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Appendix - Section 9

Miller Creek Greenway Concept Report

Miller Creek Greenway Concept Report








Miller Creek Greenway Enhancements & Regional Stormwater Facility Technical Analysis

DRAFT

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SECTION 1

Miller Creek Greenway Overview

Background

The Northeast Redevelopment Area (NERA) was created in 1997 through the adoption of the City of Burien Comprehensive Plan. The NERA was identified as an area affected by present and future aviation activities at Seattle-Tacoma International Airport. Special planning provisions were needed for this redevelopment area due to the incompatibility of current land uses, mainly consisting of single-family residences, with current and future airport operations.

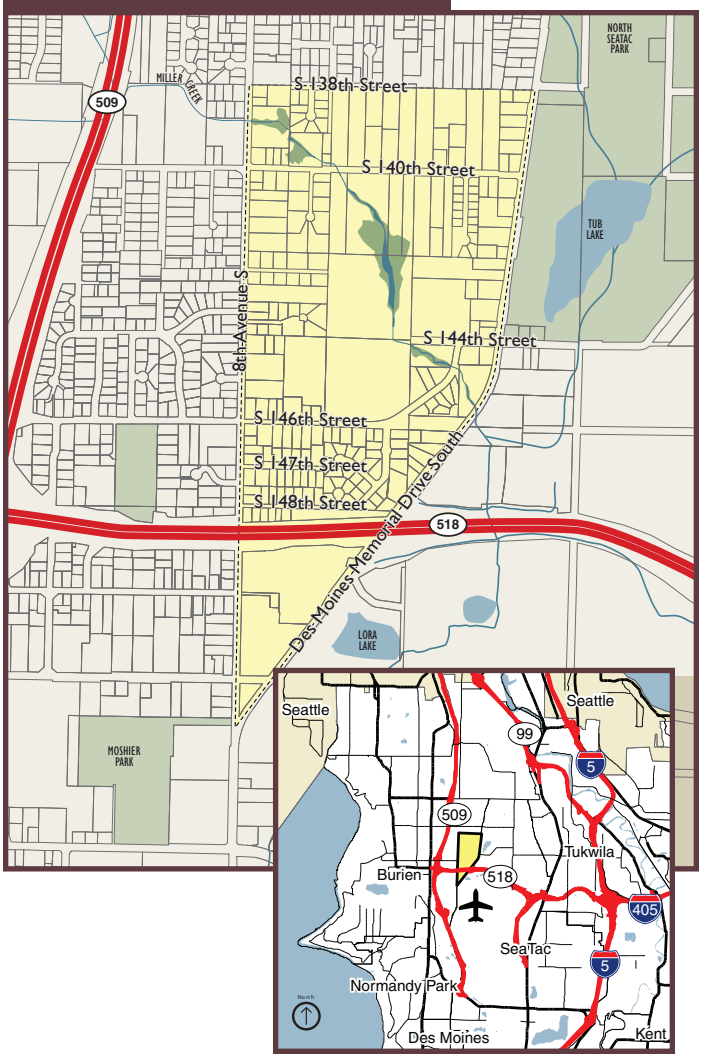
The City of Burien and Port of Seattle, a major land owner in NERA, partnered to develop a specific plan for redevelopment, supported by market and economic analysis, to determine the best course for the area's future. This analysis led to the development of the NERA Redevelopment Plan and Implementation Strategy. This plan provides a master plan for the area, which includes new commercial and industrial uses for the majority of the NERA and retains flexibility in the northwest portion for new residential, homes converted to offices, and other uses. A key component of this plan is the creative use of Federal Aviation Administration (FAA) restricted land for the development of a sub-regional stormwater facility. The sub-regional facilities paired with natural amenities of Miller Creek corridor would serve as a Greenway through NERA providing recreation and environmental enhancement opportunities.

This Greenway would provide recreational opportunities to City residents and new development by providing a vital link to the City's existing and planned Burien Loop Trail system. Additionally, a sub-regional stormwater facility would provide economic development incentives for future developers through its function in managing and treating stormwater from redevelopment sites thereby maintaining maximum developable area, reducing the costs of redevelopment for individual property owners, and providing recreational amenities for future employees.

Location

The Miller Creek Greenway bisects the NERA from the northwest to the southeast. The NERA is located in the City of Burien between 8th Avenue South to the west and Des Moines Memorial Drive to the east which merges with 8th Avenue South in the southern end of the NERA. To the north, the NERA is bounded by South 138th Street. Please refer to Figure 1—Vicinity Map.

Figure 1 – Vicinity Map





Miller

Purpose

The purpose of this report is to describe the proposed concept of developing the Miller Creek Greenway with sub-regional stormwater facilities within the NERA. The intent is to provide the City of Burien (City) with conceptual design options and cost data to inform future decision making and the pursuit of funding to implement the project. The report builds upon previous planning work by conceptualizing stormwater facilities to meet the needs of the City and NERA property owners through the establishment of the Miller Creek Greenway. The Miller Creek Greenway would serve multiple functions:

- Meeting the needs of future development through the sub-regional management and treatment of stormwater in FAA restricted and undevelopable areas of the site;
- Reducing the cost of redevelopment on individual properties and maximizing area for redevelopment by providing off-site facilities;
- Providing the opportunity for creek restoration and environmental enhancement along the Greenway;
- Serving as a natural buffer area and scenic backdrop between intensive land uses in the NERA;
- Providing a public corridor for extension of the Burien Loop Trail system and providing a vital linkage to other trails adjacent to the NERA; and
- Providing a variety of recreational opportunities for the community, including residents and employees of the NERA.



Existing Miller Creek Drainage Features - There is an opportunity to rehabilitate the creek corridor to a more natural condition.

Restricted land in the NERA includes critical areas such as the creek and its associated wetland buffers, as well as areas where development is restricted due to ownership and funding (primarily FAA funding) used to purchase the property. Miller Creek is a Type 2 stream, protected by a 100 foot buffer. Its five associated wetlands located in the NERA have buffers that range from 50 feet to 100 feet based on the type of wetland. The remainder of development restricted land is present in the eastern portion of the NERA, a majority of which is in Port ownership, with a few parcels in City of Burien ownership. Port owned property is restricted mostly due to the type of funding used to purchase the property as well as other reasons. The Port-owned (FAA restricted) land limits development to infrastructure (including stormwater facilities), parking, and open space. City of Burien-owned land was purchased with stormwater funds and is intended to serve stormwater needs and functions.

SECTION 2

Potential Greenway Enhancements



Miller Creek Existing Condi-



Elements of the Greenway

The proposed Miller Creek Greenway would include sub-regional stormwater facilities co-located with a shared-use trail and adjacent open space in the NERA, following the route of the Miller Creek corridor. The Greenway could provide a number of recreational opportunities for employees and residents of the NERA and the greater Burien community, such as a place for lunch-time walking and jogging, picnicking, environmental interpretation and education, exercise course, and other possible features.

Today, Miller Creek is an urban stream that has been heavily altered by development activities. The creek flows through ditches, culverts, underground pipes. There are only a few locations where the creek has been retained in a more natural state as it traverses the NERA. Stream and wetland enhancements including potential stream daylighting, could improve habitat and water quality, as well as general environmental quality of the area.

