TECHNICAL INFORMATION REPORT

Ravensdale Park Improvements

Prepared for

King County Department of Natural Resources and Parks
Capital Planning & Business Development Section
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Seattle, Washington 98104

and

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February 11, 2011 Draft

Note:
Some pages in this document have been purposefully skipped or blank pages inserted so that this document will copy correctly when duplexed.

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1. Project Overview

The Ravensdale Park field renovation project is located in Ravensdale Park, south of SE Kent-Kangley Road and west of 272nd Avenue SE. The project area is approximately 2.5 acres. The project includes the following elements:

- Two existing athletic fields to be renovated: one compacted dirt soccer field, approximately 1.95 acres in area, will be converted to an artificial turf field; one turf baseball field, approximately 0.55 acres in area, will be modified to have an artificial turf infield. Both fields to be fenced.
- Area adjacent to fields to the west to be cleared of invasive plant species.
- Undeveloped portion of the park to the east (parcel no. 2522069001) to be partially cleared and graded to remove invasive plant species and create a community meadow using native plant species.
- At the request of King County Water and Land Resources Division (Batts personal communication 2010), drainage from the synthetic turf athletic fields will be collected by constructing an impermeable liner below the subdrainage system. Drainage collected beneath the fields will be routed to a storm drain and then to a CONTECH Stormwater Management StormFilter® with ZPG media to provide basic treatment prior to discharging to an infiltration trench.

Figure 1 (Appendix A) contains the TIR worksheet with more information on the project.

Figure 2 (Appendix A) shows the site location. The site currently contains athletic fields and park facilities. The topography of the site is flat, with the steepest slopes onsite approximately 6 percent grade.

Figure 3 (Appendix A) shows the onsite drainage subbasins, the proposed drainage collection and conveyance network within the project limits, and a schematic of the proposed stormwater management facilities.

Figure 4 (Appendix A) shows the soil types in the site area overlain with topographic contours. The onsite soils are highly permeable outwash material of the Everett and Barneston soil series (Hong West & Associates 1997; Johnson personal communication 2007). During a site visit conducted in early February 2011 in support of this TIR, stormwater appeared to be infiltrating throughout the park. There was no evidence of erosion or stormwater leaving the athletic fields during the site visit.

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2. Conditions and Requirements Summary

The following core requirements of the Surface Water Design Manual (King County 2009) apply to the project:

Core Requirement #1 – Discharge at the Natural Location

The proposed drainage modifications within Ravensdale Park must be designed to discharge stormwater in the same manner as occurs in the pre-project condition. As noted above, stormwater runoff at the project site readily infiltrates the ground. Thus, the project needs to avoid creating a surface discharge to a nearby storm drain system or to Rock Creek.

Core Requirement #2 – Offsite Analysis

Although the project proposes to infiltrate all stormwater runoff within the project limits, and therefore can obtain an exception to this core requirement on the grounds of no modifications to existing drainage patterns, a brief Level I offsite analysis is presented in this TIR.

Core Requirement #3 – Flow Control

The project as designed will accomplish infiltration of all stormwater runoff generated within the project site, with infiltration facilities designed in accordance with SWDM criteria. Therefore, an Infiltration Facility Exemption to core requirement #3 applies.

Core Requirement #4 – Conveyance System

New drainage pipe facilities within the project limits will be designed to convey *all* stormwater runoff that is collected, for storm events up to and exceeding the 25-year recurrence flow.

Core Requirement #5 – Erosion and Sediment Control

This requirement applies to all of the proposed construction activity for ball field renovation. The CSWPPP Analysis and Design section of this report describes the applicable erosion and sediment control measures, and proposed best management practices to satisfy those required and applicable measures.

Core Requirement #6 – Maintenance and Operations

The King County Parks and Recreation Division assumes full responsibility for long-term maintenance of drainage facilities constructed under this project, in accordance with guidance set forth in the Surface Water Design Manual.

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Core Requirement #7 – Financial Guarantees and Liability

This requirement does not apply to the project.

Core Requirement #8 – Water Quality

In June 2009, the King County Department of Development and Environmental Services received a memorandum from the King County Water and Land Resources Division (Crawford 2009) outlining water quality treatment requirements for sports fields, effectively superseding the requirements for this type of land use presented in the 2009 Surface Water Design Manual (SWDM). This memorandum defines synthetic turf athletic fields as requiring enhanced basic treatment of stormwater generated on the field if the field is surrounded by land use that triggers enhanced basic treatment (associated with development projects) (Section 1.2.8.1A of the SWDM). This requirement was subsequently determined to apply to the Ravensdale Park improvements project in discussions between the Parks and Recreation Division and the Water and Land Resources Division.

King County Water and Land Resources Division further defined the following conditions for an adjustment from the King County Surface Water Design Manual (SWDM) enhanced basic treatment requirements in relation to synthetic turf fields at Ravensdale Park (Batts personal communication 2010):

- No less than basic treatment is required before discharge to a surface water or infiltration to groundwater.
- Heavy metals are not allowed in construction materials. This includes galvanized structures and fasteners (e.g., bolts, nails), and lumber treated with heavy metals for rot resistance.
- A covenant must be recorded forbidding the use of detergents or disinfectants or any use of municipal water other than spot rinsing. If it is anticipated that there could at any time be need to water or wash down or disinfect a large portion or the whole field, then a valved connection to a municipal sewer system or on-site septic system must be provided, and drainage must be diverted to the sewage or septic system during any of these procedures.
- If enhanced basic treatment is not provided as part of the initial design, a land set-aside is required for the addition of enhanced basic treatment should it become required at any time (see discussion below for sites that infiltrate stormwater).
- If enhanced basic water quality treatment is not provided, water quality monitoring and analysis of synthetic field material are required (at sites that discharge to surface water).

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The project includes basic treatment, provided by a CONTECH Stormwater Management StormFilter® with ZPG media (approved per Section 6.5.5 of the SWDM) to meet the water quality treatment requirements.

Enhanced basic treatment does not apply at Ravensdale Park because of the exception in the SWDM applicable to sites that infiltrate stormwater.

Special Requirements

The proposed project is subject to one special requirement: #5) aquifer recharge.

