CITY OF KIRKLAND
Public Works Department
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MEMORANDUM

To: Kurt Triplett, City Manager

From: Robert O'Brien, Senior Surface Water Engineer
Kelli Jones, Surface Water Program Supervisor
Julie Underwood, Interim Director of Public Works

Date: October 4, 2020

Subject: SPINNEY HOMESTEAD REGIONAL FACILITY—PHASE I UPDATE

RECOMMENDATION:

It is recommended that City Council suspend evaluation of a proposed fee-in-lieu mitigation facility at Spinney Homestead Park, and instead provide direction on the following alternatives:

1. Move forward with Phase II – 10% Design and Phase III – 30% Design as a potential Retrofit Facility instead.
2. Move forward with revised Phase II that only encompasses geotechnical investigation and infiltration testing.
3. Suspend further work until Parks develops a park master plan, incorporating a stormwater retrofit facility into future park development.

BACKGROUND DISCUSSION:

A. Introduction

The Spinney Homestead Regional Facility project was proposed and discussed during the October 15th 2019 City Council Meeting. At that meeting, the Council directed staff to evaluate the feasibility of a fee-in-lieu mitigation stormwater facility built under Spinney Homestead park that could be used by new, small short plat developments. That proposed facility would be an alternative to providing on-site stormwater mitigation for those developments. This pilot project proposed three check in points: (1) Phase I - Feasibility, (2) Phase II – 10% Design, (2) Phase III – 30% Design. The Council asked staff to return and provide an update at the end of each phase and determine whether it made sense to continue to the next phase.

Were all three design phases to be completed, additional coordination would be required for construction, operations, and maintenance. Were the project to be built, it was anticipated it would treat and infiltrate storm and surface water runoff from up to 16.6 acres of new impervious surface within the North Rose Hill and Highlands neighborhoods.

The benefits in constructing a City-owned regional facility include:

- City-owned assets are maintained by the City, thereby eliminating third-party dependence in maintenance and management;
- One larger facility is easier to maintain, as opposed to multiple smaller facilities;
- Future NPDES permitting will require stormwater retrofit requirements and goals.

The first update for the feasibility of the project is summarized below. The findings of the feasibility analysis have shifted the proposed direction of this project, and additional options to consider are further explained.

B. Summary of Findings from Phase I: Feasibility Analysis

The initial feasibility study concluded that the Spinney Homestead Park site is feasible for development of a regional stormwater facility. Phase I investigated the existing basin conveyance infrastructure, conducted a preliminary geotechnical review, conducted preliminary facility sizing, and reevaluated the available parcels within the Forbes Creek basin that potentially could develop and contribute to a fee-in-lieu mitigation facility.

In conjunction with a site investigation, a desktop review of the existing conveyance infrastructure was completed and confirmed an existing impervious surface area of 10.7 acres contributes to the Spinney Homestead Park. To be able to provide mitigation for all development parcels, an additional 5.9 acres of impervious surface would be required to contribute to the site with minor conveyance network changes upstream (see Table 2 of Attachment A, Technical Memorandum). In addition to the minor conveyance network changes to capture enough area, a mitigation facility would require further extensive downstream investigation as the proposed outfall would occur potentially on WSDOT property.

Preliminary geotechnical investigation occurred that reviewed existing literature and reports near the Spinney Homestead Park site, and included some localized hand sampling at the park. The existing reports show the possibility of infiltrative soils and this matches the findings of the hand sampling verification.

A few conservative stormwater facility sizing models were conducted to determine if the park would be large enough to support a stormwater facility. The results are shown in Table 3 of Attachment A and indicate that the facility could be fit within Spinney Homestead Park.

However, the previous study identified an estimated 91 parcels could contribute to the fee-in-lieu mitigation facility in the Forbes Creek basin. But because of new and active development and because of potential environmental restrictions on some parcels, 30 parcels were removed from the original estimate, leaving a total of 61 parcels (Attachment C in Attachment A) to contribute to the mitigation facility. The area of these parcels would require both areas mentioned above to mitigate for the development.

Detailed information regarding the full analysis conducted during Phase I is discussed in Attachment A.

C. Options for Moving Forward

Upon review of Phase I results, the option of a fee-in-lieu facility is unobtainable because of project timing and risks; the pace of development that removes potential sites from fee-in-lieu participation; and unknowns regarding permitting, design, and how to fund the final design and construction. Staff recommends that this project shift from evaluation of a fee-in-lieu mitigation facility to a design of a stormwater retrofit facility. A retrofit facility provides stormwater controls for existing development, which is not likely to redevelop soon, but was developed prior to current stormwater regulations.

Staff is proposing three options for the Council to consider.

1. **Move forward with Phase II – 10% Design and Phase III – 30% Design as a potential Retrofit Facility.**

This option changes the design from a fee-in-lieu mitigation facility to a retrofit facility and allows the project to move forward with geotechnical investigation and up to 30% design for a stormwater retrofit facility to be located at Spinney Homestead park. The advantages of this option include:

- A 30% design can facilitate applications for future grant funding opportunities. Experience has shown that this level of detail is significantly more successful in competition for external grant funding resources.
- Expectations are that future NPDES permit requirements will add a retrofitting component for surface water compliance.
- Geotechnical investigation will aid in any future park master plan considerations.

The disadvantage to moving forward is future park master plan timing is currently unknown, and the design could become outdated if too much time passes.

2. **Move forward with revised Phase II that only encompasses geotechnical investigation and infiltration testing.**

This option will only perform geotechnical investigation and infiltration testing. The advantages of this option include:

- Geotechnical investigation will aid in future park master plan considerations.
- Geotechnical investigation will provide the necessary infiltration rates for determination if a retrofit stormwater facility is feasible. Infiltration would be the main design component associated with siting a stormwater retrofit facility.

The disadvantage to moving forward with a geotechnical investigation only approach would be the opportunity cost of spending grant funding without knowing at what date construction could occur.

3. **Suspend until Parks develops a park master plan, incorporating a stormwater retrofit facility into future park development.**

The advantages of this option include:

- Coordination with park master plan timing.
- Opportunity costs with reallocating grant funding to other projects.

The disadvantage to waiting for Parks to begin a master plan for Spinney Homestead Park is that staff anticipates in future years there will be increased competition for grants to construct such a retrofit project because of impending NPDES permit requirements.

D. Staff Recommendation

While staff sees merits in pursuing Option 1, staff also understands it may be many years until a park master plan is developed for Spinney Homestead and this proposed project should be tightly coordinated with that master plan. Therefore, staff recommends Option 2, which not only aids in determination of feasibility of an infiltration retrofit facility but could be useful information for the future master plan at Spinney Homestead Park.

E. Future Project Cost and Funding

The design costs associated with either Phase I or Phase II, if approved, is 100% funded by the King County Flood Control District with their Sub-Regional Opportunity Fund. Any funding not used for this project is returned to the Sub-Regional Opportunity Fund and can be re-appropriated to future stormwater needs with the City of Kirkland in future years.

The capital cost of the facility is dependent on the following:

- Infiltration capability of the underlying soils;
- Amount of contributing area that drains to the facility; and

The 132nd Square Park Regional Facility is similar in scope to the proposed Spinney Homestead Regional Facility and has just completed a 90% construction cost estimate, which is $3.7 million. Using this cost estimate purely as a very general guide, construction and design costs could be in the magnitude of $3.1 million. Retrofit projects of this size historically have been successful with grant funding from the Department of Ecology. These grants will fund 75% of the project, with 25% City match.

F. Direction Sought

After discussing this item, staff seeks the Council's direction about which of the three options the Council prefers.

