



95 Express
April 28, 2021

City of Ponderay
Stormwater Calculation Memo

Attached are the Rational Method – Bowstring spreadsheets used to calculate the critical storm runoff rates and subsequent detention volumes required when the 95 Express plans were created. Some explanation of the spreadsheets is probably required. The ITD IDF curves for the 25-Year storm events were used:

The pre-developed 25-Year runoff rate was first calculated (see *Pre-Developed 25 YR*) to determine a theoretical pre-developed runoff rate from the site for each storm checked using the Rational Method.

These time-dependent (Duration) events were then used on the Post-Developed sheet (see *Post-developed 25 YR*) as a theoretical maximum release rate allowed. The soil type was also used in the Post-Developed sheet to calculate a theoretical infiltration rate using the grassed infiltration areas (GIAs) proposed. This left us with a detention requirement in the Post-Developed condition that centered on the 24-Hour 25-Year event (4,578 CF of detention would be required).

The Treatment Area required is calculated based upon the impervious area on the site. The Required Treatment Volume (the first ½” of runoff from all impervious areas) was found to be 1,415 CF. The proposed stormwater treatment area along the northern property boundary has a volume of 1,799 CF at a maximum depth of 8-inches.

In addition to the treatment area provided, there is an existing stormwater treatment swale (and detention pond) that was constructed as part of the Ruby Hotel improvements. There is a reciprocal easement for drainage over this GIA and a small portion of it is credited to this site. None of this apparently failing and poorly maintained facility is to be used for stormwater. Only landscaping to block the site lighting from the hostel is proposed.

The final detention volume required is then found to be $4,578 - 1,799 = \underline{2,779 \text{ CF}}$ of additional detention required. There is no requirement for additional Treatment volume. To account for this lack of on-site detention needed to meet the pre-developed peak runoff rates for the 25-year, 24-hour storm event, we request to use offsite credits per PCC 8-4-6.A.7 by paying the “*in lieu of retention fee*” for a regional municipal stormwater treatment (and detention) facility. The “*in lieu of retention fee*” was similarly used on the neighboring site for the Pape development prepared by Clearwater Engineering. We request similar consideration.

Operation and Maintenance Plan

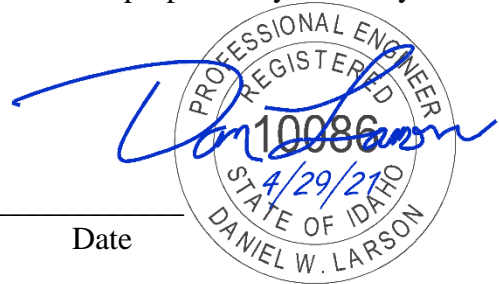
Temporary and Permanent Erosion and Stormwater control measures will be the responsibility of the Owner:

Inspection Schedule & Maintenance Activities

Both temporary and permanent erosion and sediment control measures should be inspected by the Owner and/or Contractor. Below is an inspection schedule table for convenience.

Stormwater Feature or Erosion Control Measure	Inspection Frequency	Maintenance Activities
Mulching	Weekly & following major rain event	Mulch exposed soil
Fiber Rolls	Weekly & following major rain event	Repair and remove sediment
Temporary Berms	Weekly & following major rain event	Repair or Replace as needed.
Treatment and Detention Facility	Monthly the first year and bi-annually thereafter	Mulch exposed soil and mulch cell every 2 to 3 years

In conclusion, I find that the proposed permanent improvements if properly constructed and maintained as described herein and shown on the Plans, will treat the additional runoff to be generated with the future construction of the roadway and buildings on these properties. Detention will require off-site improvements as proposed by the City of Ponderay.



Daniel W. Larson, Principal – 7B Engineering

Date



Stormwater Management Calculations
Rational Method
Pre-Developed 25 Year

Pre-Developed

Runoff from Table 6-2 Kennedy report

	Area(ft ²)	Area(acres)	CN	Runoff	
Road	0	0.00	98	0.90	0.00
Parking Lot	0	0.00	98	0.90	0.00
Building	0	0.00	98	0.90	0.00
Grass	40362	0.93	55	0.25	0.23
Totals	40362	0.9300	55	2.95	0.23

Developed "C" 0.25

Time increment 5 min
 Time of concentration 29.418079 min
 Outflow 0 cfs 1) input outflow (0.3 cfs 600 gal drywell, 1.0 cfs 1000 gal drywell)
 Design year 25
 Area (sqft) 40362 sqft 2) input surface area for basin (in sqft)
 Area (acres) 0.93 3) input the basins "C" factor
 Area x "C" 0.23
 Developed "C" factor 0.25

