Stormwater Management Plan and Drainage Study

South Lane School District – New Cottage Grove Elementary School

Branch Engineering Project #16-204

EXPIRES: 12/31/16

For
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1.0 INTRODUCTION

This Stormwater Management Plan (SWMP) has been prepared for the South Lane School District's new elementary school project to be located south of the intersection of 10th Street and Taylor Avenue. The new development will install a new multi-story elementary school, parking lots, playground areas and all associated utilities and other facilities associated with a new school.

The project is within the City of Cottage Grove which doesn't have any stormwater requirements with regard to treatment or detention. In coordinating with Ron Bradsby with Public Works, there is a capacity concern for some of the downstream storm pipes located north on 8th Street. Several Stormwater Master Planning Documents were developed in 1985 & 2007 that showed some deficiencies and will be discussed further in the report.

The stormwater management approach for this project is to provide some treatment when feasible for those paved areas that will receive vehicular traffic. The downstream deficiencies will be analyzed and depending on the results there may be a need for on-site detention, or downstream improvements. The School District has hired Hyland Construction as the CM/GC to assist in value engineering the project and will likely have some feedback for the cost benefits related to the various options.

2.0 EXISTING CONDITIONS

2.1 SITE TOPOGRAPHY & EXISTING FEATURES

The old Cottage Grove High School used to be on this site before it was removed back in 2003. The Al Kennedy Alternative High School is still on site at the northwest corner of the property, but the location where the old high school was located has since been renovated into soccer fields. Parking lots and modular buildings exist at the western end of the site fronting 8th Street with Al Kennedy school to the north, and the community pool to the south. The central portion of the site contains fields separated by maintenance buildings and other facilities to the south. The eastern portion of the site contains a parking lot accessing Taylor Avenue with additional fields further east.

There is a fair amount of grade change across the site. The southern boundary of the development is the existing football field and track that are to remain and sit at an elevation of roughly 694-695. The soccer fields where the new elementary school is to be located just to the north is at an existing elevation of roughly 679-681. The existing grades of the adjacent roadways are noticeably lower than the site and grade to the northwest corner of the site at the intersection of 8th Street and Taylor.

The existing site is approximately 18.7 acres, but the new improvements will only be on north and western 8.05 acres. The Site Review submittal includes an Existing Conditions and Demolition Plan as well as plan sheets displaying all the new improvements for additional information.

2.2 EXISTING DRAINAGE & DOWNSTREAM ANALAYSIS

The existing site essentially drains to three separate conveyance systems.

1. The eastern most portions drain north and are collected in a channel on the south side of Taylor. There is a culvert located roughly 200' west of S 13th St. that picks up this drainage and directs it north. This system primarily collects water from areas that will not be developed and is not located in an area that can be connected to from the development. For these reasons, this system will not be considered during the downstream analysis.

conducted at the northwest corner of the site delivered the best test results with a rate of 10 in/hr and a recommended design rate of 5 in/hr.

Because of the poor infiltration rates in several locations, vegetated treatment facilities will have perforated underdrains to ensure adequate drain down times.

3.0 PROPOSED DEVELOPMENT & STORMWATER MANAGEMENT

The intent of this report is to document the stormwater management resulting from the new Elementary School in Cottage Grove that will be developed south of the intersection of 10th Street and Taylor Avenue. As noted earlier, the City brought up concerns regarding the downstream capacity of the 15" storm pipe north on 8th Street.

That downstream analysis included researching the information provided in the 1985 Drainage Master Plan as well as looking at the as-builts that are available. From that information, it would seem the capacity of the 15" storm pipe is quite limited due to the flat slope of the pipe. It is for that reason that the current primary stormwater management goal at this stage in development is to control the discharge rate being released into the City's conveyance system. By maintaining current discharge rates, the School District is minimizing any downstream capacity issues by not making them worse.

One alternative to maintaining current discharge rates would be to upsize the downstream system. This option is available, and one that can be discussed between the School District and the City of Cottage Grove. For the purposes of this report however, it is assumed that on site detention to match existing discharge rates is the preferred/cost effective option for the school district.

3.1 STORMWATER SUMMARY

As mentioned previously, the primary stormwater management intent is to detain runoff and control the flow leaving the site. In order to do this, several facilities are proposed across the site.

A majority of the parking lot and drive aisles will be directed to rain garden facilities for treatment, infiltration and flow control. According to the City of Eugene Stormwater Management Manual, Rain Gardens are vegetated *"infiltration basins with a flat bottom and shallow landscaped depressions used to collect and hold stormwater runoff, allowing pollutants to settle and filter out as water percolates through the planter soils before infiltration into the ground below or piped to its downstream destination."* Due to the less than ideal infiltration rates across much of the site, these rain gardens will be filtering rain gardens and include a perforated pipe in the base rock section to ensure adequate drain down time.