The proposed stormwater facilities (described in further detail in the next section of this report) ideally would be constructed as shallow wetlands with native landscaping. These facilities would provide water quality and detention for future NERA redevelopment. The shallow stormwater ponds and new wetlands, paired with the existing creek, wetlands, and their associated buffers would provide an extensive natural corridor and green space through the heart of the NERA. We are referring to this green space that encompasses both existing natural features and the proposed stormwater facilities as the Miller Creek Greenway.

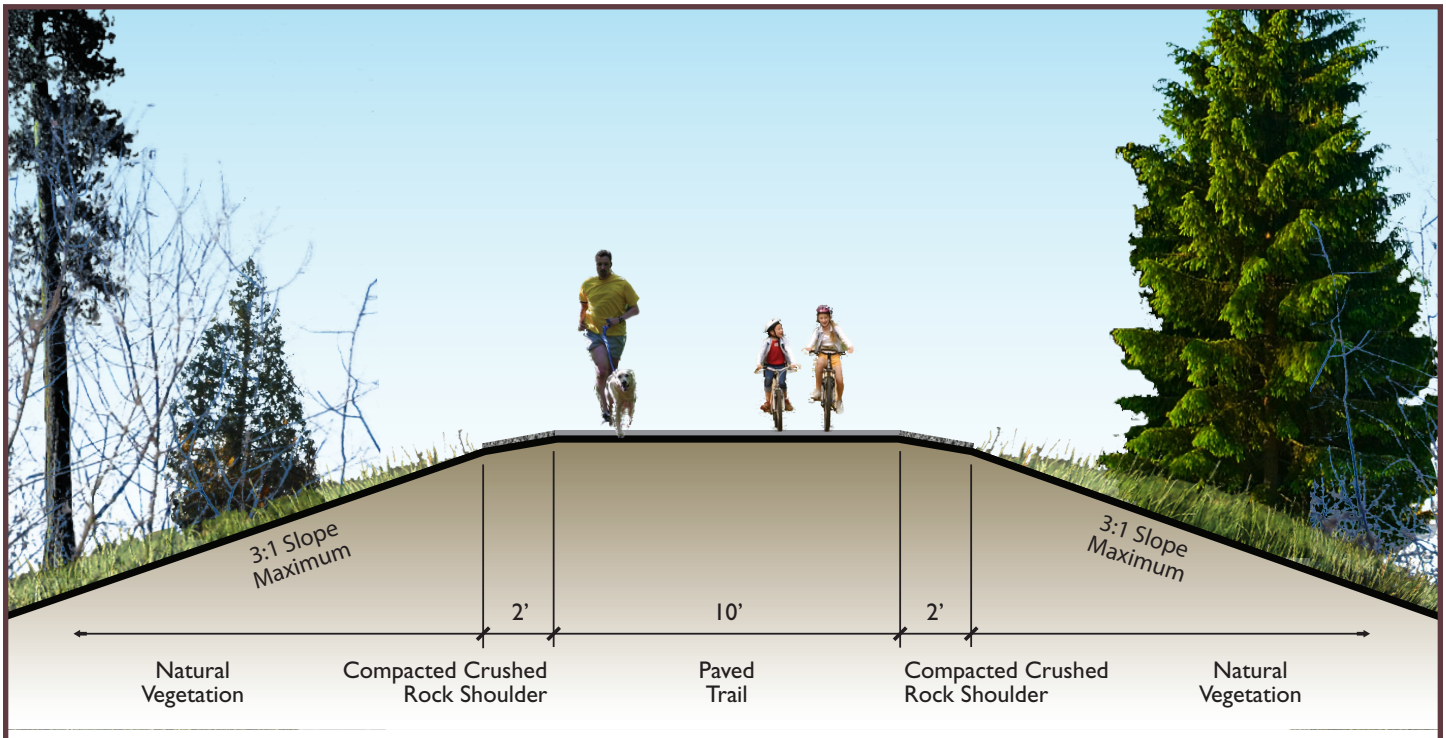
Shared-Use Trail and Recreational Opportunities

In addition to the opportunities for stormwater management and enhanced water quality and habitat functions in the creek corridor, a Greenway through the NERA would provide important recreational opportunities and economic incentives for redevelopment.

The City of Burien Bicycle and Pedestrian Plan, adoped in June 2004, identifies the Miller Creek corridor through NERA as a future trail link to the greater Burien Loop Trail. The NERA Greenway trail connection would connect the eastern portion of Burien to existing and future trail networks that eventually lead to Seahurst Park and Puget Sound. Due to the NERA's location adjacent to the City of SeaTac, this trail link would also provide opportunities for a regional connection to existing City of SeaTac parks and trails.

In addition to the creek and wetland enhancements, the Greenway could potentially include open space areas and amenities, such as the shared-use trail with one ore more bridge crossings, wayfinding elements, viewpoints, picnic areas, an exercise course and opportunities for environmental interpretation and education for people traveling through the Greenway. Refer to the graphics at the end of this section of the report for conceptual illustrations of Miller Creek Greenway enhancements and these elements, as well as cross sections illustrating area topography the relationship of the creek corridor to adjacent trail and recreation facilities, as well as existing and constructed wetland features. The conceptual plan depicts a potential alignment for the trail, as well as potential locations for recreational nodes and features along the trail.

The proposed Miller Creek Greenway Trail would be placed within a 15-foot-wide space along the creek, wetlands, and proposed stormwater facilities. This space could be an easement acquired via dedication by adjacent property owners or a public open space acquired through purchase. The trail may be located



Miller Creek Shared Use Trail
TYPICAL / SECTION DESIGN

within the Miller Creek stream and wetland buffers, in which case the width of those buffers would be increased by the 15-foot dimension.

It is recommended that the shared-use trail be constructed at a minimum width of 10 feet of hard surface with 2-foot shoulders on each side. This width will accommodate use by both pedestrians and bicyclists in the trail corridor, while also maintaining a more natural look to the linear open space. (The trail could be wider, such as 12 feet or 14 feet, depending on standards adapted for the design; however this would impact the aesthetics of the Greenway by creating a more urban character with more hardscape.)

The trail surfacing could be either asphalt or concrete to accommodate both wheels and feet. Forms of pervious pavement could be explored to increase infiltration opportunities. The shoulders should be constructed of compacted crushed rock material. The trail surface could also serve as an access drive for maintenance of the stormwater facilities.

As the trail makes its way through NERA, bridge crossings may be needed to navigate existing topography. Wayfinding signs at entrances and along the trail corridor would provide direction and information to trail users. These wayfinding signs would reinforce the identity of the trail corridor through "Burien Loop Trail" branding and could also provide information about segment lengths/ mile markers. At trail entrances, small maps of the trail system could be provided on wayfinding posts and information could be shared related to how to be a good steward of the Miller Creek Greenway (e.g. "Welcome to the Miller Creek Greenway -- Please Help Us Keep the Greenway Healthy" etc.).

