

Lot 9, Premier Industrial Park, Tualatin OR

**Developer:
Kevin Pike**

**Site:
Assessor Map 2S 1W 23CB, Tax Lot 401
Tualatin, Washington County, OR**

Preliminary Surface Water Management Report



EXPIRES: 6/30/

SISUL ENGINEERING

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Narrative:

The development site is a 0.80-acre site located on the west side of Teton Avenue, one parcel removed from the street right-of-way and north of the Hedges Creek main flow path, in Tualatin, Washington County, OR. The site is a remnant of small portions of Lots 9 and 10 of Premier Industrial Park and the tax lot number of the site is T2S, R1W, Section 23CB, Tax Lot 401.

The site is currently undeveloped and in the past was filled with a pit run type of material. The developable portion of the site is nearly flat but does have some slope north to south. There is a 40 foot wetland buffer strip along the south and west sides of the site, that is outside the proposed development area of the parcel and not addressed in these calculations. In addition, there is some further irregular shaped setback following the old 126 contour line (now the 129.52 contour line), that the developer has agreed to that is also outside the development area and these calculations. The vegetation ground cover consists of some volunteer ground cover that has taken root on the pit run material. An existing private storm drain line that drains the development area to the north, crosses into the northeast corner of the site and drains into a stormwater facility to the east of the site. The storm drain out of this existing storm drain facility also crosses the southeast corner of the proposed site development area.

The Web Soil Survey indicates that soil type onsite is 14 Cove Clay, although as noted above that original soil has been filled upon with a pit run type fill at sometime in the past. Cove Clay is in Hydrologic Soil Group D, according to the Web Soil Survey.

The site is proposed to be developed with two small commercial/industrial type buildings, and including asphalt driveways, asphalt parking areas, concrete curbs, sidewalks and landscaping. A stormwater facility will be located on the east side of the site, between the east wall of the east building and the east property line.

Existing Drainage

The existing drainage on the site consists of sheet flow across the site from north to south. The site is currently covered with sparse ground cover.

Post Developed Drainage

When the site is developed runoff from the building roofs, asphalt and sidewalks will be directed into a private storm drain system that will convey the runoff into the new stormwater facility located at the east side of the site.

Hydromodification Requirements

The site is located in the City of Tualatin, which follows the Clean Water Services Standards. Per Clean Water Services Design Standards, Section 4.03, hydromodification is required for sites which create or modify impervious surfaces greater than 1000 square feet. Therefore, hydromodification appears to be required for this site. Based on the hydromodification assessment requirements in Section 4.03, the site appears to be a low risk, medium size

project, which requires a category 2 hydromodification approach. Per table 4-7, the following requirements shall be met:

The 2 year Post Developed Runoff Rate shall be reduced to 50% of the 2 year Pre Developed Runoff Rate.

The 5 year Post Developed Runoff Rate shall be reduced to the 5 year Pre Developed Runoff Rate.

The 10 year Post Developed Runoff Rate shall be reduced to the 10 year Pre Developed Runoff Rate.

Per the City of Tualatin, the 25 year Post Developed Runoff Rate shall be reduced to the 25 year Pre Developed Runoff Rate.

Water Quality Requirements

Per Clean Water Services Design Standards, Section 4.03, water quality is required for sites which create or modify impervious surfaces greater than 1000 square feet. Therefore, water quality appears to be required for this site.

Stormwater Facilities

A new stormwater facility (detention pond) will be located at the east side of the site and PerkFilter catchbasins will be used upstream of the detention pond to meet the water quality requirements.

Pre-Development Site Conditions:

Total Area:	18,400 sf = 0.42 acres
Pervious Area:	18,400 sf = 0.42 acres

Post-Development Site Conditions:

Total Area:	18,400 sf = 0.42 acres
Pervious Area:	2,353 sf = 0.05 acres
Impervious Area:	16,047 sf = 0.37 acres

WATER QUALITY:

Three (3) PerkFilter catchbasins as manufactured by OldCastle will be used to meet the water quality requirements of Clean Water Services. PerkFilter is on the CWS approved products list for proprietary treatment system. It is also has the Washington Dept. of Ecology's (DOE) General Use Level Designation for Basic and Phosphorus treatment. The 12 inch cartridge PerkFilter has a DOE rating of being able to treat 6.8 gallons/minute per cartridge. Each PerkFilter catchbasin comes with two cartridges, thus being able to treat up to 13.6 gallons/minute.

There are 3 catchbasins and 3 separate basins planned for water quality, the easterly building and the parking area and additional asphalt north of it (6,021 SF), the westerly building and the parking area and additional asphalt north of it

(5,877 SF), and the center drive aisle that lies between the two buildings and the continuation of that northerly to the existing asphalt drive (4,149 SF). See the basin map included with this report.

Onsite Water Quality Volume and Flow Rate: (per 4.08.5, R&O 19-22)

Onsite Impervious Areas (East) = 6021 SF
(West) = 5877 SF
(Center) = 4149 SF

Water Quality Volume (WQV):

Per CWS, the water quality storm event is 0.36 inches in 4 hours.

$$\text{WQV} = \frac{0.36 \text{ (in.)} \times \text{Area (s.f.)}}{12 \text{ (in/ft)}} = \begin{array}{l} \text{East} = 181 \text{ CF} \\ \text{West} = 176 \text{ CF} \\ \text{Center} = 125 \text{ CF} \end{array}$$

Water Quality Flow (WQF):

$$\text{WQF} = \frac{\text{WQV (cu. ft.)}}{4 \text{ (hours)}} = \frac{\text{WQV (cu. ft.)}}{14,400 \text{ (s)}} = \begin{array}{l} \text{East} = 0.0126 \text{ cfs} = 5.6 \text{ gpm} \\ \text{West} = 0.0122 \text{ cfs} = 5.5 \text{ gpm} \\ \text{Center} = 0.0087 \text{ cfs} = 3.9 \text{ gpm} \end{array}$$

Each PerfFilter catchbasin will be adequately sized to handle the contributing impervious area draining into it. (Technically, only a single PerkFilter cartridge per catchbasin is required to meet the water quality requirements, although we are not sure that manufacturer makes such a catchbasin with a single cartridge).

HYDROMODIFICATION:

As stated earlier in the report, hydromodification is required by Clean Water Services. Per table 4-7, the following requirements shall be met:

The 2-year Post-Developed Runoff Rate shall be reduced to 50% of the 2-year Pre-Developed Runoff Rate.

The 5-year Post-Developed Runoff Rate shall be reduced to the 5-year Pre-Developed Runoff Rate.