Critical Aquifer Recharge Area

Based on King County GIS data, the project is located in a critical aquifer recharge area.

According to Section 5.4.1 of the SWDM, *General Requirements for Infiltration Facilities*, when infiltrating runoff from pollution-generating surfaces, the project must do one of the following:

1. Provide water quality treatment prior to infiltration as specified in Core Requirement #8 and Special Requirement #5, or

2. Demonstrate that the soil beneath the infiltration facility has properties that reduce the risk of groundwater contamination from typical stormwater runoff.

The project will continue to recharge the aquifer by infiltrating all stormwater.

As stated above, the project will meet Core Requirement #8 by providing a CONTECH Stormwater Management StormFilter® with ZPG media to treat runoff prior to infiltration.

According to the geotechnical report prepared for this project (Johnson personal communication 2007), soil layers below fill sand underlying the existing playfields have been stripped of most of their topsoil and organic matter, so it is unlikely that underlying soils would have properties that reduce the risk of groundwater contamination. For that reason, the Parks and Recreation Division is required to collect all drainage from the fields for treatment, or monitoring in lieu of treatment. The design includes an impermeable liner (see *Conveyance System Analysis and Design)* to enable it to be treated before discharge to the ground.

3. Offsite Analysis

Soils in the project area have very high permeability. According to an earlier geotechnical report prepared for this project (Hong West & Associates 1997), underlying soils in the vicinity of the proposed infiltration trench have an estimated infiltration rate of 25 to 100 inches per hour.

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An environmental scientist from Herrera visited the project site to evaluate drainage in the project limits and confirm that drainage is not leaving the site via a surface discharge pathway. The following observations were made in that site visit:

- The dirt soccer field appears to infiltrate all precipitation falling on it, with surface drainage evident only at the southeast and southwest corners of the field. It appears that overland runoff from these corners of the field infiltrates readily in the adjacent grassy area. There was no evidence of surface drainage from the field leaving the site.

- There are four catch basins located between the soccer and baseball fields. They all contain bottomless sumps, indicating that stormwater reaching these catch basins completely infiltrates into the ground. No stormwater conveyance systems associated with the catch basins was observed.

- The baseball field appears to infiltrate all precipitation falling on it. There was some evidence of stormwater flowing over a portion of the dirt infield, but it did not appear that runoff exits the field in typical storm conditions. As with the soccer field, it is expected that any surface drainage off the baseball infield will quickly infiltrate the ground in adjacent grassy areas.

The proposed project will continue to infiltrate all stormwater runoff generated within the project limits. Field drainage will not infiltrate directly. Rather, this drainage will be collected for treatment prior to entering the proposed infiltration trench. Because runoff will continue to infiltrate, the project will not change the rate, volume, duration or location of discharges to and from the project site. Therefore, the project is exempt from an offsite analysis per Section 1.22 of the SWDM.

4. Flow Control and Water Quality Facility Analysis and Design

All of the stormwater generated within the project limits will be collected and directed to an infiltration trench system, to match durations and peak flows of the existing site. While the project site is in a Level 2 flow control area, the project is subject to an Infiltration Facility Exemption. To qualify for this exemption, the onsite infiltration system must be designed per SWDM criteria.

The post-developed peak discharge rates and discharge durations were calculated using the King County Runoff Time Series (KCRTS) model, with the following assumptions:

- Post-developed condition modeled as 2.5 acres of impervious surface (due to the proposed impermeable liner beneath each of the renovated ball fields)

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- 1-hour timestep used
- Infiltration trench modeled with 3-foot depth and 3H:1V side slopes
- Infiltration allowed only through bottom area; no infiltration through sides of the trench
- Factor of 1.167 was used with the Sea-Tac precipitation gauge due to site location

Table 1 summarizes the results of the analysis:

Table 1. Peak discharge rates for post-developed project site conditions.

	2-Year Peak Discharge Rate (ft^3/second)	10-Year Peak Discharge Rate (ft^3/second)	50-Year Peak Discharge Rate (ft^3/second)	100-Year Peak Discharge Rate (ft^3/second)
Developed site	0.727	0.864	1.270	1.380

Hong West & Associates calculated infiltration rates ranging from 25 to 100 inches per hour for the project area (1997). Using the minimum infiltration rate observed (25 inches per hour) and the *Simplified Method for Calculating a Design Infiltration Rate* from the SWDM, a design infiltration rate of 120 inches per hour was calculated (see Appendix B). Since this exceeds the maximum allowable design infiltration rate set forth in the SWDM, the maximum design infiltration rate of 20 inches per hour was used for design of the infiltration trench.

Results from KCRTS show that a trench bottom area of 1,670 square feet is required to fully infiltrate all field drainage at discharge rates at and below the 50-year peak discharge rate. Additional model runs with the Western Washington Hydrologic Model (WWHM) were performed to provide a check on this result. The WWHM results indicate a similar trench bottom area required (1,634 square feet). The proposed infiltration system is comprised of 557 feet of 6-inch-diameter perforated pipe laid in a 3-feet-wide trench as shown on Figure 3.

The water quality flow used for sizing the CONTECH Stormwater Management StormFilter® is 35 percent of the 2-year peak discharge rate, or 0.25 cubic feet per second (112 gallons per minute). According to a CONTECH Construction Products representative, eleven 27-inch tall cartridges will be needed to treat the predicted water quality flow. A 96-inch-diameter manhole StormFilter configuration will provide this capacity and have adequate bypass for the 100-year peak flow calculated for the field underdrains (Thomason personal communication 2011).

5. Conveyance System Analysis and Design

D.A. Hogan & Associates, the field designers for the project, designed the field subdrainage system. Water will infiltrate through the synthetic turf, then percolate rapidly through the

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underlying aggregate. Water will then move laterally through a gravel drainage layer in which perforated underdrain pipes are laid atop the impermeable liner. The designers estimate that it will take approximately 70 minutes for water to move from the farthest point of the field surface to the underdrain collector pipes located 7 feet away laterally in the subgrade. Water in the collector pipes will then flow to 8-inch diameter storm drains at the edge of the field. The combined drainage from the north and south fields will be conveyed to the proposed infiltration trench described above, via the CONTECH StormFilter®. The modeling done for sizing of the trench did not account for any detention in the field drainage system or storage in the aggregate under the field. Therefore, the trench length is a conservative design.