Along the trail, small areas could be designated for resting spaces where benches and/or tables could be provided for picnicking. Overlook areas for viewing of the creek and wetlands could be created, along with segments of boardwalks and bridges. Interpretive displays could educate Greenway users about the creek and wetlands system, the benefits of the sub-regional stormwater facilities, as well as other general



Miller Creek Existing Condi-

environmental themes (keeping Puget Sound clean, urban wildlife, etc.) The viewpoints would allow opportunities for interaction between trail users and the natural beauty of the corridor and would provide a respite and refuge from the surrounding urban context. The Greenway could also be used for more active recreation functions, such as a fitness course with exercise stations accessible from the shared-use trail, benefiting people working in the NERA on a daily basis, as well as nearby residents.





Miller Creek Wet-

Estimated Cost of the Trail and Recreational Features

The estimated cost to develop the shared-use trail and recreational features described above would be approximately $2 million. The estimated cost for creek corridor rehabilitation and wetland enhancement along the Greenway, within the NERA, is approximately $2 million. This does not include estimated costs associated with construction of the stormwater facilities, which are discussed in Section 5. These are planning-level estimates in 2009 dollars, based on preliminary, conceptual design. The costs include construction as well as environmental permitting and design.

Benefits of the Greenway

The proposed Greenway would maximize the public usability and functions of the creek corridor. Development of the trail system and adjacent open space within the buffers of the creek and wetlands and along the fringes of the proposed stormwater facilities would expand the public benefits of these otherwise undevelopable areas. The use of FAA restricted lands for the proposed stormwater facilities would help to expand the sense of the Greenway beyond the immediate creek corridor. The Greenway would provide excellent amenities for future NERA developers and employees, not only by making efficient use of restricted land, but also by providing off-site stormwater facilities, which in turn maximizes development capacity on individual parcels and reduces costs of site development. The Greenway also would provide recreational and scenic opportunities, which may help to attract redevelopment and bring new businesses to the area.

SECTION 3

Hydrolic Analysis



Miller Creek Drainage

Introduction and Methodology

In order to inform the potential development of sub-regional stormwater facilities in the proposed Miller Creek Greenway, the total future stormwater runoff that may originate from the NERA must be calculated. Existing and planned land uses were analyzed using the hydrologic model MSG Flood. The model was used to generate the required size of detention and water quality facilities that would be necessary to treat stormwater runoff originating from the NERA in two types of facilities:

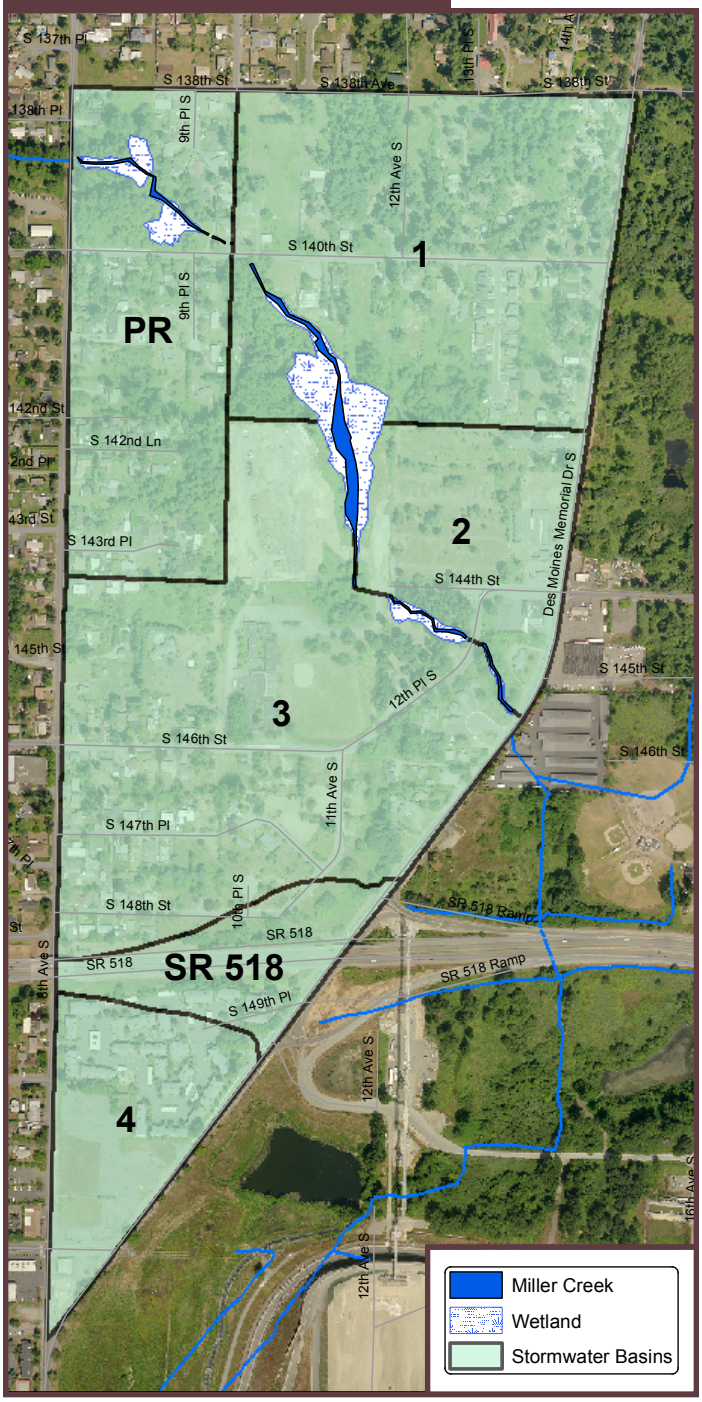
1. Combined stormwater wetland and detention areas; and
2. Underground vaults.

These types of facilities were selected because of their compatibility with future planned redevelopment by preserving developable area and providing recreation and enhancement opportunities for Miller Creek. Ultimately, the sub-regional stormwater facilities could be a combination of wetland and detention areas and vaults depending on costs and future decisions made by the City related to the potential for this project.

Based on conversations with City staff, the City will adopt the 2009 King County Surface Water Design Manual (KCSWDM) to regulate new development with regard to surface water management in early 2010 as mandated by State law. The King County manual is typically based off of the Department of Ecology manual with more specific stormwater regulations as it relates to the Puget Sound region. In 2009 the King County Manual was updated the manual to make it consistent with the Washington State Department of Ecology's 2005 Stormwater Management Manual for Western Washington (Ecology Manual). Analysis for this study is based on the 2009 KCSWDM.

The 2009 KCSWDM outlines eight core requirements and five special requirements that, depending

Figure 2 – Drainage Basins



on the amount of impervious surfaces, must be met by every development and redevelopment project. The conceptual design of the NERA sub-regional stormwater facilities will comply with Core Requirement #3—Flow Control Facilities [but not flow control Best Management Practices (BMPs)] and Core Requirement #8—Water Quality. While flow control and water quality facilities will be provided through the sub-regional facilities, each individual development project would still be required to complete a drainage review to determine what level of flow control and water quality treatment would be needed onsite before reaching the sub-regional facilities. On-site flow control and water quality could be provided through the presence of bioswales, infiltration features, or other low impact development (LID) applications.