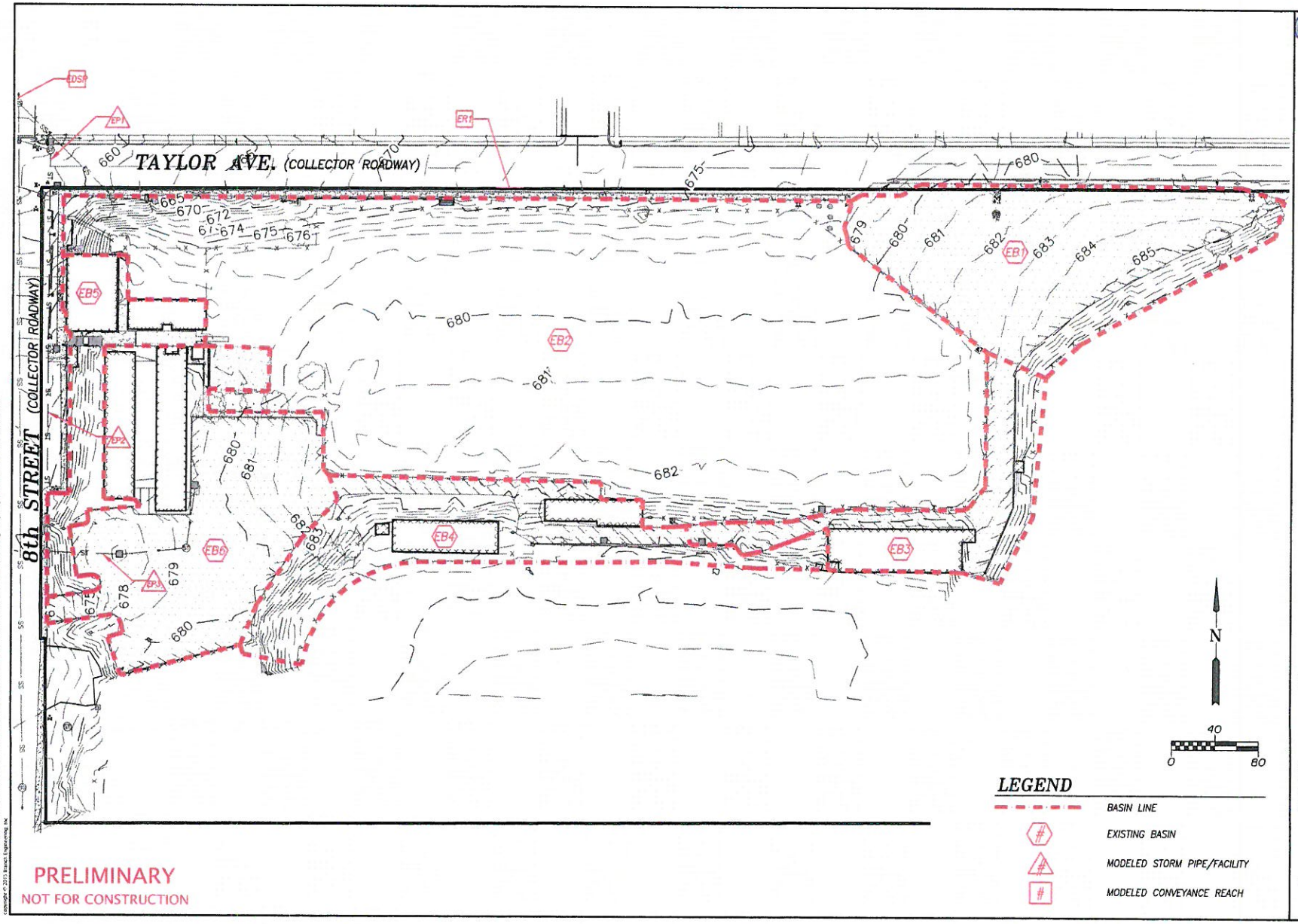
Many of the other paved areas across the site such as the playground areas, and walkways will be collected by area drains and connect into the storm conveyance system. Because these areas are not directed to treatment facilities or facilities that would slow the discharge rate, the remaining facilitates will need to account for some over detention where feasible to make up the difference.

Finally, the roof downspouts will be directed to a soakage trench along the northern border of the property where the infiltration rates were found to be more accommodating. According to the City of Eugene Stormwater Management Manual, A soakage trench is a *"flood control device that injects stormwater runoff into the ground recharging groundwater. Soakage trenches are linear excavations lined and backfilled with drain rock and gravel retaining runoff volumes as it exfiltrates into the surrounding soils. There are various components within the system – inlet piping, aggregate storage basin and perforated piping. The trench surface may be covered with grating, stone, sand, or a grassed cover with a surface inlet."* For the purpose of this facility, the soakage trench will be back covered with grass to blend in with the surrounding landscape between the building and the sidewalk on Taylor Avenue. A soakage trench for a project of this

The two options available to address this limited capacity from the School District's perspective is to either (1) coordinate with the City of Cottage Grove to increase the capacity by replacing the downstream pipe with something larger, or (2) install onsite detention to limit the peak discharge rates to match the current existing runoff rates.

For our purpose in this initial site review submittal, we wanted to propose on site-detention to give the School District and their CM/GC a better idea of the two systems and what infrastructure would be involved so that they can weigh the cost benefits of the two options.

The on-site detention system's infrastructure is displayed in the Site Review documents. For any downstream improvements, the specific infrastructure is a little less clear due to a lack of available as-builts. Though it is less clear it's not impossible to come up with some general estimates for the work. By taking a look at the 1985 Drainage Master Plan and some of the more current as-builts downstream where any new improvements might connect to, the estimated improvements would include replacing a 15" pipe with a 24" pipe for roughly 810 lineal feet north on 8th Street.