6. Special Reports and Studies

Ravensdale Park is adjacent to Rock Creek, which is an important tributary in the lower Cedar River basin. The Draft Proposed Lower Cedar River Basin and Nonpoint Pollution Action Plan (King County 1996) was reviewed to determine if special conditions in the creek may dictate special protection in the project design plans. There are no measures in the basin plan that affect the proposed project.

The Cedar River Current and Future Conditions Summary Report (King County 1993) was also reviewed in preparing this TIR. The report states that (as of the early 1990s) flooding is generally neither serious nor common in the Rock Creek subbasin due to low levels of development and the presence of outwash soils which promote infiltration of stormwater. Consequently, very little erosion or subsequent sediment deposition occurs in this subbasin. Since the development in this area is still relatively light, the water quality in Rock Creek is considered to be very good and only low levels of nonpoint pollution were identified. Septic failure rates in the Rock Creek subbasin were among the lowest in the Cedar River basin at the time the report was produced.

7. Other Permits

A King County Clearing and Grading Permit will be required. The project is also subject to environmental review under the State Environmental Policy Act (SEPA).

8. CSWPPP Analysis and Design

ESC Plan Analysis and Design (Part A)

The erosion and sediment control plan has been designed based on the site characteristics and the proposed types and duration of construction activities to prevent to the maximum extent practicable the transport of sediment to streams, wetlands, and other important resources, in accordance with the provisions of Appendix D of the SWDM.

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The site is relatively flat, with no steep slopes or critical areas. Stormwater from the existing project area infiltrates and will continue to do so during construction.

The applicable elements from Section 1.2.5 of the SWDM are discussed below:

Clearing Limits

Prior to beginning earth disturbing activities on the site, the Contractor will stake the limits of disturbance, the Rock Creek buffer, limits of the proposed infiltration trench, locations of staging areas, and the locations of the primary construction elements for review and approval by the King County Engineer. During the construction period, no disturbance beyond the flagged disturbance limits shall be permitted, unless prior approval is granted by the Engineer. The flagging shall be maintained by the Contractor for the duration of construction.

Cover Measures

As noted on the project design plans, any areas of exposed soils that will not be disturbed for 2 consecutive days during the wet season or 7 days during the dry season shall be immediately stabilized with approved ESC methods (e.g., seeding, mulching, plastic covering, etc.).

Perimeter Protection

The Contractor shall install silt fence surrounding the work area as shown in the design plans.

Traffic Area Stabilization

A temporary construction entrance/exit will be established. The construction exit shall be installed at the beginning of construction, stabilized with additional quarry spalls as needed, and maintained for the duration of the project. The construction exit will be removed and the site entrance will be restored to original conditions after construction is completed. The Contractor will immediately remove soil that has been tracked onto paved areas as a result of construction by sweeping.

Sediment Retention

There will be no concentrated drainage generated from the project area, so no sediment retention beyond perimeter protection is proposed.

Surface Water Collection

There will be no concentrated drainage generated from within the project area, so no surface water collection beyond perimeter protection is proposed. The only point in the construction process that could be conducive to extensive surface drainage is when the impermeable liner system is placed beneath each of the fields, and gravel backfill is not yet placed on the liner. Because the liner installation will only be done in dry weather, and the gravel backfill will be

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placed within a few days of liner installation, it is not expected that handling of surface drainage will be an issue of concern. If rainfall were to occur in the short window of time between liner installation and gravel backfill, the runoff from the liner surface would not be laden with sediments and thus should not be problematic to direct to a nearby grassy area where it can readily infiltrate.

Dewatering Control

There are no dewatering activities proposed.

Dust Control

Any wind transport of soil is anticipated to be minor and would not create either a traffic hazard or be deposited in water resources. Therefore, no dust control measures are proposed.

Flow Control

Soils in the project area have very high permeability. According to an earlier geotechnical report prepared for this project (Hong West & Associates 1997), underlying soils in the project area have an estimated infiltration rate of 25 to 100 inches per hour.

Since runoff will continue to infiltrate as it does under existing conditions, the project will not change the rate, volume, duration or location of discharges to and from the project site. Therefore, flow control is not proposed as part of the TESC Plan.

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9. Bond Quantities, Facility Summaries, and Declaration of Convenant

Because the project proponent is King County, this section of the standard TIR outline does not apply to the project.

10. Operations and Maintenance Manual

Appendix C provides maintenance requirements for the CONTECH StormFilter® and the infiltration trench proposed for the Ravensdale Park Improvements project, adapted from the SWDM.

11. References

Batts, David. 2010. Personal communication (letter to T.J. Davis, King County Parks and Recreation Division). King County Water and Land Resources Division. June 21, 2010.

Crawford, Curt. 2009. Personal communication (memorandum to Molly Johnson, King County Department of Development and Environmental Services, entitled Sports (Athletic) Fields Water Quality Treatment Requirements). Manager, Stormwater Services Section, King County Water and Land Resources Division. June 8, 2009.

Hong West & Associates. 1997. Soil Infiltration Evaluation: Proposed Stormwater Infiltration Facilities, Ravensdale Park. King County, Washington.

Johnson, Per. 2007. Personal communication (letter with attachments to Cory Parker, Jones & Jones Architects and Landscape Architects Ltd., summarizing the results of a site reconnaissance and soil assessment at the proposed fields at Ravensdale Park). Shannon & Wilson, Inc., Seattle, Washington.

King County. 1993. Cedar River Current and Future Conditions Summary Report. King County Department of Public Works, Surface Water Management Division, Seattle, Washington. October 1993.

King County. 1996. Watershed Management Committee Draft Proposed Lower Cedar River Basin and Nonpoint Pollution Action Plan. King County Department of Natural Resources, Surface Water Management Division, Seattle, Washington. February 1996.

Thomason, Kathryn. 2011. Personal communication (email sent with attachments to Mary Larkin, Herrera Environmental Consultants, with a size and cost estimate for a StormFilter system to provide water quality treatment for project flows in conformance with King County SWDM requirements). CONTECH Construction Products, Inc., Portland, Oregon.