The 10 year Post-Developed Runoff Rate shall be reduced to the 10-year Pre-Developed Runoff Rate.

Per the City of Tualatin, the 25-year Post-Developed Runoff Rate shall be reduced to the 25-year Pre-Developed Runoff Rate

Model Pre-Developed Peak Flows:

Pre-Developed Area:

Total Area:	18,400 sf = 0.42 acres
Pervious Area:	2,353 sf = 0.05 acres
Impervious Area (gravel):	16,047 sf = 0.37 acres

Pre-Developed CN values: (Values from HydroCAD)

Pervious Area CN = 69 (pasture grassland, fair, hydrologic group B)
Impervious Area CN = 75 (existing gravel, hydrologic group B)

Time of Concentration:

Sheet Flow: $\frac{0.42 (n_s * L)^{0.8}}{(P_2)^{0.5} * (S)^{0.4}}$	n_s = roughness coef. = 0.15 L = flow length = 120 feet P_2 = 2 yr, 24 hr rainfall = 2.5 in S = slope = 0.0165
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Sheet Flow: $\frac{0.42 (0.15 * 120)^{0.8}}{(2.5)^{0.5} * (0.0165)^{0.4}}$

Sheet Flow = 13.8 minutes

Time of Concentration = 13.8 mins

Rainfall Depths: (Table 4-4)

2-year, 24-hour Precipitation Depth	2.50 inches
5 year, 24-hour Precipitation Depth	3.10 inches
10 year, 24-hour Precipitation Depth	3.45 inches
25 year, 24-hour Precipitation Depth	3.90 inches

Soil Type

Per the NRCS soil information the onsite soils are Cove Clay a type D hydrologic group soil.

2-Year, Pre-Developed Storm Event

(HydroCAD will be used to model the pre-developed storm events.)

Summary for Subcatchment 1S: Pre-Developed Conditions

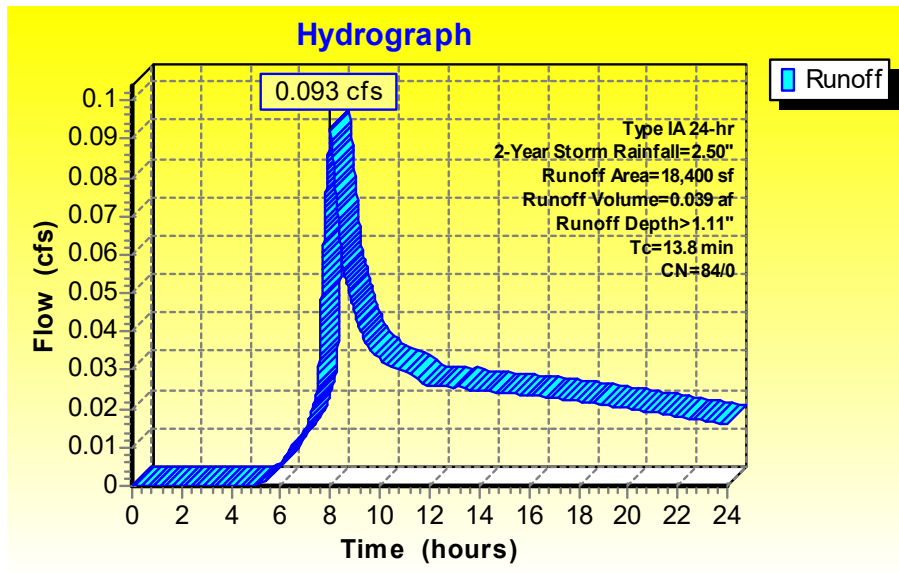
Runoff = 0.093 cfs @ 8.00 hrs, Volume= 0.039 af, Depth> 1.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Type IA 24-hr 2-Year Storm Rainfall=2.50"

Area (sf)	CN	Description
18,400	84	50-75% Grass cover, Fair, HSG D
18,400	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8					Direct Entry, Pre-Developed TOC



Per the calculations above, the 2-year, pre-developed runoff from the site is 0.093 cfs.

5-Year, Pre-Developed Storm Event

(HydroCAD will be used to model the pre-developed storm events.)

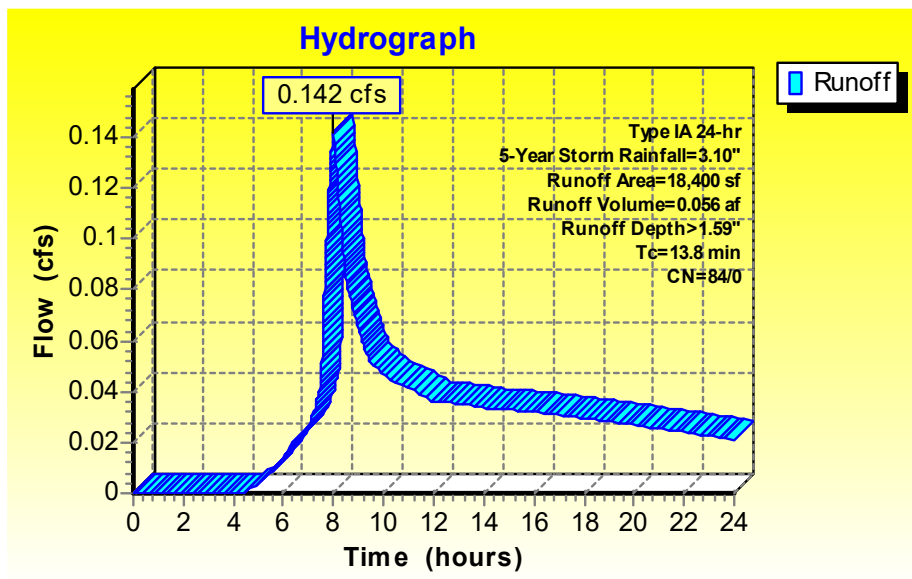
Summary for Subcatchment 1S: Pre-Developed Conditions

Runoff = 0.142 cfs @ 8.00 hrs, Volume= 0.056 af, Depth> 1.59"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5-Year Storm Rainfall=3.10"

Area (sf)	CN	Description
18,400	84	50-75% Grass cover, Fair, HSG D
18,400	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8					Direct Entry, Pre-Developed TOC



Per the calculations above, the 5-year, pre-developed runoff from the site is 0.142 cfs.

10-Year, Pre-Developed Storm Event

(HydroCAD will be used to model the pre-developed storm events.)

