimate
	SUBTOTAL SURFACE IMPROVEMENTS								$95,269	$387,408	$596,701	$557,099	$1,636,477	
	ANTICIPATED ITEMS													
54	RELOCATE WATER FACILITIES - FIRE HYDRANT		1	1		2	EACH	$20,000	$0	$20,000	$20,000	$0	$40,000	
55	RELOCATE WATER FACILITIES - METER	2	7	3	9	21	EACH	$6,000	$12,000	$42,000	$18,000	$54,000	$126,000	
56	NONSTORMWATER PLANTINGS AND PLANT ESTABLISHMENT	191	702	1,085	1,021	3,000	SQFT	$10.00	$1,915	$7,021	$10,851	$10,213	$30,000	From 2011 Estimate
	SUBTOTAL ANTICIPATED ITEMS								$13,915	$69,021	$48,851	$64,213	$196,000	

No.	ITEM	BASIN 1	BASIN 2	BASIN 3	BASIN 4	TOTALS	UNIT	UNIT COST	BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS	REMARKS
	STORMWATER IMPROVEMENTS													
57	TRENCH EXCAVATION, COMMON		550	587	576	1,714	CUYD	$17	$0	$9,191	$9,804	$9,624	$28,619	
58	TRENCH BACKFILL, CLASS B		275	294	288	857	CUYD	$33	$0	$9,081	$9,686	$9,509	$28,276	
59	STORMWATER PLANTERS		517	656	622	1,795	SQFT	$50.00	$0	$25,850	$32,800	$31,100	$89,750	on west side
60	STORMWATER SWALES						SQFT	$35.00	$0	$0	$0	$0	$0	not included in this concept
61	GREEN STREET SEDIMENTATION FOREBAY		6	7	6	19	EACH	$600.00	$0	$3,600	$4,200	$3,600	$11,400	1 in each planter/swale, cost rough est.
62	STORMWATER PLANTINGS AND PLANT ESTABLISHMENT		517	656	622	1,795	SQFT	$15.00	$0	$7,755	$9,840	$9,330	$26,925	
63	6 INCH PERFORATED PIPE		169	73	127	369	FOOT	$17.00	$0	$2,873	$1,241	$2,159	$6,273	
64	10 INCH PIPE, PVC ASTM D3034 SDR35, BEDDING TYPE: D, COMPLETE		142	191	118	451	FOOT	$75	$0	$10,650	$14,325	$8,850	$33,825	5 to 7' deep
65	12 INCH PIPE, PVC ASTM D3034 SDR35, BEDDING TYPE: D, COMPLETE		1,344	1,394	1,438	4,176	FOOT	$65	$0	$87,360	$90,610	$93,470	$271,440	5 to 7' deep
66	CONCRETE MANHOLES, 48 INCH, 0-8 FT DEPTH		3	7	5	15	EACH	$4,100	$0	$12,300	$28,700	$20,500	$61,500	
67	CONCRETE MANHOLES, SEDIMENTATION		1	1	1	3	EACH	$5,610	$0	$5,610	$5,610	$5,610	$16,830	
68	CONCRETE INLETS, TYPE G-1		13	16	14	43	EACH	$1,940	$0	$25,220	$31,040	$27,160	$83,420	
69	MINOR ADJUSTMENT OF MANHOLES						EACH	$642.00	$0	$0	$0	$0	$0	
70	CONCRETE MANHOLES, FLOW CONTROL		1	1	1	3	EACH	$8,000	$0	$8,000	$8,000	$8,000	$24,000	
71	STORMWATER FILTER VAULT (CONTECH)	1					EACH	$8,000	$8,000	$0	$0	$0	$8,000	
72	TRENCH RESURFACING	0	111	97	50	258	SQYD	$79.60	$0	$8,844	$7,739	$3,980	$20,563	At new SD pipe locations in ex asph
73	STORMWATER OUTFALL			1		1	EACH	$1,000	$0	$0	$1,000	$0	$1,000	
74	STORMWATER LEVEL SPREADER		1			1	EACH	$2,000	$0	$2,000	$0	$0	$2,000	
75	STORMWATER DETENTION POND		2,007	3,626	2,953	8,586	SQFT	$30.00	$0	$60,210	$108,780	$88,590	$257,580	
76	GENERAL EXCAVATION (earthwork, for detention pond)		446	806	656	1,908	CUYD	$20.00	$0	$8,920	$16,116	$13,124	$38,160	6' deep for footprint of pond
77	IMPERMEABLE LINER FOR DETENTION						SQFT	$1.50	$0	$0	$0	$0	$0	not assumed needed for ponds
	SUBTOTAL STORMWATER IMPROVEMENTS								$8,000	$287,465	$379,490	$334,606	$1,009,561	

SCHEDULE SUMMARY				BASIN 1 COST	BASIN 2 COST	BASIN 3 COST	BASIN 4 COST	TOTAL COSTS
BID ITEMS				$141,061	$902,896	$1,355,681	$1,218,435	$3,618,074
CONSTRUCTION CONTINGENCY	5.0%	of Bid Items*		$7,053	$45,145	$67,784	$60,922	$180,904
SUBTOTAL				$148,114	$948,041	$1,423,465	$1,279,357	$3,798,978
ANTICIPATED ITEMS				$13,915	$69,021	$48,851	$64,213	$196,000
TOTAL CONSTRUCTION				$162,029	$1,017,062	$1,472,317	$1,343,570	$3,994,978
PROJECT MANAGEMENT	5.0%	of Bid Items		$7,053	$45,145	$67,784	$60,922	$180,904
DESIGN ENGINEERING	25.0%	of Bid Items		$35,265	$225,724	$338,920	$304,609	$904,518
CONSTRUCTION MANAGEMENT	15.0%	of Bid Items		$21,159	$135,434	$203,352	$182,765	$542,711
SUBTOTAL				$63,477	$406,303	$610,056	$548,296	$1,628,133
PROJECT ENGINEERING & MANAGEMENT OVERHEAD	80.0%	of PM, Eng, and CM		$50,782	$325,042	$488,045	$438,637	$1,302,506
TOTAL PROJECT ENGINEERING & MANAGEMENT				$114,259	$731,345	$1,098,101	$986,933	$2,930,639
RIGHT-OF-WAY CONTINGENCY	19.0%	Land, Improve, and Damages (of Bid Items)		$26,802	$171,550	$257,579	$231,503	$687,434
TOTAL PROJECT RIGHT-OF-WAY				$26,802	$171,550	$257,579	$231,503	$687,434
	Years	Inflation						
INFLATION RATE ON CONTRACT	1	4.5%	of Construction	$7,291	$45,768	$66,254	$60,461	$179,774
INFLATION RATE ON PERSONNEL	1	2.0%	of Eng & Mgmt	$2,285	$14,627	$21,962	$19,739	$58,613
ESTIMATE CONTINGENCY FOR UNDEFINED OR CHANGE IN SCOPE		25.0%	of Const, Eng & Mgmt, and Inflation	$71,466	$452,201	$664,658	$602,676	$1,791,001
TOTAL PROJECT CONTINGENCY				$81,042	$512,596	$752,874	$682,876	$2,029,388
TOTAL PROJECT ESTIMATE				$384,132	$2,432,553	$3,580,871	$3,244,881	$9,642,439

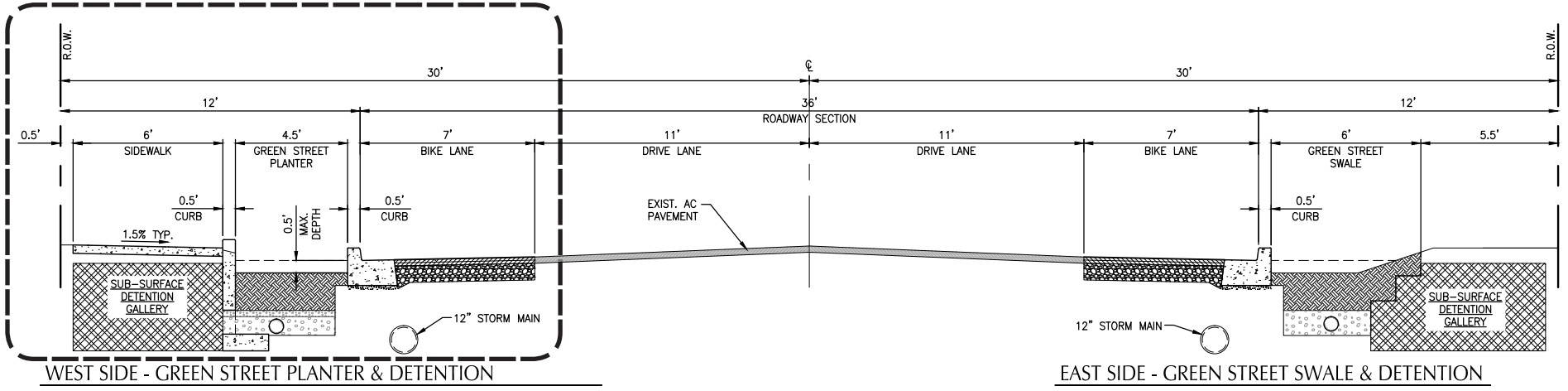
	PROPERTY ACQUISITIONS													
1	GARDEN HOME PROPERTY (8020 SW Capitol Hwy)				1		LS	$141,750	$0	$0	$0	$141,750	$141,750	9,937 SF @ $9.51 = $94,500.87 + 50%
2	PROPERTY ACQUISITION (3972 SW Dolph Ct)			1			LS	$312,450	$0	$0	$312,450	$0	$312,450	21,900 SF @ $9.51/SF = $208,269.00 + 50%
	SUBTOTAL PROPERTY ACQUISTIONS ITEMS								$0	$0	$312,450	$141,750	$454,200	
	OPERATIONS AND MAINTENANCE													
1	STORMWATER FILTER VAULT (CONTECH)	1				1	EA	$500.00	$500	$0	$0	$0	$500	Cleaned every year at $500 EA time
2	Vegetated Stormwater Facility maintainance (after 2-year establishment)	0	1034	1312	1244	3590	SF	$1.55	$0	$1,603	$2,034	$1,928	$5,565	$1.55/sf of facility area, per year
3	Flow Control MH Inspection & Cleaning	0	1	1	1	3	EA	$100	$0	$100	$100	$100	$300	Cleaned every 3 year at $300 EA time
4	Sedimentaion MH Insepction & Cleaning	0	1	1	1	3	EA	$100	$0	$100	$100	$100	$300	Cleaned every 3 year at $300 EA time
							1 Year Maintenance Total		$500	$1,803	$2,234	$2,128	**$6,665**	



