STORM WATER MANAGEMENT,
GRADING AND EROSION CONTROL PLAN
FOR
SEARS LOTS 4 & 5, LEW'S INDUSTRIAL PARK
(HAWTHORNE AVENUE)

Project:	The construction of two (2) 9,000 sf industrial buildings and associated parking and driveways along a shared approach.
Owner:	Joel Sears 4014 E Olmsted Rd Spokane, WA 99223
Prepared by:	James A. Sewell & Associates 1319 North Division Avenue Sandpoint, Idaho 83864
Date:	October 25, 2023

PROFESSIONAL ENGINEER LICENSED 14031 10-25-2023 STATE OF IDAHO JEFF JENSEN

INTRODUCTION

The purpose of this report is to assess the capability of the proposed lot to manage storm water run-off and control erosion from impervious surfaces attributed to the construction of the proposed buildings and associated impervious surfaces.

The scope of this report is based on and limited to the known general and specific topography of the site, soil types as identified by site inspection and soils information obtained from the "Soil Survey of Bonner County," and observed surface site features.

EXISTING SITE CONDITIONS

Access to the site is fully developed and there is a concrete sidewalk along the entire frontage with Hawthorne Ave. There are two existing asphalt approaches to the site and all water, sewer, and dry utilities are available. The remainder of the site is undeveloped and is covered with low lying grass vegetation, there are no trees. The site is generally lower in elevation than the sidewalk and slopes slightly to the south.

PROPOSED SITE CONDITIONS

Two (2) 9,000 sf buildings (180' long x 50' wide) are proposed for the site along with a shared approach at the property line. The two existing approaches will be removed and the existing drainage swale along Hawthorne Avenue will be extended through the locations of the existing approaches. A new asphalt approach with reconstructed sidewalk will be constructed. A concrete valley gutter will be installed along the shared property line to convey runoff to the proposed grassy infiltration areas (GIAs) which will be located at the rear of the proposed buildings (to the north and south). A few trees will be planted as landscaping on the east side of the building and a short (6" to 18" tall) retaining wall is proposed along the south property line of Lot 5 to allow for the construction of the proposed GIA. Following construction all disturbed soil areas shall be reseeded with native grassy vegetation.

SOILS

The Bonner County Soil Survey indicates this parcel is located in an area of Mission Silt Loam, 0 to 2 percent slopes. This soil is somewhat poorly drained that is shallow to a hardpan and located on terraces. If formed in silty glacial lake-laid sediment derived from volcanic ash and loess. Permeability of this soil is very slow; runoff is slow and hazard of erosion is slight.

Included in this unit are small areas of Selle fine sandy loam in higher areas on terraces and near shorelines; a soil similar to the Mission soil but that is moderately well drained does not have a hardpan and is in the higher areas on terraces, Colburn very fine sandy loam on the lower alluvial fans and terraces.

Soil Mapping Number 31 – Mission Silt loam, 0 to 2 percent slope

Map Unit Setting:

Elevation: 2,050 to 2,300 feet
Mean annual precipitation: 32 inches
Mean annual air temperature: 44 degrees
Frost-free period: 115 days

Typical profile:

+2-0 inches:	mat of needles, leaves and twigs
0-2 inches:	grayish brown, neutral silt loam
2-11 inches:	yellowish brown, slightly acid silt loam

11-20 inches:	mottled, light gray and pale brown, medium acid, dense silt loam
20-32 inches:	mottled, light gray medium acid silt
32-47 inches:	light yellowish brown and pale yellow, strongly acid silt loam and silty clay loam
47-60 inches+:	pale yellow and light yellowish brown, strongly acid and slightly acid, stratified very fine sandy loam and fine sand

Soil Properties:

Drainage:	somewhat poorly drained
Permeability:	very slow
Runoff	slow
Available Water:	moderate
Rooting Depth:	10 to 20 inches (limited by hardpan)
Seasonal Water Table Depth:	perched above the hardpan (late spring)

From Soil Survey of Bonner County Area, Idaho, USDA Soil Conservation Service, April 1981. Based on our experience, the soils at the site are conducive to the proposed construction with proper construction practices.