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APPENDIX A

Figures

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner King County Parks
Phone TJ Davis 206-263-6214
Address 201 S. Jackson St.
Seattle, WA 98104
Project Engineer Mary Larkin, P.E.
Company Herrera Environmental
Phone 503-228-4301, ext. 103

Part 2 PROJECT LOCATION AND DESCRIPTION

Project Name Ravensdale Park Improvements
DDES Permit # _____
Location Township 22
Range 06
Section 36
Site Address N. of SE Ravensdale Way, S. of SE Kent-Kangley Rd., W. of 272 Avenue SE

Part 3 TYPE OF PERMIT APPLICATION

- ☐ Landuse Services
  Subdivison / Short Subd. / UPD
- ☐ Building Services
  M/F / Commerical / SFR
- ☒ Clearing and Grading
- ☐ Right-of-Way Use
- ☐ Other _____

Part 4 OTHER REVIEWS AND PERMITS

- ☐ DFW HPA
- ☐ COE 404
- ☐ DOE Dam Safety
- ☐ FEMA Floodplain
- ☐ COE Wetlands
- ☐ Shoreline Management
- ☐ Structural Rockery/Vault/_____
- ☐ ESA Section 7
- ☒ Other SEPA checklist

Part 5 PLAN AND REPORT INFORMATION

Technical Information Report		Site Improvement Plan (Engr. Plans)	
Type of Drainage Review (circle):	(Full) / Targeted / Large Site	Type (circle one):	(Full) / Modified / Small Site
Date (include revision dates):	_____	Date (include revision dates):	_____
Date of Final:	_____	Date of Final:	_____

Part 6 ADJUSTMENT APPROVALS

Type (circle one): Standard / Complex / Preapplication / Experimental / Blanket

Description: (include conditions in TIR Section 2)

_____

Date of Approval: _____

Figure 1. TIR Worksheet.

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 7 MONITORING REQUIREMENTS

Monitoring Required: Yes / (No)

Start Date: _____

Completion Date: _____

Describe: _____

Part 8 SITE COMMUNITY AND DRAINAGE BASIN

Community Plan : _____

Special District Overlays: _____

Drainage Basin: Cedar River Basin (Rock creek)

Stormwater Requirements: Level 2 flow control

Part 9 ONSITE AND ADJACENT SENSITIVE AREAS

- [x] River/Stream Rock Creek
- [ ] Lake _____
- [ ] Wetlands _____
- [ ] Closed Depression _____
- [ ] Floodplain _____
- [ ] Other _____
- [ ] Steep Slope _____
- [ ] Erosion Hazard _____
- [ ] Landslide Hazard _____
- [ ] Coal Mine Hazard _____
- [ ] Seismic Hazard _____
- [ ] Habitat Protection _____
- [ ] _____

Part 10 SOILS

Soil Type	Slopes	Erosion Potential
Barneston gravelly coarse sandy loam	0 to 6%	low (K factor 0.15)
Everett gravelly sandy loam	0 to 5%	low (K factor 0.17)

- [ ] High Groundwater Table (within 5 feet)
- [ ] Other _____
- [ ] Sole Source Aquifer
- [ ] Seeps/Springs

- [ ] Additional Sheets Attached

Figure 1. TIR Worksheet.

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 11 DRAINAGE DESIGN LIMITATIONS	
REFERENCE	LIMITATION / SITE CONSTRAINT
☐ Core 2 – Offsite Analysis	
☒ Sensitive/Critical Areas	Critical aquifer recharge
☐ SEPA	
☐ Other	
☐	
☐ Additional Sheets Attached	

Part 12 TIR SUMMARY SHEET (provide one TIR Summary Sheet per Threshold Discharge Area)	
Threshold Discharge Area: (name or description)	
Core Requirements (all 8 apply)	
Discharge at Natural Location	Number of Natural Discharge Locations: 1 (infiltration)
Offsite Analysis	Level: 1 / 2 / 3 dated: Exempt per 1.22 of SWDM
Flow Control (incl. facility summary sheet)	Level: 1 / (2) / 3 or Exemption Number Small Site BMPs
Conveyance System	Spill containment located at: N/A
Erosion and Sediment Control	ESC Site Supervisor: To be determined (contractor) Contact Phone: After Hours Phone:
Maintenance and Operation	Responsibility: Private / (Public) If Private, Maintenance Log Required: Yes / No
Financial Guarantees and Liability	Provided: Yes / (No)
Water Quality (include facility summary sheet)	Type: (Basic) / Sens. Lake / Enhanced Basicm / Bog or Exemption No. Landscape Management Plan: Yes / No
Special Requirements (as applicable)	
Area Specific Drainage Requirements	Type: CDA / SDO / MDP / BP / LMP / Shared Fac. / None Name:
Floodplain/Floodway Delineation	Type: Major / Minor / Exemption / None 100-year Base Flood Elevation (or range): Datum:
Flood Protection Facilities	Describe:
Source Control (comm./industrial landuse)	Describe landuse: Describe any structural controls:

Figure 1. TIR Worksheet.

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Oil Control	High-use Site: Yes / No Treatment BMP: _____ Maintenance Agreement: Yes / No with whom? _____
Other Drainage Structures	
Describe:	

Part 13 EROSION AND SEDIMENT CONTROL REQUIREMENTS		
MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION		MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION
☒ Clearing Limits		☒ Stabilize Exposed Surfaces
☒ Cover Measures		☒ Remove and Restore Temporary ESC Facilities
☒ Perimeter Protection		☒ Clean and Remove All Silt and Debris, Ensure Operation of Permanent Facilities
☒ Traffic Area Stabilization		☐ Flag Limits of SAO and open space preservation areas
☐ Sediment Retention		☐ Other _____
☐ Surface Water Collection		
☐ Dewatering Control		
☐ Dust Control		
☐ Flow Control		

Part 14 STORMWATER FACILITY DESCRIPTIONS (Note: Include Facility Summary and Sketch)				
Flow Control	Type/Description		Water Quality	Type/Description
☐ Detention	_____		☐ Biofiltration	_____
☒ Infiltration	Trench		☐ Wetpool	_____
☐ Regional Facility	_____		☒ Media Filtration	StormFilter (zpg media)
☐ Shared Facility	_____		☐ Oil Control	_____
☐ Flow Control BMPs	_____		☐ Spill Control	_____
☐ Other	_____		☐ Flow Control BMPs	_____
			☐ Other	_____

Figure 1. TIR Worksheet.