1A CONCEPT#1 TYPICAL CROSS-SECTION AT POLLUTION REDUCTION FACILITIES

SCALE: NTS

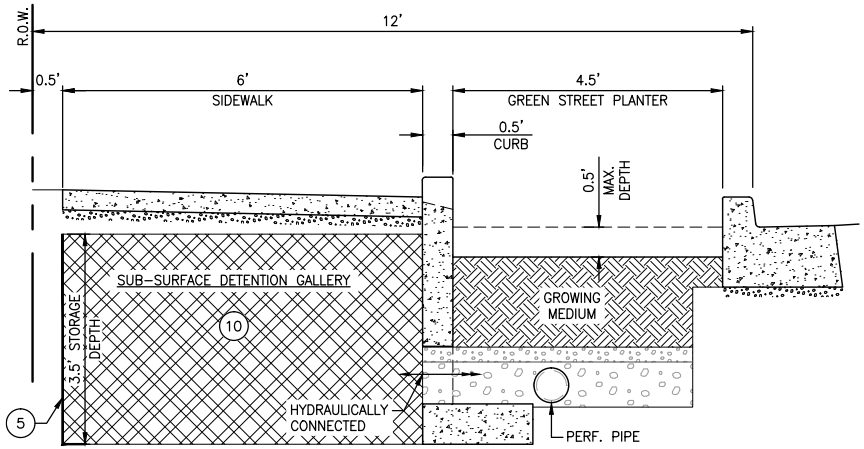
Refer to Detail Enlargement 1 & 2 on page 75



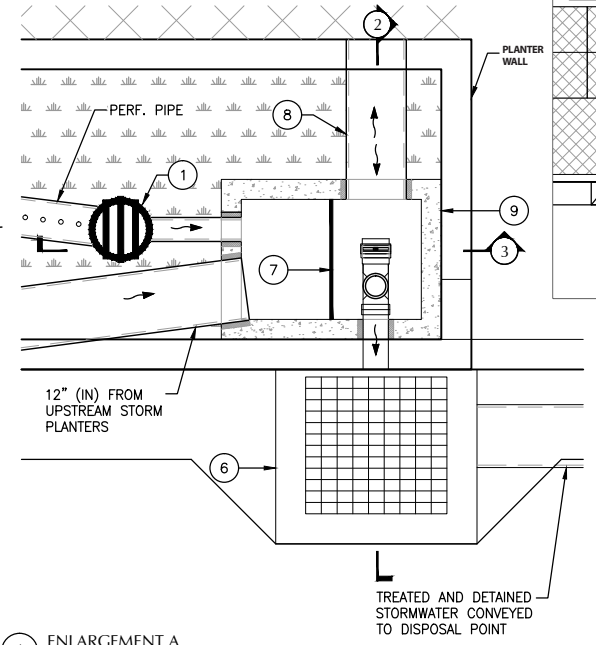
1B CONCEPT#1 TYPICAL CROSS-SECTION AT POLLUTION REDUCTION & DETENTION FACILITIES

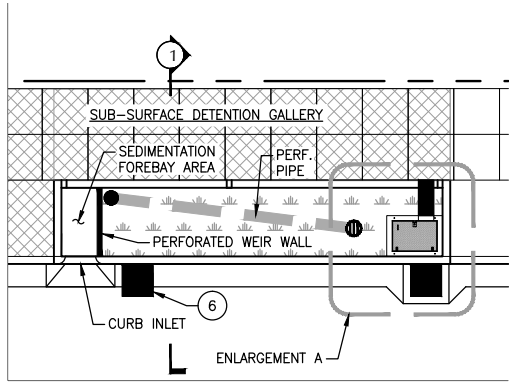
SCALE: NTS

CONCEPT 1 TYPICAL SECTIONS: DE-CENTRALIZED POLLUTION REDUCTION AND DETENTION



1 PLANTER WITH DETENTION UNDER SIDEWALK
TYP. CROSS-SECTION
SCALE: NTS





WEST SIDE - GREEN STREET DETENTION PLANTER
SCALE: 1" = 4'