LEGEND

- BASIN LINE
- EXISTING BASIN
- MODELED STORM PIPE/FACILITY
- MODELED CONVEYANCE REACH

PRELIMINARY
NOT FOR CONSTRUCTION

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SLSD NEW ELEMENTARY

COTTAGE GROVE, OREGON

revisions

date:	10/28/2106
drawn by:	MD
designer:	NP
project no:	16-204

EXISTING BASIN MAP

EXHIBIT #

sheet: **B1**

APPENDIX B

HydroCAD Analysis

Time span=0.00-36.00 hrs, dt=0.0100 hrs, 3601 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EB1: Eastern Parking Lot Runoff Area=44,265 sf 84.13% Impervious Runoff Depth=3.78"
Tc=5.0 min CN=80/98 Runoff=0.95 cfs 0.320 af

Subcatchment EB2: Landscape to Taylor Runoff Area=186,458 sf 0.00% Impervious Runoff Depth=2.29"
Flow Length=290' Tc=25.9 min CN=80/0 Runoff=1.71 cfs 0.818 af

Subcatchment EB3: SE Paving & Building Runoff Area=19,836 sf 79.99% Impervious Runoff Depth=3.71"
Flow Length=300' Slope=0.0200 '/' Tc=23.9 min CN=80/98 Runoff=0.33 cfs 0.141 af

Subcatchment EB4: South Paving & Runoff Area=18,005 sf 69.06% Impervious Runoff Depth=3.52"
Flow Length=300' Slope=0.0200 '/' Tc=23.9 min CN=80/98 Runoff=0.28 cfs 0.121 af

Subcatchment EB5: NW Bldg & Runoff Area=16,380 sf 52.50% Impervious Runoff Depth=3.22"
Tc=5.0 min CN=80/98 Runoff=0.30 cfs 0.101 af

Subcatchment EB6: SW Paving & Building Runoff Area=65,100 sf 77.57% Impervious Runoff Depth=3.67"
Tc=10.0 min CN=80/98 Runoff=1.29 cfs 0.457 af

Reach ER1: Taylor Gutter; 10th to 8th St. Avg. Flow Depth=0.26' Max Vel=4.92 fps Inflow=3.24 cfs 1.400 af
n=0.013 L=500.0' S=0.0307 '/' Capacity=19.38 cfs Outflow=3.22 cfs 1.400 af

Pond EDSP: 15" Downstream Analysis Pipe Peak Elev=648.53' Inflow=4.78 cfs 1.958 af
15.0" Round Culvert n=0.011 L=500.0' S=0.0030 '/' Outflow=4.78 cfs 1.958 af

Pond EP1: 6" Pipe Peak Elev=670.27' Inflow=3.22 cfs 1.400 af
6.0" Round Culvert n=0.011 L=33.0' S=0.0424 '/' Outflow=3.22 cfs 1.400 af

Pond EP2: 6" Pipe Peak Elev=659.62' Inflow=1.58 cfs 0.558 af
6.0" Round Culvert n=0.011 L=43.0' S=0.0414 '/' Outflow=1.58 cfs 0.558 af

Pond EP3: 6" Pipe Parking Lot Peak Elev=672.10' Inflow=1.29 cfs 0.457 af
6.0" Round Culvert n=0.011 L=70.0' S=0.0569 '/' Outflow=1.29 cfs 0.457 af

Total Runoff Area = 8.036 ac Runoff Volume = 1.958 af Average Runoff Depth = 2.92"
64.39% Pervious = 5.175 ac 35.61% Impervious = 2.861 ac

	Area (sf)	CN	Description
*	5,871	98	Impervious
*	3,970	80	Landscape
*	5,000	98	Impervious
*	4,995	98	Impervious
	19,836	94	Weighted Average
	3,970		20.01% Pervious Area
	15,866		79.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0200	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"

Summary for Subcatchment EB4: South Paving & Building

Runoff = 0.28 cfs @ 8.01 hrs, Volume= 0.121 af, Depth= 3.52"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Type IA 24-hr 10 yr Rainfall=4.30"

	Area (sf)	CN	Description
*	8,730	98	Impervious
*	3,705	98	Impervious
*	5,220	80	Landscape
*	350	80	Landscape
	18,005	92	Weighted Average
	5,570		30.94% Pervious Area
	12,435		69.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0200	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.12"

Summary for Subcatchment EB5: NW Bldg & Landscape to 8th St.

Runoff = 0.30 cfs @ 7.91 hrs, Volume= 0.101 af, Depth= 3.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Type IA 24-hr 10 yr Rainfall=4.30"

	Area (sf)	CN	Description
*	8,600	98	Impervious
*	7,780	80	Landscape
	16,380	89	Weighted Average
	7,780		47.50% Pervious Area
	8,600		52.50% Impervious Area

Summary for Pond EDSP: 15" Downstream Analysis Pipe

[57] Hint: Peaked at 648.53' (Flood elevation advised)

Inflow Area =	8.036 ac,	35.61% Impervious,	Inflow Depth =	2.92"	for 10 yr event
Inflow =	4.78 cfs @	8.00 hrs, Volume=	1.958 af		
Outflow =	4.78 cfs @	8.00 hrs, Volume=	1.958 af,	Atten= 0%,	Lag= 0.0 min
Primary =	4.78 cfs @	8.00 hrs, Volume=	1.958 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Peak Elev= 648.53' @ 8.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	646.46'	**15.0" Round Culvert** L= 500.0' Ke= 0.500 Inlet / Outlet Invert= 646.46' / 644.96' S= 0.0030 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf

Primary OutFlow Max=4.78 cfs @ 8.00 hrs HW=648.53' (Free Discharge)
↑**1=Culvert** (Barrel Controls 4.78 cfs @ 3.90 fps)

Summary for Pond EP1: 6" Pipe

[57] Hint: Peaked at 670.27' (Flood elevation advised)
[62] Hint: Exceeded Reach ER1 OUTLET depth by 11.11' @ 8.01 hrs

Inflow Area =	6.165 ac,	24.40% Impervious,	Inflow Depth =	2.72"	for 10 yr event
Inflow =	3.22 cfs @	8.01 hrs, Volume=	1.400 af		
Outflow =	3.22 cfs @	8.01 hrs, Volume=	1.400 af,	Atten= 0%,	Lag= 0.0 min
Primary =	3.22 cfs @	8.01 hrs, Volume=	1.400 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Peak Elev= 670.27' @ 8.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	657.10'	**6.0" Round Culvert** L= 33.0' Ke= 0.500 Inlet / Outlet Invert= 657.10' / 655.70' S= 0.0424 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.20 sf

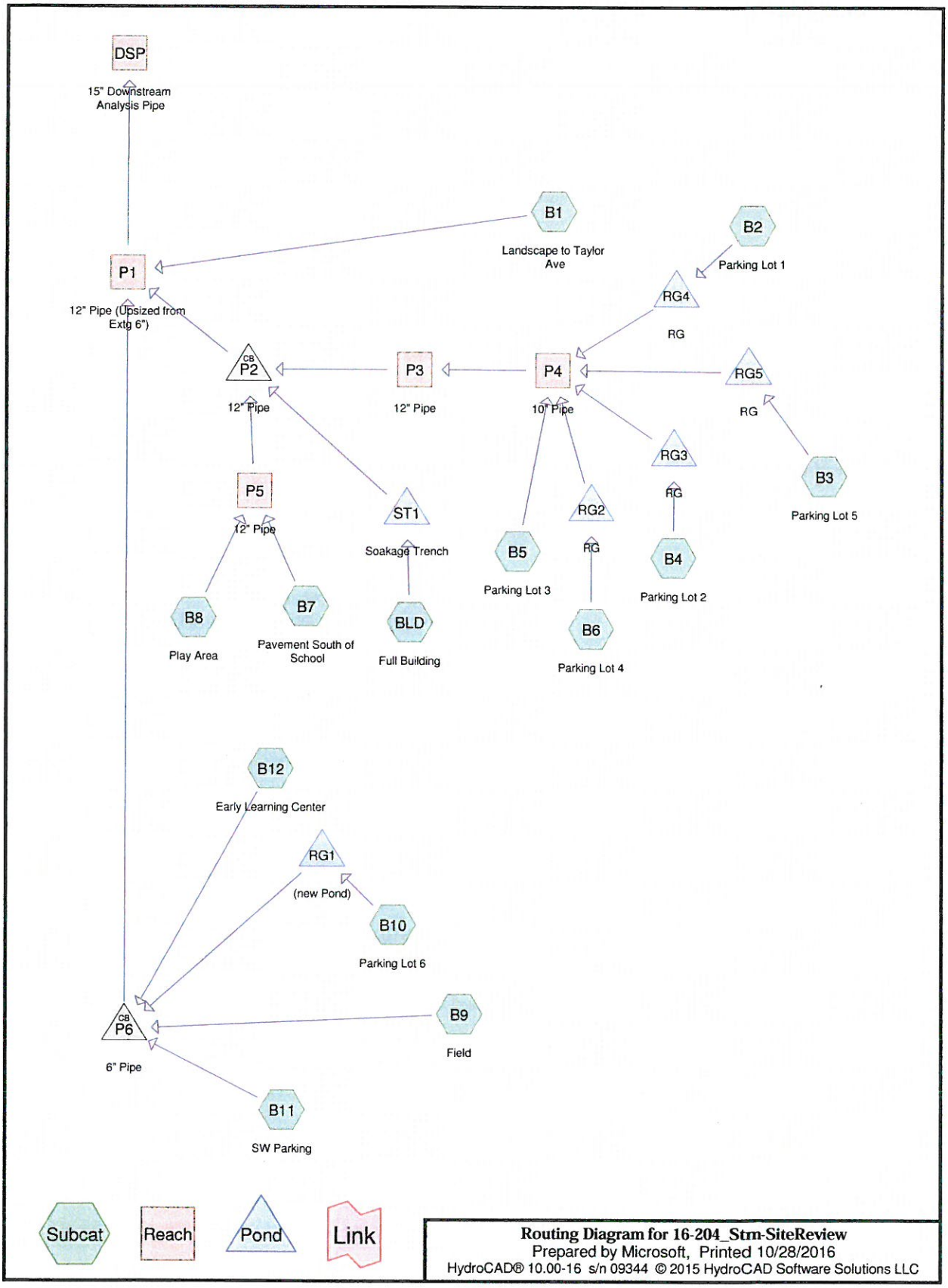
Primary OutFlow Max=3.22 cfs @ 8.01 hrs HW=670.26' TW=648.52' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 3.22 cfs @ 16.39 fps)