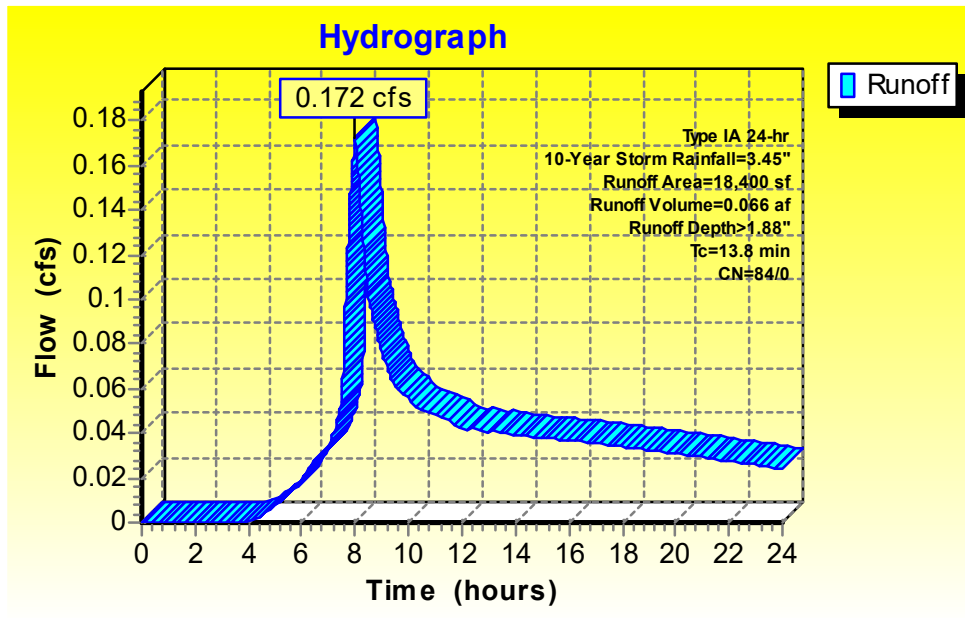
Summary for Subcatchment 1S: Pre-Developed Conditions

Runoff = 0.172 cfs @ 8.00 hrs, Volume= 0.066 af, Depth> 1.88"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Storm Rainfall=3.45"

Area (sf)	CN	Description
18,400	84	50-75% Grass cover, Fair, HSG D
18,400	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8					Direct Entry, Pre-Developed TOC



Per the calculations above, the 10-year, pre-developed runoff from the site is 0.172 cfs.

25-Year, Pre-Developed Storm Event

(HydroCAD will be used to model the pre-developed storm events.)

Summary for Subcatchment 1S: Pre-Developed Conditions

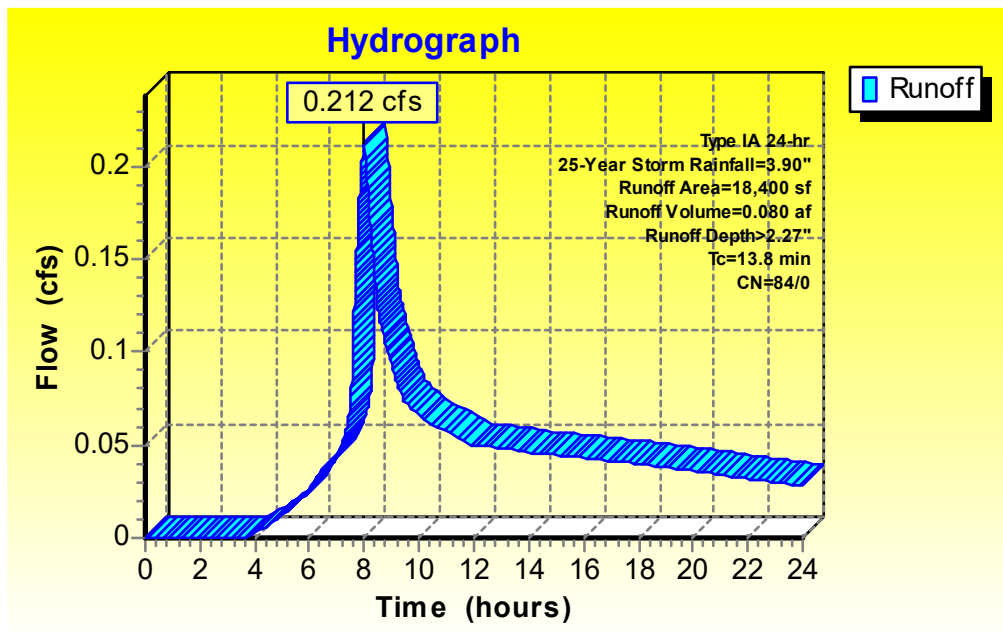
Runoff = 0.212 cfs @ 8.00 hrs, Volume= 0.080 af, Depth> 2.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Type IA 24-hr 25-Year Storm Rainfall=3.90"

Area (sf)	CN	Description
18,400	84	50-75% Grass cover, Fair, HSG D
18,400	84	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8					Direct Entry, Pre-Developed TOC



Per the calculations above, the 25-year, pre-developed runoff from the site is 0.212 cfs

Pre-Developed Storm Event Summary:

Storm	Peak Q, cfs
2-year	0.093 cfs
5-year	0.142 cfs
10-year	0.172 cfs
25-year	0.212 cfs

Model Post-Developed Peak Flows:

Post-Developed Area:

Total Area:	18,400 sf = 0.42 acres
Pervious Area:	2,353 sf = 0.05 acres
Impervious Area:	16,047 sf = 0.37 acres

Post-Developed CN values: (Values from HydroCAD)

Pervious Area CN = 69 (grass cover, fair, hydrologic group B)
Impervious Area CN = 98 (paved parking, hydrologic group B)

Time of Concentration:

Since the majority of the area is impervious, the minimum time of concentration of 5 minutes will be used.

Time of Concentration = 5.0 mins

Rainfall Depths: (Table 4-4)

2-year, 24-hour Precipitation Depth	2.50 inches
5-year, 24-hour Precipitation Depth	3.10 inches
10-year, 24-hour Precipitation Depth	3.45 inches
25-year, 24-hour Precipitation Depth	3.90 inches

NOTE:

The pond is proposed to have a wall along the west and south sides of the pond, with wall tapering to zero on both on the north and east ends.

The pond is also proposed to have a flat bottom of 12 feet, and 3H:1V side slopes on the east and north sides of the facility.

Initial design goal was for an approximately 2.5 foot working depth to the pond.

2-Year, Post-Developed Storm Event

(HydroCAD will be used to model the post developed storm events.)