Existing Drainage Patterns

The existing drainage pattern north of SR 518 in the NERA drains to Miller Creek via curb and gutter, ditches, overland flow, and underground pipes. A majority of this runoff is collected in the southern portion of the NERA, south of SR 518 on Port property, formerly Lora Lake Apartments, and is then conveyed east to Miller Creek outside the NERA boundaries.

Site Selection for Sub-regional Facilities

Several sites, delineated by existing parcel boundaries, were identified as potential locations for sub-regional stormwater facilities during the NERA master planning process. The sites were selected due to the development restrictions placed on the properties.

The project area was delineated into five basins draining to the proposed five flow control and water quality facilities. Refer to Figure 2 — Drainage Basins. The existing basins were delineated based on GIS mapping information including critical areas and topography analysis, field reconnaissance, and the conceptual design by the NERA planning group. The area labeled SR 518 is Washington State Department of Transportation (WSDOT) right-of-way was not included as part of this study.

Pre-Developed Hydrology

The MGS Flood model was used for the hydrologic modeling of the project site and for sizing of the detention volumes and water quality facilities. MGS Flood is a widely used and accepted model developed, in part, by WSDOT for analysis and design of surface water management facilities and is an accepted continuous hydrology model by the Washington State Department of Ecology. It is an acceptable model for flow control and water quality facility sizing and analysis in the 2009 KCSWDM.

Soils information for the NERA was correlated from GIS surface geology data at the University of Washington's Washington State Geospatial Data Archive. King County Soil Survey by the USDA Natural Resources Conservation Service does not extend to this portion of King County. The surface geology can be correlated with hydrologic soils types. Vashon Till (Vt) was modeled as a Type C soil in MGS Flood. Vashon Recessional outwash (Vr) closely resembles Type A/B soils. Holocene Peat (Hp) is pea in modern valley alluvial deposits, a Type D soil. See Figure 3 — Soils Data.

A Level 2 Basic Flow Control standard is required for the NERA, based on Section 1.2.3.1 of the 2009 KCSWDM and Section 2.5.5 of Volume I of the 2005 Ecology Manual. This standard requires the predeveloped land use condition be characteristic of natural conditions (i.e., prior to disturbance by European settlement). For this analysis, the historic site condition for the entire NERA was modeled as forested land cover. However, the initial analysis of the pre-developed condition produced unrealistic large detention volumes (e.g., detention ponds larger than the basin area). As a result, the pre-condition land use was modeled as Till Forest for all basins. Table 1 presents the proposed basin areas and the resulting peak discharge outputs from MGS Flood modeling.

Figure 3 – Soils Data

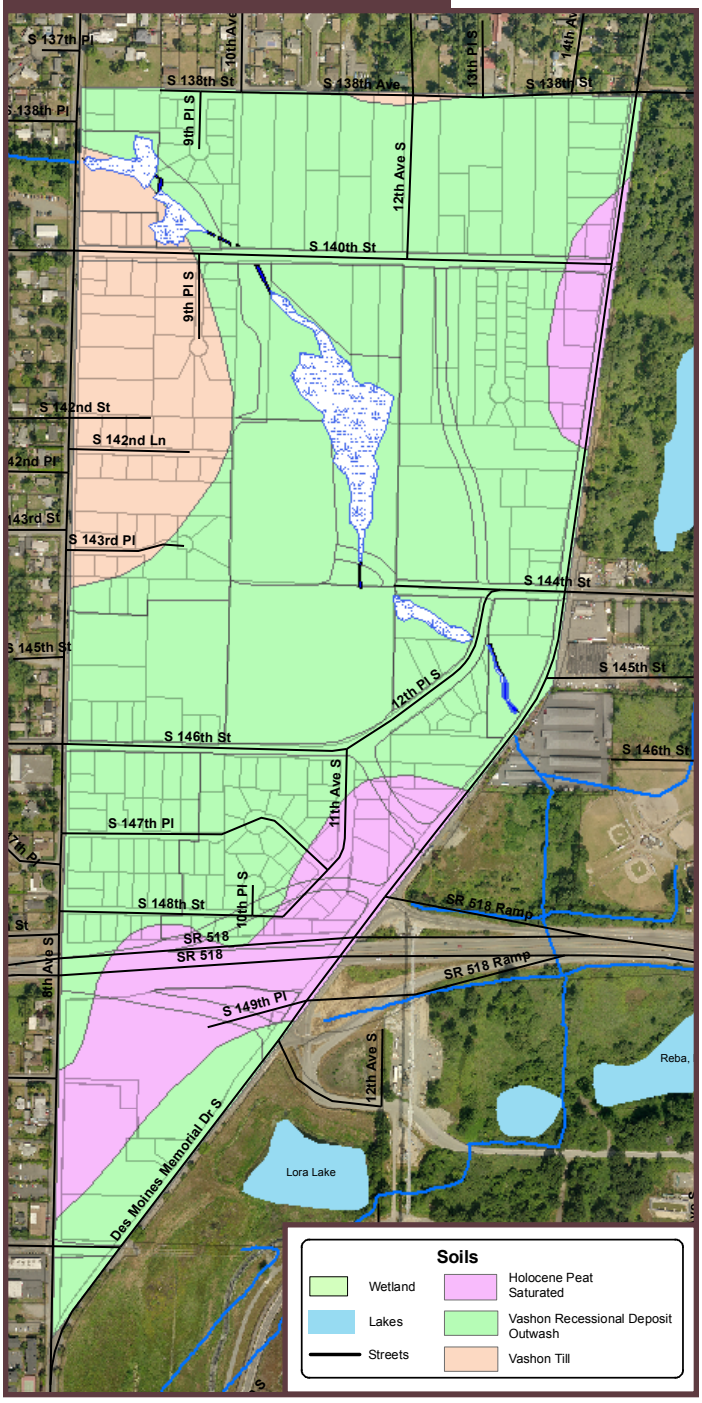


Table 1 – Pre-development Peak Flows (cfs)

Basin ID	Tributary Area (Acres)	2-Year	50-Year	100-Year
PR	29	0.6	2.0	2.1
1	46	0.9	3.1	3.4
2	17	0.4	1.2	1.3
3	55	1.1	3.8	4.1
4	14	0.3	1.0	1.1