Summary for Pond EP2: 6" Pipe

[57] Hint: Peaked at 659.62' (Flood elevation advised)

Inflow Area =	1.871 ac,	72.53% Impervious,	Inflow Depth =	3.58"	for 10 yr event
Inflow =	1.58 cfs @	7.96 hrs, Volume=	0.558 af		
Outflow =	1.58 cfs @	7.96 hrs, Volume=	0.558 af,	Atten= 0%,	Lag= 0.0 min
Primary =	1.58 cfs @	7.96 hrs, Volume=	0.558 af		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs



Routing Diagram for 16-204_Strn-SiteReview
Prepared by Microsoft, Printed 10/28/2016
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Reach P4: 10" Pipe Avg. Flow Depth=0.33' Max Vel=5.93 fps Inflow=1.20 cfs 0.718 af
10.0" Round Pipe n=0.010 L=315.0' S=0.0159 '/' Capacity=3.59 cfs Outflow=1.20 cfs 0.718 af

Reach P5: 12" Pipe Avg. Flow Depth=0.34' Max Vel=4.93 fps Inflow=1.19 cfs 0.396 af
12.0" Round Pipe n=0.010 L=340.0' S=0.0100 '/' Capacity=4.63 cfs Outflow=1.18 cfs 0.396 af

Pond P2: 12" Pipe Peak Elev=658.69' Inflow=2.92 cfs 1.316 af
12.0" Round Culvert n=0.010 L=200.0' S=0.0050 '/' Outflow=2.92 cfs 1.316 af

Pond P6: 6" Pipe Peak Elev=669.78' Inflow=1.27 cfs 0.534 af
6.0" Round Culvert n=0.010 L=370.0' S=0.0279 '/' Outflow=1.27 cfs 0.534 af

Pond RG1: (new Pond) Peak Elev=677.90' Storage=808 cf Inflow=0.63 cfs 0.211 af
Discarded=0.00 cfs 0.003 af Primary=0.34 cfs 0.208 af Outflow=0.34 cfs 0.211 af

Pond RG2: RG Peak Elev=679.29' Storage=901 cf Inflow=0.49 cfs 0.165 af
Discarded=0.01 cfs 0.016 af Primary=0.18 cfs 0.150 af Outflow=0.19 cfs 0.165 af

Pond RG3: RG Peak Elev=679.47' Storage=1,069 cf Inflow=0.60 cfs 0.199 af
Discarded=0.02 cfs 0.031 af Primary=0.24 cfs 0.169 af Outflow=0.26 cfs 0.199 af

Pond RG4: RG Peak Elev=678.02' Storage=2,565 cf Inflow=0.71 cfs 0.240 af
Discarded=0.04 cfs 0.092 af Primary=0.16 cfs 0.148 af Outflow=0.20 cfs 0.240 af

Pond RG5: RG Peak Elev=679.31' Storage=860 cf Inflow=0.25 cfs 0.090 af
Discarded=0.03 cfs 0.055 af Primary=0.03 cfs 0.034 af Outflow=0.06 cfs 0.090 af

Pond ST1: Soakage Trench Peak Elev=663.70' Storage=0.034 af Inflow=1.28 cfs 0.428 af
Discarded=0.12 cfs 0.226 af Primary=0.61 cfs 0.201 af Outflow=0.73 cfs 0.428 af

Total Runoff Area = 8.066 ac Runoff Volume = 2.437 af Average Runoff Depth = 3.63"
24.78% Pervious = 1.998 ac 75.22% Impervious = 6.067 ac

	Area (sf)	CN	Description
*	12,333	98	Impervious
*	3,823	98	Impervious
*	8,850	80	Landscape
	25,006	92	Weighted Average
	8,850		35.39% Pervious Area
	16,156		64.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment B12: Early Learning Center

Runoff = 0.29 cfs @ 7.93 hrs, Volume= 0.099 af, Depth= 2.84"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Type IA 24-hr 10 yr Rainfall=4.30"

	Area (sf)	CN	Description
*	5,630	98	Impervious
*	12,695	80	Landscape
	18,325	86	Weighted Average
	12,695		69.28% Pervious Area
	5,630		30.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment B2: Parking Lot 1

Runoff = 0.71 cfs @ 7.88 hrs, Volume= 0.240 af, Depth= 3.88"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Type IA 24-hr 10 yr Rainfall=4.30"

	Area (sf)	CN	Description
*	28,920	98	Parking Lot
*	3,415	80	Landscape
	32,335	96	Weighted Average
	3,415		10.56% Pervious Area
	28,920		89.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment B6: Parking Lot 4

Runoff = 0.49 cfs @ 7.89 hrs, Volume= 0.165 af, Depth= 3.75"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Type IA 24-hr 10 yr Rainfall=4.30"

	Area (sf)	CN	Description
*	18,930	98	Parking Lot
*	4,145	80	Landscape
	23,075	95	Weighted Average
	4,145		17.96% Pervious Area
	18,930		82.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment B7: Pavement South of School

Runoff = 0.68 cfs @ 7.88 hrs, Volume= 0.227 af, Depth= 4.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Type IA 24-hr 10 yr Rainfall=4.30"

	Area (sf)	CN	Description
*	29,180	98	Impervious
	29,180		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Summary for Subcatchment B8: Play Area