Attachment A: Technical Memorandum by AltaTerra

10/6/2020

Technical Memorandum

Spinney Homestead Park Regional Stormwater Facility Feasibility

AltaTerra

AltaTerra

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1. Introduction and Background

Spinney Homestead Park was identified as a potential regional stormwater facility to mitigate stormwater impacts related to development in the North Rose Hill sub-watershed of Forbes Creek. A previous study evaluated the number of properties that have the potential to redevelop in this sub-watershed and the stormwater management considerations associated with the development. The study confirmed the challenges of implementing flow control on small residential redevelopment sites for developers and City staff and identified a regional stormwater facility as an option for alleviating some of those challenges. The Spinney Homestead Park site was identified as a potential option for small redevelopment sites that met certain criteria to pay for stormwater mitigation in lieu of constructing on-site flow control facilities. This memorandum describes the basic feasibility of the Spinney Homestead Park site to construct a regional stormwater facility for use as a stormwater fee-in-lieu facility.

1.1 Overview of Project

The Spinney Homestead Park Regional Stormwater Facility project will be conducted in three phases, with each phase being dependent on project feasibility results from the previous phase. The three phases are:

Phase 1- Initial Feasibility

Phase 2- 10% Conceptual Design

Phase 3 – 30% PS&E and Mitigation Plan Evaluation

This memorandum describes the results of Phase 1, Initial Feasibility. Phase 1 involved verification of conveyance in the vicinity of Spinney Homestead Park, preliminary site reconnaissance, desktop geotechnical evaluation in the vicinity of Spinney Homestead Park, preliminary stormwater modeling to confirm feasibility, and an updated evaluation of potential redevelopment properties available for buy-in to the mitigation site once constructed. The goal of this Phase was to have enough information to support site feasibility and confidently move forward with Phase 2 -10% Conceptual Design.

2. Methodology and Data Sources

Site feasibility was evaluated using a combination of methods, including desktop review of maps, record drawing site plans and figures, field reconnaissance of stormwater infrastructure and surface geology, and preliminary hydraulic modeling. Additionally, an updated review of sites available for redevelopment in the North Rose Hill sub-watershed of Forbes Creek was conducted to determine the number of properties that may be available and meet the criteria for participating in a stormwater fee-in-lieu mitigation facility.

2.1 Data Sources

Data and document review included gathering and reviewing relevant information in the vicinity of Spinney Homestead Park. Table 1 lists the data sources that were reviewed, including the source, date, and author.

Table 1. List of Data Sources Used in Feasibility Analysis

Document/Data Title	Source	Date
Aerial Photograph	City of Kirkland	2018
Base Map	City of Kirkland	2019
Topographic Contours- GIS	City of Kirkland	2019
Critical Areas GIS Coverage	City of Kirkland	2016 - 2020
Property Line GIS Coverage	City of Kirkland	2019
Streets GIS Coverage	City of Kirkland	2019
Surface Water Layers GIS Coverage	City of Kirkland	2019
Record Drawing for Tank at NE 100th St. Bridge	KPFF	January 2001
Record Drawing for 116th Ave NE Sidewalk Improvements and Detention System	Skillings Connolly	May 2009
Record Drawing for NE 100th St drainage system	Del Erickson, PE	January 2000
Record Drawing for tank at 10110 117th Pl NE	Hugh Goldsmith and Associates, Inc.	December 1978
Design Phase Geotechnical Report, SR 405 Northrup to Bothell (MP 14.90 to MP 23)	Agra Earth & Environmental	November 19, 1991

2.2 Field Reconnaissance

A field reconnaissance was conducted on August 19, 2020 by three members of the consultant team to confirm locations of conveyance infrastructure and suitability for routing drainage within the catchment area upstream to Spinney Homestead Park, and to confirm mapped surface geologic conditions at Spinney Homestead Park.

The infrastructure field reconnaissance consisted of a two-person team that opened catch-basins, inspected catch basin sump and pipe connections, noted sump and invert depths, took photographs, and noted presumed flow directions and whether drainage was in the pipe or catch basin at the time of the visit. Opportunities for routing stormwater to Spinney Homestead Park were identified and deemed feasible.

The geologic field reconnaissance was focused on evaluating mapped areas of high or moderate landslide susceptibility and observing the near surface soils in the vicinity of a proposed stormwater infiltration facility in the central playfield area of the park. Shallow hand-dug explorations in the playfield areas near the baseball diamonds located in the northeast and southeast portion of the park were completed.

2.3 Modeling

WWHM2012 (Western Washington Hydrologic Model 2012) was used to model three different stormwater facility scenarios for potential use of Spinney Homestead Park as a mitigation facility. Contributing areas needed to mitigate all parcels available for the fee-in-lieu program were determined

using available GIS mapping (see Section 2.4 below) and using assumptions for future build-out conditions. Two different infiltration rates (1 inch-per-hour and 2 inches-per-hour) were tested for a preliminary infiltration vault size. Additionally, a detention vault was sized assuming no infiltration.

2.4 Evaluation of Development Status

Properties that have the potential to redevelop and meet the small-site criteria identified in the pre-curser study to this project were re-evaluated to determine how many sites have already developed and how many remain for potential redevelopment and participation in a mitigation program at Spinney Homestead Park. GIS was used for this analysis. The following steps were taken to eliminate parcels from the original parcels that were identified:

1. Parcels with active permits were eliminated.
2. Parcels within a 50 ft buffer of (a) steep slopes, or (b) high landslide areas were eliminated.
3. Parcels within a 200 ft buffer of wetlands, not including parcels with street separation, were eliminated.
4. Parcels within a 100 ft buffer of streams were eliminated.

The remaining parcels were considered viable for development and potential buy-in for the Spinney Homestead Regional Stormwater Facility mitigation site.

3. Data Review

The City of Kirkland uploaded GIS data and record drawings for stormwater facilities in the catchment area upstream of Spinney Homestead Park. The GIS data and record drawings were used to create maps for the field reconnaissance and confirm existing conditions. Additionally, geologic data including geotechnical reports and exploration logs were obtained from the Washington Department of Natural Resources (DNR) Subsurface Database (Agra, 1991) to supplement the GIS data provided by the City.

3.1 GIS

City GIS data reviewed and used in this feasibility analysis included:

- Stormwater Pipes (length, diameter, material)
- Stormwater Manholes (type, size)
- Streets
- Parcel boundaries
- Parks
- Landslide Hazards
- Infiltration Potential
- Surface Geology
- Stormwater Polygons (ponds, swales, tanks, vaults, detention pipes, etc.)
- Topographic Contours (2-ft)

The topography and stormwater infrastructure data were used to identify the approximate catchment area to Spinney Homestead Park that is currently conveyed adjacent to the park via the piped stormwater network. Additionally, using GIS topography, an additional catchment area north of the Park was identified as potentially feasible to route to the Park if infrastructure was modified. Landslide hazards and geologic conditions were preliminarily identified by GIS data.

3.2 Geologic Mapping and Reports

The geologic maps of the region indicate that the Site is located within areas mapped of advance out outwash deposits (Qva), present at the surface (Minard, 1983 and Booth et. al, 2007).

Advance outwash characterized as a sand and gravel mixture that generally grades coarser at the higher elevations of the unit. Locally some of the sediments are stained by iron oxide precipitated from ground water. Fine grained sand and some silt are common in the lower part of the unit (Minard, 1983).

A nearby geotechnical evaluation was completed for the NE 100th Street pedestrian bridge that crosses the I-405 highway east of the park (Agra, 1991). Explorations for this evaluation encountered advance outwash deposits, which is consistent with the mapped conditions.