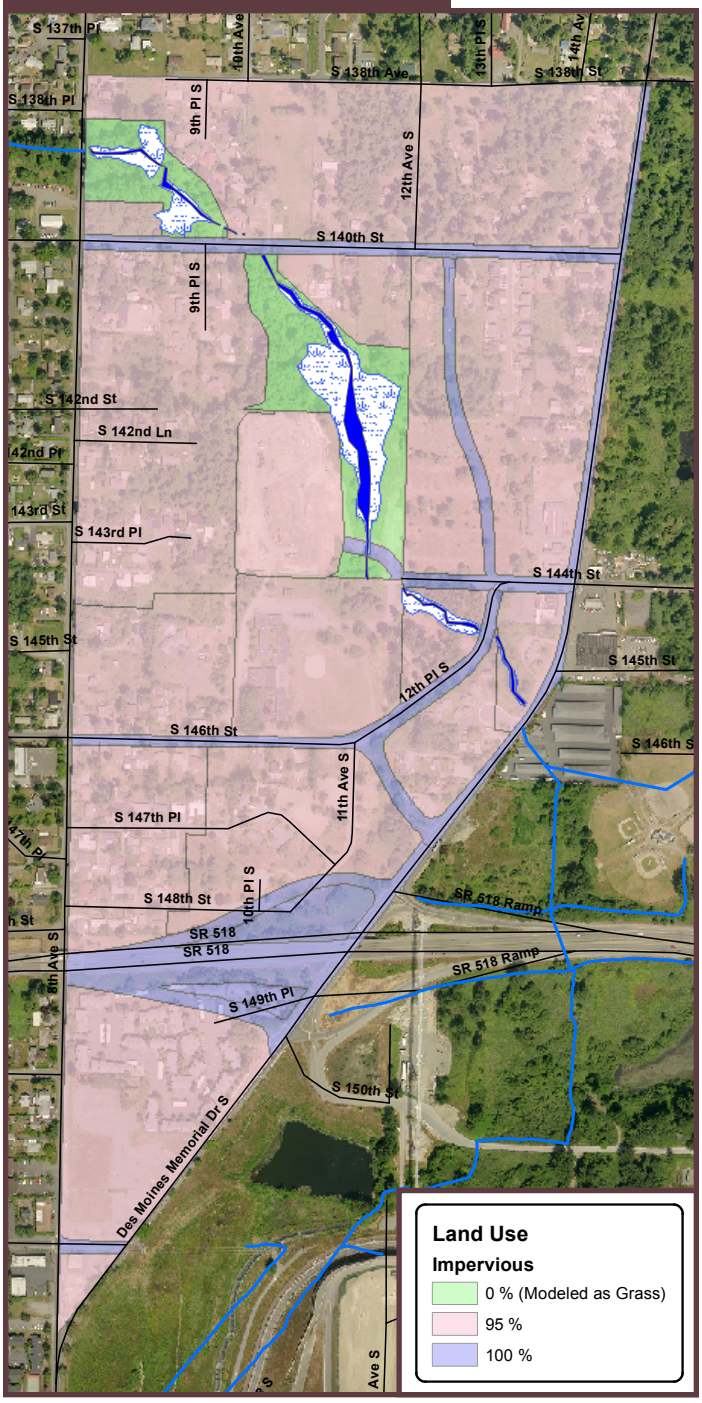
Proposed Hydrology

The planned redevelopment in the NERA, as described in the NERA Redevelopment Plan, would increase the amount of impervious surface (pavement and building). For the proposed conditions, land use within Basins 1 – 4, which include commercial and industrial uses, was determined to be 95 percent impervious, while land use within Basin PR is determined to be 85 percent impervious based on the information provided by the NERA planning group. This analysis assumes that all runoff from within the NERA will be detained and treated within five facilities, which include public right-of-way roadway runoff (excluding SR 518). Roadways in the public right-of-way are modeled as 100 percent impervious. The remaining areas, streams, wetlands and their buffers were delineated and surveyed as part of the NERA Critical Areas Study and were modeled as grass or wetland. Please refer to Figure 4 – Land Use for a graphical representation of the proposed uses and how they were modeled.

Basin Label SR 518 is WSDOT right-of-way and was not modeled in this study. It was assumed that WSDOT would provide a separate stormwater system.

The post development analysis looks at worst case scenario, the maximum amount of stormwater runoff and does not take into account land use credits that may be received through the use of flow control BMP, Section 5.2.2 in the 2009 KCSWDM. Since the actual on-site, parcel by parcel flow control BMP type is unknown at this conceptual planning level, the analysis did not include any facility sizing credits that may be available from viable BMPs. Should new development chose to provide or be required to provide more on-site flow control BMPs including Low Impact Development techniques such as infiltration, the actual sizing of the proposed facilities could shrink.

Figure 4 – Land Use



SECTION 4

Flow Control and Water Quality

Introduction

This section of the report describes basic flow control and water quality requirements and standards that would be required for the NERA stormwater facilities.

Flow Control

A Level 2 Basic Flow Control standard is required for the NERA, based on Section 1.2.3.1 of the 2009 KCSWDM and Section 2.5.5 the Volume I of the 2005 Ecology Manual. This standard requires developed condition discharge duration to match pre-developed duration for the range of pre-developed discharge rates from 50% of the 2-year flow up to the full 50-year peak flow. The objective of this standard is to prevent increases in the stream channel erosion rates above of natural conditions (i.e., prior to disturbance by European settlement). The standard intends to minimize the total amount of time that a receiving stream exceeds an erosion-causing threshold based upon historic rainfall and natural land cover conditions. For this analysis, the historic site condition for the entire NERA is required to be forested land cover.

The combined detention and wetpool configuration will allow for the water quality facility to be placed beneath the detention facility without increasing the facility surface area. It is assumed that the live storage component of the facility will be above the seasonal high water table as verification of the water table is beyond the scope of this analysis. The detention and wetpool facility will be integrated into an open space and passive recreation area along Miller Creek. See Table 2 for Detention Volume for each Basin.



Miller Creek

Table 2 – Detention Volume

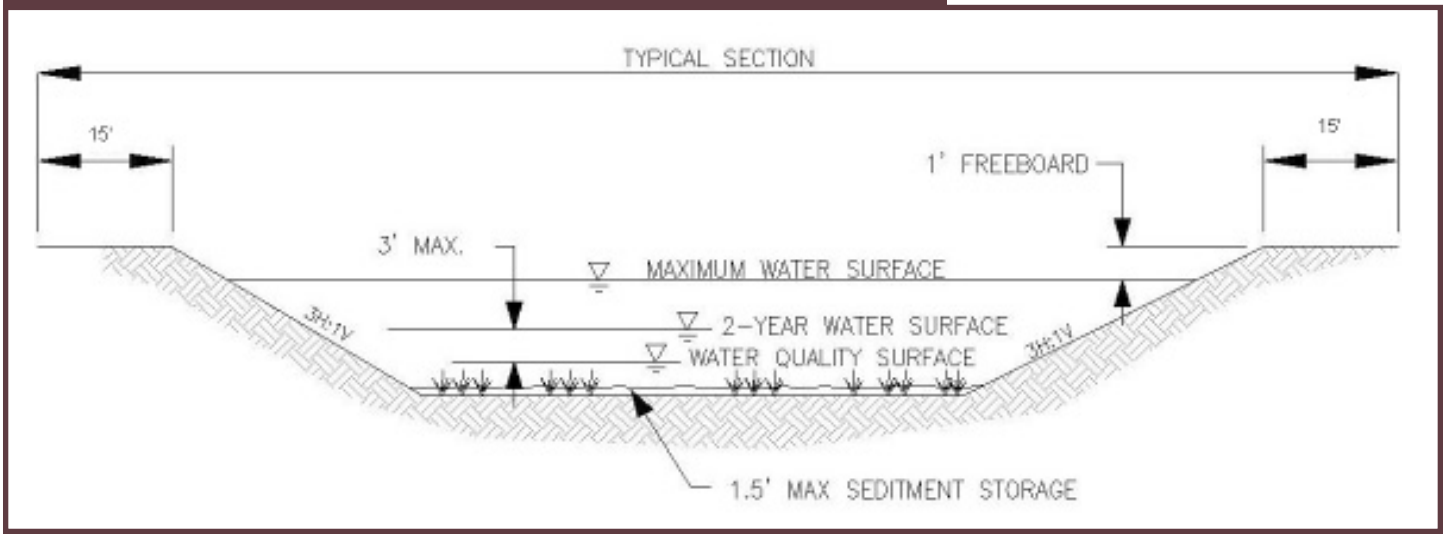
Basin ID	Tributary Area	Detention Volume (Acre-feet)
PR	29	13.2
1	46	19.9
2	17	7.3
3	55	30.3
4	14	7.3

