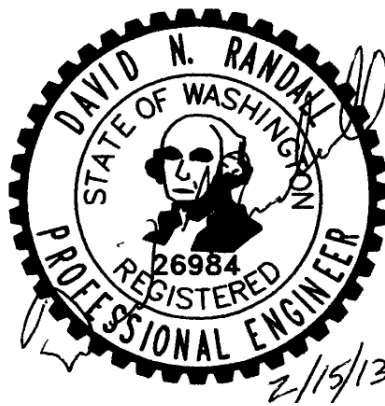


**Addendum to the Revised Engineering
Report for the
Slavic Baptist Church
2404 W. Strong Road
Spokane, Washington**

February 15, 2013



Prepared By:

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Addendum to the Revised Engineering Report
for the
Slavic Baptist Church
2404 West Strong Road
Spokane, Washington

Introduction

The following analysis has been prepared to address comment number 1 under the heading listed as “The following corrections are required:” in a Memo prepared by Cindy Kinzer of the City of Spokane dated February 4, 2013. This Addendum supplements the Revised Engineering Report dated July 16, 2012.

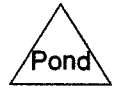
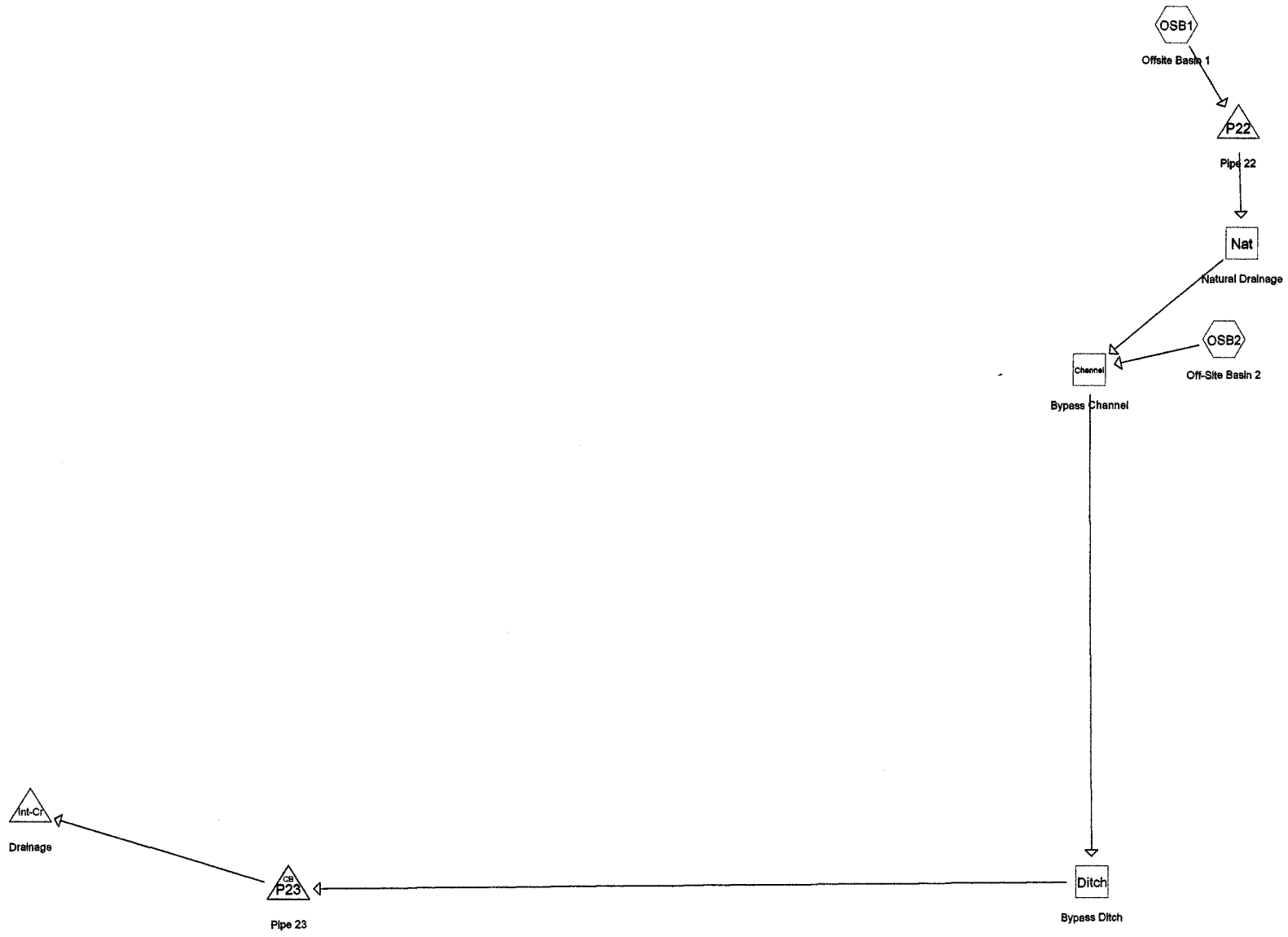
Analysis of the 50-Year Storm Event for the Off-Site Storm Water Bypass Ditch