Summary for Pond 3P: Detention Pond

Inflow Area = 0.422 ac, 87.21% Impervious, Inflow Depth > 2.03" for 2-Year Storm event
 Inflow = 0.213 cfs @ 7.89 hrs, Volume= 0.071 af
 Outflow = 0.010 cfs @ 24.00 hrs, Volume= 0.014 af, Atten= 95%, Lag= 966.8 min
 Primary = 0.010 cfs @ 24.00 hrs, Volume= 0.014 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 127.30' @ 24.00 hrs Surf.Area= 1,398 sf Storage= 2,517 cf

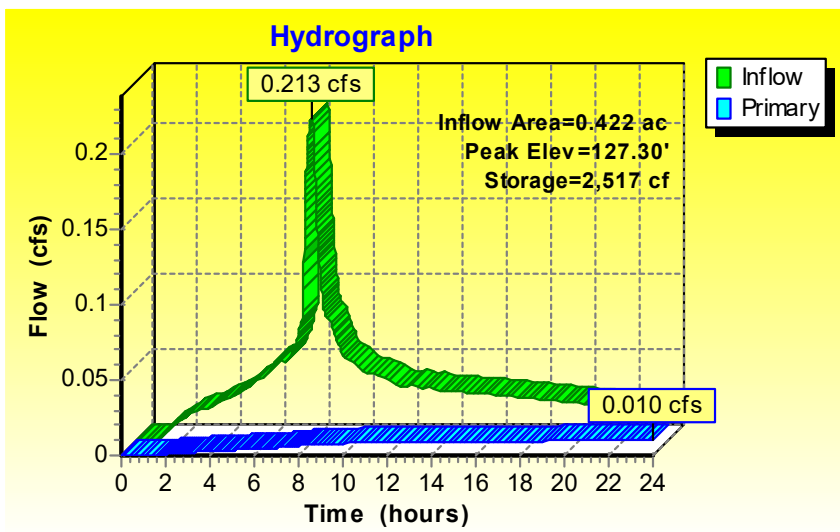
Plug-Flow detention time= 609.9 min calculated for 0.014 af (19% of inflow)
 Center-of-Mass det. time= 220.7 min (899.3 - 678.6)

Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	4,697 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	804	0	0
125.50	925	432	432
126.00	1,050	494	926
126.50	1,180	558	1,484
127.00	1,314	624	2,107
127.50	1,453	692	2,799
128.00	1,596	762	3,561
128.50	1,744	835	4,396
128.67	1,794	301	4,697

Device	Routing	Invert	Outlet Devices
#1	Primary	125.00'	12.0" Round 12" Outlet L= 50.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 125.00' / 124.50' S= 0.0100' /' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	125.00'	0.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	127.30'	1.5" Vert. Orifice/Grate C= 0.600
#4	Device 1	127.50'	3.1' long 12" Overflow 2 End Contraction(s) 2.5' Crest Height

Primary OutFlow Max=0.010 cfs @ 24.00 hrs HW=127.30' (Free Discharge)

- 1=12" Outlet (Passes 0.010 cfs of 5.084 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.010 cfs @ 7.27 fps)
- 3=Orifice/Grate (Orifice Controls 0.000 cfs @ 0.16 fps)
- 4=12" Overflow (Controls 0.000 cfs)



Per the calculations above, the 2-year, post-developed runoff is 0.010 cfs.

5-Year, Post Developed Storm Event

(HydroCAD will be used to model the post developed storm events.)

Summary for Pond 3P: Detention Pond

Inflow Area = 0.422 ac, 87.21% Impervious, Inflow Depth > 2.59" for 5-Year Storm event
 Inflow = 0.271 cfs @ 7.89 hrs, Volume= 0.091 af
 Outflow = 0.030 cfs @ 20.32 hrs, Volume= 0.028 af, Atten= 89%, Lag= 745.9 min
 Primary = 0.030 cfs @ 20.32 hrs, Volume= 0.028 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 127.48' @ 20.32 hrs Surf.Area= 1,446 sf Storage= 2,765 cf

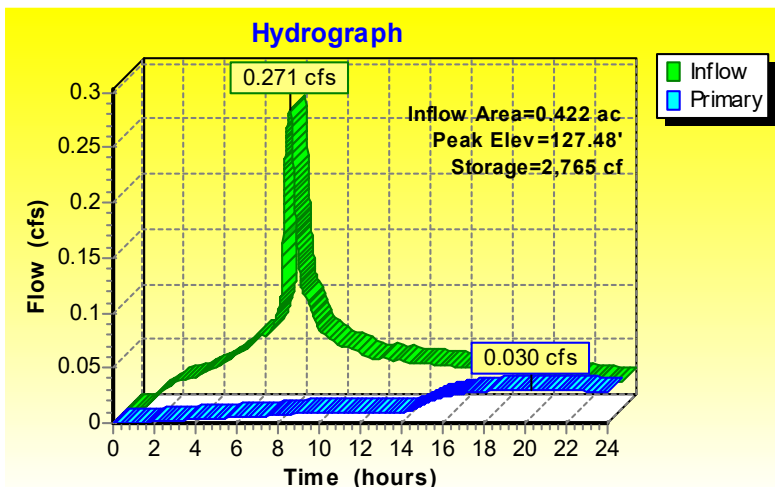
Plug-Flow detention time= 682.0 min calculated for 0.028 af (31% of inflow)
 Center-of-Mass det. time= 352.8 min (1,026.1 - 673.3)

Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	4,697 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	804	0	0
125.50	925	432	432
126.00	1,050	494	926
126.50	1,180	558	1,484
127.00	1,314	624	2,107
127.50	1,453	692	2,799
128.00	1,596	762	3,561
128.50	1,744	835	4,396
128.67	1,794	301	4,697

Device	Routing	Invert	Outlet Devices
#1	Primary	125.00'	12.0" Round 12" Outlet L= 50.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 125.00' / 124.50' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	125.00'	0.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	127.30'	1.5" Vert. Orifice/Grate C= 0.600
#4	Device 1	127.50'	3.1' long 12" Overflow 2 End Contraction(s) 2.5' Crest Height

Primary OutFlow Max=0.030 cfs @ 20.32 hrs HW=127.48' (Free Discharge)

- 1=12" Outlet (Passes 0.030 cfs of 5.324 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.010 cfs @ 7.55 fps)
- 3=Orifice/Grate (Orifice Controls 0.020 cfs @ 1.63 fps)
- 4=12" Overflow (Controls 0.000 cfs)



Per the calculations above, the 5-year, post-developed runoff is 0.030 cfs.

10-Year, Post Developed Storm Event

(HydroCAD will be used to model the post developed storm events.)