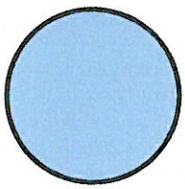
Runoff = 0.51 cfs @ 7.88 hrs, Volume= 0.169 af, Depth= 4.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Type IA 24-hr 10 yr Rainfall=4.30"

	Area (sf)	CN	Description
*	21,780	98	Impervious
	21,780		100.00% Impervious Area

Peak Storage= 614 cf @ 7.98 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.18 cfs

15.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 500.0' Slope= 0.0030 '/'
Inlet Invert= 646.46', Outlet Invert= 644.96'



Summary for Reach P1: 12" Pipe (Upsized from Extg 6")

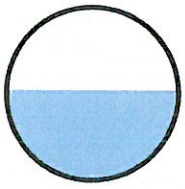
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 8.066 ac, 75.22% Impervious, Inflow Depth = 2.99" for 10 yr event
Inflow = 4.63 cfs @ 7.99 hrs, Volume= 2.013 af
Outflow = 4.63 cfs @ 7.99 hrs, Volume= 2.013 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Max. Velocity= 11.22 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 6.70 fps, Avg. Travel Time= 0.1 min

Peak Storage= 14 cf @ 7.99 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 8.67 cfs

12.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 33.0' Slope= 0.0424 '/'
Inlet Invert= 657.10', Outlet Invert= 655.70'



Summary for Reach P3: 12" Pipe

[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach P4 outlet invert by 0.29' @ 7.99 hrs

Summary for Reach P5: 12" Pipe

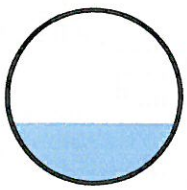
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.170 ac,100.00% Impervious, Inflow Depth = 4.06" for 10 yr event
Inflow = 1.19 cfs @ 7.88 hrs, Volume= 0.396 af
Outflow = 1.18 cfs @ 7.89 hrs, Volume= 0.396 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Max. Velocity= 4.93 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 2.75 fps, Avg. Travel Time= 2.1 min

Peak Storage= 82 cf @ 7.89 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.63 cfs

12.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 340.0' Slope= 0.0100 '/'
Inlet Invert= 675.00', Outlet Invert= 671.60'



Summary for Pond P2: 12" Pipe

[57] Hint: Peaked at 658.69' (Flood elevation advised)

Inflow Area = 5.344 ac, 90.71% Impervious, Inflow Depth = 2.96" for 10 yr event
Inflow = 2.92 cfs @ 7.99 hrs, Volume= 1.316 af
Outflow = 2.92 cfs @ 7.99 hrs, Volume= 1.316 af, Atten= 0%, Lag= 0.0 min
Primary = 2.92 cfs @ 7.99 hrs, Volume= 1.316 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Peak Elev= 658.69' @ 7.99 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	657.50'	**12.0" Round Culvert** L= 200.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 657.50' / 656.50' S= 0.0050 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.92 cfs @ 7.99 hrs HW=658.69' TW=657.62' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 2.92 cfs @ 3.95 fps)

Device	Routing	Invert	Outlet Devices
#1	Discarded	674.45'	**0.100 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	674.70'	**6.0" Round Culvert** L= 230.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 674.70' / 670.85' S= 0.0167 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#3	Device 2	674.70'	**2.7" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	677.95'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 5.72 hrs HW=675.10' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.34 cfs @ 8.23 hrs HW=677.90' TW=667.18' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.34 cfs of 1.15 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 0.34 cfs @ 8.62 fps)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond RG2: RG

Inflow Area = 0.530 ac, 82.04% Impervious, Inflow Depth = 3.75" for 10 yr event
Inflow = 0.49 cfs @ 7.89 hrs, Volume= 0.165 af
Outflow = 0.19 cfs @ 8.48 hrs, Volume= 0.165 af, Atten= 61%, Lag= 35.5 min
Discarded = 0.01 cfs @ 7.50 hrs, Volume= 0.016 af
Primary = 0.18 cfs @ 8.48 hrs, Volume= 0.150 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Peak Elev= 679.29' @ 8.48 hrs Surf.Area= 690 sf Storage= 901 cf

Plug-Flow detention time= 35.8 min calculated for 0.165 af (100% of inflow)
Center-of-Mass det. time= 35.8 min (708.3 - 672.5)

Volume	Invert	Avail.Storage	Storage Description
#1	675.20'	621 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 2,894 cf Overall - 824 cf Embedded = 2,070 cf x 30.0% Voids
#2	678.20'	824 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) Inside #1
		1,445 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
675.20	169	0	0
676.20	394	282	282
677.20	690	542	824
680.20	690	2,070	2,894

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
678.20	169	0	0
679.20	394	282	282
680.20	690	542	824

Device	Routing	Invert	Outlet Devices
#1	Discarded	676.00'	**0.750 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	676.40'	**6.0" Round Culvert** L= 50.0' CMP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 676.40' / 675.40' S= 0.0200 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#3	Device 2	676.00'	**2.3" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	679.48'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 4.56 hrs HW=676.65' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.24 cfs @ 8.38 hrs HW=679.47' TW=675.28' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.24 cfs of 1.40 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 0.24 cfs @ 8.44 fps)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond RG4: RG