Refer to the end of this Addendum for a printout of the results from the SCS analysis of a 50-year event for the off-site basins, bypass ditch, channel and proposed 24” CMP under the access roadway. For the 50-year event, the following maximum depths of flow and maximum velocities were calculated.

Natural Drainage Bypass Flow Depths & Velocities for a 50-Year Storm Event

Segment ID	Maximum Velocity	Maximum Depth of Flow
Bypass Channel	2.48 fps	0.53 ft
Bypass Ditch	2.27 fps	0.44 ft
Pipe 23	3.89 fps	1.18 ft

**50-YEAR OFF-SITE STORM DRAINAGE
BYPASS ANALYSIS**



Drainage Diagram for Slavic Church Offsite
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Slavic Church Offsite

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)
1	P22	101.50	101.00	64.0	0.0078	0.025	12.0	0.0
2	P23	79.50	78.00	120.0	0.0125	0.025	24.0	0.0

Slavic Church Offsite

Type II 24-hr 50 yr Type II Rainfall=2.20"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
 Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
 Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment OSB1: Offsite Basin 1 Runoff Area=1,372,623 sf 8.69% Impervious Runoff Depth=0.28"
 Flow Length=1,310' Tc=34.4 min CN=61/98 Runoff=4.35 cfs 31,738 cf

Subcatchment OSB2: Off-Site Basin 2 Runoff Area=2,070,915 sf 3.94% Impervious Runoff Depth=0.21"
 Flow Length=2,633' Tc=40.7 min CN=62/98 Runoff=3.40 cfs 35,563 cf

Reach Channel: Bypass Channel Avg. Depth=0.53' Max Vel=2.48 fps Inflow=5.27 cfs 67,296 cf
 n=0.030 L=426.0' S=0.0080 '/ Capacity=85.77 cfs Outflow=5.25 cfs 67,295 cf

Reach Ditch: Bypass Ditch Avg. Depth=0.44' Max Vel=2.27 fps Inflow=5.25 cfs 67,295 cf
 n=0.030 L=172.0' S=0.0087 '/ Capacity=498.41 cfs Outflow=5.25 cfs 67,295 cf

Reach Nat: Natural Drainage Avg. Depth=0.10' Max Vel=1.08 fps Inflow=2.41 cfs 31,735 cf
 n=0.030 L=1,590.0' S=0.0097 '/ Capacity=835.50 cfs Outflow=2.32 cfs 31,733 cf

Pond Int-Cr: Drainage Inflow=5.25 cfs 67,295 cf
 Primary=5.25 cfs 67,295 cf

Pond P22: Pipe 22 Peak Elev=103.36' Storage=2,935 cf Inflow=4.35 cfs 31,738 cf
 12.0" Round Culvert n=0.025 L=64.0' S=0.0078 '/ Outflow=2.41 cfs 31,735 cf

Pond P23: Pipe 23 Peak Elev=80.69' Inflow=5.25 cfs 67,295 cf
 24.0" Round Culvert n=0.025 L=120.0' S=0.0125 '/ Outflow=5.25 cfs 67,295 cf