Summary for Pond 3P: Detention Pond

Inflow Area = 0.422 ac, 87.21% Impervious, Inflow Depth > 2.92" for 10-Year Storm event
 Inflow = 0.304 cfs @ 7.88 hrs, Volume= 0.103 af
 Outflow = 0.043 cfs @ 15.74 hrs, Volume= 0.039 af, Atten= 86%, Lag= 471.5 min
 Primary = 0.043 cfs @ 15.74 hrs, Volume= 0.039 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 127.51' @ 15.74 hrs Surf.Area= 1,456 sf Storage= 2,813 cf

Plug-Flow detention time= 641.2 min calculated for 0.039 af (38% of inflow)
 Center-of-Mass det. time= 335.6 min (1,006.5 - 671.0)

Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	4,697 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	804	0	0
125.50	925	432	432
126.00	1,050	494	926
126.50	1,180	558	1,484
127.00	1,314	624	2,107
127.50	1,453	692	2,799
128.00	1,596	762	3,561
128.50	1,744	835	4,396
128.67	1,794	301	4,697

Device	Routing	Invert	Outlet Devices
#1	Primary	125.00'	12.0" Round 12" Outlet L= 50.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 125.00' / 124.50' S= 0.0100'/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	125.00'	0.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	127.30'	1.5" Vert. Orifice/Grate C= 0.600
#4	Device 1	127.50'	3.1' long 12" Overflow 2 End Contraction(s) 2.5' Crest Height

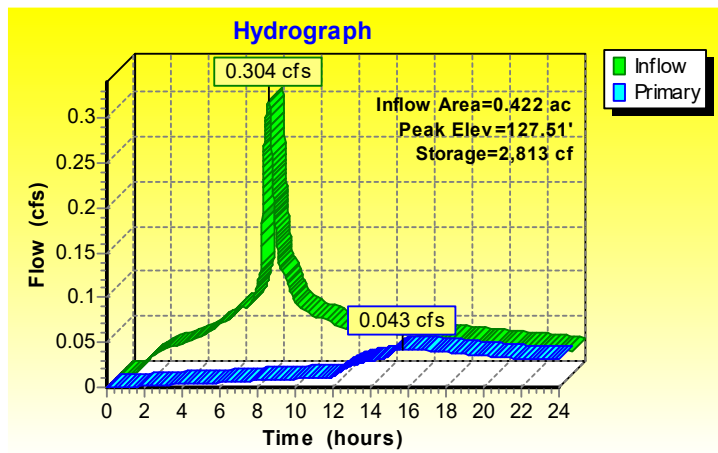
Primary OutFlow Max=0.043 cfs @ 15.74 hrs HW=127.51' (Free Discharge)

1=12" Outlet (Passes 0.043 cfs of 5.369 cfs potential flow)

2=Orifice/Grate (Orifice Controls 0.010 cfs @ 7.60 fps)

3=Orifice/Grate (Orifice Controls 0.023 cfs @ 1.85 fps)

4=12" Overflow (Weir Controls 0.010 cfs @ 0.33 fps)



Per the calculations above, the 10-year, post-developed runoff is 0.043 cfs.

25-Year, Post Developed Storm Event

(HydroCAD will be used to model the post developed storm events.)

Summary for Pond 3P: Detention Pond

Inflow Area = 0.422 ac, 87.21% Impervious, Inflow Depth > 3.34" for 25-Year Storm event
 Inflow = 0.348 cfs @ 7.88 hrs, Volume= 0.118 af
 Outflow = 0.059 cfs @ 12.54 hrs, Volume= 0.054 af, Atten= 83%, Lag= 279.6 min
 Primary = 0.059 cfs @ 12.54 hrs, Volume= 0.054 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 127.52' @ 12.54 hrs Surf.Area= 1,458 sf Storage= 2,825 cf

Plug-Flow detention time= 574.1 min calculated for 0.054 af (45% of inflow)
 Center-of-Mass det. time= 291.1 min (959.5 - 668.4)

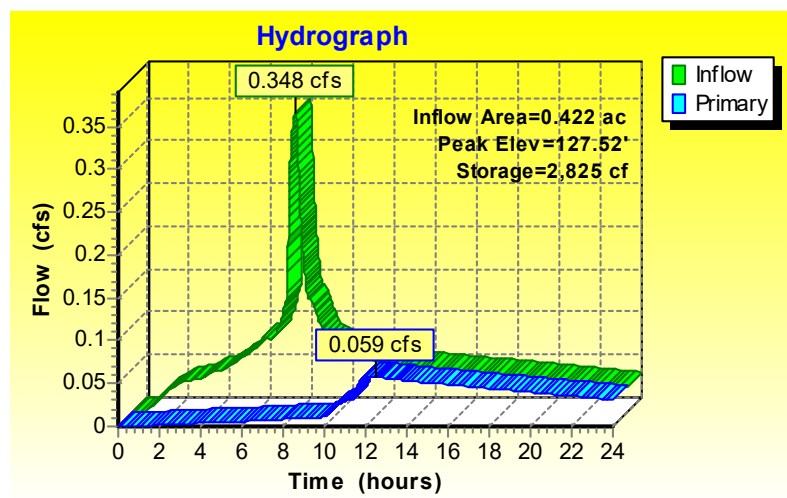
Volume	Invert	Avail.Storage	Storage Description
#1	125.00'	4,697 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
125.00	804	0	0
125.50	925	432	432
126.00	1,050	494	926
126.50	1,180	558	1,484
127.00	1,314	624	2,107
127.50	1,453	692	2,799
128.00	1,596	762	3,561
128.50	1,744	835	4,396
128.67	1,794	301	4,697

Device	Routing	Invert	Outlet Devices
#1	Primary	125.00'	12.0" Round 12" Outlet L= 50.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 125.00' / 124.50' S= 0.0100 ' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	125.00'	0.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	127.30'	1.5" Vert. Orifice/Grate C= 0.600
#4	Device 1	127.50'	3.1' long 12" Overflow 2 End Contraction(s) 2.5' Crest Height

Primary OutFlow Max=0.059 cfs @ 12.54 hrs HW=127.52' (Free Discharge)

- 1=12" Outlet (Passes 0.059 cfs of 5.380 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.010 cfs @ 7.61 fps)
- 3=Orifice/Grate (Orifice Controls 0.023 cfs @ 1.90 fps)
- 4=12" Overflow (Weir Controls 0.025 cfs @ 0.44 fps)



Per the calculations above, the 25-year, post-developed runoff is 0.059 cfs.