SOIL EROSION POTENTIAL

Due to the flat site and the type of soil, the potential for soil erosion is low and can be controlled by proper sediment control measures such as silt fence and reseeding of disturbed soil areas.

EXISTING IMPERVIOUS SURFACE AREAS

There are no impervious surfaces at the site.

PROPOSED IMPERVIOUS SURFACE AREAS (LOT 4)

Following construction of the proposed improvements the impervious surfaces on Lot 4 will be as follows:

Building	9,455 sf
Parking/Driveway	7,144 sf
Sidewalk	572 sf
Total	17,171 sf

PROPOSED IMPERVIOUS SURFACE AREAS (LOT 5)

Following construction of the proposed improvements the impervious surfaces on Lot 4 will be as follows:

Building	9,455 sf
Parking/Driveway	7,122 sf

Sidewalk	576 sf
Total	17,153 sf

STORM WATER MANAGEMENT

Storm water collection facilities in this report, such as GIAs, are designed to capture the increase in runoff associated with the created impervious surface, store the first ½" of runoff from created impervious surfaces and ensure that there will be no measurable increase in the peak rate of runoff from the site after development when compared with the runoff rate from the undeveloped state for the 25-year storm event. The following calculations demonstrate these requirements for both storage and treatment structures.

25-year Design Storm Event:

The design storm as defined by the City of Ponderay is the 25-year storm event. According to the Idaho Transportation Department, Intensity-Duration-Frequency curve for Zone C, see Appendix A, the design storm intensity varies depending on the time of concentration for the site.

The Rational Method Equation is Q=CIA where "C" is the runoff coefficient, "I" is the design storm intensity, and "A" is the area.

First ½" of Runoff

Lot 4 17,171 sf x ½" of runoff = 715 sf
Lot 5 17,153 sf x ½" of runoff = 715 sf

Calculations for Lot 4 (Note Lot 5 is very similar and the runoff is split between the two lots)

Time of Concentration (Pre-Development Conditions):

The time of concentration for overland flow with runoff lengths less than 300 feet has been calculated using the Manning-Kinematic Equation:

$T_c = 0.007*(nL)^{0.8}/(\sqrt{P_2}(S)^{0.4}$

where:

n = Surface Roughness (0.24 grass)
L = Runoff Length (200 Ft.) Estimated diagonal dimension of lot from NE to SW)
P_2 = 2 yr., 24hr rainfall in inches (1.56 inches (0.065 x 24 hrs.))
S = Slope (decimal, 0.005) Approximate Average Slope

T_c = 57.7 minutes (Use 60-minute design storm for calculation of maximum discharge)

After the proposed construction, the time of concentration will increase because the proposed drainage path to the proposed grassed infiltration area will slightly decrease and the flow path will have pavement surfacing in lieu of grass.

Original Conditions (Pre-Development):

C = 0.61, Soil type D, Meadow Area = 0.703 acres

I = 0.75 inches per hour for the 25-year, 60-minute event

A = 0.487 acres

Q = 0.22 cfs (at Tc = 60 minutes)

Proposed Conditions:

C = 0.99, Building Area = 0.217 acres

C = 0.99, Pavement/Driveway Area = 0.167 acres

C = 0.99, Curb Area = 0.013 acres

C = 0.65, Soil type D, Grass Area = 0.093 acres

Composite C = 0.925

I = 1.7 inches per hour for the 25-year, 15-minute event

A = 0.487 acres

Q = 0.765 cfs (at Tc = 15 minutes)

Storage Volume Required

As required by Ponderay City Code the storm water facilities shown have been designed to accommodate the 25-year storm event and not discharge water at a rate greater than the pre-development peak runoff rate. The Bowstring Method has been implemented to ensure that the peak discharge rate of the post-developed site not exceed that to the pre-development site. A summary can be found in Appendix B.