Total Runoff Area = 3,443,538 sf Runoff Volume = 67,301 cf Average Runoff Depth = 0.23"
94.16% Pervious = 3,242,601 sf 5.84% Impervious = 200,937 sf

Slavic Church Offsite

Type II 24-hr 50 yr Type II Rainfall=2.20"

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Summary for Subcatchment OSB1: Offsite Basin 1

Runoff = 4.35 cfs @ 12.31 hrs, Volume= 31,738 cf, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 yr Type II Rainfall=2.20"

Area (sf)	CN	Description
* 40,342	98	Pavement
* 1,251,701	61	Natural or Grass
* 1,580	85	Gravel Driveway
* 75,000	98	Roofs
* 4,000	98	Concrete Driveways
1,372,623	64	Weighted Average
1,253,281	61	91.31% Pervious Area
119,342	98	8.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0120	0.09		Sheet Flow, Grass: Short n= 0.150 P2= 1.40"
15.8	726	0.0120	0.77		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.4	484	0.0240	21.23	2,228.88	Channel Flow, Area= 105.0 sf Perim= 30.0' r= 3.50' n= 0.025
34.4	1,310	Total			

Summary for Subcatchment OSB2: Off-Site Basin 2

Runoff = 3.40 cfs @ 12.45 hrs, Volume= 35,563 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 yr Type II Rainfall=2.20"

Area (sf)	CN	Description
* 30,995	98	Pavement
* 1,935,903	61	Natural or Grass
* 53,417	85	Gravel Driveways
* 45,000	98	Roofs
* 5,600	98	Concrete Driveways
2,070,915	63	Weighted Average
1,989,320	62	96.06% Pervious Area
81,595	98	3.94% Impervious Area

Slavic Church Offsite

Type II 24-hr 50 yr Type II Rainfall=2.20"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	100	0.0120	0.09		Sheet Flow, Grass: Short n= 0.150 P2= 1.40"
20.5	943	0.0120	0.77		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
2.0	1,590	0.0097	13.50	1,416.99	Channel Flow, Area= 105.0 sf Perim= 30.0' r= 3.50' n= 0.025
40.7	2,633	Total			

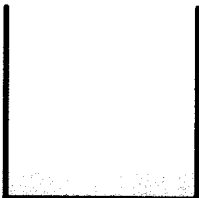
Summary for Reach Channel: Bypass Channel

Inflow Area = 3,443,538 sf, 5.84% Impervious, Inflow Depth > 0.23" for 50 yr Type II event
 Inflow = 5.27 cfs @ 12.52 hrs, Volume= 67,296 cf
 Outflow = 5.25 cfs @ 12.55 hrs, Volume= 67,295 cf, Atten= 0%, Lag= 2.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.48 fps, Min. Travel Time= 2.9 min
 Avg. Velocity = 0.98 fps, Avg. Travel Time= 7.2 min

Peak Storage= 903 cf @ 12.55 hrs, Average Depth at Peak Storage= 0.53'
 Bank-Full Depth= 4.00', Capacity at Bank-Full= 85.77 cfs

4.00' x 4.00' deep channel, n= 0.030 Earth, grassed & winding
 Length= 426.0' Slope= 0.0080 '/
 Inlet Invert= 84.40', Outlet Invert= 81.00'



Summary for Reach Ditch: Bypass Ditch

Inflow Area = 3,443,538 sf, 5.84% Impervious, Inflow Depth > 0.23" for 50 yr Type II event
 Inflow = 5.25 cfs @ 12.55 hrs, Volume= 67,295 cf
 Outflow = 5.25 cfs @ 12.56 hrs, Volume= 67,295 cf, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Max. Velocity= 2.27 fps, Min. Travel Time= 1.3 min
 Avg. Velocity = 0.96 fps, Avg. Travel Time= 3.0 min

Peak Storage= 399 cf @ 12.56 hrs, Average Depth at Peak Storage= 0.44'
 Bank-Full Depth= 4.00', Capacity at Bank-Full= 498.41 cfs