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 15 EASEMENTS/TRACTS		Part 16 STRUCTURAL ANALYSIS
☐ Drainage Easement		☐ Cast in Place Vault
☐ Covenant		☐ Retaining Wall
☐ Native Growth Protection Covenant		☐ Rockery > 4' High
☐ Tract		☐ Structural on Steep Slope
☐ Other		☐ Other

Part 17 SIGNATURE OF PROFESSIONAL ENGINEER
I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attached Technical Information Report. To the best of my knowledge the information provided here is accurate.
Mary K [illegible] 2-9-2011
Signed/Date

Figure 1. TIR Worksheet.

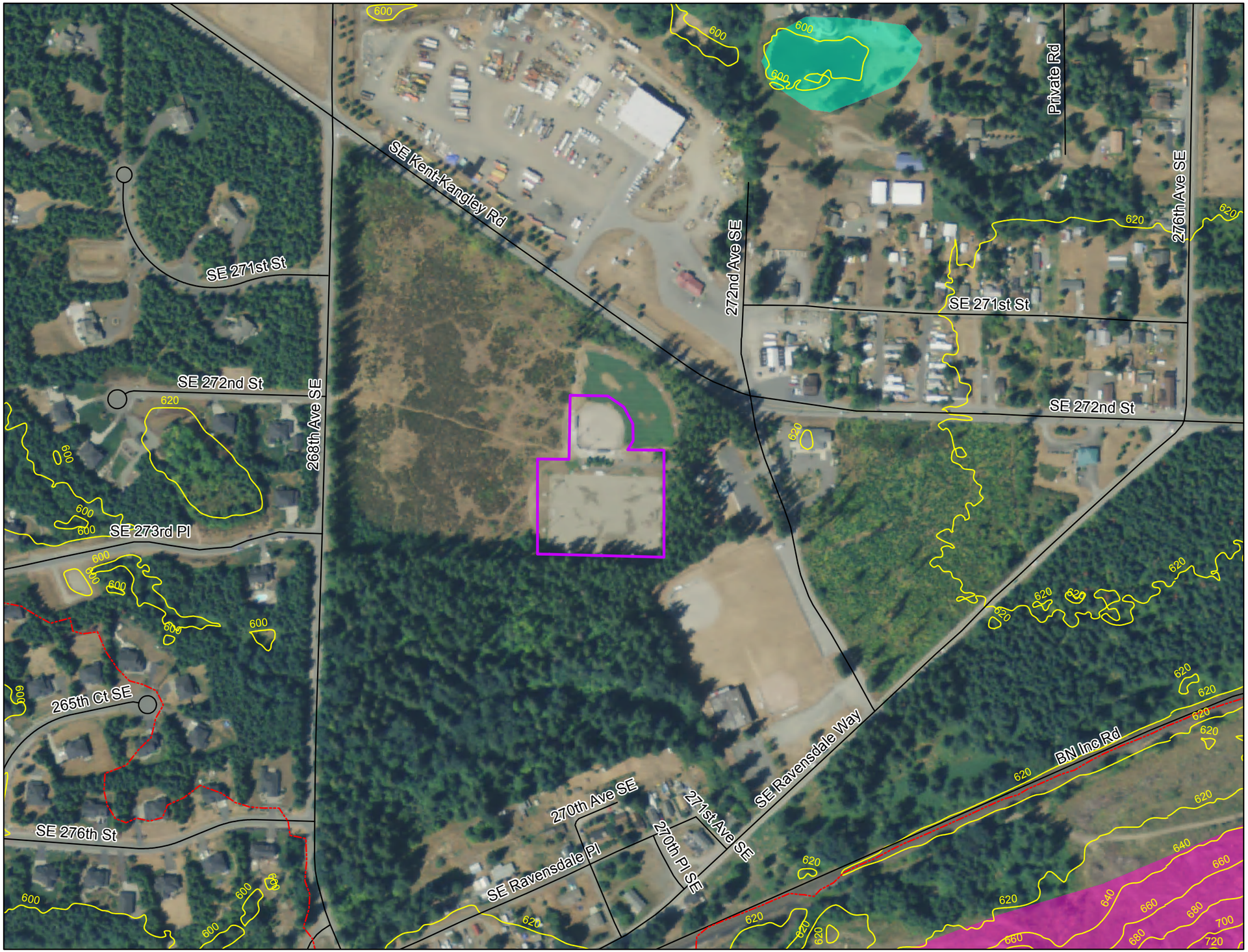


Figure 2.
Ravendale Park Site Location

Legend

- Project_site
- Basins
- Streets
- Contours
- Steep Slopes
- Wetlands

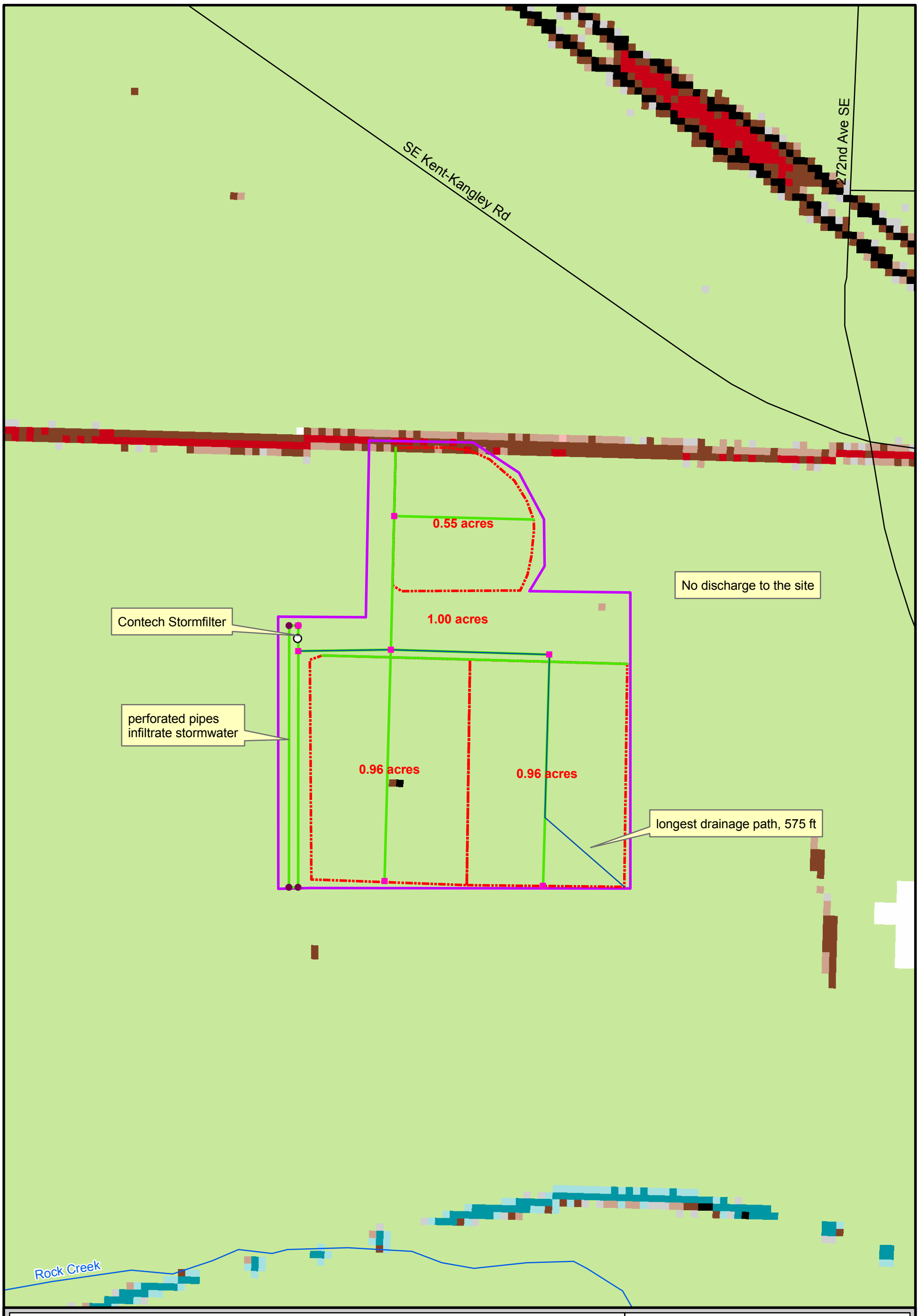
N

0 150 300 600 Feet

HERRERA

Coordinates: NAD_1983_HARN_StatePlane_ Washington_North_FIPS_4601_Feet

Produced By: GIS (A. Rhode)
Project:080399-000



Legend

- Subbasin
- Project Site
- Street
- Drainage Pipe
- Stream
- Catch Basin
- Manhole
- Longest Drainage
- Contour

Figure 3. Drainage Map.