The increase in runoff associated with the created imperious surfaces will be detained in a grassed infiltration area (GIAs). Due to low permeability of the underlying soil at the site, the GIA will be underdrained with a perforated pipe and have an assumed average infiltration rate of 1 inch per hour. The infiltration rate is expected to be approximately 0.02 cfs.

The storage volume required is 490 cf.

Total provided storage within the proposed GIA is 759 cf at depth of eight inches.

Calculations Summary

The volume of the proposed GIA exceeds the requirements set forth by the City of Ponderay. The total storage volume is greater than the proposed increase in storm water runoff and there will be no increase in the peak storm water runoff rate from the site as compared to the pre-development conditions. A complete drainage path for the proposed runoff discharge volume has been provided.

CONSTRUCTION AND REVEGETATION SCHEDULE

The approximate construction schedule is as follows:

Spring and Summer 2024

- Install temporary erosion control
- Foundation and building construction
- Initial grading
- GIA construction

Fall 2024

- Finish building construction
- Parking Lot Construction
- Reseeding of disturbed soil areas landscaping

Spring 2025

- Check vegetation growth
- Final site stabilization complete

TEMPORARY EROSION CONTROL PLAN

Silt fencing shall be placed downslope of the project site as shown in the plans. A stabilized construction entrance shall be installed at the site and all tracked soil material shall be removed from the roadway on a daily basis. All temporary soil stockpiles shall be seeded and mulched within 21 days and all stockpiles shall be surrounded with silt fence. All disturbed soil areas shall be reseeded and mulched.

Maintenance Responsibility:

All erosion control measures shall be maintained in good working order. The contractor shall be responsible for maintenance of erosion control measures until such time that final stabilization of the site is complete. Once final stabilization is complete, the land owner shall be responsible for maintenance of permanent erosion control measures.

Site Re-Vegetation

Areas disturbed during construction shall be reseeded as soon as possible after finish grading. Seed mixture recommendations may be obtained from the U.S.D.A. Natural Resource Conservation Service, landscape architect or a commercially marketed grass mixture may be applied according to the attached instructions.

OPERATION AND MAINTENANCE PLAN

During Construction

During construction, the contractor shall walk the site and inspect storm water and erosion control measures at least once every seven days and following any storm event of 0.25 inches or greater. Items the contractor shall inspect are:

- Reseeding
  - -Bare spots, washouts, and healthy growth
- Silt Fencing and Inlet protections
  - -Sediment build up
- Grassed Infiltration Areas
  - -Depth of sediment (sediment shall be removed when it reaches 10% of the design capacity of the swale, and/or at the end of construction)
  - -Healthy vegetation growth (reseed when necessary, keep vegetation trimmed to a maximum height of 6")

If maintenance is found necessary, the contractor shall begin repairs within 24 hours.

After Final Stabilization

Upon completion of construction and final stabilization, the Owner shall take responsibility for operation and maintenance of the storm water management and erosion control system as well as the funding for the continued maintenance of this system. After final stabilization, the storm water management and erosion control system shall be inspected at least every six months. The items that shall be inspected are:

- Grassed Infiltration Areas
  - -Depth of sediment (sediment shall be removed when it reaches 10% of the design capacity of the swale, and/or at the end of construction)
  - -Healthy vegetation growth (reseed when necessary, keep vegetation trimmed to a maximum height of 6")
- Reseeding
  - -Bare spots, washouts, and healthy growth
- Drainage Grates and Storm Drain Pipe
  - -Clogs and sediment buildup

SUMMARY

In summary, the proposed site is adequately suited to the construction of the proposed building as associated impervious surfaces. The site is capable of treating design storm yield run-off via the permanent use of the proposed GIAs without risk of additional run-off and/or sedimentation to ground or surface waters.