A ENLARGEMENT A
SCALE: NTS

ⓧ KEY NOTES

1 OVERFLOW INLET WITH ATRIUM GRATE.

2 USE ⅜" S.S. ROD FOR PULL ROD TO OPEN AND CLOSE KNIFE GATE VALVE.

3 HINGED VAULT HATCH.

4 KNIFE GATE VALVE BY VALTERRA WITH STAINLESS PADDLE OR APPROVED EQUAL.

5 30 MIL IMPERMEABLE LINER

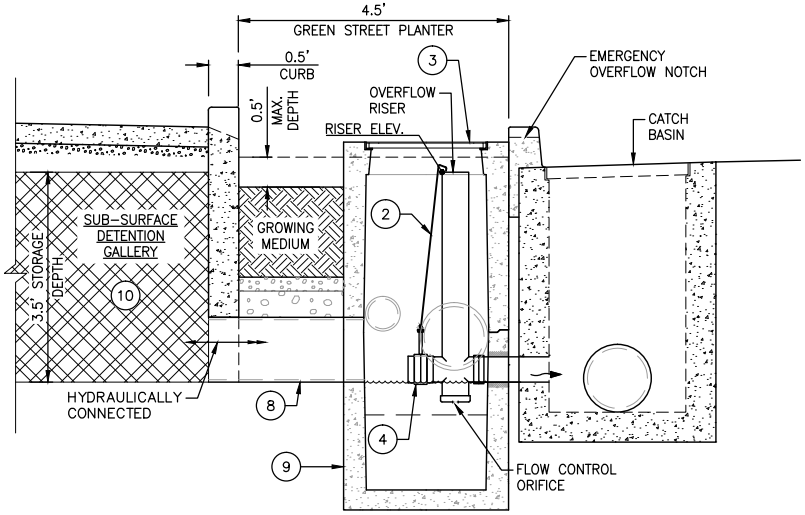
6 CONCRETE INLET TYPE G–2

7 SEDIMENT TRAP PLATE

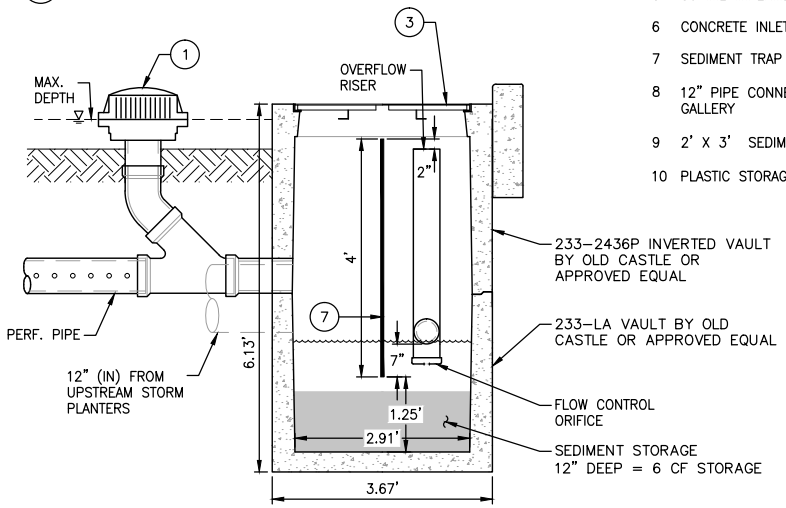
8 12" PIPE CONNECTED TO SUB–SURFACE DETENTION GALLERY

9 2' X 3' SEDIMENT TRAP & FLOW CONTROL VAULT

10 PLASTIC STORAGE CHAMBERS (95 TO 97% VOIDS)



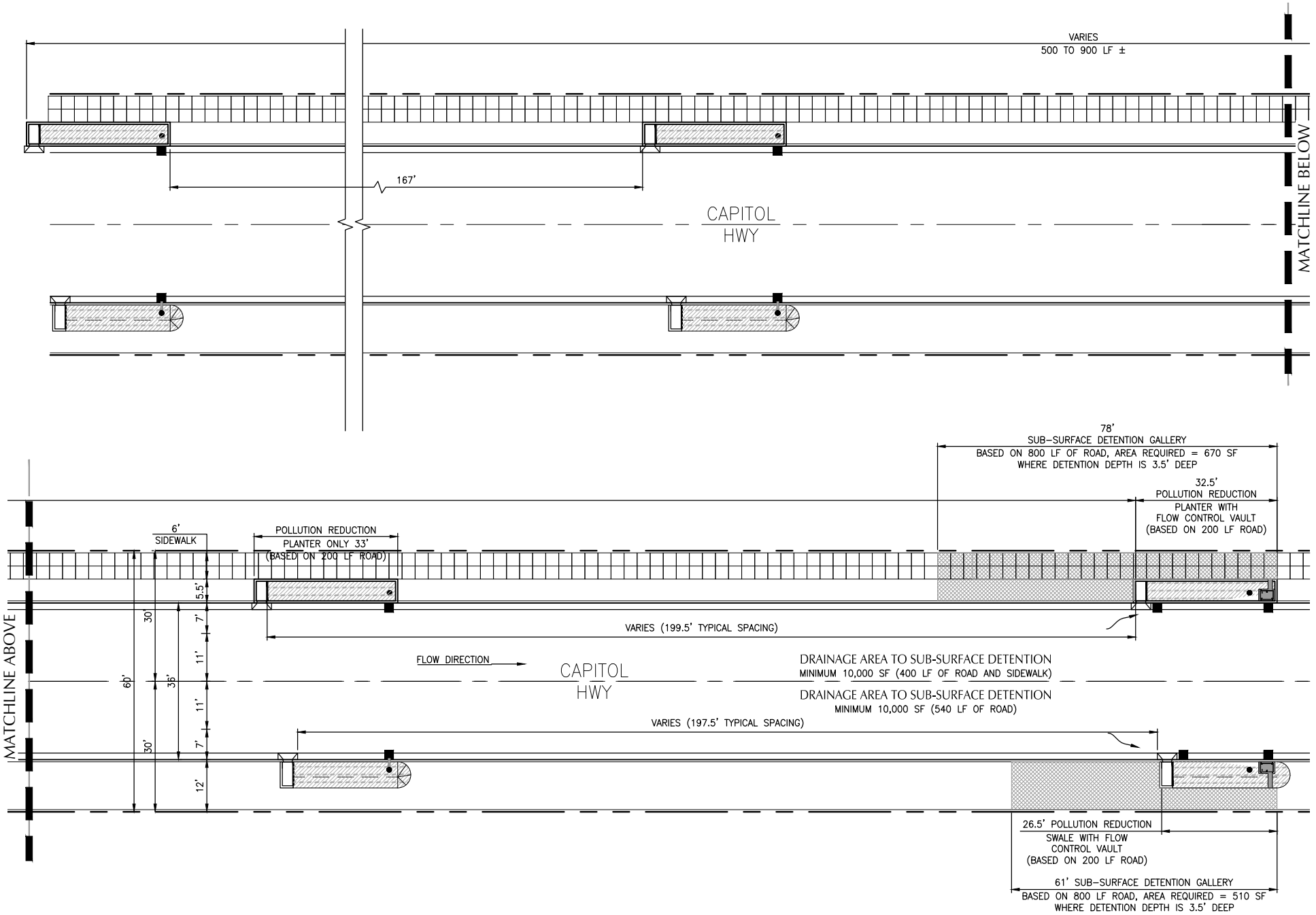
2 PLANTER WITH DETENTION UNDER SIDEWALK
TYP. CROSS-SECTION
SCALE: NTS



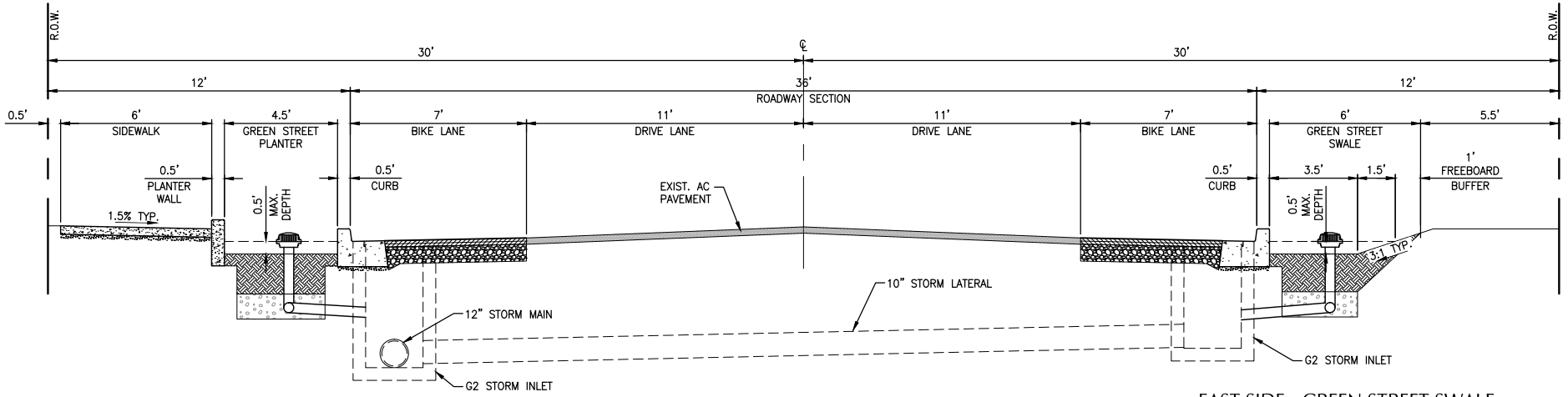
3 SECTION THROUGH FLOW-CONTROL VAULT
SCALE: NTS

