STORMWATER SITE PLAN REPORT

Ritchie Brothers Lewis County

Prepared for:	Ritchie Bros. Properties
Contact:	Scott Lennon
	9500 Glen Lyon Parkway
	Burnaby BC, Canada V5J OC6
	(801) 455-9005
	March 2010

Reviewing Agency

Jurisdiction:	Lewis County, Washington
Project Number:	Pending
Project Contact:	Shirley Kook PE

References

Stormwater Management Manual for Western Washington, 2005 ed.

Project Engineer

Prepared by:	RB Engineering, Inc. (RBE)
	PO Box 923
	Chehalis, WA 98532
	(360) 740-8919
	(360) 740-8912 Fax
Contact:	Robert W. Balmelli PE
RBE Project:	08098
File Number:	g:\rbengr\projects\2008\08098\drainage\08098.pspr.3p.doc

PROJECT ENGINEERS CERTIFICATION

"I hereby certify that this Drainage and Erosion Control Plan for **Ritchie Brothers Lewis County** has been prepared by me or under my supervision and meets minimum standards of **Lewis County** and the **Stormwater Management Manual for Western Washington** and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me."

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PART 1 – PROJECT OVERVIEW and MAPS

Permit Requested	Stormwater
Other Permits Required	NPDES Construction Permit Army Corp. 404 Permit
Agency Permit No.	Pending
Site Address:	Military Road Lewis County, WA
Parcel Numbers:	014859000000, 014860001000, 014860002000, 014860003000, 014860004000, 014860006000, 014860007000, 014860008000, 014860009000, 014860010000, 014860011000, 014872008002, 014872008003, 014872008004
Section, Township, Range:	Section 17 Township 18 North Range 1 West, W.M.
Total Site Area:	203.24 Acres
Acreage Developed:	145.0 Acres
Acreage Re-developed	0.0 Acres
Zoning:	RDD-10
WaterShed:	Stearns Creek Watershed – North Basin Olequa Creek Watershed – South Basin

Project Overall Description

The project site is located southeast of the City of Napavine in Lewis County, Washington. The site is not within the incorporated limits of the City of Napavine and/or the City's urban growth boundary. The property is bordered to the east by Interstate 5 (I-5), to the west by North Military Road, to the south by Avery Road West, and to the north by Koontz Road. The project site consists of a large farm parcel used for hay and grazing of cattle along with two undeveloped subdivisions consisting of fourteen 2 to 5 acre residential lots. Existing access to the farm parcel consists of multiple gated farm accesses off North Military Road. There are no constructed accesses to the fourteen residential parcels; however, easements were created as part of the subdivision process that provides access to these lots once a private road is constructed.

The project proposes to convert the large farm parcel and residential lots into a commercial equipment auction yard facility. Access to this facility will be from Avery

Road West, approximately 300 feet west of the southbound off ramp of I-5. A new impervious private road will be constructed within the approximate limits of the existing private road easements prepared as part of the original subdivision of the residential properties. Development of this project will require design of a new private water system for potable water and fire flow facilities, onsite commercial septic disposal system, and stormwater, water quality and flow control facilities. The main purpose of this site plan report is to outline the proposed design of the onsite stormwater control systems. Approximately 63 percent of the site will be converted from native ground to impervious surfaces as part of the construction of the equipment yard, building and access road improvements. A detailed analysis of the preliminary stormwater design is included in Part 5 of this site plan report.

Proposed Flow Control Improvements

The flow control facilities proposed for this project were designed and modeled using the latest edition of the Western Washington Hydrology Manual Continuous Simulation Program. The facility consists of two main drainage basins within sub-basins in each basin that will utilize detention ponds with metered outlets for flow control. The applicant will also be requesting a dam safety exemption from the Department of Ecology for the onsite ponds. The pond designs meet the requirements for the exemption and it is RBE's engineering opinion that the downstream drainage corridor is of low risk hazard. A formal submittal of this Drainage Site Plan Report will be submitted to the DOE requesting their review and exemption.

Proposed Water Quality Improvements

The water quality improvements for the project site runoff consist of wetpond facilities set within the limits of the stormwater flow control ponds. The main access road into the site will utilize bio-filtration swales to treat the runoff from the new road. A detailed analysis and calculations for the wetpond and bio-filtration sizing is included in Part 5 of this site plan report.

Proposed Conveyance System

The proposed conveyance systems will consist of concrete catch basins and PVC pipe in various sizes to collect and convey stormwater to the proposed water quality and flow control ponds. Roof runoff will be tightlined to nearby catch basins for discharge to the stormwater ponds. The proposed conveyance system will be sized to accommodate a minimum of the 25-year storm event.

Proposed Discharge Location

The project site is split by two separate watersheds which include the Stearns Creek watershed draining to the north and the Olequa Creek watershed that drains to the south. The proposed stormwater designs for the north and south basins will provide the flow control and water quality treatment while discharging to the existing downstream drainage course. The site grading will not redirect any stormwater from its current drainage basin as required by the Stormwater Management Manual for Western Washington (SMMWW). The south basin will discharge to the existing associated wetland corridor which drains southwest to the intersection of Avery Road

West and North Military Road. The north basin stormwater ponds will discharge to the existing stream that traverses east to west across the north end of the property and underneath North Military Road. These are the existing drainage basin discharge locations for the respective north and south basins.

Downstream Condition

Both the north and south drainage basins discharge to drainage ways that converse through existing medium to large acreage residential lots. A detailed review and description of these downstream conditions can be found in Part 3 of this site plan report.

Ritchie Brothers Site Plan

PROJECT INFORMATION

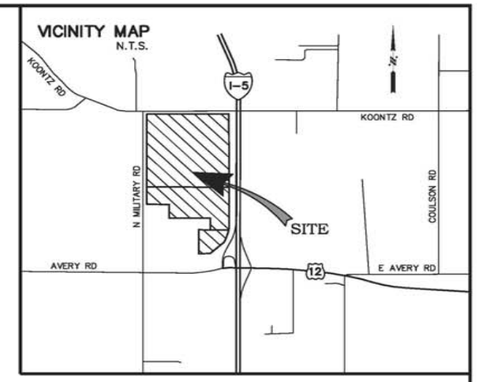
APPLICANT:	RITCHIE BROS. PROPERTIES SCOTT LENNON 9500 GLEN LYON PARKWAY BURNABY BC, CANADA V5J0C6 (801) 455-9005
SITE ADDRESS:	NORTH MILITARY RD/KOONTZ RD NAPAVINE, WA 98565
ZONING:	RDD-10
SITE AREA:	203.25 ACRES
FIRE DISTRICT:	FIRE DISTRICT 5

RITCHIE BROS. LEWIS COUNTY

SECTION 1, TOWNSHIP 12 NORTH, RANGE 2 WEST, W.M.

LEWIS COUNTY, WASHINGTON

VICINITY MAP
N.T.S.



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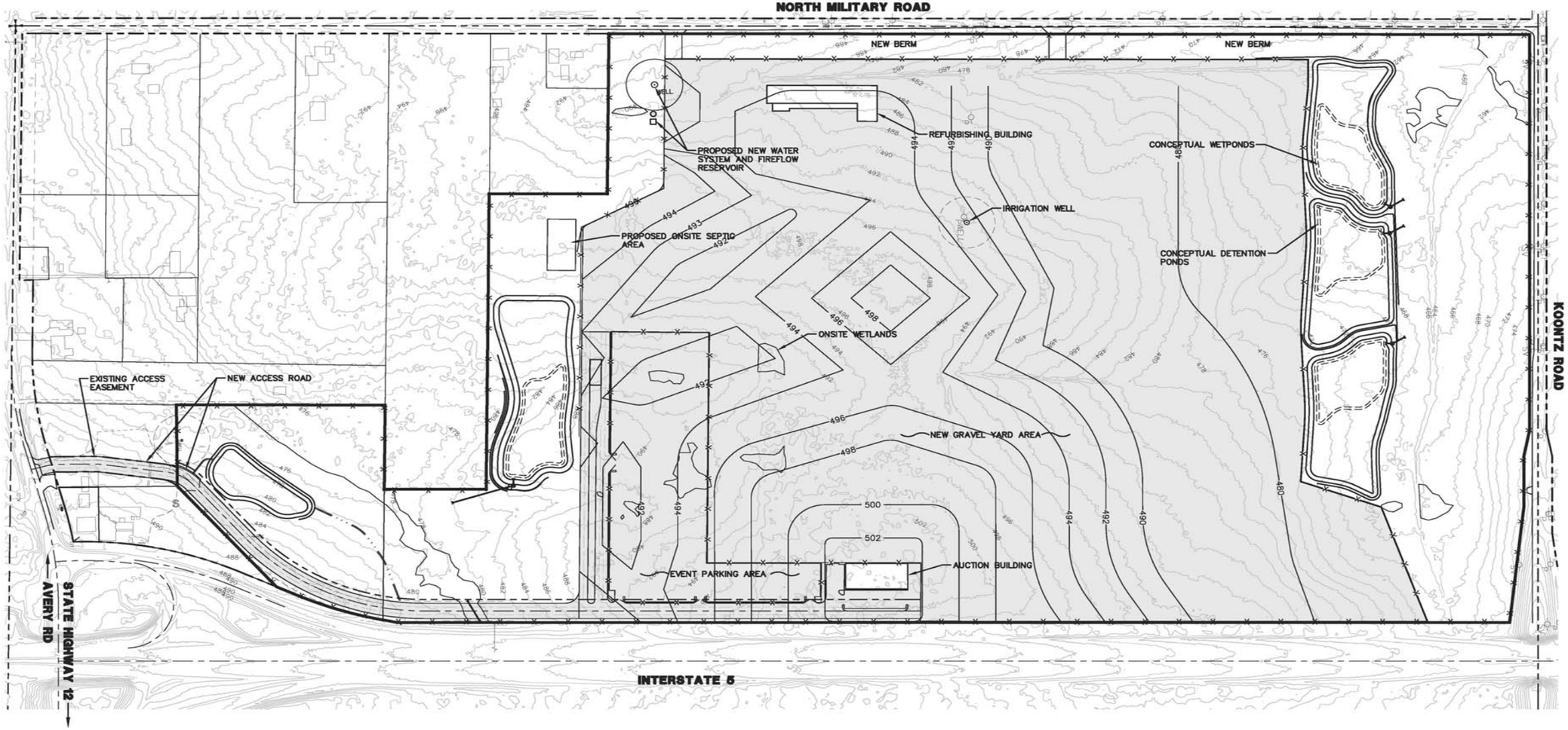


NO.	DATE	REVISION

DESIGNED BY: RWB
DRAWN BY: NJG
CHECKED BY:

DATE: 3/2/10
SCALE: 1" = 200'

RITCHIE BROS. PROPERTIES
9500 GLEN LYON PARKWAY
BURNABY BC, CANADA V5J0C6

LEWIS COUNTY WA.

SITE PLAN

RB Engineering
CIVIL ENGINEERING - LAND PLANNING - UTILITIES
P.O. Box 923 CHEHALIS, WA. 98532
OFF: (360) 740-9899
FAX: (360) 740-9892

JOB NUMBER 08098

DRAWING NAME 08098_PSP1

1 OF 1

PART 2 – EXISTING CONDITIONS SUMMARY

Project Topography

Using the Lewis County aerial 2-foot contour mapping, the site topography for the north basin drains south to north towards Koontz Road with a peak elevation of 502 feet at the high point along the watershed boundary to a discharge location at North Military Road with an elevation of 460 feet. Within this basin there are two agricultural ditches and a stream that flows east to west towards North Military Road.

The south drainage basin drains to the southeast with a peak elevation of 502 feet to the elevation of 476 at the natural discharge location of the onsite wetlands at the southern tip of the property.

Both basins slope north and south at a gentle grade of 2 to 4 percent.

Land Use and Ground Cover

The majority of the project site is used as pasture land for grazing of cattle and harvesting of hay during the summer months. Due to the grazing and hay harvesting, the majority of the site is field grass with a small stand of timber located on the upper elevations of the site.

Natural or Man Made Drainage Patterns

The northern portion of the site used for cattle grazing includes four agricultural ditches as shown on the enclosed site plan and outlined in the Ecological Land Services (ELS) wetland report prepared for this project. These agricultural drainage ditches do not redirect any basin waters outside of its original drainage basin and discharge location at the intersection of Koontz Road and North Military Road. At the northeast corner of the property a 24-inch diameter culvert discharges water from the eastside of I-5 into the stream that runs east to west along the north end of the property. This onsite stream also collects runoff from a portion of the southbound lanes of I-5 via the roadside ditch system.

Tributary and Discharge Points of Flow

As discussed in the previous paragraphs there will be two points of discharge for the project.

The north basin will discharge to the culvert underneath North Military Road at the intersection of North Military Road and Koontz Road. The area tributary to this location consists of 226 acres of undeveloped land on the east side of I-5 and the project site.

The south stormwater basin will discharge into the existing delineated wetland areas and will leave the property at its existing discharge point at the southern end of the property. Approximately 174 acres of land is tributary to the culverts at the intersection of Avery Road and N. Military Road. The runoff from the east side of the I-

5 will bypass the onsite stormwater ponds and continue in its original flow paths.

Historical Drainage Problems

RBE is not aware of any historical drainage problems with the existing site. The northern discharge point consists of a 24-inch culvert under North Military Road that is normally submerged and will likely have capacity problems during a heavy storm event and may backup into the site during extreme storm events. RBE met Lewis County Public Works onsite and they are currently in the process of redesigning the intersection of North Military Road and Koontz Road to allow better truck turning maneuvers. This project also includes providing stormwater improvements for the new impervious surfaces created by this project and Lewis County plans on replacing the submerged culvert with a bottomless box culvert due to the fish bearing classification of the stream. RBE will work with Lewis County to provide our mitigated flows to this point for their use in designing the new box culvert crossing under North Military Road.

Existing Utilities (Storm, Sewer, Water)

The existing utilities onsite include power for an onsite irrigation well. There are currently no sewer or potable water service for the farm parcel and/or 14 undeveloped residential parcels that make up this project.

Erosion Potential

Erosion of the site is moderate based on the NRCS Soil Survey for the onsite soil classifications. As part of the development plans a detailed Erosion Control Plan and Storm Water Pollution Prevention Plan will be prepared for use during site construction to minimize erosion and migration of sediment within and off the site.

Critical Areas Onsite

The site includes small wetland areas as delineated by Ecological Land Services as part of the preliminary review of the property. A copy of the Wetland Delineation Report has been submitted with the Special Use Application for this project. Please see that report for a detailed analysis of the onsite wetlands and drainage ditches.

Existing Fuel Storage Tanks

Review of the onsite parcels resulted in no evidence of existing fuel storage tanks above or below ground for this property. A check of the LUST list does not include any buried tanks for the property. Our access road does cross by the existing Texaco gas station which does incorporate underground fuel tanks in its operations.

Groundwater Wells

The large farm parcel includes an existing irrigation well based on our site review of the property. Review of the Washington State Department of Health well log search did not find any additional wells and/or even the irrigation well for the project boundaries. The existing irrigation well will be abandoned as part of the site development and a new potable water well will be drilled to provide water service to

the auctioneering facility and to provide water for the necessary fire flow reservoir for fire protection.

Septic Systems

The proposed development will require design and construction of a new onsite commercial septic system to collect and discharge sewage in a pressure designed style septic system. The system will be sized with surge tanks to accommodate the four to five auction events conducted onsite. These surge tanks will hold the sewage and programmable timers will discharge the sewage at set times between the main events to even out the discharge per State and Lewis County regulations.

Aquifer Recharge Area

Based on RBE's review of the available GIS data from NRCS and of the geotechnical report prepared by Insight Geologic, this area is not part of an aquifer recharge area.

Wellhead Protection Area

The site is not within any wellhead protection areas for public utilities. The site is surrounded by large open fields to the west and commercial and/or residential properties to the north, I-5 to the east, and residential lands to the south. Review of the properties did not identify any private residential wells within 100 feet of the development areas of the site. As part of the project there will be a minimum 200-foot buffer from Koontz Road and a proposed 100-foot buffer from North Military Road and a minimum 200-foot buffer along the residential homes along the southwest corner of the parcel. Based on this we do not anticipate any impacts to adjacent property private wells as a result of the proposed project.

Stormwater Basin Plan

RBE is not aware of any flood studies or basin planning done for this area.

Flood Hazard Zone

The proposed site is not listed on any FEMA Firm maps and is not within a flood hazard zone. The stream that traverses from east to west on the north end of the property could experience minor flooding during extreme events; however, we are not aware of any flood hazards for this stream at this time.

Onsite Soils and Geology

RBE staff reviewed the onsite soils information provided by NRCS. The following pages included copies of the site map and soil descriptions that make up the property geology. The majority of the site consists of Prather silty clay loam and the stream to the north and wetland areas to the south consist of Lacamas silt loam. In addition to the NRCS information, Insight Geologic conducted a geotechnical report for the northern portion of the farmland areas which verified the Prather silty loam soil classification. No infiltration testing was done as part of the geotechnical report and we do not anticipate any measurable infiltration capacity of the onsite soils based on our review of the geotechnical report and the NRCS soil data.

NCRS Soil Survey Data


Soil Map---Lewis County Area, Washington
(Ritchie Brothers Lewis County)
122° 53' 25"
122° 52' 21"
46° 33' 45"
46° 32' 45"
508400
508600
508800
509000
509200
509400
509600
5156400
5156200
5156000
5155800
5155600
5155400
5155200
5155000
5154800
Koontz Rd
Military Rd
Avery Rd
12
Map Scale: 1:8,800 if printed on A size (8.5" x 11") sheet.
Meters
0 50 100 200 300
Feet
0 300 600 1,200 1,800
N
USDA Natural Resources Conservation Service
Web Soil Survey
National Cooperative Soil Survey
2/17/2010
Page 1 of 3

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:8,800 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lewis County Area, Washington
Survey Area Data: Version 7, Sep 22, 2009

Date(s) aerial images were photographed: 7/23/2006

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

Lewis County Area, Washington (WA641)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
118	Lacamas silt loam, 0 to 3 percent slopes	20.6	9.6%
167	Prather silty clay loam, 0 to 5 percent slopes	192.4	89.8%
187	Salkum silty clay loam, 0 to 5 percent slopes	1.3	0.6%
Totals for Area of Interest		214.2	100.0%

PART 3 – OFFSITE ANALYSIS REPORT

Quantitative Analysis

North Basin – Stearns Creek Watershed

RBE staff visually inspected the drainage corridor within ¼ mile downstream of the proposed north drainage basin for the proposed project. The proposed stormwater flow control ponds will discharge to the existing onsite stream which flows underneath Military Road at Point A on the following map and continues along Koontz Road in the County right-of-way in a trapezoidal shaped ditchline labeled Segment 1. This segment of drainage consists of grass in the bottom of the swale and appears to be periodically cleaned out by Lewis County as part of their road maintenance. Approximately 750 feet from the intersection of Military Road the roadside swale turns into a vegetated conveyance swale labeled Segment 2 on the following basin map. This vegetated swale opens up into a grass trapezoidal swale labeled Segment 3 which runs for an additional 675 lineal feet to Point B as shown on the map. Point B includes two 24-inch concrete culverts underneath Jordan Road which discharges into a larger vegetated wetland area labeled Segment 4.

From this review of the downstream drainage, one visual drainage problem was identified at Point A which is the existing 24-inch culvert under Military Road. Due to the flat grades of the downstream drainage, this culvert appears to be 80 percent submerged at all times during the winter months.

RBE completed an upstream existing condition basin analysis for Points A and B as shown on the downstream analysis map. Using WWHM Stormwater Model, we calculated the following storm event flows for the 2, 10, 25 and 100-year events to see if the existing culverts were undersized. Below is a summary chart representing the modeled storm flows and the calculated culvert capacities.

Culvert ID Point	North Basin Existing Culverts					
	Diameter (Inches)	Slope (%)	Material	Existing Flow 100 yr. (cfs)	Max Flow (cfs)	Pass /Fail
1	24	1.0	Concrete	26.33	22.62	Fail
2	2-24	1.0	Concrete	43.68	52.66	Pass

The results of our analysis shows the existing 24-inch culvert at Point A is undersized without being submerged and would need to be upsized and/or additional culverts installed to meet the flow amounts. It is our understanding that Lewis County is currently designing an intersection improvement project for this area which includes upsizing this culvert to a box culvert. We will coordinate with Lewis County with

results of our analysis so they can adequately provide drainage underneath Military Road for the existing and post-developed conditions of our project.

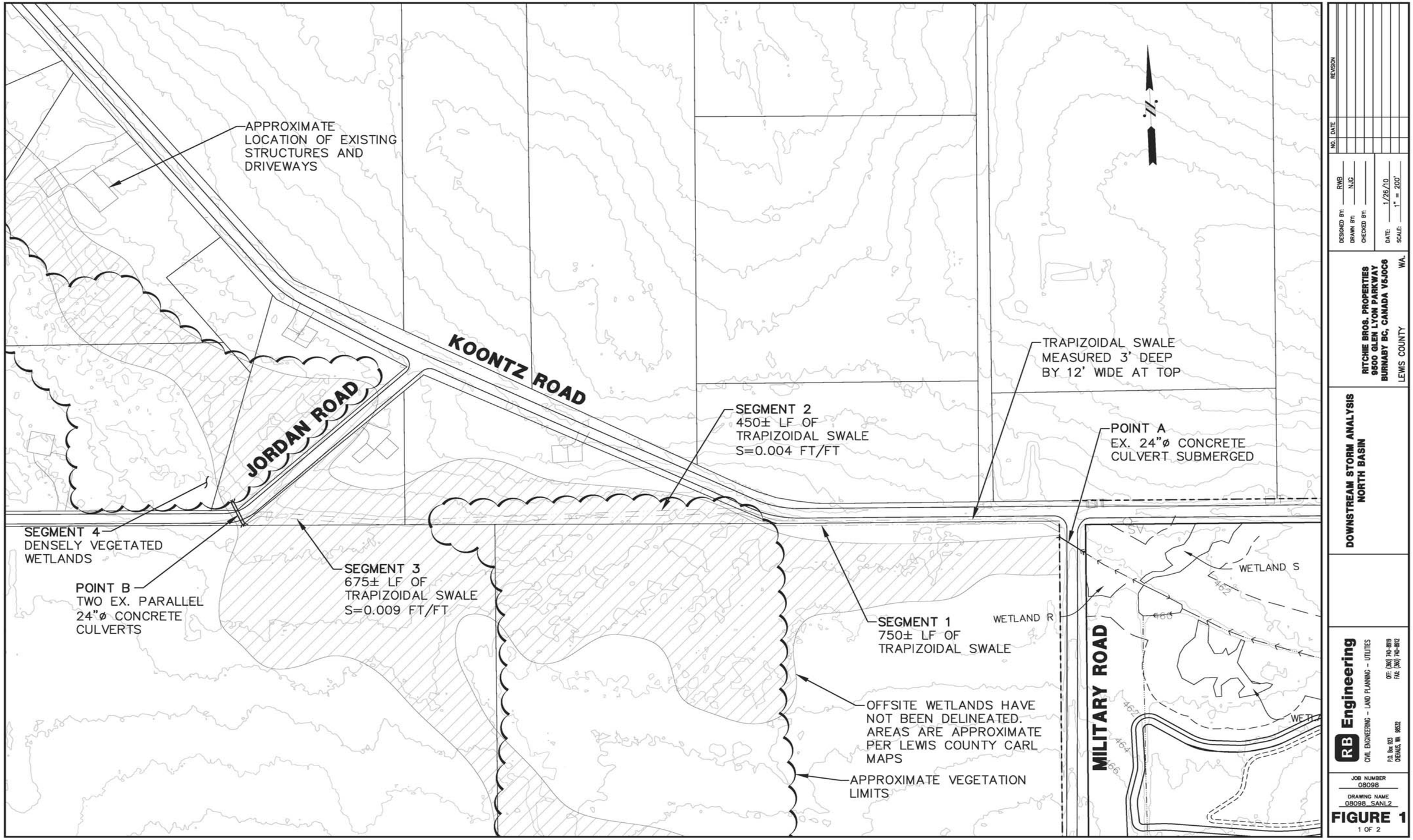
Our analysis of Point 2 resulted in the dual 24-inch diameter culverts having sufficient capacity to convey the 100-year storm without overtopping of Jordan Road.

All three trapezoidal swale areas that include segments 1, 2 and 3 can convey the 100-year flow event. FlowMaster software data output is included after this section for each segment.

The flows to these areas will not increase due to the new proposed development. The new storm ponds will detain the necessary volumes of water to release runoff at the pre-developed flow rates from the existing site conditions.

WWHM and FlowMaster Data Output

The following data output results and basin map is for the North Basin.



NO. | DATE | REVISION

DESIGNED BY: RMB
DRAWN BY: NJG
CHECKED BY:
DATE: 1/26/10
SCALE: 1" = 200'

RITCHIE BROS. PROPERTIES
9500 GLEN LYON PARKWAY
BURNABY BC, CANADA V5J0C6

LEWIS COUNTY WA.