APPENDIX A

Area Classification Map, Rainfall Intensity Diagram, Runoff Coefficients
Excerpts from USDA Soil Survey

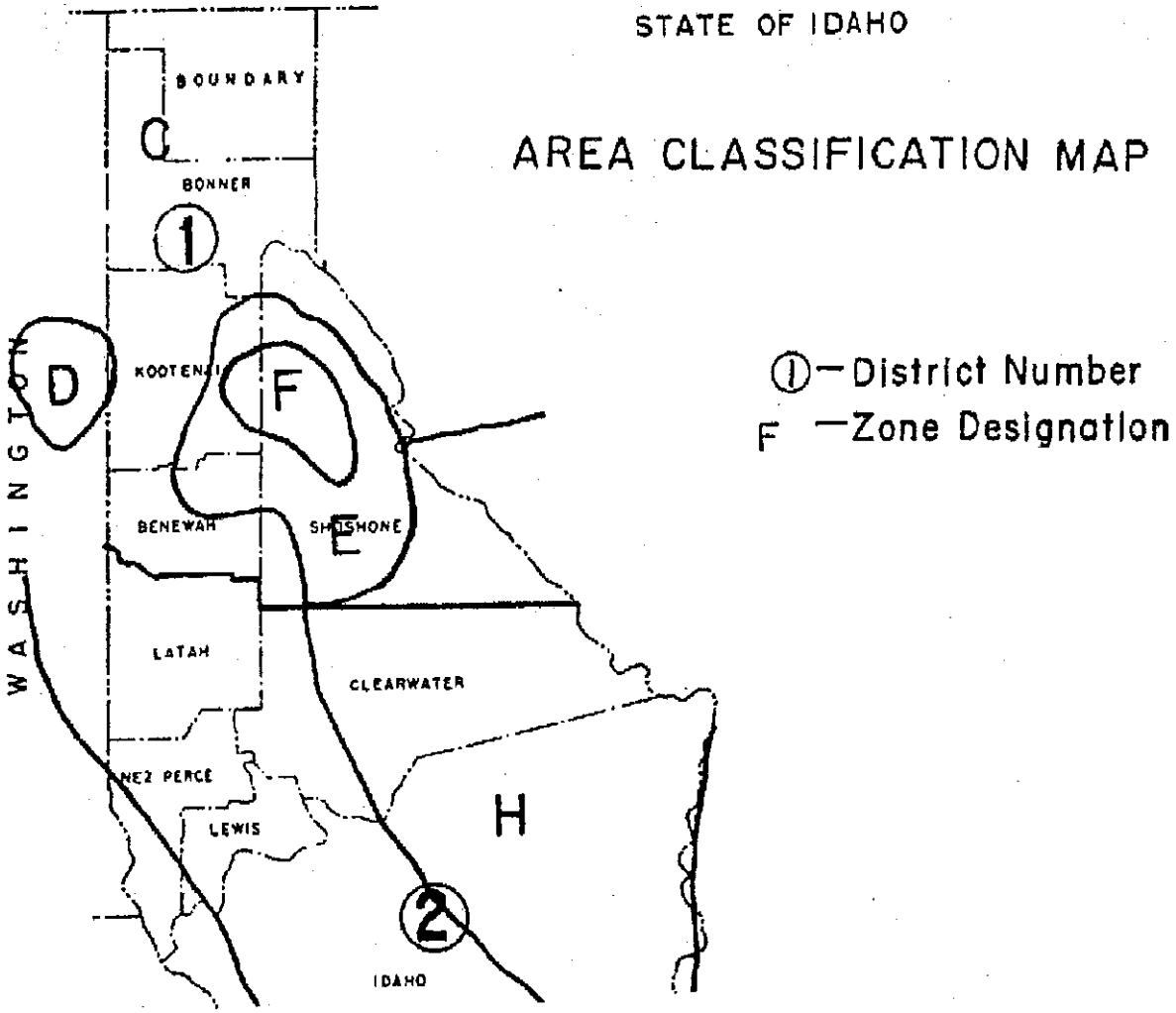


FIGURE 6-3 AREA CLASSIFICATION MAP FOR IDF CURVES - IDAHO
(IDAHO TRANSPORTATION DEPARTMENT)