N

0 50 100 200 Feet

HERRERA

Data provided by permission of King County

P:\GIS\Project\08-03999-000_Ravensdale\Projects\11x17_drainage.mxd

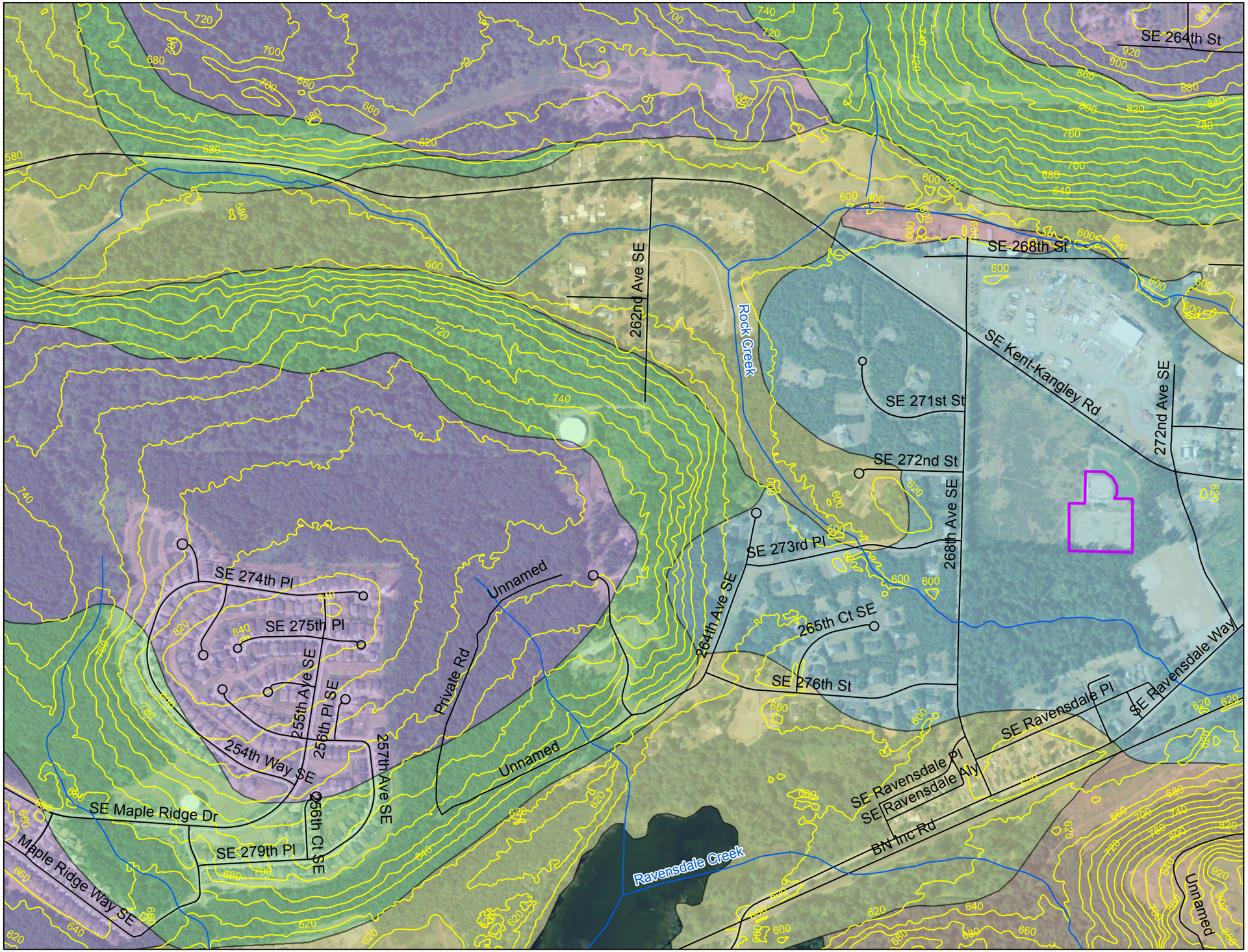


Figure 4.
Soils Map

Legend

- Stream
- Project Site
- No area draining to the site
- Street
- Contour

Soil

Soil_Type

- AgC, Till
- AgD, Till
- BeF, Till
- EvB, Outwash
- EvC, Outwash
- No, Till

N

0 300 600 1,200 Feet

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Produced By: GIS (A. Rhode)
Project:08-03999-000

APPENDIX B

Calculations

HERRERA ENVIRONMENTAL CONSULTANTS

www.herrerainc.com

PROJECT: RAVENSDALE INFILTRATION | CALCULATED BY: MK | DATE: 4.14.09
CLIENT: JONES & JONES | CHECKED BY: | DATE:
SUBJECT: INFILTRATION RATE | PAGE 1 OF 1
PROJECT NO. 08-03999-000
NOTES: | TASK NO.

FROM 2005 SURFACE WATER DESIGN MANUAL – KING COUNTY

5-61 – SIMPLIFIED METHOD FOR CALCULATING DESIGN INFILTRATION RATE

$I_{DESIGN} = I_{MEASURED} \cdot F_{TESTING} \cdot F_{GEOMETRY} \cdot F_{PLUGGING}$

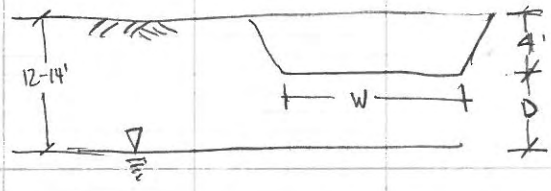
$I_{MEASURED} = 25 - 100$ in/hr

FROM HWA SOIL INFILTRATION EVALUATION, PROPOSED STORMWATER INFILTRATION FACILITIES, RAVENSDALE PARK, KING COUNTY WASHINGTON (FEB 28, 1997) p6 P2

→ $F_{TESTING} = 0.30$ EPA METHOD
– HWA (1997)
– KC DESIGN MAN (2005)

$F_{GEOMETRY} = 4 \cdot D/W + 0.05$

EXISTING



SEASONAL HIGH GW TABLE

4' – ASSUMED BOTTOM OF FACILITY

D – DEPTH FROM BOTTOM OF FACILITY TO SEASONAL HIGH GW TABLE

→ USE 8' FOR CONSERVATIVE VALUE.

W – WIDTH OF FACILITY

→ USE 2' ASSUMPTION FOR INITIAL CALCULATION

$F_{GEOMETRY} = 4 \cdot \frac{8'}{2'} + 0.05$

→ $F_G = 16.05$

352

$F_{PLUGGING} = 1.0$ COARSE SANDS OR COBBLES – HWA (1997)

$I_{DESIGN} = I_{MEASURED} \cdot F_T \cdot F_G \cdot F_P$

$I_{D_{25}} = 25$ in/hr $\cdot 0.30 \cdot 16.05 \cdot 1.0 = 120.37$ in/hr

$I_{D_{100}} = 100$ in/hr $\cdot 0.30 \cdot 16.05 \cdot 1.0 = 481.5$ in/hr

60/481 = 0.13

60 min / 1 hr / 20 in × 1 hr = 3 min/in

∴ USE $I_{D_{max}} = 20$ in/hr (KC SWDM 2005)

DO NOT WRITE IN THIS SPACE

Ravensdale Park
Synthetic Turf Soccer Field
Time of Concentration Estimate
4/16/2009