DOWNSTREAM STORM ANALYSIS
NORTH BASIN

RB Engineering
CIVIL ENGINEERING – LAND PLANNING – UTILITIES
P.O. Box 613
CHEHALIS, WA. 98532
OFF: (360) 740-9899
FAX: (360) 740-9892

JOB NUMBER
08098
DRAWING NAME
08098_SANI2

FIGURE 1
1 OF 2


ONSITE STREAM


POINT 'A' EX. 24" CULVERT
SUBMERGED

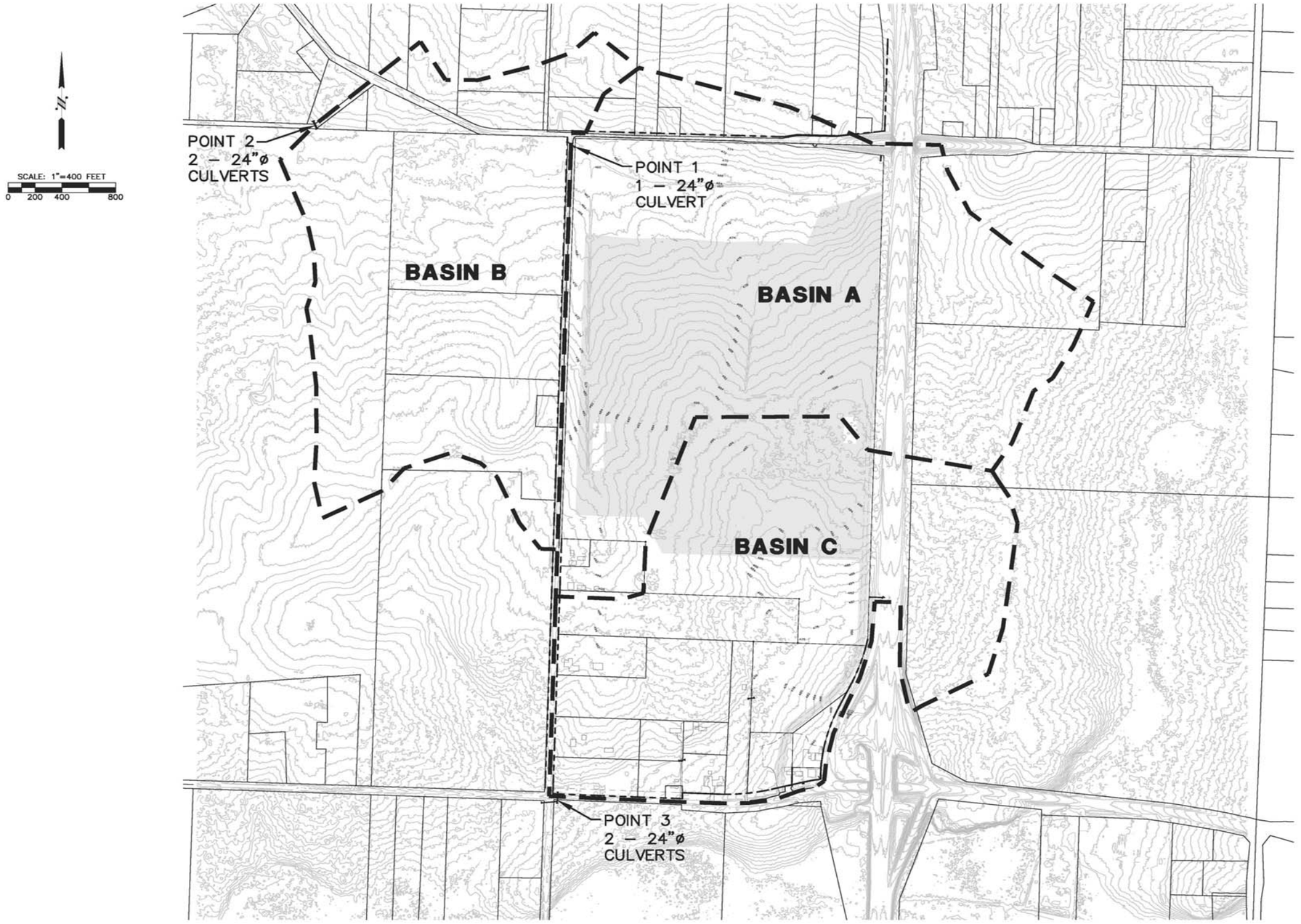

SEGMENT 1 TRAPEZOIDAL SWALE


SEGMENT 2
BRUSHY TRAPEZOIDAL SWALE


SEGMENT 3
GRASS TRAPEZOIDAL SWALE


POINT B
DUAL 24" Ø CULVERTS


SEGMENT 4
FORESTED WETLANDS



NO. | DATE | REVISION

DESIGNED BY: RWB
DRAWN BY: NJG
CHECKED BY:
DATE: 2/26/10
SCALE: 1" = 400'

RITCHIE BROS. PROPERTIES
9500 GLEN LYON PARKWAY
BURNABY BC, CANADA V5J0C6

LEWIS COUNTY WA.

DOWNSTREAM DRAINAGE
CONVEYANCE ANALYSIS

RB Engineering
CIVIL ENGINEERING – LAND PLANNING – UTILITIES
P.O. Box 923 OKEHUS, WA 98532
OFF: (360) 740-8919
FAX: (360) 740-8912

JOB NUMBER 08098
DRAWING NAME 08098_CVTA

FIGURE 1

Western Washington Hydrology Model
PROJECT REPORT

Project Name: Ritchie Brothers Lewis County
Site Address: Military Road
City : Lewis County
Report Date : 2/25/2010
Gage : Longview
Data Start : 1955/10/01
Data End : 1993/09/30
Precip Scale: 0.86
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin A (Tributary to Point A) North Basin
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	38
C, Pasture, Flat	178.93

Impervious Land Use	Acres
ROADS FLAT	9.77

Element Flows To:
Surface Interflow Groundwater

Name : Basin A+B (Tributary to Point B) North Basin
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Pasture, Flat	330.64
C, Forest, Flat	38

Impervious Land Use	Acres
ROADS FLAT	11.57

Element Flows To:
Surface Interflow Groundwater

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1 (Basin A)

Return Period	Flow(cfs)
2 year	7.857686
5 year	12.169513
10 year	15.296019
25 year	19.519881
50 year	22.85003
100 year	26.328169

Flow Frequency Return Periods for Mitigated. POC #1 (Basin A)

Return Period	Flow(cfs)
2 year	7.857686
5 year	12.169513
10 year	15.296019
25 year	19.519881
50 year	22.85003
100 year	26.328169

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1957	15.067	15.067
1958	12.758	12.758
1959	12.508	12.508
1960	9.107	9.107
1961	13.528	13.528
1962	11.039	11.039
1963	10.356	10.356
1964	21.143	21.143
1965	10.083	10.083
1966	6.762	6.762
1967	4.656	4.656
1968	5.776	5.776
1969	3.825	3.825
1970	6.352	6.352
1971	6.237	6.237
1972	8.279	8.279
1973	7.991	7.991
1974	6.158	6.158
1975	12.008	12.008
1976	10.556	10.556
1977	4.976	4.976
1978	2.746	2.746
1979	17.927	17.927
1980	7.162	7.162
1981	6.652	6.652
1982	5.978	5.978
1983	10.128	10.128
1984	7.157	7.157
1985	8.338	8.338

1986	3.159	3.159
1987	22.087	22.087
1988	11.531	11.531
1989	4.769	4.769
1990	3.349	3.349
1991	13.968	13.968
1992	5.709	5.709
1993	3.750	3.750
1994	6.308	6.308

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	22.0873	22.0873
2	21.1427	21.1427
3	17.9267	17.9267
4	15.0670	15.0670
5	13.9680	13.9680
6	13.5282	13.5282
7	12.7583	12.7583
8	12.5077	12.5077
9	12.0082	12.0082
10	11.5308	11.5308
11	11.0385	11.0385
12	10.5562	10.5562
13	10.3562	10.3562
14	10.1279	10.1279
15	10.0825	10.0825
16	9.1070	9.1070
17	8.3382	8.3382
18	8.2790	8.2790
19	7.9906	7.9906
20	7.1625	7.1625
21	7.1572	7.1572
22	6.7620	6.7620
23	6.6518	6.6518
24	6.3519	6.3519
25	6.3082	6.3082
26	6.2371	6.2371
27	6.1581	6.1581
28	5.9780	5.9780
29	5.7760	5.7760
30	5.7092	5.7092
31	4.9757	4.9757
32	4.7689	4.7689
33	4.6564	4.6564
34	3.8252	3.8252
35	3.7502	3.7502
36	3.3489	3.3489
37	3.1588	3.1588
38	2.7461	2.7461

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
3.9288	2011	2011	100	Pass
4.1200	1775	1775	100	Pass
4.3111	1571	1571	100	Pass
4.5022	1374	1374	100	Pass
4.6933	1211	1211	100	Pass
4.8845	1082	1082	100	Pass
5.0756	962	962	100	Pass
5.2667	859	859	100	Pass
5.4578	780	780	100	Pass
5.6490	710	710	100	Pass
5.8401	636	636	100	Pass
6.0312	583	583	100	Pass
6.2223	541	541	100	Pass
6.4134	495	495	100	Pass
6.6046	443	443	100	Pass
6.7957	401	401	100	Pass
6.9868	357	357	100	Pass
7.1779	328	328	100	Pass
7.3691	290	290	100	Pass
7.5602	268	268	100	Pass
7.7513	243	243	100	Pass
7.9424	228	228	100	Pass
8.1336	210	210	100	Pass
8.3247	192	192	100	Pass
8.5158	171	171	100	Pass
8.7069	165	165	100	Pass
8.8980	152	152	100	Pass
9.0892	142	142	100	Pass
9.2803	137	137	100	Pass
9.4714	128	128	100	Pass
9.6625	120	120	100	Pass
9.8537	113	113	100	Pass
10.0448	108	108	100	Pass
10.2359	101	101	100	Pass
10.4270	98	98	100	Pass
10.6182	92	92	100	Pass
10.8093	90	90	100	Pass
11.0004	87	87	100	Pass
11.1915	82	82	100	Pass
11.3826	79	79	100	Pass
11.5738	73	73	100	Pass
11.7649	70	70	100	Pass
11.9560	67	67	100	Pass
12.1471	63	63	100	Pass
12.3383	59	59	100	Pass
12.5294	56	56	100	Pass
12.7205	54	54	100	Pass
12.9116	52	52	100	Pass
13.1028	46	46	100	Pass
13.2939	44	44	100	Pass
13.4850	41	41	100	Pass
13.6761	38	38	100	Pass
13.8672	36	36	100	Pass

14.0584	34	34	100	Pass
14.2495	34	34	100	Pass
14.4406	30	30	100	Pass
14.6317	30	30	100	Pass
14.8229	28	28	100	Pass
15.0140	28	28	100	Pass
15.2051	25	25	100	Pass
15.3962	23	23	100	Pass
15.5874	22	22	100	Pass
15.7785	21	21	100	Pass
15.9696	20	20	100	Pass
16.1607	19	19	100	Pass
16.3518	17	17	100	Pass
16.5430	17	17	100	Pass
16.7341	15	15	100	Pass
16.9252	15	15	100	Pass
17.1163	12	12	100	Pass
17.3075	12	12	100	Pass
17.4986	12	12	100	Pass
17.6897	10	10	100	Pass
17.8808	10	10	100	Pass
18.0720	8	8	100	Pass
18.2631	7	7	100	Pass
18.4542	6	6	100	Pass
18.6453	6	6	100	Pass
18.8364	5	5	100	Pass
19.0276	5	5	100	Pass
19.2187	4	4	100	Pass
19.4098	3	3	100	Pass
19.6009	3	3	100	Pass
19.7921	3	3	100	Pass
19.9832	3	3	100	Pass
20.1743	2	2	100	Pass
20.3654	2	2	100	Pass
20.5566	2	2	100	Pass
20.7477	2	2	100	Pass
20.9388	2	2	100	Pass
21.1299	2	2	100	Pass
21.3210	1	1	100	Pass
21.5122	1	1	100	Pass
21.7033	1	1	100	Pass
21.8944	1	1	100	Pass
22.0855	1	1	100	Pass
22.2767	0	0	100	Pass
22.4678	0	0	0	Pass
22.6589	0	0	0	Pass
22.8500	0	0	0	Pass

Flow Frequency Return Periods for Predeveloped. POC #2 (Basin A+B)

Return Period	Flow(cfs)
2 year	12.496748
5 year	19.652915
10 year	24.900554
25 year	32.049072
50 year	37.724214

100 year 43.682599

Flow Frequency Return Periods for Mitigated. POC #2 (Basin A+B)

Return Period	Flow(cfs)
2 year	12.496748
5 year	19.652915
10 year	24.900554
25 year	32.049072
50 year	37.724214
100 year	43.682599

Yearly Peaks for Predeveloped and Mitigated. POC #2

Year	Predeveloped	Mitigated
1957	24.360	24.360
1958	20.324	20.324
1959	19.966	19.966
1960	14.573	14.573
1961	22.025	22.025
1962	17.828	17.828
1963	16.434	16.434
1964	34.540	34.540
1965	16.210	16.210
1966	10.866	10.866
1967	7.539	7.539
1968	9.186	9.186
1969	5.868	5.868
1970	10.043	10.043
1971	9.717	9.717
1972	13.608	13.608
1973	13.060	13.060
1974	10.079	10.079
1975	19.157	19.157
1976	16.584	16.584
1977	7.385	7.385
1978	3.950	3.950
1979	29.559	29.559
1980	11.485	11.485
1981	10.498	10.498
1982	9.346	9.346
1983	16.397	16.397
1984	11.377	11.377
1985	13.417	13.417
1986	5.067	5.067
1987	36.193	36.193
1988	18.345	18.345
1989	7.288	7.288
1990	5.215	5.215
1991	23.054	23.054
1992	8.932	8.932
1993	6.014	6.014
1994	9.702	9.702

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated

1	36.1928	36.1928
2	34.5396	34.5396
3	29.5589	29.5589
4	24.3602	24.3602
5	23.0541	23.0541
6	22.0247	22.0247
7	20.3237	20.3237
8	19.9663	19.9663
9	19.1574	19.1574
10	18.3451	18.3451
11	17.8282	17.8282
12	16.5836	16.5836
13	16.4337	16.4337
14	16.3973	16.3973
15	16.2102	16.2102
16	14.5734	14.5734
17	13.6084	13.6084
18	13.4166	13.4166
19	13.0602	13.0602
20	11.4848	11.4848
21	11.3774	11.3774
22	10.8657	10.8657
23	10.4976	10.4976
24	10.0791	10.0791
25	10.0434	10.0434
26	9.7173	9.7173
27	9.7017	9.7017
28	9.3461	9.3461
29	9.1856	9.1856
30	8.9315	8.9315
31	7.5387	7.5387
32	7.3847	7.3847
33	7.2881	7.2881
34	6.0137	6.0137
35	5.8677	5.8677
36	5.2151	5.2151
37	5.0669	5.0669
38	3.9499	3.9499

POC #2
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
6.2484	2304	2304	100	Pass
6.5663	2019	2019	100	Pass
6.8842	1779	1779	100	Pass
7.2022	1549	1549	100	Pass
7.5201	1359	1359	100	Pass
7.8381	1203	1203	100	Pass
8.1560	1081	1081	100	Pass
8.4739	963	963	100	Pass
8.7919	867	867	100	Pass
9.1098	788	788	100	Pass

9.4278	709	709	100	Pass
9.7457	640	640	100	Pass
10.0636	593	593	100	Pass
10.3816	540	540	100	Pass
10.6995	487	487	100	Pass
11.0174	447	447	100	Pass
11.3354	402	402	100	Pass
11.6533	361	361	100	Pass
11.9713	322	322	100	Pass
12.2892	291	291	100	Pass
12.6071	267	267	100	Pass
12.9251	247	247	100	Pass
13.2430	225	225	100	Pass
13.5609	204	204	100	Pass
13.8789	187	187	100	Pass
14.1968	174	174	100	Pass
14.5148	163	163	100	Pass
14.8327	149	149	100	Pass
15.1506	141	141	100	Pass
15.4686	134	134	100	Pass
15.7865	128	128	100	Pass
16.1044	118	118	100	Pass
16.4224	113	113	100	Pass
16.7403	106	106	100	Pass
17.0583	102	102	100	Pass
17.3762	100	100	100	Pass
17.6941	95	95	100	Pass
18.0121	92	92	100	Pass
18.3300	89	89	100	Pass
18.6479	85	85	100	Pass
18.9659	82	82	100	Pass
19.2838	73	73	100	Pass
19.6018	72	72	100	Pass
19.9197	68	68	100	Pass
20.2376	66	66	100	Pass
20.5556	60	60	100	Pass
20.8735	57	57	100	Pass
21.1914	55	55	100	Pass
21.5094	52	52	100	Pass
21.8273	48	48	100	Pass
22.1453	44	44	100	Pass
22.4632	43	43	100	Pass
22.7811	41	41	100	Pass
23.0991	38	38	100	Pass
23.4170	36	36	100	Pass
23.7350	34	34	100	Pass
24.0529	33	33	100	Pass
24.3708	31	31	100	Pass
24.6888	28	28	100	Pass
25.0067	27	27	100	Pass
25.3246	25	25	100	Pass
25.6426	25	25	100	Pass
25.9605	23	23	100	Pass
26.2785	20	20	100	Pass
26.5964	19	19	100	Pass
26.9143	18	18	100	Pass

27.2323	17	17	100	Pass
27.5502	16	16	100	Pass
27.8681	15	15	100	Pass
28.1861	14	14	100	Pass
28.5040	13	13	100	Pass
28.8220	11	11	100	Pass
29.1399	10	10	100	Pass
29.4578	10	10	100	Pass
29.7758	8	8	100	Pass
30.0937	7	7	100	Pass
30.4116	7	7	100	Pass
30.7296	6	6	100	Pass
31.0475	5	5	100	Pass
31.3655	4	4	100	Pass
31.6834	3	3	100	Pass
32.0013	3	3	100	Pass
32.3193	3	3	100	Pass
32.6372	3	3	100	Pass
32.9551	3	3	100	Pass
33.2731	2	2	100	Pass
33.5910	2	2	100	Pass
33.9090	2	2	100	Pass
34.2269	2	2	100	Pass
34.5448	1	1	100	Pass
34.8628	1	1	100	Pass
35.1807	1	1	100	Pass
35.4986	1	1	100	Pass
35.8166	1	1	100	Pass
36.1345	1	1	100	Pass
36.4525	0	0	100	Pass
36.7704	0	0	0	Pass
37.0883	0	0	0	Pass
37.4063	0	0	0	Pass
37.7242	0	0	0	Pass

Flowmaster Hydrology Software Output

Worksheet for Point 1 Culvert 24 Inch Military Road

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Full Flow Capacity	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.01000	ft/ft
Diameter:	2.00	ft
Results		
Discharge:	22.62	ft^3/s
Normal Depth:	2.00	ft
Flow Area:	3.14	ft^2
Wetted Perimeter:	6.28	ft
Top Width:	0.00	ft
Critical Depth:	1.69	ft
Percent Full:	100.0	%
Critical Slope:	0.00946	ft/ft
Velocity:	7.20	ft/s
Velocity Head:	0.81	ft
Specific Energy:	2.81	ft
Froude Number:	0.00	
Maximum Discharge:	24.33	ft^3/s
Discharge Full:	22.62	ft^3/s
Slope Full:	0.01000	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	0.00	%
Downstream Velocity:	0.00	ft/s

Worksheet for Segment 1 Koontz Road Ditchline

Project Description		
Flow Element:	Trapezoidal Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.030	
Channel Slope:	0.00700	ft/ft
Normal Depth:	3.00	ft
Left Side Slope:	1.00	ft/ft (H:V)
Right Side Slope:	1.00	ft/ft (H:V)
Bottom Width:	4.00	ft
Results		
Discharge:	123.08	ft^3/s
Flow Area:	21.00	ft^2
Wetted Perimeter:	12.49	ft
Top Width:	10.00	ft
Critical Depth:	2.49	ft
Critical Slope:	0.01420	ft/ft
Velocity:	5.86	ft/s
Velocity Head:	0.53	ft
Specific Energy:	3.53	ft
Froude Number:	0.71	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	3.00	ft
Critical Depth:	2.49	ft
Channel Slope:	0.00700	ft/ft

Worksheet for Segment 2 Wooded Swale

Project Description		
Flow Element:	Trapezoidal Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.050	
Channel Slope:	0.00700	ft/ft
Normal Depth:	3.00	ft
Left Side Slope:	1.00	ft/ft (H:V)
Right Side Slope:	1.00	ft/ft (H:V)
Bottom Width:	4.00	ft
Results		
Discharge:	73.85	ft^3/s
Flow Area:	21.00	ft^2
Wetted Perimeter:	12.49	ft
Top Width:	10.00	ft
Critical Depth:	1.87	ft
Critical Slope:	0.04137	ft/ft
Velocity:	3.52	ft/s
Velocity Head:	0.19	ft
Specific Energy:	3.19	ft
Froude Number:	0.43	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	3.00	ft
Critical Depth:	1.87	ft
Channel Slope:	0.00700	ft/ft

Worksheet for Segment 3 Grass Swale

Project Description		
Flow Element:	Trapezoidal Channel	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.030	
Channel Slope:	0.00700	ft/ft
Normal Depth:	2.00	ft
Left Side Slope:	2.00	ft/ft (H:V)
Right Side Slope:	2.00	ft/ft (H:V)
Bottom Width:	6.00	ft
Results		
Discharge:	100.65	ft^3/s
Flow Area:	20.00	ft^2
Wetted Perimeter:	14.94	ft
Top Width:	14.00	ft
Critical Depth:	1.69	ft
Critical Slope:	0.01322	ft/ft
Velocity:	5.03	ft/s
Velocity Head:	0.39	ft
Specific Energy:	2.39	ft
Froude Number:	0.74	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	2.00	ft
Critical Depth:	1.69	ft
Channel Slope:	0.00700	ft/ft

Worksheet for Point 2 Culvert 24 Inch – Jordan Road

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Full Flow Capacity	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.01000	ft/ft
Diameter:	2.00	ft
Results		
Discharge:	22.62	ft^3/s
Normal Depth:	2.00	ft
Flow Area:	3.14	ft^2
Wetted Perimeter:	6.28	ft
Top Width:	0.00	ft
Critical Depth:	1.69	ft
Percent Full:	100.0	%
Critical Slope:	0.00946	ft/ft
Velocity:	7.20	ft/s
Velocity Head:	0.81	ft
Specific Energy:	2.81	ft
Froude Number:	0.00	
Maximum Discharge:	24.33	ft^3/s
Discharge Full:	22.62	ft^3/s
Slope Full:	0.01000	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	0.00	%
Downstream Velocity:	0.00	ft/s

South Basin – Olequa Creek Watershed

The downstream drainage corridor for the southern drainage basin of our project consists of an existing wetland corridor draining southwest to the intersection of Avery Road and Military Road. The northern segment of that drainage corridor is labeled Wetland A and has been delineated by ELS as a categorically protected wetland. The wetland is fed from an 18-inch culvert that collects an undeveloped forested area on the east side of I-5 as well as impervious runoff from I-5. From Wetland A the corridor switches to a lightly vegetated wetland corridor and crosses a residential driveway at Points C and D. From Point D the vegetation density increases slightly until the drainage discharges into the County road ditch along Avery Road. Segment 2 as shown on the maps is an open ditchline that conveys runoff to a 24-inch concrete cross culvert for Avery Road and then continues to a 24-inch concrete culvert draining east to west under Military Road and then continues downstream.

Review and modeling of the existing conditions resulted in calculations of the 2, 10, 25 and 100-year storm flows for use in analysis of the 24-inch culverts at the intersection of Military Road and Avery Road. The driveway culverts at points C and D are likely 12 inches or less. RBE staff has not verified these sizes as they are located on private property. It appears a minimum of a 24-inch driveway culvert or two 12-inch culverts would be needed to convey the 100-year storm flows. Our analysis results of the south basin are listed below which show the two existing 24-inch culverts have capacity to convey the existing 100-year storm event.

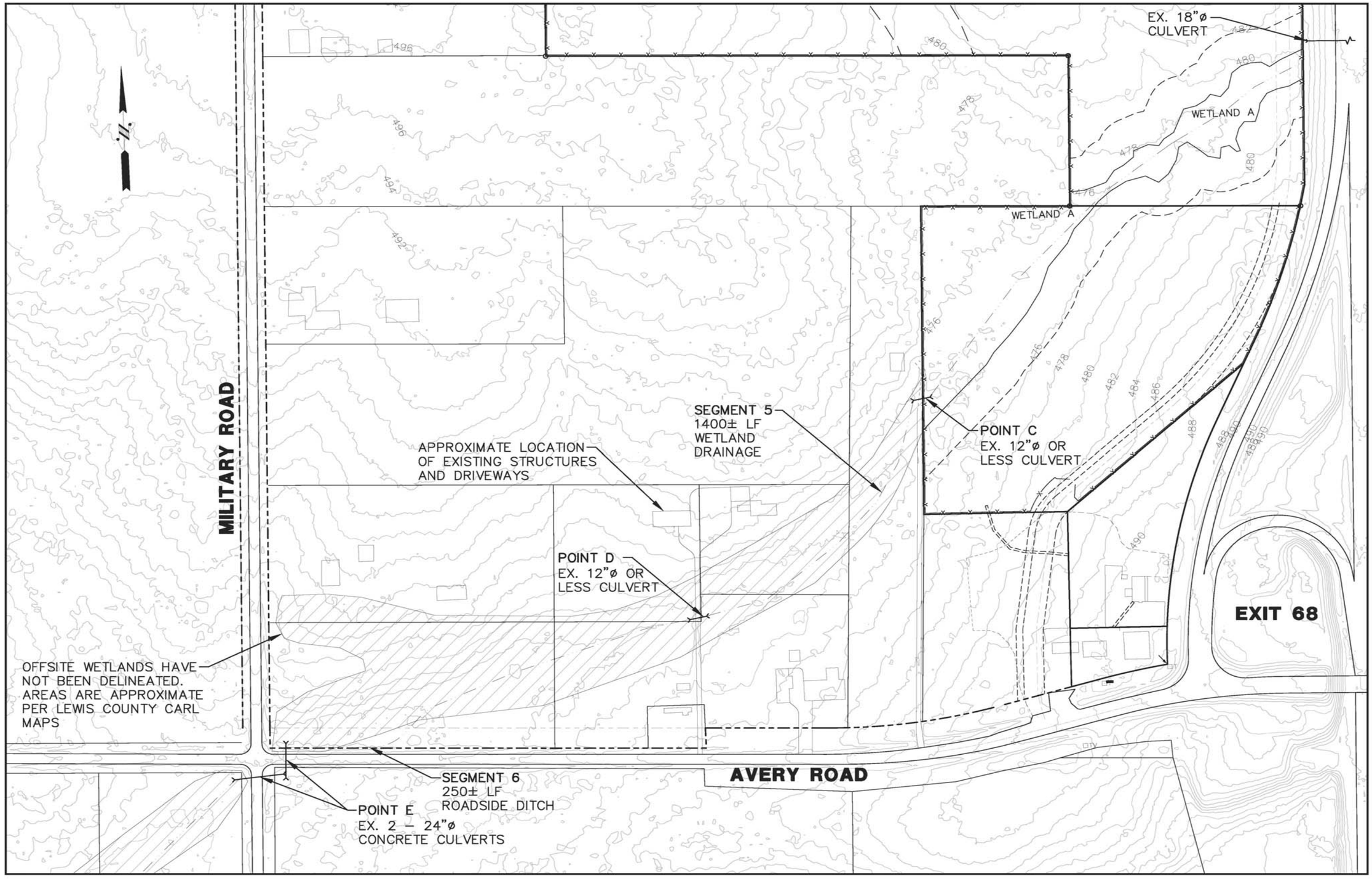
Culvert ID	South Basin Existing Culverts					
	Diameter (Inches)	Slope (%)	Material	Existing Flow 100 yr. (cfs)	Max Flow (cfs)	Pass /Fail
3	24	1.0	Concrete	18.42	22.62	Pass

RBE staff also completed a flow analysis for the wetland corridor. Based on the existing swale slope of 1.3 % and 25 to 1 side slopes, the resulting water depth was calculated using FlowMaster Hydrology Software to be 0.53 feet. Based on the aerial contours, this depth of flow would not pose any flooding threat to the existing residential structures on the downstream adjacent properties.