CONCEPT 1: DE-CENTRALIZED POLLUTION REDUCTION AND DETENTION DETAILS

APPENDIX C: PRELIMINARY ENGINEERING DETAILS

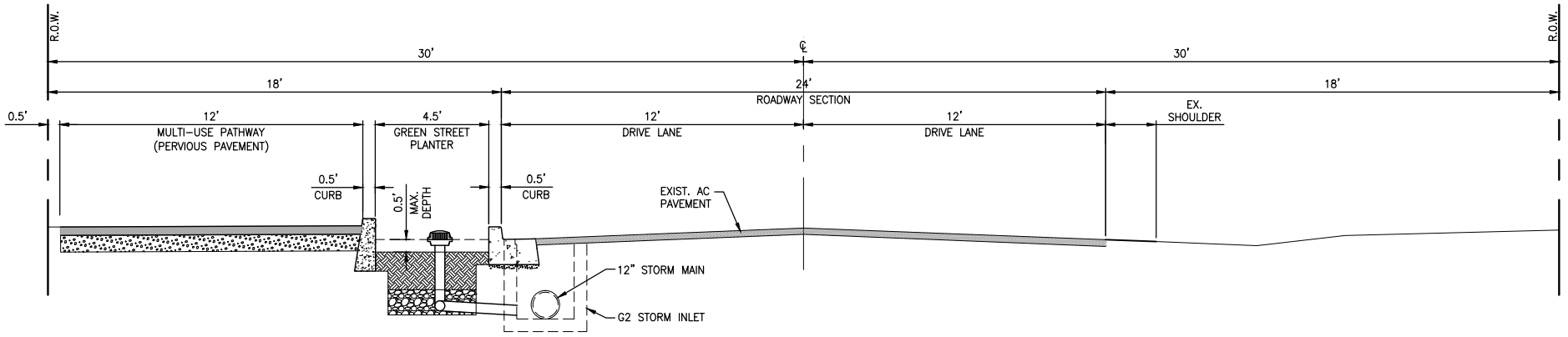


CONCEPT 1: DE-CENTRALIZED
TYPICAL STREET CONFIGURATION



2 CONCEPT #2 TYPICAL CROSS-SECTION AT POLLUTION REDUCTION FACILITIES

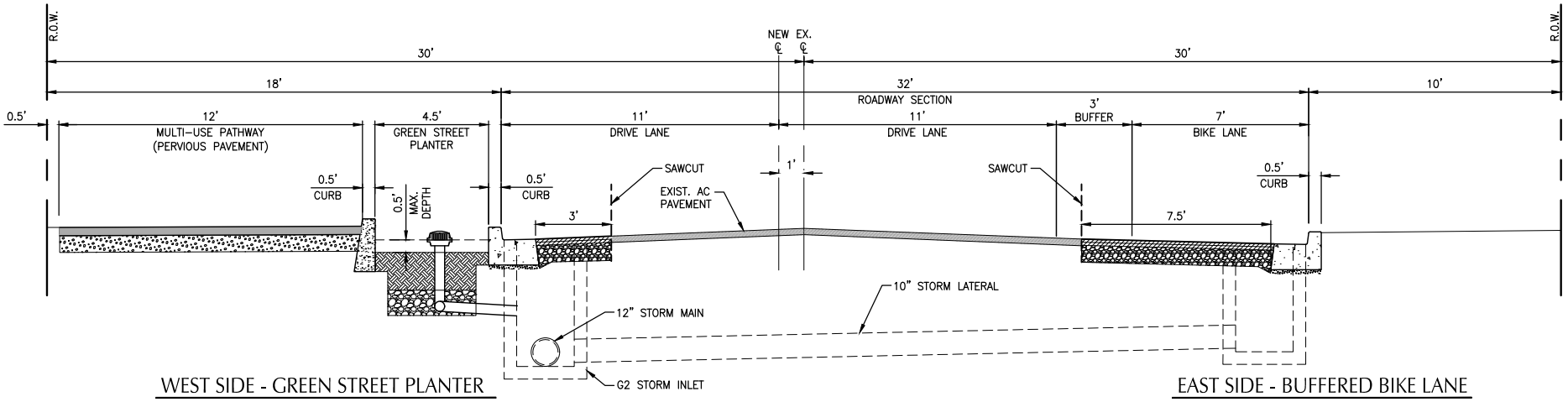
SCALE: NTS



3 CONCEPT #3 TYPICAL CROSS-SECTION AT POLLUTION REDUCTION FACILITIES

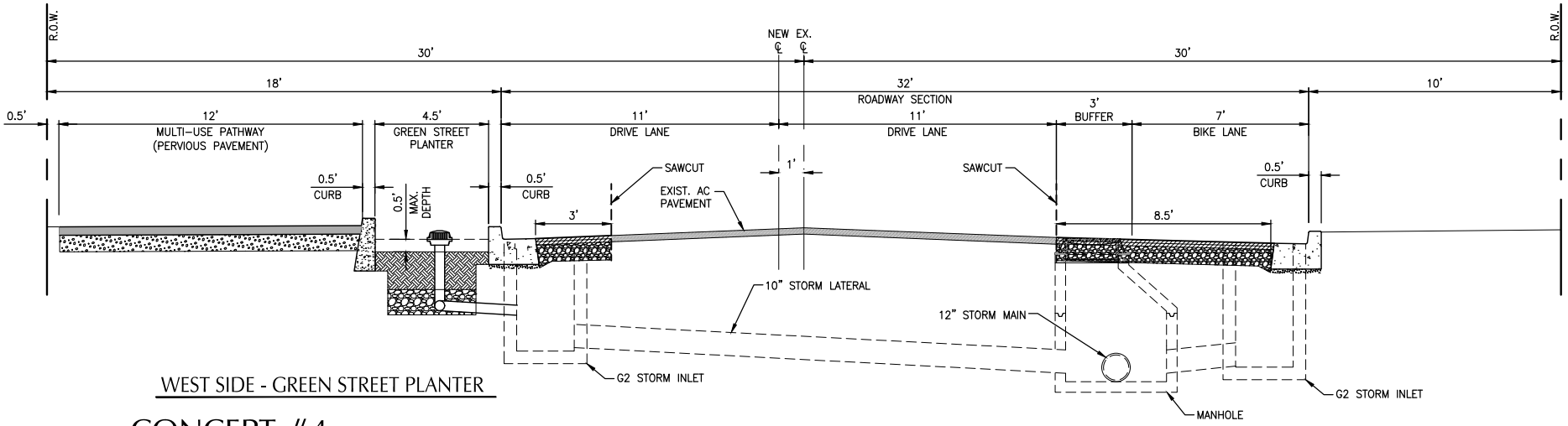
SCALE: NTS

CONCEPT 2 & 3 TYPICAL SECTIONS: DE-CENTRALIZED POLLUTION REDUCTION AND CENTRALIZED DETENTION



4 CONCEPT #4
TYPICAL CROSS-SECTION WITH STORM MAIN ON WEST SIDE

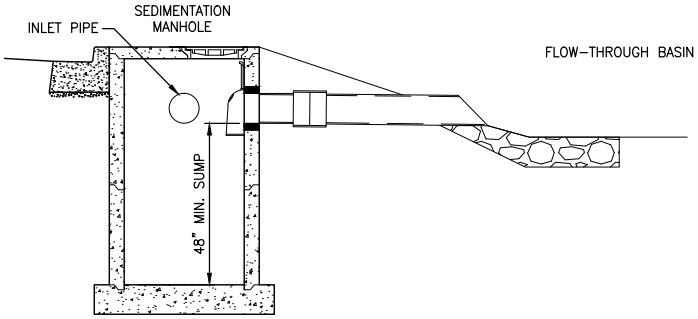
SCALE: NTS



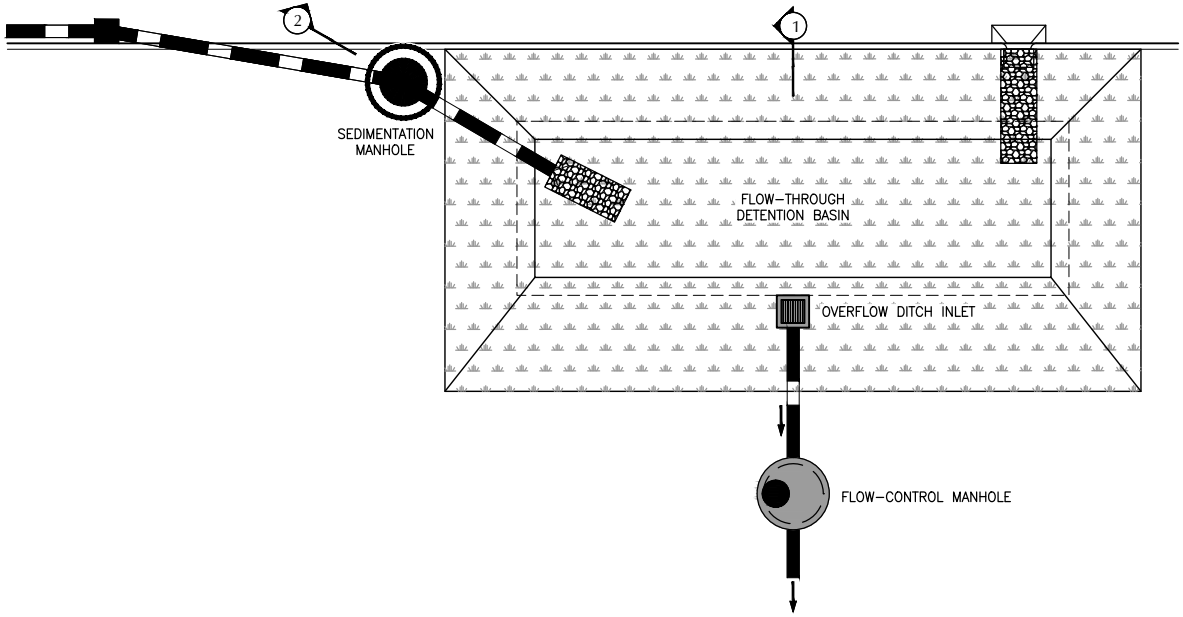
4 CONCEPT #4
TYPICAL CROSS-SECTION WITH STORM MAIN ON EAST SIDE

SCALE: NTS

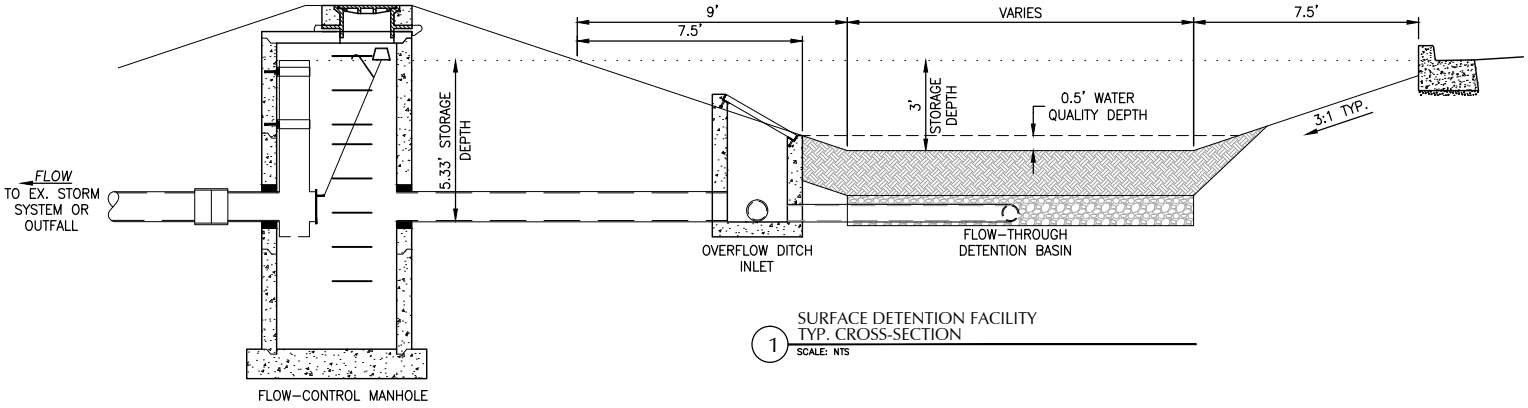
CONCEPT 4 TYPICAL SECTIONS: DISPERSED TREATMENT, CENTRALIZED DETENTIONI WEST SIDE
CENTRALIZED TREATMENT & DETENTION EAST SIDE