There will be no surface runoff from the synthetic field. All drainage from these areas overlaying the permeable aggregate will be collected by the subsurface drainage system. The time concentration for these areas is comprised of the following:

AB vertical percolation through the synthetic turf
BC vertical percolation through the permeable aggregate
CD lateral percolation on a gradient through the permeable aggregate to the subsurface drainage trench
DE vertical percolation through the pea gravel backfill
EF/EG pipe flow through the subsurface drainage system to the onsite storm system

	Reach Type	Surface Description	Permeability "k" (ft/min)	Length Feet	Upper Elev	Lower Elev	Gradient	Velocity (ft/min)	T of C (min)
AB	Percolation	Turf	.0970	0.15	615.64	615.49	1.00	0.097	1.55
BC	Percolation	Aggregate	1.3890	0.33	615.49	615.16	1.00	1.389	.24
	Gradient Buildup - assume earlier storm - no time								
CD	Percolation	Aggregate	1.3890	7.00	615.16	614.66	0.07	0.099	70.56
DE	Percolation	Pea Gravel	9.3388	0.60	614.66	614.06	1.00	9.339	0.06

	Reach Type	Pipe Type	"n"	Length Feet	Upper Elev	Lower Elev	Slope	Pipe Diam	Velocity (ft/min)	Cap (cfs)	T of C (min)
EF	Pipe	ADS	0.015	171	614.06	613.21	0.50%	4	1.333	0.12	2.14
FG	Pipe	CPEP Pipe	0.009	422	613.03	610.92	0.50%	6	2.920	0.57	2.41

Total Tc = 76.95

Synthetic Turf System Permeability

Testing performed on other synthetic fields indicated a drainage rate of approximately 70 inches/hour
This corresponds to a rate of 0.097 feet per minute

Aggregate Permeability

The permeability of the aggregate is estimated with the 10th percentile particle size. Based on sieve testing on previous synthetic field & track installations, the 10th percentile particle size typically ranges around the #20 sieve.
The permeability rate is calculated as follows:
K=100(DxD) where D = 10th % particle size in cm and K= permeability in cm/sec

D = 0.084 cm
K = 0.7056 cm/sec
K = 1.3890 ft/min

Gradient Build Up

For the purposes of this calculation, a 6 inch gradient is assumed to be already in place between each of the subsurface drainage trenches. This would be the case with successive storm events.
If a gradient is not in place, the time of concentration would be significantly longer due a flatter gradient.