Once the Ritchie Brothers site is developed the stormwater detention ponds will be releasing stormwater runoff at the historically pre-existing forested condition of the property. By using the forested condition for our point of confluence for this project, the downstream drainage should not see an increase in peak storm flows. Because the majority of this site has been cleared and is pasture land, the existing runoff from the pasture enters the system at a higher rate than our ponds will discharge once the site is developed and the storm system is functioning.

WWHM and FlowMaster Data Output

The following data output results and basin map is for the South Basin.



NO. | DATE | REVISION

DESIGNED BY: RMB
DRAWN BY: NJC
CHECKED BY:
DATE: 1/26/10
SCALE: 1" = 200'

RITCHIE BROS. PROPERTIES
9800 GLEN LYON PARKWAY
BURNABY BC, CANADA V5J0C6
LEWIS COUNTY W.A.

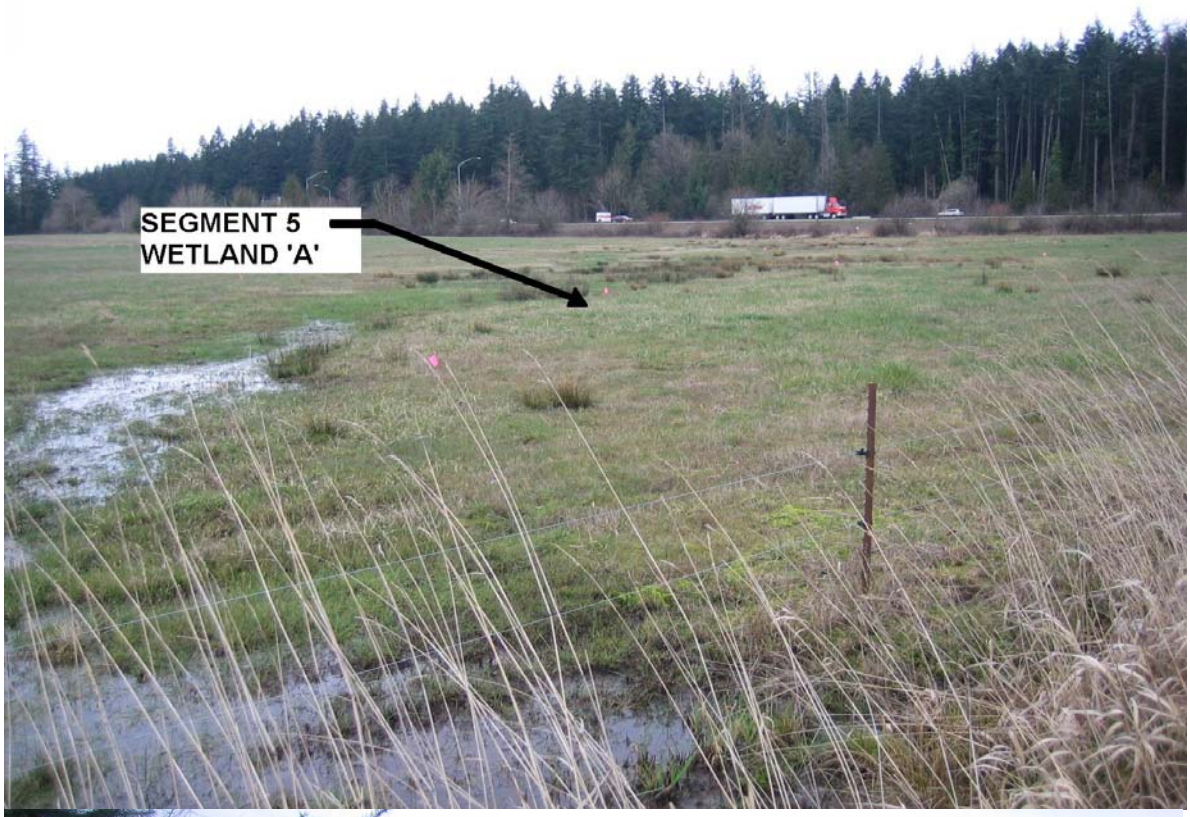
DOWNSTREAM STORM ANALYSIS
SOUTH BASIN

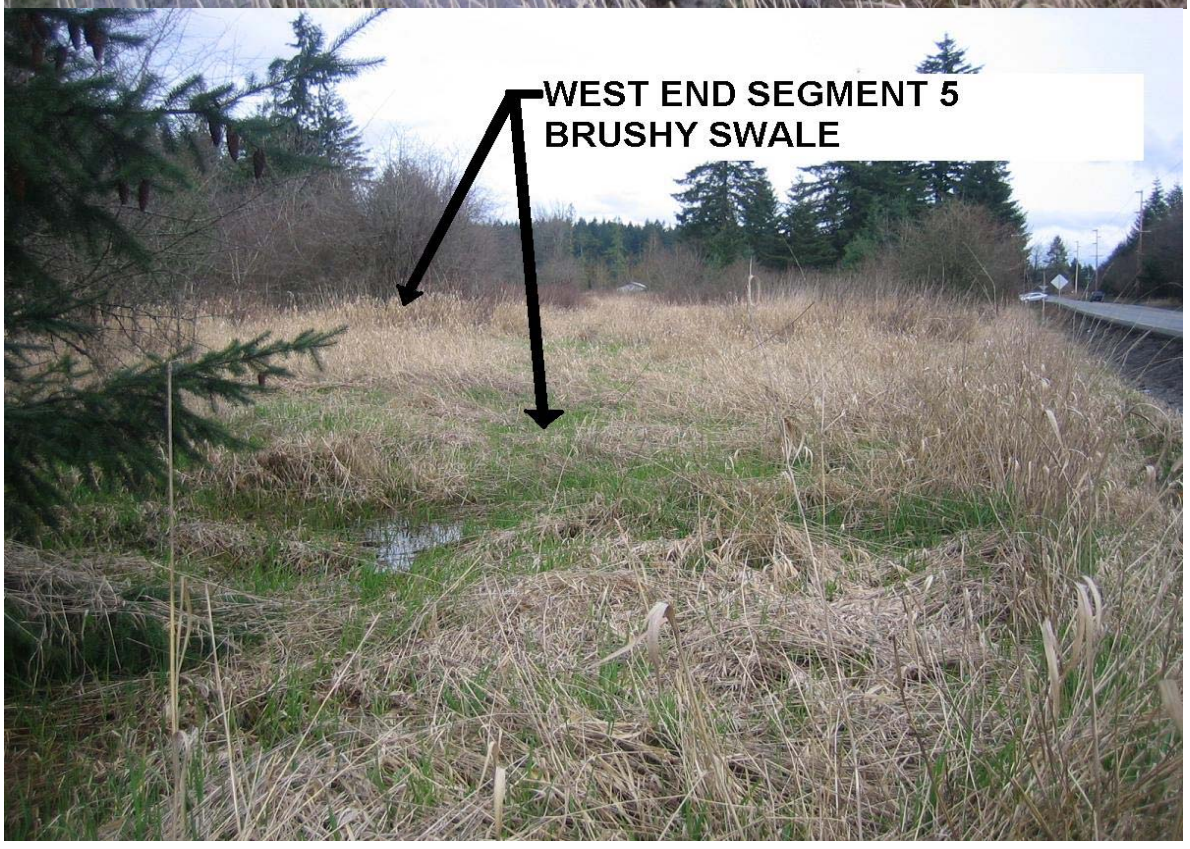
RB Engineering
CIVIL ENGINEERING – LAND PLANNING – UTILITIES
P.O. Box 923
CHEHALIS, WA 98532
OFF: (360) 740-8919
FAX: (360) 740-8912

JOB NUMBER
08098

DRAWING NAME
08098_SANL1

FIG 2
2 OF 2


SEGMENT 5
WETLAND 'A'

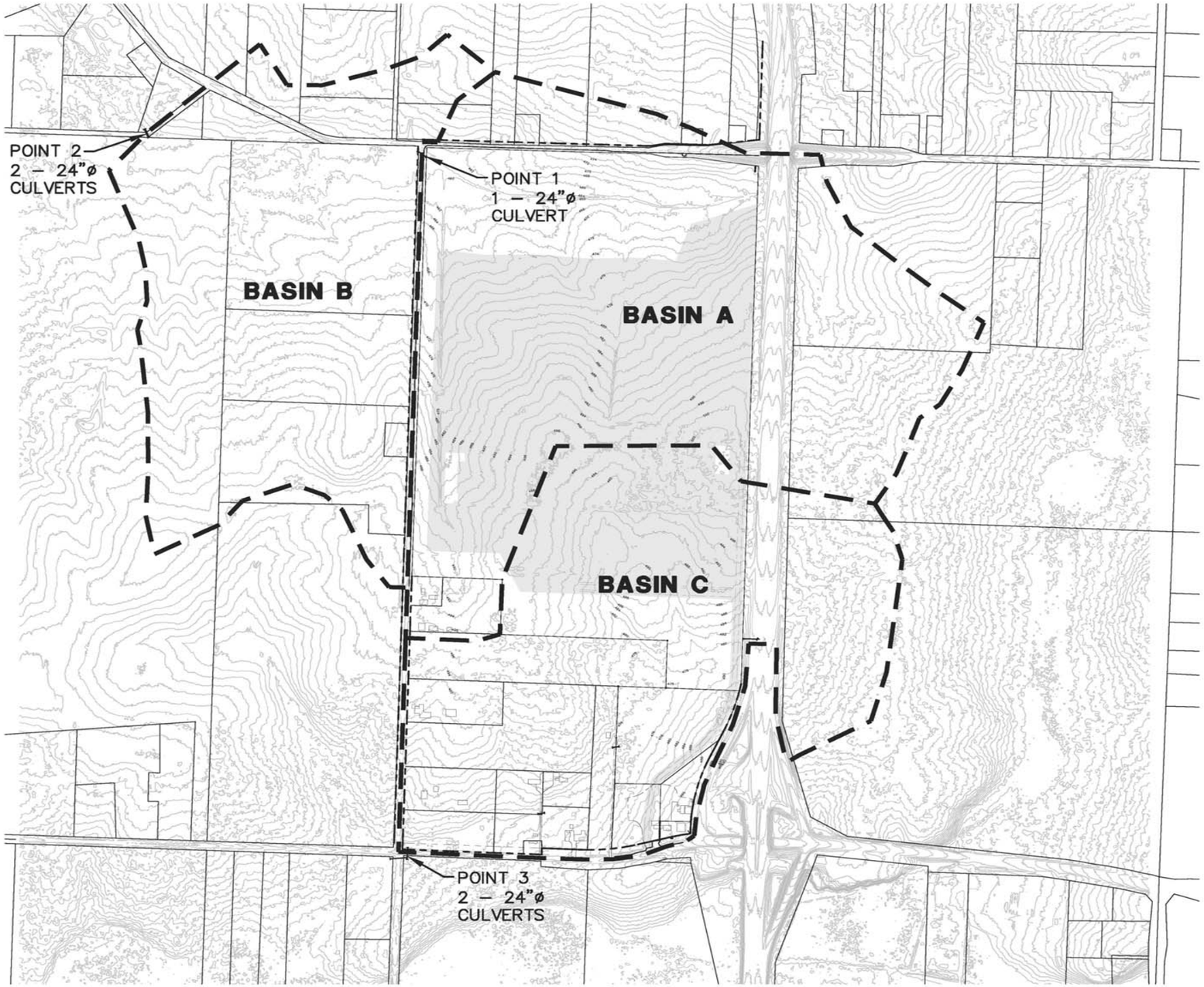

WEST END SEGMENT 5
BRUSHY SWALE


SEGMENT 6
ROADSIDE DITCH


POINT 'E' 24" Ø CULVERT

N

SCALE: 1"=400 FEET
0 200 400 800



NO.	DATE	REVISION

DESIGNED BY: RWB
DRAWN BY: NJG
CHECKED BY:
DATE: 2/26/10
SCALE: 1" = 400'

RITCHIE BROS. PROPERTIES
9500 GLEN LYON PARKWAY
BURNABY BC, CANADA V6J0C6

LEWIS COUNTY WA.

DOWNSTREAM DRAINAGE
CONVEYANCE ANALYSIS

RB Engineering
CIVIL ENGINEERING – LAND PLANNING – UTILITIES
P.O. Box 923
CHEHALIS, WA 98532
OFF.: (360) 740-8919
FAX: (360) 740-8912

JOB NUMBER
08098

DRAWING NAME
08098_CVTA

FIGURE 1

Western Washington Hydrology Model
PROJECT REPORT

Project Name: Ritchie Brothers Lewis County
Site Address: Military Road
City : Lewis County
Report Date : 2/25/2010
Gage : Longview
Data Start : 1955/10/01
Data End : 1993/09/30
Precip Scale: 0.86
WWHM3 Version:

Name : Basin C (Tributary to Point C) South Basin
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	59.2
C, Pasture, Flat	109.8

Impervious Land Use	Acres
ROADS FLAT	5.39

Element Flows To:
Surface Interflow Groundwater

Flow Frequency Return Periods for Predeveloped. POC #3 (Basin C)

Return Period	Flow(cfs)
2 year	5.449763
5 year	8.562804
10 year	10.789124
25 year	13.751965
50 year	16.052257
100 year	18.422757

Flow Frequency Return Periods for Mitigated. POC #3 (Basin C)

Return Period	Flow(cfs)
2 year	5.449763
5 year	8.562804
10 year	10.789124
25 year	13.751965
50 year	16.052257
100 year	18.422757

Yearly Peaks for Predeveloped and Mitigated. POC #3

Year	Predeveloped	Mitigated
1957	10.596	10.596
1958	8.368	8.368

1959	8.541	8.541
1960	6.424	6.424
1961	9.693	9.693
1962	7.855	7.855
1963	7.165	7.165
1964	14.721	14.721
1965	7.166	7.166
1966	4.831	4.831
1967	3.271	3.271
1968	3.762	3.762
1969	2.560	2.560
1970	4.168	4.168
1971	4.205	4.205
1972	6.048	6.048
1973	5.817	5.817
1974	3.964	3.964
1975	8.197	8.197
1976	7.032	7.032
1977	3.195	3.195
1978	1.598	1.598
1979	13.111	13.111
1980	5.002	5.002
1981	4.590	4.590
1982	4.048	4.048
1983	7.292	7.292
1984	4.850	4.850
1985	5.995	5.995
1986	2.130	2.130
1987	15.613	15.613
1988	7.817	7.817
1989	3.162	3.162
1990	2.318	2.318
1991	10.300	10.300
1992	3.963	3.963
1993	2.609	2.609
1994	4.238	4.238

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #3

Rank	Predeveloped	Mitigated
1	15.6128	15.6128
2	14.7210	14.7210
3	13.1112	13.1112
4	10.5962	10.5962
5	10.3002	10.3002
6	9.6927	9.6927
7	8.5406	8.5406
8	8.3676	8.3676
9	8.1972	8.1972
10	7.8551	7.8551
11	7.8172	7.8172
12	7.2919	7.2919
13	7.1663	7.1663
14	7.1654	7.1654
15	7.0325	7.0325
16	6.4235	6.4235

17	6.0479	6.0479
18	5.9949	5.9949
19	5.8174	5.8174
20	5.0022	5.0022
21	4.8496	4.8496
22	4.8312	4.8312
23	4.5898	4.5898
24	4.2380	4.2380
25	4.2052	4.2052
26	4.1678	4.1678
27	4.0482	4.0482
28	3.9635	3.9635
29	3.9629	3.9629
30	3.7618	3.7618
31	3.2713	3.2713
32	3.1948	3.1948
33	3.1622	3.1622
34	2.6088	2.6088
35	2.5600	2.5600
36	2.3178	2.3178
37	2.1300	2.1300
38	1.5978	1.5978

POC #3
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev		Dev	Percentage	Pass/Fail
2.7249	0	0	0		Pass
2.8595	0	0	0		Pass
2.9941	0	0	0		Pass
3.1287	0	0	0		Pass
3.2634	0	0	0		Pass
3.3980	0	0	0		Pass
3.5326	0	0	0		Pass
3.6672	0	0	0		Pass
3.8018	0	0	0		Pass
3.9365	0	0	0		Pass
4.0711	0	0	0		Pass
4.2057	0	0	0		Pass
4.3403	0	0	0		Pass
4.4749	0	0	0		Pass
4.6096	0	0	0		Pass
4.7442	0	0	0		Pass
4.8788	0	0	0		Pass
5.0134	0	0	0		Pass
5.1480	0	0	0		Pass
5.2827	0	0	0		Pass
5.4173	0	0	0		Pass
5.5519	0	0	0		Pass
5.6865	0	0	0		Pass
5.8211	0	0	0		Pass
5.9558	0	0	0		Pass
6.0904	0	0	0		Pass

6.2250	0	0	0	Pass
6.3596	0	0	0	Pass
6.4942	0	0	0	Pass
6.6289	0	0	0	Pass
6.7635	0	0	0	Pass
6.8981	0	0	0	Pass
7.0327	0	0	0	Pass
7.1673	0	0	0	Pass
7.3020	0	0	0	Pass
7.4366	0	0	0	Pass
7.5712	0	0	0	Pass
7.7058	0	0	0	Pass
7.8404	0	0	0	Pass
7.9751	0	0	0	Pass
8.1097	0	0	0	Pass
8.2443	0	0	0	Pass
8.3789	0	0	0	Pass
8.5135	0	0	0	Pass
8.6482	0	0	0	Pass
8.7828	0	0	0	Pass
8.9174	0	0	0	Pass
9.0520	0	0	0	Pass
9.1866	0	0	0	Pass
9.3213	0	0	0	Pass
9.4559	0	0	0	Pass
9.5905	0	0	0	Pass
9.7251	0	0	0	Pass
9.8597	0	0	0	Pass
9.9944	0	0	0	Pass
10.1290	0	0	0	Pass
10.2636	0	0	0	Pass
10.3982	0	0	0	Pass
10.5328	0	0	0	Pass
10.6675	0	0	0	Pass
10.8021	0	0	0	Pass
10.9367	0	0	0	Pass
11.0713	0	0	0	Pass
11.2059	0	0	0	Pass
11.3406	0	0	0	Pass
11.4752	0	0	0	Pass
11.6098	0	0	0	Pass
11.7444	0	0	0	Pass
11.8790	0	0	0	Pass
12.0137	0	0	0	Pass
12.1483	0	0	0	Pass
12.2829	0	0	0	Pass
12.4175	0	0	0	Pass
12.5521	0	0	0	Pass
12.6868	0	0	0	Pass
12.8214	0	0	0	Pass
12.9560	0	0	0	Pass
13.0906	0	0	0	Pass
13.2252	0	0	0	Pass
13.3599	0	0	0	Pass
13.4945	0	0	0	Pass
13.6291	0	0	0	Pass

13.7637	0	0	0	Pass
13.8983	0	0	0	Pass
14.0330	0	0	0	Pass
14.1676	0	0	0	Pass
14.3022	0	0	0	Pass
14.4368	0	0	0	Pass
14.5714	0	0	0	Pass
14.7061	0	0	0	Pass
14.8407	0	0	0	Pass
14.9753	0	0	0	Pass
15.1099	0	0	0	Pass
15.2445	0	0	0	Pass
15.3792	0	0	0	Pass
15.5138	0	0	0	Pass
15.6484	0	0	0	Pass
15.7830	0	0	0	Pass
15.9176	0	0	0	Pass
16.0523	0	0	0	Pass

Flowmaster Hydrology Software Output

Worksheet for Segment 5 Wetland Corridor South Basin

Project Description		
Flow Element:	Trapezoidal Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.030	
Channel Slope:	0.01300	ft/ft
Left Side Slope:	25.00	ft/ft (H:V)
Right Side Slope:	25.00	ft/ft (H:V)
Bottom Width:	1.00	ft
Discharge:	18.42	ft^3/s
Results		
Normal Depth:	0.53	ft
Flow Area:	7.68	ft^2
Wetted Perimeter:	27.75	ft
Top Width:	27.73	ft
Critical Depth:	0.49	ft
Critical Slope:	0.02074	ft/ft
Velocity:	2.40	ft/s
Velocity Head:	0.09	ft
Specific Energy:	0.62	ft
Froude Number:	0.80	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Headloss:	0.00	ft
Downstream Velocity:	0.00	ft/s
Upstream Velocity:	0.00	ft/s
Normal Depth:	0.53	ft
Critical Depth:	0.49	ft
Channel Slope:	0.01300	ft/ft

Worksheet for Point 3 Culvert 24 Inch Avery Rd and N. Military Road

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Full Flow Capacity	
Input Data		
Roughness Coefficient:	0.013	
Channel Slope:	0.01000	ft/ft
Diameter:	2.00	ft
Results		
Discharge:	22.62	ft^3/s
Normal Depth:	2.00	ft
Flow Area:	3.14	ft^2
Wetted Perimeter:	6.28	ft
Top Width:	0.00	ft
Critical Depth:	1.69	ft
Percent Full:	100.0	%
Critical Slope:	0.00946	ft/ft
Velocity:	7.20	ft/s
Velocity Head:	0.81	ft
Specific Energy:	2.81	ft
Froude Number:	0.00	
Maximum Discharge:	24.33	ft^3/s
Discharge Full:	22.62	ft^3/s
Slope Full:	0.01000	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:	N/A	
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	0.00	%
Downstream Velocity:	0.00	ft/s

PART 4 – APPLICABLE MINIMUM REQUIREMENTS

The minimum requirements for stormwater development and redevelopment sites are listed in Volume I of the SMMWW. Not all minimum requirements of this section apply to all projects. Determination of applicable minimum requirements is also based in part on Section 2.4 of the Manual.

Based on the thresholds given in Figures 2.2 and 2.3 of Volume I of the Manual, the proposed project must address or comment on Minimum Requirements #1 through #10. These requirements as they apply to the project are discussed in more detail below.

Minimum Requirement #1 – Stormwater Site Plans:

All projects meeting the thresholds of Section 2.4 of Volume I of the SMMWW shall prepare a Stormwater Site Plan for local government review.

The proposed project will create over 5,000 square feet of impervious surfacing, and therefore a Stormwater Site Plan complying with minimum requirements #1 through #10 is required.

Minimum Requirement #2 – Construction Storm Water Pollution Prevention Plan:

The proposed project exceeds the thresholds of Section 2.5 and therefore a Construction Storm Water Pollution Prevention Plan is required for this project and will be prepared as part of the final design plans for this project.

Minimum Requirement #3 – Source Control of Pollution:

All known, available and reasonable source control BMPs shall be applied to the project to limit pollutants coming in contact with stormwater. BMPs for parking lot runoff and lawn and landscape vegetation are just a few BMPs needed for this project. The BMPs for this project will be incorporated into the project's Final Operation and Maintenance Plan.

Minimum Requirement #4 – Preservation of Natural Drainage Systems/Outfalls:

Proposed stormwater discharges from the project site shall be treated, detained and released at pre-developed flow rates to the existing natural drainage ways for both the north and south drainage basins.

Minimum Requirement #5 – On-Site Stormwater Management:

Stormwater runoff will be collected, treated, detained and have metered release per the requirements of the SMMWW. Treatment and detention methods are discussed below.

Minimum Requirement #6 – Runoff Treatment:

The proposed project shall redevelop more than 5,000 square feet of openly exposed pollution generating impervious surface and therefore meets the

threshold requirements of this section.

Stormwater runoff from the onsite parking lot and equipment yard areas will be conveyed to an onsite stormwater treatment wetponds. Design calculations are included in this report.

Minimum Requirement #7 – Flow Control:

Stormwater flow will be conveyed to a series of onsite detention ponds in both drainage basins. Design calculations are included in this report.

Minimum Requirement #8 – Wetlands Protection:

The proposed project limits include numerous wetlands that were delineated as part of the wetland report prepared by ELS. A majority of the small individual wetlands will be filled and mitigation work will be completed onsite as a result of the disturbance of these small wetlands. For complete details of the onsite wetlands please see the ELS wetland.

Minimum Requirement #9 – Basin/Watershed Planning:

The project limits are located within two separate watersheds which includes the Stearns Creek Watershed that drains to the north and the Olequa Creek Watershed that drains to the south. There has been no basin or watershed planning conducted for this area. A detailed analysis by RBE was conducted for the downstream impacts from the proposed development for the north and south basins.

Minimum Requirement #10 – Operation & Maintenance:

An operation and maintenance agreement and manual will be prepared as part of the final site plan report and design.

PART 5 – PERMANENT STORMWATER CONTROL PLAN

Pre-Developed Site Hydrology

Existing site hydrology is based on our site investigation, field topographic survey, aerial topographic mapping and completed soils review for the subject project. The site consists of the basins outlined below.

NRCS Soil Survey

Hydrologic Soil Group: C
Soil Name and Number: Prather Silty Loam (167)
Lacamas Silt Loam (118)

Pre-developed Basin (P#)

Current Land Use: Undeveloped Pasture

Basin ID	Land Use Assumptions and Site Parameters				
	Land Use Cover	Slope	Acres	Hydrologic Group	Comments
	North Basin				
P1A	Pasture	Flat	47.26	C	Historically Pasture
P1B	Pasture	Flat	35.89	C	Historically Pasture
P1C	Pasture	Flat	36.93	C	Historically Pasture
	North Basin	Total	120.08		
	South Basin				
P2A	Forest	Flat	45.81	C	Historically Forested
P2D	Forest	Flat	10.11	C	Historically Forested
	South Basin	Total	55.91		

WWHM Model Results – Unmitigated Flows

Basin ID	2 Year (cfs)	10 Year (cfs)	25 Year (cfs)	100 Year (cfs)
	North Basin			
P1A	1.438	3.020	3.930	5.399
P1B	1.030	2.126	2.750	3.750

P1C	1.060	2.188	2.830	3.859
	South Basin			
P2A	1.076	2.319	2.915	3.727
P2D	0.225	0.485	0.610	0.780

Developed Site Hydrology (D#)

The developed site hydrology was modeled using the latest version of the WWHM Continuous Simulation model created by Washington State Department of Ecology. The north and south drainage basins were broken up into smaller sub-basins that were modeled using WWHM to size the stormwater treatment and flow control ponds. A complete summary for each sub-basin is included in the chart below. The additional chart also summarizes the WWHM data output results for the north and south drainage basins.