4.00' x 4.00' deep channel, n= 0.030 Earth, grassed & winding
 Side Slope Z-value= 3.0 '/' Top Width= 28.00'
 Length= 172.0' Slope= 0.0087 '/
 Inlet Invert= 81.00', Outlet Invert= 79.50'



Summary for Reach Nat: Natural Drainage

Inflow Area = 1,372,623 sf, 8.69% Impervious, Inflow Depth = 0.28" for 50 yr Type II event
 Inflow = 2.41 cfs @ 12.68 hrs, Volume= 31,735 cf
 Outflow = 2.32 cfs @ 13.06 hrs, Volume= 31,733 cf, Atten= 4%, Lag= 22.7 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Max. Velocity= 1.08 fps, Min. Travel Time= 24.6 min
 Avg. Velocity = 0.53 fps, Avg. Travel Time= 49.7 min

Peak Storage= 3,416 cf @ 13.06 hrs, Average Depth at Peak Storage= 0.10'
 Bank-Full Depth= 3.00', Capacity at Bank-Full= 835.50 cfs

20.00' x 3.00' deep channel, n= 0.030 Earth, grassed & winding
 Side Slope Z-value= 5.0 '/' Top Width= 50.00'
 Length= 1,590.0' Slope= 0.0097 '/'
 Inlet Invert= 100.50', Outlet Invert= 85.00'



Summary for Pond Int-Cr: Drainage

Inflow Area = 3,443,538 sf, 5.84% Impervious, Inflow Depth > 0.23" for 50 yr Type II event
 Inflow = 5.25 cfs @ 12.56 hrs, Volume= 67,295 cf
 Primary = 5.25 cfs @ 12.56 hrs, Volume= 67,295 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond P22: Pipe 22

Inflow Area = 1,372,623 sf, 8.69% Impervious, Inflow Depth = 0.28" for 50 yr Type II event
 Inflow = 4.35 cfs @ 12.31 hrs, Volume= 31,738 cf
 Outflow = 2.41 cfs @ 12.68 hrs, Volume= 31,735 cf, Atten= 45%, Lag= 22.4 min
 Primary = 2.41 cfs @ 12.68 hrs, Volume= 31,735 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Slavic Church Offsite

Type II 24-hr 50 yr Type II Rainfall=2.20"

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Peak Elev= 103.36' @ 12.68 hrs Surf.Area= 8,528 sf Storage= 2,935 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 5.1 min (880.2 - 875.1)

Volume	Invert	Avail.Storage	Storage Description
#1	101.00'	26,312 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
101.00	6	0	0
102.90	6	11	11
103.00	6,000	300	312
105.00	20,000	26,000	26,312

Device	Routing	Invert	Outlet Devices
#1	Primary	101.50'	12.0" Round 12" CMP Under Road L= 64.0' CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 101.00' S= 0.0078 '/ Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=2.41 cfs @ 12.68 hrs HW=103.36' (Free Discharge)

↑1=12" CMP Under Road (Barrel Controls 2.41 cfs @ 3.06 fps)

Summary for Pond P23: Pipe 23

Inflow Area = 3,443,538 sf, 5.84% Impervious, Inflow Depth > 0.23" for 50 yr Type II event
 Inflow = 5.25 cfs @ 12.56 hrs, Volume= 67,295 cf
 Outflow = 5.25 cfs @ 12.56 hrs, Volume= 67,295 cf, Atten= 0%, Lag= 0.0 min
 Primary = 5.25 cfs @ 12.56 hrs, Volume= 67,295 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Peak Elev= 80.69' @ 12.56 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	79.50'	24.0" Round 24" SD Pipe L= 120.0' CMP, square edge headwall, Ke= 0.500 Outlet Invert= 78.00' S= 0.0125 '/ Cc= 0.900 n= 0.025 Corrugated metal

Primary OutFlow Max=5.25 cfs @ 12.56 hrs HW=80.68' (Free Discharge)

↑1=24" SD Pipe (Barrel Controls 5.25 cfs @ 3.89 fps)