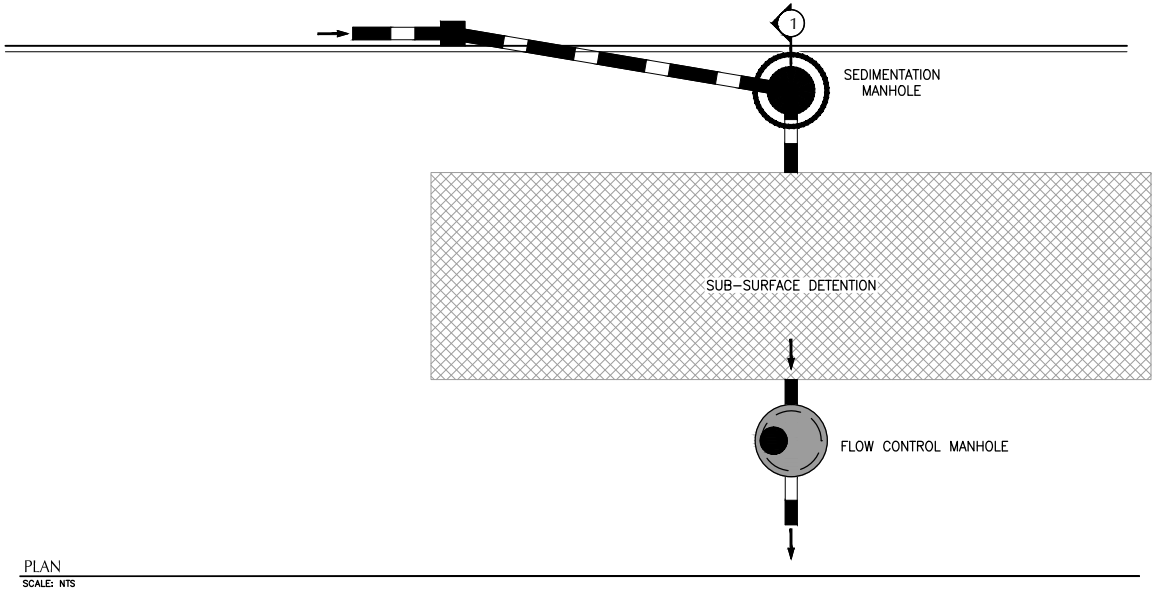
2 SHALLOW SEDIMENTATION MANHOLE AND OUTFALL INTO BASIN
SCALE: NTS

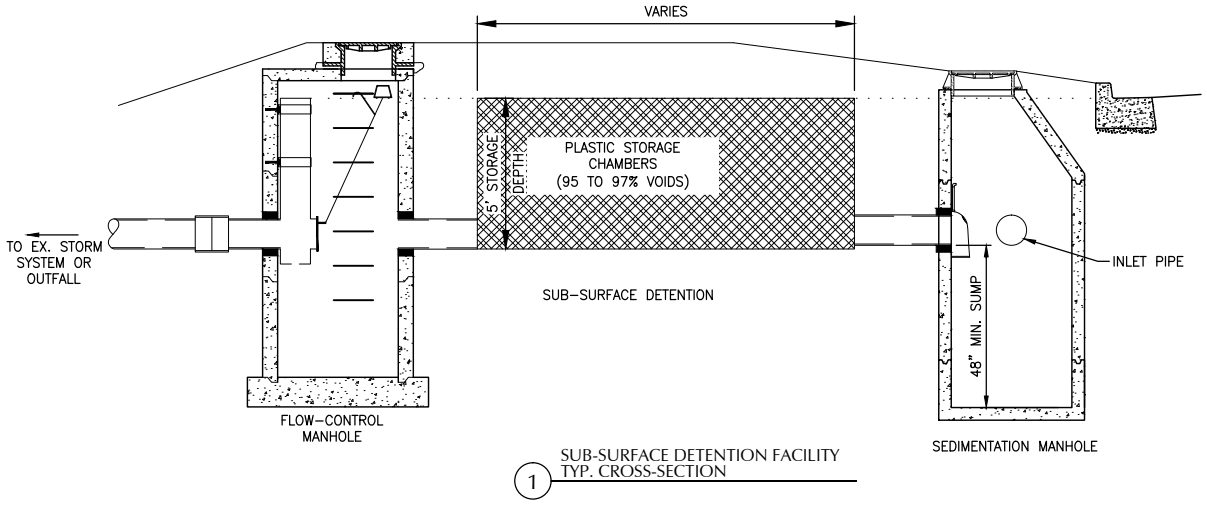


PLAN
SCALE: NTS



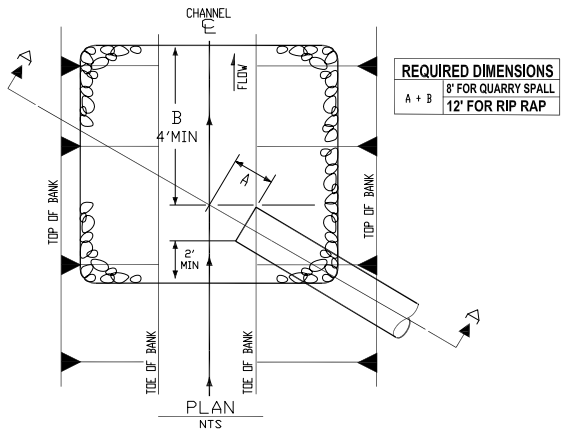
1 SURFACE DETENTION FACILITY TYP. CROSS-SECTION
SCALE: NTS

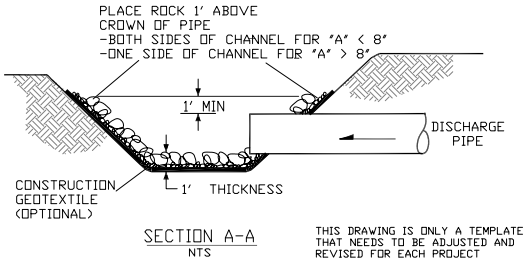




CONCEPT 2, 3 & 4: CENTRALIZED SUB-SURFACE DETENTION FACILITY

APPENDIX C: PRELIMINARY ENGINEERING DETAILS





PIPE/CULVERT OUTFALL DISCHARGE PROTECTION

NOTES

1. SOURCE: WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT) HIGHWAY RUNOFF MANUAL, FIGURE 5.4.3.8.

2. FOR MORE INFORMATION AND DETAILS SEE *CONCEPT DESIGNS AND TECHNICAL GUIDANCE: STORMWATER OUTFALLS* (HERRERA 2007).

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT MANUAL SUPPLEMENTAL DETAILS

Bureau of Environmental Services

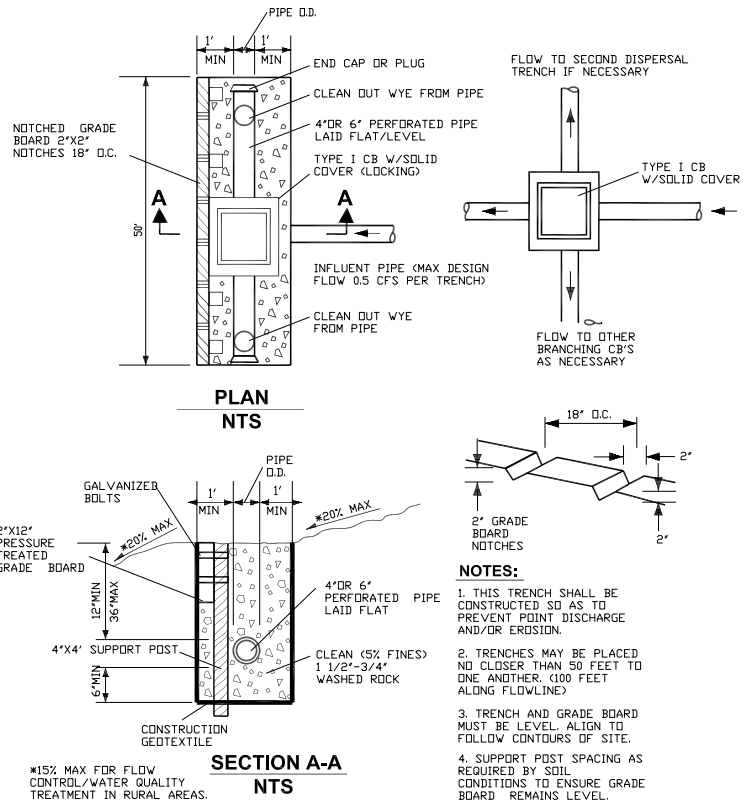
- Supplemental Details -

Outfall

Rock Energy Dissipator

NUMBER

SW-523



FLOW DISPERSAL TRENCH

NOTES

1. SOURCE: WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT) HIGHWAY RUNOFF MANUAL, FIGURE 5.4.3.9.

2. FOR MORE INFORMATION AND DETAILS SEE *CONCEPT DESIGNS AND TECHNICAL GUIDANCE: STORMWATER OUTFALLS* (HERRERA 2007).

THIS DRAWING IS ONLY A TEMPLATE
THAT NEEDS TO BE ADJUSTED AND
REVISED FOR EACH PROJECT

- DRAWING NOT TO SCALE -

STORMWATER MANAGEMENT MANUAL SUPPLEMENTAL DETAILS

Bureau of Environmental Services

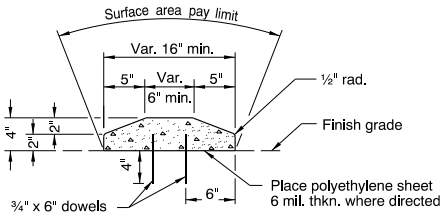
- Supplemental Details -

Outfall

Upland Dispersion

NUMBER

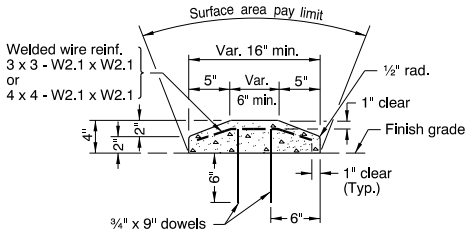
SW-524



SECTION B-B

TYPE A

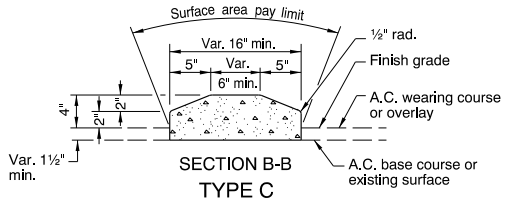
TRAFFIC SEPARATOR ON P.C. CONC. PVMT.