3.3 Stormwater As-builts

There are several existing stormwater facilities in the Spinney Homestead Park catchment area. All are older facilities (vaults, detention tanks, and detention pipes) and are not providing the level of flow control that would be required of modern more recently constructed facilities. Most of these facilities were designed for flow control purposes but likely offer limited, if any water quality treatment. A determination will be made for how to consider the level of benefit provided by these facilities in Phase 2-10% Conceptual Design.

4. Field Summary

Field reconnaissance was completed on August 19, 2020 to verify mapped conveyance conditions and identify any potential conveyance or geologic concerns that would render the Spinney Homestead Park site infeasible.

4.1 Infrastructure

Stormwater infrastructure in the catchment area south of the park and the potential catchment area north of the park was observed. In general, the stormwater conveyance infrastructure is located as it is mapped in City GIS. Additionally, the catch basins and pipes appear to be in good condition. There were only a few instances of more than a few inches of sediment observed in catch basin sumps or other obstructions such as construction sedimentation inlet filters (“socks”) that had not been removed. Field observations that did not match GIS, require maintenance, or had some other identifiable issue are described in Attachment A. The conveyance system south of the park appears to be adequate to collect and convey flow to the park. Some drainage from roof drains appeared to be collected on site and conveyed directly to the public storm system.

As discovered in the GIS evaluation and confirmed through field reconnaissance, a portion of the catchment area north of the park has the potential to be re-routed to Spinney Homestead Park. This would require some conveyance system modifications, including new structures and pipes to convey stormwater to the park. Figure 1 shows the catchment areas and approximate potential area to be re-routed. Property ownership and easements may need to be considered if this approach is advanced in the next phase.

Spinney Homestead Park is bowl-shaped with a low point near the center on the east side. The low point of the park is approximately at elevation 268 feet above mean sea level (MSL). While conveyance to the park is feasible, conveyance away from the park could be more challenging depending on facility design.

From preliminary feasibility analysis, there appears to be two locations for discharge of stormwater overflow from the facility as outlined below:

1. Connect to existing stormwater infrastructure south of the park (per available record drawings, the outlet elevation from the drainage infrastructure south of the park is 266.6 ft above MSL+/-).
    a) Via pump station. This is the most likely option due to the elevation of the low spot of the park and the outlet elevation of the storm infrastructure south of the park. This option would require much less excavation for the overflow pipe trenching, compared to Option b.
    b) Via gravity. Based on the elevation of the low spot of the park and the outlet elevation of the storm infrastructure south of the park, a gravity fed overflow connection is unlikely. Adding fill material to raise the low spot in the park may allow for a gravity-fed overflow connection to be feasible. Trenching for this connection would be very deep near the connection to the existing stormwater infrastructure.
2. Gravity fed piped outfall from the park towards the WSDOT-owned drainage ditch along I-405. This would consist of a daylighted pipe with energy dissipation at the end of the outfall location. Approval from WSDOT to work within WSDOT to work within WSDOT-owned ROW and to discharge stormwater to WSDOT-owned stormwater infrastructure will be required for this option.

Further analysis of the stormwater overflow route will be conducted during Phase 2- 10% Conceptual Design.

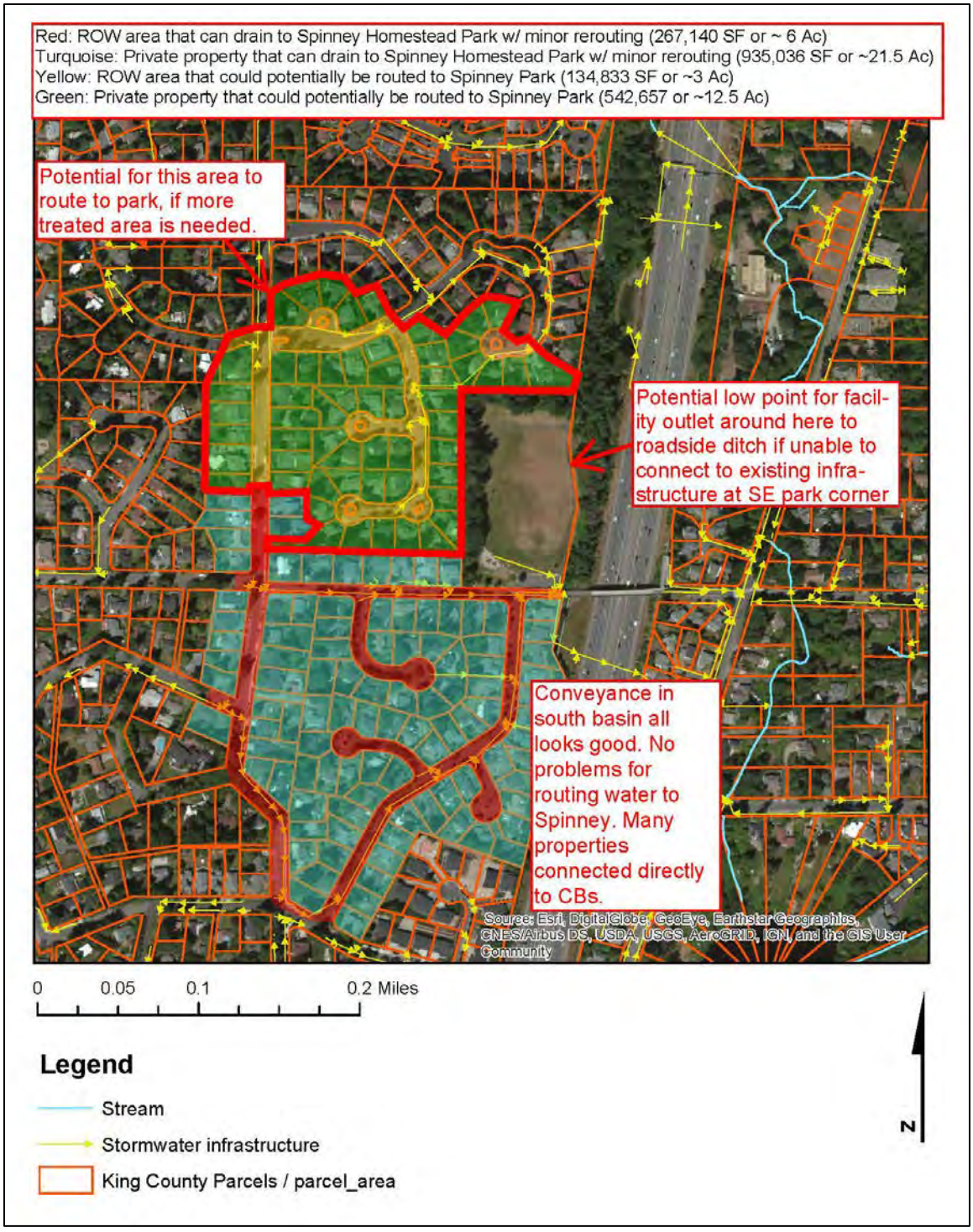


Figure 1. Map of north and south catchment areas and potential area to be re-routed.

4.2 Geology

Surface geologic conditions relative to mapped features were observed in the field. In general, the moderate landslide hazards include slopes typically inclined at gradients less than 30 percent and are vegetated with sod and brush. The mapped high landslide susceptibility areas include slopes that range

from 30 to 50 percent locally, and are vegetated with brush, deciduous and conifer trees. We observed no indication of slope movement or instability in areas mapped as areas of high or moderate landslide susceptibility, mapped on Figure 2. A constructed stormwater facility located in the along moderate to high landslide hazards areas of the park may require some slope stabilization measures or walls to mitigate these critical areas.