Basin Summary

Proposed Land Use: Commercial Auction Yard

Basin ID	Land Use Assumptions and Site Parameters				
	Land Use Cover	Slope	Acres	Hydrologic Group	Comments
	North Basin				
D1A	Lawn	Flat	12.97	C	
	Roads	Flat	0	C	
	Roofs	Flat	0.89	C	
	Parking	Flat	29.77	C	
	Pond	N/A	3.63	C	
	Total Area		47.26		
D1B	Lawn	Flat	0	C	
	Roads	Flat	0	C	
	Roofs	Flat	0	C	
	Parking	Flat	31.70	C	
	Pond	N/A	4.19	C	
	Total Area		35.89		
D1C	Lawn	Flat	2.57	C	
	Roads	Flat	0	C	
	Roofs	Flat	0.28	C	
	Parking	Flat	30.31	C	
	Pond	N/A	3.77	C	

	Total Area		36.93		
	South Basin				
D2A	Lawn	Flat	6.27	C	
	Roads	Flat	3.88	C	
	Roofs	Flat	0.23	C	
	Parking	Flat	31.75	C	
	Pond	N/A	3.68	C	
	Total Area		45.81		
D2D	Lawn	Flat	6.3	C	Field Grass
	Roads	Flat	2.52	C	Access Road
	Roofs	Flat	0.21	C	Existing Buildings
	Parking	Flat	1.61	C	Existing Offsite Imperv
	Pond	N/A	0.80	C	Pond Area
	Total Area		11.44		

WWHM Model Results – Mitigated Flows

Basin ID	2 Year (cfs)	10 Year (cfs)	25 Year (cfs)	100 Year (cfs)
	North Basin			
D1A	0.972	2.142	2.956	4.498
D1B	0.679	1.477	2.028	3.065
D1C	0.707	1.532	2.099	3.164
	South Basin			
D2A	0.689	1.687	2.452	4.017
D2D	0.128	0.324	0.478	0.799

Flow Control System Design & Analysis

The proposed stormwater facility was designed using the latest version of the WWHM stormwater model created by WSDOE. Using a mix of pasture and till forest as the pre-developed site condition, the proposed site development was modeled using WWHM that resulted in the following pond volumes listed below. The WWHM data output also outlines the control structure dimensions and elevations. See WWHM data output for that information.

Flow Control Facility Proposed: Combination Detention / Wetpond

Detention Pond Design Summary

Pond D1A

Pond Stage Storage	Elevation (ft)	Detention Volume (ac.ft)
Emergency Overflow	467.00	
Design Water Surface	466.70	13.451
Bottom Live Storage	462.00	0

Pond D1B

Pond Stage Storage	Elevation (ft)	Detention Volume (ac.ft)
Emergency Overflow	470.25	
Design Water Surface	470.00	12.898
Bottom Live Storage	465.00	0

Pond D1C

Pond Stage Storage	Elevation (ft)	Detention Volume (ac.ft)
Emergency Overflow	473.75	
Design Water Surface	473.50	15.625
Bottom Live Storage	468.50	0

Pond D2A

Pond Stage Storage	Elevation (ft)	Detention Volume (ac.ft)
Emergency Overflow	485.75	
Design Water Surface	485.50	19.7
Bottom Live Storage	480.00	0 ac.ft

Pond D2D

Pond Stage Storage	Elevation (ft)	Detention Volume (ac.ft)
Emergency Overflow	480.25	
Design Water Surface	480	4.10
Bottom Live Storage	476	0 ac.ft

Water Quality System Design & Analysis

The drainage basins delineated for this project will have openly exposed pollution generating impervious surfaces. These tributary areas will be treated using the following treatment technologies listed under the associated drainage basins.

Basin D1

Water Quality Facility Proposed: Wetpond

The tributary drainage sub-basins located in the north and south drainage basins of the property will require treatment prior to discharging offsite at the natural discharge locations discussed in previous sections of this report. RBE has selected the wetpond treatment method for water quality control for the new impervious surfaces associated with the auction yard area. Below is the summary of results from the WWHM water quality model and the associated proposed wetpond permanent pool volume for the four basins. All wetponds will be a minimum of 3 feet deep.

Wetpond D1A

Water Quality BMP Design	Volume and Flow
Required On-line Facility Volume	3.905 ac.ft
On-line Target Flow (15 min)	4.923 cfs
Off-line Target Flow (15 min)	2.734 cfs

Wetpond D1B

Water Quality BMP Design	Volume and Flow
Required On-line Facility Volume	3.779 ac.ft
On-line Target Flow (15 min)	5.302 cfs
Off-line Target Flow (15 min)	2.975 cfs

Wetpond D1C

Water Quality BMP Design	Volume and Flow
Required On-line Facility Volume	3.685 ac.ft
On-line Target Flow (15 min)	5.044 cfs
Off-line Target Flow (15 min)	2.820 cfs

Wetpond D2A

Water Quality BMP Design	Volume and Flow
Required On-line Facility Volume	4.319 ac.ft
On-line Target Flow (15 min)	5.744 cfs
Off-line Target Flow (15 min)	3.214 cfs

Water Quality Facility Proposed: **Bio-filtration Swale**

The new access road will create the requirement to provide water quality treatment for runoff of the impervious asphalt. To meet these requirements we will design two bio-filtration swales draining to the new onsite detention pond for Basin D2D. Both designs will provide a maximum velocity of 1 foot per second and more than the minimum required 9 minute retention time as outlined under BMP T9.10 in the SMMWW manual. Final swale designs will be completed during the final design phase of the project.

Conveyance System Design & Analysis

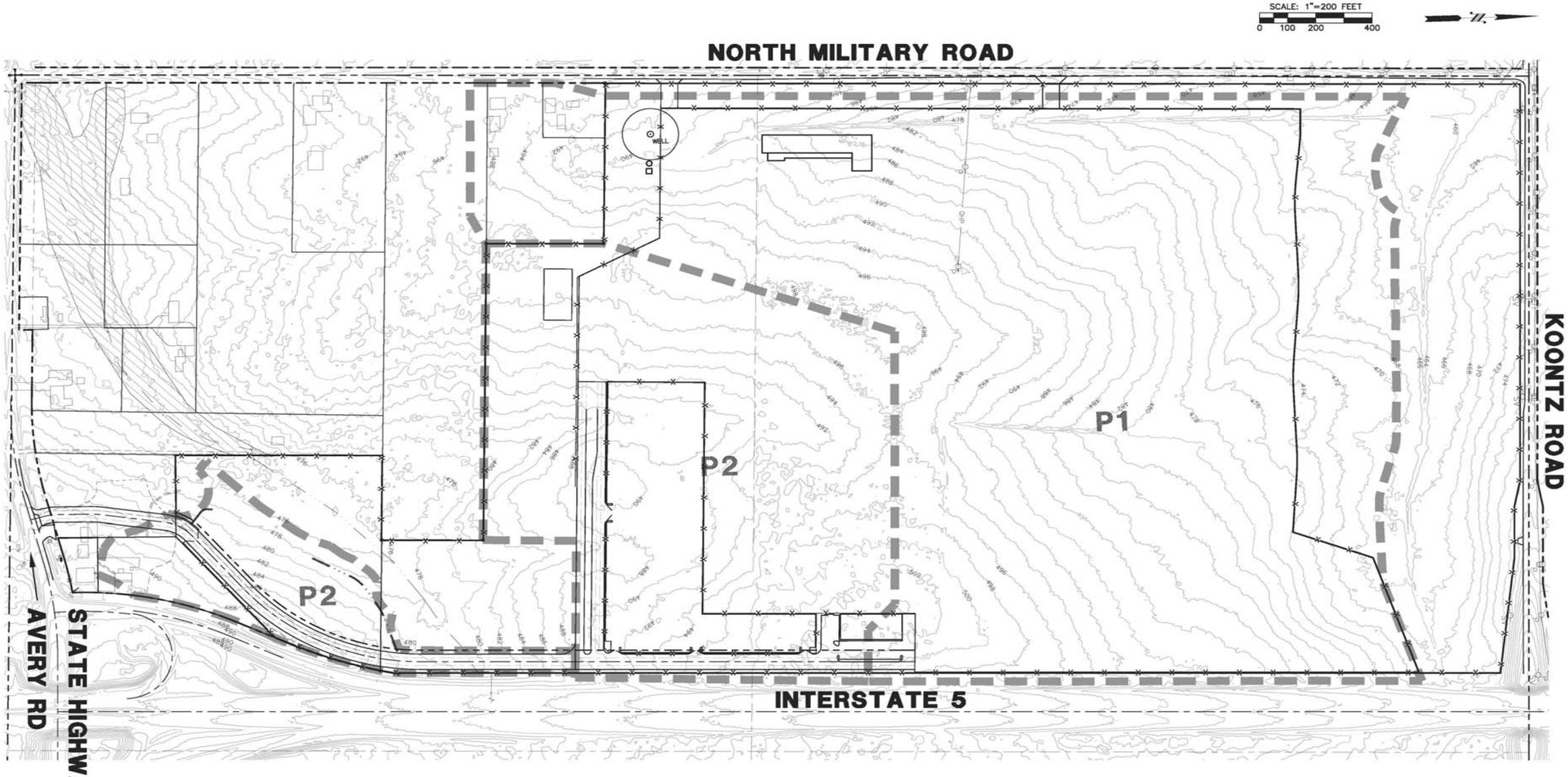
All onsite storm conveyance and new road storm conveyance systems will handle the 25-year storm flow. All proposed onsite storm drain pipe will vary from 8 to 24 inches in diameter and the minimum slope shall not be less than 1.0 %. The largest developed basins 25-year un-mitigated flows were calculated to be 14.0 to 16.0 cubic feet per second at the discharge point into the pond. All onsite conveyance systems will be designed with no backwater accumulation at the minimum slope of 1.0%.

At final design each stormwater detention pond will incorporate an emergency overflow spillway that will be design to convey the 100 year storm flow at a maximum depth of 0.5 feet.

Basin Maps and WWHM Data Output

The following figures and WWHM modeling data output are included on the following pages of this section:

Pre-Developed Basin Map – Figure 1
Post Developed Basin Map – Figure 2
Conceptual Stormwater Site Plan
WWHM Modeling Data Output



NO.	DATE	REVISION

DESIGNED BY: RWB
DRAWN BY: NJG
CHECKED BY:
DATE: 1/6/10
SCALE: 1" = 200'

RITCHIE BROS. PROPERTIES
9500 GLEN LYON PARKWAY
BURNABY BC, CANADA V5J0C6

LEWIS COUNTY WA.

PRE DEVELOPMENT BASIN MAP

RB Engineering
CIVIL ENGINEERING – LAND PLANNING – UTILITIES
P.O. Box 923 OKEMOS, MI 48532
OFF: (360) 745-8899
FAX: (360) 745-8812

JOB NUMBER 08098
DRAWING NAME 08098_BASN

FIGURE 1

SCALE: 1"=200 FEET
0 100 200 400

NORTH MILITARY ROAD

KOONTZ ROAD

WELL

PROPOSED NEW WATER SYSTEM AND FIREFLOW RESERVOIR

REFURBISHING BUILDING

D1A

IRRIGATION WELL

PROPOSED ONSITE SEPTIC AREA

CONCEPTUAL WETPOND (TYP.)

EQUIPMENT CHECK-IN BUILDING

ONSITE WETLANDS

D1B

CONCEPTUAL DETENTION POND (TYP.)

NEW GRAVEL YARD AREA

CONCEPTUAL DETENTION POND (TYP.)

CONCEPTUAL BIOFILTRATION SWALE

EXISTING TEXACO GAS AND MINI MART

CONCEPTUAL DETENTION POND (TYP.)

D2A

CONCEPTUAL WETPOND (TYP.)

CONCEPTUAL BIOFILTRATION SWALE

D2B

D1C

EVENT PARKING AREA

AUCTION BUILDING

EXISTING JAMMERS RESTAURANT

PROPOSED NEW SITE ACCESS ROAD

INTERSTATE 5

AVERY RD

STATE HIGHWAY 12

NO.	DATE	REVISION

DESIGNED BY: RWB
DRAWN BY: NJG
CHECKED BY:

DATE: 1/6/10
SCALE: 1" = 200'

RITCHIE BROS. PROPERTIES
9500 GLEN LYON PARKWAY
BURNABY BC, CANADA V5J0C6

LEWIS COUNTY WA.

POST DEVELOPMENT BASIN MAP

RB Engineering
CIVIL ENGINEERING - LAND PLANNING - UTILITIES
P.O. Box 923
CHEHALIS, WA 98532
OFF: (360) 740-8919
FAX: (360) 740-8972

JOB NUMBER
08098

DRAWING NAME
08098_BASN2

FIGURE 2

RITCHIE BROS. LEWIS COUNTY

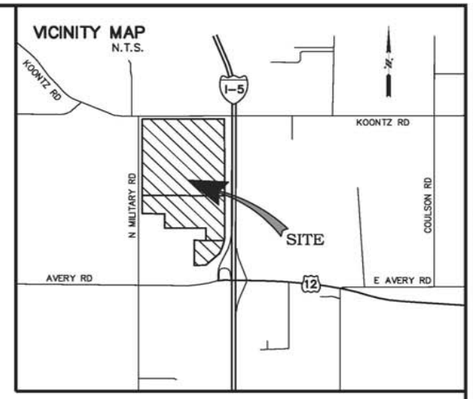
SECTION 1, TOWNSHIP 12 NORTH, RANGE 2 WEST, W.M.

LEWIS COUNTY, WASHINGTON

PROJECT INFORMATION

APPLICANT:	RITCHIE BROS. PROPERTIES SCOTT LENNON 9500 GLEN LYON PARKWAY BURNABY BC, CANADA V5J0C6 (801) 455-9005
SITE ADDRESS:	NORTH MILITARY RD/KOONTZ RD NAPAVINE, WA 98565
ZONING:	RDD-10
SITE AREA:	203.25 ACRES
FIRE DISTRICT:	FIRE DISTRICT 5

VICINITY MAP
N.T.S.



SCALE: 1"=200 FEET
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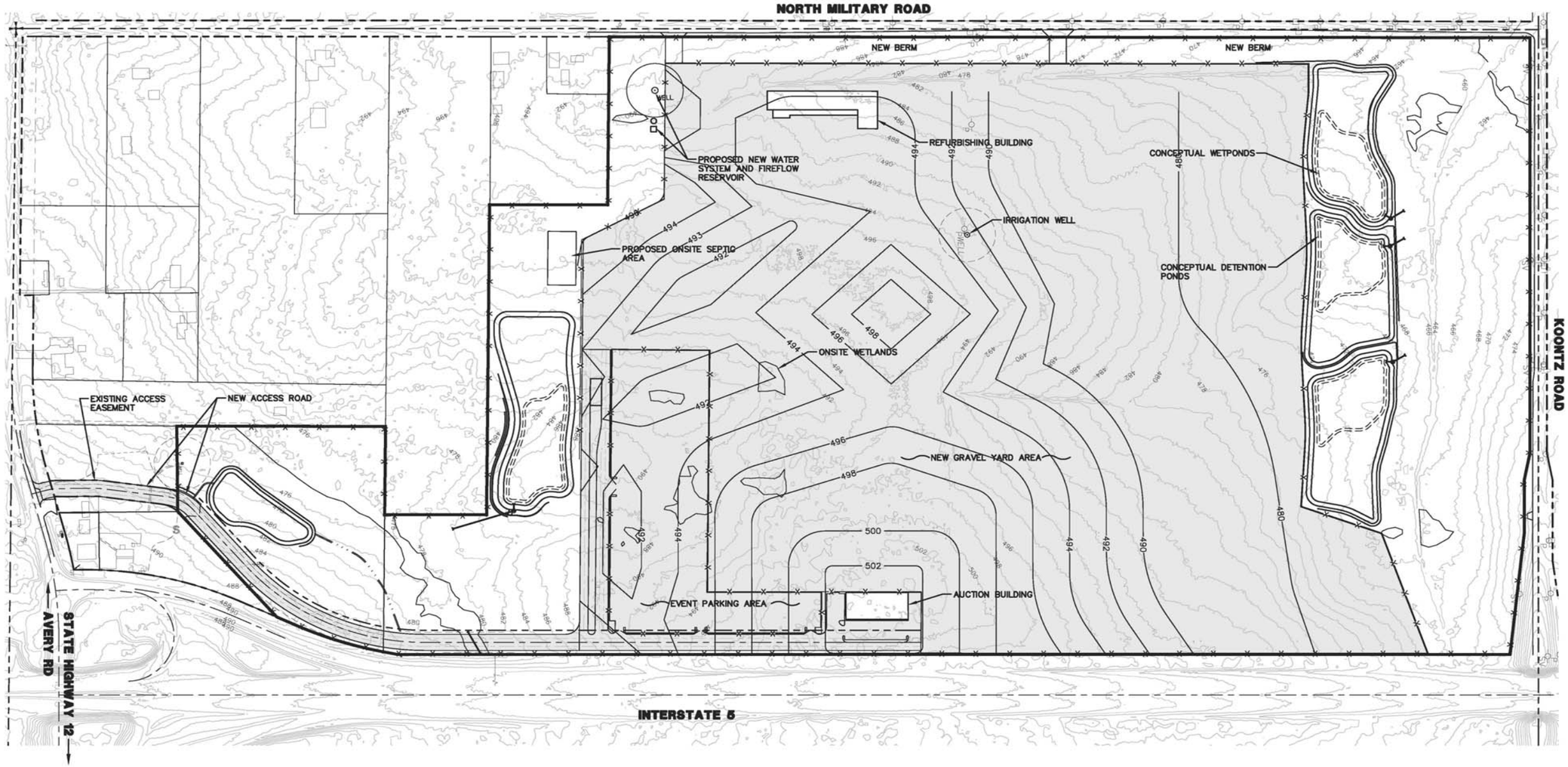

NO.	DATE	REVISION

DESIGNED BY: RWB
DRAWN BY: NJG
CHECKED BY:
DATE: 3/2/10
SCALE: 1" = 200'

RITCHIE BROS. PROPERTIES
9500 GLEN LYON PARKWAY
BURNABY BC, CANADA V5J0C6

LEWIS COUNTY WA.

SITE PLAN

RB Engineering
CIVIL ENGINEERING - LAND PLANNING - UTILITIES
P.O. Box 923
CHEHALIS, WA 98532
OFF: (360) 740-8919
FAX: (360) 740-8912

JOB NUMBER 08098
DRAWING NAME 08098_PSP1

1 OF 1

Western Washington Hydrology Model
PROJECT REPORT

Project Name: Ritchie Brothers Lewis County
Site Address: North Military Road
City : Lewis County
Report Date : 3/16/2010
Gage : Longview
Data Start : 1955/10/01
Data End : 1993/09/30
Precip Scale: 0.86
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin P1A
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Pasture, Mod	47.26

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin D1A
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	12.97

Impervious Land Use	Acres
ROOF TOPS FLAT	0.89
PARKING FLAT	29.77
POND	3.63

Element Flows To:

Surface	Interflow	Groundwater
Pond D1A,	Pond D1A,	

Name : Pond D1A
Bottom Length: 591.533882513727ft.
Bottom Width: 197.177960837906ft.
Depth : 5.7ft.
Volume at riser head : 13.3656ft.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 4.5 ft.
Riser Diameter: 24 in.
NotchType : Rectangular
Notch Width : 0.310 ft.
Notch Height: 1.644 ft.
Orifice 1 Diameter: 4.036 in. Elevation: 0 ft.

Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	2.678	0.000	0.000	0.000
0.063	2.685	0.170	0.108	0.000
0.127	2.691	0.340	0.152	0.000
0.190	2.698	0.511	0.186	0.000
0.253	2.705	0.682	0.215	0.000
0.317	2.712	0.853	0.241	0.000
0.380	2.719	1.025	0.264	0.000
0.443	2.726	1.198	0.285	0.000
0.507	2.733	1.371	0.305	0.000
0.570	2.740	1.544	0.323	0.000
0.633	2.747	1.718	0.340	0.000
0.697	2.754	1.892	0.357	0.000
0.760	2.761	2.066	0.373	0.000
0.823	2.768	2.242	0.388	0.000
0.887	2.775	2.417	0.403	0.000
0.950	2.782	2.593	0.417	0.000
1.013	2.789	2.769	0.431	0.000
1.077	2.796	2.946	0.444	0.000
1.140	2.803	3.123	0.457	0.000
1.203	2.810	3.301	0.469	0.000
1.267	2.817	3.479	0.481	0.000
1.330	2.824	3.658	0.493	0.000
1.393	2.831	3.837	0.505	0.000
1.457	2.838	4.017	0.516	0.000
1.520	2.845	4.196	0.527	0.000
1.583	2.852	4.377	0.538	0.000
1.647	2.859	4.558	0.549	0.000
1.710	2.866	4.739	0.559	0.000
1.773	2.873	4.921	0.570	0.000
1.837	2.880	5.103	0.580	0.000

1.900	2.887	5.285	0.590	0.000
1.963	2.894	5.469	0.599	0.000
2.027	2.901	5.652	0.609	0.000
2.090	2.908	5.836	0.618	0.000
2.153	2.915	6.020	0.628	0.000
2.217	2.923	6.205	0.637	0.000
2.280	2.930	6.391	0.646	0.000
2.343	2.937	6.576	0.655	0.000
2.407	2.944	6.763	0.664	0.000
2.470	2.951	6.949	0.672	0.000
2.533	2.958	7.136	0.681	0.000
2.597	2.965	7.324	0.689	0.000
2.660	2.972	7.512	0.698	0.000
2.723	2.980	7.700	0.706	0.000
2.787	2.987	7.889	0.714	0.000
2.850	2.994	8.079	0.722	0.000
2.913	3.001	8.269	0.744	0.000
2.977	3.008	8.459	0.780	0.000
3.040	3.016	8.650	0.824	0.000
3.103	3.023	8.841	0.874	0.000
3.167	3.030	9.033	0.929	0.000
3.230	3.037	9.225	0.987	0.000
3.293	3.044	9.417	1.049	0.000
3.357	3.052	9.610	1.113	0.000
3.420	3.059	9.804	1.179	0.000
3.483	3.066	9.998	1.247	0.000
3.547	3.073	10.19	1.316	0.000
3.610	3.081	10.39	1.387	0.000
3.673	3.088	10.58	1.458	0.000
3.737	3.095	10.78	1.530	0.000
3.800	3.102	10.97	1.602	0.000
3.863	3.110	11.17	1.674	0.000
3.927	3.117	11.37	1.746	0.000
3.990	3.124	11.57	1.818	0.000
4.053	3.132	11.76	1.890	0.000
4.117	3.139	11.96	1.961	0.000
4.180	3.146	12.16	2.031	0.000
4.243	3.153	12.36	2.100	0.000
4.307	3.161	12.56	2.168	0.000
4.370	3.168	12.76	2.235	0.000
4.433	3.175	12.96	2.301	0.000
4.497	3.183	13.16	2.397	0.000
4.560	3.190	13.37	2.693	0.000
4.623	3.198	13.57	3.256	0.000
4.687	3.205	13.77	3.990	0.000
4.750	3.212	13.97	4.860	0.000
4.813	3.220	14.18	5.848	0.000
4.877	3.227	14.38	6.940	0.000
4.940	3.234	14.59	8.128	0.000
5.003	3.242	14.79	9.405	0.000
5.067	3.249	15.00	10.76	0.000
5.130	3.257	15.20	12.20	0.000
5.193	3.264	15.41	13.71	0.000
5.257	3.272	15.62	15.29	0.000
5.320	3.279	15.82	16.94	0.000
5.383	3.286	16.03	18.66	0.000

5.447	3.294	16.24	20.43	0.000
5.510	3.301	16.45	22.27	0.000
5.573	3.309	16.66	24.16	0.000
5.637	3.316	16.87	26.11	0.000
5.700	3.324	17.08	28.12	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.438729
5 year	2.349955
10 year	3.020259
25 year	3.930673
50 year	4.649468
100 year	5.399528

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.972545
5 year	1.610201
10 year	2.142742
25 year	2.956456
50 year	3.674942
100 year	4.498451

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1957	2.986	1.628
1958	2.457	0.655
1959	2.594	0.650
1960	1.656	1.850
1961	2.582	2.054
1962	2.128	1.880
1963	1.874	1.006
1964	4.124	3.126
1965	1.860	1.674
1966	1.257	1.124
1967	0.875	0.694
1968	0.990	0.641
1969	0.569	0.585
1970	1.203	0.626
1971	1.066	0.815
1972	1.610	1.848
1973	1.538	1.068
1974	1.177	1.469
1975	2.411	1.351
1976	1.973	1.573
1977	0.785	0.761
1978	0.396	0.508

1979	3.568	4.453
1980	1.282	0.635
1981	1.125	0.701
1982	1.020	0.681
1983	1.941	1.064
1984	1.268	0.740
1985	1.520	0.706
1986	0.550	0.538
1987	4.552	2.177
1988	2.109	1.498
1989	0.745	0.623
1990	0.529	0.456
1991	2.764	2.123
1992	1.021	0.576
1993	0.670	0.561
1994	1.052	0.617

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	4.5517	4.4535
2	4.1238	3.1264
3	3.5680	2.1769
4	2.9861	2.1233
5	2.7639	2.0538
6	2.5936	1.8798
7	2.5822	1.8501
8	2.4571	1.8479
9	2.4109	1.6742
10	2.1278	1.6282
11	2.1085	1.5729
12	1.9731	1.4981
13	1.9406	1.4686
14	1.8736	1.3515
15	1.8598	1.1240
16	1.6560	1.0680
17	1.6096	1.0644
18	1.5380	1.0055
19	1.5201	0.8151
20	1.2824	0.7614
21	1.2684	0.7401
22	1.2566	0.7065
23	1.2031	0.7009
24	1.1772	0.6941
25	1.1245	0.6806
26	1.0663	0.6548
27	1.0523	0.6500
28	1.0205	0.6411
29	1.0203	0.6355
30	0.9902	0.6262
31	0.8746	0.6226
32	0.7847	0.6168
33	0.7453	0.5849
34	0.6702	0.5764
35	0.5695	0.5612
36	0.5499	0.5377

37	0.5289	0.5078
38	0.3963	0.4564

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.7194	2710	2671	98	Pass
0.7591	2381	2092	87	Pass
0.7988	2076	1829	88	Pass
0.8385	1811	1615	89	Pass
0.8782	1568	1432	91	Pass
0.9179	1396	1275	91	Pass
0.9576	1234	1143	92	Pass
0.9973	1100	1025	93	Pass
1.0369	973	924	94	Pass
1.0766	877	838	95	Pass
1.1163	799	754	94	Pass
1.1560	718	689	95	Pass
1.1957	645	635	98	Pass
1.2354	589	585	99	Pass
1.2751	528	527	99	Pass
1.3148	489	472	96	Pass
1.3545	448	427	95	Pass
1.3942	393	390	99	Pass
1.4339	357	350	98	Pass
1.4736	324	306	94	Pass
1.5133	295	278	94	Pass
1.5530	260	244	93	Pass
1.5927	235	211	89	Pass
1.6324	213	187	87	Pass
1.6721	196	162	82	Pass
1.7118	179	145	81	Pass
1.7515	162	129	79	Pass
1.7912	154	116	75	Pass
1.8309	145	101	69	Pass
1.8706	138	85	61	Pass
1.9103	131	76	58	Pass
1.9500	123	70	56	Pass
1.9897	119	62	52	Pass
2.0294	114	55	48	Pass
2.0691	109	48	44	Pass
2.1088	107	41	38	Pass
2.1485	101	34	33	Pass
2.1882	96	27	28	Pass
2.2279	95	23	24	Pass
2.2676	89	21	23	Pass
2.3073	85	18	21	Pass
2.3470	84	17	20	Pass
2.3867	80	15	18	Pass
2.4264	76	15	19	Pass
2.4661	68	12	17	Pass
2.5058	66	12	18	Pass

2.5455	62	12	19	Pass
2.5852	57	11	19	Pass
2.6249	54	9	16	Pass
2.6646	51	9	17	Pass
2.7043	48	9	18	Pass
2.7440	46	9	19	Pass
2.7837	43	8	18	Pass
2.8234	42	8	19	Pass
2.8631	40	8	20	Pass
2.9028	38	7	18	Pass
2.9425	35	6	17	Pass
2.9822	34	6	17	Pass
3.0218	31	5	16	Pass
3.0615	29	5	17	Pass
3.1012	26	5	19	Pass
3.1409	24	4	16	Pass
3.1806	23	4	17	Pass
3.2203	20	4	20	Pass
3.2600	19	4	21	Pass
3.2997	18	4	22	Pass
3.3394	17	4	23	Pass
3.3791	13	4	30	Pass
3.4188	12	3	25	Pass
3.4585	11	3	27	Pass
3.4982	10	3	30	Pass
3.5379	10	3	30	Pass
3.5776	9	3	33	Pass
3.6173	8	3	37	Pass
3.6570	7	3	42	Pass
3.6967	6	3	50	Pass
3.7364	6	3	50	Pass
3.7761	4	2	50	Pass
3.8158	4	2	50	Pass
3.8555	4	2	50	Pass
3.8952	4	2	50	Pass
3.9349	4	2	50	Pass
3.9746	3	2	66	Pass
4.0143	3	1	33	Pass
4.0540	3	1	33	Pass
4.0937	2	1	50	Pass
4.1334	1	1	100	Pass
4.1731	1	1	100	Pass
4.2128	1	1	100	Pass
4.2525	1	1	100	Pass
4.2922	1	1	100	Pass
4.3319	1	1	100	Pass
4.3716	1	1	100	Pass
4.4113	1	1	100	Pass
4.4510	1	1	100	Pass
4.4907	1	0	0	Pass
4.5304	1	0	0	Pass
4.5701	0	0	0	Pass
4.6098	0	0	0	Pass
4.6495	0	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 3.9055 acre-feet
On-line facility target flow: 0.01 cfs.
Adjusted for 15 min: 4.9234 cfs.
Off-line facility target flow: 2.4985 cfs.
Adjusted for 15 min: 2.7341 cfs.