Lateral Percolation

This is calculated with Darcy's Law where the flow velocity is the product of the permeability rate and the gradient.

Pipe Flows

The calculation estimates travel times assuming the pipes are flowing full. The actual flows through the subsurface drainage system lateral piping will be significantly less than full capacity and will therefore have slower flow velocities and longer travel times than those shown in the calculation.

Size and Cost Estimate

Prepared by Kathryn Thomason on February 9, 2011

Ravensdale Park – Stormwater Treatment System

King County, WA

Information provided:

- Total contributing area = 2.5 acres
- Impervious area = 2.5 acres
- Water quality flow, Q_{wq} = 0.255 cfs
- Peak hydraulic flow rate, Q_{peak} = 1.5 cfs
- Presiding agency = King County, WA

Assumptions:

- Media = ZPG cartridges
- Cartridge Height = 27”
- Cartridge flow rate = 11.25 gpm
- Drop required from inlet to outlet = 3.05’ minimum

Size and cost estimates:

The StormFilter is a flow-based system, and is therefore sized by calculating the peak water quality flow rate associated with the design storm. The water quality flow rate was calculated by the consulting engineer using WWHM and was provided to CONTECH Construction Products Inc. for the purposes of developing this estimate.

The StormFilter for this site was sized based on a water quality flow rate of 0.255 cfs. To accommodate this flow rate, CONTECH Construction Products Inc. recommends using a 96” Manhole StormFilter with 11 cartridges (see attached detail). The estimated cost of this system is $41,000, complete and delivered to the job site. This estimate assumes that the vault is 6 feet deep. The final system cost will depend on the actual depth of the units and whether extras are specified. The contractor is responsible for setting the StormFilter and all external plumbing.

Typically the precast StormFilters have internal bypass capacities of 1.8 cfs. If the peak discharge off the site is expected to exceed this rate, we recommend placing a high-flow bypass upstream of the StormFilter system. CONTECH Construction Products could provide our high-flow bypass, the StormGate, which provides a combination weir-orifice control structure to limit the flow to the StormFilter. The estimated cost of this structure is $4,000. The final cost would depend on the actual depth and size of the unit.

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APPENDIX C

Operations and Maintenance Requirements

NO. 2 – INFILTRATION FACILITIES

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Infiltration Pond General	Trash & Debris	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
	Poisonous Vegetation or Noxious Weeds	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
	Contaminants and Pollution	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
	Unmowed Grass/Ground Cover	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
	Rodent Holes	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
	Insects	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
Infiltration Pond Side Slopes	Erosion	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
Infiltration Pond Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
Infiltration Pond Emergency Overflow Spillway	Rock Missing	See "Detention Ponds" Table No. 1	See "Detention Ponds" Table No. 1
Infiltration Facility Storage Area	Sediment	A percolation test pit (ponds) or test of facility indicates facility is only working at 90% of its designed capabilities. If two inches or more sediment is present, remove.	Sediment is removed and/or facility is cleaned so that infiltration system works according to design. Ponds are reseeded if necessary to control erosion.
Infiltration Facility Rock Filters (If Applicable)	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Replaced gravel in rock filter.
Infiltration Facility Sump	Sump Filled with Sediment and Debris (If Applicable)	Any sediment and debris filling vault to 10% of depth from sump bottom to bottom of outlet pipe or obstructing flow into the connector pipe.	Clean out sump to design depth.
Infiltration Facility Filter Bags (If Applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than $^1/_2$ full.	Replaced filter bag or redesign system.
Infiltration Facility Pre-settling Ponds and Vaults	Sediment	Remove when 6" or more.	Sediment cleaned out to designed pond shape and depth or sediment is removed from vault. Ponds are reseeded if necessary to control erosion.

Note: Sediment accumulation of more than 0.25 inches per year may indicate excessive erosion is occurring upstream of the facility or that conveyance systems are not being properly maintained. The contributing drainage area should be checked for erosion problems or inadequate maintenance of conveyance systems if excessive sedimentation is noted in an infiltration facility.

Check twice a year during first 2 years of operation; once a year thereafter. Clean manholes/catch basins, repair damaged inlets/outlets, clean trash racks.

NO. 20 – STORMFILTER®

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
Media Section	Sediment Accumulation on Media.	Sediment depth exceeds 0.25 inches.	No sediment deposits that would impede permeability of the compost media.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
First Chamber	Sediment Accumulation	Sediment depth exceeds 6 inches in first chamber.	No sediment deposits in vault bottom of first chamber.
Drain Pipes Clean-Outs	Sediment Accumulation	When drain pipes, clean-outs, become full with sediment and/or debris.	Remove the accumulated material from the facilities.

NO. 21 – STORMFILTER® (CARTRIDGE TYPE)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
Compost Media	Plugged	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Replace media cartridges.
	Short Circuiting	Flows do not properly enter filter cartridges.	Replace filter cartridges.
Pipes	Damaged	Any part of the pipes that are crushed, damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
Access Cover	Damaged/Not Working	Cover cannot be opened, one person cannot open the cover, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
Vault Structure	Damage to Wall, Frame, Bottom, and/or Top Slab	Cracks wider than ½-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications.
	Damaged Pipe Joints	Cracks wider than ½-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Baffles	Damaged	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Repair or replace baffles to specification.
Access Ladder	Damaged	Ladder is corroded or deteriorated, not functioning properly, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.