FIGURE 6-4 ZONE C, INTENSITY-DURATION-FREQUENCY CURVE
(IDAHO TRANSPORTATION DEPARTMENT)

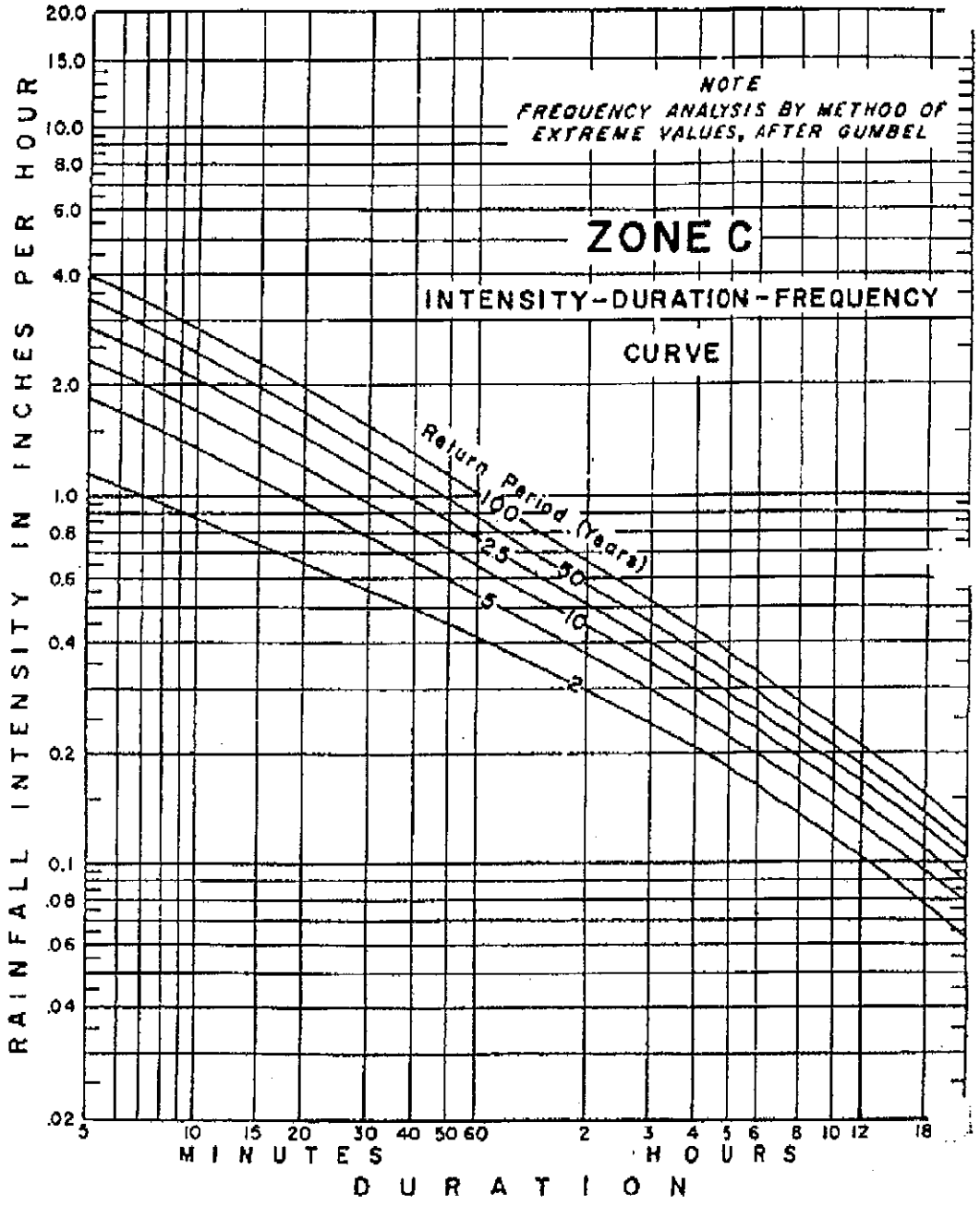


Table 1A.2. Values of Runoff Coefficient (C) for Rational Formula

Land Use	Description	Hydrologic Soils Group			
		A	B	C	D
Cultivated Land	Without conservation treatment	0.49	0.67	0.81	0.88
	With conservation treatment	0.27	0.43	0.67	0.67
Pasture or Range Land	Poor condition	0.38	0.63	0.78	0.84
	Good condition	---	0.25	0.51	0.65
Meadow	Good condition	---	---	0.41	0.61
Wood or Forest Land	Thin stand, poor cover, no mulch	---	0.34	0.59	0.70
	Good cover	---	---	0.45	0.59
Open Space, Lawn, Park, Golf Course, or Cemetery	Good condition (grass cover on 75% or more)	---	0.25	0.51	0.65
	Fair condition (grass cover on 50% to 75%)	---	0.45	0.63	0.74
Commercial and Business Area	85% impervious	0.84	0.90	0.93	0.96
Industrial District	72% impervious	0.67	0.81	0.88	0.92
Residential Lot Average lot size (acres): 1/8 1/4 1/3 1/2 1.0	Average % of lot impervious: 65 38 30 25 20	 0.59 0.29 --- --- ---	 0.76 0.55 0.49 0.45 0.41	 0.86 0.70 0.67 0.65 0.63	 0.90 0.80 0.78 0.76 0.74