Time Inc. (min)	Time Inc. (sec)	Intensity (in / hr)	Q (cfs)	Volume (cf)
5	300	2.80	0.65	261
10	600	2.10	0.49	391
11	660	2.00	0.46	410
12	720	1.90	0.44	425
13	780	1.85	0.43	448
14	840	1.75	0.41	456
15	900	1.70	0.39	475
20	1200	1.60	0.37	596
25	1500	1.40	0.32	652
30	1800	1.20	0.28	667
35	2100	1.10	0.25	688
40	2400	0.95	0.22	660
45	2700	0.90	0.21	688
50	3000	0.87	0.20	726
55	3300	0.85	0.20	768
60	3600	0.78	0.18	759
65	3900	0.75	0.17	782
70	4200	0.70	0.16	778
75	4500	0.69	0.16	815
80	4800	0.67	0.16	838
85	5100	0.65	0.15	858
90	5400	0.63	0.15	876
95	5700	0.60	0.14	876
100	6000	0.59	0.14	902
105	6300	0.58	0.13	927
110	6600	0.55	0.13	917
115	6900	0.52	0.12	903
120	7200	0.5	0.12	903
125	7500	0.49	0.11	910
130	7800	0.48	0.11	925
135	8100	0.48	0.11	958
140	8400	0.46	0.11	951
145	8700	0.45	0.10	962
150	9000	0.44	0.10	972
155	9300	0.43	0.10	980
160	9600	0.42	0.10	987
165	9900	0.41	0.09	992
170	10200	0.40	0.09	997
175	10500	0.39	0.09	1000
180	10800	0.38	0.09	1001
360	21600	0.25	0.06	1286
720	43200	0.17	0.04	1733
1440	86400	0.11	0.03	2183

24 Hr Storm

25 year design (store or discharge 25 year / 2-hour storm event)
 24-Hour Volume (pre-developed) 2183 cu ft

Time of concentration calculation

n = manning roughness(Grass)	0.25	USDA
p=2 year, 24 hour rainfall	2	
Slope (S)	0.04	
Length (L)	250 feet	
$T_c = [0.007(nL)^{0.8}] / (((P)^{0.50}) * S^{0.4}) * 60$	29.418079 min	



Stormwater Management Calculations
Rational Method
Post-Developed Peak Storm 25 Year

Post-Developed Runoff and Developed "C" Factor

	Area(ft^2)	Area(acres)	CN	Runoff C	CA
Road	24067	0.56	98	0.90	0.50
Misc	3303	0.08	98	0.90	0.07
Buildings	5526	0.13	98	0.90	0.12
Sidewalks	1056	0.03	98	0.90	0.03
Grass	6410	0.15	80	0.25	0.04
Totals	40362	0.9500	95	3.85	0.76

Developed "C" 0.80

Time increment 5 min
 Time of concentration 5 min
 Outflow (Infiltration) **0.11** CFM Exfiltration through engineered soils
 Design year 25 1) input outflow (0.3 cfs 600 gal drywell,
 Area (sqft) 40362 sqft 1.0 cfs 1000 gal drywell)
 Area (acres) 0.93 Ac 2) input surface area for basin (in sqft)
 Area x "C" 0.74 3) input the basins "C" factor
 Developed "C" factor 0.80 Weighted value