Perlnd and Implnd Changes
No changes have been made.

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Western Washington Hydrology Model
PROJECT REPORT

Project Name: Ritchie Brothers Lewis County
Site Address: N. Military Road
City : Lewis County
Report Date : 3/16/2010
Gage : Longview
Data Start : 1955/10/01
Data End : 1993/09/30
Precip Scale: 0.86
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin P1B
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Pasture, Flat	35.89

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin D1B
Bypass: No

GroundWater: No

Pervious Land Use	Acres

Impervious Land Use	Acres
PARKING FLAT	31.7
POND	4.19

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1,	Trapezoidal Pond 1,	

Name : Trapezoidal Pond 1

Bottom Length: 412.803081826524ft.
Bottom Width: 275.202054551014ft.
Depth : 6ft.
Volume at riser head : 14.2590ft.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 5 ft.
Riser Diameter: 24 in.
NotchType : Rectangular
Notch Width : 0.240 ft.
Notch Height: 1.585 ft.
Orifice 1 Diameter: 3.299 in. Elevation: 0 ft.

Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	2.608	0.000	0.000	0.000
0.067	2.614	0.174	0.074	0.000
0.133	2.621	0.349	0.104	0.000
0.200	2.627	0.523	0.128	0.000
0.267	2.633	0.699	0.148	0.000
0.333	2.640	0.875	0.165	0.000
0.400	2.646	1.051	0.181	0.000
0.467	2.652	1.227	0.195	0.000
0.533	2.659	1.404	0.209	0.000
0.600	2.665	1.582	0.221	0.000
0.667	2.672	1.760	0.233	0.000
0.733	2.678	1.938	0.245	0.000
0.800	2.684	2.117	0.256	0.000
0.867	2.691	2.296	0.266	0.000
0.933	2.697	2.476	0.276	0.000
1.000	2.704	2.656	0.286	0.000
1.067	2.710	2.836	0.295	0.000
1.133	2.716	3.017	0.304	0.000
1.200	2.723	3.198	0.313	0.000
1.267	2.729	3.380	0.322	0.000
1.333	2.736	3.562	0.330	0.000
1.400	2.742	3.745	0.338	0.000
1.467	2.749	3.928	0.346	0.000
1.533	2.755	4.111	0.354	0.000
1.600	2.762	4.295	0.362	0.000
1.667	2.768	4.480	0.369	0.000
1.733	2.775	4.664	0.376	0.000
1.800	2.781	4.850	0.383	0.000
1.867	2.788	5.035	0.391	0.000
1.933	2.794	5.221	0.397	0.000
2.000	2.801	5.408	0.404	0.000
2.067	2.807	5.595	0.411	0.000

2.133	2.814	5.782	0.417	0.000
2.200	2.820	5.970	0.424	0.000
2.267	2.827	6.158	0.430	0.000
2.333	2.834	6.347	0.437	0.000
2.400	2.840	6.536	0.443	0.000
2.467	2.847	6.725	0.449	0.000
2.533	2.853	6.915	0.455	0.000
2.600	2.860	7.106	0.461	0.000
2.667	2.867	7.297	0.467	0.000
2.733	2.873	7.488	0.473	0.000
2.800	2.880	7.680	0.478	0.000
2.867	2.886	7.872	0.484	0.000
2.933	2.893	8.065	0.490	0.000
3.000	2.900	8.258	0.495	0.000
3.067	2.906	8.451	0.501	0.000
3.133	2.913	8.645	0.506	0.000
3.200	2.920	8.840	0.511	0.000
3.267	2.926	9.035	0.517	0.000
3.333	2.933	9.230	0.522	0.000
3.400	2.940	9.426	0.527	0.000
3.467	2.946	9.622	0.542	0.000
3.533	2.953	9.819	0.569	0.000
3.600	2.960	10.02	0.604	0.000
3.667	2.967	10.21	0.643	0.000
3.733	2.973	10.41	0.687	0.000
3.800	2.980	10.61	0.734	0.000
3.867	2.987	10.81	0.783	0.000
3.933	2.994	11.01	0.835	0.000
4.000	3.000	11.21	0.888	0.000
4.067	3.007	11.41	0.942	0.000
4.133	3.014	11.61	0.998	0.000
4.200	3.021	11.81	1.055	0.000
4.267	3.027	12.01	1.112	0.000
4.333	3.034	12.21	1.170	0.000
4.400	3.041	12.42	1.227	0.000
4.467	3.048	12.62	1.285	0.000
4.533	3.055	12.82	1.343	0.000
4.600	3.061	13.03	1.400	0.000
4.667	3.068	13.23	1.457	0.000
4.733	3.075	13.44	1.513	0.000
4.800	3.082	13.64	1.568	0.000
4.867	3.089	13.85	1.623	0.000
4.933	3.096	14.05	1.676	0.000
5.000	3.102	14.26	1.729	0.000
5.067	3.109	14.47	2.068	0.000
5.133	3.116	14.67	2.685	0.000
5.200	3.123	14.88	3.484	0.000
5.267	3.130	15.09	4.428	0.000
5.333	3.137	15.30	5.498	0.000
5.400	3.144	15.51	6.681	0.000
5.467	3.151	15.72	7.967	0.000
5.533	3.158	15.93	9.348	0.000
5.600	3.165	16.14	10.82	0.000
5.667	3.172	16.35	12.37	0.000
5.733	3.178	16.56	14.01	0.000
5.800	3.185	16.77	15.72	0.000

5.867	3.192	16.99	17.50	0.000
5.933	3.199	17.20	19.35	0.000
6.000	3.206	17.41	21.27	0.000
6.067	3.213	17.63	23.25	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.030916
5 year	1.664607
10 year	2.12688
25 year	2.750964
50 year	3.241249
100 year	3.750966

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.67902
5 year	1.115337
10 year	1.47755
25 year	2.028349
50 year	2.512663
100 year	3.065945

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1957	2.061	1.389
1958	1.622	0.464
1959	1.621	0.488
1960	1.202	1.438
1961	1.906	1.248
1962	1.509	1.490
1963	1.318	0.636
1964	2.990	1.593
1965	1.356	1.288
1966	0.955	0.618
1967	0.665	0.506
1968	0.728	0.462
1969	0.422	0.417
1970	0.785	0.453
1971	0.734	0.657
1972	1.215	1.460
1973	1.146	0.650
1974	0.859	1.092
1975	1.553	1.031
1976	1.279	1.171
1977	0.595	0.512
1978	0.273	0.388
1979	2.651	3.079

1980	0.949	0.437
1981	0.829	0.494
1982	0.730	0.485
1983	1.401	0.571
1984	0.911	0.499
1985	1.129	0.473
1986	0.416	0.385
1987	3.169	1.367
1988	1.473	0.844
1989	0.516	0.444
1990	0.400	0.338
1991	2.077	1.634
1992	0.774	0.431
1993	0.510	0.390
1994	0.704	0.434

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	3.1689	3.0786
2	2.9899	1.6340
3	2.6505	1.5933
4	2.0765	1.4899
5	2.0610	1.4600
6	1.9055	1.4384
7	1.6220	1.3886
8	1.6209	1.3671
9	1.5526	1.2884
10	1.5094	1.2480
11	1.4729	1.1708
12	1.4013	1.0917
13	1.3562	1.0312
14	1.3180	0.8440
15	1.2790	0.6573
16	1.2153	0.6498
17	1.2020	0.6365
18	1.1457	0.6183
19	1.1285	0.5709
20	0.9555	0.5119
21	0.9495	0.5060
22	0.9113	0.4990
23	0.8588	0.4942
24	0.8287	0.4884
25	0.7853	0.4846
26	0.7739	0.4728
27	0.7343	0.4645
28	0.7304	0.4621
29	0.7283	0.4533
30	0.7043	0.4443
31	0.6650	0.4370
32	0.5945	0.4340
33	0.5164	0.4306
34	0.5103	0.4168
35	0.4220	0.3904
36	0.4163	0.3878
37	0.4001	0.3847

38 0.2726 0.3383

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.5155	3143	3133	99	Pass
0.5430	2773	1969	71	Pass
0.5705	2435	1662	68	Pass
0.5981	2146	1503	70	Pass
0.6256	1894	1382	72	Pass
0.6531	1656	1266	76	Pass
0.6807	1483	1175	79	Pass
0.7082	1329	1085	81	Pass
0.7357	1194	998	83	Pass
0.7633	1067	919	86	Pass
0.7908	953	857	89	Pass
0.8183	872	790	90	Pass
0.8459	794	731	92	Pass
0.8734	717	675	94	Pass
0.9009	656	630	96	Pass
0.9285	601	579	96	Pass
0.9560	545	540	99	Pass
0.9835	508	488	96	Pass
1.0111	472	431	91	Pass
1.0386	433	380	87	Pass
1.0661	386	347	89	Pass
1.0937	349	309	88	Pass
1.1212	311	272	87	Pass
1.1487	288	241	83	Pass
1.1763	266	207	77	Pass
1.2038	239	178	74	Pass
1.2313	217	155	71	Pass
1.2589	197	134	68	Pass
1.2864	179	118	65	Pass
1.3139	167	105	62	Pass
1.3415	156	92	58	Pass
1.3690	146	77	52	Pass
1.3965	140	65	46	Pass
1.4241	134	57	42	Pass
1.4516	129	47	36	Pass
1.4791	125	38	30	Pass
1.5067	120	32	26	Pass
1.5342	114	26	22	Pass
1.5617	108	21	19	Pass
1.5893	104	17	16	Pass
1.6168	102	12	11	Pass
1.6443	95	9	9	Pass
1.6719	91	8	8	Pass
1.6994	89	7	7	Pass
1.7269	86	6	6	Pass
1.7545	83	6	7	Pass
1.7820	80	6	7	Pass

1.8095	78	5	6	Pass
1.8371	71	5	7	Pass
1.8646	69	5	7	Pass
1.8921	66	5	7	Pass
1.9197	63	5	7	Pass
1.9472	59	5	8	Pass
1.9747	57	5	8	Pass
2.0023	52	4	7	Pass
2.0298	51	4	7	Pass
2.0573	47	4	8	Pass
2.0849	44	4	9	Pass
2.1124	42	4	9	Pass
2.1399	40	4	10	Pass
2.1675	39	4	10	Pass
2.1950	37	4	10	Pass
2.2225	36	4	11	Pass
2.2501	34	4	11	Pass
2.2776	32	4	12	Pass
2.3051	29	4	13	Pass
2.3327	28	4	14	Pass
2.3602	27	3	11	Pass
2.3877	25	3	12	Pass
2.4153	23	3	13	Pass
2.4428	20	3	15	Pass
2.4703	20	2	10	Pass
2.4979	19	2	10	Pass
2.5254	16	2	12	Pass
2.5529	14	2	14	Pass
2.5805	12	2	16	Pass
2.6080	12	2	16	Pass
2.6355	10	2	20	Pass
2.6631	9	2	22	Pass
2.6906	7	2	28	Pass
2.7181	6	2	33	Pass
2.7457	6	2	33	Pass
2.7732	6	2	33	Pass
2.8007	3	1	33	Pass
2.8283	3	1	33	Pass
2.8558	3	1	33	Pass
2.8833	3	1	33	Pass
2.9109	3	1	33	Pass
2.9384	3	1	33	Pass
2.9659	2	1	50	Pass
2.9934	1	1	100	Pass
3.0210	1	1	100	Pass
3.0485	1	1	100	Pass
3.0760	1	1	100	Pass
3.1036	1	0	0	Pass
3.1311	1	0	0	Pass
3.1586	1	0	0	Pass
3.1862	0	0	0	Pass
3.2137	0	0	0	Pass
3.2412	0	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 3.779 acre-feet
On-line facility target flow: 0.01 cfs.
Adjusted for 15 min: 5.3025 cfs.
Off-line facility target flow: 2.6335 cfs.
Adjusted for 15 min: 2.9759 cfs.

Perlnd and Implnd Changes
No changes have been made.

Western Washington Hydrology Model
PROJECT REPORT

Project Name: Ritchie Brothers Lewis County
Site Address: N. Military Road
City : Lewis County
Report Date : 3/16/2010
Gage : Longview
Data Start : 1955/10/01
Data End : 1993/09/30
Precip Scale: 0.86
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin P1C
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Pasture, Flat	36.93

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin D1C
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	2.57

Impervious Land Use	Acres
ROOF TOPS FLAT	0.28
PARKING FLAT	30.31
POND	3.77

Element Flows To:

Surface	Interflow	Groundwater
Trapezoidal Pond 1,	Trapezoidal Pond 1,	

Name : Trapezoidal Pond 1
Bottom Length: 569.920497673866ft.
Bottom Width: 189.973499224624ft.
Depth : 6ft.
Volume at riser head : 13.7705ft.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 5 ft.
Riser Diameter: 24 in.
NotchType : Rectangular
Notch Width : 0.250 ft.
Notch Height: 1.658 ft.
Orifice 1 Diameter: 3.363 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	2.486	0.000	0.000	0.000
0.067	2.493	0.166	0.077	0.000
0.133	2.500	0.332	0.108	0.000
0.200	2.506	0.499	0.133	0.000
0.267	2.514	0.667	0.153	0.000
0.333	2.521	0.834	0.171	0.000
0.400	2.528	1.003	0.188	0.000
0.467	2.535	1.171	0.203	0.000
0.533	2.542	1.341	0.217	0.000
0.600	2.549	1.510	0.230	0.000
0.667	2.556	1.680	0.243	0.000
0.733	2.563	1.851	0.254	0.000
0.800	2.570	2.022	0.266	0.000
0.867	2.577	2.194	0.277	0.000
0.933	2.584	2.366	0.287	0.000
1.000	2.591	2.538	0.297	0.000
1.067	2.598	2.711	0.307	0.000
1.133	2.605	2.885	0.316	0.000
1.200	2.612	3.058	0.325	0.000
1.267	2.619	3.233	0.334	0.000
1.333	2.627	3.408	0.343	0.000
1.400	2.634	3.583	0.351	0.000
1.467	2.641	3.759	0.360	0.000
1.533	2.648	3.935	0.368	0.000
1.600	2.655	4.112	0.376	0.000
1.667	2.662	4.289	0.383	0.000
1.733	2.669	4.467	0.391	0.000
1.800	2.677	4.645	0.399	0.000
1.867	2.684	4.824	0.406	0.000
1.933	2.691	5.003	0.413	0.000

2.000	2.698	5.183	0.420	0.000
2.067	2.705	5.363	0.427	0.000
2.133	2.713	5.543	0.434	0.000
2.200	2.720	5.724	0.441	0.000
2.267	2.727	5.906	0.447	0.000
2.333	2.734	6.088	0.454	0.000
2.400	2.741	6.271	0.460	0.000
2.467	2.749	6.454	0.467	0.000
2.533	2.756	6.637	0.473	0.000
2.600	2.763	6.821	0.479	0.000
2.667	2.771	7.005	0.485	0.000
2.733	2.778	7.190	0.491	0.000
2.800	2.785	7.376	0.497	0.000
2.867	2.792	7.562	0.503	0.000
2.933	2.800	7.748	0.509	0.000
3.000	2.807	7.935	0.514	0.000
3.067	2.814	8.122	0.520	0.000
3.133	2.822	8.310	0.526	0.000
3.200	2.829	8.499	0.531	0.000
3.267	2.836	8.687	0.537	0.000
3.333	2.844	8.877	0.542	0.000
3.400	2.851	9.067	0.559	0.000
3.467	2.858	9.257	0.589	0.000
3.533	2.866	9.448	0.626	0.000
3.600	2.873	9.639	0.667	0.000
3.667	2.880	9.831	0.713	0.000
3.733	2.888	10.02	0.762	0.000
3.800	2.895	10.22	0.814	0.000
3.867	2.903	10.41	0.868	0.000
3.933	2.910	10.60	0.923	0.000
4.000	2.917	10.80	0.980	0.000
4.067	2.925	10.99	1.039	0.000
4.133	2.932	11.19	1.098	0.000
4.200	2.940	11.38	1.157	0.000
4.267	2.947	11.58	1.217	0.000
4.333	2.955	11.78	1.278	0.000
4.400	2.962	11.97	1.338	0.000
4.467	2.970	12.17	1.398	0.000
4.533	2.977	12.37	1.457	0.000
4.600	2.984	12.57	1.517	0.000
4.667	2.992	12.77	1.575	0.000
4.733	2.999	12.97	1.633	0.000
4.800	3.007	13.17	1.689	0.000
4.867	3.014	13.37	1.745	0.000
4.933	3.022	13.57	1.825	0.000
5.000	3.030	13.77	1.879	0.000
5.067	3.037	13.97	2.218	0.000
5.133	3.045	14.18	2.836	0.000
5.200	3.052	14.38	3.634	0.000
5.267	3.060	14.58	4.578	0.000
5.333	3.067	14.79	5.649	0.000
5.400	3.075	14.99	6.832	0.000
5.467	3.082	15.20	8.118	0.000
5.533	3.090	15.40	9.500	0.000
5.600	3.098	15.61	10.97	0.000
5.667	3.105	15.82	12.52	0.000

5.733	3.113	16.02	14.16	0.000
5.800	3.120	16.23	15.87	0.000
5.867	3.128	16.44	17.65	0.000
5.933	3.136	16.65	19.50	0.000
6.000	3.143	16.86	21.42	0.000
6.067	3.151	17.07	23.40	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.060789
5 year	1.712843
10 year	2.188511
25 year	2.830679
50 year	3.335171
100 year	3.859658

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.707832
5 year	1.158852
10 year	1.532345
25 year	2.099167
50 year	2.596711
100 year	3.164331

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1957	2.121	1.395
1958	1.669	0.479
1959	1.668	0.500
1960	1.237	1.494
1961	1.961	1.367
1962	1.553	1.527
1963	1.356	0.694
1964	3.077	1.711
1965	1.396	1.344
1966	0.983	0.691
1967	0.684	0.522
1968	0.749	0.477
1969	0.434	0.432
1970	0.808	0.467
1971	0.756	0.680
1972	1.250	1.497
1973	1.179	0.702
1974	0.884	1.152
1975	1.598	1.064
1976	1.316	1.216
1977	0.612	0.531

1978	0.280	0.393
1979	2.727	2.822
1980	0.977	0.455
1981	0.853	0.512
1982	0.752	0.500
1983	1.442	0.633
1984	0.938	0.518
1985	1.161	0.495
1986	0.428	0.397
1987	3.261	1.479
1988	1.516	0.941
1989	0.531	0.457
1990	0.412	0.344
1991	2.137	1.688
1992	0.796	0.443
1993	0.525	0.406
1994	0.725	0.450

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	3.2607	2.8218
2	3.0765	1.7112
3	2.7273	1.6880
4	2.1367	1.5275
5	2.1207	1.4966
6	1.9607	1.4935
7	1.6690	1.4791
8	1.6679	1.3951
9	1.5976	1.3671
10	1.5531	1.3441
11	1.5156	1.2161
12	1.4419	1.1516
13	1.3955	1.0640
14	1.3562	0.9405
15	1.3160	0.7017
16	1.2505	0.6943
17	1.2368	0.6910
18	1.1789	0.6800
19	1.1612	0.6334
20	0.9831	0.5310
21	0.9770	0.5216
22	0.9377	0.5182
23	0.8837	0.5121
24	0.8528	0.5001
25	0.8081	0.5001
26	0.7964	0.4950
27	0.7556	0.4791
28	0.7516	0.4773
29	0.7494	0.4672
30	0.7247	0.4567
31	0.6843	0.4550
32	0.6118	0.4497
33	0.5314	0.4427
34	0.5250	0.4321
35	0.4343	0.4063

36	0.4284	0.3966
37	0.4117	0.3932
38	0.2805	0.3445

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.5304	3141	3136	99	Pass
0.5587	2769	2043	73	Pass
0.5871	2429	1740	71	Pass
0.6154	2151	1565	72	Pass
0.6437	1894	1411	74	Pass
0.6720	1656	1293	78	Pass
0.7004	1481	1179	79	Pass
0.7287	1332	1094	82	Pass
0.7570	1193	998	83	Pass
0.7854	1068	932	87	Pass
0.8137	952	870	91	Pass
0.8420	870	802	92	Pass
0.8704	791	739	93	Pass
0.8987	717	687	95	Pass
0.9270	653	633	96	Pass
0.9554	600	580	96	Pass
0.9837	545	544	99	Pass
1.0120	506	504	99	Pass
1.0404	472	442	93	Pass
1.0687	433	396	91	Pass
1.0970	386	363	94	Pass
1.1253	349	325	93	Pass
1.1537	313	286	91	Pass
1.1820	288	250	86	Pass
1.2103	266	225	84	Pass
1.2387	239	198	82	Pass
1.2670	217	170	78	Pass
1.2953	197	146	74	Pass
1.3237	180	128	71	Pass
1.3520	167	111	66	Pass
1.3803	156	97	62	Pass
1.4087	146	85	58	Pass
1.4370	140	74	52	Pass
1.4653	134	64	47	Pass
1.4937	129	53	41	Pass
1.5220	125	45	36	Pass
1.5503	120	39	32	Pass
1.5786	114	35	30	Pass
1.6070	108	31	28	Pass
1.6353	104	24	23	Pass
1.6636	102	19	18	Pass
1.6920	95	14	14	Pass
1.7203	91	10	10	Pass
1.7486	89	9	10	Pass
1.7770	86	9	10	Pass

1.8053	83	7	8	Pass
1.8336	80	7	8	Pass
1.8620	78	6	7	Pass
1.8903	71	5	7	Pass
1.9186	69	5	7	Pass
1.9469	66	5	7	Pass
1.9753	63	5	7	Pass
2.0036	59	5	8	Pass
2.0319	57	5	8	Pass
2.0603	52	4	7	Pass
2.0886	51	4	7	Pass
2.1169	47	4	8	Pass
2.1453	44	4	9	Pass
2.1736	42	4	9	Pass
2.2019	40	4	10	Pass
2.2303	39	4	10	Pass
2.2586	37	4	10	Pass
2.2869	36	4	11	Pass
2.3153	34	3	8	Pass
2.3436	32	2	6	Pass
2.3719	30	2	6	Pass
2.4002	28	2	7	Pass
2.4286	27	2	7	Pass
2.4569	25	2	8	Pass
2.4852	23	2	8	Pass
2.5136	20	2	10	Pass
2.5419	20	2	10	Pass
2.5702	19	2	10	Pass
2.5986	16	2	12	Pass
2.6269	14	2	14	Pass
2.6552	12	1	8	Pass
2.6836	12	1	8	Pass
2.7119	10	1	10	Pass
2.7402	9	1	11	Pass
2.7685	7	1	14	Pass
2.7969	6	1	16	Pass
2.8252	6	0	0	Pass
2.8535	6	0	0	Pass
2.8819	3	0	0	Pass
2.9102	3	0	0	Pass
2.9385	3	0	0	Pass
2.9669	3	0	0	Pass
2.9952	3	0	0	Pass
3.0235	3	0	0	Pass
3.0519	2	0	0	Pass
3.0802	1	0	0	Pass
3.1085	1	0	0	Pass
3.1369	1	0	0	Pass
3.1652	1	0	0	Pass
3.1935	1	0	0	Pass
3.2218	1	0	0	Pass
3.2502	1	0	0	Pass
3.2785	0	0	0	Pass
3.3068	0	0	0	Pass
3.3352	0	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 3.6847 acre-feet
On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 5.0441 **cfs.**
Off-line facility target flow: 2.5162 **cfs.**
Adjusted for 15 min: 2.8205 **cfs.**

Perlnd and Implnd Changes
No changes have been made.