Water Quality

In each basin, it is assumed 100 percent of the impervious areas from a commercial area will flow to the combined flow control and water quality facility. This is greater than the 45 percent impervious area threshold stated in the 2009 KCSWDM, triggering the enhanced basic water quality treatment goal for the facilities. This goal is intended to remove 80 percent of Total Suspended Solids (TSS) and to reduce 50 percent of total Zinc present in the runoff. Zinc is an indicator of a wider range of metals typically found in urban runoff.

The enhanced basic water quality menu in the 2009 KCSWDM (Section 6.1.2) includes three options: stormwater wetland (which can be combined with detention); a large sand filter; or a combination of facilities called "a treatment train" (see Table 6.1.2.A in Appendix D or in the 2009 KCSWDM for more information).

Schematic 1 — Typical Stormwater Wetland Cross Section

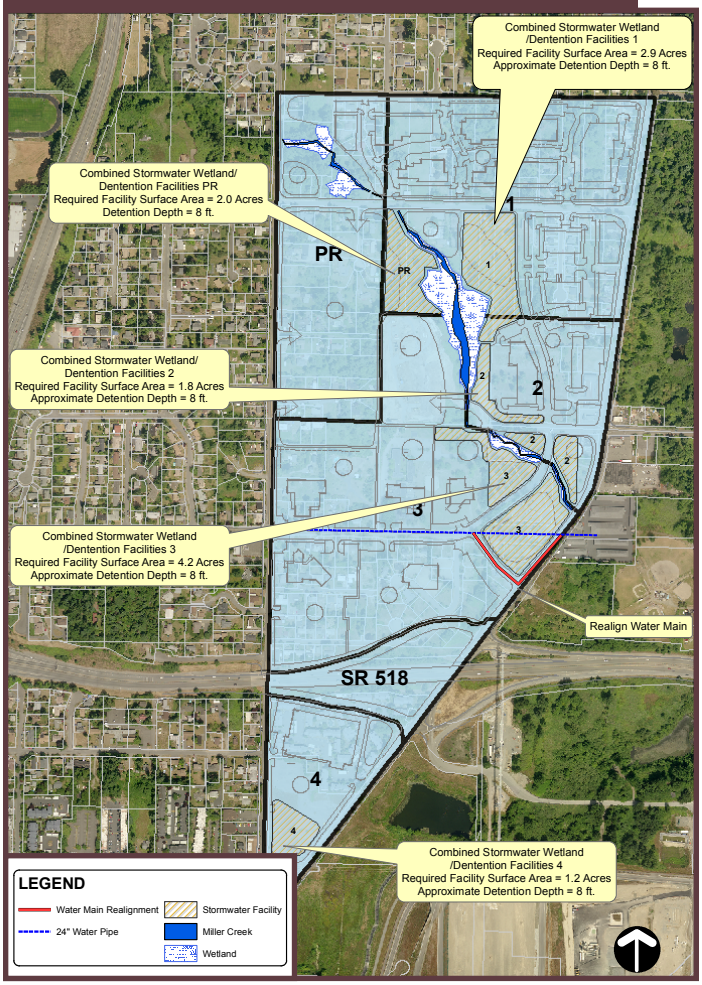


Combined Stormwater Wetland and Detention (Stormwater Wetland)

A stormwater wetland facility satisfies the 50 percent zinc removal goal of KCSWDM and is considered the most cost effective option because of the combination of the flow control volume plus the water quality treatment volume vertically into one footprint and no large underground vault is required. Although in some instances this option is not desirable because of their larger footprints, due to shallower depths of the facilities. However, for the NERA, this option provides many amenities for the area by enhancing the landscape and buffering existing residential areas, while using restricted land for the larger footprints needed. See Figure 6.4.4.A of the 2009 KCSWDM provided in Appendix D for more details on this type of facility. Please refer to Figure 5 for proposed stormwater wetland option layout.

The proposed Stormwater Wetland surface area for each basin was calculated from detention volume plus wetpool volume with 3 to 1 side slopes, 1 foot of freeboard and a 15-foot buffer to accommodate the minimum berm width, access roads, fences, and offsets from property lines. Due to the wetland vegetation in the combined facilities, the water level fluctuation is restricted to be no greater than 3 feet between the Water Quality design level and the water level associated with the 2-year runoff. See Schematic 1 and Table 3.

Figure 5 – Stormwater Wetland Layout



The proposed stormwater wetland design provides a shallow, vegetated area that serves as a stormwater function and providing habitat and green space for the area. Side slopes are designed to be very minimal in order to naturally integrate with surrounding wetlands and also potentially avoid the necessity of fencing. The 15-foot buffer along each side of the proposed facility would accommodate the proposed Miller Creek trail alignment. This trail alignment would be loaded, for the majority of the corridor, on the east side of Miller Creek, therefore in between the creek and stormwater wetlands—surrounded by continuous Greenway.

Maintenance in a stormwater wetland includes the estimated bi-annual cleaning of sediment and landscape maintenance to keep the wetland clear of noxious weeds and general maintenance of vegetation by clearing out dead material or vegetation that will hinder the facilities performance. For specific maintenance requirements, please refer to Appendix A of 2009 KCSWDM No. 18 (Stormwater Wetland).

The wetland sizing procedure, which is separate from the detention volume calculation in MGS Flood, is detailed in Section 6.4.1.1 of the 2009 KCSWDM and is used to determine the stormwater wetland size. Table 3 below summarizes the calculated water quality volumes. The wetland sizing calculations can be found Appendix C of this document.