Inflow Area =	0.742 ac, 89.44% Impervious, Inflow Depth = 3.88" for 10 yr event			
Inflow =	0.71 cfs @	7.88 hrs, Volume=	0.240 af	
Outflow =	0.20 cfs @	9.17 hrs, Volume=	0.240 af, Atten= 72%, Lag= 77.5 min	
Discarded =	0.04 cfs @	4.04 hrs, Volume=	0.092 af	
Primary =	0.16 cfs @	9.17 hrs, Volume=	0.148 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Peak Elev= 678.02' @ 9.17 hrs Surf.Area= 2,370 sf Storage= 2,565 cf

Plug-Flow detention time= 165.3 min calculated for 0.240 af (100% of inflow)
Center-of-Mass det. time= 165.3 min (831.5 - 666.2)

Volume	Invert	Avail.Storage	Storage Description
#1	674.75'	2,133 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 8,375 cf Overall - 1,264 cf Embedded = 7,111 cf x 30.0% Voids
#2	677.75'	1,264 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) Inside #1
		3,398 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
674.75	1,523	0	0
675.40	2,370	1,265	1,265
678.40	2,370	7,110	8,375

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
677.75	1,520	0	0
678.40	2,370	1,264	1,264

Device	Routing	Invert	Outlet Devices
#1	Discarded	677.50'	**0.750 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	678.00'	**6.0" Round Culvert** L= 200.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 678.00' / 676.50' S= 0.0075 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#3	Device 2	678.00'	**1.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	680.00'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 7.98 hrs HW=678.50' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.03 cfs @ 11.18 hrs HW=679.31' TW=675.23' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.03 cfs of 0.73 cfs potential flow)
  ├**3=Orifice/Grate** (Orifice Controls 0.03 cfs @ 5.52 fps)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond ST1: Soakage Trench

Inflow Area =	1.263 ac,100.00% Impervious,	Inflow Depth =	4.06"	for 10 yr event
Inflow =	1.28 cfs @	7.88 hrs, Volume=	0.428 af	
Outflow =	0.73 cfs @	8.21 hrs, Volume=	0.428 af, Atten= 43%, Lag= 19.9 min	
Discarded =	0.12 cfs @	2.41 hrs, Volume=	0.226 af	
Primary =	0.61 cfs @	8.21 hrs, Volume=	0.201 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.0100 hrs
Peak Elev= 663.70' @ 8.21 hrs Surf.Area= 0.024 ac Storage= 0.034 af

Plug-Flow detention time= 11.2 min calculated for 0.428 af (100% of inflow)
Center-of-Mass det. time= 11.2 min (669.1 - 657.9)

Volume	Invert	Avail.Storage	Storage Description
#1	660.00'	0.025 af	**4.00'W x 260.00'L x 4.00'H Prismatoid** 0.096 af Overall - 0.011 af Embedded = 0.085 af x 30.0% Voids
#2	661.00'	0.011 af	**18.0" Round Pipe Storage** Inside #1 L= 260.0'
		0.036 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	660.00'	**5.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	660.00'	**8.0" Round Culvert** L= 20.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 660.00' / 659.80' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#3	Device 2	663.70'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	660.10'	**3.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

APPENDIX C

NRCS Soils Data

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Lane County Area, Oregon
Survey Area Data: Version 12, Sep 18, 2015

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

Date(s) aerial images were photographed: Data not available.

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.

Lane County Area, Oregon

45C—Dupee silt loam, 3 to 20 percent slopes

Map Unit Setting

National map unit symbol: 2370
Elevation: 200 to 2,000 feet
Mean annual precipitation: 30 to 60 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 235 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Dupee and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dupee

Setting

Landform: Depressions on hills, drainageways on hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from sandstone

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 55 inches: silty clay
H3 - 55 to 65 inches: weathered bedrock

Properties and qualities

Slope: 3 to 20 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: No

Lane County Area, Oregon

89D—Nekia silty clay loam, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: 239h
Elevation: 350 to 1,400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Nekia and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nekia

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, nose slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and residuum derived from basalt and tuff

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
H1 - 1 to 11 inches: silty clay loam
H2 - 11 to 36 inches: clay
H3 - 36 to 40 inches: unweathered bedrock

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)

APPENDIX D

Geotechnical Report Excerpts

less than 3/16" may be expected with footing dead loads of 2.5 ksf or less.

Infiltration testing results indicate that the area north of the existing school garden has a measured infiltration rate of 10 in/hr with a design rate of 5 in/hr recommended for this region.

Perc Test 2 , just east of the east end of the Kennedy School parking area, is not suitable for infiltration designs for storm water. We recommend a rain garden filtration system for this area with a filter blanket for pollution reduction and a metered outflow to achieve flow control.

Perc Tests 3 and 4, located on the east end of the grassy field have a marginal measured infiltration rate of 1.5 in/hr or a design rate of .75 in/hr. This rate is somewhat low and would not meet City of Eugene or Springfield infiltration lower limits. Therefore we recommend that storm water facilities in this region be designed as filtration systems as recommended for the area of Perc Test 2, above.

Retaining walls may be cast in place concrete or geo-textile reinforced segmented block. The coefficient of Passive Earth Pressure, Kp is 4.08 and the coefficient of Active Earth Pressure, Ka is .233. These parameters are based on level backfill.

Direct shear testing identified the cohesion of the soil as 340 psf and the angle of internal friction, ϕ, as 37.6 degrees. We recommend a design angle of 37 degrees for retaining walls and bearing calculations

Estimated Effective Fluid Pressure (EFP) is 32 psf/ft for retaining walls with level backslope. EFP increases with increasing backslope, see "Conclusions and Recommendations" section.