Time Inc. (min)	Time Inc. (sec)	Intensity (in / hr)	Q dev (cfs)	V in	Q pre (cfs)	V pre	Storage Required
5	300	2.80	2.07	832	0.65	261	570
10	600	2.10	1.55	1089	0.49	391	697
11	660	2.00	1.48	1126	0.46	410	715
12	720	1.90	1.40	1154	0.44	425	728
13	780	1.85	1.37	1206	0.43	448	756
14	840	1.75	1.29	1218	0.41	456	760
15	900	1.70	1.26	1259	0.39	475	782
20	1200	1.60	1.18	1539	0.37	596	941
25	1500	1.40	1.03	1657	0.32	652	1002
30	1800	1.20	0.89	1686	0.28	667	1016
35	2100	1.10	0.81	1790	0.25	688	1098
40	2400	0.95	0.70	1756	0.22	660	1091
45	2700	0.90	0.66	1863	0.21	688	1170
50	3000	0.87	0.64	1994	0.20	726	1263
55	3300	0.85	0.63	2136	0.20	768	1362
60	3600	0.78	0.58	2133	0.18	759	1368
65	3900	0.75	0.55	2218	0.17	782	1428
70	4200	0.70	0.52	2225	0.16	778	1439
75	4500	0.69	0.51	2346	0.16	815	1522
80	4800	0.67	0.50	2427	0.16	838	1579
85	5100	0.65	0.48	2498	0.15	858	1630
90	5400	0.63	0.47	2561	0.15	876	1675
95	5700	0.60	0.44	2572	0.14	876	1686
100	6000	0.59	0.44	2660	0.14	902	1747
105	6300	0.58	0.43	2743	0.13	927	1805
110	6600	0.55	0.41	2723	0.13	917	1794
115	6900	0.52	0.38	2690	0.12	903	1774
120	7200	0.5	0.37	2697	0.12	903	1781
125	7500	0.49	0.36	2725	0.11	910	1800
130	7800	0.48	0.35	2776	0.11	925	1836
135	8100	0.48	0.35	2881	0.11	958	1908
140	8400	0.46	0.34	2866	0.11	951	1899
145	8700	0.45	0.33	2904	0.10	962	1926
150	9000	0.44	0.32	2938	0.10	972	1950
155	9300	0.43	0.32	2968	0.10	980	1971
160	9600	0.42	0.31	2994	0.10	987	1989
165	9900	0.41	0.30	3015	0.09	992	2004
170	10200	0.40	0.29	3032	0.09	997	2016
175	10500	0.39	0.29	3045	0.09	1000	2026
180	10800	0.38	0.28	3053	0.09	1001	2032
360	21600	0.25	0.18	4009	0.06	1286	2682
720	43200	0.17	0.13	5465	0.04	1733	3651
1440	86400	0.11	0.08	6924	0.03	2183	4578

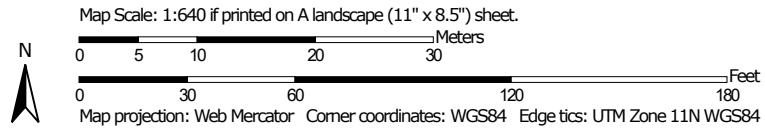
25 year design (store or infiltrate 25 year peak flow and volume)
 Peak Storm required storage **4578** cu ft

Overall Treatment Req and Soil Infiltration Rate	
Site Impervious Area	33952 SF
Req Treatment	1415 CF
Req Treatment Area (8" depth)	2122 SF
Proposed Treatment Area (8" depth)	2699 SF
Treatment soil infiltration	0.03 in/hr
Soil infiltration of Treatment Area	0.11 CFM
Depth of Treatment Area Req'd for Detention	1.70 FT

Soil Map—Bonner County Area, Idaho, Parts of Bonner and Boundary Counties




Soil Map may not be valid at this scale.





MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

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 1:24,000.

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: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

Survey Area Data: Version 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Aug 15, 2010—Aug 23, 2016

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
31	Mission silt loam, 0 to 2 percent slopes	1.5	100.0%
Totals for Area of Interest		1.5	100.0%

Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

31—Mission silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 5462
Elevation: 2,000 to 2,800 feet
Mean annual precipitation: 25 to 38 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 120 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Mission and similar soils: 75 percent
Minor components: 5 percent
*Estimates are based on observations, descriptions, and transects of
the mapunit.*

Description of Mission

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Volcanic ash and loess over silty glaciolacustrine
deposits

Typical profile

O_i - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: silt loam
B_w - 3 to 12 inches: silt loam
2B_{tx} - 12 to 21 inches: silt loam
2E - 21 to 33 inches: silt
2B_t - 33 to 48 inches: silt loam
3C - 48 to 67 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 10 to 20 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (K_{sat}): Very low
to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: F043AY527WA - Warm-Frigid, Udic, Loamy
Foothills/Valleys, high water table (western redcedar, moist
herb) Thuja plicata / Clintonia uniflora
Other vegetative classification: western redcedar/queencup
beadlily (CN530)
Hydric soil rating: No

Minor Components

Hoodoo

Percent of map unit: 3 percent
Landform: Flood plains, drainageways
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Odenson

Percent of map unit: 2 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Bonner County Area, Idaho, Parts of Bonner and Boundary
Counties
Survey Area Data: Version 16, Jun 4, 2020