Table 3 – Wetland & Detention Volume and Surface Area

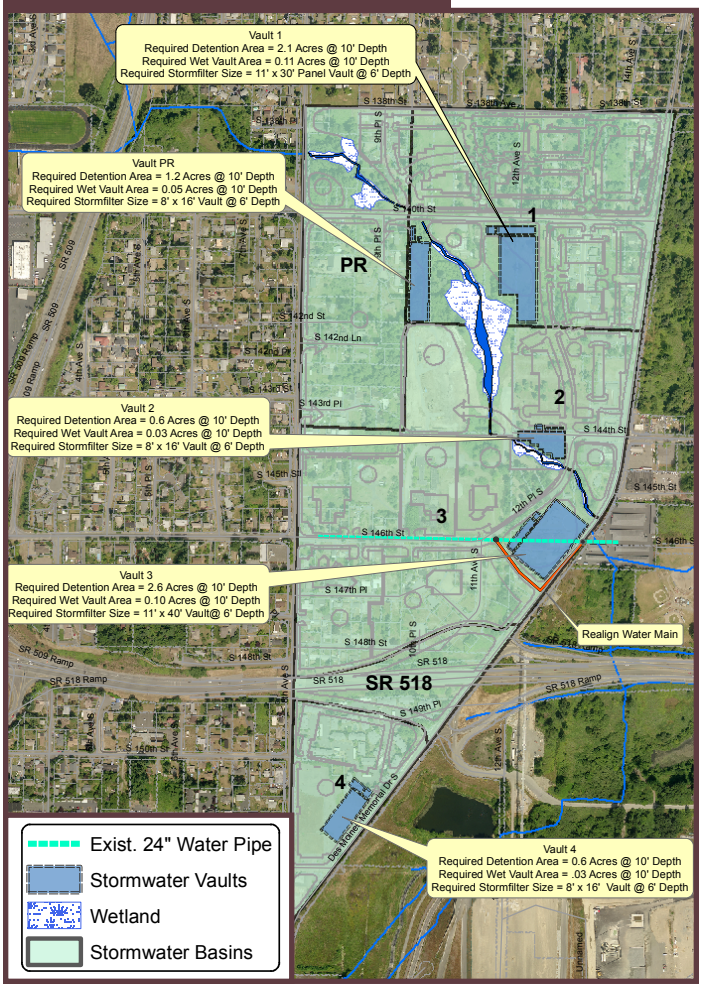
Basin ID	Tributary Area	Wetland Volume (Acre-feet)	Total Surface Area (Acres)
PR	29	2.7	2.5
1	46	4.3	3.6
2	17	1.6	2.2
3	55	5.6	5.3
4	14	1.5	1.5

Treatment Train

The treatment train option for water quality includes the use of underground vaults to minimize required facility footprint and is a viable alternative to Stormwater Wetland. The vaults may be placed underneath proposed parking areas, public roads, and other non-structural developable areas.

Each treatment train will include a wet vault, which provides basic water quality treatment, and a StormFilter vault with CSF leaf compost media, which provides the enhanced water quality treatment. This design assumes a 10-foot depth for the wet vaults and 6-foot depth for the StormFilters. A vault design provides opportunity for green space and parking above the facility, however are more costly to install and maintain due to the size of the structure and confined space which may make the facilities more challenging to maintain. Like the stormwater wetland

Figure 6 – Vault Layout



ponds, vaulted facilities too must be cleaned out on an estimated bi-yearly basis for sediment build-up. However, this maintenance can be more costly in a vault due to the confined space making it more challenging to maneuver and the need to replace filter media within the vault. For specific maintenance requirements, please refer to Appendix A of 2009 KCSWDM No. 17 (Wetvault), and 21 (StormFilter-Cartridge Type). Please refer to Figure 6 for the proposed vault option layout.

Table 4 Summarizes vault sizes for detention and water quality treatment.

Table 4 – Wetvault and StormFilters Vault Sizes

Basin ID	Tributary Area	*Wetvault Volume (Acre-feet)	Storm Filter Vault
PR	29	0.5	8' x 16' Vault
1	46	1.1	11' x 30' Panel Vault
2	17	0.3	8' x 16' Vault
3	55	1.3	11' x 40' Panel Vault
4	14	2.2	8' x 16' Vault

*Wetvault volume calculated from MGS Flood 91% exceedance Volume.

Flow Control Best Management Practices (BMPs) and Low Impact Development (LID)

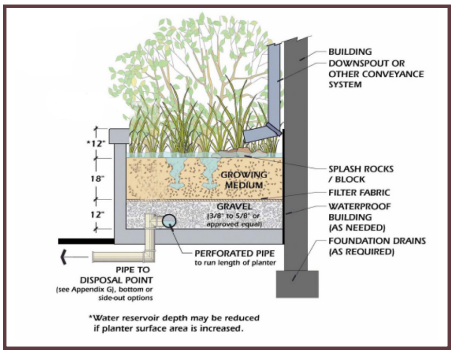
Flow control BMPs are methods and design techniques for dispersing, infiltrating, or otherwise reducing or preventing development-related increases in runoff at or near the source of those increases. In many cases, Low Impact Development techniques provide flow control BMPs on a given site. The 2009 KCSWDM requires that flow control BMPs be applied at each individual development and rather than provided for at the sub-regional facilities. This allows for the slowing and cleaning of stormwater on-site before it is sent to the sub-regional facilities. This limits sediment build-up at the sub-regional facilities and reduces the volume of water to be treated—therefore reducing the size of the sub-regional facilities because some of the stormwater is being treated or infiltrated on individual development sites. KCSWDM requires additional flow control BMPs for Large Lot (>22,000 square feet) High Impervious (>45% of site) development. Examples of these types of facilities are listed in Section 5.2.1.3 and Appendix C of the 2009 KCSWDM and can be found in Appendix D of this report. These are requirements in addition to the Level 2 flow control and enhanced water quality treatment provided by the sub-regional facilities.

It is recommended that the City review any development in the NERA to make sure that these developments have properly designed and installed Flow Control BMPs to the 2009 KCSWDM standard in order to prevent significant impacts downstream to the Miller Creek drainage system.

Infiltration

In Figure 3, the soils group identified as Vashon Recessional outwash is favorable for infiltration facilities (while the Type C and D soils are not favorable). Geotechnical investigations on a site by site basis are required for individual development to determine the infiltration rate flow and design on-site flow control BMPs. It is recommended that the City review each analysis to ensure that each development has properly designed and installed stormwater facilities per the 2009 KCSWDM for Flow Control BMPs and/or Low Impact Development (LID) facilities.

LID techniques may include processes such as, filtration, infiltration, detention/retention and aeration through natural and/or man-made elements. LID techniques should begin with required BMPs and be tailored to fit a given site. Examples of common stormwater LID techniques include: permeable pavement and concrete for use in parking areas or plaza space, the use of rain gardens and swales in parking lot landscaping islands, or on site open space and landscape buffers.



Building Landscaping LID Sche-

SECTION 5

Stormwater Infrastructure Options



Introduction

This section of the report describes potential stormwater infrastructure options and associated estimated costs for each of the defined basins in the Greenway as depicted in Figure __. It is important to note that this is a preliminary and conceptual analysis completed at an early planning stage of the project. As the project moves forward, the program and features of the Greenway and sub-regional stormwater facilities would be defined to a greater level of detail, and this may alter some of the assumptions presented below. The projected costs below are planning-level estimates in 2009 dollars, based on preliminary, conceptual design. The costs include construction as well as environmental permitting and design. Two sets of estimated costs are provided: one estimate for stormwater wetland/detention facilities and one estimate for underground vaults. Ultimately, if the system developed becomes a combination of above ground facilities and vaults, the estimated cost would fall somewhere between the two estimates provided.

Basin PR

Basin PR relates to the Professional Residential area located in the north western portion of the NERA. The stormwater wetland facility surface area required for Basin 1 is approximately 2.0 acres. Alternatively, the detention vault will acquire a 1.1 acre foot print. The available area, immediately south of the Miller Creek crossing of South 140th Street, is approximately 2.8 acres. However, to make either of these structures work in this area, a vertical wall approximately 30-feet in height will be required along the eastern and southern edge in order to accommodate the Stormwater Wetland. See Figure 5 and Figure 6.