We completed shallow hand-dug explorations in the playfield areas near the baseball diamonds located in the northeast and southeast portion of the park. We observed soils that include fine to medium sand with gravel and silt that appear consistent with mapped advance glacial outwash soils that are commonly utilized regionally as a stormwater infiltration receptor soil.

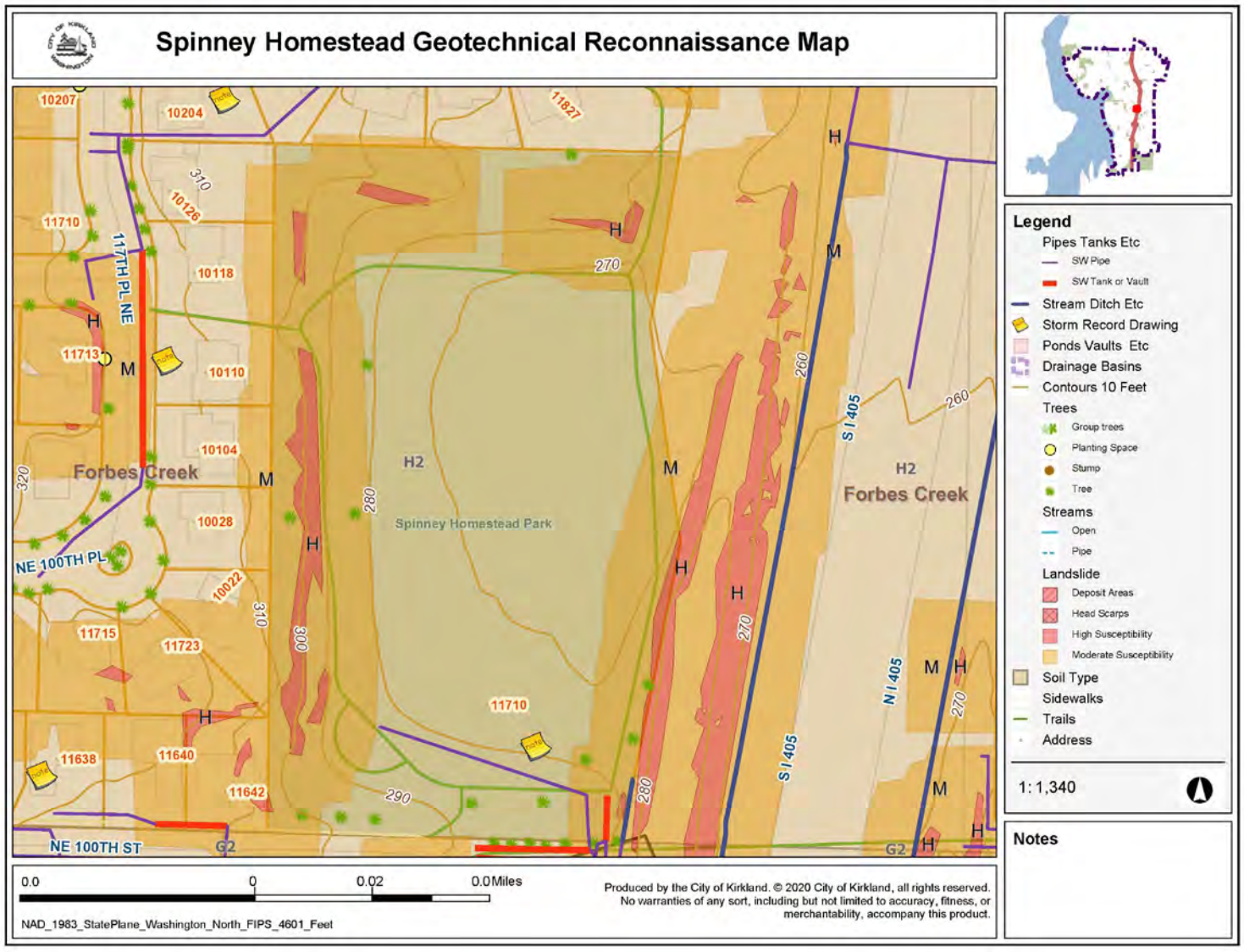


Figure 2. Geologic reconnaissance map

5. Development Status Results

An analysis was conducted on the 91 parcels that were originally identified as being viable for potential buy-in to a stormwater mitigation fee-in-lieu facility. These parcels were small lots that had the potential to redevelop and would trigger flow control under King County (and Kirkland) Surface Water Design Manual requirements but not Ecology Surface Water Design Manual requirements and are under the 10,000 square feet impervious surface threshold. The analysis involved eliminating parcels that have already started to redevelop (i.e., they have active permits), or are encumbered in some way by environmentally critical areas such as steep slopes, landslide hazards, streams or wetlands that would limit the site redevelopment viability. The analysis resulted in 61 currently viable parcels available for buy-in for off-site stormwater mitigation. Development analysis figure and tables are provided in Attachment B.

6. Modeling Results

Hydrologic modeling was used to estimate facility size needed to treat stormwater from the 61 currently available parcels that would be eligible to buy-in to the mitigation site. Table 2 shows the parcel characteristics, and catchment area characteristics that were assumed for modeling purposes:

Table 2. Summary of Area Characteristics Modeled

Catchment Areas	Total Size (acres)	Total Impervious (acres)	Pervious (acres)
Total area of Parcels for Buy-in[1]	26	16.6	9.4
South Catchment to Spinney Homestead Park	26.7	10.7	16.0
North Catchment to Spinney Homestead Park	15.9	6.6	9.3
Total Spinney Catchment Area	**42.6**	**17.3**	**25.3**

[1] This is the modeled area that was used to test Spinney Homestead Park for stormwater facility viability. Impervious surface includes 2.4 acres for assumed frontage improvements.

The areas shown in Table 2 indicate that the South and North catchment areas to Spinney Homestead Park are of sufficient size and characteristic (i.e., 17.3 acres of impervious surface) to be roughly equivalent (i.e., 16.6 acres of impervious surface) to the 61 parcels that would potentially use the Spinney Homestead site for off-site stormwater mitigation.

For modeling purposes, the modeled area was assumed to be equivalent to the total area of the viable parcels for buy-in with the same characteristics. Table 3 shows the modeling scenarios, assumptions, and sizing results for the different test cases.

Table 3. Summary of Modeling Scenario Assumptions and Results

Scenario	Depth (ft)	Riser Height (ft)	Size to 100% infiltration optimizer used?	Bottom size in square feet (acres in parentheses)		
				Infiltration Rate = 1 in/hr	Infiltration Rate = 2 in/hr	No infiltration
Detention Facility with Infiltration	7	6.5	Yes	42,000 (0.9)	33,600 (0.8)	NA
Detention Facility with no Infiltration	5	4	No	NA	NA	146,700 (3.4)

Spinney Homestead Park is 5.5 acres. Results in Table 3 indicate there is suitable area for any of the facilities based on the assumptions used in the modeling scenarios. Modeling reports are provided in Attachment C.

Preliminary modeling did not account for existing stormwater facilities in the basin that drain to the Park and the flow control they provide. Further modeling will be needed to account for existing detention systems in the catchment areas tributary to Spinney Homestead Park or an agreement reached between the team and the City on best approach to account for this existing infrastructure.

7. Summary

The following factors were evaluated to determine preliminary feasibility for developing a regional stormwater facility at Spinney Homestead Park:

- Existing stormwater conveyance infrastructure.
- Geologic data to support potential infiltration at the site.
- Analysis of parcels that are viable to buy-in for stormwater mitigation.
- Modeling to determine if site is large enough to accommodate a stormwater facility to provide the mitigation necessary.