Western Washington Hydrology Model
PROJECT REPORT

Project Name: Ritchie Brothers Lewis County
Site Address: N. Military Road
City : Lewis County
Report Date : 3/16/2010
Gage : Longview
Data Start : 1955/10/01
Data End : 1993/09/30
Precip Scale: 0.86
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin P2A
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	48.28

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin D2A
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	6.27

Impervious Land Use	Acres
ROADS FLAT	3.88
ROOF TOPS FLAT	0.23
PARKING FLAT	31.75
POND	3.68

Element Flows To:

Surface	Interflow	Groundwater
Pond D2A,	Pond D2A,	

Name : Pond D2A
Bottom Length: 687.255459558957ft.
Bottom Width: 229.085153186321ft.
Depth : 6ft.
Volume at riser head : 19.6838ft.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 5 ft.
Riser Diameter: 24 in.
NotchType : Rectangular
Notch Width : 0.509 ft.
Notch Height: 1.222 ft.
Orifice 1 Diameter: 3.276 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	3.614	0.000	0.000	0.000
0.067	3.623	0.241	0.073	0.000
0.133	3.631	0.483	0.103	0.000
0.200	3.640	0.725	0.126	0.000
0.267	3.648	0.968	0.146	0.000
0.333	3.656	1.212	0.163	0.000
0.400	3.665	1.456	0.178	0.000
0.467	3.673	1.700	0.193	0.000
0.533	3.682	1.946	0.206	0.000
0.600	3.690	2.191	0.218	0.000
0.667	3.699	2.438	0.230	0.000
0.733	3.707	2.685	0.241	0.000
0.800	3.716	2.932	0.252	0.000
0.867	3.724	3.180	0.262	0.000
0.933	3.733	3.429	0.272	0.000
1.000	3.741	3.678	0.282	0.000
1.067	3.750	3.927	0.291	0.000
1.133	3.758	4.178	0.300	0.000
1.200	3.767	4.429	0.309	0.000
1.267	3.776	4.680	0.317	0.000
1.333	3.784	4.932	0.325	0.000
1.400	3.793	5.185	0.334	0.000
1.467	3.801	5.438	0.341	0.000
1.533	3.810	5.691	0.349	0.000
1.600	3.818	5.946	0.357	0.000
1.667	3.827	6.200	0.364	0.000
1.733	3.836	6.456	0.371	0.000
1.800	3.844	6.712	0.378	0.000
1.867	3.853	6.968	0.385	0.000

1.933	3.861	7.226	0.392	0.000
2.000	3.870	7.483	0.399	0.000
2.067	3.879	7.742	0.405	0.000
2.133	3.887	8.000	0.412	0.000
2.200	3.896	8.260	0.418	0.000
2.267	3.905	8.520	0.424	0.000
2.333	3.913	8.781	0.431	0.000
2.400	3.922	9.042	0.437	0.000
2.467	3.931	9.303	0.443	0.000
2.533	3.939	9.566	0.449	0.000
2.600	3.948	9.829	0.454	0.000
2.667	3.957	10.09	0.460	0.000
2.733	3.965	10.36	0.466	0.000
2.800	3.974	10.62	0.472	0.000
2.867	3.983	10.89	0.477	0.000
2.933	3.992	11.15	0.483	0.000
3.000	4.000	11.42	0.488	0.000
3.067	4.009	11.69	0.494	0.000
3.133	4.018	11.95	0.499	0.000
3.200	4.027	12.22	0.504	0.000
3.267	4.035	12.49	0.509	0.000
3.333	4.044	12.76	0.515	0.000
3.400	4.053	13.03	0.520	0.000
3.467	4.062	13.30	0.525	0.000
3.533	4.071	13.57	0.530	0.000
3.600	4.079	13.84	0.535	0.000
3.667	4.088	14.11	0.540	0.000
3.733	4.097	14.39	0.545	0.000
3.800	4.106	14.66	0.555	0.000
3.867	4.115	14.93	0.598	0.000
3.933	4.124	15.21	0.659	0.000
4.000	4.132	15.48	0.733	0.000
4.067	4.141	15.76	0.816	0.000
4.133	4.150	16.04	0.906	0.000
4.200	4.159	16.31	1.003	0.000
4.267	4.168	16.59	1.104	0.000
4.333	4.177	16.87	1.210	0.000
4.400	4.186	17.15	1.319	0.000
4.467	4.195	17.43	1.431	0.000
4.533	4.203	17.71	1.545	0.000
4.600	4.212	17.99	1.660	0.000
4.667	4.221	18.27	1.776	0.000
4.733	4.230	18.55	1.894	0.000
4.800	4.239	18.83	2.011	0.000
4.867	4.248	19.12	2.128	0.000
4.933	4.257	19.40	2.245	0.000
5.000	4.266	19.68	2.360	0.000
5.067	4.275	19.97	2.700	0.000
5.133	4.284	20.25	3.317	0.000
5.200	4.293	20.54	4.115	0.000
5.267	4.302	20.83	5.059	0.000
5.333	4.311	21.11	6.130	0.000
5.400	4.320	21.40	7.313	0.000
5.467	4.329	21.69	8.599	0.000
5.533	4.338	21.98	9.980	0.000
5.600	4.347	22.27	11.45	0.000

5.667	4.356	22.56	13.00	0.000
5.733	4.365	22.85	14.64	0.000
5.800	4.374	23.14	16.35	0.000
5.867	4.383	23.43	18.13	0.000
5.933	4.392	23.72	19.98	0.000
6.000	4.401	24.02	21.90	0.000
6.067	4.410	24.31	23.88	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.076255
5 year	1.825811
10 year	2.319487
25 year	2.915814
50 year	3.333741
100 year	3.727253

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.68955
5 year	1.216046
10 year	1.687547
25 year	2.452199
50 year	3.164454
100 year	4.017229

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1957	2.136	2.251
1958	1.046	0.470
1959	1.439	0.516
1960	1.298	1.598
1961	2.072	0.846
1962	1.640	2.007
1963	1.319	0.554
1964	3.132	1.689
1965	1.559	1.699
1966	1.122	0.544
1967	0.679	0.505
1968	0.528	0.462
1969	0.459	0.406
1970	0.762	0.474
1971	0.725	0.669
1972	1.403	2.122
1973	1.334	0.769
1974	0.638	1.053
1975	1.612	1.510
1976	1.486	1.619

1977	0.482	0.486
1978	0.100	0.369
1979	3.034	2.352
1980	0.956	0.406
1981	0.839	0.492
1982	0.785	0.489
1983	1.614	0.530
1984	0.922	0.517
1985	1.321	0.496
1986	0.352	0.402
1987	3.346	1.088
1988	1.264	0.543
1989	0.472	0.430
1990	0.449	0.354
1991	2.466	2.396
1992	0.913	0.450
1993	0.503	0.389
1994	0.682	0.399

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	3.3462	2.3960
2	3.1324	2.3519
3	3.0337	2.2512
4	2.4658	2.1218
5	2.1363	2.0072
6	2.0718	1.6990
7	1.6403	1.6893
8	1.6137	1.6185
9	1.6124	1.5984
10	1.5590	1.5104
11	1.4863	1.0877
12	1.4389	1.0531
13	1.4032	0.8457
14	1.3338	0.7695
15	1.3210	0.6692
16	1.3193	0.5537
17	1.2981	0.5441
18	1.2638	0.5431
19	1.1215	0.5297
20	1.0455	0.5166
21	0.9565	0.5164
22	0.9225	0.5047
23	0.9131	0.4963
24	0.8385	0.4920
25	0.7848	0.4888
26	0.7623	0.4855
27	0.7245	0.4745
28	0.6822	0.4695
29	0.6792	0.4621
30	0.6382	0.4499
31	0.5275	0.4300
32	0.5027	0.4064
33	0.4820	0.4055
34	0.4715	0.4025

35	0.4589	0.3987
36	0.4486	0.3891
37	0.3516	0.3686
38	0.0999	0.3541

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.5381	3421	3378	98	Pass
0.5664	3064	2228	72	Pass
0.5946	2753	1969	71	Pass
0.6228	2467	1764	71	Pass
0.6511	2219	1608	72	Pass
0.6793	1998	1467	73	Pass
0.7076	1810	1366	75	Pass
0.7358	1636	1281	78	Pass
0.7640	1479	1203	81	Pass
0.7923	1343	1132	84	Pass
0.8205	1230	1074	87	Pass
0.8488	1143	1005	87	Pass
0.8770	1036	948	91	Pass
0.9052	953	893	93	Pass
0.9335	870	833	95	Pass
0.9617	796	772	96	Pass
0.9899	738	714	96	Pass
1.0182	686	668	97	Pass
1.0464	631	628	99	Pass
1.0747	589	589	100	Pass
1.1029	552	549	99	Pass
1.1311	516	516	100	Pass
1.1594	484	489	101	Pass
1.1876	460	463	100	Pass
1.2159	435	442	101	Pass
1.2441	405	417	102	Pass
1.2723	371	386	104	Pass
1.3006	344	365	106	Pass
1.3288	311	338	108	Pass
1.3570	288	312	108	Pass
1.3853	271	288	106	Pass
1.4135	247	259	104	Pass
1.4418	227	238	104	Pass
1.4700	207	215	103	Pass
1.4982	194	189	97	Pass
1.5265	183	168	91	Pass
1.5547	169	153	90	Pass
1.5830	161	141	87	Pass
1.6112	147	130	88	Pass
1.6394	140	119	85	Pass
1.6677	133	108	81	Pass
1.6959	130	96	73	Pass
1.7241	126	90	71	Pass
1.7524	122	84	68	Pass

1.7806	117	82	70	Pass
1.8089	113	75	66	Pass
1.8371	110	69	62	Pass
1.8653	106	64	60	Pass
1.8936	103	59	57	Pass
1.9218	100	54	54	Pass
1.9501	96	49	51	Pass
1.9783	94	45	47	Pass
2.0065	91	37	40	Pass
2.0348	88	34	38	Pass
2.0630	86	30	34	Pass
2.0912	82	27	32	Pass
2.1195	79	23	29	Pass
2.1477	75	21	28	Pass
2.1760	71	19	26	Pass
2.2042	68	16	23	Pass
2.2324	64	12	18	Pass
2.2607	62	10	16	Pass
2.2889	59	8	13	Pass
2.3172	56	7	12	Pass
2.3454	52	4	7	Pass
2.3736	51	1	1	Pass
2.4019	48	0	0	Pass
2.4301	46	0	0	Pass
2.4583	43	0	0	Pass
2.4866	40	0	0	Pass
2.5148	39	0	0	Pass
2.5431	37	0	0	Pass
2.5713	36	0	0	Pass
2.5995	35	0	0	Pass
2.6278	33	0	0	Pass
2.6560	33	0	0	Pass
2.6843	30	0	0	Pass
2.7125	28	0	0	Pass
2.7407	26	0	0	Pass
2.7690	23	0	0	Pass
2.7972	23	0	0	Pass
2.8254	22	0	0	Pass
2.8537	19	0	0	Pass
2.8819	18	0	0	Pass
2.9102	18	0	0	Pass
2.9384	15	0	0	Pass
2.9666	15	0	0	Pass
2.9949	14	0	0	Pass
3.0231	12	0	0	Pass
3.0514	10	0	0	Pass
3.0796	9	0	0	Pass
3.1078	5	0	0	Pass
3.1361	4	0	0	Pass
3.1643	4	0	0	Pass
3.1925	3	0	0	Pass
3.2208	3	0	0	Pass
3.2490	1	0	0	Pass
3.2773	1	0	0	Pass
3.3055	1	0	0	Pass
3.3337	1	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 4.3193 acre-feet
On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 5.744 **cfs.**
Off-line facility target flow: 2.8902 **cfs.**
Adjusted for 15 min: 3.2145 **cfs.**

Perlnd and Implnd Changes
No changes have been made.

Western Washington Hydrology Model
PROJECT REPORT

Project Name: Ritchie Brothers Lewis County
Site Address: Military Road
City : Lewis County
Report Date : 3/17/2010
Gage : Longview
Data Start : 1955/10/01
Data End : 1993/09/30
Precip Scale: 0.86
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin P2D
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	10.11

Impervious Land Use	Acres

Element Flows To:
Surface Interflow Groundwater

Name : Basin D2D
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	6.3

Impervious Land Use	Acres
ROADS FLAT	2.52
ROOF TOPS FLAT	0.21
PARKING FLAT	1.61
POND	0.8

Element Flows To:
Surface Interflow Groundwater
Pond D2D, Pond D2D,

Name : Pond D2D
Bottom Length: 432.054589737465ft.
Bottom Width: 86.2127277687143ft.
Depth : 5ft.
Volume at riser head : 4.0734ft.
Side slope 1: 3 To 1
Side slope 2: 3 To 1
Side slope 3: 3 To 1
Side slope 4: 3 To 1
Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 18 in.
NotchType : Rectangular
Notch Width : 0.132 ft.
Notch Height: 0.824 ft.
Orifice 1 Diameter: 1.547 in. Elevation: 0 ft.

Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	0.855	0.000	0.000	0.000
0.056	0.859	0.048	0.015	0.000
0.111	0.863	0.095	0.021	0.000
0.167	0.867	0.144	0.026	0.000
0.222	0.871	0.192	0.030	0.000
0.278	0.875	0.240	0.033	0.000
0.333	0.879	0.289	0.036	0.000
0.389	0.883	0.338	0.039	0.000
0.444	0.887	0.387	0.042	0.000
0.500	0.891	0.437	0.044	0.000
0.556	0.895	0.486	0.047	0.000
0.611	0.899	0.536	0.049	0.000
0.667	0.903	0.586	0.051	0.000
0.722	0.907	0.636	0.053	0.000
0.778	0.911	0.687	0.055	0.000
0.833	0.915	0.738	0.057	0.000
0.889	0.919	0.788	0.059	0.000
0.944	0.923	0.840	0.061	0.000
1.000	0.927	0.891	0.063	0.000
1.056	0.931	0.943	0.065	0.000
1.111	0.935	0.995	0.066	0.000
1.167	0.940	1.047	0.068	0.000
1.222	0.944	1.099	0.069	0.000
1.278	0.948	1.151	0.071	0.000
1.333	0.952	1.204	0.073	0.000
1.389	0.956	1.257	0.074	0.000
1.444	0.960	1.310	0.076	0.000
1.500	0.964	1.364	0.077	0.000
1.556	0.968	1.418	0.078	0.000

1.611	0.972	1.471	0.080	0.000
1.667	0.976	1.526	0.081	0.000
1.722	0.981	1.580	0.082	0.000
1.778	0.985	1.635	0.084	0.000
1.833	0.989	1.689	0.085	0.000
1.889	0.993	1.744	0.086	0.000
1.944	0.997	1.800	0.088	0.000
2.000	1.001	1.855	0.089	0.000
2.056	1.005	1.911	0.090	0.000
2.111	1.009	1.967	0.091	0.000
2.167	1.014	2.023	0.093	0.000
2.222	1.018	2.080	0.094	0.000
2.278	1.022	2.136	0.095	0.000
2.333	1.026	2.193	0.096	0.000
2.389	1.030	2.250	0.097	0.000
2.444	1.035	2.308	0.098	0.000
2.500	1.039	2.365	0.099	0.000
2.556	1.043	2.423	0.100	0.000
2.611	1.047	2.481	0.102	0.000
2.667	1.051	2.539	0.103	0.000
2.722	1.056	2.598	0.104	0.000
2.778	1.060	2.657	0.105	0.000
2.833	1.064	2.716	0.106	0.000
2.889	1.068	2.775	0.107	0.000
2.944	1.072	2.834	0.108	0.000
3.000	1.077	2.894	0.109	0.000
3.056	1.081	2.954	0.110	0.000
3.111	1.085	3.014	0.111	0.000
3.167	1.089	3.075	0.112	0.000
3.222	1.094	3.135	0.117	0.000
3.278	1.098	3.196	0.128	0.000
3.333	1.102	3.257	0.141	0.000
3.389	1.107	3.319	0.157	0.000
3.444	1.111	3.380	0.174	0.000
3.500	1.115	3.442	0.193	0.000
3.556	1.119	3.504	0.213	0.000
3.611	1.124	3.566	0.234	0.000
3.667	1.128	3.629	0.256	0.000
3.722	1.132	3.692	0.279	0.000
3.778	1.137	3.755	0.302	0.000
3.833	1.141	3.818	0.326	0.000
3.889	1.145	3.881	0.350	0.000
3.944	1.150	3.945	0.374	0.000
4.000	1.154	4.009	0.399	0.000
4.056	1.158	4.073	0.591	0.000
4.111	1.163	4.138	0.942	0.000
4.167	1.167	4.203	1.396	0.000
4.222	1.171	4.268	1.933	0.000
4.278	1.176	4.333	2.542	0.000
4.333	1.180	4.398	3.216	0.000
4.389	1.184	4.464	3.948	0.000
4.444	1.189	4.530	4.735	0.000
4.500	1.193	4.596	5.572	0.000
4.556	1.197	4.662	6.457	0.000
4.611	1.202	4.729	7.387	0.000
4.667	1.206	4.796	8.361	0.000

4.722	1.211	4.863	9.376	0.000
4.778	1.215	4.930	10.43	0.000
4.833	1.219	4.998	11.52	0.000
4.889	1.224	5.066	12.66	0.000
4.944	1.228	5.134	13.82	0.000
5.000	1.233	5.202	15.02	0.000
5.056	1.237	5.271	16.26	0.000

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.225371
5 year	0.382331
10 year	0.485709
25 year	0.610582
50 year	0.698097
100 year	0.7805

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.128153
5 year	0.23108
10 year	0.324818
25 year	0.478957
50 year	0.624275
100 year	0.799949

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1957	0.447	0.541
1958	0.219	0.091
1959	0.301	0.100
1960	0.272	0.288
1961	0.434	0.117
1962	0.343	0.434
1963	0.276	0.107
1964	0.656	0.392
1965	0.326	0.248
1966	0.235	0.106
1967	0.142	0.094
1968	0.110	0.087
1969	0.096	0.076
1970	0.160	0.092
1971	0.152	0.109
1972	0.294	0.407
1973	0.279	0.190
1974	0.134	0.142
1975	0.338	0.339
1976	0.311	0.331
1977	0.101	0.087
1978	0.021	0.057
1979	0.635	0.398

1980	0.200	0.076
1981	0.176	0.097
1982	0.164	0.095
1983	0.338	0.105
1984	0.193	0.105
1985	0.277	0.097
1986	0.074	0.078
1987	0.701	0.138
1988	0.265	0.104
1989	0.099	0.074
1990	0.094	0.065
1991	0.516	0.451
1992	0.191	0.088
1993	0.105	0.073
1994	0.143	0.071

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.7007	0.5411
2	0.6559	0.4514
3	0.6353	0.4340
4	0.5164	0.4074
5	0.4473	0.3982
6	0.4338	0.3920
7	0.3435	0.3390
8	0.3379	0.3310
9	0.3376	0.2879
10	0.3265	0.2476
11	0.3112	0.1903
12	0.3013	0.1424
13	0.2938	0.1385
14	0.2793	0.1169
15	0.2766	0.1085
16	0.2763	0.1072
17	0.2718	0.1056
18	0.2646	0.1053
19	0.2348	0.1050
20	0.2189	0.1035
21	0.2003	0.1000
22	0.1932	0.0973
23	0.1912	0.0970
24	0.1756	0.0952
25	0.1643	0.0941
26	0.1596	0.0916
27	0.1517	0.0906
28	0.1429	0.0883
29	0.1422	0.0874
30	0.1336	0.0867
31	0.1105	0.0779
32	0.1053	0.0761
33	0.1009	0.0758
34	0.0987	0.0737
35	0.0961	0.0728
36	0.0939	0.0710
37	0.0736	0.0654

38 0.0209 0.0572

POC #1

The Facility Passed

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.1127	3474	2817	81	Pass
0.1186	3091	2234	72	Pass
0.1245	2777	1896	68	Pass
0.1304	2485	1699	68	Pass
0.1363	2233	1558	69	Pass
0.1423	2009	1396	69	Pass
0.1482	1811	1240	68	Pass
0.1541	1634	1135	69	Pass
0.1600	1513	1060	70	Pass
0.1659	1365	980	71	Pass
0.1718	1239	925	74	Pass
0.1777	1153	874	75	Pass
0.1836	1045	830	79	Pass
0.1896	962	789	82	Pass
0.1955	875	734	83	Pass
0.2014	797	688	86	Pass
0.2073	739	657	88	Pass
0.2132	687	621	90	Pass
0.2191	633	584	92	Pass
0.2250	589	545	92	Pass
0.2310	556	515	92	Pass
0.2369	519	486	93	Pass
0.2428	486	461	94	Pass
0.2487	463	429	92	Pass
0.2546	436	406	93	Pass
0.2605	409	392	95	Pass
0.2664	372	374	100	Pass
0.2723	344	350	101	Pass
0.2783	312	327	104	Pass
0.2842	292	310	106	Pass
0.2901	271	287	105	Pass
0.2960	249	272	109	Pass
0.3019	231	252	109	Pass
0.3078	207	233	110	Pass
0.3137	196	217	110	Pass
0.3196	184	201	109	Pass
0.3256	170	171	100	Pass
0.3315	161	156	96	Pass
0.3374	148	140	94	Pass
0.3433	140	130	92	Pass
0.3492	133	116	87	Pass
0.3551	130	108	83	Pass
0.3610	126	100	79	Pass
0.3670	123	93	75	Pass
0.3729	118	88	74	Pass
0.3788	114	81	71	Pass
0.3847	111	74	66	Pass
0.3906	107	65	60	Pass

0.3965	104	58	55	Pass
0.4024	100	52	52	Pass
0.4083	97	47	48	Pass
0.4143	94	44	46	Pass
0.4202	91	41	45	Pass
0.4261	88	37	42	Pass
0.4320	86	32	37	Pass
0.4379	83	27	32	Pass
0.4438	79	24	30	Pass
0.4497	75	18	24	Pass
0.4557	71	15	21	Pass
0.4616	68	13	19	Pass
0.4675	65	12	18	Pass
0.4734	62	12	19	Pass
0.4793	59	9	15	Pass
0.4852	56	8	14	Pass
0.4911	52	7	13	Pass
0.4970	51	6	11	Pass
0.5030	49	5	10	Pass
0.5089	46	5	10	Pass
0.5148	44	5	11	Pass
0.5207	40	4	10	Pass
0.5266	39	4	10	Pass
0.5325	37	3	8	Pass
0.5384	36	1	2	Pass
0.5444	35	0	0	Pass
0.5503	33	0	0	Pass
0.5562	33	0	0	Pass
0.5621	30	0	0	Pass
0.5680	28	0	0	Pass
0.5739	26	0	0	Pass
0.5798	24	0	0	Pass
0.5857	23	0	0	Pass
0.5917	22	0	0	Pass
0.5976	19	0	0	Pass
0.6035	18	0	0	Pass
0.6094	18	0	0	Pass
0.6153	15	0	0	Pass
0.6212	15	0	0	Pass
0.6271	14	0	0	Pass
0.6331	12	0	0	Pass
0.6390	10	0	0	Pass
0.6449	10	0	0	Pass
0.6508	5	0	0	Pass
0.6567	4	0	0	Pass
0.6626	4	0	0	Pass
0.6685	3	0	0	Pass
0.6744	3	0	0	Pass
0.6804	1	0	0	Pass
0.6863	1	0	0	Pass
0.6922	1	0	0	Pass
0.6981	1	0	0	Pass

The development has an increase in flow durations
from 1/2 predeveloped 2 year flow to the 2 year flow

or more than a 10% increase from the 2 year to the 50 year flow.

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 0.2102 acre-feet
On-line facility target flow: 0.01 cfs.
Adjusted for 15 min: 0.1123 cfs.
Off-line facility target flow: 0.0709 cfs.
Adjusted for 15 min: 0.075 cfs.

PART 6 – SOURCE CONTROL BMPs

The following BMPs will be utilized for this project and will be included in the final drainage site plan report

Fueling at Dedicated Stations

Landscape and Lawn Vegetation Management

Maintenance and Repair of Vehicles and Equipment

Mobile Fueling of Vehicles and Heavy Equipment

Painting/Finishing/Coating of Vehicles/Boats/Buildings/Equipment

Parking and Storage of Vehicles and Equipment

Spills of Oil and Hazardous Substances

Washing and Steam Cleaning Vehicles/Equipment/Building Structures

PART 7 – CONSTRUCTION SWPPP

All new development and redevelopment shall comply with Construction SWPPP Elements #1 through #12 outlined in the Manual. A full SWPPP will be prepared during final design of the site and Temporary Erosion Control and Sedimentation Plan.

PART 8 – SPECIAL REPORTS AND STUDIES

Insight Geologic Inc. Report

Geotechnical Reports

The subject site was analyzed by Insight Geologic Inc. in September of 2008. The report provides recommendations for foundation, earthwork and pavement design and also comments on surface and subsurface conditions of the site. A copy of the report has been inserted on the following pages.

INSIGHT GEOLOGIC, INC.

November 7, 2008

Ritchie Brothers Properties
76500 River Road
Richmond, BC, Canada V6X-4G5

Attention: Scott Lennon.

Report
Geotechnical Evaluation
Carlson Property
Napavine, Washington

INTRODUCTION

Insight Geologic, Inc. is pleased to provide this report of our geotechnical evaluation of site soil conditions for the Carlson Property located southeast of the intersection between Military Road and Koontz Road in Napavine, Washington. The lewis County tax parcel number for the property is 014859000000. The property consists of a single parcel comprising approximately 143.16 acres. The site is located in the northwest corner of Section 01 Township 12 North, Range 02 West of the Willamette Meridian in Lewis County, Washington. The location of the site is shown in the attached Vicinity Map, Figure 1.

We understand that the proposed development project may include a maintenance shop, office space and appurtenant driveways and parking areas for heavy equipment. No excess loads for the buildings are anticipated. Final stormwater plans for the facility have not yet been developed.

SCOPE OF SERVICES

The purpose of our services was to evaluate subsurface soil conditions as they relate to foundation and pavement design as well as the infiltration and disposal of stormwater from the proposed development. The specific tasks performed are outlined below.

1. Conduct a site reconnaissance to evaluate and mark proposed test pit locations at the site.
2. Provide for clearing needed to access the property and test pit locations.
3. Perform utility location at the site to evaluate the presence of subsurface obstructions.
4. Excavate as many as 10 exploratory test pits at the site using a track-mounted

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Phone: 360.943-5003 FAX: 360.754.9299

excavator hired by RB Engineering. We anticipate that the test pits will extend to a depth of about 10 feet below ground surface. Test pits will be excavated at approximately equal spacing across the site to evaluate soil conditions.

5. Maintain logs of the soil encountered in the test pits in general accordance with the Unified Soil Classification System.
6. Prepare a report containing the results of our assessment and including recommendations for building support and pavement design.

SITE CONDITIONS

GENERAL

The site is located southeast of the intersection between Military Road and Koontz Road in Lewis County. The site is shown relative to surrounding physical features in Figure 1. The site is bordered to the north, west and south by undeveloped property. Interstate 5 borders the property to the east.

The property is roughly square in shape and comprises approximately 143 acres. The site slopes gently down from southeast to northwest. Site elevations range between about 500 feet above mean sea level to about 460 feet MSL in the northern portion. The property is currently undeveloped and vegetated with grass, and Douglas Fir trees. The property is currently used as pasture for cattle.