SECTION B-B

TYPE B

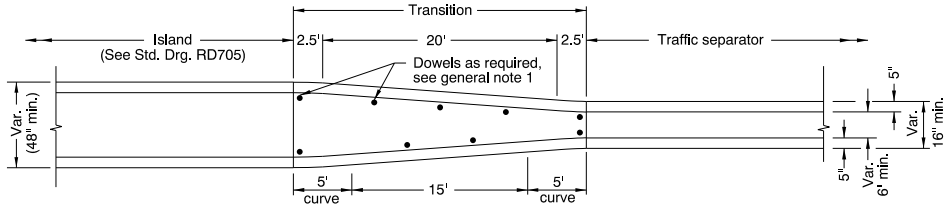
TRAFFIC SEPARATOR ON EXTG. A.C. PVMT.



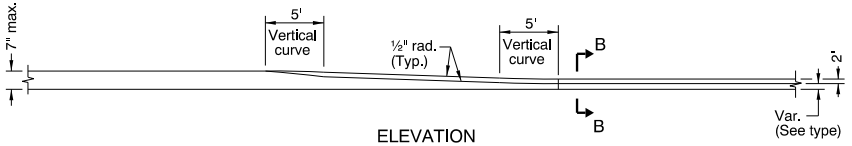
SECTION B-B

TYPE C

TRAFFIC SEPARATOR ON NEW A.C. PVMT.
OR ON EXISTING A.C. PVMT. WITH OVERLAY

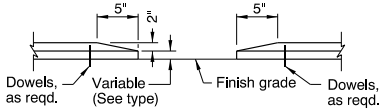


PLAN

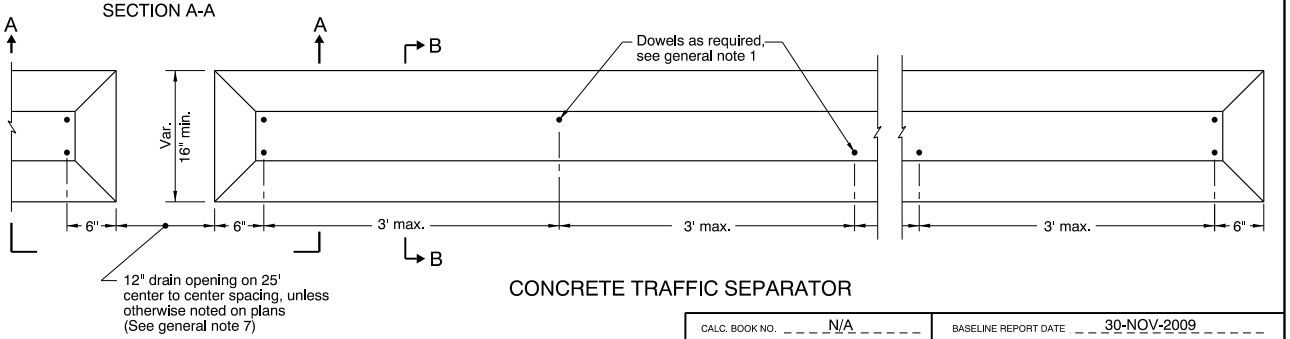


ELEVATION

TRANSITION FROM ISLAND TO TRAFFIC SEPARATOR



SECTION A-A



CONCRETE TRAFFIC SEPARATOR

GENERAL NOTES FOR ALL DETAILS:

1. In transitions conform to dowel plan per Std. Drg. RD705.
2. Standard slope face is shown. Vary as shown on typical section or as directed.
3. Transverse joints in conc. traffic separators and transitions to match joints in conc. pvmt. and to be of same type (Omit dowels in expansion joints).
4. Set joint spacing 200' max. for expansion and 15' max. for contraction.
5. Place preformed filler along one side of conc. transitions in conc. pvmt. and around all curved ends.
6. Dowels shall be ¾" dia. with length as shown. In new conc. pvmt. set dowels before conc. hardens. In extg. conc. pvmt. drill holes 1½" dia. and grout dowels In. In A.C. pvmt. drive dowels.
7. Site conditions normally require a project specific drain opening spacing design, which considers roadway conditions (sheet flow limits, cross slope, superelevation, profile, pavement type, lane and shoulder widths, etc.).

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.

CALC. BOOK NO. N/A

BASELINE REPORT DATE 30-NOV-2009

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications

OREGON STANDARD DRAWINGS

TRAFFIC SEPARATORS AND TRANSITIONS

2015

DATE	REVISION DESCRIPTION

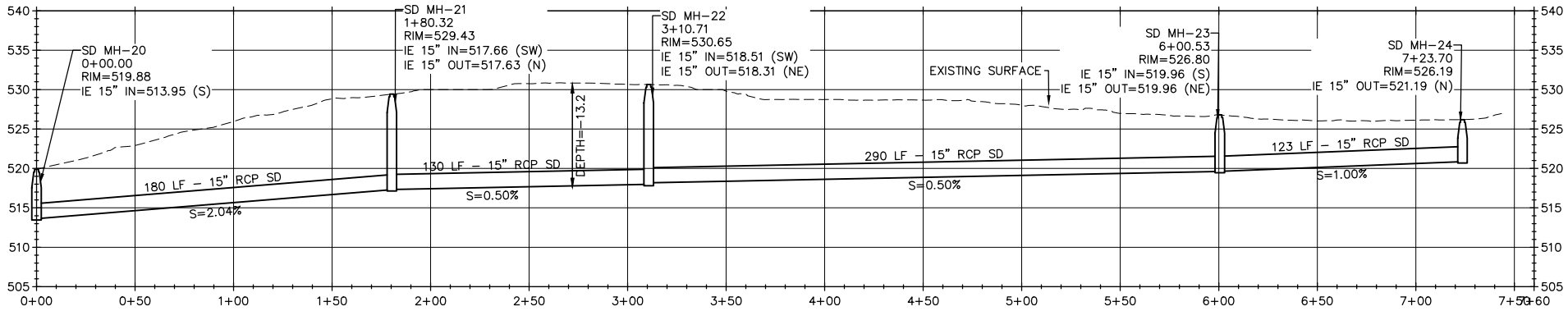
14-JUL-2014

rd706.dgn

RD706

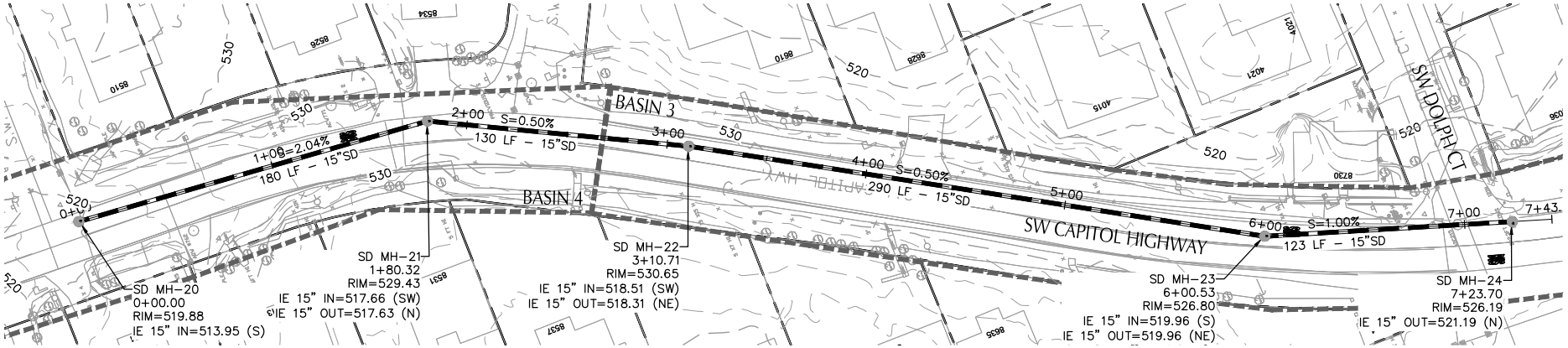
Effective Date: December 1, 2015 - May 31, 2016

RD706



SW CAPITOL HIGHWAY - PROFILE VIEW

SCALE: HORZ: 1" = 40'
VERT: 1" = 20'



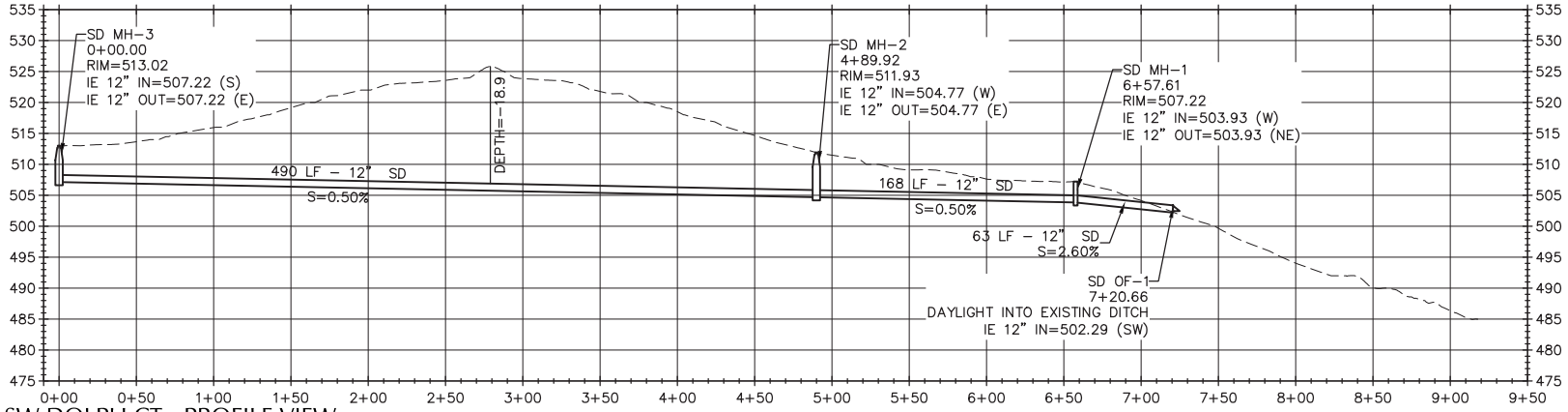
SW CAPITOL HIGHWAY - PLAN VIEW

SCALE: 1" = 40'