Site feasibility depends on the technical feasibility of constructing a facility that meets the size and treatment requirements necessary to mitigate redevelopment, and economic feasibility of having enough parcels to participate that makes construction of such a facility cost effective for the City.

7.1 Technical Site Feasibility

Based on the field reconnaissance and modeling results, the Spinney Homestead Park site is technically feasible for a stormwater mitigation facility. The conveyance network from the south catchment area is as mapped and appears to be in good condition, based on observations at the manholes and catch basins. Based on the catchment topography, and existing conveyance system to the north of Spinney Homestead Park, it appears possible to modify (minimally) the conveyance system and re-route part of

the stormwater system to a new stormwater facility in the park if additional area is needed to mitigate offsite stormwater from redeveloped parcels.

Modeling results indicate the park is large enough for a stormwater facility, although a facility that incorporates infiltration would be preferable and would utilize less area. Geologic conditions are mapped as advance glacial outwash soils, conditions that are commonly receptive to stormwater infiltration. The infiltration rates assumed in the modeling will need to be confirmed, but based on preliminary conservative estimates, a facility with infiltration appears to be potentially feasible.

7.2 Economic Feasibility

Economic feasibility depends on the number of properties in the North Rose Hill sub-watershed area that have the potential to redevelop and meet criteria to buy-in to the mitigation site at Spinney Homestead Park and the potential reduction in maintenance costs for City staff for inspecting and maintaining one large facility versus hundreds of small facilities. Based on the current analysis, there are 61 properties that meet the criteria. Approximately 30% of the original list of sites available in 2018 already have active permits. The economic feasibility of the Spinney Homestead Park Regional Stormwater Facility for fee-in-lieu stormwater mitigation will depend on the rate of redevelopment before, during, and after a facility is constructed. These are factors that will require further analysis in Phase 2 or Phase 3 to identify the risks involved with fee-in-lieu participation and City cost recovery.

8. Recommendations

This initial feasibility study concludes that the Spinney Homestead Park site is feasible for development of a regional stormwater facility. Further analysis is needed to refine hydrologic models, develop preliminary costs associated with potential conveyance modifications, confirm infiltration rates, identify park and neighborhood concerns and/or expectations, and identify potential risks and opportunities associated with mitigation. There is enough information to confidently proceed to Phase 2, 10% Conceptual Design, to answer these questions and determine costs versus benefits of a stormwater facility at Spinney Homestead Park.

9. References

Agra Earth and Environmental, 1991, Design Phase Geotechnical Report, SR 405 Northrup to Bothell (MP 14.90 to MP 23), November 19, 1991.

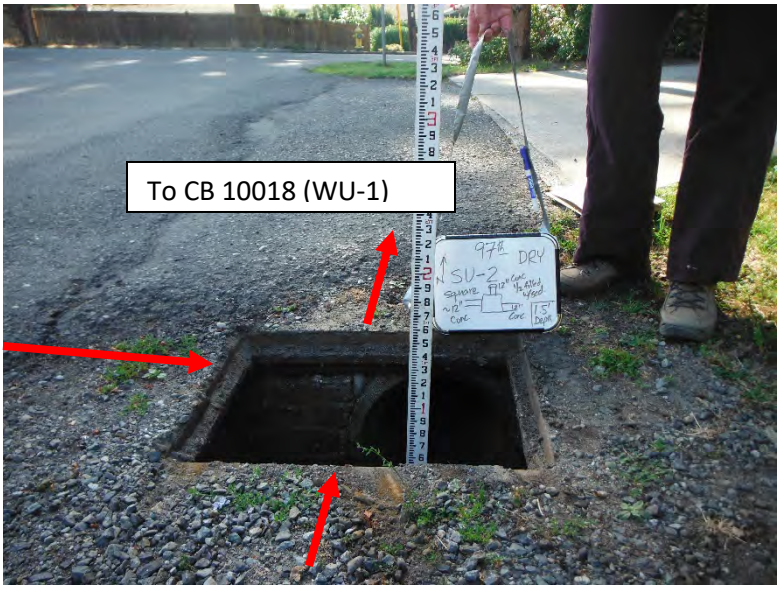
Booth, D.B., Troost, K.A., Wisher, A.P., 2007, Geologic Map of King County, GeoMapNW, University of Washington, scale 1:100,000.

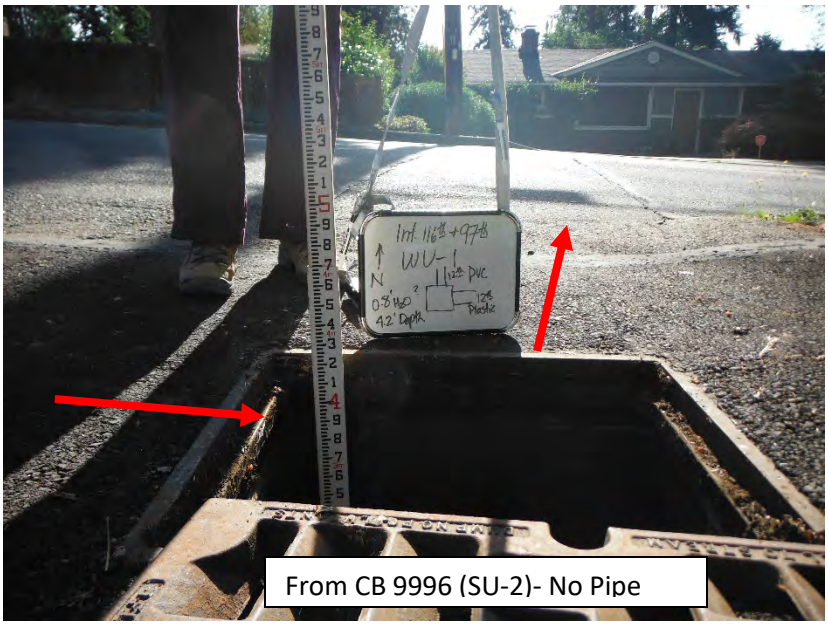
Minard, J.P., 1983, Geologic Map of the Kirkland Quadrangle, King County, Washington: U.S. Geological Survey, Miscellaneous Field Studies Map MF-1543, scale 1:24,000.

Washington Department of Natural Resources, subsurface database, https://geologyportal.dnr.wa.gov/ accessed on September 15, 2020.

Attachment A
Infrastructure Issues

Infrastructure Issue: Catch Basin 9996 (SU-2 in photo below) does not appear to be connected to catch basin 10018 (WU-1 in photo below).





New catch basins not in GIS on 116th Ave NE:

Infrastructure Issue: CB 10170 on the west side of 116th Ave NE at the intersection with NE 95th Street is overgrown and inaccessible.

Infrastructure Issue: CB 2876 (D-3 in photo) in Spinney Park doesn't appear to receive much if any flow from surrounding area (maybe in extreme events).

Infrastructure Issue: Curb weep observed flowing into catch basin 10514(SD-3 in photo) from the curb on NE 100th Street.


39830
39622
39623
2794
10509
10542
10555
10595
2876
10463
10514
NE 100TH ST
10597
10630
116TH PL NE
320
300
280


CB NE 100th St.
SD-3 DS
1.2' H2O
6.3' Depth
8" CMP
12" CMP
inv. ~1.4'
inv. ~1.2'
12"
inv. ~1.2'

Infrastructure Issues: Catch basins with construction socks that need to be removed.