Paved Area	Parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Street or Road	Paved with curbs and storm sewers	0.99	0.99	0.99	0.99
		0.57	0.76	0.84	0.88
	Gravel	0.49	0.69	0.80	0.84

Note: The designer must use judgment to select the appropriate C value within the range. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have the lowest C values. Smaller areas with dense soils, moderate to steep slopes, and sparse vegetation should assigned the highest C values.

APPENDIX B

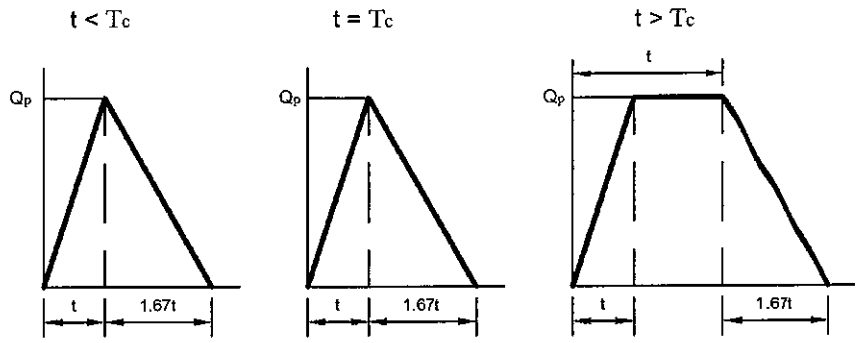
Storm Water Calculations and BMP Sizing

Bowstring Method (Modified Rational Method)

The bowstring method is used to estimate storage requirements for a given design storm using a series of hydrographs for different storm durations (t). This method computes the inflow volume and the outflow volume at intervals for a total of 24 hours. The required storage is taken as the maximum difference between the inflow and the outflow volumes during the duration of the design storm.

The time of concentration (T_c) is the time for stormwater runoff to travel from the hydraulically most distant point to the point of discharge. T_c is calculated with the Manning-Kinematic Equation.