Pre and Post Developed Storm Event Summary:

Storm Event	Pervious Area Peak Q, cfs	Impervious Area Peak Q, cfs
2-year	0.093 cfs	0.213 cfs
5-year	0.142 cfs	0.271 cfs
10-year	0.172 cfs	0.304 cfs
25-year	0.212 cfs	0.348 cfs

(Allowable and Post-Developed release rates is noted in the table below).

Hydromodification Stormwater Facility:

The stormwater facility will consist of a detention pond. There will be 2.5 feet of detention storage above the water quality swale and 1 foot of freeboard during a 25 year storm event. The flow control structure will have two orifices and a 12" overflow riser.

Maintenance Access to Stormwater Facility & Structures:

The stormwater facility is located on the east side of the site, adjacent to the parking lot for the new buildings. The edge of the stormwater facility is immediately adjacent to the parking lot and drive aisle, so access to facility will be available from the pavement. The flow control structure is located on the south end of the stormwater facility and is approximately 55' from the parking lot for access, and near the existing neighboring stormwater facilities flow control structure.

Summary:

Water quality will be provided via three (3) PerkFilter catchbasins, with all the roof and new pavement areas draining into one of three catchbasins.

Since the new impervious area is greater than 1,000 square feet, hydro-modification is required. A detention pond will be used to meet the hydromodification requirements. There will be 2.5 feet of detention storage above the water quality swale and 1 foot of freeboard during a 25 year storm event. The flow control structure will have two orifices and a 12" overflow riser. The bottom orifice will be 1/2 inches in diameter, the second orifice will be 1½" in diameter. The 5 and 10 year events will top the overflow wier but remain below the pre-developed runoff rate. Below is a table showing that the hydromodification requirements have been met.

Storm Event	Allowable Release Rate	Post Developed Release Rate
2 year	0.046 cfs	0.010 cfs
5 year	0.142 cfs	0.030 cfs
10 year	0.172 cfs	0.043 cfs
25 year	0.212 cfs	0.059 cfs

Please note that at this point we have a very conservative design. Likely we will modify this as land use process decision becomes clear and impacts to the site configuration become known.

Hedges Creek Flood Impacts:

The entirety of the development site lies within the Hedges Creek floodplain. As of this writing the site elevations, including the finish floor of the buildings, is expected to be no higher than 131.70 (1988 datum). According to the FEMA flood maps and cross-sections the 100 year flood elevation is noted to be 133.9 and the 10 year flood elevation is scaled to be 132.9.

If the developer had a choice, he would prefer to set the building finish floors above the flood elevations, but to meet the cut/fill requirements of FEMA, that will not be possible. The storm drain facilities, including the detention pond will also be below the 10 year flood elevations, and likely below smaller flood event elevations as well. While 10 year rainfall events and 10 year flood events are not locked together, in a relatively small basin such as Hedges Creek there is likely to be some correlation between the two types of events. This is noted simply to point out the fact that in larger events (10 year and up), Hedges Creek flooding will likely provide higher storage elevations than the same facility outside a floodplain area, and freeboard is not really as important in this situation as it would be outside a floodplain.

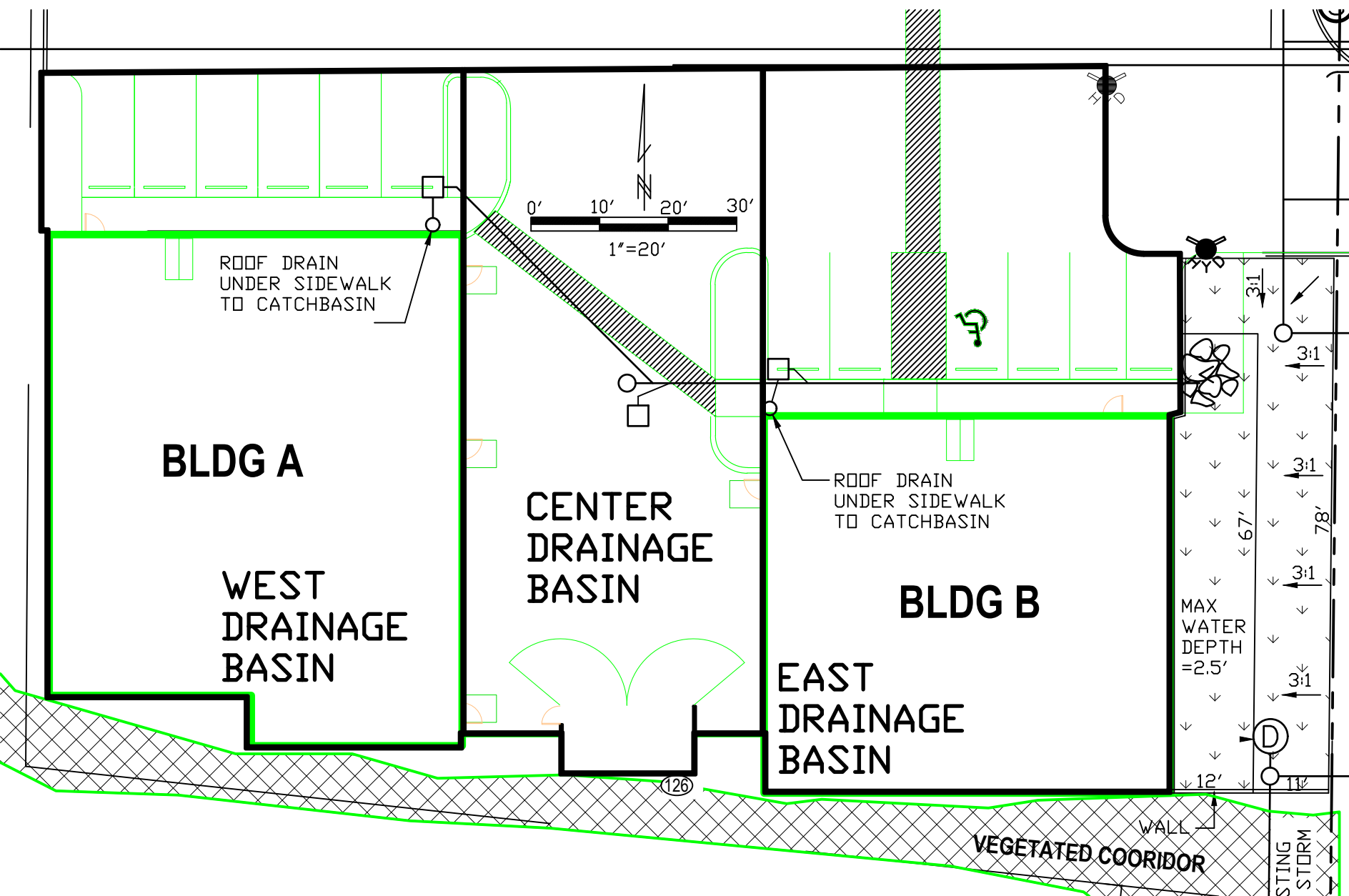
Supporting Information:

Onsite Storm Drain Basin Map

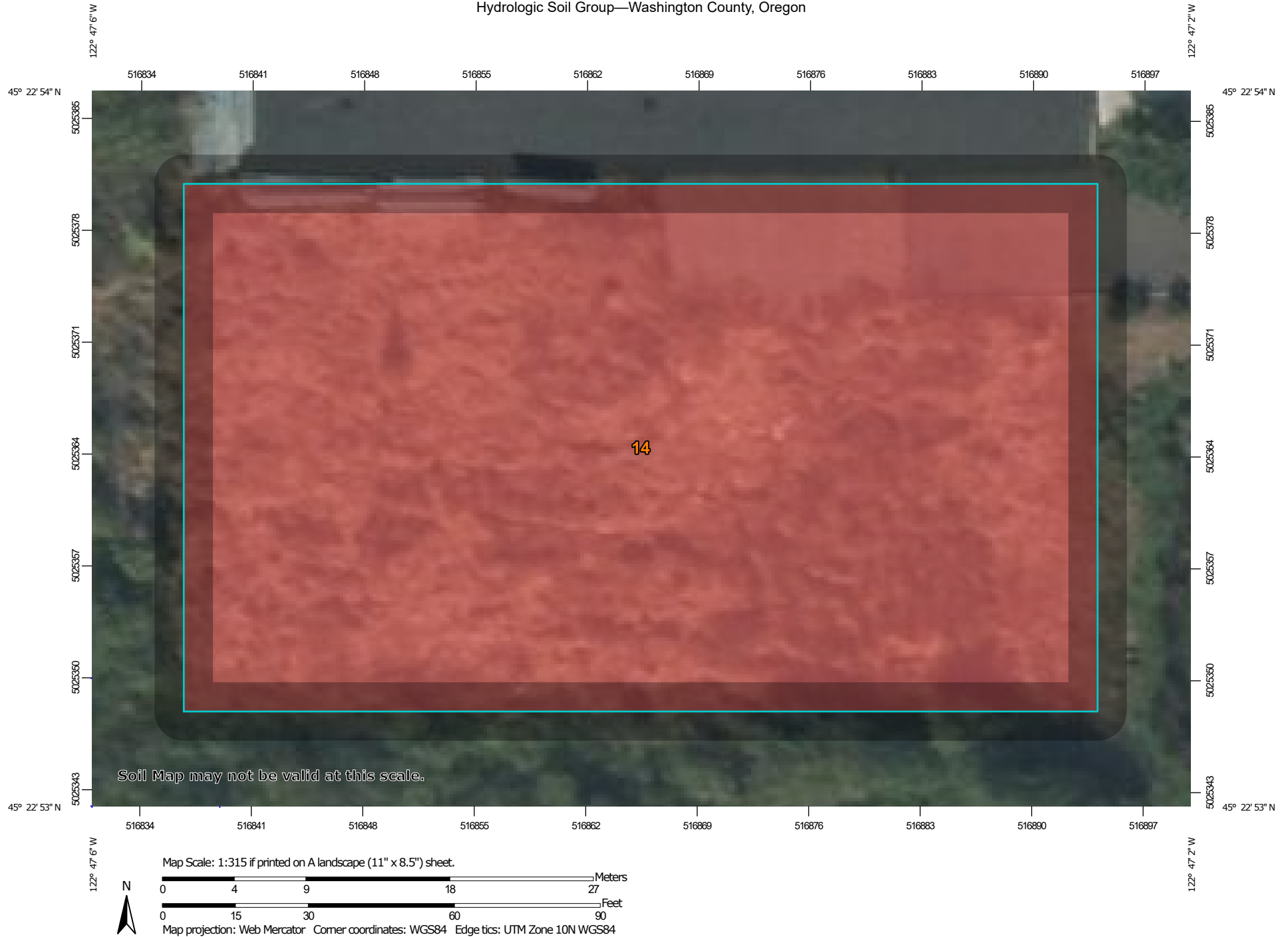
Web Soil Survey Information

Clean Water Services Approved Products List

Washington Dept. of Ecology GULD Designation for PerkFilter



Hydrologic Soil Group—Washington County, Oregon



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washington County, Oregon
 Survey Area Data: Version 23, Sep 7, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 26, 2022—Oct 11, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
14	Cove clay	D	0.5	100.0%
Totals for Area of Interest			0.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPROVED PRODUCTS LIST- PROPRIETARY TREATMENT SYSTEMS

Design and Construction Standards 4.07.8

Product	Current Manufacturer	Application	Effective Date	Remarks
Filterra	Contech	Private Water Quality Treatment Only	June 21, 2010	1
PerkFilter	Oldcastle	Private Water Quality Treatment Only	April 14, 2011	1, 2
Modular Wetlands	Contech	Private Water Quality Treatment Only	February 9, 2015	1, 2
StormFilter	Contech	Public and Private Water Quality Treatment	June 2015	1, 2
BayFilter	Advanced Drainage Systems (ADS)	Private Water Quality Treatment Only	June 13, 2016	1, 2, 3

1. The following are standard conditions of approval for proprietary treatment systems:

- A maintenance agreement is required for each installation, and this agreement must be recorded with the property treated.
- Clean Water Services reserves the right to restrict at any time the use of this product based on long-term system reliability and maintenance characteristics.
- Pretreatment of stormwater flows is required per Design and Construction Standards 4.07.1.
- Product siting and maintenance must follow manufacturer recommendations.
- Discharges from products shall not cause or contribute to water quality standards violations in receiving waters.

2. Product media must meet the specifications submitted to and approved by Washington State Department of Ecology.

3. Cartridge bay must be covered by a non-grated lid to protect maintenance indicators from being washed off by rainwater.



August 2022

GENERAL USE LEVEL DESIGNATION FOR BASIC AND PHOSPHORUS TREATMENT

For

Oldcastle Infrastructure PerkFilter™ (with ZPC Filter Media)

Ecology's Decision:

Based on Oldcastle's application submissions, including the Draft Technical Evaluation Report, dated April 2010, Ecology hereby issues the following use level designations:

1. General use level designation (GULD) for the PerkFilter™ for basic treatment:

- Using a zeolite-perlite-carbon (ZPC) filter media as specified by Oldcastle.
- Sized at hydraulic loading rate of no more than 1.5 gpm/ft² of media surface area, per Table 1.