CB 2757 (WU-1 in photo)


CB 10122 (SD-6 in photo)
NE 100th St.
SD-6
Sock in CB

Attachment B
Development Status Summary

AltaTerra

Spinney Homestead Parcels Available for Buy-In

Legend

- Favorable Parcels
- Developable Parcels Subject to Sensitive Area Considerations
- Unavailable Parcels Due to Active Development Permit
- Watershed at 1/4-Mile Downstream of Prop. Facility
- Spinney Homestead Subbasins
- Forbes Creek Watershed

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Spinney Homestead - Regional Development
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Attachment C
Modeling Reports

AltaTerra

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Vaultw1in_per_hr
Site Name:	Spinney Homestead Park
Site Address:	11710 NE 100TH ST
City:	Kirkland
Report Date:	8/26/2020
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	26
Pervious Total	26
Impervious Land Use	acre
Impervious Total	0
Basin Total	26

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	9.4
Pervious Total	9.4
Impervious Land Use	acre
ROADS MOD	2.4
ROOF TOPS FLAT	14.2
Impervious Total	16.6
Basin Total	26

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Mitigated Routing

Vault 1

Width: 204.888726238757 ft.
Length: 204.888726238757 ft.
Depth: 7 ft.
Infiltration On
Infiltration rate: 1
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 3360.621
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 3360.621
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 6.5 ft.
Riser Diameter: 18 in.
Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

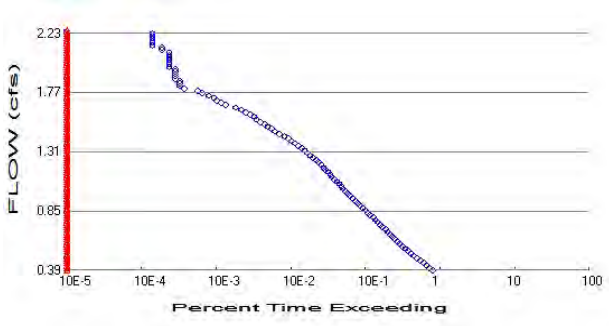
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.963	0.000	0.000	0.000
0.0778	0.963	0.075	0.000	0.971
0.1556	0.963	0.149	0.000	0.971
0.2333	0.963	0.224	0.000	0.971
0.3111	0.963	0.299	0.000	0.971
0.3889	0.963	0.374	0.000	0.971
0.4667	0.963	0.449	0.000	0.971
0.5444	0.963	0.524	0.000	0.971
0.6222	0.963	0.599	0.000	0.971
0.7000	0.963	0.674	0.000	0.971
0.7778	0.963	0.749	0.000	0.971
0.8556	0.963	0.824	0.000	0.971
0.9333	0.963	0.899	0.000	0.971
1.0111	0.963	0.974	0.000	0.971
1.0889	0.963	1.049	0.000	0.971
1.1667	0.963	1.124	0.000	0.971
1.2444	0.963	1.199	0.000	0.971
1.3222	0.963	1.274	0.000	0.971
1.4000	0.963	1.349	0.000	0.971
1.4778	0.963	1.424	0.000	0.971
1.5556	0.963	1.499	0.000	0.971
1.6333	0.963	1.574	0.000	0.971
1.7111	0.963	1.649	0.000	0.971
1.7889	0.963	1.724	0.000	0.971
1.8667	0.963	1.798	0.000	0.971
1.9444	0.963	1.873	0.000	0.971
2.0222	0.963	1.948	0.000	0.971
2.1000	0.963	2.023	0.000	0.971
2.1778	0.963	2.098	0.000	0.971
2.2556	0.963	2.173	0.000	0.971
2.3333	0.963	2.248	0.000	0.971
2.4111	0.963	2.323	0.000	0.971

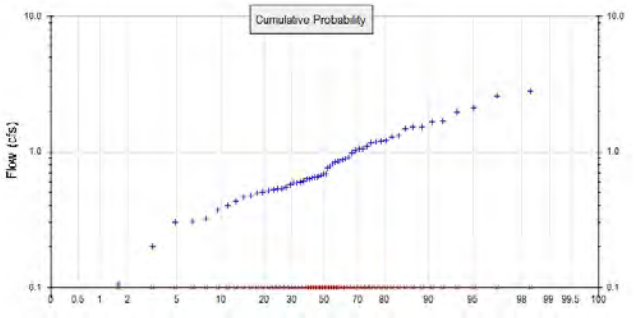
2.4889	0.963	2.398	0.000	0.971
2.5667	0.963	2.473	0.000	0.971
2.6444	0.963	2.548	0.000	0.971
2.7222	0.963	2.623	0.000	0.971
2.8000	0.963	2.698	0.000	0.971
2.8778	0.963	2.773	0.000	0.971
2.9556	0.963	2.848	0.000	0.971
3.0333	0.963	2.923	0.000	0.971
3.1111	0.963	2.998	0.000	0.971
3.1889	0.963	3.073	0.000	0.971
3.2667	0.963	3.148	0.000	0.971
3.3444	0.963	3.223	0.000	0.971
3.4222	0.963	3.298	0.000	0.971
3.5000	0.963	3.373	0.000	0.971
3.5778	0.963	3.448	0.000	0.971
3.6556	0.963	3.522	0.000	0.971
3.7333	0.963	3.597	0.000	0.971
3.8111	0.963	3.672	0.000	0.971
3.8889	0.963	3.747	0.000	0.971
3.9667	0.963	3.822	0.000	0.971
4.0444	0.963	3.897	0.000	0.971
4.1222	0.963	3.972	0.000	0.971
4.2000	0.963	4.047	0.000	0.971
4.2778	0.963	4.122	0.000	0.971
4.3556	0.963	4.197	0.000	0.971
4.4333	0.963	4.272	0.000	0.971
4.5111	0.963	4.347	0.000	0.971
4.5889	0.963	4.422	0.000	0.971
4.6667	0.963	4.497	0.000	0.971
4.7444	0.963	4.572	0.000	0.971
4.8222	0.963	4.647	0.000	0.971
4.9000	0.963	4.722	0.000	0.971
4.9778	0.963	4.797	0.000	0.971
5.0556	0.963	4.872	0.000	0.971
5.1333	0.963	4.947	0.000	0.971
5.2111	0.963	5.022	0.000	0.971
5.2889	0.963	5.097	0.000	0.971
5.3667	0.963	5.171	0.000	0.971
5.4444	0.963	5.246	0.000	0.971
5.5222	0.963	5.321	0.000	0.971
5.6000	0.963	5.396	0.000	0.971
5.6778	0.963	5.471	0.000	0.971
5.7556	0.963	5.546	0.000	0.971
5.8333	0.963	5.621	0.000	0.971
5.9111	0.963	5.696	0.000	0.971
5.9889	0.963	5.771	0.000	0.971
6.0667	0.963	5.846	0.000	0.971
6.1444	0.963	5.921	0.000	0.971
6.2222	0.963	5.996	0.000	0.971
6.3000	0.963	6.071	0.000	0.971
6.3778	0.963	6.146	0.000	0.971
6.4556	0.963	6.221	0.000	0.971
6.5333	0.963	6.296	0.096	0.971
6.6111	0.963	6.371	0.587	0.971
6.6889	0.963	6.446	1.291	0.971
6.7667	0.963	6.521	2.123	0.971
6.8444	0.963	6.596	3.009	0.971
6.9222	0.963	6.671	3.871	0.971

7.0000	0.963	6.746	4.639	0.971
7.0778	0.963	6.821	5.256	0.971
7.1556	0.000	0.000	5.703	0.000

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 26
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 9.4
Total Impervious Area: 16.6

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.774155
5 year	1.268522
10 year	1.58639
25 year	1.964508
50 year	2.226417
100 year	2.471053