According to the available soil data, the basin is situated within unfavorable soils for infiltration, flow control BMPs and LID facilities. However, infiltration investigation is recommended on a site by site basis. Due to the proximity of the facility to Miller Creek, the Stormwater Wetland facility may incorporate open space and passive recreation elements.

Runoff from the facility will be released directly to Miller Creek. There is an existing storm drain system at the north boundary of the NERA that collects street runoff from portions of the City that is outside of NERA. This storm drain system conveys runoff through NERA via open ditches and closed pipes then outfalls into Miller Creek at South 140th Street. Future development within NERA should protect the storm drain system. In addition the culvert crossing for Miller Creek at South 140th Street is often overtopped during significant rainfall events and should be replaced to avoid flooding in this area.

Total combined stormwater wetland estimate = $ 2,440,000
Total subsurface vault estimate = $ 4,280,000

Basin 1

The combined detention and stormwater wetland facility surface area required for Basin 1 is approximately 2.9 acres. Alternatively, the detention vault will acquire a 1.1 acre foot print. The available restricted land, located immediately north of the Miller Creek and south of South 140th Street, is approximately 4.0 acres and can accommodate either alternative.

A large portion of basin 1 is situated within favorable soils for infiltration, flow control BMPs and LID facilities. Infiltration investigation is recommended for all new development. Due to the proximity of the facility to Miller Creek, the facility may incorporate open space and passive recreation elements. Additionally, topography is favorable for open space above a buried vault. Runoff from either proposed facility would be released directly to Miller Creek. See Figure 5 and Figure 6.

Total combined stormwater wetland estimate = $ 1,870,000
Total subsurface vault estimate = $ 7,330,000

Basin 2

The combined detention and stormwater wetland facility surface area required for Basin 2 is approximately 1.8 acres. While a detention vault would require a 0.6 acre footprint. The available restricted area, immediately north of the Miller Creek and along South 144th Street, is approximately 2.0 acres and can accommodate either facility.

A large portion of the basin is situated within favorable soils for infiltration, flow control BMPs and LID facilities. Due to the proximity of the facility to Miller Creek, the Stormwater wetland may incorporate open space and passive recreation elements including a shared-use recreation trail. The Stormwater wetlands proposed for this basin is made up of three wetlands that run along the creek and in some instances are separated by roadways and developable land. Due to the flexibility of the stormwater wetland facilities, restricted area can be utilized for stormwater facilities. Runoff in this scenario would also release runoff directly to Miller Creek. The underground vault alternative is not as flexible in design due to the structure cells that need to be constructed. For this reason the vaulted facility would need to be located within City owned Right-of-Way or City owned property to avoid impacts on developable area. See Figure 5.

Total combined stormwater wetland estimate = $ 1,090,000
Total subsurface vault estimate = $ 2,470,000

Basin 3

The combined detention and stormwater wetland facility surface area required for Basin 3 is approximately 4.2 acres, while the detention vault will acquire a 2.4 acre footprint. The available restricted area, located immediately south of the Miller Creek and along South 144th Street, is approximately 5.0 acres and can accommodate either type of facility. Due to required depth needed for either facility, the existing 24" water transmission main will have to be realigned to allow for the construction of the stormwater facility. This would require the realignment of the water main of approximately 800-linear feet. This realignment costs has been included in the cost estimate of both alternatives.

A large portion of the basin is situated within favorable soils for infiltration, flow control BMPs and LID facilities. Due to the proximity of the facility to Miller Creek, the Stormwater wetland may incorporate open space and passive recreation elements including a shared-use recreation trail. The combined stormwater wetland and detention facility is made up of two Stormwater wetlands that run linearly along the creek and in some instances separated by roadways and developable land. Facilities in both alternatives would release runoff directly to Miller Creek. See Figure 5 and Figure 6.

Total combined stormwater pond estimate = $ 2,760,000
Total subsurface vault estimate = $ 9,200,000

Basin 4

The combined detention and stormwater wetland facility surface area required for Basin 4 is approximately 1.2 Acres. While the detention vault will acquire a 0.6 acre foot print. The available area is approximately 1.6 acres and can accommodate either facility.

A small portion of the basin is situated within favorable soils for infiltration, flow control BMPs and LID facilities. However infiltration investigation is recommended. The basin in not in the immediate vicinity to Miller Creek and runoff will be conveyed by an existing system to Lora lake east of Des Moines Memorial Drive South. See Figure 5 and Figure 6.

Total combined stormwater wetland estimate = $ 730,000
Total subsurface vault estimate = $ 2,150,000

SECTION 6

Next Steps and Conclusion





Moving Forward with the Project

Now that the concept of the Miller Creek Greenway and sub-regional stormwater facilities has been conceptually defined and analyzed, moving forward with the project would involve the following next steps.

1. FUNDING: Pursuing funding for ongoing design and implementation--there are a number of potential funding sources that could be explored to support development of the Miller Creek Greenway as a capital project. The City of Burien will be exploring opportunities to create a stormwater facilities systems charge program that NERA developers could pay into (fee in lieu of) to help support development of the project. This approach would need to be evaluated in balance with the importance of the project as an economic incentive for redevelopment. Based on similar programs in other municipalities, it is likely that paying a systems development charge would be far less costly than being required to develop the stormwater facilities on-site with each individual redevelopment project.

2. PRELIMINARY DESIGN AND MODELING: Preliminary design for the Greenway and stormwater facilities also would need to occur as a next step contingent upon available funding. Preliminary design would take the concepts and analysis explored in this report to 30 percent level of design, further defining potential phasing and implementation considerations for the project. More in-depth hydrologic modeling would occur as part of this step in concert with the increased level of design detail for the project.

3. ENVIRONMENTAL PERMITTING: Environmental permitting for the project would be required and could occur following or concurrent with design.

4. FINAL DESIGN: Final design and development of construction drawings and documents would follow preliminary design. Final design may be focused on a first phase of implementation, based on the analysis completed during preliminary design.

5. CONSTRUCTION: Construction would be the next step and could be focused on a first phase of implementation.

Conclusion

Development of the Miller Creek Greenway project would bring significant benefits to the NERA and Burien. A capital project involving construction of sub-regional stormwater facilities would benefit developers in the NERA by maximizing land capacity for redevelopment on individual sites and reducing overall costs of site development. Environmental rehabilitation of the creek corridor and wetland enhancements will improve water quality functions and general environmental health of the Miller Creek Basin. The creation of a Greenway system as a linear open space with a share-use trail and other recreational features and amenities will benefit future NERA employees, as well as nearby residents of the surrounding neighborhoods. The Miller Creek Greenway would become a lasting legacy for the community, expanding the Burien Loop Trail system and maximizing public usability of otherwise undevelopable areas in the NERA. This report has described a vision for the Miller Creek Greenway and provided a foundation to initiate the project. The City of Burien now has the opportunity to work closely with NERA property owners and other partners to move the Miller Creek Greenway project forward from vision to reality.