Sliding friction is estimated to be .25 for concrete on native soil and 0.35 for concrete on crushed rock base with rock > 1" minimum size and open surfaces.

Retaining wall backfill should be granular material meeting the one of the gradations of ODOT/APWA Specifications for Public Works Construction, Section 430.11. All retaining walls must be fitted with footing drains designed to keep the surface of native soil below the wall foundations drained with no saturation of the gravel filled excavation..

Special inspection is recommended for all retaining walls to assure proper footing support, rebar grade, size and location, mortar and grout mixtures, lap lengths, fully filled grout cells and fabric placement and length

Samples from Test Boring 2 were analyzed for Plasticity Index, California Bearing Ratio, Consolidation/Swell, Free Swell, Unconfined Strength, Direct Shear, Moisture Content and Washed Mechanical Analysis

SPT values do not correlate with bearing strength in clayey soils such as those on the subject site. Therefore, this correlation should be used with a safety factor of approximately 3. Where laboratory test data is available the SPT should be factored to account for larger a split spoon and cohesion of the soil.

Table 3, following is a summary of the laboratory test results.

Geomax, Inc.
806 N. Ninth St.
Cottage Grove, OR 97424
541-942-0126

Job Number P109
Client: South Lane School District
Address: 1000 Taylor Avenue

Date of test: 9/2/2016
Time: 8:40 AM
Site: Test Hole #1

Pipe size 6"x30" 2" exposed

Test hole soaked with a constant head of 12" for 18 hours prior to conducting test

StartTime	EndTime	Elaped Time (Min.)	Height to TOP at start		Height to TOP at end		Perc. Rate	
8:40am	8:50 AM	10	18	in	20	in	12.00	in/hr
8:50 AM	9:00 AM	10	18		19		6.00	in/hr
9:00 AM	9:10 AM	10	18		20		12.00	in/hr
9:10 AM	9:20 AM	10	18		20		12.00	in/hr
9:20 AM	9:30 AM	10	18		20		12.00	in/hr
9:30 AM	9:40 AM	10	18		20		12.00	in/hr
9:40 AM	10:10 AM	30	18		24		12.00	in/hr
10:10 AM	10:40 AM	30	18		23		10.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
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		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr

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P109 PERC TEST.xls

11 in/hr

Geomax, Inc.
806 N. Ninth St.
Cottage Grove, OR 97424
541-942-0126

Job Number P109
Client: South Lane School District
Address: 1000 Taylor Avenue

Date of test: 9/2/2016
Time: 3:30pm
Site: Test Hole #3

Pipe size 6"x30" 2" exposed

Test hole soaked with a constant head of 12" for 4 hours prior to conducting test

StartTime	EndTime	Elaped Time (Min.)	Height to TOP at start		Height to TOP at end		Perc. Rate	
3:30 PM	3:40 PM	10	18	in	18	in	0.00	in/hr
3:40 PM	3:50 PM	10	18		18.5		3.00	in/hr
3:50 PM	4:00 PM	10	18.5		19		3.00	in/hr
4:00 PM	4:10 PM	10	18		18.25		1.50	in/hr
4:10 PM	4:20 PM	10	18.25		18.5		1.50	in/hr
4:20 PM	4:30 PM	10	18.5		18.75		1.50	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr
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		30					0.00	in/hr
		30					0.00	in/hr
		30					0.00	in/hr

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P109 PERC TEST.xls

1.3125 in/hr

APPENDIX E

City of Cottage Grove Drainage

Master Plan Excerpts

#2

Kramer, Chin & Mayo, Inc.

Client: COTTAGE GROVE

LOCATION	DRAINAGE OR SERVICE AREA (AC)	PERCENT LAND USE * SF	MF	H	C/I	OS	EIA
501	17.7	80	-	-	5	15	13.9
502	13.6	30	-	-	70	-	29.4
503	30.8	60	-	-	30	10	19.8
504	21.3	20	-	-	40	30	18.9
505	16.3	10	-	-	20	70	11.7
506	18.3	60	-	-	30	10	19.8
507	20.4	70	-	-	10	20	14.5
~~508~~	~~9.8~~	~~40~~	~~10~~	~~-~~	~~-~~	~~50~~	~~9.8~~
509	28.8	60	10	-	-	30	11.8
510+523	11.6 + 11.6 ~~23.2~~	80	-	-	10	10	15.5
511	19.6	90	-	-	-	10	13.4
512	10.3	80	-	-	-	20	12.4
513	66.1	5	-	-	-	95	5
~~514~~	~~7.3~~	~~60~~	-	-	-	~~40~~	~~10.4~~
515	22.8	60	-	-	-	40	10.4
516	26.4	50	10	20	~~20~~	20	~~17.1~~ ok
517	21.3	40	-	-	-	60	8.4
518	5.7	100	-	-	-	-	14.3
519	13.1	60	-	-	-	40	10.4
520	54.1	10	-	-	-	90	5.4
521	22.8	40	-	-	-	60	8.4
522	86.4	10	-	-	-	90	5.4

JOB NO	BY	CHECK	SUBJECT	DATE	SHEET NO
851	RC	LDH	DATA INPUT Present		SA. 1/3