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.891	0.000
1950	1.058	0.000
1951	1.691	0.000
1952	0.530	0.000
1953	0.429	0.000
1954	0.659	0.000
1955	1.052	0.000
1956	0.848	0.000
1957	0.684	0.000
1958	0.760	0.000

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Vaultw2in_per_hr
Site Name:	Spinney Homestead Park
Site Address:	11710 NE 100TH ST
City:	Kirkland
Report Date:	8/26/2020
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	26
Pervious Total	26
Impervious Land Use	acre
Impervious Total	0
Basin Total	26

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	9.4
Pervious Total	9.4
Impervious Land Use	acre
ROADS MOD	2.4
ROOF TOPS FLAT	14.2
Impervious Total	16.6
Basin Total	26

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Mitigated Routing

Vault 1

Width: 183.27833883315 ft.
Length: 183.27833883315 ft.
Depth: 7 ft.
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 3360.336
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 3360.336
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 6.5 ft.
Riser Diameter: 18 in.
Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

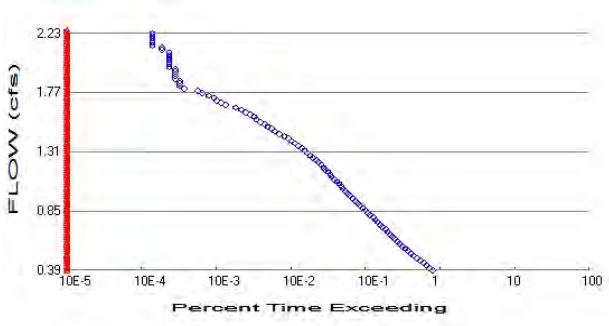
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.771	0.000	0.000	0.000
0.0778	0.771	0.060	0.000	1.555
0.1556	0.771	0.120	0.000	1.555
0.2333	0.771	0.179	0.000	1.555
0.3111	0.771	0.239	0.000	1.555
0.3889	0.771	0.299	0.000	1.555
0.4667	0.771	0.359	0.000	1.555
0.5444	0.771	0.419	0.000	1.555
0.6222	0.771	0.479	0.000	1.555
0.7000	0.771	0.539	0.000	1.555
0.7778	0.771	0.599	0.000	1.555
0.8556	0.771	0.659	0.000	1.555
0.9333	0.771	0.719	0.000	1.555
1.0111	0.771	0.779	0.000	1.555
1.0889	0.771	0.839	0.000	1.555
1.1667	0.771	0.899	0.000	1.555
1.2444	0.771	0.959	0.000	1.555
1.3222	0.771	1.019	0.000	1.555
1.4000	0.771	1.079	0.000	1.555
1.4778	0.771	1.139	0.000	1.555
1.5556	0.771	1.199	0.000	1.555
1.6333	0.771	1.259	0.000	1.555
1.7111	0.771	1.319	0.000	1.555
1.7889	0.771	1.379	0.000	1.555
1.8667	0.771	1.439	0.000	1.555
1.9444	0.771	1.499	0.000	1.555
2.0222	0.771	1.559	0.000	1.555
2.1000	0.771	1.619	0.000	1.555
2.1778	0.771	1.679	0.000	1.555
2.2556	0.771	1.739	0.000	1.555
2.3333	0.771	1.799	0.000	1.555
2.4111	0.771	1.859	0.000	1.555

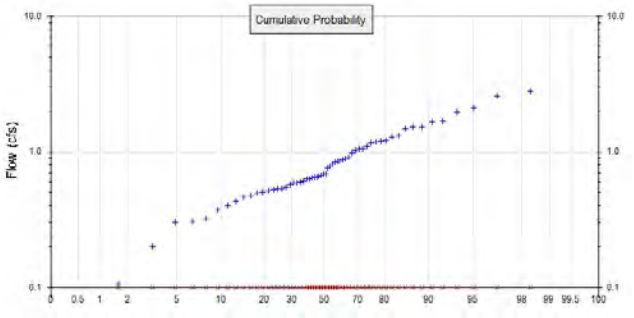
2.4889	0.771	1.919	0.000	1.555
2.5667	0.771	1.979	0.000	1.555
2.6444	0.771	2.039	0.000	1.555
2.7222	0.771	2.099	0.000	1.555
2.8000	0.771	2.159	0.000	1.555
2.8778	0.771	2.219	0.000	1.555
2.9556	0.771	2.279	0.000	1.555
3.0333	0.771	2.339	0.000	1.555
3.1111	0.771	2.399	0.000	1.555
3.1889	0.771	2.459	0.000	1.555
3.2667	0.771	2.519	0.000	1.555
3.3444	0.771	2.579	0.000	1.555
3.4222	0.771	2.639	0.000	1.555
3.5000	0.771	2.699	0.000	1.555
3.5778	0.771	2.759	0.000	1.555
3.6556	0.771	2.819	0.000	1.555
3.7333	0.771	2.878	0.000	1.555
3.8111	0.771	2.938	0.000	1.555
3.8889	0.771	2.998	0.000	1.555
3.9667	0.771	3.058	0.000	1.555
4.0444	0.771	3.118	0.000	1.555
4.1222	0.771	3.178	0.000	1.555
4.2000	0.771	3.238	0.000	1.555
4.2778	0.771	3.298	0.000	1.555
4.3556	0.771	3.358	0.000	1.555
4.4333	0.771	3.418	0.000	1.555
4.5111	0.771	3.478	0.000	1.555
4.5889	0.771	3.538	0.000	1.555
4.6667	0.771	3.598	0.000	1.555
4.7444	0.771	3.658	0.000	1.555
4.8222	0.771	3.718	0.000	1.555
4.9000	0.771	3.778	0.000	1.555
4.9778	0.771	3.838	0.000	1.555
5.0556	0.771	3.898	0.000	1.555
5.1333	0.771	3.958	0.000	1.555
5.2111	0.771	4.018	0.000	1.555
5.2889	0.771	4.078	0.000	1.555
5.3667	0.771	4.138	0.000	1.555
5.4444	0.771	4.198	0.000	1.555
5.5222	0.771	4.258	0.000	1.555
5.6000	0.771	4.318	0.000	1.555
5.6778	0.771	4.378	0.000	1.555
5.7556	0.771	4.438	0.000	1.555
5.8333	0.771	4.498	0.000	1.555
5.9111	0.771	4.558	0.000	1.555
5.9889	0.771	4.618	0.000	1.555
6.0667	0.771	4.678	0.000	1.555
6.1444	0.771	4.738	0.000	1.555
6.2222	0.771	4.798	0.000	1.555
6.3000	0.771	4.858	0.000	1.555
6.3778	0.771	4.918	0.000	1.555
6.4556	0.771	4.978	0.000	1.555
6.5333	0.771	5.038	0.096	1.555
6.6111	0.771	5.098	0.587	1.555
6.6889	0.771	5.158	1.291	1.555
6.7667	0.771	5.218	2.123	1.555
6.8444	0.771	5.278	3.009	1.555
6.9222	0.771	5.338	3.871	1.555

7.0000	0.771	5.398	4.639	1.555
7.0778	0.771	5.458	5.256	1.555
7.1556	0.000	0.000	5.703	0.000

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 26
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 9.4
Total Impervious Area: 16.6

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.774155
5 year	1.268522
10 year	1.58639
25 year	1.964508
50 year	2.226417
100 year	2.471053

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.891	0.000
1950	1.058	0.000
1951	1.691	0.000
1952	0.530	0.000
1953	0.429	0.000
1954	0.659	0.000
1955	1.052	0.000
1956	0.848	0.000
1957	0.684	0.000
1958	0.760	0.000