SCALE 1 INCH = 40 FEET
40 0 40 80

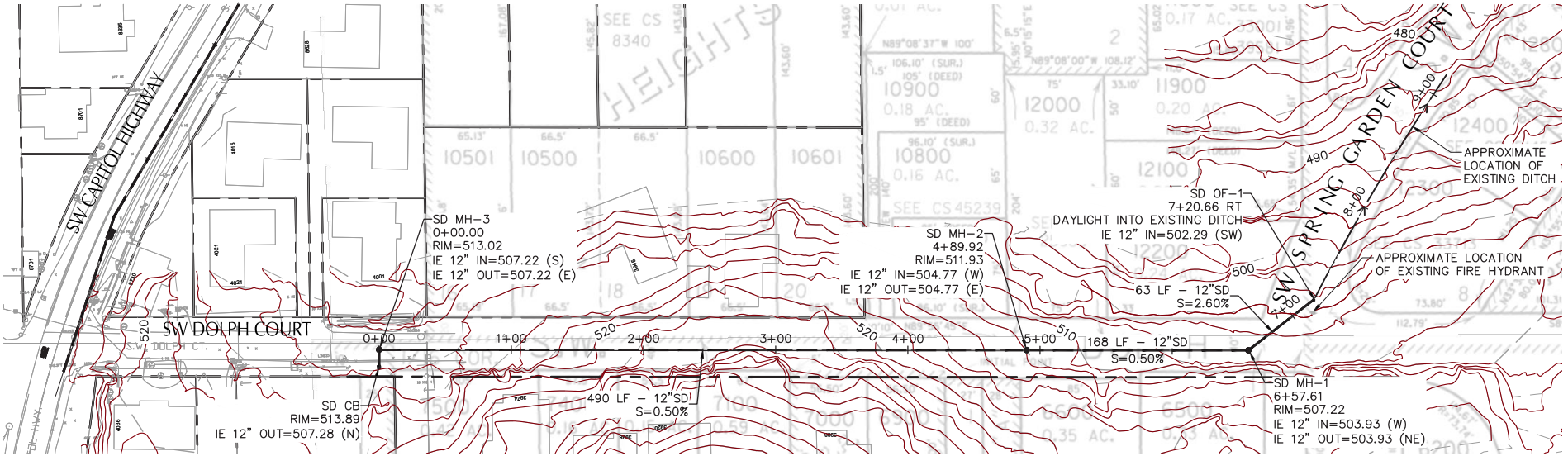
COMBINED BASIN 3 & BASIN 4
SW CAPITOL HWY STORM IMPROVEMENTS STUDY

APPENDIX D: ALTERNATIVE CONVEYANCE STUDY EXHIBITS



SW DOLPH CT - PROFILE VIEW

SCALE: HORZ: 1" = 60'
VERT: 1" = 30'



SW DOLPH CT - PLAN VIEW

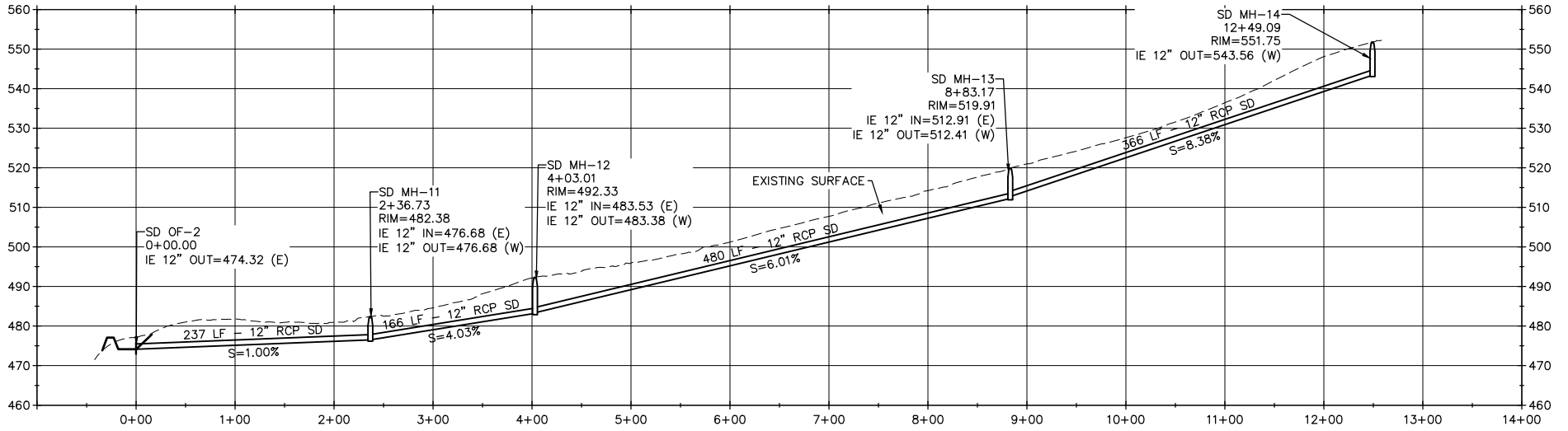
SCALE: 1" = 60'

SCALE 1 INCH = 60 FEET

60 0 60 120

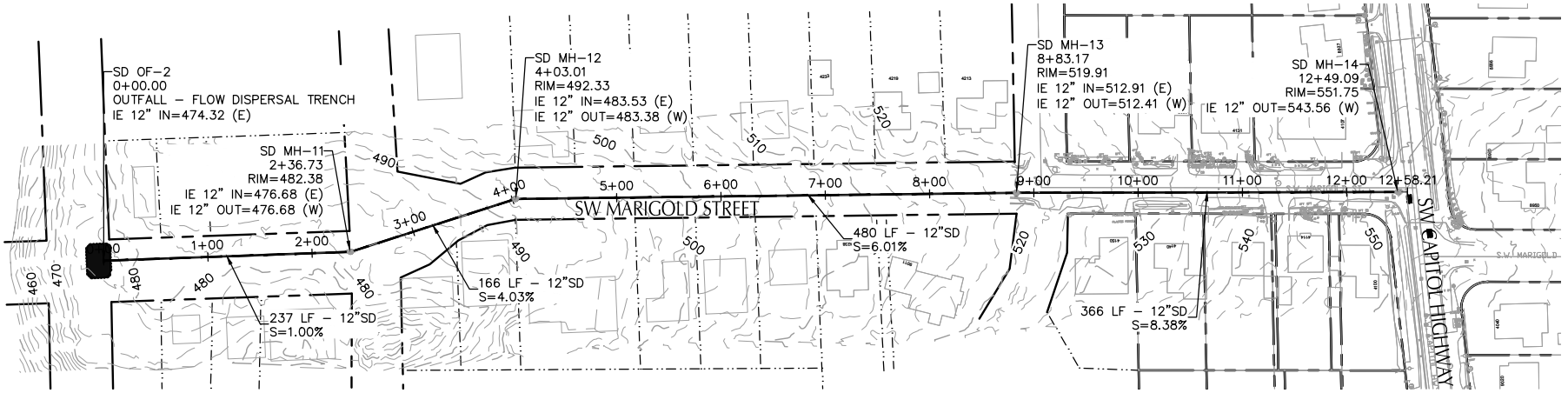
SW DOLPH COURT STORM IMPROVEMENTS STUDY

APPENDIX D: ALTERNATIVE CONVEYANCE STUDY EXHIBITS



SW MARIGOLD ST - PROFILE VIEW

SCALE: HORZ: 1" = 80'
VERT: 1" = 40'



SW MARIGOLD ST - PLAN VIEW

SCALE: 1" = 80'

SCALE 1 INCH = 80 FEET
80 0 80 160

SW MARIGOLD STREET STORM IMPROVEMENTS STUDY

APPENDIX D: ALTERNATIVE CONVEYANCE STUDY EXHIBITS

MEETING NOTES
Charrette – July 8, 2015

DATE: July 24, 2015

TO: Tim Kurtz

FROM: Shawn Kummer

PROJECT: Capitol Highway Stormwater Concept Design

RE: Charrette Meeting

Attendees:

BES:
Tim Kurtz, Stormwater System Division
John Wilson - Systems Development – Interagency Projects
Dave Nunamaker - Systems Development – Interagency Projects
Shannon Axtell - Watershed Services – Fanno/Tryon Watershed
Naomi Tsurumi, Watershed Services – Willamette Watershed
Lisa Huntington, Engineering Services

PBOT:
Rick Browning, PM
Dan Layden, Capital Program Manager
Jason Shepard, Civil Design
Denver Igarta, Transportation Planning
Sara Schooley, Ped Planning
Nicole Blanchard, Civil Design (BES green street liaison)
Arnoud Van Sisseren, Planning

Water:
Cherri Warnke

GreenWorks:
Mike Faha
Shawn Kummer

KPFF:
Curt Vanderzaden
Josh Lighthipe

Summary:
On July 8th, 2015, representatives from BES, PBOT, Water Bureau, GreenWorks and KPFF met at BES from 9am to 12 noon to discuss the Capitol Highway Corridor Stormwater Concepts project. The goal of the meeting was to include City Bureau representatives early in the project process in order to better understand project parameters and to brainstorm stormwater concept approaches that could be viable options worth pursuing by the design team.