Depending on the relative magnitude of the time of concentration (T_c) and the storm duration, the shape of the hydrograph generated with this method varies from triangular to trapezoidal



The total volume under the hydrograph at a given time (t) is given by the equation:

$V_{IN}(t) = 1.34 \times Q_p \times t$ for $t \leq T_c$

$V_{IN}(t) = (Q_p \times t) + (0.34 \times Q_p \times T_c)$ for $t > T_c$

The total volume leaving the hydrograph at a given time (t) is given by the equation:

$V_{OUT}(t) = Q_{OUT} \times t$

Note: The release of runoff off the site is limited to the peak pre-development rate at the time of concentration (T_c).

The storage required using the bowstring method is the maximum storage volume calculated for different storm durations (t).

$V_{STORAGE}(t) = V_{IN}(t) - V_{OUT}(t)$

James A Sewell & Associates, LLC

Sears - Lots 4 and 5 Lew's Industrial Park

24-Oct-23

JPJ

C - Gravel, Soil Type D:	0.84
C - Meadow, Good Condition (Soil Type D)	0.61
C - Grass, Good Condition (Soil Type D)	0.65
C Impervious surface:	0.99
I, Rainfall intensity (25-yr/24hr) (in/hr):	0.11
Infiltration Rate	0.06

Original Conditions (Pre-Development)	Acres	Sq. Ft	
Contributing Area	0.487	21,230	sf
Existing Gravel Roadway Area	0.000	0	sf
Existing Building /Pavement	0.000	0	sf
Existing Meadow Area	0.487	21,230	sf
	Total	21,230	sf

Existing Conditions	Acres	Sq. Ft	
Contributing Area	0.487	21,230	sf
Existing Gravel Roadway Area	0.000	0	sf
Existing Building /Pavement	0.000	0	sf
Existing Meadow Area	0.487	21,230	sf
	Total	21,230	sf

Proposed Conditions			
Gravel Roadway Area	0.000	0	sf
Building	0.217	9,455	sf
Parking	0.164	7,144	sf
Curb and Sidewalk	0.013	572	sf
Grass and Lawn	0.093	4,059	sf
Open Area	0.000	0	sf
	Total	21,230	sf

Calculation of Time of Concentration Original Conditions (per Manning Kinematic Equation)

n	0.24		Grass
Lo	200	ft	Max Drainage Length
P2	1.8	inches	2-yr, 24-hr Rainfall
S	0.005	ft/ft	Average Slope
tc	0.961	hr	Time of Sheet Flow
	57.7	min	

Calculation of Time of Concentration Proposed Conditions (per Manning Kinematic Equation)

n	0.024		Pavement
Lo	300	ft	Drainage Length to Swale along longest path
P2	1.8	inches	2-yr, 24-hr Rainfall
S	0.004	ft/ft	Average Slope
tc	0.230	hr	Time of Sheet Flow
	13.8	min	

Existing Impervious Surface	0	sf
Proposed Impervious Surface	17,171	sf
Created Impervious Surface	17,171	sf
First 1/2" from Impervious Surfaces	715	sf

	post	existing	pre
Composite C =	0.925	0.610	0.610
Area (ac) =	0.487	0.487	0.487
Tc=	13.8		57.7

Total infiltrative Area = 840 sf Includes Swale Bottoms
GIA Infiltration Rate = 1.00 in/hr Average Rate with Underdrain
GIA Infiltration = 0.0194 cfs
Max GIA Outflow Rate = **0.22** cfs = predevelopment 25-yr, 35-min. event