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Vault
Site Name:	Spinney Homestead Park
Site Address:	11710 NE 100TH ST
City:	Kirkland
Report Date:	8/25/2020
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	26
Pervious Total	26
Impervious Land Use	acre
Impervious Total	0
Basin Total	26

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Mod	9.4
Pervious Total	9.4

Impervious Land Use	acre
ROADS MOD	2.4
ROOF TOPS FLAT	14.2
Impervious Total	16.6
Basin Total	26

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Mitigated Routing

Vault 1

Width: 383 ft.
Length: 383 ft.
Depth: 5 ft.
Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 2.11 in. Elevation:0 ft.
Orifice 2 Diameter: 4.01 in. Elevation:2.678 ft.
Orifice 3 Diameter: 6.66 in. Elevation:3.29625000000005 ft.
Element Flows To:
Outlet 1 Outlet 2

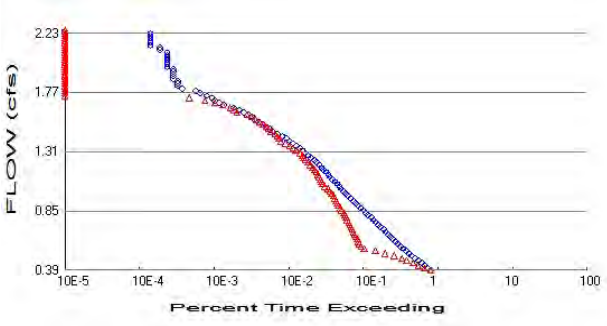
Vault Hydraulic Table

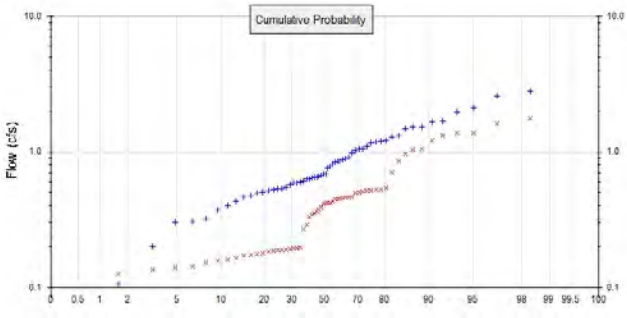
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	3.367	0.000	0.000	0.000
0.0556	3.367	0.187	0.028	0.000
0.1111	3.367	0.374	0.040	0.000
0.1667	3.367	0.561	0.049	0.000
0.2222	3.367	0.748	0.057	0.000
0.2778	3.367	0.935	0.063	0.000
0.3333	3.367	1.122	0.069	0.000
0.3889	3.367	1.309	0.075	0.000
0.4444	3.367	1.496	0.080	0.000
0.5000	3.367	1.683	0.085	0.000
0.5556	3.367	1.870	0.090	0.000
0.6111	3.367	2.057	0.094	0.000
0.6667	3.367	2.245	0.098	0.000
0.7222	3.367	2.432	0.102	0.000
0.7778	3.367	2.619	0.106	0.000
0.8333	3.367	2.806	0.110	0.000
0.8889	3.367	2.993	0.113	0.000
0.9444	3.367	3.180	0.117	0.000
1.0000	3.367	3.367	0.120	0.000
1.0556	3.367	3.554	0.124	0.000
1.1111	3.367	3.741	0.127	0.000
1.1667	3.367	3.928	0.130	0.000
1.2222	3.367	4.115	0.133	0.000
1.2778	3.367	4.302	0.136	0.000
1.3333	3.367	4.490	0.139	0.000
1.3889	3.367	4.677	0.142	0.000
1.4444	3.367	4.864	0.145	0.000
1.5000	3.367	5.051	0.148	0.000
1.5556	3.367	5.238	0.150	0.000
1.6111	3.367	5.425	0.153	0.000
1.6667	3.367	5.612	0.156	0.000
1.7222	3.367	5.799	0.158	0.000
1.7778	3.367	5.986	0.161	0.000
1.8333	3.367	6.173	0.163	0.000
1.8889	3.367	6.360	0.166	0.000
1.9444	3.367	6.547	0.168	0.000
2.0000	3.367	6.735	0.170	0.000
2.0556	3.367	6.922	0.173	0.000

2.1111	3.367	7.109	0.175	0.000
2.1667	3.367	7.296	0.177	0.000
2.2222	3.367	7.483	0.180	0.000
2.2778	3.367	7.670	0.182	0.000
2.3333	3.367	7.857	0.184	0.000
2.3889	3.367	8.044	0.186	0.000
2.4444	3.367	8.231	0.188	0.000
2.5000	3.367	8.418	0.191	0.000
2.5556	3.367	8.605	0.193	0.000
2.6111	3.367	8.793	0.195	0.000
2.6667	3.367	8.980	0.197	0.000
2.7222	3.367	9.167	0.291	0.000
2.7778	3.367	9.354	0.339	0.000
2.8333	3.367	9.541	0.375	0.000
2.8889	3.367	9.728	0.405	0.000
2.9444	3.367	9.915	0.432	0.000
3.0000	3.367	10.10	0.456	0.000
3.0556	3.367	10.29	0.479	0.000
3.1111	3.367	10.47	0.500	0.000
3.1667	3.367	10.66	0.520	0.000
3.2222	3.367	10.85	0.538	0.000
3.2778	3.367	11.03	0.556	0.000
3.3333	3.367	11.22	0.805	0.000
3.3889	3.367	11.41	0.956	0.000
3.4444	3.367	11.59	1.069	0.000
3.5000	3.367	11.78	1.165	0.000
3.5556	3.367	11.97	1.249	0.000
3.6111	3.367	12.16	1.326	0.000
3.6667	3.367	12.34	1.397	0.000
3.7222	3.367	12.53	1.464	0.000
3.7778	3.367	12.72	1.527	0.000
3.8333	3.367	12.90	1.587	0.000
3.8889	3.367	13.09	1.645	0.000
3.9444	3.367	13.28	1.700	0.000
4.0000	3.367	13.47	1.753	0.000
4.0556	3.367	13.65	2.012	0.000
4.1111	3.367	13.84	2.441	0.000
4.1667	3.367	14.03	2.976	0.000
4.2222	3.367	14.21	3.585	0.000
4.2778	3.367	14.40	4.243	0.000
4.3333	3.367	14.59	4.921	0.000
4.3889	3.367	14.78	5.592	0.000
4.4444	3.367	14.96	6.228	0.000
4.5000	3.367	15.15	6.805	0.000
4.5556	3.367	15.34	7.303	0.000
4.6111	3.367	15.52	7.714	0.000
4.6667	3.367	15.71	8.039	0.000
4.7222	3.367	15.90	8.298	0.000
4.7778	3.367	16.08	8.611	0.000
4.8333	3.367	16.27	8.867	0.000
4.8889	3.367	16.46	9.116	0.000
4.9444	3.367	16.65	9.357	0.000
5.0000	3.367	16.83	9.592	0.000
5.0556	3.367	17.02	9.821	0.000
5.1111	0.000	0.000	10.04	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 26
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 9.4
Total Impervious Area: 16.6

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.774155
5 year	1.268522
10 year	1.58639
25 year	1.964508
50 year	2.226417
100 year	2.471053

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.350348
5 year	0.65987
10 year	0.93816
25 year	1.387583
50 year	1.802886
100 year	2.295574

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.891	0.174
1950	1.058	0.704
1951	1.691	1.741
1952	0.530	0.159
1953	0.429	0.461
1954	0.659	0.446
1955	1.052	0.176
1956	0.848	1.053
1957	0.684	0.189
1958	0.760	0.392