1. **Project Goal**: The intent of this project is to develop stormwater concept options for Capitol Hwy, but also looking broader to how the concepts could be used as templates applied to future projects.

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   a. What can we do that is different from the 2011 Refinement Plan and still meet requirements of the Portland SWMM?
   b. What tools / options are most appropriate for Cap Hwy?
   c. What tools / options are most appropriate for the side streets?
   d. Do we have clear stormwater system options to move forward with?

2. **Project Background**: Dan Layden provided historical background for the project.
   a. Cap Hwy has been a major emphasis for 20 years – 1996 Plan
   b. The project is high priority for neighborhood, and politically with City commissioners.
   c. Relatively flat street (for SW) controlled by Portland – this segment is challenging.
   d. Addressing pedestrian and bike access is of primary emphasis of improvements
   e. Will likely have some level of federal funding – considerations for design: ADA, multi-modal, SLOPES V (see below).
   f. High cost of 2011 ($19 mil) project caused it to be set aside –retaining walls, property acquisition (strip taking), stormwater were some of the big items. Costs were evenly distributed between transportation and stormwater management.
   g. Currently have $5mil dedicated through SDCs. Not the whole amount needed.
   h. SLOPES V (Standard Local Operating Procedures for Endangered Species) requirement? Will have to go through with federal funding attached. Documentation for permitting approval.
      i. Requires 50% volume of 2 yr storm event (1.3") managed instead of City water quality (0.83"). This is driven by water quality.

3. **Project 'Book Ends' discussion** – where is there flexibility with design criteria?
   a. There is some flexibility with the cross section, ie. Bikes and peds combined on one side. Doesn't have to be separated if multi-use path.
   b. Provide strong benefit to bikes and peds – needs to be continuous.
   c. Doesn't have to be both sides, but not as competitive from a grant funding standpoint. Community also strongly prefers both sides.
   d. Crossings for bus stops. Need places to wait for bus that are not in a ditch.
   e. Need two way ability for bikes – slopes are a factor.
   f. 2011 plan looked at where to put ped crossings.
   g. NEPA requirements, will have to sort thru what that entails.
   h. Material types used a consideration. Could be flexible with pervious pavement.
   i. Proposed sidewalk on west side b/c of fewer retaining walls and east side already has 'goat track'. May need to preserve east side trail if possible or not create barriers; maintain access to ped crossings and bus stops.

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j. Centerline of road is in the middle of ROW. Road will not shift, but asymmetrical design ok.

k. Parking is not critical, but neighborhood may disagree. 2011 plan only accommodated a small amount. PBOT willing to forego if there's a higher, better use. Not a consideration for concept development at this time.

l. Stormwater (TK)

   i. Work early together, such as this meeting.

   ii. Previous work was confined to the corridor.

   iii. Expect to see side streets used in options - rerouting of flows from Capitol onto the side streets; managing side street flows before reaching Capitol

   iv. Look at different options that were not explored previously, such as regional facilities, pervious pavements.

m. Naomi noted the Tryon-Stephens TGM effort that has identified overlapping transportation and stormwater needs, as well as drainage complaint hotspots, for the area. There are significant stormwater needs along the side streets.

n. Baseline – stormwater – meet the manual. Process may prove need for policy conversations about requirements of the manual.

   a. Feds may be inflexible – ESA usually the main issue – protecting streams. Meeting SLOPES V has to be the start.

o. Project should aspire to meet all goals.

4. Existing Conditions

a. ROW issues

b. Existing pavement is ~24 ft wide and centered in the existing 60 ft ROW

c. Few through streets, some closed to motor vehicles, paper streets

d. Look at partial acquisition of private property rather than full take.

e. Freeman Street – existing wetland was developed at end of street – problems as a result.

f. All side streets but Dolph and 41st would be likely candidates for a 16 ft center-paved street section

g. SW 39th intersection is a sharp angle; could realign to perpendicular and use reconfigured space for stormwater management.

5. Potential other stormwater tools to consider

a. Question posed if solutions would increase intensity in streams. Need long term solutions that don't shift problem from one location to another.

b. Are deep injection wells a possibility? Seattle Ballard example.

c. Don't want to shift problems to side streets

d. Multnomah Blvd 'Green gutter' – 3' planter width. Works where not any driveways.

e. Boones Ferry & Stevenson project – sloped facility includes detention.

f. Structural soils – to connect facilities, provide under sidewalk storage

g. Under sidewalk conveyance – allows double duty for transportation and stormwater while saving space

h. Silva Cells – proprietary storage / structural soil units installed for tree health at SE Sandy & 8th; stormwater management variations exist – examples in Shoreline, WA; maybe Tacoma?

i. Hamilton/Stephenson project – road shoulder conventional system with 3' shallow swale.

j. Tryon Stephens report example – Naomi

k. Shallow ODOT-style stormwater mains – if pipes are needed, keep them shallow and consider daisy-chaining inlets

l. BES Stormwater O&M gravel shoulders – essentially a low tech version of structural soils with a perf pipe at the bottom; not sure how successful the existing examples have been, but we can discuss

6. Storm Modeling Discussion

a. Meeting detention – requires orifice – 8-9% did not meet.

b. Tough to meet ½ of 2 yr storm detention with soil as orifice. Inefficient – requires up to 14% sizing factor. 2 year event is the driver.

c. If just WQ then 4-5% sizing factor.

d. Big facilities, or make conventional system to move water around.

e. Example of deep planters - Cully Example

f. Rock – 30-40% void space.

g. R-Tank & Eco Rain are examples of proprietary subgrade storage systems.

h. Storing water under other facilities such as sidewalks may have merit. While system is expensive, may be offset by alternative expense of acquiring ROW and or building retaining walls.

i. Multi-use path on one side – less pavement and preserve 'goat paths'

7. Options Discussion

a. Alternative section – Bike and ped on one side.

   i. Would provide more efficient use of pavement

   ii. Might enable to preserve path on east side.

   iii. More space for stormwater.

   iv. Needs to be safe

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v. Neighbors concerned about combining peds with bikes. Slopes also a concern.

vi. Have to clearly communicate delineation of facilities for users.

vii. 22' curb to curb too narrow – 24' better.

b. Pervious pavements – Is on the table for consideration.

i. Impervious area running off onto pervious does not work – sediment issues.

ii. Pervious being used as an impervious area reduction technique. Ideal for sidewalks, might be possible for bike lanes as well.

c. Conveyance – gutter spread as an option? Works better with multi use path option. PBOT opposed to using gutter spread technique unless the gutter is modified for more capacity.

d. Future Private Development – what techniques do they use to discharge into the system? May have to consider this.

e. Try to keep regional facilities in ROW and not on private property. Curbless solutions on side streets.

f. Keep it simple – tendency has been to make things over complex. Concern about BES's commitment to maintaining facilities. Realistic plan that costs what City can do.

g. 'Rock ditches' – French drain section.

h. Local Side streets and regular facilities – may come into play in all three.

i. Dual purpose facilities – more expensive – but if reduce other impacts such as need for retaining walls or property acquisition, may offset cost.

a. Potential for sidewalks on both sides to come back into play.

8. **Summary of Options discussed**

a. Explore an alternative street section that combines pedestrian and bikes in a multi-use path on west side of street with traditional type facilities. Multnomah blvd. example.

b. One sided development on Cap Hwy – Explore detention under pedestrian facility. A proprietary facility for detention.

c. Focus on regional/neighborhood facilities and local streets.

d. Condense facilities on Cap Hwy.

e. Hybrid of options C & D.

f. Consider an option that has facilities on both sides of road.

g. Value-engineer the 2011 plan.

End of Notes

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Photo Credit: Google Street View

NE 33rd Ave & NE Going St.,
Portland, OR

Amsterdam, Netherlands


Photo Credit: Jean Senechal Biggs

SW Moody Ave.
Portland, OR


Photo Credit: City of Boulder

Baseline Road
Boulder, CO

APPENDIX F: EXAMPLES OF SEPARATED BIKE LANES

REFERENCE LIST

Capitol Highway Drainage Analysis Technical Memorandum, (includes maps as separate documents), by BES, March 4, 2009.

Capitol Highway Plan, Portland Bureau of Transportation, 1996

Portland Stormwater Management Manual-January 2014 (SWMM), City of Portland Bureau of Environmental Services, https://www.portlandoregon.gov/bes/64046

PBOT-BES Tryon-Stephens Headwaters Neighborhood Plan, Council Draft, November 2015; https://www.portlandoregon.gov/transportation/65574

Pre-Design Drainage Analysis Memorandum, by Systems Analysis, March 2, 2009

SW Capitol Highway Plan Refinement Report, Portland Bureau of Transportation, 2011, http://www.portlandoregon.gov/transportation/article/353046

SW Capitol Highway Refinement Plan Stormwater Disposal Drainage Assessment Technical Memorandum, (includes maps as separate documents), by BES, November 16, 2010 (Supplement to the March 4, 2009 TM)

National Association of City Transportation Officials (NACTO); https://www.nacto.org