SURFICIAL SOIL CONDITIONS

Surficial soil conditions were evaluated by reviewing the U.S. Department of Agriculture Soil Survey of Thurston County, Washington dated 1979. According to the soil survey report, The site is underlain by Cagey loamy sand (20). This soil exhibits rapid permeability, slow water runoff and a slight hazard of erosion. A seasonally high ground water table can occur in the soil between November and April.

SUBSURFACE EXPLORATIONS

GENERAL

Subsurface conditions at the site were explored by advancing 11 test pits at the approximate locations shown in Figure 2. The test pits were excavated using a track-mounted backhoe. The test pits were completed to depths ranging between 10 and 15 feet below ground surface.

A geologist from Insight Geologic monitored the excavation of the test pits and maintained logs of the soils encountered. The soils were visually classified in general accordance with the system described in ASTM D2487-06. Logs of the exploratory test pits are contained in Attachment A of this report.

The exploratory test pits were backfilled using the soil removed from the test pit. Backfilled soil was tamped in place using the bucket of the excavator. The backfilled soil

was not compacted as structural fill and should be expected to settle over time. If structures are intended to be placed over the test pit areas, the soil should be over-excavated and compacted.

SUBSURFACE CONDITIONS

The soil exposed in the test pits generally consisted of soft to medium stiff silt overlying silty sand and clay. Generally the upper 5 to 10 feet of soil consisted of silt with trace amounts of fine sand. Silty sand and/or clay was encountered in the deeper portions of our exploratory test pits.

Ground water was not encountered in any of the test pits during our study.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The test pits conducted for our study revealed the presence of silt, silty sand and clay to the maximum depth explored in our test pits. These soils appear to be suitable for the proposed commercial development planned for the site.

It is our opinion, conventionally supported buildings such as a lightly loaded office structure designed for low bearing capacity soils will be adequate for this site.

EARTHWORK

General

We expect that site grading may be accomplished using conventional earthmoving equipment. The soils in the upper three to five feet of the site contain significant amounts of fines and will be moisture sensitive. These materials may be difficult to operate on or compact during wet weather. Operation of heavy equipment at the site under wet conditions or when the soils are above optimum moisture content can be expected to result in considerable disturbance to the exposed subgrade soils. We recommend that earthwork be undertaken during periods of dry weather to reduce grading costs.

Clearing and Site Preparation

All areas to be graded should be cleared of surface and subsurface deleterious materials including trees, sod, brush, debris and other unsuitable or organic materials. We expect that stripping depths of about 6 to 10 inches will be required at the site to remove the surficial soils containing substantial amounts of organic material. Deeper stripping depths may be required in areas of heavy vegetation or, if the clearing operations cause excessive disturbance to the surficial soils, or if additional unsuitable soils are exposed during stripping operations.

We recommend that any trees be removed by overturning so that a majority of the tree roots are removed. Excavations from tree removal operations should be backfilled with structural fill compacted to the densities indicated in the "Structural Fill" section of this report.

The stripped material may be stockpiled and used later in nonstructural applications (e.g. landscape areas). Materials that cannot be used for landscaping should be removed from the project site and wasted.

Subgrade Preparation

We recommend that a member of our staff evaluate the exposed subgrade conditions after stripping is completed and prior to placement of any structural fill. The exposed subgrade soil should be evaluated by proof rolling with heavy rubber tired equipment during dry weather or by probing with a ½ inch diameter steel rod during wet weather.

Any soft, loose or otherwise unsuitable areas delineated during proof rolling or probing should be recompacted, if practical, or over-excavated and replaced by structural fill, based on the recommendations of our site representative

After completing the proof rolling, the subgrade areas should be recompacted to a firm and unyielding condition. We recommend that a member of our staff evaluate the compaction effort and any compacted soils. We recommend that all subgrade areas beneath roadways be compacted to at least 95 percent of the soil maximum dry density (MDD) in accordance with ASTM D1557 test procedure.

STRUCTURAL FILL

General

All fill that is placed at the site beneath structures and/or pavements should be placed as structural fill. We recommend that structural fill be free of debris, significant organic materials and rock fragments larger than about 6 inches. The workability of materials for use as structural fill depends on the gradation and moisture content of the soil. As the amount of fines increases, soil becomes increasingly more sensitive to small changes in moisture content. Compaction of native soils in accordance with the recommendations provided in this report then becomes difficult or impossible to achieve if the soil is above the optimum moisture content.

All fill and backfill beneath buildings should be compacted to at least 95 percent of soil MDD, based on ASTM D1557 (modified Proctor) testing procedure. Pavement subgrade soils and utility trench backfill should be compacted to at least 90 percent of the MDD up to within 2 feet of design grades; the upper 2 feet should be compacted to at least 95 percent of the MDD.

The lift thickness used during placement and compaction of structural fill will depend on the moisture and gradation characteristics of the soil and the type of equipment being used. If necessary, the material should be moisture conditioned to near-optimum moisture content prior to compaction. During fill and backfill placement, sufficient testing of in-place density should be performed to verify that adequate compaction is being achieved.

Suitability of On-Site Materials as Fill

During dry weather construction, any non-organic onsite soil may be considered for use as structural fill, provided it meets the criteria described in the Structural Fill section of this report and can be compacted as recommended. If the material is over optimum moisture content when excavated, it will be necessary to aerate or dry the soil prior to placement as structural fill.

The site soils which contain significant amounts of silt will be moisture sensitive. These materials will not likely be suitable for use as fill under wet weather conditions.

Temporary Cut Slopes

Temporary cut slopes are anticipated for construction of underground utilities. All temporary cut slopes and shoring must comply with the provisions of Washington Administrative Code (WAC) Title 296, Part N, "Excavation, Trenching and Shoring." The contractor performing the work has the primary responsibility for protection of workers and adjacent improvements, deciding whether to use shoring, and for establishing the safe inclination for open-cut slopes.

Temporary unsupported cut slopes more than 4 feet high may be inclined to 1.5H:1V maximum steepness in the soils. This guideline assumes that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the slope and that significant seepage is not present in the slope face. Flatter slopes will be necessary where significant seepage occurs. Some sloughing and raveling of the cut slopes should be expected over time. Temporary covering with heavy plastic sheeting should be used to protect these slopes during periods of wet weather.

FOUNDATION SUPPORT

The soils at the site are generally in a loose condition. Spread footings are appropriate for the soils encountered if anticipated footing loads do not exceed 1,500 pounds per square foot (psf) for combined dead and long-term live loads, exclusive of the weight of the footing and overlying backfill. This value may be increased by one third for transient loads such as those induce by seismic events or wind loadings. If higher loads are anticipated, deep foundations or removal of unsuitable soil and replacement with structural fill should be considered.

We estimate that settlement of footings designed as recommended will be less than 2 inches for the anticipated load conditions, with differential settlements of less than 1 inch between comparably loaded footings. Most of the settlements should essentially occur as loads are being applied. However, disturbance of the foundation subgrade during construction or the presence of loose or soft soils below the foundation could result in larger settlements than predicted.

Footing Depths and Widths

For frost and erosion protection, the base of all exterior footings should bear at least 24 inches below adjacent outside grades. To limit post-construction settlements, continuous (wall) and isolated (column) footings should be at least 18 and 24 inches wide, respectively.

Bearing Subgrades At least 12 inches of structural fill, compacted to a density of at least 95 percent (based on ASTM:D-1557), should underlie spread footings on this site that bear on the silt or silty sand soils.

Lateral Overexcavation Because foundation stresses are transferred outward as well as downward into the bearing soils, all structural fill placed under footings, up to 3 feet in thickness, should extend horizontally outward from the edge of each footing. This horizontal distance should be equal to the depth of placed fill. Therefore fill that extends 12 inches below the footing base should also extend 12 inches outward from the footing edges.

Subgrade Observation All footing subgrades should consist of either firm, unyielding, native soils or suitable structural fill materials. Footings should never be cast atop loose, soft, or frozen soil, slough, debris, existing uncontrolled fill, or surfaces covered by standing water. We recommend that a representative of our firm observe the condition of all subgrades before any concrete is placed.

Bearing Pressures In our opinion, for static loading, footings that bear on properly prepared, structural fill subgrades can be designed for a maximum allowable soil bearing pressures of 1,500 psf.

Footing Settlement We estimate that total post-construction settlements of properly designed footings bearing on properly prepared subgrades will not exceed 2 inches. Differential settlements for comparably loaded elements may approach one-half of this value over horizontal distances of approximately 50 feet.

Footing and Stemwall Backfill To provide erosion protection and lateral load resistance, we recommend that all footing excavations be backfilled on both sides of the footings, retaining walls, and stemwalls after the concrete has cured. Either imported structural fill or non-organic on-site soils can be used for this purpose, contingent on a suitable moisture content at the time of placement. Regardless of soil type, all footing backfill soil should be compacted to a density of at least 90 percent (based on ASTM:D-1557).

DRAINAGE CONSIDERATIONS

Foundation drains should be used where (1) crawl spaces or basements will be below a structure, (2) a slab is below the outside grade, or (3) the outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock and then wrapped in non-woven, geotextile filter fabric. At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor, and it should be sloped for drainage. All roof and surface water drains must be kept separate from the foundation drain system. Final site grading in areas adjacent to the buildings should slope away at least 2 percent, except where the area is paved.

PAVEMENT

The recommended pavement section for parking areas consists of 12 inches of compacted granular fill sub-base, 6 inches of compacted crushed rock base course and 2 inches of asphalt concrete pavement. High traffic and driveway areas should have a minimum of 12 inches of compacted granular subbase, 6 inches of compacted granular base material and 3 inches of asphaltic concrete.

STORMWATER INFILTRATION

Stormwater plans for the proposed project have not yet been developed. Based on our observations in our exploratory test pits, stormwater infiltration rates may be expected to be on the order of 2 inches per hour or less. The silty soils may be classified as Category D soils. Additional testing of soils in the areas of proposed stormwater disposal structures will be needed for design purposes.

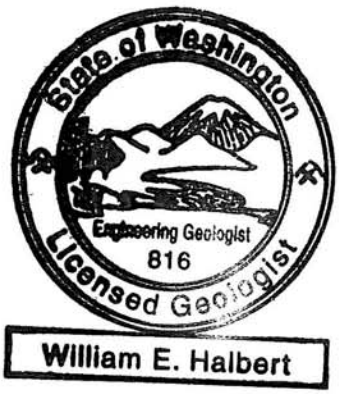
LIMITATIONS

We have prepared this geological report for use by Ritchie Brothers Properties and their authorized agents for the proposed development of the Carlson property, Parcel No. 014859000000 in Lewis County, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geological engineering in this area at the time this report was prepared. No warranty or other conditions express or implied, should be understood.

Please refer to Attachment B titled Report Limitations and Guidelines for Use for additional information pertaining to use of this report

We appreciate the opportunity to assist you with this project. Please contact us if you have questions regarding the information presented in this report or if we can provide additional services.



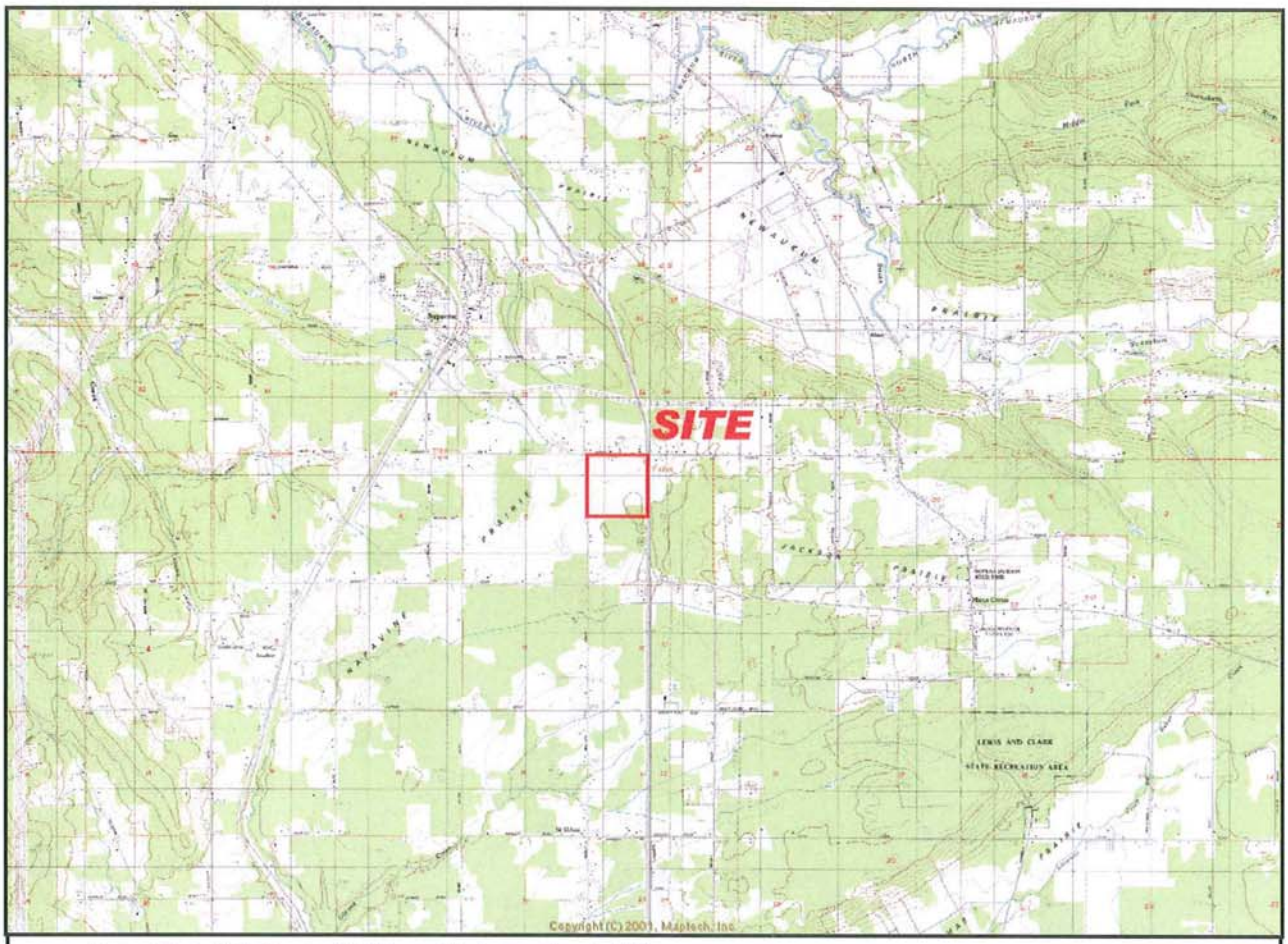
Very truly yours,

INSIGHT GEOLOGIC, INC.

William E. Halbert, L.G., L.E.G.
Principal

Attachments

cc: Bob Balmelli, P.E. – RB Engineering



Source: Maptech CD, Napavine, Washington 7.5 minute quadrangle, 1991,

NORTH

Approximate Scale 1 inch = 4,000 feet

INSIGHT GEOLOGIC, INC.

VICINITY MAP

FIGURE 1

TP-1 TEST PIT LOCATION

CARLSON PROPERTY

INSIGHT GEOLOGIC, INC.

SITE PLAN
TEST PIT LOCATIONS

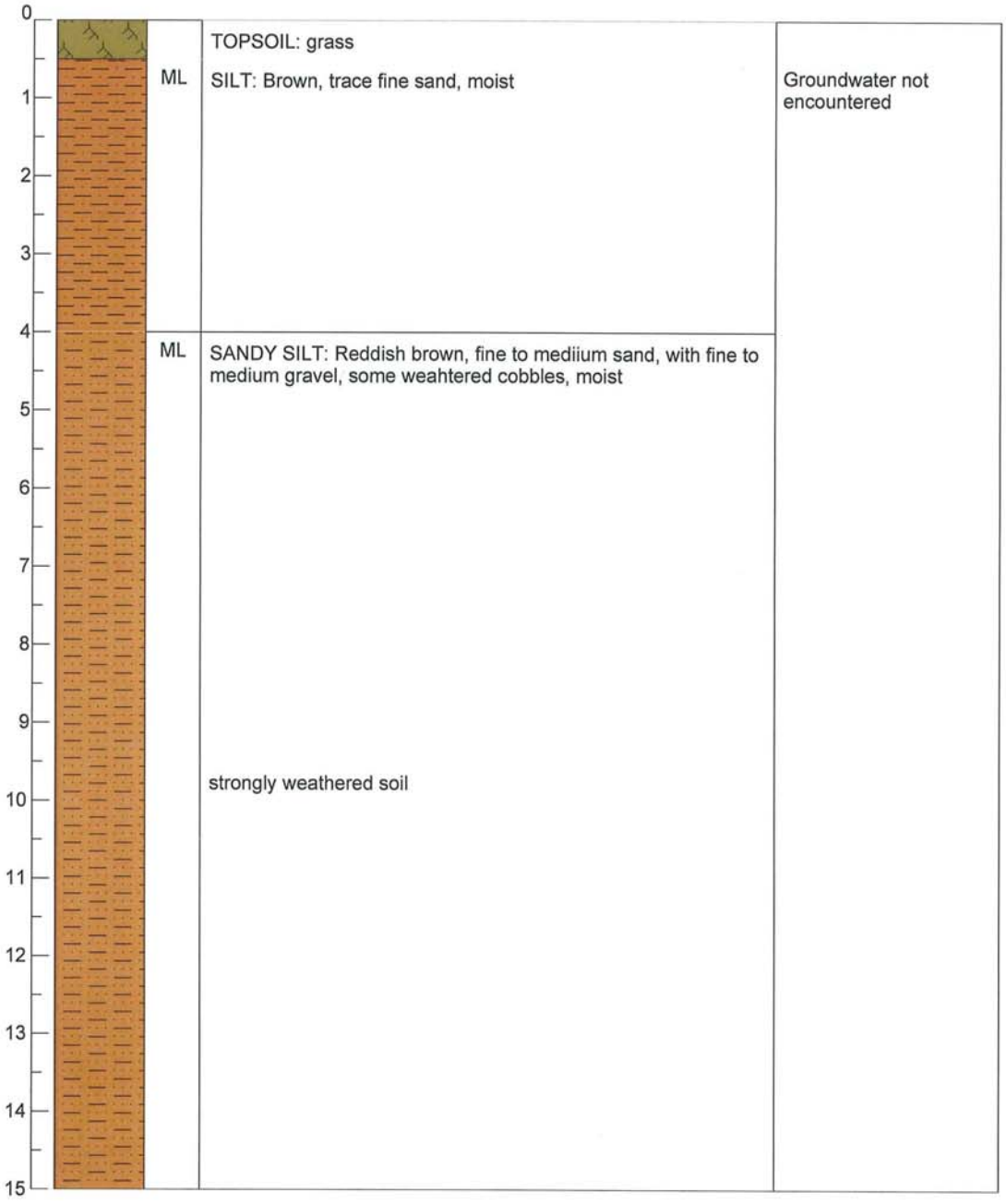
FIGURE 2

ATTACHMENT A

TEST PIT LOGS

RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE 10/21/08

Napavine, WA **TP-1** 15 feet

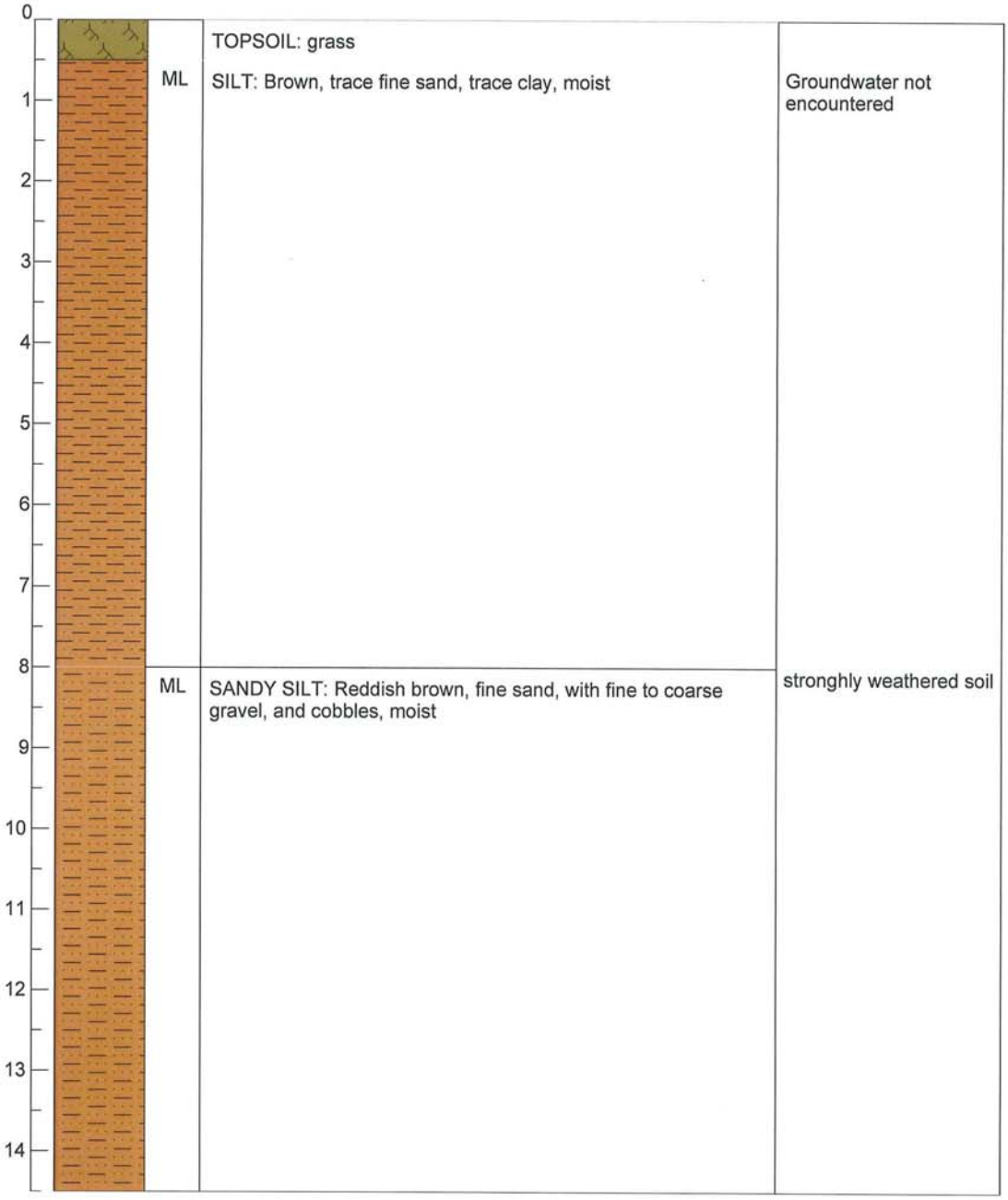


Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

INSIGHT GEOLOGIC, INC.

RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE 10/21/08

Napavine, WA **TP-2** 14.5 feet



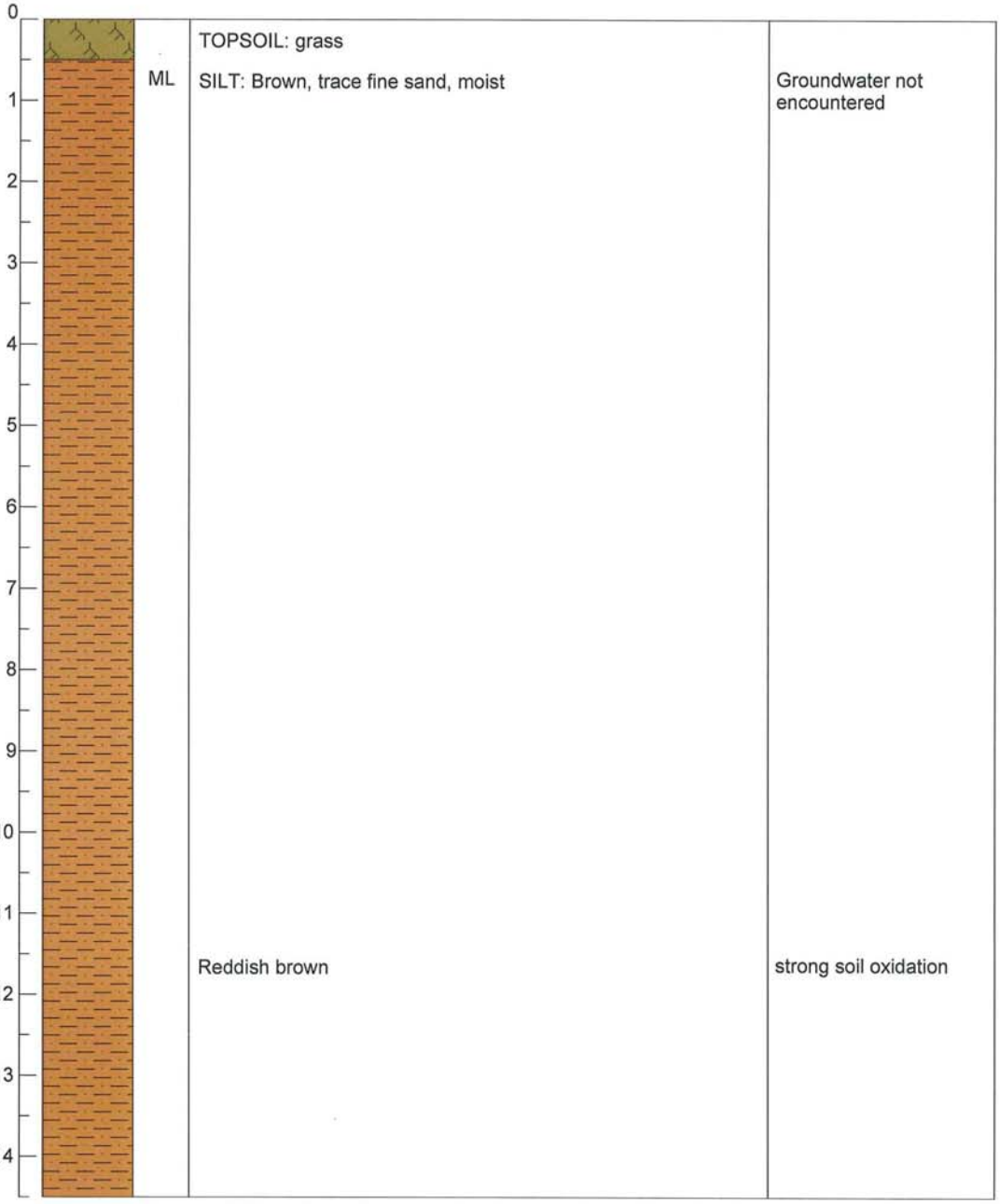
Depth (feet)	Lithology	USCS	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0			TOPSOIL: grass	
1		ML	SILT: Brown, trace fine sand, trace clay, moist	Groundwater not encountered
8		ML	SANDY SILT: Reddish brown, fine sand, with fine to coarse gravel, and cobbles, moist	stronghly weathered soil
14				

Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

INSIGHT GEOLOGIC, INC.

RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE 10/21/08

Napavine, WA **TP-3** 14.5 feet

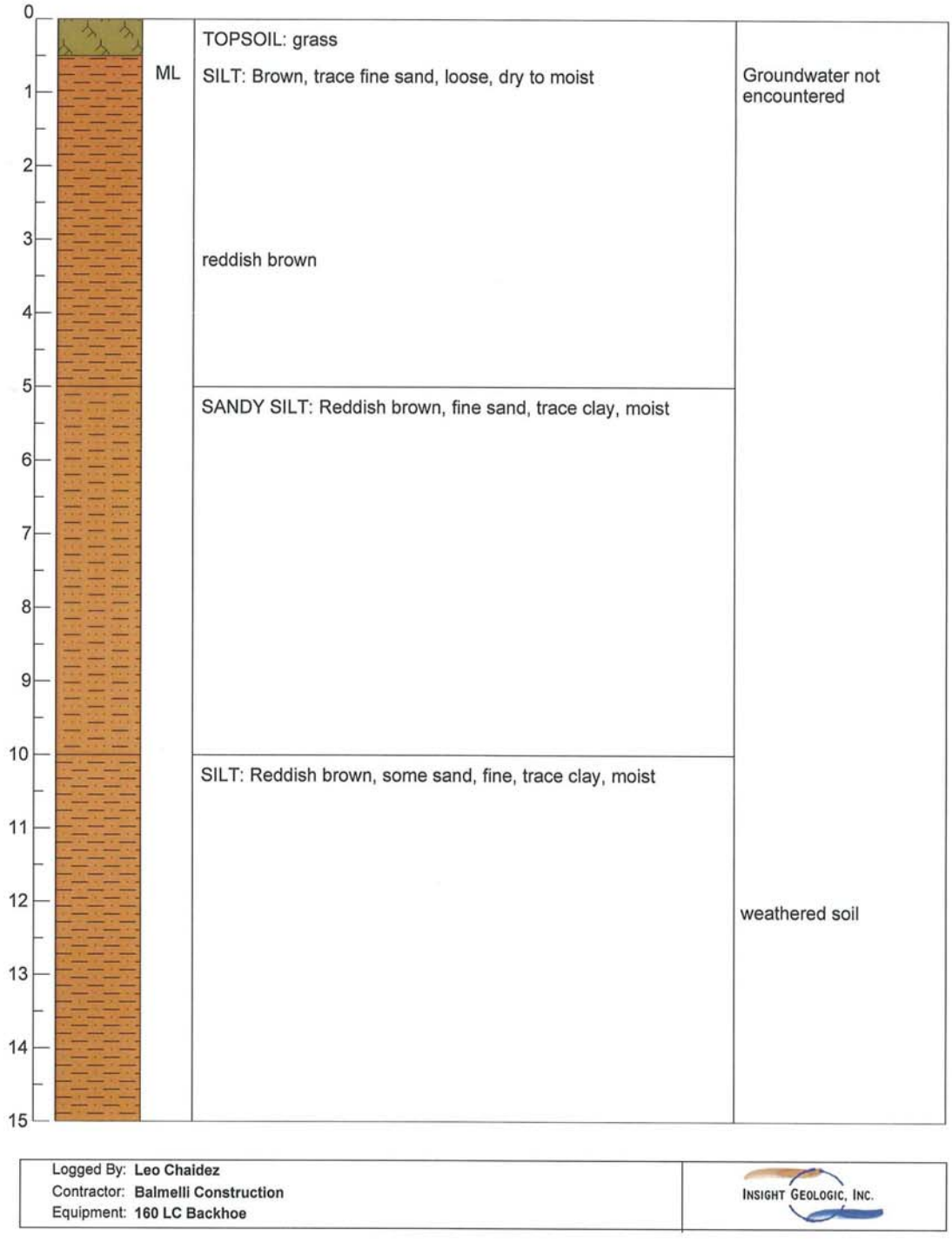


Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

INSIGHT GEOLOGIC, INC.

RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE 10/21/08

Napavine, WA **TP-4** 14.5 feet

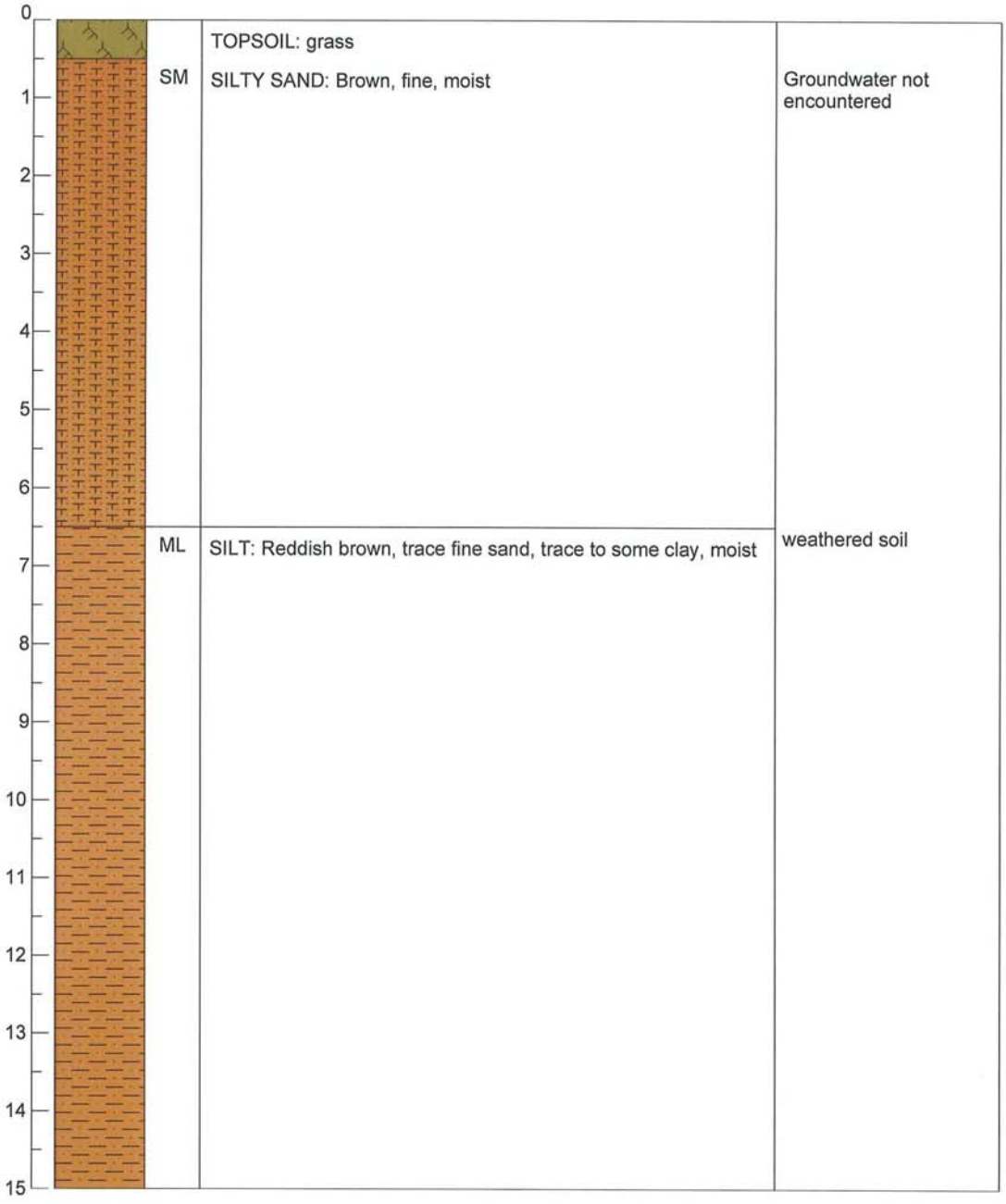


Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

INSIGHT GEOLOGIC, INC.

RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE — 10/21/08

Napavine, WA — **TP-5** — 14.5 feet



Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

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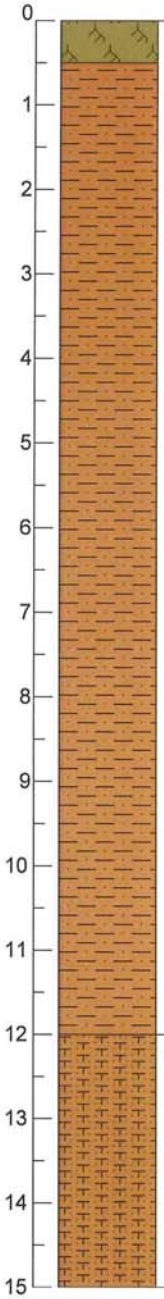
RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE — 10/21/08

Napavine, WA — **TP-6** — 14.5 feet



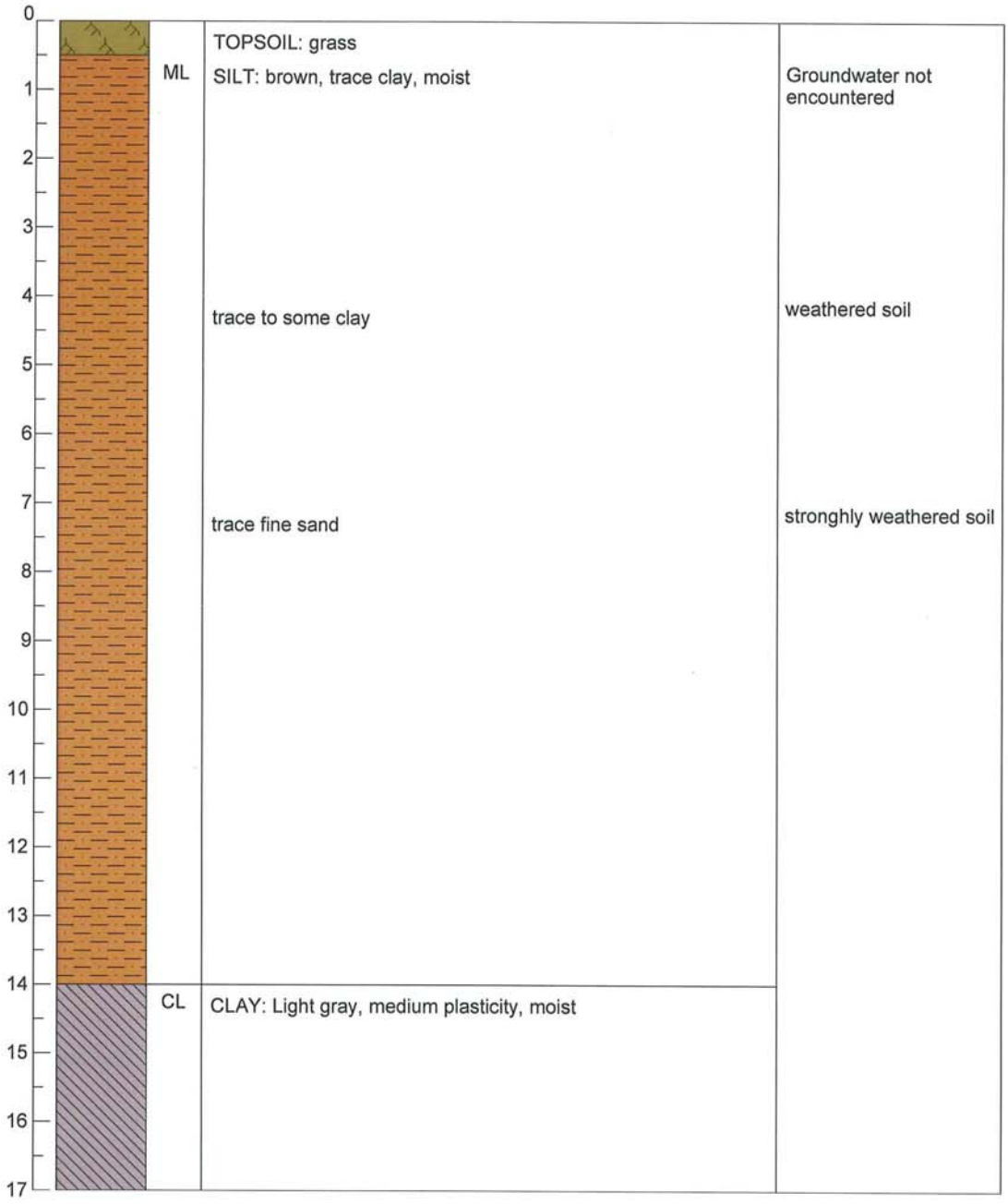
Depth (feet)	Lithology	USCS	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0 – 11		ML	TOPSOIL: grass SILT: Reddish brown, trace medium to coarse sand, moist	Groundwater not encountered weathered soil
12 – 15		SM	SILTY SAND: Reddish, fine, loose, medium gravel, cobbles, trace clay, moist	

Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

INSIGHT GEOLOGIC, INC.

RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE 10/21/08

Napavine, WA **TP-7** 14.5 feet



Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

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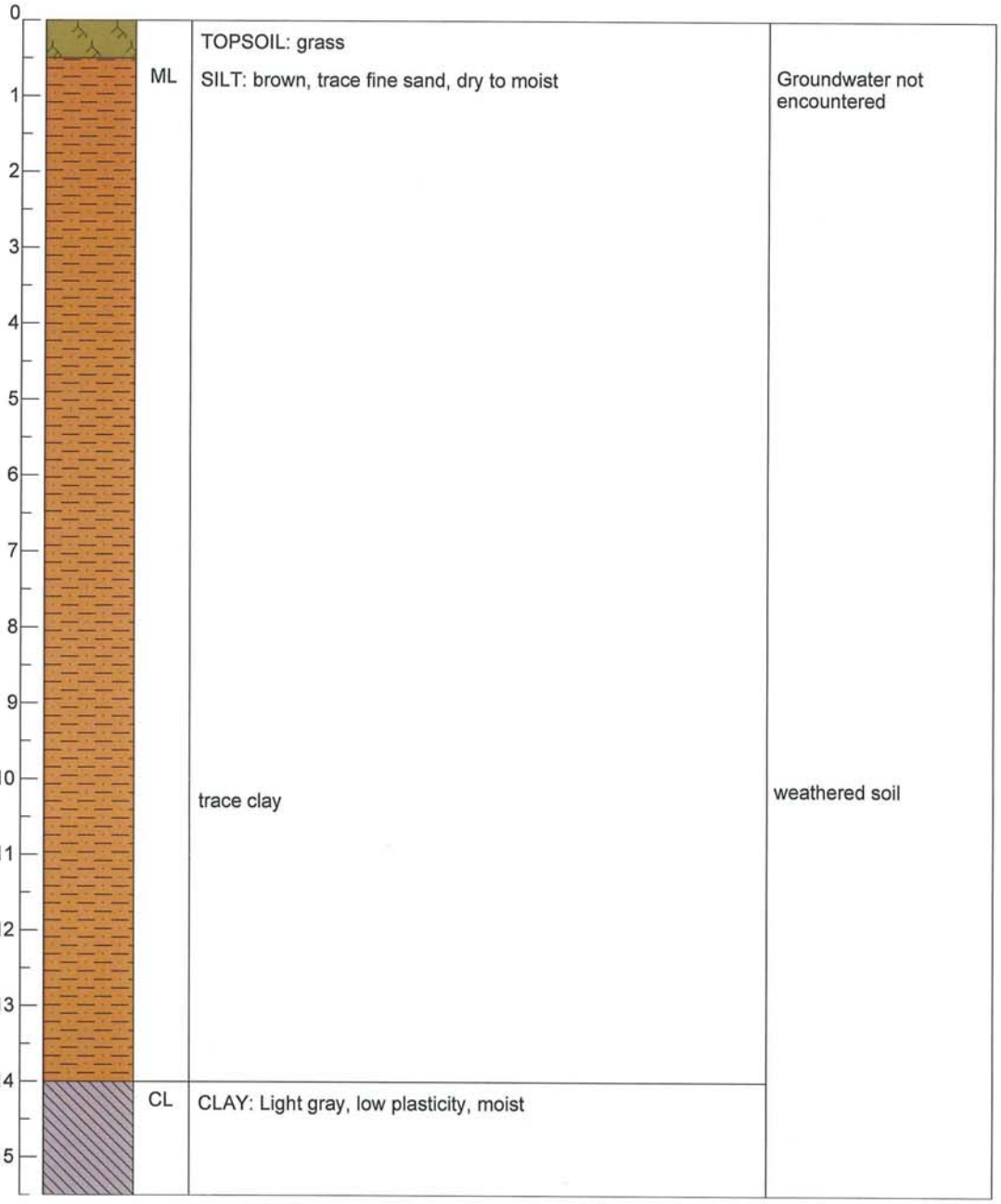
RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE 10/21/08

Napavine, WA **TP-8** 15.5



Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

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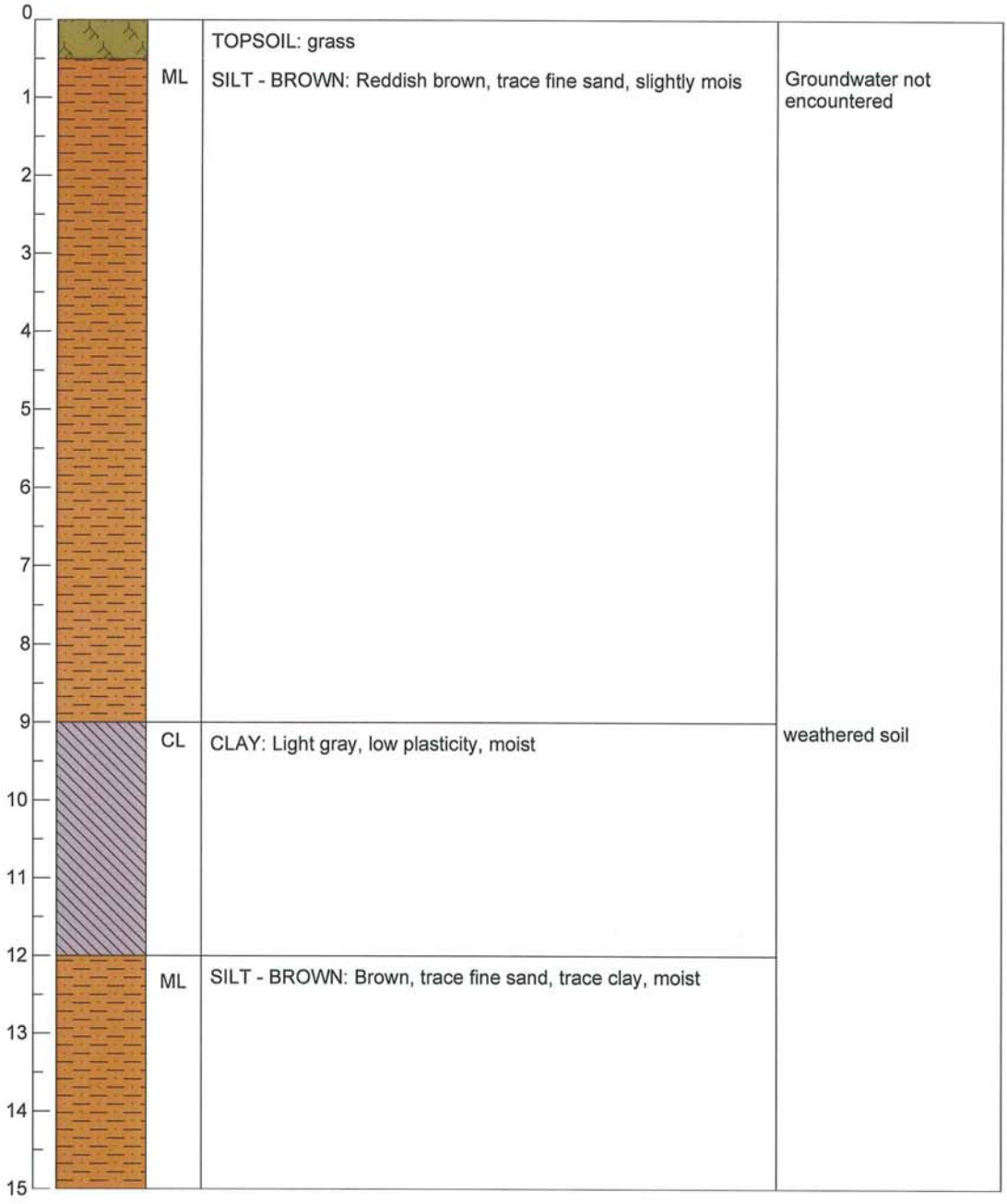
RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE — 10/21/08

Napavine, WA — **TP-9** — 15



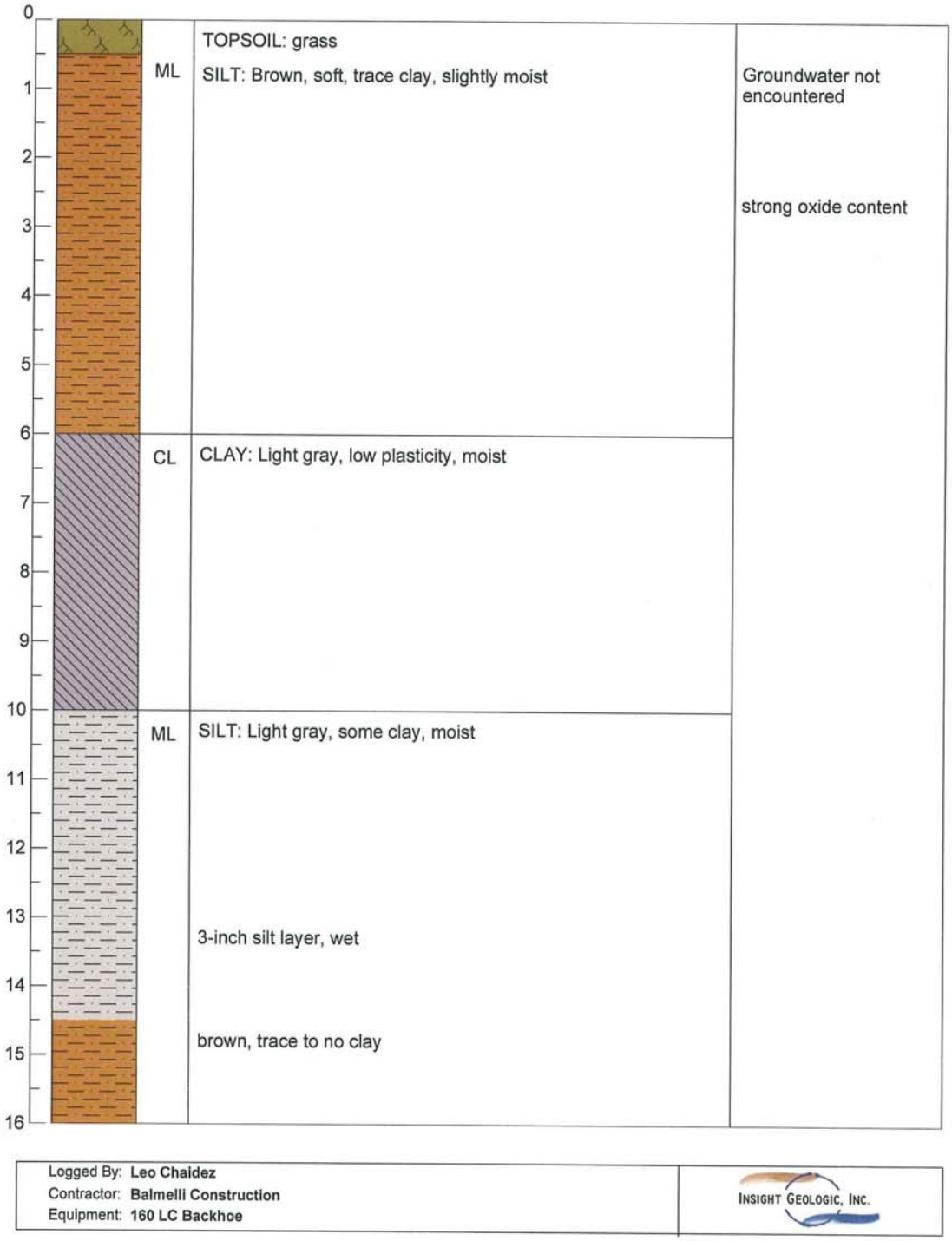
Depth (feet)	Lithology	USCS	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0 – 1		ML	TOPSOIL: grass SILT - BROWN: Reddish brown, trace fine sand, slightly mois	Groundwater not encountered
9 – 10		CL	CLAY: Light gray, low plasticity, moist	weathered soil
12 – 15		ML	SILT - BROWN: Brown, trace fine sand, trace clay, moist	

Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

INSIGHT GEOLOGIC, INC.

RITCHIE BROTHERS AUCTIONEERS - CARLSON SITE 10/21/08

Napavine, WA **TP-10** 16 feet



Logged By: **Leo Chaidez**
Contractor: **Balmelli Construction**
Equipment: **160 LC Backhoe**

INSIGHT GEOLOGIC, INC.

ATTACHMENT B

REPORT LIMITATIONS AND GUIDELINES FOR USE

ATTACHMENT B

REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This attachment provides information to help you manage your risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report has been prepared for the exclusive use of our client and their authorized agents. This report may be made available to regulatory agencies for review. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

Insight Geologic Inc. structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared.. This report should not be applied for any purpose or project except the one originally contemplated.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Insight Geologic, Inc. considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless Insight Geologic specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;

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[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, Insight Geologic should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or ground water fluctuations. Always contact Insight Geologic before applying a report to determine if it remains applicable.

MOST GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Insight Geologic reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

GEOTECHNICAL ENGINEERING REPORT RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from Insight Geologic's professional judgment and opinion. Insight Geologic's recommendations can be finalized only by observing actual subsurface conditions revealed during construction. Insight Geologic cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by Insight Geologic should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations.

Retaining Insight Geologic for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Insight Geologic confer with appropriate members of the design team after submitting the report. Also retain Insight Geologic to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Insight Geologic participate in pre-bid and pre-construction conferences, and by providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with Insight Geologic and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. Insight Geologic includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with Insight Geologic if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

PART 9 – OTHER PERMITS

The following is a list of regulatory permits needed for this project.

Special Use Permit
SEPA Review
Grading and Drainage
WSDOH Water System Approval
Building Permits
Section 404 Army Corps of Engineers
Section 401 WSDOE

PART 10 – OPERATION AND MAINTENANCE MANUAL

A final Operation and Maintenance Manual will be prepared in the Final Drainage Site Plan Report.

PART 11 – BOND QUANTITIES/FINANCIAL RESPONSIBILITY

Lewis County does not require any bonding for stormwater improvements.