



November 11, 2014

Dana Q. Shuler, P.E.
Weber County Engineering
2380 Washington Blvd., Suite 240
Ogden, UT 84401

Reference: Culvert sizing on The Retreat Phase 1 Future Road Stub

Dear Ms. Dana Shuler:

Attached is the supporting documentation that confirms the proposed 30" diameter culvert will convey the anticipated storm water runoff of 33.53 cfs based upon the 24-hr 100-year event of 4.93" of rain at this location. HydroCAD (version 10.00) storm water modeling software was used to analyze the watershed basin and size the culvert. The USDA Soil Conservation Service (SCS) TR-20 method was used in this analysis, with a Type II 24-hr storm distribution.

Please let me know if there is additional information needed for final acceptance.

Sincerely,

A handwritten signature in blue ink that reads "Kristian Mulholland".

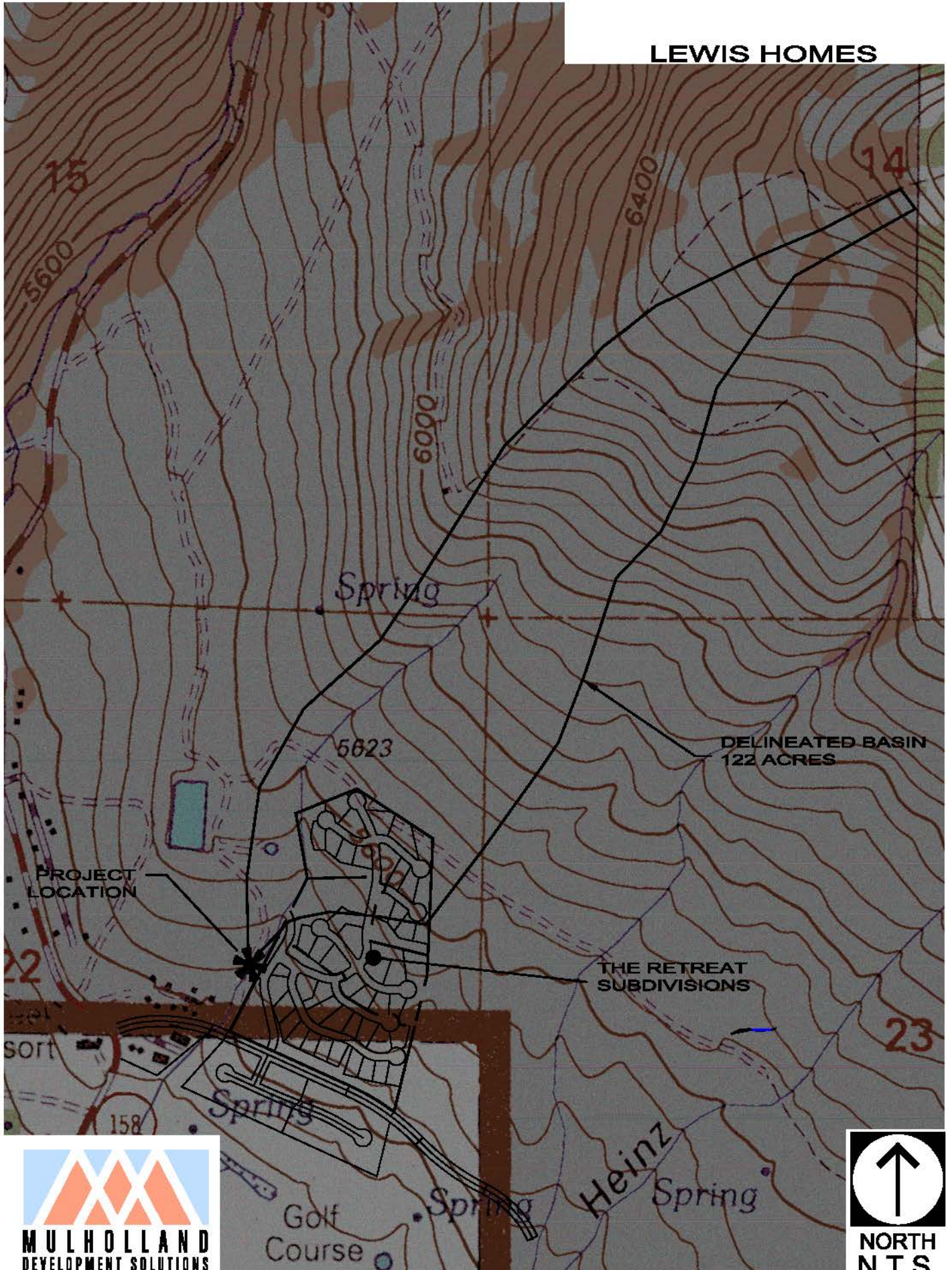
Kristian Mulholland, P.E.
Project Engineer

cc: Eric Householder

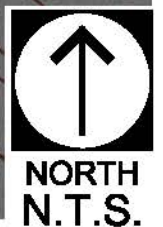


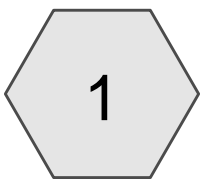
DELINEATED BASIN FOR CULVERT SIZING

LEWIS HOMES

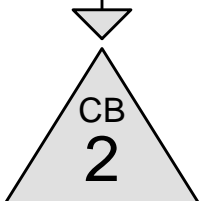


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file name: Stream Alt Exhibit.dwg | plot date: November 06, 2014 | plotted by: Kristian

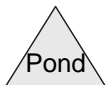
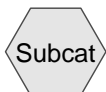




Basin



Proposed 30" Culvert



Hydrology

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The Retreat Phase 1
Type II 24-hr 100 Rainfall=4.93"

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Summary for Subcatchment 1: Basin

Runoff = 33.53 cfs @ 12.34 hrs, Volume= 248,714 cf, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 Rainfall=4.93"

Area (ac)	CN	Description
* 1.982	98	Roadway
* 1.125	98	Homesites (14)
118.893	47	Sagebrush range, Good, HSG C
122.000	48	Weighted Average
118.893		97.45% Pervious Area
3.107		2.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	300	0.2500	0.49		Sheet Flow, Range n= 0.130 P2= 1.80"
16.6	3,550	0.2590	3.56		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.9	2,937	0.2590	26.25	945.14	Channel Flow, Area= 36.0 sf Perim= 22.0' r= 1.64' n= 0.040 Earth, cobble bottom, clean sides
28.7	6,787	Total			

Hydrology

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The Retreat Phase 1
Type II 24-hr 100 Rainfall=4.93"

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Summary for Pond 2: Proposed 30" Culvert

Inflow Area = 5,314,320 sf, 2.55% Impervious, Inflow Depth = 0.56" for 100 event
Inflow = 33.53 cfs @ 12.34 hrs, Volume= 248,714 cf
Outflow = 33.53 cfs @ 12.34 hrs, Volume= 248,714 cf, Atten= 0%, Lag= 0.0 min
Primary = 33.53 cfs @ 12.34 hrs, Volume= 248,714 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Peak Elev= 5,451.76' @ 12.34 hrs

Flood Elev= 5,452.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	5,448.50'	30.0" Round Culvert L= 110.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 5,448.50' / 5,426.40' S= 0.2009 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf

Primary OutFlow Max=33.51 cfs @ 12.34 hrs HW=5,451.76' (Free Discharge)

↑**1=Culvert** (Inlet Controls 33.51 cfs @ 6.83 fps)