Time	Elapsed Time	I	Qin	Vin	Qout (GIA)	Qout (GIA Infiltration)	Vout	Qpre	Vpre	Storage Req.	
(min)	(sec)	(in/hr)	(cfs)	(cf)	(cfs)	(cfs)	(cf)	(cfs)	(cf)	(cf)	
0	0	2.8	1.26								
5	300	2.8	1.26	507	0.000	0.0194	6	0.83	335	167	
7	420	2.5	1.13	634	0.000	0.0194	8	0.74	418	208	
10	600	2.1	0.95	761	0.000	0.0194	12	0.62	502	248	
15	900	1.7	0.77	906	0.000	0.0194	18	0.51	610	279	
20	1,200	1.5	0.68	1,002	0.000	0.0194	23	0.45	717	262	
25	1,500	1.35	0.61	1,085	0.000	0.0194	29	0.40	807	249	
30	1,800	1.2	0.54	1,126	0.000	0.0194	35	0.36	860	231	
35	2,100	1.1	0.50	1,181	0.000	0.0194	41	0.33	920	220	
40	2,400	0.97	0.44	1,173	0.000	0.0194	47	0.29	927	199	
45	2,700	0.92	0.41	1,237	0.000	0.0194	53	0.27	990	195	
50	3,000	0.87	0.39	1,287	0.000	0.0194	58	0.26	1,040	189	
55	3,300	0.81	0.37	1,308	0.000	0.0194	64	0.24	1,065	179	
60	3,600	0.75	0.34	1,313	0.000	0.0194	70	0.22	1,065	177	
75	4,500	0.7	0.32	1,509	0.000	0.0194	88	0.21	1,181	240	
120	7,200	0.51	0.23	1,720	0.000	0.0194	140	0.15	1,270	310	
180	10,800	0.4	0.18	1,998	0.000	0.0194	210	0.12	1,424	364	
240	14,400	0.34	0.15	2,250	0.000	0.0194	280	0.10	1,575	396	
300	18,000	0.29	0.13	2,390	0.000	0.0194	350	0.09	1,653	387	
360	21,600	0.28	0.13	2,762	0.000	0.0194	420	0.08	1,896	446	
420	25,200	0.26	0.12	2,987	0.000	0.0194	490	0.08	2,039	458	
480	28,800	0.25	0.11	3,278	0.000	0.0194	560	0.07	2,228	490	max. storage req'd
540	32,400	0.23	0.10	3,389	0.000	0.0194	630	0.07	2,296	463	
600	36,000	0.22	0.10	3,598	0.000	0.0194	700	0.07	2,432	467	
660	39,600	0.2	0.09	3,596	0.000	0.0194	770	0.06	2,425	401	
720	43,200	0.19	0.09	3,724	0.000	0.0194	840	0.06	2,507	378	
780	46,800	0.185	0.08	3,927	0.000	0.0194	910	0.06	2,639	378	
840	50,400	0.18	0.08	4,113	0.000	0.0194	980	0.05	2,760	373	
900	54,000	0.17	0.08	4,160	0.000	0.0194	1,050	0.05	2,789	321	
960	57,600	0.165	0.07	4,306	0.000	0.0194	1,120	0.05	2,883	302	
1020	61,200	0.16	0.07	4,435	0.000	0.0194	1,190	0.05	2,967	278	
1080	64,800	0.15	0.07	4,401	0.000	0.0194	1,260	0.04	2,942	199	
1140	68,400	0.145	0.07	4,490	0.000	0.0194	1,330	0.04	2,999	160	
1200	72,000	0.14	0.06	4,562	0.000	0.0194	1,400	0.04	3,046	116	
1260	75,600	0.13	0.06	4,447	0.000	0.0194	1,470	0.04	2,967	10	
1320	79,200	0.125	0.06	4,479	0.000	0.0194	1,540	0.04	2,987	-48	
1380	82,800	0.12	0.05	4,495	0.000	0.0194	1,610	0.04	2,996	-111	
1440	86,400	0.11	0.05	4,299	0.000	0.0194	1,680	0.03	2,864	-245	

GIA	GIA Area (sf)	GIA Per. (ft)	Depth (ft)	Vol. (cf)	
1	840	450	0.67	759	Proposed
Totals	840			759	