Table 1. Design Flowrate per Cartridge

Effective Cartridge Height (inches)	12	18
Cartridge Flowrate (gpm/cartridge)	6.8	10.2

2. General use level designation (GULD) for the PerkFilter™ for phosphorus treatment:

- Using a zeolite-perlite-carbon (ZPC) filter media as specified by Oldcastle.
- Sized at hydraulic loading rate of no more than 1.5 gpm/ft² of media surface area, per Table 1.

3. Ecology approves PerkFilter™ units for treatment at the hydraulic loading rates shown in Table 1, and sized based on the water quality design flow rate for an off-line system. The internal weir in the inlet chamber functions as a bypass to route flow in excess of the water quality design flow rate around the treatment chamber. Calculate the water quality design flow rate using the following procedures:

- **Western Washington:** For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.

- **Eastern Washington:** For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
 - **Entire State:** For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
4. **These General Use Level Designations have no expiration date but may be revoked or amended by Ecology, and are subject to the conditions specified below.**

Ecology's Conditions of Use:

PerkFilter™ units shall comply with the following conditions:

1. **Design, assemble, install, operate, and maintain PerkFilter™ units in accordance with Oldcastle's applicable manuals and documents and the Ecology Decision.**
2. **Each site plan must undergo Oldcastle review and approval before site installation. This ensures that site grading and slope are appropriate for use of a PerkFilter™ unit.**
3. **PerkFilter™ media shall conform to the specifications submitted to, and approved by, Ecology.**
4. **Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.**
 - **Typically, Oldcastle designs PerkFilter systems for a target filter media replacement interval of 12 months. Maintenance includes removing accumulated sediment from the vault, and replacing spent cartridges with recharged cartridges.**
 - **Indications of the need for maintenance include effluent flow decreasing to below the design flow rate, as indicated by the scumline above the shoulder of the cartridge.**
 - **Owners/operators must inspect PerkFilter for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to SWMMEW, the wet season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.**

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
 - Accumulated vault sediment depths exceed an average of 2 inches, or
 - Accumulated sediment depths on the tops of the cartridges exceed an average of 0.5 inches, or
 - Standing water remains in the vault between rain events, or
 - Bypass occurs during storms smaller than the design storm.
- Note: If excessive floatables (trash and debris) are present, perform a minor maintenance consisting of gross solids removal, not cartridge replacement.

5. Discharges from the Perk Filter™ units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: Oldcastle Infrastructure, Inc.

Applicant's Address: 5331 SW Macadam Avenue
Suite 376
Portland, OR 97239

Application Documents:

- PerkFilter™ Final Report, prepared by: Office of Water Programs, California State University, Sacramento (September 2007)
- Verification Phase of PerkFilter™ Tests with Zeolite-Perlite-Carbon Media and Zeolite-Carbon Media (August 2007)
- Quality Assurance Project Plan KriStar PerkFilter™ Stormwater Treatment Performance Monitoring Project, October 2008 Draft
- Technical Evaluation Report Volume 1: KriStar PerkFilter™ Stormwater Treatment System Performance Monitoring, April 2010
- Technical Evaluation Report Volume 2 - Appendices: KriStar PerkFilter™ Stormwater Treatment System Performance Monitoring, April 2010.

Applicant's Use Level Request:

- General use level designation as a basic and Phosphorus treatment device in accordance with Ecology's *Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision*.

Applicant's Performance Claims:

- Capability to remove 80% of total suspended solids from stormwater runoff from sites with influent concentrations between 100 mg/L and 200 mg/L and provide effluent concentrations of 20 mg/L or less with influent concentrations less than 100 mg/L given a typical particle size distribution.
- Capability to remove 50% of Total Phosphorus from stormwater runoff from sites with influent concentrations between 0.1 mg/l and 0.5 mg/l.

Findings of Fact:

- Based on laboratory testing at a flowrate of 12 GPM per filter, the PerkFilter™ containing ZPC media had an average total suspended solids removal efficiency of 82% using Sil-Co-Sil 106 with an average influent concentration of 102 mg/L and zero initial sediment loading.
- Based on field-testing at a flowrate of 0.57 GPM/inch of cartridge height (17.25 inch diameter cartridge) (1.5 gpm per sq ft filter surface area), the PerkFilter™ containing ZPC media had an average total suspended solids removal efficiency of 82.4% for an influent concentration between 20 mg/L and 200 mg/l. The PerkFilter™ containing ZPC media had an average removal efficiency of 85.2% for an influent concentration between 100 mg/l and 200 mg/l. Removal rates fell over time and dropped below 80% after approximately 10 months.
- Based on field testing at a flowrate of 0.57 GPM/inch of cartridge height (17.25 inch diameter cartridge) (1.5 gpm per sq ft filter surface area), the PerkFilter™ containing ZPC media had an average total Phosphorus removal efficiency of 62.4% for an influent concentration between 0.1 mg/L and 0.5 mg/l. Removal rates tended to remain relatively constant during the 10 months of monitoring.
- Field Testing indicates that sediment accumulation in the Sediment Gallery during the 10 months of sampling was within the available volume for sediment. Thus, maintenance at a 6-month frequency (vacuuming of sediment from Inlet Gallery) as suggested by the manufacturer is sufficient.
- Filter flows during bypass events utilize the full 30-inch height of the filter. Without bypass, an unknown amount of filter is used. Comparing the flow through the filter during bypass events with the design flow rate shows that the Oldcastle system falls below the design flow rate after approximately 10 months of operation.
- Percent removal of TSS falls below 80% after approximately 10 months. There are earlier data points below 80% but these are from low influent concentration storms

Other PerkFilter™ Related Issues to be Addressed By the Company:

1. Oldcastle may perform additional monitoring to better determine the maintenance frequency for the filters with respect to design flow rate and Total Suspended Solids removal. Presentation of additional data may result in a modification to the requirements in this Use Level designation document.

Technology Description: Download at www.kristar.com

Contact Information:

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Applicant website: www.kristar.com

Ecology web link: <http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html>

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 870-0983
douglas.howie@ecy.wa.gov

Revision History

Date	Revision
March 2008	Original Draft use-level-designation document
June 2010	Revise Use Level to General
January 2013	Modified Design Storm Description, added Revision Table, formatted document to match Ecology standard
May 2014	Revised Company name and contact information
June 2016	Designated device for off-line sizing
August 2018	Revised Address and phone number for Oldcastle
August 2022	Removed Kristar from Company Name throughout the document